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AUTH.NAME AUTHOR AFFILIATION
WHITE,L.D. Rochester Gas & Electric Corp.
RECIP.NAME RECIPIENT AFFILIATION
ZIEMANN,D.L. Operating Rectors Branch 2

SUBJECT: Forwards ECCS Reevaluation for subject facility.Corrects for zirconium-Water reactor error & fulfills all requirements stated in 780501 exemption from requirements of 10CFR50.46(a)(1). SC6 RPT

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LEON D. WHITE, JR.
VICE PRESIDENT

TELEPHONE
AREA CODE 716 546-2700

February 2, 1979

Director of Nuclear Reactor Regulations
Attention: Mr. Dennis L. Ziemann, Chief
Operating Reactor Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: ECCS Reevaluation
With Correction for Zr-H_2O Error
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Ziemann:

On May 1, 1978 the Nuclear Regulatory Commission issed an Exemption to the license of the R.E. Ginna Nuclear Power Plant related to the requirements of 10 CFR 50.46(a)(1) that ECCS performance be calculated in accordance with an acceptable calculational model which conforms to the provisions in Appendix K, 10 CFR 50. The previously approved Westinghouse model was found to contain an error associated with the zirconium-water reactor heat generation.

Attachment A to this letter contains an ECCS Reevaluation. for the R.E. Ginna Nuclear Power Plant, which corrects for the zirconium-water reaction error and fulfills all the requirements stated in the May 1, 1978 exemption.

Very truly yours,

L.D. White, Jr.

L.D. White, Jr.

LDW:cem
Attachment

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Attachment A - ECCS Reevaluation Metal - Water Correction

The Loss of Coolant Accident (LOCA) has been re-analyzed for R.E. Ginna. The description of the various aspects of the LOCA analysis is given in WCAP-8339[2]. The individual computer codes which comprise the Westinghouse Emergency Core Cooling System (ECCS) evaluation model are described in detail in separate reports [3-6] along with code modifications specified in references 7, 10, and 11. The analysis presented here was performed with the February 1978 version of the evaluation model which includes modifications delineated in references 12, 13, 14, and 15.

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 occurence 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 the break analyzed. The location is indicated in feet, which presents 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.

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The results of several sensitivity studies are reported[8]. These results are for conditions which are not limiting in nature and hence are reported on a generic basis.

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

Figures 1 - 3:	Quality, mass velocity and clad heat transfer coefficient for the hotspot and burst locations.
Figures 4 - 6:	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 7 - 9:	Clad temperature, fluid temperature and core flow. The clad and fluid temperatures are for the hot spot and burst locations.
Figures 10 - 11:	Downcomer and core water level during reflood, and flooding rate.
Figures 12 - 13:	Emergency core cooling system flowrates, for both accumulator and pumped safety injection.
Figures 14 - 15:	Containment pressure and core power transients.
Figures 16 - 17:	Break energy release during blowdown and the containment wall condensing heat transfer coefficient for the worst break.

Conclusions - Thermal Analysis

For breaks 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 2.32 .

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

The effects of upper plenum injection for W designed 2-loop plants has been discussed with the staff [16-20]. Based on interium calculations, a 15°F increase in calculated peak clad temperatures results from explicit modeling of upper plenum injection in the R.E. Ginna Plant. The calculated peak clad temperature, including this increase, meets the 2200°F limit.

Attached in Appendix A, are the results of a generic sensitivity study for a typical 2-loop plant with 14 x 14 fuel. This sensitivity study was performed to demonstrate that the limiting break does not change due to a correction in the metal-water heat of reaction calculation which is included in the February 1978 version of the Westinghouse ECCS evaluation model. The results of this generic sensitivity study show that the limiting break for Westinghouse plants of this type is a double-ended cold leg guillotine with a discharge coefficient of 0.4. Since this agrees with past sensitivity studies [8,9] only the limiting break for R.E. Ginna is printed here.

References for Section 15.4.1

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 3, 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-Proprietary 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 Evaulation 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. Delsignore T., et al., "Westinghouse ECCS Two-Loop Sensitivity Studies (14 x 14)", WCAP 8854, (Non-Proprietary Version), September 1976.

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

11. 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.

12. 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.

13. Eicheldinger, C., "Westinghouse ECCS Evaluation Model, February 1978 Version", WCAP-9220 (Proprietary Version), WCAP-9221 (Non-Proprietary Version), February, 1978.

14. Letter from T.M. Anderson of Westinghouse Electric Corporation to John Stolz of the Nuclear Regulatory Commission, letter number NS-TMA-1830, June, 1978.

15. Letter from T.M. Anderson of Westinghouse Electric Corporation to John Stolz of the Nuclear Regulatory Commission, letter number NS-TMA-1834, June 20, 1978.

16. Letter from E.G. Case of NRC to L.D. White of RG&E - December 16, 1977.

17. Letter from L.D. White of RG&E to A. Schwencer of NRC - January 16, 1978.

18. Letter from A. Schwencer of NRC to L.D. White of RG&E - February 10, 1978.

19. Letter from K.W. Amish of RG&E to A. Schwencer of NRC - February 15, 1978.

20. "Safety Evaluation Report on Interim ECCS Evaluation model for Westinghouse Two-Loop Plants", March 1978 transmitted by letter from D.L. Ziemann of NRC to L.D. White of RG&E - May 1, 1978.

TABLE 1

LARGE BREAK - TIME SEQUENCE OF EVENTS

EVENT	OCCURENCE TIME (SECONDS)
	DECLG, C_D =0.4
Accident Initiation	0.0
Reactor Trip Signal	0.67
Safety Injection Signal	0.75
Start Accumulator Injection	10.3
End of ECC Bypass	21.95
End of Blowdown	21.95
Bottom of Core Recovery	42.4
Accumulators Empty	58.
Start Pumped ECC Injection	25.75

TABLE 2

LARGE BREAK - ANALYSIS INPUT AND RESULTS

Quantities in the calculations:

Licensed core power rating	102% of 1520 MWt
Total core peaking factor	2.32
Peak linear power	102%of 13.57 kw/ft
Accumulator water volume	1100 cubic feet per tank
Accumulator pressure	700 PSIA
Number of Safety Injection Pumps Operating	2
Steam Generator Tube Plugging Level	10 percent (uniform)
Fuel Parameters - Cycle 7	Region All

Results	DECLG, C_D = 0.4
Peak clad temperature (°F)	2057
Location (feet)	7.5
Maximum local clad/water reaction (%)	4.7
Location (feet)	7.5
Total core clad/water reaction (%)	<0.3
Hot rod burst time (seconds)	31.4
Location (feet)	6.0

TABLE 3

Dry Containment Data

Net Free Volume	1066000 FT^3
Initial Conditions	
Pressure	14.7 PSIA
Temperature	90 °F
RWST Temperature	60 °F
Service Water Temperature	37 °F
Outside Temperature	-10 °F
SPRAY SYSTEM	
Number of Pumps Operating	2
Runout Flow Rate	1800GPM
Actuation Time	2 SEC
SAFEGUARDS FAN COOLERS	
Number of Fan Coolers Operating	4
Fastest Post Accident Initiation of Fan Coolers	20 SEC

TABLE 3 (cont'd)

STRUCTURAL HEAT SINKS

THICKNESS (in)		AREA (ft^2)
1.3	Insulation	
.375	Steel	
30.0	Concrete	36945
.375	Steel	
30.0	Concrete	12370
24.0	Concrete	
.375	Steel	
24.0	Concrete	7955
60.0	Concrete	
.375	Steel	
42.0	Concrete	2342.
24.0	Concrete	
.375	Steel	
24.0	Concrete	297
.25	Steel	
30.0	Concrete	6400
30.0	Concrete	6900
30.0	Concrete	14900
6.0	Concrete	6170
1.5	Steel	9174
1.0	Steel	56020
.5	Steel	8568
.75	Steel	5756
24.0	Concrete	9162
.125	Steel	7000

Reflood Mass And Energy Releases - TABLE 4

Time (Sec.)	Mass Flowrate ($\frac{Lb.}{Sec.}$)	Energy Flowrate ($\frac{BTU}{Sec}$)
43.0	.012	15.2
48.8	30.2	39108.
59.0	65.8	83997.
71.0	124.4	98618
85.3	199.	113470
101.3	210.2	111998.
118.6	214.3	108754.
157.0	221.1	101680.
202.0	227.8	94315.
257.3	235.9	87218.

TABLE 5

Broken Loop Accumulator Mass and Energy Release

Time (sec.)	Mass Flow ($\frac{lb.}{sec.}$)	Energy Flow ($\frac{BTU}{sec.}$)
1.010	2522.382	151065.432
2.010	2409.835	144325.009
3.010	2312.506	138496.001
4.010	2227.453	133402.162
5.010	2151.288	128840.609
6.010	2082.020	124692.207
7.010	2018.485	120887.076
8.010	1960.065	117388.301
9.010	1906.637	114188.462
10.010	1857.462	111243.390
11.010	1812.132	108528.602
12.010	1770.395	106028.966
13.010	1731.668	103709.594
14.010	1695.646	101552.254
15.010	1662.489	99566.480
16.010	1631.888	97733.755
17.010	1603.576	96038.191
18.010	1577.205	94458.781
19.010	1552.533	92981.197
20.010	1529.328	91591.436
21.010	1507.532	90286.074
24.867	1432.522	85793.738
25.367	1422.482	85192.430
25.867	1412.637	84602.821
26.367	1402.981	84024.513
26.867	1393.507	83457.128
27.367	1384.209	82900.305
27.867	1375.083	82353.700
28.367	1366.121	81816.984
28.867	1357.319	81289.844
29.367	1348.672	80771.980
29.867	1340.175	80263.105
30.367	1331.824	79762.946
30.867	1323.614	79271.240
31.367	1315.541	78787.736
31.867	1307.600	78312.193
32.367	1299.789	77844.381
32.867	1292.103	77384.077
33.367	1284.539	76931.070
33.867	1277.094	76485.154
34.367	1269.763	76046.135
34.867	1262.545	75613.824
35.367	1255.436	75188.039
35.867	1248.432	74768.607
36.367	1241.532	74355.359
36.867	1234.733	73948.134
37.367	1228.031	73546.777
37.867	1221.425	73151.136
38.367	1214.912	72761.069
38.867	1208.489	72376.435
39.367	1202.156	71997.101
39.867	1195.908	71622.935
40.367	1189.745	71253.813
40.867	1183.664	70889.615
41.367	1177.663	70530.222
41.867	1171.740	70175.521
42.367	1165.894	69825.405
42.407	1165.430	69797.590

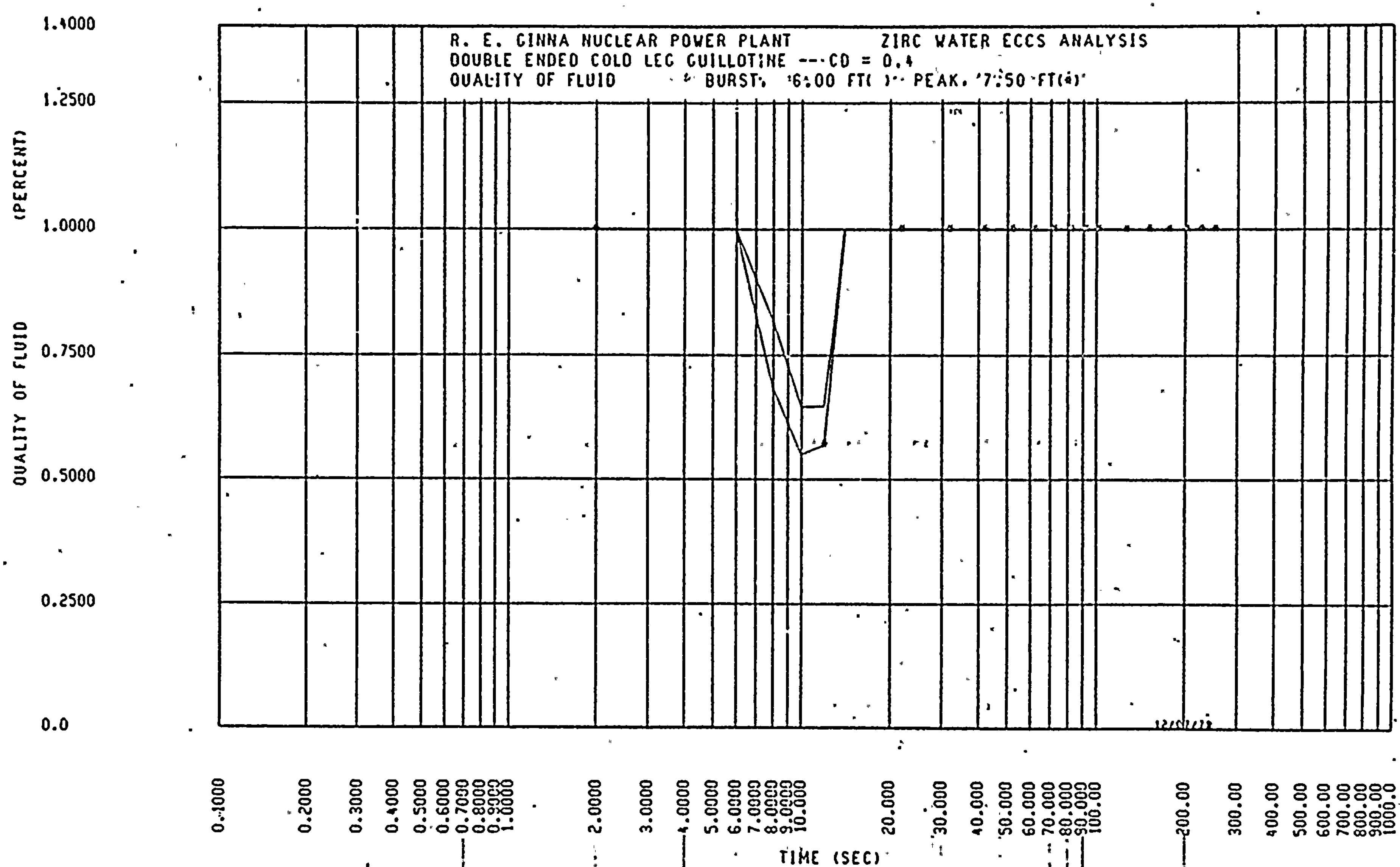

R. E. GINNA NUCLEAR POWER PLANT
ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE --- CD = 0.4
QUALITY OF FLUID
QUALITY OF FLUID (PERCENT)
TIME (SEC)
1.4000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.1000
0.2000
0.3000
0.4000
0.5000
1.0000
2.0000
3.0000
4.0000
5.0000
10.000
20.000
30.000
40.000
50.000
100.00
200.00
300.00
400.00
500.00
1000.0

FIGURE 1

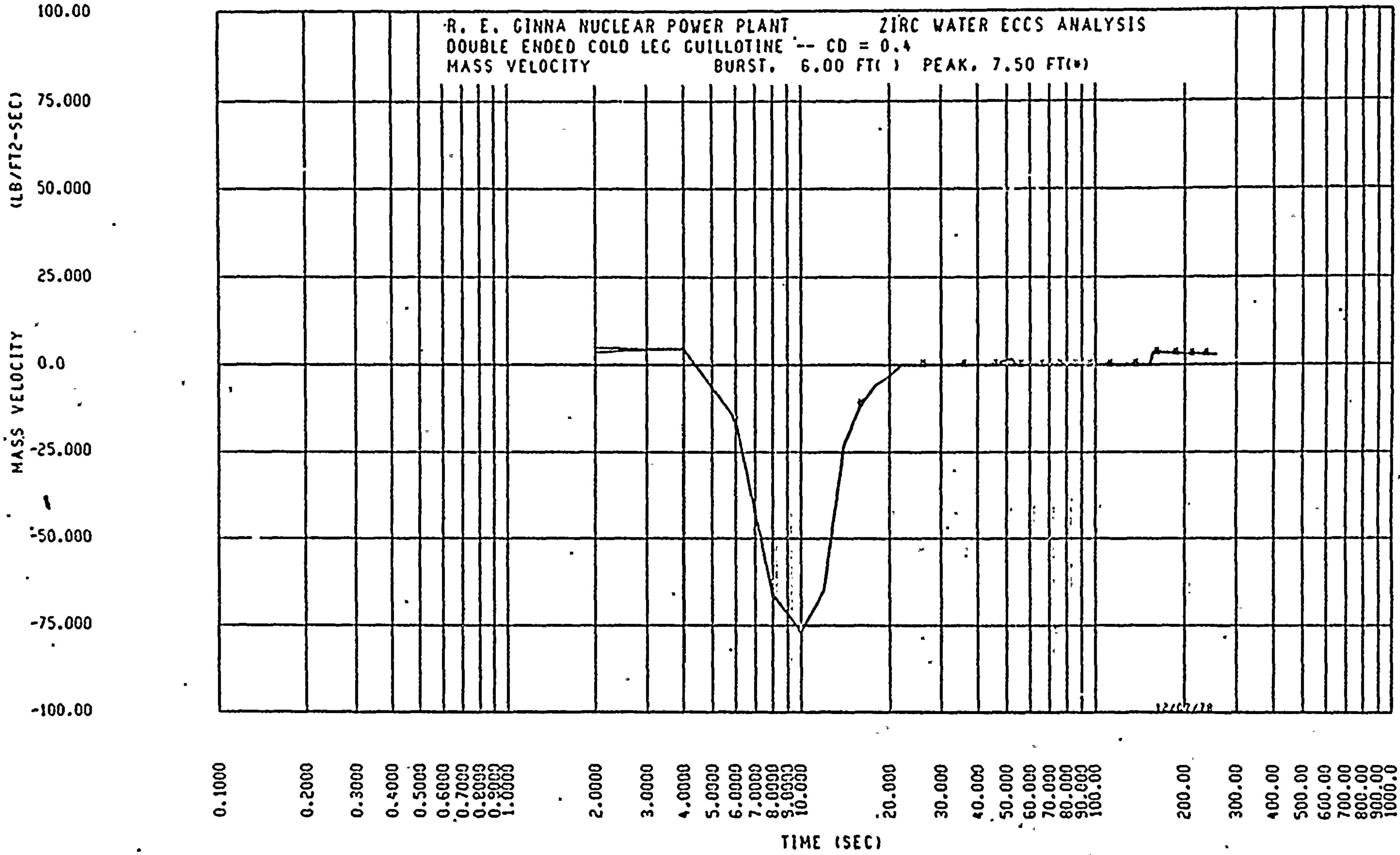

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
MASS VELOCITY BURST, 6.00 FT( ) PEAK, 7.50 FT(*)
MASS VELOCITY (LB/FT2-SEC)
100.00
75.000
50.000
25.000
0.0
-25.000
-50.000
-75.000
-100.00
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 2

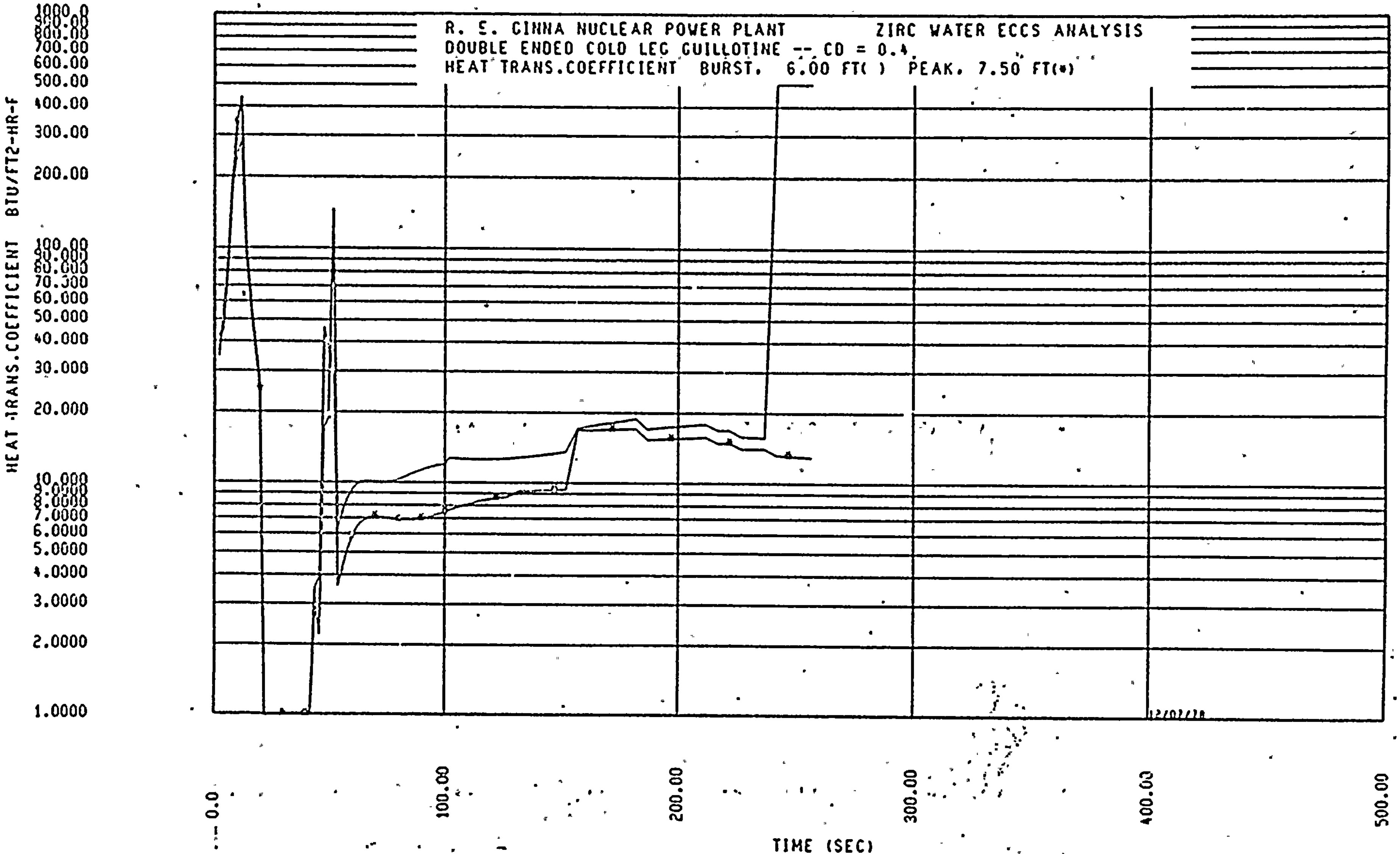
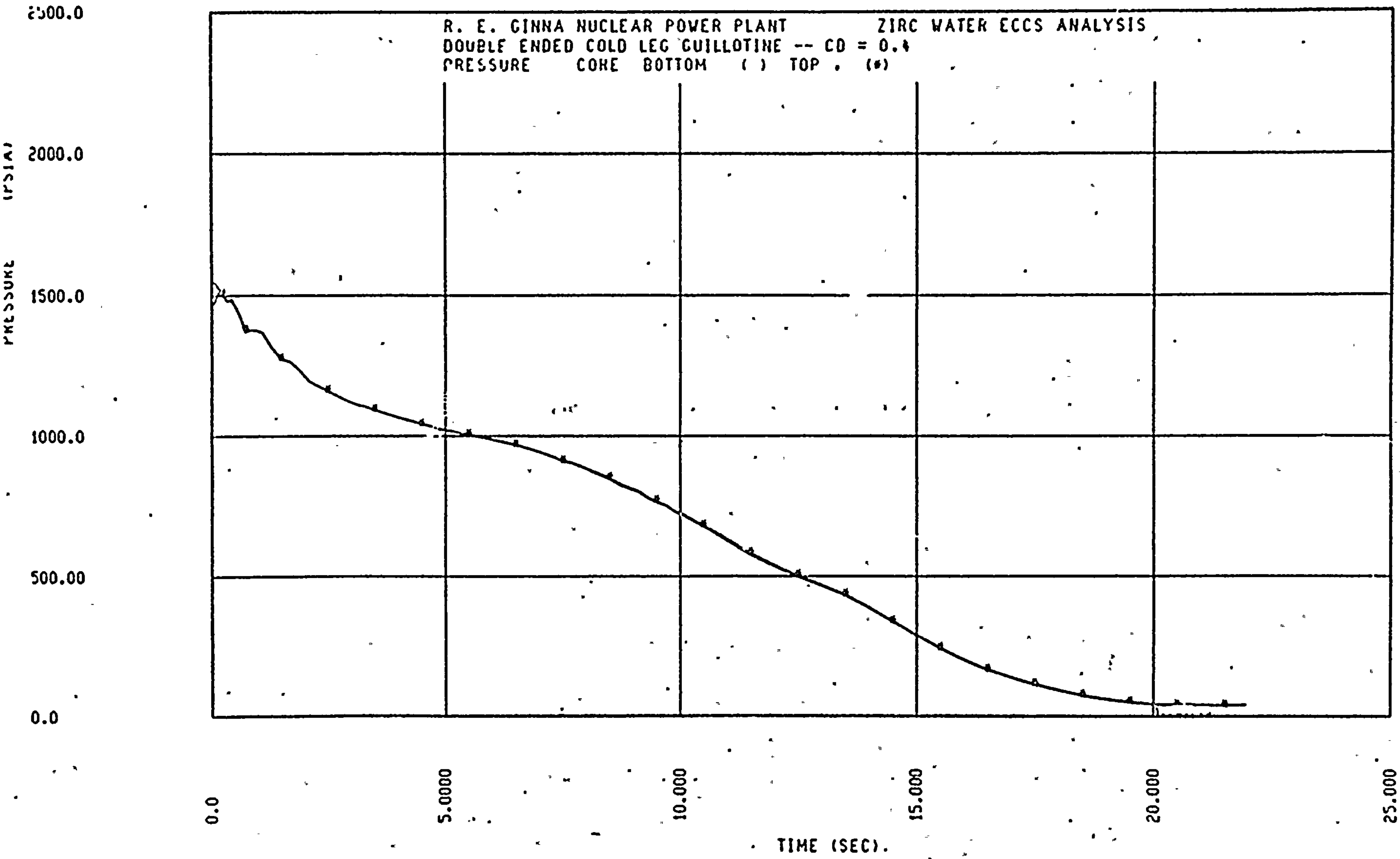

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
HEAT TRANS.COEFFICIENT BURST, 6.00 FT( ) PEAK, 7.50 FT(*)
HEAT TRANS.COEFFICIENT BTU/FT2-HR-F
1000.0
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
90.000
80.000
70.000
60.000
50.000
40.000
30.000
20.000
10.000
9.0000
8.0000
7.0000
6.0000
5.0000
4.0000
3.0000
2.0000
1.0000
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 3



R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
PRESSURE CORE BOTTOM ( ) TOP . (*)
PRESSURE (PSIA)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC).

FIGURE 4

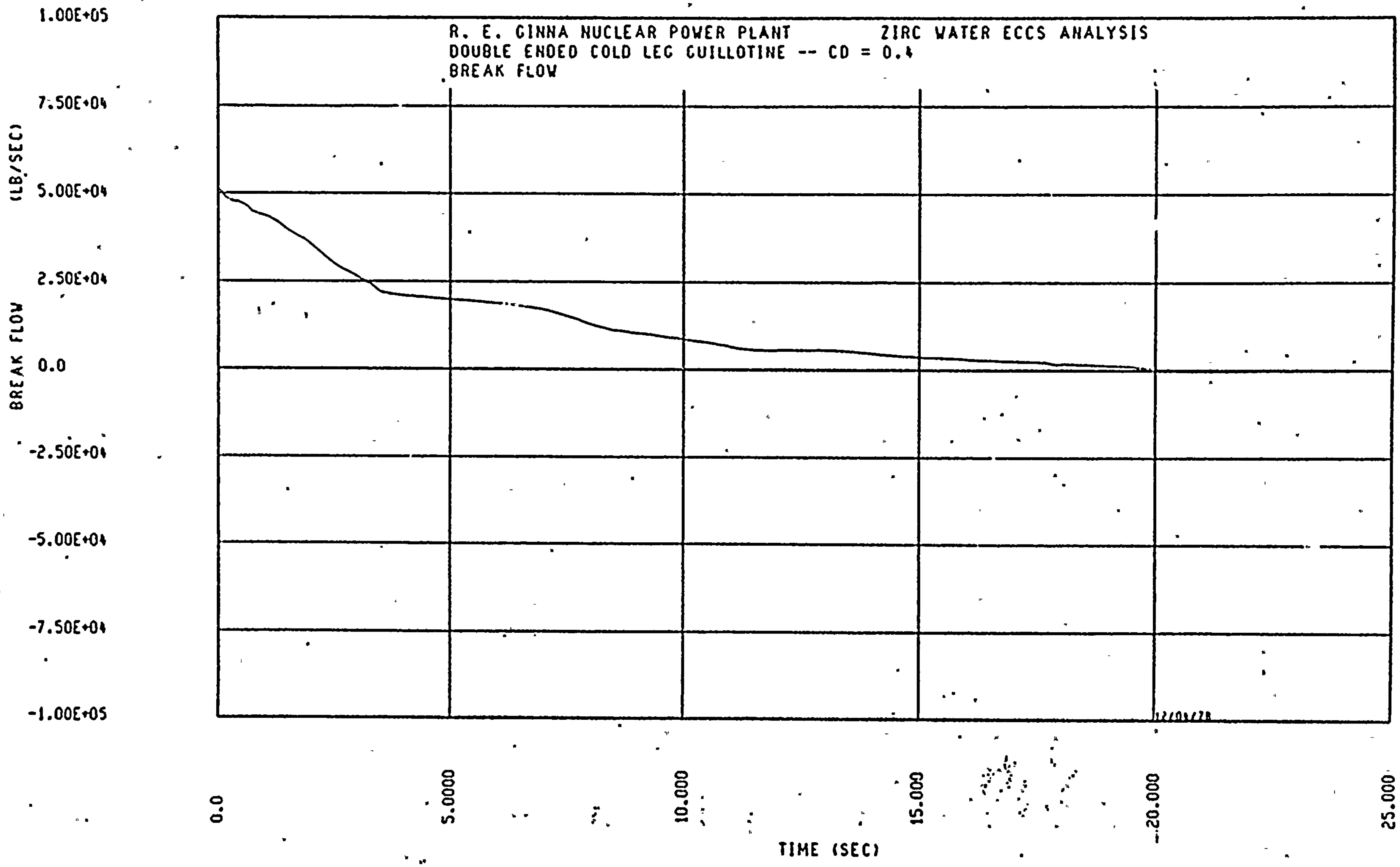

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
BREAK FLOW
BREAK FLOW (LB/SEC)
1.00E+05
7.50E+04
5.00E+04
2.50E+04
0.0
-2.50E+04
-5.00E+04
-7.50E+04
-1.00E+05
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 5

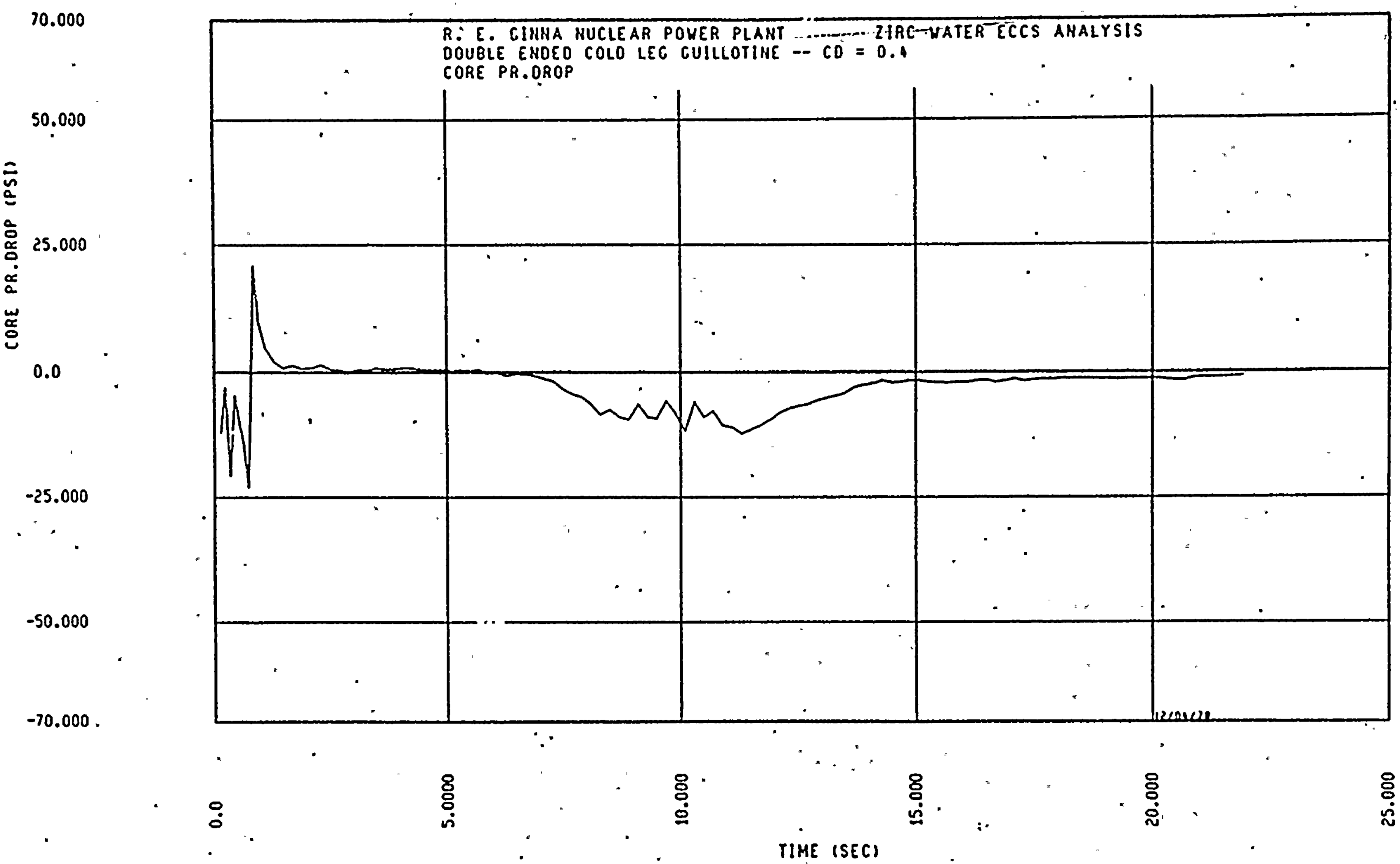

R. E. GINNA NUCLEAR POWER PLANT ZIRC-WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
CORE PR.DROP
70.000
50.000
25.000
0.0
-25.000
-50.000
-70.000
CORE PR.DROP (PSI)
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 6

