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BRENDA: A DYNAMIC SIMULATOR FOR A SODIUM-COOLED FAST REACTOR POWER PLANT

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**Prepared for
U. S. Nuclear Regulatory Commission**

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ABSTRACT

This report is a users' manual for one version of BRENDA (Breeder Reactor Nuclear Dynamic Analysis), which is a digital program for simulating the dynamic behavior of a sodium-cooled fast reactor power plant. This version, which contains 57 differential equations, represents a simplified model of the Clinch River Breeder Reactor Project (CRBRP).

BRENDA is an input deck for DARE P (Differential Analyzer Replacement, Portable), which is a continuous-system simulation language developed at the University of Arizona. DARE P is available from the University at nominal cost, and is operational on several types of computers.

This report contains brief descriptions of DARE P and BRENDA, instructions for using BRENDA in conjunction with DARE P, and some sample output. A list of variable names and a listing for BRENDA are included as appendices.

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INTRODUCTION

A digital simulator of a liquid metal fast breeder reactor (LMFBR) power plant has been developed at the University of Arizona under the sponsorship of the Division of Reactor Safety Research of the United States Nuclear Regulatory Commission. Versions of the model that have been tested contain up to 72 differential equations representing the reactor, the heat exchangers, the steam generator, the turbo-generator system, and various controllers. Special transport delay operators have been developed that employ variable time delays which are computed from varying flow rates in pipes.

The model has been used to study dynamic behavior and operational safety of a prototype demonstration plant, the Clinch River Breeder Reactor Plant design (Jacobi, 1974). Sensitivity to model variations and to values of parameters has been extensively investigated. Examples of transients include reactivity insertions, pressure, temperature, flow, and electric load variations, and reactor scram followed by pump coastdown. Transients of the latter type are studied with the aid of modules (not included in this version) that represent natural convection and the auxiliary heat removal system of the plant.

Details of the model are given in the dissertation by Shinaishin (1976) and in the paper by Hetrick, Shinaishin, and Wait (1978). The version described here has a number of limitations; e.g.,

a single heat transport loop (a composite of three loops), and a very elementary model of the turbine-feedwater loop.

BRENDA is an input deck for the DARE P (Differential Analyzer Replacement, Portable) continuous-system simulation language developed at the University of Arizona by Professors Granino Korn and John Wait (Korn and Wait, 1978). DARE P is operational on several types of computers including CDC, IBM, and UNIVAC systems. We have used both a CDC-6400 and a CDC CYBER-175, the latter since December 1977.

The DARE P system contains a number of integration rules as options, including variable-step implicit methods that can accommodate a high degree of stiffness. Most of our results have been obtained using a variable-step Runge-Kutta method, with frequent check cases using the EPISODE implicit method (Byrne and Hindmarsh, 1975). The system can be dimensioned to accommodate 200 differential equations. Output options, controlled by simple one-line commands, include numerical listings, time plots, and state-plane plots.

The scope of this report is limited to brief descriptions of DARE P and BRENDA, instructions for using one version of BRENDA in conjunction with DARE P, a listing of BRENDA, and some sample output. Inquiries about DARE P may be directed to Dr. John Wait, Department of Electrical Engineering, University of Arizona. This version of BRENDA will be submitted to the Argonne Code Center; meanwhile, inquiries may be directed to Dr. David Hetrick, Department of Nuclear Engineering, University of Arizona.

DARE P

DARE P (Differential Analyzer Replacement, Portable) is an equation-oriented continuous-system simulation language developed at the University of Arizona with support from the National Science Foundation (Korn and Wait, 1978). It can be dimensioned to solve an initial-value problem consisting of 200 simultaneous first-order non-linear differential equations (state equations).

A typical input deck for DARE P consists of the following:

1. A method block, which for the integration schemes built into DARE P consists of one card of the form \$Mm (starting in col. 2); m = 1 selects a variable-step Runge-Kutta-Merson method, m = 3 selects Gear's method (Gear, 1971), m = 11 selects EPISODE (Byrne and Hindmarsh, 1975), etc. Other methods are also included, or the user may incorporate his own method. The default method is \$M1.
2. A derivative block, introduced by the card \$D1, and containing the differential equations, any algebraic equations, values of fixed parameters, procedure blocks for logical operations, comments indicated by asterisks, and STORE commands for identifying the desired output variables. Formulas and statements are standard FORTRAN, except that, for example, the differential equation for the state variable X is written as

$$\dot{X} = F$$

where F is a FORTRAN expression. The translator converts this equation into whatever representation of a differential equation is appropriate for each integration method.

3. Function blocks, introduced by the card \$F, which play the role of subroutines that may be called in the derivative block.
4. Tables, signified by cards of the form \$T_m where m is an integer. Tables may be one-dimensional or two-dimensional. Interpolated values are called by statements in the derivative block.
5. A logic block (\$L) for controlling simulator runs and storing desired solutions. Its absence (default) signifies a single run.
6. An END card (cols. 1-3).
7. An initial-condition block containing run-control parameters, initial values of state variables (if non-zero), and any parameter values that were not stated in the derivative block. The only card that must appear is the definition of the total simulation time TMAX. Other cards override various default values, such as NPOINT (number of listed output time points; default 101), EMAX (maximum relative error permitted in variable-step methods), etc.
8. An END card.
9. Output commands such as

LIST X1, X2

PLOT X3

which generate listings and line-printer plots. The plots are automatically scaled by DARE P. The option of generating CALCOMP plots is included.

10. An END card.

Details of these and other features are discussed in the book by Korn and Wait (1978).

DARE P involves four overlays or memory loads; in our local CYBER 175 installation, a DARE P job is controlled by a procedural file which is called by a single control card. In other systems, the overlays must be sequenced by the local job control language. The source program for DARE P is in standard ANSI FORTRAN IV.

In operation, DARE P translates and sorts the equations in the derivative block. The problem will not run if an implicit algebraic loop is encountered at this stage. For proper operation of the sorting process, each procedure block contains a provision for stating in its initial line which variable is defined by, and which variables are needed by, the statements contained in that block.

After sorting, DARE P calls the translated form of the derivative block at each time step, updates the state variables, and advances the time step. In a variable-step method, the step size may increase, decrease, or remain fixed depending on an appropriate error criterion. In addition, a special computation is made at each time point for which printed output is required.

Whenever the error criterion calls for a decreasing time step, the latest results are discarded and recomputed at one half of the

time interval. The user must be careful that any switches that might be activated by discarded values of variables are reset before recomputation. Otherwise, "spurious excursions" such as unwanted activation of controllers may be introduced.

A simulator for a particular physical system (such as BRENDA) is comprised of an input deck for DARE P. Such an input deck can be quite large and unwieldy (many hundreds of cards). It is most conveniently maintained on a disk file and edited interactively. Alternatively, on CDC systems, it could be stored as a permanent file and modified by UPDATE corrections. The sample listing provided as an appendix to this report was printed from a DEC-10 disk file in which each line is a card image.

The DARE P program itself is maintained as a permanent file in our CYBER-175, and BRENDA, preceded by an appropriate job card and control card, is sent from the DEC-10 over a computer link to the CYBER. Output may be printed, or returned as a data file on the DEC-10.

DARE P may be obtained on tape at nominal cost from Dr. John Wait, Department of Electrical Engineering, University of Arizona.

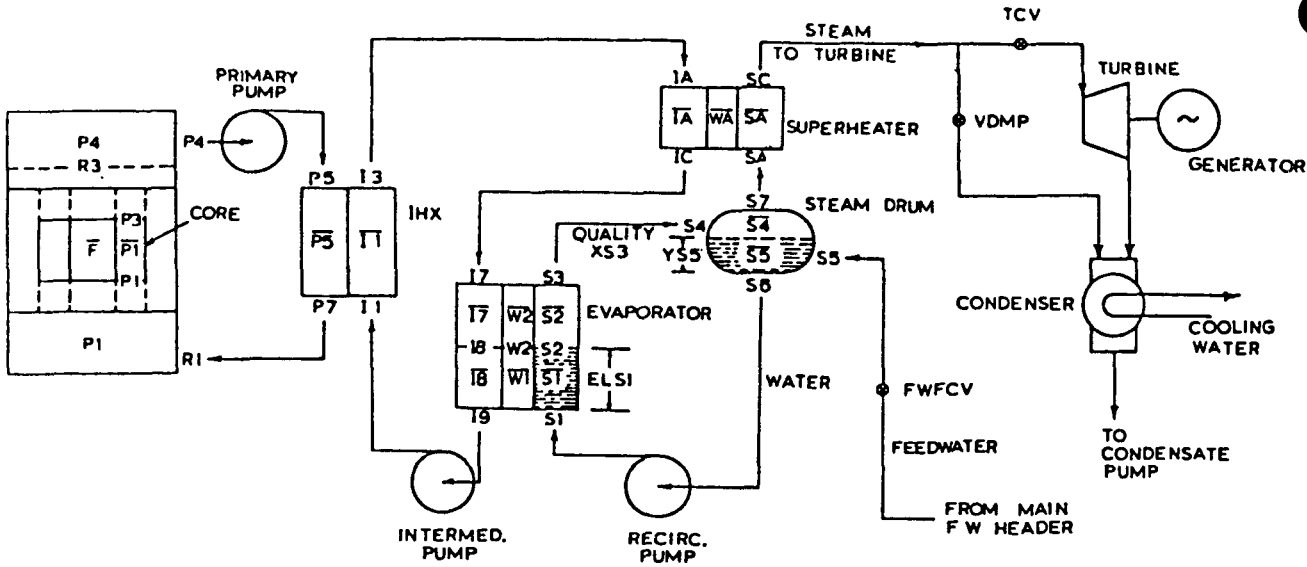
BRENDA

BRENDA (Breeder Reactor Nuclear Dynamic Analysis) is a lumped-parameter dynamic simulator for studying the approximate response of a sodium-cooled fast reactor power plant to various hypothetical perturbations. The version described here is a model for the CRBRP (Clinch River Breeder Reactor Plant) design (Jacobi, 1974) in which the three-loop heat-transport system is represented as a single composite loop. See Fig. 1.

The purpose of BRENDA is to permit inexpensive dynamic simulations for (1) scoping studies, (2) identification of key dynamic variables, (3) identification of cases for more detailed study, (4) sensitivity studies, and (5) ballpark verification. Typical transients that may be studied include reactivity insertions, flow perturbations, and electric load variations. Although many nonlinear phenomena are included in the model, the presence of many simplifying assumptions precludes the use of the model for predicting extreme off-normal behavior.

Details of the model are described in the dissertation by Shinaishin (1976) and in the paper by Hetrick, Shinaishin, and Wait (1978). This version contains some major changes from the original version, as discussed in the following.

The original version of the transport delay operator PDELAY, which is designed to permit the use of variable time delays calculated from variable flow rates in pipes, contained an option which included



Temperature

- \bar{T}_{AF}
- T_{IC} (855°F)
- T_{I3} (936°F)
- T_{I8}
- T_{I9} (651°F)
- T_{P1} (730°F)
- T_{P3}
- T_{P4} (995°F)
- T_{P7} (730°F)
- T_{R3}
- T_{SC} (905°F)
- \bar{T}_{WA}
- \bar{T}_{W1}
- \bar{T}_{W2}

Flow

- Primary(11518 lbm/sec)
- Intermed(10650 lbm/sec)
- Riser(1856 lbm/sec)
- Downcomer(1856 lbm/sec)
- S.H.-Turbine(928 lbm/sec)
- Feedwater(928 lbm/sec)

Pressure

- \bar{P}_{S4} (1765 psi)
- \bar{P}_{S2} (1830 psi)

Pump Speed

- Primary(1170 RPM)
- Intermed.(1006 RPM)

Mass

- M_{S4}
- M_{S5}

Water Height

- L_{S1}

Water Enthalpy

- H_{S6} (@ 544°F)

Turbine Variables

- Power Angle
- Turbine Speed(60 RPS)
- Turbine Power(380 MW)

Delayed Neutrons

- Six Groups

Fig. 1. Schematic Diagram of the CRBRP.

an attempt to model mixing in a pipe while the flow rate was increasing. The mixing option has been deleted.

The original model of the steam drum has been modified to include the possibility of condensation following separation of the two-phase evaporator outlet flow into saturated steam and water at the steam drum inlet. The saturated water mixes with subcooled recirculating water in the drum, not at a fictitious junction below the drum, so the water mixture in the drum is subcooled. The alternative to condensation during a pressure transient is therefore not evaporation but superheating. A number of test runs showed that condensation could be important but that superheating was negligible. Accordingly, the steam in the drum is assumed to remain saturated, and the model contains logic which uses all computed positive values of the condensation rate WC but which substitutes zero for any negative values of WC (Hetrick, Shinaishin, and Wait, 1978).

A major deficiency of the original model was the representation of the turbine-condenser-feedwater loop by a simple energy balance containing a constant plant efficiency. The most important consequence of this simplification is that any information, such as a pressure or temperature perturbation, is propagated too rapidly around the turbine-condenser-feedwater loop.

The other extreme, which would be reasonable during the early stages of a transient (especially for a transient initiated by an event in the primary loop), would be to treat the feedwater enthalpy $HS5$ as constant. An intermediate strategy would be to regard $HS5$

as the turbine exit enthalpy delayed by some effective transport delay. As discussed in the next section, these three options are available in this version of BRENDA, and the user should be aware of the limitations of all three.

The original model neglected the thermal inertia of the fuel clad, assuming instead a quasistatic radial fuel-pin temperature distribution. The present version includes a differential equation for the average clad temperature TACL. Other quasistatic approximations remain, however. The reactor fuel is treated as a single lumped region, and the spatial peak temperatures are calculated from the space-average temperature TAF by assuming static temperature distributions.

Automatic controllers, modelled from simple frequency-domain descriptions together with appropriate dead bands and limiters, regulate the following:

1. Turbine control valve (TCV)
2. Steam dump bypass valve (VDMP)
3. Steam drum water level (YS5)
4. Intermediate and primary pumps
5. Reactor control assemblies

The latter (assemblies of neutron absorbers) respond to operator action or to automatic controllers that sense the following:

1. Turbine inlet steam temperature

2. Reactor coolant outlet temperature
3. Reactor power

Independent safety systems that shut down the reactor, dump steam, and change pump speeds in response to abnormal signals from a variety of sensors are not included in this model.

The original set of controllers (Shinaishin, 1976) has been modified by altering gains and time constants and by replacing a number of fast-acting systems by instantaneous responses. The latter change, which greatly reduced the stiffness of the overall system, resulted in significant reduction of computer costs.

The original simulator also provided for stepwise motion of reactor control rods, which was derived from a continuous reactivity computation. Simulation of the stepping motion proved to be both costly and unnecessary, and it has been eliminated in this version of BRENDA.

The next two sections contain instructions for using BRENDA in conjunction with DARE P. This is followed by sample output for the response of the plant to a 10-cent reactivity step. Appendix A contains a dictionary of variables, Appendix B is a listing of BRENDA, and Appendix C contains a discussion of computer graphics.

HOW TO RUN PLANT TRANSIENTS

Provisions are made within the program for initializing common transients. These transients are:

Reactivity insertions

Opening the steam dump valve

Opening or closing the turbine control valve

Change in the electric load

The transients are initialized by specifying values in the initial conditions block of the DARE P input file (BRENDA). These values are used in procedure blocks found at the beginning of the BRENDA listing in Appendix B.

In general, each procedure block controls one type of transient through the use of three control variables. The first variable begins with the letters EN (ENROC, ENDMP, ENV9, ENLD) and can assume the values 0, 1, or 2 where

0 = No transient

1 = Step change

2 = Ramp change

Thus, for a step in reactivity ENROC = 1.0. The second control variable begins with the letters DLT and represents the size of the change in the driven variable. DLTROC = 10.0 is a 10-cent change in reactivity for a step change, or a 10-cent/sec ramp rate for a ramp change. The third control variable begins with an S and is used only for ramp changes (ENXXX = 2.0). It is the duration of the ramp in seconds;

SROC = 5.0 would signify a ramp terminated at 5.0 seconds. A summary of the control variables follows.

Control Variable Summary

Reactivity Transients

ENROC = transient type selector
 DLTROC = reactivity change (cents or cents/sec)
 SROC = total ramp duration (sec)

Dump Valve Transients

ENDMP = transient type selector
 DLTDMV = change in normalized valve stroke (% or %/sec)
 SSVDMV = total ramp duration

Turbine Control Valve Transients

ENV9 = transient type selector
 DLTV9 = change in normalized valve stroke (% or %/sec)
 SSV9 = total ramp duration

Electric Load Transients

ENLD = transient type selector
 DLTLV = change in demand (% or %/sec)
 SLD = total ramp duration

Examples:

10% step decrease in electric demand:

ENLD = 1.0 DLTLV = - 10.0

3% ramp decrease in electric demand for ten seconds:

ENLD = 2.0 DLTLV = 3.0 SLD = 10.0

10 cent step reactivity insertion (the transient which is produced by the listing as it appears in Appendix B):

ENROC = 1.0 DLTROC = 10.0

Opening of one dump valve in four seconds:

ENDMP = 2.0 DLTDMV = 0.25 SSVDMV = 4.0

Note that the source code for BRENDA as provided is initialized for the 10 cent step reactivity insertion. To run a different transient, delete ENROC = 1.0 and insert the value 1.0 or 2.0 for the desired EN variable (plus values for DLT and S variables as appropriate). Note that the value of a parameter that is not specified will be taken to be zero.

One of the user input choices is the method used to calculate the feedwater enthalpy. The control variable used to specify the desired option is ENHS5. The default value of ENHS5 is zero and it may also assume the values one or two. The three choices are:

ENHS5 = 0.0 (default)
Constant feedwater enthalpy.

ENHS5 = 1.0
Time-delayed propagation of the condenser output enthalpy, calculated by assuming a constant plant efficiency. The delay time TAUHS5 must be specified by the user.

ENHS5 = 2.0
Instantaneous propagation of the condenser output enthalpy.

If ENROC = 1.0 is deleted from the input file, the resulting output will be a steady state. A change in an initial value of a variable or in the values of certain parameters will upset this balance. Thus the response to a step change in any variable may be obtained by simply assigning a new initial value to that variable. However, new values for parameters may require new steady-state values for certain variables, compensating changes in other parameters, or both.

ISOLATING PORTIONS OF THE PLANT

It is possible, with minor modification, to isolate sections or components of the CRBRP simulator. This is accomplished by breaking the logical connections between the components, and replacing the logical inputs to components by desired external inputs. As an example, consider a heat exchanger.

The logical connections in the model would conform to the physical connections of the physical system, i.e., the pipes. In BRENDA the pipes are modelled as pure transport delays, and the inlet temperature to a region will be defined with a statement of the form:

$$T_{in} = PDELAY (T_{out}, TAU, m, TI_{in}).$$

In this statement,

T_{in} = the inlet temperature for the component.

T_{out} = the exit temperature from the component upstream.

TAU = the travel time for the fluid in the pipe.

m = an index number, different for each pipe.

TI_{in} = the initial inlet temperature, from fluid initially in the pipe.

Thus, to break this "connection" the above statement should be commented out and another statement inserted, of the form

$$T_{in} = T_{in}(t),$$

where $T_{in}(t)$ is a user desired function (analytic or tabular).

The other logical "connection" between components is the flow rate from one component, through a pipe, and through the next component.

Flow rates are defined in BRENDA for the various loops in the CRBRP, and the statements defining the flow through a component to be isolated should be located and replaced with user desired functions.

These two types of logical connections are the most common, but others also exist. For example, the reactor is coupled to the turbine control valve through the reactivity controller. Care should be taken to break these types of connections as required.

In an effort to assist the user in the identification of inputs to components, they are generally placed at the beginning of each component section in BRENDA. They are also identified with comment cards in the program.

To provide an example, consider the intermediate heat exchanger (IHX). Referring to Fig. 1, the two inlets to the IHX are the primary sodium inlet (P5) and the intermediate sodium inlet (I1). The IHX section of BRENDA begins on line 5970. The primary inlet temperature is defined at line 6060 and the intermediate inlet temperature is defined at line 6020. The primary and intermediate flow rates are defined at lines 8960 and 9780 respectively.

The initial values for TP5 and TI1 are listed in the initial conditions section, and initial values of WP and WI can be calculated from initial values of WPS and WIS using

$$WP = 3600.0 * WPS$$

$$WI = 3600.0 * WIS.$$

These four variables define the inputs to the IHX. The user is free

to remove lines 6020, 6060, 8960 and 9780 and replace them with other functions as desired. To study the effect of the primary flow rate on the secondary exit temperature, TP5, T11 and WI would be set to their initial values for all time and WP would be set to a given function, such as a ramp in time.

The most convenient way to accomplish this change is through the use of procedure blocks. Procedure blocks are used to initialize transients, and examples may be found at the beginning of BRENDA, lines 220-570. The use of procedure blocks is explained in the DARE P USERS MANUAL, which, together with the DARE P program, is available from Dr. John Wait, Department of Electrical Engineering, University of Arizona.

SAMPLE OUTPUT

The sixteen pages of output listing that follow were generated by the sixteen LIST commands that appear on the last page of Appendix B. Line 14320 of Appendix B contains the statement TMAX = 50.0, and line 14330 contains NPOINT = 51, whence the output variables are printed for every second during the simulation.

The sample transient is the response of the CRBRP to a 10-cent reactivity step, with the option of constant feedwater enthalpy HS5. ENROC = 1.0 and DLTROC = 10.0 (line 15200 of Appendix B), whereas ENHS5 has its default value of zero (see the procedure block, lines 5130-5170). In this version of BRENDA, reactivity steps or ramps are modelled as motion of the eccentric control rod (reactivity ROEXCD), while the reactivity controller operates through the main control assembly (position X and reactivity RH OCD).

Following the listings, selected output variables are plotted in Figs. 2-5, using a Tektronix Model 4010-1 graphics terminal and a copy maker. Each figure is a composite of two screen images. Figure 5 illustrates two of the many graphics options (four separate flow-rate graphs, and one graph with two sodium temperatures exhibiting the 34-sec delay time TAUTIA). The units used in Fig. 2-5 are: turbine power in megawatts, pressure in psia, temperatures in °F, flow rates in lbm/hr, heights in ft, reactor power normalized to 975 megawatts (thermal), and reactivity in dollars.

Figure 4 reflects one disadvantage of using automatic plotting in the presence of a discontinuity: the reactivity curve should descend smoothly from 0.1 and not show an apparent peak at 1 sec. Also, the true reactor power peaks at 1.11 well before 1 sec. This could be remedied by minor editing of the data files before plotting.

TURBO-GENERATOR

LIST, FETAG, OMGG, PGFETA, PONG, PGE, PT

TIME	FETAG	OMGG	PGFETA	PONG	PGE	PT
0.	2.55703E+01	3.76990E+02	3.80000E+02	7.60000E+00	0.	3.87600E+02
1.00000E+00	2.55703E+01	3.76990E+02	3.80000E+02	7.60000E+00	-2.99714E-05	3.87600E+02
2.00000E+00	2.55702E+01	3.76990E+02	3.79998E+02	7.60000E+00	-1.90792E-04	3.87598E+02
3.00000E+00	2.55700E+01	3.76990E+02	3.79995E+02	7.60000E+00	2.45692E-04	3.87596E+02
4.00000E+00	2.55722E+01	3.76990E+02	3.80027E+02	7.60000E+00	2.94251E-03	3.87631E+02
5.00000E+00	2.55816E+01	3.76990E+02	3.80157E+02	7.60000E+00	7.98466E-03	3.87766E+02
6.00000E+00	2.55994E+01	3.76990E+02	3.80403E+02	7.60001E+00	1.21949E-02	3.88016E+02
7.00000E+00	2.56225E+01	3.76990E+02	3.80723E+02	7.60001E+00	1.39925E-02	3.88337E+02
8.00000E+00	2.56463E+01	3.76990E+02	3.81052E+02	7.60001E+00	1.30829E-02	3.88665E+02
9.00000E+00	2.56670E+01	3.76990E+02	3.81340E+02	7.60001E+00	1.07986E-02	3.88950E+02
1.00000E+01	2.56836E+01	3.76990E+02	3.81569E+02	7.60000E+00	8.39749E-03	3.89177E+02
1.10000E+01	2.56964E+01	3.76990E+02	3.81746E+02	7.60000E+00	6.43958E-03	3.89352E+02
1.20000E+01	2.57062E+01	3.76990E+02	3.81882E+02	7.60000E+00	4.88814E-03	3.89486E+02
1.30000E+01	2.57134E+01	3.76990E+02	3.81982E+02	7.60000E+00	3.50163E-03	3.89585E+02
1.40000E+01	2.57182E+01	3.76990E+02	3.82049E+02	7.60000E+00	2.05516E-03	3.89651E+02
1.50000E+01	2.57205E+01	3.76990E+02	3.82081E+02	7.60000E+00	6.10384E-04	3.89681E+02
1.60000E+01	2.57204E+01	3.76990E+02	3.82079E+02	7.60000E+00	-6.71326E-04	3.89678E+02
1.70000E+01	2.57184E+01	3.76990E+02	3.82051E+02	7.60000E+00	-1.63230E-03	3.89649E+02
1.80000E+01	2.57150E+01	3.76990E+02	3.82004E+02	7.60000E+00	-2.26917E-03	3.89601E+02
1.90000E+01	2.57107E+01	3.76990E+02	3.81944E+02	7.60000E+00	-2.66944E-03	3.89541E+02
2.00000E+01	2.57058E+01	3.76990E+02	3.81877E+02	7.60000E+00	-2.94207E-03	3.89474E+02
2.10000E+01	2.57005E+01	3.76990E+02	3.81803E+02	7.60000E+00	-3.16176E-03	3.89400E+02
2.20000E+01	2.56949E+01	3.76990E+02	3.81725E+02	7.60000E+00	-3.35410E-03	3.89322E+02
2.30000E+01	2.56889E+01	3.76990E+02	3.81643E+02	7.60000E+00	-3.51500E-03	3.89239E+02
2.40000E+01	2.56827E+01	3.76990E+02	3.81557E+02	7.60000E+00	-3.63434E-03	3.89153E+02
2.50000E+01	2.56763E+01	3.76990E+02	3.81469E+02	7.60000E+00	-3.70763E-03	3.89065E+02
2.60000E+01	2.56699E+01	3.76990E+02	3.81379E+02	7.60000E+00	-3.73872E-03	3.88976E+02
2.70000E+01	2.56634E+01	3.76990E+02	3.81290E+02	7.60000E+00	-3.73521E-03	3.88886E+02
2.80000E+01	2.56570E+01	3.76990E+02	3.81200E+02	7.60000E+00	-3.70667E-03	3.88797E+02
2.90000E+01	2.56506E+01	3.76990E+02	3.81112E+02	7.60000E+00	-3.66678E-03	3.88708E+02
3.00000E+01	2.56443E+01	3.76990E+02	3.81024E+02	7.60000E+00	-3.63140E-03	3.88621E+02
3.10000E+01	2.56380E+01	3.76990E+02	3.80938E+02	7.60000E+00	-3.61119E-03	3.88534E+02
3.20000E+01	2.56317E+01	3.76990E+02	3.80851E+02	7.60000E+00	-3.60223E-03	3.88447E+02
3.30000E+01	2.56255E+01	3.76990E+02	3.80765E+02	7.60000E+00	-3.58288E-03	3.88361E+02
3.40000E+01	2.56193E+01	3.76990E+02	3.80679E+02	7.60000E+00	-3.53212E-03	3.88276E+02
3.50000E+01	2.56133E+01	3.76990E+02	3.80596E+02	7.60000E+00	-3.43616E-03	3.88192E+02
3.60000E+01	2.56075E+01	3.76990E+02	3.80515E+02	7.60000E+00	-3.28966E-03	3.88111E+02
3.70000E+01	2.56019E+01	3.76990E+02	3.80438E+02	7.60000E+00	-3.10123E-03	3.88035E+02
3.80000E+01	2.55967E+01	3.76990E+02	3.80365E+02	7.60000E+00	-3.10877E-03	3.87962E+02
3.90000E+01	2.55905E+01	3.76990E+02	3.80279E+02	7.60000E+00	-4.20036E-03	3.87875E+02
4.00000E+01	2.55822E+01	3.76990E+02	3.80164E+02	7.60000E+00	-5.22828E-03	3.87759E+02
4.10000E+01	2.55730E+01	3.76990E+02	3.80037E+02	7.60000E+00	-5.14980E-03	3.87632E+02
4.20000E+01	2.55648E+01	3.76990E+02	3.79923E+02	7.60000E+00	-4.27231E-03	3.87519E+02
4.30000E+01	2.55583E+01	3.76990E+02	3.79833E+02	7.60000E+00	-3.25712E-03	3.87430E+02
4.40000E+01	2.55534E+01	3.76990E+02	3.79765E+02	7.60000E+00	-2.48666E-03	3.87362E+02
4.50000E+01	2.55495E+01	3.76990E+02	3.79711E+02	7.60000E+00	-2.07469E-03	3.87309E+02
4.60000E+01	2.55460E+01	3.76990E+02	3.79662E+02	7.60000E+00	-1.99600E-03	3.87260E+02
4.70000E+01	2.55424E+01	3.76990E+02	3.79613E+02	7.60000E+00	-2.14644E-03	3.87211E+02
4.80000E+01	2.55385E+01	3.76990E+02	3.79559E+02	7.60000E+00	-2.37590E-03	3.87156E+02
4.90000E+01	2.55342E+01	3.76990E+02	3.79500E+02	7.60000E+00	-2.53481E-03	3.87097E+02
5.00000E+01	2.55298E+01	3.76990E+02	3.79438E+02	7.60000E+00	-2.55375E-03	3.87036E+02

TIME	WS9	PS9	TS9	HS9
0.	3.34000E+06	1.46470E+03	9.00000E+02	1.43058E+03
1.00000E+00	3.34000E+06	1.46470E+03	9.00000E+02	1.43058E+03
2.00000E+00	3.33996E+06	1.46468E+03	9.00000E+02	1.43058E+03
3.00000E+00	3.34000E+06	1.46470E+03	9.00000E+02	1.43058E+03
4.00000E+00	3.34049E+06	1.46494E+03	9.00037E+02	1.43059E+03
5.00000E+00	3.34171E+06	1.46559E+03	9.00224E+02	1.43068E+03
6.00000E+00	3.34365E+06	1.46667E+03	9.00475E+02	1.43079E+03
7.00000E+00	3.34603E+06	1.46805E+03	9.00679E+02	1.43086E+03
8.00000E+00	3.34842E+06	1.46948E+03	9.00772E+02	1.43086E+03
9.00000E+00	3.35059E+06	1.47082E+03	9.00746E+02	1.43079E+03
1.00000E+01	3.35246E+06	1.47200E+03	9.00624E+02	1.43067E+03
1.10000E+01	3.35408E+06	1.47302E+03	9.00443E+02	1.43052E+03
1.20000E+01	3.35545E+06	1.47391E+03	9.00235E+02	1.43036E+03
1.30000E+01	3.35657E+06	1.47466E+03	9.00019E+02	1.43020E+03
1.40000E+01	3.35741E+06	1.47526E+03	8.99804E+02	1.43004E+03
1.50000E+01	3.35796E+06	1.47569E+03	8.99592E+02	1.42988E+03
1.60000E+01	3.35823E+06	1.47597E+03	8.99391E+02	1.42974E+03
1.70000E+01	3.35827E+06	1.47611E+03	8.99211E+02	1.42962E+03
1.80000E+01	3.35812E+06	1.47615E+03	8.99061E+02	1.42952E+03
1.90000E+01	3.35783E+06	1.47610E+03	8.98944E+02	1.42944E+03
2.00000E+01	3.35743E+06	1.47598E+03	8.98856E+02	1.42939E+03
2.10000E+01	3.35692E+06	1.47581E+03	8.98794E+02	1.42936E+03
2.20000E+01	3.35634E+06	1.47559E+03	8.98754E+02	1.42934E+03
2.30000E+01	3.35568E+06	1.47532E+03	8.98729E+02	1.42934E+03
2.40000E+01	3.35498E+06	1.47503E+03	8.98719E+02	1.42934E+03
2.50000E+01	3.35424E+06	1.47470E+03	8.98720E+02	1.42935E+03
2.60000E+01	3.35347E+06	1.47436E+03	8.98730E+02	1.42937E+03
2.70000E+01	3.35268E+06	1.47400E+03	8.98749E+02	1.42940E+03
2.80000E+01	3.35189E+06	1.47364E+03	8.98774E+02	1.42943E+03
2.90000E+01	3.35110E+06	1.47326E+03	8.98805E+02	1.42947E+03
3.00000E+01	3.35030E+06	1.47288E+03	8.98840E+02	1.42950E+03
3.10000E+01	3.34950E+06	1.47249E+03	8.98878E+02	1.42954E+03
3.20000E+01	3.34870E+06	1.47210E+03	8.98918E+02	1.42958E+03
3.30000E+01	3.34790E+06	1.47170E+03	8.98961E+02	1.42963E+03
3.40000E+01	3.34710E+06	1.47130E+03	8.99005E+02	1.42967E+03
3.50000E+01	3.34633E+06	1.47090E+03	8.99050E+02	1.42972E+03
3.60000E+01	3.34557E+06	1.47051E+03	8.99097E+02	1.42976E+03
3.70000E+01	3.34486E+06	1.47013E+03	8.99146E+02	1.42981E+03
3.80000E+01	3.34418E+06	1.46977E+03	8.99179E+02	1.42984E+03
3.90000E+01	3.34356E+06	1.46943E+03	8.99082E+02	1.42980E+03
4.00000E+01	3.34301E+06	1.46910E+03	8.98844E+02	1.42965E+03
4.10000E+01	3.34254E+06	1.46878E+03	8.98585E+02	1.42950E+03
4.20000E+01	3.34211E+06	1.46847E+03	8.98392E+02	1.42938E+03
4.30000E+01	3.34170E+06	1.46818E+03	8.98266E+02	1.42933E+03
4.40000E+01	3.34131E+06	1.46792E+03	8.98243E+02	1.42931E+03
4.50000E+01	3.34093E+06	1.46766E+03	8.98236E+02	1.42932E+03
4.60000E+01	3.34051E+06	1.46739E+03	8.98251E+02	1.42934E+03
4.70000E+01	3.34002E+06	1.46708E+03	8.98283E+02	1.42937E+03
4.80000E+01	3.33945E+06	1.46673E+03	8.98331E+02	1.42941E+03
4.90000E+01	3.33881E+06	1.46634E+03	8.98397E+02	1.42947E+03
5.00000E+01	3.33812E+06	1.46593E+03	8.98483E+02	1.42954E+03

