XN-NF-84-72
SUPPLEMENT 1

# H. B. ROBINSON UNIT 2
# LARGE BREAK LOCA-ECCS ANALYSIS
# WITH INCREASED ENTHALPY RISE FACTOR:
# BREAK SPECTRUM

AUGUST 1984



RICHLAND WA 99352

EXXON NUCLEAR COMPANY, INC.

XN-NF-84-72
Supplement 1
Issue Date: 8/14/84

# H. B. ROBINSON UNIT 2

# LARGE BREAK LOCA-ECCS ANALYSIS

# WITH INCREASED ENTHALPY RISE FACTOR: BREAK SPECTRUM

Prepared by: T. Tahvili 8/13/84
T. Tahvili
PWR Safety Analysis

Reviewed by: W. V. Kayser 8/13/84
W. V. Kayser, Manager
PWR Safety ANalysis

Concur: R Copeland for 13 Aug 84
J. C. Chandler
Reload Fuel Licensing

Approve: R. B. Stout 13 Aug 84
R. B. Stout, Manager
Licensing & Safety Engineering

Approve: George F. Sofer 13 AUG 84
G. A. Sofer, Manager
Fuel Engineering & Technical Services

EXXON NUCLEAR COMPANY, INC.

## NUCLEAR REGULATORY COMMISSION DISCLAIMER

### IMPORTANT NOTICE REGARDING CONTENTS AND USE OF THIS DOCUMENT

### PLEASE READ CAREFULLY

This technical report was derived through research and development programs sponsored by Exxon Nuclear Company, Inc. It is being submitted by Exxon Nuclear to the USNRC as part of a technical contribution to facilitate safety analyses by licensees of the USNRC which utilize Exxon Nuclear-fabricated reload fuel or other technical services provided by Exxon Nuclear for light water power reactors and it is true and correct to the best of Exxon Nuclear's knowledge, information, and belief. The information contained herein may be used by the USNRC in its review of this report, and by licensees or applicants before the USNRC which are customers of Exxon Nuclear in their demonstration of compliance with the USNRC's regulations.

Without derogating from the foregoing, neither Exxon Nuclear nor any person acting on its behalf:

A. Makes any warranty, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this document, or that the use of any information, apparatus, method, or process disclosed in this document will not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this document.

# TABLE OF CONTENTS

## List of Tables

## List of Figures

List of Figures (Cont.)

List of Figures (Cont.)

## List of Figures (Cont.)

## List of Figures (Cont.)

## List of Figures (Cont.)

## 1.0 INTRODUCTION

A LOCA ECCS analysis was completed by Exxon Nuclear Company (ENC) and documented in XN-NF-84-72[1] in July 1984 for H.B. Robinson Unit 2. That analysis was performed as a result of the decision by Carolina Power and Light (CP&L) in 1983 to: (1) replace the H.B. Robinson Unit 2 steam generators, (2) implement a low radial leakage fuel management scheme in order to reduce vessel fluences and thereby alleviate concerns about thermal shock, and (3) to increase the peak assembly discharge exposure for H.B. Robinson fuel to 44 MWD/kgU (49 MWD/kgU peak pellet). To implement the low radial leakage fuel management scheme, the total nuclear enthalpy rise ($F^T_{\Delta H}$) was increased to 1.65 from 1.55. The analysis was performed with an LHGR, including the 1.02 factor for power uncertainty, of 14.16 kw/ft, corresponding to a total power peaking of 2.32 ($F^T_Q$). The analysis supported operation of the H.B. Robinson Unit 2 reactor at 100% power (2300 MWt) with up to 6% steam tube plugging. The analysis was performed for the previously identified limiting guillotine cold leg break with a discharge coefficient of 0.8 (the 0.8 DECLG break)[2,3] using the ENC EXEM/PWR[4] LOCA ECCS model.

This supplement documents the results of a break spectrum analysis performed to confirm that the previously identified 0.8 DECLG remain limiting using the EXEM/PWR LOCA ECCS model at the defined operating limits specified in XN-NF-84-72. The results of that analysis are presented in Section 3.0.

## 2.0 SUMMARY

The calculational basis and results of the break spectrum analysis are presented in Table 2.1. The maximum peak cladding temperature (PCT) is 2042$^{o}$F and occurs for the 0.8 DECLG break. The analysis confirms that the 0.8 DECLG break is limiting.

Table 2.1 H. B. Robinson Unit 2
Large Break Spectrum Results

Calculational Basis

| | |
|---|---|
| License Core Power, MWt | 2300 |
| Power Used for Analysis, MWt** | 2346 |
| Peak Linear Power for Analysis, kW/ft** | 14.16 |
| Total Peaking Factor, $F_Q^T$ | 2.32 |
| Enthalpy Rise, Nuclear, $F^T_H$ | 1.65 |
| Steam Generator Tube Plugging (%) | 6.00 |

| | DECLG 1.0 | DECLG 0.8*** | DECLG 0.6 |
|---|---|---|---|
| Peak Cladding Temperature, $^oF$ | 1885 | 2042 | 1808 |
| Peak Temperature Location, ft | 6.0 | 6.0 | 8.5 |
| Local Zr/$H_2O$ Reaction (Max.), %* | 2.70 | 4.65 | 2.18 |
| Local Zr/$H_2O$ Location, ft | 6.0 | 6.0 | 6.0 |
| Total Zr/$H_2O$ | <1% | <1% | <1% |
| Hot Rod Burst Time, sec | 39.66 | 39.9 | 46.40 |
| Hot Rod Burst Location, ft | 6.0 | 6.0 | 6.0 |
| Linear Heat Generation rate, BOCREC | .5130 | .5102 | .5033 |

* Computer value at 380 seconds.

** Including 1.02 factor for power uncertainties.

***XN-NF-84-72, Analysis Result for Limiting Exposure Point, 2 MWD/kgU Burnup.

## 3.0 BREAK SPECTRUM ANALYSIS

A cold leg guillotine break spectrum analysis was performed to assure that the 0.8 DECLG break, assumed limiting in the XN-NF-84-72 analysis, is the limiting break. Previous analyses in 1976(2) and in 1980(3), using the WREM-I(5) and WREM-IIA(6) LOCA ECCS models respectively, identified the limiting break to be the 0.8 DECLG break. The current analysis used the EXEM/PWR LOCA ECCS models with operating conditions and fuel parameters given in Tables 3.1 and 3.2. The operating conditions and fuel parameters are identical to those used in the XN-NF-84-72 analysis. The systems blowdown, refill, reflood, and rod heatup analysis are identical to those used in the XN-NF-84-72 analysis other than input changes required to define the guillotine break conditions. The spectrum analysis assumed a 1.365 chopped cosine axial power profile. The analyses were performed for the previously identified limiting exposure conditions, 2 MWD/kgU peak rod burnup.

### 3.1 RESULTS OF SPECTRUM ANALYSIS

The results of the spectrum analysis are summarized in Table 2.1. The previously identified limiting break, the 0.8 DECLG break, remains the limiting break. Timing and sequence of events for the three guillotine breaks are presented in Table 3.1. Figures 3.1 to 3.27 present the results of the analysis for the limiting break, the 0.8 DECLG break. Figures 3.28 to 3.54 and Figures 3.55 to 3.81 present the results for the 0.6 DECLG and 1.0 DECLG breaks respectively. Unless otherwise noted in the figures, time zero corresponds to the time of break initiation.

The maximum peak cladding temperature (PCT) calculated for the 0.8 DECLG break occurs at 2 MWD/kgU and is 2042°F. The maximum local metal-water

reaction is 4.65 after 380 seconds, and the total core metal-water reaction is less than 1%. The PCT location is at an elevation of 6.0 feet from the bottom of active core.

Table 3.1 Event Times for H. B. Robinson Unit 2
Large Break Spectrum Analysis

| Event | Time (sec) | | |
|---|---|---|---|
| | DECLG 1.0 | DECLG 0.8 | DECLG 0.6 |
| Start | 0.0 | 0.0 | 0.0 |
| Initiate Break | 0.1 | 0.1 | 0.1 |
| Safety Injection Signal | 0.6 | 0.6 | 0.6 |
| Accumulator Injection, Intact Loop | 11.8 | 12.0 | 12.9 |
| Accumulator Injection, Broken | 1.6 | 3.1 | 5.3 |
| End-of-Blowdown | 23.30 | 24.09 | 25.22 |
| End-of-Bypass | 21.81 | 22.57 | 23.70 |
| Bottom of Core Recovery | 44.69 | 45.79 | 46.93 |
| Accumulator Empty | 48.71 | 48.76 | 49.79 |
| Safety Pump Injection | 25.60 | 25.60 | 25.60 |
| Peak Clad Temperature Reached | 56. | 60. | 139. |

Table 3.2 H. B. Robinson Unit 2 System Data

| | |
|---|---|
| Primary Heat Output, MWt | 2346* |
| Primary Coolant Flow, lbm/hr | $100.3 \times 10^6$ |
| Primary Coolant Volume, $ft^3$ | 9768** |
| Operating Pressure, psia | 2,250. |
| Inlet Coolant Temperature, $^oF$ | 546.2 |
| Reactor Vessel Volume, $ft^3$ | 3660 |
| Pressurizer Volume, Total, $ft^3$ | 1300 |
| Pressurizer Volume, Liquid, $ft^3$ | 780 |
| Accumulator Volume, Total, $ft^3$ (each of three) | 1200 |
| Accumulator Volume, Liquid, $ft^3$ | 825 |
| Accumulator Trip Point Pressure, psia | 615 |
| Steam Generator Heat Transfer Area, $ft^2$ (one) | 40,859** |
| Steam Generator Secondary Flow, lbm/hr (one) | $3.37 \times 10^6$ |
| Steam Generator Secondary pressure, psia | 800 |
| Reactor Coolant Pump Head, ft | 264 |
| Reactor Coolant Pump Speed, rpm | 1180 |
| Moment of Inertia, lbm-$ft^2$/rad | 70,000 |
| Cold Leg Pipe, I.D., in | 27.5 |
| Hot Leg Pipe, I.D., in | 29.0 |
| Pump Suction Pipe, I.D., in | 31.09 |

---

* Primary Heat Output used in RELAP4-EM Model = 1.02 x 2300 = 2346 MWt.

** Includes 6% SG tube plugging.

Table 3.3 Fuel Design Parameters

| Parameter | ENC Fuel |
|---|---|
| Cladding, O.D, in. | 0.424 |
| Cladding, I.D., in. | 0.364 |
| Cladding Thickness, in. | 0.030 |
| Pellet O.D., in. | 0.3565 |
| Diametral Gap, in. | 0.0075 |
| Pellet Density, % TD | 94.0 |
| Active Fuel Length, in. | 144 |
| Enriched $UO_2$, in. | 132 |
| Upper Blanket, in. | 6.0 |
| Lower Blanket, in. | 6.0 |
| Cell Water/Fuel Ratio | 1.76 |
| Rod Pitch | 0.563 |

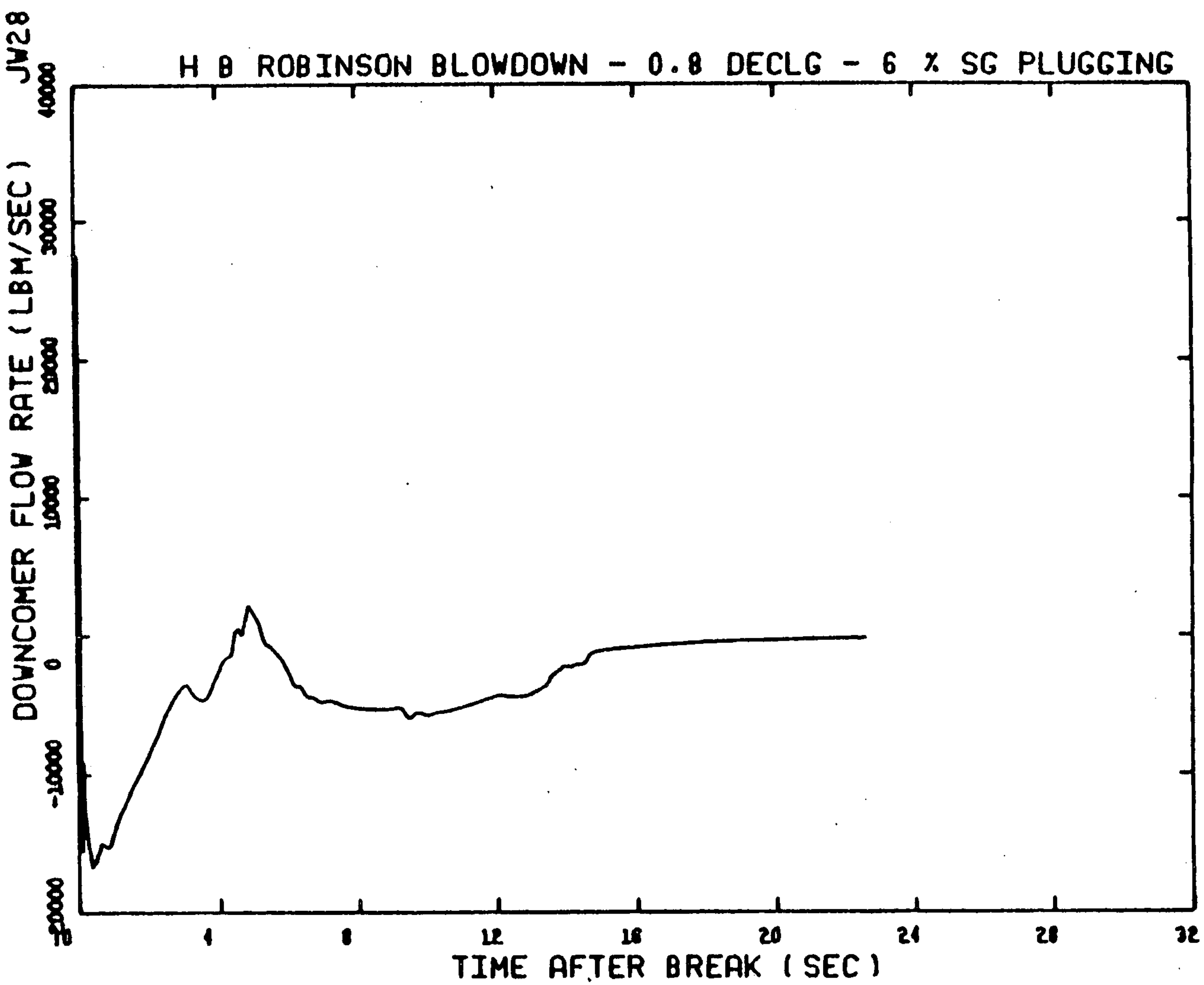



Figure 3.1  Downcomer Flow Rate During Blowdown Period, 0.8 DECLG Break

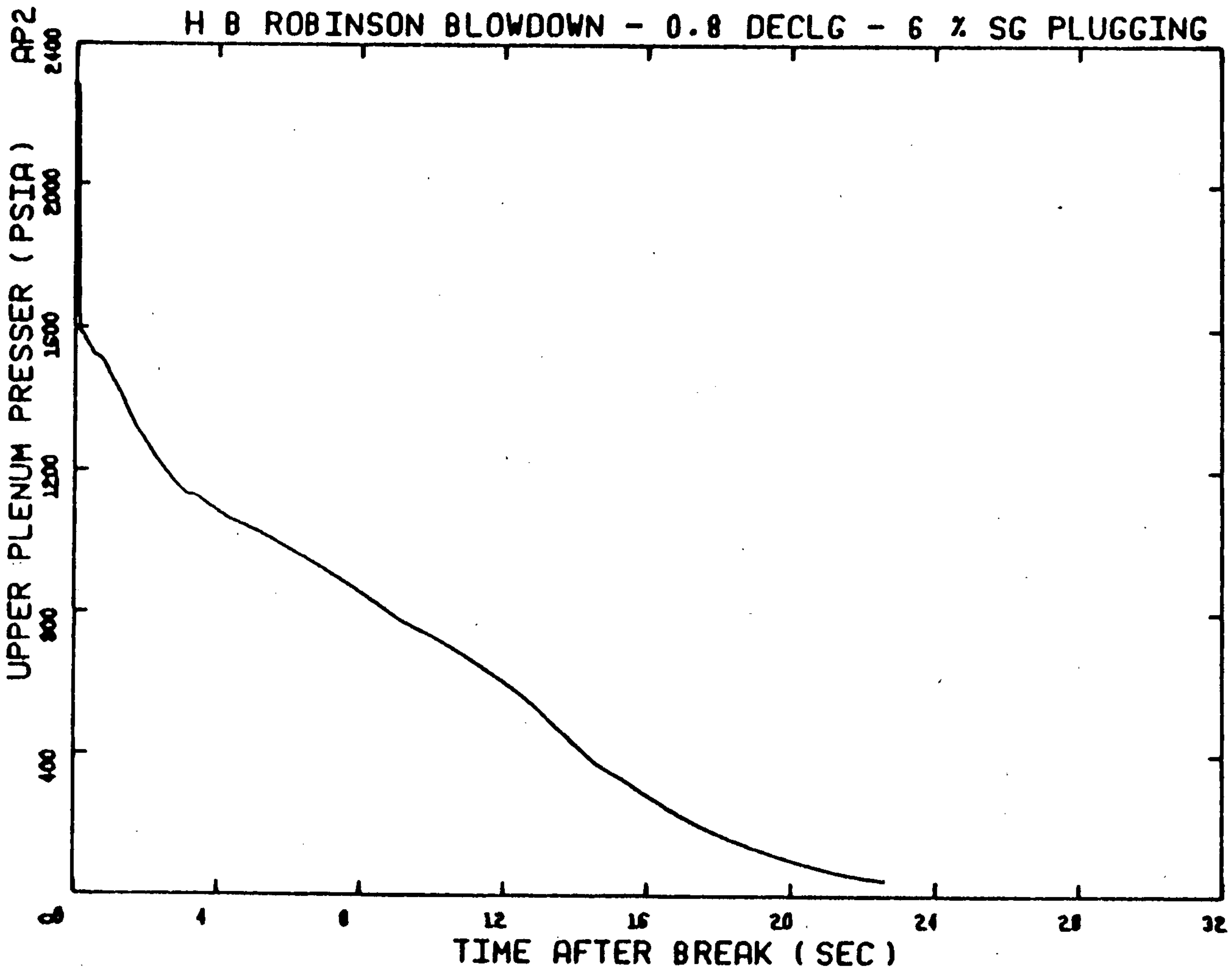



Figure 3.2 Upper Plenum Pressure During Blowdown Period, 0.8 DECLG Break

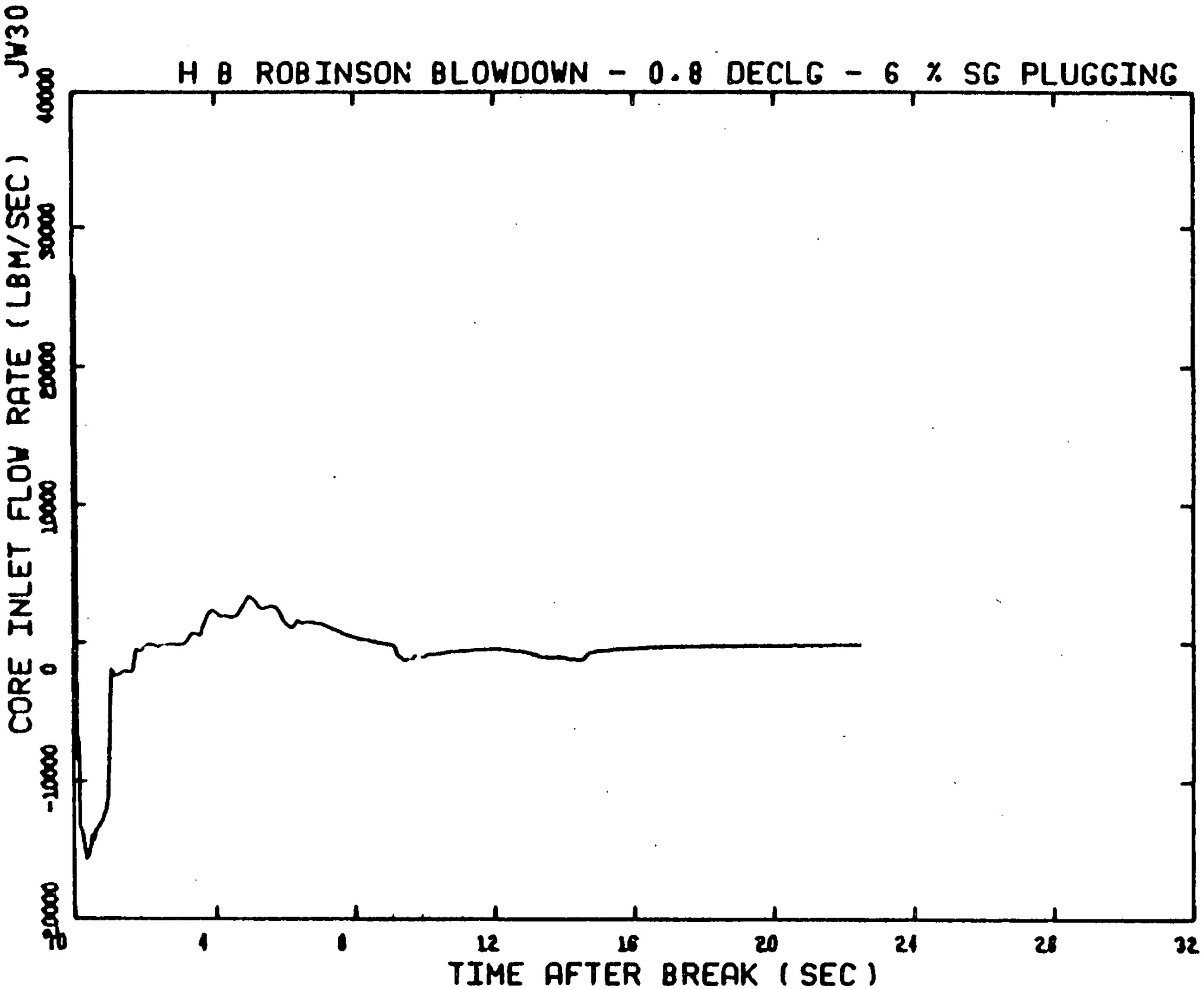



Figure 3.3 Average Core Inlet Flow During Blowdown Period, 0.8 DECLG Break

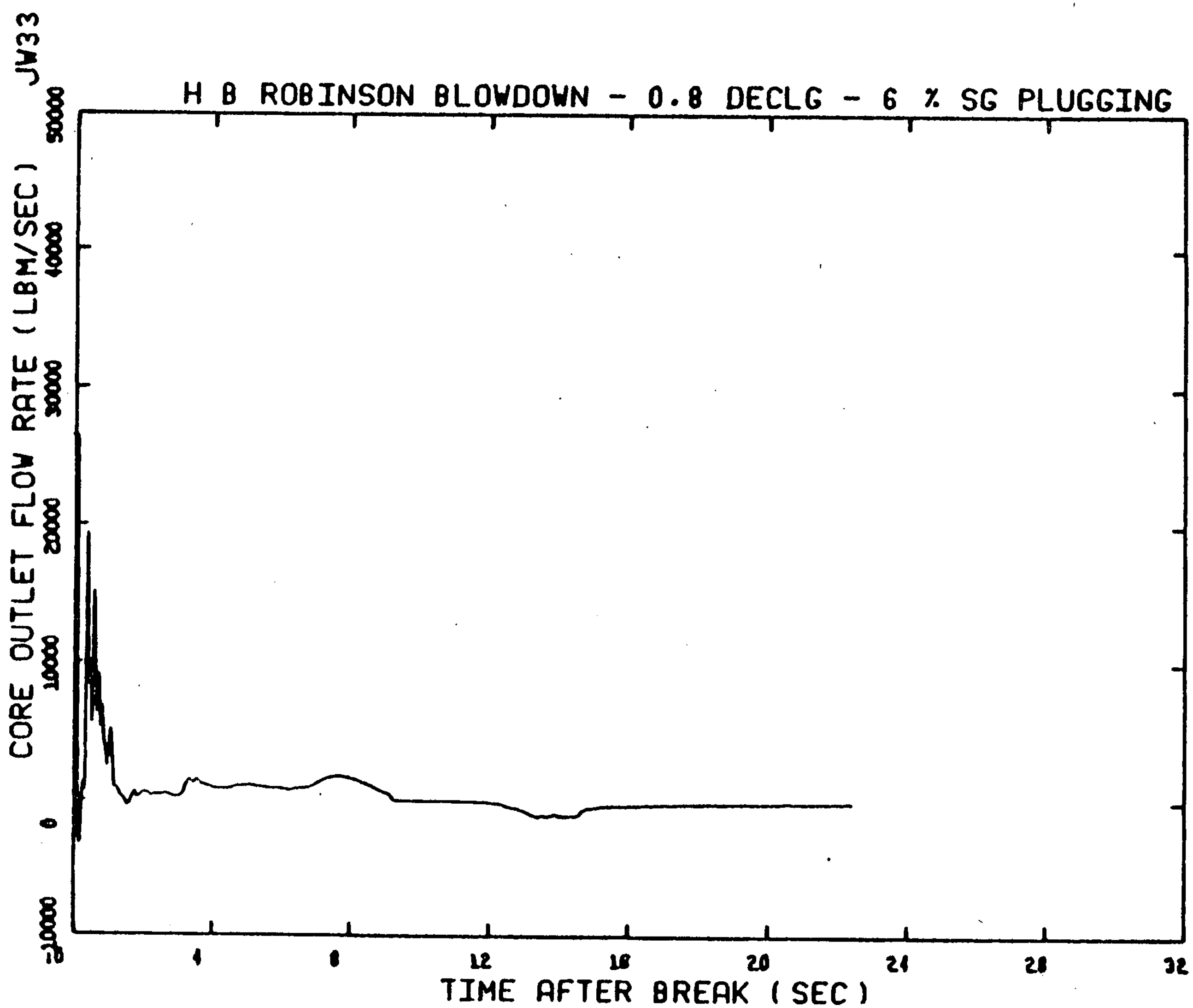



Figure 3.4 Average Core Outlet Flow During Blowdown Period, 0.8 DECLG Break

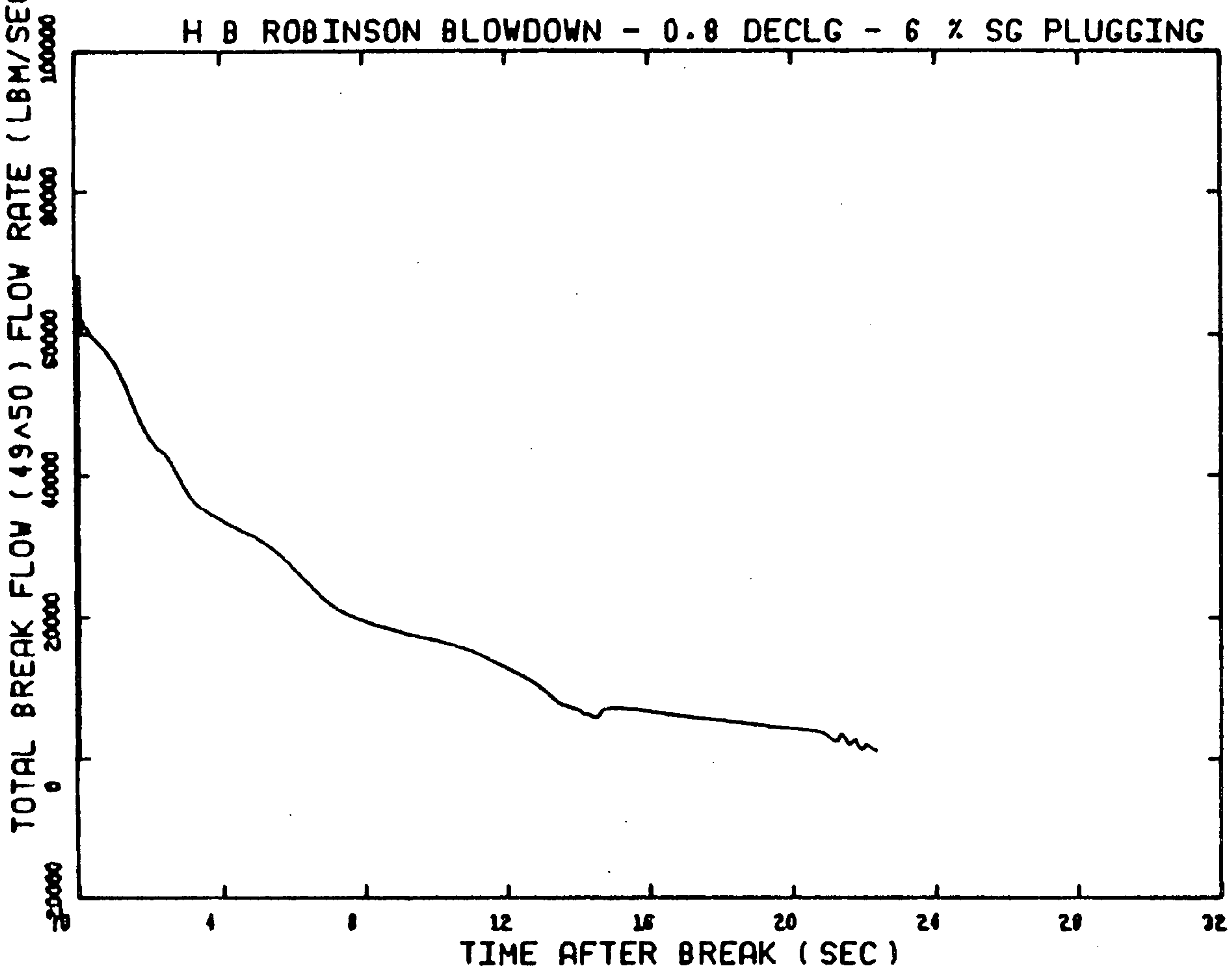



Figure 3.5 Total Break Flow During Blowdown Period, 0.8 DECLG Break

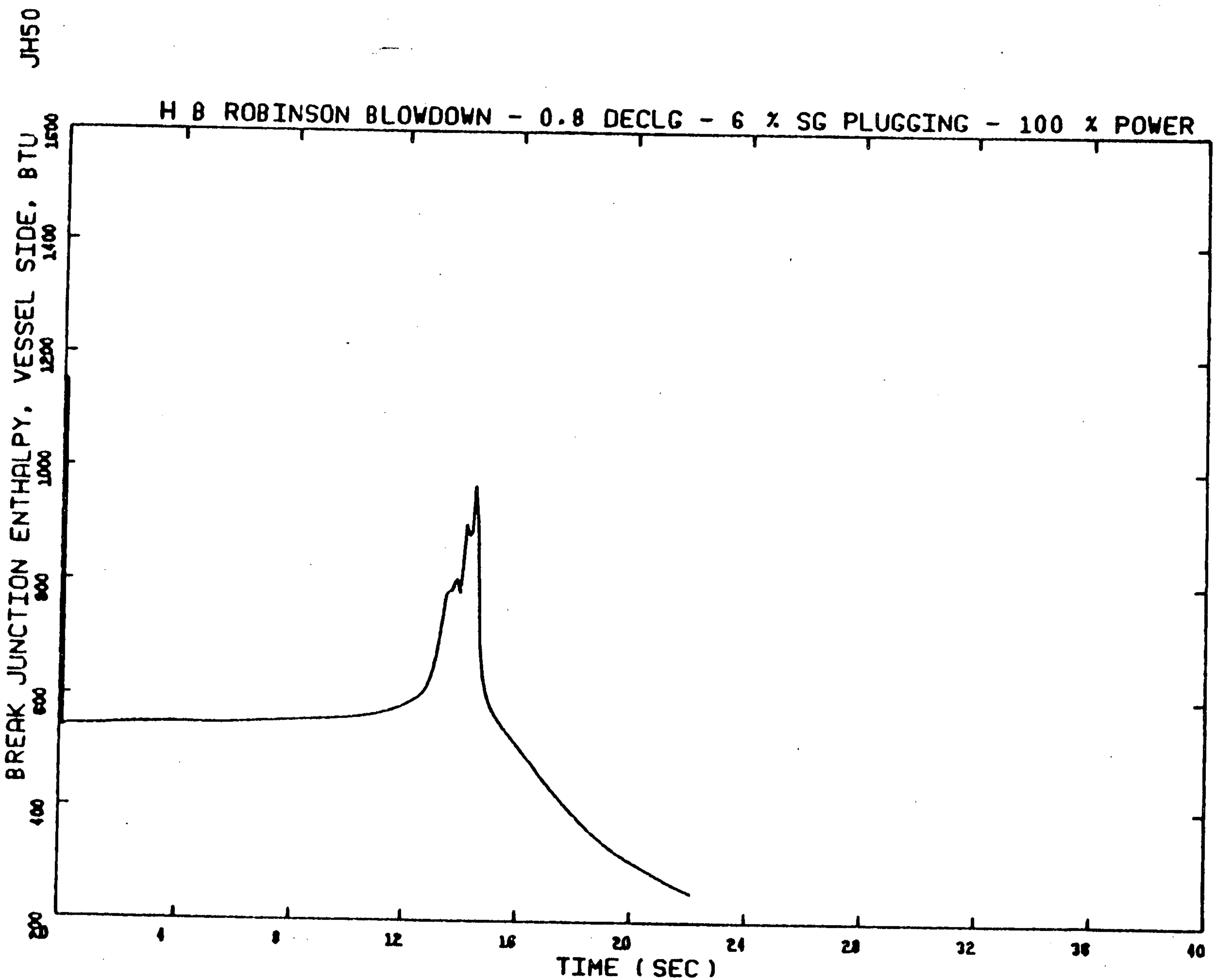



Figure 3.6 Break Flow Enthalpy During Blowdown Period, Vessel Side, 0.8 DECLG Break

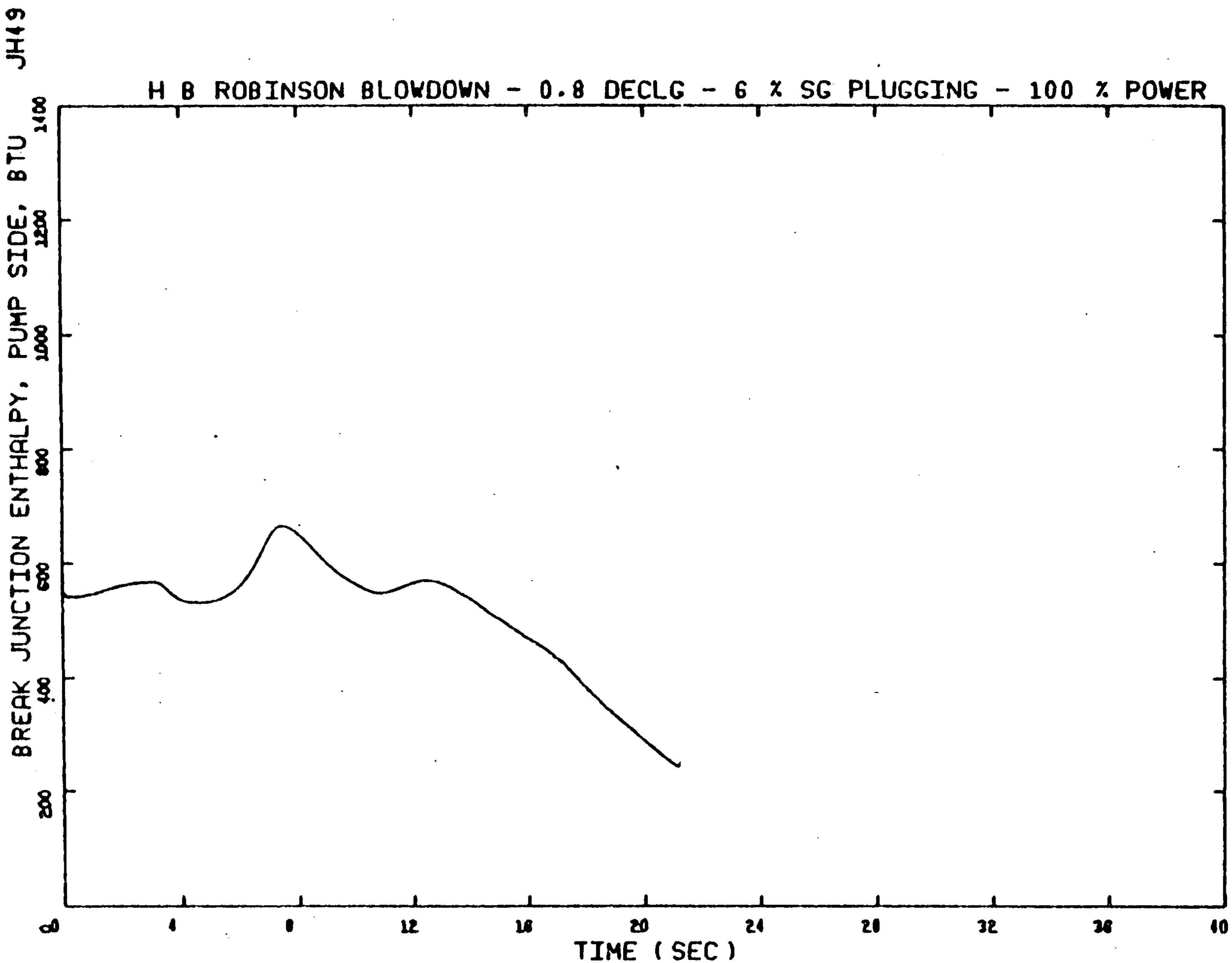



Figure 3.7 Break Flow Enthalpy During Blowdown Period, Pump Side, 0.8 DECLG Break

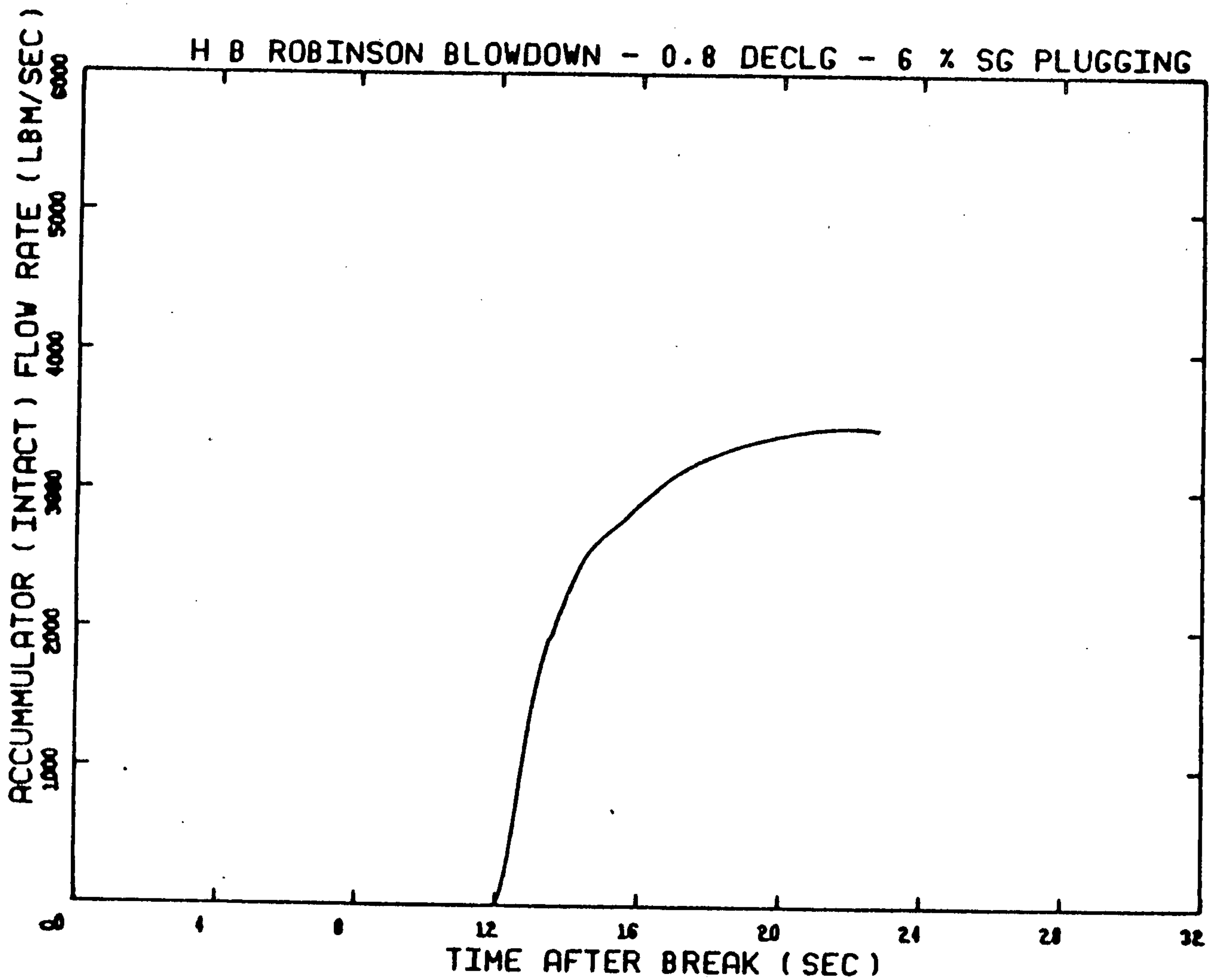



Figure 3.8 Flow from Intact Loop Accumulator During Blowdown Period, 0.8 DECLG Break