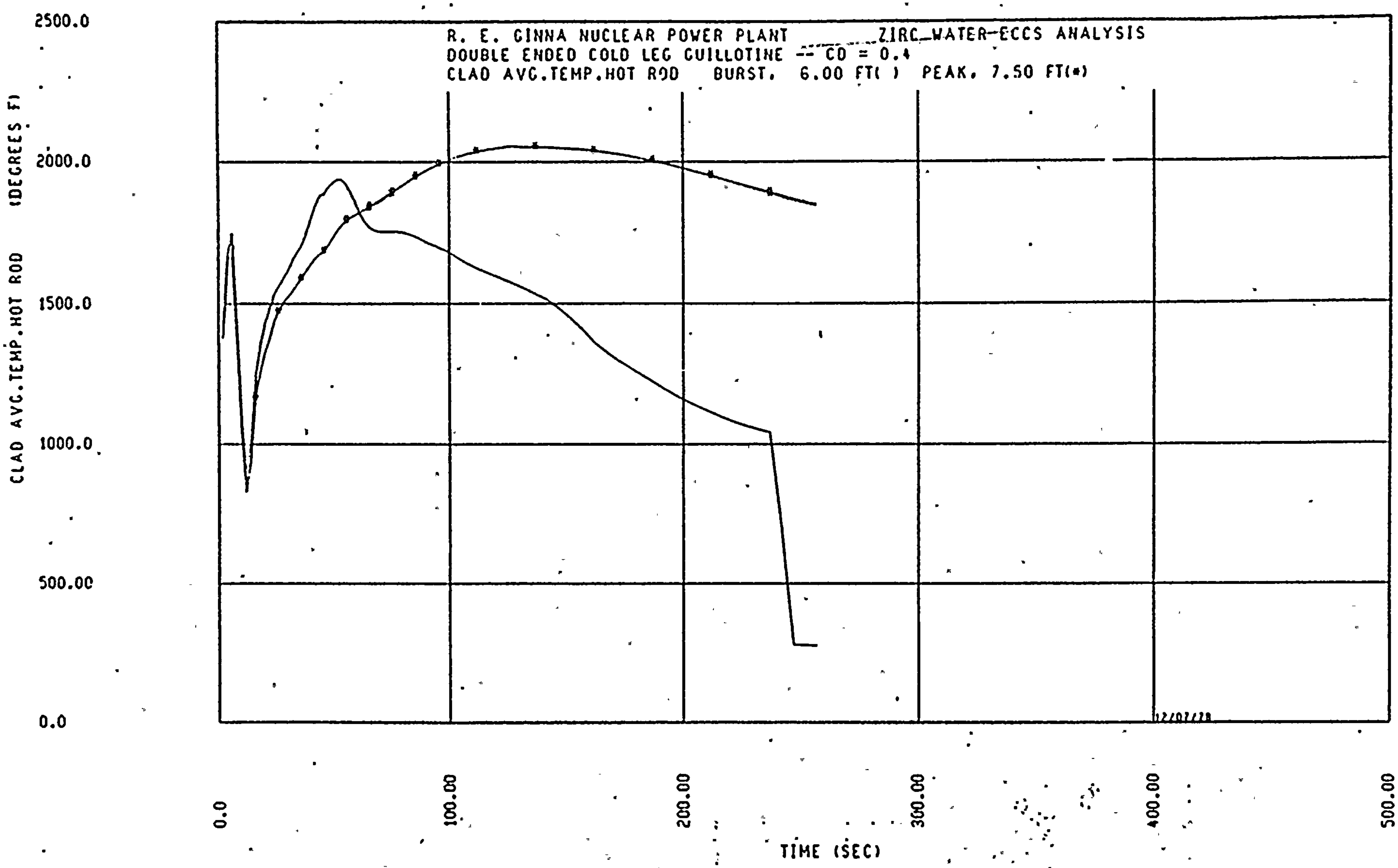

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER-ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
CLAD AVG.TEMP.HOT ROD BURST, 6.00 FT( ) PEAK, 7.50 FT(*)
CLAD AVG.TEMP.HOT ROD (DEGREES F)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 7

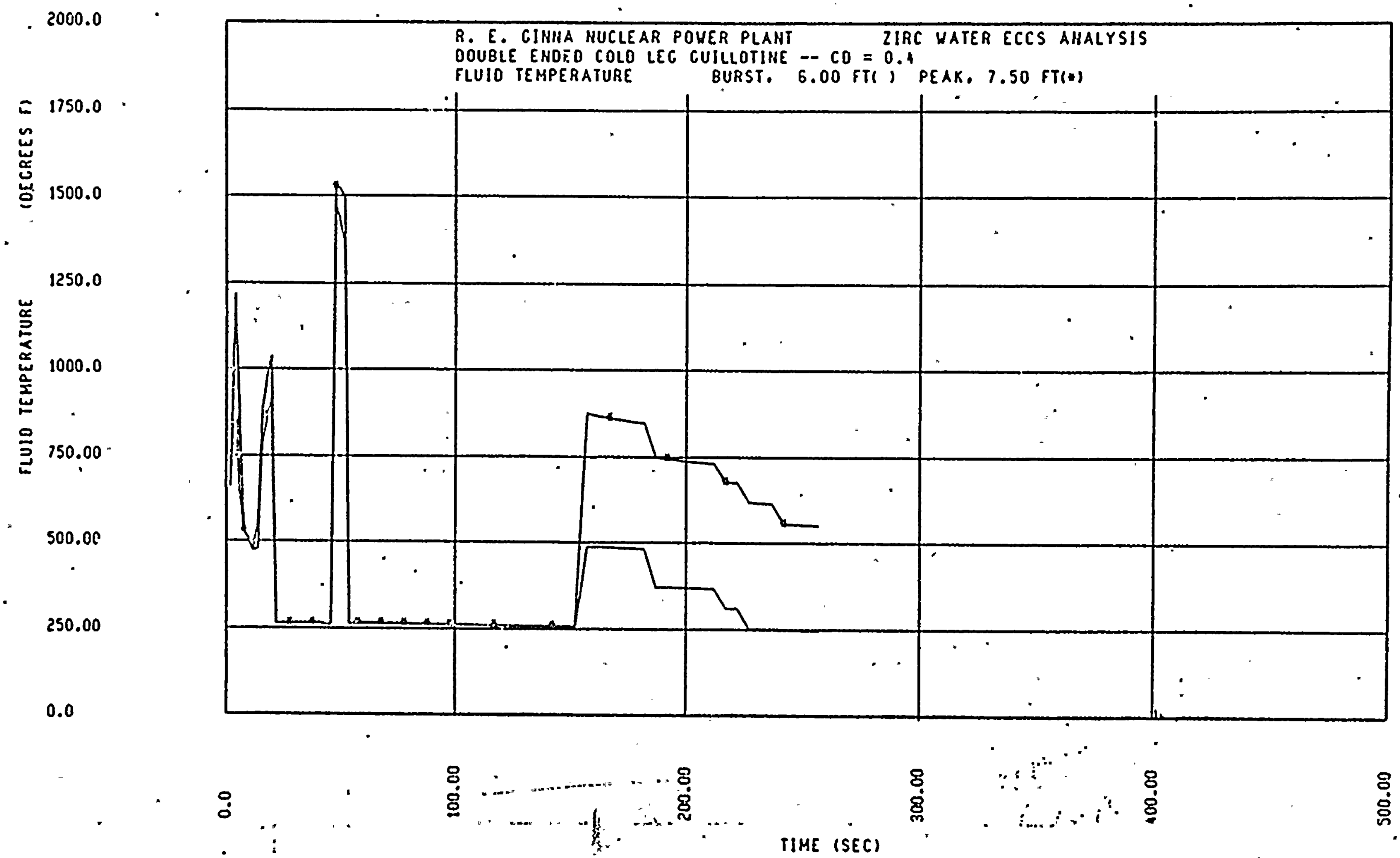

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
FLUID TEMPERATURE BURST. 6.00 FT( ) PEAK. 7.50 FT(*)
FLUID TEMPERATURE (DEGREES F)
2000.0
1750.0
1500.0
1250.0
1000.0
750.00
500.00
250.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 8

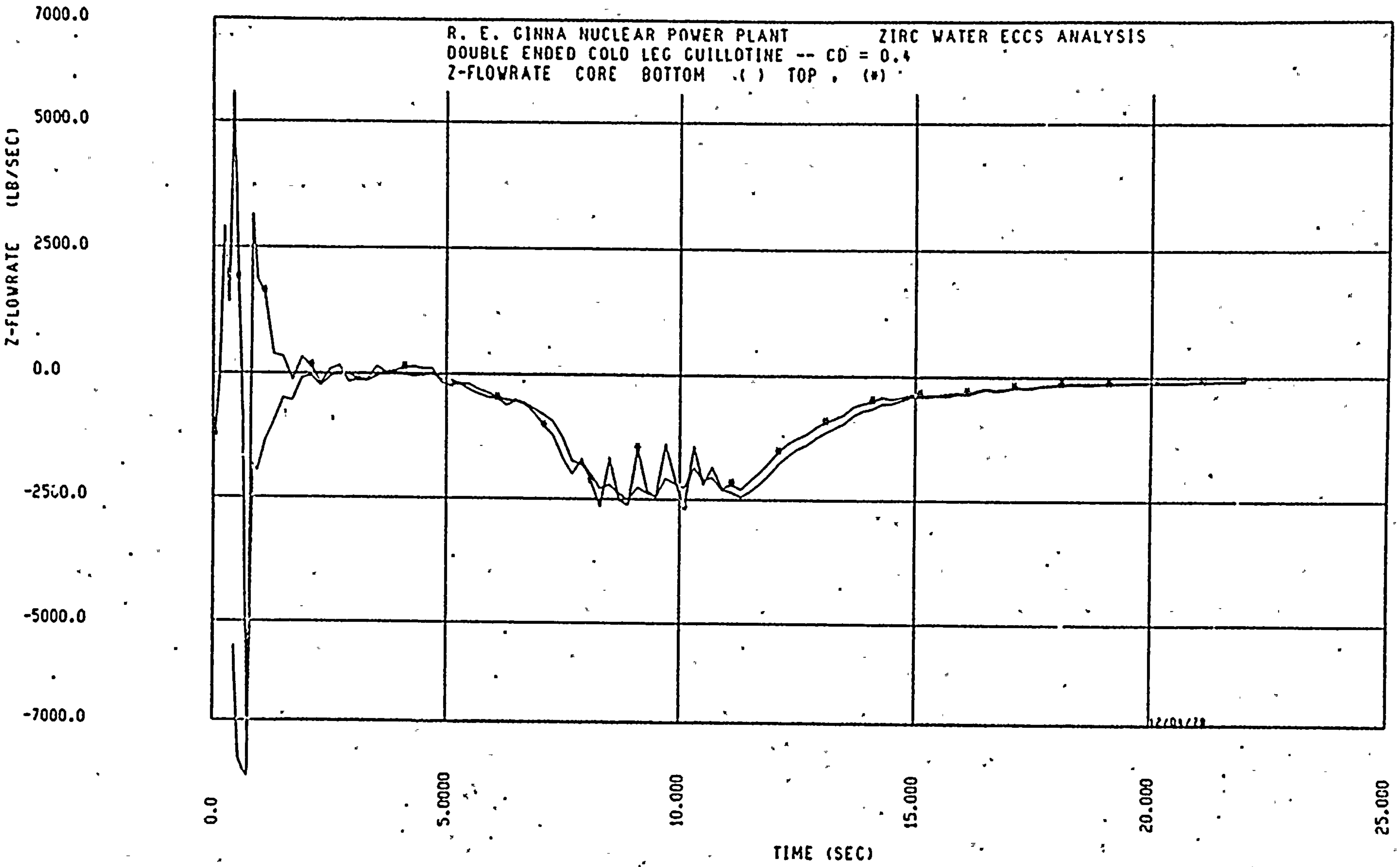

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
Z-FLOWRATE CORE BOTTOM ( ) TOP , (*)
7000.0
5000.0
2500.0
0.0
-2500.0
-5000.0
-7000.0
Z-FLOWRATE (LB/SEC)
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 9

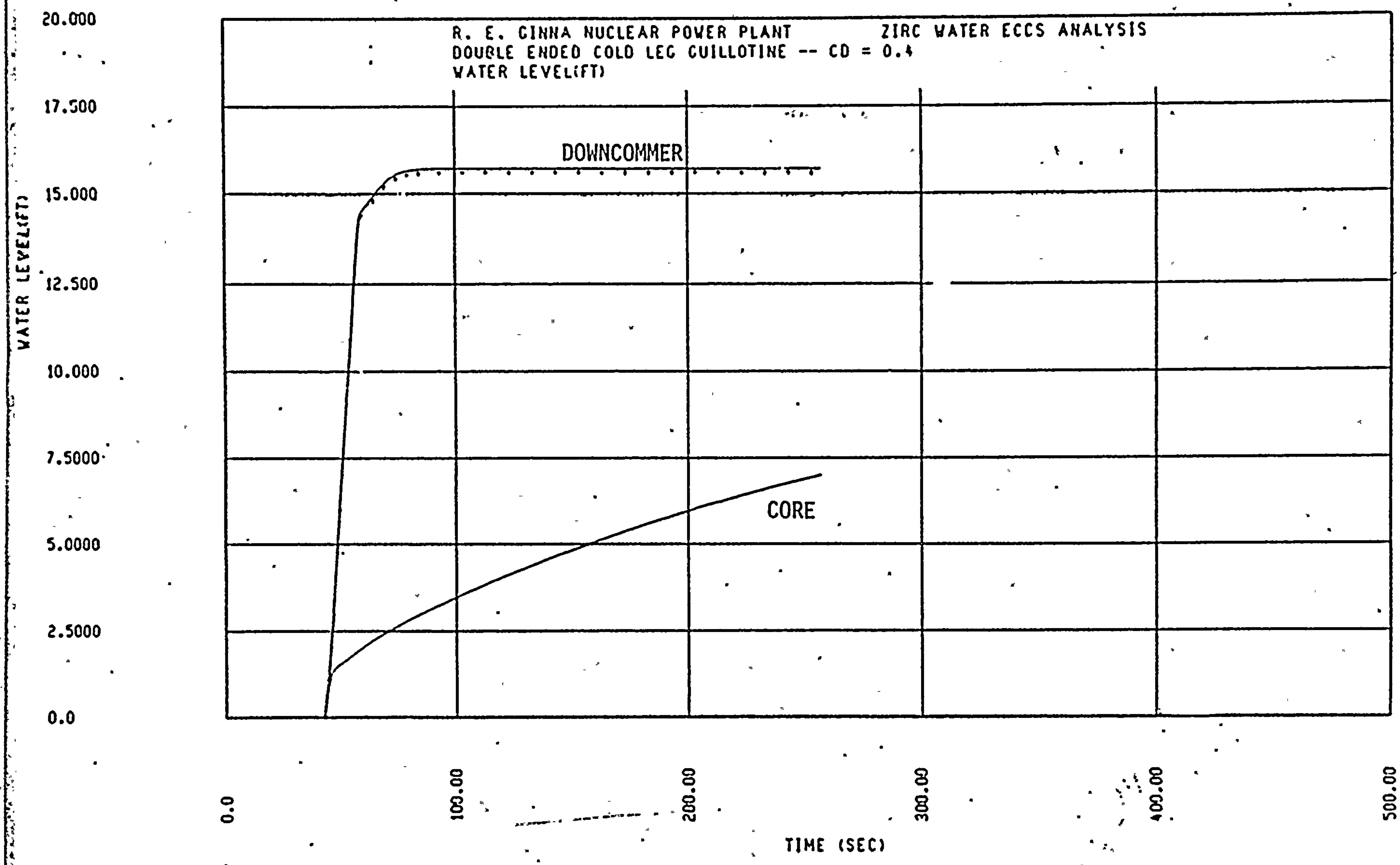

R. E. GINNA NUCLEAR POWER PLANT
ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
WATER LEVEL(FT)
DOWNCOMMER
CORE
WATER LEVEL(FT)
20.000
17.500
15.000
12.500
10.000
7.5000
5.0000
2.5000
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 10

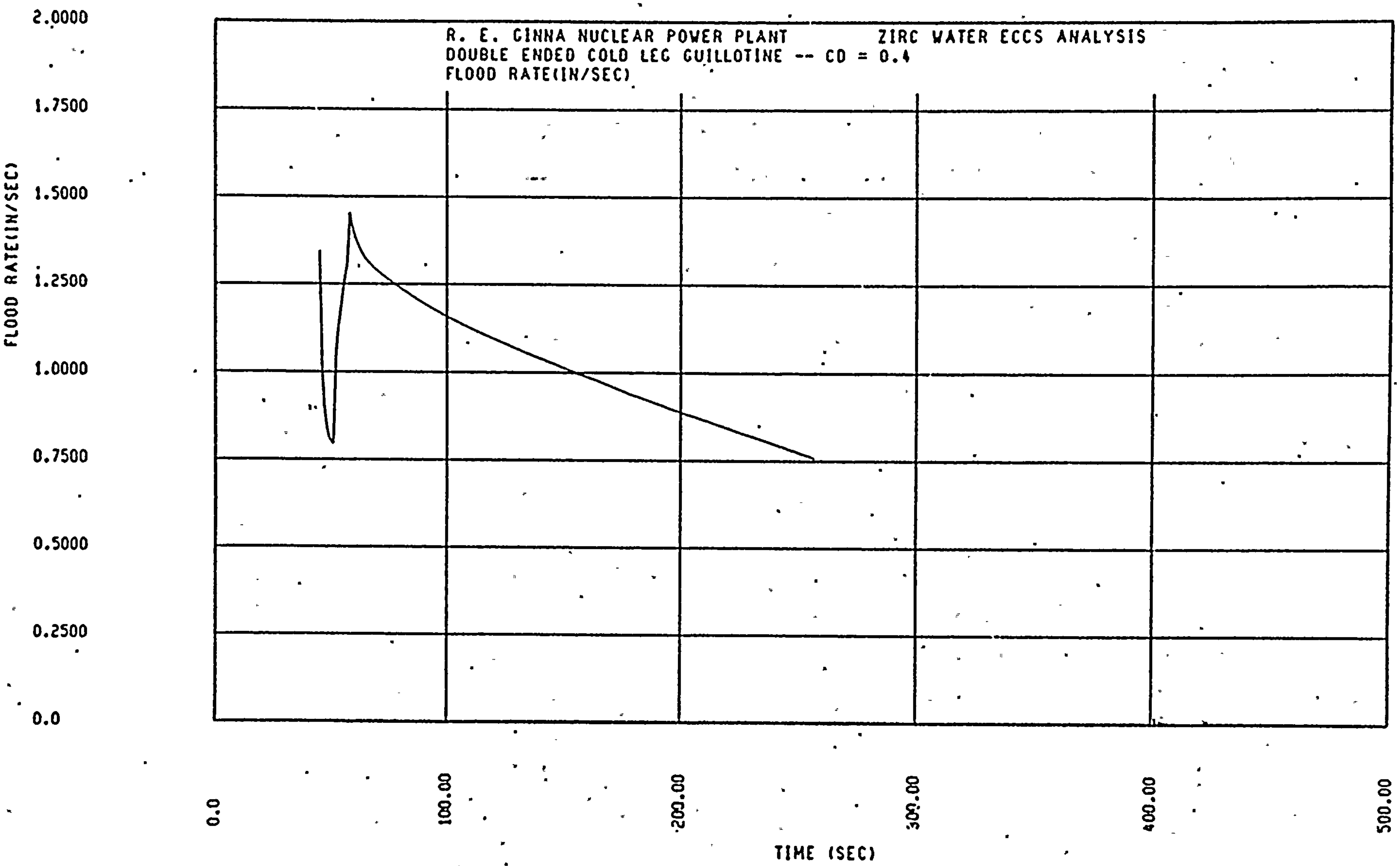

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
FLOOD RATE(IN/SEC)
FLOOD RATE(IN/SEC)
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 11

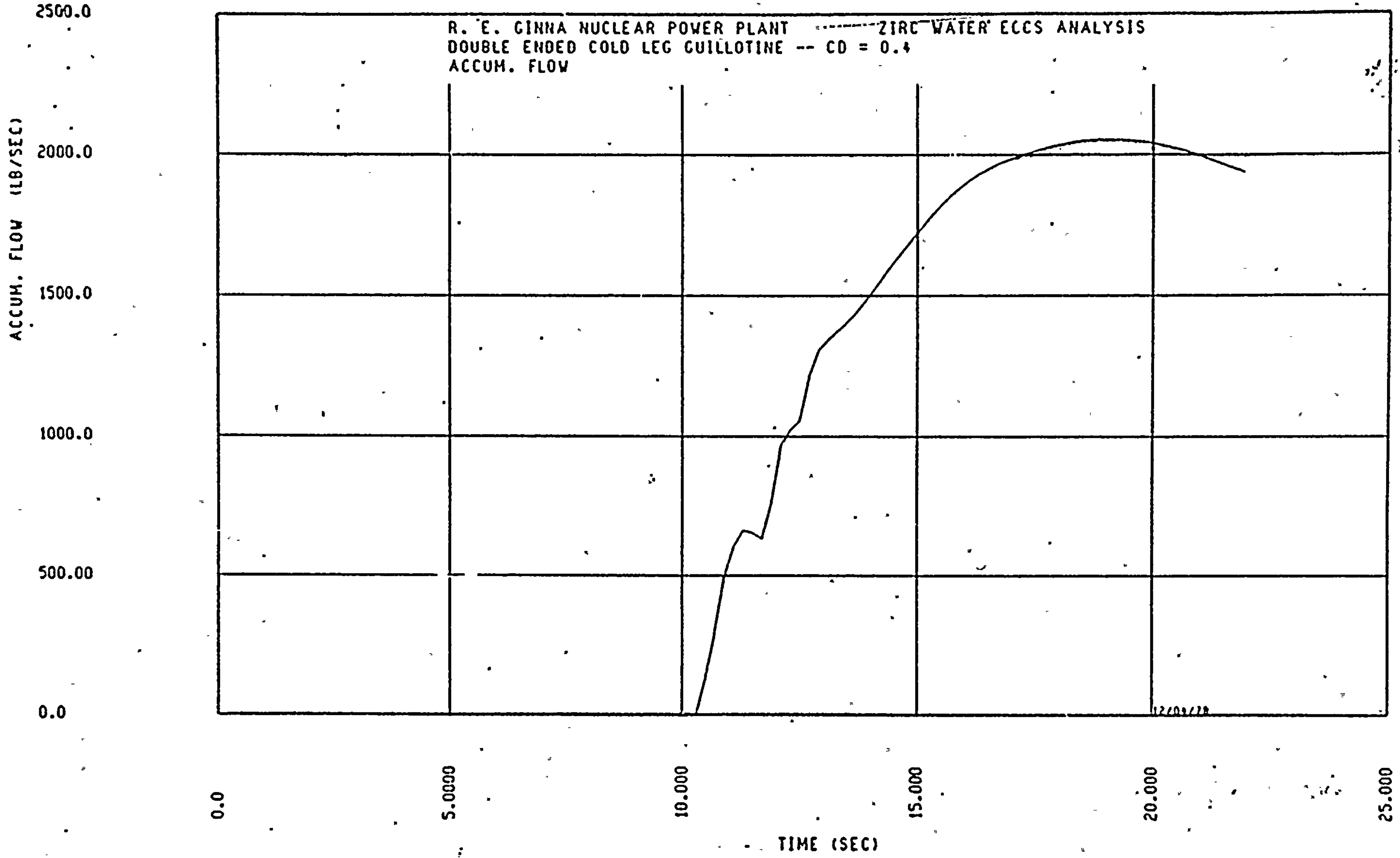

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
ACCUM. FLOW
ACCUM. FLOW (LB/SEC)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 12

