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TRANTEMP: A Code for Calculating Transient Temperature Distributions in Reactor Hydraulic Rabbit Facilities

by

Bryant N. Kristianson

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Reactor Technology

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Reactor Engineering Division

November 1968

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NOMENCLATURE

Symbol	Description
c	Specific heat, Btu/(lb)(°F)
c_m	Metal specific heat, Btu/(lb)(°F)
c_p	Specific heat at constant pressure, Btu/(lb)(°F)
c_w	Water specific heat at constant pressure, Btu/(lb)(°F)
h	Heat-transfer coefficient, Btu/(hr)(ft^2)(°F)
$h_{1,2,3,\ldots,8}$	Heat-transfer coefficients at radial nodes, Btu/(hr)(ft^2)(°F)
k	Conductivity, Btu/(hr)(ft)(°F)
k_m	Metal conductivity, Btu/(hr)(ft)(°F)
q	Heating rate, Btu/hr
r	Radius, ft
$r_{1,2,3,\ldots,8}$	Radii of nodes, ft
t	Time, hr
A	Heat-transfer area, ft^2
D	Diameter (see Fig. 1)
D_h	Hydraulic diameter, ft
G	Mass velocity, lb/(hr)(ft^2)
Q	Volumetric heating rate, Btu/(hr)(ft^3)
Q_m	Metal volumetric heating rate, Btu/(hr)(ft^3)
Q_w	Water volumetric heating rate, Btu/(hr)(ft^3)

Symbol	Description
R	Radius (see Fig. 1)
T	Temperature, °F
T_{bw}	Bulk water temperature, °F
T_W	Wall temperature, °F
$T_{1,2,3,\ldots,8}$	Temperatures at radial nodes, °F
$T^{①}$	Temperature at beginning of time interval, °F
$T^{②}$	Temperature during time interval, °F
$T^{③}$	Temperature at end of time interval, °F
V	Volume, ft^3
Δr_1	$r_2 - r_1$, ft
Δr_2	$r_3 - r_2$, ft
Δr_5	$r_6 - r_5$, ft
Δr_6	$r_7 - r_6$, ft
Δt	Time interval, hr
ΔT	Temperature increment, °F
μ	Water viscosity, lb/(hr)(ft)
ρ	Density, lb/ft^3
ρ_m	Density at metal node, lb/ft^3
ρ_w	Density at water node, lb/ft^3

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ABSTRACT

Written in FORTRAN for the CDC-3600 computer, the TRANTEMP Code (ANL designation: RE-418X) solves a set of numerical heat-balance equations. These equations describe the space- and time-dependent temperatures prevailing in a cylindrical, hydraulic rabbit assembly, which is heated by nuclear radiation and cooled by flowing water. Included are the mathematical model, the computer input specifications, a sample problem, and a FORTRAN listing of the code.

I. INTRODUCTION

Increased interest in advanced nuclear power plants has reflected a corresponding increase in the need for reactor test facilities for both short- and long-term irradiation of potential fuels and structural materials in environments approximating the high neutron fluxes, temperatures, and pressures anticipated in these plants.

Of the many types of static or dynamic irradiation facilities provided in research reactors and some production reactors, a most versatile type is the rabbit facility. Depending on the type of reactor and the experimental restrictions, small samples (rabbits) of candidate materials can by cycled into and out of the reactor core through pneumatic or hydraulic systems which penetrate the core. In either system, valuable irradiation data can be obtained up to the temperature, heat transfer, and hydraulic limits imposed by the reactor. The advantage of these systems is that, unlike some other types of irradiation facilities which require reactor shutdown for insertion of experiments, a large number of irradiations can be performed independently of reactor operation.

Coordination between reactor operation and safety is a vital factor in the planning, design, and hazards analysis of in-pile rabbit systems. Many of the experiment controls must be interlocked with reactor safety circuits to safeguard the reactor and experiment from potentially hazardous

conditions. System parameters or operating characteristics likely to promote these conditions must be interlocked with reactor control circuits to initiate reactor shutdown or to effect power reductions at a rate consistent with the nature of the hazard.

The array of vertical irradiation test facilities proposed for installation in the Internal Thermal Column (ITC) of the water-cooled and -moderated Argonne Advanced Research Reactor (AARR)[1]* included five hydraulic rabbit tubes. These were to operate safely at all times; they were not to cause, contribute to, or intensify any potentially dangerous reactor conditions. Such conditions could have included creation of voids in the ITC, reactor power excursions caused by positive reactivity inputs associated with rabbit movement, and melting of the rabbit.

Some of these conditions could be attributed to certain heat-transfer problems which might be encountered during operation of the rabbit facilities. Of particular interest were problems of transient heating and heat transfer associated with reactor power fluctuations, changes in coolant flowrate, coolant flow reversal which prefaces rabbit removal operations, and rabbit movement. For example, the time elapsed during flow reversal will reflect a temperature rise in the rabbit and coolant and a fluctuation in the coolant pressure. An increase in coolant temperature, combined with a decrease in coolant pressure, could lead to boiling at the rabbit surface, with a possible resultant increase in reactivity due to void formation in the ITC, and a possible decrease in heat transfer from the rabbit. In such an event, a continued increase in the temperature of the rabbit could result in its partial or total meltdown. Under these conditions, a large surge of pressure resulting from flow reversal could terminate in failure of the rabbit facility tubing, if a proper reactor power reduction or total shutdown had not been effected. Thus, a method for computing the transient heat generation and temperature distributions was essential to a comprehensive design and safety analysis of the proposed installation.

Transient heat-transfer analysis in this case involves complex numerical calculations that are best performed with a digital computer. Because of deficiencies in available transient heat-transfer computer codes, a code was developed for analyzing heat transfer in the AARR hydraulic rabbit system under all transient conditions, including flow reversal and rabbit ejection. Appropriately entitled TRANTEMP and written in FORTRAN for a CDC-3600 computer, the code solves a set of numerical heat-balance equations which describe the space- and time-dependent temperatures in a cylindrical hydraulic rabbit assembly heated by nuclear radiation and cooled by flowing water.

---

*The AEC terminated the AARR Project in April 1968.

Although developed specifically for analysis of the AARR hydraulic rabbit system, the TRANTEMP code possibly can be used to analyze similar systems in other water-cooled reactors. To facilitate such use, this report describes the pertinent system and transient heat balance equations, gives the computer input specifications, details a sample problem, and includes a FORTRAN listing of the code.

II. INTERNAL THERMAL COLUMN IRRADIATION FACILITY

Located centrally in the reactor core, the ITC contains an assembly (designated the ITC Facility) of nine vertical tubes for short- and long-term irradiation of encapsulated samples in a region of high thermal neutron flux (maximum unperturbed flux = 5.5×10^{15} n/(cm^2)(sec) at 100 MW). With reference to the plan view (Fig. 1), the assembly comprises five hydraulic rabbit tubes, two pneumatic rabbit U-tubes, and two static basket tubes. Long-term irradiations (several core cycles) are performed in the static basket tubes, which are inaccessible during reactor operation. Irradiations of a few milliseconds duration are performed in the fast-gas rabbit U-tube. Short to long irradiations (seconds to core life) are performed in the gas-cooled rabbit U-tube and the hydraulic rabbit tubes.

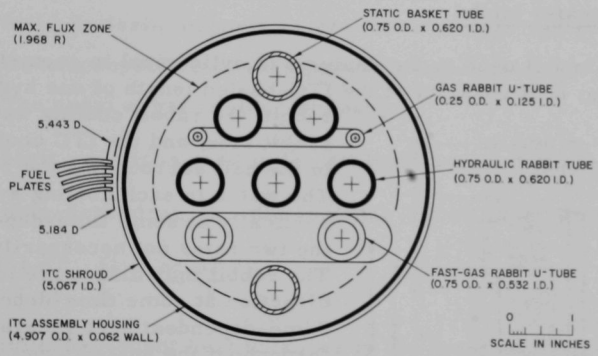

Fig. 1. Plan View of ITC Irradiation Test Facilities in AARR

The ITC Facility is a two-piece, interlocked assembly which penetrates a quick-opening closure plug in the reactor vessel. The lower, tubular section, which contains all the irradiation facilities, extends downward about 13 ft from the top of the reactor vessel and terminates just below the core. It is supported vertically by the quick-opening closure plug and laterally by guides above and below the core. During reactor fueling operations, the lower section is installed and removed as a one-piece unit. The upper section contains the fittings that interconnect with the various hydraulic and gas rabbit tubes; it is mounted atop, and breech-locked to, the closure plug. Sealing is effected by synthetic rubber O-rings.

During reactor operation, primary coolant flow is maintained through and around the lower section, the static basket tubes, and the hydraulic rabbit tubes by using the reactor-core pressure drop. Cooling water above the core enters each tube, flows down and around the sample, and discharges below the core. The outer surface of the ITC assembly housing is cooled by primary coolant, which flows through the annulus formed by the housing and the ITC shroud (see Fig. 1). Bulk ITC water within the housing is used to cool the outer surfaces of the irradiation-facility tubes; its velocity is kept intentionally low to prevent rapid introduction of voids in this area. Coolant enters the bulk ITC volume through ports in the ITC shroud, flows upward to the top of the lower ITC assembly housing and down through the housing, and discharges through holes in the rabbit tube lateral-support grid plate. A pressure differential of ~110 psi is available over the ITC facility.

The gas rabbit U-tube and the fast-gas rabbit U-tube are internally cooled by helium flow only when a sample is being irradiated. Heat generated by the in-core facility hardware is removed by the primary coolant water.

III. ANALYTICAL DEVELOPMENT

A. Heat-transfer Model

The model used in the analysis is cylindrical in geometry. As shown in Fig. 2, it consists of the ITC-heated length of one hydraulic rabbit, the rabbit cooling water, the rabbit tube, and the ITC cooling water in the cell surrounding the rabbit tube. The water in each cooling system flows vertically at some time-dependent rate, the two rates not necessarily the same. The rabbit may also move in a vertical direction at some time-dependent rate. Time-dependent heat generation occurs throughout the heated zone. This heat is supplied by the reactor via gamma and neutron radiation.

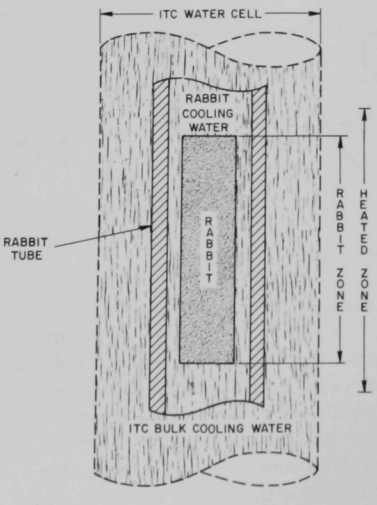

Fig. 2. Partial-section Schematic Diagram of One Hydraulic Rabbit Assembly

B. Assumptions, Conditions, and Basic Equations

The following assumptions, conditions, and basic equations are prerequisite to a numerical solution for a heat-transfer problem of this type:

1. All water present is assumed to be in the liquid state.

2. The "normal" water flow direction is downward.
3. The rabbit is a cylinder of homogeneous material perfectly centered in the rabbit tube.
4. The rabbit moves only in the upward direction when it does move.
5. The initial temperature map for the model is known.
6. No radial temperature gradient exists in either of the two water systems.
7. Radiative heat transfer is neglected.
8. One-dimensional heat transfer is by conduction and convection in the radial direction.
9. Heat transfer occurs in the time interval while all water and rabbit motion is "frozen."
10. Heat transport* for a time interval occurs in one finite, discrete "jump"; i.e., time is "frozen."
11. The radial boundary of the ITC water cell is perfectly insulated; i.e., there is no heat transfer through the boundary.
12. Solid-material properties are invariant with temperature.
13. Water properties are temperature-dependent.
14. The nodal array is fixed in space.

The basic equations used in the analysis are as follows:

For time-dependent, one-dimensional (radial) heat conduction,

$$\frac{\partial^2 T}{\partial r^2} + \frac{1}{r}\frac{\partial T}{\partial r} + \frac{Q}{k} = \frac{\rho c}{k}\frac{\partial T}{\partial t}. \tag{1}$$

For time-dependent heat balances in the two water zones,

$$hA(T_{bw} - T_W) + q = \rho V c \frac{dT_{bw}}{dt}. \tag{2}$$

With reference to Fig. 3, radial nodes are fixed at eight, with No. 1 to 3 existing only in the rabbit, No. 4 being the rabbit coolant node, No. 5 to 7 the nodes in the rabbit-tube wall, and No. 8 the ITC coolant node. Radial nodes in the rabbit and rabbit-tube wall are equally spaced, but not necessarily at the same intervals in both.

*Heat transfer due to movement of heated bodies of matter.

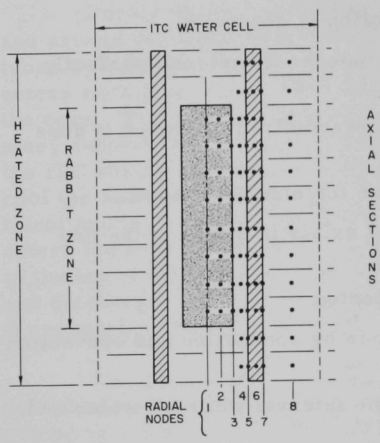

Fig. 3. Nodal Array Used in Analysis of One Hydraulic Rabbit Assembly

In the axial direction, the nodes are located at the center of equal-length sections into which the heated zone is divided. These sections, in turn, are separated into two groups: rabbit-free and rabbit-affected.

C. Transient Heat-balance Equations

1. Heat Transfer in the Stationary Mode ("Frozen" Motion)

Following the nodal arrangement and the method of Dusinberre,[2] detailed finite-difference equations are derived (from Eqs. 1 and 2) that describe the heat balance for the radial nodes in each of the rabbit-free and rabbit-affected axial sections.

a. Rabbit-free Sections (Nodes No. 4 to 8)

Node No. 4

$$\frac{2(T_5^{②} - T_4^{②})}{r_5^2} + \frac{Q_w}{h_5 r_5} = \frac{\rho_w c_w}{h_5 r_5} \frac{T_4^{③} - T_4^{①}}{\Delta t} \tag{3}$$

Node No. 5

$$\frac{8h_5 r_5 (T_4^{②} - T_5^{②})}{k_m \Delta r_5 (4r_5 + \Delta r_5)} + \frac{4(2r_5 + \Delta r_5)(T_6^{②} - T_5^{②})}{(\Delta r_5)^2 (4r_5 + \Delta r_5)} + \frac{Q_m}{k_m} = \frac{\rho_m c_m}{k_m \Delta t} (T_5^{③} - T_5^{①}) \tag{4}$$

Node No. 6

$$\frac{(2r_6 - \Delta r_6)(T_5^{②} - T_6^{②})}{2r_6 (\Delta r_6)^2} + \frac{(2r_6 + \Delta r_6)(T_7^{②} - T_6^{②})}{2r_6 (\Delta r_6)^2} + \frac{Q_m}{k_m} = \frac{\rho_m c_m}{k_m \Delta t} (T_6^{③} - T_6^{①}) \tag{5}$$

Node No. 7

$$\frac{4(2r_7 - \Delta r_6)(T_6^{②} - T_7^{②})}{(\Delta r_6)^2 (4r_7 - \Delta r_6)} + \frac{8h_7 r_7 (T_8^{②} - T_7^{②})}{k_m (\Delta r_6)(4r_7 - \Delta r_6)} + \frac{Q_m}{k_m} = \frac{\rho_m c_m}{k_m \Delta t} (T_7^{③} - T_7^{①}) \tag{6}$$

Node No. 8

$$\frac{2(T_7^{②} - T_8^{②})}{r_8^2 - r_7^2} + \frac{Q_w}{h_7 r_7} = \frac{\rho_w c_w}{h_7 r_7 \Delta t}(T_8^{③} - T_8^{①}) \tag{7}$$

b. Rabbit-affected Sections (Nodes No. 1 to 8)

Node No. 1

$$\frac{4(T_2^{②} - T_1^{②})}{(\Delta r_1)^2} + \frac{Q_m}{k_m} = \frac{\rho_m c_m}{k_m \Delta t}(T_1^{③} - T_1^{①}) \tag{8}$$

Node No. 2

$$\frac{2r_2 - \Delta r_1}{2r_2(\Delta r_1)^2}(T_1^{②} - T_2^{②}) + \frac{2r_2 + \Delta r_2}{2r_2(\Delta r_1)^2}(T_3^{②} - T_2^{②}) + \frac{Q_m}{k_m} = \frac{\rho_m c_m}{k_m \Delta t}(T_2^{③} - T_2^{①}) \tag{9}$$

Node No. 3

$$\frac{4(2r_3 - \Delta r_2)}{(\Delta r_2)^2(4r_3 - \Delta r_2)}(T_2^{②} - T_3^{②}) + \frac{8h_3 r_3}{k_m \Delta r_2(4r_3 - \Delta r_2)}(T_4^{②} - T_3^{②}) + \frac{Q_m}{k_m} =$$

$$\frac{\rho_m c_m}{k_m \Delta t}(T_3^{③} - T_3^{①}) \tag{10}$$

Node No. 4

$$\left(\frac{2}{r_5^2 - r_3^2}\right)\left[\frac{h_3 r_3(T_3^{②} - T_4^{②}) + h_5 r_5(T_5^{②} - T_4^{②})}{h_3 r_3 + h_5 r_5}\right] + \frac{Q_w}{h_3 r_3 + h_5 r_5} =$$

$$\frac{\rho_w c_w(T_4^{③} - T_4^{①})}{(h_3 r_3 + h_5 r_5)\,\Delta t} \tag{11}$$

Nodes No. 5 to 8

Equations for Nodes No. 5 to 8 are the same as Eqs. 4 to 7, respectively. The values of all $T_i^{②}$ terms in Eqs. 3 to 11 are the simple averages of the beginning-of-interval and end-of-interval temperatures; i.e.,

$$T_i^{②} = \frac{T_i^{①} + T_i^{③}}{2}. \tag{12}$$

When Eq. 12 is substituted into Eqs. 3 to 11, the only unknowns are the end-of-interval node temperatures. These temperatures are obtained by simultaneous solution of the appropriate sets of equations for each axial section. Since it is assumed that no axial heat transfer takes place, each axial section can be treated independently within each time interval. Also, since the solution is implicit, no iterating is involved and no restriction need be placed on geometric parameters or duration of the time interval. The solution will not "blow up" because of a large geometrical increment or a long time interval; however, a degree of accuracy could be sacrificed for large input values in either case.

2. Heat Transfer in the Moving Mode ("Frozen" Time)

As mentioned earlier, heat transfer is assumed to occur in the time interval while all water and rabbit motion is "frozen." However, before the heat transfer is calculated, all heat transport for that time interval is allowed to take place in one finite, discrete "jump"; i.e., time is "frozen." Also, water expansion caused by heating is allowed to occur in the direction of water flow.

Since all nodes are fixed in space, the node temperatures must be adjusted according to the amount of travel of the water and the rabbit. These adjusted temperatures are then used as the beginning-of-interval temperatures for heat-transfer calculations in the next stationary mode ("frozen" motion).

D. Empirical Formulations

1. Heat-transfer Coefficient

The heat-transfer coefficient used in some of the preceding transient heat-balance equations is determined according to the following bulk liquid correlation:[3]

$$h = \frac{0.023\,k}{D_h}\left(\frac{D_h G}{\mu}\right)^{0.8}\left(\frac{c_p \mu}{k}\right)^{0.4} . \tag{13}$$

2. Water Properties

Water properties in Eq. 13 are temperature-dependent in the following manner:[4]

$$k = 0.3329 + 0.0003148T, \tag{14}$$

$$\mu = 7.695 - 13.88(T/100) + 12.10(T/100)^2 - 5.086(T/100)^3 + 0.8176(T/100)^4, \tag{15}$$

and

$$c_p = 0.9970 + 0.1777(T/1000) - 2.090(T/1000)^2 + 12.30(T/1000)^3 - 18.33(T/1000)^4. \quad (16)$$

Temperature-dependent water density (in lb/ft^3) is given by

$$\rho = 62.20 + 1.270(T/100) - 1.952(T/100)^2 + 0.5638(T/100)^3 - 0.08217(T/100)^4. \quad (17)$$

E. Steady-state Heat-balance Equations

Steady-state equations are obtained by setting $\Delta T/\Delta t$ equal to zero in Eqs. 3 to 11. These equations can then be solved quite readily without having to adjust node temperatures because of water and rabbit movement.

IV. METHOD OF SOLUTION

A. Order of Calculations

Heat transfer in the stationary mode and heat transport in the moving mode are computed for each successive time interval in the following order:

1. Stationary Mode

a. The beginning-of-interval nodal temperature map is known, either being given as input for the first time interval or having been computed from the previous time interval.

b. Temperature-dependent properties are computed for the water in each axial section, using the beginning-of-interval nodal temperature map.

c. The flowrate in each coolant system is computed at the beginning-of-interval time, using straight-line interpolation applied to input values of time-dependent flowrate.

d. Heat-transfer coefficients are determined for each axial section, using Eq. 13.

e. Time- and position-dependent heating rates at the beginning of the time interval are determined for the metal and water in each axial section by straight-line interpolation of the time-dependent and position-dependent heating rates, given as input. The heating rate in the

two coolant systems is, in addition, density-dependent; it is calculated knowing the water density in each axial section.

At this point, all necessary values for the axial section equation sets are known except for the end-of-interval node temperatures. These temperatures are obtained by simultaneous solution of the equation sets, and may be printed out and/or used for calculations during the moving-mode adjustments preparatory to the next time interval.

2. Moving Mode

f. The node temperatures are adjusted to account for water flow, water expansion in the direction of flow, and rabbit movement. If the flow is in the normal (downward) direction, the water inlet temperature used is that given as an input value. If the flow is reversed, the water "reverse" inlet temperature is assigned the latest, highest water outlet temperature value determined during flow in the normal direction. These calculations are performed separately and independently for the two coolant systems.

The amount of rabbit movement is determined by straight-line interpolation of input values of rabbit position vs time. Rabbit position is the measured distance between the lower end of the rabbit and the lower end of the heated zone (see Fig. 2).

g. The adjusted node temperatures computed in this manner represent the temperature map input for stationary-mode ("frozen" motion) heat-transfer calculations in the next time interval.

B. Computer Input

The symbols used in this explanation of the input deck structure are for orderly cataloging only; they do not intentionally correspond to nomenclature used elsewhere in this report. Where appearing, I denotes a fixed-point (integer) input, and X a floating-point input.

Card No.: 1 Variable: I1 Format: I12

I1 = 0	New problem.
= 1	Continue previously completed problem.
= 2	Continue previous problem, which was terminated because allowed computer time was exhausted.

Card No.: 2-5 Format: 4A72

Any title desired. Four cards must be used, even if some are left blank.

Card No.: 6	Variables: I2, I3, I4, I5, I6, I7	Format: 6I12
	I2	Total number of axial sections (≤50).
	I3*	Axial section initially containing lower end of rabbit.
	I4*	Axial section initially containing upper end of rabbit.
	I5	Total number of pairs of values (≤50) for normalized (to value at time zero) heat-generation rate vs time.
	I6	Total number of pairs of values (≤50) for normalized (to value at time zero) rabbit-tube flowrate vs time.
	I7	Total number of pairs of values (≤50) for rabbit position vs time.

Card No.: 7	Variables: I8, I9, I10, I11, I12, I13	Format: 6I12
	I8 = 0	Debug option is activated, and many quantities are printed as they are computed (not normally used for production runs).
	= 1	Debug option is suppressed.
	I9 = -1	All initial node temperatures have a single value (X12 in the following).
	= 1	All initial node temperatures are read in point by point (X23 in the following).
	I10 = 0	Initial node temperatures (X12 or X23) are overridden by a steady-state calculation which determines the steady-state temperature map of the model.
	= 1	Steady-state calculation is bypassed.
	I11 = 0	Problem is terminated after printout of steady-state temperature map.
	= 1	Problem continues following printout of steady-state temperature map.
	I12	Compute/print ratio for the temperature map.
	I13	Total number of pairs of values (≤50) for normalized (to value at time zero) primary flow vs time.

*If the end of rabbit does not extend more than halfway into section, then the section is to be considered rabbit-free.

Card No.: 8* Variables: X1a, X1b, X1c, ... Format: 6E12.5

X1a	Inner-to-outer radii for radial Nodes
X1b	No. 2 to 8 (in inches).
X1c	
.	.
.	.
.	.

Card No.: 9 Variables: X2, X3, X4, X5, X6, X7 Format: 6E12.5

X2	Length of heated zone (in inches).
X3	Length of rabbit or total length of several rabbits placed end to end (in inches).
X4	Initial rabbit position (in inches).
X5	Computation time interval (in seconds).
X6	Delayed time at which the debug option will be activated if it was not activated initially (in seconds).
X7	Problem termination time (in seconds).

Card No.: 10 Variables: X8, X9, X10, X11 Format: 4E12.5

X8	Initial axial-position-dependent peak heating rate in the water systems (in W/g).
X9	Initial axial-position-dependent peak heating rate in the metal (in W/g).
X10	Initial mass flowrate in the open rabbit tube (in $lb/(hr)(ft^2)$).
X11	Initial mass flowrate in the primary water cell (in $lb/(hr)(ft^2)$).

Card No.: 11 Variables: X12, X13, X14, X15, X16, X17 Format: 6E12.5

X12	Constant temperature value for the initial node temperatures (in °F).
X13	Bulk water inlet temperature for the tube water (in °F).
X14	Bulk water inlet temperature for the primary water cell (in °F).
X15	Metal conductivity (in Btu/(hr)(ft)(°F)).
X16	Metal density (in lb/ft^3).
X17	Metal specific heat (in Btu/(lb)(°F)).

*Continuation onto one more card is necessary.

Card No.: 12* Variables: X18a, X18b, X18c, ... Format: 6E12.5

X18a X18b X18c . . .	Initial normalized (to maximum value) axial heat-generation profile. . . .

Card No.: 13* Variables: X19a, X19b, X19c, ... Format: 6E12.5

X19a X19b X19c . . .	Pairs of values for normalized (to value at time zero) heat-generation rate vs time (in seconds). Time is given first for each pair. . . .

Card No.: 14* Variables: X20a, X20b, X20c, ... Format: 6E12.5

X20a X20b X20c . . .	Pairs of values for normalized (to value at time zero) rabbit-tube flowrate vs time (in seconds). Time is given first for each pair. . . .

Card No.: 15* Variables: X21a, X21b, X21c, ... Format: 6E12.5

X21a X21b X21c . . .	Pairs of values for normalized (to value at time zero) primary water cell flowrate vs time (in seconds). Time is given first for each pair. . . .

Card No.: 16* Variables: X22a, X22b, X22c, ... Format: 6E12.5

X22a X22b X22c . . .	Pairs of values for rabbit position (in inches) vs time (in seconds). Time is given first for each pair. . . .

*Continue on as many cards as necessary.

Card No.: 17*	Variables:	X23a, X23b, X23c, ...	Format: 6E12.5
	X23a X23b X23c	If I9 = 1, initial node temperatures (in °F) read in point by point (inner-to-outer radial nodes for each axial section from top to bottom). Dummy filler values must be used in axial sections where radial Nodes No. 1 to 3 do not exist.	
	.	.	
	.	.	
	.	.	

C. Computer Output

The standard output for a problem consists of:

1. The input data in the order in which it appears on the input cards.
2. A geometric map of the model with the rabbit in its initial position.
3. The input temperature map with node temperatures placed as shown on the geometric map.
4. The overriding steady-state temperature map, if it is computed.
5. Time-dependent temperature maps.

V. GENERAL APPLICABILITY

The TRANTEMP code probably will find its primary use directed toward determining reactor operating conditions under which boiling might occur in a hydraulic rabbit system. Since the system water is always assumed to be in the liquid state, the onset of boiling, although not "flagged" by the code, can be determined if the system pressure is known, by examining the calculated time-dependent water temperatures.

There is no limit on the range of flowrates that can be used in either the rabbit cooling system or the rabbit-tube cooling system, and these two flowrates are completely independent of each other. Moreover, there is no limit on the heating rate range or on the axial heat-generation profile. Therefore, the consequences of tube-flow blockage can be analyzed.

Any dimensions can be used to fit any given heat-transfer model; the only restriction is that cylindrical geometry must be used.

*Continue on as many cards as necessary.

The TRANTEMP Code can be adapted for use on any computer with a 32k memory that can process coding written in the FORTRAN language. No unusual library functions are required. Finally, because the number of radial nodes (hence, the maximum number of equations requiring simultaneous solution) is fixed at eight, the running time for any problem is almost directly proportional to the number of axial sections and inversely proportional to the duration of the computation time interval. For example, the hypothetical problem analyzed in Appendix A required 138 sec of running time on the CDC-3600 computer.

APPENDIX A

Sample Problem

The computer input and output displayed in this appendix are illustrative of a hypothetical hydraulic rabbit system problem which can be solved using the TRANTEMP code described in the text.

The input information for the sample problem is reproduced on pages 24 and 25. The listing of the input deck is given on page 26.

Appendix B gives a complete listing of the FORTRAN source deck.

1. Problem Input

The following explanatory comments are made with reference to the input data sheets and the corresponding instructions given in Section IV.B of the text.

Card No. 1. This is a new problem (I1 = 0).

Card No. 6. There are 20 equal-length axial sections (I2). Axial section No. 4 initially contains the lower end of the rabbit (I3). Axial section No. 17 initially contains the upper end of the rabbit (I4). There are seven pairs of values (I5) for normalized heat-generation rate vs time, seven pairs of values (I6) for normalized tube flow vs time, and ten pairs of values (I7) for rabbit position vs time.

Card No. 7. The debug option is suppressed (I8 = 1). The initial node temperatures all have a single value (I9 = -1); however, these temperatures are overridden (I10 = 0) by a steady-state temperature map calculation based on time-independent conditions evaluated at time zero. The problem continues following printout of the steady-state temperature map (I11 = 1). Every 10th time-dependent temperature map computed is printed out (I12 = 10). There are seven pairs of values (I13 = 7) for normalized primary flow vs time.

Cards No. 8. The inner-to-outer radii (r_2, r_3, ..., r_8) are, respectively, 0.125, 0.25, 0.28125, 0.3125, 0.34375, 0.375, and 0.5 in. (X1a, X1b, ..., X1g). Radius r_1 is always taken to be zero.

Card No. 9. The length of the heated zone is 27.559 in. (X2). The rabbit is 20 in. long (X3) and centered in both the radial and axial directions. The bottom of the rabbit is 3.7795 in. above the bottom of the heated zone (X4). The computation time interval is 0.01 sec (X5). The debug option is to be activated at 10 sec (X6); however, since the problem termination time is 4 sec (X7), this option will not be activated.

Card No. 10. The maximum initial heating rate is 138 W/g in the two water systems (X8) and 72 W/g in the metal (X9). The initial mass flowrate is 1.4×10^6 lb/(hr)(ft^2) in the open rabbit tube (X10) and 8.9796×10^5 lb/(hr)(ft^2) in the primary water cell (X11).

Card No. 11. The single constant temperature value for the initial node temperatures (X12) is 130°F. The bulk water inlet temperature for both the tube (X13) and primary water (X14) is 120°F. The metal is aluminum, with a conductivity (X15) of 123.12 Btu/(hr)(ft)(°F), density (X16) of 168.512 lb/ft^3, and specific heat (X17) of 0.215 Btu/(lb)(°F).

Cards No. 12. An assumed sinusoidal axial heat-generation profile over the length of the heated zone is approximated by the 20 normalized node values as given on the input cards.

Cards No. 13. The pairs of values for normalized heat-generation rate vs time are listed in order for the following times: 0.0, 0.25, 0.5, 0.75, 1.0, 2.0, and 5.0 sec.

Cards No. 14. The pairs of values for normalized rabbit-tube flowrate vs time are listed in order for the following times: 0.0, 0.25, 0.5, 0.75, 1.0, 3.0, and 5.0 sec.

Cards No. 15. The pairs of values for normalized primary water cell flowrate vs time are listed in order for the following times: 0.0, 0.25, 0.5, 0.75, 1.0, 3.0, and 5.0 sec.

Cards No. 16. The pairs of values for rabbit position vs time are listed in order for the following times: 0.0, 0.75, 1.0, 1.1, 1.2, 1.3, 1.4, 2.0, 3.0, and 5.0 sec. The rabbit must not proceed in a reverse direction at a rate greater than the reverse rabbit-tube water flow (values given on Cards No. 14). If input is inadvertently submitted so that this situation occurs, a diagnostic message will be printed and the problem terminated.

Cards No. 17. Since I9 = -1, this set of cards is omitted.

2. Problem Output

The output for the sample problem is reproduced on pages 27 to 60.

INPUT DATA

PROGRAM TRANTEMP PROBLEM SAMPLE ORIGINATOR DATE PAGE 1 OF 2

	0											CARD 1
******	******	******	******	******	***TITLE1***	******	******	******	******	******	******	CARD 2
******	******	******	******	******	***TITLE2***	******	******	******	******	******	******	CARD 3
******	******	******	******	******	***TITLE3***	******	******	******	******	******	******	CARD 4
******	******	******	******	******	***TITLE4***	******	******	******	******	******	******	CARD 5
	20		4		17		7		7		10	CARD 6
	1		-1		0		1		10		7	CARD 7
	.125		.25		.28125		.3125		.34375		.375	CARD 8A
	.5											CARD 8B
	27.559		20.		3.7795		.01		10.		4.	CARD 9
	138.		72.		1.4E+6	8.9	796E+5					CARD 10
	130.		120.		120.		123.12		168.512		.215	CARD 11
	.07846		.23345		.38268		.52250		.64945		.76041	CARD 12A
	.85264		.92388		.97237		.99692		.99692		.97237	CARD 12B
	.92388		.85264		.76041		.64945		.52250		.38268	CARD 12C
	.23345		.07846									CARD 12D
	0.		1.		.25		.99		.5		.975	CARD 13A
	.75		.925		1.		.85		2.		.53	CARD 13B
	5.		.5									CARD 13C
	0.		1.		.25		.5		.5		0.	CARD 14A

INPUT DATA

PROGRAM PROBLEM ORIGINATOR DATE PAGE 2 OF 2

	.75		-.5		1.		-1.		3.		-1.	CARD 14B
	5.		-1.									CARD 14C
	0.		1.		.25		.5		.5		0.	CARD 15A
	.75		-.5		1.		-1.		3.		-1.	CARD 15B
	5.		-1.									CARD 15C
	0.		3.7795		.75		3.7795		1.		13.	CARD 16A
	1.1		17.		1.2		21.		1.3		25.	CARD 16B
	1.4		30.		2.		35.		3.		37.	CARD 16C
	5.		38.									CARD 16D

LISTING OF INPUT DECK

```
          0                                                                CARD  1
*********************************TITLE1*********************************CARD  2
*********************************TITLE2*********************************CARD  3
*********************************TITLE3*********************************CARD  4
*********************************TITLE4*********************************CARD  5
         20          4         17          7          7         10CARD  6
          1         -1          0          1         10          7CARD  7
       .125        .25     .28125      .3125     ,34375       .375CARD  8A
         .5                                                         CARD  8B
     27.559        20.     3,7795        .01        10.         4.CARD  9
       138.        72.     1,4E+6  8.9796E+5                       CARD 10
       130.       120.       120.     123.12    168,512       .215CARD 11
     .07846     .23345     .38268     ,52250     ,64945     ,76041CARD 12A
     .85264     .92388     .97237     ,99692     ,99692     ,97237CARD 12B
     .92388     .85264     .76041     ,64945     ,52250     ,38268CARD 12C
     .23345     .07846                                               CARD 12D
         0.         1.        .25        .99         ,5       ,975CARD 13A
        .75       .925         1.        .85         2.        ,53CARD 13B
         5.         ,5                                               CARD 13C
         0.         1.        .25         ,5         ,5         0.CARD 14A
        .75        -,5         1.        -1.         3.        -1.CARD 14B
         5.        -1.                                               CARD 14C
         0.         1.        ,25         ,5         ,5         0.CARD 15A
        .75        -,5         1.        -1.         3.        -1.CARD 15B
         5.        -1.                                               CARD 15C
         0.     3.7795        ,75     3.7795         1.        13.CARD 16A
        1.1        17.        1,2        21.        1,3        25.CARD 16B
        1.4        30.         2.        35.         3.        37.CARD 16C
         5.        38.                                               CARD 16D
```

INPUT INFORMATION

**********TITLE1**********
**********TITLE2**********
**********TITLE3**********
**********TITLE4**********

CARD 6***	TOTAL AXIAL SECTIONS	AXIAL SECTION CONTAINING BOTTOM END OF RABBIT SAMPLE	AXIAL SECTION CONTAINING TOP END OF RABBIT SAMPLE	TOTAL NUMBER OF NORMALIZED HEAT GENERATION RATE VERSUS TIME PAIRS OF VALUES	TOTAL NUMBER OF NORMALIZED TUBE FLOW VERSUS TIME PAIRS OF VALUES	TOTAL NUMBER OF RABBIT POSITION VERSUS TIME PAIRS OF VALUES
	20	4	17	7	7	10

CARD 7***	DEBUG OPTION (INITIAL)	OPTION FOR INITIAL TEMPERATURE MAP	STEADY-STATE COMPUTATION OPTION	STEADY-STATE TERMINATE OPTION	COMPUTE/PRINT FREQUENCY	TOTAL NUMBER OF NORMALIZED PRIMARY FLOW VERSUS TIME PAIRS OF VALUES
	1	-1	0	1	10	7

CARDS 8***

INNER-TO-OUTER RADII (INCHES)

FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH	SEVENTH	EIGHTH
0.0000	0.1250	0.2500	0.2813	0.3125	0.3438	0.3750	0.5000

CARD 9***	HEATED LENGTH OF RABBIT TUBE (INCHES)	LENGTH OF RABBIT SAMPLE (INCHES)	DISTANCE BETWEEN LOWER END OF RABBIT AND LOWER END OF HEATED SECTION (INCHES)	COMPUTATION TIME INTERVAL (SECONDS)	STARTING TIME FOR DELAYED DEBUG (SECONDS)	PROBLEM TERMINATION (SECONDS)
	27.5590	20.0000	3.7795	0.0100	10.0000	4.0000

CARD 10***	MAXIMUM, INITIAL HEATING RATE IN WATER (WATTS/GM)	MAXIMUM, INITIAL HEATING RATE IN METAL (WATTS/GM)	INITIAL MASS FLOW IN THE OPEN RABBIT TUBE (LB/HR-SQ. FT)	INITIAL MASS FLOW IN THE PRIMARY (LB/HR-SQ. FT)
	138.0000	72.0000	1400000.0000	897960.0000

CARD 11***	TEMPERATURE VALUE FOR CONSTANT TEMPERATURE MAP (DEGREE F)	TUBE WATER INLET TEMPERATURE (DEGREE F)	PRIMARY WATER INLET TEMPERATURE (DEGREE F)	METAL CONDUCTIVITY (BTU/HR-FT-DEGREE F)	METAL DENSITY (PCF)	METAL SPECIFIC HEAT (BTU/LB-DEGREE F)
	130.0000	120.0000	120.0000	123.1200	168.5120	0.2150

CARDS 12***

NORMALIZED AXIAL HEAT GENERATION PROFILE

AXIAL POSITION	NORMALIZED HEAT GENERATION RATE
1	0.0785
2	0.2334
3	0.3827
4	0.5225
5	0.6494
6	0.7604
7	0.8526
8	0.9239
9	0.9724
10	0.9969
11	0.9969
12	0.9724
13	0.9239
14	0.8526
15	0.7604
16	0.6494
17	0.5225
18	0.3827
19	0.2334
20	0.0785

CARDS 13***

NORMALIZED HEAT GENERATION RATE VERSUS TIME

TIME (SECONDS)	NORMALIZED HEAT GENERATION RATE
0.0000	1.0000
0.2500	0.9900
0.5000	0.9750
0.7500	0.9250
1.0000	0.8500
2.0000	0.5300
5.0000	0.5000

CARDS 14***

NORMALIZED RABBIT TUBE FLOW RATE VERSUS TIME

TIME (SECONDS)	NORMALIZED FLOW RATE
0.0000	1.0000
0.2500	0.5000
0.5000	0.0000
0.7500	-0.5000
1.0000	-1.0000
3.0000	-1.0000
5.0000	-1.0000

CARDS 15***

NORMALIZED PRIMARY FLOW RATE VERSUS TIME

TIME (SECONDS)	NORMALIZED FLOW RATE
0.0000	1.0000
0.2500	0.5000
0.5000	0.0000
0.7500	-0.5000
1.0000	-1.0000
3.0000	-1.0000
5.0000	-1.0000

CARDS 16***

RABBIT POSITION VERSUS TIME

TIME (SECONDS)	RABBIT POSITION (INCHES)
0.0000	3.7795
0.7500	3.7795
1.0000	13.0000
1.1000	17.0000
1.2000	21.0000
1.3000	25.0000
1.4000	30.0000
2.0000	35.0000
3.0000	37.0000
5.0000	38.0000

COMPUTED OUTPUT

THE INITIAL CONDITION GEOMETRICAL ARRANGEMENT FOR THIS PROBLEM IS DESCRIBED IN THE FOLLOWING DIAGRAM. **********
(ALL DIMENSIONS ARE IN INCHES.)