SUPERHEATER

LIST,WSC,TASA,TAWA,TAIA

TIME	WSC	TASA	TAWA	TAIA
0.	3.34000E+06	7.60105E+02	8.72255E+02	8.95500E+02
1.00000E+00	3.34000E+06	7.60124E+02	8.72300E+02	8.95544E+02
2.00000E+00	3.33996E+06	7.60217E+02	8.72456E+02	8.95692E+02
3.00000E+00	3.34000E+06	7.60345E+02	8.72645E+02	8.95867E+02
4.00000E+00	3.34049E+06	7.60460E+02	8.72804E+02	8.96011E+02
5.00000E+00	3.34171E+06	7.60540E+02	8.72908E+02	8.96105E+02
6.00000E+00	3.34365E+06	7.60582E+02	8.72964E+02	8.96156E+02
7.00000E+00	3.34603E+06	7.60590E+02	8.72986E+02	8.96179E+02
8.00000E+00	3.34842E+06	7.60571E+02	8.72983E+02	8.96182E+02
9.00000E+00	3.35059E+06	7.60533E+02	8.72961E+02	8.96168E+02
1.00000E+01	3.35246E+06	7.60483E+02	8.72923E+02	8.96139E+02
1.10000E+01	3.35408E+06	7.60426E+02	8.72870E+02	8.96097E+02
1.20000E+01	3.35545E+06	7.60363E+02	8.72806E+02	8.96044E+02
1.30000E+01	3.35657E+06	7.60299E+02	8.72736E+02	8.95984E+02
1.40000E+01	3.35741E+06	7.60238E+02	8.72669E+02	8.95926E+02
1.50000E+01	3.35796E+06	7.60184E+02	8.72608E+02	8.95874E+02
1.60000E+01	3.35823E+06	7.60138E+02	8.72555E+02	8.95828E+02
1.70000E+01	3.35827E+06	7.60100E+02	8.72510E+02	8.95788E+02
1.80000E+01	3.35812E+06	7.60070E+02	8.72470E+02	8.95753E+02
1.90000E+01	3.35783E+06	7.60045E+02	8.72436E+02	8.95722E+02
2.00000E+01	3.35743E+06	7.60026E+02	8.72406E+02	8.95693E+02
2.10000E+01	3.35692E+06	7.60011E+02	8.72379E+02	8.95668E+02
2.20000E+01	3.35634E+06	7.59999E+02	8.72355E+02	8.95644E+02
2.30000E+01	3.35568E+06	7.59989E+02	8.72333E+02	8.95623E+02
2.40000E+01	3.35498E+06	7.59983E+02	8.72314E+02	8.95603E+02
2.50000E+01	3.35424E+06	7.59978E+02	8.72296E+02	8.95585E+02
2.60000E+01	3.35347E+06	7.59975E+02	8.72281E+02	8.95568E+02
2.70000E+01	3.35268E+06	7.59973E+02	8.72266E+02	8.95553E+02
2.80000E+01	3.35189E+06	7.59972E+02	8.72253E+02	8.95538E+02
2.90000E+01	3.35110E+06	7.59973E+02	8.72241E+02	8.95525E+02
3.00000E+01	3.35030E+06	7.59974E+02	8.72230E+02	8.95512E+02
3.10000E+01	3.34950E+06	7.59975E+02	8.72220E+02	8.95500E+02
3.20000E+01	3.34870E+06	7.59977E+02	8.72211E+02	8.95489E+02
3.30000E+01	3.34790E+06	7.59980E+02	8.72202E+02	8.95478E+02
3.40000E+01	3.34710E+06	7.59983E+02	8.72195E+02	8.95469E+02
3.50000E+01	3.34633E+06	7.59978E+02	8.72168E+02	8.95395E+02
3.60000E+01	3.34557E+06	7.59907E+02	8.72026E+02	8.95146E+02
3.70000E+01	3.34486E+06	7.59767E+02	8.71794E+02	8.94864E+02
3.80000E+01	3.34418E+06	7.59618E+02	8.71565E+02	8.94651E+02
3.90000E+01	3.34356E+06	7.59505E+02	8.71396E+02	8.94516E+02
4.00000E+01	3.34301E+06	7.59436E+02	8.71294E+02	8.94447E+02
4.10000E+01	3.34254E+06	7.59399E+02	8.71237E+02	8.94410E+02
4.20000E+01	3.34211E+06	7.59381E+02	8.71207E+02	8.94391E+02
4.30000E+01	3.34170E+06	7.59375E+02	8.71193E+02	8.94385E+02
4.40000E+01	3.34131E+06	7.59378E+02	8.71193E+02	8.94393E+02
4.50000E+01	3.34093E+06	7.59389E+02	8.71206E+02	8.94416E+02
4.60000E+01	3.34051E+06	7.59409E+02	8.71232E+02	8.94453E+02
4.70000E+01	3.34002E+06	7.59437E+02	8.71271E+02	8.94499E+02
4.80000E+01	3.33945E+06	7.59470E+02	8.71313E+02	8.94543E+02
4.90000E+01	3.33881E+06	7.59501E+02	8.71353E+02	8.94580E+02
5.00000E+01	3.33812E+06	7.59530E+02	8.71386E+02	8.94608E+02

TIME	PSA	PSC	TSA	TSC	HSC	TIA	TIC
0.	1.73970E+03	1.53970E+03	6.15209E+02	9.05000E+02	1.43071E+03	9.36000E+02	8.55000E+02
1.00000E+00	1.73970E+03	1.53970E+03	6.15209E+02	9.05038E+02	1.43074E+03	9.36000E+02	8.55088E+02
2.00000E+00	1.73967E+03	1.53968E+03	6.15207E+02	9.05227E+02	1.43085E+03	9.36000E+02	8.55384E+02
3.00000E+00	1.73970E+03	1.53970E+03	6.15209E+02	9.05480E+02	1.43101E+03	9.36000E+02	8.55735E+02
4.00000E+00	1.74003E+03	1.53997E+03	6.15235E+02	9.05684E+02	1.43112E+03	9.36000E+02	8.56023E+02
5.00000E+00	1.74088E+03	1.54067E+03	6.15303E+02	9.05777E+02	1.43115E+03	9.36000E+02	8.56209E+02
6.00000E+00	1.74228E+03	1.54184E+03	6.15414E+02	9.05749E+02	1.43109E+03	9.36000E+02	8.56313E+02
7.00000E+00	1.74406E+03	1.54333E+03	6.15554E+02	9.05626E+02	1.43096E+03	9.36000E+02	8.56359E+02
8.00000E+00	1.74589E+03	1.54487E+03	6.15699E+02	9.05443E+02	1.43078E+03	9.36000E+02	8.56364E+02
9.00000E+00	1.74757E+03	1.54630E+03	6.15833E+02	9.05232E+02	1.43060E+03	9.36000E+02	8.56336E+02
1.00000E+01	1.74906E+03	1.54756E+03	6.15951E+02	9.05015E+02	1.43042E+03	9.36000E+02	8.56300E+02
1.10000E+01	1.75035E+03	1.54866E+03	6.16053E+02	9.04798E+02	1.43024E+03	9.36000E+02	8.56194E+02
1.20000E+01	1.75147E+03	1.54961E+03	6.16141E+02	9.04586E+02	1.43008E+03	9.36000E+02	8.56087E+02
1.30000E+01	1.75240E+03	1.55041E+03	6.16215E+02	9.04383E+02	1.42992E+03	9.36000E+02	8.55968E+02
1.40000E+01	1.75314E+03	1.55104E+03	6.16273E+02	9.04203E+02	1.42979E+03	9.36000E+02	8.55853E+02
1.50000E+01	1.75366E+03	1.55150E+03	6.16315E+02	9.04053E+02	1.42968E+03	9.36000E+02	8.55748E+02
1.60000E+01	1.75398E+03	1.55179E+03	6.16340E+02	9.03935E+02	1.42959E+03	9.36000E+02	8.55657E+02
1.70000E+01	1.75413E+03	1.55194E+03	6.16352E+02	9.03848E+02	1.42953E+03	9.36000E+02	8.55577E+02
1.80000E+01	1.75414E+03	1.55196E+03	6.16353E+02	9.03786E+02	1.42950E+03	9.36000E+02	8.55506E+02
1.90000E+01	1.75404E+03	1.55190E+03	6.16345E+02	9.03746E+02	1.42947E+03	9.36000E+02	8.55443E+02
2.00000E+01	1.75386E+03	1.55177E+03	6.16330E+02	9.03722E+02	1.42946E+03	9.36000E+02	8.55387E+02
2.10000E+01	1.75360E+03	1.55157E+03	6.16310E+02	9.03712E+02	1.42946E+03	9.36000E+02	8.55335E+02
2.20000E+01	1.75328E+03	1.55132E+03	6.16285E+02	9.03713E+02	1.42947E+03	9.36000E+02	8.55289E+02
2.30000E+01	1.75291E+03	1.55103E+03	6.16255E+02	9.03724E+02	1.42949E+03	9.36000E+02	8.55246E+02
2.40000E+01	1.75249E+03	1.55070E+03	6.16223E+02	9.03743E+02	1.42952E+03	9.36000E+02	8.55206E+02
2.50000E+01	1.75205E+03	1.55034E+03	6.16187E+02	9.03768E+02	1.42955E+03	9.36000E+02	8.55170E+02
2.60000E+01	1.75158E+03	1.54996E+03	6.16150E+02	9.03799E+02	1.42958E+03	9.36000E+02	8.55137E+02
2.70000E+01	1.75109E+03	1.54957E+03	6.16111E+02	9.03834E+02	1.42962E+03	9.36000E+02	8.55106E+02
2.80000E+01	1.75059E+03	1.54917E+03	6.16072E+02	9.03873E+02	1.42966E+03	9.36000E+02	8.55077E+02
2.90000E+01	1.75009E+03	1.54876E+03	6.16032E+02	9.03914E+02	1.42970E+03	9.36000E+02	8.55050E+02
3.00000E+01	1.74957E+03	1.54834E+03	6.15991E+02	9.03956E+02	1.42974E+03	9.36000E+02	8.55024E+02
3.10000E+01	1.74906E+03	1.54792E+03	6.15950E+02	9.04000E+02	1.42978E+03	9.36000E+02	8.55000E+02
3.20000E+01	1.74853E+03	1.54749E+03	6.15908E+02	9.04046E+02	1.42983E+03	9.36000E+02	8.54978E+02
3.30000E+01	1.74800E+03	1.54705E+03	6.15866E+02	9.04093E+02	1.42987E+03	9.36000E+02	8.54957E+02
3.40000E+01	1.74746E+03	1.54661E+03	6.15824E+02	9.04143E+02	1.42992E+03	9.36000E+02	8.54938E+02
3.50000E+01	1.74694E+03	1.54618E+03	6.15782E+02	9.04174E+02	1.42996E+03	9.35868E+02	8.54923E+02
3.60000E+01	1.74642E+03	1.54576E+03	6.15742E+02	9.04073E+02	1.42991E+03	9.35388E+02	8.54904E+02
3.70000E+01	1.74593E+03	1.54535E+03	6.15703E+02	9.03831E+02	1.42978E+03	9.34901E+02	8.54828E+02
3.80000E+01	1.74546E+03	1.54496E+03	6.15665E+02	9.03572E+02	1.42963E+03	9.34620E+02	8.54682E+02
3.90000E+01	1.74501E+03	1.54459E+03	6.15630E+02	9.03380E+02	1.42953E+03	9.34531E+02	8.54501E+02
4.00000E+01	1.74459E+03	1.54423E+03	6.15597E+02	9.03275E+02	1.42948E+03	9.34569E+02	8.54326E+02
4.10000E+01	1.74419E+03	1.54389E+03	6.15565E+02	9.03233E+02	1.42947E+03	9.34638E+02	8.54182E+02
4.20000E+01	1.74382E+03	1.54356E+03	6.15535E+02	9.03227E+02	1.42948E+03	9.34707E+02	8.54075E+02
4.30000E+01	1.74346E+03	1.54326E+03	6.15507E+02	9.03242E+02	1.42950E+03	9.34772E+02	8.53999E+02
4.40000E+01	1.74313E+03	1.54297E+03	6.15481E+02	9.03274E+02	1.42953E+03	9.34839E+02	8.53947E+02
4.50000E+01	1.74281E+03	1.54270E+03	6.15455E+02	9.03323E+02	1.42957E+03	9.34917E+02	8.53916E+02
4.60000E+01	1.74247E+03	1.54241E+03	6.15429E+02	9.03390E+02	1.42962E+03	9.35006E+02	8.53901E+02
4.70000E+01	1.74208E+03	1.54208E+03	6.15398E+02	9.03477E+02	1.42969E+03	9.35098E+02	8.53901E+02
4.80000E+01	1.74164E+03	1.54171E+03	6.15363E+02	9.03577E+02	1.42976E+03	9.35171E+02	8.53916E+02
4.90000E+01	1.74114E+03	1.54129E+03	6.15324E+02	9.03679E+02	1.42984E+03	9.35219E+02	8.53941E+02
5.00000E+01	1.74061E+03	1.54084E+03	6.15282E+02	9.03777E+02	1.42992E+03	9.35247E+02	8.53970E+02

EVAPORATOR

LIST, ELS1, ELS2, XS3, ALF3, HS3

TIME	ELS1	ELS2	XS3	ALF3	HS3
0.	2.13016E+01	2.46984E+01	5.00000E-01	8.97215E-01	8.98778E+02
1.00000E+00	2.12985E+01	2.47015E+01	5.00383E-01	8.97356E-01	8.98968E+02
2.00000E+00	2.12710E+01	2.47290E+01	5.01905E-01	8.97912E-01	8.99722E+02
3.00000E+00	2.12155E+01	2.47845E+01	5.04234E-01	8.98757E-01	9.00876E+02
4.00000E+00	2.11565E+01	2.48435E+01	5.06558E-01	8.99569E-01	9.02035E+02
5.00000E+00	2.11182E+01	2.48818E+01	5.08151E-01	9.00070E-01	9.02844E+02
6.00000E+00	2.11099E+01	2.48901E+01	5.08720E-01	9.00153E-01	9.03161E+02
7.00000E+00	2.11268E+01	2.48732E+01	5.08477E-01	8.99909E-01	9.03086E+02
8.00000E+00	2.11565E+01	2.48435E+01	5.07964E-01	8.99560E-01	9.02880E+02
9.00000E+00	2.11890E+01	2.48110E+01	5.07438E-01	8.99216E-01	9.02664E+02
1.00000E+01	2.12202E+01	2.47798E+01	5.06914E-01	8.98890E-01	9.02445E+02
1.10000E+01	2.12497E+01	2.47503E+01	5.06313E-01	8.98553E-01	9.02183E+02
1.20000E+01	2.12784E+01	2.47216E+01	5.05589E-01	8.98186E-01	9.01855E+02
1.30000E+01	2.13061E+01	2.46939E+01	5.04775E-01	8.97802E-01	9.01479E+02
1.40000E+01	2.13311E+01	2.46689E+01	5.03963E-01	8.97436E-01	9.01098E+02
1.50000E+01	2.13514E+01	2.46486E+01	5.03233E-01	8.97118E-01	9.00753E+02
1.60000E+01	2.13661E+01	2.46339E+01	5.02620E-01	8.96860E-01	9.00460E+02
1.70000E+01	2.13759E+01	2.46241E+01	5.02110E-01	8.96657E-01	9.00214E+02
1.80000E+01	2.13819E+01	2.46181E+01	5.01669E-01	8.96492E-01	8.99997E+02
1.90000E+01	2.13856E+01	2.46144E+01	5.01266E-01	8.96352E-01	8.99796E+02
2.00000E+01	2.13879E+01	2.46121E+01	5.00891E-01	8.96230E-01	8.99606E+02
2.10000E+01	2.13894E+01	2.46106E+01	5.00546E-01	8.96126E-01	8.99429E+02
2.20000E+01	2.13902E+01	2.46098E+01	5.00233E-01	8.96039E-01	8.99266E+02
2.30000E+01	2.13907E+01	2.46093E+01	4.99951E-01	8.95969E-01	8.99117E+02
2.40000E+01	2.13908E+01	2.46092E+01	4.99700E-01	8.95914E-01	8.98982E+02
2.50000E+01	2.13907E+01	2.46093E+01	4.99475E-01	8.95873E-01	8.98859E+02
2.60000E+01	2.13905E+01	2.46095E+01	4.99270E-01	8.95841E-01	8.98745E+02
2.70000E+01	2.13906E+01	2.46094E+01	4.99078E-01	8.95815E-01	8.98637E+02
2.80000E+01	2.13916E+01	2.46084E+01	4.98886E-01	8.95791E-01	8.98528E+02
2.90000E+01	2.13934E+01	2.46066E+01	4.98689E-01	8.95766E-01	8.98417E+02
3.00000E+01	2.13957E+01	2.46043E+01	4.98491E-01	8.95740E-01	8.98305E+02
3.10000E+01	2.13978E+01	2.46022E+01	4.98304E-01	8.95720E-01	8.98198E+02
3.20000E+01	2.13990E+01	2.46010E+01	4.98143E-01	8.95709E-01	8.98104E+02
3.30000E+01	2.13991E+01	2.46009E+01	4.98015E-01	8.95712E-01	8.98026E+02
3.40000E+01	2.13981E+01	2.46019E+01	4.97924E-01	8.95728E-01	8.97966E+02
3.50000E+01	2.13960E+01	2.46040E+01	4.97867E-01	8.95757E-01	8.97923E+02
3.60000E+01	2.13931E+01	2.46069E+01	4.97836E-01	8.95793E-01	8.97893E+02
3.70000E+01	2.13896E+01	2.46104E+01	4.97821E-01	8.95834E-01	8.97872E+02
3.80000E+01	2.13859E+01	2.46141E+01	4.97817E-01	8.95877E-01	8.97857E+02
3.90000E+01	2.13820E+01	2.46180E+01	4.97817E-01	8.95919E-01	8.97844E+02
4.00000E+01	2.13780E+01	2.46220E+01	4.97821E-01	8.95960E-01	8.97834E+02
4.10000E+01	2.13739E+01	2.46261E+01	4.97829E-01	8.96000E-01	8.97827E+02
4.20000E+01	2.13699E+01	2.46301E+01	4.97837E-01	8.96038E-01	8.97821E+02
4.30000E+01	2.13659E+01	2.46341E+01	4.97781E-01	8.96051E-01	8.97783E+02
4.40000E+01	2.13624E+01	2.46376E+01	4.97601E-01	8.96015E-01	8.97685E+02
4.50000E+01	2.13594E+01	2.46406E+01	4.97305E-01	8.95934E-01	8.97529E+02
4.60000E+01	2.13564E+01	2.46436E+01	4.96953E-01	8.95835E-01	8.97346E+02
4.70000E+01	2.13529E+01	2.46471E+01	4.96624E-01	8.95748E-01	8.97173E+02
4.80000E+01	2.13483E+01	2.46517E+01	4.96370E-01	8.95694E-01	8.97035E+02
4.90000E+01	2.13428E+01	2.46572E+01	4.96209E-01	8.95680E-01	8.96941E+02
5.00000E+01	2.13365E+01	2.46635E+01	4.96136E-01	8.95701E-01	8.96890E+02

TIME	TI8	TI9	TAW1	TAW2	HS1	TSAT
0.	7.13367E+02	6.51000E+02	6.58926E+02	7.38630E+02	5.42398E+02	6.22415E+02
1.00000E+00	7.13496E+02	6.51065E+02	6.58975E+02	7.38697E+02	5.42398E+02	6.22415E+02
2.00000E+00	7.13875E+02	6.51282E+02	6.59160E+02	7.38887E+02	5.42398E+02	6.22417E+02
3.00000E+00	7.14228E+02	6.51567E+02	6.59397E+02	7.39066E+02	5.42398E+02	6.22423E+02
4.00000E+00	7.14439E+02	6.51867E+02	6.59621E+02	7.39182E+02	5.42398E+02	6.22450E+02
5.00000E+00	7.14537E+02	6.52152E+02	6.59813E+02	7.39251E+02	5.42398E+02	6.22516E+02
6.00000E+00	7.14606E+02	6.52406E+02	6.59983E+02	7.39308E+02	5.42398E+02	6.22624E+02
7.00000E+00	7.14690E+02	6.52618E+02	6.60136E+02	7.39399E+02	5.42398E+02	6.22762E+02
8.00000E+00	7.14800E+02	6.52776E+02	6.60268E+02	7.39558E+02	5.42398E+02	6.22907E+02
9.00000E+00	7.14932E+02	6.52879E+02	6.60377E+02	7.39745E+02	5.42398E+02	6.23042E+02
1.00000E+01	7.15071E+02	6.52935E+02	6.60466E+02	7.39918E+02	5.42398E+02	6.23161E+02
1.10000E+01	7.15199E+02	6.52954E+02	6.60533E+02	7.40053E+02	5.42398E+02	6.23264E+02
1.20000E+01	7.15301E+02	6.52945E+02	6.60579E+02	7.40145E+02	5.42398E+02	6.23353E+02
1.30000E+01	7.15383E+02	6.52916E+02	6.60607E+02	7.40206E+02	5.42398E+02	6.23427E+02
1.40000E+01	7.15452E+02	6.52877E+02	6.60622E+02	7.40246E+02	5.42398E+02	6.23486E+02
1.50000E+01	7.15510E+02	6.52833E+02	6.60628E+02	7.40268E+02	5.42398E+02	6.23528E+02
1.60000E+01	7.15550E+02	6.52788E+02	6.60626E+02	7.40270E+02	5.42398E+02	6.23554E+02
1.70000E+01	7.15568E+02	6.52742E+02	6.60615E+02	7.40252E+02	5.42398E+02	6.23566E+02
1.80000E+01	7.15563E+02	6.52698E+02	6.60595E+02	7.40214E+02	5.42398E+02	6.23567E+02
1.90000E+01	7.15536E+02	6.52653E+02	6.60567E+02	7.40161E+02	5.42398E+02	6.23559E+02
2.00000E+01	7.15490E+02	6.52606E+02	6.60532E+02	7.40099E+02	5.42398E+02	6.23545E+02
2.10000E+01	7.15430E+02	6.52558E+02	6.60488E+02	7.40031E+02	5.42398E+02	6.23524E+02
2.20000E+01	7.15358E+02	6.52505E+02	6.60439E+02	7.39963E+02	5.42398E+02	6.23498E+02
2.30000E+01	7.15279E+02	6.52448E+02	6.60384E+02	7.39893E+02	5.42398E+02	6.23469E+02
2.40000E+01	7.15196E+02	6.52387E+02	6.60324E+02	7.39824E+02	5.42398E+02	6.23435E+02
2.50000E+01	7.15109E+02	6.52323E+02	6.60262E+02	7.39756E+02	5.42397E+02	6.23400E+02
2.60000E+01	7.15022E+02	6.52257E+02	6.60197E+02	7.39689E+02	5.42393E+02	6.23362E+02
2.70000E+01	7.14935E+02	6.52188E+02	6.60131E+02	7.39624E+02	5.42378E+02	6.23322E+02
2.80000E+01	7.14851E+02	6.52118E+02	6.60064E+02	7.39562E+02	5.42350E+02	6.23282E+02
2.90000E+01	7.14771E+02	6.52046E+02	6.59997E+02	7.39502E+02	5.42313E+02	6.23241E+02
3.00000E+01	7.14695E+02	6.51972E+02	6.59930E+02	7.39444E+02	5.42276E+02	6.23200E+02
3.10000E+01	7.14619E+02	6.51897E+02	6.59862E+02	7.39388E+02	5.42249E+02	6.23158E+02
3.20000E+01	7.14542E+02	6.51819E+02	6.59794E+02	7.39332E+02	5.42233E+02	6.23116E+02
3.30000E+01	7.14465E+02	6.51742E+02	6.59726E+02	7.39276E+02	5.42229E+02	6.23073E+02
3.40000E+01	7.14386E+02	6.51667E+02	6.59660E+02	7.39222E+02	5.42234E+02	6.23030E+02
3.50000E+01	7.14307E+02	6.51594E+02	6.59594E+02	7.39168E+02	5.42247E+02	6.22988E+02
3.60000E+01	7.14227E+02	6.51525E+02	6.59531E+02	7.39115E+02	5.42268E+02	6.22946E+02
3.70000E+01	7.14146E+02	6.51459E+02	6.59470E+02	7.39063E+02	5.42296E+02	6.22907E+02
3.80000E+01	7.14066E+02	6.51396E+02	6.59411E+02	7.39011E+02	5.42330E+02	6.22869E+02
3.90000E+01	7.13987E+02	6.51337E+02	6.59355E+02	7.38962E+02	5.42368E+02	6.22833E+02
4.00000E+01	7.13910E+02	6.51282E+02	6.59301E+02	7.38914E+02	5.42410E+02	6.22799E+02
4.10000E+01	7.13834E+02	6.51229E+02	6.59249E+02	7.38869E+02	5.42452E+02	6.22768E+02
4.20000E+01	7.13762E+02	6.51180E+02	6.59201E+02	7.38825E+02	5.42495E+02	6.22738E+02
4.30000E+01	7.13693E+02	6.51134E+02	6.59155E+02	7.38770E+02	5.42538E+02	6.22709E+02
4.40000E+01	7.13624E+02	6.51091E+02	6.59111E+02	7.38726E+02	5.42580E+02	6.22682E+02
4.50000E+01	7.13548E+02	6.51050E+02	6.59068E+02	7.38698E+02	5.42621E+02	6.22657E+02
4.60000E+01	7.13463E+02	6.51011E+02	6.59022E+02	7.38649E+02	5.42660E+02	6.22630E+02
4.70000E+01	7.13368E+02	6.50969E+02	6.58971E+02	7.38600E+02	5.42697E+02	6.22599E+02
4.80000E+01	7.13266E+02	6.50925E+02	6.58915E+02	7.38509E+02	5.42732E+02	6.22564E+02
4.90000E+01	7.13161E+02	6.50877E+02	6.58856E+02	7.38428E+02	5.42764E+02	6.22525E+02
5.00000E+01	7.13057E+02	6.50828E+02	6.58794E+02	7.38355E+02	5.42794E+02	6.22483E+02

EVAPORATOR

TIME	WS1	WS3	PAS2	ALFA2
0.	6.70821E+06	6.70821E+06	1.83070E+03	6.14591E-01
1.00000E+00	6.70753E+06	6.70781E+06	1.83071E+03	6.14720E-01
2.00000E+00	6.70375E+06	6.70579E+06	1.83073E+03	6.15233E-01
3.00000E+00	6.69913E+06	6.69992E+06	1.83080E+03	6.16011E-01
4.00000E+00	6.69717E+06	6.69105E+06	1.83114E+03	6.16752E-01
5.00000E+00	6.69908E+06	6.68259E+06	1.83197E+03	6.17192E-01
6.00000E+00	6.70378E+06	6.67783E+06	1.83334E+03	6.17231E-01
7.00000E+00	6.70903E+06	6.67816E+06	1.83508E+03	6.16958E-01
8.00000E+00	6.71280E+06	6.68232E+06	1.83692E+03	6.16584E-01
9.00000E+00	6.71527E+06	6.68782E+06	1.83862E+03	6.16219E-01
1.00000E+01	6.71724E+06	6.69319E+06	1.84012E+03	6.15876E-01
1.10000E+01	6.71916E+06	6.69822E+06	1.84143E+03	6.15529E-01
1.20000E+01	6.72112E+06	6.70312E+06	1.84255E+03	6.15159E-01
1.30000E+01	6.72290E+06	6.70802E+06	1.84348E+03	6.14779E-01
1.40000E+01	6.72422E+06	6.71282E+06	1.84422E+03	6.14420E-01
1.50000E+01	6.72497E+06	6.71719E+06	1.84476E+03	6.14113E-01
1.60000E+01	6.72527E+06	6.72082E+06	1.84509E+03	6.13866E-01
1.70000E+01	6.72529E+06	6.72362E+06	1.84524E+03	6.13675E-01
1.80000E+01	6.72520E+06	6.72569E+06	1.84525E+03	6.13523E-01
1.90000E+01	6.72508E+06	6.72723E+06	1.84516E+03	6.13396E-01
2.00000E+01	6.72492E+06	6.72840E+06	1.84497E+03	6.13289E-01
2.10000E+01	6.72469E+06	6.72929E+06	1.84471E+03	6.13200E-01
2.20000E+01	6.72439E+06	6.72994E+06	1.84439E+03	6.13129E-01
2.30000E+01	6.72404E+06	6.73037E+06	1.84401E+03	6.13076E-01
2.40000E+01	6.72364E+06	6.73060E+06	1.84359E+03	6.13037E-01
2.50000E+01	6.72322E+06	6.73065E+06	1.84314E+03	6.13011E-01
2.60000E+01	6.72280E+06	6.73056E+06	1.84266E+03	6.12995E-01
2.70000E+01	6.72239E+06	6.73037E+06	1.84216E+03	6.12985E-01
2.80000E+01	6.72203E+06	6.73011E+06	1.84165E+03	6.12977E-01
2.90000E+01	6.72171E+06	6.72986E+06	1.84114E+03	6.12968E-01
3.00000E+01	6.72139E+06	6.72963E+06	1.84061E+03	6.12959E-01
3.10000E+01	6.72102E+06	6.72940E+06	1.84009E+03	6.12955E-01
3.20000E+01	6.72057E+06	6.72911E+06	1.83955E+03	6.12960E-01
3.30000E+01	6.72006E+06	6.72871E+06	1.83901E+03	6.12977E-01
3.40000E+01	6.71950E+06	6.72817E+06	1.83847E+03	6.13007E-01
3.50000E+01	6.71893E+06	6.72749E+06	1.83793E+03	6.13048E-01
3.60000E+01	6.71837E+06	6.72670E+06	1.83741E+03	6.13096E-01
3.70000E+01	6.71783E+06	6.72584E+06	1.83691E+03	6.13148E-01
3.80000E+01	6.71734E+06	6.72495E+06	1.83643E+03	6.13200E-01
3.90000E+01	6.71687E+06	6.72407E+06	1.83598E+03	6.13251E-01
4.00000E+01	6.71643E+06	6.72323E+06	1.83556E+03	6.13300E-01
4.10000E+01	6.71598E+06	6.72243E+06	1.83516E+03	6.13348E-01
4.20000E+01	6.71555E+06	6.72168E+06	1.83478E+03	6.13394E-01
4.30000E+01	6.71527E+06	6.72103E+06	1.83442E+03	6.13415E-01
4.40000E+01	6.71522E+06	6.72064E+06	1.83408E+03	6.13392E-01
4.50000E+01	6.71527E+06	6.72068E+06	1.83375E+03	6.13326E-01
4.60000E+01	6.71518E+06	6.72110E+06	1.83341E+03	6.13244E-01
4.70000E+01	6.71482E+06	6.72163E+06	1.83303E+03	6.13174E-01
4.80000E+01	6.71419E+06	6.72199E+06	1.83258E+03	6.13137E-01
4.90000E+01	6.71340E+06	6.72198E+06	1.83209E+03	6.13137E-01
5.00000E+01	6.71255E+06	6.72156E+06	1.83156E+03	6.13171E-01