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

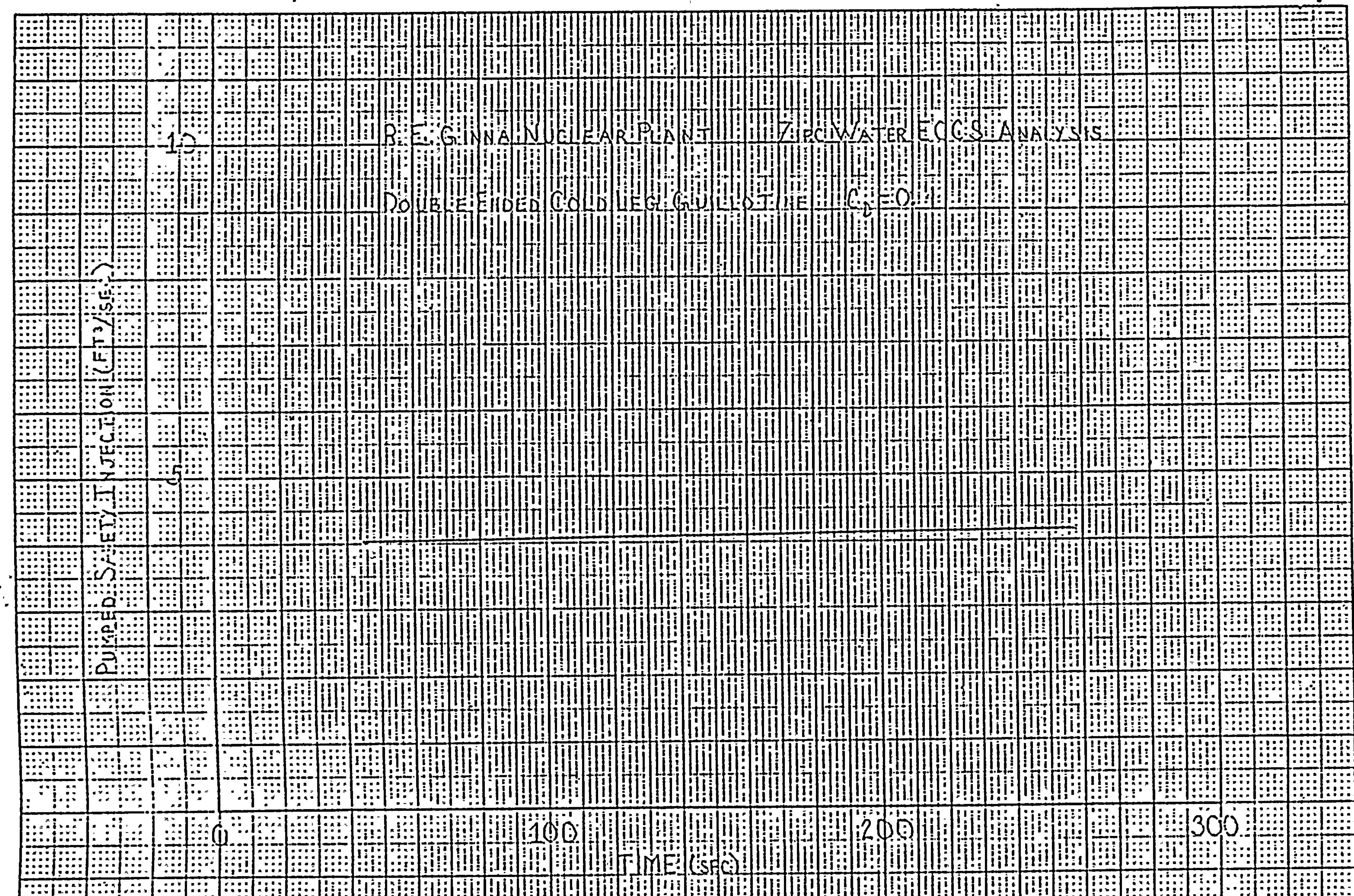


FIGURE 13

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

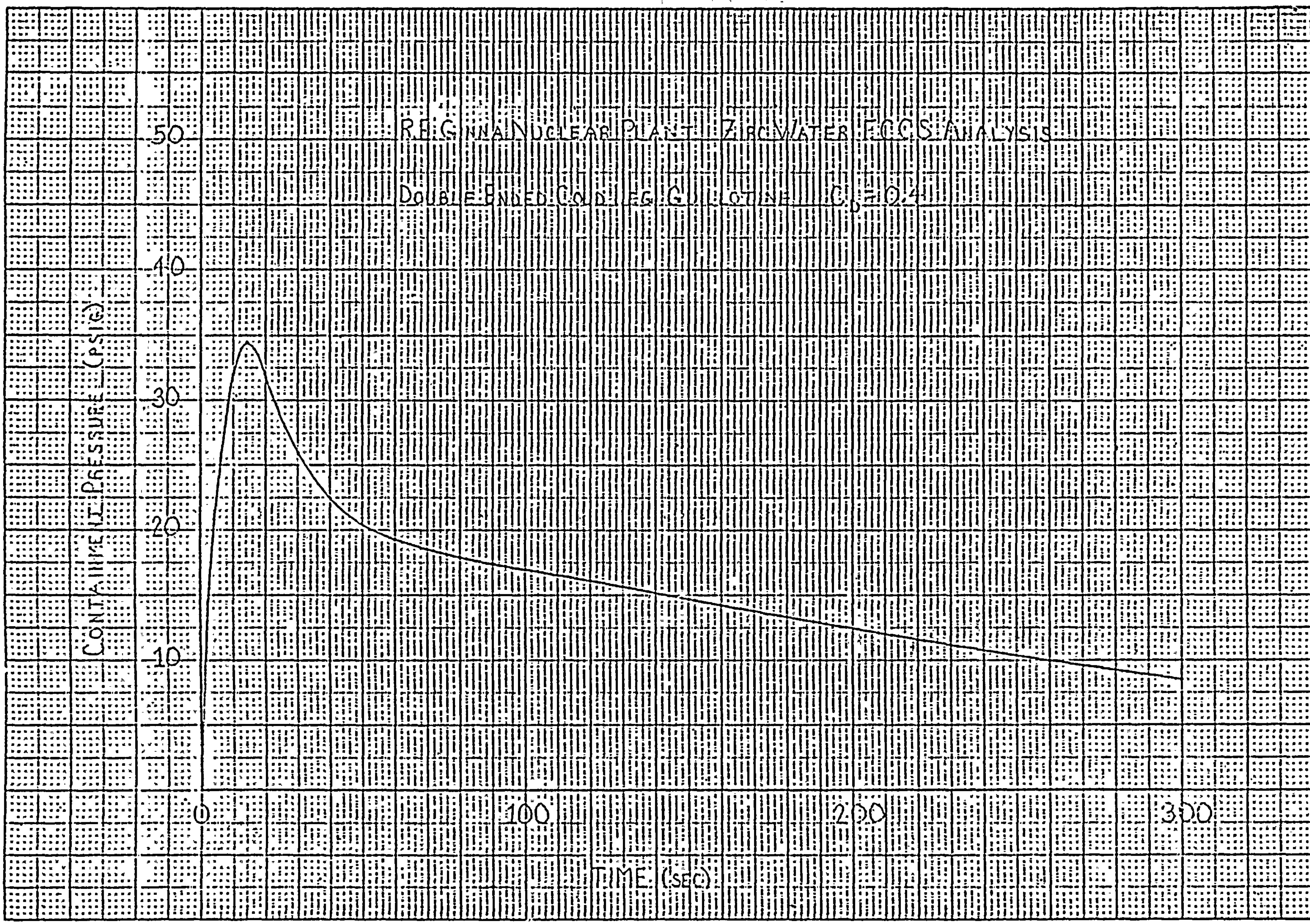


FIGURE 14

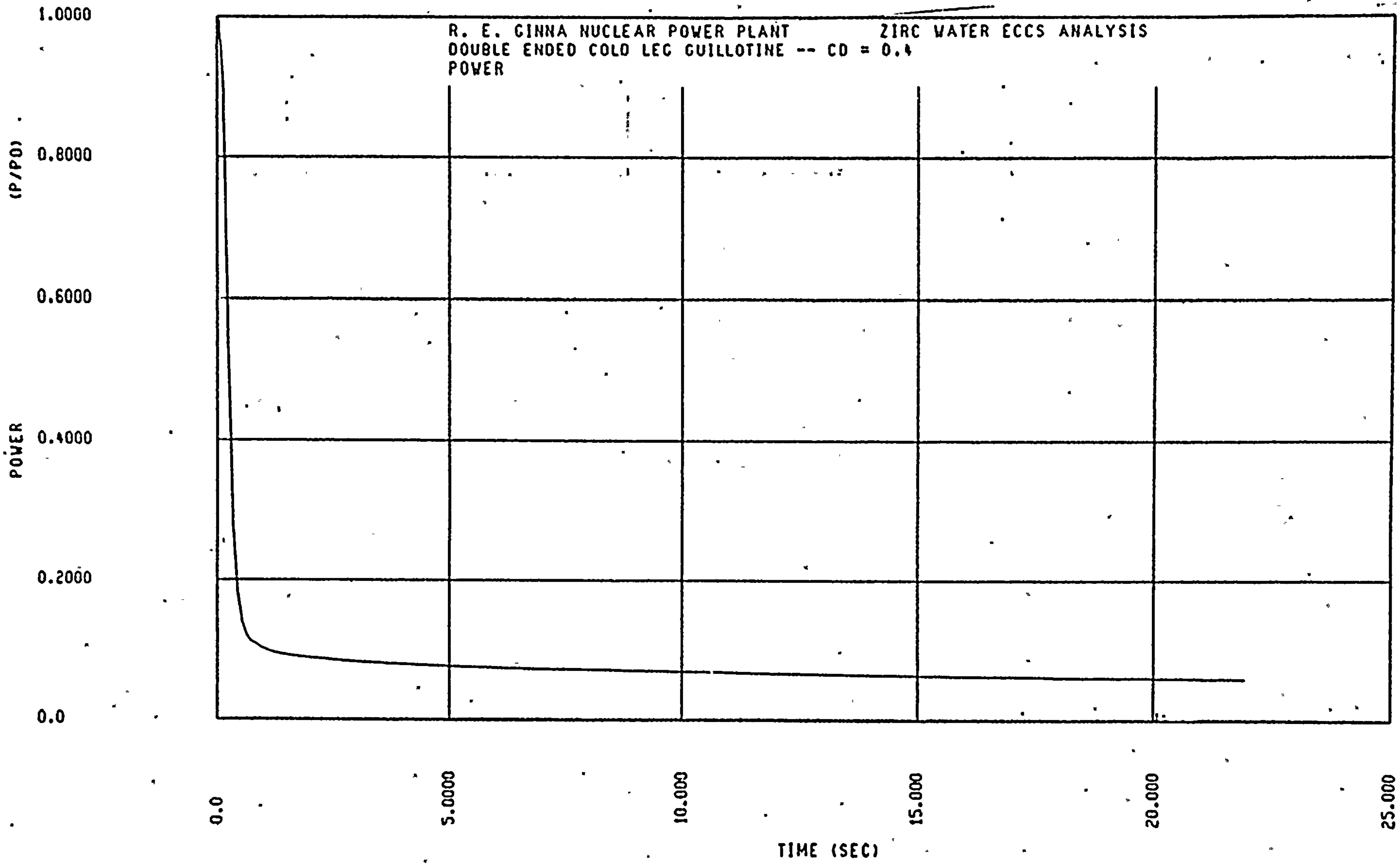
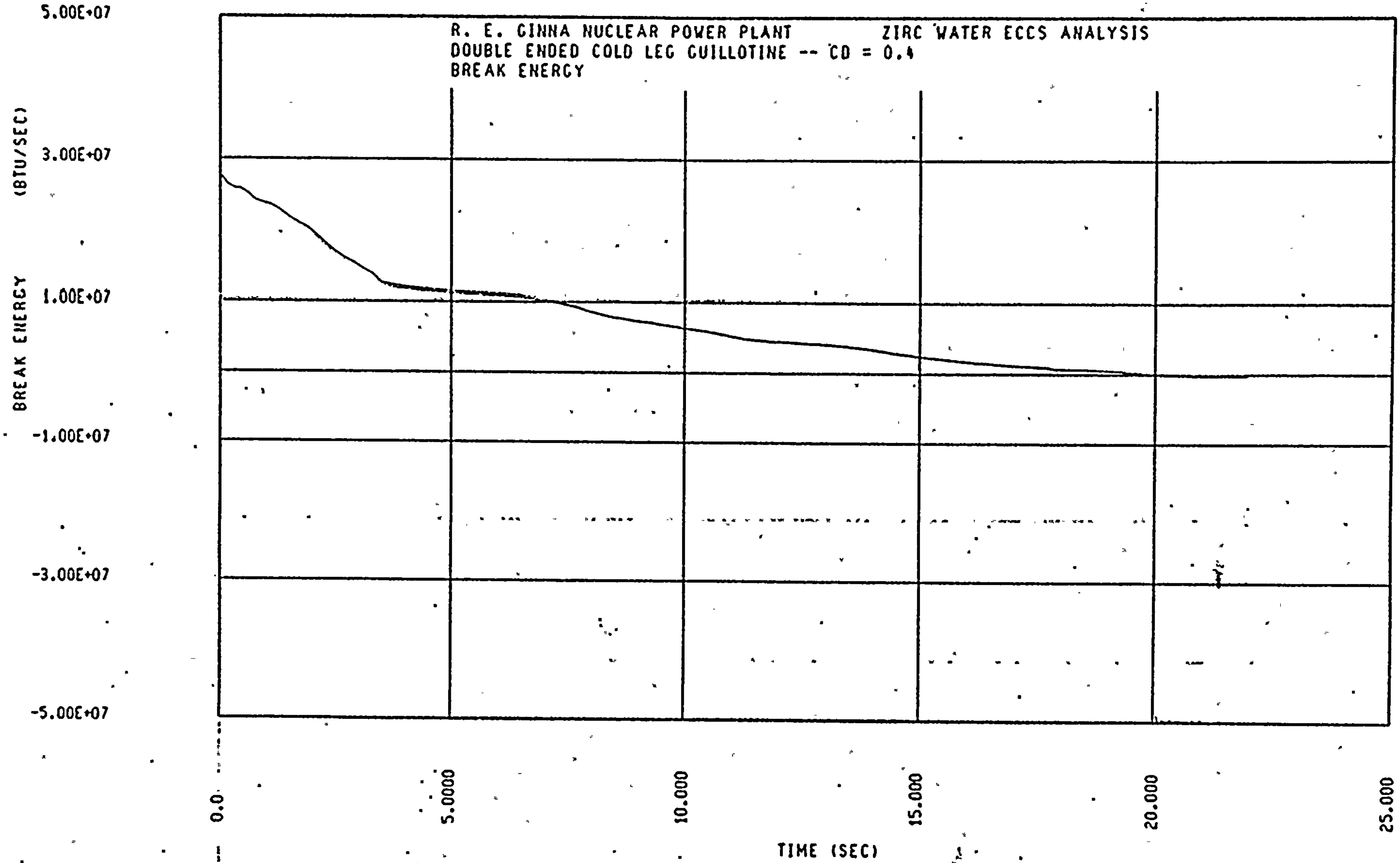

R. E. GINNA NUCLEAR POWER PLANT ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
POWER
POWER (P/PO)
1.0000
0.8000
0.6000
0.4000
0.2000
0.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 15



R. E. GINNA NUCLEAR POWER PLANT
ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
BREAK ENERGY
BREAK ENERGY (BTU/SEC)
5.00E+07
3.00E+07
1.00E+07
-1.00E+07
-3.00E+07
-5.00E+07
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 16

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

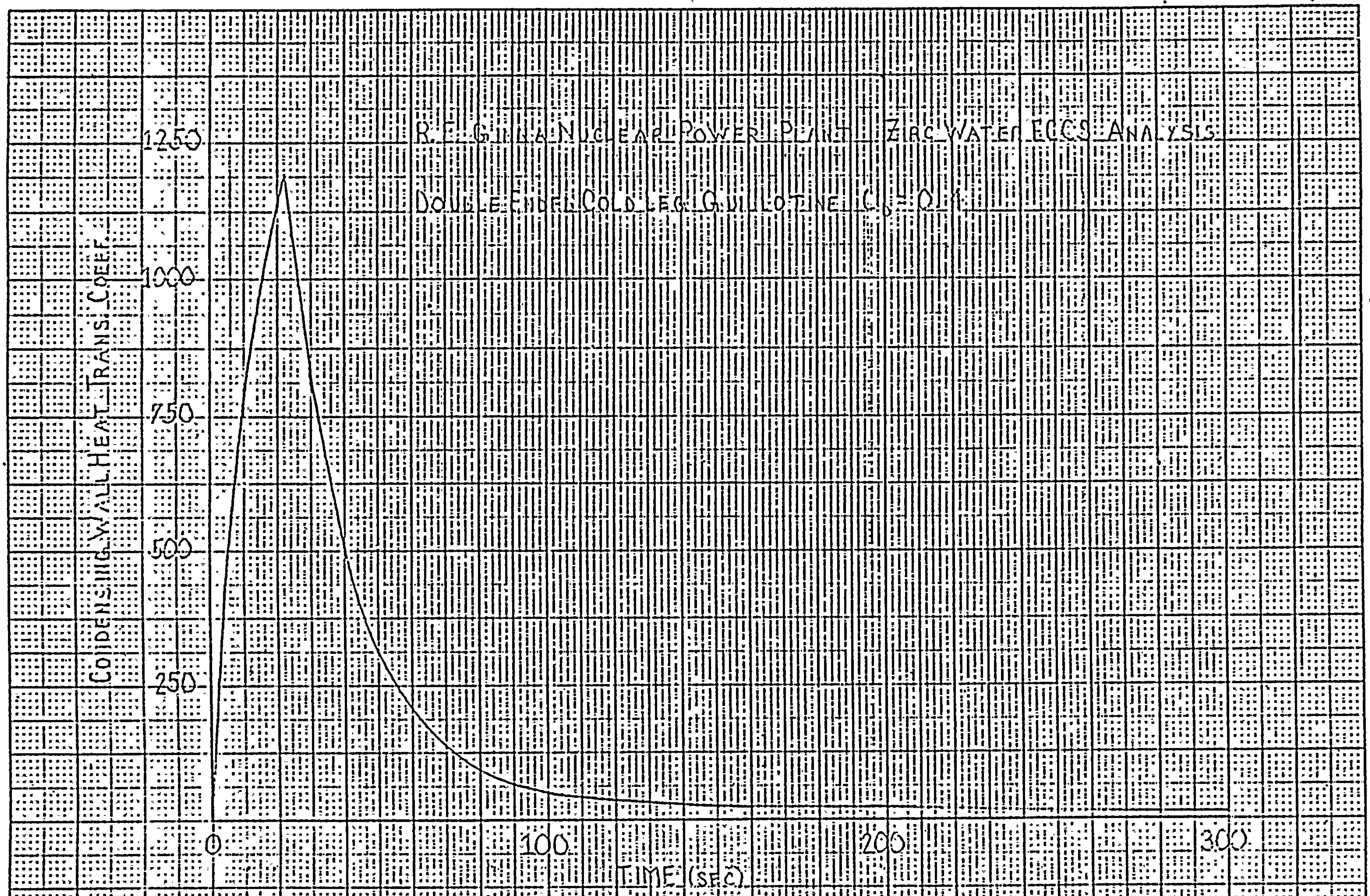


FIGURE 17

APPENDIX A

Generic Sensitivity Study Results

for

2-Loop Plant With 14 x 14 Fuel

TABLE 1

Large Break - Time Sequence of Events

EVENT	OCCURENCE TIME (SECONDS)		
	DECLG, C_D =1.0	DECLG, C_D =0.6	DECLG, C_D = 0.4
Accident Initiation	0.0	0.0	0.0
Reactor Trip Signal	0.52	0.53	0.54
Safety Injection Signal	0.48	0.56	0.67
Start Accumulator Injection	5.7	7.5	9.8
End of ECC Bypass	15.15	16.75	19.96
End of Blowdown	15.15	16.75	19.96
Bottom of Core Recovery	28.6	30.0	32.8
Accumulators Empty	37.5	39.1	42.1
Start Pumped ECC Injection	25.48	25.56	25.6

TABLE 2

LARGE BREAK - ANALYSIS INPUT AND RESULTS

Quantities in the calculations:

Licensed core power rating	102% of 1650 MWt
Total core peaking factor	2.31
Peak linear power	102% of 14.3 kw/ft
Accumulator water volume	1250 cubic feet per tank
Accumulator pressure	700 PSIA
Number of Safety Injection Pumps Operating	2
Steam Generator Tube Plugging Level	1 percent (uniform)
Fuel Parameters -	Cycle Generic Region Generic

Results	DECLG, C_D = 1.0	DECLG, C_D = 0.6	DECLG, C_D = 0.4
Peak clad temperature (^oF)	1936	1964	2193
Location (feet)	7.5	7.5	7.5
Maximum local clad/water reaction (%)	4.1	4.5	9.1
Location (feet)	7.5	7.5	7.5
Total core clad/water reaction(%)	<0.3	<0.3	<0.3
Hot rod burst time (seconds)	78.0	70.6	25.6
Location (feet)	7.0	6.75	5.75

TABLE 3

DRY CONTAINMENT DATA

NET FREE VOLUME	1.37×10^6 ft^3
INITIAL CONDITIONS	
Pressure	14.7 psia
Temperature	90° F
RWST Temperature	70° F
Service Water Temperature	32° F
Outside Temperature	20° F
SPRAY SYSTEM	
Number of Pumps Operating	2
Runout Flow Rate	1600 gpm/each
Actuation Time	15 sec
SAFEGUARDS FAN COOLERS	
Number of Fan Coolers Operating	4
Fastest Post-Accident Initiation of Fan Coolers	15 sec
STRUCTURAL HEAT SINKS	
Thickness (in.)	Area (ft^2)
1.5steel	41300
0.75 steel	32000
0.25 steel 12 concrete	7860
0.375 steel	6800
0.25 steel	32000
0.5 steel	44000
0.145 steel	1695
0.09 steel	12400
0.1 steel	6000
0.1875 steel	13125
1.44 steel	2200
12 concrete	40800
6 concrete	25070
3 concrete	7570

TABLE 3 (cont'd)

PAINTED SURFACES

Steel Thickness (in)	Minimum Painted Area (ft^2)	Paint Thickness (mils)
1.5	41300	11
.75	32000	11
.5	44000	11
.375	6800	11
.1875	13125	11
.145	1695	11
1.44	2200	11

Concrete Thickness (in)	Minimum Painted Area (ft^2)	Paint Thickness (mils)
12	4080	18
6	25070	18
3	7570	18

TABLE 4

REFLOOD MASS AND ENERGY RELEASE, C_D = 0.4 DCCLG

Time	Mass Flow (lb/sec)	Energy Flow (BTU/sec)
33.4	.002	2.43
38.0	34.16	44025.1
47.0	137.97	85563.1
61.3	225.22	102148.2
79.2	237.1	100581.8
99.5	242.07	98133.1
121.7	245.93	95368.0
171.6	252.7	89344.0
230.0	259.35	82964.7
300.6	266.46	76280.0
395.7	276.64	69442.6

TABLE 5

Broken Loop Accumulator Mass and Energy Release

Time	Mass Flow (lb/sec)	Energy Flow (BTU/sec)
0.0	4876.4	292005.
2.0	4249	254469.0
4.0	3823.0	228957.0
6.0	3508.5	210127.0
8.0	3258.7	195166.0
10.0	3053.7	182888.0
12.0	2884.2	172734.0
14.0	2739.8	164089.0
16.0	2617.0	156730.0
18.0	2513.9	150557.0
22.0	2351.7	140842.0
25.7	2214.2	132606.0
25.8	0.0	0.0

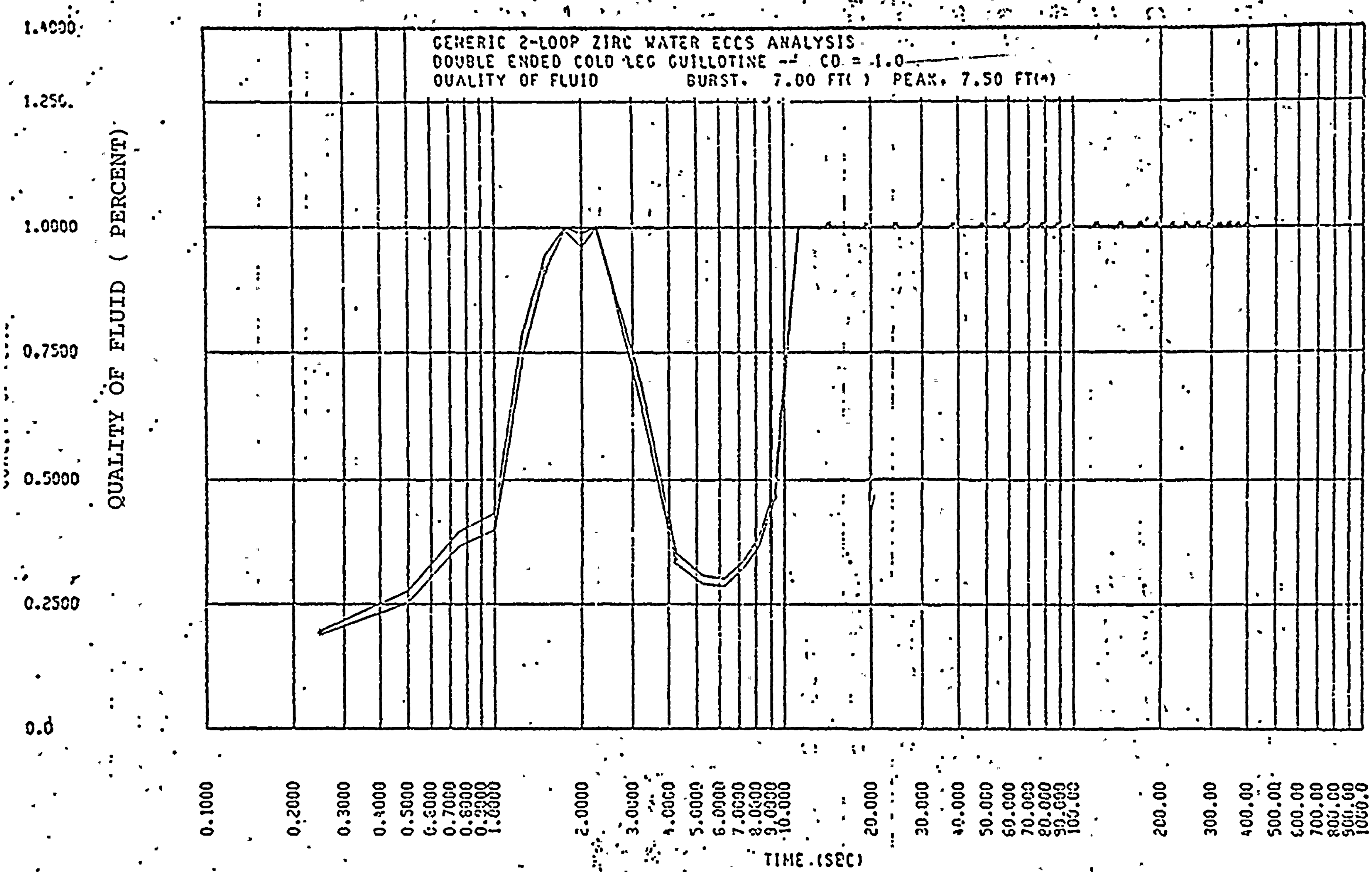

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
QUALITY OF FLUID BURST. 7.00 FT( ) PEAK. 7.50 FT(*)
QUALITY OF FLUID (PERCENT)
TIME (SEC)

FIGURE 1a

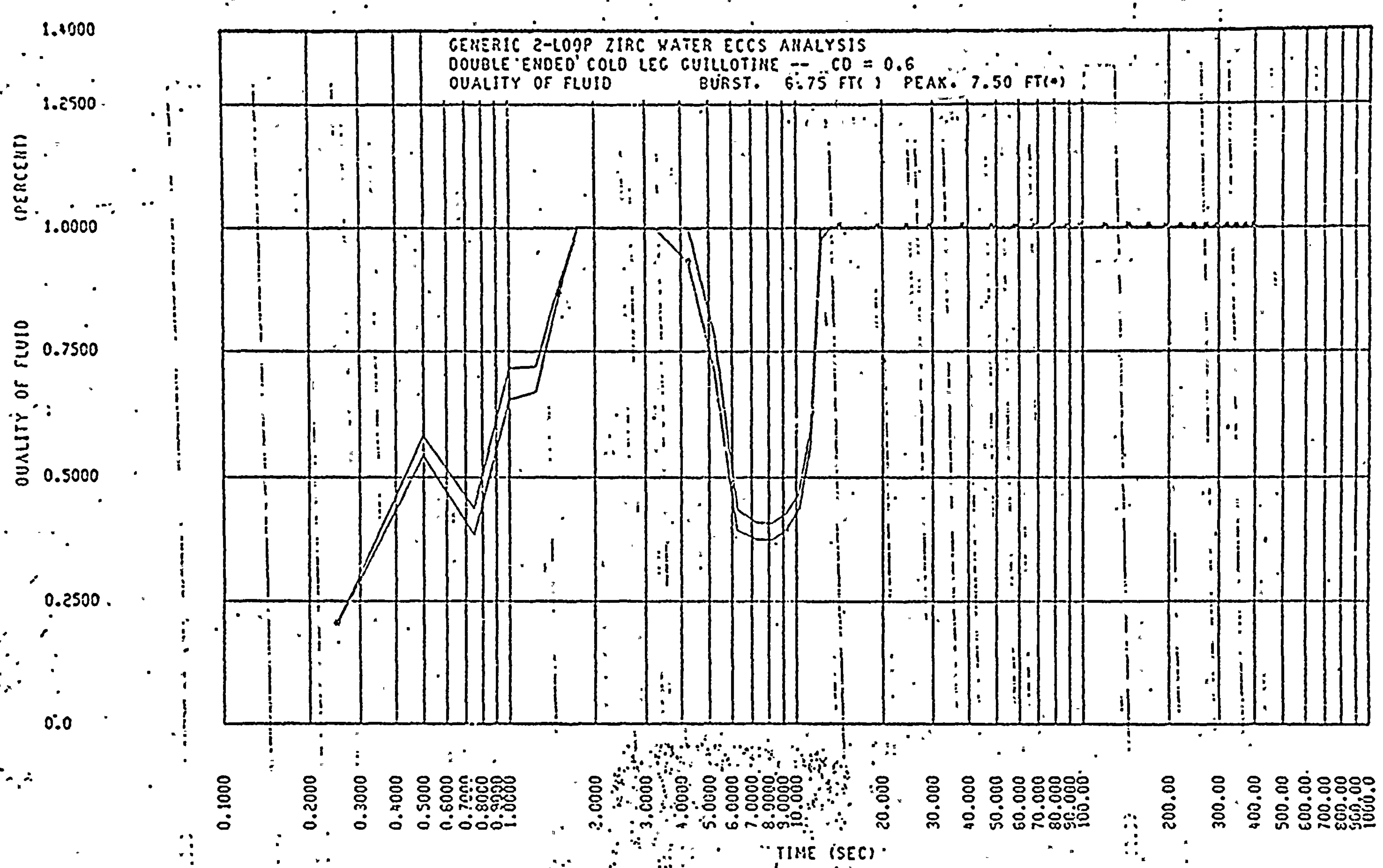
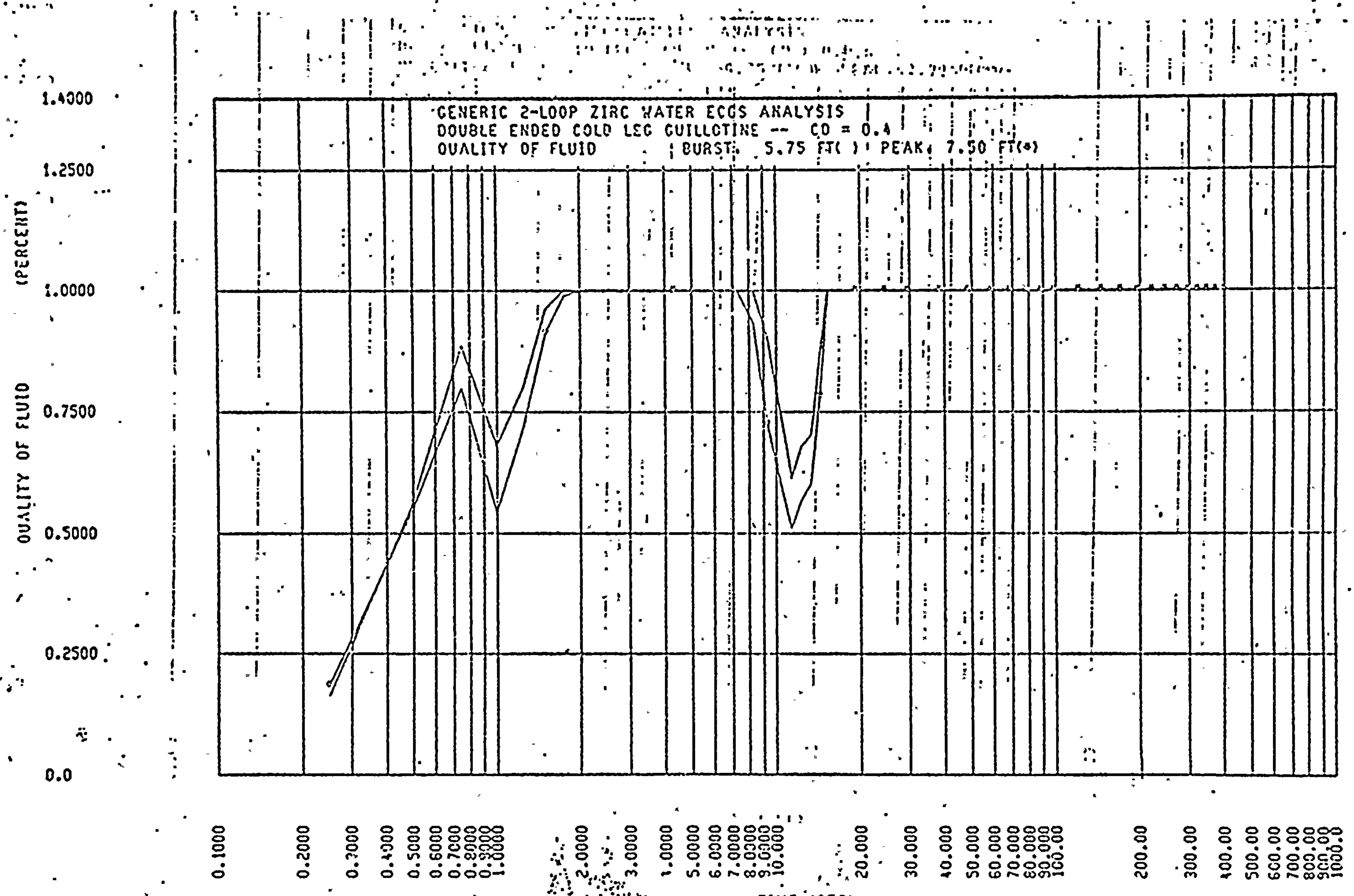
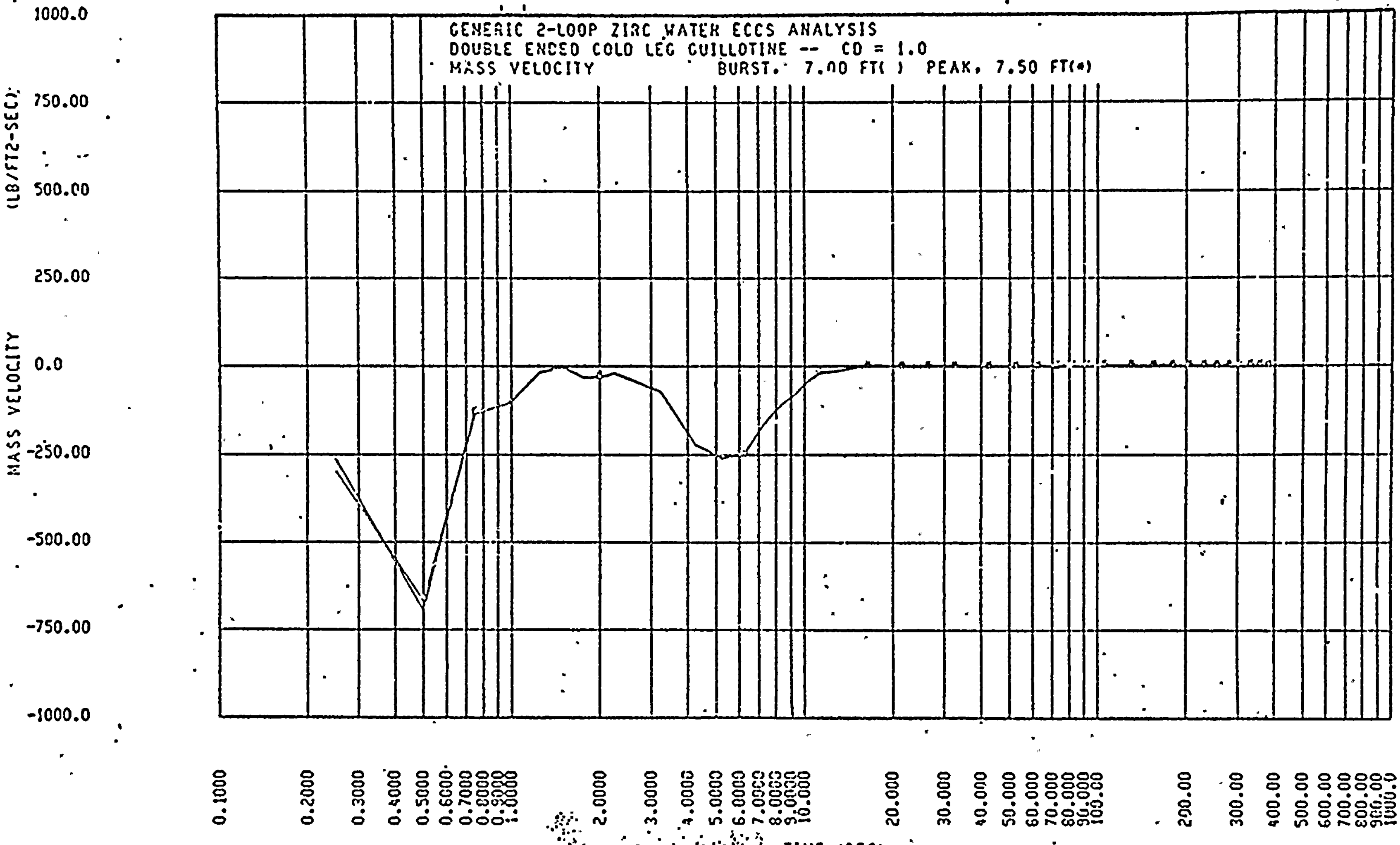

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
QUALITY OF FLUID BURST. 6.75 FT( ) PEAK. 7.50 FT(*)
QUALITY OF FLUID (PERCENT)
1.4000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.0000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.000
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 1b



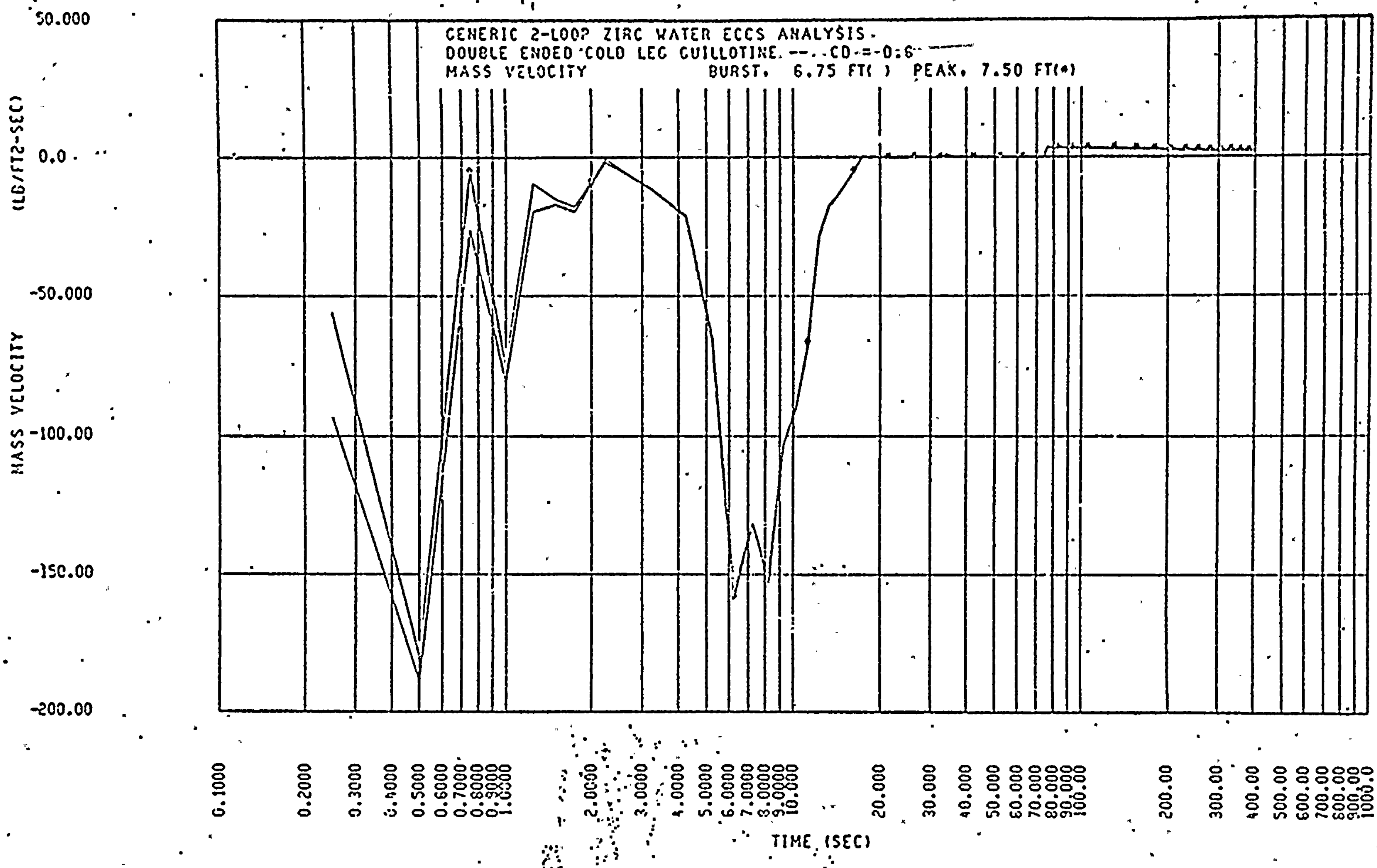
GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
QUALITY OF FLUID
BURST, 5.75 FT( ) PEAK, 7.50 FT(*)
QUALITY OF FLUID (PERCENT)
1.4000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 1c