RADIUS *

Z	(1) 0.0000	(2) 0.1250	(3) 0.2500	(4) 0.2813	(5) 0.3125	(6) 0.3438	(7) 0.3750	(8) 0.5000
(20)26.8700				X	X	X	X	X
(19)25.4921				X	X	X	X	X
(18)24.1141				X	X	X	X	X
(17)22.7362	X	X	X	X	X	X	X	X
(16)21.3582	X	X	X	X	X	X	X	X
(15)19.9803	X	X	X	X	X	X	X	X
(14)18.6023	X	X	X	X	X	X	X	X
(13)17.2244	X	X	X	X	X	X	X	X
(12)15.8464	X	X	X	X	X	X	X	X
(11)14.4685	X	X	X	X	X	X	X	X
(10)13.0905	X	X	X	X	X	X	X	X
(9)11.7126	X	X	X	X	X	X	X	X
(8)10.3346	X	X	X	X	X	X	X	X
(7) 8.9567	X	X	X	X	X	X	X	X
(6) 7.5787	X	X	X	X	X	X	X	X
(5) 6.2008	X	X	X	X	X	X	X	X
(4) 4.8228	X	X	X	X	X	X	X	X
(3) 3.4449				X	X	X	X	X
(2) 2.0669				X	X	X	X	X
(1) 0.6890				X	X	X	X	X

TIME (SECONDS) — TEMPERATURE MAP (DEGREE F)

0.0000

			130.0000	130.0000	130.0000	130.0000	130.0000
			130.0000	130.0000	130.0000	130.0000	130.0000
			130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000

THE INITIAL CONDITION, STEADY-STATE TEMPERATURE MAP*****

			120.1111	122.6490	122.6949	122.6590	120.1685
			120.4420	128.0087	128.1460	128.0399	120.6694
			121.0136	133.4343	133.6609	133.4884	121.4897
150.1053	147.9388	141.4394	121.9948	130.0436	130.6333	130.6537	122.4881
158.0389	155.3460	147.2675	123.2134	133.1473	133.8778	133.9009	123.7296
165.2591	162.1062	152.6474	124.6395	136.1915	137.0453	137.0708	125.1833
171.5906	168.0553	157.4493	126.2378	139.1021	140.0585	140.0863	126.8128
176.8867	173.0560	161.5038	127.9691	141.8113	142.8471	142.8768	128.5777
181.0300	176.9982	164.9029	129.7908	144.2576	145.3477	145.3789	130.4341
183.9354	179.8018	167.4011	131.6580	146.3879	147.5058	147.5381	132.3360
185.5494	181.4159	169.0151	133.5249	148.1571	149.2758	149.3087	134.2363
185.8506	181.8188	169.7235	135.3456	149.5295	150.6217	150.6549	136.0881
184.8484	181.0176	169.5254	137.0756	150.4781	151.5175	151.5505	137.8458
182.5806	179.0453	168.4392	138.6723	150.9854	151.9468	151.9791	139.4661
179.1125	175.9596	166.5008	140.0969	151.0427	151.9028	151.9341	140.9092
174.5327	171.8399	163.7614	141.3144	150.6502	151.3883	151.4182	142.1397
168.9530	166.7865	160.2871	142.2951	149.8172	150.4155	150.4436	143.1273
			142.8377	154.5697	154.8076	154.6454	143.9369
			143.1720	150.6023	150.7578	150.6684	144.4262
			143.2892	146.2100	146.2780	146.2622	144.5838

0.0100

			120.1719	122.6508	122.6959	122.6606	120.2277
			120.6231	128.0139	128.1489	128.0447	120.8453
			121.3265	133.4432	133.6658	133.4962	121.7778
150.1058	147.9423	141.4965	123.4301	130.1486	130.6709	130.6812	122.8389
158.0395	155.3503	147.3387	124.9962	133.2783	133.9247	133.9352	124.1660
165.2599	162.1113	152.7312	126.7260	136.3456	137.1004	137.1112	125.6944
171.5915	168.0610	157.5438	128.5769	139.2759	140.1206	140.1318	127.3860
176.8876	173.0622	161.6668	130.5032	142.0008	142.9148	142.9264	129.1987
181.0310	177.0048	165.0120	132.4576	144.4583	145.4194	145.4315	131.0877
183.9364	179.8086	167.5138	134.3921	146.5950	147.5798	147.5924	133.0059
185.5504	181.4227	169.1286	136.2592	148.3656	149.3503	149.3634	134.9060
185.8516	181.8255	169.8349	138.0129	149.7341	150.6949	150.7085	136.7411
184.8493	181.0240	169.6320	139.6104	150.6738	151.5875	151.6018	138.4659
182.5815	179.0512	168.5382	141.0125	151.1671	152.0117	152.0267	140.0380
179.1133	175.9649	166.5895	142.1850	151.2056	151.9610	151.9768	141.4187
174.5334	171.8445	163.8375	143.0993	150.7901	151.4383	151.4548	142.5743
168.9535	166.7902	160.3487	143.7331	149.9302	150.4558	150.4732	143.4762
			143.1829	154.5802	154.8132	154.6541	144.2229
			143.3560	150.6080	150.7610	150.6735	144.5991
			143.3537	146.2120	146.2790	146.2639	144.6396

0.1000

			120.1284	122.7208	122.7609	122.7297	120.1929
			120.5067	128.2291	128.3492	128.2571	120.7624
			121.0507	133.7921	133.9922	133.8437	121.6897
150.2276	148.1692	142.1474	122.4119	130.4602	131.0036	131.0316	122.8224
158.1862	155.6265	148.1456	123.7745	133.6624	134.3323	134.3654	124.2155
165.4565	162.4688	153.7331	125.4103	136.8676	137.6475	137.6841	125.8208
171.8257	168.4815	158.7040	127.2031	139.9088	140.7789	140.8182	127.5902
177.1595	173.5437	162.9696	129.1259	142.7468	143.6858	143.7271	129.4786
181.3336	177.5360	166.4278	131.1257	145.3039	146.2886	146.3308	131.4391
184.2641	180.3795	169.0142	133.1540	147.5287	148.5348	148.5770	133.4219
185.8957	182.0209	170.6820	135.1602	149.3719	150.3745	150.4157	135.3770
186.2067	182.4384	171.4100	137.0953	150.7965	151.7708	151.8101	137.2556
185.2059	181.6383	171.1974	138.9155	151.7742	152.6959	152.7322	139.0112
182.9313	179.6532	170.0638	140.5902	152.2871	153.1324	153.1644	140.6008
179.4481	176.5411	168.0462	142.0961	152.3267	153.0719	153.0980	141.9851
174.8455	172.3817	165.1960	143.3955	151.8923	152.5152	152.5337	143.1303
169.2357	167.2763	161.5796	144.4288	150.9904	151.4732	151.4834	144.0083
			144.8668	155.2698	155.4446	155.2980	144.6870
			145.1562	151.1154	151.2149	151.1303	145.0278
			145.0501	146.5134	146.5373	146.5168	145.0236

0.2000

			120.1599	122.9369	122.9712	122.9447	120.2356
			120.6256	128.8787	128.9812	128.9031	120.9165
			121.2890	134.8602	135.0302	134.9047	121.9914
150.9616	149.1438	143.8941	122.5608	131.6182	132.0990	132.1278	123.2761
159.1137	156.8633	150.3689	124.1181	135.1765	135.7657	135.7985	124.8317
166.5698	163.9429	156.3644	125.9250	138.6833	139.3670	139.4029	126.6105
173.0978	170.1608	161.6922	127.9443	142.0045	142.7628	142.8004	128.5588
178.5634	175.3895	166.2420	130.1001	145.0740	145.8873	145.9255	130.6188
182.8376	179.5060	169.9087	132.3331	147.8135	148.6608	148.6986	132.7315
185.8346	182.4282	172.6210	134.5835	150.1642	151.0237	151.0600	134.8395
187.4975	184.1014	174.3297	136.7914	152.0743	152.9241	152.9576	136.8881
187.8046	184.5036	175.0124	138.8986	153.5046	154.3229	154.3528	138.8252
186.7654	183.6422	174.6697	140.8497	154.4267	155.1925	155.2179	140.6023
184.4191	181.5521	173.3242	142.5938	154.8231	155.5170	155.5371	142.1752
180.8332	178.2946	171.0188	144.0854	154.6878	155.2921	155.3064	143.5049
176.0995	173.9535	167.8140	145.2858	154.0250	154.5242	154.5323	144.5587
170.3332	168.6344	163.7872	146.1641	152.8496	153.2312	153.2327	145.3107
			146.2835	156.7272	156.8651	156.7434	145.8343
			146.1060	152.1465	152.2265	152.1584	145.9847
			145.7916	147.1065	147.1235	147.1089	145.7617

0.3000

			120.2140	123.3002	123.3280	123.3067	120.3090
			120.8270	129.9706	130.0534	129.9909	121.1841
			121.6912	136.6647	136.8017	136.7016	122.5294
152.5934	151.0685	146.7401	123.2441	133.6916	134.0906	134.1156	124.1121
161.1775	159.2929	153.9461	125.1259	137.8244	138.3117	138.3399	125.9820
169.0162	166.8190	160.5880	127.2779	141.8442	142.4067	142.4371	128.0712
175.8748	173.4217	166.4683	129.6340	145.6203	146.2422	146.2737	130.3125
181.6074	178.9606	171.4616	132.1254	149.0694	149.7339	149.7653	132.6393
186.0794	183.3061	175.4532	134.6808	152.1058	152.7948	152.8249	134.9843
189.1998	186.3705	178.3639	137.2282	154.6616	155.3567	155.3843	137.2813
190.9094	188.0961	180.1408	139.6969	156.6798	157.3623	157.3865	139.4669
191.1854	188.4600	180.7601	142.0195	158.1179	158.7696	158.7892	141.4829
190.0385	187.4706	180.2244	144.1336	158.9467	159.5500	159.5641	143.2768
187.5108	185.1661	178.5607	145.9832	159.1502	159.6888	159.6967	144.8030
183.6741	181.6128	175.8189	147.5179	158.7255	159.1848	159.1859	146.0230
178.6260	176.9011	172.0685	148.6940	157.6820	158.0496	158.0435	146.9066
172.4890	171.1447	167.3981	149.4764	156.0421	156.3081	156.2947	147.4317
			149.2901	159.1218	159.2122	159.1140	147.6809
			148.6686	153.7917	153.8368	153.7817	147.5067
			147.8213	147.9665	147.9633	147.9513	146.9177

0.4000

			120.3199	123.8481	123.8668	123.8526	120.4429
			121.2037	131.6137	131.6694	131.6278	121.6506
			122.4222	139.3792	139.4709	139.4045	123.4260
155.3165	154.1589	151.0139	124.4492	136.9812	137.2602	137.2785	125.4647
164.6008	163.1729	159.2960	126.8543	141.9858	142.3248	142.3452	127.8038
173.0591	171.3975	166.8886	129.5528	146.7879	147.1772	147.1987	130.3472
180.4473	178.5957	173.5736	132.4546	151.2435	151.6716	151.6932	133.0065
186.6040	184.6100	179.2049	135.4688	155.2484	155.7032	155.7239	135.6991
191.3852	189.3006	183.6529	138.5040	158.7037	159.1726	159.1914	138.3457
194.6928	192.5714	186.8284	141.4702	161.5306	162.0004	162.0163	140.8713
196.4637	194.3608	188.6727	144.2808	163.6653	164.1229	164.1352	143.2053
196.6742	194.6447	189.1010	146.8545	165.0619	165.4946	165.5025	145.2841
195.3371	193.4340	188.2994	149.1175	165.6916	166.0873	166.0902	147.0521
192.4988	190.7723	186.1227	151.0051	165.5422	165.8899	165.8874	148.4628
188.2385	186.7339	182.6923	152.4636	164.6182	164.9083	164.9000	149.4801
182.6628	181.4197	178.0932	153.4514	162.9395	163.1639	163.1499	150.0778
175.9057	174.9566	172.4325	153.9400	160.5420	160.6945	160.6748	150.2408
			153.0737	162.4733	162.5211	162.4545	150.0646
			151.6794	156.0361	156.0555	156.0182	149.3995
			150.1494	149.0553	149.0435	149.0350	148.2696

0.5000

			120.5808	124.6881	124.6906	124.6888	120.7299
			122.0425	134.1209	134.1284	134.1230	122.5639
			123.9576	143.5034	143.5156	143.5071	125.0273
159.5284	158.9133	157.6179	126.7894	142.4078	142.4502	142.4559	127.7355
169.8693	169.1118	167.5164	129.9778	148.7698	148.8213	148.8279	130.7175
179.2591	178.3787	176.5247	133.4193	154.7694	154.8286	154.8358	133.8474
187.4339	186.4538	184.3900	136.9996	160.2343	160.2993	160.3069	137.0168
194.2117	193.1575	190.9376	140.6053	165.0343	165.1035	165.1111	140.1270
199.4347	198.3340	196.0164	144.1251	169.0515	169.1228	169.1302	143.0870
202.9942	201.8761	199.5220	147.4531	172.1931	172.2646	172.2715	145.8134
204.8221	203.7161	201.3884	150.4906	174.3880	174.4575	174.4637	148.2303
204.8938	203.8295	201.5905	153.1482	175.5886	175.6543	175.6595	150.2718
203.2257	202.2316	200.1418	155.3479	175.7707	175.8307	175.8347	151.8830
199.8722	198.9751	197.0910	157.0253	174.9325	174.9851	174.9877	153.0210
194.9242	194.1481	192.5204	158.1307	173.0943	173.1379	173.1391	153.6557
188.5038	187.8694	186.5417	158.6306	170.2970	170.3305	170.3301	153.7703
180.7635	180.2876	179.2947	158.5083	166.6023	166.6249	166.6229	153.3610
			156.6983	166.9370	166.9425	166.9331	152.5424
			154.1385	158.8635	158.8656	158.8603	151.1664
			151.7000	150.1833	150.1813	150.1798	149.2796

0.6000

			122.1960	125.5355	125.5505	125.5371	122.0594
			125.1074	136.5887	136.6426	136.5978	125.0242
			129.8616	147.5653	147.6472	147.5696	128.4551
165.3111	164.8203	163.0296	138.1333	147.7457	147.9234	147.8942	132.0125
177.0675	176.4539	174.1925	142.8254	155.3553	155.5949	155.5621	135.7691
187.6971	186.9757	184.2983	147.4114	162.4421	162.7375	162.7014	139.5383
196.9071	196.0964	193.0715	151.7517	168.8100	169.1530	169.1140	143.1996
204.4903	203.6113	200.3170	155.7170	174.3071	174.6884	174.6472	146.6449
210.2698	209.3457	205.8695	159.1897	178.8000	179.2091	179.1662	149.7766
214.1243	213.1800	209.6156	162.0673	182.1854	182.6111	182.5673	152.5081
215.9790	215.0401	211.4848	164.2647	184.3871	184.8177	184.7738	154.7648
215.8091	214.9013	211.4528	165.7169	185.3576	185.7814	185.7383	156.4856
213.6373	212.7854	209.5380	166.3810	185.0779	185.4834	185.4420	157.6240
209.5298	208.7570	205.7987	166.2423	183.5563	183.9326	183.8939	158.1493
203.5951	202.9221	200.3322	165.3370	180.8299	181.1661	181.1307	158.0470
195.9783	195.4232	193.2731	163.8088	176.9662	177.2501	177.2177	157.3215
186.8612	186.4404	184.7993	161.9579	172.0715	172.2865	172.2550	156.0131
			157.8004	171.2196	171.2848	171.2031	154.2172
			154.2646	161.5555	161.5894	161.5422	151.8620
			151.9893	151.2725	151.2635	151.2512	149.6369

0.7000

			131.7281	126.5793	126.5089	126.4890	126.3737
			141.0895	138.6379	138.5689	138.4746	130.6840
			153.8927	150.8528	150.7426	150.5583	135.1467
170.3430	169.7911	168.5390	165.7474	155.0011	154.4208	154.1006	139.5693
183.1343	182.2947	180.0240	170.7024	163.0651	162.6101	162.2872	144.0145
194.6456	193.5363	190.2919	174.7806	170.3931	170.0788	169.7618	148.2449
204.5685	203.2173	199.0793	177.8622	176.7912	176.6286	176.3260	152.1373
212.6813	211.1233	206.2009	179.8612	182.1117	182.1069	181.8267	155.5829
218.7982	217.0760	211.5056	180.7330	186.2342	186.3875	186.1367	158.4874
222.7928	220.9543	214.8955	180.4893	189.0760	189.3808	189.1650	160.7722
224.5888	222.6865	216.3185	179.2122	190.5900	191.0312	190.8539	162.3756
224.1642	222.2534	215.7721	177.0594	190.7675	191.3207	191.1825	163.2543
221.5488	219.6869	213.3015	174.2516	189.6369	190.2687	190.1670	163.3847
216.8210	215.0670	208.9964	171.0423	187.2615	187.9308	187.8598	162.7647
210.1087	208.5222	202.9097	167.6860	183.7374	184.3979	184.3492	161.4190
201.5841	200.2252	195.4537	164.4175	179.1905	179.7934	179.7568	159.4102
191.4656	190.3936	186.6000	161.4419	173.7782	174.2746	174.2391	156.8636
			155.6304	173.1178	173.2813	173.1258	154.0380
			153.0623	162.8499	162.9370	162.8410	151.3475
			151.8930	152.1614	152.1550	152.1267	149.6532

0.8000

			162.7502	131.3164	130.7009	130.5830	135.3138
			171.5330	144.3317	143.7489	143.5311	140.7253
178.4067	178.4901	178.8537	179.1233	160.5809	159.2260	158.6060	146.0080
189.6943	189.3433	188.3926	184.0984	168.7694	167.5931	166.9906	150.9930
201.1063	200.2195	197.5453	187.1808	175.8363	174.9220	174.3554	155.6086
210.7940	209.4008	205.0981	189.0812	181.8345	181.2007	180.6826	159.6984
218.5428	216.6928	210.9225	189.8186	186.6528	186.3048	185.8448	163.1510
224.1970	221.9587	214.9419	189.4638	190.2324	190.1622	189.7661	165.8743
227.6538	225.1120	217.1227	188.1277	192.5511	192.7379	192.4077	167.7963
228.8648	226.1174	217.4704	185.9508	193.6220	194.0338	193.7675	168.8672
227.8333	224.9872	216.0249	183.0919	193.4851	194.0807	193.8726	169.0610
224.6136	221.7800	212.8577	179.7182	192.2022	192.9335	192.7750	168.3784
219.3082	216.5989	208.0702	175.9870	189.8515	190.6670	190.5476	166.8539
212.0668	209.5898	201.7883	171.9806	186.5197	187.3715	187.2810	164.5700
203.3043	201.1451	194.3114	167.5468	182.2833	183.1425	183.0768	161.6841
193.7892	191.9899	186.2085	162.7386	177.2405	178.0757	178.0353	158.4632
			156.2255	172.8967	173.1778	172.9461	155.2963
			153.6773	172.5849	172.8330	172.6094	152.6129
			152.4181	162.7334	162.8613	162.7204	150.6124
			151.7898	152.7006	152.7002	152.6534	149.5258

0.9000

189.0517	188.7005	187.8036	185.3416	152.8347	149.8657	148.9468	149.6139
199.1597	198.4005	196.2363	190.3123	166.0693	163.7652	162.9056	155.4017
208.7306	207.4710	203.7649	193.7645	176.4965	174.7918	174.0003	160.5848
216.8109	215.0594	209.8353	195.7450	182.8587	181.5525	180.8320	165.0525
222.9605	220.7788	214.2226	196.5050	187.9619	187.0598	186.4208	168.7519
227.0313	224.5014	216.8566	196.0720	191.8346	191.3364	190.7863	171.5883
228.9751	226.1909	217.7337	194.4849	194.4486	194.3433	193.8864	173.4909
228.7895	225.8527	216.8806	191.7996	195.8109	196.0782	195.7155	174.4166
226.5203	223.5350	214.3536	188.1051	195.9558	196.5655	196.2949	174.3528
222.2800	219.3463	210.2554	183.5688	194.9479	195.8564	195.6718	173.3241
216.3212	213.5251	204.7945	178.4379	192.8761	194.0254	193.9162	171.4037
209.1910	206.5879	198.4033	173.0388	189.8561	191.1779	191.1292	168.7288
202.1107	199.7009	192.0215	167.5412	185.9835	187.4022	187.4034	165.5158
197.7984	195.5016	188.1367	163.6113	181.6610	183.0148	183.0286	162.0630
			158.0522	180.4744	180.8851	180.5661	158.7174
			155.5374	177.0441	177.4146	177.1163	155.7449
			154.0411	172.5166	172.8261	172.5545	153.3081
			152.9913	170.2976	170.5807	170.3117	151.4746
			152.2094	161.6124	161.7573	161.5870	150.1691
			151.7524	152.8888	152.8918	152.8289	149.4404

1.0000

210.6521	209.1669	204.6721	193.9016	175.5498	173.4803	172.6903	166.9942
217.3568	215.3147	209.0069	194.0424	182.4865	181.1764	180.5352	171.3750
222.2576	219.7203	211.8007	193.0403	187.5779	186.9500	186.4555	174.7803
225.2391	222.2969	213.0576	191.0658	190.4876	190.4052	190.0472	177.1584
226.2781	223.0396	212.8375	188.3588	192.2951	192.7008	192.4658	178.4911
225.4181	222.0027	211.2278	185.1207	193.0828	193.9077	193.7772	178.7700
222.7896	219.3187	208.3628	181.4770	192.9185	194.0865	194.0390	178.0308
218.6670	215.2492	204.4583	177.5751	191.8857	193.3178	193.3319	176.3624
213.5618	210.2730	199.8988	173.7840	190.1106	191.7051	191.7550	173.9158
208.2469	205.1114	195.1859	169.4695	187.5751	189.3130	189.3956	170.9053
204.0046	201.0052	191.5506	166.9223	184.7283	186.4206	186.4788	167.5986
			161.2537	185.2961	185.7803	185.4734	164.2839
			158.7151	184.4040	184.9564	184.5753	161.1565
			157.0104	181.8437	182.3674	181.9758	158.3178
			155.6252	178.8760	179.3556	178.9691	155.8580
			154.4468	175.0005	175.4158	175.0565	153.7995
			153.4615	170.4024	170.7372	170.4240	152.1420
			152.6834	167.2444	167.5259	167.2416	150.8708
			152.0873	160.0144	160.1576	159.9750	149.9378
			151.7285	152.8191	152.8218	152.7467	149.3940

1.1000

216.1006	213.1598	204.5710	186.3934	182.6459	182.2768	182.0765	178.9127
218.0422	214.7803	205.2437	184.9473	185.5127	185.6069	185.5025	180.4750
218.4604	214.9900	204.8231	182.9505	187.3045	187.7948	187.7682	180.9828
217.4778	213.9075	203.4158	180.4997	187.9646	188.7693	188.8017	180.5024
215.3295	211.7503	201.1922	177.7285	187.8985	188.9629	189.0369	179.1518
212.4081	208.8783	198.4239	174.8040	187.1825	188.4421	188.5415	177.0913
209.3316	205.8648	195.5170	171.4632	185.8381	187.2791	187.3984	174.5235
206.7819	203.3640	193.1259	169.3547	184.1340	185.5651	185.6663	171.6754
			164.1910	184.6613	185.2582	184.9485	168.7708
			161.6316	185.4951	186.0441	185.7253	165.9590
			160.0529	184.8974	185.4481	185.0931	163.2737
			158.6792	184.1467	184.6986	184.3082	160.7697
			157.3834	182.4420	182.9745	182.5701	158.4704
			156.1678	179.5942	180.0834	179.6894	156.3990
			155.0586	176.3809	176.8188	176.4458	154.5736
			154.0726	172.5217	172.8939	172.5571	152.9972
			153.2306	168.1544	168.4490	168.1612	151.6808
			152.5542	164.6174	164.8494	164.6013	150.6353
			152.0375	158.6101	158.7267	158.5636	149.8522
			151.7201	152.6662	152.6658	152.5921	149.3793

1.2000

208.3323	205.3369	196.8343	178.9867	181.6825	182.0249	182.0937	180.7911
208.1103	205.0084	196.1391	177.1861	182.6540	183.2695	183.3705	180.0114
207.2884	204.1178	194.9850	175.0995	182.9716	183.8138	183.9363	178.6011
206.2583	203.0295	193.6360	172.6266	182.6326	183.6747	183.8153	176.7345
205.3643	202.0773	192.4562	170.9600	181.9514	183.0496	183.1792	174.5927
			166.4859	182.9612	183.4669	183.2708	172.3435
			164.3718	183.8734	184.3345	184.1381	170.0930
			163.0256	184.8987	185.4065	185.1397	167.8595
			161.8253	184.9361	185.4595	185.1471	165.6496
			160.6189	184.9066	185.4442	185.0902	163.4936
			159.3944	183.8893	184.4215	184.0454	161.4024
			158.1800	182.5992	183.1209	182.7298	159.4022
			156.9966	180.5626	181.0585	180.6675	157.5069
			155.8724	177.6789	178.1310	177.7569	155.7421
			154.8378	174.4340	174.8341	174.4857	154.1382
			153.9146	170.6844	171.0208	170.7096	152.7188
			153.1248	166.5440	166.8070	166.5429	151.5116
			152.4894	162.8570	163.0539	162.8333	150.5412
			152.0106	157.6637	157.7613	157.6132	149.8157
			151.7153	152.5432	152.5403	152.4685	149.3730

1.3000

199.0926	196.3689	188.6337	171.9287	177.4074	178.0253	178.1857	177.0565
199.5490	196.6870	188.4991	170.8032	177.6427	178.3656	178.5219	175.7381
			167.5188	178.9730	179.3522	179.2869	174.2849
			166.1417	180.3666	180.7280	180.6489	172.7676
			165.2319	182.0133	182.4269	182.2788	171.1877
			164.3651	183.0032	183.4482	183.2468	169.5345
			163.4230	183.7079	184.1794	183.9300	167.8200
			162.3987	184.3441	184.8424	184.5464	166.0523
			161.3023	184.1996	184.7099	184.3812	164.2388
			160.1617	183.8139	184.3319	183.9751	162.4042
			158.9975	182.6389	183.1488	182.7781	160.5678
			157.8402	181.1052	181.5998	181.2223	158.7635
			156.7137	178.9408	179.4067	179.0344	157.0209
			155.6452	176.1016	176.5242	176.1702	155.3769
			154.6622	172.9019	173.2729	172.9454	153.8692
			153.7864	169.2825	169.5919	169.3008	152.5292
			153.0384	165.3441	165.5837	165.3374	151.3871
			152.4369	161.6322	161.8048	161.6031	150.4684
			151.9881	156.9978	157.0821	156.9445	149.7858
			151.7108	152.4388	152.4338	152.3637	149.3671

1.4000

			166.6272	174.7403	174.9813	175.0150	173.5118
			166.2729	176.4022	176.6792	176.6647	172.6732
			165.8459	178.0554	178.3718	178.3051	171.7234
			165.2945	179.5973	179.9530	179.8348	170.6493
			164.6148	181.1825	181.5808	181.4085	169.4444
			163.8124	182.2185	182.6500	182.4317	168.1052
			162.9050	182.9057	183.3646	183.1050	166.6450
			161.9107	183.3582	183.8410	183.5429	165.0797
			160.8481	183.1463	183.6401	183.3142	163.4290
			159.7431	182.5863	183.0845	182.7363	161.7258
			158.6185	181.3544	181.8432	181.4843	160.0007
			157.5020	179.7144	180.1854	179.8234	158.2931
			156.4180	177.5164	177.9576	177.6030	156.6386
			155.3924	174.7516	175.1508	174.8146	155.0754
			154.4505	171.6318	171.9805	171.6708	153.6406
			153.6137	168.1482	168.4377	168.1631	152.3656
			152.9039	164.3928	164.6158	164.3838	151.2793
			152.3406	160.7295	160.8857	160.6983	150.4057
			151.9339	156.4990	156.5744	156.4448	149.7593
			151.6956	152.3444	152.3379	152.2693	149.3614

1.5000

165.9180	173.0133	173.2179	173.2383	171.5237
165.6429	174.9859	175.2360	175.2084	170.9938
165.2388	176.8591	177.1547	177.0780	170.2952
164.6977	178.5424	178.8819	178.7564	169.4217
164.0278	180.1024	180.4852	180.3102	168.3756
163.2397	181.1715	181.5888	181.3705	167.1649
162.3510	181.8524	182.2974	182.0405	165.8103
161.3805	182.2016	182.6684	182.3769	164.3362
160.3483	181.9586	182.4357	182.1187	162.7698
159.2793	181.3097	181.7890	181.4529	161.1465
158.1980	180.0654	180.5346	180.1896	159.5003
157.1310	178.3914	178.8414	178.4951	157.8698
156.1028	176.2109	176.6308	176.2927	156.2907
155.1371	173.5364	173.9150	173.5949	154.7995
154.2358	170.5171	170.8464	170.5520	153.4312
153.4775	167.1739	167.4458	167.1850	152.2158
152.8193	163.5920	163.8000	163.5796	151.1808
152.2956	160.0233	160.1658	159.9891	150.3488
151.9159	156.1031	156.1706	156.0472	149.7348
151.6918	152.2568	152.2485	152.1813	149.3559

1.6000

165.2359	171.5326	171.7145	171.7347	170.2837
164.9637	173.6779	173.9099	173.8825	169.8769
164.5664	175.6632	175.9438	175.8679	169.2743
164.0384	177.4098	177.7359	177.6121	168.4786
163.3896	178.9360	179.3045	179.1335	167.4997
162.6321	180.0086	180.4113	180.1985	166.3526
161.7833	180.6752	181.1048	180.8548	165.0610
160.8611	180.9601	181.4094	181.1273	163.6515
159.8847	180.7039	181.1622	180.8560	162.1531
158.8759	180.0162	180.4749	180.1515	160.6003
157.8562	178.7876	179.2355	178.9040	159.0266
156.8490	177.1248	177.5528	177.2209	157.4687
155.8764	174.9941	175.3922	175.0688	155.9612
154.9509	172.4199	172.7781	172.4721	154.5385
154.1237	169.5130	169.8236	169.5425	153.2334
153.3838	166.3109	166.5665	166.3175	152.0748
152.7580	162.8933	163.0879	162.8775	151.0884
152.2503	159.4435	159.5746	159.4065	150.2957
151.9005	155.7732	155.8342	155.7157	149.7115
151.6881	152.1741	152.1642	152.0982	149.3504

1.7000

164.5388	170.2771	170.4439	170.4665	169.2946
164.2855	172.4897	172.7078	172.6827	168.9302
163.9139	174.5073	174.7742	174.7009	168.3665
163.4184	176.2606	176.5724	176.4521	167.6105
162.8076	177.7415	178.0940	177.9284	166.6748
162.0926	178.7973	179.1829	178.9766	165.5767
161.2888	179.4438	179.8550	179.6131	164.3397
160.4131	179.6868	180.1162	179.8439	162.9901
159.4843	179.4271	179.8647	179.5696	161.5568
158.5235	178.7290	179.1660	178.8551	160.0722
157.5520	177.5306	177.9569	177.6385	158.5691
156.5922	175.9034	176.3099	175.9918	157.0819
155.6659	173.8393	174.2166	173.9070	155.6437
154.7943	171.3690	171.7081	171.4152	154.2872
153.9977	168.5797	168.8730	168.6040	153.0433
153.2941	165.5176	165.7582	165.5200	151.9394
152.6993	152.2580	162.4404	162.2389	150.9998
152.2267	158.9409	159.0622	158.9015	150.2448
151.8857	155.4835	155.5388	155.4247	149.6891
151.6846	152.0945	152.0830	152.0182	149.3450

1.8000

163.9050	169.1896	169.3437	169.3670	168.3793
163.6696	171.3999	171.6048	171.5810	168.0331
163.3188	173.3977	173.6505	173.5795	167.4932
162.8478	175.1205	175.4172	175.3005	166.7678
162.2655	176.5463	176.8819	176.7217	165.8703
161.5833	177.5702	177.9378	177.7385	164.8181
160.8161	178.1905	178.5826	178.3492	163.6339
159.9807	178.4026	178.8116	178.5495	162.3431
159.0950	178.1432	178.5598	178.2761	160.9736
158.1794	177.4500	177.8655	177.5671	159.5562
157.2543	176.2895	176.6944	176.3891	158.1222
156.3409	174.7118	175.0974	174.7926	156.7043
155.4599	172.7238	173.0811	172.7847	155.3339
154.6315	170.3594	170.6800	170.3997	154.0421
153.8747	167.6904	167.9672	167.7097	152.8579
153.2065	164.7674	164.9939	164.7658	151.8074
152.6421	161.6616	161.8326	161.6394	150.9136
152.1939	158.4855	158.5979	158.4438	150.1955
151.8711	155.2184	155.2684	155.1583	149.6671
151.6810	152.0167	152.0037	151.9401	149.3396

1.9000

163.2997	168.2173	168.3606	168.3831	167.4921
163.0742	170.3802	170.5731	170.5496	167.1572
162.7382	172.3241	172.5635	172.4944	166.6367
162.2876	173.9923	174.2739	174.1608	165.9394
161.7311	175.3551	175.6740	175.5193	165.0784
161.0801	176.3373	176.6867	176.4946	164.0710
160.3488	176.9270	177.2997	177.0751	162.9386
159.5530	177.1141	177.5025	177.2509	161.7057
158.7102	176.8569	177.2524	176.9802	160.3991
157.8395	176.1775	176.5716	176.2857	159.0479
156.9603	175.0592	175.4430	175.1506	157.6821
156.0929	173.5393	173.9043	173.6127	156.3324
155.2567	171.6329	171.9707	171.6872	155.0289
154.4709	169.3753	169.6781	169.4099	153.8008
153.7534	166.8283	167.0892	166.8428	152.6755
153.1203	164.0438	164.2567	164.0383	151.6776
152.5859	161.0892	161.2493	161.0641	150.8288
152.1618	158.0589	158.1630	158.0151	150.1469
151.8568	154.9681	155.0133	154.9069	149.6454
151.6775	151.9401	151.9255	151.8631	149.3342

2.0000

162.7023	167.3187	167.4528	167.4734	166.6210
162.4848	169.4059	169.5877	169.5641	166.2943
162.1624	171.2749	171.5012	171.4339	165.7913
161.7314	172.8733	173.1400	173.0305	165.1206
161.2004	174.1682	174.4703	174.3213	164.2951
160.5803	175.1022	175.4333	175.2487	163.3314
159.8845	175.6583	176.0116	175.7960	162.2501
159.1282	175.8237	176.1917	175.9505	161.0745
158.3280	175.5698	175.9442	175.6837	159.8301
157.5020	174.9094	175.2823	175.0088	158.5445
156.6686	173.8359	174.1988	173.9192	157.2462
155.8469	172.3786	172.7233	172.4446	155.9642
155.0552	170.5572	170.8759	170.6050	154.7269
154.3117	168.4071	168.6924	168.4360	153.5619
153.6333	165.9830	166.2283	165.9927	152.4948
153.0350	163.3365	163.5362	163.3272	151.5491
152.5302	160.5315	160.6810	160.5035	150.7449
152.1300	157.6498	157.7461	157.6041	150.0989
151.8426	154.7270	154.7674	154.6646	149.6240
151.6739	151.8641	151.8481	151.7868	149.3288

