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RELAP5 Model for Advanced Neutron Source Reactor Thermal-Hydraulic Transients, Three-Element-Core Design

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Advanced Neutron Source

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LIST OF ACROYNMS

ANS	Advanced Neutron Source
ANSR	Advanced Neutron Source Reactor
BOC	Beginning of Cycle
CHF	Critical Heat Flux
CPBT	Core Pressure Boundary Tube
EOC	End of Cycle
FE	Flow Excursion
HFIR	High Flux Isotope Reactor
NEPL	Non-Exceedance Probability Level
OSV	Onset of Significant Void
PSVAW	Primary Supply Vessel Weldment Adapter

NOMENCLATURE

Symbol	Definition	Units
A	Cross-sectional area	m^2
C_d	Discharge coefficient	-
dh	Volume hydraulic diameter	m
dZ	Volume elevation rise	m
e	Surface roughness	m
f	Friction coefficient	-
g	Coolant gap dimension	m
K_f	Forward loss coefficient	-
K_r	Reverse loss coefficient	-
L	Volume length	m
r	Radial dimension	m
Re	Reynolds number	-
s	Fuel plate span	m
t_{oxide}	Oxide thickness	m
T_{sat}	Saturation temperature	K
T_w	Wall temperature	K
Δx	Fuel plate thickness	m

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ABSTRACT

In order to utilize reduced enrichment fuel, the three-element-core design has been proposed. The proposed core configuration consists of inner, middle, and outer elements, with the middle element offset axially beneath the inner and outer elements, which are axially aligned. The three-element-core RELAP5 model assumes that the reactor hardware is changed only within the core region, so that the loop piping, heat exchangers, and pumps remain as assumed for the two-element-core configuration. However, the total flow rate through the core is greater and the pressure drop across the core is less so that the primary coolant pumps and heat exchangers are operating at a different point in their performance curves. This report describes the new RELAP5 input for the core components.

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1. INTRODUCTION

As a supplement of the report, *RELAP5 Model for Advanced Neutron Source Thermal-Hydraulic Transients, Two-Element Core Design,*[1] this report documents only changes to the core region consistent with the three-element-core design. The extra-core components of the system remain unchanged, and their input description is not repeated here. The pre- and postprocessing FORTRAN programs were changed to accommodate the three-element-core configuration.

To better capture acoustic propagation phenomena and to quantify the safety margin during rapid depressurization accidents, a refined nodalization (comparable to that used in the two-element-core model) was developed for the three-element-core. The input model (listed in Appendix A) was developed for use with RELAP5/MOD3.1.1.1. The FORTRAN used to load the RELAP5 input file with fuel source terms is listed in Appendix B. This program calculates the source terms using the G1294-2d fuel grading power densities, peaking factors, and heat loading distribution within the metal and coolant components. The postprocessor and strip file input used in the three-element-core studies are listed in Appendixes C and D, respectively. In addition, steady-state and selected transient results are documented in the report, *Advanced Neutron Source Reactor Conceptual Safety Analysis Report, Three-Element-core Design.*[2]

2. INPUT DESCRIPTION

The nodalization diagram for the three-element-core RELAP5 model is shown in Fig. 1 (core region) and Fig. 2 (loop region). The core model consists of three fuel annuli regions, core bypass channels, and the central control rod region. The core is surrounded by the core pressure boundary tube (CPBT), which separates the high-pressure primary system from the low-pressure moderator tank.

2.1 FUEL ELEMENTS

Three fuel element channels are included for each of the inner, middle, and outer fuel elements: an average channel, and two hot channels corresponding to the 95% and 99.9% nonexceedance probability uncertainty levels in the power distribution. In each hot channel, two hot stripes are used to represent both the critical heat flux (CHF) and the Costa onset-of-significant-void (OSV), used in the ANSR analysis as a flow excursion (FE) correlation, peaking factors. The G1294-2d power distribution was used with peaking factors and power densities obtained at end-of-cycle (EOC) conditions for the inner core, beginning-of-cycle (BOC) conditions for the middle core, and one-day conditions for the outer core. These conditions correspond to the highest (most conservative) heat flux levels. Appendix B contains a listing of the FORTRAN computer program (power3E.f) that was used to directly insert the source terms into the RELAP5 input file. The source terms that represent heating in the CPBT and control rod region are not modified by power3E.f. The power densities and peaking factors that were used as input to power3E.f are supplied in this section.

The reactor contains three fuel annuli (cores). The core geometry is described in ref. 3. The inner fuel annulus consists of 252 fuel plates with a nominal thickness of 1.27 mm, inner radius, r_i = 102 mm, and outer radius, r_o = 162 mm. The middle (lower) fuel annulus consists of 418 fuel plates with a nominal thickness of 1.27 mm, r_i = 169 mm, and r_o = 224 mm. The outer fuel annulus consists of 571 fuel plates, also with a nominal thickness of 1.27 mm, r_i = 231 mm and r_o = 281 mm. One average channel is used in each fuel annulus to represent (as a lumped volume) all but two of the fuel channels. The two fuel channels excluded from the lumped volume serve as the 95% and 99.9% hot fuel channels, where the channel thickness is narrowed to account for uncertainties in the fuel plate manufacture. The fuel plate surface roughness was calibrated such that the pressure drop predicted by the ANSR steady-state code[4] was obtained at a middle (lower)-core inlet velocity of 20 m/s.

The length of the fuel plates is different from the two-element design. The heated length for each element in the three-element-core design is 0.418 m instead of 0.507 m. The unheated length at each core inlet is 0.05 m instead of the two-element 0.01 m. The unheated length at the exit remains unchanged at 0.01 m. As with the two-element-core, the unheated fuel sections are modeled as a part of the unheated annular channels (inlet, mid-core, and exit annular regions). To compensate for the neglect of the frictional loss due to the presence of the fuel plates in the unheated fuel regions, loss coefficients at the inlet and exit of each core are included. The actual geometry of the unheated fuel channels is not used because the axial length of 0.01 m would severely limit the acceptable computational time step (material Courant limit, equal to the axial volume length divided by the coolant velocity).

The axial spacing between the upper end of the heated fuel in the middle (lower) core and the lower end of the heated fuel in the inner and outer (upper) cores is now 0.116 m instead of the two-element spacing of 0.050 m. This spacing does include the unheated fuel lengths. The total axial length from the bottom of the middle (lower) heated fuel section to the top of the inner and outer (upper) heated fuel section is now

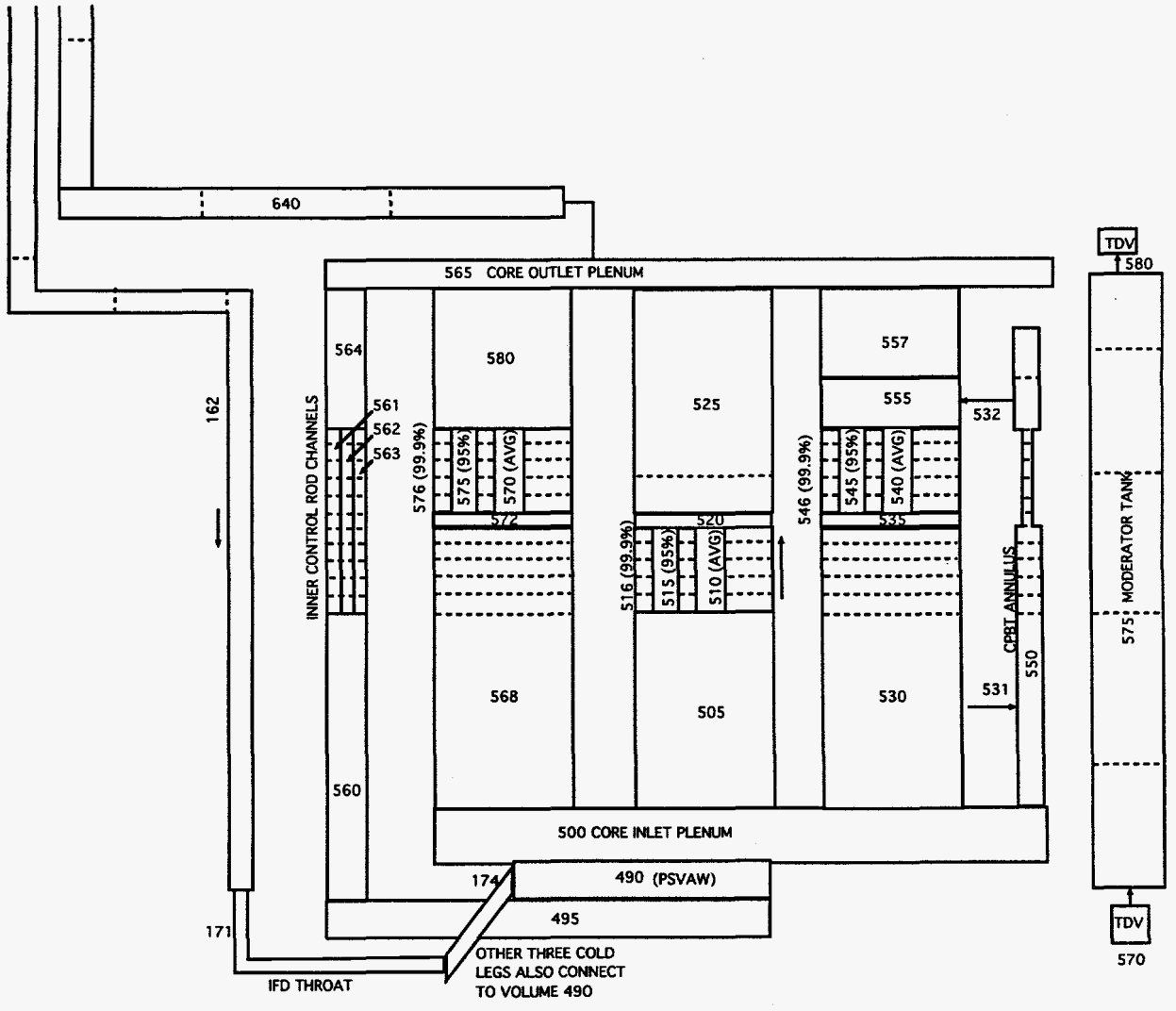

Fig. 1. ANS three-element-core RELAP5 nodalization diagram: core region.

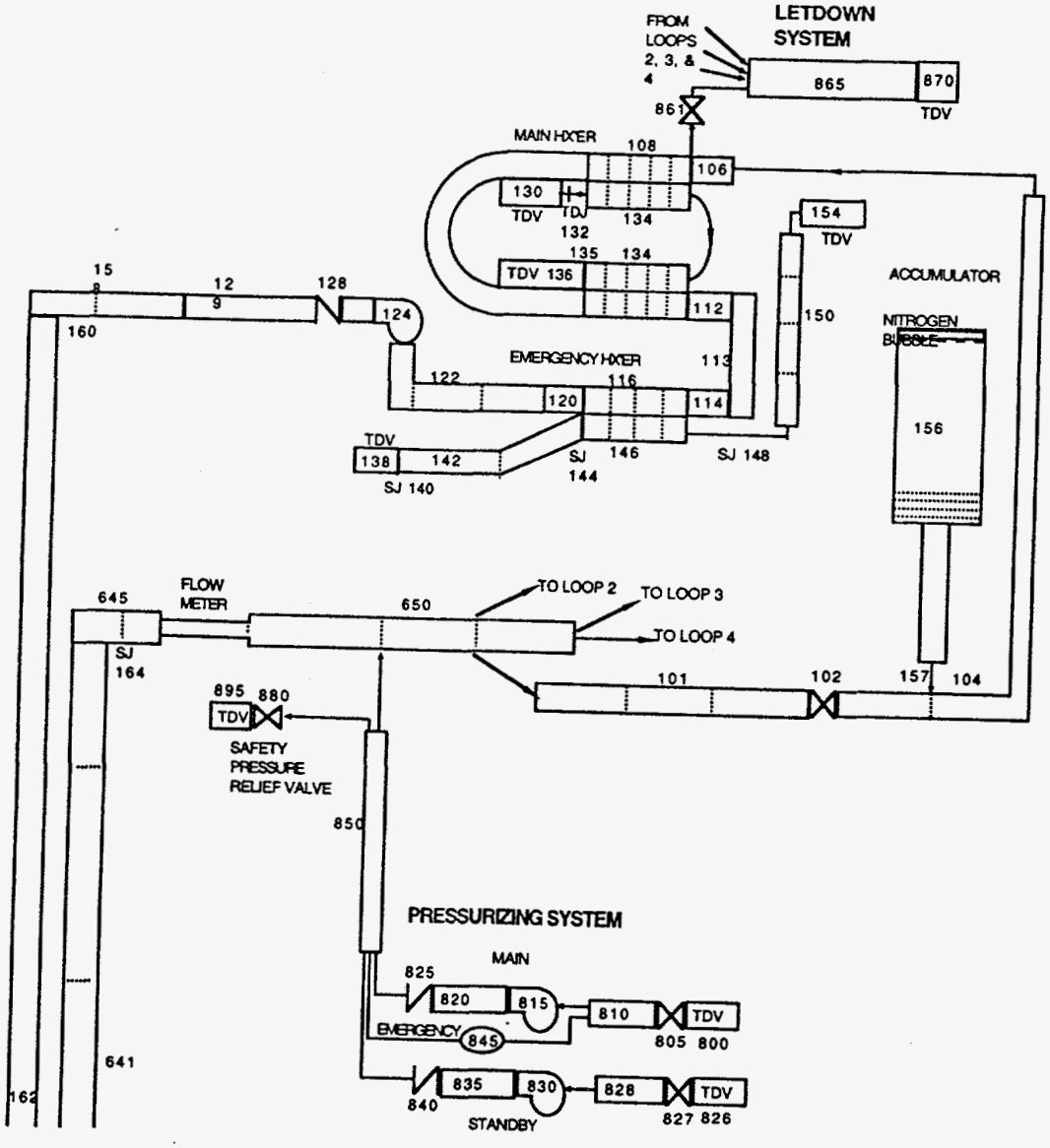

Fig. 2. ANS three-element-core RELAP5 nodalization diagram: cooling loop region.

0.952 m instead of 1.064 m. Since the total three-element heated axial span is shorter by 0.112 m, the inlet and outlet unfueled annular regions are lengthened by 0.076 m and 0.036 m, respectively. This same adjustment was made to the discretization in the control rod channels and the CPBT. Only the 0.076 m (inlet) adjustment was made in the CPBT annulus because the connection to the outer fuel channels is made below (in an axial sense) volume 557. The 0.036 m (outlet) adjustment was made in the outer fuel channels in volume 557.

2.1.1 Average Fuel Channels

Calculation of Span Length

$s_i = (r_o^2 - r_i^2)/2r_i = (162^2 - 102^2)/(2 \times 169) = 77.647$ mm

$s_m = (r_o^2 - r_i^2)/2r_i = (224^2 - 169^2)/(2 \times 102) = 63.950$ mm

$s_o = (r_o^2 - r_i^2)/2r_i = (281^2 - 231^2)/(2 \times 231) = 55.411$ mm

Calculation of Oxidized Fuel Plate Thickness

The maximum oxide thickness is 10.55×10^{-6} m for the G1294 two-element fuel grading using 95% nonexceedance probabilities for the nominal power level of 303 MWt (ref. 5). Using the same assumption that the cladding is consumed during oxide formation such that the total fuel plate thickness is increased by only 28.6% of the oxide thickness[6] gives the relation between oxidized and clean plates:

$$(\Delta x_{Alclad})_{oxidizedplate} = (\Delta x_{Alclad})_{cleanplate} - 0.714 t_{oxide} ,$$

where the clean plate Δx is 0.254 mm and the oxide thickness, t_{oxide}, is 0.01055 mm . So the oxidized plate oxide thickness is $0.254 - 0.714(0.01055) = 0.24647$ mm.

Since the total fuel meat thickness is 0.762 mm, the total oxidized plate thickness is $2 \times (0.01055 + 0.24647) + 0.762 = 1.2760$ mm $= 0.001276$ m.

The gaps between the fuel plates for each core is therefore

$$g_{middle} = \frac{\pi(169 \times 2) - 418 \text{ plates} \times 1.2760}{418 \text{ plates}} = 1.2643\text{mm}$$

$$g_{outer} = \frac{\pi(231 \times 2) - 571 \text{ plates} \times 1.2760}{571 \text{ plates}} = 1.2659\text{mm}$$

$$g_{inner} = \frac{\pi(102 \times 2) - 252 \text{ plates} \times 1.2760}{252 \text{ plates}} = 1.2672\text{mm}$$

Pipe 510

Middle-core average channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	0.033635 m^2 (total flow area in middle core, except two hot channels)
	=	$(416/418) \times [\pi(0.224^2 - 0.169^2) - (418)(1.276 \times 10^{-3})(63.950 \times 10^{-3})]$
dZ	=	0.0836 m, assumes vertical orientation of the core
e	=	1.772×10^{-6} m, calibrated to get correct pressure drop over the core
dh	=	0.0024796 m = 4(63.95)(1.2643) / 2(63.95 + 1.2643)

The ANS rectangular-channel geometry updates are invoked on card 5101001, and the pitch and span are specified to be 0.00127 m and 0.06395 m, respectively, on card 5101501.

Three sets of heat structures are attached to the average channel. The first set represents the average fuel plate. The second set represents the inner side plate, and the third represents the outer side plate. The same method applies for the upper and inner fuel regions.

Pipe 540

Outer-core average channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	3.9912×10^{-2} m^2 (total flow area in outer core except two hot channels)
	=	$(569/571) \times [\pi(0.281^2 - 0.231^2) - (571)(1.276 \times 10^{-3})(55.411 \times 10^{-3})]$
dZ	=	0.0836 m (elevation)
e	=	1.772×10^{-6} m, calibrated roughness to get correct pressure drop over the core
dh	=	0.0024722 m = 4(55.41)(1.2643) / 2(55.41 + 1.2643)

The ANS rectangular-channel geometry updates are invoked on card 5401001, and the pitch and span are specified to be 0.00127 m and 0.05541 m, respectively, on card 5401501.

Pipe 570

Inner-core average channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	2.4598×10^{-2} m^2 (total flow area in outer core except two hot channels)
	=	$(250/252) \times [\pi(0.162^2 - 0.102^2) - (252)(1.276 \times 10^{-3})(77.647 \times 10^{-3})]$
dZ	=	0.0836 m (elevation)
e	=	1.772×10^{-6} m, calibrated roughness to get correct pressure drop over the core
dh	=	0.0024937 m = 4(77.647)(1.2672) / 2(77.647 + 1.2672)

The ANS rectangular-channel geometry updates are invoked on card 5701001, and the pitch and span are specified to be 0.00127 m and 0.07765 m, respectively, on card 5701501.

2.1.2 Hot Fuel Channels

Two hot channels are used in the lower fuel region to include uncertainties combined to produce the worst-case thermal-hydraulic conditions. Each hot channel is assumed to have a minimum channel gap of 1.14 mm (equal to 90% of nominal 1.27-mm gap).[7] One of the hot channels is used to produce conditions at a 95% nonexceedance probability level (NEPL) for analysis of unlikely events, and the other at 99.9% nonexceedance probability level for analysis of anticipated events. The same method is used for the upper and inner fuel regions.

Pipes 515 and 516

Middle (lower) core 95% and 99.9% NEPL hot channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	8.0467×10^{-5} m^2 (flow area for the single channel)
	=	$(1/418) \times [\pi(0.224^2 - 0.169^2) - (418)(1.276 \times 10^{-3})(63.950 \times 10^{-3})]$
dZ	=	0.0836 m (elevation)
e	=	1.772×10^{-6} m, calibrated roughness to get correct pressure drop
dh	=	$0.002236 \text{ m} = 4 \times 90\% \times 1.2643 \times 63.95 / [2(63.95 + 90\% \times 1.2643)]$

The ANS rectangular-channel geometry updates are invoked on cards 5151001 and 5161001, and the pitch and span are specified to be 0.0011433 m and 0.06395 m, respectively, on cards 5151501 and 5161501.

Pipe 545 and 546

Upper core 95% and 99.9% NEPL hot channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	7.0145×10^{-5} m^2 (flow area for the single channel)
	=	$(1/571) \times [\pi(0.281^2 - 0.231^2) - (571)(1.276 \times 10^{-3})(55.411 \times 10^{-3})]$
dZ	=	0.0836 m (elevation)
e	=	1.772×10^{-6} m, calibrated roughness to get correct pressure drop
dh	=	$0.0022299 \text{ m} = 4 \times 90\ \% \times 1.2643 \times 55.41 / [2(55.41 + 90\% \times 1.2643)]$

The ANS rectangular-channel geometry updates are invoked on cards 5451001 and 5461001, and the pitch and span are specified to be 0.0011433 m and 0.05541 m, respectively, on cards 5451501 and 5461501.

Pipe 575 and 576

Inner core 95% and 99.9% NEPL hot channel,

L	=	0.0836 m for each of 5 nodes, giving 0.418 m total length
A	=	9.8398×10^{-5} m^2 (flow area for the single channel)
	=	$(1/252) \times [\pi(0.162^2 - 0.102^2) - (252)(1.276 \times 10^{-3})(77.647 \times 10^{-3})]$
dZ	=	0.0836 m (elevation)
e	=	1.772×10^{-6} m, calibrated roughness to get correct pressure drop
dh	=	$0.0022429 \text{ m} = 4 \times 90\% \times 1.2643 \times 77.647 / [2(77.647 + 90\% \times 1.2643)]$

The ANS rectangular-channel geometry updates are invoked on cards 5751001 and 5761001, and the pitch and span are specified to be 0.0011433 m and 0.07765 m, respectively, on cards 5751501 and 5761501.

2.1.3 Unheated Annular Channels

Several control volumes are defined to represent the annular channels upstream and downstream of each fuel element. Volumes 520, 535, and 572 are defined to represent the short (0.05-m) mid-core volumes.

Pipe 505

Lower (middle)-core inlet annulus
TOTAL LENGTH = 1.621 m = 1.545 m (ref. 8) + 0.076 m (see above discussion)

Segments 1–9, except segment 5

L	=	0.175 m (segmentation of inlet annulus to correspond to outer core segmentation)
A	=	$0.067906\ m^2 = \pi(0.224^2 - 0.169^2)$
dZ	=	0.175 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	$0.1100\ m = 4 \times 0.067906 / [2\pi(0.224 + 0.169)]$

Segment 5

L	=	$0.221\ m = 1.621 - 8 \times 0.175$
A	=	$0.067906\ m^2 = \pi(0.224^2 - 0.169^2)$
dZ	=	0.221 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	$0.1100\ m = 4 \times 0.067906 / [2\pi(0.224 + 0.169)]$

Pipe 520
Lower (middle)-core, mid-core volume

L	=	0.116 m (ref. 3)
A	=	$0.067906\ m^2 = \pi(0.224^2 - 0.169^2)$
dZ	=	0.116 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	$0.1100\ m = 4 \times 0.067906 / [2\pi(0.224 + 0.169)]$

Pipe 525
Lower (middle)-core exit annulus (upper-core bypass)
TOTAL LENGTH = 2.5108 m = 2.5638 m (ref. 3) + 0.036 m + (0.418 - 0.507) m

Segment 1

L	=	$0.1672\ m = 2 \times 0.0836$ m, exit of volume aligned with exit of 2nd volume in upper-core fuel channels.
A	=	$0.067906\ m^2 = \pi(0.224^2 - 0.169^2)$
dZ	=	0.1672 m (vertical orientation)

e = 1.52×10^{-6} m
dh = 0.1100 m = $4 \times 0.067906 / [2\pi(0.224 + 0.169)]$

Segments 2-12

L = 0.1953 m = (2.5108 - 0.1672)/12, entrance of volume aligned with exit of 2nd volume in upper-core fuel channels.
A = 0.067906 $m^2 = \pi(0.224^2 - 0.169^2)$
dZ = 0.1953 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1100 m = $4 \times 0.067906 / [2\pi(0.224 + 0.169)]$

Pipe 530
Upper (outer)-core inlet annulus
The total length of this pipe is based on ref. 8. The discretization was selected to keep node lengths close to 0.2 m. The volume No. 5 must match up to the CPBT inlet orifice.
TOTAL LENGTH OF VOLUMES 1-9 = 1.621 m = 1.545 m (ref. 8) + 0.076 m (see above discussion)

Segments 1-9, except segment 5
L = 0.175 m
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.175 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Segment 5
L = 0.221 m = $1.621 - 8 \times 0.175$
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.221 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Segments 10-14

L = 0.0836 m = 0.418 m / 5, aligned with lower-core fuel channel volumes
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.1014 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Pipe 535
Upper (outer)-core mid-core volume

L = 0.116 m (ref. 3)
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.116 m (vertical orientation)

e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Pipe 555
Upper (outer)-core bottom exit annulus
Center volume is aligned to receive cross-flow from CPBT annulus (ref. 3).
Total length of pipe 555 is 0.7715 m, same as the two-element-core dimension. The additional length for unheated annular regions in the three-element-core is made up in pipe 557.

Segments 1-5
L = 0.1543 m = 0.7715/5
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.1543 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1100 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Pipe 557
Outer-core top-exit annulus. The total length of this pipe, 1.3213 m, is equal to the two-element length of 1.2853 m plus one-half the difference in overall core length between the two-element and three-element-cores, 0.036 m. The length is segmented to keep all volume lengths near 0.2 m.

Segments 1-7
L = 0.16 m
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.16 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Segment 8
L = 0.2013 m = $1.3213 - 7 \times 0.16$
A = 0.080425 $m^2 = \pi(0.281^2 - 0.231^2)$
dZ = 0.2013 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1000 m = $4 \times 0.080425 / [2\pi(0.281 + 0.231)]$

Pipe 568
Inner-core inlet annulus
These volume lengths correspond one-to-one with the outer-core volumes.

Segments 1-9, except segment 5
L = 0.175 m
A = 0.049763 $m^2 = \pi(0.162^2 - 0.102^2)$
dZ = 0.175 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.1200 m = $4 \times 0.049763 / [2\pi(0.162 + 0.102)]$

Segment 5

L	=	0.221 m
A	=	0.049763 $m^2 = \pi(0.162^2 - 0.102^2)$
dZ	=	0.221 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.1200 m = 4 × 0.049763 / [2π(0.162 + 0.102)]

Segments 10–14

L	=	0.0836 m = 0.418 m / 5, aligned with lower-core fuel channel volumes
A	=	0.049763 $m^2 = \pi(0.162^2 - 0.102^2)$
dZ	=	0.1014 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.1200 m = 4 × 0.049763 / [2π(0.162 + 0.102)]

Pipe 572
Inner-core, mid-core volume

L	=	0.116 m (ref. 3)
A	=	0.049763 $m^2 = \pi(0.162^2 - 0.102^2)$
dZ	=	0.116 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.1200 m = 4 × 0.049763 / [2π(0.162 + 0.102)]

Pipe 580
Inner-core-exit annulus
Total length is the same as total length of volumes 555 and 557 = 2.0928 m.
Discretization is made to keep volume lengths near 0.2 m.

L	=	0.20928 m, aligned to receive cross-flow from CPBT annulus (ref. 8)
A	=	0.049763 $m^2 = \pi(0.162^2 - 0.102^2)$
dZ	=	0.20928 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.1200 m = 4 × 0.049763 / [2π(0.162 + 0.102)]

Core Flow Separation Shroud Heat Structures

Heat Structure 5052 (Separation shroud between middle and outer fuel annuli)

Number of Heat Structures (NHS) = 9
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.224-m inner radius of core flow separation shroud between middle- and outer-fuel annuli
Right-boundary coordinate = 0.231 m outer radius of core flow separation shroud between middle- and outer-fuel annuli
Composition is No. 2 - Al 6061
Left boundary is Pipe 505

Right boundary is Pipe 530

Heat Structure 5053 (Separation shroud between inner- and middle-fuel annuli)

Number of Heat Structures (NHS) = 9
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.162-m inner radius of core flow separation shroud between inner- and middle-fuel annuli
Right-boundary coordinate = 0.169-m outer radius of core flow separation shroud between inner- and middle-fuel annuli
Composition is No. 2 - Al 6061
Left boundary is Pipe 568
Right boundary is Pipe 505

Heat Structure 5202 (Separation shroud between middle- and outer-core annuli in mid-core region)

Number of Heat Structures (NHS) = 1
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.224-m inner radius of core flow separation shroud (ref. 3)
Right-boundary coordinate = 0.231-m outer radius of core flow separation shroud (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Volume 520-01
Right boundary is Volume 535-01
Heat transfer length = 0.116 m (includes unheated fuel plate)

Heat Structure 5203 (Separation shroud between inner- and lower-core annuli in mid-core region)

Number of Heat Structures (NHS) = 1
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.162-m inner radius of core flow separation shroud (ref. 3)
Right-boundary coordinate = 0.169-m outer radius of core flow separation shroud (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Volume 572-01
Right boundary is Volume 520-01
Heat transfer length = 0.116 m (includes unheated fuel plate)

Heat Structure 5551 (Separation shroud between middle- and outer-core annuli in core exit region)

Number of Heat Structures (NHS) = 2
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.224-m inner radius of core flow separation shroud (ref. 3)
Right-boundary coordinate = 0.231-m outer radius of core flow separation shroud (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Volume 525-01
Right boundary is Volume 555-01
Heat transfer length = 0.7715 m, extends only to end of pipe 550

Heat Structure 5553 (Separation shroud between inner- and middle-core annuli in core exit region)

Number of Heat Structures (NHS) = 2
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.162 m inner radius of core flow separation shroud (ref. 3)
Right-boundary coordinate = 0.169 m outer radius of core flow separation shroud (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Volume 525-01
Right boundary is Volume 580-01
Heat transfer length = 0.7715 m, extends only to end of pipe 550

2.1.4 Fuel Channel Interconnecting Junctions

Multiple Junction 507

Junction 1
Connects pipe 500 (core inlet plenum) to pipe 505 (middle-core inlet annulus)
A = 0.067906 m^2 (defaulted to area of 505)
Kf = 0.0
Kr = 0.0
Use abrupt area change model to represent sudden area contraction
dh = 0.110 m (same as the correct dh for 505)

Junction 2
Connects pipe 505 (middle-core inlet annulus) to pipe 510 (middle-core average channel)
A = 0.033635 m^2 (defaulted to area of 510)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.0024796 m

Junction 3
Connects pipe 505 (middle-core inlet annulus) to pipe 515 (middle core 95% NEPL hot channel)
A = 0.000080467 m^2 (defaulted to area of 515)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.002236 m

Junction 4
Connects pipe 505 (middle-core inlet annulus) to pipe 516 (middle-core 99.9% NEPL hot channel)
A = 0.000080467 m^2 (defaulted to area of 516)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)

Kr = 0.38
Use smooth area change model
dh = 0.002236 m

Multiple Junction 522

Junction 1
Connects pipe 510 (middle-core average channel) to pipe 520 (middle-core exit annulus)
A = 0.033635 m^2 (defaulted to area of 510)
Kf = 0.068, fL/d for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.068
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.0024796 m, same as the dh for 510

Junction 2
Connects pipe 515 (middle-core 95% NEPL hot channel) to pipe 520 (middle-core-exit annulus)
A = 0.000080467 m^2 (defaulted to area of 515)
Kf = 0.068, fL/d for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.068
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.002236 m, same as the dh for 515

Junction 3
Connects pipe 520 (middle-core mid-core volume) to pipe 525 (middle-core-exit annulus)
A = 0.067906 m^2 (defaulted to area of 520)
Kf = 0.0
Kr = 0.0
Smooth area change model used
dh = 0.110 m (same as the correct dh for 520)

Junction 4
Connects pipe 516 (middle-core 99.9% NEPL hot channel) to pipe 520 (middle-core-exit annulus)
A = 0.000080467 m^2 (defaulted to area of 516)
Kf = 0.68, fL/d for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.68
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.002236 m, same as the dh for 515

Single Junction 529

Connects pipe 500 (core inlet plenum) to pipe 530 (middle-core bypass annulus)
A = 0.080425 m^2 (defaulted to area of 530)
Kf = 0.0
Kr = 0.0
Use abrupt area change model to represent sudden area contraction
dh = 0.1000 m (same as the correct dh for 530)

Multiple Junction 537

Junction 1
Connects pipe 530 (middle-core bypass annulus) to pipe 535 (outer-core mid-core volume)
A = 0.080425 m^2 (defaulted to area of 530)
Kf = 0.0
Kr = 0.0
Use smooth area change model
dh = 0.1000 m (same as the dh for 530)

Junction 2
Connects pipe 535 (outer-core mid-core volume) to pipe 540 (outer-core average channel)
A = 0.039912 m^2 (defaulted to area of 540)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.0024722 m

Junction 3
Connects pipe 535 (outer-core mid-core volume) to pipe 545 (outer-core 95% NEPL hot channel)
A = 0.000070145 m^2 (defaulted to area of 545)
Kf = 0.38 = 0.04 (taken from HFIR value[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.0022299 m

Junction 4
Connects pipe 535 (outer-core mid-core volume) to pipe 546 (outer-core 99.9% NEPL hot channel)
A = 0.000070145 m^2 (defaulted to area of 546)
Kf = 0.38 = 0.04 (taken from HFIR value, Ref. 9) + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.0022299 m

Multiple Junction 556

Junction 1
Connects pipe 540 (outer-core average channel) to pipe 555 (outer-core exit annulus)
A = 0.039912 m^2 (defaulted to area of 540)
Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.068
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.0024722 m, same as the dh for 540

Junction 2
Connects pipe 545 (outer-core 95% NEPL hot channel) to pipe 555 (outer-core exit annulus)
A = 0.000070145 m^2 (defaulted to area of 545)
Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.068
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.0022299 m, same as the dh for 545

Junction 3
Connects pipe 546 (outer-core 99.9% NEPL hot channel) to pipe 555 (outer-core exit annulus)
A = 0.000070145 m^2 (defaulted to area of 545)
Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.010 m unheated length
Kr = 0.068
Use abrupt area change model to represent sudden expansion at core exit
dh = 0.0022299 m, same as the dh for 545

Junction 4
Connects pipe 555 (outer-core bottom-exit annulus) to pipe 557 (outer-core top-exit annulus)
A = 0.080425 m^2 (defaulted to area of 555)
Kf = 0.0
Kr = 0.0
Use smooth area change model
dh = 0.1000 m, same as 557 and 555

Multiple Junction 569

Junction 1
Connects pipe 568 (middle-core bypass annulus) to pipe 572 (inner-core mid-core volume)
A = 0.049763 m^2 (defaulted to area of 568)
Kf = 0.0
Kr = 0.0
Use smooth area change model
dh = 0.1200 m (same as the dh for 568)

Junction 2
Connects pipe 572 (inner-core mid-core volume) to pipe 570 (inner-core average channel)
A = 0.024598 m^2 (defaulted to area of 570)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5×10^5, f = 0.0169, L = 0.050 m unheated length)
Kr = 0.38
Use smooth area change model
dh = 0.0024937 m

Junction 3
Connects pipe 572 (inner-core mid-core volume) to pipe 575 (inner-core 95% NEPL hot channel)
A = 0.000098398 m^2 (defaulted to area of 575)
Kf = 0.38 = 0.04 (taken from HFIR value)[9] + 0.34 (fL/d, for smooth pipe, Re = 1.5 ×

10^5, f = 0.0169, L = 0.050 m unheated length)

Kr = 0.38

Use smooth area change model

dh = 0.0022429 m

Junction 4

Connects pipe 572 (inner-core mid-core volume) to pipe 576 (inner-core 99.9% NEPL hot channel)

A = 0.000098398 m^2 (defaulted to area of 576)

Kf = 0.38 = 0.04 (taken from HFIR value)^9 + 0.34 (fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.050 m unheated length)

Kr = 0.38

Use smooth area change model

dh = 0.0022429 m

Junction 5

Connects pipe 500 (core inlet plenum) to pipe 568 (middle-core bypass annulus)

A = 0.049763 m^2 (defaulted to area of 568)

Kf = 0.0

Kr = 0.0

Use abrupt area change model to represent sudden area contraction

dh = 0.1200 m (same as the correct dh for 568)

Multiple Junction 581

Junction 1

Connects pipe 570 (inner-core average channel) to pipe 580 (inner-core exit annulus)

A = 0.039912 m^2 (defaulted to area of 570)

Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.010 m unheated length

Kr = 0.068

Use abrupt area change model to represent sudden expansion at core exit

dh = 0.0024937 m, same as the dh for 570

Junction 2

Connects pipe 575 (inner-core 95% NEPL hot channel) to pipe 580 (inner-core exit annulus)

A = 0.000098398 m^2 (defaulted to area of 575)

Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.010 m unheated length

Kr = 0.068

Use abrupt area change model to represent sudden expansion at core exit

dh = 0.0022429 m, same as the dh for 575

Junction 3

Connects pipe 576 (inner-core 99.9% NEPL hot channel) to pipe 580 (inner-core exit annulus)

A = 0.000098398 m^2 (defaulted to area of 576)

Kf = 0.068 = fL/d, for smooth pipe, Re = 1.5 × 10^5, f = 0.0169, L = 0.010 m unheated length

Kr = 0.068

Use abrupt area change model to represent sudden expansion at core exit

dh = 0.0022429 m, same as the dh for 576

2.1.5 Average Channel Heat Structures

The fuel plates and side plates are modeled with slab (rectangular geometry) heat structures. Source terms are included within each heat structure based on neutronics calculations for the distribution of thermal power in the core. For illustration, a calculational procedure for the middle-core average fuel plates is described. The same procedure applies to upper- and inner-core fuel regions.

(A) Average Fuel Plates

Heat Structure 5101 (Lower-Core Average Fuel Plates)

Fuel plate geometry and response are symmetrical with respect to the plate centerline. Taking advantage of symmetry, the fuel plates are modeled as single-sided plates of half thickness with a convective boundary on one side and an adiabatic (symmetry) boundary on the other side.

The clean fuel plates are 1.27 mm (50 mils) thick with a 0.762-mm (30-mil)-thick fuel meat and a 0.254-mm (10-mil) aluminum 6061 clad on each side. During oxide formation, cladding is consumed such that the total plate thickness is increased by only 28.6% of the oxide thickness. For the G1294-2d fuel grading the maximum oxide thickness was 10.55×10^{-6} m. Therefore, the corroded plates consist of 0.762-mm fuel meat, 0.2465-mm clad on each side, and 0.01055-mm oxide on each side for a total thickness of 1.276-mm.

Fuel meat thickness (half plate)= 0.381 mm
Clad thickness= 0.2465 mm
Oxide thickness= 0.01055 mm

Heat Structure Group Number CCCG=5101
Number of Heat Structures (NHS) = 5
Number of Mesh Points (NMP) = 11

2 intervals from the left boundary through right coordinate (RCOORD) = 1.055×10^{-5} m (oxide)
2 intervals through RCOORD= 2.57×10^{-4} m (cladding)
6 intervals through RCOORD= 6.38×10^{-4} m (fuel meat)

Composition No. 4 (Oxide) through interval 2
Composition No. 2 (Al 6061) through interval 4
Composition No. 5 (Fuel Meat) through interval 10

Power Distribution through the fuel plate thickness

Constant, uniform values for heat generation are specified in the fuel meat and cladding.

Because of lack of information for the three-element core, an averaged power split between the fuel meat and the clad is calculated based on the two-element core L7 fuel grading calculations. In the two-element core, power is distributed as shown here:

Core	Fuel meat	Fuel clad
Upper	99.33%	0.67%
Lower	99.41%	0.59%

The average distribution from this two-element-core result of 99.37%/0.63% is assumed for all three cores. For the three-element reactor, the distribution of power among the three cores at beginning of the cycle is 15.2% - Inner, 40.5% - Middle, and 44.3% - Outer, for the G1294-2d core, according to ref. *10*:

Inner-core fuel meat source term = 0.152 × 0.90757 × 0.9937 = 0.13708,
Inner-core fuel clad source term = 0.152 × 0.90757 × 0.0063 = 0.00086909,
Middle-core fuel meat source term = 0.405 × 0.90757 × 0.9937 = 0.36525,
Middle-core fuel clad source term = 0.405 × 0.90757 × 0.0063 = 0.0023157,
Outer-core fuel meat source term = 0.443 × 0.90757 × 0.9937 = 0.39952,
Outer-core fuel clad source term = 0.443 × 0.90757 × 0.0063 = 0.0025329,

where 0.90757 is the total power fraction deposited in the fuel meat and cladding.[11]

The heat transfer area to the coolant per cell is calculated as follows:

axial heated length per cell × effective span × number of plates × 2 sides,

where the effective span is the total span length less 1.143 mm (45 mils) on both ends for the non-fuel regions. Although only half of the average fuel plate is modeled (taking advantage of symmetry), both sides of the fuel plate are included in the area calculation because the total power is used to generate the source term. The following calculations are done for the fuel plate heat structures to determine the total heat transfer area.

HS 5101 $0.418/5 \times (0.06395 - 2 \times 0.001143) \times (418-2) \times 2 = 4.29\ m^2$
HS 5151 $0.418/5 \times (0.06395 - 2 \times 0.001143) \times 1 \times 2 = 0.01031\ m^2$
HS 5161 $0.418/5 \times (0.06395 - 2 \times 0.001143) \times 1 \times 2 = 0.01031\ m^2$
HS 5401 $0.418/5 \times (0.05541 - 2 \times 0.001143) \times (571-2) \times 2 = 5.05\ m^2$
HS 5451 $0.418/5 \times (0.05541 - 2 \times 0.001143) \times 1 \times 2 = 0.00888\ m^2$
HS 5461 $0.418/5 \times (0.05541 - 2 \times 0.001143) \times 1 \times 2 = 0.00888\ m^2$
HS 5701 $0.418/5 \times (0.07765 - 2 \times 0.001143) \times (252-2) \times 2 = 3.15\ m^2$
HS 5751 $0.418/5 \times (0.07765 - 2 \times 0.001143) \times 1 \times 2 = 0.01260\ m^2$
HS 5761 $0.418/5 \times (0.07765 - 2 \times 0.001143) \times 1 \times 2 = 0.01260\ m^2$

A FORTRAN program (Appendix B: power3E.f) has been written to calculate source terms in heat structures according to RELAP5 input requirements. The procedure to calculate source terms requires the use of power allocation (Table 1), relative power density as derived from neutronic calculations (Table 2), and peaking factors (Table 3). For the power distribution within the structures, a flat radial profile in the fuel meat and clad is assumed, and a $1/r$ profile in the side plates, control rods, central hole wall, and CPBT walls is used. The source inputs for the heat structure 5101 within the fuel meat, clad, and oxide are 0.13708, 0.00086909, and 0, respectively.

Table 1. ANS heat loads for RELAP5 input

Component	Relative	Absolute (MW)
Outer fuel element	0.33917	112.13
Inner	0.13319	44.033
Middle	0.43521	143.882
Inner fuel element and plates and unheated zones	0.00080	0.264
Outer	0.00140	0.462
Middle	0.00140	0.463
Inner support tube	0.00072	0.238
Middle	0.00039	0.129
Outer	0.00050	0.166
Inner CPBT	0.00115	0.380
Outer CPBT	0.00391	1.291
Inner-fuel-element side plates	0.00129	0.426
Outer	0.00258	0.852
Middle	0.00263	0.868
Central hole D_2O (inside inner support)	0.00327	1.081
Inner D_2O channel [between M&O support (includes support structures and targets)]	0.00561	1.854
Middle D_2O channel [between M&O support (includes support structures and targets)]	0.00777	2.570
Outer D_2O channel [between M&O support (includes support structures and targets)]	0.00660	2.182
Core bypass (between CPBT walls)	0.00093	0.306
Central control rods and structures	0.00406	1.342
Reflector vessel wall	0.00206	0.682
Reflector (D_2O & components)	0.04537	14.999
Total	1.0000	330.600

Table 2. Relative power densities in each node of the RELAP5 ANSR three-element-core model

Node	Avg channel	Hot channel	CHF hot stripe	FE hot stripe
Outer element 1 day into the cycle				
1 (Inlet)	1.351	1.622	1.710	1.664
2	1.285	1.618	1.658	1.554
3	1.165	1.495	1.546	1.415
4	1.026	1.348	1.405	1.266
5 (Outlet)	0.882	1.155	1.258	0.906
Middle element at beginning of cycle				
1 (Inlet)	1.217	1.654	1.759	1.648
2	1.257	1.624	1.647	1.573
3	1.260	1.523	1.566	1.459
4	1.244	1.408	1.452	1.335
5 (Outlet)	1.158	1.230	1.326	1.025
Inner element at end of cycle				
1 (Inlet)	0.862	1.518	1.569	1.379
2	0.732	1.254	1.351	1.156
3	0.668	1.115	1.150	1.029
4	0.563	0.956	1.018	0.868
5 (Outlet)	0.385	0.790	0.858	0.693

Table 3. Uncertainty factors in each node of the RELAP5 ANSR three-element-core model

Node	Hot channel	CHF hot stripe	FE hot stripe
	95% Nonexceedance probability		
1 (Inlet)	1.074	1.631	1.305
2	1.074	1.554	1.305
3	1.074	1.554	1.305
4	1.074	1.554	1.305
5 (Outlet)	1.074	1.631	1.305
	99.9% Nonexceedance probability		
1 (Inlet)	1.113	1.995	1.592
2	1.113	1.899	1.592
3	1.113	1.899	1.592
4	1.113	1.899	1.592
5 (Outlet)	1.113	1.995	1.592

Sample Calculation: Lower-core average and hot channel fuel plate source terms

1. Determine power fractions

In the lower fuel element, the model contains 250 plates for the average channels, one plate for the 95% hot channel, and one plate for the 99.9% hot channel. The power to the lower core is apportioned to the average and hot channels by applying the conservation of energy.

$$250/252 \times P + \begin{array}{c}\text{averaged hot channel power density/averaged channel power density}\end{array} \times \begin{array}{c}\text{(1/252 peaking factor for the 95\% hot channel + 1/252 peaking factor for the 99.9\% hot channel)}\end{array} = 1 ,$$

where P is the average channel peaking factor, which must be less than 1 to compensate for the increased heat load on the 95% and 99.9% hot fuel plates.

The above equation expressed using the FORTRAN variables is

$$mavgl + ml95 + ml99 = 1 ,$$

where

mavgl =	250 × P/252 = average channel power fraction
ml95 =	1 × averaged hot channel power desity / averaged channel power density × peaking factor of the 95% hot channel /252 = 95% hot channel power fraction
ml99 =	1 × averaged hot channel power desity / averaged channel power density × peaking factor of the 99.9% hot channel /252 = 99.9% hot channel power fraction

2. Derive source terms for average fuel heat structures.

In power.f, the source multiplier (defined as W2) for the averaged fuel heat structure in the first cell of the lower core is expressed by:

$$W2 = 0.07351 \times mavgl \times pdlcac(n)/avpdla ,$$

where, in addition:

pdlcac(n) = the *n*th-cell power density, lower core, average channel heat structure

avpdla = average power density in lower-core average fuel heat structure

and the leading constant is calculated as follows:

Lower-core power fraction × total fuel meat and clad power fraction / 5 cells

$$0.405 \times 0.90757/5 = 0.07351 .$$

A similar expression applies for calculating D_2O heating on the left side of the fuel structure (defined as W3 and called left heat):

$$W3 = 0.001554 \times \text{volume fraction} \times mavgl \times pdlcac(n)/avpdla$$

wherein the leading constant is computed as 0.00777/5 = 0.001554 (0.00777, ref. 11) is the power fraction deposited in the coolant immediately next to the fuel element). Repeat the same procedure for the inner and outer side plates.

3. Load the calculated source terms into the RELAP5 input file.

As the source terms are inserted into the RELAP5 input, a summation of the itemized heat sources is performed as a check on total power conservation. For the lower-core average fuel plate (heat structure 5101), the right heat is inputed at zero because it is an adiabatic (symmetry) boundary at the fuel plate centerline.

(B) Average Channel Side Plates

<u>Heat Structure 5102 (Middle-Core Average Channel Inner Side Plate)</u>

The middle core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the average fuel plates (Pipe 510) to coolant in the inner fuel annulus middle fuel bypass (Pipe 568). RELAP5 does not allow conduction heat transfer between two heat structures. Therefore, fuel plate heat transfer cannot be modeled to flow spanwise to the side plates. In the model, heat must pass from the fuel plate to the coolant and then to the side plates. As a result, the side plate temperatures calculated will be low. The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.162 m
Right-boundary radius is 0.169 m
Composition is No. 2 - Al6061
Heat transfer length = 0.0416 m = 0.5 × 416/418 × 0.418/5

Heat Structure 5103 (Middle-Core Average Channel Outer Side Plate)

The middle-core average channel outer side plate is modeled with a two-sided structure that can pass heat from coolant between the average fuel plates (Pipe 510) to coolant in the outer fuel bypass annulus (Pipe 530). The method used for heat structure 5102 was also used here to calculate source terms. The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.224 m
Right-boundary radius is 0.231 m
Composition is No. 2 - Al6061
Heat transfer length = 0.0416 m = 0.5 × 416/418 × 0.418/5

Heat Structure 5402 (Outer-Core Average Channel Inner Side Plate)

The outer-core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the average fuel channel (Pipe 540) to coolant in the middle fuel exit annulus (Pipe 525). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.224 m
Right-boundary radius is 0.231 m
Composition is No. 2 - Al6061
Heat transfer length = 0.0417 m = 0.5 × 569/571 × 0.418/5

Heat Structure 5702 (Inner-Core Average Channel Inner Side Plate)

The inner-core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the average fuel channel (Pipe 570) to coolant in the control rod tube (Pipe 562). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.095 m
Right-boundary radius is 0.102 m
Composition is No. 2 - Al6061
Heat transfer length = 0.04147 m = 0.5 × 250/252 × 0.418/5

Heat Structure 5703 (Outer-Core Average Channel Inner Side Plate)

The inner-core average channel outer side plate is modeled with a two-sided structure that can pass heat from coolant between the average fuel channel (Pipe 570) to coolant in the middle core exit annulus (Pipe 525). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.162 m
Right-boundary radius is 0.169 m
Composition is No. 2 - Al6061
Heat transfer length = 0.04147 m = 0.5 × 250/252 × 0.418/5

2.1.6 Hot Channel Heat Structures

(A) Main Fuel Heat Structure

The peaking factors presented in Tables 3 is used to calculate the 95% and 99.9% non-exceedance probability hot channel power density distributions. Similar to the lower-core average channel, the lower-core hot channel contains heat structures 5151, 5152, and 5153 for the fuel plate, inner side plate, and outer side plate, respectively. The same procedure for calculating source terms applies.

Heat Structures 5151 and 5161 (Middle-Core 95% and 99.9% Hot Channel Main Fuel Plate)

The middle-core hot channel fuel plate has the same dimensions as the average fuel plate. The heat transfer area is different because only one fuel plate is modeled.

Left-boundary coordinate is 0.0 m
Right-boundary coordinates for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel
Heat transfer area = 0.418/5 × (0.06395 - 2 × 0.001143) × 1 × 2 = 0.01031 m^2

Heat Structures 5451 and 5461 (Outer-Core 95% and 99.9% Hot Channel Main Fuel Plate)

The outer-core hot channel fuel plate has the same dimensions as the average fuel plate. The heat transfer area is different because only one fuel plate is modeled.

Left-boundary coordinate is 0.0 m
Right-boundary coordinates for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel
Heat transfer area = 0.418/5 × (0.05541 - 2 × 0.001143) × 1 × 2 = 0.00888 m^2

Heat Structures 5751 and 5761 (Inner-Core 95% and 99.9% Hot Channel Main Fuel Plate)

The inner-core hot channel fuel plate has the same dimensions as the average fuel plate. The heat transfer area is different because only one fuel plate is modeled.

Left-boundary coordinate is 0.0 m
Right-boundary coordinates for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel

Heat transfer area = $0.418/5 \times (0.07765 - 2 \times 0.001143) \times 1 \times 2 = 0.01260\ m^2$

(B) Hot Channel Side Plates

Heat Structures 5152 and 5162 (Middle-Core 95% and 99.9% Hot Channel Inner Side Plate)

The middle-core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the hot fuel channels (Pipes 515 and 516) to coolant in the inner fuel annulus middle fuel bypass (Pipe 568). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.162 m
Right-boundary radius is 0.169 m
Composition is No. 2 - Al6061
Heat transfer length = $0.0001\ m = 0.5 \times 1/418 \times 0.418/5$

Heat Structure 5153 and 5163 (Middle-Core 95% and 99.9% Hot Channel Outer Side Plate)

The middle-core hot channel outer side plate is modeled with a two-sided structure that can pass heat from coolant between the hot fuel channels (Pipes 515 and 516) to coolant in the outer fuel bypass annulus (Pipe 530). The method used for heat structure 5102 was also used here to calculate source terms. The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.224 m
Right-boundary radius is 0.231 m
Composition is No. 2 - Al6061
Heat transfer length = $0.0001\ m = 0.5 \times 1/418 \times 0.418/5$

Heat Structures 5452 and 5462 (Outer-Core 95% and 99.9% Hot Channel Inner Side Plate)

The outer-core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the hot fuel channels (Pipes 545 and 546) to coolant in the middle fuel exit annulus (pipe 525). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.224 m
Right-boundary radius is 0.231 m
Composition is No. 2 - Al6061
Heat transfer length = $0.0000732\ m = 0.5 \times 1/571 \times 0.418/5$

Heat Structures 5752 and 5762 (Inner-Core 95% and 99.9% Hot Channel Inner Side Plate)

The inner-core average channel inner side plate is modeled with a two-sided structure that can pass heat from coolant between the hot fuel channels (Pipes 575 and 576) to coolant in the control rod pipe (Pipe 562). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.095 m
Right-boundary radius is 0.102 m
Composition is No. 2 - Al6061

Heat transfer length = 0.0001659 m = 0.5 × 1/252 × 0.418/5

Heat Structures 5753 and 5763 (Inner-Core 95% and 99.9% Hot Channel Outer Side Plate)

The inner-core average channel outer side plate is modeled with a two-sided structure that can pass heat from coolant between the hot fuel channels (Pipes 575 and 576) to coolant in the middle fuel exit annulus (Pipe 525). The same procedure that was used above was used to compute source terms.

Left-boundary radius is 0.162 m
Right-boundary radius is 0.169 m
Composition is No. 2 - Al6061
Heat transfer length = 0.0001659 m = 0.5 × 1/252 × 0.418/5

(C) Hot Stripe Heat Structures

Two separate hot-spot factors are incorporated in each of the hot channels, one for CHF (heat structures 5154, 5164, 5454, 5464, 5754, and 5764) and one for Costa OSV (FE) (heat structure 5155, 5165, 5455, 5465, 5755 and 5765).[1] These hot spots are modeled as extremely small heat structures (heat transfer area is 1/100th of that for the main hot channel fuel plate) at each axial node. The areas of these heat structures are small enough so they do not affect the hot-channel bulk coolant temperature; however, the peaking factors (Table 3) are applied to elevate the local heat flux appropriately.

Heat Structures 5154, 5155, 5164, 5165 (Middle-Core 95% and 99.9% CHF and FE Hot Stripe)

The middle-core hot stripes have the same dimensions as the average fuel plate. The heat transfer area is only 1/100th of that for a single fuel plate.

Left-boundary radius is 0.0 m
Right-boundary radii for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel
Heat transfer area = 0.0001031 m^2 = 0.01031/100 m^2

Heat Structures 5454, 5455, 5464, 5465 (Outer-Core 95% and 99.9% CHF and FE Hot Stripe)

The outer-core hot stripes have the same dimensions as the average fuel plate. The heat transfer area is only 1/100th of that for a single fuel plate.

Left-boundary radius is 0.0 m
Right-boundary radii for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel
Heat transfer area = 0.0000888 m^2 = 0.00888/100 m^2

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[1] Additionally, in the postprocessor, three thermal limit heat fluxes are calculated based on the Costa OSV hot spot fluxes for the $T_w = T_{sat}$, the incipient boiling (IB), and the modified Saha-Zuber OSV at the 95% and 99.9% non-exceedance probability levels.

Heat Structures 5754, 5755, 5764, 5765 (Inner-Core 95% and 99.9% CHF and FE Hot Stripe)

The outer-core hot stripes have the same dimensions as the average fuel plate. The heat transfer area is only 1/100th of that for a single fuel plate.

Left-boundary radius is 0.0 m
Right-boundary radii for each component are same as described for average fuel plate
Composition is the same as described for average channel fuel
Heat transfer area = 0.0001260 m^2 = 0.01260/100. m^2

2.2 CONTROL ROD CHANNELS

Dimensions are left the same as the two-element-core model, except for the axial discretization, which is modified to match up with the axial discretization in the fuel channels.

Pipe 560
Control rod inlet
Total length of pipe 560 is 2.419 + 0.036 + 0.04 = 2.495 m.

Segments 1-9, except 5

L	=	0.175 m
A	=	0.03485 $m^2 = \pi(0.130^2 - 3 \times 0.044^2)$
dZ	=	0.175 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.08468 m = $4 \times 0.03485/2\pi/(3 \times 0.044 + 0.130)$

Segment 5

L	=	0.221 m (aligned with core inlet volumes)
A	=	0.03485 $m^2 = \pi(0.130^2 - 3 \times 0.044^2)$
dZ	=	0.221 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.08468 m = $4 \times 0.03485/2\pi/(3 \times 0.044 + 0.130)$

Segments 10-14

L	=	0.1748 m = $(2.495 - 8 \times 0.175 - 0.221)/5$
A	=	0.03485 $m^2 = \pi(0.130^2 - 3 \times 0.044^2)$
dZ	=	0.1748 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.08468 m = $4 \times 0.03485/2\pi/(3 \times 0.044 + 0.130)$

Pipe 561
Coolant in control rod tube

Segments 1-11, except 6

L	=	0.0836 m corresponds to fuel volumes
A	=	0.00456159 $m^2 = 3 \times \pi \times 0.022^2$
dZ	=	0.0836 m (vertical orientation)

e = 1.52×10^{-6} m
dh = 0.044 m = 2 × 0.022

Segment 6
L = 0.116 m (ref. 3), corresponds to mid-core volume
A = 0.00456159 $m^2 = 3 \times \pi \times 0.022^2$
dZ = 0.116 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.044 m = 2 × 0.022

Pipe 562
Coolant around control rod tube

Segments 1-11, except 6
L = 0.0836 m, corresponds to fuel volumes
A = 0.0164753 $m^2 = \pi(0.095^2 - 3 \times 0.0355^2)$
dZ = 0.0836 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.0520521 m = $4 \times 0.0164753/2\pi/(0.095 + 3 \times 0.0355)$

Segment 6
L = 0.116 m, corresponds to mid-core volume
A = 0.0164753 $m^2 = \pi(0.095^2 - 3 \times 0.0355^2)$
dZ = 0.116 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.0520521 m = $4 \times 0.0164753/2\pi/(0.095 + 3 \times 0.0355)$

Pipe 563
Coolant in control rod gap

Segments 1-11, except 6
L = 0.0836 m, corresponds to fuel volumes
A = 0.0013195 $m^2 = \pi(0.0315^2 - 0.0285^2) \times 8 \times 35°/360° \times 3$
dZ = 0.0836 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.006 m = $4 \times 0.0013195 / [2\pi \times 8 \times 35°/360° \times 3(0.0315 + 0.0285)]$

Segment 6
L = 0.116 m, corresponds to mid-core volume
A = 0.0013195 $m^2 = \pi(0.0315^2 - 0.0285^2) \times 8 \times 35°/360° \times 3$
dZ = 0.116 m (vertical orientation)
e = 1.52×10^{-6} m
dh = 0.006 m = $4 \times 0.0013195 / [2\pi \times 8 \times 35°/360° \times 3(0.0315 + 0.0285)]$

Pipe 564

Control rod outlet

Segments 1-12

L	=	0.1744 m = (2.0568 + 0.036)/12
A	=	0.03485 m^2 = $\pi(0.130^2 - 3 \times 0.044^2)$
dZ	=	0.1744 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.08468 m = $4 \times 0.03485/2\pi/(3 \times 0.044 + 0.130)$

Heat Structure 5051 (Control rod shroud in the inlet region)

Number of Heat Structures (NHS) = 14
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.130-m inner radius of control rod shroud[8]
Right-boundary coordinate = 0.1365-m outer radius of control rod shroud[8]
Composition is No. 2 - Al 6061
Left boundary is Pipe 560
Right boundary is Pipe 568

Heat Structure 5201 (Control rod shroud in mid-core region)

Number of Heat Structures (NHS) = 1
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.095 m (ref. 8)
Right-boundary coordinate = 0.102 m (ref. 8)
Composition is No. 2 - Al 6061
Left boundary is Volume 562-06
Right boundary is Volume 572-01

Heat Structure 5251 (Control rod shroud in mid-core region)

This heat structure has been removed because it is identical to the inner-core inner-side plate structure.

2.3 CORE PRESSURE BOUNDARY TUBE (CPBT)

The CPBT is a double-walled containment for the fuel assemblies. Coolant flows between the inner and outer walls in the CPBT annulus (pipe 550) to keep the exterior of the inner wall pressurized. This pressurization is accomplished by sizing the inner wall orifices at the bottom (inlet) and top (outlet) appropriately. The CPBT annulus is modeled as an annular flow channel with a 3-mm gap in the axial region defined by the upper core and a 5-mm gap at all other axial locations. The steady-state-design coolant velocity in the 3-mm gap region is 7 m/s. Previous RELAP5 studies have shown that if the outer wall completely disappears, an inlet orifice diameter of 0.076 m (3 in.) and an outlet orifice diameter of 0.0508 m (2 in.) is an acceptable combination to prevent fuel damage. These orifices are represented by single junctions 531 and 532.

The outer wall has an inside radius of 0.291 m, and the inner wall has an outside radius of 0.286 m, except at the axial level of the inner and outer cores, where it is 0.288 m.

2.3.1 CPBT Volumes

Junction 531

Connects center (via crossflow junction) of 530-01 to center of 550-01
A = 0.00454 m^2 (0.076-m-diam circular orifices)
Kf = 2.79 (orifice with $C_D = 0.6$)
Kr = 2.79 (orifice with $C_D = 0.6$)
Use smooth area change model
Invoke crossflow option for both volumes
dh = 0.01 m (assume 1-cm hole diameters)

Junction 532

Connects center (via crossflow junction) of 530-01 to center of 550-01
A = 0.00204 m^2 (0.051-m-diam circular orifices)
Kf = 2.78 (orifice with $C_D = 0.6$)
Kr = 2.78 (orifice with $C_D = 0.6$)
Use smooth area change model
Invoke crossflow option for both volumes
dh = 0.0024787 m

Pipe 550 (CPBT annulus)

Segments 1–9, except 5

L = 0.175 m (same as in two-element core)
A = 0.0090635 $m^2 = \pi(0.291^2 - 0.286^2)$
dZ = 0.175 m
e = 1.52×10^{-6} m
dh = 0.0100 m $= 4 \times 0.0090635 / 2\pi(0.291 + 0.286)$

Segment 5

L = 0.221 m $= 1.545 - 8 \times 0.175 + 0.076$
A = 0.0090635 $m^2 = \pi(0.291^2 - 0.286^2)$
dZ = 0.221 m
e = 1.52×10^{-6} m
dh = 0.0100 m $= 4 \times 0.0090635 / 2\pi(0.291 + 0.286)$

Segments 10–14

L = 0.0836 m = 0.418/5 (in middle fuel axial region)
A = 0.0090635 $m^2 = \pi(0.291^2 - 0.286^2)$
dZ = 0.0836 m
e = 1.52×10^{-6} m
dh = 0.0100 m $= 4 \times 0.0090635 / 2\pi(0.291 + 0.286)$

Segment 15

L	=	0.116 m, aligned with mid-core volumes
A	=	0.0054570 $m^2 = \pi(0.291^2 - 0.288^2)$
dZ	=	0.0836 m
e	=	1.52×10^{-6} m
dh	=	0.0060 m $= 4 \times 0.0054570 / 2\pi(0.291 + 0.288)$

Segments 16–20

L	=	0.0836 m, aligned with upper-core fuel channel volumes
A	=	0.0054570 $m^2 = \pi(0.291^2 - 0.288^2)$
dZ	=	0.0836 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.006 m $= 4 \times 0.0054570 / 2\pi(0.291 + 0.288)$

Segments 21–30

L	=	0.1543 m = 1.543 m/10, (same total length as in two-element-core model)
A	=	0.0090635 $m^2 = \pi(0.291^2 - 0.286^2)$
dZ	=	0.7715 m (vertical orientation)
e	=	1.52×10^{-6} m
dh	=	0.010 m $= 4 \times 0.0090635 / 2\pi(0.291 + 0.286)$

All junctions have default areas with smooth area change option.

2.3.2 CPBT Heat Structures

Heat Structure 5001 (Reactor vessel wall at vessel inlet)

Note: This heat structure is not part of the Al CPBT wall.

Number of Heat Structures (NHS) = 1
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.2265 m (inner radius of pipe leading to CPBT)
Right-boundary coordinate = 0.2465 m (outer radius of pipe leading to CPBT)
Composition is No. 1 - SS304
Left boundary is Pipe 500
Right boundary is natural circulation to pool, heat transfer coefficient given by general table 581

Heat Structure 5351 (CPBT inner wall in mid-core region)

Number of Heat Structures (NHS) = 1
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.281 m (ref. 3)
Right-boundary coordinate = 0.286 m (ref. 3)
Composition is No. 2 - Al 6061

Left boundary is Volume 535-01
Right boundary is Volume 550-15
Heat transfer length = 0.116 m, includes unheated fuel length

Heat Structure 5501 (CPBT outer wall in fueled axial regions)

Number of Heat Structures (NHS) = 10
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.291 m (ref. 3)
Right-boundary coordinate = 0.301 m (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Pipe 550 (Volumes 2-6, 8-12)
Right boundary is Pipe 595 (Moderator Tank)
Heat transfer length = 0.0836 m = 0.418/5

Heat sources are calculated separate from the point kinetics model, and involve a complicated calculation using control variables and general tables.[12]

Heat Structure 5502 (CPBT inner wall in middle core axial region)

Number of Heat Structures (NHS) = 5
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.281 m (ref. 3)
Right-boundary coordinate = 0.286 m (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Pipe 550 (Volumes 2-6, 8-12)
Right boundary is Pipe 595 (Moderator Tank)
Heat transfer length = 0.0836 m = 0.418/5

Heat Structure 5503 (CPBT inner wall in outer-core axial region)

Number of Heat Structures (NHS) = 5
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.281 m (ref. 3)
Right-boundary coordinate = 0.288 m (ref. 3)
Composition is No. 2 - Al 6061
Left boundary is Pipe 540 (Volumes 1-5)
Right boundary is Pipe 560 (Volumes 16-20)
Heat transfer length = 0.0836 m = 0.418/5

Heat Structure 5552 (CPBT inner wall in core exit region)

Number of Heat Structures (NHS) = 10
Number of Mesh Points (NMP) = 4
Left-boundary coordinate = 0.281 m (ref. 3)
Right-boundary coordinate = 0.286 m (ref. 3)
Composition is No. 2 - Al 6061

Left boundary is Pipes 555 (Volumes 1-5), 557 (Volumes 1-5)
Right boundary is Pipe 560 (Volumes 21-31)
Heat transfer length = 0.1543 m

3. REFERENCES

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2. N. C. J. Chen, M. W. Wendel, and R. M. Harrington, *Advanced Neutron Source Reactor Conceptual Safety Analysis Report, Three Element-core Design*, ORNL/TM-13077, Lockheed Martin Energy Systems, Inc., Oak Ridge Natl. Lab., 1995 (in press).

3. ANS Monthly Progress Report for January 1995, Attachment 6, "Project Change Order 2202 - Three-element-core at 50% Enrichment," Contribution from C. D. West, February 8, 1995, ORNL/ANS/INT-5/V82.

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```
=ansr relap5 system model - fine discretization  - mod3.1.1.1 - 11/17/94
*
* 3 Element-core MODEL
*
*======= perturbed conditions case transient - first 10 s ==============*
*                                                                       *
* 1. PRESSURE AT CORE EXIT                                              *
*     Control upper core average channel exit pressure so that the      *
*     exit pressure is at 94.9% (95% uncertainty) of the best-estimate  *
*     case and the pressure drop is 1.54 MPa (95% uncertainties).       *
*                                                                       *
*     Pexit =      1.90735 * 0.949 = 1.810 MPa                          *
*                                                                       *
* 2. temperature at core inlet                                          *
*     hold secondary flow constant based on steady-state run            *
*     to 45.6 deg C (318.75 k).                                         *
*                                                                       *
* 3. velocity at core inlet                                             *
*     primary coolant pump speed is held constant until tripped.        *
*                                                                       *
* 4. reactor power                                                      *
*     set total power in point kinetics model at 1.0424*330 = 344 mw    *
*                                                                       *
* 5. letdown valve area                                                 *
*     calibrate letdown valve area to be 0.5 open at a pressurizing     *
*     flow rate of 14.6 kg/s at nominal pressure.                       *
*                                                                       *
* 6. pressurizing flow                                                  *
*     pressurizer pump speed is held constant until tripped             *
*                                                                       *
* 7. core roughness                                                     *
*     core roughness is calibrated based on ans steady-state code       *
*     (assuming 20 m/s) core pressure drop at perturbed                 *
*     conditions.  this pressure drop is imposed on the middle core     *
*     to get the calibrated nominal core roughness.                     *
*                                                                       *
* 8. velocity in control rods and cpbt                                  *
*     loss coefficients on junctions 550-12, 564-01, 564-02, and        *
*     564-03 are calibrated to get velocities in the control rod        *
*     channels to be 6.0 m/s and the entrance velocity in the cpbt      *
*     annulus to be 4.3 m/s.                                            *
*                                                                       *
* 9. control rod position                                               *
*     the control rod position at steady-state is ???????????????       *
*                                                                       *
* 10. reactor trips                                                     *
*      trips on ffr, high temperature and low pressure are enabled.     *
*                                                                       *
* 11. heat structure heat capacities                                    *
*      heat capacities are set to their true values.                    *
*                                                                       *
* 12. loss-of-offsite power                                             *
*      trips of the pressurizer pump and secondary coolant flow are     *
*      set to occur at 10 s.                                            *
*                                                                       *
*=======================================================================*
*
0000001   8     10
*-----------------------------------------------------------------------*
0000100  new         transnt
*-----------------------------------------------------------------------*
0000101  run
*-----------------------------------------------------------------------*
0000102  si           si
*-----------------------------------------------------------------------*
0000105  30.   40.      50000.
*-----------------------------------------------------------------------*
0000110  nitrogen
*-----------------------------------------------------------------------*
*
0000120 520010000 0. d2o primary
0000121 130010000 0. h2o mhx1sec
0000122 230010000 0. h2o mhx2sec
0000123 330010000 0. h2o mhx3sec
0000124 138010000 0. h2o ehx1sec
0000125 238010000 0. h2o ehx2sec
0000126 338010000 0. h2o ehx3sec
*
*-----------------------------------------------------------------------*
*      time-step and output frequency information
*-----------------------------------------------------------------------*
0000201 10.00  1.e-7 0.0160 03   60   100000 100000
*0000201 9000.0  1.e-7 0.0033 03 1000 100000 100000
*-----------------------------------------------------------------------*
*      expanded edit/plot variables
*-----------------------------------------------------------------------*
20800001    httemp 550100204 * max cpbt temp
20800002    httemp 562100306 * max cr- al temp
20800003    httemp 562100307 * max cr- hf temp
20800004    fwalf 505090000
20800005    fwalf 520010000
20800006    fwalf 535010000
20800007    fwalf 555010000
20800008    fwalf 510010000
20800009    fwalf 572010000
20800010    fwalf 580010000
* variables for modified saha-zuber correlation
20800011    csubpf 510010000
20800012    csubpf 510020000
20800013    csubpf 510030000
20800014    csubpf 510040000
20800015    csubpf 510050000
20800016    csubpf 515010000
20800017    csubpf 515020000
20800018    csubpf 515030000
20800019    csubpf 515040000
20800020    csubpf 515050000
20800021    csubpf 516010000
20800022    csubpf 516020000
20800023    csubpf 516030000
20800024    csubpf 516040000
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20800026    csubpf 540010000
20800027    csubpf 540020000
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20800030    csubpf 540050000
20800031    csubpf 545010000
20800032    csubpf 545020000
20800033    csubpf 545030000
20800034    csubpf 545040000
20800035    csubpf 545050000
20800036    csubpf 546010000
20800037    csubpf 546020000
20800038    csubpf 546030000
20800039    csubpf 546040000
20800040    csubpf 546050000
20800041    csubpf 570010000
20800042    csubpf 570020000
20800043    csubpf 570030000
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20800044    csubpf 570040000
20800045    csubpf 570050000
20800046    csubpf 575010000
20800047    csubpf 575020000
20800048    csubpf 575030000
20800049    csubpf 575040000
20800050    csubpf 575050000
20800051    csubpf 576010000
20800052    csubpf 576020000
20800053    csubpf 576030000
20800054    csubpf 576040000
20800055    csubpf 576050000
20800056    thconf 510010000
20800057    thconf 510020000
20800058    thconf 510030000
20800059    thconf 510040000
20800060    thconf 510050000
20800061    thconf 515010000
20800062    thconf 515020000
20800063    thconf 515030000
20800064    thconf 515040000
20800065    thconf 515050000
20800066    thconf 516010000
20800067    thconf 516020000
20800068    thconf 516030000
20800069    thconf 516040000
20800070    thconf 516050000
20800071    thconf 540010000
20800072    thconf 540020000
20800073    thconf 540030000
20800074    thconf 540040000
20800075    thconf 540050000
20800076    thconf 545010000
20800077    thconf 545020000
20800078    thconf 545030000
20800079    thconf 545040000
20800080    thconf 545050000
20800081    thconf 546010000
20800082    thconf 546020000
20800083    thconf 546030000
20800084    thconf 546040000
20800085    thconf 546050000
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20800087    thconf 570020000
20800088    thconf 570030000
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20800091    thconf 575010000
20800092    thconf 575020000
20800093    thconf 575030000
20800094    thconf 575040000
20800095    thconf 575050000
20800096    thconf 576010000
20800097    thconf 576020000
20800098    thconf 576030000
20800099    thconf 576040000
20800100    thconf 576050000
20800101    viscf  510010000
20800102    viscf  510020000
20800103    viscf  510030000
20800104    viscf  510040000
20800105    viscf  510050000
20800106    viscf  515010000
20800107    viscf  515020000
20800108    viscf  515030000
20800109    viscf  515040000
20800110    viscf  515050000
20800111    viscf  516010000
20800112    viscf  516020000
20800113    viscf  516030000
20800114    viscf  516040000
20800115    viscf  516050000
20800116    viscf  540010000
20800117    viscf  540020000
20800118    viscf  540030000
20800119    viscf  540040000
20800120    viscf  540050000
20800121    viscf  545010000
20800122    viscf  545020000
20800123    viscf  545030000
20800124    viscf  545040000
20800125    viscf  545050000
20800126    viscf  546010000
20800127    viscf  546020000
20800128    viscf  546030000
20800129    viscf  546040000
20800130    viscf  546050000
20800131    viscf  570010000
20800132    viscf  570020000
20800133    viscf  570030000
20800134    viscf  570040000
20800135    viscf  570050000
20800136    viscf  575010000
20800137    viscf  575020000
20800138    viscf  575030000
20800139    viscf  575040000
20800140    viscf  575050000
20800141    viscf  576010000
20800142    viscf  576020000
20800143    viscf  576030000
20800144    viscf  576040000
20800145    viscf  576050000
*-------------------------------------------------------------------------*
*      minor edit requests
*-------------------------------------------------------------------------*
0000301    mflowj         567010400
0000302    p              505010000
0000303    velfj          507010200
0000304    velfj          537010200
0000305    velfj          550020000
0000306    velfj          550070000
0000308    velfj          559010100
0000309    velfj          559010200
0000310    velfj          559010300
0000311    cntrlvar       827
0000312    cntrlvar       828
0000313    cntrlvar       829
0000314    cntrlvar       830
0000315    cntrlvar       831
0000316    cntrlvar       832
0000317    rktpow         0
0000318    tempf          490020000
0000321    mflowj         156010000
0000322    mflowj         256010000
0000323    mflowj         356010000
0000327    htrnr          515400500
0000328    htchf          515400500
0000336    pmpvel         815
0000337    pmpvel         124
0000338    cntrlvar       840
```

```
0000339    mflowj          865010000
0000340    mflowj          825000000
0000341    cntrlvar        860
0000342    tempf           505010000
0000343    cntrlvar        598
*
*-------------------------------------------------------------------------*
*              trip input
*-------------------------------------------------------------------------*
* high power-to-flow ratio trips
0000501    cntrlvar 940 gt null 0 1.20 1 -1.
0000502    time 0 gt timeof 501 0.200 1 -1.
*0000502    time 0 gt null 0 1.e6 1 -1.
* high temperature = 1.22*45 deg c = 54.8 deg c
0000503    tempf 500010000 gt null 0 328.05 1 -1.
0000504    time 0 gt timeof 503 2.0 1 -1. *high temp
*0000504    time 0 gt null 0 1.e6 1 -1.
*
* low-pressure trip is 80% of nominal at sensor location.
* sensor location is in volume 645-15, 2.44 m downstream of hotleg riser
* nominal pressure taken from 645-01 in "nom41795in" to be 1.751778 MPa
* therefore, the setpoint pressure is 1.401 MPa.
*
0000506 cntrlvar 839 lt null 0 1.401e6 1 -1.
*0000506    time 0 gt null 0 1.e6 1 -1.
* reactor trip
0000508    time 0 gt null 0 1.e6 1 -1. *manual trip
0000510    time   0 gt timeof 603 0.030 1 -1.
*0000510    time 0 gt null 0 1.e6 1 -1.
0000515    time   0 lt null 0 1.e6 1 0.    *loop1 isolation
0000516    time   0 lt null 0 1.e6 1 0.    *loop2 isolation
0000517    time   0 lt null 0 1.e6 1 0.    *loop3 isolation
* pump cavitation model trips
0000528    time   0 gt null 0 1.d6 1   * begin the transient if true
0000540    time   0 gt null 0 1.e6 1 -1. * loss of offsite power
* pressurizer pump trips
0000541    time   0 gt null 0 1.e6 n -1.   *standby przr pump
0000542    time   0 gt null 0 1.e6 n -1.   *emergency przr pump
0000550    time   0 gt null 0 1.e6 1  -1.  *standby speed table trip
0000551    cntrlvar   804   gt null 0  8358.4 1 -1. *mu tank empty
0000552    time 0  gt  timeof 551  11.0  1 -1. *przr sys isolate
* lose power to primary coolant pumps (use torque balance)
0000555    time   0 gt null 0 1800. 1 -1.
*
0000560    p   850010000   ge null 0 4.428e6 n -1. *safety valve
0000561    p   850010000   ge null 0 4.600e6 n -1. *safety valve
*
0000599    time   0 gt null 0 1.e6  1 -1.
0000600       599
0000601       502    or    504   1      -1.
0000602       601    or    506   1      -1.
0000603       602    or    508   1      -1.
0000610       560   and    611   n      -1.
0000611       561    or    610   n      -1.
0000615      -552    or   -552   n       0.
0000619      -555 and -555  n   0.
0000620      -540 and -540  n   0.
0000621      -541 and -541  n   0.
0000635       506    or    540   1      -1.0
*
*=========================================================================*
*                                                                         *
*    h y d r o d y n a m i c   c o m p o n e n t   i n p u t              *
*                                                                         *
*=========================================================================$
```

```
*                                                                         *
*                          core region                                    *
*                                                                         *
*=========================================================================$
*hydro             component name       component type
4900000              "cvgwye"              pipe
*-------------------------------------------------$-----------------------$
4900001          3
*
*hydro          vol area                                              vol
4900101          0.1993                                                 3
*
*hydro          length                                                vol
4900301          0.2                                                    1
4900302          0.143                                                  2
4900303          0.2                                                    3
*
*hydro          volume                                                vol
4900401          0.0                                                    3
*
*hydro         vert angle                                             vol
4900601          90.                                                    3
*
*hydro         delta z                                                vol
4900701          0.2                                                    1
4900702          0.143                                                  2
4900703          0.2                                                    3
*
*hydro         roughness      hyd diam                                vol
4900801       0.0000457       0.2999                                   3
*
*hydro            fe                                                  vol
4901001          00                                                     3
*
*hydro          vcahs                                                 jun
4901101          01000                                                  2
*
*hydro  ebt pressure     tempe                                         vol
4901201     0       2610280.     176859.    2419054. 0. 0.        1
4901202     0       2610428.     176859.    2419054. 0. 0.        2
4901203     0       2551046.     176859.4   2418864. 0. 0.        3
*
*hydro        f velocity   g velocity    j velocity                 jun
4901300 0
4901301       -.675027        -.85093      0.            1 * -147.844
4901302       10.04618        10.79978     0.            2 * 2200.31
*
*-------------------------------------------------------------------------$
*hydro             component name       component type
4920000              "cvgwye"              mtpljun
*-------------------------------------------------------------------------$
*hydro          no. juns            vel/flw
4920001            7                   0
*
*hydro    from          to          area      f loss    r loss    vcahs
4920011   174020002     490020003    0.          0.        0.      01101
4920012   1.0   1.0   1.0   0    0    0    1
4920021   274020002     490020003    0.          0.        0.      01101
4920022   1.0   1.0   1.0   0    0    0    2
4920031   374020002     490020003    0.          0.        0.      01101
4920032   1.0   1.0   1.0   0    0    0    3
4920041   490010000     500000000    0.          0.        0.      01100
4920042   1.0   1.0   1.0   0    0    0    4
*
* kentrance = 152 - 4.3 m/s in cr
```

```
* kentrance = 100 - 4.74 m/s
* kentrance = 80 - 5.15 m/s
* kentrance = 65 - 5.39 m/s
* kentrance = 35 - constrained by flow through control rod channels
* kentrance = 30 - 6.12
* kentrance = 20 - 6.38 m/s
*
4920051   495010000     560000000    0.          35.00     35.00     01000
4920052   1.0   1.0   1.0   0    0    0    5
4920061   490010001     495090002    0.          0.0       0.0       01100
4920062   1.0   1.0   1.0   0    0    0    6
4920071   474020002     490020003    0.          0.        0.        01101
4920072   1.0   1.0   1.0   0    0    0    7
*
4921011   8.82284  9.45046  1 * 806.762
4921021   9.05176  9.68799  2 * 827.631
4921031   7.80165  8.38953  3 * 713.762
4921041   11.12983 11.73142 4 * 2200.31
4921051   3.860334 4.20948  5 * 147.844
4921061   .675027  .827353 6 * 147.844
4921071   -5.19938-6  -5.19969-6  7 * -4.75505-4
*
4922011   0.3255 0.0 1.0 1.0 1
4922021   0.3255 0.0 1.0 1.0 2
4922031   0.3255 0.0 1.0 1.0 3
4922041   0.1799 0.0 1.0 1.0 4
4922051   0.190  0.0 1.0 1.0 5
4922061   0.2999 0.0 1.0 1.0 6
4922071   0.3255 0.0 1.0 1.0 7
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
4950000               "cpbtbot"            pipe
*-----------------------------------------------------$------------------$
4950001           9
*
*hydro          vol area                                                vol
4950101          0.2400                                                 9
*
*hydro           length                                                 vol
4950301          0.20                                                   9
*
*hydro           volume                                                 vol
4950401            0.0                                                  9
*
*hydro         vert angle                                               vol
4950601            90.                                                  9
*
*hydro         delta z                                                  vol
4950701            0.20                                                 9
*
*hydro         roughness       hyd diam                                 vol
4950801        0.0000457        0.3664                                  9
*
*hydro           vcahs                                                  jun
4951101          01000                                                  8
*
*hydro             fe                                                   vol
4951001            00                                                   9
*
*hydro  ebt pressure     tempe                                          vol
4951201     0       2629934.     145140.    2419116. 0. 0.        1
4951202     0       2627776.     173860.    2419109. 0. 0.        2
4951203     0       2625620.     173873.    2419102. 0. 0.        3
4951204     0       2623464.     173873.    2419096. 0. 0.        4
4951205     0       2621308.     173873.    2419089. 0. 0.        5
4951206     0       2619152.     173873.    2419082. 0. 0.        6
4951207     0       2616996.     173872.    2419075. 0. 0.        7
4951208     0       2614840.     173686.2   2419068. 0. 0.        8
4951209     0       2612684.     176859.    2419061. 0. 0.        9
*
*hydro         f velocity   g velocity    j velocity                jun
4951300 0
4951301       -2.923654-8      -2.92362-8   0.          1 * -7.71326-6
4951302       -5.2692-8        -5.26917-8   0.          2 * -1.390132-5
4951303       -7.61339-8       -7.61336-8   0.          3 * -2.008577-5
4951304       -9.95552-8       -9.9555-8    0.          4 * -2.62648-5
4951305       -1.229491-7      -1.22949-7   0.          5 * -3.24366-5
4951306       -1.463085-7      -1.463085-7  0.          6 * -3.85993-5
4951307       -1.69626-7       -1.69626-7   0.          7 * -4.47517-5
4951308       -1.92897-7       -1.92897-7   0.          8 * -5.08759-5
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5000000               "inlet"              pipe
*-----------------------------------------------------$------------------$
5000001           3
*
*hydro          vol area                                                vol
5000101          0.1799                                                 3
*
*hydro           length                                                 vol
5000301          0.110                                                  2
5000302          0.111                                                  3
*
*hydro           volume                                                 vol
5000401            0.                                                   3
*
*hydro         vert angle                                               vol
5000601            90.                                                  3
*
*hydro         delta z                                                  vol
5000701            0.110                                                2
5000702            0.111                                                3
*
*hydro         roughness       hyd diam                                 vol
5000801        0.0000457        0.1799                                  3
*
*hydro             fe                                                   vol
5001001            00                                                   3
*
*hydro           vcahs                                                  jun
5001101          01000                                                  2
*
*hydro  ebt pressure     tempe                                          vol
5001201     0       2535366.     176859.8   2418813. 0. 0.        1
5001202     0       2533567.     176860.    2418807. 0. 0.        2
5001203     0       2531762.     176860.5   2418801. 0. 0.        3
*
*hydro         f velocity   g velocity    j velocity                jun
5001300 0
5001301       11.1299          11.9162      0.          1 * 2200.31
5001302       11.12992         11.91625     0.          2 * 2200.31
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5050000               "lcorein"            pipe
*-----------------------------------------------------$------------------$
5050001           9
*
```

