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I am submitting herewith a thesis written by Richard Dowe Dabbs entitled "A Dynamic Thermal-Hydraulic Simulation of the Oconee 1 Main/Emergency Condensate/Feedwater Trains." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nuclear Engineering.

E. M. Katz, Major Professor

We have read this thesis
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Accepted for the Council:

The Graduate School

4

A DYNAMIC THERMAL-HYDRAULIC SIMULATION OF THE OCONEE 1 MAIN/EMERGENCY CONDENSATE/FEEDWATER TRAINS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Richard Dowe Dabbs

March 1984

ACKNOWLEDGEMENTS

The author expresses his gratitude to the many people who helped make this thesis possible. Special appreciation must be shown to Dr. E. M. Katz, the major professor, and to Dr. P. F. Pasqua, head of the Nuclear Engineering Department, for their sincere interest and valuable suggestions; to Mr. R. A. Hedrick for providing the development opportunity and continuing technical support; to C. A. Blind, D. R. Buhrmaster, T. A. Denny, A. M. Diegel, A. K. Gilliam, B. S. Hudgens, P. S. Long, L. Pollard, M. L. Wilder, and C. S. Wolfenbarger for their unending patience in the expert preparation of the document; and finally, to my wife Anne for her encouragement during the course of this graduate study.

ABSTRACT

Original development and validation of a RELAP5-compatible computer model that simulates the dynamic thermal-hydraulic behavior of the Oconee 1 nuclear station main and emergency condensate feedwater trains is described. The stand-alone model, which was generated for incorporation in the Idaho National Engineering Laboratory and Los Alamos National Laboratory pressurized thermal shock Oconee 1 total plant models, is introduced through a generic discussion of the nominal operation of the steam and power conversion system. This synopsis establishes a foundation for the detailed examination of the thermal-hydraulic characteristics of the main and emergency condensate feedwater train components under atypical operating conditions such as those found during the three major classes of pressurized thermal shock transients : loss of main steam, steam generator overfeed, and recoverable loss of primary coolant.

This RELAP5 model combines the operating information, system geometry, and steady-state thermodynamic statepoints of the Oconee 1 main and emergency condensate feedwater trains into a collection of hydrodynamic volumes, hydrodynamic junctions, and heat structures. The details of this model are defined explicitly by including both the actual RELAP5 input stream and the initial processing of this input stream.

Dynamic responses to a hypothetical main steamline break of several Oconee 1 main and emergency condensate feedwater train parameters were generated using the developed model. The results of this

transient and others performed using both the Idaho National Engineering Laboratory and Los Alamos National Laboratory Oconee 1 total plant models verify the ability of this state-of-the-art thermal-hydraulic model to calculate representative steam generator secondary-side inlet dynamic fluid conditions for pressurized thermal shock scenarios.

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LIST OF SYMBOLS

SYMBOL	DEFINITION
P	Fluid pressure, lb_f/in^2 absolute (PSIA)
Q	Thermal energy source, MW
t	Time, s
T	Fluid temperature, °F
W	Fluid mass flow, lbm/s
X	Fluid static quality, dimensionless

GLOSSARY

TERM	DEFINITION
BNL	Brookhaven National Laboratory
EFW	Emergency feedwater
FPA	Main feedwater pump A
FPB	Main feedwater pump B
HWP	Hotwell pumps
IBM	International Business Machines
ICS	Integrated Control System
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
MFW	Main feedwater
MPA	Motor-driven emergency feedwater pump A
MPB	Motor-driven emergency feedwater pump B
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
PTS	Pressurized thermal shock
PWR	Pressurized water reactor
RELAP5	Reactor Linearized Analysis Program : Update 5 (INEL)
SGA	Steam generator A
SGB	Steam generator B
SPCS	Steam and power conversion system
TAR	Valve throat area ratio
TDP	Turbine-driven emergency feedwater pump
TRAC	Transient Reactor Analysis Code (LANL)

CHAPTER I

INTRODUCTION

Background

There exists a class of atypical operational scenarios for pressurized water reactors (PWRs) that may result in excessive cooling (less than ~300°F) of the inner surface of highly-irradiated regions of the pressure vessel during periods of substantial primary system pressure (greater than ~2000 PSIA). PWR upsets of this nature are known as pressurized thermal shock (PTS) transients and are important to PWR safety as they may lead to a breach of the pressure vessel through crack propagation.

Throughout the history of PWR safety analysis, PTS transients have been overshadowed by the catastrophic loss-of-primary-coolant scenarios. The emphasis on that event space, which is far removed from PTS, resulted in the early neglect of overcooling transients. The limited pressurized thermal shock analyses that were performed used primary system thermal-hydraulic models developed for the loss-of-primary-coolant calculations. These models were unsuitable for the relatively slow PTS upsets because of their prohibitive execution cost and partial bounding through user-supplied tables of the steam generator secondary-side inlet time-dependent fluid mass flows and enthalpies. Such assumed boundary conditions were often the largest source of uncertainty in the predicted dynamic thermal-hydraulic response of the primary system and frequently

resulted in unrealistic time-dependent reactor downcomer fluid pressures, temperatures, and heat transfer coefficients. These conservative fluid parameters were in turn coupled to analyses involving fast neutron transport (to determine the impact of the incident fluence on pressure vessel material embittlement) and solid mechanics (to determine the possibility of initiation and propagation of structural failure in the pressure vessel) resulting in overestimation of the effects of PTS scenarios on the pressure vessel.

Recently, the possible severity and high frequency of occurrence for certain initiating events of PTS transients has resulted in the A-49 Program, a best-estimate investigation by the Nuclear Regulatory Commission (NRC), the Oak Ridge National Laboratory[1] (ORNL), the Idaho National Engineering Laboratory[2] (INEL), the Los Alamos National Laboratory[3] (LANL), and the Brookhaven National Laboratory (BNL) to both define highly susceptable PWR stations[4] and examine the risk of their pressure vessel failure. Three nuclear stations were selected by the NRC for comprehensive analysis in this study: Oconee 1 vendored by Babcock & Wilcox and operated by the Duke Power Company,[5] Calvert Cliffs 1 vendored by Combustion Engineering and operated by the Baltimore Gas and Electric Company,[6] and H. B. Robinson 2 vendored by Westinghouse and operated by the Carolina Power and Light Company.[7]

Total Plant Thermal-Hydraulic Analysis

Pressurized thermal shock transients may be categorized into three major event classes: recoverable loss-of-primary-coolant through small breaks such as steam generator tube ruptures; loss of main steam through possibly catastrophic steamline breaks, open turbine bypass valves, and/or open main safety/relief valves; and steam generator overfeeds through main and/or emergency feedwater control failure. Each of these classes involves significant energy transport from the pressure vessel over a relatively long time span. This allows the dynamic thermal-hydraulic response of the steam and power conversion system to dominate the primary system behavior. Therefore, to accurately simulate PTS transients, it is necessary to eliminate the bounding of the thermal-hydraulic calculations at the steam generator secondary-side inlets and develop total plant models capable of representing the overall nuclear station dynamic response to the PTS class of perturbations. Total plant models allow better prediction of PTS thermal-hydraulic scenarios as they move the assumed boundary condition to the tertiary loop (tube side of the condenser).

In creating total plant simulators, state-of-the-art thermal-hydraulic models of the steam and power conversion system must be merged with streamlined existing primary system models. The desired method of producing a total plant model is to develop model segments of the balance of plant component groups: the steam generator secondary sides (usually incorporated in the primary system model),

main steamlines, turbine bypass steamlines, condenser hotwells (including possible upper surge tanks and/or condensate storage tanks), and main and emergency condensate feedwater trains. These models are then physically combined with the updated primary system model. The high- and low-pressure turbines, reheater and moisture separator assemblies, turbine and reheater and moisture separator extraction lines, and condensate feedwater heater shell-side cascading need not be explicitly included in the A-49 Program total plant models as they are assumed isolated on initiation of PTS transients.

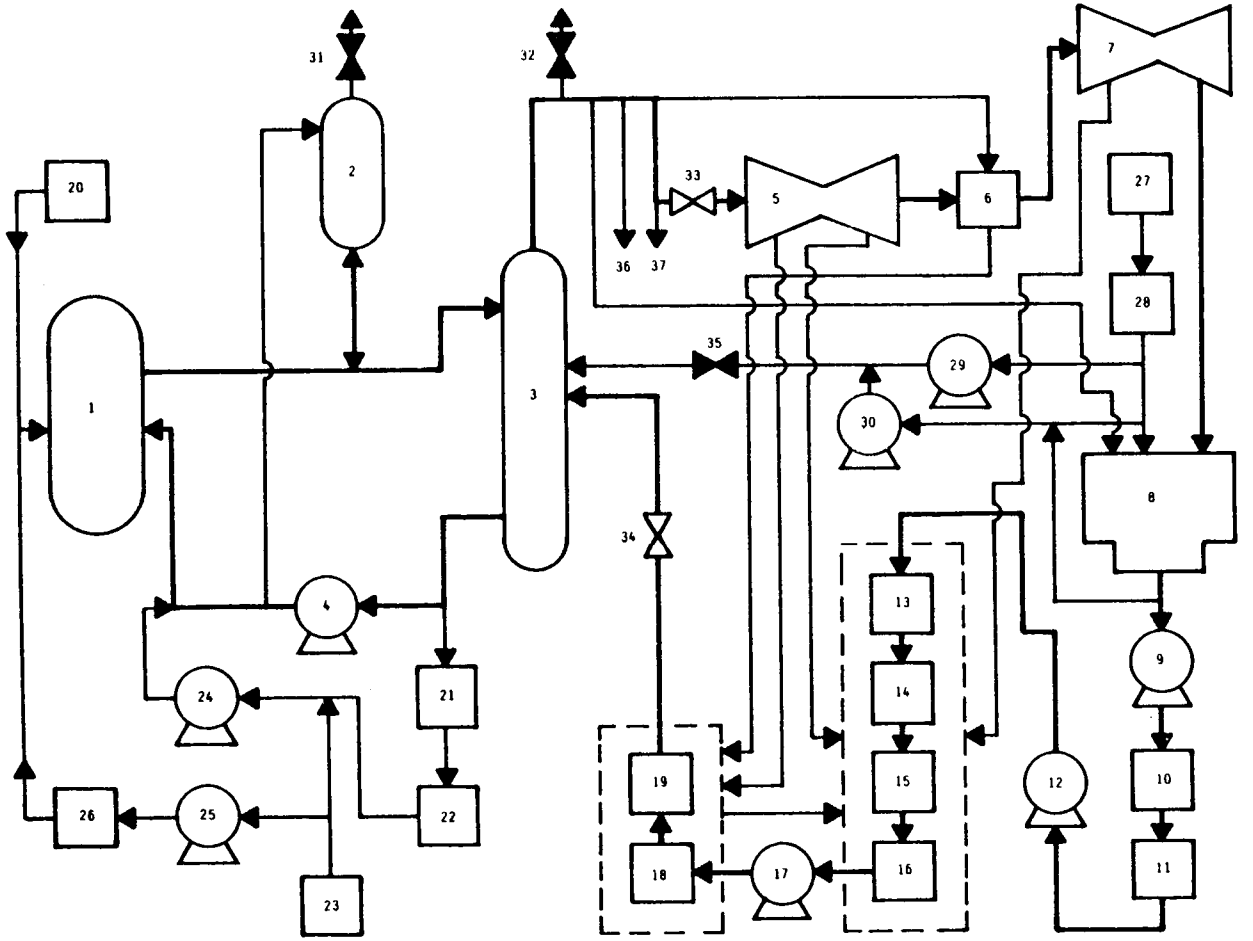
Total plant thermal-hydraulic models are the major difference between the early PTS analyses and those of the A-49 Program. ORNL serves as the program manager, provides balance of plant thermal-hydraulic model segments, conducts solid mechanics calculations, performs probabilistic risk assessment, and defines the transient event sequences to be analyzed. INEL develops total plant thermal-hydraulic models (incorporating the ORNL-supplied segments) using their Reactor Linearized Analysis Program : Update 5 (RELAP5),[2] executes ORNL-defined transients, and contributes to the interpretation of their calculational results. LANL develops total plant thermal-hydraulic models (incorporating the ORNL-supplied segments) using their Transient Reactor Analysis Code (TRAC),[3] executes ORNL-defined transients, and contributes to the interpretation of their calculational results. BNL performs quality assurance and probabilistic risk assessment on the A-49 Program

models. The spatially-dependent pressure vessel incident fast neutron fluences and plant design specifications are provided by the appropriate utility.

Objective of Thesis

Oconee 1, which is located in Seneca, South Carolina, is the charter Babcock & Wilcox nuclear steam supply system. That nuclear station is a lower-loop 177FA primary system with two once-through steam generators and is the first plant to be examined in the A-49 study because of its extensive operating history, low-inertia steam generators, and high copper content longitudinal welds in the pressure vessel. A schematic of the overall Oconee 1 layout[8] may be found in Figure 1.1.

The objective of this thesis is the original development and validation of an integral part of A-49 Program Oconee 1 total plant models: the main and emergency condensate feedwater trains model. This stand-alone thermal-hydraulic model was developed for ORNL and is RELAP5-compatible. It is utilized directly in both the INEL and LANL Oconee 1 total plant models, is the most complicated of the balance of plant segment models (covering the domain from the condenser hotwells to the steam generator secondary-side inlets), and is a critical analytical element in evaluating the risk of PTS to Oconee 1.



COMPONENT DESCRIPTION

1. REACTOR VESSEL
2. PRESSURIZER
3. STEAM GENERATORS
4. REACTOR COOLANT PUMPS
5. HIGH-PRESSURE TURBINE
6. REHEATER AND MOISTURE SEPARATOR ASSEMBLIES
7. LOW-PRESSURE TURBINES
8. CONDENSER HOTWELLS
9. HOTWELL PUMPS
10. DEMINERALIZERS
11. PLANT HEAT DUMP
12. CONDENSATE BOOSTER PUMPS
13. LOW-PRESSURE F CONDENSATE HEATERS
14. LOW-PRESSURE E CONDENSATE HEATERS
15. LOW-PRESSURE D CONDENSATE HEATERS
16. LOW-PRESSURE C CONDENSATE HEATERS
17. MAIN FEEDWATER PUMPS
18. HIGH-PRESSURE B FEEDWATER HEATERS
19. HIGH-PRESSURE A FEEDWATER HEATERS
20. CORE FLOOD TANKS
21. LETDOWN COOLERS
22. LETDOWN TANK
23. BORATED WATER STORAGE TANK
24. HIGH-PRESSURE INJECTION PUMPS
25. LOW-PRESSURE INJECTION PUMPS
26. RESIDUAL HEAT REMOVAL SYSTEM
27. CONDENSATE STORAGE TANKS
28. UPPER SURGE TANKS
29. EMERGENCY FEEDWATER PUMPS
30. EMERGENCY FEEDWATER PUMP (TURBINE)
31. PRESSURIZER SAFETY/RELIEF VALVES
32. MAIN STEAMLINE SAFETY/RELIEF VALVES
33. TURBINE STOP/GOVERNING VALVES
34. MAIN FEEDWATER CONTROL VALVES
35. EMERGENCY FEEDWATER CONTROL VALVES
36. TO MAIN FEEDWATER PUMP TURBINES
37. TO EMERGENCY FEEDWATER PUMP TURBINE

Figure 1.1. Oconee 1 nuclear station overall diagrammatic layout.

CHAPTER II

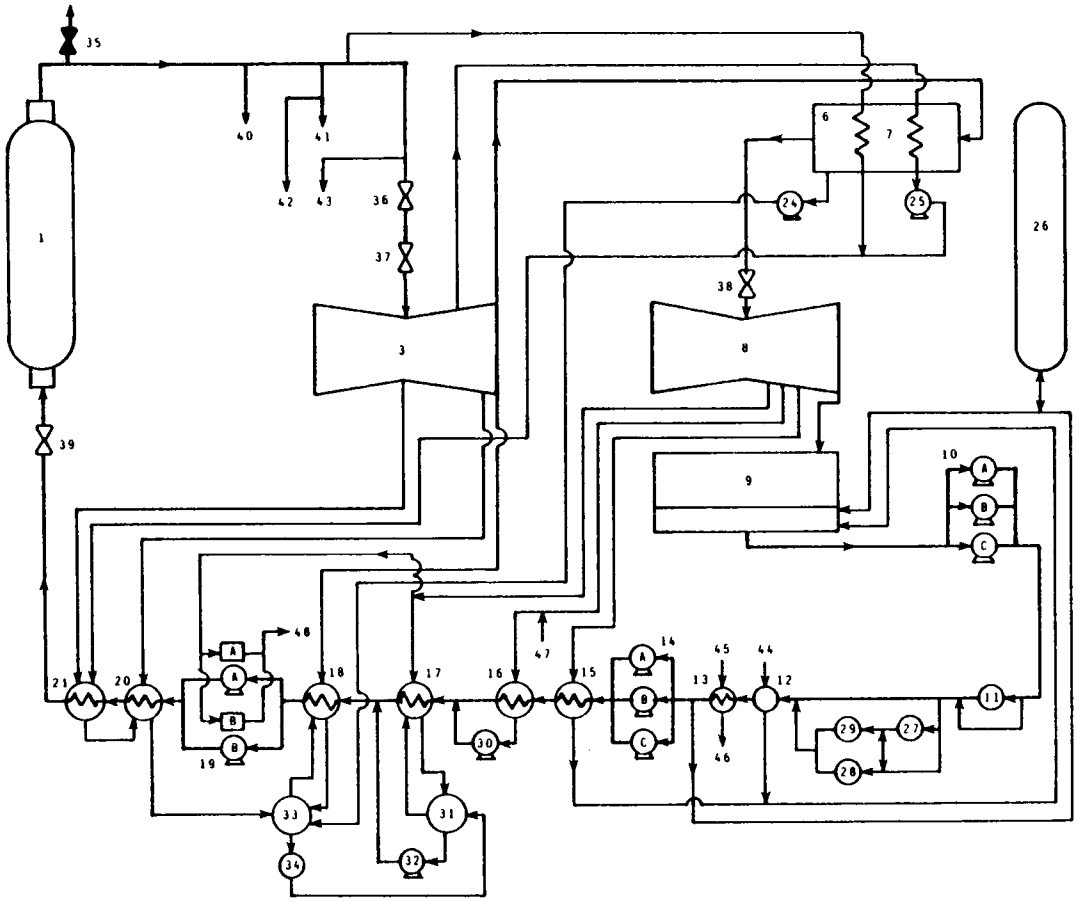
OCONEE 1 STEAM AND POWER CONVERSION SYSTEM NOMINAL OPERATION

General

The steam and power conversion system (SPCS) includes the balance of plant components whose combined purpose is to dissipate the thermal energy generated in the primary system and convert this thermal energy to electrical energy as efficiently as possible. Other functions are also provided by the SPCS including various supplies of auxiliary steam and cooling water. The Oconee 1 SPCS is shown schematically[5] in Figure 2.1, which is an idealized representation often indicating only one of multi-membered assemblies. Following the typical flowpath of the SPCS, the nominal operation of individual SPCS component groups and their interfaces with other SPCS component groups can be understood.

Steam Generators

Subcooled main feedwater enters and flows down vertically into the secondary-side of each once-through steam generator (shown schematically[5] in Figure 2.2) through a spray header system, which is located approximately at the midsection of the steam generator. As it travels to the bottom of the steam-aspirated downcomer, the main feedwater becomes almost saturated. Leaving the downcomer, the fluid turns vertically upward in the shell region of the tube bundle where



COMPONENT DESCRIPTION

1. STEAM GENERATOR A
2. STEAM GENERATOR B (NOT SHOWN)
3. HIGH-PRESSURE TURBINE
4. MOISTURE SEPARATOR A (NOT SHOWN)
5. REHEATER A (NOT SHOWN)
6. MOISTURE SEPARATOR B
7. REHEATER B
8. LOW-PRESSURE TURBINES
9. CONDENSER HOTWELLS
10. HOTWELL PUMPS
11. DEMINERALIZERS
12. CONDENSER STEAM AIR EJECTORS
13. STEAM SEAL CONDENSERS
14. CONDENSATE BOOSTER PUMPS
15. LOW-PRESSURE F CONDENSATE HEATERS
16. LOW-PRESSURE E CONDENSATE HEATERS
17. LOW-PRESSURE D CONDENSATE HEATERS
18. LOW-PRESSURE C CONDENSATE HEATERS
19. MAIN FEEDWATER PUMPS
20. HIGH-PRESSURE B FEEDWATER HEATERS
21. HIGH-PRESSURE A FEEDWATER HEATERS
22. REHEATER A DRAIN PUMP (NOT SHOWN)
23. MOISTURE SEPARATOR A DRAIN PUMP (NOT SHOWN)
24. MOISTURE SEPARATOR B DRAIN PUMP
25. REHEATER B DRAIN PUMP
26. UPPER SURGE TANKS
27. CONDENSATE COOLERS
28. HYDROGEN COOLERS
29. GENERAL WATER COOLERS
30. LOW-PRESSURE E CONDENSATE HEATER DRAIN PUMPS
31. LOW-PRESSURE D CONDENSATE HEATER FLASH TANKS
32. LOW-PRESSURE D CONDENSATE HEATER DRAIN PUMPS
33. LOW-PRESSURE C CONDENSATE HEATER FLASH TANKS
34. LOW-PRESSURE C CONDENSATE HEATER DRAIN COOLERS
35. MAIN STEAMLINE SAFETY/RELIEF VALVES
36. TURBINE STOP VALVES
37. TURBINE GOVERNING VALVES
38. REHEATER STOP/INTERCEPT VALVES
39. MAIN FEEDWATER CONTROL VALVES
40. TURBINE BYPASS STEAMLINES (TO CONDENSER)
41. MAIN FEEDWATER PUMPS AUXILIARY STEAM SUPPLY
42. CONDENSER STEAM AIR EJECTOR STEAM SUPPLY
43. EMERGENCY FEEDWATER PUMPS STEAM SUPPLY
44. FROM MAIN STEAMLINES (42)
45. FROM TURBINE STEAM SEALS
46. TO CONDENSATE STORAGE TANKS
47. STARTUP STEAM DUMP
48. TO CONDENSER

Figure 2.1. Oconee 1 nuclear station steam and power conversion system diagrammatic layout.

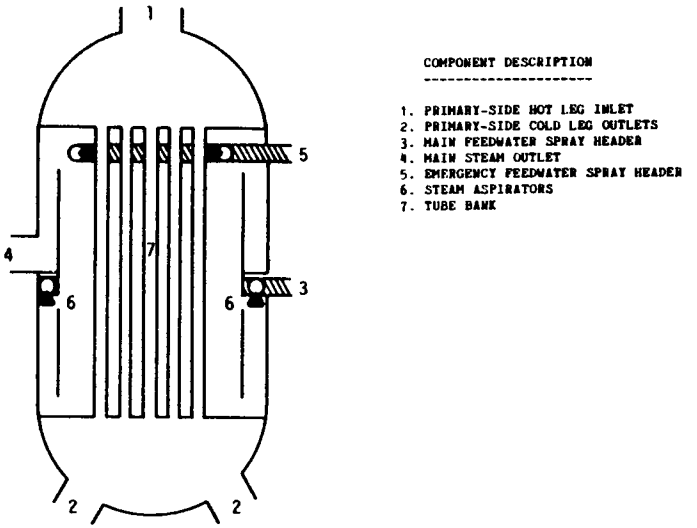


Figure 2.2. Oconee 1 nuclear station once-through steam generator diagrammatic layout.

it is converted to saturated steam before reaching the level of the downcomer aspirators, which reside slightly below the main feedwater spray header. Above the aspirators the fluid is superheated and leaves each steam generator by flowing vertically downward into an annulus, which leads to the horizontal main steam outlet (located slightly above the main feedwater spray header). When needed, emergency feedwater is injected radially through a spray header into the shell side of the tube bundle at a level near the top of the tube bundle.

Main and Turbine Bypass Steamlines

Superheated steam exits each steam generator and travels through its main steamline past the safety/relief valves (Oconee 1 has no main steam isolation valves) and steam generator cross-connects to several possible destinations: the condenser via the turbine bypass steamlines (an atypical flowpath except at low power), the steam turbine that drives one emergency feedwater pump (an auxiliary steam source exists for the main feedwater pump turbines), the tube-side of the second-stage reheaters, the condenser steam air ejectors, and the high-pressure turbine. Eight safety/relief valves exist on the main steamline associated with each steam generator to exhaust to the atmosphere the excess main steamline mass flow which cannot be accomodated by the turbine bypass steamlines.

High- and Low-Pressure Turbines, Reheater and Moisture Separator Assemblies, and Condenser Hotwells

A mixture of liquid and vapor departs the high-pressure turbine to feed the reheater and moisture separator assemblies and to supply (through extraction lines) the shell side of the high-pressure A and B feedwater heaters and low-pressure C condensate heaters. Superheated steam from the main steamlines enters the tube side of the second-stage reheaters and continues as subcooled liquid to the shell side of the high-pressure A feedwater heaters. Extraction from the high-pressure turbine moves through the tube side of the first-stage reheaters and departs as subcooled liquid through the first-stage reheater drain pumps to the shell side of the high-pressure A feedwater heaters. Liquid and vapor entering the moisture separators as exhaust from the high-pressure turbine is divided into a vapor phase which exits as superheated steam to the three low-pressure turbines and a liquid phase which arrives, after passing through the moisture separator drain pumps, at the low-pressure C condensate heater flash tanks. Superheated steam enters the low-pressure turbines, which exhaust liquid and vapor to the shell side of the condenser where the mixture is cooled and collected in the hotwells.

The condenser hotwell reservoirs may be supplemented by the upper surge tanks and condensate storage tanks. The upper surge tanks are connected to the condenser hotwells by large-capacity, gravity-feed lines so that those tanks can be considered an integral part of the condenser hotwells. The condensate storage tanks,

however, are connected to the upper surge tanks by small capacity pumps so that they can be considered isolated from the SPCS for other than extremely long transients. The tube side of the condenser is the ultimate plant heat dump.

Various stage extraction lines connect the low-pressure turbine drains to the shell side of the low-pressure E, D, and F condensate heaters. These and other extraction lines provide the thermal energy sources for the condensate feedwater heaters in this regenerative class of turbine cycle.

Main and Emergency Condensate Feedwater Trains

The main and emergency condensate feedwater trains include the component groups of Figure 2.1 from the condenser hotwell outlets to the main and emergency feedwater inlets of each steam generator. Additional details of these elements[9] are shown in Figure 2.3. The prime function of the main condensate feedwater train is to transport subcooled water from the condenser hotwell outlets to the steam generator main feedwater inlets while both pressurizing and heating it. A second obvious function of this train is to control the quantity of feedwater reaching the secondary side of each steam generator.

The prime function of the emergency condensate feedwater train is to transport subcooled water from the upper surge tanks and condenser hotwell outlets to the steam generator emergency feedwater inlets under atypical SPCS operation. The emergency condensate

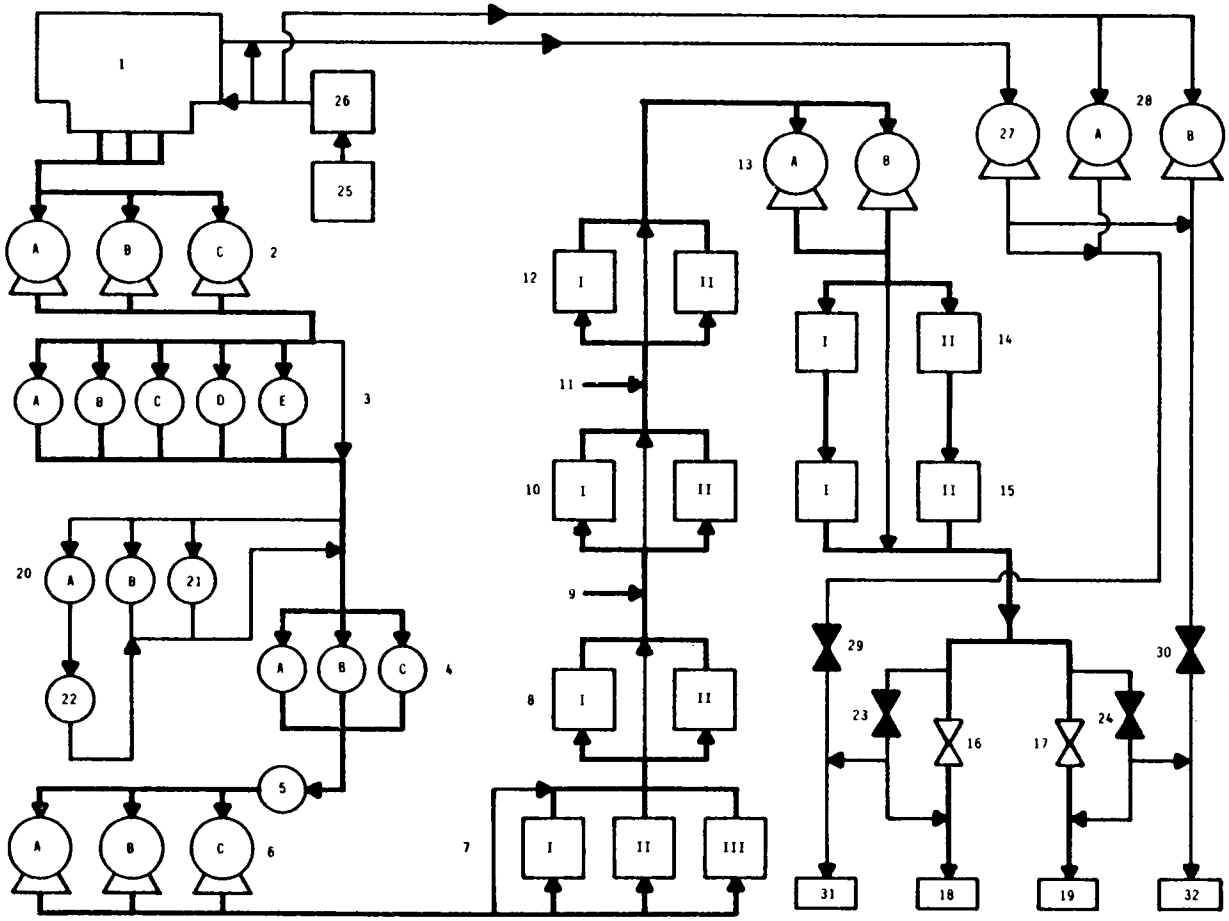


Figure 2.3. Oconee 1 nuclear station main and emergency condensate feedwater trains diagrammatic layout.

feedwater train consists of two motor-driven pumps (one for each steam generator) and one turbine-driven pump whose discharge cross-connects to the discharges of both motor-driven pumps. The motor-driven pumps draw condensate from the upper surge tanks and the turbine-driven pump draws condensate from the upper surge tanks and/or the condenser hotwells. The emergency feedwater exiting the turbine- and motor-driven pumps continues to the secondary-side emergency feedwater inlet of each steam generator through independent lines containing a steam generator level control valve. A one-way cross-connect exists for each steam generator downstream of these level control valves to allow main feedwater to enter the emergency feedwater lines during transient situations. Insignificant heating of the condensate feedwater occurs in the emergency condensate feedwater train. The emergency condensate feedwater train is check valved appropriately.

The main condensate feedwater train domain begins with condensate exiting the condenser hotwells. The condensate is immediately pressurized by three parallel, motor-driven hotwell pumps and then flows through the polishers and demineralizers, the tube side of the condensate coolers, hydrogen coolers, and general water coolers (these coolers are known collectively as the plant heat dump), condenser steam air ejectors, and steam seal condensers. The low-temperature, low-pressure condensate leaving the steam seal condensers is further pressurized by three parallel, motor-driven condensate booster pumps, whose function is to provide adequate suction pressure to the main feedwater pumps after overcoming the

frictional losses of the low-pressure condensate heaters. After it leaves the condensate booster pumps, the condensate is heated significantly by passage through the tube side of four stages of low-pressure condensate heaters. The first stage consists of three parallel, low-pressure F condensate heaters; the second stage consists of two parallel, low-pressure E condensate heaters; the third stage consists of two parallel, low-pressure D condensate heaters; and the fourth stage consists of two parallel, low-pressure C condensate heaters. The subcooled condensate now travels through the two parallel, turbine-driven main feedwater pumps, whose purpose is to provide the desired delivery feedwater pressure at the steam generator main feedwater inlets after overcoming the frictional losses in the high-pressure A and B feedwater heaters and main control valves. Departing the common main feedwater pump discharge header, the subcooled feedwater is further heated to the desired delivery temperature at the steam generator main feedwater inlets by two parallel, high-pressure B feedwater heaters in series with two parallel, high-pressure A feedwater heaters. The high-temperature, high-pressure subcooled feedwater is recombined in the high-pressure A feedwater heater outlet header before being divided into two lines containing the main control valves. Each main control valve is in parallel with a startup control valve. The startup control valves are used for low-power conditions until sufficiently fine feedwater control can be accomplished with the main control valves. The one-way cross-connect to the emergency condensate feedwater train departs

the main condensate feedwater train downstream of the startup control valves in the main control valve bypass lines. During atypical operation, the main feedwater startup control valves regulate the main feedwater through these cross connects. The main condensate feedwater train is check valved appropriately.

Complex cascading of the shell-side fluid in the high- and low-pressure condensate feedwater heaters, steam seal condensers, and condensate steam air ejectors produces a mass feedback mechanism to the condenser, upper surge tanks, condensate storage tanks, and main condensate feedwater train itself. Shell-side effluent from the high-pressure A feedwater heaters combines with the shell-side exhaust of the high-pressure B feedwater heaters before being discharged to the low-pressure C condensate heater flash tanks. The low-pressure C condensate heater flash tanks are recycle devices combining the fluid from the high-pressure feedwater heaters with effluent from the low-pressure turbines and the low-pressure C condensate heaters. They deliver fluid both to the low-pressure C condensate heaters and to the low-pressure D condensate heater flash tanks (through the low-pressure C condensate heater drain coolers). The low-pressure D condensate heater flash tanks are also recycle devices combining the fluid from the low-pressure C condensate heater drain coolers with effluent from the low-pressure D condensate heaters. They deliver fluid to the low-pressure D condensate heater drain tank pumps, which inject it into the main condensate feedwater train between the low-pressure C and D condensate heaters.

Shell-side effluent from the low-pressure E condensate heaters travels through the low-pressure E condensate heater drain tank pumps, which inject it into the main condensate feedwater train between the low-pressure E and D condensate heaters. Shell-side effluent exiting the low-pressure F condensate heaters combines with the shell-side exhaust of the condenser steam air ejectors and then travels to the condenser hotwells. Shell-side effluent of the steam seal condensers is transported to the condensate storage tanks. A recirculation line connects the main condensate feedwater train at a point upstream of the condensate booster pump suction header to the upper surge tanks and the condenser hotwells. This line supplies both the upper surge tanks and condensate storage tanks. It also serves to dissipate the plant heat dump thermal energy while providing a minimum flow through the hotwell pumps during plant startup or shutdown.

CHAPTER III

OCONEE 1 MAIN AND EMERGENCY CONDENSATE FEEDWATER TRAINS ATYPICAL OPERATION

General

All hypothetical PTS scenarios for which the current main and emergency condensate feedwater trains model will be applied are severe enough to trip both the reactor and high- and low-pressure turbines. During such operational upsets, the complexity of modeling the SPCS in general and the main and emergency condensate feedwater trains in particular is reduced significantly.[10-16]

In transients following high- and low-pressure turbine trips, these components are isolated from the SPCS through closure of the high-pressure turbine stop valves, the reheater stop valves, and the high-and low-pressure turbine extraction line valves. The steamlines leading to the tube side of the second stage reheaters are also isolated. These actions explicitly affect the operation of the main condensate feedwater train as the continuing source of thermal-energy supplied to the shell sides of the high- and low-pressure condensate feedwater heaters disappears. Loss of the extraction mass flows propagates through the heater shell-side cascading scheme of the main condensate feedwater train to dissipate the low-pressure E and D condensate heater drain mass flows.

The turbine bypass line valves are opened when the main steamline turbine header pressure rises above a given setpoint.

This allows a significant fraction of the main steam mass flow to be transferred to the condenser hotwells. The main steamline safety/ relief valves open in four stages to dissipate the remaining mass flow if the main steamline pressure rises above four corresponding setpoints. The steam supplies to the main and emergency feedwater pump turbines remain intact.

Main condensate feedwater train control actions include exponential runback of the velocity of the two main feedwater pumps and closure of the main control valves on feedwater demand error. Thus, a small fraction of the nominal main feedwater flow enters each of the steam generators during transient situations. The main feedwater pumps may trip on a high discharge pressure, a low suction pressure, or a high steam generator level. The hotwell pumps are constant speed devices and may trip on a low hotwell level or loss of condenser vacuum. The condensate booster pumps are constant speed devices and may trip on a time-sustained low suction pressure. Main feedwater realignment through the one-way cross-connect to the emergency feedwater train occurs on reactor coolant pump trip.

Emergency condensate feedwater train control actions include starting of the turbine- and motor-driven pumps on low discharge pressure of the main feedwater pumps. Additionally, these pumps may trip on a high discharge pressure (under failure of their discharge recirculation lines). The control valve in the emergency feedwater line to each steam generator is opened (if needed) after actuation of the emergency feedwater pumps to maintain steam generator level.

Active or Passive Component Modeling

The description of the atypical SPCS operation yields information on which components of the main and emergency condensate feedwater trains have significant influence on the dynamic response of the SPCS during the PTS class of transients. By effectively representing the important PTS characteristics of these components, a best-estimate thermal-hydraulic model is obtained that is capable of accurately predicting: (1) the time histories of the steam generator main and emergency feedwater inlet fluid temperatures, pressures, and static qualities; (2) the locations within the main and emergency feedwater trains at which flashing and/or choking may occur; and (3) the maximum combined main and emergency condensate feedwater train mass throughput.

Development of such a model forces incorporation of realistic mass sources both residing in the main and emergency condensate feedwater trains and available from the condenser hotwells (including the upper surge tanks) and low-pressure E and D condensate heater drains. Realistic thermal energy sources available passively in the main and emergency condensate feedwater trains (both in the fluid and system metal) and available actively from the shell sides of the high- and low-pressure condensate feedwater heaters and the plant heat dump must also be included. These considerations necessitate combining system geometric information (component transverse flow areas and

volumes, elevation changes, pressure loss coefficients, etc.), system thermodynamic information (initial distributions of pressure, temperature, etc.), and system dynamic response information (a suitable representation of the main and emergency condensate feedwater trains control system). Examining the main and emergency condensate feedwater trains according to class of component, the pertinent thermal-hydraulic characteristics of each can be identified, and it can be determined if these particular components should be modeled actively or passively.

The main and emergency condensate feedwater train pumps are active components as their actions directly influence the dynamic response of their respective systems. These pumps must, therefore, be modeled to include their specific relationships between volumetric flow and head at all velocities in two quadrants of the volumetric flow versus pump velocity space. The unnecessary quadrants are those of negative pump velocity as no pumps are allowed to have reverse rotor rotation. Each pump is represented classically by a set of single-phase homologous volumetric flow versus head and volumetric flow versus torque curves and a set of two-phase degradation and cavitation multipliers. Straight speed scaling is used to extrapolate known pump characteristics to non-rated velocity conditions; for homologous curve regimes outside positive volumetric flow and positive head, best-estimate pump characteristics are used to produce continuous pump operation through domain transitions. An additional pump parameter of importance is the velocity gradient with respect to

time in both runup and coastdown conditions. It is determined by the pump moment of inertia and hydraulic, frictional, and motor torques.

The plant heat dump is a passive component as the only desired information from it is the frictional tube-side pressure loss and time-independent, shell-side thermal energy additions. The main and emergency condensate feedwater trains piping is treated as a passive component as it need yield only correct frictional pressure losses as well as be a major contributor (in addition to the metal of individual components) to the system capacitive thermal energy additions.

The high- and low-pressure condensate feedwater heaters are active components as they need to yield the tube-side frictional pressure losses and shell-side thermal energy additions as a function of time. This is necessary to reflect SPCS isolation of the high- and low-pressure turbine and reheater and moisture separator assembly extraction lines.

The system control and check valves are active components as their action has a direct influence on the steam generator secondary-side main and emergency feedwater inlet conditions. Stem speed is the dominant characteristic of the control valves (assumed to have a linear normalized stem position versus normalized area relationship) as it dictates the dynamic response of these components. Check valves are assumed to open or close instantly based upon direction of the fluid velocity through them.

The tertiary systems of the condenser hotwells and low-pressure E and D condensate heater drains are passive components only being sources of mass and thermal energy.

Integrated Control System

The Oconee 1 total plant response is maintained by the Babcock & Wilcox Integrated Control System (ICS),[17-20] which operates through input from each major plant system. The philosophy of controlling a nuclear plant on many interacting systems combined with the high sensitivity of the Oconee 1 once-through steam generators dictates that the ICS be complex. As both primary and secondary systems are monitored by the Oconee 1 control system, it is extremely difficult to produce adequate separate-effects models covering individual plant systems. Therefore, it is necessary to develop a representation of the control subsystems pertinent to the pressurized thermal shock A-49 Program and overlay this control system model on an Oconee 1 total plant thermal-hydraulic model.

Portions of the ICS pertinent to the main and emergency condensate feedwater trains include main feedwater control and the semi-independent emergency feedwater control subsystems. Emergency feedwater control relates the steam generator A and B emergency feedwater control valve positions to the corresponding steam generator level, which is developed from a differential pressure signal. Emergency feedwater control attempts to maintain each steam generator

at startup level if the reactor coolant pumps are running and at high, high level (to encourage natural circulation) after they are tripped.

Main feedwater control regulates the turbine-driven main feedwater pumps speed, the steam generator A and B main control valves, and the steam generator A and B startup control valves. Several control system modules comprise the main feedwater demand characterization: (1) the unit load-reactor-feedwater demand, which establishes the level of electrical power generation for the nuclear station and combines that requirement with the reactor neutron power error signal to limit feedwater demand, (2) compensated feedwater demand, which provides a feedwater demand adjustment on the error between the actual feedwater temperature and the one derived from the unit load demand, (3) feedwater steam generator loop A and B demand, which produces a feedwater total demand signal while minimizing the temperature difference between the two primary system cold legs, (4) BTU limited feedwater demand, which relates the steam generator secondary-side outlet pressures, feedwater inlet temperatures, reactor outlet temperature, and primary loop mass flow to generate a BTU availability limit signal, (5) feedwater flow error, which compares actual feedwater mass flow to that demanded, and (6) high- and low-level steam generator downcomer limits, which override the feedwater flow error if it attempts to produce feedwater demand changes that force the downcomer level out of its allowable range. The result of these six control subsystems is the

neutron-cross-limited, BTU-limited, and level-limited steam generator A and B feedwater demand signals.

The main feedwater control valves are controlled from the above generated feedwater demand signals. The contribution of both the main and startup control valves for each steam generator are summed to produce the total feedwater mass flow. The smaller differential pressure across the main feedwater main control valves is compared to a minimum setpoint to modify the turbine-driven main feedwater pumps speed. Both pumps are controlled to the same speed with the total feedwater demand forcing anticipatory changes in the valve differential pressure.

CHAPTER IV

THERMAL-HYDRAULIC COMPUTER CODE SELECTION

General

The complex details of the thermal-hydraulic systems that must be included in the Oconee 1 total plant models, combined with the wide spectrum of primary and secondary transient data required to evaluate the possible risks associated with hypothetical PTS scenarios, limit the number of adequate calculational tools available for use. The scope of the problem alone dictates that a systems-type digital computer code be used for the simulations . Of such programs only a few are able to both accommodate the large total plant models and execute the required phasic, nonhomogeneous, nonequilibrium fluid dynamics. Two codes fulfilling these requirements, the INEL developed RELAP5 and the LANL developed TRAC, were chosen by the NRC to simultaneously and independently perform the PTS analyses of Oconee 1. Both codes use advanced thermal-hydraulics with TRAC solving a three-dimensional (one-dimensional outside the domain of the reactor vessel) set of six field equations allowing two-velocity, phasic, nonequilibrium, nonhomogeneous conditions. RELAP5 solves a one-dimensional set of five field equations allowing two-velocity, phasic, nonequilibrium, nonhomogeneous conditions with the simplifying assumption that the least massive phase be at saturation. RELAP5 was chosen by the NRC as the computer code with which ORNL

would develop the stand-alone main and emergency condensate feedwater trains model.

RELAP5 Characteristics

RELAP5 is a top-down, modular, best-estimate systems class computer code that allows modeling of all major nuclear station processes necessary for adequate analyses of various transient situations. Elements that can be modeled include thermal-hydraulic components of system volume, system junction, time-dependent volume, time-dependent junction, pipe volume and junction, annulus volume and junction, branch volume and junction, separator volume and junction, pump volume and junction, valve junction, jetmixer volume and junction, and accumulator volume and junction; thermal-energy components of heat structures having multiple source options including space-independent reactor kinetics; control system components of sum, difference, multiply, divide, differentiation, integration, general function, standard function, delay, unit trip, trip delay, integer power, real power, and variable power; and trip (logical and variable) components of assorted system parameters.

Important features of RELAP5 pertinent to PTS include incorporation of models unique to small break situations such as detailed horizontal and vertical flow regime models, a subcooled nonequilibrium choked flow model, a feedback control system model that enables simultaneous, nonlinear, differential equations to be advanced in time, and extensive heat transfer regime correlations.

RELAP5 solves a set of five differential field equations which consist of two phasic continuity equations, two phasic viscous stress equations, and a mixture total energy equation. These equations, as utilized in RELAP5, are shown in detail in Appendix A. Solving this system of equations requires constitutive relationships for the phenomena of interphase drag and interphase mass exchange. RELAP5 lumps all interphase mass transfer into a vapor mass generation model so that the correlation for this one phenomenon can replace constitutive relationships for interphase energy transfer, distribution of external energy transfer between phases, and distribution of energy transfer between sensible heat and heat of vaporization. RELAP5 also requires constitutive relationships for wall friction and wall heat transfer.

The RELAP5 linear, semi-implicit in time, finite-differenced numerical scheme was developed from the five differential field equations by summing and differencing the phasic differential continuity equations, summing and differencing the phasic differential viscous stress equations, and deriving the differential mixture thermal energy equation from the differential mixture total energy equation. Writing the resulting five equations in terms of hydrodynamic pressures, subsequent back-substitution is performed to obtain the system phasic velocities, qualities, and mixture internal energy and density products. Intermediate system mixture densities are determined from auxiliary equations generated from the mixture continuity and momentum equations. The system mixture internal

energies are then found by dividing the system mixture internal energy and density products by these intermediate system mixture densities. Given the system pressure, mixture internal energy, and quality combinations as independent variables, a water properties search is completed using the constitutive relationship that the least massive phase is at saturation. This yields the final system temperatures and phasic densities.

The latest released version of RELAP5, RELAP5/MOD1/019, has been tested by the NRC, INEL, and other independent groups through successful application to a wide range of hypothetical and actual problems; it is accepted by the NRC for use in commercial power reactor calculations and is the version currently being used by ORNL. This cycle of the code is written in non-standard languages compatible to 60-bit real and integer Control Data Corporation computer words and features full dynamic storage and word bit packing to allow continuous execution in the small core memory of these computers. As ORNL uses International Business Machine (IBM) computers having double-precision real words of 64 bits and integer words of 32 bits, an extensive rewriting of RELAP5/MOD1/019 was required to allow usage on the ORNL computers. A generic 32-bit machine version[21] of RELAP5/MOD1/019 has thus been created that is compatible with the IBM 370/3033 and Digital Equipment Corporation VAX-11/780 computers.

CHAPTER V

OCONEE 1 MAIN AND EMERGENCY CONDENSATE FEEDWATER TRAINS RELAP5 MODEL

General

The major analysis boundaries of the Oconee 1 main and emergency condensate feedwater trains model are the condenser hotwell outlets and the steam generator main and emergency feedwater ring header outlets. The minor analysis boundaries include the low-pressure E and D condensate heater drains. The condenser hotwell itself is not explicitly modeled as RELAP5 is unable to adequately calculate its gravity dominated, low-pressure flows (the calculations in that component oscillate severely relative to the magnitude of the absolute pressure and represent unrealistic condenser hotwell conditions). If the loss of condenser vacuum is not an important transient characteristic, the condenser hotwells can be adequately represented by a constant-temperature, constant-pressure boundary condition with its time-dependent mass inventory calculated by differencing the initial mass and integrals over time of its inlet and outlet mass flows. Plate 5.1 is an Oconee 1 component schematic of the RELAP5 model over the domain of the main and emergency condensate feedwater trains.

Systems Reduction

Examination of the main condensate feedwater train model shows a single string of components incorporating the three hotwell pumps (represented as one volume) which draw from the condenser hotwells boundary volume, the plant heat dump, the three condensate booster pumps (represented as one volume), the three low-pressure F condensate heaters (represented as one volume), the two low-pressure E condensate heaters (represented as one volume), the two low-pressure D condensate heaters (represented as one volume), and the two low-pressure C condensate heaters (represented as one volume). Mass source inlets are allowed in this single string at the suction of the hotwell pumps volume to represent the condenser hotwell outlets, between the low-pressure E and D condensate heater volumes to represent the low-pressure E condensate heater drains, and between the low-pressure D and C condensate heater volumes to represent the low-pressure D condensate heater drains. Active heat structures are associated with both the plant heat dump and the low-pressure F, E, D, and C condensate heaters to represent thermal-energy additions from their respective shell sides. A capacitive heat structure is also associated with the plant heat dump to represent half of the available stored thermal energy in the main condensate feedwater train system metal.

Exiting the low-pressure C condensate feedwater heater volume, a dual component string begins as the main condensate is divided into a line to each main feedwater pump volume. A common outlet header

connects the main feedwater pump discharges. The dual string then continues through two sets of high-pressure B and A feedwater heater volumes. Another common header exists at the outlet of the high-pressure A feedwater heaters. The main feedwater is finally transported to each steam generator main feedwater ring header via independent main feedlines before being dumped in the steam generator boundary volumes. Additional mass source outlets are allowed in the dual strings as the one-way cross-connects from each main feedwater line to each emergency feedwater line, which leave each main feedwater line upstream of the main control valves. Active heat structures are associated with each of the high-pressure B and A feedwater heater volumes to represent the thermal-energy addition from their respective shell sides. A capacitive heat structure is associated with the main feedwater pumps common suction header to represent half of the available stored thermal energy in the main condensate feedwater train system metal.

The valving in the main condensate feedwater train is incorporated into the RELAP5 model in sufficient detail to represent the dynamic response of the system to previously established PTS scenarios. Thus, system check valves are included only where possible model reverse mass flows may occur (in the dual component string around the main feedwater pumps, downstream of the high-pressure A feedwater heaters common outlet header, in the cross-connect to the emergency feedwater lines, and at the main feedwater inlet to each

steam generator). The hotwell and condensate booster pumps are check valved at their discharges in the actual system; however, in the model the main feedwater pump check valves are sufficient to prevent continuous reverse mass flows in the single string of components. The main and startup control valves regulate the feedwater mass flow to the steam generators and are represented as one motor-driven valve junction in each main feedline since the combined result of their operation is a continuous function of increasing or decreasing normalized mass flow. All check valves in this system are initially full-open; the motor-driven valves are initially half-open and have an assumed constant stem speed. A summary of the thermal-hydraulic considerations used in modeling the components of the main condensate feedwater train is presented in Table 5.1.

Examination of the emergency condensate feedwater train shows three pump components drawing from the condenser hotwells boundary volume. These volumes represent the two motor-driven and one turbine-driven emergency feedwater pumps. The turbine-driven pump discharge connects to the discharge of each motor-driven pump. An emergency feedline continues to the emergency feedwater inlet of each steam generator where it terminates in the steam generator boundary volume. The emergency feedwater pump condenser recirculation lines are not included in the model in an effort to limit model components. The resulting effect is that these pumps simply deadhead against the emergency feedwater control valves if the valves remain closed. Mass source inlets to the emergency condensate feedwater

Table 5.1. Oconee 1 main condensate feedwater train components thermal-hydraulic modeling considerations.

Component Description/Type/Name	Modeling Simplifications/Limitations
Condenser Hotwells (3 Housings)	(1) Not explicitly included as RELAP5 hydrodynamics cannot accurately solve the low-pressure, gravity-dominated conditions,
Time-dependent Volume	(2) Three condenser hotwells represented as constant-pressure, constant-temperature, infinite flow area boundary conditions,
TV400:CHW	(3) Upper surge tanks initial mass inventory implicitly included (available through high-capacity, gravity-feed lines),
	(4) Condensate storage tanks initial mass inventory not included (available only through low-capacity pumps),
	(5) Realistic mass source developed through the difference of the initial mass inventory and the time-integrated inlet and outlet mass flows,
	(6) Ultimate heat sink must remain operative and realistic amounts of thermal energy must be dumped to shell side, and

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(7)	Loss of condenser vacuum transients are invalid.
Hotwell Pumps (3 Parallel)	(1)	Three hotwell pumps represented as one hydrodynamic volume (via tripling of rated volumetric flow),
Pump Volume	(2)	Flow area preserves highest fluid velocity in hydrodynamic component domain; flow volume estimated to give realistic system fluid volume,
PV401:HWP	(3)	Forward and reverse pressure loss coefficients incorporated to yield desired system pressure distribution,
	(4)	Straight speed scaling used in conjunction with positive volumetric flow versus head relationship to produce homologous curve sets for first and second flow regimes,
	(5)	Third and fourth flow regime homologous curve sets estimated from typical pump characteristics to produce continuous operation through regime transitions,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(6) Fifth through eighth flow regime homologous curve sets are extraneous as negative pump rotor rotation is not allowed,
	(7) Volumetric flow and motor torque homologous curves developed from straight speed scaling and allowing all motor torques to equal the rated motor torque,
	(8) Moment of inertia developed from assumed hydraulic, frictional, and motor torques and a desired gradient with respect to time of the pump coastdown velocity,
	(9) Homologous curve two-phase degradation and cavitation multipliers capability included,
	(10) Homologous curve two-phase difference table accessed from internal RELAP5 data,
	(11) Constant velocity used except for coastdown conditions,
	(12) Hotwell pumps are initially running at rated conditions, and

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(13)	Hotwell pumps may trip on low hotwell level (determined from condenser hotwells mass inventory calculation).
Plant Heat Dump (General Coolers)	(1)	All general plant coolers lumped into one hydrodynamic volume (bypass ignored),
Pipe Volume with Active Heat Structure	(2)	Tube-side flow area preserves highest velocity in hydrodynamic component domain,
CV40202/HS400:PHD	(3)	Tube-side volume assumed,
	(4)	Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5)	Shell-side represented as a one-dimensional, cylindrical, active heat structure (configuration assumed),
	(6)	Shell-side volume preserved using hydrodynamic component radius (24 in. OD pipe),
	(7)	Shell-side thermal energy source magnitude (steady-state, full power) calculated via an

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution,
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10) Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11) Adiabatic boundary condition used on shell-side outer radius,
	(12) Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13) Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
System Metal Capacitive Thermal Energy Source	(1)	Low-temperature system metal (one-half of total system metal) represented (First Segment) as one-dimensional, cylindrical, capacitive heat structure,
Pipe Volume with Capacitive Heat Structure	(2)	Total system metal volume formulated from total system hydrodynamic volume and assuming entire system is 24 in. OD pipe with 1.219 in. wall thickness,
CV40202/HS401	(3)	Pipe-wall volume preserved using hydrodynamic component radius (24 in. OD pipe),
	(4)	Zero thermal energy source magnitude incorporated,
	(5)	Temperature-independent thermal conductivity and volumetric heat capacity used,
	(6)	Pipe-wall material is carbon steel with artificial volumetric heat capacitance,
	(7)	Volumetric heat capacitance determined by dividing the total system available stored thermal energy by the product of the total system metal volume and initial-to-bias-temperature

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
		difference (initial temperature being the initial temperature of the local hydrodynamic component and bias temperature being the condenser hotwells constant temperature),
	(8)	Available total system stored thermal energy calculated by integrating the volumetric heat capacity and temperature product over the volume of the system metal and subtracting the final total system stored thermal energy (a linear temperature increase is used throughout the length of the system for the integrand),
	(9)	Heat transfer package boundary condition used on the hydrodynamic component pipe-wall interface, and
	(10)	Adiabatic boundary condition used on the pipe-wall outer radius.
Condensate Booster Pumps (3 Parallel)	(1)	Three condensate booster pumps represented as one hydrodynamic volume (via tripling of rated volumetric flow); bypass ignored,

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
Pump Volume	(2)	Flow area preserves highest fluid velocity in hydrodynamic component domain; flow volume preserved,
PV403:CBP	(3)	Forward and reverse pressure loss coefficients incorporated to yield desired system pressure distribution,
	(4)	Straight speed scaling used in conjunction with positive volumetric flow versus head relationship to produce homologous curve sets for first and second flow regimes,
	(5)	Third and fourth flow regime homologous curve sets are estimated from typical pump characteristics to produce continuous operation through regime transitions,
	(6)	Fifth through eighth flow regime homologous curve sets are extraneous as negative pump rotor rotation is not allowed,
	(7)	Volumetric flow and motor torque homologous curves developed from straight speed scaling and allowing all motor torques to equal the rated motor torque,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(8) Moment of inertia developed from assumed hydraulic, frictional, and motor torques and a desired gradient with respect to time of the pump coastdown velocity,
	(9) Homologous curve two-phase degradation and cavitation multipliers capability included,
	(10) Homologous curve two-phase difference table accessed from internal RELAP5 data,
	(11) Constant velocity used except for coastdown conditions,
	(12) Condensate booster pumps are iniitally running at rated conditions, and
	(13) Condensate booster pumps may trip on sustained low suction pressure.
Low-pressure F Condensate Heaters (3 Parallel)	(1) Three low-pressure F condensate heaters lumped into one hydrodynamic volume (bypass ignored),
Pipe Volume with Active Heat Structure	(2) Tube-side flow area preserves highest velocity in hydrodynamic component domain,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
CV40401/HS402:LPF	(3) Tube-side volume assumed,
	(4) Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5) Shell-side represented as a one-dimensional, cylindrical, active heat structure (configuration same as low-pressure C condensate heaters),
	(6) Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius and geometry characteristics,
	(7) Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10) Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11) Adiabatic boundary condition used on shell-side outer radius,
	(12) Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13) Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).
Low-pressure E Condensate Heaters (2 Parallel)	(1) Two low-pressure E condensate heaters lumped into one hydrodynamic volume (bypass ignored),
Pipe Volume with Active Heat Structure	(2) Tube-side flow area preserves highest velocity in hydrodynamic component domain,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
CV40402/HS403:LPE	(3) Tube-side volume assumed,
	(4) Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5) Shell-side represented as a one-dimensional, cylindrical, active heat structure (configuration same as low-pressure C condensate heaters),
	(6) Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius and geometry characteristics,
	(7) Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10) Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11) Adiabatic boundary condition used on shell-side outer radius,
	(12) Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13) Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).
Low-pressure E Condensate Heater Drain	(1) Not explicitly included in an effort to limit model size,
Time-dependent Volume with Time-dependent Junction	(2) Heater drain inlet represented as one constant-pressure, constant-temperature, infinite-volume, infinite-flow area boundary condition, and

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
TV406,TJ407:EHD	(3)	Time-dependent mass flow specified (magnitude defined by current scenario).
Low-pressure D Condensate Heaters (2 Parallel)	(1)	Two low-pressure D condensate heaters lumped into one hydrodynamic volume (bypass ignored),
Branch Volume with Active Heat Structure	(2)	Tube-side flow area preserves highest velocity in hydrodynamic component domain,
BV408/HS404:LPD	(3)	Tube-side volume assumed,
	(4)	Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5)	Shell-side represented as a one-dimensional, cylindrical, active heat structure (configuration same as low-pressure C condensate heaters),
	(6)	Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius,
	(7)	Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10) Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11) Adiabatic boundary condition used on shell-side outer radius,
	(12) Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13) Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
Low-pressure D Condensate Heater Drain	(1)	Not explicitly included in an effort to limit model size,
Time-dependent Volume with Time-dependent Junction	(2)	Heater drain inlet represented as one constant-pressure, constant-temperature, infinite-volume, infinite-flow area boundary condition, and
TV410,TJ411:DHD	(3)	Time-dependent mass flow specified (magnitude defined by current scenario).
Low-pressure C Condensate Heaters (2 Parallel)	(1)	Two low-pressure C condensate heaters lumped into one hydrodynamic volume (bypass ignored),
Branch Volume with Active Heat Structure	(2)	Tube-side flow area preserves highest velocity in hydrodynamic component domain,
BV412/HS405:LPC	(3)	Tube-side volume assumed,
	(4)	Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5)	Shell-side represented as a one-dimensional, cylindrical, active heat structure,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(6) Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius,
	(7) Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artificially large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10) Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11) Adiabatic boundary condition used on shell-side outer radius,
	(12) Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(13)	Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).
System Metal Capacitive Thermal Energy Source (Second Segment)	(1)	High-temperature system metal (one-half of total system metal) represented as one-dimensional, cylindrical, capacitive heat structure,
Branch Volume with Capacitive Heat Structure	(2)	Total system metal volume formulated from total system hydrodynamic volume and assuming entire system is 24 in. OD pipe with 1.219 in. wall thickness,
BV500/HS500	(3)	Pipe-wall volume preserved using hydrodynamic component radius (24 in. OD pipe),
	(4)	Zero thermal energy source magnitude incorporated,
	(5)	Temperature-independent thermal conductivity and volumetric heat capacity used,
	(6)	Pipe-wall material is carbon steel with artificial volumetric heat capacitance,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(7) Volumetric heat capacitance determined by dividing the total system available stored thermal energy by the product of the total system metal volume and initial-to-bias-temperature difference (initial temperature being the initial temperature of the local hydrodynamic component and bias temperature being the condenser hotwells constant temperature),
	(8) Available total system stored thermal energy calculated by integrating the volumetric heat capacity and temperature product over the volume of the system metal and subtracting the final total system stored thermal energy (a linear temperature increase is used throughout the length of the system for the integrand),
	(9) Heat transfer package boundary condition used on the hydrodynamic component pipe-wall interface, and
	(10) Adiabatic boundary condition used on the pipe-wall outer radius.
Main Feedwater Pumps	(1) Each main feedwater pump represented as one hydrodynamic (bypass ignored),

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
Pump Volumes	(2) Flow area preserves highest fluid velocity in hydrodynamic component domain; flow volume preserved,
PV420,PV522:FPA,FPB	(3) Forward and reverse pressure loss coefficients incorporated to yield desired system pressure distribution,
	(4) Straight speed scaling used in conjunction with positive volumetric flow versus head relationship to produce homologous curve sets for first and second flow regimes,
	(5) Third and fourth flow regime homologous curve sets estimated from typical pump characteristics to produce continuous operation through regime transitions,
	(6) Fifth through eighth flow regime homologous curve sets are extraneous as negative pump rotor rotation is not allowed,
	(7) Volumetric flow and motor torque homologous curves developed from straight speed scaling and allowing all motor torques to equal the rated motor torque,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(8) Moment of inertia developed from assumed hydraulic, frictional, and motor torques and a desired gradient with respect to time of the pump coastdown velocity,
	(9) Homologous curve two-phase degradation and cavitation multipliers capability included,
	(10) Homologous curve two-phase difference table accessed from internal RELAP5 data,
	(11) Main feed pump velocity is variable and is determined by the control system operating on the smaller pressure drop across the main feedwater main control valves,
	(12) Main feed pumps are initially running symmetrically at rated conditions, and
	(13) Main feed pumps may trip on a low suction pressure or a high discharge pressure.
High-pressure B Feedwater Heaters (2 Parallel)	(1) Each high-pressure B feedwater heater represented as one hydrodynamic volume (bypass ignored),

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
Pipe Volume with Active Heat Structure	(2)	Tube-side flow area preserves highest velocity in hydrodynamic component domain,
CV42401,CV52401/HS420,HS520:HPB	(3)	Tube-side volume preserved,
	(4)	Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5)	Shell-side represented as a one-dimensional, cylindrical, active heat structure,
	(6)	Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius and geometry characteristics,
	(7)	Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8)	Temperature-independent thermal conductivities and volumetric heat capacities incorporated,

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(9)	Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a reasonable initial radial temperature distribution) used,
	(10)	Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11)	Adiabatic boundary condition used on shell-side outer radius,
	(12)	Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13)	Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).
High-pressure A Feedwater Heaters (2 Parallel)	(1)	Each high-pressure A feedwater heater represented as one hydrodynamic volume (bypass ignored),
Pipe Volume with Active Heat Structure	(2)	Tube-side flow area preserves highest velocity in hydrodynamic component domain,

Table 5.1. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
CV42402,CV52402/HS421,HS522:HPA	(3) Tube-side volume assumed,
	(4) Tube-side forward and reverse loss coefficients implemented to yield the desired tube-side system pressure distribution,
	(5) Shell-side represented as a one-dimensional, cylindrical, active heat structure,
	(6) Shell-side inner heat transfer area and volume preserved using hydrodynamic component radius and geometry characteristics,
	(7) Shell-side thermal energy source magnitude (steady-state, full power) calculated via an isobaric fluid enthalpy and mass flow balance on the tube-side hydrodynamic component to yield the desired tube-side system temperature distribution (active only over the shell space),
	(8) Temperature-independent thermal conductivities and volumetric heat capacities incorporated,
	(9) Shell-side material of saturated water at the shell-side operating pressure (with an artifically large thermal conductivity to allow a

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
		reasonable initial radial temperature distribution) used,
	(10)	Heat transfer package boundary condition used on hydrodynamic component shell-side interface,
	(11)	Adiabatic boundary condition used on shell-side outer radius,
	(12)	Shell-side, time-dependent thermal energy source magnitude determined from current scenario, and
	(13)	Shell-side, steady-state, radial temperature distribution initialized using hydrodynamic component hydraulic diameter in heat transfer package regime correlations (if required).
Main Feedwater Control Valves	(1)	Each main feedwater control valve represented as a motor valve junction having a constant stem speed,
Motor Valve Junctions	(2)	Forward and reverse loss coefficients included to yield desired system pressure distribution,
MJ428,MJ528:CVA,CVB	(3)	Valves are initially half open, and

Table 5.1. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(4)	Normalized valve areas are controlled via the control system operating on feedwater demand.
Steam Generators (A and B)	(1)	Not explicitly included as a RELAP5 hydrodynamic volume as this is the interface between the main condensate feedwater train and the total plant model,
Time-dependent Volumes	(2)	Each steam generator represented as a constant-pressure, infinite-volume, infinite-flow area boundary condition, and
TV431,TV531:SGA,SGB	(3)	Will be replaced in total plant model.

train are allowed at the condenser hotwell outlets and entrance of the one-way cross-connects from the main feedwater lines. Mass source outlets are allowed at each steam generator emergency feedwater ring header outlet. A capacitive heat structure is associated with each of the emergency feedwater pump discharges but it has been voided in the model as the system metal of the emergency feedwater system is at a temperature comparable to the condenser hotwells and therefore makes a negligible energy contribution.