2.1000

162.1344	166.4832	166.6088	166.6269	165.7787
161.9355	168.5053	168.6767	168.6524	165.4708
161.6371	170.3133	170.5275	170.4611	164.9955
161.2353	171.8578	172.1107	172.0040	164.3610
160.7380	173.1042	173.3908	173.2464	163.5794
160.1554	174.0060	174.3203	174.1419	162.6666
159.5001	174.5432	174.8785	174.6707	161.6419
158.7863	174.7013	175.0506	174.8185	160.5273
158.0298	174.4597	174.8151	174.5645	159.3469
157.2474	173.8256	174.1794	173.9166	158.1268
156.4568	172.7983	173.1424	172.8739	156.8937
155.6757	171.4018	171.7285	171.4610	155.6751
154.9218	169.6584	169.9602	169.7002	154.4979
154.2122	167.6030	167.8729	167.6268	153.3881
153.5629	165.2853	165.5171	165.2909	152.3699
152.9886	162.7563	162.9446	162.7436	151.4656
152.5025	160.0766	160.2171	160.0462	150.6944
152.1156	157.3198	157.4094	157.2724	150.0728
151.8368	154.5327	154.5692	154.4694	149.6135
151.6726	151.8023	151.7850	151.7247	149.3265

2.2000

161.6986	165.7317	165.8476	165.8634	165.0397
161.5352	167.7287	167.8892	167.8639	164.7727
161.2743	169.5159	169.7180	169.6521	164.3446
160.9113	171.0451	171.2848	171.1801	163.7624
160.4532	172.2803	172.5530	172.4119	163.0374
159.9094	173.1812	173.4809	173.3071	162.1840
159.2915	173.7255	174.0459	173.8437	161.2200
158.6130	173.8976	174.2317	174.0062	160.1660
157.8888	173.6809	174.0214	173.7782	159.0447
157.1353	173.0795	173.4187	173.1638	157.8807
156.3697	172.0955	172.4258	172.1654	156.6995
155.6096	170.7501	171.0639	170.8045	155.5272
154.8729	169.0666	169.3566	169.1045	154.3898
154.1769	167.0796	167.3390	167.1002	153.3128
153.5383	164.8358	165.0586	164.8389	152.3203
152.9723	162.3858	162.5667	162.3713	151.4348
152.4924	159.7883	159.9231	159.7585	150.6768
152.1101	157.1121	157.1976	157.0638	150.0638
151.8344	154.4110	154.4451	154.3472	149.6099
151.6721	151.7637	151.7457	151.6860	149.3257

2.3000

161.4363	165.0922	165.1971	165.2115	164.4644
161.3054	167.0911	167.2401	167.2146	164.2496
161.0752	168.8829	169.0732	169.0082	163.8758
160.7406	170.4199	170.6477	170.5450	163.3492
160.3081	171.6649	171.9256	171.7876	162.6792
159.7871	172.5808	172.8687	172.6989	161.8794
159.1891	173.1439	173.4529	173.2555	160.9661
158.5277	173.3377	173.6608	173.4406	159.9589
157.8182	173.1481	173.4781	173.2406	158.8796
157.0774	172.5769	172.9062	172.6573	157.7520
156.3227	171.6283	171.9493	171.6950	156.6014
155.5722	170.3216	170.6269	170.3733	155.4541
154.8438	168.6810	168.9634	168.7167	154.3366
154.1550	166.7410	166.9937	166.7599	153.2749
153.5224	164.5468	164.7638	164.5485	152.2941
152.9615	162.1486	162.3248	162.1330	151.4176
152.4856	159.6045	159.7356	159.5719	150.6663
152.1063	156.9802	157.0630	156.9313	150.0581
151.8328	154.3340	154.3665	154.2698	149.6075
151.6717	151.7393	151.7207	151.6614	149.3251

2.4000

161.2909	164.5825	164.6773	164.6917	164.0679
161.1777	166.5968	166.7359	166.7113	163.9028
160.9632	168.4047	168.5855	168.5223	163.5770
160.6424	169.9587	170.1774	170.0772	163.0955
160.2223	171.2209	171.4729	171.3381	162.4670
159.7124	172.1559	172.4355	172.2695	161.7043
159.1244	172.7393	173.0403	172.8470	160.8236
158.4723	172.9538	173.2694	173.0536	159.8441
157.7713	172.7871	173.1101	172.8770	158.7880
157.0381	172.2398	172.5625	172.3180	157.6796
156.2905	171.3174	171.6324	171.3823	156.5447
155.5462	170.0382	170.3380	170.0884	155.4102
154.8234	168.4273	168.7047	168.4617	154.3032
154.1396	166.5190	166.7674	166.5369	153.2502
153.5113	164.3579	164.5712	164.3587	152.2765
152.9538	161.9941	162.1672	161.9777	151.4058
152.4807	159.4850	159.6137	159.4519	150.6589
152.1036	156.8948	156.9759	156.8455	150.0541
151.8317	154.2841	154.3126	154.2198	149.6057
151.6714	151.7235	151.7046	151.6456	149.3247

2.5000

161.1964	164.1964	164.2836	164.2992	163.8202
161.0928	166.2296	166.3616	166.3388	163.6917
160.8872	168.0558	168.2299	168.1690	163.3987
160.5747	169.6277	169.8401	169.7425	162.9458
160.1623	170.9067	171.1527	171.0208	162.3420
159.6596	171.8588	172.1328	171.9698	161.6003
159.0785	172.4590	172.7547	172.5646	160.7372
158.4326	172.6900	173.0006	172.7880	159.7726
157.7374	172.5406	172.8588	172.6289	158.7292
157.0097	172.0107	172.3290	172.0875	157.6315
156.2670	171.1068	171.4178	171.1705	156.5059
155.5272	169.8469	170.1430	169.8961	155.3794
154.8085	168.2564	168.5305	168.2899	154.2793
154.1282	166.3698	166.6153	166.3869	153.2322
153.5029	164.2312	164.4420	164.2313	152.2636
152.9481	161.8906	162.0616	161.8737	151.3970
152.4771	159.4051	159.5322	159.3716	150.6534
152.1016	156.8378	156.9178	156.7883	150.0510
151.8308	154.2509	154.2818	154.1864	149.6044
151.6712	151.7130	151.6939	151.6350	149.3244

2.6000

161.1287	163.9139	163.9958	164.0131	163.6687
161.0316	165.9641	166.0911	166.0702	163.5620
160.8320	167.8060	167.9754	167.9166	163.2876
160.5252	169.3925	169.6005	169.5051	162.8506
160.1182	170.6848	170.9267	170.7970	162.2604
159.6206	171.6498	171.9199	171.7592	161.5304
159.0442	172.2625	172.5545	172.3666	160.6776
158.4028	172.5055	172.8126	172.6022	159.7220
157.7118	172.3683	172.6833	172.4555	158.6865
156.9880	171.8507	172.1661	171.9266	157.5960
156.2490	170.9600	171.2681	171.0228	156.4768
155.5126	169.7135	170.0071	169.7620	155.3561
154.7968	168.1373	168.4091	168.1702	154.2610
154.1193	166.2659	166.5094	166.2825	153.2183
153.4964	164.1429	164.3521	164.1427	152.2535
152.9435	161.8185	161.9882	161.8014	151.3900
152.4742	159.3496	159.4756	159.3158	150.6490
152.1000	156.7983	156.8775	156.7486	150.0486
151.8301	154.2279	154.2583	154.1633	149.6034
151.6710	151.7056	151.6864	151.6276	149.3241

2.7000

161.0784	163.7108	163.7890	163.8077	163.5695
160.9857	165.7737	165.8973	165.8779	163.4750
160.7903	167.6272	167.7934	167.7361	163.2111
160.4874	169.2240	169.4290	169.3351	162.7833
160.0842	170.5258	170.7647	170.6366	162.2014
159.5902	171.4998	171.7671	171.6079	161.4788
159.0173	172.1210	172.4105	172.2241	160.6327
158.3792	172.3723	172.6770	172.4681	159.6833
157.6914	172.2437	172.5564	172.3301	158.6534
156.9706	171.7348	172.0480	171.8100	157.5682
156.2344	170.8533	171.1594	170.9155	156.4537
155.5006	169.6165	169.9082	169.6644	155.3373
154.7873	168.0506	168.3207	168.0830	154.2462
154.1119	166.1901	166.4321	166.2063	153.2070
153.4909	164.0785	164.2864	164.0780	152.2451
152.9397	161.7659	161.9346	161.7485	151.3842
152.4718	159.3090	159.4342	159.2750	150.6453
152.0987	156.7695	156.8481	156.7196	150.0465
151.8295	154.2111	154.2411	154.1464	149.6025
151.6709	151.7002	151.6809	151.6222	149.3239

2.8000

161.0394	163.5648	163.6404	163.6601	163.4985
160.9498	165.6362	165.7574	165.7391	163.4111
160.7572	167.4972	167.6611	167.6049	163.1537
160.4572	169.1009	169.3036	169.2109	162.7319
160.0567	170.4087	170.6456	170.5186	162.1554
159.5654	171.3885	171.6539	171.4958	161.4379
158.9950	172.0154	172.3030	172.1178	160.5966
158.3595	172.2723	172.5752	172.3675	159.6518
157.6742	172.1496	172.4606	172.2354	158.6262
156.9558	171.6469	171.9585	171.7215	157.5449
156.2219	170.7720	171.0767	170.8338	156.4343
155.4903	169.5424	169.8327	169.5898	155.3214
154.7790	167.9841	168.2530	168.0161	154.2334
154.1054	166.1319	166.3728	166.1477	153.1971
153.4862	164.0289	164.2359	164.0281	152.2379
152.9364	161.7253	161.8932	161.7077	151.3792
152.4597	159.2776	159.4022	159.2435	150.6421
152.0975	156.7472	156.8253	156.6972	150.0447
151.8289	154.1980	154.2278	154.1333	149.6016
151.6707	151.6960	151.6766	151.6180	149.3237

2.9000

161.0078	163.4584	163.5322	163.5527	163.4439
160.9202	165.5350	165.6545	165.6368	163.3611
160.7297	167.4004	167.5626	167.5072	163.1080
160.4317	169.0079	169.2091	169.1172	162.6902
160.0332	170.3193	170.5547	170.4285	162.1176
159.5440	171.3027	171.5666	171.4093	161.4038
158.9757	171.9331	172.2193	172.0349	160.5661
158.3423	172.1937	172.4952	172.2883	159.6248
157.6590	172.0751	172.3847	172.1604	158.6026
156.9427	171.5768	171.8871	171.6509	157.5247
156.2107	170.7068	171.0103	170.7682	156.4171
155.4810	169.4826	169.7718	169.5297	155.3072
154.7715	167.9302	168.1981	167.9620	154.2220
154.0996	166.0845	166.3245	166.1001	153.1882
153.4818	163.9885	164.1946	163.9874	152.2312
152.9333	161.6921	161.8593	161.6743	151.3745
152.4677	159.2519	159.3759	159.2176	150.6391
152.0963	156.7289	156.8067	156.6789	150.0430
151.8284	154.1873	154.2168	154.1225	149.6009
151.6706	151.6926	151.6731	151.6145	149.3235

3.0000

160.9810	163.3792	163.4517	163.4727	163.3996
160.8948	165.4582	165.5765	165.5594	163.3198
160.7058	167.3257	167.4868	167.4318	163.0696
160.4092	168.9351	169.1351	169.0437	162.6546
160.0124	170.2482	170.4824	170.3568	162.0848
159.5248	171.2334	171.4961	171.3395	161.3739
158.9582	171.8659	172.1509	171.9672	160.5391
158.3266	172.1289	172.4293	172.2230	159.6006
157.6451	172.0130	172.3215	172.0979	158.5814
156.9306	171.5179	171.8272	171.5917	157.5062
156.2004	170.6517	170.9542	170.7127	156.4014
155.4724	169.4318	169.7201	169.4786	155.2941
154.7645	167.8843	168.1513	167.9157	154.2114
154.0941	166.0439	166.2831	166.0593	153.1800
153.4777	163.9537	164.1592	163.9524	152.2250
152.9304	161.6634	161.8301	161.6455	151.3701
152.4658	159.2296	159.3533	159.1953	150.6362
152.0953	156.7131	156.7906	156.6630	150.0414
151.8280	154.1780	154.2074	154.1132	149.6002
151.6705	151.6895	151.6700	151.6115	149.3233

3.1000

160.9572	163.3183	163.3899	163.4112	163.3619
160.8720	165.3979	165.5153	165.4985	163.2840
160.6840	167.2658	167.4259	167.3714	163.0358
160.3887	168.8755	169.0746	168.9836	162.6229
159.9932	170.1891	170.4223	170.2972	162.0553
159.5070	171.1749	171.4367	171.2806	161.3467
158.9419	171.8085	172.0925	171.9093	160.5143
158.3118	172.0728	172.3722	172.1665	159.5783
157.6320	171.9588	172.2664	172.0433	158.5615
156.9191	171.4661	171.7745	171.5396	157.4888
156.1905	170.6030	170.9046	170.6636	156.3866
155.4642	169.3866	169.6741	169.4331	155.2817
154.7578	167.8432	168.1095	167.8744	154.2013
154.0889	166.0075	166.2461	166.0226	153.1720
153.4737	163.9224	164.1273	163.9210	152.2191
152.9276	161.6376	161.8038	161.6195	151.3659
152.4640	159.2095	159.3328	159.1750	150.6335
152.0942	156.6988	156.7760	156.6486	150.0398
151.8275	154.1695	154.1987	154.1047	149.5995
151.6704	151.6868	151.6672	151.6087	149.3232

3.2000

160.9355	163.2698	163.3408	163.3622	163.3283
160.8510	165.3486	165.4652	165.4487	163.2517
160.6538	167.2157	167.3751	167.3208	163.0049
160.3694	168.8247	169.0230	168.9323	162.5937
159.9750	170.1378	170.3702	170.2454	162.0279
159.4900	171.1235	171.3844	171.2287	161.3212
158.9264	171.7573	172.0405	171.8577	160.4908
158.2977	172.0224	172.3210	172.1157	159.5570
157.6194	171.9097	172.2165	171.9939	158.5425
156.9080	171.4189	171.7265	171.4920	157.4722
156.1810	170.5582	170.8590	170.6186	156.3723
155.4562	169.3449	169.6317	169.3912	155.2697
154.7513	167.8052	168.0708	167.8362	154.1915
154.0837	165.9737	166.2117	165.9887	153.1643
153.4699	163.8932	164.0976	163.8917	152.2133
152.9249	161.6135	161.7792	161.5953	151.3618
152.4622	159.1907	159.3136	159.1561	150.6308
152.0932	156.6854	156.7624	156.6351	150.0383
151.8271	154.1616	154.1907	154.0967	149.5988
151.6702	151.6842	151.6645	151.6061	149.3230

3.3000

160.9149	163.2296	163.3000	163.3215	163.2973
160.8309	165.3066	165.4227	165.4062	163.2216
160.6444	167.1720	167.3308	167.2767	162.9759
160.3509	168.7796	168.9772	168.8868	162.5659
159.9575	170.0915	170.3233	170.1988	162.0017
159.4736	171.0766	171.3368	171.1814	161.2967
158.9112	171.7101	171.9926	171.8102	160.4682
158.2839	171.9755	172.2734	172.0685	159.5365
157.6071	171.8638	172.1698	171.9476	158.5241
156.8972	171.3745	171.6813	171.4473	157.4560
156.1717	170.5160	170.8161	170.5761	156.3583
155.4483	169.3055	169.5915	169.3515	155.2579
154.7449	167.7691	168.0341	167.7999	154.1819
154.0787	165.9415	166.1789	165.9563	153.1567
153.4661	163.8654	164.0693	163.8637	152.2076
152.9222	161.5905	161.7558	161.5722	151.3578
152.4605	159.1727	159.2953	159.1381	150.6282
152.0922	156.6726	156.7493	156.6223	150.0368
151.8266	154.1540	154.1829	154.0891	149.5981
151.6701	151.6817	151.6620	151.6036	149.3228

3.4000

160.8952	163.1948	163.2648	163.2863	163.2680
160.8116	165.2694	165.3850	165.3686	163.1929
160.6257	167.1326	167.2908	167.2368	162.9481
160.3329	168.7382	168.9353	168.8451	162.5392
159.9404	170.0486	170.2797	170.1555	161.9763
159.4576	171.0326	171.2921	171.1370	161.2729
158.8964	171.6656	171.9473	171.7653	160.4462
158.2704	171.9310	172.2281	172.0237	159.5163
157.5950	171.8199	172.1252	171.9034	158.5060
156.8865	171.3319	171.6380	171.4044	157.4401
156.1625	170.4754	170.7747	170.5352	156.3445
155.4406	169.2674	169.5528	169.3132	155.2463
154.7386	167.7343	167.9986	167.7648	154.1724
154.0737	165.9104	166.1472	165.9250	153.1493
153.4623	163.8385	164.0419	163.8366	152.2019
152.9195	161.5681	161.7330	161.5497	151.3537
152.4587	159.1552	159.2774	159.1205	150.6256
152.0912	156.6601	156.7366	156.6097	150.0353
151.8262	154.1466	154.1754	154.0817	149.5974
151.6700	151.6792	151.6595	151.6011	149.3226

3.5000

160.8760	163.1637	163.2334	163.2548	163.2398
160.7927	165.2354	165.3506	165.3342	163.1651
160.6073	167.0959	167.2537	167.1998	162.9210
160.3152	168.6993	168.8958	168.8058	162.5131
159.9235	170.0078	170.2383	170.1144	161.9514
159.4418	170.9904	171.2494	171.0945	161.2495
158.8818	171.6227	171.9038	171.7220	160.4245
158.2570	171.8879	172.1844	171.9803	159.4965
157.5830	171.7773	172.0819	171.8605	158.4882
156.8759	171.2905	171.5959	171.3627	157.4243
156.1534	170.4357	170.7344	170.4953	156.3309
155.4329	169.2302	169.5149	169.2758	155.2348
154.7323	167.7001	167.9639	167.7305	154.1630
154.0687	165.8799	166.1161	165.8943	153.1418
153.4586	163.8120	164.0149	163.8100	152.1963
152.9169	161.5462	161.7106	161.5276	151.3498
152.4570	159.1380	159.2599	159.1032	150.6230
152.0903	156.6478	156.7241	156.5974	150.0338
151.8257	154.1393	154.1679	154.0743	149.5968
151.6699	151.6768	151.6570	151.5987	149.3225

3.6000

160.8571	163.1350	163.2043	163.2258	163.2123
160.7741	165.2035	165.3183	165.3020	163.1379
160.5891	167.0611	167.2184	167.1646	162.8944
160.2977	168.6619	168.8580	168.7680	162.4874
159.9069	169.9684	170.1984	170.0746	161.9268
159.4261	170.9495	171.2078	171.0533	161.2263
158.8672	171.5808	171.8613	171.6799	160.4030
158.2438	171.8458	172.1416	171.9378	159.4768
157.5710	171.7355	172.0395	171.8185	158.4705
156.8654	171.2498	171.5545	171.3217	157.4086
156.1443	170.3967	170.6947	170.4560	156.3174
155.4253	169.1936	169.4776	169.2389	155.2234
154.7260	167.6664	167.9296	167.6966	154.1537
154.0638	165.8497	166.0854	165.8639	153.1344
153.4549	163.7859	163.9883	163.7838	152.1907
152.9143	161.5245	161.6885	161.5058	151.3458
152.4553	159.1210	159.2426	159.0861	150.6204
152.0893	156.6357	156.7117	156.5852	150.0324
151.8253	154.1321	154.1606	154.0671	149.5961
151.6698	151.6745	151.6546	151.5963	149.3223

3.7000

160.8385	163.1078	163.1769	163.1983	163.1853
160.7557	165.1729	165.2874	165.2710	163.1111
160.5711	167.0274	167.1843	167.1306	162.8681
160.2803	168.6256	168.8211	168.7314	162.4619
159.8903	169.9299	170.1593	170.0357	161.9025
159.4105	170.9094	171.1671	171.0128	161.2034
158.8527	171.5397	171.8195	171.6384	160.3816
158.2305	171.8043	172.0994	171.8960	159.4572
157.5591	171.6943	171.9975	171.7769	158.4528
156.8549	171.2095	171.5135	171.2812	157.3931
156.1352	170.3581	170.6554	170.4171	156.3039
155.4176	169.1572	169.4407	169.2023	155.2120
154.7198	167.6330	167.8956	167.6630	154.1443
154.0589	165.8198	166.0550	165.8339	153.1270
153.4512	163.7600	163.9619	163.7577	152.1851
152.9116	161.5029	161.6666	161.4841	151.3418
152.4536	159.1041	159.2254	159.0691	150.6178
152.0883	156.6237	156.6994	156.5731	150.0309
151.8248	154.1250	154.1533	154.0599	149.5955
151.6697	151.6721	151.6522	151.5940	149.3221

3.8000

160.8200	163.0817	163.1506	163.1718	163.1585
160.7374	165.1432	165.2574	165.2410	163.0845
160.5532	166.9945	167.1510	167.0974	162.8419
160.2630	168.5899	168.7850	168.6953	162.4366
159.8738	169.8920	170.1208	169.9975	161.8783
159.3950	170.8697	171.1269	170.9728	161.1805
158.8383	171.4989	171.7781	171.5973	160.3603
158.2174	171.7631	172.0575	171.8545	159.4377
157.5473	171.6534	171.9559	171.7357	158.4352
156.8445	171.1695	171.4728	171.2409	157.3775
156.1262	170.3197	170.6164	170.3785	156.2904
155.4100	169.1211	169.4040	169.1660	155.2007
154.7136	167.5998	167.8618	167.6296	154.1350
154.0540	165.7901	166.0247	165.8039	153.1197
153.4475	163.7342	163.9357	163.7317	152.1796
152.9090	161.4814	161.6447	161.4625	151.3379
152.4518	159.0873	159.2082	159.0522	150.6152
152.0873	156.6117	156.6872	156.5610	150.0294
151.8244	154.1178	154.1460	154.0527	149.5948
151.6696	151.6698	151.6498	151.5916	149.3220

3.9000

160.8015	163.0562	163.1249	163.1460	163.1318
160.7192	165.1141	165.2279	165.2116	163.0580
160.5354	166.9621	167.1183	167.0646	162.8159
160.2458	168.5547	168.7493	168.6598	162.4114
159.8573	169.8544	170.0828	169.9595	161.8541
159.3795	170.8304	171.0870	170.9332	161.1577
158.8239	171.4585	171.7370	171.5565	160.3390
158.2042	171.7222	172.0160	171.8132	159.4182
157.5355	171.6126	171.9146	171.6947	158.4177
156.8340	171.1297	171.4323	171.2008	157.3620
156.1172	170.2814	170.5775	170.3400	156.2770
155.4024	169.0852	169.3673	169.1298	155.1893
154.7073	167.5667	167.8281	167.5963	154.1257
154.0491	165.7604	165.9945	165.7741	153.1123
153.4437	163.7085	163.9095	163.7059	152.1740
152.9064	161.4600	161.6229	161.4410	151.3339
152.4501	159.0705	159.1911	159.0353	150.6126
152.0863	156.5997	156.6750	156.5490	150.0279
151.8240	154.1107	154.1388	154.0456	149.5941
151.6695	151.6674	151.6474	151.5892	149.3218

4.0000

160.7831	163.0312	163.0996	163.1207	163.1053
160.7010	165.0854	165.1989	165.1825	163.0316
160.5176	166.9301	167.0858	167.0322	162.7900
160.2286	168.5197	168.7139	168.6245	162.3862
159.8409	169.8171	170.0449	169.9219	161.8300
159.3640	170.7913	171.0473	170.8937	161.1349
158.8095	171.4182	171.6961	171.5159	160.3178
158.1910	171.6814	171.9745	171.7721	159.3987
157.5236	171.5721	171.8733	171.6538	158.4001
156.8236	171.0899	171.3920	171.1608	157.3465
156.1082	170.2433	170.5387	170.3016	156.2635
155.3948	169.0493	169.3308	169.0936	155.1780
154.7011	167.5337	167.7945	167.5630	154.1164
154.0441	165.7308	165.9643	165.7443	153.1049
153.4400	163.6828	163.8833	163.6800	152.1684
152.9037	161.4387	161.6011	161.4195	151.3299
152.4484	159.0538	159.1741	159.0185	150.6101
152.0854	156.5877	156.6628	156.5370	150.0265
151.8235	154.1036	154.1315	154.0384	149.5935
151.6694	151.6651	151.6450	151.5869	149.3216

A NEW MAXIMUM COMPUTATION TIME MUST BE PLACED AFTER THE VARIABLE DUMP IF THIS PROBLEM IS TO BE CONTINUED.

CARD DUMP OUTPUT

1					
9	3	4	18	19	0
2	1	6	2	1	3
0	0	20	2	17	1
20	1	21	20	20	20
21	1	1	0	1	2
1	7	7	1	7	0
-1	10	1	0	0	0
6	8	10			
1					
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0				
-4,36698+005	5.95565+003	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	1.47456+003	-2,62944+005	7,03767+004	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	1.51052+005
-2,53392+005	1.44319+005	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	7.70793+004	-2,55553+005	1,31657+003	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	5.29830+003
-4,27908+005	7.03767+004	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	1.51052+005	-2,53392+005	1,44319+005	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	7.70793+004
-2,55821+005	1.31657+003	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	5.56656+003	-4,06483+005	7,03978-003	-6.88975-001
1.23120+002	2.15000-001	1.60783+002	1,63031+002	1,63100+002	1.63121+002
1.63105+002	1.76064+002	1.76233+002	1,75421+002	5,20833-002	1.04167-002
2,08333-002	1.04167-002	1.04167-002	2,60417-003	2,60417-003	6.11637+001
2,77778-006	3.60000-001	-1.40000+006	-3,88889+006	-8,97960+005	8.97960+005
1,40000+006	2.25000+000	7.20000+001	1,38000+002	0,00000+000	1.04167-002
2,08333-002	2.34375-002	2.60417-002	2,86458-002	3,12500-002	4.16667-002
1,98162+000	2.74284+000	7.42843-001	2,57157-001	7,03978-003	1.68512+002
6,17125+001	6.17125+001	6.11642+001	6,12099+001	1,66667+000	0.00000+000
1,72572+001	1.14829-001	2.77778-003	4,00000+000	1,11111-003	1.20000+002
1,20000+002	4.00000+000	1.51627+002	1,49218+002	1,30000+002	1.00000+000
9,89024-001	1.09756-002	3.05611-007	2,44647-004	2,74004-004	2.68516-006
1,09756-002	9.27580+003	2.29658+000			
2.94912+003	1.06533+004	4.51752+005	1,14939+004	3,02105+005	6.11747+003
1,05936+005	1.40753+005	1.54159+005	6,11747+003	1,05936+005	2.88637+005
1,00383+004	6.11747+003	1.05936+005	2,63314+003	1,06486+004	4.51410+005
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	0.00000+000	1,00909+000	1,00877+000	0.00000+000
0,00000+000	0.00000+000	7.84600-002	0,00000+000	1,88867+003	1.57575+003
7,53183+005	2.88162+000	5.52310+000	5,23976+005	5,24359+005	0.00000+000
6,11634+001	6.12086+001	1.49322+002	9,89024-001	1,67714-002	2.44650-004
2,74008-004	1.00000+000	2.94912+003	3,16856+004	4,51583+005	1.14980+004
3,02105+005	1.82019+004	1.05936+005	1,40753+005	1,54159+005	1.82019+004
1,05936+005	2.88637+005	1.00466+004	1,82019+004	1,05936+005	2.63314+003
3,16559+004	4.51024+005	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	1.00910+000
1,00880+000	0.00000+000	0.00000+000	0,00000+000	2,33450-001	0.00000+000
1,88935+003	1.57704+003	2.24102+006	8,57396+000	1,64334+001	1.55899+006
1,56008+006	0.00000+000	6.11605+001	6,12046+001	1,49593+002	9.89024-001
1,67703-002	2.44657-004	2.74013-004	1,00000+000	2,94912+003	5.18963+004
4,51213+005	1.15070+004	3.02105+005	2,98373+004	1,05936+005	1.40753+005
1,54159+005	2.98373+004	1.05936+005	2,88637+005	1,00611+004	2.98373+004
1,05936+005	2.63314+003	5.18104+004	4,50341+005	0,00000+000	0.00000+000
0,00000+000	0.00000+000	0.00000+000	0,00000+000	0,00000+000	0.00000+000

0.00000+000	0.00000+000	0.00000+000	0.00000+000	0.00000+000	0.00000+000
0.00000+000	1.00913+000	1.00885+000	0.00000+000	0.00000+000	0.00000+000
3.82680-001	0.00000+000	1.89083+003	1.57932+003	3.67357+006	1.40548+001
2.69383+001	2.55540+006	2.55704+006	0.00000+000	6.11555+001	6.11975+001
1.50026+002	8.24444-001	1.67684-002	2.04400-004	2.74017-004	8.35419-001
2.94912+003	7.07665+004	4.50651+005	1.15207+004	3.02105+005	4.07389+004
1.05936+005	1.40753+005	1.54159+005	4.07389+004	1.05936+005	2.88637+005
1.00818+004	4.07389+004	1.05936+005	2.63314+003	7.05841+004	4.49378+005
3.68640+004	7.33956+004	1.05936+005	4.60800+003	1.38240+004	7.33956+004
1.05936+005	1.57989+004	6.55116+003	7.33956+004	1.05936+005	3.64089+003
4.55111+003	3.64270+004	1.28839+005	1.00917+000	1.00892+000	0.00000+000
0.00000+000	0.00000+000	5.22500-001	3.67581+003	1.89309+003	1.58256+003
5.01578+006	1.91900+001	3.67808+001	3.48873+006	3.49074+006	0.00000+000
6.11485+001	6.11875+001	1.50610+002	3.49024-001	1.67656-002	8.80844-005
2.74022-004	3.60000-001	2.94912+003	8.78113+004	4.49912+005	1.15388+004
3.02105+005	5.06371+004	1.05936+005	1.40753+005	1.54159+005	5.06371+004
1.05936+005	2.88637+005	1.01080+004	5.06371+004	1.05936+005	2.63314+003
8.74879+004	4.48159+005	3.68640+004	9.00370+004	1.05936+005	4.60800+003
1.38240+004	9.00370+004	1.05936+005	1.57989+004	7.37419+003	9.00370+004
1.05936+005	3.64089+003	4.55111+003	3.96734+004	1.14419+005	1.00923+000
1.00901+000	0.00000+000	0.00000+000	0.00000+000	6.49450-001	4.13761+003
1.89606+003	1.58667+003	6.23445+006	2.38525+001	4.57173+001	4.33583+006
4.33796+006	0.00000+000	6.11398+001	6.11748+001	1.51330+002	3.49024-001
1.67622-002	8.80876-005	2.74026-004	3.60000-001	2.94912+003	1.02602+005
4.49014+005	1.15609+004	3.02105+005	5.92886+004	1.05936+005	1.40753+005
1.54159+005	5.92886+004	1.05936+005	2.88637+005	1.01392+004	5.92886+004
1.05936+005	2.63314+003	1.02094+005	4.46715+005	3.68640+004	1.04025+005
1.05936+005	4.60800+003	1.38240+004	1.04025+005	1.05936+005	1.57989+004
8.17364+003	1.04025+005	1.05936+005	3.64089+003	4.55111+003	4.13340+004
1.03201+005	1.00929+000	1.00912+000	0.00000+000	0.00000+000	0.00000+000
7.60410-001	4.58618+003	1.89969+003	1.59158+003	7.29961+006	2.79277+001
5.35281+001	5.07583+006	5.07785+006	0.00000+000	6.11295+001	6.11596+001
1.52168+002	3.49024-001	1.67580-002	8.80904-005	2.74030-004	3.60000-001
2.94912+003	1.14772+005	4.47979+005	1.15864+004	3.02105+005	6.64797+004
1.05936+005	1.40753+005	1.54159+005	6.64797+004	1.05936+005	2.88637+005
1.01748+004	6.64797+004	1.05936+005	2.63314+003	1.14045+005	4.45083+005
3.68640+004	1.15079+005	1.05936+005	4.60800+003	1.38240+004	1.15079+005
1.05936+005	1.57989+004	8.95129+003	1.15079+005	1.05936+005	3.64089+003
4.55111+003	4.17386+004	9.42175+004	1.00937+000	1.00924+000	0.00000+000
0.00000+000	0.00000+000	8.52640-001	5.02251+003	1.90389+003	1.59716+003
8.18498+006	3.13151+001	6.00206+001	5.69046+006	5.69214+006	0.00000+000
6.11178+001	6.11423+001	1.53105+002	3.49024-001	1.67533-002	8.80927-005
2.74033-004	3.60000-001	2.94912+003	1.24033+005	4.46835+005	1.16148+004
3.02105+005	7.20343+004	1.05936+005	1.40753+005	1.54159+005	7.20343+004
1.05936+005	2.88637+005	1.02138+004	7.20343+004	1.05936+005	2.63314+003
1.23063+005	4.43303+005	3.68640+004	1.23423+005	1.05936+005	4.60800+003
1.38240+004	1.23423+005	1.05936+005	1.57989+004	9.55162+003	1.23423+005
1.05936+005	3.64089+003	4.55111+003	4.19319+004	8.82739+004	1.00946+000
1.00938+000	0.00000+000	0.00000+000	0.00000+000	9.23880-001	5.35935+003
1.90855+003	1.60329+003	8.86886+006	3.39315+001	6.50354+001	6.16469+006
6.16582+006	0.00000+000	6.11051+001	6.11234+001	1.54116+002	3.49024-001
1.67481-002	8.80943-005	2.74036-004	3.60000-001	2.94912+003	1 30172+005
4.45607+005	1.16454+004	3.02105+005	7.58150+004	1.05936+005	1 40753+005
1.54159+005	7.58150+004	1.05936+005	2.88637+005	1.02555+004	7.58150+004
1.05936+005	2.63314+003	1.28953+005	4.41420+005	3.68640+004	1.28117+005
1.05936+005	4.60800+003	1.38240+004	1.28117+005	1.05936+005	1.57989+004
1.02847+004	1.28117+005	1.05936+005	3.64089+003	4.55111+003	4.04204+004
8.19778+004	1.00956+000	1.00953+000	0.00000+000	0.00000+000	0.00000+000
9.72370-001	5.77067+003	1.91358+003	1.60984+003	9.33434+006	3.57124+001
6.84488+001	6.48685+006	6.48729+006	0.00000+000	6.11916+001	6.11032+001

1.55177+002	3.49024-001	1.67425-002	8.80953-005	2.74037-004	3.60000-001
2.94912+003	1.33063+005	4.44329+005	1.16775+004	3.02105+005	7.77291+004
1.05936+005	1.40753+005	1.54159+005	7.77291+004	1.05936+005	2.88637+005
1.02989+004	7.77291+004	1.05936+005	2.63314+003	1.31607+005	4.39479+005
3.68640+004	1.29523+005	1.05936+005	4.60800+003	1.38240+004	1.29523+005
1.05936+005	1.57989+004	1.10050+004	1.29523+005	1.05936+005	3.64089+003
4.55111+003	3.81861+004	7.66086+004	1.00966+000	1.00968+000	0.00000+000
0.00000+000	0.00000+000	9.96920-001	6.17485+003	1.91885+003	1.61664+003
9.57001+006	3.66141+001	7.01770+001	6.64914+006	6.64879+006	0.00000+000
6.10777+001	6.10822+001	1.56263+002	3.49024-001	1.67368-002	8.80957-005
2.74038-004	3.60000-001	2.94912+003	1.32660+005	4.43030+005	1.17103+004
3.02105+005	7.77291+004	1.05936+005	1.40753+005	1.54159+005	7.77291+004
1.05936+005	2.88637+005	1.03428+004	7.77291+004	1.05936+005	2.63314+003
1.31003+005	4.37529+005	3.68640+004	1.28060+005	1.05936+005	4.60800+003
1.38240+004	1.28060+005	1.05936+005	1.57989+004	1.10477+004	1.28060+005
1.05936+005	3.64089+003	4.55111+003	3.75969+004	7.62999+004	1.00976+000
1.00984+000	0.00000+000	0.00000+000	0.00000+000	9.96920-001	6.19878+003
1.92423+003	1.62353+003	9.57001+006	3.66141+001	7.01770+001	6.64762+006
6.64648+006	0.00000+000	6.10637+001	6.10610+001	1.57346+002	3.49024-001
1.67310-002	8.80954-005	2.74038-004	3.60000-001	2.94912+003	1.29004+005
4.41743+005	1.17429+004	3.02105+005	7.58150+004	1.05936+005	1.40753+005
1.54159+005	7.58150+004	1.05936+005	2.88637+005	1.03862+004	7.58150+004
1.05936+005	2.63314+003	1.27199+005	4.35619+005	3.68640+004	1.23004+005
1.05936+005	4.60800+003	1.38240+004	1.23004+005	1.05936+005	1.57989+004
1.10690+004	1.23004+005	1.05936+005	3.64089+003	4.55111+003	3.60372+004
7.61467+004	1.00987+000	1.01000+000	0.00000+000	0.00000+000	0.00000+000
9.72370-001	6.21073+003	1.92960+003	1.63035+003	9.33434+006	3.57124+001
6.84488+001	6.48245+006	6.48059+006	0.00000+000	6.10500+001	6.10401+001
1.58399+002	3.49024-001	1.67252-002	8.80945-005	2.74038-004	3.60000-001
2.94912+003	1.22213+005	4.40499+005	1.17746+004	3.02105+005	7.20343+004
1.05936+005	1.40753+005	1.54159+005	7.20343+004	1.05936+005	2.88637+005
1.04280+004	7.20343+004	1.05936+005	2.63314+003	1.20331+005	4.33794+005
3.68640+004	1.15515+005	1.05936+005	4.60800+003	1.38240+004	1.15515+005
1.05936+005	1.57989+004	1.11165+004	1.15515+005	1.05936+005	3.64089+003
4.55111+003	3.36862+004	7.58071+004	1.00997+000	1.01015+000	0.00000+000
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8.86886+006	3.39315+001	6.50354+001	6.15782+006	6.15538+006	0.00000+000
6.10368+001	6.10199+001	1.59398+002	3.49024-001	1.67197-002	8.80930-005
2.74036-004	3.60000-001	2.94912+003	1.12479+005	4.39329+005	1.18047+004
3.02105+005	6.64797+004	1.05936+005	1.40753+005	1.54159+005	6.64797+004
1.05936+005	2.88637+005	1.04672+004	6.64797+004	1.05936+005	2.63314+003
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1.38240+004	1.04939+005	1.05936+005	1.57989+004	1.11373+004	1.04939+005
1.05936+005	3.64089+003	4.55111+003	3.05401+004	7.56592+004	1.01006+000
1.01029+000	0.00000+000	0.00000+000	0.00000+000	8.52640-001	6.24908+003
1.93975+003	1.64307+003	8.18498+006	3.13151+001	6.00206+001	5.68181+006
5.67899+006	0.00000+000	6.10246+001	6.10011+001	1.60317+002	3.49024-001
1.67146-002	8.80911-005	2.74034-004	3.60000-001	2.94912+003	1.00060+005
4.38261+005	1.18322+004	3.02105+005	5.92886+004	1.05936+005	1.40753+005
1.54159+005	5.92886+004	1.05936+005	2.88637+005	1.05027+004	5.92886+004
1.05936+005	2.63314+003	9.82779+004	4.30573+005	3.68640+004	9.24721+004
1.05936+005	4.60800+003	1.38240+004	9.24721+004	1.05936+005	1.57989+004
1.11795+004	9.24721+004	1.05936+005	3.64089+003	4.55111+003	2.68019+004
7.53615+004	1.01015+000	1.01043+000	0.00000+000	0.00000+000	0.00000+000
7.60410-001	6.27273+003	1.94427+003	1.64864+003	7.29961+006	2.79277+001
5.35281+001	5.06623+006	5.06328+006	0.00000+000	6.10136+001	6.09840+001
1.61134+002	3.49024-001	1.67099-002	8.80888-005	2.74030-004	3.60000-001
2.94912+003	8.52688+004	4.37321+005	1.18566+004	3.02105+005	5.06371+004
1.05936+005	1.40753+005	1.54159+005	5.06371+004	1.05936+005	2.88637+005
1.05336+004	5.06371+004	1.05936+005	2.63314+003	8.36707+004	4.29256+005

