BABCOCK & WILCOX
NUCLEAR POWER GENERATION DIVISION

TECHNICAL DOCUMENT

FUNCTIONAL CONTRACT SPECIFICATION

18 - 1005812 - 00 N557

Doc. ID – Serial No., Revision No.

for

REACTOR COOLANT SYSTEM

ACCEPTABILITY OF FUNCTIONAL SPECIFICATION 18-1005812-00

CERTIFICATION DOCUMENT

Babcock & Wilcox Co. Contract No. 620-0007-50

User: Florida Power Corporation

User Contract No. PR3-1000

I certify that Functional Contract Specification 18-1005812-00 has been reviewed to show that the primary piping, as shown by the Babcock & Wilcox Co. drawings identified on pages iv and v of the Stress Report Certification Document dated January 27, 1976, would meet the design requirements of Tentative American Standard Code for Pressure Piping, Nuclear Power Piping U.S.A.S. B31.7, February 1968. The basis of this review and acceptability of the Functional Specification for a licensing power upgrade of this contract consisted of both a comparison of the specification with the corresponding Functional Specification of a physically duplicate component, B&W Contract 620-0012-50, and an assumption that the stress evaluation of B&W Contract 620-0012-50 provides accurate assurance of acceptable code stress values. With the above conditions, the component would be shown to meet applicable code stress limits if reanalyzed.

Exceptions:

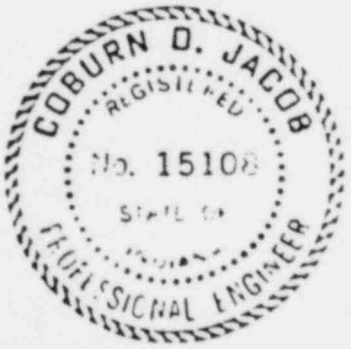
(1) The stress limit condition of Table 3, Case III, of the Functional Contract Specification 18-1005812-00 is excluded from this certification.

This certification consists of one (1) sheet. Attested to this date 2-2-79.

By: Coburn O Jacob

Coburn O. Jacob, Senior Engineer
Component Engineering
Mt. Vernon Engineering Dept.
The Babcock & Wilcox Company

License No. 15108
Indiana State Board
of Professional
Engineers



CERTIFICATION DOCUMENT

FOR

REACTOR VESSEL ACCEPTABILITY OF

FUNCTIONAL SPECIFICATION 18-1005812-00

SHEET 1 OF 1

Babcock & Wilcox Contract No. 620-0007-51/52

User: Florida Power Corp.

User Contract No. PR3-1000

The reactor vessel stress report last certified by N.G. Dadiras on 3-27-74 has been reviewed and is acceptable to functional specification 18-1005812-00 with the following notation:

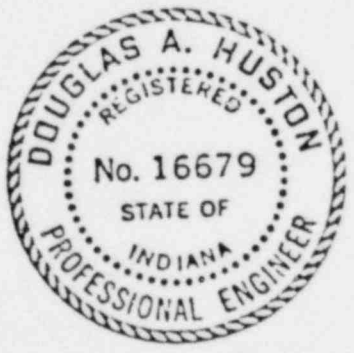
> Loading condition III in table 3 of specification 18-1005812-00, which was included in the original functional specification has not been analysed nor was it required by the specifications or codes.

Attested to this date 2-2-79.

By: Douglas A. Huston

Douglas A. Huston
Mt. Vernon Component
Engineering
The Babcock & Wilcox Co.

License No. 16679
Indiana State Board
of Professional Engineers



ACCEPTABILITY OF FUNCTIONAL SPECIFICATION 18-1005812-00

CERTIFICATION DOCUMENT

Babcock & Wilcox Co. Contract No. 620-0007-59

User: Florida Power Corporation

User Contract No. PR3-1000

I certify that Functional Contract Specification 18-1005812-00 has been reviewed to show that the Pressurizer, as shown by the Babcock & Wilcox Co. drawings identified on page 3 of the Stress Report Certification Document dated February 18, 1974, would meet the design requirements of the ASME Code, Section III, 1965 Edition with Addenda through Summer 1967.

The basis of this review and acceptability of the Functional Specification for a licensing power upgrade of this contract consisted of both a comparison of the specification with the corresponding Functional Specification of a physically duplicate component, B&W Contract 620-0012-59, and an assumption that the stress evaluation of B&W Contract 620-0012-59 provides accurate assurance of acceptable code stress values. With the above conditions, the component would be shown to meet applicable code stress limits if reanalyzed.

Exceptions:

(1) The stress limit condition of Table 3, Case III, of the Functional Contract Specification 18-1005812-00 is excluded from this certification.

This certification consists of one (1) sheet. Attested to this date 2-2-79.

By: R. W. Schaffstein

R.W. Schaffstein, Associate Engineer
Component Engineering
Mt. Vernon Engineering Dept.
The Babcock & Wilcox Company

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Indiana State Board
of Professional
Engineers

ACCEPTABILITY OF FUNCTIONAL SPECIFICATION 18-1005812-00

CERTIFICATION DOCUMENT

Babcock & Wilcox Co. Contract No. 620-0007-55

User: Florida Power Corporation

User Contract No. PR3-1000

I certify that Functional Contract Specification 18-1005812-00 has been reviewed to show that the Once Through Steam Generator, as shown by the Babcock & Wilcox Co. drawings identified on page 4 and 5 of the Stress Report Certification Document dated 3/27/74, would meet the design requirements of ASME Code, Section III, 1965 Edition with Addenda through Summer 1967. The basis of this review and acceptability of the Functional Specification for a licensing power upgrade of this contract consisted of both a comparison of the specification with the corresponding Functional Specification of a physically duplicate component, B&W Contract 620-0012-55, and an assumption that the stress evaluation of B&W Contract 620-0012-55 provides accurate assurance of acceptable code stress values. With the above conditions, the component would be shown to meet applicable code stress limits if reanalyzed.

Exceptions:

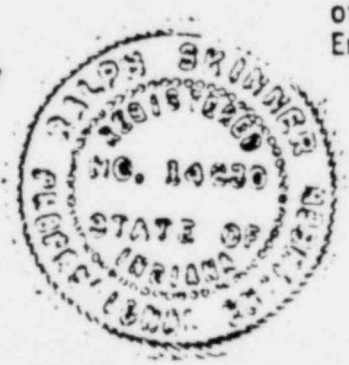
(1) The stress limit condition of Table 3, Case III, of the Functional Contract Specification 18-1005812-00 is excluded from this certification.

This certification consists of one (1) sheet. Attested to this date 2-2-79.

By: Ralph S Skinner

Ralph Skinner, Senior Engineer
Component Engineering
Mt. Vernon Engineering Dept.
The Babcock & Wilcox Company

License No. 14730
Indiana State Board
of Professional
Engineers



FILE NO.:

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

To [redacted] - PROJECT MANAGER

From
J. M. BURNETT - RCS COMPONENTS

BDS 663.5

Cust.
FLORIDA POWER CORPORATION

File No. 620-0007-T3.55/
or Ref. T3.59/T3.51/T3.5

Subj.
POWER UPGRADE - STRESS REPORT REVIEW

Date
FEBRUARY 20, 1979

This letter to cover one customer and one subject only.

Attachments:
(1) Stress Report Certification Document for Steam Generator, certified by Ralph Skinner on 2/2/79.

(2) Stress Report Certification Document for RC Piping, certified by Coburn O. Jacob on 2/2/79.

(3) Stress Report Certification Document for Reactor Vessel, certified by Douglas O. Houston on 2/2/79.

(4) Stress Report Certification Document for Pressurizer, certified by R. W. Schaffstein on 2/2/79.

(5) Functional Contract Specification for Reactor Coolant System, Document # 18-1005812-00.

The original stress analyses for the Steam Generator, RC Piping, Pressurizer, and Reactor Vessel have been reviewed to assess their applicability in light of revised functional requirements contained in Attachment (5). This review was done by means of comparison of the revised FPCo requirements with the corresponding requirements and stress analyses of a physically duplicate set of components on another B&W contract. No unique reanalysis was done for FPCo. The review performed indicates that the FPCo components would meet the requirements of the original contract Codes if reanalyzed. A copy of each component recertification (Attachment 1-4) is attached.

J. M. Burnett

JMB:dla

cc: R.M. Douglass
T.C. Helms
D.C. Leinhart (w/att. 1-4 only)
R.B. Park
R.N. Tornow

Sent to Florida Power -
C. E. Barksdale
FEB 22 1979

PDS-21039-3 (2-73)

E C Simpson

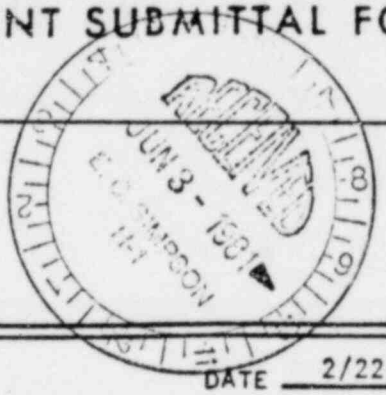
DOCUMENT SUBMITTAL FORM

Babcock & Wilcox

Power Generation Group

P.O. Box 1260, Lynchburg, Va. 24505

Telephone: (804) 384-5111



TO Florida Power Corporation
Crystal River, Florida

ATTN Mr. G. P. Beatty

DATE 2/22/79

B&W CONTRACT NO. NSC-12B

CUST. Florida Power Corporation

CUST. ORDER NO

SHEET 1 OF 5

TYPE DOC

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DOCUMENT DESCRIPTION

ORIGIN	VENDOR DOC. NO.	B&W DOC. NO.	COMP NO.	GRP NO.	DOC. TITLE
B&W		18-1005812-00	-	-	Functional Contract Specification

As a result of the CR-3 power upgrade to 2544 MWt a new specification was prepared to establish the General Functional Requirements for reactor coolant system components. Enclosed, please find one copy of the functional specification and certifications of compliance for the reactor vessel, piping, steam generators, and pressurizer which concludes that the CR-3 components will meet the design requirements of the functional specification.

Certificates of compliance should be filed in your Quality Assurance folders for the respective components and the functional specification should be maintained in your Quality Assurance folders which contain all NSS and Auxiliary System Component Specifications.

Copies of this transmittal letter have been forwarded to personnel within the FPC Licensing Section in the event reference need to be made to the NRC during the licensing process.

If you have any questions or comments, please advise.

C. E. Barksdale

C. E. Barksdale

cc: Q. B. DuBors w/o att.
E. C. Simpson w/o att.
P. Y. Baynard w/o att.
J. S. Laing w/o att.
J. R. Shetler w/o att.
W. P. Ellsberry w/o att.

bcc: R. J. Finnin w/o at
J. M. Burnett w/o at
NSC-12B-12B w/o at

6.17.3 Transient Data

6.17.3.1 Reactor Coolant System

The reactor coolant pressure, temperature and surge line flow rate are shown in Figure 16-1. The make-up and high pressure injection flow rate and temperature are shown in Figure 16-2. In this transient, the makeup alone is not able to supply enough water to makeup for the contraction losses of the reactor coolant system and the low pressure causes the high pressure injection system to be turned on. The flow shown is split between the 4 HP injection nozzles, one of which has been kept cool by the makeup flow. The other three are at reactor coolant temperature when the cold water from the borated water storage tank begins being injected into the reactor coolant system.

6.17.3.2 Steam Generators

The steam generator conditions for the steam line break are presented in Figure 16-3. The blowdown thrust forces are defined in Reference 3 of Appendix II.

6.18 Transient 17 A&B (Upset & Emergency Conditions)

6.18.1 General Description

Transients 17A and 17B are to be used for analysis of unusual operations of the steam generators. Transient 17A is a transient in which feedwater flow is lost to a steam generator, which causes a reactor trip, and the steam generator is evaporated to a dry, pressurized condition. Following the reactor trip, auxiliary feedwater is slowly introduced to the dry steam generator to obtain minimum level. Transient 17B is an emergency transient in which a turbine bypass valve is assumed to stick open. The affected steam generator blows down to a dry, depressurized condition, and a reactor trip occurs. The faulted bypass valve is isolated and feedwater is slowly introduced through the auxiliary feed nozzles on the dry steam generator until minimum water level and pressure are restored.

6.18.2 Cycles

The number of loss of feedwater to one steam generator events for design purposes shall be 20. This event is included in the reactor trip cycle category and a complete cycle will consist of: a) Loss of feedwater to one steam generator with resultant reactor trip and recovery of level in the steam generator, and b) Return to full power as described in Transient 3 (Power Loading).

The number of stuck-open bypass valve events for design purposes shall be 10. This event is included in the reactor trip cycle category and a complete cycle will consist of: a) Stuck-open bypass valve with reactor trip and resultant depressurization of the steam generator and recovery of steam generator level, and b) Return to full power as described in Transient 3 (Power Loading).