TIME	WS5	HS5	YS5	PAS4	WC	EMS4	EMS5
0.	3.34000E+06	4.32560E+02	3.00000E+00	1.76570E+03	4.70210E+03	2.17993E+03	2.34510E+04
1.00000E+00	3.33994E+06	4.32560E+02	3.00000E+00	1.76570E+03	4.70680E+03	2.17993E+03	2.34510E+04
2.00000E+00	3.33894E+06	4.32560E+02	3.00003E+00	1.76567E+03	4.72123E+03	2.17987E+03	2.34511E+04
3.00000E+00	3.33844E+06	4.32560E+02	3.00002E+00	1.76570E+03	4.63903E+03	2.17992E+03	2.34511E+04
4.00000E+00	3.34395E+06	4.32560E+02	2.99986E+00	1.76604E+03	4.40240E+03	2.18056E+03	2.34503E+04
5.00000E+00	3.35559E+06	4.32560E+02	2.99947E+00	1.76691E+03	4.06998E+03	2.18222E+03	2.34484E+04
6.00000E+00	3.36746E+06	4.32560E+02	2.99889E+00	1.76835E+03	3.76913E+03	2.18492E+03	2.34455E+04
7.00000E+00	3.36471E+06	4.32560E+02	2.99811E+00	1.77016E+03	3.61911E+03	2.18835E+03	2.34416E+04
8.00000E+00	3.35074E+06	4.32560E+02	2.99698E+00	1.77202E+03	3.63787E+03	2.19205E+03	2.34360E+04
9.00000E+00	3.33773E+06	4.32560E+02	2.99562E+00	1.77374E+03	3.74645E+03	2.19562E+03	2.34292E+04
1.00000E+01	3.32623E+06	4.32560E+02	2.99412E+00	1.77526E+03	3.87181E+03	2.19891E+03	2.34217E+04
1.10000E+01	3.31618E+06	4.32560E+02	2.99249E+00	1.77658E+03	3.98876E+03	2.20193E+03	2.34136E+04
1.20000E+01	3.30749E+06	4.32560E+02	2.99078E+00	1.77771E+03	4.10119E+03	2.20469E+03	2.34051E+04
1.30000E+01	3.30020E+06	4.32560E+02	2.98900E+00	1.77866E+03	4.21896E+03	2.20715E+03	2.33963E+04
1.40000E+01	3.29443E+06	4.32560E+02	2.98722E+00	1.77941E+03	4.34662E+03	2.20927E+03	2.33874E+04
1.50000E+01	3.29029E+06	4.32560E+02	2.98547E+00	1.77994E+03	4.47584E+03	2.21101E+03	2.33787E+04
1.60000E+01	3.28772E+06	4.32560E+02	2.98380E+00	1.78027E+03	4.59454E+03	2.21235E+03	2.33704E+04
1.70000E+01	3.28651E+06	4.32560E+02	2.98222E+00	1.78041E+03	4.69418E+03	2.21335E+03	2.33625E+04
1.80000E+01	3.28640E+06	4.32560E+02	2.98073E+00	1.78042E+03	4.77226E+03	2.21406E+03	2.33551E+04
1.90000E+01	3.28715E+06	4.32560E+02	2.97933E+00	1.78032E+03	4.83278E+03	2.21453E+03	2.33481E+04
2.00000E+01	3.28858E+06	4.32560E+02	2.97803E+00	1.78013E+03	4.88155E+03	2.21481E+03	2.33417E+04
2.10000E+01	3.29057E+06	4.32560E+02	2.97683E+00	1.77986E+03	4.92245E+03	2.21491E+03	2.33357E+04
2.20000E+01	3.29305E+06	4.32560E+02	2.97572E+00	1.77953E+03	4.95675E+03	2.21486E+03	2.33302E+04
2.30000E+01	3.29594E+06	4.32560E+02	2.97473E+00	1.77915E+03	4.98462E+03	2.21466E+03	2.33252E+04
2.40000E+01	3.29916E+06	4.32560E+02	2.97384E+00	1.77873E+03	5.00620E+03	2.21434E+03	2.33208E+04
2.50000E+01	3.30263E+06	4.32560E+02	2.97306E+00	1.77827E+03	5.02198E+03	2.21391E+03	2.33169E+04
2.60000E+01	3.30628E+06	4.32560E+02	2.97239E+00	1.77778E+03	5.03270E+03	2.21339E+03	2.33136E+04
2.70000E+01	3.31007E+06	4.32560E+02	2.97182E+00	1.77729E+03	5.03918E+03	2.21280E+03	2.33108E+04
2.80000E+01	3.31394E+06	4.32560E+02	2.97135E+00	1.77677E+03	5.04244E+03	2.21213E+03	2.33084E+04
2.90000E+01	3.31786E+06	4.32560E+02	2.97099E+00	1.77626E+03	5.04391E+03	2.21141E+03	2.33066E+04
3.00000E+01	3.32183E+06	4.32560E+02	2.97072E+00	1.77573E+03	5.04502E+03	2.21063E+03	2.33053E+04
3.10000E+01	3.32584E+06	4.32560E+02	2.97056E+00	1.77520E+03	5.04667E+03	2.20979E+03	2.33045E+04
3.20000E+01	3.32991E+06	4.32560E+02	2.97050E+00	1.77466E+03	5.04817E+03	2.20889E+03	2.33042E+04
3.30000E+01	3.33401E+06	4.32560E+02	2.97055E+00	1.77412E+03	5.04779E+03	2.20793E+03	2.33045E+04
3.40000E+01	3.33812E+06	4.32560E+02	2.97070E+00	1.77357E+03	5.04410E+03	2.20692E+03	2.33052E+04
3.50000E+01	3.34218E+06	4.32560E+02	2.97095E+00	1.77303E+03	5.03617E+03	2.20588E+03	2.33064E+04
3.60000E+01	3.34613E+06	4.32560E+02	2.97129E+00	1.77250E+03	5.02402E+03	2.20482E+03	2.33081E+04
3.70000E+01	3.34993E+06	4.32560E+02	2.97171E+00	1.77200E+03	5.00856E+03	2.20376E+03	2.33102E+04
3.80000E+01	3.35355E+06	4.32560E+02	2.97220E+00	1.77152E+03	4.99113E+03	2.20270E+03	2.33126E+04
3.90000E+01	3.35696E+06	4.32560E+02	2.97276E+00	1.77106E+03	4.97320E+03	2.20167E+03	2.33154E+04
4.00000E+01	3.36018E+06	4.32560E+02	2.97338E+00	1.77063E+03	4.95633E+03	2.20065E+03	2.33185E+04
4.10000E+01	3.36321E+06	4.32560E+02	2.97406E+00	1.77023E+03	4.94110E+03	2.19964E+03	2.33219E+04
4.20000E+01	3.36609E+06	4.32560E+02	2.97479E+00	1.76984E+03	4.92684E+03	2.19864E+03	2.33255E+04
4.30000E+01	3.36879E+06	4.32560E+02	2.97557E+00	1.76948E+03	4.91128E+03	2.19767E+03	2.33294E+04
4.40000E+01	3.37131E+06	4.32560E+02	2.97640E+00	1.76915E+03	4.89758E+03	2.19671E+03	2.33335E+04
4.50000E+01	3.37375E+06	4.32560E+02	2.97728E+00	1.76882E+03	4.89590E+03	2.19574E+03	2.33379E+04
4.60000E+01	3.37632E+06	4.32560E+02	2.97823E+00	1.76847E+03	4.91191E+03	2.19471E+03	2.33426E+04
4.70000E+01	3.37922E+06	4.32560E+02	2.97927E+00	1.76808E+03	4.94169E+03	2.19356E+03	2.33479E+04
4.80000E+01	3.38255E+06	4.32560E+02	2.98044E+00	1.76763E+03	4.97477E+03	2.19225E+03	2.33537E+04
4.90000E+01	3.38629E+06	4.32560E+02	2.98173E+00	1.76712E+03	5.00095E+03	2.19079E+03	2.33601E+04
5.00000E+01	3.39029E+06	4.32560E+02	2.98313E+00	1.76658E+03	5.01439E+03	2.18922E+03	2.33671E+04

IHX

LIST,TP7,TI3,TP5,TI1,TAP5,TAI1

TIME	TP7	TI3	TP5	TI1	TAP5	TAI1
0.	7.30000E+02	9.36000E+02	9.94731E+02	6.51000E+02	8.62366E+02	7.93500E+02
1.00000E+00	7.30330E+02	9.35804E+02	9.94731E+02	6.51000E+02	8.62530E+02	7.93402E+02
2.00000E+00	7.30861E+02	9.35276E+02	9.94731E+02	6.51000E+02	8.62796E+02	7.93138E+02
3.00000E+00	7.31029E+02	9.34811E+02	9.94731E+02	6.51000E+02	8.62880E+02	7.92906E+02
4.00000E+00	7.30948E+02	9.34568E+02	9.94731E+02	6.51000E+02	8.62839E+02	7.92784E+02
5.00000E+00	7.30803E+02	9.34532E+02	9.94731E+02	6.51000E+02	8.62767E+02	7.92766E+02
6.00000E+00	7.30672E+02	9.34589E+02	9.94731E+02	6.51000E+02	8.62702E+02	7.92705E+02
7.00000E+00	7.30562E+02	9.34663E+02	9.94731E+02	6.51000E+02	8.62647E+02	7.92832E+02
8.00000E+00	7.30465E+02	9.34731E+02	9.94731E+02	6.51000E+02	8.62598E+02	7.92866E+02
9.00000E+00	7.30369E+02	9.34797E+02	9.94731E+02	6.51000E+02	8.62550E+02	7.92899E+02
1.00000E+01	7.30267E+02	9.34870E+02	9.94731E+02	6.51000E+02	8.62499E+02	7.92935E+02
1.10000E+01	7.30158E+02	9.34953E+02	9.94731E+02	6.51000E+02	8.62445E+02	7.92977E+02
1.20000E+01	7.30045E+02	9.35048E+02	9.94731E+02	6.51000E+02	8.62388E+02	7.93024E+02
1.30000E+01	7.29956E+02	9.35136E+02	9.94731E+02	6.51000E+02	8.62344E+02	7.93068E+02
1.40000E+01	7.29898E+02	9.35198E+02	9.94731E+02	6.51000E+02	8.62315E+02	7.93099E+02
1.50000E+01	7.29860E+02	9.35234E+02	9.94730E+02	6.51000E+02	8.62295E+02	7.93117E+02
1.60000E+01	7.29830E+02	9.35259E+02	9.94750E+02	6.51000E+02	8.62290E+02	7.93129E+02
1.70000E+01	7.29803E+02	9.35289E+02	9.94791E+02	6.51000E+02	8.62297E+02	7.93144E+02
1.80000E+01	7.29778E+02	9.35328E+02	9.94840E+02	6.51000E+02	8.62309E+02	7.93144E+02
1.90000E+01	7.29757E+02	9.35377E+02	9.94893E+02	6.51000E+02	8.62325E+02	7.93188E+02
2.00000E+01	7.29740E+02	9.35433E+02	9.94948E+02	6.51000E+02	8.62344E+02	7.93216E+02
2.10000E+01	7.29728E+02	9.35494E+02	9.95003E+02	6.51003E+02	8.62365E+02	7.93249E+02
2.20000E+01	7.29730E+02	9.35554E+02	9.95056E+02	6.51094E+02	8.62393E+02	7.93324E+02
2.30000E+01	7.29771E+02	9.35595E+02	9.95106E+02	6.51319E+02	8.62438E+02	7.93457E+02
2.40000E+01	7.29857E+02	9.35627E+02	9.95152E+02	6.51601E+02	8.62504E+02	7.93614E+02
2.50000E+01	7.29978E+02	9.35662E+02	9.95192E+02	6.51893E+02	8.62585E+02	7.93777E+02
2.60000E+01	7.30122E+02	9.35708E+02	9.95226E+02	6.52168E+02	8.62674E+02	7.93938E+02
2.70000E+01	7.30280E+02	9.35767E+02	9.95253E+02	6.52415E+02	8.62766E+02	7.94091E+02
2.80000E+01	7.30442E+02	9.35839E+02	9.95273E+02	6.52621E+02	8.62857E+02	7.94230E+02
2.90000E+01	7.30598E+02	9.35923E+02	9.95288E+02	6.52775E+02	8.62943E+02	7.94349E+02
3.00000E+01	7.30740E+02	9.36016E+02	9.95299E+02	6.52877E+02	8.63020E+02	7.94466E+02
3.10000E+01	7.30865E+02	9.36114E+02	9.95305E+02	6.52933E+02	8.63085E+02	7.94524E+02
3.20000E+01	7.30970E+02	9.36213E+02	9.95308E+02	6.52953E+02	8.63139E+02	7.94583E+02
3.30000E+01	7.31055E+02	9.36308E+02	9.95308E+02	6.52946E+02	8.63182E+02	7.94627E+02
3.40000E+01	7.31120E+02	9.36394E+02	9.95305E+02	6.52918E+02	8.63212E+02	7.94656E+02
3.50000E+01	7.31166E+02	9.36469E+02	9.95299E+02	6.52880E+02	8.63232E+02	7.94675E+02
3.60000E+01	7.31195E+02	9.36535E+02	9.95291E+02	6.52837E+02	8.63243E+02	7.94686E+02
3.70000E+01	7.31210E+02	9.36590E+02	9.95280E+02	6.52792E+02	8.63245E+02	7.94691E+02
3.80000E+01	7.31212E+02	9.36634E+02	9.95269E+02	6.52747E+02	8.63240E+02	7.94690E+02
3.90000E+01	7.31203E+02	9.36667E+02	9.95255E+02	6.52703E+02	8.63229E+02	7.94685E+02
4.00000E+01	7.31183E+02	9.36691E+02	9.95240E+02	6.52658E+02	8.63212E+02	7.94675E+02
4.10000E+01	7.31154E+02	9.36705E+02	9.95224E+02	6.52613E+02	8.63189E+02	7.94659E+02
4.20000E+01	7.31116E+02	9.36711E+02	9.95206E+02	6.52565E+02	8.63161E+02	7.94638E+02
4.30000E+01	7.31069E+02	9.36709E+02	9.95188E+02	6.52513E+02	8.63129E+02	7.94611E+02
4.40000E+01	7.31014E+02	9.36701E+02	9.95169E+02	6.52457E+02	8.63091E+02	7.94579E+02
4.50000E+01	7.30950E+02	9.36685E+02	9.95150E+02	6.52398E+02	8.63050E+02	7.94541E+02
4.60000E+01	7.30878E+02	9.36663E+02	9.95129E+02	6.52335E+02	8.63004E+02	7.94499E+02
4.70000E+01	7.30799E+02	9.36636E+02	9.95109E+02	6.52269E+02	8.62954E+02	7.94452E+02
4.80000E+01	7.30713E+02	9.36603E+02	9.95088E+02	6.52201E+02	8.62900E+02	7.94402E+02
4.90000E+01	7.30621E+02	9.36565E+02	9.95067E+02	6.52132E+02	8.62844E+02	7.94348E+02
5.00000E+01	7.30524E+02	9.36522E+02	9.95046E+02	6.52061E+02	8.62785E+02	7.94291E+02

TIME	WP	WI	X	RHOD	EN	TAF	TAFL
0.	4.14460E+07	3.83400E+07	1.20000E+01	9.66686E-09	1.00000E+00	2.16550E+03	8.98354E+02
1.00000E+00	4.23798E+07	3.88615E+07	1.18500E+01	4.60804E-02	1.07770E+00	2.21931E+03	9.01133E+02
2.00000E+00	4.26252E+07	3.93473E+07	1.17000E+01	2.31921E-02	1.05670E+00	2.23599E+03	9.01752E+02
3.00000E+00	4.25020E+07	3.95033E+07	1.15500E+01	1.28016E-02	1.04532E+00	2.23744E+03	9.02332E+02
4.00000E+00	4.23869E+07	3.94481E+07	1.14000E+01	7.04656E-03	1.03793E+00	2.23327E+03	9.02387E+02
5.00000E+00	4.23023E+07	3.93292E+07	1.12500E+01	3.04528E-03	1.03196E+00	2.22700E+03	9.02059E+02
6.00000E+00	4.22302E+07	3.92312E+07	1.11000E+01	-2.21536E-04	1.02640E+00	2.21985E+03	9.01566E+02
7.00000E+00	4.21603E+07	3.91572E+07	1.09500E+01	-3.10828E-03	1.02089E+00	2.21227E+03	9.01005E+02
8.00000E+00	4.20868E+07	3.90913E+07	1.08000E+01	-5.76897E-03	1.01532E+00	2.20439E+03	9.00424E+02
9.00000E+00	4.20049E+07	3.90216E+07	1.06500E+01	-8.29444E-03	1.00959E+00	2.19628E+03	8.99874E+02
1.00000E+01	4.19121E+07	3.89426E+07	1.05000E+01	-1.06727E-02	1.00377E+00	2.18796E+03	8.99353E+02
1.10000E+01	4.18099E+07	3.88534E+07	1.03500E+01	-1.28957E-02	9.97909E-01	2.17949E+03	8.98844E+02
1.20000E+01	4.17196E+07	3.87627E+07	1.02913E+01	-1.06112E-02	9.97165E-01	2.17234E+03	8.98427E+02
1.30000E+01	4.16740E+07	3.87017E+07	1.02650E+01	-8.64165E-03	9.97237E-01	2.16799E+03	8.98145E+02
1.40000E+01	4.16480E+07	3.86685E+07	1.02528E+01	-7.21430E-03	9.97302E-01	2.16534E+03	8.97961E+02
1.50000E+01	4.16286E+07	3.86490E+07	1.02458E+01	-6.31606E-03	9.97173E-01	2.16372E+03	8.97858E+02
1.60000E+01	4.16111E+07	3.86333E+07	1.02458E+01	-5.47243E-03	9.97193E-01	2.16269E+03	8.97782E+02
1.70000E+01	4.15945E+07	3.86175E+07	1.02458E+01	-4.92140E-03	9.97080E-01	2.16204E+03	8.97787E+02
1.80000E+01	4.15779E+07	3.86003E+07	1.02458E+01	-4.50816E-03	9.96928E-01	2.16156E+03	8.97791E+02
1.90000E+01	4.15615E+07	3.85818E+07	1.02458E+01	-4.16795E-03	9.96779E-01	2.16119E+03	8.97776E+02
2.00000E+01	4.15458E+07	3.85626E+07	1.02458E+01	-3.87225E-03	9.96650E-01	2.16089E+03	8.97782E+02
2.10000E+01	4.15311E+07	3.85433E+07	1.02458E+01	-3.61292E-03	9.96540E-01	2.16064E+03	8.97842E+02
2.20000E+01	4.15173E+07	3.85242E+07	1.02458E+01	-3.38738E-03	9.96441E-01	2.16043E+03	8.97815E+02
2.30000E+01	4.15043E+07	3.85054E+07	1.02458E+01	-3.18852E-03	9.96354E-01	2.16026E+03	8.97767E+02
2.40000E+01	4.14918E+07	3.84868E+07	1.02458E+01	-3.00642E-03	9.96281E-01	2.16011E+03	8.97714E+02
2.50000E+01	4.14800E+07	3.84686E+07	1.02458E+01	-2.84383E-03	9.96215E-01	2.15998E+03	8.97821E+02
2.60000E+01	4.14687E+07	3.84508E+07	1.02458E+01	-2.69675E-03	9.96157E-01	2.15987E+03	8.97821E+02
2.70000E+01	4.14580E+07	3.84332E+07	1.02458E+01	-2.56249E-03	9.96106E-01	2.15977E+03	8.97829E+02
2.80000E+01	4.14478E+07	3.84161E+07	1.02458E+01	-2.44076E-03	9.96060E-01	2.15968E+03	8.97819E+02
2.90000E+01	4.14376E+07	3.83993E+07	1.02458E+01	-2.32900E-03	9.96018E-01	2.15961E+03	8.97833E+02
3.00000E+01	4.14280E+07	3.83828E+07	1.02458E+01	-2.23036E-03	9.95974E-01	2.15954E+03	8.97839E+02
3.10000E+01	4.14187E+07	3.83667E+07	1.02458E+01	-2.14686E-03	9.95924E-01	2.15948E+03	8.97843E+02
3.20000E+01	4.14096E+07	3.83512E+07	1.02474E+01	-2.06657E-03	9.95954E-01	2.15944E+03	8.97873E+02
3.30000E+01	4.14006E+07	3.83385E+07	1.02501E+01	-1.86243E-03	9.96014E-01	2.15945E+03	8.97905E+02
3.40000E+01	4.13910E+07	3.83269E+07	1.02549E+01	-1.63617E-03	9.96170E-01	2.15950E+03	8.97954E+02
3.50000E+01	4.13807E+07	3.83153E+07	1.02571E+01	-1.63162E-03	9.96127E-01	2.15959E+03	8.98020E+02
3.60000E+01	4.13684E+07	3.83033E+07	1.02603E+01	-1.56308E-03	9.96136E-01	2.15965E+03	8.98098E+02
3.70000E+01	4.13560E+07	3.82915E+07	1.02646E+01	-1.50654E-03	9.96172E-01	2.15979E+03	8.98193E+02
3.80000E+01	4.13411E+07	3.82798E+07	1.02694E+01	-1.39583E-03	9.96239E-01	2.15988E+03	8.98299E+02
3.90000E+01	4.13251E+07	3.82685E+07	1.02732E+01	-1.36625E-03	9.96231E-01	2.15998E+03	8.98412E+02
4.00000E+01	4.13079E+07	3.82576E+07	1.02774E+01	-1.30800E-03	9.96252E-01	2.16008E+03	8.98528E+02
4.10000E+01	4.12900E+07	3.82473E+07	1.02823E+01	-1.23628E-03	9.96296E-01	2.16019E+03	8.98661E+02
4.20000E+01	4.12714E+07	3.82377E+07	1.02876E+01	-1.14278E-03	9.96371E-01	2.16032E+03	8.98792E+02
4.30000E+01	4.12523E+07	3.82288E+07	1.02930E+01	-1.05659E-03	9.96445E-01	2.16047E+03	8.98926E+02
4.40000E+01	4.12327E+07	3.82206E+07	1.02962E+01	-1.09198E-03	9.96394E-01	2.16060E+03	8.99060E+02
4.50000E+01	4.12124E+07	3.82130E+07	1.03007E+01	-1.03853E-03	9.96430E-01	2.16073E+03	8.99193E+02
4.60000E+01	4.11918E+07	3.82057E+07	1.03058E+01	-9.37690E-04	9.96518E-01	2.16086E+03	8.99325E+02
4.70000E+01	4.11712E+07	3.81990E+07	1.03093E+01	-9.24327E-04	9.96520E-01	2.16099E+03	8.99450E+02
4.80000E+01	4.11507E+07	3.81927E+07	1.03130E+01	-8.93380E-04	9.96545E-01	2.16112E+03	8.99574E+02
4.90000E+01	4.11302E+07	3.81870E+07	1.03165E+01	-8.56489E-04	9.96572E-01	2.16124E+03	8.99762E+02
5.00000E+01	4.11098E+07	3.81818E+07	1.03198E+01	-8.23877E-04	9.96599E-01	2.16137E+03	8.99805E+02

REACTOR

LIST, TR1, TP1, TAP1, TP3, TR3, TP4

TIME	TR1	TP1	TAP1	TP3	TR3	TP4
0.	7.30000E+02	7.30000E+02	8.82865E+02	1.03573E+03	9.94730E+02	9.94730E+02
1.00000E+00	7.30000E+02	7.30000E+02	8.85107E+02	1.04021E+03	9.95686E+02	9.94749E+02
2.00000E+00	7.30000E+02	7.30000E+02	8.85610E+02	1.04122E+03	9.96090E+02	9.94791E+02
3.00000E+00	7.30000E+02	7.30000E+02	8.86172E+02	1.04234E+03	9.96298E+02	9.94841E+02
4.00000E+00	7.30000E+02	7.30000E+02	8.86251E+02	1.04250E+03	9.96428E+02	9.94895E+02
5.00000E+00	7.30000E+02	7.30000E+02	8.85977E+02	1.04195E+03	9.96504E+02	9.94951E+02
6.00000E+00	7.30000E+02	7.30000E+02	8.85548E+02	1.04110E+03	9.96534E+02	9.95007E+02
7.00000E+00	7.30004E+02	7.30000E+02	8.85055E+02	1.04011E+03	9.96518E+02	9.95060E+02
8.00000E+00	7.30426E+02	7.30012E+02	8.84548E+02	1.03908E+03	9.96459E+02	9.95111E+02
9.00000E+00	7.30909E+02	7.30060E+02	8.84068E+02	1.03808E+03	9.96361E+02	9.95157E+02
1.00000E+01	7.31027E+02	7.30125E+02	8.83626E+02	1.03713E+03	9.96228E+02	9.95197E+02
1.10000E+01	7.30931E+02	7.30185E+02	8.83198E+02	1.03621E+03	9.96063E+02	9.95230E+02
1.20000E+01	7.30788E+02	7.30232E+02	8.82838E+02	1.03544E+03	9.95895E+02	9.95256E+02
1.30000E+01	7.30661E+02	7.30266E+02	8.82593E+02	1.03492E+03	9.95754E+02	9.95276E+02
1.40000E+01	7.30554E+02	7.30289E+02	8.82434E+02	1.03458E+03	9.95631E+02	9.95290E+02
1.50000E+01	7.30458E+02	7.30304E+02	8.82347E+02	1.03439E+03	9.95520E+02	9.95300E+02
1.60000E+01	7.30363E+02	7.30312E+02	8.82326E+02	1.03434E+03	9.95419E+02	9.95306E+02
1.70000E+01	7.30262E+02	7.30312E+02	8.82299E+02	1.03429E+03	9.95326E+02	9.95308E+02
1.80000E+01	7.30153E+02	7.30304E+02	8.82298E+02	1.03429E+03	9.95240E+02	9.95308E+02
1.90000E+01	7.30041E+02	7.30290E+02	8.82317E+02	1.03434E+03	9.95161E+02	9.95304E+02
2.00000E+01	7.29954E+02	7.30270E+02	8.82304E+02	1.03434E+03	9.95086E+02	9.95297E+02
2.10000E+01	7.29897E+02	7.30246E+02	8.82282E+02	1.03432E+03	9.95017E+02	9.95289E+02
2.20000E+01	7.29859E+02	7.30220E+02	8.82307E+02	1.03439E+03	9.94953E+02	9.95278E+02
2.30000E+01	7.29829E+02	7.30194E+02	8.82348E+02	1.03450E+03	9.94893E+02	9.95266E+02
2.40000E+01	7.29802E+02	7.30168E+02	8.82319E+02	1.03447E+03	9.94837E+02	9.95252E+02
2.50000E+01	7.29778E+02	7.30142E+02	8.82320E+02	1.03450E+03	9.94785E+02	9.95237E+02
2.60000E+01	7.29757E+02	7.30116E+02	8.82327E+02	1.03454E+03	9.94736E+02	9.95220E+02
2.70000E+01	7.29740E+02	7.30091E+02	8.82327E+02	1.03456E+03	9.94691E+02	9.95203E+02
2.80000E+01	7.29728E+02	7.30066E+02	8.82341E+02	1.03462E+03	9.94650E+02	9.95184E+02
2.90000E+01	7.29730E+02	7.30043E+02	8.82340E+02	1.03464E+03	9.94611E+02	9.95165E+02
3.00000E+01	7.29772E+02	7.30022E+02	8.82348E+02	1.03467E+03	9.94575E+02	9.95145E+02
3.10000E+01	7.29858E+02	7.30008E+02	8.82365E+02	1.03472E+03	9.94542E+02	9.95125E+02
3.20000E+01	7.29979E+02	7.30002E+02	8.82378E+02	1.03475E+03	9.94513E+02	9.95104E+02
3.30000E+01	7.30123E+02	7.30005E+02	8.82413E+02	1.03482E+03	9.94487E+02	9.95083E+02
3.40000E+01	7.30281E+02	7.30019E+02	8.82459E+02	1.03490E+03	9.94467E+02	9.95062E+02
3.50000E+01	7.30442E+02	7.30042E+02	8.82522E+02	1.03500E+03	9.94451E+02	9.95041E+02
3.60000E+01	7.30598E+02	7.30075E+02	8.82599E+02	1.03512E+03	9.94441E+02	9.95020E+02
3.70000E+01	7.30740E+02	7.30116E+02	8.82691E+02	1.03527E+03	9.94438E+02	9.95000E+02
3.80000E+01	7.30865E+02	7.30163E+02	8.82792E+02	1.03542E+03	9.94440E+02	9.94981E+02
3.90000E+01	7.30970E+02	7.30215E+02	8.82905E+02	1.03559E+03	9.94449E+02	9.94962E+02
4.00000E+01	7.31055E+02	7.30270E+02	8.83029E+02	1.03579E+03	9.94464E+02	9.94945E+02
4.10000E+01	7.31120E+02	7.30326E+02	8.83150E+02	1.03597E+03	9.94487E+02	9.94928E+02
4.20000E+01	7.31166E+02	7.30383E+02	8.83279E+02	1.03618E+03	9.94516E+02	9.94914E+02
4.30000E+01	7.31195E+02	7.30437E+02	8.83410E+02	1.03638E+03	9.94553E+02	9.94901E+02
4.40000E+01	7.31210E+02	7.30490E+02	8.83541E+02	1.03659E+03	9.94596E+02	9.94889E+02
4.50000E+01	7.31212E+02	7.30539E+02	8.83670E+02	1.03680E+03	9.94645E+02	9.94880E+02
4.60000E+01	7.31203E+02	7.30585E+02	8.83797E+02	1.03701E+03	9.94700E+02	9.94873E+02
4.70000E+01	7.31184E+02	7.30627E+02	8.83922E+02	1.03722E+03	9.94761E+02	9.94868E+02
4.80000E+01	7.31155E+02	7.30664E+02	8.84042E+02	1.03742E+03	9.94826E+02	9.94865E+02
4.90000E+01	7.31118E+02	7.30696E+02	8.84105E+02	1.03751E+03	9.94897E+02	9.94865E+02
5.00000E+01	7.31071E+02	7.30724E+02	8.84267E+02	1.03781E+03	9.94972E+02	9.94868E+02

REACTOR

LIST, ENPP, ETAPP, HOPP, ENIP, ETAIP, HOIP

TIME	ENPP	ETAPP	HOPP	ENIP	ETAIP	HOIP
0.	1.17000E+03	7.92719E-01	4.52315E+02	1.00600E+03	8.02666E-01	3.31999E+02
1.00000E+00	1.20261E+03	7.93034E-01	4.77581E+02	1.03387E+03	8.03510E-01	3.58275E+02
2.00000E+00	1.20394E+03	7.92752E-01	4.78095E+02	1.03583E+03	8.02880E-01	3.57874E+02
3.00000E+00	1.20048E+03	7.92753E-01	4.74779E+02	1.03084E+03	8.02274E-01	3.53354E+02
4.00000E+00	1.19769E+03	7.92776E-01	4.72497E+02	1.02630E+03	8.02047E-01	3.48577E+02
5.00000E+00	1.18546E+03	7.92783E-01	4.70736E+02	1.02403E+03	8.02104E-01	3.46460E+02
6.00000E+00	1.19346E+03	7.92785E-01	4.69174E+02	1.02281E+03	8.02198E-01	3.45508E+02
7.00000E+00	1.19145E+03	7.92783E-01	4.67614E+02	1.02174E+03	8.02258E-01	3.44637E+02
8.00000E+00	1.18928E+03	7.92777E-01	4.65947E+02	1.02047E+03	8.02288E-01	3.43505E+02
9.00000E+00	1.18680E+03	7.92768E-01	4.64068E+02	1.01890E+03	8.02304E-01	3.42081E+02
1.00000E+01	1.18396E+03	7.92756E-01	4.61947E+02	1.01706E+03	8.02319E-01	3.40420E+02
1.10000E+01	1.18080E+03	7.92741E-01	4.59640E+02	1.01497E+03	8.02337E-01	3.38582E+02
1.20000E+01	1.17831E+03	7.92744E-01	4.57923E+02	1.01345E+03	8.02396E-01	3.37405E+02
1.30000E+01	1.17712E+03	7.92749E-01	4.57130E+02	1.01297E+03	8.02475E-01	3.37232E+02
1.40000E+01	1.17639E+03	7.92749E-01	4.56630E+02	1.01276E+03	8.02520E-01	3.37193E+02
1.50000E+01	1.17581E+03	7.92747E-01	4.56232E+02	1.01253E+03	8.02540E-01	3.37057E+02
1.60000E+01	1.17526E+03	7.92744E-01	4.55852E+02	1.01221E+03	8.02547E-01	3.36802E+02
1.70000E+01	1.17473E+03	7.92741E-01	4.55489E+02	1.01184E+03	8.02551E-01	3.36496E+02
1.80000E+01	1.17420E+03	7.92738E-01	4.55123E+02	1.01143E+03	8.02554E-01	3.36153E+02
1.90000E+01	1.17368E+03	7.92735E-01	4.54767E+02	1.01101E+03	8.02558E-01	3.35801E+02
2.00000E+01	1.17318E+03	7.92732E-01	4.54429E+02	1.01058E+03	8.02564E-01	3.35454E+02
2.10000E+01	1.17272E+03	7.92729E-01	4.54113E+02	1.01016E+03	8.02570E-01	3.35116E+02
2.20000E+01	1.17228E+03	7.92727E-01	4.53815E+02	1.00974E+03	8.02576E-01	3.34785E+02
2.30000E+01	1.17186E+03	7.92724E-01	4.53533E+02	1.00933E+03	8.02583E-01	3.34461E+02
2.40000E+01	1.17146E+03	7.92722E-01	4.53264E+02	1.00893E+03	8.02589E-01	3.34143E+02
2.50000E+01	1.17108E+03	7.92719E-01	4.53007E+02	1.00853E+03	8.02595E-01	3.33830E+02
2.60000E+01	1.17071E+03	7.92717E-01	4.52764E+02	1.00814E+03	8.02601E-01	3.33523E+02
2.70000E+01	1.17036E+03	7.92715E-01	4.52532E+02	1.00775E+03	8.02607E-01	3.33223E+02
2.80000E+01	1.17003E+03	7.92713E-01	4.52313E+02	1.00737E+03	8.02612E-01	3.32930E+02
2.90000E+01	1.16973E+03	7.92712E-01	4.52088E+02	1.00700E+03	8.02618E-01	3.32643E+02
3.00000E+01	1.16945E+03	7.92712E-01	4.51882E+02	1.00664E+03	8.02623E-01	3.32362E+02
3.10000E+01	1.16918E+03	7.92712E-01	4.51679E+02	1.00628E+03	8.02628E-01	3.32086E+02
3.20000E+01	1.16892E+03	7.92712E-01	4.51481E+02	1.00593E+03	8.02633E-01	3.31855E+02
3.30000E+01	1.16866E+03	7.92711E-01	4.51282E+02	1.00555E+03	8.02630E-01	3.31699E+02
3.40000E+01	1.16837E+03	7.92711E-01	4.51065E+02	1.00511E+03	8.02622E-01	3.31497E+02
3.50000E+01	1.16806E+03	7.92710E-01	4.50832E+02	1.00465E+03	8.02612E-01	3.31286E+02
3.60000E+01	1.16770E+03	7.92709E-01	4.50551E+02	1.00417E+03	8.02602E-01	3.31061E+02
3.70000E+01	1.16733E+03	7.92709E-01	4.50271E+02	1.00374E+03	8.02594E-01	3.30866E+02
3.80000E+01	1.16690E+03	7.92708E-01	4.49935E+02	1.00330E+03	8.02586E-01	3.30664E+02
3.90000E+01	1.16643E+03	7.92707E-01	4.49576E+02	1.00289E+03	8.02579E-01	3.30474E+02
4.00000E+01	1.16593E+03	7.92707E-01	4.49191E+02	1.00250E+03	8.02572E-01	3.30294E+02
4.10000E+01	1.16542E+03	7.92707E-01	4.48794E+02	1.00214E+03	8.02566E-01	3.30132E+02
4.20000E+01	1.16490E+03	7.92707E-01	4.48385E+02	1.00182E+03	8.02562E-01	3.29984E+02
4.30000E+01	1.16436E+03	7.92707E-01	4.47966E+02	1.00152E+03	8.02558E-01	3.29848E+02
4.40000E+01	1.16381E+03	7.92708E-01	4.47530E+02	1.00124E+03	8.02554E-01	3.29719E+02
4.50000E+01	1.16325E+03	7.92708E-01	4.47084E+02	1.00097E+03	8.02550E-01	3.29596E+02
4.60000E+01	1.16268E+03	7.92709E-01	4.46637E+02	1.00072E+03	8.02546E-01	3.29481E+02
4.70000E+01	1.16212E+03	7.92710E-01	4.46188E+02	1.00050E+03	8.02543E-01	3.29376E+02
4.80000E+01	1.16156E+03	7.92712E-01	4.45743E+02	1.00029E+03	8.02540E-01	3.29281E+02
4.90000E+01	1.16101E+03	7.92713E-01	4.45295E+02	1.00010E+03	8.02538E-01	3.29192E+02
5.00000E+01	1.16046E+03	7.92714E-01	4.44854E+02	9.99922E+02	8.02536E-01	3.29113E+02