```
*hydro          vol area                                                vol
5050101           0.067906                                               9
*
*hydro           length                                                 vol
5050301           0.175                                                  4
5050302           0.221                                                  5
5050303           0.175                                                  9
*
*hydro           volume                                                 vol
5050401           0.                                                     9
*
*hydro          vert angle                                              vol
5050601           90.                                                    9
*
*hydro          delta z                                                 vol
5050701           0.175                                                  4
5050702           0.221                                                  5
5050703           0.175                                                  9
*
*hydro          roughness       hyd diam                                vol
5050801         0.00000152       0.1100                                 9
*
*hydro             fe                                                   vol
5051001            00                                                    9
*
*hydro           vcahs                                                  jun
5051101          01000                                                  8
*
*hydro  ebt pressure     tempe                                          vol
5051201     0        2543117.     176861.3   2418838. 0. 0.         1
5051202     0        2540273.     176862.2   2418828. 0. 0.         2
5051203     0        2537429.     176863.    2418819. 0. 0.         3
5051204     0        2534584.     176864.    2418810. 0. 0.         4
5051205     0        2531366.     176865.    2418800. 0. 0.         5
5051206     0        2528148.     176866.    2418789. 0. 0.         6
5051207     0        2525303.     176866.8   2418780. 0. 0.         7
5051208     0        2522459.     176867.6   2418770. 0. 0.         8
5051209     0        2519614.     176868.5   2418761. 0. 0.         9
*
*hydro         f velocity   g velocity    j velocity                 jun
5051300 0
5051301       9.95127          10.60288     0.              1 * 742.59
5051302       9.95128          10.60294     0.              2 * 742.59
5051303       9.9513           10.603       0.              3 * 742.59
5051304       9.9513           10.60307     0.              4 * 742.59
5051305       9.95132          10.60314     0.              5 * 742.59
5051306       9.95134          10.60321     0.              6 * 742.59
5051307       9.95135          10.60328     0.              7 * 742.59
5051308       9.95136          10.60334     0.              8 * 742.59
*
*-------------------------------------------------------------------$
*hydro              component name      component type
5070000              "lcinlt"             mtpljun
*-------------------------------------------------------------------$
5070001     4        0
* inlet loss coefficients are:
*  0.04 (from hfir data) + 0.34 (50 mm unheated length)
*
*----- Decrease loss coeff to match SS code pressure drop
*----- target nominal 3-elem core delta p is 0.712 MPa
*   inlet loss coeff.      delta p
*       0.230              0.7134   (no losses at core exit)
*       0.198              0.71024  (no losses at core exit)
*hydro    from          to           area      f loss     r loss     vcahs
5070011   500010000     505000000    0.          0.         0.      01100
5070012   1.0   1.0   1.0   0    0    0    1
5070021   505010000      510000000    0.          0.207     0.207   01000
5070022   1.0   1.0   1.0   0    0    0    2
5070031   505010000      515000000    0.          0.207     0.207   01000
5070032   1.0   1.0   1.0   0    0    0    3
5070041   505010000      516000000    0.          0.207     0.207   01000
5070042   1.0   1.0   1.0   0    0    0    4
*
*hydro    f velocity     g velocity
5071011   9.95132  10.45336 1 * 742.59
5071021   19.99998 19.99998 2 * 739.229
5071031   18.9942  18.9942  3 * 1.679565
5071041   19.0192  19.0192  4 * 1.681777
*
5072011   0.1100       0.0 1.0 1.0 1
5072021   0.0024796    0.0 1.0 1.0 2
5072031   0.002236     0.0 1.0 1.0 3
5072041   0.002236     0.0 1.0 1.0 4
*
*-------------------------------------------------------------------*
*hydro  component name component type
5100000  "lcavchan"      pipe
*-------------------------------------------------------$-----------$
5100001           5
*
*hydro          vol area                                              vol
5100101        0.033635                                               5
*
*hydro           length                                               vol
5100301          0.0836                                               5
*
*hydro           volume                                               vol
5100401            0.                                                 5
*
*hydro         vert angle                                             vol
5100601           90.                                                 5
*
*hydro          delta z                                               vol
5100701          0.0836                                               5
*
* calibration of roughness
*
* unheated fuel losses are included as form loss at the entrance and exit.
*
*   fuel roughness (m)        pressure drop (mpa)
*        1.0000e-10                  0.821 (still not low enough)
* Additional calibration is done by lowering the inlet loss coefficient.
*
*hydro          roughness      hyd diam                               vol
5100801          1.0000e-10    0.0024796                               5
*
*hydro             fe                                                  vol
*noans**5101001            00                                        5
5101001           200                                                  5
*
*hydro           vcahs                                                jun
5101101          01000                                                 4
*
*hydro  ebt pressure     tempe                                         vol
5101201     0        2238850.     211556.8   2417302. 0. 0.         1
5101202     0        2101294.     247367.3   2416517. 0. 0.         2
5101203     0        1966581.     283249.    2415625. 0. 0.         3
5101204     0        1834269.     318662.6   2414448. 0. 0.         4
5101205     0        1703941.     351620.5   2413056. 0. 0.         5
*
```

```
*hydro         f velocity   g velocity    j velocity                jun
5101300 0
5101301       20.07342         26.10264      0.            1 * 739.229
5101302       20.159           26.23567      0.            2 * 739.229
5101303       20.2553          26.38304      0.            3 * 739.229
5101304       20.36026         26.5422       0.            4 * 739.229
*
*hydro   jun hyd diam                                              jun
5101401      0.0024796 0.0 1.0 1.0                                  4
*
*hydro    pitch       span    vol
5103101  1.27e-3     63.95e-3  5
*-------------------------------------------------------------------------*
*hydro              component name       component type
5150000             "lchotch1"              pipe
*-------------------------------------------------$-----------------$
5150001              5
*
*hydro          vol area                                            vol
5150101        0.000080467                                           5
*
*hydro           length                                             vol
5150301          0.0836                                             5
*
*hydro           volume                                             vol
5150401            0.                                               5
*
*hydro         vert angle                                           vol
5150601           90.                                               5
*
*hydro          delta z                                             vol
5150701          0.0836                                             5
*
*hydro         roughness      hyd diam                             vol
5150801         1.0000e-10   0.002236                               5
*
*hydro             fe                                              vol
*noans**5151001            00                                     5
5151001           200                                              5
*
*hydro           vcahs                                             jun
5151101          01000                                              4
*
*hydro  ebt pressure     tempe                                     vol
5151201     0       2264342.     231904.    2417444. 0. 0.        1
5151202     0       2124386.     285866.    2416652. 0. 0.        2
5151203     0       1988097.     336460.    2415810. 0. 0.        3
5151204     0       1854594.     383217.    2414633. 0. 0.        4
5151205     0       1723179.     424025.    2413282. 0. 0.        5
*
*hydro          vel/flw
*
*hydro         f velocity   g velocity    j velocity                jun
5151300 0
5151301       19.108           24.8368       0.            1 * 1.679565
5151302       19.24235         25.03184      0.            2 * 1.679565
5151303       19.388           25.242        0.            3 * 1.679565
5151304       19.53895         25.4597       0.            4 * 1.679565
*
*hydro   jun hyd diam                                              jun
5151401      0.002236   0.0 1.0 1.0                                 4
*
*hydro    pitch       span    vol
5153101  1.14330e-3  63.95e-3  5
*
```

```
*-------------------------------------------------------------------------*
*hydro              component name       component type
5160000             "lchotch2"              pipe
*-------------------------------------------------$-----------------$
5160001              5
*
*hydro          vol area                                            vol
5160101        0.000080467                                           5
*
*hydro           length                                             vol
5160301          0.0836                                             5
*
*hydro           volume                                             vol
5160401            0.                                               5
*
*hydro         vert angle                                           vol
5160601           90.                                               5
*
*hydro          delta z                                             vol
5160701          0.0836                                             5
*
*hydro         roughness      hyd diam                             vol
5160801         1.0000e-10   0.002236                               5
*
*hydro             fe                                              vol
*noans**5161001            00                                     5
5161001           200                                              5
*
*hydro           vcahs                                             jun
5161101          01000                                              4
*
*hydro  ebt pressure     tempe                                     vol
5161201     0       2263691.     234098.    2417440. 0. 0.        1
5161202     0       2123599.     290208.    2416647. 0. 0.        2
5161203     0       1987242.     342823.    2415803. 0. 0.        3
5161204     0       1853695.     391454.    2414625. 0. 0.        4
5161205     0       1722236.     433900.    2413271. 0. 0.        5
*
*hydro          vel/flw
5161300 0
*
*hydro         f velocity   g velocity    j velocity                jun
5161301       19.13817         24.8762       0.            1 * 1.681777
5161302       19.2794          25.08016      0.            2 * 1.681777
5161303       19.43305         25.3007       0.            3 * 1.681777
5161304       19.5927          25.52974      0.            4 * 1.681777
*
*hydro   jun hyd diam                                              jun
5161401      0.002236   0.0 1.0 1.0                                 4
*
*hydro    pitch       span    vol
5163101  1.14330e-3  63.95e-3  5
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5200000              "lcoutlt"              pipe
*-------------------------------------------------$-----------------$
5200001              1
*
*hydro          vol area                                            vol
5200101         0.067906                                             1
*
*hydro           length                                             vol
5200301          0.116                                              1
*
```

```
*hydro           volume                                                vol
5200401           0.0                                                   1
*
*hydro          vert angle                                             vol
5200601           90.                                                   1
*
*hydro          delta z                                                vol
5200701           0.116                                                 1
*
*hydro          roughness       hyd diam                               vol
5200801         0.00000152       0.1100                                1
*
*hydro             fe                                                  vol
5201001            00                                                   1
*
*hydro           vcahs                                                 jun
*5201101           01100                                                1
*
*hydro  ebt pressure     tempe                                          vol
5201201     0        1806794.     351838.    2414195. 0. 0.         1
*
*hydro          f velocity   g velocity    j velocity                  jun
*5201300 0
*5201301    7.52105    7.52105 0.                                       2
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5220000               "lcoutl"             mtpljun
*-------------------------------------------------------------------------$
5220001     4         0
*
* loss coefficient at fuel channel exit = 0.068 (10 mm unheated length)
*
* no AAC model =======> 0.76 MPa
* f loss = 0.0 =======> 0.747 MPa
*hydro    from          to            area      f loss    r loss    vcahs
*5220011   510010000     520000000    0.          0.068     0.068  01100
5220011   510010000     520000000    0.          0.000     0.000  01000
5220012   1.0   1.0   1.0   0    0    0    1
*5220021   515010000     520000000    0.          0.068     0.068  01100
5220021   515010000     520000000    0.          0.000     0.000  01000
5220022   1.0   1.0   1.0   0    0    0    2
5220031   520010000     525000000    0.          0.0       0.0    01000
5220032   1.0   1.0   1.0   0    0    0    3
*5220041   516010000     520000000    0.          0.063     0.068  01100
5220041   516010000     520000000    0.          0.000     0.000  01000
5220042   1.0   1.0   1.0   0    0    0    4
*
*hydro    f velocity     g velocity
5221011   20.46654 26.70386 1 * 739.229
5221021   19.6835  25.67    2 * 1.679565
5221031   10.18342 10.70162 3 * 742.59
5221041   19.74594 25.7514  4 * 1.681777
*
5222011   0.0024796   0.0 1.0 1.0 1
5222021   0.002236    0.0 1.0 1.0 2
5222031   0.1100      0.0 1.0 1.0 3
5222041   0.002236    0.0 1.0 1.0 4
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
5250000               "lcoutlet"              pipe
*-------------------------------------------------------$-----------------$
5250001           13
*
```

```
*hydro          vol area                                               vol
5250101         0.067906                                               13
*
*hydro           length                                                vol
5250301          0.1672                                                 1
5250302          0.1953                                                13
*
*hydro           volume                                                vol
5250401            0.                                                  13
*
*hydro         vert angle                                              vol
5250601           90.                                                  13
*
*hydro          delta z                                                vol
5250701          0.1672                                                 1
5250702          0.1953                                                13
*
*hydro         roughness       hyd diam                                vol
5250801        0.00000152       0.1100                                13
*
*hydro             fe                                                  vol
5251001            00                                                  13
*
*hydro           vcahs                                                 jun
5251101          01000                                                 12
*
*hydro  ebt pressure     tempe                                          vol
5251201     0        1804571.     352540.    2414175. 0. 0.         1
5251202     0        1801709.     353318.    2414148. 0. 0.         2
5251203     0        1798625.     354084.    2414120. 0. 0.         3
5251204     0        1795543.     354749.    2414091. 0. 0.         4
5251205     0        1792462.     355266.6   2414062. 0. 0.         5
5251206     0        1789387.     355078.5   2414034. 0. 0.         6
5251207     0        1786321.     355079.4   2414005. 0. 0.         7
5251208     0        1783252.     355080.    2413976. 0. 0.         8
5251209     0        1780183.     355081.    2413941. 0. 0.         9
5251210     0        1777114.     355082.    2413906. 0. 0.         10
5251211     0        1774045.     355083.    2413871. 0. 0.         11
5251212     0        1770976.     355084.    2413836. 0. 0.         12
5251213     0        1767907.     355085.    2413801. 0. 0.         13
*
*hydro          vel/flw
5251300 0
*
*hydro          f velocity   g velocity    j velocity                  jun
5251301         10.1846          10.72861      0.          1 * 742.59
5251302         10.1859          10.73         0.          2 * 742.59
5251303         10.18717         10.73136      0.          3 * 742.59
5251304         10.18829         10.73256      0.          4 * 742.59
5251305         10.18916         10.7335       0.          5 * 742.59
5251306         10.18886         10.73325      0.          6 * 742.59
5251307         10.18888         10.73332      0.          7 * 742.59
5251308         10.1889          10.73339      0.          8 * 742.59
5251309         10.18891         10.73345      0.          9 * 742.59
5251310         10.18893         10.73352      0.          10 * 742.59
5251311         10.18894         10.7336       0.          11 * 742.59
5251312         10.18896         10.73366      0.          12 * 742.59
*
*hydro   jun hyd diam                                                   jun
5251401      0.132       0.0 1.0 1.0                                    12
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
5290000               "ucinlet"              sngljun
*-------------------------------------------------------*----------------*
```

```
*hydro    from          to            area      f loss    r loss    vcahs
5290101   500010000     530000000     0.          0.        0.      01100
*
*hydro    jun hyd diam
5290110       0.1000        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
5290201     0             10.36976       10.87009        0. * 916.475
*
*-----------------------------------------------------------------------*
*hydro              component name       component type
5300000             "ucinlet"               pipe
*-------------------------------------------------$-----------------$
5300001           14
*
*hydro          vol area                                              vol
5300101         0.080425                                              14
*
*hydro           length                                               vol
5300301          0.175                                                4
5300302          0.221                                                5
5300303          0.175                                                9
5300304          0.0836                                              14
*
*hydro           volume                                               vol
5300401            0.                                                14
*
*hydro         vert angle                                             vol
5300601           90.                                                 14
*
*hydro          delta z                                               vol
5300701          0.175                                                4
5300702          0.221                                                5
5300703          0.175                                                9
5300704          0.0836                                              14
*
*hydro         roughness      hyd diam                                vol
5300801        0.00000152      0.1000                                  14
*
*hydro            fe                                                  vol
5301001           00                                                 14
*
*hydro           vcahs                                                jun
5301101          01000                                               13
*
*hydro  ebt pressure     tempe                                        vol
5301201     0       2538334.     176861.5   2418822. 0. 0.       1
5301202     0       2535291.     176862.6   2418812. 0. 0.       2
5301203     0       2532248.     176863.6   2418802. 0. 0.       3
5301204     0       2529204.     176864.7   2418792. 0. 0.       4
5301205     0       2527095.     176866.    2418786. 0. 0.       5
5301206     0       2527587.     176867.    2418787. 0. 0.       6
5301207     0       2524639.     176868.    2418778. 0. 0.       7
5301208     0       2521690.     176868.8   2418768. 0. 0.       8
5301209     0       2518742.     176869.8   2418758. 0. 0.       9
5301210     0       2516562.     177225.8   2418751. 0. 0.       10
5301211     0       2515150.     177596.    2418747. 0. 0.       11
5301212     0       2513738.     177969.5   2418742. 0. 0.       12
5301213     0       2512326.     178343.3   2418738. 0. 0.       13
5301214     0       2510914.     178702.    2418733. 0. 0.       14
*
*hydro          vel/flw
5301300 0
*
*hydro         f velocity   g velocity    j velocity                jun
5301301       10.36974        10.86997     0.          1 * 916.475
5301302       10.36975        10.87002     0.          2 * 916.475
5301303       10.36977        10.87008     0.          3 * 916.475
5301304       10.36978        10.87014     0.          4 * 916.475
5301305       9.9065          10.39483     0.          5 * 875.529
5301306       9.90649         10.39482     0.          6 * 875.529
5301307       9.9065          10.39487     0.          7 * 875.529
5301308       9.90652         10.39493     0.          8 * 875.529
5301309       9.90653         10.39498     0.          9 * 875.529
5301310       9.90687         10.39536     0.          10 * 875.529
5301311       9.90723         10.39574     0.          11 * 875.529
5301312       9.90758         10.39612     0.          12 * 875.529
5301313       9.90794         10.3965      0.          13 * 875.529
*
*hydro   jun hyd diam                                                 jun
5301401      0.1000      0.0 1.0 1.0                                  13
*
*-----------------------------------------------------------------------*
*hydro              component name       component type
5310000             "gapinlt"               sngljun
*-------------------------------------------------*---------------------*
*
*hydro    from          to            area      f loss    r loss    vcahs
5310101   530050003     550050003     0.004540    2.79      2.79     01003
*
*hydro    jun hyd diam
5310110       0.010        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
5310201     0               8.20724        8.20724        0. * 40.9461
*
*-----------------------------------------------------------------------$
*hydro              component name       component type
5350000             "ucinlet"               pipe
*-------------------------------------------------$-----------------$
5350001           1
*
*hydro          vol area                                              vol
5350101          0.080425                                             1
*
*hydro           length                                               vol
5350301          0.116                                                1
*
*hydro           volume                                               vol
5350401          0.0000                                               1
*
*hydro         vert angle                                             vol
5350601           90.                                                 1
*
*hydro          delta z                                               vol
5350701          0.116                                                1
*
*hydro         roughness      hyd diam                                vol
5350801        0.00000152      0.1000                                  1
*
*hydro            fe                                                  vol
5351001           00                                                 1
*
*hydro           vcahs                                                jun
*5351101          01100                                               1
*
*hydro  ebt pressure     tempe                                        vol
5351201     0       2509230.     178788.7   2418727. 0. 0.       1
*
*hydro         f velocity   g velocity    j velocity                jun
```

```
*5351300 0
*5351301    7.52105    7.52105 0.                                        2
*
*-------------------------------------------------------------------$
*hydro              component name       component type
5370000              "ucinlt"              mtpljun
*-------------------------------------------------------------------$
5370001     4        0
* inlet loss coefficients are:
*  0.04 (from hfir data) + 0.34 (50 mm unheated length)
*hydro    from          to            area      f loss     r loss     vcahs
5370011   530010000      535000000     0.          0.         0.      01000
5370012   1.0   1.0   1.0   0     0     0     1
5370021   535010000      540000000     0.          0.207      0.207   01000
5370022   1.0   1.0   1.0   0     0     0     2
5370031   535010000      545000000     0.          0.207      0.207   01000
5370032   1.0   1.0   1.0   0     0     0     3
5370041   535010000      546000000     0.          0.207      0.207   01000
5370042   1.0   1.0   1.0   0     0     0     4
*
*hydro    vel/flw       f velocity     g velocity     j velocity
5371011   9.90828  10.39687 1 * 875.529
5371021   19.89953 19.89953 2 * 872.616
5371031   18.88315 18.88315 3 * 1.455286
5371041   18.9076  18.9076  4 * 1.45717
*
5372011   0.1000       0.0 1.0 1.0 1
5372021   0.0024722    0.0 1.0 1.0 2
5372031   0.0022299    0.0 1.0 1.0 3
5372041   0.0022299    0.0 1.0 1.0 4
*
*-------------------------------------------------------------------*
*hydro              component name       component type
5400000              "ucavchan"              pipe
*-------------------------------------------------$-----------------$
5400001           5
*
*hydro          vol area                                             vol
5400101        0.039912                                              5
*
*hydro           length                                              vol
5400301          0.0836                                              5
*
*hydro           volume                                              vol
5400401            0.                                                5
*
*hydro         vert angle                                            vol
5400601           90.                                                5
*
*hydro          delta z                                              vol
5400701          0.0836                                              5
*
*hydro         roughness      hyd diam                               vol
5400801         1.0000e-10   0.0024722                               5
*
*hydro             fe                                                vol
*noans**5401001            00                                      5
5401001           200                                               5
*
*hydro           vcahs                                               jun
5401101          01000                                               4
*
*hydro  ebt pressure     tempe                                       vol
5401201     0       2231850.     216956.    2417264. 0. 0.         1
5401202     0       2095465.     253246.7   2416483. 0. 0.         2
5401203     0       1961839.     286140.5   2415584. 0. 0.         3
5401204     0       1830404.     315105.5   2414412. 0. 0.         4
5401205     0       1700718.     340004.    2413018. 0. 0.         5
*
*hydro          vel/flw
5401300 0
*
*hydro         f velocity   g velocity    j velocity                jun
5401301       19.9809          25.9827      0.            1 * 872.616
5401302       20.06888         26.11855     0.            2 * 872.616
5401303       20.15793         26.2563      0.            3 * 872.616
5401304       20.24345         26.3901      0.            4 * 872.616
*
*hydro   jun hyd diam                                                 jun
5401401      0.0024722  0.0 1.0 1.0                                    4
*
*hydro    pitch       span     vol
5403101  1.27e-3     55.41e-3  5
*
*-------------------------------------------------------------------*
*hydro              component name       component type
5450000              "uchotch1"              pipe
*-------------------------------------------------$-----------------$
5450001           5
*
*hydro          vol area                                             vol
5450101       0.000070145                                            5
*
*hydro           length                                              vol
5450301          0.0836                                              5
*
*hydro           volume                                              vol
5450401            0.                                                5
*
*hydro         vert angle                                            vol
5450601           90.                                                5
*
*hydro          delta z                                              vol
5450701          0.0836                                              5
*
*hydro         roughness      hyd diam                               vol
5450801         1.0000e-10   0.0022299                               5
*
*hydro             fe                                                vol
*noans**5451001            00                                      5
5451001           200                                               5
*
*hydro           vcahs                                               jun
5451101          01000                                               4
*
*hydro  ebt pressure     tempe                                       vol
5451201     0       2257128.     232062.    2417404. 0. 0.         1
5451202     0       2118248.     285127.5   2416616. 0. 0.         2
5451203     0       1982927.     334156.    2415766. 0. 0.         3
5451204     0       1850324.     378367.    2414594. 0. 0.         4
5451205     0       1719767.     416213.    2413242. 0. 0.         5
*
*hydro          vel/flw
5451300 0
*
*hydro         f velocity   g velocity    j velocity                jun
5451301       18.99318         24.68793     0.            1 * 1.455286
5451302       19.1244          24.87866     0.            2 * 1.455286
5451303       19.26417         25.081       0.            3 * 1.455286
5451304       19.40498         25.2853      0.            4 * 1.455286
```

```
*
*hydro   jun hyd diam                                                  jun
5451401      0.0022299   0.0 1.0 1.0                                    4
*
*hydro    pitch       span    vol
5453101  1.14300e-3  55.41e-3  5
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
5460000             "uchotch2"              pipe
*-------------------------------------------------$-----------------$
5460001           5
*
*hydro          vol area                                                vol
5460101      0.000070145                                                 5
*
*hydro           length                                                 vol
5460301          0.0836                                                 5
*
*hydro           volume                                                 vol
5460401            0.                                                   5
*
*hydro         vert angle                                               vol
5460601           90.                                                   5
*
*hydro          delta z                                                 vol
5460701          0.0836                                                 5
*
*hydro         roughness      hyd diam                                  vol
5460801         1.0000e-10   0.0022299                                  5
*
*hydro             fe                                                   vol
*noans**5461001             00                                         5
5461001           200                                                   5
*
*hydro           vcahs                                                  jun
5461101          01000                                                  4
*
*hydro  ebt pressure     tempe                                          vol
5461201     0       2256493.     234182.3    2417401. 0. 0.        1
5461202     0       2117480.     289349.     2416612. 0. 0.        2
5461203     0       1982093.     340318.     2415759. 0. 0.        3
5461204     0       1849450.     386278.     2414586. 0. 0.        4
5461205     0       1718862.     425613.     2413232. 0. 0.        5
*
*hydro          vel/flw
5461300            0
*
*hydro         f velocity   g velocity    j velocity                 jun
5461301       19.02255         24.7263      0.            1 * 1.45717
5461302       19.1604          24.92567     0.            2 * 1.45717
5461303       19.30778         25.13783     0.            3 * 1.45717
5461304       19.45657         25.35255     0.            4 * 1.45717
*
*hydro   jun hyd diam                                                  jun
5461401      0.0022299   0.0 1.0 1.0                                    4
*
*hydro    pitch       span    vol
5463101  1.14300e-3  55.41e-3  5
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
5500000             "cpbtann1"              pipe
*-------------------------------------------------$-----------------$
5500001           30
```

```
*
*hydro          vol area                                                vol
5500101        0.0090635                                                14
5500102        0.004590                                                 20
5500103        0.0090635                                                30
*
*hydro          jun area                                                jun
5500201        0.0090635                                                14
5500202        0.004590                                                 19
5500203        0.0090635                                                29
*
*hydro           length                                                 vol
5500301          0.175                                                   4
5500302          0.221                                                   5
5500303          0.175                                                   9
5500304          0.0836                                                 14
5500305          0.116                                                  15
5500306          0.0836                                                 20
5500307          0.1543                                                 30
*
*hydro           volume                                                 vol
5500401            0.                                                   30
*
*hydro         vert angle                                               vol
5500601           90.                                                   30
*
*hydro         roughness      hyd diam                                  vol
*5500801        0.00000152       0.010                                  14
*5500802        0.00000152       0.006                                  20
*5500803        0.00000152       0.010                                  30
5500801        1.e-10           0.010                                  14
5500802        1.e-10           0.006                                  20
5500803        1.e-10           0.010                                  30
*
*hydro             kf        kr                                         jun
5500901          0.0         0.0                                        19
*
* calibrate losses to get 4.3 m/s in cpbt
*  k =    0.05  v= 4.09
*
5500902         0.00       0.00                                         20
5500903         0.         0.                                           29
*
*hydro             fe                                                   vol
5501001            00                                                   30
*
*hydro           vcahs                                                  jun
5501101          01000                                                  29
*
*hydro  ebt pressure     tempe                                          vol
5501201     0       2431503.     173872.6    2418342. 0. 0.        1
5501202     0       2429617.     173872.6    2418333. 0. 0.        2
5501203     0       2427730.     173872.     2418323. 0. 0.        3
5501204     0       2425844.     173774.3    2418313. 0. 0.        4
5501205     0       2423710.     176867.     2418302. 0. 0.        5
5501206     0       2409493.     176869.8    2418227. 0. 0.        6
5501207     0       2404388.     176872.7    2418200. 0. 0.        7
5501208     0       2399284.     176875.6    2418173. 0. 0.        8
5501209     0       2394180.     176878.6    2418146. 0. 0.        9
5501210     0       2390410.     180881.4    2418126. 0. 0.        10
5501211     0       2387973.     184702.     2418113. 0. 0.        11
5501212     0       2385541.     188191.8    2418100. 0. 0.        12
5501213     0       2383114.     191479.     2418088. 0. 0.        13
5501214     0       2380692.     194691.     2418075. 0. 0.        14
5501215     0       2345454.     214849.4    2417886. 0. 0.        15
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5501216     0       2333104.     217797.    2417820. 0. 0.       16
5501217     0       2322867.     221792.7   2417764. 0. 0.       17
5501218     0       2312650.     226208.    2417709. 0. 0.       18
5501219     0       2302460.     230877.6   2417654. 0. 0.       19
5501220     0       2292294.     235739.4   2417598. 0. 0.       20
5501221     0       2312125.     237214.    2417706. 0. 0.       21
5501222     0       2307761.     238668.6   2417682. 0. 0.       22
5501223     0       2308639.     239715.5   2417687. 0. 0.       23
5501224     0       2311674.     335450.    2417704. 0. 0.       24
5501225     0       2310044.     335523.    2417695. 0. 0.       25
5501226     0       2308415.     335571.    2417686. 0. 0.       26
5501227     0       2306786.     335571.4   2417677. 0. 0.       27
5501228     0       2305156.     335572.    2417668. 0. 0.       28
5501229     0       2303526.     335573.    2417659. 0. 0.       29
5501230     0       2301897.     335573.5   2417650. 0. 0.       30
*
*hydro          vel/flw
5501300          0
*
*hydro         f velocity    g velocity    j velocity              jun
5501301       5.211-9          5.21112-9     0.          1 * 5.19134-8
5501302       1.051876-8       1.051888-8    0.          2 * 1.047907-7
5501303       1.602034-8       1.602047-8    0.          3 * 1.596002-7
5501304       2.18138-8        2.181394-8    0.          4 * 2.172537-7
5501305       4.11128          4.11128       0.          5 * 40.9461
5501306       4.11131          4.11131       0.          6 * 40.9461
5501307       4.11132          4.11132       0.          7 * 40.9461
5501308       4.11133          4.11133       0.          8 * 40.9461
5501309       4.11134          4.11134       0.          9 * 40.9461
5501310       4.11291          4.11291       0.          10 * 40.9461
5501311       4.11444          4.11444       0.          11 * 40.9461
5501312       4.11586          4.11586       0.          12 * 40.9461
5501313       4.11722          4.11722       0.          13 * 40.9461
5501314       4.11857          4.11857       0.          14 * 40.9461
5501315       8.15027          8.15027       0.          15 * 40.9461
5501316       8.153            8.153         0.          16 * 40.9461
5501317       8.15672          8.15672       0.          17 * 40.9461
5501318       8.1609           8.1609        0.          18 * 40.9461
5501319       8.16539          8.16539       0.          19 * 40.9461
5501320       4.13758          4.13758       0.          20 * 40.9461
5501321       4.13828          4.13828       0.          21 * 40.9461
5501322       4.13901          4.13901       0.          22 * 40.9461
5501323       -2.78312-6       -2.783156-6   0.          23 * -2.716463-5
5501324       -2.352953-6      -2.352976-6   0.          24 * -2.296596-5
5501325       -1.950455-6      -1.95047-6    0.          25 * -1.903716-5
5501326       -1.553616-6      -1.553626-6   0.          26 * -1.516374-5
5501327       -1.161286-6      -1.161292-6   0.          27 * -1.133447-5
5501328       -7.72333-7       -7.72335-7    0.          28 * -7.53818-6
5501329       -3.856096-7      -3.8561-7     0.          29 * -3.76365-6
*
*hydro   jun hyd diam                                              jun
5501401        0.010  0.0 1.0 1.0                                   13
5501402        0.006  0.0 1.0 1.0                                   19
5501403        0.010  0.0 1.0 1.0                                   29
*
*-------------------------------------------------------------------$
*hydro              component name       component type
5550000              "lcoutlt"              pipe
*-------------------------------------------------$-----------------$
5550001          5
*
*hydro          vol area                                           vol
5550101          0.080425                                           5
*
*hydro          length                                             vol
```

```
5550301          0.1543                                             5
*
*hydro          volume                                             vol
5550401          0.0                                                5
*
*hydro         vert angle                                          vol
5550601          90.                                                5
*
*hydro         delta z                                             vol
5550701          0.1543                                             5
*
*hydro         roughness       hyd diam                            vol
5550801        0.00000152       0.1000                             5
*
*hydro           fe                                                 vol
5551001          00                                                 5
*
*hydro          vcahs                                              jun
5551101          01000                                              4
*
*hydro  ebt pressure     tempe                                      vol
5551201     0       1801555.     340239.    2414147. 0. 0.        1
5551202     0       1799042.     340172.    2414124. 0. 0.        2
5551203     0       1795246.     335638.    2414088. 0. 0.        3
5551204     0       1788735.     335639.    2414028. 0. 0.        4
5551205     0       1786135.     335640.    2414003. 0. 0.        5
*
*hydro         f velocity    g velocity    j velocity              jun
5551300 0
5551301       10.11876         10.80447      0.          1 * 875.529
5551302       10.11866         10.80442      0.          2 * 875.529
5551303       10.58435         11.28672      0.          3 * 916.475
5551304       10.58438         11.2869       0.          4 * 916.475
*
*-------------------------------------------------------------------$
*hydro              component name       component type
5560000              "lcoutl"               mtpljun
*-------------------------------------------------------------------$
5560001     4        0
*
* loss coefficient at fuel channel exit = 0.068 (10 mm unheated length)
*hydro    from          to            area       f loss     r loss     vcahs
*5560011   540010000     555000000     0.          0.068      0.068   01100
5560011   540010000     555000000     0.          0.000      0.000   01000
5560012   1.0   1.0   1.0   0    0    0    1
*5560021   545010000     555000000     0.          0.068      0.068   01100
5560021   545010000     555000000     0.          0.000      0.000   01000
5560022   1.0   1.0   1.0   0    0    0    2
*5560031   546010000     555000000     0.          0.068      0.068   01100
5560031   546010000     555000000     0.          0.000      0.000   01000
5560032   1.0   1.0   1.0   0    0    0    3
5560041   555010000     557000000     0.          0.0        0.0     01000
5560042   1.0   1.0   1.0   0    0    0    4
*
*hydro                 f velocity     g velocity     j velocity
5561011   20.3222  26.5159  1 * 872.616
5561021   19.5366  25.4786  2 * 1.455286
5561031   19.5959  25.55594 3 * 1.45717
5561041   10.5844  11.10052 4 * 916.475
*
5562011   0.0024722    0.0 1.0 1.0 1
5562021   0.0022299    0.0 1.0 1.0 2
5562031   0.0022299    0.0 1.0 1.0 3
5562041   0.1000       0.0 1.0 1.0 4
*
```

```
*-------------------------------------------------------------------*
*hydro              component name       component type
5320000              "gapoutl"              sngljun
*-------------------------------------------------*-----------------*
*
*hydro    from          to           area      f loss     r loss     vcahs
5320101   550230003     555030003    0.00204     2.78       2.78     01003
*
*hydro    jun hyd diam
*5320110       0.0024787    0.0 1.0 1.0
5320110       0.01         0.0 1.0 1.0
*
*hydro    vel/flw       f velocity      g velocity      j velocity
5320201     0              18.39152        18.39152        0. * 40.9462
*
*-------------------------------------------------------------------$
*hydro              component name       component type
5570000              "ucoutlt2"             pipe
*-------------------------------------------------$-----------------$
5570001            8
*
*hydro          vol area                                            vol
5570101          0.080425                                           8
*
*hydro          length                                              vol
5570301          0.16                                               7
5570302          0.2013                                             8
*
*hydro          volume                                              vol
5570401          0.                                                 8
*
*hydro         vert angle                                           vol
5570601          90.                                                8
*
*hydro         delta z                                              vol
5570701          0.16                                               7
5570702          0.2013                                             8
*
*hydro         roughness      hyd diam                              vol
5570801       0.00000152      0.1000                                8
*
*hydro            fe                                                vol
5571001          00                                                 8
*
*hydro          vcahs                                               jun
5571101          01000                                              7
*
*hydro  ebt pressure     tempe                                      vol
5571201     0       1783487.     335688.    2413979. 0. 0.        1
5571202     0       1780791.     335689.    2413948. 0. 0.        2
5571203     0       1778096.     335690.    2413918. 0. 0.        3
5571204     0       1775400.     335691.    2413886. 0. 0.        4
5571205     0       1772704.     335691.6   2413856. 0. 0.        5
5571206     0       1770009.     335692.6   2413825. 0. 0.        6
5571207     0       1767313.     335693.5   2413794. 0. 0.        7
5571208     0       1764270.     335695.    2413759. 0. 0.        8
*
*hydro         f velocity   g velocity    j velocity               jun
5571300 0
5571301       10.5845         11.28711     0.          1 * 916.475
5571302       10.5845         11.28719     0.          2 * 916.475
5571303       10.58452        11.28726     0.          3 * 916.475
5571304       10.58453        11.28733     0.          4 * 916.475
5571305       10.58455        11.2874      0.          5 * 916.475
5571306       10.58456        11.28748     0.          6 * 916.475
5571307       10.58457        11.28755     0.          7 * 916.475
*
*-------------------------------------------------------------------$
*hydro              component name       component type
5600000              "crinlet"              pipe
*-------------------------------------------------$-----------------$
5600001            14
*
*hydro          vol area                                            vol
5600101          0.03485                                            14
*
*hydro          length                                              vol
5600301          0.175                                              4
5600302          0.221                                              5
5600303          0.175                                              9
5600304          0.1748                                             14
*
*hydro          volume                                              vol
5600401          0.                                                 14
*
*hydro         vert angle                                           vol
5600601          90.                                                14
*
*hydro         delta z                                              vol
5600701          0.175                                              4
5600702          0.221                                              5
5600703          0.175                                              9
5600704          0.1748                                             14
*
*hydro         roughness      hyd diam                              vol
5600801       0.00000152      0.08468                               14
*
*hydro            fe                                                vol
5601001          00                                                 14
*
*hydro          vcahs                                               jun
5601101          01000                                              13
*
*hydro  ebt pressure     tempe                                      vol
5601201     0       2315028.     176859.    2417722. 0. 0.        1
5601202     0       2312914.     176859.3   2417710. 0. 0.        2
5601203     0       2310802.     176859.5   2417699. 0. 0.        3
5601204     0       2308690.     176859.8   2417687. 0. 0.        4
5601205     0       2306300.     176860.    2417674. 0. 0.        5
5601206     0       2303910.     176860.3   2417661. 0. 0.        6
5601207     0       2301798.     176860.5   2417650. 0. 0.        7
5601208     0       2299686.     176860.8   2417638. 0. 0.        8
5601209     0       2297574.     176861.    2417627. 0. 0.        9
5601210     0       2295462.     176861.2   2417615. 0. 0.        10
5601211     0       2293353.     176861.4   2417604. 0. 0.        11
5601212     0       2291243.     176861.6   2417592. 0. 0.        12
5601213     0       2289134.     176862.    2417580. 0. 0.        13
5601214     0       2287024.     176862.    2417569. 0. 0.        14
*
*hydro         f velocity   g velocity    j velocity               jun
5601300 0
5601301       3.86084         4.22279      0.          1 * 147.844
5601302       3.86084         4.22281      0.          2 * 147.844
5601303       3.860845        4.22284      0.          3 * 147.844
5601304       3.86085         4.22286      0.          4 * 147.844
5601305       3.86085         4.22289      0.          5 * 147.844
5601306       3.86086         4.22292      0.          6 * 147.844
5601307       3.86086         4.22295      0.          7 * 147.844
5601308       3.860865        4.22297      0.          8 * 147.844
5601309       3.86087         4.223        0.          9 * 147.844
```

```
5601310       3.86087          4.22302       0.           10 * 147.844
5601311       3.860875         4.22305       0.           11 * 147.844
5601312       3.86088          4.22307       0.           12 * 147.844
5601313       3.86088          4.2231        0.           13 * 147.844
*
*----------------------------------------------------------------------$
*hydro              component name       component type
5590000              "crinlt"               mtpljun
*----------------------------------------------------------------------$
5590001     3        0
*hydro    from           to           area       f loss     r loss     vcahs
5590011   560010000      561000000    0.           0.         0.       01000
5590012   1.0   1.0   1.0   0     0     0     1
5590021   560010000      562000000    0.           0.         0.       01000
5590022   1.0   1.0   1.0   0     0     0     2
5590031   560010000      563000000    0.           0.         0.       01000
5590032   1.0   1.0   1.0   0     0     0     3
*
*hydro                  f flowrate     g flowrate     j flowrate
5591011                   5.99335 5.99335 1 * 30.04
5591021                   6.02416  6.02416  2 * 109.0545
5591031                   6.03478 6.03478 3 * 8.74953
*
*hydro    jun hyd diam
5592011   0.044        0.0 1.0 1.0 1
5592021   0.0520521    0.0 1.0 1.0 2
5592031   0.006        0.0 1.0 1.0 3
*
$=====================================================================$
*hydro              component name       component type
5610000            "innercr"        pipe    *flow within control tube
*-------------------------------------------------$-----------------$
*hydro       no. volumes
5610001           11
*
*hydro          vol area                                          vol
5610101        0.00456159                                         11
*
*hydro           length                                           vol
5610301          0.0836                                          5
5610302          0.116                                           6
5610303          0.0836                                          11
*
*hydro           volume                                           vol
5610401            0.                                            11
*
*hydro         vert angle                                         vol
5610601           90.                                            11
*
*hydro         roughness      hyd diam                            vol
5610801         1.52e-6         0.044                            11
*
*hydro             fe                                            vol
5611001            00                                            11
*
*hydro           vcahs                                           jun
5611101          01000                                           10
*
*hydro  ebt pressure     tempe                                    vol
5611201     0       2273800.     178281.3   2417496. 0. 0.       1
5611202     0       2272367.     180051.5   2417488. 0. 0.       2
5611203     0       2270934.     181893.    2417480. 0. 0.       3
5611204     0       2269501.     183746.5   2417472. 0. 0.       4
5611205     0       2268069.     185603.8   2417465. 0. 0.       5
5611206     0       2266362.     185659.    2417455. 0. 0.       6
```

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5611207     0       2264661.     185769.    2417446. 0. 0.       7
5611208     0       2263236.     185878.    2417438. 0. 0.       8
5611209     0       2261810.     185986.3   2417430. 0. 0.       9
5611210     0       2260386.     186093.8   2417422. 0. 0.       10
5611211     0       2258960.     186200.5   2417414. 0. 0.       11
*
*hydro          vel/flw
5611300            0
*
*hydro   f flowrate   g flowrate    j flowrate jun
5611301       5.99419          5.99419       0.           1 * 30.04
5611302       5.9952           5.9952        0.           2 * 30.04
5611303       5.99627          5.99627       0.           3 * 30.04
5611304       5.99735          5.99735       0.           4 * 30.04
5611305       5.99844          5.99844       0.           5 * 30.04
5611306       5.99848          5.99848       0.           6 * 30.04
5611307       5.99855          5.99855       0.           7 * 30.04
5611308       5.99862          5.99862       0.           8 * 30.04
5611309       5.99868          5.99868       0.           9 * 30.04
5611310       5.99875          5.99875       0.           10 * 30.04
*
*hydro   jun hyd diam                                                jun
5611401     0.044        0.0 1.0 1.0                                 10
*
$=====================================================================$
*hydro              component name       component type
5620000              "outercr"      pipe   *flow around control tube
*-------------------------------------------------$-----------------$
*hydro       no. volumes
5620001           11
*
*hydro          vol area                                          vol
5620101         0.0164753                                          11
*
*hydro           length                                           vol
5620301          0.0836                                          5
5620302          0.116                                           6
5620303          0.0836                                          11
*
*hydro           volume                                           vol
5620401            0.                                            11
*
*hydro         vert angle                                         vol
5620601           90.                                            11
*
*hydro         roughness      hyd diam                            vol
5620801         1.52e-6         0.0520521                        11
*
*hydro             fe                                            vol
5621001            00                                            11
*
*hydro           vcahs                                           jun
5621101          01000                                           10
*
*hydro  ebt pressure     tempe                                    vol
5621201     0       2273583.     180702.7   2417495. 0. 0.       1
5621202     0       2272234.     184311.7   2417488. 0. 0.       2
5621203     0       2270886.     187742.    2417480. 0. 0.       3
5621204     0       2269540.     190817.    2417473. 0. 0.       4
5621205     0       2268197.     193283.7   2417466. 0. 0.       5
5621206     0       2266600.     193284.4   2417456. 0. 0.       6
5621207     0       2265008.     196442.6   2417448. 0. 0.       7
5621208     0       2263664.     200337.6   2417440. 0. 0.       8
5621209     0       2262320.     204344.    2417433. 0. 0.       9
5621210     0       2260976.     208329.8   2417426. 0. 0.       10
```

```
5621211     0       2259633.     212275.4   2417418. 0. 0.       11
*
*hydro          vel/flw
5621300            0
*
*hydro   f flowrate   g flowrate    j flowrate  jun
5621301       6.02639          6.02639       0.          1 * 109.0545
5621302       6.0285           6.0285        0.          2 * 109.0545
5621303       6.03055          6.03055       0.          3 * 109.0545
5621304       6.0324           6.0324        0.          4 * 109.0545
5621305       6.03391          6.03391       0.          5 * 109.0545
5621306       6.03392          6.03392       0.          6 * 109.0545
5621307       6.03587          6.03587       0.          7 * 109.0545
5621308       6.03832          6.03832       0.          8 * 109.0545
5621309       6.04089          6.04089       0.          9 * 109.0545
5621310       6.04348          6.04348       0.          10 * 109.0545
*
*hydro   jun hyd diam                                                 jun
5621401      0.0520521   0.0 1.0 1.0                                  10
*
$=====================================================================$
*hydro              component name       component type
5630000                "gap"                 pipe
*-------------------------------------------------$-----------------$
*hydro       no. volumes
5630001           11
*
*hydro          vol area                                              vol
5630101         0.0013195                                             11
*
*hydro           length                                               vol
5630301          0.0836                                               5
5630302          0.116                                                6
5630303          0.0836                                              11
*
*hydro           volume                                               vol
5630401           0.                                                 11
*
*hydro         vert angle                                             vol
5630601           90.                                                11
*
*hydro         roughness       hyd diam                               vol
5630801         1.52e-6         0.00600                              11
*
*hydro             fe                                                 vol
5631001           00000                                              11
*
*hydro           vcahs                                                jun
5631101          01000                                               10
*
*hydro  ebt pressure     tempe                                        vol
5631201     0       2270866.     186484.    2417480. 0. 0.       1
5631202     0       2264064.     198293.6   2417442. 0. 0.       2
5631203     0       2257300.     210358.2   2417405. 0. 0.       3
5631204     0       2250576.     222265.4   2417368. 0. 0.       4
5631205     0       2243893.     233954.    2417331. 0. 0.       5
5631206     0       2235952.     233677.    2417286. 0. 0.       6
5631207     0       2228052.     233129.    2417242. 0. 0.       7
5631208     0       2221433.     232607.5   2417205. 0. 0.       8
5631209     0       2214812.     232113.    2417168. 0. 0.       9
5631210     0       2208190.     231645.4   2417131. 0. 0.       10
5631211     0       2201565.     231204.    2417094. 0. 0.       11
*
*hydro          vel/flw
5631300            0
*
*hydro   f flowrate   g flowrate j flowrate jun
5631301       6.04043          6.04043       0.          1 * 8.74953
5631302       6.04768          6.04768       0.          2 * 8.74953
5631303       6.05548          6.05548       0.          3 * 8.74953
5631304       6.06356          6.06356       0.          4 * 8.74953
5631305       6.07185          6.07185       0.          5 * 8.74953
5631306       6.07167          6.07167       0.          6 * 8.74953
5631307       6.0713           6.0713        0.          7 * 8.74953
5631308       6.07094          6.07094       0.          8 * 8.74953
5631309       6.0706           6.0706        0.          9 * 8.74953
5631310       6.07029          6.07029       0.          10 * 8.74953
*
*hydro   jun hyd diam                                                 jun
5631401      0.006       0.0 1.0 1.0                                  10
*
*---------------------------------------------------------------------$
*hydro              component name       component type
5640000                "croutlt"             pipe
*-------------------------------------------------$-----------------$
5640001           12
*
*hydro          vol area                                              vol
5640101           0.03485                                              12
*
*hydro           length                                               vol
5640301          0.1744                                               12
*
*hydro           volume                                               vol
5640401           0.                                                  12
*
*hydro         vert angle                                             vol
5640601           90.                                                 12
*
*hydro         delta z                                                vol
5640701          0.1744                                               12
*
*hydro         roughness       hyd diam                               vol
5640801         0.00000152       0.08468                             12
*
*hydro             fe                                                 vol
5641001           00                                                 12
*
*hydro           vcahs                                                jun
5641101          01000                                               11
*
*hydro  ebt pressure     tempe                                        vol
5641201     0       1920980.     208097.4   2415226. 0. 0.       1
5641202     0       1918884.     208097.6   2415208. 0. 0.       2
5641203     0       1916790.     208098.    2415190. 0. 0.       3
5641204     0       1914695.     208098.    2415171. 0. 0.       4
5641205     0       1912601.     208098.2   2415152. 0. 0.       5
5641206     0       1910506.     208098.4   2415134. 0. 0.       6
5641207     0       1908412.     208098.6   2415115. 0. 0.       7
5641208     0       1906317.     208099.    2415097. 0. 0.       8
5641209     0       1904222.     208099.    2415078. 0. 0.       9
5641210     0       1902128.     208099.2   2415060. 0. 0.       10
5641211     0       1900033.     208099.4   2415041. 0. 0.       11
5641212     0       1897939.     208099.6   2415022. 0. 0.       12
*
*hydro         f velocity   g velocity    j velocity                jun
5641300 0
5641301       3.873745         4.24045       0.          1 * 147.844
5641302       3.87375          4.240476      0.          2 * 147.844
5641303       3.87375          4.2405        0.          3 * 147.844
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5641304       3.873755          4.24053       0.          4 * 147.844
5641305       3.87376           4.24056       0.          5 * 147.844
5641306       3.87376           4.24058       0.          6 * 147.844
5641307       3.87377           4.24061       0.          7 * 147.844
5641308       3.87377           4.24064       0.          8 * 147.844
5641309       3.87377           4.240665      0.          9 * 147.844
5641310       3.87378           4.24069       0.          10 * 147.844
5641311       3.87378           4.24072       0.          11 * 147.844
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5660000               "crinlt"              mtpljun
*-------------------------------------------------------------------------$
5660001     3         0
*
* calibrated exit losses to get velocity to 6 m/s in cr channels
*
*   21.58/21.40/18.30  ====>  nominal steady state
*   19.58/19.40/16.30  ====>  5.83263/5.85857/5.86511
*
*hydro    from          to          area       f loss     r loss     vcahs
5660011   561010000     564000000   0.           17.58      17.58    01000
5660012   1.0   1.0   1.0   0     0    0    1
5660021   562010000     564000000   0.           17.40      17.40    01000
5660022   1.0   1.0   1.0   0     0    0    2
5660031   563010000     564000000   0.           14.30      14.30    01000
5660032   1.0   1.0   1.0   0     0    0    3
*
*hydro                  f flowrate     g flowrate     j flowrate
5661011                   5.99882  6.35841  1 * 30.04
5661021                   6.04609  6.04609  2 * 109.0545
5661031                   6.06999  6.06999  3 * 8.74953
*
*hydro    jun hyd diam
5662011   0.08468     0.0 1.0 1.0 1
5662021   0.0520521   0.0 1.0 1.0 2
5662031   0.006       0.0 1.0 1.0 3
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5650000               "cpbtex"              pipe
*-------------------------------------------------------------------------$
5650001          5
*
*hydro          vol area                                              vol
5650101           0.24663                                               5
*
*hydro           length                                               vol
5650301           0.1836                                                5
*
*hydro           volume                                               vol
5650401           0.                                                    5
*
*hydro         vert angle                                             vol
5650601           90.                                                   3
5650602           0.                                                    5
*
*hydro         delta z                                                vol
5650701           0.180                                                 3
5650702           0.                                                    5
*
*hydro         roughness      hyd diam                                vol
5650801       0.0000457       0.56037                                  5
*
*hydro             fe                                                 vol
```

```
5651001           00                                                    5
*
*hydro          vcahs                                                 jun
5651101         01000                                                   4
*
*hydro  ebt pressure     tempe                                         vol
5651201     0       1778325.     319133.5   2413920. 0. 0.        1
5651202     0       1776227.     319133.6   2413896. 0. 0.        2
5651203     0       1774161.     319134.    2413872. 0. 0.        3
5651204     0       1773047.     319134.    2413860. 0. 0.        4
5651205     0       1772886.     319134.    2413858. 0. 0.        5
*
*hydro         f velocity   g velocity    j velocity                 jun
5651300 0
5651301       8.821            9.5611       0.            1 * 2348.155
5651302       8.821            9.56116      0.            2 * 2348.155
5651303       8.82102          9.56121      0.            3 * 2348.155
5651304       8.82102          8.82102      0.            4 * 2348.155
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5670000               "cpbtex"              mtpljun
*-------------------------------------------------------------------------$
5670001     5         0
*hydro    from          to          area       f loss     r loss     vcahs
5670011   557010000     565000000   0.           0.         0.       01100
5670012   1.0   1.0   1.0   0     0    0    1
5670021   525010000     565000000   0.           0.         0.       01100
5670022   1.0   1.0   1.0   0     0    0    2
*
* kexit = 0.15*kentrance =   5.25
*
5670031   564010000     565000000   0.0250354    5.25       5.25     01000
5670032   1.0   1.0   1.0   0     0    0    3
5670041   565010000     640000000   0.           0.24       0.24     01100
5670042   1.0   1.0   1.0   0     0    0    4
5670051   580010000     565000000   0.           0.         0.       01100
5670052   1.0   1.0   1.0   0     0    0    5
*
*hydro                  f velocity     g velocity     j velocity
5671011   10.58459 11.09873 1 * 916.475
5671021   10.18897 10.70605 2 * 742.59
5671031   5.39242  5.81871  3 * 147.844
5671041   8.82102  8.82102  4 * 2348.155
5671051   10.00963 10.53437 5 * 541.245
*
*hydro    jun hyd diam
5672011   0.100  0.0 1.0 1.0 1
5672021   0.110  0.0 1.0 1.0 2
5672031   0.190  0.0 1.0 1.0 3
5672041   0.5604 0.0 1.0 1.0 4
5672051   0.120  0.0 1.0 1.0 5
*
* inner core input
*-------------------------------------------------------------------------$
*hydro              component name       component type
5690000               "icinlt"              mtpljun
*-------------------------------------------------------------------------$
5690001     5         0
* inlet loss coefficients are:
*  0.04 (from hfir data) + 0.34 (50 mm unheated length)
*hydro    from          to          area       f loss     r loss     vcahs
5690011   568010000     572000000   0.           0.         0.       01000
5690012   1.0   1.0   1.0   0     0    0    1
5690021   572010000     570000000   0.           0.207      0.207    01000
```

```
5690022   1.0   1.0   1.0   0    0    0    2
5690031   572010000     575000000    0.          0.207     0.207  01000
5690032   1.0   1.0   1.0   0    0    0    3
5690041   572010000     576000000    0.          0.207     0.207  01000
5690042   1.0   1.0   1.0   0    0    0    4
5690051   500010000     568000000    0.          0.        0.     01100
5690052   1.0   1.0   1.0   0    0    0    5
*
*hydro    vel/flw       f velocity     g velocity     j velocity
5691011   9.8996   10.41223 1 * 541.245
5691021   19.8759  19.8759  2 * 537.147
5691031   18.94505 18.94505 3 * 2.048088
5691041   18.96823 18.96823 4 * 2.050595
5691051   9.89754  10.40988 5 * 541.245
*
5692011   0.120       0.0 1.0 1.0 1
5692021   0.0024937   0.0 1.0 1.0 2
5692031   0.0022429   0.0 1.0 1.0 3
5692041   0.0022429   0.0 1.0 1.0 4
5692051   0.120       0.0 1.0 1.0 5
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
5680000            "icinlet"               pipe
*-------------------------------------------------$-----------------$
5680001          14
*
*hydro          vol area                                          vol
5680101         0.049763                                           14
*
*hydro           length                                           vol
5680301          0.175                                             4
5680302          0.221                                             5
5680303          0.175                                             9
5680304          0.0836                                           14
*
*hydro           volume                                           vol
5680401            0.                                            14
*
*hydro         vert angle                                         vol
5680601           90.                                            14
*
*hydro          delta z                                           vol
5680701          0.175                                             4
5680702          0.221                                             5
5680703          0.175                                             9
5680704          0.0836                                           14
*
*hydro         roughness      hyd diam                           vol
5680801        0.00000152      0.1200                             14
*
*hydro             fe                                            vol
5681001            00                                            14
*
*hydro           vcahs                                           jun
5681101          01000                                           13
*
*hydro  ebt pressure     tempe                                    vol
5681201     0       2543756.     176861.2    2418840. 0. 0.       1
5681202     0       2541014.     176862.     2418831. 0. 0.       2
5681203     0       2538270.     176862.8    2418822. 0. 0.       3
5681204     0       2535528.     176863.5    2418813. 0. 0.       4
5681205     0       2532424.     176864.5    2418803. 0. 0.       5
5681206     0       2529320.     176865.3    2418793. 0. 0.       6
5681207     0       2526578.     176866.     2418784. 0. 0.       7
5681208     0       2523834.     176866.8    2418775. 0. 0.       8
5681209     0       2521092.     176867.6    2418766. 0. 0.       9
5681210     0       2519064.     177273.     2418760. 0. 0.       10
5681211     0       2517750.     177697.7    2418755. 0. 0.       11
5681212     0       2516435.     178129.8    2418751. 0. 0.       12
5681213     0       2515121.     178563.     2418746. 0. 0.       13
5681214     0       2513806.     178974.5    2418742. 0. 0.       14
*
*hydro          vel/flw
5681300 0
*
*hydro         f velocity   g velocity    j velocity                jun
5681301       9.89748          10.52103      0.          1 * 541.245
5681302       9.8975           10.52109      0.          2 * 541.245
5681303       9.8975           10.52115      0.          3 * 541.245
5681304       9.89752          10.5212       0.          4 * 541.245
5681305       9.89754          10.52127      0.          5 * 541.245
5681306       9.89755          10.52134      0.          6 * 541.245
5681307       9.89756          10.5214       0.          7 * 541.245
5681308       9.89758          10.52145      0.          8 * 541.245
5681309       9.89759          10.52151      0.          9 * 541.245
5681310       9.89798          10.52194      0.          10 * 541.245
5681311       9.89838          10.52238      0.          11 * 541.245
5681312       9.89879          10.52283      0.          12 * 541.245
5681313       9.8992           10.52327      0.          13 * 541.245
*
*hydro   jun hyd diam                                                jun
*
*-------------------------------------------------$-----------------$
*hydro             component name       component type
5720000            "icinlet"               pipe
*-------------------------------------------------$-----------------$
5720001          1
*
*hydro          vol area                                          vol
5720101          0.049763                                           1
*
*hydro           length                                           vol
5720301          0.116                                              1
*
*hydro           volume                                           vol
5720401          0.0000                                             1
*
*hydro         vert angle                                         vol
5720601           90.                                             1
*
*hydro          delta z                                           vol
5720701          0.116                                              1
*
*hydro         roughness      hyd diam                           vol
5720801        0.00000152      0.1200                             1
*
*hydro             fe                                            vol
5721001            00                                            1
*
*hydro           vcahs                                           jun
*5721101          01100                                          1
*
*hydro  ebt pressure     tempe                                    vol
5721201     0       2512240.     179053.     2418737. 0. 0.       1
*
*hydro         f velocity   g velocity    j velocity                jun
*5721300 0
*5721301    7.52105    7.52105 0.                                   2
*
```

```
*-------------------------------------------------------------------*
*hydro             component name      component type
5700000            "icavchan"              pipe
*-------------------------------------------------$-----------------$
5700001          5
*
*hydro          vol area                                          vol
5700101        0.024598                                            5
*
*hydro           length                                           vol
5700301          0.0836                                            5
*
*hydro           volume                                           vol
5700401            0.                                              5
*
*hydro         vert angle                                         vol
5700601           90.                                              5
*
*hydro          delta z                                           vol
5700701          0.0836                                            5
*
*hydro         roughness      hyd diam                            vol
5700801         1.0000e-10   0.0024937                             5
*
*hydro             fe                                             vol
*noans**5701001            00                                    5
5701001           200                                             5
*
*hydro           vcahs                                            jun
5701101          01000                                             4
*
*hydro  ebt pressure     tempe                                     vol
5701201     0       2235437.     203661.4   2417284. 0. 0.        1
5701202     0       2099314.     224574.6   2416505. 0. 0.        2
5701203     0       1965106.     243665.5   2415612. 0. 0.        3
5701204     0       1832404.     259772.    2414431. 0. 0.        4
5701205     0       1700855.     270824.7   2413019. 0. 0.        5
*
*hydro          vel/flw
5701300 0
*
*hydro         f velocity   g velocity    j velocity               jun
5701301       19.9277          25.91313     0.           1 * 537.147
5701302       19.9751          25.99654     0.           2 * 537.147
5701303       20.02173         26.0794      0.           3 * 537.147
5701304       20.06356         26.15674     0.           4 * 537.147
*
*hydro   jun hyd diam                                             jun
5701401      0.0024937  0.0 1.0 1.0                               4
*
*hydro    pitch       span    vol
5703101  1.27e-3     77.65e-3  5
*
*-------------------------------------------------------------------*
*hydro             component name      component type
5750000            "ichotch1"              pipe
*-------------------------------------------------$-----------------$
5750001          5
*
*hydro          vol area                                          vol
5750101      9.8398d-5                                             5
*
*hydro           length                                           vol
5750301          0.0836                                            5
*
*hydro           volume                                           vol
5750401            0.                                              5
*
*hydro         vert angle                                         vol
5750601           90.                                              5
*
*hydro          delta z                                           vol
5750701          0.0836                                            5
*
*hydro         roughness      hyd diam                            vol
5750801         1.0000e-10   0.0022429                             5
*
*hydro             fe                                             vol
*noans**5751001            00                                    5
5751001           200                                             5
*
*hydro           vcahs                                            jun
5751101          01000                                             4
*
*hydro  ebt pressure     tempe                                     vol
5751201     0       2258405.     229312.3   2417411. 0. 0.        1
5751202     0       2119098.     270872.4   2416621. 0. 0.        2
5751203     0       1982981.     307804.    2415766. 0. 0.        3
5751204     0       1849206.     339484.    2414584. 0. 0.        4
5751205     0       1717236.     365671.    2413212. 0. 0.        5
*
*hydro          vel/flw
5751300 0
*
*hydro         f velocity   g velocity    j velocity               jun
5751301  19.0488  24.7605  0. 1 * 2.048088
5751302  19.14945 24.91195 0. 2 * 2.048088
5751303  19.2499  25.06365 0. 3 * 2.048088
5751304  19.34414 25.20793 0. 4 * 2.048088
*
*hydro   jun hyd diam                                             jun
5751401      0.0022429   0.0 1.0 1.0                              4
*
*hydro    pitch       span    vol
5753101  1.14300e-3  77.65e-3  5
*
*-------------------------------------------------------------------*
*hydro             component name      component type
5760000            "ichotch2"              pipe
*-------------------------------------------------$-----------------$
5760001          5
*
*hydro          vol area                                          vol
5760101      9.8398d-5                                             5
*
*hydro           length                                           vol
5760301          0.0836                                            5
*
*hydro           volume                                           vol
5760401            0.                                              5
*
*hydro         vert angle                                         vol
5760601           90.                                              5
*
*hydro          delta z                                           vol
5760701          0.0836                                            5
*
*hydro         roughness      hyd diam                            vol
5760801         1.0000e-10   0.0022429                             5
*
```

```
*hydro              fe                                                  vol
*noans**5761001              00                                        5
5761001             200                                                5
*
*hydro             vcahs                                               jun
5761101            01000                                               4
*
*hydro  ebt pressure     tempe                                         vol
5761201     0       2257800.     231295.    2417408. 0. 0.        1
5761202     0       2118362.     274499.    2416616. 0. 0.        2
5761203     0       1982191.     312887.    2415760. 0. 0.        3
5761204     0       1848402.     345816.6   2414577. 0. 0.        4
5761205     0       1716444.     373035.4   2413203. 0. 0.        5
*
*hydro           vel/flw
5761300             0
*
*hydro         f velocity    g velocity    j velocity                jun
5761301 19.07656 24.79676 0. 1 * 2.050595
5761302 19.1822  24.95473 0. 2 * 2.050595
5761303 19.28795 25.1133  0. 3 * 2.050595
5761304 19.3873  25.26426 0. 4 * 2.050595
*
*hydro   jun hyd diam                                                  jun
5761401      0.0022429   0.0 1.0 1.0                                   4
*
*hydro    pitch       span    vol
5763101  1.14300e-3  77.65e-3  5
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
5800000              "icoutlt"              pipe
*-------------------------------------------------$-------------------$
5800001             10
*
*hydro           vol area                                              vol
5800101           0.049763                                            10
*
*hydro           length                                                vol
5800301           0.20928                                             10
*
*hydro           volume                                                vol
5800401           0.0                                                 10
*
*hydro          vert angle                                             vol
5800601           90.                                                 10
*
*hydro          delta z                                                vol
5800701           0.20928                                             10
*
*hydro          roughness      hyd diam                                vol
5800801        0.00000152       0.120                                 10
*
*hydro             fe                                                  vol
5801001           00                                                  10
*
*hydro           vcahs                                                 jun
5801101          01000                                                 9
*
*hydro  ebt pressure     tempe                                         vol
5801201     0       1798513.     271824.    2414118. 0. 0.        1
5801202     0       1795296.     271824.7   2414089. 0. 0.        2
5801203     0       1792077.     271825.6   2414059. 0. 0.        3
5801204     0       1788858.     271826.5   2414029. 0. 0.        4
5801205     0       1785639.     271827.3   2.414+6  0. 0.        5
5801206     0       1782419.     272087.6   2413967. 0. 0.        6
5801207     0       1779197.     272088.5   2413930. 0. 0.        7
5801208     0       1775978.     272089.4   2413893. 0. 0.        8
5801209     0       1772759.     272090.3   2413856. 0. 0.        9
5801210     0       1769540.     272091.    2413820. 0. 0.        10
*
*hydro         f velocity    g velocity    j velocity                jun
5801300 0
5801301 10.00914 10.6494  0. 1 * 541.245
5801302 10.00916 10.64948 0. 2 * 541.245
5801303 10.00917 10.64956 0. 3 * 541.245
5801304 10.00919 10.64964 0. 4 * 541.245
5801305 10.0092  10.64972 0. 5 * 541.245
5801306 10.00956 10.65015 0. 6 * 541.245
5801307 10.00958 10.65023 0. 7 * 541.245
5801308 10.0096  10.65031 0. 8 * 541.245
5801309 10.00961 10.6504  0. 9 * 541.245
*
*-------------------------------------------------$-------------------$
*hydro              component name       component type
5810000              "icoutl"               mtpljun
*-------------------------------------------------$-------------------$
5810001     3        0
*
* loss coefficient at fuel channel exit = 0.068 (10 mm unheated length)
*hydro    from          to            area       f loss    r loss    vcahs
*5810011   570010000     580000000     0.           0.068     0.068  01100
5810011   570010000     580000000     0.           0.000     0.000  01000
5810012   1.0   1.0   1.0   0    0    0    1
*5810021   575010000     580000000     0.           0.068     0.068  01100
5810021   575010000     580000000     0.           0.000     0.000  01000
5810022   1.0   1.0   1.0   0    0    0    2
*5810031   576010000     580000000     0.           0.068     0.068  01100
5810031   576010000     580000000     0.           0.000     0.000  01000
5810032   1.0   1.0   1.0   0    0    0    3
*
*hydro                  f velocity     g velocity     j velocity
5811011   20.09383 26.2198  1 * 537.147
5811021   19.4276  25.33905 2 * 2.048088
5811031   19.47543 25.4015  3 * 2.050595
*
5812011   0.0024937   0.0 1.0 1.0 1
5812021   0.0022429   0.0 1.0 1.0 2
5812031   0.0022429   0.0 1.0 1.0 3
*
*************************************************$******************$
*
*                       moderator tank
*
*************************************************$******************$
*
*-------------------------------------------------*------------------*
*hydro              component name       component type
1670000              "connect"              sngljun
*-------------------------------------------------*------------------*
*hydro    from          to          area       f loss  r loss fvcahs disch
1670101   530050003  595020003   0.0000001  1.e6    1.e6  031000  1.0
*
1670110       0.3255        0.0 1.0 1.0
*
*hydro       vel/flw       f massrate     g massrate     j massrate
1670201 0  .061264  .061264  0. * 6.73232-6
*
*-------------------------------------------------*------------------*
*hydro              component name       component type
```

```
5900000              "modcool"              tmdpvol
*-------------------------------------------------*-----------------*
*hydro         area       length      volume
5900101        1.e6         .0        1.0e+06
*
*hydro      horz angle  vert angle    delta z
5900102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
5900103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
5900200 003
*
*hydro   time     pressure     tempe
5900201   0.      1.e5         300.
*
*-------------------------------------------------*-----------------*
*hydro              component name       component type
5910000              "tankcool"             tmdpjun
*-------------------------------------------------*-----------------*
*hydro    from          to             area
5910101   590000000     595000000      0.0286
*
*hydro    vel/flw       trip no.       alpha vrc      numeric vrc
5910200      1
*
*hydro   time           f flow         g flow         j flow
5910201   0.            316.4          0.                0
5910202   1.e6          316.4          0.                0
*
*-------------------------------------------------*-----------------*
*hydro              component name       component type
5950000              "modtank"              pipe
*-------------------------------------------------$-----------------$
5950001          4
*
*hydro          vol area                                          vol
5950101         2.7539                                             4
*
*hydro           length                                           vol
5950301         1.2675                                             1
5950302         1.545                                              2
5950303         1.064                                              3
5950304         0.7715                                             4
*
*hydro           volume                                           vol
5950401           0.                                               4
*
*hydro         vert angle                                         vol
5950601           90.                                              4
*
*hydro         delta z                                            vol
5950701         1.2675                                             1
5950702         1.545                                              2
5950703         1.064                                              3
5950704         0.7715                                             4
*
*hydro         roughness      hyd diam                            vol
5950801       0.0000457       0.532                               4
*
*hydro            fe                                              vol
5951001          00                                               4
*
*hydro          vcahs                                             jun
```

```
5951101          01000                                             3
*
*hydro  ebt pressure     tempe                                     vol
5951201     0       143458.5     98228.6     2339196. 0.        0. 1
5951202     0       128232.2     98228.6     2335630. 0. 0.        2
5951203     0       114107.6     98228.6     2331943. 0. 0.        3
5951204     0       104170.7     98228.6     2329100. 0. 0.        4
5951301       .10406           .124206      0.            1 * 316.4
5951302       .1040607         .124207      0.            2 * 316.4
5951303       .1040614         .1242078     0.            3 * 316.4
*
*-------------------------------------------------------------------*
*hydro              component name       component type
5960000              "tankout"              sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to             area      f loss    r loss    vcahs
5960101   595010000     600000000      0.028603    0.        0.      01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
5960201     0              10.01909       10.66446       0. * 316.4
*
*-------------------------------------------------------------------*
*hydro              component name       component type
6000000              "modtankp"             tmdpvol
*-------------------------------------------------------------------*
*hydro         area       length      volume
6000101        1.e6         .0        1.0e+06
*
*hydro      horz angle  vert angle    delta z
6000102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
6000103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
6000200 003
*
*hydro   time     pressure     tempe
6000201   0.      1.e5         300.
6000202   1.e6    1.e5         300.
*
*=================================================================$
*
*                    hot leg main header
*
*=================================================================$
*
*-------------------------------------------------------------------*
*hydro              component name       component type
6400000              "coreout"              pipe
*-------------------------------------------------*-----------------*
6400001          10
*
*hydro          vol area                                          vol
6400101         0.24663                                            10
*
*hydro           length                                           vol
6400301         0.18801                                            10
*
*hydro           volume                                           vol
6400401           0.                                               10
*
*hydro           volume                                           vol
6400501           0.                                               10
*
```

```
*hydro         vert angle                                          vol
6400601          0.                                                10
*
*hydro         vert length                                         vol
6400701          0.00                                              10
*
*hydro         roughness      hyd diam                             vol
6400801        0.0000457       0.56037                           10
*
*hydro           f loss        r loss                              jun
6400901           0.00          0.00                              9
*
*hydro            fe                                              vol
6401001           00                                              10
*
*hydro           vcahs                                            jun
6401101          01000                                             9
*
*hydro  ebt pressure     tempe                                    vol
6401201     0       1762634.     319127.    2413740. 0. 0.       1
6401202     0       1762468.     319119.6   2413738. 0. 0.       2
6401203     0       1762304.     319112.3   2413736. 0. 0.       3
6401204     0       1762139.     319112.5   2413734. 0. 0.       4
6401205     0       1761974.     319112.6   2413732. 0. 0.       5
6401206     0       1761809.     319113.    2413730. 0. 0.       6
6401207     0       1761644.     319113.    2413729. 0. 0.       7
6401208     0       1761479.     319113.    2413727. 0. 0.       8
6401209     0       1761314.     319113.    2413725. 0. 0.       9
6401210     0       1761150.     319113.4   2413723. 0. 0.       10
*
*hydro          vel/flw
6401300            0
*
*hydro         f flowrate   g flowrate    j flowrate              jun
6401301       8.82105          8.82105       0.            1 • 2348.155
6401302       8.82104          8.82104       0.            2 • 2348.155
6401303       8.82103          8.82103       0.            3 • 2348.155
6401304       8.82103          8.82103       0.            4 • 2348.155
6401305       8.82103          8.82103       0.            5 • 2348.155
6401306       8.82104          8.82104       0.            6 • 2348.155
6401307       8.82104          8.82104       0.            7 • 2348.155
6401308       8.82104          8.82104       0.            8 • 2348.155
6401309       8.82104          8.82104       0.            9 • 2348.155
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
1640000             "riserin"           sngljun
*-----------------------------------------------$-----------------------$
*hydro    from          to           area      f loss     r loss     vcahs
1640101 640010000  641000000          0.         0.4        0.4     01000
*
*hydro    hyd diam
1640110 0.56037 0.  1. 1.
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1640201     0              8.82104        8.82104         0. • 2348.155
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
6410000             "hlriser"               pipe
*-----------------------------------------------*-------------------*
6410001          36
•
*hydro          vol area                                           vol
6410101          0.24663                                           36
```

```
•
*hydro          length                                             vol
6410301          0.1947225                                         36
•
*hydro          volume                                             vol
6410401          0.                                                36
*
•hydro          volume                                             vol
6410501          0.                                                36
*
*hydro         vert angle                                          vol
6410601          90.                                               36
*
*hydro         vert length                                         vol
6410701          0.1947225                                         36
•
*hydro         roughness      hyd diam                             vol
6410801        0.0000457       0.56037                           36
*
*hydro           f loss        r loss                              jun
6410901           0.            0.                               35
*
*hydro            fe                                              vol
6411001           00                                              36
*
*hydro           vcahs                                            jun
6411101          01000                                             35
*
*hydro  ebt pressure     tempe                                    vol
6411201     0       1743135.     319086.    2413515. 0. 0.       1
6411202     0       1740903.     319059.    2413489. 0. 0.       2
6411203     0       1738672.     319032.    2413463. 0. 0.       3
6411204     0       1736440.     319032.    2413437. 0. 0.       4
6411205     0       1734208.     319032.    2413411. 0. 0.       5
6411206     0       1731976.     319032.    2413385. 0. 0.       6
6411207     0       1729744.     319032.3   2413359. 0. 0.       7
6411208     0       1727512.     319032.5   2413333. 0. 0.       8
6411209     0       1725280.     319032.7   2413307. 0. 0.       9
6411210     0       1723048.     319033.    2413280. 0. 0.       10
6411211     0       1720816.     319033.    2413254. 0. 0.       11
6411212     0       1718584.     319033.    2413228. 0. 0.       12
6411213     0       1716352.     319033.    2413202. 0. 0.       13
6411214     0       1714120.     319033.4   2413176. 0. 0.       14
6411215     0       1711888.     319033.6   2413150. 0. 0.       15
6411216     0       1709657.     319034.    2413123. 0. 0.       16
6411217     0       1707425.     319034.    2413097. 0. 0.       17
6411218     0       1705193.     319034.    2413070. 0. 0.       18
6411219     0       1702961.     319034.    2413044. 0. 0.       19
6411220     0       1700729.     319034.4   2413018. 0. 0.       20
6411221     0       1698497.     319034.5   2412992. 0. 0.       21
6411222     0       1696265.     319035.    2412965. 0. 0.       22
6411223     0       1694033.     319035.    2412938. 0. 0.       23
6411224     0       1691801.     319035.    2412912. 0. 0.       24
6411225     0       1689569.     319035.    2412886. 0. 0.       25
6411226     0       1687338.     319035.    2412859. 0. 0.       26
6411227     0       1685106.     319035.5   2412832. 0. 0.       27
6411228     0       1682874.     319035.6   2412806. 0. 0.       28
6411229     0       1680642.     319036.    2412779. 0. 0.       29
6411230     0       1678410.     319036.    2412752. 0. 0.       30
6411231     0       1676178.     319036.    2412726. 0. 0.       31
6411232     0       1673946.     319036.    2412699. 0. 0.       32
6411233     0       1671714.     319036.4   2412672. 0. 0.       33
6411234     0       1669482.     319036.6   2412646. 0. 0.       34
6411235     0       1667250.     319037.    2412619. 0. 0.       35
6411236     0       1665019.     319037.    2412592. 0. 0.       36
```

```
*
*hydro          vel/flw
6411300           0
*
*hydro        f flowrate   g flowrate    j flowrate              jun
6411301       8.82107        9.56198      0.          1 * 2348.155
6411302       8.82104        9.562        0.          2 * 2348.155
6411303       8.82102        9.56203      0.          3 * 2348.155
6411304       8.82102        9.56209      0.          4 * 2348.155
6411305       8.82103        9.56215      0.          5 * 2348.155
6411306       8.82104        9.56221      0.          6 * 2348.155
6411307       8.82105        9.56227      0.          7 * 2348.155
6411308       8.82106        9.56233      0.          8 * 2348.155
6411309       8.82107        9.5624       0.          9 * 2348.155
6411310       8.82108        9.56245      0.          10 * 2348.155
6411311       8.82109        9.56251      0.          11 * 2348.155
6411312       8.8211         9.56257      0.          12 * 2348.155
6411313       8.8211         9.56264      0.          13 * 2348.155
6411314       8.82111        9.5627       0.          14 * 2348.155
6411315       8.82112        9.56276      0.          15 * 2348.155
6411316       8.82113        9.56282      0.          16 * 2348.154
6411317       8.82114        9.56288      0.          17 * 2348.154
6411318       8.82115        9.56294      0.          18 * 2348.154
6411319       8.82116        9.563        0.          19 * 2348.154
6411320       8.82116        9.56306      0.          20 * 2348.154
6411321       8.82117        9.56312      0.          21 * 2348.154
6411322       8.82118        9.56318      0.          22 * 2348.154
6411323       8.82119        9.56325      0.          23 * 2348.154
6411324       8.8212         9.5633       0.          24 * 2348.154
6411325       8.8212         9.56337      0.          25 * 2348.154
6411326       8.82122        9.56343      0.          26 * 2348.154
6411327       8.82123        9.5635       0.          27 * 2348.154
6411328       8.82123        9.56355      0.          28 * 2348.154
6411329       8.82124        9.56361      0.          29 * 2348.154
6411330       8.82125        9.56367      0.          30 * 2348.154
6411331       8.82126        9.56374      0.          31 * 2348.154
6411332       8.82127        9.5638       0.          32 * 2348.154
6411333       8.82128        9.56386      0.          33 * 2348.154
6411334       8.82129        9.56392      0.          34 * 2348.154
6411335       8.8213         9.56398      0.          35 * 2348.154
*
*-------------------------------------------------------------------------$
*hydro            component name       component type
6450000             "coreout"             pipe
*-------------------------------------------------------------$-----------$
6450001           50
*
*hydro          vol area                                          vol
6450101          0.24663                                          50
*
*hydro          length                                            vol
6450301          0.1646                                           50
*
*hydro          volume                                            vol
6450401          0.0                                              50
*
*hydro          vert angle                                        vol
6450601          0.                                               50
*
*hydro          delta z                                           vol
6450701          0.                                               50
*
*hydro          roughness      hyd diam                           vol
6450801        0.0000457        0.56037                          50
*
```

```
*hydro             fe                                             vol
6451001            00                                             50
*
*hydro           vcahs                                            jun
6451101          01000                                            49
*
*hydro  ebt pressure     tempe                                     vol
6451201     0       1653741.     318940.     2412456. 0. 0.       1
6451202     0       1653597.     318940.     2412454. 0. 0.       2
6451203     0       1653453.     318940.5    2412452. 0. 0.       3
6451204     0       1653308.     318940.6    2412450. 0. 0.       4
6451205     0       1653164.     318941.     2412449. 0. 0.       5
6451206     0       1653020.     318941.     2412447. 0. 0.       6
6451207     0       1652875.     318941.     2412445. 0. 0.       7
6451208     0       1652731.     318941.     2412444. 0. 0.       8
6451209     0       1652586.     318941.     2412442. 0. 0.       9
6451210     0       1652442.     318941.4    2412440. 0. 0.       10
6451211     0       1652298.     318941.5    2412438. 0. 0.       11
6451212     0       1652154.     318941.7    2412436. 0. 0.       12
6451213     0       1652009.     318942.     2412435. 0. 0.       13
6451214     0       1651865.     318942.     2412433. 0. 0.       14
6451215     0       1651720.     318942.     2412431. 0. 0.       15
6451216     0       1651576.     318942.     2412430. 0. 0.       16
6451217     0       1651432.     318942.3    2412428. 0. 0.       17
6451218     0       1651287.     318942.5    2412426. 0. 0.       18
6451219     0       1651143.     318942.6    2412424. 0. 0.       19
6451220     0       1.651+6      318943.     2412422. 0. 0.       20
6451221     0       1650854.     318943.     2412421. 0. 0.       21
6451222     0       1650710.     318943.     2412419. 0. 0.       22
6451223     0       1650566.     318943.     2412417. 0. 0.       23
6451224     0       1650421.     318943.     2412416. 0. 0.       24
6451225     0       1650277.     318943.4    2412414. 0. 0.       25
6451226     0       1650132.     318943.5    2412412. 0. 0.       26
6451227     0       1649988.     318943.7    2412410. 0. 0.       27
6451228     0       1649844.     318944.     2412409. 0. 0.       28
6451229     0       1649700.     318944.     2412407. 0. 0.       29
6451230     0       1649555.     318944.     2412405. 0. 0.       30
6451231     0       1649411.     318944.     2412404. 0. 0.       31
6451232     0       1649266.     318944.3    2412402. 0. 0.       32
6451233     0       1649122.     318944.5    2412400. 0. 0.       33
6451234     0       1648978.     318944.6    2412398. 0. 0.       34
6451235     0       1648833.     318945.     2412396. 0. 0.       35
6451236     0       1648689.     318945.     2412395. 0. 0.       36
6451237     0       1648545.     318945.     2412393. 0. 0.       37
6451238     0       1648400.     318945.     2412391. 0. 0.       38
6451239     0       1648256.     318945.     2412390. 0. 0.       39
6451240     0       1648112.     318945.4    2412388. 0. 0.       40
6451241     0       1647967.     318945.5    2412386. 0. 0.       41
6451242     0       1647823.     318946.     2412384. 0. 0.       42
6451243     0       1647678.     318946.     2412382. 0. 0.       43
6451244     0       1647534.     318946.     2412381. 0. 0.       44
6451245     0       1647390.     318946.     2412379. 0. 0.       45
6451246     0       1647245.     318946.     2412377. 0. 0.       46
6451247     0       1647101.     318946.3    2412376. 0. 0.       47
6451248     0       1646957.     318946.5    2412374. 0. 0.       48
6451249     0       1646812.     318946.6    2412372. 0. 0.       49
6451250     0       1646668.     318947.     2412370. 0. 0.       50
*
*hydro        f velocity   g velocity    j velocity              jun
6451300 0
6451301       8.82122        8.82122      0.          1 * 2348.154
6451302       8.82122        8.82122      0.          2 * 2348.154
6451303       8.82122        8.82122      0.          3 * 2348.154
6451304       8.82122        8.82122      0.          4 * 2348.154
6451305       8.82122        8.82122      0.          5 * 2348.154
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6451306      8.82122         8.82122      0.          6 * 2348.154
6451307      8.82122         8.82122      0.          7 * 2348.154
6451308      8.82122         8.82122      0.          8 * 2348.154
6451309      8.82122         8.82122      0.          9 * 2348.154
6451310      8.82123         8.82123      0.         10 * 2348.154
6451311      8.82123         8.82123      0.         11 * 2348.154
6451312      8.82123         8.82123      0.         12 * 2348.154
6451313      8.82123         8.82123      0.         13 * 2348.154
6451314      8.82123         8.82123      0.         14 * 2348.154
6451315      8.82123         8.82123      0.         15 * 2348.154
6451316      8.82123         8.82123      0.         16 * 2348.154
6451317      8.82123         8.82123      0.         17 * 2348.154
6451318      8.82123         8.82123      0.         18 * 2348.154
6451319      8.82123         8.82123      0.         19 * 2348.154
6451320      8.82123         8.82123      0.         20 * 2348.154
6451321      8.82123         8.82123      0.         21 * 2348.154
6451322      8.82123         8.82123      0.         22 * 2348.154
6451323      8.82123         8.82123      0.         23 * 2348.154
6451324      8.82123         8.82123      0.         24 * 2348.154
6451325      8.82124         8.82124      0.         25 * 2348.154
6451326      8.82124         8.82124      0.         26 * 2348.154
6451327      8.82124         8.82124      0.         27 * 2348.154
6451328      8.82124         8.82124      0.         28 * 2348.154
6451329      8.82124         8.82124      0.         29 * 2348.154
6451330      8.82124         8.82124      0.         30 * 2348.154
6451331      8.82124         8.82124      0.         31 * 2348.154
6451332      8.82124         8.82124      0.         32 * 2348.154
6451333      8.82124         8.82124      0.         33 * 2348.154
6451334      8.82124         8.82124      0.         34 * 2348.154
6451335      8.82124         8.82124      0.         35 * 2348.154
6451336      8.82124         8.82124      0.         36 * 2348.154
6451337      8.82124         8.82124      0.         37 * 2348.154
6451338      8.82125         8.82125      0.         38 * 2348.154
6451339      8.82125         8.82125      0.         39 * 2348.154
6451340      8.82125         8.82125      0.         40 * 2348.154
6451341      8.82125         8.82125      0.         41 * 2348.154
6451342      8.82125         8.82125      0.         42 * 2348.154
6451343      8.82125         8.82125      0.         43 * 2348.154
6451344      8.82125         8.82125      0.         44 * 2348.154
6451345      8.82125         8.82125      0.         45 * 2348.154
6451346      8.82125         8.82125      0.         46 * 2348.154
6451347      8.82125         8.82125      0.         47 * 2348.154
6451348      8.82125         8.82125      0.         48 * 2348.154
6451349      8.82125         8.82125      0.         49 * 2348.154
*
*-------------------------------------------------------------------$
*hydro              component name       component type
6470000              "creout"               mtpljun
*-------------------------------------------------------------------$
6470001    2        0
*hydro    from          to           area      f loss     r loss     vcahs
6470011   641010000     645000000    0.          0.24       0.24     01000
6470012   1.0   1.0   1.0   0    0    0    1
6470021   645010000     650000000    0.          0.         0.       01000
6470022   1.0   1.0   1.0   0    0    0    2
*
6471011   8.8213   9.56404  1 * 2348.154
6471021   24.5026  24.5026  2 * 2348.154
*
6472011   0.56037 0.0 1.0 1.0 1
6472021   0.56037 0.0 1.0 1.0 2
*
*-------------------------------------------------------------------$
*hydro              component name       component type
6500000              "hothead"              pipe
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*-----------------------------------------------$-----------------$
6500001        48
*
*hydro         vol area                                          vol
6500101        0.08879                                           10
6500102        0.24663                                           48
*
*hydro         length                                            vol
6500301        0.168                                             10
6500302        0.195                                             28
6500303        0.1525                                            38
6500304        0.183                                             48
*
*hydro         volume                                            vol
6500401        0.                                                48
*
*hydro         vert angle                                        vol
6500601        0.                                                48
*
*hydro         elev. change                                      vol
6500701        0.                                                48
*
*hydro         roughness      hyd diam                           vol
6500801        0.0000457      0.33622                            10
6500802        0.0000457      0.56037                            48
*
*hydro         f loss         r loss                             jun
6500901        0.00           0.00                               37
6500902        0.20           0.20                               38
6500903        0.00           0.00                               47
*
*hydro         fe                                                vol
6501001        00                                                48
*
*hydro         vcahs                                             jun
6501101        01000                                             47
*
*hydro  ebt pressure     tempe                                    vol
6501201    0       1363569.     318928.5   2408301. 0. 0.       1
6501202    0       1361441.     318930.4   2408265. 0. 0.       2
6501203    0       1355926.     317584.7   2408171. 0. 0.       3
6501204    0       1353358.     317586.6   2408128. 0. 0.       4
6501205    0       1351262.     317588.5   2408092. 0. 0.       5
6501206    0       1349167.     317590.5   2408056. 0. 0.       6
6501207    0       1347071.     317592.4   2408020. 0. 0.       7
6501208    0       1344976.     317594.4   2407984. 0. 0.       8
6501209    0       1342880.     317596.    2407948. 0. 0.       9
6501210    0       1340784.     317598.    2407913. 0. 0.       10
6501211    0       1625159.     317558.    2412108. 0. 0.       11
6501212    0       1624993.     317558.    2412106. 0. 0.       12
6501213    0       1624820.     317558.    2412104. 0. 0.       13
6501214    0       1624646.     317558.4   2412102. 0. 0.       14
6501215    0       1624473.     317558.6   2412100. 0. 0.       15
6501216    0       1624300.     317559.    2412097. 0. 0.       16
6501217    0       1624127.     317559.    2412095. 0. 0.       17
6501218    0       1623954.     317559.    2412093. 0. 0.       18
6501219    0       1623781.     317559.    2412091. 0. 0.       19
6501220    0       1623608.     317559.4   2412089. 0. 0.       20
6501221    0       1623435.     317559.5   2412087. 0. 0.       21
6501222    0       1623262.     317560.    2412084. 0. 0.       22
6501223    0       1623088.     317560.    2412082. 0. 0.       23
6501224    0       1622915.     317560.    2412080. 0. 0.       24
6501225    0       1622742.     317560.    2412078. 0. 0.       25
6501226    0       1622569.     317560.3   2412076. 0. 0.       26
6501227    0       1622396.     317560.5   2412074. 0. 0.       27
```