Minimum valving is incorporated in the emergency condensate feedwater train. System check valves are included only where possible model reverse mass flows may occur (at the discharges of the three emergency feedwater pumps and at the emergency feedwater inlet to each steam generator). To conserve the number of motor-driven valves in the main and emergency condensate feedwater trains, the emergency control valves are placed downstream of the one-way cross-connect from each main feedline (they are located upstream of these lines in the actual system and main feedwater control is performed by the startup control valve after main feedwater realignment). This valving configuration is required due to the lumping of the main feedwater startup control valve and the main feedwater block valve with the main feedwater control valve. Thus, effective post-realignment control of the feedwater to each steam generator can be accomplished if the model emergency feedwater control valve reflects the combined action of the system main feedwater startup control valve and the system emergency feedwater control valve. Possible

model feedwater control problems can occur if emergency feedwater is being supplied before realignment of the main feedwater has been accomplished and conditions are such that a non-zero flow exists in the one-way cross-connects. For transients involving such scenarios, it may be necessary to model the actual system cross-connect configurations. The four check valves at the emergency feedwater pump discharges are initially closed, the check valves at the emergency feedwater inlets are initially open, and the emergency control valves are initially closed and have an assumed constant stem speed. A summary of the thermal-hydraulic considerations used in modeling each component of the emergency condensate feedwater train is presented in Table 5.2.

Net elevation changes in the main and emergency condensate feedwater trains are preserved in the model. A common elevation gain exists for both the main and emergency condensate feedwater systems between the condenser hotwell outlets and the cross-connect lines. This elevation change is the difference in the elevation of the hotwell pump suctions and steam generator main feedwater ring headers. Another elevation gain occurs in the emergency condensate feedwater train to account for the elevation difference in the steam generator main and emergency feedwater ring headers.

Thermodynamic Statepoints

Plate 5.1 concerns the nominal, full-power, steady-state, symmetric-string thermodynamic conditions for the main and emergency

Table 5.2. Oconee 1 emergency condensate feedwater train components thermal-hydraulic modeling considerations.

Component Description/Type/Name	Modeling Simplifications/Limitations
Condenser Hotwells (3 Housings)	(1) Not explicitly included as RELAP5 hydrodynamics cannot accurately solve the low-pressure, gravity-dominated conditions,
Time-dependent Volume	(2) Three condenser hotwells represented as constant-pressure, constant-temperature, infinite flow area boundary conditions,
TV602,TV624,TV652:CHW	(3) Upper surge tanks initial mass inventory implicitly included (available through high-capacity, gravity-feed lines),
	(4) Condensate storage tanks initial mass inventory not included (available only through low-capacity pumps),
	(5) Realistic mass source developed through the difference of the initial mass inventory and the time-integrated inlet and outlet mass flows,
	(6) Ultimate heat sink must remain operative and realistic amounts of thermal energy must be dumped to shell side, and

Table 5.2. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(7)	Loss of condenser vacuum transients are invalid.
Emergency Feedwater Motor-driven Pumps	(1)	Each emergency feedwater motor-driven pump represented as one hydrodynamic volume,
Pump Volume	(2)	Flow area preserves highest fluid velocity in hydrodynamic component domain; flow volume estimated to give realistic system fluid volume,
PV603,PV625:MPA,MPB	(3)	Forward and reverse pressure loss coefficients incorporated to yield desired system pressure distribution,
	(4)	Straight speed scaling used in conjunction with positive volumetric flow versus head relationship to produce homologous curve sets for first and second flow regimes,
	(5)	Third and fourth flow regime homologous curve sets estimated from typical pump characteristics to produce continuous operation through regime transitions,
	(6)	Fifth through eighth flow regime homologous curve sets are extraneous as negative pump rotor rotation is not allowed,

Table 5.2. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(7) Volumetric flow and motor torque homologous curves developed from straight speed scaling and allowing all motor torques to equal the rated motor torque,
	(8) Moment of inertia developed from assumed hydraulic, frictional, and motor torques and a desired gradient with respect to time of the pump coastdown velocity,
	(9) Homologous curve two-phase degradation and cavitation multipliers capability included,
	(10) Homologous curve two-phase difference table accessed from internal RELAP5 data,
	(11) Constant velocity used except for runup and coastdown conditions,
	(12) Emergency feedwater motor-driven pumps are initially off,
	(13) Emergency feedwater motor-driven pumps may start due to main feedwater pump low discharge pressure, and

Table 5.2. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(14)	Emergency feedwater motor-driven pumps may trip due to high discharge pressure.
Emergency Feedwater Turbine-driven Pump	(1)	The emergency feedwater turbine-driven pump represented as one hydrodynamic volume,
Pump Volume	(2)	Flow area preserves highest fluid velocity in hydrodynamic component domain; flow volume estimated to give realistic system fluid volume,
PV653:TDP	(3)	Forward and reverse pressure loss coefficients incorporated to yield desired system pressure distribution,
	(4)	Straight speed scaling used in conjunction with positive volumetric flow versus head relationship to produce homologous curve sets for first and second flow regimes,
	(5)	Third and fourth flow regime homologous curve sets estimated from typical pump characteristics to produce continuous operation through regime transitions,

Table 5.2. (Continued)

Component Description/Type/Name	Modeling Simplifications/Limitations
	(6) Fifth through eighth flow regime homologous curve sets are extraneous as negative pump rotor rotation is not allowed,
	(7) Volumetric flow and motor torque homologous curves developed from straight speed scaling and allowing all motor torques to equal the rated motor torque,
	(8) Moment of inertia developed from assumed hydraulic, frictional, and motor torques and a desired gradient with respect to time of the pump coastdown velocity,
	(9) Homologous curve two-phase degradation and cavitation multipliers capability included,
	(10) Homologous curve two-phase difference table accessed from internal RELAP5 data,
	(11) Constant velocity used except for runup and coastdown conditions,

Table 5.2. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
	(12)	The emergency feedwater turbine-driven pump is initially off,
	(13)	The emergency feedwater turbine-driven pump may start due to main feedwater pump low discharge pressure, and
	(14)	The emergency feedwater turbine-driven pump may trip due to high discharge pressure.
Emergency Feedwater Control Valves	(1)	Each emergency feedwater control valve represented as a motor valve junction having a constant stem speed,
Motor Valve Junctions	(2)	Forward and reverse loss coefficients included to yield desired system pressure distribution,
MJ610,MJ632:LVA,LVB	(3)	Valves are initially closed, and
	(4)	Normalized valve areas are controlled via the control system operating on steam generator level.

Table 5.2. (Continued)

Component Description/Type/Name		Modeling Simplifications/Limitations
Steam Generators (A and B)	(1)	Not explicitly included as a RELAP5 hydrodynamic volume as this is the interface between the main condensate feedwater trains and the total plant model,
Time-dependent Volumes	(2)	Each steam generator represented as a constant-pressure, infinite-volume, infinite-flow area boundary condition, and
TV613,TV635:SGA,SGB	(3)	Will be replaced in total plant model.

condensate feedwater trains. Given at pertinent locations throughout the systems are fluid pressures, P (PSIA), fluid temperatures, T (°F), fluid mass flows, W (lbm/s), and active heat structure thermal energy source values, Q (MW). These statepoints were determined from Oconee 1 secondary-system heat balances, system drawings, and other supplied data.[10-16] The condenser hotwell outlet conditions were determined from the nominal condenser operating conditions and the static head developed between the hotwell inlets and hotwell pump suctions. The steam generator main feedwater ring header outlet conditions are for nominal full-power operation. The emergency feedwater ring header outlet conditions are determined from a full-power gross energy balance on the secondary side of each steam generator. As the emergency feedwater lines are initially stagnant, this statepoint is equivalenced to those residing in the emergency feedwater headers. The Plate 5.1 conditions should be the values incorporated into the Oconee 1 total plant models when 2565 MW is dumped to the secondary side of the steam generators. This power level includes a combination of the reactor core addition, reactor coolant pump addition, and containment coolers depletion and may vary considerably for different PTS scenarios.

The Plate 5.1 system pressure distribution is calculated from the above endpoints by utilizing the pump-developed heads, recorded absolute pressures at specific locations, static head relative pressure increases or decreases, dynamic head relative pressure losses, controlled relative pressure losses through individual

components, and system blockages. The Plate 5.1 tube-side system temperature distribution is also calculated from the above endpoints by allowing given temperature rises to occur across the plant heat dump, the low-pressure condensate heaters (equal for each stage), and the high-pressure feedwater heaters (equal for each stage). The Plate 5.1 shell-side system statepoint distribution is determined by allowing saturation temperatures to exist in the components at shell-side operating pressures. These methods of determining the tube- and shell-side temperature distributions are adequate for the PTS class of transient but can lead to discrepencies when the shell-side component temperature is less than the tube-side component temperature. This discepreny produces no modeling problems as the tube- and shell-side conditions are uncoupled by using an active heat structure configuration for each component where the RELAP5 heat transfer package calculates the wall fluid tube-side energy transfer, the outer heat structure boundary is adiabatic, and a thermal energy source is supplied.

Capacitive heat structures are configured to preserve the system metal volume, have a material thermal conductivity compatible to carbon steel, and have a volumetric heat capacity calculated from the available system metal stored energy divided by the product of the system metal volume and the temperature difference between a particular heat structure temperature and a base temperature. Capacitive heat structures have a thermal energy source of zero.

Nodalization

The transformation of the component-reduced main and emergency condensate feedwater trains to a RELAP5 formulation is shown in Plate 5.2, which is the actual volume and junction construction of the model. Fifty-eight volumes and sixty junctions comprise the model, each of which are labelled according to both RELAP5 component type and input stream numbering scheme (e.g., MJ428 is motor valve junction component number 428). Fourteen heat structures are included of which nine are active and five capacitive. Major component names are placed beside the volumes and junctions which they represent (e.g., PV653 is the turbine-driven emergency feedwater pump). A one-to-one component correspondence exists between Plate 5.1 and Plate 5.2.

It must be remembered that the RELAP5 model is one-dimensional and that Plate 5.2 is only a representative schematic of the inlet and outlet orientations of the various volume and junction components. The flowpaths and finer noding of the main and emergency condensate feedwater trains as the steam generators are approached, however, can be readily visualized as well as the single- and dual-string construction of the main condensate feedwater train and locations of the one-way cross connects to the emergency condensate feedwater train.

Boundary conditions in the main and emergency condensate feedwater trains are represented by time-dependent volumes 400, 602, 624, and 652 (the condenser hotwell outlets), time-dependent volumes and junctions 406 and 407 (the low-pressure E condensate heater drains),

time-dependent volumes and junctions 410 and 411 (the low-pressure D condensate heater drains), time-dependent volumes 431 and 531 (the main feedwater inlets for steam generators A and B, respectively), and time-dependent volumes 613 and 635 (the emergency feedwater inlets for steam generators A and B, respectively). All inlet boundary conditions are pressure and temperature except for the low-pressure E and D condensate heater drains which are pressure and temperature and mass flow. All outlet boundary conditions are pressure only. If the condenser is represented in the total plant models as a pressure and temperature boundary condition, the only thermal-hydraulic interfaces to the total plant models will be to the proper locations in the A and B steam generator segments through replacement of time-dependent volumes 431, 531, 613, and 635.

RELAP5 Input Stream

In applying RELAP5 to the Oconee 1 main and emergency condensate feedwater trains, the analysis boundaries are first defined and then the incorporated physical space of these systems is dissected to segregate major components such as pumps, condensate feedwater heaters, valves, etc. from their connecting piping. A collection of one-dimensional RELAP5 volumes, junctions, and heat structures is then generated by closely following these break points in the system. Transient functions of these RELAP5 components are related to the dynamics of the actual system components through the RELAP5 control system, variable trips, and logical trips.

Generic input information is needed for each volume and junction with additional detailed information needed for specific components (e.g., an initial normalized stem position for a motor valve junction). Volumes require a transverse flow area, length, volume, vertical orientation angle, elevation change, wall roughness, hydraulic diameter, pressure, internal energy, and static quality. Junctions require a transverse flow area, energy loss coefficient, subcooled discharge coefficient, two-phase discharge coefficient, and initial liquid, vapor, and interface velocities. Heat structures are the only non-hydrodynamic RELAP5 component and require a left boundary coordinate, right boundary coordinate, mesh structure, material distribution, thermal energy source distribution, left boundary condition type, right boundary condition type, and material thermal property data. System boundary conditions are represented through user-supplied tables and are often in the form of pressure, internal energy, quality combinations in conjunction with fluid velocities and mass flows. RELAP5 allows input data and subsequent calculations to be in either British units or Systéme International d'Unités. The model of the Oconee 1 main and emergency condensate feedwater trains is developed in British units (except for control system variable trip parameters which must be in Systéme International d'Unités).

The developed RELAP5 input stream for the Oconee 1 main and emergency condensate feedwater trains is presented in Appendix B. This RELAP5-formatted input stream consists of all generic information required to complete the current thermal-hydraulic model as well

as specific information describing a hypothetical PTS scenario. As Appendix B is only sparsely commented, the RELAP5 input user's guide must be used to decode that data.

The RELAP5 initial processing of the Oconee 1 main and emergency condensate feedwater trains is presented in Appendix C. The information found there is a reconfiguration of the model geometric, thermodynamic, and component control parameters contained in Appendix B. The user-oriented Appendix C, which may be used to easily retrieve modeling data, consists of commented sectional edits for transient controls, hydrodynamic components, heat structure components, material physical properties, general tabular data, control system components, logical and variable trips, and steady-state thermodynamic conditions.

CHAPTER VI

MODEL VERIFICATION

General

Before the accuracy of any analytical tool can be established, it must be verified through application to problems having known solutions. This philosophy applies equally to the formulation of equations describing the physics of a process, to the creation of generic computer codes incorporating these equations, or to specific modeling efforts using such computer codes.

In the current context, the RELAP5 phasic field equations and constitutive relationships, which describe the physics of water dynamics, as well as the RELAP5 computer code, which applies this set of field equations to flow problems, have been well documented. Thus, the effectiveness of RELAP5 (and TRAC) in producing realistic solutions (given adequate models) to transients involving thermal-hydraulic systems such as the Oconee 1 main and emergency condensate feedwater trains is well established. The stand-alone model presented herein, however, must be validated before it can be utilized to predict the steam generator secondary-side inlet fluid conditions during PTS scenarios.

Verification of the Oconee 1 main and emergency condensate feedwater trains model is designed to be a twofold process. To examine the adequacy of this thermal-hydraulic model within a predetermined domain of PTS transients, the stand-alone version containing a

simplified representation of the integrated control system will first be used to calculate the limiting transient values of critical system parameters. This study evaluates the accuracy of the general noding scheme, the steady-state conditions, and detail of component descriptions. Final verification of the actual dynamic response of the model is performed using the INEL and LANL total plant models, which incorporate a detailed representation of the Oconee 1 integrated control system. Results of calculations using these models can be compared against actual plant data (for applicable cases) and can be subjected to extensive qualitative analyses by the NRC, ORNL, and Duke Power.

Hypothetical Main Steamline Break

As previously stated, the geometric and steady-state thermal-hydraulic characteristics of the Oconee 1 main and emergency condensate feedwater trains RELAP5 model can be verified by creation of the specific RELAP5 input stream and subsequent examination RELAP5 processing of this input stream. The limiting dynamic trends of the model, however, must be observed through actual transient calculations.

To establish the asymptotic behavior of the Oconee 1 main and emergency condensate feedwater trains, a PTS scenario involving a double-ended break of the main steamline of steam generator A was postulated. The desired transient is simulated with the current stand-alone model by defining anticipated actions of the Oconee 1

integrated control system through a collection of component trips. These trips allow a reasonable transient response of the main and emergency condensate feedwater trains without requiring a total plant model to feed the integrated control system. A detailed description of all specific boundary condition magnitudes and time durations for this PTS scenario is presented in Table 6.1 as a function of system component labels, which are formed by fusing the component labels from Plate 5.1 and the input stream component numbers.

The hypothetical transient is initiated at time zero from full power, steady-state conditions through depressurization in 30 seconds of time-dependent volumes 431 and 613 to 50 PSIA and 25 PSIA, respectively. The initial conditions include a total mass flow of 3055.6 lbm/s, hotwell outlet fluid conditions of 90.0°F and 7.208 PSIA, steam generator feedwater conditions of 460.0°F and 950.0 PSIA, main feedwater pump speeds of 5000 RPM, and main feedwater main control valve throat area ratios of 0.5. The steam generators are initially operating symmetrically. Nominal control system operations work throughout the systems except for the steam generator A main feedwater control/block valve, which is assumed locked at its steady-state position. The SPCS isolation of the high- and low-pressure turbines and reheater and moisture separator assemblies is represented through shutoff in 5 seconds of the low-pressure E and D condensate heater mass flows and all low- and high-pressure condensate feedwater heater active thermal-energy sources. Table 6.2 describes, for a given system component label, the latch condition of its

Table 6.1. Oconee 1 main and emergency condensate feedwater trains boundary conditions for a hypothetical main steamline break.

Component	Boundary Condition
CHW400	Constant Properties (T = 90.0°F, P = 7.208 PSIA, X = 0.0)
EHD406	Constant Properties (T = 210.0°F, P = 435.0 PSIA, X = 0.0)
EHD407	W = 139.0 to 0.0 lbm/s in 5.0 s
DHD410	Constant Properties (T = 290.0°F, P = 470.0 PSIA, X = 0.0)
DHD411	W = 1150.0 to 0.0 lbm/s in 5.0 s
CHW602	Constant Properties (T = 90.0°F, P = 7.208 PSIA, X = 0.0)
CHW624	Constant Properties (T = 90.0°F, P = 7.208 PSIA, X = 0.0)
CHW652	Constant Properties (T = 90.0°F, P = 7.208 PSIA, X = 0.0)
SGA431	T = 460.0 to 90.0°F and P = 950.0 to 50.0 PSIA in 30.0 s
SGA613	T = 578.0 to 90.0°F and P = 925.0 to 25.0 PSIA in 30.0 s
SGB531	Constant Properties (T = 460.0°F, P = 950.0 PSIA, X = 0.0)
SGB635	Constant Properties (T = 578.0°F, P = 925.0 PSIA, X = 1.0)
HS400	Q = 9.0 MW
HS401	Capacitive (Q = 0.0 MW)
HS402	Q = 120.0 to 0.0 MW in 5.0 s
HS403	Q = 130.0 to 0.0 MW in 5.0 s

Table 6.1. (Continued)

Component	Boundary Condition
HS404	Q = 145.0 to 0.0 MW in 5.0 s
HS405	Q = 247.0 to 0.0 MW in 5.0 s
HS420	Q = 77.0 to 0.0 MW in 5.0 s
HS421	Q = 79.0 to 0.0 MW in 5.0 s
HS500	Capacitive (Q = 0.0 MW)
HS521	Q = 77.0 to 0.0 MW in 5.0 s
HS522	Q = 79.0 to 0.0 MW in 5.0 s
HS600	Capacitive (void)
HS625	Capacitive (void)
HS650	Capacitive (void)

Table 6.2. Oconee 1 main and emergency condensate feedwater trains control system representation for a hypothetical main steamline break.

Component	Latch	Trip Logic	Control Description
CVA428/OPEN	N	W(42800) < -10^6 lbm/s	Position control fails at steady-state throat area ratio (0.500); simulates feedwater isolation if SGA feedwater mass flow falls below 4% of initial value after 22.0 s.
CVA428/CLOSE	L	W(61000) < 61.1 lbm/s and t > 22.0 s	
CVB528/OPEN	N	W(52800) < 100.0 lbm/s and t < 20.0 s	Steady-state throat area ratio of 0.500; SGB level maintained by 6.5% of full power main feedwater mass flow before feedwater realignment; closes on RCP trip at 20.0 s for feedwater realignment.
CVB528/CLOSE	N	W(52800) > 100.0 lbm/s or t > 20.0 s	
LVA610/OPEN	N	t > 20.0 s	Steady-state area ratio is 0.000; SGA feedwater realignment occurs on RCP trip at 20.0 s. (SGA level falls below trip point before 20.0 s and never recovers assumed.)
LVA610/CLOSE	N	t < 20.0 s	
LVB632/OPEN	N	W(63200) < 100.0 lbm/s and t > 20.0 s	Steady-state throat area ratio is 0.000; SGB level maintained after feedwater realignment has occurred at 20.0 s. (Magnitude of mass flow to maintain SGB level assumed.)
LVB632/CLOSE	N	W(63200) > 100.0 lbm/s or t < 20.0 s	

Table 6.2. (Continued)

Component	Latch	Trip Logic	Control Description
HWP401/OFF	L	$\int_0^t$ [W(40101) + W(60301) + W(62501) + W(65301)]dt > 753434.4 kg	Constant speed is 1183.0 RPM; hotwell level falls below trip point--linear coastdown in 7.1 s from rated speed after trip. (Condenser inlet mass flows are assumed to equal zero.)
CBP403/OFF	L	P(40202) < 30.7 PSIA and t - t (trip) > 5.0 s	Constant speed is 3580.0 RPM; suction pressure falls below trip point for 5.0 s duration--linear coast-down in 21.5 s from rated speed after trip.
FPA420/OFF FPB522/OFF	L	P(50000) < 249.7 PSIA or P(50100) > 1289.7 PSIA	Initial speed is 5000.0 RPM; suction pressure falls below trip point or discharge pressure rises above trip point; exponential velocity runback in 180.0 s to 45% rated speed from transient initialization until trip--linear coastdown in 30.0 s from rated speed after trip.
MPA603/ON	N	P(50101) < 764.7 PSIA and P(60402) < 2000.0 PSIA	Initial speed is 0.0 RPM; FPA/FPB discharge pressure falls below trip point and MPA discharge pressure remains below trip point; exponential velocity runup in 15.0 s to 3560.0 RPM until trip--linear coastdown in 21.4 s from rated speed after trip.
MPA603/OFF	N	P(60402) > 2000.0 PSIA	

Table 6.2. (Continued)

Component	Latch	Trip Logic	Control Description
MPB625/ON	N	P(50101) < 764.7 PSIA and P(62602) < 2000.0 PSIA	Initial speed is 0.0 RPM; FPA/FPB discharge pressure falls below trip point and MPB discharge pressure remains below trip point; exponential velocity runup in 15.0 s to 3560.0 RPM until trip--linear coastdown in 21.4 s from rated speed after trip.
MPB625/OFF	N	P(62602) > 2000.0 PSIA	
TDP653/ON	N	P(50101) < 764.7 PSIA and P(65402) < 2000.0 PSIA	Initial speed is 0.0 RPM; FPA/FPB discharge pressure falls below trip point and TDP discharge pressure remains below trip point; exponential velocity runup in 15.0 s to 3575.0 RPM until trip--linear coastdown in 21.5 s from rated speed after trip.
TDP653/OFF	N	P(65402) > 2000.0 PSIA	

engage and disengage trips, the specific trip logic which controls the dynamic behavior (indicating both the magnitude of the system parameter and volume number on which the trip acts), and a description of the represented control logic. All magnitudes of component actions, system trips, and system boundary conditions are representative of the actual control system. The only disregarded pump component trips are the loss of condenser vacuum and high steam generator levels.

Stand-Alone Model Simulation

The hypothetical main steamline break transient as defined by the boundary conditions of Table 6.1 and control system representation of Table 6.2 was performed using the RELAP5 computer code. Calculations were processed using the timestep sequence found in the transient control edit section of Appendix C and were terminated on low fluid level in the condenser hotwell.

Minor edits were created during this transient for sixty-three pertinent system parameters of which twenty-six were plotted versus time and are included as Figures 6.1 through 6.26. These figures primarily represent the main and emergency feedwater inlet conditions (pressure, temperature, mass flow, and static quality) for steam generators A and B. Major component actions such as valve positions and pump mass flows are also shown.

The most concise method of qualitatively analyzing the thermal-hydraulic response of the Oconee 1 main and emergency condensate

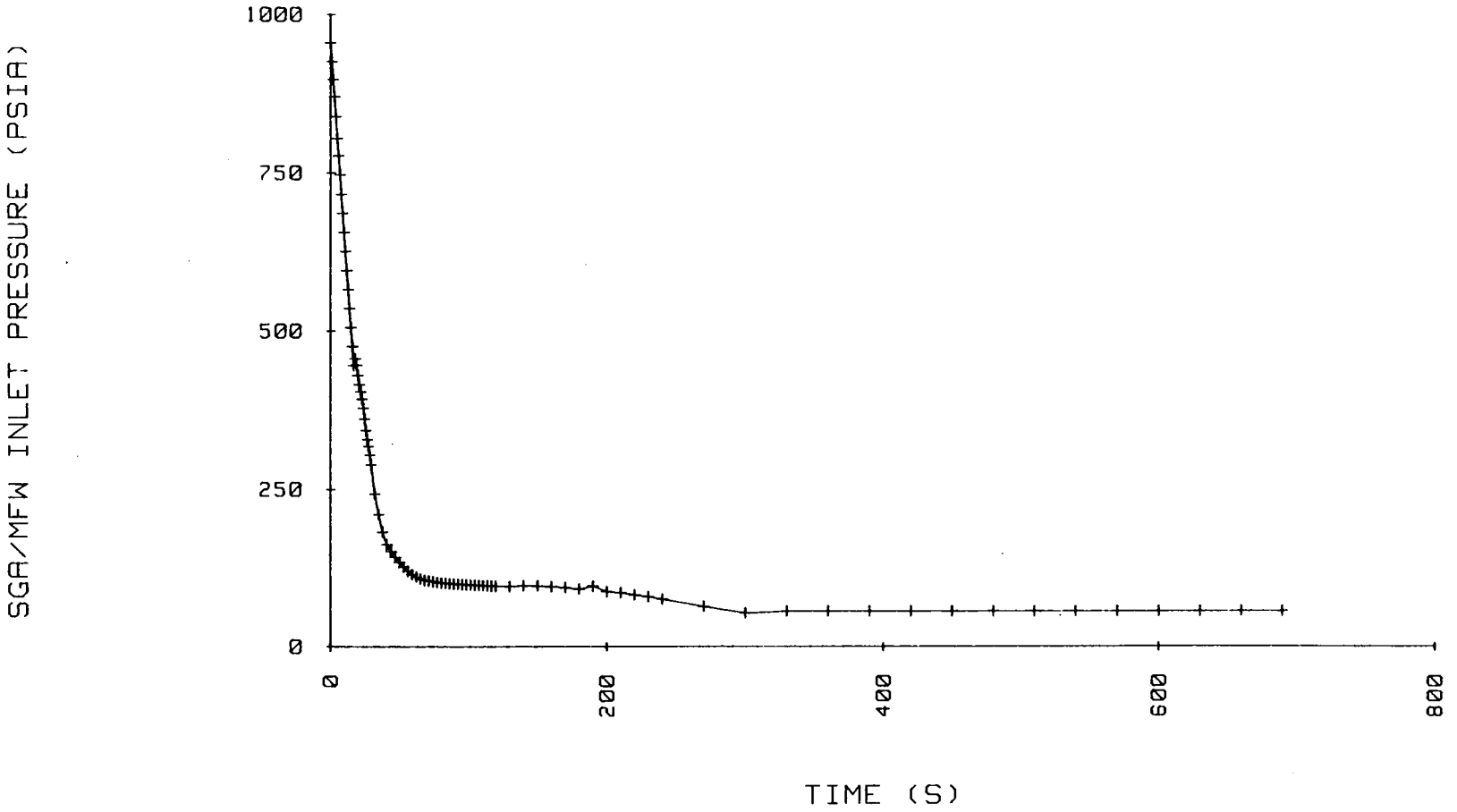


Figure 6.1. RELAP5-calculated steam generator A main feedwater inlet fluid pressure response to a hypothetical main steamline break.

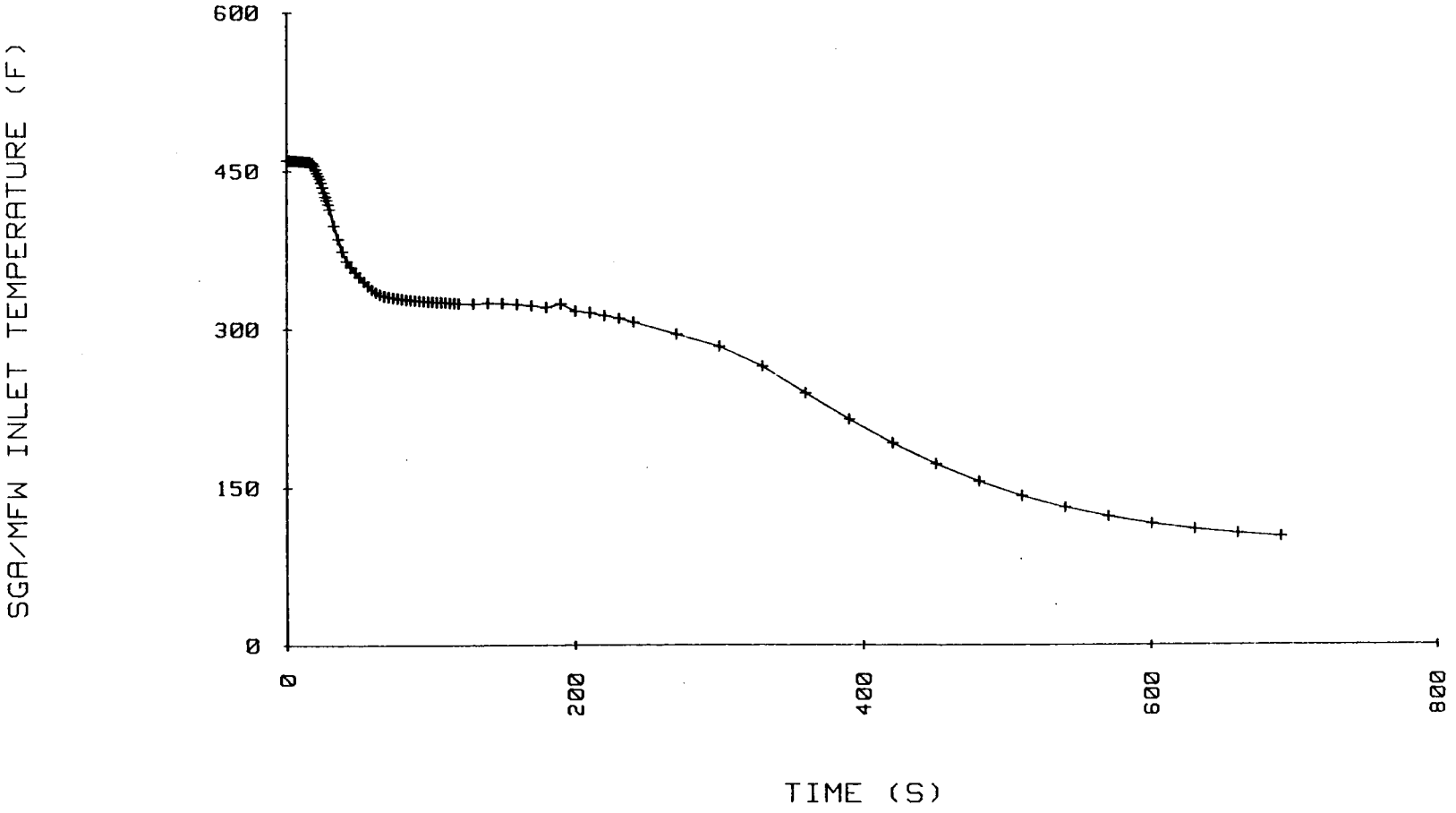


Figure 6.2. RELAP5-calculated steam generator A main feedwater inlet fluid temperature response to a hypothetical main steamline break.

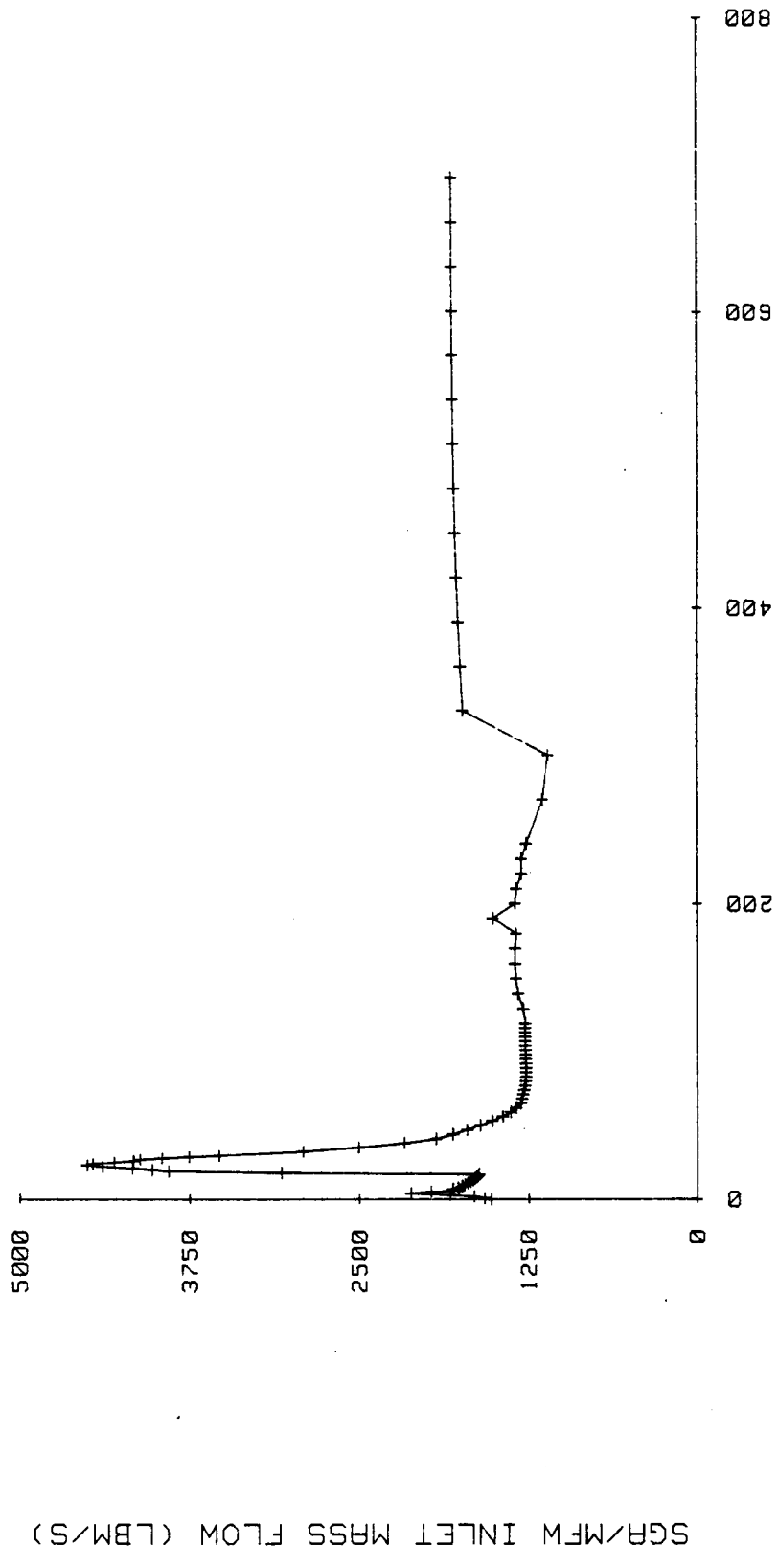


Figure 6.3. RELAP5-calculated steam generator A main feedwater inlet fluid mass flow response to a hypothetical main steamline break.

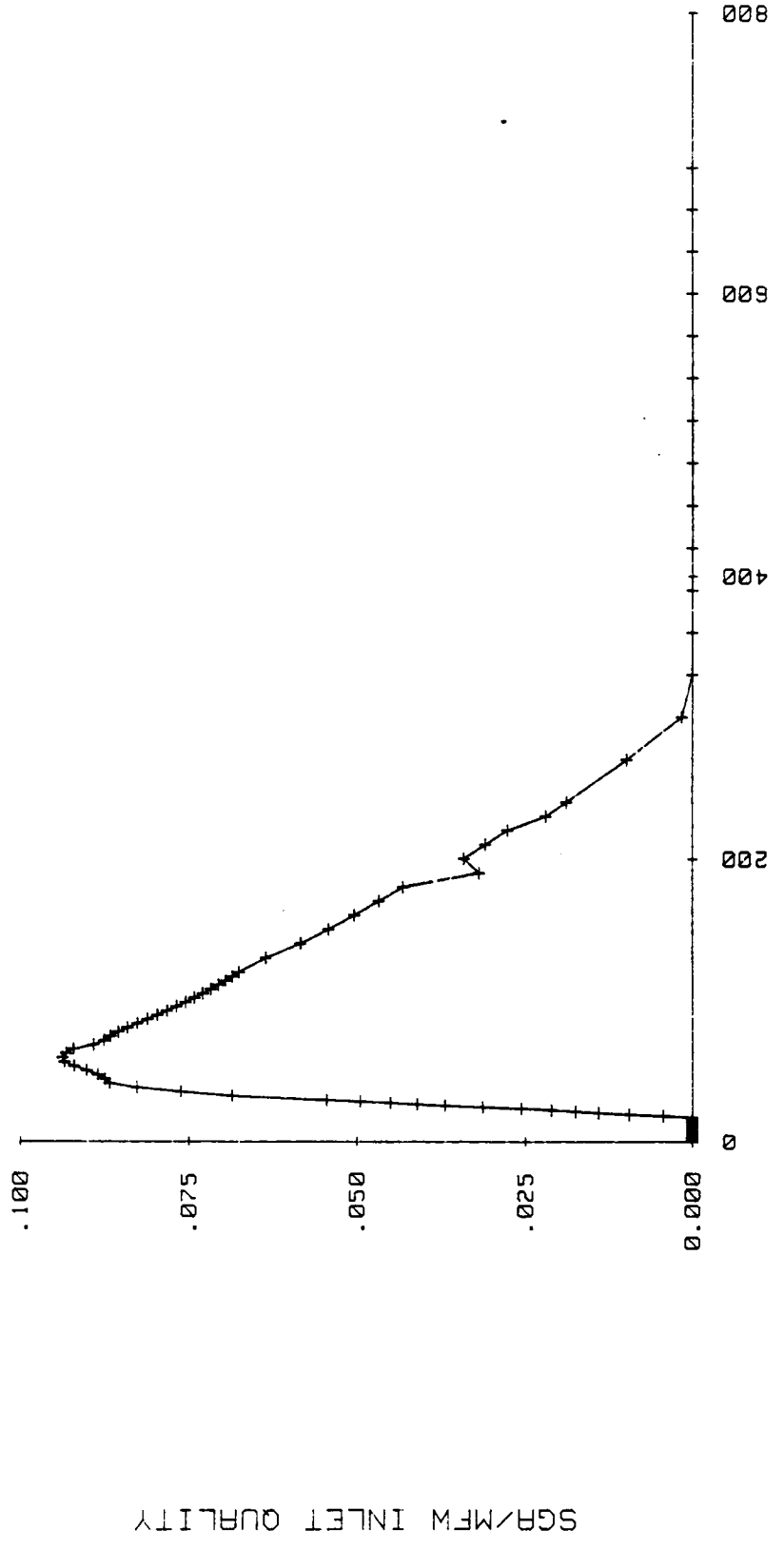


Figure 6.4. RELAP5-calculated steam generator A main feedwater inlet fluid static quality response to a hypothetical main steamline break.

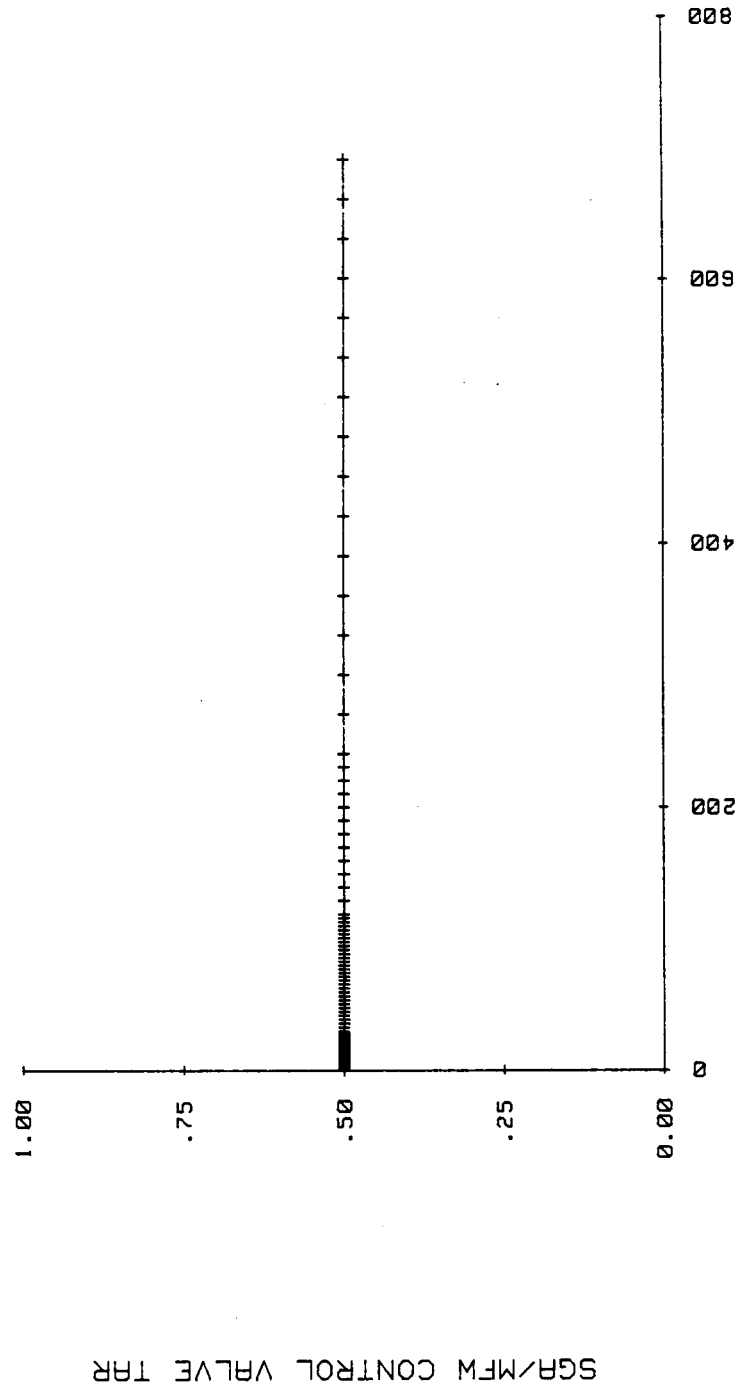


Figure 6.5. RELAP5-calculated steam generator A main feedwater control/block valve throat area ratio response to a hypothetical main steamline break.

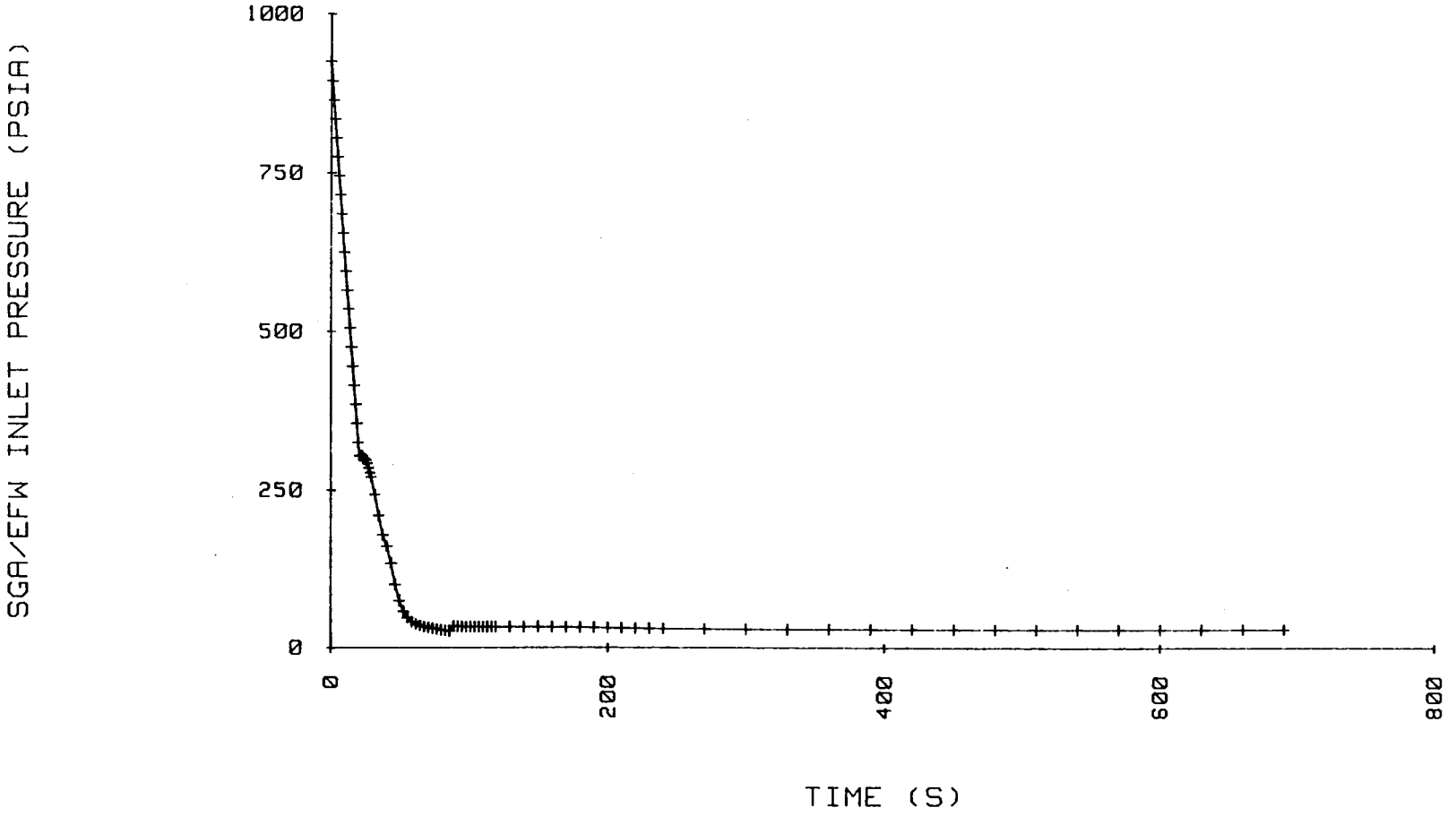


Figure 6.6. RELAP5-calculated steam generator A emergency feedwater inlet fluid pressure response to a hypothetical main steamline break.

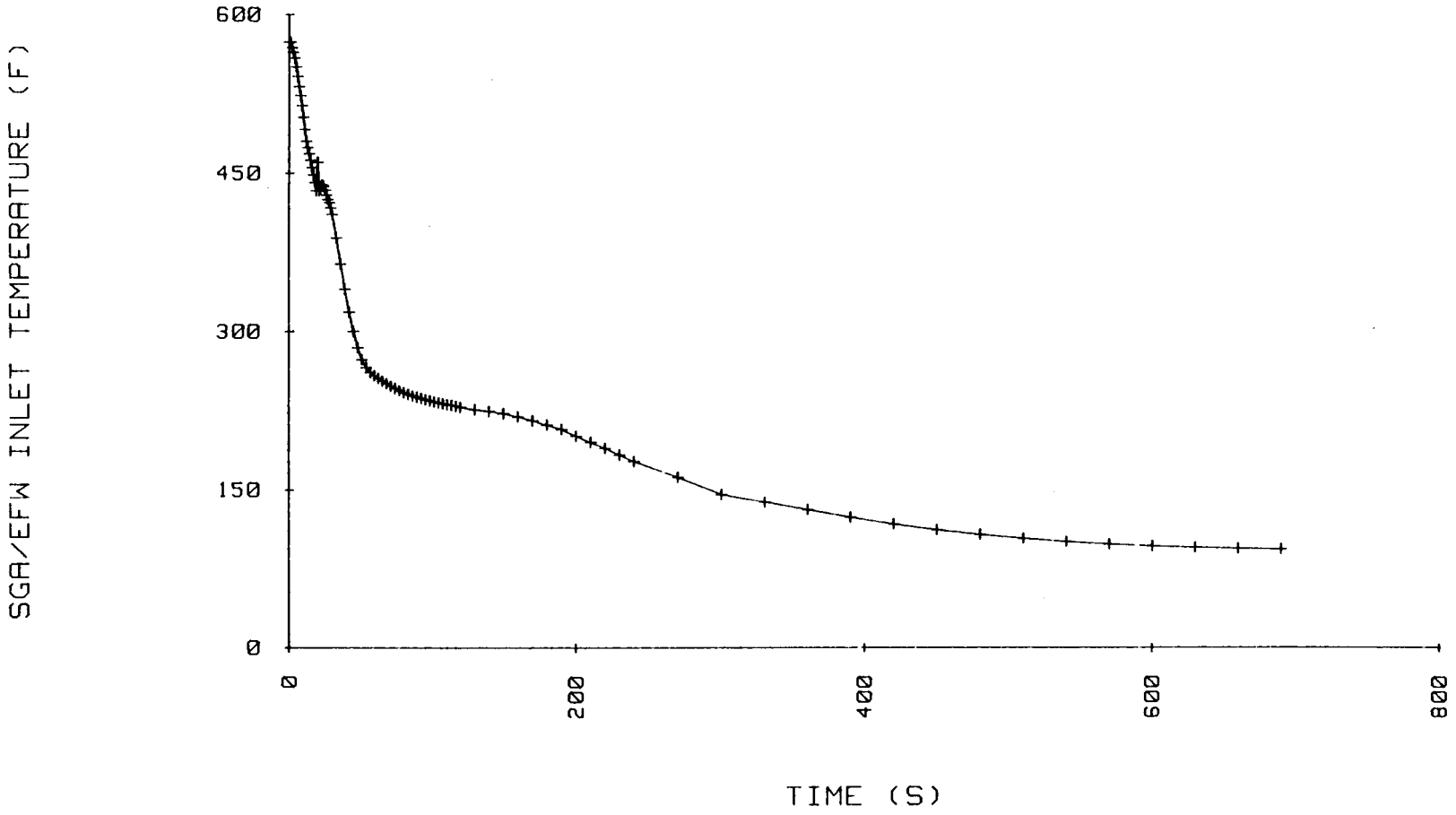


Figure 6.7. RELAP5-calculated steam generator A emergency feedwater inlet fluid temperature response to a hypothetical main steamline break.

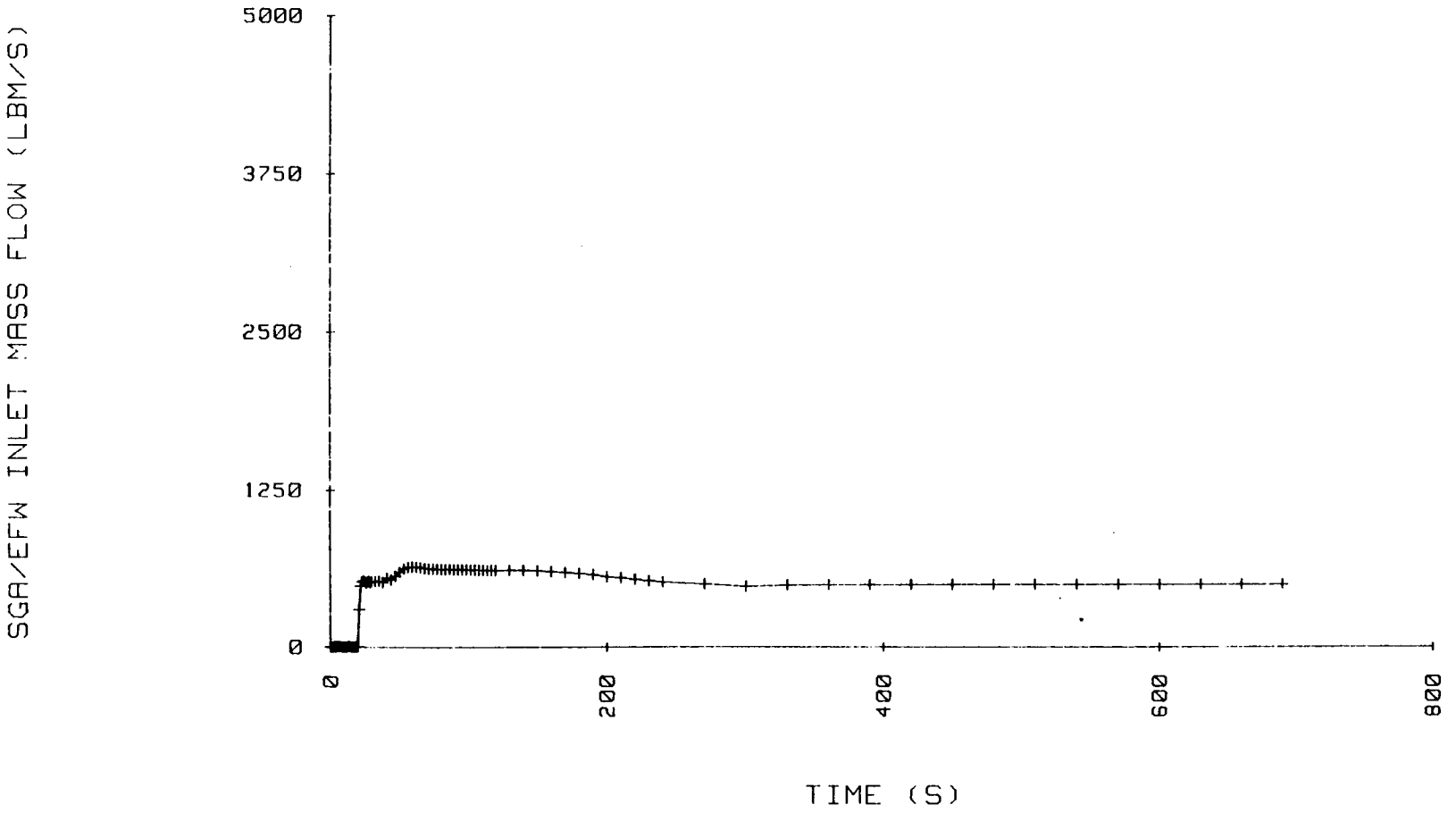


Figure 6.8. RELAP5-calculated steam generator A emergency feedwater inlet fluid mass flow response to a hypothetical main steamline break.

