PAUL SCHERRER INSTITUT

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PANDA Transient Tests

M3 Integral System Test Apparent Test Results

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Summary:

This Apparent Test Results (ATR) report is compiled in accordance with the requirements specified in the Test Plan (TP) 25A5764R1 (GE document) section 10. The report covers the results for the PANDA Transient Test M3. The ATR summarizes the apparent results and includes: test number, test objective, test date and time, data recording period, data analysis period, name of data file and ORACLE data tables, list of failed or unavailable instruments considered to be required for the test, list of required instruments with zero or reference check points not in tolerance or in over-range or under-range during test, deviations from test procedure and problems which occured during test. Statements are made whether or not the test objective has been reached and the data were recorded correctly. A table of actual initial conditions based on average and standard deviation over one minute time period just before the test start for all parameters with a specified acceptance criteria in section 9.2 of TP is provided as well as time history plots over test duration for all top priority measurements.

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PANDA INTEGRAL SYSTEM TEST
APPARENT TEST RESULTS

TEST M3

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TEST M3

1. TEST OBJECTIVES:

The objectives of the PANDA integral system tests are to provide additional data to: a) confirm the capability of TRACG to predict SBWR containement system performance, including potential systems interaction effects (*Integral System Tests*) and b) demonstrate startup and long-term operation of a passive containement cooling system (*Concept Demonstration*).

The specific objective of test M3 wich was conducted with nominal post-LOCA conditions after a Main Steam Line Break is to establish the base case and demonstrate transient system response.

2. REFERENCE DOCUMENTS:

Test Plan:	GE document 25A5764R1
Test Procedure:	ALPHA-520-0

3. TEST DATE/TIME:

Test Start:	03-OCT-95 / 22:58:10
Test Stop:	04-OCT-95 / 19:23:20
Test Duration:	20:25:10
Test Period:	0 to 73510 sec

4. DATA RECORDING PERIOD:

Start:	03-OCT-95 / 22:36:34
Stop:	04-OCT-95 / 19:23:20
Data Recording Period:	-1296 to 73510 sec

5. FILE NAMES:

Raw Data:	panda_M3.dat
DAS-Configuration / Channel List:	kbt99999999.o10

6. ORACLE DATA TABLES:

PANDA_M3_MT_LINE
PANDA_M3_MT_POOL
PANDA_M3_MT_REF
PANDA_M3_MT_VESSEL
PANDA_M3_M_OTHER
PANDA_M3_M_TIME
PANDA_M3_KBT
INFO_TESTS

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7. RPV POWER CURVE:

Power analysis[1] period: 20 to 73510 sec

Maximum negative deviation:
Maximum positive deviation:
Standard deviation:

Power curve tolerance: ±25.0 [kW]

Definition of RPV power deviation (ΔPower) and standard deviation (σ):

$$\Delta Power = Power_{th} - \sum_{j=1}^{6} MW.RP.j$$

$$\sigma = \sqrt{\frac{1}{n}\sum_{k=1}^{n}\left(Power_{th}^{k} - \sum_{j=1}^{6} MW.RP.j^{k}\right)^{2}}$$

$Power_{th}$: theoretical power

$\sum_{j=1}^{6} MW.RP.j$: measured power

n: # of measurements throughout the test

8. TEST INSTRUMENTATION

LIST OF FAILED OR UNAVAILABLE REQUIRED INSTRUMENTS:

Mass flow rate in GDCS Return Line	MV.GRT	(NCR: P-007)
Air partial pressure in DW2	MPG.D2.3	Back-up instruments: MPG.D2.1 & MP.D2.2
Pressure difference in Main Vent 2 (Hydrostatic water head at Main Vent outlet)	MD.MV2	Back-up instrument: MD.MV1

LIST OF REQUIRED INSTRUMENTS WITH ZERO NOT IN TOLERANCE OR OVER-RANGE OR UNDER-RANGE DURING TEST:

Mass flow rate under-range in Main Steam Lines	MV.MS1, MV.MS2	(NCR: P-011)
Mass flow rate under-range in PCC2 Feed Line	MV.P2F	(NCR: P-012)

1 The power curve analysis has been performed without considering power spikes due to switching between rod groups (see NCR p-013).

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9. DEVIATIONS FROM TEST PROCEDURE:

None

10. LIST OF DEVIATIONS FROM INITIAL CONDITIONS:

11. TEST PROCESSING

PROBLEMS:

None

HAS THE TEST OBJECTIVE BEEN REACHED:

Yes

HAVE THE DATA BEEN CORRECTLY RECORDED:

Yes

2. Refer to Test Procedure on how the air partial pressure is adjusted in the DW's (not based on oxygen probe measurements, but on pressure increase during air injection).

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12. INITIAL CONDITIONS

DATA ANALYSIS PERIOD FOR INITIAL CONDITIONS:

Data analysis period (in second): [-458 : -398]

Initial conditions are calculated over one m nute just before connection of Drywells to RPV (phase n°13.8 of Test Procedure).