JW48

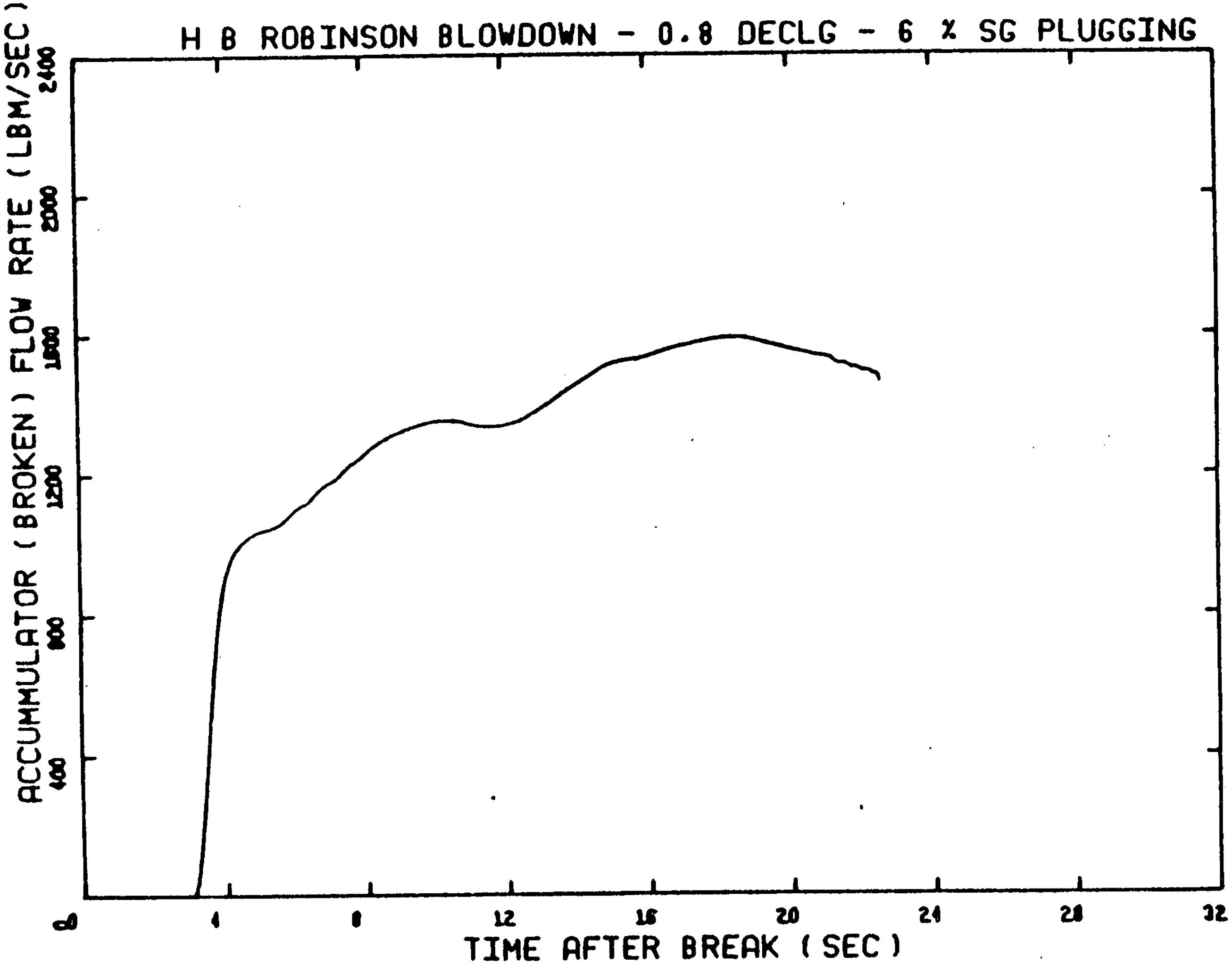



Figure 3.9 Flow From Broken Loop Accumulator During Blowdown Period, 0.8 DECLG Break

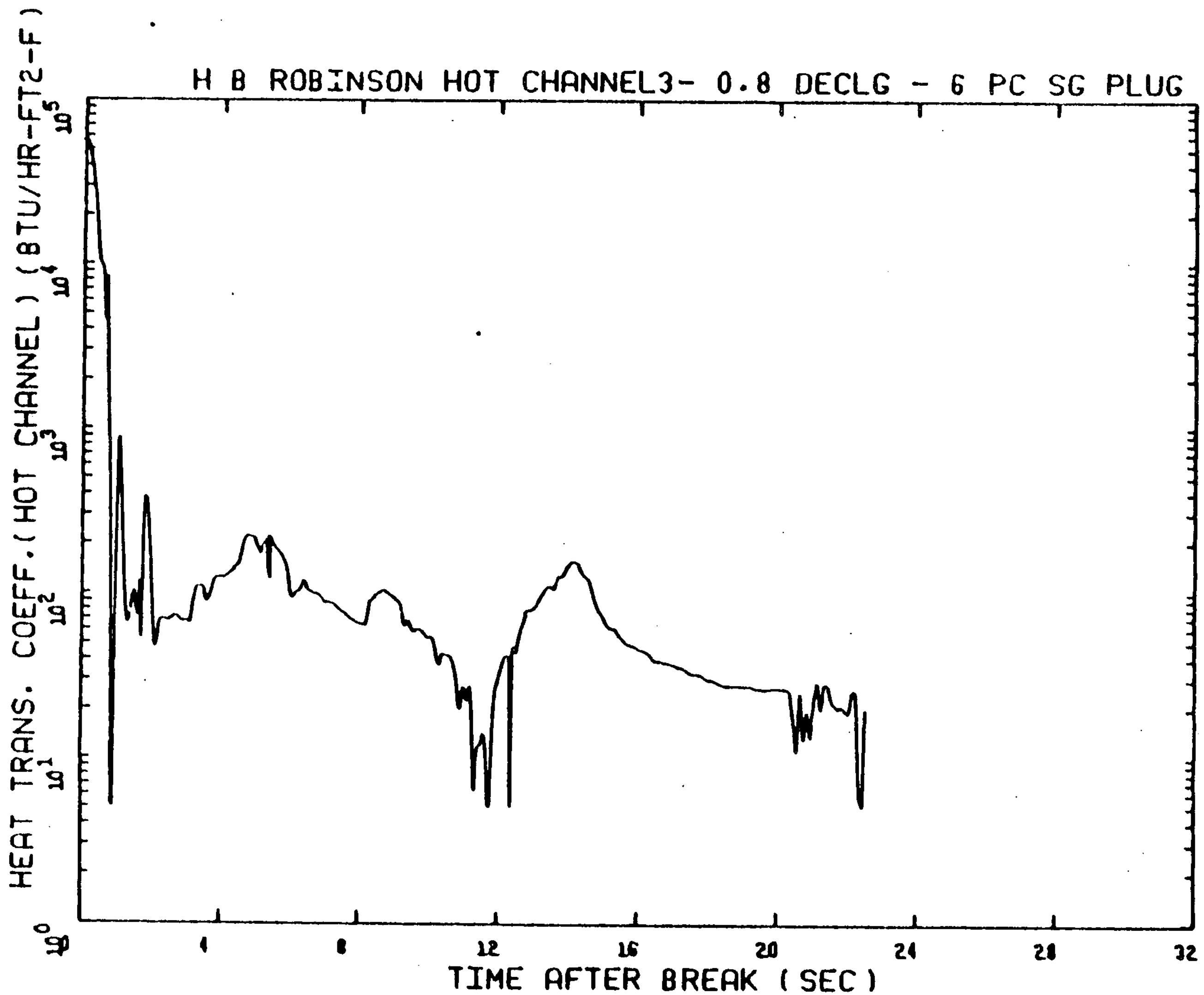



Figure 3.10 Heat Transfer Coefficient During Blowdown Period at PCT Node, 0.8 DECLG Break, 2 MWD/KgU

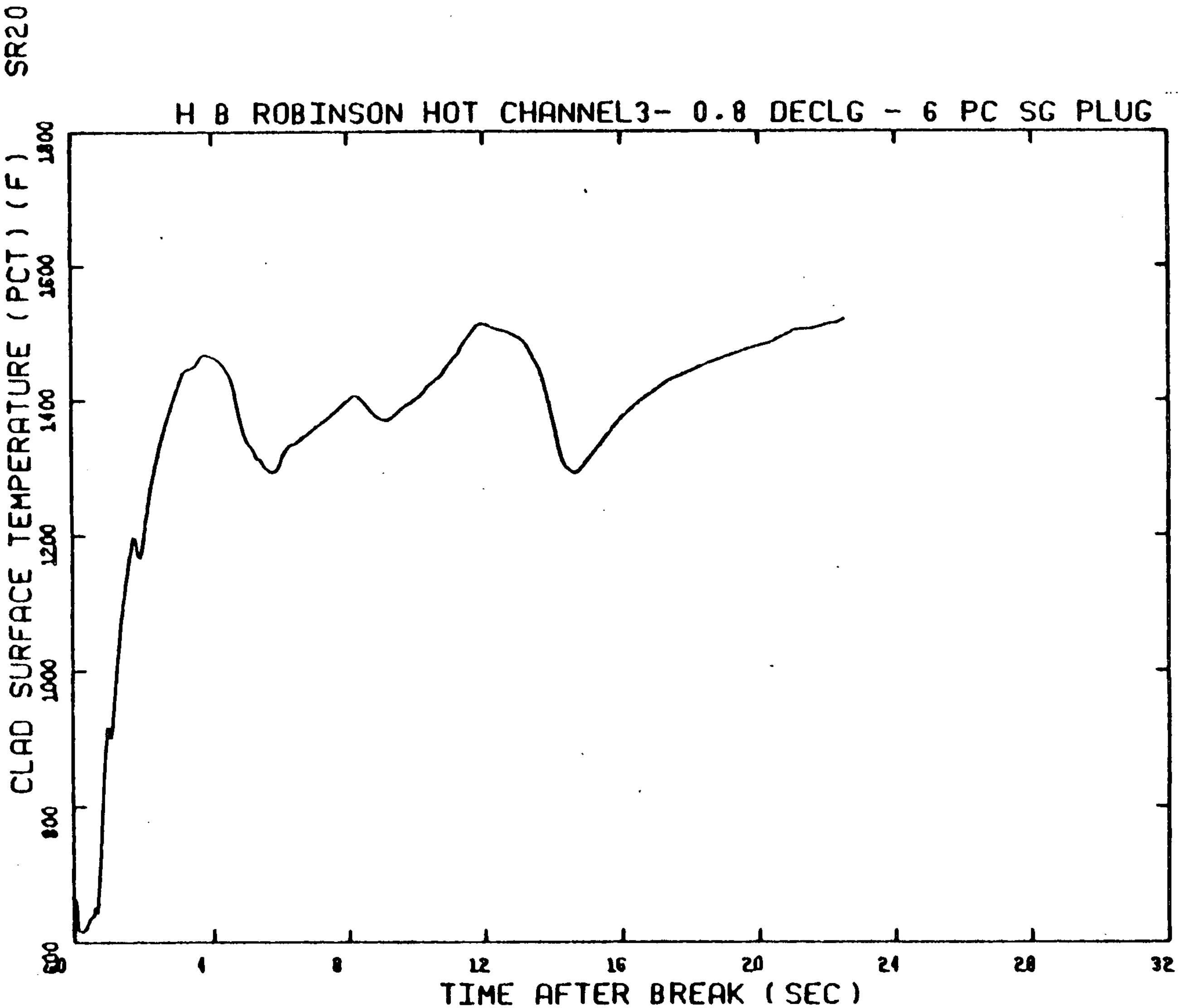



Figure 3.11 Clad Surface Temperature during Blowdown Period
PCT Node, 0.8 DECLG Break, 2 MWD/KgU

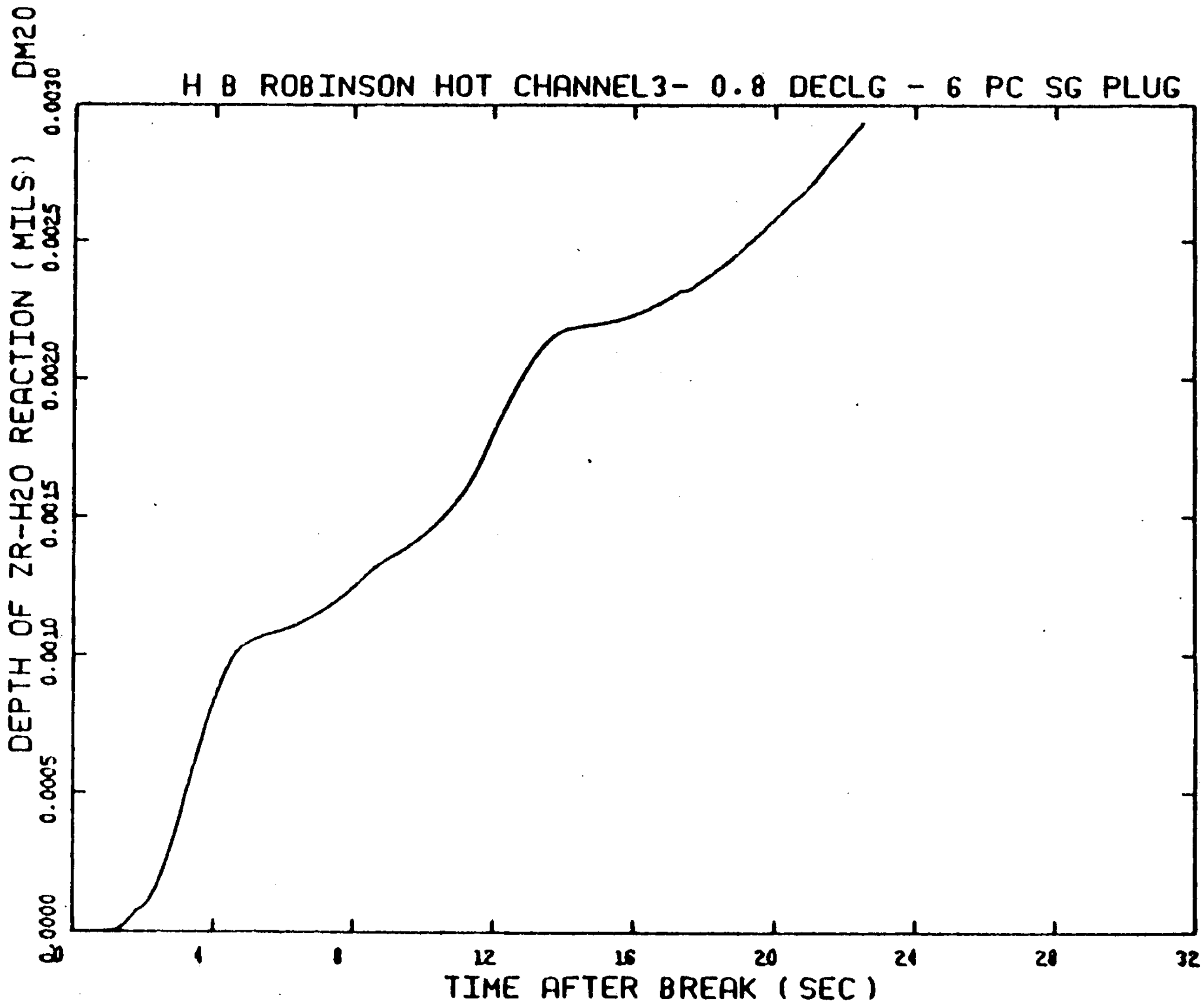



Figure 3.12 Depth of Metal-Water Reaction During Blowdown Period at PCT Node, 0.8 DECLG Break, 2 MWD/KgU

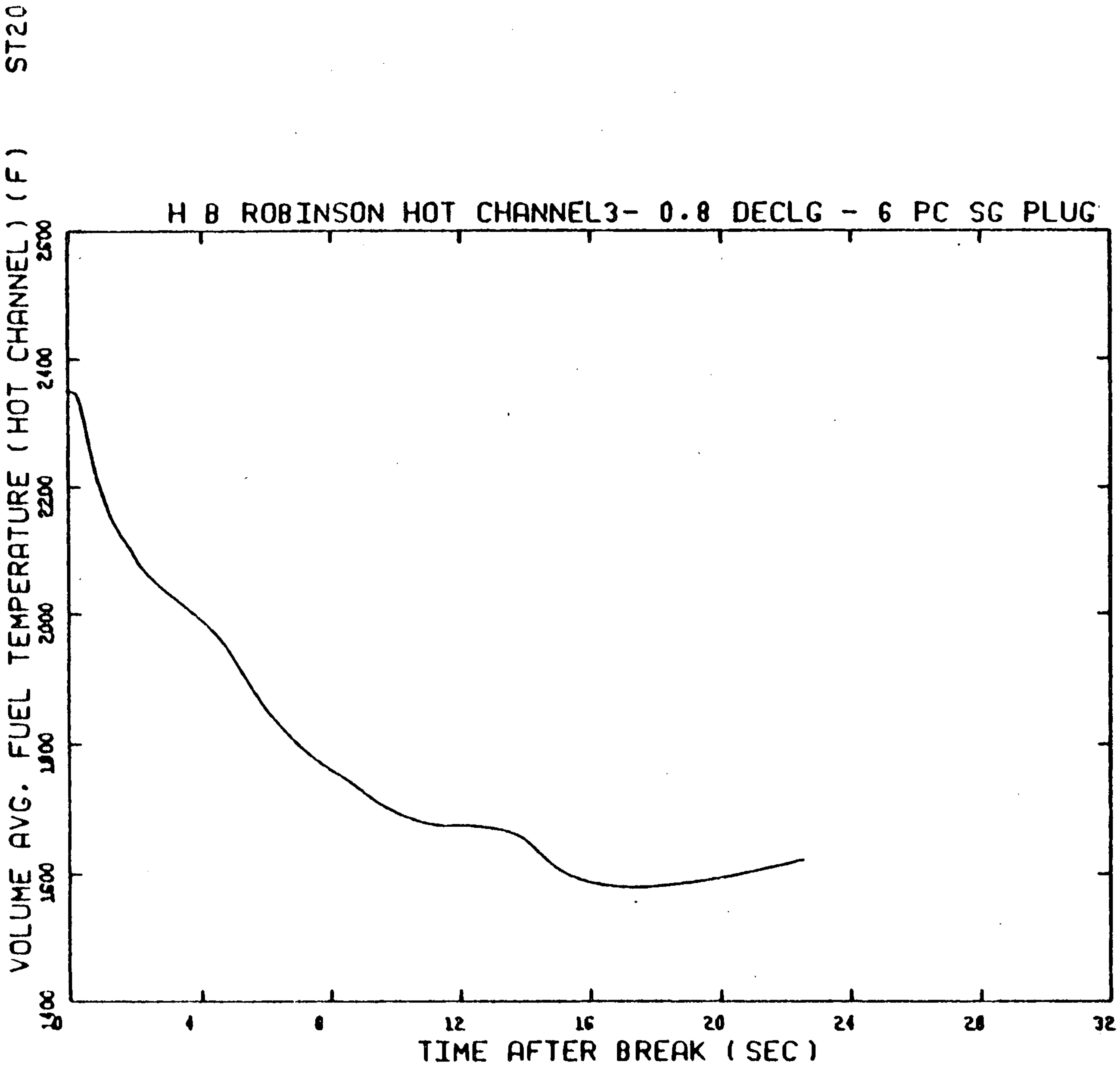



Figure 3.13 Average Fuel Temperature During Blowdown Period at PCT Node, 0.8 DECLG Break, 2 MWD/KgU

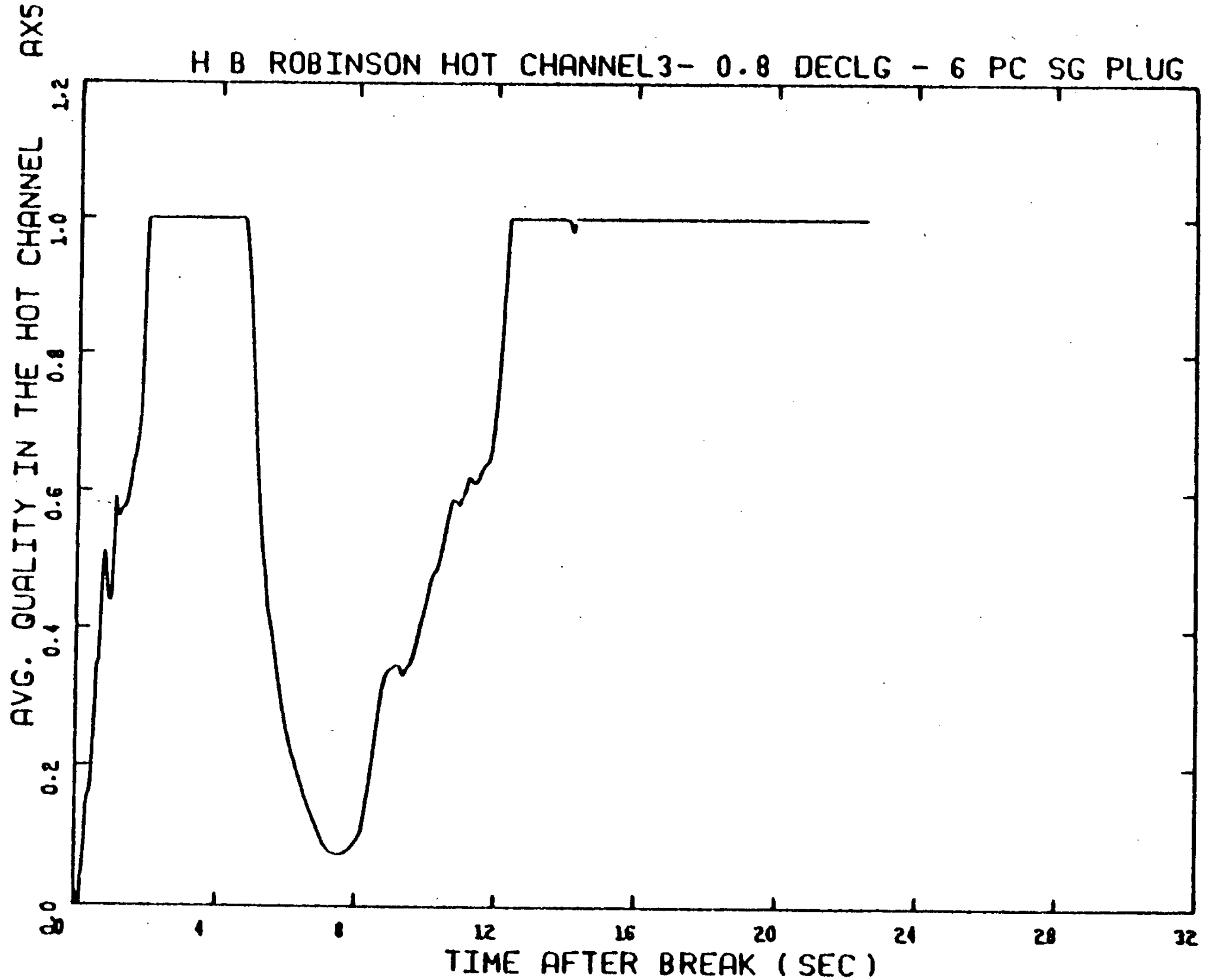



Figure 3.14 Hot Channel Average Quality, Center Volume
0.8 DECLG Break, 2 MWD/kgU

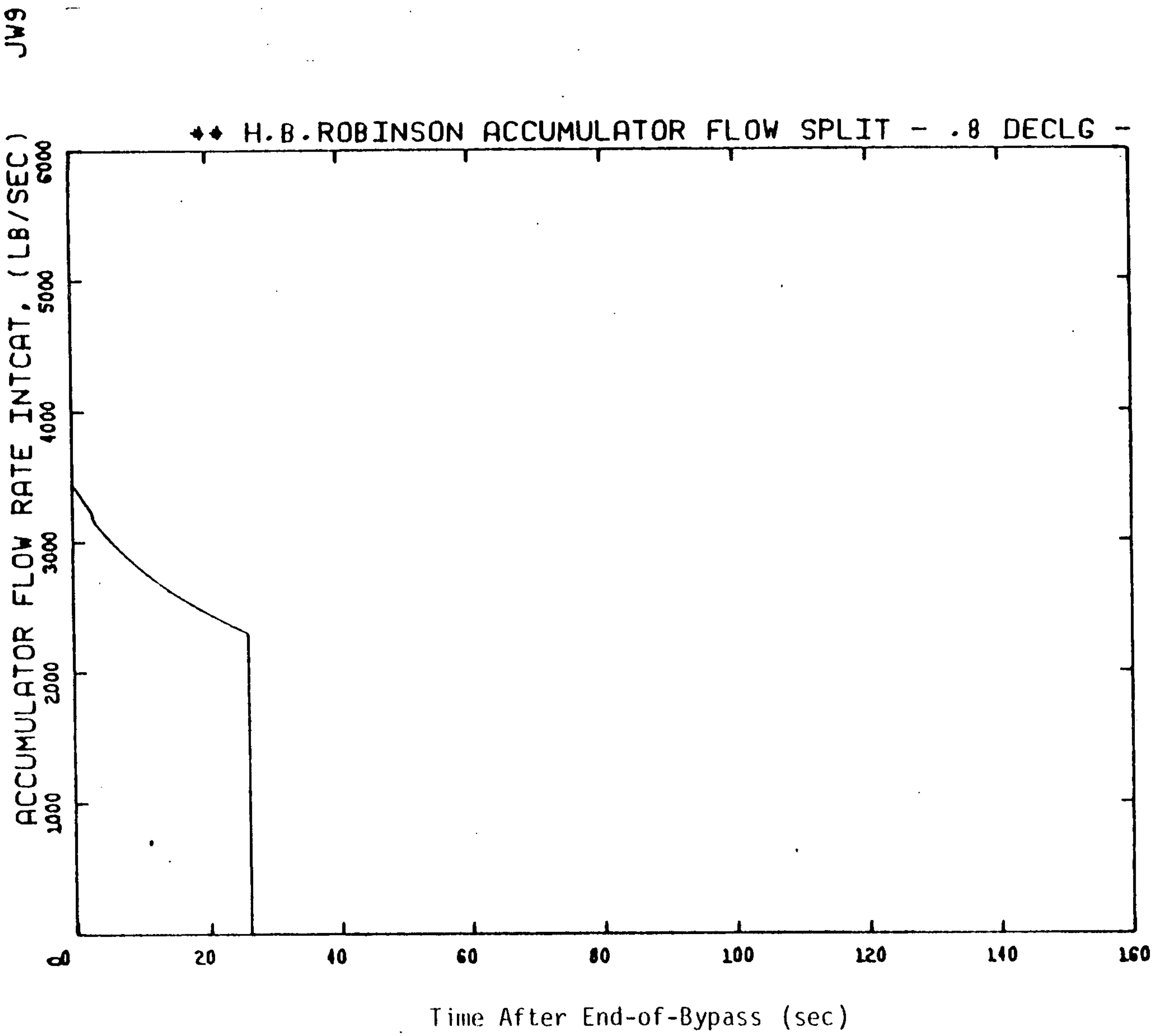



Figure 3.15 Accumulator (Intact) Flow During Refill and Reflood Periods, 0.8 DECLG Break

JW5

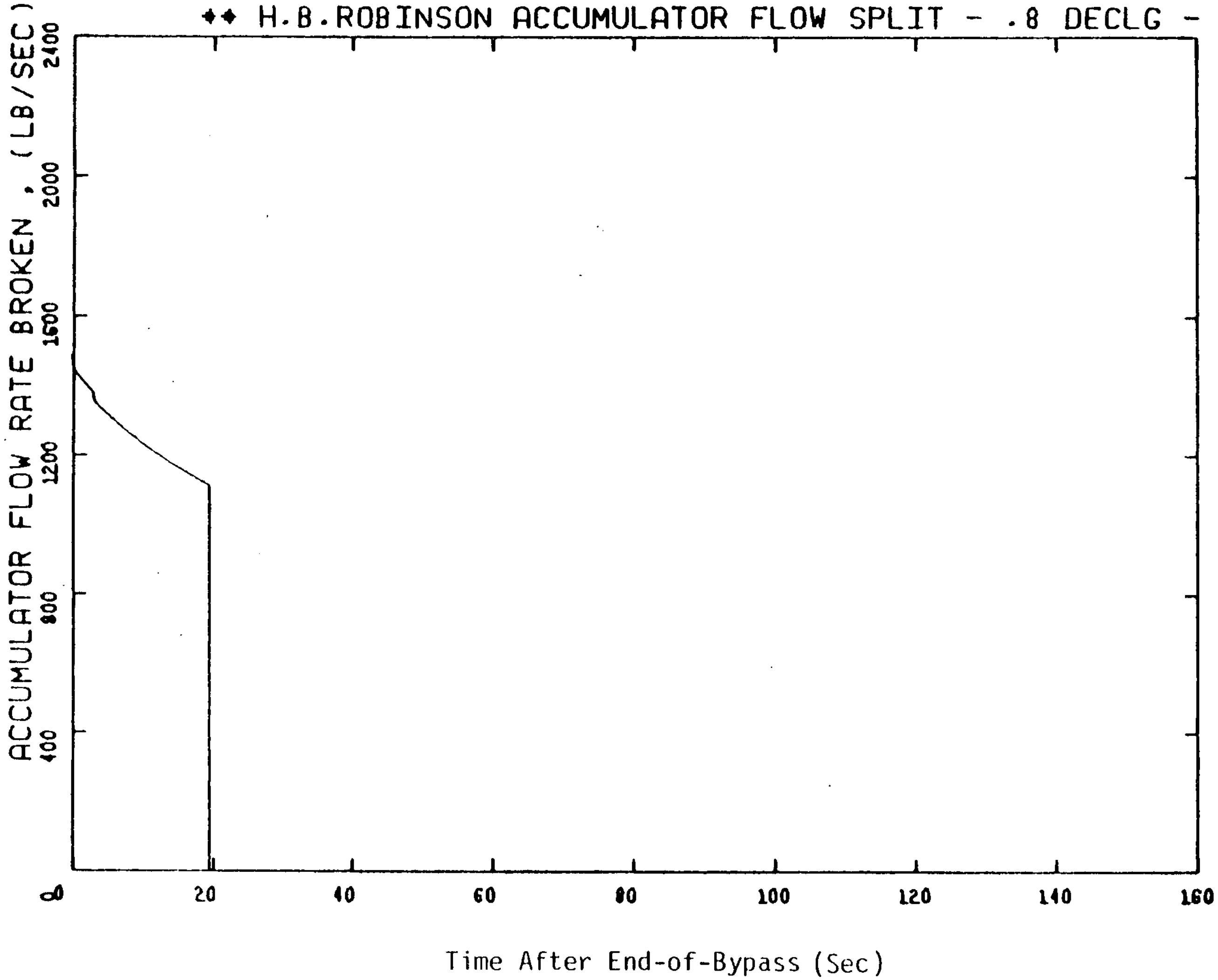



Figure 3.16 Accumulator (Broken) Flow During Refill and Reflood Periods, 0.8 DECLG Break

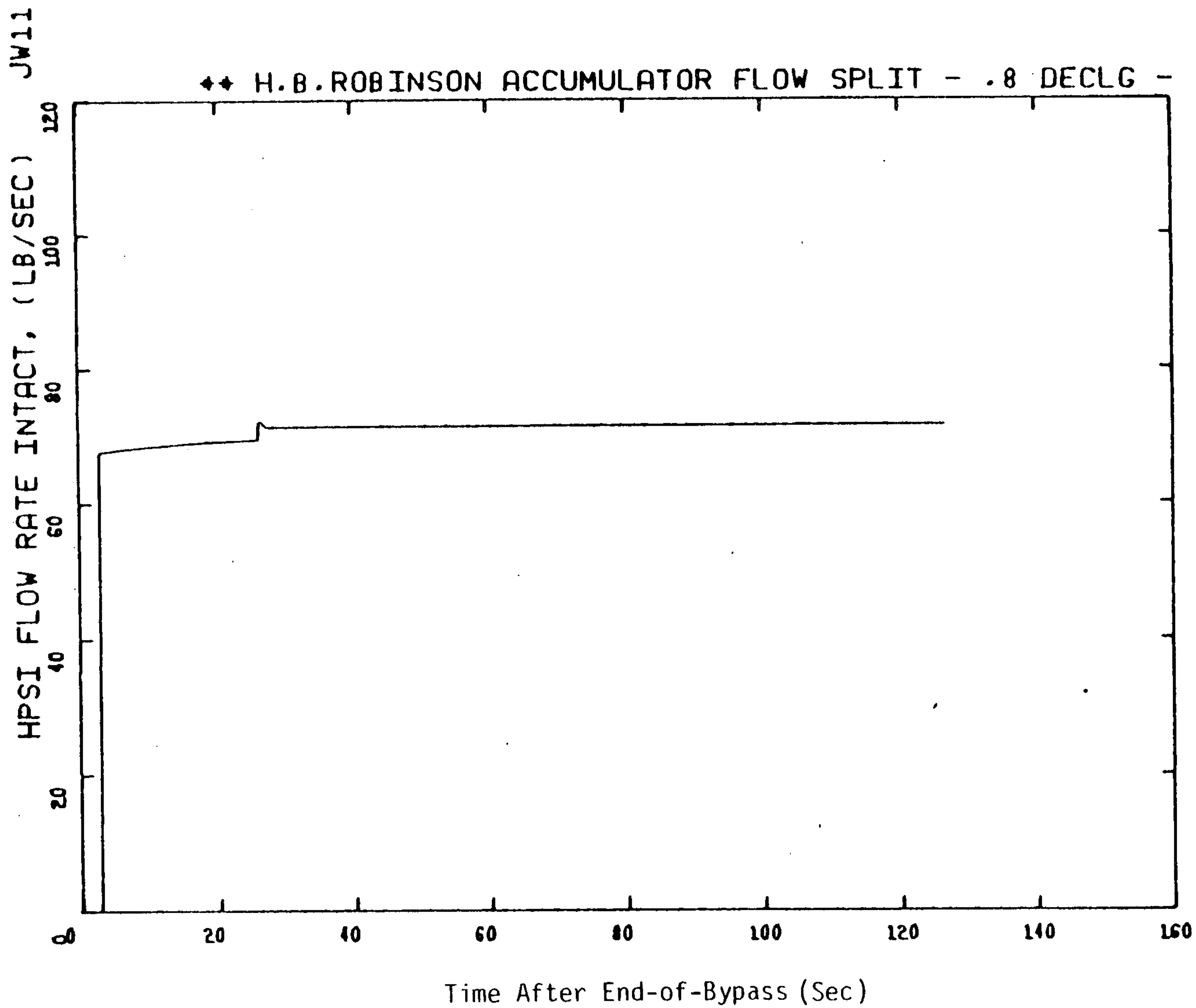



Figure 3.17 HPSI (Intact) Flow During Refill and Reflood Periods, 0.8 DECLG Break

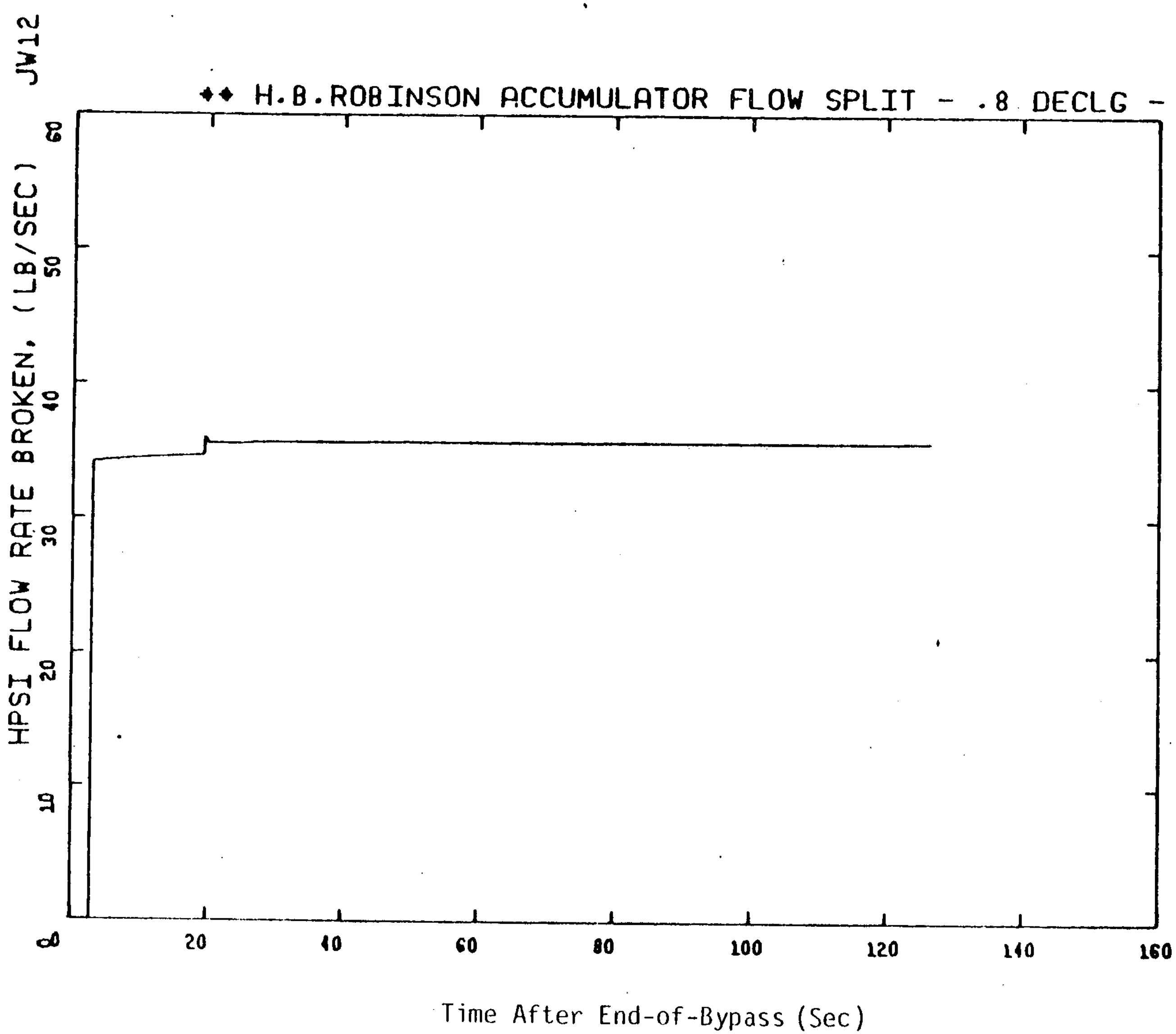
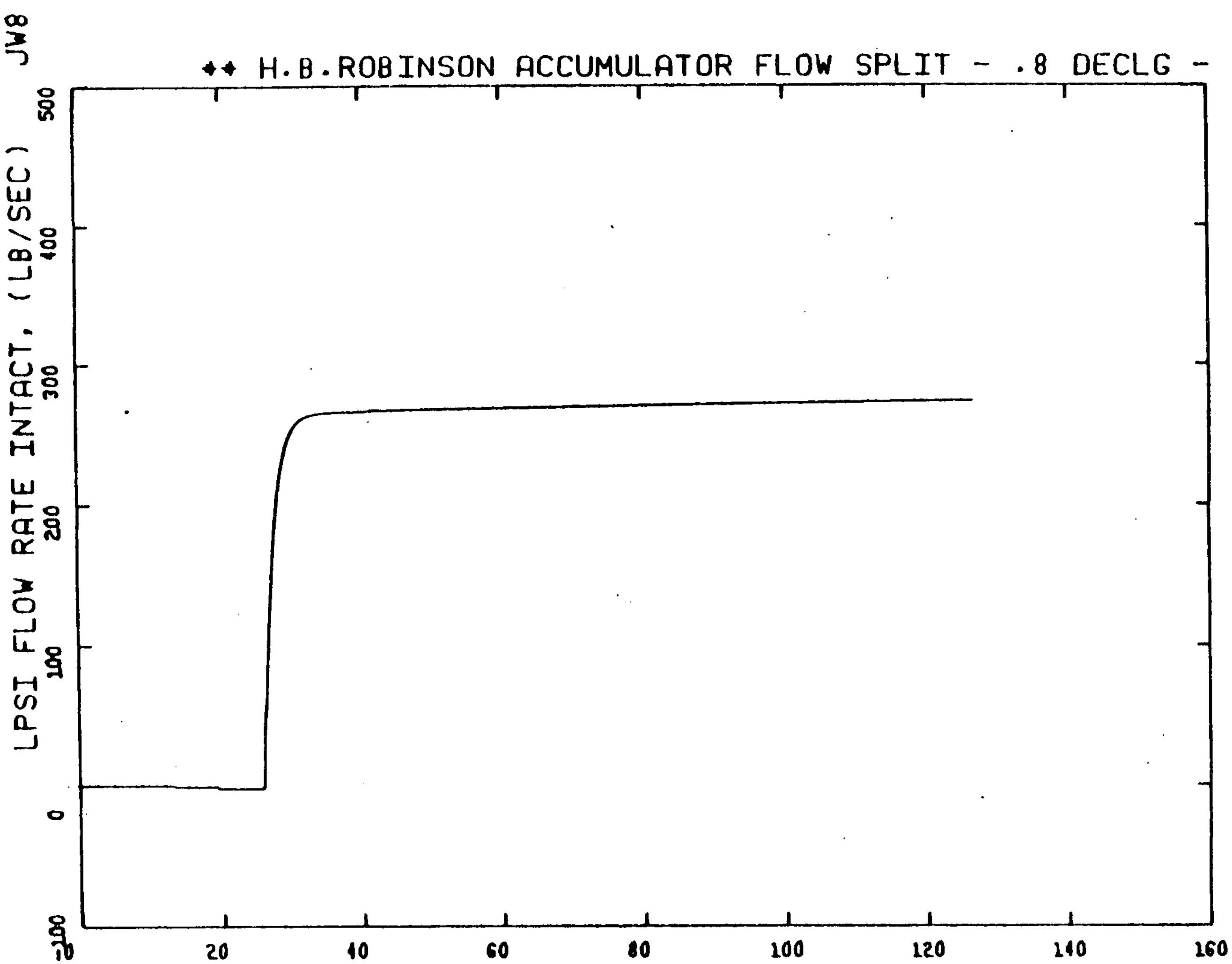



