SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

September 30, 1982

SIDNEY MINOR
PROJECT MANAGER
OPERATING REACTORS BRANCH #4
DIVISION OF LICENSING
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON DC 20555

DOCKET NO. 50-312

Enclosed is a copy of the Transient Assessment Report for the Rancho Seco reactor trip on August 7, 1981, as requested by one of your staff engineers.

If you have any questions regarding this report, please contact R. W. Colombo of my Rancho Seco staff.

J. J. Mattimoe

J. J. Mattimoe
General Manager

Enclosure

A001

TRANSIENT ASSESSMENT REPORT

FOR

RANCHO SECO REACTOR TRIP

ON

AUGUST 7, 1981

PREPARED AND RELEASED BY

SACRAMENTO MUNICIPAL UTILITY DISTRICT

<u>Transient Assessment Program</u>

12-1129805-00

TRANSIENT REPORT NO. 53

SUMMARY

SMUD was supplying power to satisfy an unprecedented demand for 1660 MW on August 7, 1981. Rancho Seco was returning to power after a 7-hour maintenance outage. During the escalation, operators discovered that the turbine controls would not remain in the MANUAL mode when selected. I&C Technicians were requested to investigate the problem. The station was developing 52% full power generating 380 MWe.

The event was initiated when turbine controls were shifted, at the request of I&C technicians, from the AUTO to the MANUAL mode. Three turbine throttle stop valves immediately began to cycle to the closed position. Power output of the station rapidly decreased. Concerned that generator "motoring" was imminent, operators separated the generator from the switchyard by opening the 220 KV circuit breakers. Generator power output continued to decrease and the main exciter breaker was opened. Voltage at the Unit Auxiliary Transformers began to decay immediately. The four Reactor Coolant Pumps, connected to the generator through Unit Auxiliary Transformer Number 1, automatically tripped as voltage decayed. The Reactor was tripped by a Reactor Protection System Power/Pumps trip. The ensuing transient was complicated by a turbine trip, Main Feedwater Pump trip, sporadic dissimilar pressure response in the two loops of the Secondary System, and a low voltage condition on many of the electrical buses throughout the plant

which resulted from the relatively low voltage available from the 230KV grid.

Two discontinuities in the electronic circuitry of the Turbine Electro-Hydraulic controls were responsible for causing the event. A misaligned edge pin connector was found on the power supply circuit board 1A04A; malfunctioning circuitry was found on the Turbine Manual Latch circuit board 1A04E.

SELECTED SEQUENCE OF EVENTS

The following selected sequence of events was compiled by a review of plant computer print-out sheets containing alarms and trip review data, entries made in the Shift Supervisor and Control Room Logbooks, the Shift Supervisor's Post Trip Transient Report No. 53 (AP 28), and discussions with the Operators.

1536:38	Turbine in MANUAL.
1536:39	No. 1 Stop Valve in transit from full open position.
	No. 2 Stop Valve in transit from full open position.
	No. 3 Stop Valve in transit from full open position.
1536:51	No. 1 Stop Valve closed.
1536:53	Turbine Manual - Off.
1537:02	B-OTSG Outlet Steam Pressure High.
	A-OTSG Outlet Steam Pressure High.
1537:37	Turbine in MANUAL.
1537:50	Overspeed Protection Monitor Bad.
	No. 1 Stop Valve Closed.
	No. 3 Stop Valve Closed.
	No. 4 Stop Valve Closed.
1537:52	No. 1 Stop Valve not Closed.
	No. 3 Stop Valve not Closed.
	No. 4 Stop Valve not Closed.
1538:07	220 KV Breaker OCB 220 Open.

1538:09 220 KV Breaker OCB 230 Open.

EHC Speed Reference Monitor Bad.

Overspeed Protection Monitor Bad.

1538:09 No. 2 Governor Valve Closed.

1538:10 Generator Volts 23.71 KV.

Generator Frequency 60.24 HZ.

1538:11 Generator Frequency Bad.

1538:17 Regulator Supply Breaker (Generator Exciter) Open.

1538:19 Generator volts 21.48 KV.

A Feedpump Control System Trouble.

1538:20 Generator Volt Low (19.34 KV).

1538:21 Generator Frequency Low 59.78 HZ.

EHC Speed Reference Monitor Bad.

Governor Control Off.

Auto Stop Latch Off.

Generator Hydrogen High Temperature Trip.

No. 1 Stop Valve Closed.

No. 3 Stop Valve Closed.

No. 4 Stop Valve Closed.

No. 2 Governor Valve Closed.

No. 1 L Reheat Stop Valve Closed.

No. 1 R Reheat Stop Valve Not Open.

No. 2 L Reheat Stop Valve Closed.

No. 2 R Reheat Stop Valve Closed.

No. 1 L Reheat Intercept Valve Closed.

No. 1 R Reheat Intercept Valve Closed.

No. 2 L Reheat Intercept Valve Closed.

No. 2 R Reheat Intercept Valve Closed.

1538:22 Generator frequency High (60.12 HZ).

B BFP Bearing Oil Pressure Low.

1538:22 CRD Trip Confirm --Trip.

1538:23 RPS Channel A Power/Pumps Trip.

RPS Channel B Power/Pumps Trip.

RPS Channel C Power/Pumps Trip.

RPS Channel D Power/Pumps Trip.

Turbine Overspeed Trip.

1538:23 A BFP Control System Normal.

1538:24 B BFP Bearing Oil Pressure Normal.

1538:27 B RCPM Motor Status--Trip.

A RCPM Motor Status--Trip.

D RCPM Motor Status--Trip.

C RCPM Motor Status--Trip.

1538:34 Reactor/Generator Protection/Feedpump Trip.

1538:35 Main BFP Suction Pressure Bad.

1538:42 B RCPM Shaft Speed Low.

A RCPM Shaft Speed Low.

C RCPM Shaft Speed Low.

D RCPM Shaft Speed Low.

1539:02 RPS Channel B RC Loop A Flow Low 18.21 MLB/HR.

RPS Channel A RC Loop B Flow Low 18.27 MLB/HR.

RPS Channel D RC Loop A Flow Low 18.00 MLB/HR.

RPS Channel C RC Loop B Flow Low 18.82 MLB/HR.

TRANSIENT ASSESSMENT

This discussion is an analysis of the August 7, 1981 transient, including a review of the pre-trip status of the plant; examinations of the initiating event, reactor trip, and post-trip response of the plant; an identification of key operator actions and a review of pertinent procedures.

PRE-TRIP PLANT STATUS

Rancho Seco was returning to power after a 7-hour outage initiated when RCP-210A lube oil reservoir levels decreased to the minimum allowable for continued pump operation. Immediately prior to the transient, the station was developing 52% full power and generating 380 MWe.[1] The Integrated Control System (ICS) was in the AUTO mode with the exception of the Reactor Coolant System (RCS) cold leg temperature controls and the A Main Feedwater Pump. The B-MFP was secured. The B Boric Acid Pump (P-631B), a Turbine Bypass Valve (PV-20563), and one B loop Modulating Atmospheric Dump Valve were out of service. Site electrical loads had been transferred from the startup transformers to the Unit Auxiliary Transformers at approximately 30% power during escalation.

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1. During the 1981 refueling outage, 8 rows of blades were removed from the turbine, thereby reducing station full power capability to approximately 820 MWe.

INITIATING EVENT AND REACTOR TRIP

The transient was initiated when Turbine controls were placed in the MANUAL mode. The aforementioned discrepancies on Turbine Electro-Hydraulic Control (EHC) circuit boards 1A04A and 1A04E caused an improper and uncoordinated response from the turbine throttle stop valves. The resulting rapid reduction of generator output prompted operators to open circuit breakers OCB-220 and OCB-230, separating the generator from the switchyard.[2] The Generator Exciter Circuit Breaker (41) was manually opened eight seconds later,[3] causing a voltage decay and loss of frequency control on all plant buses receiving power thru unit auxiliary transformer Numbers 1 and 2.

The 6900 volt Reactor Coolant Pump Buses S6A and S6B were among the buses subjected to this voltage decay, which is depicted by Figure 1. When voltage on the buses had decayed to approximately 5580V (83% of normal bus voltage), a transfer to

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2. Operators were concerned that the grid, operating at conditions approaching maximum available generating capacity, would be subjected to a blackout if the Rancho Seco generator was motored.

3. A Turbine trip will initiate a Reactor/Generator Protection/Feedwater Pump trip when Reactor power level is greater than 15% full power if one of the three circuit breakers, OCB-220, OCB-230, or the Generator Exciter Circuit Breaker (41) is closed. A Reactor trip of this nature is precluded when all three of these breakers are open.

an alternate power source[4] (Start-up Transformer No. 1) and a low voltage trip of the Reactor Coolant Pumps[5] was initiated. However, the Synchronization Check Relays[6], 625A and 625B, prevented completion of this transfer, and voltage on the RCP buses continued to decay. When voltage had decayed to approximately 54% of normal bus voltage, the underpower trip relays, 637A and 637B, initiated a Reactor Protection System (RPS) Power/Pumps trip which tripped the reactor.

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4. Power source transfer is accomplished by opening circuit breaker 52-6A01 (52-6B01) and closing 52-6A04 (52-6B04) on bus S6A (S6B) respectively. Unit Auxiliary Transformer No. 1 is disconnected and Start-up Transformer No. 1 is connected by this action. Elapsed time required to accomplish this transfer is about two seconds.

5. A low voltage trip of Reactor Coolant Pumps P-210A and C (P-210B and D) is initiated at a bus voltage of approximately 5580 volts by delayed operation of relays 627-1 (627-2). Elapsed time required to complete this trip is about 15.8 seconds in order to allow time for several attempts at the power source transfer as described in footnote 4.

6. A prerequisite for the low voltage bus transfer from the Auxiliary Transformer to the Start-up Transformer is an in-phase frequency condition between the bus and the start-up Transformers. Should a phase difference of more than 27 degrees (30 degrees) exist, Synchronization Check Relay 625A (625B) will prevent a transfer. This ensures that the RCP's will not be subjected to damaging accelerations caused by an out-of-phase transfer.

PO3T TRIP PLANT RESPONSE

Post-trip response of the RCS is represented in Figures 2 through 17. Pertinent parameter limits obtained from the Plant Computer Memory Trip Review are listed in Table 1.

TABLE 1 TRANSIENT REACTOR COOLANT SYSTEM RESPONSE

RCS Parameter	Maximum	Minimum
RCS Loop A Pressure (PSIG)	2219	1864
RCS Loop B Pressure (PSIG)	2236	1881
RCS Loop A Hot Leg Temperature (F)	596	542
RCS Loop B Hot Leg Temperature (F)	598	544
Calculated Subcooling Margin (F)	-	79.3
Pressurizer Level (inches)	218	60

Immediately following the trip, the Reactor was subjected to a large reduction of RCS coolant flow when all of the RCP's tripped.[7] Total RCS flow, which is shown in Figure 4, decreased from approximately 150 to 12 million pounds per hour. The affect of this reduction upon the reactor coolant temperature difference across the Reactor is shown in Figures 14 through 17.[8]

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7. The Reactor Coolant Pumps were tripped by completion of the RCP undervoltage trip which had been initiated prior to the Reactor trip.

8. The curves shown in these figures suggest that RCS cold leg temperatures were greater than the corresponding hot leg temperatures for a short period of time. This is attributed to the computer cold leg temperature data used to plot these curves. The cold leg temperatures listed by the computer represent the calculated average of values measured over the previous minute and, as such, are greater than the actual temperatures. Therefore the curves shown in these figures are approximations of the coolant temperature difference occurring across the Reactor.

Forced circulation was reestablished approximately 90 seconds after the Reactor trip, causing RCS temperatures to stabilize. High pressure injection (HPI) was manually initiated in RCS Loop A through HPI Nozzle 2 (SFV-23811) utilizing the Make-up and B-HPI pumps.

Post-trip response of the Secondary System is represented by Figures 18 through 23. Pertinent parameter extreme values obtained from the Plant Computer Memory Trip Review and Strip Charts are listed in Table 2.

TABLE 2 TRANSIENT SECONDARY SYSTEM RESPONSE

Secondary System Parameter	Maximum	Minimum
A-OTSG Outlet Pressure (PSIG)	1018	944
B-OTSG Outlet Pressure (PSIG)	1059	942
A-OTSG Temperature (F)	594	537
B-OTSG Temperature (F)	597	537
A-OTSG Level (% Operating Range)	28	3
B-OTSG Level (% Operating Range)	24	3

The Turbine was tripped at 1538:21 when the High Generator Hydrogen Temperature Turbine Trip[9] was activated. All High Pressure Turbine Throttle Stop Valves and Low Pressure Turbine Intercept Valves, except H-P Turbine Throttle Stop Valve No. 2, closed[10] at 1538:21. Governor Valve No. 2 closed in lieu of

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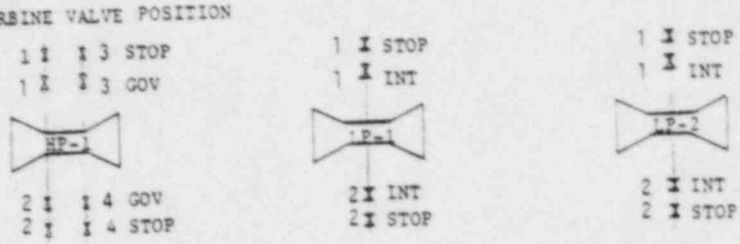
9. Although the cause of the high generator temperature has not been determined, heating attributed to large currents circulating in the face of the rotor after the field breaker was opened may be responsible.