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3,68640+004 7.80255+004 1.05936+005 4.60800+003 1.38240+004 7.80255+004
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4,35910+005 1.18933+004 3.02105+005 2,98373+004 1,05936+005 1.40753+005
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 1,44319+005 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 7.70793+004-2.55763+005 1,31657+003 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 5,50825+003-4.10958+005
-4,38795+005 5.92829+003 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 1.47456+003-2,62917+005 7,03767+004 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 1.51052+005
-2,53392+005 1.44319+005 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 7.70793+004-2,55521+005 1,31657+003 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 5.26680+003
-4,30572+005 7.03767+004 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 1.51052+005-2,53392+005 1,44319+005 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 7.70793+004
-2,55786+005 1.31657+003 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 5.53115+003-4,09189+005-4,38005+005 5.93856+003
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 1,47456+003-2,62927+005 7.03767+004 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 1,51052+005-2,53392+005 1,44319+005
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 7,70793+004-2,55534+005 1.31657+003 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 5,27951+003-4,29493+005 7.03767+004
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 1,51052+005-2,53392+005 1.44319+005 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 7,70793+004-2,55795+005 1.31657+003
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 5,54043+003-4.08476+005-4.37384+005 5,94666+003 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 1,47456+003-2.62935+005
 7,03767+004 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 1.51052+005-2.53392+005 1,44319+005 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 7,70793+004-2.55544+005
 1,31657+003 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 5.28916+003-4.28678+005 7,03767+004 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 1,51052+005-2.53392+005
```

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 1,44319+005 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 7.70793+004-2.55809+005 1,31657+003 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 5,55422+003-4.07422+005
-4,36947+005 5.95238+003 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 1.47456+003-2,62941+005 7,03767+004 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 1.51052+005
-2,53392+005 1.44319+005 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 7.70793+004-2,55550+005 1,31657+003 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 5.29548+003
-4,28145+005 7.03767+004 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 1.51052+005-2,53392+005 1,44319+005 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 7.70793+004
-2,55818+005 1.31657+003 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 5.56296+003-4,06756+005-4,36698+005 5.95565+003
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 1,47456+003-2.62944+005 7.03767+004 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 1,51052+005-2,53392+005 1.44319+005
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 7,70793+004-2.55553+005 1.31657+003 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 5,29830+003-4,27908+005 7.03767+004
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 1,51052+005-2.53392+005 1.44319+005 0,00000+000 0,00000+000 0.00000+000
 0,00000+000 0.00000+000 0.00000+000 7,70793+004-2,55821+005 1.31657+003
 0,00000+000 0.00000+000 0.00000+000 0,00000+000 0,00000+000 0.00000+000
 5,56656+003-4.06483+005
```

APPENDIX B

FORTRAN Listing of TRANTEMP Code

```
      PROGRAM TRANTEMP
C
C     THIS IS THE MAIN SUBROUTINE.
C
C     THIS CODE HAS BEEN NAMED TRANTEMP (TRANSIENT TEMPERATURE) AND IS
C     USED TO DETERMINE THE TIME-DEPENDENT TEMPERATURE MAP OF A
C     HYDRAULIC RABBIT ASSEMBLY.  IT HAS BEEN ASSIGNED THE ARGONNE
C     NATIONAL LABORATORY IDENTIFICATION NUMBER RE418X.
C
C
C
      DIMENSION A(8,8),A1(50),A2(50),A3(50),A4(50),A5(50),A6(50),A7(50),
     XA8(50),A9(50),A10(50),A11(50),A12(50),A13(50),A14(50),A15(50),
     XA16(50),A17(50),A18(50),
     XB1(50),B2(50),B3(50),B4(50),B5(50),B6(50),B7(50),B8(50),B9(50),
     XB10(50),B11(50),B12(50),B13(50),B14(50),B15(50),
     XCP4(50),CP8(50),
     XD(8),DIS4(50),DIS8(50),
     XF(8,50),FRAC8(50),
     XG(8,8,50),
     XHEAT(50),HL3(50),HL5(50),HL7(50),
     XIFRAC8(50),
     XQAL(50),QALWPG(50),QW20(50),QW204(50),QW208(50),
     XR(8),REMAN8(50),RHO4(50),RHO8(50),
     XSTORE(50),
     XT(8,50),TFLOW(50),THEAT(50),TITCFLOW(50),TPOSN(50),
     XVEQUIV(50),VINTMD(50),VOL1(50),VOL3(50),VSTORE(50),
     XYFLOW(50),YHEAT(50),YITCFLOW(50),YPOSN(50)
      TYPE LOGICAL DEBUG
      COMMON/1/DEBUG/2/TIME,TPOSN,YPOSN,PRABT/3/MPOSN/4/TFLOW,YFLOW,
     XMFLOW,GPRIMARY,G1,G2,G3,GZERO/5/R/8/RNODE,RLNGTH,RHO4,RHRVS4,
     XRMOVE,
     XFACTOR,TRVRS4/9/T/10/JJ,K1,K2,KK1,KKK2/11/HEAT,THEAT,YHEAT,QW20,
     XQALWPG,QMAXW,QMAXM/12/MHEAT/14/CONDAL,RHOAL,CP4,CP8,RHO8,HL5,
     XHL7,D1,D2,D3,DELR1,DELR2,DELR5,DELR6,RBTRM,RBTRM2,TMPIN4,
     XTMPIN8/15/IRABT,IRABT2,MRVRS/16/VOL3,VOLND3,STORE,DTAU,VOLND1,
     XRBTNOD,RBTEND,RNDEND,RHRVS8,TRVRS8
      COMMON/17/MITCFLOW,TITCFLOW,YITCFLOW
    1 FORMAT(6E12.5)
    2 FORMAT(6I12)
    3 FORMAT(36X,7F12.4)
    4 FORMAT(1X,F11.4,9F12.4)
    5 FORMAT(1X,E11.4,9E12.4)
    6 FORMAT(1X,F11.4,9E12.4)
    7 FORMAT(1X,I11,9I12)
    8 FORMAT(/)
    9 FORMAT(1H1)
   10 FORMAT(34H COOLANT WATER EXPANSION TOO LARGE)
   11 FORMAT(1X,E11.4,F12.4,2I12)
   12 FORMAT(1X,E11.4,E12.4,I12,E12.4)
   13 FORMAT(1X,F11.5,5F12.5)
   14 FORMAT(106H0A NEW MAXIMUM COMPUTATION TIME MUST BE PLACED AFTER THT
     XE VARIABLE DUMP IF THIS PROBLEM IS TO BE CONTINUED.)
   15 FORMAT(L12,5I12)
   16 FORMAT(52X,17HINPUT INFORMATION/)
   17 FORMAT(53X,15HCOMPUTED OUTPUT/)
   18 FORMAT(10H CARD 6***,3X,11HTOTAL AXIAL,2X,13HAXIAL SECTION,
     X3X,13HAXIAL SECTION,3X,26HTOTAL NUMBER OF NORMALIZED,3X,
     X15HTOTAL NUMBER OF,3X,15HTOTAL NUMBER OF/14X,8HSECTIONS,5X,
     X10HCONTAINING,4X,14HCONTAINING TOP,6X,20HHEAT GENERATION RATE,6X,
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  X15HNORMALIZED TUBE,3X,15HRABBIT POSITION/26X,13HBOTTOM END OF,6X,  TRAN  61
  X6HEND OF,11X,17HVERSUS TIME PAIRS,7X,16HFLOW VERSUS TIME,4X,       TRAN  62
  X11HVERSUS TIME/26X,13HRABBIT SAMPLE,3X,13HRABBIT SAMPLE,12X,       TRAN  63
  X11HVERSUS TIME/26X,13HRABBIT SAMPLE,3X,13HRABBIT SAMPLE,12X,       TRAN  64
  X9HOF VALUES,11X,15HPAIRS OF VALUES,3X,15HPAIRS OF VALUES)          TRAN  65
19 FORMAT(1X,I18,I14,I16,I22,I24,I18)                                 TRAN  66
20 FORMAT(10H CARD 7***,3X,12HDEBUG OPTION,2X,18HOPTION FOR INITIAL,  TRAN  67
  X4X,12HSTEADY-STATE,7X,12HSTEADY-STATE,4X,13HCOMPUTE/PRINT,4X,      TRAN  68
  X15HTOTAL NUMBER OF/14X,9H(INITIAL),5X,15HTEMPERATURE MAP,3X,       TRAN  69
  X18HCOMPUTATION OPTION,2X,16HTERMINATE OPTION,4X,9HFREQUENCY,5X,    TRAN  70
  X18HNORMALIZED PRIMARY/98X,22HFLOW VERSUS TIME PAIRS/104X,          TRAN  71
  X9HOF VALUES)                                                       TRAN  72
21 FORMAT(1X,L18,I16,I21,I19,I16,I19)                                 TRAN  73
22 FORMAT(11H CARDS 8***,35X,29HINNER-TO-OUTER RADII (INCHES)/13X,    TRAN  74
  X5HFIRST,9X,6HSECOND,9X,5HTHIRD,9X,6HFOURTH,9X,5HFIFTH,9X,5HSIXTH,  TRAN  75
  X8X,7HSEVENTH,9X,6HEIGHTH)                                          TRAN  76
23 FORMAT(1X,F17.4,F15.4,F14.4,F15.4,F14.4,F14.4,F15.4,F15.4)         TRAN  77
24 FORMAT(10H CARD 9***,3X,16HHEATED LENGTH OF,4X,9HLENGTH OF,6X,     TRAN  78
  X16HDISTANCE BETWEEN,7X,16HCOMPUTATION TIME,2X,                     TRAN  79
  X17HSTARTING TIME FOR,5X,7HPROBLEM/15X,11HRABBIT TUBE,5X,           TRAN  80
  X13HRABBIT SAMPLE,3X,19HLOWER END OF RABBIT,9X,8HINTERVAL,8X,       TRAN  81
  X13HDELAYED DEBUG,5X,11HTERMINATION/17X,8H(INCHES),8X,8H(INCHES),   TRAN  82
  X4X,23HAND LOWER END OF HEATED,6X,9H(SECONDS),10X,9H(SECONDS),8X,   TRAN  83
  X9H(SECONDS)/48X,16HSECTION (INCHES))                               TRAN  84
25 FORMAT(1X,F23.4,F18.4,F17.4,F22.4,F19.4,F18.4)                     TRAN  85
26 FORMAT(11H CARD 10***,2X,16HMAXIMUM, INITIAL,10X,                  TRAN  86
  X16HMAXIMUM, INITIAL,14X,17HINITIAL MASS FTRAN 87
  XLOW                                                                TRAN  88
  X                    /13X,15HHEATING RATE IN,11X,15HHEATING RATE IN,TRAN  89
  X12X,23HIN THE OPEN RABBIT TUBE,15X,14HIN THE PRIMARY/13X,          TRAN  90
  X16HWATER (WATTS/GM),10X,16HMETAL (WATTS/GM),15X,14H(LB/HR-SQ. FT),TRAN  91
  X21X,14H(LB/HR-SQ. FT))                                             TRAN  92
27 FORMAT(1X,F24.4,F26.4,F32.4,F35.4)                                 TRAN  93
28 FORMAT(11H CARD 11***,5X,17HTEMPERATURE VALUE,5X,                  TRAN  94
  X16HTUBE WATER INLET,1X,19HPRIMARY WATER INLET,7X,5HMETAL,10X,      TRAN  95
  X5HMETAL,3X,14HMETAL SPECIFIC/13X,24HFOR CONSTANT TEMPERATURE,3X,   TRAN  96
  X11HTEMPERATURE,8X,11HTEMPERATURE,8X,12HCONDUCTIVITY,5X,7HDENSITY,  TRAN  97
  X7X,4HHEAT/18X,14HMAP (DEGREE F),9X,10H(DEGREE F),8X,10H(DEGREE F),TRAN  98
  X5X,20H(BTU/HR-FT-DEGREE F),2X,5H(PCF),2X,17H(BTU/LB-DEGREE F))     TRAN  99
29 FORMAT(1X,F27.4,F22.4,F18.4,F19.4,F15.4,F12.4)                     TRAN 100
30 FORMAT(12H CARDS 12***,28X,40HNORMALIZED AXIAL HEAT GENERATION PROTRAN 101
  XFILE//32X,14HAXIAL POSITION,13X,31HNORMALIZED HEAT GENERATION RATETRAN 102
  X)                                                                  TRAN 103
31 FORMAT(1X,I39,F37.4)                                               TRAN 104
32 FORMAT(12H CARDS 13***,26X,43HNORMALIZED HEAT GENERATION RATE VERSTRAN 105
  XUS TIME//33X,14HTIME (SECONDS),13X,31HNORMALIZED HEAT GENERATION RTRAN 106
  XATE)                                                               TRAN 107
33 FORMAT(1X,F41.4,F35.4)                                             TRAN 108
34 FORMAT(12H CARDS 14***,26X,44HNORMALIZED RABBIT TUBE FLOW RATE VERTRAN 109
  XSUS TIME//                                                         TRAN 110
  X33X,14HTIME (SECONDS),18X,20HNORMALIZED FLOW RATE)                 TRAN 111
35 FORMAT(1X,14HTIME (SECONDS),32X,26HTEMPERATURE MAP (DEGREE F)//)   TRAN 112
36 FORMAT(1X,L11)                                                     TRAN 113
37 FORMAT(70HOALLOWED COMPUTER TIME IS EXHAUSTED.  A PUNCHED CARD DUMTRAN 114
  XP IS PROVIDED.)                                                    TRAN 115
38 FORMAT(120H THE INITIAL CONDITION GEOMETRICAL ARRANGEMENT FOR THISTRAN 116
  X PROBLEM IS DESCRIBED IN THE FOLLOWING DIAGRAM.  ****************/TRAN 117
  X89X,31H(ALL DIMENSIONS ARE IN INCHES.)//)                          TRAN 118
39 FORMAT(13X,92HRADIUS * * * * * * * * * * * * * * * * * * * * * * * *TRAN 119
  X * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * */17X,3H(1),9X,3H(2),9X,   TRAN 120
  X3H(3),9X,3H(4),9X,3H(5),9X,3H(6),9X,3H(7),9X,3H(8))                TRAN 121
```

```
   40 FORMAT(9X,6F12.4/)                                                TRAN 121
   41 FORMAT(6X,1HZ)                                                    TRAN 122
   42 FORMAT(1X,1H(,I2,1H),F7.4,42X,1HX,11X,1HX,11X,1HX,11X,1HX,11X,1HX)TRAN 123
   43 FORMAT(1X,1H(,I2,1H),F7.4,6X,1HX,11X,1HX,11X,1HX,11X,1HX,11X,1HX, TRAN 124
     X11X,1HX,11X,1HX,11X,1HX)                                          TRAN 125
   44 FORMAT(12H CARDS 16***,34X,27HRABBIT POSITION VERSUS TIME//       TRAN 126
     X33X,14HTIME (SECONDS),15X,24HRABBIT POSITION (INCHES))            TRAN 127
   45 FORMAT(1H1,12HMAIN PROGRAM//)                                     TRAN 128
   46 FORMAT(1X,I5)                                                     TRAN 129
   47 FORMAT(9A8)                                                       TRAN 130
   48 FORMAT(24X,9A8)                                                   TRAN 131
   49 FORMAT(12H CARDS 15***,28X,40HNORMALIZED PRIMARY FLOW RATE VERSUS TRAN 132
     XTIME//33X,14HTIME (SECONDS),18X,20HNORMALIZED FLOW RATE)          TRAN 133
C                                                                       TRAN 134
C                                                                       TRAN 135
C     NEW PROBLEM BEGINS HERE                                           TRAN 136
C                                                                       TRAN 137
C                                                                       TRAN 138
  100 CONTINUE                                                          TRAN 139
      LSTEDY=0                                                          TRAN 140
      MPRINT=0                                                          TRAN 141
      MRVRS=0                                                           TRAN 142
      TIME=0.                                                           TRAN 143
      PRINT 9                                                           TRAN 144
      READ 2, MPASS                                                     TRAN 145
      IF(EOF,60)1850,110                                                TRAN 146
  110 IF(MPASS-1)111,1802,1792                                          TRAN 147
  111 CONTINUE                                                          TRAN 148
      PRINT 16                                                          TRAN 149
      DO 112 I=1,4                                                      TRAN 150
      READ 47, T1,T2,T3,T4,T5,T6,T7,T8,T9                               TRAN 151
  112 PRINT 48, T1,T2,T3,T4,T5,T6,T7,T8,T9                              TRAN 152
      PRINT 8 $ PRINT 8                                                 TRAN 153
      READ 2, JJ,K1,K2,MHEAT,MFLOW,MPOSN                                TRAN 154
      READ 15, DEBUG,MOPT,MSTEDY,MEND,NPRINT,MITCFLOW                   TRAN 155
      READ 1, (R(I),I=2,8)                                              TRAN 156
      READ 1, ZTUBE,RLNGTH,PRABT,DTAU,TDEBUG,TFINAL                     TRAN 157
      READ 1, QMAXW,QMAXM,GZERO,QPRIMARY                                TRAN 158
      READ 1, TSTART,TMPIN4,TMPIN8,CONDAL,RHOAL,CPAL                    TRAN 159
      READ 1, (HEAT(J),J=1,JJ)                                          TRAN 160
      READ 1, (THEAT(I),YHEAT(I),I=1,MHEAT)                             TRAN 161
      READ 1, (TFLOW(I),YFLOW(I),I=1,MFLOW)                             TRAN 162
      READ 1, (TITCFLOW(I),YITCFLOW(I),I=1,MITCFLOW)                    TRAN 163
      READ 1, (TPOSN(I),YPOSN(I),I=1,MPOSN)                             TRAN 164
      IF(MOPT)120,120,150                                               TRAN 165
  120 DO 140 J=1,JJ                                                     TRAN 166
      DO 130 K=1,8                                                      TRAN 167
  130 T(K,J)=TSTART                                                     TRAN 168
  140 CONTINUE                                                          TRAN 169
      GO TO 170                                                         TRAN 170
  150 DO 160 J=1,JJ                                                     TRAN 171
      I=JJ-J+1                                                          TRAN 172
  160 READ 1, (T(K,I),K=1,8)                                            TRAN 173
  170 CONTINUE                                                          TRAN 174
      PRINT 18                                                          TRAN 175
      PRINT 19, JJ,K1,K2,MHEAT,MFLOW,MPOSN                              TRAN 176
      PRINT 8                                                           TRAN 177
      PRINT 20                                                          TRAN 178
      PRINT 21, DEBUG,MOPT,MSTEDY,MEND,NPRINT,MITCFLOW                  TRAN 179
      PRINT 8                                                           TRAN 180
```

```
      PRINT 8                                                           TRAN 181
      PRINT 22                                                          TRAN 182
      PRINT 23, 0.,(R(I),I=2,8)                                         TRAN 183
      PRINT 8                                                           TRAN 184
      PRINT 8                                                           TRAN 185
      PRINT 24                                                          TRAN 186
      PRINT 25, ZTUBE,RLNGTH,PRABT,DTAU,TDEBUG,TFINAL                   TRAN 187
      PRINT 8                                                           TRAN 188
      PRINT 8                                                           TRAN 189
      PRINT 26                                                          TRAN 190
      PRINT 27, QMAXW,QMAXM,GZERO,GPRIMARY                              TRAN 191
      PRINT 8                                                           TRAN 192
      PRINT 8                                                           TRAN 193
      PRINT 28                                                          TRAN 194
      PRINT 29, TSTART,TMPIN4,TMPIN8,CONDAL,RHOAL,CPAL                  TRAN 195
      PRINT 8                                                           TRAN 196
      PRINT 8                                                           TRAN 197
      PRINT 30                                                          TRAN 198
      PRINT 31, (J,HEAT(J),J=1,JJ)                                      TRAN 199
      PRINT 8                                                           TRAN 200
      PRINT 8                                                           TRAN 201
      PRINT 32                                                          TRAN 202
      PRINT 33, (THEAT(I),YHEAT(I),I=1,MHEAT)                           TRAN 203
      PRINT 8                                                           TRAN 204
      PRINT 8                                                           TRAN 205
      PRINT 34                                                          TRAN 206
      PRINT 33, (TFLOW(I),YFLOW(I),I=1,MFLOW)                           TRAN 207
      PRINT 8                                                           TRAN 208
      PRINT 8                                                           TRAN 209
      PRINT 49                                                          TRAN 210
      PRINT 33, (TITCFLOW(I),YITCFLOW(I),I=1,MITCFLOW)                  TRAN 211
      PRINT 8                                                           TRAN 212
      PRINT 8                                                           TRAN 213
      PRINT 44                                                          TRAN 214
      PRINT 33, (TPOSN(I),YPOSN(I),I=1,MPOSN)                           TRAN 215
      PRINT 9                                                           TRAN 216
      PRINT 17                                                          TRAN 217
      PRINT 38                                                          TRAN 218
      PRINT 39                                                          TRAN 219
      PRINT 40, 0.,(R(I),I=2,8)                                         TRAN 220
      PRINT 41                                                          TRAN 221
      KK1=K1-1                                                          TRAN 222
      KKK2=K2+1                                                         TRAN 223
      AXIAL=ZTUBE*(1.-(.5/JJ))                                          TRAN 224
      DO 171 J=KKK2,JJ                                                  TRAN 225
      K=JJ+KKK2-J                                                       TRAN 226
      PRINT 42, K,AXIAL                                                 TRAN 227
  171 AXIAL=AXIAL-(ZTUBE/JJ)                                            TRAN 228
      DO 172 J=K1,K2                                                    TRAN 229
      K=K2+K1-J                                                         TRAN 230
      PRINT 43, K,AXIAL                                                 TRAN 231
  172 AXIAL=AXIAL-(ZTUBE/JJ)                                            TRAN 232
      DO 173 J=1,KK1                                                    TRAN 233
      K=KK1+1-J                                                         TRAN 234
      PRINT 42, K,AXIAL                                                 TRAN 235
  173 AXIAL=AXIAL-(ZTUBE/JJ)                                            TRAN 236
      PRINT 9                                                           TRAN 237
      PRINT 35                                                          TRAN 238
      PRINT 4, 0.                                                       TRAN 239
      DO 180 J=KKK2,JJ                                                  TRAN 240
```