6.18.3 Transient Data

6.18.3.1 Reactor Coolant System

The reactor coolant system conditions for Transient 17A are presented in Figures 17A-1, 17A-2, and 17A-3. Figures 17A-1, 17A-2, and 17A-3 show the conditions during loss of feedwater flow and Figures 17A-4, 17A-5 and 17A-6 show conditions during restart of the steam generator. Restart of the steam generator is accomplished with the auxiliary feedwater nozzle.

The reactor coolant system conditions for Transient 17B are presented in Figures 17B-1, 17B-2, and 17B-3. These figures show the conditions during depressurization and Figures 17B-4 and 17B-5 show the conditions during restart of the steam generator.

6.18.3.2 Steam Generator

The steam generator conditions for Transient 17A are presented in Figures 17A-4, 17A-5 and 17A-6.

The steam generator conditions for Transient 17B are presented in Figures 17B-4 and 17B-5.

6.19 Transient 18 - Loss of Feedwater Heater (Upset Condition)

6.19.1 General Description

The feedwater heaters are arranged so that one or more heaters can be isolated if necessary. When a feedwater heater is isolated, the feedwater temperature entering the steam generators will decrease. The control system will cause feedwater flow changes necessary to hold reactor power constant and no perturbations are expected in the reactor coolant system.