Figure 3.18 HPSI (Broken) Flow During Refill and Reflood Periods, 0.8 DECLG Break




Time After End-of-Bypass (Sec)

Figure 3.19 LPSI (Intact) Flow During Refill and Reflood Periods, 0.8 DECLG Break

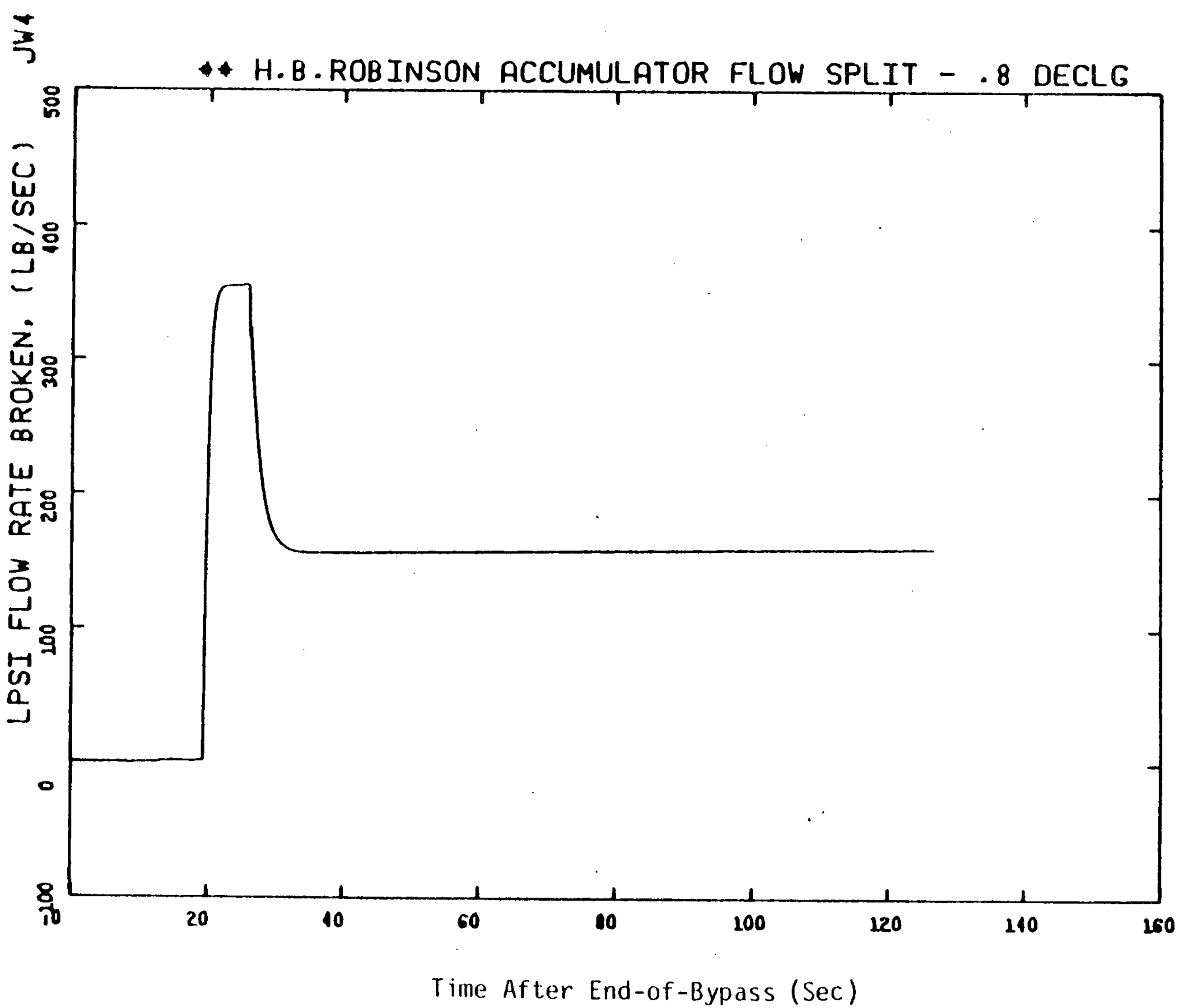



Figure 3.20 LPSI (Broken) Flow During Refill and Reflood Periods, 0.8 DECLG Break

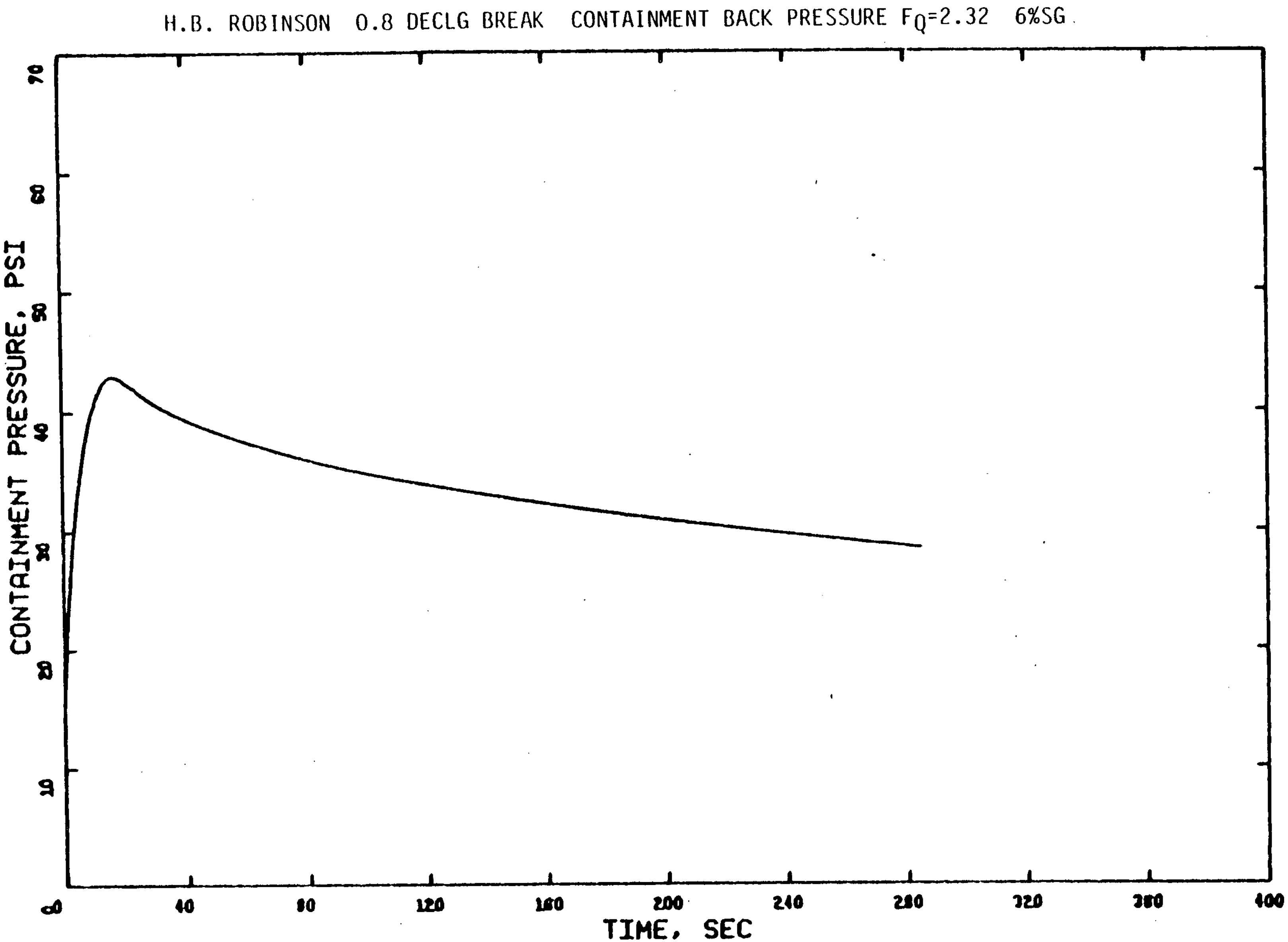



Figure 3.21 Containment Back Pressure, 0.8 DECLG Break

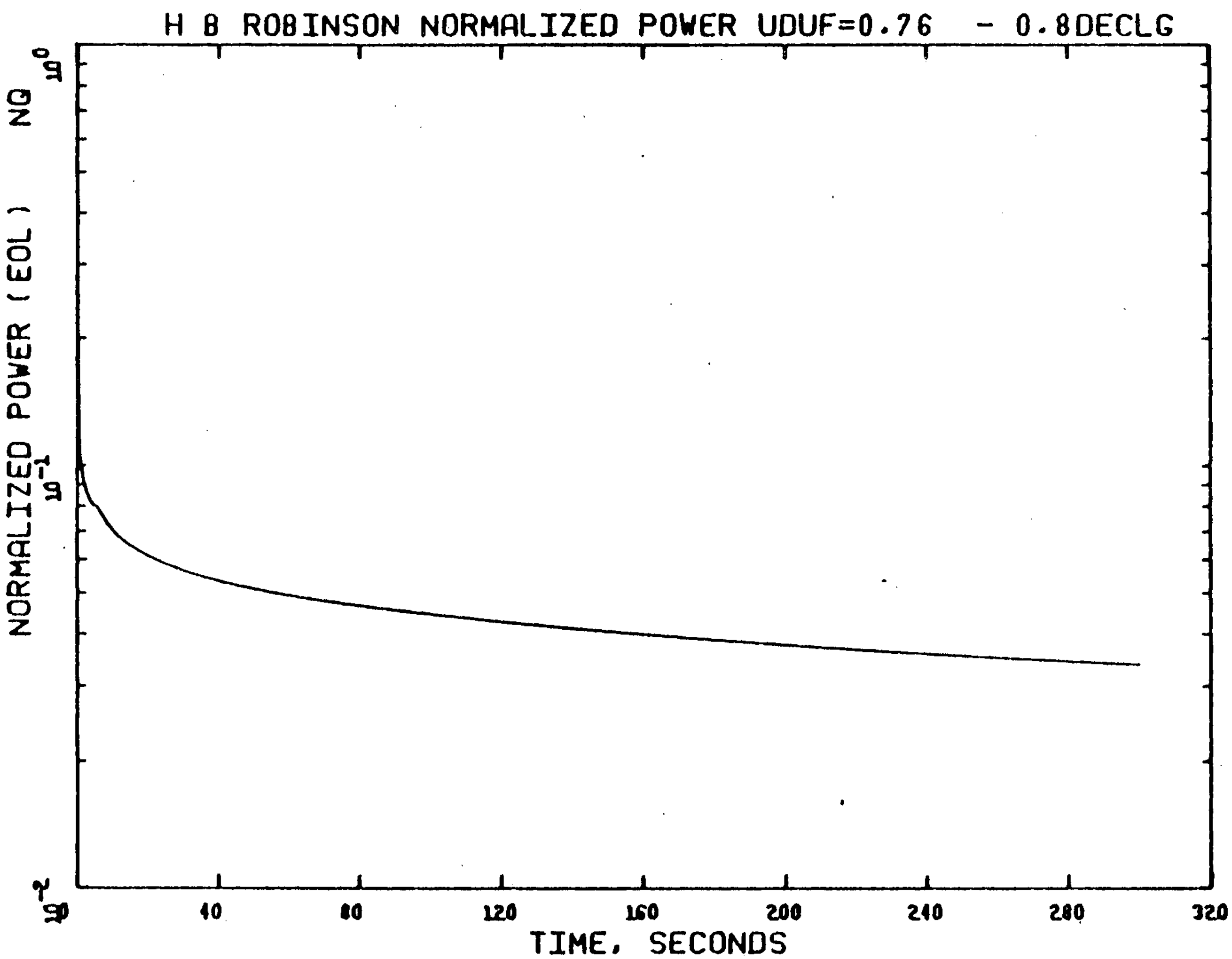



Figure 3.22 Normalized Power, 0.8 DECLG Break

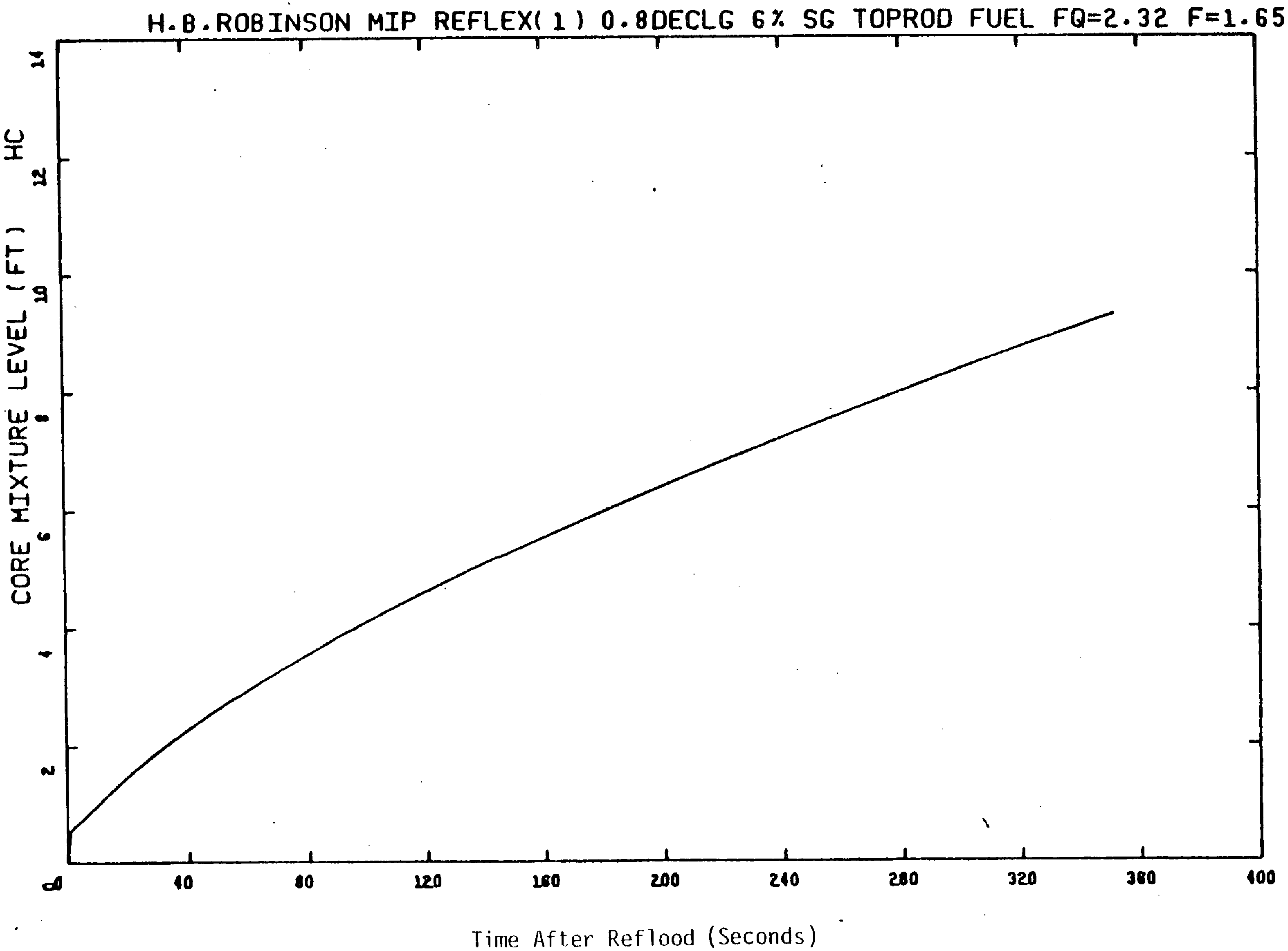



Figure 3.23 Reflood Core Mixture Level, 0.8 DECLG Break

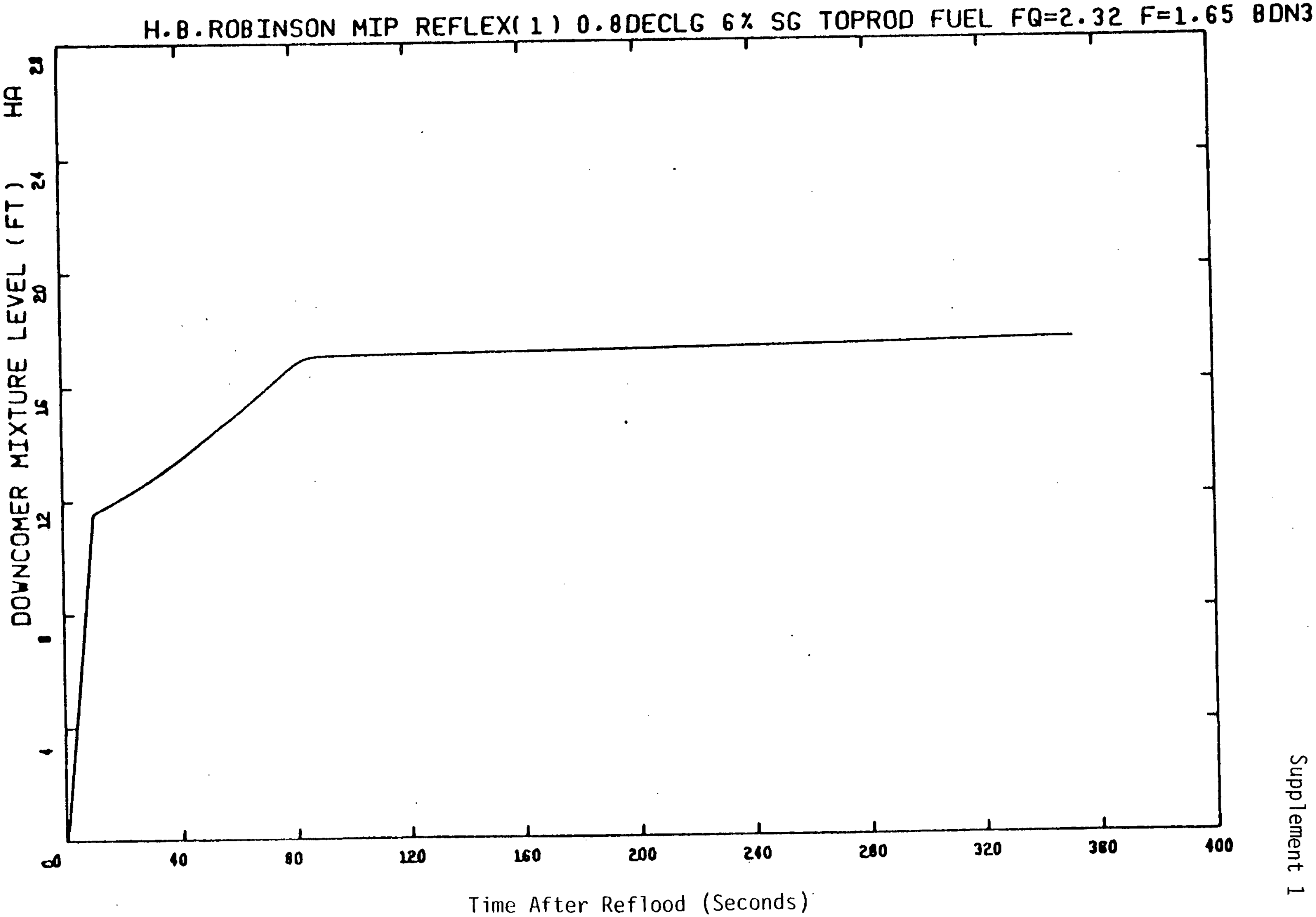



Figure 3.24 Reflood Downcomer Mixture Level, 0.8 DECLG Break

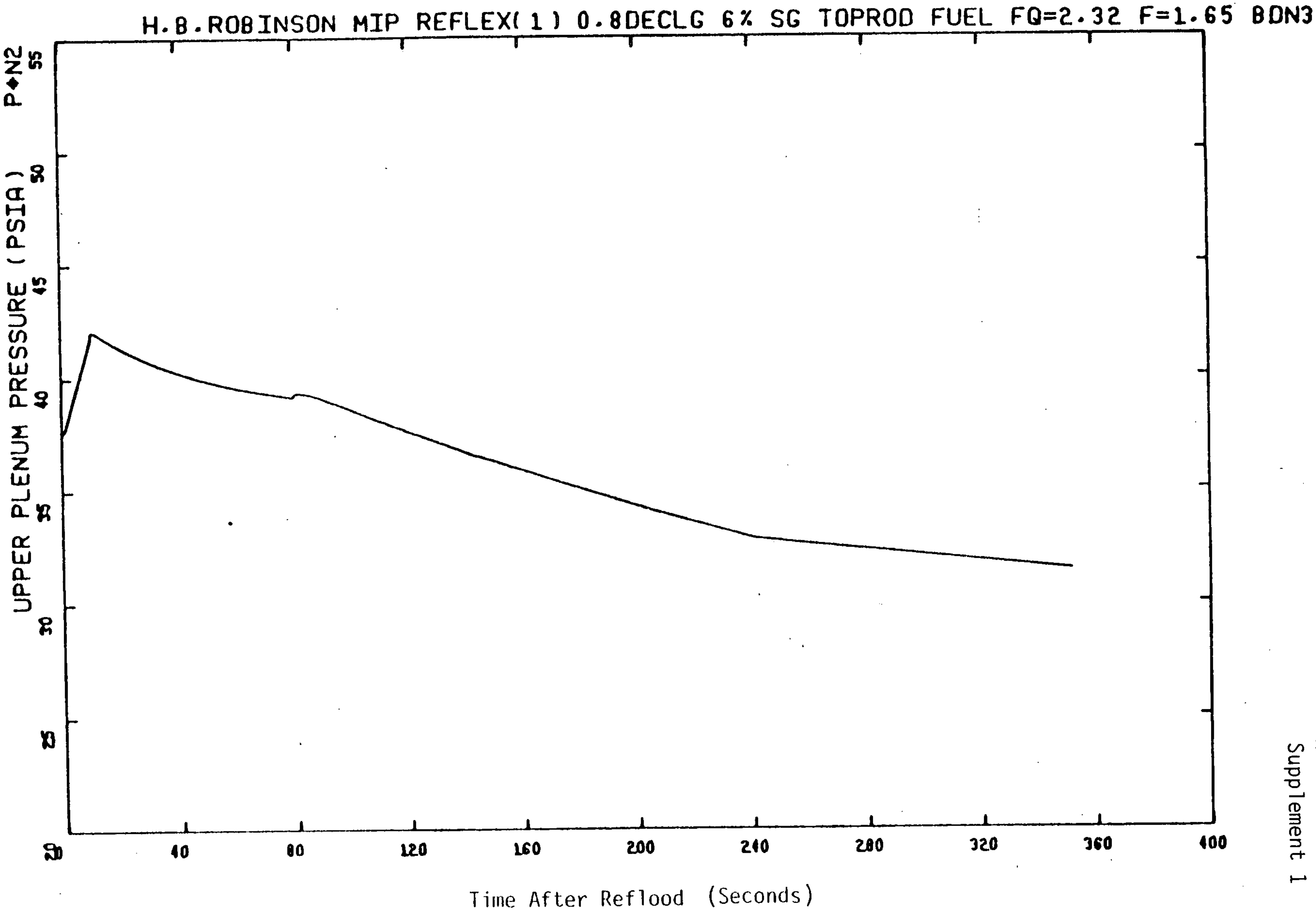



Figure 3.25 Reflood Upper Plenum Pressure, 0.8 DECLG Break

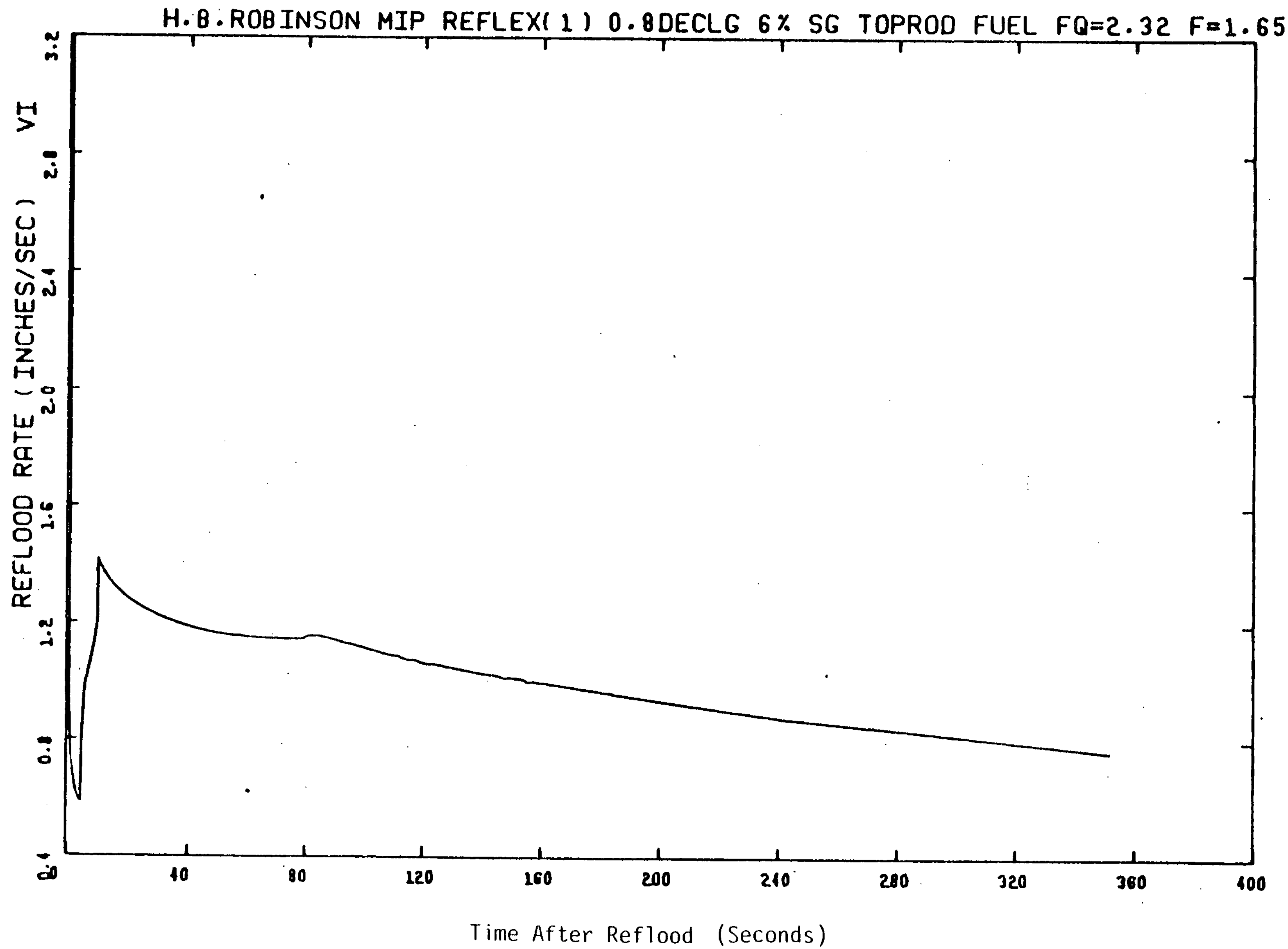



Figure 3.26 Core Flooding Rate, 0.8 DECLG Break

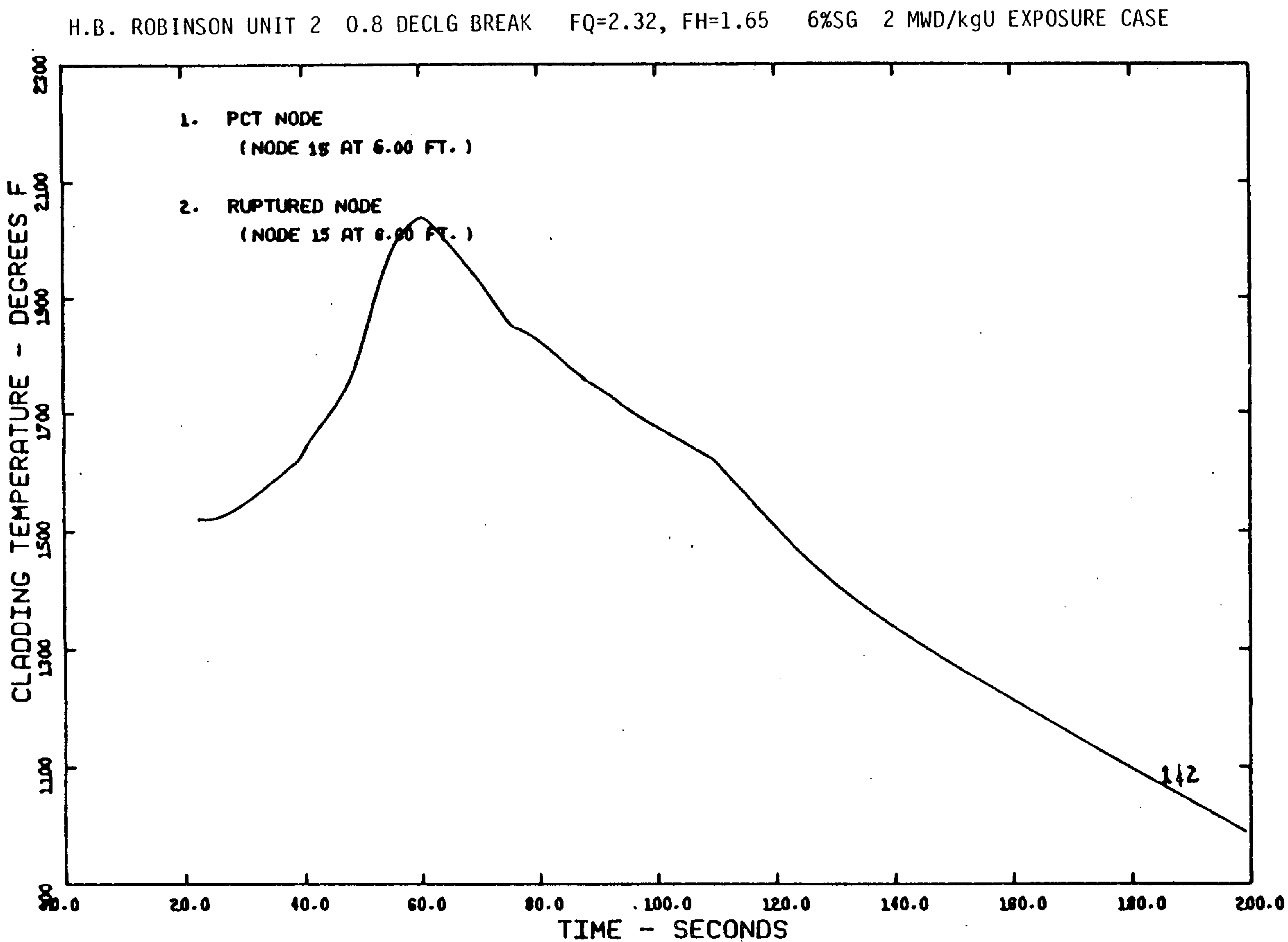



Figure 3.27 TOODEE2 Cladding Temperature vs. Time, 0.8 DECLG Break, 2 MWD/kgU Exposure