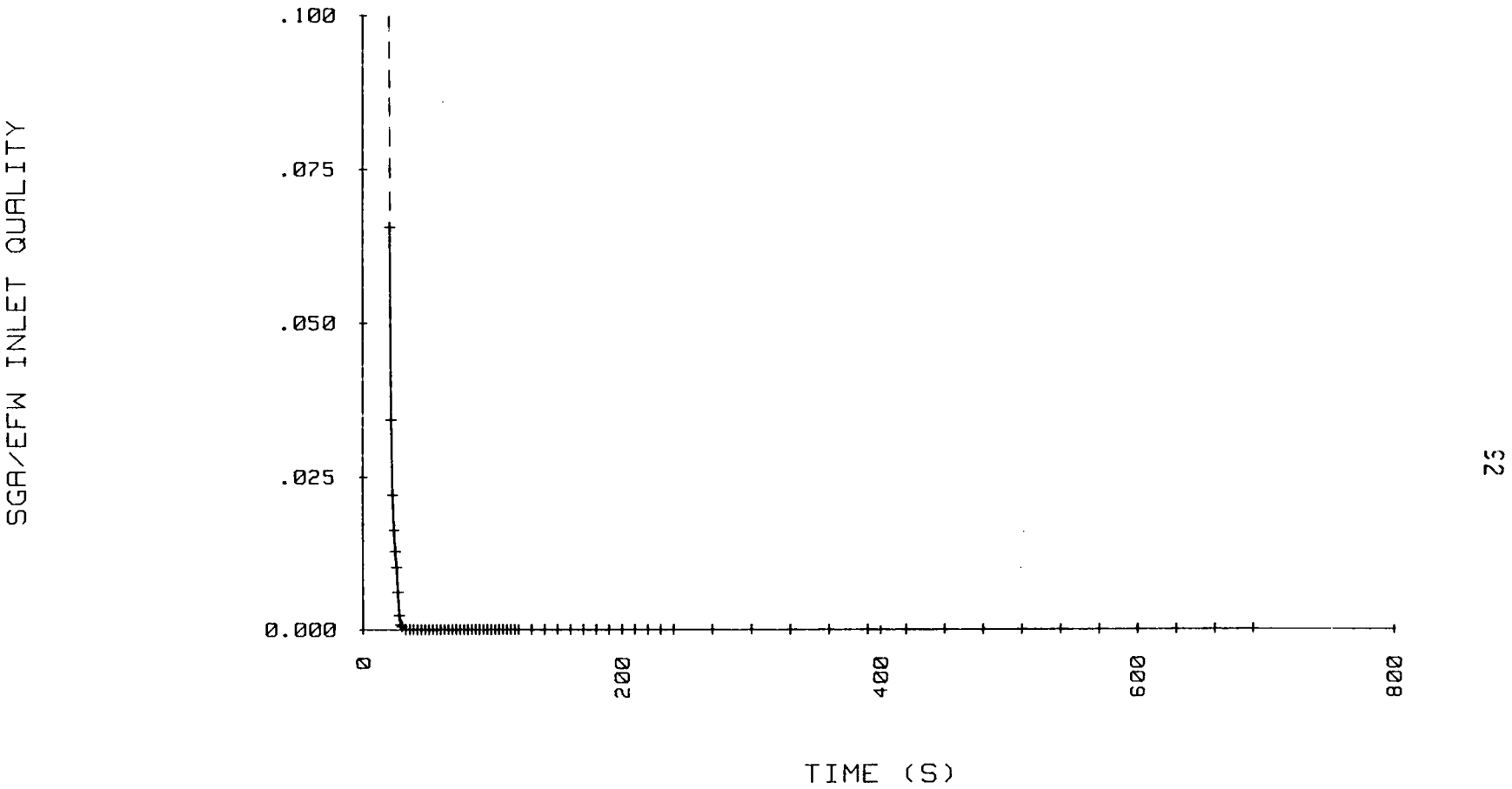


Figure 6.9. RELAP5-calculated steam generator A emergency feedwater inlet fluid static quality response to a hypothetical main steamline break.

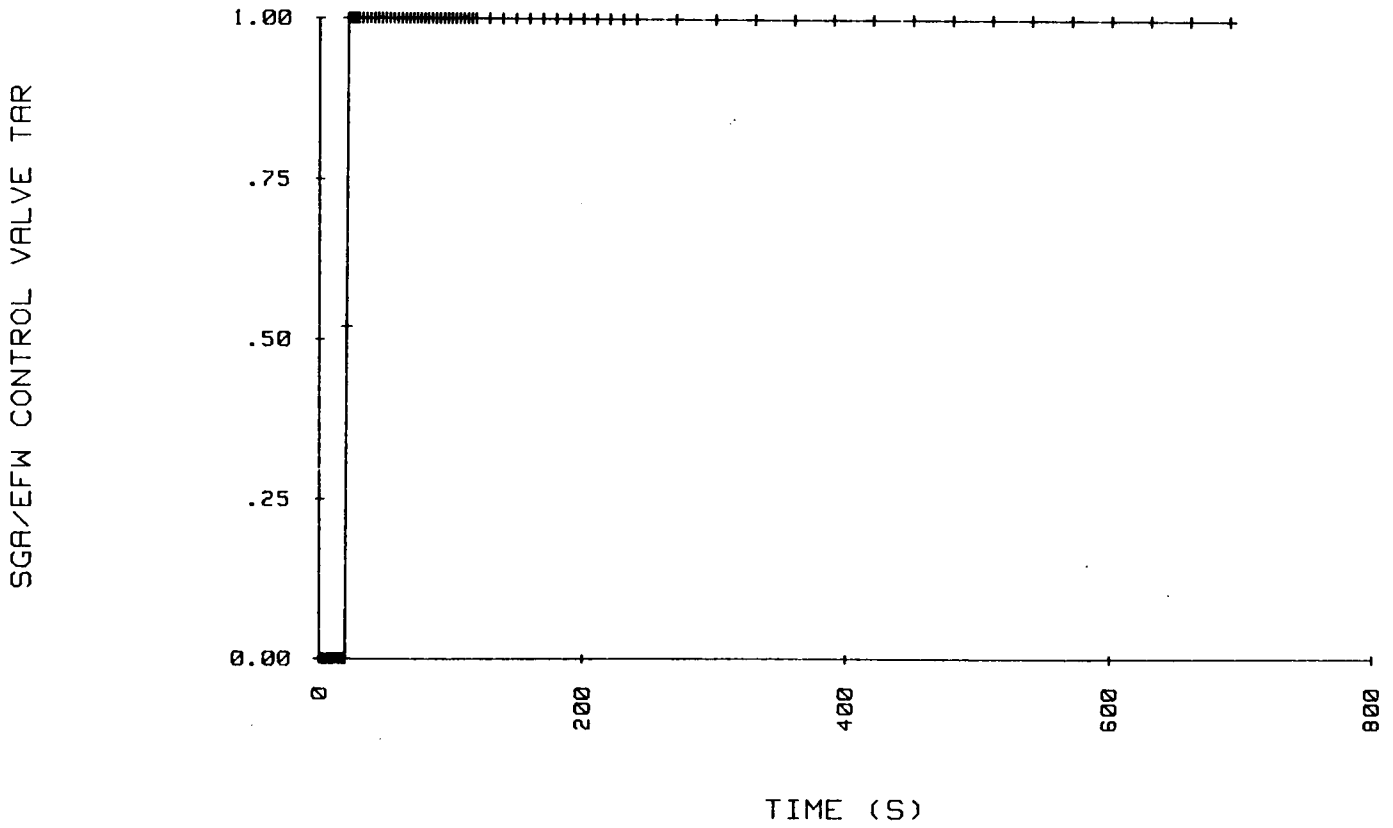


Figure 6.10. RELAP5-calculated steam generator A emergency feedwater control valve throat area ratio response to a hypothetical main steamline break.

Figure 6.11. RELAP5-calculated steam generator B main feedwater inlet fluid pressure response to a hypothetical main steamline break.

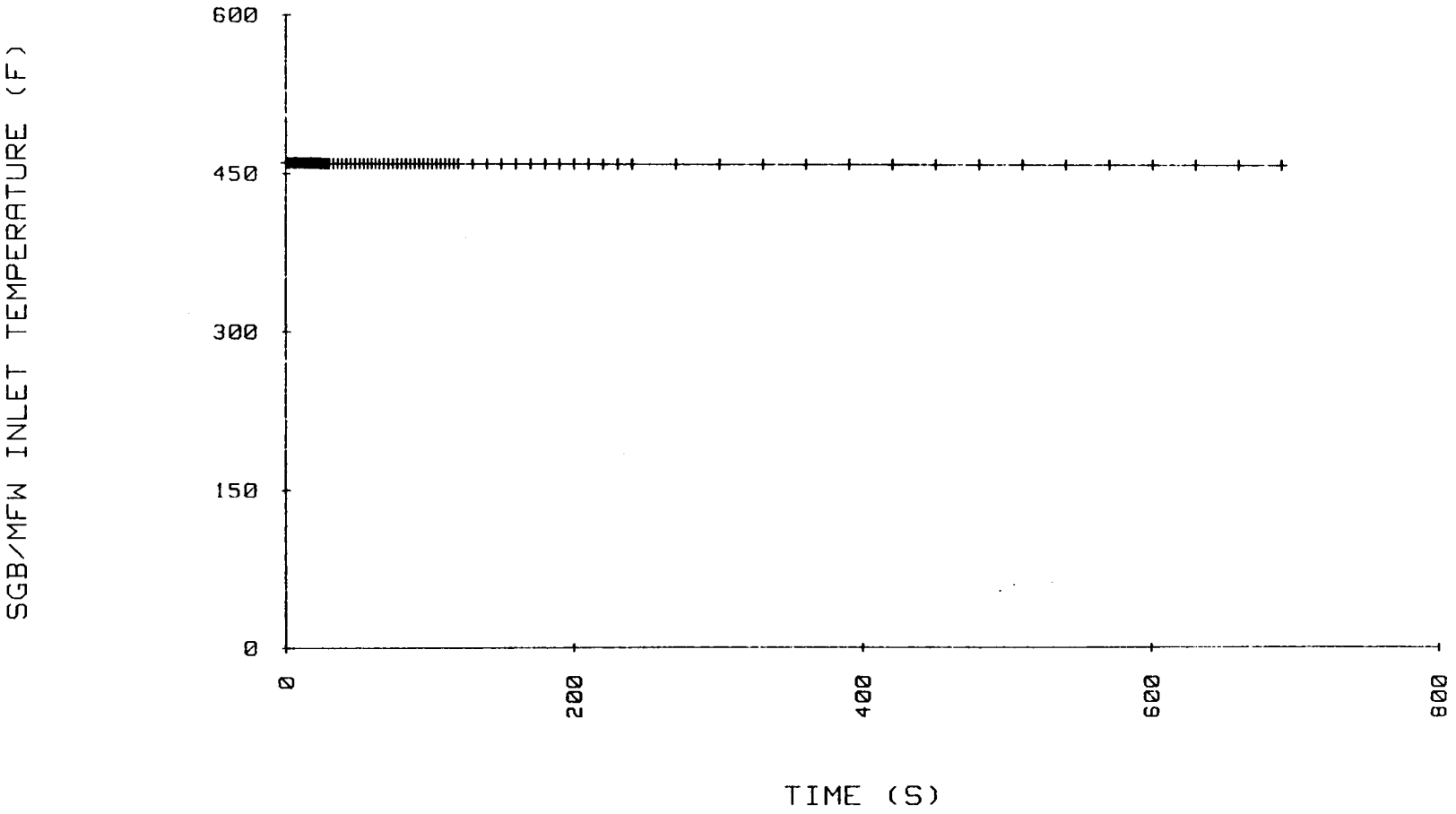


Figure 6.12. RELAP5-calculated steam generator B main feedwater inlet fluid temperature response to a hypothetical main steamline break.

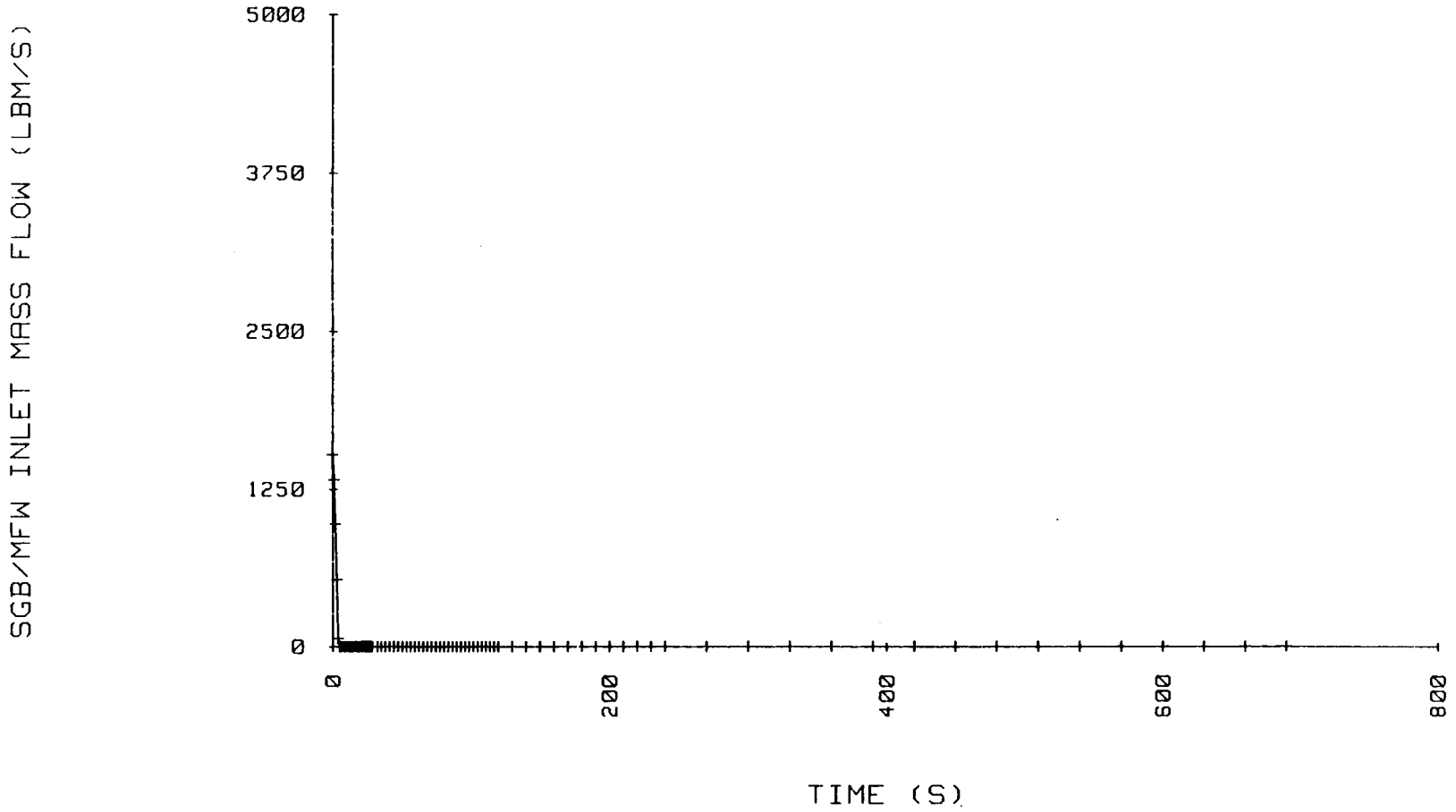


Figure 6.13. RELAP5-calculated steam generator B main feedwater inlet fluid mass flow response to a hypothetical main steamline break.

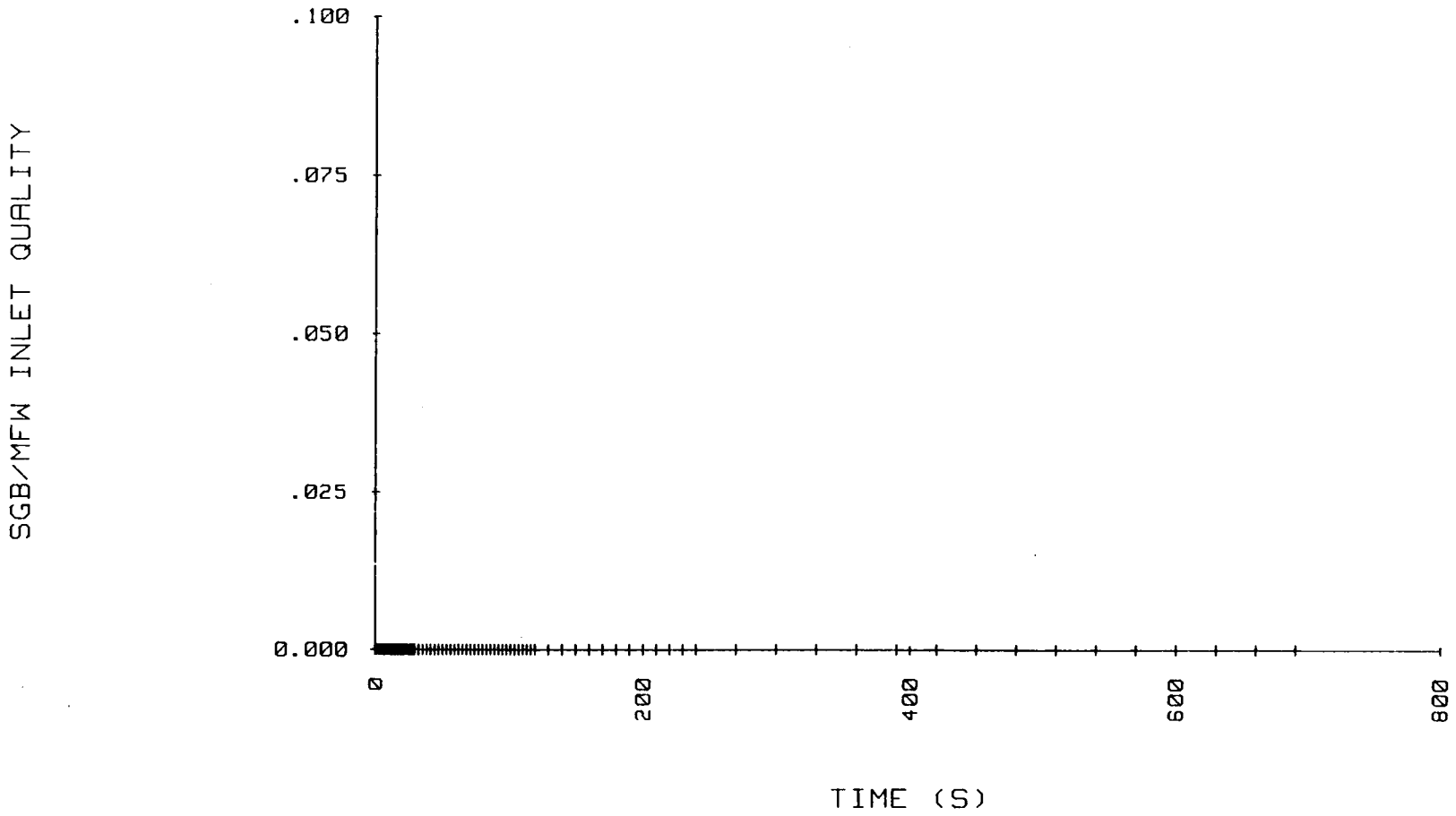


Figure 6.14. RELAP5-calculated steam generator B main feedwater inlet fluid static quality response to a hypothetical main steamline break.

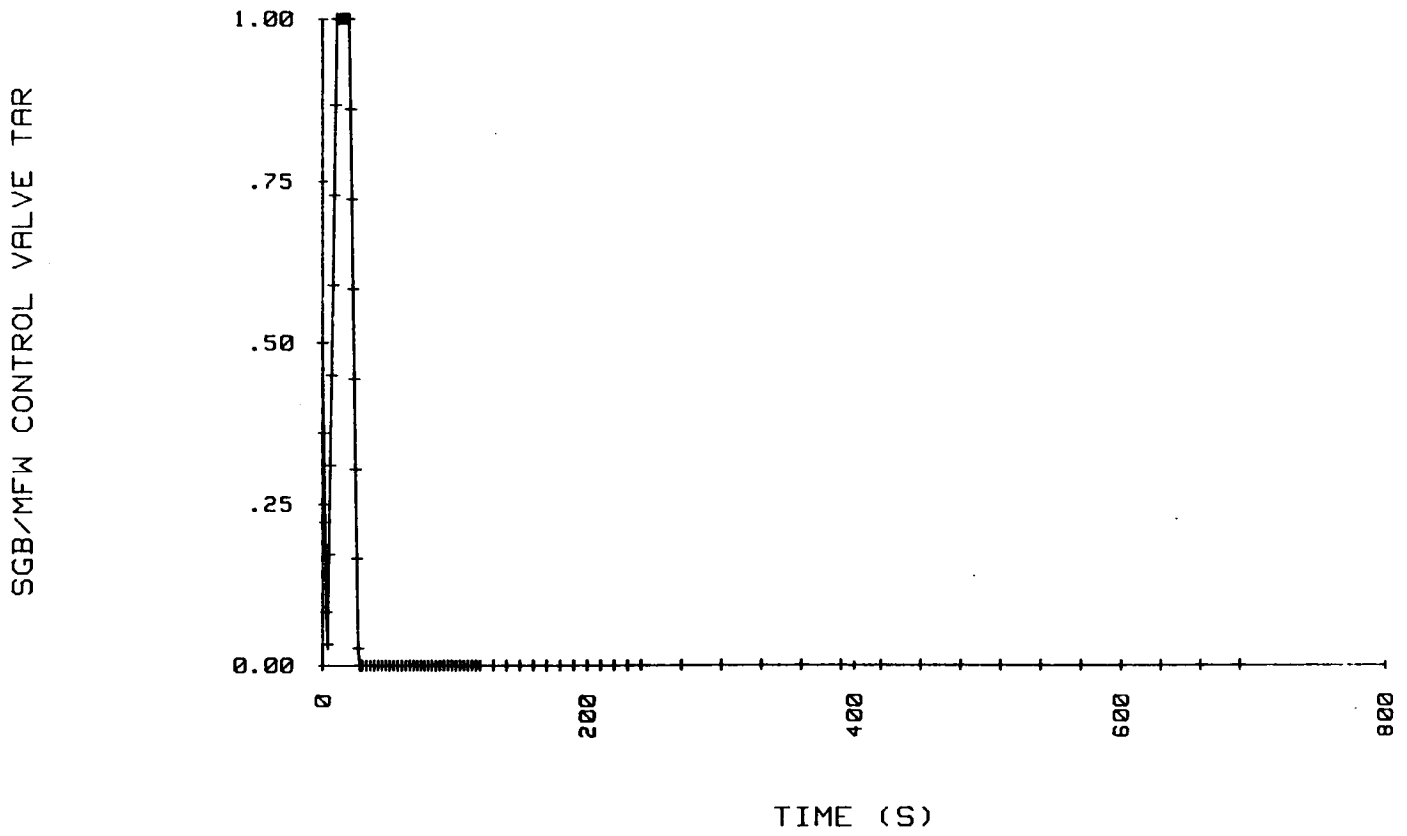


Figure 6.15. RELAP5-calculated steam generator B main feedwater control/block valve throat area ratio response to a hypothetical main steamline break.

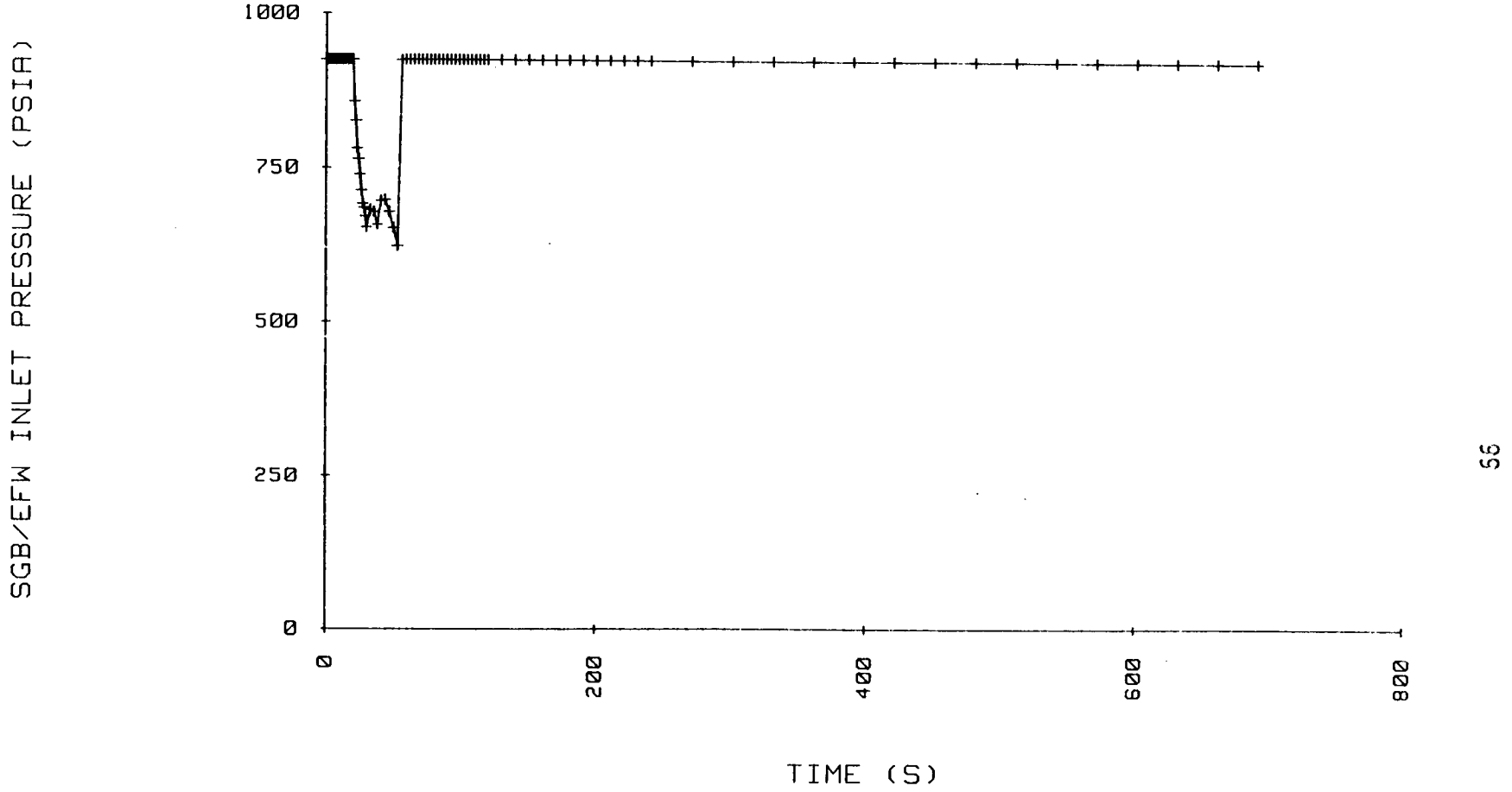


Figure 6.16. RELAP5-calculated steam generator B emergency feedwater inlet fluid pressure response to a hypothetical main steamline break.

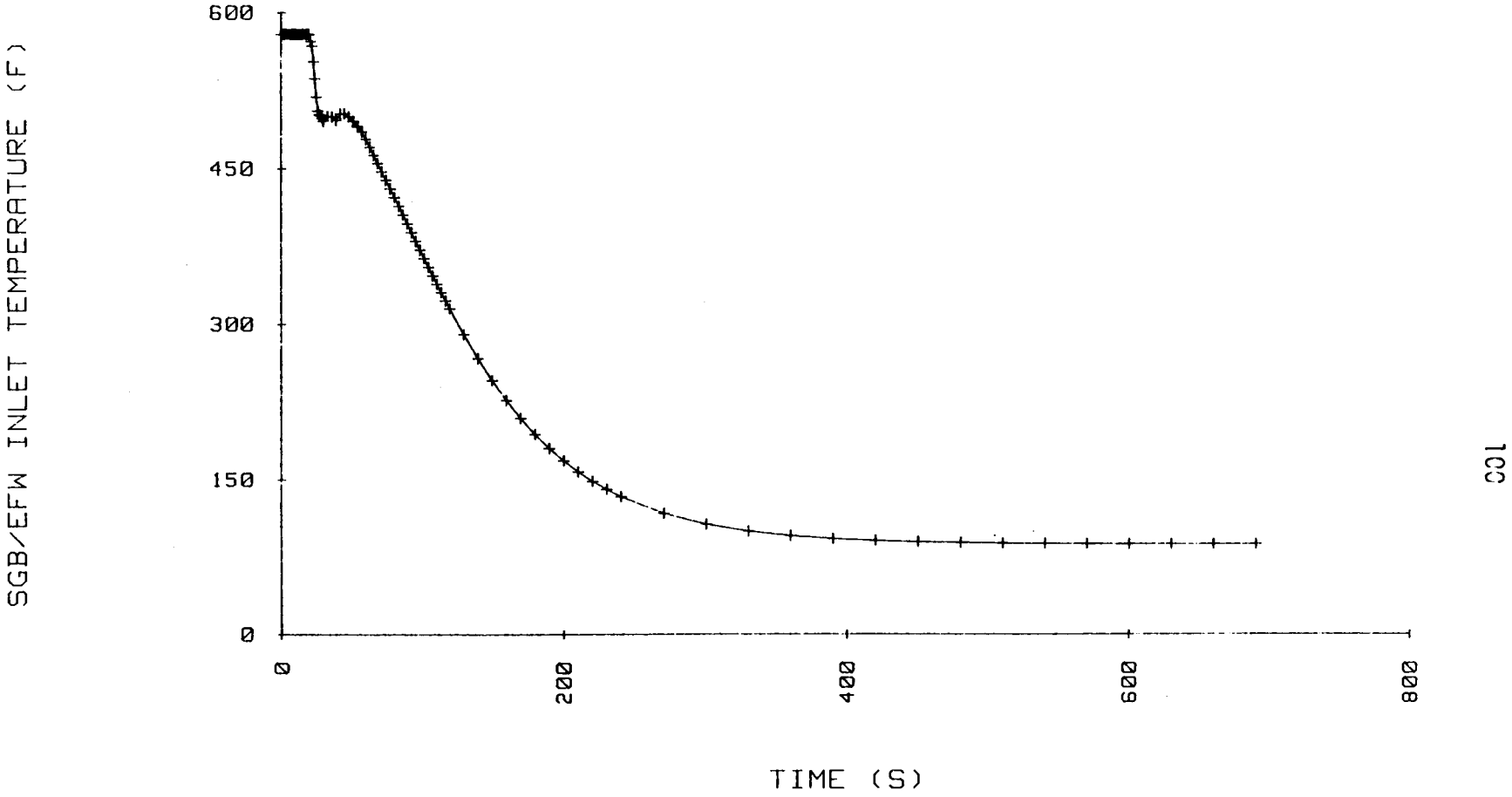


Figure 6.17. RELAP5-calculated steam generator B emergency feedwater inlet fluid temperature response to a hypothetical main steamline break.

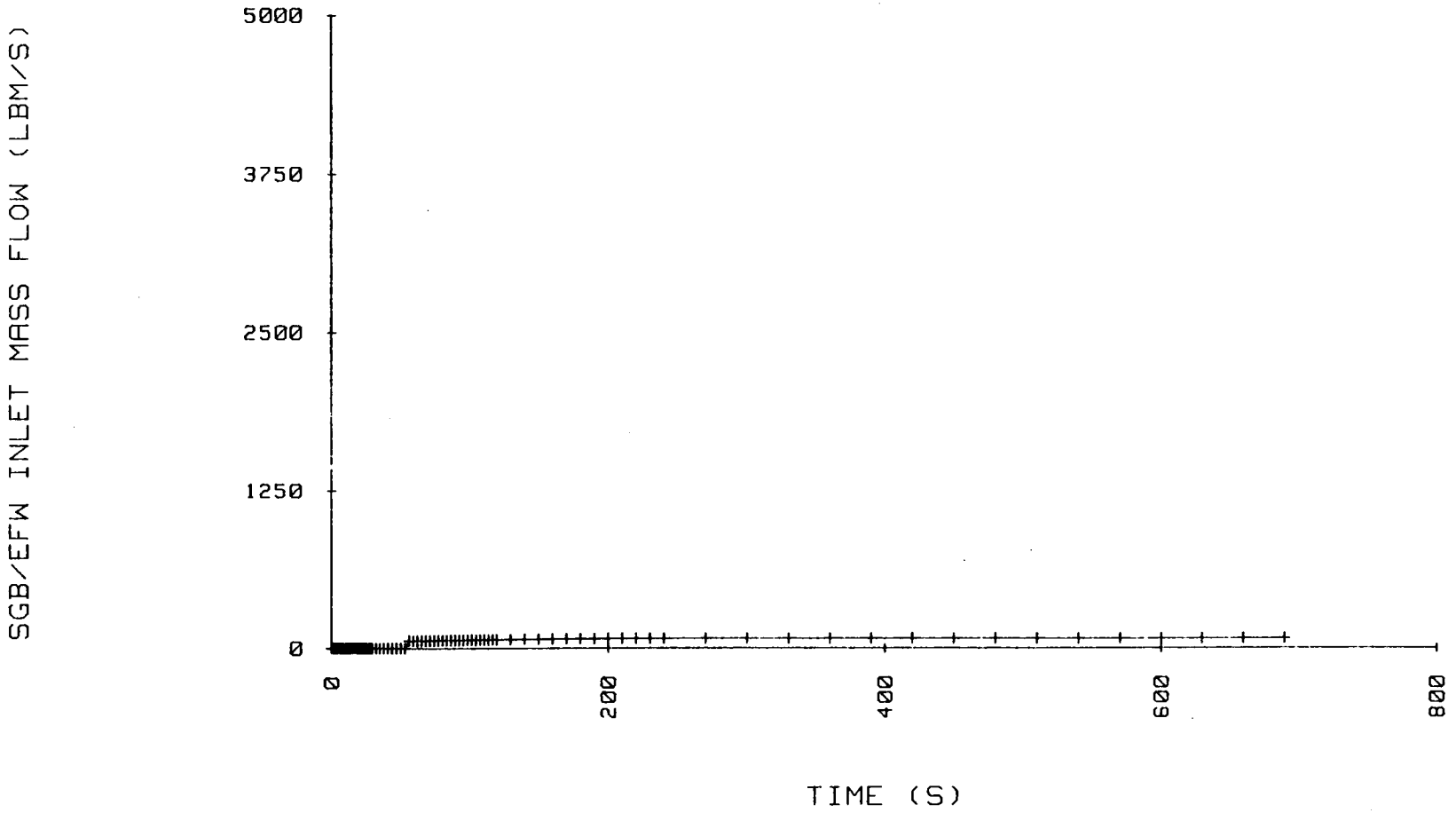


Figure 6.18. RELAP5-calculated steam generator B emergency feedwater inlet fluid mass flow response to a hypothetical main steamline break.

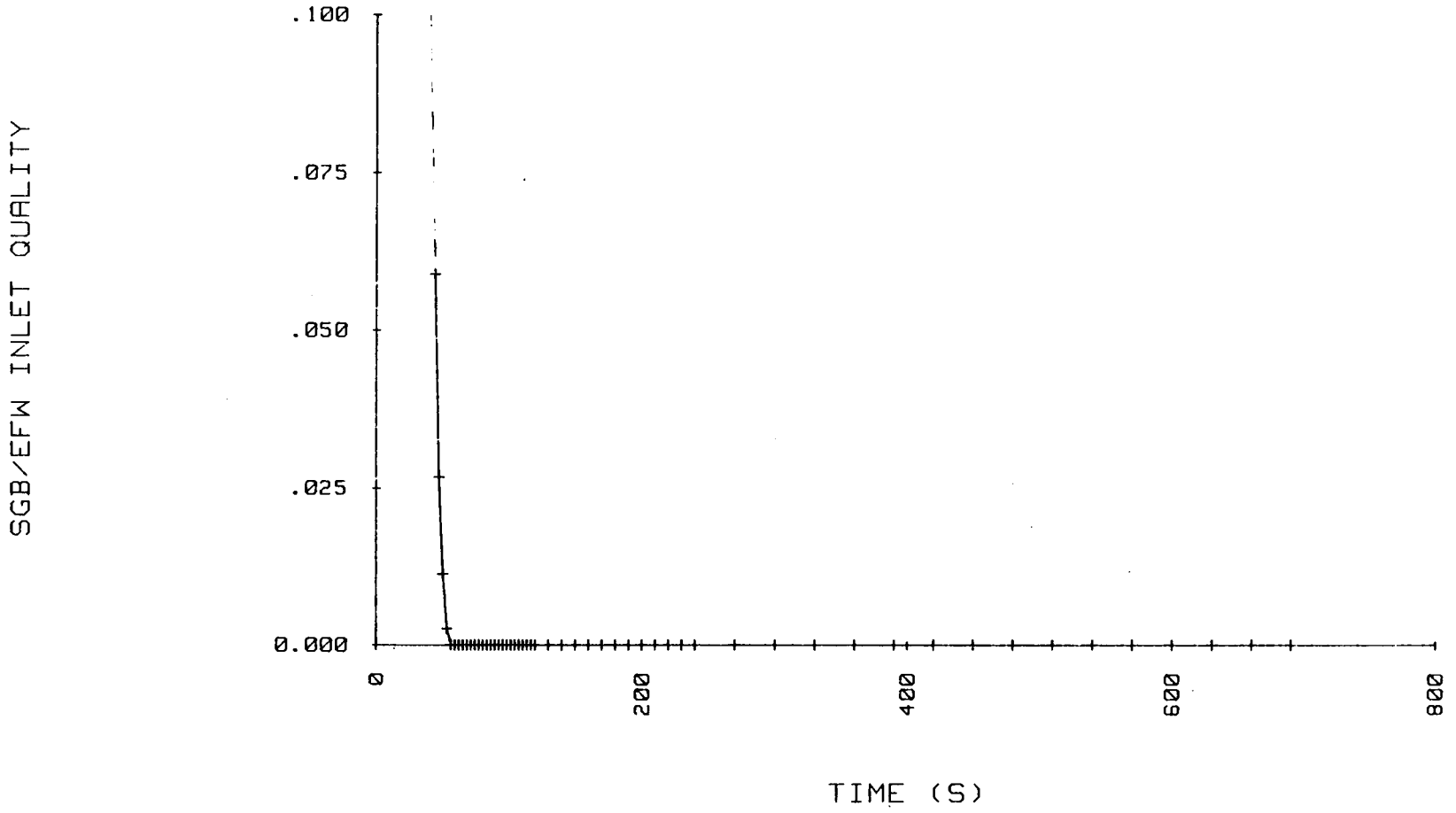


Figure 6.19. RELAP5-calculated steam generator B emergency feedwater inlet fluid static quality response to a hypothetical main steamline break.

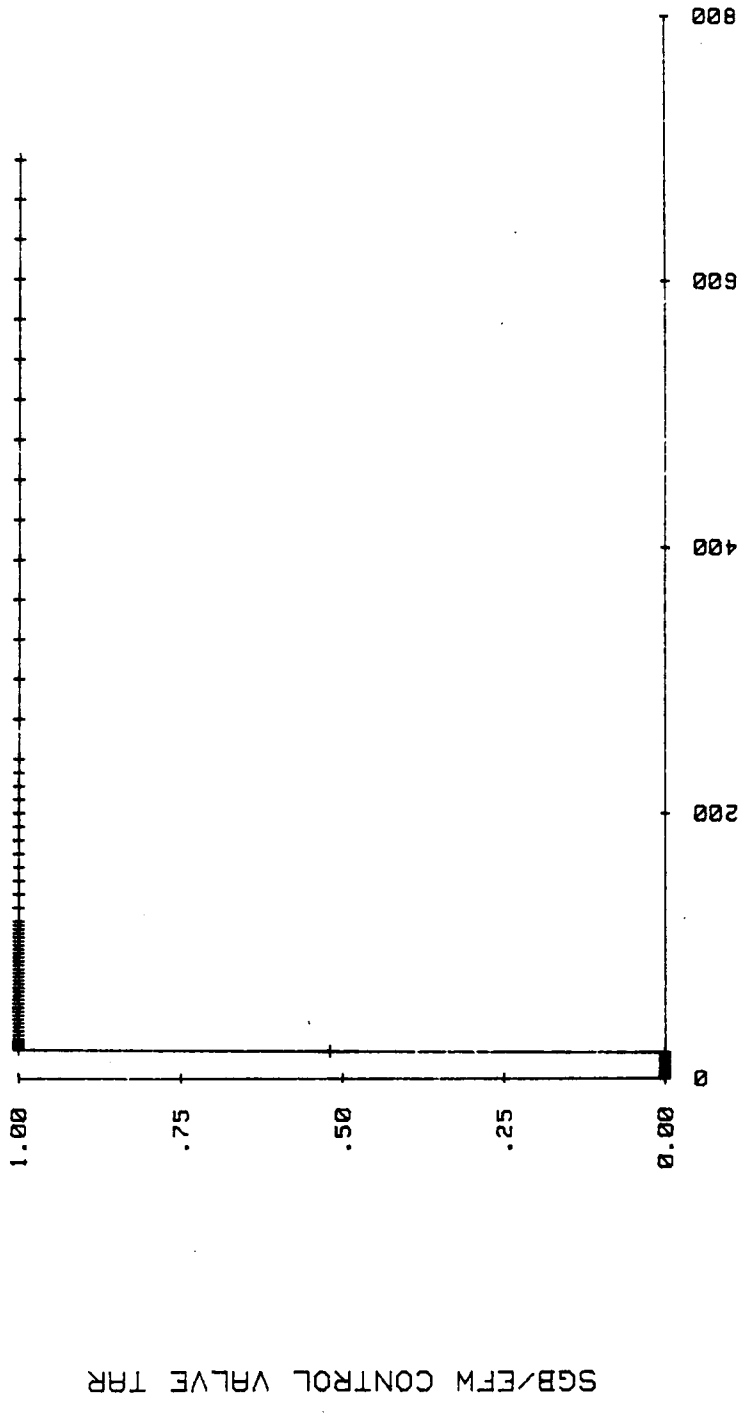


Figure 6.20. RELAP5-calculated steam generator B emergency feedwater control valve throat area ratio response to a hypothetical main steamline break.

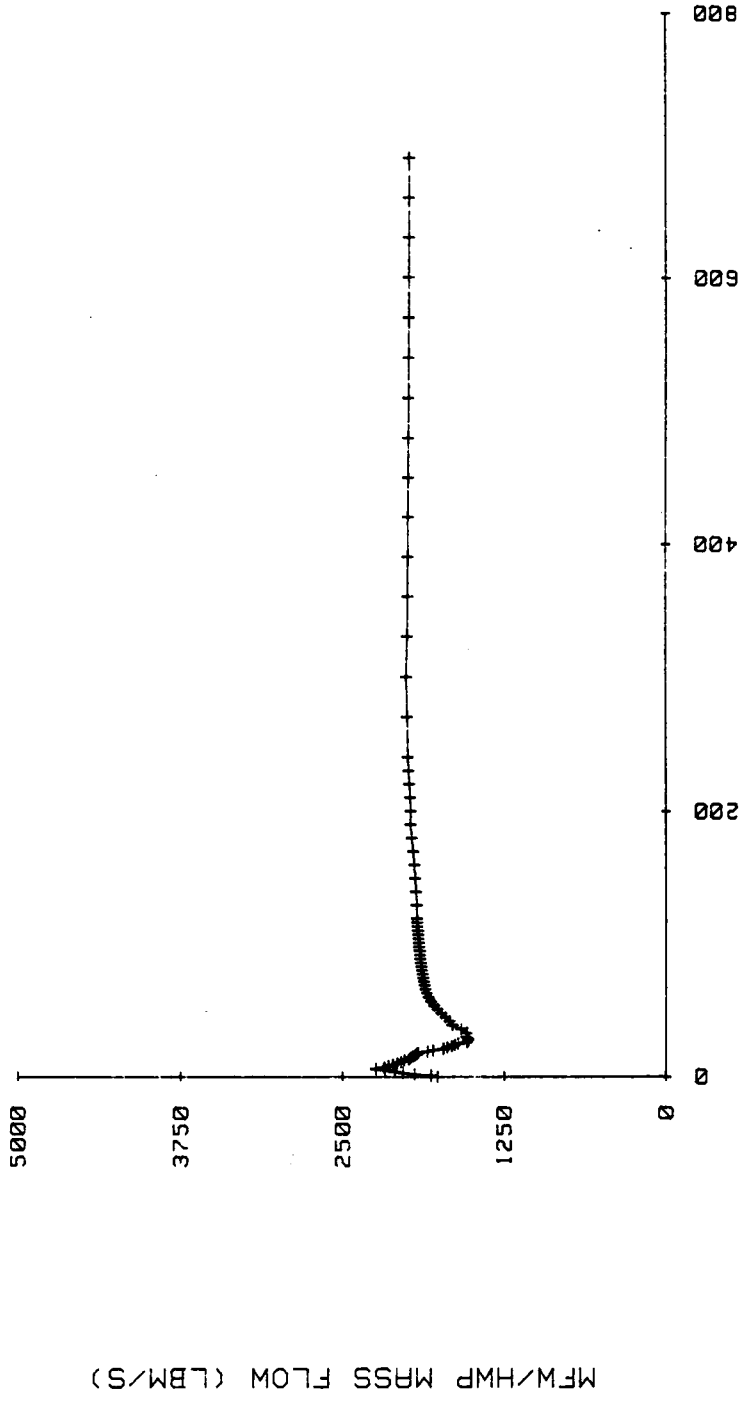


Figure 6.21. RELAP5-calculated hotwell pumps mass flow response to a hypothetical main steamline break.

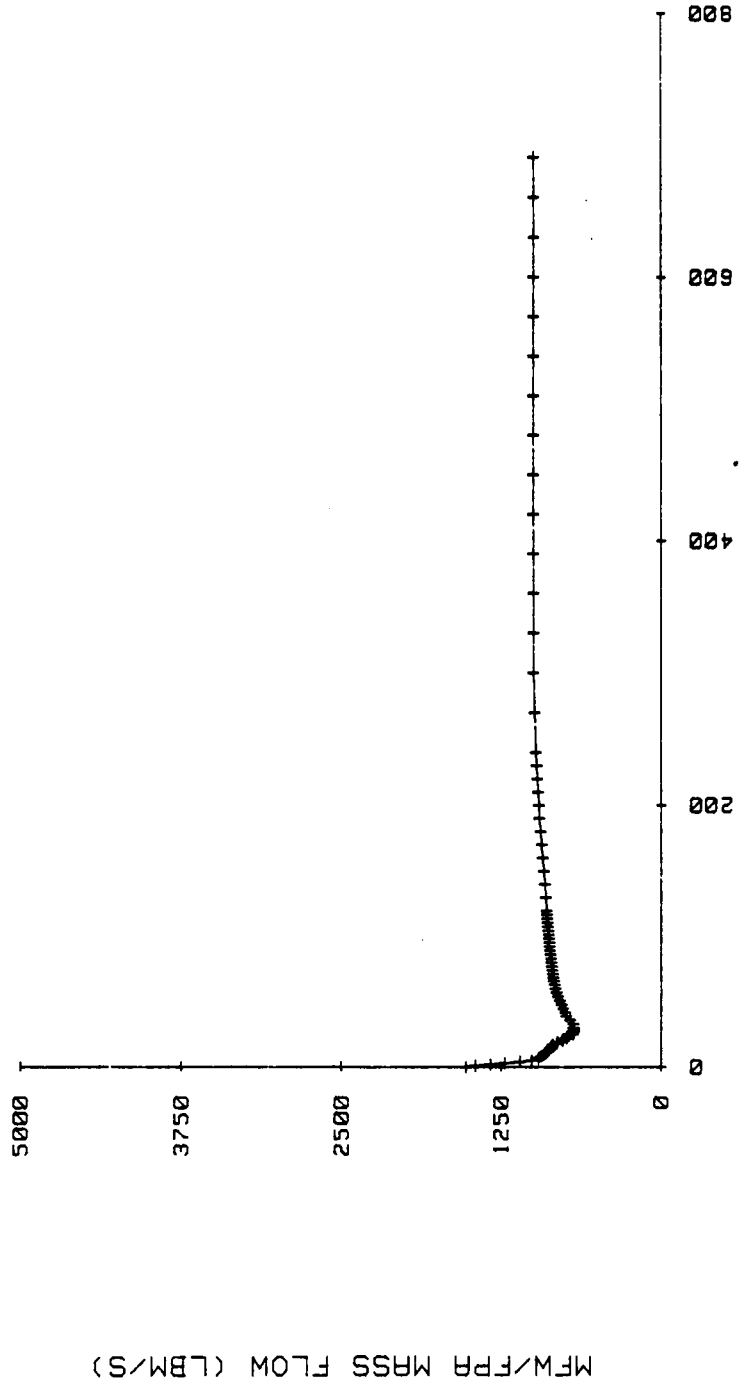


Figure 6.22. RELAP5-calculated main feedwater pump A mass flow response to a hypothetical main steamline break.

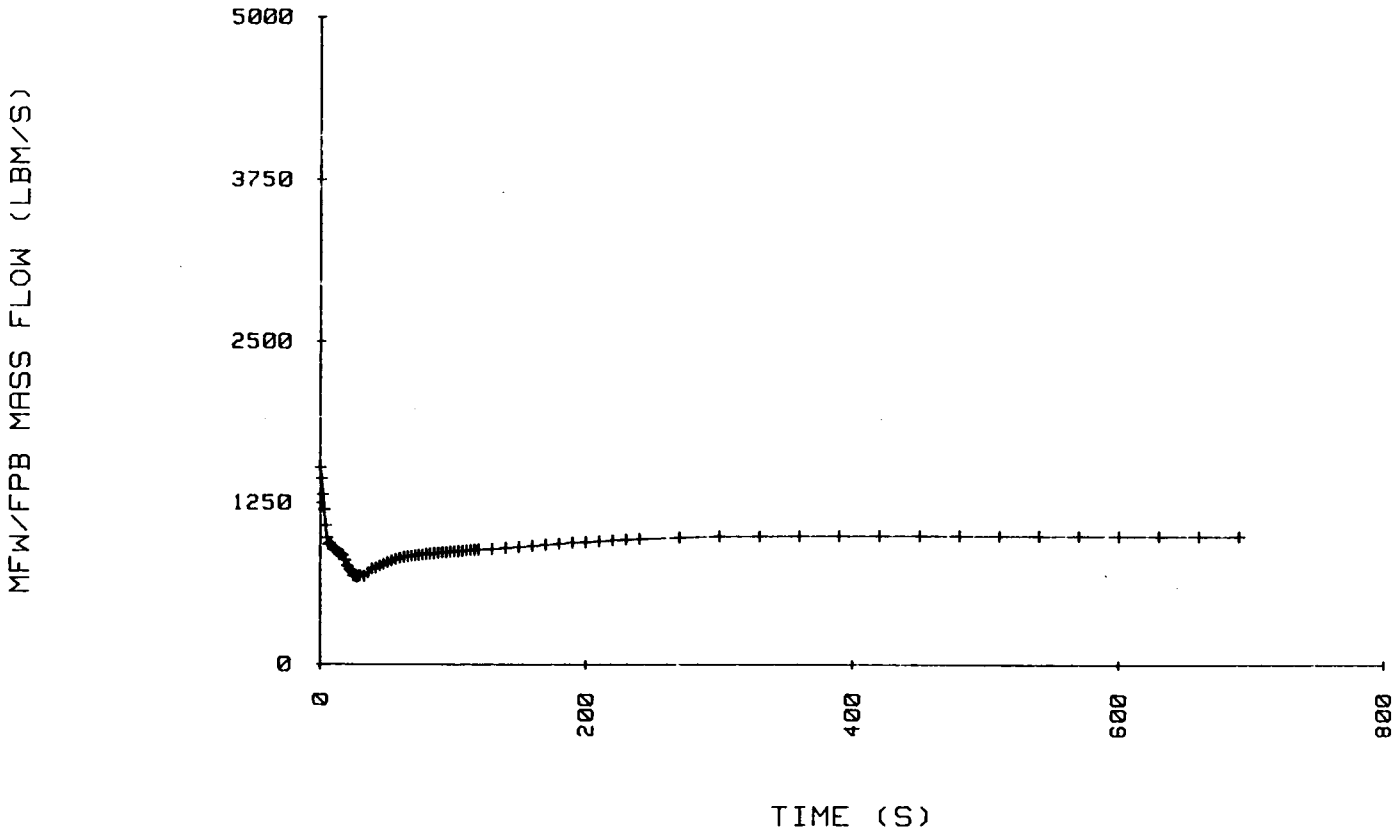


Figure 6.23. RELAP5-calculated main feedwater pump B mass flow response to a hypothetical main steamline break.

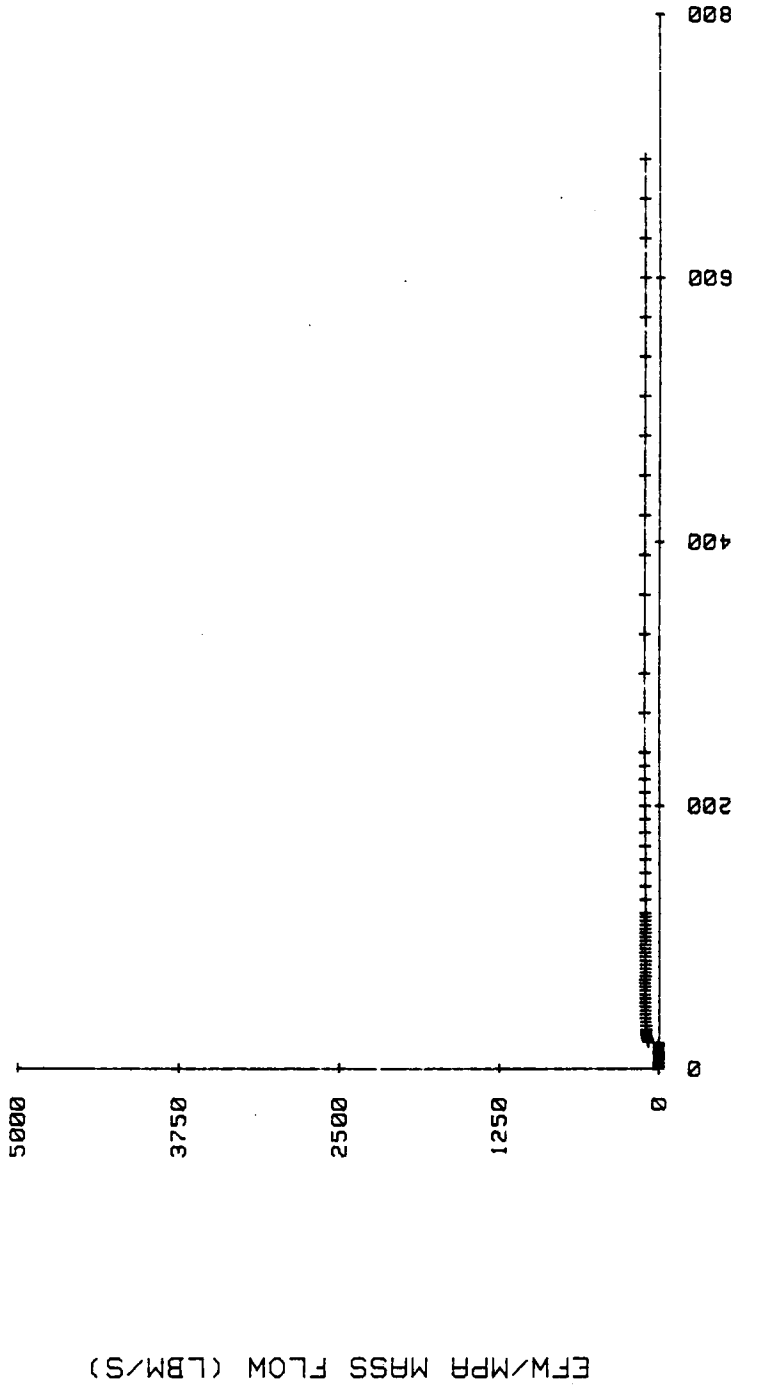


Figure 6.24. RELAP5-calculated motor-driven emergency feedwater pump A mass flow response to a hypothetical main steamline break.

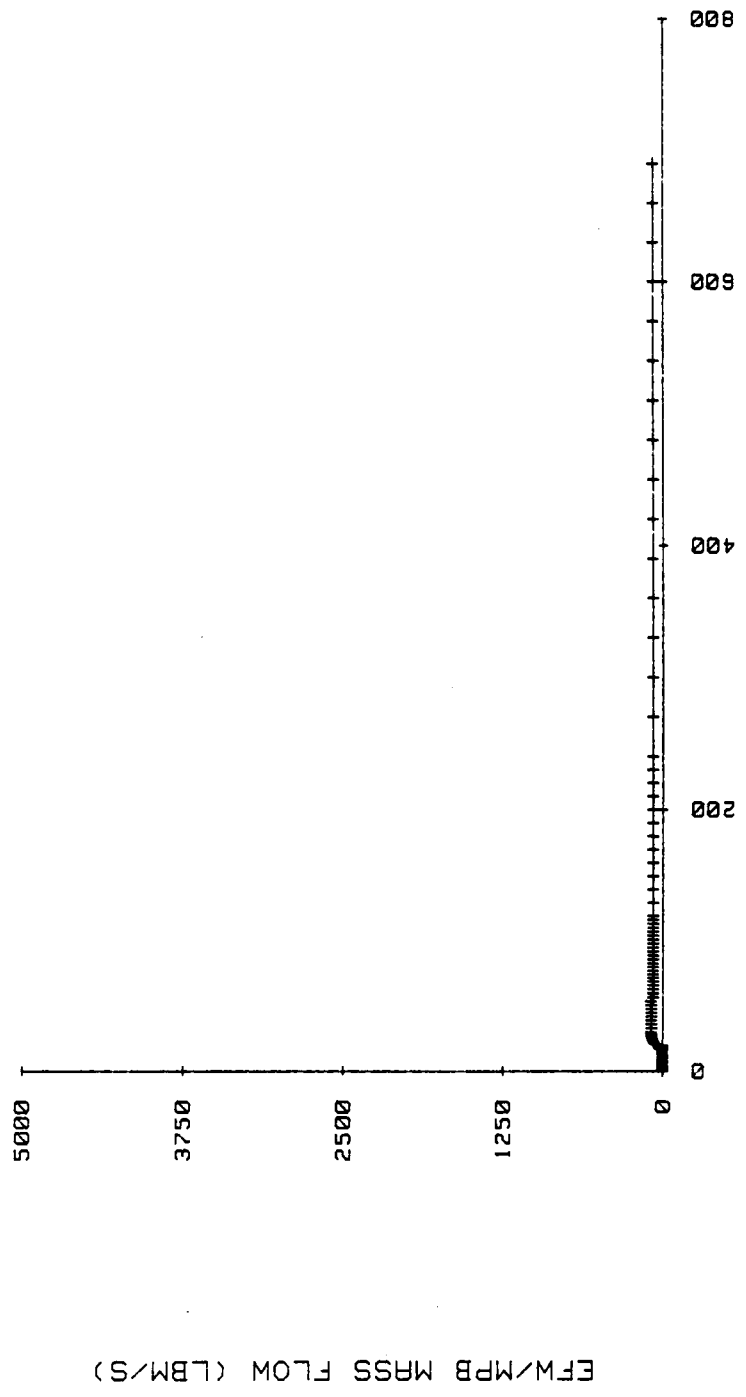


Figure 6.25. RELAP5-calculated motor-driven emergency feedwater pump B mass flow response to a hypothetical main steamline break.