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6501228     0       1622223.     317560.7   2412072. 0. 0.       28
6501229     0       1622069.     317546.7   2412070. 0. 0.       29
6501230     0       1621933.     317547.    2412068. 0. 0.       30
6501231     0       1621798.     317547.    2412066. 0. 0.       31
6501232     0       1621663.     317547.    2412065. 0. 0.       32
6501233     0       1621527.     317547.    2412063. 0. 0.       33
6501234     0       1621392.     317547.    2412062. 0. 0.       34
6501235     0       1621256.     317547.4   2412060. 0. 0.       35
6501236     0       1621121.     317547.5   2412058. 0. 0.       36
6501237     0       1620986.     317547.7   2412057. 0. 0.       37
6501238     0       1620850.     317548.    2412055. 0. 0.       38
6501239     0       1658609.     317480.6   2412514. 0. 0.       39
6501240     0       1658593.     317480.7   2412514. 0. 0.       40
6501241     0       1658578.     317480.7   2412514. 0. 0.       41
6501242     0       1658562.     317481.    2412514. 0. 0.       42
6501243     0       1658547.     317481.    2412514. 0. 0.       43
6501244     0       1658531.     317481.    2412514. 0. 0.       44
6501245     0       1658516.     317481.    2412514. 0. 0.       45
6501246     0       1658500.     317481.    2412513. 0. 0.       46
6501247     0       1658485.     317481.    2412513. 0. 0.       47
6501248     0       1658470.     317481.    2412513. 0. 0.       48
*
*hydro          vel/flw
6501300           0
*
*hydro         f flowrate   g flowrate    j flowrate              jun
6501301       24.50554       24.50554     0.          1 * 2348.154
6501302       24.50557       24.50557     0.          2 * 2348.154
6501303       24.65305       24.65305     0.          3 * 2362.76
6501304       24.6531        24.6531      0.          4 * 2362.76
6501305       24.6531        24.6531      0.          5 * 2362.76
6501306       24.65314       24.65314     0.          6 * 2362.76
6501307       24.65317       24.65317     0.          7 * 2362.76
6501308       24.6532        24.6532      0.          8 * 2362.76
6501309       24.65323       24.65323     0.          9 * 2362.76
6501310       24.65326       24.65326     0.          10 * 2362.76
6501311       8.87434        8.87434      0.          11 * 2362.76
6501312       8.87435        8.87435      0.          12 * 2362.76
6501313       8.87435        8.87435      0.          13 * 2362.76
6501314       8.87435        8.87435      0.          14 * 2362.76
6501315       8.87435        8.87435      0.          15 * 2362.76
6501316       8.87435        8.87435      0.          16 * 2362.76
6501317       8.87435        8.87435      0.          17 * 2362.76
6501318       8.87435        8.87435      0.          18 * 2362.76
6501319       8.87435        8.87435      0.          19 * 2362.76
6501320       8.87435        8.87435      0.          20 * 2362.76
6501321       8.87435        8.87435      0.          21 * 2362.76
6501322       8.87435        8.87435      0.          22 * 2362.76
6501323       8.87436        8.87436      0.          23 * 2362.76
6501324       8.87436        8.87436      0.          24 * 2362.76
6501325       8.87436        8.87436      0.          25 * 2362.76
6501326       8.87436        8.87436      0.          26 * 2362.76
6501327       8.87436        8.87436      0.          27 * 2362.76
6501328       8.87436        8.87436      0.          28 * 2362.76
6501329       8.87434        8.87434      0.          29 * 2362.76
6501330       8.87434        8.87434      0.          30 * 2362.76
6501331       8.87434        8.87434      0.          31 * 2362.76
6501332       8.87434        8.87434      0.          32 * 2362.76
6501333       8.87434        8.87434      0.          33 * 2362.76
6501334       8.87434        8.87434      0.          34 * 2362.76
6501335       8.87435        8.87435      0.          35 * 2362.76
6501336       8.87435        8.87435      0.          36 * 2362.76
6501337       8.87435        8.87435      0.          37 * 2362.76
6501338       2.699286       2.699286     0.          38 * 718.674
6501339       2.699214       2.699214     0.          39 * 718.674
6501340       2.699214       2.699214     0.          40 * 718.674
6501341       2.699214       2.699214     0.          41 * 718.674
6501342       2.699214       2.699214     0.          42 * 718.674
6501343       2.699214       2.699214     0.          43 * 718.674
6501344       2.699214       2.699214     0.          44 * 718.674
6501345       2.699214       2.699214     0.          45 * 718.674
6501346       2.699214       2.699214     0.          46 * 718.674
6501347       2.699214       2.699214     0.          47 * 718.674
*
*=================================================================$
*
*                  pressurizing system
*
*=================================================================$
*
*-----------------------------------------------------------------$
*hydro             component name       component type
8000000             "mutank"               tmdpvol
*-----------------------------------------------------------------$
*hydro         area        length       volume
8000101       1.e6          .0         1.0e+06
*
*hydro      horz angle  vert angle    delta z
8000102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
8000103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
8000200 003
*
*hydro   time     pressure     tempe
8000201   0.      0.165e6      300.
*
*-----------------------------------------------------------------$
*  trip valve to isolate the pressurizing system following
*  draining of the makeup tank
*-----------------------------------------------------------------$
*
8050000     isolate      valve
8050101    800000000    810000000 0.00811  0.48 0.48 01000
8050201     0              1.630935       1.630935        0. * 14.6041
8050300   trpvlv
8050301    615
*
*-----------------------------------------------------------------$
*hydro             component name       component type
8100000             "suction"              branch
*-------------------------------------------------$----------------$
*hydro           no. juns             vel/flw
8100001             0                    0
*
*hydro            area                 length              volume
8100101        0.00811                6.096                 0.
*
*hydro          horz angle           vert angle           delta z
8100102           0.                   0.                   0.
*
*hydro          roughness            hyd diam             fe
8100103         0.0000457              0.1016              00
*
*hydro  ebt pressure     tempe
8100200     0       161994.      97873.7 2343093. 0.
*
*-----------------------------------------------------------------
```

```
*hydro        component name     component type
8150000     mainprz     pump
*------------------------------------------------------------------
*hydro          area           length         volume
8150101       0.00811           0.              .0203
*
8150102            0.                   0.                   0.
*
*hydro         equil flag
8150103            00
*
*hydro       from       jun area     f loss      r loss      vcahs
8150108      810010000  0.00811       0.16        0.16       01000
*
*hydro        to         jun area     f loss      r loss      vcahs
8150109      820000000  0.00811       0.16        0.16       01000
*
*hydro  ebt pressure     tempe
8150200      0        933854.       100867.4 2398547. 0.
*
*hydro    vel/flw     f velocity       g velocity     j velocity
8150201              0                 1.630937          1.630937 0. * 14.6041
*
*hydro    vel/flw     f velocity       g velocity     j velocity
8150202 0    1.630604    1.630604   0. * 14.6041
*
*hydro      ptdi   2fazi   diff i   tork i   pvel i   trip no.   rvrs i
8150301      0      -1       -3       -1        0        540        0
*
*hydro   rated pump vel.   init/rated vel.   rated flow    rated head
8150302         221.55       1.11034           0.01366         106.39
*
*hydro    rated torque     mom of inertia    rated dens    mtr torque
8150303       217.82           2.381           1098.           .0
*
*hydro     coeff. tf2        coeff. tf0      coeff. tf1    coeff. tf3
8150304       2.1782            2.1782           0.            0.
*
*-------------------------------------------------------------------$
* single phase homologous curves
*-------------------------------------------------------------------$
* han homologous data
8151100 1 1 0.000 1.228  0.050 1.226  0.100 1.225
8151101 0.150 1.224  0.200 1.223  0.250 1.223
8151102 0.300 1.222  0.350 1.220  0.400 1.218
8151103 0.450 1.214  0.500 1.209  0.550 1.202
8151104 0.600 1.192  0.650 1.180  0.700 1.165
8151105 0.750 1.147  0.800 1.126  0.850 1.101
8151106 0.900 1.072  0.950 1.038  1.000 1.000
* hvn homologous data
8151200 1 2 0.513 -.270  0.526 -.233  0.541 -.195
8151201 0.556 -.155  0.571 -.113  0.588 -.069
8151202 0.606 -.023  0.625 0.025  0.645 0.076
8151203 0.667 0.130  0.690 0.187  0.714 0.249
8151204 0.741 0.316  0.769 0.388  0.800 0.466
8151205 0.833 0.551  0.870 0.646  0.909 0.751
8151206 0.952 0.868  1.000 1.000
* had homologous data taken from bingham pump in relap
8151300 1 3 -1. 2.5 -.9 2.28  -.63 2.  -.55 1.74
8151301 -.5 1.68  -.42 1.6  -.15 1.4  0. 1.228
* hvd homologous data taken from bingham pump in relap
8151400 1 4 -1. 2.5 -.9 2.28  -.63 2.  -.55 1.74
8151401 -.5 1.68  -.42 1.6  -.15 1.4  0. 1.228
* ban homologous data
8151500 2 1 0.000 0.470  0.050 0.500  0.100 0.529
8151501 0.150 0.559  0.200 0.589  0.250 0.618
8151502 0.300 0.648  0.350 0.677  0.400 0.706
8151503 0.450 0.734  0.500 0.762  0.550 0.789
8151504 0.600 0.816  0.650 0.842  0.700 0.867
8151505 0.750 0.892  0.800 0.915  0.850 0.938
8151506 0.900 0.960  0.950 0.980  1.000 1.000
* bvn homologous data
8151600 2 2 0.513 0.283  0.526 0.302  0.541 0.321
8151601 0.556 0.342  0.571 0.364  0.588 0.388
8151602 0.606 0.413  0.625 0.439  0.645 0.468
8151603 0.667 0.498  0.690 0.531  0.714 0.566
8151604 0.741 0.604  0.769 0.645  0.800 0.691
8151605 0.833 0.740  0.870 0.795  0.909 0.856
8151606 0.952 0.924  1.000 1.000
* bad homologous data taken from bingham pump in relap
8151700 2 3 -1. 2.5  -.8 2.  -.6 1.45  -.46 1.15
8151701 -.3 .95  -.13 .8  0. .8
* bvd homologous data taken from bingham pump in relap
8151800 2 4 -1. 2.5  -.65 2.15  -.4 1.79  -.30 1.61
8151801 -.13 1.5  0. 1.44
* pump trip
8156100  620  cntrlvar 815
*8156100  0  cntrlvar 591
8156101 -1.e6 -1.e6
8156102 1.e6 1.e6
*
*-------------------------------------------------------------------$
*hydro            component name      component type
8200000             "maindisc"           snglvol
*-------------------------------------------------$-----------------$
*hydro            area               length            volume
8200101        0.00811              30.48               0.
*
*hydro         horz angle          vert angle          delta z
8200102           0.                   0.                  0.
*
*hydro          roughness          hyd diam             fe
8200103        0.0000457            0.1016              00
*
*hydro  ebt pressure     tempe
8200200     0       1702409.     100875.4 2413038. 0.
*
*-------------------------------------------------------------------$
*hydro            component name      component type
8250000             "mainpump"           valve
*-------------------------------------------------$-----------------$
*hydro    from          to           area      f loss    r loss    vcahs
8250101   820010000     850000000    0.00811    1.28      1.28     01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
8250201     0              1.630025       1.630025        0. * 14.60408
*
*hydro                valve type
8250300                chkvlv
*
*hydro    chkvlv type  init. posn  back press  leak ratio
8250301        0           0           0.          0.
*
*-------------------------------------------------------------------$
*hydro            component name      component type
8260000              "mutank"             tmdpvol
*-------------------------------------------------------------------$
*hydro         area       length      volume
8260101       1.e6          .0       1.0e+06
*
```

```
*hydro      horz angle  vert angle    delta z
8260102         .0          .0          .0
*
*hydro       roughness   hyd diam       fe
8260103          .0          .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
8260200 003
*
*hydro   time     pressure     tempe
8260201   0.      0.165e6      300.
*
*---------------------------------------------------------------------$
* trip valve to shut off time dependent volume from przing system
* following draining of the makeup tank
*---------------------------------------------------------------------$
*
8270000  isolate valve
8270101 826000000 828000000 0.00811 0.48 0.48 01000
8270201     0              5.41742-42     -2.614093-21    0. * 4.8513-41
8270300 trpvlv
8270301  615
*
*---------------------------------------------------------------------$
*hydro             component name      component type
8280000             "suction"             branch
*-------------------------------------------$---------------------$
*hydro           no. juns            vel/flw
8280001             0                   0
*
*hydro            area               length              volume
8280101         0.00811              6.096                0.
*
*hydro         horz angle          vert angle           delta z
8280102           0.                  0.                   0.
*
*hydro          roughness           hyd diam             fe
8280103         0.0000457            0.1016               00
*
*hydro  ebt pressure     uf         ug         voidg
8280200     0       1.65+5       172710.5 2343686. 0.
*
*-------------------------------------------$---------------------$
*hydro             component name      component type
8300000             "standby"             pump
*-------------------------------------------$---------------------$
*hydro            area               length              volume
8300101         0.00811              0.                  0.0232
*
*hydro         horz angle          vert angle           delta z
8300102           0.                  0.                   0.
*
*hydro         equil flag
8300103           00
*
*hydro       from       jun area     f loss      r loss      vcahs
8300108     828010000  0.00811       0.16        0.16        01000
*
*hydro        to        jun area     f loss      r loss      vcahs
8300109     835000000  0.00811       0.16        0.16        01000
*
*hydro  ebt pressure     tempe
8300200     0       1.65+5       173854.8 2343686. 0.
*
*hydro    vel/flw     f velocity       g velocity     j velocity
8300201             0                1.249958-42       1.906844-21 0. *
+ * 1.11263-41
+ * 1.11263-41
+ * 1.11263-41
+ * 1.11263-41
+ * 1.611493-43
*
*hydro    vel/flw     f velocity       g velocity     j velocity
8300202 0   3.265025-43  -5.1268-22  0. * 2.90489-42
*
*hydro      ptdi   2fazi   diff i   tork i   pvel i   trip no.   rvrs i
8300301     815     -1      -3       -1       0         541        0
*
*hydro   rated pump vel.   init/rated vel.   rated flow    rated head
8300302        221.55       0.                0.01366        106.39
*
*hydro    rated torque     mom of inertia    rated dens    mtr torque
8300303       217.82           2.381            1098.          .0
*
*hydro     coeff. tf2        coeff. tf0       coeff. tf1    coeff. tf3
8300304      2.1782            2.1782            0.            0.
*
*hydro       trip no.          alpha vrc    numeric vrc
8306100       621               cntrlvar        817
*
*hydro      search arg         pump vel.
8306101      -1.e6              -1.e6
8306102       1.e6               1.e6
*
*---------------------------------------------------------------------$
*hydro             component name      component type
8350000             "sbdisc"              snglvol
*-------------------------------------------$---------------------$
*hydro            area               length              volume
8350101         0.00811              30.48                0.
*
*hydro         horz angle          vert angle           delta z
8350102           0.                  0.                   0.
*
*hydro          roughness           hyd diam             fe
8350103         0.0000457            0.1016               00
*
*hydro  ebt pressure     tempe
8350200     0       1.65+5       173871.5 2343686. 0.
*
*---------------------------------------------------------------------$
*hydro             component name      component type
8400000             "sbpump"              valve
*-------------------------------------------$---------------------$
*hydro    from          to           area      f loss      r loss     vcahs
8400101   835010000     850000000    0.00811    1.28        1.28      01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
8400201     0             0.             0.             0. * 0.
*
*hydro                valve type
8400300                chkvlv
*
*hydro    chkvlv type  init. posn  back press  leak ratio
8400301        0           1          0.          0.
*
*---------------------------------------------------------------------$
*hydro             component name      component type
8450000             "emerpump"            tmdpjun
*---------------------------------------------------------------------$
```

```
*hydro    from          to            area
8450101   810010000     850000000     0.001
*
*hydro    vel/flw       trip no.      alpha vrc      numeric vrc
8450200      0            542
*
*hydro   time           f velocity    g velocity     j velocity
8450201 -1.               0.            0.             00
8450202  0.               0.            0.             00
8450203  10.              25.           0.             00
8450204  1.e6             25.           0.             00
•
*-------------------------------------------------------------------------$
*hydro             component name      component type
8500000             "przrout"             branch
*-----------------------------------------$---------------------$
*hydro           no. juns            vel/flw
8500001            1                   0
*
*hydro            area               length              volume
8500101         0.00456               12.20               0.
*
*hydro         horz angle          vert angle           delta z
8500102          0.                  0.                  0.
*
*hydro          roughness          hyd diam             fe
8500103         0.0000457           0.0762              00
•
*hydro  ebt pressure     tempe
8500200     0       1686135.     100888.2 2412844. 0.
•
*hydro    from          to           area      f loss    r loss    vcahs
8501101   850010002     650030001    0.0       0.        0.        01100
*
*hydro                  f velocity    g velocity     j velocity
8501201               2.89904         2.89904          0. * 14.60408
•
*=========================================================================$
$
$                        letdown system
$
*=========================================================================$
•
*-------------------------------------------------------------------------$
*hydro             component name      component type
8610000             "letdown"             valve
*-----------------------------------------$---------------------$
*hydro    from          to           area      f loss    r loss    vcahs
8610101   106010000     865000000    0.000283  0.        0.        00100
*
*hydro    vel/flw       f flowrate    g flowrate     j flowrate
8610201     0              .0539757      .0539757       0. * 4.84941
*
*hydro                 valve type
8610300                 srvvlv
•
*hydro      cntrlvar   table no.
8610301       860          0
•
$=========================================================================$
*hydro             component name      component type
8620000             "letdown"             valve
*-----------------------------------------$---------------------$
*hydro    from          to           area      f loss    r loss    vcahs
8620101   206010000     865000000    0.000283  0.        0.        00100
•
*hydro    vel/flw       f flowrate    g flowrate     j flowrate
8620201     0              .0538995      .0538995       0. * 4.84253
•
*hydro                 valve type
8620300                 srvvlv
*
*hydro      cntrlvar   table no.
8620301       860          0
*
$=========================================================================$
*hydro             component name      component type
8630000             "letdown"             valve
*-----------------------------------------$---------------------$
*hydro    from          to           area      f loss    r loss    vcahs
8630101   306010000     865000000    0.000283  0.        0.        00100
*
*hydro    vel/flw       f flowrate    g flowrate     j flowrate
8630201     0              .0546713      .0546713       0. * 4.91202
•
*hydro                 valve type
8630300                 srvvlv
•
*hydro      cntrlvar   table no.
8630301       860          0
•
$=========================================================================$
*hydro             component name      component type
8650000             "ldoutlet"            branch
*-----------------------------------------$---------------------$
•hydro           no. juns            vel/flw
8650001            1                   0
•
*hydro            area               length              volume
8650101         0.3333                1.                  0.
*
*hydro         horz angle          vert angle           delta z
8650102          0.                  0.                  0.
•
*hydro          roughness          hyd diam             fe
8650103         0.0000457           0.                  00
*
*hydro  ebt pressure     tempe
8650200     0       99999.1      316965.5 2327831. 0.
*
*hydro    from          to           area      f loss    r loss    vcahs
8651101   865010000     870000000    0.3333    0.        0.        01000
*
*hydro                  f flowrate    g flowrate     j flowrate
8651201               .0406114        .0406114         0. * 14.60396
•
$=========================================================================$
•hydro             component name      component type
8700000             "ldsink"              tmdpvol
*-------------------------------------------------------------------------$
*hydro          area        length       volume
8700101         1.e6          .0         1.0e+06
*
*hydro       horz angle  vert angle    delta z
8700102          .0          .0           .0
*
•hydro        roughness   hyd diam       fe
8700103          .0          .0          10
•
*hydro  ebt         trip no.       alpha vrc      numeric vrc
```

```
8700200 003
*
*hydro   time     pressure     tempe
8700201  0.       0.1e6        356.5
*
*$---------------------------------------------------------------------$
* primary coolant system safety pressure relief valve
*---------------------------------------------------------------------$
*hydro              component name      component type
8800000              "relief"              valve
*-------------------------------------------$---------------------$
*hydro    from          to          area      f loss    r loss    vcahs
8800101  850010000     895000000    2.456e-4   0.        0.       01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
8800201    0              0.             0.             0. * 0.
*
*hydro                 valve type
8800300                 trpvlv
*
*hydro                 trip no.
8800301                 611
*
*$---------------------------------------------------------------------$
*hydro              component name      component type
8950000              "vlvsink"             tmdpvol
*---------------------------------------------------------------------$
*hydro         area       length      volume
8950101       1.e6          .0       1.0e+06
*
*hydro      horz angle  vert angle    delta z
8950102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
8950103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
8950200 002
*
*hydro   time     pressure     quale
8950201  0.       0.1e6        1.
*
*$---------------------------------------------------------------------$
*                                                                     $
*   >>>>>>>   individual heat exchanger/pump loops     <<<<<<<        $
*                                                                     $
*$---------------------------------------------------------------------$
*
*---------------------------------------------------------------------$
*
*       components 1xx - heat exchanger coolant loop 1
*
*---------------------------------------------------------------------$
*hydro              component name      component type
1010000              "hlsplit1"            pipe
*-------------------------------------------$---------------------$
1010001          36
*
*hydro          vol area                                          vol
1010101          0.08322                                         36
*
*hydro          length                                            vol
1010301          0.214                                            5
1010302          0.183                                           25
1010303          0.2                                             35
1010304          0.21                                            36
*
*hydro          volume                                            vol
1010401          0.0                                             36
*
*hydro         vert angle                                         vol
1010601          0.                                              36
*
*hydro         delta z                                           vol
1010701          0.                                              36
*
*hydro         roughness       hyd diam                          vol
1010801       0.0000457         0.3255                          36
*
*hydro         kf       kr                                       jun
1010901       0.0      0.0                                       4
1010902       0.182    0.182                                     5
1010903       0.0      0.0                                       24
1010904       0.182    0.182                                     25
1010905       0.0      0.0                                       35
*
*hydro            fe                                             vol
1011001          00                                              36
*
*hydro          vcahs                                             jun
1011101          01000                                           35
*
*hydro  ebt pressure     tempe                                    vol
1011201     0       1613056.     317520.    2411959. 0. 0.       1
1011202     0       1612681.     317520.    2411954. 0. 0.       2
1011203     0       1612305.     317520.4   2411950. 0. 0.       3
1011204     0       1611929.     317521.    2411945. 0. 0.       4
1011205     0       1611553.     317521.    2411940. 0. 0.       5
1011206     0       1603178.     317424.    2411837. 0. 0.       6
1011207     0       1602857.     317424.6   2411833. 0. 0.       7
1011208     0       1602536.     317425.    2411829. 0. 0.       8
1011209     0       1602214.     317425.    2411825. 0. 0.       9
1011210     0       1601892.     317425.5   2411821. 0. 0.       10
1011211     0       1601571.     317426.    2411817. 0. 0.       11
1011212     0       1601250.     317426.    2411813. 0. 0.       12
1011213     0       1600928.     317426.4   2411809. 0. 0.       13
1011214     0       1600606.     317427.    2411805. 0. 0.       14
1011215     0       1600285.     317427.    2411801. 0. 0.       15
1011216     0       1599963.     317427.    2411797. 0. 0.       16
1011217     0       1599642.     317427.6   2411793. 0. 0.       17
1011218     0       1599320.     317428.    2411789. 0. 0.       18
1011219     0       1.599+6      317428.    2411785. 0. 0.       19
1011220     0       1598677.     317428.5   2411781. 0. 0.       20
1011221     0       1598356.     317429.    2411777. 0. 0.       21
1011222     0       1598034.     317429.    2411773. 0. 0.       22
1011223     0       1597713.     317429.4   2411769. 0. 0.       23
1011224     0       1597391.     317429.7   2411765. 0. 0.       24
1011225     0       1597070.     317430.    2411761. 0. 0.       25
1011226     0       1588707.     317372.    2411657. 0. 0.       26
1011227     0       1588356.     317372.    2411653. 0. 0.       27
1011228     0       1588005.     317372.3   2411648. 0. 0.       28
1011229     0       1587653.     317373.    2411644. 0. 0.       29
1011230     0       1587302.     317373.    2411640. 0. 0.       30
1011231     0       1586951.     317373.3   2411635. 0. 0.       31
1011232     0       1586599.     317373.7   2411631. 0. 0.       32
1011233     0       1586248.     317374.    2411626. 0. 0.       33
1011234     0       1585896.     317374.    2411622. 0. 0.       34
1011235     0       1585545.     317374.6   2411618. 0. 0.       35
1011236     0       1585185.     317375.    2411613. 0. 0.       36
*
```

```
*hydro          vel/flw
1011300           0
*
*hydro        f velocity   g velocity    j velocity              jun
1011301       9.03406        9.03406      0.          1 * 811.611
1011302       9.03407        9.03407      0.          2 * 811.611
1011303       9.03407        9.03407      0.          3 * 811.611
1011304       9.03407        9.03407      0.          4 * 811.611
1011305       9.03407        9.03407      0.          5 * 811.611
1011306       9.03397        9.03397      0.          6 * 811.611
1011307       9.03397        9.03397      0.          7 * 811.611
1011308       9.03398        9.03398      0.          8 * 811.611
1011309       9.03398        9.03398      0.          9 * 811.611
1011310       9.03398        9.03398      0.         10 * 811.611
1011311       9.03398        9.03398      0.         11 * 811.611
1011312       9.03398        9.03398      0.         12 * 811.611
1011313       9.03399        9.03399      0.         13 * 811.611
1011314       9.03399        9.03399      0.         14 * 811.611
1011315       9.03399        9.03399      0.         15 * 811.611
1011316       9.03399        9.03399      0.         16 * 811.611
1011317       9.034          9.034        0.         17 * 811.611
1011318       9.034          9.034        0.         18 * 811.611
1011319       9.034          9.034        0.         19 * 811.611
1011320       9.034          9.034        0.         20 * 811.611
1011321       9.034          9.034        0.         21 * 811.611
1011322       9.034          9.034        0.         22 * 811.611
1011323       9.034          9.034        0.         23 * 811.611
1011324       9.034          9.034        0.         24 * 811.611
1011325       9.034          9.034        0.         25 * 811.611
1011326       9.03396        9.03396      0.         26 * 811.611
1011327       9.03396        9.03396      0.         27 * 811.611
1011328       9.03396        9.03396      0.         28 * 811.611
1011329       9.03396        9.03396      0.         29 * 811.611
1011330       9.03397        9.03397      0.         30 * 811.611
1011331       9.03397        9.03397      0.         31 * 811.611
1011332       9.03397        9.03397      0.         32 * 811.611
1011333       9.03397        9.03397      0.         33 * 811.611
1011334       9.03397        9.03397      0.         34 * 811.611
1011335       9.03397        9.03397      0.         35 * 811.611
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1030000             "hlspij"               mtpljun
*-------------------------------------------------------------------$
1030001    1        0
*hydro    from          to           area      f loss    r loss    vcahs
1030011   650380002     101010001    0.24663     1.20      1.20     01000
1030012   1.0   1.0   1.0   0    0    0    1
*
1031011   3.048353 3.048353 1 * 811.611
*
1032011   0.56037 0.0 1.0 1.0 1
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1020000             "isolate"              valve
*-----------------------------------------$--------------------$
*hydro    from          to           area      f loss    r loss    vcahs
1020101   101010000     104000000    0.08322   0.104     0.104     01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
1020201    0              9.03398        9.03398        0. * 811.611
*
*hydro               valve type
1020300               trpvlv
```

```
*
*hydro                trip no.
1020301                 515
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1040000             "hotleg"               pipe
*-----------------------------------------$--------------------$
1040001          81
*
*hydro         vol area                                          vol
1040101        0.08322                                           81
*
*hydro          length                                           vol
1040301          0.23                                            3
1040302          0.2                                             67
1040303          0.15                                            68
1040304          0.2                                             80
1040305          0.11                                            81
*
*hydro          volume                                           vol
1040401          0.                                              81
*
*hydro          volume                                           vol
1040501          0.                                              81
*
*hydro        vert angle                                         vol
1040601          0.                                              68
1040602          90.                                             81
*
*hydro         delta z                                           vol
1040701          0.0                                             68
1040702          0.2                                             80
1040703          0.04                                            81
*
*hydro        roughness      hyd diam                           vol
1040801      0.0000457       0.3255                             81
*
*hydro          f loss         r loss                           jun
1040901          0.0            0.0                             67
1040902          0.24           0.24                            68
1040903          0.0            0.0                             80
*
*hydro           fe                                             vol
1041001          00                                              81
*
*hydro          vcahs                                            jun
1041101          01000                                           80
*
*hydro  ebt pressure     tempe                                   vol
1041201    0       1580212.     317357.    2411551. 0. 0.       1
1041202    0       1579808.     317357.4   2411546. 0. 0.       2
1041203    0       1579404.     317358.    2411541. 0. 0.       3
1041204    0       1579622.     317015.    2411544. 0. 0.       4
1041205    0       1578681.     317015.    2411532. 0. 0.       5
1041206    0       1578330.     317016.    2411527. 0. 0.       6
1041207    0       1577978.     317016.    2411523. 0. 0.       7
1041208    0       1577627.     317016.6   2411518. 0. 0.       8
1041209    0       1577276.     317017.    2411514. 0. 0.       9
1041210    0       1576924.     317017.3   2411510. 0. 0.       10
1041211    0       1576573.     317017.7   2411505. 0. 0.       11
1041212    0       1576222.     317018.    2411501. 0. 0.       12
1041213    0       1575870.     317018.    2411496. 0. 0.       13
1041214    0       1575519.     317018.5   2411492. 0. 0.       14
1041215    0       1575168.     317019.    2411488. 0. 0.       15
```

```
1041216   0      1574816.    317019.    2411483. 0. 0.      16
1041217   0      1574465.    317019.4   2411479. 0. 0.      17
1041218   0      1574114.    317020.    2411474. 0. 0.      18
1041219   0      1573763.    317020.    2411470. 0. 0.      19
1041220   0      1573411.    317020.4   2411466. 0. 0.      20
1041221   0      1573060.    317021.    2411461. 0. 0.      21
1041222   0      1572709.    317021.    2411457. 0. 0.      22
1041223   0      1572357.    317021.4   2411452. 0. 0.      23
1041224   0      1572006.    317022.    2411448. 0. 0.      24
1041225   0      1571655.    317022.    2411444. 0. 0.      25
1041226   0      1571304.    317022.4   2411439. 0. 0.      26
1041227   0      1570952.    317023.    2411434. 0. 0.      27
1041228   0      1570601.    317023.    2411430. 0. 0.      28
1041229   0      1570250.    317023.3   2411426. 0. 0.      29
1041230   0      1569898.    317023.7   2411421. 0. 0.      30
1041231   0      1569547.    317024.    2411417. 0. 0.      31
1041232   0      1569196.    317024.3   2411412. 0. 0.      32
1041233   0      1568844.    317024.6   2411408. 0. 0.      33
1041234   0      1568493.    317025.    2411404. 0. 0.      34
1041235   0      1568142.    317025.    2411399. 0. 0.      35
1041236   0      1567790.    317025.6   2411395. 0. 0.      36
1041237   0      1567439.    317026.    2411390. 0. 0.      37
1041238   0      1567088.    317026.    2411386. 0. 0.      38
1041239   0      1566737.    317026.6   2411382. 0. 0.      39
1041240   0      1566385.    317027.    2411377. 0. 0.      40
1041241   0      1566034.    317027.    2411372. 0. 0.      41
1041242   0      1565683.    317027.6   2411368. 0. 0.      42
1041243   0      1565332.    317028.    2411364. 0. 0.      43
1041244   0      1564980.    317028.    2411359. 0. 0.      44
1041245   0      1564629.    317028.6   2411355. 0. 0.      45
1041246   0      1564278.    317029.    2411350. 0. 0.      46
1041247   0      1563926.    317029.    2411346. 0. 0.      47
1041248   0      1563575.    317029.5   2411342. 0. 0.      48
1041249   0      1563224.    317030.    2411337. 0. 0.      49
1041250   0      1562872.    317030.    2411333. 0. 0.      50
1041251   0      1562521.    317030.5   2411328. 0. 0.      51
1041252   0      1562170.    317031.    2411324. 0. 0.      52
1041253   0      1561818.    317031.    2411320. 0. 0.      53
1041254   0      1561467.    317031.5   2411315. 0. 0.      54
1041255   0      1561116.    317032.    2411310. 0. 0.      55
1041256   0      1560764.    317032.    2411306. 0. 0.      56
1041257   0      1560413.    317032.5   2411302. 0. 0.      57
1041258   0      1560062.    317033.    2411297. 0. 0.      58
1041259   0      1559711.    317033.    2411293. 0. 0.      59
1041260   0      1559359.    317033.4   2411288. 0. 0.      60
1041261   0      1559008.    317034.    2411284. 0. 0.      61
1041262   0      1558657.    317034.    2411280. 0. 0.      62
1041263   0      1558306.    317034.4   2411275. 0. 0.      63
1041264   0      1557954.    317035.    2411270. 0. 0.      64
1041265   0      1557603.    317035.    2411266. 0. 0.      65
1041266   0      1557252.    317035.4   2411262. 0. 0.      66
1041267   0      1556900.    317036.    2411257. 0. 0.      67
1041268   0      1556593.    317036.    2411253. 0. 0.      68
1041269   0      1544643.    317036.    2411101. 0. 0.      69
1041270   0      1542174.    317036.6   2411070. 0. 0.      70
1041271   0      1539705.    317037.    2411038. 0. 0.      71
1041272   0      1537236.    317037.    2411007. 0. 0.      72
1041273   0      1534767.    317037.6   2410975. 0. 0.      73
1041274   0      1532298.    317038.    2410944. 0. 0.      74
1041275   0      1529830.    317038.    2410912. 0. 0.      75
1041276   0      1527361.    317038.5   2410880. 0. 0.      76
1041277   0      1524892.    317039.    2410848. 0. 0.      77
1041278   0      1522423.    317039.    2410816. 0. 0.      78
1041279   0      1519954.    317039.5   2410784. 0. 0.      79
1041280   0      1517486.    316974.    2410752. 0. 0.      80
1041281   0      1515944.    316974.3   2410733. 0. 0.      81
*
*hydro          vel/flw
1041300           0
*
*hydro          f flowrate    g flowrate    j flowrate              jun
1041301        9.03397       9.03397       0.          1 * 811.611
1041302        9.03397       9.03397       0.          2 * 811.611
1041303        9.03398       9.03398       0.          3 * 811.611
1041304        9.03355       9.03355       0.          4 * 811.615
1041305        9.03356       9.03356       0.          5 * 811.615
1041306        9.03356       9.03356       0.          6 * 811.615
1041307        9.03356       9.03356       0.          7 * 811.615
1041308        9.03356       9.03356       0.          8 * 811.615
1041309        9.03357       9.03357       0.          9 * 811.615
1041310        9.03357       9.03357       0.          10 * 811.615
1041311        9.03357       9.03357       0.          11 * 811.615
1041312        9.03357       9.03357       0.          12 * 811.615
1041313        9.03357       9.03357       0.          13 * 811.615
1041314        9.03358       9.03358       0.          14 * 811.615
1041315        9.03358       9.03358       0.          15 * 811.615
1041316        9.03358       9.03358       0.          16 * 811.615
1041317        9.03358       9.03358       0.          17 * 811.615
1041318        9.03358       9.03358       0.          18 * 811.615
1041319        9.03358       9.03358       0.          19 * 811.615
1041320        9.03359       9.03359       0.          20 * 811.615
1041321        9.03359       9.03359       0.          21 * 811.615
1041322        9.03359       9.03359       0.          22 * 811.615
1041323        9.0336        9.0336        0.          23 * 811.615
1041324        9.0336        9.0336        0.          24 * 811.615
1041325        9.0336        9.0336        0.          25 * 811.615
1041326        9.0336        9.0336        0.          26 * 811.615
1041327        9.0336        9.0336        0.          27 * 811.615
1041328        9.0336        9.0336        0.          28 * 811.615
1041329        9.0336        9.0336        0.          29 * 811.615
1041330        9.0336        9.0336        0.          30 * 811.615
1041331        9.0336        9.0336        0.          31 * 811.615
1041332        9.0336        9.0336        0.          32 * 811.615
1041333        9.03361       9.03361       0.          33 * 811.615
1041334        9.03361       9.03361       0.          34 * 811.615
1041335        9.03361       9.03361       0.          35 * 811.615
1041336        9.03361       9.03361       0.          36 * 811.615
1041337        9.03362       9.03362       0.          37 * 811.615
1041338        9.03362       9.03362       0.          38 * 811.615
1041339        9.03362       9.03362       0.          39 * 811.615
1041340        9.03362       9.03362       0.          40 * 811.615
1041341        9.03362       9.03362       0.          41 * 811.615
1041342        9.03363       9.03363       0.          42 * 811.615
1041343        9.03363       9.03363       0.          43 * 811.615
1041344        9.03363       9.03363       0.          44 * 811.615
1041345        9.03363       9.03363       0.          45 * 811.615
1041346        9.03363       9.03363       0.          46 * 811.615
1041347        9.03363       9.03363       0.          47 * 811.615
1041348        9.03364       9.03364       0.          48 * 811.615
1041349        9.03364       9.03364       0.          49 * 811.615
1041350        9.03364       9.03364       0.          50 * 811.615
1041351        9.03364       9.03364       0.          51 * 811.615
1041352        9.03364       9.03364       0.          52 * 811.615
1041353        9.03364       9.03364       0.          53 * 811.615
1041354        9.03365       9.03365       0.          54 * 811.615
1041355        9.03365       9.03365       0.          55 * 811.615
1041356        9.03365       9.03365       0.          56 * 811.615
1041357        9.03365       9.03365       0.          57 * 811.615
1041358        9.03365       9.03365       0.          58 * 811.615
1041359        9.03366       9.03366       0.          59 * 811.615
```

```
1041360       9.03366          9.03366       0.          60 * 811.615
1041361       9.03366          9.03366       0.          61 * 811.615
1041362       9.03366          9.03366       0.          62 * 811.615
1041363       9.03366          9.03366       0.          63 * 811.615
1041364       9.03366          9.03366       0.          64 * 811.615
1041365       9.03367          9.03367       0.          65 * 811.615
1041366       9.03367          9.03367       0.          66 * 811.615
1041367       9.03367          9.03367       0.          67 * 811.615
1041368       9.03367          9.03367       0.          68 * 811.615
1041369       9.03372          9.68787       0.          69 * 811.615
1041370       9.03373          9.68793       0.          70 * 811.615
1041371       9.03374          9.688         0.          71 * 811.615
1041372       9.03375          9.68806       0.          72 * 811.615
1041373       9.03376          9.68812       0.          73 * 811.615
1041374       9.03377          9.68819       0.          74 * 811.615
1041375       9.03378          9.68825       0.          75 * 811.615
1041376       9.03379          9.68831       0.          76 * 811.615
1041377       9.0338           9.68838       0.          77 * 811.615
1041378       9.03381          9.68844       0.          78 * 811.615
1041379       9.03382          9.6885        0.          79 * 811.615
1041380       9.03374          9.68848       0.          80 * 811.615
*
*$------------------------------------------------------------------$
*
*               main heat exchanger - loop 1
*
*$------------------------------------------------------------------$
*
*$------------------------------------------------------------------$
*hydro             component name       component type
1060000             "hxplin1"              branch
*-------------------------------------------------$-------------------$
*hydro            no. juns             vel/flw
1060001             2                    0
*
*hydro             area                 length               volume
1060101           0.08322                1.0                  0.
*
*hydro          horz angle           vert angle           delta z
1060102            0.                   0.                   0.
*
*hydro          roughness            hyd diam              fe
1060103          0.0000457              0.3255               0
*
*hydro  ebt pressure     tempe
1060200     0        1557948.     316976.  2411270. 0.
*
*hydro    from          to           area       f loss     r loss     vcahs
1061101 106000000    108000000        0.          0.15       0.15    01000
1062101 104010000    106000000        0.          0.         0.      01000
*
*hydro   hyd diam
1061110 0.3255   0.0 1.0 1.0
1062110 0.3255   0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
1061201                 8.9796         8.9796           0. * 806.766
1062201                 9.03375        9.6885           0. * 811.615
*
*------------------------------------------------------------------*
*hydro             component name       component type
1080000             "mhx-prim"             pipe
*-------------------------------------------------$-----------------$
1080001          11
*
```

```
*hydro          vol area                                          vol
1080101          0.8258                                            5
1080102          0.841                                             6
1080103          0.8258                                           11
*
*hydro           length                                           vol
1080301            1.11                                            5
1080302            2.03                                            6
1080303            1.11                                           11
*
*hydro           volume                                           vol
1080401            0.                                             11
*
*hydro         vert angle                                         vol
1080601            0.                                             11
*
*hydro          delta z                                           vol
1080701            0.0                                            11
*
*hydro         roughness       hyd diam                           vol
1080801         0.0000457      0.636                               5
1080802         0.0000457      0.894                               6
1080803         0.0000457      0.636                              11
*
*hydro            fe                                              vol
1081001           00                                              11
*
*hydro           vcahs                                            jun
1081101          01000                                            10
*
*hydro  ebt pressure     tempe                                     vol
1081201     0        1549239.     285799.    2411160. 0. 0.        1
1081202     0        1549232.     258784.    2411160. 0. 0.        2
1081203     0        1549226.     235249.5   2411160. 0. 0.        3
1081204     0        1549218.     214645.5   2411160. 0. 0.        4
1081205     0        1549210.     196523.3   2411160. 0. 0.        5
1081206     0        1549216.     196512.6   2411160. 0. 0.        6
1081207     0        1549190.     192532.8   2411159. 0. 0.        7
1081208     0        1549180.     188953.    2411159. 0. 0.        8
1081209     0        1549171.     185729.5   2411159. 0. 0.        9
1081210     0        1549161.     182824.3   2411159. 0. 0.       10
1081211     0        1549151.     180203.    2411159. 0. 0.       11
*
*hydro          f velocity    g velocity    j velocity                jun
1081300 0
1081301         .900856          .900856       0.          1 * 806.766
1081302         .897605          .897605       0.          2 * 806.766
1081303         .894986          .894986       0.          3 * 806.765
1081304         .892862          .892862       0.          4 * 806.765
1081305         .89113           .89113        0.          5 * 806.765
1081306         .89113           .89113        0.          6 * 806.765
1081307         .890767          .890767       0.          7 * 806.765
1081308         .890446          .890446       0.          8 * 806.765
1081309         .890162          .890162       0.          9 * 806.764
1081310         .88991           .88991        0.         10 * 806.764
*
*hydro   jun hyd diam                                              jun
1081401      0.100       0.0 1.0 1.0                               10
*
*$------------------------------------------------------------------$
*hydro             component name       component type
1120000             "hxplout1"             branch
*-------------------------------------------------$-------------------$
*hydro            no. juns             vel/flw
1120001             2                    0
```

```
*
*hydro            area                length              volume
1120101          0.08322               1.0                 0.
*
*hydro          horz angle          vert angle          delta z
1120102             0.                  0.                  0.
*
*hydro          roughness           hyd diam             fe
1120103          0.0000457             0.3255              0
*
*hydro  ebt pressure     tempe
1120200     0       1499502.     180204.5 2410518. 0.
*
*hydro    from          to            area      f loss    r loss    vcahs
1121101 108010000    112000000        0.          0.15      0.15    01000
1122101 112010000    113000000        0.08322     0.        0.      01000
*
*hydro   hyd diam
1121110 0.3255  0.0 1.0 1.0
1122110 0.3255 0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
1121201                  8.82843        8.82843          0. * 806.764
1122201                  8.82862        8.82862          0. * 806.764
*
*-----------------------------------------------------------------------$
*hydro              component name      component type
1130000             "joinhx"              pipe
*-------------------------------------------------$-------------------$
1130001           19
*
*hydro          vol area                                          vol
1130101          0.08322                                         19
*
*hydro           length                                           vol
1130301          0.1981                                          10
1130302          0.205                                           16
1130303          0.2032                                          19
*
*hydro           volume                                           vol
1130401            0.                                            19
*
*hydro          vert angle                                       vol
1130601            -22.6                                         10
1130602            -29.7                                         16
1130603            -90.                                          19
*
*hydro          elev. change                                     vol
1130701            -0.0762                                       10
1130702            -0.10155                                      16
1130703            -0.2032                                       19
*
*hydro          roughness       hyd diam                         vol
1130801         0.0000457        0.3255                          19
*
*hydro           f loss         r loss                           jun
1130901           0.0            0.0                             9
1130902           0.182          0.182                           10
1130903           0.0            0.0                             15
1130904           0.182          0.182                           16
1130905           0.0            0.0                             18
*
*hydro             fe                                            vol
1131001           00                                            19
*
```

```
*hydro           vcahs                                           jun
1131101          01000                                           18
*
*hydro  ebt pressure     tempe                                    vol
1131201     0       1498879.     180204.8   2410508. 0. 0.       1
1131202     0       1499358.     180205.    2410516. 0. 0.       2
1131203     0       1499838.     180205.4   2410523. 0. 0.       3
1131204     0       1500317.     180205.7   2410530. 0. 0.       4
1131205     0       1500797.     180206.    2410536. 0. 0.       5
1131206     0       1501276.     180206.3   2410542. 0. 0.       6
1131207     0       1501756.     180206.6   2410548. 0. 0.       7
1131208     0       1502235.     180207.    2410555. 0. 0.       8
1131209     0       1502715.     180207.3   2410561. 0. 0.       9
1131210     0       1503194.     180207.6   2410567. 0. 0.       10
1131211     0       1496007.     180208.    2410463. 0. 0.       11
1131212     0       1496747.     180208.2   2410474. 0. 0.       12
1131213     0       1497488.     180208.5   2410486. 0. 0.       13
1131214     0       1498228.     180209.    2410498. 0. 0.       14
1131215     0       1498969.     180209.2   2410509. 0. 0.       15
1131216     0       1499709.     180209.5   2410521. 0. 0.       16
1131217     0       1493201.     180209.8   2410418. 0. 0.       17
1131218     0       1495040.     180210.    2410448. 0. 0.       18
1131219     0       1496878.     180210.5   2410476. 0. 0.       19
*
*hydro          vel/flw
1131300            0
*
*hydro          f flowrate    g flowrate    j flowrate                jun
1131301         8.82862          8.82862       0.          1 * 806.764
1131302         8.82862          8.82862       0.          2 * 806.764
1131303         8.82862          8.82862       0.          3 * 806.764
1131304         8.82862          8.82862       0.          4 * 806.764
1131305         8.82862          8.82862       0.          5 * 806.764
1131306         8.82862          8.82862       0.          6 * 806.764
1131307         8.82862          8.82862       0.          7 * 806.764
1131308         8.82861          8.82861       0.          8 * 806.764
1131309         8.82861          8.82861       0.          9 * 806.764
1131310         8.82861          8.82861       0.          10 * 806.764
1131311         8.82864          8.82864       0.          11 * 806.764
1131312         8.82864          8.82864       0.          12 * 806.764
1131313         8.82863          8.82863       0.          13 * 806.764
1131314         8.82863          8.82863       0.          14 * 806.764
1131315         8.82863          8.82863       0.          15 * 806.764
1131316         8.82863          8.82863       0.          16 * 806.764
1131317         8.82865          9.47656       0.          17 * 806.764
1131318         8.82864          9.47651       0.          18 * 806.764
*
*-----------------------------------------------------------------------$
*       main heat exchanger secondary flow system (tube side)           $
*-----------------------------------------------------------------------$
*
*-----------------------------------------------------------------------*
*hydro              component name      component type
1300000             "secsrc1"             tmdpvol
*-----------------------------------------------------------------------*
*hydro          area         length       volume
1300101         1.e6            .0        1.0e+06
*
*hydro       horz angle   vert angle     delta z
1300102           .0           .0            .0
*
*hydro       roughness    hyd diam        fe
1300103           .0           .0           10
*
*hydro  ebt         trip no.        alpha vrc       numeric vrc
```

```
1300200 003
*
*hydro   time     pressure     tempe
1300201   0.      5.000e5      302.55
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
1320000             "sectdj1"            tmdpjun
*-------------------------------------------------------------------------*
*hydro    from          to             area
1320101   130000000     134000000      0.7122
*
*hydro    vel/flw       trip no.       alpha vrc      numeric vrc
1320200     1             0             cntrlvar          598
*
*hydro   time           f flow         g flow         j flow
1320201  -1.e6          -1.e6           0.                0
1320202   1.e6           1.e6           0.                0
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
1340000             "mhx-sec"              pipe
*-------------------------------------------------$-----------------$
1340001          10
*
*hydro          vol area                                              vol
1340101         0.776                                                  10
*
*hydro           length                                               vol
1340301           1.314                                                10
*
*hydro           volume                                               vol
1340401           0.                                                   10
*
*hydro         vert angle                                             vol
1340601           0.                                                   10
*
*hydro          delta z                                               vol
1340701           0.0                                                  10
*
*hydro         roughness      hyd diam                                vol
1340801         0.0000457      0.01588                                10
*
*hydro            fe                                                  vol
1341001           00                                                   10
*
*hydro           vcahs                                                jun
1341101          01000                                                 9
*
*hydro  ebt pressure     tempe                                         vol
1341201     0       499089.      131802.2    2559869. 0. 0.       1
1341202     0       493515.      141690.     2559514. 0. 0.       2
1341203     0       487959.      152982.3    2559156. 0. 0.       3
1341204     0       482423.      165942.8    2558796. 0. 0.       4
1341205     0       476906.      180898.     2558434. 0. 0.       5
1341206     0       471395.5     182158.     2558069. 0. 0.       6
1341207     0       465889.      183554.2    2557700. 0. 0.       7
1341208     0       460385.      185102.7    2557329. 0. 0.       8
1341209     0       454882.      186822.     2556954. 0. 0.       9
1341210     0       449381.      188732.7    2556576. 0. 0.       10
*
*hydro         f velocity   g velocity    j velocity                jun
1341300 0
1341301       2.176145        2.176145     0.            1 * 1681.036
1341302       2.177846        2.177846     0.            2 * 1681.036
1341303       2.179917        2.179917     0.            3 * 1681.036
1341304       2.182453        2.182453     0.            4 * 1681.036
1341305       2.185586        2.185586     0.            5 * 1681.036
1341306       2.185864        2.185864     0.            6 * 1681.036
1341307       2.186174        2.186174     0.            7 * 1681.036
1341308       2.18652         2.18652      0.            8 * 1681.036
1341309       2.186904        2.186904     0.            9 * 1681.036
*
*hydro   jun hyd diam                                                   jun
1341401      0.01588     0.0 1.0 1.0                                    9
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
1350000             "tubeout"              sngljun
*-----------------------------------------*---------------------*
*hydro    from          to             area      f loss    r loss    vcahs
1350101   134010000     136000000      0.0         0.        0.      01000
*
*hydro   hyd diam
1350110   0.01588      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1350201     0              2.187335       2.187335       0. * 1681.036
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
1360000             "secsnk1"              tmdpvol
*-------------------------------------------------------------------------*
*hydro         area        length       volume
1360101        1.e6         .0         1.0e+06
*
*hydro      horz angle  vert angle    delta z
1360102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
1360103          .0         .0           10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
1360200 003
*
*hydro   time     pressure     tempe
1360201   0.      4.490e5      319.
*
*=========================================================================$
*
*        emergency heat exchanger - loop 1
*
*=========================================================================$
*
*-------------------------------------------------------------------------$
*hydro             component name       component type
1140000               hxplin1                branch
*-----------------------------------------$---------------------$
*hydro          no. juns             vel/flw
1140001            2                    0
*
*hydro           area                 length              volume
1140101         0.08322                1.0                 0.
*
*hydro        horz angle           vert angle           delta z
1140102          0.                   0.                   0.
*
*hydro         roughness           hyd diam             fe
1140103        0.0000457            0.3255               0
*
```

```
*hydro  ebt pressure     tempe
1140200      0       1538888.     180212.  2411028. 0.
*
*hydro    from          to           area       f loss     r loss     vcahs
1141101 114000000     116000000        0.          0.15       0.15    01000
1142101 113010000     114000000        0.          0.         0.      01000
*
*hydro   hyd diam
1141110 0.3255    0.0 1.0 1.0
1142110 0.3255    0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
1141201                 8.82847        8.82847          0. * 806.764
1142201                 8.82864        9.47646          0. * 806.764
*
*----------------------------------------------------------------------*
*hydro              component name       component type
1160000              "ehx-prim"               pipe
*-------------------------------------------------$------------------$
1160001           4
*
*hydro          vol area                                          vol
1160101          0.894                                            4
*
*hydro          length                                            vol
1160301            1.6                                            4
*
*hydro          volume                                            vol
1160401            0.                                             /4
*
*hydro         vert angle                                         vol
1160601            0.                                             4
*
*hydro          delta z                                           vol
1160701            0.0                                            4
*
* calibrated hydraulic diameter to match pressure drop
*
*hydro         roughness       hyd diam                           vol
*1160801         0.0000457       0.0346                          4
1160801          0.0000457       0.00170                         4
*
*hydro          f loss          r loss                            jun
1160901          0.0             0.0                             3
*
*hydro            fe                                             vol
1161001          00                                              4
*
*hydro          vcahs                                             jun
1161101          01000                                           3
*
*hydro  ebt pressure     tempe                                     vol
1161201     0       1525246.     180191.    2410853. 0. 0.        1
1161202     0       1514964.     180129.    2410720. 0. 0.        2
1161203     0       1504717.     179844.    2410587. 0. 0.        3
1161204     0       1494503.     178215.    2410439. 0. 0.        4
*
*hydro         f velocity   g velocity    j velocity               jun
1161300 0
1161301       .821821          .821821      0.           1 * 806.764
1161302       .82182           .82182       0.           2 * 806.763
1161303       .821801          .821801      0.           3 * 806.763
*
*hydro   jun hyd diam                                              jun
1161401      0.00170     0.0 1.0 1.0                               3
```

```
*
*----------------------------------------------------------------------$
*hydro              component name       component type
1200000              hxplout1                 branch
*-------------------------------------------------$------------------$
*hydro           no. juns             vel/flw
1200001            2                    0
*
*hydro            area                length              volume
1200101          0.08322               1.0                 0.
*
*hydro         horz angle           vert angle            delta z
1200102            0.                   0.                  0.
*
*hydro          roughness           hyd diam              fe
1200103          0.0000457             0.3255              0
*
*hydro  ebt pressure     tempe
1200200      0       1439698.     178216.6 2409562. 0.
*
*hydro    from          to           area       f loss     r loss     vcahs
1201101 116010000     120000000        0.          0.15       0.15    01000
1202101 120010000     122000000        0.08322     0.         0.      01000
*
*hydro   hyd diam
1201110 0.3255  0.0 1.0 1.0
1202110 0.3255 0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
1201201                 8.82696        8.82696          0. * 806.763
1202201                 8.82717        8.82717          0. * 806.763
*
*----------------------------------------------------------------------$
*       emergency heat exchanger secondary flow system (tube side)     $
*----------------------------------------------------------------------$
*
*----------------------------------------------------------------------*
*hydro              component name       component type
1380000              "secsrc1"                tmdpvol
*----------------------------------------------------------------------*
*hydro          area        length       volume
1380101         1.e6           .0        1.0e+06
*
*hydro       horz angle  vert angle    delta z
1380102           .0          .0           .0
*
*hydro        roughness   hyd diam       fe
1380103            .0          .0          10
*
*hydro  ebt         trip no.        alpha vrc       numeric vrc
1380200 003
*
*hydro   time      pressure      tempe
1380201   0.      1.800e5       311.15
*
*----------------------------------------------------------------------*
*hydro              component name       component type
1400000              "tubein"                 sngljun
*-------------------------------------------------*--------------------*
*hydro    from          to           area       f loss     r loss     vcahs
1400101   138000000     142000000    0.0          0.         0.      01100
*
*hydro   hyd diam
1400110   0.4573        0.0       1.0       1.0
*
```

```
*hydro    vel/flw       f velocity     g velocity     j velocity
1400201     0             .1070562       .1070562       0. * 45.333
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
1420000             "ehx-sec"             pipe
*-------------------------------------------------$-----------------$
1420001          2
*
*hydro          vol area                                              vol
1420101         0.4264                                                  2
*
*hydro           length                                               vol
1420301         0.7622                                                  2
*
*hydro           volume                                               vol
1420401           0.                                                    2
*
*hydro         vert angle                                             vol
1420601           0.                                                    2
*
*hydro          delta z                                               vol
1420701           0.0                                                   2
*
*hydro         roughness      hyd diam                                vol
1420801         0.0000457      0.4573                                  2
*
*hydro             fe                                                 vol
1421001           00                                                    2
*
*hydro           vcahs                                                jun
1421101         01000                                                   1
*
*hydro  ebt pressure     tempe                                         vol
1421201     0       179992.       159067.4   2525552. 0. 0.        1
1421202     0       179991.7      159067.4   2525552. 0. 0.        2
*
*hydro         f velocity   g velocity    j velocity                 jun
1421300 0
1421301       .1070562         .1070562     0.            1 * 45.333
*
*hydro   jun hyd diam                                                 jun
1421401      0.4573      0.0 1.0 1.0                                    1
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
1440000             "tubein"              sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to           area      f loss     r loss     vcahs
1440101   142010000     146000000    0.0         0.         0.       01100
*
*hydro   hyd diam
1440110   0.01905       0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1440201     0             .1070562       .1070562       0. * 45.333
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
1460000             "ehx-sec"             pipe
*-------------------------------------------------$-----------------$
1460001          4
*
*hydro          vol area                                              vol
1460101         0.476                                                   4
*
*hydro           length                                               vol
1460301          1.6                                                    4
*
*hydro           volume                                               vol
1460401           0.                                                    4
*
*hydro         vert angle                                             vol
1460601           0.                                                    4
*
*hydro          delta z                                               vol
1460701           0.0                                                   4
*
*hydro         roughness      hyd diam                                vol
1460801         0.0000457      0.01905                                 4
*
*hydro             fe                                                 vol
1461001           00                                                    4
*
*hydro           vcahs                                                jun
1461101         01000                                                   3
*
*hydro  ebt pressure     tempe                                         vol
1461201     0       179984.       187906.7   2525551. 0. 0.        1
1461202     0       179966.6      192815.    2525548. 0. 0.        2
1461203     0       179949.3      193751.2   2525544. 0.         0. 3
1461204     0       179932.       193959.    2525541. 0.          0. 4
*
*hydro         f velocity   g velocity    j velocity                 jun
1461300 0
1461301       .0961659         .0961659     0.            1 * 45.333
1461302       .0962145         .0962145     0.            2 * 45.333
1461303       .0962238         .0962238     0.            3 * 45.333
*
*hydro   jun hyd diam                                                 jun
1461401      0.01905      0.0 1.0 1.0                                    3
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
1480000             "tubeout"             sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to           area      f loss     r loss     vcahs
1480101   146010000     150000000    0.0         0.         0.       01100
*
*hydro   hyd diam
1480110   0.01905       0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1480201     0             .225633        .225633        0. * 45.333
*
*-------------------------------------------------------------------------$
*hydro             component name      component type
1500000             "chimney"             pipe
*-------------------------------------------------$-----------------$
1500001          4
*
*hydro          vol area                                              vol
1500101         0.203                                                   4
*
*hydro           length                                               vol
1500301         0.75                                                    4
*
*hydro           volume                                               vol
1500401           0.                                                    4
*
```

```
*hydro         vert angle                                              vol
1500601             90.                                               4
*
*hydro         elev. change                                            vol
1500701            0.75                                               4
*
*hydro         roughness      hyd diam                                 vol
1500801        0.0000457       0.508                                  4
*
*hydro           f loss        r loss                                  jun
1500901            0.           0.                                    3
*
*hydro             fe                                                  vol
1501001            00                                                 4
*
*hydro           vcahs                                                 jun
1501101          01000                                                3
*
*hydro  ebt pressure     tempe                                         vol
1501201     0       176255.      193912.    2524834. 0. 0.        1
1501202     0       168975.      193865.    2523398. 0. 0.        2
1501203     0       161695.      193818.2   2521911. 0. 0.        3
1501204     0       154414.8     193771.4   2520367. 0. 0.        4
*
*hydro          vel/flw
1501300            0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
1501301       .2256325          .27735       0.            1 * 45.333
1501302       .225632           .277349      0.            2 * 45.333
1501303       .2256317          .277349      0.            3 * 45.333
*
*---------------------------------------------------------------------
*hydro             component name      component type
1520000             "tubeout"             sngljun
*---------------------------------------------------------------------
*hydro    from          to           area      f loss    r loss  vcahs
1520101   150010000     154000000    0.0         0.        0.    01100
*
*hydro   hyd diam
1520110   0.508        0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1520201     0              .2256313       .236521        0. * 45.333
*
*---------------------------------------------------------------------*
*hydro             component name      component type
1540000             "secsnk1"             tmdpvol
*---------------------------------------------------------------------*
*hydro         area       length      volume
1540101        1.e6          .0       1.0e+06
*
*hydro      horz angle  vert angle    delta z
1540102          .0          .0          .0
*
*hydro       roughness   hyd diam       fe
1540103          .0          .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
1540200 003
*
*hydro   time     pressure     tempe
1540201   0.     150773.66    311.15
*
*=====================================================================$
```

```
*
*     accumulator and surge line - loop 1
*       assembled from normal relap5 components.
*       a tank wall heat structure (#1561) has been defined
*
*=====================================================================$
*
*hydro             component name      component type
1560000             "accum1"              pipe
*-----------------------------------------------------$-----------------$
*hydro       no. volumes
1560001            6
*
*hydro          vol area                                               vol
1560101        1.65                                                    5
1560102        0.08322                                                 6
*
*hydro          length                                                 vol
1560301        4.09                                                    1
1560302        0.12                                                    5
1560303        4.88                                                    6
*
*hydro          volume                                                 vol
1560401          0.                                                    6
*
*hydro         vert angle                                              vol
1560601          -90.                                                  6
*
*hydro         roughness      hyd diam                                 vol
1560801        0.0000457       1.449                                  5
1560802        0.0000457       0.3255                                 6
*
*hydro           f loss        r loss                                  jun
1560901            0.           0.                                    4
1560902           0.5           1.0                                   5
*
*hydro             fe                                                  vol
1561001            00000                                              6
*
*hydro           vcahs                                                 jun
1561101          00000                                                5
*
*hydro  ebt                                                            vol
* try for quala of 0.077054   for 0.52 m^3
1561201 6    1544923.    107025.  373137.  .076731   .998377 1
1561202     0       1566045.     160330.4   2411373. 0. 0.        2
1561203     0       1567339.     172367.7   2411389. 0. 0.        3
1561204     0       1568632.     173881.    2411406. 0. 0.        4
1561205     0       1569925.     175438.    2411422. 0. 0.        5
1561206     0       1596826.     188547.5   2411758. 0. 0.        6
*
*hydro          vel/flw
1561300            0
*
*hydro         f velocity   g velocity    j velocity                jun
1561301       2.37322-6        -.576589     0.            1 * .003992375
1561302       2.191466-6       2.19152-6    0.            2 * .00397779
1561303       2.19341-6        2.19346-6    0.            3 * .00397705
1561304       2.195416-6       2.19547-6    0.            4 * .00398014
1561305       4.3568-5         4.35892-5    0.            5 * .003983185
$=====================================================================$
*hydro             component name      component type
1570000             "accumout"            sngljun
*-----------------------------------------------$---------------------$
*hydro    from          to           area      f loss    r loss    vcahs
```

```
1570101 156060002  104040001 0.08322     0.     0.      01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1570201     0              4.35363-5      4.35363-5       0. * .0039753
*
$=====================================================================$
*hydro             component name       component type
1220000             "coldleg"              pipe
*-------------------------------------------------$-----------------$
1220001           26
*
*hydro          vol area                                          vol
1220101         0.08322                                           26
*
*hydro           length                                           vol
1220301           0.1925                                         12
1220302           0.213                                          22
1220303           0.1905                                         26
*
*hydro           volume                                           vol
1220401           0.                                             26
*
*hydro           volume                                           vol
1220501           0.                                             26
*
*hydro         vert angle                                         vol
1220601          -7.6                                            12
1220602           0.                                             22
1220603           90.                                            26
*
*hydro          delta z                                           vol
1220701          -0.0254                                         11
1220702          -0.0256                                         12
1220703           0.                                             22
1220704           0.1905                                         26
*
*hydro         roughness      hyd diam                           vol
1220801        0.0000457       0.3255                            26
*
*hydro           f loss        r loss                            jun
1220901           0.0           0.0                             11
1220902           0.182         0.182                           12
1220903           0.0           0.0                             21
1220904           0.182         0.182                           22
1220905           0.0           0.0                             25
*
*hydro             fe                                            vol
1221001            00                                           26
*
*hydro           vcahs                                           jun
1221101          01000                                           25
*
*hydro  ebt pressure     tempe                                    vol
1221201     0       1438806.     178207.4   2409548. 0. 0.       1
1221202     0       1438749.     178207.7   2409547. 0. 0.       2
1221203     0       1438691.     178208.    2409546. 0. 0.       3
1221204     0       1438633.     178208.3   2409545. 0. 0.       4
1221205     0       1438575.     178208.6   2409544. 0. 0.       5
1221206     0       1438517.     178209.    2409544. 0. 0.       6
1221207     0       1438459.     178209.2   2409542. 0. 0.       7
1221208     0       1438401.     178209.5   2409542. 0. 0.       8
1221209     0       1438343.     178209.8   2409540. 0. 0.       9
1221210     0       1438285.     178210.    2409540. 0. 0.       10
1221211     0       1438227.     178210.4   2409539. 0. 0.       11
1221212     0       1438170.     178210.7   2409538. 0. 0.       12
1221213     0       1430163.     178202.3   2409408. 0. 0.       13
1221214     0       1429796.     178202.6   2409402. 0. 0.       14
1221215     0       1429429.     178203.    2409396. 0. 0.       15
1221216     0       1429062.     178203.3   2409390. 0. 0.       16
1221217     0       1428696.     178203.6   2409384. 0. 0.       17
1221218     0       1428329.     178204.    2409378. 0. 0.       18
1221219     0       1427962.     178204.3   2409372. 0. 0.       19
1221220     0       1427595.     178204.6   2409366. 0. 0.       20
1221221     0       1427228.     178205.    2409360. 0. 0.       21
1221222     0       1426862.     178205.3   2409354. 0. 0.       22
1221223     0       1417692.     178202.5   2409203. 0. 0.       23
1221224     0       1415312.     178202.8   2409164. 0. 0.       24
1221225     0       1412932.     178203.    2409125. 0. 0.       25
1221226     0       1410552.     178203.4   2409086. 0. 0.       26
*
*hydro          vel/flw
1221300            0
*
*hydro         f flowrate    g flowrate    j flowrate                jun
1221301       8.82717          8.82717       0.          1 * 806.763
1221302       8.82717          8.82717       0.          2 * 806.763
1221303       8.82717          8.82717       0.          3 * 806.763
1221304       8.82717          8.82717       0.          4 * 806.763
1221305       8.82717          8.82717       0.          5 * 806.763
1221306       8.82717          8.82717       0.          6 * 806.763
1221307       8.82717          8.82717       0.          7 * 806.763
1221308       8.82717          8.82717       0.          8 * 806.763
1221309       8.82717          8.82717       0.          9 * 806.763
1221310       8.82717          8.82717       0.          10 * 806.763
1221311       8.82717          8.82717       0.          11 * 806.763
1221312       8.82717          8.82717       0.          12 * 806.763
1221313       8.8272           8.8272        0.          13 * 806.763
1221314       8.8272           8.8272        0.          14 * 806.763
1221315       8.8272           8.8272        0.          15 * 806.763
1221316       8.8272           8.8272        0.          16 * 806.763
1221317       8.8272           8.8272        0.          17 * 806.763
1221318       8.8272           8.8272        0.          18 * 806.763
1221319       8.8272           8.8272        0.          19 * 806.763
1221320       8.8272           8.8272        0.          20 * 806.763
1221321       8.82721          8.82721       0.          21 * 806.763
1221322       8.82721          8.82721       0.          22 * 806.763
1221323       8.82725          9.47674       0.          23 * 806.763
1221324       8.82726          9.4768        0.          24 * 806.763
1221325       8.82726          9.47686       0.          25 * 806.763
*
*=====================================================================$
*
*     primary coolant pump - loop 1
*
*=====================================================================$
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1240000             "rcpump1"              pump
*-------------------------------------------------$-----------------$
*hydro            area                 length               volume
1240101            0.                   0.500                0.7739
*
*hydro          horz angle           vert angle             delta z
1240102            0.                    0.                   0.000
*
*hydro          equil flag
1240103            00
*
*hydro       from       jun area     f loss       r loss       vcahs
```

```
1240108      122010000     0.          0.0          0.0          01000
*
* assume k=2.0 for strainer loss coefficient
*
*hydro        to          jun area     f loss       r loss       vcahs
1240109      126000000     0.           2.0          2.0         01000
*
*hydro  ebt pressure     tempe
1240200     0       2227564.     178292.3 2417240. 0.
*
*hydro    vel/flw     f flowrate       g flowrate      j flowrate
1240201    0             8.82727          9.47692        0. * 806.763
*
*hydro    vel/flw     f flowrate       g flowrate      j flowrate
1240202    0             8.82418          8.82418        0. * 806.763
*
*hydro      ptdi   2fazi   diff i   tork i   pvel i   trip no.   rvrs i
1240301      0       0       0       -1        0         555       0
*
*hydro   rated pump vel.   init/rated vel.   rated flow    rated head
1240302         188.5          .909385          0.643         207.3
*
*hydro    rated torque     mom of inertia    rated dens    mtr torque
1240303       7616.8           91.50           1098.          .0
*
*hydro     coeff. tf2       coeff. tf0      coeff. tf1    coeff. tf3
1240304       10.0             150.0             0.            0.
*
*hydro       curve type          regime
1241100          1                 1
*
*hydro          v/a              head          $normal       (+q,+n)
1241101         0.               1.126
1241102         .196             1.147
1241103         .392             1.163
1241104         .588             1.140
1241105         .784             1.091
1241106         0.98             1.009
1241107         1.00             1.000
*
*hydro       curve type          regime
1241200          1                 2
*
*hydro          a/v              head          $normal       (+q,+n)
1241201         0.               -.35
1241204         .425              0.
1241205         .567             0.142
1241206         .637             0.239
1241207         0.728            0.391
1241208         0.850            0.644
1241209         1.000            1.
*
*hydro       curve type          regime
1241300          1                 3
*
*hydro          v/a              head          $energy       (-q,+n)
1241301         -1.0             1.5
1241304         0.               1.126
*
*hydro       curve type          regime
1241400          1                 4
*
*hydro          v/a              head          $energy       (-q,+n)
1241401         -1.0             1.5
1241404         0.               0.7
*
*hydro       curve type          regime
1241900          2                 1
*
*hydro          v/a              torque        $normal       (+q,+n)
1241901         0.               .4
1241902         .2               .46
1241903         .4               .62
1241904         .6               .76
1241905         .79              .88
1241906         1.               1.
*
*hydro       curve type          regime
1242000          2                 2
*
*hydro          a/v              torque        $normal       (+q,+n)
1242001         0.              -.32
1242002         .2              -.1
1242003         .4               .15
1242004         .6               .4
1242005         .8               .7
1242006         1.               1.
*
*hydro       curve type          regime
1242100          2                 3
*
*hydro          v/a              torque        $energy       (-q,+n)
1242101         -1.0             0.8
1242104         0.               0.4
*
*hydro       curve type          regime
1242200          2                 4
*
*hydro          v/a              torque        $energy       (-q,+n)
1242201         -1.0             0.8
1242204         0.               0.3
*
*
*hydro       extrap ind      void fraction         head
1243000          0                0.00             0.00
1243001                         0.83e-4           0.00
1243002                         7.16e-3           0.98
1243003                          0.60             0.97
1243004                          0.80             0.90
1243005                          0.90             0.80
1243006                          0.96             0.50
1243007                          1.00             0.0
*
*hydro       extrap ind      void fraction         torque
1243100          0                0.0              0.0
1243101                           1.0              0.0
*
*hydro       curve type          regime
1244100          1                 1
*
*hydro          v/a              head          $normal       (+q,+n)
1244101         0.00             0.00
1244102         0.10             0.83
1244103         0.20             1.09
1244104         0.50             1.02
1244105         0.70             1.01
1244106         0.90             0.94
1244107         1.00             1.00
*
*hydro       curve type          regime
```

```
1244200         1               2
*
*hydro          a/v             head        $normal      (+q,+n)
1244201         0.00            0.00
1244202         0.10           -0.04
1244203         0.20            0.0
1244204         0.30            0.10
1244205         0.40            0.21
1244206         0.80            0.67
1244207         0.90            0.80
1244208         1.00            1.00
*
*hydro       curve type         regime
1244300         1               3
*
*hydro          v/a             head        $dissipation (-q,+n)
1244301        -1.00           -1.16
1244302        -0.90           -1.24
1244303        -0.80           -1.77
1244304        -0.70           -2.36
1244305        -0.60           -2.79
1244306        -0.50           -2.91
1244307        -0.40           -2.67
1244308        -0.25           -1.69
1244309        -0.10           -0.50
1244310         0.00            0.00
*
*hydro       curve type         regime
1244400         1               4
*
*hydro          a/v             head        $dissipation (-q,+n)
1244401        -1.0            -1.16
1244402        -0.90           -0.78
1244403        -0.80           -0.50
1244404        -0.70           -0.31
1244405        -0.60           -0.17
1244406        -0.50           -0.08
1244407        -0.35            0.00
1244408        -0.20            0.05
1244409        -0.10            0.08
1244410         0.00            0.11
*
*hydro       curve type         regime
1244500         1               5
*
*hydro          v/a             head        $turbine     (-q,-n)
1244501         0.00            0.00
1244502         0.20           -0.34
1244503         0.40           -0.65
1244504         0.60           -0.95
1244505         0.80           -1.19
1244506         1.00           -1.47
*
*hydro       curve type         regime
1244600         1               6
*
*hydro          a/v             head        $turbine     (-q,-n)
1244601         0.00            0.11
1244602         0.10            0.13
1244603         0.25            0.15
1244604         0.40            0.13
1244605         0.50            0.07
1244606         0.60           -0.04
1244607         0.70           -0.23
1244608         0.80           -0.51
1244609         0.90           -0.91
1244610         1.00           -1.47
*
*hydro       curve type         regime
1244700         1               7
*
*hydro          v/a             head        $reverse     (+q,-n)
1244701        -1.00            0.00
1244702         0.00            0.00
*
*hydro       curve type         regime
1244800         1               8
*
*hydro          a/v             head        $reverse     (+q,-n)
1244801        -1.00            0.00
1244802         0.00            0.00
*
*hydro       curve type         regime
1244900         2               1
*
*hydro          v/a             head        $normal      (+q,+n)
1244901         0.00            0.00
1244907         1.00            0.00
*
*hydro       curve type         regime
1245000         2               2
*
*hydro          a/v             head        $normal      (+q,+n)
1245001         0.00            0.00
1245008         1.00            0.00
*
*hydro       curve type         regime
1245100         2               3
*
*hydro          v/a             head        $dissipation (-q,+n)
1245101        -1.00            0.00
1245110         0.00            0.00
*
*hydro       curve type         regime
1245200         2               4
*
*hydro          a/v             head        $dissipation (-q,+n)
1245201        -1.0             0.00
1245210         0.00            0.00
*
*hydro       curve type         regime
1245300         2               5
*
*hydro          v/a             head        $turbine     (-q,-n)
1245301         0.00            0.00
1245306         1.00            0.00
*
*hydro       curve type         regime
1245400         2               6
*
*hydro          a/v             head        $turbine     (-q,-n)
1245401         0.00            0.00
1245410         1.00            0.00
*
*hydro       curve type         regime
1245500         2               7
*
*hydro          v/a             head        $reverse     (+q,-n)
1245501        -1.00            0.00
1245502         0.00            0.00
```

```
*
*hydro       curve type          regime
1245600          2                 8
*
*hydro          a/v               head          $reverse      (+q,-n)
1245601        -1.00               0.00
1245602         0.00               0.00
*-------------------------------------------------------------------*
*      pump speed table
*1246100      0    cntrlvar 83
1246100      619    cntrlvar 195
1246101      -1.e6   -1.e6
1246102       1.e6    1.e6
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1260000             "pmpdisc"               pipe
*-------------------------------------------------------------------$
1260001          5
*
*hydro          vol area                                          vol
1260101         0.08322                                             5
*
*hydro           length                                           vol
1260301          0.18292                                           5
*
*hydro           volume                                           vol
1260401            0.                                             5
*
*hydro           volume                                           vol
1260501            0.                                             5
*
*hydro         vert angle                                         vol
1260601            0.0                                            5
*
*hydro          delta z                                           vol
1260701          0.0                                              5
*
*hydro         roughness      hyd diam                           vol
1260801        0.0000457       0.3255                             5
*
*hydro           f loss        r loss                            jun
1260901           0.0           0.0                              4
*
*hydro             fe                                            vol
1261001            00                                            5
*
*hydro           vcahs                                           jun
1261101          01000                                            4
*
*hydro  ebt pressure     tempe                                    vol
1261201     0       2874648.     178289.5   2419576. 0. 0.       1
1261202     0       2874352.     178290.    2419576. 0. 0.       2
1261203     0       2874037.     178290.    2419575. 0. 0.       3
1261204     0       2873722.     178290.4   2419574. 0. 0.       4
1261205     0       2873407.     178290.7   2419574. 0. 0.       5
*
*hydro          vel/flw
1261300            0
*
*hydro         f flowrate   g flowrate    j flowrate              jun
1261301       8.82167          8.82167      0.           1 * 806.763
1261302       8.82167          8.82167      0.           2 * 806.763
1261303       8.82168          8.82168      0.           3 * 806.763
1261304       8.82168          8.82168      0.           4 * 806.763
```

```
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1280000             "check"                 valve
*-------------------------------------------------$-----------------$
*hydro    from          to           area      f loss     r loss     vcahs
1280101   126010000     129000000    0.08322     0.98       0.98     01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
1280201     0             8.82168        8.82168         0. * 806.763
*
*hydro               valve type
1280300               chkvlv
*
*hydro    chkvlv type  init. posn  back press  leak ratio
1280301       0           0           0.          0.
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1290000             "cljoin"                pipe
*-------------------------------------------------$-----------------$
1290001          31
*
*hydro          vol area                                          vol
1290101         0.08322                                            31
*
*hydro           length                                           vol
1290301          0.2016                                            31
*
*hydro           volume                                           vol
1290401            0.                                             31
*
*hydro           volume                                           vol
1290501            0.                                             31
*
*hydro         vert angle                                         vol
1290601            0.0                                            31
*
*hydro          delta z                                           vol
1290701          0.0                                              31
*
*hydro         roughness      hyd diam                           vol
1290801        0.0000457       0.3255                             31
*
*hydro           f loss        r loss                            jun
1290901           0.0           0.0                              30
*
*hydro             fe                                            vol
1291001            00                                            31
*
*hydro           vcahs                                           jun
1291101          01000                                            30
*
*hydro  ebt pressure     tempe                                    vol
1291201     0       2831124.     178265.    2419499. 0. 0.       1
1291202     0       2830776.     178265.3   2419498. 0. 0.       2
1291203     0       2830428.     178265.6   2419498. 0. 0.       3
1291204     0       2830082.     178266.    2419497. 0. 0.       4
1291205     0       2829734.     178266.2   2419496. 0. 0.       5
1291206     0       2829388.     178266.6   2419496. 0. 0.       6
1291207     0       2829041.     178267.    2419495. 0. 0.       7
1291208     0       2828694.     178267.2   2419494. 0. 0.       8
1291209     0       2828347.     178267.5   2419494. 0. 0.       9
1291210     0       2.828+6      178268.    2419493. 0. 0.       10
1291211     0       2827653.     178268.    2419492. 0. 0.       11
```

```
1291212     0       2827306.     178268.5   2419492. 0. 0.       12
1291213     0       2826959.     178268.8   2419491. 0. 0.       13
1291214     0       2826612.     178269.    2419491. 0. 0.       14
1291215     0       2826265.     178269.4   2419490. 0. 0.       15
1291216     0       2825918.     178269.7   2419490. 0. 0.       16
1291217     0       2825571.     178270.    2419489. 0. 0.       17
1291218     0       2825224.     178270.4   2419488. 0. 0.       18
1291219     0       2824877.     178270.7   2419488. 0. 0.       19
1291220     0       2824530.     178271.    2419487. 0. 0.       20
1291221     0       2824183.     178271.3   2419486. 0. 0.       21
1291222     0       2823836.     178271.6   2419486. 0. 0.       22
1291223     0       2823489.     178272.    2419485. 0. 0.       23
1291224     0       2823142.     178272.2   2419484. 0. 0.       24
1291225     0       2822795.     178272.6   2419484. 0. 0.       25
1291226     0       2822448.     178273.    2419483. 0. 0.       26
1291227     0       2822101.     178273.2   2419483. 0. 0.       27
1291228     0       2821754.     178273.5   2419482. 0. 0.       28
1291229     0       2821407.     178274.    2419482. 0. 0.       29
1291230     0       2821060.     178274.    2419481. 0. 0.       30
1291231     0       2820714.     178274.5   2419480. 0. 0.       31
*
*hydro          vel/flw
1291300            0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
1291301        8.82182          8.82182       0.           1 * 806.763
1291302        8.82182          8.82182       0.           2 * 806.763
1291303        8.82182          8.82182       0.           3 * 806.763
1291304        8.82183          8.82183       0.           4 * 806.763
1291305        8.82183          8.82183       0.           5 * 806.763
1291306        8.82183          8.82183       0.           6 * 806.763
1291307        8.82183          8.82183       0.           7 * 806.763
1291308        8.82183          8.82183       0.           8 * 806.763
1291309        8.82183          8.82183       0.           9 * 806.763
1291310        8.82183          8.82183       0.          10 * 806.763
1291311        8.82184          8.82184       0.          11 * 806.763
1291312        8.82184          8.82184       0.          12 * 806.763
1291313        8.82184          8.82184       0.          13 * 806.763
1291314        8.82184          8.82184       0.          14 * 806.763
1291315        8.82184          8.82184       0.          15 * 806.763
1291316        8.82184          8.82184       0.          16 * 806.763
1291317        8.82185          8.82185       0.          17 * 806.763
1291318        8.82185          8.82185       0.          18 * 806.763
1291319        8.82185          8.82185       0.          19 * 806.763
1291320        8.82185          8.82185       0.          20 * 806.763
1291321        8.82185          8.82185       0.          21 * 806.763
1291322        8.82185          8.82185       0.          22 * 806.763
1291323        8.82185          8.82185       0.          23 * 806.763
1291324        8.82186          8.82186       0.          24 * 806.763
1291325        8.82186          8.82186       0.          25 * 806.763
1291326        8.82186          8.82186       0.          26 * 806.763
1291327        8.82186          8.82186       0.          27 * 806.763
1291328        8.82186          8.82186       0.          28 * 806.763
1291329        8.82186          8.82186       0.          29 * 806.763
1291330        8.82187          8.82187       0.          30 * 806.763
*
*-------------------------------------------------------------------*
*hydro             component name       component type
1310000             "elbow1"               sngljun
*-----------------------------------------*---------------------*
*hydro    from          to          area      f loss    r loss    vcahs
1310101  129010000     158000000    0.083220    0.182     0.182    01000
*
*hydro    vel/flw       f velocity      g velocity      j velocity
1310201    0              8.82187         8.82187          0. * 806.763
```