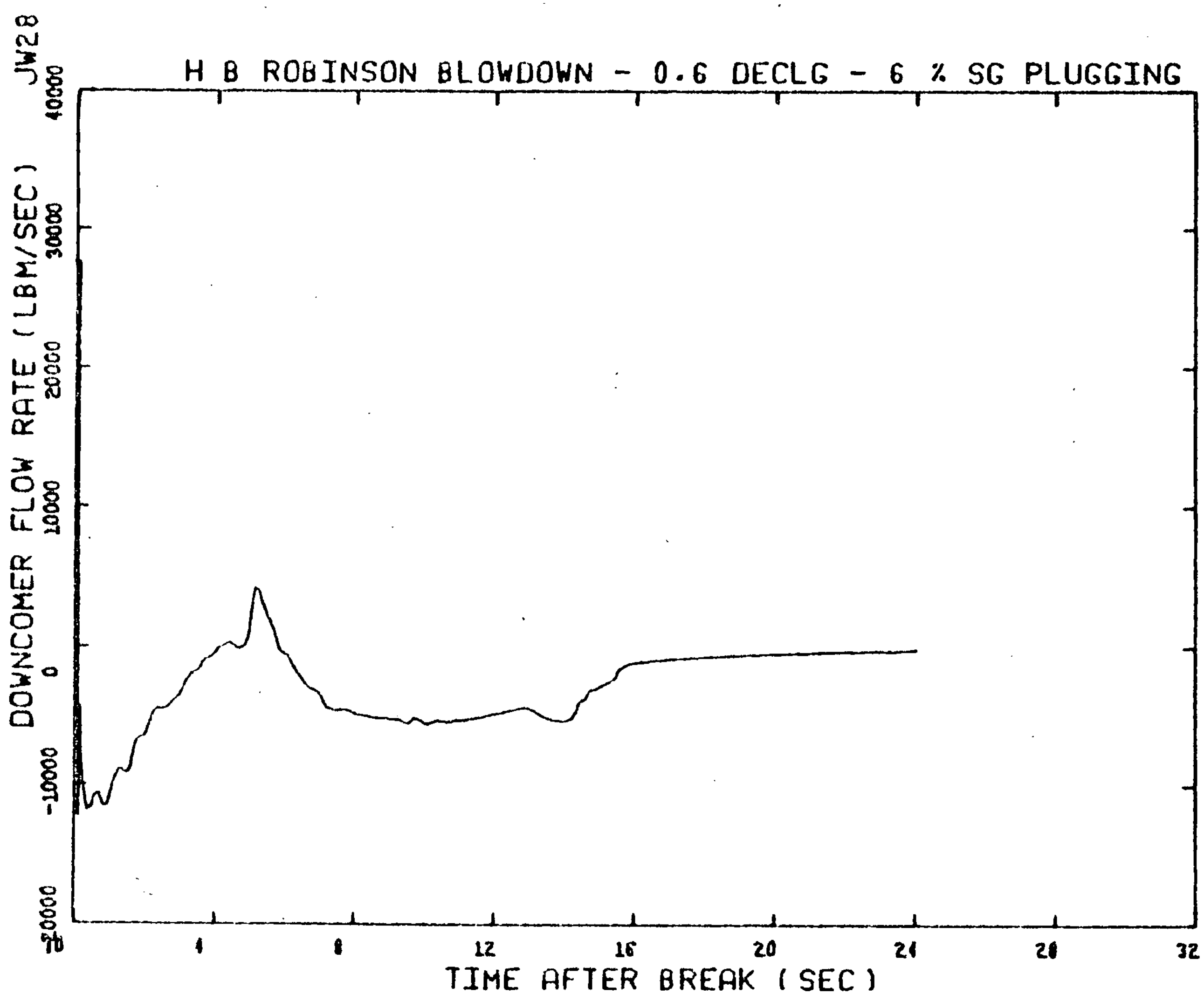



Figure 3.28 Downcomer Flow Rate During Blowdown Period, 0.6 DECLG Break

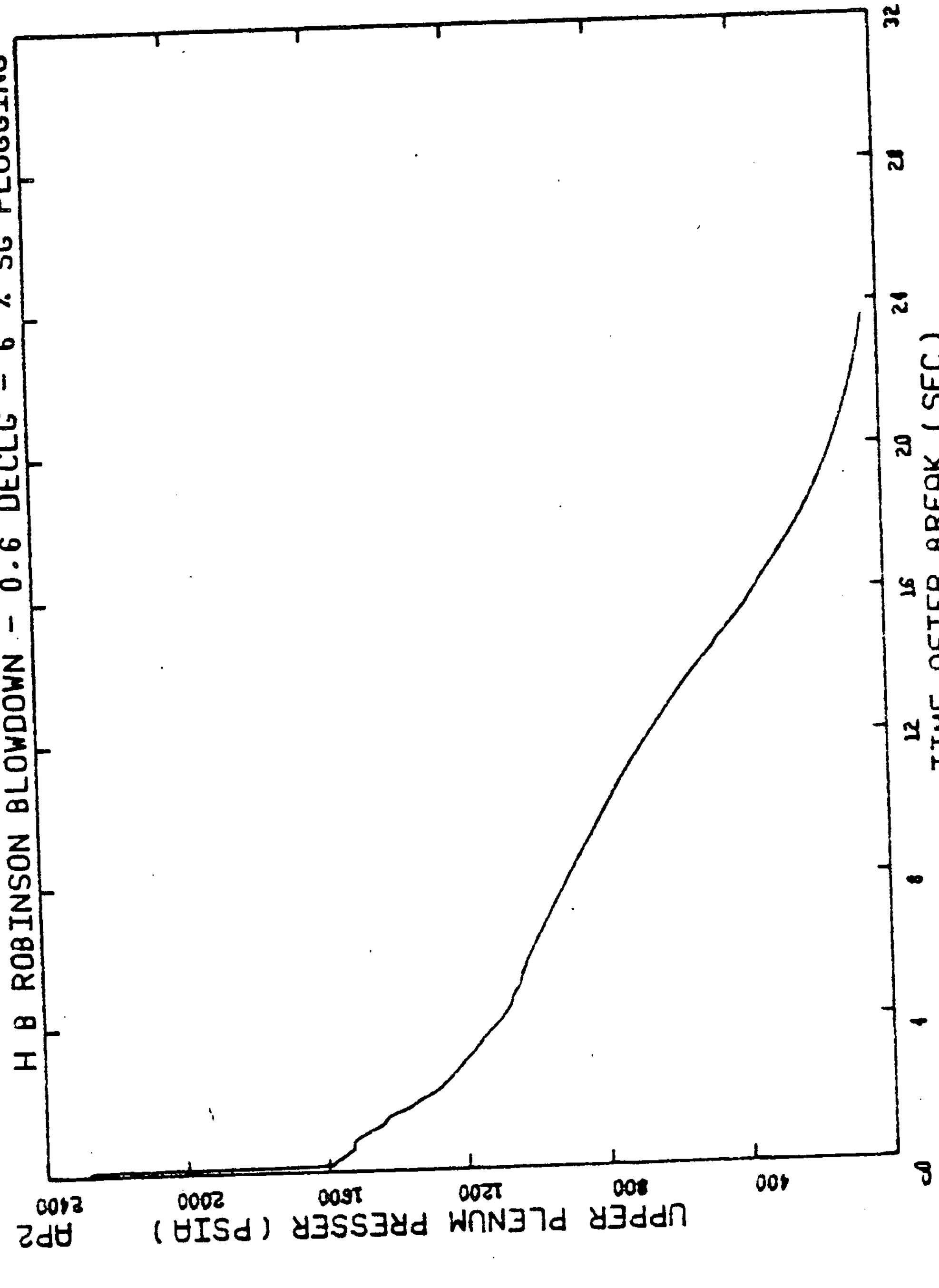



Figure 3.29 Upper Plenum Pressure During Blowdown Period, 0.6 DECLG Break

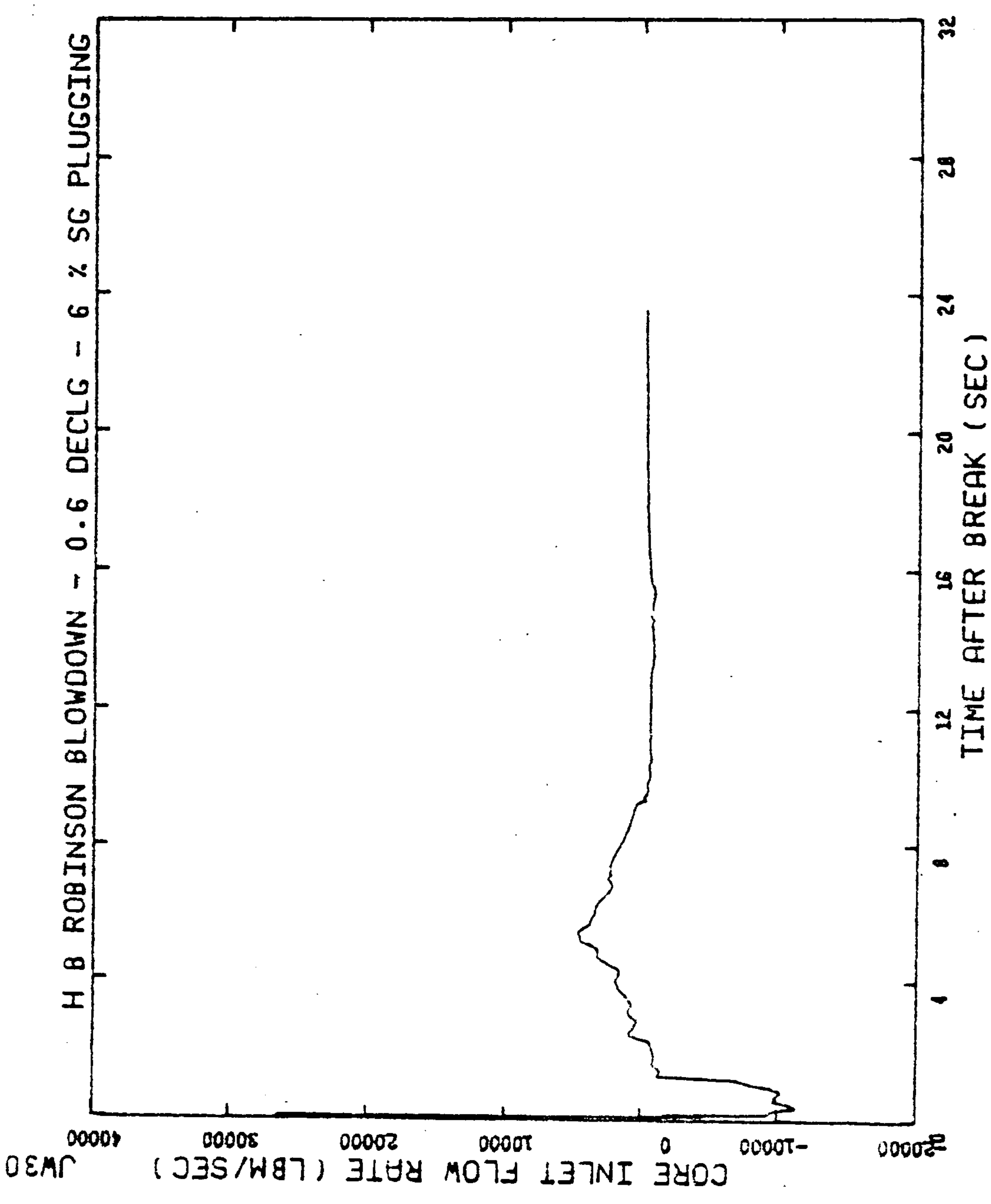



Figure 3.30 Average Core Inlet Flow During Blowdown Period, 0.6 DECLG Break

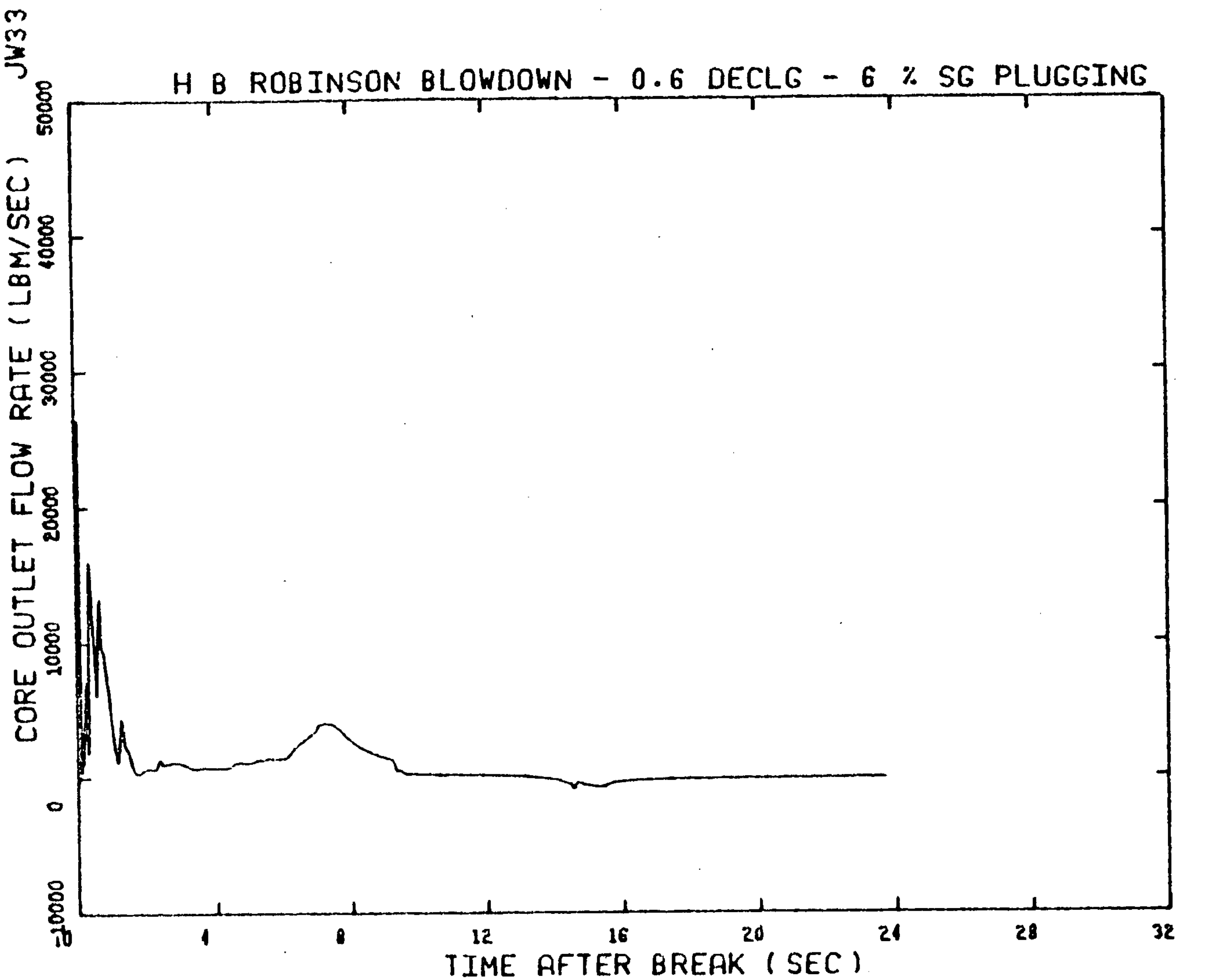



Figure 3.31 Average Core Outlet Flow During Blowdown Period, 0.6 DECLG Break

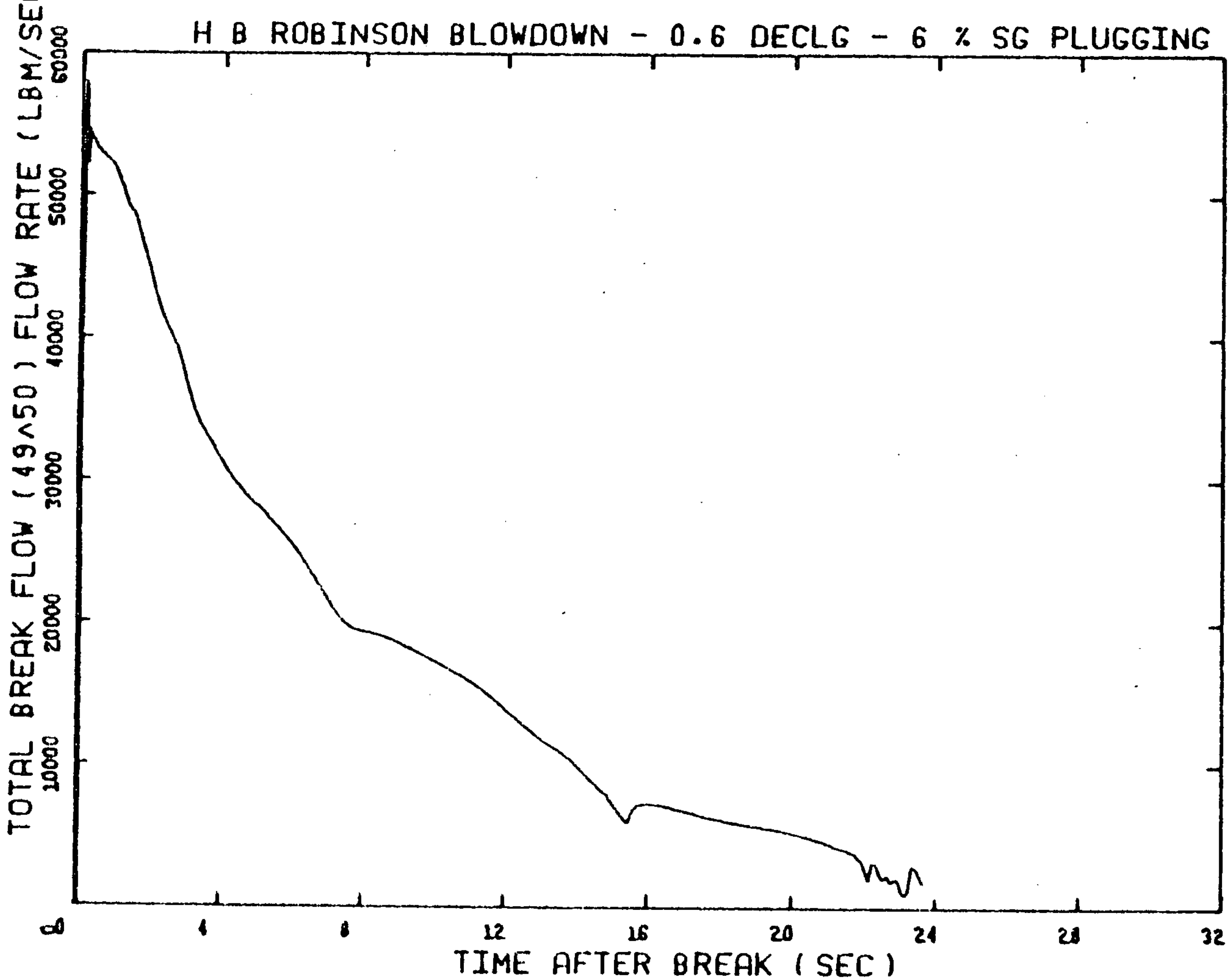



Figure 3.32 Total Break Flow During Blowdown Period, 0.6 DECLG Break

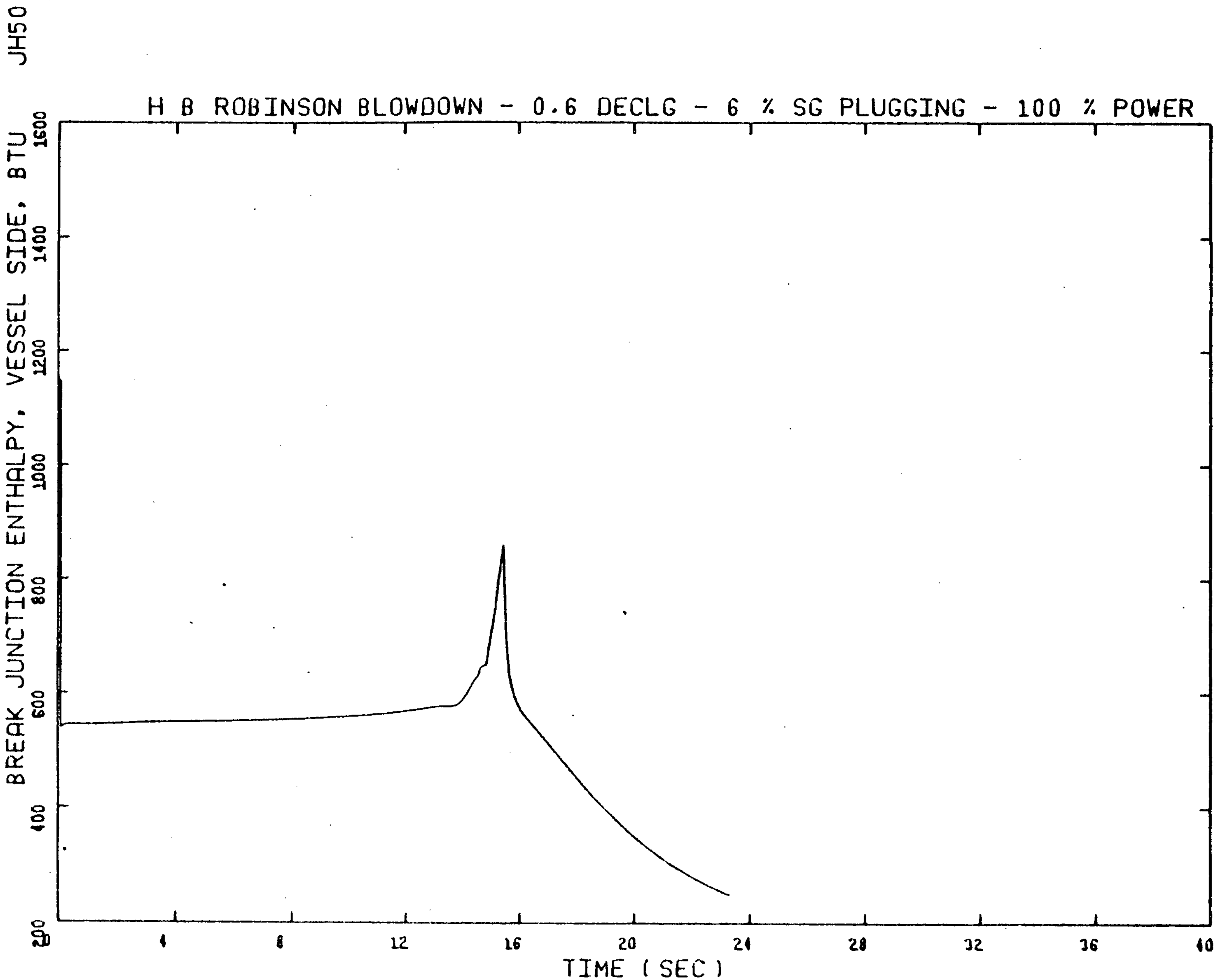



Figure 3.33 Break Flow Enthalpy During Blowdown Period, Vessel Side, 0.6 DECLG Break

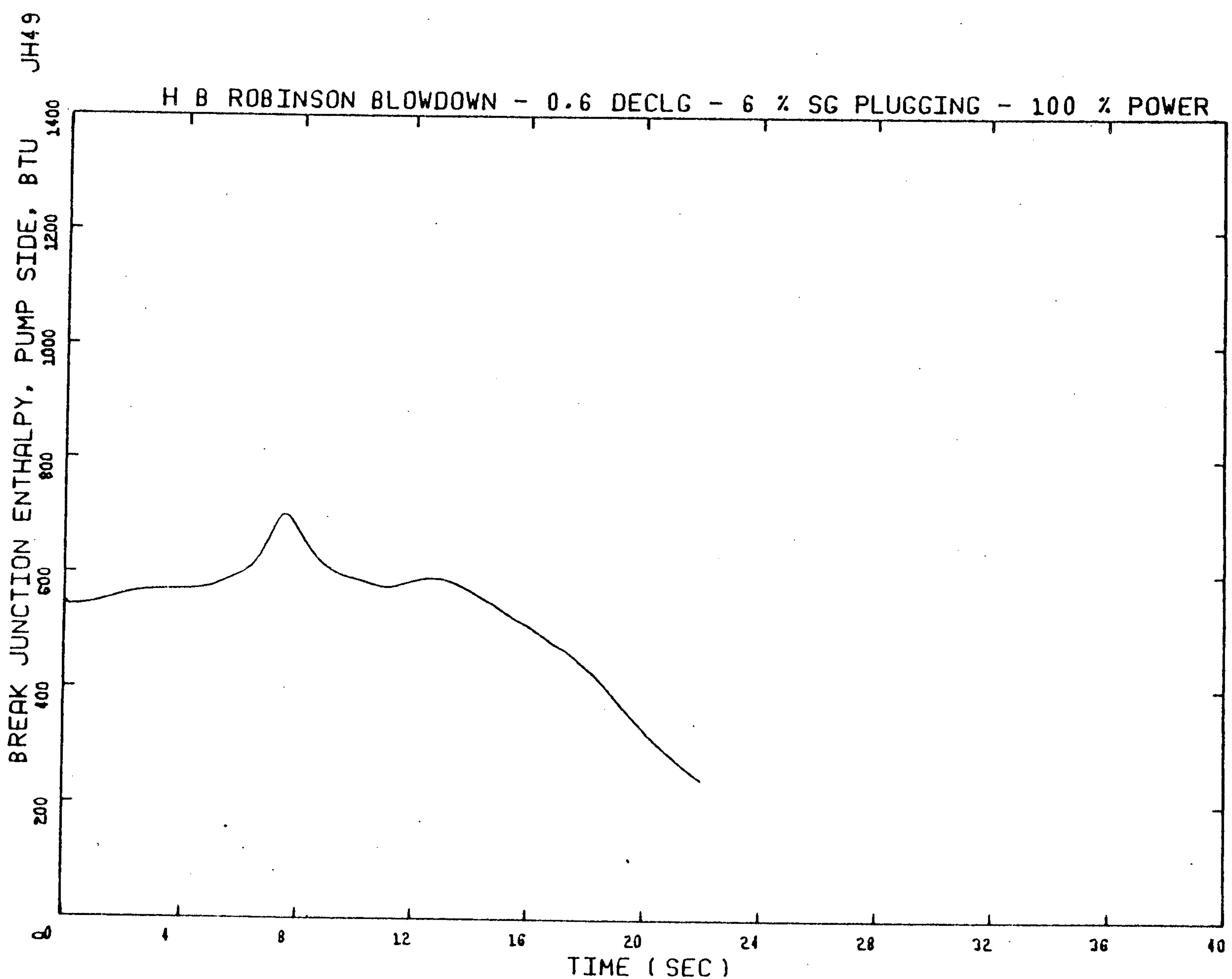



Figure 3.34 Break Flow Enthalpy During Blowdown Period, Pump Side, 0.6 DECLG Break

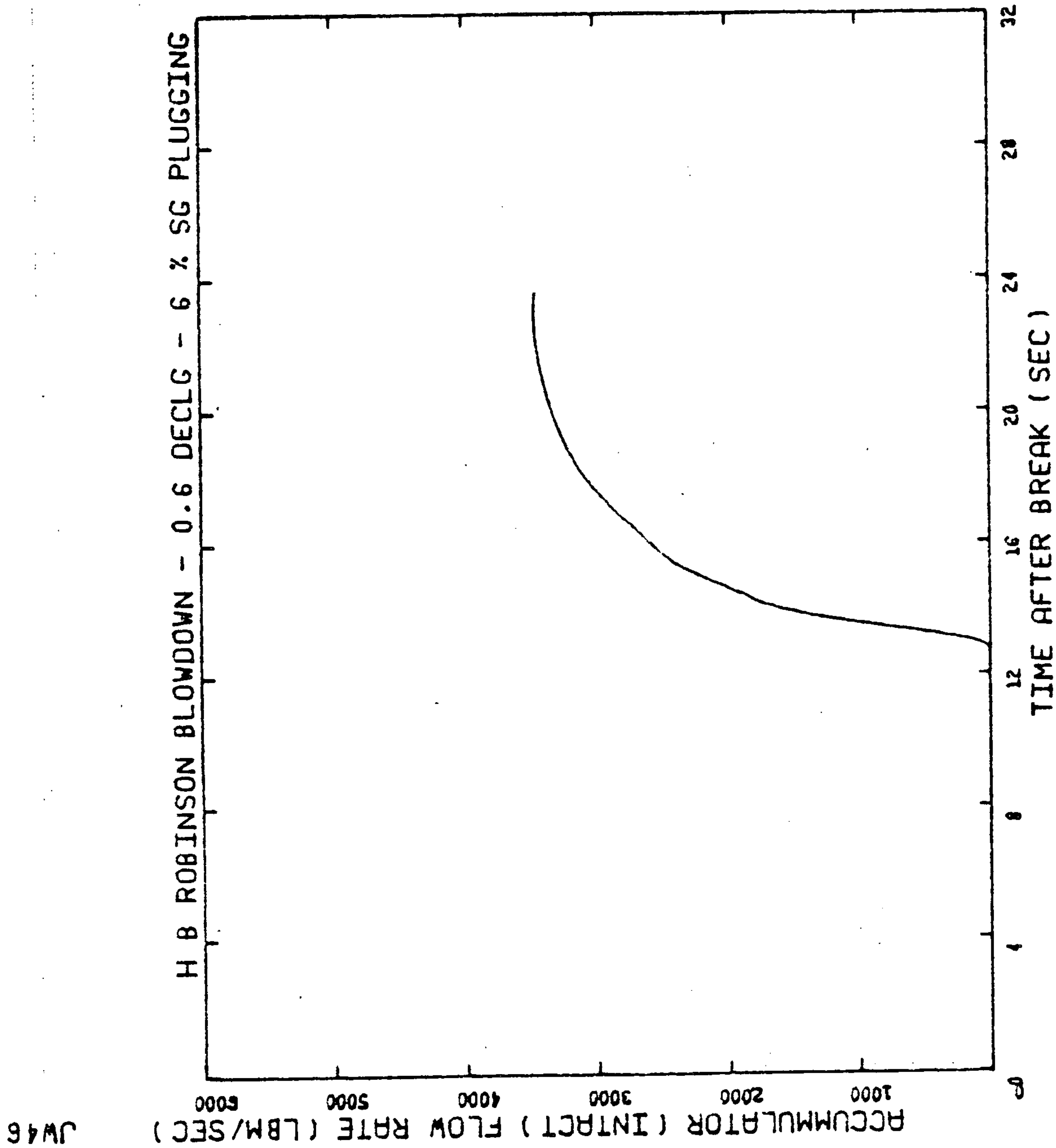



Figure 3.35 Flow from Intact Loop Accumulator During Blowdown Period, 0.6 DECLG Break

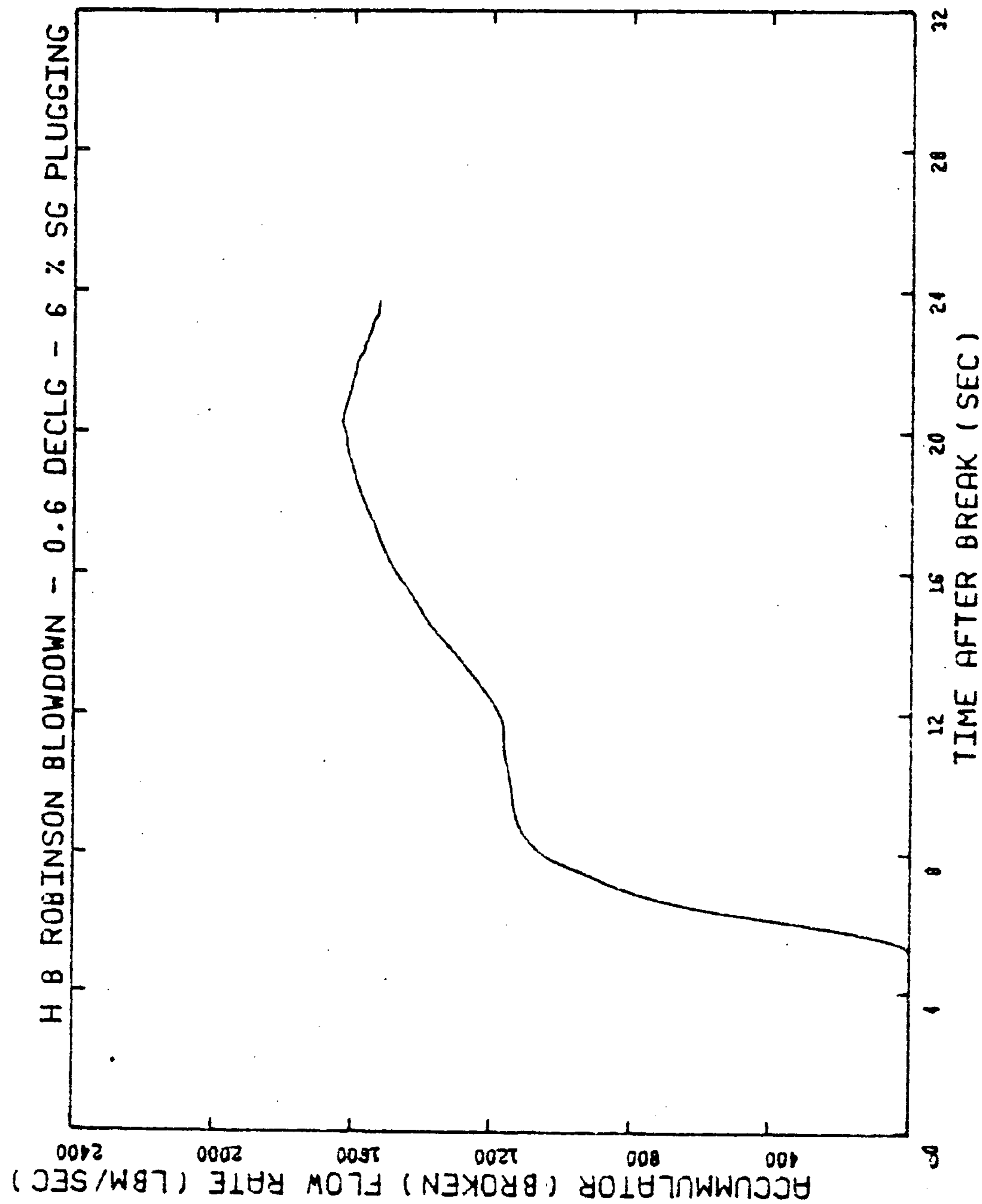



Figure 3.36 Flow from Broken Loop Accumulator During Blowdown Period, 0.6 DECLG Break

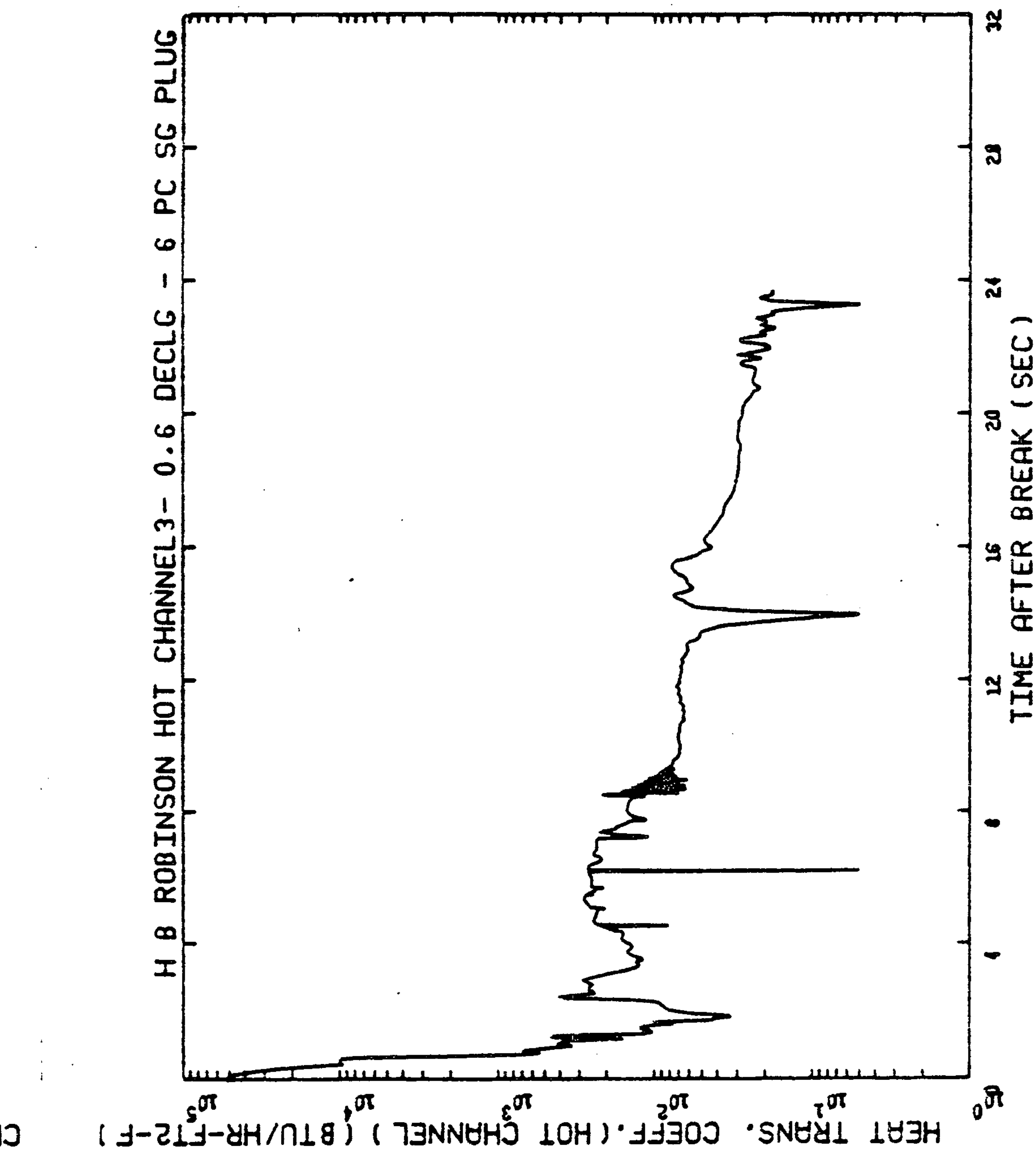



Figure 3.37 Heat Transfer Coefficient During Blowdown Period at PCT Node, 0.6 DECLG Break, 2 MWD/KgU

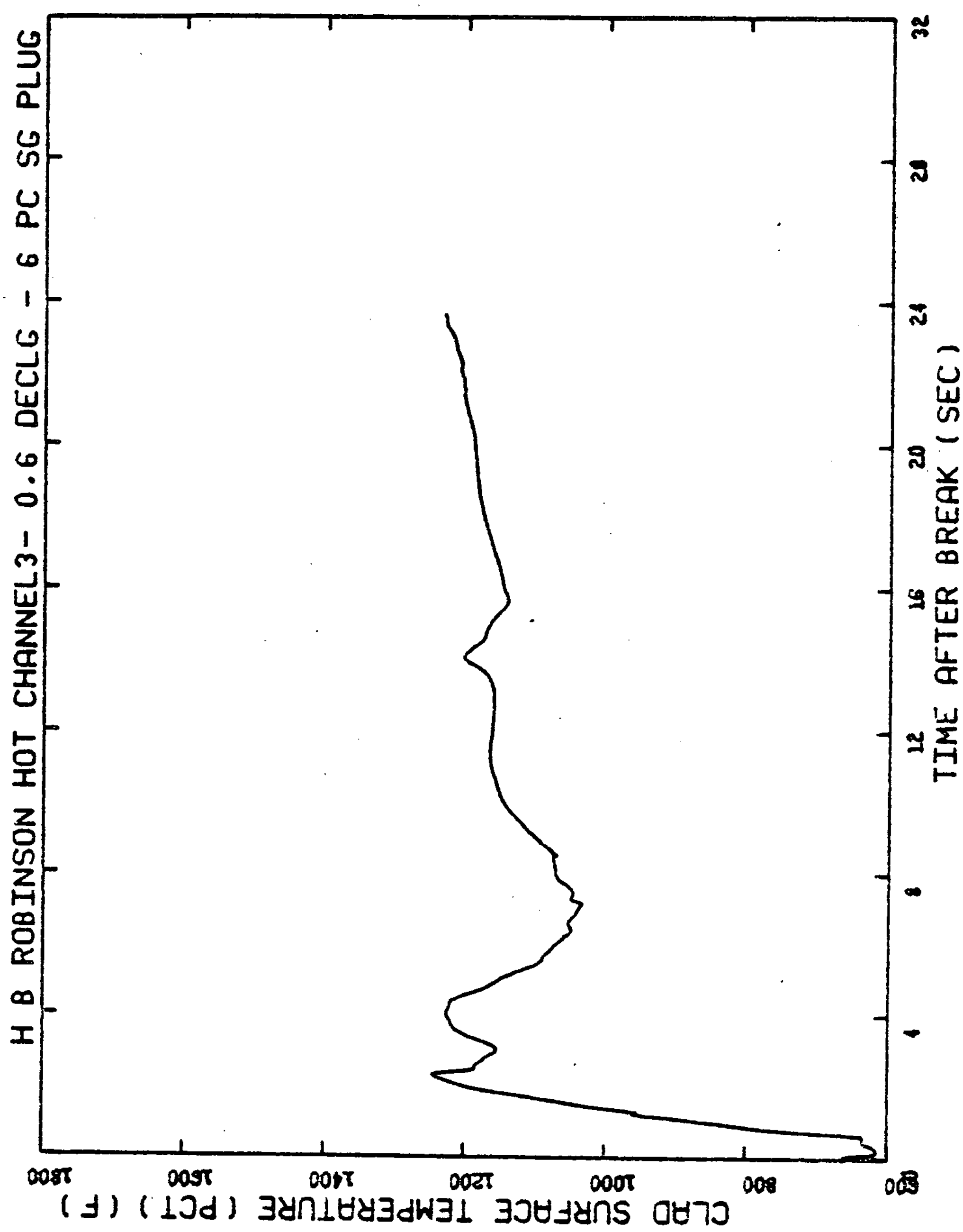



Figure 3.38 Clad Surface Temperature During Blowdown Period
PCT Node, 0.6 DECLG Break, 2 MWD/KgU

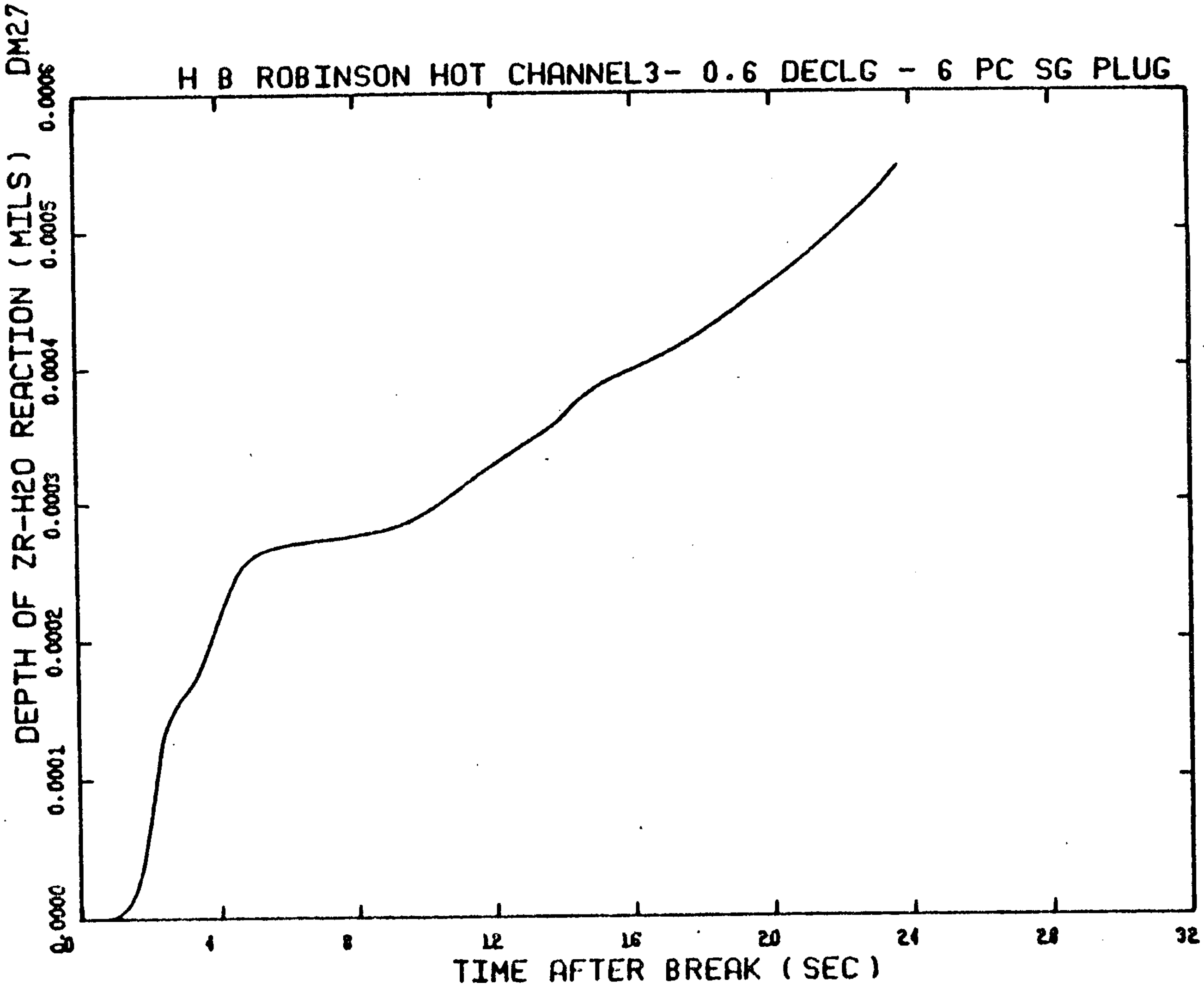



Figure 3.39 Depth of Metal-Water Reaction During Blowdown Period at PCT Node, 0.6 DECLG Break, 2 MWD/KgU