TABLE OF INITIAL CONDITIONS

VARIABLE	PROCESSID	UNIT	Average Value	Standard Deviation	Requested Value	Tolerance
ENVIRONMENT PARAMETERS:						
Atmospheric pressure	MP.EN	bar				
Temperature of saturation for atmospheric pressure (T_{sat_EN})		C				
RPV PARAMETERS:						
Total pressure	MP.RP.1	bar				
Fluid temperatures:						
Spatial average	T_{F_mean}(RP)	C				
Local	MTF.RP.1	C				
	MTF.RP.2	C				
	MTF.RP.3	C				
	MTF.RP.4	C				
	MTF.RP.5	C				
Water level	ML.RP.1	m				

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TABLE OF INITIAL CONDITIONS (Cont'd)

VARIABLE	PROCESSID	UNIT	Average Value	Standard Deviation	Requested Value	Tolerance
DRYWELL PARAMETERS:						
*Total pressure	MP.D1	bar				
Air partial pressure	MPG.D1.1	bar				
	MPG.D1.2	bar				
	MPG.D1.3	bar				
Air partial pressure	MPG.D2.1	bar				
	MPG.D2.2	bar				
Gas temperatures:						
Spatial average	$T_{G_mean}(D1)$	C				
Local	MTG.D1.1	C				
	MTG.D1.2	C				
	MTG.D1.3	C				
	MTG.D1.4	C				
	MTG.D1.5	C				
	MTG.D1.6	C				
Spatial average	$T_{G_mean}(D2)$	C				
Local	MTG.D2.1	C				
	MTG.D2.2	C				
	MTG.D2.3	C				
	MTG.D2.4	C				
	MTG.D2.5	C				
	MTG.D2.6	C				
Water level	ML.D1	m				
	ML.D2	m				

* The Drywell total pressures are not independant variables, they are given by temperatures and air partial pressures. The corresponding tolerance is calculated from temperature and gas partial pressure tolerances.

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TABLE OF INITIAL CONDITIONS (Cont'd)

VARIABLE	PROCESSID	UNIT	Average Value	Standard Deviation	Requested Value	Tolerance
SUPPRESSION CHAMBER PARAMETERS						
Total pressure	MP.S1	bar				
**Air partial pressure	MPG.S1	bar				
	MPG.S2	bar				
Water temperatures:						
Spatial average	$T_{W_mean}(S1)$	C				
Local	MTL.S1.1	C				
	MTL.S1.2	C				
	MTL.S1.3	C				
	MTL.S1.4	C				
	MTL.S1.5	C				
	MTL.S1.6	C				
Spatial average	$T_{W_mean}(S2)$	C				
Local	MTL.S2_1	C				
	MTL.S2_2	C				
	MTL.S2_3	C				
	MTL.S2_4	C				
	MTL.S2_5	C				
	MTL.S2_6	C				
Gas temperatures:						
Spatial average	$T_{G_mean}(S1)$	C				
Local	MTG.S1.1	C				
	MTG.S1.2	C				
	MTG.S1.3	C				
	MTG.S1.4	C				
	MTG.S1.5	C				
	MTG.S1.6	C				
Spatial average	$T_{G_mean}(S2)$	C				
Local	MTG.S2.1	C				

**The Suppression Chamber air partial pressures are not independant variables, they are given by temperatures and total pressures. The corresponding tolerance is calculated from temperature and total pressure tolerances

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TABLE OF INITIAL CONDITIONS (Cont'd)

VARIABLE	PROCESSID	UNIT	Average Value	Standard Deviation	Requested Value	Tolerance
SUPPRESSION CHAMBER PARAMETERS (Cont'd)						
Gas Temperatures:	MTG.S2.2	C				
Local	MTG.S2.3	C				
	MTG.S2.4	C				
	MTG.S2.5	C				
	MTG.S2.6	C				
Water level	ML.S1	m				
	ML.S2	m				
GDCS PARAMETERS:						
Total pressure	MP.GD	bar				
Fluid temperatures:						
Spatial average	T_{F_mean}(GD)	C				
Local	MTF.GD.1	C				
	MTF.GD.2	C				
	MTF.GD.3	C				
	MTF.GD.4	C				
	MTF.GD.5	C				
	MTF.GD.6	C				
	MTF.GD.7	C				
Water level	ML.GD	m				
PCC1 PARAMETERS						
Water temperatures:						
Spatial average	T_{W_mean}(U1)	C				
Local	MTL.U1.1	C				
	MTL.U1.2	C				
	MTL.U1.3	C				
	MTL.U1.4	C				
	MTL.U1.5	C				
	MTL.U1.6	C				
	MTL.U1.7	C				
Water level	ML.U1	m				

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TABLE OF INITIAL CONDITIONS (Cont'd)

VARIABLE	PROCESSID	UNIT	Average Value	Standard Deviation	Requested Value	Tolerance
PCC2 PARAMETERS						
Water temperatures:						
Spatial average	T_{w_mean}(U2)	C				
Local	MTL.U2.1	C				
	MTL.U2.2	C				
	MTL.U2.3	C				
	MTL.U2.4	C				
	MTL.U2.5	C				
	MTL.U2.6	C				
	MTL.U2.7	C				
Water level	ML.U2	m				
PCC3 PARAMETERS						
Water temperatures:						
Spatial average	T_{w_mean}(U3)	C				
Local	MTL.U3.1	C				
	MTL.U3.2	C				
	MTL.U3.3	C				
	MTL.U3.4	C				
	MTL.U3.5	C				
	MTL.U3.6	C				
	MTL.U3.7	C				
	MTL.U3.8	C				
	MTL.U3.9	C				
	MTL.U3.10	C				
	MTL.U3.11	C				
	MTL.U3.12	C				
	MTL.U3.13	C				
	MTL.U3.14	C				
	MTL.U3.15	C				
	MTL.U3.16	C				
	MTL.U3.17	C				
	MTL.U3.18	C				
	MTL.U3.19	C				
Water level	ML.U3	m				

