reactivity insertion upon ejection greater than 0.[illegible] k/k at rated power. Inoperable rod worth shall be determined within 4 weeks.

b. A control rod shall be considered inoperable if

(a) the rod cannot be moved by CRDM, or
(b) the rod is misaligned from its bank by more than 15 inches, or
(c) the rod drop time is not met.

c. If a control rod cannot be moved by the drive mechanism, shutdown margin shall be increased by boron addition to compensate for the withdrawn worth of the inoperable rod.

5. CONTROL ROD POSITION INDICATION

If either the power range channel deviation alarm or the rod deviation monitor alarm is not operable, rod positions shall be logged once per shift and after a load change greater than 10% of rated power. If both alarms are inoperable for two hours or more, the nuclear overpower trip shall be reset to 93% of rated power.

6. POWER DISTRIBUTION LIMITS

a. Hot channel factors:

(1) F_Q Limit

The hot channel factors (defined in Bases) must meet the following limits at all times except during low power physics tests:

$$F_Q(Z) \leq ([F_Q]_{L/P}) \times K(Z), \text{ for } P > 0.5$$

$$F_Q(Z) \leq (2 \times [F_Q]_L) \times K(Z), \text{ for } P \leq 0.5$$

$$F^N_{\Delta H} \leq 1.55\,[1.0 + 0.2\,(1 - P)]$$

Where P is the fraction of rated power at which the core is operating; K(Z) is the function given in Figure 3.2-3 or Figure 3.2-3a; Z is the core height location of F_Q. $[F_Q]_L$ and K(Z) are dependent on the steam generator tube plugging level as follows:

Plugging level	$[F_Q]_L$	Figure Number for K(Z)
>5 % and $\leq$ 28%	2.125	3.2-3
$\leq$ 5%	2.30	3.2-3a

(2) Augmented Surveillance (MIDS)

If $[F_Q]_p$, as predicted by approved physics calculations, exceeds $[F_Q]_L$ then the power will be limited to a turnon power fraction, P_T, equal to the ratio of $[F_Q]_L$ divided by $[F_Q]_p$, or, for operation at power levels above P_T, augmented surveillance of hot channel factors shall be implemented, except in Base Load

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HOT CHANNEL FACTOR
NORMALIZED OPERATING ENVELOPE

(for ≤ 5% steam generator tube plugging and F_q=2.30)

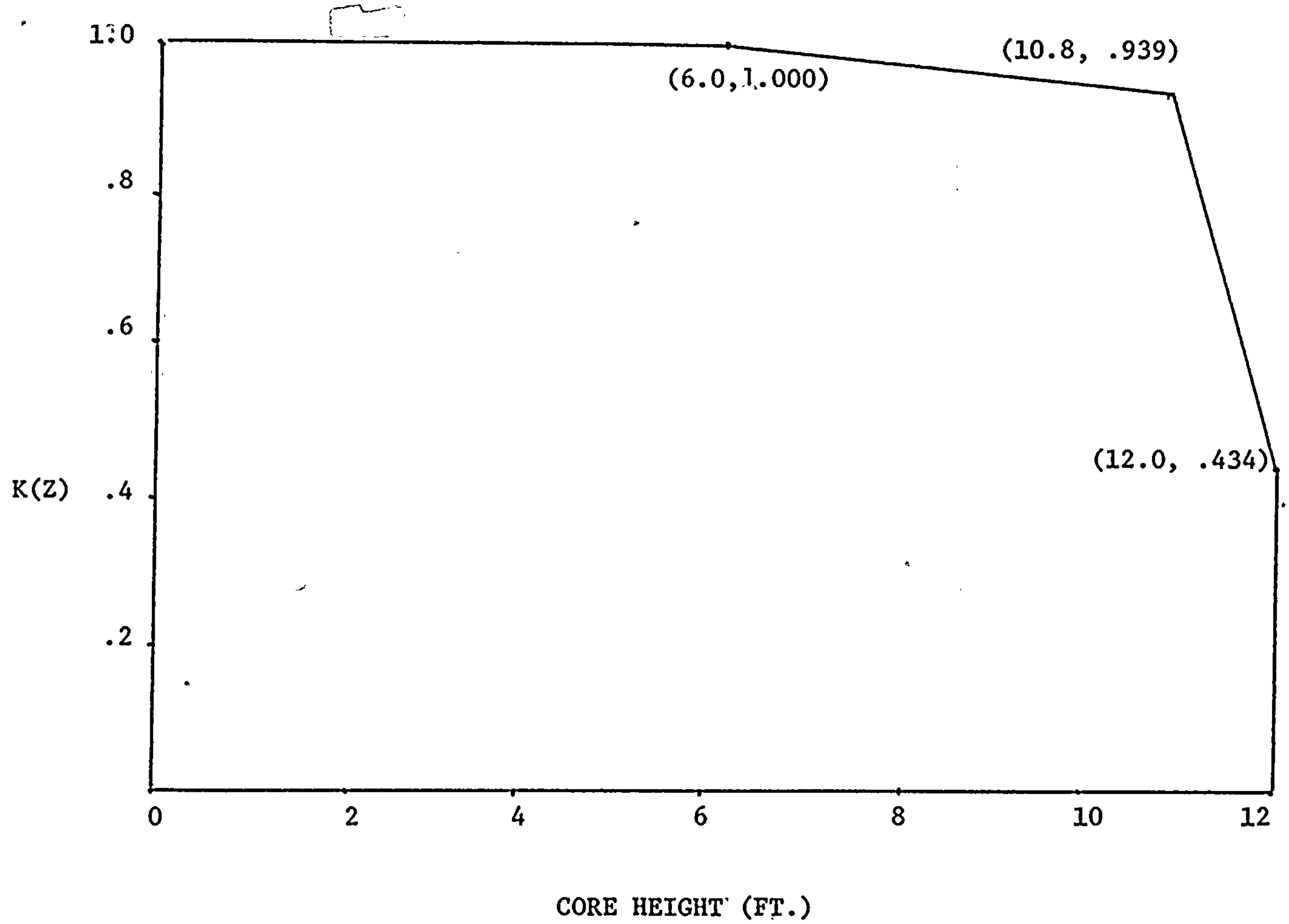


FIG. 3.2-3a

Safety Analysis for Turkey Point Unit 3 and 4
Loss-of-Coolant-Accident

The loss-of-coolant accident (LOCA) has been reanalyzed for Turkey Point Unit 3 with replaced model 44F steam generators and 5 percent steam generator tube plugging. This analysis would also be applicable to Turkey Point Unit 4 (FLA) provided that it also has replaced model 44F steam generator. The following report amends the section of the Safety Analysis Report on major reactor coolant system pipe ruptures (Chapter 14.3.2). The analysis presented here is in accordance with the requirements of 10CFR50.46, Appendix K provided in reference 1.

A description of the Westinghouse Emergency Core Cooling System (ECCS) Evaluation Model used for this analysis is presented in WCAP-8839 (reference 2). The individual computer codes which comprise the Westinghouse ECCS Evaluation Model are described in detail in references 3, 4, 5, and 6. The results of several sensitivity studies are reported in reference 8. These results are for conditions which are not limiting in nature and hence are reported on a generic basis.

Since the initial development of the Appendix K ECCS Evaluation Model, several model changes were made, submitted to the NRC for review and approved for use in design LOCA analyses. These modifications are specified in references 7, 9, 10, 11, 12, 13, and 14.

The LOCA analysis presented in this report utilized the 1981 version of the evaluation model which is the model currently used and accepted for plant licensing calculations. The modifications which comprise the 1981 evaluation model are delineated in reference 12.

Results

The analysis of the loss-of-coolant accident is performed at 102 percent of the licensed core power rating. The peak linear power and total core power used in the analysis are given in Table 2. Since there is margin between the value of peak linear power density used in this analysis and the value of the peak linear power density expected during plant operation, the peak clad temperature calculated in this analysis is greater than the maximum clad temperature expected to exist.

Table 1 presents the occurrence time for various events throughout the accident transient.

Table 2 presents selected input values and results from the hot fuel rod thermal transient calculation. For these results, the hot spot is defined as the location of maximum peak clad temperatures. That location is specified in Table 2 for each break analyzed. The location is indicated in feet which is the elevation above the bottom of the active fuel stack.

Table 3 presents a summary of the various containment systems parameters and structural parameters which were used as input to the COCO computer code[6] used in this analysis.

Tables 4 and 5 present reflood mass and energy releases to the containment, and the broken loop accumulator mass and energy release to the containment, respectively.

Figures 1 through 17 present the transients for the principle parameters for the break sizes analyzed. The following items are noted:

Figures 1A - 3B: Quality, mass velocity and clad heat transfer coefficient for the hotspot and burst locations

Figures 4A - 6B: Core pressure, break flow, and core pressure drop. The break flow is the sum of the flowrates from both ends of the guillotine break. The core pressure drop is taken as the pressure just before the core inlet to the pressure just beyond the core outlet

Figures 7A - 9B: Clad temperature, fluid temperature and core flow. The clad and fluid temperatures are for the hot spot and burst location.

Figures 10A - 11B: Downcomer and core water level during reflood, and flooding rate

Figures 12A - 13B: Emergency core cooling system flowrates, for both accumulator and pumped safety injection

Figures 14A - 15B: Containment pressure and core power transient

Figures 16, 17: Break energy release during blowdown and the containment wall condensing heat transfer coefficient for the worst break

Conclusions - Thermal Analysis

For break up to and including the double-ended severance of a reactor coolant pipe, the Emergency Core Cooling System will meet the Acceptance Criteria as presented in 10CFR50.46[1] That is:

1. The calculated peak clad temperature does not exceed 2200°F based on a total core peaking factor of 2.30.

2. The amount of fuel element cladding that reacts chemically with water or steam does not exceed 1 percent of the total amount of Zircaloy in the reactor.

3. The clad temperature transient is terminated at a time when the core geometry is still amenable to cooling. The cladding oxidation limits of 17 percent are not exceeded during or after quenching.

4. The core temperature is reduced and decay heat is removed for an extended period of time, as required by the long-lived radioactivity remaining in the core.

References

1. "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Cooled Nuclear Power Reactors", 10CFR50.46 and Appendix K of 10CFR50.46. Federal Register, Volume 39, Number 2, January 4, 1974.

2. Bordelon, F. M., Massie, H. W., and Zordan, T. A., "Westinghouse ECCS Evaluation Model-Summary", WCAP-8339, July 1974.

3. Bordelon, F. M., et al., "SATAN-VI Program: Comprehensive Space-Time Dependent Analysis of Loss-of-Coolant", WCAP-8302 (Proprietary Version), WCAP-8306 (Non-Propietary Version), June 1974.

4. Bordelon, F. M., et al., "LOCTA-IV Program: Loss-of-Coolant Transient Analysis", WCAP-8301 (Proprietary Version), WCAP-8305 (Non-Proprietary Version), June 1974.

5. Kelly, R. D., et al., "Calculational Model for Core Reflooding After a Loss-of-Coolant Accident (WREFLOOD Code)". WCAP-8170 (Proprietary Version), WCAP-8171 (Non-Proprietary Version), June 1974.

6. Bordelon, F. M., and Murphy E. T., "Containment Pressure Analysis Code (COCO)", WCAP-8327 (Proprietary Version), WCAP-8326 (Non-Proprietary Version), June 1974.

7. Bordelon, F. M., et al., "The Westinghouse ECCS Evaluation Model: Supplementary Information", WCAP-8471 (Proprietary Version), WCAP-8472 (Non-Proprietary Version), January 1975.

8. Salvatori, R., "Westinghouse ECCS - Plant Sensitivity Studies", WCAP-8340 (Proprietary Version), WCAP-8356 (Non-Proprietary Version), July 1974.

9. "Westinghouse ECCS Evaluation Model, October, 1975 Versions," WCAP-8622 (Proprietary Version), WCAP-8623 (Non-Proprietary Version), November 1975.

10. Letter from C. Eicheldinger of Westinghouse Electric Corporation to D. B. Vassalo of the Nuclear Regulatory Commission, letter number NS-CE-924, January 23, 1976.

11. Kelly, R. D., Thompson, C. M., et al., "Westinghouse Emergency Core Cooling System Evaluation Model for Analyzing Large LOCA's During Operation With One Loop Out of Service for Plants Without Loop Isolation Valves", WCAP-9166, February 1978.

12. Eicheldinger C., "Westinghouse ECCS Evaluation Model, 1981 Version", WCAP-9220-P-A (Proprietary Version), WCAP-9221-A (Non-Proprietary Version), Revision 1, December 1981.

13. Letter from T. A. Anderson of Westinghouse Electric Corporation to John Stolz of the Nuclear Regulatory Commission, letter number NS-TMA-1981, November 1, 1978.

14. Letter from T. A. Anderson of Westinghouse Electric Corporation to R. L. Tedesco of the Nuclear Regulatory Commission, letter number NS-TMA-2014, December 11, 1978.

TABLE 1

LARGE BREAK

TIME SEQUENCE OF EVENTS

	DECL C_D = 0.4 (Sec)	DECL C_D = 0.6 (Sec)
START	0.0	0.0
Rx Trip Signal	0.72	0.71
S. I. Signal	1.13	0.60
Acc. Injection	14.7	11.3
End of Blowdown	32.93	28.14
Bottom of Core Recovery	54.44	49.00
Acc. Empty	62.79	57.83
Pump Injection	25.74	25.60
End of Bypass	32.93	28.14

TABLE 2

LARGE BREAK

	DECLG C_D = 0.4	DECLG C_D = 0.6
Results		
Peak Clad Temp. ^oF	2195	2053
Peak Clad Location Ft.	7.25	6.75
Local Zr/H_2O Rxn (max)%	6.07	3.968
Local Zr/H_2O Location Ft.	7.25	7.5
Total Zr/H_2O Rxn %	< 0.3	< 0.3
Hot Rod Burst Time sec	45.2	45.0
Hot Rod Burst Location Ft.	5.75	6.0

Calculation	
NSSS Power Mwt 102% of	2200
Peak Linear Power kw/ft 102% of	13.07
Peaking Factor (At License Rating)	2.30
Accumulator Water Volume (PER ACCUMULATOR)	875 ft^3

Fuel region + cycle analyzed	Cycle	Region
UNIT 3	8	All
UNIT 4 (If applicable)	8	All

CONTAINMENT DATA (DRY CONTAINMENT)

Net Free Volume	1.55×10^6 Ft^3
Initial Conditions	
Pressure	14.7 psia
Temperature	90.0 °F
RWST Temperature	39.0 °F
Service Water Temperature	63.0 °F
Spray System	
Number of Pumps Operating	2
Runout Flow Rate	1450 gpm
Actuation Time	26 sec.
Safeguards Fan Coolers	
Number of Fan Coolers Operating	3
Fastest Post Accident Initiation of Fan Coolers	26 secs.

STRUCTURAL HEAT SINK DATA

Wall	Material	Thickness (in)	Area (Ft^2)
1	Paint	0.006996	
	Carbon Steel	0.2898	87335.8
2	Carbon Steel	0.006996	1000086.0
3	Paint	0.006996	
	Carbon Steel	0.4896	35660.11
4	Carbon Steel	0.4896	12367.5
5	Paint	0.006996	
	Carbon Steel	0.2898	
	Concrete	24.0	50430.0
6	Carbon Steel	0.2898	
	Concrete	24.0	16810.0
7	Paint	0.006996	
	Carbon Steel	1.56	4622.69
8	Carbon Steel	1.56	1540.89
9	Paint	0.006996	
	Carbon Steel	5.496	1277.87
10	Carbon Steel	5.496	425.93
11	Paint	0.006996	
	Carbon Steel	2.748	951.525

STRUCTURAL HEAT SINK DATA

Wall	Material	Thickness (in)	Area (Ft^2)
12	Carbon Steel	2.748	317.175
13	Paint	0.006996	
	Carbon Steel	0.03	23550.0
14	Paint	0.006996	
	Carbon Steel	0.063	80368.5
15	Paint	0.006996	
	Carbon Steel	0.10	42278.25
16	Carbon Steel	0.2898	17190.0
17	Stainless Steel	0.032	113253.4
18	Stainless Steel	2.1264	3704.0
19	Stainless Steel	0.1398	
	Concrete	24.0	14392.0
20	Concrete	24.0	59132.0

TABLE 4

REFLOOD MASS AND ENERGY RELEASES

DECLG $C_D = 0.4$

Time (sec)	$\dot{M}$Total (lbm/sec)	$\dot{M}$hTotal (Btu/sec)
54.347	0	0
55.669	0.028	35.68
62.891	19.48	25135
74.291	32.84	42383
92.191	45.47	57824
111.591	62.32	78159
130.791	75.63	94204
149.791	87.12	108032
186.891	285.03	161152
226.791	298.71	152313
271.091	312.18	141932
321.491	328.83	130016
382.191	342.69	115551

TABLE 4B

REFLOOD MASS AND ENERGY RELEASES

DECLG C_D = 0.6

Time (sec)	$\dot{m}_{TOTAL}$ (lbm/sec)	$\dot{m}h_{TOTAL}$ (BTU/Sec)
49.001	0	0
49.826	0.03	35.2
57.410	33.17	42713
68.529	34.49	44423
85.929	50.14	63315
104.929	65.35	81692
124.029	77.64	96478
142.929	88.47	109506
179.929	274.99	162328
219.329	291.11	154284
263.229	304.64	143981
313.329	321.21	132490
373.829	341.73	117812

Table 5A

DECLG C_D=0.4

Broken Loop Injection Spill During Blowdown

TIME	MASS	ENERGY	ENTHALPY
0.000	3083.402	183832.451	59.620
1.010	2775.985	165504.238	59.620
2.010	2549.479	151999.952	59.620
3.010	2371.235	141373.054	59.620
4.010	2225.996	132713.868	59.620
5.010	2104.580	125475.082	59.620
6.010	2000.289	119257.219	59.620
7.010	1909.287	113831.700	59.620
8.010	1828.531	109016.989	59.620
9.010	1756.087	104697.907	59.620
10.010	1690.537	100789.842	59.620
11.010	1630.928	97235.939	59.620
12.010	1576.546	93993.651	59.620
13.010	1526.743	91024.431	59.620
14.010	1480.928	88292.925	59.620
15.010	1438.640	85771.693	59.620
16.010	1399.477	83436.827	59.620
17.010	1363.118	81269.116	59.620
18.010	1329.230	79248.708	59.620
19.010	1297.278	77343.735	59.620
20.010	1267.106	75544.886	59.620
21.010	1238.699	73851.229	59.620
22.010	1212.124	72266.830	59.620
23.010	1187.431	70794.611	59.620
24.010	1164.479	69426.222	59.620
25.010	1142.940	68142.087	59.620
26.010	1122.957	66950.723	59.620
27.010	1104.421	65845.604	59.620
28.010	1086.744	64791.649	59.620
29.010	1070.187	63804.549	59.620
30.010	1054.268	62855.469	59.620
31.010	1039.041	61947.622	59.620
32.010	1024.474	61079.153	59.620

