ARKANSAS POWER & LIGHT COMPANY
POST OFFICE BOX 551 LITTLE ROCK, ARKANSAS 72203 (501) 371-4000

August 1, 1984

2CANØ884Ø1

Director of Nuclear Reactor Regulation
ATTN: Mr. James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Summary of Meeting of July 12, 1984,
in Bethesda, Maryland, Regarding the
ANO-2 Inadequate Core Cooling Instrument Installation

Gentlemen:

The meeting of July 12, 1984, was held to discuss the current status of the ANO Unit 2 project to install instrumentation for monitoring inadequate core cooling (ICC). AP&L presented to the NRC staff the project schedule adjustments required for installation during the fourth refueling outage (2R4), a summary of progress to date, and preliminary results of the confirmatory test program. A list of the persons attending and copy of the presentation transparencies are included as attachments 1 and 2, respectively, to this letter.

A review of project progress from the original NRC order to the present was discussed first. The review included discussion of the confirmatory test program which was executed to demonstrate the effectiveness of the ICC system. It was noted that the tests were completed in June 1984 and that the final test report would be provided for NRC review by early August 1984. Also, pertinent to the second item of the presentation, the discussion noted that:

a. The ANO-2 ICC system detailed design phase was initiated and the project plan developed in June 1984;

b. materials with long lead times have been ordered;

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c. the locations for the in-core sensor lines, and the number and placement of sensors have been selected; and

d. preliminary interface drawings have been received.

A review of the original schedule, proposed in the AP&L letter dated April 15, 1983, (2CAN048306), as compared to the current schedule was the second item of discussion. It was illustrated that the project has to date held to the original schedule, an area of concern previously expressed by the NRC. Also, it was explained with illustration (see Milestone Schedule, Fig. A-3 of Attachment 2), that all adjustments to the schedule have affected only that portion of the project after June 1984. The cause for the adjustments has been earlier than originally expected occurrence of 2R4. The affect of the adjustments is to set various portions of the project in parallel with the required NRC reviews. The length of the original schedule allowed holds on certain activities during the NRC review cycles for the test results and final design reports. This change from serial to parallel reviews does not affect or circumvent required NRC approvals. AP&L explained how it plans to continue the project in parallel with its effort to obtain the required NRC approvals for the ANO-2 ICC system. Clarification was made to explain that 2R4 could not occur sooner than planned by the current schedule (February 2, 1985).

The final item of discussion was a review of preliminary results from the ICC instrument confirmatory test program. The three phases and the objectives of each phase were outlined. The review concentrated on sample results of the second and third phases for above and in-core instrumentation respectively. The types of sensors, variations in sensor design, and models in which the sensors were tested were briefly described. The capability of the sensor to accurately detect loss of coolant inventory and reflood were illustrated and some discussion of optimum sensor design was provided.

During the course of the meeting, it was indicated that Oak Ridge National Labs (ORNL) would likely not be used by the NRC for review of the AP&L ICC system. The concern seemed to be that ORNL personnel might not be in position to conduct an objective review given that testing of the AP&L ICC system was conducted at ORNL.

We wish to make it clear that, with the exception of use of some ORNL Technicians to physically run certain equipment, the testing was conducted completely independent of ORNL personnel. The facilities were leased by AP&L (or TEC), and all data collected and analyzed by AP&L (or TEC) without ORNL personnel involvement.

As other ICC systems have been reviewed by ORNL, we believe that use of those personnel (by NRC) to conduct the AP&L review would likely result in the most efficient and thorough review based on their previous experience. We further believe that our testing program was conducted (purposely) in such a way that ORNL independence or objectivity is not jeopardized.

As indicated during the meeting, AP&L (and TEC) will be happy to meet with the staff following submittal (in August) of the final test report.

Very truly yours,

John R. Marshall
Manager, Licensing

JRM/JM/ac

Attachments

ATTACHMENT 1

Attendees of AP&L/NRC Meeting on July 12, 1984
Regarding Inadequate Core Cooling Instrumentation
Phillips Building, Bethesda, Maryland

NRC

L. Phillips
L. Lambrose
R. Lee
G. Schwenk

AP&L

R. Rothwell
R. Oakley
T. Enos
A. Cox
J. Melito

TEC

D. Bell
R. Hedrick
G. Pannell

SCAN POWER

J. Waring
R. Smith

ATTACHMENT 2

ARKANSAS NUCLEAR ONE

UNIT 2

INADEQUATE CORE COOLING SYSTEM

STATUS REPORT

TO

U.S. NUCLEAR REGULATORY COMMISSION

BY

ARKANSAS POWER AND LIGHT COMPANY

TECHNOLOGY FOR ENERGY CORPORATION

JULY 12, 1984

AGENDA

ANO-2 ICC STATUS MEETING

JULY 12, 1984

P-114

BETHESDA, MARYLAND

1:30	-	Introduction	T. Enos - AP&L
	-	Progress Summary	R. Oakley - AP&L
	-	CPM Scheduling NRC Review	T. Enos - AP&L
	-	Overview of Preliminary Test Results	R. Hedrick - TEC
3:30	-	Adjourn	

PURPOSE OF MEETING

- UPDATE NRC ON PROGRESS AND IMPLEMENTATION SCHEDULE
- DISCUSS PRELIMINARY TEST RESULTS
- DISCUSS NRC REVIEW OF OPERATING SYSTEM

KEY MILESTONES COMPLETED

TO DATE FOR ANO-2

- o 12/82 - NRC ORDER
- o 3/83 - MEETING WITH NRC
- o 4/83 - RESPONSE TO ORDER
- o 5/83 - SUPPLEMENTAL RESPONSE
- o 8/83 - ICC PROGRAM PLAN COMPLETED
- o 9/83 - NRC SER RECEIVED
- o 9/83 - RESPONSES TO SER
- o 10/83 - CONFIRMATORY TESTING PROJECT PLAN DEVELOPED (CPM SCHEDULE FOR TESTING)
- o 10/33 - CONFIRMATORY TEST PLAN DEVELOPED TO DEFINE BASIC OBJECTIVES AND PROGRAM ELEMENTS OF THE TESTING WHICH ARE:
  - o AIR-WATER TESTING IN AIR ENTRAINMENT LOOP FACILITY AT ORNL
  - o UPPER HEAD TESTING IN FORCED CONVECTION TEST FACILITY (FCTF) AT ORNL
  - o IN-CORE TESTING IN FCTF AT ORNL CONTAINING 3X3 ARRAY OF SIMULATED FUEL RODS
- o 12/83 - SUPPLEMENTAL RESPONSE TO SER
- o 12/83 - AIR ENTRAINMENT TEST FIXTURE DESIGNED AND CONSTRUCTED
- o 1/84 - 5 PROTOTYPE RGT RODS FABRICATED FOR CONFIRMATORY TESTING

- 2/84 - FORCED CONVECTION TEST FACILITY (FCTF) REFURBISHED
- 2/84 - AIR-WATER TESTING COMPLETED
- 4/84 - UPPER HEAD TESTING COMPLETED
- 6/84 - IN-CORE TESTING COMPLETED
- - QUICK-LOOK REPORTS WITH TEST PROGRAM RESULTS AND PRELIMINARY ANALYSIS DEVELOPED FOR:
  - AIR-WATER TESTS
  - UPPER-HEAD TESTS
  - IN-CORE TESTS
- 6/84 - ANO-2 DETAILED DESIGN PHASE INITIATED
- 6/84 - ANO-2 DETAILED DESIGN PHASE PROJECT PLAN DEVELOPED
- 6/84 - PROCUREMENT OF LONG LEAD ITEMS FOR ANO-2 INITIATED
- 6/84 - ANO-2 RGT INSTRUMENT LOCATIONS SELECTED
- 6/84 - ANO-2 SENSOR LOCATIONS ON ROD SELECTED
- 7/84 - PRELIMINARY INTERFACE DRAWINGS FOR ANO-2 RECEIVED
- 7/84 - UPDATE TO NRC ON SCHEDULE