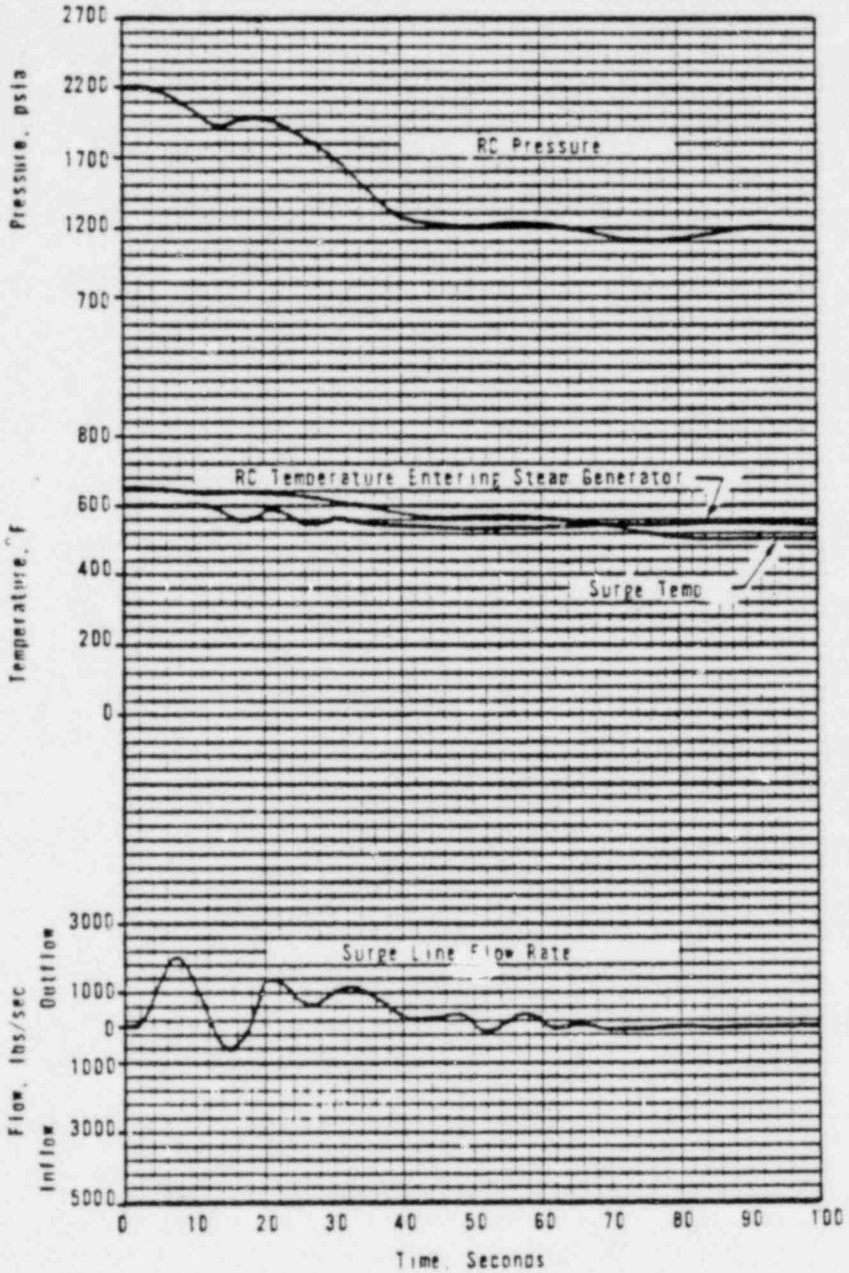

FIGURE 16-1

TRANSIENT NO 16 (STEAM LINE FAILURE)
REACTOR COOLANT SYSTEM PARAMETERS

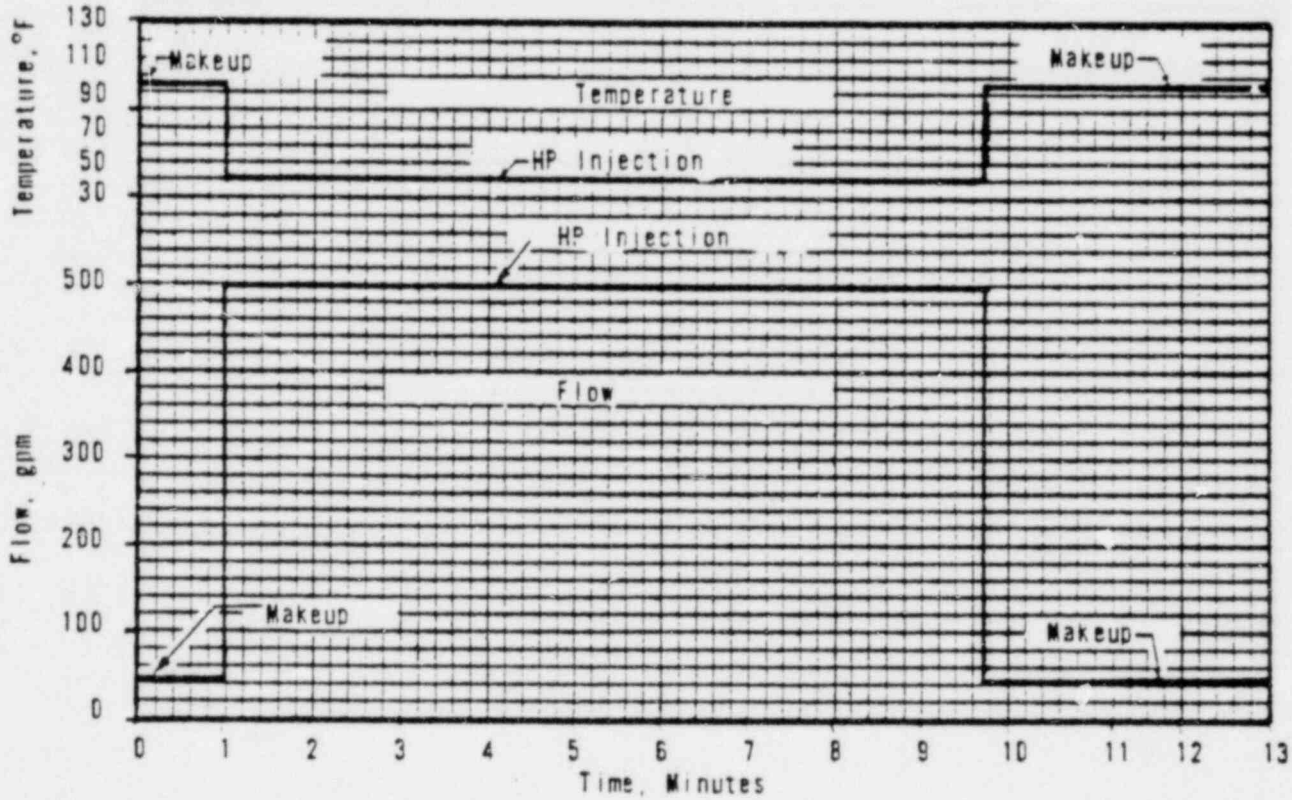

FIGURE 16-2

TRANSIENT NO. 16 (STEAM LINE FAILURE)
MAKEUP AND HP INJECTION FLOW RATE AND
TEMPERATURE

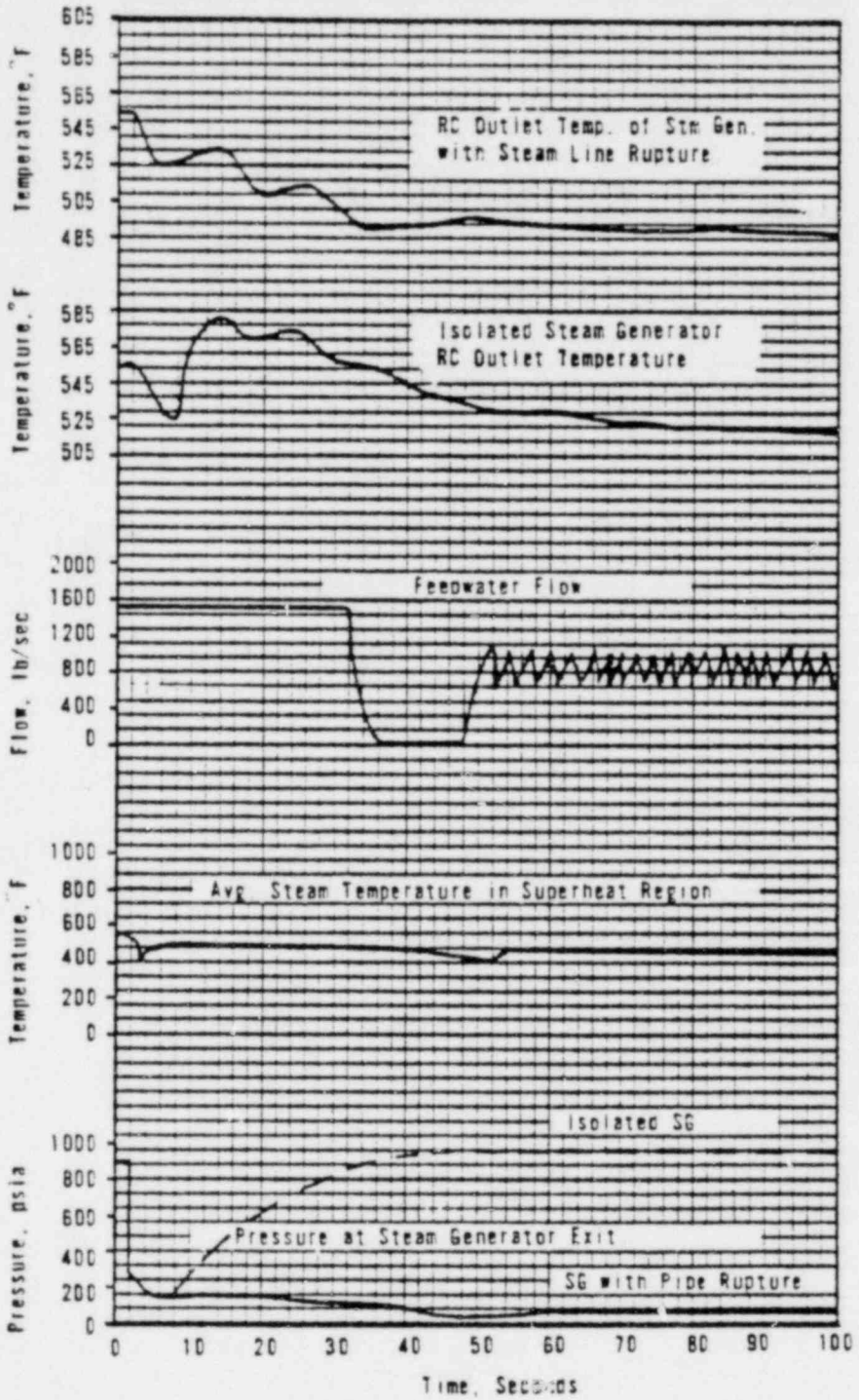

FIGURE 16-3

TRANSIENT NO. 16 (STEAM LINE FAILURE)
FEEDWATER-STEAM SYSTEM PARAMETERS

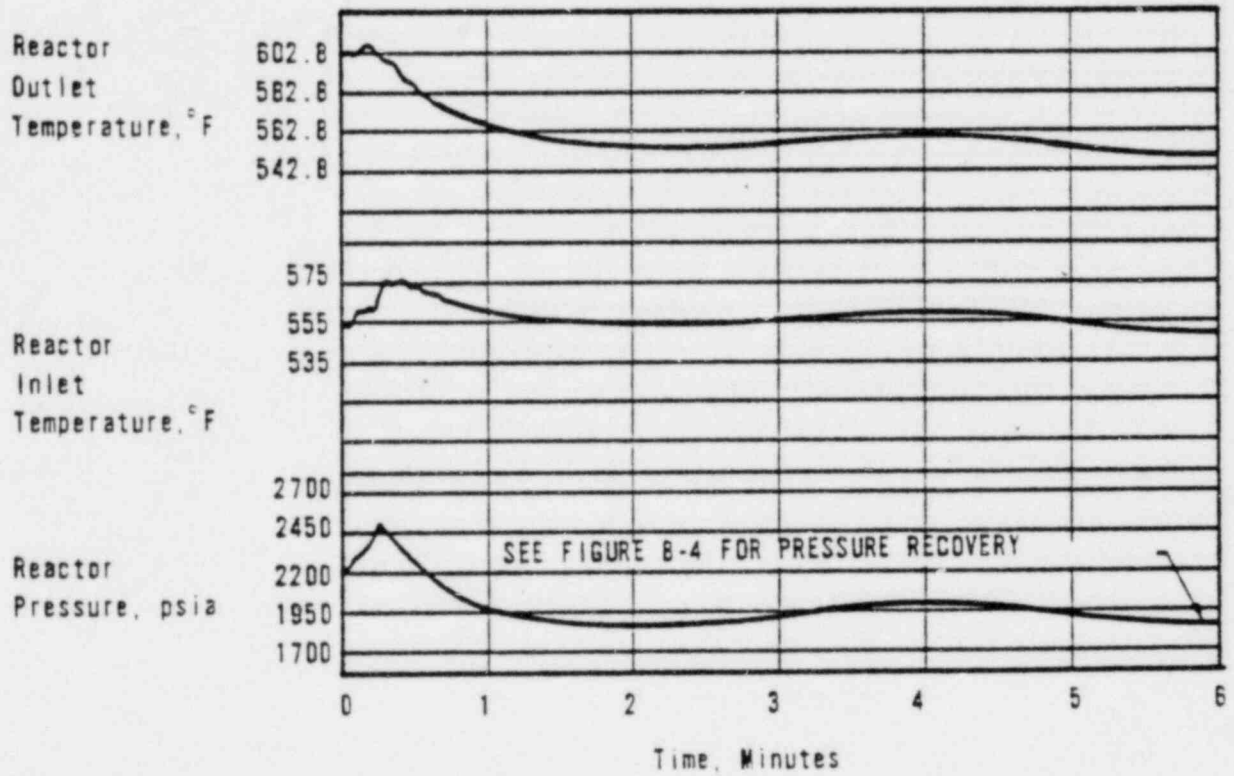

FIGURE 17A-1

TRANSIENT NO. 17A (LOSS OF FEEDWATER TO ONE STEAM GENERATOR) REACTOR COOLANT TEMPERATURE AND PRESSURE

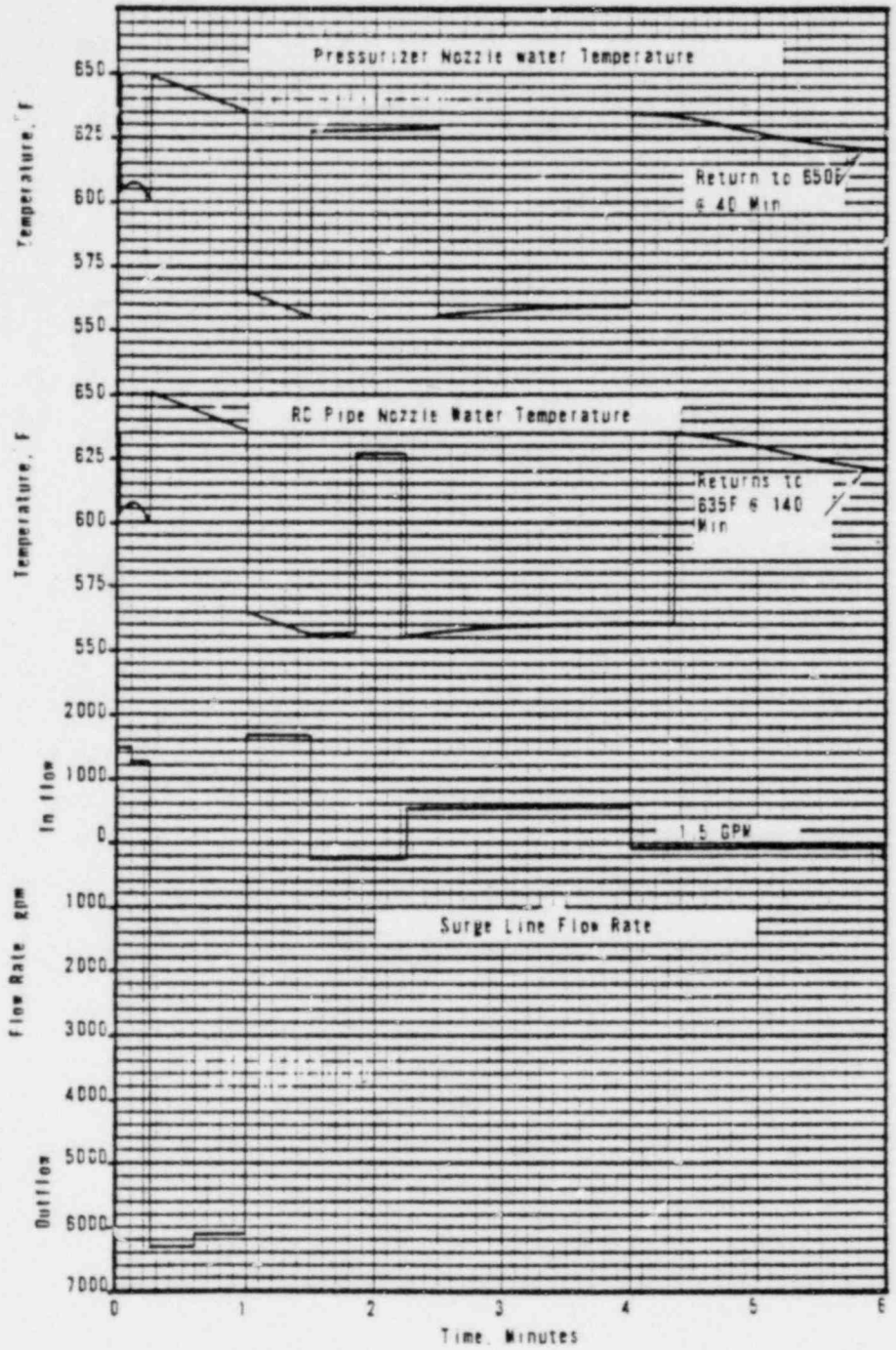

FIGURE 17A-2

TRANSIENT NO. 17A (LOSS OF FEEDWATER TO ONE STEAM GENERATOR)SURGE LINE FLOW AND WATER TEMPERATURE

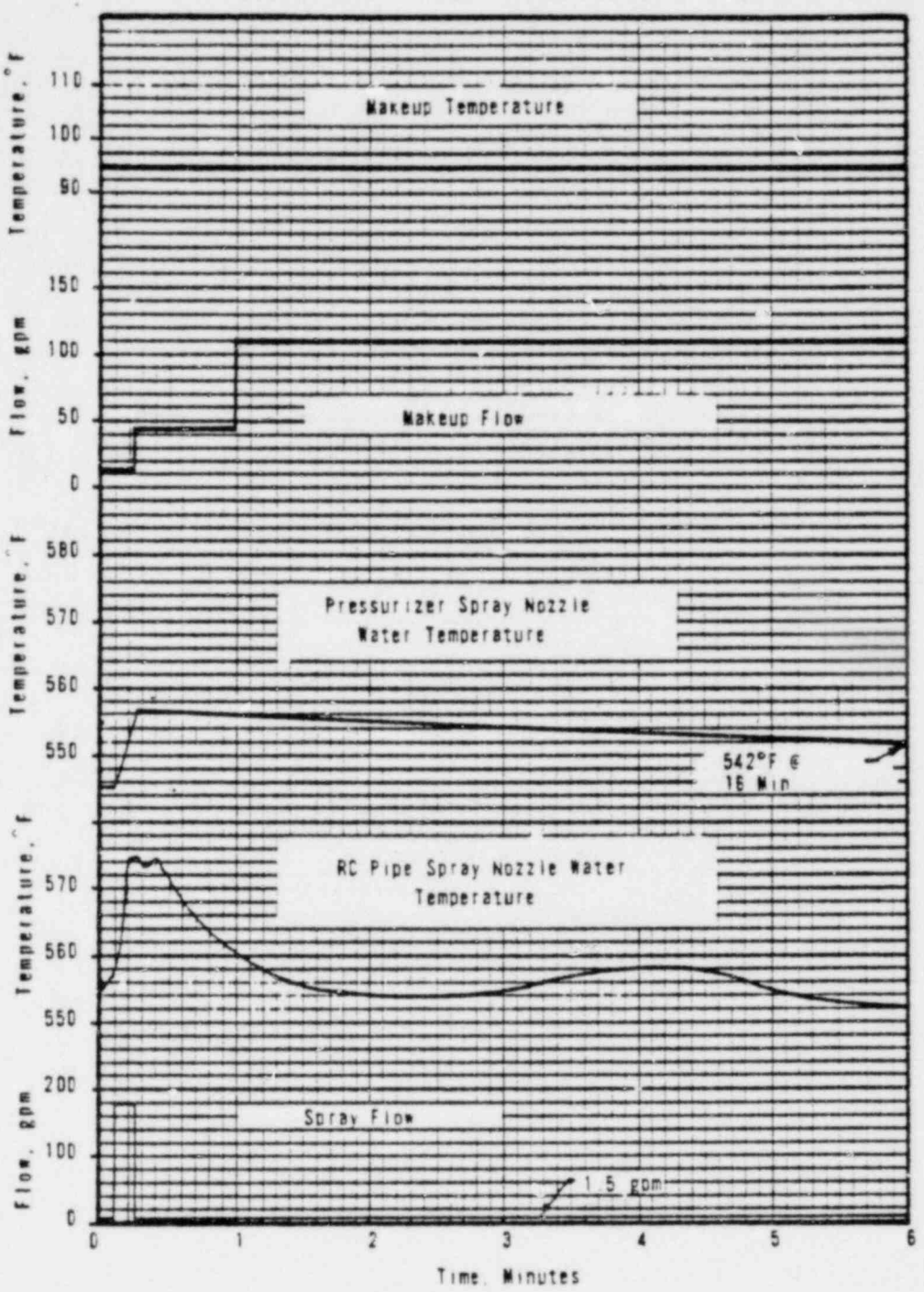

FIGURE 17A-3

TRANSIENT NO. 17A (LOSS OF FEEDWATER FLOW TO ONE STEAM GENERATOR) MAKEUP AND SPRAY TEMPERATURE AND FLOW RATE

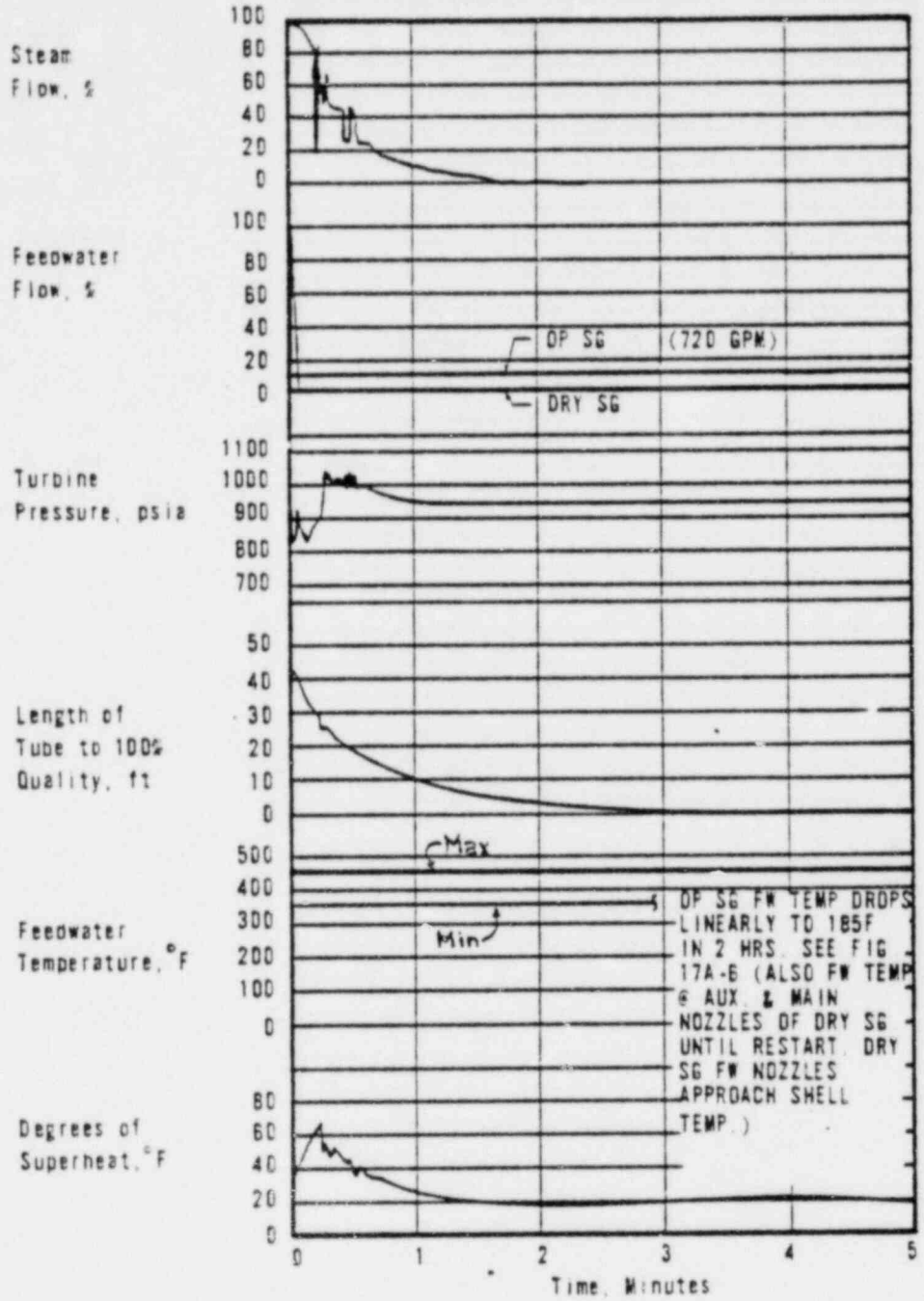

FIGURE 17A-4

TRANSIENT NO. 17A (LOSS OF FEEDWATER TO ONE STEAM GENERATOR) STEAM-FEEDWATER SYSTEM PARAMETERS

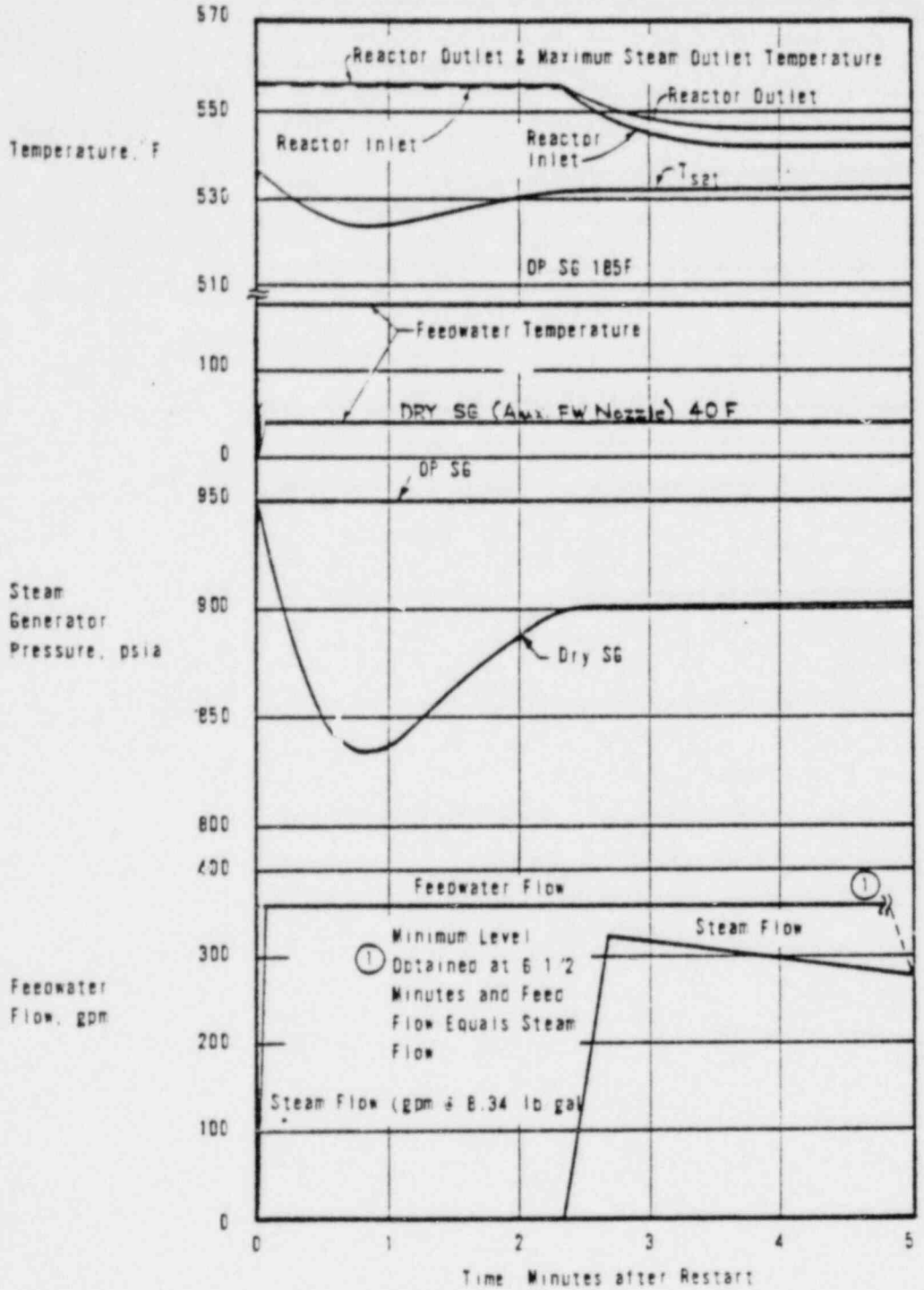

FIGURE 17A-5

TRANSIENT NO. 17A (LOSS OF FEEDWATER TO ONE STEAM GENERATOR)
STARTUP OF "DRY" PRESSURIZED STEAM GENERATOR

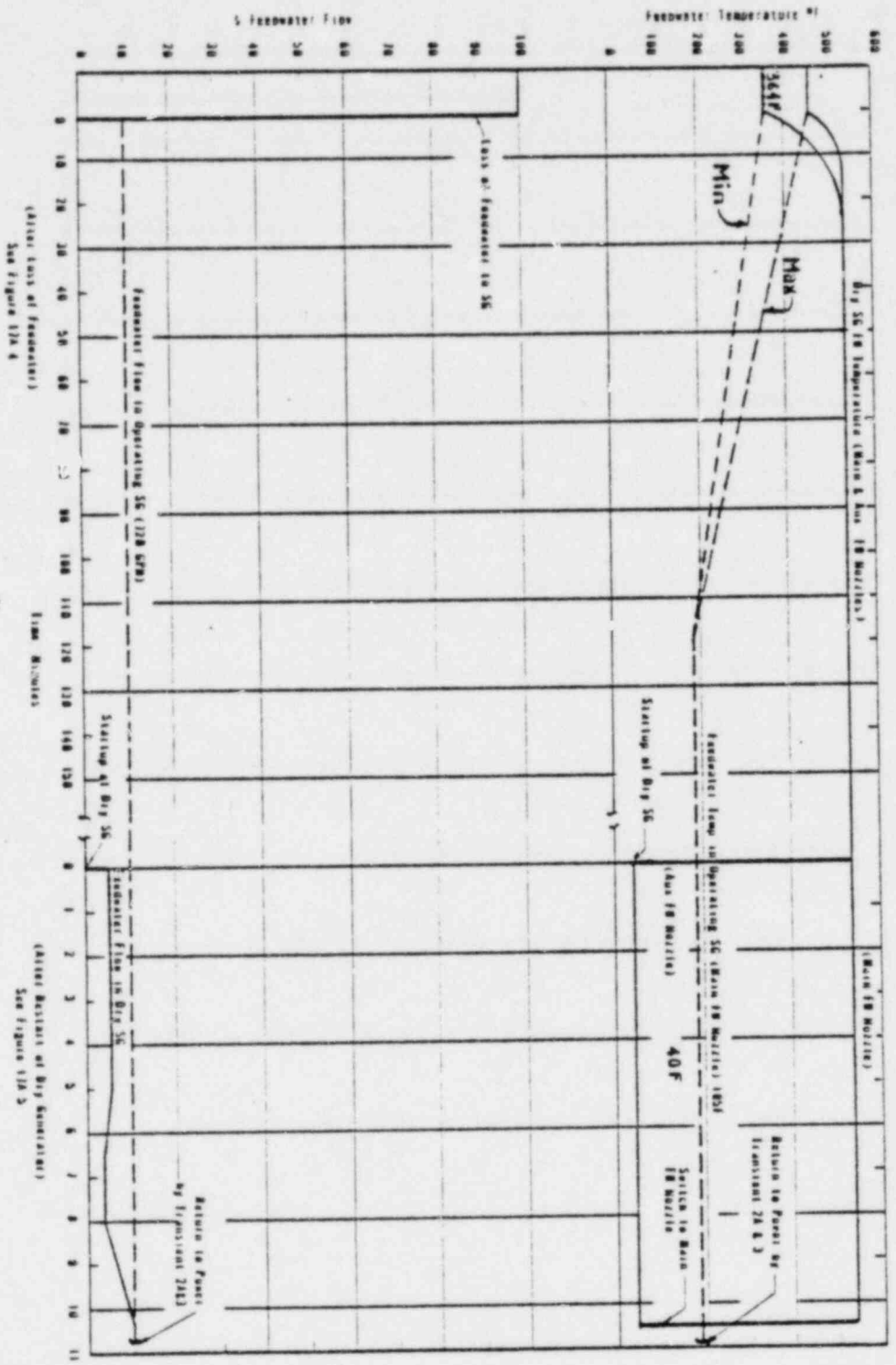

FIGURE 17A-6

TRANSIENT NO. 17A - LOSS OF FEEDWATER TO ONE STEAM GENERATOR
FEEDWATER FLOW AND TEMPERATURE