Table 5B

DECLG C_D=0.6

Broken Loop Injection Spill During Blowdown

TIME	MASS	ENERGY	ENTHALPY
[illegible]	[illegible]	[illegible]	[illegible]
1.010	2773.[illegible]	[illegible]	59.[illegible]
2.010	2544.223	[illegible]	59.620
3.010	2364.[illegible]	[illegible]	59.[illegible]
4.010	2217.[illegible]	[illegible]	59.620
5.010	2094.502	124374.218	59.620
6.010	1988.200	118536.465	59.620
7.010	1895.206	112992.209	59.620
8.010	1812.907	108085.507	59.620
9.010	1739.353	103700.219	59.620
10.010	1673.202	99756.274	59.620
11.010	1613.547	96199.686	59.620
12.010	1559.682	92988.245	59.620
13.010	1510.[illegible]	[illegible]0035.043	59.620
14.010	1466.596	87438.469	59.620
15.010	1425.293	84975.953	59.620
16.010	1386.597	82668.919	59.620
17.010	1350.397	80510.683	59.620
18.010	1317.382	78542.306	59.620
19.010	1286.947	76727.764	59.620
20.010	1258.891	75055.089	59.620
21.010	1233.052	73514.588	59.620
22.010	1208.918	72075.697	59.620
23.010	1186.570	70743.321	59.620
24.010	1165.640	69495.430	59.620
25.010	1145.727	68308.260	59.620
26.010	1126.662	67171.562	59.620
27.010	1108.630	66096.497	59.620

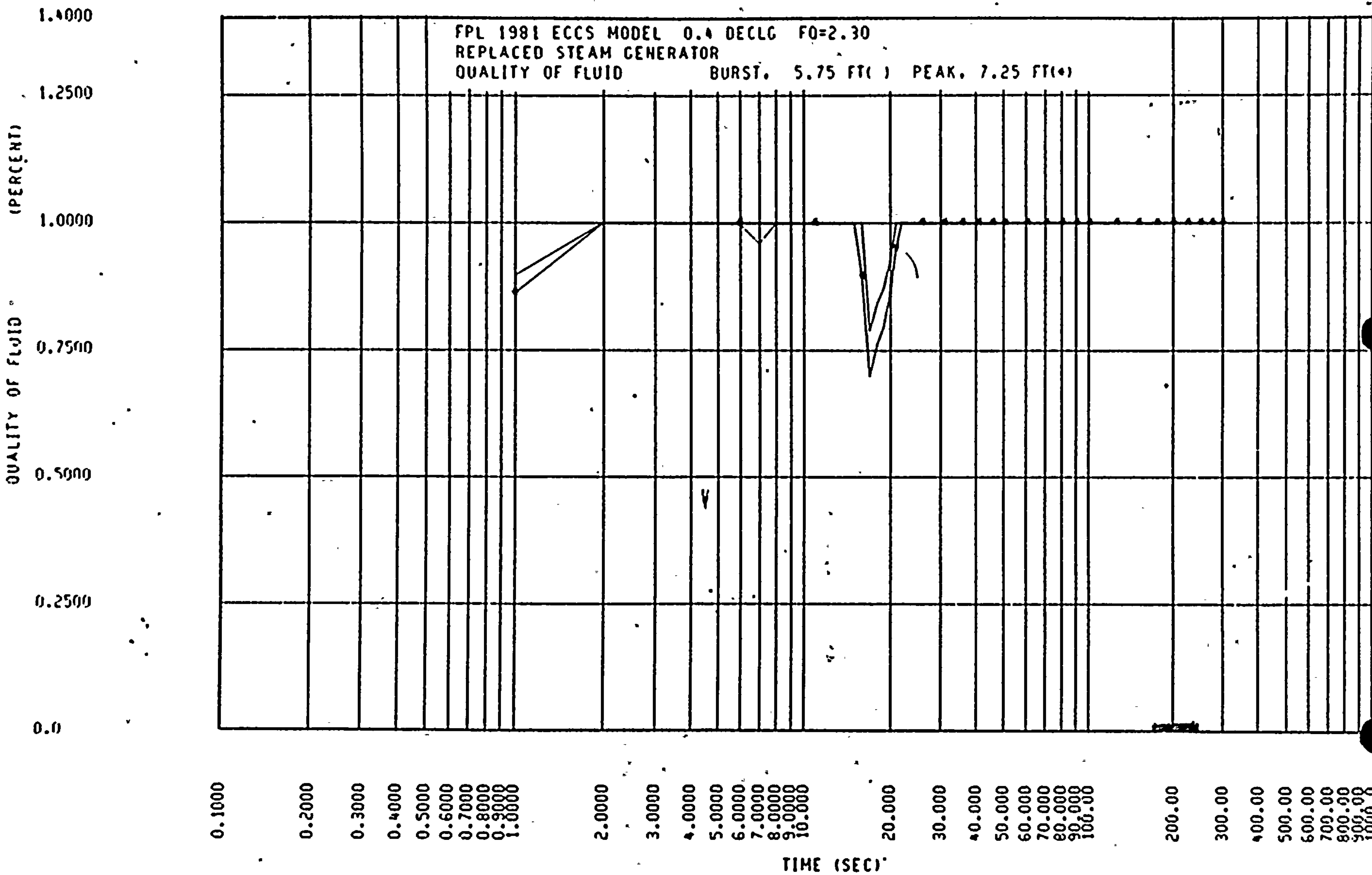


FIGURE 1A FLUID QUALITY
DECLG(CD = 0.4)

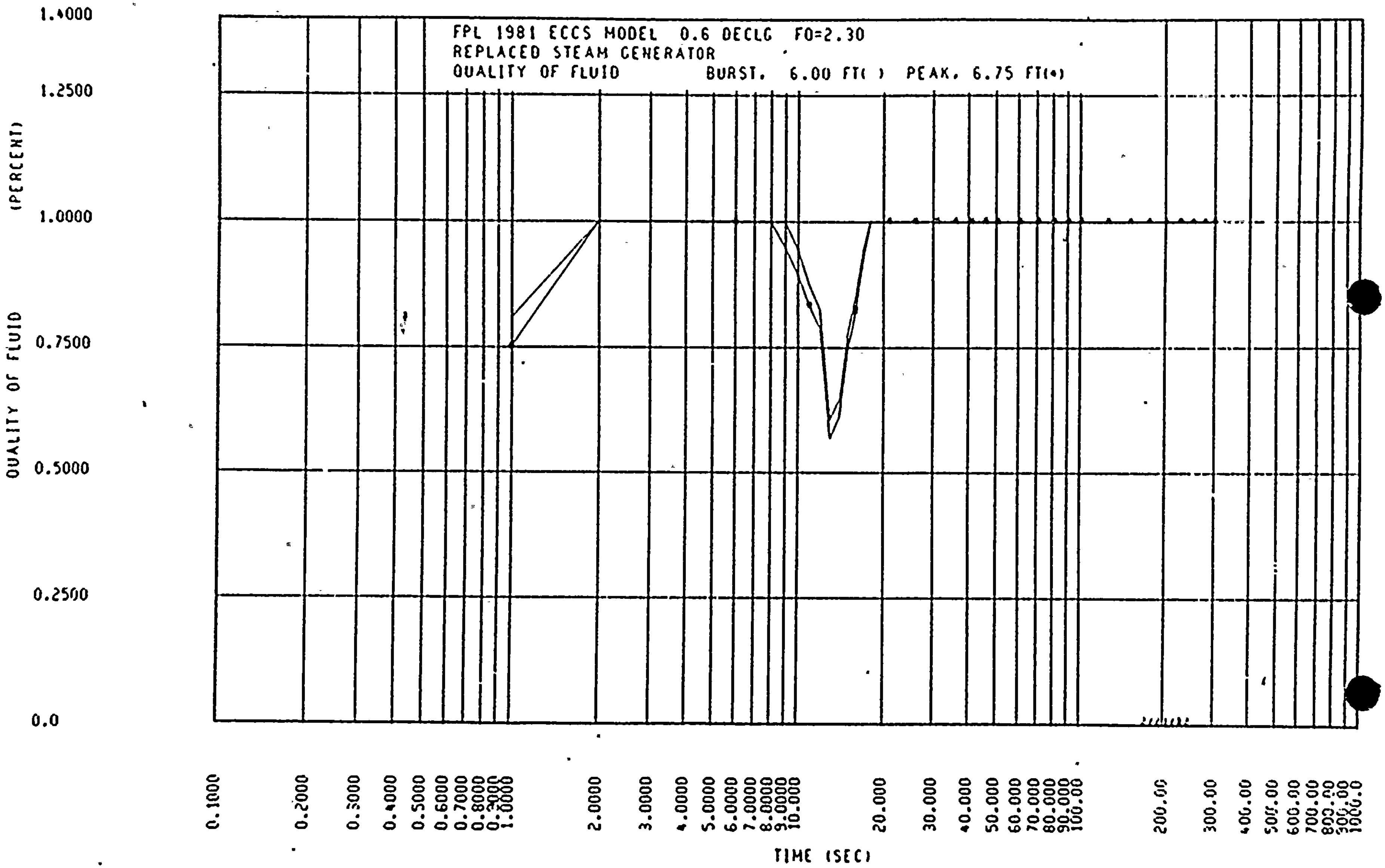


FIGURE 3E [illegible]UID QUALITY
DECLG(CD = 0.[illegible]

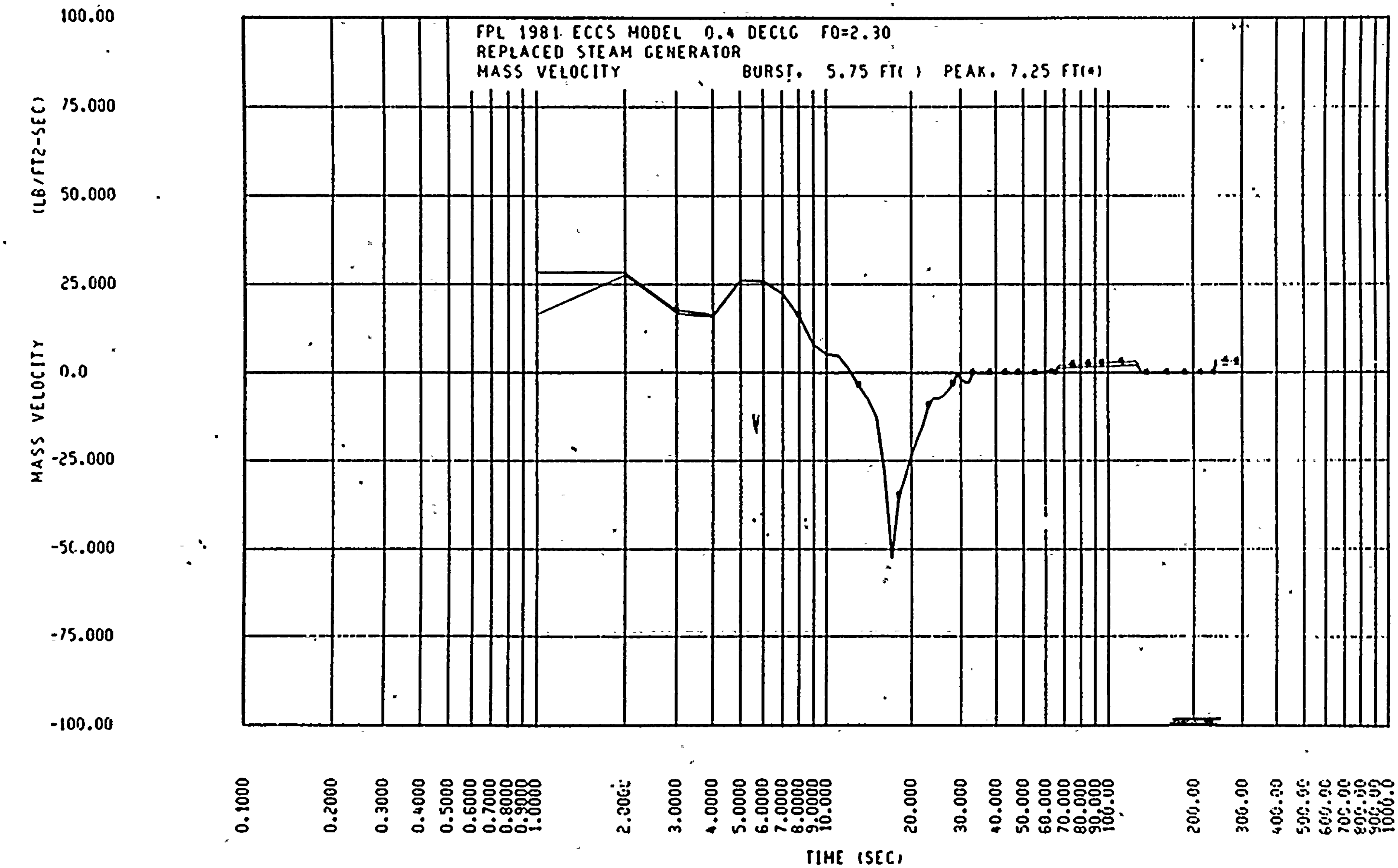


FIGURE 2A MASS VELOCITY
DECLG(CD = 0.4)

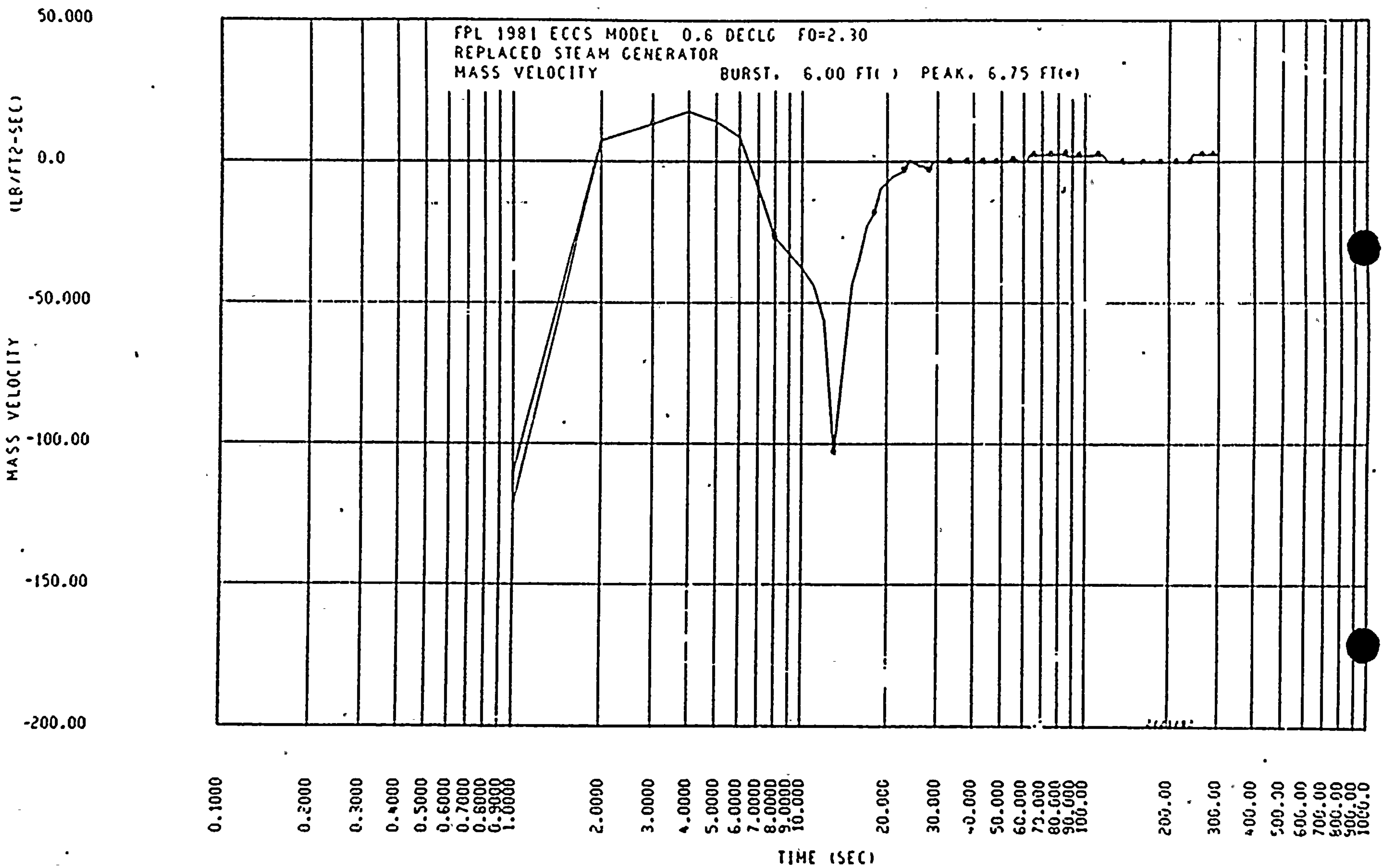


FIGURE .. MASS VELOC...
DECLG(CD ...