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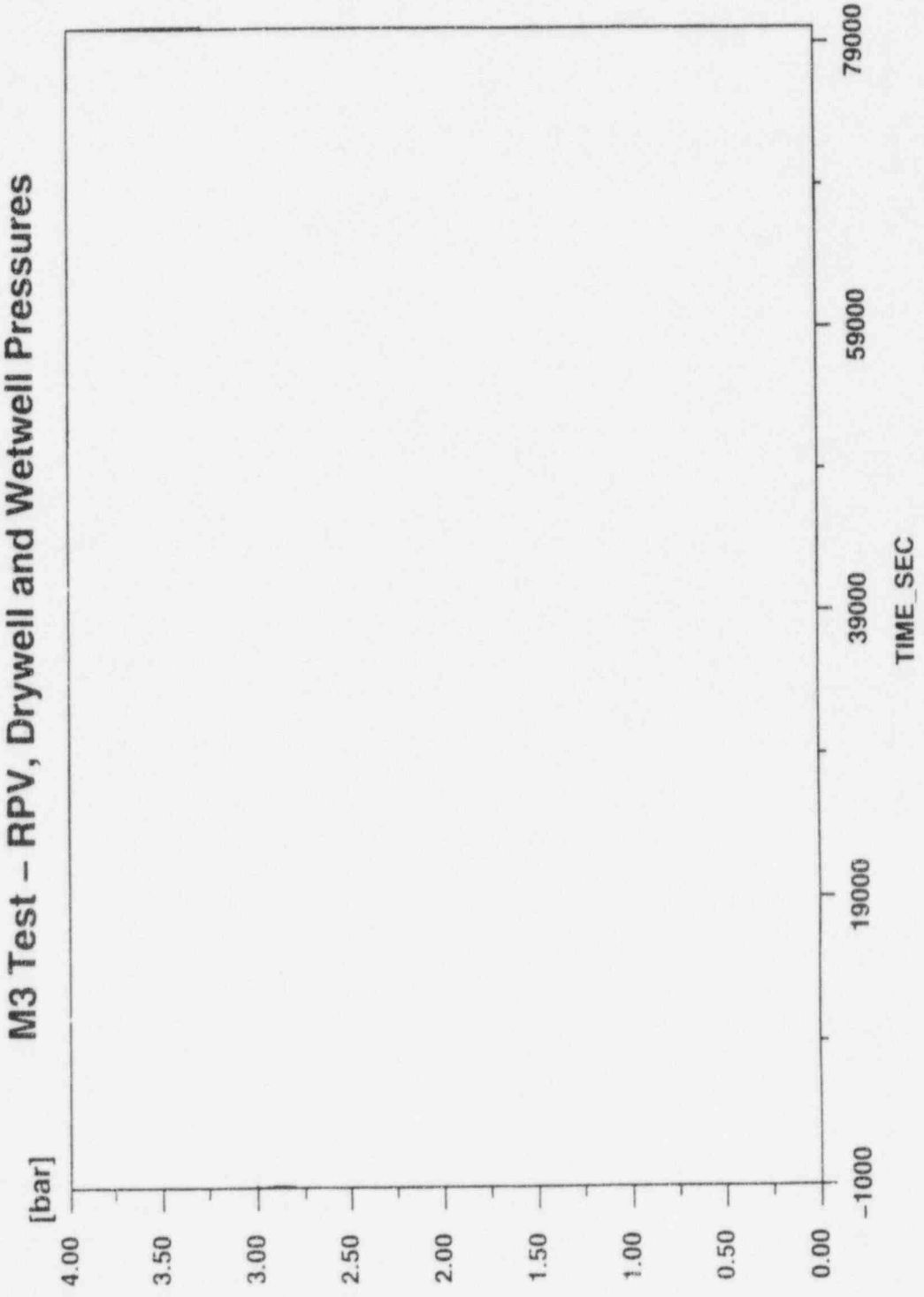