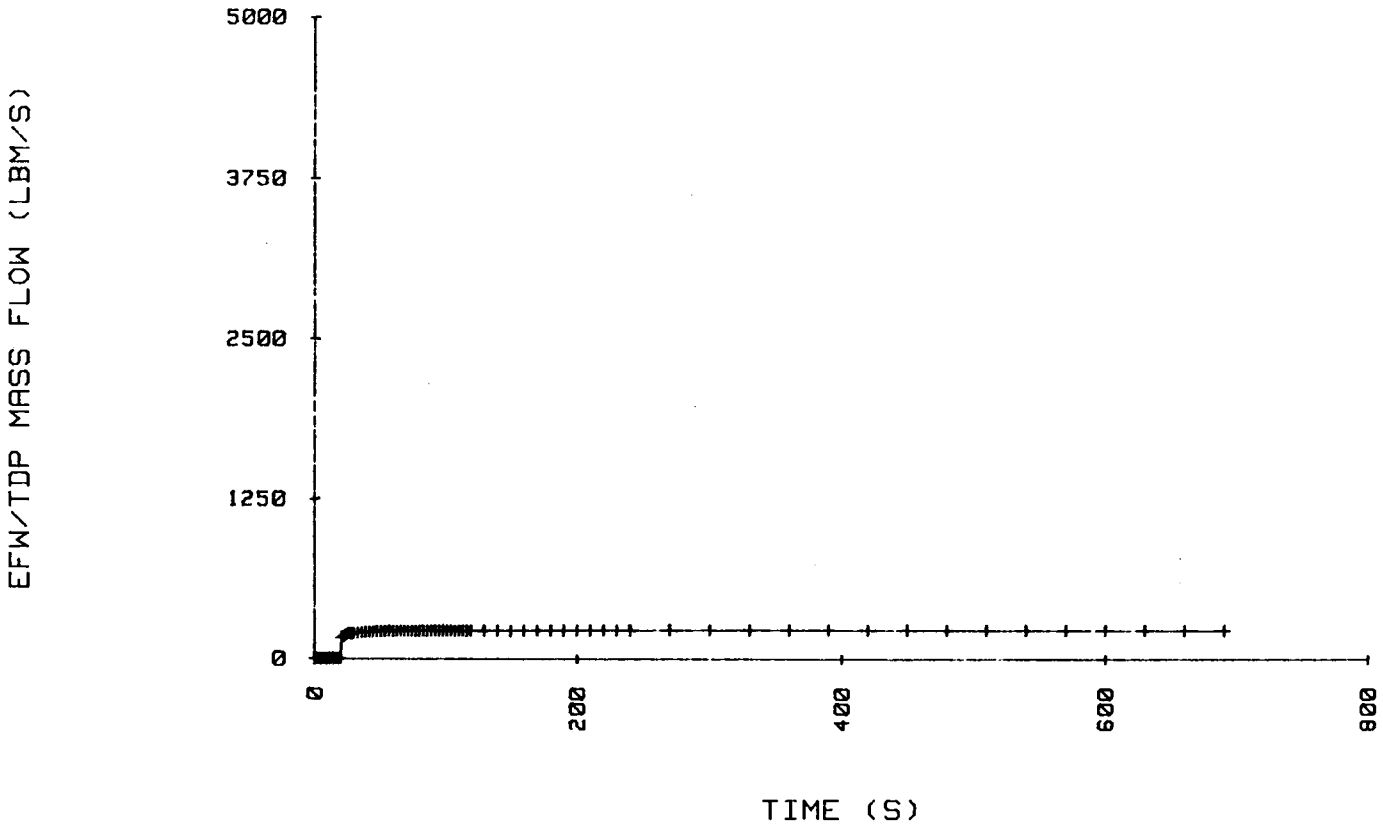


Figure 6.26. RELAP5-calculated turbine-driven emergency feedwater pump mass flow response to a hypothetical main steamline break.

feedwater trains stand-alone model is a transient event sequence such as the one found in Table 6.3. This table contains, versus transient time, the major events which occur during the calculations and a brief description of the physical mechanisms responsible for them.

The RELAP5 calculations, using the stand-alone model of the Oconee 1 main and emergency condensate feedwater trains, indicate that the model is adequate to predict the steam generator A and B main feedwater inlet fluid conditions under one of the more severe PTS scenarios. Minor anomolies occurred in some system parameters due to RELAP5 numerical problems involving boundary condition implementation in the stand-alone model. On an integral basis, however, system response was very reasonable. This best-estimate model immediately revealed an ability of the Oconee 1 main and emergency condensate feedwater trains to supply, for a longer period of time, high-temperature feedwater to the steam generator secondary-side inlets than previously assumed in the extremely conservative boundary conditions implemented in PTS calculations before the A-49 Program.

Total Plant Model Simulation

The philosophy defined by the NRC for creating the INEL and LANL Oconee 1 total plant models is to develop thermal-hydraulic modules for the balance-of-plant systems which can be merged using minimal effort with streamlined primary system models. This allows a concentrated effort to be applied to the state-of-the-art overlaying in these total plant models of the Oconee 1 integrated control system.

Table 6.3. Oconee 1 main and emergency condensate feedwater trains transient event sequence for a hypothetical main steamline break.

Time (s)	Phenomena
0.0	Transient initiation through SGA depressurization; main feedwater pump speeds start exponential runback to 45% of rated and SGB/MFW main control valve closure begins, both due to a rapid decrease in control system main feedwater demand signal; low- and high-pressure heater thermal energy sources and low-pressure D and E heater drain mass sources begin shutdown, both due to closure of turbine and moisture separator reheater extraction line valves; SGA/MFW main control valve throat area ratio is locked at 0.5 due to assumed control failure; reactor and turbines trip off due to control system safeguards.
3.9	SGB/MFW main control valve begins mass flow modulation to maintain SGB level; W,SGA/MFW maximizes at 2126 lbm/s from initial value of 1527 lbm/s due to depressurization of SGA.
4.3	W,SGB/MFW equals zero for duration of transient due to loss of main feedwater pressure and check valves closing.
4.6	Main feedwater pump mass flows decrease below 1020 lbm/s each due to speed runback.
	P,SGB/MFW falls to 935 PSIA due to mass depletion from SGB mass flow mismatch and subsequent check valve closure.

Table 6.3. (Continued)

Time (s)	Phenomena
4.7	Main feedwater pumps trip off due to low suction pressure; W,SGA/MFW begins decreasing rapidly to 1763 lbm/s due to main feedwater pumps trip (trend continues until SGA inlet becomes two-phase).
5.0	Low- and high-pressure heater thermal energy source shutdowns and low-pressure D and E heater drain mass source shutdowns complete, both due to loss of extraction line mass flows.
6.0	Hotwell pumps mass flow surges to 2242 lbm/s from initial value of 1766 lbm/s due to SGA depressurization; subsequent decrease results from MFP runback.
11.8	Motor- and turbine-driven emergency feedwater pump speed runup to 100% of rated begin due to low discharge pressure of main feedwater pumps.
16.6	SGA/MFW inlet becomes two-phase due to pressure (457 PSIA) reaching saturation for the current temperature (458°F); P,SGA/MFW depressurization rate lessens and T,SGA/MFW begins decreasing due to following saturation, trend continues until 315 s; W,SGA/MFW begins increasing rapidly due to increase in pressure gradient; X,SGA/MFW becomes nonzero.
20.0	Main feedwater realignment begins due to assumed reactor coolant pumps trip; SGA/EFW control valve opening begins due to low SGA level; SGB/MFW main control valve begins closure due to main feedwater realignment.

Table 6.3. (Continued)

Time (s)	Phenomena
22.0	SGA/EFW and SGB/EFW control valves open completely for remainder of transient due to low SGA level and stagnant SGB mass flow, respectively; EFW motor-driven pump A mass flow equals 110 lbm/s for duration of transient; EFW motor-driven pump B mass flow equals 74 lbm/s for duration of transient; EFW turbine-driven pump mass flow equals 220 lbm/s for duration of transient; W,SGA/EFW reaches 250 lbm/s for duration of transient; P,SGA/EFW falling lessens due to increase in W,SGA/EFW and reaching saturation (304 PSIA) for current temperature (418°F); T,SGA/EFW continues falling with saturated conditions (discontinuity due to SGA/MFW mixing after reconfiguration); P,SGB/EFW drops sharply to 680 PSIA from 925 PSIA due to opening of SGB/EFW control valve and subsequent steam/water mixing; T,SGB/EFW falls sharply to follow saturation.
23.2	W,SGA/MFW maximizes at 4509 lbm/s with dramatic decrease due to mass depletion.
27.0	P,SGB/MFW falls to 694 PSIA for duration of transient due to steam-water mixing when SGB/EFW control valve opens and subsequent check valve closure when EFW pumps deliver.
27.3	Main feedwater pump mass flows minimize at 650 lbm/s due to coastdown with recovery occurring because of condensate booster and hotwell pumps increased feed flow.

Table 6.3. (Continued)

Time (s)	Phenomena
32.3	Main feedwater pump coastdowns complete; Hotwell pumps mass flow minimizes at 1527 lbm/s due to interplay of critical flow at SGA/MFW inlet and MFP dynamics.
40.0	X,SGA/EFW reaches zero for duration of transient from initial value of 1.0 due to input of subcooled fluid.
55.4	P,SGB/EFW recovers to 925 PSIA for the duration of the transient due to subcooling of fluid; T,SGB/EFW falls below saturation; W,SGB/EFW rises to 60 lbm/s due to SGB inlet pressure recovery above 925 PSIA; X,SGB/EFW equals zero from initial value of 1.0 for duration of transient due to entering subcooled fluid.
63.0	X,SGA/MFW maximizes at 0.093 with subsequent decrease due to cold fluid input.
68.0	T,SGA/EFW falls below saturation due to input of cold fluid.
79.0	W,SGA/MFW levels at 1275 lbm/s due to balancing of system.
189.5	W,SGA/MFW maximizes at 1513 lbm/s; X,SGA/MFW minimizes to 0.032; P,SGA/MFW spikes slightly to 95 PSIA; T,SGA/MFW spikes slightly – all due to choking front location changes.
310.0	W,SGA/MFW choking stops due to loss of pressure potential.

Table 6.3. (Continued)

Time (s)	Phenomena
315.0	SGA/MFW becomes subcooled due to fluid temperature (277°F) falling below saturation for the current pressure (56 PSIA); W,SGA/MFW minimizes at 915 lbm/s due to lessening system pressure; X,SGA/MFW becomes zero for duration of transient.
703.8	Hotwell pumps trip due to low hotwell level as determined by condenser hotwell mass flow integration.
704.8	Transient termination one second after hotwell pumps trip; P,SGA/MFW equals 55 PSIA which is 5 PSIA above the boundary condition pressure due to dynamic losses occurring in the SGA inlet junction; T,SGA/MFW equals 100°F about 10°F above the condenser hotwell temperature due to system capacitive effects; T,SGB/EFW equals 90°F due to no mass input from SGB/MFW system; W,SGA/MFW equals 1827 lbm/s; Hotwell pumps mass flow equals 1995 lbm/s due to balance of system; P,SGA/EFW equals 28 PSIA about 3 PSIA above SGA due to dynamic losses in SGA inlet junction; T,SGA/EFW equals 100°F due to mixture with W,SGA/MFW; X,SGB/MFW equals zero for entire transient; T,SGB/MFW equals 460°F due to flow stagnation.
>704.8	Hotwell pumps trip cascades to trip condensate booster pumps due to sustained low suction pressure; main condensate feedwater system stagnates; emergency feedwater pumps trip due to loss of mass source; emergency condensate feedwater system stagnates.

Because of this NRC directive, the Oconee 1 main and emergency condensate feedwater trains model, which incorporates the majority of the thermal-hydraulic modeling effort required for a PTS balance of plant model, was developed independent of INEL and LANL. Those laboratories created models of the remaining active balance-of-plant systems, which include the main and turbine bypass steamlines (since the steam generator secondary sides are included in the primary system models).

The NRC philosophy objectives were met in both the TRAC and RELAP5 Oconee 1 PTS total plant model developments as the main and emergency condensate feedwater stand-alone model was successfully coupled with only minor modifications. The basic noding structure and component details were used as presented. The TRAC model required simple format restructuring of the input stream. The RELAP5 model incorporated two additional heat structures representing the capacitive effects of the system metal as fluid energy instabilities were encountered around the main feedwater pumps in the INEL total plant model as driven by their integrated control system representation.

The stand-alone Oconee 1 main and emergency condensate feedwater train model calculations were performed to minimize the possibility of major model modifications to these systems once the total plant models were completed. Benchmarking the asymptotic transient

response of the stand-alone model established a high level of confidence that only tuning modifications (such as those actually performed) to that model would be needed when it was incorporated in the PTS total plant models. The actual dynamic response characteristics of the Oconee 1 main and emergency condensate feedwater trains model, therefore, could then be assessed by examining transient calculations performed with the total plant models.

A set of Oconee 1 transients was defined by ORNL[22] to best represent the domain of the PTS class of operational upsets. Some of these transients were run independently by both INEL and LANL to establish the consistency of the total plant models. The remaining transients were divided between INEL and LANL for completion. Table 6.4 summarizes the set of Oconee 1 ORNL-defined PTS transients and which laboratory calculated them.

The transient calculations performed by INEL and LANL were reviewed[23,24,25] by both ORNL and Duke Power. The base case transient was analyzed and compared against actual plant data. Agreement between the recorded and calculated plant response for this case was found to be acceptable by the two reviewing bodies, thus establishing the adequacy of the dynamic response of the Oconee 1 main and emergency condensate feedwater trains model. Detailed information concerning this review and the review of the subsequent transients continues to be unavailable as ORNL has not released the A-49 Program report.

Table 6.4. Oconee 1 PTS transients calculated using the INEL and LANL total plant models.

Model Utilized	Transient Characteristics
INEL/LANL	Oconee base case; turbine and reactor trip with operator reduced feedwater and nominal ANS decay power.
INEL/LANL	Oconee base case; turbine and reactor trip with operator reduced feedwater and plant-obtained decay power.
INEL/LANL	Double ended main steamline break on steam generator A having various combinations of reactor coolant pump restart and auxiliary feedwater initiation.
INEL/LANL	Various sized hot leg breaks located primarily in the pressurizer surge line.
LANL	Stuck open turbine bypass valves with various combinations of banks failing and auxiliary feedwater level control.
INEL	Steam generator overfeeds by locking main feedwater pumps at maximum speed.
INEL	Stuck open turbine bypass valve from hot standby.
LANL	Stuck open pressurizer power operated relief valve.
INEL	Small cold leg break in reactor coolant pump suction line.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

An original stand-alone thermal-hydraulic model has been developed for the Oconee 1 main and emergency condensate feedwater trains using the RELAP5 computer code. Verification of this state-of-the-art model, which is designed to simulate the dynamic behavior of these balance-of-plant systems during the PTS class of transients, has been performed.

The consistency and accuracy of the geometric and thermodynamic input variables of the model have been determined through initial RELAP5 processing combined with detailed examination of all system parameters. Acceptable asymptotic transient characteristics of the model have been qualified through calculations simulating a hypothetical main steamline break using a simplified representation of the Oconee 1 integrated control system.

Evaluation of the ability of the above model to effectively predict the steam generator secondary-side inlet fluid characteristics has been completed (under the A-49 Program) through incorporation of this stand-alone model into the INEL and LANL Oconee 1 total plant models. These models, which are overlayed with a detailed representation of the Oconee 1 integrated control system, have been used to calculate an extensive set of PTS transients. These transients have been qualitatively analyzed by both ORNL and Duke Power, whose

examinations have validated the dynamic response of this Oconee 1 main and emergency condensate feedwater train model.

The model presented herein is not intended to be an all encompassing thermal-hydraulic simulation of a generic pressurized water reactor balance of plant system. The model is Oconee 1 specific and has been developed and verified only for the PTS class of transients. This model, therefore, must not be used for purposes that lie outside of its original scope.

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LIST OF REFERENCES

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APPENDICES

APPENDIX A

RELAP5 DIFFERENTIAL FIELD EQUATIONS

General

RELAP5 models the physics of the two-phase flow phenomena with a set of five differential field equations.[2] These transient, one-dimensional, nonconservative, nonequilibrium differential equations consist of two phasic continuity equations, two phasic momentum equations, and one mixture total energy equation. The thorough development of these field equations has been previously recorded;[26] therefore, only the basic form, as incorporated in RELAP5, of each will be presented.

Conservation of Mass

The two phasic continuity equations are developed from the time-averaged, single-phase continuity equation (derived from the General Transport theorem) by performing a spatial integration and separating the resulting volume integrals into liquid and vapor domains. These differential equations are thus recorded with time and one spatial dimension as independent variables and dependent variables that are time- and volume-averaged. The phasic continuity equations for the liquid and vapor phases are

$$\frac{\partial}{\partial t}(\alpha_\eta \rho_\eta) + \frac{1}{A_x}\frac{\partial}{\partial x}(\alpha_\eta \rho_\eta u_\eta A_x) = \Gamma_\eta \,, \qquad (A.1)$$

where

η = f, g for the liquid or vapor phase, respectively,
t = time,
x = spatial dimension,
α_η = void fraction for phase η,
ρ_η = density for phase η,
A_x = flow channel transverse area,
u_η = bulk velocity for phase η, and
Γ_η = mass generation for phase η.

Generally, there are no mass sources or sinks so that the phasic continuity equations sum to zero.

Conservation of Momentum

The two phasic viscous stress equations of motion are developed from the time-averaged, single-phase conservation of momentum equation (derived from Newton's second law) by performing a spatial integration and separating the resulting volume integrals into liquid and vapor domains. These differential equations are thus recorded with time and one spatial dimension as independent variables and dependent variables that are time- and volume-averaged. The phasic viscous stress equations for the liquid and vapor phases are

$$\alpha_\eta \rho_\eta A_x \frac{\partial}{\partial t}(u_\eta) + \frac{\alpha_\eta \rho_\eta A_x}{2} \frac{\partial}{\partial x}(u_\eta^2)$$

$$= - \alpha_\eta A_x \frac{\partial}{\partial x}(P) + \alpha_\eta \rho_\eta \beta A_x - \alpha_\eta \rho_\eta A_x \phi_\eta u_\eta$$

$$+ \Gamma_\eta A_x (u_\eta - u_\eta) - \alpha_\eta \rho_\eta A_x \psi_\eta (u_\eta - u_{|\eta|})$$

$$- C\alpha_\eta\alpha_{|\eta|}\rho A_x \left[\frac{\partial}{\partial x}(u_\eta - u_{|\eta|}) + u_{|\eta|}\frac{\partial}{\partial x}(u_\eta) - u_\eta\frac{\partial}{\partial x}(u_{|\eta|})\right] \qquad (A.2)$$

where

η = f, g for the liquid or vapor phase, respectively,
$|\eta|$ = g, f for η = f, g, respectively,
t = time,
x = spatial dimension,
α_η = void fraction for phase η,
ρ_η = density for phase η,
A_x = flow channel transverse area,
u_η = bulk velocity for phase η,
P = static normal surface stress,
β = body stress,
ϕ_η = wall friction constitutive coefficient for phase η,
Γ_η = mass generation for phase η,
μ_η = interfacial velocity for phase η,
Ψ_η = interphase friction constitutive coefficient for phase η,
C = virtual mass coefficient, and
ρ = average of the phasic densities.

This nonconservative form of the phasic viscous stress equations of motion arises because the derivation requires keeping the summation of the phasic continuity equations.

Conservation of Energy

The mixture total energy equation is developed by spatially integrating the time-averaged, single-phase total energy equation (derived from the first law of thermodynamics). The resulting differential equation is thus recorded with time and one spatial dimension as independent variables and dependent variables that are time- and volume-averaged. The mixture total energy equation is

$$\frac{\partial}{\partial t}\left[\sum_{\eta=f,g}(\alpha_\eta\rho_\eta E_\eta)\right] + \frac{1}{A_x}\frac{\partial}{\partial x}\left[A_x\sum_{\eta=f,g}(\alpha_\eta\rho_\eta E_\eta)\right]$$

$$= -\frac{1}{A_x}\frac{\partial}{\partial x}\left[PA_x\sum_{\eta=f,g}(\alpha_\eta u_\eta)\right]$$

$$+ \beta\sum_{\eta=f,g}(\alpha_\eta\rho_\eta u_\eta) + Q, \qquad (A.3)$$

where

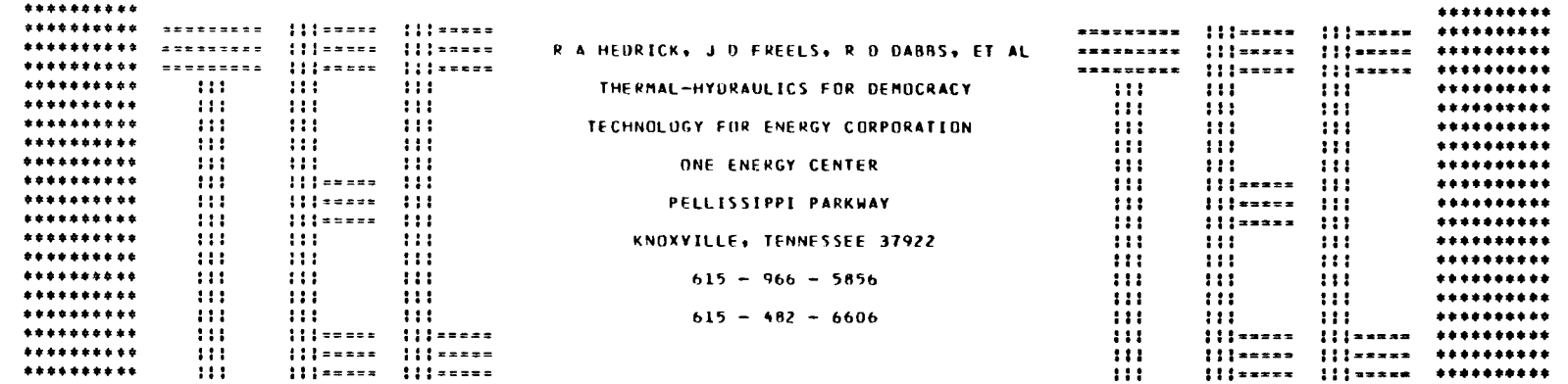
η = f,g for the liquid or vapor phase, respectively,
t = time,
x = spatial dimension,
α_η = void fraction for phase η,
ρ_η = density for phase η,
A_x = flow channel transverse area,
u_η = bulk velocity for phase η,
E_η = summation of internal and kinetic energies for phase η,
P = static normal surface stress,
β = body stress, and
Q = thermal energy source.

APPENDIX B

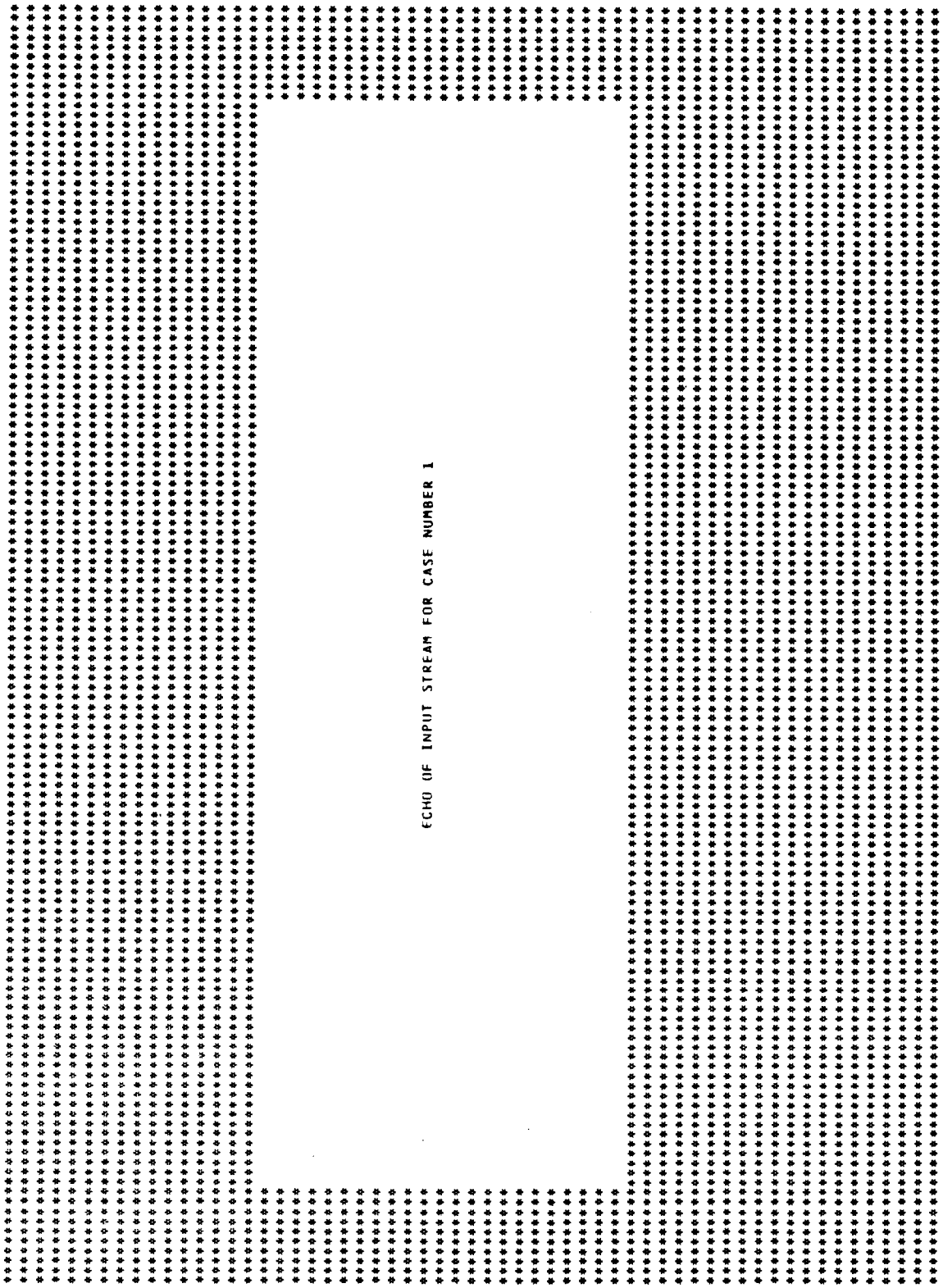
OCONEE 1 MAIN AND EMERGENCY CONDENSATE FEEDWATER TRAINS MODEL RELAP5 INPUT STREAM

This appendix consists of the complete echo of the input stream for the Oconee 1 main and emergency condensate feedwater trains thermal-hydraulic model. Interpretation requires the model characteristics presented in this thesis coupled with the input stream formatting described in the RELAP5 code manual. Being the total input stream for a RELAP5 calculation, it includes specific information defining a hypothetical main steamline break as well as generic information on the Oconee 1 main and emergency condensate feedwater trains.

```
**********
********** CONVERSION BASE : RELAP5/MOD1/014 WITH UPDATES : V H RANSOM, ET AL, EG&G IDAHO, INC., IDAHO FALLS, IDAHO, 1982 **********
**********
```




```
**********
**********
**********
```


ECHO OF INPUT STREAM FOR CASE NUMBER 1

```
1
2     *********0*********0*********0*********0*********0*********0*********0*********0
3     *********0*********0*********0*********0*********0*********0*********0*********0
4     *****                                                                 *********0
5     ***** R D DABBS                              ONE ENERGY CENTER        *********0
6     ***** TECHNOLOGY FOR ENERGY CORP.            PELLISSIPPI PARKWAY      *********0
7     ***** 615 - 966 - 5856                       KNOXVILLE, TENNESSEE 37922 *********0
8     *****                                                                 *********0
9     *****                    NUCLEAR ENERGY DEPARTMENT                    *********0
10    *****                                                                 *********0
11    *********0*********0*********0*********0*********0*********0*********0*********0
12    *********0*********0*********0*********0*********0*********0*********0*********0
13
14    *** GENERAL INFORMATION *****0*********0*********0*********0*********0*********0
15
16    =CCONEE 1. SPCS CONDENSATE/FEEDWATER TRAINS * CASE: MSNE-001 * 15OCT83
17
18    00000100          NEW    TRANSNT
19    00000101      INP-CHK
20    00000102      BRITISH    BRITISH
21
22    00000104         NONE
23    00000105      5.00000  10.00000
24
25    00000201     20.00000 100.0D-08   0.01000      00002   10   100 4096
26    00000202     30.00000 100.0D-08 250.0D-05      00002   40   400 4096
27    00000203     40.00000 100.0D-08   0.00500      00002   20   200 4096
28    00000204     80.00000 100.0D-08   0.01000      00002   10   100 4096
29    00000205    120.00000 100.0D-08   0.01000      00002   10   100 4096
30    00000206    160.00000 100.0D-08   0.01000      00002   50  1000 4096
31    00000207    180.00000 100.0D-08   0.01000      00002   50  1000 4096
32    00000208    190.00000 100.0D-08   0.01000      00002   50  1000 4096
33    00000209    200.00000 100.0D-08   0.01000      00002   50  1000 4096
34    00000210    240.00000 100.0D-08   0.01000      00002   50  1000 4096
35    00000211    360.00000 100.0D-08   0.01000      00002  500  3000 4096
36    00000212    480.00000 100.0D-08   0.01000      00002  500  3000 4096
37    00000213    600.00000 100.0D-08   0.01000      00002  500  3000 4096
38    00000214    720.00000 100.0D-08   0.01000      00002  500  3000 4096
39    00000215    840.00000 100.0D-08   0.01000      00002  500  3000 4096
40    00000216    960.00000 100.0D-08   0.01000      00002  500  3000 4096
41    00000217   1080.00000 100.0D-08   0.01000      00002  500  3000 4096
42    00000218   1200.00000 100.0D-08   0.01000      00002  500  3000 4096
43
44    00000301  P,402020000
45    00000302  P,500010000
46    00000303  P,501010000
47    00000304  MFLOWJ,401010000
48    00000305  MFLOWJ,403020000
49    00000306  MFLOWJ,420020000
50    00000307  MFLOWJ,522020000
51    00000308  PMPVEL,420
52    00000309  PMPVEL,522
53    00000310  MFLOWJ,426000000
54    00000311  MFLOWJ,428000000
55    00000312  MFLOWJ,607000000
56    00000313  MFLOWJ,610000000
57    00000314  MFLOWJ,526000000
58    00000315  MFLOWJ,528000000
59    00000316  MFLOWJ,629000000
60    00000317  MFLOWJ,632000000
61    00000318  CNTRLVAR,010
62    00000319  MFLOWJ,603010000
```

```
00000320  MFLOWJ,625010000
00000321  MFLOWJ,653010000
00000322  P,604020000
00000323  P,626020000
00000324  P,654020000
00000325  MFLOWJ,658000000
00000326  VLVAREA,610
00000327  VLVAREA,632
00000328  P,429030000
00000329  TEMP,429030000
00000330  MFLOWJ,430000000
00000331  QUALE,429030000
00000332  VLVAREA,428
00000333  P,611030000
00000334  TEMP,611030000
00000335  MFLOWJ,612000000
00000336  QUALE,611030000
00000337  P,529030000
00000338  TEMP,529030000
00000339  MFLOWJ,530000000
00000340  QUALE,529030000
00000341  VLVAREA,528
00000342  P,633030000
00000343  TEMP,633030000
00000344  MFLOWJ,634000000
00000345  QUALE,633030000
00000346  P,429020000
00000347  TEMP,429020000
00000348  MFLOWJ,429020000
00000349  QUALE,429020000
00000350  VLVAREA,428
00000351  P,611020000
00000352  TEMP,611020000
00000353  MFLOWJ,611020000
00000354  QUALE,611020000
00000355  P,529020000
00000356  TEMP,529020000
00000357  MFLOWJ,529020000
00000358  QUALE,529020000
00000359  VLVAREA,528
00000360  P,633020000
00000361  TEMP,633020000
00000362  MFLOWJ,633020000
00000363  QUALE,633020000

*** HOTWELL PUMP VARIABLE TRIPS *******0*********0*********0*********0*********0

00000501  TIME,0            GE NULL,0              0.00000 N
00000502  CNTRLVAR,010      GE NULL,0         753434.40200 N
00000503  TIME,0            GE TIMEOF,601          1.00000 N

*** CONDENSATE BOOSTER PUMP VARIABLE TRIPS ******0*********0*********0*********0

00000511  P,402020000       LT NULL,0             30.67000 N
00000512  TIME,0            GE TIMEOF,511          5.00000 N

*** MAIN FEEDWATER PUMP VARIABLE TRIPS 0*********0*********0*********0*********0

00000521  P,500010000       LT NULL,0            249.67000 N
00000522  P,501010000       GE NULL,0           1289.67000 N

*** MAIN CONTROL VALVE VARIABLE TRIPS *0*********0*********0*********0*********0
```

```
00000531  MFLOWJ,428000000 LT NULL,0              -100.0D+04 N
00000532  MFLOWJ,610000000 LT NULL,0               61.111D0 N
00000533  TIME,0           GE NULL,0               22.00000 N
00000534  MFLOWJ,528000000 LT NULL,0              100.00000 N
00000535  TIME,0           GE NULL,0               20.00000 N

*** EMERGENCY FEEDWATER PUMPS VARIABLE TRIPS ****0*********0*********0*********0

00000541  P,501010000      LT NULL,0              764.67000 L
00000542  P,604020000      GE NULL,0             2000.00000 N
00000543  P,626020000      GE NULL,0             2000.00000 N
00000544  P,654020000      GE NULL,0             2000.00000 N
00000545  TIME,0           GE TIMEOF,542            1.00000 L
00000546  TIME,0           GE TIMEOF,543            1.000D0 L
00000547  TIME,0           GE TIMEOF,544            1.000D0 L

*** EMERGENCY CONTROL VALVE VARIABLE TRIPS *******0*********0*********0*********0

00000551  MFLOWJ,610000000 LT NULL,0              -100.0D+04 N
00000552  MFLOWJ,632000000 LT NULL,0              100.00000 N
00000553  TIME,0           GE NULL,0               20.00000 N

*** TRANSIENT TERMINATION TRIP ********0*********0*********0*********0*********0

00000600   503

*** HOTWELL PUMP LOGICAL TRIPS ********0*********0*********0*********0*********0

00000601   502 AND  502 L

*** CONDENSATE BOOSTER PUMP LOGICAL TRIPS ********0*********0*********0*********0

00000611   511 AND  512 L

*** MAIN FEEDWATER PUMP LOGICAL TRIPS *0*********0*********0*********0*********0

00000621   521 OR   522 L
00000622  -621 AND -621 N
00000623  -621 AND -621 N

*** MAIN CONTROL VALVE LOGICAL TRIPS **0*********0*********0*********0*********0

00000631   531 AND  531 N
00000632   532 AND  533 L
00000633   534 AND -535 N
00000634  -534  OR  535 N

*** EMERGENCY FEEDWATER PUMP LOGICAL TRIPS *******0*********0*********0*********0

00000641   541 AND -545 N
00000642  -641 AND -641 N
00000643   541 AND -546 N
00000644  -643 AND -643 N
00000645   541 AND -547 N
00000646  -645 AND -645 N
00000647  -642 AND -642 N
00000648  -644 AND -644 N
00000649  -646 AND -646 N

*** EMERGENCY CONTROL VALVE LOGICAL TRIPS ********0*********0*********0*********0

00000651   551  OR  553 N
00000652  -551 AND -553 N
```

```
00000653   552 AND  553 N
00000654  -552  OR -553 N

*** STRIP REQUEST *0*********0*********0*********0*********0*********0

$ZZ CARDS 00001001 - 00001999 NOT CURRENTLY INCLUDED ZZZZZZZZZZZZZZZZZ

***** MFW COMMON CONDENSATE SUBSYSTEM *0*********0*********0*********0*********0

04000000    MFW/CHWL     TMDPVOL
04000101   100.0D+04    0.00000 100.0D+04    0.00000    0.00000    0.00000
04000102     0.00000    0.00000         11
04000200           0          0
04000201     0.00000    7.2080D   58.015D0    0.00000
04000202   100.0D+04    7.2080D   58.015D0    0.00000

***** MFW HOTWELL PUMPS SUBSYSTEM *****0*********0*********0*********0*********0

04010000    MFW/HWLP       PUMP
04010101     2.5360D    0.00000 750.00000    0.00000    0.00000    0.00000
04010102           0
04010108  400000000    0.00000   2.3430D 100.00000       0000
04010109  402000000    0.00000  72.1760D 100.00000       0000
04010200           0 113.00000  57.9720D    0.00000
04010201           0  11.2130D  11.2130D    0.00000
04010202           0  11.2090D  11.2090D    0.00000
04010301           0          0         -2          0         -1        601
                   0
04010302   1183.0000    1.00000 12756.0D0 500.00000 100.0D-08 1843.21D0
04010303      0.0     1000.0000   0.00000 1000.0000    0.00000    0.00000
04010310   100.0D+04 100.0D+04 -10.0D+05

04011100           1          1
04011101     0.000D0    1.2360D
04011102     0.200D0    1.225D0
04011103     0.400D0    1.2020D
04011104     0.600D0    1.157D0
04011105     0.800D0    1.056D0
04011106     1.000D0    1.000D0

04011200           2          1
04011201     0.00000    1.00000
04011202     1.00000    1.00000

04011300           1          2
04011301     0.000D0   -0.3000D
04011302     0.500D0    0.000D0
04011303     0.625D0    0.277D0
04011304     0.714D0    0.424D0
04011305     0.833D0    0.648D0
04011306     0.999D0    0.998D0

04011400           2          2
04011401     0.00000   -0.1500D
04011402     0.500D0    0.250D0
04011403     0.625D0    0.391D0
04011404     0.714D0    0.510D0
04011405     0.833D0    0.694D0
04011406     0.999D0    0.998D0

04011500           1          3
04011501    -1.00000    1.2360D
04011502    -0.000D0    1.236D0
```

```
          *
04011600          2          3
04011601    -1.00000    0.00000
04011602    -0.00000    0.00000
          *
04011700          1          4
04011701    -0.99900 -100.0000
04011702    -0.00000 -100.0000
          *
04011800          2          4
04011801    -0.99900  -0.00000
04011802    -0.00000  -0.00000
          *
04013000          0
04013001     0.00000   0.00000
04013002     0.10000   0.00000
04013003     0.15000   0.05000
04013004     0.24000   0.80000
04013005     0.30000   0.96000
04013006     0.40000   0.98000
04013007     0.60000   0.97000
04013008     0.80000   0.90000
04013009     0.90000   0.80000
04013010     0.96000   0.50000
04013011     1.00000   0.00000
          *
04013100          0
04013101     0.00000   0.00000
04013102     0.10000   0.00000
04013103     0.15000   0.05000
04013104     0.24000   0.80000
04013105     0.30000   0.96000
04013106     0.40000   0.98000
04013107     0.60000   0.97000
04013108     0.80000   0.90000
04013109     0.90000   0.80000
04013110     0.96000   0.50000
04013111     1.00000   0.00000
          *
04016001     0.00000   1.00000
04016002   100.00+04   1.00000

***** MFW COMMON CONDENSATE SUBSYSTEM (CONT'D) **0**********0**********0**********0

04020000    MFW/DMDA      PIPE
04020001          2
04020101     2.53600         1
04020102     2.53600         2
04020201     0.00000         1
04020301     0.00000         1
04020302     0.00000         2
04020401   750.00000         1
04020402   750.00000         2
04020501     0.00000         1
04020502     0.00000         2
04020601     0.00000         1
04020602     0.00000         2
04020701     0.00000         1
04020702     0.00000         2
04020801   150.00-06   0.00000         1
04020802   150.00-06   0.00000         2
04020901    71.27600  71.27600         1
04021001          10         1
```

```
04021002          10          2
04021101        0000          1
04021201           0 160.00000  57.96400   0.00000   0.00000          1
04021202           0 100.00000  62.97300   0.00000   0.00000          2
04021300           0
04021301    11.20800  11.20800   0.00000          1
*****  MFW CONDENSATE BOOSTER PUMPS SUBSYSTEM ****0*********0*********0*********0
04030000     MFW/COMP       PUMP
04030101     2.53600    0.00000 750.00000   0.00000   0.00000   0.00000
04030102           0
04030108   402010000    0.00000   1.91100 100.00000      0000
04030109   404000000    0.00000   1.91200 100.00000      0000
04030200           0 310.00000  62.90300   0.00000
04030201           0  11.22000  11.22000   0.00000
04030202           0  11.21300  11.21300   0.00000
04030301           0         0        -2         0        -1       611
          *        0
04030302    3580.0000    1.00000 12768.000 983.00000 100.00-08 1843.2100
04030303       0.0    1000.0000   0.00000 1000.0000   0.00000   0.00000
04030310   100.00+04 100.00+04 -10.00+05
          *
04031100           1          1
04031101     0.00000    1.06800
04031102     0.20000    1.06300
04031103     0.40000    1.05800
04031104     0.60000    1.04700
04031105     0.80000    1.03100
04031106     1.00000    1.00000
          *
04031200           2          1
04031201     0.00000    1.00000
04031202     1.00000    1.00000
          *
04031300           1          2
04031301     0.00000   -0.30000
04031302     0.50000    0.00000
04031303     0.62500    0.28800
04031304     0.71400    0.43000
04031305     0.83300    0.65800
04031306     0.99900    0.99800
          *
04031400           2          2
04031401     0.00000   -0.15000
04031402     0.50000    0.25000
04031403     0.62500    0.39100
04031404     0.71400    0.51000
04031405     0.83300    0.69400
04031406     0.99900    0.99800
          *
04031500           1          3
04031501    -1.00000    1.06800
04031502    -0.00000    1.06800
          *
04031600           2          3
04031601    -1.00000    0.00000
04031602    -0.00000    0.00000
          *
04031700           1          4
04031701    -0.99900 -100.0000
04031702    -0.00000 -100.0000
          *
```

```
04031800          2          4
04031801    -0.99900   -0.00000
04031802    -0.00000   -0.00000
          *
04033000          0
04033001    0.00000    0.00000
04033002    0.10000    0.00000
04033003    0.15000    0.05000
04033004    0.24000    0.80000
04033005    0.30000    0.96000
04033006    0.40000    0.98000
04033007    0.60000    0.97000
04033008    0.80000    0.90000
04033009    0.90000    0.80000
04033010    0.96000    0.50000
04033011    1.00000    0.00000
        *
04033100          0
04033101    0.00000    0.00000
04033102    0.10000    0.00000
04033103    0.15000    0.05000
04033104    0.24000    0.80000
04033105    0.30000    0.96000
04033106    0.40000    0.98000
04033107    0.60000    0.97000
04033108    0.80000    0.90000
04033109    0.90000    0.80000
04033110    0.96000    0.50000
04033111    1.00000    0.00000
      *
04036001    0.00000    1.00000
04036002  100.00+04    1.00000
    *

***** MFW COMMON CONDENSATE SUBSYSTEM (CONT'D) **0*********0*********0*********0

04040000    MFW/LPFE       PIPE
04040001          2
04040101    2.53600          1
04040102    1.11700          2
04040201    0.00000          1
04040301    0.00000          1
04040302    0.00000          2
04040401 1416.0000           1
04040402 1062.0000           2
04040501    0.00000          1
04040502    0.00000          2
04040601    0.00000          1
04040602    0.00000          2
04040701    0.00000          1
04040702    0.00000          2
04040801  150.00-06    0.00000          1
04040802  150.00-06    0.00000          2
04040901    6.74000    6.74000          1
04041001         10          1
04041002         10          2
04041101       0000          1
04041201          0 520.00000 127.65200   0.00000   0.00000          1
04041202          0 490.25000 197.85700   0.00000   0.00000          2
04041300          0
04041301   25.88400   25.88400   0.00000          1

04050000    MFW/LPFD   SNGL JUN
```

```
04050101   404010000 408000000   0.00000   7.44000   7.44000       0000
04050102     1.00000   0.60000
04050201           0  26.60000  26.60000   0.00000

***** MFW LOW-PRESSURE E HEATER DRAIN SUBSYSTEM *0*********0*********0*********0

04060000    MFW/LPED    TMDPVOL
04060101   100.0D+04   0.00000 100.0D+04   0.00000   0.00000   0.00000
04060102     0.00000   0.00000         11
04060200           0         0
04060201     0.00000 470.00000 177.73600   0.00000
04060202   100.0D+04 470.00000 177.73600   0.00000

04070000    MFW/LPED    TMDPJUN
04070101   406000000 408000000   2.53600
04070200           0         0
04070201     0.00000   0.91500   0.91500   0.00000
04070202     5.00000   0.00000   0.00000   0.00000
04070203   100.0D+04   0.00000   0.00000   0.00000

***** MFW COMMON CONDENSATE SUBSYSTEM (CONT'D) **0*********0*********0*********0

04080000    MFW/LPDH     BRANCH
04080001           0         0
04080101     2.53600   0.00000 1062.0000   0.00000   0.00000   0.00000
04080102   150.0D-06   0.00000         10
04080200           0 456.50000 269.01100   0.00000

04090000    MFW/LPDD    SNGLJUN
04090101   408010000 412000000   0.00000  31.81000  31.81000       0000
04090102     1.00000   0.60000
04090201           0  13.09200  13.09200   0.00000

***** MFW LOW-PRESSURE D HEATER DRAIN SUBSYSTEM *0*********0*********0*********0

04100000    MFW/LPDD    TMDPVOL
04100101   100.0D+04   0.00000 100.0D+04   0.00000   0.00000   0.00000
04100102     0.00000   0.00000         11
04100200           0         0
04100201     0.00000 435.00000 258.77800   0.00000
04100202   100.0D+04 435.00000 258.77800   0.00000

04110000    MFW/LPDD    TMDPJUN
04110101   410000000 412000000   4.16200
04110200           0         0
04110201     0.00000   4.78800   4.78800   0.00000
04110202     5.00000   0.00000   0.00000   0.00000
04110203   100.0D+04   0.00000   0.00000   0.00000

***** MFW COMMON CONDENSATE SUBSYSTEM (CONT'D) **0*********0*********0*********0

04120000    MFW/LPCH     BRANCH
04120001           0         0
04120101     4.16200   0.00000 1239.0000   0.00000   0.00000   0.00000
04120102   150.0D-06   0.00000         10
04120200           0 422.75000 341.87900   0.00000

04130000    MFW/LPCD    SNGLJUN
04130101   412010000 500000000   0.00000  31.90000  31.90000       0000
04130102     1.00000   0.60000
04130201           0  13.36800  13.36800   0.00000

***** MFW SGA CONDENSATE SUBSYSTEM ****0*********0*********0*********0*********0
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504
505     ***** MFW SGA MAIN FEEDWATER PUMP SUBSYSTEM *****0*********0*********0*********0
506
507     04200000     MFW/MFPA       PUMP
508     04200101      1.11700   0.00000 605.00000   0.00000   0.00000   0.00000
509     04200102            0
510     04200108   500010000   0.00000   2.62400 100.00000      0000
511     04200109   421000000   0.00000   2.69000 100.00000      0000
512     04200200            0 822.50000 341.09600   0.00000
513     04200201            0  24.90900  24.90900   0.00000
514     04200202            0  24.85000  24.85000   0.00000
515     04200301            0         0        -2         0         0       621
516           *             0
517     04200302   5000.0000   1.00000 12459.000 2320.0000 100.0D-08 1843.2100
518     04200303      0.0     1000.0000   0.00000 1000.0000   0.00000   0.00000
519     04200310   100.0D+04 100.0D+04 -10.0D+05
520           *
521     04201100            1         1
522     04201101      0.00000   1.20700
523     04201102      0.20000   1.09900
524     04201103      0.40000   1.05200
525     04201104      0.60000   1.04300
526     04201105      0.80000   1.03000
527     04201106      1.00000   1.00000
528           *
529     04201200            2         1
530     04201201      0.00000   1.00000
531     04201202      1.00000   1.00000
532           *
533     04201300            1         2
534     04201301      0.00000  -0.30000
535     04201302      0.50000   0.00000
536     04201303      0.62500   0.28600
537     04201304      0.71400   0.42200
538     04201305      0.83300   0.63800
539     04201306      0.99900   0.99800
540           *
541     04201400            2         2
542     04201401      0.00000  -0.15000
543     04201402      0.50000   0.25000
544     04201403      0.62500   0.39100
545     04201404      0.71400   0.51000
546     04201405      0.83300   0.69400
547     04201406      0.99900   0.99800
548           *
549     04201500            1         3
550     04201501     -1.00000   1.20700
551     04201502     -0.00000   1.20700
552           *
553     04201600            2         3
554     04201601     -1.00000   0.00000
555     04201602     -0.00000   0.00000
556           *
557     04201700            1         4
558     04201701     -0.99900 -100.0000
559     04201702     -0.00000 -100.0000
560           *
561     04201800            2         4
562     04201801     -0.99900  -0.00000
563     04201802     -0.00000  -0.00000
564           *
565     04203000            0
566     04203001      0.00000   0.00000
```

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04203002      0.10000   0.00000
04203003      0.15000   0.05000
04203004      0.24000   0.80000
04203005      0.30000   0.96000
04203006      0.40000   0.98000
04203007      0.60000   0.97000
04203008      0.80000   0.90000
04203009      0.90000   0.80000
04203010      0.96000   0.50000
04203011      1.00000   0.00000
        *
04203100            0
04203101      0.00000   0.00000
04203102      0.10000   0.00000
04203103      0.15000   0.05000
04203104      0.24000   0.80000
04203105      0.30000   0.96000
04203106      0.40000   0.98000
04203107      0.60000   0.97000
04203108      0.80000   0.90000
04203109      0.90000   0.80000
04203110      0.96000   0.50000
04203111      1.00000   0.00000
        *
04206001      0.00000   1.00000
04206002    100.00+04   1.00000
        *
04206100          622
04206101      0.00000 5000.0000
04206102     20.00000 3261.6700
04206103     40.00000 2622.1700
04206104     60.00000 2386.9100
04206105     90.00000 2280.5500
04206106    120.00000 2256.8200
04206107    180.00000 2250.0000
04206108    100.00+04 2250.0000

***** MFW SGA FEEDWATER SUBSYSTEM *****0*********0*********0*********0*********0

04210000    MFW/FPDA    SNGLVOL
04210101      2.5360    0.00000 317.00000   0.00000   0.00000   0.00000
04210102    150.00-06   0.00000         10
04210200            0 1256.0000 340.24800   0.00000

04220000    MFW/PCHA      VALVE
04220101   421010000 501000000   2.5360    1.4100    1.4100       0100
04220102     1.00000   0.60000
04220201            0 10.91900  10.91900   0.00000
        *
04220300      CHKVLV
04220301          -1          0   0.00000   0.00000

04230000    MFW/HAIA    SNGLJUN
04230101   501010000 424000000   0.00000 218.49500 218.49500       0000
04230102     1.00000   0.60000
04230201            0 10.92000  10.92000   0.00000

04240000    MFW/HABA       PIPE
04240001           2
04240101      2.5360          1
04240102      2.5360          2
04240201      0.00000         1
04240301      0.00000         1
```

```
630     04240302      0.00000          2
631     04240401    606.82400          1
632     04240402    497.44800          2
633     04240501      0.00000          1
634     04240502      0.00000          2
635     04240601      0.00000          1
636     04240602     90.00000          2
637     04240701      0.00000          1
638     04240702      9.50000          2
639     04240801   150.00-06   0.00000D          1
640     04240802   150.00-06   0.00000D          2
641     04240901    48.10500   48.10500D          1
642     04241001          10          1
643     04241002          10          2
644     04241101        0000          1
645     04241201           0 1100.0000D 388.43900 0.00000D 0.00000D          1
646     04241202           0 1063.0000D 437.93400 0.00000D 0.00000D          2
647     04241300           0
648     04241301    11.29900   11.29900D  0.00000D          1
649
650     04250000    MFW/H80A    SNGL JUN
651     04250101  424010000  502000000    0.00000D 43.46900D 43.46900D       0000
652     04250102     1.00000D   0.60000
653     04250201           0  11.75500   11.75500D  0.00000D
654
655     04260000    MFW/ACHA       VALVE
656     04260101  502010000  427000000    2.53600 18.17500D 18.17500D       0100
657     04260102     1.00000D   0.60000
658     04260201           0  11.75900   11.75900D  0.00000D
659         *
660     04260300      CHKVLV
661     04260301          -1          0  0.00000D  0.00000D
662
663     04270000    MFW/SGIA      BRANCH
664     04270001           0          0
665     04270101     2.53600D   0.00000 164.82300D  0.00000D  0.00000D  0.00000D
666     04270102   150.00-06   0.00000          10
667     04270200           0 1000.0000D 438.12500D  0.00000D
668
669     04280000    MFW/MCVA       VALVE
670     04280101  427010000  429000000    2.53600 41.81200D 41.81200D       0100
671     04280102     1.00000D   0.60000
672     04280201           0  11.76100   11.76100D  0.00000D
673         *
674     04280300      MTRVLV
675     04280301          631        632 1.3910-01  0.50000D        428
676     20242800    NORMAREA
677     20242801     0.00000D   0.00000D
678     20242802     1.00000D   1.00000D
679
680     04290000    MFW/SGIA        PIPE
681     04290001           3
682     04290101     2.53600D          1
683     04290102     2.53600D          2
684     04290103     1.70400D          3
685     04290201     0.00000D          1
686     04290202     0.00000D          2
687     04290301     0.00000D          1
688     04290302     0.00000D          2
689     04290303     0.00000D          3
690     04290401   304.32000D          1
691     04290402   507.20000D          2
692     04290403   302.39200D          3
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```
693    04290501      0.00000          1
694    04290502      0.00000          2
695    04290503      0.00000          3
696    04290601      0.00000          1
697    04290602      0.00000          2
698    04290603      0.00000          3
699    04290701      0.00000          1
700    04290702      0.00000          2
701    04290703      0.00000          3
702    04290801   150.00-06    0.00000          1
703    04290802   150.00-06    0.00000          2
704    04290803   150.00-06    0.00000          3
705    04290901     6.543D0    6.543D0          1
706    04290902     2.954D0    2.954D0          2          .
707    04291001          10          1
708    04291002          10          2
709    04291003          10          3
710    04291101        0000          1
711    04291102        0000          2
712    04291201           0 965.00000 438.23100   0.000D0    0.000D0          1
713    04291202           0 960.00000 438.2460D   0.000D0    0.000D0          2
714    04291203           0 955.00000 438.2620D   0.000D0    0.000D0          3
715    04291300           0
716    04291301    11.764D0   11.764D0    0.000D0          1
717    04291302    17.509D0   17.509D0    0.000D0          2
718
719    04300000     MFW/HCHA      VALVE
720    04300101   429010000 431000000     1.704D0    2.954D0    2.954D0       0100
721    04300102     1.000D0     0.600D0
722    04300201           0   17.51000   17.510D0    0.00000
723          *
724    04300300      CHKVLV
725    04300301          -1          0    0.00000    0.00000
726
727    04310000     MFW/SGVA    TMDPVOL
728    04310101   100.0D+04    0.000D0 100.0D+04    0.00000    0.00000    0.00000
729    04310102     0.00000    0.00000          11
730    04310200           0          0
731    04310201     0.00000 950.00000 438.277D0    0.000D0
732    04310202    30.00000    50.000D0    58.000D0    0.000D0
733    04310203   100.0D+04    50.000D0    58.000D0    0.000D0
734
735    ***** MFW SGA/SGB CROSSOVERS SUBSYSTEM 0**********0**********0**********0**********0
736
737    05000000     MFW/MFPI     BRANCH
738    05000001           0          0
739    05000101     4.162D0    0.000D0 1169.52D0    0.00000    0.00000    0.00000
740    05000102   150.00-06    0.00000          10
741    05000200           0 389.00000 341.946D0    0.000D0
742
743    05010000     MFW/HPHI     BRANCH
744    05010001           0          0
745    05010101     4.162D0    0.00000 865.696D0    0.00000    0.00000    0.00000
746    05010102   150.0D-06    0.000D0          10
747    05010200           0 1255.0000 340.250D0    0.00000
748
749    05020000     MFW/MCVI     BRANCH
750    05020001           0          0
751    05020101     4.162D0    0.000D0 187.30300    0.00000   90.00000   40.00000
752    05020102   150.0D-06    0.000D0          10
753    05020200           0 1021.0000 438.061D0    0.00000
754
755    ***** MFW SGB CONDENSATE SUBSYSTEM ****0**********0**********0**********0**********0
```

```
05200000     MFW/PCHB      VALVE
05200101    500010000 521000000    2.53600    1.40300    1.40300       0100
05200102      1.00000    0.60000
05200201            0   10.9710D   10.9710D    0.00000
          *
05200300       CHKVLV
05200301           -1          0    0.00000    0.00000
          *

05210000     MFW/FAIB    SNGLVOL
05210101      2.53600    0.00000 598.4960D    0.00000    0.00000    0.00000
05210102   150.0D-06     0.00000         10
05210200            0 388.00000 341.9480D    0.00000

***** MFW SGB MAIN FEEDWATER PUMP SUBSYSTEM *****0*********0*********0*********0

05220000     MFW/MFPB       PUMP
05220101      1.11700    0.00000 417.0000D    0.00000    0.00000    0.00000
05220102            0
05220108   521010000     0.00000    2.6240D  100.00000       0000
05220109   501000000     0.00000    2.6900D  100.00000       0000
05220200            0 821.5000D 341.0980D    0.00000
05220201            0   24.9090D   24.9090D    0.00000
05220202            0   24.8500D   24.8500D    0.00000
05220301            0          0         -2          0          0        621
          *         0
05220302    5000.0000    1.00000 12459.0D0 2320.0000 100.0D-08 1843.21D0
05220303       0.0    1000.0000    0.00000 1000.0000    0.00000    0.00000
05220310   100.0D+04 100.0D+04 -10.0D+05
          *
05221100            1          1
05221101      0.00000    1.2070D
05221102      0.20000    1.0990D
05221103      0.40000    1.0520D
05221104      0.60000    1.0430D
05221105      0.80000    1.0300D
05221106      1.00000    1.00000
          *
05221200            2          1
05221201      0.00000    1.00000
05221202      1.00000    1.00000
          *
05221300            1          2
05221301      0.00000   -0.3000D
05221302      0.50000    0.00000
05221303      0.6250D    0.2860D
05221304      0.7140D    0.4220D
05221305      0.8330D    0.6380D
05221306      0.9990D    0.9980D
          *
05221400            2          2
05221401      0.00000   -0.1500D
05221402      0.50000    0.2500D
05221403      0.6250D    0.3910D
05221404      0.7140D    0.5100D
05221405      0.8330D    0.6940D
05221406      0.9990D    0.9980D
          *
05221500            1          3
05221501     -1.00000    1.2070D
05221502     -0.00000    1.2070D
          *
```