DELAYS

LIST,TAUTS9,TAUHS9,TAUHS4,TAUHS1,TAUT17,TAUTIA

TIME	TAUTS9	TAUHS9	TAUHS4	TAUHS1	TAUT17	TAUTIA
0.	3.00987E+00	1.55935E+00	1.50898E+00	2.25263E+01	5.80901E+00	3.45239E+01
1.00000E+00	3.00975E+00	1.55935E+00	1.50816E+00	2.25286E+01	5.73098E+00	3.40617E+01
2.00000E+00	3.00915E+00	1.55934E+00	1.50501E+00	2.25413E+01	5.65995E+00	3.36442E+01
3.00000E+00	3.00839E+00	1.55935E+00	1.50087E+00	2.25568E+01	5.63729E+00	3.35140E+01
4.00000E+00	3.00794E+00	1.55953E+00	1.49773E+00	2.25637E+01	5.64493E+00	3.35623E+01
5.00000E+00	3.00817E+00	1.56002E+00	1.49676E+00	2.25577E+01	5.66182E+00	3.36640E+01
6.00000E+00	3.00919E+00	1.56085E+00	1.49796E+00	2.25427E+01	5.67587E+00	3.37477E+01
7.00000E+00	3.01084E+00	1.56193E+00	1.50034E+00	2.25260E+01	5.68656E+00	3.38111E+01
8.00000E+00	3.01280E+00	1.56307E+00	1.50258E+00	2.25141E+01	5.69614E+00	3.38677E+01
9.00000E+00	3.01479E+00	1.56416E+00	1.50443E+00	2.25064E+01	5.70634E+00	3.39278E+01
1.00000E+01	3.01669E+00	1.56513E+00	1.50608E+00	2.25000E+01	5.71796E+00	3.39962E+01
1.10000E+01	3.01845E+00	1.56599E+00	1.50778E+00	2.24936E+01	5.73117E+00	3.40738E+01
1.20000E+01	3.02007E+00	1.56673E+00	1.50962E+00	2.24868E+01	5.74468E+00	3.41529E+01
1.30000E+01	3.02154E+00	1.56737E+00	1.51147E+00	2.24805E+01	5.75384E+00	3.42062E+01
1.40000E+01	3.02281E+00	1.56789E+00	1.51312E+00	2.24755E+01	5.75888E+00	3.42352E+01
1.50000E+01	3.02385E+00	1.56829E+00	1.51446E+00	2.24722E+01	5.76189E+00	3.42523E+01
1.60000E+01	3.02464E+00	1.56856E+00	1.51546E+00	2.24704E+01	5.76431E+00	3.42661E+01
1.70000E+01	3.02521E+00	1.56872E+00	1.51622E+00	2.24693E+01	5.76675E+00	3.42800E+01
1.80000E+01	3.02559E+00	1.56880E+00	1.51682E+00	2.24686E+01	5.76938E+00	3.42950E+01
1.90000E+01	3.02584E+00	1.56881E+00	1.51734E+00	2.24680E+01	5.77220E+00	3.43112E+01
2.00000E+01	3.02596E+00	1.56877E+00	1.51777E+00	2.24675E+01	5.77512E+00	3.43279E+01
2.10000E+01	3.02599E+00	1.56867E+00	1.51811E+00	2.24672E+01	5.77806E+00	3.43447E+01
2.20000E+01	3.02594E+00	1.56855E+00	1.51836E+00	2.24672E+01	5.78097E+00	3.43614E+01
2.30000E+01	3.02581E+00	1.56838E+00	1.51853E+00	2.24675E+01	5.78384E+00	3.43780E+01
2.40000E+01	3.02562E+00	1.56819E+00	1.51863E+00	2.24679E+01	5.78666E+00	3.43943E+01
2.50000E+01	3.02538E+00	1.56798E+00	1.51866E+00	2.24684E+01	5.78943E+00	3.44104E+01
2.60000E+01	3.02510E+00	1.56775E+00	1.51865E+00	2.24690E+01	5.79215E+00	3.44261E+01
2.70000E+01	3.02479E+00	1.56750E+00	1.51862E+00	2.24696E+01	5.79482E+00	3.44415E+01
2.80000E+01	3.02445E+00	1.56725E+00	1.51858E+00	2.24701E+01	5.79744E+00	3.44564E+01
2.90000E+01	3.02409E+00	1.56698E+00	1.51855E+00	2.24706E+01	5.80000E+00	3.44710E+01
3.00000E+01	3.02371E+00	1.56672E+00	1.51852E+00	2.24711E+01	5.80251E+00	3.44852E+01
3.10000E+01	3.02331E+00	1.56644E+00	1.51844E+00	2.24719E+01	5.80496E+00	3.44991E+01
3.20000E+01	3.02296E+00	1.56616E+00	1.51831E+00	2.24729E+01	5.80734E+00	3.45125E+01
3.30000E+01	3.02246E+00	1.56587E+00	1.51813E+00	2.24743E+01	5.80928E+00	3.45234E+01
3.40000E+01	3.02202E+00	1.56557E+00	1.51788E+00	2.24758E+01	5.81105E+00	3.45333E+01
3.50000E+01	3.02162E+00	1.56528E+00	1.51759E+00	2.24775E+01	5.81282E+00	3.45433E+01
3.60000E+01	3.02163E+00	1.56499E+00	1.51728E+00	2.24793E+01	5.81467E+00	3.45538E+01
3.70000E+01	3.02208E+00	1.56471E+00	1.51696E+00	2.24809E+01	5.81653E+00	3.45641E+01
3.80000E+01	3.02259E+00	1.56444E+00	1.51666E+00	2.24826E+01	5.81843E+00	3.45744E+01
3.90000E+01	3.02289E+00	1.56418E+00	1.51636E+00	2.24841E+01	5.82032E+00	3.45844E+01
4.00000E+01	3.02289E+00	1.56392E+00	1.51609E+00	2.24857E+01	5.82215E+00	3.45942E+01
4.10000E+01	3.02266E+00	1.56365E+00	1.51581E+00	2.24873E+01	5.82384E+00	3.46034E+01
4.20000E+01	3.02231E+00	1.56338E+00	1.51555E+00	2.24890E+01	5.82541E+00	3.46120E+01
4.30000E+01	3.02193E+00	1.56313E+00	1.51544E+00	2.24901E+01	5.82683E+00	3.46201E+01
4.40000E+01	3.02152E+00	1.56291E+00	1.51560E+00	2.24906E+01	5.82812E+00	3.46275E+01
4.50000E+01	3.02108E+00	1.56269E+00	1.51595E+00	2.24907E+01	5.82932E+00	3.46346E+01
4.60000E+01	3.02059E+00	1.56247E+00	1.51634E+00	2.24913E+01	5.83044E+00	3.46413E+01
4.70000E+01	3.02001E+00	1.56222E+00	1.51660E+00	2.24928E+01	5.83147E+00	3.46476E+01
4.80000E+01	3.01935E+00	1.56194E+00	1.51666E+00	2.24953E+01	5.83241E+00	3.46534E+01
4.90000E+01	3.01865E+00	1.56163E+00	1.51651E+00	2.24983E+01	5.83326E+00	3.46588E+01
5.00000E+01	3.01793E+00	1.56129E+00	1.51621E+00	2.25015E+01	5.83402E+00	3.46638E+01

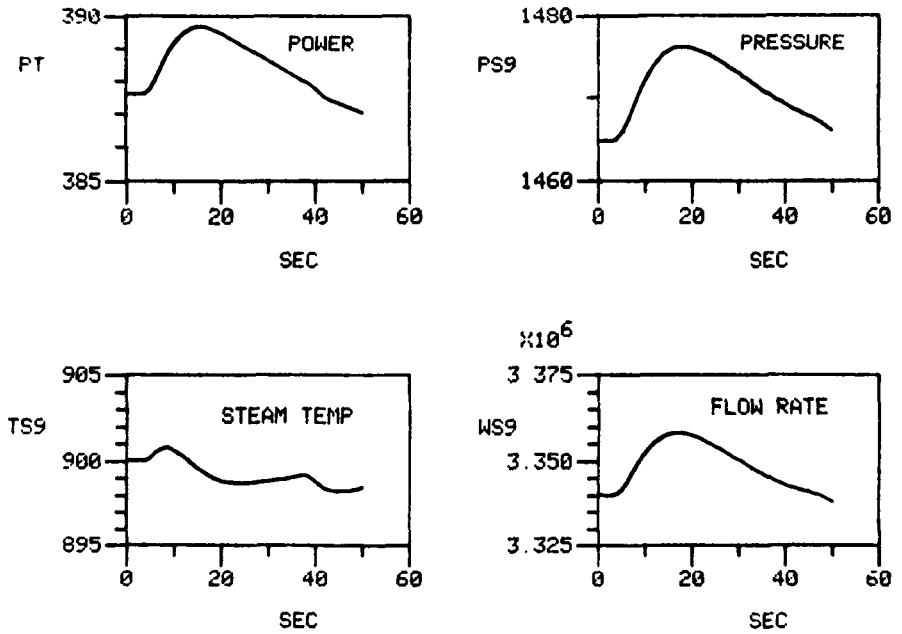
TIME	TAUTI1	TAUPP5	TAUTR1
0.	2.11632E+01	1.51904E+01	6.99342E+00
1.00000E+00	2.08791E+01	1.48556E+01	6.83897E+00
2.00000E+00	2.06206E+01	1.47700E+01	6.79904E+00
3.00000E+00	2.05382E+01	1.48127E+01	6.81857E+00
4.00000E+00	2.05660E+01	1.48528E+01	6.83717E+00
5.00000E+00	2.06273E+01	1.48823E+01	6.85100E+00
6.00000E+00	2.06780E+01	1.49076E+01	6.86284E+00
7.00000E+00	2.07164E+01	1.49322E+01	6.87434E+00
8.00000E+00	2.07509E+01	1.49581E+01	6.88645E+00
9.00000E+00	2.07876E+01	1.49871E+01	6.89996E+00
1.00000E+01	2.08296E+01	1.50202E+01	6.91535E+00
1.10000E+01	2.08774E+01	1.50568E+01	6.93237E+00
1.20000E+01	2.09262E+01	1.50894E+01	6.94751E+00
1.30000E+01	2.09593E+01	1.51059E+01	6.95521E+00
1.40000E+01	2.09774E+01	1.51152E+01	6.95961E+00
1.50000E+01	2.09881E+01	1.51222E+01	6.96288E+00
1.60000E+01	2.09968E+01	1.51286E+01	6.96585E+00
1.70000E+01	2.10056E+01	1.51346E+01	6.96866E+00
1.80000E+01	2.10151E+01	1.51407E+01	6.97148E+00
1.90000E+01	2.10253E+01	1.51467E+01	6.97425E+00
2.00000E+01	2.10359E+01	1.51524E+01	6.97689E+00
2.10000E+01	2.10466E+01	1.51578E+01	6.97937E+00
2.20000E+01	2.10572E+01	1.51628E+01	6.98169E+00
2.30000E+01	2.10677E+01	1.51676E+01	6.98385E+00
2.40000E+01	2.10780E+01	1.51722E+01	6.98585E+00
2.50000E+01	2.10882E+01	1.51766E+01	6.98771E+00
2.60000E+01	2.10982E+01	1.51808E+01	6.98946E+00
2.70000E+01	2.11081E+01	1.51847E+01	6.99109E+00
2.80000E+01	2.11177E+01	1.51885E+01	6.99264E+00
2.90000E+01	2.11272E+01	1.51923E+01	6.99419E+00
3.00000E+01	2.11365E+01	1.51959E+01	6.99565E+00
3.10000E+01	2.11456E+01	1.51993E+01	6.99708E+00
3.20000E+01	2.11544E+01	1.52027E+01	6.99851E+00
3.30000E+01	2.11617E+01	1.52061E+01	6.99994E+00
3.40000E+01	2.11683E+01	1.52097E+01	7.00149E+00
3.50000E+01	2.11749E+01	1.52135E+01	7.00319E+00
3.60000E+01	2.11818E+01	1.52181E+01	7.00523E+00
3.70000E+01	2.11886E+01	1.52227E+01	7.00732E+00
3.80000E+01	2.11952E+01	1.52283E+01	7.00984E+00
3.90000E+01	2.12017E+01	1.52342E+01	7.01256E+00
4.00000E+01	2.12079E+01	1.52406E+01	7.01551E+00
4.10000E+01	2.12138E+01	1.52472E+01	7.01858E+00
4.20000E+01	2.12193E+01	1.52541E+01	7.02179E+00
4.30000E+01	2.12244E+01	1.52613E+01	7.02509E+00
4.40000E+01	2.12290E+01	1.52685E+01	7.02850E+00
4.50000E+01	2.12334E+01	1.52761E+01	7.03202E+00
4.60000E+01	2.12376E+01	1.52837E+01	7.03562E+00
4.70000E+01	2.12415E+01	1.52914E+01	7.03922E+00
4.80000E+01	2.12451E+01	1.52990E+01	7.04282E+00
4.90000E+01	2.12484E+01	1.53067E+01	7.04644E+00
5.00000E+01	2.12515E+01	1.53142E+01	7.05003E+00

MAX. TEMPS. IN THE AVG. AND HOT CHANNELS AND THEIR AXIAL LOCATIONS
 LIST,TPMAX,TPMM,YCMAX,TCMAX,YCMM,TCMM

TIME	TPMAX	TPMM	YCMAX	TCMAX	YCMM	TCMM
0.	1.03573E+03	1.33303E+03	1.50000E+00	1.04583E+03	1.50000E+00	1.35646E+03
1.00000E+00	1.05222E+03	1.35580E+03	1.50000E+00	1.06303E+03	1.50000E+00	1.38086E+03
2.00000E+00	1.04413E+03	1.34463E+03	1.50000E+00	1.05470E+03	1.50000E+00	1.36915E+03
3.00000E+00	1.04164E+03	1.34120E+03	1.50000E+00	1.05211E+03	1.50000E+00	1.36548E+03
4.00000E+00	1.04028E+03	1.33932E+03	1.50000E+00	1.05069E+03	1.50000E+00	1.36345E+03
5.00000E+00	1.03911E+03	1.33770E+03	1.50000E+00	1.04947E+03	1.50000E+00	1.36171E+03
6.00000E+00	1.03797E+03	1.33613E+03	1.50000E+00	1.04828E+03	1.50000E+00	1.36002E+03
7.00000E+00	1.03683E+03	1.33455E+03	1.50000E+00	1.04708E+03	1.50000E+00	1.35833E+03
8.00000E+00	1.03570E+03	1.33299E+03	1.50000E+00	1.04590E+03	1.50000E+00	1.35665E+03
9.00000E+00	1.03461E+03	1.33149E+03	1.50000E+00	1.04477E+03	1.50000E+00	1.35503E+03
1.00000E+01	1.03360E+03	1.33007E+03	1.50000E+00	1.04370E+03	1.50000E+00	1.35350E+03
1.10000E+01	1.03262E+03	1.32872E+03	1.50000E+00	1.04267E+03	1.50000E+00	1.35203E+03
1.20000E+01	1.03310E+03	1.32937E+03	1.50000E+00	1.04315E+03	1.50000E+00	1.35268E+03
1.30000E+01	1.03348E+03	1.32990E+03	1.50000E+00	1.04354E+03	1.50000E+00	1.35322E+03
1.40000E+01	1.03371E+03	1.33022E+03	1.50000E+00	1.04377E+03	1.50000E+00	1.35354E+03
1.50000E+01	1.03383E+03	1.33037E+03	1.50000E+00	1.04389E+03	1.50000E+00	1.35370E+03
1.60000E+01	1.03397E+03	1.33057E+03	1.50000E+00	1.04403E+03	1.50000E+00	1.35390E+03
1.70000E+01	1.03406E+03	1.33069E+03	1.50000E+00	1.04412E+03	1.50000E+00	1.35402E+03
1.80000E+01	1.03413E+03	1.33078E+03	1.50000E+00	1.04419E+03	1.50000E+00	1.35411E+03
1.90000E+01	1.03419E+03	1.33087E+03	1.50000E+00	1.04425E+03	1.50000E+00	1.35420E+03
2.00000E+01	1.03424E+03	1.33095E+03	1.50000E+00	1.04430E+03	1.50000E+00	1.35428E+03
2.10000E+01	1.03429E+03	1.33102E+03	1.50000E+00	1.04435E+03	1.50000E+00	1.35435E+03
2.20000E+01	1.03434E+03	1.33108E+03	1.50000E+00	1.04440E+03	1.50000E+00	1.35441E+03
2.30000E+01	1.03438E+03	1.33115E+03	1.50000E+00	1.04444E+03	1.50000E+00	1.35448E+03
2.40000E+01	1.03442E+03	1.33121E+03	1.50000E+00	1.04448E+03	1.50000E+00	1.35454E+03
2.50000E+01	1.03446E+03	1.33127E+03	1.50000E+00	1.04453E+03	1.50000E+00	1.35460E+03
2.60000E+01	1.03450E+03	1.33133E+03	1.50000E+00	1.04456E+03	1.50000E+00	1.35466E+03
2.70000E+01	1.03454E+03	1.33138E+03	1.50000E+00	1.04460E+03	1.50000E+00	1.35472E+03
2.80000E+01	1.03458E+03	1.33144E+03	1.50000E+00	1.04464E+03	1.50000E+00	1.35477E+03
2.90000E+01	1.03462E+03	1.33149E+03	1.50000E+00	1.04468E+03	1.50000E+00	1.35483E+03
3.00000E+01	1.03465E+03	1.33155E+03	1.50000E+00	1.04472E+03	1.50000E+00	1.35488E+03
3.10000E+01	1.03469E+03	1.33160E+03	1.50000E+00	1.04475E+03	1.50000E+00	1.35494E+03
3.20000E+01	1.03476E+03	1.33170E+03	1.50000E+00	1.04483E+03	1.50000E+00	1.35504E+03
3.30000E+01	1.03485E+03	1.33182E+03	1.50000E+00	1.04491E+03	1.50000E+00	1.35516E+03
3.40000E+01	1.03498E+03	1.33200E+03	1.50000E+00	1.04505E+03	1.50000E+00	1.35535E+03
3.50000E+01	1.03507E+03	1.33212E+03	1.50000E+00	1.04514E+03	1.50000E+00	1.35546E+03
3.60000E+01	1.03519E+03	1.33229E+03	1.50000E+00	1.04526E+03	1.50000E+00	1.35564E+03
3.70000E+01	1.03534E+03	1.33248E+03	1.50000E+00	1.04541E+03	1.50000E+00	1.35583E+03
3.80000E+01	1.03552E+03	1.33272E+03	1.50000E+00	1.04559E+03	1.50000E+00	1.35608E+03
3.90000E+01	1.03568E+03	1.33294E+03	1.50000E+00	1.04576E+03	1.50000E+00	1.35630E+03
4.00000E+01	1.03587E+03	1.33320E+03	1.50000E+00	1.04595E+03	1.50000E+00	1.35656E+03
4.10000E+01	1.03607E+03	1.33347E+03	1.50000E+00	1.04615E+03	1.50000E+00	1.35684E+03
4.20000E+01	1.03629E+03	1.33376E+03	1.50000E+00	1.04637E+03	1.50000E+00	1.35713E+03
4.30000E+01	1.03651E+03	1.33405E+03	1.50000E+00	1.04659E+03	1.50000E+00	1.35743E+03
4.40000E+01	1.03669E+03	1.33430E+03	1.50000E+00	1.04678E+03	1.50000E+00	1.35768E+03
4.50000E+01	1.03690E+03	1.33458E+03	1.50000E+00	1.04699E+03	1.50000E+00	1.35797E+03
4.60000E+01	1.03713E+03	1.33489E+03	1.50000E+00	1.04722E+03	1.50000E+00	1.35828E+03
4.70000E+01	1.03733E+03	1.33515E+03	1.50000E+00	1.04741E+03	1.50000E+00	1.35855E+03
4.80000E+01	1.03752E+03	1.33542E+03	1.50000E+00	1.04761E+03	1.50000E+00	1.35882E+03
4.90000E+01	1.03772E+03	1.33569E+03	1.50000E+00	1.04781E+03	1.50000E+00	1.35909E+03
5.00000E+01	1.03790E+03	1.33594E+03	1.50000E+00	1.04800E+03	1.50000E+00	1.35935E+03

MAX. TEMPS. IN THE AVG. AND HOT CHANNELS AND THEIR AXIAL LOCATIONS
 LIST, TSMAX, YSMH, TSMH, YFMAX, TFMAX, YFHM, TFHM

TIME	TSMAX	YSMH	TSMH	YFMAX	TFMAX	YFHM	TFHM
0.	1.67889E+03	2.95874E-01	2.41288E+03	1.16110E-01	3.25303E+03	1.18404E-01	4.33030E+03
1.00000E+00	1.73998E+03	2.92356E-01	2.510C8E+03	1.12965E-01	3.45859E+03	1.15376E-01	4.60334E+03
2.00000E+00	1.72042E+03	2.90262E-01	2.47946E+03	1.11973E-01	3.41215E+03	1.14381E-01	4.53994E+03
3.00000E+00	1.71092E+03	2.90866E-01	2.46431E+03	1.12244E-01	3.38490E+03	1.14655E-01	4.50319E+03
4.00000E+00	1.70507E+03	2.91428E-01	2.45497E+03	1.12593E-01	3.36559E+03	1.14997E-01	4.47747E+03
5.00000E+00	1.70051E+03	2.91753E-01	2.44770E+03	1.12895E-01	3.34908E+03	1.15287E-01	4.45566E+03
6.00000E+00	1.69632E+03	2.91976E-01	2.44104E+03	1.13177E-01	3.33330E+03	1.15556E-01	4.43489E+03
7.00000E+00	1.69220E+03	2.92173E-01	2.43449E+03	1.13462E-01	3.31753E+03	1.15825E-01	4.41416E+03
8.00000E+00	1.68804E+03	2.92388E-01	2.42787E+03	1.13762E-01	3.30151E+03	1.16109E-01	4.39311E+03
9.00000E+00	1.68381E+03	2.92661E-01	2.42112E+03	1.14091E-01	3.28511E+03	1.16422E-01	4.37154E+03
1.00000E+01	1.67954E+03	2.93013E-01	2.41429E+03	1.14457E-01	3.26844E+03	1.16771E-01	4.34962E+03
1.10000E+01	1.67525E+03	2.93430E-01	2.40742E+03	1.14853E-01	3.25163E+03	1.17152E-01	4.32753E+03
1.20000E+01	1.67530E+03	2.93937E-01	2.40741E+03	1.15218E-01	3.24776E+03	1.17507E-01	4.32275E+03
1.30000E+01	1.67576E+03	2.94191E-01	2.40810E+03	1.15417E-01	3.24666E+03	1.17700E-01	4.32154E+03
1.40000E+01	1.67607E+03	2.94333E-01	2.40855E+03	1.15533E-01	3.24604E+03	1.17812E-01	4.32087E+03
1.50000E+01	1.67612E+03	2.94440E-01	2.40861E+03	1.15613E-01	3.24526E+03	1.17890E-01	4.31992E+03
1.60000E+01	1.67626E+03	2.94544E-01	2.40882E+03	1.15679E-01	3.24504E+03	1.17954E-01	4.31969E+03
1.70000E+01	1.67624E+03	2.94655E-01	2.40877E+03	1.15737E-01	3.24458E+03	1.18012E-01	4.31911E+03
1.80000E+01	1.67618E+03	2.94765E-01	2.40866E+03	1.15791E-01	3.24409E+03	1.18066E-01	4.31862E+03
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3.00000E+01	1.67576E+03	2.95775E-01	2.40794E+03	1.16243E-01	3.24130E+03	1.18521E-01	4.31488E+03
3.10000E+01	1.67575E+03	2.95838E-01	2.40791E+03	1.16270E-01	3.24118E+03	1.18549E-01	4.31472E+03
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3.40000E+01	1.67605E+03	2.96059E-01	2.40835E+03	1.16351E-01	3.24185E+03	1.18632E-01	4.31562E+03
3.50000E+01	1.67605E+03	2.96142E-01	2.40833E+03	1.16379E-01	3.24181E+03	1.18662E-01	4.31555E+03
3.60000E+01	1.67611E+03	2.96243E-01	2.40839E+03	1.16415E-01	3.24190E+03	1.18698E-01	4.31565E+03
3.70000E+01	1.67619E+03	2.96349E-01	2.40849E+03	1.16450E-01	3.24208E+03	1.18734E-01	4.31587E+03
3.80000E+01	1.67631E+03	2.96476E-01	2.40865E+03	1.16493E-01	3.24233E+03	1.18779E-01	4.31619E+03
3.90000E+01	1.67637E+03	2.96609E-01	2.40871E+03	1.16538E-01	3.24241E+03	1.18827E-01	4.31627E+03
4.00000E+01	1.67647E+03	2.96753E-01	2.40882E+03	1.16588E-01	3.24256E+03	1.18878E-01	4.31645E+03
4.10000E+01	1.67658E+03	2.96905E-01	2.40895E+03	1.16640E-01	3.24277E+03	1.18932E-01	4.31671E+03
4.20000E+01	1.67672E+03	2.97063E-01	2.40914E+03	1.16694E-01	3.24306E+03	1.18987E-01	4.31708E+03
4.30000E+01	1.67686E+03	2.97226E-01	2.40932E+03	1.16748E-01	3.24336E+03	1.19044E-01	4.31745E+03
4.40000E+01	1.67689E+03	2.97388E-01	2.40932E+03	1.16805E-01	3.24335E+03	1.19102E-01	4.31741E+03
4.50000E+01	1.67700E+03	2.97557E-01	2.40945E+03	1.16863E-01	3.24355E+03	1.19163E-01	4.31765E+03
4.60000E+01	1.67716E+03	2.97730E-01	2.40965E+03	1.16922E-01	3.24387E+03	1.19224E-01	4.31806E+03
4.70000E+01	1.67723E+03	2.97899E-01	2.40974E+03	1.16981E-01	3.24399E+03	1.19285E-01	4.31819E+03
4.80000E+01	1.67733E+03	2.98068E-01	2.40985E+03	1.17040E-01	3.24416E+03	1.19346E-01	4.31839E+03
4.90000E+01	1.67738E+03	2.98251E-01	2.40990E+03	1.17101E-01	3.24429E+03	1.19410E-01	4.31853E+03
5.00000E+01	1.67751E+03	2.98403E-01	2.41007E+03	1.17158E-01	3.24449E+03	1.19468E-01	4.31880E+03



SUPERHEATER STEAM

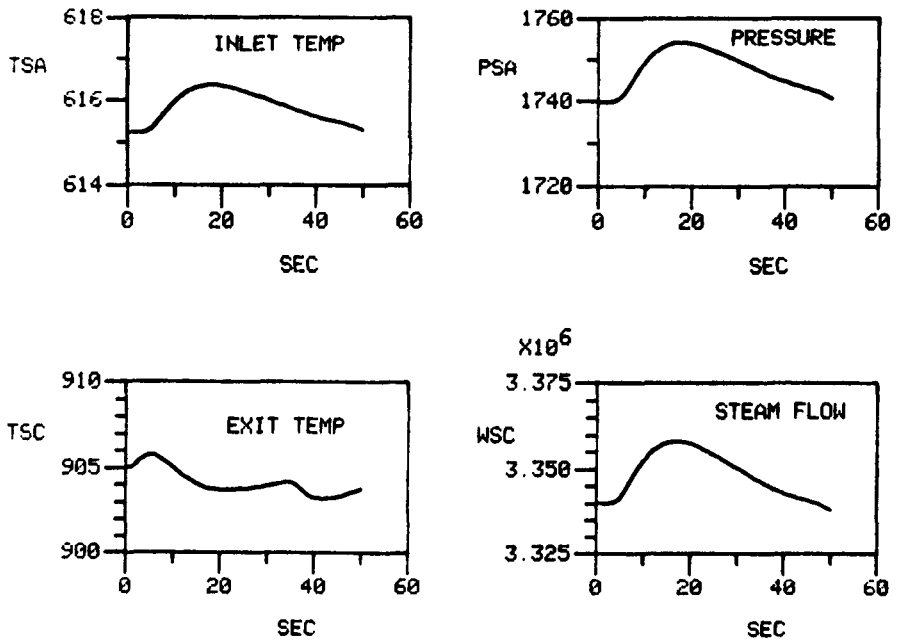
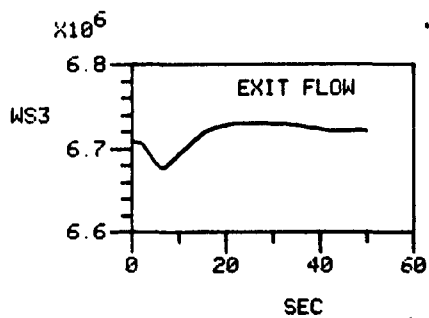
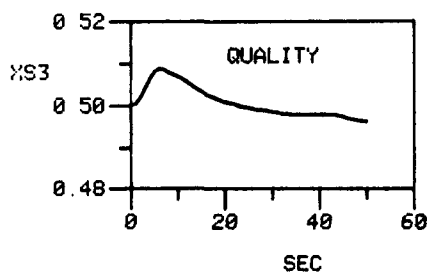
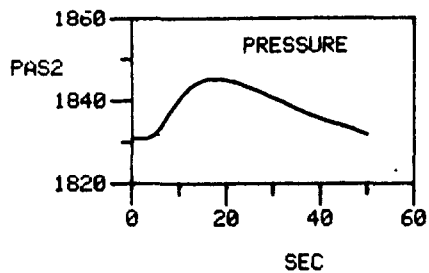
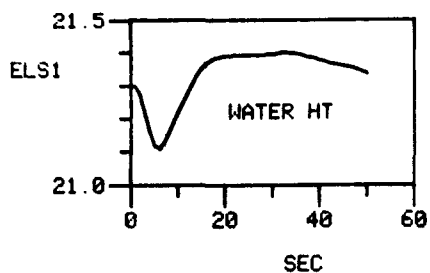


Fig. 2 Response of the CRBRP to a 10-cent Reactivity Step.

EVAPORATOR



STEAM DRUM

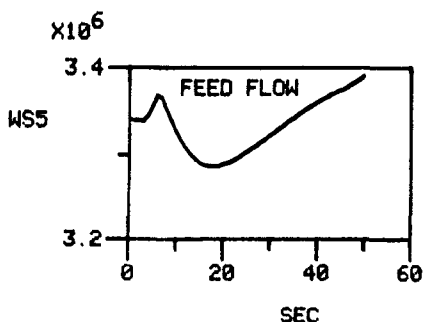
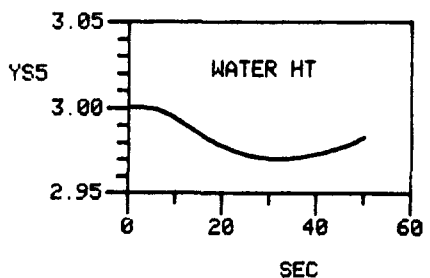
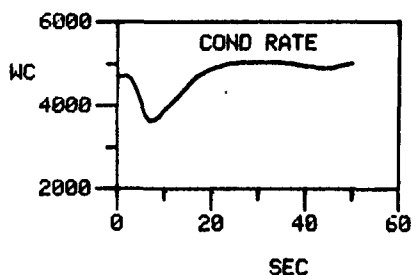
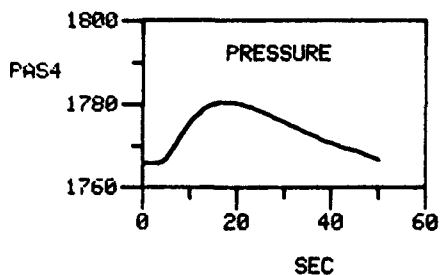


Fig. 3 Response of the CRBRP to a 10-cent Reactivity Step (Cont.).