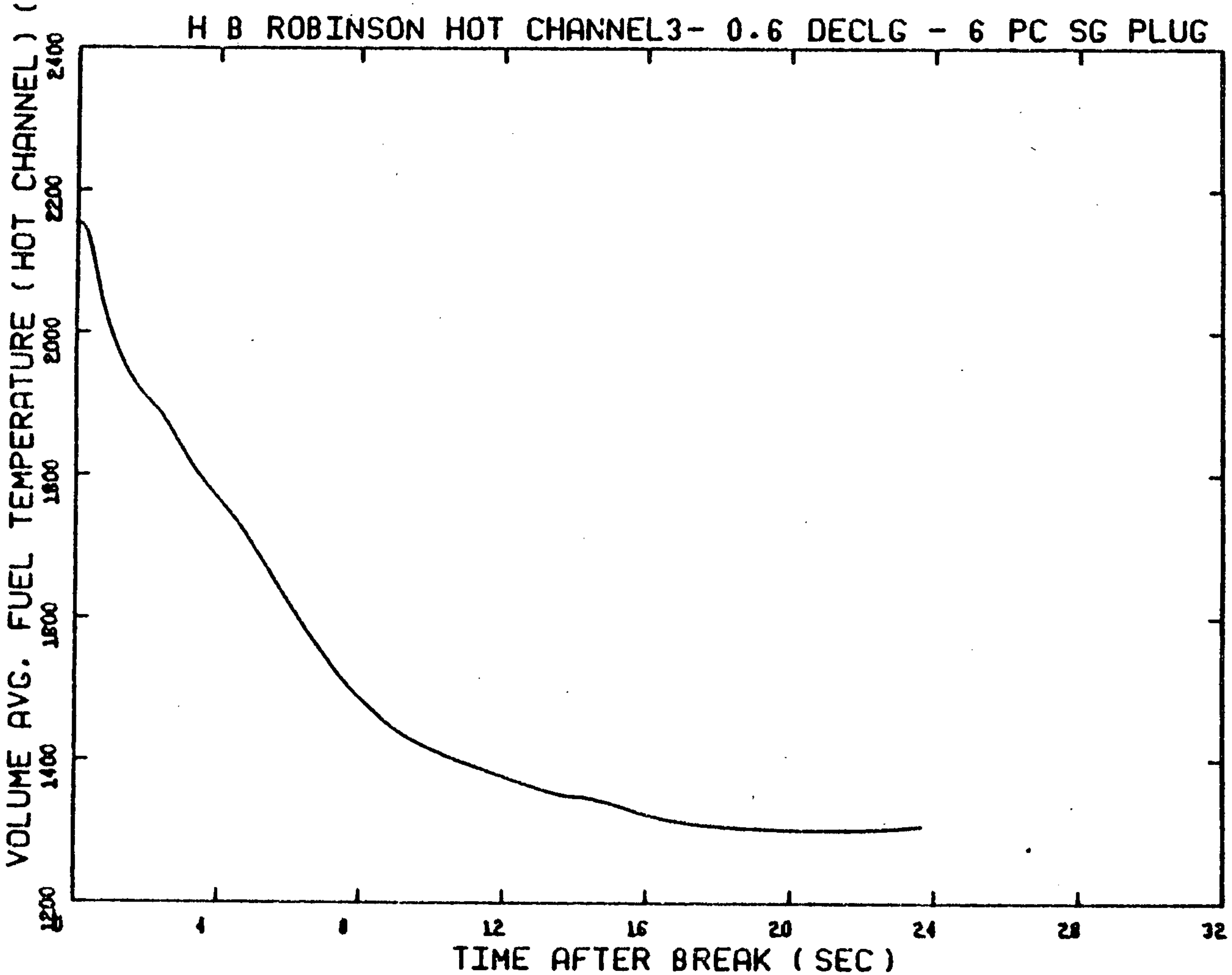



Figure 3.40 Average Fuel Temperature During Blowdown Period at PCT Node, 0.6 DECLG Break, 2 MWD/KgU

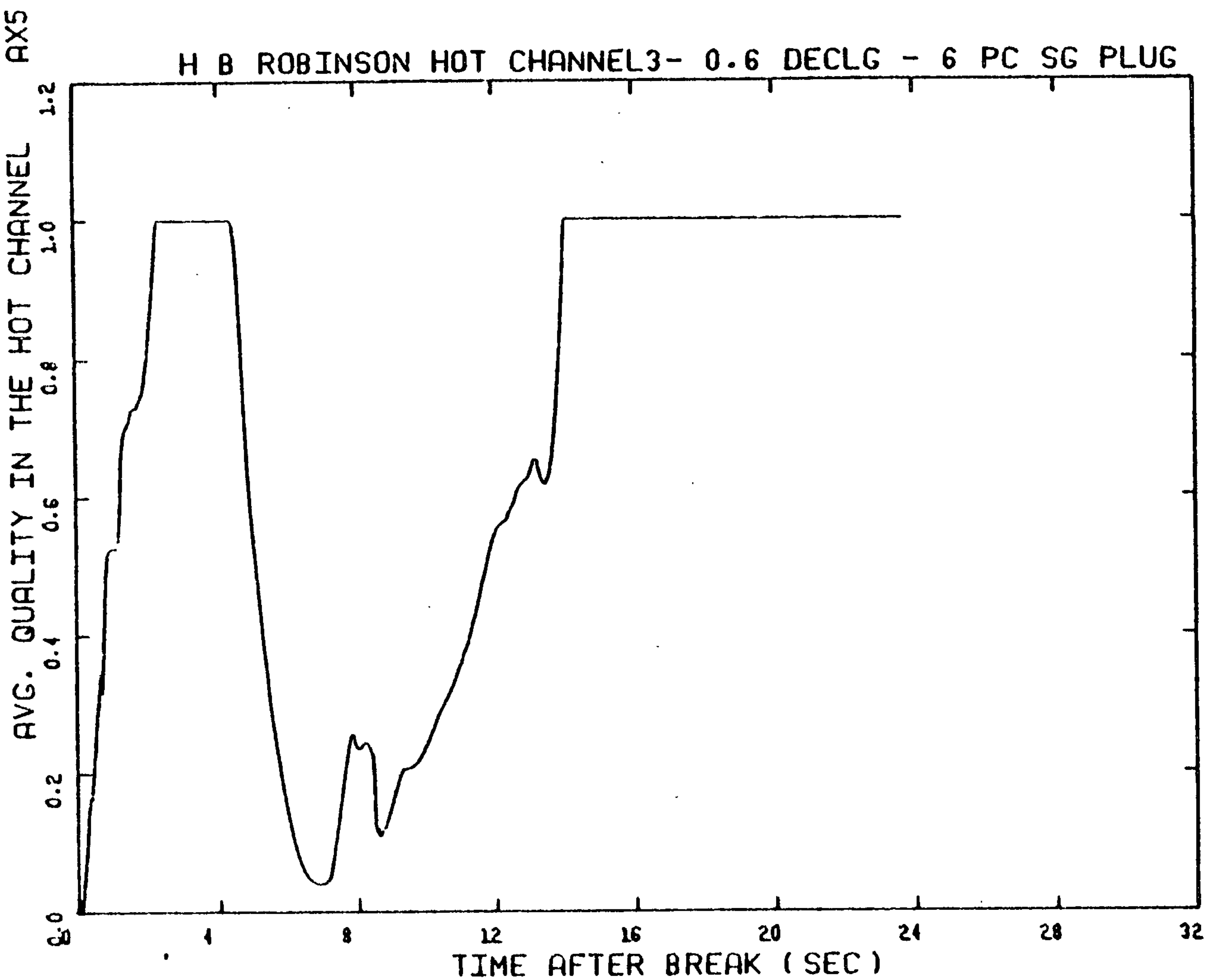



Figure 3.41 Hot Channel Average Quality, Center Volume
0.6 DECLG Break, 2 MWD/KgU

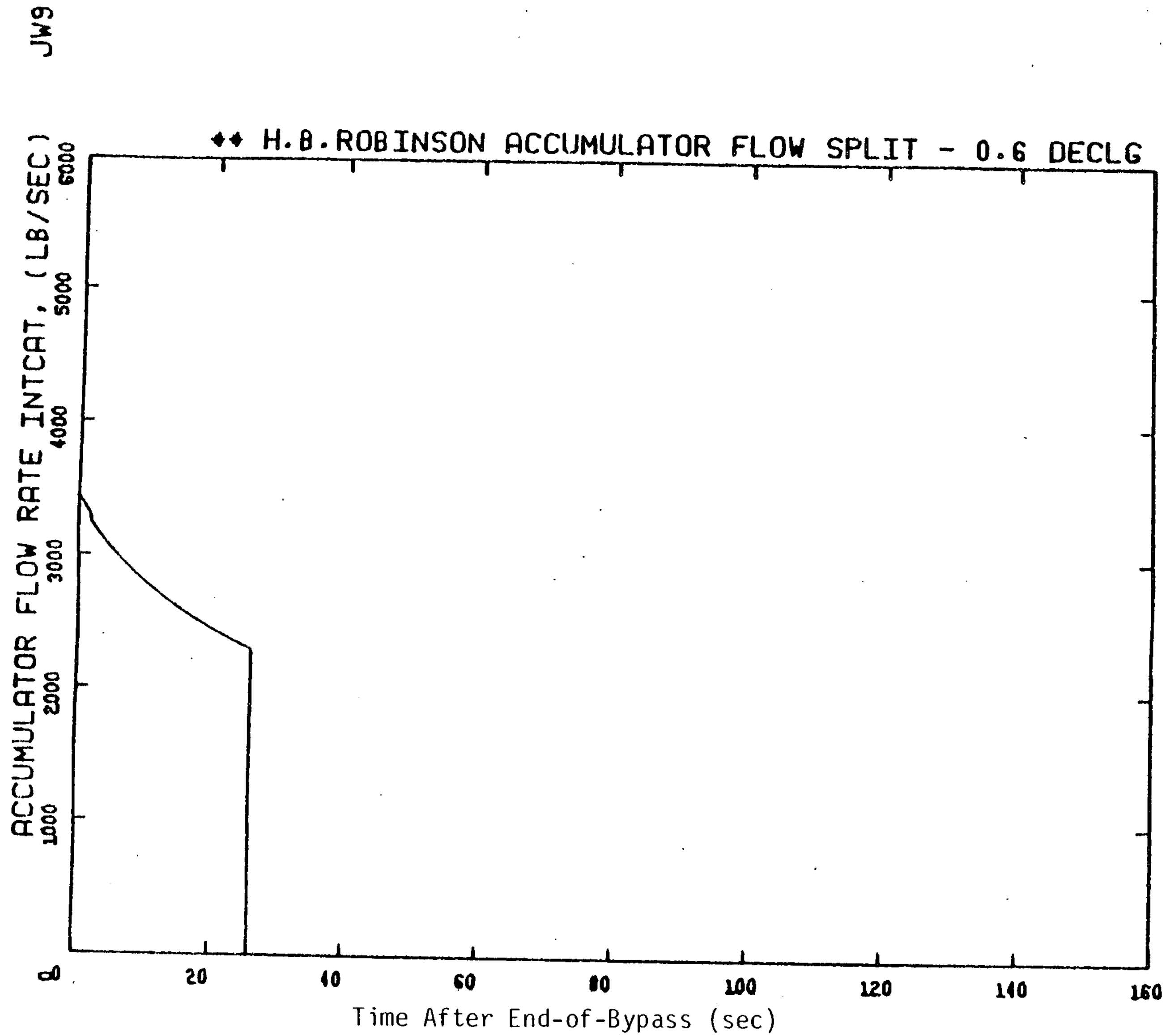



Figure 3.42 Accumulator (Intact) Flow During Refill and Reflood Periods, 0.6 DECLG Break

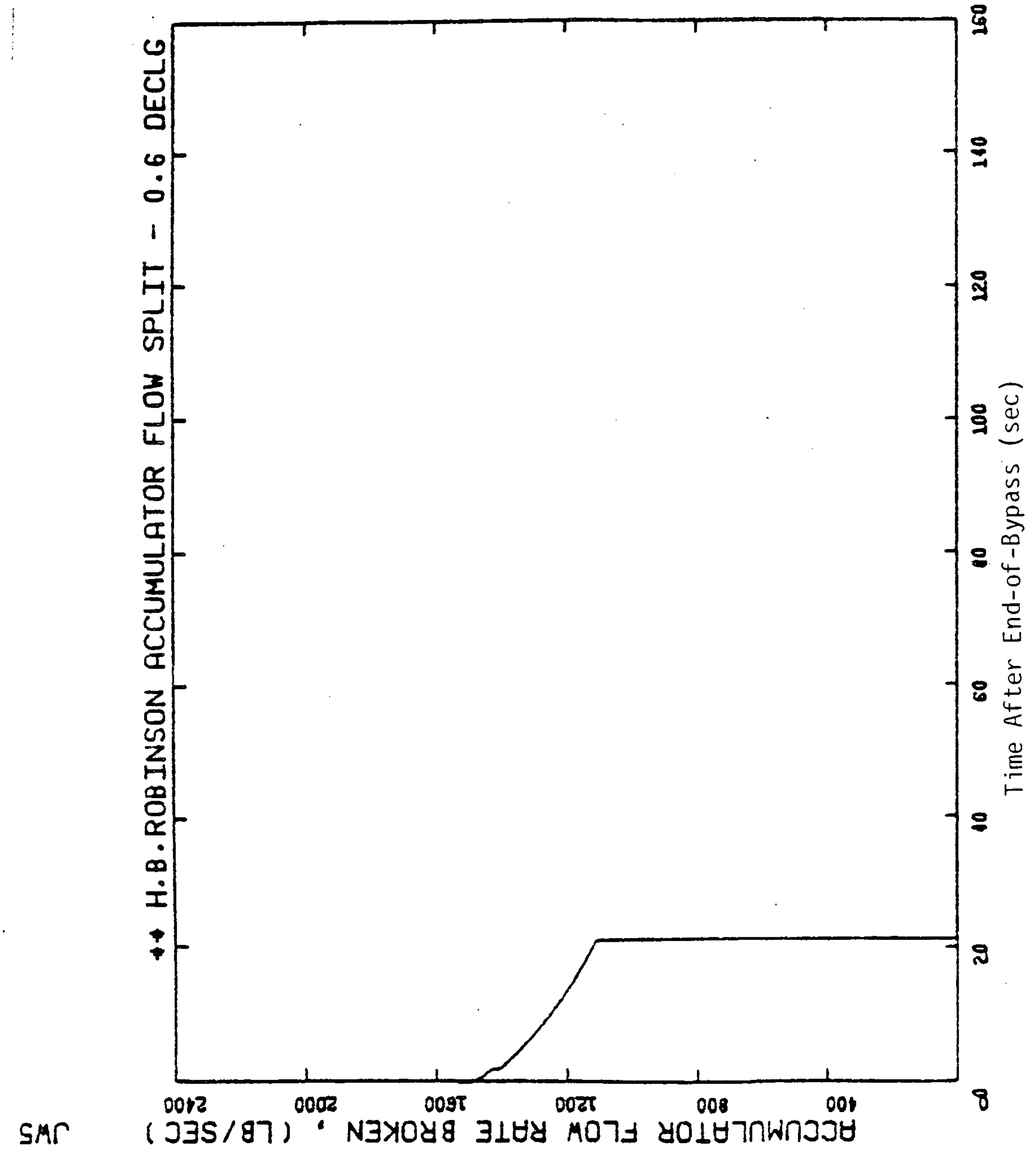



Figure 3.43 Accumulator (Broken) Flow During Refill and Reflood Periods, 0.6 DECLG Break

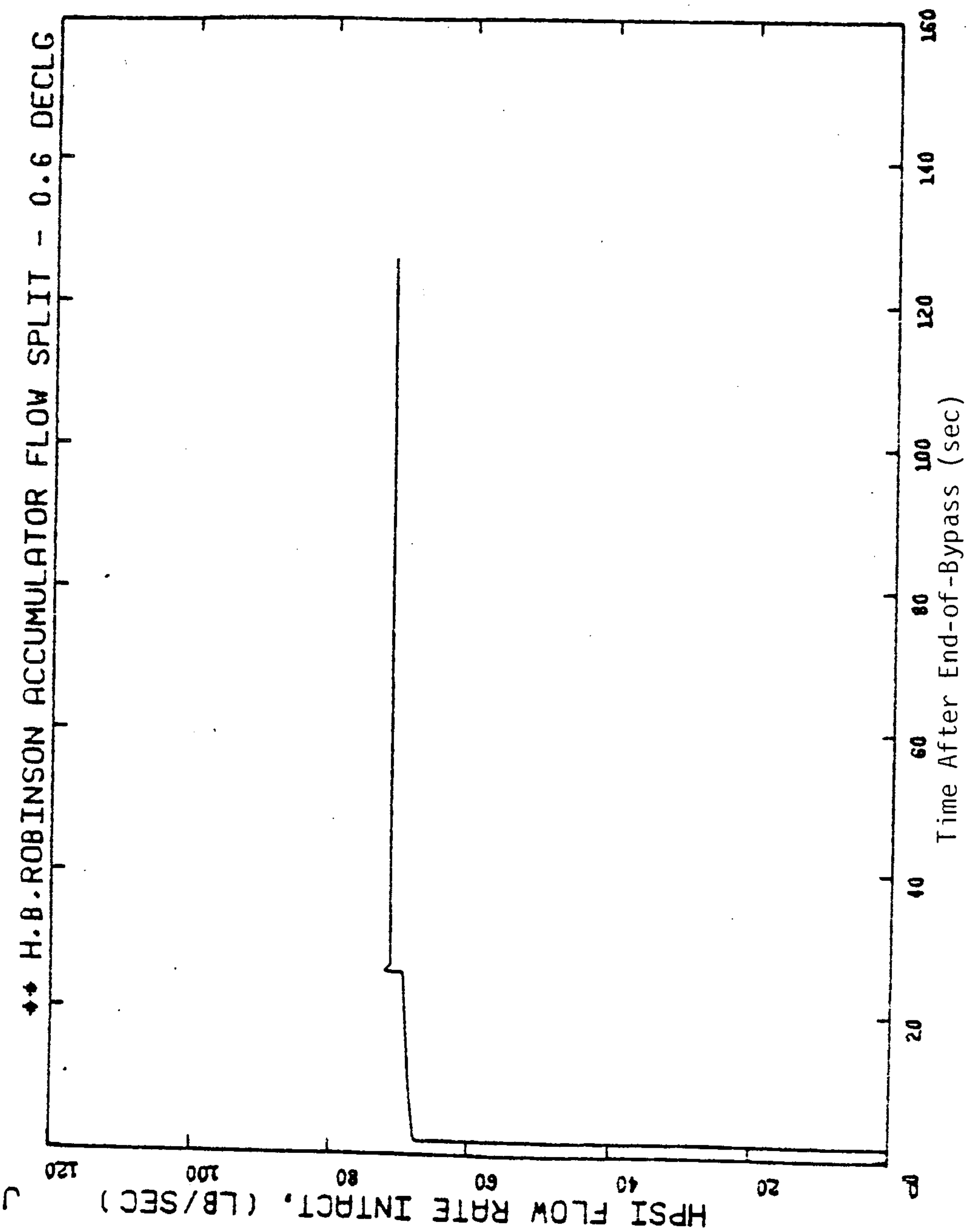



Figure 3.44 HPSI (Intact) Flow During Refill and Reflood Periods, 0.6 DECLG Break

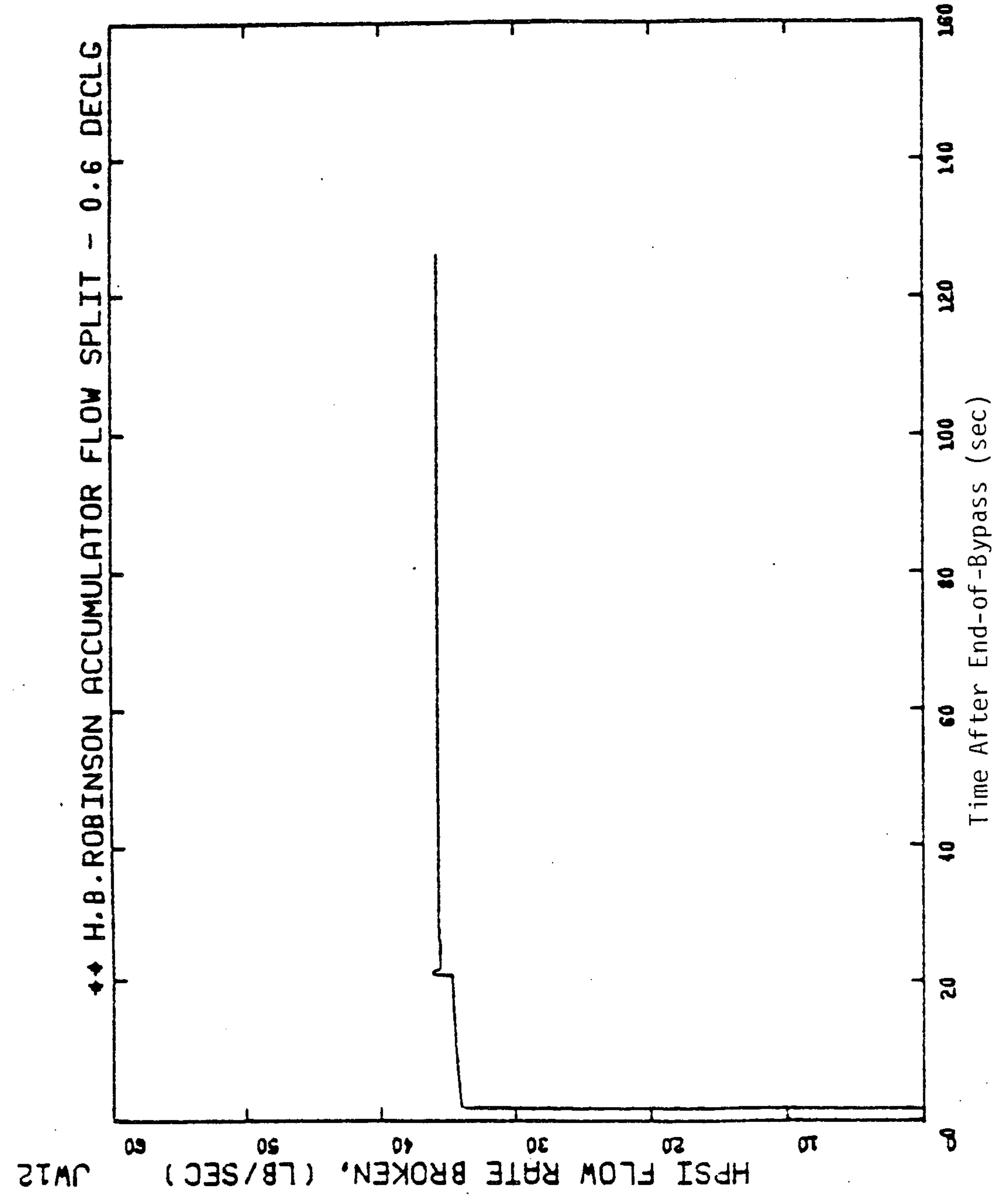
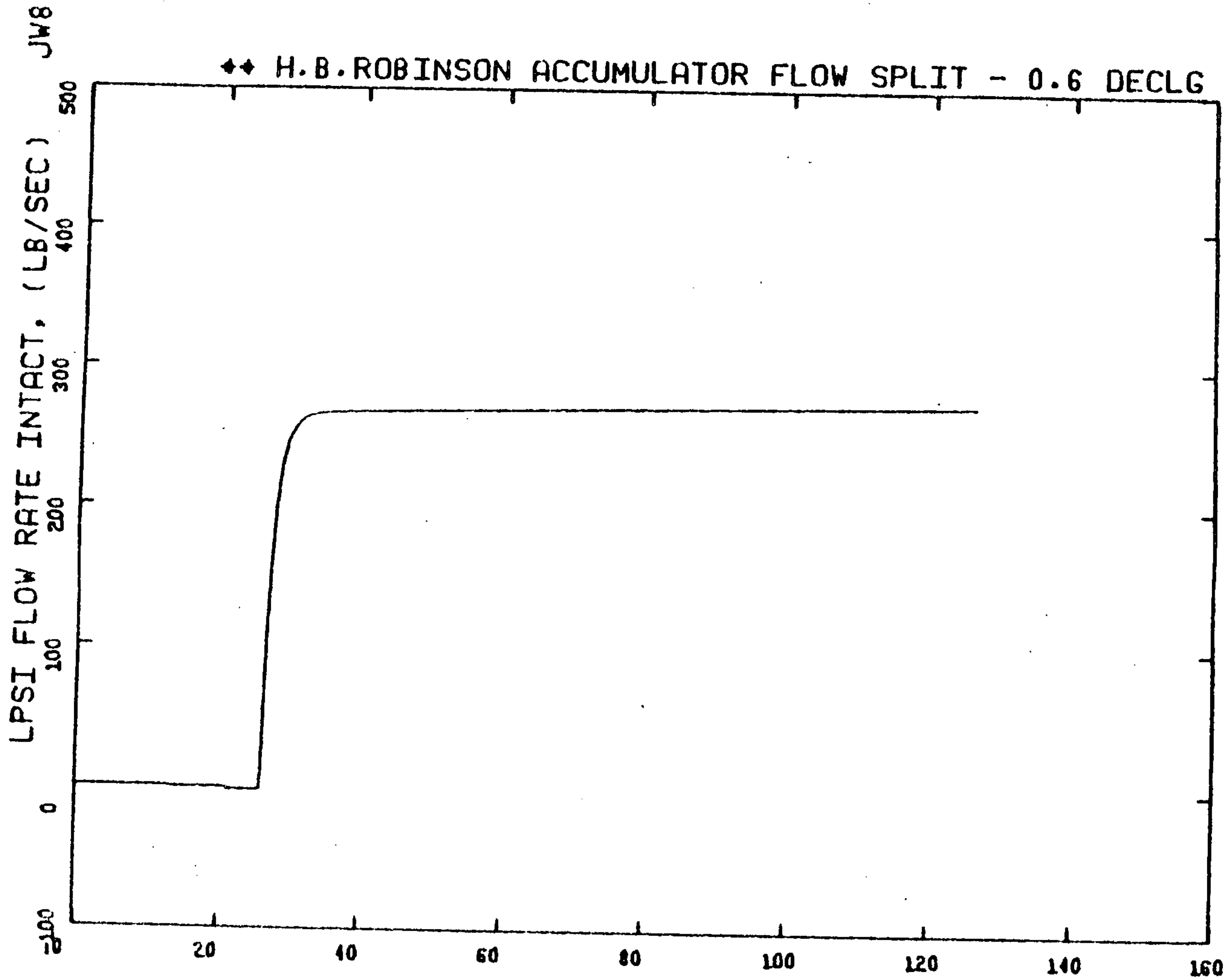



Figure 3.45 HPSI (Broken) Flow During Refill and Reflood Periods, 0.6 DECLG Break




Time After End-of-Bypass (sec)

Figure 3.46 LPSI (Intact) Flow During Refill and Reflood Periods, 0.6 DECLG Break

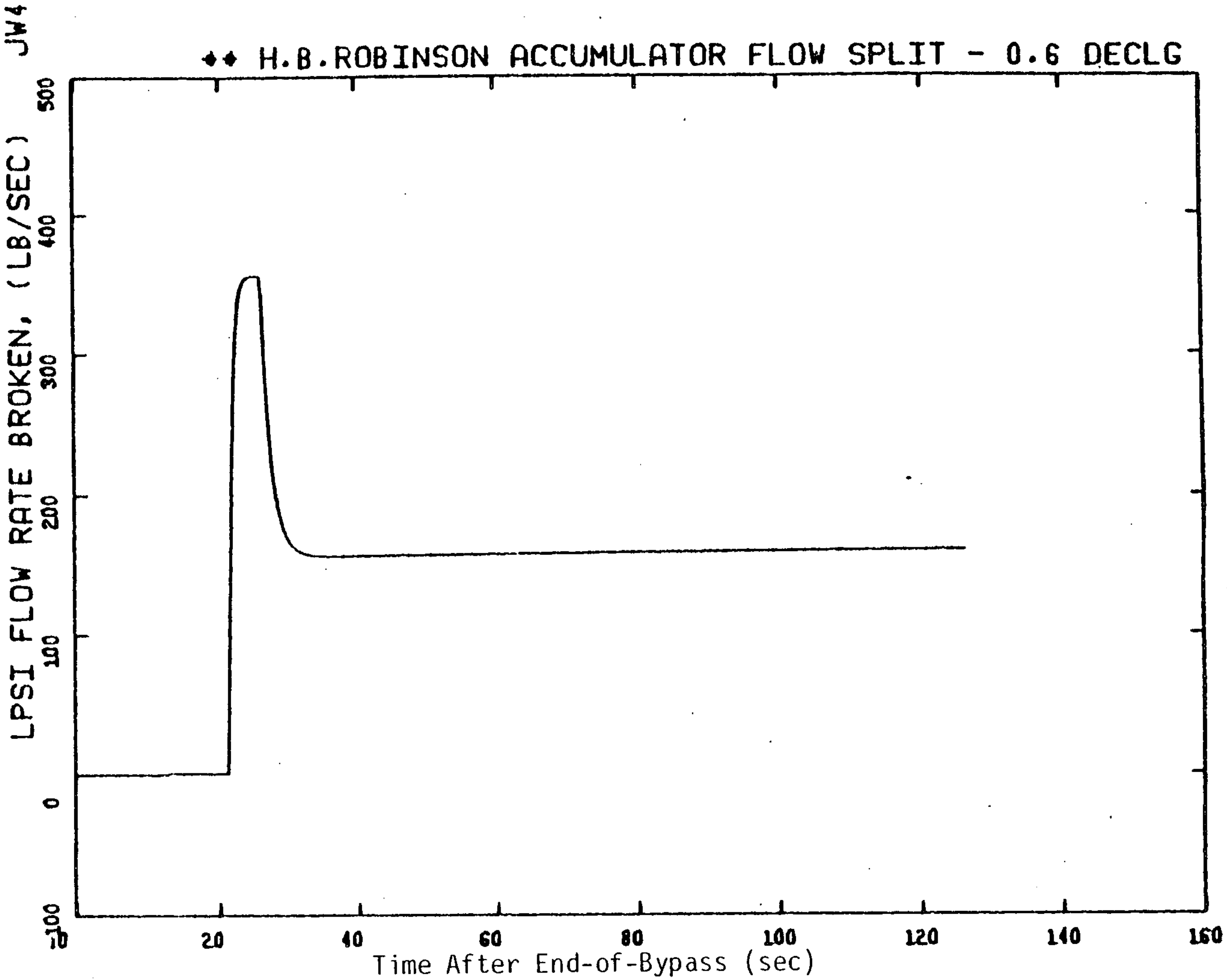



Figure 3.47 LPSI (Broken) Flow During Refill and Reflood Periods, 0.6 DECLG Break