```
*
*-------------------------------------------------------------------$
*hydro             component name       component type
1580000             "coldleg"              pipe
*-----------------------------------------------$-----------------$
1580001          50
*
*hydro          vol area                                          vol
1580101         0.08322                                            50
*
*hydro          length                                            vol
1580301          0.18                                              50
*
*hydro           volume                                           vol
1580401            0.                                              50
*
*hydro         horz angle                                         vol
1580501            0.                                              50
*
*hydro         vert angle                                         vol
1580601            0.                                              50
*
*hydro         delta z                                            vol
1580701            0.                                              50
*
*hydro         roughness       hyd diam                           vol
1580801        0.0000457        0.3255                            50
*
*hydro           kf               kr                              jun
1580901         0.0               0.0                             49
*
*hydro            fe                                             vol
1581001           00                                              50
*
*hydro           vcahs                                           jun
1581101          01000                                            49
*
*hydro  ebt pressure     tempe                                    vol
1581201     0       2812594.     178256.    2419466. 0. 0.       1
1581202     0       2812284.     178256.3   2419465. 0. 0.       2
1581203     0       2811974.     178256.6   2419464. 0. 0.       3
1581204     0       2811664.     178257.    2419464. 0. 0.       4
1581205     0       2811354.     178257.    2419464. 0. 0.       5
1581206     0       2811044.     178257.5   2419463. 0. 0.       6
1581207     0       2810735.     178257.7   2419462. 0. 0.       7
1581208     0       2810425.     178258.    2419462. 0. 0.       8
1581209     0       2810115.     178258.3   2419461. 0. 0.       9
1581210     0       2809805.     178258.6   2419460. 0. 0.       10
1581211     0       2809496.     178259.    2419460. 0. 0.       11
1581212     0       2809186.     178259.    2419460. 0. 0.       12
1581213     0       2808876.     178259.4   2419459. 0. 0.       13
1581214     0       2808566.     178259.7   2419458. 0. 0.       14
1581215     0       2808256.     178260.    2419458. 0. 0.       15
1581216     0       2807946.     178260.3   2419457. 0. 0.       16
1581217     0       2807637.     178260.5   2419457. 0. 0.       17
1581218     0       2807327.     178261.    2419456. 0. 0.       18
1581219     0       2807017.     178261.    2419456. 0. 0.       19
1581220     0       2806707.     178261.4   2419455. 0. 0.       20
1581221     0       2806398.     178261.7   2419454. 0. 0.       21
1581222     0       2806088.     178262.    2419454. 0. 0.       22
1581223     0       2805778.     178262.2   2419454. 0. 0.       23
1581224     0       2805468.     178262.5   2419453. 0. 0.       24
1581225     0       2805158.     178262.8   2419452. 0. 0.       25
1581226     0       2804848.     178244.4   2419452. 0. 0.       26
1581227     0       2804539.     178244.7   2419451. 0. 0.       27
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1581228     0       2804229.     178245.    2419450. 0. 0.       28
1581229     0       2803919.     178245.2   2419450. 0. 0.       29
1581230     0       2803610.     178245.5   2419450. 0. 0.       30
1581231     0       2803300.     178245.8   2419449. 0. 0.       31
1581232     0       2802990.     178246.    2419448. 0. 0.       32
1581233     0       2802680.     178246.4   2419448. 0. 0.       33
1581234     0       2802370.     178246.6   2419447. 0. 0.       34
1581235     0       2802060.     178247.    2419447. 0. 0.       35
1581236     0       2801751.     178247.2   2419446. 0. 0.       36
1581237     0       2801441.     178247.5   2419446. 0. 0.       37
1581238     0       2801131.     178247.8   2419445. 0. 0.       38
1581239     0       2800821.     178248.    2419444. 0. 0.       39
1581240     0       2800512.     178248.3   2419444. 0. 0.       40
1581241     0       2800202.     178248.6   2419443. 0. 0.       41
1581242     0       2799892.     178249.    2419443. 0. 0.       42
1581243     0       2799582.     178249.2   2419442. 0. 0.       43
1581244     0       2799272.     178249.5   2419442. 0. 0.       44
1581245     0       2798962.     178249.8   2419441. 0. 0.       45
1581246     0       2798653.     178250.    2419440. 0. 0.       46
1581247     0       2798343.     178250.3   2419440. 0. 0.       47
1581248     0       2798033.     178250.6   2419440. 0. 0.       48
1581249     0       2797723.     178251.    2419439. 0. 0.       49
1581250     0       2797414.     178251.    2419438. 0. 0.       50
*
*hydro          vel/flw
1581300           0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1581301      8.82188          8.82188      0.          1 * 806.763
1581302      8.82188          8.82188      0.          2 * 806.763
1581303      8.82189          8.82189      0.          3 * 806.763
1581304      8.82189          8.82189      0.          4 * 806.763
1581305      8.82189          8.82189      0.          5 * 806.763
1581306      8.82189          8.82189      0.          6 * 806.763
1581307      8.8219           8.8219       0.          7 * 806.763
1581308      8.8219           8.8219       0.          8 * 806.763
1581309      8.8219           8.8219       0.          9 * 806.763
1581310      8.8219           8.8219       0.         10 * 806.763
1581311      8.8219           8.8219       0.         11 * 806.763
1581312      8.8219           8.8219       0.         12 * 806.763
1581313      8.8219           8.8219       0.         13 * 806.763
1581314      8.8219           8.8219       0.         14 * 806.763
1581315      8.8219           8.8219       0.         15 * 806.763
1581316      8.8219           8.8219       0.         16 * 806.763
1581317      8.8219           8.8219       0.         17 * 806.763
1581318      8.8219           8.8219       0.         18 * 806.763
1581319      8.8219           8.8219       0.         19 * 806.763
1581320      8.82191          8.82191      0.         20 * 806.763
1581321      8.82191          8.82191      0.         21 * 806.763
1581322      8.82191          8.82191      0.         22 * 806.763
1581323      8.82191          8.82191      0.         23 * 806.763
1581324      8.82192          8.82192      0.         24 * 806.763
1581325      8.82192          8.82192      0.         25 * 806.763
1581326      8.8219           8.8219       0.         26 * 806.763
1581327      8.8219           8.8219       0.         27 * 806.763
1581328      8.8219           8.8219       0.         28 * 806.763
1581329      8.8219           8.8219       0.         29 * 806.763
1581330      8.8219           8.8219       0.         30 * 806.763
1581331      8.82191          8.82191      0.         31 * 806.763
1581332      8.82191          8.82191      0.         32 * 806.763
1581333      8.82191          8.82191      0.         33 * 806.763
1581334      8.82191          8.82191      0.         34 * 806.763
1581335      8.82192          8.82192      0.         35 * 806.763
1581336      8.82192          8.82192      0.         36 * 806.763
1581337      8.82192          8.82192      0.         37 * 806.763
1581338      8.82192          8.82192      0.         38 * 806.763
1581339      8.82192          8.82192      0.         39 * 806.763
1581340      8.82192          8.82192      0.         40 * 806.763
1581341      8.82192          8.82192      0.         41 * 806.763
1581342      8.82193          8.82193      0.         42 * 806.763
1581343      8.82193          8.82193      0.         43 * 806.763
1581344      8.82193          8.82193      0.         44 * 806.763
1581345      8.82193          8.82193      0.         45 * 806.763
1581346      8.82193          8.82193      0.         46 * 806.763
1581347      8.82193          8.82193      0.         47 * 806.763
1581348      8.82193          8.82193      0.         48 * 806.763
1581349      8.82193          8.82193      0.         49 * 806.763
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
1600000              "elbow1"               sngljun
*-------------------------------------------------------------------------*
*hydro    from          to           area      f loss    r loss    vcahs
1600101   158010000     162000000    0.083220  0.182     0.182     01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1600201     0              8.82194        8.82194        0. * 806.763
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
1620000              "14incdlg"             pipe
*-------------------------------------------------------------------------*
1620001           87
*
*hydro          vol area                                          vol
1620101         0.08322                                          87
*
*hydro          length                                            vol
1620301          0.183                                           10
1620302          0.19625                                         18
1620303          0.18125                                         26
1620304          0.2                                             86
1620305          0.10439                                         87
*
*hydro          volume                                            vol
1620401            0.                                            87
*
*hydro         horz angle                                         vol
1620501            0.                                            87
*
*hydro         vert angle                                         vol
1620601          -90.                                            10
1620602            0.                                            26
1620603          -90.                                            87
*
*hydro         delta z                                            vol
1620701          -0.183                                          10
1620702           0.                                             26
1620703         -0.2                                             86
1620704         -0.10439                                         87
*
*hydro         roughness      hyd diam                           vol
1620801        0.0000457       0.3255                            87
*
*hydro           kf              kr                               jun
1620901         0.0               0.0                             9
1620902         0.182             0.182                           10
1620903         0.0               0.0                             17
1620904         0.13              0.13                            18
1620905         0.0               0.0                             25
```

```
1620906         0.182             0.182                                  26
1620907         0.0               0.0                                    86
*
*hydro            fe                                                     vol
1621001           00                                                     87
*
*hydro          vcahs                                                    jun
1621101         01000                                                    86
*
*hydro  ebt pressure     tempe                                           vol
1621201     0       2790296.    178244.    2419426. 0. 0.        1
1621202     0       2791953.    178244.3   2419428. 0. 0.        2
1621203     0       2793610.    178244.6   2419432. 0. 0.        3
1621204     0       2795267.    178245.    2419434. 0. 0.        4
1621205     0       2796924.    178245.    2419438. 0. 0.        5
1621206     0       2798582.    178245.5   2419440. 0. 0.        6
1621207     0       2800238.    178245.8   2419444. 0. 0.        7
1621208     0       2801896.    178246.    2419446. 0. 0.        8
1621209     0       2803553.    178246.3   2419450. 0. 0.        9
1621210     0       2805210.    178246.6   2419452. 0. 0.        10
1621211     0       2798078.    178240.4   2419440. 0. 0.        11
1621212     0       2797740.    178240.7   2419439. 0. 0.        12
1621213     0       2797403.    178241.    2419438. 0. 0.        13
1621214     0       2797065.    178241.3   2419438. 0. 0.        14
1621215     0       2796727.    178241.6   2419437. 0. 0.        15
1621216     0       2796390.    178242.    2419436. 0. 0.        16
1621217     0       2796052.    178242.2   2419436. 0. 0.        17
1621218     0       2795714.    178242.5   2419435. 0. 0.        18
1621219     0       2789824.    178236.8   2419425. 0. 0.        19
1621220     0       2789512.    178237.    2419424. 0. 0.        20
1621221     0       2789200.    178237.4   2419424. 0. 0.        21
1621222     0       2788888.    178237.7   2419423. 0. 0.        22
1621223     0       2788576.    178238.    2419422. 0. 0.        23
1621224     0       2788264.    178238.2   2419422. 0. 0.        24
1621225     0       2787952.    178238.5   2419421. 0. 0.        25
1621226     0       2787640.    178238.8   2419421. 0. 0.        26
1621227     0       2780598.    178190.    2419408. 0. 0.        27
1621228     0       2782409.    178190.5   2419411. 0. 0.        28
1621229     0       2784220.    178190.8   2419414. 0. 0.        29
1621230     0       2786032.    178191.    2419418. 0. 0.        30
1621231     0       2787843.    178191.4   2419421. 0. 0.        31
1621232     0       2789654.    178191.7   2419424. 0. 0.        32
1621233     0       2791465.    178192.    2419428. 0. 0.        33
1621234     0       2793276.    178192.4   2419431. 0. 0.        34
1621235     0       2795087.    178192.7   2419434. 0. 0.        35
1621236     0       2796898.    178193.    2419438. 0. 0.        36
1621237     0       2798710.    178193.3   2419441. 0. 0.        37
1621238     0       2800521.    178193.6   2419444. 0. 0.        38
1621239     0       2802332.    178194.    2419447. 0. 0.        39
1621240     0       2804143.    178194.2   2419450. 0. 0.        40
1621241     0       2805954.    178194.6   2419454. 0. 0.        41
1621242     0       2807766.    178195.    2419457. 0. 0.        42
1621243     0       2809576.    178195.2   2419460. 0. 0.        43
1621244     0       2811388.    178195.5   2419464. 0. 0.        44
1621245     0       2813199.    178196.    2419467. 0. 0.        45
1621246     0       2815010.    178196.    2419470. 0. 0.        46
1621247     0       2816821.    178196.5   2419473. 0. 0.        47
1621248     0       2818632.    178196.8   2419476. 0. 0.        48
1621249     0       2820444.    178197.    2419480. 0. 0.        49
1621250     0       2822255.    178197.4   2419483. 0. 0.        50
1621251     0       2824066.    178197.7   2419486. 0. 0.        51
1621252     0       2825877.    178198.    2419490. 0. 0.        52
1621253     0       2827688.    178198.4   2419493. 0. 0.        53
1621254     0       2829500.    178198.7   2419496. 0. 0.        54
1621255     0       2831311.    178199.    2419499. 0. 0.        55
1621256     0       2833122.    178199.3   2419502. 0. 0.        56
1621257     0       2834933.    178199.6   2419506. 0. 0.        57
1621258     0       2836744.    178200.    2419509. 0. 0.        58
1621259     0       2838556.    178200.2   2419512. 0. 0.        59
1621260     0       2840366.    178200.6   2419515. 0. 0.        60
1621261     0       2842178.    178201.    2419518. 0. 0.        61
1621262     0       2843989.    178201.2   2419522. 0. 0.        62
1621263     0       2845800.    178201.5   2419525. 0. 0.        63
1621264     0       2847612.    178202.    2419528. 0. 0.        64
1621265     0       2849422.    178202.    2419531. 0. 0.        65
1621266     0       2851234.    178202.5   2419534. 0. 0.        66
1621267     0       2853045.    178202.8   2419538. 0. 0.        67
1621268     0       2854856.    178203.    2419541. 0. 0.        68
1621269     0       2856668.    178203.4   2419544. 0. 0.        69
1621270     0       2858479.    178203.7   2419548. 0. 0.        70
1621271     0       2860290.    178204.    2419550. 0. 0.        71
1621272     0       2862101.    178204.3   2419554. 0. 0.        72
1621273     0       2863912.    178204.7   2419557. 0. 0.        73
1621274     0       2865724.    178205.    2419560. 0. 0.        74
1621275     0       2867535.    178205.3   2419564. 0. 0.        75
1621276     0       2869346.    178205.6   2419566. 0. 0.        76
1621277     0       2871157.    178206.    2419570. 0. 0.        77
1621278     0       2872968.    178206.2   2419573. 0. 0.        78
1621279     0       2874780.    178206.5   2419576. 0. 0.        79
1621280     0       2876591.    178207.    2419580. 0. 0.        80
1621281     0       2878402.    178207.2   2419582. 0. 0.        81
1621282     0       2880213.    178207.5   2419586. 0. 0.        82
1621283     0       2882024.    178207.8   2419589. 0. 0.        83
1621284     0       2883836.    178208.    2419592. 0. 0.        84
1621285     0       2885647.    178208.5   2419595. 0. 0.        85
1621286     0       2887458.    178208.8   2419598. 0. 0.        86
1621287     0       2888836.    178209.    2419601. 0. 0.        87
*
*hydro          vel/flw
1621300           0
•
*hydro        f velocity   g velocity    j velocity              jun
1621301     8.82196          9.44594       0.          1 • 806.763
1621302     8.82195          9.44591       0.          2 • 806.763
1621303     8.82195          9.44588       0.          3 • 806.763
1621304     8.82194          9.44584       0.          4 • 806.763
1621305     8.82193          9.44581       0.          5 • 806.763
1621306     8.82193          9.44578       0.          6 • 806.762
1621307     8.82192          9.44574       0.          7 * 806.762
1621308     8.82191          9.44571       0.          8 • 806.762
1621309     8.8219           9.44568       0.          9 • 806.762
1621310     8.8219           9.44565       0.          10 • 806.762
1621311     8.82192          8.82192       0.          11 • 806.762
1621312     8.82193          8.82193       0.          12 * 806.762
1621313     8.82193          8.82193       0.          13 • 806.762
1621314     8.82193          8.82193       0.          14 • 806.762
1621315     8.82193          8.82193       0.          15 • 806.762
1621316     8.82193          8.82193       0.          16 • 806.762
1621317     8.82193          8.82193       0.          17 • 806.762
1621318     8.82194          8.82194       0.          18 • 806.762
1621319     8.82195          8.82195       0.          19 • 806.762
1621320     8.82195          8.82195       0.          20 * 806.762
1621321     8.82196          8.82196       0.          21 • 806.762
1621322     8.82196          8.82196       0.          22 * 806.762
1621323     8.82196          8.82196       0.          23 • 806.762
1621324     8.82196          8.82196       0.          24 • 806.762
1621325     8.82196          8.82196       0.          25 • 806.762
1621326     8.82196          8.82196       0.          26 • 806.762
1621327     8.82195          9.44609       0.          27 * 806.762
1621328     8.82194          9.44605       0.          28 • 806.762
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1621329      8.82194        9.44602      0.          29 * 806.762
1621330      8.82193        9.44598      0.          30 * 806.762
1621331      8.82192        9.44595      0.          31 * 806.762
1621332      8.82192        9.44591      0.          32 * 806.762
1621333      8.82191        9.44587      0.          33 * 806.762
1621334      8.8219         9.44584      0.          34 * 806.762
1621335      8.8219         9.4458       0.          35 * 806.762
1621336      8.82189        9.44577      0.          36 * 806.762
1621337      8.82188        9.44573      0.          37 * 806.762
1621338      8.82188        9.4457       0.          38 * 806.762
1621339      8.82187        9.44566      0.          39 * 806.762
1621340      8.82186        9.44562      0.          40 * 806.762
1621341      8.82185        9.44559      0.          41 * 806.762
1621342      8.82185        9.44555      0.          42 * 806.762
1621343      8.82184        9.44551      0.          43 * 806.762
1621344      8.82183        9.44548      0.          44 * 806.762
1621345      8.82183        9.44544      0.          45 * 806.762
1621346      8.82182        9.4454       0.          46 * 806.762
1621347      8.82181        9.44537      0.          47 * 806.762
1621348      8.8218         9.44533      0.          48 * 806.762
1621349      8.8218         9.4453       0.          49 * 806.762
1621350      8.8218         9.44526      0.          50 * 806.762
1621351      8.82179        9.44523      0.          51 * 806.762
1621352      8.82178        9.44519      0.          52 * 806.762
1621353      8.82177        9.44515      0.          53 * 806.762
1621354      8.82177        9.44512      0.          54 * 806.762
1621355      8.82176        9.44508      0.          55 * 806.762
1621356      8.82175        9.44505      0.          56 * 806.762
1621357      8.82175        9.44501      0.          57 * 806.762
1621358      8.82174        9.44497      0.          58 * 806.762
1621359      8.82173        9.44494      0.          59 * 806.762
1621360      8.82173        9.4449       0.          60 * 806.762
1621361      8.82172        9.44487      0.          61 * 806.762
1621362      8.82171        9.44483      0.          62 * 806.762
1621363      8.8217         9.4448       0.          63 * 806.762
1621364      8.8217         9.44476      0.          64 * 806.762
1621365      8.8217         9.44472      0.          65 * 806.762
1621366      8.82169        9.44469      0.          66 * 806.762
1621367      8.82168        9.44465      0.          67 * 806.762
1621368      8.82167        9.44462      0.          68 * 806.762
1621369      8.82167        9.44458      0.          69 * 806.762
1621370      8.82166        9.44454      0.          70 * 806.762
1621371      8.82165        9.4445       0.          71 * 806.762
1621372      8.82164        9.44447      0.          72 * 806.762
1621373      8.82164        9.44444      0.          73 * 806.762
1621374      8.82163        9.4444       0.          74 * 806.762
1621375      8.82162        9.44437      0.          75 * 806.762
1621376      8.82162        9.44433      0.          76 * 806.762
1621377      8.82161        9.4443       0.          77 * 806.762
1621378      8.8216         9.44426      0.          78 * 806.762
1621379      8.8216         9.44422      0.          79 * 806.762
1621380      8.8216         9.44419      0.          80 * 806.762
1621381      8.82158        9.44415      0.          81 * 806.762
1621382      8.82158        9.44412      0.          82 * 806.762
1621383      8.82157        9.44408      0.          83 * 806.762
1621384      8.82156        9.44404      0.          84 * 806.762
1621385      8.82156        9.444        0.          85 * 806.762
1621386      8.82155        9.44397      0.          86 * 806.762
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
1720000              "inlet"              sngljun
*-------------------------------------------------------------------------*
*hydro    from          to           area      f loss    r loss    vcahs
1720101   162010000     171000000    0.03095   0.2062    0.4513    01000
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*
*hydro    jun hyd diam
1720110      0.1985        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity      g velocity      j velocity
1720201    0               23.71984        24.6401          0. * 806.762
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
1710000              "ifdthrot"               pipe
*-------------------------------------------------------------------------$
1710001          24
*
*hydro          vol area                                              vol
1710101         0.03095                                               24
*
*hydro           length                                               vol
1710301           0.15                                                2
1710302           0.20                                               12
1710303           0.19                                               24
*
*hydro           volume                                               vol
1710401           0.                                                 24
*
*hydro           volume                                               vol
1710501           0.                                                 24
*
*hydro         vert angle                                             vol
1710601          -90.0                                                2
1710602           0.0                                                24
*
*hydro          delta z                                               vol
1710701          -0.15                                                2
1710702           0.0                                                24
*
*hydro         roughness       hyd diam                               vol
1710801        0.0000457        0.1985                                24
*
*hydro           f loss         r loss                                 jun
1710901           0.0            0.0                                  1
1710902           0.196          0.196                                2
1710903           0.0            0.0                                 11
1710904           0.196          0.196                               12
1710905           0.0            0.0                                 23
*
*hydro             fe                                                 vol
1711001           00                                                 24
*
*hydro           vcahs                                                jun
1711101          01000                                               23
*
*hydro  ebt pressure     tempe                                         vol
1711201    0       2558306.     178210.6   2418887. 0. 0.      1
1711202    0       2556522.     178213.6   2418881. 0. 0.      2
1711203    0       2492810.     178210.3   2418660. 0. 0.      3
1711204    0       2488354.     178214.3   2418637. 0. 0.      4
1711205    0       2483909.     178218.3   2418614. 0. 0.      5
1711206    0       2479464.     178222.4   2418592. 0. 0.      6
1711207    0       2475019.     178226.4   2418568. 0. 0.      7
1711208    0       2470574.     178230.5   2418546. 0. 0.      8
1711209    0       2466129.     178234.5   2418523. 0. 0.      9
1711210    0       2461684.     178238.5   2418500. 0. 0.     10
1711211    0       2457239.     178242.6   2418477. 0. 0.     11
1711212    0       2452794.     178246.6   2418454. 0. 0.     12
1711213    0       2387826.     178242.    2418112. 0. 0.     13
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1711214     0       2383591.     178246.    2418090. 0. 0.       14
1711215     0       2379368.     178249.7   2418068. 0. 0.       15
1711216     0       2375145.     178253.6   2418045. 0. 0.       16
1711217     0       2370922.     178257.4   2418023. 0. 0.       17
1711218     0       2366699.     178261.2   2.418+6  0. 0.       18
1711219     0       2362476.     178265.    2417978. 0. 0.       19
1711220     0       2358253.     178269.    2417955. 0. 0.       20
1711221     0       2354030.     178272.8   2417932. 0. 0.       21
1711222     0       2349807.     178276.6   2417910. 0. 0.       22
1711223     0       2345584.     178280.4   2417887. 0. 0.       23
1711224     0       2341361.     178284.3   2417864. 0. 0.       24
*
*hydro          vel/flw
1711300           0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
1711301       23.7233          24.6515       0.           1 • 806.762
1711302       23.7233          24.65156      0.           2 • 806.762
1711303       23.72396         23.72396      0.           3 • 806.762
1711304       23.724           23.724        0.           4 • 806.762
1711305       23.72407         23.72407      0.           5 • 806.762
1711306       23.7241          23.7241       0.           6 • 806.762
1711307       23.7242          23.7242       0.           7 • 806.762
1711308       23.72423         23.72423      0.           8 * 806.762
1711309       23.7243          23.7243       0.           9 • 806.762
1711310       23.72434         23.72434      0.           10 • 806.762
1711311       23.7244          23.7244       0.           11 * 806.762
1711312       23.72445         23.72445      0.           12 * 806.762
1711313       23.7251          23.7251       0.           13 • 806.762
1711314       23.72517         23.72517      0.           14 • 806.762
1711315       23.72523         23.72523      0.           15 • 806.762
1711316       23.7253          23.7253       0.           16 • 806.762
1711317       23.72533         23.72533      0.           17 • 806.762
1711318       23.7254          23.7254       0.           18 • 806.762
1711319       23.72544         23.72544      0.           19 • 806.762
1711320       23.7255          23.7255       0.           20 • 806.762
1711321       23.72554         23.72554      0.           21 • 806.762
1711322       23.7256          23.7256       0.           22 • 806.762
1711323       23.72565         23.72565      0.           23 • 806.762
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
1730000             "ifdexit"               snglljun
*-------------------------------------------*----------------------*
*hydro    from          to          area      f loss     r loss    vcahs
1730101   171010000     174000000   0.03095   0.1028     0.04696   01000
*
*hydro    jun hyd diam
1730110       0.1985       0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
1730201     0               23.7257        23.7257         0. * 806.762
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
1740000             "psvaw-1"               pipe
*-------------------------------------------------$-----------------$
1740001           2
*
*hydro          vol area                                          vol
1740101         0.08322                                            2
*
*hydro           length                                           vol
1740301           0.25                                             2
*
```

```
*hydro           volume                                           vol
1740401            0.                                              2
*
*hydro           volume                                           vol
1740501            0.                                              2
*
*hydro         vert angle                                         vol
1740601           45.0                                             2
*
*hydro          delta z                                           vol
1740701           0.25                                             2
*
*hydro         roughness       hyd diam                           vol
1740801        0.0000457        0.3255                             2
*
*hydro           f loss         r loss                            jun
1740901           0.0             0.0                             1
*
*hydro             fe                                             vol
1741001            00                                              2
*
*hydro           vcahs                                            jun
1741101          01000                                             1
*
*hydro  ebt pressure     tempe                                     vol
1741201     0        2572343.     178282.8   2418932. 0. 0.        1
1741202     0        2569224.     178283.2   2418922. 0. 0.        2
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate                jun
1741300 0
1741301       8.82283          9.15815       0.           1 • 806.762
*
*-------------------------------------------------------------------------$
*
*        components 2xx - heat exchanger coolant loop 2
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
2010000              "hlsplit2"              pipe
*-------------------------------------------------$-----------------$
2010001           36
*
*hydro          vol area                                          vol
2010101         0.08322                                            36
*
*hydro           length                                           vol
2010301          0.214                                             5
2010302          0.183                                            25
2010303          0.2                                              35
2010304          0.21                                             36
*
*hydro           volume                                           vol
2010401           0.0                                             36
*
*hydro         vert angle                                         vol
2010601            0.                                             36
*
*hydro         delta z                                            vol
2010701           0.                                              36
*
*hydro         roughness       hyd diam                           vol
2010801        0.0000457        0.3255                             36
*
```

```
*hydro          kf        kr                                          jun
2010901         0.0       0.0                                          4
2010902         0.182     0.182                                        5
2010903         0.0       0.0                                         24
2010904         0.182     0.182                                       25
2010905         0.0       0.0                                         35
*
*hydro             fe                                                 vol
2011001            00                                                 36
*
*hydro           vcahs                                                jun
2011101          01000                                                35
*
*hydro  ebt pressure     tempe                                        vol
2011201     0       1610438.     317520.4    2411927. 0. 0.        1
2011202     0       1610043.     317521.     2411922. 0. 0.        2
2011203     0       1609648.     317521.     2411917. 0. 0.        3
2011204     0       1609252.     317521.5    2411912. 0. 0.        4
2011205     0       1608857.     317522.     2411907. 0. 0.        5
2011206     0       1600046.     317427.5    2411798. 0. 0.        6
2011207     0       1599709.     317428.     2411794. 0. 0.        7
2011208     0       1599371.     317428.     2411790. 0. 0.        8
2011209     0       1599032.     317428.4    2411786. 0. 0.        9
2011210     0       1598694.     317429.     2411781. 0. 0.        10
2011211     0       1598356.     317429.     2411777. 0. 0.        11
2011212     0       1598018.     317429.4    2411773. 0. 0.        12
2011213     0       1597680.     317430.     2411769. 0. 0.        13
2011214     0       1597342.     317430.     2411764. 0. 0.        14
2011215     0       1597004.     317430.     2411760. 0. 0.        15
2011216     0       1596666.     317430.6    2411756. 0. 0.        16
2011217     0       1596327.     317431.     2411752. 0. 0.        17
2011218     0       1595989.     317431.     2411748. 0. 0.        18
2011219     0       1595651.     317431.6    2411744. 0. 0.        19
2011220     0       1595313.     317432.     2411739. 0. 0.        20
2011221     0       1594975.     317432.     2411735. 0. 0.        21
2011222     0       1594637.     317432.5    2411731. 0. 0.        22
2011223     0       1594299.     317433.     2411727. 0. 0.        23
2011224     0       1593960.     317433.     2411722. 0. 0.        24
2011225     0       1593622.     317433.4    2411718. 0. 0.        25
2011226     0       1584824.     317376.6    2411608. 0. 0.        26
2011227     0       1584455.     317377.     2411604. 0. 0.        27
2011228     0       1584086.     317377.     2411599. 0. 0.        28
2011229     0       1583716.     317377.7    2411595. 0. 0.        29
2011230     0       1583347.     317378.     2411590. 0. 0.        30
2011231     0       1582977.     317378.3    2411586. 0. 0.        31
2011232     0       1582608.     317379.     2411581. 0. 0.        32
2011233     0       1582238.     317379.     2411576. 0. 0.        33
2011234     0       1581868.     317379.3    2411572. 0. 0.        34
2011235     0       1581499.     317380.     2411567. 0. 0.        35
2011236     0       1581120.     317380.     2411562. 0. 0.        36
*
*hydro          vel/flw
2011300           0
*
*hydro        f velocity   g velocity    j velocity              jun
2011301       9.26629         9.26629      0.          1 * 832.473
2011302       9.26629         9.26629      0.          2 * 832.473
2011303       9.2663          9.2663       0.          3 * 832.473
2011304       9.2663          9.2663       0.          4 * 832.473
2011305       9.2663          9.2663       0.          5 * 832.473
2011306       9.2662          9.2662       0.          6 * 832.473
2011307       9.2662          9.2662       0.          7 * 832.473
2011308       9.2662          9.2662       0.          8 * 832.473
2011309       9.2662          9.2662       0.          9 * 832.473
2011310       9.2662          9.2662       0.          10 * 832.473
2011311       9.26621         9.26621      0.          11 * 832.473
2011312       9.26621         9.26621      0.          12 * 832.473
2011313       9.26621         9.26621      0.          13 * 832.473
2011314       9.26621         9.26621      0.          14 * 832.473
2011315       9.26622         9.26622      0.          15 * 832.473
2011316       9.26622         9.26622      0.          16 * 832.473
2011317       9.26622         9.26622      0.          17 * 832.473
2011318       9.26622         9.26622      0.          18 * 832.473
2011319       9.26622         9.26622      0.          19 * 832.473
2011320       9.26623         9.26623      0.          20 * 832.473
2011321       9.26623         9.26623      0.          21 * 832.473
2011322       9.26623         9.26623      0.          22 * 832.473
2011323       9.26623         9.26623      0.          23 * 832.473
2011324       9.26623         9.26623      0.          24 * 832.473
2011325       9.26623         9.26623      0.          25 * 832.473
2011326       9.26619         9.26619      0.          26 * 832.473
2011327       9.2662          9.2662       0.          27 * 832.473
2011328       9.2662          9.2662       0.          28 * 832.473
2011329       9.2662          9.2662       0.          29 * 832.473
2011330       9.2662          9.2662       0.          30 * 832.473
2011331       9.2662          9.2662       0.          31 * 832.473
2011332       9.2662          9.2662       0.          32 * 832.473
2011333       9.2662          9.2662       0.          33 * 832.473
2011334       9.2662          9.2662       0.          34 * 832.473
2011335       9.2662          9.2662       0.          35 * 832.473
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
2030000              "hlsplj"               mtpljun
*-------------------------------------------------------------------------$
2030001     1         0
*hydro    from          to           area      f loss     r loss     vcahs
2030011   650380002     201010001    0.24663     1.20       1.20     01000
2030012   1.0   1.0   1.0   0     0     0     1
*
2031011   3.12671  3.12671  1 * 832.473
*
2032011   0.56037 0.0 1.0 1.0 1
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
2020000              "isolate"              valve
*-----------------------------------------$----------------------$
*hydro    from          to           area      f loss     r loss     vcahs
2020101   201010000     204000000    0.08322   0.104      0.104      01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
2020201     0              9.26621        9.26621        0. * 832.473
*
*hydro                valve type
2020300                trpvlv
*
*hydro                trip no.
2020301                515
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
2040000              "hotleg"               pipe
*-----------------------------------------$----------------------$
2040001          81
*
*hydro          vol area                                              vol
2040101        0.08322                                                 81
*
*hydro          length                                                vol
```

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2040301          0.23                                                  3
2040302          0.2                                                   67
2040303          0.15                                                  68
2040304          0.2                                                   80
2040305          0.11                                                  81
*
*hydro           volume                                                vol
2040401            0.                                                  81
*
*hydro           volume                                                vol
2040501            0.                                                  81
*
*hydro         vert angle                                              vol
2040601            0.                                                  68
2040602           90.                                                  81
*
*hydro          delta z                                                vol
2040701            0.0                                                 68
2040702            0.2                                                 80
2040703            0.04                                                81
*
*hydro         roughness       hyd diam                                vol
2040801        0.0000457        0.3255                                 81
*
*hydro           f loss          r loss                                jun
2040901            0.0             0.0                                 67
2040902            0.24            0.24                                68
2040903            0.0             0.0                                 80
*
*hydro            fe                                                   vol
2041001            00                                                  81
*
*hydro           vcahs                                                 jun
2041101          01000                                                 80
*
*hydro  ebt pressure     tempe                                         vol
2041201    0       1575888.     317362.6    2411497. 0. 0.       1
2041202    0       1575464.     317363.     2411491. 0. 0.       2
2041203    0       1575039.     317363.4    2411486. 0. 0.       3
2041204    0       1575268.     317029.     2411489. 0. 0.       4
2041205    0       1574278.     317029.     2411476. 0. 0.       5
2041206    0       1573909.     317030.     2411472. 0. 0.       6
2041207    0       1573539.     317030.     2411467. 0. 0.       7
2041208    0       1573170.     317030.6    2411462. 0. 0.       8
2041209    0       1572800.     317031.     2411458. 0. 0.       9
2041210    0       1572431.     317031.4    2411453. 0. 0.       10
2041211    0       1572061.     317032.     2411448. 0. 0.       11
2041212    0       1571692.     317032.     2411444. 0. 0.       12
2041213    0       1571322.     317032.4    2411439. 0. 0.       13
2041214    0       1570953.     317033.     2411434. 0. 0.       14
2041215    0       1570583.     317033.     2411430. 0. 0.       15
2041216    0       1570214.     317033.     2411425. 0. 0.       16
2041217    0       1569844.     317033.6    2411421. 0. 0.       17
2041218    0       1569475.     317034.     2411416. 0. 0.       18
2041219    0       1569106.     317034.     2411411. 0. 0.       19
2041220    0       1568736.     317034.6    2411407. 0. 0.       20
2041221    0       1568367.     317035.     2411402. 0. 0.       21
2041222    0       1567997.     317035.3    2411398. 0. 0.       22
2041223    0       1567628.     317036.     2411393. 0. 0.       23
2041224    0       1567258.     317036.     2411388. 0. 0.       24
2041225    0       1566889.     317036.4    2411384. 0. 0.       25
2041226    0       1566519.     317037.     2411379. 0. 0.       26
2041227    0       1566150.     317037.     2411374. 0. 0.       27
2041228    0       1565780.     317037.4    2411370. 0. 0.       28
2041229    0       1565411.     317038.     2411365. 0. 0.       29
2041230    0       1565041.     317038.     2411360. 0. 0.       30
2041231    0       1564672.     317038.4    2411356. 0. 0.       31
2041232    0       1564302.     317039.     2411351. 0. 0.       32
2041233    0       1563933.     317039.     2411346. 0. 0.       33
2041234    0       1563564.     317039.4    2411342. 0. 0.       34
2041235    0       1563194.     317040.     2411337. 0. 0.       35
2041236    0       1562825.     317040.     2411332. 0. 0.       36
2041237    0       1562455.     317040.5    2411328. 0. 0.       37
2041238    0       1562086.     317041.     2411323. 0. 0.       38
2041239    0       1561716.     317041.     2411318. 0. 0.       39
2041240    0       1561347.     317041.5    2411314. 0. 0.       40
2041241    0       1560977.     317042.     2411309. 0. 0.       41
2041242    0       1560608.     317042.     2411304. 0. 0.       42
2041243    0       1560238.     317042.6    2411300. 0. 0.       43
2041244    0       1559869.     317043.     2411295. 0. 0.       44
2041245    0       1559500.     317043.     2411290. 0. 0.       45
2041246    0       1559130.     317043.6    2411285. 0. 0.       46
2041247    0       1558760.     317044.     2411281. 0. 0.       47
2041248    0       1558391.     317044.     2411276. 0. 0.       48
2041249    0       1558022.     317044.6    2411271. 0. 0.       49
2041250    0       1557652.     317045.     2411267. 0. 0.       50
2041251    0       1557283.     317045.     2411262. 0. 0.       51
2041252    0       1556913.     317045.6    2411257. 0. 0.       52
2041253    0       1556544.     317046.     2411252. 0. 0.       53
2041254    0       1556174.     317046.3    2411248. 0. 0.       54
2041255    0       1555805.     317046.7    2411243. 0. 0.       55
2041256    0       1555435.     317047.     2411238. 0. 0.       56
2041257    0       1555066.     317047.3    2411234. 0. 0.       57
2041258    0       1554696.     317048.     2411229. 0. 0.       58
2041259    0       1554327.     317048.     2411224. 0. 0.       59
2041260    0       1553958.     317048.4    2411220. 0. 0.       60
2041261    0       1553588.     317049.     2411215. 0. 0.       61
2041262    0       1553218.     317049.     2411210. 0. 0.       62
2041263    0       1552849.     317049.4    2411206. 0. 0.       63
2041264    0       1552480.     317050.     2411201. 0. 0.       64
2041265    0       1552110.     317050.     2411196. 0. 0.       65
2041266    0       1551741.     317050.4    2411192. 0. 0.       66
2041267    0       1551371.     317051.     2411187. 0. 0.       67
2041268    0       1551048.     317051.     2411183. 0. 0.       68
2041269    0       1538531.     317051.3    2411023. 0. 0.       69
2041270    0       1536044.     317052.     2410992. 0. 0.       70
2041271    0       1533557.     317052.     2410960. 0. 0.       71
2041272    0       1531070.     317052.4    2410928. 0. 0.       72
2041273    0       1528583.     317053.     2410896. 0. 0.       73
2041274    0       1526096.     317053.     2410864. 0. 0.       74
2041275    0       1523609.     317053.4    2410832. 0. 0.       75
2041276    0       1521122.     317054.     2410800. 0. 0.       76
2041277    0       1518635.     317054.     2410768. 0. 0.       77
2041278    0       1516148.     317054.4    2410735. 0. 0.       78
2041279    0       1513661.     317055.     2410703. 0. 0.       79
2041280    0       1511174.     316991.     2410671. 0. 0.       80
2041281    0       1509618.     316991.     2410651. 0. 0.       81
*
*hydro         vel/flw
2041300          0
*
*hydro        f flowrate    g flowrate    j flowrate                 jun
2041301       9.2662        9.2662        0.          1 * 832.473
2041302       9.26621       9.26621       0.          2 * 832.473
2041303       9.26621       9.26621       0.          3 * 832.473
2041304       9.26579       9.26579       0.          4 * 832.477
2041305       9.2658        9.2658        0.          5 * 832.477
2041306       9.2658        9.2658        0.          6 * 832.477
2041307       9.2658        9.2658        0.          7 * 832.477
2041308       9.2658        9.2658        0.          8 * 832.477
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2041309     9.2658          9.2658          0.          9 * 832.477
2041310     9.2658          9.2658          0.          10 * 832.477
2041311     9.2658          9.2658          0.          11 * 832.477
2041312     9.2658          9.2658          0.          12 * 832.477
2041313     9.2658          9.2658          0.          13 * 832.477
2041314     9.2658          9.2658          0.          14 * 832.477
2041315     9.26581         9.26581         0.          15 * 832.477
2041316     9.26581         9.26581         0.          16 * 832.477
2041317     9.26581         9.26581         0.          17 * 832.477
2041318     9.26582         9.26582         0.          18 * 832.477
2041319     9.26582         9.26582         0.          19 * 832.477
2041320     9.26582         9.26582         0.          20 * 832.477
2041321     9.26582         9.26582         0.          21 * 832.477
2041322     9.26583         9.26583         0.          22 * 832.477
2041323     9.26583         9.26583         0.          23 * 832.477
2041324     9.26583         9.26583         0.          24 * 832.477
2041325     9.26583         9.26583         0.          25 * 832.477
2041326     9.26583         9.26583         0.          26 * 832.477
2041327     9.26583         9.26583         0.          27 * 832.477
2041328     9.26584         9.26584         0.          28 * 832.477
2041329     9.26584         9.26584         0.          29 * 832.477
2041330     9.26584         9.26584         0.          30 * 832.477
2041331     9.26584         9.26584         0.          31 * 832.477
2041332     9.26584         9.26584         0.          32 * 832.477
2041333     9.26585         9.26585         0.          33 * 832.477
2041334     9.26585         9.26585         0.          34 * 832.477
2041335     9.26585         9.26585         0.          35 * 832.477
2041336     9.26585         9.26585         0.          36 * 832.477
2041337     9.26585         9.26585         0.          37 * 832.477
2041338     9.26586         9.26586         0.          38 * 832.477
2041339     9.26586         9.26586         0.          39 * 832.477
2041340     9.26586         9.26586         0.          40 * 832.477
2041341     9.26586         9.26586         0.          41 * 832.477
2041342     9.26586         9.26586         0.          42 * 832.477
2041343     9.26587         9.26587         0.          43 * 832.477
2041344     9.26587         9.26587         0.          44 * 832.477
2041345     9.26587         9.26587         0.          45 * 832.477
2041346     9.26587         9.26587         0.          46 * 832.477
2041347     9.26587         9.26587         0.          47 * 832.477
2041348     9.26588         9.26588         0.          48 * 832.477
2041349     9.26588         9.26588         0.          49 * 832.477
2041350     9.26588         9.26588         0.          50 * 832.477
2041351     9.26588         9.26588         0.          51 * 832.477
2041352     9.26588         9.26588         0.          52 * 832.477
2041353     9.26589         9.26589         0.          53 * 832.477
2041354     9.26589         9.26589         0.          54 * 832.477
2041355     9.26589         9.26589         0.          55 * 832.477
2041356     9.2659          9.2659          0.          56 * 832.477
2041357     9.2659          9.2659          0.          57 * 832.477
2041358     9.2659          9.2659          0.          58 * 832.477
2041359     9.2659          9.2659          0.          59 * 832.477
2041360     9.2659          9.2659          0.          60 * 832.477
2041361     9.2659          9.2659          0.          61 * 832.477
2041362     9.2659          9.2659          0.          62 * 832.477
2041363     9.2659          9.2659          0.          63 * 832.477
2041364     9.2659          9.2659          0.          64 * 832.477
2041365     9.2659          9.2659          0.          65 * 832.477
2041366     9.26591         9.26591         0.          66 * 832.477
2041367     9.26591         9.26591         0.          67 * 832.477
2041368     9.26591         9.26591         0.          68 * 832.477
2041369     9.26596         9.9291          0.          69 * 832.477
2041370     9.26597         9.92916         0.          70 * 832.477
2041371     9.26599         9.92922         0.          71 * 832.477
2041372     9.266           9.92929         0.          72 * 832.477
2041373     9.266           9.92935         0.          73 * 832.477
2041374     9.26602         9.92942         0.          74 * 832.477
2041375     9.26603         9.92948         0.          75 * 832.477
2041376     9.26604         9.92955         0.          76 * 832.477
2041377     9.26605         9.92961         0.          77 * 832.477
2041378     9.26606         9.92968         0.          78 * 832.477
2041379     9.26607         9.92974         0.          79 * 832.477
2041380     9.26599         9.92972         0.          80 * 832.477
*
*=================================================================$
*
*               main heat exchanger - loop 2
*
*=================================================================$
*
*-----------------------------------------------------------------$
*hydro             component name      component type
2060000             "hxplin2"             branch
*-----------------------------------------------$-----------------$
*hydro           no. juns            vel/flw
2060001             2                   0
*
*hydro            area               length              volume
2060101          0.08322               1.0                 0.
*
*hydro         horz angle          vert angle          delta z
2060102           0.                  0.                  0.
*
*hydro         roughness           hyd diam            fe
2060103         0.0000457             0.3255              0
*
*hydro  ebt pressure     tempe
2060200     0       1553821.     316993.  2411218. 0.
*
*hydro    from          to            area      f loss    r loss    vcahs
2061101 206000000    208000000        0.          0.15      0.15    01000
2062101 204010000    206000000        0.          0.        0.      01000
*
*hydro   hyd diam
2061110 0.3255   0.0 1.0 1.0
2062110 0.3255   0.0 1.0 1.0
*
*hydro                 f velocity     g velocity     j velocity
2061201                 9.21192        9.21192          0. * 827.634
2062201                 9.266          9.92975          0. * 832.477
*
*-----------------------------------------------------------------*
*hydro             component name      component type
2080000             "mhx-prim"            pipe
*-----------------------------------------------$-----------------$
2080001         11
*
*hydro          vol area                                          vol
2080101          0.8258                                            5
2080102          0.841                                             6
2080103          0.8258                                           11
*
*hydro          length                                            vol
2080301           1.11                                             5
2080302           2.03                                             6
2080303           1.11                                            11
*
*hydro          volume                                            vol
2080401           0.                                              11
*
*hydro         vert angle                                         vol
```

```
2080601           0.                                                    11
*
*hydro          delta z                                                 vol
2080701           0.0                                                   11
•
*hydro         roughness      hyd diam                                  vol
2080801         0.0000457     0.636                                     5
2080802         0.0000457     0.894                                     6
2080803         0.0000457     0.636                                     11
•
*hydro            fe                                                    vol
2081001           00                                                    11
*
*hydro          vcahs                                                   jun
2081101         01000                                                   10
*
*hydro  ebt pressure     tempe                                          vol
2081201     0       1544656.     286236.6   2411102. 0. 0.       1
2081202     0       1544649.     259480.5   2411102. 0. 0.       2
2081203     0       1544642.     236085.    2411101. 0. 0.       3
2081204     0       1544634.     215530.8   2411101. 0. 0.       4
2081205     0       1544626.     197392.7   2411101. 0. 0.       5
2081206     0       1544632.     197382.    2411101. 0. 0.       6
2081207     0       1544605.     193481.2   2411101. 0. 0.       7
2081208     0       1544595.     189961.    2411101. 0. 0.       8
2081209     0       1544585.     186781.2   2411100. 0. 0.       9
2081210     0       1544574.     183906.    2411100. 0. 0.       10
2081211     0       1544564.     181304.2   2411100. 0. 0.       11
*
*hydro         f velocity   g velocity    j velocity                jun
2081300 0
2081301       .924217          .924217       0.          1 • 827.634
2081302       .920907          .920907       0.          2 • 827.634
2081303       .91823           .91823        0.          3 • 827.634
2081304       .91605           .91605        0.          4 • 827.634
2081305       .914266          .914266       0.          5 • 827.634
2081306       .914264          .914264       0.          6 * 827.633
2081307       .913898          .913898       0.          7 • 827.633
2081308       .913573          .913573       0.          8 • 827.633
2081309       .913284          .913284       0.          9 • 827.633
2081310       .913027          .913027       0.          10 • 827.633
*
*hydro   jun hyd diam                                                   jun
2081401      0.100       0.0 1.0 1.0                                    10
•
*-------------------------------------------------------------------$
*hydro             component name      component type
2120000              "hxplout1"             branch
*-------------------------------------------$---------------------$
*hydro           no. juns            vel/flw
2120001             2                   0
*
*hydro            area               length              volume
2120101          0.08322                1.0                 0.
*
*hydro         horz angle          vert angle          delta z
2120102             0.                  0.                  0.
•
*hydro          roughness          hyd diam              fe
2120103          0.0000457           0.3255               0
*
*hydro  ebt pressure     tempe
2120200     0       1492308.     181306.  2410404. 0.
•
*hydro    from          to          area      f loss    r loss    vcahs
```

```
2121101 208010000    212000000       0.         0.15       0.15   01000
2122101 212010000    213000000       0.08322    0.         0.     01000
•
*hydro   hyd diam
2121110 0.3255  0.0 1.0 1.0
2122110 0.3255 0.0 1.0 1.0
•
*hydro                 f velocity     g velocity     j velocity
2121201              9.05777          9.05777          0. • 827.633
2122201              9.05798          9.05798          0. • 827.633
•
*-------------------------------------------------------------------$
•hydro             component name      component type
2130000              "joinhx"               pipe
*-------------------------------------------$-----------------$
2130001           19
*
*hydro          vol area                                               vol
2130101          0.08322                                               19
*
*hydro           length                                                vol
2130301          0.1981                                                10
2130302          0.205                                                 16
2130303          0.2032                                                19
*
*hydro           volume                                                vol
2130401            0.                                                  19
*
•hydro          vert angle                                             vol
2130601            -22.6                                               10
2130602            -29.7                                               16
2130603            -90.                                                19
*
*hydro          elev. change                                           vol
2130701           -0.0762                                              10
2130702           -0.10155                                             16
2130703           -0.2032                                              19
*
•hydro          roughness      hyd diam                                vol
2130801         0.0000457       0.3255                                19
*
*hydro           f loss         r loss                                 jun
2130901           0.0            0.0                                  9
2130902           0.182          0.182                                10
2130903           0.0            0.0                                  15
2130904           0.182          0.182                                16
2130905           0.0            0.0                                  18
*
•hydro            fe                                                   vol
2131001           00                                                   19
*
*hydro          vcahs                                                  jun
2131101         01000                                                  18
*
*hydro  ebt pressure     tempe                                         vol
2131201     0       1491632.     181306.    2410394. 0. 0.       1
2131202     0       1492093.     181306.5   2410401. 0. 0.       2
2131203     0       1492555.     181307.    2410408. 0. 0.       3
2131204     0       1493017.     181307.    2410416. 0. 0.       4
2131205     0       1493478.     181307.5   2410423. 0. 0.       5
2131206     0       1493940.     181307.8   2410430. 0. 0.       6
2131207     0       1494402.     181308.    2410438. 0. 0.       7
2131208     0       1494863.     181308.5   2410445. 0. 0.       8
2131209     0       1495325.     181308.8   2410452. 0. 0.       9
2131210     0       1495787.     181309.    2410459. 0. 0.       10
```

```
2131211     0       1488172.     181309.5   2410339. 0. 0.       11
2131212     0       1488894.     181309.8   2410350. 0. 0.       12
2131213     0       1489616.     181310.    2410362. 0. 0.       13
2131214     0       1490338.     181310.5   2410373. 0. 0.       14
2131215     0       1491060.     181310.8   2410385. 0. 0.       15
2131216     0       1491782.     181311.    2410396. 0. 0.       16
2131217     0       1484847.     181311.5   2410286. 0. 0.       17
2131218     0       1486667.     181311.8   2410315. 0. 0.       18
2131219     0       1488486.     181312.    2410344. 0. 0.       19
*
*hydro          vel/flw
2131300            0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
2131301       9.05798          9.05798       0.          1 • 827.633
2131302       9.05798          9.05798       0.          2 • 827.633
2131303       9.05798          9.05798       0.          3 • 827.633
2131304       9.05798          9.05798       0.          4 • 827.633
2131305       9.05797          9.05797       0.          5 • 827.633
2131306       9.05797          9.05797       0.          6 • 827.633
2131307       9.05797          9.05797       0.          7 • 827.633
2131308       9.05797          9.05797       0.          8 • 827.633
2131309       9.05797          9.05797       0.          9 • 827.633
2131310       9.05797          9.05797       0.          10 • 827.633
2131311       9.058            9.058         0.          11 • 827.633
2131312       9.058            9.058         0.          12 • 827.633
2131313       9.058            9.058         0.          13 • 827.633
2131314       9.05799          9.05799       0.          14 • 827.633
2131315       9.05799          9.05799       0.          15 • 827.633
2131316       9.05798          9.05798       0.          16 • 827.633
2131317       9.05801          9.71495       0.          17 • 827.633
2131318       9.058            9.7149        0.          18 • 827.633
•
*-------------------------------------------------------------------------$
*       main heat exchanger secondary flow system (tube side)            $
*-------------------------------------------------------------------------$
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
2300000              "secsrc2"              tmdpvol
*-------------------------------------------------------------------------*
*hydro          area        length       volume
2300101         1.e6           .0        1.0e+06
*
*hydro       horz angle   vert angle     delta z
2300102          .0           .0            .0
*
*hydro        roughness    hyd diam        fe
2300103           .0           .0           10
*
*hydro  ebt         trip no.        alpha vrc       numeric vrc
2300200 003
*
*hydro   time      pressure      tempe
2300201  0.       5.000e5       302.55
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
2320000              "sectdj1"              tmdpjun
*-------------------------------------------------------------------------*
*hydro    from           to             area
2320101   230000000      234000000      0.7122
*
*hydro    vel/flw        trip no.       alpha vrc       numeric vrc
2320200     1              0             cntrlvar          598
*
*hydro   time           f flow          g flow          j flow
2320201   -1.e6          -1.e6            0.                0
2320202    1.e6           1.e6            0.                0
•
*-------------------------------------------------------------------------*
*hydro              component name       component type
2340000              "mhx-sec"              pipe
*-------------------------------------------------$-----------------$
2340001          10
•
*hydro          vol area                                              vol
2340101         0.776                                                  10
•
*hydro           length                                               vol
2340301            1.314                                              10
*
*hydro           volume                                               vol
2340401            0.                                                 10
*
*hydro         vert angle                                             vol
2340601            0.                                                 10
*
*hydro          delta z                                               vol
2340701            0.0                                                10
*
*hydro         roughness       hyd diam                               vol
2340801         0.0000457       0.01588                               10
•
*hydro             fe                                                 vol
2341001            00                                                 10
*
*hydro           vcahs                                                jun
2341101          01000                                                 9
*
*hydro  ebt pressure     tempe                                        vol
2341201     0       499077.      132035.     2559868. 0. 0.       1
2341202     0       493504.      142154.     2559513. 0. 0.       2
2341203     0       487950.      153670.     2559155. 0. 0.       3
2341204     0       482415.      166838.3    2558795. 0. 0.       4
2341205     0       476899.      181973.3    2558433. 0. 0.       5
2341206     0       471389.5     183256.3    2558068. 0. 0.       6
2341207     0       465884.5     184673.4    2557700. 0. 0.       7
2341208     0       460381.      186240.4    2557329. 0. 0.       8
2341209     0       454880.      187974.5    2556954. 0. 0.       9
2341210     0       449380.      189895.8    2556576. 0. 0.       10
•
*hydro         f velocity    g velocity     j velocity                jun
2341300 0
2341301       2.176183         2.176183      0.          1 • 1681.036
2341302       2.17793          2.17793       0.          2 • 1681.036
2341303       2.180047         2.180047      0.          3 • 1681.036
2341304       2.182634         2.182634      0.          4 • 1681.036
2341305       2.18582          2.18582       0.          5 • 1681.036
2341306       2.186104         2.186104      0.          6 • 1681.036
2341307       2.18642          2.18642       0.          7 • 1681.036
2341308       2.18677          2.18677       0.          8 • 1681.036
2341309       2.18716          2.18716       0.          9 • 1681.036
•
*hydro   jun hyd diam                                                  jun
2341401      0.01588      0.0 1.0 1.0                                   9
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
2350000              "tubeout"              sngljun
```

```
*-------------------------------------------*----------------------*
*hydro    from          to          area      f loss    r loss    vcahs
2350101   234010000     236000000   0.0       0.        0.        01000
*
*hydro   hyd diam
2350110   0.01588      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2350201     0              2.187596       2.187596       0. * 1681.036
*
*-------------------------------------------------------------------*
*hydro             component name       component type
2360000             "secsnk1"             tmdpvol
*-------------------------------------------------------------------*
*hydro          area       length      volume
2360101        1.e6          .0       1.0e+06
*
*hydro      horz angle  vert angle    delta z
2360102          .0          .0          .0
*
*hydro       roughness   hyd diam       fe
2360103           .0          .0         10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
2360200 003
*
*hydro   time     pressure     tempe
2360201   0.      4.490e5      319.
*
*===================================================================$
*
*        emergency heat exchanger - loop 2
*
*===================================================================$
*
*-------------------------------------------------------------------$
*hydro             component name       component type
2140000               hxplin1               branch
*-------------------------------------------$----------------------$
*hydro           no. juns            vel/flw
2140001             2                   0
*
*hydro            area               length              volume
2140101          0.08322              1.0                 0.
*
*hydro         horz angle          vert angle          delta z
2140102           0.                  0.                  0.
*
*hydro          roughness          hyd diam            fe
2140103          0.0000457           0.3255              0
*
*hydro  ebt pressure     tempe
2140200     0       1532647.     181313.8 2410948. 0.
*
*hydro    from          to          area      f loss    r loss    vcahs
2141101 214000000     216000000   0.          0.15      0.15    01000
2142101 213010000     214000000   0.          0.        0.      01000
*
*hydro   hyd diam
2141110 0.3255   0.0 1.0 1.0
2142110 0.3255   0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
2141201                9.05782        9.05782          0. * 827.633
2142201                9.058          9.71485          0. * 827.633
*
*-------------------------------------------------------------------*
*hydro             component name       component type
2160000             "ehx-prim"            pipe
*-------------------------------------------$----------------------$
2160001          4
*
*hydro          vol area                                          vol
2160101          0.894                                              4
*
*hydro          length                                            vol
2160301          1.6                                                4
*
*hydro          volume                                            vol
2160401          0.                                                 4
*
*hydro         vert angle                                         vol
2160601          0.                                                 4
*
*hydro          delta z                                           vol
2160701          0.0                                                4
*
* calibrated hydraulic diameter to match pressure drop
*
*hydro         roughness      hyd diam                            vol
*2160801        0.0000457      0.0346                               4
2160801         0.0000457      0.00170                              4
*
*hydro          f loss         r loss                             jun
2160901          0.0            0.0                               3
*
*hydro           fe                                               vol
2161001          00                                                 4
*
*hydro          vcahs                                             jun
2161101          01000                                              3
*
*hydro  ebt pressure     tempe                                     vol
2161201     0       1517779.     179262.7   2410756. 0. 0.        1
2161202     0       1505956.     179075.    2410603. 0. 0.        2
2161203     0       1494156.     179048.    2410434. 0. 0.        3
2161204     0       1482360.     179038.6   2410247. 0. 0.        4
*
*hydro         f velocity   g velocity    j velocity               jun
2161300 0
2161301       .843008          .843008      0.           1 * 827.632
2161302       .842997          .842997      0.           2 * 827.632
2161303       .842999          .842999      0.           3 * 827.632
*
*hydro   jun hyd diam                                              jun
2161401      0.00170     0.0 1.0 1.0                               3
*
*-------------------------------------------------------------------$
*hydro             component name       component type
2200000               hxplout1              branch
*-------------------------------------------$----------------------$
*hydro           no. juns            vel/flw
2200001             2                   0
*
*hydro            area               length              volume
2200101          0.08322              1.0                 0.
*
*hydro         horz angle          vert angle          delta z
2200102           0.                  0.                  0.
*
```

```
*hydro          roughness           hyd diam              fe
2200103          0.0000457           0.3255               0
*
*hydro  ebt pressure     tempe
2200200     0       1424153.     179040.2 2409309. 0.
*
*hydro    from          to          area       f loss    r loss    vcahs
2201101 216010000    220000000       0.         0.15       0.15   01000
2202101 220010000    222000000       0.08322    0.         0.     01000
*
*hydro   hyd diam
2201110 0.3255  0.0 1.0 1.0
2202110 0.3255 0.0 1.0 1.0
*
*hydro                 f velocity     g velocity     j velocity
2201201              9.05604          9.05604          0. * 827.632
2202201              9.05628          9.05628          0. * 827.632
*
*----------------------------------------------------------------------$
*       emergency heat exchanger secondary flow system (tube side)          $
*----------------------------------------------------------------------$
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2380000             "secsrc1"             tmdpvol
*----------------------------------------------------------------------*
*hydro         area       length      volume
2380101        1.e6          .0       1.0e+06
*
*hydro      horz angle  vert angle    delta z
2380102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
2380103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
2380200 003
*
*hydro   time     pressure     tempe
2380201   0.      1.800e5      311.15
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2400000             "tubein"              sngljun
*-------------------------------------------*----------------------*
*hydro    from          to          area       f loss    r loss    vcahs
2400101   238000000     242000000    0.0          0.        0.      01100
*
*hydro   hyd diam
2400110   0.4573       0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2400201     0              -.0798972      -.0798972       0. * -33.72203
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2420000             "ehx-sec"             pipe
*-----------------------------------------------$-----------------$
2420001          2
*
*hydro          vol area                                          vol
2420101         0.4264                                             2
*
*hydro           length                                           vol
2420301          0.7622                                           2
*
*hydro          volume                                            vol
2420401          0.                                               2
*
*hydro         vert angle                                         vol
2420601          0.                                               2
*
*hydro          delta z                                           vol
2420701          0.0                                              2
*
*hydro         roughness      hyd diam                           vol
2420801         0.0000457      0.4573                            2
*
*hydro            fe                                             vol
2421001          00                                               2
*
*hydro          vcahs                                            jun
2421101          01000                                            1
*
*hydro  ebt pressure     tempe                                    vol
2421201     0       180000.5     192851.7   2525554. 0. 0.        1
2421202     0       180000.6     192851.6   2525554. 0. 0.        2
*
*hydro         f velocity    g velocity    j velocity               jun
2421300 0
2421301       -.0798972        -.0798972    0.           1 * -33.72203
*
*hydro   jun hyd diam                                              jun
2421401      0.4573      0.0 1.0 1.0                              1
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2440000             "tubein"              sngljun
*-------------------------------------------*----------------------*
*hydro    from          to          area       f loss    r loss    vcahs
2440101   242010000     246000000    0.0          0.        0.      01100
*
*hydro   hyd diam
2440110   0.01905      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2440201     0              -.0798972      -.0798972       0. * -33.72203
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2460000             "ehx-sec"             pipe
*-----------------------------------------------$-----------------$
2460001          4
*
*hydro          vol area                                          vol
2460101         0.476                                              4
*
*hydro           length                                           vol
2460301          1.6                                              4
*
*hydro          volume                                            vol
2460401          0.                                               4
*
*hydro         vert angle                                         vol
2460601          0.                                               4
*
*hydro          delta z                                           vol
2460701          0.0                                              4
*
*hydro         roughness      hyd diam                           vol
```

```
2460801         0.0000457     0.01905                                    4
*
*hydro             fe                                                   vol
2461001            00                                                    4
*
*hydro            vcahs                                                 jun
2461101           01000                                                  3
*
*hydro  ebt pressure     tempe                                          vol
2461201     0       180004.7     192851.5   2525555. 0.          0. 1
2461202     0       180011.6     192789.4   2525556. 0.          0. 2
2461203     0       180018.4     192303.7   2525557. 0.          0. 3
2461204     0       180025.      187865.5   2525558. 0.          0. 4
*
*hydro         f velocity   g velocity    j velocity                jun
2461300 0
2461301       -.0715713        -.0715713    0.            1 * -33.72204
2461302       -.0715677        -.0715677    0.            2 * -33.72204
2461303       -.071535         -.071535     0.            3 * -33.72204
*
*hydro   jun hyd diam                                                  jun
2461401      0.01905     0.0 1.0 1.0                                   3
*
*---------------------------------------------------------------------*
*hydro             component name       component type
2480000             "tubeout"              sngljun
*-------------------------------------------*---------------------*
*hydro    from          to           area      f loss    r loss    vcahs
2480101   246010000     250000000    0.0         0.        0.      01100
*
*hydro   hyd diam
2480110   0.01905      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2480201     0              -.1669746      -.1876687      0. * -33.72204
*
*---------------------------------------------------------------------$
*hydro             component name       component type
2500000             "chimney"              pipe
*-------------------------------------------------$-----------------$
2500001          4
*
*hydro          vol area                                              vol
2500101          0.203                                                 4
*
*hydro          length                                                vol
2500301          0.75                                                  4
*
*hydro          volume                                                vol
2500401            0.                                                  4
*
*hydro         vert angle                                             vol
2500601             90.                                                4
*
*hydro         elev. change                                           vol
2500701             0.75                                               4
*
*hydro         roughness       hyd diam                               vol
2500801       0.0000457        0.508                                  4
*
*hydro           f loss        r loss                                 jun
2500901           0.            0.                                    3
*
*hydro             fe                                                 vol
2501001           00                                                  4
```

```
*
*hydro            vcahs                                               jun
2501101           01000                                                3
*
*hydro  ebt pressure     tempe                                          vol
2501201     0       176363.4     137692.    2524855. 0. 0.          1
2501202     0       169046.5     137657.4   2523412. 0. 0.          2
2501203     0       161729.6     137622.8   2521918. 0. 0.          3
2501204     0       154412.7     137588.    2520367. 0. 0.          4
*
*hydro          vel/flw
2501300            0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
2501301       -.1669747        -.203076     0.            1 * -33.72204
2501302       -.1669748        -.203076     0.            2 * -33.72204
2501303       -.166975         -.203076     0.            3 * -33.72204
*
*---------------------------------------------------------------------
*hydro             component name       component type
2520000             "tubeout"              sngljun
*---------------------------------------------------------------------
*hydro    from          to           area      f loss    r loss    vcahs
2520101   250010000     254000000    0.0         0.        0.      01100
*
*hydro   hyd diam
2520110   0.508        0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2520201     0              -.1669746      -.1669746      0. * -33.72204
*
*---------------------------------------------------------------------*
*hydro             component name       component type
2540000             "secsnk1"              tmdpvol
*---------------------------------------------------------------------*
*hydro          area       length      volume
2540101         1.e6          .0       1.0e+06
*
*hydro       horz angle  vert angle    delta z
2540102           .0          .0           .0
*
*hydro        roughness   hyd diam       fe
2540103           .0          .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
2540200 003
*
*hydro   time     pressure     tempe
2540201   0.     150773.66    306.
*
*=====================================================================$
*
*     accumulator and surge line - loop 2
*       assembled from normal relap5 components.
*       a tank wall heat structure (#2561) has been defined
*
*=====================================================================$
*
*hydro             component name       component type
2560000             "accum2"               pipe
*-------------------------------------------------$-----------------$
*hydro       no. volumes
2560001            6
*
*hydro          vol area                                              vol
```

```
2560101         1.65                                                    5
2560102         0.08322                                                 6
*
*hydro           length                                                 vol
*
*hydro           length                                                 vol
2560301          4.09                                                   1
2560302          0.12                                                   5
2560303          4.88                                                   6
*
*hydro           volume                                                 vol
2560401            0.                                                   6
*
*hydro         vert angle                                               vol
2560601          -90.                                                   6
*
*hydro         roughness       hyd diam                                 vol
2560801        0.0000457        1.449                                   5
2560802        0.0000457        0.3255                                  6
*
*hydro           f loss         r loss                                   jun
2560901           0.             0.                                     4
2560902          0.5            1.0                                     5
*
*hydro             fe                                                   vol
2561001            00000                                                6
*
*hydro           vcahs                                                  jun
2561101          00000                                                  5
*
*hydro  ebt                                                             vol
2561201 6    1542832.    107024.3 373140.5 .0767266 .998375 1
2561202     0       1563954.     160349.3   2411346. 0. 0.        2
2561203     0       1565248.     172373.3   2411363. 0. 0.        3
2561204     0       1566541.     173880.7   2411379. 0. 0.        4
2561205     0       1567834.     175432.2   2411395. 0. 0.        5
2561206     0       1594736.     188522.    2411732. 0. 0.        6
*
*hydro          vel/flw
2561300           0
*
*hydro         f velocity   g velocity    j velocity                  jun
2561301       2.249343-6       -.578241     0.            1 * .003784
2561302       2.07705-6        2.0771-6     0.            2 * .003770104
2561303       2.07886-6        2.078906-6   0.            3 * .00376935
2561304       2.080727-6       2.080775-6   0.            4 * .00377221
2561305       4.12913-5        4.13104-5    0.            5 * .00377504
*
$=====================================================================$
*hydro             component name      component type
2570000             "accumout"            sngljun
*-------------------------------------------$---------------------$
*hydro    from          to           area      f loss    r loss     vcahs
2570101   256060002  204040001 0.08322  0.     0.      01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2570201     0              4.126095-5     4.1261-5        0. * .003767545
*
$=====================================================================$
*hydro             component name      component type
2220000             "coldleg"             pipe
*-------------------------------------------$-----------------$
2220001          26
*
2220101         0.08322                                                 26
```

```
*
*hydro           length                                                 vol
2220301          0.1925                                                 12
2220302          0.213                                                  22
2220303          0.1905                                                 26
*
*hydro           volume                                                 vol
2220401            0.                                                   26
*
*hydro           volume                                                 vol
2220501            0.                                                   26
*
*hydro         vert angle                                               vol
2220601          -7.6                                                   12
2220602            0.                                                   22
2220603           90.                                                   26
*
*hydro          delta z                                                 vol
2220701          -0.0254                                                11
2220702          -0.0256                                                12
2220703            0.                                                   22
2220704            0.1905                                               26
*
*hydro         roughness       hyd diam                                 vol
2220801        0.0000457        0.3255                                  26
*
*hydro           f loss         r loss                                   jun
2220901           0.0            0.0                                    11
2220902           0.182          0.182                                  12
2220903           0.0            0.0                                    21
2220904           0.182          0.182                                  22
2220905           0.0            0.0                                    25
*
*hydro             fe                                                   vol
2221001            00                                                   26
*
*hydro           vcahs                                                  jun
2221101          01000                                                  25
*
*hydro  ebt pressure     tempe                                          vol
2221201     0       1423208.     179031.    2409294. 0. 0.        1
2221202     0       1423133.     179031.3   2409292. 0. 0.        2
2221203     0       1423058.     179031.6   2409291. 0. 0.        3
2221204     0       1422983.     179032.    2409290. 0. 0.        4
2221205     0       1422908.     179032.3   2409289. 0. 0.        5
2221206     0       1422833.     179032.6   2409288. 0. 0.        6
2221207     0       1422758.     179033.    2409286. 0. 0.        7
2221208     0       1422682.     179033.2   2409285. 0. 0.        8
2221209     0       1422607.     179033.5   2409284. 0. 0.        9
2221210     0       1422532.     179034.    2409283. 0. 0.        10
2221211     0       1422457.     179034.2   2409282. 0. 0.        11
2221212     0       1422383.     179034.5   2409280. 0. 0.        12
2221213     0       1413948.     179026.    2409142. 0. 0.        13
2221214     0       1413562.     179026.4   2409136. 0. 0.        14
2221215     0       1413176.     179026.8   2409129. 0. 0.        15
2221216     0       1412791.     179027.    2409123. 0. 0.        16
2221217     0       1412405.     179027.5   2409116. 0. 0.        17
2221218     0       1412019.     179027.8   2409110. 0. 0.        18
2221219     0       1411633.     179028.    2409104. 0. 0.        19
2221220     0       1411247.     179028.5   2409097. 0. 0.        20
2221221     0       1410862.     179029.    2409091. 0. 0.        21
2221222     0       1410476.     179029.2   2409084. 0. 0.        22
2221223     0       1400879.     179026.5   2408926. 0. 0.        23
2221224     0       1398482.     179026.8   2408886. 0. 0.        24
2221225     0       1396086.     179027.    2408846. 0. 0.        25
```

```
2221226     0       1393689.     179027.4   2408806. 0. 0.       26
*
*hydro          vel/flw
2221300            0
*
*hydro          f flowrate   g flowrate    j flowrate                jun
2221301        9.05627          9.05627       0.            1 * 827.632
2221302        9.05627          9.05627       0.            2 * 827.632
2221303        9.05627          9.05627       0.            3 * 827.632
2221304        9.05627          9.05627       0.            4 * 827.632
2221305        9.05627          9.05627       0.            5 * 827.632
2221306        9.05628          9.05628       0.            6 * 827.632
2221307        9.05628          9.05628       0.            7 * 827.632
2221308        9.05628          9.05628       0.            8 * 827.632
2221309        9.05628          9.05628       0.            9 * 827.632
2221310        9.05628          9.05628       0.            10 * 827.632
2221311        9.05628          9.05628       0.            11 * 827.632
2221312        9.05628          9.05628       0.            12 * 827.632
2221313        9.0563           9.0563        0.            13 * 827.632
2221314        9.0563           9.0563        0.            14 * 827.632
2221315        9.0563           9.0563        0.            15 * 827.632
2221316        9.05631          9.05631       0.            16 * 827.632
2221317        9.05631          9.05631       0.            17 * 827.632
2221318        9.05631          9.05631       0.            18 * 827.632
2221319        9.05632          9.05632       0.            19 * 827.632
2221320        9.05632          9.05632       0.            20 * 827.632
2221321        9.05632          9.05632       0.            21 * 827.632
2221322        9.05632          9.05632       0.            22 * 827.632
2221323        9.05636          9.71509       0.            23 * 827.632
2221324        9.05637          9.71515       0.            24 * 827.632
2221325        9.05638          9.71521       0.            25 * 827.632
*
*=================================================================$
*
*     primary coolant pump - loop 2
*
*=================================================================$
*
*-----------------------------------------------------------------$
*hydro              component name       component type
2240000              "rcpump2"                pump
*-----------------------------------------------------$-----------$
*hydro             area               length              volume
2240101             0.                 0.500               0.7739
*
*hydro          horz angle          vert angle           delta z
2240102            0.                   0.                  0.
*
*hydro          equil flag
2240103            00
*
*hydro       from       jun area     f loss      r loss      vcahs
2240108      222010000     0.          0.00        0.00        01000
*
* assume k=2.0 for strainer loss coefficient
*
*hydro         to         jun area     f loss      r loss      vcahs
2240109      226000000     0.          2.0         2.0         01000
*
*hydro  ebt pressure     tempe
2240200      0        2189579.     179130.4 2417026. 0.
*hydro    vel/flw     f flowrate       g flowrate     j flowrate
2240201    0             9.05639          9.71528        0. * 827.632
*hydro    vel/flw     f flowrate       g flowrate     j flowrate
2240202    0             9.0533           9.0533         0. * 827.631
*
*hydro      ptdi   2fazi   diff i   tork i   pvel i   trip no.   rvrs i
2240301     124     124     124       -1       0        555       0
*
*hydro   rated pump vel.   init/rated vel.   rated flow     rated head
2240302         188.5          .909385          0.643          207.3
*
*hydro    rated torque     mom of inertia     rated dens     mtr torque
2240303       7616.8            91.50            1098.           .0
*
*hydro     coeff. tf2        coeff. tf0       coeff. tf1     coeff. tf3
2240304       10.0              150.0              0.             0.
*      pump speed table
*2246100  0  cntrlvar 83
2246100  619  cntrlvar 195
2246101     -1.e6   -1.e6
2246102      1.e6    1.e6
*
*-----------------------------------------------------------------$
*hydro              component name       component type
2260000              "pmpdisc"                pipe
*-----------------------------------------------------$-----------$
2260001          5
*
*hydro          vol area                                          vol
2260101         0.08322                                            5
*
*hydro           length                                           vol
2260301          0.18292                                           5
*
*hydro          volume                                            vol
2260401           0.                                               5
*
*hydro          volume                                            vol
2260501           0.                                               5
*
*hydro         vert angle                                         vol
2260601           0.0                                              5
*
*hydro          delta z                                           vol
2260701          0.0                                               5
*
*hydro         roughness      hyd diam                            vol
2260801        0.0000457       0.3255                             5
*
*hydro          f loss        r loss                              jun
2260901          0.0           0.0                                4
*
*hydro            fe                                             vol
2261001          00                                               5
*
*hydro          vcahs                                            jun
2261101          01000                                            4
*
*hydro  ebt pressure     tempe                                    vol
2261201     0        2806569.     179127.6   2419455. 0. 0.        1
2261202     0        2806256.     179128.    2419454. 0. 0.        2
2261203     0        2805925.     179128.2   2419454. 0. 0.        3
2261204     0        2805594.     179128.5   2419453. 0. 0.        4
2261205     0        2805262.     179128.8   2419452. 0. 0.        5
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate                jun
2261300 0
```

```
2261301      9.05086          9.05086      0.            1 * 827.631
2261302      9.05086          9.05086      0.            2 * 827.631
2261303      9.05086          9.05086      0.            3 * 827.631
2261304      9.05086          9.05086      0.            4 * 827.631
*
*----------------------------------------------------------------------$
*hydro             component name      component type
2280000              "check"              valve
*-------------------------------------------------$--------------------$
*hydro    from          to          area      f loss     r loss     vcahs
2280101   226010000     229000000   0.08317    0.98       0.98      01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
2280201     0              9.05086        9.05086         0. * 827.631
*
*hydro               valve type
2280300               chkvlv
*
*hydro    chkvlv type  init. posn  back press  leak ratio
2280301       0           0           0.          0.
*----------------------------------------------------------------------$
*hydro             component name      component type
2290000              "cljoin"             pipe
*-------------------------------------------------$------------------$
2290001          31
*
*hydro          vol area                                              vol
2290101         0.08322                                               31
*
*hydro           length                                               vol
2290301          0.2016                                               31
*
*hydro           volume                                               vol
2290401           0.                                                  31
*
*hydro           volume                                               vol
2290501           0.                                                  31
*
*hydro         vert angle                                             vol
2290601           0.0                                                 31
*
*hydro          delta z                                               vol
2290701           0.0                                                 31
*
*hydro         roughness      hyd diam                                vol
2290801       0.0000457        0.3255                                31
*
*hydro           f loss        r loss                                 jun
2290901           0.0           0.0                                  30
*
*hydro             fe                                                 vol
2291001           00                                                  31
*
*hydro           vcahs                                                jun
2291101         01000                                                 30
*
*hydro  ebt pressure     tempe                                        vol
2291201     0       2760760.     179103.    2419372. 0. 0.       1
2291202     0       2760394.     179103.5   2419371. 0. 0.       2
2291203     0       2760028.     179103.8   2419371. 0. 0.       3
2291204     0       2759664.     179104.    2419370. 0. 0.       4
2291205     0       2759298.     179104.5   2419369. 0. 0.       5
2291206     0       2758934.     179104.8   2419369. 0. 0.       6
2291207     0       2758569.     179105.    2419368. 0. 0.       7
2291208     0       2758204.     179105.5   2419367. 0. 0.       8
2291209     0       2757839.     179105.8   2419367. 0. 0.       9
2291210     0       2757474.     179106.    2419366. 0. 0.       10
2291211     0       2757109.     179106.5   2419365. 0. 0.       11
2291212     0       2756744.     179106.8   2419365. 0. 0.       12
2291213     0       2756379.     179107.    2419364. 0. 0.       13
2291214     0       2756014.     179107.5   2419363. 0. 0.       14
2291215     0       2755649.     179107.8   2419363. 0. 0.       15
2291216     0       2755284.     179108.    2419362. 0. 0.       16
2291217     0       2754919.     179108.5   2419361. 0. 0.       17
2291218     0       2754554.     179108.8   2419361. 0. 0.       18
2291219     0       2754189.     179109.    2419360. 0. 0.       19
2291220     0       2753824.     179109.5   2419359. 0. 0.       20
2291221     0       2753459.     179109.8   2419359. 0. 0.       21
2291222     0       2753094.     179110.    2419358. 0. 0.       22
2291223     0       2752729.     179110.5   2419357. 0. 0.       23
2291224     0       2752364.     179110.8   2419357. 0. 0.       24
2291225     0       2.752+6      179111.    2419356. 0. 0.       25
2291226     0       2751634.     179111.4   2419355. 0. 0.       26
2291227     0       2751269.     179111.8   2419355. 0. 0.       27
2291228     0       2750904.     179112.    2419354. 0. 0.       28
2291229     0       2750540.     179112.4   2419353. 0. 0.       29
2291230     0       2750174.     179112.8   2419353. 0. 0.       30
2291231     0       2749810.     179113.    2419352. 0. 0.       31
*
*hydro          vel/flw
*
*hydro          f flowrate   g flowrate    j flowrate                jun
2291300 0
2291301      9.05102          9.05102      0.            1 * 827.631
2291302      9.05102          9.05102      0.            2 * 827.631
2291303      9.05102          9.05102      0.            3 * 827.631
2291304      9.05102          9.05102      0.            4 * 827.631
2291305      9.05102          9.05102      0.            5 * 827.631
2291306      9.05103          9.05103      0.            6 * 827.631
2291307      9.05103          9.05103      0.            7 * 827.631
2291308      9.05103          9.05103      0.            8 * 827.631
2291309      9.05103          9.05103      0.            9 * 827.631
2291310      9.05103          9.05103      0.            10 * 827.631
2291311      9.05103          9.05103      0.            11 * 827.631
2291312      9.05104          9.05104      0.            12 * 827.631
2291313      9.05104          9.05104      0.            13 * 827.631
2291314      9.05104          9.05104      0.            14 * 827.631
2291315      9.05104          9.05104      0.            15 * 827.631
2291316      9.05104          9.05104      0.            16 * 827.631
2291317      9.05104          9.05104      0.            17 * 827.631
2291318      9.05105          9.05105      0.            18 * 827.631
2291319      9.05105          9.05105      0.            19 * 827.631
2291320      9.05105          9.05105      0.            20 * 827.631
2291321      9.05105          9.05105      0.            21 * 827.631
2291322      9.05105          9.05105      0.            22 * 827.631
2291323      9.05105          9.05105      0.            23 * 827.631
2291324      9.05106          9.05106      0.            24 * 827.631
2291325      9.05106          9.05106      0.            25 * 827.631
2291326      9.05106          9.05106      0.            26 * 827.631
2291327      9.05106          9.05106      0.            27 * 827.631
2291328      9.05106          9.05106      0.            28 * 827.631
2291329      9.05106          9.05106      0.            29 * 827.631
2291330      9.05107          9.05107      0.            30 * 827.631
*
*----------------------------------------------------------------------*
*hydro             component name      component type
2310000              "elbow1"             sngljun
*-------------------------------------------------*--------------------*
*hydro    from          to          area      f loss     r loss     vcahs
2310101   229010000     258000000   0.083220   0.182      0.182     01000
```

```
*
*hydro    vel/flw       f velocity      g velocity      j velocity
2310201     0              9.05107         9.05107          0. * 827.631
*
*-------------------------------------------------------------------$
*hydro              component name       component type
2580000              "coldleg"             pipe
*-------------------------------------------------$-----------------$
2580001          50
•
*hydro          vol area                                          vol
2580101         0.08322                                            50
*
*hydro          length                                            vol
2580301          0.180                                             50
*
*hydro           volume                                           vol
2580401            0.                                             50
*
*hydro         horz angle                                         vol
2580501            0.                                             50
*
*hydro         vert angle                                         vol
2580601            0.                                             50
*
•hydro         delta z                                            vol
2580701             0.                                            50
*
*hydro         roughness       hyd diam                           vol
2580801        0.0000457        0.3255                            50
*
*hydro           kf               kr                              jun
2580901         0.0               0.0                            49
*
*hydro             fe                                            vol
2581001            00                                             50
•
*hydro           vcahs                                            jun
2581101          01000                                            49
•
*hydro  ebt pressure     tempe                                     vol
2581201     0       2741264.     179094.7    2419336. 0. 0.       1
2581202     0       2740938.     179076.3    2419336. 0. 0.       2
2581203     0       2740612.     179076.6    2419335. 0. 0.       3
2581204     0       2740286.     179077.     2419335. 0. 0.       4
2581205     0       2739960.     179077.2    2419334. 0. 0.       5
2581206     0       2739634.     179077.5    2419334. 0. 0.       6
2581207     0       2739308.     179077.8    2419333. 0. 0.       7
2581208     0       2738983.     179078.     2419332. 0. 0.       8
2581209     0       2738657.     179078.4    2419332. 0. 0.       9
2581210     0       2738331.     179078.7    2419331. 0. 0.       10
2581211     0       2738005.     179079.     2419330. 0. 0.       11
2581212     0       2737679.     179079.3    2419330. 0. 0.       12
2581213     0       2737354.     179079.6    2419329. 0. 0.       13
2581214     0       2737028.     179080.     2419329. 0. 0.       14
2581215     0       2736702.     179080.2    2419328. 0. 0.       15
2581216     0       2736376.     179080.5    2419328. 0. 0.       16
2581217     0       2736050.     179080.8    2419327. 0. 0.       17
2581218     0       2735724.     179081.     2419326. 0. 0.       18
2581219     0       2735398.     179081.4    2419326. 0. 0.       19
2581220     0       2735072.     179081.7    2419325. 0. 0.       20
2581221     0       2734746.     179082.     2419324. 0. 0.       21
2581222     0       2734421.     179082.2    2419324. 0. 0.       22
2581223     0       2734095.     179082.5    2419323. 0. 0.       23
2581224     0       2733769.     179083.     2419323. 0. 0.       24
2581225     0       2733443.     179083.     2419322. 0. 0.       25
2581226     0       2733117.     179083.4    2419322. 0. 0.       26
2581227     0       2732791.     179083.7    2419321. 0. 0.       27
2581228     0       2732466.     179084.     2419320. 0. 0.       28
2581229     0       2732140.     179084.3    2419320. 0. 0.       29
2581230     0       2731814.     179084.6    2419319. 0. 0.       30
2581231     0       2731488.     179085.     2419318. 0. 0.       31
2581232     0       2731162.     179085.2    2419318. 0. 0.       32
2581233     0       2730836.     179085.5    2419317. 0. 0.       33
2581234     0       2730510.     179085.8    2419317. 0. 0.       34
2581235     0       2730184.     179086.     2419316. 0. 0.       35
2581236     0       2729858.     179086.4    2419316. 0. 0.       36
2581237     0       2729533.     179086.7    2419315. 0. 0.       37
2581238     0       2729207.     179087.     2419314. 0. 0.       38
2581239     0       2728881.     179087.3    2419314. 0. 0.       39
2581240     0       2728555.     179087.6    2419313. 0. 0.       40
2581241     0       2728229.     179088.     2419312. 0. 0.       41
2581242     0       2727903.     179088.2    2419312. 0. 0.       42
2581243     0       2727578.     179088.5    2419311. 0. 0.       43
2581244     0       2727252.     179088.8    2419311. 0. 0.       44
2581245     0       2726926.     179089.     2419310. 0. 0.       45
2581246     0       2726600.     179089.4    2419310. 0. 0.       46
2581247     0       2726274.     179089.7    2419309. 0. 0.       47
2581248     0       2725948.     179090.     2419308. 0. 0.       48
2581249     0       2725622.     179090.2    2419308. 0. 0.       49
2581250     0       2725296.     179090.5    2419307. 0. 0.       50
*
2581300 0
2581301      9.05109          9.05109          0.          1 • 827.631
2581302      9.05107          9.05107          0.          2 • 827.631
2581303      9.05107          9.05107          0.          3 • 827.631
2581304      9.05107          9.05107          0.          4 * 827.631
2581305      9.05108          9.05108          0.          5 • 827.631
2581306      9.05108          9.05108          0.          6 • 827.631
2581307      9.05108          9.05108          0.          7 • 827.631
2581308      9.05108          9.05108          0.          8 * 827.631
2581309      9.05108          9.05108          0.          9 * 827.631
2581310      9.05108          9.05108          0.          10 * 827.631
2581311      9.05109          9.05109          0.          11 * 827.631
2581312      9.05109          9.05109          0.          12 * 827.631
2581313      9.05109          9.05109          0.          13 * 827.631
2581314      9.05109          9.05109          0.          14 • 827.631
2581315      9.0511           9.0511           0.          15 • 827.631
2581316      9.0511           9.0511           0.          16 • 827.631
2581317      9.0511           9.0511           0.          17 * 827.631
2581318      9.0511           9.0511           0.          18 * 827.631
2581319      9.0511           9.0511           0.          19 * 827.631
2581320      9.0511           9.0511           0.          20 * 827.631
2581321      9.0511           9.0511           0.          21 * 827.631
2581322      9.0511           9.0511           0.          22 * 827.631
2581323      9.0511           9.0511           0.          23 * 827.631
2581324      9.0511           9.0511           0.          24 * 827.631
2581325      9.0511           9.0511           0.          25 * 827.631
2581326      9.0511           9.0511           0.          26 * 827.631
2581327      9.05111          9.05111          0.          27 • 827.631
2581328      9.05111          9.05111          0.          28 • 827.631
2581329      9.05111          9.05111          0.          29 • 827.631
2581330      9.05111          9.05111          0.          30 * 827.631
2581331      9.05112          9.05112          0.          31 * 827.631
2581332      9.05112          9.05112          0.          32 * 827.631
2581333      9.05112          9.05112          0.          33 * 827.631
2581334      9.05112          9.05112          0.          34 • 827.631
2581335      9.05112          9.05112          0.          35 • 827.631
2581336      9.05112          9.05112          0.          36 • 827.631
2581337      9.05112          9.05112          0.          37 * 827.631
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2581338      9.05113          9.05113      0.          38 * 827.631
2581339      9.05113          9.05113      0.          39 * 827.631
2581340      9.05113          9.05113      0.          40 * 827.631
2581341      9.05113          9.05113      0.          41 * 827.631
2581342      9.05113          9.05113      0.          42 * 827.631
2581343      9.05113          9.05113      0.          43 * 827.631
2581344      9.05114          9.05114      0.          44 * 827.631
2581345      9.05114          9.05114      0.          45 * 827.631
2581346      9.05114          9.05114      0.          46 * 827.631
2581347      9.05114          9.05114      0.          47 * 827.631
2581348      9.05114          9.05114      0.          48 * 827.631
2581349      9.05114          9.05114      0.          49 * 827.631
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
2600000             "elbow2"               sngljun
*-------------------------------------------------*-----------------------*
*hydro    from          to           area      f loss     r loss     vcahs
2600101  258010000     262000000    0.083220    0.182      0.182     01000
*
*hydro    vel/flw       f velocity     g velocity      j velocity
2600201    0              9.05114        9.05114         0. * 827.631
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
2620000             "14incdlg"             pipe
*-------------------------------------------------*-----------------------*
2620001          73
*
*hydro          vol area                                              vol
2620101         0.08322                                                73
*
*hydro          length                                                vol
2620301         0.215127                                                3
2620302         0.2                                                    72
2620303         0.13439                                                73
*
*hydro          volume                                                vol
2620401           0.                                                   73
*
*hydro         horz angle                                             vol
2620501           0.                                                   73
*
*hydro         vert angle                                             vol
2620601           0.                                                    3
2620602          -90.                                                  73
*
*hydro         delta z                                                vol
2620701          0.0                                                    3
2620702         -0.2                                                   72
2620703         -0.13439                                               73
*
*hydro         roughness       hyd diam                               vol
2620801        0.0000457        0.3255                                 73
*
*hydro          kf              kr                                    jun
2620901         0.0             0.0                                    2
2620902         0.182           0.182                                  3
2620903         0.0             0.0                                   72
*
*hydro            fe                                                  vol
2621001          00                                                    73
*
*hydro          vcahs                                                 jun
2621101         01000                                                  72
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*
*hydro  ebt pressure     tempe                                          vol
2621201     0       2716738.    179088.2    2419292. 0. 0.          1
2621202     0       2716348.    179088.6    2419291. 0. 0.          2
2621203     0       2715959.    179089.     2419290. 0. 0.          3
2621204     0       2708460.    179033.     2419276. 0. 0.          4
2621205     0       2710254.    179033.2    2419280. 0. 0.          5
2621206     0       2712047.    179033.6    2419283. 0. 0.          6
2621207     0       2713840.    179034.     2419286. 0. 0.          7
2621208     0       2715633.    179034.2    2419289. 0. 0.          8
2621209     0       2717426.    179034.6    2419293. 0. 0.          9
2621210     0       2719219.    179035.     2419296. 0. 0.         10
2621211     0       2721012.    179035.2    2419299. 0. 0.         11
2621212     0       2722805.    179035.6    2419302. 0. 0.         12
2621213     0       2724598.    179036.     2419306. 0. 0.         13
2621214     0       2726391.    179036.2    2419309. 0. 0.         14
2621215     0       2728184.    179036.6    2419312. 0. 0.         15
2621216     0       2729977.    179037.     2419316. 0. 0.         16
2621217     0       2731770.    179037.2    2419319. 0. 0.         17
2621218     0       2733564.    179037.6    2419322. 0. 0.         18
2621219     0       2735356.    179038.     2419326. 0. 0.         19
2621220     0       2737150.    179038.2    2419329. 0. 0.         20
2621221     0       2738943.    179038.5    2419332. 0. 0.         21
2621222     0       2740736.    179039.     2419336. 0. 0.         22
2621223     0       2742529.    179039.2    2419339. 0. 0.         23
2621224     0       2744322.    179039.5    2419342. 0. 0.         24
2621225     0       2746115.    179040.     2419345. 0. 0.         25
2621226     0       2747908.    179040.2    2419348. 0. 0.         26
2621227     0       2749701.    179040.5    2419352. 0. 0.         27
2621228     0       2751494.    179041.     2419355. 0. 0.         28
2621229     0       2753288.    179041.2    2419358. 0. 0.         29
2621230     0       2755080.    179041.5    2419362. 0. 0.         30
2621231     0       2756874.    179042.     2419365. 0. 0.         31
2621232     0       2758667.    179042.2    2419368. 0. 0.         32
2621233     0       2760460.    179042.5    2419372. 0. 0.         33
2621234     0       2762253.    179043.     2419375. 0. 0.         34
2621235     0       2764046.    179043.2    2419378. 0. 0.         35
2621236     0       2765839.    179043.5    2419381. 0. 0.         36
2621237     0       2767632.    179044.     2419384. 0. 0.         37
2621238     0       2769425.    179044.2    2419388. 0. 0.         38
2621239     0       2771218.    179044.5    2419391. 0. 0.         39
2621240     0       2773012.    179045.     2419394. 0. 0.         40
2621241     0       2774805.    179045.2    2419398. 0. 0.         41
2621242     0       2776598.    179045.5    2419401. 0. 0.         42
2621243     0       2778391.    179046.     2419404. 0. 0.         43
2621244     0       2780184.    179046.     2419407. 0. 0.         44
2621245     0       2781977.    179046.5    2419410. 0. 0.         45
2621246     0       2783770.    179047.     2419414. 0. 0.         46
2621247     0       2785564.    179047.     2419417. 0. 0.         47
2621248     0       2787356.    179047.5    2419420. 0. 0.         48
2621249     0       2789150.    179048.     2419424. 0. 0.         49
2621250     0       2790943.    179048.     2419427. 0. 0.         50
2621251     0       2792736.    179048.5    2419430. 0. 0.         51
2621252     0       2794529.    179049.     2419433. 0. 0.         52
2621253     0       2796322.    179049.     2419436. 0. 0.         53
2621254     0       2798116.    179049.5    2419440. 0. 0.         54
2621255     0       2799908.    179050.     2419443. 0. 0.         55
2621256     0       2801702.    179050.     2419446. 0. 0.         56
2621257     0       2803495.    179050.5    2419449. 0. 0.         57
2621258     0       2805288.    179051.     2419452. 0. 0.         58
2621259     0       2807081.    179051.     2419456. 0. 0.         59
2621260     0       2808874.    179051.5    2419459. 0. 0.         60
2621261     0       2810668.    179051.8    2419462. 0. 0.         61
2621262     0       2812461.    179052.     2419466. 0. 0.         62
2621263     0       2814254.    179052.5    2419468. 0. 0.         63
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2621264     0       2816047.     179052.8   2419472. 0. 0.       64
2621265     0       2817840.     179053.    2419475. 0. 0.       65
2621266     0       2819633.     179053.5   2419478. 0. 0.       66
2621267     0       2821426.     179053.8   2419482. 0. 0.       67
2621268     0       2823220.     179054.    2419485. 0. 0.       68
2621269     0       2825013.     179054.5   2419488. 0. 0.       69
2621270     0       2826806.     179054.8   2419491. 0. 0.       70
2621271     0       2828599.     179055.    2419494. 0. 0.       71
2621272     0       2830392.     179055.5   2419498. 0. 0.       72
2621273     0       2831891.     179055.7   2419500. 0. 0.       73
*
*hydro          f velocity   g velocity    j velocity                jun
2621300 0
2621301       9.05118          9.05118       0.          1 * 827.631
2621302       9.05118          9.05118       0.          2 * 827.631
2621303       9.05118          9.05118       0.          3 * 827.631
2621304       9.05116          9.68502       0.          4 * 827.631
2621305       9.05116          9.68498       0.          5 * 827.631
2621306       9.05115          9.68494       0.          6 * 827.631
2621307       9.05114          9.6849        0.          7 * 827.631
2621308       9.05113          9.68487       0.          8 * 827.631
2621309       9.05113          9.68483       0.          9 * 827.631
2621310       9.05112          9.6848        0.         10 * 827.631
2621311       9.05111          9.68476       0.         11 * 827.631
2621312       9.0511           9.68472       0.         12 * 827.631
2621313       9.0511           9.68469       0.         13 * 827.631
2621314       9.0511           9.68465       0.         14 * 827.631
2621315       9.05109          9.68462       0.         15 * 827.631
2621316       9.05108          9.68458       0.         16 * 827.631
2621317       9.05107          9.68454       0.         17 * 827.631
2621318       9.05107          9.6845        0.         18 * 827.631
2621319       9.05106          9.68447       0.         19 * 827.631
2621320       9.05105          9.68443       0.         20 * 827.631
2621321       9.05105          9.6844        0.         21 * 827.631
2621322       9.05104          9.68436       0.         22 * 827.631
2621323       9.05103          9.68432       0.         23 * 827.631
2621324       9.05102          9.68429       0.         24 * 827.631
2621325       9.05102          9.68425       0.         25 * 827.631
2621326       9.05101          9.68421       0.         26 * 827.631
2621327       9.051            9.68418       0.         27 * 827.631
2621328       9.051            9.68414       0.         28 * 827.631
2621329       9.05099          9.6841        0.         29 * 827.631
2621330       9.05098          9.68407       0.         30 * 827.631
2621331       9.05098          9.68403       0.         31 * 827.631
2621332       9.05097          9.684         0.         32 * 827.631
2621333       9.05096          9.68396       0.         33 * 827.631
2621334       9.05096          9.68392       0.         34 * 827.631
2621335       9.05095          9.68389       0.         35 * 827.631
2621336       9.05094          9.68385       0.         36 * 827.631
2621337       9.05094          9.68381       0.         37 * 827.631
2621338       9.05093          9.68378       0.         38 * 827.631
2621339       9.05092          9.68374       0.         39 * 827.631
2621340       9.05091          9.6837        0.         40 * 827.631
2621341       9.0509           9.68367       0.         41 * 827.631
2621342       9.0509           9.68363       0.         42 * 827.631
2621343       9.0509           9.6836        0.         43 * 827.631
2621344       9.05089          9.68356       0.         44 * 827.631
2621345       9.05088          9.68352       0.         45 * 827.631
2621346       9.05087          9.68349       0.         46 * 827.631
2621347       9.05087          9.68345       0.         47 * 827.631
2621348       9.05086          9.68341       0.         48 * 827.631
2621349       9.05085          9.68338       0.         49 * 827.631
2621350       9.05085          9.68334       0.         50 * 827.631
2621351       9.05084          9.6833        0.         51 * 827.631
2621352       9.05083          9.68327       0.         52 * 827.631
2621353       9.05083          9.68323       0.         53 * 827.631
2621354       9.05082          9.6832        0.         54 * 827.631
2621355       9.05081          9.68316       0.         55 * 827.631
2621356       9.0508           9.68312       0.         56 * 827.631
2621357       9.0508           9.68309       0.         57 * 827.631
2621358       9.0508           9.68305       0.         58 * 827.631
2621359       9.05079          9.68301       0.         59 * 827.631
2621360       9.05078          9.68298       0.         60 * 827.631
2621361       9.05077          9.68294       0.         61 * 827.631
2621362       9.05076          9.6829        0.         62 * 827.631
2621363       9.05076          9.68287       0.         63 * 827.631
2621364       9.05075          9.68283       0.         64 * 827.631
2621365       9.05074          9.6828        0.         65 * 827.631
2621366       9.05074          9.68276       0.         66 * 827.631
2621367       9.05073          9.68273       0.         67 * 827.631
2621368       9.05072          9.68269       0.         68 * 827.631
2621369       9.05072          9.68265       0.         69 * 827.631
2621370       9.05071          9.68262       0.         70 * 827.631
2621371       9.0507           9.68258       0.         71 * 827.631
2621372       9.0507           9.68255       0.         72 * 827.631
*
*-------------------------------------------------------------------------*
*hydro              component name        component type
2720000              "inlet"                sngljun
*-------------------------------------------------*---------------------*
*hydro    from          to            area      f loss    r loss    vcahs
2720101   262010000     271000000     0.03095   0.2062    0.4513    01000
*
*hydro    jun hyd diam
2720110      0.1985        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity      g velocity      j velocity
2720201    0               24.336          25.27005        0. * 827.631
*
*-------------------------------------------------------------------------*
*hydro              component name        component type
2710000              "ifdthrot"               pipe
*-------------------------------------------------$-----------------$
2710001          9
*
*hydro          vol area                                              vol
2710101         0.03095                                                9
*
*hydro           length                                               vol
2710301          0.15                                                  2
2710302          0.145                                                 4
2710303          0.188                                                 9
*
*hydro           volume                                               vol
2710401          0.                                                    9
*
*hydro           volume                                               vol
2710501          0.                                                    9
*
*hydro         vert angle                                             vol
2710601          -90.0                                                 2
2710602          0.0                                                   9
*
*hydro          delta z                                              vol
2710701         -0.15                                                  2
2710702         0.0                                                    9
*
*hydro         roughness      hyd diam                                vol
2710801        0.0000457       0.1985                                  9
*
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*hydro          f loss        r loss                              jun
2710901          0.0          0.0                                  1
2710902          0.196         0.196                               2
2710903          0.0          0.0                                  3
2710904          0.196         0.196                               4
2710905          0.0          0.0                                  8
*
*hydro            fe                                              vol
2711001           00                                               9
*
*hydro           vcahs                                            jun
2711101          01000                                             8
*
*hydro  ebt pressure     tempe                                    vol
2711201     0       2484067.     179057.5   2418615. 0. 0.        1
2711202     0       2482102.     179060.7   2418605. 0. 0.        2
2711203     0       2415646.     179062.6   2418260. 0. 0.        3
2711204     0       2412241.     179065.7   2418242. 0. 0.        4
2711205     0       2344530.     179066.2   2417881. 0. 0.        5
2711206     0       2340120.     179070.2   2417858. 0. 0.        6
2711207     0       2335723.     179074.2   2417834. 0. 0.        7
2711208     0       2331326.     179078.2   2417810. 0. 0.        8
2711209     0       2326930.     179082.2   2417786. 0. 0.        9
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate               jun
2711300 0
2711301       24.3397          25.2823      0.            1 * 827.631
2711302       24.3397          25.2824      0.            2 * 827.631
2711303       24.34043         24.34043     0.            3 * 827.631
2711304       24.34047         24.34047     0.            4 * 827.631
2711305       24.3412          24.3412      0.            5 * 827.631
2711306       24.34125         24.34125     0.            6 * 827.631
2711307       24.3413          24.3413      0.            7 * 827.631
2711308       24.34137         24.34137     0.            8 * 827.631
*
*-------------------------------------------------------------------------*
*hydro             component name       component type
2730000             "ifdexit"              sngljun
*-------------------------------------------------*---------------------*
*hydro    from          to          area      f loss    r loss    vcahs
2730101   271010000     274000000   0.03095   0.1028    0.04696   01000
*
*hydro    jun hyd diam
2730110       0.1985       0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
2730201     0               24.3414        24.3414         0. * 827.631
*
*-------------------------------------------------------------------------$
*hydro             component name       component type
2740000             "psvaw-2"              pipe
*-------------------------------------------------$------------------$
2740001          2
*
*hydro          vol area                                          vol
2740101        0.08322                                             2
*
*hydro           length                                           vol
2740301          0.25                                              2
*
*hydro           volume                                           vol
2740401           0.                                               2
*
```

```
*hydro           volume                                           vol
2740501           0.                                               2
*
*hydro         vert angle                                         vol
2740601          45.0                                              2
*
*hydro          delta z                                           vol
2740701          0.25                                              2
*
*hydro         roughness      hyd diam                           vol
2740801       0.0000457       0.3255                              2
*
*hydro           f loss        r loss                             jun
2740901          0.0           0.0                                1
*
*hydro            fe                                             vol
2741001           00                                              2
*
*hydro           vcahs                                           jun
2741101          01000                                            1
*
*hydro  ebt pressure     tempe                                    vol
2741201     0       2570131.     179080.8   2418925. 0. 0.        1
2741202     0       2566991.     179081.2   2418915. 0. 0.        2
*
*hydro          vel/flw
2741300 0
*
*hydro         f flowrate   g flowrate    j flowrate               jun
2741301       9.05175          9.39183      0.            1 * 827.631
*
*-------------------------------------------------------------------------$
*
*        components 3xx - heat exchanger coolant loop 3
*
*-------------------------------------------------------------------------$
*hydro             component name       component type
3010000             "hlsplit3"             pipe
*-------------------------------------------------$------------------$
3010001          16
*
*hydro          vol area                                          vol
3010101        0.08322                                             16
*
*hydro           length                                           vol
3010301          0.205                                             16
*
*hydro           volume                                           vol
3010401          0.0                                               16
*
*hydro         vert angle                                         vol
3010601           0.                                               16
*
*hydro         delta z                                           vol
3010701           0.                                               16
*
*hydro         roughness      hyd diam                           vol
3010801       0.0000457       0.3255                              16
*
*hydro            fe                                             vol
3011001           00                                              16
*
*hydro           vcahs                                           jun
3011101          01000                                            15
*
```

```
3011300          0
*
*hydro        f velocity   g velocity    j velocity              jun
3011301       7.99936        7.99936      0.          1 * 718.673
3011302       7.99936        7.99936      0.          2 * 718.673
3011303       7.99936        7.99936      0.          3 * 718.673
3011304       7.99936        7.99936      0.          4 * 718.673
3011305       7.99936        7.99936      0.          5 * 718.673
3011306       7.99936        7.99936      0.          6 * 718.673
3011307       7.99936        7.99936      0.          7 * 718.673
3011308       7.99937        7.99937      0.          8 * 718.673
3011309       7.99937        7.99937      0.          9 * 718.673
3011310       7.99937        7.99937      0.          10 * 718.673
3011311       7.99937        7.99937      0.          11 * 718.673
3011312       7.99937        7.99937      0.          12 * 718.673
3011313       7.99937        7.99937      0.          13 * 718.673
3011314       7.99937        7.99937      0.          14 * 718.673
3011315       7.99937        7.99937      0.          15 * 718.673
*
*hydro  ebt pressure     tempe                                    vol
3011201  0  1627041.    317383.  2412131. 0.        0. 1
3011202  0  1626758.    317383.4 2412128. 0.        0. 2
3011203  0  1626476.    317383.6 2412124. 0.        0. 3
3011204  0  1626193.    317384.  2412120. 0.        0. 4
3011205  0  1625910.    317384.  2412117. 0.        0. 5
3011206  0  1625627.    317384.4 2412114. 0.        0. 6
3011207  0  1625344.    317384.7 2412110. 0.        0. 7
3011208  0  1625061.    317385.  2412107. 0.        0. 8
3011209  0  1624778.    317385.  2412103. 0.        0. 9
3011210  0  1624495.    317385.5 2412100. 0.        0. 10
3011211  0  1624212.    317386.  2412096. 0.        0. 11
3011212  0  1623929.    317386.  2412093. 0.        0. 12
3011213  0  1623646.    317386.  2412089. 0.        0. 13
3011214  0  1623364.    317386.5 2412086. 0.        0. 14
3011215  0  1623081.    317387.  2412082. 0.        0. 15
3011216  0  1622798.    317387.  2412079. 0.        0. 16
*
*----------------------------------------------------------------------$
*hydro              component name       component type
3030000               "hlsp1j"             mtpljun
*----------------------------------------------------------------------$
3030001     1        0
*hydro    from          to           area      f loss     r loss     vcahs
3030011   650010000     301000000    0.24663     0.17       0.17     01000
3030012   1.0   1.0   1.0   0    0    0    1
*
3031011   2.699214 2.699214 1 * 718.673
*
3032011   0.3255 0.0 1.0 1.0 1
*
*----------------------------------------------------------------------$
*hydro              component name       component type
3020000              "isolate"               valve
*-------------------------------------------$---------------------$
*hydro    from          to           area      f loss     r loss     vcahs
3020101   301010000     304000000    0.08322   0.104      0.104      01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
3020201     0              7.99938        7.99938         0. * 718.673
*
*hydro                 valve type
3020300                  trpvlv
*
*hydro                 trip no.
3020301                    515
```

```
*
*----------------------------------------------------------------------$
*hydro              component name       component type
3040000               "hotleg"                pipe
*-------------------------------------------$---------------------$
3040001          81
*
*hydro          vol area                                          vol
3040101        0.08322                                             81
*
*hydro           length                                           vol
3040301          0.23                                              3
3040302          0.2                                              67
3040303          0.15                                             68
3040304          0.2                                              80
3040305          0.11                                             81
*
*hydro           volume                                           vol
3040401          0.                                               81
*
*hydro           volume                                           vol
3040501          0.                                               81
*
*hydro         vert angle                                         vol
3040601          0.                                               68
3040602          90.                                              81
*
*hydro          delta z                                           vol
3040701          0.0                                              68
3040702          0.2                                              80
3040703          0.04                                             81
*
*hydro         roughness      hyd diam                            vol
3040801       0.0000457       0.3255                              81
*
*hydro          f loss         r loss                             jun
3040901          0.0            0.0                              67
3040902          0.24           0.24                             68
3040903          0.0            0.0                              80
*
*hydro            fe                                             vol
3041001          00                                               81
*
*hydro          vcahs                                            jun
3041101        01000                                              80
*
*hydro  ebt pressure     tempe                                    vol
3041201     0       1618901.     317367.    2412031. 0. 0.       1
3041202     0       1618584.     317367.    2412027. 0. 0.       2
3041203     0       1618266.     317367.    2412023. 0. 0.       3
3041204     0       1618433.     316981.    2412025. 0. 0.       4
3041205     0       1617698.     316981.4   2412016. 0. 0.       5
3041206     0       1617423.     316982.    2412013. 0. 0.       6
3041207     0       1617147.     316982.    2412010. 0. 0.       7
3041208     0       1616871.     316982.7   2412006. 0. 0.       8
3041209     0       1616595.     316983.    2412003. 0. 0.       9
3041210     0       1616319.     316983.    2.412+6  0. 0.       10
3041211     0       1616043.     316983.4   2411996. 0. 0.       11
3041212     0       1615767.     316983.7   2411992. 0. 0.       12
3041213     0       1615491.     316984.    2411989. 0. 0.       13
3041214     0       1615215.     316984.    2411986. 0. 0.       14
3041215     0       1614939.     316984.    2411982. 0. 0.       15
3041216     0       1614663.     316984.5   2411979. 0. 0.       16
3041217     0       1614387.     316985.    2411976. 0. 0.       17
3041218     0       1614111.     316985.    2411972. 0. 0.       18
```