```
05221600           2           3
05221601    -1.00000    0.00000
05221602    -0.00000    0.00000
*
05221700           1           4
05221701    -0.99900 -100.0000
05221702    -0.00000 -100.0000
*
05221800           2           4
05221801    -0.99900  -0.00000
05221802    -0.00000  -0.00000
*
05223000           0
05223001     0.00000   0.00000
05223002     0.10000   0.00000
05223003     0.15000   0.05000
05223004     0.24000   0.80000
05223005     0.30000   0.96000
05223006     0.40000   0.98000
05223007     0.60000   0.97000
05223008     0.80000   0.90000
05223009     0.90000   0.80000
05223010     0.96000   0.50000
05223011     1.00000   0.00000
*
05223100           0
05223101     0.00000   0.00000
05223102     0.10000   0.00000
05223103     0.15000   0.05000
05223104     0.24000   0.80000
05223105     0.30000   0.96000
05223106     0.40000   0.98000
05223107     0.60000   0.97000
05223108     0.80000   0.90000
05223109     0.90000   0.80000
05223110     0.96000   0.50000
05223111     1.00000   0.00000
*
05226001     0.00000   1.00000
05226002   100.00+04   1.00000
*
05226100         623
05226101     0.00000 5000.0000
05226102    20.00000 3261.6700
05226103    40.00000 2622.1700
05226104    60.00000 2386.9100
05226105    90.00000 2280.5500
05226106   120.00000 2256.8200
05226107   180.00000 2250.0000
05226108   100.00+04 2250.0000

***** MFW SGB FEEDWATER SUBSYSTEM *****0*********0*********0*********0*********0

05230000    MFW/HAIB    SNGLJUN
05230101   501010000 524000000   0.00000 218.49500 218.49500       0000
05230102     1.00000   0.60000
05230201           0  10.92000  10.92000   0.00000

05240000    MFW/HABB       PIPE
05240001           2
05240101     2.53600          1
05240102     2.53600          2
05240201     0.00000          1
```

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882     05240301      0.00000          1
883     05240302      0.00000          2
884     05240401    613.82400          1
885     05240402    519.44800          2
886     05240501      0.00000          1
887     05240502      0.00000          2
888     05240601      0.00000          1
889     05240602     90.00000          2
890     05240701      0.00000          1
891     05240702      9.50000          2
892     05240801   150.0D-06    0.00000          1
893     05240802   150.0D-06    0.00000          2
894     05240901    48.10500   48.10500          1
895     05241001          10          1
896     05241002          10          2
897     05241101        0000          1
898     05241201           0 1100.0000 388.43900   0.00000   0.00000          1
899     05241202           0 1063.0000 437.93400   0.00000   0.00000          2
900     05241300           0
901     05241301    11.29900   11.29900   0.00000          1
902
903     05250000    MFW/HBOB    SNGLJUN
904     05250101   524010000  502000000   0.00000  43.46900  43.46900        0000
905     05250102     1.00000    0.60000
906     05250201           0  11.75500  11.75500   0.00000
907
908     05260000    MFW/ACHB      VALVE
909     05260101   502010000  527000000   2.53600  18.17500  18.17500        0100
910     05260102     1.00000    0.60000
911     05260201           0  11.75900  11.75900   0.00000
912          *
913     05260300      CHKVLV
914     05260301          -1          0   0.00000   0.00000
915
916     05270000    MFW/SGIB     BRANCH
917     05270001           0          0
918     05270101     2.53600    0.00000 164.82300   0.00000   0.00000   0.00000
919     05270102   150.0D-06    0.00000         10
920     05270200           0 1000.0000 438.12500   0.00000
921
922     05280000    MFW/MCVB      VALVE
923     05280101   527010000  529000000   2.53600  41.81200  41.81200        0100
924     05280102     1.00000    0.60000
925     05280201           0  11.76100  11.76100   0.00000
926          *
927     05280300      MTRVLV
928     05280301         633        634 1.3910-01   0.50000        528
929     20252800    NORMAREA
930     20252801     0.00000    0.00000
931     20252802     1.00000    1.00000
932
933     05290000    MFW/SGIB       PIPE
934     05290001            3
935     05290101     2.53600          1
936     05290102     2.53600          2
937     05290103     1.70400          3
938     05290201     0.00000          1
939     05290202     0.00000          2
940     05290301     0.00000          1
941     05290302     0.00000          2
942     05290303     0.00000          3
943     05290401   190.20000          1
944     05290402   190.20000          2
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 945    05290403   238.99200          3
 946    05290501     0.00000          1
 947    05290502     0.00000          2
 948    05290503     0.00000          3
 949    05290601     0.00000          1
 950    05290602     0.00000          2
 951    05290603     0.00000          3
 952    05290701     0.00000          1
 953    05290702     0.00000          2
 954    05290703     0.00000          3
 955    05290801   150.0D-06   0.00000          1
 956    05290802   150.0D-06   0.00000          2
 957    05290803   150.0D-06   0.00000          3
 958    05290901     6.5430D   6.5430D          1
 959    05290902     2.9540D   2.9540D          2
 960    05291001          10         1
 961    05291002          10         2
 962    05291003          10         3
 963    05291101        0000         1
 964    05291102        0000         2
 965    05291201           0 965.00000 438.2310D   0.0000D   0.00000          1
 966    05291202           0 960.00000 438.2460D   0.0000D   0.00000          2
 967    05291203           0 955.00000 438.2620D   0.0000D   0.00000          3
 968    05291300           0
 969    05291301    11.7640D  11.7640D   0.0000D          1
 970    05291302    17.5090D  17.5090D   0.0000D          2
 971
 972    05300000     MFW/HCHB      VALVE
 973    05300101   529010000 531000000    1.7040D   2.9540D   2.9540D       0100
 974    05300102     1.00000   0.6000D
 975    05300201           0  17.5100D  17.5100D   0.0000D
 976           *
 977    05300300       CHKVLV
 978    05300301          -1          0   0.0000D   0.0000D
 979
 980    05310000     MFW/SGV8    TMDPVOL
 981    05310101   100.0D+04   0.00000 100.0D+04   0.0000D   0.0000D   0.0000D
 982    05310102     0.0000D   0.00000         11
 983    05310200           0         0
 984    05310201     0.0000D 950.0000D 438.2770D   0.0000D
 985    05310202    30.0000D 950.0000D 438.2770D   0.0000D
 986    05310203   100.0D+04 950.0000D 438.2770D   0.0000D
 987
 988    ***** EFW SGA (MOTOR) SUBSYSTEM ********0*********0*********0*********0*********0
 989
 990    06020000     EFW/CHWL    TMDPVOL
 991    06020101   100.0D+04   0.00000 100.0D+04   0.0000D   0.0000D   0.0000D
 992    06020102     0.0000D   0.00000         11
 993    06020200           0         0
 994    06020201     0.0000D   7.2080D  58.0150D   0.0000D
 995    06020202   100.0D+04   7.2080D  58.0150D   0.0000D
 996
 997    ***** EFW SGA MOTOR-DRIVEN PUMP SUBSYSTEM ********0*********0*********0*********0
 998
 999    06030000     EFW/MDPA       PUMP
1000    06030101     0.3170D   0.00000  20.0000D   0.0000D   0.0000D   0.0000D
1001    06030102           0
1002    06030108   602000000   0.00000 498.2050D 100.0D+04      0000
1003    06030109   604000000   0.00000 114.6460D 100.0D+04      0000
1004    06030200           0   7.2080D  58.0150D   0.0000D
1005    06030201           0   0.00000   0.0000D   0.0000D
1006    06030202           0   0.00000   0.0000D   0.0000D
1007    06030301           0         0        -2         0         0       642
```

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          *          0
06030302   3560.0000   0.00000 500.00000 2750.0000 100.0D-08 1843.2100
06030303     0.0     1000.0000   0.00000 1000.0000   0.00000   0.00000
06030310   100.0D+04 100.0D+04 -10.0D+05
          *
06031100           1         1
06031101     0.00000   1.21800
06031102     0.20000   1.21800
06031103     0.40000   1.20000
06031104     0.60000   1.18200
06031105     0.80000   1.09100
06031106     1.00000   1.00000
          *
06031200           2         1
06031201     0.00000   1.00000
06031202     1.00000   1.00000
          *
06031300           1         2
06031301     0.00000   0.00000
06031302     0.50000   0.09100
06031303     0.62500   0.20600
06031304     0.71400   0.35300
06031305     0.83300   0.59400
06031306     0.99900   0.99800
          *
06031400           2         2
06031401     0.00000   0.00000
06031402     0.50000   0.25000
06031403     0.62500   0.39100
06031404     0.71400   0.51000
06031405     0.83300   0.69400
06031406     0.99900   0.99800
          *
06031500           1         3
06031501    -1.00000   1.21800
06031502    -0.00000   1.21800
          *
06031600           2         3
06031601    -1.00000   0.00000
06031602    -0.00000   0.00000
          *
06031700           1         4
06031701    -0.99900 -100.0000
06031702    -0.00000 -100.0000
          *
06031800           2         4
06031801    -0.99900  -0.00000
06031802    -0.00000  -0.00000
          *
06033000           0
06033001     0.00000   0.00000
06033002     0.10000   0.00000
06033003     0.15000   0.05000
06033004     0.24000   0.80000
06033005     0.30000   0.96000
06033006     0.40000   0.98000
06033007     0.60000   0.97000
06033008     0.80000   0.90000
06033009     0.90000   0.80000
06033010     0.96000   0.50000
06033011     1.00000   0.00000
          *
06033100           0
```

```
06033101      0.00000    0.00000
06033102      0.10000    0.00000
06033103      0.15000    0.05000
06033104      0.24000    0.80000
06033105      0.30000    0.96000
06033106      0.40000    0.98000
06033107      0.60000    0.97000
06033108      0.80000    0.90000
06033109      0.90000    0.80000
06033110      0.96000    0.50000
06033111      1.00000    0.00000
*
06036001      0.00000    1.00000
06036002   100.00+04     1.00000
*
06036100          647
06036101      0.00000    0.00000
06036102      1.00000  787.46900
06036103      2.00000 1400.86000
06036104      3.00000 1878.26000
06036105      4.00000 2250.28000
06036106      5.00000 2540.06000
06036107      6.00000 2765.76000
06036108      7.00000 2941.27000
06036109      8.00000 3078.33000
06036110      9.00000 3184.78000
06036111     10.00000 3267.72000
06036112     11.00000 3332.52000
06036113     12.00000 3382.71000
06036114     15.00000 3560.00000
06036115   100.00+04  3560.00000

***** EFW SGA (MOTOR) SUBSYSTEM (CONT'D) ********0*********0*********0*********0

06040000    EFW/MDPA       PIPE
06040001           2
06040101     0.18100          1
06040102     0.18100          2
06040201     0.00000          1
06040301     0.00000          1
06040302     0.00000          2
06040401    20.00000          1
06040402    20.00000          2
06040501     0.00000          1
06040502     0.00000          2
06040601     0.00000          1
06040602     0.00000          2
06040701     0.00000          1
06040702     0.00000          2
06040801   150.00-06    0.00000          1
06040802   150.00-06    0.00000          2
06040901   197.083D0  197.083D0          1
06041001          10          1
06041002          10          2
06041101        0000          1
06041201           0    7.208D0  58.015D0   0.000D0   0.000D0          1
06041202           0    7.208D0  58.015D0   0.000D0   0.000D0          2
06041300           0
06041301     0.00000    0.000D0   0.00000          1

06050000    EFW/MDPA      VALVE
06050101   604010000  606000000   0.181D0 154.804D0 154.804D0       0100
06050102     1.00000    0.60000
```

```
1134    06050201          0 -10.0D-07 -10.0D-07   0.00000
1135          *
1136    06050300      CHKVLV
1137    06050301          -1          1   0.00000   0.00000
1138
1139    06060000     EFW/MDPA     BRANCH
1140    06060001            0          0
1141    06060101       0.181D0   0.00000  40.00000   0.00000  90.00000  49.50000
1142    06060102    150.0D-06    0.00000         10
1143    06060200            0 1008.81D0 438.098D0   0.00000
1144
1145    06070000     EFW/MDPA    SNGLJUN
1146    06070101    606010000 608000000   0.00000  14.076D0  14.076D0      0000
1147    06070102       1.00000   0.60000
1148    06070201            0   0.00000   0.00000   0.00000
1149
1150    06080000     EFW/AFWA     BRANCH
1151    06080001            0          0
1152    06080101       0.181D0   0.00000  80.00000   0.00000   0.00000   0.00000
1153    06080102    150.0D-06    0.00000         10
1154    06080200            0 1000.0000 438.125D0   0.00000
1155
1156    06090000     EFW/AFWA      VALVE
1157    06090101    427010000 608000000   0.181D0   0.00000   0.00000      0100
1158    06090102       1.00000   0.60000
1159    06090201            0 100.0D-08 100.0D-08   0.00000
1160          *
1161    06090300      CHKVLV
1162    06090301          -1          0   0.00000   0.00000
1163
1164    06100000     EFW/SGIA      VALVE
1165    06100101    608010000 611000000   0.181D0   4.716D0   4.716D0      0100
1166    06100102       1.00000   0.60000
1167    06100201            0   0.00000   0.00000   0.00000
1168          *
1169    06100300      MTRVLV
1170    06100301         651         652 5.207D-01   0.00000       610
1171    20261000    NORMAREA
1172    20261001     0.00000   0.00000
1173    20261002     1.00000   1.00000
1174
1175    06110000     EFW/SGIA       PIPE
1176    06110001            3
1177    06110101       0.181D0          1
1178    06110102       0.181D0          2
1179    06110103       0.181D0          3
1180    06110201       0.00000          1
1181    06110202       0.00000          2
1182    06110301       0.00000          1
1183    06110302       0.00000          2
1184    06110303       0.00000          3
1185    06110401      21.720D0          1
1186    06110402      36.200D0          2
1187    06110403      26.629D0          3
1188    06110501       0.00000          1
1189    06110502       0.00000          2
1190    06110503       0.00000          3
1191    06110601       0.00000          1
1192    06110602      90.00000          2
1193    06110603       0.00000          3
1194    06110701       0.00000          1
1195    06110702      20.00000          2
1196    06110703       0.00000          3
```

```
06110801   150.00-06   0.00000          1
06110802   150.00-06   0.00000          2
06110803   150.00-06   0.00000          3
06110901     0.53500   0.53500          1
06110902     0.06400   0.06400          2
06111001          10         1
06111002          10         2
06111003          10         3
06111101        0000         1
06111102        0000         2
06111201           0 925.25600 1145.7900   1.00000   0.00000          1
06111202           0 925.12800 1145.8000   1.00000   0.00000          2
06111203           0 925.00000 1145.8200   1.00000   0.00000          3
06111300           0
06111301     0.00000   0.00000   0.00000          1
06111302     0.00000   0.00000   0.00000          2

06120000    EFW/MCHA     VALVE
06120101   611010000 613000000   0.18100   0.94300   0.94300       0100
06120102     1.00000   0.60000
06120201           0 100.00-08 100.00-08   0.00000
         *
06120300     CHKVLV
06120301          -1         0   0.00000   0.00000

06130000    EFW/SGVA   TMDPVOL
06130101   100.00+04   0.00000 100.00+04   0.00000   0.00000   0.00000
06130102     0.00000   0.00000         11
06130200           0         0
06130201     0.00000 925.00000 1145.8200   1.00000
06130202    30.00000  25.00000  58.00900   0.00000
06130203   100.00+04  25.00000  58.00900   0.00000

***** EFW SGB (MOTOR) SUBSYSTEM ********0**********0**********0**********0**********0

06240000    EFW/CHWL   TMDPVOL
06240101   100.00+04   0.00000 100.00+04   0.00000   0.00000   0.00000
06240102     0.00000   0.00000         11
06240200           0         0
06240201     0.00000   7.20800  58.01500   0.00000
06240202   100.00+04   7.20800  58.01500   0.00000

***** EFW SGA MOTOR-DRIVEN PUMP SUBSYSTEM ********0**********0**********0**********0

06250000    EFW/MDPB      PUMP
06250101     0.31700   0.00000  20.00000   0.00000   0.00000   0.00000
06250102           0
06250108   624000000   0.00000 498.20500 100.00+04      0000
06250109   626000000   0.00000 114.64600 100.00+04      0000
06250200           0   7.20800  58.01500   0.00000
06250201           0   0.00000   0.00000   0.00000
06250202           0   0.00000   0.00000   0.00000
06250301           0         0        -2         0         0       644
         *         0
06250302   3560.0000   0.00000 500.00000 2750.0000 100.00-08 1843.2100
06250303        0.0 1000.0000   0.00000 1000.0000   0.00000   0.00000
06250310   100.00+04 100.00+04 -10.00+05
         *
06251100          1         1
06251101     0.00000   1.21800
06251102     0.20000   1.21800
06251103     0.40000   1.20000
06251104     0.60000   1.18200
```

```
1260    06251105      0.80000   1.09100
1261    06251106      1.00000   1.00000
1262          *
1263    06251200            2         1
1264    06251201      0.00000   1.00000
1265    06251202      1.00000   1.00000
1266          *
1267    06251300            1         2
1268    06251301      0.00000   0.00000
1269    06251302      0.50000   0.09100
1270    06251303      0.62500   0.20600
1271    06251304      0.71400   0.35300
1272    06251305      0.83300   0.59400
1273    06251306      0.99900   0.99800
1274          *
1275    06251400            2         2
1276    06251401      0.00000   0.00000
1277    06251402      0.50000   0.25000
1278    06251403      0.62500   0.39100
1279    06251404      0.71400   0.51000
1280    06251405      0.83300   0.69400
1281    06251406      0.99900   0.99800
1282          *
1283    06251500            1         3
1284    06251501     -1.00000   1.21800
1285    06251502     -0.00000   1.21800
1286          *
1287    06251600            2         3
1288    06251601     -1.00000   0.00000
1289    06251602     -0.00000   0.00000
1290          *
1291    06251700            1         4
1292    06251701     -0.99900 -100.0000
1293    06251702     -0.00000 -100.0000
1294          *
1295    06251800            2         4
1296    06251801     -0.99900  -0.00000
1297    06251802     -0.00000  -0.00000
1298          *
1299    06253000            0
1300    06253001      0.00000   0.00000
1301    06253002      0.10000   0.00000
1302    06253003      0.15000   0.05000
1303    06253004      0.24000   0.80000
1304    06253005      0.30000   0.96000
1305    06253006      0.40000   0.98000
1306    06253007      0.60000   0.97000
1307    06253008      0.80000   0.90000
1308    06253009      0.90000   0.80000
1309    06253010      0.96000   0.50000
1310    06253011      1.00000   0.00000
1311          *
1312    06253100            0
1313    06253101      0.00000   0.00000
1314    06253102      0.10000   0.00000
1315    06253103      0.15000   0.05000
1316    06253104      0.24000   0.80000
1317    06253105      0.30000   0.96000
1318    06253106      0.40000   0.98000
1319    06253107      0.60000   0.97000
1320    06253108      0.80000   0.90000
1321    06253109      0.90000   0.80000
1322    06253110      0.96000   0.50000
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1323    06253111      1.00000    0.00000
1324          *
1325    06256001      0.00000    1.00000
1326    06256002    100.00+04    1.00000
1327          *
1328    06256100          648
1329    06256101      0.00000    0.00000
1330    06256102      1.00000  787.46900
1331    06256103      2.00000 1400.8600
1332    06256104      3.00000 1878.2600
1333    06256105      4.00000 2250.2800
1334    06256106      5.00000 2540.0600
1335    06256107      6.00000 2765.7600
1336    06256108      7.00000 2941.2700
1337    06256109      8.00000 3078.3300
1338    06256110      9.00000 3184.7800
1339    06256111     10.00000 3267.7200
1340    06256112     11.00000 3332.5200
1341    06256113     12.00000 3382.7100
1342    06256114     15.00000 3560.0000
1343    06256115    100.00+04 3560.0000
1344
1345    ***** EFW SGB (MOTOR) SUBSYSTEM (CONT'D) *********0*********0*********0**********0
1346
1347    06260000    EFW/MDPB       PIPE
1348    06260001           2
1349    06260101     0.18100          1
1350    06260102     0.18100          2
1351    06260201     0.00000          1
1352    06260301     0.00000          1
1353    06260302     0.00000          2
1354    06260401    20.00000          1
1355    06260402    20.00000          2
1356    06260501     0.00000          1
1357    06260502     0.00000          2
1358    06260601     0.00000          1
1359    06260602     0.00000          2
1360    06260701     0.00000          1
1361    06260702     0.00000          2
1362    06260801   150.00-06   0.00000          1
1363    06260802   150.00-06   0.00000          2
1364    06260901   197.08300 197.08300          1
1365    06261001          10          1
1366    06261002          10          2
1367    06261101        0000          1
1368    06261201           0   7.20800  58.01500   0.00000   0.00000          1
1369    06261202           0   7.20800  58.01500   0.00000   0.00000          2
1370    06261300           0
1371    06261301     0.00000   0.00000   0.00000          1
1372
1373    06270000    EFW/MDPB       VALVE
1374    06270101   626010000 628000000   0.1810 154.8040 154.8040       0100
1375    06270102     1.00000   0.60000
1376    06270201           0 -10.00-07 -10.00-07   0.00000
1377          *
1378    06270300       CHKVLV
1379    06270301          -1          1   0.00000   0.00000
1380
1381    06280000    EFW/MDPB      BRANCH
1382    06280001           0           0
1383    06280101     0.1810D   0.00000  40.00000   0.00000  90.00000  49.5000D
1384    06280102   150.00-06   0.00000          10
1385    06280200           0 1008.81D0 438.0980D   0.00000
```

```
1386
1387    06290000    EFW/MDPB    SNGLJUN
1388    06290101  628010000 630000000    0.00000  14.07600  14.07600       0000
1389    06290102    1.00000   0.60000
1390    06290201          0   0.00000   0.00000   0.00000
1391
1392    06300000    EFW/AFW8      BRANCH
1393    06300001          0          0
1394    06300101     0.1310D   0.00000  80.00000   0.00000   0.00000D0  0.00000
1395    06300102  150.00-06    0.00000        10
1396    06300200          0 1000.0000 438.12500   0.00000
1397
1398    06310000    EFW/AFW8       VALVE
1399    06310101  527010000 630000000    0.1810D   0.00000   0.00000D       0100
1400    06310102    1.00000   0.60000
1401    06310201          0 100.00-08 100.00-08   0.00000
1402          *
1403    06310300      CHKVLV
1404    06310301          -1          0   0.00000   0.00000
1405
1406    06320000    EFW/SG1B       VALVE
1407    06320101  630010000 633000000    0.1810D   4.71600   4.71600D       0100
1408    06320102    1.00000   0.60000
1409    06320201          0   0.00000   0.00000   0.00000
1410          *
1411    06320300      MTRVLV
1412    06320301         653         654 5.2070-01   0.00000D       632
1413    20263200    NORMAREA
1414    20263201     0.00000D   0.00000
1415    20263202     1.00000D   1.00000
1416
1417    06330000    EFW/SG1B        PIPE
1418    06330001            3
1419    06330101     0.1810D           1
1420    06330102     0.1810D           2
1421    06330103     0.1810D           3
1422    06330201     0.00000           1
1423    06330202     0.00000           2
1424    06330301     0.00000D          1
1425    06330302     0.00000           2
1426    06330303     0.00000           3
1427    06330401    13.57500           1
1428    06330402    13.57500           2
1429    06330403    22.1010D           3
1430    06330501     0.00000           1
1431    06330502     0.00000           2
1432    06330503     0.00000           3
1433    06330601     0.00000           1
1434    06330602    90.00000           2
1435    06330603     0.00000           3
1436    06330701     0.00000           1
1437    06330702    20.00000           2
1438    06330703     0.00000           3
1439    06330801  150.00-06    0.00000           1
1440    06330802  150.00-06    0.00000           2
1441    06330803  150.00-06    0.00000           3
1442    06330901     0.5350D   0.5350D           1
1443    06330902     0.0640D   0.0640D           2
1444    06331001          10          1
1445    06331002          10          2
1446    06331003          10          3
1447    06331101        0000          1
1448    06331102        0000          2
```

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1449    06331201          0 925.25600 1145.7900   1.00000   0.00000         1
1450    06331202          0 925.12800 1145.8000   1.00000   0.00000         2
1451    06331203          0 925.00000 1145.8200   1.00000   0.00000         3
1452    06331300          0
1453    06331301    0.00000   0.00000   0.00000         1
1454    06331302    0.00000   0.00000   0.00000         2
1455
1456    06340000    EFW/HCHB     VALVE
1457    06340101  633010000 635000000   0.1810D   0.943D0   0.943D0      0100
1458    06340102    1.00000   0.60000
1459    06340201          0 100.0D-08 100.0D-08   0.00000
1460          *
1461    06340300     CHKVLV
1462    06340301         -1         0   0.00000   0.00000
1463
1464    06350000    EFW/SGVB   TMDPVOL
1465    06350101  100.0D+04   0.00000 100.0D+04   0.00000   0.00000   0.00000
1466    06350102    0.00000   0.00000        11
1467    06350200          0         0
1468    06350201    0.00000 925.00000 1145.8200   1.00000
1469    06350202   30.00000 925.00000 1145.8200   1.00000
1470    06350203  100.0D+04 925.00000 1145.8200   1.00000
1471
1472    ***** EFW SGA/SGB (TURBINE) SUBSYSTEM *0*********0*********0*********0*********0
1473
1474    06520000    EFW/CHWL   TMDPVOL
1475    06520101  100.0D+04   0.00000 100.0D+04   0.00000   0.00000   0.00000
1476    06520102    0.00000   0.00000        11
1477    06520200          0         0
1478    06520201    0.00000   7.208D0  58.015D0   0.00000
1479    06520202  100.0D+04   7.208D0  58.015D0   0.00000
1480
1481    ***** EFW SGA/SGB TURBINE-DRIVEN PUMP SUBSYSTEM *0*********0*********0*********0
1482
1483    06530000    EFW/TBDP      PUMP
1484    06530101    0.317D0   0.00000  20.000D0   0.00000   0.00000   0.00000
1485    06530102          0
1486    06530108  652000000   0.00000 124.514D0 100.0D+04      0000
1487    06530109  654000000   0.00000  28.656D0 100.0D+04      0000
1488    06530200          0   7.208D0  58.015D0   0.00000
1489    06530201          0   0.00000   0.00000   0.00000
1490    06530202          0   0.00000   0.00000   0.00000
1491    06530301          0         0        -2         0         0       646
1492          *           0
1493    06530302   3575.00D0   0.00000 1000.0000 2750.0000 100.0D-08 1843.21D0
1494    06530303     0.0     1000.0000   0.00000 1000.0000   0.00000   0.00000
1495    06530310  100.0D+04 100.0D+04 -10.0D+05
1496          *
1497    06531100          1         1
1498    06531101    0.00000   1.218D0
1499    06531102    0.20000   1.200D0
1500    06531103    0.40000   1.182D0
1501    06531104    0.60000   1.145D0
1502    06531105    0.80000   1.091D0
1503    06531106    1.00000   1.000D0
1504          *
1505    06531200          2         1
1506    06531201    0.00000   1.00000
1507    06531202    1.00000   1.00000
1508          *
1509    06531300          1         2
1510    06531301    0.00000   0.000D0
1511    06531302    0.50000   0.123D0
```

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1512    06531303      0.62500   0.24100
1513    06531304      0.71400   0.38000
1514    06531305      0.83300   0.60600
1515    06531306      0.99900   0.99800
1516          *
1517    06531400            2         2
1518    06531401      0.00000   0.00000
1519    06531402      0.50000   0.25000
1520    06531403      0.62500   0.39100
1521    06531404      0.71400   0.51000
1522    06531405      0.83300   0.69400
1523    06531406      0.99900   0.99800
1524          *
1525    06531500            1         3
1526    06531501     -1.00000   1.21800
1527    06531502     -0.00000   1.21800
1528          *
1529    06531600            2         3
1530    06531601     -1.00000   0.00000
1531    06531602     -0.00000   0.00000
1532          *
1533    06531700            1         4
1534    06531701     -0.99900 -100.0000
1535    06531702     -0.00000 -100.0000
1536          *
1537    06531800            2         4
1538    06531801     -0.99900  -0.00000
1539    06531802     -0.00000  -0.00000
1540          *
1541    06533000            0
1542    06533001      0.00000   0.00000
1543    06533002      0.10000   0.00000
1544    06533003      0.15000   0.05000
1545    06533004      0.24000   0.80000
1546    06533005      0.30000   0.96000
1547    06533006      0.40000   0.98000
1548    06533007      0.60000   0.97000
1549    06533008      0.80000   0.90000
1550    06533009      0.90000   0.80000
1551    06533010      0.96000   0.50000
1552    06533011      1.00000   0.00000
1553          *
1554    06533100            0
1555    06533101      0.00000   0.00000
1556    06533102      0.10000   0.00000
1557    06533103      0.15000   0.05000
1558    06533104      0.24000   0.80000
1559    06533105      0.30000   0.96000
1560    06533106      0.40000   0.98000
1561    06533107      0.60000   0.97000
1562    06533108      0.80000   0.90000
1563    06533109      0.90000   0.80000
1564    06533110      0.96000   0.50000
1565    06533111      1.00000   0.00000
1566          *
1567    06536001      0.00000   1.00000
1568    06536002    100.00+04   1.00000
1569          *
1570    06536100          649
1571    06536101      0.00000   0.00000
1572    06536102      1.00000 790.79000
1573    06536103      2.00000 1406.7600
1574    06536104      3.00000 1886.1700
```

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06536105      4.00000  2259.7600
06536106      5.00000  2550.7600
06536107      6.00000  2777.4200
06536108      7.00000  2953.6600
06536109      8.00000  3091.3000
06536110      9.00000  3198.1900
06536111     10.00000  3281.4900
06536112     11.00000  3346.5600
06536113     12.00000  3396.9600
06536114     15.00000  3575.0000
06536115    100.00+04  3575.0000

***** EFW SGA/SGB (TURBINE) SUBSYSTEM (CONT'D) **0*********0*********0*********0

06540000    EFW/TLIN       PIPE
06540001           2
06540101      0.1810          1
06540102      0.1810          2
06540201      0.00000         1
06540301      0.00000         1
06540302      0.00000         2
06540401     20.00000         1
06540402     20.00000         2
06540501      0.00000         1
06540502      0.00000         2
06540601      0.00000         1
06540602      0.00000         2
06540701      0.00000         1
06540702      0.00000         2
06540801   150.00-06   0.00000         1
06540802   150.00-06   0.00000         2
06540901    49.26600  49.26600         1
06541001          10         1
06541002          10         2
06541101        0000         1
06541201           0   7.2080  58.0150   0.00000   0.00000         1
06541202           0   7.2080  58.0150   0.00000   0.00000         2
06541300           0
06541301     0.00000   0.00000   0.00000         1

06550000    EFW/TLIN    SNGLJUN
06550101   654010000 656000000   0.00000  24.6280  24.6280      0000
06550102     1.00000   0.6000
06550201           0   0.00000   0.00000   0.00000

06560000    EFW/TLIN     BRANCH
06560001           0          0
06560101      0.1810    0.00000  23.7490   0.00000   0.00000   0.00000
06560102   150.00-06    0.00000        10
06560200           0    7.2080  58.0150   0.00000

06570000    EFW/TLIN      VALVE
06570101   656010000 628000000   0.1810  56.3040  56.3040      0100
06570102     1.00000   0.6000
06570201           0 -10.00-07 -10.00-07   0.00000
          *
06570300      CHKVLV
06570301          -1          1   0.00000   0.00000

06580000    EFW/TLIN    SNGLJUN
06580101   656010000 659000000   0.00000   0.00000   0.00000      0000
06580102     1.00000   0.6000
06580201           0   0.00000   0.00000   0.00000
```

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1638
1639    06590000    EFW/TLIN     BRANCH
1640    06590001           0          0
1641    06590101     0.18100   0.00000D  22.45100   0.00000    0.00000    0.00000
1642    06590102   150.00-06   0.00000D        10
1643    06590200           0   7.20800  58.01500   0.00000
1644
1645    06600000    EFW/TLIN      VALVE
1646    06600101   659010000 606000000    0.18100  56.30400  56.30400       0100
1647    06600102     1.00000   0.60000
1648    06600201           0 -10.00-07 -10.00-07   0.00000
1649          *
1650    06600300      CHKVLV
1651    06600301          -1          1   0.00000   0.00000
1652
1653    $$$$$ MFW PLANT HEAT DUMP ACTIVE HEAT STRUCTURE $0$$$$$$$$$$0$$$$$$$$$$0$$$$$$$$$$0
1654
1655    14002000           1          5          2          1  0.8985D0
1656    14002100           0          1
1657    14002101           4   1.00000
1658    14002201         400          1
1659    14002202         400          2
1660    14002203         400          3
1661    14002204         400          4
1662    14002301     1.00000          1
1663    14002302     1.00000          2
1664    14002303     1.00000          3
1665    14002304     1.00000          4
1666    14002400           0
1667    14002401    95.00000          5
1668    14002501   402020000          0          1          1 295.741D0          1
1669    14002601           0          0          0          1 295.741D0          1
1670    14002701         400   1.00000  0.00000   0.00000          1
1671    14002801           0   0.00000  0.00000 295.741D0          1
1672          *
1673    20140000    TBL/FCTN          1          1
1674    20140001    32.00000 100.00+04
1675    20140002  1500.00000 100.00+04
1676    20140051    32.00000  60.191D0
1677    20140052  1500.00000  60.191D0
1678          *
1679    20240000       POWER
1680    20240001     0.00000   9.295D0
1681    20240002     5.00000   9.295D0
1682    20240003   100.00+04   9.295D0
1683
1684    $$$$$ MFW CAPACITIVE HEAT STRUCTURE : SEGMENT 01 0$$$$$$$$$$0$$$$$$$$$$0$$$$$$$$$$0
1685
1686    14012000           1          5          2          1  0.8985D0
1687    14012100           0          1
1688    14012101           4   1.00000
1689    14012201         401          1
1690    14012202         401          2
1691    14012203         401          3
1692    14012204         401          4
1693    14012301     1.00000          1
1694    14012302     1.00000          2
1695    14012303     1.00000          3
1696    14012304     1.00000          4
1697    14012400           0
1698    14012401    95.00000          5
1699    14012501   402020000          0          1          1 3205.47D0          1
1700    14012601           0          0          0          1 3205.47D0          1
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14012701           0   0.00000D0   0.00000   0.00000          1
14012801           0   0.00000D0   0.00000 3205.47D0          1
      *
20140100    TBL/FCTN           1         1
20140101    32.00000 739.1D-05
20140102  1500.00000 739.1D-05
20140151    32.00000 2139.92D0
20140152  1500.00000 2139.92D0

$$$$$ MFW LOW-PRESSURE F HEATERS ACTIVE HEAT STRUCTURE $$$$0$$$$$$$$$$0$$$$$$$$$$0

14022000           1         5         2         1  0.8985D0
14022100           0         1
14022101           4  0.8997D0
14022201         402         1
14022202         402         2
14022203         402         3
14022204         402         4
14022301     1.00000         1
14022302     1.00000         2
14022303     1.00000         3
14022304     1.00000         4
14022400           0
14022401   160.00000         5
14022501   404010000         0         1         1 11159.4D0          1
14022601           0         0         0         1 11159.4D0          1
14022701         402   1.00000   0.000D0   0.00000          1
14022801           0   0.000D0   0.000D0 11159.4D0          1
      *
20140200    TBL/FCTN           1         1
20140201    32.00000 100.0D+04
20140202  1500.00000 100.0D+04
20140251    32.00000  30.602D0
20140252  1500.00000  30.602D0
      *
20240200       POWER
20240201     0.00000 120.765D0
20240202     5.00000   0.00000
20240203   100.0D+04   0.00000

$$$$$ MFW LOW-PRESSURE E HEATERS ACTIVE HEAT STRUCTURE $$$$0$$$$$$$$$$0$$$$$$$$$$0

14032000           1         5         2         1  0.5963D0
14032100           0         1
14032101           4  0.5975D0
14032201         403         1
14032202         403         2
14032203         403         3
14032204         403         4
14032301     1.00000         1
14032302     1.00000         2
14032303     1.00000         3
14032304     1.00000         4
14032400           0
14032401   230.00000         5
14032501   404020000         0         1         1 11210.000          1
14032601           0         0         0         1 11210.000          1
14032701         403   1.00000   0.00000   0.000D0          1
14032801           0   0.00000   0.00000 11210.000          1
      *
20140300    TBL/FCTN           1         1
20140301    32.00000 100.0D+04
20140302  1500.00000 100.0D+04
```

```
20140351    32.00000  30.10500
20140352  1500.00000  30.10500
*
20240300       POWER
20240301     0.00000 130.81800
20240302     5.00000   0.00000
20240303   100.00+04   0.00000

$$$$$ NEW LOW-PRESSURE D HEATERS ACTIVE HEAT STRUCTURE $$$$0$$$$$$$$$$0$$$$$$$$$0

14042000           1         5         2         1  0.898500
14042100           0         1
14042101           4  0.899700
14042201         404         1
14042202         404         2
14042203         404         3
14042204         404         4
14042301     1.00000         1
14042302     1.00000         2
14042303     1.00000         3
14042304     1.00000         4
14042400           0
14042401   300.00000         5
14042501   408010000         0         1         1 7439.6300         1
14042601           0         0         0         1 7439.6300         1
14042701         404   1.00000   0.00000   0.00000         1
14042801           0   0.00000   0.00000 7439.6300         1
*
20140400    TBL/FCTN         1         1
20140401    32.00000 100.00+04
20140402  1500.00000 100.00+04
20140451    32.00000  29.57200
20140452  1500.00000  29.57200
*
20240400       POWER
20240401     0.00000 145.98000
20240402     5.00000   0.00000
20240403   100.00+04   0.00000

$$$$$ NEW LOW-PRESSURE C HEATERS ACTIVE HEAT STRUCTURE $$$$0$$$$$$$$$$0$$$$$$$$$0

14052000           1         5         2         1  1.151000
14052100           0         1
14052101           4  1.152200
14052201         405         1
14052202         405         2
14052203         405         3
14052204         405         4
14052301     1.00000         1
14052302     1.00000         2
14052303     1.00000         3
14052304     1.00000         4
14052400           0
14052401   370.00000         5
14052501   412010000         0         1         1 5807.5700         1
14052601           0         0         0         1 5807.5700         1
14052701         405   1.00000   0.00000   0.00000         1
14052801           0   0.00000   0.00000 5807.5700         1
*
20140500    TBL/FCTN         1         1
20140501    32.00000 100.00+04
20140502  1500.00000 100.00+04
20140551    32.00000  29.17000
```

```
20140552  1500.00000  29.17000
*
20240500       POWER
20240501     0.00000 247.30600
20240502     5.00000   0.00000
20240503   100.00+04   0.00000

$$$$$ MFW SGA HIGH-PRESSURE A HEATER ACTIVE HEAT STRUCTURE O$$$$$$$$$$O$$$$$$$$$$O

14202000           1         5         2         1  0.89850D0
14202100           0         1
14202101           4  0.90470D0
14202201         420         1
14202202         420         2
14202203         420         3
14202204         420         4
14202301     1.00000         1
14202302     1.00000         2
14202303     1.00000         3
14202304     1.00000         4
14202400           0
14202401   415.00000         5
14202501   424010000         0         1         1 3631.2500         1
14202601           0         0         0         1 3631.2500         1
14202701         420   1.00000   0.00000   0.00000         1
14202801           0   0.00000   0.00000 3631.2500         1
*
20142000    TBL/FCTN         1         1
20142001    32.00000 100.00+04
20142002  1500.00000 100.00+04
20142051    32.00000  29.20300
20142052  1500.00000  29.20300
*
20242000       POWER
20242001     0.00000  77.35400
20242002     5.00000   0.00000
20242003   100.00+04   0.00000

$$$$$ MFW SGA HIGH-PRESSURE B HEATER ACTIVE HEAT STRUCTURE O$$$$$$$$$$O$$$$$$$$$$O

14212000           1         5         2         1  0.89850D0
14212100           0         1
14212101           4  0.90470D0
14212201         421         1
14212202         421         2
14212203         421         3
14212204         421         4
14212301     1.00000         1
14212302     1.00000         2
14212303     1.00000         3
14212304     1.00000         4
14212400           0
14212401   460.00000         5
14212501   424020000         0         1         1 3896.9500         1
14212601           0         0         0         1 3896.9500         1
14212701         421   1.00000   0.00000   0.00000         1
14212801           0   0.00000   0.00000 3896.9500         1
*
20142100    TBL/FCTN         1         1
20142101    32.00000 100.00+04
20142102  1500.00000 100.00+04
20142151    32.00000  29.54300
20142152  1500.00000  29.54300
```

```
1890            *
1891     20242100        POWER
1892     20242101      0.00000   79.837D0
1893     20242102      5.00000    0.00000
1894     20242103    100.0D+04    0.00000
1895
1896     $$$$$ MFW CAPACITIVE HEAT STRUCTURE : SEGMENT 02 0$$$$$$$$$$0$$$$$$$$$$0$$$$$$$$$$0
1897
1898     15002000            1          5          2          1  1.151000
1899     15002100            0          1
1900     15002101            4   1.250000
1901     15002201          500          1
1902     15002202          500          2
1903     15002203          500          3
1904     15002204          500          4
1905     15002301      1.00000          1
1906     15002302      1.00000          2
1907     15002303      1.00000          3
1908     15002304      1.00000          4
1909     15002400            0
1910     15002401    370.00000          5
1911     15002501    500010000          0          1          1 2598.5800          1
1912     15002601            0          0          0          1 2598.5800          1
1913     15002701            0    0.00000    0.00000    0.00000          1
1914     15002801            0    0.00000    0.00000 2598.5800          1
1915            *
1916     20150000     TBL/FCTN          1          1
1917     20150001     32.00000 739.1D-05
1918     20150002   1500.00000 739.1D-05
1919     20150051     32.00000  38.213D0
1920     20150052   1500.00000  38.213D0
1921
1922     $$$$$ MFW SGB HIGH-PRESSURE A HEATER ACTIVE HEAT STRUCTURE 0$$$$$$$$$$0$$$$$$$$$$0
1923
1924     15212000            1          5          2          1  0.898500
1925     15212100            0          1
1926     15212101            4   0.904700
1927     15212201          521          1
1928     15212202          521          2
1929     15212203          521          3
1930     15212204          521          4
1931     15212301      1.00000          1
1932     15212302      1.00000          2
1933     15212303      1.00000          3
1934     15212304      1.00000          4
1935     15212400            0
1936     15212401    415.00000          5
1937     15212501    524010000          0          1          1 3631.2500          1
1938     15212601            0          0          0          1 3631.2500          1
1939     15212701          521    1.00000    0.00000    0.00000          1
1940     15212801            0    0.00000    0.00000 3631.2500          1
1941            *
1942     20152100     TBL/FCTN          1          1
1943     20152101     32.00000 100.0D+04
1944     20152102   1500.00000 100.0D+04
1945     20152151     32.00000  29.543D0
1946     20152152   1500.0000   29.543D0
1947            *
1948     20252100        POWER
1949     20252101      0.00000   77.354D0
1950     20252102      5.00000    0.00000
1951     20252103    100.0D+04    0.00000
1952
```

```
$$$$$ MFW SGH HIGH-PRESSURE B HEATER ACTIVE HEAT STRUCTURE 0$$$$$$$$$$0$$$$$$$$$$0
*
15222000          1          5          2          1  0.8985D0
15222100          0          1
15222101          4  0.9047D0
15222201        522          1
15222202        522          2
15222203        522          3
15222204        522          4
15222301    1.00000          1
15222302    1.00000          2
15222303    1.00000          3
15222304    1.00000          4
15222400          0
15222401  460.000D0          5
15222501  524020000          0          1          1 3896.95D0          1
15222601          0          0          0          1 3896.95D0          1
15222701        522   1.00000D   0.00000   0.00000D          1
15222801          0   0.00000D   0.00000 3896.95D0          1
*
20152200    TBL/FCTN          1          1
20152201   32.00000D 100.0D+04
20152202 1500.00000D 100.0D+04
20152251   32.00000D 29.203D0
20152252 1500.00000D 29.203D0
*
20252200       POWER
20252201    0.00000D 79.837D0
20252202    5.00000D  0.00000D
20252203  100.0D+04   0.00000D

$$$$$ EFW SGA (MOTOR) CAPACITIVE HEAT STRUCTURE $0$$$$$$$$$$0$$$$$$$$$$0$$$$$$$$$$0

$VOID$    16002000          1          5          2          1 D??LBCORD
$VOID$    16002100          0          1
$VOID$    16002101          4 D??RBCORD
$VOID$    16002201        600          1
$VOID$    16002202        600          2
$VOID$    16002203        600          3
$VOID$    16002204        600          4
$VOID$    16002301    1.00000D         1
$VOID$    16002302    1.00000D         2
$VOID$    16002303    1.00000D         3
$VOID$    16002304    1.00000D         4
$VOID$    16002400          0
$VOID$    16002401  D??TEMPTR          5
$VOID$    16002501  I??TOCODE          0 I??BCTYPE          1 D??SFAREA          1
$VOID$    16002601  I??TOCODE          0 I??BCTYPE          1 D??SFAREA          1
$VOID$    16002701        600   1.00000D   0.00000D   0.00000D          1
$VOID$    16002801          0   0.00000D   0.00000D D??CLNGTH          1
$VOID$    16002901          0   0.00000D   0.00000D D??CLNGTH          1
$VOID$          *
$VOID$    20160000    TBL/FCTN          1          1
$VOID$    20160001   32.00000D D??THCOND
$VOID$    20160002 1500.00000D D??THCOND
$VOID$    20160051   32.00000D D??VHCPTY
$VOID$    20160052 1500.00000D D??VHCPTY
$VOID$          *
$VOID$    20260000       POWER
$VOID$    20260001    0.00000D D??FNCVAL
$VOID$    20260002  100.0D+04 D??FNCVAL

$$$$$ EFW SGB (MOTOR) CAPACITIVE HEAT STRUCTURE $0$$$$$$$$$$0$$$$$$$$$$0$$$$$$$$$$0
```

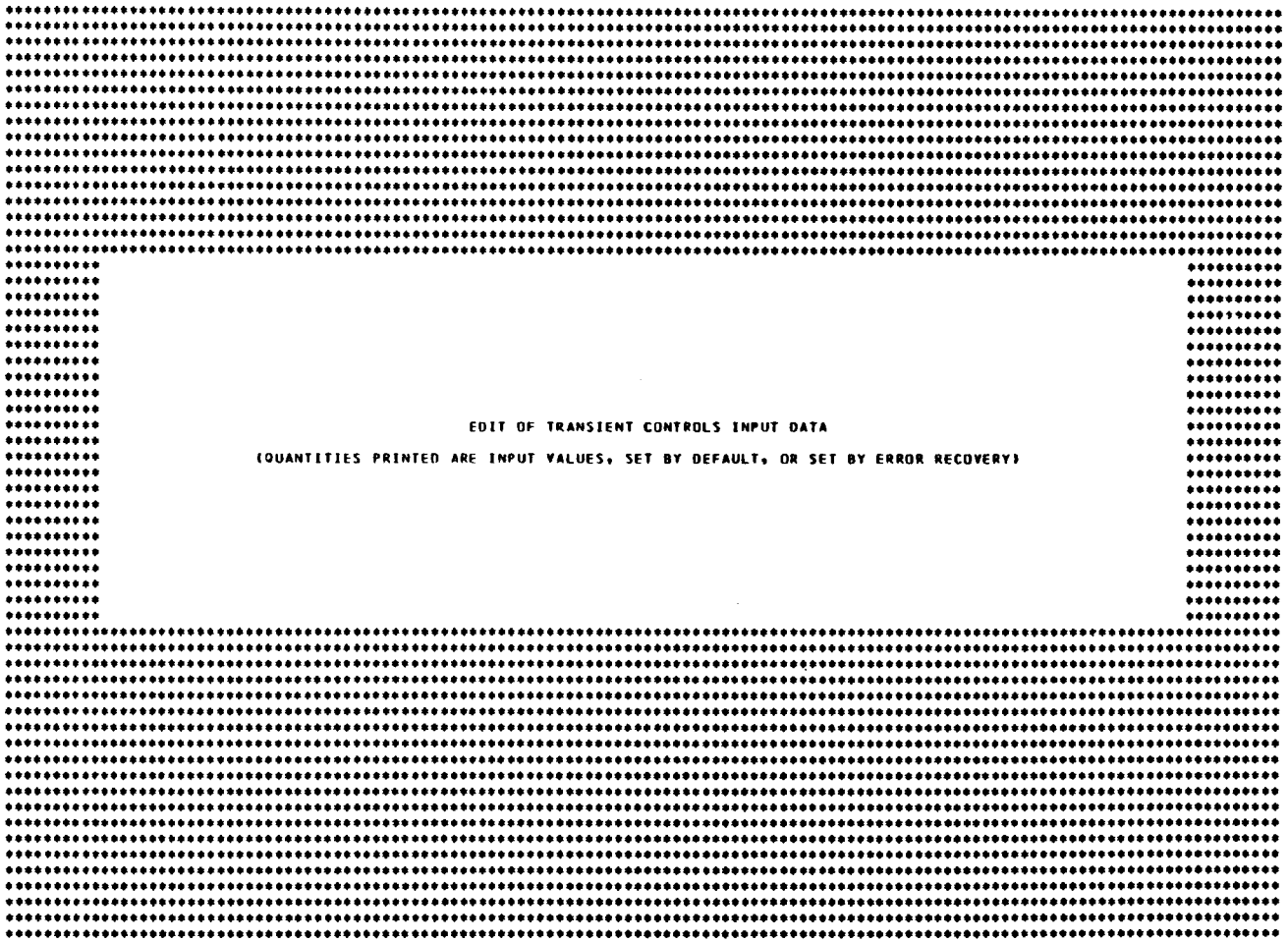
```
2016
2017    $VOID$    16252000          1          5          2          1 D??LBCORD
2018    $VOID$    16252100          0          1
2019    $VOID$    16252101          4 D??KBCORD
2020    $VOID$    16252201        625          1
2021    $VOID$    16252202        625          2
2022    $VOID$    16252203        625          3
2023    $VOID$    16252204        625          4
2024    $VOID$    16252301    1.00000          1
2025    $VOID$    16252302    1.00000          2
2026    $VOID$    16252303    1.00000          3
2027    $VOID$    16252304    1.00000          4
2028    $VOID$    16252400          0
2029    $VOID$    16252401  D??TEMPTR          5
2030    $VOID$    16252501  I??TUCODE          0 I??BCTYPE          1 D??SFAREA          1
2031    $VOID$    16252601  I??TUCODE          0 I??BCTYPE          1 D??SFAREA          1
2032    $VOID$    16252701        625   1.00000   0.00000   0.00000          1
2033    $VOID$    16252801          0   0.00000   0.00000 D??CLNGTH          1
2034    $VOID$    16252901          0   0.00000   0.00000 D??CLNGTH          1
2035    $VOID$            *
2036    $VOID$    20162500    TBL/FCTN          1          1
2037    $VOID$    20162501    32.00000 D??THCOND
2038    $VOID$    20162502  1500.00000 D??THCOND
2039    $VOID$    20162551    32.00000 D??VHCPTY
2040    $VOID$    20162552  1500.00000 D??VHCPTY
2041    $VOID$            *
2042    $VOID$    20262500       POWER
2043    $VOID$    20262501     0.00000 D??FNCVAL
2044    $VOID$    20262502   100.00+04 D??FNCVAL
2045
2046    $$$$$ EFW SGA/SGB (TURBINE) CAPACITIVE HEAT STRUCTURE $$$$$0$$$$$$$$$0$$$$$$$$$0
2047
2048    $VOID$    16502000          1          5          2          1 D??LBCORD
2049    $VOID$    16502100          0          1
2050    $VOID$    16502101          4 D??RBCORD
2051    $VOID$    16502201        650          1
2052    $VOID$    16502202        650          2
2053    $VOID$    16502203        650          3
2054    $VOID$    16502204        650          4
2055    $VOID$    16502301    1.00000          1
2056    $VOID$    16502302    1.00000          2
2057    $VOID$    16502303    1.00000          3
2058    $VOID$    16502304    1.00000          4
2059    $VOID$    16502400          0
2060    $VOID$    16502401  D??TEMPTR          5
2061    $VOID$    16502501  I??TUCODE          0 I??BCTYPE          1 D??SFAREA          1
2062    $VOID$    16502601  I??TUCODE          0 I??BCTYPE          1 D??SFAREA          1
2063    $VOID$    16502701        650   1.00000   0.00000   0.00000          1
2064    $VOID$    16502801          0   0.00000   0.00000 D??CLNGTH          1
2065    $VOID$    16502901          0   0.00000   0.00000 D??CLNGTH          1
2066    $VOID$            *
2067    $VOID$    20165000    TBL/FCTN          1          1
2068    $VOID$    20165001    32.00000 D??THCOND
2069    $VOID$    20165002  1500.00000 D??THCOND
2070    $VOID$    20165051    32.00000 D??VHCPTY
2071    $VOID$    20165052  1500.00000 D??VHCPTY
2072    $VOID$            *
2073    $VOID$    20265000       POWER
2074    $VOID$    20265001     0.00000 D??FNCVAL
2075    $VOID$    20265002   100.00+04 D??FNCVAL
2076
2077    *** PLOT REQUEST **0*********0*********0*********0*********0*********0*********0
2078
```