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
MASS VELOCITY BURST, 7.00 FT( ) PEAK, 7.50 FT(*)
MASS VELOCITY (LB/FT2-SEC)
1000.0
750.00
500.00
250.00
0.0
-250.00
-500.00
-750.00
-1000.0
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 2a



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS.
DOUBLE ENDED COLD LEG GUILLOTINE. CD = 0.6
MASS VELOCITY
BURST, 6.75 FT( ) PEAK, 7.50 FT(*)
MASS VELOCITY (LB/FT2-SEC)
50.000
0.0
-50.000
-100.00
-150.00
-200.00
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 2b

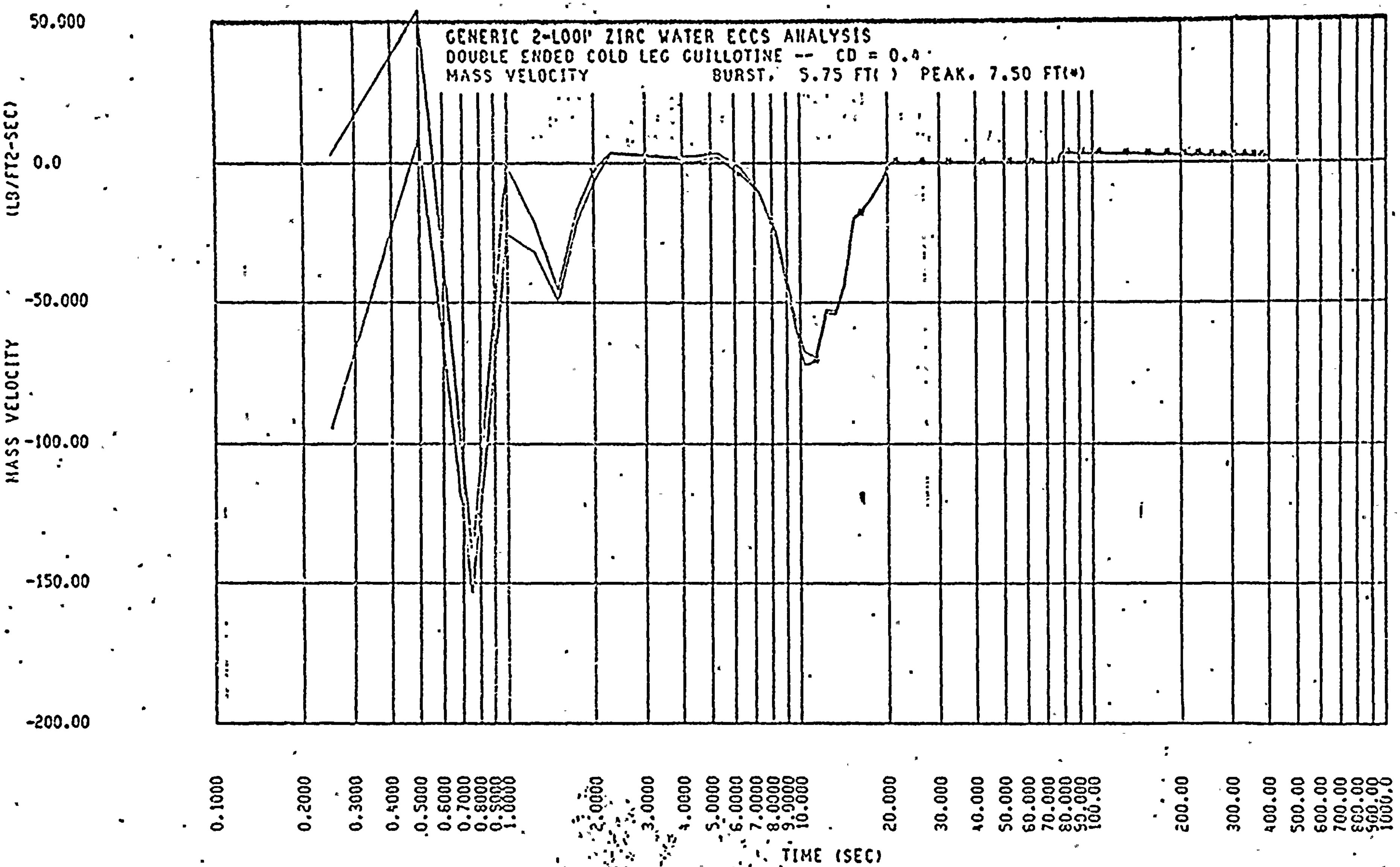

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
MASS VELOCITY BURST, 5.75 FT( ) PEAK, 7.50 FT(*)
MASS VELOCITY (LB/FT2-SEC)
50.000
0.0
-50.000
-100.00
-150.00
-200.00
0.1000
0.2000
0.3000
0.4000
0.5000
0.6000
0.7000
0.8000
0.9000
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
8.0000
9.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
90.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1000.0
TIME (SEC)

FIGURE 2c

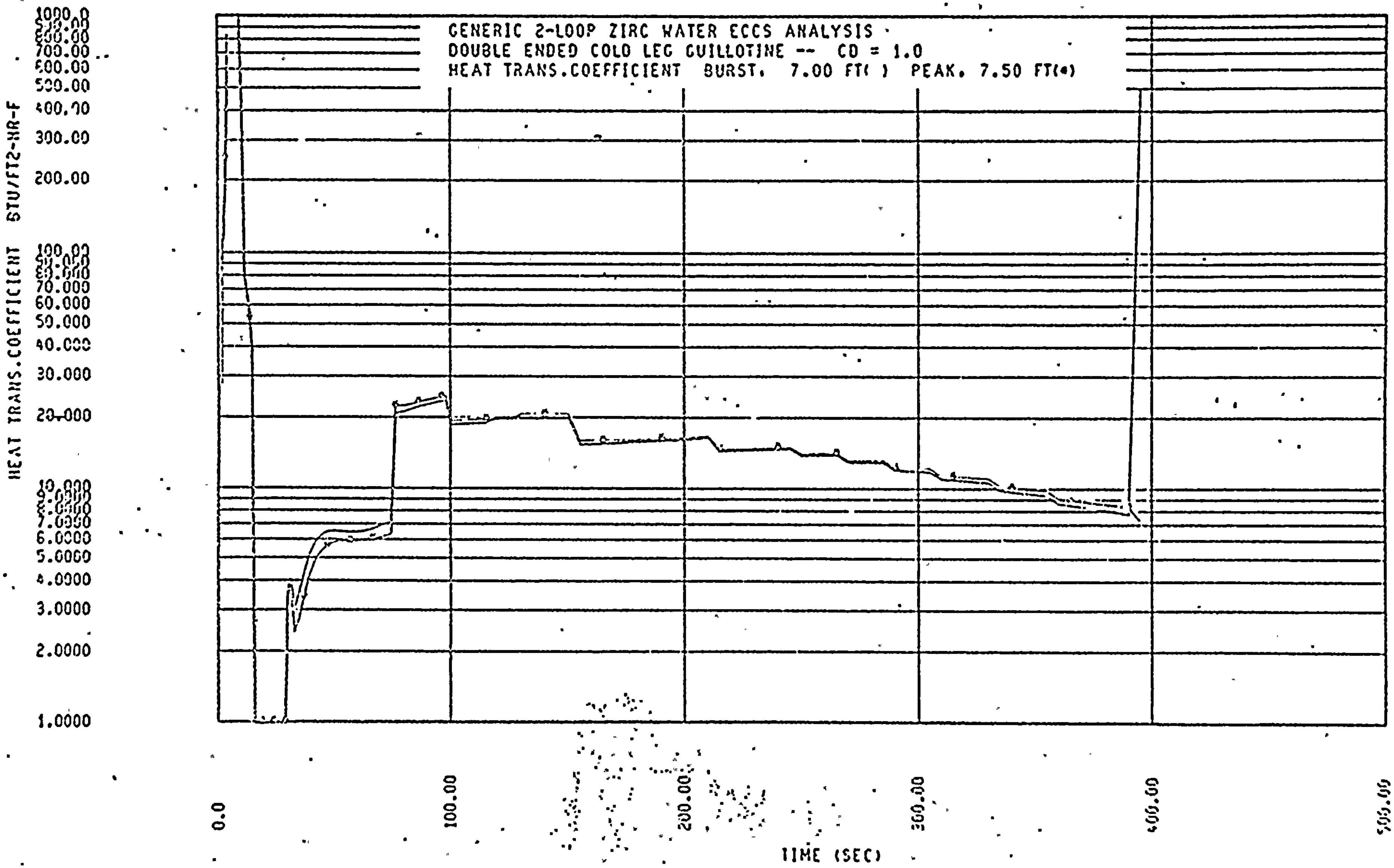

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
HEAT TRANS.COEFFICIENT BURST, 7.00 FT( ) PEAK, 7.50 FT(*)
HEAT TRANS.COEFFICIENT BTU/FT2-HR-F
1000.0
700.00
600.00
500.00
400.00
300.00
200.00
100.00
70.000
60.000
50.000
40.000
30.000
20.000
10.000
6.0000
5.0000
4.0000
3.0000
2.0000
1.0000
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 3a

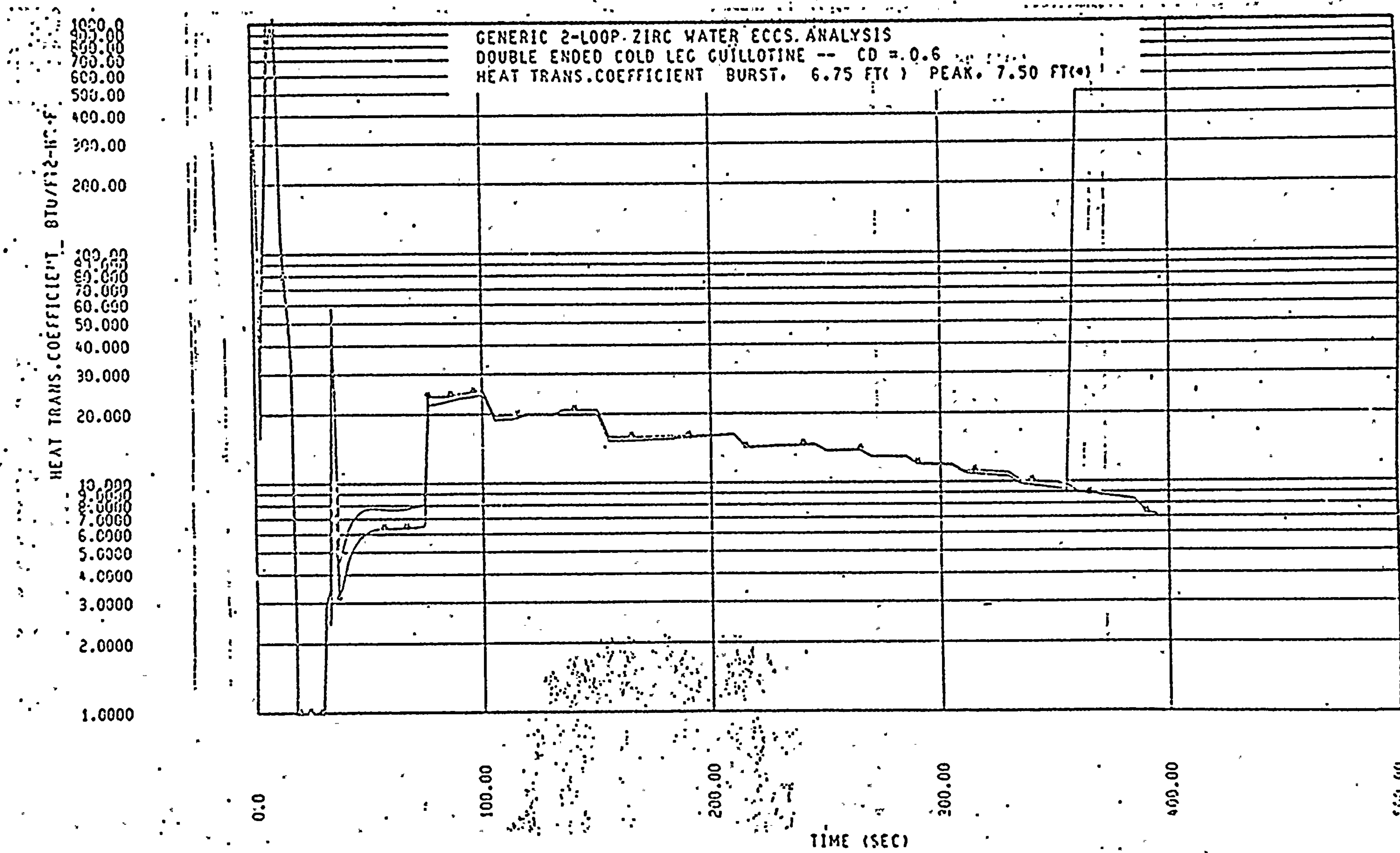
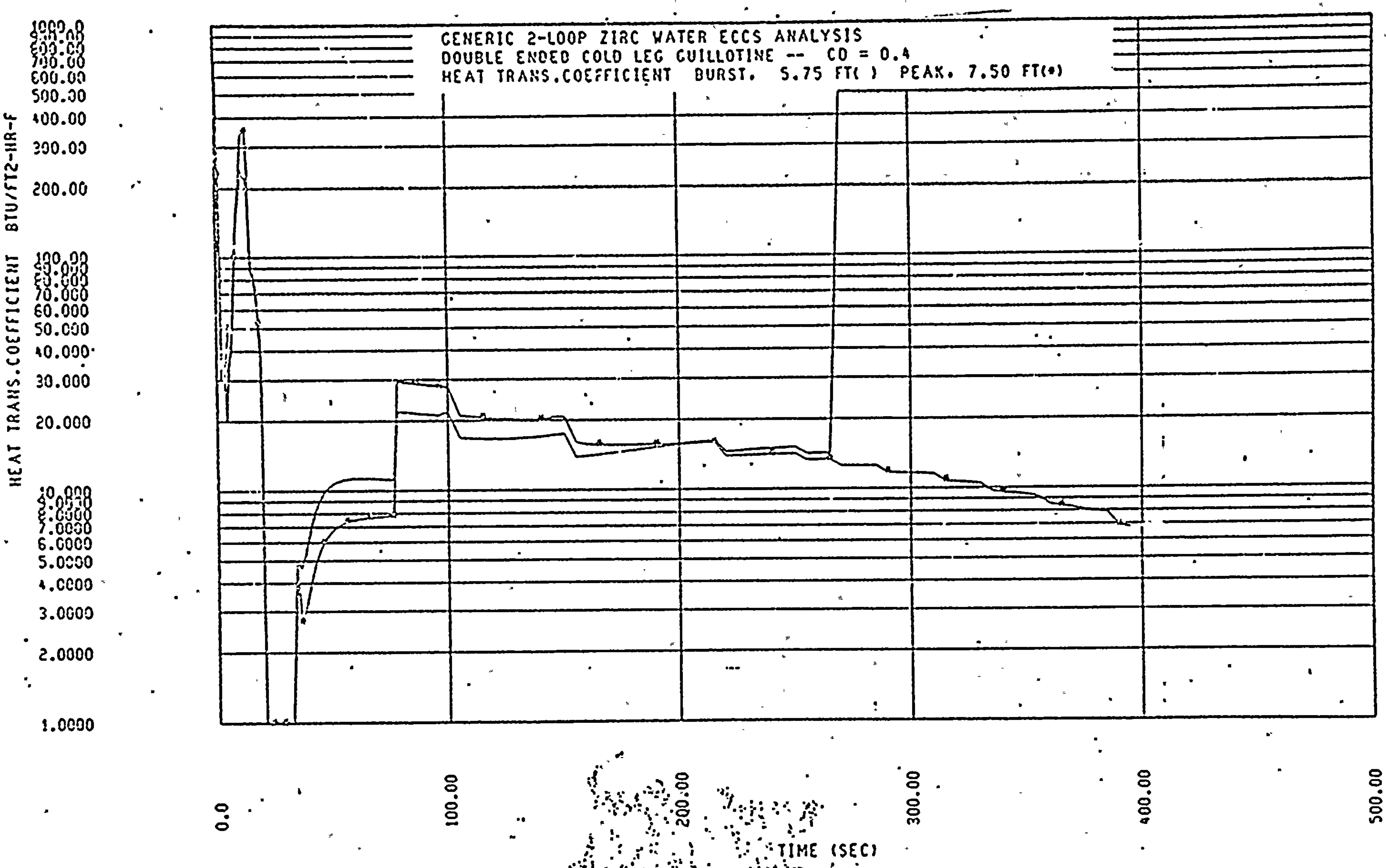

GENERIC 2-LOOP ZIRC WATER ECCS. ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD =.0.6
HEAT TRANS.COEFFICIENT BURST. 6.75 FT( ) PEAK. 7.50 FT(*)
HEAT TRANS.COEFFICIENT BTU/FT2-HR-F
1.0000
2.0000
3.0000
4.0000
5.0000
6.0000
7.0000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
100.00
200.00
300.00
400.00
500.00
600.00
700.00
0.0
100.00
200.00
300.00
400.00
TIME (SEC)

FIGURE 3b



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
HEAT TRANS.COEFFICIENT BURST. 5.75 FT( ) PEAK. 7.50 FT(*)
HEAT TRANS.COEFFICIENT BTU/FT2-HR-F
1000.0
500.00
400.00
300.00
200.00
100.00
60.000
50.000
40.000
30.000
20.000
10.000
6.0000
5.0000
4.0000
3.0000
2.0000
1.0000
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 3c

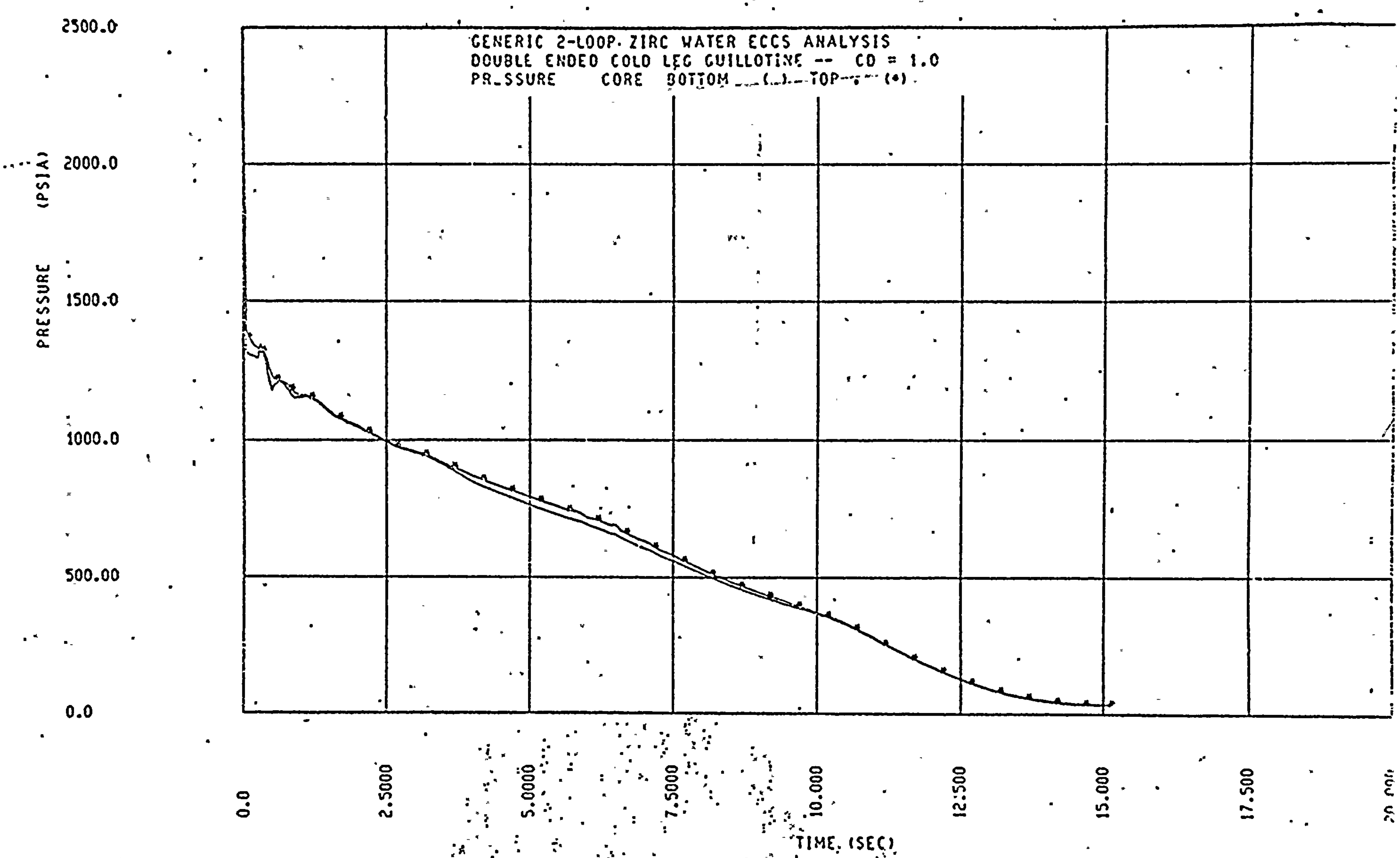

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
PR_SSURE CORE BOTTOM (-) TOP (+)
PRESSURE (PSIA)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 4a

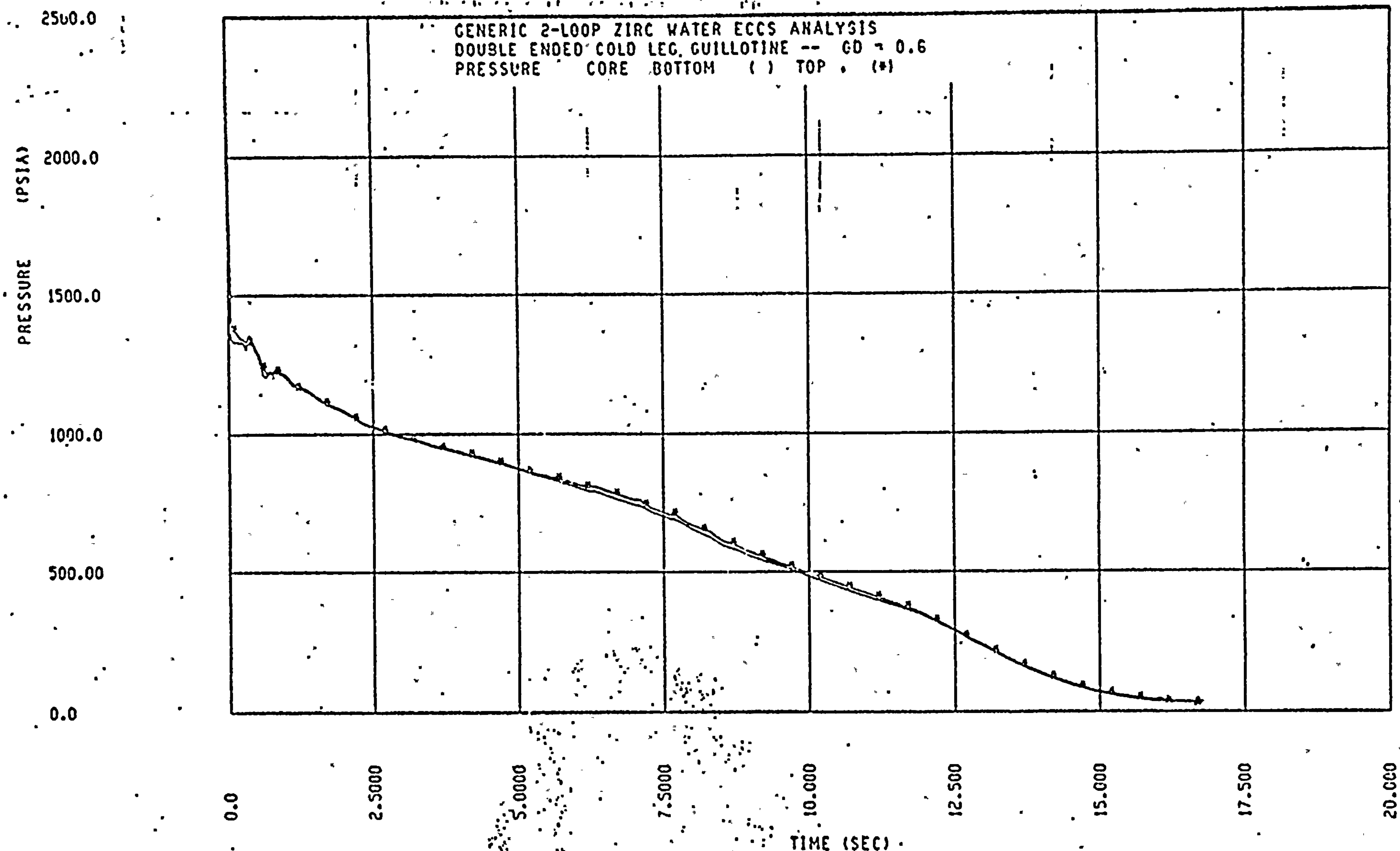

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
PRESSURE CORE BOTTOM ( ) TOP , (*)
PRESSURE (PSIA)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 4b

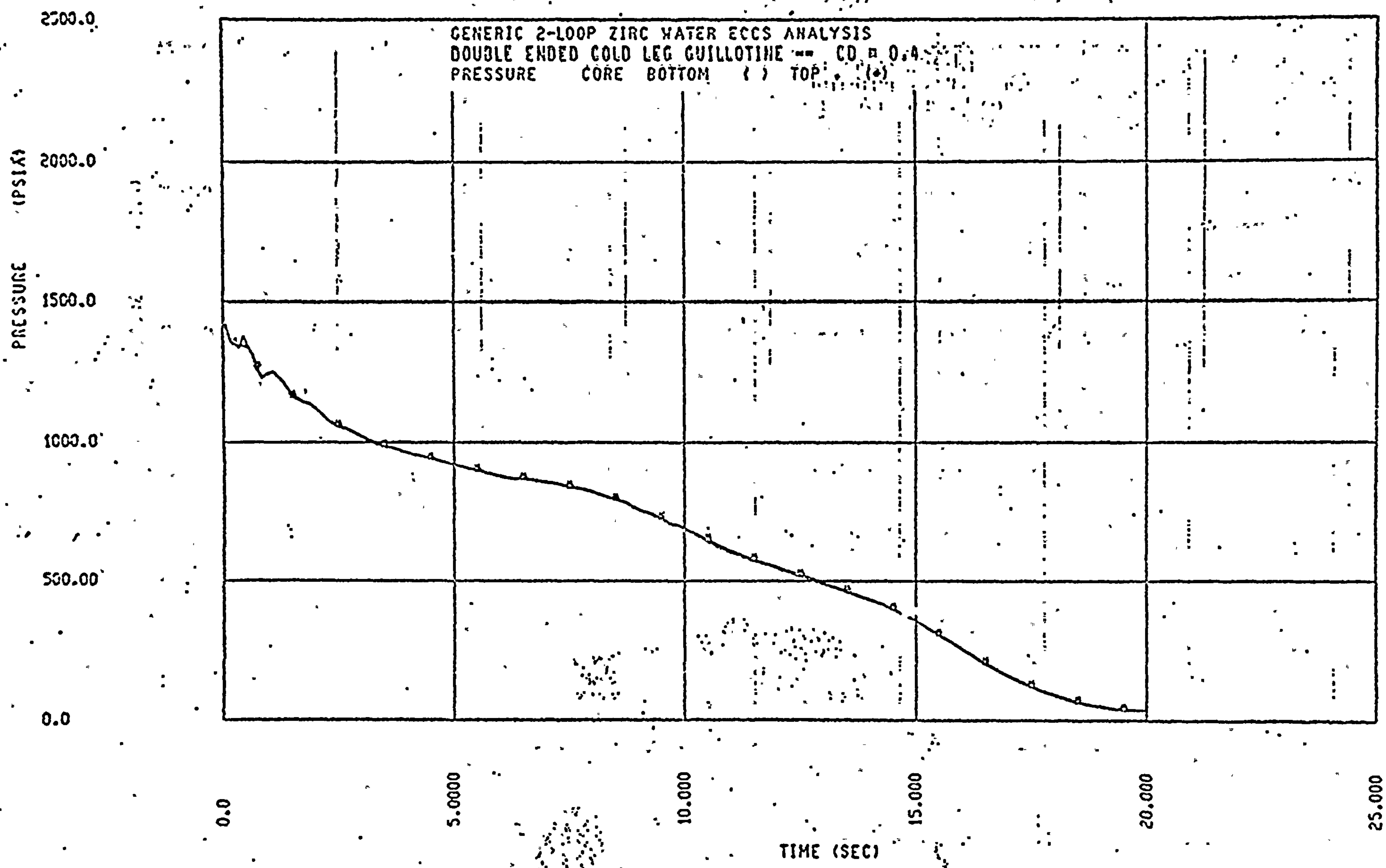
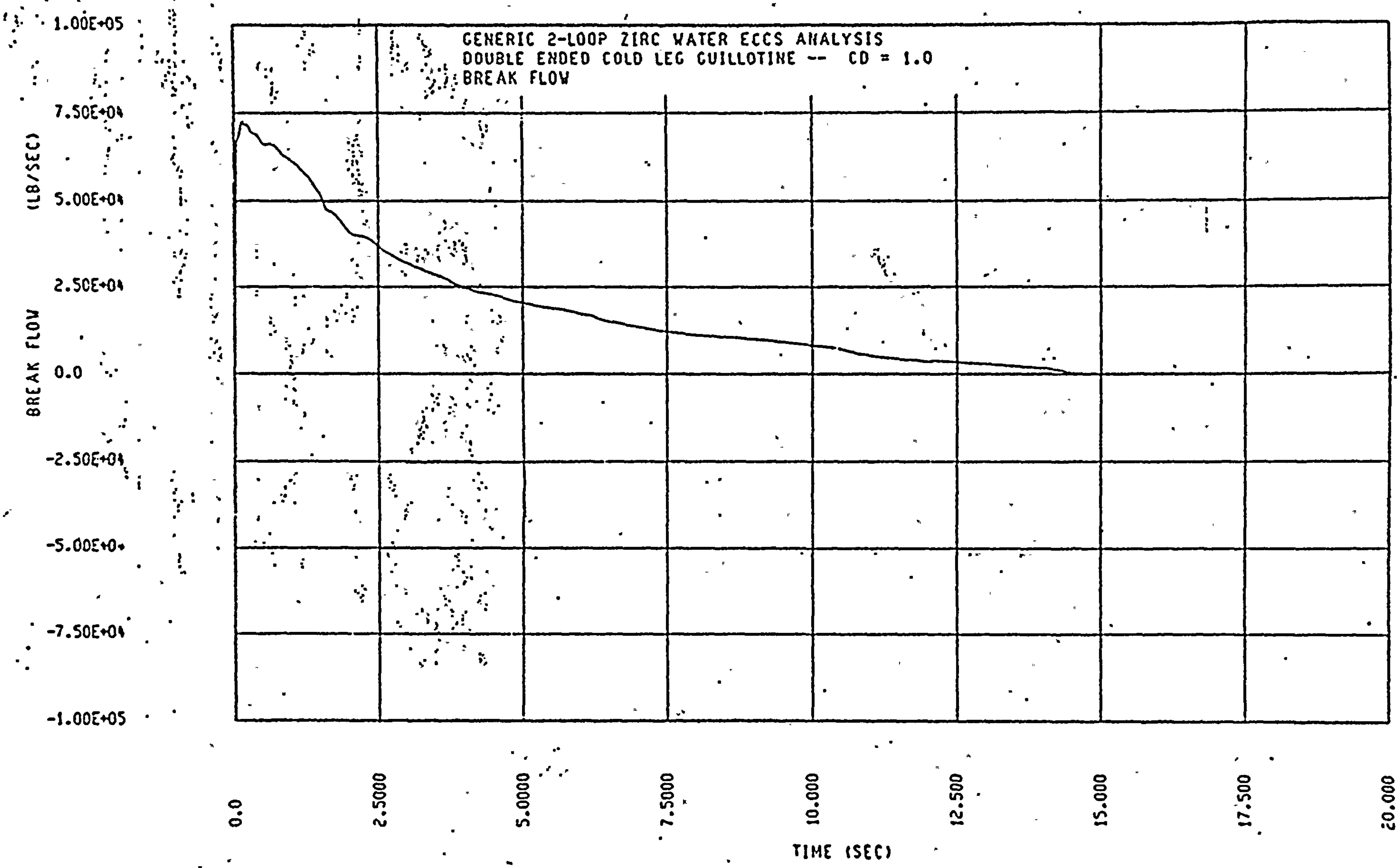