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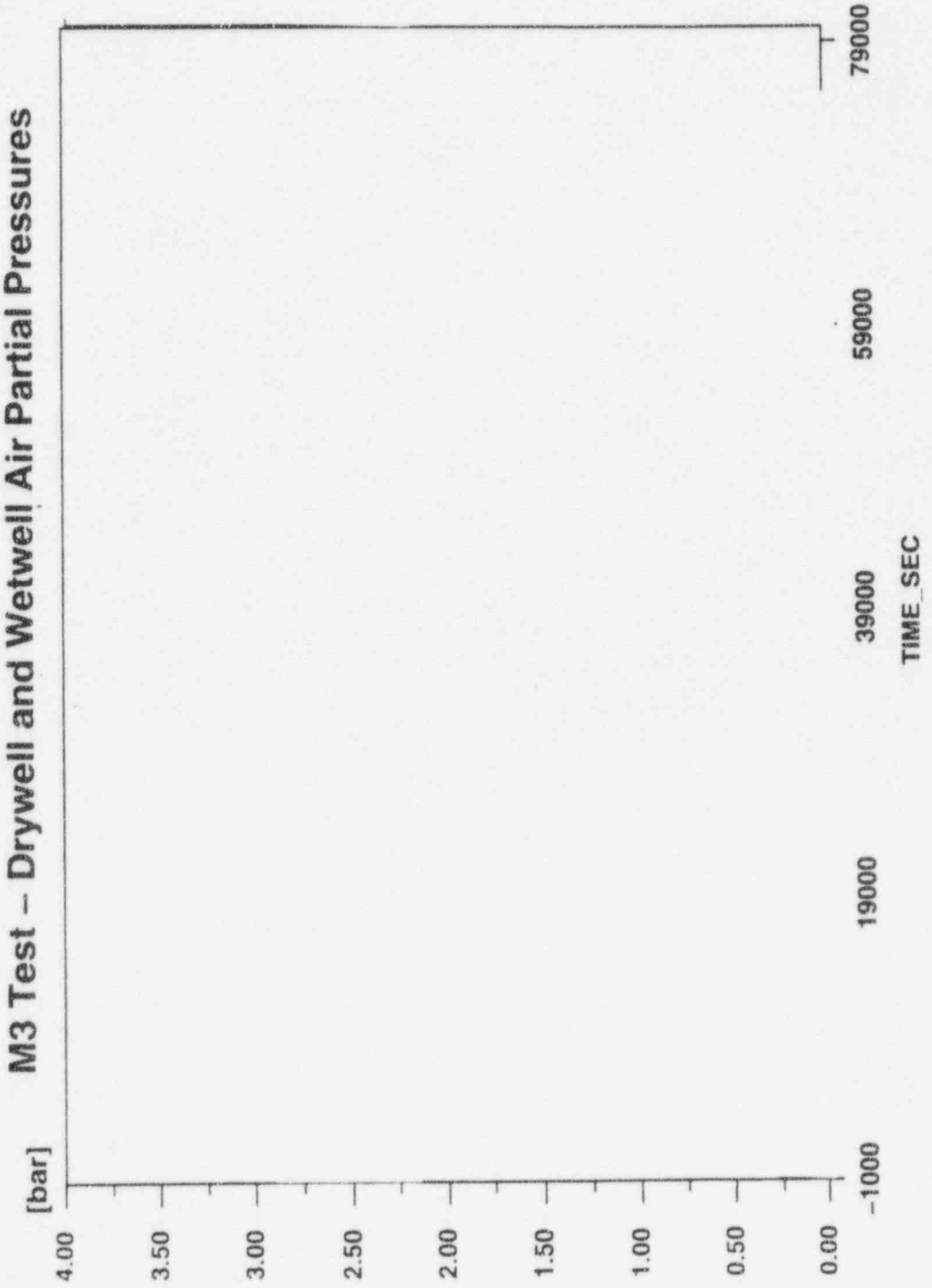

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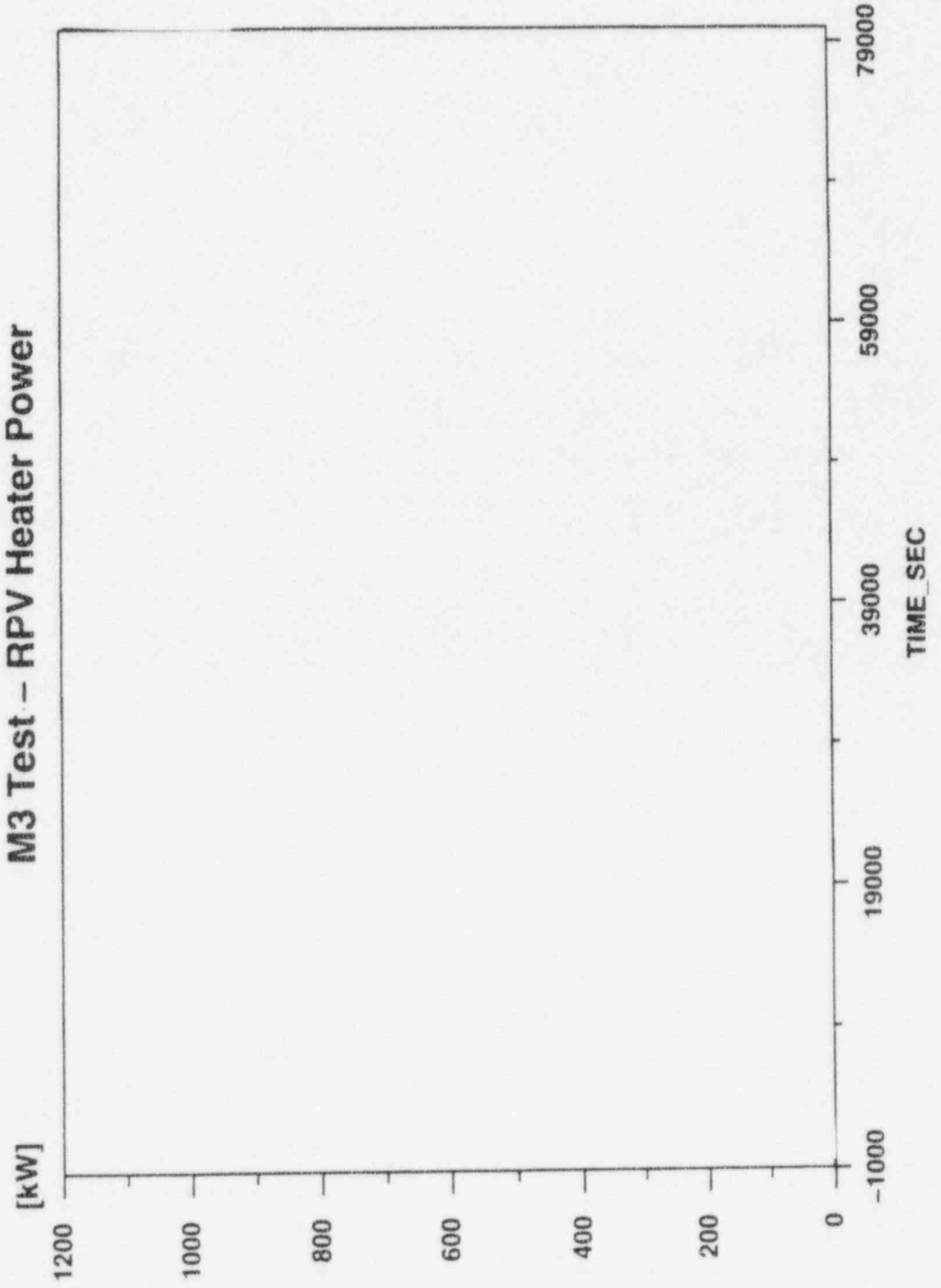