```
2079    $ZZ CARDS 20300000 - 20499999 NOT CURRENTLY INCLUDED ZZZZZZZZZZZZZZZZZ
2080
2081    *** CONTROL SYSTEM 0*********0*********0*********0*********0*********0*********0
2082
2083    *** HOTWELL LOW LEVEL INDICATOR ********0*********0*********0*********0*********0
2084
2085    20500100    TRNSTART  TRIPUNIT   1.00000   0.00000         0
2086    20500101         501
2087
2088    20500200    IGRND006      MULT   1.00000   0.00000         0
2089    20500201  MFLOWJ,401010000
2090    20500202  CNTRLVAR,001
2091
2092    20500300    IGRND007      MULT   1.00000   0.00000         0
2093    20500301  MFLOWJ,603010000
2094    20500302  CNTRLVAR,001
2095
2096    20500400    IGRND008      MULT   1.00000   0.00000         0
2097    20500401  MFLOWJ,625010000
2098    20500402  CNTRLVAR,001
2099
2100    20500500    IGRND009      MULT   1.00000   0.00000         0
2101    20500501  MFLOWJ,653010000
2102    20500502  CNTRLVAR,001
2103
2104    20500600    HWPUMPKG  INTEGRAL   1.00000   0.00000         0
2105    20500601  CNTRLVAR,002
2106
2107    20500700    EFWMPAKG  INTEGRAL   1.00000   0.00000         0
2108    20500701  CNTRLVAR,003
2109
2110    20500800    EFWMPBKG  INTEGRAL   1.00000   0.00000         0
2111    20500801  CNTRLVAR,004
2112
2113    20500900    EFWTDPKG  INTEGRAL   1.00000   0.00000         0
2114    20500901  CNTRLVAR,005
2115
2116    20501000    HWLOUTKG       SUM   1.00000   0.00000         0
2117    20501001     0.00000
2118    20501002     1.00000 CNTRLVAR,006
2119    20501003     1.00000 CNTRLVAR,007
2120    20501004     1.00000 CNTRLVAR,008
2121    20501005     1.00000 CNTRLVAR,009
2122
2123    *** SPACE-INDEPENDENT REACTOR KINETICS **********0**********0**********0**********0
2124
2125    $ZZ CARDS 30000000 - 30099999 NOT CURRENTLY INCLUDED ZZZZZZZZZZZZZZZZZ
2126
2127    .
```

APPENDIX C

OCONEE 1 MAIN AND EMERGENCY CONDENSATE FEEDWATER TRAINS MODEL RELAP5 INITIAL PROCESSING

This appendix consists of the RELAP5 initial processing of the Oconee 1 main and emergency condensate feedwater trains thermal-hydraulic model input stream. This is the internal editing performed by RELAP5 to create the necessary foundation for beginning the transient calculations. Being the initial processing of the total input stream for a RELAP5 calculation, it includes specific information defining a hypothetical main steamline break as well as generic information on the Oconee 1 main and emergency condensate feedwater trains.


EDIT OF TRANSIENT CONTROLS INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

INP-CHK, RUN OPTION IS INP-CHK

NO RESTART-PLOT FILE IS TO BE WRITTEN.

INPUT UNITS ARE ASSUMED BRITISH OUTPUT UNITS ARE BRITISH

REMAINING CPU TIME VALUES ARE 5.0 AND 10. SEC.

TIME STEP CONTROL DATA

END TIME (SEC)	MIN.TIME STEP (SEC)	MAX.TIME STEP (SEC)	OPTION	MINOR EDIT FREQUENCY	MAJOR EDIT FREQUENCY	RESTART FREQUENCY
2.000000E+01	1.000000E-06	1.000000E-02	2	10	100	4096
3.000000E+01	1.000000E-06	2.500000E-03	2	40	400	4096
4.000000E+01	1.000000E-06	5.000000E-03	2	20	200	4096
8.000000E+01	1.000000E-06	1.000000E-02	2	10	100	4096
1.200000E+02	1.000000E-06	1.000000E-02	2	10	100	4096
1.600000E+02	1.000000E-06	1.000000E-02	2	50	1000	4096
1.800000E+02	1.000000E-06	1.000000E-02	2	50	1000	4096
1.900000E+02	1.000000E-06	1.000000E-02	2	50	1000	4096
2.000000E+02	1.000000E-06	1.000000E-02	2	50	1000	4096
2.400000E+02	1.000000E-06	1.000000E-02	2	50	1000	4096
3.600000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
4.800000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
6.000000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
7.200000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
8.400000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
9.600000E+02	1.000000E-06	1.000000E-02	2	500	3000	4096
1.080000E+03	1.000000E-06	1.000000E-02	2	500	3000	4096
1.200000E+03	1.000000E-06	1.000000E-02	2	500	3000	4096

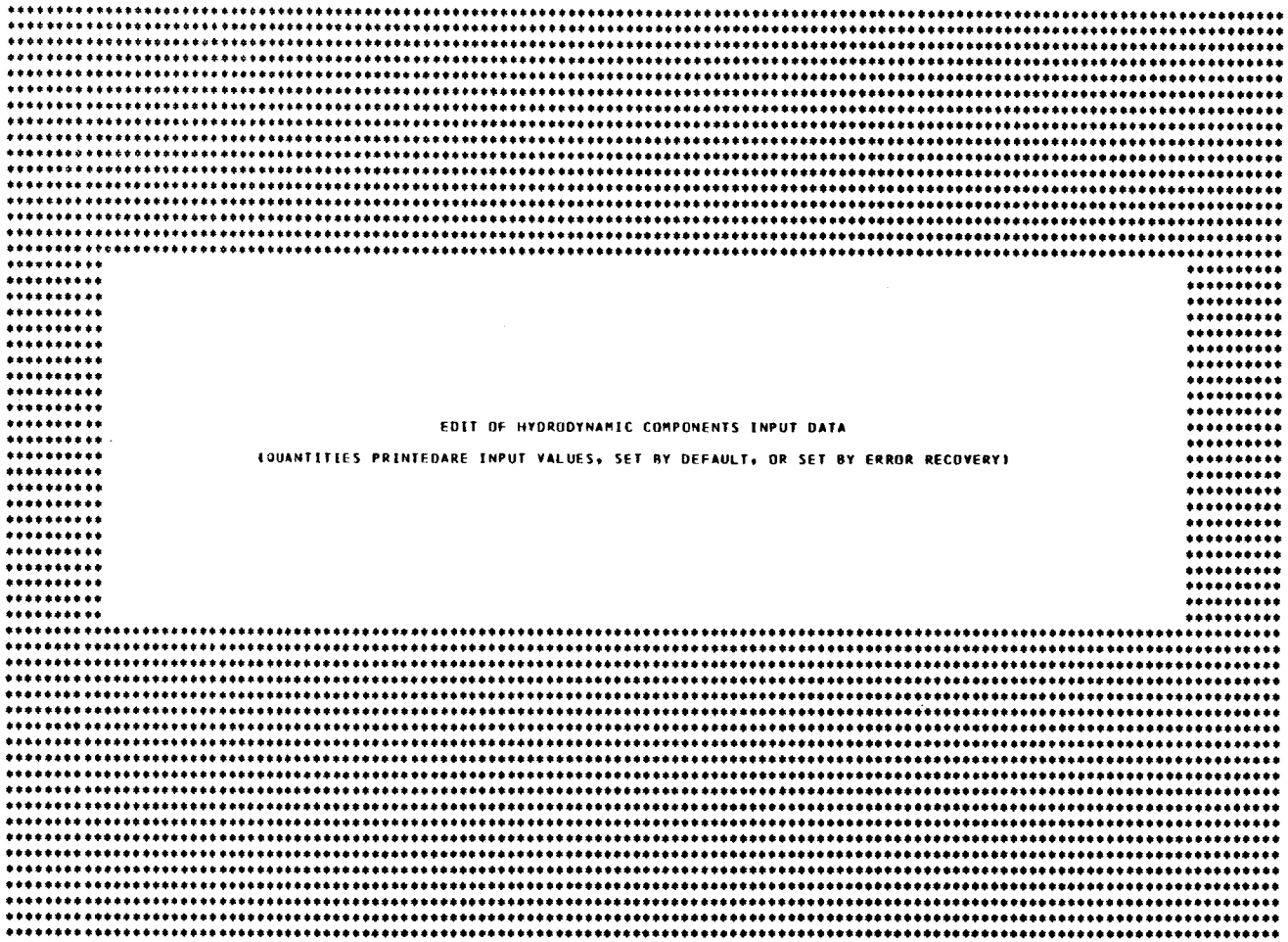
FORTRAN UNIT 16 INITIALIZED TO 32760 BYTES PER RECORD OF ZERO

A TOTAL OF 120 RECORDS WERE WRITTEN THUS CREATING 3931200 BYTES EQUAL TO ZERO

MINOR EDIT REQUESTS

REQ.NO.	VARIABLE CODE	PARAMETER
301	P	402020000
302	P	500010000
303	P	501010000
304	MFLOWJ	401010000
305	MFLOWJ	403020000
306	MFLOWJ	420020000
307	MFLOWJ	522020000
308	PMPVEL	420
309	PMPVEL	522
310	MFLOWJ	426000000
311	MFLOWJ	428000000
312	MFLOWJ	607000000
313	MFLOWJ	610000000
314	MFLOWJ	526000000
315	MFLOWJ	528000000
316	MFLOWJ	629000000
317	MFLOWJ	632000000
318	CNTRLVAR	10
319	MFLOWJ	603010000
320	MFLOWJ	625010000
321	MFLOWJ	653010000
322	P	604020000

323	P	626020000
324	P	654020000
325	MFLOWJ	658000000
326	VLVAREA	610
327	VLVAREA	632
328	P	429030000
329	TEMP	429030000
330	MFLOWJ	430000000
331	QUALE	429030000
332	VLVAREA	428
333	P	611030000
334	TEMP	611030000
335	MFLOWJ	612000000
336	QUALE	611030000
337	P	529030000
338	TEMP	529030000
339	MFLOWJ	530000000
340	QUALE	529030000
341	VLVAREA	528
342	P	633030000
343	TEMP	633030000
344	MFLOWJ	634000000
345	QUALE	633030000
346	P	429020000
347	TEMP	429020000
348	MFLOWJ	429020000
349	QUALE	429020000
350	VLVAREA	428
351	P	611020000
352	TEMP	611020000
353	MFLOWJ	611020000
354	QUALE	611020000
355	P	529020000
356	TEMP	529020000
357	MFLOWJ	529020000
358	QUALE	529020000
359	VLVAREA	528
360	P	633020000
361	TEMP	633020000
362	MFLOWJ	633020000
363	QUALE	633020000


EDIT OF HYDRODYNAMIC COMPONENTS INPUT DATA
(QUANTITIES PRINTEDARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

****
********** INPUT DATA FOR COMPONENT 400, MFW/CHWL TMDPVOL , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
400010000	1.000000E+06	1.000000E+00	1.000000E+06	0.000000E+00	0.000000E+00	0.000000E+00

VOL.NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	EQUIL. FLAG
400010000	0.000000E+00	1.128379E+03	1

TABLE TRIP NUMBER IS 0

TABULAR DATA

TIME (SEC)	PRESSURE (PSIA)	INTERNAL ENERGY (BTU/LBM)	STATIC QUALITY
0.000000E+00	7.208000E+00	5.801500E+01	0.000000E+00
1.000000E+06	7.208000E+00	5.801500E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 401, MFW/HWLP PUMP , HAVING 1 VOLUME AND 2 JUNCTIONS **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
401010000	2.536000E+00	2.957414E+02	7.500000E+02	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	EQUIL. FLAG	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
401010000	5	0	1.130000E+02	5.797200E+01	0.000000E+00	0.000000E+00

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS
401010000	400000000	401000000	0.000000E+00	2.343000E+00	1.000000E+02	0

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
401010000	1.121300E+01	1.121300E+01	0.000000E+00

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS
401020000	401010000	402000000	0.000000E+00	7.217600E+01	1.000000E+02	0

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
401020000	1.120900E+01	1.120900E+01	0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX	0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX	0
2 PHASE DIFFERENCE TABLE SET INDEX	-2
PUMP MOTOR TORQUE TABLE INDEX	0
TIME DEPENDENT PUMP SPEED TABLE INDEX	-1

```
PUMP TRIP NUMBER INDEX ..........................   601
PUMP REVERSE INDICATOR ..........................     0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED ..................... =  1.1830E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  1.0000E+00
RATED PUMP FLOW ...................... =  1.2756E+04    (GAL/M)
RATED PUMP HEAD ...................... =  5.0000E+02    (FT)
RATED PUMP TORQUE .................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ............... =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY ................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE .............. =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME ..................... =     1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ........ =     1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ........ =    -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --

 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.236000E+00
                                        2.000000E-01     1.225000E+00
                                        4.000000E-01     1.202000E+00
                                        6.000000E-01     1.157000E+00
                                        8.000000E-01     1.056000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.000000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -3.000000E-01
                                        5.000000E-01     0.000000E+00
                                        6.250000E-01     2.770000E-01
                                        7.140000E-01     4.240000E-01
                                        8.330000E-01     6.480000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -1.500000E-01
                                        5.000000E-01     2.500000E-01
                                        6.250000E-01     3.910000E-01
                                        7.140000E-01     5.100000E-01
                                        8.330000E-01     6.940000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     1.236000E+00
```

```
                                        0.000000E+00      1.236000E+00

 --- FOR TORQUE CURVE NO.     3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00      0.000000E+00
                                        0.000000E+00      0.000000E+00

 --- FOR  HEAD  CURVE NO.     4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01     -1.000000E+02
                                        0.000000E+00     -1.000000E+02

 --- FOR TORQUE CURVE NO.     4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01      0.000000E+00
                                        0.000000E+00      0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.800000E-01
                        6.000000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000E-01
                        1.000000E+00      0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.800000E-01
                        6.000000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000E-01
                        1.000000E+00      0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE
                  PUMP VELOCITY     REL.PUMP MTR.TORQUE
                    (REV/ M)
                        0.000000E+00      1.000000E+00
                        1.000000E+06      1.000000E+00

**********************************************************************************************************************************
**********                                                                                                      **********
**********  INPUT DATA FOR COMPONENT 402, MFW/DMDA PIPE     , HAVING  2 VOLUME(S) AND  1 JUNCTION(S)            **********
**********                                                                                                      **********
**********************************************************************************************************************************

  VOL NO.      FLOW AREA         FLOW LENGTH       VOLUME            HORIZ. ANGLE      VERT. ANGLE       ELEV. CHNG.
               (FT2)             (FT)              (FT3)             (DEG)             (DEG)             (FT)
402010000      2.536000E+00      2.957414E+02      7.500000E+02      0.000000E+00      0.000000E+00      0.000000E+00
402020000      2.536000E+00      2.957414E+02      7.500000E+02      0.000000E+00      0.000000E+00      0.000000E+00

  VOL NO.      ROUGHNESS         HYDRAULIC DIAM.     VOLUME  INIT. COND.     I.C.VALUE 1     I.C.VALUE 2     I.C.VALUE 3     I.C.VALUE 4
               (FT)              (FT)                FLAGS   FLAG
```

```
402010000   1.500000E-04   1.796924E+00        10          0   1.600000E+02   5.796400E+01   0.000000E+00   0.000000E+00
402020000   1.500000E-04   1.796924E+00        10          0   1.000000E+02   6.297300E+01   0.000000E+00   0.000000E+00

  JUN.NO.     JUNCTION AREA     FORWARD LOSS      REVERSE LOSS       JUNCTION     INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
              (FT2)             COEFFICIENT       COEFFICIENT          FLAGS        (FT/SEC)         (FT/SEC)         (FT/SEC)
402010000   2.536000E+00   7.127600E+01   7.127600E+01              0   1.120800E+01   1.120800E+01   0.000000E+00

**********************************************************************************************************************
**********                                                                                                  **********
**********  INPUT DATA FOR COMPONENT 403, MFW/CDBP PUMP    , HAVING 1 VOLUME AND 2 JUNCTIONS                **********
**********                                                                                                  **********
**********************************************************************************************************************

  VOL NO.     FLOW AREA         FLOW LENGTH       VOLUME            HORIZ. ANGLE      VERT. ANGLE       ELEV. CHNG.
              (FT2)             (FT)              (FT3)             (DEG)             (DEG)             (FT)
403010000   2.536000E+00   2.957414E+02   7.500000E+02   0.000000E+00   0.000000E+00   0.000000E+00

  VOL NO.    EQUIL. FLAG   INIT. COND. FLAG   I.C.VALUE 1       I.C.VALUE 2       I.C.VALUE 3       I.C.VALUE 4
403010000              5                  0   3.100000E+02   6.290300E+01   0.000000E+00   0.000000E+00

  JUN.NO.  FROM VOL.   TO VOL.    JUNCTION AREA     FORWARD LOSS      REVERSE LOSS      JUNCTION
                                   (FT2)             COEFFICIENT       COEFFICIENT         FLAGS
403010000  402010000  403000000   0.000000E+00   1.911000E+00   1.000000E+02              0

  JUN.NO.                        INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                   (FT/SEC)          (FT/SEC)          (FT/SEC)
403010000                      1.122000E+01   1.122000E+01   0.000000E+00

  JUN.NO.  FROM VOL.   TO VOL.    JUNCTION AREA     FORWARD LOSS      REVERSE LOSS      JUNCTION
                                   (FT2)             COEFFICIENT       COEFFICIENT         FLAGS
403020000  403010000  404000000   0.000000E+00   1.912000E+00   1.000000E+02              0

  JUN.NO.                        INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                   (FT/SEC)          (FT/SEC)          (FT/SEC)
403020000                      1.121300E+01   1.121300E+01   0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX ..................      0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX      0
2 PHASE DIFFERENCE TABLE SET INDEX ...........     -2
PUMP MOTOR TORQUE TABLE INDEX .................      0
TIME DEPENDENT PUMP SPEED TABLE INDEX .......     -1
PUMP TRIP NUMBER INDEX ........................    611
PUMP REVERSE INDICATOR ........................      0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED ..................... =  3.5800E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  1.0000E+00
RATED PUMP FLOW ...................... =  1.2768E+04    (GAL/M)
RATED PUMP HEAD ...................... =  9.8300E+02    (FT)
RATED PUMP TORQUE .................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ............... =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY ................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE .............. =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :
```

```
PUMP STOP TIME ..................... =     1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ........ =     1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ........ =    -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --

 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.068000E+00
                                        2.000000E-01     1.063000E+00
                                        4.000000E-01     1.058000E+00
                                        6.000000E-01     1.047000E+00
                                        8.000000E-01     1.031000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.000000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -3.000000E-01
                                        5.000000E-01     0.000000E+00
                                        6.250000E-01     2.880000E-01
                                        7.140000E-01     4.300000E-01
                                        8.330000E-01     6.580000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -1.500000E-01
                                        5.000000E-01     2.500000E-01
                                        6.250000E-01     3.910000E-01
                                        7.140000E-01     5.100000E-01
                                        8.330000E-01     6.940000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     1.068000E+00
                                        0.000000E+00     1.068000E+00

 --- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     0.000000E+00
                                        0.000000E+00     0.000000E+00

 --- FOR  HEAD  CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01    -1.000000E+02
                                        0.000000E+00    -1.000000E+02

 --- FOR TORQUE CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01     0.000000E+00
                                        0.000000E+00     0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =     0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
```

```
                    0.000000E+00     0.000000E+00
                    1.000000E-01     0.000000E+00
                    1.500000E-01     5.000000E-02
                    2.400000E-01     8.000000E-01
                    3.000000E-01     9.600000E-01
                    4.000000E-01     9.800000E-01
                    6.000000E-01     9.700000E-01
                    8.000000E-01     9.000000E-01
                    9.000000E-01     8.000000E-01
                    9.600000E-01     5.000000E-01
                    1.000000E+00     0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =     0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                    0.000000E+00     0.000000E+00
                    1.000000E-01     0.000000E+00
                    1.500000E-01     5.000000E-02
                    2.400000E-01     8.000000E-01
                    3.000000E-01     9.600000E-01
                    4.000000E-01     9.800000E-01
                    6.000000E-01     9.700000E-01
                    8.000000E-01     9.000000E-01
                    9.000000E-01     8.000000E-01
                    9.600000E-01     5.000000E-01
                    1.000000E+00     0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE
                 PUMP VELOCITY    REL.PUMP MTR.TORQUE
                   (REV/ M)
                    0.000000E+00     1.000000E+00
                    1.000000E+06     1.000000E+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 404, MFW/LPFE PIPE    , HAVING  2 VOLUME(S) AND  1 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
404010000     2.536000E+00     5.583597E+02     1.416000E+03     0.000000E+00     0.000000E+00     0.000000E+00
404020000     1.117000E+00     9.507611E+02     1.062000E+03     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.    I.C.VALUE 1     I.C.VALUE 2     I.C.VALUE 3     I.C.VALUE 4
              (FT)             (FT)                FLAGS         FLAG
404010000     1.500000E-04     1.796924E+00          10            0    5.200000E+02    1.276520E+02    0.000000E+00    0.000000E+00
404020000     1.500000E-04     1.192564E+00          10            0    4.902500E+02    1.978570E+02    0.000000E+00    0.000000E+00

  JUN.NO.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
              (FT2)            COEFFICIENT      COEFFICIENT          FLAGS        (FT/SEC)         (FT/SEC)       (FT/SEC)
404010000     1.117000E+00     6.740000E+00     6.740000E+00             0     2.588400E+01     2.588400E+01     0.000000E+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 405, MFW/LPEO SNGLJUN , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     SUBCOOLED        TWO-PHASE
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS     DISCHARGE COEF.  DISCHARGE COEF.
405000000 404010000 408000000     0.000000E+00     7.440000E+00     7.440000E+00             0     1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
```

```
405000000                    2.660000E+01    2.660000E+01    0.000000E+00

**********
**********  INPUT DATA FOR COMPONENT 406, MFW/LPED TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  **********
**********
**********

  VOL NO.     FLOW AREA       FLOW LENGTH     VOLUME          HORIZ. ANGLE    VERT. ANGLE     ELEV. CHNG.
              (FT2)           (FT)            (FT3)           (DEG)           (DEG)           (FT)
406010000     1.000000E+06    1.000000E+00    1.000000E+06    0.000000E+00    0.000000E+00    0.000000E+00

  VOL.NO.     ROUGHNESS       HYDRAULIC DIAM.   EQUIL.
              (FT)            (FT)              FLAG
406010000     0.000000E+00    1.128379E+03          1

TABLE TRIP NUMBER IS    0

TABULAR DATA
      TIME            PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)           (PSIA)            (BTU/LBM)


    0.000000E+00      4.700000E+02      1.777360E+02      0.000000E+00
    1.000000E+06      4.700000E+02      1.777360E+02      0.000000E+00

**********
**********  INPUT DATA FOR COMPONENT 407, MFW/LPED TMDPJUN , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)  **********
**********
**********

  JUN.NO. FROM VOL.    TO VOL.      JUNCTION AREA
                                    (FT2)
407000000 406000000 408000000      2.536000E+00

TABLE TRIP NUMBER IS    0

TABULAR DATA
      TIME            LIQUID VELOCITY   VAPOR VELOCITY    INTERFACE VOL.
      (SEC)             (FT/SEC)          (FT/SEC)        (FT/SEC)


    0.000000E+00      9.150000E-01      9.150000E-01      0.000000E+00
    5.000000E+00      0.000000E+00      0.000000E+00      0.000000E+00
    1.000000E+06      0.000000E+00      0.000000E+00      0.000000E+00

**********
**********  INPUT DATA FOR COMPONENT 408, MFW/LPDH BRANCH  , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  **********
**********
**********

  VOL NO.     FLOW AREA       FLOW LENGTH     VOLUME          HORIZ. ANGLE    VERT. ANGLE     ELEV. CHNG.
              (FT2)           (FT)            (FT3)           (DEG)           (DEG)           (FT)
408010000     2.536000E+00    4.187698E+02    1.062000E+03    0.000000E+00    0.000000E+00    0.000000E+00

 VOL NO.      ROUGHNESS       HYDRAULIC DIAM.   VOLUME  INIT. COND.     I.C. VALUE 1     I.C. VALUE 2     I.C.VALUE 3   I.C. VALUE 4
              (FT)            (FT)              FLAGS   FLAG
408010000     1.500000E-04    1.796924E+00          10        0     4.565000E+02     2.690110E+02     0.000000E+00  1.500E-04

**********
**********
```

********** INPUT DATA FOR COMPONENT 409, MFW/LPDD SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
409000000	408010000	412000000	0.000000E+00	3.181000E+01	3.181000E+01	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
409000000	1.309200E+01	1.309200E+01	0.000000E+00

********** INPUT DATA FOR COMPONENT 410, MFW/LPDD TMDPVOL , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
410010000	1.000000E+06	1.000000E+00	1.000000E+06	0.000000E+00	0.000000E+00	0.000000E+00

VOL.NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	EQUIL. FLAG
410010000	0.000000E+00	1.128379E+03	1

TABLE TRIP NUMBER IS 0

TABULAR DATA

TIME (SEC)	PRESSURE (PSIA)	INTERNAL ENERGY (BTU/LBM)	STATIC QUALITY
0.000000E+00	4.350000E+02	2.587780E+02	0.000000E+00
1.000000E+06	4.350000E+02	2.587780E+02	0.000000E+00

********** INPUT DATA FOR COMPONENT 411, MFW/LPDD TMDPJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)
411000000	410000000	412000000	4.162000E+00

TABLE TRIP NUMBER IS 0

TABULAR DATA

TIME (SEC)	LIQUID VELOCITY (FT/SEC)	VAPOR VELOCITY (FT/SEC)	INTERFACE VOL. (FT/SEC)
0.000000E+00	4.788000E+00	4.788000E+00	0.000000E+00
5.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
1.000000E+06	0.000000E+00	0.000000E+00	0.000000E+00

********** INPUT DATA FOR COMPONENT 412, MFW/LPCH BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********

VOL NO.	FLOW AREA	FLOW LENGTH	VOLUME	HORIZ. ANGLE	VERT. ANGLE	ELEV. CHNG.

```
                (FT2)              (FT)               (FT3)              (DEG)              (DEG)              (FT)
412010000       4.162000E+00       2.976935E+02       1.239000E+03       0.000000E+00       0.000000E+00       0.000000E+00

 VOL NO.      ROUGHNESS          HYDRAULIC DIAM.     VOLUME  INIT. COND.      I.C. VALUE 1      I.C. VALUE 2      I.C.VALUE 3    I.C. VALUE 4
                (FT)               (FT)               FLAGS          FLAG
412010000       1.500000E-04       2.302004E+00          10             0      4.227500E+02      3.418790E+02      0.000000E+00  1.500E-04

**********************************************************************************************************************************
**********                                                                                                              **********
**********  INPUT DATA FOR COMPONENT 413, MFW/LPCO SNGLJUN , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)                    **********
**********                                                                                                              **********
**********************************************************************************************************************************

  JUN.NO. FROM VOL.    TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS       JUNCTION      SUBCOOLED         TWO-PHASE
                                      (FT2)             COEFFICIENT       COEFFICIENT         FLAGS      DISCHARGE COEF.   DISCHARGE COEF.
413000000 412010000 500000000       0.000000E+00      3.190000E+01      3.190000E+01            0      1.000000E+00      6.000000E-01

  JUN.NO.                           INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                      (FT/SEC)          (FT/SEC)          (FT/SEC)
413000000                           1.336800E+01      1.336800E+01      0.000000E+00

**********************************************************************************************************************************
**********                                                                                                              **********
**********  INPUT DATA FOR COMPONENT 420, MFW/MFPA PUMP    , HAVING 1 VOLUME AND 2 JUNCTIONS                            **********
**********                                                                                                              **********
**********************************************************************************************************************************

  VOL NO.      FLOW AREA          FLOW LENGTH        VOLUME             HORIZ. ANGLE       VERT. ANGLE        ELEV. CHNG.
                 (FT2)              (FT)               (FT3)              (DEG)              (DEG)              (FT)
420010000       1.117000E+00       5.416294E+02       6.050000E+02       0.000000E+00       0.000000E+00       0.000000E+00

  VOL NO.      EQUIL. INIT. COND.      I.C.VALUE 1       I.C.VALUE 2       I.C.VALUE 3       I.C.VALUE 4
                 FLAG        FLAG
420010000          5           0      8.225000E+02      3.410960E+02      0.000000E+00      0.000000E+00

  JUN.NO. FROM VOL.    TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS       JUNCTION
                                      (FT2)             COEFFICIENT       COEFFICIENT         FLAGS
420010000 500010000 420000000       0.000000E+00      2.624000E+00      1.000000E+02            0

  JUN.NO.                           INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                      (FT/SEC)          (FT/SEC)          (FT/SEC)
420010000                           2.490900E+01      2.490900E+01      0.000000E+00

  JUN.NO. FROM VOL.    TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS       JUNCTION
                                      (FT2)             COEFFICIENT       COEFFICIENT         FLAGS
420020000 420010000 421000000       0.000000E+00      2.690000E+00      1.000000E+02            0

  JUN.NO.                           INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                      (FT/SEC)          (FT/SEC)          (FT/SEC)
420020000                           2.485000E+01      2.485000E+01      0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX .................     0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX      0
2 PHASE DIFFERENCE TABLE SET INDEX ...........    -2
PUMP MOTOR TORQUE TABLE INDEX ................     0
TIME DEPENDENT PUMP SPEED TABLE INDEX ........     0
PUMP TRIP NUMBER INDEX .......................   621
PUMP REVERSE INDICATOR .......................     0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----
```

```
RATED PUMP SPEED ..................... =  5.0000E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  1.0000E+00
RATED PUMP FLOW ...................... =  1.2459E+04    (GAL/M)
RATED PUMP HEAD ...................... =  2.3200E+03    (FT)
RATED PUMP TORQUE .................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ............... =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY ................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE .............. =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME ..................... =      1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ........ =      1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ........ =     -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --


 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.207000E+00
                                        2.000000E-01     1.099000E+00
                                        4.000000E-01     1.052000E+00
                                        6.000000E-01     1.043000E+00
                                        8.000000E-01     1.030000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.000000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -3.000000E-01
                                        5.000000E-01     0.000000E+00
                                        6.250000E-01     2.860000E-01
                                        7.140000E-01     4.220000E-01
                                        8.330000E-01     6.380000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -1.500000E-01
                                        5.000000E-01     2.500000E-01
                                        6.250000E-01     3.910000E-01
                                        7.140000E-01     5.100000E-01
                                        8.330000E-01     6.940000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     1.207000E+00
                                        0.000000E+00     1.207000E+00

 --- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE
```

```
                                        -1.000000E+00      0.000000E+00
                                         0.000000E+00      0.000000E+00

 --- FOR  HEAD  CURVE NO.     4 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                        -9.990000E-01     -1.000000E+02
                                         0.000000E+00     -1.000000E+02

 --- FOR TORQUE CURVE NO.     4 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                        -9.990000E-01      0.000000E+00
                                         0.000000E+00      0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.800000E-01
                        6.000000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000E-01
                        1.000000E+00      0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.800000E-01
                        6.000000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000E-01
                        1.000000E+00      0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE
                    PUMP VELOCITY     REL.PUMP MTR.TORQUE
                      (REV/ M)
                        0.000000E+00      1.000000E+00
                        1.000000E+06      1.000000E+00

PUMP VELOCITY TRIP NUMBER IS 622.

EDIT OF PUMP VELOCITY TABLE
       TIME             PUMP VELOCITY
       (SEC)              (REV/ M)


     0.000000E+00       5000.00
      20.0000           3261.67
      40.0000           2622.17
      60.0000           2386.91
      90.0000           2280.55
      120.000           2256.82
      180.000           2250.00
     1.000000E+06       2250.00

**********************************************************************************************************************************************************
```

****
********** INPUT DATA FOR COMPONENT 421, MFW/FPOA SNGLVOL , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
421010000	2.536000E+00	1.250000E+02	3.170000E+02	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
421010000	1.500000E-04	1.796924E+00	10	0	1.256000E+03	3.402480E+02	0.000000E+00	

****
********** INPUT DATA FOR COMPONENT 422, MFW/PCHA VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
422000000	421010000	501000000	2.536000E+00	1.410000E+00	1.410000E+00	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
422000000	7.337229E+00	7.337229E+00	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
422000000	0.000000E+00	0.000000E+00	100

****
********** INPUT DATA FOR COMPONENT 423, MFW/HAIA SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
423000000	501010000	424000000	0.000000E+00	2.184950E+02	2.184950E+02	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
423000000	1.092000E+01	1.092000E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 424, MFW/HABA PIPE , HAVING 2 VOLUME(S) AND 1 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
424010000	2.536000E+00	2.392839E+02	6.068240E+02	0.000000E+00	0.000000E+00	0.000000E+00
424020000	2.536000E+00	1.961546E+02	4.974480E+02	0.000000E+00	9.000000E+01	9.500000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
424010000	1.500000E-04	1.796924E+00	10	0	1.100000E+03	3.884390E+02	0.000000E+00	0.000000E+00
424020000	1.500000E-04	1.796924E+00	10	0	1.063000E+03	4.379340E+02	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)

424010000 2.536000E+00 4.810500E+01 4.810500E+01 0 1.129900E+01 1.129900E+01 0.000000E+00

****
********** INPUT DATA FOR COMPONENT 425, MFW/HBOA SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
425000000	424010000	502000000	0.000000E+00	4.346900E+01	4.346900E+01	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
425000000	1.175500E+01	1.175500E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 426, MFW/ACHA VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
426000000	502010000	427000000	2.536000E+00	1.817500E+01	1.817500E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
426000000	7.901683E+00	7.901683E+00	0.000000E+00

JUN.NO.	HACK PRESSURE (MF/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
426000000	0.000000E+00	0.000000E+00	100

****
********** INPUT DATA FOR COMPONENT 427, MFW/SGIA BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
427010000	2.536000E+00	6.499330E+01	1.648230E+02	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
427010000	1.500000E-04	1.796924E+00	10	0	1.000000E+03	4.381250E+02	0.000000E+00	1.500E-04

****
********** INPUT DATA FOR COMPONENT 428, MFW/MCVA VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
428000000	427010000	429000000	2.536000E+00	4.181200E+01	4.181200E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
428000000	7.903027E+00	7.903027E+00	0.000000E+00

JUN.NO.	OPEN TRIP NO.	CLOSE TRIP NO.	TABLE NO.	SLOPE (1.0/SEC)	INITIAL POSITION

```
428000000                    631          632          428          1.39100E-01   5.00000E-01

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 429, MFW/SGIA PIPE    , HAVING  3 VOLUME(S) AND  2 JUNCTION(S)   *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
429010000     2.536000E+00     1.200000E+02     3.043200E+02     0.000000E+00     0.000000E+00     0.000000E+00
429020000     2.536000E+00     2.000000E+02     5.072000E+02     0.000000E+00     0.000000E+00     0.000000E+00
429030000     1.704000E+00     1.774601E+02     3.023920E+02     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.    I.C.VALUE 1     I.C.VALUE 2     I.C.VALUE 3     I.C.VALUE 4
              (FT)             (FT)                FLAGS         FLAG
429010000     1.500000E-04     1.796924E+00          10            0    9.650000E+02    4.382310E+02    0.000000E+00    0.000000E+00
429020000     1.500000E-04     1.796924E+00          10            0    9.600000E+02    4.382460E+02    0.000000E+00    0.000000E+00
429030000     1.500000E-04     1.472956E+00          10            0    9.550000E+02    4.382620E+02    0.000000E+00    0.000000E+00

  JUN.NO.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
              (FT2)            COEFFICIENT      COEFFICIENT          FLAGS        (FT/SEC)         (FT/SEC)        (FT/SEC)
429010000     2.536000E+00     6.543000E+00     6.543000E+00             0     1.176400E+01     1.176400E+01     0.000000E+00
429020000     1.704000E+00     2.954000E+00     2.954000E+00             0     1.750900E+01     1.750900E+01     0.000000E+00

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 430, MFW/HCHA VALVE   , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)   *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     SUBCOOLED        TWO-PHASE
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS      DISCHARGE COEF.  DISCHARGE COEF.
430000000 429010000 431000000     1.704000E+00     2.954000E+00     2.954000E+00           100      1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                   (FT/SEC)         (FT/SEC)        (FT/SEC)
430000000                         1.176618E+01     1.176618E+01     0.000000E+00

  JUN.NO.                         BACK PRESSURE    LEAKAGE          CHECK VALVE
                                   (#F/IN2)        (% AREA OPEN)    FLAGS
430000000                         0.000000E+00     0.000000E+00     100

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 431, MFW/SGVA TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)   *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
431010000     1.000000E+06     1.000000E+00     1.000000E+06     0.000000E+00     0.000000E+00     0.000000E+00

  VOL.NO.     ROUGHNESS        HYDRAULIC DIAM.    EQUIL.
              (FT)             (FT)                FLAG
431010000     0.000000E+00     1.128379E+03           1

TABLE TRIP NUMBER IS    0

TABULAR DATA
      TIME            PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)           (PSIA)            (BTU/LBM)
```

```
   0.000000E+00     9.500000E+02     4.382770E+02     0.000000E+00
   3.000000E+01     5.000000E+01     5.800000E+01     0.000000E+00
   1.000000E+06     5.000000E+01     5.800000E+01     0.000000E+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 500, MFW/MFPI BRANCH  , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
500010000     4.162000E+00     2.809996E+02     1.169520E+03     0.000000E+00     0.000000E+00     0.000000E+00

 VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.     I.C. VALUE 1     I.C. VALUE 2     I.C.VALUE 3   I.C. VALUE 4
              (FT)             (FT)                FLAGS         FLAG
500010000     1.500000E-04     2.302004E+00          10            0     3.890000E+02     3.419460E+02     0.000000E+00  1.500E-04

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 501, MFW/HPHI BRANCH  , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
501010000     4.162000E+00     2.080000E+02     8.656960E+02     0.000000E+00     0.000000E+00     0.000000E+00

 VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.     I.C. VALUE 1     I.C. VALUE 2     I.C.VALUE 3   I.C. VALUE 4
              (FT)             (FT)                FLAGS         FLAG
501010000     1.500000E-04     2.302004E+00          10            0     1.255000E+03     3.402500E+02     0.000000E+00  1.500E-04

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 502, MFW/MCVI BRANCH  , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
502010000     4.162000E+00     4.500313E+01     1.873030E+02     0.000000E+00     9.000000E+01     4.000000E+01

 VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.     I.C. VALUE 1     I.C. VALUE 2     I.C.VALUE 3   I.C. VALUE 4
              (FT)             (FT)                FLAGS         FLAG
502010000     1.500000E-04     2.302004E+00          10            0     1.021000E+03     4.380610E+02     0.000000E+00  1.500E-04

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 520, MFW/PCHB VALVE   , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     SUBCOOLED        TWO-PHASE
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS      DISCHARGE COEF.  DISCHARGE COEF.
520000000 500010000 521000000     2.536000E+00     1.403000E+00     1.403000E+00           100      1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
520000000                         7.372172E+00     7.372172E+00     0.000000E+00

  JUN.NO.                         BACK PRESSURE    LEAKAGE          CHECK VALVE
                                    (#F/IN2)       (% AREA OPEN)    FLAGS
```

```
520000000                          0.000000E+00     0.000000E+00     100

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 521, MFW/FAIB SNGLVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
521010000     2.536000E+00     2.360000E+02     5.984960E+02     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.    I.C.VALUE 1     I.C.VALUE 2     I.C.VALUE 3     I.C.VALUE 4
              (FT)             (FT)                FLAGS         FLAG
521010000     1.500000E-04     1.796924E+00          10            0     3.880000E+02    3.419480E+02    0.000000E+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 522, MFW/MFPB PUMP    , HAVING 1 VOLUME AND 2 JUNCTIONS          *******************
*******************                                                                                   *******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
522010000     1.117000E+00     3.733214E+02     4.170000E+02     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.    EQUIL. INIT. COND.     I.C.VALUE 1      I.C.VALUE 2      I.C.VALUE 3      I.C.VALUE 4
               FLAG        FLAG
522010000        5           0     8.215000E+02     3.410980E+02     0.000000E+00     0.000000E+00

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS
522010000 521010000 522000000     0.000000E+00     2.624000E+00     1.000000E+02             0

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
522010000                         2.490900E+01     2.490900E+01     0.000000E+00

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS
522020000 522010000 501000000     0.000000E+00     2.690000E+00     1.000000E+02             0

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
522020000                         2.485000E+01     2.485000E+01     0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX ................     0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX      0
2 PHASE DIFFERENCE TABLE SET INDEX ..........    -2
PUMP MOTOR TORQUE TABLE INDEX ...............     0
TIME DEPENDENT PUMP SPEED TABLE INDEX .......     0
PUMP TRIP NUMBER INDEX ......................   621
PUMP REVERSE INDICATOR ......................     0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED ..................... =  5.0000E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  1.0000E+00
RATED PUMP FLOW ...................... =  1.2459E+04    (GAL/M)
RATED PUMP HEAD ...................... =  2.3200E+03    (FT)
```

```
RATED PUMP TORQUE ..................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ................ =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY .................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE ............... =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME ..................... =     1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ....... =     1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ....... =    -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --


 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.207000E+00
                                        2.000000E-01     1.099000E+00
                                        4.000000E-01     1.052000E+00
                                        6.000000E-01     1.043000E+00
                                        8.000000E-01     1.030000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.000000E+00
                                        1.000000E+00     1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -3.000000E-01
                                        5.000000E-01     0.000000E+00
                                        6.250000E-01     2.860000E-01
                                        7.140000E-01     4.220000E-01
                                        8.330000E-01     6.380000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00    -1.500000E-01
                                        5.000000E-01     2.500000E-01
                                        6.250000E-01     3.910000E-01
                                        7.140000E-01     5.100000E-01
                                        8.330000E-01     6.940000E-01
                                        9.990000E-01     9.980000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     1.207000E+00
                                        0.000000E+00     1.207000E+00

 --- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -1.000000E+00     0.000000E+00
                                        0.000000E+00     0.000000E+00

 --- FOR  HEAD  CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01    -1.000000E+02
```

```
                                        0.000000E+00    -1.000000E+02

 --- FOR TORQUE CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                       -9.990000E-01     0.000000E+00
                                        0.000000E+00     0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00     0.000000E+00
                        1.000000E-01     0.000000E+00
                        1.500000E-01     5.000000E-02
                        2.400000E-01     8.000000E-01
                        3.000000E-01     9.600000E-01
                        4.000000E-01     9.800000E-01
                        6.000000E-01     9.700000E-01
                        8.000000E-01     9.000000E-01
                        9.000000E-01     8.000000E-01
                        9.600000E-01     5.000000E-01
                        1.000000E+00     0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00     0.000000E+00
                        1.000000E-01     0.000000E+00
                        1.500000E-01     5.000000E-02
                        2.400000E-01     8.000000E-01
                        3.000000E-01     9.600000E-01
                        4.000000E-01     9.800000E-01
                        6.000000E-01     9.700000E-01
                        8.000000E-01     9.000000E-01
                        9.000000E-01     8.000000E-01
                        9.600000E-01     5.000000E-01
                        1.000000E+00     0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE
                  PUMP VELOCITY     REL.PUMP MTR.TORQUE
                    (REV/ M)
                        0.000000E+00     1.000000E+00
                        1.000000E+06     1.000000E+00

PUMP VELOCITY TRIP NUMBER IS 623.

EDIT OF PUMP VELOCITY TABLE
       TIME              PUMP VELOCITY
       (SEC)               (REV/ M)


     0.000000E+00        5000.00
      20.0000            3261.67
      40.0000            2622.17
      60.0000            2386.91
      90.0000            2280.55
      120.000            2256.82
      180.000            2250.00
     1.000000E+06        2250.00

************************************************************************************************************************
**********                                                                                                    **********
**********  INPUT DATA FOR COMPONENT 523, MFW/HAIR SNGLJUN , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)          **********
**********                                                                                                    **********
************************************************************************************************************************

  JUN.NO. FROM VOL.    TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS        JUNCTION      SUBCOOLED         TWO-PHASE
```

		(FT2)	COEFFICIENT	COEFFICIENT	FLAGS	DISCHARGE COEF.	DISCHARGE COEF.
523000000 501010000 524000000		0.000000E+00	2.184950E+02	2.184950E+02	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
523000000	1.092000E+01	1.092000E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 524, MFW/HABB PIPE , HAVING 2 VOLUME(S) AND 1 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
524010000	2.536000E+00	2.420442E+02	6.138240E+02	0.000000E+00	0.000000E+00	0.000000E+00
524020000	2.536000E+00	2.048297E+02	5.194480E+02	0.000000E+00	9.000000E+01	9.500000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
524010000	1.500000E-04	1.796924E+00	10	0	1.100000E+03	3.884390E+02	0.000000E+00	0.000000E+00
524020000	1.500000E-04	1.796924E+00	10	0	1.063000E+03	4.379340E+02	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
524010000	2.536000E+00	4.810500E+01	4.810500E+01	0	1.129900E+01	1.129900E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 525, MFW/HB0B SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
525000000	524010000	502000000	0.000000E+00	4.346900E+01	4.346900E+01	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
525000000	1.175500E+01	1.175500E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 526, MFW/ACH8 VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
526000000	502010000	527000000	2.536000E+00	1.817500E+01	1.817500E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
526000000	7.901683E+00	7.901683E+00	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
526000000	0.000000E+00	0.000000E+00	100

****
********** INPUT DATA FOR COMPONENT 527, MFW/SG1B BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
527010000	2.536000E+00	6.499330E+01	1.648230E+02	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
527010000	1.500000E-04	1.796924E+00	10	0	1.000000E+03	4.381250E+02	0.000000E+00	1.500E-04

****
********** INPUT DATA FOR COMPONENT 528, MFW/MCVH VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S)
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
528000000	527010000	529000000	2.536000E+00	4.181200E+01	4.181200E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
528000000	7.903027E+00	7.903027E+00	0.000000E+00

JUN.NO.	OPEN TRIP NO.	CLOSE TRIP NO.	TABLE NO.	SLOPE (1.0/SEC)	INITIAL POSITION
528000000	633	634	528	1.39100E-01	5.00000E-01

****
********** INPUT DATA FOR COMPONENT 529, MFW/SGIB PIPE , HAVING 3 VOLUME(S) AND 2 JUNCTION(S)
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
529010000	2.536000E+00	7.500001E+01	1.902000E+02	0.000000E+00	0.000000E+00	0.000000E+00
529020000	2.536000E+00	7.500001E+01	1.902000E+02	0.000000E+00	0.000000E+00	0.000000E+00
529030000	1.704000E+00	1.402535E+02	2.389920E+02	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
529010000	1.500000E-04	1.796924E+00	10	0	9.650000E+02	4.382310E+02	0.000000E+00	0.000000E+00
529020000	1.500000E-04	1.796924E+00	10	0	9.600000E+02	4.382460E+02	0.000000E+00	0.000000E+00
529030000	1.500000E-04	1.472956E+00	10	0	9.550000E+02	4.382620E+02	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
529010000	2.536000E+00	6.543000E+00	6.543000E+00	0	1.176400E+01	1.176400E+01	0.000000E+00
529020000	1.704000E+00	2.954000E+00	2.954000E+00	0	1.750900E+01	1.750900E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 530, MFW/MCHB VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S)
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
530000000	529010000	531000000	1.704000E+00	2.954000E+00	2.954000E+00	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)

```
530000000                          1.176618E+01     1.176618E+01     0.000000E+00

  JUN. NO.                         BACK PRESSURE    LEAKAGE          CHECK VALVE
                                     (#F/IN2)       (% AREA OPEN)    FLAGS
530000000                          0.000000E+00     0.000000E+00     100

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 531, MFW/SGV8 TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  VOL NO.      FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
               (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
531010000      1.000000E+06     1.000000E+00     1.000000E+06     0.000000E+00     0.000000E+00     0.000000E+00

  VOL.NO.      ROUGHNESS        HYDRAULIC DIAM.    EQUIL.
               (FT)             (FT)                FLAG
531010000      0.000000E+00     1.128379E+03          1

TABLE TRIP NUMBER IS   0

TABULAR DATA
      TIME            PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)           (PSIA)           (BTU/LBM)

    0.000000E+00      9.500000E+02     4.382770E+02     0.000000E+00
    3.000000E+01      9.500000E+02     4.382770E+02     0.000000E+00
    1.000000E+06      9.500000E+02     4.382770E+02     0.000000E+00

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 602, EFW/CHWL TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  VOL NO.      FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
               (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
602010000      1.000000E+06     1.000000E+00     1.000000E+06     0.000000E+00     0.000000E+00     0.000000E+00

  VOL.NO.      ROUGHNESS        HYDRAULIC DIAM.    EQUIL.
               (FT)             (FT)                FLAG
602010000      0.000000E+00     1.128379E+03          1

TABLE TRIP NUMBER IS   0

TABULAR DATA
      TIME            PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)           (PSIA)           (BTU/LBM)

    0.000000E+00      7.208000E+00     5.801500E+01     0.000000E+00
    1.000000E+06      7.208000E+00     5.801500E+01     0.000000E+00

*****************************************************************************************************************
*********************                                                                                   *********************
*********************  INPUT DATA FOR COMPONENT 603, EFW/MDPA PUMP    , HAVING 1 VOLUME AND 2 JUNCTIONS        *********************
*********************                                                                                   *********************
*****************************************************************************************************************

  VOL NO.      FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
               (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
```

```
603010000     3.170000E-01     6.309149E+01     2.000000E+01     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.    EQUIL. FLAG  INIT. COND. FLAG    I.C.VALUE 1      I.C.VALUE 2      I.C.VALUE 3      I.C.VALUE 4
603010000          5             0        7.208000E+00     5.801500E+01     0.000000E+00     0.000000E+00

  JUN.NO.  FROM VOL.   TO VOL.     JUNCTION AREA (FT2)   FORWARD LOSS COEFFICIENT   REVERSE LOSS COEFFICIENT   JUNCTION FLAGS
603010000 602000000 603000000      0.000000E+00          4.982050E+02               1.000000E+06                    0

  JUN.NO.                          INIT. LIQ. VEL. (FT/SEC)   INIT. VAP. VEL. (FT/SEC)   INTERFACE VEL. (FT/SEC)
603010000                          0.000000E+00               0.000000E+00               0.000000E+00

  JUN.NO.  FROM VOL.   TO VOL.     JUNCTION AREA (FT2)   FORWARD LOSS COEFFICIENT   REVERSE LOSS COEFFICIENT   JUNCTION FLAGS
603020000 603010000 604000000      0.000000E+00          1.146460E+02               1.000000E+06                    0

  JUN.NO.                          INIT. LIQ. VEL. (FT/SEC)   INIT. VAP. VEL. (FT/SEC)   INTERFACE VEL. (FT/SEC)
603020000                          0.000000E+00               0.000000E+00               0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX .................     0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX      0
2 PHASE DIFFERENCE TABLE SET INDEX ...........    -2
PUMP MOTOR TORQUE TABLE INDEX ................     0
TIME DEPENDENT PUMP SPEED TABLE INDEX ........     0
PUMP TRIP NUMBER INDEX .......................   642
PUMP REVERSE INDICATOR .......................     0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED ..................... =  3.5600E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  0.0000E+00
RATED PUMP FLOW ...................... =  5.0000E+02    (GAL/M)
RATED PUMP HEAD ...................... =  2.7500E+03    (FT)
RATED PUMP TORQUE .................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ............... =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY ................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE .............. =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME ..................... =      1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ....... =      1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ....... =     -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --

 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                        0.000000E+00     1.218000E+00
                                        2.000000E-01     1.218000E+00
                                        4.000000E-01     1.200000E+00
                                        6.000000E-01     1.182000E+00
```

```
                                        8.000000E-01      1.091000E+00
                                        1.000000E+00      1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                        0.000000E+00      1.000000E+00
                                        1.000000E+00      1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                        0.000000E+00      0.000000E+00
                                        5.000000E-01      9.100000E-02
                                        6.250000E-01      2.060000E-01
                                        7.140000E-01      3.530000E-01
                                        8.330000E-01      5.940000E-01
                                        9.990000E-01      9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                        0.000000E+00      0.000000E+00
                                        5.000000E-01      2.500000E-01
                                        6.250000E-01      3.910000E-01
                                        7.140000E-01      5.100000E-01
                                        8.330000E-01      6.940000E-01
                                        9.990000E-01      9.990000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                       -1.000000E+00      1.218000E+00
                                        0.000000E+00      1.218000E+00

 --- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                       -1.000000E+00      0.000000E+00
                                        0.000000E+00      0.000000E+00

 --- FOR  HEAD  CURVE NO.    4 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                       -9.990000E-01     -1.000000E+02
                                        0.000000E+00     -1.000000E+02

 --- FOR TORQUE CURVE NO.    4 IN SET : INDEP. VARIABLE   DEPEND. VARIABLE

                                       -9.990000E-01      0.000000E+00
                                        0.000000E+00      0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.600000E-01
                        6.990000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000E-01
                        1.000000E+00      0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
```

1.000000E-01	0.000000E+00
1.500000E-01	5.000000E-02
2.400000E-01	8.000000E-01
3.000000E-01	9.600000E-01
4.000000E-01	9.800000E-01
6.000000E-01	9.700000E-01
8.000000E-01	9.000000E-01
9.000000E-01	8.000000E-01
9.600000E-01	5.000000E-01
1.000000E+00	0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE

PUMP VELOCITY (REV/ M)	REL.PUMP MTR.TORQUE
0.000000E+00	1.000000E+00
1.000000E+06	1.000000E+00

PUMP VELOCITY TRIP NUMBER IS 647.

EDIT OF PUMP VELOCITY TABLE

TIME (SEC)	PUMP VELOCITY (REV/ M)
0.000000E+00	0.000000E+00
1.00000	787.469
2.00000	1400.86
3.00000	1878.26
4.00000	2250.28
5.00000	2540.06
6.00000	2765.76
7.00000	2941.27
8.00000	3078.33
9.00000	3184.78
10.0000	3267.72
11.0000	3332.52
12.0000	3382.71
15.0000	3560.00
1.000000E+06	3560.00

****
********** INPUT DATA FOR COMPONENT 604, EFW/MDPA PIPE , HAVING 2 VOLUME(S) AND 1 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
604010000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00
604020000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
604010000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00
604020000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
604010000	1.810000E-01	1.970830E+02	1.970830E+02	0	0.000000E+00	0.000000E+00	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 605, EFW/MDPA VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

```
**********                                                
```

```
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS     DISCHARGE COEF.  DISCHARGE COEF.
609000000 427010000 608000000     1.810000E-01     0.000000E+00     0.000000E+00          100     1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
609000000                         6.719690E-07     6.719690E-07     0.000000E+00

  JUN.NO.                         BACK PRESSURE    LEAKAGE          CHECK VALVE
                                    (#F/IN2)       (% AREA OPEN)    FLAGS
609000000                         0.000000E+00     0.000000E+00     100

*****************************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 610, EFW/SGIA VALVE   , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************************

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     SUBCOOLED        TWO-PHASE
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS     DISCHARGE COEF.  DISCHARGE COEF.
610000000 608010000 611000000     1.810000E-01     4.716000E+00     4.716000E+00          100     1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
                                    (FT/SEC)         (FT/SEC)       (FT/SEC)
610000000                         0.000000E+00     0.000000E+00     0.000000E+00

  JUN.NO.                         OPEN TRIP NO. CLOSE TRIP NO. TABLE NO.     SLOPE          INITIAL POSITION
                                                                             (1.0/SEC)
610000000                         651            652           610           5.20700E-01    0.00000E+00

*****************************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 611, EFW/SGIA PIPE    , HAVING  3 VOLUME(S) AND  2 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
611010000     1.810000E-01     1.200000E+02     2.172000E+01     0.000000E+00     0.000000E+00     0.000000E+00
611020000     1.810000E-01     2.000000E+02     3.620000E+01     0.000000E+00     9.000000E+01     2.000000E+01
611030000     1.810000E-01     1.471216E+02     2.662900E+01     0.000000E+00     0.000000E+00     0.000000E+00

  VOL NO.     ROUGHNESS        HYDRAULIC DIAM.    VOLUME  INIT. COND.    I.C.VALUE 1     I.C.VALUE 2     I.C.VALUE 3     I.C.VALUE 4
              (FT)             (FT)                FLAGS         FLAG
611010000     1.500000E-04     4.800587E-01          10            0    9.252560E+02    1.145790E+03    0.000000E+00    0.000000E+00
611020000     1.500000E-04     4.800587E-01          10            0    9.251280E+02    1.145800E+03    0.000000E+00    0.000000E+00
611030000     1.500000E-04     4.800587E-01          10            0    9.250000E+02    1.145820E+03    0.000000E+00    0.000000E+00

  JUN.NO.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
              (FT2)            COEFFICIENT      COEFFICIENT          FLAGS       (FT/SEC)         (FT/SEC)       (FT/SEC)
611010000     1.810000E-01     5.350000E-01     5.350000E-01              0     0.000000E+00     0.000000E+00     0.000000E+00
611020000     1.810000E-01     6.400000E-02     6.400000E-02              0     0.000000E+00     0.000000E+00     0.000000E+00

*****************************************************************************************************************************
*******************                                                                                   *******************
*******************  INPUT DATA FOR COMPONENT 612, EFW/HCHA VALVE   , HAVING  0 VOLUME(S) AND  1 JUNCTION(S)  *******************
*******************                                                                                   *******************
*****************************************************************************************************************************

  JUN.NO. FROM VOL.   TO VOL.     JUNCTION AREA    FORWARD LOSS     REVERSE LOSS       JUNCTION     SUBCOOLED        TWO-PHASE
                                  (FT2)            COEFFICIENT      COEFFICIENT          FLAGS     DISCHARGE COEF.  DISCHARGE COEF.
612000000 611010000 613000000     1.810000E-01     9.430000E-01     9.430000E-01          100     1.000000E+00     6.000000E-01

  JUN.NO.                         INIT. LIQ. VEL.  INIT. VAP. VEL.  INTERFACE VEL.
```

```
                                  (FT/SEC)        (FT/SEC)        (FT/SEC)
612000000                       6.719690E-07    6.719690E-07    0.000000E+00

  JUN.NO.                       BACK PRESSURE   LEAKAGE         CHECK VALVE
                                  (#F/IN2)      (% AREA OPEN)   FLAGS
612000000                       0.000000E+00    0.000000E+00    100

*****************************************************************************************************************
*******************                                                                                   ******************
*******************  INPUT DATA FOR COMPONENT 613, EFW/SGVA TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  ******************
*******************                                                                                   ******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
613010000     1.000000E+06     1.000000E+00     1.000000E+06     0.000000E+00     0.000000E+00     0.000000E+00

  VOL.NO.     ROUGHNESS        HYDRAULIC DIAM.    EQUIL.
              (FT)             (FT)                FLAG
613010000     0.000000E+00     1.128379E+03          1

TABLE TRIP NUMBER IS    0

TABULAR DATA
      TIME           PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)          (PSIA)           (BTU/LBM)

    0.000000E+00     9.250000E+02     1.145820E+03     1.000000E+00
    3.000000E+01     2.500000E+01     5.800900E+01     0.000000E+00
    1.000000E+06     2.500000E+01     5.800900E+01     0.000000E+00

*****************************************************************************************************************
*******************                                                                                   ******************
*******************  INPUT DATA FOR COMPONENT 624, EFW/CHWL TMDPVOL , HAVING  1 VOLUME(S) AND  0 JUNCTION(S)  ******************
*******************                                                                                   ******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
              (FT2)            (FT)             (FT3)            (DEG)            (DEG)            (FT)
624010000     1.000000E+06     1.000000E+00     1.000000E+06     0.000000E+00     0.000000E+00     0.000000E+00

  VOL.NO.     ROUGHNESS        HYDRAULIC DIAM.    EQUIL.
              (FT)             (FT)                FLAG
624010000     0.000000E+00     1.128379E+03          1

TABLE TRIP NUMBER IS    0

TABULAR DATA
      TIME           PRESSURE          INTERNAL ENERGY  STATIC QUALITY
      (SEC)          (PSIA)           (BTU/LBM)

    0.000000E+00     7.208000E+00     5.801500E+01     0.000000E+00
    1.000000E+06     7.208000E+00     5.801500E+01     0.000000E+00

*****************************************************************************************************************
*******************                                                                                   ******************
*******************  INPUT DATA FOR COMPONENT 625, EFW/MDPB PUMP    , HAVING 1 VOLUME AND 2 JUNCTIONS        ******************
*******************                                                                                   ******************
*****************************************************************************************************************

  VOL NO.     FLOW AREA        FLOW LENGTH      VOLUME           HORIZ. ANGLE     VERT. ANGLE      ELEV. CHNG.
```

```
              (FT2)              (FT)              (FT3)              (DEG)              (DEG)              (FT)
625010000     3.170000E-01      6.309149E+01      2.000000E+01      0.000000E+00      0.000000E+00      0.000000E+00

  VOL NO.    EQUIL. INIT. COND.     I.C.VALUE 1       I.C.VALUE 2       I.C.VALUE 3       I.C.VALUE 4
               FLAG        FLAG
625010000        5           0      7.208000E+00      5.801500E+01      0.000000E+00      0.000000E+00

  JUN.NO. FROM VOL.   TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS        JUNCTION
                                   (FT2)             COEFFICIENT       COEFFICIENT           FLAGS
625010000 624000000 625000000      0.000000E+00      4.982050E+02      1.000000E+06              0

  JUN.NO.                          INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                     (FT/SEC)          (FT/SEC)         (FT/SEC)
625010000                          0.000000E+00      0.000000E+00      0.000000E+00

  JUN.NO. FROM VOL.   TO VOL.      JUNCTION AREA     FORWARD LOSS      REVERSE LOSS        JUNCTION
                                   (FT2)             COEFFICIENT       COEFFICIENT           FLAGS
625020000 625010000 626000000      0.000000E+00      1.146460E+02      1.000000E+06              0

  JUN.NO.                          INIT. LIQ. VEL.   INIT. VAP. VEL.   INTERFACE VEL.
                                     (FT/SEC)          (FT/SEC)         (FT/SEC)
625020000                          0.000000E+00      0.000000E+00      0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX ..................      0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX       0
2 PHASE DIFFERENCE TABLE SET INDEX ...........     -2
PUMP MOTOR TORQUE TABLE INDEX ................      0
TIME DEPENDENT PUMP SPEED TABLE INDEX .......      0
PUMP TRIP NUMBER INDEX .......................    644
PUMP REVERSE INDICATOR .......................      0


---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED ..................... =  3.5600E+03    (REV/M)
PUMP SPEED RATIO (INITIAL / RATED) .. =  0.0000E+00
RATED PUMP FLOW ...................... =  5.0000E+02    (GAL/M)
RATED PUMP HEAD ...................... =  2.7500E+03    (FT)
RATED PUMP TORQUE .................... =  1.0000E-06    (LBF-FT)
PUMP MOMENT-OF-INERTIA ............... =  1.8432E+03    (#FT**2)
PUMP RATED DENSITY ................... =  0.0000E+00    (#/F**3)
PUMP RATED MOTOR TORQUE .............. =  1.0000E+03    (LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #1 =  1.0000E+03
PUMP FRICTIONAL TORQUE COEFFICIENT #2 =  0.0000E+00
PUMP FRICTIONAL TORQUE COEFFICIENT #4 =  0.0000E+00

 PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME .................... =     1.000000E+06    (SEC)
PUMP MAXIMUM FORWARD SPEED ....... =     1.000000E+06    (REV/M)
PUMP MAXIMUM REVERSE SPEED ....... =    -1.000000E+06    (REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --


 --- FOR  HEAD  CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                          0.000000E+00     1.218000E+00
                                          2.000000E-01     1.218000E+00
```

```
                                    4.000000E-01      1.200000E+00
                                    6.000000E-01      1.182000E+00
                                    8.000000E-01      1.091000E+00
                                    1.000000E+00      1.000000E+00

 --- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00      1.000000E+00
                                    1.000000E+00      1.000000E+00

 --- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00      0.000000E+00
                                    5.000000E-01      9.100000E-02
                                    6.250000E-01      2.060000E-01
                                    7.140000E-01      3.530000E-01
                                    8.330000E-01      5.940000E-01
                                    9.990000E-01      9.980000E-01

 --- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00      0.000000E+00
                                    5.000000E-01      2.500000E-01
                                    6.250000E-01      3.910000E-01
                                    7.140000E-01      5.100000E-01
                                    8.330000E-01      6.940000E-01
                                    9.990000E-01      9.980000E-01

 --- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -1.000000E+00      1.218000E+00
                                    0.000000E+00      1.218000E+00

 --- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -1.000000E+00      0.000000E+00
                                    0.000000E+00      0.000000E+00

 --- FOR  HEAD  CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -9.990000E-01     -1.000000E+02
                                    0.000000E+00     -1.000000E+02