3041219	0	1613835.	316985.3	2411969.	0.	0. 19
3041220	0	1613560.	316985.4	2411965.	0.	0. 20
3041221	0	1613284.	316986.	2411962.	0.	0. 21
3041222	0	1613008.	316986.	2411958.	0.	0. 22
3041223	0	1612732.	316986.4	2411955.	0.	0. 23
3041224	0	1612456.	316986.7	2411952.	0.	0. 24
3041225	0	1612180.	316987.	2411948.	0.	0. 25
3041226	0	1611904.	316987.	2411945.	0.	0. 26
3041227	0	1611628.	316987.4	2411942.	0.	0. 27
3041228	0	1611352.	316987.6	2411938.	0.	0. 28
3041229	0	1611076.	316988.	2411935.	0.	0. 29
3041230	0	1610800.	316988.	2411931.	0.	0. 30
3041231	0	1610524.	316988.4	2411928.	0.	0. 31
3041232	0	1610248.	316988.7	2411924.	0.	0. 32
3041233	0	1609972.	316989.	2411921.	0.	0. 33
3041234	0	1609696.	316989.	2411918.	0.	0. 34
3041235	0	1609420.	316989.4	2411914.	0.	0. 35
3041236	0	1609144.	316990.	2411911.	0.	0. 36
3041237	0	1608868.	316990.	2411907.	0.	0. 37
3041238	0	1608593.	316990.	2411904.	0.	0. 38
3041239	0	1608317.	316990.4	2411900.	0.	0. 39
3041240	0	1608041.	316991.	2411897.	0.	0. 40
3041241	0	1607765.	316991.	2411894.	0.	0. 41
3041242	0	1607489.	316991.	2411890.	0.	0. 42
3041243	0	1607213.	316991.5	2411887.	0.	0. 43
3041244	0	1606937.	316992.	2411884.	0.	0. 44
3041245	0	1606661.	316992.	2411880.	0.	0. 45
3041246	0	1606385.	316992.	2411877.	0.	0. 46
3041247	0	1606109.	316992.5	2411873.	0.	0. 47
3041248	0	1605833.	316993.	2411870.	0.	0. 48
3041249	0	1605557.	316993.	2411866.	0.	0. 49
3041250	0	1605281.	316993.	2411863.	0.	0. 50
3041251	0	1605005.	316993.5	2411860.	0.	0. 51
3041252	0	1604730.	316994.	2411856.	0.	0. 52
3041253	0	1604454.	316994.	2411853.	0.	0. 53
3041254	0	1604178.	316994.	2411849.	0.	0. 54
3041255	0	1603902.	316994.5	2411846.	0.	0. 55
3041256	0	1603626.	316995.	2411842.	0.	0. 56
3041257	0	1603350.	316995.	2411839.	0.	0. 57
3041258	0	1603074.	316995.3	2411836.	0.	0. 58
3041259	0	1602798.	316995.6	2411832.	0.	0. 59
3041260	0	1602522.	316996.	2411829.	0.	0. 60
3041261	0	1602246.	316996.	2411826.	0.	0. 61
3041262	0	1601970.	316996.3	2411822.	0.	0. 62
3041263	0	1601694.	316996.6	2411818.	0.	0. 63
3041264	0	1601418.	316997.	2411815.	0.	0. 64
3041265	0	1601142.	316997.	2411812.	0.	0. 65
3041266	0	1600866.	316997.3	2411808.	0.	0. 66
3041267	0	1600590.	316997.6	2411805.	0.	0. 67
3041268	0	1600349.	316998.	2411802.	0.	0. 68
3041269	0	1590749.	316998.	2411682.	0.	0. 69
3041270	0	1588355.	316998.3	2411653.	0.	0. 70
3041271	0	1585962.	316998.6	2411623.	0.	0. 71
3041272	0	1583568.	316999.	2411593.	0.	0. 72
3041273	0	1581175.	316999.	2411563.	0.	0. 73
3041274	0	1578781.	316999.3	2411533.	0.	0. 74
3041275	0	1576388.	316999.6	2411503.	0.	0. 75
3041276	0	1573994.	3.17+5	2411473.	0.	0. 76
3041277	0	1571601.	3.17+5	2411443.	0.	0. 77
3041278	0	1569208.	317000.3	2411413.	0.	0. 78
3041279	0	1566814.	317000.6	2411382.	0.	0. 79
3041280	0	1564421.	316927.	2411352.	0.	0. 80
3041281	0	1562937.	316927.	2411334.	0.	0. 81
*						
*hydro		vel/flw				