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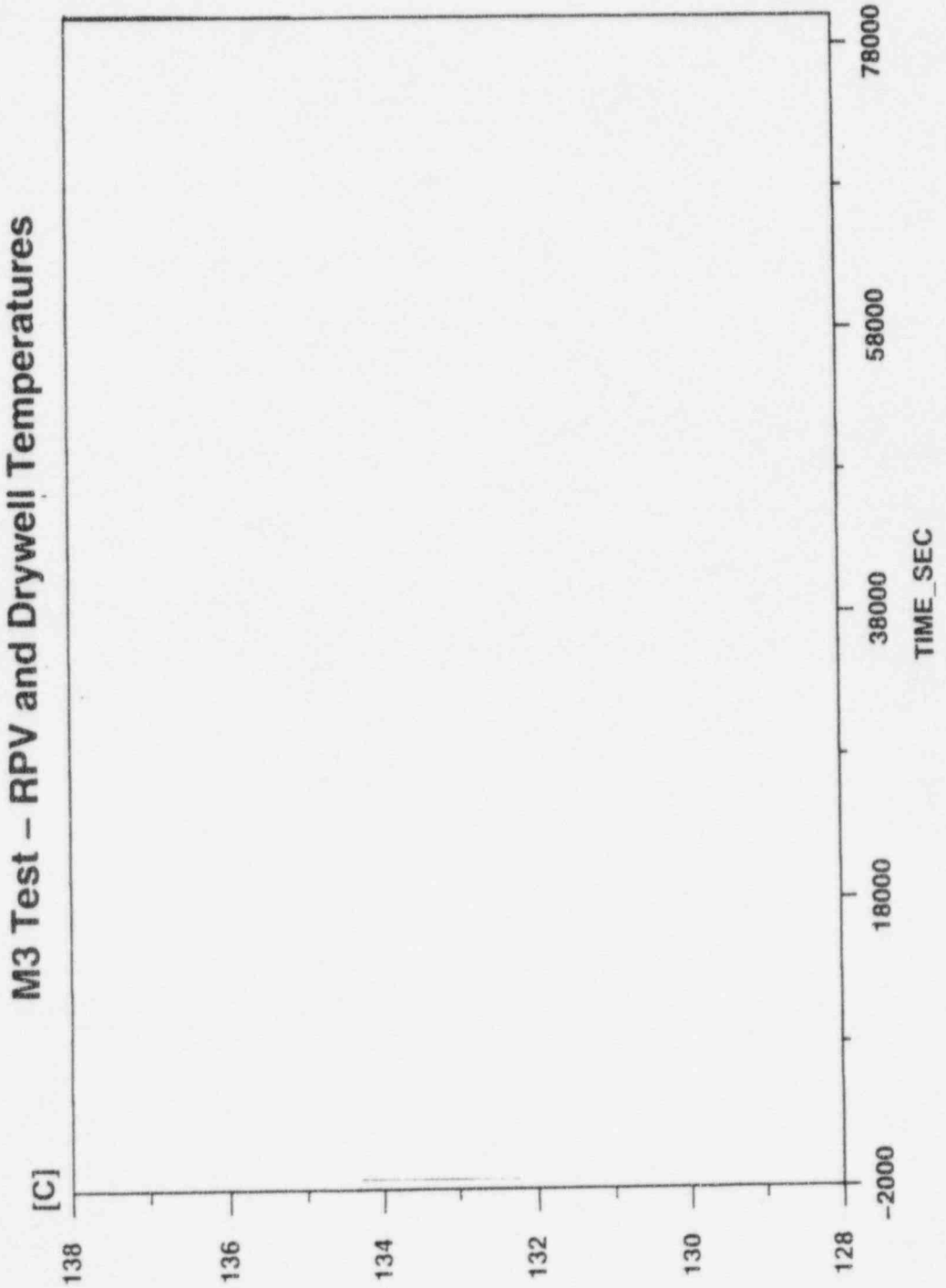