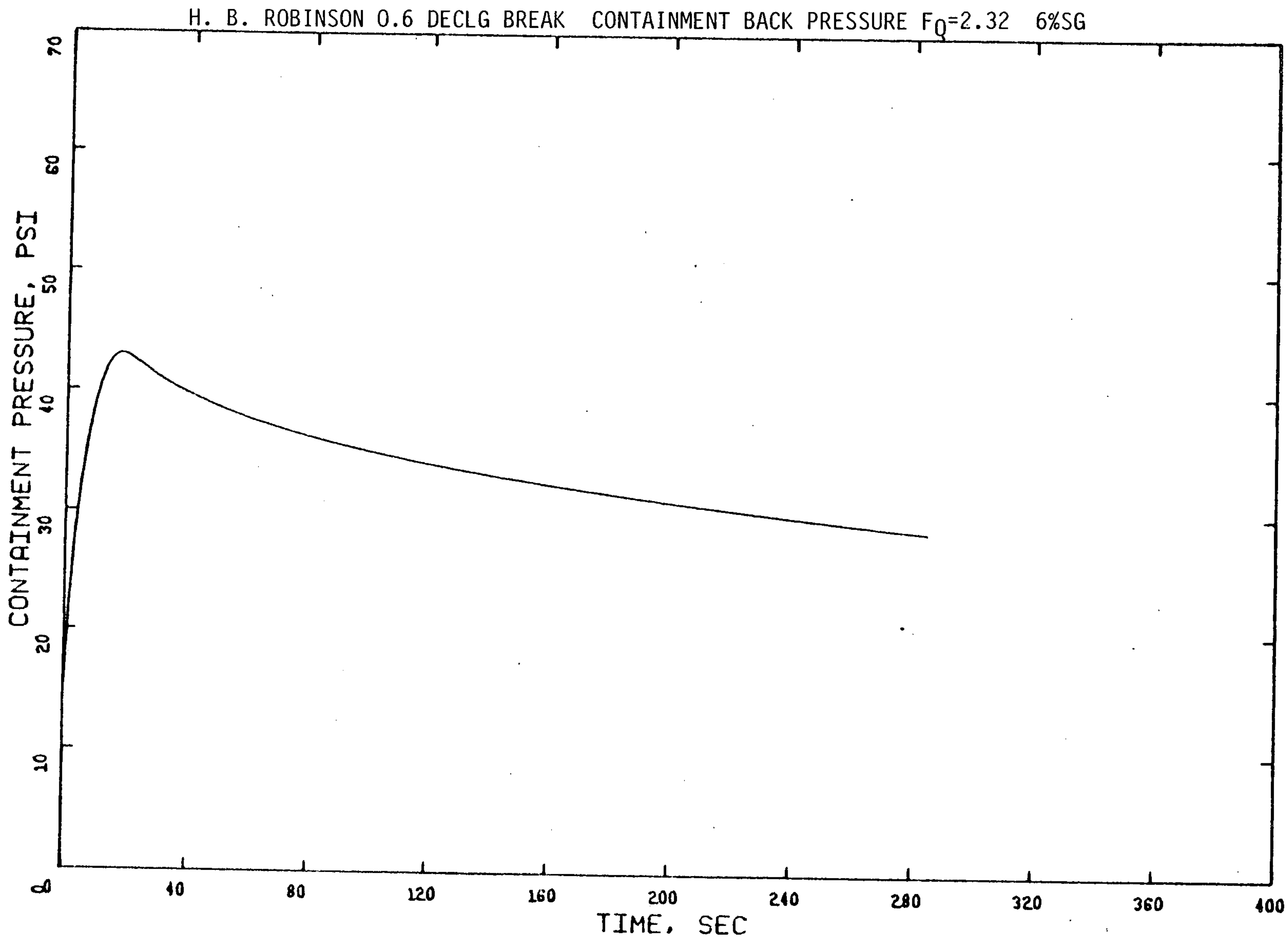



Figure 3.48 Containment Back Pressure, 0.6 DECLG Break

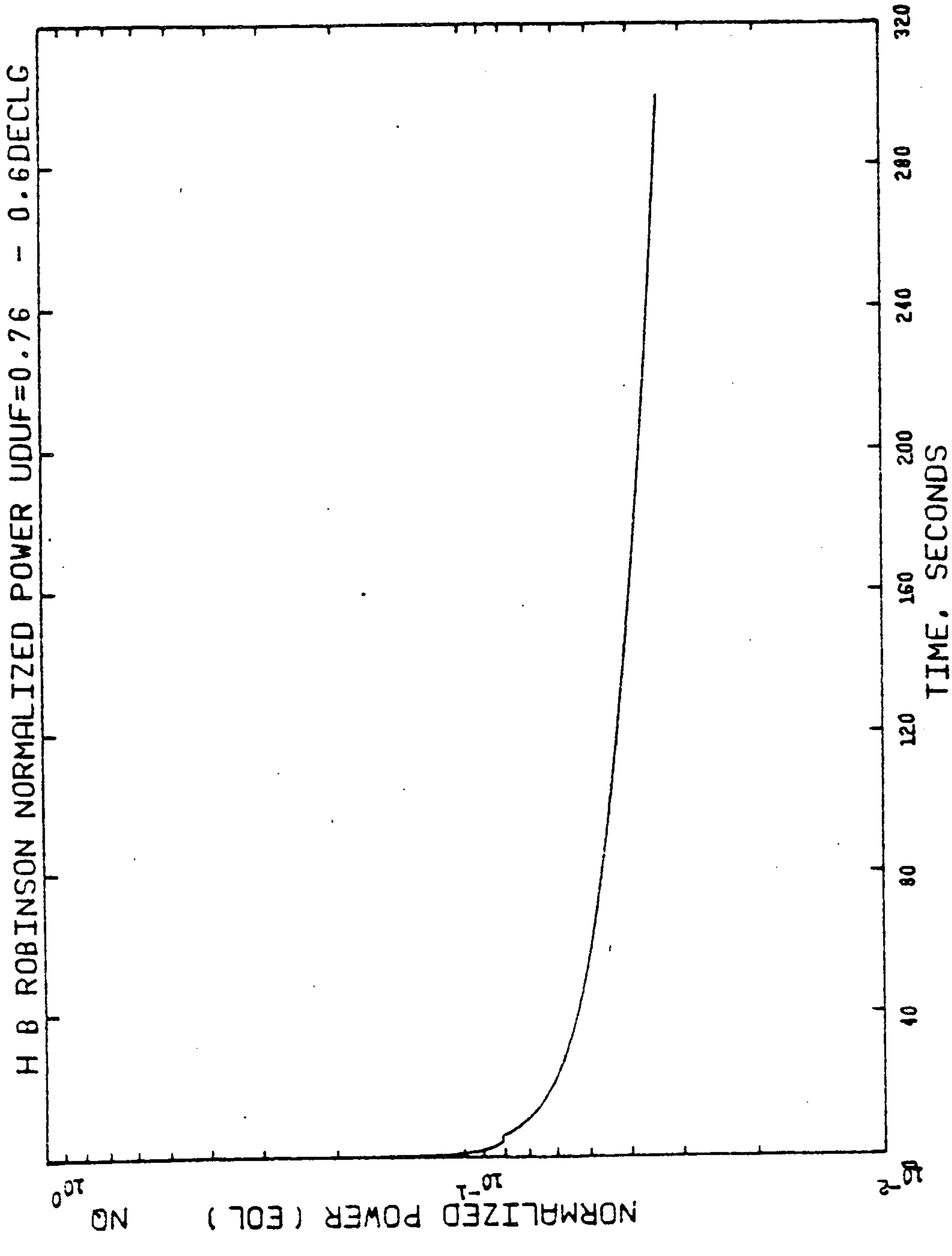



Figure 3.49 Normalized Power, 0.6 DECLG Break

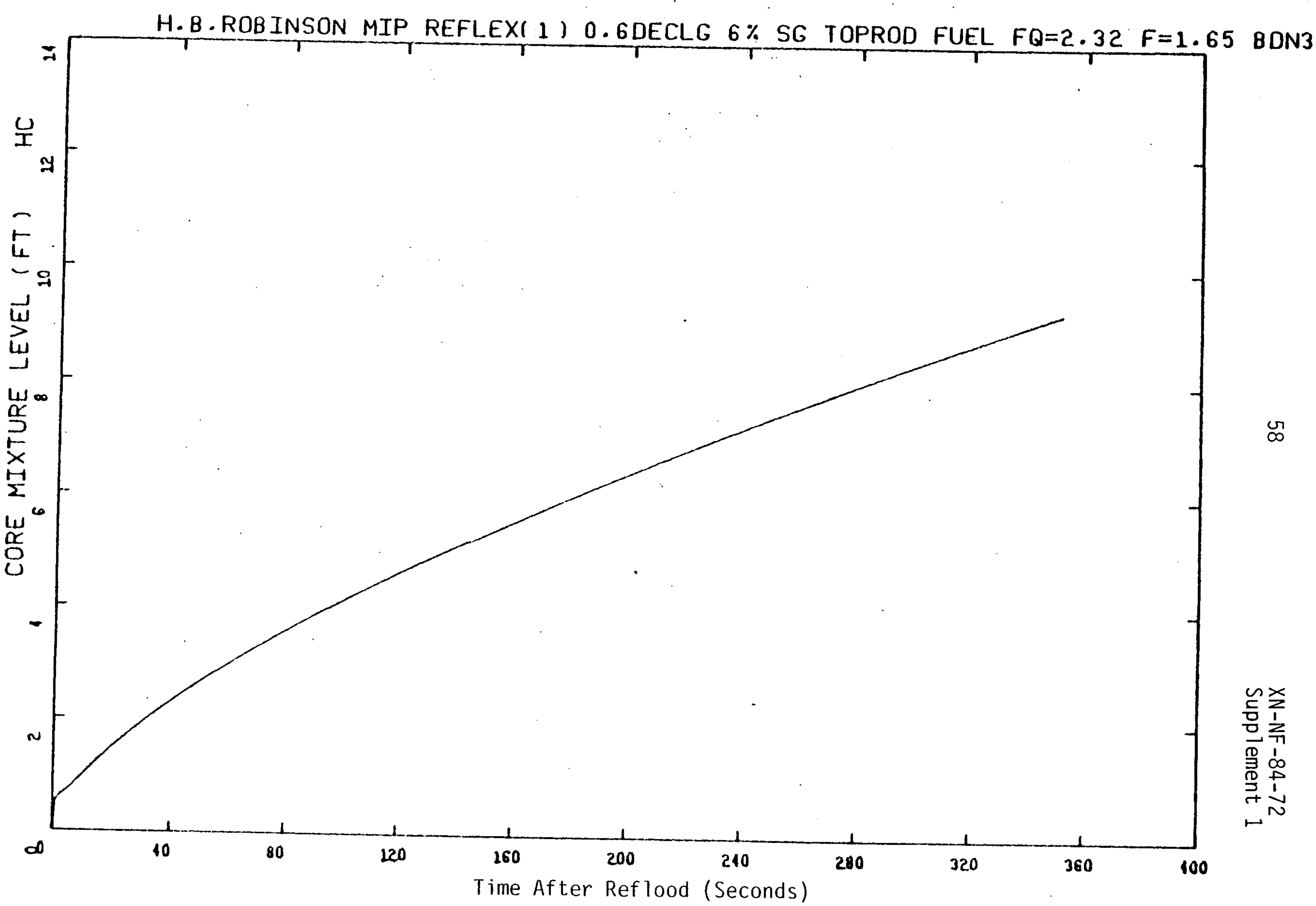



Figure 3.50 Reflood Core Mixture Level, 0.6 DECLG Break

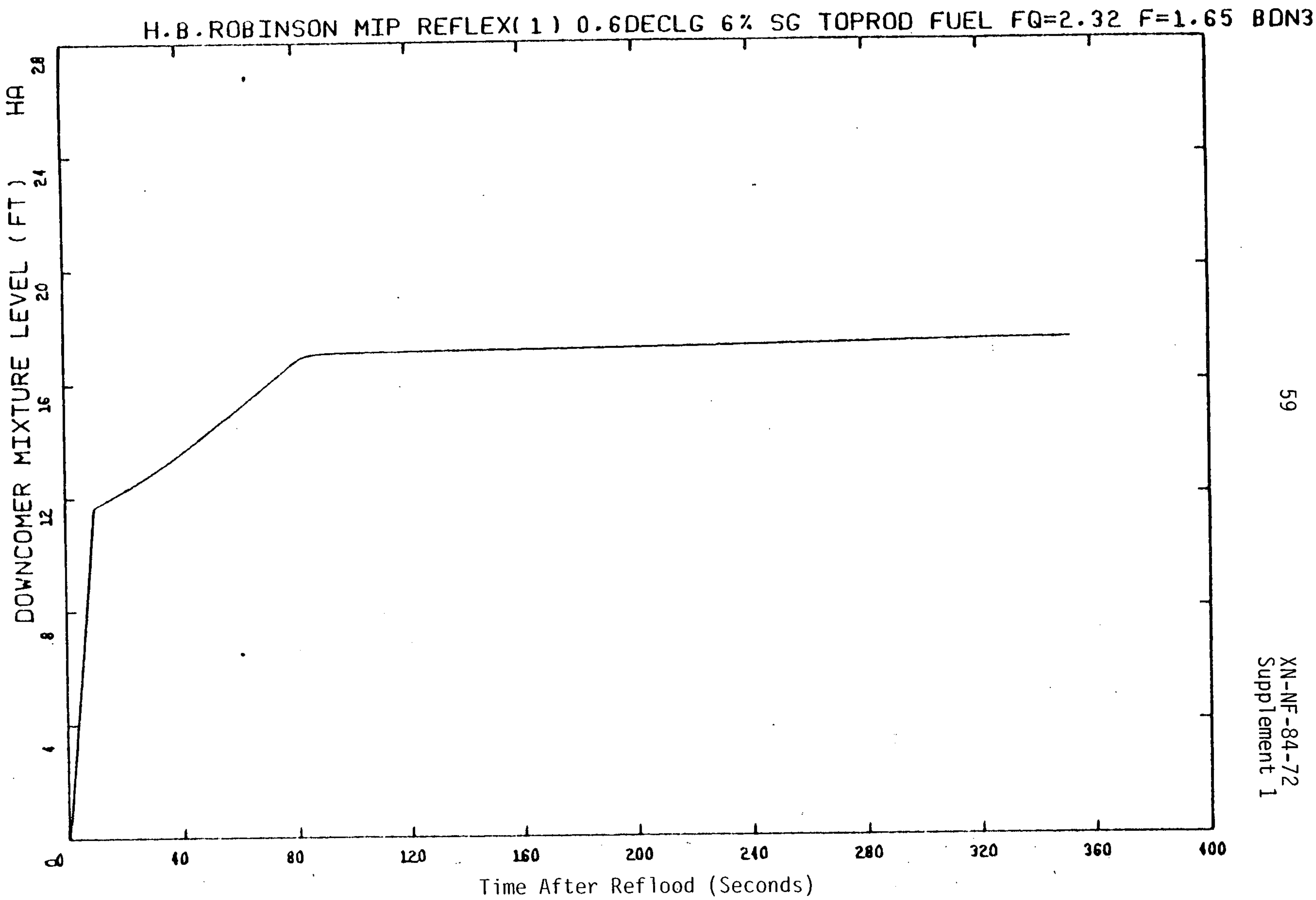



Figure 3.51 Reflood Downcomer Mixture Level, 0.6 DECLG Break

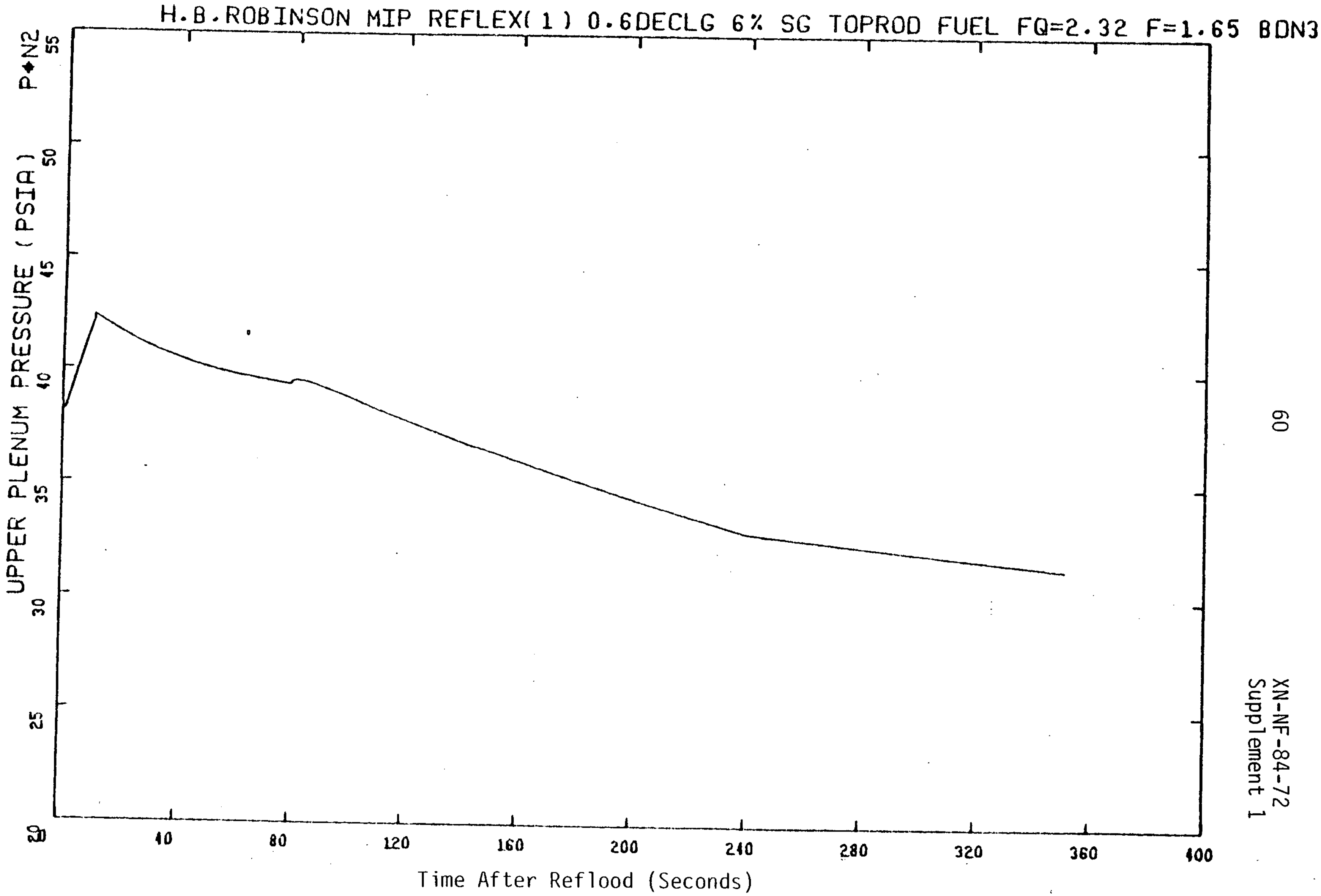



Figure 3.52 Reflood Upper Plenum Pressure, 0.6 DECLG Break

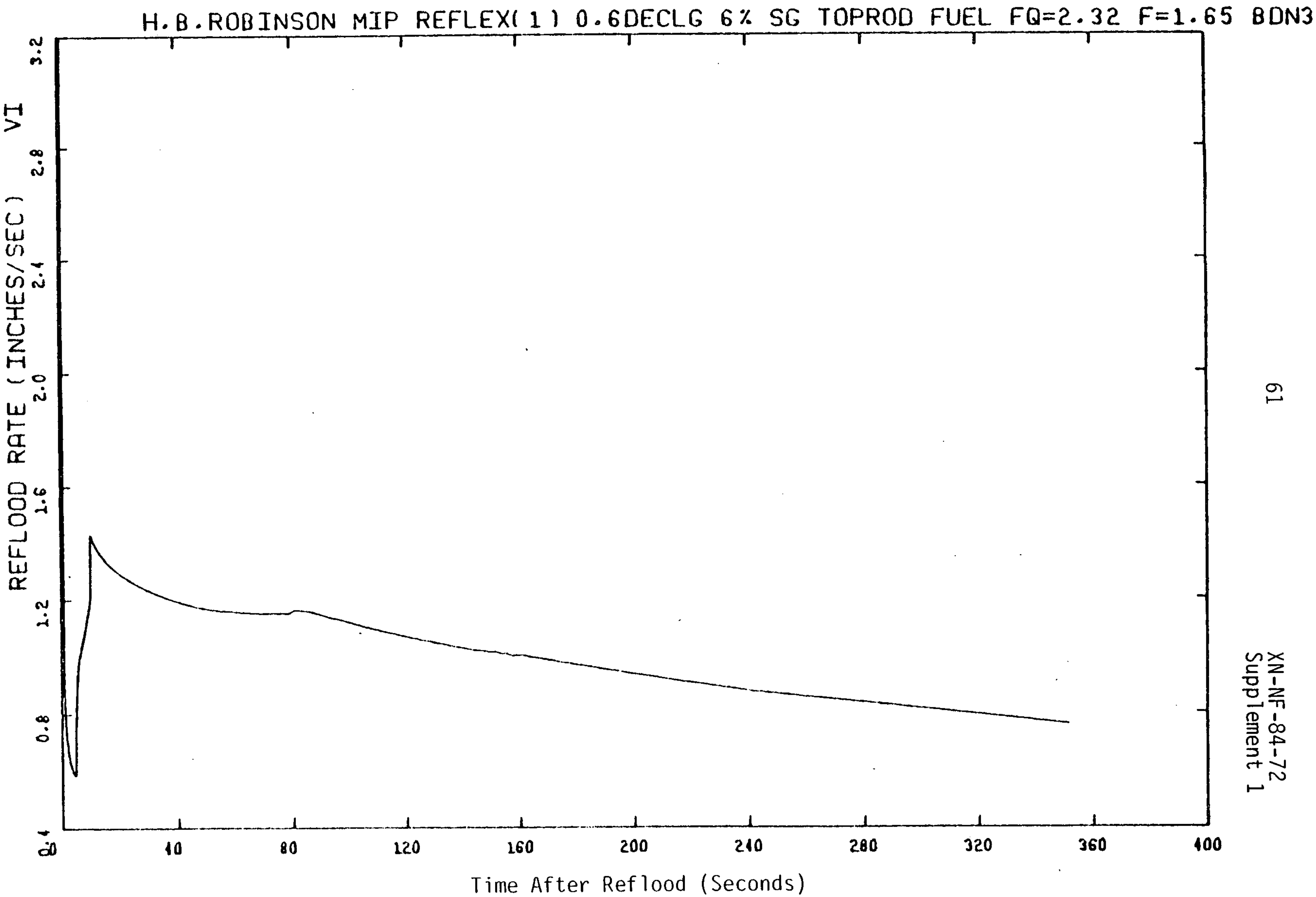



Figure 3.53 Core Flooding Rate, 0.6 DECLG Break

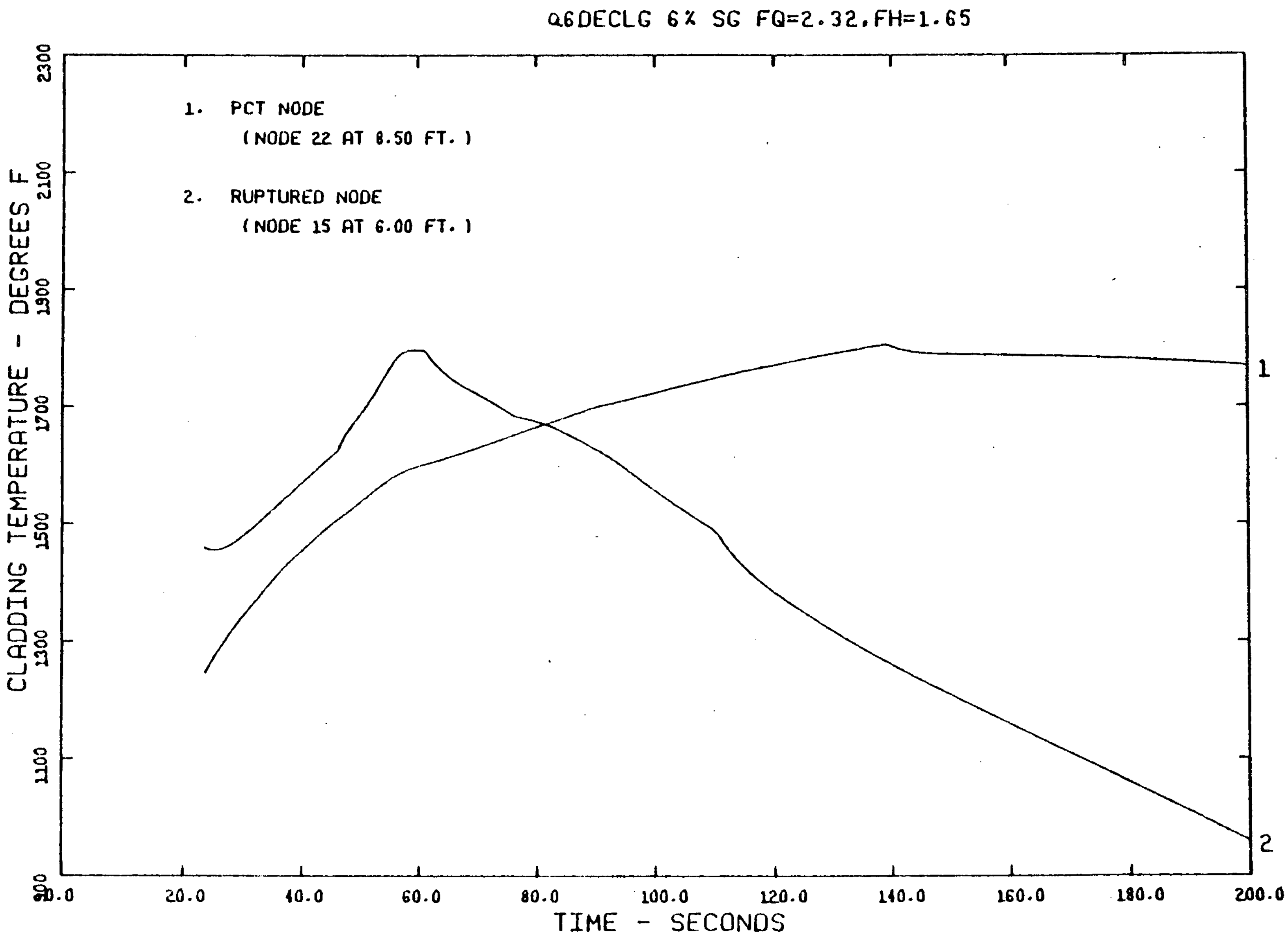



Figure 3.54 TOODEE2 Cladding Temperature vs. Time, 0.6 DECLG Break, 2 MWD/KgU Exposure

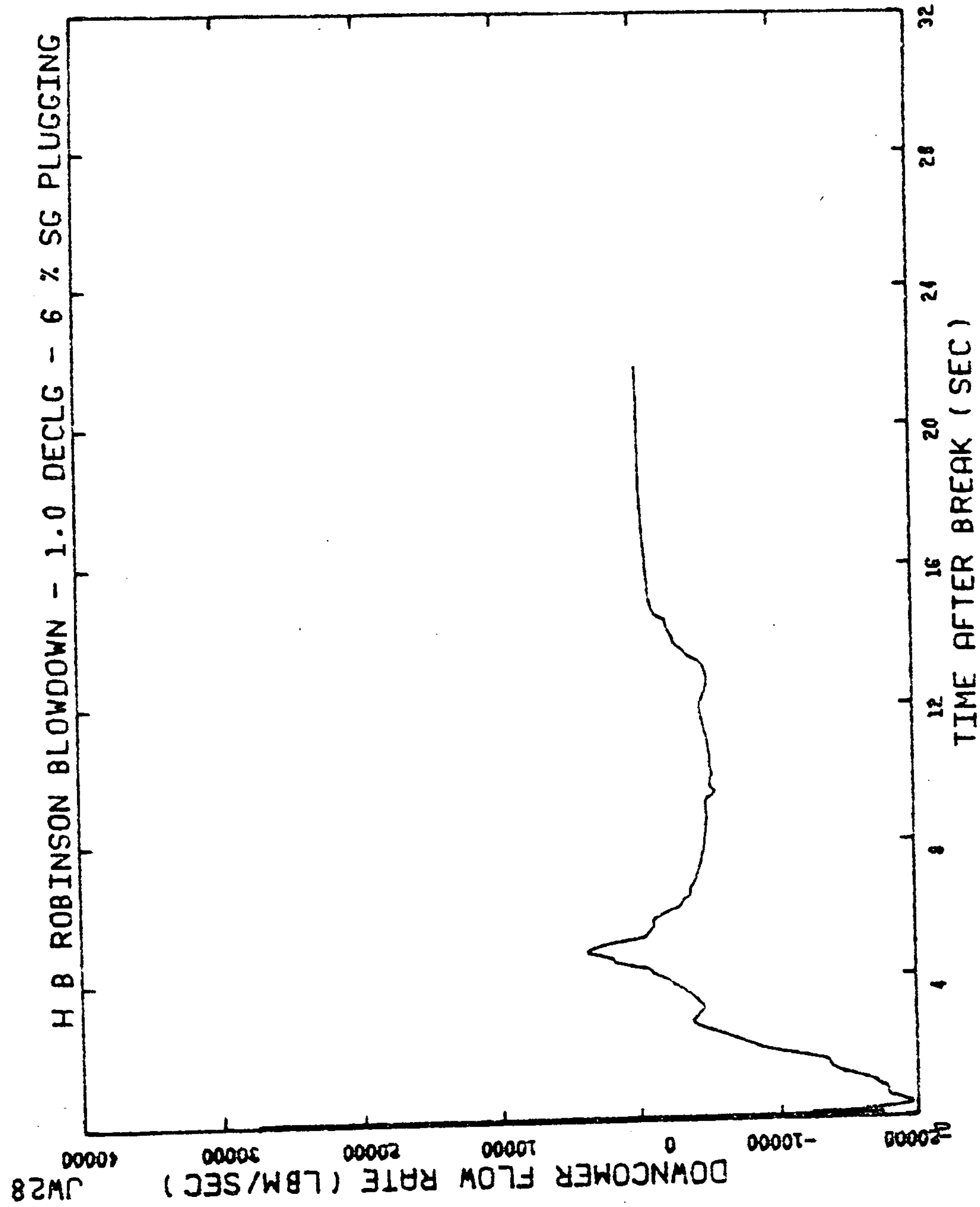



Figure 3.55 Downcomer Flow Rate During Blowdown Period, 1.0 DECLG Break

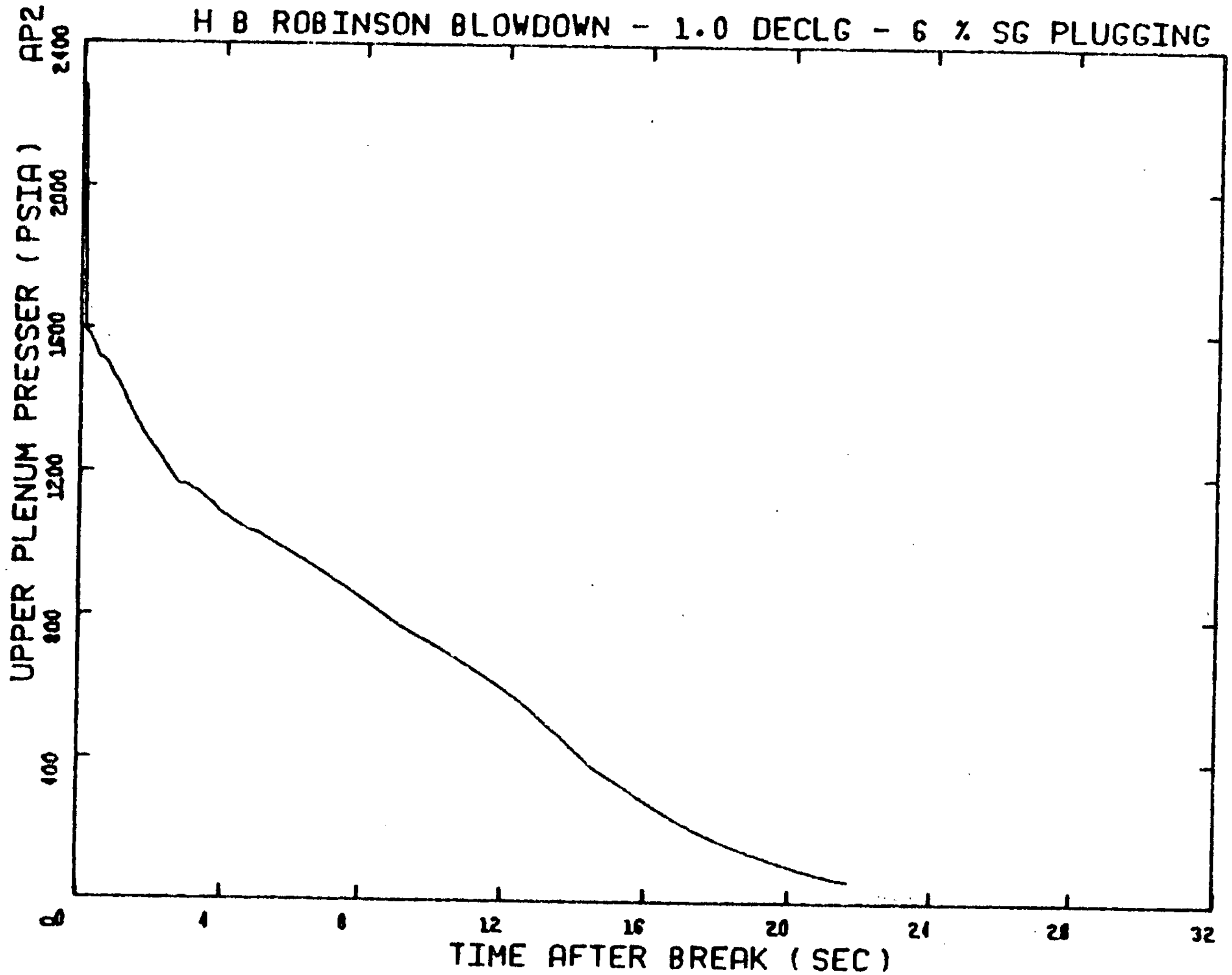



Figure 3.56 Upper Plenum Pressure During Blowdown Period, 1.0 DECLG Break

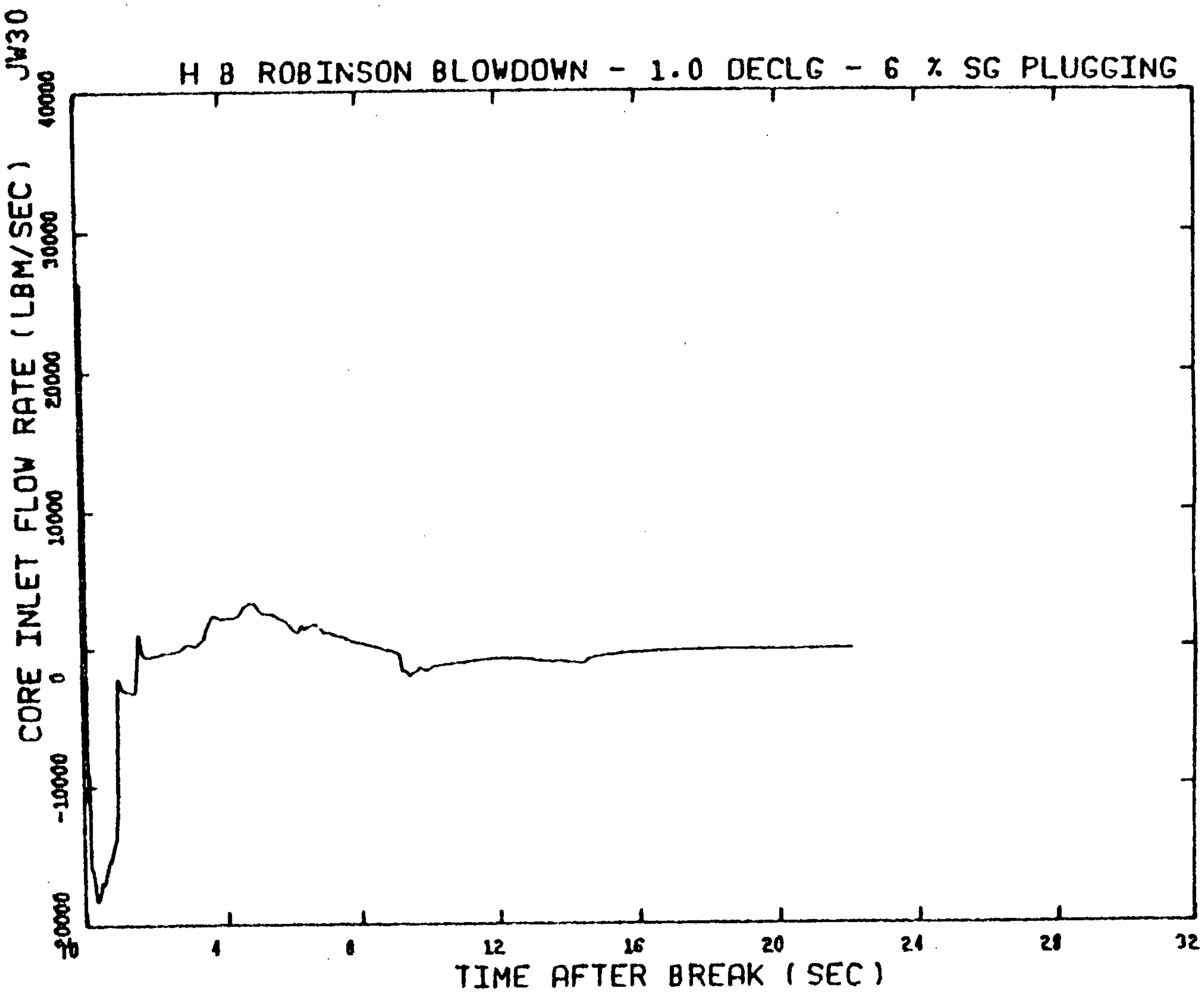



Figure 3.57 Average Core Inlet Flow During Blowdown Period, 1.0 DECLG Break

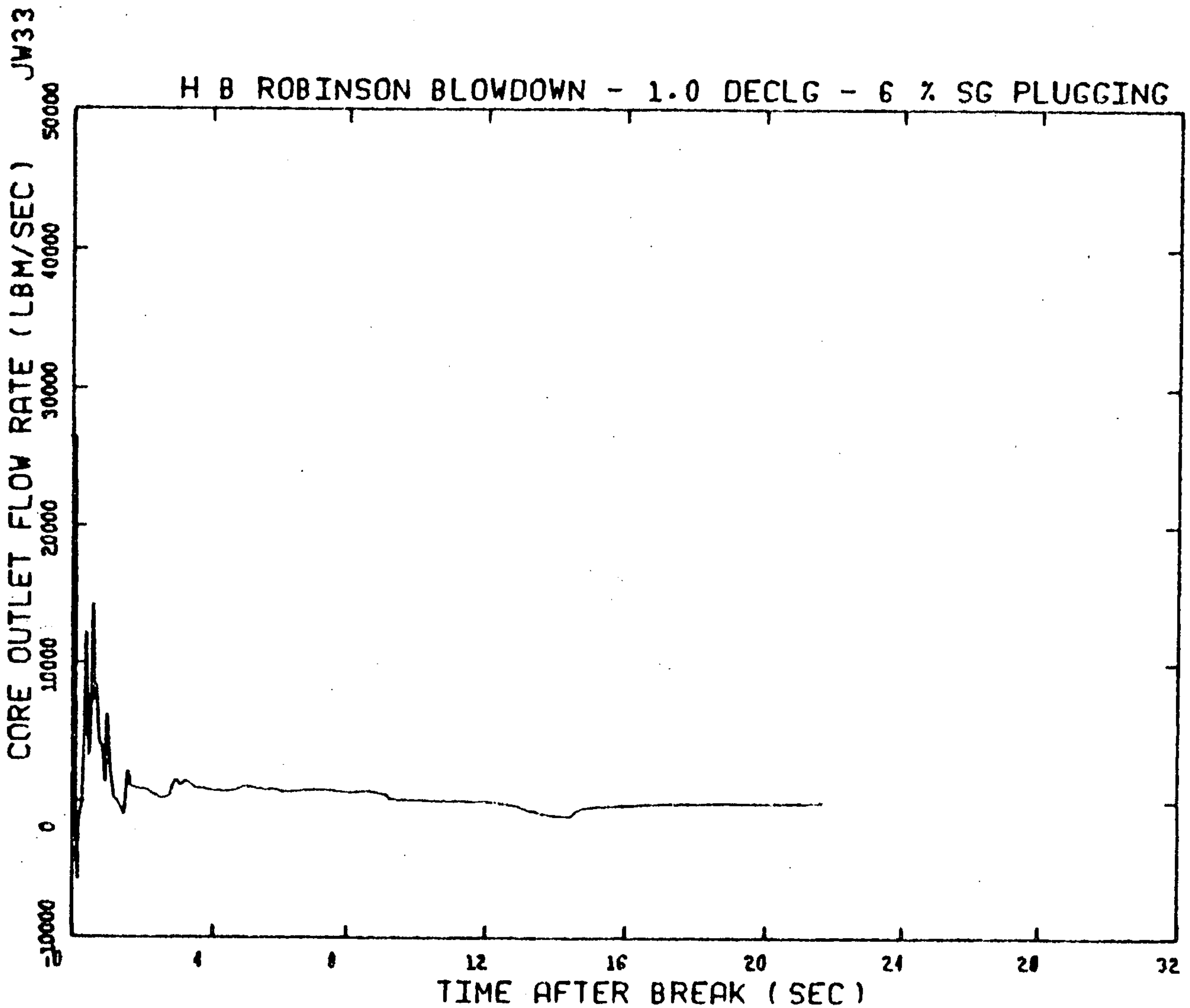



Figure 3.58 Average Core Outlet Flow During Blowdown Period, 1.0 DECLG Break

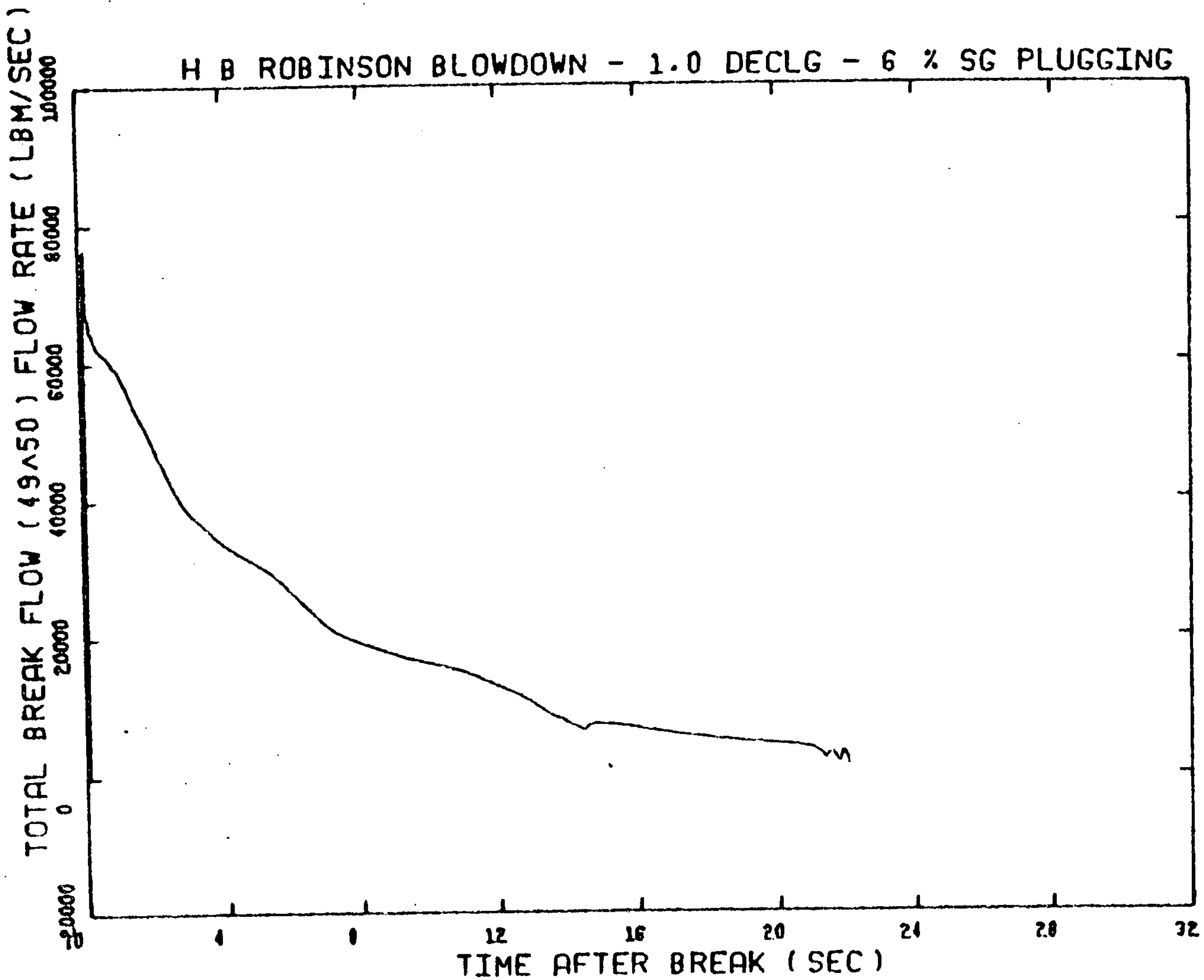



Figure 3.59 Total Break Flow During Blowdown Period, 1.0 DECLG Break

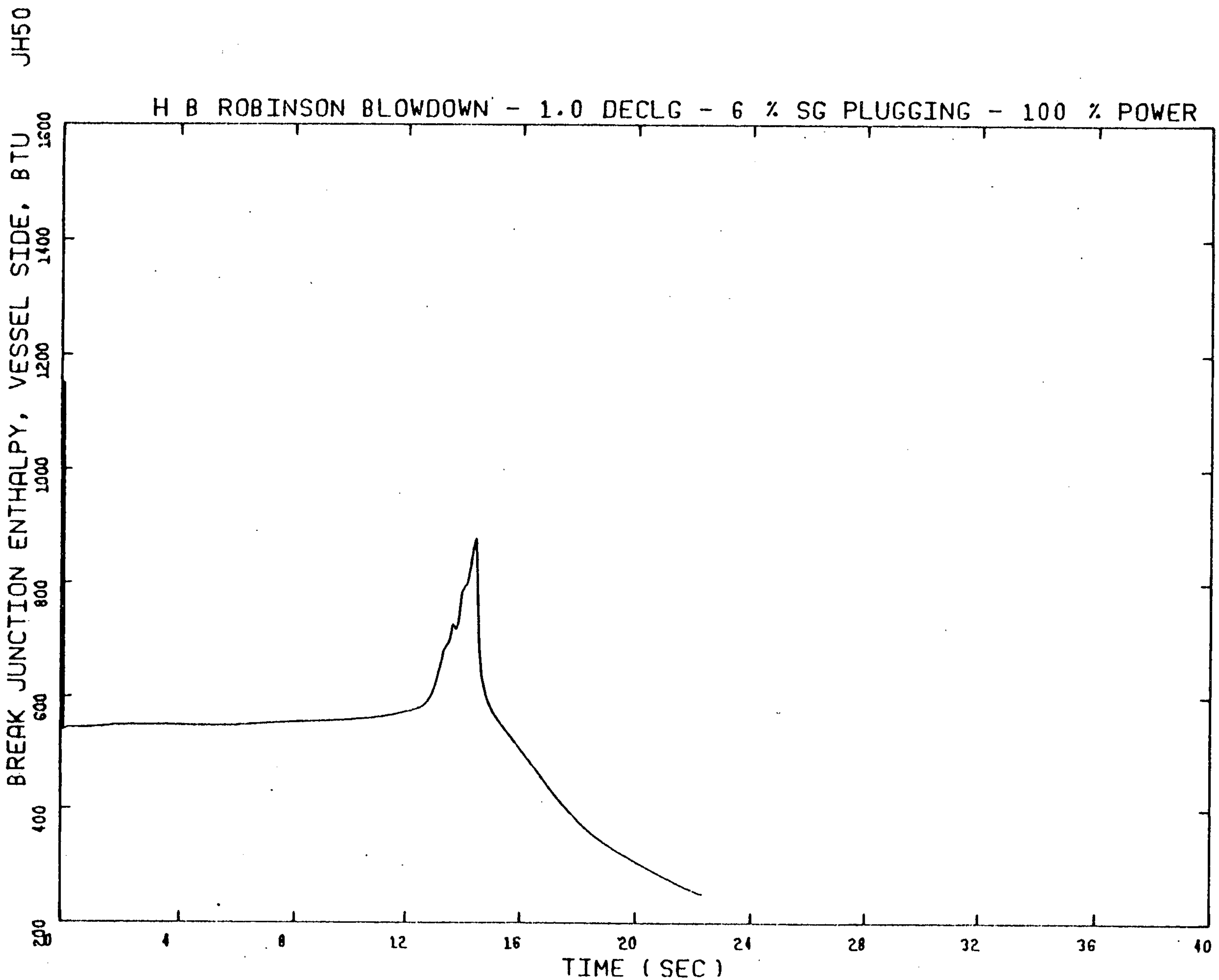



Figure 3.60 Break Flow Enthalpy During Blowdown Period, Vessel Side, 1.0 DECLG Break

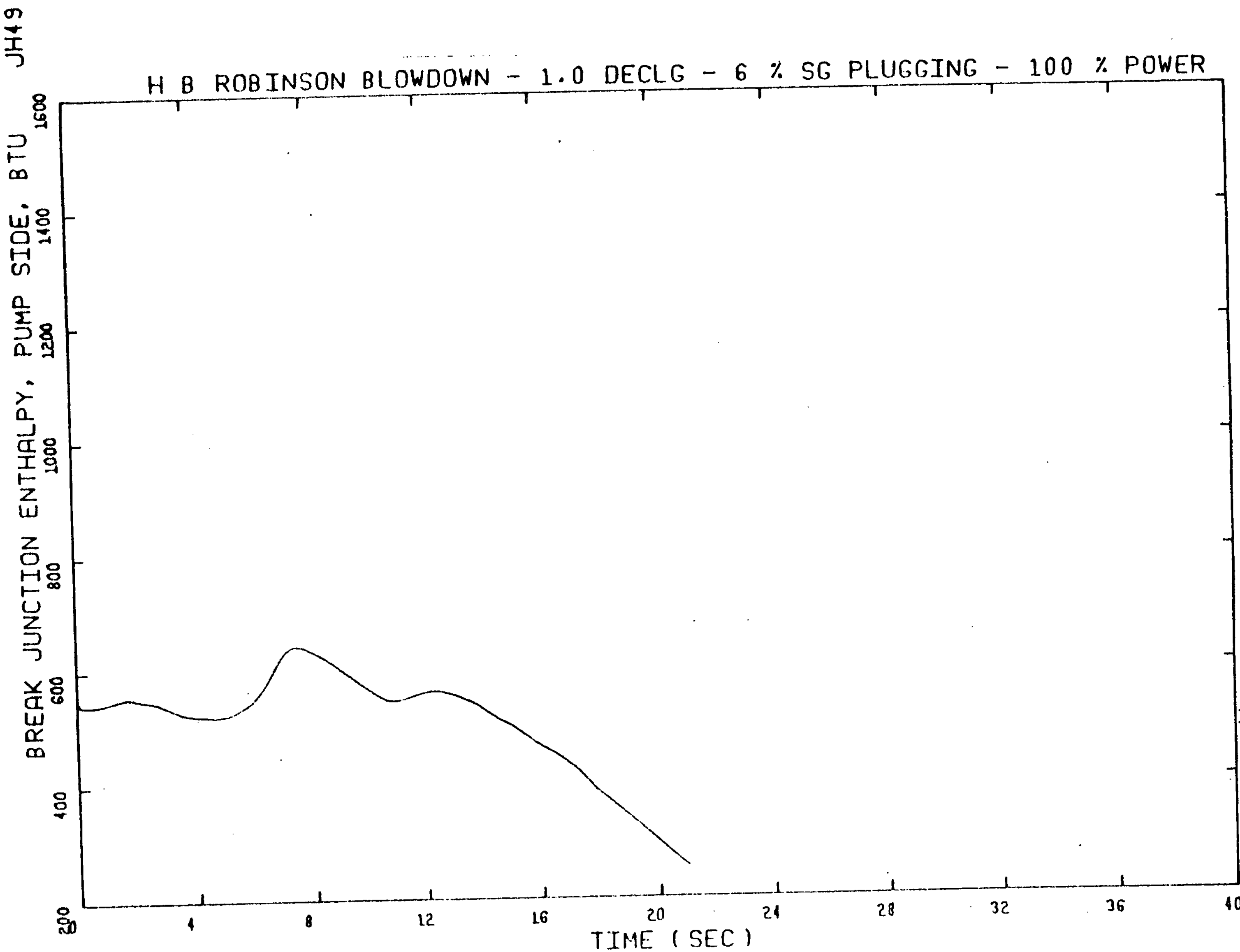



Figure 3.61 Break Flow Enthalpy During Blowdown Period, Pump Side, 1.0 DECLG Break