*				
*hydro	f flowrate	g flowrate	j flowrate	jun
3041300 0				
3041301	7.99936	7.99936	0.	1 * 718.673
3041302	7.99937	7.99937	0.	2 * 718.673
3041303	7.99937	7.99937	0.	3 * 718.673
3041304	7.99895	7.99895	0.	4 * 718.678
3041305	7.99895	7.99895	0.	5 * 718.678
3041306	7.99896	7.99896	0.	6 * 718.678
3041307	7.99896	7.99896	0.	7 * 718.678
3041308	7.99896	7.99896	0.	8 * 718.678
3041309	7.99896	7.99896	0.	9 * 718.678
3041310	7.99896	7.99896	0.	10 * 718.678
3041311	7.99896	7.99896	0.	11 * 718.678
3041312	7.99896	7.99896	0.	12 * 718.678
3041313	7.99896	7.99896	0.	13 * 718.678
3041314	7.99897	7.99897	0.	14 * 718.678
3041315	7.99897	7.99897	0.	15 * 718.678
3041316	7.99897	7.99897	0.	16 * 718.678
3041317	7.99897	7.99897	0.	17 * 718.678
3041318	7.99897	7.99897	0.	18 * 718.678
3041319	7.99897	7.99897	0.	19 * 718.678
3041320	7.99897	7.99897	0.	20 * 718.678
3041321	7.99897	7.99897	0.	21 * 718.678
3041322	7.99898	7.99898	0.	22 * 718.678
3041323	7.99898	7.99898	0.	23 * 718.678
3041324	7.99898	7.99898	0.	24 * 718.678
3041325	7.99898	7.99898	0.	25 * 718.678
3041326	7.99898	7.99898	0.	26 * 718.678
3041327	7.99898	7.99898	0.	27 * 718.678
3041328	7.99898	7.99898	0.	28 * 718.678
3041329	7.99898	7.99898	0.	29 * 718.678
3041330	7.99899	7.99899	0.	30 * 718.678
3041331	7.99899	7.99899	0.	31 * 718.678
3041332	7.99899	7.99899	0.	32 * 718.678
3041333	7.99899	7.99899	0.	33 * 718.678
3041334	7.99899	7.99899	0.	34 * 718.678
3041335	7.999	7.999	0.	35 * 718.678
3041336	7.999	7.999	0.	36 * 718.678
3041337	7.999	7.999	0.	37 * 718.678
3041338	7.999	7.999	0.	38 * 718.678
3041339	7.999	7.999	0.	39 * 718.678
3041340	7.999	7.999	0.	40 * 718.678
3041341	7.999	7.999	0.	41 * 718.678
3041342	7.999	7.999	0.	42 * 718.678
3041343	7.999	7.999	0.	43 * 718.678
3041344	7.999	7.999	0.	44 * 718.678
3041345	7.999	7.999	0.	45 * 718.678
3041346	7.999	7.999	0.	46 * 718.678
3041347	7.999	7.999	0.	47 * 718.678
3041348	7.99901	7.99901	0.	48 * 718.678
3041349	7.99901	7.99901	0.	49 * 718.678
3041350	7.99901	7.99901	0.	50 * 718.678
3041351	7.99901	7.99901	0.	51 * 718.678
3041352	7.99901	7.99901	0.	52 * 718.678
3041353	7.99901	7.99901	0.	53 * 718.678
3041354	7.99902	7.99902	0.	54 * 718.678
3041355	7.99902	7.99902	0.	55 * 718.678
3041356	7.99902	7.99902	0.	56 * 718.678
3041357	7.99902	7.99902	0.	57 * 718.678
3041358	7.99902	7.99902	0.	58 * 718.678
3041359	7.99902	7.99902	0.	59 * 718.678
3041360	7.99902	7.99902	0.	60 * 718.678
3041361	7.99902	7.99902	0.	61 * 718.678
3041362	7.99903	7.99903	0.	62 * 718.678

```
3041363       7.99903          7.99903       0.          63 • 718.678
3041364       7.99903          7.99903       0.          64 • 718.678
3041365       7.99903          7.99903       0.          65 • 718.678
3041366       7.99903          7.99903       0.          66 • 718.678
3041367       7.99903          7.99903       0.          67 • 718.678
3041368       7.99903          7.99903       0.          68 • 718.678
3041369       7.99907          8.61149       0.          69 • 718.678
3041370       7.99908          8.61154       0.          70 • 718.678
3041371       7.99908          8.6116        0.          71 • 718.678
3041372       7.9991           8.61166       0.          72 • 718.678
3041373       7.9991           8.61171       0.          73 • 718.678
3041374       7.99911          8.61177       0.          74 • 718.678
3041375       7.99912          8.61182       0.          75 • 718.678
3041376       7.99913          8.61188       0.          76 • 718.678
3041377       7.99914          8.61194       0.          77 • 718.678
3041378       7.99914          8.612         0.          78 • 718.678
3041379       7.99915          8.61205       0.          79 • 718.678
3041380       7.99907          8.61202       0.          80 • 718.678
*
*=================================================================$
•
•               main heat exchanger - loop 3
*
*=================================================================$
*
*-----------------------------------------------------------------$
*hydro              component name       component type
3060000              "hxplin3"               branch
*-------------------------------------------------$----------------$
*hydro            no. juns             vel/flw
3060001              2                    0
*
*hydro             area                 length               volume
3060101           0.08322                1.0                  0.
*
*hydro          horz angle           vert angle           delta z
3060102             0.                   0.                   0.
*
*hydro           roughness            hyd diam              fe
3060103           0.0000457              0.3255               0
•
*hydro  ebt pressure     tempe
3060200     0        1595824.     316928.  2411746. 0.
*
*hydro    from          to           area       f loss     r loss     vcahs
3061101 306000000     308000000        0.          0.15       0.15    01000
3062101 304010000     306000000        0.          0.         0.      01000
*
*hydro   hyd diam
3061110 0.3255    0.0 1.0 1.0
3062110 0.3255    0.0 1.0 1.0
*
*hydro                  f velocity     g velocity     j velocity
3061201                  7.9443         7.9443          0. * 713.766
3062201                  7.99908        8.61205         0. * 718.678
*
*-----------------------------------------------------------------*
*hydro              component name       component type
3080000              "mhx-prim"              pipe
*-------------------------------------------------$----------------$
3080001          11
*
*hydro          vol area                                          vol
3080101          0.8258                                            5
3080102          0.841                                             6
3080103          0.8258                                            11
*
*hydro          length                                            vol
3080301          1.11                                              5
3080302          2.03                                              6
3080303          1.11                                              11
*
•hydro          volume                                            vol
3080401          0.                                                11
•
*hydro         vert angle                                          vol
3080601          0.                                                11
*
*hydro          delta z                                           vol
3080701          0.0                                               11
*
*hydro         roughness      hyd diam                            vol
3080801        0.0000457      0.636                               5
3080802        0.0000457      0.894                               6
3080803        0.0000457      0.636                               11
•
•hydro            fe                                             vol
3081001           00                                             11
•
*hydro           vcahs                                           jun
3081101          01000                                           10
•
*hydro  ebt pressure     tempe                                   vol
3081201     0        1589006.     283733.    2411661. 0. 0.       1
3081202     0        1.589+6      255500.    2411661. 0. 0.       2
3081203     0        1588995.     231329.5   2411661. 0. 0.       3
3081204     0        1588989.     210511.    2411660. 0. 0.       4
3081205     0        1588983.     192480.3   2411660. 0. 0.       5
3081206     0        1588987.     192469.3   2411660. 0. 0.       6
3081207     0        1588967.     188111.    2411660. 0. 0.       7
3081208     0        1588959.     184250.    2411660. 0. 0.       8
3081209     0        1588951.     180824.8   2411660. 0. 0.       9
3081210     0        1588944.     177782.    2411660. 0. 0.       10
3081211     0        1588936.     175076.    2411660. 0. 0.       11
•
*hydro          f velocity   g velocity    j velocity                jun
3081300 0
3081301         .796768          .796768       0.          1 * 713.765
3081302         .793785          .793785       0.          2 • 713.765
3081303         .791434          .791434       0.          3 * 713.765
3081304         .789564          .789564       0.          4 * 713.765
3081305         .788066          .788066       0.          5 • 713.765
3081306         .788065          .788065       0.          6 • 713.765
3081307         .78772           .78772        0.          7 • 713.764
3081308         .78742           .78742        0.          8 • 713.764
3081309         .78716           .78716        0.          9 • 713.764
3081310         .786931          .786931       0.          10 • 713.764
*
*hydro   jun hyd diam                                                jun
3081401      0.100       0.0 1.0 1.0                                 10
*
*-----------------------------------------------------------------$
*hydro              component name       component type
3120000              "hxplout3"              branch
*-------------------------------------------------$----------------$
*hydro            no. juns             vel/flw
3120001              2                    0
*
*hydro             area                 length               volume
3120101           0.08322                1.0                  0.
```

```
*
*hydro         horz angle          vert angle            delta z
3120102             0.                  0.                  0.
*
*hydro          roughness           hyd diam              fe
3120103          0.0000457           0.3255               0
*
*hydro  ebt pressure     tempe
3120200     0       1550090.     175077.3 2411171. 0.
*
*hydro    from          to           area      f loss    r loss    vcahs
3121101 308010000    312000000       0.         0.15      0.15    01000
3122101 312010000    313000000       0.08322    0.        0.      01000
*
*hydro   hyd diam
3121110 0.3255  0.0 1.0 1.0
3122110 0.3255 0.0 1.0 1.0
*
*hydro                 f velocity     g velocity     j velocity
3121201              7.80681          7.80681          0. * 713.764
3122201              7.80694          7.80694          0. * 713.764
*
*-------------------------------------------------------------------$
*hydro             component name       component type
3130000             "joinhx"               pipe
*-----------------------------------------------------$-----------$
3130001          19
*
*hydro          vol area                                          vol
3130101          0.08322                                           19
*
*hydro          length                                            vol
3130301          0.1981                                            10
3130302          0.205                                             16
3130303          0.2032                                            19
*
*hydro          volume                                            vol
3130401          0.                                                19
*
*hydro         vert angle                                         vol
3130601           -22.6                                            10
3130602           -29.7                                            16
3130603           -90.                                             19
*
*hydro         elev. change                                       vol
3130701          -0.0762                                           10
3130702          -0.10155                                          16
3130703          -0.2032                                           19
*
*hydro         roughness      hyd diam                            vol
3130801       0.0000457       0.3255                              19
*
*hydro          f loss        r loss                              jun
3130901          0.0           0.0                                9
3130902          0.182         0.182                              10
3130903          0.0           0.0                                15
3130904          0.182         0.182                              16
3130905          0.0           0.0                                18
*
*hydro            fe                                             vol
3131001          00                                                19
*
*hydro          vcahs                                             jun
3131101          01000                                             18
*
```

```
*hydro  ebt pressure     tempe                                          vol
3131201     0       1549689.     175077.5   2411166. 0. 0.        1
3131202     0       1550243.     175077.8   2411172. 0. 0.        2
3131203     0       1550796.     175078.    2411180. 0. 0.        3
3131204     0       1551349.     175078.3   2411187. 0. 0.        4
3131205     0       1551902.     175078.5   2411194. 0. 0.        5
3131206     0       1552455.     175078.8   2411201. 0. 0.        6
3131207     0       1553009.     175079.    2411208. 0. 0.        7
3131208     0       1553562.     175079.2   2411215. 0. 0.        8
3131209     0       1554115.     175079.5   2411222. 0. 0.        9
3131210     0       1554668.     175079.7   2411229. 0. 0.        10
3131211     0       1549252.     175080.    2411160. 0. 0.        11
3131212     0       1550069.     175080.2   2411170. 0. 0.        12
3131213     0       1550886.     175080.5   2411181. 0. 0.        13
3131214     0       1551703.     175080.7   2411191. 0. 0.        14
3131215     0       1552520.     175081.    2411202. 0. 0.        15
3131216     0       1553337.     175081.2   2411212. 0. 0.        16
3131217     0       1548602.     175081.5   2411152. 0. 0.        17
3131218     0       1550516.     175081.7   2411176. 0. 0.        18
3131219     0       1552431.     175082.    2411200. 0. 0.        19
*
*hydro          vel/flw
3131300            0
*
*hydro         f flowrate    g flowrate    j flowrate                jun
3131301       7.80694          7.80694       0.          1 * 713.764
3131302       7.80694          7.80694       0.          2 * 713.764
3131303       7.80694          7.80694       0.          3 * 713.764
3131304       7.80694          7.80694       0.          4 * 713.764
3131305       7.80694          7.80694       0.          5 * 713.764
3131306       7.80694          7.80694       0.          6 * 713.764
3131307       7.80693          7.80693       0.          7 * 713.764
3131308       7.80693          7.80693       0.          8 * 713.764
3131309       7.80693          7.80693       0.          9 * 713.764
3131310       7.80693          7.80693       0.          10 * 713.764
3131311       7.80695          7.80695       0.          11 * 713.764
3131312       7.80694          7.80694       0.          12 * 713.764
3131313       7.80694          7.80694       0.          13 * 713.764
3131314       7.80694          7.80694       0.          14 * 713.764
3131315       7.80694          7.80694       0.          15 * 713.764
3131316       7.80693          7.80693       0.          16 * 713.764
3131317       7.80695          8.41291       0.          17 * 713.764
3131318       7.80694          8.41287       0.          18 * 713.764
*
*-------------------------------------------------------------------$
*       main heat exchanger secondary flow system (tube side)        $
*-------------------------------------------------------------------$
*
*-------------------------------------------------------------------*
*hydro             component name       component type
3300000             "secsrc3"              tmdpvol
*-------------------------------------------------------------------*
*hydro          area        length       volume
3300101         1.e6           .0        1.0e+06
*
*hydro       horz angle  vert angle    delta z
3300102          .0          .0           .0
*
*hydro        roughness   hyd diam       fe
3300103          .0          .0           10
*
*hydro  ebt         trip no.        alpha vrc       numeric vrc
3300200 003
*
*hydro   time     pressure     tempe
```

```
3300201   0.      5.000e5      302.55
*
*---------------------------------------------------------------------*
*hydro             component name      component type
3320000             "sectdj1"           tmdpjun
*---------------------------------------------------------------------*
*hydro    from          to             area
3320101   330000000     334000000      0.7122
*
*hydro    vel/flw       trip no.       alpha vrc      numeric vrc
3320200     1             0             cntrlvar          598
*
*hydro   time           f flow         g flow         j flow
3320201   -1.e6         -1.e6           0.                0
3320202    1.e6          1.e6           0.                0
*
*---------------------------------------------------------------------*
*hydro             component name      component type
3340000             "mhx-sec"           pipe
*-------------------------------------------------$-----------------$
3340001         10
*
*hydro          vol area                                          vol
3340101        0.776                                              10
*
*hydro          length                                            vol
3340301          1.314                                            10
*
*hydro          volume                                            vol
3340401          0.                                               10
*
*hydro         vert angle                                         vol
3340601          0.                                               10
*
*hydro          delta z                                           vol
3340701          0.0                                              10
*
*hydro         roughness      hyd diam                           vol
3340801        0.0000457      0.01588                            10
*
*hydro            fe                                             vol
3341001          00                                               10
*
*hydro          vcahs                                             jun
3341101        01000                                               9
*
*hydro  ebt pressure     tempe                                    vol
3341201     0       499142.      130761.     2559873. 0. 0.       1
3341202     0       493565.      139600.5    2559517. 0. 0.       2
3341203     0       488005.      149861.3    2559158. 0. 0.       3
3341204     0       482463.5     161844.8    2558798. 0. 0.       4
3341205     0       476941.      175932.5    2558436. 0. 0.       5
3341206     0       471424.      177084.     2558070. 0. 0.       6
3341207     0       465912.      178378.3    2557702. 0. 0.       7
3341208     0       460401.      179834.7    2557330. 0. 0.       8
3341209     0       454892.      181475.7    2556955. 0. 0.       9
3341210     0       449385.5     183327.6    2556576. 0. 0.       10
*
*hydro         f velocity    g velocity    j velocity              jun
3341300 0
3341301       2.175972        2.175972      0.          1 * 1681.036
3341302       2.17748         2.17748       0.          2 * 1681.036
3341303       2.179332        2.179332      0.          3 * 1681.036
3341304       2.181634        2.181634      0.          4 * 1681.036
3341305       2.184523        2.184523      0.          5 * 1681.036
3341306       2.184773        2.184773      0.          6 * 1681.036
3341307       2.185054        2.185054      0.          7 * 1681.036
3341308       2.18537         2.18537       0.          8 * 1681.036
3341309       2.18573         2.18573       0.          9 * 1681.036
*
*hydro   jun hyd diam                                              jun
3341401      0.01588     0.0 1.0 1.0                               9
*
*---------------------------------------------------------------------*
*hydro             component name      component type
3350000             "tubeout"           sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to             area       f loss     r loss     vcahs
3350101   334010000     336000000      0.0          0.         0.       01000
*
*hydro   hyd diam
3350110   0.01588       0.0       1.0       1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3350201     0              2.18614        2.18614        0. * 1681.036
*
*---------------------------------------------------------------------*
*hydro             component name      component type
3360000             "secsnk1"           tmdpvol
*---------------------------------------------------------------------*
*hydro          area        length       volume
3360101         1.e6          .0         1.0e+06
*
*hydro      horz angle  vert angle    delta z
3360102          .0          .0           .0
*
*hydro       roughness   hyd diam       fe
3360103           .0          .0         10
*
*hydro  ebt         trip no.        alpha vrc       numeric vrc
3360200 003
*
*hydro   time      pressure      tempe
3360201   0.      4.490e5       319.
*
*=====================================================================$
*
*        emergency heat exchanger - loop 3
*
*=====================================================================$
*
*---------------------------------------------------------------------$
*hydro             component name      component type
3140000             hxplin1             branch
*-------------------------------------------------$-------------------$
*hydro           no. juns             vel/flw
3140001             2                    0
*
*hydro            area                length              volume
3140101         0.08322                 1.0                0.
*
*hydro          horz angle           vert angle          delta z
3140102           0.                    0.                 0.
*
*hydro          roughness            hyd diam            fe
3140103         0.0000457              0.3255             0
*
*hydro  ebt pressure     tempe
3140200     0       1585533.     175083.2 2411618. 0.
*
```

```
*hydro    from          to           area      f loss    r loss    vcahs
3141101 314000000    316000000       0.         0.15       0.15   01000
3142101 313010000    314000000       0.         0.         0.     01000
*
*hydro   hyd diam
3141110 0.3255   0.0 1.0 1.0
3142110 0.3255   0.0 1.0 1.0
*
*hydro                f velocity     g velocity     j velocity
3141201              7.80682        7.80682          0. * 713.764
3142201              7.80694        8.41282          0. * 713.764
*
*----------------------------------------------------------------------*
*hydro             component name      component type
3160000              "ehx-prim"             pipe
*-------------------------------------------------$-----------------$
3160001          4
*
*hydro          vol area                                          vol
3160101          0.894                                              4
*
*hydro          length                                            vol
3160301          1.6                                                4
*
*hydro          volume                                            vol
3160401          0.                                                 4
*
*hydro         vert angle                                         vol
3160601          0.                                                 4
*
*hydro          delta z                                           vol
3160701          0.0                                                4
*
* calibrated hydraulic diameter to match pressure drop
*
*hydro         roughness      hyd diam                            vol
*3160801         0.0000457      0.0346                             4
3160801          0.0000457      0.00170                            4
*
*hydro          f loss         r loss                             jun
3160901          0.0            0.0                                3
*
*hydro            fe                                              vol
3161001          00                                                 4
*
*hydro          vcahs                                             jun
3161101          01000                                              3
*
*hydro  ebt pressure     tempe                                     vol
3161201     0       1574261.     172956.    2411476. 0. 0.         1
3161202     0       1565020.     172757.    2411360. 0. 0.         2
3161203     0       1555773.     172727.5   2411243. 0. 0.         3
3161204     0       1546526.     172716.4   2411125. 0. 0.         4
*
*hydro         f velocity   g velocity    j velocity                jun
3161300 0
3161301       .726576          .726576      0.            1 * 713.763
3161302       .726565          .726565      0.            2 * 713.763
3161303       .726566          .726566      0.            3 * 713.763
*
*hydro   jun hyd diam                                               jun
3161401      0.00170     0.0 1.0 1.0                                3
*
*----------------------------------------------------------------------$
*hydro             component name      component type
```

```
3200000              hxplout1              branch
*-------------------------------------------------$-----------------$
*hydro           no. juns            vel/flw
3200001             2                   0
*
*hydro            area                length              volume
3200101          0.08322                1.0                 0.
*
*hydro         horz angle          vert angle            delta z
3200102             0.                  0.                  0.
*
*hydro          roughness          hyd diam              fe
3200103          0.0000457          0.3255                0
*
*hydro  ebt pressure     tempe
3200200     0       1503018.     172717.7 2410565. 0.
*
*hydro    from          to           area      f loss    r loss    vcahs
3201101 316010000    320000000       0.         0.15       0.15   01000
3202101 320010000    322000000       0.08322    0.         0.     01000
*
*hydro   hyd diam
3201110 0.3255  0.0 1.0 1.0
3202110 0.3255 0.0 1.0 1.0
*
*hydro                f velocity     g velocity     j velocity
3201201              7.80523        7.80523          0. * 713.763
3202201              7.80539        7.80539          0. * 713.763
*
*-------------------------------------------------------------------$
*       emergency heat exchanger secondary flow system (tube side)          $
*-------------------------------------------------------------------$
*
*----------------------------------------------------------------------*
*hydro             component name      component type
3380000              "secsrc1"              tmdpvol
*----------------------------------------------------------------------*
*hydro          area       length      volume
3380101        1.e6          .0        1.0e+06
*
*hydro      horz angle  vert angle    delta z
3380102          .0          .0          .0
*
*hydro       roughness   hyd diam       fe
3380103          .0          .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
3380200 003
*
*hydro   time     pressure     tempe
3380201   0.     1.800e5      311.15
*
*----------------------------------------------------------------------*
*hydro             component name      component type
3400000              "tubein"               sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to           area      f loss    r loss    vcahs
3400101   338000000    342000000    0.0        0.         0.     01100
*
*hydro   hyd diam
3400110   0.4573       0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3400201     0             -.0806497      -.0806497       0. * -34.0615
*
```

```
*-------------------------------------------------------------------*
*hydro             component name      component type
3420000             "ehx-sec"            pipe
*-------------------------------------------------$-----------------$
3420001          2
*
*hydro          vol area                                          vol
3420101         0.4264                                             2
*
*hydro           length                                           vol
3420301          0.7622                                            2
*
*hydro           volume                                           vol
3420401           0.                                              2
*
*hydro         vert angle                                         vol
3420601           0.                                              2
*
*hydro          delta z                                           vol
3420701           0.0                                             2
*
*hydro         roughness      hyd diam                           vol
3420801         0.0000457     0.4573                             2
*
*hydro            fe                                             vol
3421001           00                                              2
*
*hydro           vcahs                                           jun
3421101          01000                                            1
*
*hydro  ebt pressure     tempe                                    vol
3421201     0       180000.5     186593.    2525554. 0. 0.        1
3421202     0       180000.6     186593.    2525554. 0. 0.        2
*
*hydro         f velocity   g velocity    j velocity               jun
3421300 0
3421301       -.0806497        -.0806497    0.            1 * -34.0615
*
*hydro   jun hyd diam                                             jun
3421401      0.4573      0.0 1.0 1.0                              1
*
*-------------------------------------------------------------------*
*hydro             component name      component type
3440000             "tubein"             sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to           area      f loss    r loss    vcahs
3440101   342010000     346000000    0.0         0.        0.      01100
*
*hydro   hyd diam
3440110   0.01905      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3440201     0              -.0806497      -.0806497       0. * -34.0615
*
*-------------------------------------------------------------------*
*hydro             component name      component type
3460000             "ehx-sec"            pipe
*-------------------------------------------------$-----------------$
3460001          4
*
*hydro          vol area                                          vol
3460101         0.476                                              4
*
*hydro           length                                           vol
3460301          1.6                                               4
*
*hydro          volume                                            vol
3460401           0.                                               4
*
*hydro         vert angle                                         vol
3460601           0.                                               4
*
*hydro          delta z                                           vol
3460701           0.0                                              4
*
*hydro         roughness      hyd diam                           vol
3460801         0.0000457     0.01905                            4
*
*hydro            fe                                             vol
3461001           00                                              4
*
*hydro           vcahs                                           jun
3461101          01000                                            3
*
*hydro  ebt pressure     tempe                                    vol
3461201     0       180004.7     186593.    2525555. 0. 0.        1
3461202     0       180011.5     186536.2   2525556. 0.        0. 2
3461203     0       180018.2     186091.4   2525557. 0.         0. 3
3461204     0       180025.      182093.    2525558. 0.         0. 4
*
*hydro         f velocity   g velocity    j velocity               jun
3461300 0
3461301       -.0722454        -.0722454    0.            1 * -34.0615
3461302       -.0722422        -.0722422    0.            2 * -34.0615
3461303       -.0722132        -.0722132    0.            3 * -34.0615
*
*hydro   jun hyd diam                                             jun
3461401      0.01905     0.0 1.0 1.0                              3
*
*-------------------------------------------------------------------*
*hydro             component name      component type
3480000             "tubeout"            sngljun
*-------------------------------------------------*-----------------*
*hydro    from          to           area      f loss    r loss    vcahs
3480101   346010000     350000000    0.0         0.        0.      01100
*
*hydro   hyd diam
3480110   0.01905      0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3480201     0              -.1686556      -.189866        0. * -34.06153
*
*-------------------------------------------------------------------$
*hydro             component name      component type
3500000             "chimney"            pipe
*-------------------------------------------------$-----------------$
3500001          4
*
*hydro          vol area                                          vol
3500101         0.203                                              4
*
*hydro           length                                           vol
3500301          0.75                                              4
*
*hydro           volume                                           vol
3500401           0.                                              4
*
*hydro         vert angle                                         vol
3500601           90.                                              4
*
```

```
*hydro         elev. change                                          vol
3500701           0.75                                               4
*
*hydro         roughness      hyd diam                               vol
3500801        0.0000457       0.508                                 4
*
*hydro           f loss        r loss                                jun
3500901            0.           0.                                   3
*
*hydro             fe                                                vol
3501001            00                                                4
*
*hydro           vcahs                                               jun
3501101          01000                                               3
*
*hydro  ebt pressure     tempe                                        vol
3501201     0       176363.      137691.    2524855. 0. 0.        1
3501202     0       169046.      137656.7   2523412. 0. 0.        2
3501203     0       161729.2     137622.3   2521918. 0. 0.        3
3501204     0       154412.3     137587.9   2520367. 0. 0.        4
*
*hydro          vel/flw
3501300            0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
3501301       -.1686557        -.2051964    0.            1 * -34.06153
3501302       -.1686558        -.2051965    0.            2 * -34.06153
3501303       -.168656         -.2051966    0.            3 * -34.06153
*
*-------------------------------------------------------------------
*hydro             component name      component type
3520000             "tubeout"             sngljun
*-------------------------------------------------------------------
*hydro    from          to           area      f loss    r loss  vcahs
3520101   350010000     354000000    0.0         0.        0.    01100
*
*hydro   hyd diam
3520110   0.508        0.0      1.0      1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3520201     0              -.1686557      -.1686557       0. * -34.06153
*
*-------------------------------------------------------------------*
*hydro             component name      component type
3540000             "secsnk1"             tmdpvol
*-------------------------------------------------------------------*
*hydro         area       length      volume
3540101        1.e6         .0        1.0e+06
*
*hydro      horz angle  vert angle    delta z
3540102         .0          .0           .0
*
*hydro       roughness   hyd diam       fe
3540103          .0         .0          10
*
*hydro  ebt        trip no.       alpha vrc      numeric vrc
3540200 003
*
*hydro   time     pressure     tempe
3540201   0.     150773.66    306.
*
*$=================================================================$
*
*     accumulator and surge line - loop 3
*       assembled from normal relap5 components.
```

```
*       a tank wall heat structure (#3561) has been defined
*
*$=================================================================$
*
*hydro             component name      component type
3560000             "accum3"              pipe
*-------------------------------------------------$-----------------$
*hydro       no. volumes
3560001           6
*
*hydro          vol area                                            vol
3560101        1.65                                                 5
3560102        0.08322                                              6
*
*hydro          length                                              vol
*
*hydro          length                                              vol
3560301        4.09                                                 1
3560302        0.12                                                 5
3560303        4.88                                                 6
*
*hydro          volume                                              vol
3560401          0.                                                 6
*
*hydro         vert angle                                           vol
3560601          -90.                                               6
*
*hydro         roughness      hyd diam                              vol
3560801        0.0000457       1.52                                 5
3560802        0.0000457       0.3255                               6
*
*hydro           f loss        r loss                               jun
3560901           0.            0.                                  4
3560902           0.5           1.0                                 5
*
*hydro             fe                                               vol
3561001            00000                                           6
*
*hydro           vcahs                                              jun
3561101          00000                                              5
*
*hydro  ebt                                                         vol
3561201 6    1574359.    107023.9 373079.5 .0767345 .998407 1
3561202     0       1595482.     160395.3   2411742. 0. 0.        2
3561203     0       1596776.     172385.4   2411758. 0. 0.        3
3561204     0       1598069.     173928.    2411774. 0. 0.        4
3561205     0       1599362.     175752.5   2411790. 0. 0.        5
3561206     0       1626260.     189765.    2412121. 0. 0.        6
*
*hydro          vel/flw
3561300           0
*
*hydro         f velocity   g velocity    j velocity                jun
3561301       2.59546-6        -.57638      0.            1 * .004366285
3561302       2.396596-6       2.39666-6    0.            2 * .00435016
3561303       2.398644-6       2.39871-6    0.            3 * .004349235
3561304       2.400764-6       2.40083-6    0.            4 * .00435246
3561305       4.76416-5        4.76669-5    0.            5 * .00435554
*
$=================================================================$
*hydro             component name      component type
3570000             "accumout"            sngljun
*-------------------------------------------------$-----------------$
*hydro    from          to           area      f loss    r loss    vcahs
3570101   356060002  304040001 0.08322  0.        0.      01000
```

```
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3570201     0             4.76046-5      4.76046-5      0. * .0043463
*
$=====================================================================$
*hydro              component name       component type
3220000              "coldleg"               pipe
*-------------------------------------------------$-----------------$
3220001           26
*
3220101         0.08322                                              26
*
*hydro            length                                             vol
3220301           0.1925                                             12
3220302           0.213                                              22
3220303           0.1905                                             26
*
*hydro            volume                                             vol
3220401           0.                                                 26
*
*hydro            volume                                             vol
3220501           0.                                                 26
*
*hydro          vert angle                                           vol
3220601           -7.6                                               12
3220602           0.                                                 22
3220603           90.                                                26
*
*hydro           delta z                                             vol
3220701           -0.0254                                            11
3220702           -0.0256                                            12
3220703           0.                                                 22
3220704           0.1905                                             26
*
*hydro          roughness      hyd diam                             vol
3220801         0.0000457       0.3255                               26
*
*hydro            f loss         r loss                             jun
3220901           0.0            0.0                                11
3220902           0.182          0.182                              12
3220903           0.0            0.0                                21
3220904           0.182          0.182                              22
3220905           0.0            0.0                                25
*
*hydro             fe                                                vol
3221001           00                                                 26
*
*hydro            vcahs                                              jun
3221101           01000                                              25
*
*hydro  ebt pressure     tempe                                        vol
3221201     0       1502347.     172709.     2410556. 0. 0.        1
3221202     0       1502361.     172709.     2410556. 0. 0.        2
3221203     0       1502374.     172709.4    2410556. 0. 0.        3
3221204     0       1502388.     172709.6    2410556. 0. 0.        4
3221205     0       1502401.     172710.     2410557. 0. 0.        5
3221206     0       1502415.     172710.     2410557. 0. 0.        6
3221207     0       1502428.     172710.3    2410557. 0. 0.        7
3221208     0       1502442.     172710.6    2410557. 0. 0.        8
3221209     0       1502455.     172710.8    2410558. 0. 0.        9
3221210     0       1502468.     172711.     2410558. 0. 0.        10
3221211     0       1502482.     172711.3    2410558. 0. 0.        11
3221212     0       1502496.     172711.5    2410558. 0. 0.        12
3221213     0       1496260.     172703.5    2410467. 0. 0.        13
3221214     0       1495972.     172703.8    2410462. 0. 0.        14
3221215     0       1495684.     172704.     2410458. 0. 0.        15
3221216     0       1495396.     172704.3    2410453. 0. 0.        16
3221217     0       1495108.     172704.6    2410448. 0. 0.        17
3221218     0       1494821.     172705.     2410444. 0. 0.        18
3221219     0       1494533.     172705.     2410440. 0. 0.        19
3221220     0       1494245.     172705.3    2410435. 0. 0.        20
3221221     0       1493957.     172705.6    2410430. 0. 0.        21
3221222     0       1493669.     172706.     2410426. 0. 0.        22
3221223     0       1486270.     172703.2    2410309. 0. 0.        23
3221224     0       1483959.     172703.5    2410272. 0. 0.        24
3221225     0       1481649.     172703.7    2410236. 0. 0.        25
3221226     0       1479338.     172704.     2410199. 0. 0.        26
*
*hydro         vel/flw
3221300          0
*
*hydro        f flowrate   g flowrate    j flowrate              jun
3221301      7.80538        7.80538       0.          1 * 713.763
3221302      7.80538        7.80538       0.          2 * 713.763
3221303      7.80538        7.80538       0.          3 * 713.763
3221304      7.80538        7.80538       0.          4 * 713.763
3221305      7.80538        7.80538       0.          5 * 713.763
3221306      7.80538        7.80538       0.          6 * 713.763
3221307      7.80538        7.80538       0.          7 * 713.763
3221308      7.80538        7.80538       0.          8 * 713.763
3221309      7.80538        7.80538       0.          9 * 713.763
3221310      7.80538        7.80538       0.          10 * 713.763
3221311      7.80538        7.80538       0.          11 * 713.763
3221312      7.80538        7.80538       0.          12 * 713.763
3221313      7.8054         7.8054        0.          13 * 713.763
3221314      7.8054         7.8054        0.          14 * 713.763
3221315      7.8054         7.8054        0.          15 * 713.763
3221316      7.8054         7.8054        0.          16 * 713.763
3221317      7.8054         7.8054        0.          17 * 713.763
3221318      7.8054         7.8054        0.          18 * 713.763
3221319      7.8054         7.8054        0.          19 * 713.763
3221320      7.8054         7.8054        0.          20 * 713.763
3221321      7.8054         7.8054        0.          21 * 713.763
3221322      7.80541        7.80541       0.          22 * 713.763
3221323      7.80543        8.41258       0.          23 * 713.763
3221324      7.80544        8.41263       0.          24 * 713.763
3221325      7.80545        8.41269       0.          25 * 713.763
*
*=====================================================================$
*
*     primary coolant pump - loop 3
*
*=====================================================================$
*
*---------------------------------------------------------------------$
*hydro              component name       component type
3240000              "rcpump3"               pump
*-------------------------------------------------$-----------------$
*hydro             area                 length               volume
3240101             0.                   0.500                0.7739
*
*hydro          horz angle           vert angle             delta z
3240102             0.                   0.                   0.
*
*hydro          equil flag
3240103             00
*
*hydro       from       jun area     f loss       r loss       vcahs
3240108     322010000     0.          0.00         0.00         01000
*
```

```
* assume k=2.0 for strainer loss coefficient
*
*hydro        to        jun area      f loss       r loss       vcahs
3240109      326000000     0.         2.0          2.0         01000
*
*hydro  ebt pressure     tempe
3240200     0        2381871.     172748.  2418081. 0.
*
*hydro    vel/flw     f flowrate       g flowrate     j flowrate
3240201    0             7.80546          8.41274        0. * 713.763
*
*hydro    vel/flw     f flowrate       g flowrate     j flowrate
3240202    0             7.80238          7.80238        0. * 713.762
*
*hydro      ptdi    2fazi    diff i    tork i    pvel i    trip no.    rvrs i
3240301     124      124      124       -1         0         555        0
*
*hydro   rated pump vel.   init/rated vel.   rated flow    rated head
3240302         188.5           .909385          0.643         207.3
*
*hydro    rated torque     mom of inertia    rated dens    mtr torque
3240303       7616.8            91.50           1098.          .0
*
*hydro     coeff. tf2        coeff. tf0      coeff. tf1    coeff. tf3
3240304       10.0              150.0             0.            0.
*      pump speed table
*3246100      0 cntrlvar 83
3246100      619 cntrlvar 195
3246101     -1.e6    -1.e6
3246102      1.e6     1.e6
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
3260000             "pmpdisc"               pipe
*-------------------------------------------------------------$-----------$
3260001          5
*
*hydro          vol area                                              vol
3260101         0.08322                                               5
*
*hydro           length                                               vol
3260301          0.18292                                              5
*
*hydro           volume                                               vol
3260401           0.                                                  5
*
*hydro           volume                                               vol
3260501           0.                                                  5
*
*hydro         vert angle                                             vol
3260601           0.0                                                 5
*
*hydro          delta z                                               vol
3260701          0.0                                                  5
*
*hydro         roughness      hyd diam                                vol
3260801        0.0000457       0.3255                                5
*
*hydro           f loss        r loss                                 jun
3260901          0.0           0.0                                   4
*
*hydro            fe                                                 vol
3261001          00                                                  5
*
*hydro           vcahs                                               jun
```

```
3261101          01000                                                4
*
*hydro  ebt pressure     tempe                                        vol
3261201     0        3151684.     172745.7    2419673. 0. 0.        1
3261202     0        3151454.     172746.     2419673. 0. 0.        2
3261203     0        3151207.     172746.     2419674. 0. 0.        3
3261204     0        3150960.     172746.3    2419674. 0. 0.        4
3261205     0        3150713.     172746.6    2419674. 0. 0.        5
*
*hydro          vel/flw
3261300            0
*
*hydro         f flowrate   g flowrate    j flowrate                 jun
3261301       7.79975          7.79975       0.            1 * 713.762
3261302       7.79975          7.79975       0.            2 * 713.762
3261303       7.79975          7.79975       0.            3 * 713.762
3261304       7.79975          7.79975       0.            4 * 713.762
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
3280000              "check"                 valve
*-------------------------------------------------$-----------------------$
*hydro    from          to           area      f loss     r loss     vcahs
3280101   326010000     329000000    0.08317    0.98       0.98      01100
*
*hydro    vel/flw       f flowrate     g flowrate     j flowrate
3280201     0              7.79975        7.79975        0. * 713.762
*
*hydro                valve type
3280300                chkvlv
*
*hydro    chkvlv type  init. posn  back press  leak ratio
3280301        0           0           0.          0.
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
3290000             "cljoin"                pipe
*-------------------------------------------------$-----------------------$
3290001          31
*
*hydro          vol area                                              vol
3290101         0.08322                                               31
*
*hydro           length                                               vol
3290301          0.2016                                               31
*
*hydro           volume                                               vol
3290401           0.                                                  31
*
*hydro           volume                                               vol
3290501           0.                                                  31
*
*hydro         vert angle                                             vol
3290601           0.0                                                 31
*
*hydro          delta z                                               vol
3290701          0.0                                                  31
*
*hydro         roughness      hyd diam                                vol
3290801        0.0000457       0.3255                                31
*
*hydro           f loss        r loss                                 jun
3290901          0.0           0.0                                   30
*
*hydro            fe                                                 vol
```

```
3291001           00                                                  31
*
*hydro          vcahs                                                 jun
3291101         01000                                                  30
*
*hydro  ebt pressure     tempe                                        vol
3291201     0       3117631.    172722.3   2419700. 0. 0.        1
3291202     0       3117358.    172722.6   2419700. 0. 0.        2
3291203     0       3117086.    172723.    2419700. 0. 0.        3
3291204     0       3116814.    172723.    2419700. 0. 0.        4
3291205     0       3116541.    172723.3   2419700. 0. 0.        5
3291206     0       3116269.    172723.6   2419701. 0. 0.        6
3291207     0       3115996.    172723.8   2419701. 0. 0.        7
3291208     0       3115724.    172724.    2419701. 0. 0.        8
3291209     0       3115452.    172724.3   2419702. 0. 0.        9
3291210     0       3115180.    172724.6   2419702. 0. 0.        10
3291211     0       3114907.    172724.8   2419702. 0. 0.        11
3291212     0       3114635.    172725.    2419702. 0. 0.        12
3291213     0       3114362.    172725.3   2419702. 0. 0.        13
3291214     0       3114090.    172725.5   2419702. 0. 0.        14
3291215     0       3113818.    172725.8   2419703. 0. 0.        15
3291216     0       3113545.    172726.    2419703. 0. 0.        16
3291217     0       3113273.    172726.3   2419703. 0. 0.        17
3291218     0       3.113+6     172726.5   2419703. 0. 0.        18
3291219     0       3112728.    172726.8   2419704. 0. 0.        19
3291220     0       3112456.    172727.    2419704. 0. 0.        20
3291221     0       3112184.    172727.3   2419704. 0. 0.        21
3291222     0       3111911.    172727.5   2419704. 0. 0.        22
3291223     0       3111639.    172727.8   2419704. 0. 0.        23
3291224     0       3111366.    172728.    2419704. 0. 0.        24
3291225     0       3111094.    172728.3   2419705. 0. 0.        25
3291226     0       3110822.    172728.5   2419705. 0. 0.        26
3291227     0       3110549.    172728.8   2419705. 0. 0.        27
3291228     0       3110277.    172729.    2419706. 0. 0.        28
3291229     0       3110004.    172729.3   2419706. 0. 0.        29
3291230     0       3109732.    172729.5   2419706. 0. 0.        30
3291231     0       3109460.    172729.8   2419706. 0. 0.        31
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate                jun
3291300 0
3291301       7.79985         7.79985      0.          1 * 713.762
3291302       7.79985         7.79985      0.          2 * 713.762
3291303       7.79985         7.79985      0.          3 * 713.762
3291304       7.79985         7.79985      0.          4 * 713.762
3291305       7.79985         7.79985      0.          5 * 713.762
3291306       7.79985         7.79985      0.          6 * 713.762
3291307       7.79985         7.79985      0.          7 * 713.762
3291308       7.79985         7.79985      0.          8 * 713.762
3291309       7.79985         7.79985      0.          9 * 713.762
3291310       7.79986         7.79986      0.          10 * 713.762
3291311       7.79986         7.79986      0.          11 * 713.762
3291312       7.79986         7.79986      0.          12 * 713.762
3291313       7.79986         7.79986      0.          13 * 713.762
3291314       7.79986         7.79986      0.          14 * 713.762
3291315       7.79986         7.79986      0.          15 * 713.762
3291316       7.79986         7.79986      0.          16 * 713.762
3291317       7.79986         7.79986      0.          17 * 713.762
3291318       7.79986         7.79986      0.          18 * 713.762
3291319       7.79987         7.79987      0.          19 * 713.762
3291320       7.79987         7.79987      0.          20 * 713.762
3291321       7.79987         7.79987      0.          21 * 713.762
3291322       7.79987         7.79987      0.          22 * 713.762
3291323       7.79987         7.79987      0.          23 * 713.762
3291324       7.79987         7.79987      0.          24 * 713.762
3291325       7.79987         7.79987      0.          25 * 713.762
3291326       7.79987         7.79987      0.          26 * 713.762
3291327       7.79987         7.79987      0.          27 * 713.762
3291328       7.79987         7.79987      0.          28 * 713.762
3291329       7.79988         7.79988      0.          29 * 713.762
3291330       7.79988         7.79988      0.          30 * 713.762
*
*----------------------------------------------------------------------*
*hydro             component name       component type
3310000             "elbow1"               sngljun
*-------------------------------------------------*--------------------*
*hydro    from          to           area      f loss    r loss    vcahs
3310101   329010000     358000000    0.083220    0.182     0.182    01000
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3310201    0              7.79988        7.79988        0. * 713.762
*
*----------------------------------------------------------------------$
*hydro             component name       component type
3580000             "coldleg"              pipe
*-------------------------------------------------$------------------$
3580001         80
*
*hydro          vol area                                              vol
3580101        0.08322                                                80
*
*hydro          length                                                vol
3580301          0.181                                                80
*
*hydro          volume                                                vol
3580401          0.                                                   80
*
*hydro         horz angle                                             vol
3580501          0.                                                   80
*
*hydro         vert angle                                             vol
3580601          0.                                                   80
*
*hydro         delta z                                                vol
3580701          0.                                                   80
*
*hydro         roughness      hyd diam                                vol
3580801       0.0000457       0.3255                                 80
*
*hydro           kf              kr                                   jun
3580901        0.0             0.0                                   79
*
*hydro           fe                                                   vol
3581001         00                                                   80
*
*hydro          vcahs                                                 jun
3581101        01000                                                  79
*
*hydro  ebt pressure     tempe                                        vol
3581201     0       3103106.    172701.7   2419711. 0. 0.        1
3581202     0       3102862.    172673.6   2419711. 0. 0.        2
3581203     0       3102617.    172674.    2419712. 0. 0.        3
3581204     0       3102372.    172674.    2419712. 0. 0.        4
3581205     0       3102128.    172674.3   2419712. 0. 0.        5
3581206     0       3101884.    172674.5   2419712. 0. 0.        6
3581207     0       3101639.    172674.8   2419712. 0. 0.        7
3581208     0       3101394.    172675.    2419712. 0. 0.        8
3581209     0       3101150.    172675.2   2419713. 0. 0.        9
3581210     0       3100905.    172675.4   2419713. 0. 0.        10
```

```
3581211  0    3100661.   172675.6  2419713. 0. 0.    11
3581212  0    3100416.   172676.   2419713. 0. 0.    12
3581213  0    3100172.   172676.   2419714. 0. 0.    13
3581214  0    3099927.   172676.3  2419714. 0. 0.    14
3581215  0    3099682.   172676.5  2419714. 0. 0.    15
3581216  0    3099438.   172676.8  2419714. 0. 0.    16
3581217  0    3099194.   172677.   2419714. 0. 0.    17
3581218  0    3098949.   172677.2  2419714. 0. 0.    18
3581219  0    3098704.   172677.4  2419714. 0. 0.    19
3581220  0    3098460.   172677.6  2419715. 0. 0.    20
3581221  0    3098216.   172678.   2419715. 0. 0.    21
3581222  0    3097971.   172678.   2419715. 0. 0.    22
3581223  0    3097726.   172678.3  2419715. 0. 0.    23
3581224  0    3097482.   172678.5  2419716. 0. 0.    24
3581225  0    3097237.   172678.8  2419716. 0. 0.    25
3581226  0    3096993.   172679.   2419716. 0. 0.    26
3581227  0    3096748.   172679.2  2419716. 0. 0.    27
3581228  0    3096504.   172679.4  2419716. 0. 0.    28
3581229  0    3096259.   172679.6  2419716. 0. 0.    29
3581230  0    3096014.   172680.   2419717. 0. 0.    30
3581231  0    3095770.   172680.   2419717. 0. 0.    31
3581232  0    3095526.   172680.3  2419717. 0. 0.    32
3581233  0    3095281.   172680.5  2419717. 0. 0.    33
3581234  0    3095036.   172680.8  2419718. 0. 0.    34
3581235  0    3094792.   172681.   2419718. 0. 0.    35
3581236  0    3094547.   172681.2  2419718. 0. 0.    36
3581237  0    3094303.   172681.4  2419718. 0. 0.    37
3581238  0    3094058.   172681.6  2419718. 0. 0.    38
3581239  0    3093814.   172682.   2419718. 0. 0.    39
3581240  0    3093569.   172682.   2419719. 0. 0.    40
3581241  0    3093325.   172682.3  2419719. 0. 0.    41
3581242  0    3093080.   172682.5  2419719. 0. 0.    42
3581243  0    3092836.   172682.8  2419719. 0. 0.    43
3581244  0    3092591.   172683.   2419720. 0. 0.    44
3581245  0    3092346.   172683.2  2419720. 0. 0.    45
3581246  0    3092102.   172683.4  2419720. 0. 0.    46
3581247  0    3091858.   172683.6  2419720. 0. 0.    47
3581248  0    3091613.   172684.   2419720. 0. 0.    48
3581249  0    3091368.   172684.   2419720. 0. 0.    49
3581250  0    3091124.   172684.3  2419720. 0. 0.    50
3581251  0    3090879.   172684.5  2419721. 0. 0.    51
3581252  0    3090635.   172684.8  2419721. 0. 0.    52
3581253  0    3090390.   172685.   2419721. 0. 0.    53
3581254  0    3090146.   172685.2  2419721. 0. 0.    54
3581255  0    3089901.   172685.4  2419722. 0. 0.    55
3581256  0    3089657.   172685.6  2419722. 0. 0.    56
3581257  0    3089412.   172686.   2419722. 0. 0.    57
3581258  0    3089168.   172686.   2419722. 0. 0.    58
3581259  0    3088923.   172686.3  2419722. 0. 0.    59
3581260  0    3088678.   172686.5  2419722. 0. 0.    60
3581261  0    3088434.   172686.8  2419723. 0. 0.    61
3581262  0    3088190.   172687.   2419723. 0. 0.    62
3581263  0    3087945.   172687.2  2419723. 0. 0.    63
3581264  0    3087700.   172687.4  2419723. 0. 0.    64
3581265  0    3087456.   172687.6  2419724. 0. 0.    65
3581266  0    3087211.   172688.   2419724. 0. 0.    66
3581267  0    3086967.   172688.   2419724. 0. 0.    67
3581268  0    3086722.   172688.3  2419724. 0. 0.    68
3581269  0    3086478.   172688.5  2419724. 0. 0.    69
3581270  0    3086233.   172688.8  2419724. 0. 0.    70
3581271  0    3085988.   172689.   2419725. 0. 0.    71
3581272  0    3085744.   172689.2  2419725. 0. 0.    72
3581273  0    3085500.   172689.4  2419725. 0. 0.    73
3581274  0    3085255.   172689.6  2419725. 0. 0.    74
3581275  0    3085010.   172690.   2419726. 0. 0.    75
3581276  0    3084766.   172690.   2419726. 0. 0.    76
3581277  0    3084521.   172690.3  2419726. 0. 0.    77
3581278  0    3084277.   172690.5  2419726. 0. 0.    78
3581279  0    3084032.   172690.8  2419726. 0. 0.    79
3581280  0    3083788.   172691.   2419726. 0. 0.    80
*
3581300 0
3581301     7.79988     7.79988     0.     1 * 713.762
3581302     7.79986     7.79986     0.     2 * 713.762
3581303     7.79986     7.79986     0.     3 * 713.762
3581304     7.79986     7.79986     0.     4 * 713.762
3581305     7.79986     7.79986     0.     5 * 713.762
3581306     7.79986     7.79986     0.     6 * 713.762
3581307     7.79987     7.79987     0.     7 * 713.762
3581308     7.79987     7.79987     0.     8 * 713.762
3581309     7.79987     7.79987     0.     9 * 713.762
3581310     7.79987     7.79987     0.     10 * 713.762
3581311     7.79987     7.79987     0.     11 * 713.762
3581312     7.79987     7.79987     0.     12 * 713.762
3581313     7.79987     7.79987     0.     13 * 713.762
3581314     7.79987     7.79987     0.     14 * 713.762
3581315     7.79987     7.79987     0.     15 * 713.762
3581316     7.79987     7.79987     0.     16 * 713.762
3581317     7.79987     7.79987     0.     17 * 713.762
3581318     7.79988     7.79988     0.     18 * 713.762
3581319     7.79988     7.79988     0.     19 * 713.762
3581320     7.79988     7.79988     0.     20 * 713.762
3581321     7.79988     7.79988     0.     21 * 713.762
3581322     7.79988     7.79988     0.     22 * 713.762
3581323     7.79988     7.79988     0.     23 * 713.762
3581324     7.79988     7.79988     0.     24 * 713.762
3581325     7.79988     7.79988     0.     25 * 713.762
3581326     7.79988     7.79988     0.     26 * 713.762
3581327     7.79988     7.79988     0.     27 * 713.762
3581328     7.79989     7.79989     0.     28 * 713.762
3581329     7.79989     7.79989     0.     29 * 713.762
3581330     7.79989     7.79989     0.     30 * 713.762
3581331     7.79989     7.79989     0.     31 * 713.762
3581332     7.79989     7.79989     0.     32 * 713.762
3581333     7.79989     7.79989     0.     33 * 713.762
3581334     7.79989     7.79989     0.     34 * 713.762
3581335     7.79989     7.79989     0.     35 * 713.762
3581336     7.7999      7.7999      0.     36 * 713.762
3581337     7.7999      7.7999      0.     37 * 713.762
3581338     7.7999      7.7999      0.     38 * 713.762
3581339     7.7999      7.7999      0.     39 * 713.762
3581340     7.7999      7.7999      0.     40 * 713.762
3581341     7.7999      7.7999      0.     41 * 713.762
3581342     7.7999      7.7999      0.     42 * 713.762
3581343     7.7999      7.7999      0.     43 * 713.762
3581344     7.7999      7.7999      0.     44 * 713.762
3581345     7.7999      7.7999      0.     45 * 713.762
3581346     7.7999      7.7999      0.     46 * 713.762
3581347     7.7999      7.7999      0.     47 * 713.762
3581348     7.7999      7.7999      0.     48 * 713.762
3581349     7.7999      7.7999      0.     49 * 713.762
3581350     7.7999      7.7999      0.     50 * 713.762
3581351     7.79991     7.79991     0.     51 * 713.762
3581352     7.79991     7.79991     0.     52 * 713.762
3581353     7.79991     7.79991     0.     53 * 713.762
3581354     7.79991     7.79991     0.     54 * 713.762
3581355     7.79991     7.79991     0.     55 * 713.762
3581356     7.79991     7.79991     0.     56 * 713.762
3581357     7.79991     7.79991     0.     57 * 713.762
3581358     7.79991     7.79991     0.     58 * 713.762
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3581359       7.79992          7.79992       0.          59 * 713.762
3581360       7.79992          7.79992       0.          60 * 713.762
3581361       7.79992          7.79992       0.          61 * 713.762
3581362       7.79992          7.79992       0.          62 * 713.762
3581363       7.79992          7.79992       0.          63 * 713.762
3581364       7.79992          7.79992       0.          64 * 713.762
3581365       7.79992          7.79992       0.          65 * 713.762
3581366       7.79992          7.79992       0.          66 * 713.762
3581367       7.79992          7.79992       0.          67 * 713.762
3581368       7.79992          7.79992       0.          68 * 713.762
3581369       7.79993          7.79993       0.          69 * 713.762
3581370       7.79993          7.79993       0.          70 * 713.762
3581371       7.79993          7.79993       0.          71 * 713.762
3581372       7.79993          7.79993       0.          72 * 713.762
3581373       7.79993          7.79993       0.          73 * 713.762
3581374       7.79993          7.79993       0.          74 * 713.762
3581375       7.79993          7.79993       0.          75 * 713.762
3581376       7.79993          7.79993       0.          76 * 713.762
3581377       7.79993          7.79993       0.          77 * 713.762
3581378       7.79993          7.79993       0.          78 * 713.762
3581379       7.79993          7.79993       0.          79 * 713.762
*
*----------------------------------------------------------------------*
*hydro              component name       component type
3600000              "elbow3"               sngljun
*-----------------------------------------------*----------------------*
*hydro    from           to            area      f loss     r loss     vcahs
3600101  358010000      362000000     0.083220     0.182      0.182      01000
*
*hydro    vel/flw        f velocity     g velocity     j velocity
3600201    0               7.79994        7.79994         0. * 713.762
*
*----------------------------------------------------------------------*
*hydro              component name       component type
3620000              "14incdlg"             pipe
*-----------------------------------------------*----------------------*
3620001          77
*
*hydro          vol area                                              vol
3620101          0.08322                                               77
*
*hydro          length                                                vol
3620301          0.1738                                                 7
3620302          0.2                                                   76
3620303          0.13439                                               77
*
*hydro          volume                                                vol
3620401            0.                                                  77
*
*hydro          horz angle                                            vol
3620501            0.                                                  77
*
*hydro          vert angle                                            vol
3620601            0.                                                   7
3620602          -90.                                                  77
*
*hydro          delta z                                               vol
3620701            0.0                                                  7
3620702          -0.2                                                  76
3620703          -0.13439                                              77
*
*hydro          roughness       hyd diam                              vol
3620801          0.0000457         0.3255                              77
*
*hydro            kf              kr                                   jun
```

```
3620901          0.0             0.0                                    6
3620902          0.182           0.182                                  7
3620903          0.182           0.182                                 76
*
*hydro             fe                                                  vol
3621001            00                                                  77
*
*hydro           vcahs                                                 jun
3621101          01000                                                 76
*
*hydro  ebt pressure     tempe                                         vol
3621201    0       3077452.    172686.4   2419732. 0. 0.        1
3621202    0       3077218.    172633.7   2419732. 0. 0.        2
3621203    0       3076983.    172634.    2419732. 0. 0.        3
3621204    0       3076748.    172634.    2419732. 0. 0.        4
3621205    0       3076514.    172634.3   2419732. 0. 0.        5
3621206    0       3076278.    172634.5   2419732. 0. 0.        6
3621207    0       3076044.    172634.7   2419732. 0. 0.        7
3621208    0       3070774.    172635.    2419737. 0. 0.        8
3621209    0       3066565.    172635.2   2419740. 0. 0.        9
3621210    0       3062356.    172635.5   2419744. 0. 0.        10
3621211    0       3058146.    172635.7   2419747. 0. 0.        11
3621212    0       3053937.    172636.    2419750. 0. 0.        12
3621213    0       3049728.    172636.2   2419754. 0. 0.        13
3621214    0       3045518.    172636.4   2419757. 0. 0.        14
3621215    0       3041309.    172636.7   2419760. 0. 0.        15
3621216    0       3037100.    172637.    2419764. 0. 0.        16
3621217    0       3032890.    172637.    2419767. 0. 0.        17
3621218    0       3028681.    172637.4   2419770. 0. 0.        18
3621219    0       3024472.    172637.6   2419774. 0. 0.        19
3621220    0       3020262.    172638.    2419777. 0. 0.        20
3621221    0       3016053.    172638.    2419780. 0. 0.        21
3621222    0       3011844.    172638.3   2419784. 0. 0.        22
3621223    0       3007634.    172638.6   2419787. 0. 0.        23
3621224    0       3003424.    172639.    2419791. 0. 0.        24
3621225    0       2999215.    172639.    2419792. 0. 0.        25
3621226    0       2995006.    172639.3   2419785. 0. 0.        26
3621227    0       2990796.    172639.5   2419778. 0. 0.        27
3621228    0       2986586.    172639.8   2419770. 0. 0.        28
3621229    0       2982377.    172640.    2419763. 0. 0.        29
3621230    0       2978167.    172640.3   2419756. 0. 0.        30
3621231    0       2973958.    172640.5   2419749. 0. 0.        31
3621232    0       2969748.    172640.8   2419742. 0. 0.        32
3621233    0       2965538.    172641.    2419734. 0. 0.        33
3621234    0       2961329.    172641.2   2419727. 0. 0.        34
3621235    0       2957119.    172641.5   2419720. 0. 0.        35
3621236    0       2952910.    172641.7   2419712. 0. 0.        36
3621237    0       2948700.    172642.    2419705. 0. 0.        37
3621238    0       2944490.    172642.2   2419698. 0. 0.        38
3621239    0       2940280.    172642.4   2419691. 0. 0.        39
3621240    0       2936071.    172642.7   2419684. 0. 0.        40
3621241    0       2931861.    172643.    2419676. 0. 0.        41
3621242    0       2927652.    172643.2   2419669. 0. 0.        42
3621243    0       2923442.    172643.4   2419662. 0. 0.        43
3621244    0       2919232.    172643.6   2419654. 0. 0.        44
3621245    0       2915022.    172644.    2419647. 0. 0.        45
3621246    0       2910812.    172644.    2419640. 0. 0.        46
3621247    0       2906602.    172644.4   2419632. 0. 0.        47
3621248    0       2902392.    172644.6   2419625. 0. 0.        48
3621249    0       2898183.    172645.    2419617. 0. 0.        49
3621250    0       2893973.    172645.    2419610. 0. 0.        50
3621251    0       2889763.    172645.3   2419602. 0. 0.        51
3621252    0       2885553.    172645.6   2419595. 0. 0.        52
3621253    0       2881343.    172645.8   2419588. 0. 0.        53
3621254    0       2877133.    172646.    2419580. 0. 0.        54
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3621255     0       2872923.    172646.3   2419573. 0. 0.       55
3621256     0       2868713.    172646.5   2419566. 0. 0.       56
3621257     0       2864503.    172646.8   2419558. 0. 0.       57
3621258     0       2860293.    172647.    2419550. 0. 0.       58
3621259     0       2856083.    172647.3   2419543. 0. 0.       59
3621260     0       2851873.    172647.5   2419536. 0. 0.       60
3621261     0       2847663.    172647.8   2419528. 0. 0.       61
3621262     0       2843453.    172648.    2419521. 0. 0.       62
3621263     0       2839243.    172648.2   2419513. 0. 0.       63
3621264     0       2835033.    172648.5   2419506. 0. 0.       64
3621265     0       2830823.    172648.7   2419498. 0. 0.       65
3621266     0       2826612.    172649.    2419491. 0. 0.       66
3621267     0       2822402.    172649.2   2419483. 0. 0.       67
3621268     0       2818192.    172649.4   2419476. 0. 0.       68
3621269     0       2813982.    172649.7   2419468. 0. 0.       69
3621270     0       2809772.    172650.    2419460. 0. 0.       70
3621271     0       2805562.    172650.    2419453. 0. 0.       71
3621272     0       2801352.    172650.4   2419446. 0. 0.       72
3621273     0       2797141.    172650.6   2419438. 0. 0.       73
3621274     0       2792931.    172651.    2419430. 0. 0.       74
3621275     0       2788721.    172651.    2419423. 0. 0.       75
3621276     0       2784510.    172651.4   2419415. 0. 0.       76
3621277     0       2779991.    172651.5   2419407. 0. 0.       77
*
*hydro          f velocity    g velocity    j velocity                jun
3621300 0
3621301       7.79995         7.79995       0.          1 * 713.762
3621302       7.79992         7.79992       0.          2 * 713.762
3621303       7.79992         7.79992       0.          3 * 713.762
3621304       7.79992         7.79992       0.          4 * 713.762
3621305       7.79992         7.79992       0.          5 * 713.762
3621306       7.79992         7.79992       0.          6 * 713.762
3621307       7.79992         7.79992       0.          7 * 713.762
3621308       7.79994         8.38038       0.          8 * 713.762
3621309       7.79995         8.38045       0.          9 * 713.762
3621310       7.79997         8.38053       0.          10 * 713.762
3621311       7.79998         8.3806        0.          11 * 713.762
3621312       7.8             8.38068       0.          12 * 713.762
3621313       7.80001         8.38076       0.          13 * 713.762
3621314       7.80003         8.38083       0.          14 * 713.762
3621315       7.80004         8.3809        0.          15 * 713.762
3621316       7.80006         8.38098       0.          16 * 713.762
3621317       7.80007         8.38106       0.          17 * 713.762
3621318       7.80009         8.38114       0.          18 * 713.762
3621319       7.8001          8.38121       0.          19 * 713.762
3621320       7.80011         8.38129       0.          20 * 713.762
3621321       7.80013         8.38137       0.          21 * 713.762
3621322       7.80014         8.38144       0.          22 * 713.762
3621323       7.80016         8.38152       0.          23 * 713.762
3621324       7.80017         8.3816        0.          24 * 713.762
3621325       7.80019         8.38167       0.          25 * 713.762
3621326       7.8002          8.38175       0.          26 * 713.762
3621327       7.80022         8.38183       0.          27 * 713.762
3621328       7.80023         8.3819        0.          28 * 713.762
3621329       7.80025         8.38198       0.          29 * 713.762
3621330       7.80026         8.38205       0.          30 * 713.762
3621331       7.80027         8.38213       0.          31 * 713.762
3621332       7.80029         8.38221       0.          32 * 713.762
3621333       7.8003          8.38229       0.          33 * 713.762
3621334       7.80032         8.38236       0.          34 * 713.762
3621335       7.80033         8.38244       0.          35 * 713.762
3621336       7.80035         8.38252       0.          36 * 713.762
3621337       7.80036         8.3826        0.          37 * 713.762
3621338       7.80038         8.38267       0.          38 * 713.762
3621339       7.80039         8.38275       0.          39 * 713.762
3621340       7.8004          8.38282       0.          40 * 713.762
3621341       7.80042         8.3829        0.          41 * 713.762
3621342       7.80043         8.38298       0.          42 * 713.762
3621343       7.80045         8.38306       0.          43 * 713.762
3621344       7.80046         8.38313       0.          44 * 713.762
3621345       7.80048         8.38321       0.          45 * 713.762
3621346       7.8005          8.38329       0.          46 * 713.762
3621347       7.8005          8.38337       0.          47 * 713.762
3621348       7.80052         8.38344       0.          48 * 713.762
3621349       7.80054         8.38352       0.          49 * 713.762
3621350       7.80055         8.3836        0.          50 * 713.762
3621351       7.80057         8.38368       0.          51 * 713.762
3621352       7.80058         8.38375       0.          52 * 713.762
3621353       7.8006          8.38383       0.          53 * 713.762
3621354       7.80061         8.38391       0.          54 * 713.762
3621355       7.80062         8.38399       0.          55 * 713.762
3621356       7.80064         8.38406       0.          56 * 713.762
3621357       7.80065         8.38414       0.          57 * 713.762
3621358       7.80067         8.38422       0.          58 * 713.762
3621359       7.80068         8.3843        0.          59 * 713.762
3621360       7.8007          8.38437       0.          60 * 713.762
3621361       7.80071         8.38445       0.          61 * 713.762
3621362       7.80073         8.38453       0.          62 * 713.762
3621363       7.80074         8.38461       0.          63 * 713.762
3621364       7.80075         8.38469       0.          64 * 713.762
3621365       7.80077         8.38476       0.          65 * 713.762
3621366       7.80078         8.38484       0.          66 * 713.762
3621367       7.8008          8.38492       0.          67 * 713.762
3621368       7.80081         8.385         0.          68 * 713.762
3621369       7.80083         8.38508       0.          69 * 713.762
3621370       7.80084         8.38516       0.          70 * 713.762
3621371       7.80086         8.38523       0.          71 * 713.762
3621372       7.80087         8.38531       0.          72 * 713.762
3621373       7.80089         8.38539       0.          73 * 713.762
3621374       7.8009          8.38547       0.          74 * 713.762
3621375       7.80091         8.38555       0.          75 * 713.762
3621376       7.80093         8.38563       0.          76 * 713.762
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
3720000              "inlet"               sngljun
*-------------------------------------------------------------------------*
*hydro    from          to            area      f loss    r loss    vcahs
3720101   362010000     371000000     0.03095   0.2062    0.4513    01000
*
*hydro    jun hyd diam
3720110       0.1985        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3720201     0             20.9756        21.84074       0. * 713.762
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
3710000              "ifdthrot"              pipe
*-----------------------------------------------$-----------------$
3710001          9
*
*hydro          vol area                                              vol
3710101         0.03095                                                9
*
*hydro           length                                               vol
3710301           0.15                                                2
3710302           0.255                                               4
3710303           0.196                                               9
*
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*hydro          volume                                              vol
3710401           0.                                                 9
*
*hydro          volume                                              vol
3710501           0.                                                 9
*
*hydro        vert angle                                            vol
3710601          -90.0                                               2
3710602           0.0                                                9
*
*hydro         delta z                                              vol
3710701          -0.15                                               2
3710702           0.0                                                9
*
*hydro        roughness      hyd diam                               vol
3710801       0.0000457       0.1985                                 9
*
*hydro          f loss        r loss                                jun
3710901           0.0           0.0                                 1
3710902         0.196         0.196                                 2
3710903           0.0           0.0                                 3
3710904         0.196         0.196                                 4
3710905           0.0           0.0                                 8
*
*hydro           fe                                                 vol
3711001          00                                                  9
*
*hydro          vcahs                                               jun
3711101         01000                                                8
*
*hydro  ebt pressure     tempe                                       vol
3711201    0       2521827.     172652.7   2418768. 0. 0.        1
3711202    0       2520792.     172655.    2418765. 0. 0.        2
3711203    0       2470639.     172657.3   2418546. 0. 0.        3
3711204    0       2466192.     172661.3   2418523. 0. 0.        4
3711205    0       2414828.     172661.    2418255. 0. 0.        5
3711206    0       2411408.     172664.    2418237. 0. 0.        6
3711207    0       2407996.     172667.2   2418219. 0. 0.        7
3711208    0       2404583.     172670.3   2418201. 0. 0.        8
3711209    0       2401170.     172673.4   2418183. 0. 0.        9
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate                jun
3711300 0
3711301       20.97798         21.849        0.            1 * 713.762
3711302       20.978           21.84905      0.            2 * 713.762
3711303       20.97846         20.97846      0.            3 * 713.762
3711304       20.9785          20.9785       0.            4 * 713.762
3711305       20.979           20.979        0.            5 * 713.762
3711306       20.979           20.979        0.            6 * 713.762
3711307       20.97905         20.97905      0.            7 * 713.762
3711308       20.9791          20.9791       0.            8 * 713.762
*
*-------------------------------------------------------------------------*
*hydro             component name      component type
3730000             "ifdexit"             sngljun
*-------------------------------------------------*---------------------*
*hydro    from          to           area      f loss    r loss    vcahs
3730101   371010000     374000000    0.03095   0.1028    0.04696   01000
*
*hydro    jun hyd diam
3730110       0.1985      0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
3730201     0             20.97913       20.97913       0. * 713.762
*
*-------------------------------------------------------------------------$
*hydro             component name      component type
3740000             "psvaw-3"             pipe
*-------------------------------------------------$-------------------$
3740001          2
*
*hydro          vol area                                             vol
3740101        0.08322                                               2
*
*hydro           length                                              vol
3740301          0.25                                                2
*
*hydro           volume                                              vol
3740401           0.                                                 2
*
*hydro           volume                                              vol
3740501           0.                                                 2
*
*hydro         vert angle                                            vol
3740601          45.0                                                2
*
*hydro          delta z                                              vol
3740701          0.25                                                2
*
*hydro         roughness      hyd diam                               vol
3740801       0.0000457       0.3255                                 2
*
*hydro          f loss        r loss                                jun
3740901           0.0           0.0                                 1
*
*hydro           fe                                                 vol
3741001          00                                                  2
*
*hydro          vcahs                                               jun
3741101         01000                                                1
*
*hydro  ebt pressure     tempe                                       vol
3741201    0       2581518.     172672.    2418962. 0. 0.        1
3741202    0       2578488.     172672.2   2418952. 0. 0.        2
*
*hydro          vel/flw
*
*hydro         f flowrate   g flowrate    j flowrate                jun
3741300 0
3741301       7.80164          8.11497       0.            1 * 713.762
*
*************************************************************************$
*
*       components 4xx - inactive heat exchanger/pump loop
*
*************************************************************************$
*
*hydro             component name      component type
4510000             "hlsplit4"            pipe
*-------------------------------------------------$-------------------$
4510001          1
*
*hydro          vol area                                             vol
4510101        0.08322                                               1
*
*hydro           length                                              vol
4510301          3.28                                                1
*
```

```
*hydro          volume                                              vol
4510401          0.0                                                 1
*
*hydro         vert angle                                           vol
4510601           0.                                                 1
*
*hydro         delta z                                              vol
4510701           0.                                                 1
*
*hydro         roughness      hyd diam                              vol
4510801        0.0000457       0.3255                               1
*
*hydro            fe                                                vol
4511001           00                                                 1
*
*hydro          vcahs                                               jun
*4511101         01000                                               1
*
*hydro         f velocity   g velocity    j velocity                jun
*4511300 0
*4511301    0.          0.      0.                                    2
*
*hydro  ebt pressure     tempe                                       vol
4511201     0       1662402.     148115.    2412560. 0. 0.        1
*
*-----------------------------------------------------------------------$
*hydro              component name      component type
4530000              "hlspij"             mtpljun
*-----------------------------------------------------------------------$
4530001     1        0
*hydro    from          to           area      f loss     r loss     vcahs
4530011   650010000     451000000    0.24663     0.00       0.00     01000
*
4530012   1.0   1.0   1.0   0     0     0     1
*
4531011   2.557785-7  2.55777-7   1 * 6.81018-5
*
4532011   0.3255 0.0 1.0 1.0 1
*
*-----------------------------------------------------------------------$
*hydro              component name      component type
4290000              "cljoin"               pipe
*-------------------------------------------------$------------------$
4290001          31
*
*hydro          vol area                                            vol
4290101        0.08322                                               31
*
*hydro           length                                             vol
4290301          0.2016                                              31
*
*hydro           volume                                             vol
4290401           0.                                                 31
*
*hydro           volume                                             vol
4290501           0.                                                 31
*
*hydro         vert angle                                           vol
4290601           0.0                                                31
*
*hydro          delta z                                             vol
4290701          0.0                                                 31
*
*hydro         roughness      hyd diam                              vol
4290801        0.0000457       0.3255                               31
*
*hydro          f loss        r loss                                jun
4290901          0.0           0.0                                  30
*
*hydro            fe                                                vol
4291001          00                                                 31
*
*hydro          vcahs                                               jun
4291101         01000                                               30
*
*hydro  ebt pressure     tempe                                       vol
4291201     0       2462377.     144827.6   2418503. 0. 0.        1
4291202     0       2462377.     173817.7   2418503. 0. 0.        2
4291203     0       2462377.     173872.    2418503. 0. 0.        3
4291204     0       2462377.     173872.4   2418503. 0. 0.        4
4291205     0       2462377.     173872.4   2418503. 0. 0.        5
4291206     0       2462377.     173872.4   2418503. 0. 0.        6
4291207     0       2462377.     173872.4   2418503. 0. 0.        7
4291208     0       2462377.     173872.4   2418503. 0. 0.        8
4291209     0       2462377.     173872.4   2418503. 0. 0.        9
4291210     0       2462377.     173872.4   2418503. 0. 0.        10
4291211     0       2462377.     173872.4   2418503. 0. 0.        11
4291212     0       2462377.     173872.4   2418503. 0. 0.        12
4291213     0       2462377.     173872.4   2418503. 0. 0.        13
4291214     0       2462377.     173872.4   2418503. 0. 0.        14
4291215     0       2462377.     173872.4   2418503. 0. 0.        15
4291216     0       2462377.     173872.4   2418503. 0. 0.        16
4291217     0       2462377.     173872.4   2418503. 0. 0.        17
4291218     0       2462377.     173872.4   2418503. 0. 0.        18
4291219     0       2462377.     173872.4   2418503. 0. 0.        19
4291220     0       2462377.     173872.4   2418503. 0. 0.        20
4291221     0       2462377.     173873.    2418503. 0. 0.        21
4291222     0       2462377.     173873.    2418503. 0. 0.        22
4291223     0       2462377.     173873.    2418503. 0. 0.        23
4291224     0       2462377.     173873.    2418503. 0. 0.        24
4291225     0       2462377.     173873.    2418503. 0. 0.        25
4291226     0       2462377.     173873.    2418503. 0. 0.        26
4291227     0       2462377.     173873.    2418503. 0. 0.        27
4291228     0       2462377.     173872.    2418503. 0. 0.        28
4291229     0       2462377.     173867.6   2418503. 0. 0.        29
4291230     0       2462377.     173773.    2418503. 0. 0.        30
4291231     0       2462377.     172004.    2418503. 0. 0.        31
*
*hydro          vel/flw
4291300           0
*
*hydro         f flowrate   g flowrate    j flowrate                jun
4291301       -2.823345-8     -2.823345-8   0.          1 * -2.58263-6
4291302       -5.60252-8      -5.60252-8    0.          2 * -5.12483-6
4291303       -8.38168-8      -8.38168-8    0.          3 * -7.66703-6
4291304       -1.116093-7     -1.116093-7   0.          4 * -1.020932-5
4291305       -1.39403-7      -1.39403-7    0.          5 * -1.27517-5
4291306       -1.67198-7      -1.67198-7    0.          6 * -1.529424-5
4291307       -1.94995-7      -1.94995-7    0.          7 * -1.783692-5
4291308       -2.22794-7      -2.22794-7    0.          8 * -2.03798-5
4291309       -2.505953-7     -2.505953-7   0.          9 * -2.29229-5
4291310       -2.78399-7      -2.78399-7    0.          10 * -2.54662-5
4291311       -3.06206-7      -3.06206-7    0.          11 * -2.80098-5
4291312       -3.34016-7      -3.34016-7    0.          12 * -3.05537-5
4291313       -3.618294-7     -3.618294-7   0.          13 * -3.30979-5
4291314       -3.89647-7      -3.89647-7    0.          14 * -3.564244-5
4291315       -4.17468-7      -4.17468-7    0.          15 * -3.818735-5
4291316       -4.45293-7      -4.45293-7    0.          16 * -4.073265-5
4291317       -4.73123-7      -4.73123-7    0.          17 * -4.32784-5
4291318       -5.00958-7      -5.00958-7    0.          18 * -4.58245-5
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4291319       -5.28798-7       -5.28798-7   0.          19 * -4.837115-5
4291320       -5.56643-7       -5.56643-7   0.          20 * -5.09183-5
4291321       -5.84494-7       -5.84494-7   0.          21 * -5.34659-5
4291322       -6.12351-7       -6.12351-7   0.          22 * -5.6014-5
4291323       -6.40213-7       -6.40213-7   0.          23 * -5.85627-5
4291324       -6.68082-7       -6.68082-7   0.          24 * -6.1112-5
4291325       -6.95958-7       -6.95958-7   0.          25 * -6.36619-5
4291326       -7.2384-7        -7.2384-7    0.          26 * -6.62124-5
4291327       -7.5173-7        -7.5173-7    0.          27 * -6.87635-5
4291328       -7.79626-7       -7.79626-7   0.          28 * -7.13153-5
4291329       -8.0753-7        -8.0753-7    0.          29 * -7.38684-5
4291330       -8.35443-7       -8.35443-7   0.          30 * -7.64343-5
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
4310000              "elbow1"               sngljun
*-------------------------------------------------*-----------------------*
*hydro    from          to           area      f loss     r loss     vcahs
4310101   429010000     458000000    0.083220     0.182     0.182     01000
*
*hydro    vel/flw       f velocity      g velocity      j velocity
4310201     0              -8.63545-7      -8.63545-7       0. * -7.91886-5
*
*-------------------------------------------------------------------------$
*hydro              component name       component type
4580000              "coldleg"              pipe
*-------------------------------------------------$------------------$
4580001          80
*
*hydro          vol area                                                 vol
4580101          0.08322                                                  80
*
*hydro          length                                                   vol
4580301            0.181                                                  80
*
*hydro           volume                                                  vol
4580401            0.                                                     80
*
*hydro          horz angle                                               vol
4580501            0.                                                     80
*
*hydro          vert angle                                               vol
4580601            0.                                                     80
*
*hydro          delta z                                                  vol
4580701            0.                                                     80
*
*hydro          roughness       hyd diam                                 vol
4580801          0.0000457        0.3255                                  80
*
*hydro            kf               kr                                     jun
4580901          0.0                0.0                                   79
*
*hydro              fe                                                    vol
4581001            00                                                     80
*
*hydro            vcahs                                                  jun
4581101            01000                                                  79
*
*hydro  ebt pressure     tempe                                            vol
4581201    0       2462377.     144831.     2418503. 0. 0.       1
4581202    0       2462377.     144831.2    2418503. 0. 0.       2
4581203    0       2462377.     171735.3    2418503. 0. 0.       3
4581204    0       2462377.     173747.4    2418503. 0. 0.       4
4581205    0       2462377.     173865.     2418503. 0. 0.       5
4581206    0       2462377.     173872.     2418503. 0. 0.       6
4581207    0       2462377.     173872.4    2418503. 0. 0.       7
4581208    0       2462377.     173873.     2418503. 0. 0.       8
4581209    0       2462377.     173873.     2418503. 0. 0.       9
4581210    0       2462377.     173873.     2418503. 0. 0.       10
4581211    0       2462377.     173873.     2418503. 0. 0.       11
4581212    0       2462377.     173873.     2418503. 0. 0.       12
4581213    0       2462377.     173873.     2418503. 0. 0.       13
4581214    0       2462377.     173873.     2418503. 0. 0.       14
4581215    0       2462377.     173873.     2418503. 0. 0.       15
4581216    0       2462377.     173873.     2418503. 0. 0.       16
4581217    0       2462377.     173873.     2418503. 0. 0.       17
4581218    0       2462377.     173873.     2418503. 0. 0.       18
4581219    0       2462377.     173873.     2418503. 0. 0.       19
4581220    0       2462377.     173873.     2418503. 0. 0.       20
4581221    0       2462377.     173873.     2418503. 0. 0.       21
4581222    0       2462377.     173873.     2418503. 0. 0.       22
4581223    0       2462377.     173873.     2418503. 0. 0.       23
4581224    0       2462377.     173873.     2418503. 0. 0.       24
4581225    0       2462377.     173873.     2418503. 0. 0.       25
4581226    0       2462377.     173873.     2418503. 0. 0.       26
4581227    0       2462377.     173873.     2418503. 0. 0.       27
4581228    0       2462377.     173873.     2418503. 0. 0.       28
4581229    0       2462377.     173873.     2418503. 0. 0.       29
4581230    0       2462377.     173873.     2418503. 0. 0.       30
4581231    0       2462377.     173873.     2418503. 0. 0.       31
4581232    0       2462377.     173873.     2418503. 0. 0.       32
4581233    0       2462377.     173873.     2418503. 0. 0.       33
4581234    0       2462377.     173873.     2418503. 0. 0.       34
4581235    0       2462377.     173873.     2418503. 0. 0.       35
4581236    0       2462377.     173873.     2418503. 0. 0.       36
4581237    0       2462377.     173873.     2418503. 0. 0.       37
4581238    0       2462377.     173873.     2418503. 0. 0.       38
4581239    0       2462377.     173873.     2418503. 0. 0.       39
4581240    0       2462377.     173873.     2418503. 0. 0.       40
4581241    0       2462377.     173873.     2418503. 0. 0.       41
4581242    0       2462377.     173873.     2418503. 0. 0.       42
4581243    0       2462377.     173873.     2418503. 0. 0.       43
4581244    0       2462377.     173873.     2418503. 0. 0.       44
4581245    0       2462377.     173873.     2418503. 0. 0.       45
4581246    0       2462377.     173873.     2418503. 0. 0.       46
4581247    0       2462377.     173873.     2418503. 0. 0.       47
4581248    0       2462377.     173873.     2418503. 0. 0.       48
4581249    0       2462377.     173873.     2418503. 0. 0.       49
4581250    0       2462377.     173873.     2418503. 0. 0.       50
4581251    0       2462377.     173873.     2418503. 0. 0.       51
4581252    0       2462376.     173873.     2418503. 0. 0.       52
4581253    0       2462376.     173873.     2418503. 0. 0.       53
4581254    0       2462376.     173873.     2418503. 0. 0.       54
4581255    0       2462376.     173873.     2418503. 0. 0.       55
4581256    0       2462376.     173873.     2418503. 0. 0.       56
4581257    0       2462376.     173873.     2418503. 0. 0.       57
4581258    0       2462376.     173873.     2418503. 0. 0.       58
4581259    0       2462376.     173873.     2418503. 0. 0.       59
4581260    0       2462376.     173873.     2418503. 0. 0.       60
4581261    0       2462376.     173873.     2418503. 0. 0.       61
4581262    0       2462376.     173873.     2418503. 0. 0.       62
4581263    0       2462376.     173873.     2418503. 0. 0.       63
4581264    0       2462376.     173873.     2418503. 0. 0.       64
4581265    0       2462376.     173873.     2418503. 0. 0.       65
4581266    0       2462376.     173873.     2418503. 0. 0.       66
4581267    0       2462376.     173873.     2418503. 0. 0.       67
4581268    0       2462376.     173873.     2418503. 0. 0.       68
4581269    0       2462376.     173873.     2418503. 0. 0.       69
4581270    0       2462376.     173873.     2418503. 0. 0.       70
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4581271    0       2462376.    173873.    2418503. 0. 0.       71
4581272    0       2462376.    173873.    2418503. 0. 0.       72
4581273    0       2462376.    173873.    2418503. 0. 0.       73
4581274    0       2462376.    173873.    2418503. 0. 0.       74
4581275    0       2462376.    173872.6   2418503. 0. 0.       75
4581276    0       2462376.    173872.    2418503. 0. 0.       76
4581277    0       2462376.    173865.4   2418503. 0. 0.       77
4581278    0       2462376.    173818.7   2418503. 0. 0.       78
4581279    0       2462376.    173489.2   2418503. 0. 0.       79
4581280    0       2462376.    170644.5   2418503. 0. 0.       80
*
4581300 0
4581301       -8.89682-7       -8.89682-7   0.          1 * -8.15854-5
4581302       -9.1602-7        -9.1602-7    0.          2 * -8.38083-5
4581303       -9.41131-7       -9.41131-7   0.          3 * -8.60898-5
4581304       -9.66226-7       -9.66226-7   0.          4 * -8.83843-5
4581305       -9.91326-7       -9.91326-7   0.          5 * -9.06803-5
4581306       -1.016433-6      -1.016433-6  0.          6 * -9.2977-5
4581307       -1.041547-6      -1.041547-6  0.          7 * -9.52742-5
4581308       -1.066669-6      -1.066669-6  0.          8 * -9.75722-5
4581309       -1.091798-6      -1.091798-6  0.          9 * -9.98708-5
4581310       -1.116934-6      -1.116934-6  0.          10 * -1.021701-4
4581311       -1.142078-6      -1.142078-6  0.          11 * -1.044701-4
4581312       -1.16723-6       -1.16723-6   0.          12 * -1.067708-4
4581313       -1.192388-6      -1.192388-6  0.          13 * -1.090722-4
4581314       -1.217555-6      -1.217555-6  0.          14 * -1.113743-4
4581315       -1.24273-6       -1.24273-6   0.          15 * -1.136772-4
4581316       -1.267913-6      -1.267913-6  0.          16 * -1.159807-4
4581317       -1.293103-6      -1.293103-6  0.          17 * -1.18285-4
4581318       -1.318302-6      -1.318302-6  0.          18 * -1.2059-4
4581319       -1.343508-6      -1.343508-6  0.          19 * -1.228957-4
4581320       -1.368723-6      -1.368723-6  0.          20 * -1.252022-4
4581321       -1.393946-6      -1.393946-6  0.          21 * -1.275094-4
4581322       -1.419177-6      -1.419177-6  0.          22 * -1.298174-4
4581323       -1.444416-6      -1.444416-6  0.          23 * -1.32126-4
4581324       -1.469663-6      -1.469663-6  0.          24 * -1.344356-4
4581325       -1.494918-6      -1.494918-6  0.          25 * -1.367457-4
4581326       -1.52018-6       -1.52018-6   0.          26 * -1.390567-4
4581327       -1.545453-6      -1.545453-6  0.          27 * -1.413684-4
4581328       -1.570733-6      -1.570733-6  0.          28 * -1.436808-4
4581329       -1.59602-6       -1.59602-6   0.          29 * -1.45994-4
4581330       -1.621316-6      -1.621316-6  0.          30 * -1.48308-4
4581331       -1.64662-6       -1.64662-6   0.          31 * -1.506225-4
4581332       -1.671932-6      -1.671932-6  0.          32 * -1.52938-4
4581333       -1.697252-6      -1.697252-6  0.          33 * -1.55254-4
4581334       -1.72258-6       -1.72258-6   0.          34 * -1.57571-4
4581335       -1.747916-6      -1.747916-6  0.          35 * -1.598884-4
4581336       -1.77326-6       -1.77326-6   0.          36 * -1.622066-4
4581337       -1.79861-6       -1.79861-6   0.          37 * -1.645256-4
4581338       -1.82397-6       -1.82397-6   0.          38 * -1.668453-4
4581339       -1.849335-6      -1.849335-6  0.          39 * -1.691656-4
4581340       -1.87471-6       -1.87471-6   0.          40 * -1.714866-4
4581341       -1.90009-6       -1.90009-6   0.          41 * -1.738083-4
4581342       -1.925478-6      -1.925478-6  0.          42 * -1.761307-4
4581343       -1.950873-6      -1.950873-6  0.          43 * -1.784537-4
4581344       -1.976276-6      -1.976276-6  0.          44 * -1.807773-4
4581345       -2.001685-6      -2.001685-6  0.          45 * -1.831016-4
4581346       -2.0271-6        -2.0271-6    0.          46 * -1.854265-4
4581347       -2.052523-6      -2.052523-6  0.          47 * -1.87752-4
4581348       -2.07795-6       -2.07795-6   0.          48 * -1.90078-4
4581349       -2.103387-6      -2.103387-6  0.          49 * -1.924047-4
4581350       -2.12883-6       -2.12883-6   0.          50 * -1.94732-4
4581351       -2.154275-6      -2.154275-6  0.          51 * -1.970596-4
4581352       -2.17973-6       -2.17973-6   0.          52 * -1.99388-4
4581353       -2.205187-6      -2.205187-6  0.          53 * -2.017167-4
4581354       -2.23065-6       -2.23065-6   0.          54 * -2.04046-4
4581355       -2.25612-6       -2.25612-6   0.          55 * -2.063757-4
4581356       -2.281593-6      -2.281593-6  0.          56 * -2.08706-4
4581357       -2.30707-6       -2.30707-6   0.          57 * -2.110365-4
4581358       -2.332554-6      -2.332554-6  0.          58 * -2.133675-4
4581359       -2.35804-6       -2.35804-6   0.          59 * -2.15699-4
4581360       -2.383533-6      -2.383533-6  0.          60 * -2.180307-4
4581361       -2.40903-6       -2.40903-6   0.          61 * -2.20363-4
4581362       -2.434527-6      -2.434527-6  0.          62 * -2.226953-4
4581363       -2.46003-6       -2.46003-6   0.          63 * -2.25028-4
4581364       -2.485534-6      -2.485534-6  0.          64 * -2.27361-4
4581365       -2.51104-6       -2.51104-6   0.          65 * -2.296944-4
4581366       -2.53655-6       -2.53655-6   0.          66 * -2.32028-4
4581367       -2.562065-6      -2.562065-6  0.          67 * -2.343617-4
4581368       -2.58758-6       -2.58758-6   0.          68 * -2.366956-4
4581369       -2.613095-6      -2.613095-6  0.          69 * -2.390296-4
4581370       -2.63861-6       -2.63861-6   0.          70 * -2.41364-4
4581371       -2.66413-6       -2.66413-6   0.          71 * -2.43698-4
4581372       -2.68965-6       -2.68965-6   0.          72 * -2.460323-4
4581373       -2.71517-6       -2.71517-6   0.          73 * -2.483667-4
4581374       -2.74069-6       -2.74069-6   0.          74 * -2.50701-4
4581375       -2.76621-6       -2.76621-6   0.          75 * -2.530354-4
4581376       -2.791726-6      -2.791726-6  0.          76 * -2.5537-4
4581377       -2.817243-6      -2.817243-6  0.          77 * -2.57705-4
4581378       -2.84276-6       -2.84276-6   0.          78 * -2.60047-4
4581379       -2.868284-6      -2.868284-6  0.          79 * -2.624507-4
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
4600000              "elbow3"               sngljun
*-------------------------------------------------------*-----------------*
*hydro    from           to            area      f loss    r loss     vcahs
4600101   458010000      462000000     0.083220    0.182     0.182      01000
*
*hydro    vel/flw        f velocity     g velocity     j velocity
4600201     0               -2.894313-6    -2.894313-6     0. * -2.654107-4
*
*-------------------------------------------------------------------------*
*hydro              component name       component type
4620000              "14incdlg"             pipe
*-------------------------------------------------------*-----------------*
4620001          77
*
*hydro          vol area                                              vol
4620101         0.08322                                              77
*
*hydro          length                                                vol
4620301          0.1738                                               7
4620302          0.2                                                  76
4620303          0.13439                                              77
*
*hydro          volume                                                vol
4620401            0.                                                 77
*
*hydro         horz angle                                             vol
4620501            0.                                                 77
*
*hydro         vert angle                                             vol
4620601            0.                                                 7
4620602          -90.                                                 77
*
*hydro         delta z                                                vol
4620701            0.0                                                7
4620702          -0.2                                                 76
4620703          -0.13439                                             77
```

```
*
*hydro          roughness       hyd diam                                vol
4620801         0.0000457       0.3255                                  77
*
*hydro            kf              kr                                    jun
4620901           0.0             0.0                                    6
4620902           0.182           0.182                                  7
4620903           0.182           0.182                                 76
*
*hydro             fe                                                   vol
4621001            00                                                   77
*
*hydro            vcahs                                                 jun
4621101           01000                                                 76
*
*hydro  ebt pressure     tempe                                          vol
4621201     0       2462376.    144965.2    2418503. 0. 0.        1
4621202     0       2462376.    144832.     2418503. 0. 0.        2
4621203     0       2462376.    167817.     2418503. 0. 0.        3
4621204     0       2462376.    172917.     2418503. 0. 0.        4
4621205     0       2462376.    173729.2    2418503. 0. 0.        5
4621206     0       2462376.    173849.4    2418503. 0. 0.        6
4621207     0       2462376.    173868.7    2418503. 0. 0.        7
4621208     0       2463454.    173872.     2418509. 0. 0.        8
4621209     0       2465610.    173873.     2418520. 0. 0.        9
4621210     0       2467766.    173873.     2418531. 0. 0.       10
4621211     0       2469922.    173873.     2418542. 0. 0.       11
4621212     0       2472078.    173873.     2418554. 0. 0.       12
4621213     0       2474234.    173873.     2418564. 0. 0.       13
4621214     0       2476390.    173873.     2418576. 0. 0.       14
4621215     0       2478545.    173873.     2418587. 0. 0.       15
4621216     0       2480701.    173873.     2418598. 0. 0.       16
4621217     0       2482857.    173873.     2418609. 0. 0.       17
4621218     0       2485013.    173873.     2418620. 0. 0.       18
4621219     0       2487169.    173873.     2418631. 0. 0.       19
4621220     0       2489325.    173873.     2418642. 0. 0.       20
4621221     0       2491480.    173873.     2418653. 0. 0.       21
4621222     0       2493636.    173873.     2418664. 0. 0.       22
4621223     0       2495792.    173873.     2418676. 0. 0.       23
4621224     0       2497948.    173873.     2418686. 0. 0.       24
4621225     0       2500104.    173873.     2418697. 0. 0.       25
4621226     0       2502260.    173873.     2418704. 0. 0.       26
4621227     0       2504416.    173873.     2418712. 0. 0.       27
4621228     0       2506572.    173873.     2418718. 0. 0.       28
4621229     0       2508728.    173873.     2418726. 0. 0.       29
4621230     0       2510884.    173873.     2418733. 0. 0.       30
4621231     0       2513039.    173873.     2418740. 0. 0.       31
4621232     0       2515195.    173873.     2418747. 0. 0.       32
4621233     0       2517351.    173873.     2418754. 0. 0.       33
4621234     0       2519507.    173873.     2418761. 0. 0.       34
4621235     0       2521663.    173873.     2418768. 0. 0.       35
4621236     0       2523819.    173873.     2418775. 0. 0.       36
4621237     0       2525975.    173873.     2418782. 0. 0.       37
4621238     0       2528131.    173873.     2418789. 0. 0.       38
4621239     0       2530286.    173873.     2418796. 0. 0.       39
4621240     0       2532442.    173873.     2418803. 0. 0.       40
4621241     0       2534598.    173873.     2418810. 0. 0.       41
4621242     0       2536754.    173873.     2418817. 0. 0.       42
4621243     0       2538910.    173873.     2418824. 0. 0.       43
4621244     0       2541066.    173873.     2418831. 0. 0.       44
4621245     0       2543222.    173873.     2418838. 0. 0.       45
4621246     0       2545378.    173873.     2418845. 0. 0.       46
4621247     0       2547534.    173873.     2418852. 0. 0.       47
4621248     0       2549690.    173873.     2418859. 0. 0.       48
4621249     0       2551846.    173873.     2418866. 0. 0.       49
4621250     0       2.554+6     173873.     2418873. 0. 0.       50
4621251     0       2556158.    173873.     2418880. 0. 0.       51
4621252     0       2558314.    173873.     2418887. 0. 0.       52
4621253     0       2560470.    173873.     2418894. 0. 0.       53
4621254     0       2562626.    173873.     2418901. 0. 0.       54
4621255     0       2564781.    173873.     2418908. 0. 0.       55
4621256     0       2566937.    173873.     2418915. 0. 0.       56
4621257     0       2569093.    173873.     2418922. 0. 0.       57
4621258     0       2571249.    173873.     2418929. 0. 0.       58
4621259     0       2573405.    173873.     2418936. 0. 0.       59
4621260     0       2575561.    173873.     2418942. 0. 0.       60
4621261     0       2577717.    173873.     2418950. 0. 0.       61
4621262     0       2579873.    173873.     2418956. 0. 0.       62
4621263     0       2582029.    173873.     2418964. 0. 0.       63
4621264     0       2584185.    173873.     2418970. 0. 0.       64
4621265     0       2586341.    173873.     2418977. 0. 0.       65
4621266     0       2588497.    173873.     2418984. 0. 0.       66
4621267     0       2590653.    173873.     2418991. 0. 0.       67
4621268     0       2592809.    173873.     2.419+6  0. 0.       68
4621269     0       2594965.    173873.     2419005. 0. 0.       69
4621270     0       2597121.    173873.     2419012. 0. 0.       70
4621271     0       2599277.    173873.     2419018. 0. 0.       71
4621272     0       2601433.    173872.     2419026. 0. 0.       72
4621273     0       2603589.    173870.     2419032. 0. 0.       73
4621274     0       2605744.    173860.     2419039. 0. 0.       74
4621275     0       2607900.    173806.4    2419046. 0. 0.       75
4621276     0       2610057.    173485.8    2419053. 0. 0.       76
4621277     0       2611859.    170338.     2419059. 0. 0.       77
*
*hydro          f velocity    g velocity    j velocity                jun
4621300 0
4621301        -2.925653-6     -2.925653-6  0.          1 * -2.682874-4
4621302        -2.952726-6     -2.952726-6  0.          2 * -2.702464-4
4621303        -2.9773-6       -2.9773-6    0.          3 * -2.72369-4
4621304        -3.0018-6       -3.0018-6    0.          4 * -2.745894-4
4621305        -3.02628-6      -3.02628-6   0.          5 * -2.76826-4
4621306        -3.05076-6      -3.05076-6   0.          6 * -2.790646-4
4621307        -3.075234-6     -3.0753-6    0.          7 * -2.81303-4
4621308        -3.10339-6      -3.1035-6    0.          8 * -2.83879-4
4621309        -3.131536-6     -3.13165-6   0.          9 * -2.86454-4
4621310        -3.159676-6     -3.15979-6   0.         10 * -2.890283-4
4621311        -3.18781-6      -3.187923-6  0.         11 * -2.91602-4
4621312        -3.21593-6      -3.21605-6   0.         12 * -2.94175-4
4621313        -3.244044-6     -3.244164-6  0.         13 * -2.967466-4
4621314        -3.27215-6      -3.27227-6   0.         14 * -2.993177-4
4621315        -3.30024-6      -3.300364-6  0.         15 * -3.01888-4
4621316        -3.32832-6      -3.32845-6   0.         16 * -3.04457-4
4621317        -3.35639-6      -3.35652-6   0.         17 * -3.07025-4
4621318        -3.38445-6      -3.38458-6   0.         18 * -3.095915-4
4621319        -3.41249-6      -3.412625-6  0.         19 * -3.12157-4
4621320        -3.44052-6      -3.44066-6   0.         20 * -3.147215-4
4621321        -3.46854-6      -3.468675-6  0.         21 * -3.172845-4
4621322        -3.49654-6      -3.49668-6   0.         22 * -3.19846-4
4621323        -3.52452-6      -3.524664-6  0.         23 * -3.22406-4
4621324        -3.55249-6      -3.552634-6  0.         24 * -3.24965-4
4621325        -3.58044-6      -3.58059-6   0.         25 * -3.27522-4
4621326        -3.60837-6      -3.60852-6   0.         26 * -3.300775-4
4621327        -3.63629-6      -3.63644-6   0.         27 * -3.32631-4
4621328        -3.66418-6      -3.664334-6  0.         28 * -3.35183-4
4621329        -3.692056-6     -3.69221-6   0.         29 * -3.377333-4
4621330        -3.71991-6      -3.72007-6   0.         30 * -3.402816-4
4621331        -3.74774-6      -3.7479-6    0.         31 * -3.42828-4
4621332        -3.77555-6      -3.77571-6   0.         32 * -3.45372-4
4621333        -3.803336-6     -3.8035-6    0.         33 * -3.47914-4
4621334        -3.8311-6       -3.831265-6  0.         34 * -3.50454-4
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4621335       -3.858835-6       -3.859004-6  0.          35 * -3.529916-4
4621336       -3.88655-6        -3.88672-6   0.          36 * -3.55527-4
4621337       -3.91423-6        -3.914406-6  0.          37 * -3.5806-4
4621338       -3.94189-6        -3.942066-6  0.          38 * -3.6059-4
4621339       -3.96952-6        -3.9697-6    0.          39 * -3.63118-4
4621340       -3.99712-6        -3.9973-6    0.          40 * -3.65643-4
4621341       -4.02469-6        -4.024874-6  0.          41 * -3.681655-4
4621342       -4.05223-6        -4.05242-6   0.          42 * -3.70685-4
4621343       -4.07974-6        -4.07993-6   0.          43 * -3.73202-4
4621344       -4.107215-6       -4.10741-6   0.          44 * -3.75716-4
4621345       -4.13466-6        -4.13485-6   0.          45 * -3.78226-4
4621346       -4.162065-6       -4.16226-6   0.          46 * -3.80734-4
4621347       -4.18944-6        -4.18964-6   0.          47 * -3.83238-4
4621348       -4.21677-6        -4.216975-6  0.          48 * -3.85739-4
4621349       -4.24407-6        -4.24428-6   0.          49 * -3.88237-4
4621350       -4.27133-6        -4.27154-6   0.          50 * -3.90731-4
4621351       -4.29855-6        -4.29876-6   0.          51 * -3.93221-4
4621352       -4.32573-6        -4.325945-6  0.          52 * -3.95708-4
4621353       -4.35287-6        -4.353085-6  0.          53 * -3.98191-4
4621354       -4.379966-6       -4.38018-6   0.          54 * -4.0067-4
4621355       -4.40702-6        -4.40724-6   0.          55 * -4.03145-4
4621356       -4.43402-6        -4.434245-6  0.          56 * -4.05616-4
4621357       -4.46098-6        -4.46121-6   0.          57 * -4.08082-4
4621358       -4.48789-6        -4.48812-6   0.          58 * -4.10544-4
4621359       -4.51475-6        -4.51499-6   0.          59 * -4.13002-4
4621360       -4.54157-6        -4.5418-6    0.          60 * -4.15455-4
4621361       -4.568325-6       -4.56856-6   0.          61 * -4.17903-4
4621362       -4.59503-6        -4.59527-6   0.          62 * -4.20347-4
4621363       -4.62168-6        -4.62192-6   0.          63 * -4.22785-4
4621364       -4.648275-6       -4.64852-6   0.          64 * -4.25218-4
4621365       -4.67481-6        -4.67506-6   0.          65 * -4.27646-4
4621366       -4.70129-6        -4.70154-6   0.          66 * -4.300685-4
4621367       -4.7277-6         -4.72795-6   0.          67 * -4.32485-4
4621368       -4.75405-6        -4.75431-6   0.          68 * -4.34896-4
4621369       -4.78033-6        -4.78059-6   0.          69 * -4.37301-4
4621370       -4.80655-6        -4.80681-6   0.          70 * -4.397-4
4621371       -4.8327-6         -4.83296-6   0.          71 * -4.42092-4
4621372       -4.85877-6        -4.85904-6   0.          72 * -4.44478-4
4621373       -4.88477-6        -4.88504-6   0.          73 * -4.46857-4
4621374       -4.91069-6        -4.91097-6   0.          74 * -4.49231-4
4621375       -4.936535-6       -4.93681-6   0.          75 * -4.51609-4
4621376       -4.96231-6        -4.96259-6   0.          76 * -4.54099-4
*
*----------------------------------------------------------------------*
*hydro             component name       component type
4720000             "inlet"               sngljun
*-------------------------------------------*----------------------*
*hydro    from          to           area      f loss    r loss    vcahs
4720101   462010000     471000000    0.03095   0.2062    0.4513    01000
*
*hydro    jun hyd diam
4720110       0.1985        0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
4720201     0              -1.339118-5    -1.339322-5     0. * -4.56638-4
*
*----------------------------------------------------------------------*
*hydro             component name       component type
4710000             "ifdthrot"               pipe
*-------------------------------------------$----------------$
4710001          9
*
*hydro          vol area                                          vol
4710101          0.03095                                          9
*
```

```
*hydro          length                                            vol
4710301          0.15                                             2
4710302          0.255                                            4
4710303          0.196                                            9
*
*hydro          volume                                            vol
4710401          0.                                               9
*
*hydro          volume                                            vol
4710501          0.                                               9
*
*hydro         vert angle                                         vol
4710601          -90.0                                            2
4710602          0.0                                              9
*
*hydro          delta z                                           vol
4710701          -0.15                                            2
4710702          0.0                                              9
*
*hydro         roughness       hyd diam                           vol
4710801        0.0000457        0.1985                            9
*
*hydro           f loss         r loss                             jun
4710901          0.0            0.0                               1
4710902          0.196          0.196                             2
4710903          0.0            0.0                               3
4710904          0.196          0.196                             4
4710905          0.0            0.0                               8
*
*hydro            fe                                              vol
4711001          00                                               9
*
*hydro           vcahs                                            jun
4711101          01000                                            8
*
*hydro  ebt pressure      tempe                                    vol
4711201     0       2613394.      147360.6   2419064. 0. 0.        1
4711202     0       2615015.      145167.    2419069. 0. 0.        2
4711203     0       2615826.      144968.3   2419071. 0. 0.        3
4711204     0       2615826.      166434.2   2419071. 0. 0.        4
4711205     0       2615826.      171937.    2419071. 0. 0.        5
4711206     0       2615826.      173323.3   2419071. 0. 0.        6
4711207     0       2615825.      173599.    2419071. 0. 0.        7
4711208     0       2615825.      173195.4   2419071. 0. 0.        8
4711209     0       2615825.      169524.3   2419071. 0. 0.        9
*
*hydro         f flowrate    g flowrate    j flowrate                jun
4711300 0
4711301       -1.345007-5     -1.345212-5   0.          1 * -4.58726-4
4711302       -1.34751-5      -1.347512-5   0.          2 * -4.59587-4
4711303       -1.352588-5     -1.352588-5   0.          3 * -4.60488-4
4711304       -1.355776-5     -1.355776-5   0.          4 * -4.61343-4
4711305       -1.358185-5     -1.358185-5   0.          5 * -4.62104-4
4711306       -1.360567-5     -1.360567-5   0.          6 * -4.62903-4
4711307       -1.362924-5     -1.362924-5   0.          7 * -4.63722-4
4711308       -1.36526-5      -1.36526-5    0.          8 * -4.64673-4
*
*----------------------------------------------------------------------*
*hydro             component name       component type
4730000             "ifdexit"               sngljun
*-------------------------------------------*----------------------*
*hydro    from          to           area      f loss    r loss    vcahs
4730101   471010000     474000000    0.03095   0.1028    0.04696   01000
*
*hydro    jun hyd diam
```

```
4730110       0.1985      0.0 1.0 1.0
*
*hydro    vel/flw       f velocity     g velocity     j velocity
4730201     0              -1.367722-5    -1.367718-5     0. * -4.66353-4
*
*-------------------------------------------------------------------$
*hydro             component name       component type
4740000             "psvaw-4"             pipe
*-------------------------------------------------------$-----------$
4740001          2
*
*hydro          vol area                                          vol
4740101        0.08322                                            2
*
*hydro           length                                           vol
4740301          0.25                                             2
*
*hydro           volume                                           vol
4740401          0.                                               2
*
*hydro           volume                                           vol
4740501          0.                                               2
*
*hydro         vert angle                                         vol
4740601          45.0                                             2
*
*hydro          delta z                                           vol
4740701          0.25                                             2
*
*hydro         roughness      hyd diam                           vol
4740801       0.0000457       0.3255                             2
*
*hydro          f loss        r loss                             jun
4740901          0.0           0.0                              1
*
*hydro            fe                                            vol
4741001          00                                             2
*
*hydro           vcahs                                          jun
4741101          01000                                          1
*
*hydro  ebt pressure     tempe                                  vol
4741201     0       2614475.     148396.    2419067. 0. 0.        1
4741202     0       2611776.     169494.8   2419058. 0. 0.        2
*
*hydro         f flowrate   g flowrate    j flowrate              jun
4741300 0
4741301       -5.17031-6       -5.17039-6   0.           1 * -4.731685-4
*
********************************************************************$
*                                                                   *
*           m a t e r i a l    p r o p e r t i e s                  *
*                                                                   *
*-------------------------------------------------------------------$
*                                                                   *
*               composition 1  stainless 3041                       *
*               composition 2  6061 aluminum                        *
*               composition 3  hafnium                              *
*               composition 4  boehmite (oxide)                     *
*               composition 5  u3si2-al fuel meat                   *
*                                                                   *
*-------------------------------------------------------------------$
*   thermal properties of composition   1  -  ss3041                $
*-------------------------------------------------------------------$
*compxn       composition    th.con flg      ht.cap flg      material
20100100       tbl/fctn         1               1          $ss3041
*
*compxn       temperature           th. cond.
20100101       273.2                 14.7
20100102       300.                  15.2
20100103       400.                  17.0
20100104       500.                  18.4
20100105       600.                  19.8
20100106       700.                  21.2
20100107       800.                  22.5
20100108       900.                  23.9
20100109      1000.                  25.3
20100110      1200.                  28.1
20100111      1400.                  30.9
20100112     20000.                  30.9
*
*compxn       temperature           vol ht cap
*steady*20100151        273.2                 10.0
*steady*20100152        20000.                10.0
20100151       250.                  2.97e6
20100152       478.                  3.00e6
20100153       700.                  3.13e6
20100154       811.                  3.23e6
20100155       866.                  3.33e6
20100156       922.                  3.43e6
20100157      1033.                  3.59e6
20100158      1200.                  3.76e6
20100159      1311.                  3.82e6
20100160      1400.                  3.82e6
20100161     20000.                  3.82e6
*******************************************************************$
*   thermal properties of composition   2  -  al6061                $
*-------------------------------------------------------------------$
*compxn       composition    th.con flg      ht.cap flg      material
20100200       tbl/fctn         1               1          $al6061
*
*compxn       temperature           th. cond.
20100201       271.9                 155.0
20100202       299.7                 155.0
20100203       349.7                 161.9
20100204       399.7                 165.9
20100205       499.7                 179.8
20100206       549.7                 183.9
20100207       649.7                 180.9
20100208       749.7                 174.9
20100209       799.7                 171.9
20100210       849.7                 167.9
20100211       924.7                  85.9
20100212       999.7                  87.9
20100213     20000.                   87.9
*
*compxn       temperature           vol ht cap
20100251       271.9                 2.429e6
20100252       299.7                 2.429e6
20100253       399.7                 2.542e6
20100254       499.7                 2.666e6
20100255       599.7                 2.791e6
20100256       699.7                 2.915e6
20100257       799.7                 3.039e6
20100258       899.7                 3.163e6
20100259       924.7                 2.826e6
20100260      1060.8                 2.826e6
20100261      1100.                  2.826e6
20100262     20000.                  2.826e6
*******************************************************************$
```

```
*   thermal properties of composition   3  -  hafnium                 $
*-------------------------------------------------------------------$
*compxn       composition     th.con flg      ht.cap flg      material
20100300        tbl/fctn          1               1          $hafnium
*
*compxn       temperature           th. cond.
20100301        250.                  23.6
20100302        273.2                 23.3
20100303        300.                  23.0
20100304        400.                  22.3
20100305        600.                  21.3
20100306        800.                  20.8
20100307       1200.                  20.9
20100308       1600.                  21.5
20100309       2000.                  22.6
20100310      20000.                  22.6
*
*compxn       temperature           vol ht cap
20100351        252.9                 1.870e6
20100352        278.                  1.898e6
20100353        315.5                 1.924e6
20100354        400.                  1.975e6
20100355        500.                  2.031e6
20100356        600.                  2.087e6
20100357        800.                  2.199e6
20100358       1000.                  2.314e6
20100359       1350.                  2.514e6
20100360       1400.                  2.514e6
20100361      20000.                  2.514e6
*===================================================================$
*   thermal properties of composition   4  -  boehmite               $
*-------------------------------------------------------------------$
*compxn       composition     th.con flg      ht.cap flg      material
20100400        tbl/fctn          1               1          $boehmite
*
*compxn                           th. cond.
20100401                            2.25
*
*
*compxn       temperature           vol ht cap
20100451        273.                  2.198e6
20100452        373.                  2.739e6
20100453        473.                  3.096e6
20100454        573.                  3.316e6
20100455        673.                  3.453e6
20100456        773.                  3.554e6
20100457        873.                  3.638e6
20100458        973.                  3.707e6
20100459       1073.                  3.759e6
20100460       1173.                  3.803e6
20100461       1200.                  3.803e6
20100462      20000.                  3.803e6
*===================================================================$
*   thermal properties of composition   5  -  u3si2-al               $
*-------------------------------------------------------------------$
*compxn       composition     th.con flg      ht.cap flg      material
20100500        tbl/fctn          1               1          $u3si2-al
*
*compxn       temperature           th. cond.
20100501        273.                  51.86
20100502        333.                  59.0
20100503       1333.                 178.0
20100504      20000.                 178.0
*
*compxn       temperature           vol ht cap
20100551        273.                  2.176e6
20100552        373.                  2.289e6
20100553        473.                  2.402e6
20100554        673.                  2.628e6
20100555        873.                  2.854e6
20100556       1073.                  3.080e6
20100557       1273.                  3.306e6
20100558       1300.                  3.306e6
20100559      20000.                  3.306e6
$===================================================================$
$   thermal properties of composition   6  -  heavy water            $
*-------------------------------------------------------------------$
*compxn       composition     th.con flg      ht.cap flg      material
20100600        tbl/fctn          1               1       $heavy water
*
*compxn                           th. cond.
20100601                           0.627
*
*
*compxn                           vol ht cap
20100651                             4.56e6
*
*===================================================================*
*                                                                   *
*        h e a t    s t r u c t u r e    i n p u t                   *
*                                                                   *
*===================================================================*
*
*loop1*loop1*loop1*loop1*loop1*loop1*loop1*loop1*loop1*loop1*loop1*loop1
*
$===================================================================
$                  ht str no. 1081          hx shell
*-------------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11081000    10      4     2     1     1.009  0   0        0
*
*htstr         mesh locn        mesh fmt
11081100           0                1
*
*htstr         intervals        rt. coord
11081101           3                1.054
*
*htstr         compxn no.       interval
11081201           1                3
*
*htstr         source           interval
11081301           0.               3
*
*htstr                          temp flg
11081400                           0
*
*htstr         temp             mesh pt.
11081401        302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11081501   108010000   10000   1        1       0.555           5
11081502   108070000   10000   1        1       0.555           10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11081601   -501        0       4599     1       0.555           10
*
*htstr      s. type     s. mult     left heat   right heat   ht str no.
11081701      0           0            0           0           10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
```

```
11081801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11081901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
$=================================================================
$                ht str no. 1082          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11082000    1       4     1     1      0.00  0   0         0
*
*htstr         mesh locn       mesh fmt
11082100           0              1
*
*htstr         intervals       rt. coord
11082101           3              0.0445
*
*htstr         compxn no.      interval
11082201           1              3
*
*htstr         source          interval
11082301         0.               3
*
*htstr                         temp flg
11082400                          0
*
*htstr         temp            mesh pt.
11082401       302.               4

*htstr     left vol    incr  b.cond  sa code  area/factor    ht str no.
11082501   108060000   00000   1        1       3.49            1
*
*htstr     right vol   incr  b.cond  sa code  area/factor    ht str no.
11082601   -501        0       4581     1       3.49            1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11082701       0           0           0          0            1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11082801   0. 10. 10. 0. 0. 0. 0. 1.  1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11082901   0. 10. 10. 0. 0. 0. 0. 1.  1
*
$=================================================================$
$                ht str no. 1083          hx tube                 $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11083000    10      4     2     1    7.049e-3    0   0         0
*
*htstr         mesh locn       mesh fmt
11083100           0              1
*
*htstr         intervals       rt. coord
11083101           3              7.938e-3
*
*htstr         compxn no.      interval
11083201           1              3
*
*htstr         source          interval
11083301         0.               3
*
*htstr                         temp flg
11083400                          0
*
```

```
*htstr         temp            mesh pt.
11083401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor    ht str no.
11083501   108010000   10000   1        1       8700.4          5
11083502   108070000   10000   1        1       8700.4         10
*
*htstr     right vol   incr  b.cond  sa code  area/factor    ht str no.
11083601   134050000  -10000   1        1       8700.4          5
11083602   134100000  -10000   1        1       8700.4         10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11083701       0           0           0          0            10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11083801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11083901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
* tube and shell heat structures for emergency heat exchanger
*
$=================================================================
$                ht str no. 1161          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11161000    4       4     2     1     0.5334 0   0         0
*
*htstr         mesh locn       mesh fmt
11161100           0              1
*
*htstr         intervals       rt. coord
11161101           3              0.5556
*
*htstr         compxn no.      interval
11161201           1              3
*
*htstr         source          interval
11161301         0.               3
*
*htstr                         temp flg
11161400                          0
*
*htstr         temp            mesh pt.
11161401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor    ht str no.
11161501   116010000   10000   1        1       1.6             4
*
*htstr     right vol   incr  b.cond  sa code  area/factor    ht str no.
11161601   -501        0       4591     1       1.6             4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11161701       0           0           0          0            4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11161801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11161901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*
$=================================================================$
$                ht str no. 1163          hx tube                 $
*-----------------------------------------------------------------*
```

```
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11163000     4      4     2     1    8.636e-3    0   0         0
*
*htstr         mesh locn        mesh fmt
11163100           0              1
*
*htstr         intervals        rt. coord
11163101           3              9.525e-3
*
*htstr         compxn no.       interval
11163201           1              3
*
*htstr         source           interval
11163301         0.               3
*
*htstr                          temp flg
11163400                         0
*
*htstr         temp             mesh pt.
11163401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11163501   116010000   10000   1        1        2672.          4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11163601   146040000  -10000   1        1        2672.          4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11163701       0           0            0          0           4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11163801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11163901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
$=================================================================$
$                  ht str no. 1501          chimney                $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11501000     4      4     2     1    0.2287      0   0         0
*
*htstr         mesh locn        mesh fmt
11501100           0              1
*
*htstr         intervals        rt. coord
11501101           3              0.2541
*
*htstr         compxn no.       interval
11501201           1              3
*
*htstr         source           interval
11501301         0.               3
*
*htstr                          temp flg
11501400                         0
*
*htstr         temp             mesh pt.
11501401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11501501   150010000   10000   1        1        0.75           4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11501601   -501          0     4581     1        0.75           4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11501701       0           0            0          0           4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11501801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11501901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
* accumulator heat structure - loop 1
*
$=================================================================$
$                  ht str no. 1561          tankwall               $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11561000     5      4     2     1     0.7245    0   0         0
*
*htstr         mesh locn        mesh fmt
11561100           0              1
*
*htstr         intervals        rt. coord
11561101           3              0.7396
*
*htstr         compxn no.       interval
11561201           1              3
*
*htstr         source           interval
11561301         0.               3
*
*htstr                          temp flg
11561400                         0
*
*htstr         temp             mesh pt.
11561401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11561501   156010000   10000   1  1        4.09           1
11561502   156020000   10000   1  1        0.12           5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11561601   0           0       0  1        4.09           1
11561602   0           0       0  1        0.12           5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11561701       0           0       0          0           5
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
11561801   0. 10. 10. 0. 0. 0. 0. 1.  5
*
*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2*loop2
$=================================================================
$                  ht str no. 2081          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12081000    10      4     2     1     1.009  0   0         0
*
*htstr         mesh locn        mesh fmt
12081100           0              1
*
*htstr         intervals        rt. coord
12081101           3              1.054
*
*htstr         compxn no.       interval
12081201           1              3
```

```
*
*htstr          source          interval
12081301          0.              3
*
*htstr                          temp flg
12081400                          0
*
*htstr          temp            mesh pt.
12081401        302.              4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12081501   208010000   10000   1        1       0.555          5
12081502   208070000   10000   1        1       0.555          10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12081601   -501        0       4599     1       0.555          10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12081701       0           0           0          0           10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12081801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12081901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
$=================================================================
$                  ht str no. 2082          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12082000    1       4     1     1      0.00  0   0        0
*
*htstr          mesh locn       mesh fmt
12082100            0               1
*
*htstr          intervals       rt. coord
12082101            3             0.0445
*
*htstr          compxn no.      interval
12082201            1               3
*
*htstr          source          interval
12082301          0.                3
*
*htstr                          temp flg
12082400                          0
*
*htstr          temp            mesh pt.
12082401        302.              4

*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12082501   208060000   00000   1        1       3.49           1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12082601   -501        0       4581     1       3.49           1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12082701       0           0           0          0           1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12082801   0. 10. 10. 0. 0. 0. 0. 1.  1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12082901   0. 10. 10. 0. 0. 0. 0. 1.  1
*
```

```
$=================================================================$
$                  ht str no. 2083          hx tube                $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12083000    10      4     2     1    7.049e-3    0   0        0
*
*htstr          mesh locn       mesh fmt
12083100            0               1
*
*htstr          intervals       rt. coord
12083101            3              7.938e-3
*
*htstr          compxn no.      interval
12083201            1               3
*
*htstr          source          interval
12083301          0.                3
*
*htstr                          temp flg
12083400                          0
*
*htstr          temp            mesh pt.
12083401        302.              4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12083501   208010000   10000   1        1       8700.4         5
12083502   208070000   10000   1        1       8700.4         10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12083601   234050000  -10000   1        1       8700.4         5
12083602   234100000  -10000   1        1       8700.4         10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12083701       0           0           0          0           10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12083801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12083901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
* tube and shell heat structures for emergency heat exchanger
*
$=================================================================
$                  ht str no. 2161          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12161000    4       4     2     1     0.5334 0   0        0
*
*htstr          mesh locn       mesh fmt
12161100            0               1
*
*htstr          intervals       rt. coord
12161101            3              0.5556
*
*htstr          compxn no.      interval
12161201            1               3
*
*htstr          source          interval
12161301          0.                3
*
*htstr                          temp flg
12161400                          0
*
*htstr          temp            mesh pt.
```

```
12161401       302.              4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12161501   216010000   10000   1        1        1.6            4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12161601   -501        0       4591     1        1.6            4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12161701       0           0           0          0           4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12161801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12161901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*
$=====================================================================$
$                  ht str no. 2163          hx tube                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
12163000     4      4     2     1    8.636e-3    0   0        0
*
*htstr         mesh locn       mesh fmt
12163100           0              1
*
*htstr         intervals       rt. coord
12163101           3             9.525e-3
*
*htstr         compxn no.      interval
12163201           1              3
*
*htstr         source          interval
12163301         0.               3
*
*htstr                         temp flg
12163400                         0
*
*htstr         temp            mesh pt.
12163401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12163501   216010000   10000   1        1        2672.          4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12163601   246040000  -10000   1        1        2672.          4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12163701       0           0           0          0           4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12163801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12163901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
$=====================================================================$
$                  ht str no. 2501          chimney                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
12501000     4      4     2     1    0.2287      0   0        0
*
*htstr         mesh locn       mesh fmt
12501100           0              1
*
*htstr         intervals       rt. coord
12501101           3             0.2541
*
*htstr         compxn no.      interval
12501201           1              3
*
*htstr         source          interval
12501301         0.               3
*
*htstr                         temp flg
12501400                         0
*
*htstr         temp            mesh pt.
12501401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12501501   250010000   10000   1        1        0.75           4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12501601   -501          0     4581     1        0.75           4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12501701       0           0           0          0           4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12501801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12501901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
* accumulator heat structure - loop2
*
$=====================================================================$
$                  ht str no. 2561          tankwall                  $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
12561000     5      4  2  1     0.7245      0      0        0
*
*htstr         mesh locn       mesh fmt
12561100           0              1
*
*htstr         intervals       rt. coord
12561101           3              0.7396
*
*htstr         compxn no.      interval
12561201           1              3
*
*htstr         source          interval
12561301         0.               3
*
*htstr                         temp flg
12561400                         0
*
*htstr         temp            mesh pt.
12561401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12561501   256010000   10000   1  1       4.09           1
12561502   256020000   10000   1  1       0.12           5
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12561601   0     0       0        1       4.09           1
12561602   0     0       0        1       0.12           5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
```

```
12561701    0        0            0          0           5
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
12561801   0. 10. 10. 0. 0. 0. 0. 1.  5
*
*loop3*loop3*loop3*loop3*loop3*loop3*loop3*loop3*loop3*loop3*loop3*loop3
*
$=====================================================================
$                  ht str no. 3081          hx shell
*---------------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13081000    10      4     2     1     1.009  0   0        0
*
*htstr         mesh locn       mesh fmt
13081100           0              1
*
*htstr         intervals       rt. coord
13081101           3             1.054
*
*htstr         compxn no.      interval
13081201           1              3
*
*htstr         source          interval
13081301          0.              3
*
*htstr                         temp flg
13081400                          0
*
*htstr         temp            mesh pt.
13081401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13081501   308010000   10000   1        1       0.555           5
13081502   308070000   10000   1        1       0.555          10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13081601   -501        0       4599     1       0.555          10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13081701       0           0            0          0           10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13081801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13081901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
$=====================================================================
$                  ht str no. 3082          hx shell
*---------------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13082000    1       4     1     1      0.00  0   0        0
*
*htstr         mesh locn       mesh fmt
13082100           0              1
*
*htstr         intervals       rt. coord
13082101           3             0.0445
*
*htstr         compxn no.      interval
13082201           1              3
*
*htstr         source          interval
13082301          0.              3
*
```

```
*htstr                         temp flg
13082400                          0
*
*htstr         temp            mesh pt.
13082401       302.               4

*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13082501   308060000   00000   1        1       3.49            1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13082601   -501        0       4581     1       3.49            1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13082701       0           0            0          0           1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13082801   0. 10. 10. 0. 0. 0. 0. 1.  1
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13082901   0. 10. 10. 0. 0. 0. 0. 1.  1
*
$=====================================================================$
$                  ht str no. 3083          hx tube                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13083000    10      4     2     1    7.049e-3    0   0        0
*
*htstr         mesh locn       mesh fmt
13083100           0              1
*
*htstr         intervals       rt. coord
13083101           3             7.938e-3
*
*htstr         compxn no.      interval
13083201           1              3
*
*htstr         source          interval
13083301          0.              3
*
*htstr                         temp flg
13083400                          0
*
*htstr         temp            mesh pt.
13083401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13083501   308010000   10000   1        1       8700.4          5
13083502   308070000   10000   1        1       8700.4         10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13083601   334050000  -10000   1        1       8700.4          5
13083602   334100000  -10000   1        1       8700.4         10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13083701       0           0            0          0           10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13083801   0. 10. 10. 0. 0. 0. 0. 1.  10
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13083901   0. 10. 10. 0. 0. 0. 0. 1.  10
*
* tube and shell heat structures for emergency heat exchanger
*
$=====================================================================
```

```
$                ht str no. 3161          hx shell
*-----------------------------------------------------------------
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13161000    4       4     2     1     0.5334 0   0        0
*
*htstr         mesh locn       mesh fmt
13161100           0              1
*
*htstr         intervals       rt. coord
13161101           3              0.5556
*
*htstr         compxn no.      interval
13161201           1              3
*
*htstr         source          interval
13161301          0.              3
*
*htstr                         temp flg
13161400                          0
*
*htstr         temp            mesh pt.
13161401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13161501   316010000   10000   1        1        1.6            4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13161601   -501        0       4591     1        1.6            4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13161701      0           0           0          0            4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13161801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13161901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
$=================================================================$
$                ht str no. 3163          hx tube                 $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13163000    4       4     2     1     8.636e-3   0   0        0
*
*htstr         mesh locn       mesh fmt
13163100           0              1
*
*htstr         intervals       rt. coord
13163101           3              9.525e-3
*
*htstr         compxn no.      interval
13163201           1              3
*
*htstr         source          interval
13163301          0.              3
*
*htstr                         temp flg
13163400                          0
*
*htstr         temp            mesh pt.
13163401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13163501   316010000   10000   1        1        2672.          4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13163601   346040000  -10000   1        1        2672.          4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13163701      0           0           0          0            4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13163801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13163901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
$=================================================================$
$                ht str no. 3501          chimney                 $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13501000    4       4     2     1     0.2287     0   0        0
*
*htstr         mesh locn       mesh fmt
13501100           0              1
*
*htstr         intervals       rt. coord
13501101           3              0.2541
*
*htstr         compxn no.      interval
13501201           1              3
*
*htstr         source          interval
13501301          0.              3
*
*htstr                         temp flg
13501400                          0
*
*htstr         temp            mesh pt.
13501401       302.               4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13501501   350010000   10000   1        1        0.75           4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13501601   -501          0     4581     1        0.75           4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13501701      0           0           0          0            4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13501801   0. 10. 10. 0. 0. 0. 0. 1.   4
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13501901   0. 10. 10. 0. 0. 0. 0. 1.   4
*
* accumulator heat structure - loop 3
*
$=================================================================$
$                ht str no. 3561          tankwall                $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
13561000    5       4  2  1     0.7245     0      0        0
*
*htstr         mesh locn       mesh fmt
13561100           0              1
*
*htstr         intervals       rt. coord
13561101           3              0.7396
*
```

```
*htstr          compxn no.      interval
13561201            1               3
*
*htstr          source          interval
13561301          0.                3
*
*htstr                          temp flg
13561400                          0
*
*htstr          temp            mesh pt.
13561401        302.              4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13561501   356010000   10000   1  1       4.09            1
13561502   356020000   10000   1  1       0.12            5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13561601   0  0        0       1       4.09            1
13561602   0  0        0       1       0.12            5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13561701       0  0            0          0           5
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
13561801   0. 10. 10. 0. 0. 0. 0. 1.  5
*
*-------------------------------------------------------------------$
*                  ht str no. 1011          hotleg                  $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11011000   3  4  2  1               0.1627    0      0        0
*
*htstr          mesh locn       mesh fmt
11011100            0               1
*
*htstr          intervals       rt. coord
11011101            3             0.1778
*
*htstr          compxn no.      interval
11011201            1               3
*
*htstr          source          interval
11011301          0.                3
11011401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11011501   101010000   0       1       1        1.07           1
11011502   101060000   0       1       1        3.66           2
11011503   101260000   0       1       1        2.21           3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11011601   -501        0     4511       1        1.07           1
11011602   -501        0     4511       1        3.66           2
11011603   -501        0     4511       1        2.21           3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11011701       0           0            0          0           3
*
*htstr
*mod2.5*11011801 0 0.0 0.0 0.0 3
11011801 0. 10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*11011901 0 0.0 0.0 0.0 3
11011901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*-------------------------------------------------------------------$
```

```
*                  ht str no. 1041          hotleg                  $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11041000   3  4  2  1               0.1627    0      0        0
*
*htstr          mesh locn       mesh fmt
11041100            0               1
*
*htstr          intervals       rt. coord
11041101            3             0.1778
*
*htstr          compxn no.      interval
11041201            1               3
*
*htstr          source          interval
11041301          0.                3
11041401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11041501   104010000   0       1       1        0.69           1
11041502   104040000   0       1       1        12.96          2
11041503   104800000   0       1       1        2.51           3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11041601   -501        0     4511       1        0.69           1
11041602   -501        0     4511       1        12.96          2
11041603   -501        0     4581       1        2.51           3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11041701       0           0            0          0           3
*
*htstr
*mod2.5*11041801 0 0.0 0.0 0.0 3
11041801 0. 10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*11041901 0 0.0 0.0 0.0 3
11041901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*===================================================================$
*                  ht str no. 1221          coldleg                 $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11221000   3  4  2  1               0.1627    0      0        0
*
*htstr          mesh locn       mesh fmt
11221100            0               1
*
*htstr          intervals       rt. coord
11221101            3             0.1778
*
*htstr          compxn no.      interval
11221201            1               3
*
*htstr          source          interval
11221301          0.                3
11221401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11221501   122010000   0       1       1        2.31           1
11221502   122130000   0       1       1        2.13           2
11221503   122230000   0       1       1        0.762          3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11221601   -501        0     4511       1        2.31           1
11221602   -501        0     4511       1        2.13           2
11221603   -501        0     4581       1        0.762          3
```

```
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11221701       0           0           0          0           3
*
*htstr
*mod2.5*11221801 0 0.0 0.0 0.0 3
11221801  0.0  10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*11221901 0 0.0 0.0 0.0 3
11221901  0.0  10. 10. 0. 0. 0. 0. 1. 3
*
*=====================================================================$
*                  ht str no. 1261          coldleg                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11261000   1  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
11261100           0              1
*
*htstr         intervals       rt. coord
11261101           3             0.1778
*
*htstr         compxn no.      interval
11261201           1              3
*
*htstr         source          interval
11261301          0.              3
11261401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11261501   126010000   0       1       1        0.9146         1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11261601   -501        0     4511      1        0.9146         1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11261701       0           0           0          0           1
*
*htstr
*mod2.5*11261801 0 0.0 0.0 0.0 1
11261801 0.0  10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*11261901 0 0.0 0.0 0.0 1
11261901 0.0  10. 10. 0. 0. 0. 0. 1. 1
*---------------------------------------------------------------------$
*                  ht str no. 1291          14-incdleg                $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11291000   1  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
11291100           0              1
*
*htstr         intervals       rt. coord
11291101           3             0.1778
*
*htstr         compxn no.      interval
11291201           1              3
*
*htstr         source          interval
11291301          0.              3
11291401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11291501   129010000   0       1       1        6.25           1
*
```

```
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11291601   -501        0     4511      1        6.25           1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11291701       0           0           0          0           1
*
*htstr
*mod2.5*11291801 0 0.0 0.0 0.0 1
11291801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*11291901 0 0.0 0.0 0.0 1
11291901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*=====================================================================$
*                  ht str no. 1581          14-in cdleg               $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11581000   2  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
11581100           0              1
*
*htstr         intervals       rt. coord
11581101           3             0.1778
*
*htstr         compxn no.      interval
11581201           1              3
*
*htstr         source          interval
11581301          0.              3
11581401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11581501   158010000  250000   1       1        4.50           2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11581601   -501        0     4511      1        4.50           2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11581701       0           0           0          0           2
*
*htstr
*mod2.5*11581801 0 0.0 0.0 0.0 2
11581801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
11581901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*=====================================================================
*                  ht str no. 1621          14-in cdleg               $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11621000   4  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
11621100           0              1
*
*htstr         intervals       rt. coord
11621101           3             0.1778
*
*htstr         compxn no.      interval
11621201           1              3
*
*htstr         source          interval
11621301          0.              3
```

```
11621401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11621501   162010000     0     1        1       1.83          1
11621502   162110000     0     1        1       1.57          2
11621503   162190000     0     1        1       1.45          3
11621504   162270000     0     1        1       12.10439      4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11621601   -501        0       4581     1       1.83          1
11621602   -501        0       4511     1       1.57          2
11621603   -501        0       4511     1       1.45          3
11621604   -501        0       4581     1       12.10439      4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11621701       0           0           0          0           4
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 4
11621801 0. 10. 10. 0. 0. 0. 0. 1. 4
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 4
11621901 0. 10. 10. 0. 0. 0. 0. 1. 4
*
*=================================================================$
*                  ht str no. 1711          8-in cdleg              $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11711000   3  4  2  1                0.09925    0      0       0
*
*htstr         mesh locn       mesh fmt
11711100          0               1
*
*htstr         intervals       rt. coord
11711101          3               0.1016
*
*htstr         compxn no.      interval
11711201          1               3
*
*htstr         source          interval
11711301        0.                3
11711401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11711501   171010000   0       1        1       0.300         1
11711502   171030000   0       1        1       2.000         2
11711503   171130000   0       1        1       2.280         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11711601   -501        0       4581     1       0.300         1
11711602   -501        0       4531     1       2.000         2
11711603   -501        0       4531     1       2.280         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11711701       0           0           0          0           3
*
*htstr
*mod2.5*11711801 0 0.0 0.0 0.0 3
11711801 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*htstr
*mod2.5*11711901 0 0.0 0.0 0.0 3
11711901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
```

```
*=================================================================
*                  ht str no. 1741          14-in cdleg             $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
11741000   1  4  2  1                0.1627     0      0       0
*
*htstr         mesh locn       mesh fmt
11741100          0               1
*
*htstr         intervals       rt. coord
11741101          3               0.1778
*
*htstr         compxn no.      interval
11741201          1               3
*
*htstr         source          interval
11741301        0.                3
11741401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
11741501   174010000     0     1        1       0.50          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
11741601   -501        0       4511     1       0.50          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
11741701       0           0           0          0           1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
11741801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
11741901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-----------------------------------------------------------------$
*                  ht str no. 2011          hotleg                  $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12011000   3  4  2  1                0.1627     0      0       0
*
*htstr         mesh locn       mesh fmt
12011100          0               1
*
*htstr         intervals       rt. coord
12011101          3               0.1778
*
*htstr         compxn no.      interval
12011201          1               3
*
*htstr         source          interval
12011301        0.                3
12011401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12011501   201010000   0       1        1       1.07          1
12011502   201060000   0       1        1       3.66          2
12011503   201260000   0       1        1       2.21          3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12011601   -501        0       4511     1       1.07          1
12011602   -501        0       4511     1       3.66          2
12011603   -501        0       4511     1       2.21          3
*
```

```
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12011701       0           0           0          0           3
*
*htstr
*mod2.5*12011801 0 0.0 0.0 0.0 3
12011801 0. 10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*12011901 0 0.0 0.0 0.0 3
12011901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*-------------------------------------------------------------------$
*                ht str no. 2041          hotleg                    $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12041000   3  4  2  1                0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
12041100           0              1
*
*htstr         intervals       rt. coord
12041101           3              0.1778
*
*htstr         compxn no.      interval
12041201           1              3
*
*htstr         source          interval
12041301         0.               3
12041401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12041501   204010000   0       1       1        0.69          1
12041502   204040000   0       1       1         12.96        2
12041503   204800000   0       1       1         2.51         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12041601   -501        0     4511       1        0.69          1
12041602   -501        0     4511       1         12.96        2
12041603   -501        0     4581       1         2.51         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12041701       0           0           0          0           3
*
*htstr
*mod2.5*12041801 0 0.0 0.0 0.0 3
12041801 0. 10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*12041901 0 0.0 0.0 0.0 3
12041901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*===================================================================$
*                ht str no. 2221          coldleg                   $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12221000   3  4  2  1                0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
12221100           0              1
*
*htstr         intervals       rt. coord
12221101           3              0.1778
*
*htstr         compxn no.      interval
12221201           1              3
*
*htstr         source          interval
12221301         0.               3
12221401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12221501   222010000   0       1       1         2.31          1
12221502   222130000   0       1       1         2.13          2
12221503   222230000   0       1       1         0.762         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12221601   -501        0     4511       1         2.31          1
12221602   -501        0     4511       1         2.13          2
12221603   -501        0     4581       1         0.762         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12221701       0           0           0          0           3
*
*htstr
*mod2.5*12221801 0 0.0 0.0 0.0 3
12221801  0.0  10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*12221901 0 0.0 0.0 0.0 3
12221901  0.0  10. 10. 0. 0. 0. 0. 1. 3
*
*===================================================================$
*                ht str no. 2261          coldleg                   $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12261000   1  4  2  1                0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
12261100           0              1
*
*htstr         intervals       rt. coord
12261101           3              0.1778
*
*htstr         compxn no.      interval
12261201           1              3
*
*htstr         source          interval
12261301         0.               3
12261401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12261501   226010000   0       1       1         0.9146        1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12261601   -501        0     4511       1         0.9146        1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12261701       0           0           0          0           1
*
*htstr
*mod2.5*12261801 0 0.0 0.0 0.0 1
12261801 0.0  10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*12261901 0 0.0 0.0 0.0 1
12261901 0.0  10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------$
*                ht str no. 2291          14-incdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12291000   1  4  2  1                0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
12291100           0              1
*
*htstr         intervals       rt. coord
12291101           3              0.1778
```

```
*
*htstr         compxn no.      interval
12291201           1              3
*
*htstr         source          interval
12291301         0.               3
12291401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12291501   229010000   0       1       1        6.25          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12291601   -501        0     4511      1        6.25          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12291701       0           0            0          0           1
*
*htstr
*mod2.5*12291801 0 0.0 0.0 0.0 1
12291801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*12291901 0 0.0 0.0 0.0 1
12291901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------*
*                ht str no. 2581          14-in cdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12581000   2  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
12581100           0              1
*
*htstr         intervals       rt. coord
12581101           3             0.1778
*
*htstr         compxn no.      interval
12581201           1              3
*
*htstr         source          interval
12581301         0.               3
12581401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12581501   258010000   10000   1       1        4.50          2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12581601   -501        0     4511      1        4.50          2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12581701       0           0            0          0           2
*
*htstr
*mod2.5*12581801 0 0.0 0.0 0.0 2
12581801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*12581901 0 0.0 0.0 0.0 2
12581901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
********************************************************************
*                ht str no. 2621          14-in cdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12621000   2  4  2  1                0.1627    0      0        0
*
```

```
*htstr         mesh locn       mesh fmt
12621100           0              1
*
*htstr         intervals       rt. coord
12621101           3             0.1778
*
*htstr         compxn no.      interval
12621201           1              3
*
*htstr         source          interval
12621301         0.               3
12621401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12621501   262010000   0       1       1        0.64538       1
12621502   262040000   0       1       1       13.93439       2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12621601   -501        0     4511      1        0.64538       1
12621602   -501        0     4581      1       13.93439       2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12621701       0           0            0          0           2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
12621801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
12621901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*******************************************************************$
*                ht str no. 2711          8-in cdleg                 $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12711000   3  4  2  1                0.09925   0      0        0
*
*htstr         mesh locn       mesh fmt
12711100           0              1
*
*htstr         intervals       rt. coord
12711101           3             0.1016
*
*htstr         compxn no.      interval
12711201           1              3
*
*htstr         source          interval
12711301         0.               3
12711401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12711501   271010000   0       1       1        0.300         1
12711502   271030000   0       1       1        0.290         2
12711503   271050000   0       1       1        0.940         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12711601   -501        0     4581      1        0.300         1
12711602   -501        0     4531      1        0.290         2
12711603   -501        0     4531      1        0.940         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12711701       0           0            0          0           3
*
*htstr
```

```
*mod2.5*12711801 0 0.0 0.0 0.0 3
12711801 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*htstr
*mod2.5*12711901 0 0.0 0.0 0.0 3
12711901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*$
*                ht str no. 2741          14-in cdleg                $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
12741000   1  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
12741100           0              1
*
*htstr         intervals       rt. coord
12741101           3              0.1778
*
*htstr         compxn no.      interval
12741201           1              3
*
*htstr         source          interval
12741301          0.              3
12741401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
12741501   274010000     0     1        1       0.50           1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
12741601   -501        0       4511     1       0.50           1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
12741701       0           0            0          0           1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
12741801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
12741901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*$
*                ht str no. 3011          hotleg                     $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13011000   1  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
13011100           0              1
*
*htstr         intervals       rt. coord
13011101           3              0.1778
*
*htstr         compxn no.      interval
13011201           1              3
*
*htstr         source          interval
13011301          0.              3
13011401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13011501   301010000   0       1        1       3.28           1
*
```

```
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13011601   -501        0       4511     1       3.28           1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13011701       0           0            0          0           1
*
*htstr
*mod2.5*13011801 0 0.0 0.0 0.0 1
13011801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*13011901 0 0.0 0.0 0.0 1
13011901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-----------------------------------------------------------------$
*                ht str no. 3041          hotleg                     $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13041000   3  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
13041100           0              1
*
*htstr         intervals       rt. coord
13041101           3              0.1778
*
*htstr         compxn no.      interval
13041201           1              3
*
*htstr         source          interval
13041301          0.              3
13041401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13041501   304010000   0       1        1        0.69           1
13041502   304040000   0       1        1        12.96          2
13041503   304800000   0       1        1        2.51           3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13041601   -501        0       4511     1        0.69           1
13041602   -501        0       4511     1        12.96          2
13041603   -501        0       4581     1        2.51           3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13041701       0           0            0          0           3
*
*htstr
*mod2.5*13041801 0 0.0 0.0 0.0 3
13041801 0. 10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*13041901 0 0.0 0.0 0.0 3
13041901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*-----------------------------------------------------------------*
*                ht str no. 3221          coldleg                    $
*-----------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13221000   3  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
13221100           0              1
*
*htstr         intervals       rt. coord
13221101           3              0.1778
*
*htstr         compxn no.      interval
13221201           1              3
*
```

```
*htstr          source          interval
13221301          0.              3
13221401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13221501   322010000   0       1       1        2.31          1
13221502   322130000   0       1       1        2.13          2
13221503   322230000   0       1       1        0.762         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13221601   -501        0     4511     1        2.31          1
13221602   -501        0     4511     1        2.13          2
13221603   -501        0     4581     1        0.762         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13221701       0           0           0          0           3
*
*htstr
*mod2.5*13221801 0 0.0 0.0 0.0 3
13221801  0.  10. 10. 0. 0. 0. 0. 1. 3
*mod2.5*13221901 0 0.0 0.0 0.0 3
13221901  0.  10. 10. 0. 0. 0. 0. 1. 3
*
*-------------------------------------------------------------------*
*                ht str no. 3261          coldleg                   $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13261000   1  4  2  1                0.1627    0      0       0
*
*htstr          mesh locn       mesh fmt
13261100            0              1
*
*htstr          intervals       rt. coord
13261101            3             0.1778
*
*htstr          compxn no.      interval
13261201            1              3
*
*htstr          source          interval
13261301          0.              3
13261401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13261501   326010000   0       1       1        0.9146        1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13261601   -501        0     4511     1        0.9146        1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13261701       0           0           0          0           1
*
*htstr
*mod2.5*13261801 0 0.0 0.0 0.0 1
13261801 0.  10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*13261901 0 0.0 0.0 0.0 1
13261901 0.  10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------$
*                ht str no. 3291          14-incdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13291000   1  4  2  1                0.1627    0      0       0
*
*htstr          mesh locn       mesh fmt
13291100            0              1
*
*htstr          intervals       rt. coord
13291101            3             0.1778
*
*htstr          compxn no.      interval
13291201            1              3
*
*htstr          source          interval
13291301          0.              3
13291401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13291501   329010000   0       1       1        6.25          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13291601   -501        0     4511     1        6.25          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13291701       0           0           0          0           1
*
*htstr
*mod2.5*13291801 0 0.0 0.0 0.0 1
13291801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*13291901 0 0.0 0.0 0.0 1
13291901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------*
*                ht str no. 3581          14-in cdleg               $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13581000   2  4  2  1                0.1627    0      0       0
*
*htstr          mesh locn       mesh fmt
13581100            0              1
*
*htstr          intervals       rt. coord
13581101            3             0.1778
*
*htstr          compxn no.      interval
13581201            1              3
*
*htstr          source          interval
13581301          0.              3
13581401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13581501   358010000   10000   1       1        7.24          2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13581601   -501        0     4511     1        7.24          2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13581701       0           0           0          0           2
*
*htstr
*mod2.5*13581801 0 0.0 0.0 0.0 2
13581801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*13581901 0 0.0 0.0 0.0 2
13581901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*===================================================================*
*                ht str no. 3621          14-in cdleg               $
*-------------------------------------------------------------------*
```

```
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13621000   2  4   2  1               0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
13621100           0              1
*
*htstr         intervals       rt. coord
13621101           3              0.1778
*
*htstr         compxn no.      interval
13621201           1              3
*
*htstr         source          interval
13621301          0.              3
13621401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13621501   362010000     0     1        1       1.2166        1
13621502   362020000     0     1        1      13.93439       2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13621601   -501        0       4511     1       1.2166        1
13621602   -501        0       4581     1      13.93439       2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13621701       0           0            0          0          2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
13621801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
13621901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*=============================================================================$
*                  ht str no. 3711          8-in cdleg                        $
*-----------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13711000   3  4   2  1               0.09925   0      0       0
*
*htstr         mesh locn       mesh fmt
13711100           0              1
*
*htstr         intervals       rt. coord
13711101           3              0.1016
*
*htstr         compxn no.      interval
13711201           1              3
*
*htstr         source          interval
13711301          0.              3
13711401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13711501   371010000   0       1        1       0.300         1
13711502   371030000   0       1        1       0.510         2
13711503   371050000   0       1        1       0.980         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13711601   -501        0       4581     1       0.300         1
13711602   -501        0       4531     1       0.510         2
13711603   -501        0       4531     1       0.980         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13711701       0           0            0          0          3
*
*htstr
*mod2.5*13711801 0 0.0 0.0 0.0 3
13711801 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*htstr
*mod2.5*13711901 0 0.0 0.0 0.0 3
13711901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*=============================================================================$
*                  ht str no. 3741          14-in cdleg                       $
*-----------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
13741000   1  4   2  1               0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
13741100           0              1
*
*htstr         intervals       rt. coord
13741101           3              0.1778
*
*htstr         compxn no.      interval
13741201           1              3
*
*htstr         source          interval
13741301          0.              3
13741401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
13741501   374010000     0     1        1       0.50          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
13741601   -501        0       4511     1       0.50          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
13741701       0           0            0          0          1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
13741801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
13741901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*=============================================================================$
*                  ht str no. 4011          hotleg                            $
*-----------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14011000   1  4   2  1               0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
14011100           0              1
*
*htstr         intervals       rt. coord
14011101           3              0.1778
*
*htstr         compxn no.      interval
14011201           1              3
*
*htstr         source          interval
14011301          0.              3
14011401 400. 4
*
```

```
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14011501   451010000   0       1       1        3.28          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14011601   -501        0     4511      1        3.28          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14011701       0           0           0          0           1
*
*htstr
*mod2.5*14011801 0 0.0 0.0 0.0 1
14011801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*14011901 0 0.0 0.0 0.0 1
14011901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------$
*                 ht str no. 4291          14-incdleg                 $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14291000   1  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
14291100           0              1
*
*htstr         intervals       rt. coord
14291101           3             0.1778
*
*htstr         compxn no.      interval
14291201           1              3
*
*htstr         source          interval
14291301         0.               3
14291401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14291501   429010000   0       1       1        6.25          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14291601   -501        0     4511      1        6.25          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14291701       0           0           0          0           1
*
*htstr
*mod2.5*14291801 0 0.0 0.0 0.0 1
14291801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*14291901 0 0.0 0.0 0.0 1
14291901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-------------------------------------------------------------------*
*                 ht str no. 4581          14-in cdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14581000   2  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
14581100           0              1
*
*htstr         intervals       rt. coord
14581101           3             0.1778
*
*htstr         compxn no.      interval
14581201           1              3
*
*htstr         source          interval
14581301         0.               3
14581401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14581501   458010000   10000   1       1        7.24          2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14581601   -501        0     4511      1        7.24          2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14581701       0           0           0          0           2
*
*htstr
*mod2.5*14581801 0 0.0 0.0 0.0 2
14581801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*14581901 0 0.0 0.0 0.0 2
14581901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
********************************************************************
*                 ht str no. 4621          14-in cdleg                $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14621000   2  4  2  1                0.1627    0      0        0
*
*htstr         mesh locn       mesh fmt
14621100           0              1
*
*htstr         intervals       rt. coord
14621101           3             0.1778
*
*htstr         compxn no.      interval
14621201           1              3
*
*htstr         source          interval
14621301         0.               3
14621401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14621501   462010000     0     1       1        1.2166        1
14621502   462020000     0     1       1       13.93439       2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14621601   -501        0     4511      1        1.2166        1
14621602   -501        0     4581      1       13.93439       2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14621701       0           0           0          0           2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
14621801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 2
14621901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*******************************************************************$
*                 ht str no. 4711          8-in cdleg                 $
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14711000   3  4  2  1                0.09925   0      0        0
*
*htstr         mesh locn       mesh fmt
```

```
14711100          0             1
*
*htstr         intervals       rt. coord
14711101          3            0.1016
*
*htstr         compxn no.      interval
14711201          1               3
*
*htstr         source          interval
14711301          0.              3
14711401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14711501   471010000   0       1       1       0.300         1
14711502   471020000   0       1       1       0.510         2
14711503   471030000   0       1       1       0.980         3
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14711601   -501        0       4581    1       0.300         1
14711602   -501        0       4531    1       0.510         2
14711603   -501        0       4531    1       0.980         3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14711701       0           0            0          0           3
*
*htstr
*mod2.5*14711801 0 0.0 0.0 0.0 3
14711801 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*htstr
*mod2.5*14711901 0 0.0 0.0 0.0 3
14711901 0. 10. 10. 0. 0. 0. 0. 1. 3
*
*=============================================================================$
*                  ht str no. 4741          14-in cdleg                      $
*-----------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14741000   1  4  2  1               0.1627    0      0       0
*
*htstr         mesh locn       mesh fmt
14741100          0               1
*
*htstr         intervals       rt. coord
14741101          3             0.1778
*
*htstr         compxn no.      interval
14741201          1               3
*
*htstr         source          interval
14741301          0.              3
14741401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14741501   474010000     0     1       1       0.50          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14741601   -501        0       4511    1       0.50          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14741701       0           0            0          0           1
*
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
14741801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
```

```
*htstr
*mod2.5*11581901 0 0.0 0.0 0.0 1
14741901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*-----------------------------------------------------------------------------*
*                  ht str no. 4951          cpbt bottom                      $
*-----------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
14951000   1  4  2  1               0.2865    0      0       0
*
*htstr         mesh locn       mesh fmt
14951100          0               1
*
*htstr         intervals       rt. coord
14951101          3             0.3165
*
*htstr         compxn no.      interval
14951201          1               3
*
*htstr         source          interval
14951301          0.              3
14951401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
14951501   495010000   0       1       1       1.800         1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
14951601   -501        0       4581    1       1.800         1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
14951701       0           0            0          0           1
*
*htstr
*mod2.5*14951801 0 0.0 0.0 0.0 1
14951801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*14951901 0 0.0 0.0 0.0 1
14951901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*core*core*core*core*core*core*core*core*core*core*core*core*core*core*core*c
*                                                                           *
*                heat structures in core region                             *
*                                                                           *
*---------------------------------------------------------------------------*
*  ht str 5001 - core inlet pipe wall (lower cpbt wall)                     *
*---------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15001000   3  4  2  1               0.2265    0      0       0
*
*htstr         mesh locn       mesh fmt
15001100          0               1
*
*htstr         intervals       rt. coord
15001101          3             0.2465
*
*htstr         compxn no.      interval
15001201          1               3
*
*htstr         source          interval
15001301          0.              3
15001401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15001501   500010000   10000   1       1       0.110         2
15001502   500030000   0       1       1       0.111         3
*
```

```
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15001601   -501        0       4581     1        0.110          2
15001602   -501        0       4581     1        0.111          3
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15001701       0           0            0          0            3
*
*htstr
*mod2.5*15001801 0 0.0 0.0 0.0 3
15001801 0.0  10. 10. 0. 0. 0. 0. 1. 3
*
*htstr
*mod2.5*15001901 0 0.0 0.0 0.0 3
15001901 0.0  10. 10. 0. 0. 0. 0. 1. 3
*
*-------------------------------------------------------------------*
*  ht str 5051 - control rod shroud in core inlet region            *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15051000  14  4  2  1                0.130     0      0        0
*
*htstr         mesh locn       mesh fmt
15051100           0              1
*
*htstr         intervals       rt. coord
15051101           3             0.1365
*
*htstr         compxn no.      interval
15051201           2              3
*
*htstr         source          interval
15051301          0.              3
15051401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15051501   560010000   10000   1        1        0.175          4
15051502   560050000   0       1        1        0.145          5
15051503   560060000   10000   1        1        0.175          9
15051504   560100000   10000   1        1        0.0836        14
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15051601   568010000   10000   1        1        0.175          4
15051602   568050000   0       1        1        0.145          5
15051603   568060000   10000   1        1        0.175          9
15051604   560100000   10000   1        1        0.0836        14
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15051701       0           0            0          0           14
*
*htstr
*mod2.5*15051801 0 0.0 0.0 0.0 14
15051801 0.0  10. 10. 0. 0. 0. 0. 1. 14
*
*htstr
*mod2.5*15051901 0 0.0 0.0 0.0 14
15051901 0.0  10. 10. 0. 0. 0. 0. 1. 14
*
*-------------------------------------------------------------------*
* ht str 5052 - lower/upper core flow seprtn shrd in core inlet region *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15052000   9  4  2  1                0.224     0      0        0
*
*htstr         mesh locn       mesh fmt
15052100           0              1
*
*htstr         intervals       rt. coord
15052101           3             0.231
*
*htstr         compxn no.      interval
15052201           2              3
*
*htstr         source          interval
15052301          0.              3
15052401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15052501   505010000   0       1        1        0.175          4
15052502   505020000   0       1        1        0.145          5
15052503   505030000   0       1        1        0.175          9
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15052601   530010000   0       1        1        0.175          4
15052602   530020000   0       1        1        0.145          5
15052603   530030000   0       1        1        0.175          9
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15052701       0           0            0          0            9
*
*htstr
*mod2.5*15052801 0 0.0 0.0 0.0 9
15052801 0.0 10. 10. 0. 0. 0. 0. 1. 9
*
*htstr
*mod2.5*15052901 0 0.0 0.0 0.0 9
15052901 0.0 10. 10. 0. 0. 0. 0. 1. 9
*
*-------------------------------------------------------------------*
* ht str 5053 - inner/lower core flow seprtn shrd in core inlet region *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15053000   9  4  2  1                0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15053100           0              1
*
*htstr         intervals       rt. coord
15053101           3             0.169
*
*htstr         compxn no.      interval
15053201           2              3
*
*htstr         source          interval
15053301          0.              3
15053401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15053501   568010000   0       1        1        0.175          4
15053502   568020000   0       1        1        0.145          5
15053503   568030000   0       1        1        0.175          9
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15053601   505010000   0       1        1        0.175          4
15053602   505020000   0       1        1        0.145          5
15053603   505030000   0       1        1        0.175          9
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15053701       0           0            0          0            9
*
*htstr
```

```
*mod2.5*15053801 0 0.0 0.0 0.0 9
15053801 0.0 10. 10. 0. 0. 0. 0. 1. 9
*
*htstr
*mod2.5*15053901 0 0.0 0.0 0.0 9
15053901 0.0 10. 10. 0. 0. 0. 0. 1. 9
*
*----------------------------------------------------------------------*
* ht str 5101 - lower core average fuel plates                         *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15101000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15101100           0              1
*
*htstr         intervals       rt. coord
15101101           2             1.055e-5
15101102           2             2.5700e-4
15101103           6             6.3800e-4
*
*htstr         compxn no.      interval
15101201           4              2
15101202           2              4
15101203           5              10
*
*htstr         source          interval
15101301          0.              2
15101302       0.0023234          4
15101303       0.36647            10
*
15101401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15101501   510010000   10000     1       0       4.29        5
15101501   510010000   10000   102       0       4.29        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15101601   0           0       0        0       4.29             5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15101701   1000  7.2439725d-02  1.5313084d-03  0.0000000d+00      1
15101702   1000  7.4820653d-02  1.5816390d-03  0.0000000d+00      2
15101703   1000  7.4999223d-02  1.5854138d-03  0.0000000d+00      3
15101704   1000  7.4046851d-02  1.5652816d-03  0.0000000d+00      4
15101705   1000  6.8927857d-02  1.4570708d-03  0.0000000d+00      5
*
*htstr
*mod2.5*15101801 0 0.0 0.0 0.0 5
15101801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15101901 0 0.0 0.0 0.0 5
15101901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5102 - lower core average channel inner side plate            *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15102000   5  4  2  1                 0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15102100           0              1
*
*htstr         intervals       rt. coord
15102101           3             0.169
*
*htstr         compxn no.      interval
15102201           2              3
*
*htstr         source          interval
15102301          1.              3
15102401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15102501   568100000   10000   1        1       0.0416          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15102601   510010000   10000   1        1       0.0416          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15102701   1000  2.1831493d-04  5.5182288d-04  0.0000000d+00      1
15102702   1000  2.2549044d-04  5.6996003d-04  0.0000000d+00      2
15102703   1000  2.2602860d-04  5.7132031d-04  0.0000000d+00      3
15102704   1000  2.2315840d-04  5.6406545d-04  0.0000000d+00      4
15102705   1000  2.0773105d-04  5.2507057d-04  0.0000000d+00      5
*
*htstr
*mod2.5*15102801 0 0.0 0.0 0.0 5
15102801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15102901 0 0.0 0.0 0.0 5
15102901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
*  ht str 5103 - lower core average channel outer side plate           *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15103000   5  4  2  1                 0.224     0      0        0
*
*htstr         mesh locn       mesh fmt
15103100           0              1
*
*htstr         intervals       rt. coord
15103101           3             0.231
*
*htstr         compxn no.      interval
15103201           2              3
*
*htstr         source          interval
15103301          1.              3
15103401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15103501   510010000   10000   1        1       0.0416          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15103601   530100000   10000   1        1       0.0416          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15103701   1000  3.0000442d-04  0.0000000d+00  6.4839188d-04      1
15103702   1000  3.0986488d-04  0.0000000d+00  6.6970303d-04      2
15103703   1000  3.1060441d-04  0.0000000d+00  6.7130137d-04      3
15103704   1000  3.0666023d-04  0.0000000d+00  6.6277691d-04      4
15103705   1000  2.8546024d-04  0.0000000d+00  6.1695793d-04      5
*
*htstr
*mod2.5*15103801 0 0.0 0.0 0.0 5
15103801 0. 10. 10. 0. 0. 0. 0. 1. 5
```

```
•
*htstr
*mod2.5*15103901 0 0.0 0.0 0.0 5
15103901 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*---------------------------------------------------------------------*
•  ht str 5151 - lower core hot channel fuel plates                    •
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15151000   5 11  1  1                  0.      0      0       0
•
*htstr         mesh locn       mesh fmt
15151100           0              1
•
*htstr         intervals       rt. coord
15151101           2             1.055e-5
15151102           2             2.5700e-4
15151103           6             6.3800e-4
*
*htstr         compxn no.      interval
15151201           4              2
15151202           2              4
15151203           5              10
*
*htstr         source          interval
15151301         0.               2
15151302       0.0023234          4
15151303       0.36647            10
•
15151401 400. 11
•
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15151501   515010000   10000     1      0       0.01031          5
15151501   515010000   10000     102    0      0.01031          5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15151601   0           0       0       0      0.01031          5
•
*htstr       s.type     s.mult      left heat   right heat   ht str
15151701   1000  2.5457355d-04  5.3814481d-06  0.0000000d+00      1
15151702   1000  2.4995613d-04  5.2838402d-06  0.0000000d+00      2
15151703   1000  2.3441083d-04  4.9552270d-06  0.0000000d+00      3
15151704   1000  2.1671073d-04  4.5810634d-06  0.0000000d+00      4
15151705   1000  1.8931407d-04  4.0019233d-06  0.0000000d+00      5
*htstr
*mod2.5*15151801 0 0.0 0.0 0.0 5
15151801 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*htstr
*mod2.5*15151901 0 0.0 0.0 0.0 5
15151901 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*---------------------------------------------------------------------*
*  ht str 5152 - lower core hot channel inner side plate - (95%)      •
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15152000   5  4  2  1                0.162     0      0       0
*
*htstr         mesh locn       mesh fmt
15152100           0              1
•
*htstr         intervals       rt. coord
15152101           3             0.169
•
*htstr         compxn no.      interval
15152201           2              3
•
*htstr         source          interval
15152301         1.               3
15152401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15152501   568100000   10000   1       1       0.0001           5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15152601   515010000   10000   1       1       0.0001           5
*
*htstr       s. type     s. mult     left heat   right heat   ht str no.
15152701   1000  7.6721999d-07  1.9392606d-06  0.0000000d+00      1
15152702   1000  7.5330427d-07  1.9040866d-06  0.0000000d+00      2
15152703   1000  7.0645468d-07  1.7856674d-06  0.0000000d+00      3
15152704   1000  6.5311109d-07  1.6508337d-06  0.0000000d+00      4
15152705   1000  5.7054449d-07  1.4421346d-06  0.0000000d+00      5
•
*htstr
*mod2.5*15152801 0 0.0 0.0 0.0 5
15152801 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*htstr
*mod2.5*15152901 0 0.0 0.0 0.0 5
15152901 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*---------------------------------------------------------------------*
*  ht str 5153 - lower core hot channel outer side plate (95%)        *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15153000   5  4  2  1                 0.224     0      0       0
*
*htstr         mesh locn       mesh fmt
15153100           0              1
*
*htstr         intervals       rt. coord
15153101           3              0.231
*
*htstr         compxn no.      interval
15153201           2              3
*
*htstr         source          interval
15153301         1.               3
15153401 400. 4
•
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15153501   515010000   10000   1       1       0.0001           5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15153601   530100000   10000   1       1       0.0001           5
*
*htstr       s. type     s. mult     left heat   right heat   ht str no.
15153701   1000  1.0542998d-06  0.0000000d+00  2.2786312d-06      1
15153702   1000  1.0351771d-06  0.0000000d+00  2.2373018d-06      2
15153703   1000  9.7079723d-07  0.0000000d+00  2.0981592d-06      3
15153704   1000  8.9749344d-07  0.0000000d+00  1.9397296d-06      4
15153705   1000  7.8403191d-07  0.0000000d+00  1.6945081d-06      5
•
*htstr
*mod2.5*15153801 0 0.0 0.0 0.0 5
15153801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15153901 0 0.0 0.0 0.0 5
```

```
15153901 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*-----------------------------------------------------------------------*
•  ht str 5154 - lower core hot stripe - 95% probability - chf          •
*-----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
15154000   5 11  1  1                  0.      0      0        0
•
*htstr         mesh locn       mesh fmt
15154100           0              1
•
*htstr         intervals       rt. coord
15154101           2             1.055e-5
15154102           2             2.5700e-4
15154103           6             6.3800e-4
•
*htstr         compxn no.      interval
15154201           4              2
15154202           2              4
15154203           5              10
•
*htstr         source          interval
15154301         0.               2
15154302       0.0023234          4
15154303       0.36647            10
*
15154401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15154501   515010000   10000     1     0      0.0001031          5
15154501   515010000   10000     102  0      0.0001031          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15154601   0           0       0      0      0.0001031          5
•
*htstr       s.type     s.mult      left heat    right heat    ht str
15154701   1000  3.9945971d-06  0.0000000d+00  0.0000000d+00       1
15154702   1000  3.7402509d-06  0.0000000d+00  0.0000000d+00       2
15154703   1000  3.5563042d-06  0.0000000d+00  0.0000000d+00       3
15154704   1000  3.2974161d-06  0.0000000d+00  0.0000000d+00       4
15154705   1000  3.0112767d-06  0.0000000d+00  0.0000000d+00       5
*
*htstr
*mod2.5*15154801 0 0.0 0.0 0.0 5
15154801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15154901 0 0.0 0.0 0.0 5
15154901 0. 10. 10. 0. 0. 0. 0. 1.  5
•
*-----------------------------------------------------------------------*
•  ht str 5155 - lower core hot stripe - 95% probability - fe          •
*-----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
15155000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15155100           0              1
•
*htstr         intervals       rt. coord
15155101           2             1.055e-5
15155102           2             2.5700e-4
15155103           6             6.3800e-4
*
*htstr         compxn no.      interval
15155201           4              2
15155202           2              4
15155203           5              10
•
*htstr         source          interval
15155301         0.               2
15155302       0.0023234          4
15155303       0.36647            10
*
15155401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15155501   515010000   10000     1     0      0.0001031          5
15155501   515010000   10000     102  0      0.0001031          5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15155601   0           0       0      0      0.0001031          5
•
*htstr       s.type     s.mult      left heat    right heat    ht str
15155701   1000  3.0820611d-06  0.0000000d+00  0.0000000d+00       1
15155702   1000  2.9417974d-06  0.0000000d+00  0.0000000d+00       2
15155703   1000  2.7285965d-06  0.0000000d+00  0.0000000d+00       3
15155704   1000  2.4966939d-06  0.0000000d+00  0.0000000d+00       4
15155705   1000  1.9169373d-06  0.0000000d+00  0.0000000d+00       5
*
*htstr
*mod2.5*15155801 0 0.0 0.0 0.0 5
15155801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15155901 0 0.0 0.0 0.0 5
15155901 0. 10. 10. 0. 0. 0. 0. 1.  5
•
*-----------------------------------------------------------------------*
•  ht str 5161 - lower core hot channel fuel plates (99.9% probability)*
*-----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  1.coord   refl  b.vol  axl. incr
15161000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15161100           0              1
*
*htstr         intervals       rt. coord
15161101           2             1.055e-5
15161102           2             2.5700e-4
15161103           6             6.3800e-4
•
*htstr         compxn no.      interval
15161201           4              2
15161202           2              4
15161203           5              10
*
*htstr         source          interval
15161301         0.               2
15161302       0.0023234          4
15161303       0.36647            10
•
15161401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15161501   516010000   10000     1      0      0.01031          5
15161501   516010000   10000     102    0      0.01031          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15161601   0           0       0       0      0.01031          5
```

```
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15161701   1000  2.6381783d-04  5.5768637d-06  0.0000000d+00      1
15161702   1000  2.5903275d-04  5.4757114d-06  0.0000000d+00      2
15161703   1000  2.4292295d-04  5.1351653d-06  0.0000000d+00      3
15161704   1000  2.2458012d-04  4.7474148d-06  0.0000000d+00      4
15161705   1000  1.9618860d-04  4.1472445d-06  0.0000000d+00      5
*htstr
*mod2.5*15161801 0 0.0 0.0 0.0 5
15161801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15161901 0 0.0 0.0 0.0 5
15161901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*
*---------------------------------------------------------------------*
*  ht str 5162 - lower core hot channel inner side plate (99.9%)      *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15162000   5  4  2  1                0.095     0      0        0
*
*htstr         mesh locn       mesh fmt
15162100           0              1
*
*htstr         intervals       rt. coord
15162101           3             0.102
*
*htstr         compxn no.      interval
15162201           2              3
*
*htstr         source          interval
15162301          1.              3
15162401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15162501   568100000   10000   1        1       0.0001          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15162601   516010000   10000   1        1       0.0001          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15162701   1000  7.9507992d-07  2.0096950d-06  0.0000000d+00      1
15162702   1000  7.8065888d-07  1.9732435d-06  0.0000000d+00      2
15162703   1000  7.3210805d-07  1.8505233d-06  0.0000000d+00      3
15162704   1000  6.7682740d-07  1.7107924d-06  0.0000000d+00      4
15162705   1000  5.9126257d-07  1.4945132d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15162801 0 0.0 0.0 0.0 5
15162801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15162901 0 0.0 0.0 0.0 5
15162901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*---------------------------------------------------------------------*
*  ht str 5163 - lower core hot channel outer side plate (99.9%)      *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15163000   5  4  2  1                0.168     0      0        0
*
*htstr         mesh locn       mesh fmt
15163100           0              1
*
*htstr         intervals       rt. coord
15163101           3             0.175
*
*htstr         compxn no.      interval
15163201           2              3
*
*htstr         source          interval
15163301          1.              3
15163401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15163501   516010000   10000   1        1       0.0001          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15163601   530100000   10000   1        1       0.0001          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15163701   1000  1.0925844d-06  0.0000000d+00  2.3613748d-06      1
15163702   1000  1.0727673d-06  0.0000000d+00  2.3185445d-06      2
15163703   1000  1.0060496d-06  0.0000000d+00  2.1743493d-06      3
15163704   1000  9.3008397d-07  0.0000000d+00  2.0101667d-06      4
15163705   1000  8.1250233d-07  0.0000000d+00  1.7560405d-06      5
*
*htstr
*mod2.5*15163801 0 0.0 0.0 0.0 5
15163801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15163901 0 0.0 0.0 0.0 5
15163901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*---------------------------------------------------------------------*
*  ht str 5164 - lower core hot stripe  - 99.9% probability - chf     *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15164000   5 11  1  1                    0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15164100           0              1
*
*htstr         intervals       rt. coord
15164101           2             1.055e-5
15164102           2             2.5700e-4
15164103           6             6.3800e-4
*
*htstr         compxn no.      interval
15164201           4              2
15164202           2              4
15164203           5              10
*
*htstr         source          interval
15164301          0.              2
15164302       0.0023234          4
15164303       0.36647            10
*
15164401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15164501   516010000   10000     1    0      0.0001031          5
15164501   516010000   10000     102  0      0.0001031          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15164601   0           0       0      0      0.0001031          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
```

```
15164701   1000  4.8833404d-06  0.0000000d+00  0.0000000d+00      1
15164702   1000  4.5724057d-06  0.0000000d+00  0.0000000d+00      2
15164703   1000  4.3475333d-06  0.0000000d+00  0.0000000d+00      3
15164704   1000  4.0310462d-06  0.0000000d+00  0.0000000d+00      4
15164705   1000  3.6812446d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15164801 0 0.0 0.0 0.0 5
15164801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15164901 0 0.0 0.0 0.0 5
15164901 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*----------------------------------------------------------------------*
*  ht str 5165 - lower core hot stripe  - 99.9% probability - fe       *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15165000   5 11  1  1                  0.      0      0       0
*
*htstr         mesh locn       mesh fmt
15165100           0              1
*
*htstr         intervals       rt. coord
15165101           2             1.055e-5
15165102           2             2.5700e-4
15165103           6             6.3800e-4
*
*htstr         compxn no.      interval
15165201           4              2
15165202           2              4
15165203           5              10
*
*htstr         source          interval
15165301          0.              2
15165302       0.0023234          4
15165303       0.36647            10
*
15165401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15165501   516010000   10000     1    0      0.0001031          5
15165501   516010000   10000     102  0      0.0001031          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15165601   0           0       0      0      0.0001031          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15165701   1000  3.7598783d-06  0.0000000d+00  0.0000000d+00      1
15165702   1000  3.5887673d-06  0.0000000d+00  0.0000000d+00      2
15165703   1000  3.3286786d-06  0.0000000d+00  0.0000000d+00      3
15165704   1000  3.0457752d-06  0.0000000d+00  0.0000000d+00      4
15165705   1000  2.3385165d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15165801 0 0.0 0.0 0.0 5
15165801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15165901 0 0.0 0.0 0.0 5
15165901 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*----------------------------------------------------------------------*
*  ht str 5201 - control rod shroud in mid core region                 *
*----------------------------------------------------------------------*
```

```
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15201000   1  4  2  1                  0.095     0      0       0
*
*htstr         mesh locn       mesh fmt
15201100           0              1
*
*htstr         intervals       rt. coord
15201101           3              0.102
*
*htstr         compxn no.      interval
15201201           2              3
*
*htstr         source          interval
15201301          0.              3
15201401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15201501   562060000   0       1       1        0.116          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15201601   572010000   0       1       1        0.116          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15201701     0            0.           0.          0.         1
*
*htstr
*mod2.5*15201801 0 0.0 0.0 0.0 1
15201801 0.19 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*15201901 0 0.0 0.0 0.0 1
15201901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*----------------------------------------------------------------------*
*  ht str 5202 - lower/upper core separation shroud in mid core region *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15202000   1  4  2  1                  0.224     0      0       0
*
*htstr         mesh locn       mesh fmt
15202100           0              1
*
*htstr         intervals       rt. coord
15202101           3              0.231
*
*htstr         compxn no.      interval
15202201           2              3
*
*htstr         source          interval
15202301          0.              3
15202401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15202501   520010000   0       1       1        0.116          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15202601   535010000   0       1       1        0.116          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15202701     0            0.           0.          0.         1
*
*htstr
*mod2.5*15202801 0 0.0 0.0 0.0 1
15202801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
```

```
*htstr
*mod2.5*15202901 0 0.0 0.0 0.0 1
15202901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*---------------------------------------------------------------------*
*  ht str 5203 - inner/lower core separation shroud in mid core region *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15203000   1  4  2  1                0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15203100           0              1
*
*htstr         intervals       rt. coord
15203101           3             0.169
*
*htstr         compxn no.      interval
15203201           2              3
*
*htstr         source          interval
15203301          0.              3
15203401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15203501   572010000   0       1        1        0.116          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15203601   520010000   0       1        1        0.116          1
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15203701       0           0.           0.         0.          1
*
*htstr
*mod2.5*15203801 0 0.0 0.0 0.0 1
15203801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*15203901 0 0.0 0.0 0.0 1
15203901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*---------------------------------------------------------------------*
*  ht str 5351 - cbpt in mid core region                              *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15351000   1  4  2  1                0.281     0      0        0
*
*htstr         mesh locn       mesh fmt
15351100           0              1
*
*htstr         intervals       rt. coord
15351101           3             0.286
*
*htstr         compxn no.      interval
15351201           2              3
*
*htstr         source          interval
15351301          0.              3
15351401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15351501   535010000   0       1        1        0.116          1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15351601   550150000   0       1        1        0.116          1
*
```

```
* include all of the d2o heating in cpbt annulus here
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15351701      1000         0.0          0.0     0.00245         1
*
*htstr
*mod2.5*15351801 0 0.0 0.0 0.0 1
15351801 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*htstr
*mod2.5*15351901 0 0.0 0.0 0.0 1
15351901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*---------------------------------------------------------------------*
*  ht str 5401 - upper core average channel fuel plates               *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15401000   5 11  1  1                   0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15401100           0              1
*
*htstr         intervals       rt. coord
15401101           2             1.055e-5
15401102           2             2.5700e-4
15401103           6             6.3800e-4
*
*htstr         compxn no.      interval
15401201           4              2
15401202           2              4
15401203           5              10
*
*htstr         source          interval
15401301          0.              2
15401302       0.0025414          4
15401303       0.40085            10
*
15401401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15401501   540010000   10000     1       0        5.05           5
15401501   540010000   10000     102     0       5.05           5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15401601   0           0       0        0       5.05           5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15401701   1000  9.4681501d-02  1.5542655d-03  0.0000000d+00      1
15401702   1000  9.0056054d-02  1.4783355d-03  0.0000000d+00      2
15401703   1000  8.1646150d-02  1.3402808d-03  0.0000000d+00      3
15401704   1000  7.1904678d-02  1.1803675d-03  0.0000000d+00      4
15401705   1000  6.1812793d-02  1.0147018d-03  0.0000000d+00      5
*
*htstr
*mod2.5*15401801 0 0.0 0.0 0.0 5
15401801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15401901 0 0.0 0.0 0.0 5
15401901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*---------------------------------------------------------------------*
*  ht str 5402 - upper core average channel inner side plate          *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15402000   5  4  2  1                0.224     0      0        0
```

```
*
*htstr          mesh locn       mesh fmt
15402100            0             1
*
*htstr          intervals       rt. coord
15402101            3             0.231
*
*htstr          compxn no.      interval
15402201            2             3
*
*htstr          source          interval
15402301          1.              3
15402401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15402501   525010000   10000   1        1       0.0417          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15402601   540010000   10000   1        1       0.0417          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15402701   1000  2.6994765d-04  9.1371970d-04  0.0000000d+00      1
15402702   1000  2.5675998d-04  8.6908203d-04  0.0000000d+00      2
15402703   1000  2.3278240d-04  7.8792262d-04  0.0000000d+00      3
15402704   1000  2.0500836d-04  6.9391297d-04  0.0000000d+00      4
15402705   1000  1.7623526d-04  5.9652167d-04  0.0000000d+00      5
*
*htstr
*mod2.5*15402801 0 0.0 0.0 0.0 5
15402801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15402901 0 0.0 0.0 0.0 5
15402901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5451 - upper core hot channel fuel plates (95%)               *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15451000   5 11  1  1                  0.       0      0        0
*
*htstr          mesh locn       mesh fmt
15451100            0             1
*
*htstr          intervals       rt. coord
15451101            2             1.055e-5
15451102            2             2.5700e-4
15451103            6             6.3800e-4
*
*htstr          compxn no.      interval
15451201            4             2
15451202            2             4
15451203            5             10
*
*htstr          source          interval
15451301          0.              2
15451302        0.0025414         4
15451303        0.40085           10
*
15451401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15451501   545010000   10000     1       0      0.00888         5
15451501   545010000   10000     102     0      0.00888         5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15451601   0           0       0        0      0.00888         5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15451701   1000  2.1485370d-04  3.5269793d-06  0.0000000d+00      1
15451702   1000  2.1432385d-04  3.5182814d-06  0.0000000d+00      2
15451703   1000  1.9803100d-04  3.2508225d-06  0.0000000d+00      3
15451704   1000  1.7855905d-04  2.9311764d-06  0.0000000d+00      4
15451705   1000  1.5299385d-04  2.5115050d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15451801 0 0.0 0.0 0.0 5
15451801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15451901 0 0.0 0.0 0.0 5
15451901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5452 - upper core hot channel inner side plate (95%)          *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15452000   5  4  2  1                  0.224     0      0        0
*
*htstr          mesh locn       mesh fmt
15452100            0             1
*
*htstr          intervals       rt. coord
15452101            3             0.231
*
*htstr          compxn no.      interval
15452201            2             3
*
*htstr          source          interval
15452301          1.              3
15452401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15452501   525010000   10000   1        1       0.0000732       5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15452601   545010000   10000   1        1       0.0000732       5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15452701   1000  6.1257216d-07  2.0734363d-06  0.0000000d+00      1
15452702   1000  6.1106150d-07  2.0683230d-06  0.0000000d+00      2
15452703   1000  5.6460874d-07  1.9110895d-06  0.0000000d+00      3
15452704   1000  5.0909203d-07  1.7231764d-06  0.0000000d+00      4
15452705   1000  4.3620274d-07  1.4764605d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15452801 0 0.0 0.0 0.0 5
15452801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15452901 0 0.0 0.0 0.0 5
15452901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5454 - upper core hot stripe - 95% probability - chf          *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15454000   5 11  1  1                  0.       0      0        0
*
*htstr          mesh locn       mesh fmt
```

```
15454100           0              1
*
*htstr         intervals       rt. coord
15454101           2             1.055e-5
15454102           2             2.5700e-4
15454103           6             6.3800e-4
*
*htstr         compxn no.      interval
15454201           4               2
15454202           2               4
15454203           5               10
*
*htstr         source          interval
15454301         0.                2
15454302       0.0025414           4
15454303       0.40085             10
*
15454401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15454501   545010000   10000     1    0      0.0000888          5
15454501   545010000   10000     102  0      0.0000888          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15454601   0           0       0      0      0.0000888          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15454701   1000  3.3410527d-06  0.0000000d+00  0.0000000d+00      1
15454702   1000  3.2394535d-06  0.0000000d+00  0.0000000d+00      2
15454703   1000  3.0206243d-06  0.0000000d+00  0.0000000d+00      3
15454704   1000  2.7451340d-06  0.0000000d+00  0.0000000d+00      4
15454705   1000  2.4579207d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15454801 0 0.0 0.0 0.0 5
15454801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15454901 0 0.0 0.0 0.0 5
15454901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5455 - upper core hot stripe - 95% probability - fe           *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15455000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15455100           0               1
*
*htstr         intervals       rt. coord
15455101           2             1.055e-5
15455102           2             2.5700e-4
15455103           6             6.3800e-4
*
*htstr         compxn no.      interval
15455201           4               2
15455202           2               4
15455203           5               10
*
*htstr         source          interval
15455301         0.                2
15455302       0.0025414           4
15455303       0.40085             10
*
```

```
15455401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15455501   545010000   10000     1    0      0.0000888          5
15455501   545010000   10000     102  0      0.0000888          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15455601   0           0       0      0      0.0000888          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15455701   1000  2.6782525d-06  0.0000000d+00  0.0000000d+00      1
15455702   1000  2.5012045d-06  0.0000000d+00  0.0000000d+00      2
15455703   1000  2.2774803d-06  0.0000000d+00  0.0000000d+00      3
15455704   1000  2.0376608d-06  0.0000000d+00  0.0000000d+00      4
15455705   1000  1.4582312d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15455801 0 0.0 0.0 0.0 5
15455801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15455901 0 0.0 0.0 0.0 5
15455901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
* ht str 5461 - upper core hot channel fuel plates (99.9%)             *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15461000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15461100           0               1
*
*htstr         intervals       rt. coord
15461101           2             1.055e-5
15461102           2             2.5700e-4
15461103           6             6.3800e-4
*
*htstr         compxn no.      interval
15461201           4               2
15461202           2               4
15461203           5               10
*
*htstr         source          interval
15461301         0.                2
15461302       0.0025414           4
15461303       0.40085             10
*
15461401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15461501   546010000   10000     1      0      0.00888          5
15461501   546010000   10000     102    0      0.00888          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15461601   0           0       0        0      0.00888          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15461701   1000  2.2265565d-04  3.6550541d-06  0.0000000d+00      1
15461702   1000  2.2210656d-04  3.6460404d-06  0.0000000d+00      2
15461703   1000  2.0522207d-04  3.3688692d-06  0.0000000d+00      3
15461704   1000  1.8504305d-04  3.0376158d-06  0.0000000d+00      4
15461705   1000  1.5854949d-04  2.6027050d-06  0.0000000d+00      5
*
*htstr
```

```
*mod2.5*15461801 0 0.0 0.0 0.0 5
15461801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15461901 0 0.0 0.0 0.0 5
15461901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
* ht str 5462 - upper core hot channel inner side plate (99.9%)     *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15462000   5  4  2  1                 0.224     0      0        0
*
*htstr         mesh locn       mesh fmt
15462100           0              1
*
*htstr         intervals       rt. coord
15462101           3             0.231
*
*htstr         compxn no.      interval
15462201           2              3
*
*htstr         source          interval
15462301          1.              3
15462401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15462501   525010000   10000   1        1       0.0000732       5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15462601   546010000   10000   1        1       0.0000732       5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15462701   1000  6.3481642d-07  2.1487287d-06  0.0000000d+00      1
15462702   1000  6.3325090d-07  2.1434297d-06  0.0000000d+00      2
15462703   1000  5.8511131d-07  1.9804867d-06  0.0000000d+00      3
15462704   1000  5.2757862d-07  1.7857499d-06  0.0000000d+00      4
15462705   1000  4.5204252d-07  1.5300750d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15462801 0 0.0 0.0 0.0 5
15462801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15462901 0 0.0 0.0 0.0 5
15462901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
* ht str 5464 - upper core hot stripe - 99.9% probability - chf     *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15464000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15464100           0              1
*
*htstr         intervals       rt. coord
15464101           2             1.055e-5
15464102           2             2.5700e-4
15464103           6             6.3800e-4
*
*htstr         compxn no.      interval
15464201           4              2
15464202           2              4
15464203           5              10
*
*htstr         source          interval
15464301          0.              2
15464302       0.0025414          4
15464303       0.40085            10
*
15464401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15464501   546010000   10000     1    0      0.0000888          5
15464501   546010000   10000     102  0       0.0000888          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15464601   0           0       0      0       0.0000888          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15464701   1000  4.0843664d-06  0.0000000d+00  0.0000000d+00      1
15464702   1000  3.9601635d-06  0.0000000d+00  0.0000000d+00      2
15464703   1000  3.6926494d-06  0.0000000d+00  0.0000000d+00      3
15464704   1000  3.3558683d-06  0.0000000d+00  0.0000000d+00      4
15464705   1000  3.0047561d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15464801 0 0.0 0.0 0.0 5
15464801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15464901 0 0.0 0.0 0.0 5
15464901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
* ht str 5465 - upper core hot stripe - 99.9% probability - fe      *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15465000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15465100           0              1
*
*htstr         intervals       rt. coord
15465101           2             1.055e-5
15465102           2             2.5700e-4
15465103           6             6.3800e-4
*
*htstr         compxn no.      interval
15465201           4              2
15465202           2              4
15465203           5              10
*
*htstr         source          interval
15465301          0.              2
15465302       0.0025414          4
15465303       0.40085            10
*
15465401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15465501   546010000   10000     1    0      0.0000888          5
15465501   546010000   10000     102  0       0.0000888          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15465601   0           0       0      0       0.0000888          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15465701   1000  3.2672629d-06  0.0000000d+00  0.0000000d+00      1
```

```
15465702   1000  3.0512779d-06  0.0000000d+00  0.0000000d+00      2
15465703   1000  2.7783515d-06  0.0000000d+00  0.0000000d+00      3
15465704   1000  2.4857901d-06  0.0000000d+00  0.0000000d+00      4
15465705   1000  1.7789304d-06  0.0000000d+00  0.0000000d+00      5
•
*htstr
*mod2.5*15465801 0 0.0 0.0 0.0 5
15465801 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*htstr
*mod2.5*15465901 0 0.0 0.0 0.0 5
15465901 0. 10. 10. 0. 0. 0. 0. 1. 5
•
*------------------------------------------------------------------------*
•  ht str 5501 - outer cpbt in uc and lc regions                         *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15501000   10 4  2  1                 0.291     0       0        0
•
*htstr         mesh locn       mesh fmt
15501100           0             1
*
*htstr         intervals       rt. coord
15501101           3             0.301
•
*htstr         compxn no.      interval
15501201           2             3
*
*htstr         source          interval
15501301          1.             3
15501401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15501501   550100000   10000   1        1       0.0836          5
15501502   550160000   10000   1        1       0.0836         10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15501601   595010000   0       1        1       0.0836         10
•
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15501701    10775       0.626         0.0         0.0          1
15501702    10774       0.626         0.0         0.0          2
15501703    10773       0.626         0.0         0.0          3
15501704    10772       0.626         0.0         0.0          4
15501705    10771       0.626         0.0         0.0          5
15501706    10735       0.789         0.0         0.0          6
15501707    10734       0.789         0.0         0.0          7
15501708    10733       0.789         0.0         0.0          8
15501709    10732       0.789         0.0         0.0          9
15501710    10731       0.789         0.0         0.0         10
*
*htstr
*mod2.5*15501801 0 0.0 0.0 0.0 10
15501801 0. 10. 10. 0. 0. 0. 0. 1. 10
•
*htstr
*mod2.5*15501901 0 0.0 0.0 0.0 10
15501901 0. 10. 10. 0. 0. 0. 0. 1. 10
*
*------------------------------------------------------------------------*
•  ht str 5502 - inner cbpt in lower core region                         *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15502000   5  4  2  1                 0.281     0       0        0
*
```

```
*htstr         mesh locn       mesh fmt
15502100           0             1
•
*htstr         intervals       rt. coord
15502101           3             0.286
•
*htstr         compxn no.      interval
15502201           2             3
*
*htstr         source          interval
15502301          1.             3
15502401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15502501   530100000   10000   1        1       0.0836          5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15502601   550100000   10000   1        1       0.0836         5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15502701    10775       0.374         0.          0.           1
15502702    10774       0.374         0.          0.           2
15502703    10773       0.374         0.          0.           3
15502704    10772       0.374         0.          0.           4
15502705    10771       0.374         0.          0.           5
*
*htstr
*mod2.5*15502801 0 0.0 0.0 0.0 5
15502801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15502901 0 0.0 0.0 0.0 5
15502901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*------------------------------------------------------------------------*
•  ht str 5503 - inner cbpt in upper core region                         *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord    refl  b.vol  axl. incr
15503000   5  4  2  1                 0.281     0       0        0
•
*htstr         mesh locn       mesh fmt
15503100           0             1
•
*htstr         intervals       rt. coord
15503101           3             0.288
•
*htstr         compxn no.      interval
15503201           2             3
•
*htstr         source          interval
15503301          1.             3
15503401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15503501   540010000   10000   1        1       0.0836          5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15503601   550160000   10000   1        1       0.0836         5
•
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15503701    10735       0.211         0.          0.           1
15503702    10734       0.211         0.          0.           2
15503703    10733       0.211         0.          0.           3
15503704    10732       0.211         0.          0.           4
15503705    10731       0.211         0.          0.           5
```

```
*
*htstr
*mod2.5*15503801 0 0.0 0.0 0.0 5
15503801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15503901 0 0.0 0.0 0.0 5
15503901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*----------------------------------------------------------------------*
*  ht str 5551 - lower/upper core sprtn shroud in core outlet region   *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15551000   2  4  2  1                0.224     0      0        0
*
*htstr         mesh locn       mesh fmt
15551100           0              1
*
*htstr         intervals       rt. coord
15551101           3              0.231
*
*htstr         compxn no.      interval
15551201           2              3
*
*htstr         source          interval
15551301           0.             3
15551401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15551501   525010000   10000   1        1        0.7715         2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15551601   555010000   2000000 1        1        0.7715         2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15551701       0           0            0          0           2
*
*htstr
*mod2.5*15551801 0 0.0 0.0 0.0 2
15551801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*15551901 0 0.0 0.0 0.0 2
15551901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*----------------------------------------------------------------------*
*  ht str 5552 - cbpt in core outlet region                            *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15552000  10  4  2  1                0.281     0      0        0
*
*htstr         mesh locn       mesh fmt
15552100           0              1
*
*htstr         intervals       rt. coord
15552101           3              0.286
*
*htstr         compxn no.      interval
15552201           2              3
*
*htstr         source          interval
15552301           0.             3
15552401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15552501   555010000   10000   1        1        0.1543         5
15552502   557010000   10000   1        1        0.1543         10
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15552601   550210000   10000   1        1        0.1543         10
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15552701       0           0            0          0           10
*
*htstr
*mod2.5*15552801 0 0.0 0.0 0.0 10
15552801 0. 10. 10. 0. 0. 0. 0. 1. 10
*
*htstr
*mod2.5*15552901 0 0.0 0.0 0.0 10
15552901 0. 10. 10. 0. 0. 0. 0. 1. 10
*
*----------------------------------------------------------------------*
*  ht str 5553 - inner/lower core sprtn shroud in core outlet region   *
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15553000   2  4  2  1                0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15553100           0              1
*
*htstr         intervals       rt. coord
15553101           3              0.169
*
*htstr         compxn no.      interval
15553201           2              3
*
*htstr         source          interval
15553301           0.             3
15553401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15553501   580010000   50000   1        1        0.7715         2
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15553601   525010000   50000   1        1        0.7715         2
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15553701       0           0            0          0           2
*
*htstr
*mod2.5*15553801 0 0.0 0.0 0.0 2
15553801 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*htstr
*mod2.5*15553901 0 0.0 0.0 0.0 2
15553901 0. 10. 10. 0. 0. 0. 0. 1. 2
*
*----------------------------------------------------------------------*
*
$       ht str no. 5611  control rod aluminum (8-35 deg sectors)
*----------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15611000    11      4     2     1     0.022     0      0        0
*
*htstr         mesh locn       mesh fmt
15611100           0              1
*
*htstr         intervals       rt. coord
15611101           3              0.0285
```

```
*
*htstr         compxn no.      interval
15611201           2               3
*
*htstr         source          interval
15611301          1.               3
15611401  400.  4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15611501   561010000   10000   1       1       0.23660         5
15611502   561060000   0       1       1       0.11667         6
15611503   561070000   10000   1       1       0.23660         11
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15611601   563010000   10000   1       1       0.23660         5
15611602   563060000   0       1       1       0.11667         6
15611603   563070000   10000   1       1       0.23660         11
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15611701     10641       0.166          0.         0.          1
15611702     10641       0.205          0.         0.          2
15611703     10641       0.211          0.         0.          3
15611704     10641       0.210          0.         0.          4
15611705     10641       0.208          0.         0.          5
15611706       0           0            0          0           6
15611707       0           0            0.         0.          7
15611708       0           0            0.         0.          8
15611709       0           0            0.         0.          9
15611710       0           0            0.         0.          10
15611711       0           0            0.         0.          11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15611801       0           0.           0          0            11
15611801    0. 10. 10. 0. 0. 0. 0. 1. 11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15611901       0           0.           0          0            11
15611901    0. 10. 10. 0. 0. 0. 0. 1. 11
*
$=====================================================================$
$  ht str no. 5621   control rod hafnium/aluminum (8-10 degree sectors)
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15621000    11     10     2     1     0.022     0      0        0
*
*htstr         mesh locn       mesh fmt
15621100           0               1
*
*htstr         intervals       rt. coord
15621101           3              0.0285
15621102           2             0.03125
15621103           1              0.0315
15621104           3              0.0355
*
*htstr         compxn no.      interval
15621201           2               5
15621202           6               6
15621203           3               9
*
*htstr         source          interval
15621301         0.2               5
15621302         0.                6
15621303         0.8               9
*
15621401  400.  10
```

```
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15621501   561010000   10000   1       1       0.0676          5
15621502   561060000   0       1       1       0.0333          6
15621503   561070000   10000   1       1       0.0676          11
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15621601   562010000   10000   1       1       0.0676          5
15621602   562060000   0       1       1       0.0333          6
15621603   562070000   10000   1       1       0.0676          11
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15621701     10642       0.166          0.         0.          1
15621702     10642       0.205          0.         0.          2
15621703     10642       0.211          0.         0.          3
15621704     10642       0.210          0.         0.          4
15621705     10642       0.208          0.         0.          5
15621706       0           0            0          0           6
15621707       0           0            0.         0.          7
15621708       0           0            0.         0.          8
15621709       0           0            0.         0.          9
15621710       0           0            0.         0.          10
15621711       0           0            0.         0.          11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15621801       0           0.           0          0            11
15621801    0. 10. 10. 0. 0. 0. 0. 1. 11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15621901       0           0.           0          0            11
15621901    0. 10. 10. 0. 0. 0. 0. 1. 11
*
$=====================================================================$
$  ht str no. 5631  control rod hafnium structure (8-35 degree sectors)
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15631000    11     4     2     1     0.03125    0      0        0
*
*htstr         mesh locn       mesh fmt
15631100           0               1
*
*htstr         intervals       rt. coord
15631101           3              0.0355
*
*htstr         compxn no.      interval
15631201           3               3
*
*htstr         source          interval
15631301          1.               3
15631401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15631501   563010000   10000   1       1       0.23660         5
15631502   563060000   0       1       1       0.11667         6
15631503   563070000   10000   1       1       0.23660         11
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15631601   562010000   10000   1       1       0.23660         5
15631602   562060000   0       1       1       0.11667         6
15631603   562070000   10000   1       1       0.23660         11
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15631701     10643       0.166          0.         0.          1
15631702     10643       0.205          0.         0.          2
15631703     10643       0.211          0.         0.          3
```

```
15631704     10643       0.210          0.          0.          4
15631705     10643       0.208          0.          0.          5
15631706       0           0            0           0          6
15631707       0           0            0.          0.         7
15631708       0           0            0.          0.         8
15631709       0           0            0.          0.         9
15631710       0           0            0.          0.         10
15631711       0           0            0.          0.         11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15631801       0           0.           0          0           11
15631801    0. 10. 10. 0. 0. 0. 0. 1. 11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15631901       0           0.           0          0           11
15631901    0. 10. 10. 0. 0. 0. 0. 1. 11
*
$=====================================================================$
$        ht str no. 5612  structure for gamma heating of inner flow    $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15612000    11 .     2     1     1       0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15612100           0              1
*
*htstr         intervals       rt. coord
15612101           1              0.001
*
*htstr         compxn no.      interval
15612201           2              1
*
*htstr         source          interval
15612301          1.              1
15612401 400. 2
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15612501   561010000   10000   1        0          0.01         11
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15612601   0           0       0        0          0.01         11
*
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15612701     10613         0.          .166        0.           1
15612702     10613         0.          .205        0.           2
15612703     10613         0.          .211        0.           3
15612704     10613         0.          .210        0.           4
15612705     10613         0.          .208        0.           5
15612706       0           0.          0.          0.           6
15612707     10640         0.          .166        0.           7
15612708     10640         0.          .205        0.           8
15612709     10640         0.          .211        0.           9
15612710     10640         0.          .210        0.           10
15612711     10640         0.          .208        0.           11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15612801       0           0.           0          0           11
15612801   0.  10.  10. 0. 0. 0. 0. 1. 11
*
$=====================================================================$
$       ht str no. 5622  structure for gamma heating of flow around rod
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15622000    11      2     1     1       0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15622100           0              1
*
*htstr         intervals       rt. coord
15622101           1              0.001
*
*htstr         compxn no.      interval
15622201           2              1
*
*htstr         source          interval
15622301          1.              1
15622401 400. 2
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15622501   562010000   10000   1        0          0.01         11
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15622601   0           0       0        0          0.01         11
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15622701     10700         0.          1.          0.           1
15622702     10699         0.          1.          0.           2
15622703     10698         0.          1.          0.           3
15622704     10697         0.          1.          0.           4
15622705     10696         0.          1.          0.           5
15622706       0           0.          1.          0.           6
15622707     10675         0.          1.          0.           7
15622708     10674         0.          1.          0.           8
15622709     10673         0.          1.          0.           9
15622710     10672         0.          1.          0.           10
15622711     10671         0.          1.          0.           11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15622801       0           0.           0          0           11
15622801    0.    10. 10. 0. 0. 0. 0. 1. 11
*
*htstr     chf flag     hyd diam    equiv diam   ch. len    ht str no.
*mod2.5*15622901       0           0.           0          0           11
15622901    0.    10. 10. 0. 0. 0. 0. 1. 11
*
*---------------------------------------------------------------------*
*  ht str 5651 - core outlet pipe wall                                *
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15651000   5  4  2  1                0.28019   0      0        0
*
*htstr         mesh locn       mesh fmt
15651100           0              1
*
*htstr         intervals       rt. coord
15651101           3              0.3048
*
*htstr         compxn no.      interval
15651201           1              3
*
*htstr         source          interval
15651301          0.              3
15651401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15651501   565010000   10000   1        1          0.1836       5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15651601   0           0       0        1          0.1836       5
*
```

```
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15651701       0           0           0          0           5
*
*htstr
*mod2.5*15651801 0 0.0 0.0 0.0 5
15651801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15651901 0 0.0 0.0 0.0 5
15651901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------------*
*  ht str 5701 - inner core average channel fuel plates                   *
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15701000   5 11  1  1                  0.      0      0       0
*
*htstr         mesh locn       mesh fmt
15701100           0              1
*
*htstr         intervals       rt. coord
15701101           2             1.055e-5
15701102           2             2.5700e-4
15701103           6             6.3800e-4
*
*htstr         compxn no.      interval
15701201           4              2
15701202           2              4
15701203           5              10
*
*htstr         source          interval
15701301          0.              2
15701302       0.00087199         4
15701303       0.13754            10
*
15701401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15701501   570010000   10000     1       0       3.15           5
15701501   570010000   10000     102     0       3.15           5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15701601   0           0       0       0       3.15           5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15701701   1000  3.6480518d-02  1.4835430d-03  0.0000000d+00      1
15701702   1000  3.0978815d-02  1.2598068d-03  0.0000000d+00      2
15701703   1000  2.8270285d-02  1.1496598d-03  0.0000000d+00      3
15701704   1000  2.3826603d-02  9.6894978d-04  0.0000000d+00      4
15701705   1000  1.6293503d-02  6.6260331d-04  0.0000000d+00      5
*
*htstr
*mod2.5*15701801 0 0.0 0.0 0.0 5
15701801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15701901 0 0.0 0.0 0.0 5
15701901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------------*
*  ht str 5702 - inner core average channel inner side plate              *
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15702000   5  4  2  1                0.095     0      0       0
*
```

```
*htstr         mesh locn       mesh fmt
15702100           0              1
*
*htstr         intervals       rt. coord
15702101           3              0.102
*
*htstr         compxn no.      interval
15702201           2              3
*
*htstr         source          interval
15702301          1.              3
15702401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15702501   562010000   10000   1       1       0.04147        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15702601   570010000   10000   1       1       0.04147        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15702701   1000  2.0038410d-04  8.6473902d-04  0.0000000d+00      1
15702702   1000  1.7016376d-04  7.3432595d-04  0.0000000d+00      2
15702703   1000  1.5528605d-04  6.7012259d-04  0.0000000d+00      3
15702704   1000  1.3087732d-04  5.6478895d-04  0.0000000d+00      4
15702705   1000  8.9498697d-05  3.8622335d-04  0.0000000d+00      5
*
*htstr
*mod2.5*15702801 0 0.0 0.0 0.0 5
15702801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15702901 0 0.0 0.0 0.0 5
15702901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------------*
*  ht str 5703 - inner core average channel outer side plate              *
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15703000   5  4  2  1                0.162     0      0       0
*
*htstr         mesh locn       mesh fmt
15703100           0              1
*
*htstr         intervals       rt. coord
15703101           3              0.169
*
*htstr         compxn no.      interval
15703201           2              3
*
*htstr         source          interval
15703301          1.              3
15703401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15703501   570010000   10000   1       1       0.04147        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15703601   525010000   10000   1       1       0.04147        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15703701   1000  1.4075148d-04  0.0000000d+00  1.0260512d-03      1
15703702   1000  1.1952446d-04  0.0000000d+00  8.7131030d-04      2
15703703   1000  1.0907423d-04  0.0000000d+00  7.9513016d-04      3
15703704   1000  9.1929332d-05  0.0000000d+00  6.7014713d-04      4
15703705   1000  6.2864641d-05  0.0000000d+00  4.5827113d-04      5
```

```
*
*htstr
*mod2.5*15703801 0 0.0 0.0 0.0 5
15703801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15703901 0 0.0 0.0 0.0 5
15703901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*------------------------------------------------------------------------*
* ht str 5751 - inner core hot channel fuel plates (95%)                 *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15751000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15751100           0              1
*
*htstr         intervals       rt. coord
15751101           2             1.055e-5
15751102           2             2.5700e-4
15751103           6             6.3800e-4
*
*htstr         compxn no.      interval
15751201           4              2
15751202           2              4
15751203           5              10
*
*htstr         source          interval
15751301          0.              2
15751302       0.00087199         4
15751303       0.13754            10
*
15751401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15751501   575010000   10000     1       0      0.01260          5
15751501   575010000   10000     102     0      0.01260          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15751601   0           0       0        0      0.01260          5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15751701   1000  2.7803161d-04  1.1306634d-05  0.0000000d+00      1
15751702   1000  2.2967829d-04  9.3402627d-06  0.0000000d+00      2
15751703   1000  2.0421953d-04  8.3049385d-06  0.0000000d+00      3
15751704   1000  1.7509764d-04  7.1206468d-06  0.0000000d+00      4
15751705   1000  1.4469366d-04  5.8842165d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15751801 0 0.0 0.0 0.0 5
15751801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15751901 0 0.0 0.0 0.0 5
15751901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*------------------------------------------------------------------------*
*  ht str 5752 - inner core hot channel inner side plate - (95%)         *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15752000   5  4  2  1                 0.095     0      0        0
*
*htstr         mesh locn       mesh fmt
15752100           0              1
*
*htstr         intervals       rt. coord
15752101           3              0.102
*
*htstr         compxn no.      interval
15752201           2              3
*
*htstr         source          interval
15752301          1.              3
15752401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15752501   562010000   10000   1        1       0.0001659        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15752601   575010000   10000   1        1       0.0001659        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15752701   1000  1.5272018d-06  6.5904982d-06  0.0000000d+00      1
15752702   1000  1.2616015d-06  5.4443246d-06  0.0000000d+00      2
15752703   1000  1.1217589d-06  4.8408468d-06  0.0000000d+00      3
15752704   1000  9.6179509d-07  4.1505377d-06  0.0000000d+00      4
15752705   1000  7.9478883d-07  3.4298377d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15752801 0 0.0 0.0 0.0 5
15752801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15752901 0 0.0 0.0 0.0 5
15752901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*------------------------------------------------------------------------*
*  ht str 5753 - inner core hot channel outer side plate (95%)           *
*------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15753000   5  4  2  1                 0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15753100           0              1
*
*htstr         intervals       rt. coord
15753101           3              0.169
*
*htstr         compxn no.      interval
15753201           2              3
*
*htstr         source          interval
15753301          1.              3
15753401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15753501   575010000   10000   1        1       0.0001659        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15753601   525010000   10000   1        1       0.0001659        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15753701   1000  1.0727195d-06  0.0000000d+00  7.8199183d-06      1
15753702   1000  8.8615956d-07  0.0000000d+00  6.4599325d-06      2
15753703   1000  7.8793294d-07  0.0000000d+00  5.7438794d-06      3
15753704   1000  6.7557300d-07  0.0000000d+00  4.9247970d-06      4
15753705   1000  5.5826639d-07  0.0000000d+00  4.0696545d-06      5
*
*htstr
```

```
*mod2.5*15753801 0 0.0 0.0 0.0 5
15753801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15753901 0 0.0 0.0 0.0 5
15753901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------------*
*  ht str 5754 - lower core hot stripe - 95% probability - chf            *
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15754000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15754100           0              1
*
*htstr         intervals       rt. coord
15754101           2             1.055e-5
15754102           2             2.5700e-4
15754103           6             6.3800e-4
*
*htstr         compxn no.      interval
15754201           4              2
15754202           2              4
15754203           5              10
*
*htstr         source          interval
15754301          0.              2
15754302       0.00087199         4
15754303       0.13754            10
*
15754401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15754501   575010000   10000     1    0      0.0001260          5
15754501   575010000   10000     102  0      0.0001260          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15754601   0           0       0      0      0.0001260          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15754701   1000  4.2421692d-06  0.0000000d+00  0.0000000d+00      1
15754702   1000  3.6527537d-06  0.0000000d+00  0.0000000d+00      2
15754703   1000  3.1093018d-06  0.0000000d+00  0.0000000d+00      3
15754704   1000  2.7524081d-06  0.0000000d+00  0.0000000d+00      4
15754705   1000  2.3198095d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15754801 0 0.0 0.0 0.0 5
15754801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15754901 0 0.0 0.0 0.0 5
15754901 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*-------------------------------------------------------------------------*
*  ht str 5755 - inner core hot stripe - 95% probability - fe             *
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15755000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15755100           0              1
*
*htstr         intervals       rt. coord
15755101           2             1.055e-5
15755102           2             2.5700e-4
15755103           6             6.3800e-4
*
*htstr         compxn no.      interval
15755201           4              2
15755202           2              4
15755203           5              10
*
*htstr         source          interval
15755301          0.              2
15755302       0.00087199         4
15755303       0.13754            10
*
15755401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15755501   575010000   10000     1    0      0.0001260          5
15755501   575010000   10000     102  0      0.0001260          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15755601   0           0       0      0      0.0001260          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15755701   1000  3.0689720d-06  0.0000000d+00  0.0000000d+00      1
15755702   1000  2.5726843d-06  0.0000000d+00  0.0000000d+00      2
15755703   1000  2.2900451d-06  0.0000000d+00  0.0000000d+00      3
15755704   1000  1.9317387d-06  0.0000000d+00  0.0000000d+00      4
15755705   1000  1.5422753d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15755801 0 0.0 0.0 0.0 5
15755801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15755901 0 0.0 0.0 0.0 5
15755901 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*-------------------------------------------------------------------------*
*  ht str 5761 - inner core hot channel fuel plates (99.9% probability)*
*-------------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15761000   5 11  1  1                  0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15761100           0              1
*
*htstr         intervals       rt. coord
15761101           2             1.055e-5
15761102           2             2.5700e-4
15761103           6             6.3800e-4
*
*htstr         compxn no.      interval
15761201           4              2
15761202           2              4
15761203           5              10
*
*htstr         source          interval
15761301          0.              2
15761302       0.00087199         4
15761303       0.13754            10
*
15761401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
```

```
*mod2.5*15761501   576010000   10000     1      0      0.01260          5
15761501   576010000   10000     102    0      0.01260          5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15761601   0           0     0       0        0.01260          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15761701   1000  2.8812773d-04  1.1717210d-05  0.0000000d+00      1
15761702   1000  2.3801856d-04  9.6794342d-06  0.0000000d+00      2
15761703   1000  2.1163532d-04  8.6065145d-06  0.0000000d+00      3
15761704   1000  1.8145594d-04  7.3792178d-06  0.0000000d+00      4
15761705   1000  1.4994790d-04  6.0978892d-06  0.0000000d+00      5
*htstr
*mod2.5*15761801 0 0.0 0.0 0.0 5
15761801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15761901 0 0.0 0.0 0.0 5
15761901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
*  ht str 5762 - inner core hot channel inner side plate (99.9%)    *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15762000   5  4  2  1                0.095     0      0        0
*
*htstr         mesh locn       mesh fmt
15762100          0               1
*
*htstr         intervals       rt. coord
15762101          3               0.102
*
*htstr         compxn no.      interval
15762201          2               3
*
*htstr         source          interval
15762301          1.              3
15762401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15762501   562010000   10000  1       1        0.0001659        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15762601   576010000   10000  1       1        0.0001659        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15762701   1000  1.5826589d-06  6.8298180d-06  0.0000000d+00      1
15762702   1000  1.3074139d-06  5.6420235d-06  0.0000000d+00      2
15762703   1000  1.1624932d-06  5.0166318d-06  0.0000000d+00      3
15762704   1000  9.9672062d-07  4.3012556d-06  0.0000000d+00      4
15762705   1000  8.2364988d-07  3.5543848d-06  0.0000000d+00      5
*
*htstr
*mod2.5*15762801 0 0.0 0.0 0.0 5
15762801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15762901 0 0.0 0.0 0.0 5
15762901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
*  ht str 5763 - inner core hot channel outer side plate (99.9%)    *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15763000   5  4  2  1                0.162     0      0        0
*
*htstr         mesh locn       mesh fmt
15763100          0               1
*
*htstr         intervals       rt. coord
15763101          3               0.169
*
*htstr         compxn no.      interval
15763201          2               3
*
*htstr         source          interval
15763301          1.              3
15763401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
15763501   576010000   10000  1       1        0.0001659        5
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15763601   525010000   10000  1       1        0.0001659        5
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
15763701   1000  1.1116730d-06  0.0000000d+00  8.1038819d-06      1
15763702   1000  9.1833854d-07  0.0000000d+00  6.6945111d-06      2
15763703   1000  8.1654503d-07  0.0000000d+00  5.9524560d-06      3
15763704   1000  7.0010498d-07  0.0000000d+00  5.1036305d-06      4
15763705   1000  5.7853863d-07  0.0000000d+00  4.2174352d-06      5
*
*htstr
*mod2.5*15763801 0 0.0 0.0 0.0 5
15763801 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*htstr
*mod2.5*15763901 0 0.0 0.0 0.0 5
15763901 0. 10. 10. 0. 0. 0. 0. 1. 5
*
*-------------------------------------------------------------------*
*  ht str 5764 - inner core hot stripe  - 99.9% probability - chf   *
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15764000   5 11  1  1                   0.      0      0        0
*
*htstr         mesh locn       mesh fmt
15764100          0               1
*
*htstr         intervals       rt. coord
15764101          2               1.055e-5
15764102          2               2.5700e-4
15764103          6               6.3800e-4
*
*htstr         compxn no.      interval
15764201          4               2
15764202          2               4
15764203          5               10
*
*htstr         source          interval
15764301          0.              2
15764302       0.00087199         4
15764303       0.13754            10
*
15764401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15764501   576010000   10000     1    0      0.0001260          5
15764501   576010000   10000     102  0      0.0001260          5
*
```

```
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15764601   0           0       0      0       0.0001260          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15764701   1000  5.1860445d-06  0.0000000d+00  0.0000000d+00      1
15764702   1000  4.4654851d-06  0.0000000d+00  0.0000000d+00      2
15764703   1000  3.8011161d-06  0.0000000d+00  0.0000000d+00      3
15764704   1000  3.3648141d-06  0.0000000d+00  0.0000000d+00      4
15764705   1000  2.8359632d-06  0.0000000d+00  0.0000000d+00      5
*
*htstr
*mod2.5*15764801 0 0.0 0.0 0.0 5
15764801 0. 10. 10. 0. 0. 0. 0. 1.  5
*
*htstr
*mod2.5*15764901 0 0.0 0.0 0.0 5
15764901 0. 10. 10. 0. 0. 0. 0. 1.  5
•
*-------------------------------------------------------------------*
•  ht str 5765 - inner core hot stripe  - 99.9% probability - fe      •
*-------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
15765000   5 11  1  1                  0.      0      0        0
•
*htstr         mesh locn       mesh fmt
15765100           0              1
•
*htstr         intervals       rt. coord
15765101           2             1.055e-5
15765102           2             2.5700e-4
15765103           6             6.3800e-4
*
*htstr         compxn no.      interval
15765201           4              2
15765202           2              4
15765203           5              10
*
*htstr         source          interval
15765301         0.               2
15765302       0.00087199         4
15765303       0.13754            10
*
15765401 400. 11
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
*mod2.5*15765501   576010000   10000     1     0      0.0001260          5
15765501   576010000   10000     102  0      0.0001260          5
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
15765601   0           0       0      0       0.0001260          5
*
*htstr       s.type     s.mult      left heat   right heat   ht str
15765701   1000  3.7439107d-06  0.0000000d+00  0.0000000d+00      1
15765702   1000  3.1384777d-06  0.0000000d+00  0.0000000d+00      2
15765703   1000  2.7936795d-06  0.0000000d+00  0.0000000d+00      3
15765704   1000  2.3565732d-06  0.0000000d+00  0.0000000d+00      4
15765705   1000  1.8814576d-06  0.0000000d+00  0.0000000d+00      5
•
*htstr
*mod2.5*15765801 0 0.0 0.0 0.0 5
15765801 0. 10. 10. 0. 0. 0. 0. 1.  5
•
*htstr
*mod2.5*15765901 0 0.0 0.0 0.0 5
15765901 0. 10. 10. 0. 0. 0. 0. 1.  5
```

```
*
*=====================================================================$
*                  ht str no. 6401          hotpipe                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
16401000   6  4  2  1                0.28019    0      0        0
*
*htstr         mesh locn       mesh fmt
16401100           0              1
•
*htstr         intervals       rt. coord
16401101           3              0.3048
*
*htstr         compxn no.      interval
16401201           1              3
*
*htstr         source          interval
16401301         0.               3
16401401 400. 4
•
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
16401501   640010000   10000   1        1        0.6267          3
16401502   641010000   10000   1        1        2.33667         6
•
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
16401601   -501        0      4521     1        0.6267          3
16401602   -501        0      4581     1        2.33667         6
•
*htstr      s. type     s. mult     left heat  right heat   ht str no.
16401701       0           0           0          0           6
*
*htstr
*mod2.5*16401801 0 0.0 0.0 0.0 6
16401801 0. 10. 10. 0. 0. 0. 0. 1. 6
*
*htstr
*mod2.5*16401901 0 0.0 0.0 0.0 6
16401901 0. 10. 10. 0. 0. 0. 0. 1. 6
*
*=====================================================================$
*                  ht str no. 6451          hotpipe                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
16451000   1  4  2  1                0.28019    0      0        0
*
*htstr         mesh locn       mesh fmt
16451100           0              1
*
*htstr         intervals       rt. coord
16451101           3              0.3048
*
*htstr         compxn no.      interval
16451201           1              3
•
*htstr         source          interval
16451301         0.               3
16451401 400. 4
•
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
16451501   645010000   0       1        1        8.23            1
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
16451601   -501        0      4521     1        8.23            1
•
*htstr      s. type     s. mult     left heat  right heat   ht str no.
```

```
16451701       0           0           0          0           1
*
*htstr
*mod2.5*16451801 0 0.0 0.0 0.0 1
16451801 0. 10. 10. 0. 0. 0. 0. 1. 1
*mod2.5*16451901 0 0.0 0.0 0.0 1
16451901 0. 10. 10. 0. 0. 0. 0. 1. 1
*
*=====================================================================$
*                  ht str no. 6501          hothead                   $
*---------------------------------------------------------------------*
*htstr   ht strs  m pts  geom  init  l.coord   refl  b.vol  axl. incr
16501000   4  4  2  1                0.28019    0      0        0
*
*htstr          mesh locn       mesh fmt
16501100           0               1
*
*htstr          intervals       rt. coord
16501101           3              0.3048
*
*htstr          compxn no.      interval
16501201           1               3
*
*htstr          source          interval
16501301           0.              3
16501401 400. 4
*
*htstr     left vol    incr  b.cond  sa code  area/factor   ht str no.
16501501   650010000       0       1        1        1.68           1
16501502   650110000       0       1        1        3.51           2
16501503   650290000       0       1        1        1.22           3
16501504   650390000       0       1        1        1.83           4
*
*htstr     right vol   incr  b.cond  sa code  area/factor   ht str no.
16501601   -501        0       4521     1        1.68          1
16501602   -501        0       4521     1        3.51          2
16501603   -501        0       4521     1        1.22          3
16501604   -501        0       4521     1        1.83          4
*
*htstr      s. type     s. mult     left heat  right heat   ht str no.
16501701       0           0           0          0           4
*
*htstr
*mod2.5*16501801 0 0.0 0.0 0.0 4
16501801 0. 10. 10. 0. 0. 0. 0. 1. 4
*mod2.5*16501901 0 0.0 0.0 0.0 4
16501901 0. 10. 10. 0. 0. 0. 0. 1. 4
*
*=====================================================================*
*                                                                     *
*            g e n e r a l   d a t a   t a b l e s                    *
*                                                                     *
*=====================================================================*
*
* saturation table (pressure as a fcn. of temperature)
*
20203500 reac-t
20203503 40.       6.549e3
20203505 50.      11.121e3
20203506 60.      18.200e3
20203507 70.      28.80e3
20203508 80.      44.23e3
20203509 90.      66.07e3
20203510 100.     96.25e3
20203511 110.    137.06e3
20203512 120.    191.1e3
20203513 130.    261.5e3
20203514 140.    351.7e3
20203515 150.    465.3e3
20203516 160.    606.7e3
20203517 170.    780.3e3
20203518 180.    991.2e3
20203519 190.   1244.5e3
20203520 200.   1546.0e3
*
* primary coolant pump post-cavitation head degradation factor
*
20203900 reac-t
20203901 0.0 0.0
20203902 0.7 0.0
20203903 0.8 0.95
20203904 1.0 1.0
*
* main circulation pump homologous curve: hvn
*
20204100 reac-t
20204101    0.       -0.35
20204102    0.425     0.
20204103    0.567     0.142
20204104    0.637     0.239
20204105    0.728     0.391
20204106    0.850     0.644
20204107    1.        1.
*
* main circulation pump homologous curve: hvn inverse
*
20204200 reac-t
20204201   -0.35      0.
20204202    0.        0.425
20204203    0.142     0.567
20204204    0.239     0.637
20204205    0.391     0.728
20204206    0.644     0.850
20204207    1.        1.
*
* main circulation pump speed vs. frictional torque
* tf = 150 + 10*n**2
*
20204300 reac-t
20204301 .000  150.  .100  150.1  .200  150.4 .300  150.9
20204302 .400  151.6 .500  152.5  .600  153.6 .700  154.9
20204303 .800  156.4 .900  158.1  1.0   160.
*
* main circulation pump
* relative speed vs. pony motor torque (n-m)
* the hfir data have been normalized keeping the ratio between the
* pony motor locked-rotor torque and the main motor rated torque constant.
*
20204400 reac-t
20204401  0.0000  2408.
20204402  0.0731  1035.4
20204403  0.1134   613.1
20204404  0.1537   382.1
20204405  0.2142   203.9
20204406  0.2681   126.8
20204407  0.4032     0.0
20204408  1.00000    0.0
*
*---------------------------------------------------------------------$
*                  table no. 135 - mcp coastdown
```

```
*---------------------------------------------------------------------*
*
20213500 reac-t 635
20213501  -1.  1.
20213502   0.  1.
20213503   0.001  0.9995
20213504   0.005  0.9975
20213505   0.1    0.9529
20213506   0.2    0.9100
20213507   0.5    0.8021
20213508   1.     0.6704
20213509   2.     0.5064
20213510   3.     0.4091
20213511   6.     0.2644
20213512   9.     0.2010
20213513   10.    0.1874
20213514   15.    0.1457
20213515   20.    0.1256
20213516   50.    0.1012
20213517   100.   0.1000
20213518   1.e6   0.1000
*
20223500 reac-t 635
20223501  -1.  1.
20223502   0.  1.
20223503   0.001  0.9995
20223504   0.005  0.9975
20223505   0.1    0.9529
20223506   0.2    0.9100
20223507   0.5    0.8021
20223508   1.     0.6704
20223509   2.     0.5064
20223510   3.     0.4091
20223511   6.     0.2644
20223512   9.     0.2010
20223513   10.    0.1874
20223514   15.    0.1457
20223515   20.    0.1256
20223516   50.    0.1012
20223517   100.   0.1000
20223518   1.e6   0.1000
*
20233500 reac-t 635
20233501  -1.  1.
20233502   0.  1.
20233503   0.001  0.9995
20233504   0.005  0.9975
20233505   0.1    0.9529
20233506   0.2    0.9100
20233507   0.5    0.8021
20233508   1.     0.6704
20233509   2.     0.5064
20233510   3.     0.4091
20233511   6.     0.2644
20233512   9.     0.2010
20233513   10.    0.1874
20233514   15.    0.1457
20233515   20.    0.1256
20233516   50.    0.1012
20233517   100.   0.1000
20233518   1.e6   0.1000
*
*---------------------------------------------------------------------$
*                  table no. 500 - core power
*---------------------------------------------------------------------*
```

```
*table      table type   trip no.    factor 1    factor 2
20250000      power        510         1.0         3.5e8
*
*table                     time                   power
20250001                  -1.                     1.0
20250002                   0.                     1.0
20250003                   1.e6                   1.0
*
*=====================================================================$
* table for water pool temperature - used as boundary condition for
* outside surfaces of hot and cold leg piping within the pool
*---------------------------------------------------------------------$
*                table no. 501 - pool temp
*---------------------------------------------------------------------*
*table      table type   trip no.    factor 1    factor 2    constant
20250100      temp
*
*table                     time                   temp
20250101                   0.                    311.15
*
*=====================================================================$
*     table no. 511 - htc from outside of 14-in. horizontal pipe
*          assumes pool temperature of 311.15 k
*---------------------------------------------------------------------*
20251100  htc-temp
20251101  320.     639.        330.     877.        340.    1056.
20251102  350.    1200.        360.    1315.        370.    1438.
20251103  380.    1594.        390.    1729.        400.    1845.
20251104  410.    1944.        420.    2024.        430.    2143.
20251105  440.    2260.        450.    2364.        460.    2455.
*
*=====================================================================$
*     table no. 521 - htc from outside of 24-in. horizontal pipe
*          assumes pool temperature of 311.15 k
*---------------------------------------------------------------------*
20252100  htc-temp
20252101  320.     630.        330.     866.        340.    1044.
20252102  350.    1186.        360.    1301.        370.    1423.
20252103  380.    1579.        390.    1713.        400.    1829.
20252104  410.    1926.        420.    2006.        430.    2125.
20252105  440.    2242.        450.    2345.        460.    2435.
*
*=====================================================================$
*     table no. 531 - htc from outside of 8-in. horizontal pipe
*          assumes pool temperature of 311.15 k
*---------------------------------------------------------------------*
20253100  htc-temp
20253101  320.     652.        330.     893.        340.    1073.
20253102  350.    1218.        360.    1334.        370.    1458.
20253103  380.    1616.        390.    1752.        400.    1868.
20253104  410.    1967.        420.    2048.        430.    2168.
20253105  440.    2286.        450.    2390.        460.    2482.
*
*=====================================================================$
*     table no. 581 - htc from vertical piping - independent of length
*        assumes pool temperature of 311.15 k,  mcadams 0.13*ra**1/3
*---------------------------------------------------------------------*
20258100  htc-temp
20258101  320.     613.        330.     855.        340.    1042.
20258102  350.    1197.        360.    1327.        370.    1467.
20258103  380.    1639.        390.    1793.        400.    1929.
20258104  410.    2049.        420.    2153.        430.    2295.
20258105  440.    2435.        450.    2562.        460.    2677.
*
*=====================================================================$
```

```
*     table no. 591 - htc from outside of 43.75-in. horizontal ehx shell
*           assumes pool temperature of 311.15 k
*=====================================================================$
*
20259100  htc-temp
20259101  320.     622.        330.     856.        340.    1033.
20259102  350.    1175.        360.    1289.        370.    1411.
20259103  380.    1566.        390.    1700.        400.    1815.
20259104  410.    1912.        420.    1992.        430.    2110.
20259105  440.    2226.        450.    2329.        460.    2419.
*
*=====================================================================$
*     table no. 599 - htc from outside of 83-in. horizontal hx shell
*           assumes pool temperature of 311.15 k
*---------------------------------------------------------------------*
20259900  htc-temp
20259901  320.     615.        330.     849.        340.    1025.
20259902  350.    1167.        360.    1280.        370.    1402.
20259903  380.    1556.        390.    1689.        400.    1804.
20259904  410.    1901.        420.    1980.        430.    2098.
20259905  440.    2214.        450.    2316.        460.    2407.
*
$=====================================================================$
$ table 606 - normalized fission power as a funtion of
$             time after scram
*---------------------------------------------------------------------$
*                 table no. 606 - norm fis power
*---------------------------------------------------------------------*
*table       table type      trip no. factor1 factor2
20260600      reac-t          510     1.0     1.0
*
*table
*  time  power
20260601   -1.          1.0000000
+           0.          1.0000000
+           0.0010000   1.0000000
+           0.0020000   1.0000000
+           0.0030000   1.0000000
+           0.0040000   1.0000000
+           0.0050000   1.0000000
+           0.0060000   1.0000000
+           0.0070000   1.0000000
+           0.0080000   1.0000000
+           0.0090000   1.0000000
+           0.0100000   1.0000000
+           0.0110000   1.0000000
+           0.0120000   1.0000000
+           0.0130000   1.0000000
+           0.0140000   1.0000000
+           0.0150000   1.0000000
+           0.0160000   1.0000000
+           0.0170000   1.0000000
+           0.0180000   1.0000000
+           0.0190000   1.0000000
+           0.0200000   1.0000000
+           0.0300000   1.0000000
+           0.0400000   0.9952940
+           0.0500000   0.9706620
+           0.0600000   0.9135980
+           0.0700000   0.8185900
+           0.0800000   0.6913340
+           0.0900000   0.5482860
+           0.1000000   0.4104350
+           0.1100000   0.2948530
+           0.1200000   0.2085720
+           0.1300000   0.1502310
+           0.1400000   0.1155010
+           0.1500000   0.0962423
+           0.1600000   0.0845212
+           0.1700000   0.0766344
+           0.1800000   0.0715573
+           0.1900000   0.0673201
+           0.2000000   0.0634865
+           0.3000000   0.0389523
+           0.4000000   0.0206108
+           0.5000000   0.0200444
+           0.6000000   0.0195264
+           0.7000000   0.0190503
+           0.8000000   0.0187457
+           0.9000000   0.0181940
+           1.0000000   0.0178052
+           1.1000000   0.0174368
+           1.2000000   0.0170881
+           1.3000000   0.0167569
+           1.4000000   0.0164414
+           1.5000000   0.0161401
+           1.6000000   0.0158517
+           1.7000000   0.0155752
+           1.8000000   0.0153096
+           1.9000000   0.0150541
+           2.0000000   0.0148080
+           3.0000000   0.0127552
+           4.0000000   0.0112157
+           5.0000000   0.0100163
+           6.0000000   0.0090598
+           7.0000000   0.0082837
+           8.0000000   0.0076467
+           9.0000000   0.0071162
+           10.000000   0.0066687
+           11.000000   0.0062861
+           12.000000   0.0059539
+           13.000000   0.0056637
+           14.000000   0.0054083
+           15.000000   0.0051792
+           16.000000   0.0049729
+           17.000000   0.0047840
+           18.000000   0.0046092
+           19.000000   0.0044484
+           20.000000   0.0042995
+           30.000000   0.0032245
+           40.000000   0.0025527
+           50.000000   0.0020821
+           60.000000   0.0017350
+           70.000000   0.0014720
+           80.000000   0.0012695
+           90.000000   0.0011122
+           100.00000   9.890e-04
+           110.00000   8.918e-04
+           120.00000   8.146e-04
+           130.00000   7.529e-04
+           140.00000   7.031e-04
+           150.00000   6.628e-04
+           160.00000   6.299e-04
+           170.00000   6.028e-04
+           180.00000   5.804e-04
+           190.00000   5.618e-04
+           200.00000   5.463e-04
$=====================================================================$
$ table 607 - fission product decay power as a function of
$             time after scram
```

```
*----------------------------------------------------------------------$
*                  table no. 607 - norm fpd power
*----------------------------------------------------------------------*
* table         type           trip   factor1  factor2
20260700       reac-t         510    1.0      17.378
*
*table          time             power
20260701        -1.              0.0575440
+               0.              0.0575440
+               0.0010000       0.0575440
+               0.0020000       0.0575440
+               0.0030000       0.0575440
+               0.0040000       0.0575440
+               0.0050000       0.0575440
+               0.0060000       0.0575440
+               0.0070000       0.0575440
+               0.0080000       0.0575440
+               0.0090000       0.0575440
+               0.0100000       0.0575440
+               0.0110000       0.0575440
+               0.0120000       0.0575440
+               0.0130000       0.0575440
+               0.0140000       0.0575440
+               0.0150000       0.0575440
+               0.0160000       0.0575440
+               0.0170000       0.0575440
+               0.0180000       0.0575440
+               0.0190000       0.0575440
+               0.0200000       0.0575440
+               0.0300000       0.0575440
+               0.0400000       0.0575440
+               0.0500000  0.0575440
+               0.0600000  0.0575440
+               0.0700000  0.0575440
+               0.0800000  0.0575440
+               0.0900000  0.0575440
+               0.1000000  0.0575440
+               0.1100000  0.0575440
+               0.1200000  0.0575440
+               0.1300000  0.0575440
+               0.1400000  0.0575440
+               0.1500000  0.0575440
+               0.1600000  0.0575440
+               0.1700000  0.0575440
+               0.1800000  0.0575440
+               0.1900000  0.0575440
+               0.2000000  0.0575440
+               0.3000000  0.0575440
+               0.4000000  0.0575440
+               0.5000000  0.0575440
+               0.6000000  0.0575440
+               0.7000000  0.0575440
+               0.8000000  0.0575440
+               0.9000000  0.0575440
+               1.0000000  0.0575440
+               1.1000000  0.0575440
+               1.2000000  0.0571496
+               1.3000000  0.0567496
+               1.4000000  0.0563844
+               1.5000000  0.0560485
+               1.6000000  0.0557379
+               1.7000000  0.0554489
+               1.8000000  0.0551790
+               1.9000000  0.0549257
+               2.0000000  0.0546874
+               3.0000000  0.0528604
+               4.0000000  0.0516186
+               5.0000000  0.0506824
+               6.0000000  0.0499335
+               7.0000000  0.0493110
+               8.0000000  0.0487792
+               9.0000000  0.0483157
+               10.000000  0.0479055
+               11.000000  0.0471744
+               12.000000  0.0464751
+               13.000000  0.0458414
+               14.000000  0.0452628
+               15.000000  0.0447310
+               16.000000  0.0442395
+               17.000000  0.0437828
+               18.000000  0.0433568
+               19.000000  0.0429577
+               20.000000  0.0425827
+               30.000000  0.0397339
+               40.000000  0.0378315
+               50.000000  0.0364198
+               60.000000  0.0353061
+               70.000000  0.0343914
+               80.000000  0.0336184
+               90.000000  0.0329510
+               100.00000  0.0323654
+               110.00000  0.0315756
+               120.00000  0.0308686
+               130.00000  0.0302323
+               140.00000  0.0296548
+               150.00000  0.0291272
+               160.00000  0.0286422
+               170.00000  0.0281940
+               180.00000  0.0277778
+               190.00000  0.0273898
+               200.00000  0.0270268
$=====================================================================$
$ table 608 - al-28 decay power as a function of
$             time after scram
*----------------------------------------------------------------------$
*                  table no. 608 - al decay power
*----------------------------------------------------------------------*
* table         type           trip   factor1  factor2
20260800       reac-t         510    1.0      1.0
*
*table          time             power
20260801        -1.          1.0
+               0.           1.0
+               0.0010000    0.9999948
+               0.0100000    0.9999487
+               0.1000000    0.9994866
+               1.0000000    0.9948787
+               2.0000000    0.9897835
+               3.0000000    0.9847148
+               4.0000000    0.9796718
+               5.0000000    0.9746546
+               6.0000000    0.9696631
+               7.0000000    0.9646972
+               8.0000000    0.9597568
+               9.0000000    0.9548416
+               10.000000    0.9499516
+               11.000000    0.9450866
+               12.000000    0.9402466
+               13.000000    0.9354314
+               14.000000    0.9306407
```

```
+               15.000000  0.9258747
+               16.000000  0.9211331
+               17.000000  0.9164157
+               18.000000  0.9117225
+               19.000000  0.9070533
+               20.000000  0.9024081
+               30.000000  0.8572440
+               40.000000  0.8143403
+               50.000000  0.7735839
+               60.000000  0.7348672
+               70.000000  0.6980883
+               80.000000  0.6631501
+               90.000000  0.6299605
+               100.00000  0.5984320
+               110.00000  0.5684815
+               120.00000  0.5400299
+               130.00000  0.5130022
+               140.00000  0.4873273
+               150.00000  0.4629373
+               160.00000  0.4397681
+               170.00000  0.4177584
+               180.00000  0.3968502
+               190.00000  0.3769885
+               200.00000  0.3581209
*
*=================================================================$
*                table no. 820 - sb pzr speed
*-----------------------------------------------------------------*
*table       table type   trip no.    factor 1    factor 2
20282000       reac-t       550          1.          1.
*
*table                      time                reactivity
20282001                   -1.                    0.
20282002                    0.                    0.
20282003                    5.                  214.7884
20282004                    1.e6                214.7884
*
$=================================================================$
$                table no. 855 - ldvalve
*-----------------------------------------------------------------*
*table       table type   trip no.    factor 1    factor 2
*20285500       reac-t       550          1.          1.
*
*table                      time                reactivity
*20285501                   -1.                    1.
*20285502                    0.                    1.
*20285503                    1.                    0.
*20285504                    1.e6                  1.e6
*
*=================================================================*
*      table 956 - scram rod reactivity as function of time after trip
*-----------------------------------------------------------------*
*table       table type   trip no.    factor 1    factor 2
20295600       reac-t       510          1.          1.
*
*table                      time                reactivity
20295601                   -1.                    0.
20295602                    0.                    0.
20295603                    0.005                 0.2931
20295604                    0.01                  0.5802
20295605                    0.015                 0.8555
20295606                    0.02                  1.1133
20295607                    0.025                 1.3485
20295608                    0.03                  1.5561
20295609                    0.035                 1.7321
20295610                    0.04                  1.8727
20295611                    0.045                 1.9752
20295612                    0.0491                2.0292
20295613                    0.06                  2.1360
20295614                    1.0                  11.3480
*=================================================================*
* table 970 - control rod reactivity as function of normalized rod
*             position (biased to zero at initial position)
*-----------------------------------------------------------------*
*table       table type   trip no.    factor 1    factor 2
20297000       reac-t
*
*table                      time                reactivity
20297001                   0.                     3.93
20297002                   0.1218                 3.50
20297003                   0.2195                 2.33
20297004                   0.2790                 0.
20297005                   0.4391                -6.27
20297006                   0.6098               -18.18
20297007                   0.7805               -28.89
20297008                   1.                   -32.78
*
*=================================================================*
*                                                                 *
*     c o n t r o l   v a r i a b l e   i n p u t                 *
*                                                                 *
*=================================================================*
*
* control mcp speed to reach new steady-state
*
20507700 tr-tu    tripunit  1.000000d+00  1.          1
20507701 -528
20507800 priflow  constant  2.00000d+01
20507900 flerror  sum       1.00000d+00  2.01796-5   1
20507901 0. 1.,cntrlvar,78 -1.,velfj,507010200
20508000 flerr    mult      1.000000d+00  2.01796-5   0
20508001 cntrlvar,77 cntrlvar,79
20508100 flo-pi   prop-int  1.00000d+00  171.419     0
20508101 0.20 2.0 cntrlvar 80
20508200 flo-d    diffrend  1.00000d-06  -1.407062-10 0
20508201 cntrlvar,80
20508300 mcp-vel  sum       1.00000d+00  171.419     1
20508301 0. 1.,cntrlvar,81 1.,cntrlvar,82
*
*=================================================================$
*
* specified speed coastdown for mcps
*
*-----------------------------------------------------------------$
20519500 mcp1sp function  171.419     171.419    0 3     .00  171.419
20519501 time 0 135
*
$=================================================================$
*
* these control variables are for purely cosmetic purposes (i.e. the
* solution is not dependend upon) to monitor the limits in the fuel.
*
** costa flow excursion predictions (w/m^2)
* - lower fuel hot channel - 95% uncertainty
20520000 sqrtvelf powerr    1.000000d+00  4.36474      0
20520001 velf 515010000 0.5
20520100 sattemp  sum       1.0           490.326      1
20520101 0. 0.5,sattemp,515010000 0.5,sattemp,515020000
20520200 subcoolf sum       1.000000d+00  158.4946     0
20520201 0. 1.,cntrlvar,201  -1.,tempf,515010000
```

```
20520300 costaf   mult      7.812500d+04  54045876.    0
20520301 cntrlvar,200 cntrlvar,202
20520400 sqrtvelf powerr    1.000000d+00  4.37892      0
20520401 velf 515020000 0.5
20520500 sattemp  sum       1.0           487.03       1
20520501 0. 0.5,sattemp,515020000 0.5,sattemp,515030000
20520600 subcoolf sum       1.000000d+00  142.3255     0
20520601 0. 1.,cntrlvar,205  -1.,tempf,515020000
20520700 costaf   mult      7.812500d+04  4.869+7      0
20520701 cntrlvar,204 cntrlvar,206
20520800 sqrtvelf powerr    1.000000d+00  4.39487      0
20520801 velf 515030000 0.5
20520900 sattemp  sum       1.0           483.64       1
20520901 0. 0.5,sattemp,515030000 0.5,sattemp,515040000
20521000 subcoolf sum       1.000000d+00  126.8238     0
20521001 0. 1.,cntrlvar,209  -1.,tempf,515030000
20521100 costaf   mult      7.812500d+04  43544880.    0
20521101 cntrlvar,208 cntrlvar,210
20521200 sqrtvelf powerr    1.000000d+00  4.41171      0
20521201 velf 515040000 0.5
20521300 sattemp  sum       1.0           480.126      1
20521301 0. 0.5,sattemp,515040000 0.5,sattemp,515050000
20521400 subcoolf sum       1.000000d+00  112.086      0
20521401 0. 1.,cntrlvar,213  -1.,tempf,515040000
20521500 costaf   mult      7.812500d+04  38632132.    0
20521501 cntrlvar,212 cntrlvar,214
20521600 sqrtvelf powerr    1.000000d+00  4.42843      0
20521601 velf 515050000 0.5
20521700 sattemp  sum       1.0           476.543      1
20521701 0. 1.5,sattemp,515050000 -0.5,sattemp,515040000
20521800 subcoolf sum       1.000000d+00  98.6883      0
20521801 0. 1.,cntrlvar 217      -1.,tempf,515050000
20521900 costaf   mult      7.812500d+04  34143260.    0
20521901 cntrlvar,216 cntrlvar,218
*
* - lower fuel hot channel - 99.9% uncertainty
20522000 sqrtvelf powerr    1.000000d+00  4.367895     0
20522001 velf 516010000 0.5
20522100 sattemp  sum       1.0           490.309      1
20522101 0. 0.5,sattemp,516010000 0.5,sattemp,516020000
20522200 subcoolf sum       1.000000d+00  157.955      0
20522201 0. 1.,cntrlvar,221  -1.,tempf,516010000
20522300 costaf   mult      7.812500d+04  53900860.    0
20522301 cntrlvar,220 cntrlvar,222
20522400 sqrtvelf powerr    1.000000d+00  4.38275      0
20522401 velf 516020000 0.5
20522500 sattemp  sum       1.0           487.01       1
20522501 0. 0.5,sattemp,516020000 0.5,sattemp,516030000
20522600 subcoolf sum       1.000000d+00  141.2668     0
20522601 0. 1.,cntrlvar,225  -1.,tempf,516020000
20522700 costaf   mult      7.812500d+04  48370108.    0
20522701 cntrlvar,224 cntrlvar,226
20522800 sqrtvelf powerr    1.000000d+00  4.39954      0
20522801 velf 516030000 0.5
20522900 sattemp  sum       1.0           483.617      1
20522901 0. 0.5,sattemp,516030000 0.5,sattemp,516040000
20523000 subcoolf sum       1.000000d+00  125.2745     0
20523001 0. 1.,cntrlvar,229  -1.,tempf,516030000
20523100 costaf   mult      7.812500d+04  43058564.    0
20523101 cntrlvar,228 cntrlvar,230
20523200 sqrtvelf powerr    1.000000d+00  4.4173       0
20523201 velf 516040000 0.5
20523300 sattemp  sum       1.0           480.101      1
20523301 0. 0.5,sattemp,516040000 0.5,sattemp,516050000
20523400 subcoolf sum       1.000000d+00  110.0802     0
20523401 0. 1.,cntrlvar,233  -1.,tempf,516040000
20523500 costaf   mult      7.812500d+04  37988860.    0
20523501 cntrlvar,232 cntrlvar,234
20523600 sqrtvelf powerr    1.000000d+00  4.43498      0
20523601 velf 516050000 0.5
20523700 sattemp  sum       1.0           476.515      1
20523701 0. 1.5,sattemp,516050000 -0.5,sattemp,516040000
20523800 subcoolf sum       1.000000d+00  96.2818      0
20523801 0. 1.,cntrlvar 237      -1.,tempf,516050000
20523900 costaf   mult      7.812500d+04  33359958.    0
20523901 cntrlvar,236 cntrlvar,238
*
* - upper fuel hot channel - 95% uncertainty
20524000 sqrtvelf powerr    1.000000d+00  4.35178      0
20524001 velf 545010000 0.5
20524100 sattemp  sum       1.0           490.171      1
20524101 0. 0.5,sattemp,545010000 0.5,sattemp,545020000
20524200 subcoolf sum       1.000000d+00  158.302      0
20524201 0. 1.,cntrlvar,241  -1.,tempf,545010000
20524300 costaf   mult      7.812500d+04  53819940.    0
20524301 cntrlvar,240 cntrlvar,242
20524400 sqrtvelf powerr    1.000000d+00  4.36561      0
20524401 velf 545020000 0.5
20524500 sattemp  sum       1.0           486.891      1
20524501 0. 0.5,sattemp,545020000 0.5,sattemp,545030000
20524600 subcoolf sum       1.000000d+00  142.364      0
20524601 0. 1.,cntrlvar,245  -1.,tempf,545020000
20524700 costaf   mult      7.812500d+04  48555096.    0
20524701 cntrlvar,244 cntrlvar,246
20524800 sqrtvelf powerr    1.000000d+00  4.3811       0
20524801 velf 545030000 0.5
20524900 sattemp  sum       1.0           483.518      1
20524901 0. 0.5,sattemp,545030000 0.5,sattemp,545040000
20525000 subcoolf sum       1.000000d+00  127.2553     0
20525001 0. 1.,cntrlvar,249  -1.,tempf,545030000
20525100 costaf   mult      7.812500d+04  43556100.    0
20525101 cntrlvar,248 cntrlvar,250
20525200 sqrtvelf powerr    1.000000d+00  4.39708      0
20525201 velf 545040000 0.5
20525300 sattemp  sum       1.0           480.022      1
20525301 0. 0.5,sattemp,545040000 0.5,sattemp,545050000
20525400 subcoolf sum       1.000000d+00  113.1481     0
20525401 0. 1.,cntrlvar,253  -1.,tempf,545040000
20525500 costaf   mult      7.812500d+04  38868864.    0
20525501 cntrlvar,252 cntrlvar,254
20525600 sqrtvelf powerr    1.000000d+00  4.41255      0
20525601 velf 545050000 0.5
20525700 sattemp  sum       1.0           476.456      1
20525701 0. 1.5,sattemp,545050000 -0.5,sattemp,545040000
20525800 subcoolf sum       1.000000d+00  100.4831     0
20525801 0. 1.,cntrlvar 257      -1.,tempf,545050000
20525900 costaf   mult      7.812500d+04  34639572.    0
20525901 cntrlvar,256 cntrlvar,258
*
* - upper fuel hot channel - 99.9% uncertainty
20526000 sqrtvelf powerr    1.000000d+00  4.35487      0
20526001 velf 546010000 0.5
20526100 sattemp  sum       1.0           490.154      1
20526101 0. 0.5,sattemp,546010000 0.5,sattemp,546020000
20526200 subcoolf sum       1.000000d+00  157.7802     0
20526201 0. 1.,cntrlvar,261  -1.,tempf,546010000
20526300 costaf   mult      7.812500d+04  53680664.    0
20526301 cntrlvar,260 cntrlvar,262
20526400 sqrtvelf powerr    1.000000d+00  4.36935      0
20526401 velf 546020000 0.5
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20526500 sattemp  sum       1.0           486.872      1
20526501 0. 0.5,sattemp,546020000 0.5,sattemp,546030000
20526600 subcoolf sum       1.000000d+00  141.3347     0
20526601 0. 1.,cntrlvar,265  -1.,tempf,546020000
20526700 costaf   mult      7.812500d+04  48245388.    0
20526701 cntrlvar,264 cntrlvar,266
20526800 sqrtvelf powerr    1.000000d+00  4.38564      0
20526801 velf 546030000 0.5
20526900 sattemp  sum       1.0           483.496      1
20526901 0. 0.5,sattemp,546030000 0.5,sattemp,546040000
20527000 subcoolf sum       1.000000d+00  125.7548     0
20527001 0. 1.,cntrlvar,269  -1.,tempf,546030000
20527100 costaf   mult      7.812500d+04  43087096.    0
20527101 cntrlvar,268 cntrlvar,270
20527200 sqrtvelf powerr    1.000000d+00  4.40249      0
20527201 velf 546040000 0.5
20527300 sattemp  sum       1.0           479.997      1
20527301 0. 0.5,sattemp,546040000 0.5,sattemp,546050000
20527400 subcoolf sum       1.000000d+00  111.2214     0
20527401 0. 1.,cntrlvar,273  -1.,tempf,546040000
20527500 costaf   mult      7.812500d+04  38253956.    0
20527501 cntrlvar,272 cntrlvar,274
20527600 sqrtvelf powerr    1.000000d+00  4.41882      0
20527601 velf 546050000 0.5
20527700 sattemp  sum       1.0           476.429      1
20527701 0. 1.5,sattemp,546050000 -0.5,sattemp,546040000
20527800 subcoolf sum       1.000000d+00  98.1924      0
20527801 0. 1.,cntrlvar 277      -1.,tempf,546050000
20527900 costaf   mult      7.812500d+04  3.3898+7     0
20527901 cntrlvar,276 cntrlvar,278
*
* - inner fuel hot channel - 95% uncertainty
20528000 sqrtvelf powerr    1.000000d+00  4.35853      0
20528001 velf 575010000 0.5
20528100 sattemp  sum       1.0           490.196      1
20528101 0. 0.5,sattemp,575010000 0.5,sattemp,575020000
20528200 subcoolf sum       1.000000d+00  158.9817     0
20528201 0. 1.,cntrlvar,281  -1.,tempf,575010000
20528300 costaf   mult      7.812500d+04  54134860.    0
20528301 cntrlvar,280 cntrlvar,282
20528400 sqrtvelf powerr    1.000000d+00  4.37024      0
20528401 velf 575020000 0.5
20528500 sattemp  sum       1.0           486.902      1
20528501 0. 0.5,sattemp,575020000 0.5,sattemp,575030000
20528600 subcoolf sum       1.000000d+00  145.781      0
20528601 0. 1.,cntrlvar,285  -1.,tempf,575020000
20528700 costaf   mult      7.812500d+04  49773260.    0
20528701 cntrlvar,284 cntrlvar,286
20528800 sqrtvelf powerr    1.000000d+00  4.38173      0
20528801 velf 575030000 0.5
20528900 sattemp  sum       1.0           483.504      1
20528901 0. 0.5,sattemp,575030000 0.5,sattemp,575040000
20529000 subcoolf sum       1.000000d+00  133.557      0
20529001 0. 1.,cntrlvar,289  -1.,tempf,575030000
20529100 costaf   mult      7.812500d+04  45719612.    0
20529101 cntrlvar,288 cntrlvar,290
20529200 sqrtvelf powerr    1.000000d+00  4.392825     0
20529201 velf 575040000 0.5
20529300 sattemp  sum       1.0           479.971      1
20529301 0. 0.5,sattemp,575040000 0.5,sattemp,575050000
20529400 subcoolf sum       1.000000d+00  122.4368     0
20529401 0. 1.,cntrlvar,293  -1.,tempf,575040000
20529500 costaf   mult      7.812500d+04  4.2019+7     0
20529501 cntrlvar,292 cntrlvar,294
20529600 sqrtvelf powerr    1.000000d+00  4.40293      0
20529601 velf 575050000 0.5
20529700 sattemp  sum       1.0           476.364      1
20529701 0. 1.5,sattemp,575050000 -0.5,sattemp,575040000
20529800 subcoolf sum       1.000000d+00  112.5494     0
20529801 0. 1.,cntrlvar,297      -1.,tempf,575050000
20529900 costaf   mult      7.812500d+04  38714600.    0
20529901 cntrlvar,296 cntrlvar,298
*
* - inner fuel hot channel - 99.9% uncertainty
20530000 sqrtvelf powerr    1.000000d+00  4.36145      0
20530001 velf 576010000 0.5
20530100 sattemp  sum       1.0           490.18       1
20530101 0. 0.5,sattemp,576010000 0.5,sattemp,576020000
20530200 subcoolf sum       1.000000d+00  158.4936     0
20530201 0. 1.,cntrlvar,301  -1.,tempf,576010000
20530300 costaf   mult      7.812500d+04  54004828.    0
20530301 cntrlvar,300 cntrlvar,302
20530400 sqrtvelf powerr    1.000000d+00  4.3737       0
20530401 velf 576020000 0.5
20530500 sattemp  sum       1.0           486.883      1
20530501 0. 0.5,sattemp,576020000 0.5,sattemp,576030000
20530600 subcoolf sum       1.000000d+00  144.8957     0
20530601 0. 1.,cntrlvar,305  -1.,tempf,576020000
20530700 costaf   mult      7.812500d+04  49510160.    0
20530701 cntrlvar,304 cntrlvar,306
20530800 sqrtvelf powerr    1.000000d+00  4.38577      0
20530801 velf 576030000 0.5
20530900 sattemp  sum       1.0           483.483      1
20530901 0. 0.5,sattemp,576030000 0.5,sattemp,576040000
20531000 subcoolf sum       1.000000d+00  132.3187     0
20531001 0. 1.,cntrlvar,309  -1.,tempf,576030000
20531100 costaf   mult      7.812500d+04  45337396.    0
20531101 cntrlvar,308 cntrlvar,310
20531200 sqrtvelf powerr    1.000000d+00  4.39744      0
20531201 velf 576040000 0.5
20531300 sattemp  sum       1.0           479.949      1
20531301 0. 0.5,sattemp,576040000 0.5,sattemp,576050000
20531400 subcoolf sum       1.000000d+00  120.8957     0
20531401 0. 1.,cntrlvar,313  -1.,tempf,576040000
20531500 costaf   mult      7.812500d+04  41533756.    0
20531501 cntrlvar,312 cntrlvar,314
20531600 sqrtvelf powerr    1.000000d+00  4.40809      0
20531601 velf 576050000 0.5
20531700 sattemp  sum       1.0           476.341      1
20531701 0. 1.5,sattemp,576050000 -0.5,sattemp,576040000
20531800 subcoolf sum       1.000000d+00  110.7572     0
20531801 0. 1.,cntrlvar,317      -1.,tempf,576050000
20531900 costaf   mult      7.812500d+04  38142804.    0
20531901 cntrlvar,316 cntrlvar,318
*
* peclet numbers for hot channels
* assume hydraulic diameters of 0.002236 for lc and 0.0022299for uc
* lc 95% probability
20532000 dh-g-cp   mult     0.002236          195377.4 1
20532001 velf,515010000 rhof,515010000 csubpf,515010000
20532100 pelc95-1  div       1.0              313842.  1
20532101 thconf,515010000  cntrlvar,320
20532200 dh-g-cp   mult     0.002236          194558.7 1
20532201 velf,515020000 rhof,515020000 csubpf,515020000
20532300 pelc95-2  div       1.0              309300.4 1
20532301 thconf,515020000  cntrlvar,322
20532400 dh-g-cp   mult     0.002236          193873.2 1
20532401 velf,515030000 rhof,515030000 csubpf,515030000
20532500 pelc95-3  div       1.0              306184.  1
20532501 thconf,515030000  cntrlvar,324
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20532600 dh-g-cp   mult     0.002236         193365.4 1
20532601 velf,515040000 rhof,515040000 csubpf,515040000
20532700 pelc95-4  div      1.0              304305.4 1
20532701 thconf,515040000  cntrlvar,326
20532800 dh-g-cp   mult     0.002236         193101.  1
20532801 velf,515050000 rhof,515050000 csubpf,515050000
20532900 pelc95-5  div      1.0              303539.  1
20532901 thconf,515050000  cntrlvar,328
* lc 99.9% probability
20533000 dh-g-cp   mult     0.002236         195579.7 1
20533001 velf,516010000 rhof,516010000 csubpf,516010000
20533100 pelc99-1  div      1.0              314012.3 1
20533101 thconf,516010000  cntrlvar,330
20533200 dh-g-cp   mult     0.002236         194723.2 1
20533201 velf,516020000 rhof,516020000 csubpf,516020000
20533300 pelc99-2  div      1.0              309350.6 1
20533301 thconf,516020000  cntrlvar,332
20533400 dh-g-cp   mult     0.002236         194014.6 1
20533401 velf,516030000 rhof,516030000 csubpf,516030000
20533500 pelc99-3  div      1.0              306216.7 1
20533501 thconf,516030000  cntrlvar,334
20533600 dh-g-cp   mult     0.002236         193501.  1
20533601 velf,516040000 rhof,516040000 csubpf,516040000
20533700 pelc99-4  div      1.0              304404.  1
20533701 thconf,516040000  cntrlvar,336
20533800 dh-g-cp   mult     0.002236         193256.3 1
20533801 velf,516050000 rhof,516050000 csubpf,516050000
20533900 pelc99-5  div      1.0              303778.  1
20533901 thconf,516050000  cntrlvar,338
* uc 95% probability
20534000 dh-g-cp   mult     0.0022299        193684.  1
20534001 velf,545010000 rhof,545010000 csubpf,545010000
20534100 pelc95-1  div      1.0              311110.5 1
20534101 thconf,545010000  cntrlvar,340
20534200 dh-g-cp   mult     0.0022299        192880.  1
20534201 velf,545020000 rhof,545020000 csubpf,545020000
20534300 pelc95-2  div      1.0              306668.  1
20534301 thconf,545020000  cntrlvar,342
20534400 dh-g-cp   mult     0.0022299        192230.5 1
20534401 velf,545030000 rhof,545030000 csubpf,545030000
20534500 pelc95-3  div      1.0              303662.  1
20534501 thconf,545030000  cntrlvar,344
20534600 dh-g-cp   mult     0.0022299        191766.  1
20534601 velf,545040000 rhof,545040000 csubpf,545040000
20534700 pelc95-4  div      1.0              301865.6 1
20534701 thconf,545040000  cntrlvar,346
20534800 dh-g-cp   mult     0.0022299        191519.5 1
20534801 velf,545050000 rhof,545050000 csubpf,545050000
20534900 pelc95-5  div      1.0              301078.6 1
20534901 thconf,545050000  cntrlvar,348
* uc 99.9% probability
20535000 dh-g-cp   mult     0.0022299        193881.7 1
20535001 velf,546010000 rhof,546010000 csubpf,546010000
20535100 pelc99-1  div      1.0              311280.3 1
20535101 thconf,546010000  cntrlvar,350
20535200 dh-g-cp   mult     0.0022299        193041.  1
20535201 velf,546020000 rhof,546020000 csubpf,546020000
20535300 pelc99-2  div      1.0              306719.  1
20535301 thconf,546020000  cntrlvar,352
20535400 dh-g-cp   mult     0.0022299        192370.5 1
20535401 velf,546030000 rhof,546030000 csubpf,546030000
20535500 pelc99-3  div      1.0              303694.6 1
20535501 thconf,546030000  cntrlvar,354
20535600 dh-g-cp   mult     0.0022299        191902.  1
20535601 velf,546040000 rhof,546040000 csubpf,546040000
20535700 pelc99-4  div      1.0              301958.  1
20535701 thconf,546040000  cntrlvar,356
20535800 dh-g-cp   mult     0.0022299        191673.5 1
20535801 velf,546050000 rhof,546050000 csubpf,546050000
20535900 pelc99-5  div      1.0              301292.3 1
20535901 thconf,546050000  cntrlvar,358
* ic 95% probability
20536000 dh-g-cp   mult     0.0022299        194384.6 1
20536001 velf,575010000 rhof,575010000 csubpf,575010000
20536100 pelc95-1  div      1.0              312431.  1
20536101 thconf,575010000  cntrlvar,360
20536200 dh-g-cp   mult     0.0022299        193856.5 1
20536201 velf,575020000 rhof,575020000 csubpf,575020000
20536300 pelc95-2  div      1.0              308965.  1
20536301 thconf,575020000  cntrlvar,362
20536400 dh-g-cp   mult     0.0022299        193382.  1
20536401 velf,575030000 rhof,575030000 csubpf,575030000
20536500 pelc95-3  div      1.0              306441.  1
20536501 thconf,575030000  cntrlvar,364
20536600 dh-g-cp   mult     0.0022299        193038.7 1
20536601 velf,575040000 rhof,575040000 csubpf,575040000
20536700 pelc95-4  div      1.0              304775.  1
20536701 thconf,575040000  cntrlvar,366
20536800 dh-g-cp   mult     0.0022299        192816.4 1
20536801 velf,575050000 rhof,575050000 csubpf,575050000
20536900 pelc95-5  div      1.0              303759.3 1
20536901 thconf,575050000  cntrlvar,368
* uc 99.9% probability
20537000 dh-g-cp   mult     0.0022299        194573.2 1
20537001 velf,576010000 rhof,576010000 csubpf,576010000
20537100 pelc99-1  div      1.0              312593.  1
20537101 thconf,576010000  cntrlvar,370
20537200 dh-g-cp   mult     0.0022299        194020.2 1
20537201 velf,576020000 rhof,576020000 csubpf,576020000
20537300 pelc99-2  div      1.0              309029.  1
20537301 thconf,576020000  cntrlvar,372
20537400 dh-g-cp   mult     0.0022299        193528.8 1
20537401 velf,576030000 rhof,576030000 csubpf,576030000
20537500 pelc99-3  div      1.0              306469.  1
20537501 thconf,576030000  cntrlvar,374
20537600 dh-g-cp   mult     0.0022299        193175.8 1
20537601 velf,576040000 rhof,576040000 csubpf,576040000
20537700 pelc99-4  div      1.0              304809.  1
20537701 thconf,576040000  cntrlvar,376
20537800 dh-g-cp   mult     0.0022299        192954.5 1
20537801 velf,576050000 rhof,576050000 csubpf,576050000
20537900 pelc99-5  div      1.0              303831.  1
20537901 thconf,576050000  cntrlvar,378
*
* prandtl numbers for hot channels
* lc 95%
20544400 visc-cp   mult     1.0              2.367397 1
20544401 viscf,515010000 csubpf,515010000
20544500 prand511  div      1.0              3.80284  1
20544501 thconf,515010000  cntrlvar,444
20544600 visc-cp   mult     1.0              1.948485 1
20544601 viscf,515020000 csubpf,515020000
20544700 prand512  div      1.0              3.09761  1
20544701 thconf,515020000  cntrlvar,446
20544800 visc-cp   mult     1.0              1.656296 1
20544801 viscf,515030000 csubpf,515030000
20544900 prand513  div      1.0              2.61579  1
20544901 thconf,515030000  cntrlvar,448
20545000 visc-cp   mult     1.0              1.446564 1
20545001 viscf,515040000 csubpf,515040000
```

```
20545100 prand514  div      1.0              2.276504 1
20545101 thconf,515040000  cntrlvar,450
20545200 visc-cp   mult     1.0              1.298663 1
20545201 viscf,515050000 csubpf,515050000
20545300 prand515  div      1.0              2.041393 1
20545301 thconf,515050000  cntrlvar,452
* lc 99.9%
20545400 visc-cp   mult     1.0              2.347557 1
20545401 viscf,516010000 csubpf,516010000
20545500 prand911  div      1.0              3.76911  1
20545501 thconf,516010000  cntrlvar,454
20545600 visc-cp   mult     1.0              1.920113 1
20545601 viscf,516020000 csubpf,516020000
20545700 prand912  div      1.0              3.050423 1
20545701 thconf,516020000  cntrlvar,456
20545800 visc-cp   mult     1.0              1.624742 1
20545801 viscf,516030000 csubpf,516030000
20545900 prand913  div      1.0              2.56436  1
20545901 thconf,516030000  cntrlvar,458
20546000 visc-cp   mult     1.0              1.414302 1
20546001 viscf,516040000 csubpf,516040000
20546100 prand914  div      1.0              2.2249   1
20546101 thconf,516040000  cntrlvar,460
20546200 visc-cp   mult     1.0              1.266842 1
20546201 viscf,516050000 csubpf,516050000
20546300 prand915  div      1.0              1.99134  1
20546301 thconf,516050000  cntrlvar,462
* uc 95%
20546400 visc-cp   mult     1.0              2.36598  1
20546401 viscf,545010000 csubpf,545010000
20546500 prand5u1  div      1.0              3.800424 1
20546501 thconf,545010000  cntrlvar,464
20546600 visc-cp   mult     1.0              1.95339  1
20546601 viscf,545020000 csubpf,545020000
20546700 prand5u2  div      1.0              3.105777 1
20546701 thconf,545020000  cntrlvar,466
20546800 visc-cp   mult     1.0              1.66799  1
20546801 viscf,545030000 csubpf,545030000
20546900 prand5u3  div      1.0              2.634884 1
20546901 thconf,545030000  cntrlvar,468
20547000 visc-cp   mult     1.0              1.466167 1
20547001 viscf,545040000 csubpf,545040000
20547100 prand5u4  div      1.0              2.307944 1
20547101 thconf,545040000  cntrlvar,470
20547200 visc-cp   mult     1.0              1.324867 1
20547201 viscf,545050000 csubpf,545050000
20547300 prand5u5  div      1.0              2.08276  1
20547301 thconf,545050000  cntrlvar,472
* uc 99.9%
20547400 visc-cp   mult     1.0              2.34682  1
20547401 viscf,546010000 csubpf,546010000
20547500 prand9u1  div      1.0              3.767856 1
20547501 thconf,546010000  cntrlvar,474
20547600 visc-cp   mult     1.0              1.925685 1
20547601 viscf,546020000 csubpf,546020000
20547700 prand9u2  div      1.0              3.059683 1
20547701 thconf,546020000  cntrlvar,476
20547800 visc-cp   mult     1.0              1.637054 1
20547801 viscf,546030000 csubpf,546030000
20547900 prand9u3  div      1.0              2.58441  1
20547901 thconf,546030000  cntrlvar,478
20548000 visc-cp   mult     1.0              1.434436 1
20548001 viscf,546040000 csubpf,546040000
20548100 prand9u4  div      1.0              2.257084 1
20548101 thconf,546040000  cntrlvar,480
20548200 visc-cp   mult     1.0              1.293455 1
20548201 viscf,546050000 csubpf,546050000
20548300 prand9u5  div      1.0              2.033186 1
20548301 thconf,546050000  cntrlvar,482
* ic 95%
20548400 visc-cp   mult     1.0              2.39121  1
20548401 viscf,575010000 csubpf,575010000
20548500 prand5u1  div      1.0              3.843354 1
20548501 thconf,575010000  cntrlvar,484
20548600 visc-cp   mult     1.0              2.051986 1
20548601 viscf,575020000 csubpf,575020000
20548700 prand5u2  div      1.0              3.27042  1
20548701 thconf,575020000  cntrlvar,486
20548800 visc-cp   mult     1.0              1.812146 1
20548801 viscf,575030000 csubpf,575030000
20548900 prand5u3  div      1.0              2.8716   1
20548901 thconf,575030000  cntrlvar,488
20549000 visc-cp   mult     1.0              1.641434 1
20549001 viscf,575040000 csubpf,575040000
20549100 prand5u4  div      1.0              2.591544 1
20549101 thconf,575040000  cntrlvar,490
20549200 visc-cp   mult     1.0              1.51994  1
20549201 viscf,575050000 csubpf,575050000
20549300 prand5u5  div      1.0              2.394487 1
20549301 thconf,575050000  cntrlvar,492
* ic 99.9%
20549400 visc-cp   mult     1.0              2.37297  1
20549401 viscf,576010000 csubpf,576010000
20549500 prand9u1  div      1.0              3.81232  1
20549501 thconf,576010000  cntrlvar,494
20549600 visc-cp   mult     1.0              2.02613  1
20549601 viscf,576020000 csubpf,576020000
20549700 prand9u2  div      1.0              3.22715  1
20549701 thconf,576020000  cntrlvar,496
20549800 visc-cp   mult     1.0              1.78275  1
20549801 viscf,576030000 csubpf,576030000
20549900 prand9u3  div      1.0              2.823134 1
20549901 thconf,576030000  cntrlvar,498
20550000 visc-cp   mult     1.0              1.610505 1
20550001 viscf,576040000 csubpf,576040000
20550100 prand9u4  div      1.0              2.54119  1
20550101 thconf,576040000  cntrlvar,500
20550200 visc-cp   mult     1.0              1.488473 1
20550201 viscf,576050000 csubpf,576050000
20550300 prand9u5  div      1.0              2.34379  1
20550301 thconf,576050000  cntrlvar,502
*
*-------------------------------------------------------------------$
*
* control pzr speed to reach new steady-state (487-491)
* these control variables should only be active when
* a new steady pressurizing flow rate is being sought
*-------------------------------------------------------------------$
*
20558700 pzrvel   constant  1.629971 3.465 0
20558800 flerror  sum       1.00000d+00  -5.43169-5  1
20558801 0. 1.,cntrlvar,587 -1.,velfj,825000000
20558900 flo-pi   prop-int  1.0  246.00   0
20558901 8.0 80. cntrlvar 588
20559000 flo-d    diffrend  1.00000d-06  8.07164-11   0
20559001 cntrlvar,588
20559100 pzrvel sum    1.0  246.00   1
20559101 0. 1.,cntrlvar,589 1.,cntrlvar,590
*
*-------------------------------------------------------------------$
```

```
*
* control system to control primary coolant system temperature by
* adjusting the secondary flow
*-----------------------------------------------------------------------$
*ctlvar      name        type      factor     init    f c      min    max
20559200 terror    sum         1.00000d+00 -9.77584-5    1
20559201  318.75      -1.       tempf        500010000
*
*20559300 picntrl  prop-int -1.00000d+00  1681.036  0
*20559301 30. 3.0 cntrlvar 592
20559300 secflow  constant 1681.036
*
20559400 se-off tripunit  1.0000d+00  0.          0 3      .00  1.0000d+00
20559401  540
*
20559500 deltat    sum    1.00000d+00  180.704  0 1 0.
20559501 -10.    1.,time,0
*
20559600 factor mult  0.1  0.  0 3 0.0 0.9677
20559601  cntrlvar,594 cntrlvar,595
*
20559700 se-dec sum   1.0  1.  0
20559701 1. -1.,cntrlvar,596
*
20559800 seflo1    mult      1.00000d+00  1681.036     0
20559801 cntrlvar,593  cntrlvar,597
*
$=======================================================================$
*
$ the 600 to 700 series inputs the transient powers into the control
$ rods and the surrounding d2o.
*=======================================================================*
$ flag for scram 0.0-no  1.0-yes
*ctlvar      name        type      factor     init    f c      min
20560000  "scram"     tripunit     1.0       0.      1 0
*
*ctlvar      trip no.
20560001      510
$=======================================================================$
$complement flag for no scram 0.0-yes  1.0-no
*ctlvar      name        type      factor     init    f c      min
20560100 "noscram"    tripunit     1.0       1.      1 0
*
*ctlvar      trip no.
20560101      -510
$=======================================================================$
* get current power into system
*ctlvar      name        type      factor     init    f c      min
20560200  "pwcntl"       sum         1.0     3.44+8      1 0
*
*ctlvar            a0        coeff         variable name  parameter no.
20560201          0.0          1.0              rktpow           0
$=======================================================================$
$ multiply current power by no-scram
$ should have no value after scram
*ctlvar      name        type      factor     init    f c      min
20560300  "pwr01"       mult        1.0       3.44+8      1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20560301    cntrlvar         601            cntrlvar         602
$=======================================================================$
$ multiply current, saved power by scram
$ should have no value before scram
*ctlvar      name        type      factor     init    f c      min
20560400  "pwr02"       mult        1.0       0.        1 0
```

```
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20560401    cntrlvar         600            cntrlvar         605
$=======================================================================$
$ add scram-weighted powers together.  before scram, should be true,
$ kinetic power; after scram should be the last saved power before
$ scram
*ctlvar      name        type      factor     init    f c      min
20560500  "savpow"       sum         1.0       3.44+8      1 0
*
*ctlvar            a0        coeff         variable name  parameter no.
20560501          0.0          1.0              cntrlvar         603
20560502                       1.0              cntrlvar         604
*
$ multiplies the no-scram flag by saved power and by the factor which
$ represents the total power by fission neutrons, fission gammas,
$ fission product gammas, and al-28 gamma & beta decay.  factor
$ includes axial peaking.  local heating will follow power until
$ scram, at which point it should go to zero because this heat
$ source is moved to another volume.
$=======================================================================$
$ the next 15 controls multiple normalized power from a tabular
$ function of time by a scalar.  table 606 is the fission power
$ table; table 607 is the fission decay power table; table 608 is
$ al-28 decay table.
$ titles fspwxx refer to fission gammas and neutrons.  the factor
$ is the sum of those sources on level xx in the zr/al/hf composite
$ multiplied by a level factor and divided by 3.5e8 watts.
$ titles fsdkxx refer to fission decay gammas.  the factor
$ is the sum of those sources on level xx in the zr/al/hf composite
$ multiplied by a level factor and divided by 3.5e8 watts.
$ titles aldkxx refer to aluminum beta and gamma decay.  the factor
$ is the sum of those sources on level xx in the zr/al/hf composite
$ multiplied by a level factor and divided by 3.5e8 watts.
$ radial distribution is applied via the heat structure cards.
$ summation and by the last saved power before scram.  the local
$ decay powers are thus scaled by the power at scram and weighted
$ by the scram flag (before scram = no value, after scram = value)
$=======================================================================$
$ as above, these 15 cards multiply the appropriate scalars by the
$ corresponding tables, in this case for the power in the d2o in the
$ central rod hole.
$=======================================================================$
$ the sums are multiplied the th saved power at scram and the scram
$ flag.  as above there is no value before scram.
$=======================================================================$
*ctlvar      name        type      factor     init    f c      min    max
20561100  "al1ss"       mult    4.9028e-04  168656.3 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20561101    cntrlvar         601            cntrlvar         605
$=======================================================================$
*ctlvar      name        type      factor     init    f c      min    max
20561200  "hf1ss"       mult    2.3105e-03  794812. 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20561201    cntrlvar         601            cntrlvar         605
$=======================================================================$
*ctlvar      name        type      factor     init    f c      min    max
20561300  "d2o1ss"      mult    2.1391e-04  73585.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20561301    cntrlvar         601            cntrlvar         605
$=======================================================================$
*ctlvar      name        type      factor     init    f c      min    max
```

```
20561400  "alcomp"      mult   2.1689e-4   74610.2 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20561401    cntrlvar         601             cntrlvar         605
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20561500  "hfcomp"      mult   6.6004e-4  227053.8 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20561501    cntrlvar         601             cntrlvar         605
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20561600  "alhfss"      sum       1.0      301664.  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20561601          0.0         1.0           cntrlvar         614
20561602              .       1.0           cntrlvar         615
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562100  "alfsp"     function 4.8823e-4   4.8823-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562101          time              0                606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562200  "alfsd"     function 3.4996e-5   3.4996-5   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562201          time              0                607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562300   "alal"     function 1.0733e-5   1.0733-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562301          time              0                608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562400  "altot1"      sum       1.0      5.33959-4 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20562401          0.0         1.0           cntrlvar         621
20562402              .       1.0           cntrlvar         622
20562403              .       1.0           cntrlvar         623
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562500  "altot2"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20562501    cntrlvar         600             cntrlvar         605
20562502    cntrlvar         624
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562600  "hffsp"     function 1.8708e-3   .0018708  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562601          time              0                606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562700  "hffsd"     function 3.9623e-4   3.9623-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562701          time              0                607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562800   "hfal"     function 4.3444e-5   4.3444-5  1 0
```

```
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20562801          time              0                608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20562900  "hftot1"      sum       1.0      .002310474 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20562901          0.0         1.0           cntrlvar         626
20562902              .       1.0           cntrlvar         627
20562903              .       1.0           cntrlvar         628
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563000  "hftot2"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20563001    cntrlvar         600             cntrlvar         605
20563002    cntrlvar         629
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563100  "sumfsp"    function 7.5041e-4   7.5041-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563101          time              0                606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563200  "sumfsd"    function 1.2868e-4   1.2868-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563201          time              0                607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563300  "sumal"     function 1.7159e-5   1.7159-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563301          time              0                608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563400 "sumtot1"      sum       1.0      8.96249-4  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20563401          0.0         1.0           cntrlvar         631
20563402              .       1.0           cntrlvar         632
20563403              .       1.0           cntrlvar         633
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563500 "sumtot2"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20563501    cntrlvar         600             cntrlvar         605
20563502    cntrlvar         634
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563600  "d2ofsp"    function 2.1238e-4   2.1238-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563601          time              0                606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20563700  "d2ofsd"    function 7.6092e-6   7.6092-6  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563701          time              0                607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
```

```
20563800  "d2oal"     function 1.5251e-6   1.5251-6   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20563801          time              0                  608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20563900 "d2otot1"      sum        1.0      2.215143-4 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20563901          0.0        1.0            cntrlvar         636
20563902                     1.0            cntrlvar         637
20563903                     1.0            cntrlvar         638
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20564000 "d2otot2"      mult       1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20564001    cntrlvar         600            cntrlvar         605
20564002    cntrlvar         639
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20564100   "alhs"       sum         1.    168656.3   0 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20564101          0.         1.            cntrlvar         625
20564102                     1.            cntrlvar         611
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20564200  "alhfhs"      sum         1.    301664.  0 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20564201          0.         1.            cntrlvar         635
20564202                     1.            cntrlvar         616
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20564300   "hfhs"       sum         1.    794812.   0 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20564301          0.         1.            cntrlvar         630
20564302                     1.            cntrlvar         612
* these are the outer d2o cards.  they parallel the above cards
*ctlvar      name       type     factor    init   f c     min    max
20567100  "wohs1"       mult   1.2489e-3    429622.  1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20567101    cntrlvar         601            cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567200  "wohs2"       mult   1.2610e-3   433784.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20567201    cntrlvar         601            cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567300  "wohs3"       mult   1.2670e-3   435848.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20567301    cntrlvar         601            cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567400  "wohs4"       mult   1.2310e-3   423464.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20567401    cntrlvar         601            cntrlvar         605
$=====================================================================$
```

```
*ctlvar      name       type     factor    init   f c     min    max
20567500  "wohs5"       mult   9.9681e-4   342902.6 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20567501    cntrlvar         601            cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567600 "fspwwo1"    function 9.6471e-4   9.6471-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20567601          time              0                  606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567700 "fsdkwo1"    function 2.6619e-4   2.6619-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20567701          time              0                  607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567800 "aldkwo1"    function 1.8902e-5   1.8902-5   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20567801          time              0                  608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20567900 "fspwwo2"    function 9.7398e-4   9.7398-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20567901          time              0                  606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568000 "fsdkwo2"    function 2.6875e-4   2.6875-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568001          time              0                  607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568100 "aldkwo2"    function 1.8232e-5   1.8232-5   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568101          time              0                  608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568200 "fspwwo3"    function 9.7866e-4   9.7866-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568201          time              0                  606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568300 "fsdkwo3"    function 2.7003e-4   2.7003-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568301          time              0                  607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568400 "aldkwo3"    function 1.8319e-5   1.8319-5   1   0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568401          time              0                  608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20568500 "fspwwo4"    function 9.5081e-4   9.5081-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20568501          time              0                  606
```