10 Valve positions are depicted in Table 3.

TABLE 3: TURBINE VALVE POSITION



	HP-1 VALVES								LP-1 VALVES				LP-2 VALVES				
	STOP				GOV				STOP		INT		STOP		INT		
	1	2	3	4	1	2	3	4	1	2	1	2	1	2	1	2	
1536:38	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
1536:39	NO	O	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	
1536:39	NO	NO	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	
1536:51	C	NO	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	
1536:54	NC	NO	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	Note 1
1537:50	C	NO	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	
1537:51	C	C	NO	O	O	O	O	O	O	O	O	O	O	O	O	O	
1537:51	C	C	NO	C	O	O	O	O	O	O	O	O	O	O	O	O	
1537:52	NC	C	NO	C	O	O	O	O	O	O	O	O	O	O	O	O	
1537:52	NC	NC	NO	C	O	O	O	O	O	O	O	O	O	O	O	O	
1537:52	NC	NC	NO	NC	O	O	O	O	C	O	O	O	O	O	O	O	
1537:54	NC	NC	NO	NC	O	O	O	O	O	O	O	O	O	O	O	O	Note 2
1538:09	NC	NC	NO	NC	O	O	C	O	O	O	O	O	O	O	O	O	Note 3
1538:10	NC	NC	NO	NC	O	O	C	O	O	O	O	O	O	O	O	O	Note 4
1538:12	NC	NC	NO	NC	O	O	NC	O	O	O	O	O	O	O	O	O	
1538:17	NC	NC	NO	NC	O	O	NC	O	C	O	O	O	O	O	O	O	Note 5
1538:21	C	C	NO	C	O	O	C	O	NO	C	C	C	C	C	C	C	Note 6

Note 1: Overspeed Protection Monitor bad

Note 2: Overspeed Protection Monitor norm

Note 3: OCB-220 & OCB-230 open, EHC Speed Reference Monitor bad, Overspeed Protection Monitor bad

Note 4: EHC Speed Reference Monitor bad

Note 5: Generator Exciter Breaker Open

Note 6: EHC Speed Reference Monitor bad, Governor Control off, Trans Throttle Valve to Governor Valve incomplete, Turbine manual, Auto Stop Latch, Generator Hi Temp trip (Turbine trip)

KEY: O: OPEN C: CLOSED NO: NOT OPENED NC: NOT CLOSED

Stop Valve No. 2. A Turbine Overspeed Trip Alarm[11] was recorded at 1538:23.

Dissimilar pressure response of the two secondary loops is revealed by a comparison of the OTSG outlet steam pressure charts, Figures 22 and 23. One Turbine Bypass Valve (PV-20563) in the A Loop and one Modulating Atmospheric Dump Valve in the B Loop were out of service. With these valves out of service, pressure relief capabilities of the two loops were different--possibly causing the dissimilar pressure response.

Maximum pressure recorded at the B-OTSG outlet was greater than the 1050 PSIG setpoint for safety relief valves PSV-20544 and PSV-20546, implying that these valves may have operated.

A reduction in feedwater flow was initiated by the Integrated Control System (ICS) about 1537:50 as a consequence of the momentary closure of three Main Turbine Throttle Stop Valves. The ICS initiated flow reduction signal was augmented by a power interruption on 120 VAC bus 1E, the power supply for a portion of the feedwater pump controls. This resulted in a demand signal for a much reduced feedwater flow rate. When power was restored to bus 1E, the demand signal was corrected and feedwater flow began to increase. However, before full main feedwater flow could be reestablished, the A-MFP was

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11. Turbine speed which initiates this trip alarm is 111.5% normal speed. The overspeed is attributed to expansion of the steam remaining in the Low Pressure Turbines after the stop, governor, and intercept valves were closed and the electrical load removed.

tripped when pump lube oil pressure[12] decreased to 57 PSIG--the low pressure trip setpoint. OTSG levels were then maintained by both Auxiliary Feedwater Pumps,[13] which had automatically started when the RCP's tripped at 1538:02.

A power interruption, which affected all plant buses utilizing Unit Auxiliary Transformer No. 2 as a power source, occurred after the Generator Exciter Circuit Breaker (41) was opened[14]. Among those affected were the 4160 V Circulating Water Buses (S4E1 and S4E2), the 4160 V Normal Auxiliary Buses (S4C and S4D), and the 480 V Normal Auxiliary Buses (S3C1, S3C2, S3D1, S3D2, and S3E). Operation of the A-MFP lube oil

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12. The decay of MFP lube oil pressure is attributed to a loss of power to the 480 V lube oil pumps, P-868A and B.

13. The B-MFP was out of service.

14. When the Generator Exciter Circuit Breaker (41) was opened, buses S4C, S4D, S4E1, and S4E2 were subjected to an immediate voltage decay. When voltage had decayed to about 80% of the normal value, transfer from Unit Auxiliary Transformer No. 2 to Start-up Transformer No. 2 was initiated by opening circuit breakers connecting the buses to the Unit Auxiliary Transformer No. 2. Concurrent with the aforementioned voltage decay, an out-of-phase frequency condition developed between the buses and Start-up Transformer No. 2. Due to this out-of-phase condition, the bus sync-check relays prevented completion of the transfer. As a result, power was interrupted on the buses. When bus voltage had decayed to about 50% normal voltage, the sync-check relay was bypassed and the transfer completed.

pump was terminated by the power interruption.[15] When power was not restored to the pump motors, the resulting decrease in lube oil pressure caused the A-MFP to trip. The Condensate Pump Motors, which were also subjected to the power interruption, continued to operate.[16]

The Diesel Generators, which were manually started, were utilized to supply power to the 4160 V Nuclear Service Buses when low bus voltage became apparent. However, there were no consequences attributed to this low voltage condition after the transient.

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15. The A-MFP lube oil pumps, P-868A and P-868B, are connected to buses S3C1 and S3E through motor control centers S2C5 and S2E1. During normal operations, only one of these pumps is utilized to supply lubrication to the A-MFP. The power interruption caused the contacts in the circuit connecting the operating lube oil pump motor to the bus to open. As a result, the operating lube oil pump stopped. Under these circumstances, reclosure of the contacts can be affected in two different ways: manually--utilizing the lube oil pump start button or automatically--starting the first condensate pump. Neither of these requisites were accomplished after power was restored; therefore, the lube oil pump did not restart.

16. Elapsed time required to complete a trip of the Condensate Pump Motors is approximately 15 seconds. Duration of the power interruption is estimated to be 2.7 seconds--not long enough to trip the Condensate Pump Motors.

During the course of the transient, the alarms of all radiation monitors were activated[17].

An undervoltage condition existed in the plant switchyard for several hours after the transient. Voltages measured at 1700 hours were: West Bus 23A--206.4KV; East Bus 23B--205.8KV.[18] Due to the low voltage condition, restart of the plant was delayed for several hours.

KEY OPERATOR ACTIONS:

Four key actions were performed by operators during this event. These are listed here for reference:

1. Opened Generator/Switchyard Circuit Breakers (OCB 220 & OCB 230).
2. Opened Generator Exciter Circuit Breaker 41.
3. Manually started Diesel Generators.
4. Manually initiated high pressure injection.

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17. Conditions which activate radiation monitor alarms include:

    1. Radiation levels which exceed monitor setpoints.
    2. Loss of monitor instrumentation electrical power supply from the Nuclear Service Bus.
    3. Low (approximately 65% normal) Nuclear Service Bus voltage which is effectively condition No. 2.
    4. Instrumentation voltage "spikes" or "noise".

    Conditions 2 and/or 3 would be accompanied by an automatic start of the Diesel Generators. Since this did not occur, condition 4 is the suspected cause.

18. 214 KV is the lowest switchyard voltage which has been evaluated for adverse effects upon the plant. See LER #81-34 and 81-39.

PLANT PROCEDURES

Plant procedures pertaining to the systems considered in this assessment were reviewed. The following comments about these procedures are included for information:

PLANT MAINTENANCE - INSTRUMENT MANUAL

I-020 Electro-Hydraulic Control System: Sections 5.4 and 5.5 provide instructions for calibration and checkout of EHC Power Supplies and Servos. This procedure is to be performed after maintenance, calibration, and shutdown.

PLANT OPERATIONS MANUAL

A.46 Main Turbine System: Section 7.0 provides procedures for abnormal operations including unit separation from the system, carrying house loads. This procedure ends with opening the OCB's.

A.50 Feedwater Pump Operation: Section 3.11 states "Prior to operating a main feedpump, one condensate pump must be running and low feedpump suction alarm reset." Section 4.8 contains a note: "If AC pump breakers are racked in, they will start automatically when the first condensate pump is started." AC pump refers to the lube oil pump.

A.54 220 KV Electrical System: Section 7.0 provides procedures for abnormal operations including "clearing Main and Unit Auxiliary Transformers." Initial conditions require that "Plant Loads are being supplied from Start-up Transformers Numbers 1 and 2.

PLANT OPERATIONS MANUAL (CONT)

A. 64 Generator and Exciter System: Section 6.0 provides procedures for shutdown of the Excitation System. Iritial conditions specify that all plant loads have been transferred to the Start-up Transformers. Section 7.0 provides procedures for abnormal operations. Precautionary notes which warn the operator about the consequences associated with opening the Generator Exciter Circuit Breaker (41) while site loads are connected to Normal Auxiliary Transformers are not included.

B.4 Plant Shutdown and Cooldown: Section 4.0 provides procedures for plant shutdown and includes a cautionary note describing the voidance of the Reactor/Turbine trip when circuit breakers OCB-220, OCB-230, and the Generator Exciter Circuit Breaker (41) are open.

PLANT OPERATIONS MANUAL EMERGENCY PROCEDURES

D.1 Load Rejection: Section 2.0 defines a load rejection as "a condition in which the turbine generator is separated from the 220 KV System (OCB's 220 and 230 open) with an accompanying reactor/turbine trip." Automatic and Operator actions are described in the remainder of the discussion. These procedures do not include instructions for operation of the Generator Exciter Circuit Breaker (41). Therefore, precautionary notes, which warn the operator about the consequences associated with opening the Generator Exciter Circuit Breaker (41) prior to the transfer of site loads, are not included.

<u>D.2/D.3 Reactor/Turbine Trip</u>: Lists malfunctions which will cause a Reactor/Turbine Trip, outlines automatic and operator actions. Precautionary notes, which warn the operator about the voidance of a Reactor/Turbine trip when breakers OCB-220, OCB-230, and the Generator Exciter Circuit Breaker (41) are open, are not included.

<u>D.10 Loss of Reactor Coolant Flow-RCP Trip</u>: Outlines automatic and operator actions required upon the trip of one or more Reactor Coolant Pumps.

CONCLUSIONS

In spite of several unusual responses, the transient was concluded with the plant in the desired stabilized post transient condition.

Automatic response of the plant occurred much as expected, inspite of the complications attributed to the voltage decay and power interruption on various plant electrical buses. Prolonged transfer delays, caused by out-of-phase frequency conditions, were responsible for these complications.

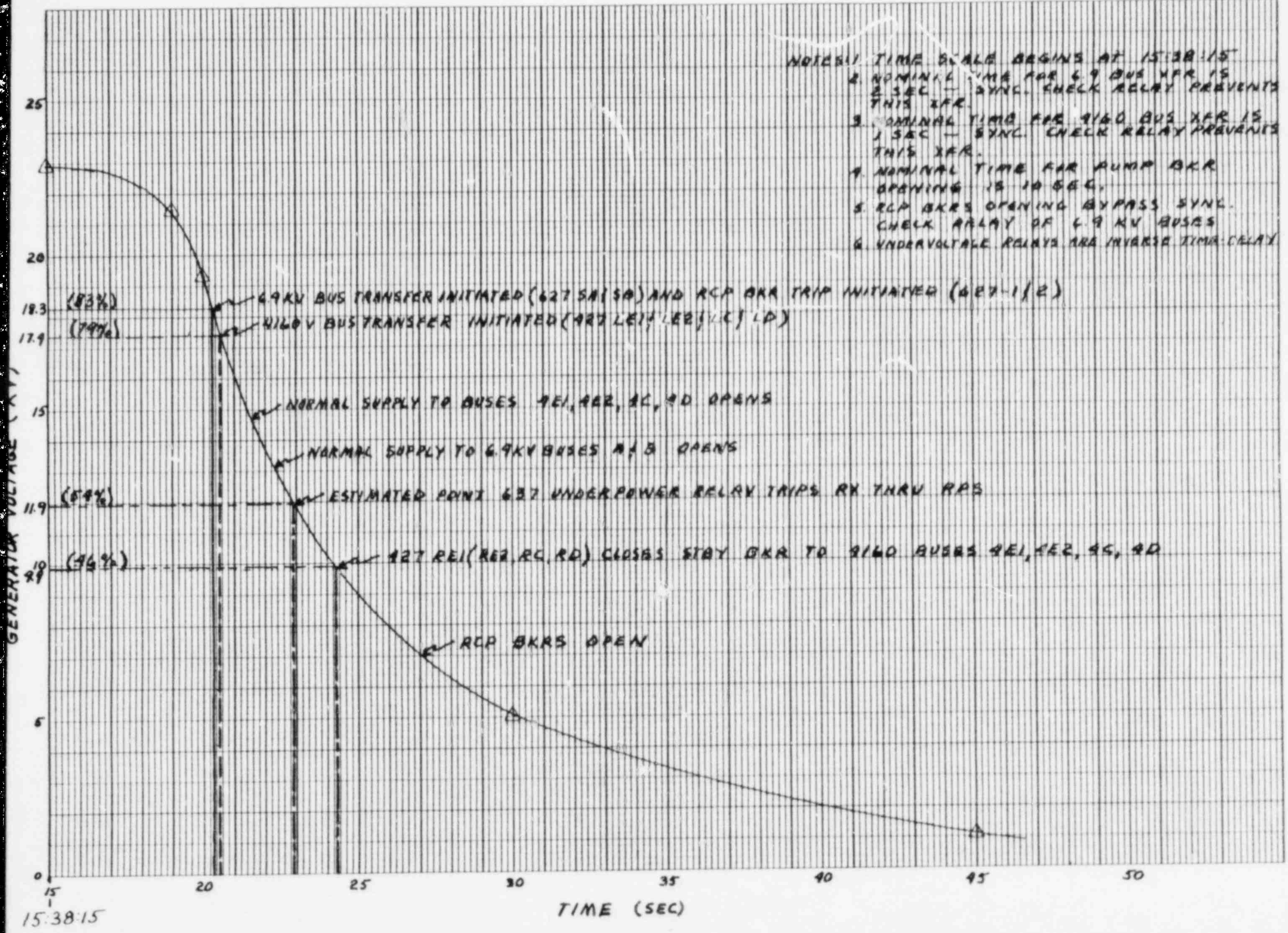
Although operators acted in accordance with plant procedures, one possible exception was noted. The previously described electrical problems could have been avoided if site loads had been transferred from the Unit Auxiliary Transformers to the Start-up Tranformers before the Generator Exciter Circuit Breaker was opened.

Plant Operating Procedures provided adequate instructions with the following exception:

> A precautionary note explaining the defeat of the Reactor/Turbine Trip caused by opening generator-switchyard circuit breakers (OCB220 and OCB230) and the main Generator Exciter Circuit Breaker (41) is not included in procedures A.64, D.1, and D.2/3.