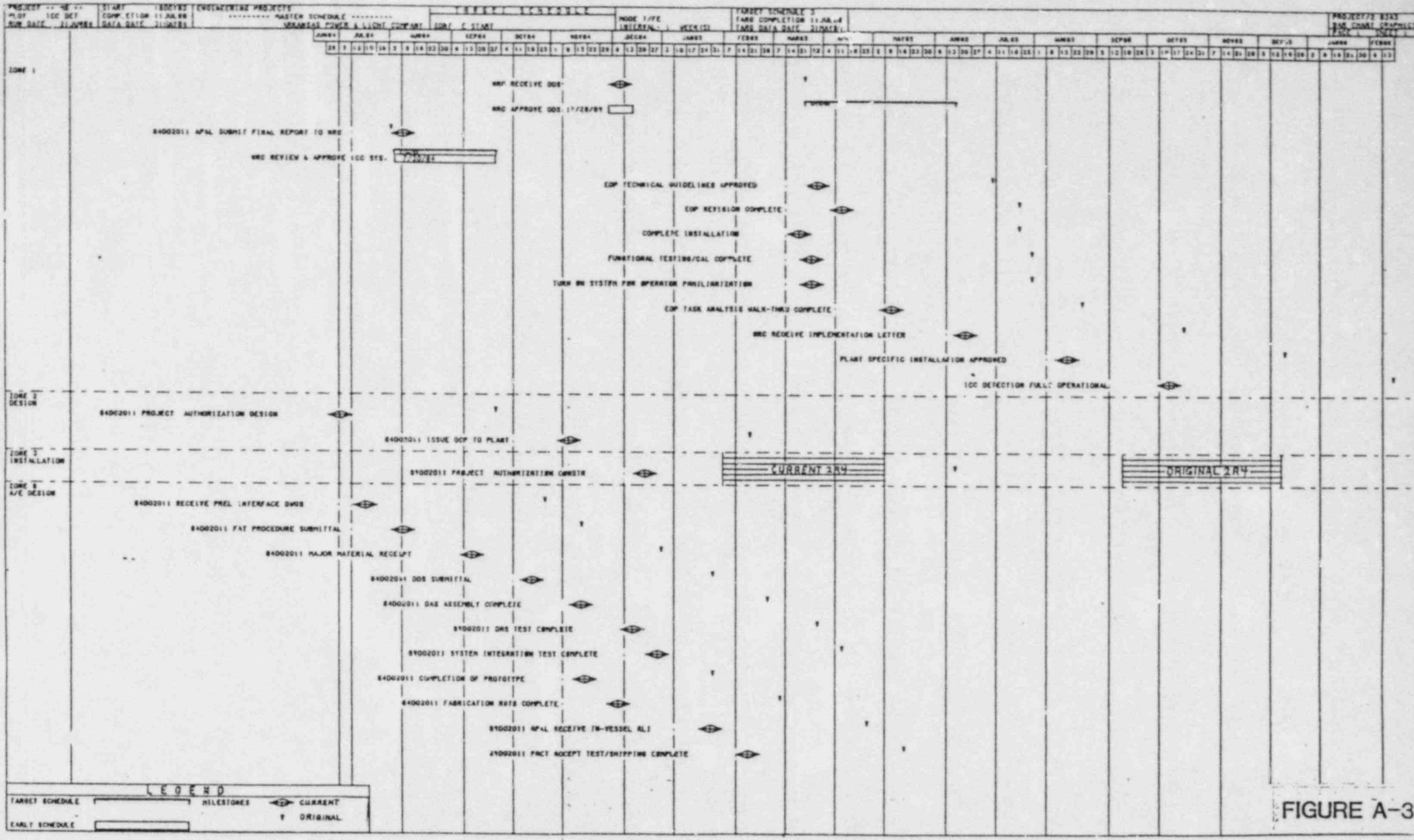

ENGINEERING PROJECTS
MASTER SCHEDULE
VERMONT POWER & LIGHT COMPANY
ZONE 1
NRC RECEIVE DDS
NRC APPROVE DDS: 1/28/89
84002011 APAL SUBMIT FINAL REPORT TO NRC
NRC REVIEW & APPROVE ICC SYS.
EOP TECHNICAL GUIDELINES APPROVED
EOP REVISION COMPLETE
COMPLETE INSTALLATION
FUNCTIONAL TESTING/CAL COMPLETE
TURN ON SYSTEM FOR OPERATOR FAMILIARIZATION
EOP TASK ANALYSIS WALK-THRU COMPLETE
NRC RECEIVE IMPLEMENTATION LETTER
PLANT SPECIFIC INSTALLATION APPROVED
ICC DETECTION FULLY OPERATIONAL
ZONE 3 DESIGN
84002011 PROJECT AUTHORIZATION DESIGN
84007011 ISSUE DCP TO PLANT
ZONE 3 INSTALLATION
84002011 PROJECT AUTHORIZATION CONSTR
CURRENT 2R4
ORIGINAL 2R4
ZONE 8 A/E DESIGN
84002011 RECEIVE PREL INTERFACE DWGS
84002011 FAT PROCEDURE SUBMITTAL
84002011 MAJOR MATERIAL RECEIPT
84002011 DDS SUBMITTAL
84002011 DAS ASSEMBLY COMPLETE
84002011 DAS TEST COMPLETE
84002011 SYSTEM INTEGRATION TEST COMPLETE
84002011 COMPLETION OF PROTOTYPE
84002011 FABRICATION KITS COMPLETE
84002011 APAL RECEIVE IN-VESSEL ALI
84002011 FACT ACCEPT TEST/SHIPPING COMPLETE
LEGEND
TARGET SCHEDULE
EARLY SCHEDULE
MILESTONES
CURRENT
ORIGINAL

FIGURE A-3

SUMMARY

- o TESTING COMPLETED - ANO 1 AND 2
- o TESTING SUCCESSFUL - ANO 1 AND 2
- o FINAL ENGINEERING PROCEEDING - ANO-2
- o MATERIAL ORDERED - ANO-2
- o INSTALLATION FOR 2R4 PROCEEDING - ANO-2

OVERVIEW OF THE PRELIMINARY RESULTS OF THE RADCAL INVENTORY METER CONFIRMATORY TEST PROGRAM

ARKANSAS POWER AND LIGHT COMPANY

TECHNOLOGY for ENERGY CORPORATION

JULY 12, 1984

30357A30

THE CONFIRMATORY TEST PROGRAM HAD THREE PRIMARY OBJECTIVES

- DEMONSTRATE THAT THE RADCAL INSTRUMENT CAN EFFECTIVELY MONITOR ICC OVER THE ENTIRE REACTOR VESSEL.

- PROVIDE DATA TO DETERMINE THE BOUNDARY CONDITIONS ON UNAMBIGUOUS ICC MONITORING PERFORMANCE - RATE OF INVENTORY LOSS (BLOWDOWN) - RATE OF INVENTORY GAIN (REFLOOD).

- PROVIDE DATA TO SELECT THE OPTIMUM SENSOR TYPES AND ARRANGEMENT FOR ANO-1 AND ANO-2.

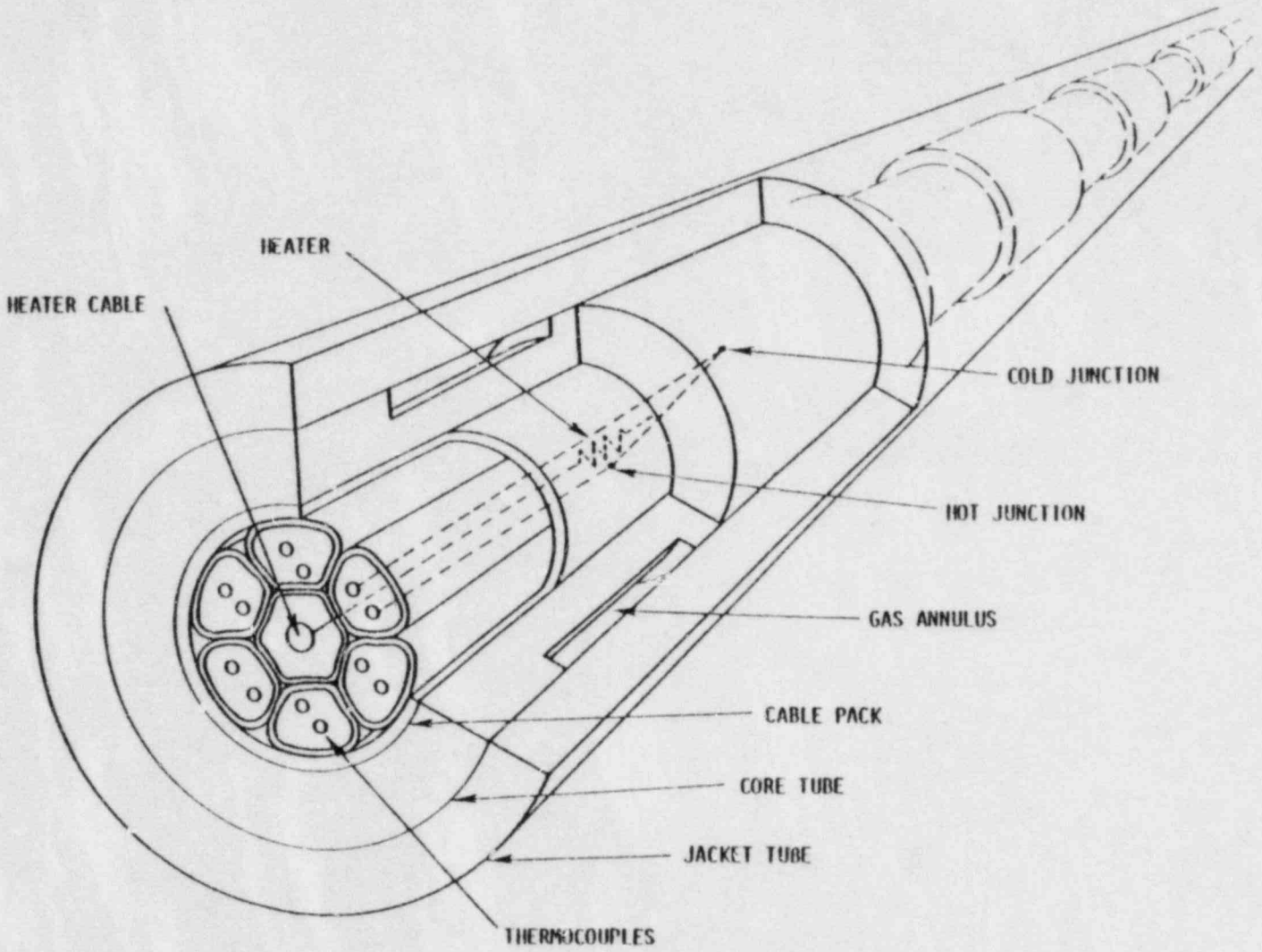
30357A31

THE PRIMARY OBJECTIVES WERE ACCOMPLISHED IN A THREE PHASE TEST PROGRAM

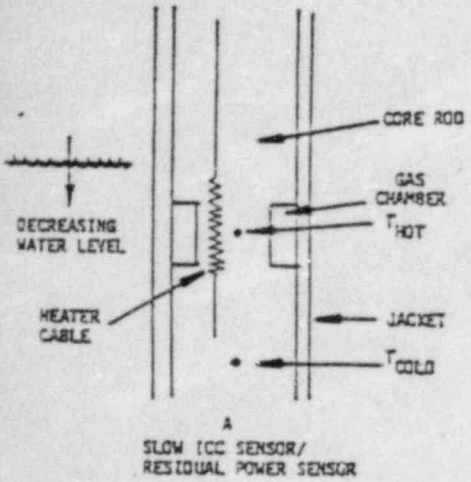
- AIR WATER TEST SERIES
  - ATMOSPHERIC CONDITIONS
  - BASIC RESPONSE DATA
  - MANOMETER TESTING
- UPPER HEAD TEST SERIES
  - PWR INITIAL CONDITIONS
  - UPPER HEAD CONFIGURATION
  - STEADY STATE TEMPERATURE AND FLOW DATA
  - BLOWDOWN AND REFLOOD TRANSIENT DATA
- IN-CORE TEST SERIES
  - PWR INITIAL CONDITIONS
  - FUEL LATTICE CONFIGURATION
  - STEADY STATE TEMPERATURE AND FLOW DATA
  - BLOWDOWN AND REFLOOD TRANSIENT DATA

30357A32

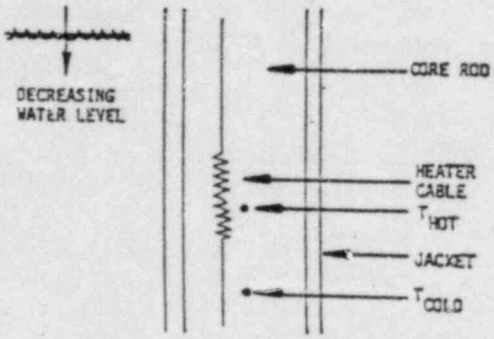
ROD STRUCTURE



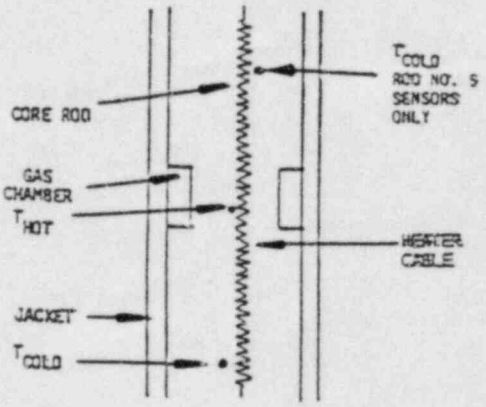
Prototype Sensor Designs Used in Upper Head Tests



A
SLOW ICC SENSOR/
RESIDUAL POWER SENSOR

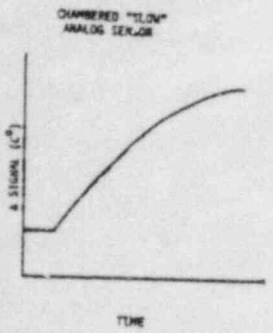


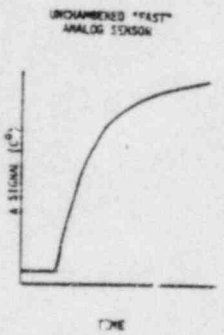
C
FAST ICC SENSOR

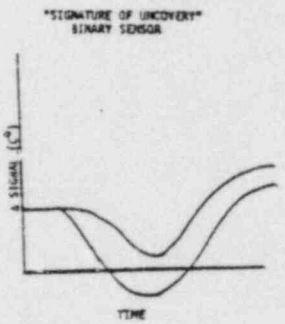


B
SIGNATURE OF UNCOVERY SENSOR

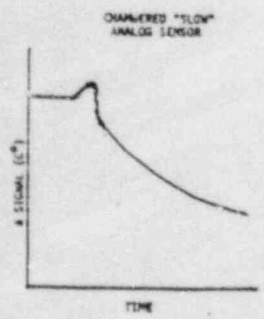
RADCAL UNCOVERY RESPONSE CHARACTERISTICS