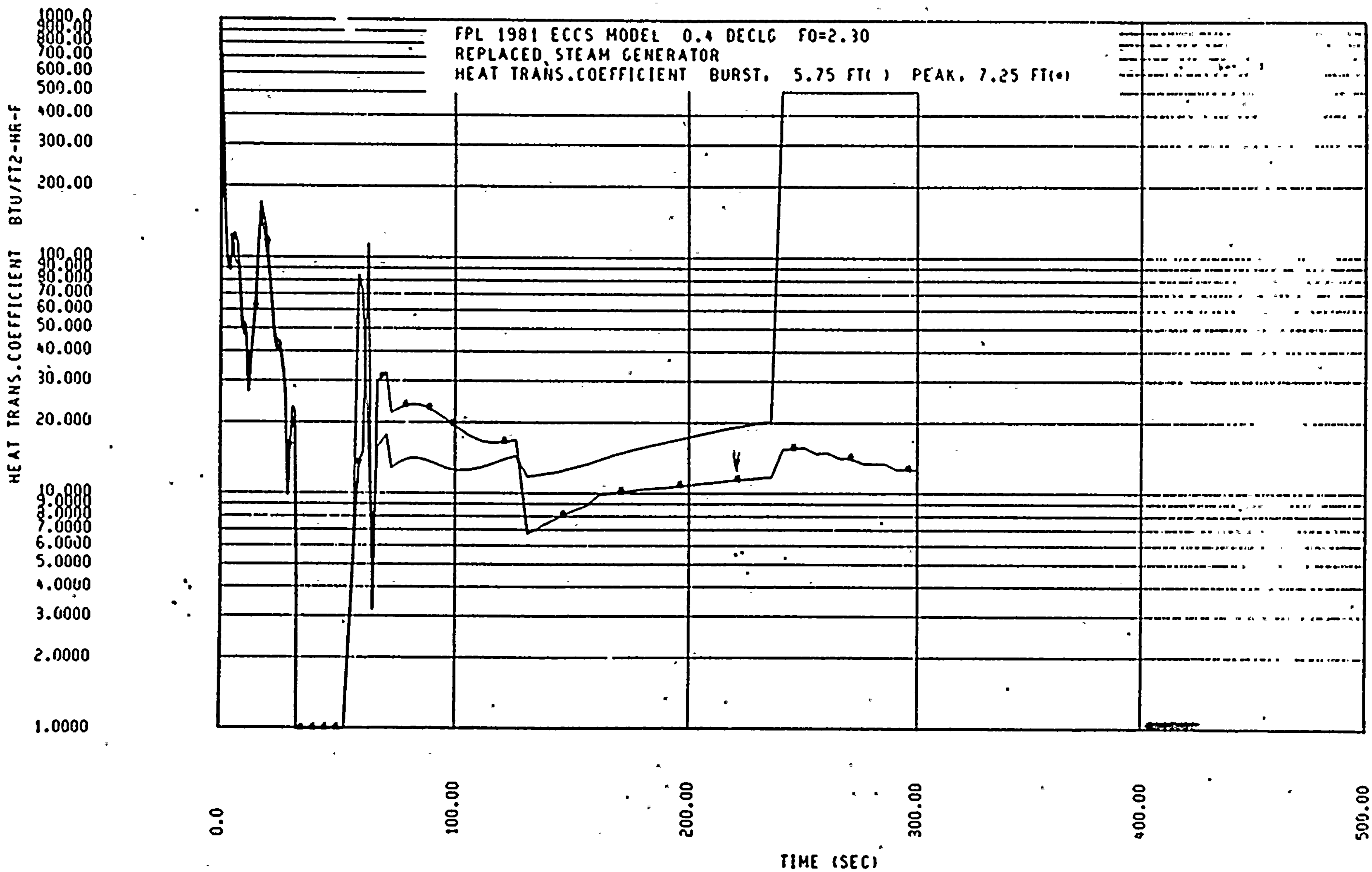


FIGURE 3A HEAT TRANSFER COEFFICIENT
DECLG(CD = 0.4)

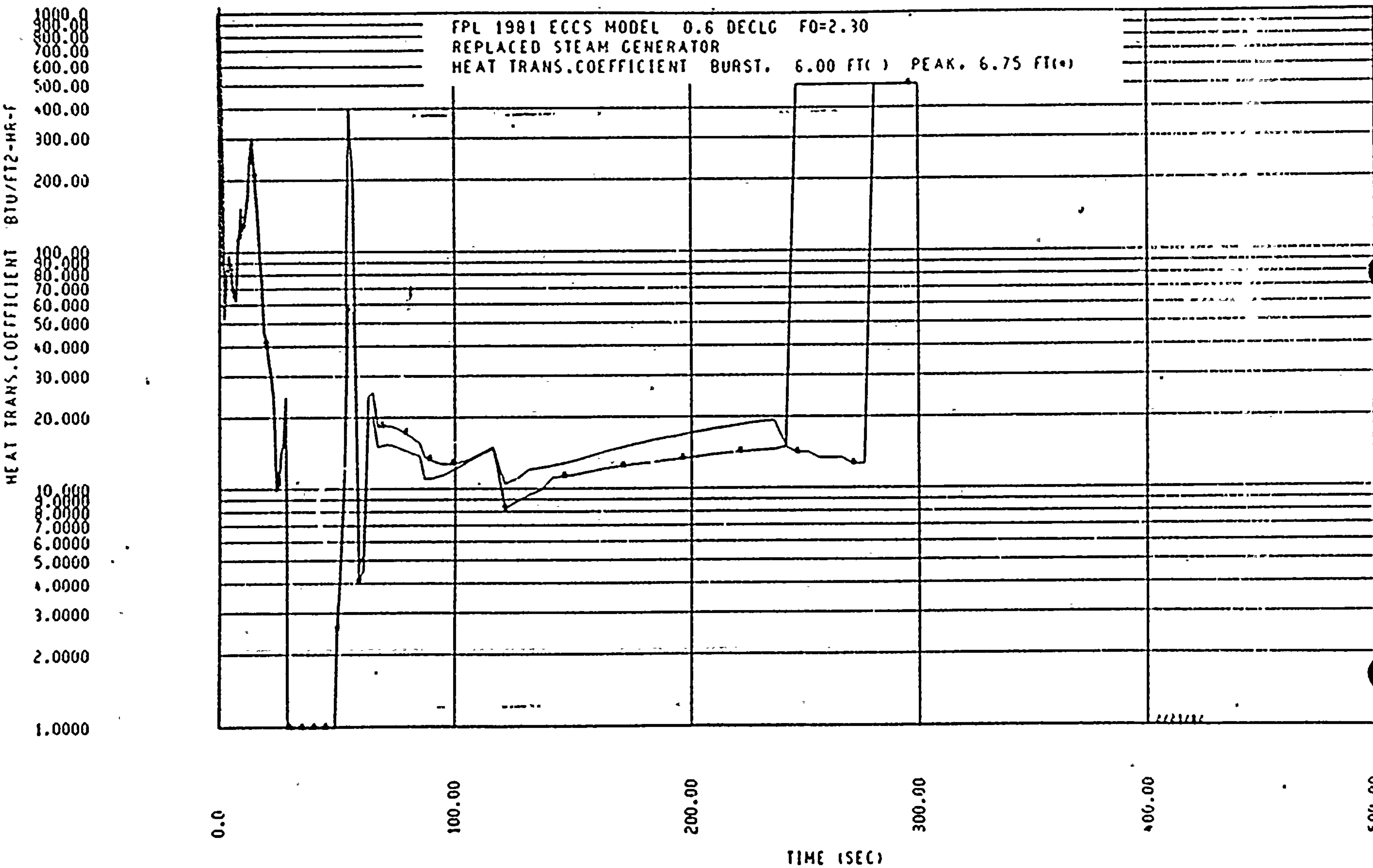


FIGURE [illegible] HEAT TRANSF[illegible] [illegible]FFICIENT
DECLG(CD =

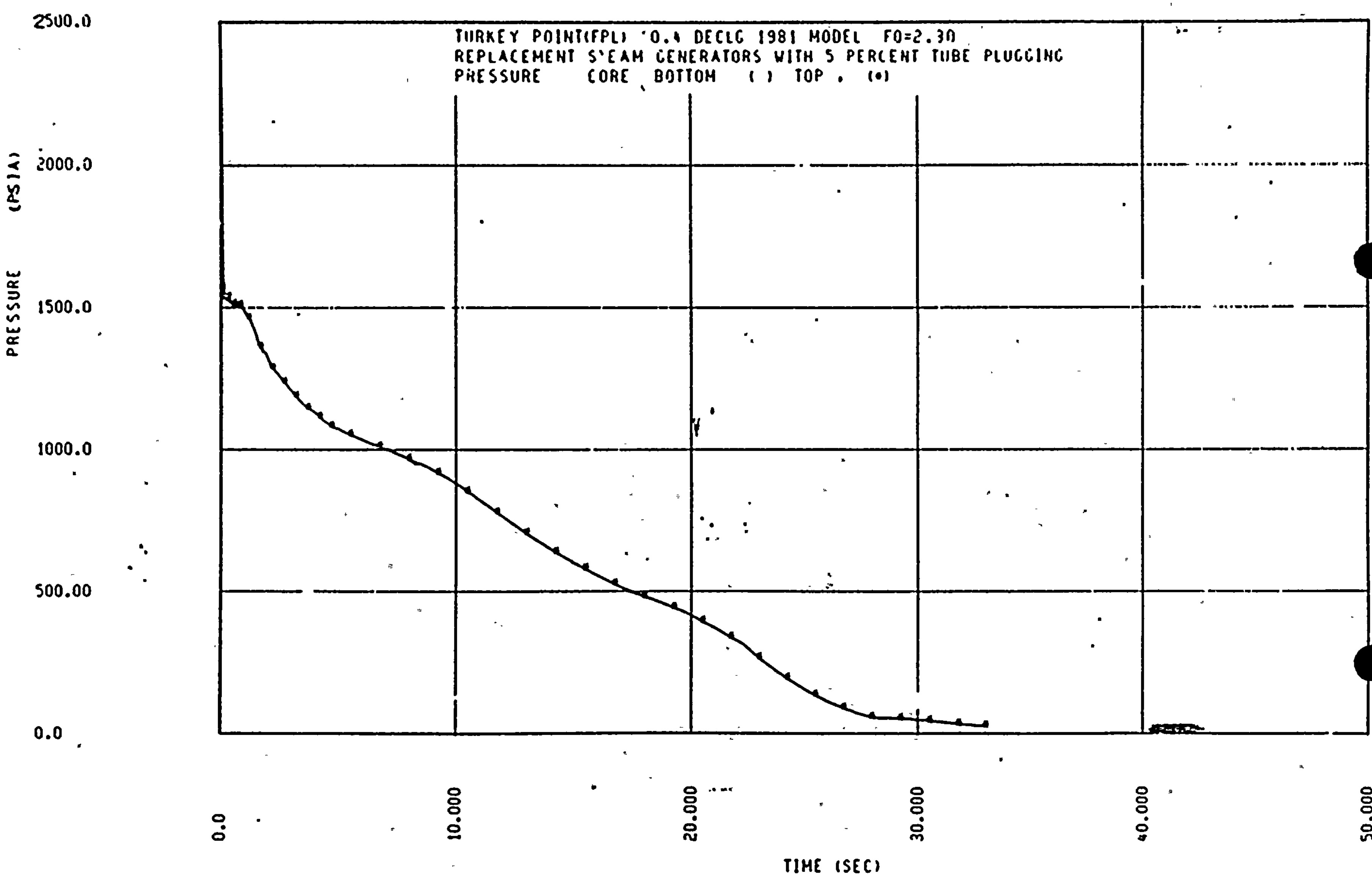


FIGURE 4A CORE PRESSURE
DECLG(CD = 0.4)

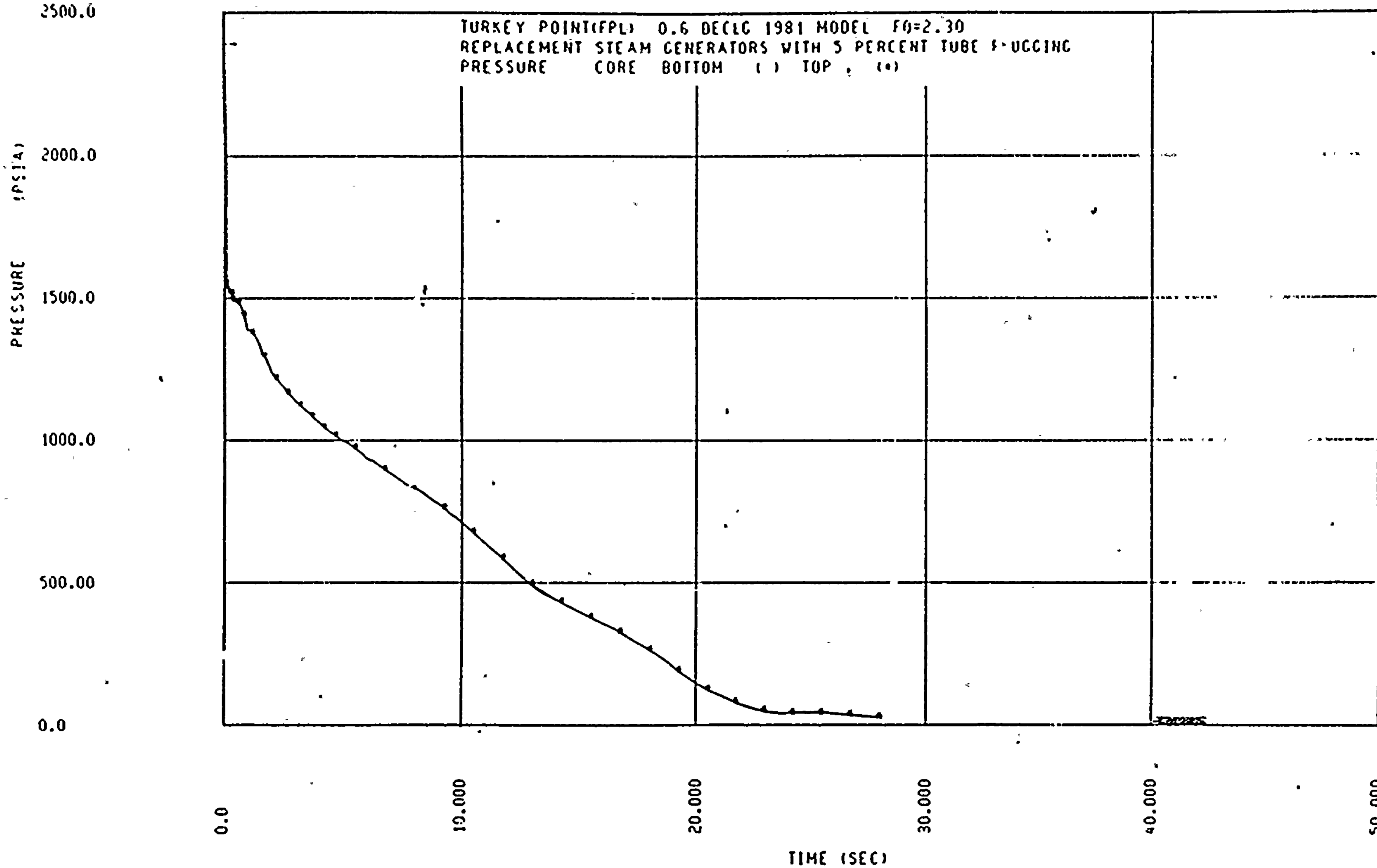


FIGURE ?" CORE PRESSURE
DECLG(CD = 0

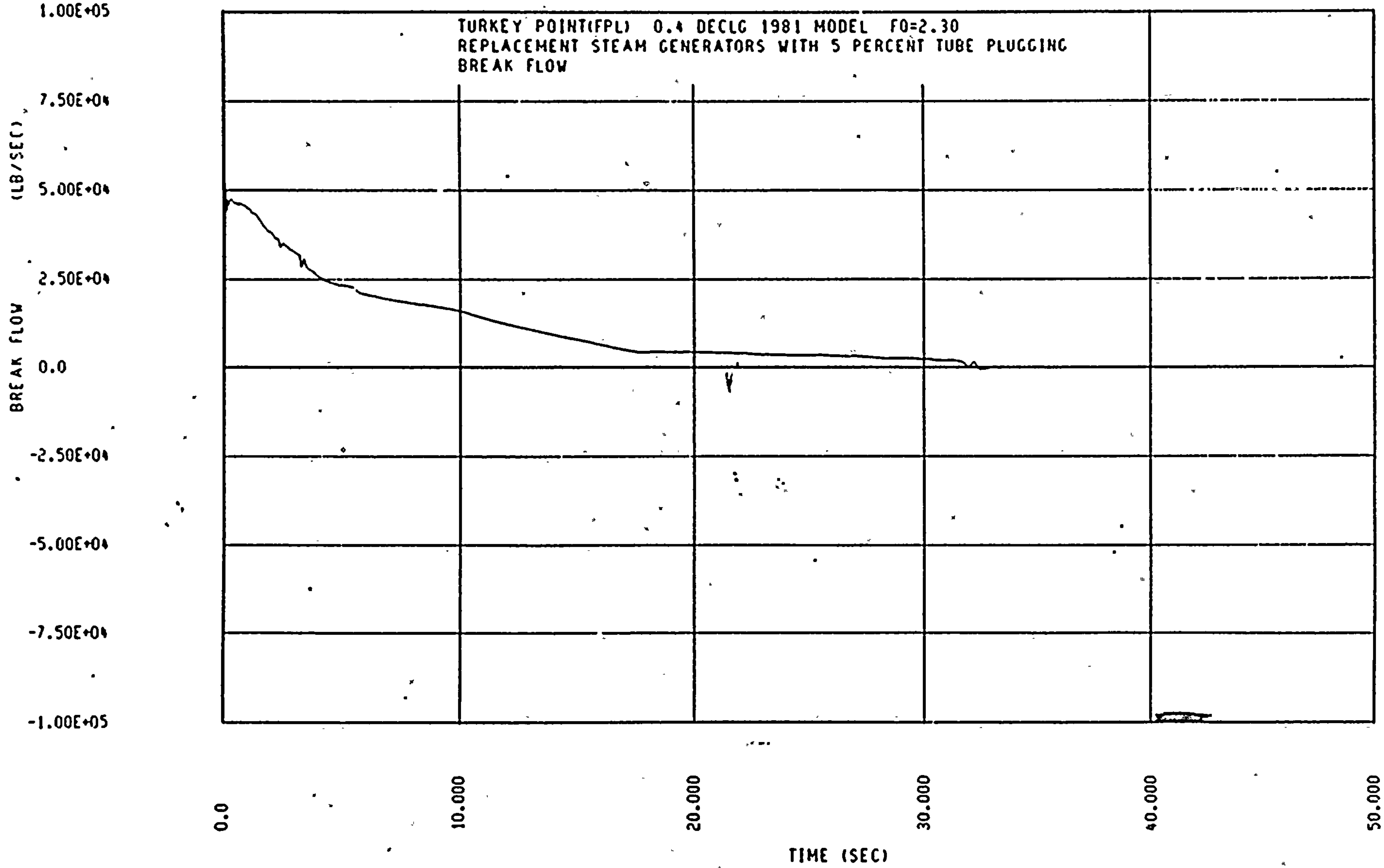


FIGURE 5A BREAK FLOW RATE
DECLG(CD = 0.4)