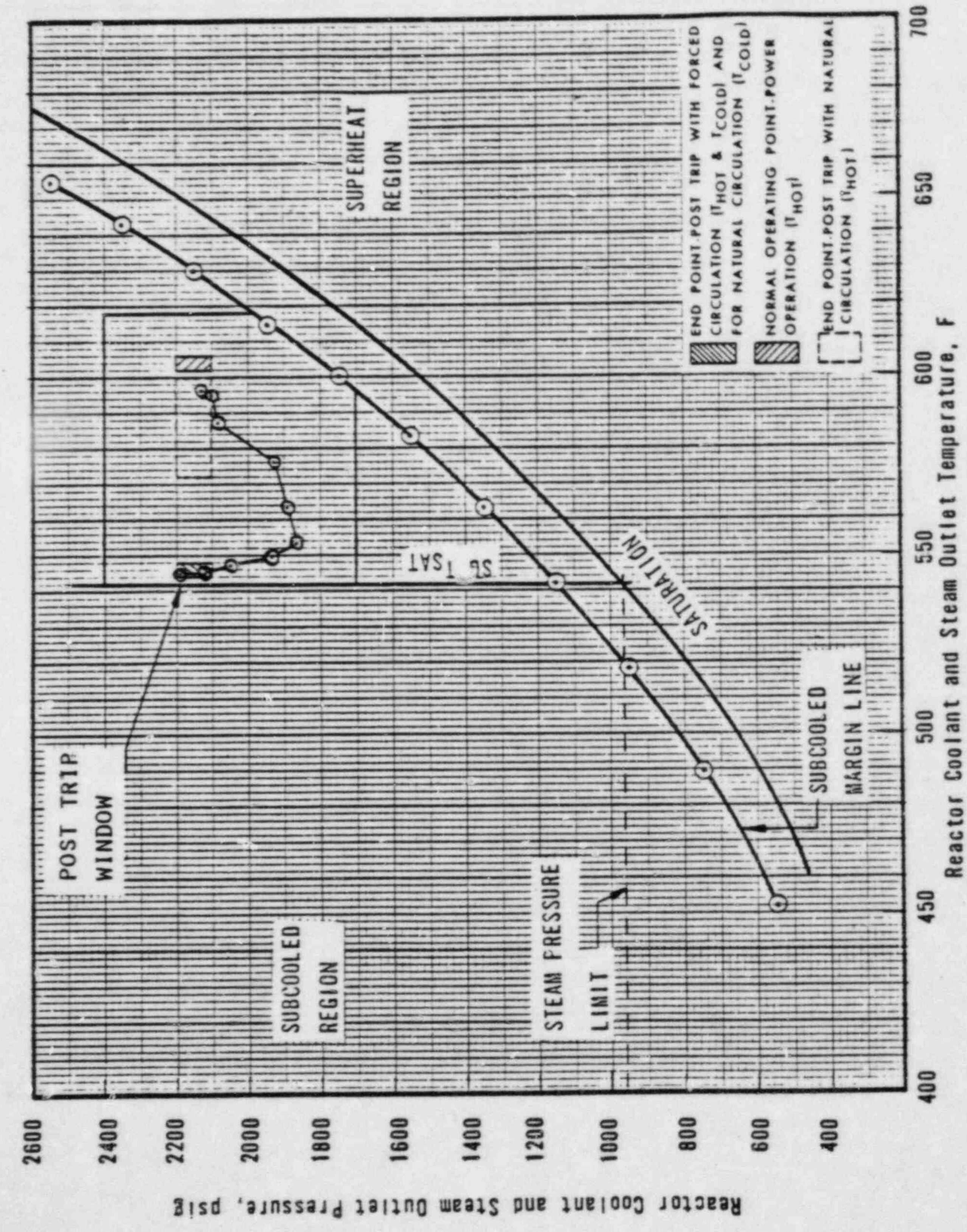
Plant Instrument Maintenance Procedure I-020 provides for an adequate post maintenance/calibration/shutdown checkout of EHC power supplies and servos. The misaligned EHC edge connector would probably have been found during a performance of the described checkout. However, previous maintenance had been performed with the unit in service and there was no reason to perform a checkout.