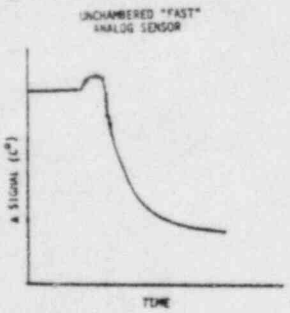


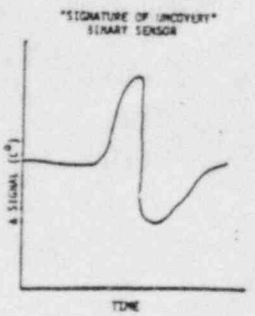




RADCAL REFLOOD RESPONSE CHARACTERISTICS







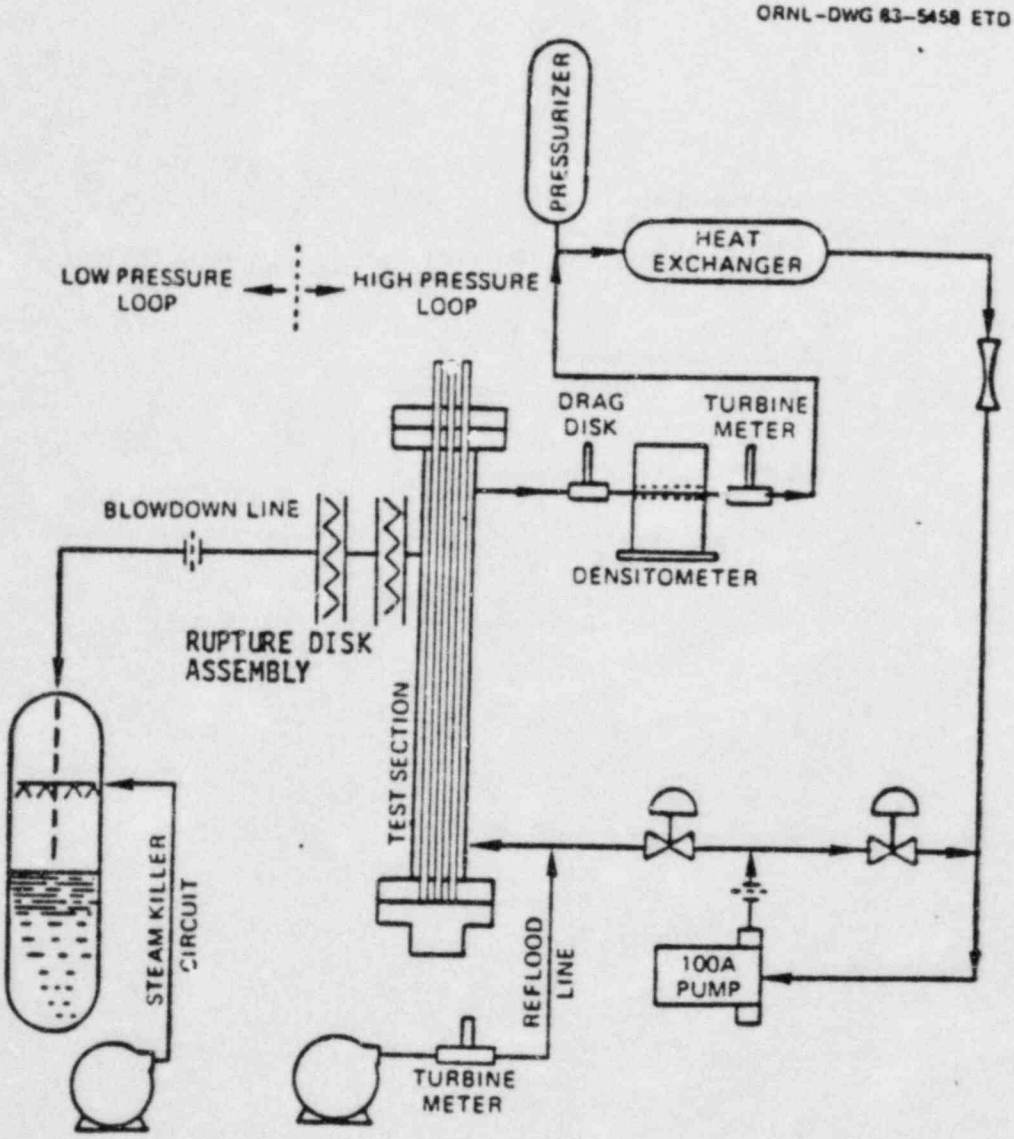


Figure 2-1. ORNL forced convection test facility schematic.

Scotch
Transparency Mounting Frame
Commercial Tape Division/3M

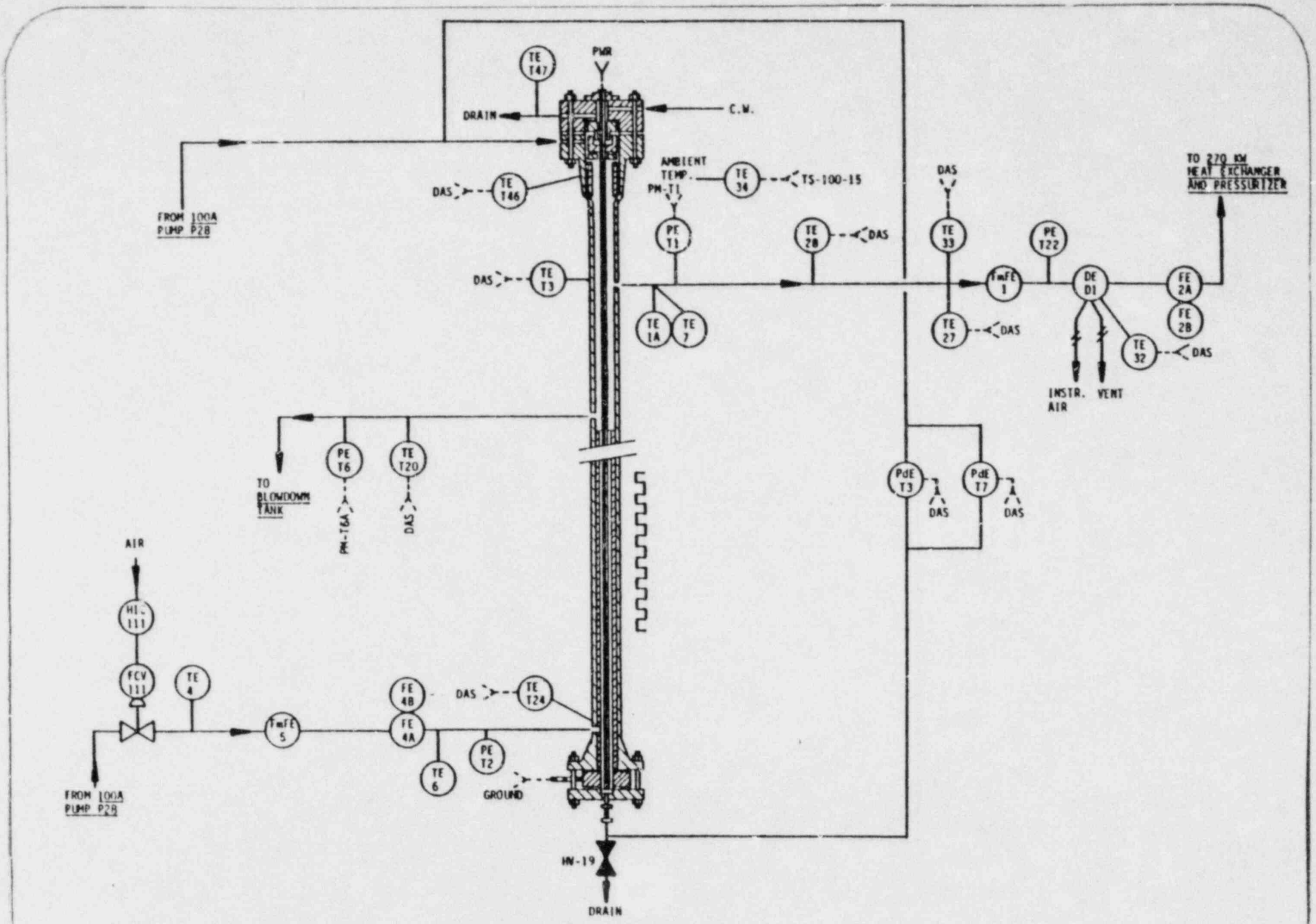


Figure 2-3. Major FCTF test section instrumentation.