 --- FOR TORQUE CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -9.990000E-01      0.000000E+00
                                    0.000000E+00      0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                        0.000000E+00      0.000000E+00
                        1.000000E-01      0.000000E+00
                        1.500000E-01      5.000000E-02
                        2.400000E-01      8.000000E-01
                        3.000000E-01      9.600000E-01
                        4.000000E-01      9.800000E-01
                        6.000000E-01      9.700000E-01
                        8.000000E-01      9.000000E-01
                        9.000000E-01      8.000000E-01
                        9.600000E-01      5.000000F-01
                        1.000000E+00      0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =      0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
```

0.000000E+00	0.000000E+00
1.000000E-01	0.000000E+00
1.500000E-01	5.000000E-02
2.400000E-01	8.000000E-01
3.000000E-01	9.600000E-01
4.000000E-01	9.800000E-01
6.000000E-01	9.700000E-01
8.000000E-01	9.000000E-01
9.000000E-01	8.000000E-01
9.600000E-01	5.000000E-01
1.000000E+00	0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE

PUMP VELOCITY (REV/ M)	REL.PUMP MTR.TORQUE
0.000000E+00	1.000000E+00
1.000000E+06	1.000000E+00

PUMP VELOCITY TRIP NUMBER IS 648.

EDIT OF PUMP VELOCITY TABLE

TIME (SEC)	PUMP VELOCITY (REV/ M)
0.000000E+00	0.000000E+00
1.00000	787.469
2.00000	1400.86
3.00000	1878.26
4.00000	2250.28
5.00000	2540.06
6.00000	2765.76
7.00000	2941.27
8.00000	3078.33
9.00000	3184.78
10.0000	3267.72
11.0000	3332.52
12.0000	3382.71
15.0000	3560.00
1.000000E+06	3560.00

****
********** INPUT DATA FOR COMPONENT 626, EFW/MDPB PIPE , HAVING 2 VOLUME(S) AND 1 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
626010000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00
626020000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
626010000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00
626020000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
626010000	1.810000E-01	1.970830E+02	1.970830E+02	0	0.000000E+00	0.000000E+00	0.000000E+00

****
****

********** INPUT DATA FOR COMPONENT 627, EFW/MDPB VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
627000000	626010000	626000000	1.810000E-01	1.548040E+02	1.548040E+02	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
627000000	0.000000E+00	0.000000E+00	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
627000000	0.000000E+00	0.000000E+00	101

********** INPUT DATA FOR COMPONENT 628, EFW/MDPB BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
628010000	1.810000E-01	2.209945E+02	4.000000E+01	0.000000E+00	9.000000E+01	4.950000E+01

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
628010000	1.500000E-04	4.800587E-01	10	0	1.008810E+03	4.380980E+02	0.000000E+00	1.500E-04

********** INPUT DATA FOR COMPONENT 629, EFW/MDPB SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
629000000	628010000	630000000	0.000000E+00	1.407600E+01	1.407600E+01	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
629000000	0.000000E+00	0.000000E+00	0.000000E+00

********** INPUT DATA FOR COMPONENT 630, EFW/AFWB BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
630010000	1.810000E-01	4.419890E+02	8.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
630010000	1.500000E-04	4.800587E-01	10	0	1.000000E+03	4.381250E+02	0.000000E+00	1.500E-04

********** INPUT DATA FOR COMPONENT 631, EFW/AFWB VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
631000000	527010000	630000000	1.810000E-01	0.000000E+00	0.000000E+00	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
631000000	6.719690E-07	6.719690E-07	0.000000E+00

JUN.NO.	BACK PRESSURE (LBF/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
631000000	0.000000E+00	0.000000E+00	100

****
********** INPUT DATA FOR COMPONENT 632, EFW/SGIB VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
632000000	630010000	633000000	1.810000E-01	4.716000E+00	4.716000E+00	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
632000000	0.000000E+00	0.000000E+00	0.000000E+00

JUN.NO.	OPEN TRIP NO.	CLOSE TRIP NO.	TABLE NO.	SLOPE (1.0/SEC)	INITIAL POSITION
632000000	653	654	632	5.20700E-01	0.00000E+00

****
********** INPUT DATA FOR COMPONENT 633, EFW/SGIB PIPE , HAVING 3 VOLUME(S) AND 2 JUNCTION(S) **********
****
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
633010000	1.810000E-01	7.500001E+01	1.357500E+01	0.000000E+00	0.000000E+00	0.000000E+00
633020000	1.810000E-01	7.500001E+01	1.357500E+01	0.000000E+00	9.000000E+01	2.000000E+01
633030000	1.810000E-01	1.221050E+02	2.210100E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
633010000	1.500000E-04	4.800587E-01	10	0	9.252560E+02	1.145790E+03	0.000000E+00	0.000000E+00
633020000	1.500000E-04	4.800587E-01	10	0	9.251280E+02	1.145800E+03	0.000000E+00	0.000000E+00
633030000	1.500000E-04	4.800587E-01	10	0	9.250000E+02	1.145820E+03	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
633010000	1.810000E-01	5.350000E-01	5.350000E-01	0	0.000000E+00	0.000000E+00	0.000000E+00
633020000	1.810000E-01	6.400000E-02	6.400000E-02	0	0.000000E+00	0.000000E+00	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 634, EFW/HCHB VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
634000000	633010000	635000000	1.810000E-01	9.430000E-01	9.430000E-01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
634000000	6.719690E-07	6.719690E-07	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
634000000	0.000000E+00	0.000000E+00	100

****
********** INPUT DATA FOR COMPONENT 635, EFW/SGYB TMDPVOL , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
635010000	1.000000E+06	1.000000E+00	1.000000E+06	0.000000E+00	0.000000E+00	0.000000E+00

VOL.NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	EQUIL. FLAG
635010000	0.000000E+00	1.128379E+03	1

TABLE TRIP NUMBER IS 0

TABULAR DATA

TIME (SEC)	PRESSURE (PSIA)	INTERNAL ENERGY (BTU/LBM)	STATIC QUALITY
0.000000E+00	9.250000E+02	1.145820E+03	1.000000E+00
3.000000E+01	9.250000E+02	1.145820E+03	1.000000E+00
1.000000E+06	9.250000E+02	1.145820E+03	1.000000E+00

****
********** INPUT DATA FOR COMPONENT 652, EFW/CHWL TMDPVOL , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
652010000	1.000000E+06	1.000000E+00	1.000000E+06	0.000000E+00	0.000000E+00	0.000000E+00

VOL.NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	EQUIL. FLAG
652010000	0.000000E+00	1.128379E+03	1

TABLE TRIP NUMBER IS 0

TABULAR DATA

TIME (SEC)	PRESSURE (PSIA)	INTERNAL ENERGY (BTU/LBM)	STATIC QUALITY
0.000000E+00	7.208000E+00	5.801500E+01	0.000000E+00
1.000000E+06	7.208000E+00	5.801500E+01	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 653, EFW/TBDP PUMP , HAVING 1 VOLUME AND 2 JUNCTIONS **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
653010000	3.170000E-01	6.309149E+01	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	EQUIL. FLAG	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
653010000	5	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS
653010000	652000000	653000000	0.000000E+00	1.245140E+02	1.000000E+06	0

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
653010000	0.000000E+00	0.000000E+00	0.000000E+00

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS
653020000	653010000	654000000	0.000000E+00	2.865600E+01	1.000000E+06	0

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
653020000	0.000000E+00	0.000000E+00	0.000000E+00

---- EDIT OF PUMP INDEX & OPTION INDICATORS

SINGLE PHASE TABLE SET INDEX	0
2 PHASE HEAD & TORQUE MULTIPLIER TABLE INDEX	0
2 PHASE DIFFERENCE TABLE SET INDEX	-2
PUMP MOTOR TORQUE TABLE INDEX	0
TIME DEPENDENT PUMP SPEED TABLE INDEX	0
PUMP TRIP NUMBER INDEX	646
PUMP REVERSE INDICATOR	0

---- EDIT OF PUMP FIXED DATA PARAMETERS ----

RATED PUMP SPEED	=	3.5750E+03	(REV/M)
PUMP SPEED RATIO (INITIAL / RATED) ..	=	0.0000E+00	
RATED PUMP FLOW	=	1.0000E+03	(GAL/M)
RATED PUMP HEAD	=	2.7500E+03	(FT)
RATED PUMP TORQUE	=	1.0000E-06	(LBF-FT)
PUMP MOMENT-OF-INERTIA	=	1.8432E+03	(#FT**2)
PUMP RATED DENSITY	=	0.0000E+00	(#/F**3)
PUMP RATED MOTOR TORQUE	=	1.0000E+03	(LBF-FT)
PUMP FRICTIONAL TORQUE COEFFICIENT #3	=	0.0000E+00	
PUMP FRICTIONAL TORQUE COEFFICIENT #1	=	1.0000E+03	
PUMP FRICTIONAL TORQUE COEFFICIENT #2	=	0.0000E+00	
PUMP FRICTIONAL TORQUE COEFFICIENT #4	=	0.0000E+00	

PUMP STOP PARAMETER VALUES INPUT ARE :

PUMP STOP TIME	=	1.000000E+06	(SEC)
PUMP MAXIMUM FORWARD SPEED	=	1.000000E+06	(REV/M)
PUMP MAXIMUM REVERSE SPEED	=	-1.000000E+06	(REV/M)

-- EDIT FOR PUMP -SINGLE PHASE- TABLE SET INPUT --

--- FOR HEAD CURVE NO. 1 IN SET : INDEP. VARIABLE DEPEND. VARIABLE

0.000000E+00 1.218000E+00

```
                                    2.000000E-01     1.200000E+00
                                    4.000000E-01     1.182000E+00
                                    6.000000E-01     1.145000E+00
                                    8.000000E-01     1.091000E+00
                                    1.000000E+00     1.000000E+00

--- FOR TORQUE CURVE NO.    1 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00     1.000000E+00
                                    1.000000E+00     1.000000E+00

--- FOR  HEAD  CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00     0.000000E+00
                                    5.000000E-01     1.230000E-01
                                    6.250000E-01     2.410000E-01
                                    7.140000E-01     3.800000E-01
                                    8.330000E-01     6.060000E-01
                                    9.990000E-01     9.980000E-01

--- FOR TORQUE CURVE NO.    2 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                    0.000000E+00     0.000000E+00
                                    5.000000E-01     2.500000E-01
                                    6.250000E-01     3.910000E-01
                                    7.140000E-01     5.100000E-01
                                    8.330000E-01     6.940000E-01
                                    9.990000E-01     9.980000E-01

--- FOR  HEAD  CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -1.000000E+00     1.218000E+00
                                    0.000000E+00     1.218000E+00

--- FOR TORQUE CURVE NO.    3 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -1.000000E+00     0.000000E+00
                                    0.000000E+00     0.000000E+00

--- FOR  HEAD  CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -9.990000E-01    -1.000000E+02
                                    0.000000E+00    -1.000000E+02

--- FOR TORQUE CURVE NO.    4 IN SET : INDEP. VARIABLE  DEPEND. VARIABLE

                                   -9.990000E-01     0.000000E+00
                                    0.000000E+00     0.000000E+00

---- EDIT FOR PUMP  HEAD  MULTIPLIER TABLE INPUT:  CONTROL WORD =     0  (EXTRAPOLATION FACTOR)
DATA VALUES ARE : INDEP. VARIABLE  DEPEND. VARIABLE
                  0.000000E+00     0.000000E+00
                  1.000000E-01     0.000000E+00
                  1.500000E-01     5.000000E-02
                  2.400000E-01     8.000000E-01
                  3.000000E-01     9.600000E-01
                  4.000000E-01     9.800000E-01
                  6.000000E-01     9.700000E-01
                  8.000000E-01     9.000000E-01
                  9.000000E-01     8.000000E-01
                  9.600000E-01     5.000000E-01
                  1.000000E+00     0.000000E+00

---- EDIT FOR PUMP TORQUE MULTIPLIER TABLE INPUT:  CONTROL WORD =     0  (EXTRAPOLATION FACTOR)
```

DATA VALUES ARE : INDEP. VARIABLE DEPEND. VARIABLE

0.000000E+00	0.000000E+00
1.000000E-01	0.000000E+00
1.500000E-01	5.000000E-02
2.400000E-01	8.000000E-01
3.000000E-01	9.600000E-01
4.000000E-01	9.800000E-01
6.000000E-01	9.700000E-01
8.000000E-01	9.000000E-01
9.000000E-01	8.000000E-01
9.600000E-01	5.000000E-01
1.000000E+00	0.000000E+00

EDIT OF RELATIVE PUMP MOTOR TORQUE TABLE

PUMP VELOCITY (REV/ M)	REL.PUMP MTR.TORQUE
0.000000E+00	1.000000E+00
1.000000E+06	1.000000E+00

PUMP VELOCITY TRIP NUMBER IS 649.

EDIT OF PUMP VELOCITY TABLE

TIME (SEC)	PUMP VELOCITY (REV/ M)
0.000000E+00	0.000000E+00
1.00000	790.790
2.00000	1406.76
3.00000	1886.17
4.00000	2259.76
5.00000	2550.76
6.00000	2777.42
7.00000	2953.66
8.00000	3091.30
9.00000	3198.19
10.0000	3281.49
11.0000	3346.56
12.0000	3396.96
15.0000	3575.00
1.000000E+06	3575.00

****

********** INPUT DATA FOR COMPONENT 654, EFW/TLIN PIPE , HAVING 2 VOLUME(S) AND 1 JUNCTION(S) **********

****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
654010000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00
654020000	1.810000E-01	1.104973E+02	2.000000E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C.VALUE 1	I.C.VALUE 2	I.C.VALUE 3	I.C.VALUE 4
654010000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00
654020000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	0.000000E+00

JUN.NO.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
654010000	1.810000E-01	4.926600E+01	4.926600E+01	0	0.000000E+00	0.000000E+00	0.000000E+00

****

****
********** INPUT DATA FOR COMPONENT 655, EFW/TLIN SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
655000000	654010000	656000000	0.000000E+00	2.462800E+01	2.462800E+01	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
655000000	0.000000E+00	0.000000E+00	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 656, EFW/TLIN BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********
****

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
656010000	1.810000E-01	1.312100E+02	2.374900E+01	0.000000E+00	0.000000E+00	0.000000E+00

VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
656010000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	1.500E-04

****
********** INPUT DATA FOR COMPONENT 657, EFW/TLIN VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
657000000	656010000	628000000	1.810000E-01	5.630400E+01	5.630400E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
657000000	0.000000E+00	0.000000E+00	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
657000000	0.000000E+00	0.000000E+00	101

****
********** INPUT DATA FOR COMPONENT 658, EFW/TLIN SNGLJUN , HAVING 0 VOLUME(S) AND 1 JUNCTION(S) **********
****

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
658000000	656010000	659000000	0.000000E+00	0.000000E+00	0.000000E+00	0	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
658000000	0.000000E+00	0.000000E+00	0.000000E+00

****
********** INPUT DATA FOR COMPONENT 659, EFW/TLIN BRANCH , HAVING 1 VOLUME(S) AND 0 JUNCTION(S) **********

VOL NO.	FLOW AREA (FT2)	FLOW LENGTH (FT)	VOLUME (FT3)	HORIZ. ANGLE (DEG)	VERT. ANGLE (DEG)	ELEV. CHNG. (FT)
659010000	1.810000E-01	1.240387E+02	2.245100E+01	0.000000E+00	0.000000E+00	0.000000E+00

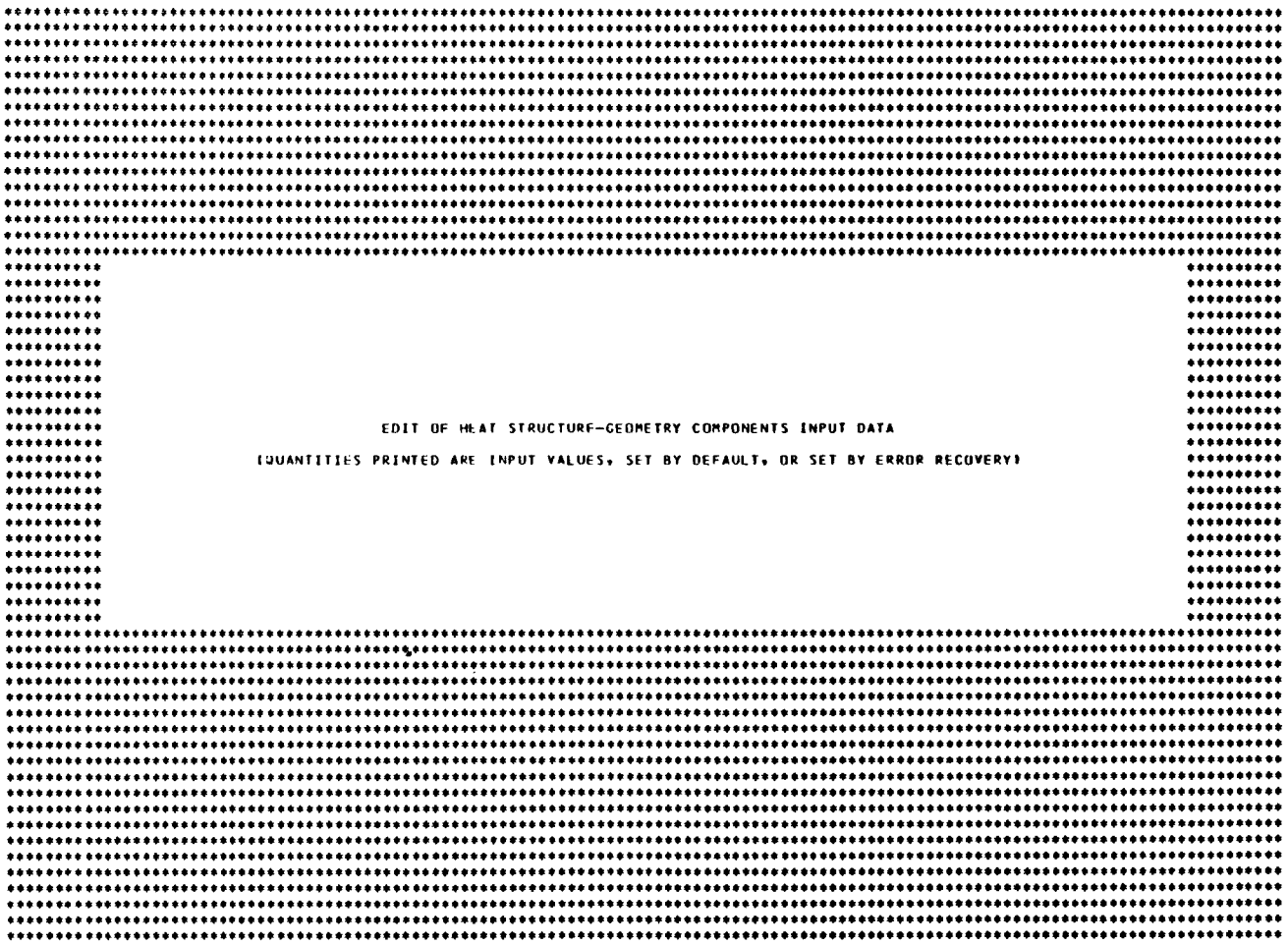
VOL NO.	ROUGHNESS (FT)	HYDRAULIC DIAM. (FT)	VOLUME FLAGS	INIT. COND. FLAG	I.C. VALUE 1	I.C. VALUE 2	I.C.VALUE 3	I.C. VALUE 4
659010000	1.500000E-04	4.800587E-01	10	0	7.208000E+00	5.801500E+01	0.000000E+00	1.500E-04

INPUT DATA FOR COMPONENT 660, EFW/TLIN VALVE , HAVING 0 VOLUME(S) AND 1 JUNCTION(S)

JUN.NO.	FROM VOL.	TO VOL.	JUNCTION AREA (FT2)	FORWARD LOSS COEFFICIENT	REVERSE LOSS COEFFICIENT	JUNCTION FLAGS	SUBCOOLED DISCHARGE COEF.	TWO-PHASE DISCHARGE COEF.
660000000	659010000	606000000	1.810000E-01	5.630400E+01	5.630400E+01	100	1.000000E+00	6.000000E-01

JUN.NO.	INIT. LIQ. VEL. (FT/SEC)	INIT. VAP. VEL. (FT/SEC)	INTERFACE VEL. (FT/SEC)
660000000	0.000000E+00	0.000000E+00	0.000000E+00

JUN.NO.	BACK PRESSURE (#F/IN2)	LEAKAGE (% AREA OPEN)	CHECK VALVE FLAGS
660000000	0.000000E+00	0.000000E+00	101


EDIT OF HEAT STRUCTURE-GEOMETRY COMPONENTS INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

```
*****************************************************************************************************************
*********************                                                                                   *********************
*********************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4002                  *********************
*********************                                                                                   *********************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  2.537500D-02

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  8.985000D-01      2,  9.238750D-01      3,  9.492500D-01      4,  9.746250D-01      5,  1.000000D+00

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 400

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  9.500000D+01

STRUCTURE       SOURCE        INTERNAL SOURCE
   NUMBER         CODE        FACTOR
  4002001          400        1.000000D+00

STRUCTURE  LEFT  VOL.        LEFT         LEFT       LEFT  SURFACE     LEFT  DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE      AREA ENTRY        SOURCE FACTOR
  4002001    402020000           1            1      2.957410D+02      0.000000D+00

STRUCTURE  LEFT  CHF-      LEFT  HYDRAULIC  LEFT  HEATED      LEFT  CHANNEL
   NUMBER HTR OPTIONS      DIAM. (FT)        EQV.DIAM (FT)     LENGTH (FT)
  4002001           0      0.000000D+00      0.000000D+00      2.957410D+02

STRUCTURE  RIGHT VOL.        RIGHT        RIGHT      RIGHT SURFACE     RIGHT DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE      AREA ENTRY        SOURCE FACTOR
  4002001           0           0            1      2.957410D+02      0.000000D+00

*****************************************************************************************************************
*********************                                                                                   *********************
*********************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4012                  *********************
*********************                                                                                   *********************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  2.537500D-02

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  8.985000D-01      2,  9.238750D-01      3,  9.492500D-01      4,  9.746250D-01      5,  1.000000D+00

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
```

```
     5, 401

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  9.500000D+01

STRUCTURE       SOURCE        INTERNAL SOURCE
   NUMBER         CODE        FACTOR
  4012001            0        0.000000D+00

STRUCTURE  LEFT  VOL.        LEFT         LEFT       LEFT  SURFACE     LEFT  DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE       AREA ENTRY        SOURCE FACTOR
  4012001   402020000            1            1       3.205470D+03      0.000000D+00

STRUCTURE  LEFT  CHF-      LEFT  HYDRAULIC  LEFT  HEATED      LEFT  CHANNEL
   NUMBER HTR OPTIONS      DIAM. (FT)       EQV.DIAM (FT)     LENGTH (FT)
  4012001            0     0.000000D+00     0.000000D+00      3.205470D+03

STRUCTURE  RIGHT VOL.        RIGHT        RIGHT      RIGHT SURFACE     RIGHT DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE       AREA ENTRY        SOURCE FACTOR
  4012001            0            0            1       3.205470D+03      0.000000D+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************                  INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4022                   *******************
*******************                                                                                   *******************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  3.000000D-04

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  8.985000D-01      2,  8.988000D-01      3,  8.991000D-01      4,  8.994000D-01      5,  8.997000D-01

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 402

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.600000D+02

STRUCTURE       SOURCE        INTERNAL SOURCE
   NUMBER         CODE        FACTOR
  4022001          402        1.000000D+00

STRUCTURE  LEFT  VOL.        LEFT         LEFT       LEFT  SURFACE     LEFT  DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE       AREA ENTRY        SOURCE FACTOR
  4022001   404010000            1            1       1.115940D+04      0.000000D+00

STRUCTURE  LEFT  CHF-      LEFT  HYDRAULIC  LEFT  HEATED      LEFT  CHANNEL
   NUMBER HTR OPTIONS      DIAM. (FT)       EQV.DIAM (FT)     LENGTH (FT)
  4022001            0     0.000000D+00     0.000000D+00      1.115940D+04
```

STRUCTURE NUMBER	RIGHT VOL. NUMBER	RIGHT BDRY. TYPE	RIGHT SRFC. CODE	RIGHT SURFACE AREA ENTRY	RIGHT DIRECT SOURCE FACTOR
4022001	0	0	1	1.115940D+04	0.0000000D+00

****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4032 **********
****

NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY: 1
NUMBER OF MESH POINTS: 5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION: YES

MESH POINT NUMBER, MESH INTERVAL (FT) (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
5, 3.0000000-04

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
1, 5.9630000-01 2, 5.9660000-01 3, 5.9690000-01 4, 5.9720000-01 5, 5.9750000-01

MESH POINT NUMBER, COMPOSITION NUMBER (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
5, 403

MESH POINT NUMBER, SOURCE FACTOR (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
5, 1.0000000+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF) (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
5, 2.3000000+02

STRUCTURE NUMBER	SOURCE CODE	INTERNAL SOURCE FACTOR
4032001	403	1.0000000+00

STRUCTURE NUMBER	LEFT VOL. NUMBER	LEFT BDRY. TYPE	LEFT SRFC. CODE	LEFT SURFACE AREA ENTRY	LEFT DIRECT SOURCE FACTOR
4032001	404020000	1	1	1.1210000+04	0.0000000+00

STRUCTURE NUMBER	LEFT CHF-THR OPTIONS	LEFT HYDRAULIC DIAM. (FT)	LEFT HEATED EQV.DIAM (FT)	LEFT CHANNEL LENGTH (FT)
4032001	0	0.0000000+00	0.0000000+00	1.1210000+04

STRUCTURE NUMBER	RIGHT VOL. NUMBER	RIGHT BDRY. TYPE	RIGHT SRFC. CODE	RIGHT SURFACE AREA ENTRY	RIGHT DIRECT SOURCE FACTOR
4032001	0	0	1	1.1210000+04	0.0000000+00

****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4042 **********
****

NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY: 1
NUMBER OF MESH POINTS: 5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION: YES

MESH POINT NUMBER, MESH INTERVAL (FT) (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
5, 3.0000000-04

MESH POINT NUMBER, MESH POINT COORDINATE (FT)

```
     1,  8.985000D-01      2,  8.986000D-01      3,  8.991000D-01      4,  8.994000D-01      5,  8.997000D-01

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 404

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  3.000000D+02

STRUCTURE      SOURCE       INTERNAL SOURCE
   NUMBER        CODE       FACTOR
  4042001         404       1.000000D+00

STRUCTURE  LEFT  VOL.       LEFT        LEFT      LEFT  SURFACE    LEFT  DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  4042001   408010000           1           1     7.439630D+03     0.000000D+00

STRUCTURE  LEFT  CHF-     LEFT  HYDRAULIC  LEFT  HEATED     LEFT  CHANNEL
   NUMBER HTR OPTIONS     DIAM. (FT)       EQV.DIAM (FT)    LENGTH (FT)
  4042001           0     0.000000D+00     0.000000D+00     7.439630D+03

STRUCTURE  RIGHT VOL.       RIGHT       RIGHT     RIGHT SURFACE    RIGHT DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  4042001           0           0           1     7.439630D+03     0.000000D+00

*****************************************************************************************************************
*******************                                                                                  *******************
*******************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4052                 *******************
*******************                                                                                  *******************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  3.000000D-04

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  1.151000D+00      2,  1.151300D+00      3,  1.151600D+00      4,  1.151900D+00      5,  1.152200D+00

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 405

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  3.700000D+02

STRUCTURE      SOURCE       INTERNAL SOURCE
   NUMBER        CODE       FACTOR
  4052001         405       1.000000D+00

STRUCTURE  LEFT  VOL.       LEFT        LEFT      LEFT  SURFACE    LEFT  DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  4052001   412010000           1           1     5.807570D+03     0.000000D+00

STRUCTURE  LEFT  CHF-     LEFT  HYDRAULIC  LEFT  HEATED     LEFT  CHANNEL
```

NUMBER	HTR OPTIONS	DIAM. (FT)	EQV.DIAM (FT)	LENGTH (FT)
4052001	0	0.000000D+00	0.000000D+00	5.807570D+03

STRUCTURE NUMBER	RIGHT VOL. NUMBER	RIGHT BOUNDARY TYPE	RIGHT SURFACE CODE	RIGHT SURFACE AREA ENTRY	RIGHT DIRECT SOURCE FACTOR
4052001	0	0	1	5.807570D+03	0.000000D+00

****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4202 **********
****

NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY: 1
NUMBER OF MESH POINTS: 5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION: YES

MESH POINT NUMBER, MESH INTERVAL (FT) (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
5, 1.550000D-03

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
1, 8.985000D-01 2, 9.000500D-01 3, 9.016000D-01 4, 9.031500D-01 5, 9.047000D-01

MESH POINT NUMBER, COMPOSITION NUMBER (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
5, 420

MESH POINT NUMBER, SOURCE FACTOR (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
5, 1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF) (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
5, 4.150000D+02

STRUCTURE NUMBER	SOURCE CODE	INTERNAL SOURCE FACTOR
4202001	420	1.000000D+00

STRUCTURE NUMBER	LEFT VOL. NUMBER	LEFT BOUNDARY TYPE	LEFT SURFACE CODE	LEFT SURFACE AREA ENTRY	LEFT DIRECT SOURCE FACTOR
4202001	424010000	1	1	3.631250D+03	0.000000D+00

STRUCTURE NUMBER	LEFT CHF-HTR OPTIONS	LEFT HYDRAULIC DIAM. (FT)	LEFT HEATED EQV.DIAM (FT)	LEFT CHANNEL LENGTH (FT)
4202001	0	0.000000D+00	0.000000D+00	3.631250D+03

STRUCTURE NUMBER	RIGHT VOL. NUMBER	RIGHT BOUNDARY TYPE	RIGHT SURFACE CODE	RIGHT SURFACE AREA ENTRY	RIGHT DIRECT SOURCE FACTOR
4202001	0	0	1	3.631250D+03	0.000000D+00

****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4212 **********
****

NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY: 1
NUMBER OF MESH POINTS: 5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION: YES

MESH POINT NUMBER, MESH INTERVAL (FT) (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)

```
     5,  1.550000D-03

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  8.985000D-01      2,  9.000500D-01      3,  9.016000D-01      4,  9.031500D-01      5,  9.047000D-01

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 421

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  4.600000D+02

STRUCTURE       SOURCE        INTERNAL SOURCE
   NUMBER         CODE        FACTOR
  4212001          421        1.000000D+00

STRUCTURE  LEFT  VOL.        LEFT         LEFT       LEFT  SURFACE     LEFT  DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE      AREA ENTRY        SOURCE FACTOR
  4212001   424020000           1            1      3.896950D+03      0.000000D+00

STRUCTURE  LEFT  CHF-      LEFT  HYDRAULIC  LEFT  HEATED      LEFT  CHANNEL
   NUMBER HTR OPTIONS      DIAM. (FT)       EQV.DIAM (FT)     LENGTH (FT)
  4212001            0     0.000000D+00     0.000000D+00      3.896950D+03

STRUCTURE  RIGHT VOL.        RIGHT        RIGHT      RIGHT SURFACE     RIGHT DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE      AREA ENTRY        SOURCE FACTOR
  4212001            0           0            1      3.896950D+03      0.000000D+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5002                  *******************
*******************                                                                                   *******************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  2.475000D-02

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  1.151000D+00      2,  1.175750D+00      3,  1.200500D+00      4,  1.225250D+00      5,  1.250000D+00

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 500

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  3.700000D+02

STRUCTURE       SOURCE        INTERNAL SOURCE
   NUMBER         CODE        FACTOR
  5002001            0        0.000000D+00

STRUCTURE  LEFT  VOL.        LEFT         LEFT       LEFT  SURFACE     LEFT  DIRECT
   NUMBER       NUMBER  BDRY. TYPE  SRFC. CODE      AREA ENTRY        SOURCE FACTOR
```

```
 5002001   500010000          1          1     2.598580D+03     0.000000D+00

STRUCTURE  LEFT  CHF-     LEFT  HYDRAULIC  LEFT  HEATED     LEFT  CHANNEL
   NUMBER HTR OPTIONS     DIAM. (FT)       EQV.DIAM (FT)    LENGTH (FT)
  5002001           0     0.000000D+00     0.000000D+00     2.598580D+03

STRUCTURE  RIGHT VOL.       RIGHT       RIGHT     RIGHT SURFACE    RIGHT DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  5002001           0           0          1     2.598580D+03     0.000000D+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5212                  *******************
*******************                                                                                   *******************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
STEADY STATE INITIALIZATION:      YES

MESH POINT NUMBER, MESH INTERVAL (FT)  (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.550000D-03

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
     1,  8.985000D-01      2,  9.000500D-01      3,  9.016000D-01      4,  9.031500D-01      5,  9.047000D-01

MESH POINT NUMBER, COMPOSITION NUMBER  (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
     5, 521

MESH POINT NUMBER, SOURCE FACTOR  (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  1.000000D+00

MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF)  (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
     5,  4.150000D+02

STRUCTURE      SOURCE       INTERNAL SOURCE
   NUMBER        CODE       FACTOR
  5212001         521       1.000000D+00

STRUCTURE  LEFT  VOL.       LEFT        LEFT      LEFT  SURFACE    LEFT  DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  5212001   524010000          1          1     3.631250D+03     0.000000D+00

STRUCTURE  LEFT  CHF-     LEFT  HYDRAULIC  LEFT  HEATED     LEFT  CHANNEL
   NUMBER HTR OPTIONS     DIAM. (FT)       EQV.DIAM (FT)    LENGTH (FT)
  5212001           0     0.000000D+00     0.000000D+00     3.631250D+03

STRUCTURE  RIGHT VOL.       RIGHT       RIGHT     RIGHT SURFACE    RIGHT DIRECT
   NUMBER      NUMBER  BDRY. TYPE  SRFC. CODE     AREA ENTRY       SOURCE FACTOR
  5212001           0           0          1     3.631250D+03     0.000000D+00

*****************************************************************************************************************
*******************                                                                                   *******************
*******************                    INPUT DATA FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5222                  *******************
*******************                                                                                   *******************
*****************************************************************************************************************


NUMBER OF HEAT STRUCTURES WITH THIS GEOMETRY:  1
NUMBER OF MESH POINTS:  5
GEOMETRY TYPE: CYLINDRICAL
```

STEADY STATE INITIALIZATION: YES

MESH POINT NUMBER, MESH INTERVAL (FT) (MESH INTERVAL CONSTANT BETWEEN INDICATED MESH POINTS)
 5, 1.550000D-03

MESH POINT NUMBER, MESH POINT COORDINATE (FT)
 1, 8.985000D-01 2, 9.000500D-01 3, 9.016000D-01 4, 9.031500D-01 5, 9.047000D-01

MESH POINT NUMBER, COMPOSITION NUMBER (COMPOSITION NUMBER CONSTANT BETWEEN INDICATED MESH POINTS)
 5, 522

MESH POINT NUMBER, SOURCE FACTOR (SOURCE FACTOR CONSTANT BETWEEN INDICATED MESH POINTS)
 5, 1.0000000+00

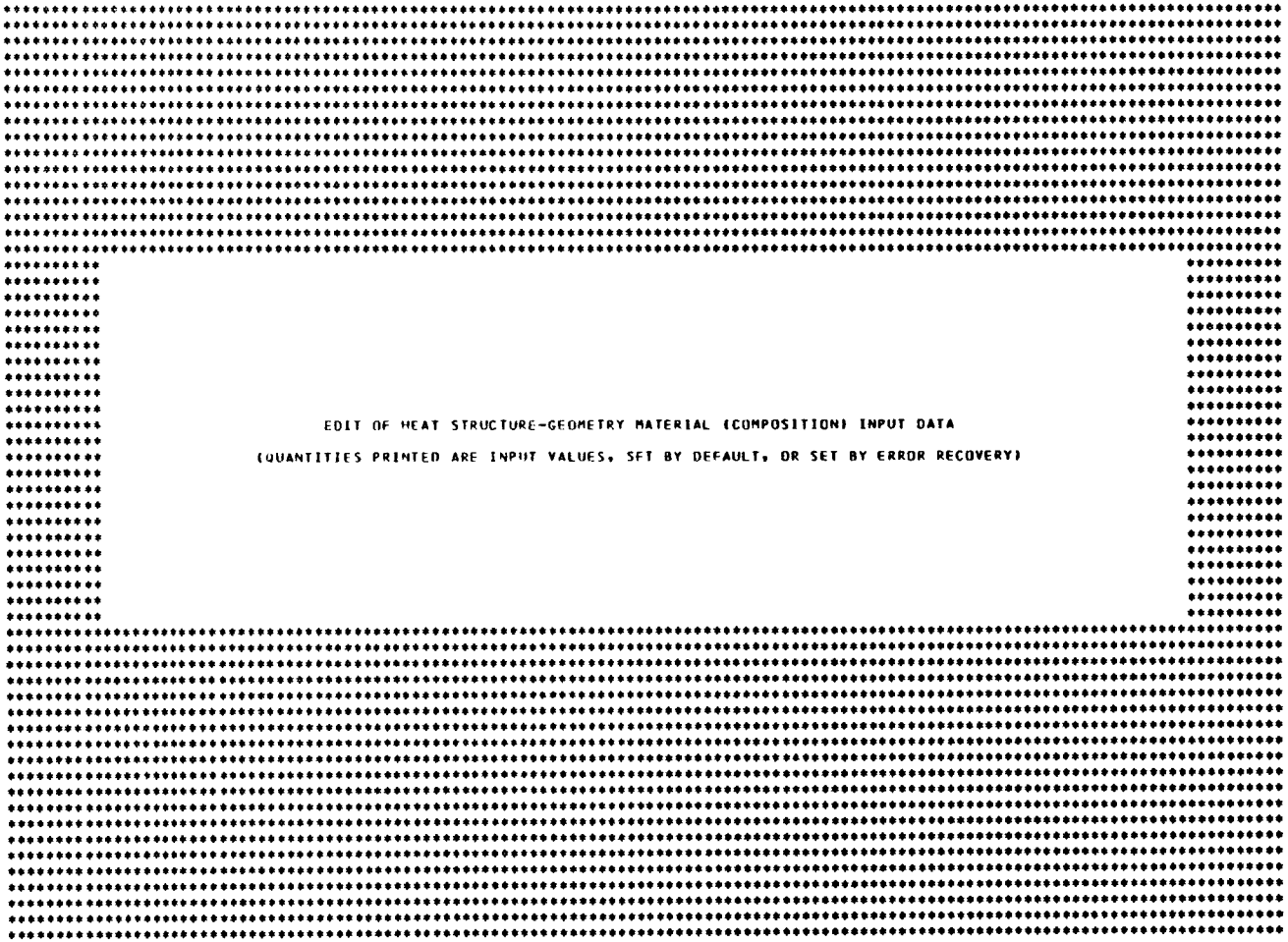
MESH POINT NUMBER, INITIAL TEMPERATURE (DEGF) (INITIAL TEMPERATURE CONSTANT BETWEEN INDICATED MESH POINTS)
 5, 4.6000000+02

STRUCTURE NUMBER	SOURCE CODE	INTERNAL SOURCE FACTOR
5222001	522	1.0000000+00

STRUCTURE NUMBER	LEFT VOL. NUMBER	LEFT BDRY. TYPE	LEFT SRFC. CODE	LEFT SURFACE AREA ENTRY	LEFT DIRECT SOURCE FACTOR
5222001	524020000	1	1	3.8969500+03	0.0000000+00

STRUCTURE NUMBER	LEFT CHF-HTR OPTIONS	LEFT HYDRAULIC DIAM. (FT)	LEFT HEATED EQV.DIAM (FT)	LEFT CHANNEL LENGTH (FT)
5222001	0	0.0000000+00	0.0000000+00	3.8969500+03

STRUCTURE NUMBER	RIGHT VOL. NUMBER	RIGHT BDRY. TYPE	RIGHT SRFC. CODE	RIGHT SURFACE AREA ENTRY	RIGHT DIRECT SOURCE FACTOR
5222001	0	0	1	3.8969500+03	0.0000000+00


EDIT OF HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

****
****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 400 **********
****
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	6.019100E+01	1.500000E+03	6.019100E+01

****
****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 401 **********
****
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	7.391000E-03	1.500000E+03	7.391000E-03

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	2.139920E+03	1.500000E+03	2.139920E+03

****
****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 402 **********
****
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	3.060200E+01	1.500000E+03	3.060200E+01

****
****
********** INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 403 **********
****
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	3.010500E+01	1.500000E+03	3.010500E+01

****
INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 404
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	2.957200E+01	1.500000E+03	2.957200E+01

****
INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 405
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	2.917000E+01	1.500000E+03	2.917000E+01

****
INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 420
****

THERMAL CONDUCTIVITY TABLE

TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)	TEMPERATURE (DEGF)	THERMAL CONDUCT. (BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200000E+01	2.920300E+01	1.500000E+03	2.920300E+01

```
*****************************************************************************************************************
*******************                                                                                   *******************
*******************          INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 421        *******************
*******************                                                                                   *******************
*****************************************************************************************************************

THERMAL CONDUCTIVITY TABLE

    TEMPERATURE      THERMAL CONDUCT.      TEMPERATURE      THERMAL CONDUCT.
    (DEGF)           (BTU/SEC-FT-DGF)      (DEGF)           (BTU/SEC-FT-DGF)
    3.200000E+01     1.000000E+06          1.500000E+03     1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

    TEMPERATURE      HEAT CAPACITY         TEMPERATURE      HEAT CAPACITY
    (DEGF)           (BTU/FT3-DEGF)        (DEGF)           (BTU/FT3-DEGF)
    3.200000E+01     2.954300E+01          1.500000E+03     2.954300E+01

*****************************************************************************************************************
*******************                                                                                   *******************
*******************          INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 500        *******************
*******************                                                                                   *******************
*****************************************************************************************************************

THERMAL CONDUCTIVITY TABLE

    TEMPERATURE      THERMAL CONDUCT.      TEMPERATURE      THERMAL CONDUCT.
    (DEGF)           (BTU/SEC-FT-DGF)      (DEGF)           (BTU/SEC-FT-DGF)
    3.200000E+01     7.391000E-03          1.500000E+03     7.391000E-03

VOLUMETRIC HEAT CAPACITY TABLE

    TEMPERATURE      HEAT CAPACITY         TEMPERATURE      HEAT CAPACITY
    (DEGF)           (BTU/FT3-DEGF)        (DEGF)           (BTU/FT3-DEGF)
    3.200000E+01     3.821300E+01          1.500000E+03     3.821300E+01

*****************************************************************************************************************
*******************                                                                                   *******************
*******************          INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 521        *******************
*******************                                                                                   *******************
*****************************************************************************************************************

THERMAL CONDUCTIVITY TABLE

    TEMPERATURE      THERMAL CONDUCT.      TEMPERATURE      THERMAL CONDUCT.
    (DEGF)           (BTU/SEC-FT-DGF)      (DEGF)           (BTU/SEC-FT-DGF)
    3.200000E+01     1.000000E+06          1.500000E+03     1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

    TEMPERATURE      HEAT CAPACITY         TEMPERATURE      HEAT CAPACITY
    (DEGF)           (BTU/FT3-DEGF)        (DEGF)           (BTU/FT3-DEGF)
    3.200000E+01     2.954300E+01          1.500000E+03     2.954300E+01

*****************************************************************************************************************
*******************                                                                                   *******************
*******************          INPUT DATA FOR HEAT STRUCTURE-GEOMETRY MATERIAL (COMPOSITION) 522        *******************
*******************                                                                                   *******************
*****************************************************************************************************************

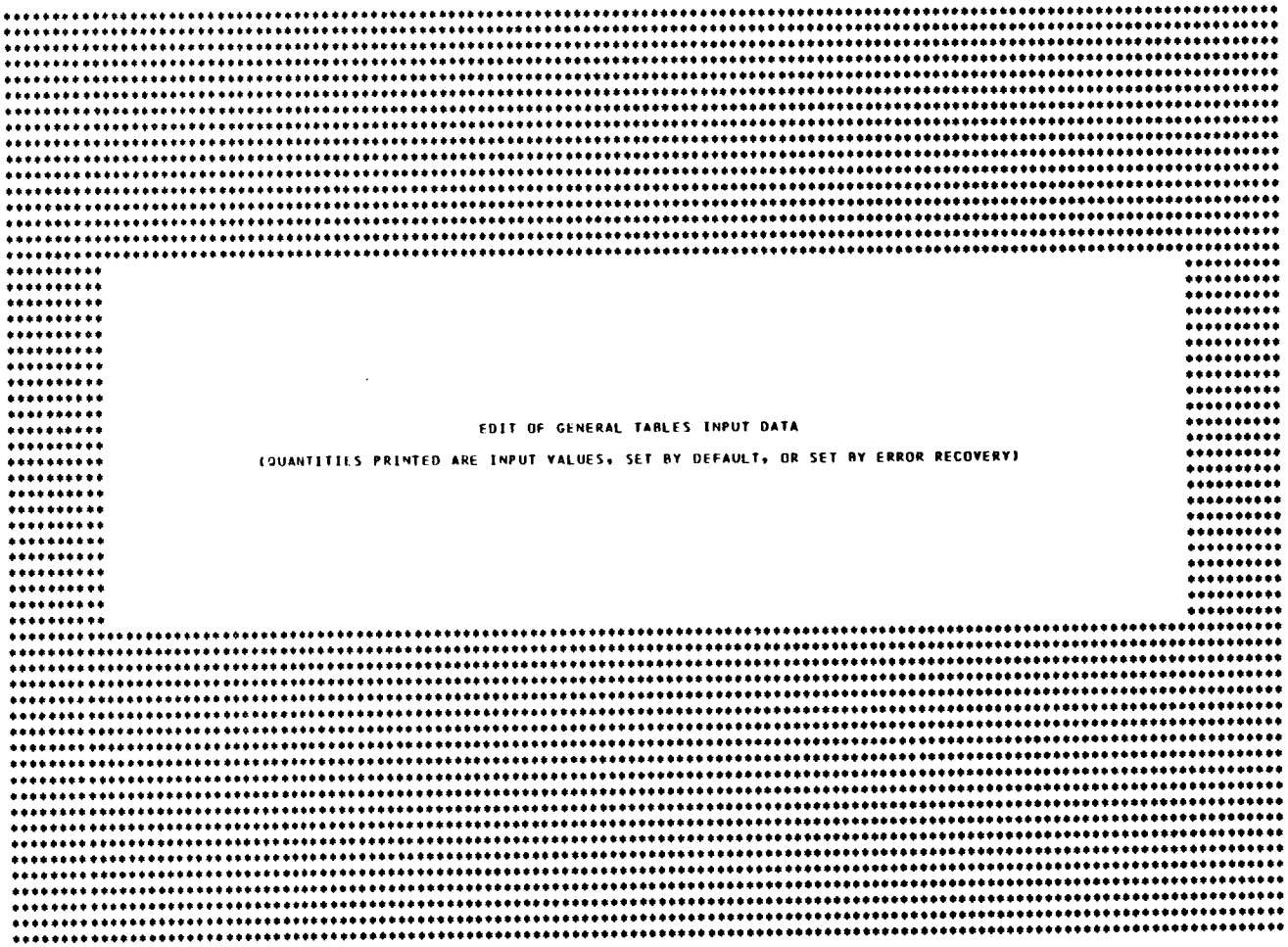
THERMAL CONDUCTIVITY TABLE

    TEMPERATURE      THERMAL CONDUCT.      TEMPERATURE      THERMAL CONDUCT.
```

(DEGF)	(BTU/SEC-FT-DGF)	(DEGF)	(BTU/SEC-FT-DGF)
3.200000E+01	1.000000E+06	1.500000E+03	1.000000E+06

VOLUMETRIC HEAT CAPACITY TABLE

TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)	TEMPERATURE (DEGF)	HEAT CAPACITY (BTU/FT3-DEGF)
3.200900E+01	2.920300E+01	1.500000E+03	2.920300E+01


EDIT OF GENERAL TABLES INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

INPUT DATA FOR GENERAL TABLE NUMBER 400

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.000000D+00, POWER FACTOR IS 1.000000D+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.000000D+00	9.295000D+00	0.000000D+00	9.295000D+00
5.000000D+00	9.295000D+00	5.000000D+00	9.295000D+00
1.000000D+06	9.295000D+00	1.000000D+06	9.295000D+00

INPUT DATA FOR GENERAL TABLE NUMBER 402

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.000000D+00, POWER FACTOR IS 1.000000D+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.000000D+00	1.207650D+02	0.000000D+00	1.207650D+02
5.000000D+00	0.000000D+00	5.000000D+00	0.000000D+00
1.000000D+06	0.000000D+00	1.000000D+06	0.000000D+00

INPUT DATA FOR GENERAL TABLE NUMBER 403

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.000000D+00, POWER FACTOR IS 1.000000D+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.000000D+00	1.308180D+02	0.000000D+00	1.308180D+02
5.000000D+00	0.000000D+00	5.000000D+00	0.000000D+00
1.000000D+06	0.000000D+00	1.000000D+06	0.000000D+00

INPUT DATA FOR GENERAL TABLE NUMBER 404

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.000000D+00, POWER FACTOR IS 1.000000D+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.000000D+00	1.459800D+02	0.000000D+00	1.459800D+02
5.000000D+00	0.000000D+00	5.000000D+00	0.000000D+00
1.000000D+06	0.000000D+00	1.000000D+06	0.000000D+00

INPUT DATA FOR GENERAL TABLE NUMBER 405

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.0000000+00, POWER FACTOR IS 1.0000000+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.0000000+00	2.4730600+02	0.0000000+00	2.4730600+02
5.0000000+00	0.0000000+00	5.0000000+00	0.0000000+00
1.0000000+06	0.0000000+00	1.0000000+06	0.0000000+00

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INPUT DATA FOR GENERAL TABLE NUMBER 420

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.0000000+00, POWER FACTOR IS 1.0000000+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.0000000+00	7.7354000+01	0.0000000+00	7.7354000+01
5.0000000+00	0.0000000+00	5.0000000+00	0.0000000+00
1.0000000+06	0.0000000+00	1.0000000+06	0.0000000+00

****

INPUT DATA FOR GENERAL TABLE NUMBER 421

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.0000000+00, POWER FACTOR IS 1.0000000+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.0000000+00	7.9837000+01	0.0000000+00	7.9837000+01
5.0000000+00	0.0000000+00	5.0000000+00	0.0000000+00
1.0000000+06	0.0000000+00	1.0000000+06	0.0000000+00

****

INPUT DATA FOR GENERAL TABLE NUMBER 428

TABLE IS NORMALIZED AREA VERSUS NORMALIZED LENGTH, NORM. LENGTH FACTOR IS 1.0000000+00, NORM. AREA IS 1.0000000+00

NORM. LENGTH (AS INPUT)	NORM. AREA (AS INPUT)	NORM. LENGTH	NORM. AREA
0.0000000+00	0.0000000+00	0.0000000+00	0.0000000+00
1.0000000+00	1.0000000+00	1.0000000+00	1.0000000+00

****

INPUT DATA FOR GENERAL TABLE NUMBER 521

TABLE IS POWER VS. TIME, TIME FACTOR IS 1.0000000+00, POWER FACTOR IS 1.0000000+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.0000000+00	7.7354000+01	0.0000000+00	7.7354000+01
5.0000000+00	0.0000000+00	5.0000000+00	0.0000000+00
1.0000000+06	0.0000000+00	1.0000000+06	0.0000000+00

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INPUT DATA FOR GENERAL TABLE NUMBER 522

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TABLE IS POWER VS. TIME, TIME FACTOR IS 1.0000000+00, POWER FACTOR IS 1.0000000+00

TIME (AS INPUT)	POWER (AS INPUT)	TIME (SEC)	POWER (MW)
0.0000000+00	7.9837000+01	0.0000000+00	7.9837000+01
5.0000000+00	0.0000000+00	5.0000000+00	0.0000000+00
1.0000000+06	0.0000000+00	1.0000000+06	0.0000000+00

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INPUT DATA FOR GENERAL TABLE NUMBER 528

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TABLE IS NORMALIZED AREA VERSUS NORMALIZED LENGTH, NORM. LENGTH FACTOR IS 1.0000000+00, NORM. AREA IS 1.0000000+00

NORM. LENGTH (AS INPUT)	NORM. AREA (AS INPUT)	NORM. LENGTH	NORM. AREA
0.0000000+00	0.0000000+00	0.0000000+00	0.0000000+00
1.0000000+00	1.0000000+00	1.0000000+00	1.0000000+00

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****
****

INPUT DATA FOR GENERAL TABLE NUMBER 610

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TABLE IS NORMALIZED AREA VERSUS NORMALIZED LENGTH, NORM. LENGTH FACTOR IS 1.0000000+00, NORM. AREA IS 1.0000000+00

NORM. LENGTH (AS INPUT)	NORM. AREA (AS INPUT)	NORM. LENGTH	NORM. AREA
0.0000000+00	0.0000000+00	0.0000000+00	0.0000000+00
1.0000000+00	1.0000000+00	1.0000000+00	1.0000000+00

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****

INPUT DATA FOR GENERAL TABLE NUMBER 632

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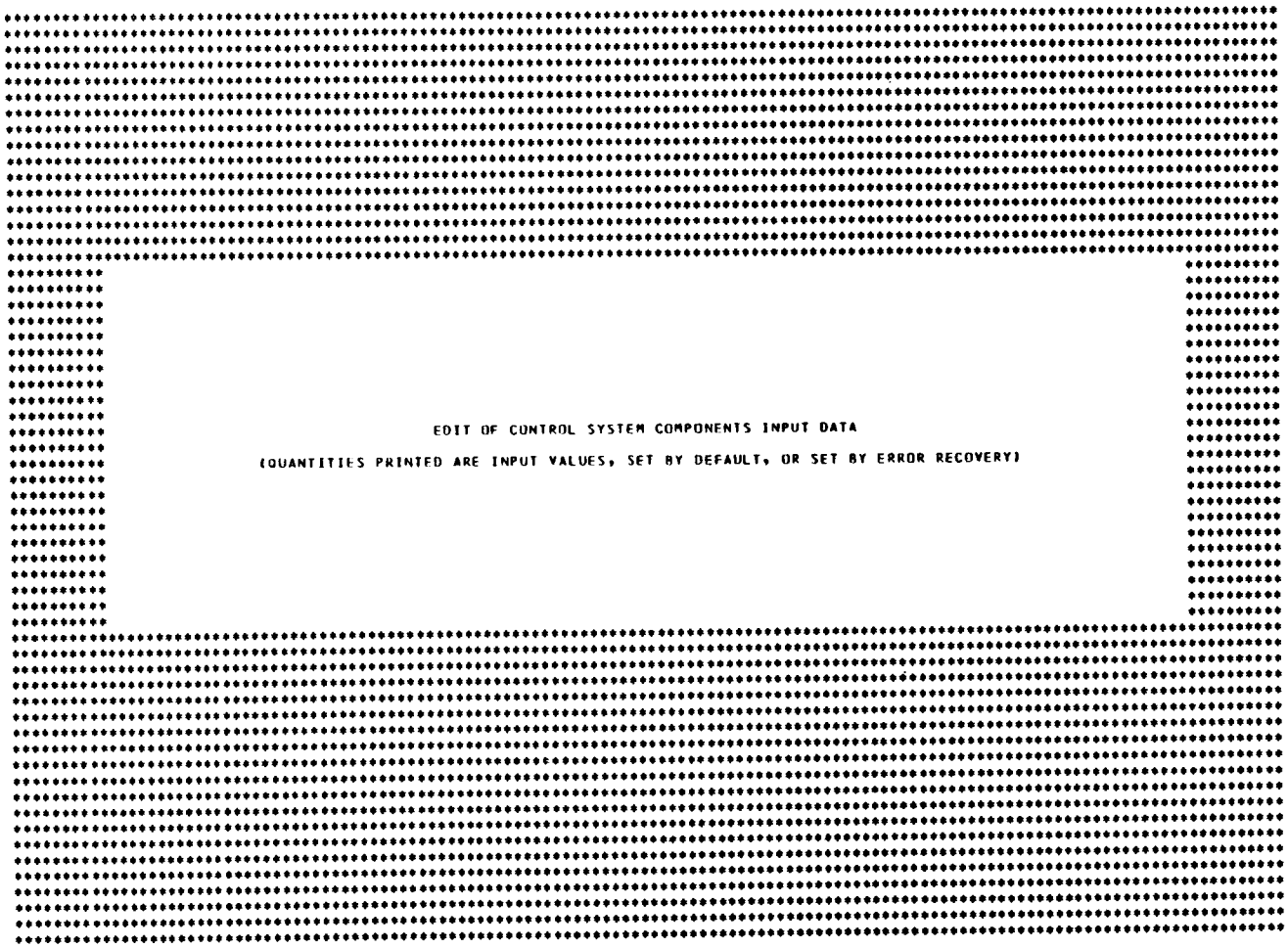
****

TABLE IS NORMALIZED AREA VERSUS NORMALIZED LENGTH, NORM. LENGTH FACTOR IS 1.0000000+00, NORM. AREA IS 1.0000000+00

NORM. LENGTH (AS INPUT)	NORM. AREA (AS INPUT)	NORM. LENGTH	NORM. AREA
0.0000000+00	0.0000000+00	0.0000000+00	0.0000000+00
1.0000000+00	1.0000000+00	1.0000000+00	1.0000000+00


EDIT OF CONTROL SYSTEM COMPONENTS INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

```
INPUT DATA FOR CONTROL COMPONENT   1, TRNSTART, TYPE= TRIPUNIT

          Y =   1.0000      * UNITTRIP ( 501 )

          INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   2, IGRND006, TYPE= MULT

          Y =   1.0000      * ( MFLOWJ      401010000 )
                            * ( CNTRLVAR              1 )

          INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   3, IGRND007, TYPE= MULT

          Y =   1.0000      * ( MFLOWJ      603010000 )
                            * ( CNTRLVAR              1 )

          INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   4, IGRND008, TYPE= MULT

          Y =   1.0000      * ( MFLOWJ      625010000 )
                            * ( CNTRLVAR              1 )

          INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   5, IGRND009, TYPE= MULT

          Y =   1.0000      * ( MFLOWJ      653010000 )
                            * ( CNTRLVAR              1 )

          INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   6, HWPUMPKG, TYPE= INTEGRAL

          Y =   1.0000      * INT ( CNTRLVAR              2 )

          INITIAL VALUE OF INTEGRAL OF Y =  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   7, EFWMPAKG, TYPE= INTEGRAL

          Y =   1.0000      * INT ( CNTRLVAR              3 )

          INITIAL VALUE OF INTEGRAL OF Y =  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   8, EFWMPBKG, TYPE= INTEGRAL

          Y =   1.0000      * INT ( CNTRLVAR              4 )

          INITIAL VALUE OF INTEGRAL OF Y =  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT   9, EFWTDPKG, TYPE= INTEGRAL

          Y =   1.0000      * INT ( CNTRLVAR              5 )