FIGURE 1
GENERATOR VOLTAGE DECAY VS TIME



RANCHO SECO
AUG 7, 1981
RCS LOOP A

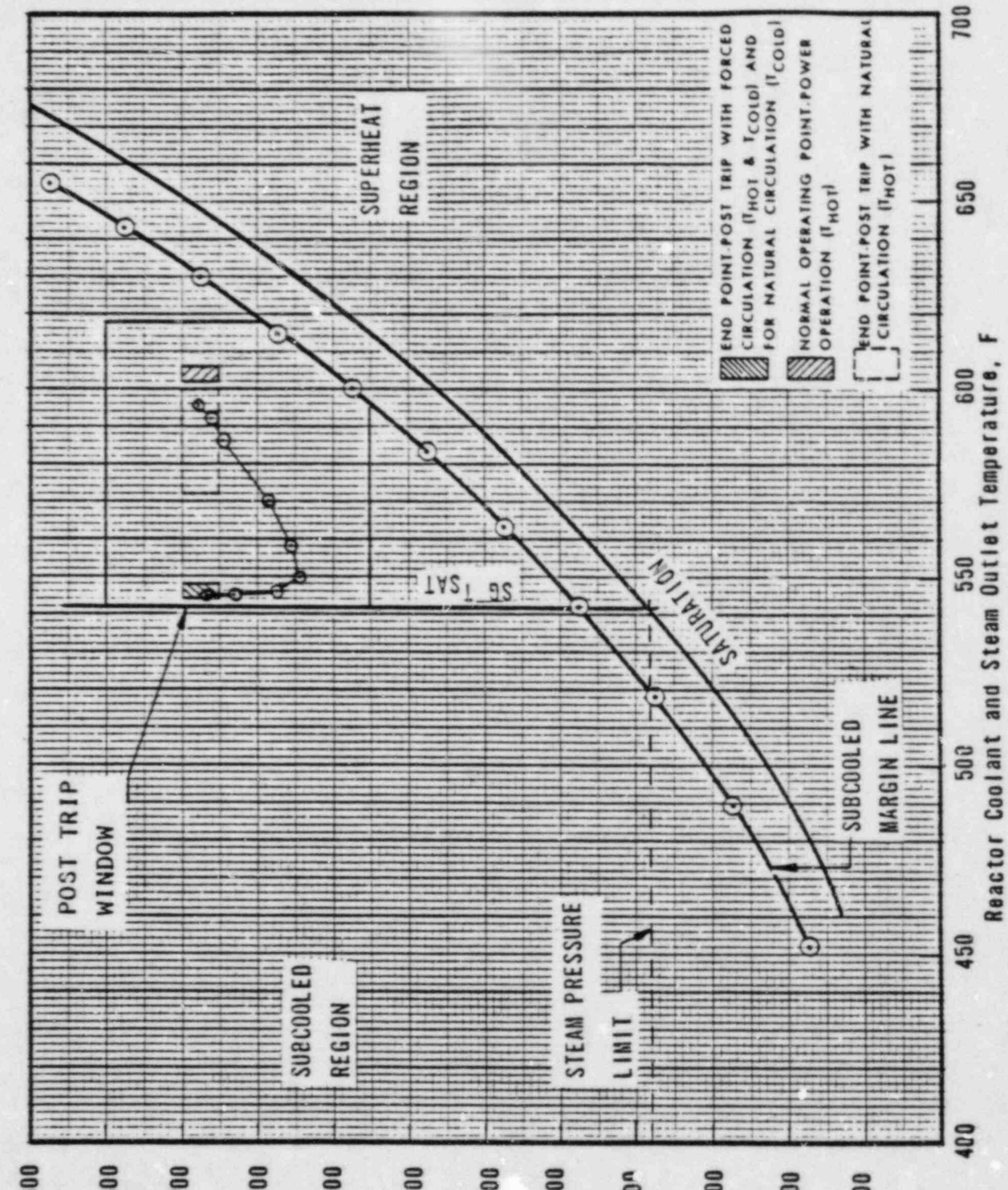
THOT VS PRESSURE FIGURE 2



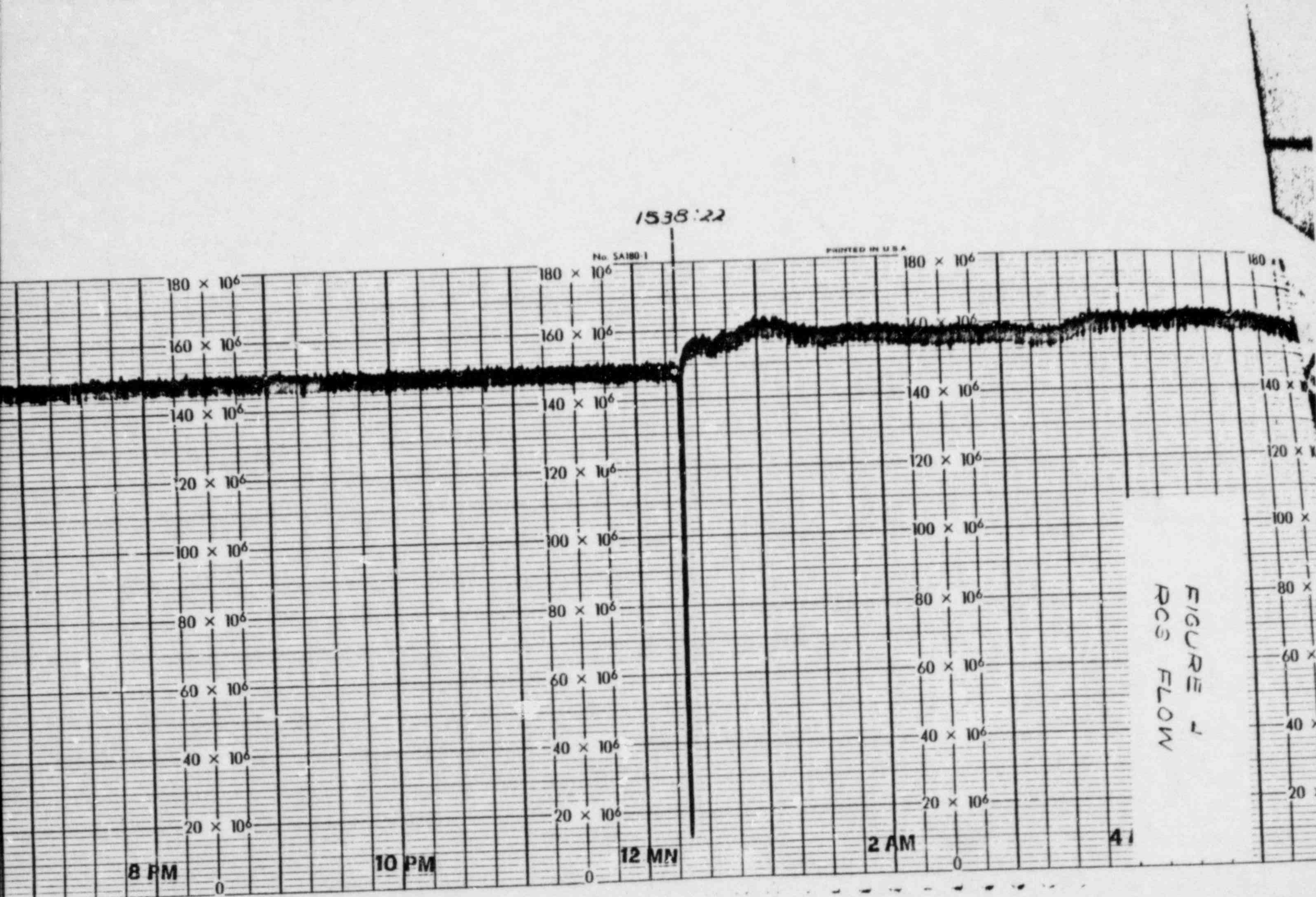
RANCHO SECO
AUG 7, 1981
RCS LOOP B

THOT VS PRESSURE

FIGURE 3



FR 21027
8-7-81
TOTAL RCS FLOW



LR [illegible]03
PRESSURIZER LEVEL
8-7-81

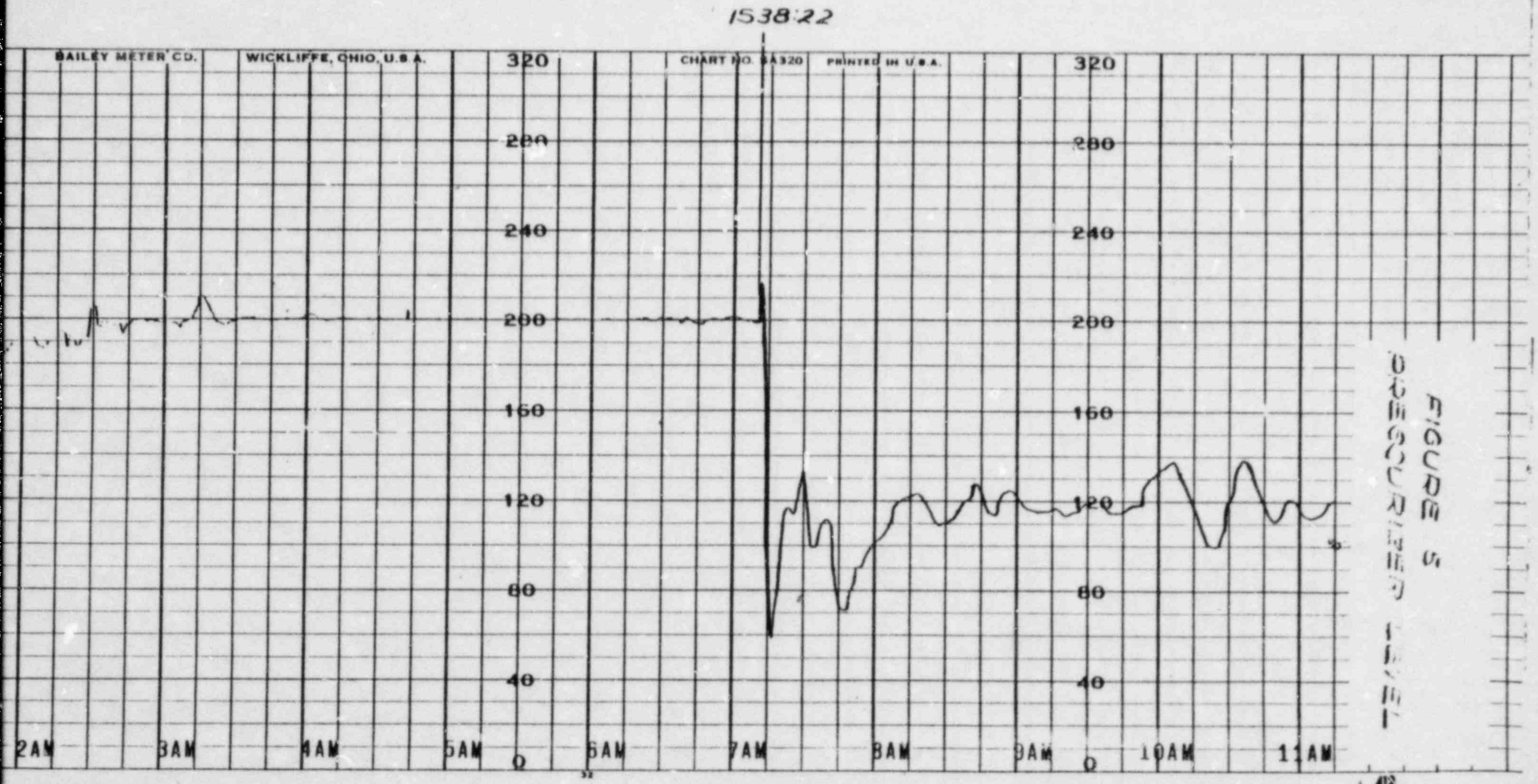


FIGURE 5
PRESSURIZER LEVEL

FIGURE 6