UPPER HEAD TEST SERIES

9 TESTS TOTAL

1 STEADY STATE TEST

6 BLOWDOWN TESTS

2 REFLOOD TESTS

30357A33

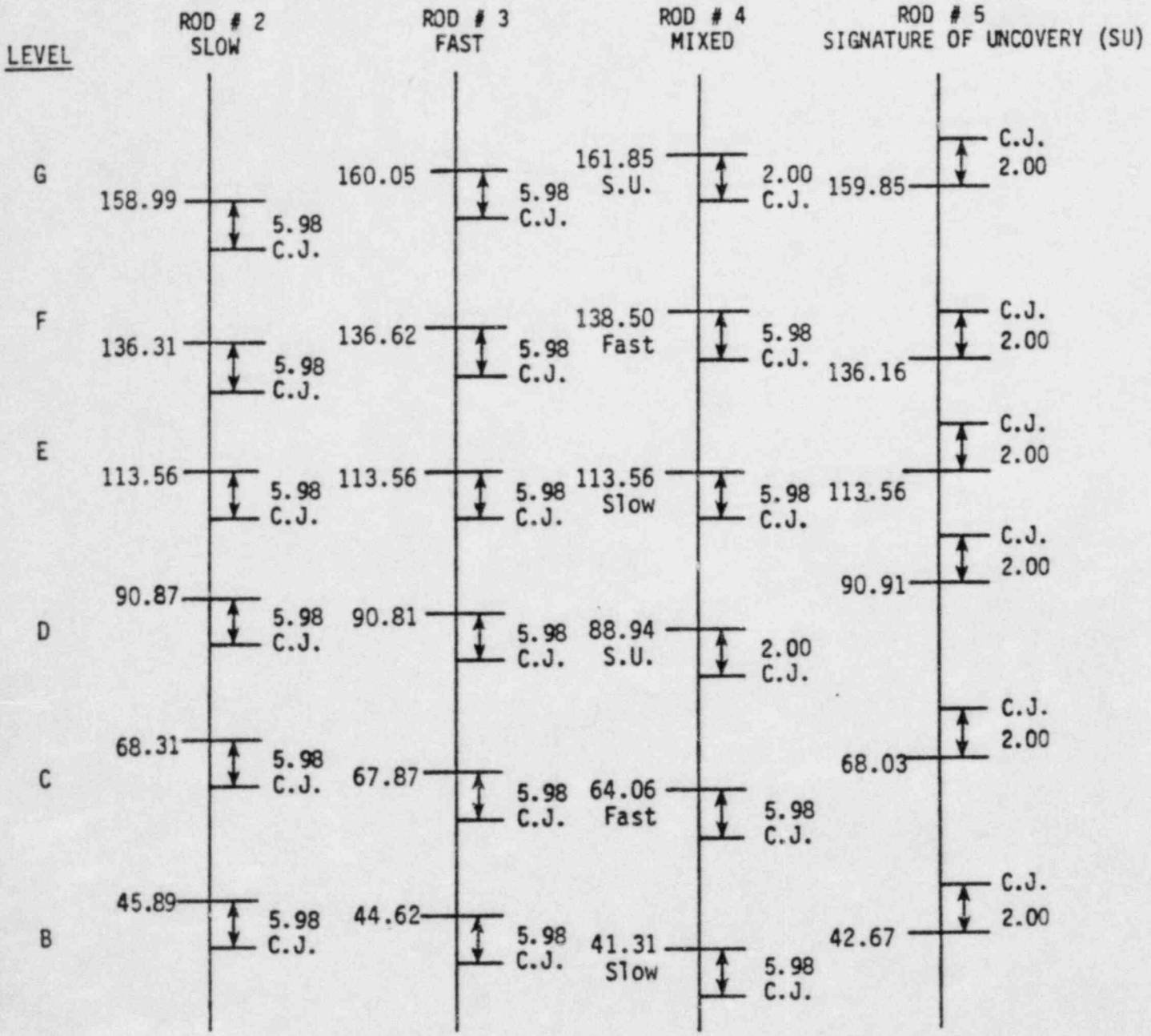
Table 2-1

SUMMARY OF UPPER HEAD PROBE SENSOR ARRANGEMENT

(S - Slow, F - Fast, SU - Signature of Uncovery)

		Rod 2			Rod 3		Rod 4			Rod 5		
Upper Head Bundle Level	Approximate Hot Junction Elevation* (ft)	Sensor Type	Approximate Cold Junction Elevation* (ft)	Gas Gap Length (in)	Sensor Type	Approximate Cold Junction Elevation* (ft)	Sensor Type	Approximate Cold Junction Elevation* (ft)	Gas Gap Length (in)	Sensor Type	Approximate Cold Junction Elevation* (ft)	Gas Gap Length (in)
G	13.600	S	13.102	1.25	F	13.102	SU	13.433	1.00	SU	13.767	1.25
F	11.544	S	11.046	1.25	F	11.046	F	11.046	NA	SU	11.711	1.25
E	9.463	S	8.965	1.00	F	8.965	S	8.965	1.00	SU	9.630	1.00
D	7.409	S	6.911	1.00	F	6.911	SU	7.242	1.00	SU	7.576	1.00
C	5.330	S	4.832	0.75	F	4.832	F	4.832	NA	SU	5.497	0.75
B	3.253	S	2.755	0.75	F	2.755	S	2.755	1.00	SU	3.420	0.75

*Zero is the centerline of the stainless steel bundle ground plate.



NOTE: Figure not to scale. All levels are centerline of hot junction. Absolute thermocouple located at cold junction (C.J.) in Rods 2, 3, and 4; and hot junctions in Rod 5.

Zero elevation is centerline of stainless steel ground plate. All dimensions are in inches.

Figure 2-6. Relative positions of the upper head bundle sensors.

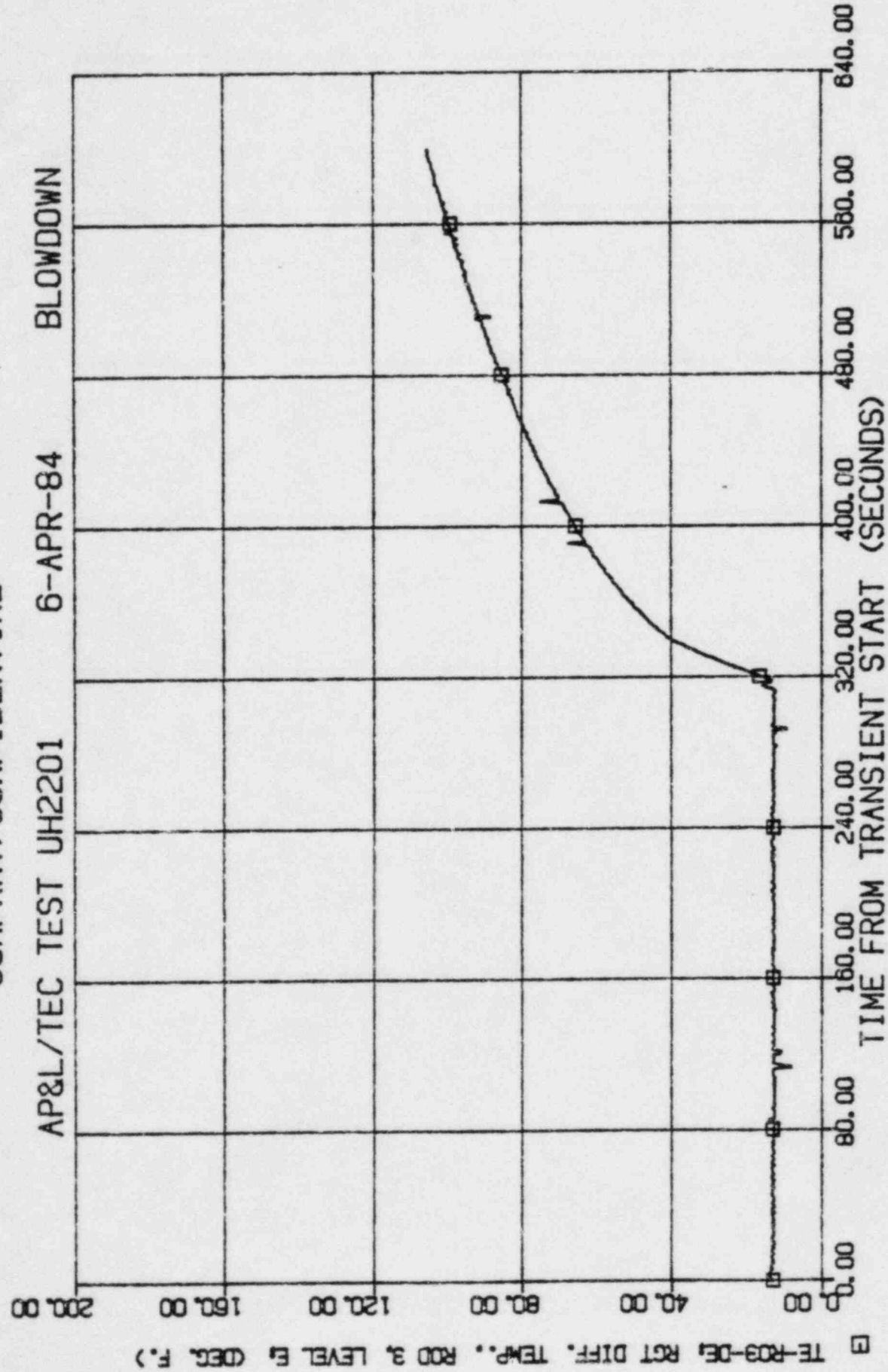


Figure 3-14. Response of a fast-type sensor to a medium rate of level fall (1.33 ft/min).

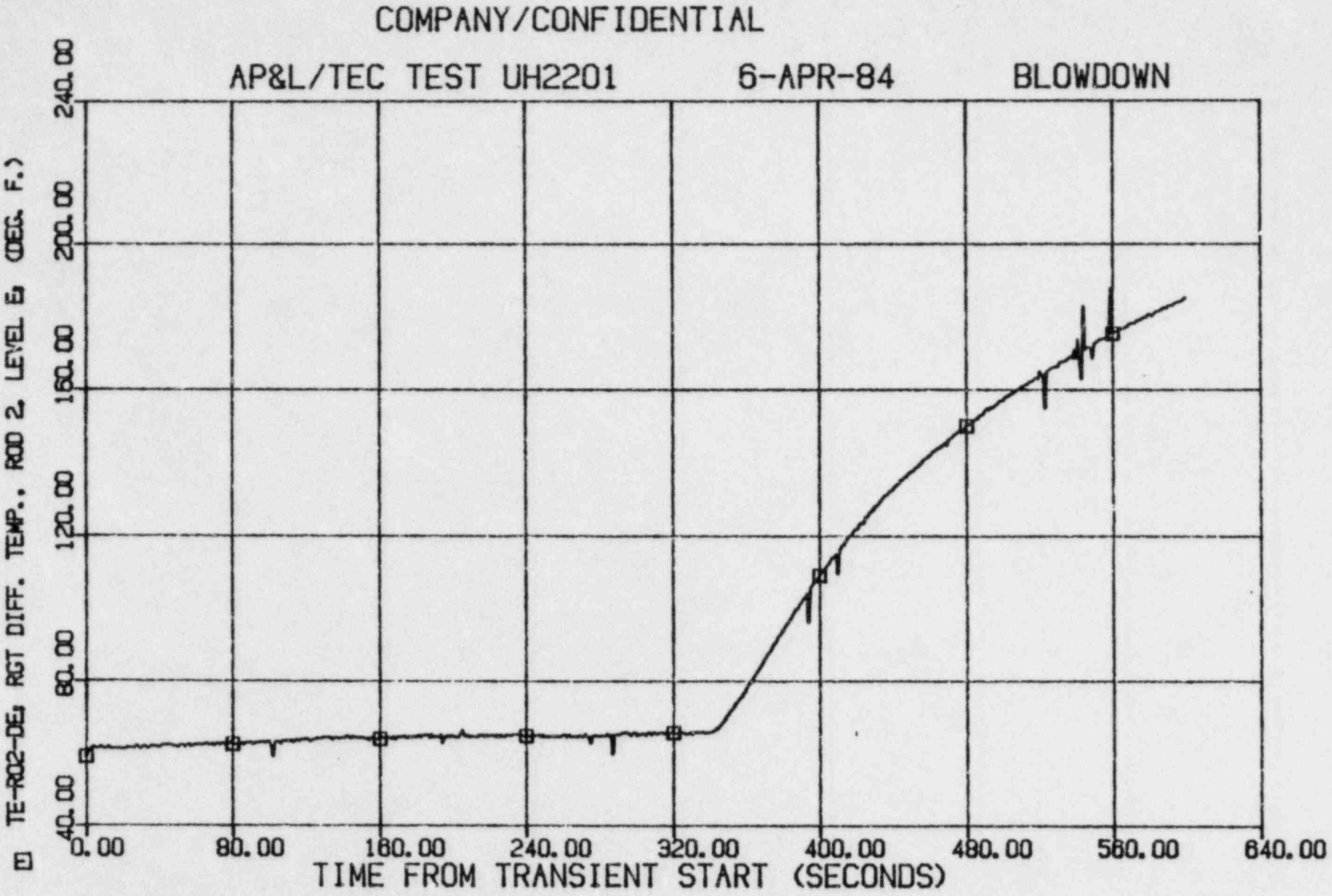


Figure 3-13. Response of a slow-type sensor to a medium rate of level fall (1.33 ft/min).