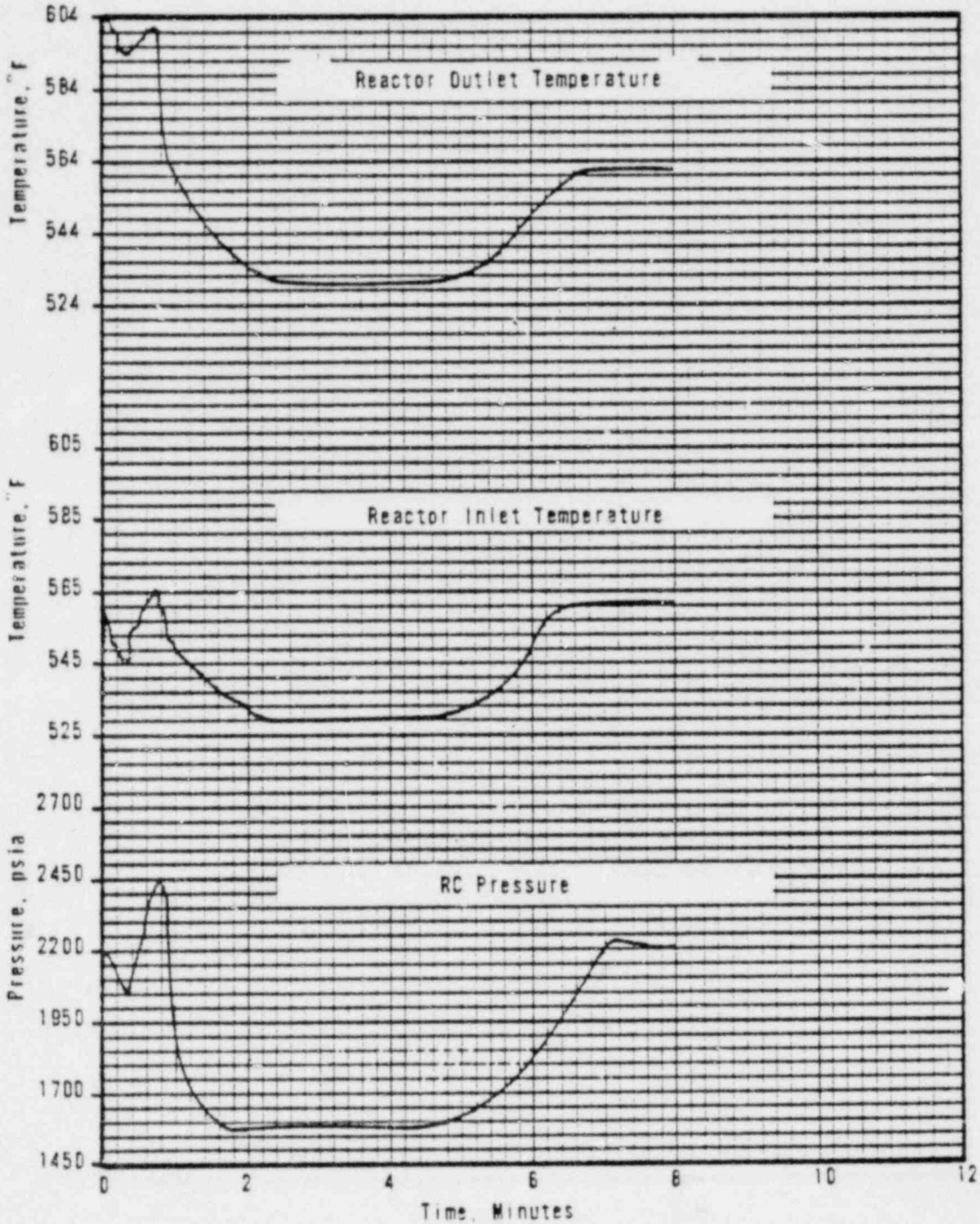

FIGURE 17B-1

TRANSIENT 17B (STUCK OPEN TURBINE BYPASS VALVE)
REACTOR COOLANT TEMPERATURE AND PRESSURE

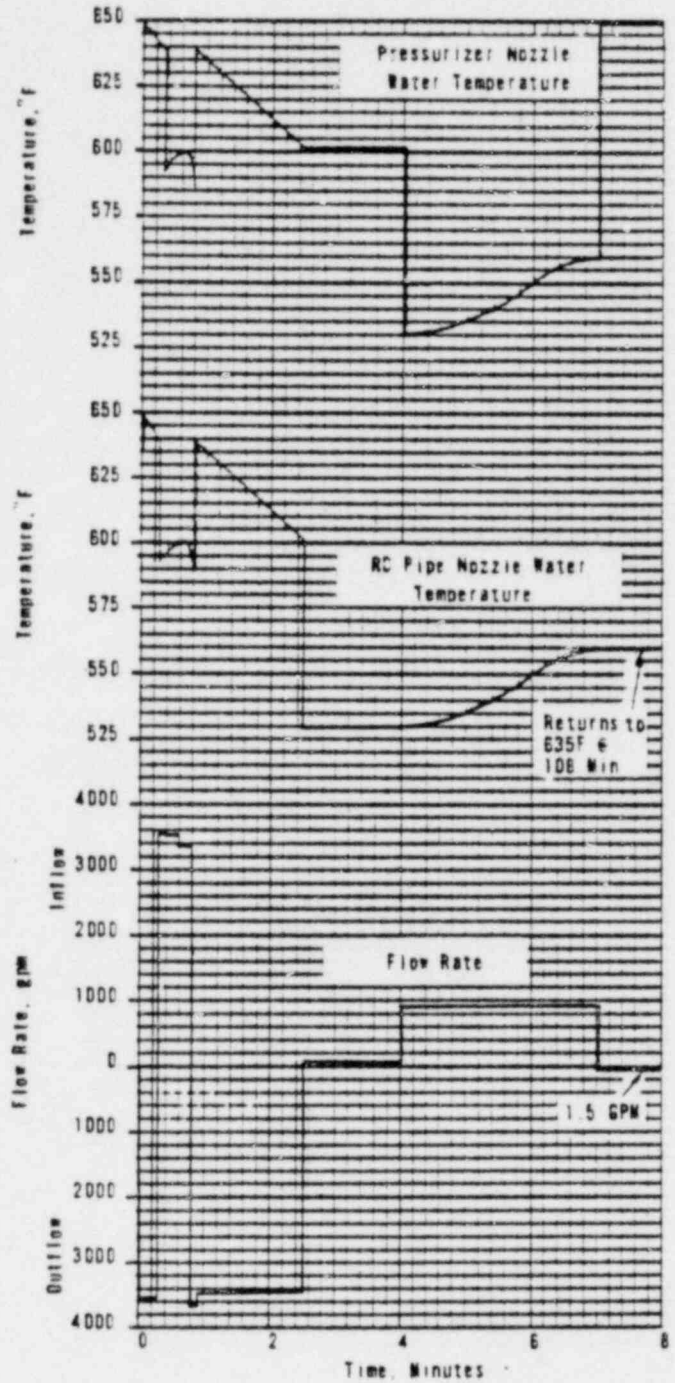

FIGURE 178-2

TRANSIENT NO. 178 (STUCK OPEN TURBINE BYPASS VALVE) SURGE LINE WATER TEMPERATURE AND FLOW

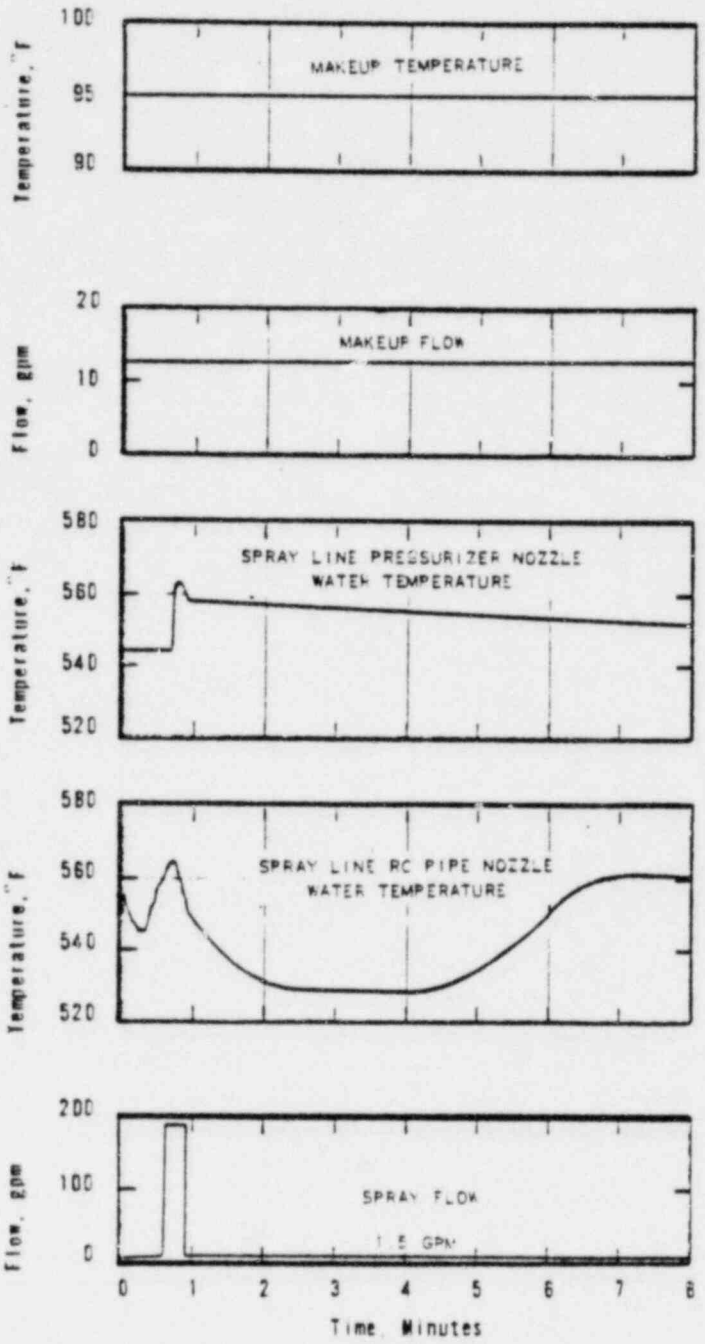

FIGURE 17B-3

TRANSIENT NO. 17B (STUCK OPEN TURBINE BYPASS VALVE)
MAKEUP AND SPRAY TEMPERATURE AND FLOW RATE

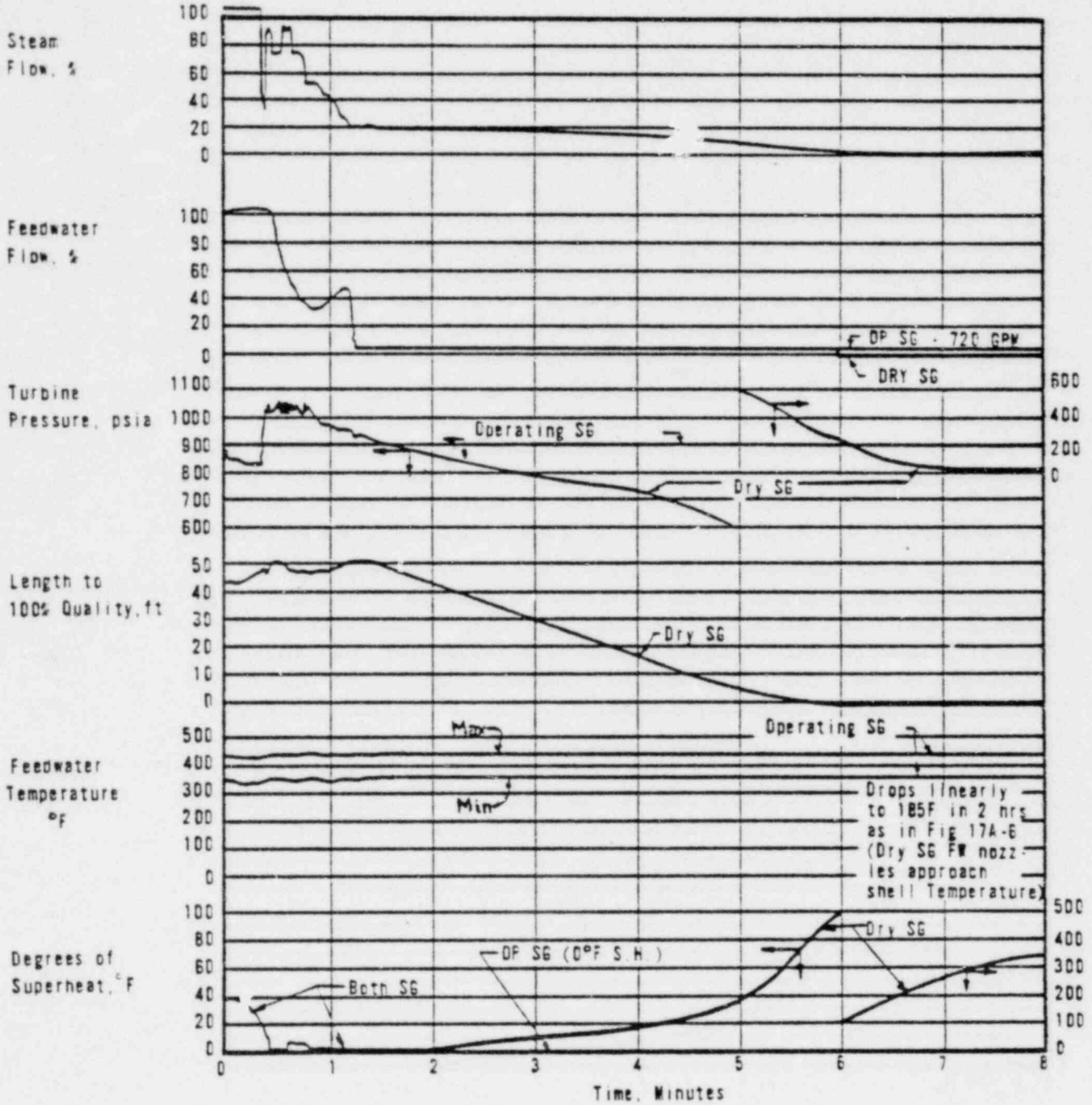

FIGURE 17B-4

TRANSIENT NO. 17B. (STUCK OPEN TURBINE BYPASS VALVE)
STEAM-FEEDWATER SYSTEM PARAMETERS

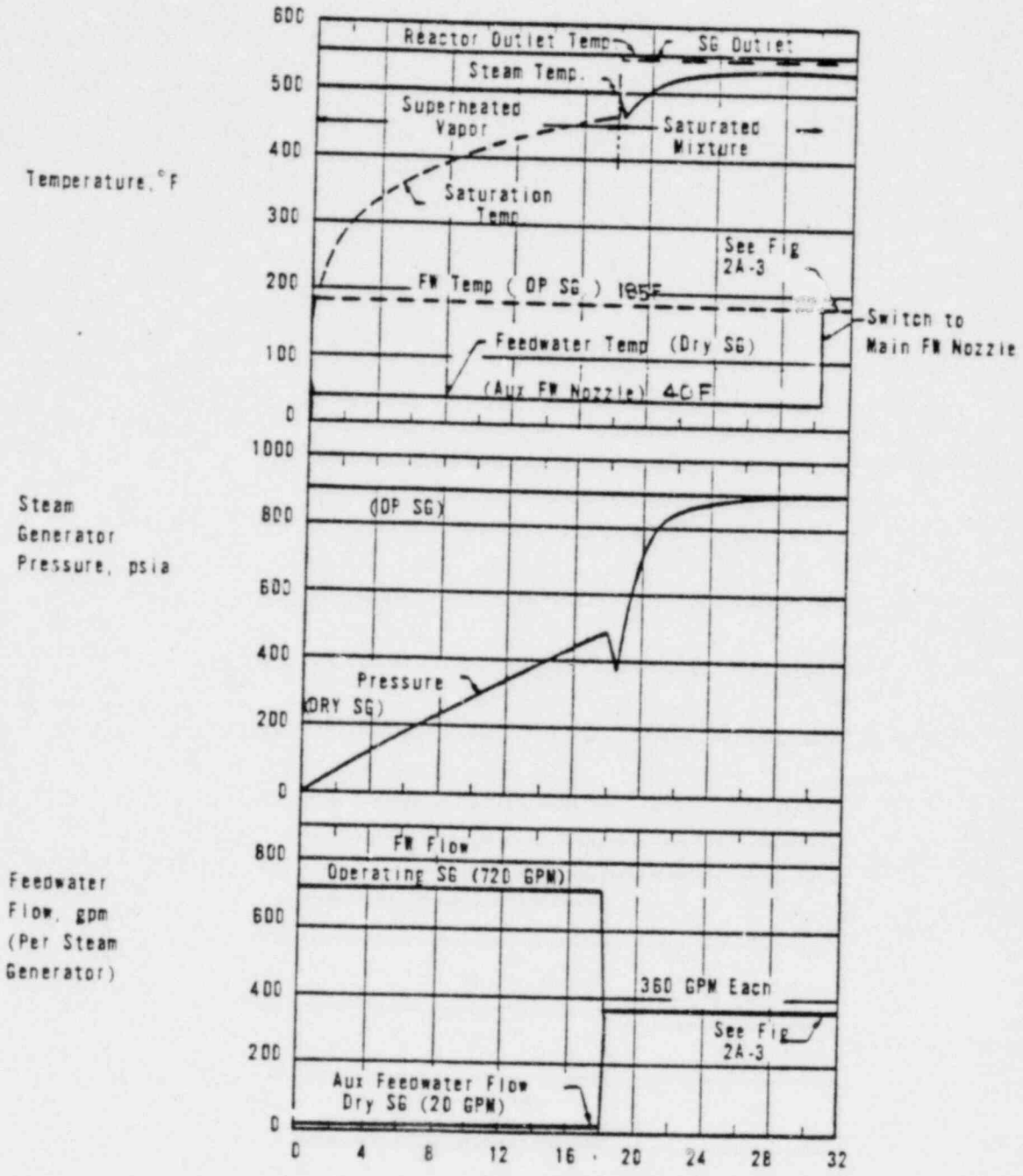

FIGURE 17B-5

TRANSIENT NO. 17B (STUCK OPEN TURBINE BYPASS VALVE) STARTUP OF "DRY" DEPRESSURIZED STEAM GENERATOR

5) Load reduction to hot standby following load rejection.

The maximum loading or unloading rates are ± 3/4%/min.

6.3.2 Number of Cycles

The total number of cycles for design purposes shall be 1440.

6.3.3 Transient Description - 0% to 15% Power

6.3.3.1 Reactor Coolant System

The reactor coolant system conditions are shown in Figures 2A-1, 2A-4, and 2A-5.

The pressurizer water inventory is shown on Figure 2A-1 for letdown rates of 70 and 140 gpm.

6.3.3.2 Steam Generators

The steam generator conditions are shown in Figures 2A-2 and 2A-3.