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
PRESSURE CORE BOTTOM ( ) TOP (+)
PRESSURE (PSIA)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 4c



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
BREAK FLOW
BREAK FLOW (LB/SEC)
1.00E+05
7.50E+04
5.00E+04
2.50E+04
0.0
-2.50E+04
-5.00E+04
-7.50E+04
-1.00E+05
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 5a

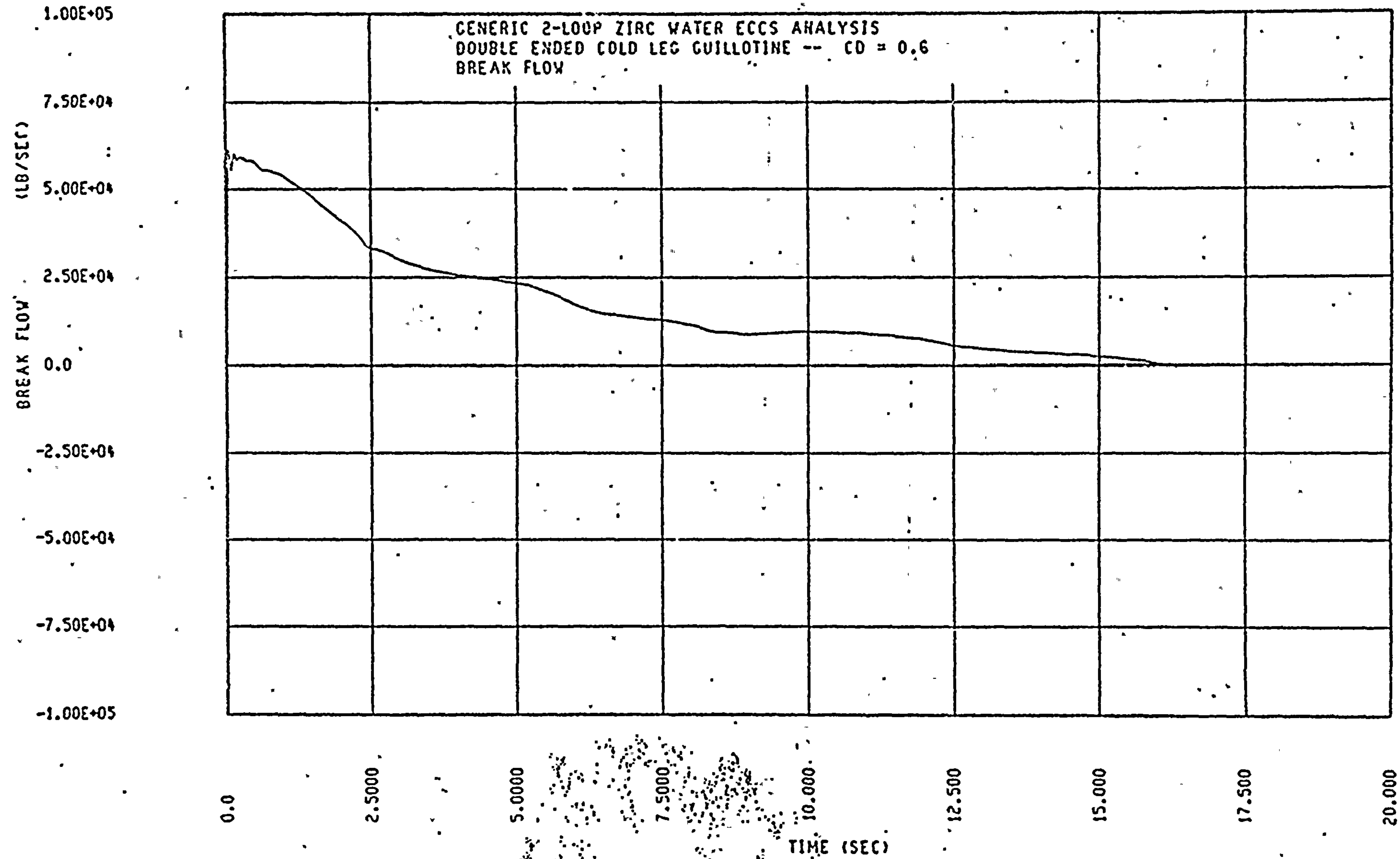

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
BREAK FLOW
BREAK FLOW (LB/SEC)
1.00E+05
7.50E+04
5.00E+04
2.50E+04
0.0
-2.50E+04
-5.00E+04
-7.50E+04
-1.00E+05
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 5b

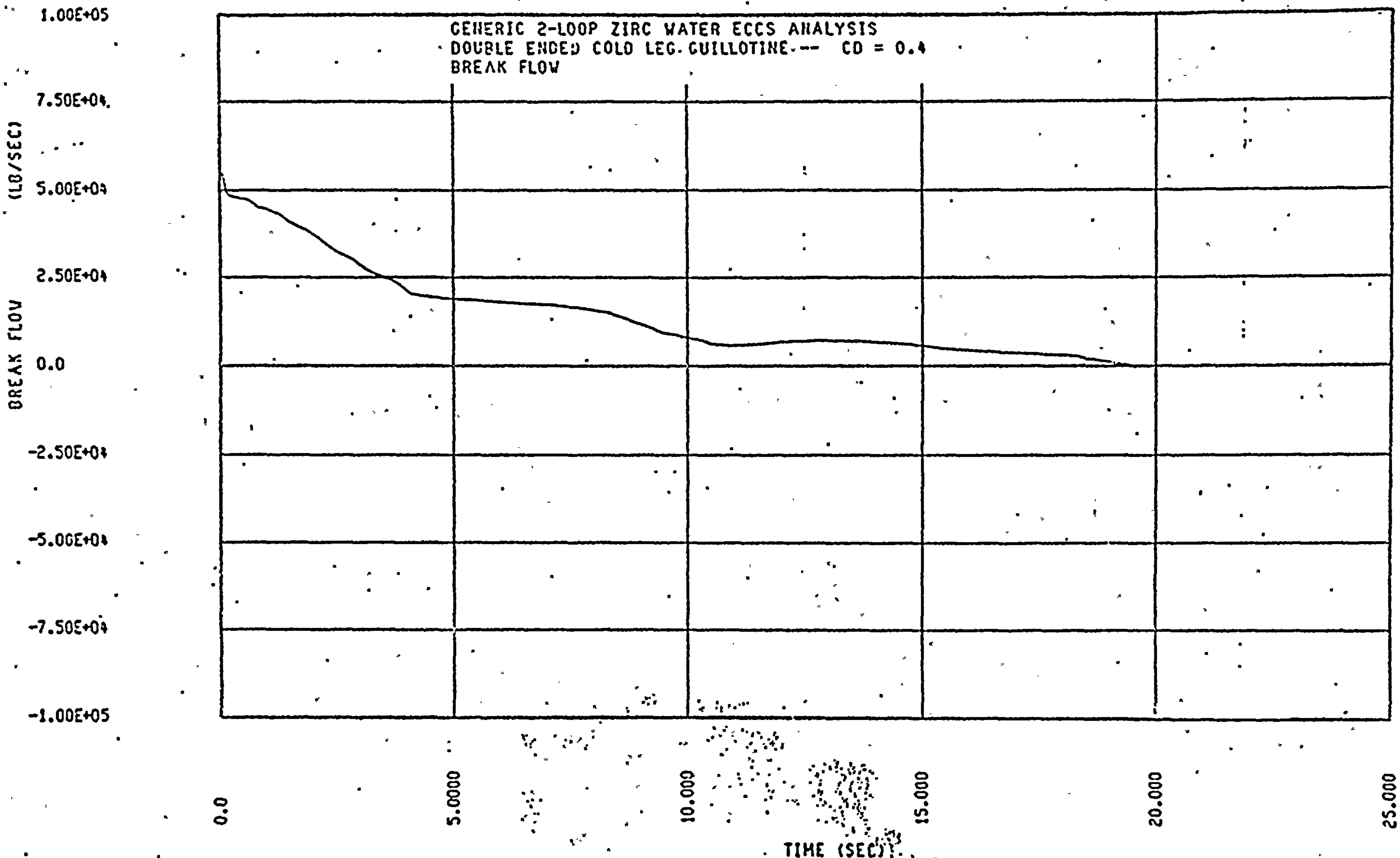

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
BREAK FLOW
BREAK FLOW (LB/SEC)
1.00E+05
7.50E+04
5.00E+04
2.50E+04
0.0
-2.50E+04
-5.00E+04
-7.50E+04
-1.00E+05
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 5c

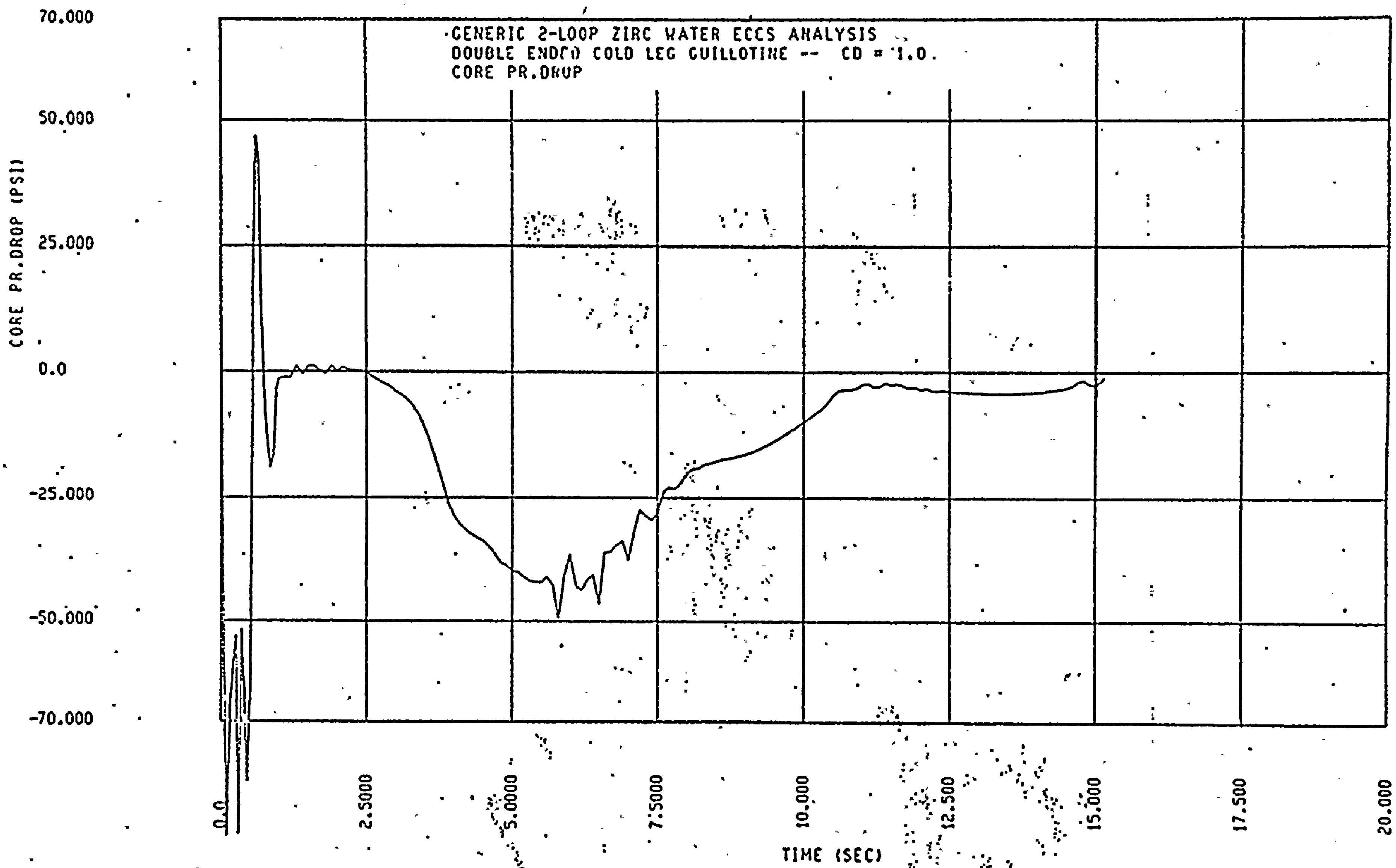

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
CORE PR.DROP
CORE PR.DROP (PSI)
70.000
50.000
25.000
0.0
-25.000
-50.000
-70.000
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 6a

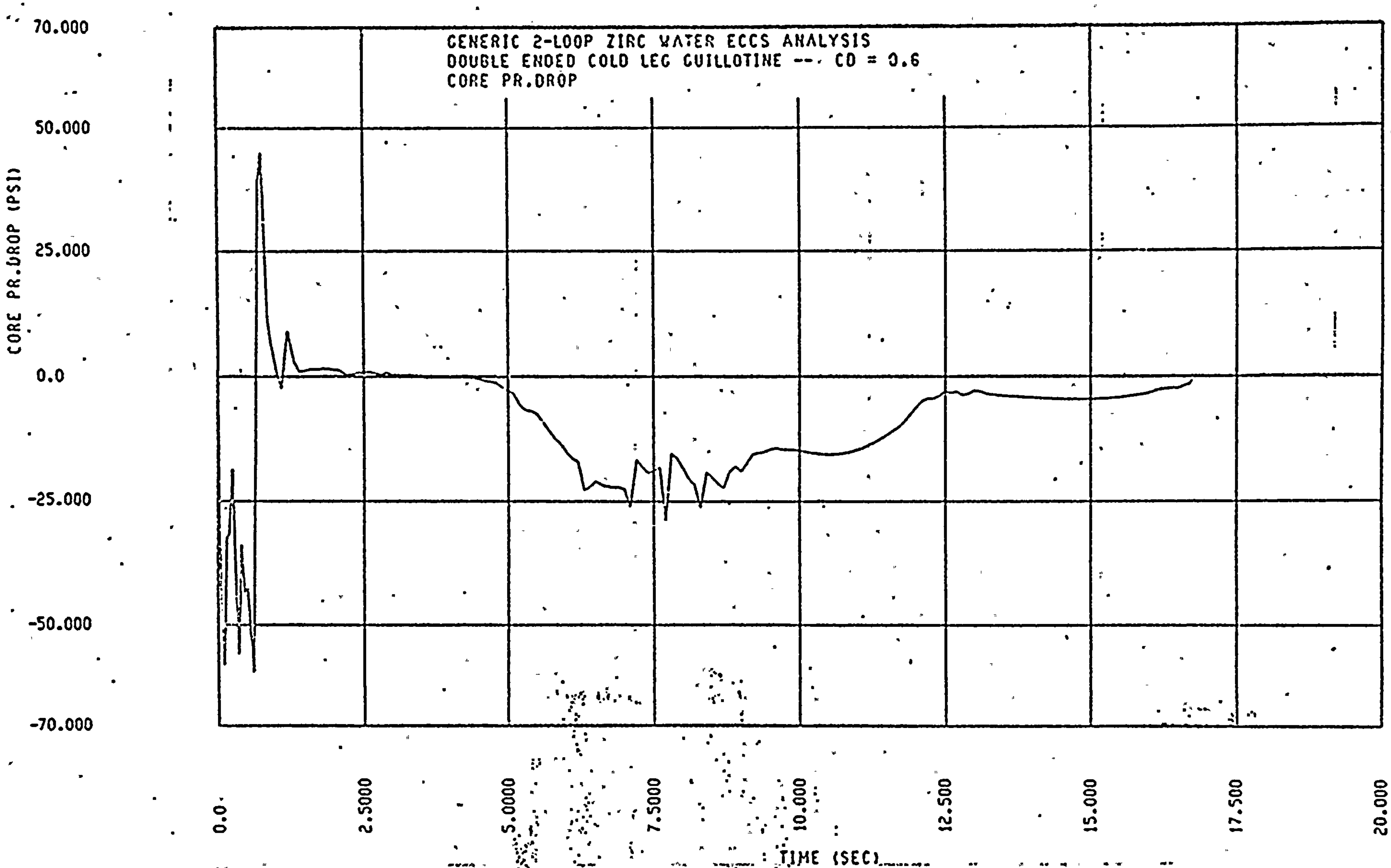

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE --- CD = 0.6
CORE PR.DROP
CORE PR.DROP (PSI)
70.000
50.000
25.000
0.0
-25.000
-50.000
-70.000
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 6b

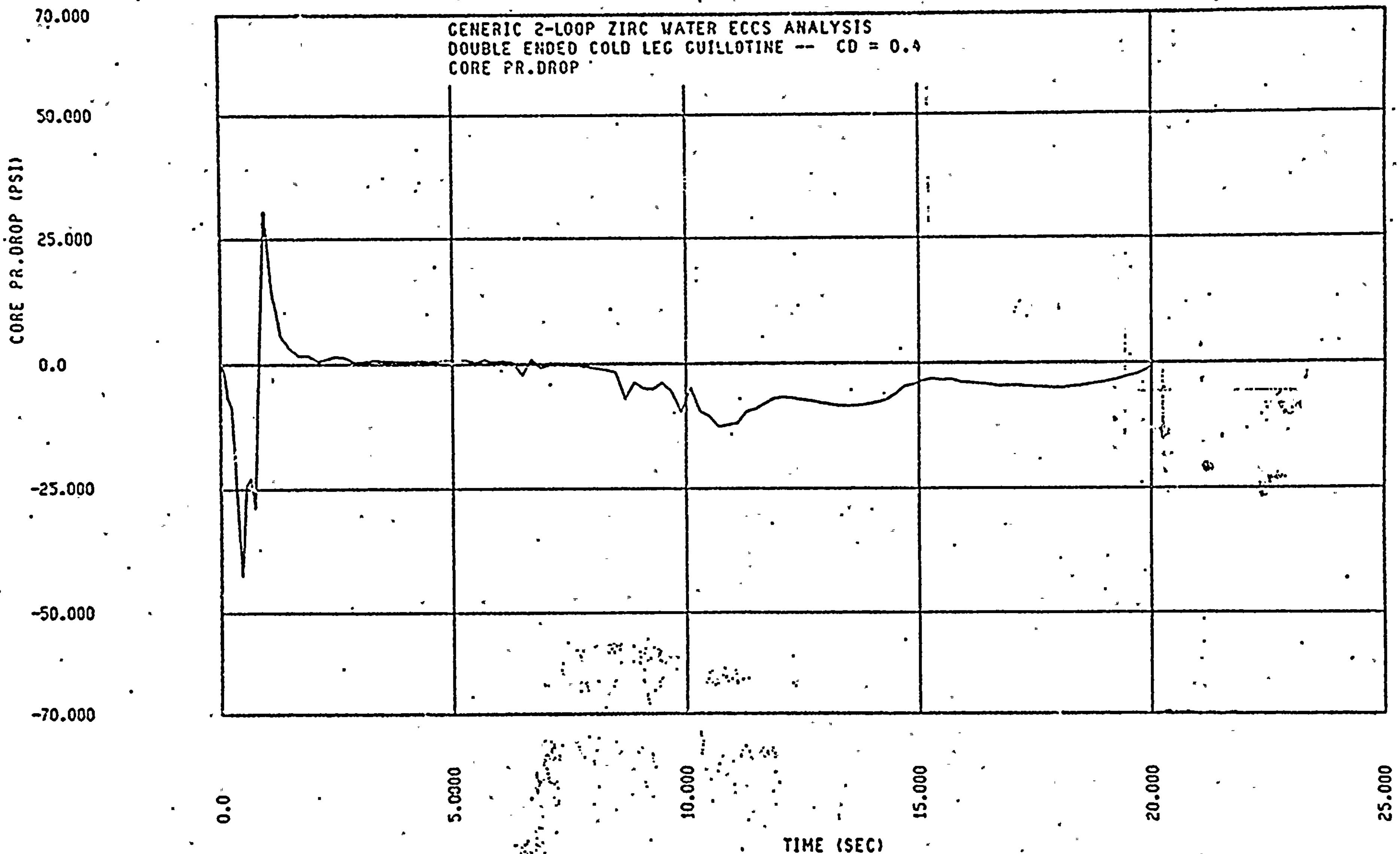

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
CORE PR.DROP
CORE PR.DROP (PSI)
70.000
50.000
25.000
0.0
-25.000
-50.000
-70.000
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 6c

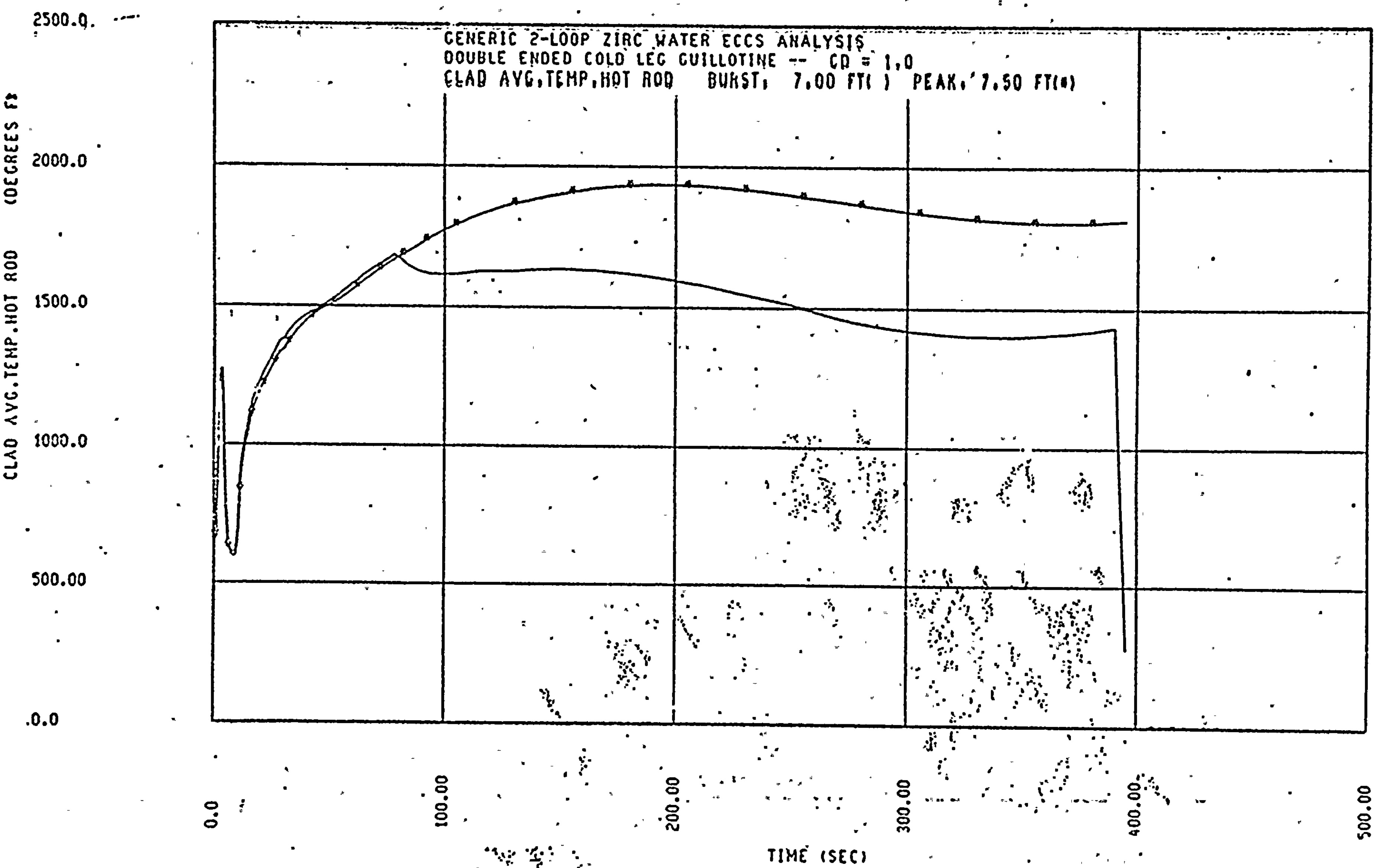

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
CLAD AVG.TEMP.HOT ROD BURST, 7.00 FT( ) PEAK, 7.50 FT(*)
CLAD AVG.TEMP.HOT ROD (DEGREES F)
2500.0
2000.0
1500.0
1000.0
500.00
.0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 7a

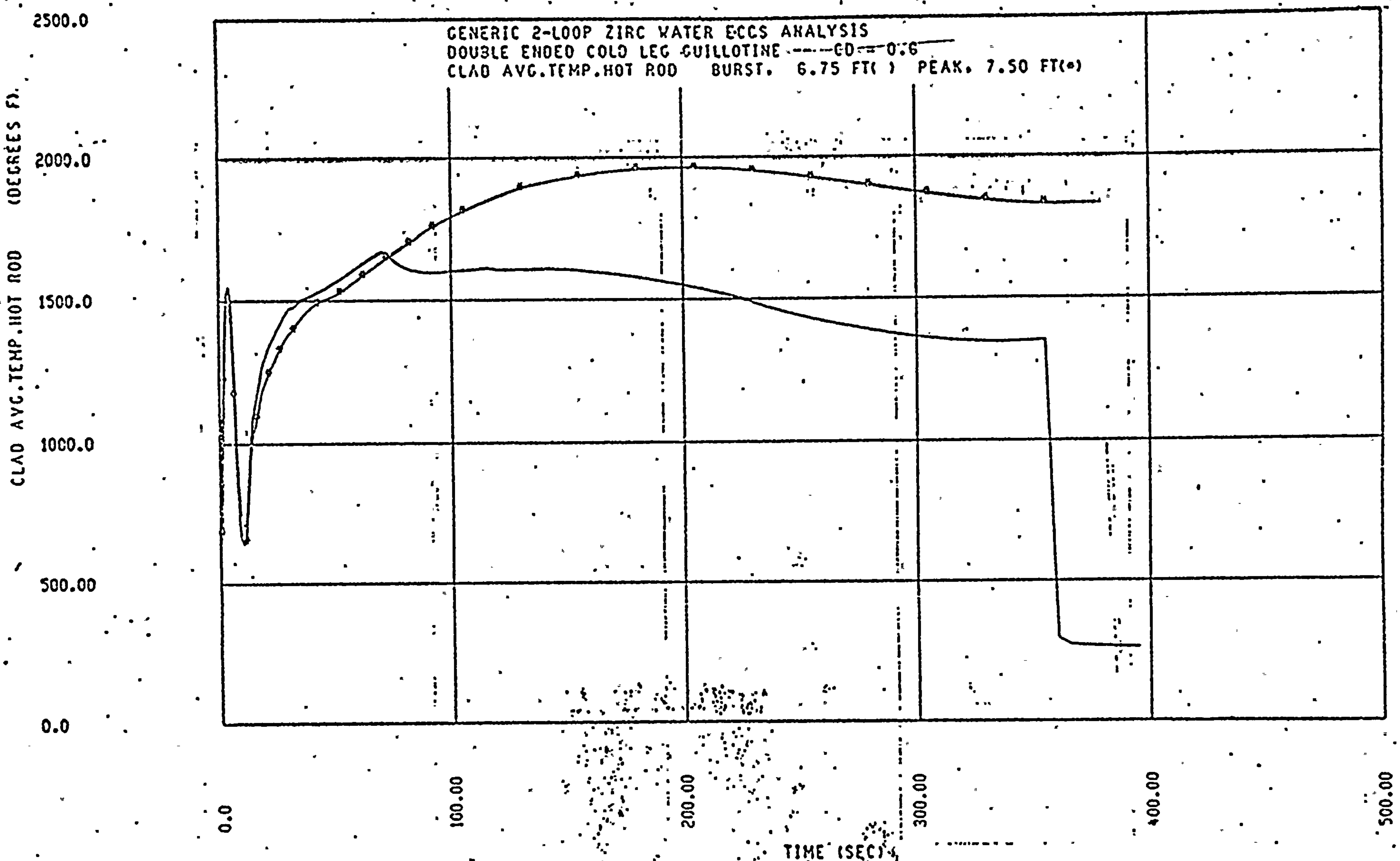

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE ---- CD = 0.6
CLAD AVG.TEMP.HOT ROD BURST, 6.75 FT( ) PEAK, 7.50 FT(*)
CLAD AVG.TEMP.HOT ROD (DEGREES F)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 7b

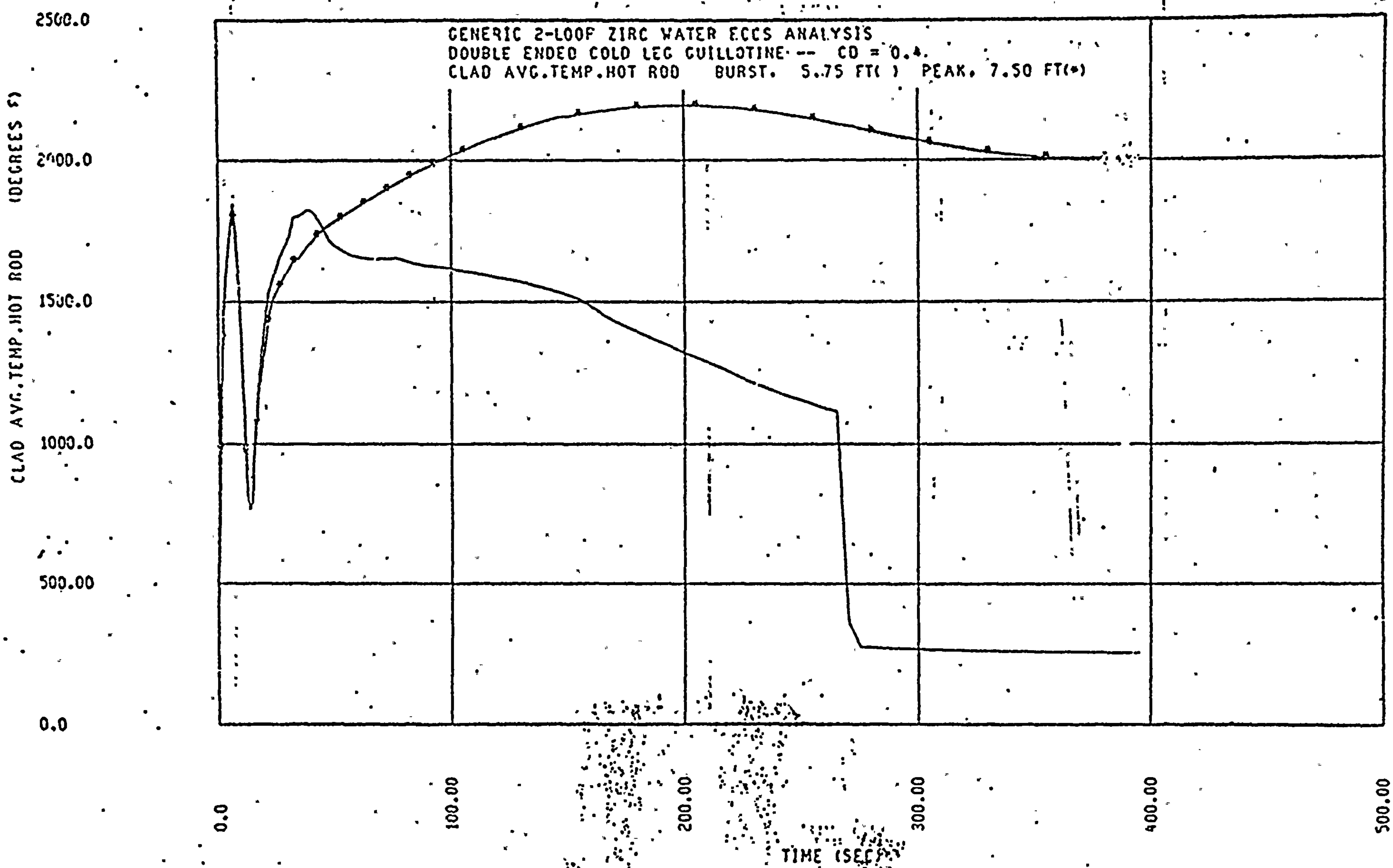
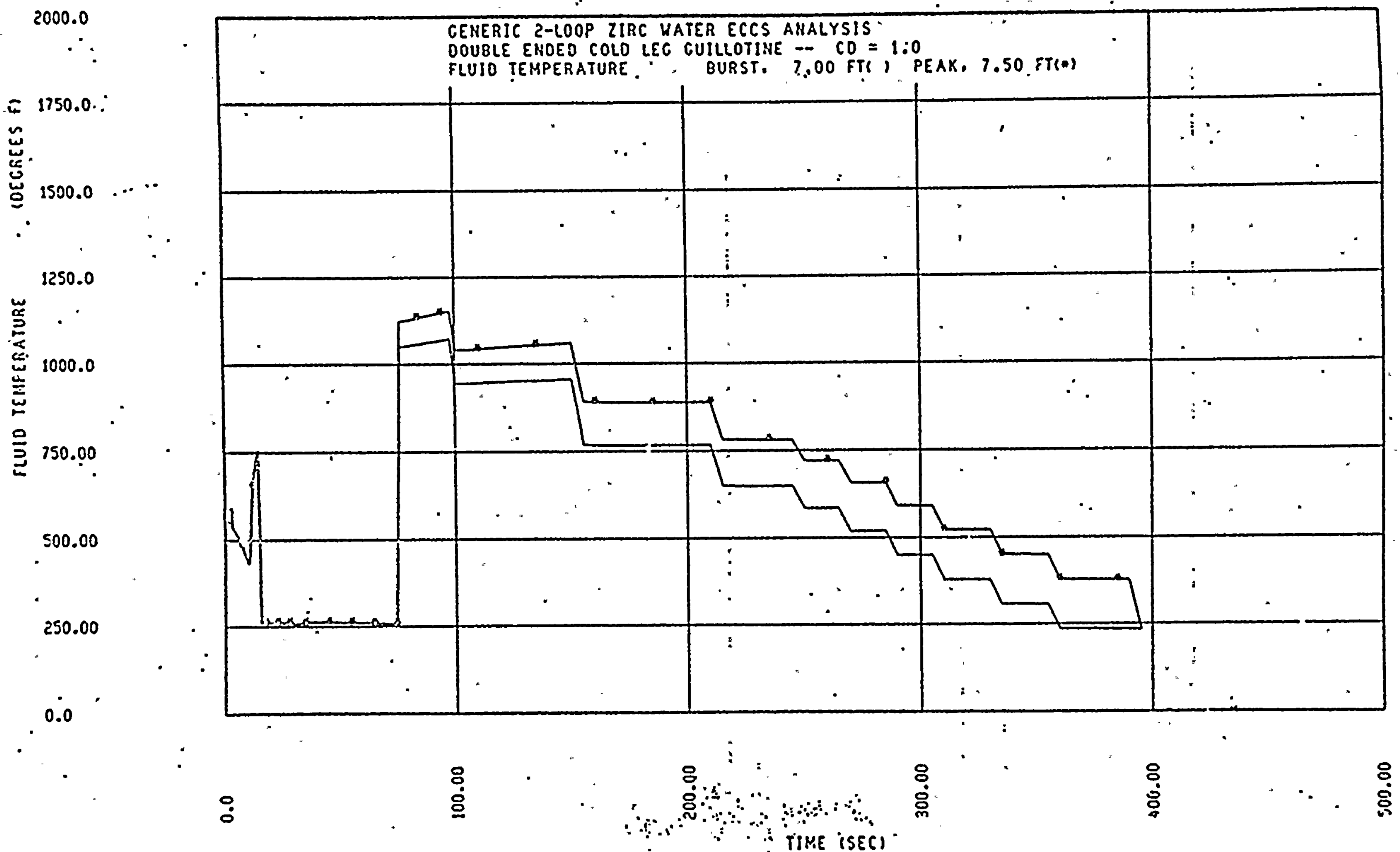