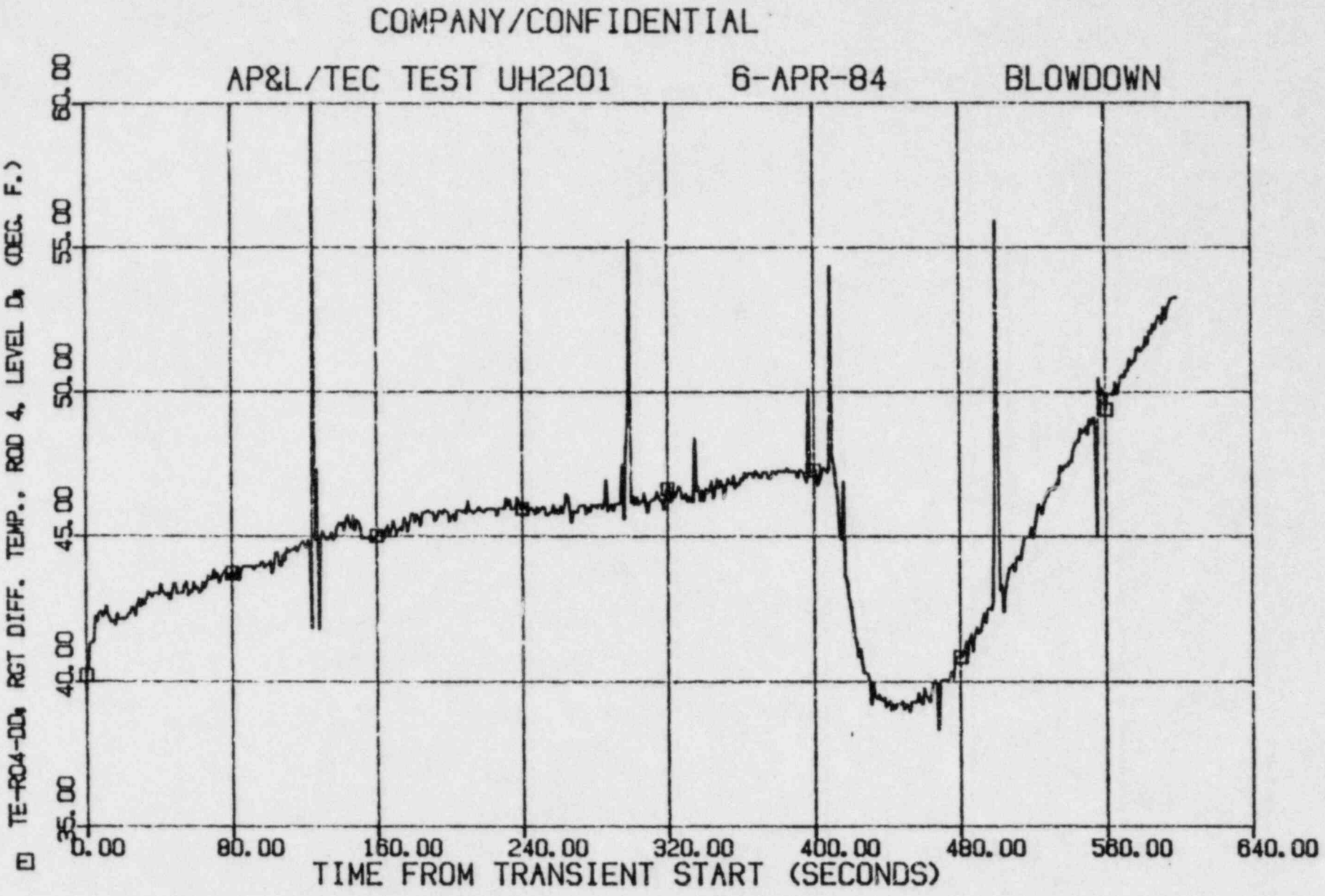


Figure 3-15. Response of a signature of uncovery sensor to a medium rate of level fall (1.33 ft/min)

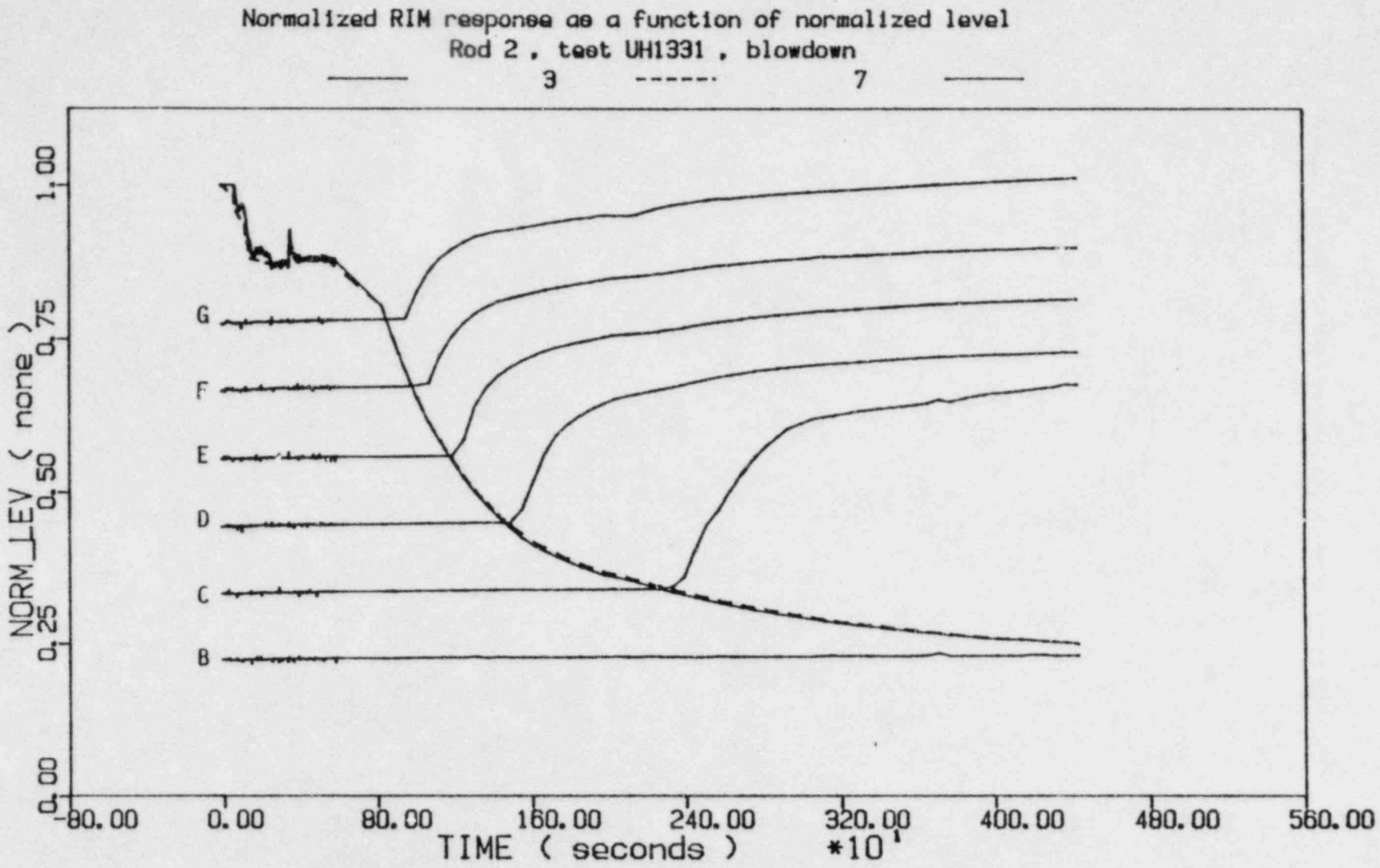


Figure 3-60. Comparison of collapsed liquid level calculated from differential pressure transducers PDE-T3 (3) and PDE-T7 (7) with the responses of slow sensors in rod #2 during test UH1331.

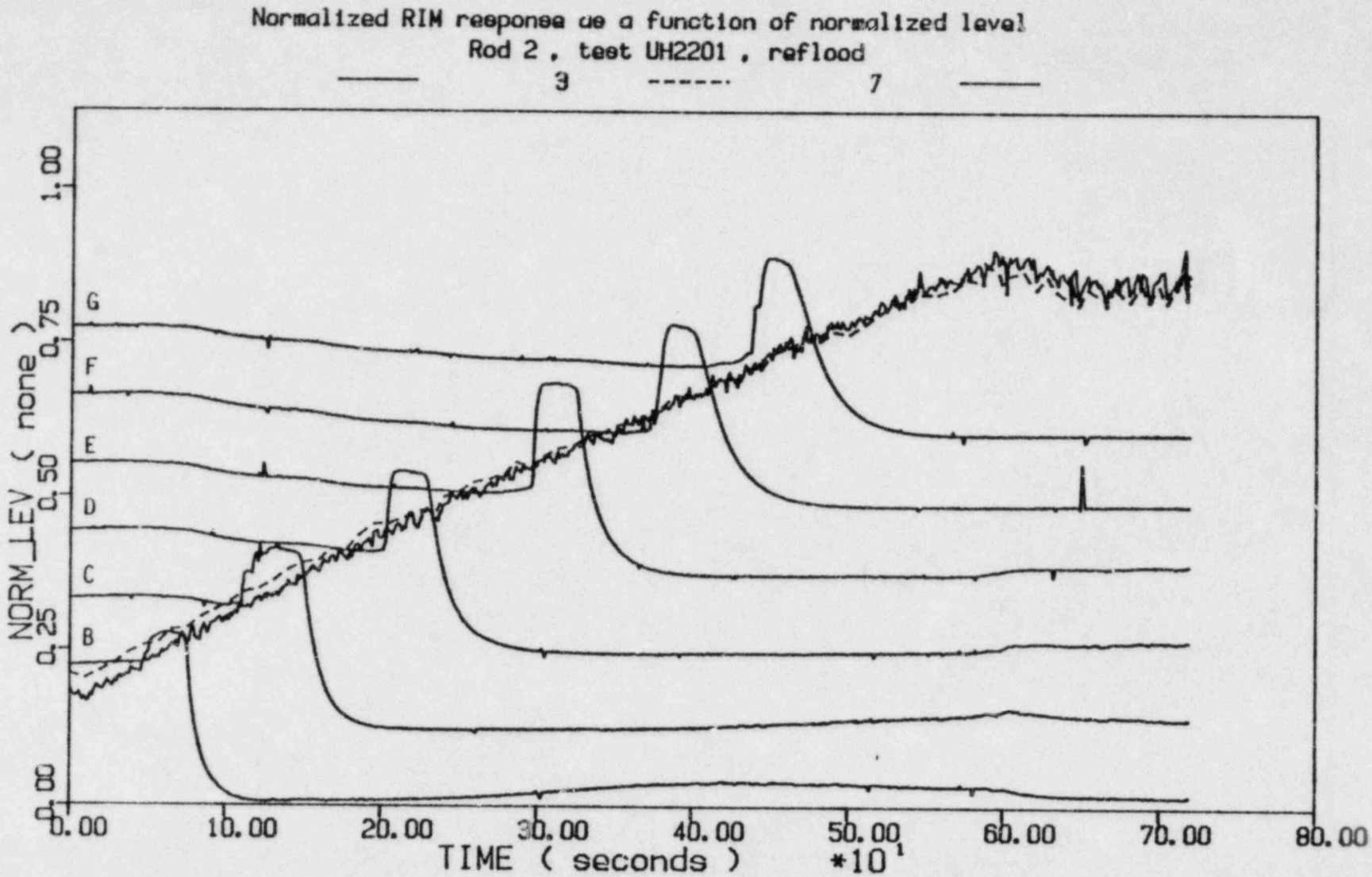


Figure 3-105. Comparison of collapsed liquid level calculated from differential pressure transducers PDE-T3 (3) and PDE-T7 (7) with the responses of slow sensors in rod #2 during test UH2201 reflood.