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      K=JJ+KKK2-J                                                       TRAN 241
  180 PRINT 3, (T(I,K),I=4,8)                                           TRAN 242
      DO 190 J=K1,K2                                                    TRAN 243
      K=K2+K1-J                                                         TRAN 244
  190 PRINT 4, (T(I,K),I=1,8)                                           TRAN 245
      DO 200 J=1,KK1                                                    TRAN 246
      K=KK1+1-J                                                         TRAN 247
  200 PRINT 3, (T(I,K),I=4,8)                                           TRAN 248
      PRINT 8                                                           TRAN 249
      TRVRS4=T(4,1)                                                     TRAN 250
      TRVRS8=T(8,1)                                                     TRAN 251
      PRINT 8                                                           TRAN 252
      DO 210 L=2,8                                                      TRAN 253
  210 R(L)=R(L)/12.                                                     TRAN 254
      DELR1=R(2)                                                        TRAN 255
      DELR2=DELR1                                                       TRAN 256
      DELR5=R(6)-R(5)                                                   TRAN 257
      DELR6=DELR5                                                       TRAN 258
      D1=2.*R(5)                                                        TRAN 259
      D2=2.*(R(5)-R(3))                                                 TRAN 260
      D3=2.*(R(8)-R(7))                                                 TRAN 261
      TDEBUG=TDEBUG/3600.                                               TRAN 262
      DTAU=DTAU/3600.                                                   TRAN 263
      RLNGTH=RLNGTH/12.                                                 TRAN 264
      ZTUBE=ZTUBE/12.                                                   TRAN 265
      PRABT=PRABT/12.                                                   TRAN 266
      RNODE=ZTUBE/JJ                                                    TRAN 267
      VOLND3=3.1415927*(R(8)**2-R(7)**2)*RNODE                          TRAN 268
      RBTNOD=PRABT/RNODE                                                TRAN 269
      IRABT=RBTNOD                                                      TRAN 270
      RBTRM=RBTNOD-IRABT                                                TRAN 271
      IF(RBTRM-.5)220,220,230                                           TRAN 272
  220 K1=IRABT+1                                                        TRAN 273
      GO TO 240                                                         TRAN 274
  230 K1=IRABT+2                                                        TRAN 275
  240 CONTINUE                                                          TRAN 276
      RBTEND=PRABT+RLNGTH                                               TRAN 277
      RNDEND=RBTEND/RNODE                                               TRAN 278
      IRABT2=RNDEND                                                     TRAN 279
      RBTRM2=RNDEND-IRABT2                                              TRAN 280
      IF(RBTRM2-.5)250,250,260                                          TRAN 281
  250 K2=IRABT2                                                         TRAN 282
      GO TO 270                                                         TRAN 283
  260 K2=IRABT2+1                                                       TRAN 284
  270 CONTINUE                                                          TRAN 285
      G1=GZERO                                                          TRAN 286
      G3=GPRIMARY                                                       TRAN 287
      RHOIN4=DENSE(TMPIN4)                                              TRAN 288
      RHOIN8=DENSE(TMPIN8)                                              TRAN 289
C                                                                       TRAN 290
C                                                                       TRAN 291
C                                                                       TRAN 292
C     ENTRY POINT FOR PROBLEM CONTINUATION IN THE NEXT TIME INTERVAL    TRAN 293
C                                                                       TRAN 294
C                                                                       TRAN 295
C                                                                       TRAN 296
  300 CALL FLOW                                                         TRAN 297
      IF(TIME-TDEBUG)304,303,303                                        TRAN 298
  303 DEBUG=0                                                           TRAN 299
  304 IF(TIME)100,305,305                                               TRAN 300
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  305 IF(DEBUG) GO TO 320                                              TRAN 301
      PRINT 45                                                         TRAN 302
      PRINT 46, 305                                                    TRAN 303
      PRINT 5, DELR1,DELR2,DELR5,DELR6,D1,D2,D3,DTAU,RLNGTH,ZTUBE      TRAN 304
      PRINT 5, TPRINT,R(3),R(5),G1,G2,G3                               TRAN 305
      PRINT 8                                                          TRAN 306
      PRINT 8                                                          TRAN 307
  320 CONTINUE                                                         TRAN 308
C                                                                      TRAN 309
      IF(K2-JJ)321,321,322                                             TRAN 310
  322 K2=JJ                                                            TRAN 311
      IF(K1-JJ)321,321,323                                             TRAN 312
  323 K1=JJ+1                                                          TRAN 313
  321 CONTINUE                                                         TRAN 314
      IF(KKK2-JJ)324,324,325                                           TRAN 315
  325 KKK2=JJ+1                                                        TRAN 316
      IF(KK1-JJ)324,324,326                                            TRAN 317
  326 KK1=JJ                                                           TRAN 318
  324 CONTINUE                                                         TRAN 319
C     RABBIT-FREE  SECTION                                             TRAN 320
      DO 330 J=1,KK1                                                   TRAN 321
      CALL WATER(T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J))                   TRAN 322
  330 CONTINUE                                                         TRAN 323
      DO 340 J=KKK2,JJ                                                 TRAN 324
      CALL WATER(T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J))                   TRAN 325
  340 CONTINUE                                                         TRAN 326
C                                                                      TRAN 327
C     RABBIT  SECTION  ONLY                                            TRAN 328
      DO 350 J=K1,K2                                                   TRAN 329
      CALL WATER(T(4,J),D2,G2,HL5(J),RHO4(J),CP4(J))                   TRAN 330
      HL3(J)=HL5(J)                                                    TRAN 331
  350 CONTINUE                                                         TRAN 332
      IF(DEBUG) GO TO 400                                              TRAN 333
      PRINT 46, 350                                                    TRAN 334
      DO 370 J=1,KK1                                                   TRAN 335
  370 PRINT 6, T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J)                      TRAN 336
      DO 380 J=K1,K2                                                   TRAN 337
  380 PRINT 6, T(4,J),D2,G2,HL5(J),RHO4(J),CP4(J)                      TRAN 338
      DO 390 J=KKK2,JJ                                                 TRAN 339
  390 PRINT 6, T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J)                      TRAN 340
      PRINT 8                                                          TRAN 341
      PRINT 8                                                          TRAN 342
  400 CONTINUE                                                         TRAN 343
C                                                                      TRAN 344
C     OUTER  WATER                                                     TRAN 345
      DO 410 J=1,JJ                                                    TRAN 346
      CALL WATER(T(8,J),D3,G3,HL7(J),RHO8(J),CP8(J))                   TRAN 347
  410 CONTINUE                                                         TRAN 348
      IF(DEBUG) GO TO 440                                              TRAN 349
      PRINT 46, 430                                                    TRAN 350
      DO 430 J=1,JJ                                                    TRAN 351
  430 PRINT 6, T(8,J),D3,G3,HL7(J),RHO8(J),CP8(J)                      TRAN 352
      PRINT 8                                                          TRAN 353
      PRINT 8                                                          TRAN 354
  440 CONTINUE                                                         TRAN 355
      CALL QHEAT                                                       TRAN 356
      IF(TIME)100,405,405                                              TRAN 357
  405 DO 450 J=1,JJ                                                    TRAN 358
      QH204(J)=1551.0774*RWO4(J)*QH20(J)                               TRAN 359
      QH208(J)=1551.0774*RWO8(J)*QH20(J)                               TRAN 360
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  450 QAL(J)=1551.0774*RHOAL*QALWPG(J)                                  TRAN 361
      IF(DEBUG) GO TO 480                                               TRAN 362
      PRINT 46, 470                                                     TRAN 363
      DO 470 J=1,JJ                                                     TRAN 364
  470 PRINT 5, QH204(J),QH208(J),QAL(J)                                 TRAN 365
      PRINT 8                                                           TRAN 366
      PRINT 8                                                           TRAN 367
  480 CONTINUE                                                          TRAN 368
C                                                                       TRAN 369
      IF(LSTEDY)4480,4480,483                                           TRAN 370
 4480 IF(MSTEDY)482,482,481                                             TRAN 371
  482 CALL STEADY                                                       TRAN 372
      IF(MEND)100,100,481                                               TRAN 373
  481 LSTEDY=1                                                          TRAN 374
      PRINT 9                                                           TRAN 375
      GO TO 300                                                         TRAN 376
  483 CONTINUE                                                          TRAN 377
C     RABBIT-FREE  SECTION                                              TRAN 378
      DO 490 J=1,KK1                                                    TRAN 379
      A1(J)=2./(R(5)**2)                                                TRAN 380
      A2(J)=QH204(J)/(HL5(J)*R(5))                                      TRAN 381
      A3(J)=(RHO4(J)*CP4(J))/(HL5(J)*R(5)*DTAU)                         TRAN 382
      A4(J)=(8.*HL5(J)*R(5))/(CONDAL*DELR5*(4.*R(5)+DELR5))             TRAN 383
      A5(J)=(4.*(2.*R(5)+DELR5))/((DELR5**2)*(4.*R(5)+DELR5))           TRAN 384
      A6(J)=QAL(J)/CONDAL                                               TRAN 385
      A7(J)=(RHOAL*CPAL)/(CONDAL*DTAU)                                  TRAN 386
      A8(J)=(2.*R(6)-DELR5)/(2.*R(6)*DELR6**2)                          TRAN 387
      A9(J)=(2.*R(6)+DELR6)/(2.*R(6)*DELR6**2)                          TRAN 388
      A10(J)=A6(J)                                                      TRAN 389
      A11(J)=A7(J)                                                      TRAN 390
      A12(J)=(4.*(2.*R(7)-DELR6))/((DELR6**2)*(4.*R(7)-DELR6))          TRAN 391
      A13(J)=(8.*HL7(J)*R(7))/(CONDAL*DELR6*(4.*R(7)-DELR6))            TRAN 392
      A14(J)=A6(J)                                                      TRAN 393
      A15(J)=A7(J)                                                      TRAN 394
      A16(J)=2./(R(8)**2-R(7)**2)                                       TRAN 395
      A17(J)=QH208(J)/(HL7(J)*R(7))                                     TRAN 396
  490 A18(J)=(RHO8(J)*CP8(J))/(HL7(J)*R(7)*DTAU)                        TRAN 397
      DO 500 J=KKK2,JJ                                                  TRAN 398
      A1(J)=2./(R(5)**2)                                                TRAN 399
      A2(J)=QH204(J)/(HL5(J)*R(5))                                      TRAN 400
      A3(J)=(RHO4(J)*CP4(J))/(HL5(J)*R(5)*DTAU)                         TRAN 401
      A4(J)=(8.*HL5(J)*R(5))/(CONDAL*DELR5*(4.*R(5)+DELR5))             TRAN 402
      A5(J)=(4.*(2.*R(5)+DELR5))/((DELR5**2)*(4.*R(5)+DELR5))           TRAN 403
      A6(J)=QAL(J)/CONDAL                                               TRAN 404
      A7(J)=(RHOAL*CPAL)/(CONDAL*DTAU)                                  TRAN 405
      A8(J)=(2.*R(6)-DELR5)/(2.*R(6)*DELR6**2)                          TRAN 406
      A9(J)=(2.*R(6)+DELR6)/(2.*R(6)*DELR6**2)                          TRAN 407
      A10(J)=A6(J)                                                      TRAN 408
      A11(J)=A7(J)                                                      TRAN 409
      A12(J)=(4.*(2.*R(7)-DELR6))/((DELR6**2)*(4.*R(7)-DELR6))          TRAN 410
      A13(J)=(8.*HL7(J)*R(7))/(CONDAL*DELR6*(4.*R(7)-DELR6))            TRAN 411
      A14(J)=A6(J)                                                      TRAN 412
      A15(J)=A7(J)                                                      TRAN 413
      A16(J)=2./(R(8)**2-R(7)**2)                                       TRAN 414
      A17(J)=QH208(J)/(HL7(J)*R(7))                                     TRAN 415
  500 A18(J)=(RHO8(J)*CP8(J))/(HL7(J)*R(7)*DTAU)                        TRAN 416
      IF(RBTRM-.5)520,520,510                                           TRAN 417
  510 A2( KK1 )=A2( KK1 )*(1./QH204( KK1 ))*((1.-RBTRM)*QH204( KK1 )    TRAN 418
     X+RBTRM*(((R(5)**2)-(R(3)**2))/(R(5)**2))*QH204( KK1 )             TRAN 419
     X+RBTRM*((R(3)**2)/(R(5)**2))*QAL( KK1 ))                          TRAN 420
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  520 CONTINUE                                                          TRAN 421
      IF(RBTRM2-.5)530,530,540                                          TRAN 422
  530 A2(KKK2)=A2(KKK2)*(1./QH204(KKK2))*((1.-RBTRM2)*QH204(KKK2)       TRAN 423
     X+RBTRM2*(((R(5)**2)-(R(3)**2))/(R(5)**2))*QH204(KKK2)             TRAN 424
     X+RBTRM2*((R(3)**2)/(R(5)**2))*QAL(KKK2))                          TRAN 425
  540 CONTINUE                                                          TRAN 426
      IF(DEBUG) GO TO 580                                               TRAN 427
      PRINT 46, 560                                                     TRAN 428
      DO 560 J=1,KK1                                                    TRAN 429
  560 PRINT 5, A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),A7(J),A8(J),A9(J),   TRAN 430
     XA10(J),A11(J),A12(J),A13(J),A14(J),A15(J),A16(J),A17(J),A18(J)    TRAN 431
      DO 570 J=KKK2,JJ                                                  TRAN 432
  570 PRINT 5, A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),A7(J),A8(J),A9(J),   TRAN 433
     XA10(J),A11(J),A12(J),A13(J),A14(J),A15(J),A16(J),A17(J),A18(J)    TRAN 434
      PRINT 8                                                           TRAN 435
      PRINT 8                                                           TRAN 436
  580 CONTINUE                                                          TRAN 437
C                                                                       TRAN 438
C     RABBIT-FREE  SECTION                                              TRAN 439
      DO 590 J=1,KK1                                                    TRAN 440
      F(1,J)=-.5*A1(J)*(T(5,J)-T(4,J))-A2(J)-A3(J)*T(4,J)               TRAN 441
      F(2,J)=-.5*A4(J)*(T(4,J)-T(5,J))-.5*A5(J)*(T(6,J)-T(5,J))         TRAN 442
     X-A6(J)-A7(J)*T(5,J)                                               TRAN 443
      F(3,J)=-.5*A8(J)*(T(5,J)-T(6,J))-.5*A9(J)*(T(7,J)-T(6,J))         TRAN 444
     X-A10(J)-A11(J)*T(6,J)                                             TRAN 445
      F(4,J)=-.5*A12(J)*(T(6,J)-T(7,J))-.5*A13(J)*(T(8,J)-T(7,J))       TRAN 446
     X-A14(J)-A15(J)*T(7,J)                                             TRAN 447
  590 F(5,J)=-.5*A16(J)*(T(7,J)-T(8,J))-A17(J)-A18(J)*T(8,J)            TRAN 448
      DO 600 J=KKK2,JJ                                                  TRAN 449
      F(1,J)=-.5*A1(J)*(T(5,J)-T(4,J))-A2(J)-A3(J)*T(4,J)               TRAN 450
      F(2,J)=-.5*A4(J)*(T(4,J)-T(5,J))-.5*A5(J)*(T(6,J)-T(5,J))         TRAN 451
     X-A6(J)-A7(J)*T(5,J)                                               TRAN 452
      F(3,J)=-.5*A8(J)*(T(5,J)-T(6,J))-.5*A9(J)*(T(7,J)-T(6,J))         TRAN 453
     X-A10(J)-A11(J)*T(6,J)                                             TRAN 454
      F(4,J)=-.5*A12(J)*(T(6,J)-T(7,J))-.5*A13(J)*(T(8,J)-T(7,J))       TRAN 455
     X-A14(J)-A15(J)*T(7,J)                                             TRAN 456
  600 F(5,J)=-.5*A16(J)*(T(7,J)-T(8,J))-A17(J)-A18(J)*T(8,J)            TRAN 457
      IF(DEBUG) GO TO 640                                               TRAN 458
      PRINT 46, 620                                                     TRAN 459
      DO 620 J=1,KK1                                                    TRAN 460
  620 PRINT 5, F(1,J),F(2,J),F(3,J),F(4,J),F(5,J)                       TRAN 461
      DO 630 J=KKK2,JJ                                                  TRAN 462
  630 PRINT 5, F(1,J),F(2,J),F(3,J),F(4,J),F(5,J)                       TRAN 463
      PRINT 8                                                           TRAN 464
      PRINT 8                                                           TRAN 465
  640 CONTINUE                                                          TRAN 466
C                                                                       TRAN 467
C     RABBIT-FREE  SECTION                                              TRAN 468
      DO 650 J=1,KK1                                                    TRAN 469
      G(1,1,J)=-.5*A1(J)-A3(J)                                          TRAN 470
      G(1,2,J)=.5*A1(J)                                                 TRAN 471
      G(2,1,J)=.5*A4(J)                                                 TRAN 472
      G(2,2,J)=-.5*A4(J)-.5*A5(J)-A7(J)                                 TRAN 473
      G(2,3,J)=.5*A5(J)                                                 TRAN 474
      G(3,2,J)=.5*A8(J)                                                 TRAN 475
      G(3,3,J)=-.5*A8(J)-.5*A9(J)-A11(J)                                TRAN 476
      G(3,4,J)=.5*A9(J)                                                 TRAN 477
      G(4,3,J)=.5*A12(J)                                                TRAN 478
      G(4,4,J)=-.5*A12(J)-.5*A13(J)-A15(J)                              TRAN 479
      G(4,5,J)=.5*A13(J)                                                TRAN 480
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      G(5,4,J)=.5*A16(J)                                                TRAN 481
  650 G(5,5,J)=-.5*A16(J)-A18(J)                                        TRAN 482
      DO 660 J=KKK2,JJ                                                  TRAN 483
      G(1,1,J)=-.5*A1(J)-A3(J)                                          TRAN 484
      G(1,2,J)=.5*A1(J)                                                 TRAN 485
      G(2,1,J)=.5*A4(J)                                                 TRAN 486
      G(2,2,J)=-.5*A4(J)-.5*A5(J)-A7(J)                                 TRAN 487
      G(2,3,J)=.5*A5(J)                                                 TRAN 488
      G(3,2,J)=.5*A8(J)                                                 TRAN 489
      G(3,3,J)=-.5*A8(J)-.5*A9(J)-A11(J)                                TRAN 490
      G(3,4,J)=.5*A9(J)                                                 TRAN 491
      G(4,3,J)=.5*A12(J)                                                TRAN 492
      G(4,4,J)=-.5*A12(J)-.5*A13(J)-A15(J)                              TRAN 493
      G(4,5,J)=.5*A13(J)                                                TRAN 494
      G(5,4,J)=.5*A16(J)                                                TRAN 495
  660 G(5,5,J)=-.5*A16(J)-A18(J)                                        TRAN 496
      IF(DEBUG) GO TO 700                                               TRAN 497
      PRINT 46, 680                                                     TRAN 498
      DO 680 J=1,KK1                                                    TRAN 499
  680 PRINT 5, G(1,1,J),G(1,2,J),G(2,1,J),G(2,2,J),G(2,3,J),G(3,2,J),   TRAN 500
     XG(3,3,J),G(3,4,J),G(4,3,J),G(4,4,J),G(4,5,J),G(5,4,J),G(5,5,J)    TRAN 501
      DO 690 J=KKK2,JJ                                                  TRAN 502
  690 PRINT 5, G(1,1,J),G(1,2,J),G(2,1,J),G(2,2,J),G(2,3,J),G(3,2,J),   TRAN 503
     XG(3,3,J),G(3,4,J),G(4,3,J),G(4,4,J),G(4,5,J),G(5,4,J),G(5,5,J)    TRAN 504
      PRINT 8                                                           TRAN 505
      PRINT 8                                                           TRAN 506
  700 CONTINUE                                                          TRAN 507
C                                                                       TRAN 508
C     RABBIT  SECTION  ONLY                                             TRAN 509
      DO 710 J=K1,K2                                                    TRAN 510
      A4(J)=(8.*HL5(J)*R(5))/(CONDAL*DELR5*(4.*R(5)+DELR5))             TRAN 511
      A5(J)=(4.*(2.*R(5)+DELR5))/((DELR5**2)*(4.*R(5)+DELR5))           TRAN 512
      A6(J)=QAL(J)/CONDAL                                               TRAN 513
      A7(J)=(RHOAL*CPAL)/(CONDAL*DTAU)                                  TRAN 514
      A8(J)=(2.*R(6)-DELR5)/(2.*R(6)*DELR6**2)                          TRAN 515
      A9(J)=(2.*R(6)+DELR6)/(2.*R(6)*DELR6**2)                          TRAN 516
      A10(J)=A6(J)                                                      TRAN 517
      A11(J)=A7(J)                                                      TRAN 518
      A12(J)=(4.*(2.*R(7)-DELR6))/((DELR6**2)*(4.*R(7)-DELR6))          TRAN 519
      A13(J)=(8.*HL7(J)*R(7))/(CONDAL*DELR6*(4.*R(7)-DELR6))            TRAN 520
      A14(J)=A6(J)                                                      TRAN 521
      A15(J)=A7(J)                                                      TRAN 522
      A16(J)=2./(R(8)**2-R(7)**2)                                       TRAN 523
      A17(J)=QH208(J)/(HL7(J)*R(7))                                     TRAN 524
      A18(J)=(RHO8(J)*CP8(J))/(HL7(J)*R(7)*DTAU)                        TRAN 525
      B1(J)=4./(DELR1**2)                                               TRAN 526
      B2(J)=QAL(J)/CONDAL                                               TRAN 527
      B3(J)=(RHOAL*CPAL)/(CONDAL*DTAU)                                  TRAN 528
      B4(J)=(2.*R(2)-DELR1)/(2.*R(2)*DELR1**2)                          TRAN 529
      B5(J)=(2.*R(2)+DELR2)/(2.*R(2)*DELR1**2)                          TRAN 530
      B6(J)=B2(J)                                                       TRAN 531
      B7(J)=B3(J)                                                       TRAN 532
      B8(J)=(4.*(2.*R(3)-DELR2))/((DELR2**2)*(4.*R(3)-DELR2))           TRAN 533
      B9(J)=(8.*HL3(J)*R(3))/((CONDAL*DELR2)*(4.*R(3)-DELR2))           TRAN 534
      B10(J)=B2(J)                                                      TRAN 535
      B11(J)=B3(J)                                                      TRAN 536
      B12(J)=(2.*HL3(J)*R(3))/((R(5)**2-R(3)**2)*(HL3(J)*R(3)           TRAN 537
     X+HL5(J)*R(5)))                                                    TRAN 538
      B13(J)=(2.*HL5(J)*R(5))/((R(5)**2-R(3)**2)*(HL3(J)*R(3)           TRAN 539
     X+HL5(J)*R(5)))                                                    TRAN 540
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      B14(J)=QH204(J)/(HL3(J)*R(3)+HL5(J)*R(5))                          TRAN 541
  710 B15(J)=(RHO4(J)*CP4(J))/(DTAU*(HL3(J)*R(3)+HL5(J)*R(5)))           TRAN 542
      IF(RBTRM-.5)720,720,730                                            TRAN 543
  720 B2(K1)=B2(K1)*(1./QAL(K1))*(RBTRM*QH204(K1)+(1.-RBTRM)*QAL(K1))    TRAN 544
      B6(K1)=B2(K1)                                                      TRAN 545
      B10(K1)=B2(K1)                                                     TRAN 546
  730 CONTINUE                                                           TRAN 547
      IF(RBTRM2-.5)750,750,740                                           TRAN 548
  740 B2(K2)=B2(K2)*(1./QAL(K2))*((1.-RBTRM2)*QH204(K2)+RBTRM2*QAL(K2))  TRAN 549
      B6(K2)=B2(K2)                                                      TRAN 550
      B10(K2)=B2(K2)                                                     TRAN 551
  750 CONTINUE                                                           TRAN 552
      IF(DEBUG) GO TO 780                                                TRAN 553
      PRINT 46, 770                                                      TRAN 554
      DO 770 J=K1,K2                                                     TRAN 555
  770 PRINT 5, B1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B7(J),B8(J),B9(J),    TRAN 556
     XB10(J),B11(J),B12(J),B13(J),B14(J),B15(J)                          TRAN 557
      PRINT 8                                                            TRAN 558
      PRINT 8                                                            TRAN 559
  780 CONTINUE                                                           TRAN 560
C                                                                        TRAN 561
C     RABBIT  SECTION  ONLY                                              TRAN 562
      DO 790 J=K1,K2                                                     TRAN 563
      F(1,J)=-.5*B1(J)*(T(2,J)-T(1,J))-B2(J)-B3(J)*T(1,J)                TRAN 564
      F(2,J)=-.5*B4(J)*(T(1,J)-T(2,J))-.5*B5(J)*(T(3,J)-T(2,J))          TRAN 565
     X-B6(J)-B7(J)*T(2,J)                                                TRAN 566
      F(3,J)=-.5*B8(J)*(T(2,J)-T(3,J))-.5*B9(J)*(T(4,J)-T(3,J))          TRAN 567
     X-B10(J)-B11(J)*T(3,J)                                              TRAN 568
      F(4,J)=-.5*B12(J)*(T(3,J)-T(4,J))-.5*B13(J)*(T(5,J)-T(4,J))        TRAN 569
     X-B14(J)-B15(J)*T(4,J)                                              TRAN 570
      F(5,J)=-.5*A4(J)*(T(4,J)-T(5,J))-.5*A5(J)*(T(6,J)-T(5,J))          TRAN 571
     X-A6(J)-A7(J)*T(5,J)                                                TRAN 572
      F(6,J)=-.5*A8(J)*(T(5,J)-T(6,J))-.5*A9(J)*(T(7,J)-T(6,J))          TRAN 573
     X-A10(J)-A11(J)*T(6,J)                                              TRAN 574
      F(7,J)=-.5*A12(J)*(T(6,J)-T(7,J))-.5*A13(J)*(T(8,J)-T(7,J))        TRAN 575
     X-A14(J)-A15(J)*T(7,J)                                              TRAN 576
  790 F(8,J)=-.5*A16(J)*(T(7,J)-T(8,J))-A17(J)-A18(J)*T(8,J)             TRAN 577
      IF(DEBUG) GO TO 820                                                TRAN 578
      PRINT 46, 810                                                      TRAN 579
      DO 810 J=K1,K2                                                     TRAN 580
  810 PRINT 5, F(1,J),F(2,J),F(3,J),F(4,J),F(5,J),F(6,J),F(7,J),F(8,J)   TRAN 581
      PRINT 8                                                            TRAN 582
      PRINT 8                                                            TRAN 583
  820 CONTINUE                                                           TRAN 584
C                                                                        TRAN 585
C     RABBIT  SECTION  ONLY                                              TRAN 586
      DO 830 J=K1,K2                                                     TRAN 587
      G(1,1,J)=-.5*B1(J)-B3(J)                                           TRAN 588
      G(1,2,J)=.5*B1(J)                                                  TRAN 589
      G(2,1,J)=.5*B4(J)                                                  TRAN 590
      G(2,2,J)=-.5*B4(J)-.5*B5(J)-B7(J)                                  TRAN 591
      G(2,3,J)=.5*B5(J)                                                  TRAN 592
      G(3,2,J)=.5*B8(J)                                                  TRAN 593
      G(3,3,J)=-.5*B8(J)-.5*B9(J)-B11(J)                                 TRAN 594
      G(3,4,J)=.5*B9(J)                                                  TRAN 595
      G(4,3,J)=.5*B12(J)                                                 TRAN 596
      G(4,4,J)=-.5*B12(J)-.5*B13(J)-B15(J)                               TRAN 597
      G(4,5,J)=.5*B13(J)                                                 TRAN 598
      G(5,4,J)=.5*A4(J)                                                  TRAN 599
      G(5,5,J)=-.5*A4(J)-.5*A5(J)-A7(J)                                  TRAN 600
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      G(5,6,J)=.5*A5(J)                                                 TRAN 601
      G(6,5,J)=.5*A8(J)                                                 TRAN 602
      G(6,6,J)=-.5*A8(J)-.5*A9(J)-A11(J)                                TRAN 603
      G(6,7,J)=.5*A9(J)                                                 TRAN 604
      G(7,6,J)=.5*A12(J)                                                TRAN 605
      G(7,7,J)=-.5*A12(J)-.5*A13(J)-A15(J)                              TRAN 606
      G(7,8,J)=.5*A13(J)                                                TRAN 607
      G(8,7,J)=.5*A16(J)                                                TRAN 608
  830 G(8,8,J)=-.5*A16(J)-A18(J)                                        TRAN 609
      IF(DEBUG) GO TO 860                                               TRAN 610
      PRINT 46, 850                                                     TRAN 611
      DO 850 J=K1,K2                                                    TRAN 612
  850 PRINT 5, G(1,1,J),G(1,2,J),G(2,1,J),G(2,2,J),G(2,3,J),G(3,2,J),   TRAN 613
     XG(3,3,J),G(3,4,J),G(4,3,J),G(4,4,J),G(4,5,J),G(5,4,J),G(5,5,J),   TRAN 614
     XG(5,6,J),G(6,5,J),G(6,6,J),G(6,7,J),G(7,6,J),G(7,7,J),G(7,8,J),   TRAN 615
     XG(8,7,J),G(8,8,J)                                                 TRAN 616
      PRINT 8                                                           TRAN 617
      PRINT 8                                                           TRAN 618
  860 CONTINUE                                                          TRAN 619
C                                                                       TRAN 620
      KK1=K1-1                                                          TRAN 621
      KKK2=K2+1                                                         TRAN 622
C                                                                       TRAN 623
C     BOTTOM  WATER  SECTION                                            TRAN 624
      DO 950 J=1,KK1                                                    TRAN 625
      A(1,1)=G(1,1,J)                                                   TRAN 626
      A(1,2)=G(1,2,J)                                                   TRAN 627
      DO 880 I=2,4                                                      TRAN 628
      III=I-1                                                           TRAN 629
      DO 870 II=1,3                                                     TRAN 630
      A(I,III)=G(I,III,J)                                               TRAN 631
  870 III=III+1                                                         TRAN 632
  880 CONTINUE                                                          TRAN 633
      A(5,4)=G(5,4,J)                                                   TRAN 634
      A(5,5)=G(5,5,J)                                                   TRAN 635
      DO 890 N=1,5                                                      TRAN 636
  890 D(N)=F(N,J)                                                       TRAN 637
      IF(DEBUG) GO TO 910                                               TRAN 638
      PRINT 46, 890                                                     TRAN 639
      PRINT 5, A(1,1),A(1,2),D(1)                                       TRAN 640
      PRINT 5, A(2,1),A(2,2),A(2,3),D(2)                                TRAN 641
      PRINT 5, A(3,2),A(3,3),A(3,4),D(3)                                TRAN 642
      PRINT 5, A(4,3),A(4,4),A(4,5),D(4)                                TRAN 643
      PRINT 5, A(5,4),A(5,5),D(5)                                       TRAN 644
  910 CONTINUE                                                          TRAN 645
      CALL GAUSS1(A,5,D)                                                TRAN 646
      DO 920 N=1,5                                                      TRAN 647
      NN=N+3                                                            TRAN 648
  920 T(NN,J)=D(N)                                                      TRAN 649
      IF(DEBUG) GO TO 940                                               TRAN 650
      PRINT 46, 920                                                     TRAN 651
      PRINT 3, (T(LMN,J),LMN=4,8)                                       TRAN 652
      PRINT 8                                                           TRAN 653
      PRINT 8                                                           TRAN 654
  940 CONTINUE                                                          TRAN 655
  950 CONTINUE                                                          TRAN 656
C                                                                       TRAN 657
C     RABBIT  SECTION                                                   TRAN 658
      DO 1040 J=K1,K2                                                   TRAN 659
      A(1,1)=G(1,1,J)                                                   TRAN 660
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      A(1,2)=G(1,2,J)                                                   TRAN 661
      DO 970 I=2,7                                                      TRAN 662
      III=I-1                                                           TRAN 663
      DO 960 II=1,3                                                     TRAN 664
      A(I,III)=G(I,III,J)                                               TRAN 665
  960 III=III+1                                                         TRAN 666
  970 CONTINUE                                                          TRAN 667
      A(8,7)=G(8,7,J)                                                   TRAN 668
      A(8,8)=G(8,8,J)                                                   TRAN 669
      DO 980 N=1,8                                                      TRAN 670
  980 D(N)=F(N,J)                                                       TRAN 671
      IF(DEBUG) GO TO 1000                                              TRAN 672
      PRINT 46, 980                                                     TRAN 673
      PRINT 5, A(1,1),A(1,2),D(1)                                       TRAN 674
      PRINT 5, A(2,1),A(2,2),A(2,3),D(2)                                TRAN 675
      PRINT 5, A(3,2),A(3,3),A(3,4),D(3)                                TRAN 676
      PRINT 5, A(4,3),A(4,4),A(4,5),D(4)                                TRAN 677
      PRINT 5, A(5,4),A(5,5),A(5,6),D(5)                                TRAN 678
      PRINT 5, A(6,5),A(6,6),A(6,7),D(6)                                TRAN 679
      PRINT 5, A(7,6),A(7,7),A(7,8),D(7)                                TRAN 680
      PRINT 5, A(8,7),A(8,8),D(8)                                       TRAN 681
 1000 CONTINUE                                                          TRAN 682
      CALL GAUSS1(A,8,D)                                                TRAN 683
      DO 1010 N=1,8                                                     TRAN 684
 1010 T(N,J)=D(N)                                                       TRAN 685
      IF(DEBUG) GO TO 1030                                              TRAN 686
      PRINT 46, 1010                                                    TRAN 687
      PRINT 4, (T(LMN,J),LMN=1,8)                                       TRAN 688
      PRINT 8                                                           TRAN 689
      PRINT 8                                                           TRAN 690
 1030 CONTINUE                                                          TRAN 691
 1040 CONTINUE                                                          TRAN 692
C                                                                       TRAN 693
C     UPPER  WATER  SECTION                                             TRAN 694
      DO 1130 J=KKK2,JJ                                                 TRAN 695
      A(1,1)=G(1,1,J)                                                   TRAN 696
      A(1,2)=G(1,2,J)                                                   TRAN 697
      DO 1060 I=2,4                                                     TRAN 698
      III=I-1                                                           TRAN 699
      DO 1050 II=1,3                                                    TRAN 700
      A(I,III)=G(I,III,J)                                               TRAN 701
 1050 III=III+1                                                         TRAN 702
 1060 CONTINUE                                                          TRAN 703
      A(5,4)=G(5,4,J)                                                   TRAN 704
      A(5,5)=G(5,5,J)                                                   TRAN 705
      DO 1070 N=1,5                                                     TRAN 706
 1070 D(N)=F(N,J)                                                       TRAN 707
      IF(DEBUG) GO TO 1090                                              TRAN 708
      PRINT 46, 1070                                                    TRAN 709
      PRINT 5, A(1,1),A(1,2),D(1)                                       TRAN 710
      PRINT 5, A(2,1),A(2,2),A(2,3),D(2)                                TRAN 711
      PRINT 5, A(3,2),A(3,3),A(3,4),D(3)                                TRAN 712
      PRINT 5, A(4,3),A(4,4),A(4,5),D(4)                                TRAN 713
      PRINT 5, A(5,4),A(5,5),D(5)                                       TRAN 714
 1090 CONTINUE                                                          TRAN 715
      CALL GAUSS1(A,5,D)                                                TRAN 716
      DO 1100 N=1,5                                                     TRAN 717
      NN=N+3                                                            TRAN 718
 1100 T(NN,J)=D(N)                                                      TRAN 719
      IF(DEBUG) GO TO 1120                                              TRAN 720
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      PRINT 46, 1100                                                    TRAN 721
      PRINT 3, (T(LMN,J),LMN=4,8)                                       TRAN 722
      PRINT 8                                                           TRAN 723
      PRINT 8                                                           TRAN 724
 1120 CONTINUE                                                          TRAN 725
 1130 CONTINUE                                                          TRAN 726
C                                                                       TRAN 727
      IF(TIME)1132,1132,1131                                            TRAN 728
 1131 IF(MPRINT-NPRINT)1169,1132,1132                                   TRAN 729
 1132 CONTINUE                                                          TRAN 730
      TPRINT=(TIME+DTAU)*3600.                                          TRAN 731
      PRINT 4, TPRINT                                                   TRAN 732
      DO 1140 J=KKK2,JJ                                                 TRAN 733
      K=JJ+KKK2-J                                                       TRAN 734
 1140 PRINT 3, (T(I,K),I=4,8)                                           TRAN 735
      DO 1150 J=K1,K2                                                   TRAN 736
      K=K2+K1-J                                                         TRAN 737
 1150 PRINT 4, (T(I,K),I=1,8)                                           TRAN 738
      DO 1160 J=1,KK1                                                   TRAN 739
      K=KK1+1-J                                                         TRAN 740
 1160 PRINT 3, (T(I,K),I=4,8)                                           TRAN 741
      PRINT 8                                                           TRAN 742
      PRINT 8                                                           TRAN 743
      IF(TIME)1162,1162,1161                                            TRAN 744
 1161 MPRINT=0                                                          TRAN 745
      GO TO 1169                                                        TRAN 746
 1162 MPRINT=1                                                          TRAN 747
C                                                                       TRAN 748
C                                                                       TRAN 749
C                                                                       TRAN 750
 1169 CONTINUE                                                          TRAN 751
      TIME=TIME+DTAU                                                    TRAN 752
      CALL FLOW                                                         TRAN 753
      IF(TIME)100,1170,1170                                             TRAN 754
 1170 MPRINT=MPRINT+1                                                   TRAN 755
      IF(G1)1175,1171,1171                                              TRAN 756
 1171 IF(TRVRS4-T(4,1))1173,1172,1172                                   TRAN 757
 1173 TRVRS4=T(4,1)                                                     TRAN 758
      RHRVS4=DENSE(TRVRS4)                                              TRAN 759
 1172 IF(TRVRS8-T(8,1))1174,1175,1175                                   TRAN 760
 1174 TRVRS8=T(8,1)                                                     TRAN 761
      RHRVS8=DENSE(TRVRS8)                                              TRAN 762
 1175 IF(DEBUG) GO TO 1180                                              TRAN 763
      PRINT 46, 1175                                                    TRAN 764
      PRINT 5, VOLND3                                                   TRAN 765
 1180 CONTINUE                                                          TRAN 766
      DO 1190 J=1,JJ                                                    TRAN 767
      VINTMD(J)=VOLND3*RHO8(J)                                          TRAN 768
      RHO8(J)=DENSE(T(8,J))                                             TRAN 769
 1190 VOL3(J)=VINTMD(J)/RHO8(J)                                         TRAN 770
      IF(DEBUG) GO TO 1205                                              TRAN 771
      PRINT 46, 1190                                                    TRAN 772
      PRINT 5, (VINTMD(J),J=1,JJ)                                       TRAN 773
      PRINT 8                                                           TRAN 774
      PRINT 5, (RHO8(J),J=1,JJ)                                         TRAN 775
      PRINT 8                                                           TRAN 776
      PRINT 5, (VOL3(J),J=1,JJ)                                         TRAN 777
      PRINT 8                                                           TRAN 778
 1205 CONTINUE                                                          TRAN 779
      DO 1210 J=1,JJ                                                    TRAN 780
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 1210 STORE(J)=T(8,J)                                                   TRAN 781
      IF(DEBUG) GO TO 1220                                              TRAN 782
      PRINT 46, 1210                                                    TRAN 783
      PRINT 4, (STORE(J),J=1,JJ)                                        TRAN 784
      PRINT 8                                                           TRAN 785
 1220 IF(G1)1221,1224,1224                                              TRAN 786
 1221 CALL REVRSE                                                       TRAN 787
      IF(MRVRS)1223,1223,100                                            TRAN 788
 1223 IF(TIME)100,1224,1224                                             TRAN 789
 1224 IF(G3)1225,1222,1222                                              TRAN 790
 1225 CALL PREVRSE                                                      TRAN 791
      IF(MRVRS)1226,1226,100                                            TRAN 792
 1226 IF(TIME)100,1411,1411                                             TRAN 793
 1222 VOLEXS=0.                                                         TRAN 794
      L=1                                                               TRAN 795
      M=0                                                               TRAN 796
      DO 1280 J=2,JJ                                                    TRAN 797
      K=JJ-J+1                                                          TRAN 798
      VOLEXS=VOLEXS+VOL3(K+1)-VOLND3                                    TRAN 799
      IF(VOLND3-VOLEXS)1230,1240,1240                                   TRAN 800
 1230 T(8,K)=STORE(K+L)                                                 TRAN 801
      VOLEXS=VOLEXS-VOLND3                                              TRAN 802
      M=M+1                                                             TRAN 803
      L=L+1                                                             TRAN 804
      GO TO 1250                                                        TRAN 805
 1240 CONTINUE                                                          TRAN 806
      T(8,K)=(VOLEXS*RHO8(K+L)*STORE(K+L)+(VOLND3-VOLEXS)*RHO8(K+M)     TRAN 807
     X*STORE(K+M))/(VOLEXS*RHO8(K+L)+(VOLND3-VOLEXS)*RHO8(K+M))         TRAN 808
 1250 CONTINUE                                                          TRAN 809
      IF(DEBUG) GO TO 1270                                              TRAN 810
      PRINT 46, 1250                                                    TRAN 811
      PRINT 11, VOLEXS,T(8,K),M,L                                       TRAN 812
 1270 CONTINUE                                                          TRAN 813
 1280 CONTINUE                                                          TRAN 814
C                                                                       TRAN 815
      DO 1290 J=1,JJ                                                    TRAN 816
 1290 RHO8(J)=DENSE(T(8,J))                                             TRAN 817
      IF(DEBUG) GO TO 1310                                              TRAN 818
      PRINT 46, 1290                                                    TRAN 819
      PRINT 8                                                           TRAN 820
      PRINT 4, (RHO8(J),J=1,JJ)                                         TRAN 821
      PRINT 8                                                           TRAN 822
 1310 CONTINUE                                                          TRAN 823
C                                                                       TRAN 824
C                                                                       TRAN 825
      DO 1320 J=1,JJ                                                    TRAN 826
 1320 STORE(J)=T(8,J)                                                   TRAN 827
      IF(DEBUG) GO TO 1340                                              TRAN 828
      PRINT 46, 1320                                                    TRAN 829
      PRINT 4, (STORE(J),J=1,JJ)                                        TRAN 830
      PRINT 8                                                           TRAN 831
 1340 CONTINUE                                                          TRAN 832
      VOLREP=(G3*3.1415927*(R(8)**2-R(7)**2)*DTAU)/RHOIN8               TRAN 833
      ADVNCE=VOLREP/VOLND3                                              TRAN 834
      I=ADVNCE                                                          TRAN 835
      REMAIN=ADVNCE-I                                                   TRAN 836
      IF(DEBUG) GO TO 1360                                              TRAN 837
      PRINT 46, 1340                                                    TRAN 838
      PRINT 8                                                           TRAN 839
      PRINT 12, VOLREP,ADVNCE,I,REMAIN                                  TRAN 840
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 1360 CONTINUE                                                          TRAN 841
      DO 1370 J=1,I                                                     TRAN 842
      K=JJ-J+1                                                          TRAN 843
 1370 T(8,K)=TMPIN8                                                     TRAN 844
      INTERM=JJ-I                                                       TRAN 845
      T(8,INTERM)=(REMAIN*TMPIN8*RHOIN8+(1.-REMAIN)*STORE(JJ)           TRAN 846
     X*RHO8(JJ))/(REMAIN*RHOIN8+(1.-REMAIN)*RHO8(JJ))                   TRAN 847
      IJKLMN=I+2                                                        TRAN 848
      DO 1380 J=IJKLMN,JJ                                               TRAN 849
      K=JJ-J+1                                                          TRAN 850
 1380 T(8,K)=(REMAIN*STORE(K+I+1)*RHO8(K+I+1)+(1.-REMAIN)*STORE(K+I)    TRAN 851
     X*RHO8(K+I))/(REMAIN*RHO8(K+I+1)+(1.-REMAIN)*RHO8(K+I))            TRAN 852
C                                                                       TRAN 853
      DO 1390 J=1,JJ                                                    TRAN 854
 1390 RHO8(J)=DENSE(T(8,J))                                             TRAN 855
C                                                                       TRAN 856
      IF(DEBUG) GO TO 1410                                              TRAN 857
      PRINT 46, 1390                                                    TRAN 858
      PRINT 8                                                           TRAN 859
      PRINT 4, (T(8,J),J=1,JJ)                                          TRAN 860
      PRINT 8                                                           TRAN 861
      PRINT 4, (RHO8(J),J=1,JJ)                                         TRAN 862
      PRINT 8                                                           TRAN 863
 1410 CONTINUE                                                          TRAN 864
C                                                                       TRAN 865
C                                                                       TRAN 866
C                                                                       TRAN 867
 1411 IF(G1)1780,1412,1412                                              TRAN 868
 1412 CONTINUE                                                          TRAN 869
C                                                                       TRAN 870
C                                                                       TRAN 871
C                                                                       TRAN 872
      VOLND1=3.1415927*(R(5)**2)*RNODE                                  TRAN 873
      FACTOR=(R(5)**2-R(3)**2)/(R(5)**2)                                TRAN 874
      DO 1420 J=1,IRABT                                                 TRAN 875
 1420 VOL1(J)=VOLND1                                                    TRAN 876
      I15=IRABT+1                                                       TRAN 877
      VOL1(I15)=RBTRM*VOLND1+(1.-RBTRM)*VOLND1*FACTOR                   TRAN 878
      I16=I15+1                                                         TRAN 879
      DO 1430 J=I16,K2                                                  TRAN 880
 1430 VOL1(J)=FACTOR*VOLND1                                             TRAN 881
      I17=K2+1                                                          TRAN 882
      VOL1(I17)=RBTRM2*FACTOR*VOLND1+(1.-RBTRM2)*VOLND1                 TRAN 883
      I18=I17+1                                                         TRAN 884
      DO 1440 J=I18,JJ                                                  TRAN 885
 1440 VOL1(J)=VOLND1                                                    TRAN 886
      IF(DEBUG) GO TO 1460                                              TRAN 887
      PRINT 46, 1440                                                    TRAN 888
      PRINT 8                                                           TRAN 889
      PRINT 5, PRABT,RBTNOD,RBTRM,RBTEND,RNDEND,RBTRM2,VOLND1,FACTOR    TRAN 890
      PRINT 7, IRABT,IRABT2,K1,K2                                       TRAN 891
      PRINT 5, (VOL1(J),J=1,JJ)                                         TRAN 892
 1460 CONTINUE                                                          TRAN 893
C                                                                       TRAN 894
C                                                                       TRAN 895
 1465 DO 1470 J=1,JJ                                                    TRAN 896
 1470 VSTORE(J)=VOL1(J)                                                 TRAN 897
      IF(DEBUG) GO TO 1490                                              TRAN 898
      PRINT 46, 1470                                                    TRAN 899
      PRINT 8                                                           TRAN 900
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      PRINT 5, (VSTORE(J),J=1,JJ)                                       TRAN 901
      PRINT 8                                                           TRAN 902
 1490 CONTINUE                                                          TRAN 903
      DO 1500 J=1,JJ                                                    TRAN 904
      VINTMD(J)=VSTORE(J)*RHO4(J)                                       TRAN 905
      RHO4(J)=DENSE(T(4,J))                                             TRAN 906
 1500 VOL1(J)=VINTMD(J)/RHO4(J)                                         TRAN 907
      IF(DEBUG) GO TO 1520                                              TRAN 908
      PRINT 46, 1500                                                    TRAN 909
      PRINT 8                                                           TRAN 910
      PRINT 5, (RHO4(J),J=1,JJ)                                         TRAN 911
      PRINT 8                                                           TRAN 912
      PRINT 5, (VOL1(J),J=1,JJ)                                         TRAN 913
      PRINT 8                                                           TRAN 914
 1520 CONTINUE                                                          TRAN 915
      DO 1530 J=1,JJ                                                    TRAN 916
 1530 STORE(J)=T(4,J)                                                   TRAN 917
      IF(DEBUG) GO TO 1550                                              TRAN 918
      PRINT 46, 1530                                                    TRAN 919
      PRINT 4, (STORE(J),J=1,JJ)                                        TRAN 920
      PRINT 8                                                           TRAN 921
 1550 CONTINUE                                                          TRAN 922
      VOLEXS=0.                                                         TRAN 923
      DO 1600 J=2,JJ                                                    TRAN 924
      K=JJ-J+1                                                          TRAN 925
      VOLEXS=VOLEXS+VOL1(K+1)-VSTORE(K+1)                               TRAN 926
      IF(VOLEXS-FACTOR*VOLND1)1570,1560,1560                            TRAN 927
 1560 PRINT 10                                                          TRAN 928
      GO TO 100                                                         TRAN 929
 1570 CONTINUE                                                          TRAN 930
      T(4,K)=(VOLEXS*RHO4(K+1)*STORE(K+1)+(VSTORE(K)-VOLEXS)*RHO4(K)    TRAN 931
     X*STORE(K))/(VOLEXS*RHO4(K+1)+(VSTORE(K)-VOLEXS)*RHO4(K))          TRAN 932
      IF(DEBUG) GO TO 1590                                              TRAN 933
      PRINT 46, 1570                                                    TRAN 934
      PRINT 5, VOLEXS,T(4,K)                                            TRAN 935
      PRINT 8                                                           TRAN 936
 1590 CONTINUE                                                          TRAN 937
 1600 CONTINUE                                                          TRAN 938
      VOLREP=(G1*3.1415927*(R(5)**2)*DTAU)/RHOIN4                       TRAN 939
      DO 1610 J=1,JJ                                                    TRAN 940
 1610 VEQUIV(J)=VSTORE(J)/VSTORE(JJ)                                    TRAN 941
      VRPEQV=VOLREP/VSTORE(JJ)                                          TRAN 942
      DO 1620 J=1,JJ                                                    TRAN 943
 1620 VSTORE(J)=VEQUIV(J)                                               TRAN 944
      VADD=0.                                                           TRAN 945
      DO 1630 J=1,JJ                                                    TRAN 946
      K=JJ-J+1                                                          TRAN 947
      VADD=VADD+VEQUIV(K)                                               TRAN 948
      IF(VADD-VRPEQV)1630,1630,1640                                     TRAN 949
 1630 CONTINUE                                                          TRAN 950
      DO 1631 J=1,JJ                                                    TRAN 951
 1631 T(4,J)=TMPIN4                                                     TRAN 952
      GO TO 1780                                                        TRAN 953
 1640 CONTINUE                                                          TRAN 954
      VEXEQV=VADD-VRPEQV                                                TRAN 955
      IF(DEBUG) GO TO 1660                                              TRAN 956
      PRINT 46, 1640                                                    TRAN 957
      PRINT 5, VRPEQV,VADD,VEXEQV                                       TRAN 958
 1660 CONTINUE                                                          TRAN 959
      DO 1670 J=1,JJ                                                    TRAN 960
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1670 RHO4(J)=DENSE(T(4,J))                                              TRAN 961
     DO 1680 J=1,JJ                                                     TRAN 962
1680 STORE(J)=T(4,J)                                                    TRAN 963
     IF(DEBUG) GO TO 1700                                               TRAN 964
     PRINT 46, 1680                                                     TRAN 965
     PRINT 8                                                            TRAN 966
     PRINT 5, (RHO4(J),J=1,JJ)                                          TRAN 967
     PRINT 8                                                            TRAN 968
     PRINT 4, (STORE(J),J=1,JJ)                                         TRAN 969
     PRINT 8                                                            TRAN 970
1700 CONTINUE                                                           TRAN 971
     I20=JJ-K                                                           TRAN 972
     KEXIT=K                                                            TRAN 973
     DO 1710 L=1,I20                                                    TRAN 974
     MM=JJ-L+1                                                          TRAN 975
1710 T(4,MM)=TMPIN4                                                     TRAN 976
     T(4,K)=((VEQUIV(K)-VEXEQV)*TMPIN4*RHOIN4+VEXEQV*STORE(JJ)*RHO4(JJ)TRAN 977
    X)/                                                                 TRAN 978
    X((VEQUIV(K)-VEXEQV)*RHOIN4+VEXEQV*RHO4(JJ))                        TRAN 979
     I21=I20+2                                                          TRAN 980
     VLEFT=VEQUIV(JJ)-VEXEQV                                            TRAN 981
     LINCRS=1                                                           TRAN 982
     INCRES=0                                                           TRAN 983
     DO 1770 J=I21,JJ                                                   TRAN 984
     XNMRTR=0.                                                          TRAN 985
     INNER=0                                                            TRAN 986
     DENMTR=0.                                                          TRAN 987
     K=JJ-J+1                                                           TRAN 988
     M=K+JJ-KEXIT+LINCRS-INCRES                                         TRAN 989
1720 IF(VLEFT-VEQUIV(K))1730,1760,1760                                  TRAN 990
1730 XNMRTR=VLEFT*STORE(M)*RHO4(M)+XNMRTR                               TRAN 991
     DENMTR=VLEFT*RHO4(M)+DENMTR                                        TRAN 992
     VEQUIV(K)=VEQUIV(K)-VLEFT                                          TRAN 993
     MINUS=M-1                                                          TRAN 994
     VLEFT=VSTORE(MINUS)                                                TRAN 995
     IF(VLEFT-VEQUIV(K))1740,1740,1750                                  TRAN 996
1740 IMARK=M-1-INNER                                                    TRAN 997
     XNMRTR=VLEFT*STORE(IMARK)*RHO4(IMARK)+XNMRTR                       TRAN 998
     DENMTR=VLEFT*RHO4(IMARK)+DENMTR                                    TRAN 999
     VEQUIV(K)=VEQUIV(K)-VLEFT                                          TRAN1000
     IMARK2=IMARK-1                                                     TRAN1001
     VLEFT=VSTORE(IMARK2)                                               TRAN1002
     INCRES=INCRES+1                                                    TRAN1003
     INNER=INNER+1                                                      TRAN1004
     IF(VLEFT-VEQUIV(K))1740,1740,1750                                  TRAN1005
1750 IMARK=M-1-INNER                                                    TRAN1006
     XNMRTR=XNMRTR+VEQUIV(K)*STORE(IMARK)*RHO4(IMARK)                   TRAN1007
     DENMTR=DENMTR+VEQUIV(K)*RHO4(IMARK)                                TRAN1008
     T(4,K)=XNMRTR/DENMTR                                               TRAN1009
     VLEFT=VLEFT-VEQUIV(K)                                              TRAN1010
     GO TO 1770                                                         TRAN1011
1760 T(4,K)=STORE(M)                                                    TRAN1012
     VLEFT=VLEFT-VEQUIV(K)                                              TRAN1013
     LINCRS=LINCRS+1                                                    TRAN1014
1770 CONTINUE                                                           TRAN1015
1780 IF(DEBUG) GO TO 1790                                               TRAN1016
     PRINT 8                                                            TRAN1017
     PRINT 46, 1780                                                     TRAN1018
     PRINT 4, (T(4,J),J=1,JJ)                                           TRAN1019
     PRINT 8                                                            TRAN1020
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 1790 CONTINUE                                                          TRAN1021
      GO TO 1795                                                        TRAN1022
C                                                                       TRAN1023
C                                                                       TRAN1024
C                                                                       TRAN1025
 1792 READ 2, I,I15,I16,I17,I18,I20,I21,II,                             TRAN1026
     XIII,IJKLMN,IMARK,IMARK2,INCRES,INNER,INTERM,                      TRAN1027
     XIRABT,IRABT2,J,JJ,K,K1,K2,                                        TRAN1028
     XKEXIT,KK1,KKK2,L,LINCRS,LMN,LSTEDY,                               TRAN1029
     XM,MEND,MFLOW,MHEAT,MINUS,MM,MOPT,                                 TRAN1030
     XMPOSN,MPRINT,MRVRS,MSTEDY,MSTOP,N,NN,NPRINT                       TRAN1031
      READ 36, DEBUG                                                    TRAN1032
      READ 2, (IFRAC8(J),J=1,JJ)                                        TRAN1033
      READ 1, A,ADVNCE,AXIAL,CONDAL,CPAL,D,D1,D2,                       TRAN1034
     XD3,DELR1,DELR2,DELR5,DELR6,DENMTR,DTAU,FACTOR,                    TRAN1035
     XG1,G2,G3,GPRIMARY,GZERO,PRABT,QMAXM,QMAXW,R,RBTEND,               TRAN1036
     XRBTNOD,RBTRM,RBTRM2,REMAIN,RHOAL,RHOIN4,RHOIN8,RHRVS4,RHRVS8,     TRAN1037
     XRLNGTH,RMOVE,RNDEND,RNODE,TDEBUG,                                 TRAN1038
     XTFINAL,TIME,TMPIN4,TMPIN8,                                        TRAN1039
     XTPRINT,TRVRS4,TRVRS8,TSTART,VADD,VEXEQV,VLEFT,VOLEXS,             TRAN1040
     XVOLND1,VOLND3,VOLREP,VREQV,XNMRTR,ZTUBE                           TRAN1041
      READ 1, (A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),                     TRAN1042
     XA7(J),A8(J),A9(J),A10(J),A11(J),A12(J),A13(J),                    TRAN1043
     XA14(J),A15(J),A16(J),A17(J),A18(J),                               TRAN1044
     XB1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B7(J),B8(J),                  TRAN1045
     XB9(J),B10(J),B11(J),B12(J),B13(J),B14(J),B15(J),                  TRAN1046
     XCP4(J),CP8(J),DIS4(J),DIS8(J),FRAC8(J),                           TRAN1047
     XHEAT(J),HL3(J),HL5(J),HL7(J),QAL(J),QALWPG(J),                    TRAN1048
     XQH20(J),QH204(J),QH208(J),REMAN8(J),RHO4(J),                      TRAN1049
     XRHO8(J),STORE(J),VEQUIV(J),VINTMD(J),VOL1(J),                     TRAN1050
     XVOL3(J),VSTORE(J),J=1,JJ)                                         TRAN1051
      READ 1, (TFLOW(J),YFLOW(J),J=1,MFLOW)                             TRAN1052
      READ 1, (TITCFLOW(J),YITCFLOW(J),J=1,MITCFLOW)                    TRAN1053
      READ 1, (THEAT(J),YHEAT(J),J=1,MHEAT)                             TRAN1054
      READ 1, (TPOSN(J),YPOSN(J),J=1,MPOSN)                             TRAN1055
      READ 1, ((F(LMN,J),LMN=1,8),J=1,JJ)                               TRAN1056
      READ 1, ((T(LMN,J),LMN=1,8),J=1,JJ)                               TRAN1057
      READ 1, (((G(LMN,L951,J),LMN=1,8),L951=1,8),J=1,JJ)               TRAN1058
C                                                                       TRAN1059
C                                                                       TRAN1060
C                                                                       TRAN1061
 1795 IF(TIMELEFT(1).LT.9500)1830,1800                                  TRAN1062
 1830 CONTINUE                                                          TRAN1063
      PRINT 37                                                          TRAN1064
      PUNCH 2, 2                                                        TRAN1065
      PUNCH 2, I,I15,I16,I17,I18,I20,I21,II,                            TRAN1066
     XIII,IJKLMN,IMARK,IMARK2,INCRES,INNER,INTERM,                      TRAN1067
     XIRABT,IRABT2,J,JJ,K,K1,K2,                                        TRAN1068
     XKEXIT,KK1,KKK2,L,LINCRS,LMN,LSTEDY,                               TRAN1069
     XM,MEND,MFLOW,MHEAT,MINUS,MITCFLOW,MM,MOPT,                        TRAN1070
     XMPOSN,MPRINT,MRVRS,MSTEDY,MSTOP,N,NN,NPRINT                       TRAN1071
      PUNCH 36, DEBUG                                                   TRAN1072
      PUNCH 2, (IFRAC8(J),J=1,JJ)                                       TRAN1073
      PUNCH 1, A,ADVNCE,AXIAL,CONDAL,CPAL,D,D1,D2,                      TRAN1074
     XD3,DELR1,DELR2,DELR5,DELR6,DENMTR,DTAU,FACTOR,                    TRAN1075
     XG1,G2,G3,GPRIMARY,GZERO,PRABT,QMAXM,QMAXW,R,RBTEND,               TRAN1076
     XRBTNOD,RBTRM,RBTRM2,REMAIN,RHOAL,RHOIN4,RHOIN8,RHRVS4,RHRVS8,     TRAN1077
     XRLNGTH,RMOVE,RNDEND,RNODE,TDEBUG,                                 TRAN1078
     XTFINAL,TIME,TMPIN4,TMPIN8,                                        TRAN1079
     XTPRINT,TRVRS4,TRVRS8,TSTART,VADD,VEXEQV,VLEFT,VOLEXS,             TRAN1080
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     XVOLND1,VOLND3,VOLREP,VKPEQV,XNMRTR,ZTUBE                          TRAN1081
      PUNCH 1, (A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),                    TRAN1082
     XA7(J),A8(J),A9(J),A10(J),A11(J),A12(J),A13(J),                    TRAN1083
     XA14(J),A15(J),A16(J),A17(J),A18(J),                               TRAN1084
     XB1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B7(J),B8(J),                  TRAN1085
     XB9(J),B10(J),B11(J),B12(J),B13(J),B14(J),B15(J),                  TRAN1086
     XCP4(J),CP8(J),DIS4(J),DIS8(J),FRAC8(J),                           TRAN1087
     XHEAT(J),HL3(J),HL5(J),HL7(J),QAL(J),QALWPG(J),                    TRAN1088
     XQH2O(J),QH2O4(J),QH2O8(J),REMAN8(J),RHO4(J),                      TRAN1089
     XRHO8(J),STORE(J),VEQUIV(J),VINTMD(J),VOL1(J),                     TRAN1090
     XVOL3(J),VSTORE(J),J=1,JJ)                                         TRAN1091
      PUNCH 1, (TFLOW(J),YFLOW(J),J=1,MFLOW)                            TRAN1092
      PUNCH 1, (TITCFLOW(J),YITCFLOW(J),J=1,MITCFLOW)                   TRAN1093
      PUNCH 1, (THEAT(J),YHEAT(J),J=1,MHEAT)                            TRAN1094
      PUNCH 1, (TPOSN(J),YPOSN(J),J=1,MPOSN)                            TRAN1095
      PUNCH 1, ((F(LMN,J),LMN=1,8),J=1,JJ)                              TRAN1096
      PUNCH 1, ((T(LMN,J),LMN=1,8),J=1,JJ)                              TRAN1097
      PUNCH 1, (((G(LMN,L951,J),LMN=1,8),L951=1,8),J=1,JJ)              TRAN1098
      GO TO 1850                                                        TRAN1099
 1800 CONTINUE                                                          TRAN1100
      GO TO 1805                                                        TRAN1101
 1802 READ 2, I,I15,I16,I17,I18,I20,I21,II,                             TRAN1102
     XIII,IJKLMN,IMARK,IMARK2,INCRES,INNER,INTERM,                      TRAN1103
     XIRABT,IRABT2,J,JJ,K,K1,K2,                                        TRAN1104
     XKEXIT,KK1,KKK2,L,LINCRS,LMN,LSTEDY,                               TRAN1105
     XM,MEND,MFLOW,MHEAT,MINUS,MITCFLOW,MM,MOPT,                        TRAN1106
     XMPOSN,MPRINT,MRVRS,MSTEDY,MSTOP,N,NN,NPRINT                       TRAN1107
      READ 36, DEBUG                                                    TRAN1108
      READ 2, (IFRAC8(J),J=1,JJ)                                        TRAN1109
      READ 1, A,ADVNCE,AXIAL,CONDAL,CPAL,D,D1,D2,                       TRAN1110
     XD3,DELR1,DELR2,DELR5,DELR6,DENMTR,DTAU,FACTOR,                    TRAN1111
     XG1,G2,G3,GPRIMARY,GZERO,PRABT,QMAXM,QMAXW,R,RBTEND,               TRAN1112
     XRBTNOD,RBTRM,RBTRM2,REMAIN,RHOAL,RHOIN4,RHOIN8,RHRVS4,RHRVS8,     TRAN1113
     XRLNGTH,RMOVE,RNDEND,RNODE,TDEBUG,                                 TRAN1114
     XTFINAL,TIME,TMPIN4,TMPIN8,                                        TRAN1115
     XTPRINT,TRVRS4,TRVRS8,TSTART,VADD,VEXEQV,VLEFT,VOLEXS,             TRAN1116
     XVOLND1,VOLND3,VOLREP,VKPEQV,XNMRTR,ZTUBE                          TRAN1117
      READ 1, (A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),                     TRAN1118
     XA7(J),A8(J),A9(J),A10(J),A11(J),A12(J),A13(J),                    TRAN1119
     XA14(J),A15(J),A16(J),A17(J),A18(J),                               TRAN1120
     XB1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B7(J),B8(J),                  TRAN1121
     XB9(J),B10(J),B11(J),B12(J),B13(J),B14(J),B15(J),                  TRAN1122
     XCP4(J),CP8(J),DIS4(J),DIS8(J),FRAC8(J),                           TRAN1123
     XHEAT(J),HL3(J),HL5(J),HL7(J),QAL(J),QALWPG(J),                    TRAN1124
     XQH2O(J),QH2O4(J),QH2O8(J),REMAN8(J),RHO4(J),                      TRAN1125
     XRHO8(J),STORE(J),VEQUIV(J),VINTMD(J),VOL1(J),                     TRAN1126
     XVOL3(J),VSTORE(J),J=1,JJ)                                         TRAN1127
      READ 1, (TFLOW(J),YFLOW(J),J=1,MFLOW)                             TRAN1128
      READ 1, (TITCFLOW(J),YITCFLOW(J),J=1,MITCFLOW)                    TRAN1129
      READ 1, (THEAT(J),YHEAT(J),J=1,MHEAT)                             TRAN1130
      READ 1, (TPOSN(J),YPOSN(J),J=1,MPOSN)                             TRAN1131
      READ 1, ((F(LMN,J),LMN=1,8),J=1,JJ)                               TRAN1132
      READ 1, ((T(LMN,J),LMN=1,8),J=1,JJ)                               TRAN1133
      READ 1, (((G(LMN,L951,J),LMN=1,8),L951=1,8),J=1,JJ)               TRAN1134
      READ 1, TFINAL                                                    TRAN1135
 1805 IF(TPRINT-TFINAL)300,1810,1810                                    TRAN1136
 1810 CONTINUE                                                          TRAN1137
      PUNCH 2, 1                                                        TRAN1138
      PUNCH 2, I,I15,I16,I17,I18,I20,I21,II,                            TRAN1139
     XIII,IJKLMN,IMARK,IMARK2,INCRES,INNER,INTERM,                      TRAN1140
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      XIRABT,IRABT2,J,JJ,K,K1,K2,                                       TRAN1141
      XKEXIT,KK1,KKK2,L,LINCRS,LMN,LSTEDY,                              TRAN1142
      XM,MEND,MFLOW,MHEAT,MINUS,MITCFLOW,MM,MOPT,                       TRAN1143
      XMPOSN,MPRINT,MRVRS,MSTEDY,MSTOP,N,NN,NPRINT                      TRAN1144
       PUNCH 36, DEBUG                                                  TRAN1145
       PUNCH 2, (IFRAC8(J),J=1,JJ)                                      TRAN1146
       PUNCH 1, A,ADVNCE,AXIAL,CONDAL,CPAL,D,D1,D2,                     TRAN1147
      XD3,DELR1,DELR2,DELR5,DELR6,DENMTR,DTAU,FACTOR,                   TRAN1148
      XG1,G2,G3,GPRIMARY,GZERO,PRABT,QMAXM,QMAXW,R,RBTEND,              TRAN1149
      XRRTNOD,RBTRM,RBTRM2,REMAIN,RHOAL,RHOIN4,RHOIN8,RHRVS4,RHRVS8,    TRAN1150
      XRLNGTH,RMOVE,RNDEND,RNODE,TDEBUG,                                TRAN1151
      XTFINAL,TIME,TMPIN4,TMPIN8,                                       TRAN1152
      XTPRINT,TRVRS4,TRVRS8,TSTART,VADD,VEXEQV,VLEFT,VOLEXS,            TRAN1153
      XVOLND1,VOLND3,VOLREP,VREQV,XNMRTR,ZTUBE                          TRAN1154
       PUNCH 1, (A1(J),A2(J),A3(J),A4(J),A5(J),A6(J),                   TRAN1155
      XA7(J),A8(J),A9(J),A10(J),A11(J),A12(J),A13(J),                   TRAN1156
      XA14(J),A15(J),A16(J),A17(J),A18(J),                              TRAN1157
      XB1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B7(J),B8(J),                 TRAN1158
      XB9(J),B10(J),B11(J),B12(J),B13(J),B14(J),B15(J),                 TRAN1159
      XCP4(J),CP8(J),DIS4(J),DIS8(J),FRAC8(J),                          TRAN1160
      XHEAT(J),HL3(J),HL5(J),HL7(J),QAL(J),QALWPG(J),                   TRAN1161
      XQH20(J),QH204(J),QH208(J),REMAN8(J),RHO4(J),                     TRAN1162
      XRHO8(J),STORE(J),VEQUIV(J),VINTMD(J),VOL1(J),                    TRAN1163
      XVOL3(J),VSTORE(J),J=1,JJ)                                        TRAN1164
       PUNCH 1, (TFLOW(J),YFLOW(J),J=1,MFLOW)                           TRAN1165
       PUNCH 1, (TITCFLOW(J),YITCFLOW(J),J=1,MITCFLOW)                  TRAN1166
       PUNCH 1, (THEAT(J),YHEAT(J),J=1,MHEAT)                           TRAN1167
       PUNCH 1, (TPOSN(J),YPOSN(J),J=1,MPOSN)                           TRAN1168
       PUNCH 1, ((F(LMN,J),LMN=1,8),J=1,JJ)                             TRAN1169
       PUNCH 1, ((T(LMN,J),LMN=1,8),J=1,JJ)                             TRAN1170
       PUNCH 1, (((G(LMN,L951,J),LMN=1,8),L951=1,8),J=1,JJ)             TRAN1171
       PRINT 14                                                         TRAN1172
       GO TO 100                                                        TRAN1173
 1850 END                                                               TRAN1174
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      SUBROUTINE STEADY                                                 STEA   1
C                                                                       STEA   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE STEADY-STATE TEMPERATURE STEA   3
C     MAP OF A HYDRAULIC RABBIT ASSEMBLY.                               STEA   4
C                                                                       STEA   5
      DIMENSION A1(50),A2(50),A3(50),A4(50),A5(50),A6(50),A7(50),A8(50).STEA   6
     XA9(50),A10(50),A11(50),A12(50),A13(50),A14(50),A15(50),           STEA   7
     XB1(50),B2(50),B3(50),B4(50),B5(50),B6(50),B7(50),B8(50),B9(50),   STEA   8
     XB10(50),B11(50),B12(50),                                          STEA   9
     XCP4(50),CP8(50),                                                  STEA  10
     XF(50),                                                            STEA  11
     XG(8,8),                                                           STEA  12
     XHEAT(50),HL3(50),HL5(50),HL7(50),                                 STEA  13
     XQAL(50),QALWPG(50),QW20(50),QH204(50),QH208(50),                  STEA  14
     XR(8),RHO4(50),RHO8(50),                                           STEA  15
     XT(8,50),TFLOW(50),THEAT(50),TITCFLOW(50),                         STEA  16
     XYFLOW(50),YHEAT(50),YITCFLOW(50)                                  STEA  17
      TYPE LOGICAL DEBUG                                                STEA  18
      COMMON/1/DEBUG/2/TIME,BLANK1(101)/4/TFLOW,YFLOW,MFLOW,            STEA  19
     XGPRIMARY,G1,G2,                                                   STEA  20
     XG3,GZERO/5/R/8/RNODE,RLNGTH,RHO4,BLANK2(4)/9/T/10/JJ,K1,K2,KK1,   STEA  21
     XKKK2/11/HEAT,THEAT,YHEAT,QH20,QALWPG,QMAXW,QMAXM/12/MHEAT         STEA  22
     X/14/CONDAL,RHOAL,CP4,CP8,RHO8,HL5,HL7,D1,D2,D3,DELR1,DELR2,       STEA  23
     XDELR5,DELR6,RBTRM,RBTRM2,TMPIN4,TMPIN8                            STEA  24
      COMMON/17/MITCFLOW,TITCFLOW,YITCFLOW                              STEA  25
    1 FORMAT(10E12.5)                                                   STEA  26
    2 FORMAT(10I12)                                                     STEA  27
    3 FORMAT(36X,7F12.4)                                                STEA  28
    4 FORMAT(10F12.4)                                                   STEA  29
    5 FORMAT(57H THE INITIAL CONDITION, STEADY-STATE TEMPERATURE MAP****STEA  30
     X*//)                                                              STEA  31
    6 FORMAT(1H1,17HSUBROUTINE STEADY//)                                STEA  32
    7 FORMAT(1X,I3)                                                     STEA  33
    8 FORMAT(/)                                                         STEA  34
    9 FORMAT(1X,I5)                                                     STEA  35
   10 FORMAT(12X,                                                       STEA  36
     X        97H THE DEBUG OPTION WILL BE USED IN THIS PROBLEM WHEN DETESTEA  37
     XRMINING THE STEADY-STATE TEMPERATURE MAP./)                       STEA  38
      IF(DEBUG)GO TO 100                                                STEA  39
      PRINT 6                                                           STEA  40
      PRINT 10                                                          STEA  41
  100 CONTINUE                                                          STEA  42
      LPASS=0                                                           STEA  43
      LPASS9=0                                                          STEA  44
      IF(DEBUG)GO TO 110                                                STEA  45
      PRINT 9, 100                                                      STEA  46
      PRINT 1, R,CONDAL,DELR1,DELR2,DELR5,DELR6,RNODE,((T(I,J),I=1,8),  STEA  47
     XJ=1,JJ),(TFLOW(I),I=1,MFLOW),(YFLOW(I),I=1,MFLOW),GPRIMARY,G1,G2, STEA  48
                                                                        STEA  49
     XG3,                                                               STEA  50
     XGZERO,D1,(HL5(I),I=1,JJ),(RHO4(I),I=1,JJ),(CP4(I),I=1,JJ),D3,     STEA  51
     X(HL7(I),I=1,JJ),(RHO8(I),I=1,JJ),(CP8(I),I=1,JJ),QMAXW,QMAXM,     STEA  52
     X(HEAT(I),I=1,JJ),(THEAT(I),I=1,MHEAT),(YHEAT(I),I=1,MHEAT),       STEA  53
     X(QH20(I),I=1,JJ),(QALWPG(I),I=1,JJ),TMPIN4,TMPIN8,RHOAL           STEA  54
      PRINT 2, MFLOW,JJ,MHEAT                                           STEA  55
  110 CALL FLOW                                                         STEA  56
      CALL QHEAT                                                        STEA  57
      IF(DEBUG)GO TO 120                                                STEA  58
      PRINT 8                                                           STEA  59
      PRINT 9, 110                                                      STEA  60
      PRINT 1, (TFLOW(I),I=1,MFLOW),(YFLOW(I),I=1,MFLOW),GPRIMARY,R(3), STEA  60
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     XR(5),G1,G2,G3,GZERO                                               STEA  61
      PRINT 2, MFLOW                                                    STEA  62
  120 L=JJ-KKK2                                                         STEA  63
      DO 310 K=1,L                                                      STEA  64
  130 J=JJ-K+1                                                          STEA  65
  140 CONTINUE                                                          STEA  66
      IF(DEBUG)GO TO 150                                                STEA  67
      PRINT 8                                                           STEA  68
      PRINT 9, 140                                                      STEA  69
      PRINT 2, K,J,JJ,MHEAT                                             STEA  70
      PRINT 1, QMAXW,QMAXM,(HEAT(I),I=1,JJ),(THEAT(I),I=1,MHEAT),       STEA  71
     X(YHEAT(I),I=1,MHEAT),(QH2O(I),I=1,JJ),(QALWPG(I),I=1,JJ)          STEA  72
                                                                        STEA  73
  150 QAL(J)=1551.0774*RHOAL*QALWPG(J)                                  STEA  74
      A5(J)=4.*CONDAL*(2.*R(5)+DELR5)                                   STEA  75
      A6(J)=(DELR5**2)*QAL(J)*(4.*R(5)+DELR5)                           STEA  76
      A7(J)=CONDAL*(2.*R(6)-DELR5)                                      STEA  77
      A8(J)=CONDAL*(2.*R(6)+DELR6)                                      STEA  78
      A9(J)=2.*R(6)*(DELR6**2)*QAL(J)                                   STEA  79
      A10(J)=4.*CONDAL*(2.*R(7)-DELR6)                                  STEA  80
      A12(J)=(DELR6**2)*QAL(J)*(4.*R(7)-DELR6)                          STEA  81
      IF(DEBUG)GO TO 160                                                STEA  82
      PRINT 8                                                           STEA  83
      PRINT 9, 150                                                      STEA  84
      PRINT 1, QAL(J),A5(J),A6(J),A7(J),A8(J),A9(J),A10(J),A12(J)       STEA  85
  160 INDEX=1                                                           STEA  86
  170 CALL WATER(T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J))                    STEA  87
      CALL WATER(T(8,J),D3,G3,HL7(J),RHO8(J),CP8(J))                    STEA  88
      IF(DEBUG)GO TO 180                                                STEA  89
      PRINT 8                                                           STEA  90
      PRINT 9, 170                                                      STEA  91
      PRINT 1, T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J),T(8,J),D3,G3,         STEA  92
     XHL7(J),RHO8(J),CP8(J)                                             STEA  93
  180 QH204(J)=1551.0774*RHO4(J)*QH2O(J)                                STEA  94
      QH208(J)=1551.0774*RHO8(J)*QH2O(J)                                STEA  95
      A1(J)=2.*HL5(J)                                                   STEA  96
      IF(LPASS)190,190,200                                              STEA  97
  190 A2(J)=R(5)*QH204(J)                                               STEA  98
      GO TO 210                                                         STEA  99
  200 A2(J)=R(5)*((1.-RBTRM2)*QH204(J)+RBTRM2*(((R(5)**2-R(3)**2)/      STEA 100
     XR(5)**2)*QH204(J)+((R(3)**2)/(R(5)**2))*QAL(J)))                  STEA 101
  210 A3(J)=R(5)*ABSF(G1)*CP4(J)/RNODE                                  STEA 102
      A4(J)=8.*R(5)*DELR5*HL5(J)                                        STEA 103
      A11(J)=8.*HL7(J)*R(7)*DELR6                                       STEA 104
      A13(J)=2.*R(7)*HL7(J)                                             STEA 105
      A14(J)=(R(8)**2-R(7)**2)*QH208(J)                                 STEA 106
      A15(J)=(R(8)**2-R(7)**2)*ABSF(G3)*CP8(J)/RNODE                    STEA 107
      IF(DEBUG)GO TO 220                                                STEA 108
      PRINT 8                                                           STEA 109
      PRINT 9, 210                                                      STEA 110
      PRINT 1, QH204(J),QH208(J),A1(J),A2(J),A3(J),A4(J),A11(J),A13(J), STEA 111
     XA14(J),A15(J)                                                     STEA 112
  220 IF(K-1)230,230,240                                                STEA 113
  230 F(1)=-A2(J)-A3(J)*TMPIN4                                          STEA 114
      F(5)=-A14(J)-A15(J)*TMPIN8                                        STEA 115
      GO TO 250                                                         STEA 116
  240 F(1)=-A2(J)-A3(J)*T(4,J+1)                                        STEA 117
      F(5)=-A14(J)-A15(J)*T(8,J+1)                                      STEA 118
  250 F(2)=-A6(J)                                                       STEA 119
      F(3)=-A9(J)                                                       STEA 120
      F(4)=-A12(J)
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      IF(DEBUG)GO TO 260                                                STEA 121
      PRINT 8                                                           STEA 122
      PRINT 9, 250                                                      STEA 123
      PRINT 1, (F(I),I=1,5)                                             STEA 124
  260 G(1,1)=-A1(J)-A3(J)                                               STEA 125
      G(1,2)=A1(J)                                                      STEA 126
      G(2,1)=A4(J)                                                      STEA 127
      G(2,2)=-A4(J)-A5(J)                                               STEA 128
      G(2,3)=A5(J)                                                      STEA 129
      G(3,2)=A7(J)                                                      STEA 130
      G(3,3)=-A7(J)-A8(J)                                               STEA 131
      G(3,4)=A8(J)                                                      STEA 132
      G(4,3)=A10(J)                                                     STEA 133
      G(4,4)=-A10(J)-A11(J)                                             STEA 134
      G(4,5)=A11(J)                                                     STEA 135
      G(5,4)=A13(J)                                                     STEA 136
      G(5,5)=-A13(J)-A15(J)                                             STEA 137
      IF(DEBUG)GO TO 270                                                STEA 138
      PRINT 8                                                           STEA 139
      PRINT 9, 260                                                      STEA 140
      PRINT 1, G(1,1),G(1,2),G(2,1),G(2,2),G(2,3),G(3,2),G(3,3),G(3,4), STEA 141
     XG(4,3),G(4,4),G(4,5),G(5,4),G(5,5)                                STEA 142
  270 CALL GAUSS1(G,5,F)                                                STEA 143
      IF(DEBUG)GO TO 280                                                STEA 144
      PRINT 8                                                           STEA 145
      PRINT 9, 270                                                      STEA 146
      PRINT 1, (F(I),I=1,5)                                             STEA 147
  280 DO 290 N=1,5                                                      STEA 148
      NN=N+3                                                            STEA 149
  290 T(NN,J)=F(N)                                                      STEA 150
      IF(DEBUG)GO TO 300                                                STEA 151
      PRINT 9, 290                                                      STEA 152
      PRINT 3, (T(LMN,J),LMN=4,8)                                       STEA 153
  300 INDEX=INDEX+1                                                     STEA 154
      IF(INDEX-5)170,170,310                                            STEA 155
  310 CONTINUE                                                          STEA 156
      IF(LPASS)320,320,340                                              STEA 157
  320 IF(RBTRM2-.5)330,330,340                                          STEA 158
  330 J=J-1                                                             STEA 159
      LPASS=1                                                           STEA 160
      GO TO 140                                                         STEA 161
  340 CONTINUE                                                          STEA 162
      L8=JJ-J+2                                                         STEA 163
      L9=JJ-KK1                                                         STEA 164
      IF(DEBUG)GO TO 350                                                STEA 165
      PRINT 8                                                           STEA 166
      PRINT 9, 340                                                      STEA 167
      PRINT 2, L8,L9                                                    STEA 168
  350 DO 530 K=L8,L9                                                    STEA 169
      J=JJ-K+1                                                          STEA 170
  360 CONTINUE                                                          STEA 171
      IF(DEBUG)GO TO 370                                                STEA 172
      PRINT 8                                                           STEA 173
      PRINT 9, 360                                                      STEA 174
      PRINT 2, K,J,JJ,MHEAT                                             STEA 175
      PRINT 1, QMAXW,QMAXM,(HEAT(I),I=1,JJ),(THEAT(I),I=1,MHEAT),       STEA 176
     X(YHEAT(I),I=1,MHEAT),(QH2O(I),I=1,JJ),(QALWPG(I),I=1,JJ)          STEA 177
  370 QAL(J)=1551.0774*RHOAL*QALWPG(J)                                  STEA 178
      A5(J)=4.*CONDAL*(2.*R(5)+DELR5)                                   STEA 179
      A6(J)=(DELR5**2)*QAL(J)*(4.*R(5)+DELR5)                           STEA 180
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      A7(J)=CONDAL*(2.*R(6)-DELR5)                                      STEA 181
      A8(J)=CONDAL*(2.*R(6)+DELR6)                                      STEA 182
      A9(J)=2.*R(6)*(DELR6**2)*QAL(J)                                   STEA 183
      A10(J)=4.*CONDAL*(2.*R(7)-DELR6)                                  STEA 184
      A12(J)=(DELR6**2)*QAL(J)*(4.*R(7)-DELR6)                          STEA 185
      B1(J)=4.*CONDAL                                                   STEA 186
      B2(J)=(DELR1**2)*QAL(J)                                           STEA 187
      B3(J)=CONDAL*(2.*R(2)-DELR1)                                      STEA 188
      B4(J)=CONDAL*(2.*R(2)+DELR2)                                      STEA 189
      B5(J)=2.*R(2)*(DELR1**2)*QAL(J)                                   STEA 190
      B6(J)=4.*CONDAL*(2.*R(3)-DELR2)                                   STEA 191
      B8(J)=(DELR2**2)*(4.*R(3)-DELR2)*QAL(J)                           STEA 192
      IF(DEBUG)GO TO 380                                                STEA 193
      PRINT 8                                                           STEA 194
      PRINT 9, 370                                                      STEA 195
      PRINT 1, QAL(J),A5(J),A6(J),A7(J),A8(J),A9(J),A10(J),A12(J)       STEA 196
     X,B1(J),B2(J),B3(J),B4(J),B5(J),B6(J),B8(J)                        STEA 197
  380 INDEX=1                                                           STEA 198
  390 CALL WATER(T(4,J),D2,G2,HL5(J),RHO4(J),CP4(J))                    STEA 199
      CALL WATER(T(8,J),D3,G3,HL7(J),RHO8(J),CP8(J))                    STEA 200
      HL3(J)=HL5(J)                                                     STEA 201
      IF(DEBUG)GO TO 400                                                STEA 202
      PRINT 8                                                           STEA 203
      PRINT 9, 390                                                      STEA 204
      PRINT 1, T(4,J),D2,G2,HL3(J),RHO4(J),CP4(J),T(8,J),D3,G3,         STEA 205
     XHL7(J),RHO8(J),CP8(J)                                             STEA 206
  400 QH204(J)=1551.0774*RHO4(J)*QH20(J)                                STEA 207
      QH208(J)=1551.0774*RHO8(J)*QH20(J)                                STEA 208
      A4(J)=8.*R(5)*DELR5*HL5(J)                                        STEA 209
      A11(J)=8.*HL7(J)*R(7)*DELR6                                       STEA 210
      A13(J)=2.*R(7)*HL7(J)                                             STEA 211
      A14(J)=(R(8)**2-R(7)**2)*QH208(J)                                 STEA 212
      A15(J)=(R(8)**2-R(7)**2)*G3*CP8(J)/RNODE                          STEA 213
      B7(J)=8.*DELR2*HL3(J)*R(3)                                        STEA 214
      B9(J)=2.*HL3(J)*R(3)                                              STEA 215
      B10(J)=2.*HL5(J)*R(5)                                             STEA 216
      B11(J)=(R(5)**2-R(3)**2)*QH204(J)                                 STEA 217
      B12(J)=(R(5)**2-R(3)**2)*ABSF(G2)*CP4(J)/RNODE                    STEA 218
      IF(DEBUG)GO TO 410                                                STEA 219
      PRINT 8                                                           STEA 220
      PRINT 9, 400                                                      STEA 221
      PRINT 1, QH204(J),QH208(J),A1(J),A2(J),A3(J),A4(J),A11(J),A13(J), STEA 222
     XA14(J),A15(J)                                                     STEA 223
     X,B7(J),B9(J),B10(J),B11(J),B12(J)                                 STEA 224
  410 IF(LPASS9)420,420,440                                             STEA 225
  420 IF(LPASS)430,430,470                                              STEA 226
  430 QFIX   =   ((1.-RBTRM2)*QH204(J)+RBTRM2*(((R(5)**2-R(3)**2)/      STEA 227
     XR(5)**2)*QH204(J)+((R(3)**2)/(R(5)**2))*QAL(J)))                  STEA 228
      LPASS=1                                                           STEA 229
      GO TO 450                                                         STEA 230
  440 QFIX=(RBTRM*QH204(J)*(1.-RBTRM)*(((R(5)**2-R(3)**2)/              STEA 231
     XR(5)**2)*QH204(J)+((R(3)**2)/(R(5)**2))*QAL(J)))                  STEA 232
  450 B2(J)=(DELR1**2)*QFIX                                             STEA 233
      B5(J)=2.*R(2)*(DELR1**2)*QFIX                                     STEA 234
      B8(J)=(DELR2**2)*(4.*R(3)-DELR2)*QFIX                             STEA 235
      IF(DEBUG)GO TO 460                                                STEA 236
      PRINT 8                                                           STEA 237
      PRINT 9, 450                                                      STEA 238
      PRINT 1, B2(J),B5(J),B8(J)                                        STEA 239
  460 CONTINUE                                                          STEA 240
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470 CONTINUE                                                            STEA 241
    F(1)=-B2(J)                                                         STEA 242
    F(2)=-B5(J)                                                         STEA 243
    F(3)=-B8(J)                                                         STEA 244
    F(4)=-B11(J)-B12(J)*T(4,J+1)                                        STEA 245
    F(5)=-A6(J)                                                         STEA 246
    F(6)=-A9(J)                                                         STEA 247
    F(7)=-A12(J)                                                        STEA 248
    F(8)=-A14(J)-A15(J)*T(8,J+1)                                        STEA 249
    IF(DEBUG)GO TO 480                                                  STEA 250
    PRINT 8                                                             STEA 251
    PRINT 9, 470                                                        STEA 252
    PRINT 1, (F(I),I=1,8)                                               STEA 253
480 G(1,1)=-B1(J)                                                       STEA 254
    G(1,2)=B1(J)                                                        STEA 255
    G(2,1)=B3(J)                                                        STEA 256
    G(2,2)=-B3(J)-B4(J)                                                 STEA 257
    G(2,3)=B4(J)                                                        STEA 258
    G(3,2)=B6(J)                                                        STEA 259
    G(3,3)=-B6(J)-B7(J)                                                 STEA 260
    G(3,4)=B7(J)                                                        STEA 261
    G(4,3)=B9(J)                                                        STEA 262
    G(4,4)=-B9(J)-B10(J)-B12(J)                                         STEA 263
    G(4,5)=B10(J)                                                       STEA 264
    G(5,4)=A4(J)                                                        STEA 265
    G(5,5)=-A4(J)-A5(J)                                                 STEA 266
    G(5,6)=A5(J)                                                        STEA 267
    G(6,5)=A7(J)                                                        STEA 268
    G(6,6)=-A7(J)-A8(J)                                                 STEA 269
    G(6,7)=A8(J)                                                        STEA 270
    G(7,6)=A10(J)                                                       STEA 271
    G(7,7)=-A10(J)-A11(J)                                               STEA 272
    G(7,8)=A11(J)                                                       STEA 273
    G(8,7)=A13(J)                                                       STEA 274
    G(8,8)=-A13(J)-A15(J)                                               STEA 275
    IF(DEBUG)GO TO 490                                                  STEA 276
    PRINT 8                                                             STEA 277
    PRINT 9, 480                                                        STEA 278
    PRINT 1, G(1,1),G(1,2),G(2,1),G(2,2),G(2,3),G(3,2),G(3,3),G(3,4),   STEA 279
   XG(4,3),G(4,4),G(4,5),G(5,4),G(5,5),G(5,6),G(6,5),G(6,6),G(6,7),     STEA 280
   XG(7,6),G(7,7),G(7,8),G(8,7),G(8,8)                                  STEA 281
490 CALL GAUSS1(G,8,F)                                                  STEA 282
    IF(DEBUG)GO TO 500                                                  STEA 283
    PRINT 8                                                             STEA 284
    PRINT 9, 490                                                        STEA 285
    PRINT 1, (F(I),I=1,8)                                               STEA 286
500 DO 510 N=1,8                                                        STEA 287
510 T(N,J)=F(N)                                                         STEA 288
    IF(DEBUG)GO TO 520                                                  STEA 289
    PRINT 9, 510                                                        STEA 290
    PRINT 4, (T(LMN,J),LMN=1,8)                                         STEA 291
520 INDEX=INDEX+1                                                       STEA 292
    IF(INDEX-5)390,390,530                                              STEA 293
530 CONTINUE                                                            STEA 294
    IF(LPASS9)540,540,560                                               STEA 295
540 IF(RBTRM-.5)550,560,560                                             STEA 296
550 J=J-1                                                               STEA 297
    LPASS9=1                                                            STEA 298
    GO TO 360                                                           STEA 299
560 CONTINUE                                                            STEA 300
```

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      L88=JJ-J+2                                                        STEA 301
      L99=JJ                                                            STEA 302
      DO 700 K=L88,L99                                                  STEA 303
      J=JJ-K+1                                                          STEA 304
      IF(DEBUG)GO TO 570                                                STEA 305
      PRINT 8                                                           STEA 306
      PRINT 9, 560                                                      STEA 307
      PRINT 2, K,J,JJ,MHEAT                                             STEA 308
      PRINT 1, QMAXW,QMAXM,(HEAT(I),I=1,JJ),(THEAT(I),I=1,MHEAT),       STEA 309
     X(YHEAT(I),I=1,MHEAT),(QH2O(I),I=1,JJ),(QALWPG(I),I=1,JJ)          STEA 310
                                                                        STEA 311
  570 QAL(J)=1551.0774*RHOAL*QALWPG(J)                                  STEA 312
      A5(J)=4.*CONDAL*(2.*R(5)*DELR5)                                   STEA 313
      A6(J)=(DELR5**2)*QAL(J)*(4.*R(5)+DELR5)                           STEA 314
      A7(J)=CONDAL*(2.*R(6)-DELR5)                                      STEA 315
      A8(J)=CONDAL*(2.*R(6)+DELR6)                                      STEA 316
      A9(J)=2.*R(6)*(DELR6**2)*QAL(J)                                   STEA 317
      A10(J)=4.*CONDAL*(2.*R(7)-DELR6)                                  STEA 318
      A12(J)=(DELR6**2)*QAL(J)*(4.*R(7)-DELR6)                          STEA 319
      IF(DEBUG)GO TO 580                                                STEA 320
      PRINT 8                                                           STEA 321
      PRINT 9, 570                                                      STEA 322
      PRINT 1, QAL(J),A5(J),A6(J),A7(J),A8(J),A9(J),A10(J),A12(J)       STEA 323
  580 INDEX=1                                                           STEA 324
  590 CALL WATER(T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J))                    STEA 325
      CALL WATER(T(8,J),D3,G3,HL7(J),RHO8(J),CP8(J))                    STEA 326
      IF(DEBUG)GO TO 600                                                STEA 327
      PRINT 8                                                           STEA 328
      PRINT 9, 590                                                      STEA 329
      PRINT 1, T(4,J),D1,G1,HL5(J),RHO4(J),CP4(J),T(8,J),D3,G3,         STEA 330
     XHL7(J),RHO8(J),CP8(J)                                             STEA 331
  600 QH204(J)=1551.0774*RHO4(J)*QH2O(J)                                STEA 332
      QH208(J)=1551.0774*RHO8(J)*QH2O(J)                                STEA 333
      A1(J)=2.*HL5(J)                                                   STEA 334
      IF(LPASS9)620,620,610                                             STEA 335
  610 A2(J)=R(5)*QH204(J)                                               STEA 336
      GO TO 630                                                         STEA 337
  620 A2(J)=R(5)*((   RBTRM )*QH204(J)+(1.-RBTRM)*(((R(5)**2-R(3)**2)/  STEA 338
     XR(5)**2)*QH204(J)+((R(3)**2)/(R(5)**2))*QAL(J)))                  STEA 339
      LPASS9=1                                                          STEA 340
  630 A3(J)=R(5)*ABSF(G1)*CP4(J)/RNODE                                  STEA 341
      A4(J)=8.*R(5)*DELR5*HL5(J)                                        STEA 342
      A11(J)=8.*HL7(J)*R(7)*DELR6                                       STEA 343
      A13(J)=2.*R(7)*HL7(J)                                             STEA 344
      A14(J)=(R(8)**2-R(7)**2)*QH208(J)                                 STEA 345
      A15(J)=(R(8)**2-R(7)**2)*ABSF(G3)*CP8(J)/RNODE                    STEA 346
      IF(DEBUG)GO TO 640                                                STEA 347
      PRINT 8                                                           STEA 348
      PRINT 9, 630                                                      STEA 349
      PRINT 1, QH204(J),QH208(J),A1(J),A2(J),A3(J),A4(J),A11(J),A13(J), STEA 350
     XA14(J),A15(J)                                                     STEA 351
  640 F(1)=-A2(J)-A3(J)*T(4,J+1)                                        STEA 352
      F(5)=-A14(J)-A15(J)*T(8,J+1)                                      STEA 353
      F(2)=-A6(J)                                                       STEA 354
      F(3)=-A9(J)                                                       STEA 355
      F(4)=-A12(J)                                                      STEA 356
      IF(DEBUG)GO TO 650                                                STEA 357
      PRINT 8                                                           STEA 358
      PRINT 9, 640                                                      STEA 359
      PRINT 1, (F(I),I=1,5)                                             STEA 360
  650 G(1,1)=-A1(J)-A3(J)                                               STEA 361
```