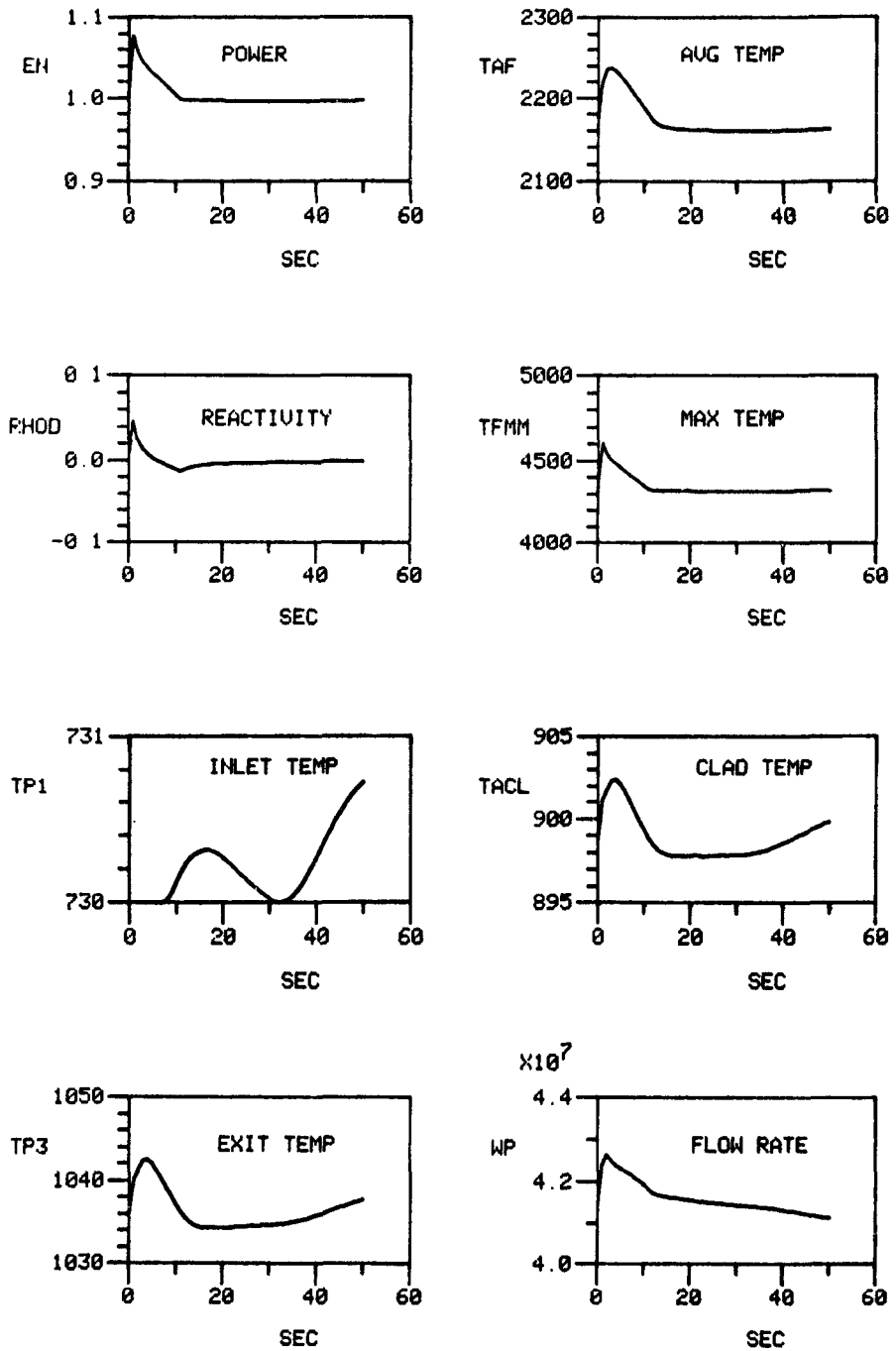
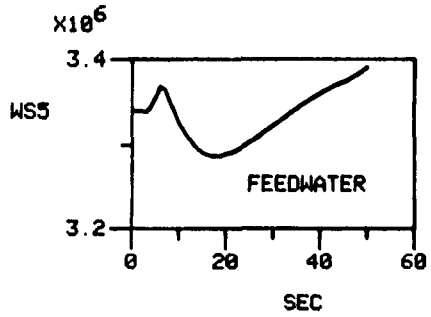
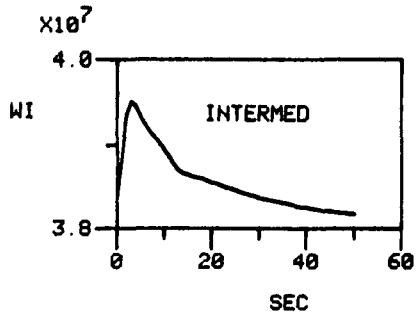
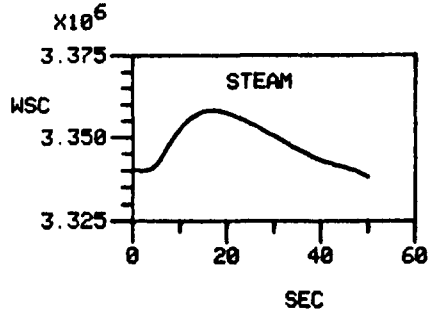
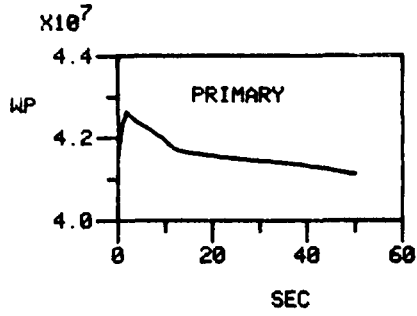


Fig. 4 Response of the CRBRP to a 10-cent Reactivity Step (Cont.).

FLOW RATES



INTERMEDIATE LOOP SODIUM TEMPERATURES

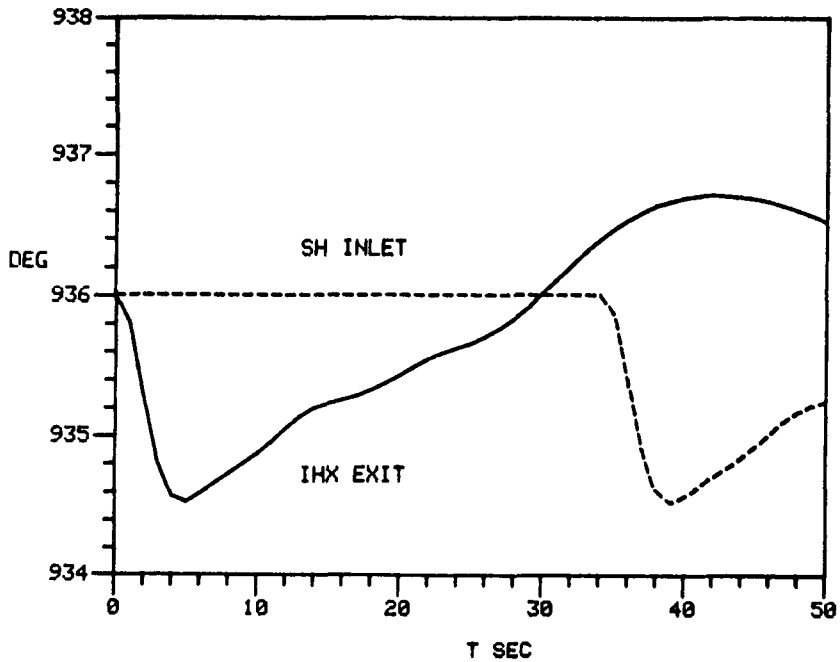


Fig. 5. Response of the CRBRP to a 10-cent Reactivity Step (Cont.).

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APPENDIX A

Glossary of Variable Names Used in BRENDA

The following is an alphabetical list of variable names used in this version of BRENDA. Figure 1 should be consulted for a key to locations in the plant; for example, TSC is the steam temperature at the superheater exit, HS5 is the feedwater enthalpy, etc. Region averages are generally signified by using A as the second letter; for example, TAWA is the average superheater wall temperature, PAS2 is the two-phase pressure in the evaporator, etc.

This glossary was prepared for an uncontrolled version of the plant model, so that many of the variables and parameters in the controller models are not included. The controllers can generally be understood by noting that the names of gains begin with the letter A, error signals with E, and time constants with T. The names of measured values end with the letter M, and the names of demand values end with D. Hence, for example, in the turbine valve controller we have gain factors such as AEPT, equations such as

$$EPS9 = PS9D - PS9M,$$

and time constants such as TSV9. For details, see the dissertation by Shinaishin (1976).

A		GROUPING OF TERMS USED IN CALCULATING DPAS2
A11T		GROUPING OF TERMS USED IN CALCULATING DETERM AND WS3DD
A12T		GROUPING OF TERMS USED IN CALCULATING DETERM AND WS1DD
A21T		GROUPING OF TERMS USED IN CALCULATING DETERM AND WS3DD
A22T		GROUPING OF TERMS USED IN CALCULATING DETERM AND WS1DD
AI	KAMPS	ARMATURE CURRENT
AII P	LBF-FT-SEC**2/RAD**2	INTERMEDIATE PUMP INERTIA
AIPP	LBF-FT-SEC**2/RAD**2	PRIMARY PUMP INERTIA
AKF	BTU/HR-FT-F	FUEL THERMAL CONDUCTIVITY
AKFW	W/CM-C	FUEL THERMAL CONDUCTIVITY
ALF3		VOID FRACTION AT NODE S3
ALFA2		AVERAGE VOID FRACTION IN REGION AS2
AS1	FT**2	EFFECTIVE STEAM CROSS SECTION AT NODE S1
AV9	PSI-SEC/LBM	CONSTANT USED IN CALCULATING PV9
AXECC	CENTS/F	AXIAL EXPANSION COEFFICIENT
B		GROUPING OF TERMS USED IN CALCULATING DLS1
B1T		GROUPING OF TERMS USED IN CALCULATING WS1DD AND WS3DD
E2T		GROUPING OF TERMS USED IN CALCULATING WS1DD AND WS3DD
BD		SUM OF THE PRODUCTS OF THE INDIVIDUAL DELAY GROUP NORMALIZED CONCENTRATIONS MULTIPLIED BY THEIR INDIVIDUAL DELAY GROUP FRACTIONS
BDOB		BD/BETA
BETA		TOTAL FRACTION OF DELAYED NEUTRONS
C		GROUPING OF TERMS USED IN CALCULATING DLS1
CDMP		DUMP FLOW CONSTANT
CHMPH	LBF/FT**2	CHANGE OF MOMENTUM PRESSURE HEAD
CPS	BTU/LBM-F	STEAM SPECIFIC HEAT IN REGION ASA
CS9	LBM/SEC-PSI	CONSTANT USED IN CALCULATING PS9C
CV9	LBM/SEC-PSI**1.5	CONSTANT USED IN CALCULATING PS9SC
D		A FACTOR APPEARING IN DENOMINATOR OF PAS4 DIFFERENTIAL EQUATION
D1-D6		NORMALIZED CONCENTRATION OF ITH DELAY GROUP
D1.-D6.		TIME DERIVATIVES OF D1-D6
DC	\$	DOPPLER CONSTANT
DEMS4	LBM/SEC	TIME DERIVATIVE OF EMS4
DEMS5	LBM/HR	TIME DERIVATIVE OF EMS5
DETERM		DETERMINENT USED IN CALCULATING WS1DD AND WS3DD
DHF	BTU/LBM-PSI	FUNCTION SUBROUTINE WHICH CALCULATES THE DERIVATIVE OF THE SATURATED WATER ENTHALPY WITH RESPECT TO PRESSURE IN THE EVAPORATER
DHFP2	BTU/LBM-PSI	DERIVATIVE OF SATURATED WATER ENTHALPY WITH RESPECT TO PAS2 AT NODE S2
DHG	BTU/LBM-PSI	FUNCTION SUBROUTINE WHICH CALCULATES THE DERIVATIVE OF THE SATURATED STEAM ENTHALPY WITH RESPECT TO PRESSURE IN THE EVAPORATER
DHGP2	BTU/LBM-PSI	DERIVATIVE OF SATURATED STEAM ENTHALPY WITH RESPECT TO PAS2 AT NODE S2

DHS1	BTU/LBM-HR	TIME DERIVATIVE OF ENTHALPY AT NODE S1
DHS6	BTU/LBM-HR	TIME DERIVATIVE OF ENTHALPY AT NODE S6
DLS1	FT/HR	TIME DERIVATIVE OF LENGTH OF REGION AS1
DLTDMP	%, %/SEC	FORCED CHANGE IN SVDMP
DLTHS1	%, %/SEC	FORCED CHANGE IN HS1
DLTHS4	%, %/SEC	FORCED CHANGE IN HS4
DLTHS5	%, %/SEC	FORCED CHANGE IN HS5
DLTI1	F, F/SEC	FORCED DELTA TEMP IN TI1
DLTTI7	F, F/SEC	DELTA TEMP CHANGE IN TI7
DLTLD	%, %/SEC	FORCED CHANGE IN TURBOGENERATOR LOAD DEMAND
DLTPSA	%, %/SEC	FORCED CHANGE IN PSA
DLTROC	%, %/SEC	FORCED CHANGE IN ROEXCD
DLTTIA	F, F/SEC	FORCED DELTA TEMP IN TIA
DLTTP5	F, F/SEC	FORCED DELTA TEMP IN TP5
DLTTR1	F, F/SEC	FORCED DELTA TEMP IN TR1
DLTV5	%, %/SEC	FORCED CHANGE IN SV5
DLTWI	%, %/SEC	FORCED CHANGE IN WI
DLTWP	%, %/SEC	FORCED CHANGE IN WP
DLTWSA	%, %/SEC	FORCED CHANGE IN WSA
DLTWS1	%, %/SEC	FORCED CHANGE IN WS1
DLTWS4	%, %/SEC	FORCED CHANGE IN WS4
DLTWS5	%, %/SEC	FORCED CHANGE IN WS5
DOD	FT	DRUM OUTER DIAMETER
DPAS2	PSI/HR	TIME DERIVATIVE OF PAS2
DPAS4	PSI/HR	TIME DERIVATIVE OF PAS4
DPRC	PSI	RECIRCULATING PUMP HEAD
DPRCSF	PSI	RECIRCULATION PUMP SHUT OFF HEAD
DPV5	PSI	PRESSURE DROP THRU SV5
DRFP2	LBM/FT**3-PSI	DERIVATIVE OF SATURATED WATER DENSITY WITH RESPECT TO PAS2 AT NODE S2
DRGP2	LBM/FT**3-PSI	DERIVATIVE OF SATURATED STEAM DENSITY WITH RESPECT TO PAS2 AT NODE S2
DRHFP2	BTU/FT**3-PSI	DERIVATIVE OF PRODUCT OF SATURATED WATER DENSITY AND ENTHALPY AT NODE S2 WITH RESPECT TO PAS4
DRHG2	BTU/FT**3-PSI	DERIVATIVE OF PRODUCT OF SATURATED STEAM DENSITY AND ENTHALPY AT NODE S2 WITH RESPECT TO PAS4
DSVDMP		EQUAL TO DLTDMP
DTAW1	F/HR	TIME DERIVATIVE OF TAW1
DTAW2	F/HR	TIME DERIVATIVE OF TAW2
DTAWA	F/SEC	TIME DERIVATIVE OF TAWA
DTI8	F/HR	TIME DERIVATIVE OF TI8
DTI9	F/HR	TIME DERIVATIVE OF TI9
DTIC	F/SEC	TIME DERIVATIVE OF TIC
DTP1	F/SEC	TIME DERIVATIVE OF TP1
DTP1CM	F	TEMP RISE OF SODIUM FROM CORE INLET TO LEVEL OF MAX. TEMP AT CLAD OUTER SURFACE IN HOT CHANNEL
DTP1CX	F	TEMP RISE OF SODIUM FROM CORE INLET TO LEVEL OF MAX. TEMP AT CLAD OUTER SURFACE IN AVERAGE CHANNEL
DTP1FM	F	TEMP RISE OF SODIUM FROM CORE INLET TO LEVEL OF MAX. TEMP AT FUEL CENTERLINE IN HOT CHANNEL
DTP1FX	F	TEMP RISE OF SODIUM FROM CORE INLET TO LEVEL OF MAX. TEMP AT FUEL CENTERLINE IN AVERAGE CHANNEL
DTP1SM	F	SODIUM TEMP AT LEVEL OF MAX. TEMP AT FUEL

DTP1SX	F	SURFACE IN HOT CHANNEL TEMP RISE OF SODIUM FROM CORE INLET TO LEVEL OF MAX. TEMP AT FUEL SURFACE IN AVERAGE CHANNEL
DTPCM	F	DELTA TEMP BETWEEN CLAD OUTER SURFACE AND SODIUM AT LEVEL OF MAX. CLAD OUTER SURFACE TEMP IN HOT CHANNEL
DTPCMX	F	DELTA TEMP BETWEEN CLAD OUTER SURFACE AND SODIUM AT LEVEL OF MAX. CLAD OUTER SURFACE TEMP IN AVERAGE CHANNEL
DTSC	F/SEC	TIME DERIVATIVE OF TSC
DV	FT**3	STEAM DRUM VOLUME
DVF	FT**3/LBM-PSI	FUNCTION SUBROUTINE WHICH CALCULATES THE SATURATED WATER SPECIFIC VOLUME WITH RESPECT TO PRESSURE IN THE EVAPORATER
DVG	FT**3/LBM-PSI	FUNCTION SUBROUTINE WHICH CALCULATES THE SATURATED STEAM SPECIFIC VOLUME WITH RESPECT TO PRESSURE IN THE EVAPORATER
DWDMP5	LBM/SEC	STEP CHANGE IN TURBOGENERATOR DUMP FLOW
DWIS	LBM/SEC**2	TIME DERIVATIVE OF WIS
DWIST		DWIS MULTIPLIED BY TAUWI
DWPS	LBM/SEC**2	TIME DERIVATIVE OF WPS
DWPST		DWPS MULTIPLIED BY TAUWP
DWS1D	LBM/SEC**2	TIME DERIVATIVE OF WS1D
DWS3D	LBM/SEC**2	TIME DERIVATIVE OF WS3D
DWS5S	LBM/SEC**2	TIME DERIVATIVE OF WS5S
DWSAS	LBM/SEC**2	TIME DERIVATIVE OF WSAS
DWSASD	LBM/SEC**2	TIME DERIVATIVE OF WSAS FOR A CLOSED LOOP
E	KV	STATOR E.M.F.
ELS1	FT	LENGTH OF REGION AS1
ELS1.	FT/SEC	TIME DERIVATIVE OF ELS1
ELS2	FT	LENGTH OF REGION AS2
ELS5	FT	LENGTH OF PIPE LINE BETWEEN MAIN FEEDWATER HEADER AND NODE S5
ELS7	FT	LENGTH OF PIPE LINE BETWEEN NODE S7 AND NODE SA
ELS31	FT	PIPE LENGTH OF RISER OF DIAMETER #1
ELS32	FT	PIPE LENGTH OF RISER OF DIAMETER #2
ELS61	FT	PIPE LENGTH OF DOWNCOMER OF DIAMETER #1
ELS62	FT	PIPE LENGTH OF DOWNCOMER OF DIAMETER #2
ELS63	FT	PIPE LENGTH OF DOWNCOMER OF DIAMETER #3
ELS64	FT	PIPE LENGTH OF DOWNCOMER OF DIAMETER #4
ELSC1	FT	LENGTH OF PIPE LINE BETWEEN NODE SC AND SUPERHEATED STEAM HEADER
ELSC2	FT	LENGTH OF PIPE LINE BETWEEN SUPERHEATED STEAM HEADER AND NODE S9
ELSHT	FT	TOTAL LENGTH OF SUPERHEATER AND EVAPORATOR TUBES (IDENTICAL UNITS)
EMS4	LBM	MASS OF SATURATED STEAM IN STEAM DRUM
EMS4D	LBM	EMS4 DELAYED BY 0.1 SEC
EMS4I	LBM	INITIAL EMS4
EMS5	LBM	MASS OF SATURATED WATER IN STEAM DRUM
EMS5.	LBM/SEC	TIME DERIVATIVE OF EMS5
EMS5I	LBM	INITIAL EMS5
EMW	SEC VS. MW	TURBOGENERATOR LOAD DEMAND TABLE AS A FUNCTION OF TIME
EMWD	MW	TURBOGENERATOR LOAD DEMAND
EMWI	MW	INITIAL TURBOGENERATOR LOAD DEMAND
EMWM	MW	MANUAL SETTING OF TURBOGENERATOR LOAD DEMAND

EN		NORMALIZED REACTOR POWER LEVEL
ENDMP		SWITCH PARAMETER FOR SVDMP AND DSVDMF
ENE		NUMBER OF EVAPORATOR TUBES
ENEVAP		NUMBER OF EVAPORATORS
ENHS1		SWITCH PARAMETER FOR HS1
ENHS5		SWITCH PARAMETER FOR HS5
ENI		NUMBER OF TUBES IN IHX
ENIP	RPM	INTERMEDIATE PUMP SPEED
ENIP.	RPM/SEC	TIME DERIVATIVE OF ENIP
ENL		NUMBER OF HEAT TRANSPORT LOOPS IN THE PLANT
ENLD		SWITCH PARAMETER FOR AI AND EMWD
ENMWM		SWITCH PARAMETER FOR EMWM
ENP		NUMBER OF FUEL PINS IN THE CORE
ENPP	RPM	PRIMARY PUMP SPEED
ENPP.	RPM/SEC	TIME DERIVATIVE OF ENPP
ENPSA		SWITCH PARAMETER FOR PSA
ENROC		SWITCH PARAMETER FOR ROEXCD
ENS		NUMBER OF TUBES IN THE SUPERHEATER
ENS94		NUMBER OF TURBINE CONTROL VALVES AT NODE S9
ENSC2		NUMBER OF PIPE LINES BETWEEN SUPERHEATED STEAM HEADER AND NODE S9
ENSSC		SWITCH PARAMETER FOR SHORT CIRCUIT
ENSUB		NUMBER OF FUEL SUBASSEMBLIES IN THE CORE
ENTI1		SWITCH CONTROLLING TI1
ENTI7		SWITCH PARAMETER FOR TI7
ENTIA		SWITCH PARAMETER FOR TIA
ENTP5		SWITCH PARAMETER FOR TP5
ENTR1		SWITCH PARAMETER FOR TR1
ENV5		SWITCH PARAMETER FOR SV5
ENWI		SWITCH PARAMETER FOR WI AND DWIS
ENWP		SWITCH PARAMETER FOR WP AND DWPS
ENWS1		SWITCH PARAMETER FOR WS1
ENWS4		SWITCH PARAMETER FOR WS4
ENWS5		SWITCH PARAMETER FOR WS5
ENWS6		SWITCH PARAMETER FOR WS6
ENWS7		SWITCH PARAMETER FOR WS7
ENWSA		SWITCH PARAMETER FOR WSA AND DWSAS
EPS	BTU/HR	RATED REACTOR THERMAL POWER
ETAIP		EFFICIENCY OF INTERMEDIATE PUMP
ETAPP		EFFICIENCY OF PRIMARY PUMP
EXAI	1/RAD	DAMPING FACTOR
F143	PSF-SEC**2/LBM**2	PRESSURE LOSS COEFFICIENT FOR INLET NOZZLES OF FUEL SUBASSEMBLIES, SHIELD/ORIFICE, ROD BUNDLE, AND FUEL SUBASSEMBLIES LUMPED INTO ONE TERM
FETAG	DEGREES	POWER ANGLE
FETAG.	DEGREES/SEC	TIME DERIVATIVE OF FETAG
FPC		FRACTION OF SODIUM PASSING THRU CORE
FPGC		FRACTION OF POWER GENERATED IN THE CORE
FPC	PSI/(LBM/SEC)**2	RECIRCULATION PUMP FRICTION COEF.
FRPH	LBF/FT**2	FRICTION PRESSURE HEAD IN THE EVAPORATOR/STEAM DRUM LOOP
FRPH34	LBF/FT**2	FRICTION PRESSURE HEAD IN THE RISEP
FS1		FRICTION FACTOR IN REGION AS1 OBTAINED FROM EQUATIONS DESCRIBING MOODY CHART
FS1A	PSI-SEC**2/LBM**2-FT	PRESSURE LOSS COEFFICIENT PER FOOT IN REGION AS1
FS2		FRICTION FACTOR IN REGION AS2 OBTAINED

FS2A	PSI-SEC**2/LBM**2-FT	FROM EQUATIONS DESCRIBING MOODY CHART PRESSURE LOSS COEFFICIENT PER FOOT IN REGION AS2
FS5		FRICITION FACTOR IN THE FEEDWATER PIPE LINES OBTAINED FROM EQUATIONS DESCRIBING MOODY CHART
FS6	LBF/FT**2/ (LBM/SEC) **2	FRICITION FACTOR IN THE DOWNCOMER
FSC1	PSI-SEC**2/LBM**2	PRESSURE LOSS COEFFICIENT BETWEEN NODE SC AND SUPERHEATED STEAM HEADER
FSC2	PSI-SEC**2/LBM**2	PRESSURE LOSS COEFFICIENT BETWEEN SUPERHEATED STEAM HEADER AND TURBINE
FV5	PSI/ (LBM/SEC) **2	FRICITION FACTOR FOR SV5
HAS1	BTU/LBM	AVERAGE ENTHALPY IN REGION AS1
HASA	BTU/LBM	AVERAGE ENTHALPY IN REGION ASA
HC	BTU/HR-F-FT**2	SODIUM FILM HEAT TRANSFER COEFFICIENT IN THE CORE
HDG	BTU/HR-F-FT**2	FUEL GAP CONDUCTANCE
HDS1	BTU/HR-F-FT	HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN MIDWALL OF REGION AW1 AND REGION AS1
HDS2	BTU/HR-F-FT	HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN MIDWALL OF REGION AW2 AND REGION AS2
HDSPH	LBF/FT**2	HYDRO-PRESSURE HEAD IN THE EVAPORATER/ STEAM DRUM LOOP
HDW1	BTU/HR-F-FT	HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN MIDWALL OF REGION AW1 AND REGION AI8
HDW2	BTU/HR-F-FT	HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN MIDWALL OF REGION AW2 AND REGION AI7
HEXH	BTU/LBM	ENTHALPY AT EXHAUST OF TURBINE
HF	PSI VS. BTU/LBM	ENTHALPY OF SATURATED WATER TABLE AS A FUNCTION OF PRESSURE
HFS2	BTU/LBM	ENTHALPY OF SATURATED WATER AT NCDE S2
HG	PSI VS. BTU/LBM	SATURATED STEAM ENTHALPY TABLE AS A FUNCTION OF PRESSURE
HGS2	BTU/LBM	ENTHALPY OF STEAM AT NCDE S2
HGS4	BTU/LBM	ENTHALPY OF SATURATED STEAM AT REGION S4
HGS4I	BTU/LBM	INITIAL HGS4
HI	BTU/HR-F	OVERALL HEAT TRANSFER COEFFICIENT BETWEEN THE PRIMARY AND SECNDARY SODIUM IN IHX
HMM	RPM VS. 10**3GPM VS. FT	HEAD OF PUMP TABLE AS A FUNCTION OF THE PUMPS SPEED AND FLOW
HNE	BTU/HR-F-FT**2	SODIUM FILM HEAT TRANSFER COEFFICIENT IN REGIONS AI7 AND AI8
HNII	BTU/HR-F-FT**2	SECONDARY SODIUM FILM HEAT TRANSFER COEFFICIENT IN IHX
HNIP	BTU/HR-F-FT**2	PRIMARY SODIUM FILM HEAT TRANSFER COEFFICIENT IN IHX
HNS	BTU/HR-F-FT**2	SODIUM FILM HEAT TRANSFER COEFFICIENT IN REGION AIA
HOIP	FT	HEAD OF INTERMEDIATE PUMP
HOPP	FT	HEAD OF PRIMARY PUMP
HP	BTU/HR-F	OVERALL HEAT TRANSFER COEFFICIENT BETWEEN FUEL AND SODIUM IN THE CORE
HRM	BTU/HR-F-FT	OVERALL HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN FUEL CENTERLINE AND SODIUM IN THE CORE
HRS	BTU/HR-F-FT	OVERALL HEAT TRANSFER COEFFICIENT PER FOOT BETWEEN FUEL SURFACE AND SODIUM IN

		THE CORE
HS1	BTU/LBM	ENTHALPY AT NODE S1
HS1I	BTU/LBM	INITIAL HS1
HS2	BTU/LBM	ENTHALPY AT NODE S2
HS3	BTU/LBM	ENTHALPY AT NODE S3
HS4	BTU/LBM	ENTHALPY AT NODE S4
HS4I	BTU/LBM	INITIAL HS4
HS5	BTU/LBM	ENTHALPY AT NODE S5
HS5D	BTU/LBM	ENTHALPY AT NODE S5 FOR A CLOSED LOOP
HS5I	BTU/LBM	INITIAL HS5
HS6	BTU/LBM	ENTHALPY AT NODE S6
HS9	BTU/LBM	ENTHALPY AT NODE S9
HSA	BTU/LBM	ENTHALPY AT NODE SA
HSC	BTU/LBM	ENTHALPY AT NODE SC
HSH	PSI VS. F VS. BTU/LBM	SUPERHEATED STEAM ENTHALPY TABLE AS A FUNCTION OF PRESSURE AND TEMP
HSPH34	LBF/FT**2	HYDRO-PRESSURE HEAD IN THE RISER
HSS	BTU/HR-F-FT**2	SUPERHEATED STEAM FILM HEAT TRANSFER COEFFICIENT IN REGION ASA
HSSA	BTU/HR-F	HEAT TRANSFER COEFFICIENT BETWEEN MIDWALL OF REGION AWA AND REGION ASA
HWA	BTU/HR-F	HEAT TRANSFER COEFFICIENT BETWEEN MIDWALL OF REGION AWA AND REGION AIA
HWE	BTU/HR-F-FT**2	WATER FILM HEAT TRANSFER COEFFICIENT IN REGION AS1
OMGG	RAD/SEC	TURBOGENERATOR SHAFT SPEED
OMGG.	RAD/SEC**2	TIME DERIVATIVE OF OMGG
PAS2	PSI	AVERAGE PRESSURE IN REGION AS2
PAS2.	PSI/SEC	TIME DERIVATIVE OF PAS2
PAS4	PSI	PRESSURE IN REGION AS4
PAS4.	PSI/SEC	TIME DERIVATIVE OF PAS4
PAS4I	PSI	INITIAL PAS4
PDELAY		MASS FLOW DELAY FUNCTION INCORPORATED IN THE PROGRAM DAREP VERSION 4
PEE		PECLET NUMBER IN EVAPORATOR
PES		PECLET NUMBER IN SUPERHEATER
PF		POWER FACTOR
PGA	MW	NET POWER CHANGE IN TURBOGENERATOR
PGE	MW	TURBOGENERATOR ELECTRIC POWER LOSSES
PGFETA	MW	ELECTRIC (REAL) POWER TRANSMITTED BY TRANSMISSION LINES
PGFETD	MW	ELECTRIC (REAL) POWER GENERATED BY TURBOGENERATOR
PHFW	PSI	PRESSURE HEAD IN THE MAIN FEEDWATER HEADER
POMG	MW	TURBINE FRICTIONAL POWER LOSS
PRV9		RATIO THAT DETERMINES WHICH (CRITICAL OR SUPERCRITICAL FLOW) PS9 EQUATION WILL BE USED
PFV91		RATIO OF PV9/PS9SC
PS9	PSI	PRESSURE AT NODE S9
PS9I	PSI	INITIAL PS9
PS9C	PSI	EQUALS PS9 FOR CRITICAL FLOW THRU TURBINE CONTROL VALVE
PS9SC	PSI	EQUALS PS9 FOR SUPER CRITICAL FLOW THRU TURBINE CONTROL VALVE
PSA	PSI	PRESSURE AT NODE SA
PSAD	PSI	PRESSURE AT NODE SA
PSAI	PSI	INITIAL PSA
PSC	PSI	PRESSURE AT NODE SC