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4.
CLAD AVG.TEMP.HOT ROD BURST. 5.75 FT( ) PEAK. 7.50 FT(*)
CLAD AVG.TEMP.HOT ROD (DEGREES F)
2500.0
2000.0
1500.0
1000.0
500.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 7c



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
FLUID TEMPERATURE BURST, 7.00 FT( ) PEAK, 7.50 FT(*)
FLUID TEMPERATURE (DEGREES F)
2000.0
1750.0
1500.0
1250.0
1000.0
750.00
500.00
250.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 8a

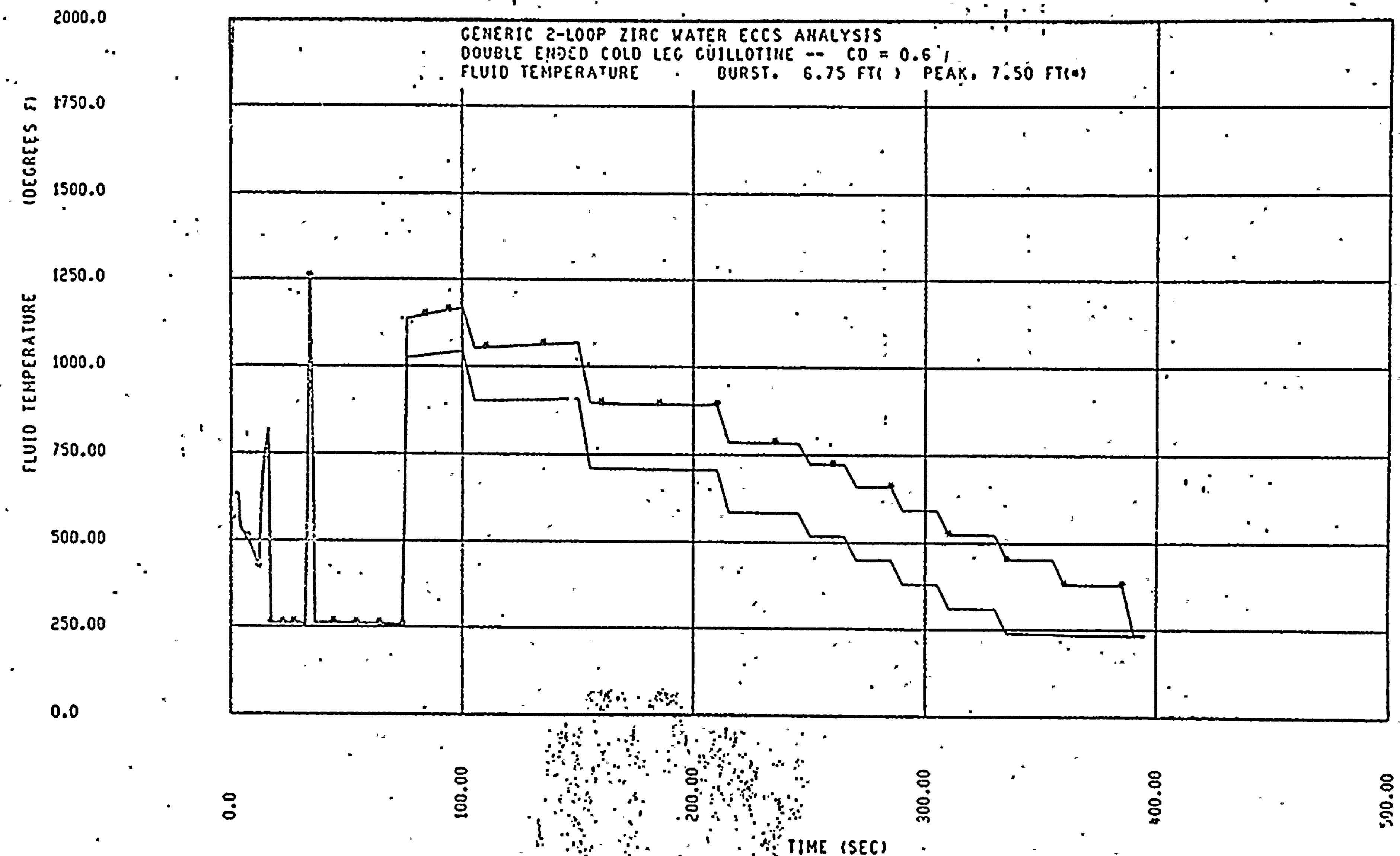

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
FLUID TEMPERATURE BURST. 6.75 FT( ) PEAK. 7.50 FT(*)
FLUID TEMPERATURE (DEGREES F)
2000.0
1750.0
1500.0
1250.0
1000.0
750.00
500.00
250.00
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 8b

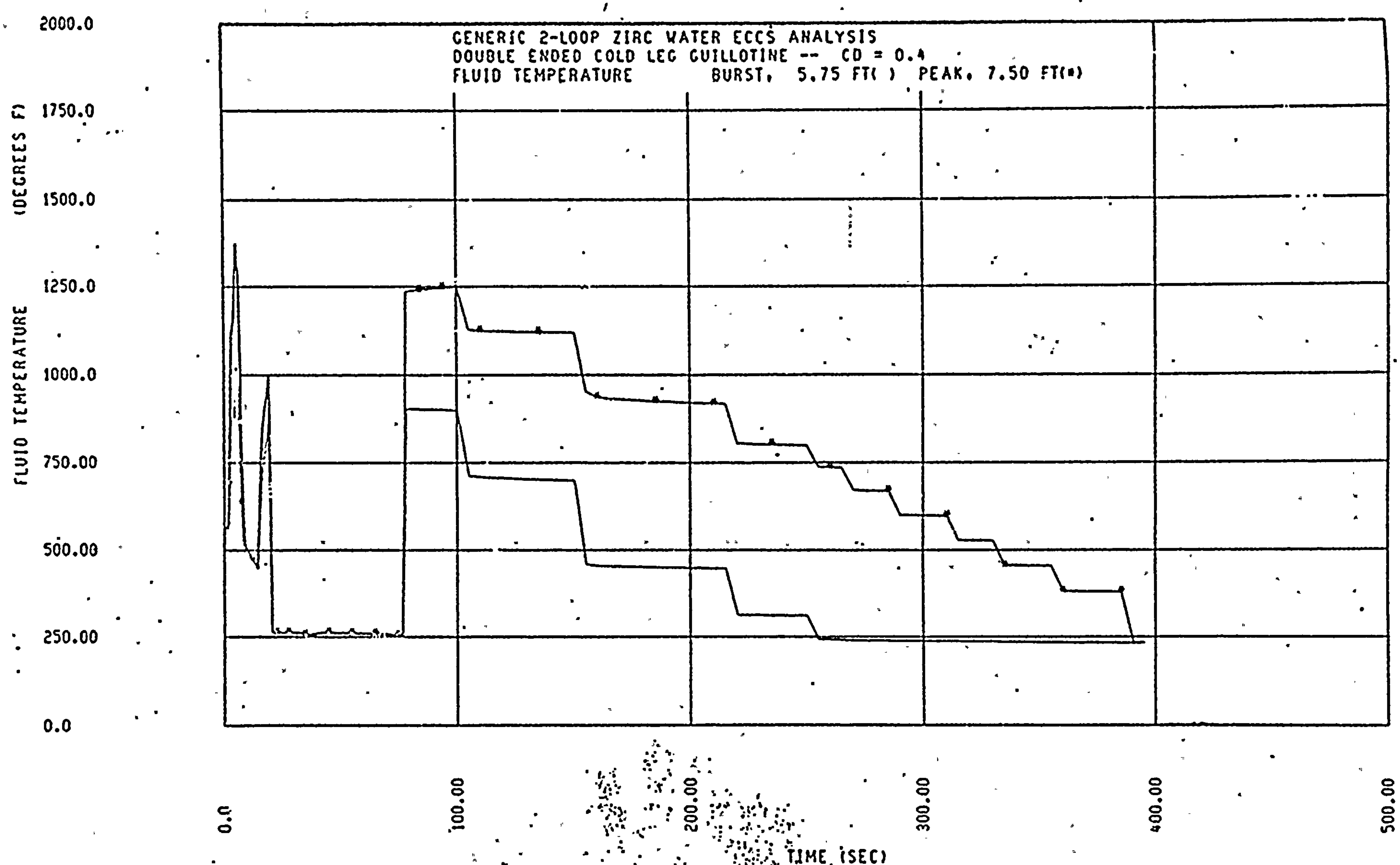

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
FLUID TEMPERATURE BURST, 5.75 FT( ) PEAK, 7.50 FT(*)
FLUID TEMPERATURE (DEGREES F)
2000.0
1750.0
1500.0
1250.0
1000.0
750.00
500.00
250.00
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 8c

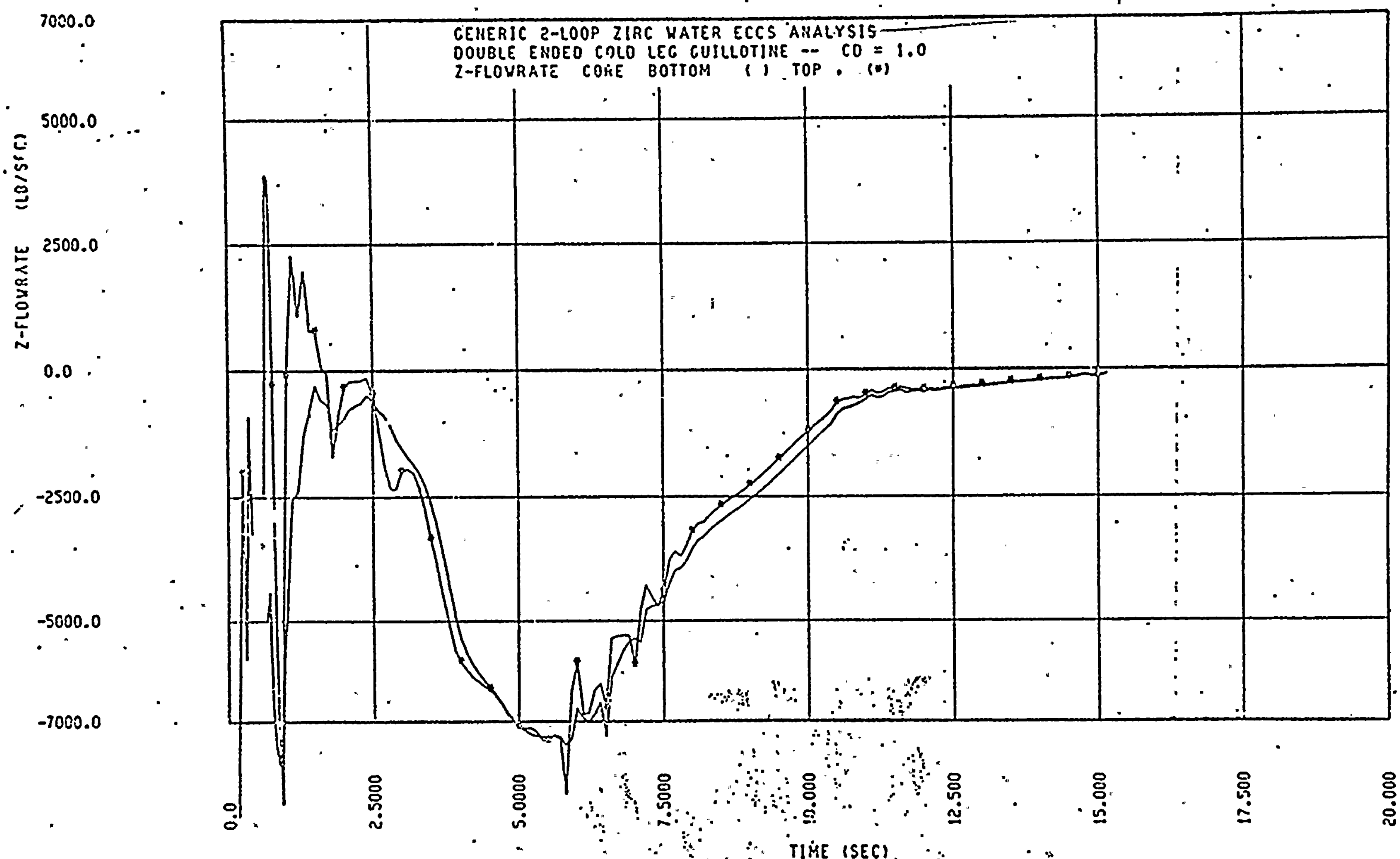

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
Z-FLOWRATE CORE BOTTOM ( ) TOP . (*)
Z-FLOWRATE (LB/SEC)
7000.0
5000.0
2500.0
0.0
-2500.0
-5000.0
-7000.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 9-a

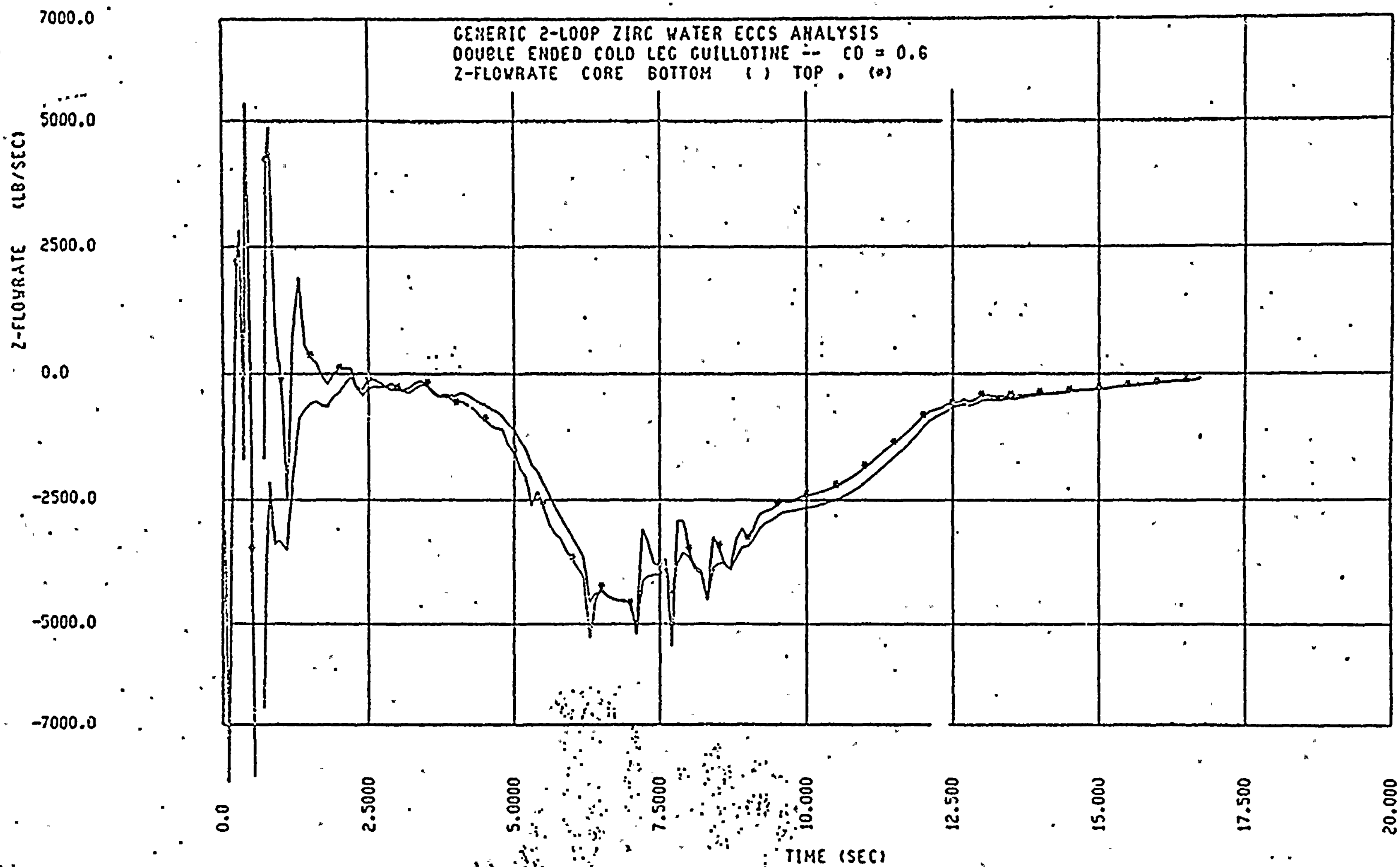

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
Z-FLOWRATE CORE BOTTOM ( ) TOP , (*)
Z-FLOWRATE (LB/SEC)
7000.0
5000.0
2500.0
0.0
-2500.0
-5000.0
-7000.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 9-6

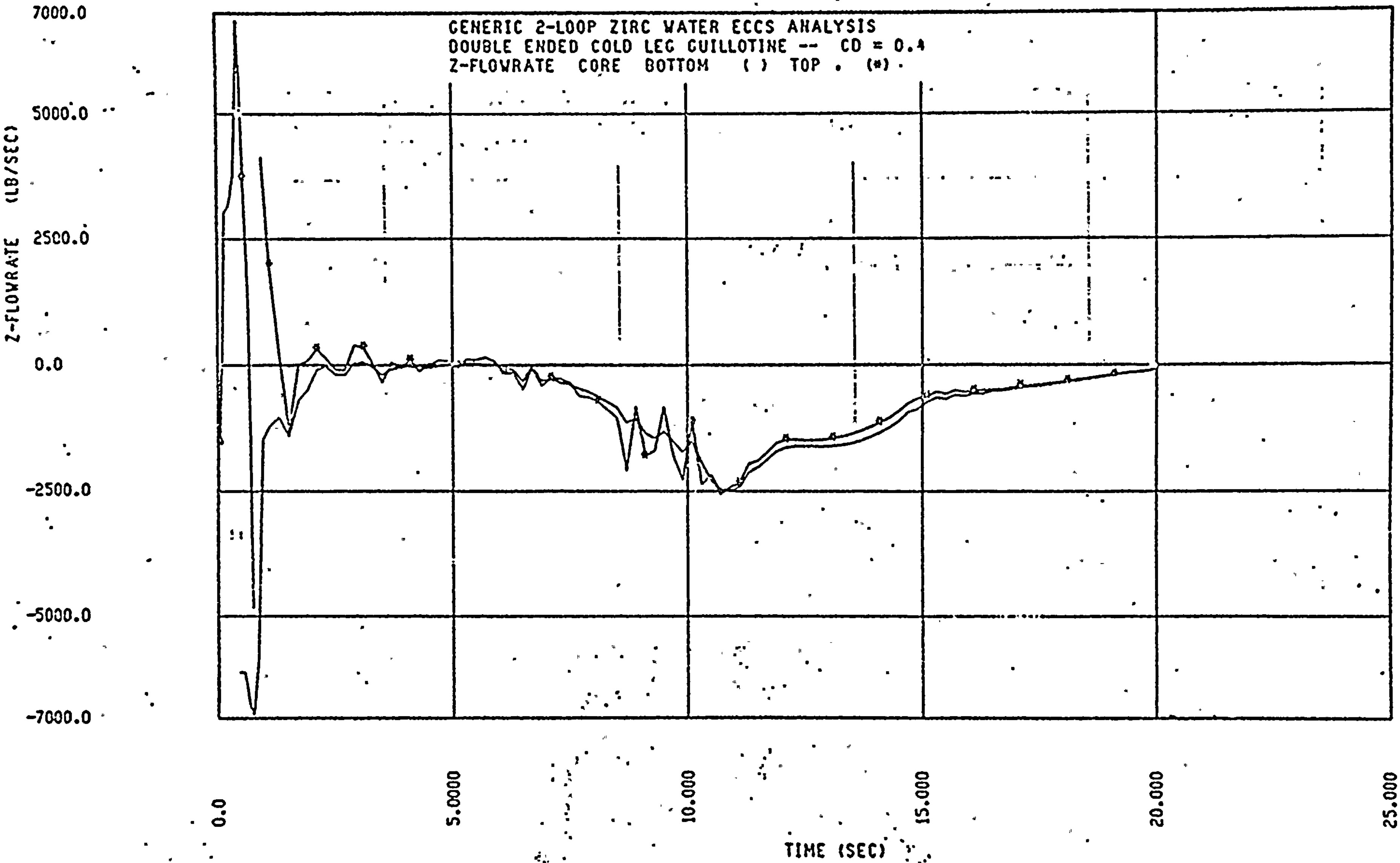

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
Z-FLOWRATE CORE BOTTOM ( ) TOP . (*)
Z-FLOWRATE (LB/SEC)
7000.0
5000.0
2500.0
0.0
-2500.0
-5000.0
-7000.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 9-c

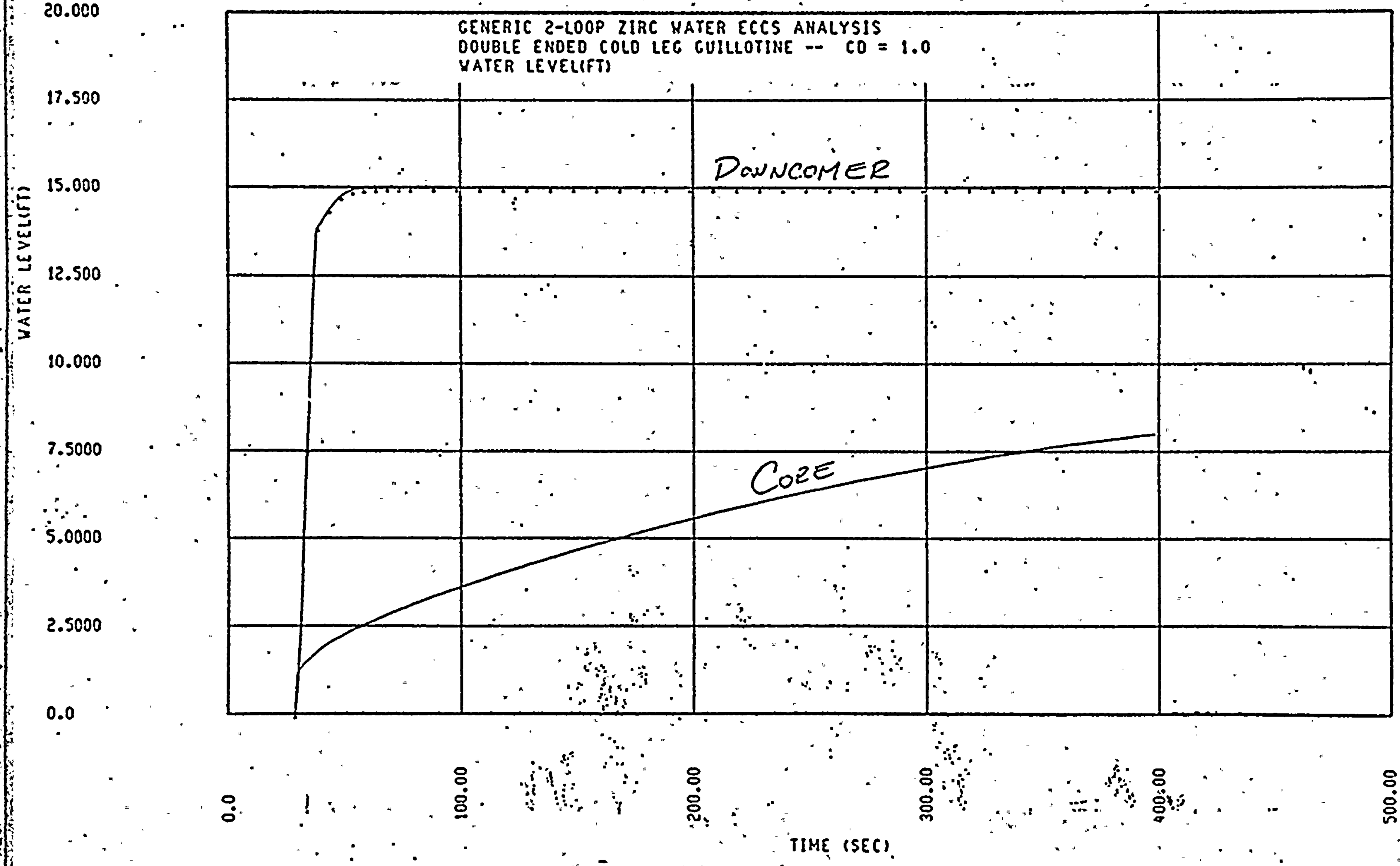
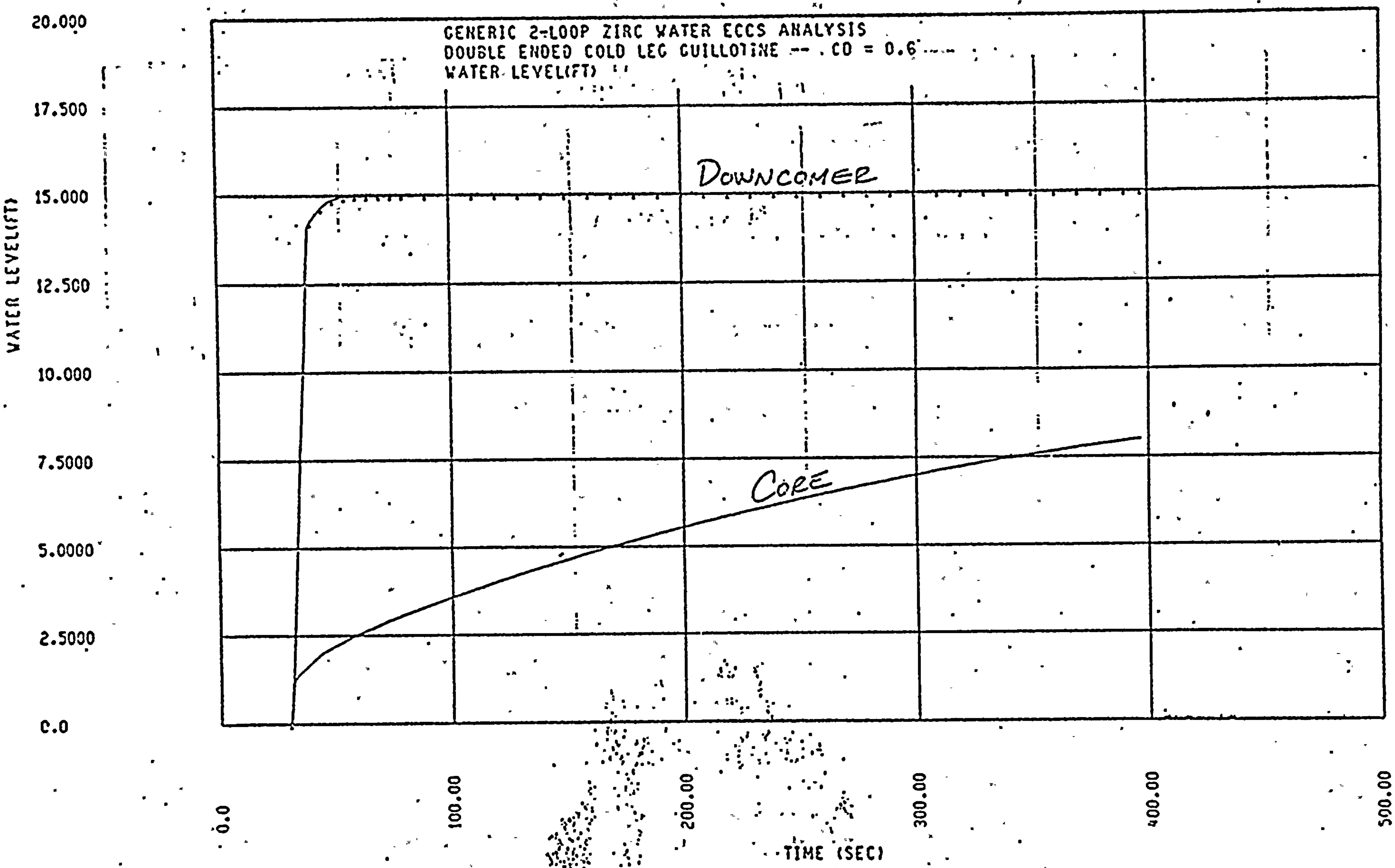
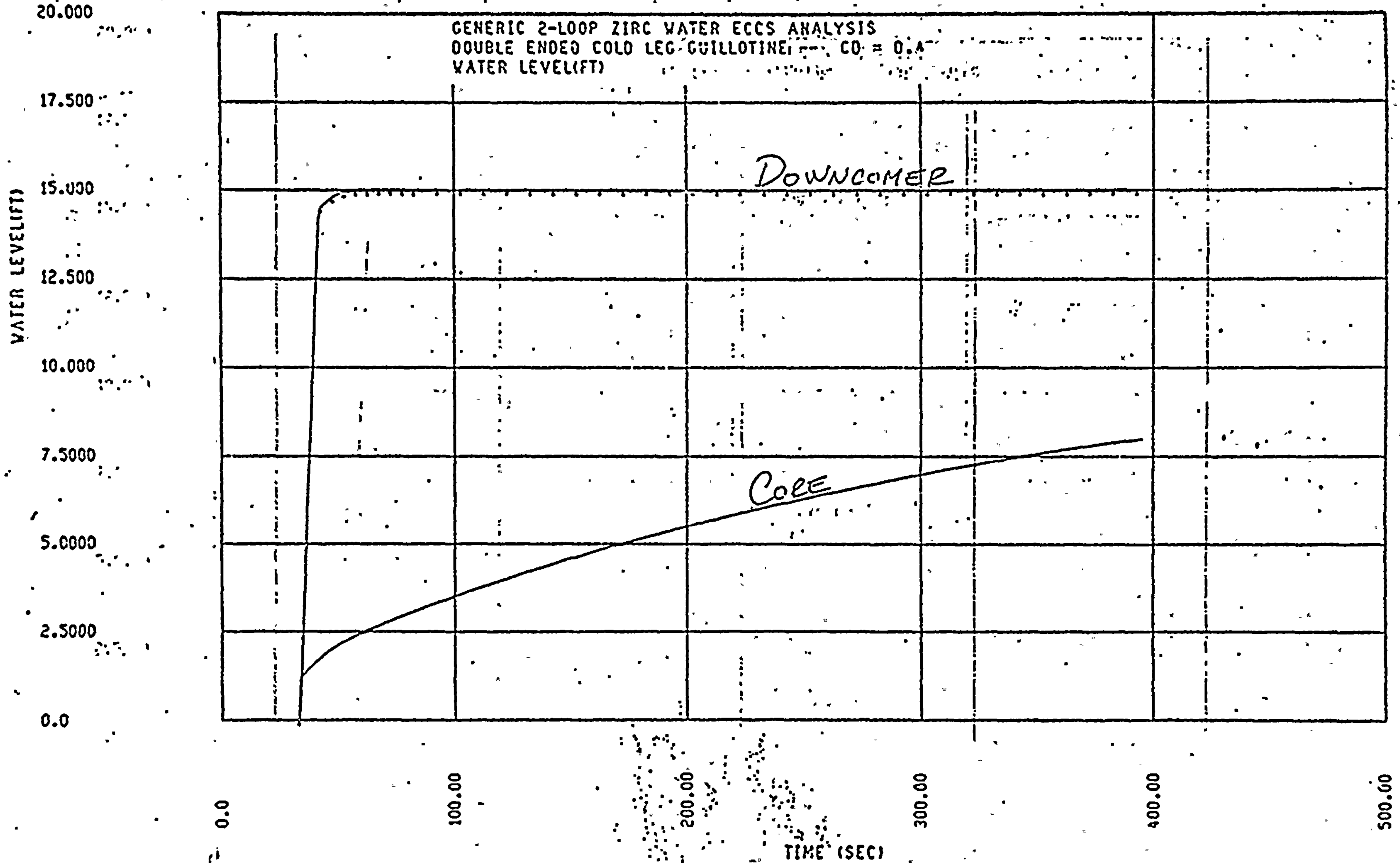