IN-CORE TEST SERIES

12 TESTS TOTAL

3 STEADY STATE TESTS

5 BLOWDOWN TESTS

4 REFLOOD TESTS

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no.

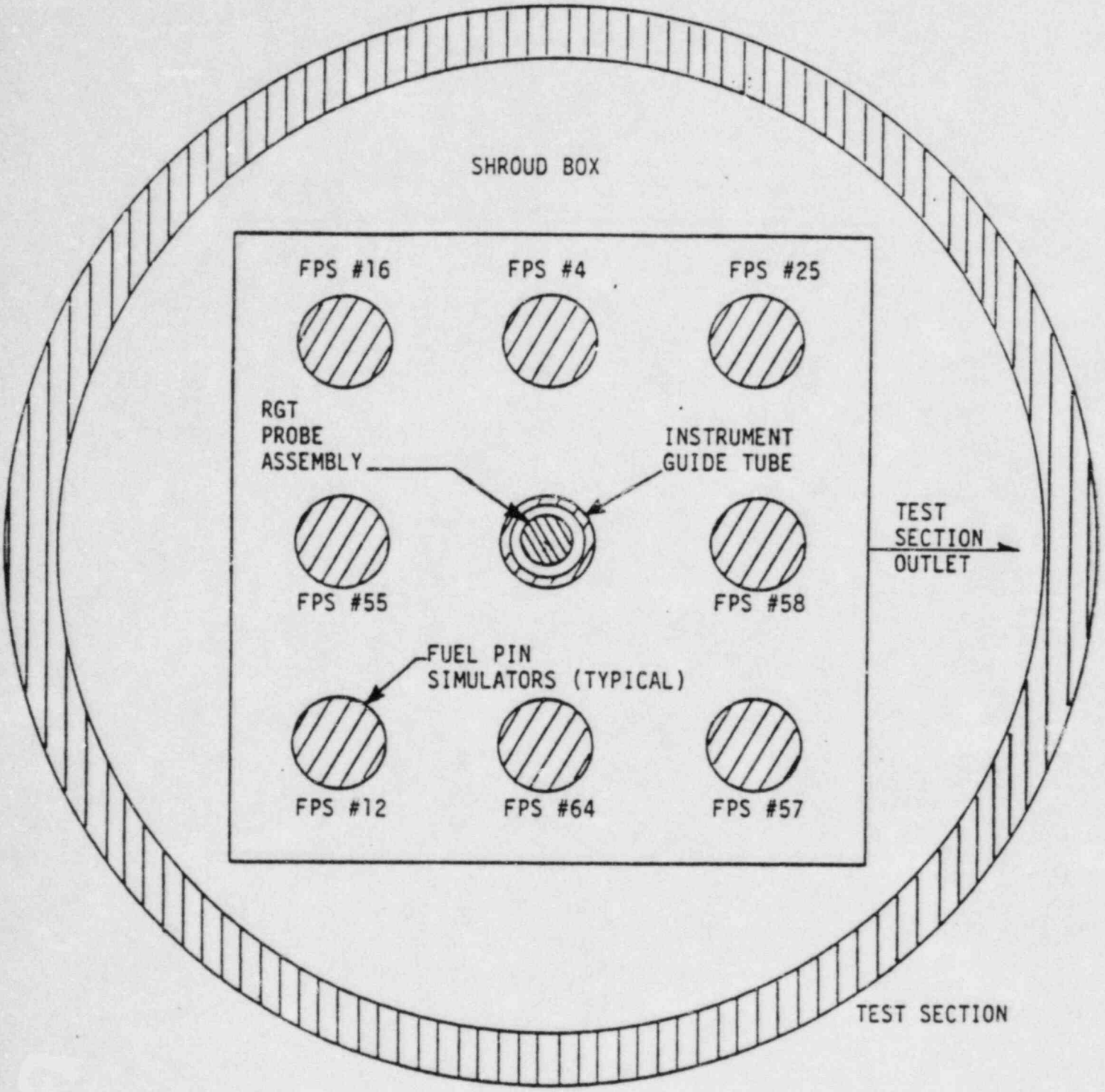
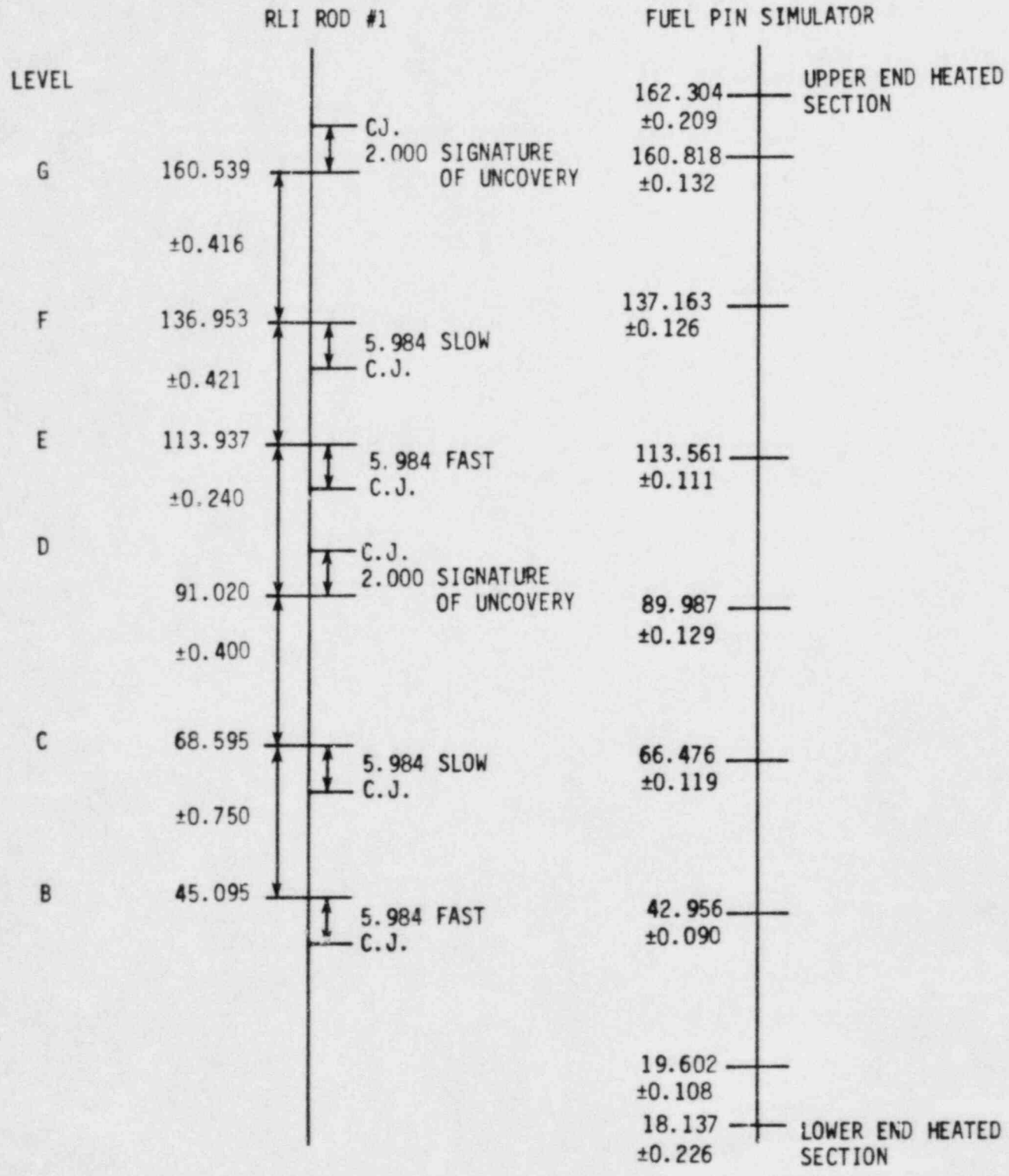


Figure 4-1. In-Core Test Bundle Cross Section.

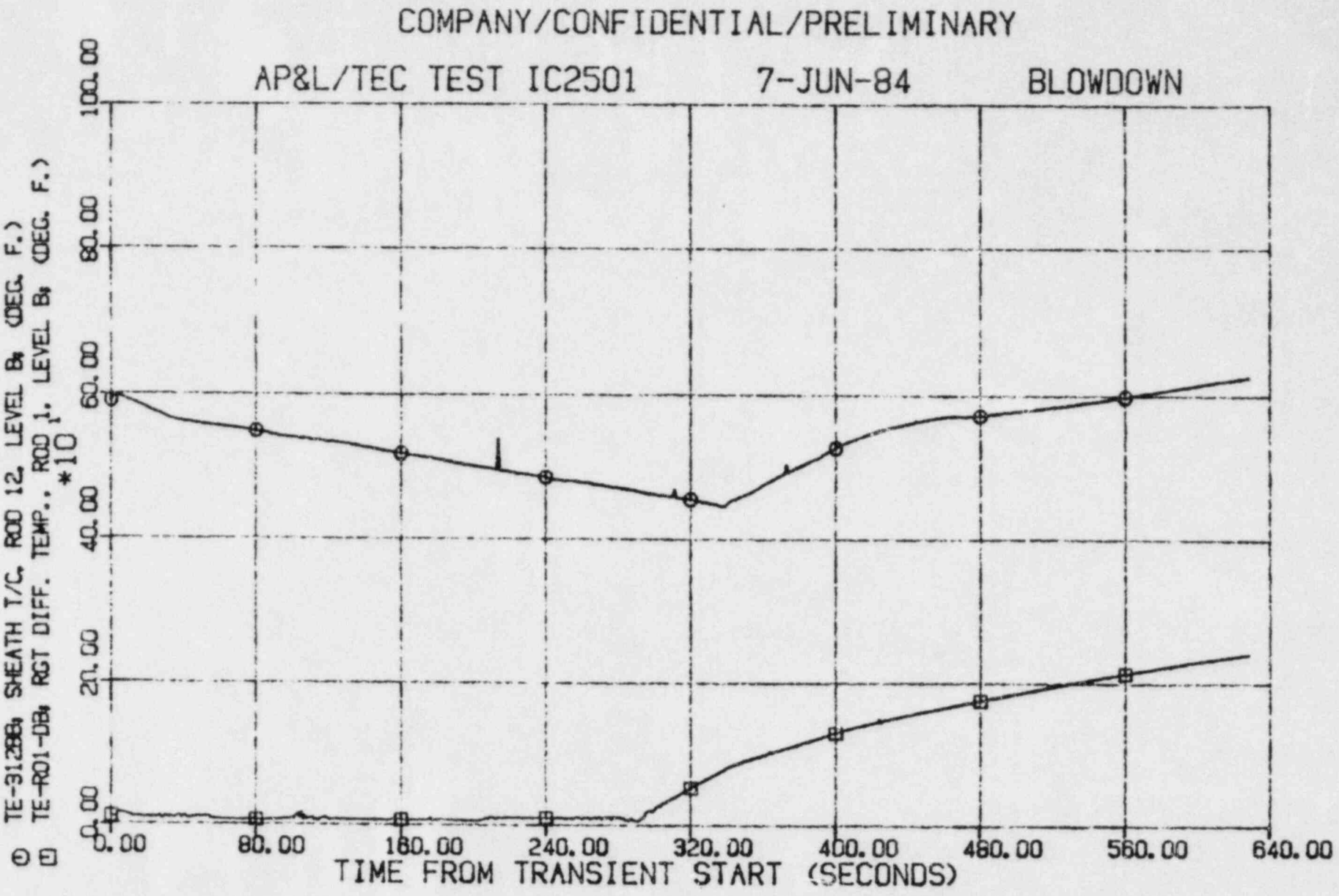
Scotch
584 Transparency Mounting Frame
Commercial Tape Division 3M