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      G(1,2)=A1(J)                                                      STEA 361
      G(2,1)=A4(J)                                                      STEA 362
      G(2,2)=-A4(J)-A5(J)                                               STEA 363
      G(2,3)=A5(J)                                                      STEA 364
      G(3,2)=A7(J)                                                      STEA 365
      G(3,3)=-A7(J)-A8(J)                                               STEA 366
      G(3,4)=A8(J)                                                      STEA 367
      G(4,3)=A10(J)                                                     STEA 368
      G(4,4)=-A10(J)-A11(J)                                             STEA 369
      G(4,5)=A11(J)                                                     STEA 370
      G(5,4)=A13(J)                                                     STEA 371
      G(5,5)=-A13(J)-A15(J)                                             STEA 372
      IF(DEBUG)GO TO 660                                                STEA 373
      PRINT 8                                                           STEA 374
      PRINT 9, 650                                                      STEA 375
      PRINT 1, G(1,1),G(1,2),G(2,1),G(2,2),G(2,3),G(3,2),G(3,3),G(3,4), STEA 376
     XG(4,3),G(4,4),G(4,5),G(5,4),G(5,5)                                STEA 377
  660 CALL GAUSS1(G,5,F)                                                STEA 378
      IF(DEBUG)GO TO 670                                                STEA 379
      PRINT 8                                                           STEA 380
      PRINT 9, 660                                                      STEA 381
      PRINT 1, (F(I),I=1,5)                                             STEA 382
  670 DO 680 N=1,5                                                      STEA 383
      NN=N+3                                                            STEA 384
  680 T(NN,J)=F(N)                                                      STEA 385
      IF(DEBUG)GO TO 690                                                STEA 386
      PRINT 9, 680                                                      STEA 387
      PRINT 3, (T(LMN,J),LMN=4,8)                                       STEA 388
  690 INDEX=INDEX+1                                                     STEA 389
      IF(INDEX-5)590,590,700                                            STEA 390
  700 CONTINUE                                                          STEA 391
      PRINT 8                                                           STEA 392
      PRINT 8                                                           STEA 393
      PRINT 5                                                           STEA 394
      K1=KK1+1                                                          STEA 395
      K2=KKK2-1                                                         STEA 396
      DO 710 K=KKK2,JJ                                                  STEA 397
      J=JJ+KKK2-K                                                       STEA 398
  710 PRINT 3, (T(LMN,J),LMN=4,8)                                       STEA 399
      DO 720 K=K1,K2                                                    STEA 400
      J=K2+K1-K                                                         STEA 401
  720 PRINT 4, (T(LMN,J),LMN=1,8)                                       STEA 402
      DO 730 K=1,KK1                                                    STEA 403
      J=KK1+1-K                                                         STEA 404
  730 PRINT 3, (T(LMN,J),LMN=4,8)                                       STEA 405
      PRINT 8                                                           STEA 406
      PRINT 8                                                           STEA 407
      RETURN                                                            STEA 408
      END                                                               STEA 409
```