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
WATER LEVEL(FT)
DOWNCOMER
CORE
20.000
17.500
15.000
12.500
10.000
7.5000
5.0000
2.5000
0.0
WATER LEVEL(FT)
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 10-a



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
WATER LEVEL(FT)
DOWNCOMER
CORE
WATER LEVEL(FT)
20.000
17.500
15.000
12.500
10.000
7.5000
5.0000
2.5000
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 10-b



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE
WATER LEVEL(FT)
DOWNCOMER
CORE
WATER LEVEL(FT)
20.000
17.500
15.000
12.500
10.000
7.5000
5.0000
2.5000
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 10-c

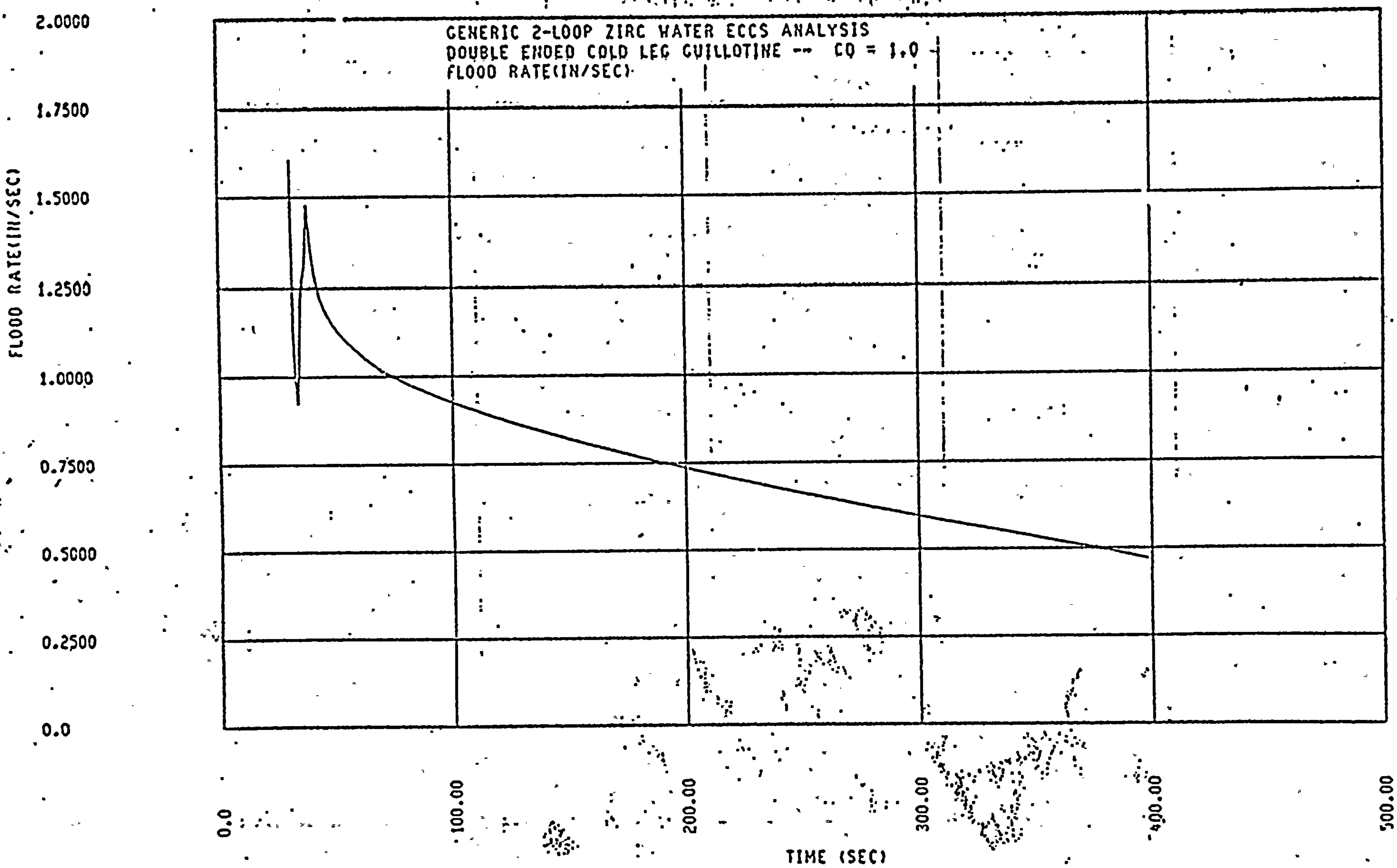

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
FLOOD RATE(IN/SEC)
FLOOD RATE(IN/SEC)
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 11-a

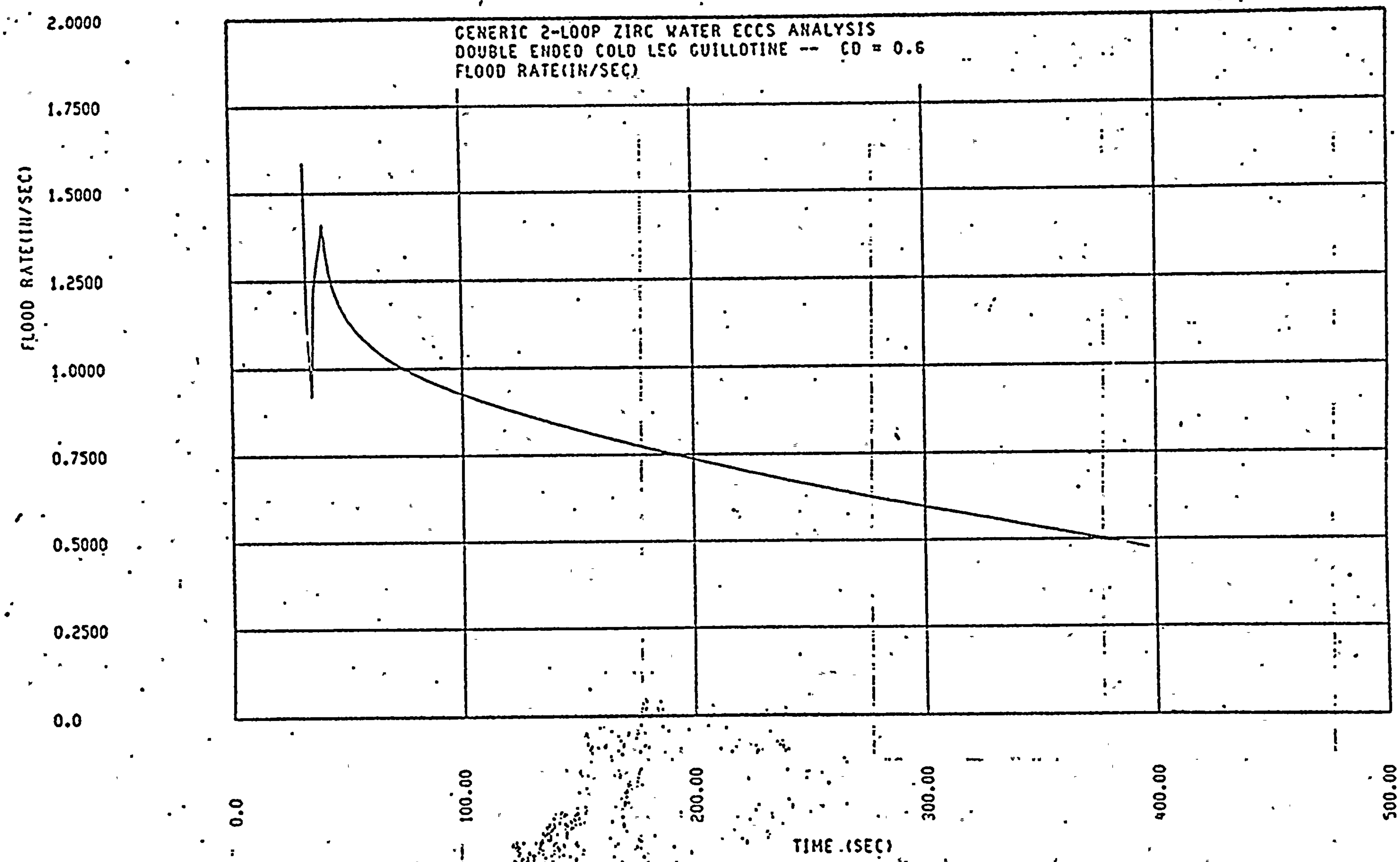

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
FLOOD RATE(IN/SEC)
FLOOD RATE(IN/SEC)
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 11-b

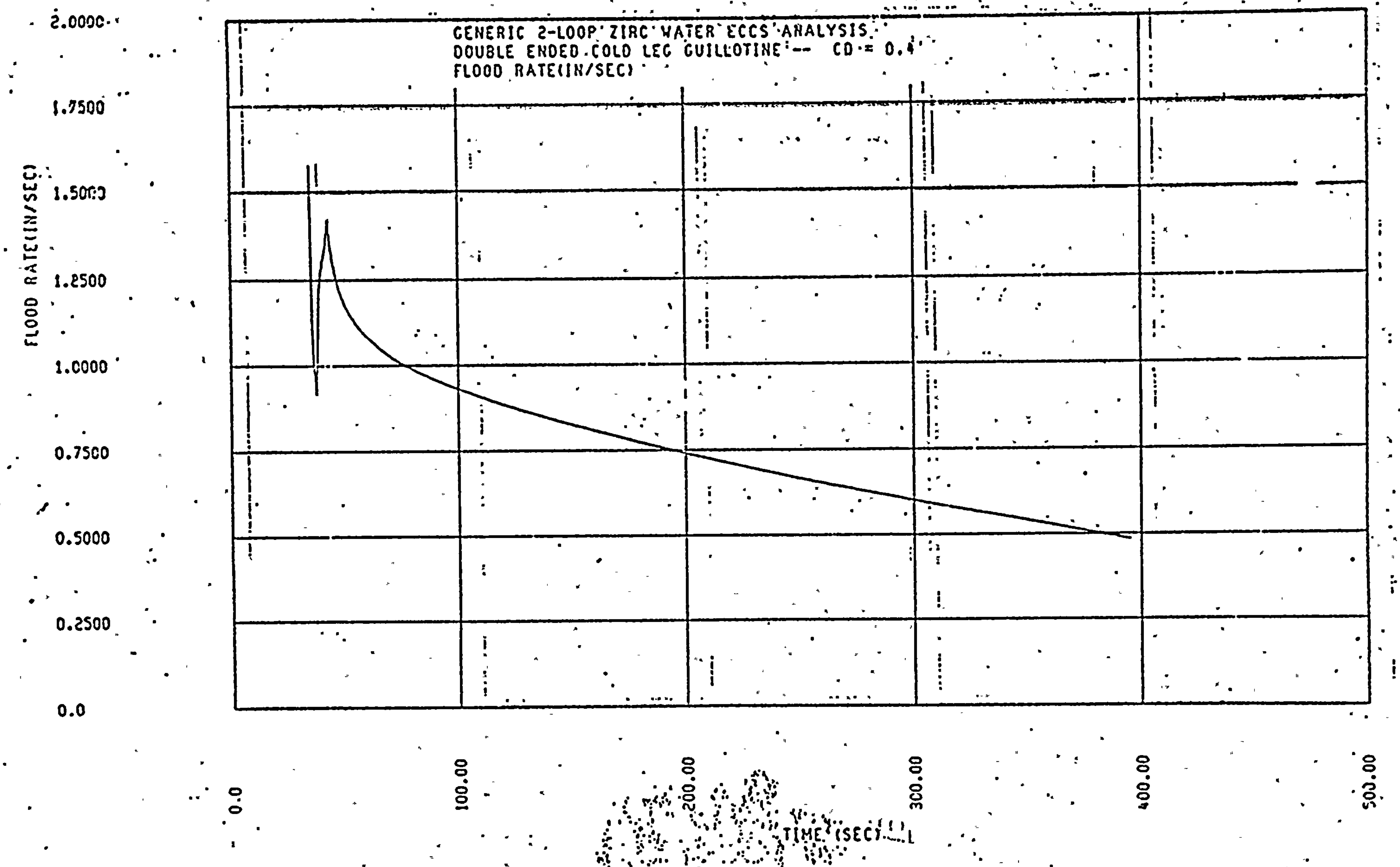
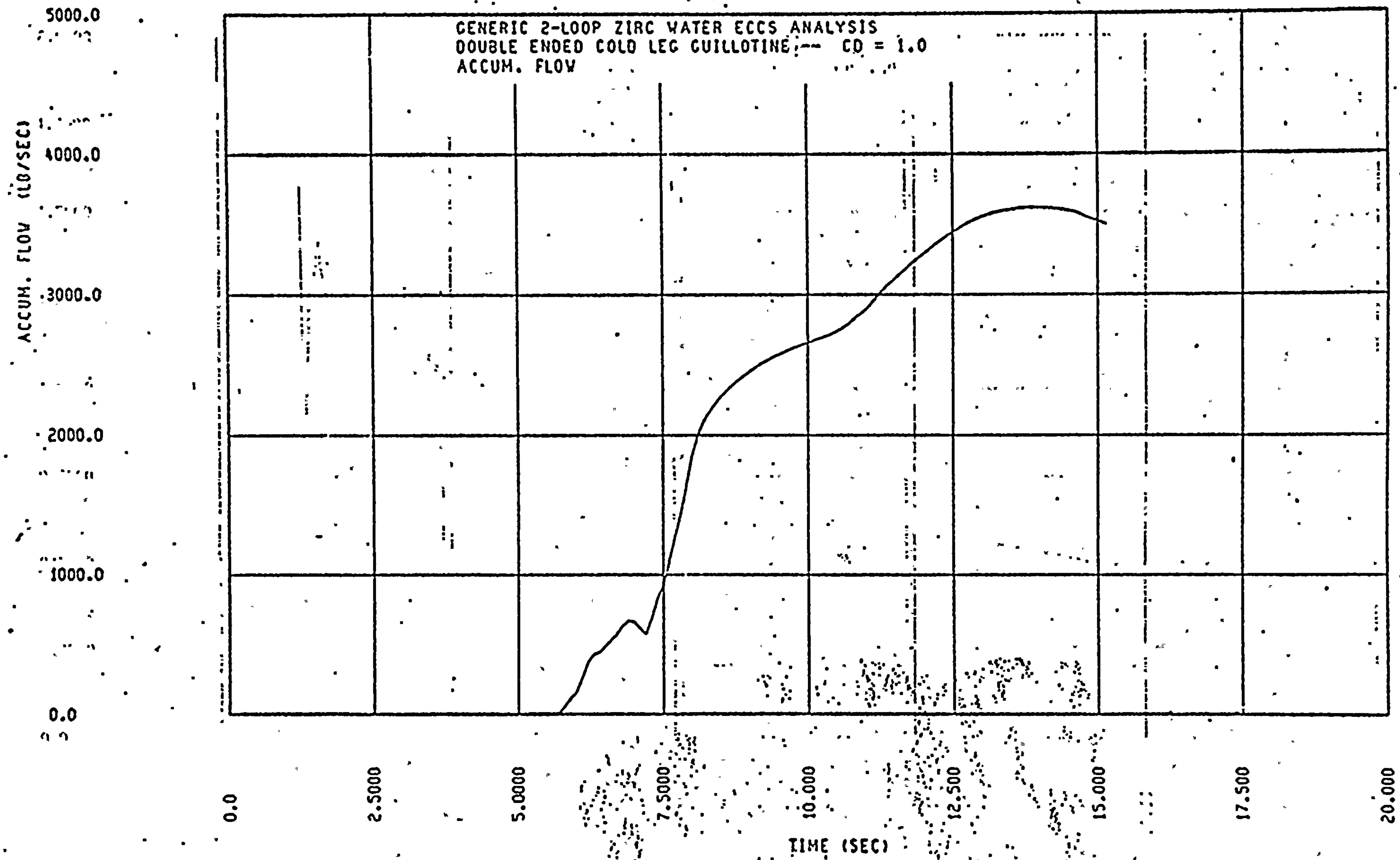

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
FLOOD RATE(IN/SEC)
FLOOD RATE(IN/SEC)
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.0
100.00
200.00
300.00
400.00
500.00
TIME (SEC)

FIGURE 11-c



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
ACCUM. FLOW
ACCUM. FLOW (LB/SEC)
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE: 12-a

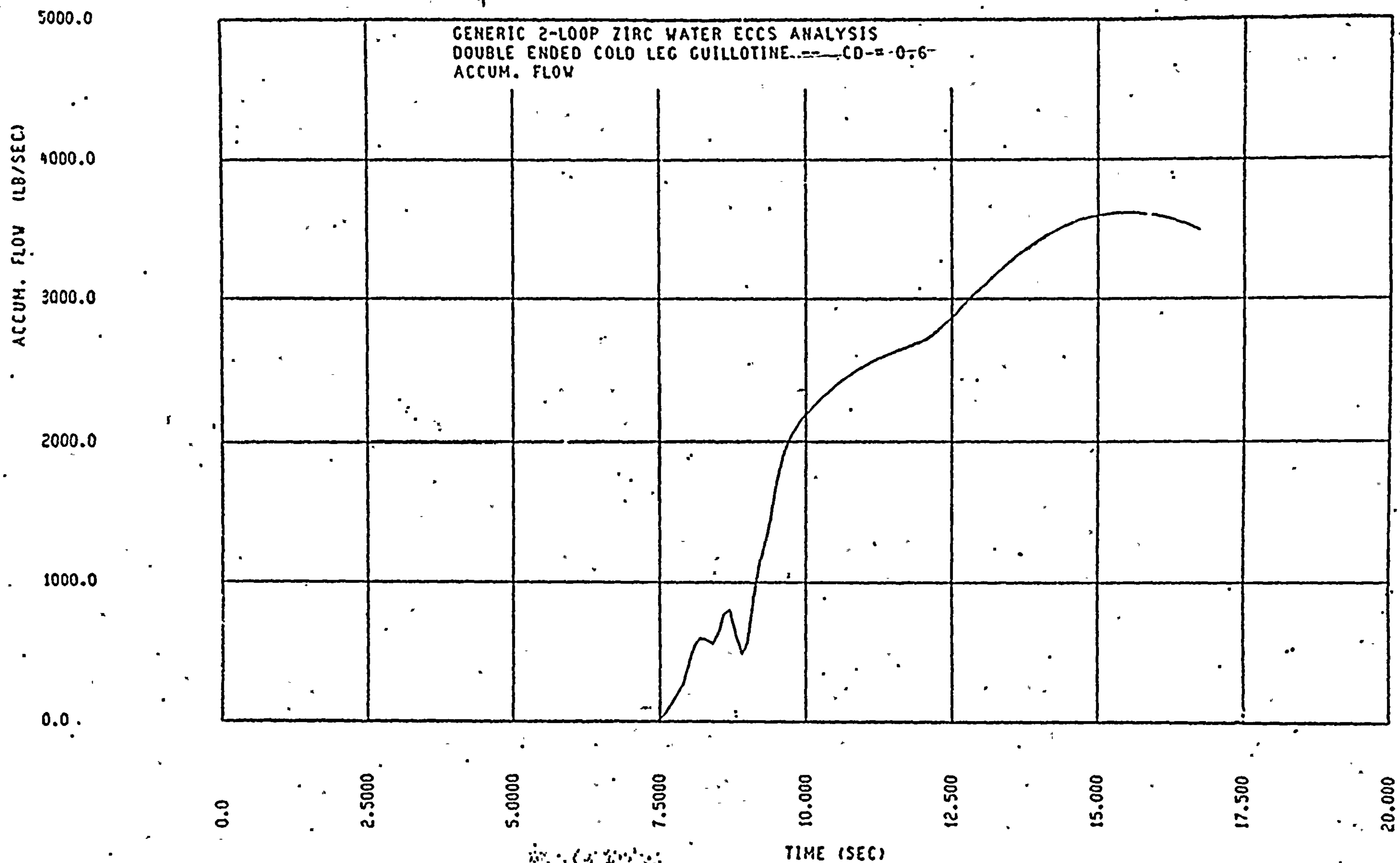

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE --- CD = 0.6
ACCUM. FLOW
ACCUM. FLOW (LB/SEC)
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 12-b

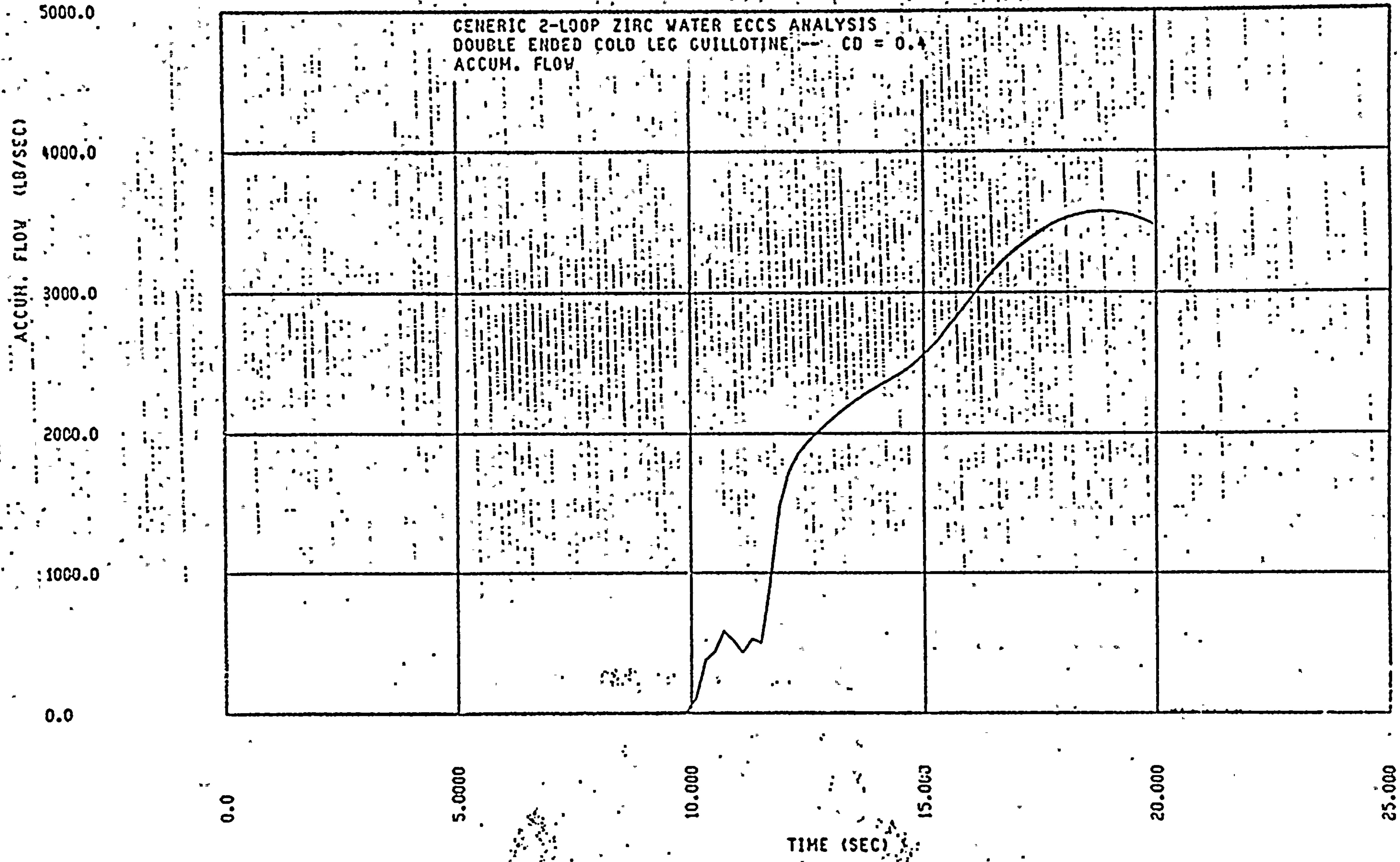
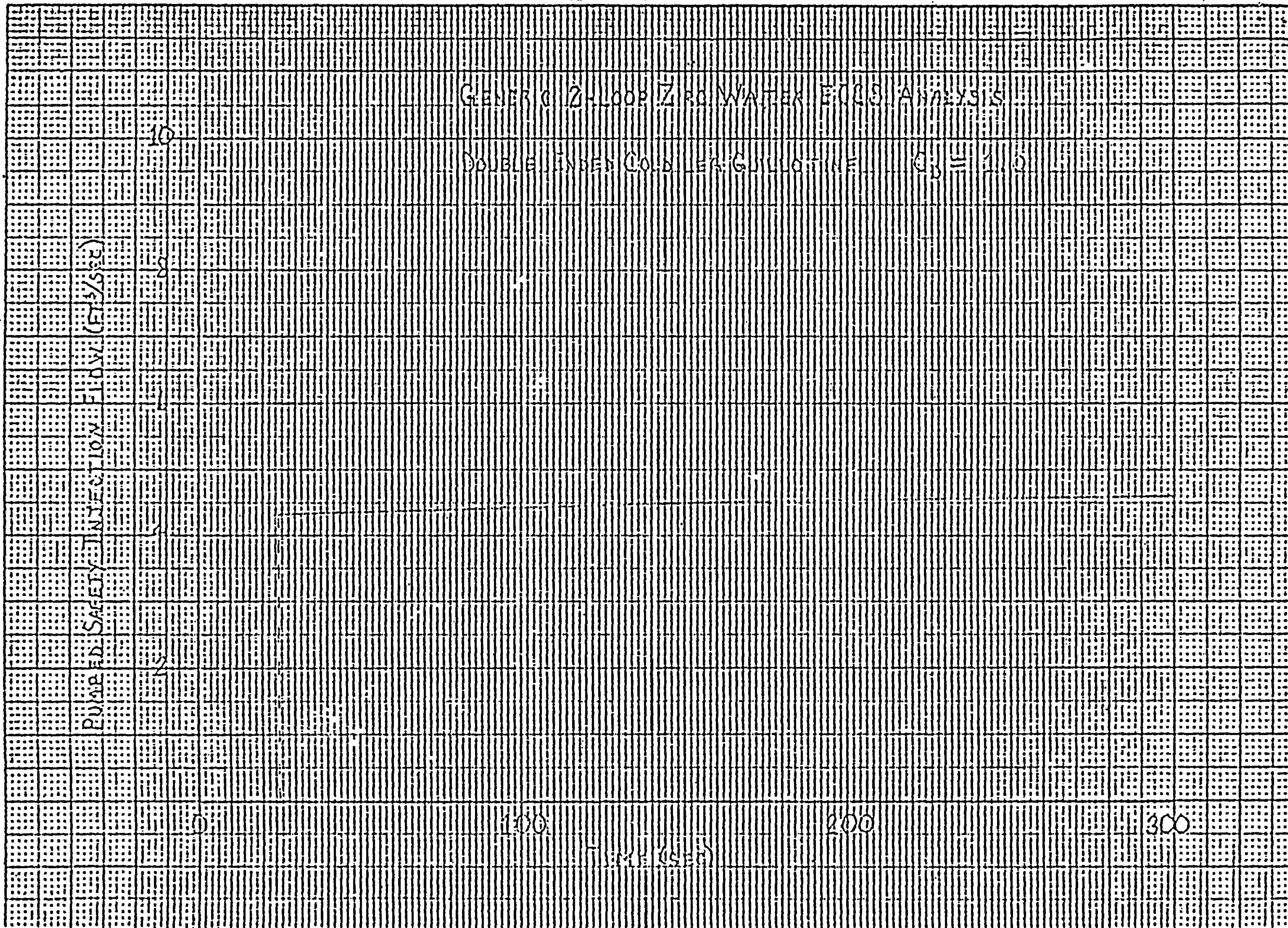
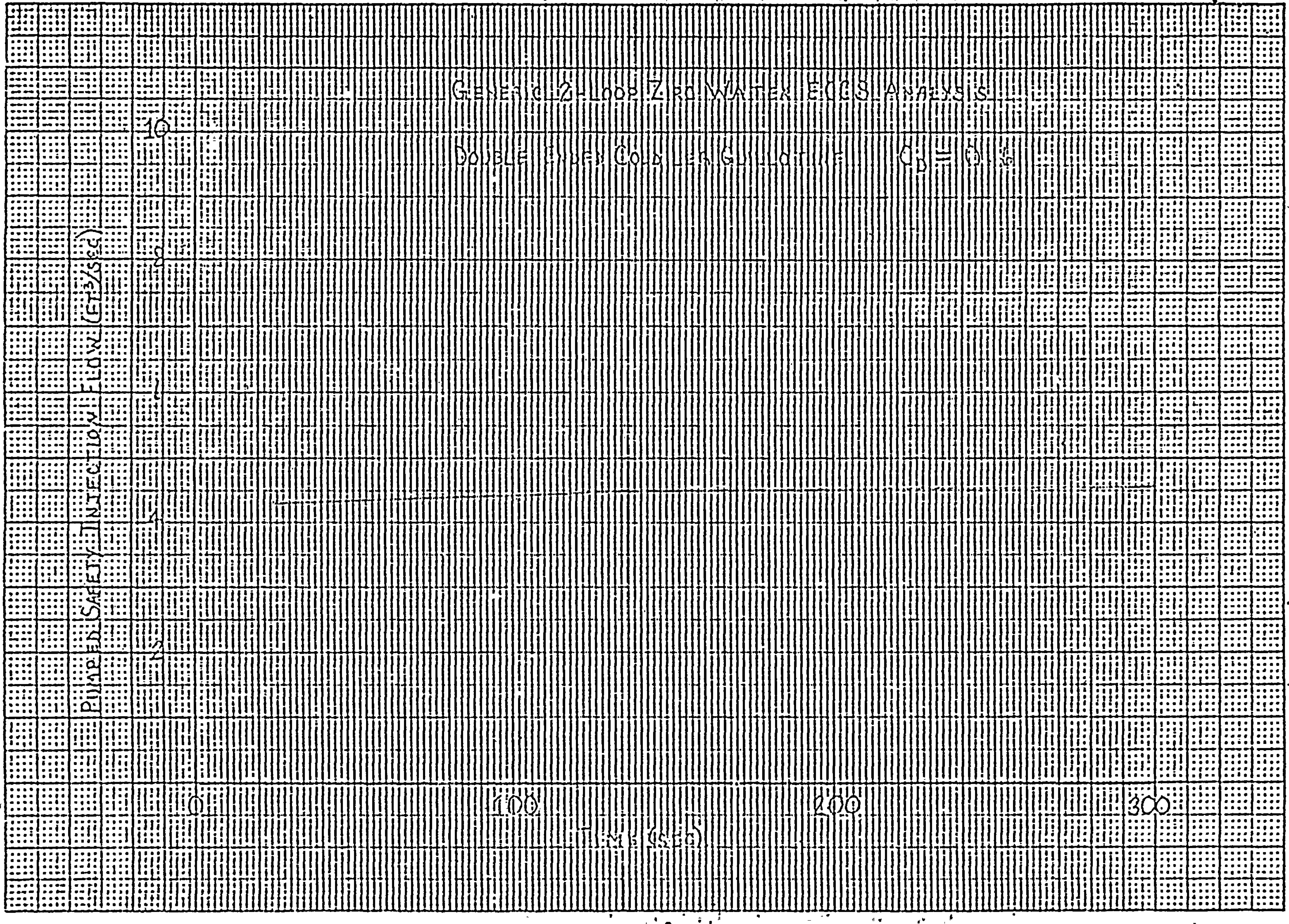

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
ACCUM. FLOW
ACCUM. FLOW (LB/SEC)
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 12-c