The delay in feedwater temperature shown on Figure 2A-3 results from the flow time between the first point feedwater heater and the steam generator. The steam and feedwater flows required at 15% power increase as the feedwater temperature increases.

6.3.4 Transient Description - 15% to 0% Power

6.3.4.1 Reactor Coolant System

The reactor coolant conditions are shown in Figures 2B-1 and 2B-4.

The pressurizer inventory shown for this transient is based on starting from normal water level, and 108 gpm total makeup flow is required to maintain the indicated inventory.

6.3.4.2 Steam Generators

The steam generator conditions are shown in Figures 2B-2 and 2B-3.

The feedwater temperature delay results from the flow delay between the first point feedwater heater and the steam generator. The steam and feedwater flow requirements at a given power level decrease as feedwater temperature decreases.

Hot standby is defined as operation at power levels equivalent to decay heat level (0 to 3% thermal power) plus heat input from up to four reactor coolant pumps. During this operation the feedwater flow is routed through the main feedwater nozzles. If there are perturbations in feedwater flow a thermal transient could occur in the main feedwater nozzles although a feedwater temperature is constant. A typical cyclic feedwater flow t[illegible] is shown in Figure 2B-5.

The number of potential cycles for the main feedwater nozzles in hot standby is 120,000.

6.4 Transient 3 - Power Loading 8% to 100% Power (Normal Condition)

6.4.1 General Description

This transient is the design power loading cycle. Starting at 8% power the reactor power is manually increased to 15% power at rates up to 3/4%/min, placed in automatic control and power is then increased at rates up to 5%/min between 15% and 20% power, 10%/min between 20% and 90% power and 5%/min between 90% and 100% power. The transient curves are based on loading at 3/4%/min up to 15% power, and 10%/min from 15% to 100% power.

6.4.2 Loading Cycles

The total number of loading events for design purposes shall be 48,000. This corresponds to approximately 3 full loadings per day for 40 years plant life.

6.4.3 Transient Data

6.4.3.1 Reactor Coolant System

The reactor coolant system conditions for power loading are shown on Figures 3-1, 3-2, and 3-3.

The initial water inventory at the start of the transient is assumed to be at minimum water level, 350 ft^3. The letdown rate is assumed to be constant and the pressurizer inventory rises with temperature during the first part of the transient.

6.4.3.2 Steam Generators

The steam generator conditions for power loading are shown in Figure 3-4.

The maximum and normally expected steam temperatures are shown.