PSS	PSI	AVERAGE STEAM PRESSURE IN SUPERHEATER
PT	MW	TURBINE POWER ACTUATING THE SHAFT
PT.	MW/SEC	TIME DERIVATIVE OF PT
PV9	PSI	PRESSURE AT NODE V9
QC	BTU/HR-FT**3	VOLUMETRIC HEAT GENERATION AT CENTER OF FUEL PIN IN THE AVERAGE CHANNEL
QIONI	10**3 GALLONS/REV	INTERMEDIATE PUMP FLOW DIVIDED BY INTERMEDIATE PUMP SPEED
QIP	10**3GPM	FLOW RATE OF INTERMEDIATE PUMP
QPONP	10**3 GALLONS/REV	PRIMARY PUMP FLOW DIVIDED BY PRIMARY PUMP SPEED
QPP	10**3 GPM	FLOW RATE IN PRIMARY PUMP
R		2 PHASE FLOW FRICTION MULTIPLIER
FD	PSI VS. QUALITY VS. F.M.	FRICTION MULTIPLIER TABLE FOR REGION AS2 AS A FUNCTION OF PRESSURE AND QUALITY
RECC	CENTS/F	RADIAL EXPANSION COEFFICIENT
FES		REYNOLDS NUMBER IN SUPERHEATER
RES1		REYNOLDS NUMBER IN REGION AS1
RES2		REYNOLDS NUMBER IN REGION AS2
RHOAS1	LBM/FT**3	AVERAGE DENSITY IN REGION AS1
RHOAS2	LBM/FT**3	AVERAGE DENSITY IN REGION AS2
PHOASA	LBM/FT**3	AVERAGE DENSITY IN REGION ASA
PHOCD	\$	CONTROL ROD REACTIVITY
RHOCDI	\$	INITIAL RHOC
RHOD	\$	TOTAL CORE REACTIVITY
PHOFEC	CENTS	TOTAL REACTIVITY FEEDBACK
RHOFBD	\$	TOTAL REACTIVITY FEEDBACK
RHOFBS2	LBM/FT**3	DENSITY OF SATURATED WATER AT NODE S2
RHOFBS4	LBM/FT**3	DENSITY OF SATURATED WATER IN REGION AS4
RHOGS2	LBM/FT**3	DENSITY OF SATURATED STEAM AT NODE S2
RHOGS4	LBM/FT**3	DENSITY OF SATURATED STEAM IN REGION AS4
RHOIE	LBM/FT**3	AVERAGE SODIUM DENSITY IN EVAPORATOR
RHONA	F VS. LBM/FT**3	DENSITY OF SODIUM TABLE AS A FUNCTION OF TEMP
RHOS3	LBM/FT**3	DENSITY AT NODE S3
RHOSC	LBM/FT**3	DENSITY AT NODE SC
RHOTI1	LBM/FT**3	DENSITY AT NODE I1
RHOTI3	LBM/FT**3	DENSITY AT NODE I3
RHOTIC	LBM/FT**3	DENSITY AT NODE IC
RHOTP1	LBM/FT**3	DENSITY AT NODE P1
RHOTP3	LBM/FT**3	DENSITY AT NODE P3
RHOTP4	LBM/FT**3	DENSITY AT NODE P4
RHOTR1	LBM/FT**3	DENSITY AT NODE R1
RHOTR3	LBM/FT**3	DENSITY AT NODE R3
RHOTS6	LBM/FT**3	DENSITY AT NODE S6
RHOW	F VS. LBM/FT**3	DENSITY OF SATURATED WATER TABLE AS A FUNCTION OF TEMP
ROEXCD	\$	ECCENTRIC CONTROL ROD REACTIVITY
ROFBCI	CENTS	REACTIVITY FEEDBACK DUE TO AVERAGE FUEL TEMPERATURE AT COLD STANDBY CONDITIONS
ROTAI1	LBM/FT**3	DENSITY IN REGION AI1
POTAIA	LBM/FT**3	DENSITY IN REGION AIA
ROTAP1	LBM/FT**3	DENSITY IN REGION AP1
ROTAP5	LBM/FT**3	DENSITY IN REGION AP5
S9	PSI VS. F VS. BTU/LBM-R	SUPERHEATED STEAM ENTROPY TABLE AS A FUNCTION OF PRESSURE AND TEMP
SAI		RATIO OF STEAM/WATER DENSITIES AT NODE S2
SEXH	BTU/LBM-R	ENTROPY AT EXHAUST OF TURBINE
SHS1	SEC	TIME AT END OF RAMP CHANGE IN HS1
SHS4	SEC	TIME AT END OF RAMP CHANGE IN HS4
SHS5	SEC	TIME AT END OF RAMP CHANGE IN HS5

SLD	SEC	TIME AT END OF RAMP CHANGE IN EMWD
SMHCD		PRODUCT OF SODIUM EQUIVALENT AREA, SPECIFIC HEAT, RHOIE AND ENE IN THE EVAPORATER
SODDCC	CENTS/F	SODIUM DENSITY COEFFICIENT
SPSA	SEC	TIME AT END OF RAMP CHANGE IN PSA
SROC	SEC	TIME AT END OF RAMP CHANGE IN ROEXCD
SS9	BTU/LBM	ENTROPY AT NODE S9
SSV5	SEC	TIME AT END OF RAMP CHANGE IN SV5
SSVDMP	SEC	TIME AT END OF RAMP CHANGE IN SVDMP
STI1	SEC	TIME AT END OF RAMP CHANGE IN TI1
STI7	SEC	TIME AT END OF RAMP CHANGE IN TI7
STIA	SEC	TIME AT END OF RAMP CHANGE IN TIA
STP5	SEC	TIME AT END OF RAMP CHANGE IN TP5
STR1	SEC	TIME AT END OF RAMP CHANGE IN TR1
STWBTU	BTU	TURBINE STEAM WORK
STWMW	MW	TURBINE STEAM WORK
SV5		VALVE STROKE FRACTION AT V5
SV5I		INITIAL SV5
SVDMP		TURBOGENERATOR DUMP FLOW VALVE NORMALIZED STROKE
SV9		TURBINE CONTROL VALVE NORMALIZED STROKE
SV9.	1/SEC	TIME DERIVATIVE OF SV9
SWI	SEC	TIME AT END OF RAMP CHANGE IN WI
SWP	SEC	TIME AT END OF RAMP CHANGE IN WP
SWS1	SEC	TIME AT END OF RAMP CHANGE IN WS1
SWS4	SEC	TIME AT END OF RAMP CHANGE IN WS4
SWS5	SEC	TIME AT END OF RAMP CHANGE IN WS5
WSA	SEC	TIME AT END OF RAMP CHANGE IN WSA
TACL	F	AVERAGE CLADDING TEMP IN THE CORE
TACL.	F/SEC	TIME DERIVATIVE OF TACL
TAF	F	AVERAGE FUEL TEMP IN THE CORE
TAF.	F/SEC	TIME DERIVATIVE OF TAF
TAFI	F	AVERAGE FUEL TEMP IN THE CORE AT COLD STANDBY CONDITIONS
TAI1	F	AVERAGE TEMP IN REGION AI1
TAI7	F	AVERAGE TEMP IN REGION AI7
TAI8	F	AVERAGE TEMP IN REGION AI8
TAIA	F	AVERAGE TEMP IN REGION AIA
TAP1	F	AVERAGE TEMP IN REGION AP1
TAP5	F	AVERAGE TEMP IN REGION AP5
TAS1	F	AVERAGE TEMP IN REGION AS1
TASA	F	AVERAGE TEMP IN REGION ASA
TAUHS1	SEC	FLOW RATE TIME FROM HS6 TO HS1
TAUHS4	SEC	TIME DELAY TO DETERMINE HS4 FROM HS3
TAUHSA	SEC	FLOW RATE TIME FROM HGS4 TO HSA
TAUTI1	SEC	FLOW RATE TIME FROM TI9 TO TI1
TAUTI7	SEC	FLOW RATE TIME FROM TIC TO TI7
TAUTIA	SEC	FLOW RATE TIME FROM TI3 TO TIA
TAUTP5	SEC	FLOW RATE TIME FROM IP4 TO TP5
TAUTR1	SEC	FLOW RATE TIME FROM IP7 TO TR1
TAUTS9	SEC	FLOW RATE TIME FROM ISC TO TS9
TAUWI	1/FT	COEF. OF TIME DERIVATIVE TERM IN THE INTERMEDIATE LOCP MOMENTUM EQ.
TAUWP	1/FT	COEF. OF TIME DERIVATIVE TERM IN THE PRIMARY LOOP MOMENTUM EQ.
TAUWS1	1/FT	COEF. OF THE TIME DERIVATIVE TERM IN THE DOWNCOMER MOMENTUM EQ.
TAUWS3	1/FT	COEF. OF TIME DERIVATIVE TERM IN THE RISER MOMENTUM EQ.
TAUWS5	1/FT	COEF. OF THE TIME DERIVATIVE TERM IN

TAUWSA	1/FT	THE FEEDWATER LOCP MOMENTUM EQ. COEF. OF THE TIME DERIVATIVE TERM IN SUPERHEATER MOMENTUM EQ.
TAW1	F	TEMP OF EVAPORATOR WALL IN REGION AW1
TAW1.	F/SEC	TIME DERIVATIVE OF TAW1
TAW2	F	TEMP OF EVAPORATOR WALL IN REGION AW2
TAW2.	F/SEC	TIME DERIVATIVE OF TAW2
TAWA	F	TEMP OF SUPERHEATER WALL IN REGION AWA
TAWA.	F/SEC	TIME DERIVATIVE OF TAWA
TCMAX	F	MAXIMUM CLAD OUTER SURFACE TEMP IN THE AVERAGE CHANNEL
TCMM	F	MAXIMUM CLAD OUTER SURFACE TEMP IN THE HOT CHANNEL
TFC	C	TEMP OF FUEL
TFK	K	TEMP OF FUEL
TFMAX	F	MAXIMUM FUEL CENTERLINE TEMP IN THE AVERAGE CHANNEL
TFMM	F	MAXIMUM FUEL CENTERLINE TEMP IN THE HOT CHANNEL
TFR	SEC	TIME FOR RECOVERY AFTER TRANSMISSION LINE FAILURE
TI1	F	TEMP AT NODE I1
TI1I	F	INITIAL TI1
TI3	F	TEMP AT NODE I3
TI3.	F/SEC	TIME DERIVATIVE OF TI3
TI3I	F	INITIAL TI3
TI7	F	TEMP AT NODE I7
TI7I	F	INITIAL TI7
TI8	F	TEMP AT NODE I8
TI8.	F/SEC	TIME DERIVATIVE OF TI8
TI9	F	TEMP AT NODE I9
TI9.	F/SEC	TIME DERIVATIVE OF TI9
TI9I	F	INITIAL TI9
TIA	F	TEMP AT NODE IA
TIAI	F	INITIAL TIA
TIC	F	TEMP AT NODE IC
TIC.	F/SEC	TIME DERIVATIVE OF TIC
TICI	F	INITIAL TIC
TIE	F	AVERAGE SODIUM TEMP IN EVAPORATOR
TP1	F	TEMP AT NODE P1
TP1.	F/SEC	TIME DERIVATIVE OF TP1
TP3	F	TEMP AT NODE P3
TP3.	F/SEC	TIME DERIVATIVE OF TP3
TP4	F	TEMP AT NODE P4
TP4.	F/SEC	TIME DERIVATIVE OF TP4
TP4I	F	INITIAL TP4
TP5	F	TEMP AT NODE P5
TP5I	F	INITIAL TP5
TP7	F	INITIAL TP7
TP7.	F/SEC	TIME DERIVATIVE OF TP7
TP7I	F	INITIAL TP7
TPMAX	F	SODIUM MAXIMUM TEMP AT EXIT OF AVERAGE CHANNEL
TPMM	F	SODIUM MAXIMUM TEMP AT EXIT OF HOT CHANNEL
TPYCMX	F	SODIUM TEMP AT THE LEVEL OF MAXIMUM TEMP OF CLAD OUTER SURFACE IN AVERAGE CHANNEL
TPYFMX	F	SODIUM TEMP AT THE LEVEL OF MAXIMUM TEMP OF FUEL CENTERLINE IN AVERAGE CHANNEL
TPYSMX	F	SODIUM TEMP AT THE LEVEL OF MAXIMUM TEMP OF FUEL SURFACE IN AVERAGE CHANNEL

TR1	F	TEMP AT NODE R1
TR1I	F	INITIAL TR1
TR3	F	TEMP AT NODE R3
TR3.	F/SEC	TIME DERIVATIVE OF TR3
TRQIP	LBF-FT/RAD	INTERMEDIATE PUMP MOTOR TORQUE
TRQPP	LBF-FT/RAD	PRIMARY PUMP MOTOR TORQUE
TS1	F	TEMP AT NODE S1
TS1F	BTU/LBM VS. F	TEMP OF SATURATED WATER TABLE AS A FUNCTION OF ENTHALPY
TS5	F	TEMP AT NODE S5
TS9	F	TEMP AT NODE S9
TSA	F	TEMP AT NODE SA
TSAT	F	SATURATION TEMP IN EVAPORATOR
TSATF	PSI VS. F	TEMP OF SATURATED WATER TABLE AS A FUNCTION OF PRESSURE
TSC	F	TEMP AT NODE SC
TSC.	F/SEC	TIME DERIVATIVE OF TSC
TSCI	F	INITIAL TSC
TSMAX	F	MAXIMUM FUEL SURFACE TEMP IN AVERAGE CHANNEL
TSMH	F	MAXIMUM FUEL SURFACE TEMP IN HOT CHANNEL
W2	F	TEMP OF EVAPORATOR WALL AT NODE W2
V	KV	STATOR TERMINAL VOLTAGE
VF	PSI VS. FT**3/LBM	SPECIFIC VOLUME OF SATURATED WATER TABLE AS A FUNCTION OF PRESSURE
VFS2	FT**3/LBM	SATURATED WATER SPECIFIC VOLUME AT NODE S2
VFS4	FT**3/LBM	SATURATED WATER SPECIFIC VOLUME IN REGION AS4
VG	PSI VS. FT**3/LBM	SATURATED STEAM SPECIFIC VOLUME TABLE AS A FUNCTION OF PRESSURE
VGS2	FT**3/LBM	SATURATED STEAM SPECIFIC VOLUME IN REGION AS2
VGS4	FT**3/LBM	SATURATED STEAM SPECIFIC VOLUME IN REGION AS4
VGSA	FT**3/LBM	SATURATED STEAM SPECIFIC VOLUME AT NODE SA
VP1	FT**3	VOLUME OF LOWER REACTOR PLENUM
VP4	FT**3	VOLUME OF UPPER REACTOR PLENUM
VSC	FT**3/LBM	SPECIFIC VOLUME AT NODE SC
VSH	PSI VS. F VS. FT**3/LBM	SUPERHEATED STEAM SPECIFIC VOLUME TABLE AS A FUNCTION OF PRESSURE AND TEMP
WC	LBM/HR	CONDENSATION RATE IN STEAM DRUM
WDMP	LBM/HR	TURBOGENERATOR STEAM DUMP FLOW
WDMPS	LBM/SEC	TURBOGENERATOR STEAM DUMP FLOW
WI	LBM/HR	INTERMEDIATE SODIUM FLOW RATE
WI8	LBM/HR	FLOW RATE AT NODE I8
WI1	LBM/HR	INITIAL WI
WIS	LBM/SEC	INTERMEDIATE SODIUM FLOW RATE
WIS.	LBM/SEC**2	TIME DERIVATIVE OF WIS
WMHCD		PRODUCT OF EVAPORATOR WALL EFFECTIVE CROSS SECTION, DENSITY, SPECIFIC HEAT, AND ENH
WP	LBM/HR	PRIMARY SODIUM FLOW RATE
WPI	LBM/HR	INITIAL WP
WPD	LBM/HR	PRIMARY SODIUM FLOW RATE PER CHANNEL IN THE CORE
WPS	LBM/SEC	PRIMARY SODIUM FLOW RATE
WPS.	LBM/SEC**2	TIME DERIVATIVE OF WP
WS1	LBM/HR	MASS FLOW RATE AT NODE S1

WS1D	LBM/SEC	EQUAL TO WS1S PER EVAPORATER TUBE
WS1D.	LBM/SEC**2	TIME DERIVATIVE OF WS1D
WS1DD	LBM/SEC**2	EQUAL TO DWS1D FOR SWITCH PARAMETER
		ENWS1=0.0
WS1I	LBM/HR	INITIAL WS1
WS1S	LBM/SEC	MASS FLOW RATE AT NODE S1
WS2	LBM/HR	FLOW RATE AT NODE S2 RELATIVE TO MOVING BOUNDARY
WS3	LBM/HR	MASS FLOW RATE AT NODE S3
WS3D	LBM/SEC	EQUAL TO WS3S PER EVAPORATER TUBE
WS3D.	LBM/SEC**2	TIME DERIVATIVE OF WS3D
WS3DD	LBM/SEC**2	EQUAL TO DWS3D FOR SWITCH PARAMETER
		ENWS1=0.0
WS3S	LBM/SEC	MASS FLOW RATE AT NODE S3
WS4	LBM/HR	MASS FLOW RATE AT NODE S4
WS4I	LBM/HR	INITIAL WS4
WS5	LBM/HR	MASS FLOW RATE AT NODE S5
WS5I	LBM/HR	INITIAL WS5
WS5S	LBM/SEC	MASS FLOW RATE AT NODE S5
WS5S.	LBM/SEC**2	TIME DERIVATIVE OF WS5S
WS5SD	LBM/SEC**2	TIME DERIVATIVE OF WS5S
WS6	LBM/HR	MASS FLOW RATE AT NODE 66
WS6I	LBM/HR	INITIAL WS6
WS7	LBM/HR	MASS FLOW RATE AT NODE S7
WS7I	LBM/HR	INITIAL WS7
WS9	LBM/HR	MASS FLOW RATE AT NODE S9
WS9S	LBM/SEC	MASS FLOW RATE AT NODE S9
WSA	LBM/HR	MASS FLOW RATE AT NODE SA
WSAI	LBM/HR	INITIAL WSA
WSAS	LBM/SEC	MASS FLOW RATE AT NODE SA
WSAS.	LBM/SEC**2	TIME DERIVATIVE OF WSAS
WSC	LBM/HR	MASS FLOW RATE AT NODE SC
WSCS	LBM/SEC	MASS FLOW RATE AT NODE SC
X	IN	CONTROL ROD POSITION
X.	IN/SEC	TIME DERIVATIVE OF X
XD	OHMS	D-AXIS BLONDEL REACTANCE
XEXH		QUALITY AT EXHAUST OF TURBINE
XS3		QUALITY AT NODE S3
YCMAX	FT	ACTUAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT CLAD OUTER SURFACE IN THE AVERAGE CHANNEL
YCMH	FT	ACTUAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT CLAD OUTER SURFACE IN THE HOT CHANNEL
YCMTH	FT	THEORETICAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT CLAD OUTER SURFACE IN THE HOT CHANNEL
YCMXTH	FT	THEORETICAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT CLAD OUTER SURFACE IN THE AVERAGE CHANNEL
YFMAX	FT	ACTUAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT FUEL CENTERLINE IN THE AVERAGE CHANNEL
YFMM	FT	ACTUAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF THE MAXIMUM TEMP AT FUEL CENTERLINE IN THE HOT CHANNEL
YFMTH	FT	THEORETICAL LOCATION, MEASURED FROM CENTERLINE OF CORE, OF MAXIMUM TEMP AT CENTERLINE IN THE HOT CHANNEL
YFMXTH	FT	THEORETICAL LOCATION, MEASURED FROM CENTERLINE OF THE CORE, OF THE MAX TEMP

YSS	FT	AT FUEL CENTERLINE IN THE AVERAGE CHANNEL
YSMAX	FT	HEIGHT OF SATURATED WATER IN STEAM DRUM
		ACTUAL LOCATION, MEASURED FROM CENTERLINE
		OF CORE, OF MAXIMUM TEMP AT FUEL SURFACE
		IN THE AVERAGE CHANNEL
YSMM	FT	ACTUAL LOCATION, MEASURED FROM CENTERLINE
		OF CORE, OF MAXIMUM TEMP AT FUEL SURFACE
		IN HOT CHANNEL
YSMTH	FT	THEORETICAL LOCATION, MEASURED FROM
		CENTERLINE OF CORE, OF MAXIMUM TEMP AT
		FUEL SURFACE IN THE HOT CHANNEL
YSMXTH	FT	THEORETICAL LOCATION, MEASURED FROM
		CENTERLINE OF CORE, OF MAXIMUM TEMP AT
		FUEL SURFACE IN THE AVERAGE CHANNEL

APPENDIX B

BRENDA, a DARE P Input File

The following 26 pages is a listing for BRENDA, a DARE P input file containing 1550 lines (card images). The structure of the blocks is described earlier, in the section entitled DARE P. The listing contains the following:

<u>Block Name</u>	<u>Line Numbers</u>
Method	00010
Derivative	00020 - 11990
Tables	12040 - 13930
Functions	13950 - 14270
Initial Conditions	14320 - 15200
Output Commands	15230 - 15490

The dollar sign that introduces each of the first four blocks is in column 2. An asterisk denoting a comment is in column 1. Equations begin in column 7, but may be indented further. A continuation is signified by a dollar sign in column 6. Several initial conditions separated by commas may appear on a single line. The comment that appears just before each output command is printed as an identifying label in the output, together with the output commands and appropriate column headings. For other details, see the book by Korn and Wait (1978).

```

00010 $M1
00020 $D1
00030 *
00040 *
00050
00060 ***** BRENDA *****
00070 ***** BRENDA *****
00080 ***** BRENDA *****
00090 ***** BRENDA *****
00100 ***** BRENDA *****
00110 ***** CRBRP CONTROLLED PLANT SIMULATOR *****
00120 ***** CRBRP CONTROLLED PLANT SIMULATOR *****
00130
00140 * THE PROCEDURE BLOCKS USED TO INITIALIZE THE TRANSIENTS
00150 * FOLLOW THESE COMMENTS. ONLY THE TRANSIENTS REPRESENTED
00160 * SHOULD BE RUN WITH THIS MODEL. THE DIRECTIONS FOR THE
00170 * USE OF THE PROCEDURE BLOCKS CAN BE FOUND IN NUREG-0110.
00180
00190
00200 * CONTROL ROD REACTIVITY S.P. (ENROC)
00210 *
00220 PROCED ROEXCD=ENROC,DLTROC,RHOCDI,SROC
00230 IF(ENROC.EQ.0.0) ROEXCD=2.4215565
00240 IF(ENROC.EQ.1.0.AND.T.EQ.0.0) ROEXCD=2.4215565
00250 IF(ENROC.EQ.1.0.AND.T.NE.0.0) ROEXCD=2.4215565+DLTROC/100.0
00260 IF(ENROC.EQ.2.0.AND.T.LE.SROC) ROEXCD=2.4215565+DLTROC*T/100.0
00270 ENDPRO
00280 *
00290 *
00300 * STEAM DUMP VALVE S.P. (ENDMP)
00310 *
00320 PROCED SVDMP=ENDMP,DLTDMP,SSVDMP,SVDMP
00330 IF(ENDMP.EQ.0.0) SVDMP=SVDMP
00340 IF(ENDMP.EQ.1..AND.T.EQ.0.0) SVDMP=0.0
00350 IF(ENDMP.EQ.1..AND.T.NE.0.0) SVDMP=DLTDMP
00360 IF(ENDMP.EQ.2.0.AND.T.LE.SVDMP) SVDMP=DLTDMP*T
00370 ENDPRO
00380 *
00390 *
00400 * TURBINE CONTROL VALVE S.P. (ENV9)
00410 *
00420 PROCED SV9=ENV9,DLTV9,SV9I,SSV9,T,SV9C
00430 IF(ENV9.EQ.0.0) SV9=SV9C
00440 IF(ENV9.EQ.1..AND.T.EQ.0.0) SV9=SV9I
00450 IF(ENV9.EQ.1..AND.T.NE.0.0) SV9=SV9I+DLTV9
00460 IF(ENV9.EQ.2..AND.T.LE.SSV9) SV9=SV9I+DLTV9*T
00470 ENDPRO
00480 *
00490 *
00500 * ELECTRIC LOAD SWITCH PARAMETER (ENLD)
00510 *
00520 PROCED EMW=ENLD,DLTLD,EMWI,SLD,T
00530 IF(ENLD.EQ.0.0) EMW=EMWI
00540 IF(ENLD.EQ.1..AND.T.EQ.0.0) EMW=EMWI
00550 IF(ENLD.EQ.1..AND.T.GT.0.0) EMW=EMWI*(1.+DLTLD/100.0)
00560 IF(ENLD.EQ.2..AND.T.LE.SLD) EMW=EMWI*(1.+DLTLD*T/100.0)
00570 ENDPRO
00580 *
00590 *
00600 *
00610 * I. TURBOGENERATOR

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```

00620 *
00630 *
00640 *
00650 *           TURBINE CONTROL VALVE CONTROLLER
00660 *
00670 OMSGD=OMGGI
00680 EPS9=PS9D-PS9H
00690 EPEXH=0.4912*(PEXHD-PEXHM)
00700 *
00710 EEMW=EMW-PGM
00720 EOMGG=OMGGD-OMGG
00730 EEMW1=AEPT*(AEPS91*EPS9+AEPEXH*EPEXH)+AEOMGG*EOMGG+EEMW
00740 EEMW1I.=PEM1
00750 EEMW2=AEEMW1*(EEMW1+EEMW1I/TEEMW)
00760 DESV9=(1./TSV9)*(ASV9*EEMW2-ESV9)
00770 ESV9.=DESV9
00780 *
00790 PROCED SV9C=ESV9,SV9I
00800 SV9AC=SV9I+ESV9
00810 IF(SV9AC.LE.0.0) SV9C=0.0001
00820 IF(SV9AC.GT.0.0.AND.SV9AC.LE.1.0) SV9C=SV9AC
00830 IF(SV9AC.GT.1.0) SV9C=1.0
00840 ENDPRO
00850 *
00860 *
00870 *           DUMP VALVE CONTROLLER
00880 *
00890 ESDM=AEVDMP*EPS9
00900 ESDMI.=ESDM
00910 ESDMP=ESDM+ESDMI/TEVDMP
00920 *
00930 PROCED ENVDM=PS9,PS9D,PS9MX
00940 IF(PS9.GE.PS9MX.AND.RLDONE) ENVDM=1.0
00950 IF(PS9.LE.PS9D.AND.RLDONE) ENVDM=0.0
00960 ENDPRO
00970 *
00980 PROCED SVDMPD=ENVDM,ESDMP
00990 IF(ENVDM.EQ.1.0) SVDMPD=ESDMP
01000 IF(ENVDM.EQ.0.0) SVDMPD=0.0
01010 ENDPRO
01020 *
01030 SVDMC.= (SVDMPD-SVDMC)/0.5
01040 *
01050 PROCED SVDMPC=SVDMC
01060 IF(SVDMC.LE.0.0) SVDMPC=0.0
01070 IF(SVDMC.GT.0.0.AND.SVDMC.LE.1.0) SVDMPC=SVDMC
01080 IF(SVDMC.GT.1.0) SVDMPC=1.0
01090 ENDPRO
01100 *
01110 PROCED WDMPS=PS9I,CDMP,SVDMP
01120 IF(T.EQ.0.0.AND.ENDMP.NE.0.0) WDMPS=CDMP*PS9I*SVDMP
01130 IF(T.EQ.0.0.AND.ENDMP.EQ.0.0) WDMPS=4.0*CDMP*PS9I*SVDMP
01140 IF(T.GT.0.0.AND.ENDMP.NE.0.0) WDMPS=CDMP*PS9*SVDMP
01150 IF(T.GT.0.0.AND.ENDMP.EQ.0.0) WDMPS=4.0*CDMP*PS9*SVDMP
01160 ENDPROC
01170 *
01180 WDM=3600.0*WDMPS
01190 *
01200 *
01210 *

```

```

01220      WSC=WSA
01230      WSCS=WSC/3600.0
01240      *
01250      WS9S=WSCS-WDMPS
01260      WS9=3600.0*WS9S
01270      *
01280      *
01290      PROCED CS9=PRV91,PS9SC,WS9,SV9,ENS94
01300      IF (PRV91.GT..55) CS9=WS9/(ENS94*SV9*PS9SC)
01310      ENDPRO
01320      *
01330      PV9=AV9*WS9S/ENS94
01340      PS9SC=PV9+(WS9S/(CV9*ENS94*SV9))**2.0
01350      PS9C=WS9/(ENS94*CS9*SV9)
01360      *
01370      PRV91=PV9/PS9SC
01380      *
01390      PROCED PRV9=PS9I,PV9
01400      IF (T.EQ.0.0) PRV9=PV9/PS9I
01410      IF (T.GT.0.0) PRV9=PV9/PS9
01420      ENDPRO
01430      *
01440      PROCED PS9=PS9SC,PS9C,PRV9
01450      IF (PRV9.GT.0.55) PS9=PS9SC
01460      IF (PRV9.LE.0.55) PS9=PS9C
01470      ENDPRO
01480      *
01490      PS9M=PS9
01500      PEXH=APEXH*WS9S
01510      PEXHM=PEXH
01520      *
01530      TSA=TSATF (PSA)
01540      TASA=(TSA+TSC)/2.
01550      *
01560      RHOSC=1./VSC
01570      TAUTS9=(1.57625*ELSC1*ENL+1.96895*ELSC2*ENSC2)*(RHOSC/WSCS)
01580      *
01590      TS9=0.994475*PDELAY (TSC,TAUTS9,6,TSCI)
01600      *
01610      *
01620      HS9=HSH (PS9,TS9)
01630      *
01640      SS9=S9 (PS9,TS9)
01650      SEXH=SS9
01660      XEXH=(SEXH-0.1313)/1.8487
01670      HEXH=68.997+1036.5*XEXH
01680      *
01690      STWBTU=0.706639*(HS9-HEXH)*WS9
01700      STWMW=2.931E-7*STWBTU
01710      PT.=(STWMW-PT)/0.5
01720      *
01730      *
01740      V=22.0*EMW/EMWI
01750      *
01760      XD=0.9918032
01770      *
01780      E=19.845232+20.009242*XD
01790      *
01800      PROCED AI=V,E,XD,FETAG
01810      IF (ENLD.NE.2.0) AI=((0.431618*V/XD)**2.0
01820      + ((E-0.902056*V)/XD)**2.0)**0.5

```



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01830      IF (ENLD.EQ.2.0)  AI= ((V*SIN(0.017453292*FETAG)/XD)**2.0
01840      $    + ((E-V*COS(0.017453292*FETAG))/XD)**2.0)**0.5 ,
01850      ENDPRO
01860      *
01870      PGFETD=(V*E/XD)*SIN(0.017453292*FETAG)
01880      *  SHORT CIRCUIT S. P. (ENSSC)
01890      *
01900      PROCED  PGFETA=ENSSC,PGFETD,T,TFR
01910      IF(ENSSC.NE.0.0)  GO TO 30
01920      PGFETA=PGFETD
01930      GO TO 40
01940      30 IF (T.GT.0.0.AND.T.LE.TFR)  PGFETA=0.0
01950      IF(T.EQ.0.0.OR.T.GT.TFR)  PGFETA=PGFETD
01960      40 CONTINUE
01970      ENDPRO
01980      *
01990      PGM=PGFETA
02000      *
02010      PF=PGFETA/(AI*V)
02020      *
02030      *
02040      POMG=0.020159685*OMGG
02050      PGE=165.38356*EXAI*(OMGG-376.99)
02060      PGA=PT-(POMG+PGE+PGFETA)
02070      *
02080      FETAG.=(OMGG-OMGGI)/0.017453292
02090      OMGG.=48.539*PGA/OMGG
02100      *
02110      *
02120      *
02130      *  II. SUPERHEATER
02140      *
02150      *  STEAM FLOW RATE
02160      WSA=3600.0*WSAS
02170      *
02180      *  INLET STEAM ENTHALPY
02190      TAUHSA=0.92175*ELS7*ENL*RHOGS4/WSAS
02200      HSA=PDELAY(HGS4,TAUHSA,7,HGS4I)
02210      *
02220      *  SODIUM INLET TEMPERATURE
02230      TIA=PDELAY(TI3,TAUTIA,3,TI3I)
02240      DTIA=(TI3-TIA)/TAUTIA
02250      *
02260      *  INLET STEAM PRESSURE
02270      PSA=PSAD
02280      *
02290      *
02300      FSC1=7.841775E-4*ELSC1/(ELSC1+0.573425*ELSC2*(ENL/ENSC2)**2.0)
02310      FSC2=3.48525E-4*ELSC2/(ELSC2+1.74391*ELSC1*(ENSC2/ENL)**2.0)
02320      *
02330      TAUHSA=2.339742E-4*ELS7/ENL+3.1533E-4*ELSHT/ENL
02340      $    +1.3682E-4*ELSC1/ENL+1.095337E-4*ELSC2/ENSC2
02350      *
02360      DWSASD=(1./TAUWSA)*(PAS4-PS9+(53.21+YS5)*RHOGS4/144.0
02370      $    -(2.3807823E-3+FSC1)*(WSAS/ENL)**2.0-FSC2*(WSAS/ENSC2)**2.0)
02380      *
02390      DWSAS=DWSASD
02400      *
02410      WSAS.=DWSAS
02420      VGS4=VG(PAS4)

```

02430 RHOGS4=1./VGS4
 02440 *
 02450 PSAD=PAS4+ (1./144.) * (-0.03369228*ELS7*DWSAS/ENL+ (53.21+YS5) *RHOGS4
 02460 \$ -0.0417085*(WSAS/ENL) **2.0)
 02470 *
 02480 PSC=PSA-2.09114E-3*(WSAS/ENL) **2.0-3.1533E-4*ELSHT*DWSAS/ENL
 02490 *
 02500 *
 02510 TAI1= (TI1+TI3) /2.0
 02520 *
 02530 RHOTI3=RHONA (TI3)
 02540 *
 02550 TAUTIA=8474400.0*RHOTI3*ENL/WI
 02560 *
 02570 *
 02580 HGS4I=HG (PAS4I)
 02590 HGS4=HG (PAS4)
 02600 HSC=HSH (PSC, TSC)
 02610 *
 02620 *
 02630 CPS= (HSC-HSA) / (TSC-TSA)
 02640 *
 02650 HASA= (HSA+HSC) /2.0
 02660 PSS= (PSA+PSC) /2.0
 02670 *
 02680 VGS4=VG (PSA)
 02690 VSC=VSH (PSC, TSC)
 02700 RHOASA= (1./VGS4+1./VSC) /2.0
 02710 *
 02720 TAIA= (TIA+TIC) /2.0
 02730 ROTAIA=RHONA (TAIA)
 02740 *
 02750 * HEAT TRANSFER COEFFICIENTS IN THE SUPERHEATER
 02760 *
 02770 PES=0.18802368*(WI/ENS)
 02780 HNS=1222.0787+1.9258444*(WI/ENS) **0.8
 02790 HWA=144.51325*ENS/(0.0048751818+19.2/HNS)
 02800 *
 02810 RES=536.289*(WSA/ENS)
 02820 HSS=4.2454582*(WSA/ENS) **0.8
 02830 HSSA=144.51325*ENS/(0.01901711+29.484029/HSS)
 02840 *
 02850 *
 02860 * II-1. SUPERHEATED STEAM
 02870 *
 02880 DTSC= (0.0066838/(CPS*RHOASA*ENS)) *(HSSA*(TAWA-TASA)
 02890 \$ -WSA*(HSC-HSA))
 02900 TSC.=DTSC
 02910 *
 02920 *
 02930 * II-2. WALL
 02940 *
 02950 DTAWA= (8.2682436E- 5/ENS) * (HWA*(TAIA-TAWA) -HSSA*(TAWA-TASA))
 02960 TAWA.=DTAWA
 02970 *
 02980 * II-3. INTERMEDIATE SODIUM
 02990 *
 03000 DTIC= (2.93739E- 3/(ROTAIA*ENS)) *(0.3014*WI*(TIA-TIC)
 03010 \$ -HWA*(TAIA-TAWA))
 03020 TIC.=DTIC
 03030 *