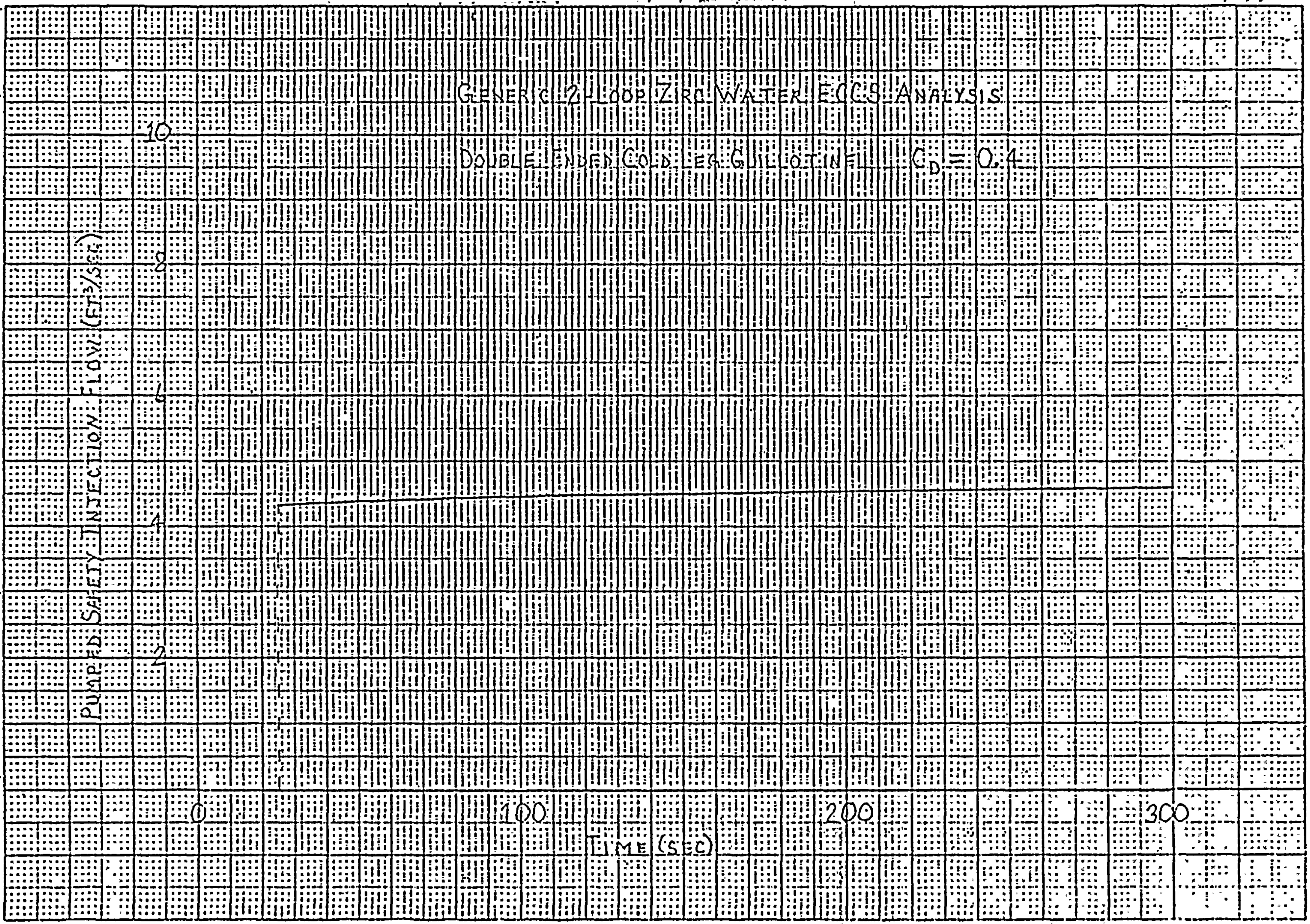
K&E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1320



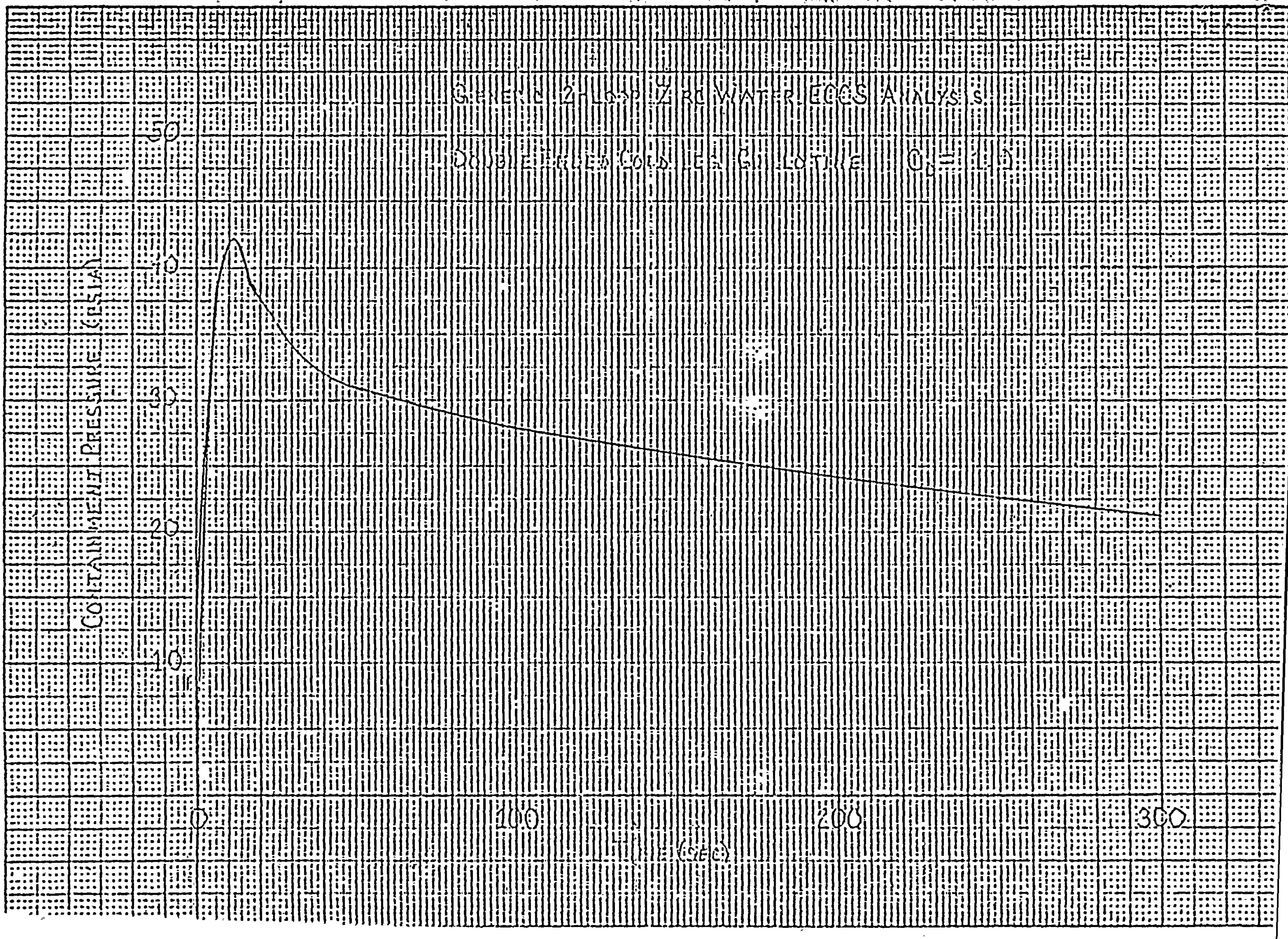
K&E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1320



K&E 10 X 10 TO 1/2 INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN USA 46 1320



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



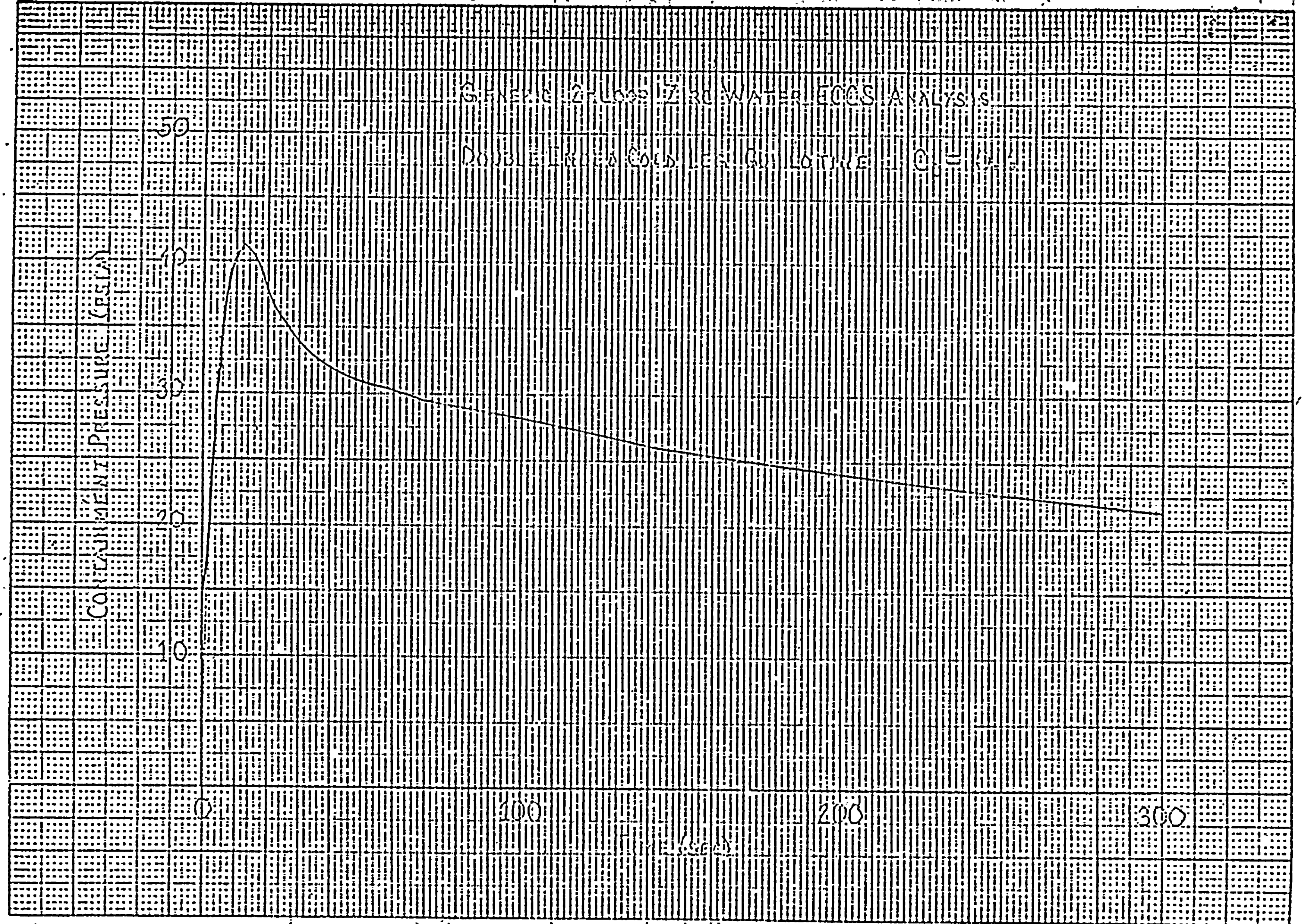
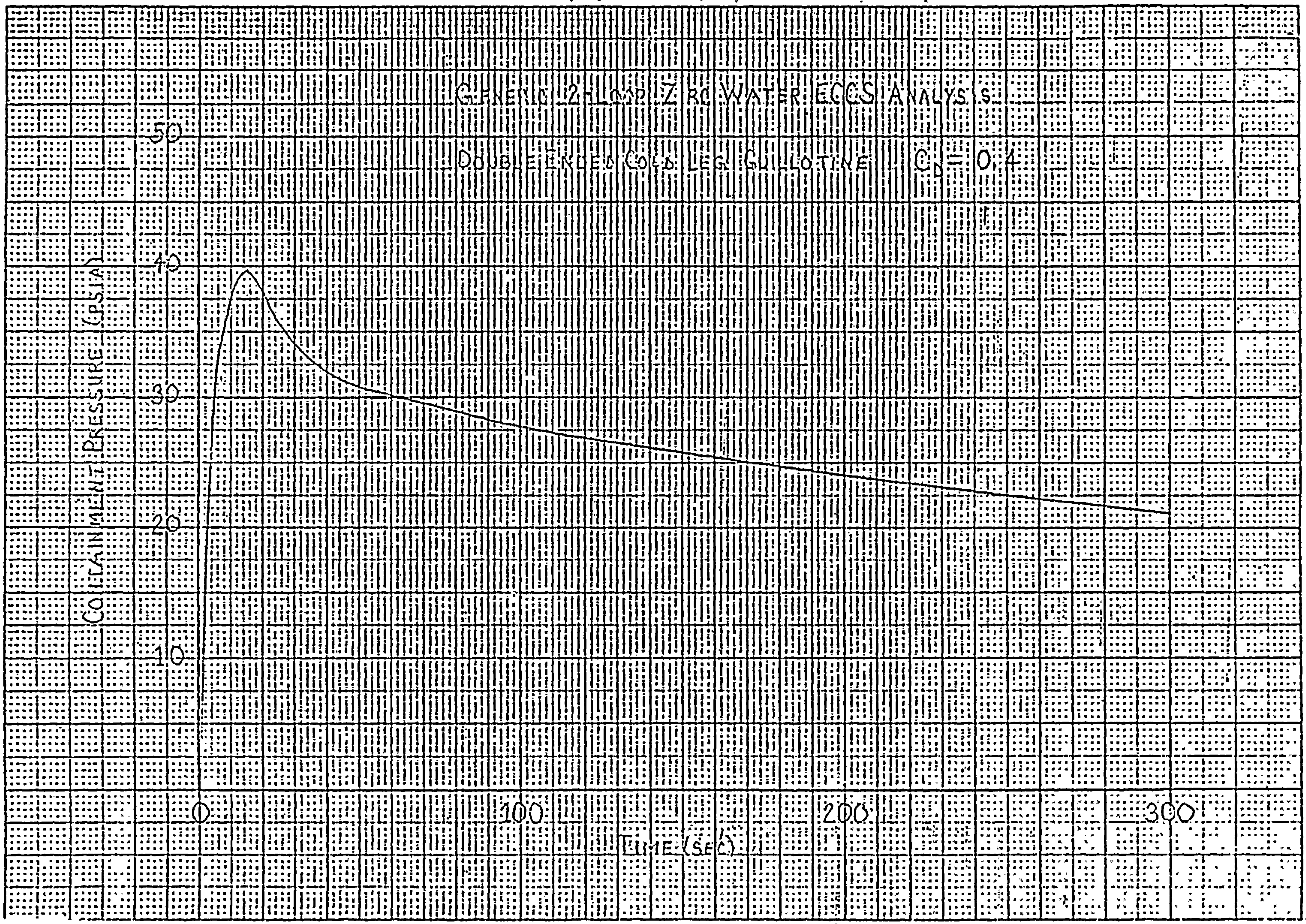

WATER ECCS ANALYSIS
CONTAINMENT PRESSURE (PSIA)
50
40
30
20
10
0
100
200
300

FIGURE 14-6

K&E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 1320



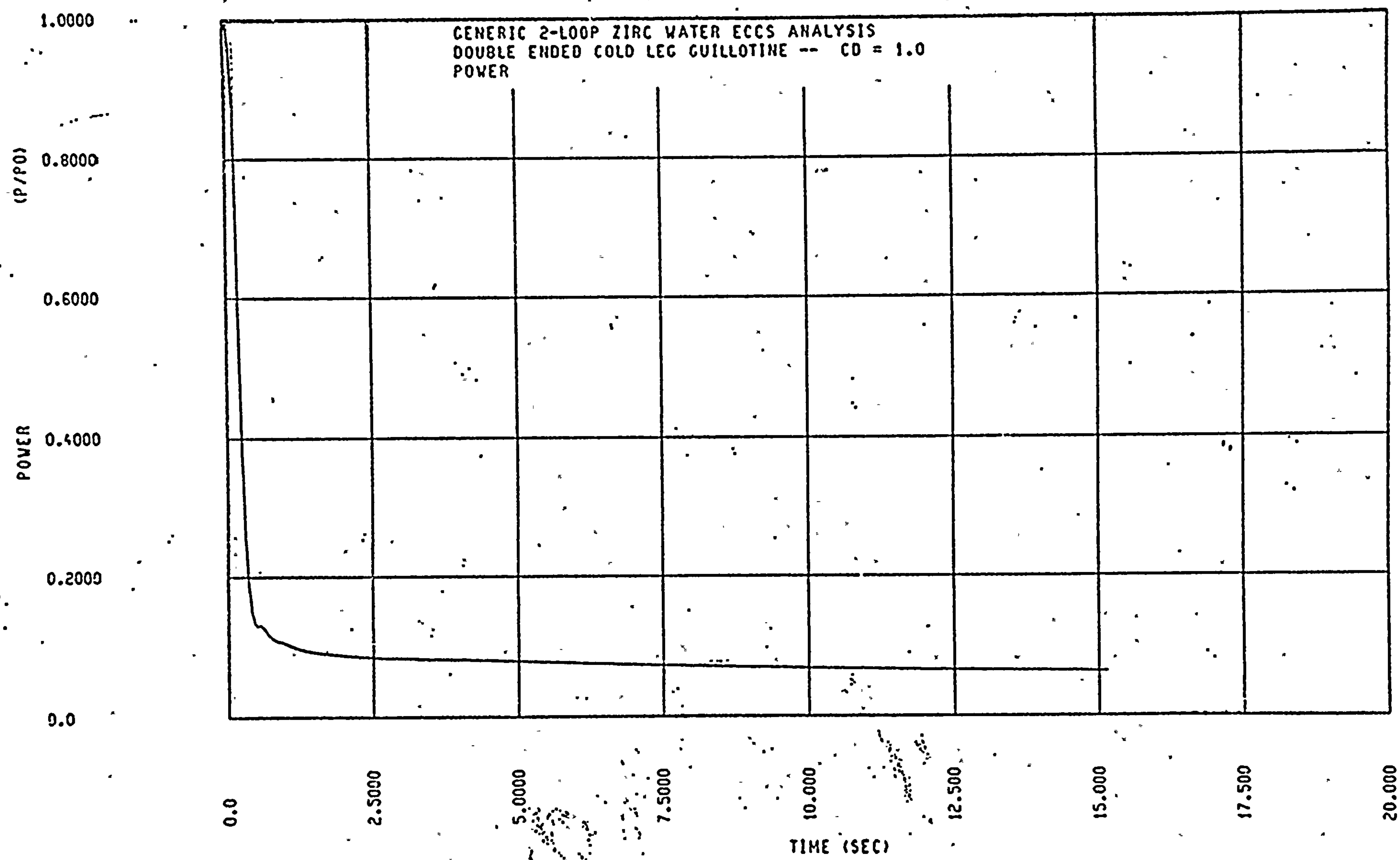

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 1.0
POWER
POWER (P/PO)
1.0000
0.8000
0.6000
0.4000
0.2000
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 15-a

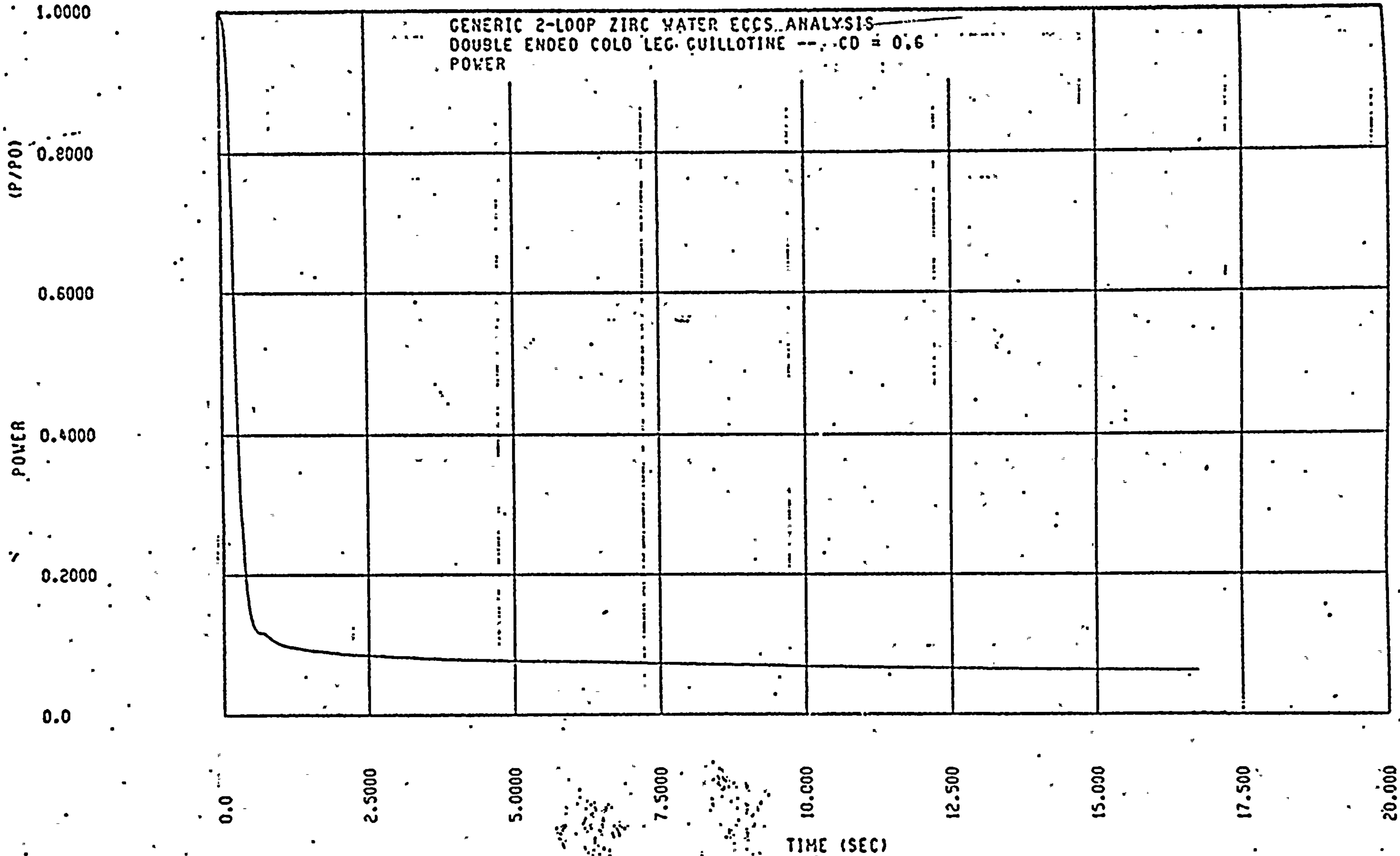
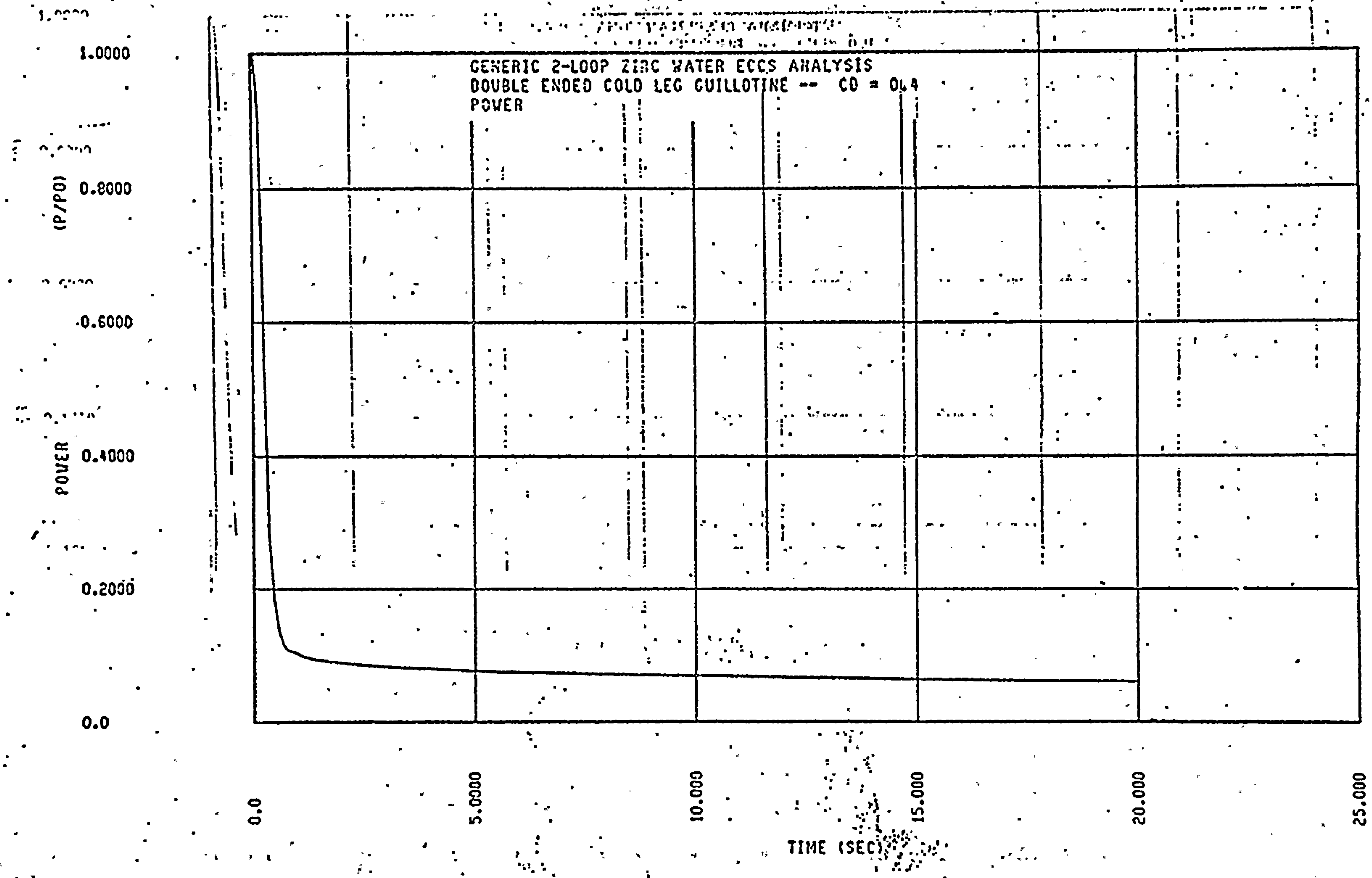
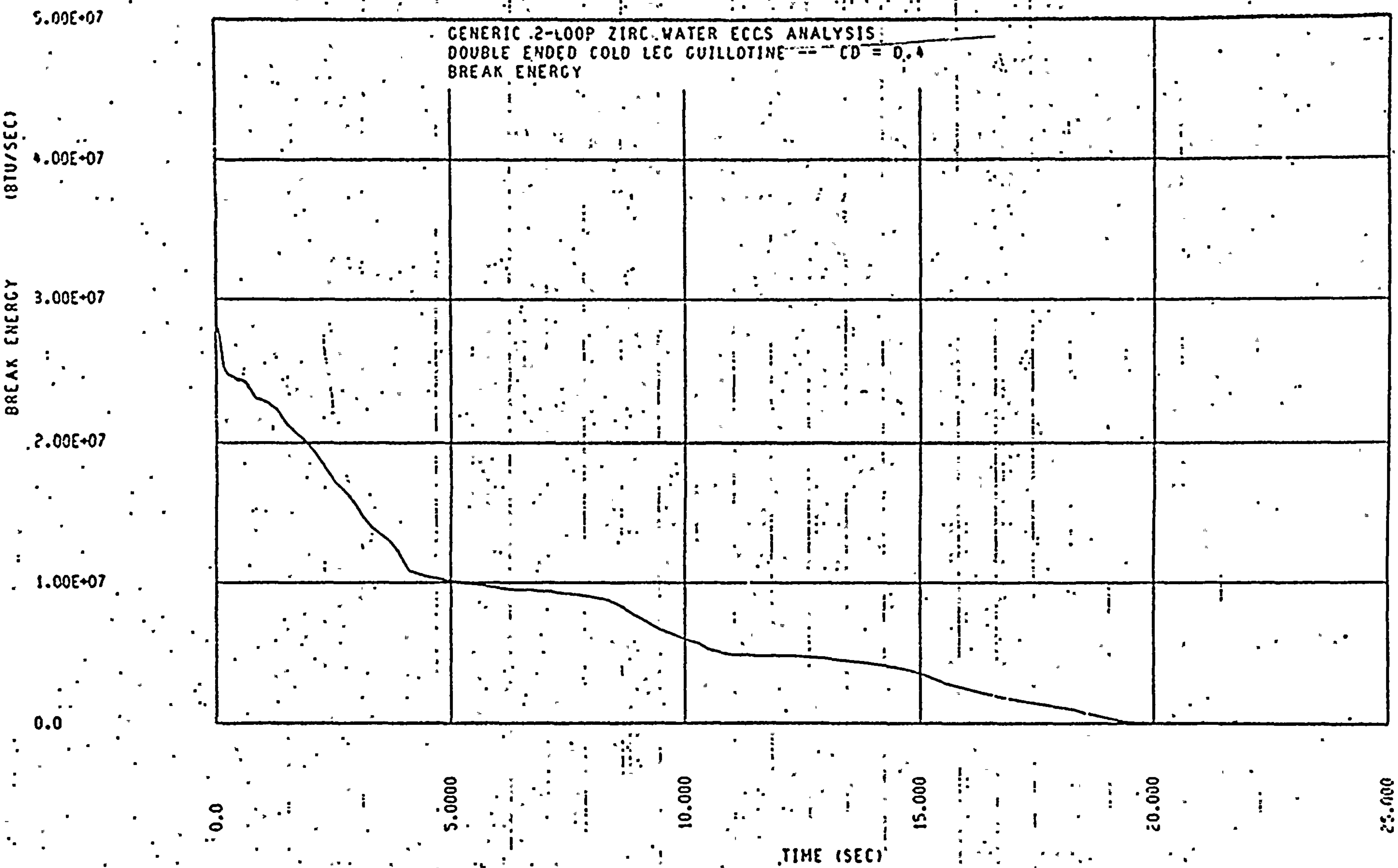

GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.6
POWER
POWER (P/PO)
1.0000
0.8000
0.6000
0.4000
0.2000
0.0
0.0
2.5000
5.0000
7.5000
10.000
12.500
15.000
17.500
20.000
TIME (SEC)

FIGURE 15-b



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
POWER
POWER (P/PO)
1.0000
0.8000
0.6000
0.4000
0.2000
0.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 15-c



GENERIC 2-LOOP ZIRC WATER ECCS ANALYSIS
DOUBLE ENDED COLD LEG GUILLOTINE -- CD = 0.4
BREAK ENERGY
BREAK ENERGY (BTU/SEC)
5.00E+07
4.00E+07
3.00E+07
2.00E+07
1.00E+07
0.0
0.0
5.0000
10.000
15.000
20.000
25.000
TIME (SEC)

FIGURE 16

K+E 10 X 10 TO 1/2 INCH KEUFFEL & ESSER CO. 46 1320

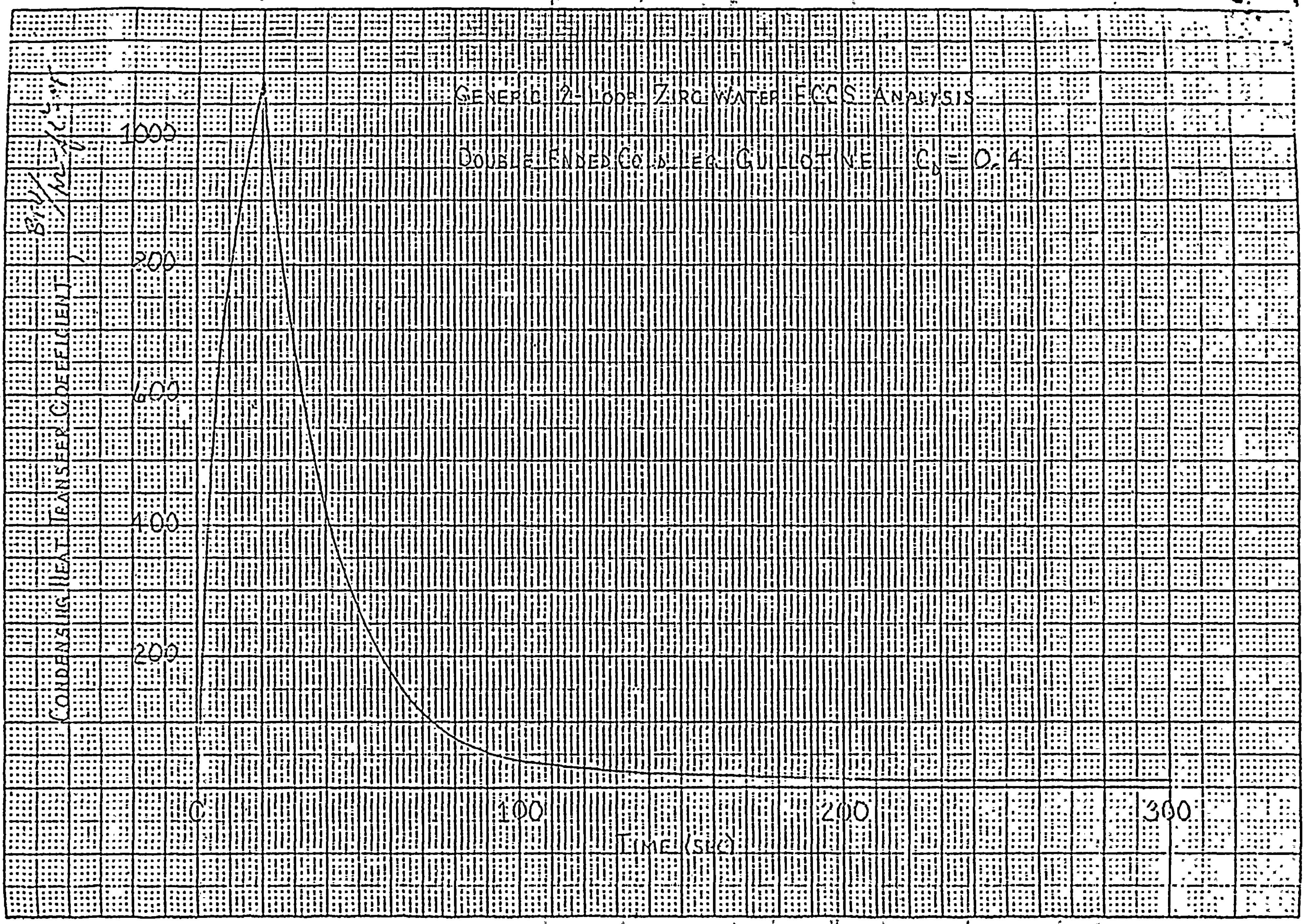


FIGURE 17