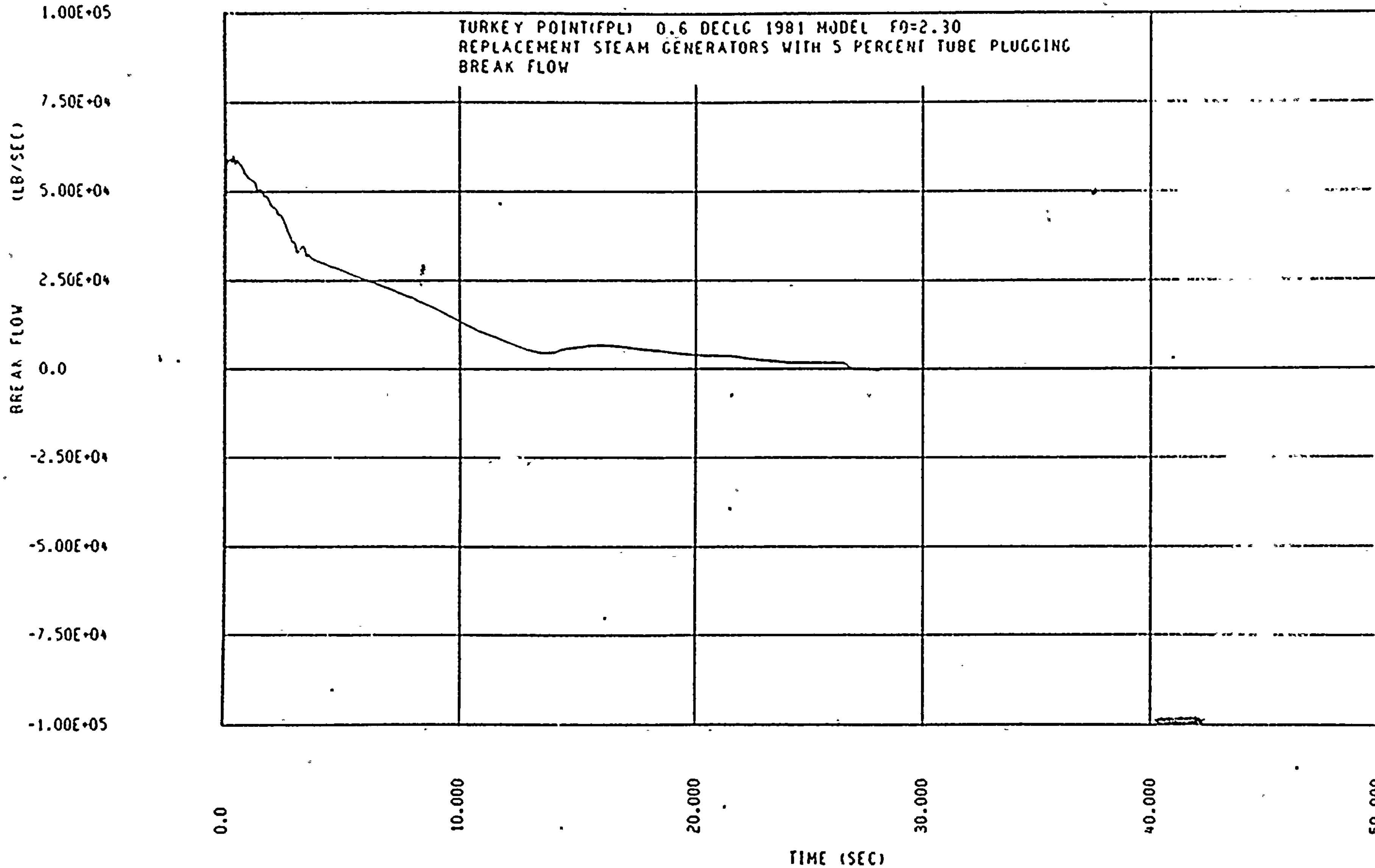


FIGURE BREAK FLOW
DECLG(CD =

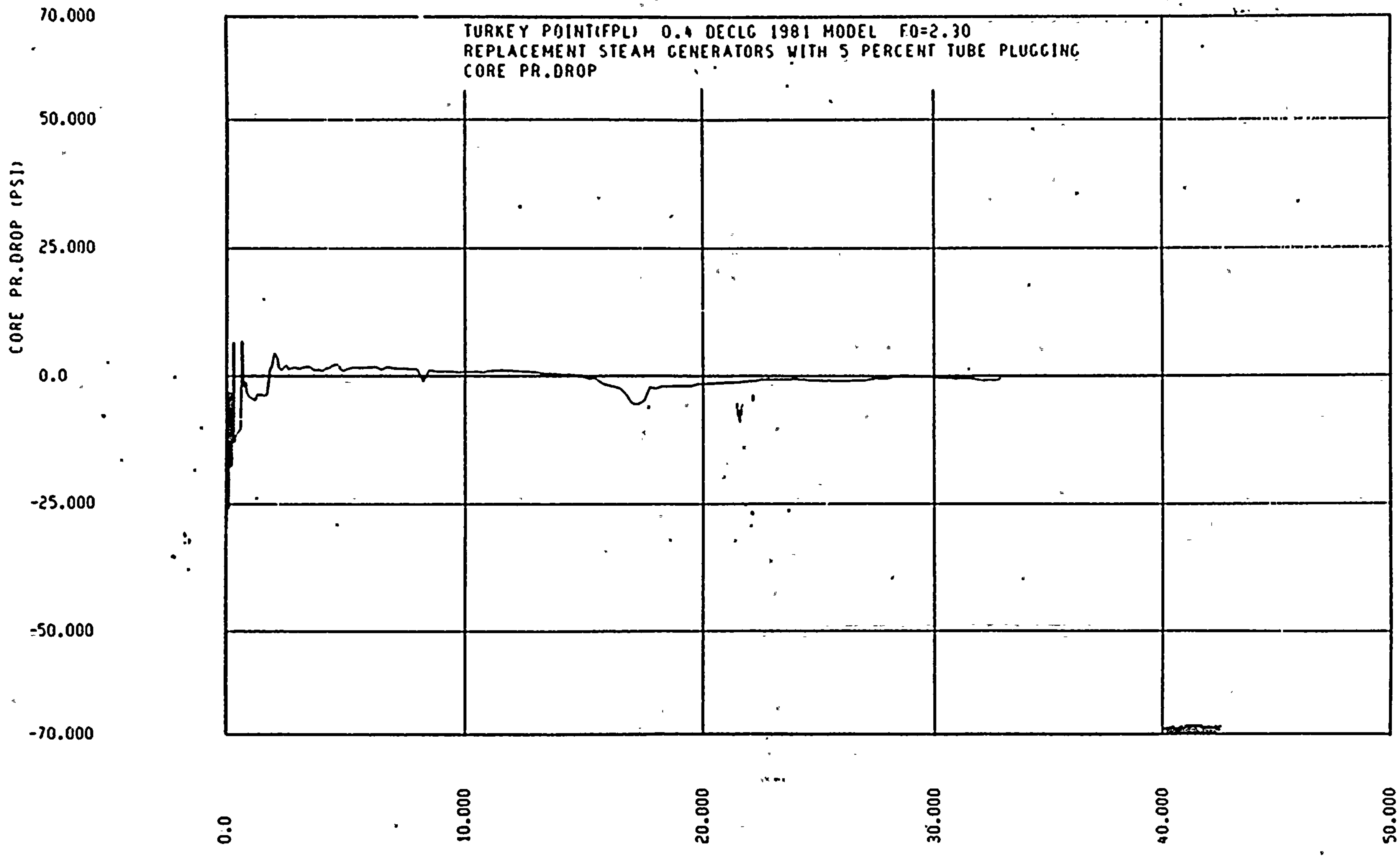


FIGURE 6A CORE PRESSURE DROP
DECLG(CD = 0.4)

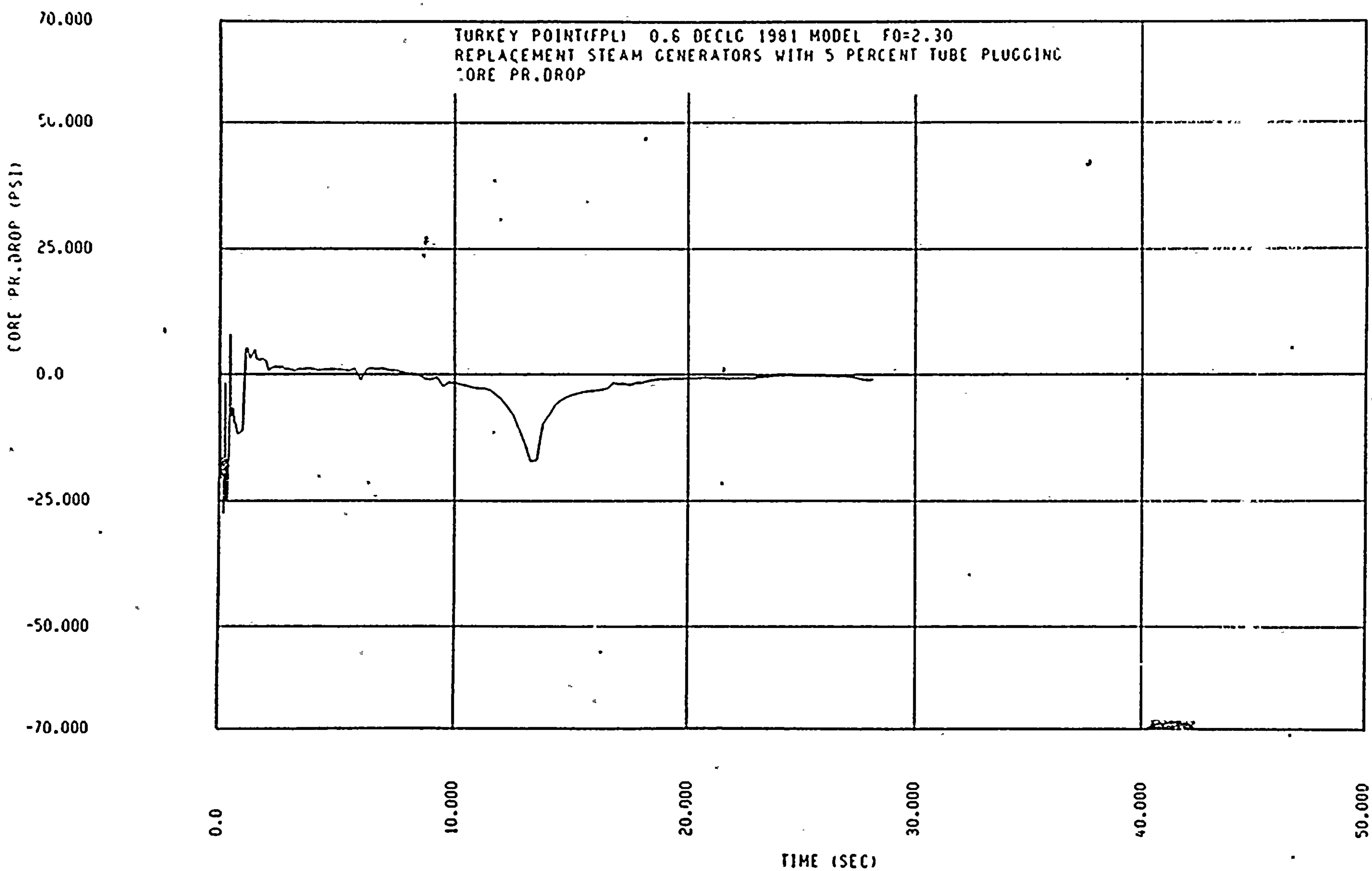


FIGURE [illegible] CORE PRESSURE [illegible]
DECLG(CD = [illegible])

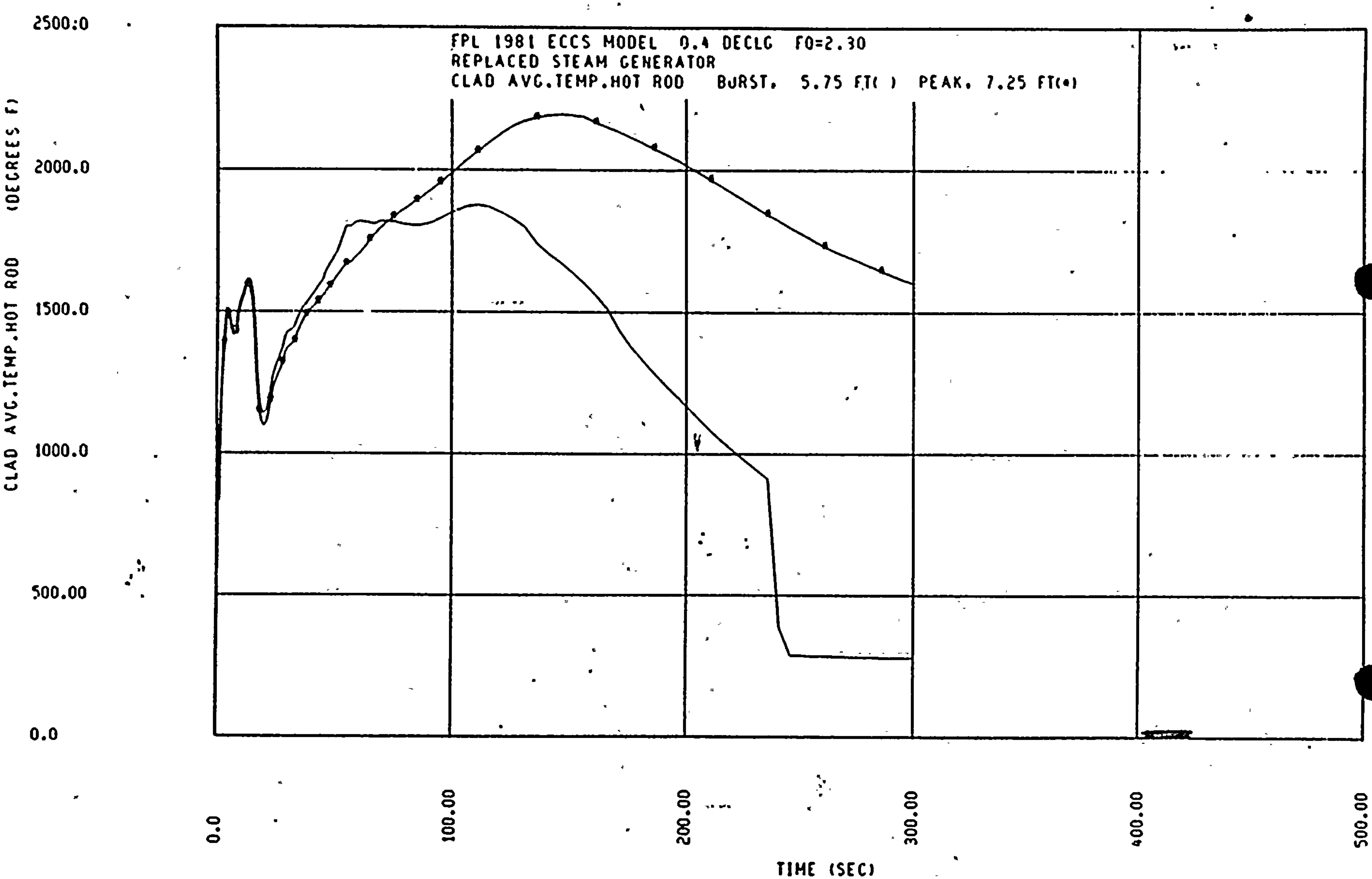


FIGURE 7A PEAK CLAD TEMPERATURE
DECLG(CD = 0.4)