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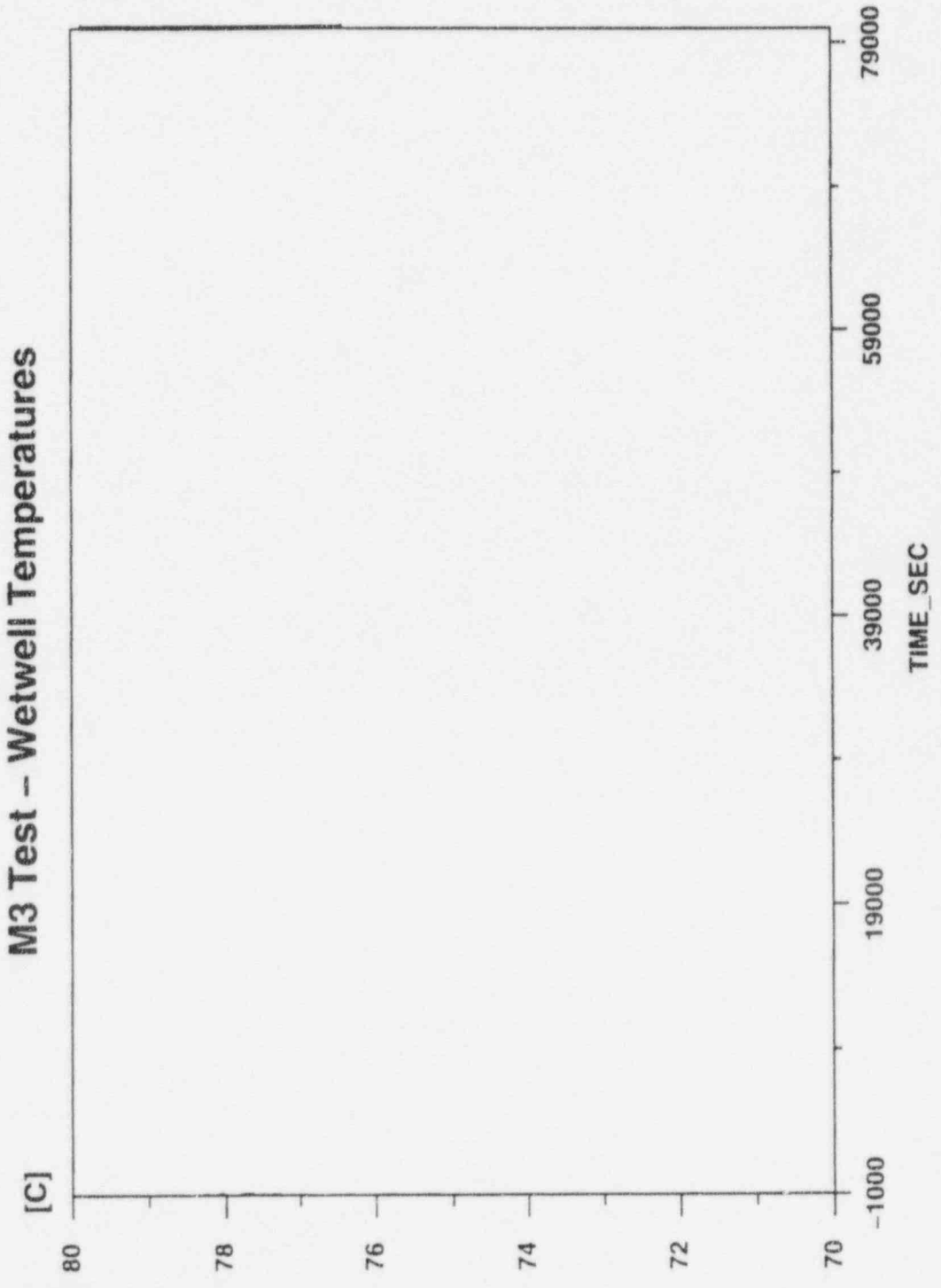