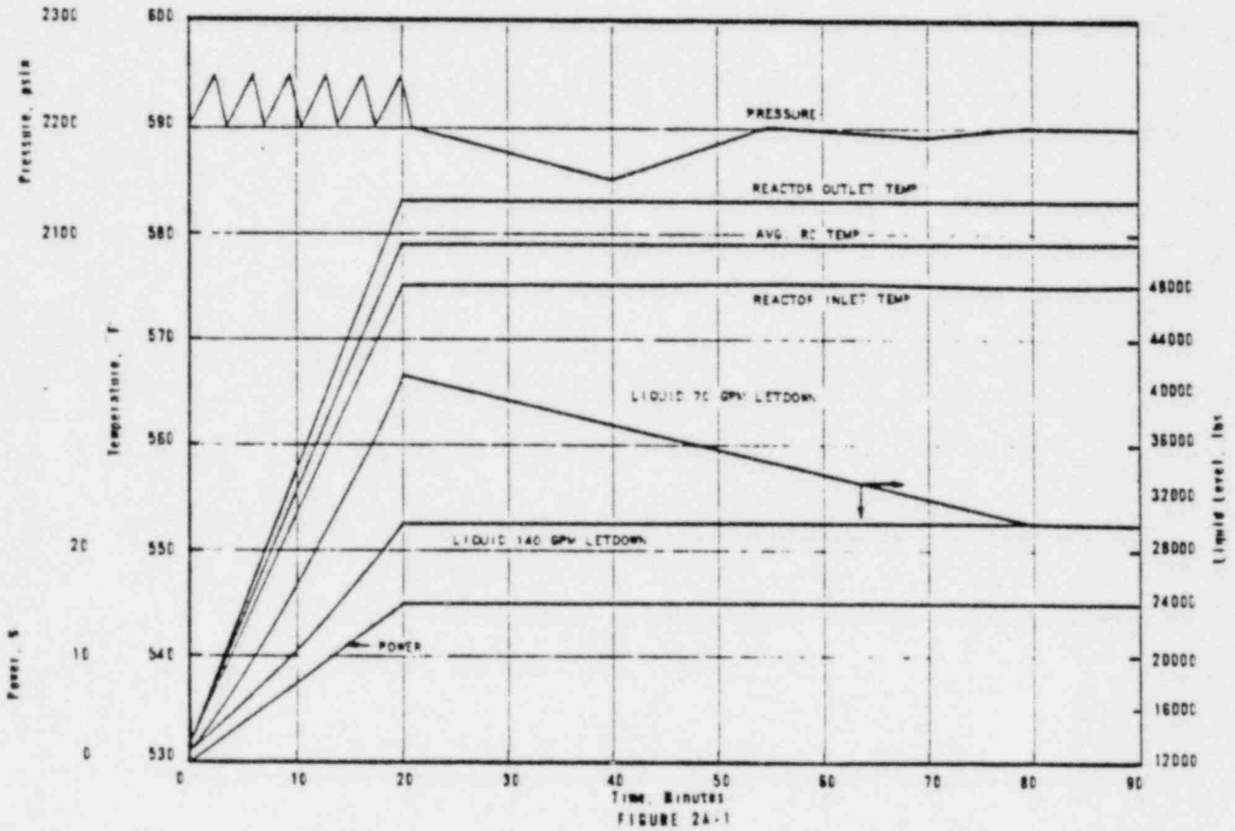

FIGURE 2A-1

TRANSIENT 2A (HEATUP 0 TO 15% FP) REACTOR COOLANT TEMPERATURE AND PRESSURIZER LIQUID LEVEL AND PRESSUER

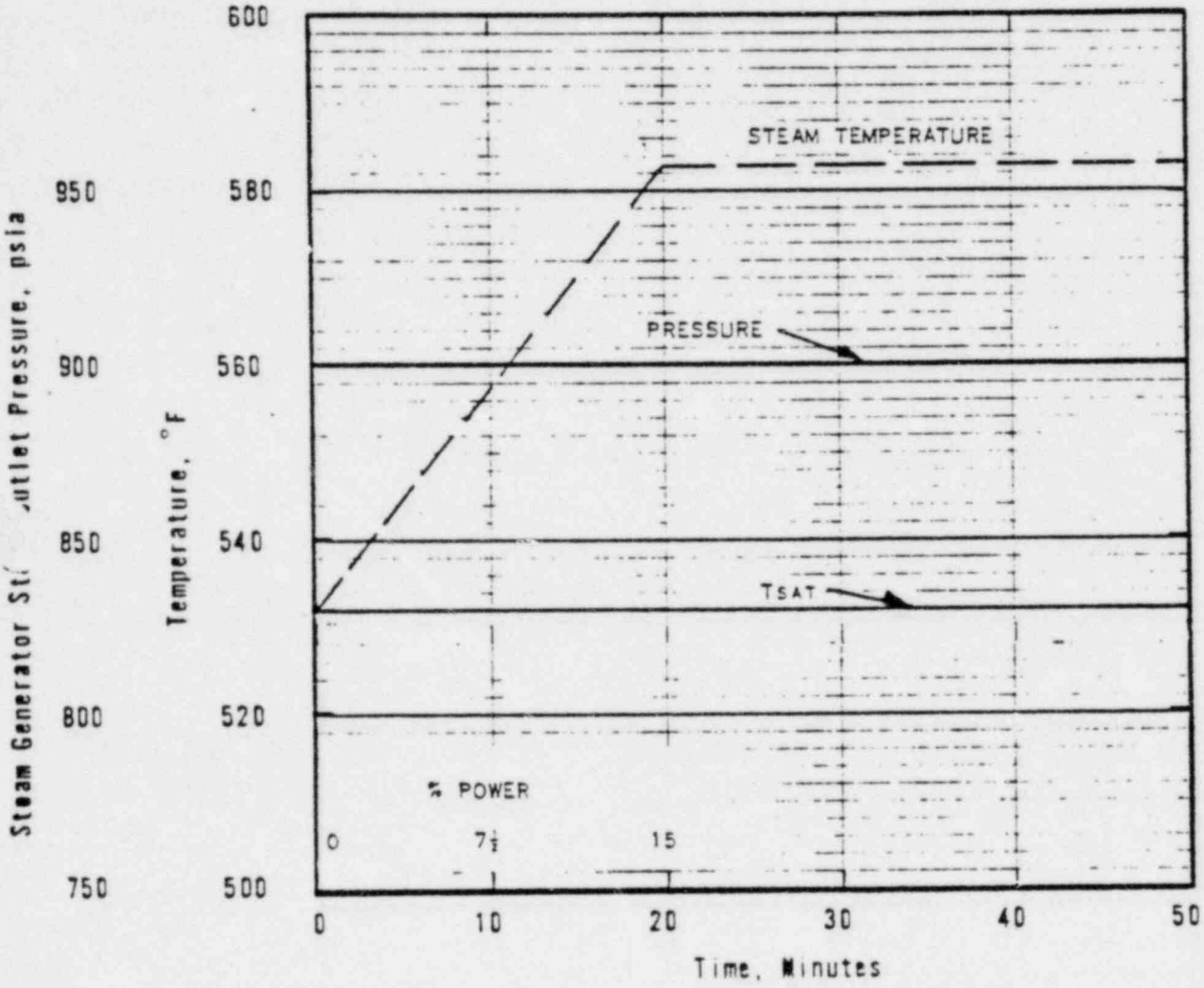

FIGURE 2A-2

TRANSIENT NO. 2A (HEATUP 0 TO 15% FP) STEAM TEMPERATURE & PRESSURE

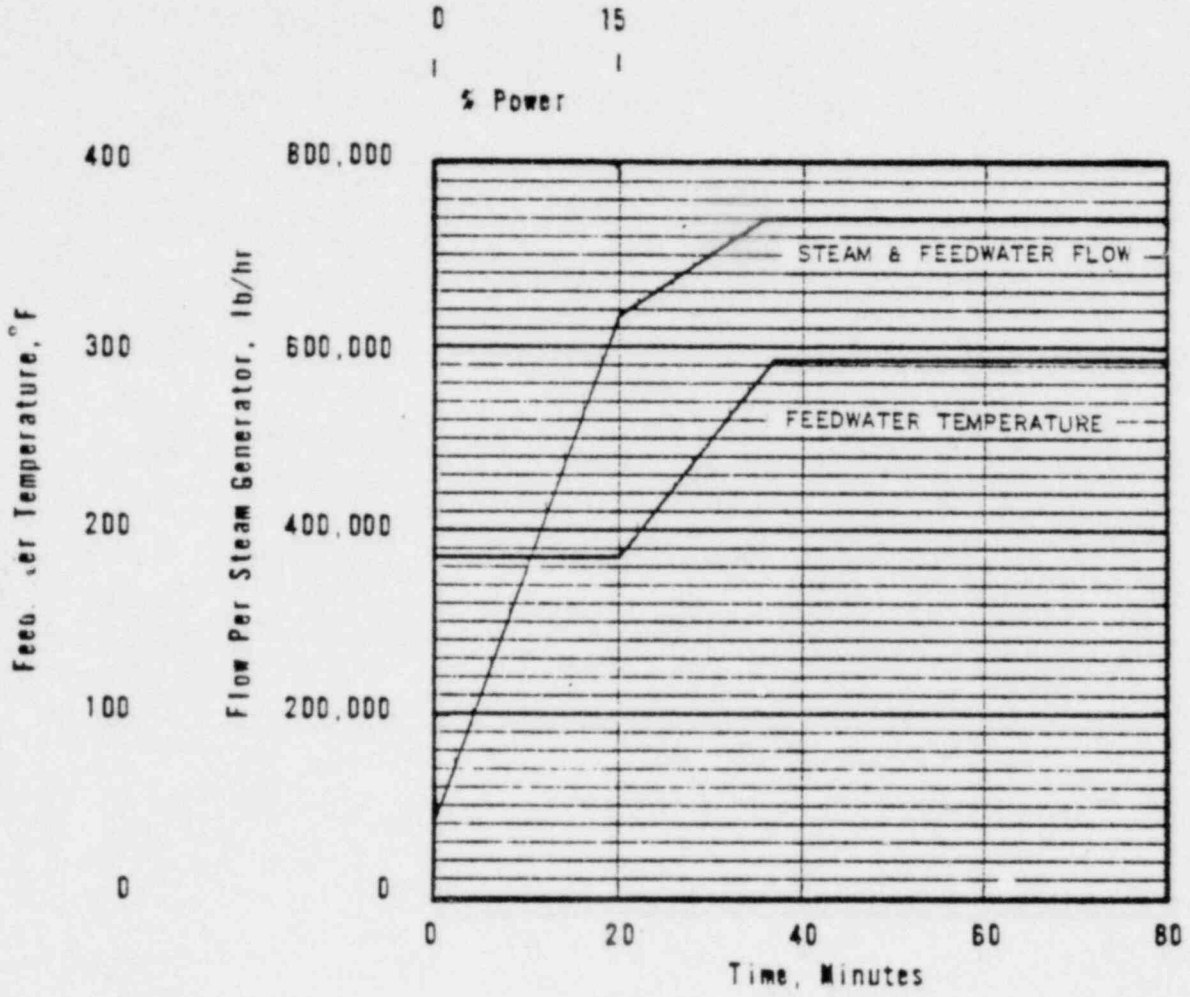

FIGURE 2A-3

TRANSIENT NO. 2A (HEATUP 0 TO 15% FP)
FEEDWATER TEMPERATURE AND FLOW

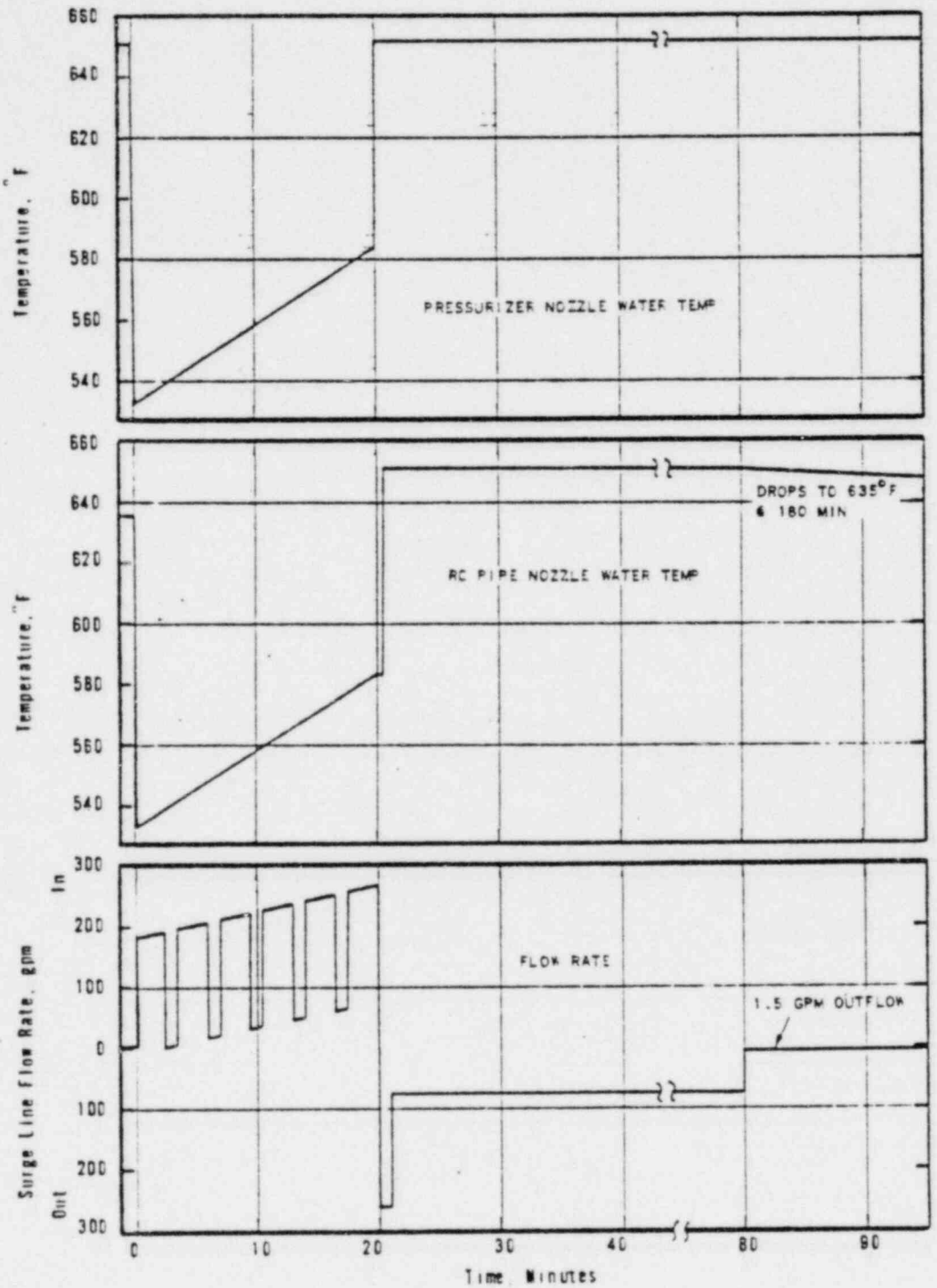

FIGURE 2A-4

TRANSIENT NO 2A (HEATUP 0 TO 15% FP)
SURGE LINE TEMPERATURE AND FLOW

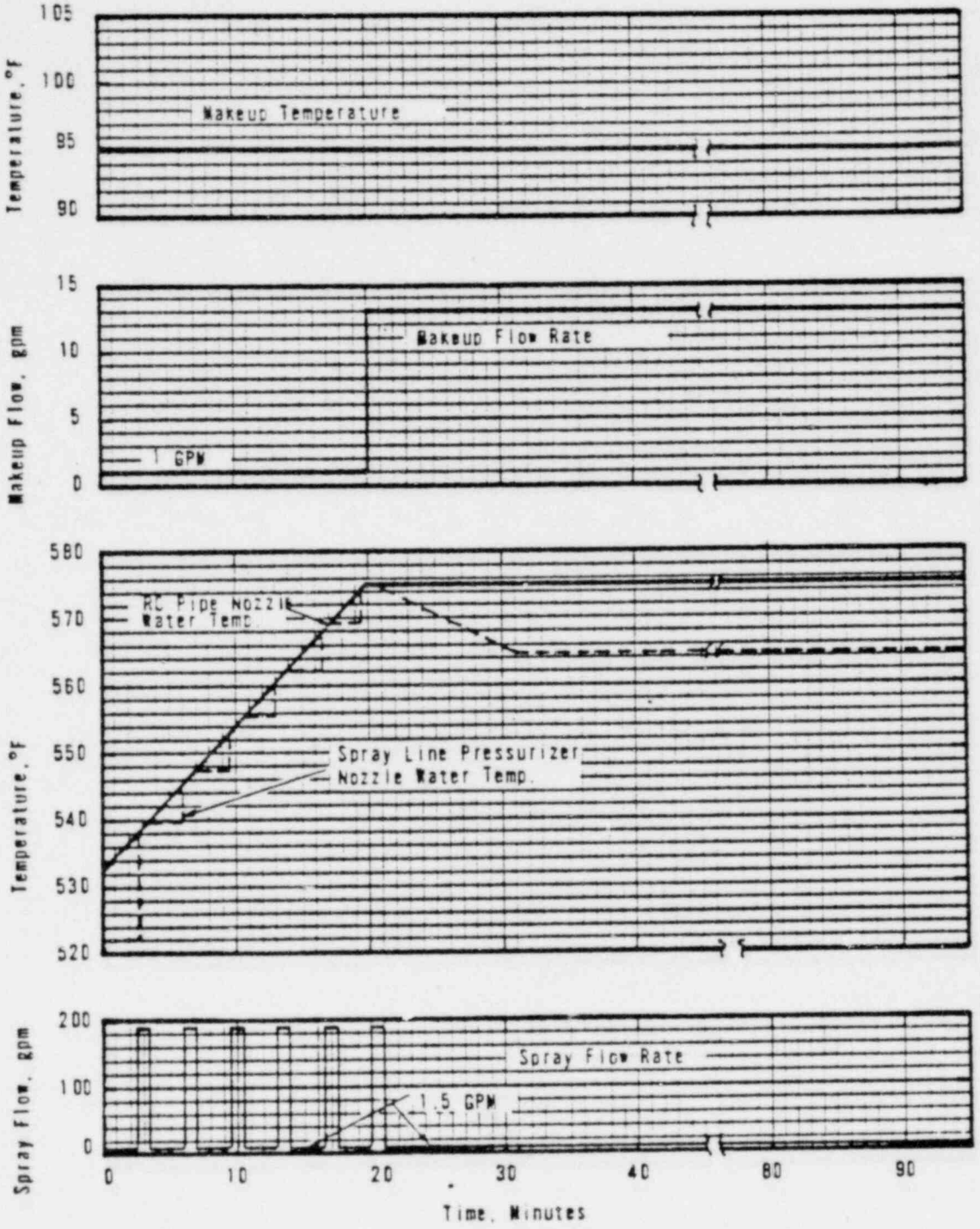

FIGURE 2A-5