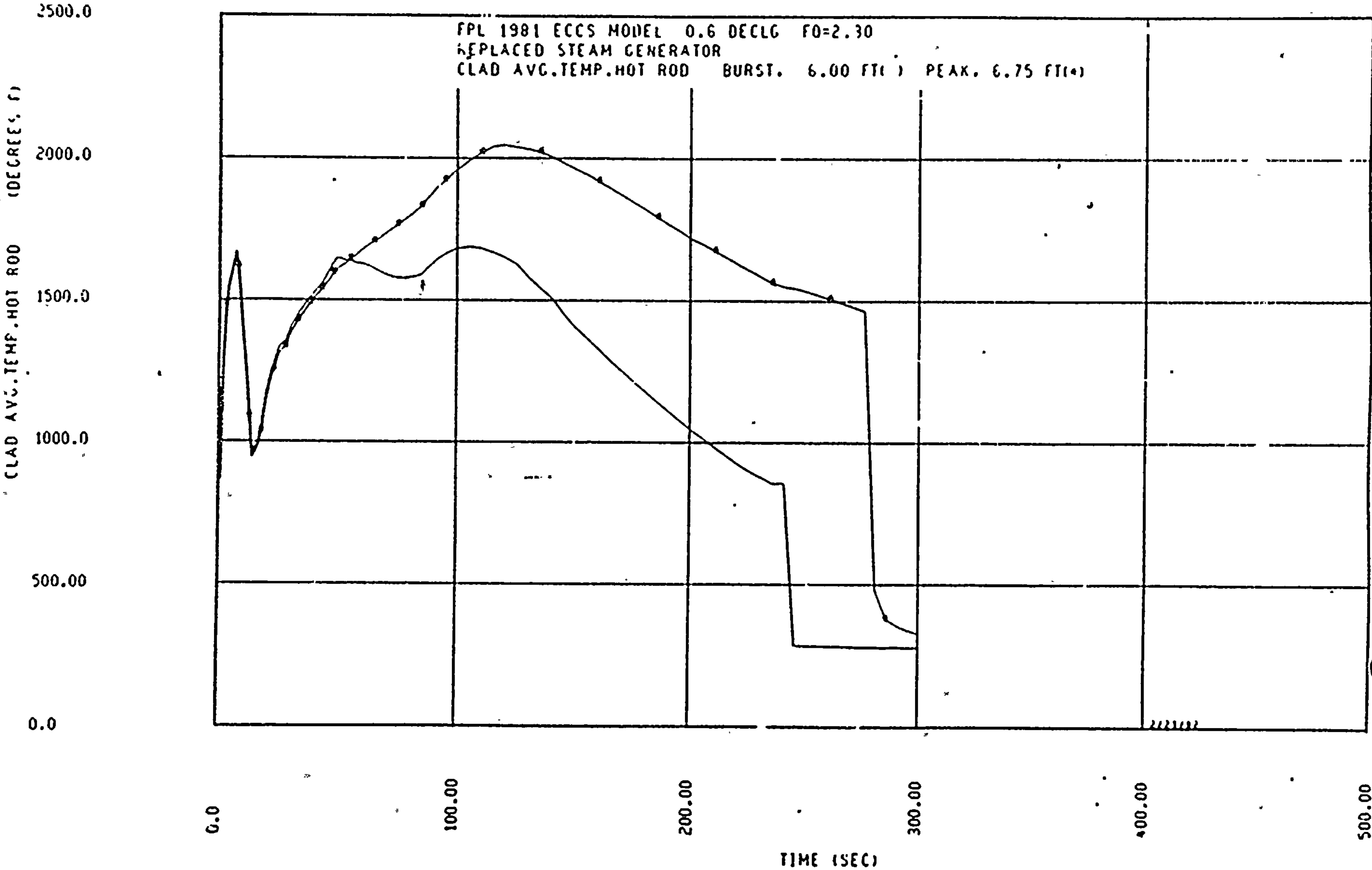


FIGURE PEAK CLAD TEMP
DECLG(CD = 0.6)

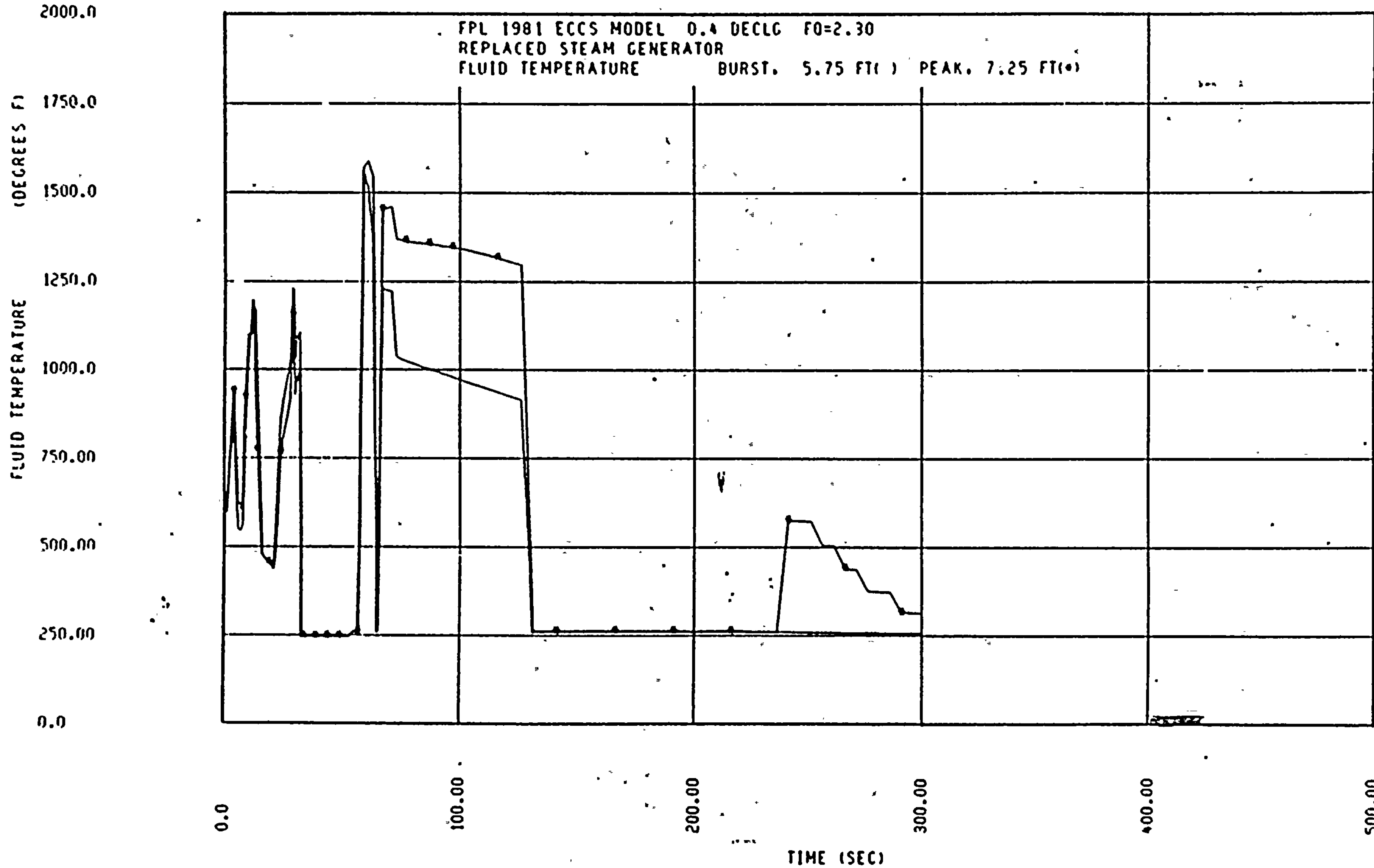


FIGURE 8A FLUID TEMPERATURE
DECLG(CD = 0.4)

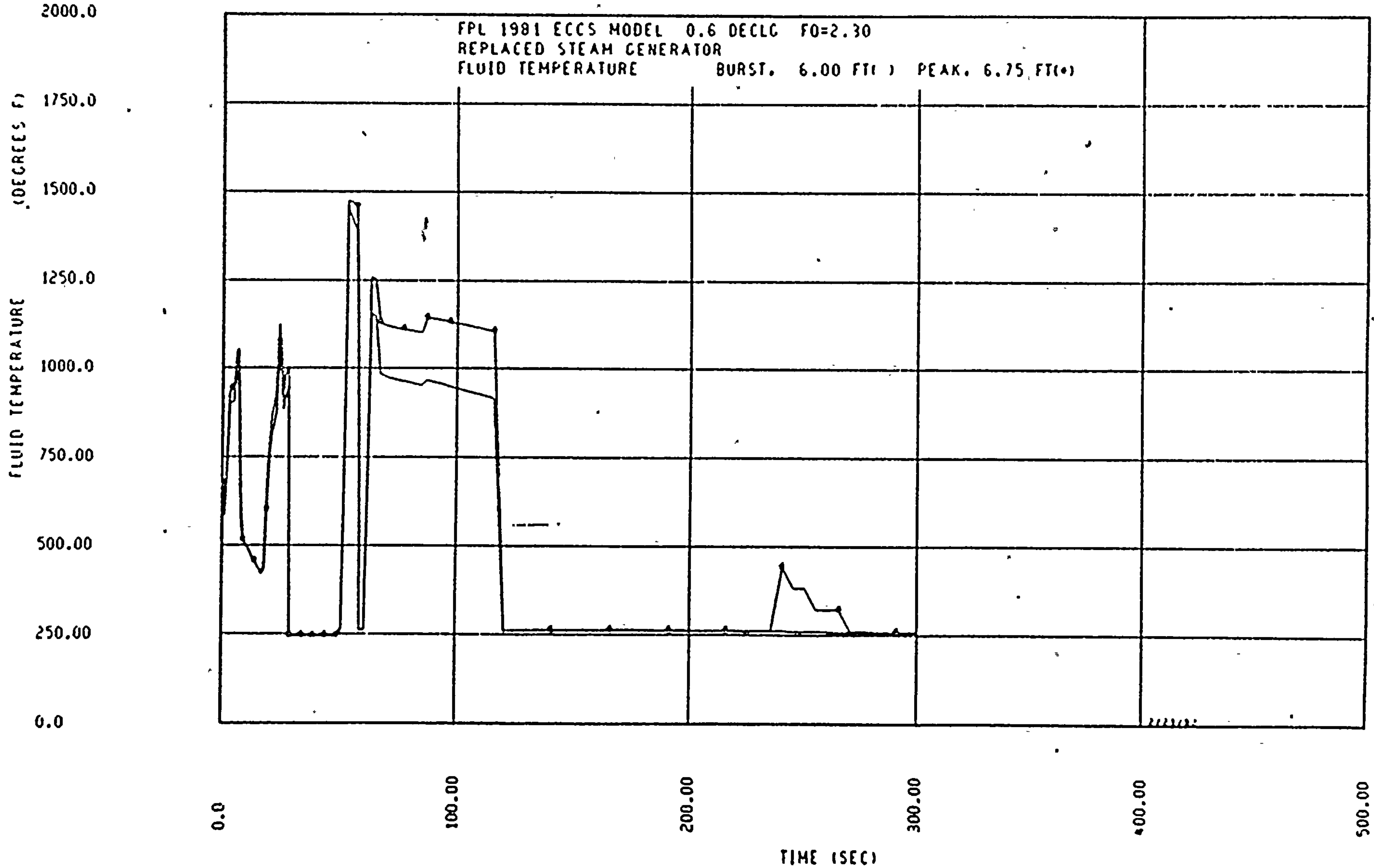


FIGURE [illegible] FLUID T[illegible]
[illegible]

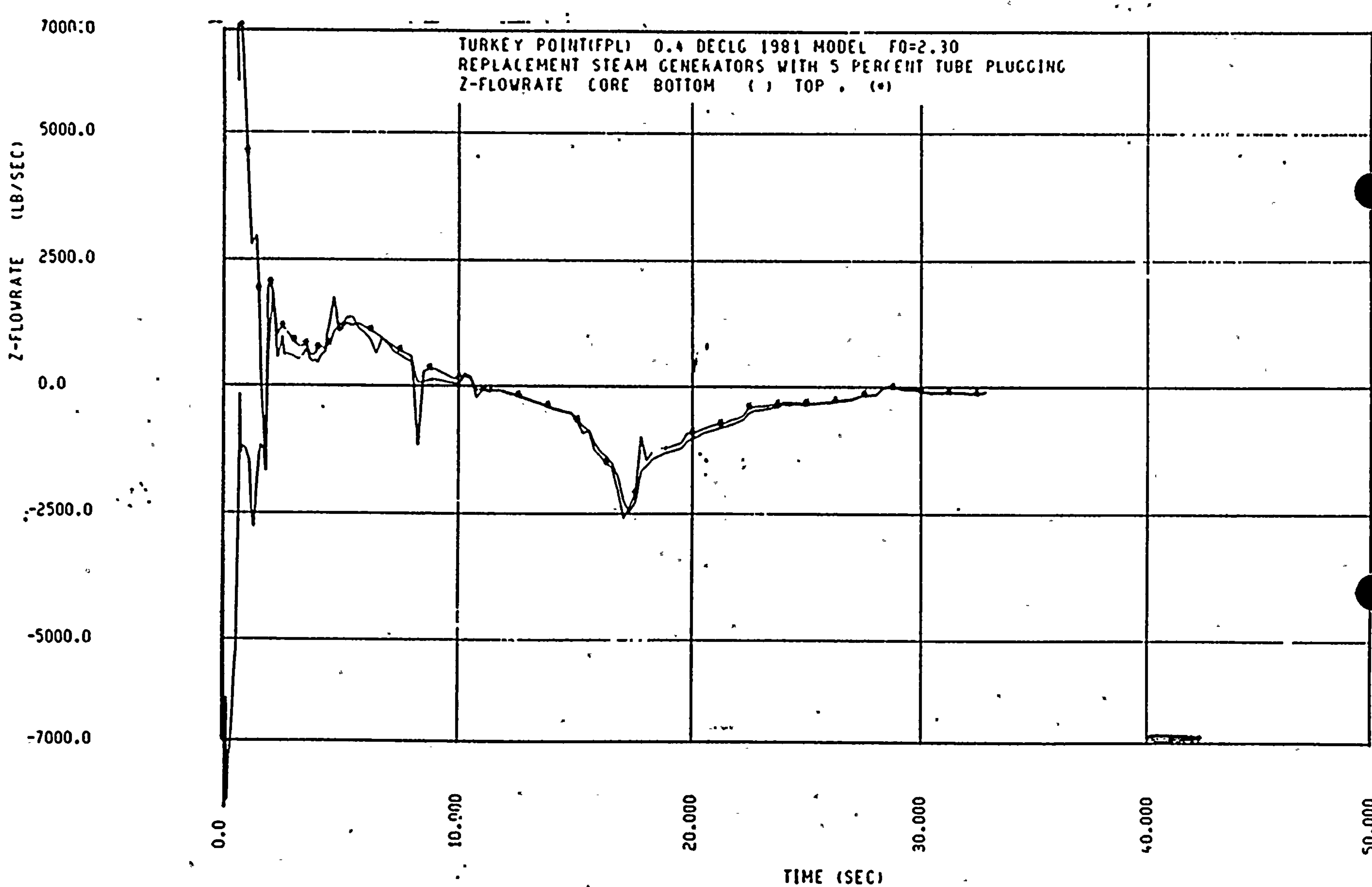


FIGURE 9A CORE FLOW (TOP AND BOTTOM)
DECLG(CD = 0.4)

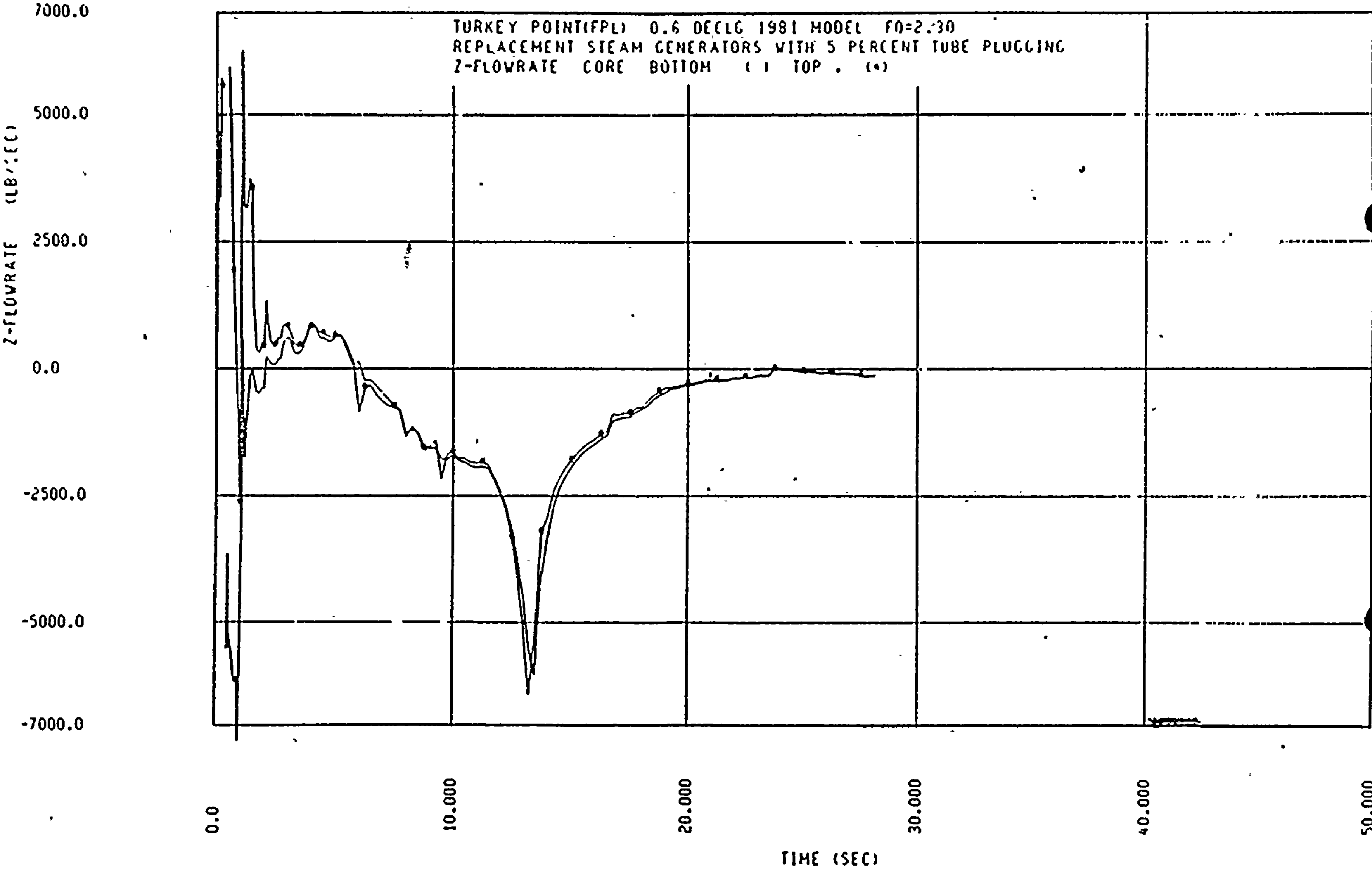


FIGURE [illegible] CORE FLOW (TOP AND BOTTOM)
DECLG(CD = 0.6)