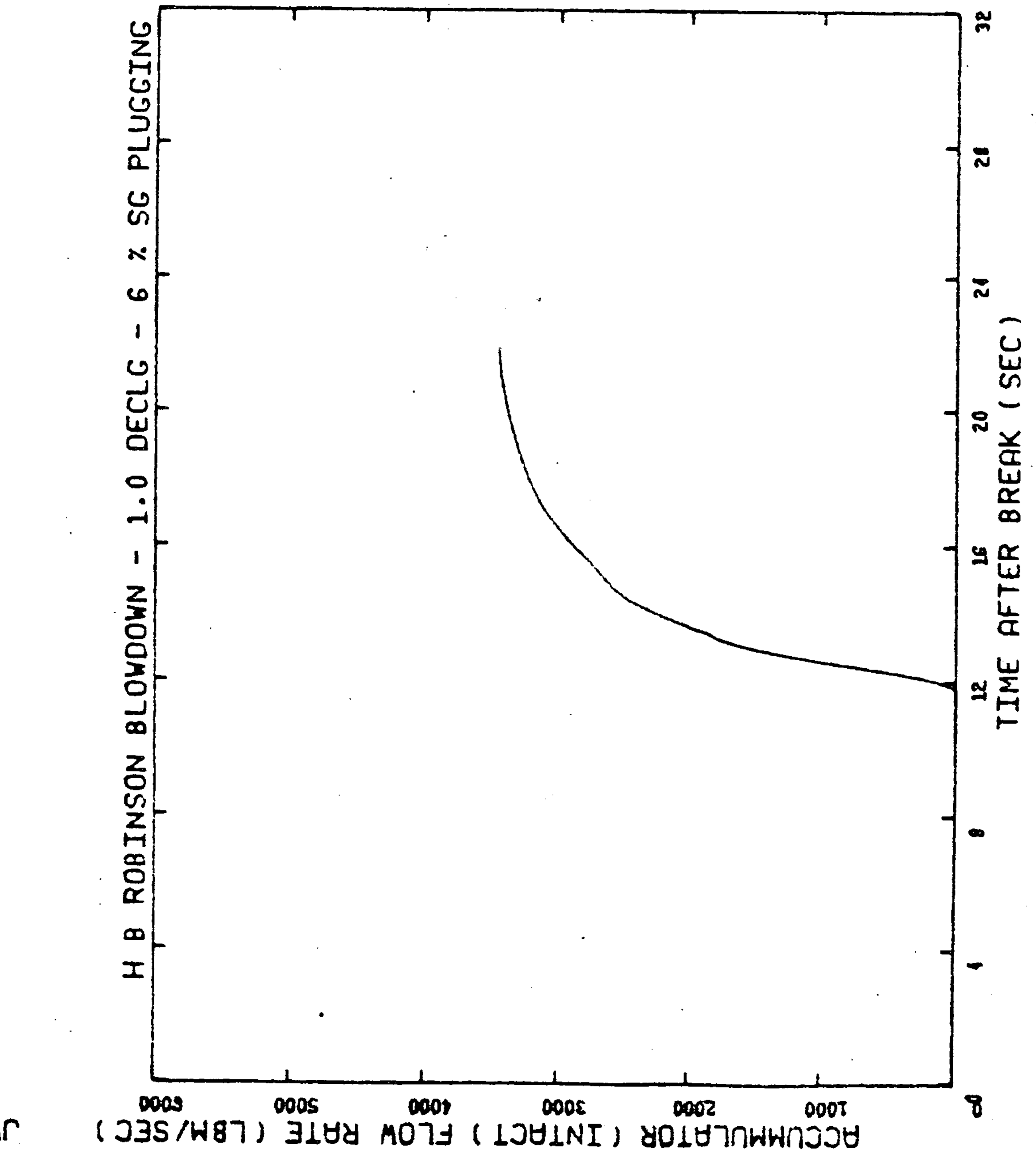



Figure 3.62 Flow from Intact Loop Accumulator During Blowdown Period, 1.0 DECLG Break

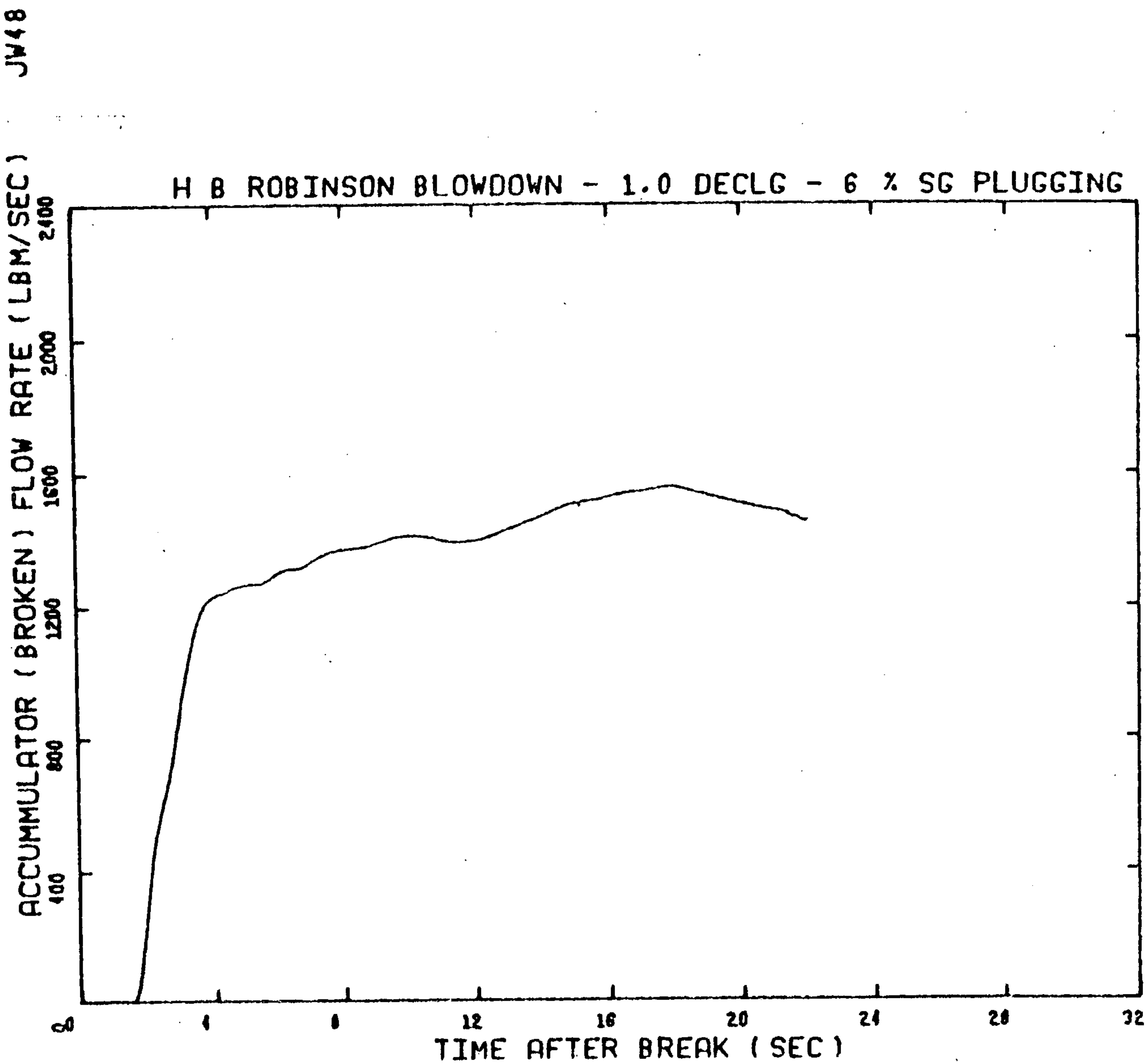



Figure 3.63 Flow from Intact Loop Accumulator During Blowdown Period, 1.0 DECLG Break

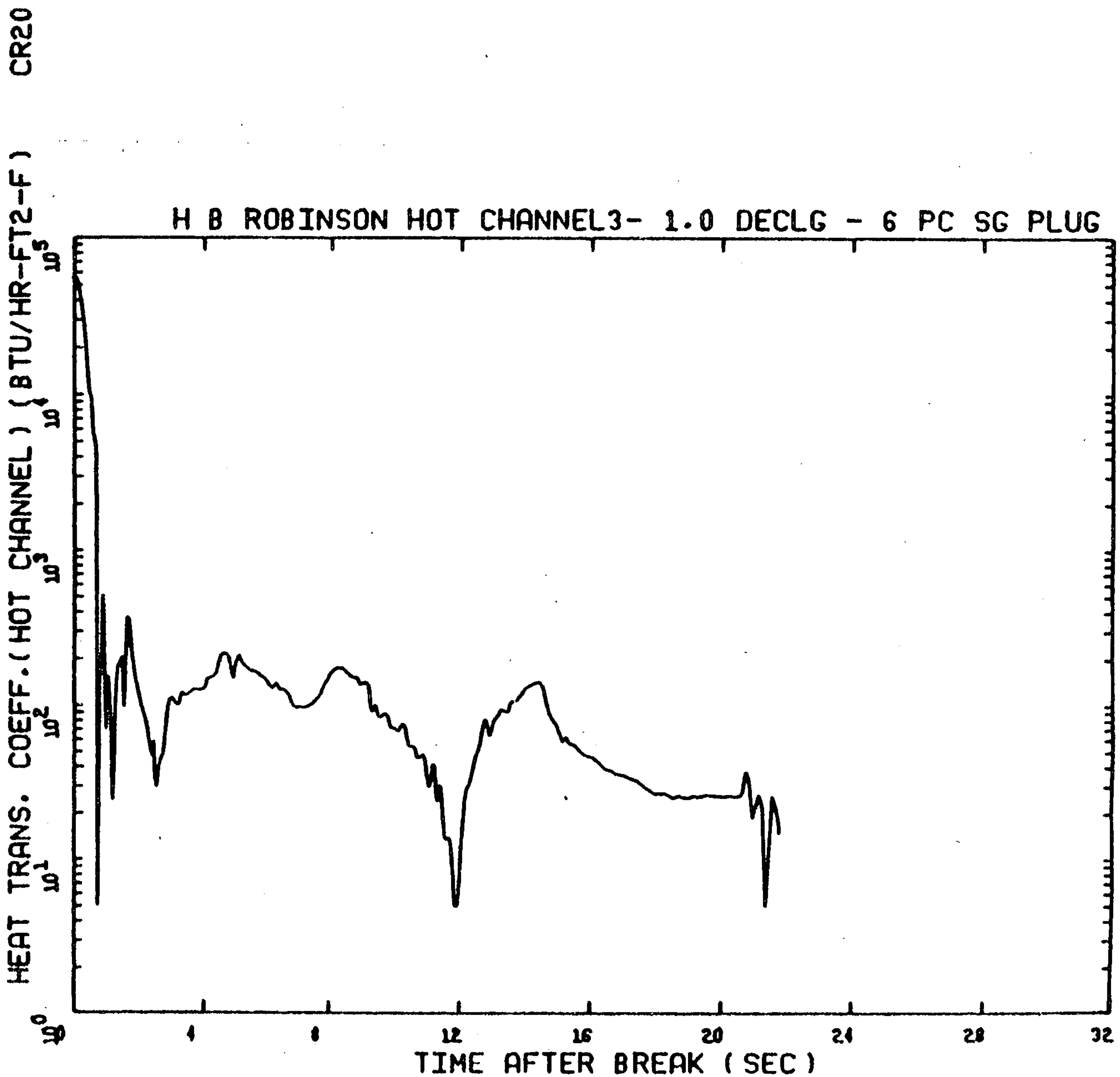



Figure 3.64 Heat Transfer Coefficient during Blowdown Period at PCT Node, 1.0 DECLG Break, 2 MWD/KgU

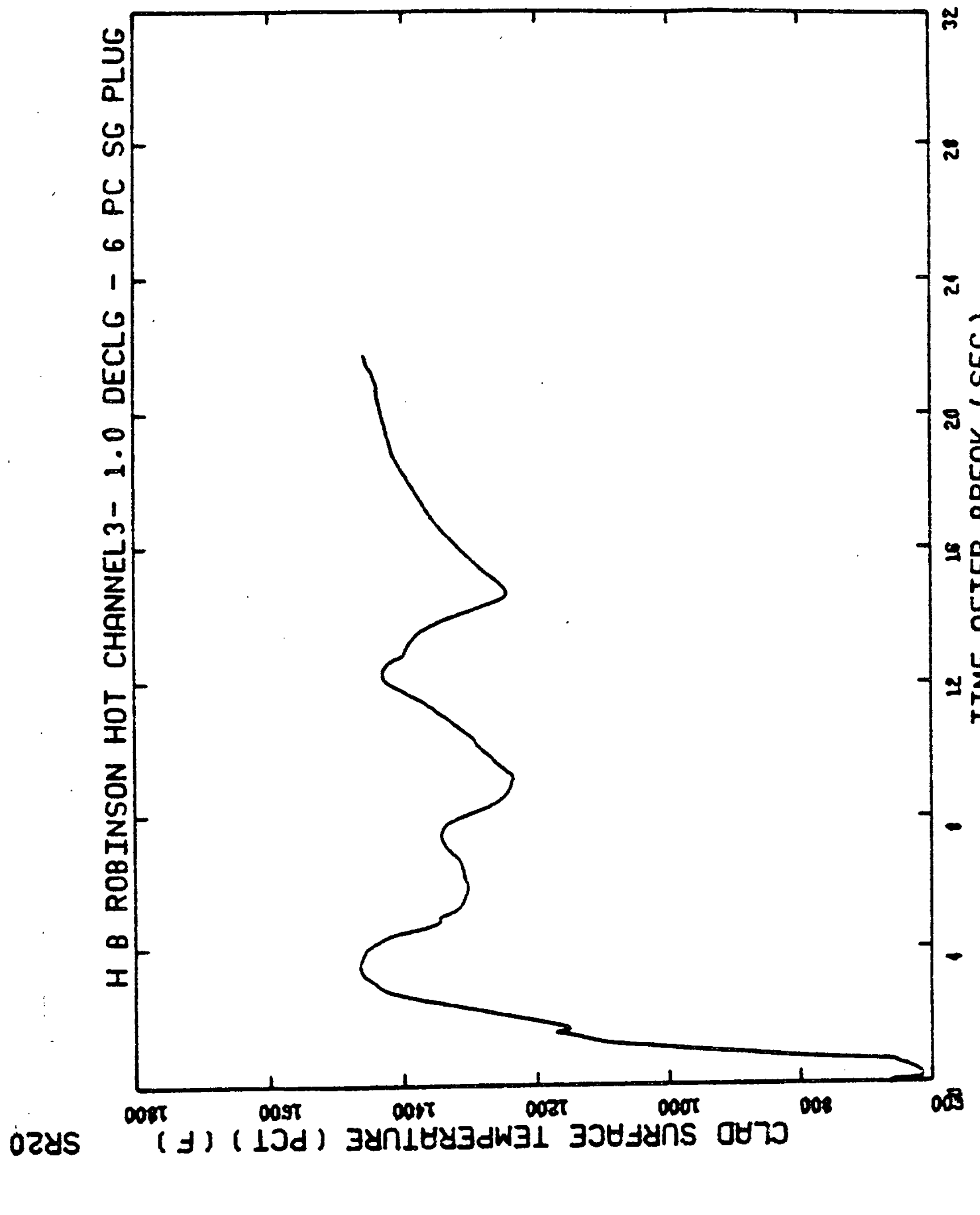



Figure 3.65 Clad Surface Temperature during Blowdown Period, PCT Node, 1.0 DECLG Break, .2 MWD/KgU

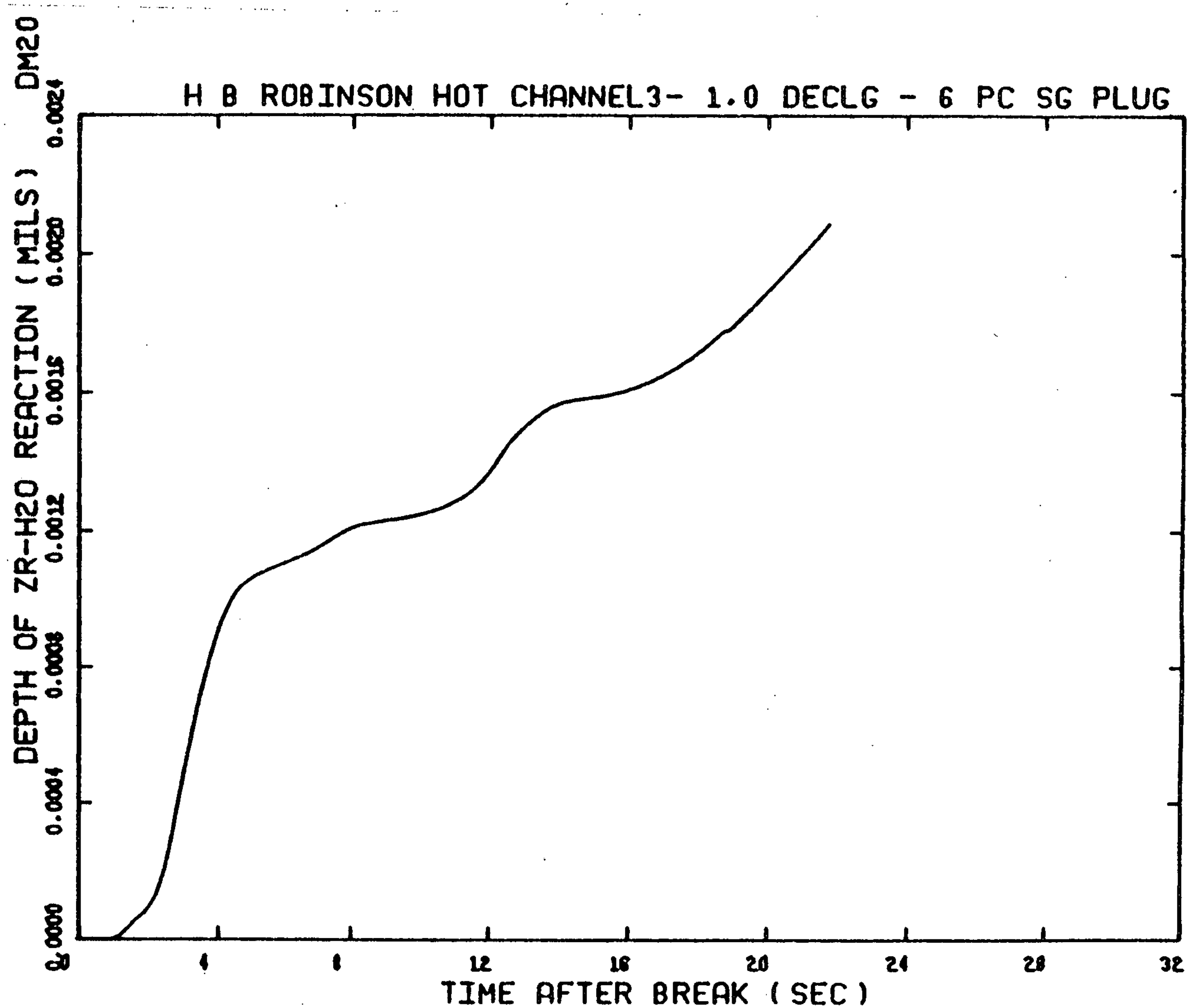



Figure 3.66 Depth of Metal-Water Reaction During Blowdown Period at PCT Node, 1.0 DECLG Break, 2 MWD/KgU

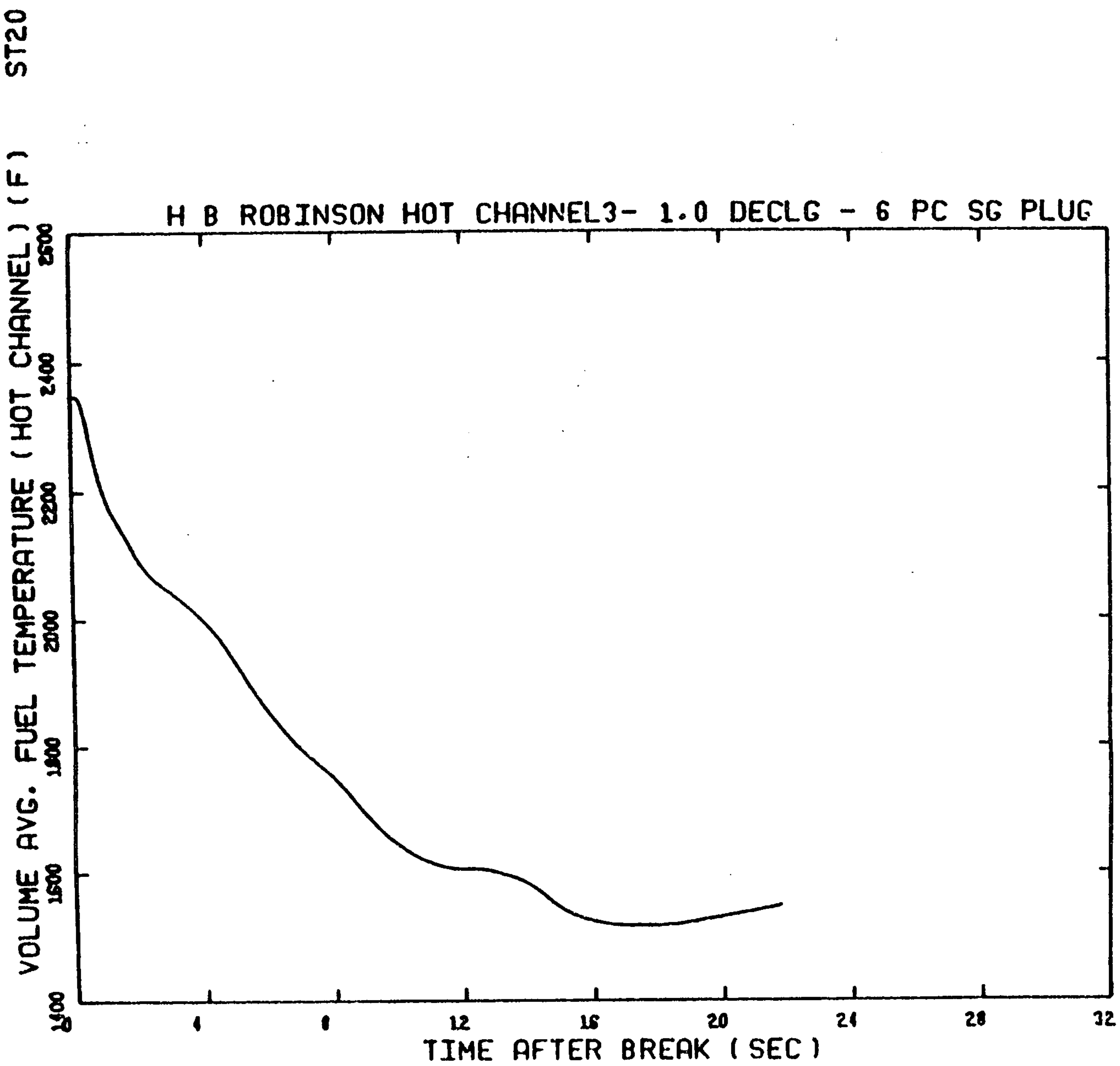



Figure 3.67 Average Fuel Temperature during Blowdown Period at PCT Node, 1.0 DECLG Break, 2 MWD/KgU

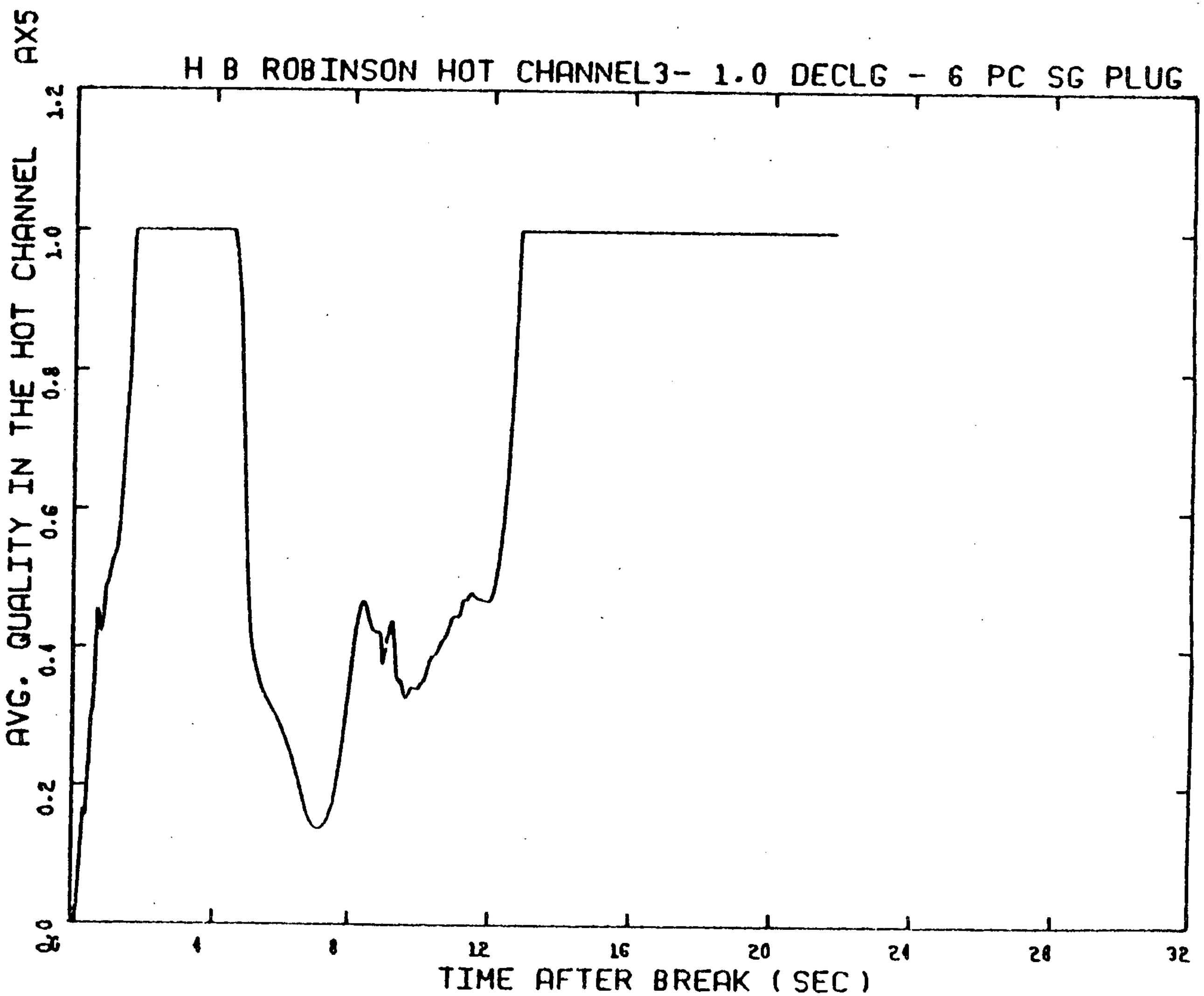



Figure 3.68 Hot Channel Average Quality, Center Volume 1.0 DECLG Break, 2 MWD/KgU

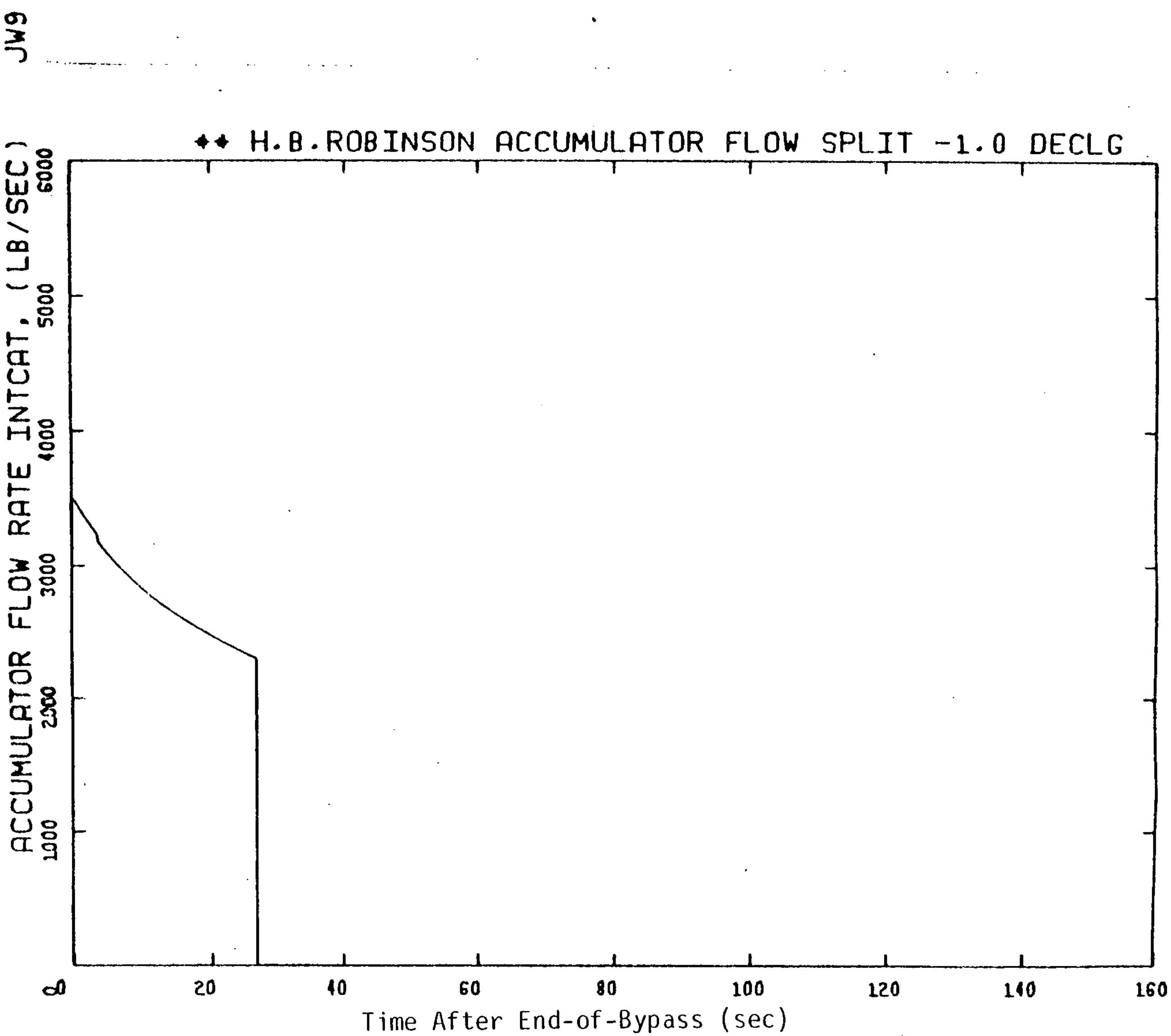



Figure 3.69 Accumulator (Intact) Flow During Refill and Reflood Periods, 1.0 DECLG Break

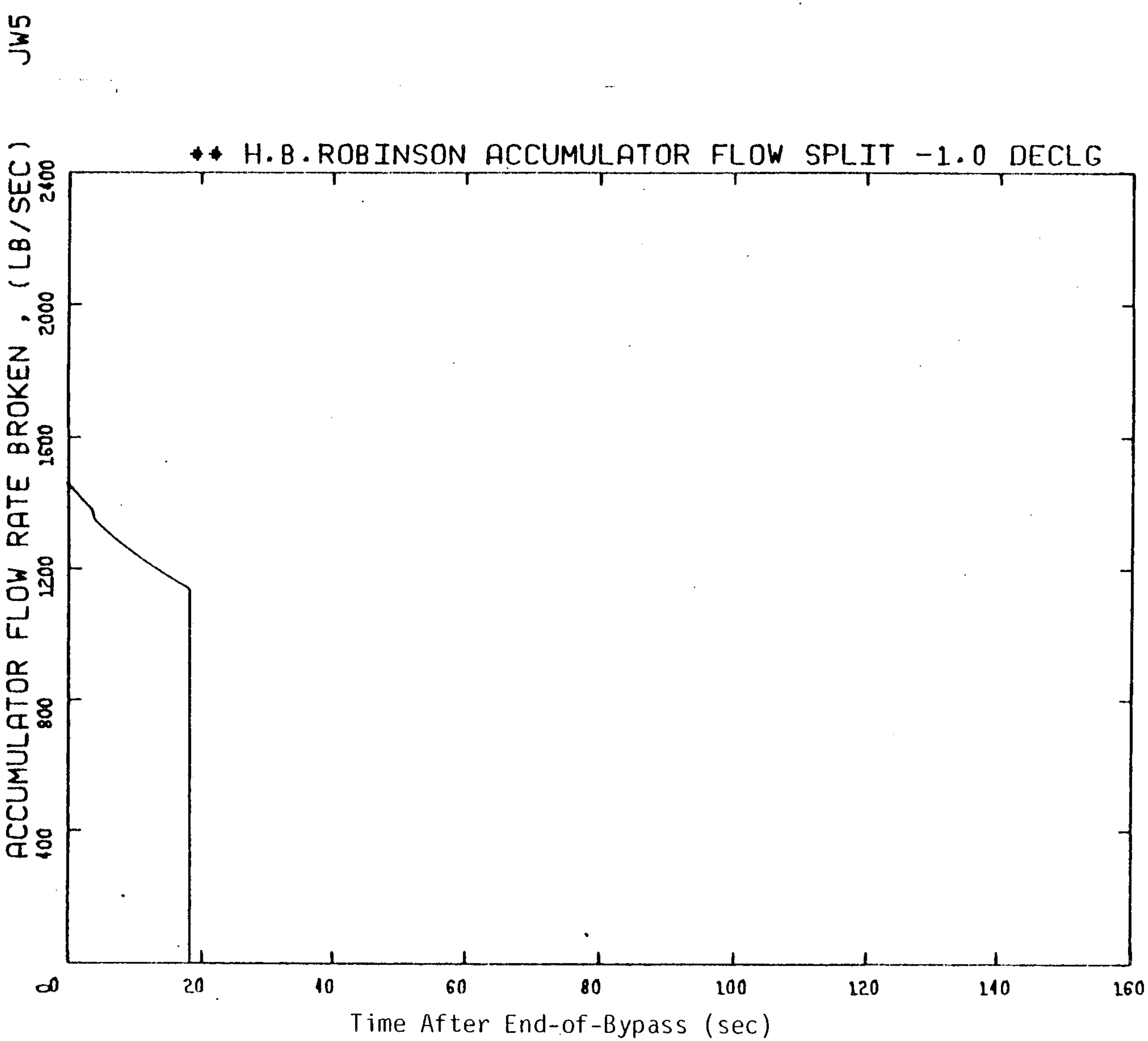



Figure 3.70 Accumulator (Broken) Flow During Refill and Reflood Periods, 1.0 DECLG Break

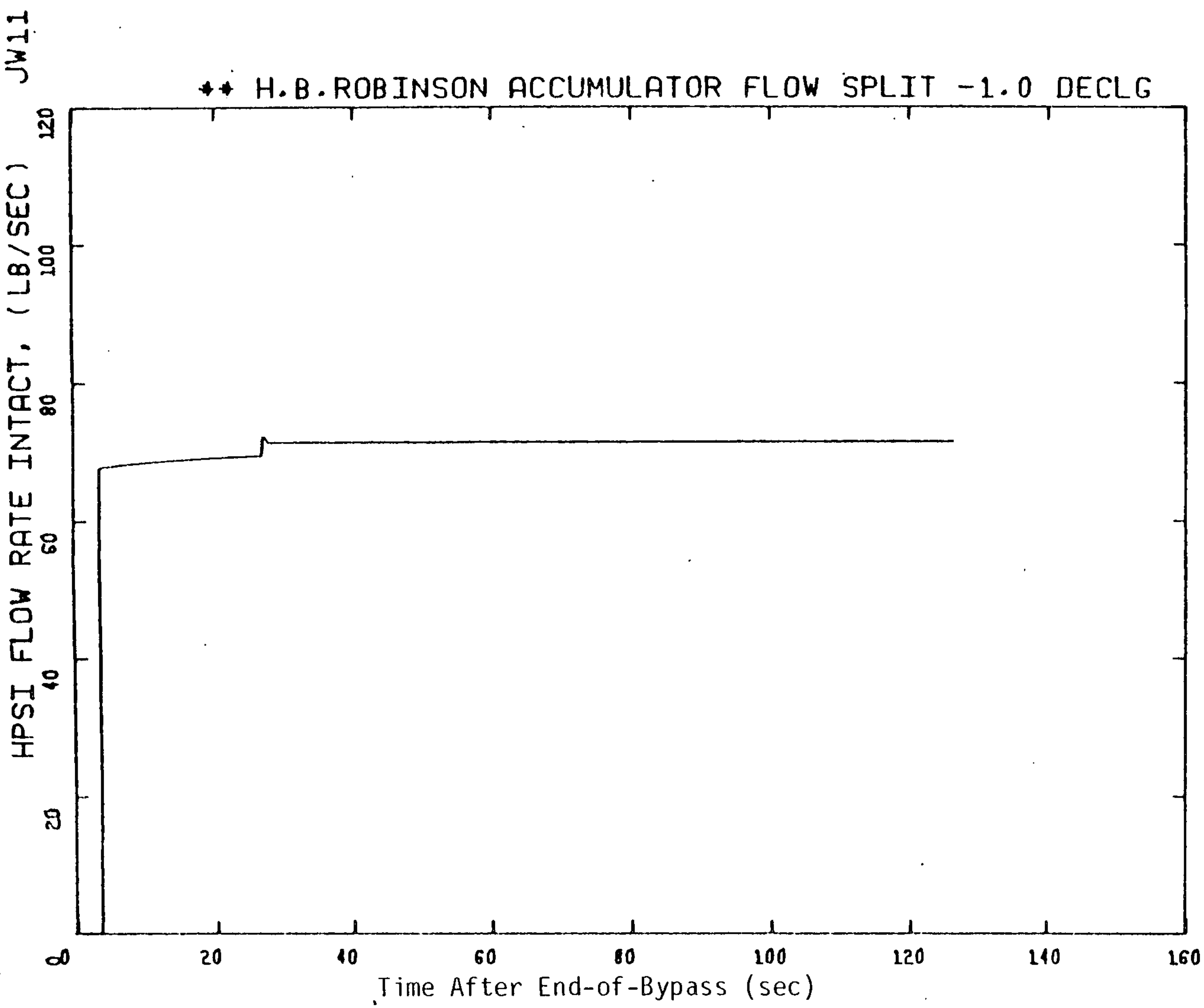



Figure 3.71 HPSI (Intact) Flow During Refill and Reflood Periods, 1.0 DECLG Break