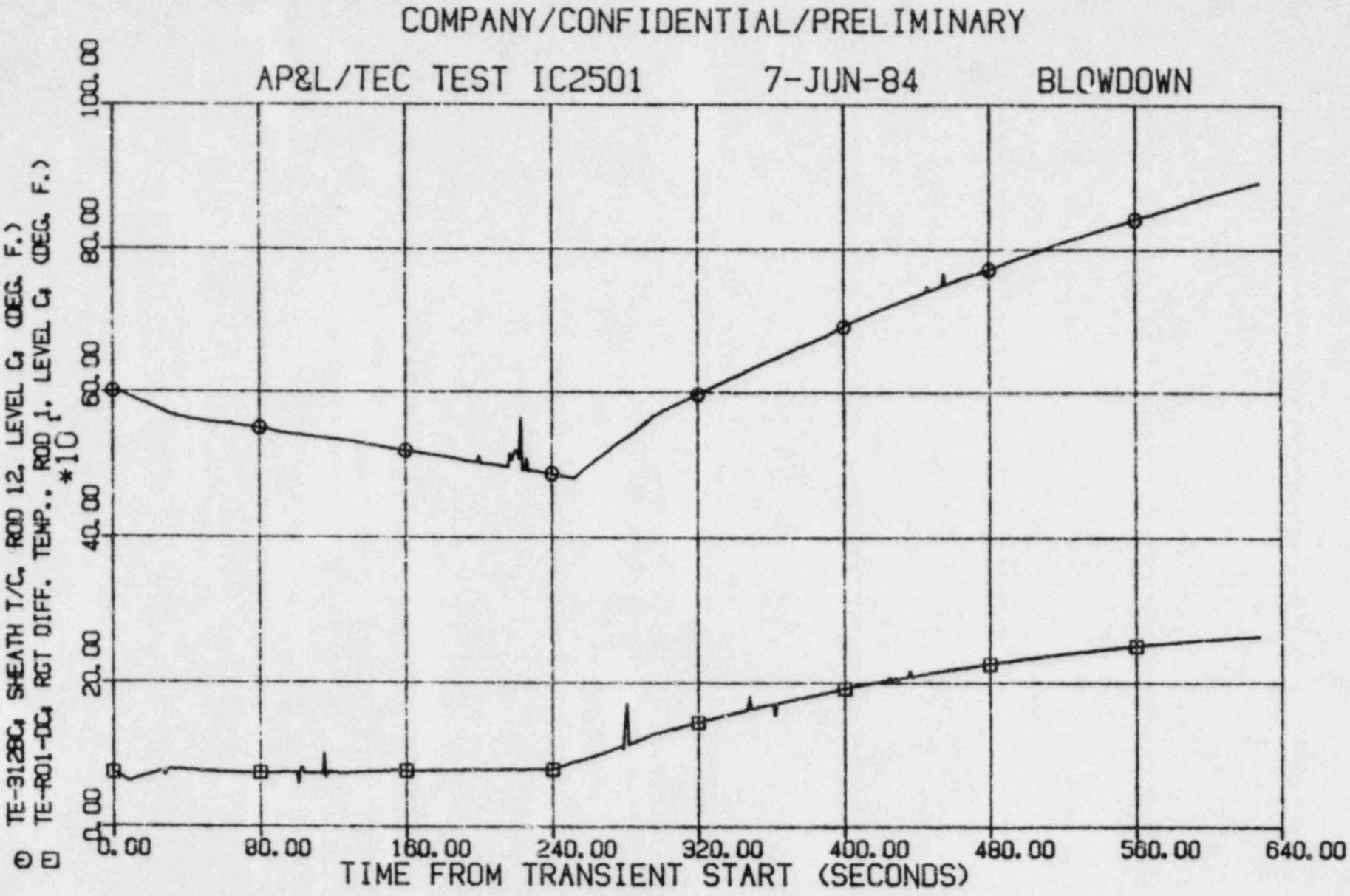


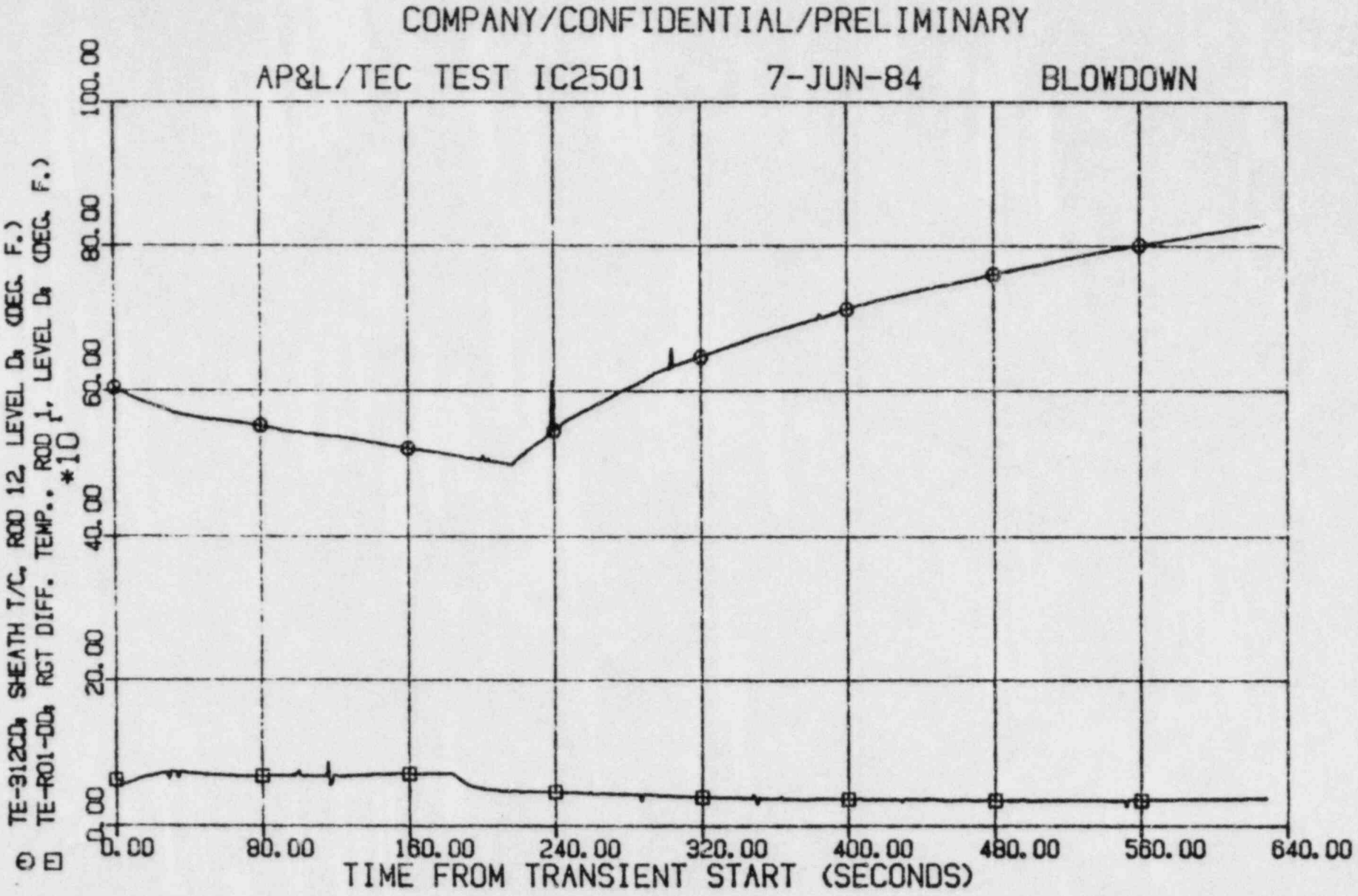
NOTE: Figure not to scale. All levels are centerline of hot junction. Absolute thermocouple located at cold junction (C.J.)

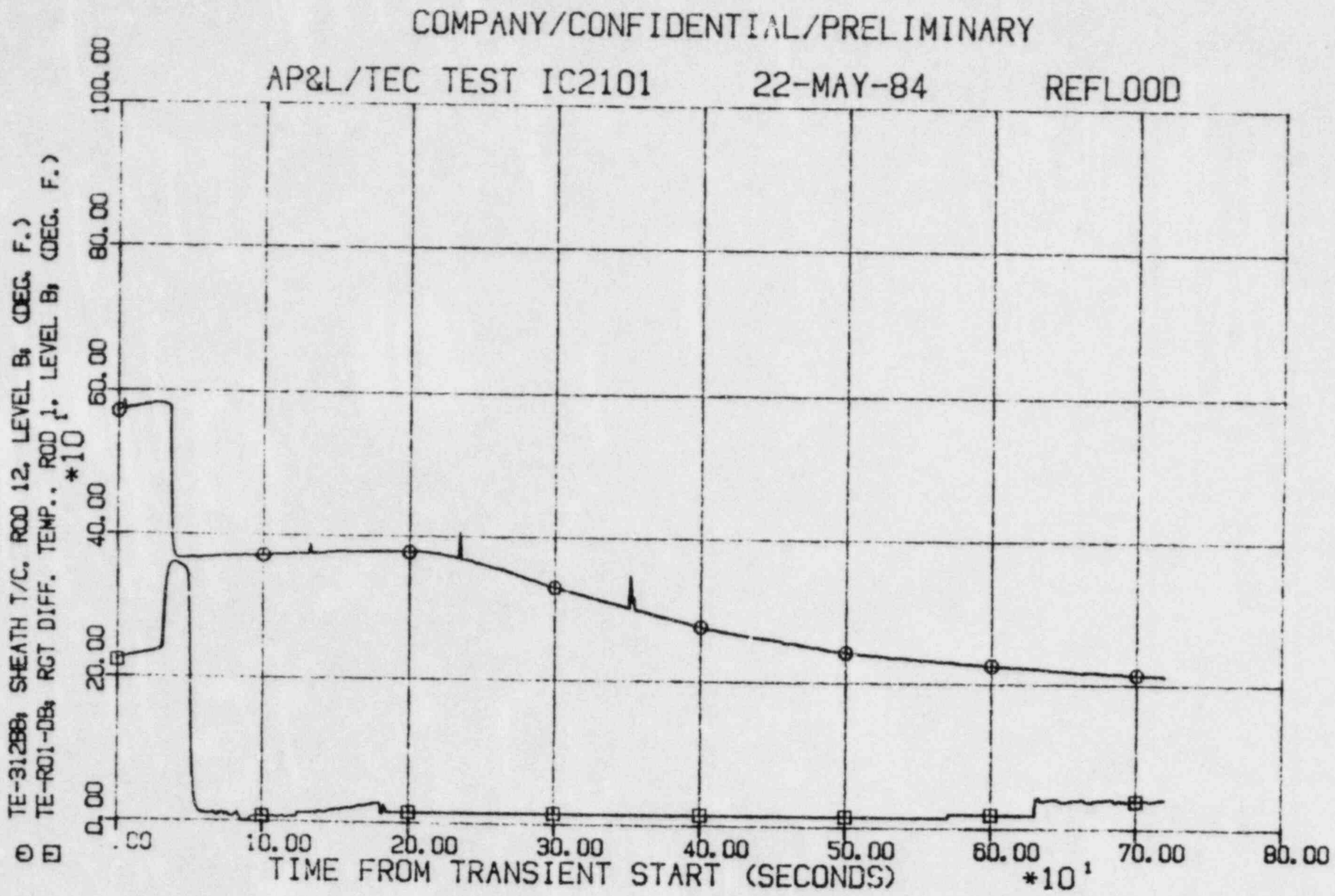
Zero elevation is centerline of stainless steel ground plate. All dimensions are in inches.