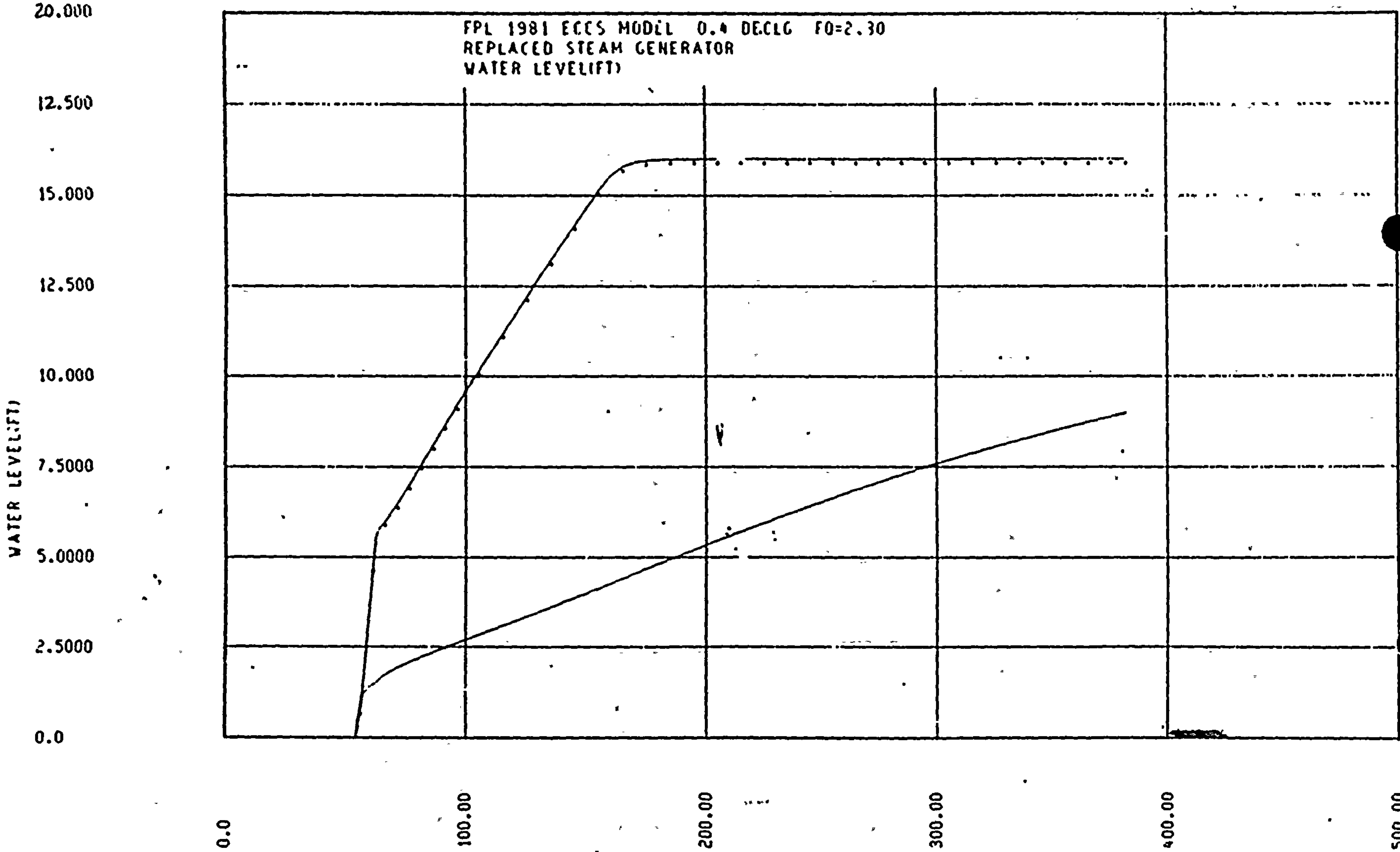


FIGURE 10A REFLOOD TRANSIENT - CORE & DOWNCOMER WATER LEVELS DECLG(CD = 0.4)

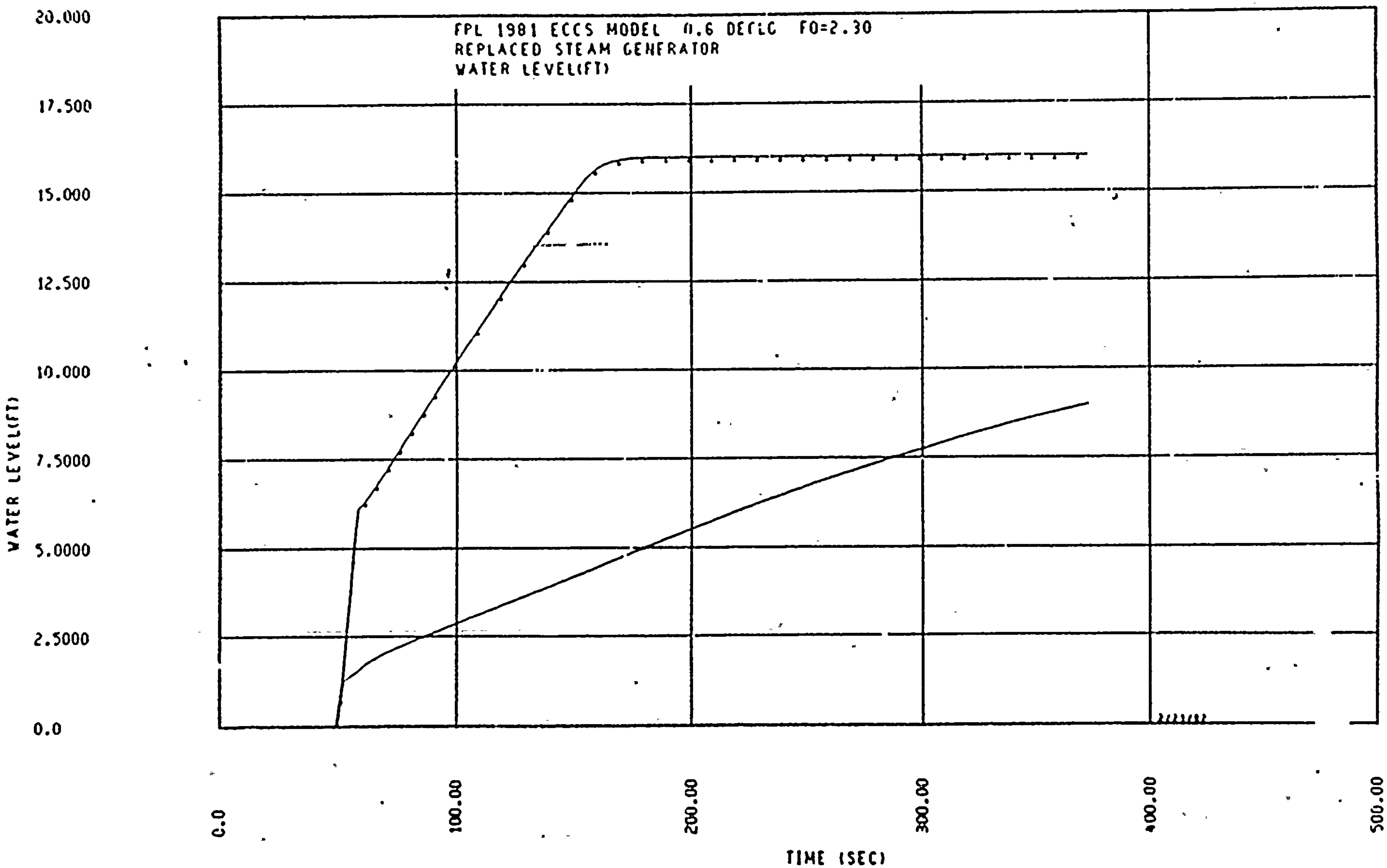


FIGURE [illegible] REFLOOD TRAN[illegible] CORE
& DOWNCOMER [illegible] LEVELS
[illegible]

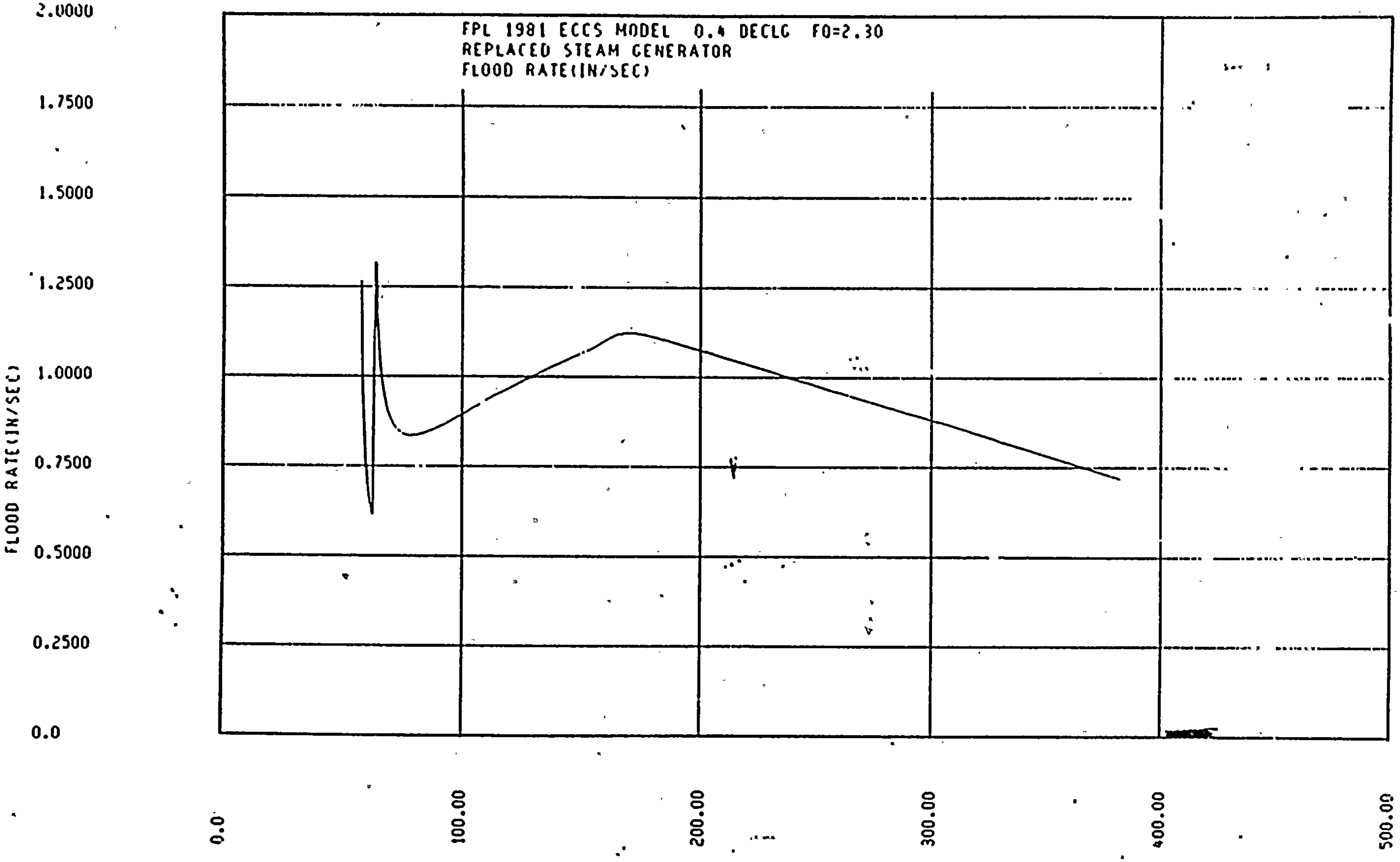


FIGURE 11A REFLOOD TRANSIENT
CORE INLET VELOCITY
DECLG(CD = 0.4)

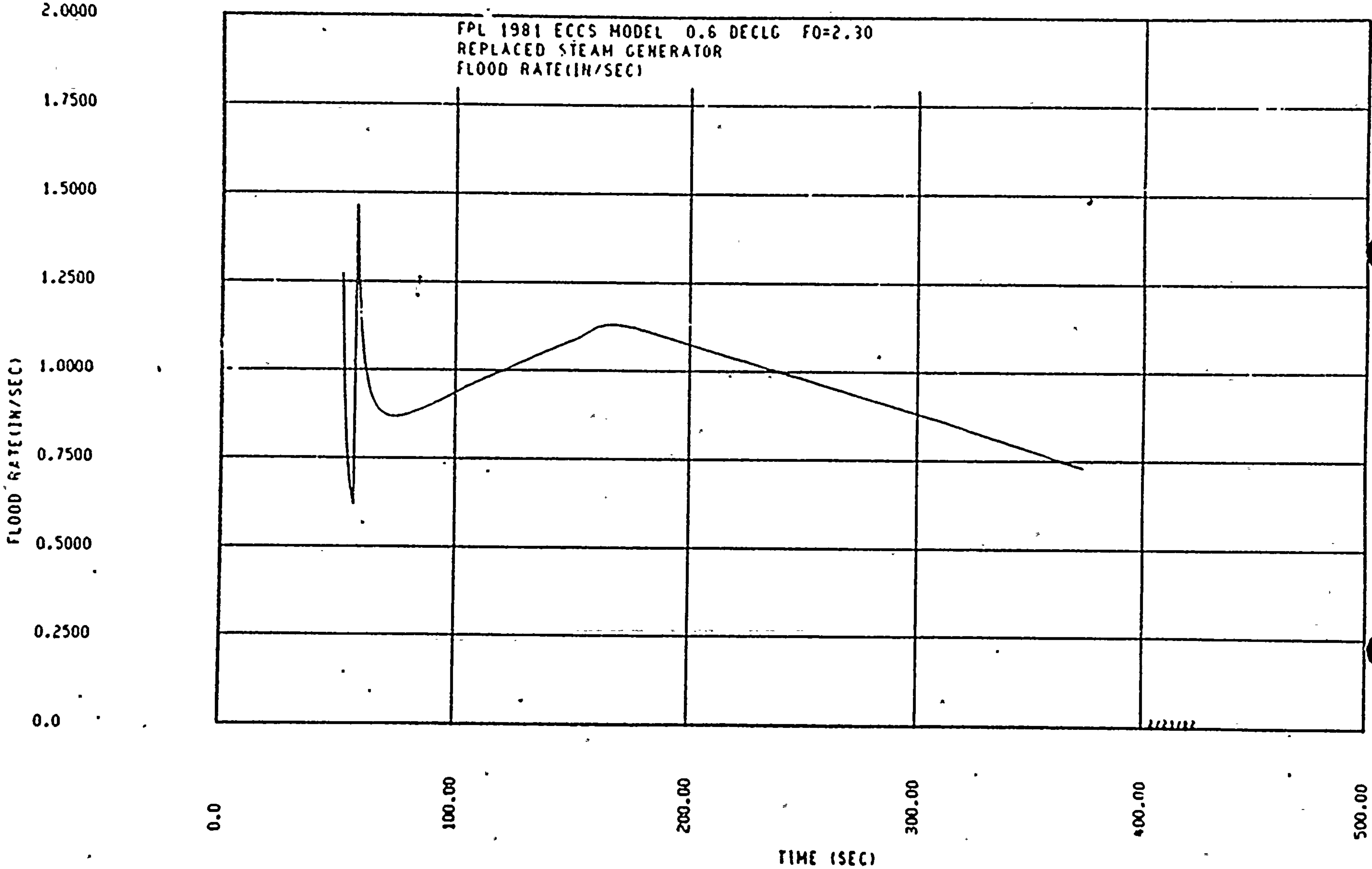


FIGURE [illegible] REFLOOD [illegible]
CORE INLET [illegible]
[illegible]

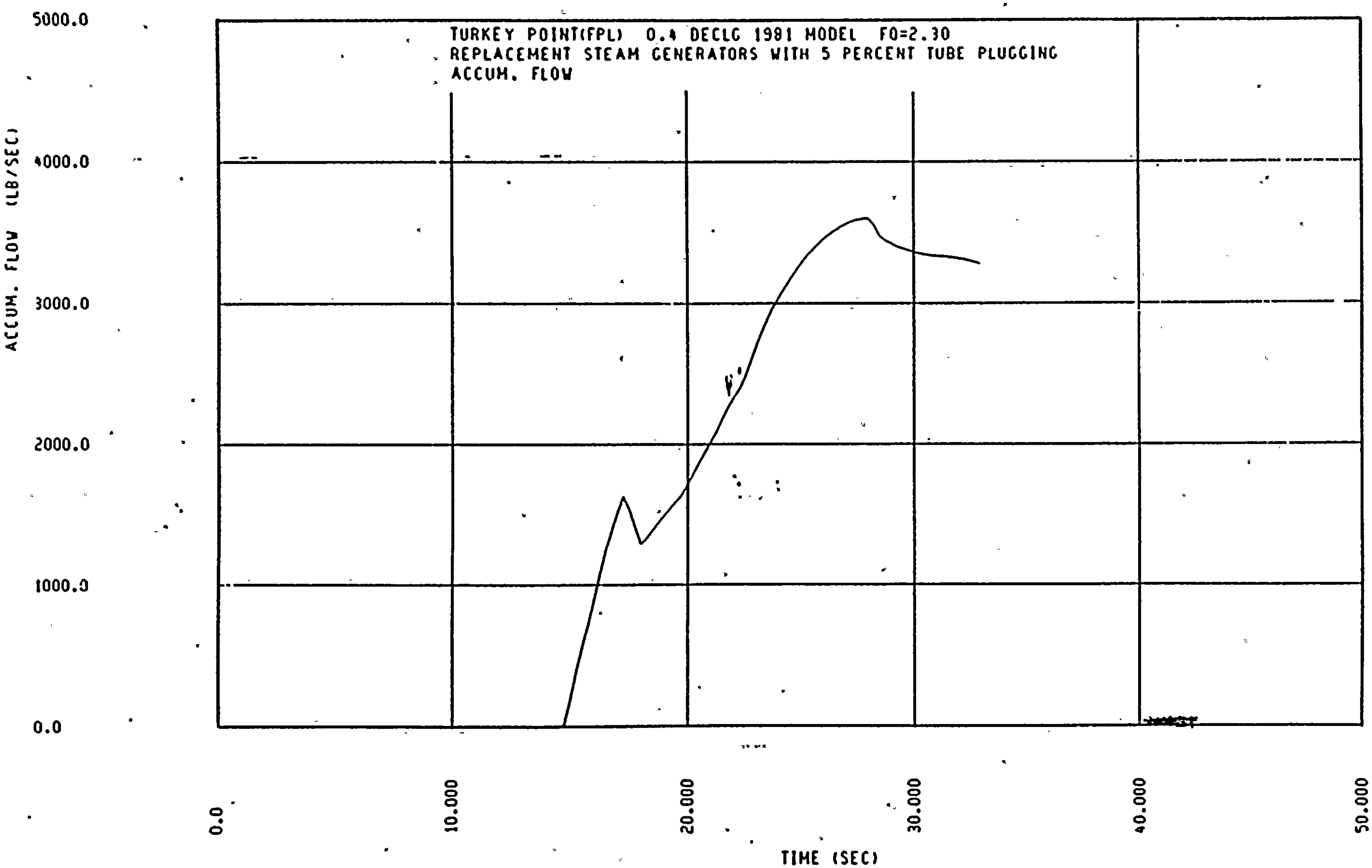


FIGURE 12A ACCUMULATOR FLOW(BLOWDOWN)
DECLG(CD = 0.4)