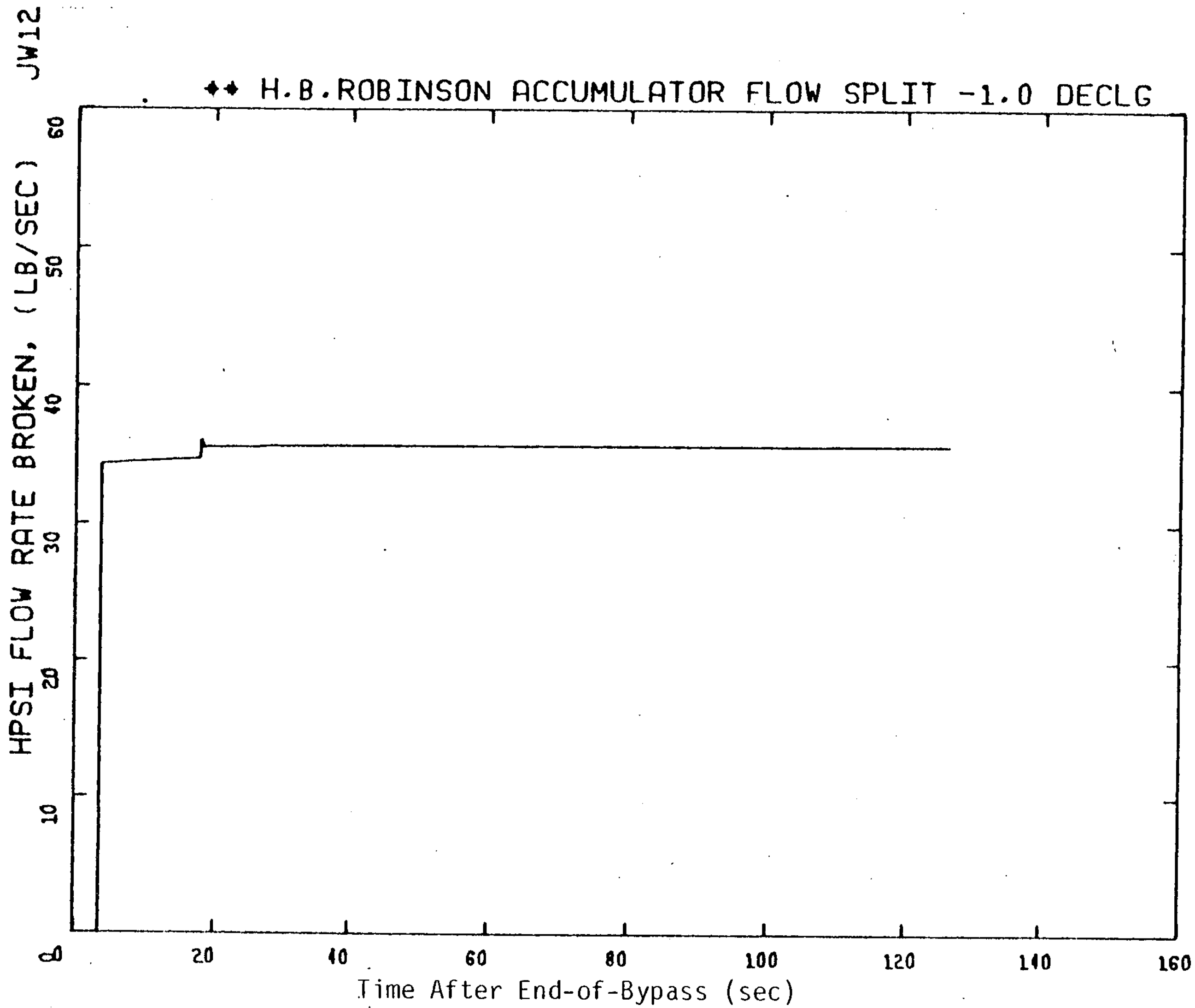



Figure 3.72 HPSI (Broken) Flow during Refill and Reflood Periods, 1.0 DECLG Break

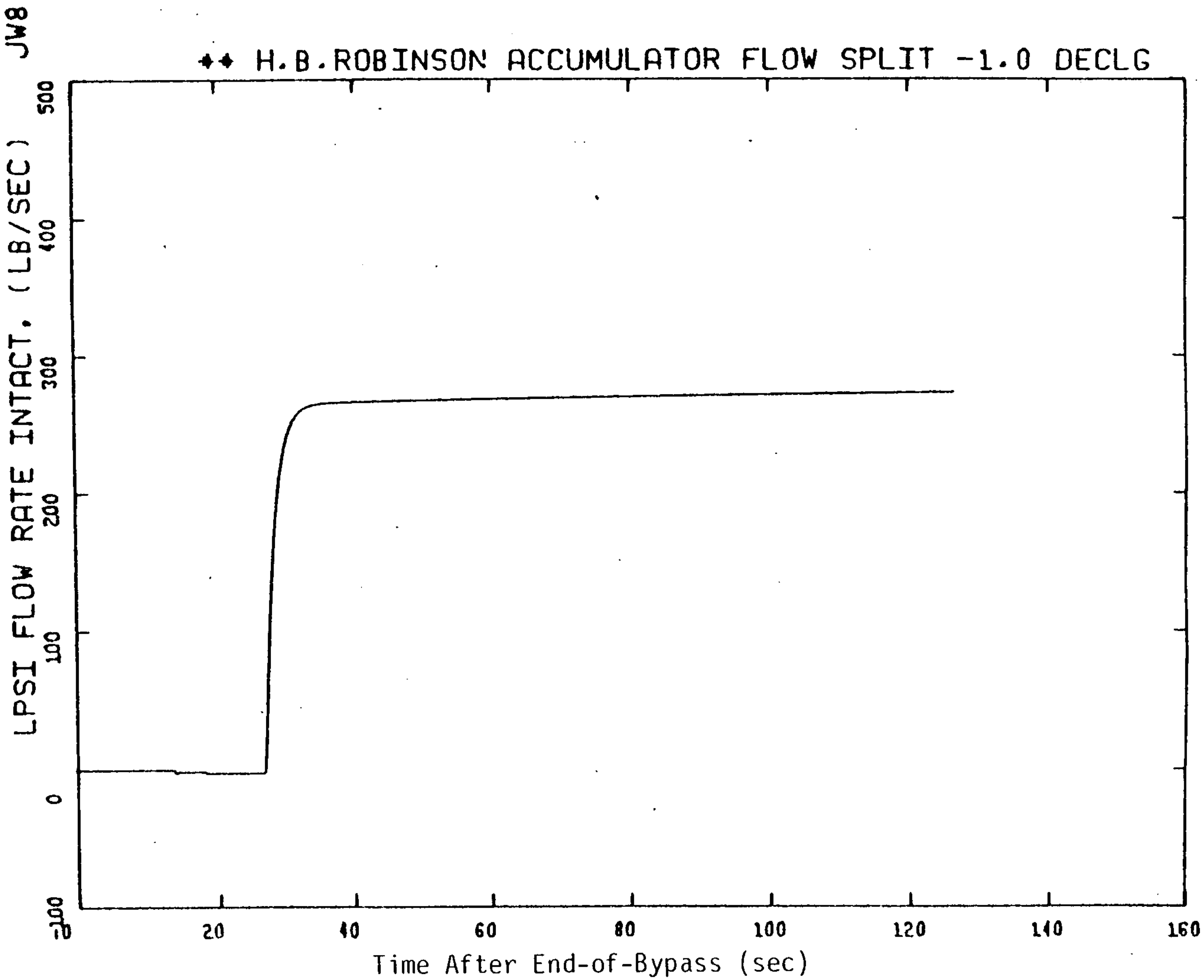



Figure 3.73 LPSI (Intact) Flow during Refill and Reflood Periods, 1.0 DECLG Break

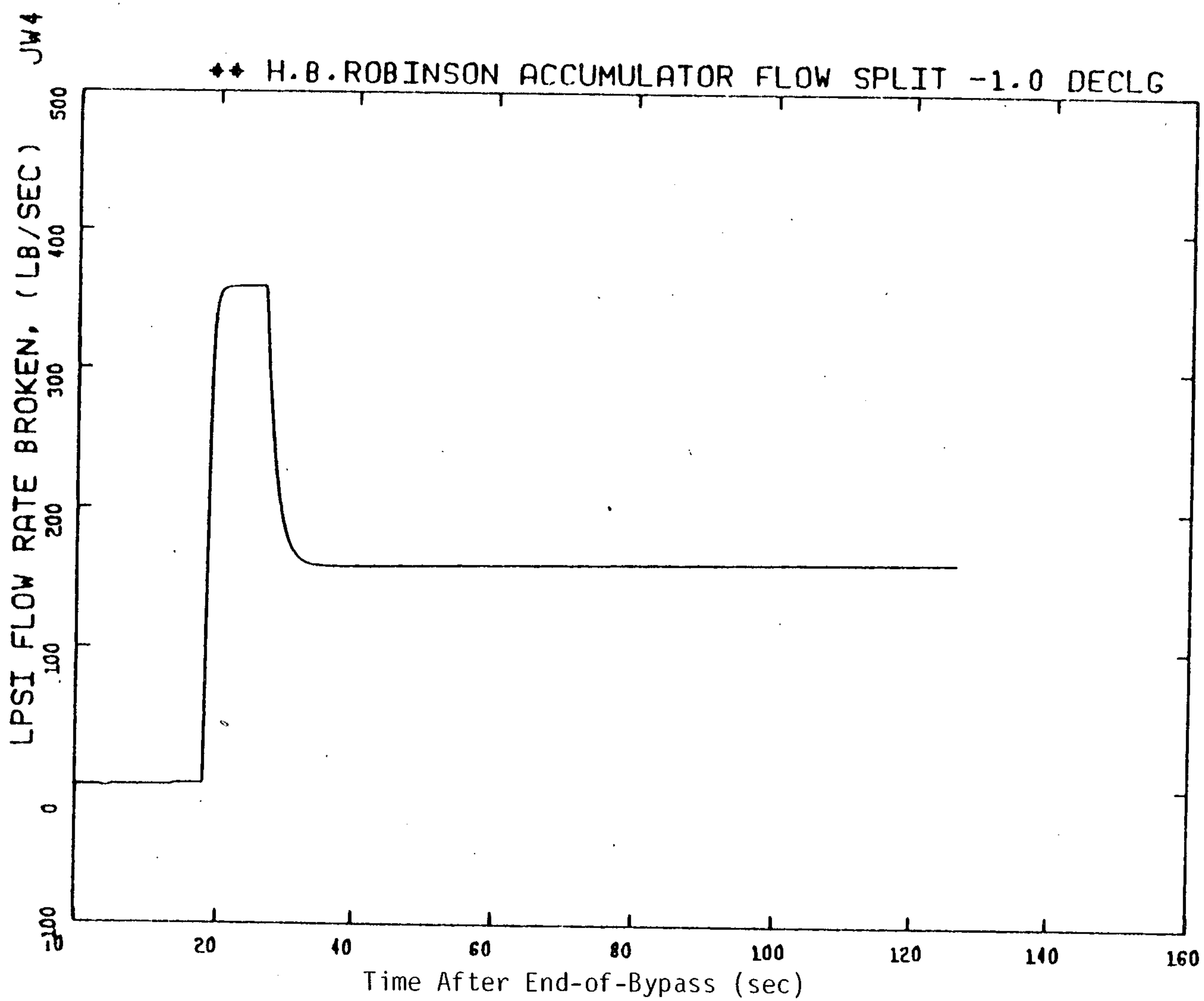



Figure 3.74 LPSI (Broken) Flow During Refill and Reflood Periods, 1.0 DECLG Break

H.B. ROBINSON 1.0 DECLG BREAK CONTAINMENT BACK PRESSURE $F_Q$=2.32 6%SG

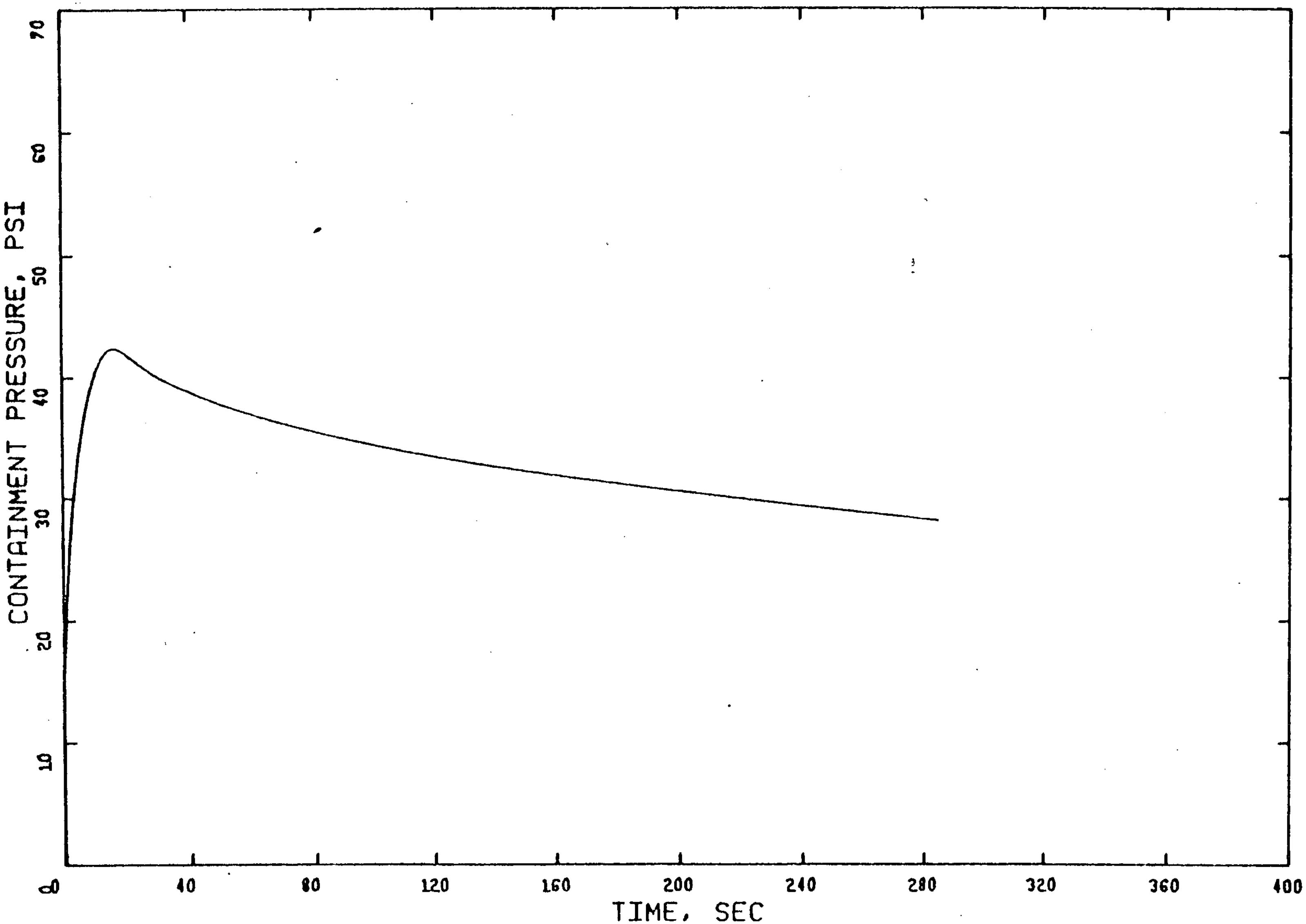



Figure 3.75 Containment Back Pressure, 1.0 DECLG Break

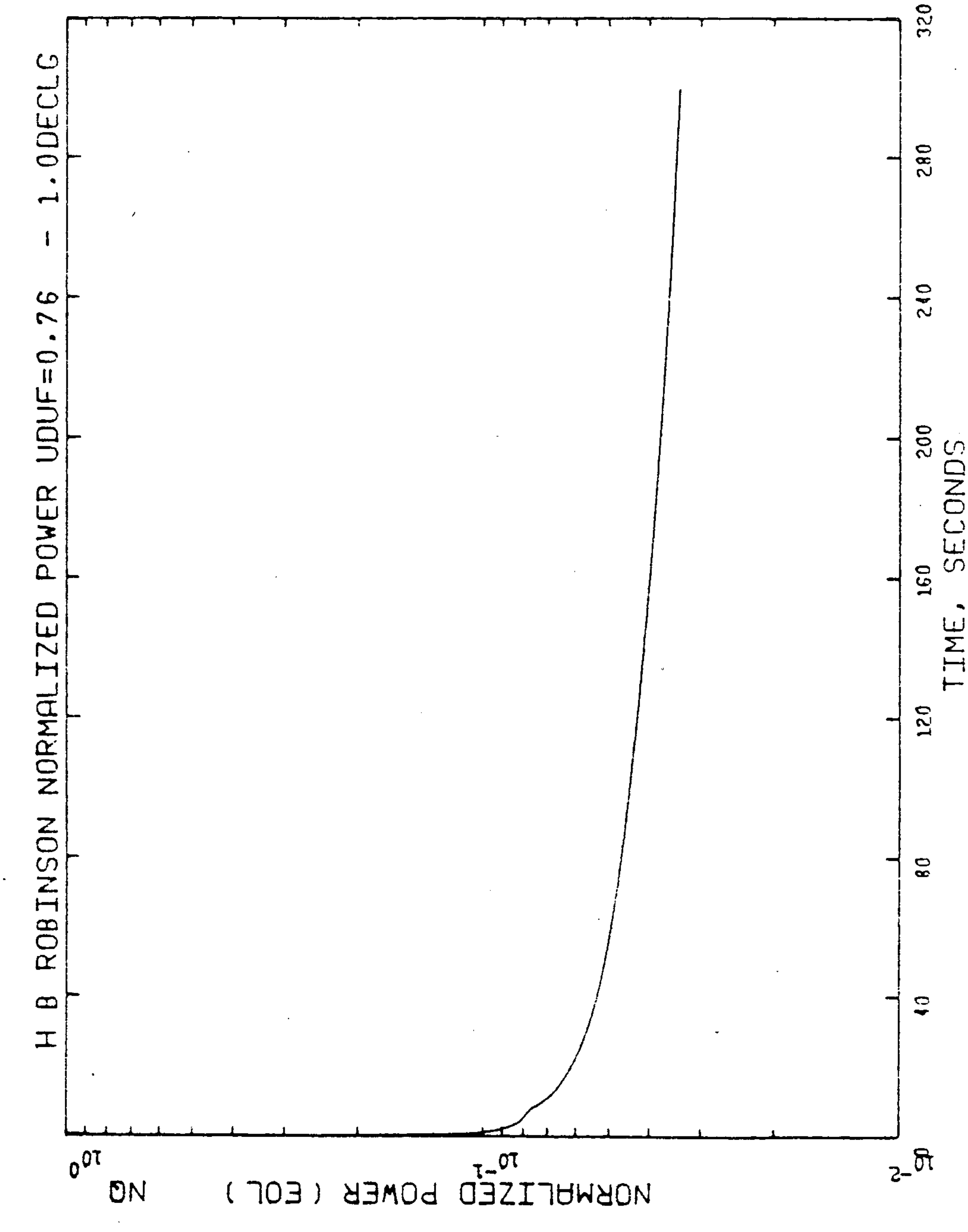



Figure 3.76 Normalized Power, 1.0 DECLG Break

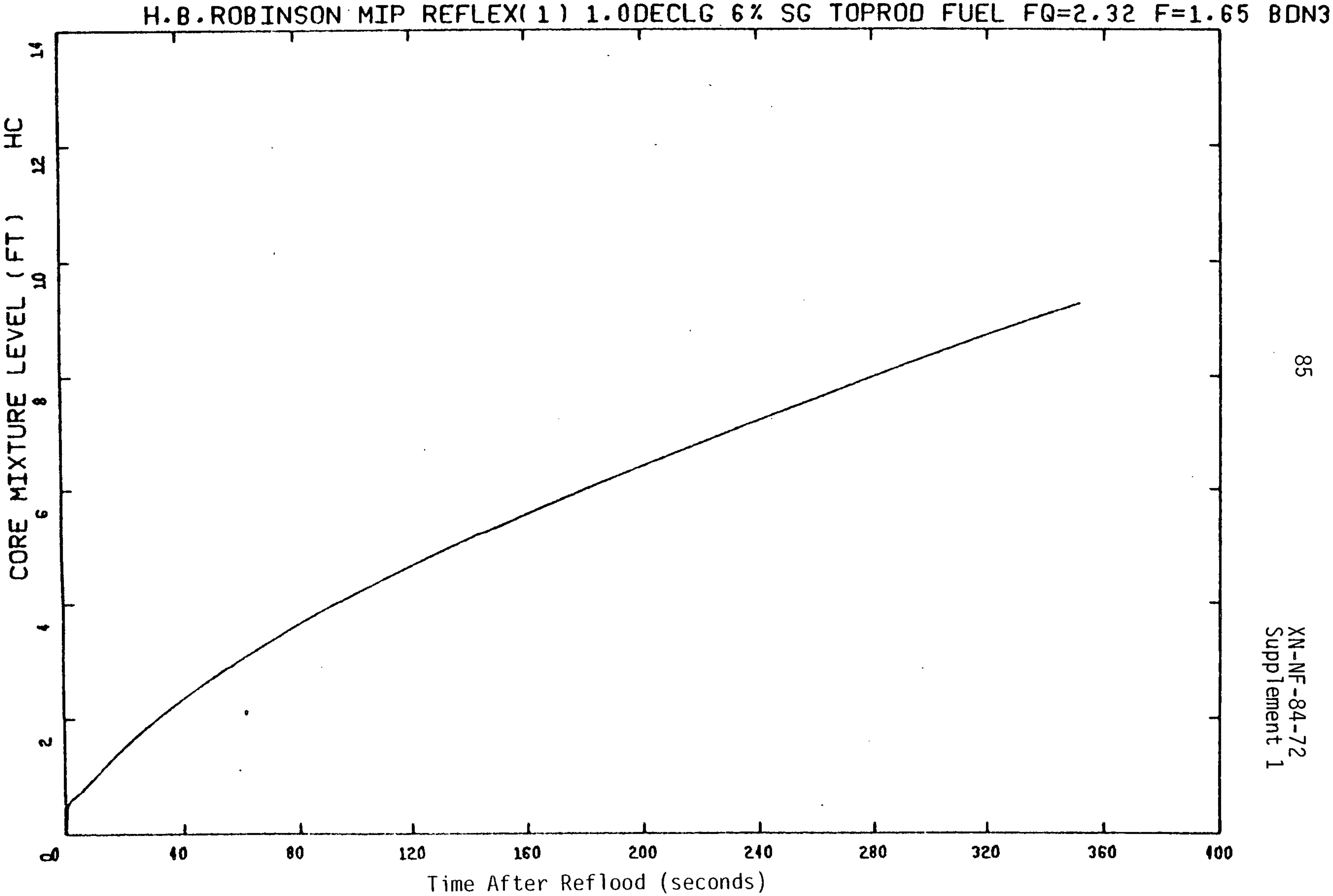



Figure 3.77 Reflood Core Mixture Level, 1.0-DECLG Break

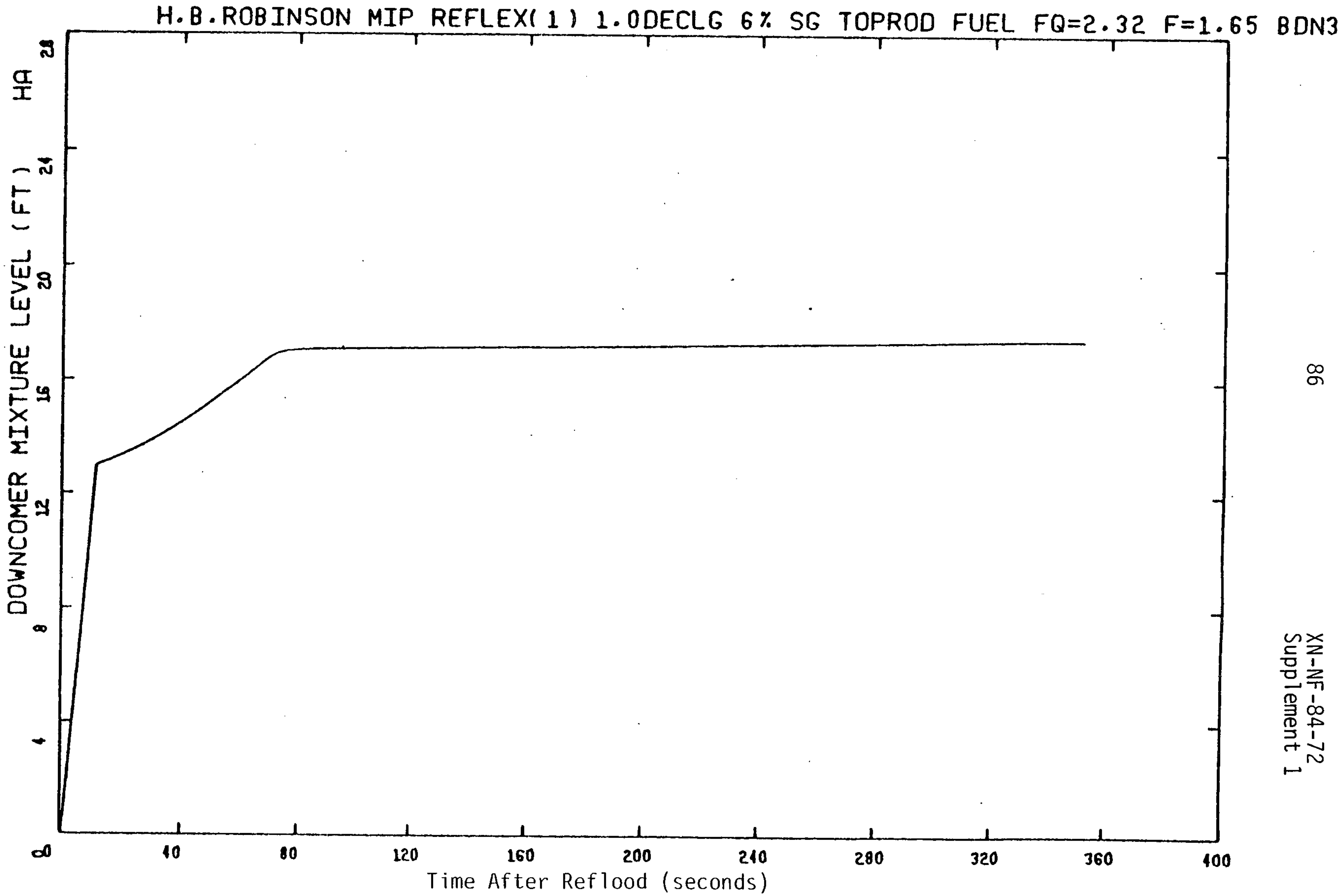



Figure 3.78 Reflood Downcomer Mixture Level, 1.0 DECLG Break

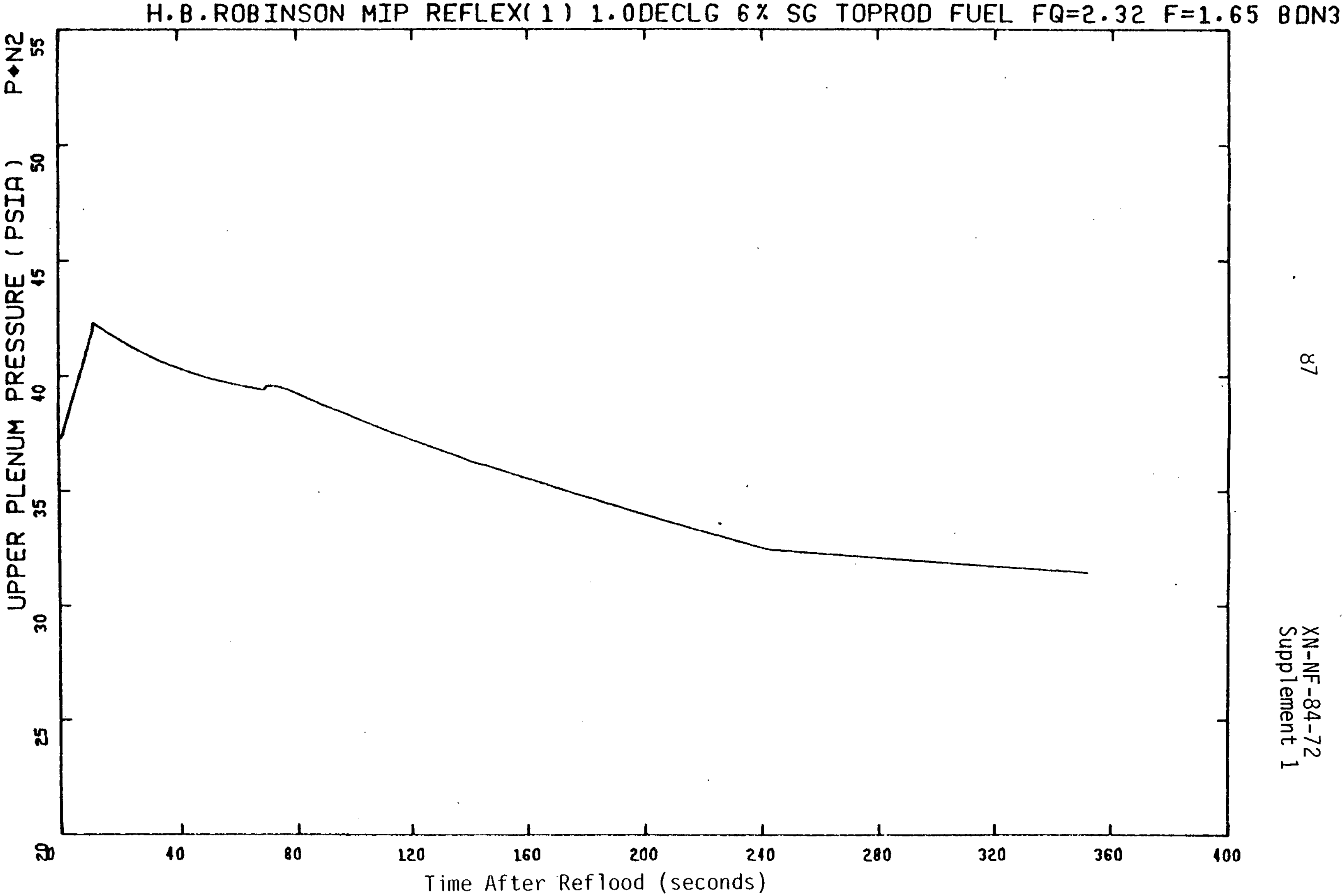



Figure 3.79 Reflood Upper Plenum Pressure, 1.0 DECLG Break

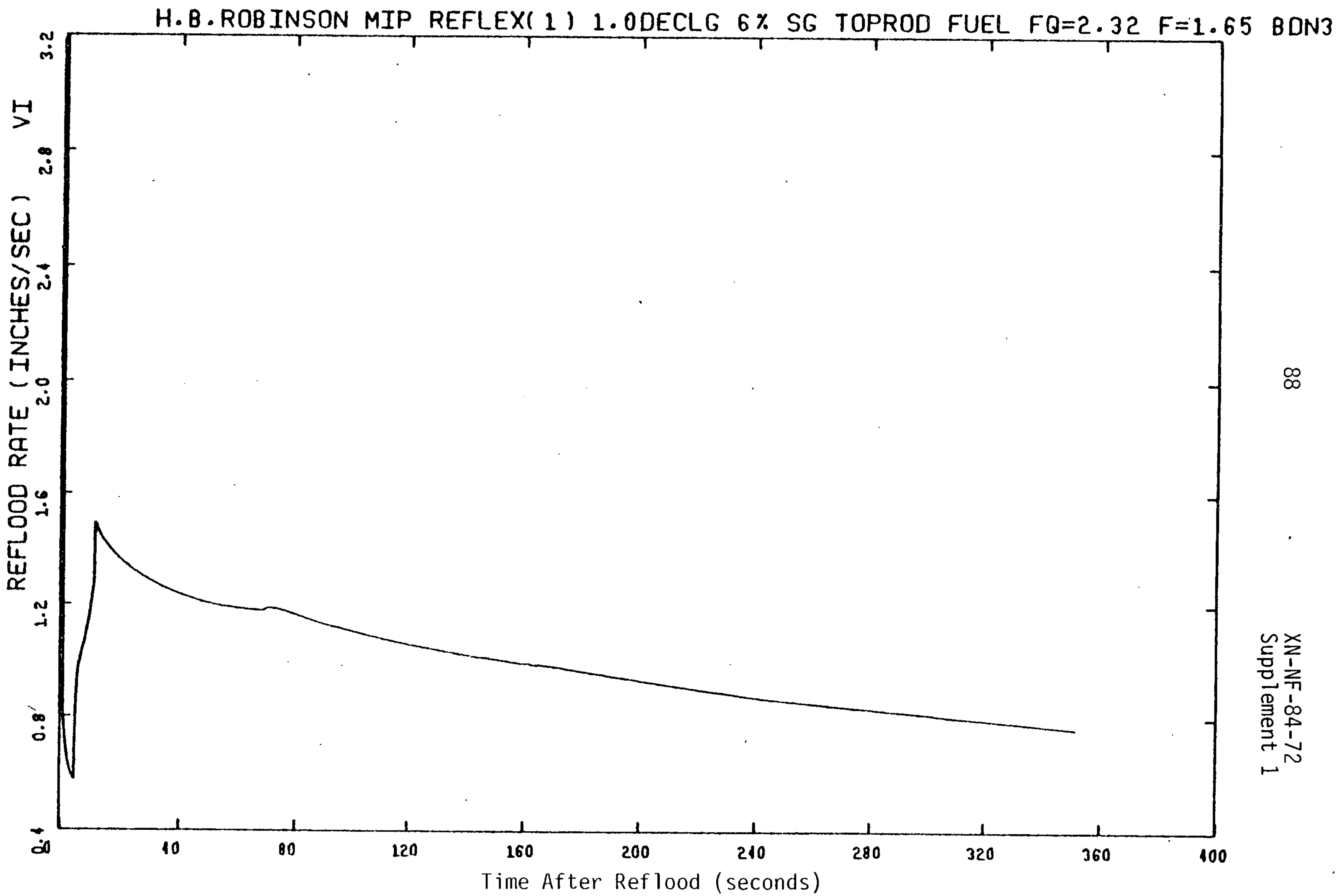



Figure 3.80 Core Flooding Rate, 1.0 DECLG Break

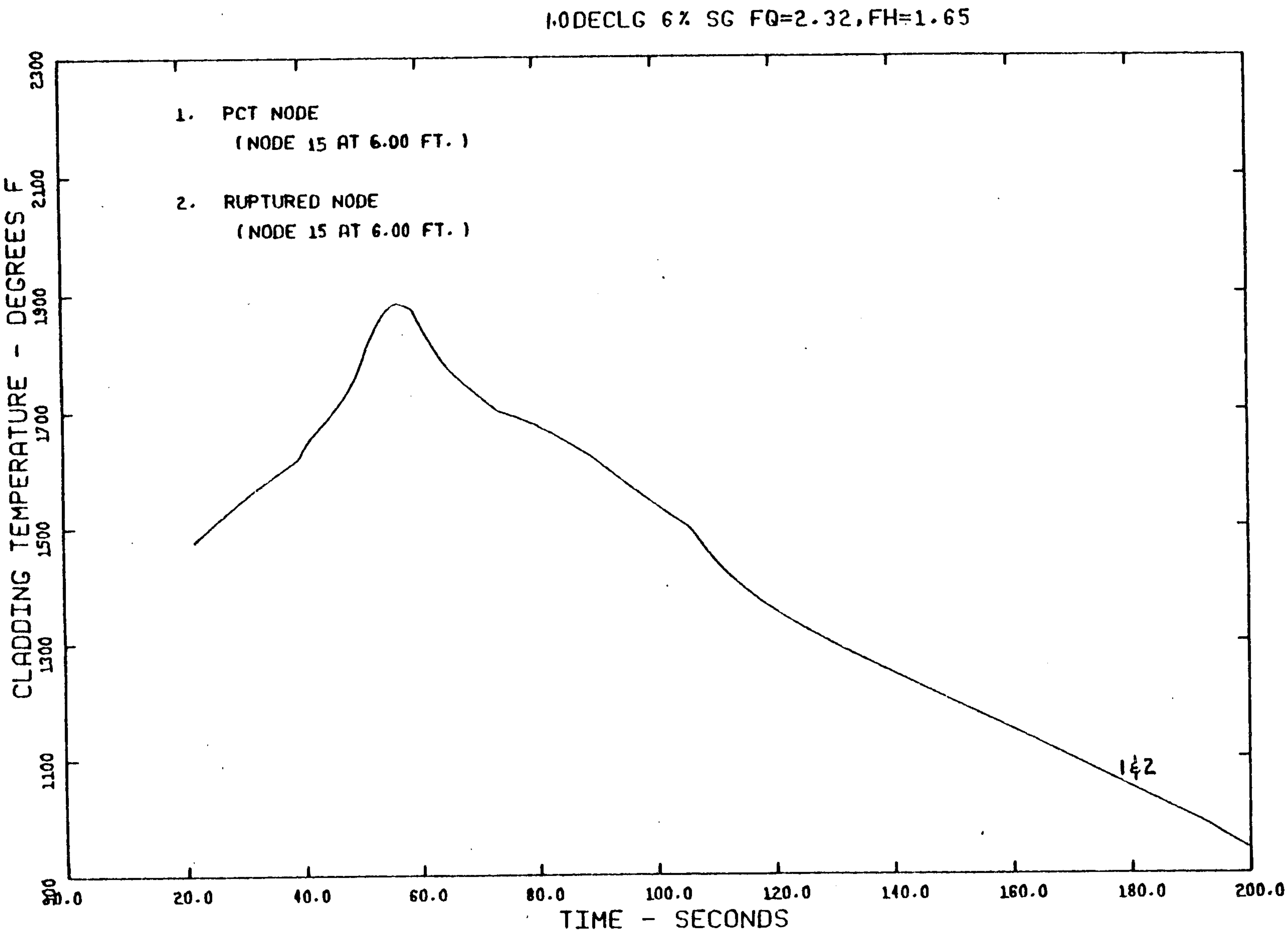



Figure 3.81 TOODEE2 Cladding Temperature vs. Time, 1.0 DECLG Break, 2 MWD/KgU Exposure

## 4.0 CONCLUSION

For breaks up to and including the double-ended severance of a reactor coolant pipe, the Emergency Core Cooling System for H.B. Robinson Unit 2 will meet the Acceptance Criteria as presented in 10 CFR 50.46, with the 2.32 $F_Q^T$ and 1.65 $F_{\Delta H}^T$ limits. The criteria are as follows:

(1) The calculated peak fuel element clad temperature does not exceed the 2200°F limit.

(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 cladding temperature transient is terminated at a time when the core geometry is still amenable to cooling. The hot fuel rod 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.

## 5.0 REFERENCES

1. "H.B. Robinson Unit 2 Large Break LOCA-ECCS Analysis With Increased Enthalpy Rise Factor," XN-NF-84-20, Exxon Nuclear Company, Richland, WA 99352, July 1984.

2. "LOCA Analyses for H.B. Robinson Unit 2 Using WREM-Based PWR ECCS Evaluation Model With Reduced LPSI Flow, Steam Generator Plugging and Increased Upper Head Temperature," XN-76-54, Exxon Nuclear Company, Richland, WA 99352, December 1976.

3. "ECCS and PTS Analyses for H.B. Robinson Unit 2 Reactor With 6%, 10% and 15% Steam Generator Tube Plugging," XN-NF-80-43, Exxon Nuclear Company, Richland, WA 99352, September 1980.

4. "Exxon Nuclear Company Evaluation Model EXEM/PWR ECCS Model Updates," XN-NF-82-20(P), Exxon Nuclear Company, Richland, WA 99352, February 1982.

5. "Exxon Nuclear Company WREM-Based Generic PWR ECCS Evaluation Model," XN-75-41, Exxon Nuclear Company, Richland, WA 99352, July 1975.

6. "Exxon Nuclear Company WREM-Based Generic PWR ECCS Evaluation Model Update ENC WREM-IIA," XN-NF-78-30, Exxon Nuclear Company, Richland, WA 99352, August 1979.

XN-NF-84-72, Supplement 1
Issue Date: 8/14/84

# H. B. ROBINSON UNIT 2
# LIMITING BREAK LOCA-ECCS ANALYSIS
# WITH INCREASED ENTHALPY RISE FACTOR:
# BREAK SPECTRUM ANALYSIS

Distribution

MJ Ades
GJ Busselman
JC Chandler
RE Collingham
GC Cooke
LJ Federico
SE Jensen
WV Kayser
CE Leach
MR Killgore
GA Sofer
IZ Stone
RB Stout
T Tahvili
NRC/CP&L/TJ Helbling (82)
Document Control (5)