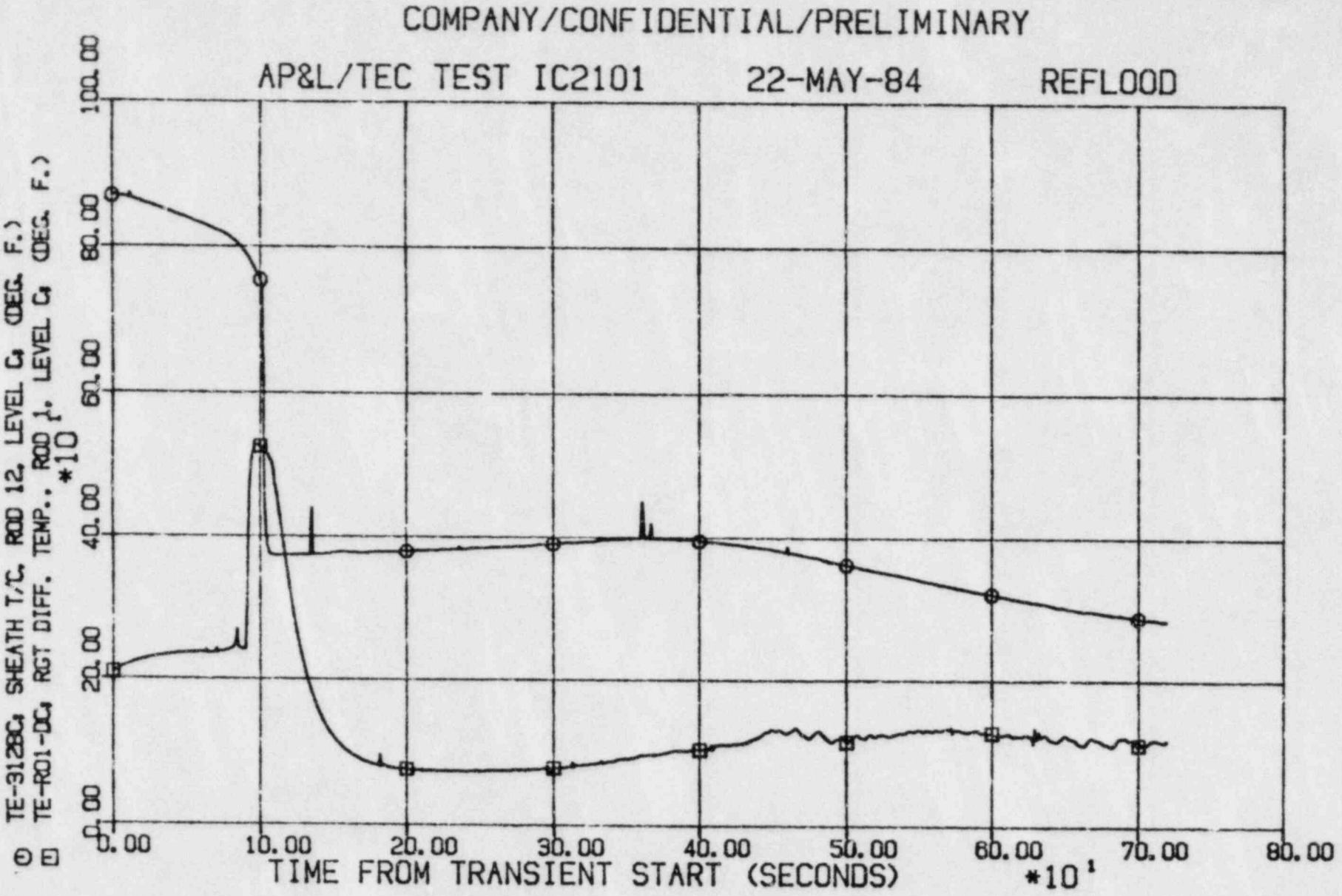
Figure 3. Relative positions of incore bundle sensors.

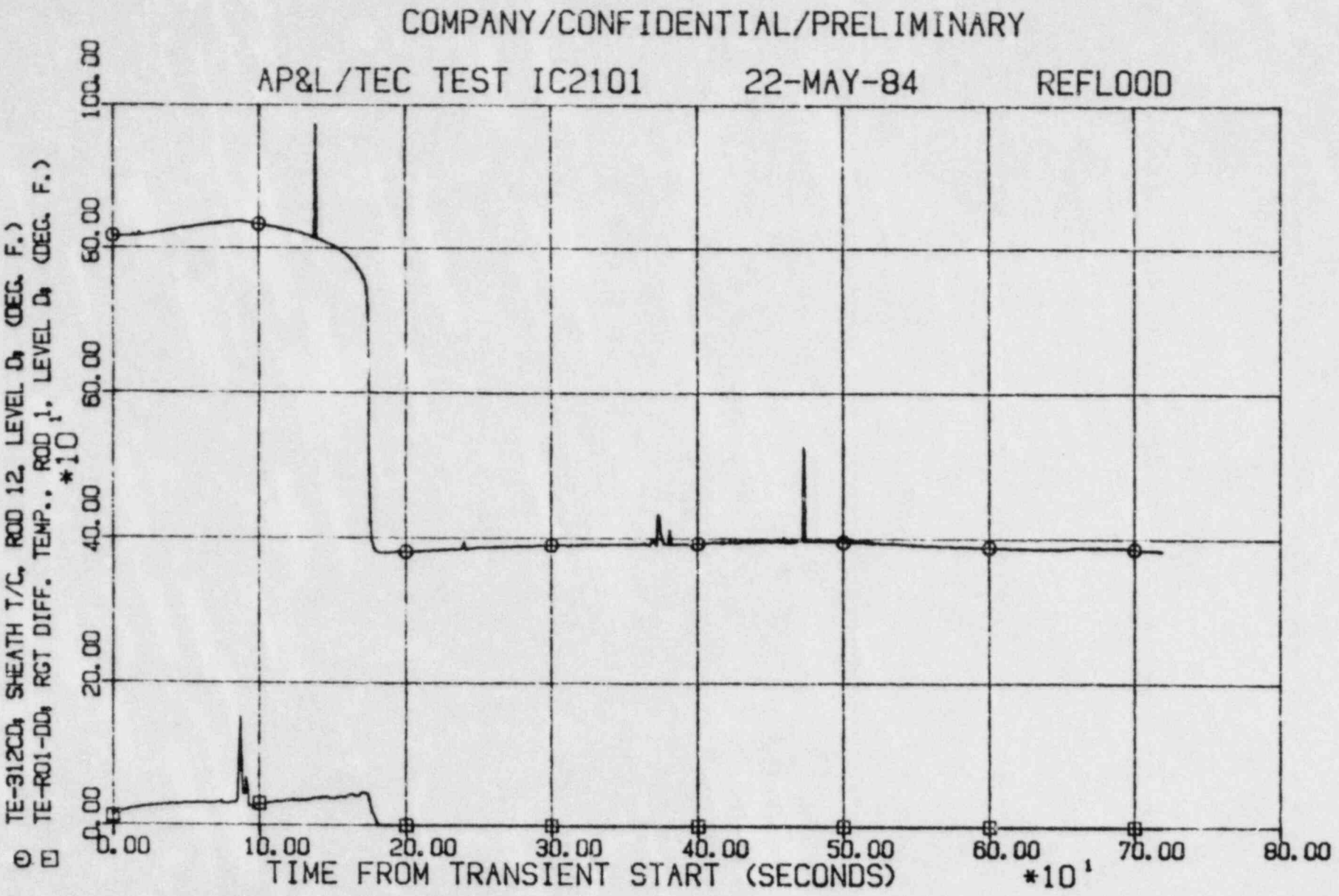

COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2501
7-JUN-84
BLOWDOWN
TE-31288 SHEATH T/C, ROD 12, LEVEL B (DEG. F.)
TE-R01-DB RGT DIFF. TEMP., ROD 1, LEVEL B (DEG. F.)
*10
100.00
80.00
60.00
40.00
20.00
0.00
0.00
80.00
160.00
240.00
320.00
400.00
480.00
560.00
640.00
TIME FROM TRANSIENT START (SECONDS)


COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2501
7-JUN-84
BLOWDOWN
TE-31280, SHEATH T/C, ROD 12, LEVEL 0 (DEG. F.)
TE-R01-00, RGT DIFF. TEMP., ROD 1, LEVEL 0 (DEG. F.)
*10
100.00
80.00
60.00
40.00
20.00
0.00
0.00
80.00
160.00
240.00
320.00
400.00
480.00
560.00
640.00
TIME FROM TRANSIENT START (SECONDS)


COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2501
7-JUN-84
BLOWDOWN
TE-312CDa SHEATH T/C, ROD 12, LEVEL Da (DEG. F.)
TE-R01-DDa RGT DIFF. TEMP., ROD 1, LEVEL Da (DEG. F.)
*10
100.00
80.00
60.00
40.00
20.00
0.00
0.00
80.00
160.00
240.00
320.00
400.00
480.00
560.00
640.00
TIME FROM TRANSIENT START (SECONDS)


COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2101
22-MAY-84
REFLOOD
TE-31288, SHEATH T/C, ROD 12, LEVEL B, (DEG. F.)
TE-R01-DB, RCT DIFF. TEMP., ROD 1, LEVEL B, (DEG. F.)
100.00
80.00
60.00
40.00
20.00
0.00
*10
.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
TIME FROM TRANSIENT START (SECONDS)
*10 1


COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2101
22-MAY-84
REFLOOD
TE-312BC, SHEATH T/C, ROD 12, LEVEL C4 (DEG. F.)
TE-R01-DC, RGT DIFF. TEMP., ROD 1, LEVEL C4 (DEG. F.)
*10
100.00
80.00
60.00
40.00
20.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
TIME FROM TRANSIENT START (SECONDS)
*10 1


COMPANY/CONFIDENTIAL/PRELIMINARY
AP&L/TEC TEST IC2101
22-MAY-84
REFLOOD
TE-312CD, SHEATH T/C, ROD 12, LEVEL D, (DEG. F.)
TE-R01-DD, RGT DIFF. TEMP., ROD 1, LEVEL D, (DEG. F.)
*10
100.00
80.00
60.00
40.00
20.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
TIME FROM TRANSIENT START (SECONDS)
*10 1