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$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20568600 "fsdkwo4"    function 2.6235e-4   2.6235-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20568601          time              0                   607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20568700 "aldkwo4"    function 1.7798e-5   1.7798-5   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20568701          time              0                   608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20568800 "fspwwo5"    function 7.6993e-4   7.6993-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20568801          time              0                   606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20568900  "fsdkwo5"    function 2.1244e-4   2.1244-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20568901          time              0                   607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569000  "aldkwo5"    function 1.4412e-5   1.4412-5   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20569001          time              0                   608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569100 "wosum01"      sum       1.0      .001249802 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20569101          0.0        1.0           cntrlvar         676
20569102                     1.0           cntrlvar         677
20569103                     1.0           cntrlvar         678
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569200 "wosum02"      sum       1.0      .001260962 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20569201          0.0        1.0           cntrlvar         679
20569202                     1.0           cntrlvar         680
20569203                     1.0           cntrlvar         681
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569300 "wosum03"      sum       1.0      .00126701  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20569301          0.0        1.0           cntrlvar         682
20569302                     1.0           cntrlvar         683
20569303                     1.0           cntrlvar         684
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569400 "wosum04"      sum       1.0      .001230958 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20569401          0.0        1.0           cntrlvar         685
20569402                     1.0           cntrlvar         686
20569403                     1.0           cntrlvar         687
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569500 "wosum05"      sum       1.0      9.96782-4  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20569501          0.0        1.0           cntrlvar         688
20569502                     1.0           cntrlvar         689
20569503                     1.0           cntrlvar         690
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569600  "powwo1"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20569601    cntrlvar         600           cntrlvar         605
20569602    cntrlvar         691
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569700  "powwo2"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20569701    cntrlvar         600           cntrlvar         605
20569702    cntrlvar         692
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569800  "powwo3"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20569801    cntrlvar         600           cntrlvar         605
20569802    cntrlvar         693
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20569900  "powwo4"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20569901    cntrlvar         600           cntrlvar         605
20569902    cntrlvar         694
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20570000  "powwo5"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570001    cntrlvar         600           cntrlvar         605
20570002    cntrlvar         695
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20570100  "cpbt1"       mult   5.3967e-4   185646.5 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570101    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20570200  "cpbt2"       mult   5.4486e-4   187432.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570201    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20570300  "cpbt3"       mult   5.4745e-4   188322.8 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570301    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20570400  "cpbt4"       mult   5.3189e-4   182970.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570401    cntrlvar         601           cntrlvar         605
$=====================================================================$
```

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*ctlvar      name       type     factor    init   f c     min    max
20570500  "cpbt5"       mult   4.3070e-4   148160.8 1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20570501    cntrlvar          601            cntrlvar          605
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20570600 "fspwpt1"    function 3.1372e-4   3.1372-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20570601          time              0                606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20570700 "fsdkpt1"    function 7.5233e-5   7.5233-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20570701          time              0                607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20570800 "aldkpt1"    function 7.5233e-5   7.5233-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20570801          time              0                608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20570900 "fspwpt2"    function 3.1676e-4   3.1676-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20570901          time              0                606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571000 "fsdkpt2"    function 1.5219e-4   1.5219-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571001          time              0                607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571100 "aldkpt2"    function 7.5956e-5   7.5956-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571101          time              0                608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571200 "fspwpt3"    function 3.1826e-4   3.1826-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571201          time              0                606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571300 "fsdkpt3"    function 1.5291e-4   1.5291-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571301          time              0                607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571400 "aldkpt3"    function 7.6318e-5   7.6318-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571401          time              0                608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571500 "fspwpt4"    function 3.0921e-4   3.0921-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571501          time              0                606
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$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571600 "fsdkpt4"    function 1.4856e-4   1.4856-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571601          time              0                607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571700 "aldkpt4"    function 7.4148e-5   7.4148-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571701          time              0                608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571800 "fspwpt5"    function 2.5038e-4   2.5038-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571801          time              0                606
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20571900 "fsdkpt5"    function 1.2030e-4   1.203-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20571901          time              0                607
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572000 "aldkpt5"    function 6.0042e-5   6.0042-5  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20572001          time              0                608
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572100  "ptsum1"       sum       1.0      4.64186-4  1 0
*
*ctlvar            a0        coeff        variable name  parameter no.
20572101          0.0          1.0           cntrlvar          706
20572102                       1.0           cntrlvar          707
20572103                       1.0           cntrlvar          708
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572200  "ptsum2"       sum       1.0      5.44906-4 1 0
*
*ctlvar            a0        coeff        variable name  parameter no.
20572201          0.0          1.0           cntrlvar          709
20572202                       1.0           cntrlvar          710
20572203                       1.0           cntrlvar          711
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572300  "ptsum3"       sum       1.0      5.47488-4 1 0
*
*ctlvar            a0        coeff        variable name  parameter no.
20572301          0.0          1.0           cntrlvar          712
20572302                       1.0           cntrlvar          713
20572303                       1.0           cntrlvar          714
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572400  "ptsum4"       sum       1.0      5.31918-4  1 0
*
*ctlvar            a0        coeff        variable name  parameter no.
20572401          0.0          1.0           cntrlvar          715
20572402                       1.0           cntrlvar          716
20572403                       1.0           cntrlvar          717
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20572500  "ptsum5"       sum       1.0      4.30722-4  1 0
```