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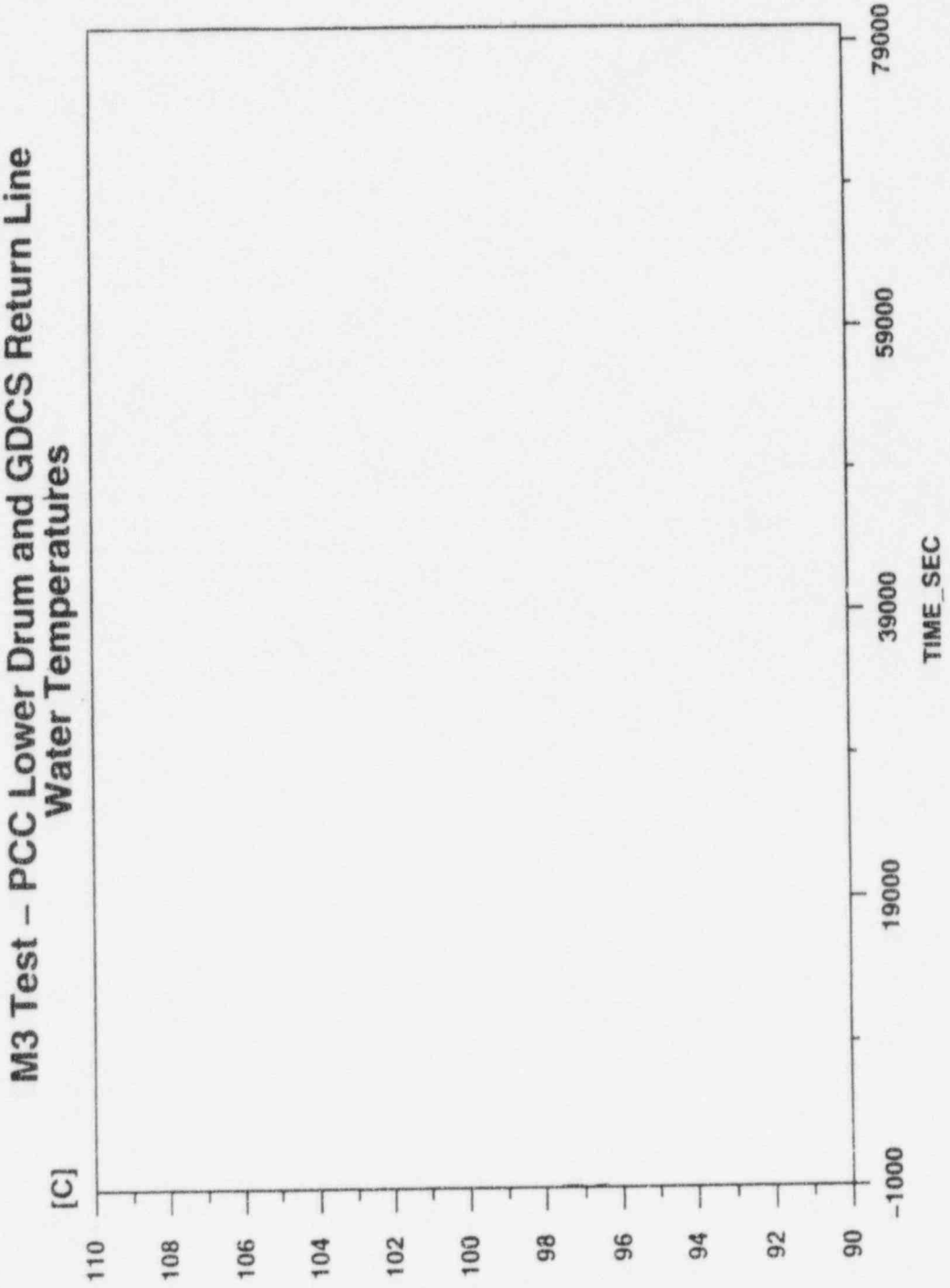

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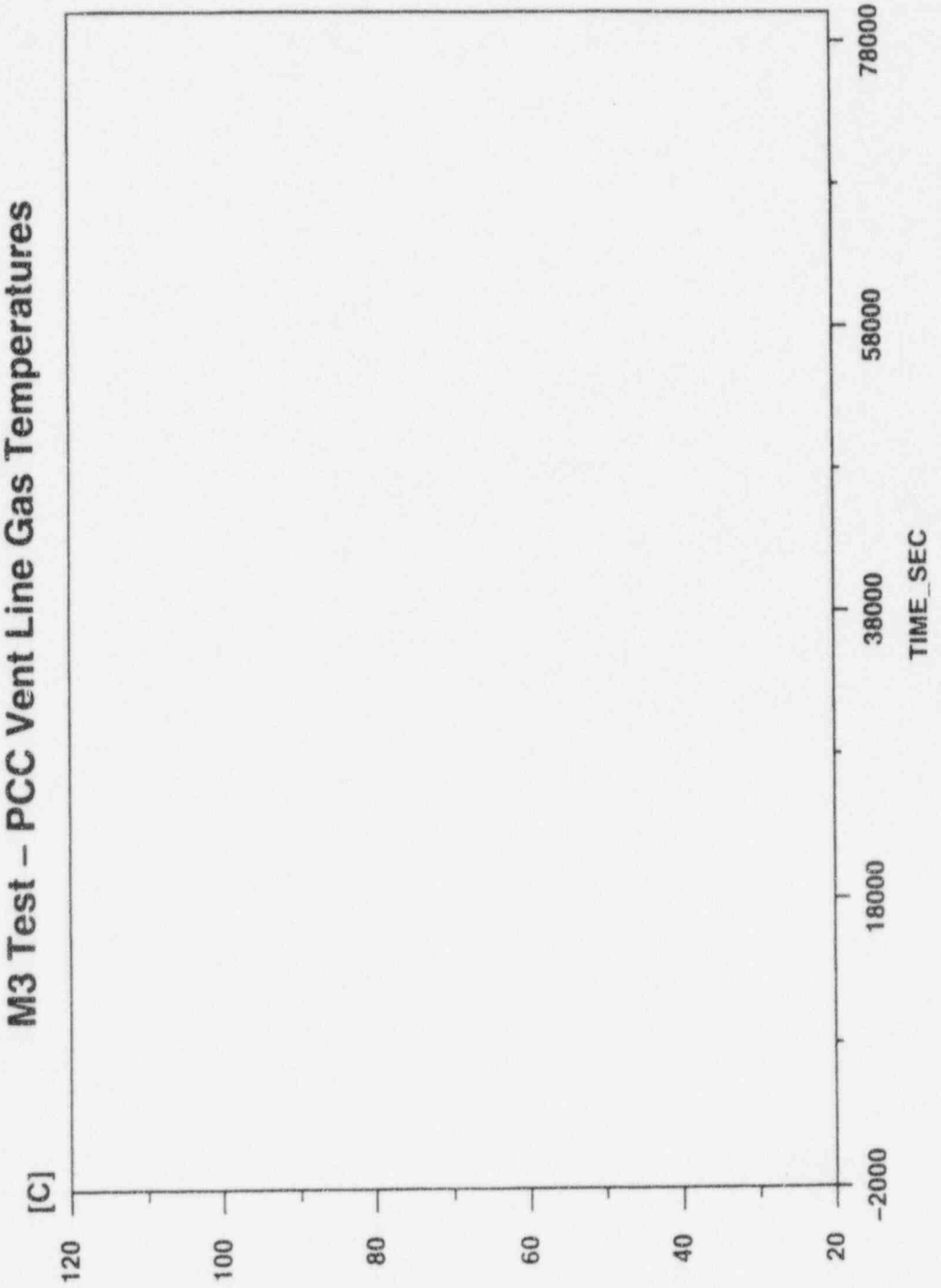