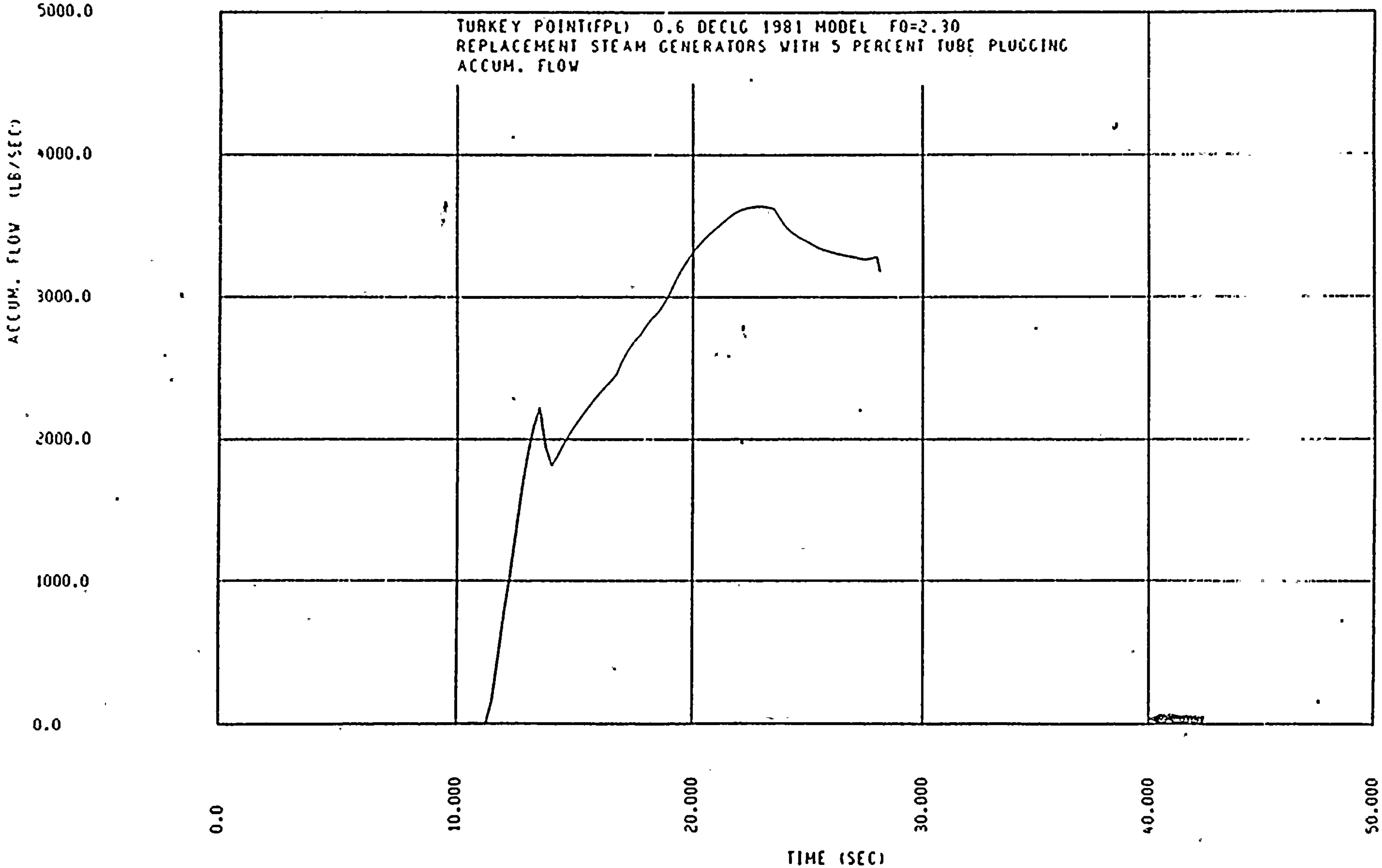

TURKEY POINT(FPL) 0.6 DECLG 1981 MODEL FQ=2.30
REPLACEMENT STEAM GENERATORS WITH 5 PERCENT TUBE PLUGGING
ACCUM. FLOW
ACCUM. FLOW (LB/SEC)
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
0.0
10.000
20.000
30.000
40.000
50.000
TIME (SEC)

FIGURE [illegible]

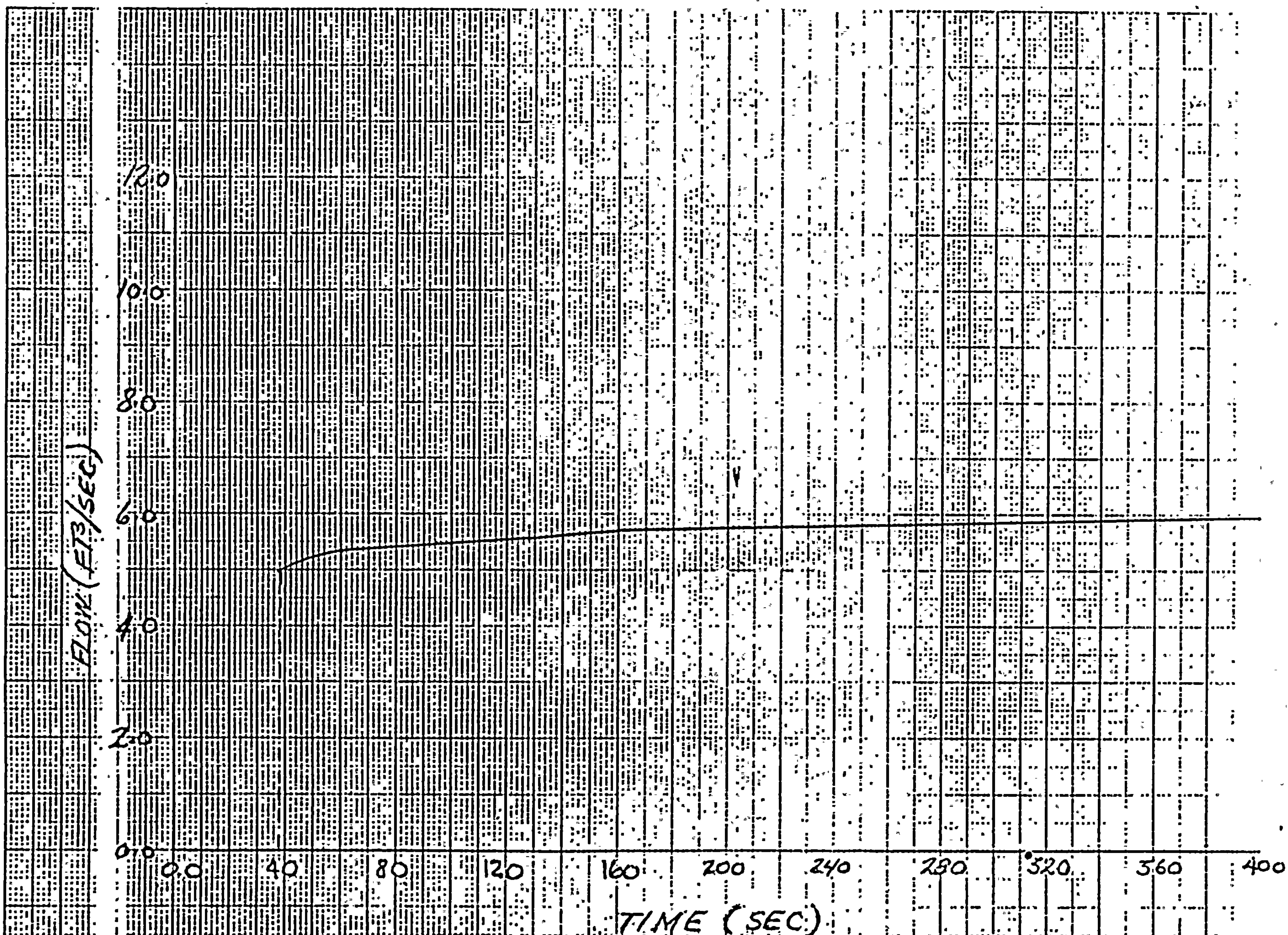


FIGURE 13A PUMPED ECCS FLOW(REFLOOD)
DECLG(CD = 0.4)

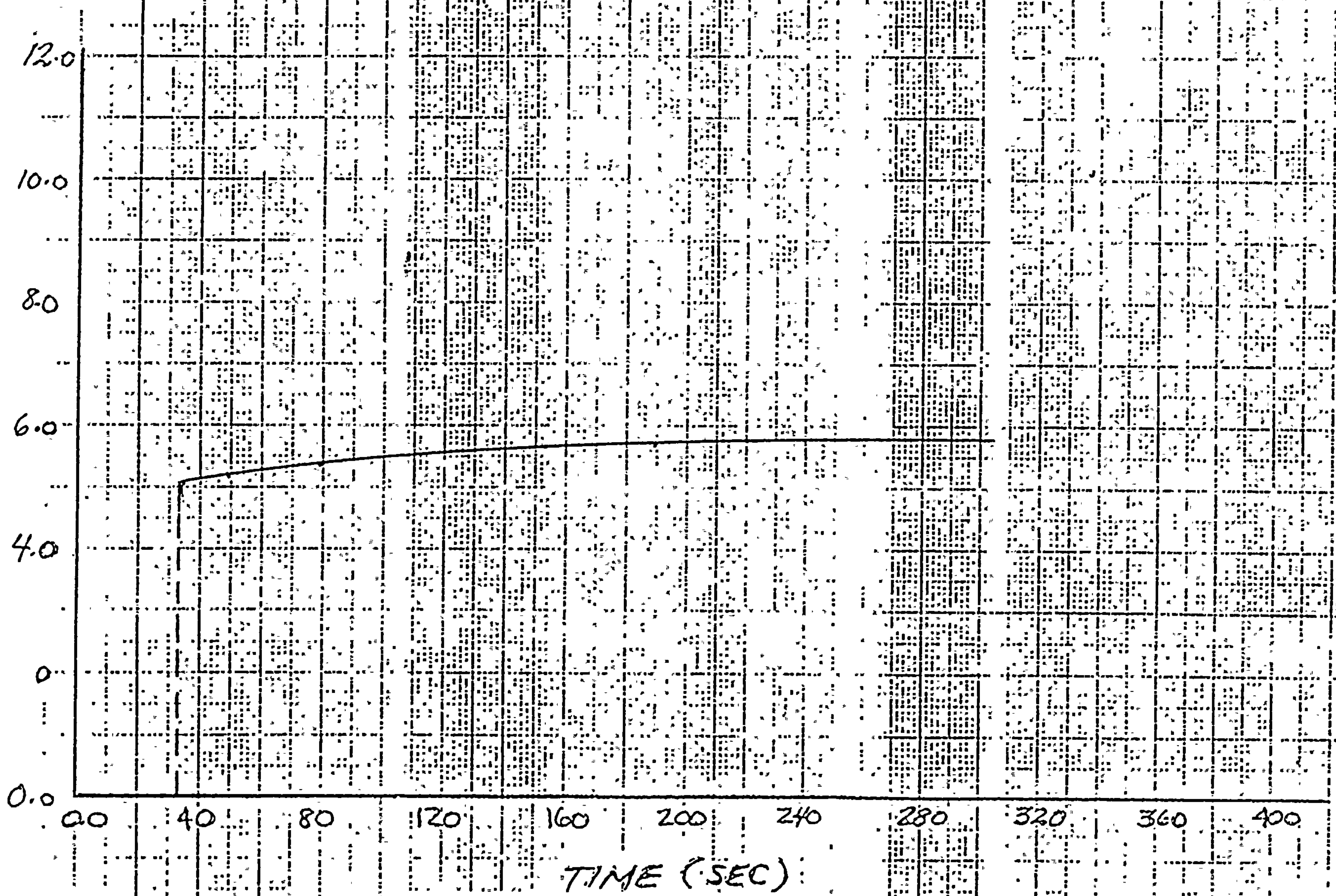


FIGURE 13B [illegible] ECCS [illegible]

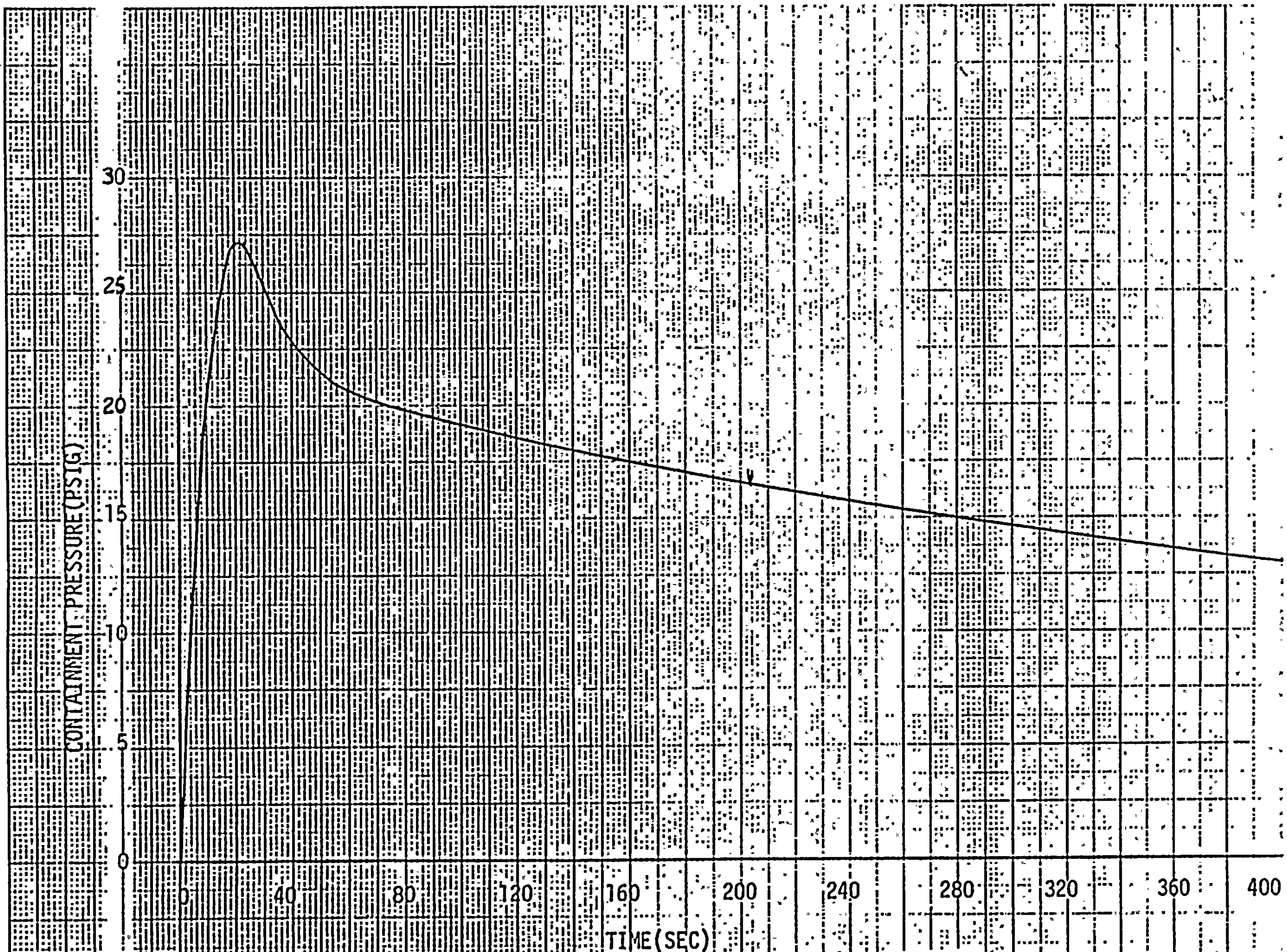
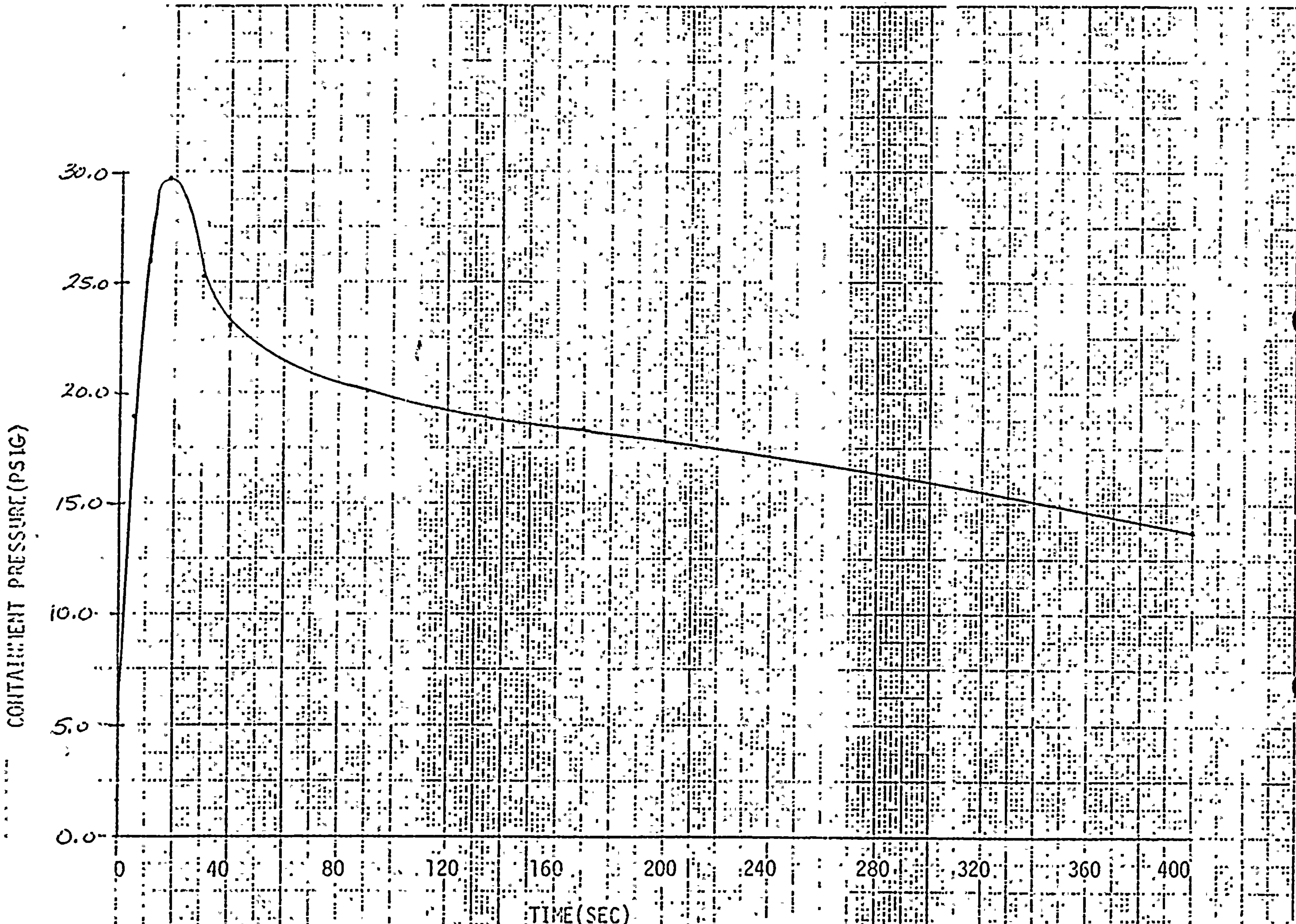