RCS LOOP A PRESSURE VS TIME

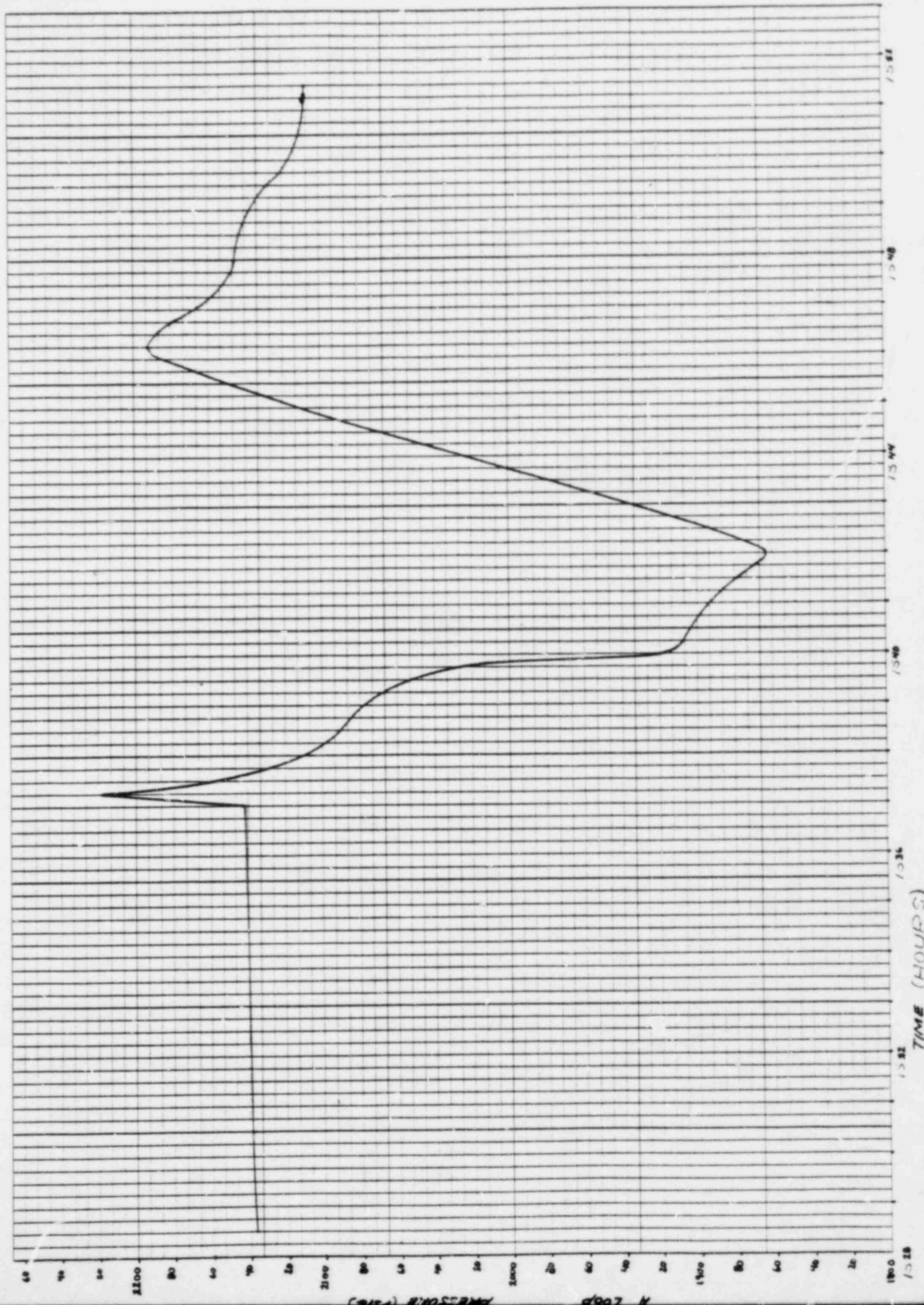


FIGURE 7

RCS LOOP B HOT LEG TEMP VS. TIME

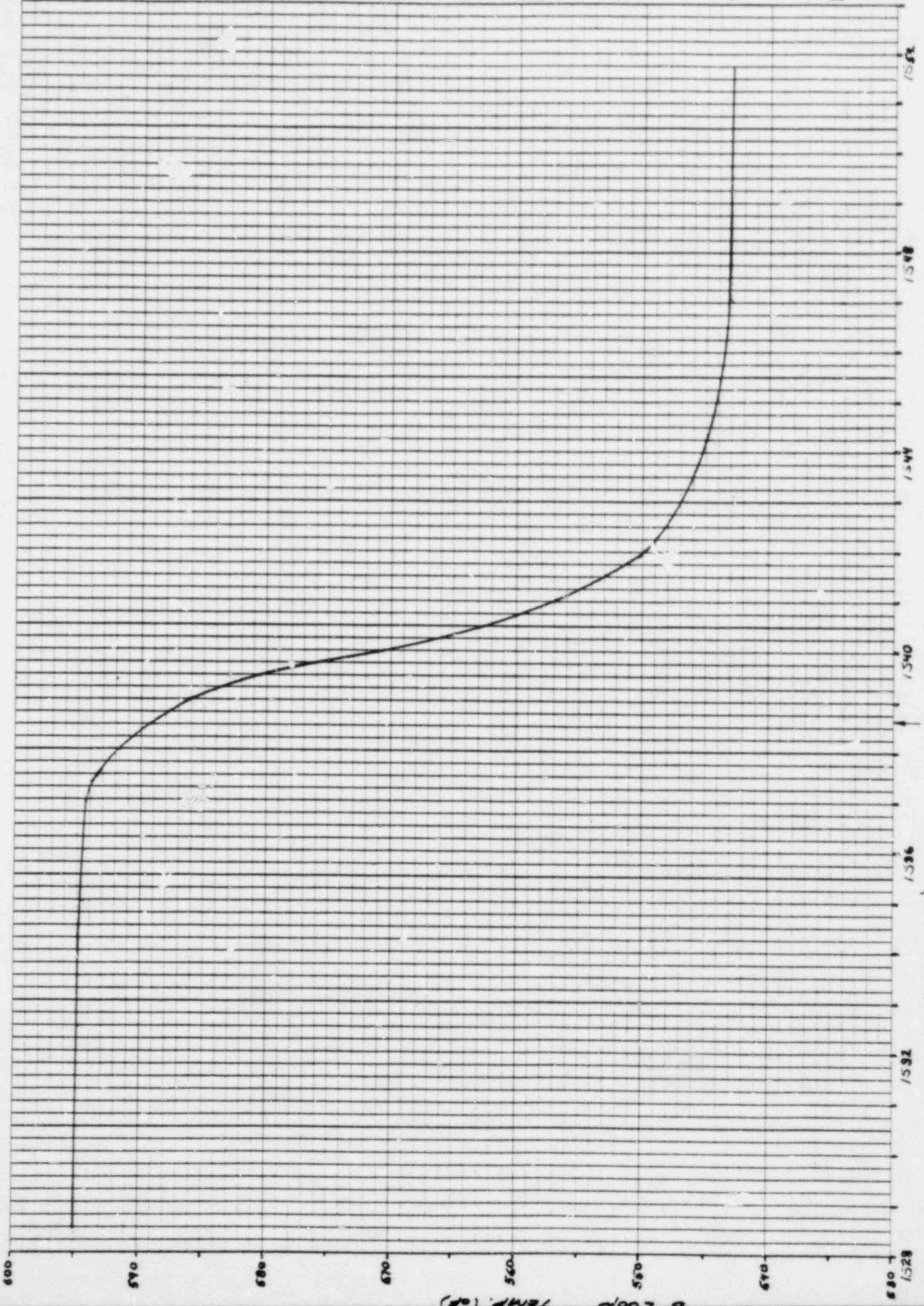


FIGURE 8

RCS LOOP A HOT LEG TEMP VS TIME

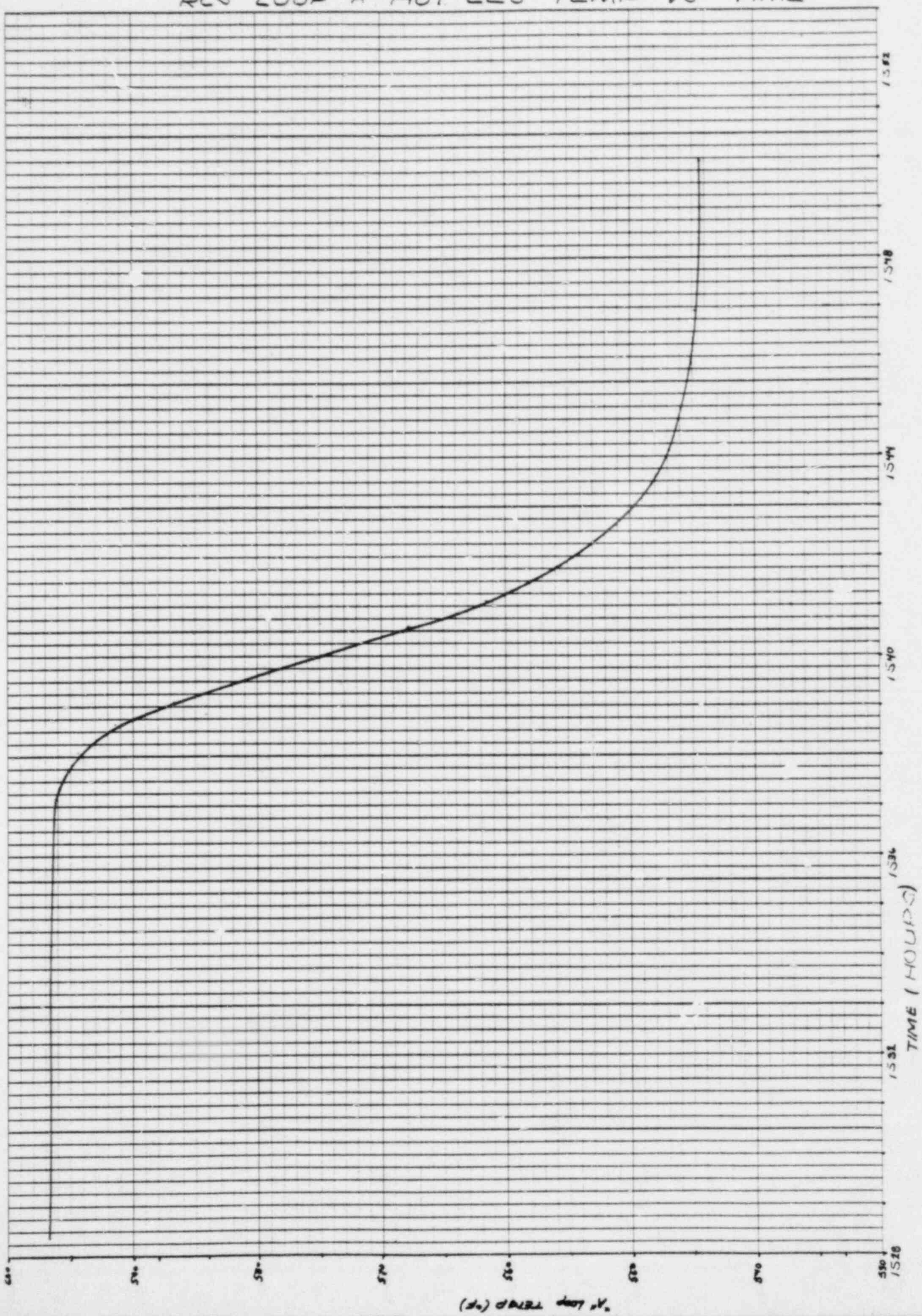


FIGURE 9

RCS LOOP B PRESSURE VS TIME

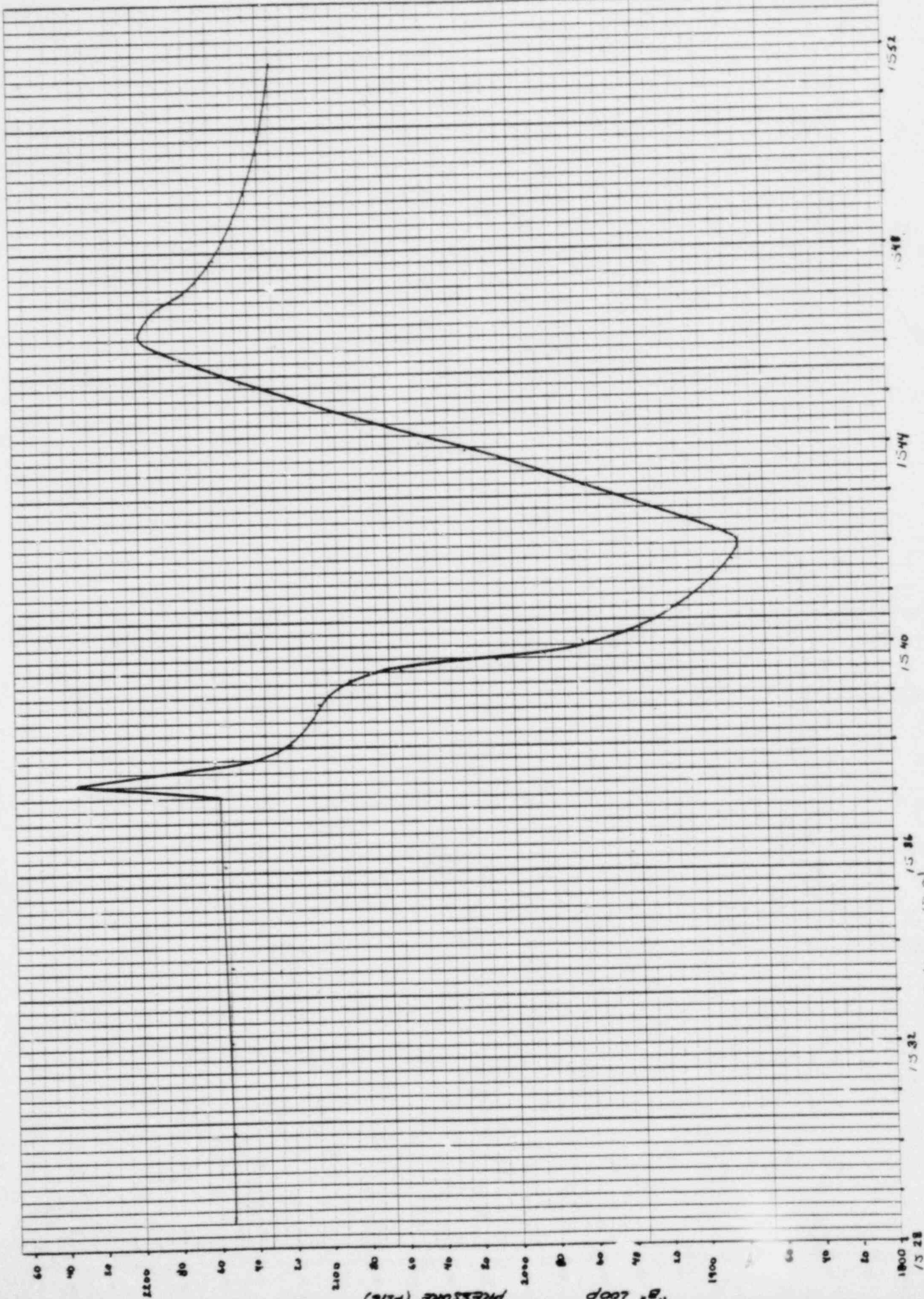


FIGURE 10

RCS LOOP A LEG A COLD LEG TEMPERATURE

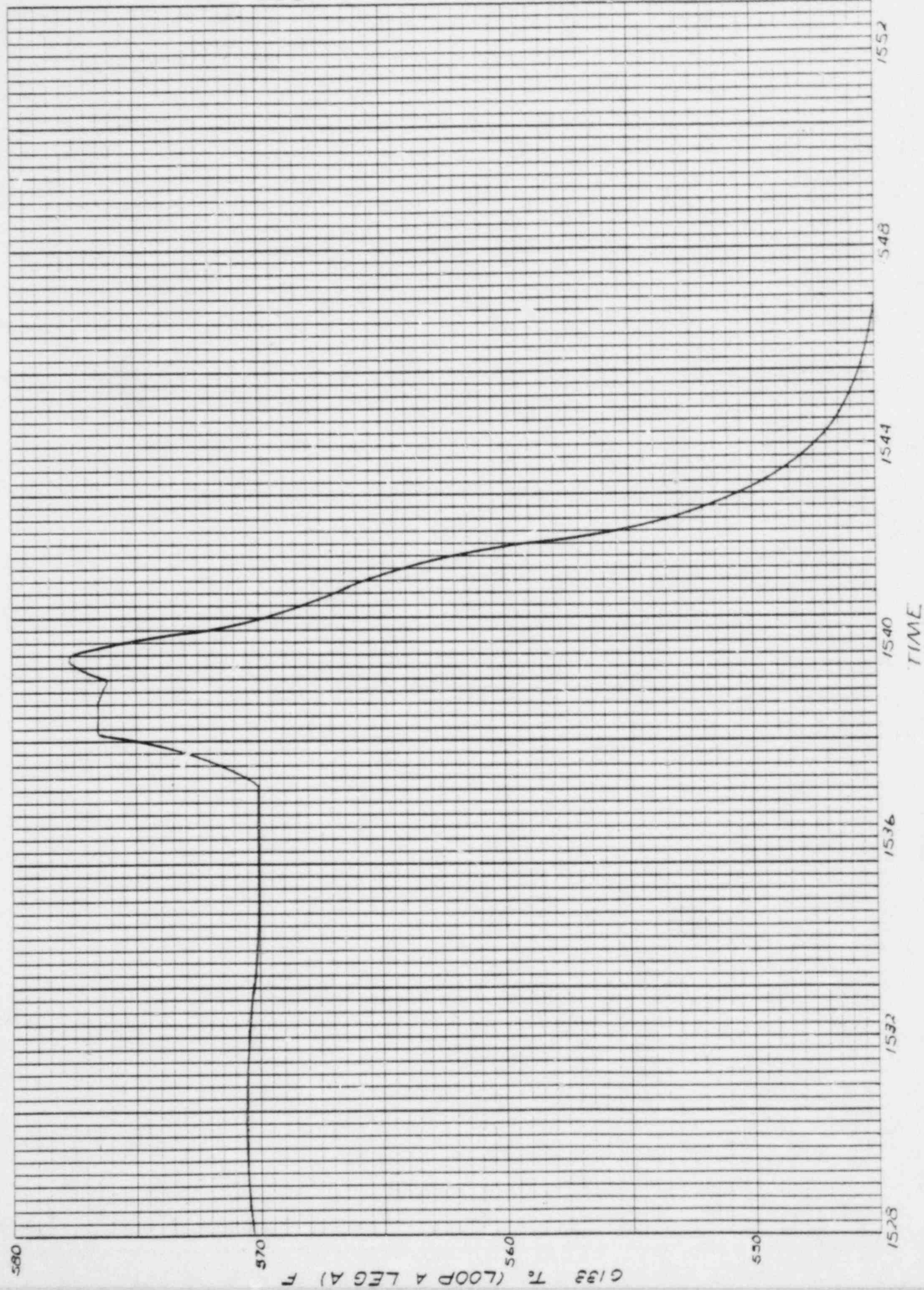