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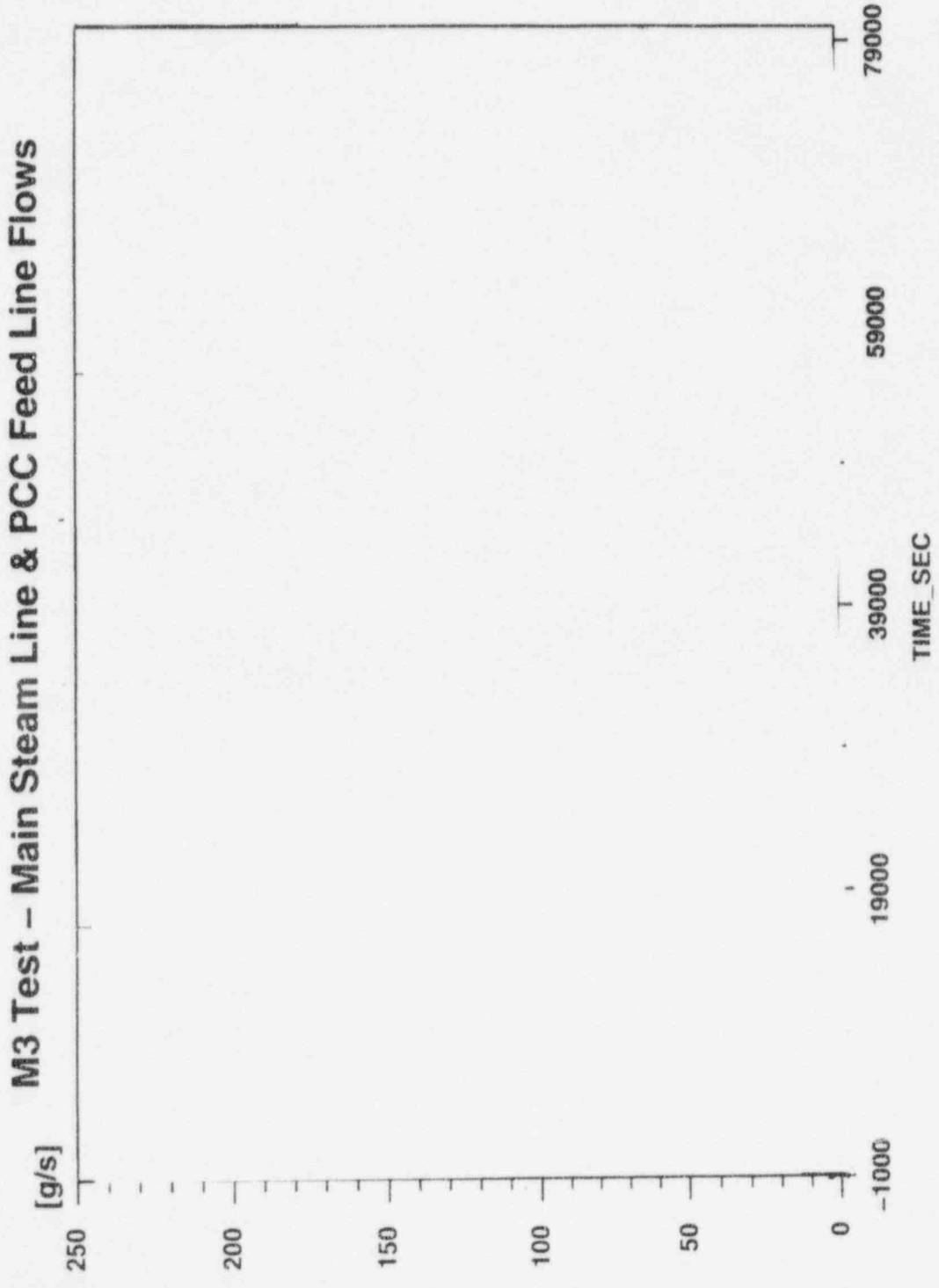
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