```
      SUBROUTINE FLOW                                                   FLOW    1
C                                                                       FLOW    2
C     THIS SUBROUTINE IS USED TO DETERMINE THE TIME-DEPENDENT WATER FLOWFLOW    3
C     RATE IN THE RABBIT TUBE WATER.                                    FLOW    4
C                                                                       FLOW    5
      DIMENSION X(50),                                                  FLOW    6
     XY(50)                                                             FLOW    7
      COMMON/2/TIME,BLANK1(101)/4/X,Y,M,GPRIMARY,G1,G2,G3,GZERO/5/R(8)  FLOW    8
      R3=R(3) $ R5=R(5)                                                 FLOW    9
    1 FORMAT(23H0INDEPENDENT VARIABLE (,E12.5,1X,                       FLOW   10
     X37H) OUT OF RANGE...,.PROBLEM TERMINATED/)                        FLOW   11
      CALL PRIMARY                                                      FLOW   12
      IF(TIME)180,99,99                                                 FLOW   13
   99 CONTINUE                                                          FLOW   14
      N=2                                                               FLOW   15
      IF(X(1)-TIME*3600.)110,100,160                                    FLOW   16
  100 G1=Y(1)                                                           FLOW   17
      GO TO 170                                                         FLOW   18
  110 IF(TIME*3600.-X(M))120,120,160                                    FLOW   19
  120 IF(TIME*3600.-X(N))130,140,150                                    FLOW   20
  130 G1=((TIME*3600.-X(N-1))/(X(N)-X(N-1)))*(Y(N)-Y(N-1))+Y(N-1)       FLOW   21
      GO TO 170                                                         FLOW   22
  140 G1=Y(N)                                                           FLOW   23
      GO TO 170                                                         FLOW   24
  150 N=N+1                                                             FLOW   25
      GO TO 110                                                         FLOW   26
  160 TPRINT=TIME*3600.                                                 FLOW   27
      PRINT 1, TPRINT                                                   FLOW   28
      TIME=-20.                                                         FLOW   29
      GO TO 180                                                         FLOW   30
  170 G1=G1*GZERO                                                       FLOW   31
      G2=G1*(R5**2/(R5**2-R3**2))                                       FLOW   32
  180 CONTINUE                                                          FLOW   33
      RETURN                                                            FLOW   34
      END                                                               FLOW   35
```

```
      SUBROUTINE PRIMARY                                                PRIM   1
C                                                                       PRIM   2
C     THIS SURROUTINE IS USED TO DETERMINE THE TIME-DEPENDENT WATER FLOWPRIM   3
C     RATE IN THE WATER CELL SURROUNDING THE RABBIT TUBE.               PRIM   4
C                                                                       PRIM   5
      DIMENSION X(50),Y(50)                                             PRIM   6
      DIMENSION XPRIMARY(50),YPRIMARY(50)                               PRIM   7
      COMMON/2/TIME,BLANK1(101)/4/X,Y,M,GPRIMARY,G1,32,G3,GZERO/5/R(8)  PRIM   8
      COMMON/17/MPRIMARY,XPRIMARY,YPRIMARY                              PRIM   9
    1 FORMAT(23H0INDEPENDENT VARIABLE (,E12.5,1X,                       PRIM  10
     X37H) OUT OF RANGE....PROBLEM TERMINATED/)                         PRIM  11
      N=2                                                               PRIM  12
      IF(XPRIMARY(1)-TIME*3600.)110,100,160                             PRIM  13
  100 G3=YPRIMARY(1)                                                    PRIM  14
      GO TO 170                                                         PRIM  15
  110 IF(TIME*3600.-XPRIMARY(MPRIMARY))120,120,160                      PRIM  16
  120 IF(TIME*3600.-XPRIMARY(N))130,140,150                             PRIM  17
  130 G3=((TIME*3600.-XPRIMARY(N-1))/(XPRIMARY(N)-XPRIMARY(N-1)))       PRIM  18
     X*(YPRIMARY(N)-YPRIMARY(N-1))+YPRIMARY(N-1)                        PRIM  19
      GO TO 170                                                         PRIM  20
  140 G3=YPRIMARY(N)                                                    PRIM  21
      GO TO 170                                                         PRIM  22
  150 N=N+1                                                             PRIM  23
      GO TO 110                                                         PRIM  24
  160 TPRINT=TIME*3600.                                                 PRIM  25
      PRINT 1, TPRINT                                                   PRIM  26
      TIME=-20.                                                         PRIM  27
      GO TO 180                                                         PRIM  28
  170 G3=G3*GPRIMARY                                                    PRIM  29
  180 CONTINUE                                                          PRIM  30
      RETURN                                                            PRIM  31
      END                                                               PRIM  32
```

```
      SUBROUTINE REVRSE                                                 REVR   1
C                                                                       REVR   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE FLOW-REVERSAL WATER      REVR   3
C     TEMPERATURE ADJUSTMENT IN THE RABBIT TUBE WATER.                  REVR   4
C                                                                       REVR   5
      DIMENSION R(8),RHO4(50),RHO8(50),                                 REVR   6
     XSTORE(50),                                                        REVR   7
     XT(8,50),TFLOW(50),TPOSN(50),                                      REVR   8
     XVEQUIV(50),VINTMD(50),VOL1(50),VOL3(50),VSTORE(50),               REVR   9
     XYFLOW(50),YPOSN(50)                                               REVR  10
      TYPE LOGICAL DEBUG                                                REVR  11
      COMMON/1/DEBUG/2/TIME,TPOSN,YPOSN,PRABT/3/MPOSN/4/TFLOW,YFLOW,    REVR  12
     XMFLOW,GPRIMARY,G1,G2,G3,GZERO/5/R/8/RNODE,RLNGTH,RHO4,RHRVS4,     REVR  13
     XRMOVE,FACTOR,TRVRS4/9/T/10/JJ,K1,K2,KK1,KKK2/14/BLANK3(102),RHO8, REVR  14
     XBLANK4(100),D1,D2,D3,BLANK5(4),RBTRM,RBTRM2,TMPIN4,TMPIN8         REVR  15
     X/15/IRABT,IRABT2,MRVRS/16/VOL3,VOLND3,STORE,DTAU,VOLND1,RBTNOD,   REVR  16
     XRBTEND,RNDEND,RHRVS8,TRVRS8                                       REVR  17
      COMMON/18/STORE8(50)                                              REVR  18
    1 FORMAT(10F12.4)                                                   REVR  19
    2 FORMAT(10E12.4)                                                   REVR  20
    3 FORMAT(10I12)                                                     REVR  21
    4 FORMAT(/)                                                         REVR  22
    5 FORMAT(34H COOLANT WATER EXPANSION TOO LARGE)                     REVR  23
    6 FORMAT(E12.4,F12.4,2I12)                                          REVR  24
    7 FORMAT(2E12.4,I12,E12.4)                                          REVR  25
    8 FORMAT(1H1,17HSUBROUTINE REVRSE//)                                REVR  26
    9 FORMAT(1X,I5)                                                     REVR  27
   10 FORMAT(//96H RABBIT REVERSE VELOCITY EXCEEDS TUBE WATER REVERSE VEREVR  28
     XLOCITY. INVALID INPUT. PROBLEM TERMINATED.)                       REVR  29
      VOLEXS=0.                                                         REVR  30
      L=1                                                               REVR  31
      M=0                                                               REVR  32
      IF(DEBUG) GO TO 100                                               REVR  33
      PRINT 8                                                           REVR  34
      PRINT 4                                                           REVR  35
      PRINT 9, 9                                                        REVR  36
      PRINT 3, JJ,IRABT,K2,IRABT2,K1,MFLOW,MRVRS                        REVR  37
      PRINT 2, VOLND3,D3,G3,DTAU,RNODE,VOLND1,RBTRM,RBTRM2,PRABT,RBTNOD,REVR  38
     XRBTEND,RNDEND,TIME,GPRIMARY,G2,GZERO,RHRVS8,TRVRS8,G1,D1,RHRVS4,  REVR  39
     XTRVRS4,(VOL3(J),STORE(J),RHO8(J),RHO4(J),J=1,JJ),(R(I),I=1,8),    REVR  40
     X(TFLOW(I100),YFLOW(I100),I100=1,MFLOW),((T(I101,I102),I102=1,JJ), REVR  41
     XI101=1,8)                                                         REVR  42
      PRINT 4                                                           REVR  43
  100 CONTINUE                                                          REVR  44
      DO 110 J=1,JJ                                                     REVR  45
  110 STORE8(J)=STORE(J)                                                REVR  46
      VOLND1=3.1415927*(R(5)**2)*RNODE                                  REVR  47
      FACTOR=(R(5)**2-R(3)**2)/(R(5)**2)                                REVR  48
      K501=K1-1                                                         REVR  49
      DO 250 J=1,K501                                                   REVR  50
  250 VOL1(J)=VOLND1                                                    REVR  51
      I15=K501+1                                                        REVR  52
      VOL1(I15)=RBTRM*VOLND1+(1.-RBTRM)*VOLND1*FACTOR                   REVR  53
      I16=I15+1                                                         REVR  54
      DO 260 J=I16,K2                                                   REVR  55
  260 VOL1(J)=FACTOR*VOLND1                                             REVR  56
      I17=K2+1                                                          REVR  57
      VOL1(I17)=RBTRM2*FACTOR*VOLND1+(1.-RBTRM2)*VOLND1                 REVR  58
      I18=I17+1                                                         REVR  59
      DO 270 J=I18,JJ                                                   REVR  60
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  270 VOL1(J)=VOLND1                                                    REVR  61
      IF(DEBUG) GO TO 280                                               REVR  62
      PRINT 4                                                           REVR  63
      PRINT 9, 270                                                      REVR  64
      PRINT 2, PRABT,RBTNOD,RBTRM,RBTEND,RNDEND,RBTR42,VOLND1,FACTOR    REVR  65
      PRINT 3, IRABT,IRABT2,K1,K2                                       REVR  66
      PRINT 2, (VOL1(J),J=1,JJ)                                         REVR  67
  280 CONTINUE                                                          REVR  68
C                                                                       REVR  69
C                                                                       REVR  70
  290 DO 300 J=1,JJ                                                     REVR  71
  300 VSTORE(J)=VOL1(J)                                                 REVR  72
      IF(DEBUG) GO TO 310                                               REVR  73
      PRINT 4                                                           REVR  74
      PRINT 9, 300                                                      REVR  75
      PRINT 2, (VSTORE(J),J=1,JJ)                                       REVR  76
      PRINT 4                                                           REVR  77
  310 CONTINUE                                                          REVR  78
      DO 320 J=1,JJ                                                     REVR  79
      VINTMD(J)=VSTORE(J)*RHO4(J)                                       REVR  80
      RHO4(J)=DENSE(T(4,J))                                             REVR  81
  320 VOL1(J)=VINTMD(J)/RHO4(J)                                         REVR  82
      IF(DEBUG) GO TO 330                                               REVR  83
      PRINT 4                                                           REVR  84
      PRINT 9, 320                                                      REVR  85
      PRINT 2, (RHO4(J),J=1,JJ)                                         REVR  86
      PRINT 4                                                           REVR  87
      PRINT 2, (VOL1(J),J=1,JJ)                                         REVR  88
      PRINT 4                                                           REVR  89
  330 CONTINUE                                                          REVR  90
      DO 340 J=1,JJ                                                     REVR  91
  340 STORE(J)=T(4,J)                                                   REVR  92
      IF(DEBUG) GO TO 350                                               REVR  93
      PRINT 9, 340                                                      REVR  94
      PRINT 1, (STORE(J),J=1,JJ)                                        REVR  95
      PRINT 4                                                           REVR  96
  350 CONTINUE                                                          REVR  97
      VOLEXS=0.                                                         REVR  98
      DO 390 J=2,JJ                                                     REVR  99
      VOLEXS=VOLEXS+VOL1(J-1)-VSTORE(J-1)                               REVR 100
      IF(VOLEXS-FACTOR*VOLND1)370,360,360                               REVR 101
  360 PRINT 5                                                           REVR 102
      MRVRS=1                                                           REVR 103
      GO TO 580                                                         REVR 104
  370 CONTINUE                                                          REVR 105
      T(4,J)=(VOLEXS*RHO4(J-1)*STORE(J-1)+(VSTORE(J)-VOLEXS)*RHO4(J)    REVR 106
     X*STORE(J))/(VOLEXS*RHO4(J-1)+(VSTORE(J)-VOLEXS)*RHO4(J))          REVR 107
      IF(DEBUG) GO TO 380                                               REVR 108
      PRINT 9, 370                                                      REVR 109
      PRINT 2, VOLEXS,T(4,J)                                            REVR 110
      PRINT 4                                                           REVR 111
  380 CONTINUE                                                          REVR 112
  390 CONTINUE                                                          REVR 113
      RMOVE=0.                                                          REVR 114
      CALL RABTGO                                                       REVR 115
      VOLREP=(-(G1*3.1415927*(R(5)**2)*DTAU)/RHRVS4)                    REVR 116
     X-RMOVE*3.1415927*R(5)**2                                          REVR 117
      IF(VOLREP)391,590,392                                             REVR 118
  391 PRINT 10                                                          REVR 119
      STOP                                                              REVR 120
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392 CONTINUE                                                            REVR 121
    DO 400 J=1,JJ                                                       REVR 122
400 VEQUIV(J)=VSTORE(J)/VSTORE(JJ)                                      REVR 123
    VRPEQV=VOLREP/VSTORE(JJ)                                            REVR 124
    IF(DEBUG) GO TO 401                                                 REVR 125
    PRINT 9, 400                                                        REVR 126
    PRINT 2, (VEQUIV(J),J=1,JJ),(VSTORE(J),J=1,JJ),VRPEQV,VOLREP,G1,    REVR 127
   XR(5),DTAU,RHRVS4,RMOVE                                              REVR 128
401 CONTINUE                                                            REVR 129
    DO 410 J=1,JJ                                                       REVR 130
410 VSTORE(J)=VEQUIV(J)                                                 REVR 131
    VADD=0.                                                             REVR 132
    DO 420 J=1,JJ                                                       REVR 133
    VADD=VADD+VEQUIV(J)                                                 REVR 134
    K=J                                                                 REVR 135
    IF(VADD-VRPEQV)420,420,440                                          REVR 136
420 CONTINUE                                                            REVR 137
    DO 430 J=1,JJ                                                       REVR 138
430 T(4,J)=TRVRS4                                                       REVR 139
    GO TO 580                                                           REVR 140
440 CONTINUE                                                            REVR 141
    VEXEQV=VADD-VRPEQV                                                  REVR 142
    IF(DEBUG) GO TO 450                                                 REVR 143
    PRINT 9, 440                                                        REVR 144
    PRINT 2, VRPEQV,VADD,VEXEQV                                         REVR 145
    PRINT 3, K                                                          REVR 146
450 CONTINUE                                                            REVR 147
    DO 460 J=1,JJ                                                       REVR 148
460 CALL WATER(T(4,J),D1,G1,WLDUMB,RHO4(J),CPDUMB)                      REVR 149
    DO 470 J=1,JJ                                                       REVR 150
470 STORE(J)=T(4,J)                                                     REVR 151
    IF(DEBUG) GO TO 480                                                 REVR 152
    PRINT 4                                                             REVR 153
    PRINT 9, 470                                                        REVR 154
    PRINT 2, (RHO4(J),J=1,JJ)                                           REVR 155
    PRINT 4                                                             REVR 156
    PRINT 1, (STORE(J),J=1,JJ)                                          REVR 157
    PRINT 4                                                             REVR 158
480 CONTINUE                                                            REVR 159
    I20=K-1                                                             REVR 160
    KEXIT=K                                                             REVR 161
490 DO 500 L=1,I20                                                      REVR 162
500 T(4,L)=TRVRS4                                                       REVR 163
    T(4,K)=((VEQUIV(K)-VEXEQV)*TRVRS4+RHRVS4+VEXEQV*STORE(1)*RHO4(1))/REVR 164
   X((VEQUIV(K)-VEXEQV)*RHRVS4+VEXEQV*RHO4(1 ))                         REVR 165
    IF(K-JJ)510,580,580                                                 REVR 166
510 I21=I20+2                                                           REVR 167
    VLEFT=VEQUIV(1 )-VEXEQV                                             REVR 168
    LINCRS=1                                                            REVR 169
    INCRES=0                                                            REVR 170
    DO 570 J=I21,JJ                                                     REVR 171
    XNMRTR=0.                                                           REVR 172
    INNER=0                                                             REVR 173
    DENMTR=0.                                                           REVR 174
    M=J+1-KEXIT-LINCRS+INCRES                                           REVR 175
    IF(DEBUG) GO TO 519                                                 REVR 176
    PRINT 9, 510                                                        REVR 177
    PRINT 3, J,INNER,M                                                  REVR 178
    PRINT 2, XNMRTR,DENMTR,VEQUIV(J),VLEFT                              REVR 179
519 CONTINUE                                                            REVR 180
```

```
520 IF(VLEFT-VEQUIV(J))530,560,560                                      REVR 181
530 XNMRTR=VLEFT*STORE(M)*RHO4(M)+XNMRTR                                REVR 182
    DENMTR=VLEFT*RHO4(M)+DENMTR                                         REVR 183
    VEQUIV(J)=VEQUIV(J)-VLEFT                                           REVR 184
    MINUS=M+1                                                           REVR 185
    VLEFT=VSTORE(MINUS)                                                 REVR 186
    IF(DEBUG) GO TO 539                                                 REVR 187
    PRINT 9, 530                                                        REVR 188
    PRINT 3, MINUS                                                      REVR 189
    PRINT 2, XNMRTR,DENMTR,VEQUIV(J),VLEFT                              REVR 190
539 CONTINUE                                                            REVR 191
    IF(VLEFT-VEQUIV(J))540,540,550                                      REVR 192
540 IMARK=M+1+INNER                                                     REVR 193
    XNMRTR=VLEFT*STORE(IMARK)*RHO4(IMARK)+XNMRTR                        REVR 194
    DENMTR=VLEFT*RHO4(IMARK)+DENMTR                                     REVR 195
    VEQUIV(J)=VEQUIV(J)-VLEFT                                           REVR 196
    IMARK2=IMARK+1                                                      REVR 197
    VLEFT=VSTORE(IMARK2)                                                REVR 198
    INCRES=INCRES+1                                                     REVR 199
    INNER=INNER+1                                                       REVR 200
    IF(DEBUG) GO TO 549                                                 REVR 201
    PRINT 9, 540                                                        REVR 202
    PRINT 3, IMARK,IMARK2,INCRES,INNER                                  REVR 203
    PRINT 2, XNMRTR,DENMTR,VEQUIV(J),VLEFT                              REVR 204
549 CONTINUE                                                            REVR 205
    IF(VLEFT-VEQUIV(J))540,540,550                                      REVR 206
550 IMARK=M+1+INNER                                                     REVR 207
    XNMRTR=XNMRTR+VEQUIV(J)*STORE(IMARK)*RHO4(IMARK)                    REVR 208
    DENMTR=DENMTR+VEQUIV(J)*RHO4(IMARK)                                 REVR 209
    T(4,J)=XNMRTR/DENMTR                                                REVR 210
    VLEFT=VLEFT-VEQUIV(J)                                               REVR 211
    IF(DEBUG) GO TO 559                                                 REVR 212
    PRINT 9, 550                                                        REVR 213
    PRINT 3, IMARK                                                      REVR 214
    PRINT 2, XNMRTR,DENMTR,T(4,J),VLEFT                                 REVR 215
559 CONTINUE                                                            REVR 216
    GO TO 570                                                           REVR 217
560 T(4,J)=STORE(M)                                                     REVR 218
    VLEFT=VLEFT-VEQUIV(J)                                               REVR 219
    LINCRS=LINCRS+1                                                     REVR 220
    IF(DEBUG) GO TO 569                                                 REVR 221
    PRINT 9, 560                                                        REVR 222
    PRINT 3, LINCRS                                                     REVR 223
    PRINT 2, T(4,J),VLEFT                                               REVR 224
569 CONTINUE                                                            REVR 225
570 CONTINUE                                                            REVR 226
580 CONTINUE                                                            REVR 227
    IF(DEBUG) GO TO 590                                                 REVR 228
    PRINT 4                                                             REVR 229
    PRINT 9, 580                                                        REVR 230
    PRINT 1, (T(4,J),J=1,JJ)                                            REVR 231
    PRINT 3, JJ,IRABT,K2,IRABT2,K1,MFLOW,MRVRS                          REVR 232
    PRINT 2, VOLND3,D3,G3,DTAU,RNODE,VOLND1,RBTRM,RBTRM2,PRABT,RBTNOD,REVR 233
   XRBTEND,RNDEND,TIME,GPRIMARY,G2,GZERO,RHRVS8,TRVRS8,G1,D1,RHRVS4,    REVR 234
   XTRVRS4,(VOL3(J),STORE(J),RHO8(J),RHO4(J),J=1,JJ),(R(I),I=1,8),      REVR 235
   X(TFLOW(I100),YFLOW(I100),I100=1,MFLOW),((T(I101,I102),I102=1,JJ),   REVR 236
   XI101=1,8)                                                           REVR 237
    PRINT 4                                                             REVR 238
590 RETURN                                                              REVR 239
    END                                                                 REVR 240
```

```
      SUBROUTINE PREVRSE                                                PREV   1
C                                                                       PREV   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE FLOW-REVERSAL WATER      PREV   3
C     TEMPERATURE ADJUSTMENT IN THE WATER CELL SURROUNDING THE RABBIT   PREV   4
C     TUBE.                                                             PREV   5
C                                                                       PREV   6
      DIMENSION R(8),RHO4(50),RHO8(50),                                 PREV   7
     XSTORE(50),                                                        PREV   8
     XT(8,50),TFLOW(50),TPOSN(50),                                      PREV   9
     XVEQUIV(50),VINTMD(50),VOL1(50),VOL3(50),VSTORE(50),               PREV  10
     XYFLOW(50),YPOSN(50)                                               PREV  11
      TYPE LOGICAL DEBUG                                                PREV  12
      COMMON/1/DEBUG/2/TIME,TPOSN,YPOSN,PRABT/3/MPOSN/4/TFLOW,YFLOW,    PREV  13
     XMFLOW,GPRIMARY,G1,G2,G3,GZERO/5/R/8/RNODE,RLNGTH,RHO4,RHRVS4,     PREV  14
     XRMOVE,FACTOR,TRVRS4/9/T/10/JJ,K1,K2,KK1,KKK2/14/BLANK3(102),RHO8, PREV  15
     XBLANK4(100),D1,D2,D3,BLANK5(4),RBTRM,RBTRM2,TMPIN4,TMPIN8         PREV  16
     X/15/IRABT,IRABT2,MRVRS/16/VOL3,VOLND3,STORE,DTAU,VOLND1,RBTNOD,   PREV  17
     XRBTEND,RNDEND,RHRVS8,TRVRS8                                       PREV  18
      COMMON/18/STORE8(50)                                              PREV  19
    1 FORMAT(10F12.4)                                                   PREV  20
    2 FORMAT(10E12.4)                                                   PREV  21
    3 FORMAT(10I12)                                                     PREV  22
    4 FORMAT(/)                                                         PREV  23
    5 FORMAT(34H COOLANT WATER EXPANSION TOO LARGE)                     PREV  24
    6 FORMAT(E12.4,F12.4,2I12)                                          PREV  25
    7 FORMAT(2E12.4,I12,E12.4)                                          PREV  26
    8 FORMAT(1H1,17HSUBROUTINE REVRSE//)                                PREV  27
    9 FORMAT(1X,I5)                                                     PREV  28
      VOLEXS=0.                                                         PREV  29
      L=1                                                               PREV  30
      M=0                                                               PREV  31
      DO 150 J=2,JJ                                                     PREV  32
      VOLEXS=VOLEXS+VOL3(J-L)-VOLND3                                    PREV  33
      IF(VOLND3-VOLEXS)110,120,120                                      PREV  34
  110 T(8,J)=STORE8(J-L)                                                PREV  35
      VOLEXS=VOLEXS-VOLND3                                              PREV  36
      M=M+1                                                             PREV  37
      L=L+1                                                             PREV  38
      GO TO 130                                                         PREV  39
  120 CONTINUE                                                          PREV  40
      T(8,J)=(VOLEXS*RHO8(J-L)*STORE8(J-L)+(VOLND3-VOLEXS)*RHO8(J-M)    PREV  41
     X*STORE8(J-M))/(VOLEXS*RHO8(J-L)+(VOLND3-VOLEXS)*RHO8(J-M))        PREV  42
  130 CONTINUE                                                          PREV  43
      IF(DEBUG) GO TO 140                                               PREV  44
      PRINT 9, 130                                                      PREV  45
      PRINT 6, VOLEXS,T(8,J),M,L                                        PREV  46
  140 CONTINUE                                                          PREV  47
  150 CONTINUE                                                          PREV  48
      DO 160 J=1,JJ                                                     PREV  49
  160 RHO8(J)=DENSE(T(8,J))                                             PREV  50
      IF(DEBUG) GO TO 170                                               PREV  51
      PRINT 4                                                           PREV  52
      PRINT 9, 170                                                      PREV  53
      PRINT 1, (RHO8(J),J=1,JJ)                                         PREV  54
      PRINT 4                                                           PREV  55
  170 CONTINUE                                                          PREV  56
C                                                                       PREV  57
C                                                                       PREV  58
      DO 180 J=1,JJ                                                     PREV  59
  180 STORE(J)=T(8,J)                                                   PREV  60
```

```
      IF(DEBUG) GO TO 190                                               PREV  61
      PRINT 9, 180                                                      PREV  62
      PRINT 1, (STORE(J),J=1,JJ)                                        PREV  63
      PRINT 4                                                           PREV  64
  190 CONTINUE                                                          PREV  65
      VOLREP=-(G3*3.1415927*(R(8)**2-R(7)**2)*DTAU)/RHRVS8              PREV  66
      ADVNCE=VOLREP/VOLND3                                              PREV  67
      I=ADVNCE                                                          PREV  68
      REMAIN=ADVNCE-I                                                   PREV  69
      IF(DEBUG) GO TO 200                                               PREV  70
      PRINT 4                                                           PREV  71
      PRINT 9, 190                                                      PREV  72
      PRINT 7, VOLREP,ADVNCE,I,REMAIN                                   PREV  73
  200 CONTINUE                                                          PREV  74
      DO 210 J=1,I                                                      PREV  75
  210 T(8,J)=TRVRS8                                                     PREV  76
      INTERM=I+1                                                        PREV  77
      T(8,INTERM)=(REMAIN*TRVRS8*RHRVS8+(1.-REMAIN)*STORE(1)            PREV  78
     X*RHO8(1 ))/(REMAIN*RHRVS8+(1.-REMAIN)*RHO8(1 ))                   PREV  79
      IJKLMN=I+2                                                        PREV  80
      DO 220 J=IJKLMN,JJ                                                PREV  81
  220 T(8,J)=(REMAIN*STORE(J-I-1)*RHO8(J-I-1)+(1.-REMAIN)*STORE(J-I)    PREV  82
     X*RHO8(J-I))/(REMAIN*RHO8(J-I-1)+(1.-REMAIN)*RHO8(J-I))            PREV  83
C                                                                       PREV  84
      DO 230 J=1,JJ                                                     PREV  85
  230 RHO8(J)=DENSE(T(8,J))                                             PREV  86
C                                                                       PREV  87
      IF(DEBUG) GO TO 240                                               PREV  88
      PRINT 4                                                           PREV  89
      PRINT 9, 230                                                      PREV  90
      PRINT 1, (T(8,J),J=1,JJ)                                          PREV  91
      PRINT 4                                                           PREV  92
      PRINT 1, (RHO8(J),J=1,JJ)                                         PREV  93
      PRINT 4                                                           PREV  94
  240 CONTINUE                                                          PREV  95
C                                                                       PREV  96
      RETURN                                                            PREV  97
      END                                                               PREV  98
```