```

03040 *
03050 *
03060 *
03070 *       III.  EVAPORATOR
03080 *
03090 *       INLET SODIUM TEMPERATURE
03100 *       TI7=PDELAY (TIC,TAUTI7,14,TICI)
03110 *
03120 *       INLET WATER ENTHALPY
03130 *       DHS1=3600.0*(HS6-HS1)/TAUHS1
03140 *       HS1=PDELAY(HS6,TAUHS1,8,HS1I)
03150 *
03160 *
03170 *       TS6=TS1F(HS6)
03180 *       RHOTS6=RHOW(TS6)
03190 *
03200 *       TAUHS1=(1.76744*ELS61+1.576246*ELS62+1.22718*ELS63
03210 *       $ +0.441786*ENEVAP*ELS64/ENL)*(ENL*RHOTS6/WS1S)
03220 *
03230 *       HS2=HF(PAS2)
03240 *       HAS1=(HS1+HS2)/2.0
03250 *       TS1=TS1F(HS1)
03260 *       TSAT=TSATP(PAS2)
03270 *       TAS1=(TS1+TSAT)/2.0
03280 *       HFS2=HS2
03290 *       HGS2=HG(PAS2)
03300 *       VFS2=VF(PAS2)
03310 *       RHOPS2=1./VFS2
03320 *       VGS2=VG(PAS2)
03330 *       RHOGS2=1./VGS2
03340 *
03350 *       INLET WATER FLOW
03360 *       WS1=3600.0*ENE*WS1D
03370 *
03380 *       WS3=3600.0*ENE*WS3D
03390 *
03400 *
03410 *       WS1S=ENE*WS1D
03420 *       WS3S=ENE*WS3D
03430 *       WS2AD=(WS1D+WS3D)/2.0
03440 *
03450 *       HEAT TRANSFER COEFFICIENTS IN THE EVAPORATOR
03460 *
03470 *       RES1=172.99645*(WS1/ENE)
03480 *       RES2=187.70115*(WS1/ENE)
03490 *       HWE=12.917068*(WS1/ENE)**0.8
03500 *       HDS1=3.1415926*ENE/(0.024675823+29.484029/HWE)
03510 *       HDS2=127.3146044*ENE
03520 *
03530 *       PEE=0.18186595*(WI/ENE)
03540 *       HNE=1281.3193+1.9661152*(WI/ENE)**0.8
03550 *       HDW1=3.1415926*ENE/(0.0048751818+19.2/HNE)
03560 *       HDW2=HDW1
03570 *
03580 *       AS1=0.00090347512*ENE
03590 *
03600 *       STEAM PROPERTIES
03610 *
03620 *       ELS2=46.0-ELS1
03630 *

```

```

03640 SAI=RHOGS2/RHOFS2
03650 XS3=HDS2*ELS2*(TAW2-TSAT)/(WS3*(HGS2-HS2))
03660 ALP3=XS3/(SAI+(1.-SAI)*XS3)
03670 ALFSI=ALP3*(1.-SAI)
03680 ALFA2=ALP3*(0.5+ALFSI/6.0+ALFSI*ALFSI/12.)
03690 *
03700 RHOAS1=RHOW(TAS1)
03710 RHOAS2=ALFA2*RHOGS2+(1.-ALFA2)*RHOFS2
03720 RHOHS2=ALFA2*RHOGS2*HGS2+(1.-ALFA2)*RHOFS2*HFS2
03730 *
03740 HS3=HGS2*XS3+HFS2*(1.-XS3)
03750 RHOS3=ALP3*RHOGS2+(1.-ALP3)*RHOFS2
03760 *
03770 DRFP2=- (1./VPS2**2.0)*DVF(PAS2)
03780 DRGP2=- (1./VGS2**2.0)*DVG(PAS2)
03790 DHFP2=DHF(PAS2)
03800 DHGP2=DHG(PAS2)
03810 DRHFP2=RHOFS2*DHFP2+HFS2*DRFP2
03820 DRHGP2=RHOGS2*DHGP2+HGS2*DRGP2
03830 *
03840 A=ELS2*(ALFA2*(DRHGP2-DRGP2*HFS2)+(1.-ALFA2)*(DRHFP2-DRFP2*HFS2))
03850 B=ELS1*RHOGS2*DHFP2*(HGS2-HFS2)/(2.0*A*(HS2-HS1))
03860 C=1.0+2.*B*(RHOAS1-RHOFS2)/(RHOFS2-RHOGS2)
03870 *
03880 * III-1. WATER / STEAM
03890 *
03900 DLS1=(2./C)*(-HDS1*ELS1*(TAW1-TAS1)/(AS1*RHOAS1*(HS2-HS1))
03910 $ +WS1/(AS1*RHOAS1)+(ELS1/2.0)*DHS6/(HS2-HS1)
03920 $ +B*(WS1-WS3)/(AS1*(RHOFS2-RHOGS2))
03930 ELS1.=DLS1/3600.0
03940 *
03950 WS2=WS1-AS1*RHOAS1*DLS1
03960 *
03970 DPAS2=(RHOGS2*(HGS2-HFS2)/(A*(RHOFS2-RHOGS2)))*(-(RHOAS1-RHOFS2)
03980 $ *DLS1+(WS1-WS3)/AS1)
03990 PAS2.=DPAS2/3600.0
04000 *
04010 * III-2. WALL
04020 *
04030 WMHCD=0.073034229*ENE
04040 TW2=(TAW1*ELS1+TAW2*ELS2)/46.0
04050 *
04060 DTAW1=(1./WMHCD)*(-(HDW1+HDS1+WMHCD*DLS1/ELS1)*TAW1
04070 $ +HDS1*TAS1+HDW1*TAI8)+TW2*DLS1/ELS1
04080 TAW1.=DTAW1/3600.0
04090 *
04100 DTAW2=(1./WMHCD)*(-(HDW2+HDS2-WMHCD*DLS1/ELS2)*TAW2
04110 $ +HDS2*TSAT+HDW2*TAI7)-TW2*DLS1/ELS2
04120 TAW2.=DTAW2/3600.0
04130 *
04140 * III-3. INTERMEDIATE SODIUM
04150 *
04160 *
04170 RHOTIC=RHONA(TIC)
04180 TAUTI7=703800.0*RHOTIC*ENEVAP/WI
04190 *
04200 TAI7=(TI7+TI8)/2.0
04210 TAI8=(TI8+TI9)/2.0
04220 *
04230 TIE=(TI7+TI9)/2
04240 RHOIE=RHONA(TIE)

```

```

04250      SMHCD=0.0020848433*RHOIE*ENE
04260      WI8=WI+0.00682079*ENE*RHOIE*DLS1
04270      *
04280      DTI8=(1./(SMHCD*ELS2))*(-(HDW2*ELS2-SMHCD*DLS1)*TAI7
04290      $   +HDW2*ELS2*TAW2+0.30566168*(WI*TI7-WI8*TI8))
04300      TI8.=DTI8/3600.0
04310      *
04320      DTI9=(1./(SMHCD*ELS1))*(-(HDW1*ELS1+SMHCD*DLS1)*TAI8
04330      $   +HDW1*ELS1*TAW1+0.30566168*(WI8*TI8-WI*TI9))
04340      TI9.=DTI9/3600.0
04350      *
04360      *
04370      *           RECIRCULATION LOOP MOMENTUM EQUATIONS
04380      *
04390      *
04400      R=RD(PAS2,XS3)
04410      *
04420      TAUWS3=ELS31/(21.25048*ENEVAP)+ELS32/(68.844553*ENL)
04430      TAUWS1=ELS61/(56.9*ENL)+ELS62/(50.755*ENL)
04440      $   +ELS63/(39.515*ENL)+ELS64/(14.22555*ENEVAP)
04450      *
04460      A11T=ELS1/(32.2*AS1)+ELS2/(64.4*AS1)+TAUWS1
04470      A12T=ELS2/(64.4*AS1)+0.30020714/AS1+TAUWS3
04480      A21T=ELS2/(128.8*AS1)
04490      A22T=ELS2/(128.8*AS1)+0.15010357/AS1+TAUWS3
04500      *
04510      DETERM=A11T*A22T-A12T*A21T
04520      *
04530      *           FRICTION COEFFICIENTS
04540      *
04550      PROCED FS1=RES1
04560      IF (RES1.LT.1000.0) FS1=8.0/RES1
04570      IF (RES1.GE.1000.0.AND.RES1.LT.100000.0) FS1=0.05256/(RES1**0.243)
04580      IF (RES1.GE.100000.0) FS1=0.02117/(RES1**0.164)
04590      ENDPRO
04600      FS1A=102467.41*FS1
04610      *
04620      PROCED FS2=RES2
04630      IF (RES2.LT.1000.0) FS2=8.0/RES2
04640      IF (RES2.GE.1000.0.AND.RES2.LT.100000.0) FS2=0.05256/(RES2**0.243)
04650      IF (RES2.GE.100000.0) FS2=0.02117/(RES2**0.164)
04660      ENDPRO
04670      FS2A=111974.13*FS2
04680      *
04690      DPRC=DPRCSF-FRC*(WS1S/ENL)**2
04700      *
04710      HDSPH=ELS1*RHCAS1+ELS2*RHOAS2+10.208*RHOS3-52.71*RHOTS6
04720      $   -(YS5+(DOD-6.0)/2.0)*RHOTS6
04730      CHMPH=(1./(32.2*AS1*AS1))* (WS3S**2/RHOS3-WS1S**2/RHOPS2)
04740      FRPH=(FS1A*ELS1+3529.61724+(ENE/ENL)**2.0*FS6)*(WS1D**2.0)
04750      $   +(FS2A*R*ELS2)*(WS2AD**2)+(34480.4003+9.67*FS2A*R)*(WS3D**2)
04760      *
04770      HSPH34=ELS2*RHOAS2/2.0+7.6665*RHOS3
04780      FRPH34=FS2A*R*ELS2*(WS2AD**2)/2.0+(4.835*FS2A*R
04790      $   +27809.2264)*(WS3D**2)
04800      B1T=- (HDSPH+CHMPH-144.0*DPRC+FRPH)
04810      B2T=144.0*(PAS2-PAS4)-HSPH34-CHMPH/2.0-FRPH34
04820      *
04830      WS1DD=(A22T*B1T-A12T*B2T)/(ENE*DETERM)
04840      WS3DD=(A11T*B2T-A21T*B1T)/(ENE*DETERM)

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04850 *
04860 *           DWS1D=WS1DD
04870 *
04880 *           DWS3D=WS3DD
04890 *
04900 *           WS1D.=DWS1D
04910 *           WS3D.=DWS3D
04920 *
04930 *
04940 *           IV.  STEAM  DRUM
04950 *
04960 *           FLOW TO RECIRCULATION PUMP
04970 *           WS6=WS1
04980 *
04990 *           FLOW TO SUPERHEATER
05000 *           WS7=WSA
05010 *
05020 *           TWO-PHASE MIXTURE QUALITY AND FLOW RATE
05030 *           XS4=PDELAY(XS3,TAUHS4,5,XS4I)
05040 *           WS4=WS3
05050 *
05060 *           FEEDWATER FLOW
05070 *           DWS5S=DRWS5S
05080 *           WS5S.=DWS5S
05090 *           WS5=3600.0*WS5S
05100 *
05110 *           FEEDWATER ENTHALPY
05120 *           HS5D=(WSC*HSC-3.412E6*PT/0.396688361)/WS5
05130 *           PROCED HS5=HS5D
05140 *           IF(T.EQ.0.0) HS5I=HS5=HS5D
05150 *           IF(ENHS5.EQ.1.0) HS5=PDELAY(HS5D,TAUHSS,18,HS5I)
05160 *           IF(ENHS5.EQ.2.0) HS5=HS5D
05170 *           ENDPRO
05180 *
05190 *           TWO-PHASE MIXTURE ENTHALPY
05200 *           TAUHS4=(0.66*ENEVAP*ELS31/ENL+2.1380*ELS32)*(ENL*RRHS3/WS3S)
05210 *           HFS4=HF(PAS4)
05220 *           HFS4D=PDELAY(HFS2,TAUHS4,12,HFS4DI)
05230 *           HGS4D=PDELAY(HGS2,TAUHS4,11,HGS4DI)
05240 *
05250 *
05260 *           DRUM WATER LEVEL CONTROLLER
05270 *
05280 *           YS5=3.0*(1.0+SIN(1.5707963*(EMS5/EMS5I-1.0)))
05290 *
05300 *           YS5M=YS5
05310 *           EYS5=YS5D-YS5M
05320 *           EYS5I.=EYS5
05330 *           EWS5=WSCSM-WS5SM+AEYS5*(EYS5+EYS5I/TEYS5)
05340 *           EWS5I.=EWS5
05350 *           ESV5A=AEV5*(EWS5+EWS5I/TEV5)
05360 *
05370 *           ESV5=ESV5A
05380 *
05390 *           PROCED SV5C=ESV5,SV5I
05400 *           SV5AC=SV5I+ESV5
05410 *           IF(SV5AC.LE.0.0) SV5C=0.0001
05420 *           IF(SV5AC.GT.0.0.AND.SV5AC.LE.1.0) SV5C=SV5AC
05430 *           IF(SV5AC.GT.1.0) SV5C=1.0
05440 *           ENDPRO
05450 *

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05460 *
05470      WSCSM=WSCS
05480      WS5SM=WS5S
05490 *
05500 * FEEDWATER CONTROL VALVE S.P. (ENV5)
05510 *
05520      PROCED SV5=ENV5,DLTV5,SV5I,SSV5,T,SV5C
05530      IF(ENV5.EQ.0.0) SV5=SV5C
05540      IF(ENV5.EQ.1..AND.T.EQ.0.0) SV5=SV5I
05550      IF(ENV5.EQ.1..AND.T.NE.0.0) SV5=SV5I+DLTV5
05560      IF(ENV5.EQ.2..AND.T.LE.SSV5) SV5=SV5I+DLTV5*T
05570      ENDPRO
05580 *
05590      TS5=TS1F(HS5)
05600      TAUWS5=ELS5/(21.25*ENL)
05610 *
05620      DPV5=PV5*(WS5S/(ENL*SV5))**2.0
05630 *
05640      DRWS5S=(1./TAUWS5)*(144.0*(PHFW-PAS4)-12.5*RHOW(TS5)
05650 $ -PS5*(WS5S/ENL)**2.-144.*DPV5)
05660 *
05670 *
05680      WCTEST=EMS4*DHG(PAS4)*DPAS4-XS4*WS4*(HGS4D-HGS4)/ENL
05690 *
05700 *
05710      PROCED WC=HGS4,HFS4
05720      IF(T.EQ.0.0)*WC=4702.104407
05730      IF(T.GT.0.0.AND.WCTEST.GT.0.0) WC=WCTEST/(2.*(HGS4-HFS4))
05740      IF(T.GT.0.0.AND.WCTEST.LE.0.0) WC=0.0
05750      ENDPRO
05760 *
05770 *
05780      VPS4=VP(PAS4)
05790      RHOPS4=1./VPS4
05800 *
05810 *
05820      DEMS4=(XS4*WS4-WS7)/ENL-WC
05830 *
05840      DEMS5=((1.-XS4)*WS4+WSS-WS6)/ENL+WC
05850      EMS5.=DEMS5/3600.0
05860      EMS4.=DEMS4/3600.0
05870 *
05880      D=EMS4*DVG(PAS4)
05890      DPAS4=(-1./D)*(VGS4*DEMS4+DEMS5/46.902)
05900      PAS4.=DPAS4/3600.0
05910 *
05920      DHS6=(1./(EMS5*ENL))*((1.-XS4)*WS4*HFS4D+WS5*HS5
05930 $ -WS6*HS6+ENL*WC*HFS4-ENL*HS6*DEMS5)
05940      HS6.=DHS6/3600.0
05950 *
05960 *
05970 * V. INTERMEDIATE HEAT EXCHANGER
05980 *
05990 *
06000 *
06010 * INTERMEDIATE INLET TEMPERATURE
06020      TI1=PDELAY(TI9,TAUTI1,4,TI9I)
06030      DTI1=(TI9-TI1)/TAUTI1
06040 *
06050 * PRIMARY INLET TEMPERATURE

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06060      TP5=PDELAY (TP4,TAUTP5,2,TP4I)
06070      DTP5=(TP4-TP5)/TAUTP5
06080      *
06090      RHOTP4=RHONA (TP4)
06100      TAUTP5=4071600.0*RHOTP4*ENL/WP
06110      *
06120      *
06130      TAP5=(TP5+TP7)/2.0
06140      *
06150      *
06160      ‡           HEAT TRANSFER COEFFICIENTS IN THE IHX
06170      *
06180      HNIP=1906.8776+2.2875323*(WP/ENI)**0.8
06190      HNII=2476.4331+3.1930386*(WI/ENI)**0.8
06200      HI=227149.4/(0.007650483+15.286624/HNII+13.714285/HNIP)
06210      *
06220      ROTAP5=RHONA (TAP5)
06230      *
06240      TP7=(2.0488692E-6/ROTAP5)*(-HI*(TAP5-TAI1)
06250      $   +0.3032*WP*(TP5-TP7)/ENL)
06260      *
06270      RHOTI1=RHONA (TI9)
06280      TAUTI1=4968000.0*RHOTI1*ENL/WI
06290      *
06300      *
06310      *
06320      ROTAI1=RHONA (TAI1)
06330      TI3=(3.7545E-6/ROTAI1)*(HI*(TAP5-TAI1)
06340      $   +0.30445*WI*(TI1-TI3)/ENL)
06350      *
06360      *
06370      *           VI. REACTOR
06380      *
06390      *           VI-1. POINT KINETIC EQUATIONS
06400      *           WITH FEEDBACK
06410      *
06420      BETA=3.65E- 3
06430      BD=(0.8254*D1+7.756*D2+6.66*D3+13.54*D4
06440      $   +5.908*D5+1.81*D6)*1.0E- 4
06450      BDOB=BD/BETA
06460      RHOFBC=(100.0*DC/BETA)*ALOG((460.0+TAF)/(460.0+TAFI))
06470      $   +AXECC*TAF+SODDCC*TAP1+RECC*TP1+ROPBCI
06480      RHOFBD=RHOFBC/100.0
06490      *
06500      *           LINEAR APPROXIMATIONS OF THE DESIRED PRIMARY AND INTERMEDIATE
06510      *           FLOW RATES AS WELL AS REACTOR INLET AND EXIT TEMPERATURES
06520      *           AS FUNCTIONS OF THE POWER LEVEL IN THE AUTOMATIC CONTROL RANGE.
06530      *
06540      *
06550      PROCED WPSD,WISD,TP4D,TR1D=EN,TP4I,TP7I
06560      IF(EN.GE.0.6.AND.EN.LE.ENMX) GO TO 60
06570      IF(EN.LT.0.6.AND.EN.GE.0.4) GO TO 70
06580      PRINT 50 , EN
06590      50 FORMAT(1H-//*0 POWER LEVEL IS OUT OF THE AUTOMATIC*,
06600      $* CONTROL RANGE*/10X,* EN= *,E15.5)
06610      STOP
06620      60 WPSD=11512.777*EN
06630      WISD=-1422.833+12072.833*EN
06640      TP4D=TP4I
06650      TR1D=TP7I
06660      IF(SWEN.NE.0.0.OR.EMW.NE.EMWI) TP4D=898.0+96.73*EN

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06670      IF (SWEN.NE.0.0.OR.EMW.NE.EMWI)  TR1D=644.0+86.0*EN
06680      GO TO 80
06690      70 WPSD=11512.777*EN
06700      WISD=9701.4446*EN
06710      TP4D=TP4I
06720      TR1I=TP7I
06730      IF (SWEN.NE.0.0.OR.EMW.NE.EMWI)  TP4D=918.75+62.15*EN
06740      IF (SWEN.NE.0.0.OR.EMW.NE.EMWI)  TR1D=662.7+54.834*EN
06750      80 CONTINUE
06760      ENDPRO
06770      *
06780      *
06790      *      REACTIVITY CONTROLLER
06800      *
06810      TS9M.=(1./TTS9)*(TS9-TS9M)
06820      *
06830      DTP3M=(1./TTP3)*(TP3-TP3M)
06840      TP3M.=DTP3M
06850      TP4M=TP4
06860      *
06870      PROCED ETS9=TS9D,TS9
06880      ETS9=TS9D-TS9M
06890      IF (ETS9.LE.6.0.AND.ETS9.GE.-6.0) ETS9=0.0
06900      ENDPRO
06910      ETS9I.=ETS9
06920      IP4AC=TP4D+AETS9*(ETS9+ETS9I/TETS9)
06930      *
06940      *      REACTOR OUTLET TEMPERATURE S.P. (SWTP4)
06950      *
06960      PROCED ETP41=SWTP4,TP4AC,TP4MC,TP4M
06970      IF (SWTP4.EQ.0.0) ETP41=TP4AC-TP4M
06980      IF (SWTP4.NE.0.0) ETP41=TP4MC-TP4M
06990      ENDPRO
07000      *
07010      PROCED ETP42=ETP41
07020      DTT41=1.0
07030      DTT42=-1.0
07040      IF (ETP41.GT.DTT42.AND.ETP41.LE.DTT41) ETP42=0.0
07050      IF (ETP41.GT.DTT41.OR.ETP41.LE.DTT42) ETP42=ETP41
07060      ENDPRO
07070      *
07080      ETP4I.=ETP42
07090      ENAC=EMW/EMWI+AETP4*(ETP42+ETP4I/TETP4)
07100      *
07110      *      REACTOR POWER S.P. (SWEN)
07120      *
07130      PROCED ENAC1=SWEN,ENAC,ENMC
07140      IF (SWEN.EQ.0.0) ENAC1=ENAC
07150      IF (SWEN.NE.0.0) ENAC1=ENMC
07160      ENDPRO
07170      *
07180      PROCED ENAC2=ENAC1,ENMX
07190      IF (ENAC1.LE.0.0) ENAC2=0.0
07200      IF (ENAC1.GT.0.0.AND.ENAC1.LE.ENMX) ENAC2=ENAC1
07210      IF (ENAC1.GT.ENMX) ENAC2=ENMX
07220      ENDPRO
07230      *
07240      ENM=EN
07250      *
07260      EEN=ENAC2-ENM

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07270      EENI.=EEN
07280      ECR=AEEN*(EEN+EENI/TEEN)
07290      *
07300      PROCED VCR=VCROUT,VCRIN
07310      DTVCR1=0.001
07320      DTVCR2=-0.001
07330      IF (ECR.GT.DTVCR2.AND.ECR.LT.DTVCR1) VCR=0.0
07340      IF (ECR.GT.DTVCR1) VCR=VCROUT
07350      IF (ECR.LT.DTVCR2) VCR=-VCRIN
07360      ENDPRO
07370      *
07380      X.=VCR
07390      *
07400      ROCRXD=ROCRHD*FROCRX (X)
07410      *
07420      ROCDAC=ROCRXD+ROEXCD
07430      *
07440      RHOD=ROCDAC
07450      *
07460      RHOD=RHOD+RHOFBD
07470      *
07480      PROCED EN=BDOB,RHOD
07490      EN=BDOB/(1.0 - RHOD)
07500      IF (T.EQ.0.0) EN=1.0
07510      ENDPRO
07520      *
07530      D1.=0.0129*(EN-D1)
07540      D2.=0.0312*(EN-D2)
07550      D3.=0.1330*(EN-D3)
07560      D4.=0.3450*(EN-D4)
07570      D5.=1.4100*(EN-D5)
07580      D6.=3.7500*(EN-D6)
07590      *
07600      *
07610      *      VI-2. REACTOR THERMODYNAMIC EQUATIONS
07620      *
07630      *      REACTOR INLET TEMPERATURE
07640      *
07650      TR1=PDELAY (TP7,TAUTR1,1,TP7I)
07660      *
07670      TFC=(5./9.)*(TAF-32.0)
07680      TPK=TFC+273.0
07690      AKFW=36.100867/(TFK+129.2)+5.782936E-13*TFK**3.0
07700      AKF=57.78*AKFW
07710
07720      TCLIDC=(5./9.)*(TACL-32.)
07730      TGAP=TCLIDC+273.0+0.34547*QLPR*EN
07740      HDGM=.0347424*SQRT (TGAP)-0.57059
07750      HDG=HDGM*1761.014
07760      WPD=FPC*WP/ENP
07770      HC=14861.86+51.921027*WPD**0.8
07780      *      HR=9.4247778*ENP/(0.125/AKF+60.00024/HDG+52.173914/HC
07790      *      $      +0.0052151492)
07800      HR1=9.4247778*ENP/(0.125/AKF+60.00024/HDG)
07810      HR2=9.4247778*ENP/(52.173914/HC)
07820
07830      CPCLAD=CP316 (TACL)
07840
07850      *
07860      *
07870      TAF.=2.520883E- 7*(EPS*FPGC*EN-HR1*(TAF-TACL))

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07880 *
07890 TA CL.= (6. 1690421E-8/CPCLAD) * (HR1*(TAF-TACL) -HR2*(TACL-TAP1))
07900 *
07910 *
07920 RHOTR1=RHONA (TP7)
07930 RHOTP1=RHONA (TP1)
07940 TAUTR1=1796400.0*RHOTR1*ENL/WP
07950 *
07960 DTP1= (WP/(3600.0*VP1*RHOTP1)) * (TR1-TP1)
07970 TP1.=DTP1
07980 *
07990 ROTAP1=RHONA (TAP1)
08000 TAP1= (TP1+TP3)/2.0
08010 RHOTP3=RHONA (TP3)
08020 RHOTR3=RHONA (TR3)
08030 *
08040 TP3.= (3. 4093E-5/ROTAP1) * (HR2*(TACL-TAP1) +0.3032*PFC*WP*(TP1-TP3))
08050 *
08060 TR3.= (3. 71815E-7/(RHOTP1+RHOTR3)) * (EPS*EN-0.3032*WP*(TR3-TP1))
08070 TP4.= (WP/(3600.0*VP4*RHOTP4)) * (TR3-TP4)
08080 *
08090 *
08100 *
08110 *      PRIMARY AND INTERMEDIATE LOOPS MOMENTUM EQUATIONS
08120 *
08130 QPP=1.2465E-4*WP/(ENL*RHOTP4)
08140 *
08150 QPPD=0.4487625*WPSD/(ENL*RHOTP4)
08160 HOPPD=HMM (ENPPD, QPPD)
08170 *
08180 HOPP=HMM (ENPP, QPP)
08190 QPONP=QPP/ENPP
08200 ETAPP=0.019275+69.86*QPONP-1970.0*QPONP**2.0+16531.46*QPONP**3.0
08210 *
08220 QPONPD=QPPD/ENPPD
08230 ETAPPD=0.019275+69.86*QPONPD-1970.0*QPONPD**2.0+16531.46*QPONPD**3.0
08240 *
08250 *      PRIMARY PUMP SPEED CONTROLLER
08260 *
08270 *
08280 TR1M.= (1./TTR1) * (TR1-TR1M)
08290 ETR1=TR1D-TR1M
08300 ETR1I.=ETR1
08310 *
08320 WPSAC=WPSD+AETR1*(ETR1+ETR1I/TETR1)
08330 *
08340 *      PRIMARY PUMP FLOW S. P. (SWWPS)
08350 *
08360 PROCED ENPS=SWWPS,WPSAC,WPSMC,WPSM
08370 IF (SWWPS.EQ.0.0) ENPS=WPSAC-WPSM
08380 IF (SWWPS.NE.0.0) ENPS=WPSMC-WPSM
08390 ENDPRO
08400 *
08410 EWPSI.=EWPS
08420 ENPPDD=ENPPD+AEWPS*(EWPS+EWPSI/TEWPS)
08430 *
08440 PROCED ENPPAC=ENPPDD,ENPPMX
08450 IF (ENPPDD.LE.0.0) ENPPAC=0.0
08460 IF (ENPPDD.GT.0.0.AND.ENPPDD.LE.ENPPMX) ENPPAC=ENPPDD
08470 IF (ENPPDD.GT.ENPPMX) ENPPAC=ENPPMX
08480 ENDPRO

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08490 *
08500 * PRIMARY PUMP SPEED S.P. (SWENPP)
08510 *
08520 PROCED EENPP=SWENPP,ENPPMC,ENPPAC,ENPP
08530 IF (SWENPP.EQ.0.0) EENPP=ENPPAC-ENPP
08540 IF (SWENPP.NE.0.0) EENPP=ENPPMC-ENPP
08550 ENDPRO
08560 *
08570 * ENPPI.=EENPP
08580 * EENPPC=EENPP+ENPPI/TEENPP
08590 *
08600 * ETRQP=ATRQP*EENPPC
08610 *
08620 TRQPD=9.5492952*WPSD*HOPPD/(ENL*ENPPD*ETAPPD)
08630 TRQDD=TRQPD+ETRQP
08640 *
08650 PROCED TRQPAC=TRQDD,TRQPMX
08660 IF (TRQDD.LE.0.0) TRQPAC=0.0
08670 IF (TRQDD.GT.0.0.AND.TRQDD.LE.TRQPMX) TRQPAC=TRQDD
08680 IF (TRQDD.GT.TRQPMX) TRQPAC=TRQPMX
08690 ENDPRO
08700 *
08710 * PRIMARY PUMP TORQUE S.P. (SWTRQP)
08720 *
08730 PROCED TRQPP=SWTRQP,TRQPAC,TRQPMC
08740 IF (SWTRQP.EQ.0.0) TRQPP=TRQPAC
08750 IF (SWTRQP.NE.0.0) TRQPP=TRQPMC
08760 ENDPRO
08770 *
08780 * WPSM=WPS
08790 *
08800 DRENPP=(9.5493/AIPP)*(TRQPP-8.84194E-04*WP*HOPP/(ENPP*ETAPP))
08810 *
08820 TAUWP=3.5491816/ENL+1421.9498*PFC/ENP
08830 DWPST=15.8392*RHOTR1-11.0*RHOTP1-3.0*ROTAP1-5.68333*RHOTP3
08840 $ +(HOPP-21.403855)*RHOTP4+25.369791*ROTAP5
08850 $ -(6.5714464E-4/ENL**2+F143*(PFC/ENSUB)**2.+9.7776E-6)
08860 $ *(WPS**2.)
08870 *
08880 PROCED DWPS,DENPP=ENWP,TAUWP,DWPST,DRENPP
08890 IF (ENWP.EQ.0.0) DWPS=DWPST/TAUWP
08900 IF (ENWP.EQ.0.0) DENPP=DRENPP
08910 IF (ENWP.NE.0.0) DWPS=0.0
08920 IF (ENWP.NE.0.0) DENPP=0.0
08930 ENDPRO
08940 *
08950 * SODIUM FLOW RATE IN THE PRIMARY LOOP
08960 WP=3600.0*WPS
08970 WPS.=DWPS
08980 *
08990 ENPP.=DENPP
09000 *
09010 QIP=1.24657E-4*WI/(ENL*RHOTI1)
09020 *
09030 QIPD=0.4487625*WISD/(ENL*RHOTI1)
09040 HOIPD=HMM(ENIPD,QIPD)
09050 HOIP=HMM(ENIP,QIP)
09060 QIONI=QIP/ENIP
09070 ETAIP=0.006337+72.0258*QIONI-2049.*QIONI**2+17671.51*QIONI**3
09080 *
09090 *

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09100 QIONID=QIPD/ENIPD
09110 ETAIPD=0.006337+72.0258*QIONID-2049.*QIONID**2+17671.51*QIONID**3
09120 *
09130 *
09140 * INTERMEDIATE PUMP SPEED CONTROLLER
09150 *
09160 *
09170 EPS9I.=EPS9
09180 WISAC=WISD+AEPS92*(EPS9+EPS9I/TEPS9)
09190 *
09200 PROCED EWIS=SWWIS,WISMC,WISAC
09210 IF(SWWIS.EQ.0.0) EWIS=WISAC-WISM
09220 IF(SWWIS.NE.0.0) EWIS=WISMC-WISM
09230 ENDPRO
09240 *
09250 EWISI.=EWIS
09260 ENIPDD=ENIPD+AEWIS*(EWIS+EWISI/TEWIS)
09270 *
09280 PROCED ENIPAC=ENIPDD,ENIPMX
09290 IF(ENIPDD.LE.0.0) ENIPAC=0.0
09300 IF(ENIPDD.GT.0.0.AND.ENIPDD.LE.ENIPMX) ENIPAC=ENIPDD
09310 IF(ENIPDD.GT.ENIPMX) ENIPAC=ENIPMX
09320 ENDPRO
09330 *
09340 *
09350 PROCED EENIP=SWENIP,ENIPMC,ENIPAC,ENIP
09360 IF(SWENIP.EQ.0.0) EENIP=ENIPAC-ENIP
09370 IF(SWENIP.NE.0.0) EENIP=ENIPMC-ENIP
09380 ENDPRO
09390 *
09400 ENIPI.=EENIP
09410 EENIPC=EENIP+ENIPI/TEENIP
09420 *
09430 ETRQI=ATRQI*EENIPC
09440 *
09450 TRQID=9.5492952*WISD*HOIPD/(ENL*ENIPD*ETAIPD)
09460 TRQIDD=TRQID+ETRQI
09470 *
09480 PROCED TRQIAC=TRQIDD,TRQIMX
09490 IF(TRQIDD.LE.0.0) TRQIAC=0.0
09500 IF(TRQIDD.GT.0.0.AND.TRQIDD.LE.TRQIMX) TRQIAC=TRQIDD
09510 IF(TRQIDD.GT.TRQIMX) TRQIAC=TRQIMX
09520 ENDPRO
09530 *
09540 PROCED TRQIP=SWTRQI,TRQIAC,TRQIMC
09550 IF(SWTRQI.EQ.0.0) TRQIP=TRQIAC
09560 IF(SWTRQI.NE.0.0) TRQIP=TRQIMC
09570 ENDPRO
09580 *
09590 WISM=WIS
09600 *
09610 DRENIP=(9.5493/AIIP)*(TRQIP-8.84194E-04*WI*HOIP/(ENIP*ETAIP))
09620 *
09630 TAUWI=2.4431/ENEVAP+14.356/ENL
09640 *
09650 DWIST=(HOIP+7.815098)*RHOTI1-25.36979*ROTAI1
09660 $ -17.86197*RHOTI3+35.416666*(ROTAIA+RHOIE-RHOTIC)
09670 $ -(1.1521861E-3/ENEVAP**2.+1.148583E-3/ENL**2.)*(WIS**2.)
09680 *
09690 PROCED DWIS,DENIP=ENWI,TAUWI,DWIST,DRENIP
09700 IF(ENWI.EQ.0.0) DWIS=DWIST/TAUWI