TRANSINET NO. 2A (HEATUP 0% TO 15% FP) SPRAY AND MAKEUP TEMPERATURE AND FLOW RATE

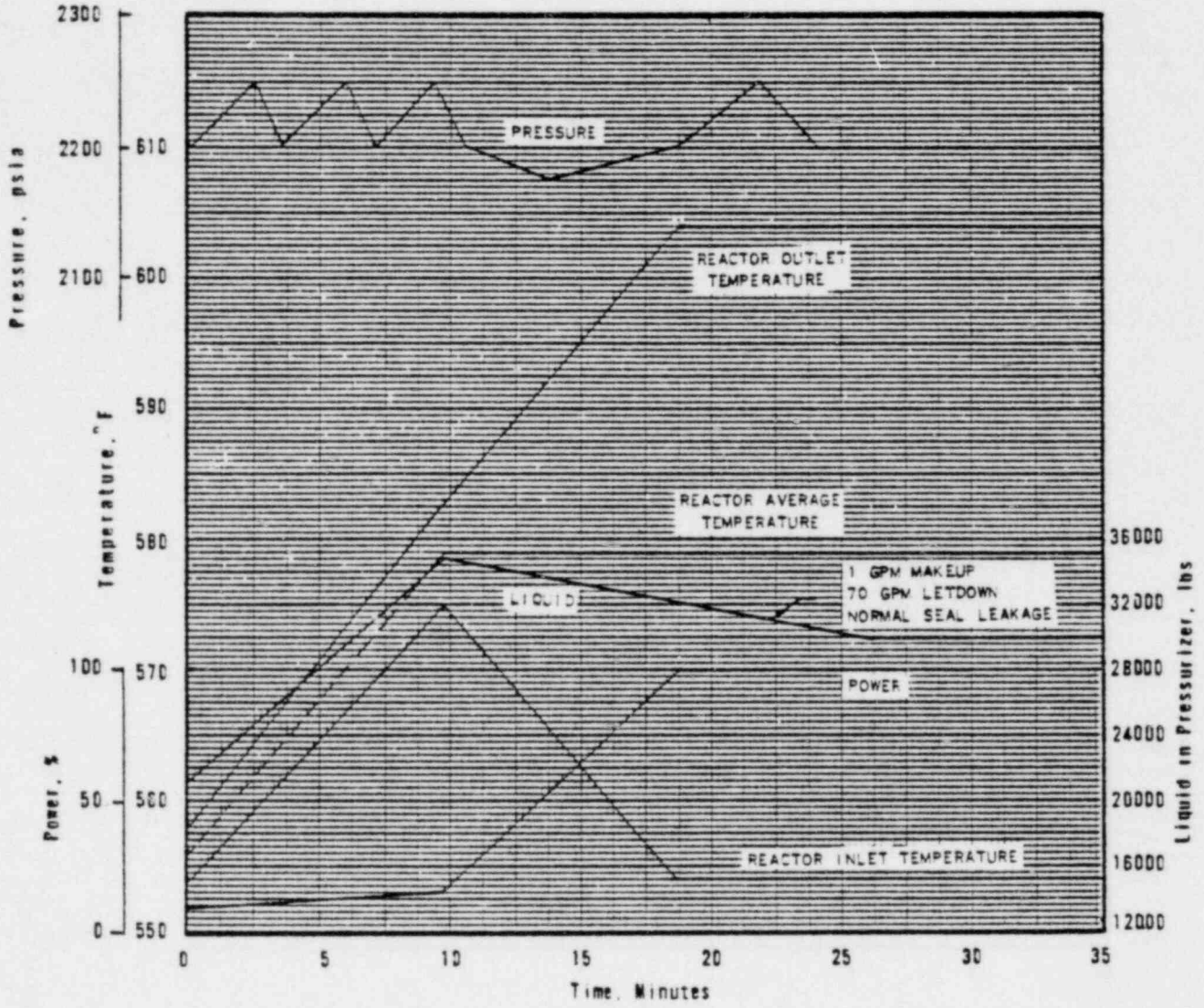

FIGURE 3-1

TRANSIENT NO. 3 (PLANT LOADING FROM 8% TO 100% FP)
REACTOR COOLANT TEMPERATURE AND PRESSURIZER LIQUID
LEVEL AND PRESSURE

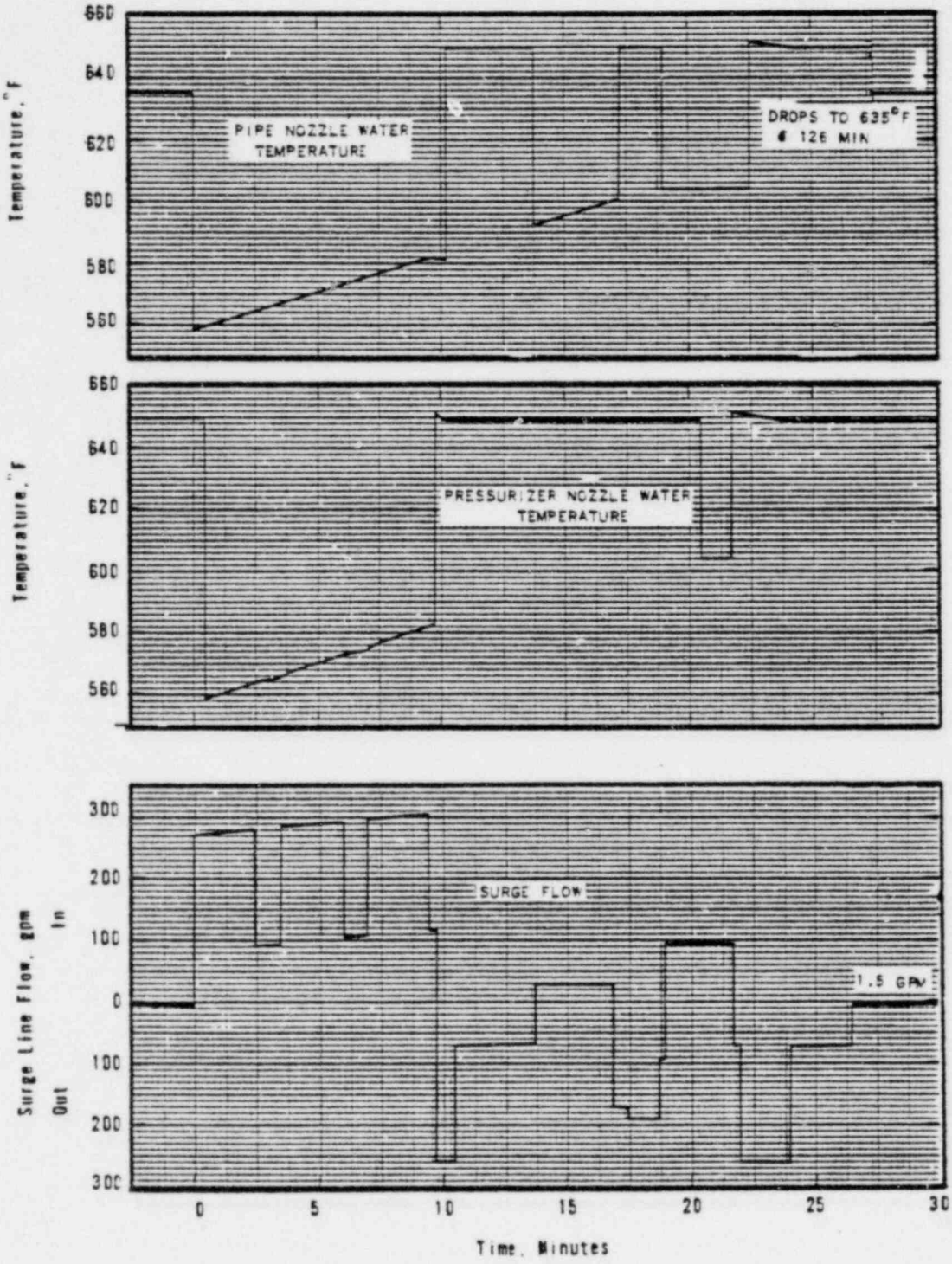

FIGURE 3-2

TRANSIENT NO. 3 (LOADING 8-100%) SURGE LINE FLOW AND NOZZLE TEMPERATURES

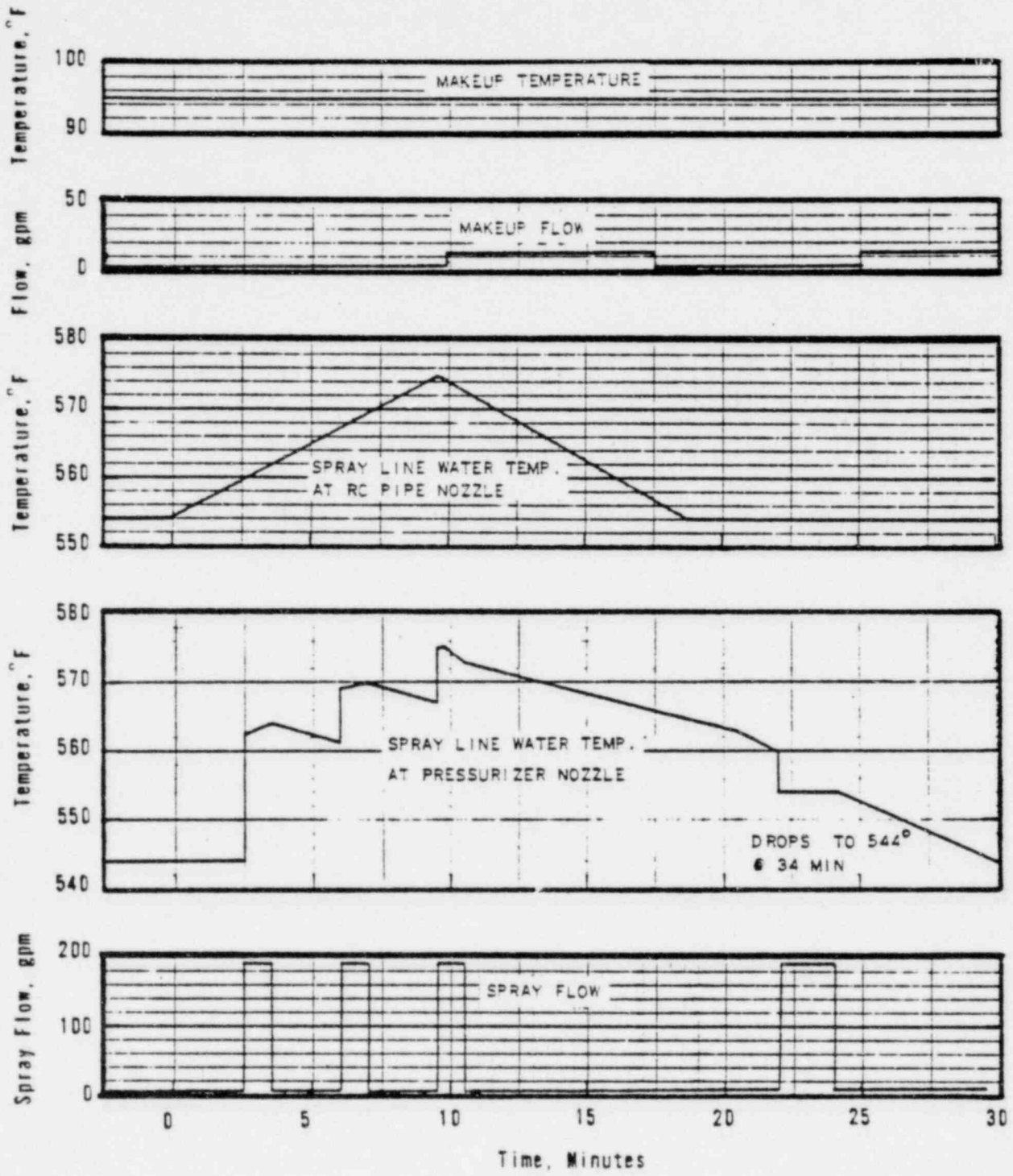

FIGURE 3-3

TRANSIENT NO 3 (PLANT LOADING 8-100% FP)
MAKEUP AND SPRAY LINE TEMPERATURE & FLOW

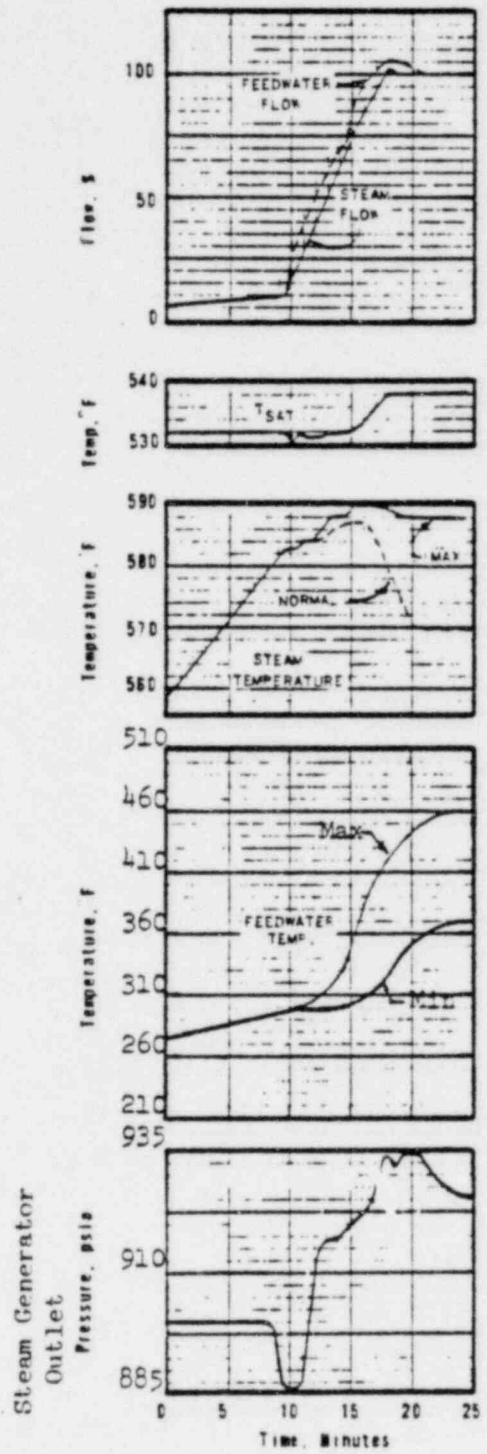

FIGURE 3-4

TRANSIENT NO. 3 (PLANT LOADING FROM 8% TO 100% FP)
STEAM AND FEEDWATER TEMPERATURE AND FLOW