FIGURE 14A CONTAINMENT PRESSURE
DECLG(CD = 0.4)



[illegible]RE 14B CONTAIN[illegible]NT PRESS[illegible]
DECL[illegible]

K&E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

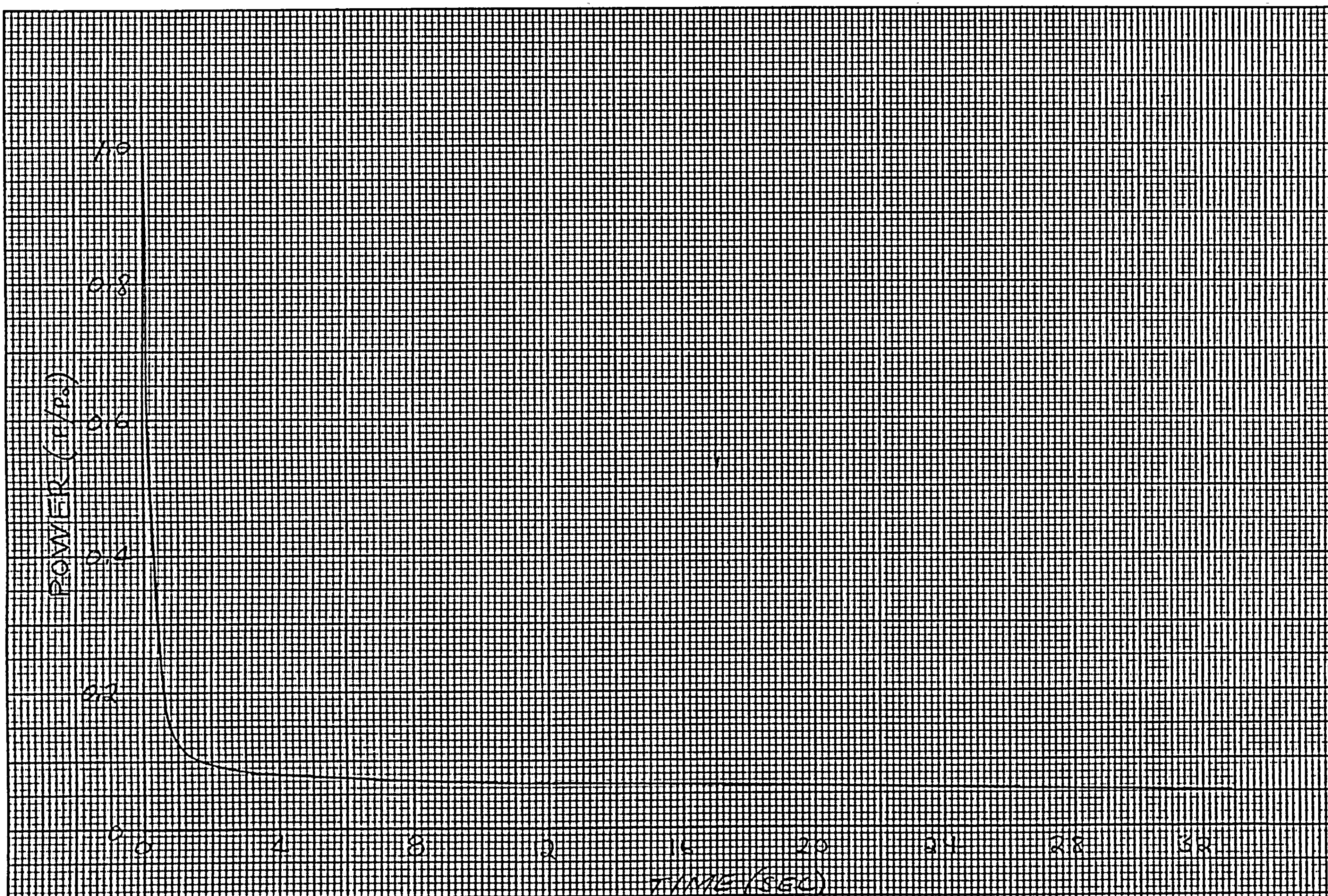


FIGURE 15A CORE POWER TRANSIENT
DECLG(CD = 0.4)

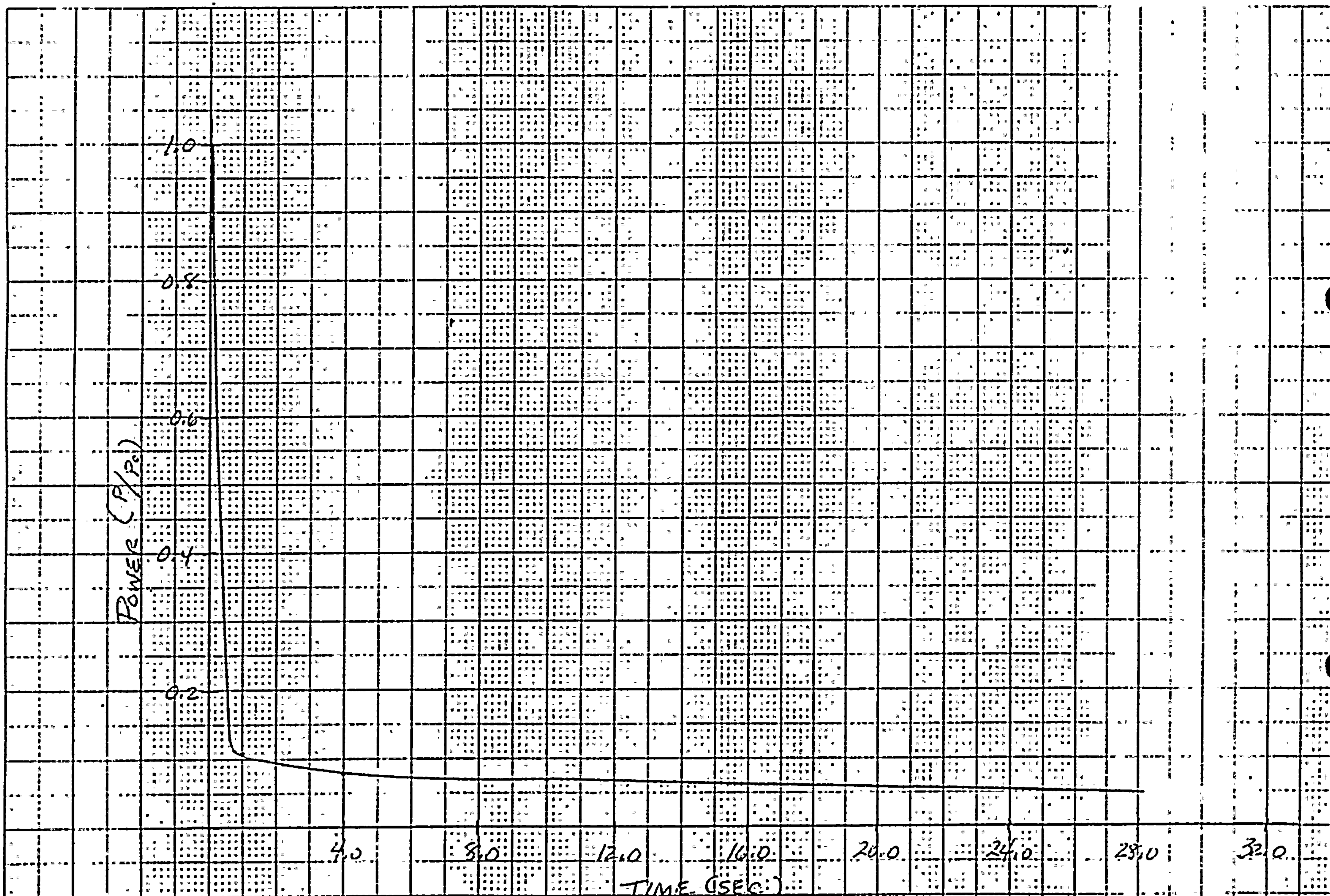


FIGURE 15B CORE POWER TRANSIENT

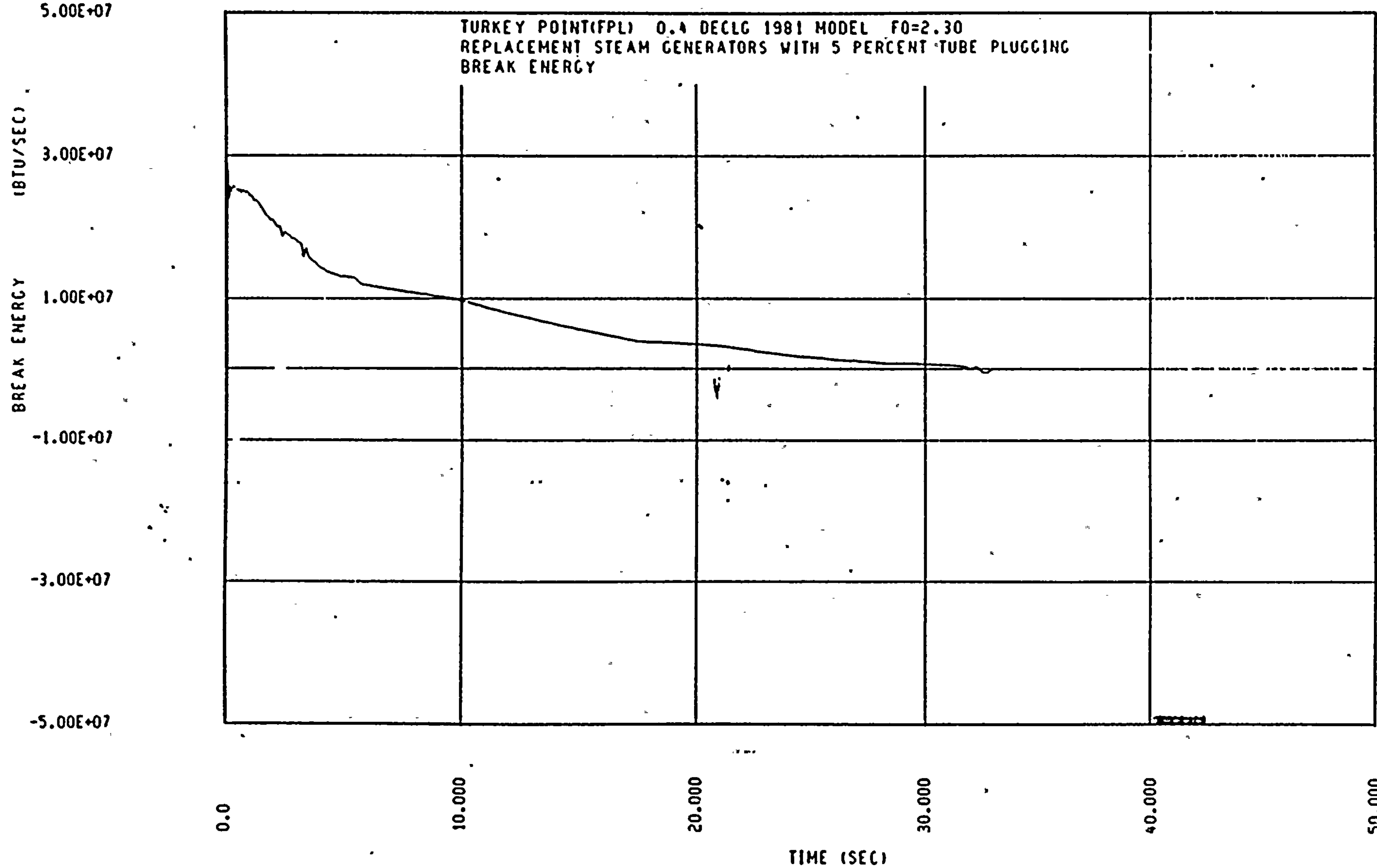


FIGURE 16 BREAK ENERGY RELEASED TO CONTAINMENT

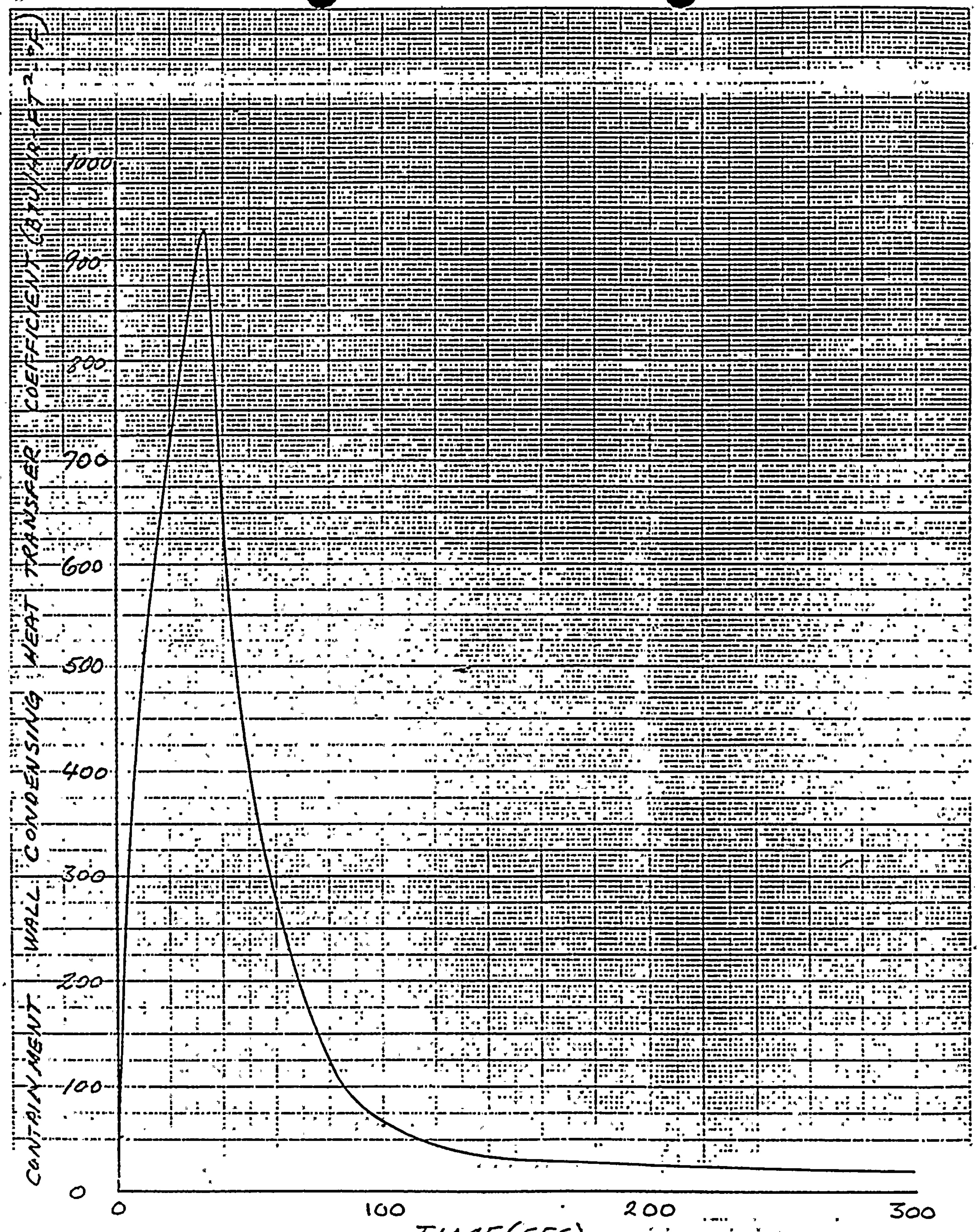


FIGURE 17 CONTAINMENT WALL HEAT TRANSFER COEFFICIENT ($C_D = 0.4$)

STATE OF FLORIDA)
) ss.
COUNTY OF DADE)

Robert E. Uhrig, being first duly sworn, deposes and says:

That he is Vice President of Florida Power & Light Company, the herein;

That he has executed the foregoing document; that the statements made in this said document are true and correct to the best of his knowledge, information, and belief, and that he is authorized to execute the document on behalf of said

Robert E. Uhrig

Subscribed and sworn to before me this

15 day of April, 1982

Cheryl L. Fredrick

NOTARY PUBLIC, in and for the County of Dade, State of Florida

My commission expires: Notary Public, State of Florida at Large My Commission Expires October 30, 1983 Bonded thru Maynard Bonding Agency