          INITIAL VALUE OF INTEGRAL OF Y =  0.00000E+00

INPUT DATA FOR CONTROL COMPONENT  10, HWLOUTKG, TYPE= SUM

          Y =   1.0000      * (      0.00000E+00
                             +     1.0000      * ( CNTRLVAR              6 )
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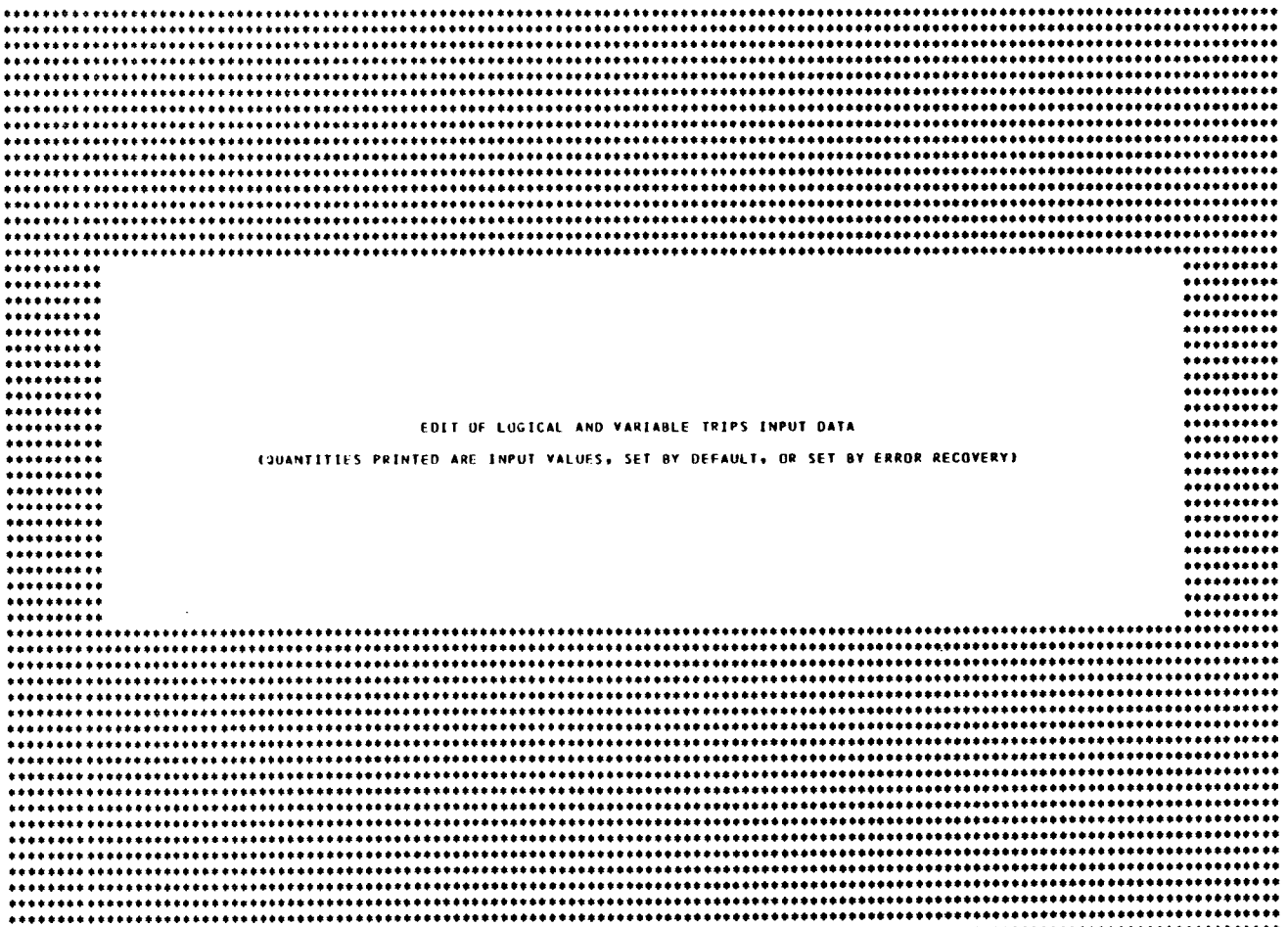
```
     +     1.0000     * ( CNTRLVAR          7 )
     +     1.0000     * ( CNTRLVAR          8 )
     +     1.0000     * ( CNTRLVAR          9 ) )
INITIALIZATION FLAG IS OFF, INPUT INITIAL VALUE IS  0.00000E+00
```


EDIT OF LOGICAL AND VARIABLE TRIPS INPUT DATA
(QUANTITIES PRINTED ARE INPUT VALUES, SET BY DEFAULT, OR SET BY ERROR RECOVERY)

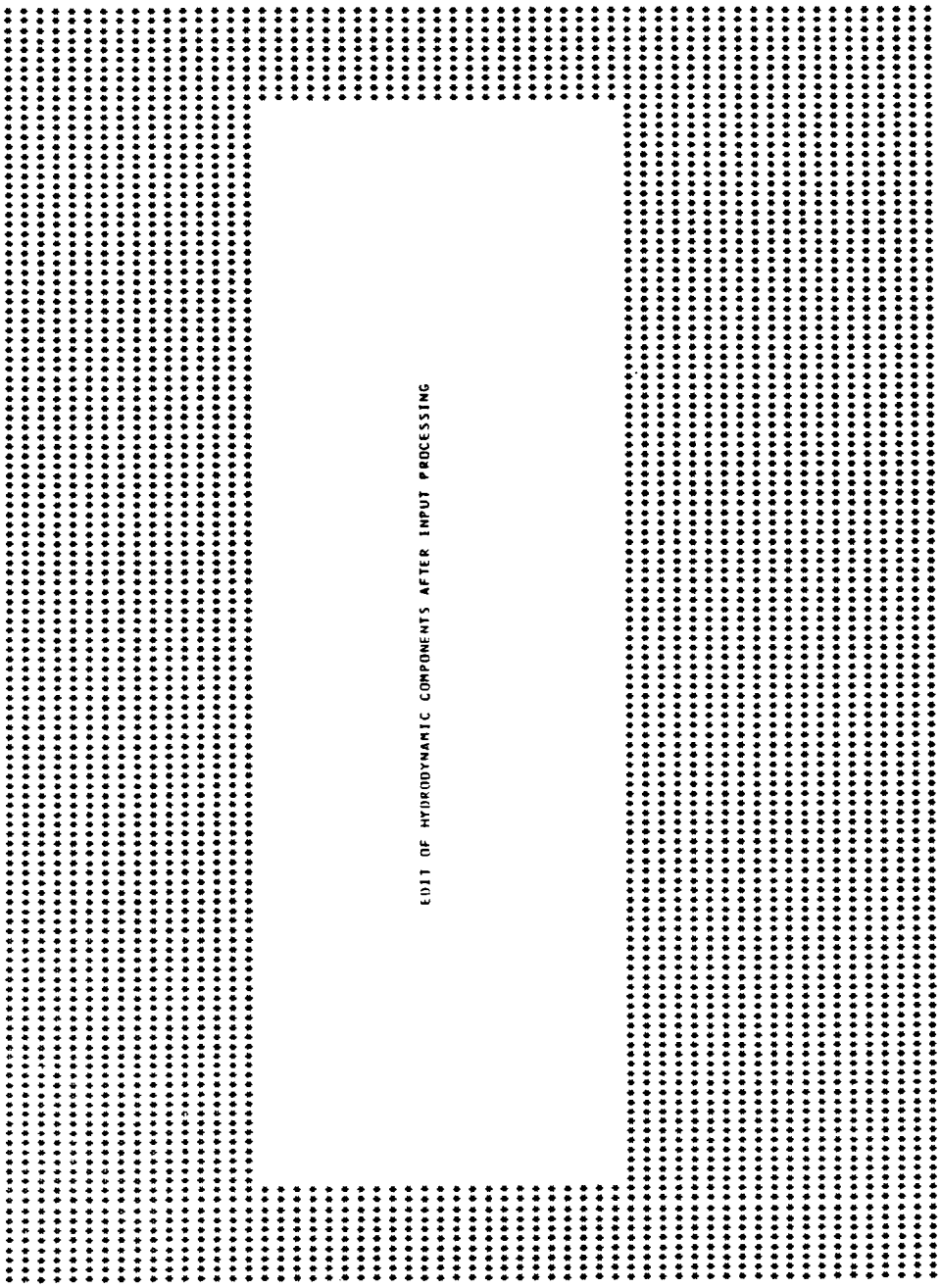
VARIABLE TRIPS

NO.	LEFT VAR. CODE	PARAMETER	REL.	RIGHT VAR. CODE	PARAMETER	+ CONSTANT	
501	TIME	0	GE	NULL	0	0.000000E+00	NOLATCH
502	CNTRLVAR	10	GE	NULL	0	7.534344E+05	NOLATCH
503	TIME	0	GE	TIMEOF	601	1.000000E+00	NOLATCH
511	P	402020000	LT	NULL	0	3.067000E+01	NOLATCH
512	TIME	0	GE	TIMEOF	511	5.000000E+00	NOLATCH
521	P	500010000	LT	NULL	0	2.496700E+02	NOLATCH
522	P	501010000	GE	NULL	0	1.289670E+03	NOLATCH
531	MFLOWJ	428000000	LT	NULL	0	-1.000000E+06	NOLATCH
532	MFLOWJ	610000000	LT	NULL	0	6.111100E+01	NOLATCH
533	TIME	0	GE	NULL	0	2.200000E+01	NOLATCH
534	MFLOWJ	528000000	LT	NULL	0	1.000000E+02	NOLATCH
535	TIME	0	GE	NULL	0	2.000000E+01	NOLATCH
541	P	501010000	LT	NULL	0	7.646700E+02	LATCH
542	P	604020000	GE	NULL	0	2.000000E+03	NOLATCH
543	P	626020000	GE	NULL	0	2.000000E+03	NOLATCH
544	P	654020000	GE	NULL	0	2.000000E+03	NOLATCH
545	TIME	0	GE	TIMEOF	542	1.000000E+00	LATCH
546	TIME	0	GE	TIMEOF	543	1.000000E+00	LATCH
547	TIME	0	GE	TIMEOF	544	1.000000E+00	LATCH
551	MFLOWJ	610000000	LT	NULL	0	-1.000000E+06	NOLATCH
552	MFLOWJ	632000000	LT	NULL	0	1.000000E+02	NOLATCH
553	TIME	0	GE	NULL	0	2.000000E+01	NOLATCH

LOGICAL TRIPS

NO.	LEFT TRIP	REL.	RIGHT TRIP	
601	502	AND	502	LATCH
611	511	AND	512	LATCH
621	521	OR	522	LATCH
622	-621	AND	-621	NOLATCH
623	-621	AND	-621	NOLATCH
631	531	AND	531	NOLATCH
632	532	AND	533	LATCH
633	534	AND	-535	NOLATCH
634	-534	OR	535	NOLATCH
641	541	AND	-545	NOLATCH
642	-641	AND	-641	NOLATCH
643	541	AND	-546	NOLATCH
644	-643	AND	-643	NOLATCH
645	541	AND	-547	NOLATCH
646	-645	AND	-645	NOLATCH
647	-642	AND	-642	NOLATCH
648	-644	AND	-644	NOLATCH
649	-646	AND	-646	NOLATCH
651	551	OR	553	NOLATCH
652	-551	AND	-553	NOLATCH
653	552	AND	553	NOLATCH
654	-552	OR	-553	NOLATCH

TRANSIENT ADVANCEMENT WILL BE TERMINATED BY TRIP 503


EDIT OF HYDRODYNAMIC COMPONENTS AFTER INPUT PROCESSING

NUMBER OF VOLUMES = 58, NUMBER OF JUNCTIONS = 60

TOTAL SYSTEM MASS = 9.42607E+05 LBM, TOTAL SYSTEM VOLUME = 1.68395E+04 FT3

VOL.NO.	PRESSURE (PSIA)	INT. ENERGY (BTU/LBM)	STATIC QUAL.	EQU.QUAL.	VOIDG	TEMPF (DEGF)	TEMPG (DEGF)	TEMPE (DEGF)	VOLUME FLAGS
400010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	11
401010000	1.13000E+02	5.79720E+01	0.00000E+00	0.00000E+00	0.00000E+00	8.99892E+01	8.99892E+01	8.99892E+01	10
402010000	1.60000E+02	5.79640E+01	0.00000E+00	0.00000E+00	0.00000E+00	8.99951E+01	8.99951E+01	8.99951E+01	10
402020000	1.90000E+02	5.79730E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.49988E+01	9.49988E+01	9.49988E+01	10
403010000	3.10000E+02	6.29030E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.49957E+01	9.49957E+01	9.49957E+01	10
404010000	5.20000E+02	1.27652E+02	0.00000E+00	0.00000E+00	0.00000E+00	1.60024E+02	1.60024E+02	1.60024E+02	10
404020000	4.70250E+02	1.97857E+02	0.00000E+00	0.00000E+00	0.00000E+00	2.30023E+02	2.30023E+02	2.30023E+02	10
406010000	4.70000E+02	1.77736E+02	0.00000E+00	0.00000E+00	0.00000E+00	2.09996E+02	2.09996E+02	2.09996E+02	11
408010000	4.56500E+02	2.69011E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.00027E+02	3.00027E+02	3.00027E+02	10
410010000	4.35000E+02	2.58779E+02	0.00000E+00	0.00000E+00	0.00000E+00	2.90003E+02	2.90003E+02	2.90003E+02	11
412010000	4.22750E+02	3.41879E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.70023E+02	3.70023E+02	3.70023E+02	10
420010000	8.22500E+02	3.41096E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.70015E+02	3.70015E+02	3.70015E+02	10
421010000	1.25600E+03	3.40249E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.69991E+02	3.69991E+02	3.69991E+02	10
424010000	1.10000E+03	3.88439E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.14930E+02	4.14930E+02	4.14930E+02	10
424020000	1.06300E+03	4.37934E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59989E+02	4.59989E+02	4.59989E+02	10
427010000	1.00000E+03	4.38125E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
429010000	9.65000E+02	4.38231E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59979E+02	4.59979E+02	4.59979E+02	10
429020000	9.60000E+02	4.38246E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59978E+02	4.59978E+02	4.59978E+02	10
429030000	9.55000E+02	4.38262E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59978E+02	4.59978E+02	4.59978E+02	10
431010000	9.50000E+02	4.38277E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59977E+02	4.59977E+02	4.59977E+02	11
500010000	3.89000E+02	3.41946E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.70024E+02	3.70024E+02	3.70024E+02	10
501010000	1.25500E+03	3.40250E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.69991E+02	3.69991E+02	3.69991E+02	10
502010000	1.02100E+03	4.38061E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59984E+02	4.59984E+02	4.59984E+02	10
521010000	3.48000E+02	3.41943E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.70024E+02	3.70024E+02	3.70024E+02	10
522010000	8.21500E+02	3.41098E+02	0.00000E+00	0.00000E+00	0.00000E+00	3.70015E+02	3.70015E+02	3.70015E+02	10
524010000	1.10000E+03	3.88439E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.14930E+02	4.14930E+02	4.14930E+02	10
524020000	1.06300E+03	4.37934E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59989E+02	4.59989E+02	4.59989E+02	10
527010000	1.00000E+03	4.38125E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
529010000	9.65000E+02	4.38231E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59979E+02	4.59979E+02	4.59979E+02	10
529020000	9.60000E+02	4.38246E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59978E+02	4.59978E+02	4.59978E+02	10
529030000	9.55000E+02	4.38262E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59978E+02	4.59978E+02	4.59978E+02	10
531010000	9.50000E+02	4.38277E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59977E+02	4.59977E+02	4.59977E+02	11
602010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	11
603010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
604010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
604020000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
606010000	1.00881E+03	4.38098E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
608010000	1.00000E+03	4.38125E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
611010000	9.25256E+02	1.14579E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78972E+02	5.78972E+02	5.78972E+02	10
611020000	9.25128E+02	1.14580E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78967E+02	5.78967E+02	5.78967E+02	10
611030000	9.25000E+02	1.14582E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78977E+02	5.78977E+02	5.78977E+02	10
613010000	9.25000E+02	1.14582E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78977E+02	5.78977E+02	5.78977E+02	11
624010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	11
625010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
626010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
626020000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
628010000	1.00881E+03	4.38098E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
630010000	1.00000E+03	4.38125E+02	0.00000E+00	0.00000E+00	0.00000E+00	4.59983E+02	4.59983E+02	4.59983E+02	10
633010000	9.25256E+02	1.14579E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78972E+02	5.78972E+02	5.78972E+02	10
633020000	9.25128E+02	1.14580E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78967E+02	5.78967E+02	5.78967E+02	10
633030000	9.25000E+02	1.14582E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78977E+02	5.78977E+02	5.78977E+02	10
635010000	9.25000E+02	1.14582E+03	1.00000E+00	1.00000E+00	1.00000E+00	5.78977E+02	5.78977E+02	5.78977E+02	11
652010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	11
653010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10

654010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
654020000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
656010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10
659010000	7.20800E+00	5.80150E+01	0.00000E+00	0.00000E+00	0.00000E+00	9.00010E+01	9.00010E+01	9.00010E+01	10

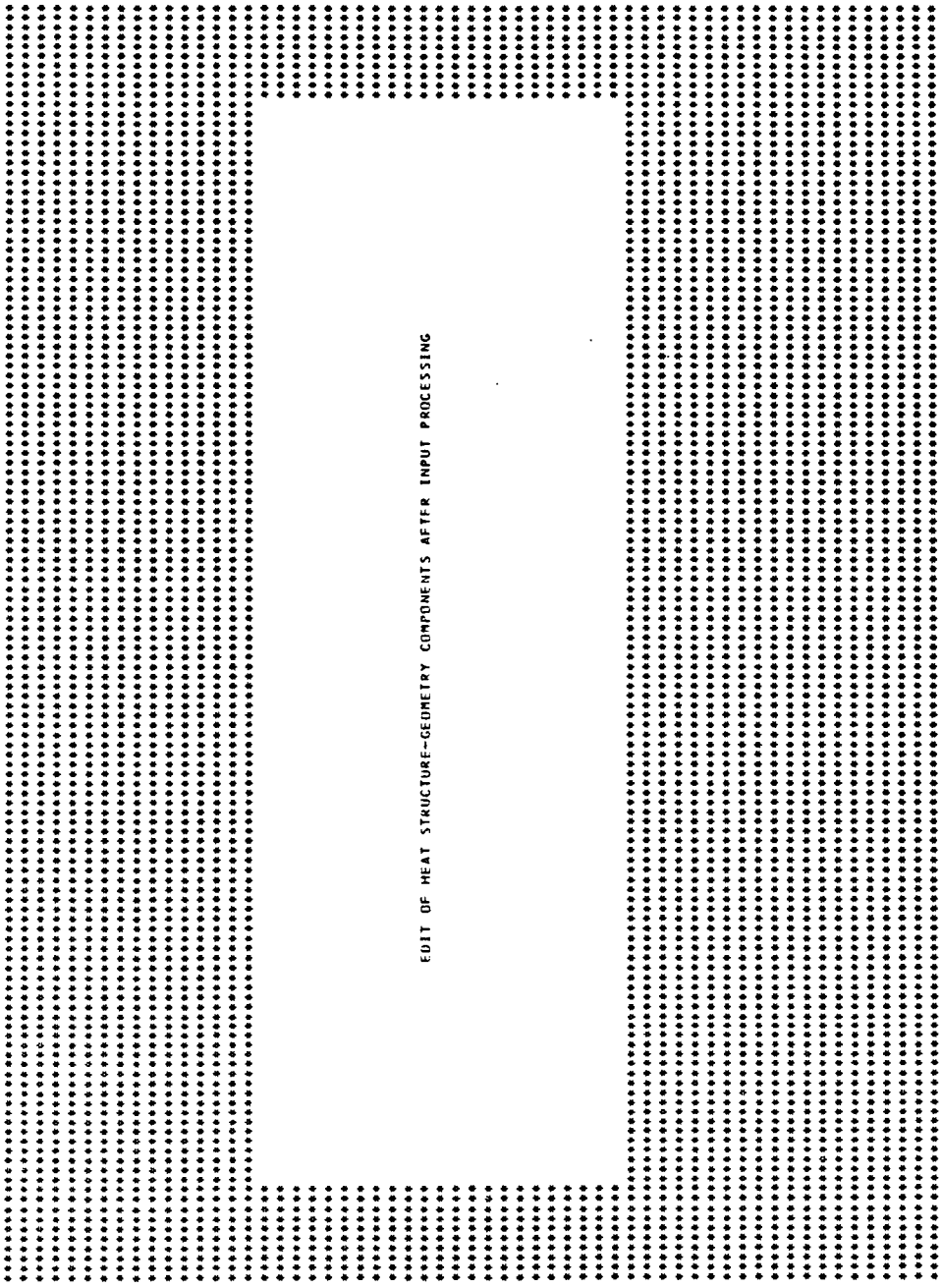
VOL.NO.	RHO (LBM/FT3)	RHOF (LBM/FT3)	RHOG (LBM/FT3)	VOLUME (FT3)	UF (BTU/LBM)	UG (BTU/LBM)
400010000	6.21178E+01	6.21178E+01	1.91574E-02	0.00000E+00	5.80150E+01	1.06784E+03
401010000	6.21381E+01	6.21381E+01	2.53395E-01	7.50000E+02	5.79720E+01	1.10681E+03
402010000	6.21470E+01	6.21470E+01	3.52907E-01	7.50000E+02	5.79640E+01	1.11117E+03
402020000	6.20773E+01	6.20773E+01	2.25704E-01	7.50000E+02	6.29730E+01	1.10510E+03
403010000	6.21171E+01	6.21171E+01	6.69387E-01	7.50000E+02	6.29030E+01	1.11738E+03
404010000	6.10920E+01	6.10920E+01	1.12187E+00	1.41600E+03	1.27652E+02	1.11875E+03
404020000	5.94493E+01	5.94493E+01	1.05673E+00	1.06200E+03	1.97857E+02	1.11884E+03
406010000	5.99576E+01	5.99576E+01	1.01260E+00	0.00000E+00	1.77736E+02	1.11887E+03
408010000	5.73930E+01	5.73930E+01	9.83285E-01	1.06200E+03	2.69011E+02	1.11888E+03
410010000	5.77057E+01	5.77057E+01	9.36744E-01	0.00000E+00	2.58778E+02	1.11883E+03
412010000	5.49185E+01	5.49185E+01	9.10313E-01	1.23900E+03	3.41879E+02	1.11876E+03
420010000	5.50403E+01	5.50403E+01	1.81071E+00	6.05000E+02	3.41096E+02	1.11461E+03
421010000	5.51707E+01	5.51707E+01	2.91023E+00	3.17000E+02	3.40248E+02	1.10224E+03
424010000	5.33203E+01	5.33203E+01	2.49634E+00	6.06824E+02	3.88439E+02	1.10741E+03
424020000	5.12509E+01	5.12509E+01	2.40144E+00	4.97448E+02	4.37934E+02	1.10855E+03
427010000	5.12238E+01	5.12238E+01	2.24235E+00	1.64823E+02	4.38125E+02	1.11037E+03
429010000	5.12087E+01	5.12087E+01	2.15538E+00	3.04320E+02	4.38231E+02	1.11124E+03
429020000	5.12066E+01	5.12066E+01	2.14304E+00	5.07200E+02	4.38246E+02	1.11137E+03
429030000	5.12044E+01	5.12044E+01	2.13071E+00	3.02392E+02	4.38262E+02	1.11149E+03
431010000	5.12022E+01	5.12022E+01	2.11841E+00	0.00000E+00	4.38277E+02	1.11162E+03
500010000	5.49081E+01	5.49081E+01	8.37756E-01	1.16952E+03	3.41946E+02	1.11856E+03
501010000	5.51704E+01	5.51704E+01	2.90750E+00	8.65696E+02	3.40250E+02	1.10228E+03
502010000	5.12328E+01	5.12328E+01	2.29503E+00	1.87303E+02	4.38061E+02	1.10983E+03
521010000	5.49078E+01	5.49078E+01	8.35613E-01	5.98496E+02	3.41948E+02	1.11855E+03
522010000	5.50400E+01	5.50400E+01	1.80835E+00	4.17000E+02	3.41098E+02	1.11463E+03
524010000	5.33203E+01	5.33203E+01	2.49634E+00	6.13824E+02	3.88439E+02	1.10741E+03
524020000	5.12509E+01	5.12509E+01	2.40144E+00	5.19448E+02	4.37934E+02	1.10855E+03
527010000	5.12238E+01	5.12238E+01	2.24235E+00	1.64823E+02	4.38125E+02	1.11037E+03
529010000	5.12087E+01	5.12087E+01	2.15538E+00	1.90200E+02	4.38231E+02	1.11124E+03
529020000	5.12066E+01	5.12066E+01	2.14304E+00	1.90200E+02	4.38246E+02	1.11137E+03
529030000	5.12044E+01	5.12044E+01	2.13071E+00	2.38992E+02	4.38262E+02	1.11149E+03
531010000	5.12022E+01	5.12022E+01	2.11841E+00	0.00000E+00	4.38277E+02	1.11162E+03
602010000	6.21178E+01	6.21178E+01	1.91574E-02	0.00000E+00	5.80150E+01	1.06784E+03
603010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
604010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
604020000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
606010000	5.12276E+01	5.12276E+01	2.26441E+00	4.00000E+01	4.38098E+02	1.11015E+03
608010000	5.12238E+01	5.12238E+01	2.24235E+00	8.00000E+01	4.38125E+02	1.11037E+03
611010000	1.84134E+00	4.69009E+01	1.84134E+00	2.17200E+01	5.27195E+02	1.14579E+03
611020000	1.84102E+00	4.69019E+01	1.84102E+00	3.62000E+01	5.27174E+02	1.14580E+03
611030000	1.84065E+00	4.69029E+01	1.84065E+00	2.66290E+01	5.27154E+02	1.14582E+03
613010000	1.84065E+00	4.69029E+01	1.84065E+00	0.00000E+00	5.27154E+02	1.14582E+03
624010000	6.21178E+01	6.21178E+01	1.91574E-02	0.00000E+00	5.80150E+01	1.06784E+03
625010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
626010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
626020000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
628010000	5.12276E+01	5.12276E+01	2.26441E+00	4.00000E+01	4.38098E+02	1.11015E+03
630010000	5.12238E+01	5.12238E+01	2.24235E+00	8.00000E+01	4.38125E+02	1.11037E+03
633010000	1.84134E+00	4.69009E+01	1.84134E+00	1.35750E+01	5.27195E+02	1.14579E+03
633020000	1.84102E+00	4.69019E+01	1.84102E+00	1.35750E+01	5.27174E+02	1.14580E+03
633030000	1.84065E+00	4.69029E+01	1.84065E+00	2.21010E+01	5.27154E+02	1.14582E+03
635010000	1.84065E+00	4.69029E+01	1.84065E+00	0.00000E+00	5.27154E+02	1.14582E+03
652010000	6.21178E+01	6.21178E+01	1.91574E-02	0.00000E+00	5.80150E+01	1.06784E+03
653010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
654010000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
654020000	6.21178E+01	6.21178E+01	1.91574E-02	2.00000E+01	5.80150E+01	1.06784E+03
656010000	6.21178E+01	6.21178E+01	1.91574E-02	2.37490E+01	5.80150E+01	1.06784E+03
659010000	6.21178E+01	6.21178E+01	1.91574E-02	2.24510E+01	5.80150E+01	1.06784E+03

JUN.NO.	FROM VOL.	TO VOL.	LIQ. VEL. (FT/SEC)	VAP. VEL. (FT/SEC)	MASS FLOW (LBM/SEC)	JUN. AREA (FT2)	THROAT RATIO	JUNCTION FLAGS	CHOKE FLAG
401010000	400010000	401010000	1.12139E+01	1.12139E+01	1.76639E+03	2.53600E+00	1.00000E+00	0	0
401020000	401010000	402010000	1.12090E+01	1.12090E+01	1.76634E+03	2.53600E+00	1.00000E+00	0	0
402010000	402010000	402020000	1.12080E+01	1.12080E+01	1.76643E+03	2.53600E+00	1.00000E+00	0	0
403010000	402020000	403010000	1.12200E+01	1.12200E+01	1.76634E+03	2.53600E+00	1.00000E+00	0	0
403020000	403010000	404010000	1.12130E+01	1.12130E+01	1.76637E+03	2.53600E+00	1.00000E+00	0	0
404010000	404010000	404020000	2.58840E+01	2.58840E+01	1.76632E+03	1.11700E+00	1.00000E+00	0	0
405000000	404020000	408010000	2.66000E+01	2.66000E+01	1.76637E+03	1.11700E+00	1.00000E+00	0	0
407000000	406010000	408010000	9.15000E-01	9.15000E-01	1.39128E+02	2.53600E+00	1.00000E+00	0	0
409000000	408010000	412010000	1.30920E+01	1.30920E+01	1.90552E+03	2.53600E+00	1.00000E+00	0	0
411000000	410010000	412010000	4.78800E+00	4.78800E+00	1.14994E+03	4.16200E+00	1.00000E+00	0	0
413000000	412010000	503010000	1.33680E+01	1.33680E+01	3.05553E+03	4.16200E+00	1.00000E+00	0	0
420010000	501010000	420010000	2.49090E+01	2.49090E+01	1.52773E+03	1.11700E+00	1.00000E+00	0	0
420020000	420010000	421010000	2.48500E+01	2.48500E+01	1.52778E+03	1.11700E+00	1.00000E+00	0	0
422000000	421010000	501010000	1.09190E+01	1.09190E+01	1.52771E+03	2.53600E+00	1.00000E+00	100	0
423000000	501010000	424010000	1.09200E+01	1.09200E+01	1.52784E+03	2.53600E+00	1.00000E+00	0	0
424010000	424010000	424020000	1.12990E+01	1.12990E+01	1.52785E+03	2.53600E+00	1.00000E+00	0	0
425000000	424020000	502010000	1.17550E+01	1.17550E+01	1.52782E+03	2.53600E+00	1.00000E+00	0	0
426000000	502010000	427010000	1.17590E+01	1.17590E+01	1.52781E+03	2.53600E+00	1.00000E+00	100	0
428000000	427010000	429010000	2.35220E+01	2.35220E+01	1.52780E+03	2.53600E+00	5.00000E-01	100	0
429010000	429010000	429020000	1.17640E+01	1.17640E+01	1.52774E+03	2.53600E+00	1.00000E+00	0	0
429020000	429020000	429030000	1.75090E+01	1.75090E+01	1.52777E+03	1.70400E+00	1.00000E+00	0	0
430000000	429030000	431010000	1.75100E+01	1.75100E+01	1.52779E+03	1.70400E+00	1.00000E+00	100	0
520000000	500010000	521010000	1.09710E+01	1.09710E+01	1.52768E+03	2.53600E+00	1.00000E+00	100	0
522010000	521010000	522010000	2.49090E+01	2.49090E+01	1.52772E+03	1.11700E+00	1.00000E+00	0	0
522020000	522010000	501010000	2.48500E+01	2.48500E+01	1.52777E+03	1.11700E+00	1.00000E+00	0	0
523000000	501010000	524010000	1.09200E+01	1.09200E+01	1.52784E+03	2.53600E+00	1.00000E+00	0	0
524010000	524010000	524020000	1.12990E+01	1.12990E+01	1.52785E+03	2.53600E+00	1.00000E+00	0	0
525000000	524020000	502010000	1.17550E+01	1.17550E+01	1.52782E+03	2.53600E+00	1.00000E+00	0	0
526000000	502010000	527010000	1.17590E+01	1.17590E+01	1.52781E+03	2.53600E+00	1.00000E+00	100	0
528000000	527010000	529010000	2.35220E+01	2.35220E+01	1.52780E+03	2.53600E+00	5.00000E-01	100	0
529010000	529010000	529020000	1.17640E+01	1.17640E+01	1.52774E+03	2.53600E+00	1.00000E+00	0	0
529020000	529020000	529030000	1.75090E+01	1.75090E+01	1.52777E+03	1.70400E+00	1.00000E+00	0	0
530000000	529030000	531010000	1.75100E+01	1.75100E+01	1.52779E+03	1.70400E+00	1.00000E+00	100	0
603010000	602010000	603010000	0.00000E+00	0.00000E+00	0.00000E+00	3.17000E-01	1.00000E+00	0	0
603020000	603010000	604010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
604010000	604010000	604020000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
605000000	604020000	606010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	100	0
607000000	606010000	608010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
609000000	427010000	608010000	1.00000E-06	1.00000E-06	9.27151E-06	1.81000E-01	1.00000E+00	100	0
610000000	608010000	611010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	0.00000E+00	100	0
611010000	611010000	611020000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
611020000	611020000	611030000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
612000000	611030000	613010000	1.00000E-06	1.00000E-06	3.33158E-07	1.81000E-01	1.00000E+00	100	0
625010000	624010000	625010000	0.00000E+00	0.00000E+00	0.00000E+00	3.17000E-01	1.00000E+00	0	0
625020000	625010000	626010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
626010000	626010000	626020000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
627000000	626020000	628010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	100	0
629000000	628010000	630010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
631000000	527010000	630010000	1.00000E-06	1.00000E-06	9.27151E-06	1.81000E-01	1.00000E+00	100	0
632000000	630010000	633010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	0.00000E+00	100	0
633010000	633010000	633020000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
633020000	633020000	633030000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
634000000	633030000	635010000	1.00000E-06	1.00000E-06	3.33158E-07	1.81000E-01	1.00000E+00	100	0
653010000	652010000	653010000	0.00000E+00	0.00000E+00	0.00000E+00	3.17000E-01	1.00000E+00	0	0
653020000	653010000	654010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
654010000	654010000	654020000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
655000000	654020000	656010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0
657000000	656010000	628010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	100	0
658000000	656010000	659010000	0.00000E+00	0.00000E+00	0.00000E+00	1.81000E-01	1.00000E+00	0	0

660000000 657C10300 606010000 -1.00000E+00 0.00000E+00 0.00000E+00 1.81000E-01 1.00000E+00 100 0

JUN.NO.	RHOEJ (LBM/FT3)	RHOGJ (LBM/FT3)	UEJ (BTU/LBM)	UFG (BTU/LBM)
401010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
401020000	6.21381E+01	2.53335E-01	5.79720E+01	1.10681E+03
402010000	6.21470E+01	3.52907E-01	5.79640E+01	1.11117E+03
403010000	6.20774E+01	2.25704E-01	6.29730E+01	1.10510E+03
403020000	6.21171E+01	6.69387E-01	6.29030E+01	1.11738E+03
404010000	6.10920E+01	1.12137E+00	1.27652E+02	1.11875E+03
405000000	5.94493E+01	1.05671E+00	1.97857E+02	1.11984E+03
407000000	5.99576E+01	1.01263E+00	1.77736E+02	1.11887E+03
409000000	5.73930E+01	9.81245E-01	2.69011E+02	1.11868E+03
411000000	5.77057E+01	9.36744E-01	2.58778E+02	1.11883E+03
413000000	5.49145E+01	9.10313E-01	3.41879E+02	1.11876E+03
420010000	5.49081E+01	8.37756E-01	3.41946E+02	1.11856E+03
420020000	5.50403E+01	1.81071E+00	3.41096E+02	1.11461E+03
422000000	5.51707E+01	2.91023E+00	3.40248E+02	1.10224E+03
423000000	5.51704E+01	2.90750E+00	3.40250E+02	1.10228E+03
424010000	5.33203E+01	2.49634E+00	3.88439E+02	1.10741E+03
425000000	5.12509E+01	2.40144E+00	4.37934E+02	1.10855E+03
426000000	5.12328E+01	2.29503E+00	4.38061E+02	1.10983E+03
428000000	5.12248E+01	2.24235E+00	4.38125E+02	1.11037E+03
429010000	5.12087E+01	2.15538E+00	4.38231E+02	1.11124E+03
429020000	5.12066E+01	2.14304E+00	4.38246E+02	1.11137E+03
430000000	5.12044E+01	2.13071E+00	4.38262E+02	1.11149E+03
520000000	5.49081E+01	8.37756E-01	3.41946E+02	1.11856E+03
522010000	5.49078E+01	8.35613E-01	3.41948E+02	1.11855E+03
522020000	5.50400E+01	1.80835E+00	3.41098E+02	1.11463E+03
523000000	5.51704E+01	2.90750E+00	3.40250E+02	1.10228E+03
524010000	5.33203E+01	2.49634E+00	3.88439E+02	1.10741E+03
525000000	5.12509E+01	2.40144E+00	4.37934E+02	1.10855E+03
526000000	5.12328E+01	2.29503E+00	4.38061E+02	1.10983E+03
528000000	5.12238E+01	2.24235E+00	4.38125E+02	1.11037E+03
529010000	5.12087E+01	2.15538E+00	4.38231E+02	1.11124E+03
529020000	5.12066E+01	2.14304E+00	4.38246E+02	1.11137E+03
530000000	5.12044E+01	2.13071E+00	4.38262E+02	1.11149E+03
603010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
603020000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
604010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
605000000	5.48577E+01	1.14178E+00	3.11404E+02	1.08899E+03
607000000	5.12251E+01	2.25338E+00	4.38116E+02	1.11026E+03
609000000	5.12238E+01	2.24235E+00	4.38125E+02	1.11037E+03
610000000	5.12238E+01	1.84134E+00	4.38125E+02	1.14579E+03
611010000	4.69014E+01	1.84114E+00	5.27185E+02	1.14580E+03
611020000	4.69024E+01	1.84087E+00	5.27164E+02	1.14581E+03
612000000	4.69029E+01	1.84065E+00	5.27154E+02	1.14582E+03
625010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
625020000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
626010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
627000000	5.48577E+01	1.14178E+00	3.11404E+02	1.08899E+03
629000000	5.12251E+01	2.25338E+00	4.38116E+02	1.11026E+03
631000000	5.12238E+01	2.24235E+00	4.38125E+02	1.11037E+03
632000000	5.12238E+01	1.84134E+00	4.38125E+02	1.14579E+03
633010000	4.69014E+01	1.84114E+00	5.27185E+02	1.14579E+03
633020000	4.69024E+01	1.84079E+00	5.27164E+02	1.14581E+03
634000000	4.69029E+01	1.84065E+00	5.27154E+02	1.14582E+03
653010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
653020000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
654010000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
655000000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03
657000000	5.52846E+01	1.14178E+00	2.96502E+02	1.08899E+03
658000000	6.21178E+01	1.91574E-02	5.80150E+01	1.06784E+03

660000000 5.51426E+01 1.14176E+00 3.01459E+02 1.08899E+03


EDIT OF HEAT STRUCTURE-GEOMETRY COMPONENTS AFTER INPUT PROCESSING

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4002001

111.24 111.24 111.24 111.24 111.24

VOLUME AVERAGED TEMPERATURE = 111.24 DEGF
SPACE INTEGRATED SOURCE = 0.60538 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 0.60538 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4012001

94.999 94.999 94.999 94.999 94.999

VOLUME AVERAGED TEMPERATURE = 94.999 DEGF
SPACE INTEGRATED SOURCE = 0.60538 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 0.60538 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4022001

164.31 164.31 164.31 164.31 164.31

VOLUME AVERAGED TEMPERATURE = 164.31 DEGF
SPACE INTEGRATED SOURCE = 6.77905E-03 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 6.77905E-03 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4032001

232.75 232.75 232.75 232.75 232.75

VOLUME AVERAGED TEMPERATURE = 232.75 DEGF
SPACE INTEGRATED SOURCE = 4.50052E-03 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 4.50052E-03 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4042001

305.27 305.27 305.27 305.27 305.27

VOLUME AVERAGED TEMPERATURE = 305.27 DEGF
SPACE INTEGRATED SOURCE = 6.77905E-03 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 6.77905E-03 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4052001

378.67 378.67 378.67 378.67 378.67

VOLUME AVERAGED TEMPERATURE = 378.67 DEGF
SPACE INTEGRATED SOURCE = 8.68286E-03 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 8.68286E-03 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4202001

420.84 420.84 420.84 420.84 420.84

VOLUME AVERAGED TEMPERATURE = 420.84 DEGF
SPACE INTEGRATED SOURCE = 3.51225E-02 FT2

INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 3.51225E-02 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 4212001

465.48 465.48 465.48 465.48 465.48

VOLUME AVERAGED TEMPERATURE = 465.48 DEGF
SPACE INTEGRATED SOURCE = 3.51225E-02 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 3.51225E-02 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5002001

370.02 370.02 370.02 370.02 370.02

VOLUME AVERAGED TEMPERATURE = 370.02 DEGF
SPACE INTEGRATED SOURCE = 0.74675 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 0.74675 FT2

TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5212001

420.84 420.84 420.84 420.84 420.84

VOLUME AVERAGED TEMPERATURE = 420.84 DEGF
SPACE INTEGRATED SOURCE = 3.51225E-02 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 3.51225E-02 FT2

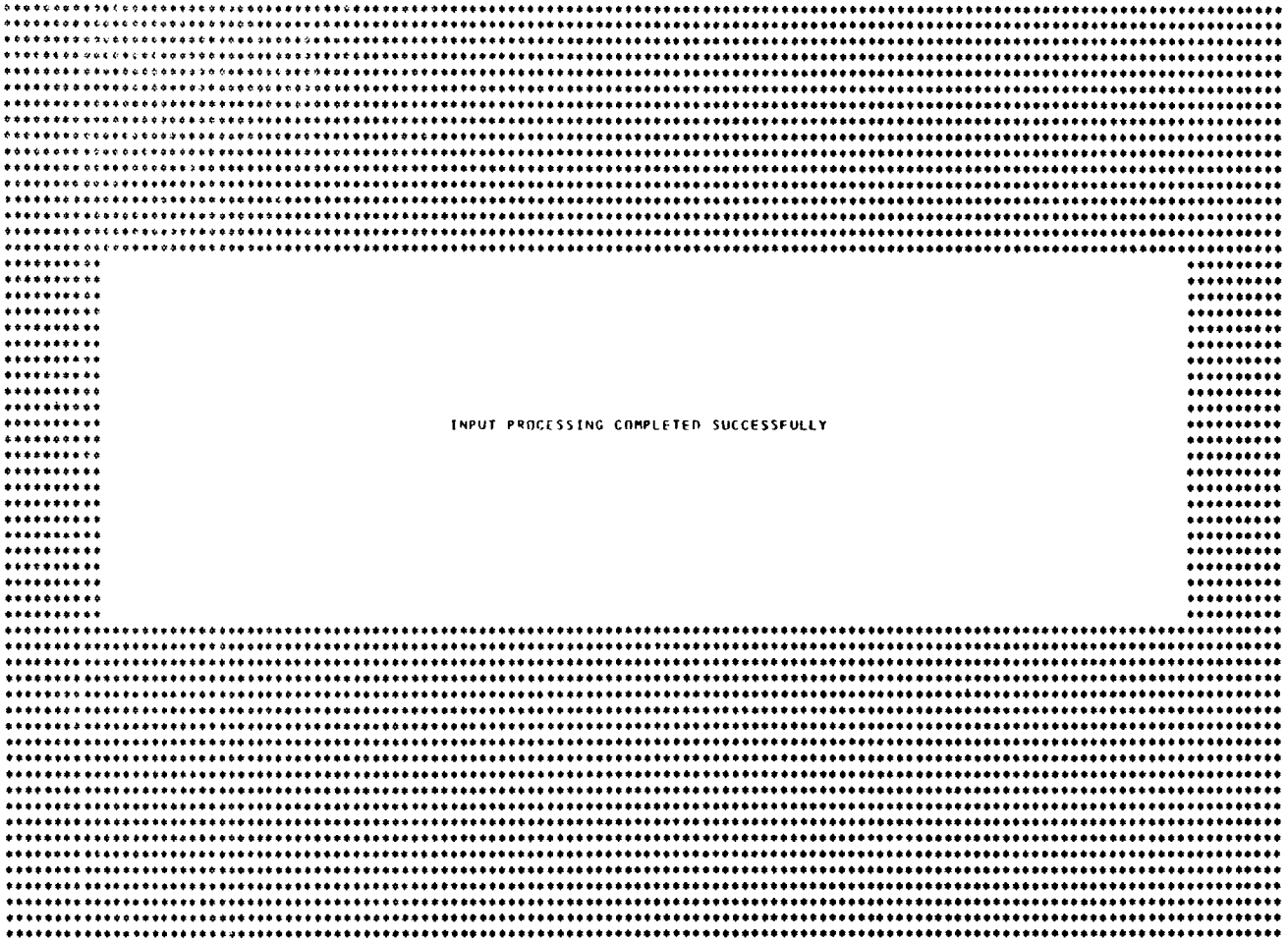
TEMPERATURES (DEGF) FROM STEADY-STATE INITIALIZATION FOR HEAT STRUCTURE-GEOMETRY COMPONENT 5222001

465.48 465.48 465.48 465.48 465.48

VOLUME AVERAGED TEMPERATURE = 465.48 DEGF
SPACE INTEGRATED SOURCE = 3.51225E-02 FT2
INTEGRAL FOR VOLUME AVERAGED TEMPERATURE = 3.51225E-02 FT2

NUMBER OF HEAT STRUCTURES = 11, TOTAL NUMBER OF MESH POINTS = 55

STRUCT. NUMBER	SIDE	BOUND.VOL. NUMBER	HEAT TRF. SURF.AREA FT2	HEAT TRF. RATE (BTU/SEC -FT2)	CRITICAL HEAT FLUX (BTU/SEC -FT2)	M O D E	HEAT TRF. COEF. (BTU/S-F T2-DEGF)	INT.HEAT SOURCE (BTU/S)	HEAT TRF. OUT (BTU/S)	NET HEAT LOSS (BTU/S)
4002001	LEFT	402020000	1.66959E+03	5.27673E+00	0.00000E+00	1	3.24888E-01	8.80996E+03	8.80996E+03	1.08373E-03
	RIGHT	0	1.35420E+03	0.00000E+00	0.00000E+00	0	0.00000E+00			
4012001	LEFT	402020000	1.80963E+04	2.61806E-15	0.00000E+00	1	3.24888E-01	0.00000E+00	4.73772E-11	4.73772E-11
	RIGHT	0	2.91405E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4022001	LEFT	404010000	6.29997E+04	1.81681E+00	0.00000E+00	1	4.23941E-01	1.14463E+05	1.14458E+05	-4.86745E+00
	RIGHT	0	9.30839E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4032001	LEFT	404020000	4.20001E+04	2.95215E+00	0.00000E+00	1	1.08184E+00	1.23992E+05	1.23991E+05	-7.94450E-01
	RIGHT	0	4.20846E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4042001	LEFT	408010000	4.20000E+04	3.29439E+00	0.00000E+00	1	6.27853E-01	1.38362E+05	1.38364E+05	2.09311E+00
	RIGHT	0	4.20561E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4052001	LEFT	412010000	4.20000E+04	5.58096E+00	0.00000E+00	1	6.45455E-01	2.34401E+05	2.34400E+05	-4.49646E-01
	RIGHT	0	4.20438E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4202001	LEFT	424010000	2.05000E+04	3.57646E+00	0.00000E+00	1	6.05519E-01	7.33174E+04	7.33174E+04	4.29531E-03
	RIGHT	0	2.06415E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
4212001	LEFT	424020000	2.20000E+04	3.43957E+00	0.00000E+00	1	6.26697E-01	7.56709E+04	7.56706E+04	-2.36617E-01
	RIGHT	0	2.21518E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
5002001	LEFT	500010000	1.87928E+04	1.07568E-15	0.00000E+00	20	6.57788E-01	0.00000E+00	2.02151E-11	2.02151E-11
	RIGHT	0	2.04092E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
5212001	LEFT	524010000	2.05000E+04	3.57646E+00	0.00000E+00	1	6.05519E-01	7.33174E+04	7.33174E+04	4.29531E-03
	RIGHT	0	2.06415E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			
5222001	LEFT	524020000	2.20000E+04	3.43957E+00	0.00000E+00	1	6.26697E-01	7.56709E+04	7.56706E+04	-2.36617E-01
	RIGHT	0	2.21518E+04	0.00000E+00	0.00000E+00	0	0.00000E+00			


INPUT PROCESSING COMPLETED SUCCESSFULLY

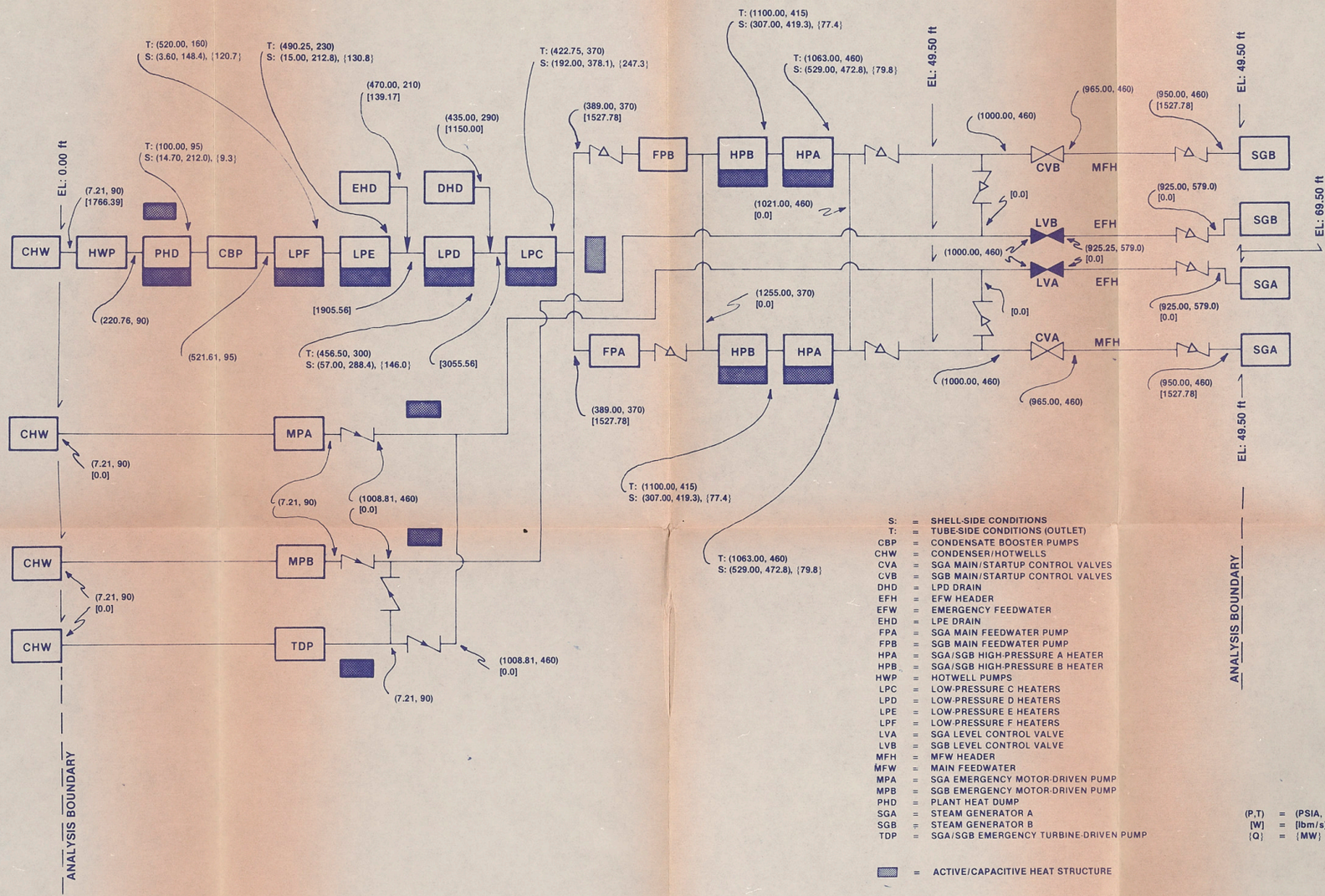
VITA

Richard Dowe Dabbs, born in Florence, Alabama, on August 16, 1955, is the only child of Rosier Willis Dabbs and the former Patra Elizabeth Patton. After graduating from Roane County High School, Kingston, Tennessee in June 1973, he entered The University of Tennessee, Knoxville in September 1973 and received a Bachelor of Science degree in nuclear engineering in June 1977.

Immediately following graduation, Dowe accepted a position with the Oak Ridge National Laboratory, Oak Ridge, Tennessee, in the Analysis Section of the Blowdown Heat Transfer Program of the Engineering Technology Division. He entered the Graduate School of The University of Tennessee, Knoxville, in April 1978 as a part-time student.

From September 1981 through July 1983, Mr. Dabbs was employed by the Modeling, Analysis, and Diagnostics Division of the Oak Ridge, Tennessee office of Science Applications International Corporation. He is currently a member of the Nuclear Energy Department of the Technology for Energy Corporation, Knoxville, Tennessee.

Mr. Dabbs is married to the former Anne Goodwin Grisham of Kingston, Tennessee, daughter of Arthur Clyde Grisham and the former Isabelle Waller Goodwin. They are expecting their first child in June 1984.



S: = SHELL-SIDE CONDITIONS
T: = TUBE-SIDE CONDITIONS (OUTLET)
CBP = CONDENSATE BOOSTER PUMPS
CHW = CONDENSER/HOTWELLS
CVA = SGA MAIN/STARTUP CONTROL VALVES
CVB = SGB MAIN/STARTUP CONTROL VALVES
DHD = LPD DRAIN
EFH = EFW HEADER
EFW = EMERGENCY FEEDWATER
EHD = LPE DRAIN
FPA = SGA MAIN FEEDWATER PUMP
FPB = SGB MAIN FEEDWATER PUMP
HPA = SGA/SGB HIGH-PRESSURE A HEATER
HPB = SGA/SGB HIGH-PRESSURE B HEATER
HWP = HOTWELL PUMPS
LPC = LOW-PRESSURE C HEATERS
LPD = LOW-PRESSURE D HEATERS
LPE = LOW-PRESSURE E HEATERS
LPF = LOW-PRESSURE F HEATERS
LVA = SGA LEVEL CONTROL VALVE
LVB = SGB LEVEL CONTROL VALVE
MFH = MFW HEADER
MFW = MAIN FEEDWATER
MPA = SGA EMERGENCY MOTOR-DRIVEN PUMP
MPB = SGB EMERGENCY MOTOR-DRIVEN PUMP
PHD = PLANT HEAT DUMP
SGA = STEAM GENERATOR A
SGB = STEAM GENERATOR B
TDP = SGA/SGB EMERGENCY TURBINE-DRIVEN PUMP

(P,T) = (PSIA, °F)
[W] = [lbm/s]
{Q} = {MW}

= ACTIVE/CAPACITIVE HEAT STRUCTURE

STEADY-STATE THERMODYNAMIC STATEPOINTS FOR 2565 MW(t)
TOTAL MAIN FEEDWATER MASS FLOW = 11 · 10^6 lbm/hr

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No	REVISION	DATE	CHK	APP'VD

DES.		
DRW.		
CHK.		
APP'VD.		
		DATE

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ±
DECIMALS ±
ANGLES
BREAK SHARP EDGES MAX.
FINISH

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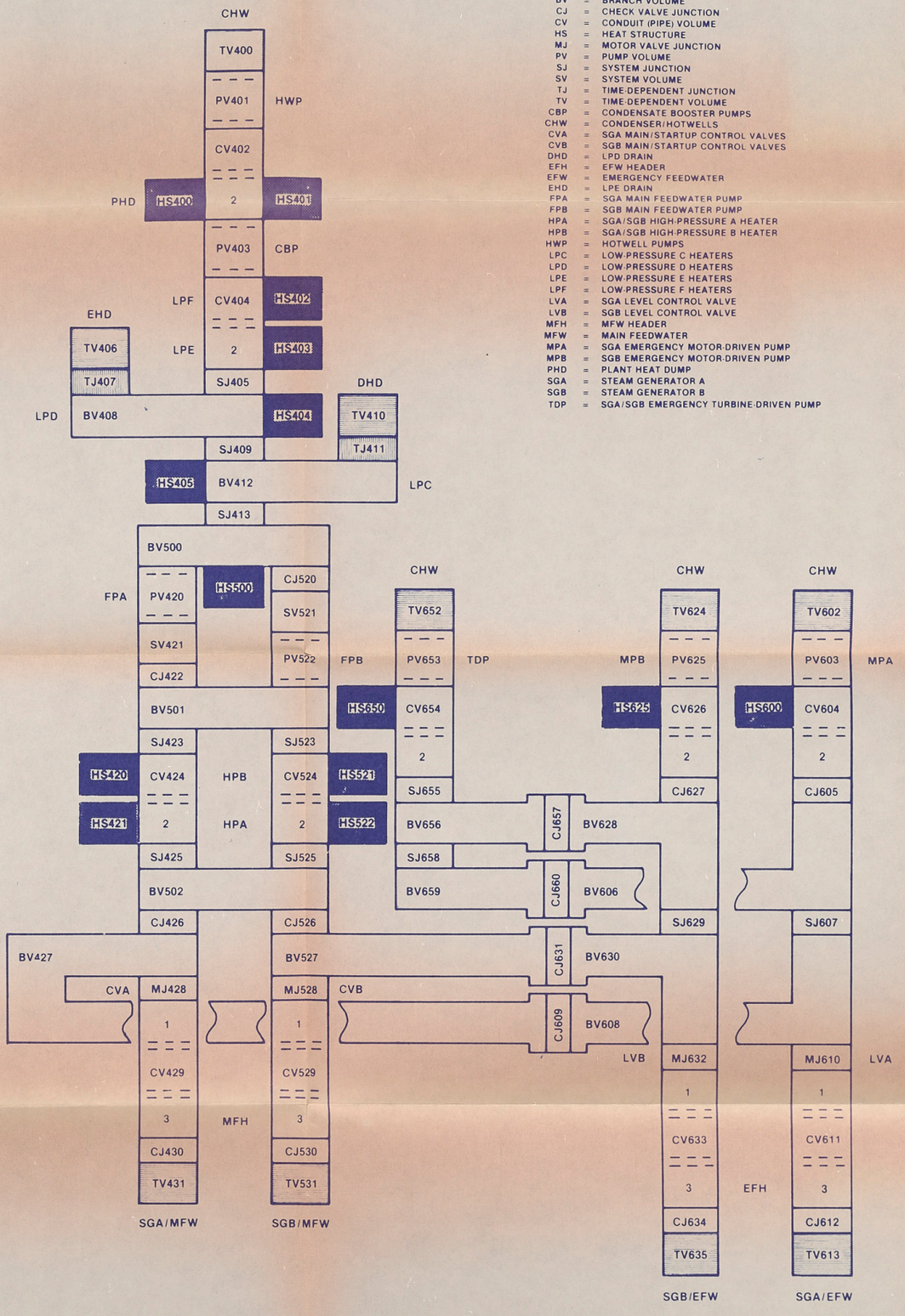
800 OAK RIDGE TURNPIKE P.O. BOX 843, OAK RIDGE, TENN. 37830

PLATE 5.1

THE OCONEE 1 SPCS MAIN/EMERGENCY CONDENSATE/FEEDWATER TRAINS RELAP5 MODEL COMPONENT SCHEMATIC

CUST. CONT. No.	ACCEPTED	SHT. OF
SCALE		REV

0" 1" 2"



BV = BRANCH VOLUME
CJ = CHECK VALVE JUNCTION
CV = CONDUIT (PIPE) VOLUME
HS = HEAT STRUCTURE
MJ = MOTOR VALVE JUNCTION
PV = PUMP VOLUME
SJ = SYSTEM JUNCTION
SV = SYSTEM VOLUME
TJ = TIME-DEPENDENT JUNCTION
TV = TIME-DEPENDENT VOLUME
CBP = CONDENSATE BOOSTER PUMPS
CHW = CONDENSER/HOTWELLS
CVA = SGA MAIN/STARTUP CONTROL VALVES
CVB = SGB MAIN/STARTUP CONTROL VALVES
DHD = LPD DRAIN
EFH = EFW HEADER
EFW = EMERGENCY FEEDWATER
EHD = LPE DRAIN
FPA = SGA MAIN FEEDWATER PUMP
FPB = SGB MAIN FEEDWATER PUMP
HPA = SGA/SGB HIGH-PRESSURE A HEATER
HPB = SGA/SGB HIGH-PRESSURE B HEATER
HWP = HOTWELL PUMPS
LPC = LOW-PRESSURE C HEATERS
LPD = LOW-PRESSURE D HEATERS
LPE = LOW-PRESSURE E HEATERS
LPF = LOW-PRESSURE F HEATERS
LVA = SGA LEVEL CONTROL VALVE
LVB = SGB LEVEL CONTROL VALVE
MFH = MFW HEADER
MFW = MAIN FEEDWATER
MPA = SGA EMERGENCY MOTOR-DRIVEN PUMP
MPB = SGB EMERGENCY MOTOR-DRIVEN PUMP
PHD = PLANT HEAT DUMP
SGA = STEAM GENERATOR A
SGB = STEAM GENERATOR B
TDP = SGA/SGB EMERGENCY TURBINE-DRIVEN PUMP

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No	REVISION	DATE	CHK	APPVD

DES.
DRW.
CHK.
APPVD.
DATE

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONS ±
DECIMALS ±
ANGLES
BREAK SHARP EDGES
FINISH
MAX.

CUST.
CONT. No.
SCALE

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DESIGN ENGINEERING & APPLIED MECHANICS DIV.
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THE OCONEE 1 SPCS MAIN/EMERGENCY CONDENSATE/FEEDWATER TRAINS RELAP5 MODEL NODALIZATION

PLATE 5.2

ACCEPTED

SHT. OF

REV