FIGURE 11

RCS LOOP A LEG B COLD LEG TEMPERATURE

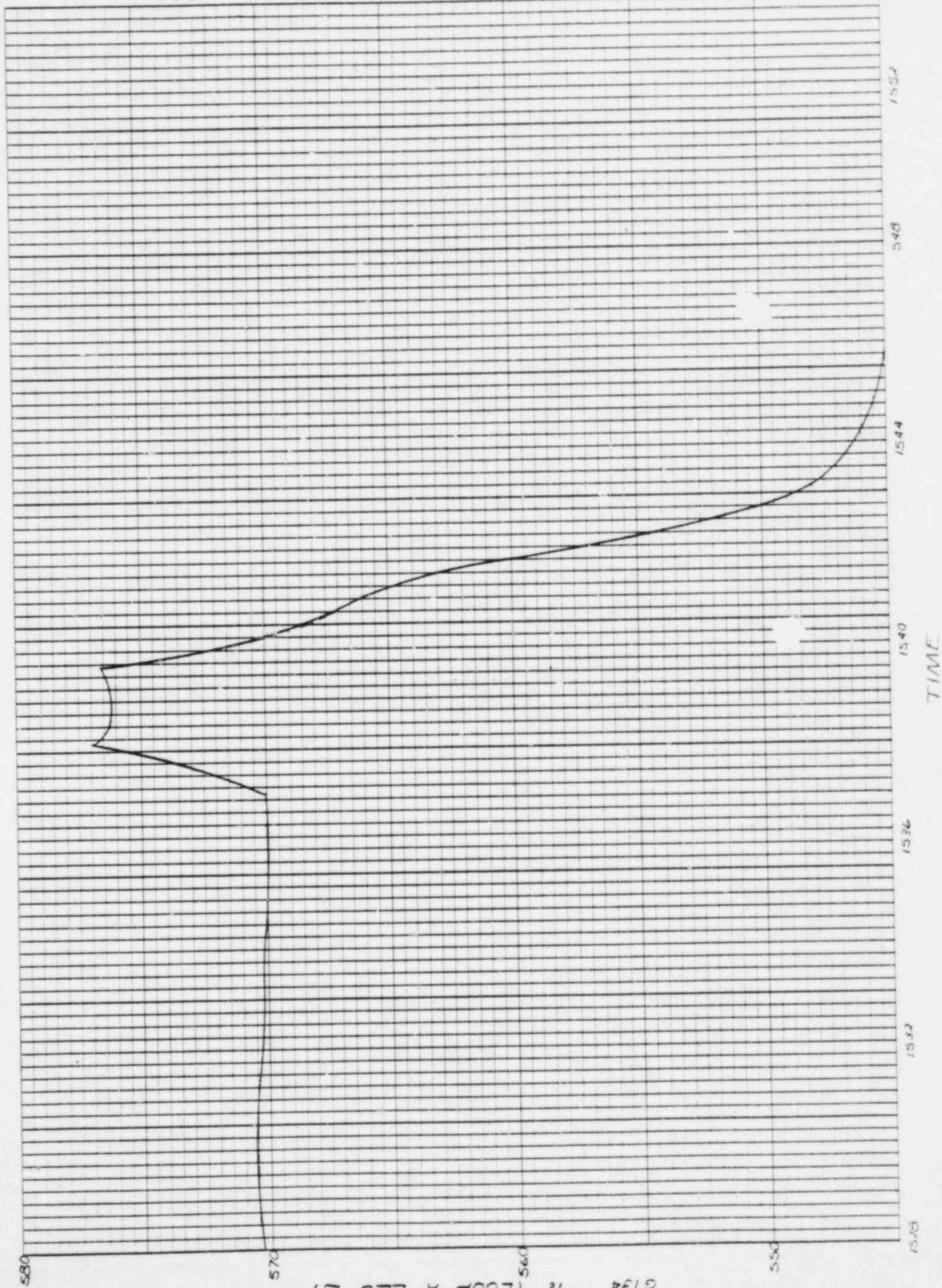


FIGURE 12

RCS LOOP B LEG C COLD LEG TEMPERATURE

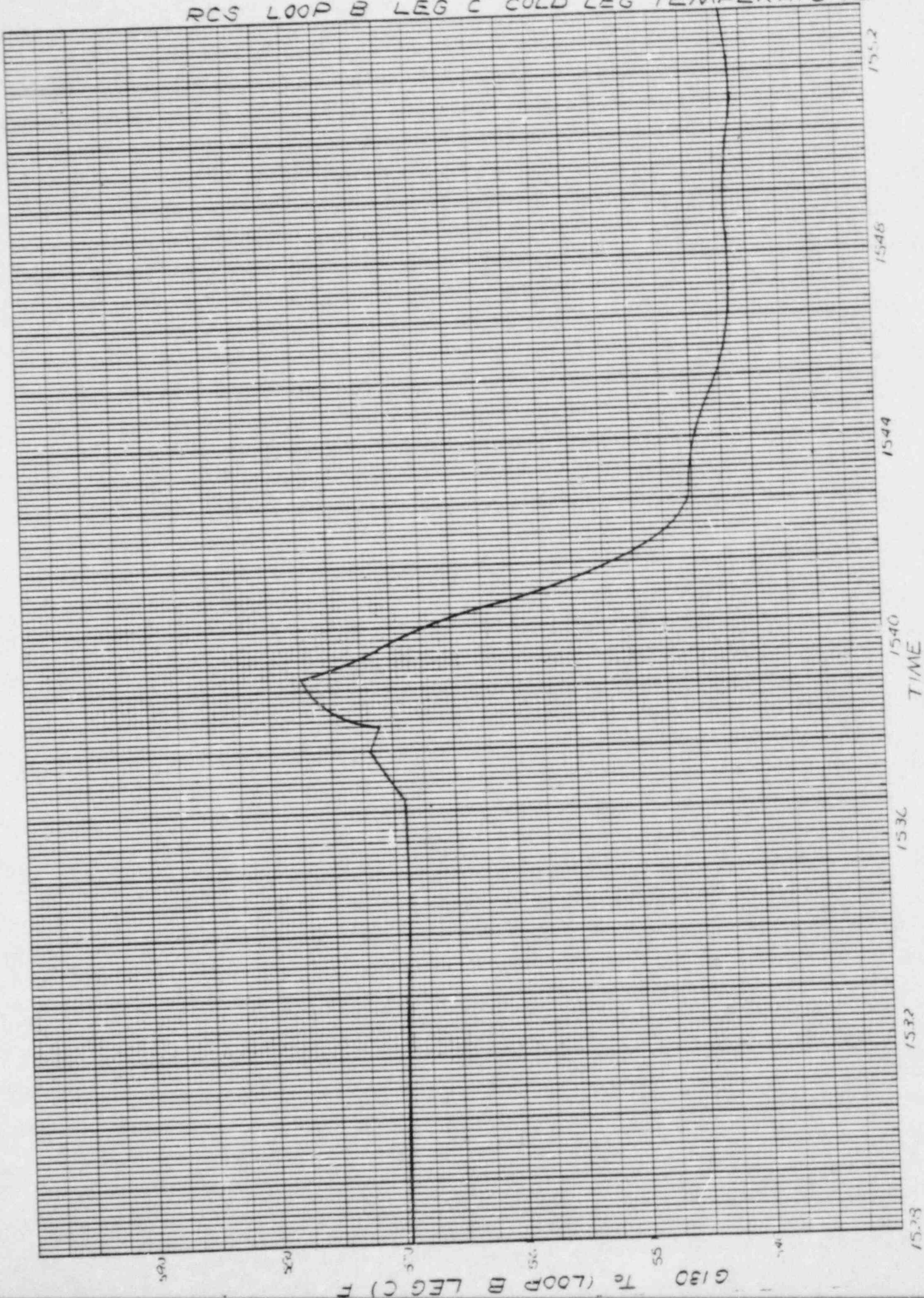


FIGURE 13

RCS LOOP B LEG D COLD LEG TEMPERATURE

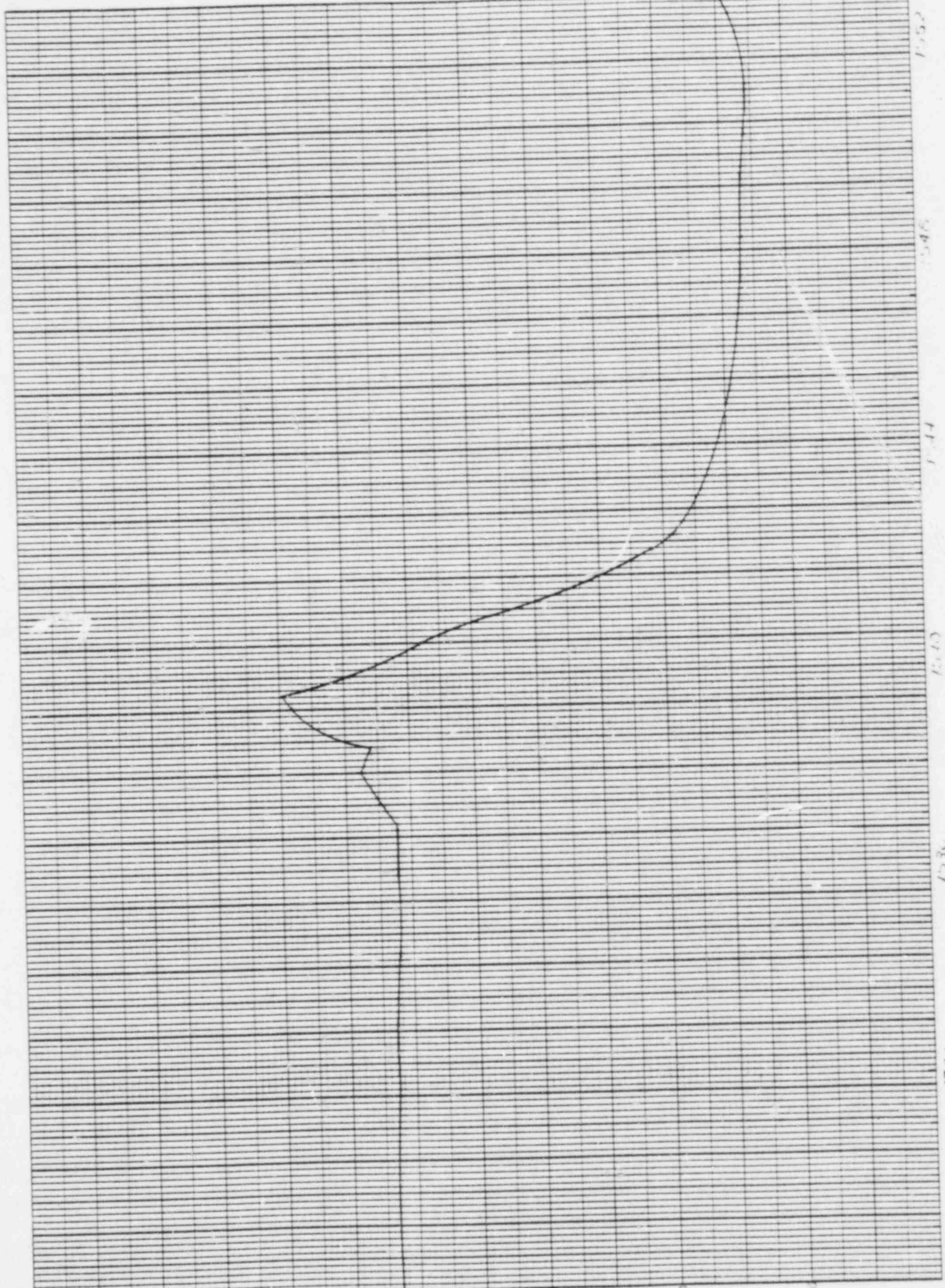


FIGURE 14

RCS LOOP A HOT/COLD LEG (A) TEMPERATURE DIFFERENCE

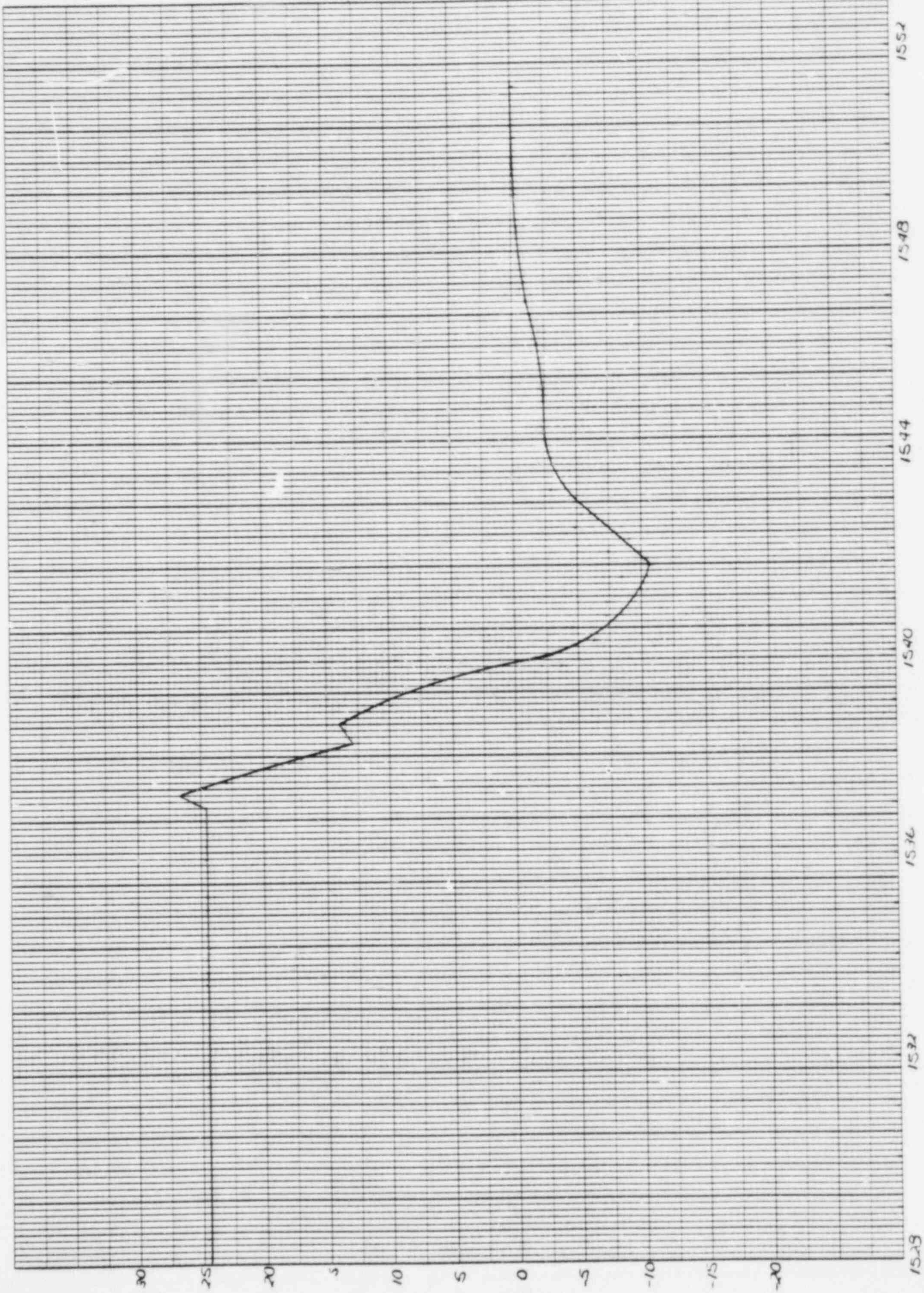


FIGURE 15

RCS LOOP A HOT/COLD LEG (B) TEMPERATURE DIFFERENCE