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09710      IF (ENWI.EQ.0.0)  DENIP=DRENIP
09720      IF (ENWI.NE.0.0)  DWIS=0.0
09730      IF (ENWI.NE.0.0)  DENIP=0.0
09740      ENDPRO
09750      *
09760      *  SODIUM FLOW RATE FOR THE INTERMEDIATE LOOP
09770      WIS.=DWIS
09780      WI=3600.0*WIS
09790      *
09800      ENIP.=DENIP
09810      *
09820      *  THE REMAINING EQUATIONS IN THE $D1 BLOCK ARE APPROXIMATIONS
09830      *  OF THE MAXIMUM FUEL, CLAD, AND COOLANT TEMPERATURES
09840      *  BASED ON THE ASSUMPTION OF STEADY STATE HEAT FLOW.
09850      *  THEY ARE NOT FULLY CONSISTENT WITH THE DYNAMIC MODEL
09860      *  USED TO SOLVE FOR THE AVERAGE FUEL, CLAD, AND COOLANT
09870      *  TEMPERATURES AND SHOULD NOT BE INTERPRETED AS SUCH.
09880      *
09890      *
09900      *  MAX. AVERAGE AND HOT CHANNEL TEMPERATURES
09910      *  AND THEIR LOCATIONS RELATIVE TO CORE CENTRAL PLANE
09920      *
09930      HRM=      1. / (0.25 /AKF+60.00024/HDG+52.173914/HC +0.0052151492)
09940      HRS=1./{(60.00024/HDG+52.173914/HC+0.0052151492)}
09950      *
09960      *
09970      *  THE THEORETICAL LOCATIONS OF THE MAX. TEMPS. AT THE PIN-CLAD
09980      *  OUTER SURFACE, PIN SURFACE, AND FUEL
09990      *  PIN CENTER LINE IN THE AVG. CHANNEL
10000      *
10010      YCMXTH=1.5078339*ATAN(0.29944753*HC/WPD)
10020      YSMXTH=1.5078339*ATAN(15.62335*HRS/WPD)
10030      YPMXTH=1.5078339*ATAN(15.62335*HRM/WPD)
10040      *
10050      *
10060      *  THE LOCATION OF THE CLAD OUTER SURFACE MAX. TEMP. IN
10070      *  THE AVG. CHANNEL
10080      *
10090      PROCED  YCMAX=YCMXTH
10100      IF (YCMXTH.LT.1.5)  YCMAX=YCMXTH
10110      IF (YCMXTH.GE.1.5)  YCMAX=1.5
10120      ENDPRO
10130      *
10140      *  THE LOCATION OF THE FUEL PIN MAX. SURFACE TEMP. IN
10150      *  THE AVG. CHANNEL
10160      *
10170      PROCED  YSMAX=YSMXTH
10180      IF (YSMXTH.LT.1.5)  YSMAX=YSMXTH
10190      IF (YSMXTH.GE.1.5)  YSMAX=1.5
10200      ENDPRO
10210      *
10220      *  THE LOCATION OF THE FUEL PIN MAX. CENTER LINE TEMP. IN
10230      *  THE AVG. CHANNEL
10240      *
10250      PROCED  YPMAX=YPMXTH
10260      IF (YPMXTH.LT.1.5)  YPMAX=YPMXTH
10270      IF (YPMXTH.GE.1.5)  YPMAX=1.5
10280      ENDPRO
10290      *
10300      *  THE THEORETICAL LOCATIONS OF THE MAX. TEMPS. AT THE PIN-CLAD
10310      *  OUTER SURFACE, PIN SURFACE, AND FUEL PIN CENTER LINE IN THE

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10320 *      HOT CHANNEL
10330 *
10340      YCMTH=1.5078339*ATAN(0.17787267*HC/WPD)
10350      YSMTH=1.5078339*ATAN(0.001401791/(WPD*(0.0078808679/HC
10360 $      +4.4692799E- 7+0.0063842402/HDG)))
10370      YFMTH=1.5078339*ATAN(0.001401791/(WPD*(0.0078808679/HC
10380 $      +4.4692799E- 7+0.0063842402/HDG+1.9770937E- 5/AKF)))
10390 *
10400 *      THE LOCATION OF THE PIN-CLAD OUTER SURFACE MAX.
10410 *      TEMP. IN THE HOT CHANNEL
10420 *
10430      PROCED YCMM=YCMTH
10440      IF (YCMTH.LT.1.5)   YCMM=YCMTH
10450      IF (YCMTH.GE.1.5)   YCMM=1.5
10460      ENDPRO
10470 *
10480 *      THE LOCATION OF THE FUEL PIN MAX. SURFACE TEMP. IN
10490 *      THE HOT CHANNEL
10500 *
10510      PROCED YSMH=YSMTH
10520      IF (YSMTH.LT.1.5)   YSMH=YSMTH
10530      IF (YSMTH.GE.1.5)   YSMH=1.5
10540      ENDPRO
10550 *
10560 *      THE LOCATION OF THE FUEL PIN MAX. CENTER LINE TEMP. IN
10570 *      THE HOT CHANNEL
10580 *
10590      PROCED YFMM=YFMTH
10600      IF (YFMTH.LT.1.5)   YFMM=YFMTH
10610      IF (YFMTH.GE.1.5)   YFMM=1.5
10620      ENDPRO
10630 *
10640 *
10650 *
10660 *      VOLUMETRIC HEAT GENERATION AT THE CENTER OF THE FUEL
10670 *      PIN IN THE AVG. CHANNEL
10680 *
10690      QC=0.045077766*EPS*PPGC*EN
10700 *
10710 *      COOLANT MAX. TEMP. AT THE EXIT OF THE AVG. CHANNEL
10720 *
10730      TPCMAX=TP1+7.6761921E- 5*EPS*PPGC*EN/WPD
10740 *
10750 *      THE TEMP. RISE OF THE SODIUM COOLANT
10760 *      FROM THE CORE INLET TO THE LEVEL
10770 *      OF THE MAX. TEMP. AT THE PIN-CLAD
10780 *      OUTER SURFACE IN THE AVG. CHANNEL
10790 *
10800      DTP1CX=(4.5780019E- 5*EPS*PPGC*EN/WPD)
10810 $      *(0.838378+SIN(0.66320299*YCMAX))
10820 *
10830 *      THE TEMP. RISE OF THE SODIUM COOLANT
10840 *      FROM THE CORE INLET TO THE LEVEL
10850 *      OF THE MAX. TEMP. AT THE PIN-CLAD
10860 *      OUTER SURFACE IN THE HOT CHANNEL
10870 *
10880      DTP1CM=(5.06327E- 5*EPS*PPGC*EN/WPD)
10890 $      *(0.838378+SIN(0.66320299*YCMH))
10900 *
10910 *      THE SODIUM COOLANT TEMP. AT THE

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10920 * LEVEL OF THE MAX. TEMP. OF THE
 10930 * PIN-CLAD OUTER SURFACE IN THE AVG. CHANNEL
 10940 *
 10950 * $TPYCMX=TP1+DTP1CX$
 10960 *
 10970 * THE DIFFERENCE BETWEEN THE PIN-CLAD
 10980 * OUTER SURFACE TEMP. AND THE
 10990 * SODIUM COOLANT TEMP. AT THE LEVEL
 11000 * OF THE MAX. TEMP. OF THE CLAD
 11010 * OUTER SURFACE IN THE AVG. CHANNEL
 11020 *
 11030 * $DTPCMX=0.0033915082*QC*COS(0.66320299*YCMAX)/HC$
 11040 *
 11050 * THE DIFFERENCE BETWEEN THE PIN-CLAD
 11060 * OUTER SURFACE TEMP. AND THE
 11070 * SODIUM COOLANT TEMP. AT THE LEVEL
 11080 * OF THE MAX. TEMP. OF THE CLAD
 11090 * OUTER SURFACE IN THE HOT CHANNEL
 11100 *
 11110 * $DTPCH=0.0033915082*QC*COS(0.66320299*YCHM)/HC$
 11120 *
 11130 * MAX. PIN-CLAD OUTER SURFACE TEMP. IN THE AVG. CHANNEL
 11140 *
 11150 * $TCMAX=TPYCMX+DTPCMX$
 11160 *
 11170 * THE TEMP. RISE OF THE SODIUM COOLANT
 11180 * FROM THE CORE INLET TO THE LEVEL
 11190 * OF THE MAX. TEMP. AT THE FUEL
 11200 * PIN SURFACE IN THE AVG. CHANNEL
 11210 *
 11220 * $DTP1SX=(4.5780019E-5*EPS*FPGC*EN/WPD)$
 11230 * $S*(0.838378+SIN(0.66320299*YSMAX))$
 11240 *
 11250 * THE SODIUM COOLANT TEMP. AT THE LEVEL
 11260 * OF THE MAX. TEMP. OF THE
 11270 * FUEL PIN SURFACE IN THE HOT CHANNEL
 11280 *
 11290 * $DIP1SM=(5.06327E-5*EPS*FPGC*EN/WPD)$
 11300 * $S*(0.838378+SIN(0.66320299*YSMM))$
 11310 *
 11320 * THE SODIUM COOLANT TEMP. AT THE LEVEL
 11330 * OF THE MAX. TEMP. OF THE
 11340 * FUEL PIN SURFACE IN THE AVG. CHANNEL
 11350 *
 11360 * $TPYSMX=TP1+DTP1SX$
 11370 *
 11380 * MAX. FUEL PIN SURFACE TEMP. IN THE AVG. CHANNEL
 11390 *
 11400 * $ISMAY=TPYSMX+6.5003905E-5*QC*COS(0.66320299*YSMAX)/HRS$
 11410 *
 11420 * THE TEMP. RISE OF THE SODIUM COOLANT
 11430 * FROM THE CORE INLET TO THE LEVEL
 11440 * OF THE MAX. TEMP. AT THE FUEL PIN
 11450 * CENTER LINE IN THE AVG. CHANNEL
 11460 *
 11470 * $DTP1FX=(4.5780019E-5*EPS*FPGC*EN/WPD)$
 11480 * $S*(0.838378+SIN(0.66320299*YFMAX))$
 11490 *
 11500 * THE TEMP. RISE OF THE SODIUM COOLANT
 11510 * FROM THE CORE INLET TO THE LEVEL
 11520 * OF THE MAX. TEMP. AT THE FUEL PIN


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11530 * CENTER LINE IN THE HOT CHANNEL
11540 *
11550 DTP1FM=(5.06327E- 5*EPS*FPGC*EN/WPD)
11560 $ *(0.838378+SIN(0.66320299*YFMM))
11570 *
11580 * THE SODIUM COOLANT TEMP. AT THE LEVEL OF THE MAX. TEMP. OF THE
11590 * FUEL PIN AT ITS CENTER LINE IN THE AVG. CHANNEL
11600 *
11610 TPYPMX=TP1+DTP1FX
11620 *
11630 * MAX. FUEL PIN TEMP. AT ITS CENTER LINE IN THE AVG. CHANNEL
11640 *
11650 TFMAX=TPYPMX+6.5003905E- 5*QC* $\cos(0.66320299*YFMAX)$ /HRM
11660 *
11670 * COOLANT MAX. TEMP. IN THE HOT CHANNEL
11680 *
11690 TPNM=1.248*(TP1+8.4898684E-5*EPS*FPGC*EN/WPD)
11700 *
11710 * PIN-CLAD MAX. OUTER SURFACE TEMP. IN THE HOT CHANNEL
11720 *
11730 TCMN=1.248*(TP1+DTP1CM)+2.323706*DTPCM
11740 *
11750 * FUEL PIN MAX. SURFACE TEMP. IN THE HOT CHANNEL
11760 *
11770 TSMN=1.248*(TP1+DTP1SM)+(0.0078808679/HC+4.4692799E- 7
11780 $ +0.0063842402/HDG)*QC* $\cos(0.66320299*YSMN)$ 
11790 *
11800 * FUEL PIN MAX. CENTER LINE TEMP. IN THE HOT CHANNEL
11810 *
11820 TFMN=1.248*(TP1+DTP1FM)+(0.0078808679/HC+4.4692799E- 7
11830 $ +0.0063842402/HDG+1.9770937E- 5/AKF)*QC* $\cos(0.66320299*YFMN)$ 
11840 *
11850 *
11860 *
11870 *
11880 *
11890 STORE , WS9,PS9,TS9,HS9,SS9,XEXH,HEXH,STWBTU,PT,PGPETA,PONG,PGE,
11900 $ EMW,PGA,PETAG,OMGG,AL,E,PF,XD,WSA,WSC,RHOASA,CPS,PSA,PSC,TSA,
11910 $ TSC,HSA,HSC,TIC,TASA,TAWA,TAIA,ELS1,ELS2,WS1,WS3,XS3,ALF3,HS3,
11920 $ TAW1,TAW2,TAI7,TAI8,TAI9,PAS2,ALPA2,HS1,TS1,TAS1,TSAT,B1T,B2T,
11930 $ DETERM,EMS4,EMS5,YS5,PAS4,HS6,RHCD,EN,TAF,TAP1,TAP5,TAI1,TAI3,
11940 $ TAUTR1,TP7,TP1,TAUTP5,TP3,TP4,TP5,WP,WI,TPMAX,TPMM,YCMAX,YCMM,
11950 $ TCMAX,TCMM,YSMAX,TSMAX,YSMM,TSMM,YFMAX,TFMAX,YFMM,TFMM,WC,
11960 $ DWPS,DWIS,TAUWP,TAUWI,WS5,HS5,QPP,HOPP,QIP,HOIP,TR1,DWSAS,
11970 $ ROEXCD,X,XCR,TAUTI1,TAUTIA,TAUTI7,TAUHS1,TAUHS4,TAUHS5,TAUTS9,
11980 $ WDMP,TAI7,TAI8,TAI9,TAI1,TR3,ENPP,ETAPP,ENIP,ETAIP,DPAS4,DEMS4,
11990 $ DEMS5,TACL,ENAC2,EENI,ECR,EEN
12000 *
12010 *
12020 *
12030 *
12040 $T1
12050 RHONA , 6
12060 * NEXT IS THE INDEPENDENT VARIABLE FOLLOWED BY THE DEPENDENT
12070 392.0 ,56.4
12080 572.0 ,55.1
12090 752.0 ,53.6
12100 932.0 ,52.1
12110 1112.0 ,50.5
12120 1292.0 ,48.9
12130 $T2

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12140	TS1F , 12	
12150	374.97	,400.0
12160	396.77	,420.0
12170	418.9	,440.0
12180	430.1	,450.0
12190	441.4	,460.0
12200	464.4	,480.0
12210	487.8	,500.0
12220	511.9	,520.0
12230	536.6	,540.0
12240	562.2	,560.0
12250	588.9	,580.0
12260	610.0	,600.0
12270	\$T3	
12280	RHOW , 12	
12290	400.0	,53.648
12300	420.0	,52.798
12310	440.0	,51.921
12320	450.0	,51.546
12330	460.0	,51.02
12340	480.0	,50.0
12350	500.0	,49.02
12360	520.0	,47.847
12370	540.0	,46.512
12380	560.0	,45.249
12390	580.0	,43.860
12400	600.0	,43.373
12410	\$T4	
12420	VF , 6	
12430	1200.0	,0.0223
12440	1300.0	,0.0227
12450	1400.0	,0.0231
12460	1500.0	,0.0235
12470	2000.0	,0.0257
12480	2500.0	,0.0287
12490	\$T5	
12500	HF , 6	
12510	1200.0	,571.7
12520	1300.0	,585.4
12530	1400.0	,598.7
12540	1500.0	,611.6
12550	2000.0	,671.7
12560	2500.0	,730.6
12570	\$T6	
12580	TSATF , 6	
12590	1200.0	,567.22
12600	1300.0	,577.46
12610	1400.0	,587.1
12620	1500.0	,596.23
12630	2000.0	,635.82
12640	2500.0	,668.13
12650	\$T7	
12660	VG , 6	
12670	1200.0	,0.3619
12680	1300.0	,0.3293
12690	1400.0	,0.3012
12700	1500.0	,0.2765
12710	2000.0	,0.1878
12720	2500.0	,0.1307
12730	\$T8	
12740	HG , 6	

12750		1200.0	,1183.4				
12760		1300.0	,1178.6				
12770		1400.0	,1173.4				
12780		1500.0	,1167.9				
12790		2000.0	,1135.1				
12800		2500.0	,1091.1				
12810	\$T9						
12820	RD , 3 , 5						
12830	*						
12840	* THE FOLLOWING IS A DEFINITION OF THE SECOND						
12850	* INDEPENDENT VARIABLE.						
12860	*						
12870		0.2	,0.4	,0.6	,0.8	,1.0	
12880	*						
12890	* NEXT COMES THE FIRST INDEPENDENT VARIABLE						
12900	* FOLLOWED BY THE DEPENDENT VARIABLE.						
12910	*						
12920		1000.0	,4.81801	,7.43707	,10.6082	,12.915	,14.4123
12930		2000.0	,2.48938	,3.21363	,4.30274	,4.97874	,5.35559
12940		2500.0	,1.72844	,2.23131	,2.6778	,2.98751	,2.98751
12950	\$T10						
12960	VSH , 6,5						
12970		700.0	,800.0	,900.0	,1000.0	,1200.0	
12980		1200.0	,0.4909	,0.5617	,0.6250	,0.6843	,0.7967
12990		1400.0	,0.4062	,0.4714	,0.5281	,0.5805	,0.6789
13000		1600.0	,0.3417	,0.4034	,0.4553	,0.5027	,0.5906
13010		1800.0	,0.2907	,0.3502	,0.3986	,0.4421	,0.5218
13020		2000.0	,0.2489	,0.3074	,0.3532	,0.3935	,0.4668
13030		2500.0	,0.1686	,0.2294	,0.2710	,0.3061	,0.3678
13040	\$T11						
13050	HSH , 6,5						
13060		700.0	,800.0	,900.0	,1000.0	,1200.0	
13070		1200.0	,1311.0	,1379.3	,1440.7	,1499.2	,1613.1
13080		1400.0	,1295.5	,1369.1	,1433.1	,1493.2	,1608.9
13090		1600.0	,1278.7	,1358.4	,1425.3	,1487.0	,1604.6
13100		1800.0	,1260.3	,1347.2	,1417.4	,1480.8	,1600.4
13110		2000.0	,1240.0	,1335.5	,1409.2	,1474.5	,1596.1
13120		2500.0	,1176.8	,1303.6	,1387.8	,1458.4	,1585.3
13130	\$T12						
13140	S9 , 6,5						
13150		700.0	,800.0	,900.0	,1000.0	,1200.0	
13160		1200.0	,1.4843	,1.5409	,1.5859	,1.6293	,1.7025
13170		1400.0	,1.4567	,1.5177	,1.5666	,1.6093	,1.6386
13180		1600.0	,1.4304	,1.4964	,1.5476	,1.5914	,1.6669
13190		1800.0	,1.4044	,1.4765	,1.5301	,1.5752	,1.6520
13200		2000.0	,1.3783	,1.4576	,1.5139	,1.5603	,1.6384
13210		2500.0	,1.3073	,1.4127	,1.4772	,1.5273	,1.6088
13220	\$T13						
13230	HMM , 9,12						
13240		0.0	,4.0	,8.0	,12.0	,16.0	
13250	\$,20.0	,24.0	,28.0	,32.0	,36.0	,40.0
13260	\$,44.0					
13270		500.0	,98.8	,97.8	,94.9	,89.2	,79.5
13280	\$,65.7	,50.0	,32.0	,22.0	,10.0	,5.0
13290	\$,2.0					
13300		980.0	,380.0	,378.0	,376.0	,370.0	,363.0
13310	\$,353.0	,340.0	,322.0	,302.0	,277.0	,244.0
13320	\$,210.0					
13330		1006.0	,400.0	,398.5	,396.0	,391.0	,384.0
13340	\$,374.0	,361.0	,342.647	,308.92	,300.0	,266.0

13350	\$,230.0					
13360		1030.0	,419.0	,418.0	,415.0	,410.0	,404.0
13370	\$,393.0	,380.0	,364.0	,343.0	,319.0	,288.0
13380	\$,253.0					
13390		1150.0	,514.0	,512.0	,510.0	,504.0	,496.0
13400	\$,486.0	,470.0	,454.0	,440.0	,420.0	,390.0
13410	\$,355.0					
13420		1170.0	,532.0	,531.0	,528.0	,522.0	,514.0
13430	\$,504.0	,489.0	,472.0	,463.6156	,431.5789	,410.0
13440	\$,375.0					
13450		1200.0	,560.0	,558.0	,555.0	,549.0	,541.5
13460	\$,531.0	,516.0	,500.0	,485.0	,466.0	,439.0
13470	\$,404.0					
13480		1400.0	,775.0	,773.0	,770.0	,765.0	,758.0
13490	\$,749.0	,738.0	,723.0	,705.0	,684.0	,658.0
13500	\$,634.0					
13510		1500.0	,874.0	,872.0	,870.0	,865.0	,856.0
13520	\$,846.0	,833.0	,817.0	,797.0	,776.0	,758.0
13530	\$,736.0					
13540	\$T14						
13550		ELD, 13					
13560		0.0	,380.0				
13570		3600.0	,381.5				
13580		7200.0	,382.3				
13590		10800.0	,383.5				
13600		14400.0	,384.7				
13610		18000.0	,388.0				
13620		21600.0	,391.0				
13630		25200.0	,392.0				
13640		28800.0	,392.2				
13650		32400.0	,392.1				
13660		36000.0	,391.9				
13670		39600.0	,391.0				
13680		43200.0	,390.0				
13690	*						
13700	\$T15						
13710		PROCRX, 13					
13720		0.0	,0.0				
13730		2.4	,0.01				
13740		4.8	,0.04				
13750		7.2	,0.09334				
13760		12.0	,0.24				
13770		14.4	,0.32667				
13780		18.0	,0.47334				
13790		21.6	,0.62667				
13800		26.4	,0.82667				
13810		28.8	,0.92				
13820		31.2	,0.97334				
13830		33.6	,0.99334				
13840		36.0	,1.0				
13850	*						
13860	\$T16						
13870		CP316, 6					
13880		800.	,0.13491				
13890		1000.	,0.13691				
13900		1200.	,0.13990				
13910		1400.	,0.14690				
13920		1600.	,0.15490				
13930		1800.	,0.16489				
13940	*						
13950	\$F						

```

13960      FUNCTION DHF (PAS)
13970      PAS21=PAS-50.0
13980      PAS22=PAS+50.0
13990      HF1=HF (PAS21)
14000      HF2=HF (PAS22)
14010      DHF= (HF2-HF1) /100.0
14020      RETURN
14030      END
14040      FUNCTION DVF (PAS)
14050      PAS21=PAS-50.0
14060      PAS22=PAS+50.0
14070      VF1=VF (PAS21)
14080      VF2=VF (PAS22)
14090      DVF= (VF2-VF1) /100.0
14100      RETURN
14110      END
14120      FUNCTION DVG (PAS)
14130      PAS21=PAS-50.0
14140      PAS22=PAS+50.0
14150      VG1=VG (PAS21)
14160      VG2=VG (PAS22)
14170      DVG= (VG2-VG1) /100.0
14180      RETURN
14190      END
14200      FUNCTION DHG (PAS)
14210      PAS21=PAS-50.0
14220      PAS22=PAS+50.0
14230      HG1=HG (PAS21)
14240      HG2=HG (PAS22)
14250      DHG= (HG2-HG1) /100.0
14260      RETURN
14270      END
14280      *
14290      *
14300      *
14310      END
14320      TMAX=50.0      ,      DT=1.0E-5      ,      DTMIN=1.0E-6
14330      NPOINT=51
14340      ZMAX=1.0E-4
14350      SY (8) =3.0
14360      PETAG=25.5703      ,      OMGG=376.99
14370      WSAS=927.7778      ,      PT=387.6
14380      ISC=905.0      ,      TAWA=872.25542      ,      TIC=855.0
14390      ELS1=21.30163215
14400      PAS2=1830.7      ,      PAS4=1765.7
14410      WS1D=0.410258133      ,      WS3D=0.410258133      ,      WS5S=927.7778
14420      TAW1=658.92569      ,      TAW2=738.6297799
14430      TI8=713.3668532      ,      TI9=651.0
14440      EMS5=23451.00      ,      HS6=542.3975098
14450      D1=1.0      ,      D2=1.0      ,      D3=1.0
14460      D4=1.0      ,      D5=1.0      ,      D6=1.0
14470      WPS=11512.777      ,      WIS=10650.0
14480      TAP=2165.50      ,      TP3=1035.729      ,      QLPR=229.67
14490      TACL=898.354
14500      TP1=730.0      ,      TP4=994.73      ,      TR3=994.73
14510      TP7=730.0      ,      TI3=936.0
14520      ENPP=1170.0      ,      ENIP=1006.0
14530      ZNS=2271      ,      ENSC2=2.0
14540      ENL=3.0      ,      ENEVAP=6.0
14550      ENI=8550.0      ,      ENE=4542.0

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14560	ENP=42966.0		
14570	EMWI=380.0		
14580	EXAI=0.2		
14590	SV9I=0.85		
14600	PS9I=1464.7		
14610	CV9=22.28	,	ENS94=4.0
14620	AV9=5.66816		
14630	CDMP=0.126685		
14640	OMGGI=376.99		
14650	HS1I=542.3975098		
14660	TICI=855.0		
14670	DPRCSP=175.0	,	FRC=6.9983815E-5 , FS6=1.6211611E-2
14680	DOD=7.0		
14690	EMS5I=23451.0		
14700	FS5=0.323461696	,	FV5=7.685E-5 , SV5I=0.7
14710	HFS4DI=651.35014	,	HGS4DI=1146.20608 , XS4I=.5
14720	EMS4=2179.933261		
14730	RHOCDI=2.9015527	,	ROFBCI=95.6 , DC=-0.0058
14740	SODDCC=-0.006	,	RECC=-0.21 , AXECC=-0.023
14750	VP1=3000.0	,	VP4=6325.0
14760	EPS=3.3267E 9	,	PPGC=0.9239
14770	AIPP=497.3	,	AIIP=497.3
14780	PFC=0.8		
14790	TAFI=400.0	,	TP7I=730.0
14800	TP4I=994.73135		
14810	TI3I=936.0	,	TI9I=651.0
14820	TSCI=905.0	,	PAS4I=1765.7
14830	F143=5.72335	,	ENSUB=198.0
14840	ELSC1=200.0	,	ELSC2=100.0
14850	ELSH7=65.0	,	ELS7=120.0
14860	ELS31=70.0	,	ELS32=10.0
14870	ELS61=15.0	,	ELS62=100.0
14880	ELS63=75.0	,	ELS64=30.0
14890	ELS5=250.0		
14900	TS9D=900.0		
14910	PS9D=1464.7	,	PEXHD=2.0 , PS9MX=1500.0
14920	YS5D=3.0		
14930	ENPPD=1170.0	,	ENIPD=1006.0
14940	TS9M=900.0		
14950	TP3M=1035.73		
14960	TR1M=730.0		
14970	AEPT=0.7	,	AEPS91=-0.05 , AEPEXH=13.5
14980	AEOMGG=3.0	,	AEMW1=1.0 , ASV9=2.25E-3
14990	AEYS5=8.0E4	,	AESV5=2.25E-3 , APEXH=2.1556E-3
15000	AEPS92=0.5	,	AETR1=50.0 , AEVDMP=-0.0007
15010	AEWPS=0.1	,	AEWIS=0.1
15020	ATRQP=15.3	,	ATRQI=13.85
15030	AETS9=1.1	,	AETP4=0.0001
15040	AZEN=1.0	,	VCROUT=0.15 , VCRIN=0.15
15050	TEEMW=10.0	,	TSV9=0.5
15060	TEYS5=10.0	,	TESV5=10.0
15070	TTR1=5.0		
15080	TEPS9=10.0	,	TETR1=10.0 , TEVDMP=10.0
15090	TEENPP=10.0	,	TEENIP=10.0
15100	TEWPS=10.0	,	TEWIS=10.0
15110	TTS9=5.0		
15120	TEEN=100.0		
15130	TTP3=5.0		
15140	PHFW=2000.0		
15150	ENPPMX=1500.0	,	ENIPMX=1400.0
15160	TRQPMX=2.3E4	,	TRQIMX=2.0E4

```

15170      TETS9=100.0      ,      TETP4=100.0
15180      ENMX=1.5
15190      X=12.0          ,      ROCRHD=2.0
15200      ENROC=1.0      ,      DLTROC=10.
15210      *
15220      END
15230      *      CRBRP ATWS SIMULATOR WITH CONTROLLERS
15240      *      TURBO-GENERATOR
15250      LIST,FETAG,OMGG,PGFETA,POMG,PGE,PT
15260      LIST,WS9,PS9,TS9,HS9
15270      *      STEAM-GENERATOR
15280      *      SUPERHEATER
15290      LIST,WSC,TASA,TAWA,TAIA
15300      LIST,PSA,PSC,TSA,TSC,HSC,TIA,TIC
15310      *      EVAPORATOR
15320      LIST,ELS1,ELS2,XS3,ALF3,HS3
15330      LIST,TI8,TI9,TAW1,TAW2,HS1,TSAT
15340      LIST,WS1,WS3,PAS2,ALFA2
15350      *      STEAM DRUM
15360      LIST,WS5,HS5,YS5,PAS4,WC,EMS4,EMS5
15370      *      REACTOR AND IHX
15380      *      IHX
15390      LIST,TP7,TI3,TP5,TI1,TAP5,TAI1
15400      *      REACTOR
15410      LIST,WP,WI,X,RHOD,EN,TAF,TACL
15420      LIST,TR1,TP1,TAP1,TP3,TR3,TP4
15430      LIST,ENPP,ETAPP,HOPP,ENIP,ETAIP,HOIP
15440      *      DELAYS
15450      LIST,TAUTS9,TAUHS4,TAUHS1,TAUTI7,TAUTIA
15460      LIST,TAUTII1,TAUTP5,TAUTR1
15470      *      MAX. TEMPS. IN THE AVG. AND HOT CHANNELS AND THEIR AXIAL LOCATIONS
15480      LIST,TPMAX,TPHM,YCMAX,TCMAX,YCHM,TCMH
15490      LIST,TSMAX,YSMM,TSMM,YFMAX,TFMAX,YFMM,TFMM
15500      END

```

APPENDIX C

Some Comments on Computer Graphics

In addition to the capability of generating output listings such as the samples in the report, DARE P contains two graphics packages (line printer plots and CALCOMP graphs). At our local installation, we have augmented these by interactive graphics using a Tektronix Model 4010-1 terminal in conjunction with a DEC-10 computer. Samples are shown in Figs. 2-5.

These graphs are generated on the Tektronix screen using interactive FORTRAN programs that call the Tektronix Advanced Graphics subroutines. The DARE P output listings are sent over a computer link from the CYBER-175 to the DEC-10, where they appear as disk files. These files are read by the interactive graphics programs, and graphs are plotted in response to keyboard commands.

Options include: number and size of graphs, line style, number of grid lines, placement of labels, and the ability to select a portion of any graph for plotting on an expanded scale. This capability is very useful in the interpretation of large system simulations.

POSTSCRIPT

Since this manual was prepared, an error was discovered in the reactor thermodynamic equations.

The error is in the heat transfer coefficients for heat transfer from fuel to cladding and cladding to coolant. To correct this, the following lines should be changed.

230-270 Replace 2.4215565 with 2.4524460 wherever it appears.
 7800 HR1 = 9.4247778*ENP/(0.125/AKF + 60.09024/HDG + .0027891)
 7810 HR2 = 9.4247778*ENP/(52.173914/HC + .0024258)
 14480 TAF = 2202.67, TP3 = 1035.729, QLPR = 229.67
 14490 TACL = 916.8293

The underlines indicate the portions that have alterations or additions.

The resulting changes in the output are very small. The peak value of TAF changes from 2237.44 to 2275.56; the increase in TAF above its initial value changes from 71.94 to 72.89. The peak value of TACL changes from 902.387 to 921.603; the increase in TACL above its initial value changes from 4.033 to 4.774. The peaks are not shifted in time. The reactivity RHOD changes sign at the right time, and typical values are, at $t = 50$, $-8.23877E-4$ (old) and $-8.17164E-4$ (new). Most of the other variables are affected only in the sixth significant figure (if at all).

The BRENDA models are under continuing review and evaluation. A file of changes is being maintained, and is available from the authors on request.