```
      SUBROUTINE POSITN                                                 POSI   1
C                                                                       POSI   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE TIME-DEPENDENT RABBIT    POSI   3
C     VERTICAL POSITION.                                                POSI   4
C                                                                       POSI   5
      DIMENSION X(50),                                                  POSI   6
     XY(50)                                                             POSI   7
      COMMON/2/TIME,X,Y,Z/3/M                                           POSI   8
    1 FORMAT(23H0INDEPENDENT VARIABLE (,E12.5,1X,                       POSI   9
     X37H) OUT OF RANGE.....PROBLEM TERMINATED/)                        POSI  10
      N=2                                                               POSI  11
      IF(X(1)-TIME*3600.)110,100,160                                    POSI  12
  100 Z=Y(1)                                                            POSI  13
      GO TO 170                                                         POSI  14
  110 IF(TIME*3600.-X(M))120,120,160                                    POSI  15
  120 IF(TIME*3600.-X(N))130,140,150                                    POSI  16
  130 Z=((TIME*3600.-X(N-1))/(X(N)-X(N-1)))*(Y(N)-Y(N-1))+Y(N-1)        POSI  17
      GO TO 170                                                         POSI  18
  140 Z=Y(N)                                                            POSI  19
      GO TO 170                                                         POSI  20
  150 N=N+1                                                             POSI  21
      GO TO 110                                                         POSI  22
  160 TPRINT=TIME*3600.                                                 POSI  23
      PRINT 1, TPRINT                                                   POSI  24
      TIME=-20.                                                         POSI  25
      GO TO 180                                                         POSI  26
  170 CONTINUE                                                          POSI  27
  180 CONTINUE                                                          POSI  28
      Z=Z/12.                                                           POSI  29
      RETURN                                                            POSI  30
      END                                                               POSI  31
```

```
      SUBROUTINE RABTGO                                                 RABT   1
C                                                                       RABT   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE RABBIT POSITION          RABT   3
C     ADJUSTMENT DURING THE RABBIT EJECTION PHASE.                      RABT   4
C                                                                       RABT   5
      DIMENSION RHO4(50),                                               RABT   6
     XT(8,50),TKEEP(3,50),TPOSN(50),TRBT1(3),TRBT2(3),TSTORE(50),       RABT   7
     XYPOSN(50)                                                         RABT   8
      TYPE LOGICAL DEBUG                                                RABT   9
      COMMON/1/DEBUG/2/TIME,TPOSN,YPOSN,PRABT/3/MPOSN/8/RNODE,RLNGTH,   RABT  10
     XRHO4,RHRVS4,RMOVE,FACTOR,THVRS4/9/T/10/JJ,K1,K2,KK1,KKK2          RABT  11
C                                                                       RABT  12
    1 FORMAT(1H1,17HSUBROUTINE RABTGO//)                                RABT  13
    2 FORMAT(1X,I5)                                                     RABT  14
    3 FORMAT(1X,E11.5,9E12.5)                                           RABT  15
    4 FORMAT(10I12)                                                     RABT  16
    8 FORMAT(/)                                                         RABT  17
C                                                                       RABT  18
   70 CONTINUE                                                          RABT  19
      DO 100 J=1,JJ                                                     RABT  20
  100 TSTORE(J)=T(4,J)                                                  RABT  21
      IF(DEBUG) GO TO 9000 $ PRINT 1 $ PRINT 2, 100                     RABT  22
      PRINT 3, (TSTORE(J),J=1,JJ) $ PRINT 8                             RABT  23
 9000 CONTINUE                                                          RABT  24
      DO 120 J=K1,K2                                                    RABT  25
      DO 110 I=1,3                                                      RABT  26
  110 TKEEP(I,J)=T(I,J)                                                 RABT  27
  120 CONTINUE                                                          RABT  28
      IF(DEBUG) GO TO 9010 $ PRINT 2, 110 $ PRINT 4, JJ,K1,K2           RABT  29
      PRINT 3, ((TKEEP(I,J),I=1,3),J=K1,K2) $ PRINT 8                   RABT  30
 9010 CONTINUE                                                          RABT  31
      STORE1=PRABT                                                      RABT  32
      STORE2=PRABT/RNODE                                                RABT  33
      ISTOR3=STORE2                                                     RABT  34
      STORE4=STORE2-ISTOR3                                              RABT  35
      STORE5=(PRABT+RLNGTH)/RNODE                                       RABT  36
      ISTOR6=STORE5                                                     RABT  37
      STORE7=STORE5-ISTOR6                                              RABT  38
      ISTOR8=K1                                                         RABT  39
      ISTOR9=K2                                                         RABT  40
      IF(DEBUG) GO TO 9020 $ PRINT 2, 120                               RABT  41
      PRINT 4, ISTOR3,ISTOR6,ISTOR8,ISTOR9                              RABT  42
      PRINT 3, STORE1,STORE2,STORE4,STORE5,STORE7  $ PRINT 8            RABT  43
 9020 CONTINUE                                                          RABT  44
      IF(ISTOR8-JJ)130,130,920                                          RABT  45
  130 IF(STORE4-.5)160,160,140                                          RABT  46
  140 IF(ISTOR8+2-JJ)145,145,141                                        RABT  47
  141 IF(ISTOR8+1-JJ)142,142,144                                        RABT  48
  142 DO 143 I=1,3                                                      RABT  49
  143 TRBT1(I)=2.*TKEEP(I,ISTOR8)-TKEEP(I,ISTOR8+1)                     RABT  50
      GO TO 151                                                         RABT  51
  144 DO 146 I=1,3                                                      RABT  52
  146 TRBT1(I)=TKEEP(I,ISTOR8)                                          RABT  53
      GO TO 151                                                         RABT  54
  145 DO 150 I=1,3                                                      RABT  55
  150 TRBT1(I)=TKEEP(I,ISTOR8+2)-3.*TKEEP(I,ISTOR8+1)+3.*TKEEP(I,ISTOR8)RABT  56
                                                                        RABT  57
  151 CONTINUE                                                          RABT  58
      IF(DEBUG) GO TO 9030 $ PRINT 2, 150 $ PRINT 3, (TRBT1(I),I=1,3)   RABT  59
      PRINT 8                                                           RABT  60
 9030 CONTINUE
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  160 CONTINUE                                                          RABT  61
      IF(ISTOR9-JJ)170,170,920                                          RABT  62
  170 IF(STORE7-.5)180,180,200                                          RABT  63
  180 DO 190 I=1,3                                                      RABT  64
  190 TRBT2(I)=TKEEP(I,ISTOR9-2)*3.*TKEEP(I,ISTOR9-1)+3.*TKEEP(I,ISTOR9)RABT  65
      IF(DEBUG) GO TO 9040 $ PRINT 2, 190 $ PRINT 3, (TRBT2(I),I=1,3)   RABT  66
      PRINT 8                                                           RABT  67
 9040 CONTINUE                                                          RABT  68
  200 CONTINUE                                                          RABT  69
C                                                                       RABT  70
      CALL POSITN                                                       RABT  71
C                                                                       RABT  72
      RMOVE=PRABT-STORE1                                                RABT  73
      IF(DEBUG) GO TO 9050 $ PRINT 2, 200 $ PRINT 3, RMOVE $ PRINT 8    RABT  74
 9050 CONTINUE                                                          RABT  75
      IF(RMOVE)1050,1050,210                                            RABT  76
  210 RBTNOD=PRABT/RNODE                                                RABT  77
      IRABT=RBTNOD                                                      RABT  78
      RBTRM=RBTNOD-IRABT                                                RABT  79
      IF(DEBUG) GO TO 9060 $ PRINT 2, 210 $ PRINT 4, IRABT              RABT  80
      PRINT 3, RBTNOD,RBTRM $ PRINT 8                                   RABT  81
 9060 CONTINUE                                                          RABT  82
      IF(RBTRM-.5)220,220,230                                           RABT  83
  220 K1=IRABT+1                                                        RABT  84
      IF(DEBUG) GO TO 9070 $ PRINT 2, 220 $ PRINT 4, K1 $ PRINT 8       RABT  85
 9070 CONTINUE                                                          RABT  86
      GO TO 240                                                         RABT  87
  230 K1=IRABT+2                                                        RABT  88
      IF(DEBUG) GO TO 9080 $ PRINT 2, 230 $ PRINT 4, K1 $ PRINT 8       RABT  89
 9080 CONTINUE                                                          RABT  90
  240 CONTINUE                                                          RABT  91
      RBTEND=PRABT+RLNGTH                                               RABT  92
      RNDEND=RBTEND/RNODE                                               RABT  93
      IRABT2=RNDEND                                                     RABT  94
      RBTRM2=RNDEND-IRABT2                                              RABT  95
      IF(DEBUG) GO TO 9090 $ PRINT 2, 240 $ PRINT 4, IRABT2             RABT  96
      PRINT 3, RBTEND,RNDEND,RBTRM2 $ PRINT 8                           RABT  97
 9090 CONTINUE                                                          RABT  98
      IF(RBTRM2-.5)250,250,260                                          RABT  99
  250 K2=IRABT2                                                         RABT 100
      IF(DEBUG) GO TO 9100 $ PRINT 2, 250 $ PRINT 4, K2 $ PRINT 8       RABT 101
 9100 CONTINUE                                                          RABT 102
      GO TO 270                                                         RABT 103
  260 K2=IRABT2+1                                                       RABT 104
      IF(DEBUG) GO TO 9110 $ PRINT 2, 260 $ PRINT 4, K2 $ PRINT 8       RABT 105
 9110 CONTINUE                                                          RABT 106
  270 CONTINUE                                                          RABT 107
      KK1=K1-1                                                          RABT 108
      KKK2=K2+1                                                         RABT 109
      EMOVE=RMOVE/RNODE                                                 RABT 110
      IMOVE=EMOVE                                                       RABT 111
      EREMAN=EMOVE-IMOVE                                                RABT 112
      IF(DEBUG) GO TO 9120 $ PRINT 2, 270 $ PRINT 4, KK1,KKK2,IMOVE     RABT 113
      PRINT 3, EMOVE,EREMAN $ PRINT 8                                   RABT 114
 9120 CONTINUE                                                          RABT 115
C                                                                       RABT 116
      IF(K1-JJ)280,280,920                                              RABT 117
  280 CONTINUE                                                          RABT 118
      IF(STORE4-.5)500,500,290                                          RABT 119
  290 IF(EREMAN-(1.-STORE4))300,300,380                                 RABT 120
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  300 DO 310 I=1,3                                                      RABT 121
  310 T(I,K1)=EREMAN*TRBT1(I)+(1.-EREMAN)*TKEEP(I,ISTOR8)               RABT 122
      IF(DEBUG) GO TO 9130 $ PRINT 2, 310 $ PRINT 3, (T(I,K1),I=1,3)    RABT 123
      PRINT 8                                                           RABT 124
 9130 CONTINUE                                                          RABT 125
      IF(K1+1-JJ)320,320,920                                            RABT 126
  320 IEND1=K1+1                                                        RABT 127
      IF(DEBUG) GO TO 9140 $ PRINT 2, 320 $ PRINT 4, IEND1 $ PRINT 8    RABT 128
 9140 CONTINUE                                                          RABT 129
      IF(K2-1-JJ)330,340,340                                            RABT 130
  330 IEND2=K2-1                                                        RABT 131
      IF(DEBUG) GO TO 9150 $ PRINT 2, 330 $ PRINT 4, IEND2 $ PRINT 8    RABT 132
 9150 CONTINUE                                                          RABT 133
      GO TO 350                                                         RABT 134
  340 IEND2=JJ                                                          RABT 135
      IF(DEBUG) GO TO 9160 $ PRINT 2, 340 $ PRINT 4, IEND2 $ PRINT 8    RABT 136
 9160 CONTINUE                                                          RABT 137
  350 DO 370 J=IEND1,IEND2                                              RABT 138
      IBACK=J-IMOVE-1                                                   RABT 139
      DO 360 I=1,3                                                      RABT 140
  360 T(I,J)=EREMAN*TKEEP(I,IBACK)+(1.-EREMAN)*TKEEP(I,IBACK+1)         RABT 141
  370 CONTINUE                                                          RABT 142
      IF(DEBUG) GO TO 9170 $ PRINT 2, 360                               RABT 143
      PRINT 3, ((T(I,J),I=1,3),J=IEND1,IEND2) $ PRINT 8                 RABT 144
 9170 CONTINUE                                                          RABT 145
      GO TO 700                                                         RABT 146
C                                                                       RABT 147
  380 CONTINUE                                                          RABT 148
      IF(RBTRM-.5)410,410,390                                           RABT 149
  390 DO 400 I=1,3                                                      RABT 150
  400 T(I,K1)=EREMAN*TKEEP(I,ISTOR8)+(1.-EREMAN)*TKEEP(I,ISTOR8+1)      RABT 151
      IF(DEBUG) GO TO 9180 $ PRINT 2, 400 $ PRINT 3, (T(I,K1),I=1,3)    RABT 152
      PRINT 8                                                           RABT 153
 9180 CONTINUE                                                          RABT 154
      GO TO 430                                                         RABT 155
  410 DO 420 I=1,3                                                      RABT 156
  420 T(I,K1)=((1.-STORE4)*TRBT1(I)+(STORE4-RBTRM)*TKEEP(I,ISTOR8))     RABT 157
     X/(1.-RBTRM)                                                       RABT 158
      IF(DEBUG) GO TO 9190 $ PRINT 2, 420 $ PRINT 3, (T(I,K1),I=1,3)    RABT 159
      PRINT 8                                                           RABT 160
 9190 CONTINUE                                                          RABT 161
  430 CONTINUE                                                          RABT 162
      IF(K1+1-JJ)440,440,920                                            RABT 163
  440 IEND1=K1+1                                                        RABT 164
      IF(DEBUG) GO TO 9200 $ PRINT 2, 440 $ PRINT 4, IEND1 $ PRINT 8    RABT 165
 9200 CONTINUE                                                          RABT 166
      IF(K2-1-JJ)450,450,460                                            RABT 167
  450 IEND2=K2-1                                                        RABT 168
      IF(DEBUG) GO TO 9210 $ PRINT 2, 450 $ PRINT 4, IEND2 $ PRINT 8    RABT 169
 9210 CONTINUE                                                          RABT 170
      GO TO 470                                                         RABT 171
  460 IEND2=JJ                                                          RABT 172
      IF(DEBUG) GO TO 9220 $ PRINT 2, 460 $ PRINT 4, IEND2 $ PRINT 8    RABT 173
 9220 CONTINUE                                                          RABT 174
  470 DO 490 J=IEND1,IEND2                                              RABT 175
      IBACK=J-IMOVE-1                                                   RABT 176
      DO 480 I=1,3                                                      RABT 177
  480 T(I,J)=EREMAN*TKEEP(I,IBACK)+(1.-EREMAN)*TKEEP(I,IBACK+1)         RABT 178
  490 CONTINUE                                                          RABT 179
      IF(DEBUG) GO TO 9230 $ PRINT 2, 480                               RABT 180
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      PRINT 3, ((T(I,J),I=1,3),J=IEND1,IEND2) $ PRINT 8                 RABT 181
 9230 CONTINUE                                                          RABT 182
      GO TO 710                                                         RABT 183
C                                                                       RABT 184
  500 CONTINUE                                                          RABT 185
      IF(EREMAN-(.5-STORE4))510,510,590                                 RABT 186
  510 DO 520 I=1,3                                                      RABT 187
  520 T(I,K1)=T(I,ISTOR8)                                               RABT 188
      IF(DEBUG) GO TO 9240 $ PRINT 2, 520 $ PRINT 3, (T(I,K1),I=1,3)    RABT 189
      PRINT 8                                                           RABT 190
 9240 CONTINUE                                                          RABT 191
      IF(K1+1-JJ)530,530,920                                            RABT 192
  530 IEND1=K1+1                                                        RABT 193
      IF(DEBUG) GO TO 9250 $ PRINT 2, 530 $ PRINT 4, IEND1 $ PRINT 8    RABT 194
 9250 CONTINUE                                                          RABT 195
      IF(K2-1-JJ)540,550,550                                            RABT 196
  540 IEND2=K2-1                                                        RABT 197
      IF(DEBUG) GO TO 9260 $ PRINT 2, 540 $ PRINT 4, IEND2 $ PRINT 8    RABT 198
 9260 CONTINUE                                                          RABT 199
      GO TO 560                                                         RABT 200
  550 IEND2=JJ                                                          RABT 201
      IF(DEBUG) GO TO 9270 $ PRINT 2, 550 $ PRINT 4, IEND2 $ PRINT 8    RABT 202
 9270 CONTINUE                                                          RABT 203
  560 DO 580 J=IEND1,IEND2                                              RABT 204
      IBACK=J-IMOVE-1                                                   RABT 205
      DO 570 I=1,3                                                      RABT 206
  570 T(I,J)=EREMAN*TKEEP(I,IBACK)+(1.-EREMAN)*TKEEP(I,IBACK+1)         RABT 207
  580 CONTINUE                                                          RABT 208
      IF(DEBUG) GO TO 9280 $ PRINT 2, 570                               RABT 209
      PRINT 3, ((T(I,J),I=1,3),J=IEND1,IEND2) $ PRINT 8                 RABT 210
 9280 CONTINUE                                                          RABT 211
      GO TO 710                                                         RABT 212
C                                                                       RABT 213
  590 CONTINUE                                                          RABT 214
      IF(EREMAN-(1.-STORE4))620,620,600                                 RABT 215
  600 DO 610 I=1,3                                                      RABT 216
  610 T(I,K1)=((1.-STORE4)*TKEEP(I,ISTOR8)+(1.-EREMAN)*TKEEP(I,ISTOR8+1)RABT 217
     X)/(2.-STORE4-EREMAN)                                              RABT 218
      IF(DEBUG) GO TO 9290 $ PRINT 2, 610 $ PRINT 3, (T(I,K1),I=1,3)    RABT 219
      PRINT 8                                                           RABT 220
 9290 CONTINUE                                                          RABT 221
      GO TO 640                                                         RABT 222
  620 DO 630 I=1,3                                                      RABT 223
  630 T(I,K1)=EREMAN*TKEEP(I,ISTOR8)+(1.-EREMAN)*TKEEP(I,ISTOR8+1)      RABT 224
      IF(DEBUG) GO TO 9300 $ PRINT 2, 630 $ PRINT 3, (T(I,K1),I=1,3)    RABT 225
      PRINT 8                                                           RABT 226
 9300 CONTINUE                                                          RABT 227
  640 CONTINUE                                                          RABT 228
      IF(K1+1-JJ)650,650,920                                            RABT 229
  650 IEND1=K1+1                                                        RABT 230
      IF(DEBUG) GO TO 9310 $ PRINT 2, 650 $ PRINT 4, IEND1 $ PRINT 8    RABT 231
 9310 CONTINUE                                                          RABT 232
      IF(K2-1-JJ)660,670,670                                            RABT 233
  660 IEND2=K2-1                                                        RABT 234
      IF(DEBUG) GO TO 9320 $ PRINT 2, 660 $ PRINT 4, IEND2 $ PRINT 8    RABT 235
 9320 CONTINUE                                                          RABT 236
      GO TO 680                                                         RABT 237
  670 IEND2=JJ                                                          RABT 238
      IF(DEBUG) GO TO 9330 $ PRINT 2, 670 $ PRINT 4, IEND2 $ PRINT 8    RABT 239
 9330 CONTINUE                                                          RABT 240
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  680 DO 700 J=IEND1,IEND2                                          RABT 241
      IBACK=J-IMOVE-1                                               RABT 242
      DO 690 I=1,3                                                  RABT 243
  690 T(I,J)=EREMAN*TKEEP(I,IBACK)+(1.-EREMAN)*TKEEP(I,IBACK+1)     RABT 244
  700 CONTINUE                                                      RABT 245
      IF(DEBUG) GO TO 9340 $ PRINT 2, 690                           RABT 246
      PRINT 3, ((T(I,J),I=1,3),J=IEND1,IEND2) $ PRINT 8             RABT 247
 9340 CONTINUE                                                      RABT 248
C                                                                   RABT 249
  710 IF(K2-JJ)720,720,910                                          RABT 250
  720 IF(STORE7-.5)730,820,820                                      RABT 251
  730 IF(STORE7+EREMAN-.5)740,740,760                               RABT 252
  740 DO 750 I=1,3                                                  RABT 253
  750 T(I,K2)=EREMAN*TKEEP(I,ISTOR9-1)+(1.-EREMAN)*TKEEP(I,ISTOR9)  RABT 254
      IF(DEBUG) GO TO 9350 $ PRINT 2, 750 $ PRINT 3, (T(I,K2),I=1,3) RABT 255
      PRINT 8                                                       RABT 256
 9350 CONTINUE                                                      RABT 257
      GO TO 910                                                     RABT 258
C                                                                   RABT 259
  760 CONTINUE                                                      RABT 260
      IF(STORE7+EREMAN-1.)790,790,770                               RABT 261
  770 DO 780 I=1,3                                                  RABT 262
  780 T(I,K2)=EREMAN*TKEEP(I,ISTOR9)+(1.-EREMAN)*TRBT2(I)           RABT 263
      IF(DEBUG) GO TO 9360 $ PRINT 2, 780 $ PRINT 3, (T(I,K2),I=1,3) RABT 264
      PRINT 8                                                       RABT 265
 9360 CONTINUE                                                      RABT 266
      GO TO 810                                                     RABT 267
  790 DO 800 I=1,3                                                  RABT 268
  800 T(I,K2)=(EREMAN*TKEEP(I,ISTOR9)+STORE7*TRBT2(I))/(EREMAN+STORE7) RABT 269
      IF(DEBUG) GO TO 9370 $ PRINT 2, 800 $ PRINT 3, (T(I,K2),I=1,3) RABT 270
      PRINT 8                                                       RABT 271
 9370 CONTINUE                                                      RABT 272
  810 CONTINUE                                                      RABT 273
      GO TO 910                                                     RABT 274
C                                                                   RABT 275
  820 IF(STORE7+EREMAN-1.)830,830,850                               RABT 276
  830 DO 840 I=1,3                                                  RABT 277
  840 T(I,K2)=(EREMAN*TKEEP(I,ISTOR9-1)+STORE7*TKEEP(I,ISTOR9))/(EREMAN RABT 278
     X+STORE7)                                                      RABT 279
      IF(DEBUG) GO TO 9380 $ PRINT 2, 840 $ PRINT 3, (T(I,K2),I=1,3) RABT 280
      PRINT 8                                                       RABT 281
 9380 CONTINUE                                                      RABT 282
      GO TO 910                                                     RABT 283
C                                                                   RABT 284
  850 CONTINUE                                                      RABT 285
      IF(RBTRM2-.5)880,880,860                                      RABT 286
  860 DO 870 I=1,3                                                  RABT 287
  870 T(I,K2)=TKEEP(I,ISTOR9)                                       RABT 288
      IF(DEBUG) GO TO 9390 $ PRINT 2, 870 $ PRINT 3, (T(I,K2),I=1,3) RABT 289
      PRINT 8                                                       RABT 290
 9390 CONTINUE                                                      RABT 291
      GO TO 900                                                     RABT 292
  880 DO 890 I=1,3                                                  RABT 293
  890 T(I,K2)=EREMAN*TKEEP(I,ISTOR9-1)+(1.-EREMAN)*TKEEP(I,ISTOR9)  RABT 294
      IF(DEBUG) GO TO 9400 $ PRINT 2, 890 $ PRINT 3, (T(I,K2),I=1,3) RABT 295
      PRINT 8                                                       RABT 296
 9400 CONTINUE                                                      RABT 297
  900 CONTINUE                                                      RABT 298
C                                                                   RABT 299
  910 CONTINUE                                                      RABT 300
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  920 CONTINUE                                                          RABT 301
      CHECK=RMOVE/RNODE                                                 RABT 302
      ICHECK=CHECK                                                      RABT 303
      EXCESS=CHECK-ICHECK                                               RABT 304
      IF(DEBUG) GO TO 9410 $ PRINT 2, 920 $ PRINT 4, ICHECK             RABT 305
      PRINT 3, CHECK,EXCESS $ PRINT 8                                   RABT 306
 9410 CONTINUE                                                          RABT 307
      IF(ICHECK)950,950,930                                             RABT 308
  930 DO 940 I=1,ICHECK                                                 RABT 309
      T(4,I)=TRVRS4                                                     RABT 310
      IF(DEBUG) GO TO 9420 $ PRINT 2, 930 $ PRINT 3, T(4,I) $ PRINT 8   RABT 311
 9420 CONTINUE                                                          RABT 312
      IF(I-JJ)940,1050,1050                                             RABT 313
  940 CONTINUE                                                          RABT 314
  950 ICK2=ICHECK+1                                                     RABT 315
      T(4,ICK2)=(EXCESS*TRVRS4*RHRVS4+(1.-EXCESS)*TSTORE(1)*RHO4(1))    RABT 316
     X/(EXCESS*RHRVS4+(1.-EXCESS)*RHO4(1))                              RABT 317
      ICK3=ICK2+1                                                       RABT 318
      IF(DEBUG) GO TO 9430 $ PRINT 2, 950 $ PRINT 4, ICK2,ICK3          RABT 319
      PRINT 3, T(4,ICK2) $ PRINT 8                                      RABT 320
 9430 CONTINUE                                                          RABT 321
      DO 960 I=ICK3,IRABT                                               RABT 322
      M1=I-ICHECK-1                                                     RABT 323
      MM1=I-ICHECK                                                      RABT 324
      T(4,I)=(EXCESS*TSTORE(M1)*RHO4(M1)+(1.-EXCESS)*TSTORE(MM1)*       RABT 325
     XRHO4(MM1))/(EXCESS*RHO4(M1)+(1.-EXCESS)*RHO4(MM1))                RABT 326
      IF(DEBUG) GO TO 9440 $ PRINT 2, 950 $ PRINT 3, T(4,I) $ PRINT 8   RABT 327
 9440 CONTINUE                                                          RABT 328
      IF(I-JJ)960,1050,1050                                             RABT 329
C                                                                       RABT 330
  960 CONTINUE                                                          RABT 331
      KADVNC=IRABT+1                                                    RABT 332
      M2=KADVNC-ICHECK-1                                                RABT 333
      M3=KADVNC-ICHECK                                                  RABT 334
      IF(DEBUG) GO TO 9450 $ PRINT 2, 960 $ PRINT 4, KADVNC,M2,M3       RABT 335
      PRINT 8                                                           RABT 336
 9450 CONTINUE                                                          RABT 337
      IF(RBTRM-EXCESS)970,970,980                                       RABT 338
  970 T(4,KADVNC)=(RBTRM*TSTORE(  M2)         *RHO4(M2)                 RABT 339
     X+(EXCESS-RBTRM)*FACTOR*TSTORE(  M2)         *RHO4(M2)             RABT 340
     X+(1.-EXCESS)*FACTOR*TSTORE(  M3)       *RHO4(M3))/                RABT 341
     X(RBTRM*RHO4(M2                )+(EXCESS-RBTRM)*FACTOR*RHO4(M2)   RABT 342
     X          +(1.-EXCESS)*FACTOR*RHO4(M3))                           RABT 343
      IF(DEBUG) GO TO 9460 $ PRINT 2, 970 $ PRINT 3, T(4,KADVNC)        RABT 344
      PRINT 8                                                           RABT 345
 9460 CONTINUE                                                          RABT 346
      GO TO 990                                                         RABT 347
  980 T(4,KADVNC)=(EXCESS*TSTORE(M2)*RHO4(M2)+(RBTRM-EXCESS)*           RABT 348
     XTSTORE(M3)*RHO4(M3)+FACTOR*(1.-RBTRM)*TSTORE(M3)*RHO4(M3))        RABT 349
     X/(EXCESS*RHO4(M2)+(RBTRM-EXCESS)*RHO4(M3)+FACTOR*(1.-RBTRM)       RABT 350
     X*RHO4(M3))                                                        RABT 351
  990 LADVNC=KADVNC+1                                                   RABT 352
      IF(DEBUG) GO TO 9470 $ PRINT 2, 980 $ PRINT 4, LADVNC             RABT 353
      PRINT 3, T(4,KADVNC) $ PRINT 8                                    RABT 354
 9470 CONTINUE                                                          RABT 355
      DO 1000 I=LADVNC,IRABT2                                           RABT 356
      M4=I-ICHECK-1                                                     RABT 357
      M5=I-ICHECK                                                       RABT 358
      T(4,I)=(EXCESS*TSTORE(  M4)         *RHO4(M4)+                    RABT 359
     X(1.-EXCESS)*TSTORE(  M5)       *RHO4(M5))/                        RABT 360
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     X(EXCESS*RHO4(M4                )+(1.-EXCESS)*RHO4(M5))                RABT 361
      IF(DEBUG) GO TO 9480 $ PRINT 2, 990 $ PRINT 3, T(4,I) $ PRINT 8      RABT 362
 9480 CONTINUE                                                             RABT 363
      IF(I-JJ)1000,1050,1050                                               RABT 364
 1000 CONTINUE                                                             RABT 365
      KADVN2=IRABT2+1                                                      RABT 366
      M6=KADVN2-ICHECK-1                                                   RABT 367
      M7=KADVN2-ICHECK                                                     RABT 368
      IF(DEBUG) GO TO 9490 $ PRINT 2, 1000 $ PRINT 4, KADVN2,M6,M7         RABT 369
      PRINT 8                                                              RABT 370
 9490 CONTINUE                                                             RABT 371
      IF(RBTRM2-EXCESS)1020,1020,1010                                      RABT 372
 1010 T(4,KADVN2)=(EXCESS*TSTORE(  M6)         *RHO4(M6)                   RABT 373
     X*FACTOR+(RBTRM2-EXCESS)*TSTORE(  M7)       *RHO4(M7)*                RABT 374
     XFACTOR+(1.-RBTRM2)*TSTORE(  M7)       *RHO4(M7))/                    RABT 375
     X(EXCESS*RHO4(M6                )*FACTOR+(RBTRM2-EXCESS)*RHO4(M7)     RABT 376
     X        *FACTOR+(1.-RBTRM2)*RHO4(M7))                                RABT 377
      IF(DEBUG) GO TO 9500 $ PRINT 2, 1010 $ PRINT 3, T(4,KADVN2)          RABT 378
      PRINT 8                                                              RABT 379
 9500 CONTINUE                                                             RABT 380
      GO TO 1030                                                           RABT 381
 1020 T(4,KADVN2)=(RBTRM2*FACTOR*TSTORE(M6)*RHO4(M6)+(EXCESS-RBTRM2)       RABT 382
     X*TSTORE(M6)*RHO4(M6)*(1.-EXCESS)*TSTORE(M7)*RHO4(M7))                RABT 383
     X/(RBTRM2*FACTOR*RHO4(M6)*(EXCESS-RBTRM2)*RHO4(M6)*(1.-EXCESS)        RABT 384
     X*RHO4(M7))                                                           RABT 385
 1030 KADVN3=KADVN2+1                                                      RABT 386
      IF(DEBUG) GO TO 9510 $ PRINT 2, 1020 $ PRINT 4, KADVN3               RABT 387
      PRINT 3, T(4,KADVN2) $ PRINT 8                                       RABT 388
 9510 CONTINUE                                                             RABT 389
      DO 1040 I=KADVN3,JJ                                                  RABT 390
      M8=I-ICHECK-1                                                        RABT 391
      M9=I-ICHECK                                                          RABT 392
      T(4,I)=(EXCESS*TSTORE(  M8)         *RHO4(M8)+                       RABT 393
     X(1.-EXCESS)*TSTORE(  M9)       *RHO4(M9            ))/(EXCESS*        RABT 394
     XRHO4(M8                )+(1.-EXCESS)*RHO4(M9))                       RABT 395
 1040 CONTINUE                                                             RABT 396
      IF(DEBUG) GO TO 9520 $ PRINT 2, 1030                                 RABT 397
      PRINT 3, (T(4,I),I=KADVN3,JJ) $ PRINT 8                              RABT 398
 9520 CONTINUE                                                             RABT 399
 1050 RETURN                                                               RABT 400
      END                                                                  RABT 401
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```
      SUBROUTINE QHEAT                                                  QHEA   1
C                                                                       QHEA   2
C     THIS SUBROUTINE IS USED TO DETERMINE THE TIME-DEPENDENT AND       QHEA   3
C     POSITION-DEPENDENT HEATING RATE OF A HYDRAULIC RABBIT ASSEMBLY.   QHEA   4
C                                                                       QHEA   5
      DIMENSION HEAT(50),                                               QHEA   6
     XQAL(50),QH20(50),                                                 QHEA   7
     XX(50),                                                            QHEA   8
     XY(50)                                                             QHEA   9
      COMMON/2/TIME,BLANK1(101)/10/JJ,IBLANK1(4)/11/HEAT,X,Y,QH20,QAL,  QHEA  10
     XQMAXW,QMAXM/12/M                                                  QHEA  11
    1 FORMAT(23H0INDEPENDENT VARIABLE (,E12.5,1X,                       QHEA  12
     X37H) OUT OF RANGE....PROBLEM TERMINATED/)                         QHEA  13
      N=2                                                               QHEA  14
      IF(X(1)-TIME*3600.)110,100,160                                    QHEA  15
  100 QVSTIM=Y(1)                                                       QHEA  16
      GO TO 170                                                         QHEA  17
  110 IF(TIME*3600.-X(M))120,120,160                                    QHEA  18
  120 IF(TIME*3600.-X(N))130,140,150                                    QHEA  19
  130 QVSTIM=((TIME*3600.-X(N-1))/(X(N)-X(N-1)))*(Y(N)-Y(N-1))+Y(N-1)   QHEA  20
      GO TO 170                                                         QHEA  21
  140 QVSTIM=Y(N)                                                       QHEA  22
      GO TO 170                                                         QHEA  23
  150 N=N+1                                                             QHEA  24
      GO TO 110                                                         QHEA  25
  160 TPRINT=TIME*3600.                                                 QHEA  26
      PRINT 1, TPRINT                                                   QHEA  27
      TIME=-20.                                                         QHEA  28
      GO TO 190                                                         QHEA  29
  170 CONTINUE                                                          QHEA  30
      DO 180 J=1,JJ                                                     QHEA  31
      QH20(J)=QMAXW*HEAT(J)*QVSTIM                                      QHEA  32
  180 QAL(J)=QMAXM*HEAT(J)*QVSTIM                                       QHEA  33
  190 CONTINUE                                                          QHEA  34
      RETURN                                                            QHEA  35
      END                                                               QHEA  36


      SUBROUTINE WATER(T,D,G,HL,RHO,CP)                                 WATE   1
C                                                                       WATE   2
C     THIS SUBROUTINE IS USED TO DETERMINE WATER AND HEAT TRANSFER      WATE   3
C     PROPERTIES AS A FUNCTION OF TEMPERATURE, FLOW RATE, AND GEOMETRY. WATE   4
C                                                                       WATE   5
      RHO=62.19615+1.269555*(T/100.)-1.952005*((T/100.)**2)             WATE   6
     X+.5637521*((T/100.)**3)-.08217391*((T/100.)**4)                   WATE   7
      VISC=7.694890-.1387822*T+.1209692*((T/10.)**2)                    WATE   8
     X-5.086437*((T/100.)**3)+.8175711*((T/100.)**4)                    WATE   9
      COND=.33293+.00031481481*T                                        WATE  10
      CP=.9970146+.1777121*(T/1000.)-2.089844*((T/1000.)**2)            WATE  11
     X+12.29523*((T/1000.)**3)-18.33239*((T/1000.)**4)                  WATE  12
      HL=(.023*COND/D)*((D*ABSF(G)/VISC)**.8)*((CP*VISC/COND)**.4)      WATE  13
      RETURN                                                            WATE  14
      END                                                               WATE  15


      FUNCTION DENSE(T)                                                 DENS   1
C                                                                       DENS   2
C     THIS FUNCTION IS USED TO DETERMINE THE TEMPERATURE-DEPENDENT      DENS   3
C     DENSITY OF WATER.                                                 DENS   4
C                                                                       DENS   5
      DENSE=62.19615+1.269555*(T/100.)-1.952005*((T/100.)**2)           DENS   6
     X+.5637521*((T/100.)**3)-.08217391*((T/100.)**4)                   DENS   7
      RETURN                                                            DENS   8
      END                                                               DENS   9
```

```
      SUBROUTINE GAUSS1(ARRAY,N,D)                                      GAUS   1
C                                                                       GAUS   2
C     THIS SUBROUTINE IS USED TO SOLVE A SET OF SIMULTANEOUS EQUATIONS  GAUS   3
C     USING THE METHOD OF GAUSS.                                        GAUS   4
C                                                                       GAUS   5
      DIMENSION ARRAY(8,8),A(8),B(8),C(8),D(8),ALPHA(8),S(8)            GAUS   6
      NN=N-1                                                            GAUS   7
      B(1)=ARRAY(1,1)                                                   GAUS   8
      C(1)=-ARRAY(1,2)                                                  GAUS   9
      DO 100 I=2,NN                                                     GAUS  10
      II=I-1                                                            GAUS  11
      III=I+1                                                           GAUS  12
      A(I)=-ARRAY(I,II)                                                 GAUS  13
      B(I)=ARRAY(I,I)                                                   GAUS  14
  100 C(I)=-ARRAY(I,III)                                                GAUS  15
      A(N)=-ARRAY(N,NN)                                                 GAUS  16
      B(N)=ARRAY(N,N)                                                   GAUS  17
      ALPHA(1)=B(1)                                                     GAUS  18
      DO 110 I=2,N                                                      GAUS  19
      II=I-1                                                            GAUS  20
  110 ALPHA(I)=B(I)-A(I)*C(II)/ALPHA(II)                                GAUS  21
      S(1)=D(1)                                                         GAUS  22
      DO 120 I=2,N                                                      GAUS  23
      II=I-1                                                            GAUS  24
  120 S(I)=D(I)+A(I)*S(II)/ALPHA(II)                                    GAUS  25
      D(N)=S(N)/ALPHA(N)                                                GAUS  26
      DO 130 I=1,NN                                                     GAUS  27
      II=NN-I+1                                                         GAUS  28
      III=II+1                                                          GAUS  29
  130 D(II)=(S(II)+C(II)*D(III))/ALPHA(II)                              GAUS  30
      RETURN                                                            GAUS  31
      END                                                               GAUS  32
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