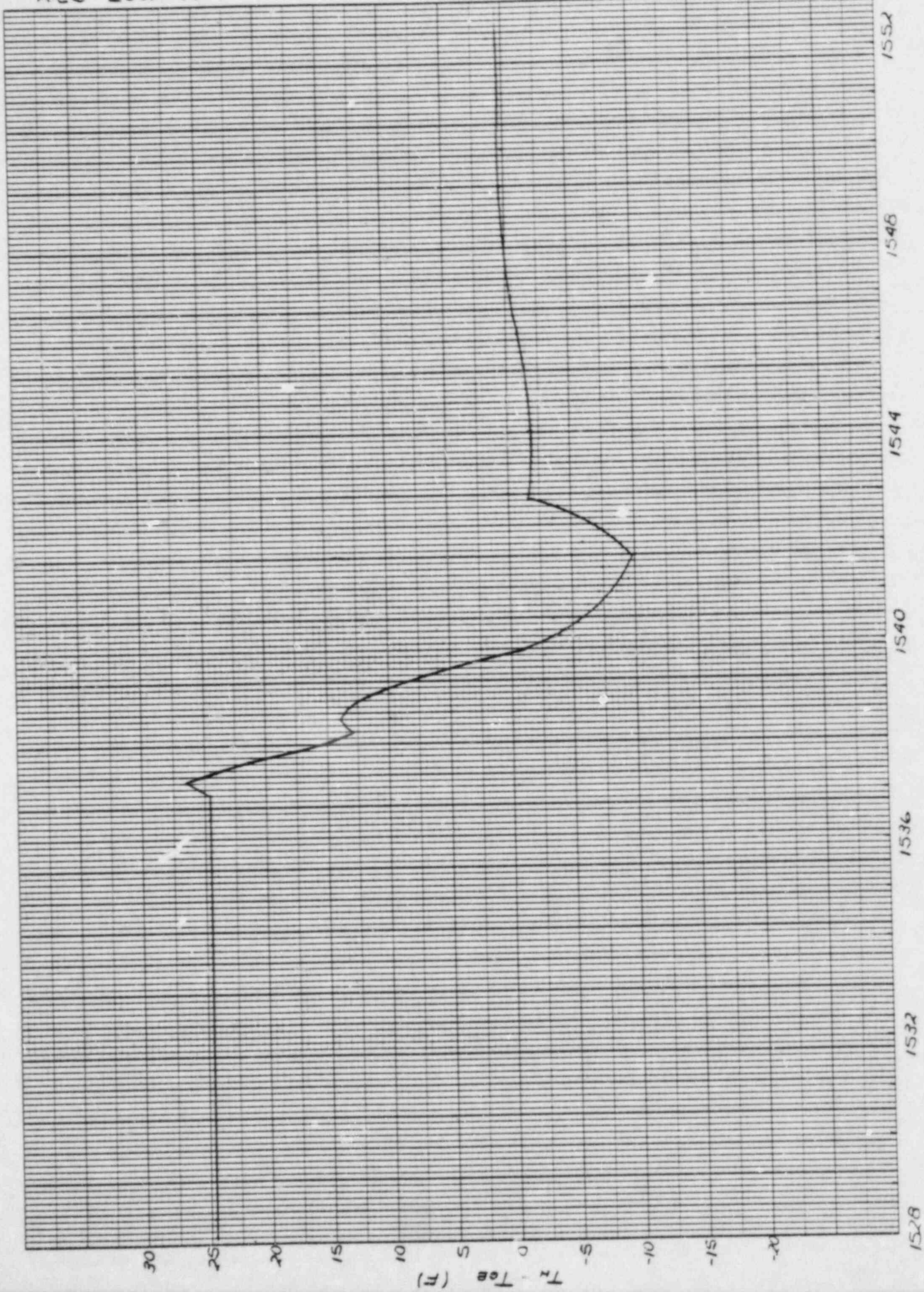


FIGURE 16

RCS LOOP B HOT/COLD LEG (C) TEMPERATURE DIFFERENCE

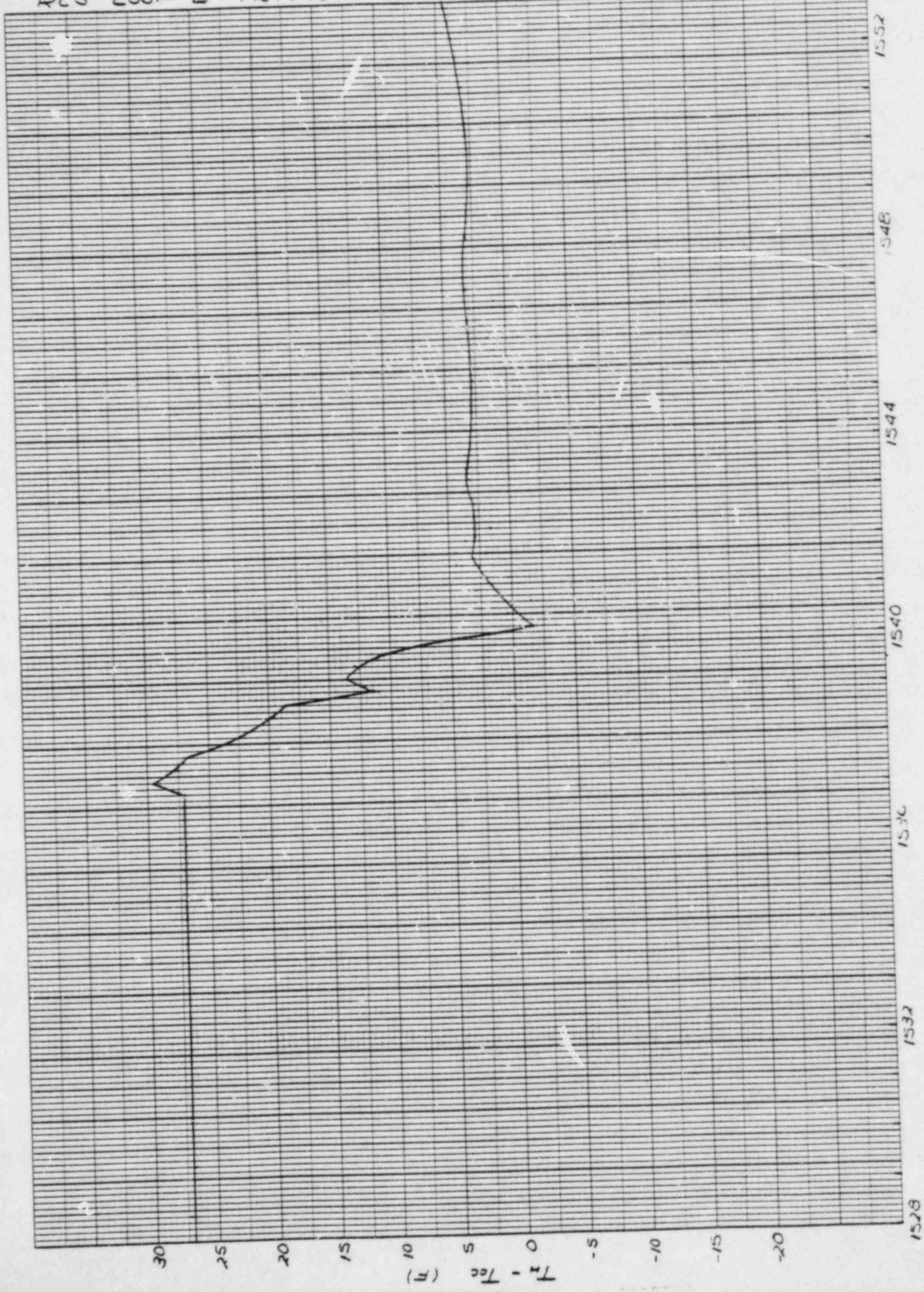


FIGURE 17

RCS LOOP B HOT/COLD LEG (D) TEMPERATURE DIFFERENC

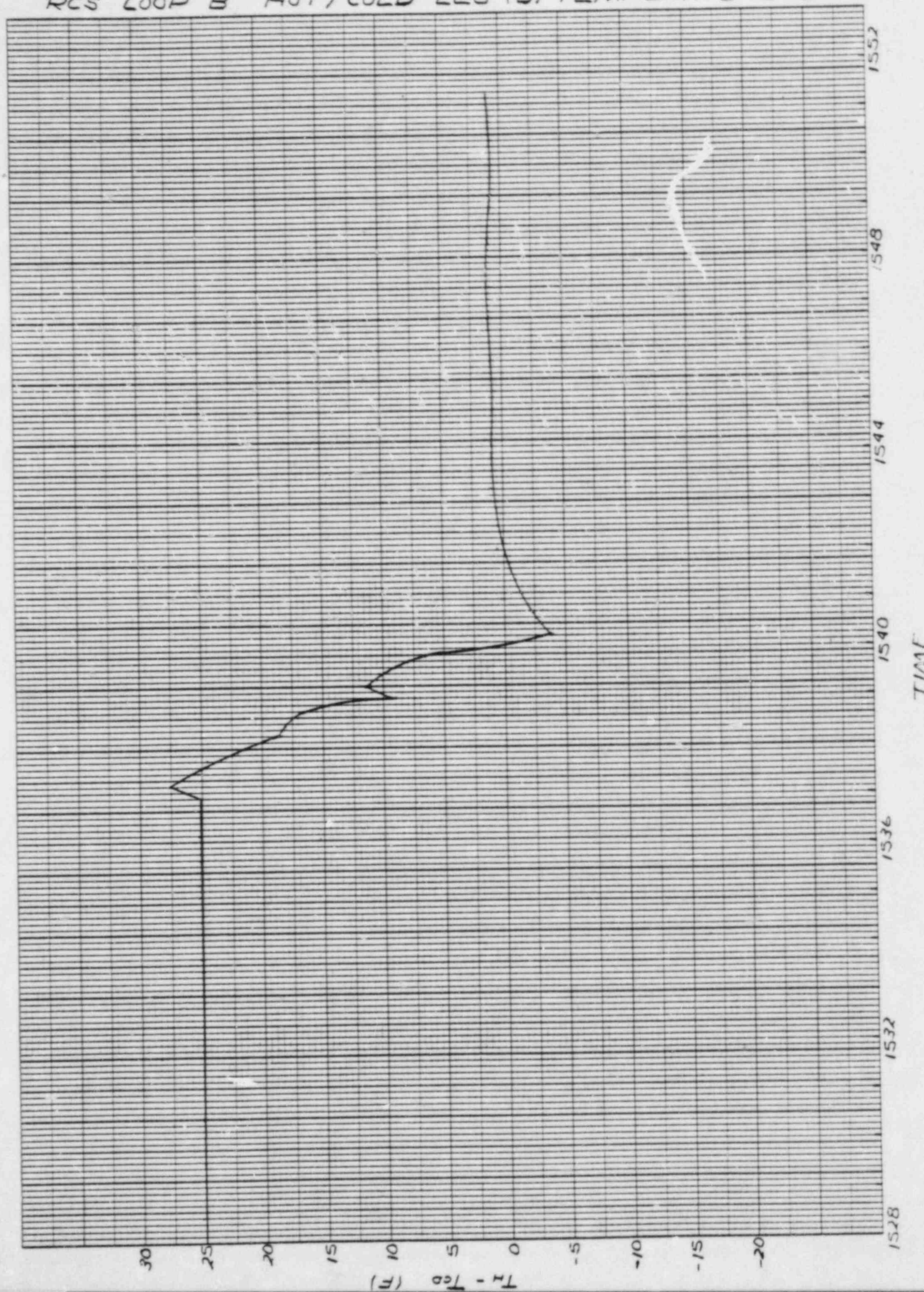


FIGURE 18

A-OTSG OUTLET PRESSURE

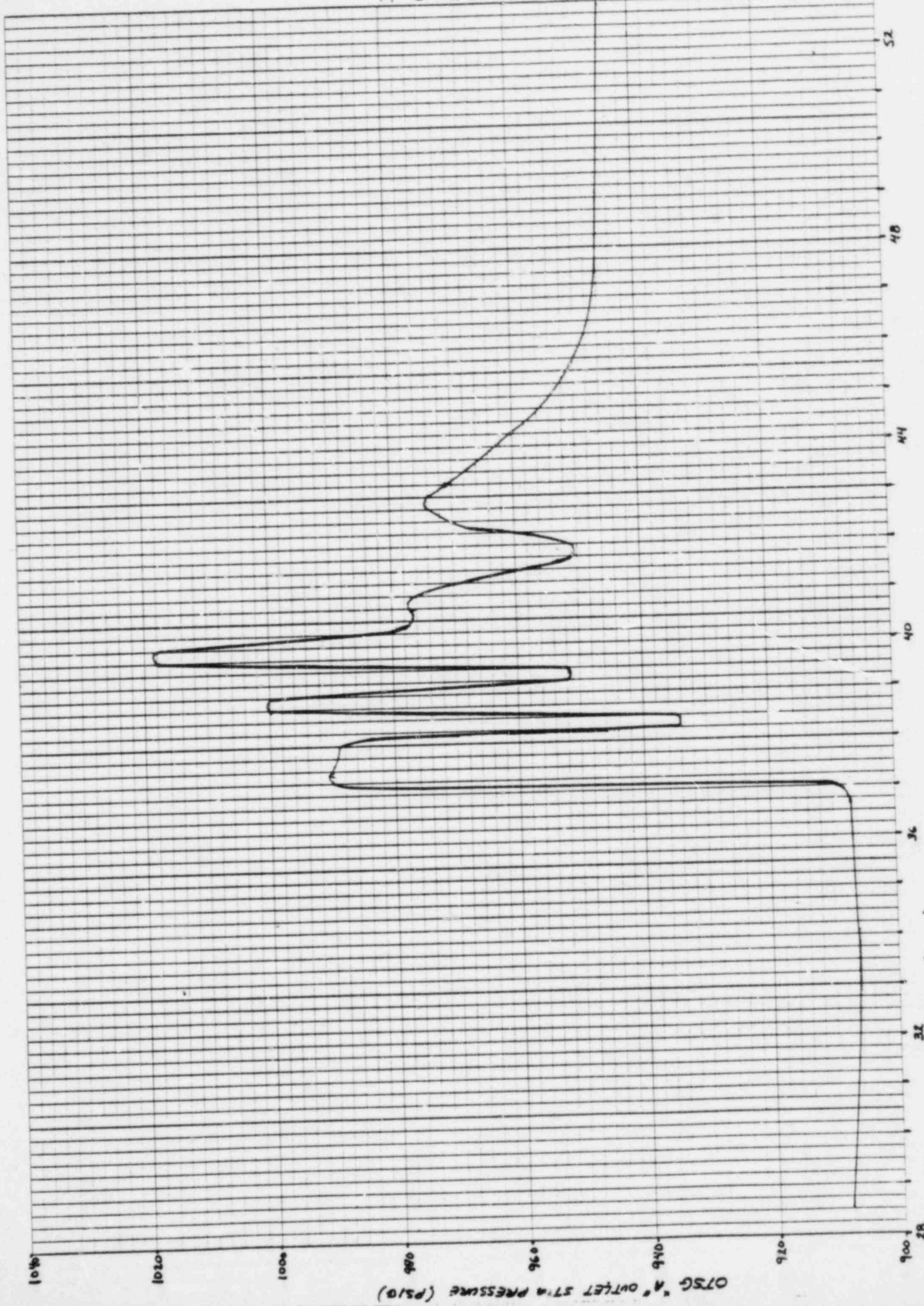


FIGURE 19
B-OTSG OUTLET PRESSURE

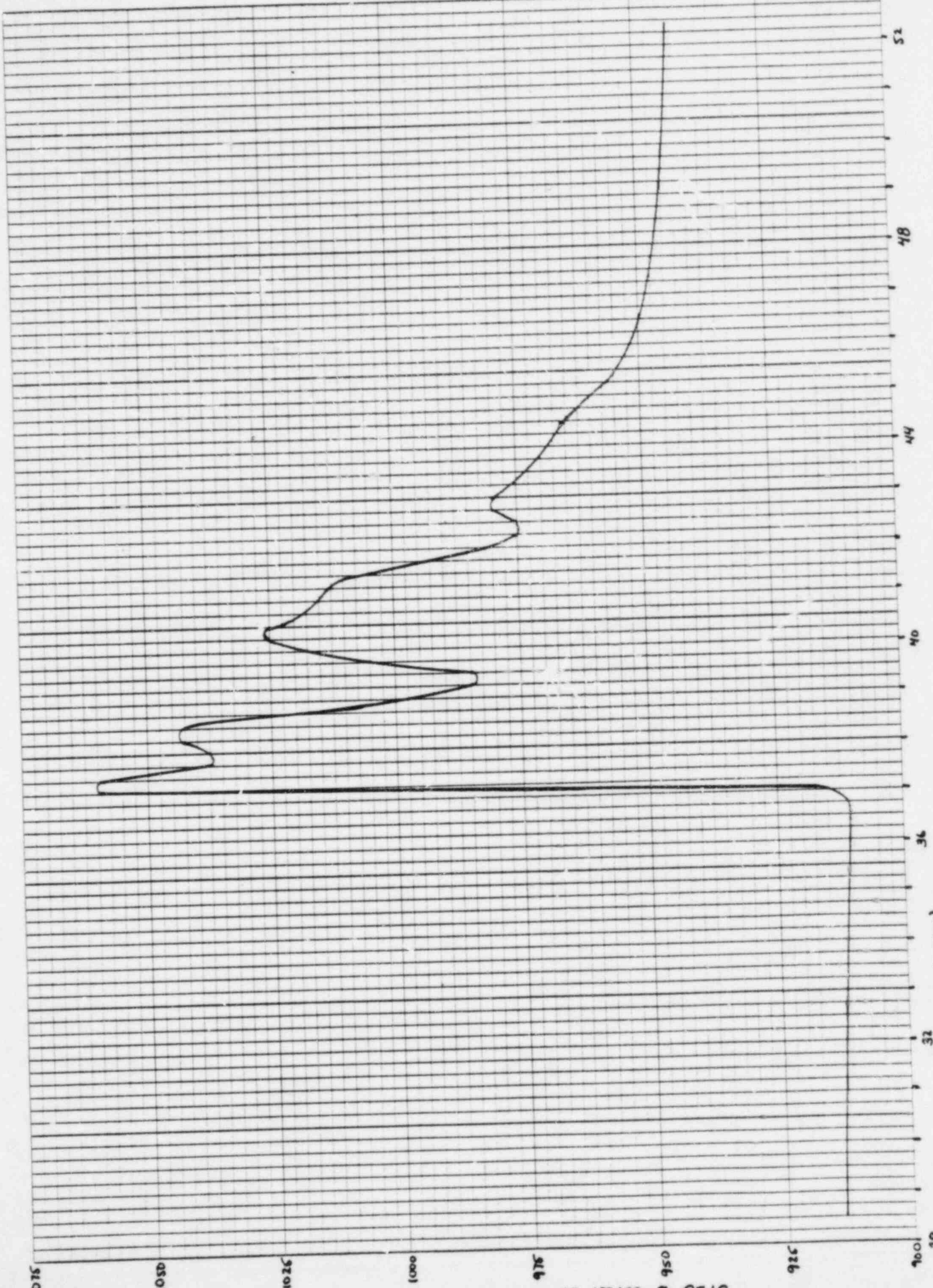


FIGURE 20
A MAIN FEEGWATER FLOW

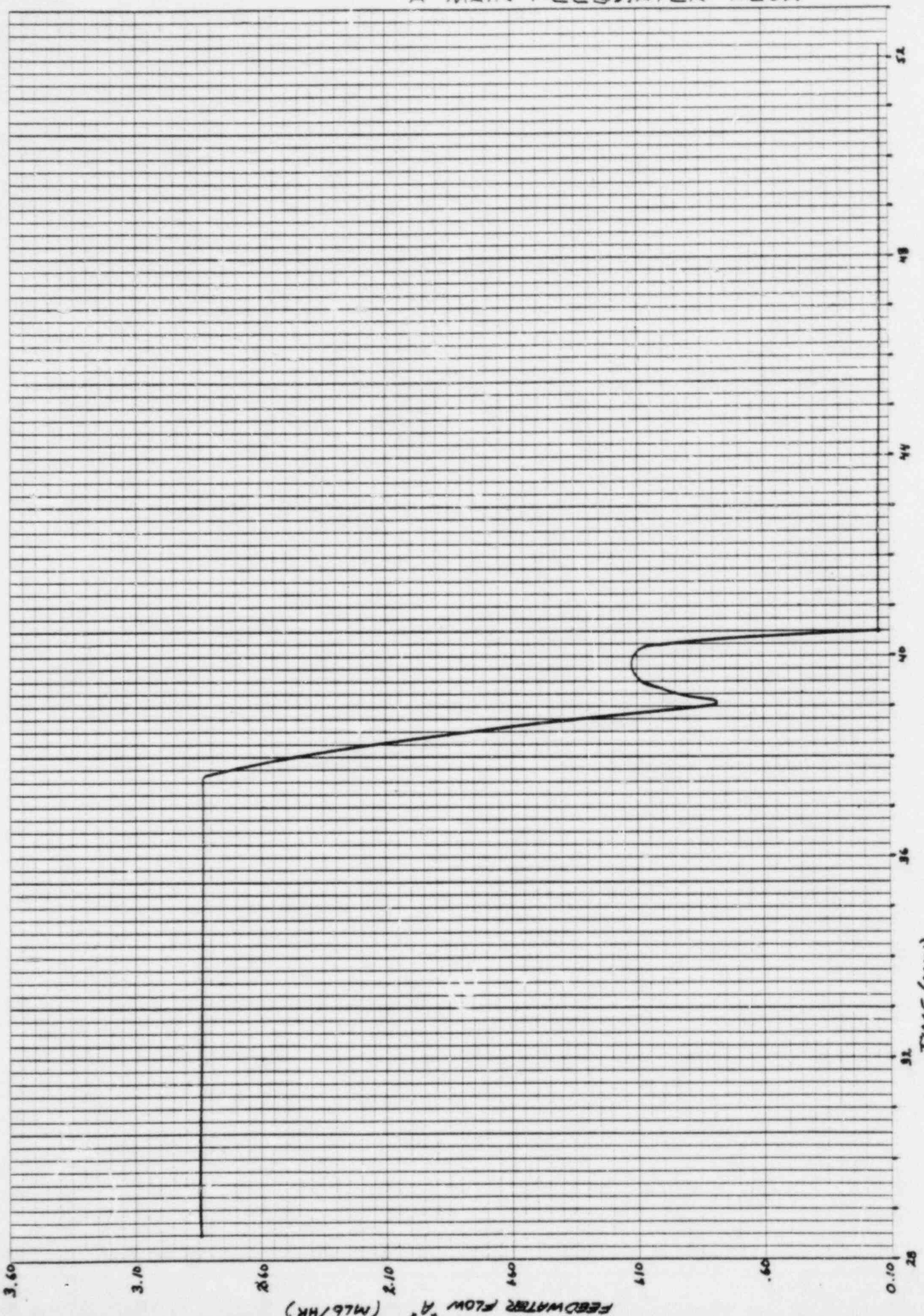
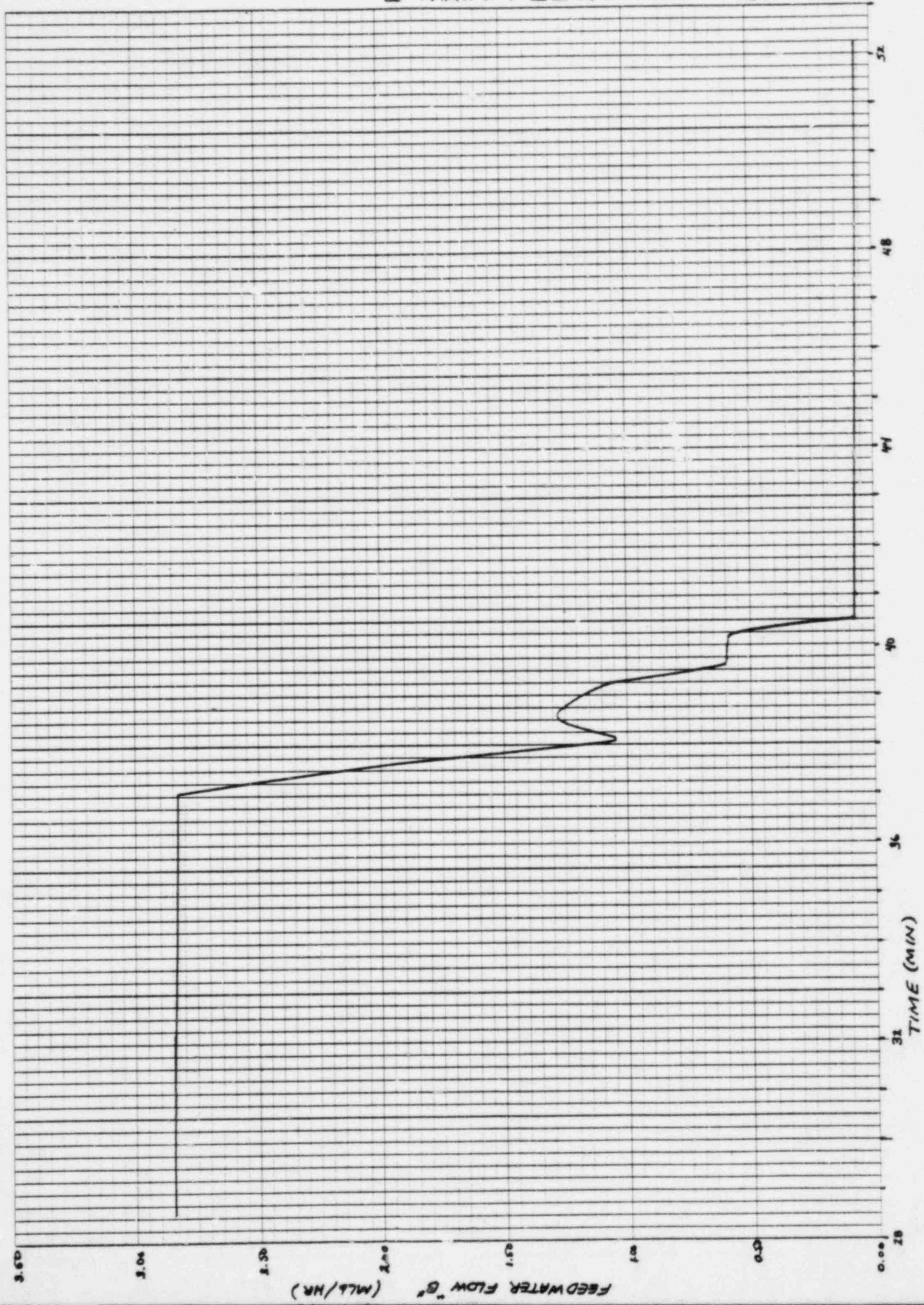


FIGURE 21

B MAIN FEEDWATER FLOW



OTSG A LEVEL (% OPERATING RANGE)

8-7-81

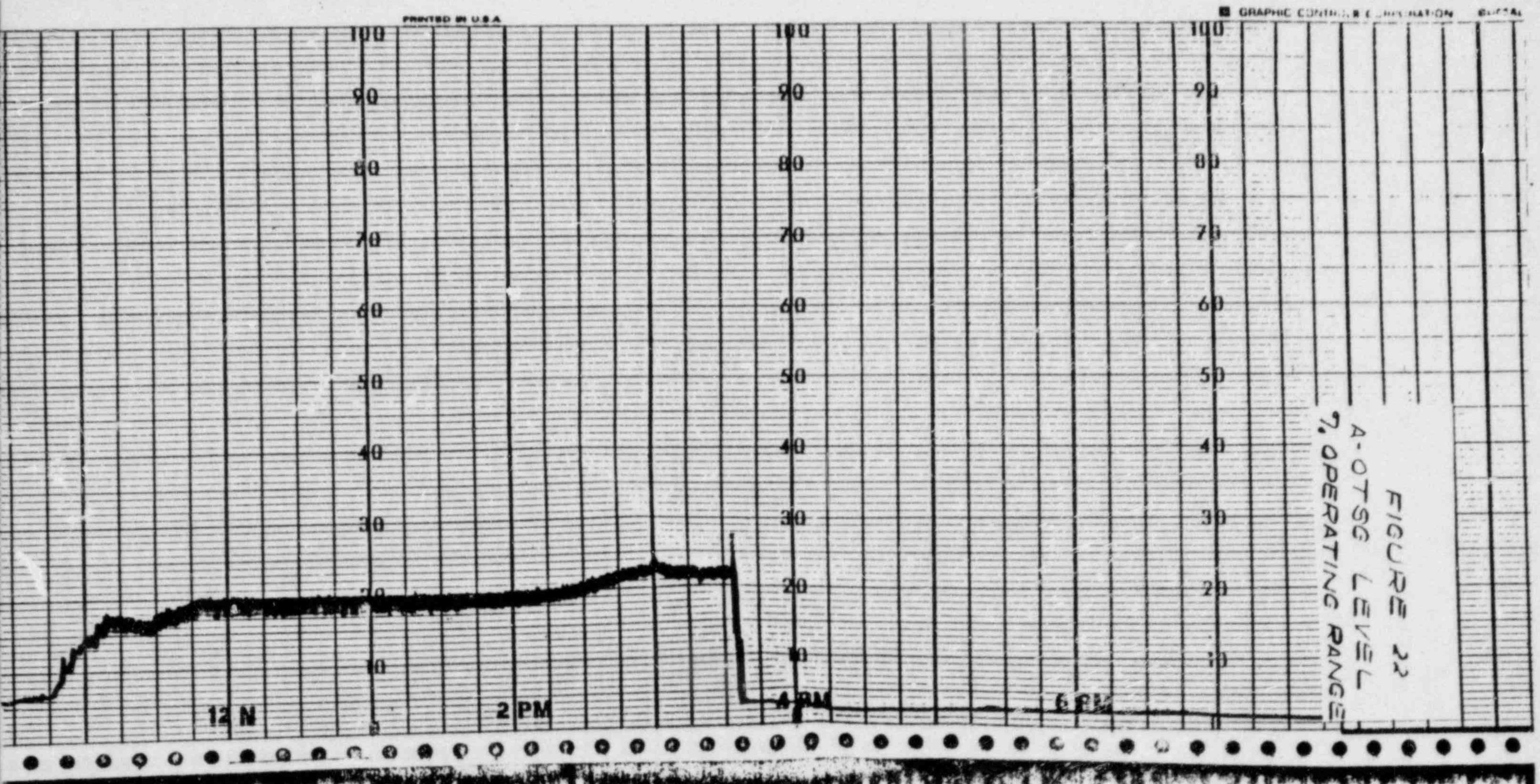


FIGURE 22
A-OTSG LEVEL
% OPERATING RANGE

OTSG B LEVEL (% OPERATING RANGE)
8-7-81

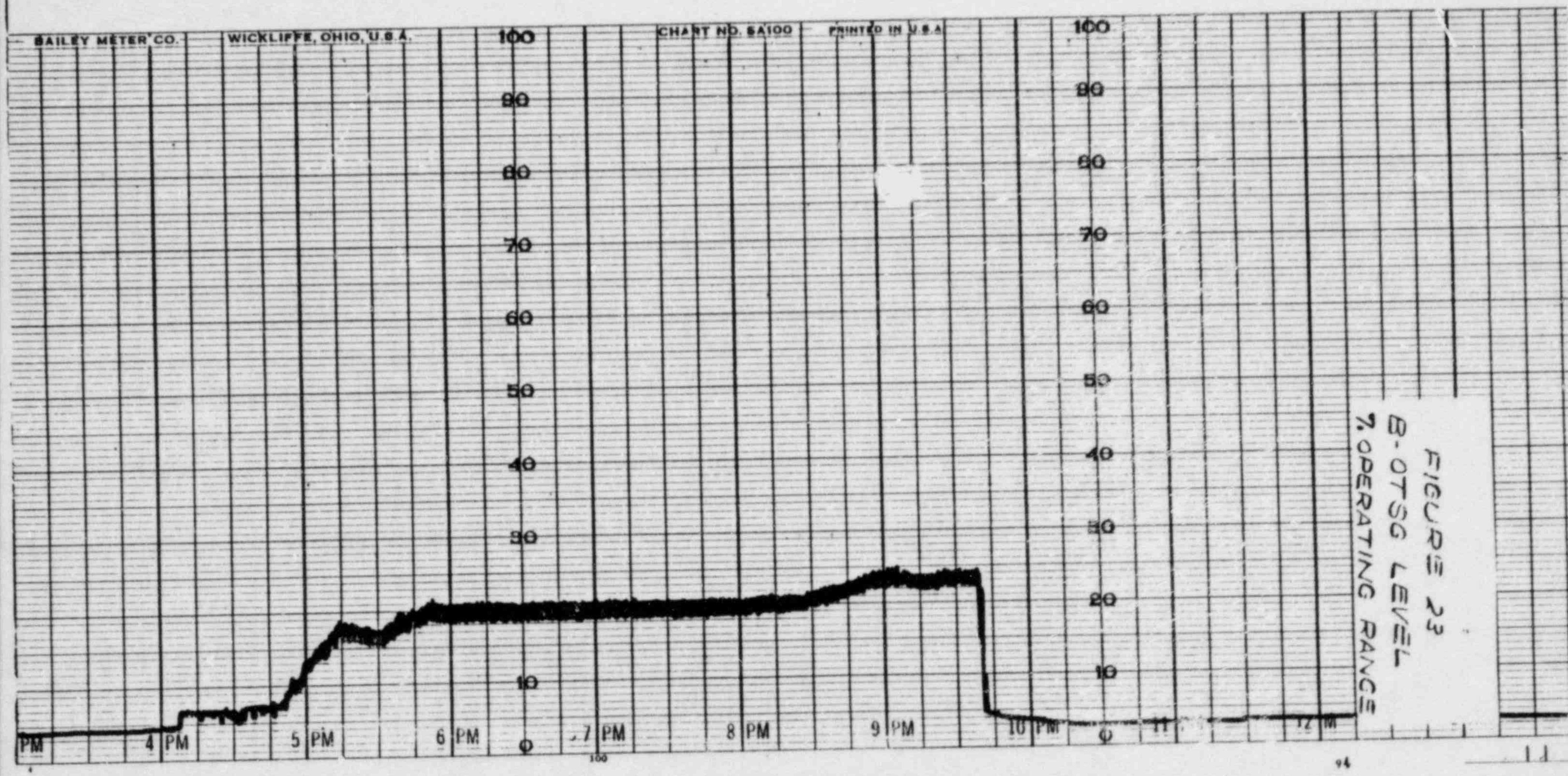


FIGURE 23
B-OTSG LEVEL
% OPERATING RANGE