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*
*ctlvar            a0       coeff        variable name  parameter no.
20572501          0.0        1.0           cntrlvar         718
20572502                     1.0           cntrlvar         719
20572503                     1.0           cntrlvar         720
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20572600  "ptpow1"       mult      1.0      0.       1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20572601    cntrlvar         600           cntrlvar         605
20572602    cntrlvar         721
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20572700  "ptpow2"       mult      1.0      0.       1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20572701    cntrlvar         600           cntrlvar         605
20572702    cntrlvar         722
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20572800  "ptpow3"       mult      1.0      0.       1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20572801    cntrlvar         600           cntrlvar         605
20572802    cntrlvar         723
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20572900  "ptpow4"       mult      1.0      0.       1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20572901    cntrlvar         600           cntrlvar         605
20572902    cntrlvar         724
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573000  "ptpow5"       mult      1.0      0.       1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20573001    cntrlvar         600           cntrlvar         605
20573002    cntrlvar         725
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573100   "pt1"         sum       1.0     185646.5 1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20573101          0.0        1.0           cntrlvar         701
20573102                     1.0           cntrlvar         726
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573200   "pt2"         sum       1.0     187432.   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20573201          0.0        1.0           cntrlvar         702
20573202                     1.0           cntrlvar         727
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573300   "pt3"         sum       1.0     188322.8  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20573301          0.0        1.0           cntrlvar         703
20573302                     1.0           cntrlvar         728
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573400   "pt4"         sum       1.0     182970.   1 0
*
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*ctlvar            a0       coeff        variable name  parameter no.
20573401          0.0        1.0           cntrlvar         704
20573402                     1.0           cntrlvar         729
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20573500   "pt5"         sum       1.0     148160.8  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20573501          0.0        1.0           cntrlvar         705
20573502                     1.0           cntrlvar         730
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574100  "cpbt6"       mult   5.3373e-4   183603.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20574101    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574200  "cpbt7"       mult   5.4248e-4   186613.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20574201    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574300  "cpbt8"       mult   5.7164e-4   196644.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20574301    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574400  "cpbt9"       mult   6.2123e-4   213703.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20574401    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574500  "cpbt0"       mult   6.4748e-4   222733.  1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20574501    cntrlvar         601           cntrlvar         605
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574600 "fspwpt6"    function 2.9139e-4   2.9139-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20574601          time              0                  606
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574700 "fsdkpt6"    function 1.1863e-4   1.1863-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20574701          time              0                  607
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574800 "aldkpt6"    function 1.2370e-4   1.237-4    1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20574801          time              0                  608
$=====================================================================$
*ctlvar      name        type     factor    init   f c     min     max
20574900 "fspwpt7"    function 2.9617e-4   2.9617-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20574901          time              0                  606
$=====================================================================$
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*ctlvar      name       type     factor    init   f c     min    max
20575000 "fsdkpt7"    function 1.2058e-4   1.2058-4 1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575001          time              0                 607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575100 "aldkpt8"    function 1.2573e-4   1.2573-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575101          time              0                 608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575200 "fspwpt8"    function 3.1210e-4   3.121-4    1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575201          time              0                 606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575300 "fsdkpt8"    function 1.2706e-4   1.2706-4  1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575301          time              0                 607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575400 "aldkpt8"    function 1.3249e-4   1.3249-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575401          time              0                 608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575500 "fspwpt9"    function 3.3917e-4   3.3917-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575501          time              0                 606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575600 "fsdkpt9"    function 1.3808e-4   1.3808-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575601          time              0                 607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575700 "aldkpt9"    function 1.4398e-4   1.4398-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575701          time              0                 608
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575800 "fspwpt0"    function 3.5350e-4   3.535-4    1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575801          time              0                 606
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20575900 "fsdkpt0"    function 1.4392e-4   1.4392-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20575901          time              0                 607
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576000 "aldkpt0"    function 1.5006e-4   1.5006-4   1 0
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20576001          time              0                 608
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$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576100  "ptsum6"      sum       1.0      5.3372-4   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20576101          0.0        1.0            cntrlvar         746
20576102                     1.0            cntrlvar         747
20576103                     1.0            cntrlvar         748
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576200  "ptsum7"      sum       1.0      5.4248-4   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20576201          0.0        1.0            cntrlvar         749
20576202                     1.0            cntrlvar         750
20576203                     1.0            cntrlvar         751
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576300  "ptsum8"      sum       1.0      5.7165-4   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20576301          0.0        1.0            cntrlvar         752
20576302                     1.0            cntrlvar         753
20576303                     1.0            cntrlvar         754
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576400  "ptsum9"      sum       1.0      6.2123-4   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20576401          0.0        1.0            cntrlvar         755
20576402                     1.0            cntrlvar         756
20576403                     1.0            cntrlvar         757
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576500  "ptsum0"      sum       1.0      6.4748-4   1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20576501          0.0        1.0            cntrlvar         758
20576502                     1.0            cntrlvar         759
20576503                     1.0            cntrlvar         760
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576600  "ptpow6"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20576601     cntrlvar         600            cntrlvar         605
20576602     cntrlvar         761
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576700  "ptpow7"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20576701     cntrlvar         600            cntrlvar         605
20576702     cntrlvar         762
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576800  "ptpow8"      mult      1.0      0.         1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20576801     cntrlvar         600            cntrlvar         605
20576802     cntrlvar         763
$=================================================================$
*ctlvar      name       type     factor    init   f c     min    max
20576900  "ptpow9"      mult      1.0      0.         1 0
*
```

```
*ctlvar  variable name  parameter no.    variable name  parameter no.
20576901    cntrlvar         600            cntrlvar         605
20576902    cntrlvar         764
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577000  "ptpow0"      mult      1.0      0.        1 0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20577001    cntrlvar         600            cntrlvar         605
20577002    cntrlvar         765
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577100   "pt6"        sum       1.0      183603.   1 0
*
*ctlvar           a0       coeff        variable name  parameter no.
20577101          0.0        1.0           cntrlvar         741
20577102                     1.0           cntrlvar         766
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577200   "pt7"        sum       1.0      186613.   1 0
*
*ctlvar           a0       coeff        variable name  parameter no.
20577201          0.0        1.0           cntrlvar         742
20577202                     1.0           cntrlvar         767
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577300   "pt8"        sum       1.0      196644.   1 0
*
*ctlvar           a0       coeff        variable name  parameter no.
20577301          0.0        1.0           cntrlvar         743
20577302                     1.0           cntrlvar         768
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577400   "pt9"        sum       1.0      213703.   1 0
*
*ctlvar           a0       coeff        variable name  parameter no.
20577401          0.0        1.0           cntrlvar         744
20577402                     1.0           cntrlvar         769
$=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20577500   "pt0"        sum       1.0      222733.   1 0
*
*ctlvar           a0       coeff        variable name  parameter no.
20577501          0.0        1.0           cntrlvar         745
20577502                     1.0           cntrlvar         770
$=====================================================================$
*
* logic to trip pressurizer pumps when make-up tank empties
*
*---------------------------------------------------------------------$
*ctlvar      name       type     factor    init   f c     min     max
20580100 binary tripunit  1.0000d+00  0.         0 3     .00  1.0000d+00
*
*ctlvar      trip no.
20580101       550
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580200 flow     sum        1.00000d+00  14.60408    0
*
*ctlvar           a0       coeff        variable name  parameter no.
20580201          0.         1.             mflowj       850010000
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580300 flow     mult       1.00000d+00  0.          0
*
```

```
*ctlvar  variable name  parameter no.    variable name  parameter no.
20580301    cntrlvar         801            cntrlvar         802
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580400 intflow  integral  1.00000d+00  0.          0
*
*ctlvar      integrand name   integrand no.
20580401        cntrlvar          803
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580500 binary tripunit  1.0000d+00  0.         0 3     .00  1.0000d+00
*
*ctlvar      trip no.
20580501       551
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580600 dnrpm  mult     -1.0000d+00  0.         0 3   -1.00  1.0000d+00
*
*cntrlvar     var. name   parameter no.       var. name    parameter no.
20580601      cntrlvar         943             cntrlvar         805
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20580700 nrpm   sum       1.0000d+00  1.         0 3     .00  1.0000d+00
*
*ctlvar           a0       coeff        variable name  parameter no.
20580701          0.         1.            cntrlvar         807
20580702                     1.            cntrlvar         806
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20581500 mpzrsp sum       245.9957    245.9957   0 3     .00  245.9957
*
*ctlvar           a0       coeff        variable name  parameter no.
20581501          0.         1.            cntrlvar         807
*
*=====================================================================$
*
* logic to ramp standby pressurizer pump on
*
*ctlvar      name       type     factor    init   f c     min     max
20581600 sbpzrs function  1.0000d+00  0.         0 3     .00  245.9957
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20581601          time              0                  820
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20581700 sbpzrs mult      1.0000d+00  0.         0 3     .00  245.9957
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20581701    cntrlvar         816            cntrlvar         807
*=====================================================================$
*
* pressure drop from cell center to junction
*
*  delta p = 1/2 * ajun/avol * (delta x)vol * fwalfvol * velfjun
*
*=====================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20582100    dp-505      mult    0.0433402 477.05   1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582101   fwalf           505090000          velfj        507010200
*
*ctlvar      name       type     factor    init   f c     min     max
20582200    dp-520      mult    0.0123587  128.9298 1
*
```

```
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582201     fwalf        520010000         velfj        522010100
*
*ctlvar      name       type     factor    init   f c     min     max
20582300    dp-535       mult   0.010047  122.4094 1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582301     fwalf        535010000           velfj        537010200
*
*ctlvar      name       type     factor    init   f c     min     max
20582400    dp-555       mult   0.038294  443.271  1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582401     fwalf        555010000           velfj        556010100
*
*ctlvar      name       type     factor    init   f c     min     max
20582500    dp-572       mult   0.0286696 281.5674 1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582501     fwalf        572010000           velfj        569010200
*
*ctlvar      name       type     factor    init   f c     min     max
20582600    dp-580       mult   0.0517239 490.6165 1
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20582601     fwalf        580010000           velfj        581010100
*
*=================================================================$
*
* delta p in average fuel channels including entrance and exit losses
*
*=================================================================$
*
*ctlvar      name       type     factor    init   f c     min     max
20582700    lcexitp      sum       1.0    1806924. 0
*
*ctlvar           a0        coeff        variable name  parameter no.
20582701         0.0          1.0          p              520010000
20582702                      1.0          cntrlvar       822
*
*ctlvar      name       type     factor    init   f c     min     max
20582800    lcdeltap     sum       1.0    712214.  0
*
*ctlvar           a0        coeff        variable name  parameter no.
20582801         0.0          1.0          p              505090000
20582802                     -1.0          cntrlvar       821
20582803                     -1.0          cntrlvar       827
*
*ctlvar      name       type     factor    init   f c     min     max
20582900    ucexitp      sum       1.0    1801998. 0
*
*ctlvar           a0        coeff        variable name  parameter no.
20582901         0.0          1.0          p              555010000
20582902                      1.0          cntrlvar       824
*
*ctlvar      name       type     factor    init   f c     min     max
20583000    ucdeltap     sum       1.0    707110.  0
*
*ctlvar           a0        coeff        variable name  parameter no.
20583001         0.0          1.0          p              535010000
20583002                     -1.0          cntrlvar       823
20583003                     -1.0          cntrlvar       829
*
*ctlvar      name       type     factor    init   f c     min     max
20583100    icexitp      sum       1.0    1799004. 0
```

```
*
*ctlvar           a0        coeff        variable name  parameter no.
20583101         0.0          1.0          p              580010000
20583102                      1.0          cntrlvar       826
*
*ctlvar      name       type     factor    init   f c     min     max
20583200    icdeltap     sum       1.0    712954.  0
*
*ctlvar           a0        coeff        variable name  parameter no.
20583201         0.0          1.0          p              572010000
20583202                     -1.0          cntrlvar       825
20583203                     -1.0          cntrlvar       831
*
*=================================================================$
*
* first order lag applied to sensor location pressure
*
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20583900 lagpres  lag       1.00000d+00  1651716.    0
*
*ctlvar         tau-1                    variable name  parameter no.
20583901          0.03                      p            645150000
*=================================================================$
*
* control system to control primary coolant system pressure by
* adjusting the letdown flow area using:
*
* d=k*(p-ps)
* dx/dt=(d-x)/tau
*
* where:
*  k = proportional constant = 5/mpa
*  tau = time constant = 1 s
*  p = measured sensor pressure
*  ps = setpoint pressure = 3.2 mpa
*  d = demand (cv 840)
*  x = valve position
*    = -1 for fully closed,
*    = 1 for fully open,
*    = 0 at normal position
*
* note: letdown valve orifice area = 0.000283  m^2
*       (calibrated for half-open valve at x=0)
*
20584000 perror sum 5. -.0153826   1 0
20584001 -1.810   1.e-6 cntrlvar 827
*
* sf = a0, multiplier on cv860 = 1/a0
20584200 dadt sum .5 1.652712-5  1 0
20584201 1.0  -2. cntrlvar 860
20584202       1.     cntrlvar 840
*
20584400 dt sum 1. .004      1 0
20584401  0.  1. time 0
20584402      -1. cntrlvar 845
*
20584500 oldtime sum 1. 190.704  1 0
20584501  0.  1.  time 0
*
20584700 da mult 1. 6.61085-8   1 0
20584701 cntrlvar 842  cntrlvar 844
*
20586000 ldvarea sum 1. .492292  0 3 0. 1.
20586001 0.  1.  cntrlvar 860
```

```
20586002     1.  cntrlvar 847
$=====================================================================$
*
* heat gain across cores
*
20586100 pvin  div       1.0           2375.26      1
20586101 rhof,490010000  p,490010000
20586200 pvout  div       1.0           1647.586     1
20586201 rhof,565010000  p,565010000
20586300 dhspec  sum       1.0           141546.8     1
20586301 0. 1.0,uf,565010000 -1.,uf,490010000
20586302 1.,cntrlvar,862 -1.,cntrlvar,861
20586400 qgain   mult     1.0           332373632.   1
20586401 mflowj,567010400 cntrlvar,863
$=====================================================================$
** costa flow excursion predictions (w/m^2)
*
* these control variables are for purely cosmetic purposes to monitor
* the flow excursion thermal limit at the hot channel exit locations
*
* - upper fuel hot channel 4th axial volume (95%)
20586500 sqrtvelf powerr    1.000000d+00  4.39708      0
20586501 velf 545040000 0.5
20586600 sattemp  sum       1.0           480.022      1
20586601 0. 0.5,sattemp,545040000 0.5,sattemp,545050000
20586700 subcoolf sum       1.000000d+00  113.1481     0
20586701 0. 1.,cntrlvar,866  -1.,tempf,545040000
20586800 costaf   mult      7.812500d+04  38868864.    0
20586801 cntrlvar,865 cntrlvar,867
* - lower fuel hot channel 5th axial volume (95%)
20587000 sqrtvelf powerr    1.000000d+00  4.42843      0
20587001 velf 515050000 0.5
20587100 sattemp  sum       1.0           476.543      1
20587101 0. 1.5,sattemp,515050000 -0.5,sattemp,515040000
20587200 subcoolf sum       1.000000d+00  98.6883      0
20587201 0. 1.,cntrlvar 871      -1.,tempf,515050000
20587400 costaf   mult      7.812500d+04  34143260.    0
20587401 cntrlvar,870 cntrlvar,872
* - lower fuel hot channel 5th axial volume (99.9%)
20587600 sqrtvelf powerr    1.000000d+00  4.43498      0
20587601 velf 516050000 0.5
20587700 sattemp  sum       1.0           476.515      1
20587701 0. 1.5,sattemp,516050000 -0.5,sattemp,516040000
20587800 subcoolf sum       1.000000d+00  96.2818      0
20587801 0. 1.,cntrlvar,877 -1.,tempf,516050000
20588000 costaf   mult      7.812500d+04  33359958.    0
20588001 cntrlvar,876 cntrlvar,878
* - upper fuel hot channel 5th axial volume (95%)
20588200 sqrtvelf powerr    1.000000d+00  4.41255      0
20588201 velf 545050000 0.5
20588300 sattemp  sum       1.0           476.456      1
20588301 0. 1.5,sattemp,545050000 -0.5,sattemp,545040000
20588400 subcoolf sum       1.000000d+00  100.4831     0
20588401 0. 1.,cntrlvar,883  -1.,tempf,545050000
20588600 costaf   mult      7.812500d+04  34639572.    0
20588601 cntrlvar,882 cntrlvar,884
* - upper fuel hot channel 5th axial volume (99.9%)
20588800 sqrtvelf powerr    1.000000d+00  4.41882      0
20588801 velf 546050000 0.5
20588900 sattemp  sum       1.0           476.429      1
20588901 0. 1.5,sattemp,546050000 -0.5,sattemp,546040000
20589000 subcoolf sum       1.000000d+00  98.1924      0
20589001 0. 1.,cntrlvar,889 -1.,tempf,546050000
20589200 costaf   mult      7.812500d+04  3.3898+7     0
20589201 cntrlvar,888 cntrlvar,890
* - lower fuel hot channel 4th axial volume (95%)
20589300 sqrtvelf powerr    1.000000d+00  4.41171      0
20589301 velf 515040000 0.5
20589400 sattemp  sum       1.0           480.126      1
20589401 0. 0.5,sattemp,515040000 0.5,sattemp,515050000
20589500 subcoolf sum       1.000000d+00  112.086      0
20589501 0. 1.,cntrlvar 894      -1.,tempf,515040000
20589600 costaf   mult      7.812500d+04  38632132.    0
20589601 cntrlvar,893 cntrlvar,895
*
*=====================================================================*
*
* control variables to develop total reactivity for kinetics model
*  (cntrlvar 972 is total reactivity driving the kinetics model)
*
*=====================================================================*
*
*ctlvar      name       type     factor    init   f c     min     max
20590000 c510rm   sum       7.69000d-02  417.064     1
*
*ctlvar           a0       coeff        variable name  parameter no.
20590001          0.         1.             rho          510010000
20590002                     1.             rho          510020000
20590003                     1.             rho          510030000
20590004                     1.             rho          510040000
20590005                     1.             rho          510050000
*=====================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590100 c515rm   sum       3.22000d-04  1.733114    1
*
*ctlvar           a0       coeff        variable name  parameter no.
20590101          0.         1.             rho          515010000
20590102                     1.             rho          515020000
20590103                     1.             rho          515030000
20590104                     1.             rho          515040000
20590105                     1.             rho          515050000
*=====================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590200 c540rm   sum       1.22000d-01  661.743     1
*
*ctlvar           a0       coeff        variable name  parameter no.
20590201          0.         1.             rho          540010000
20590202                     1.             rho          540020000
20590203                     1.             rho          540030000
20590204                     1.             rho          540040000
20590205                     1.             rho          540050000
*=====================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590300 c545rm   sum       2.94000d-04  1.583257    1
*
*ctlvar           a0       coeff        variable name  parameter no.
20590301          0.         1.             rho          545010000
20590302                     1.             rho          545020000
20590303                     1.             rho          545030000
20590304                     1.             rho          545040000
20590305                     1.             rho          545050000
*=====================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590400 drho     sum       1.00000d+00 .89603       1
*
*ctlvar           a0       coeff        variable name  parameter no.
20590401       -467.766       0.7600        cntrlvar        900
20590402                      0.7600        cntrlvar        901
20590403                      0.2267        cntrlvar        902
20590404                      0.2267        cntrlvar        903
```

```
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590500 cdenrx   sum        7.50000d-02 .00620261    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20590501           0.     0.0922978          cntrlvar         904
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590800 c510dtm  sum        7.69000d-02  27.02664    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20590801           0.         1.             htvat         5101001
20590802                     -.5              htvat         5102001
20590803                     -.5              htvat         5103001
20590804                      1.              htvat         5101002
20590805                     -.5              htvat         5102002
20590806                     -.5              htvat         5103002
20590807                      1.              htvat         5101003
20590808                     -.5              htvat         5102003
20590809                     -.5              htvat         5103003
20590810                      1.              htvat         5101004
20590811                     -.5              htvat         5102004
20590812                     -.5              htvat         5103004
20590813                      1.              htvat         5101005
20590814                     -.5              htvat         5102005
20590815                     -.5              htvat         5103005
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20590900 c515dtm  sum        3.22000d-04  .1468073    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20590901           0.         1.             htvat         5151001
20590902                     -.5              htvat         5152001
20590903                     -.5              htvat         5153001
20590904                      1.              htvat         5151002
20590905                     -.5              htvat         5152002
20590906                     -.5              htvat         5153002
20590907                      1.              htvat         5151003
20590908                     -.5              htvat         5152003
20590909                     -.5              htvat         5153003
20590910                      1.              htvat         5151004
20590911                     -.5              htvat         5152004
20590912                     -.5              htvat         5153004
20590913                      1.              htvat         5151005
20590914                     -.5              htvat         5152005
20590915                     -.5              htvat         5153005
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591000 c540dtm  sum        1.22000d-01  236.4414    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20591001           0.         1.             htvat         5401001
20591002                     -.1              htvat         5402001
20591004                      1.              htvat         5401002
20591005                     -.1              htvat         5402002
20591007                      1.              htvat         5401003
20591008                     -.1              htvat         5402003
20591010                      1.              htvat         5401004
20591011                     -.1              htvat         5402004
20591013                      1.              htvat         5401005
20591014                     -.1              htvat         5402005
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591100 c545dtm  sum        2.92000d-04  .619647     1
*
```

```
*ctlvar            a0       coeff        variable name  parameter no.
20591101           0.         1.             htvat         5451001
20591102                     -.1              htvat         5452001
20591104                      1.              htvat         5451002
20591105                     -.1              htvat         5452002
20591107                      1.              htvat         5451003
20591108                     -.1              htvat         5452003
20591110                      1.              htvat         5451004
20591111                     -.1              htvat         5452004
20591113                      1.              htvat         5451005
20591114                     -.1              htvat         5452005
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591200 dtfsp    sum        1.00000d+00  -14.74075   1
*
*ctlvar            a0       coeff        variable name  parameter no.
20591201       -89.1343       0.7600         cntrlvar         908
20591202                      0.7600         cntrlvar         909
20591203                      0.2267         cntrlvar         910
20591204                      0.2267         cntrlvar         911
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591300 expanrx  sum       -6.19000d-04 .00912452    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20591301           0.         1.             cntrlvar         912
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591700 drho     sum        1.00000d+00 1.021442     1
*
*ctlvar            a0       coeff        variable name  parameter no.
20591701       -1085.22     0.14586            rho         500010000
20591702                    0.07207            rho         505010000
20591703                    0.12983            rho         530010000
20591704                    0.01712            rho         530020000
20591705                    0.01712            rho         530030000
20591706                    0.01453            rho         530040000
20591707                    0.01453            rho         530050000
20591708                    0.01453            rho         530060000
20591709                    0.18451            rho         555010000
20591710                    0.01550            rho         525010000
20591711                    0.12177            rho         525020000
20591712                    0.25263            rho         565010000
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20591800 axmodrx  sum        3.33000d-02 .0031343     1
*
*ctlvar            a0       coeff        variable name  parameter no.
20591801           0.     0.0921472          cntrlvar         917
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20592200 drho     sum        1.00000d+00  1.071552    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20592201       -1088.98     0.34802            rho         520010000
20592202                    0.65198            rho         535010000
*=================================================================*
*ctlvar      name       type     factor    init   f c     min     max
20592300 midplrx  sum        3.33000d-02  .00327671   1
*
*ctlvar            a0       coeff        variable name  parameter no.
20592301           0.     0.0918291          cntrlvar         922
$=================================================================$
*ctlvar      name       type     factor    init   f c     min     max
20592700  "prelim"       sum         1.      500.483 1 0
```

```
*
*ctlvar            a0       coeff        variable name  parameter no.
20592701           0.      0.24883            rho          560010000
20592702                   0.00669            rho          561010000
20592703                   0.00669            rho          561020000
20592704                   0.00669            rho          561030000
20592705                   0.02418            rho          562010000
20592706                   0.02418            rho          562020000
20592707                   0.02418            rho          562030000
20592708                   0.001936           rho          563010000
20592709                   0.001936           rho          563020000
20592710                   0.001936           rho          563030000
20592711                   0.00888            rho          561040000
20592712                   0.00888            rho          561050000
20592713                   0.00438            rho          561060000
20592714                   0.03206            rho          562040000
20592715                   0.03206            rho          562050000
20592716                   0.01581            rho          562060000
20592717                   0.00257            rho          563040000
20592718                   0.00257            rho          563050000
20592719                   0.00127            rho          563060000
$=================================================================$
*ctlvar      name       type      factor    init    f c      min     max
20592800 drho      sum        1.00000d+00  1.337867  1 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20592801        -1095.32   1.0                cntrlvar        927
20592802                   0.006274           rho          561070000
20592803                   0.006274           rho          561080000
20592804                   0.02266            rho          562070000
20592805                   0.02266            rho          562080000
20592806                   0.001815           rho          563070000
20592807                   0.001815           rho          563080000
20592808                   0.005407           rho          561090000
20592809                   0.005407           rho          561100000
20592810                   0.005407           rho          561110000
20592811                   0.01953            rho          562090000
20592812                   0.01953            rho          562100000
20592813                   0.01953            rho          562110000
20592814                   0.001564           rho          563090000
20592815                   0.001564           rho          563100000
20592816                   0.001564           rho          563110000
20592817                   0.403272           rho          564010000
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20592900 centrx    sum        9.10000d-02 .0111151     1
*
*ctlvar            a0       coeff        variable name  parameter no.
20592901           0.       0.0912975       cntrlvar         928
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20593400 tankrx    sum       -1.74000d-02  .0289381    1
*
*ctlvar            a0       coeff        variable name  parameter no.
20593401        -301.747     1.               tempf        595010000
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
* nominal power = 330,000,000 W and nominal flow = 2352 kg/s
20594000 powflor   div        7.127d-06  1.044092    0
*
*ctlvar  divisor name    divisor no.     dividend name  dividend no.
20594001    mflowj        650010000          rktpow          0
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20594300 timest    sum        1.00000d+00  .004        0
```

```
*
*ctlvar            a0       coeff        variable name  parameter no.
20594301           0.         1.               time           0
20594302                     -1.              cntrlvar        944
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20594400 oldtime   sum        1.00000d+00  190.704     0
*
*ctlvar            a0       coeff        variable name  parameter no.
20594401           0.         1.               time           0
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20594500 noscram   tripunit  1.00000d+00  1.          1
*
*ctlvar      trip no.
20594501      -510
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20594600 scram     tripunit  1.00000d+00  0.          1
*
*ctlvar      trip no.
20594601       510
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20594900 powerr    sum        1.00000d+00  -1.672826-5 0
*
*ctlvar            a0       coeff        variable name  parameter no.
20594901        -344.       1.e-6            rktpow           0
*20594900 powerr    constant   0.
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20595000 lagerr    lag        1.00000d+00  3.87724-6   0
*
*ctlvar         tau-1                      variable name  parameter no.
20595001         0.5                         cntrlvar         949
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20595400 shimsp sum       1.0000d+00  3.074653-10  0 3 -1.59  1.5900d-03
*
*ctlvar            a0       coeff        variable name  parameter no.
20595401           0.      7.93e-5          cntrlvar         950
*=================================================================*
*ctlvar      name       type      factor    init    f c      min
20595600 scramsp   function  6.51000d-01  0.          0 1  0.00000d+00
*
*ctlvar      srch arg. name   srch arg. no.          table no.
20595601          time              0                  956
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20595900 shimsp    mult       1.00000d+00  3.074653-10  0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20595901     cntrlvar         954            cntrlvar         945
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20596000 scramsp   mult       1.00000d+00  0.          0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20596001     cntrlvar         956            cntrlvar         946
*=================================================================*
*ctlvar      name       type      factor    init    f c      min     max
20596100 rodspeed sum        1.00000d+00  3.074653-10  0
*
*ctlvar            a0       coeff        variable name  parameter no.
20596101           0.         1.               cntrlvar         959
```

```
20596102                    1.          cntrlvar        960
*=================================================================*
*ctlvar     name       type     factor    init   f c     min    max
20596500 deltapos mult      1.00000d+00  1.229861-12  0
*
*ctlvar  variable name  parameter no.    variable name  parameter no.
20596501    cntrlvar        961           cntrlvar        943
*=================================================================*
*ctlvar     name       type     factor    init   f c     min    max
20596700 newpos sum       1.0000d+00  .2805935   0 3     .00  1.0000d+00
*
*ctlvar           a0       coeff        variable name  parameter no.
20596701          0.         1.           cntrlvar        968
20596702                     1.           cntrlvar        965
*=================================================================*
*ctlvar     name       type     factor    init   f c     min    max
20596800 oldpos sum       1.0000d+00  .2805935   0 3     .00  1.0000d+00
*
*ctlvar           a0       coeff        variable name  parameter no.
20596801          0.         1.           cntrlvar        967
*=================================================================*
*ctlvar     name       type     factor    init   f c     min    max
20597000 rodrea function  1.0000d+00  -.0624074  1 3   -32.78 3.9300d+00
*
*ctlvar      srch arg. name   srch arg. no.         table no.
20597001        cntrlvar          967                970
*=================================================================*
*ctlvar     name       type     factor    init   f c     min    max
20597200 totalrx  sum       1.00000d+00  -6.16065-4  1
*
*ctlvar           a0       coeff        variable name  parameter no.
20597201          0.         1.           cntrlvar        905
20597202                     1.           cntrlvar        913
20597203                     1.           cntrlvar        918
20597204                     1.           cntrlvar        923
20597205                     1.           cntrlvar        929
20597206                     1.           cntrlvar        934
20597207                     1.           cntrlvar        970
*20597200 totalrx constant 0.
*
*=================================================================*
*
*                  p o i n t   k i n e t i c s
*
*=================================================================*
*
*kinetix           kinetics type        feedback type
30000000              point                separabl
*
* beta = 0.0074, lambda = 0.0005 s
*
*kinetix  fp type    ttl power     react.    delay fr.  fp yld  u239 yl
30000001   gamma       3.44e8         0.        14.8      1.0      1.0
*
*kinetix  fp type  mev/fsn
30000002  ans79-1    200.
*
* total reactivity input from cntrlvar 972
30000011 10972
*
* irradiation history - power, duration
30000401   3.44e8   17. day
*
*dummy reactivity coefficients entered to satisfy input requirements
30000501    1098. 0.
30000601     322. 0.
30000701  510010000 0 0.5 0.
30000702  510020000 0 0.5 0.
30000801 5101001 0 0.5 0.
30000802 5101002 0 0.5 0.
*
. * end of case
```

```
c
c This program modifies the ans RELAP5 input
c fuel heat structure source terms
c
c For Three-element core, a third, inner fuel element has been added.
c The upper fuel element now refers to the outermost element, and
c the lower fuel element refers to the middle element.
c
      implicit double precision (a-h,p-z)
      character*80 arec
c
c  Variable Definition
c  avpdua - average power density in upper core average fuel ht str
c  avpdla - average power density in lower core average fuel ht str
c  avpdia - average power density in inner core average fuel ht str
c  avpduh - average power density in upper core hot fuel ht str
c  avpdlh - average power density in lower core hot fuel ht str
c  avpdih - average power density in inner core hot fuel ht str
c  avpdus - avg pwr density in upper core hot stripe ht str (CHF,FE)
c  avpdls - avg pwr density in lower core hot stripe ht str (CHF,FE)
c  avpdis - avg pwr density in inner core hot stripe ht str (CHF,FE)
c  pducac - power density, upper core, average channel
c  pduchc - power density, upper core, hot channel
c  pduchs - power density, upper core, hot stripe (CHF,FE)
c  pdlcac - power density, lower core, average channel
c  pdlchc - power density, lower core, hot channel
c  pdlchs - power density, lower core, hot stripe (CHF,FE)
c  pdicac - power density, inner core, average channel
c  pdichc - power density, inner core, hot channel
c  pdichs - power density, inner core, hot stripe (CHF,FE)
c  pf95hc - peaking factor, 95% uncertainty, hot channel
c  pf95hs - peaking factor, 95% uncertainty, hot stripe (CHF,FE)
c  pf99hc - peaking factor, 99.9% uncertainty, hot channel
c  pf99hs - peaking factor, 99.9% uncertainty, hot stripe (CHF,FE)
c
c........1.........2.........3.........4.........5.........6.........7
      real mavgl, mavgu, mavgi, ml99, ml95, mu99, mu95, mi95, mi99
      dimension avpdus(2),avpdls(2),avpdis(2)
      dimension pducac(5),pduchc(5),pduchs(5,2)
      dimension pdlcac(5),pdlchc(5),pdlchs(5,2)
      dimension pdicac(5),pdichc(5),pdichs(5,2)
      dimension pf95hc(5),pf95hs(5,2),pf99hc(5),pf99hs(5,2)
      open(unit=21,file='indta',status='old',form='formatted')
      open(unit=23,file='pd.dat',status='old',form='formatted')
      open(unit=24,file='pf.dat',status='old',form='formatted')
      open(unit=22,file='INDTA',status='unknown',form='formatted')
      pi = 4*datan(1.d0)
c-----------------------------------------------------------------------c
c calculate total core coolant volumes (cubic millimeters)
c
      radol = 224.
      radil = 169.
      radou = 281.
      radiu = 231.
      radoi = 162.
      radii = 102.
      hetlen = 418.
      vl = pi*(radol*radol-radil*radil)*hetlen/2.
      vu = pi*(radou*radou-radiu*radiu)*hetlen/2.
      vi = pi*(radoi*radoi-radii*radii)*hetlen/2.
c volumes for annular regions
      vlann = pi*(radol*radol-radil*radil)*(2.582+3.0)
      vuann = pi*(radou*radou-radiu*radiu)*(2.582+3.0)
      viann = pi*(radoi*radoi-radii*radii)*(2.582+3.0)
c
      vtot = vl+vu+vi
c-----------------------------------------------------------------------c
c
c read in power densities and peaking factors
c
c
c power densities
c
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      do 5 i=1,5
    5 read(23,9992)iz,pducac(iz),pduchc(iz),pduchs(iz,1),pduchs(iz,2)
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      do 6 i=1,5
    6 read(23,9992)iz,pdlcac(iz),pdlchc(iz),pdlchs(iz,1),pdlchs(iz,2)
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      read(23,9998)arec
      do 7 i=1,5
    7 read(23,9992)iz,pdicac(iz),pdichc(iz),pdichs(iz,1),pdichs(iz,2)
c
c peaking factors
c
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      do 9 i=1,5
    9 read(24,9992)iz,pf95hc(iz),pf95hs(iz,1),
     .               pf95hs(iz,2)
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      read(24,9998)arec
      do 16 i=1,5
   16 read(24,9992)iz,pf99hc(iz),pf99hs(iz,1),
     .               pf99hs(iz,2)
c
c calculate average power densities
c
            avpdua = (pducac(1)+pducac(2)+pducac(3)+pducac(4)
     .             + pducac(5))/5.
            avpdla = (pdlcac(1)+pdlcac(2)+pdlcac(3)+pdlcac(4)
     .             + pdlcac(5))/5.
            avpdia = (pdicac(1)+pdicac(2)+pdicac(3)+pdicac(4)
     .             + pdicac(5))/5.
            avpduh = (pduchc(1)+pduchc(2)+pduchc(3)+pduchc(4)
     .             + pduchc(5))/5.
            avpdlh = (pdlchc(1)+pdlchc(2)+pdlchc(3)+pdlchc(4)
     .             + pdlchc(5))/5.
            avpdih = (pdichc(1)+pdichc(2)+pdichc(3)+pdichc(4)
     .             + pdichc(5))/5.
            avpdus(1) = (pduchs(1,1)+pduchs(2,1)+pduchs(3,1)
     .             + pduchs(4,1)+pduchs(5,1))/5.
```

```
            avpdus(2) = (pduchs(1,2)+pduchs(2,2)+pduchs(3,2)
     .                + pduchs(4,2)+pduchs(5,2))/5.
            avpdls(1) = (pdlchs(1,1)+pdlchs(2,1)+pdlchs(3,1)
     .                + pdlchs(4,1)+pdlchs(5,1))/5.
            avpdls(2) = (pdlchs(1,2)+pdlchs(2,2)+pdlchs(3,2)
     .                + pdlchs(4,2)+pdlchs(5,2))/5.
            avpdis(1) = (pdichs(1,1)+pdichs(2,1)+pdichs(3,1)
     .                + pdichs(4,1)+pdichs(5,1))/5.
            avpdis(2) = (pdichs(1,2)+pdichs(2,2)+pdichs(3,2)
     .                + pdichs(4,2)+pdichs(5,2))/5.
c-----------------------------------------------------------------------c
c
c calculate the power fractions
c
c hot channels
      mi99 = avpdih/avpdia*pf99hc(1)/252.
      mi95 = avpdih/avpdia*pf95hc(1)/252.
      ml99 = avpdlh/avpdla*pf99hc(1)/418.
      ml95 = avpdlh/avpdla*pf95hc(1)/418.
      mu99 = avpduh/avpdua*pf99hc(1)/571.
      mu95 = avpduh/avpdua*pf95hc(1)/571.
c average channels
      mavgi = 1. - mi99 - mi95
      mavgl = 1. - ml99 - ml95
      mavgu = 1. - mu99 - mu95
c-----------------------------------------------------------------------c
c
c zero summations
c
      sum = 0.
      sumif = 0.
      sumlf = 0.
      sumuf = 0.
      sumoth = 0.
      sumcli = 0.
      sumcll = 0.
      sumclu = 0.
      sumclo = 0.
      sumisp = 0.
      sumlsp = 0.
      sumusp = 0.
      sumcpc = 0.
c-----------------------------------------------------------------------c
c
c Read input data to modify heat structure sources
c
   10 read(21,9998,end=999)arec
c IF THIS IS A HEAT STRUCTURE CARD
      if(arec(1:1).eq.'1'.and.arec(8:8).ne.' '.and.
     .   arec(6:6).eq.'7') then
        iptr = 9
        iw1 = iread(iptr,arec)
        if(iw1.ne.0) then
          w2 = dread(iptr,arec)
          w3 = dread(iptr,arec)
          w4 = dread(iptr,arec)
          iw5 = iread(iptr,arec)
        endif
c IF THE SOURCE TERM IS 1000 (POINT KINETICS)
        if(iw1.eq.1000) then
          read(arec(8:8),'(i1)')n
c
c Leading factors on fuel w2 source terms are calculated from
c  tot core pwr frctn x fuel meat and clad pwr frctn / 5 cells
c
```

```
c Leading factors on fuel w3 source terms are calculated from
c  tot core coolant pwr frctn / 5 cells x
c           single core volume / total volume of all cores
c
c LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL
c
c                 Lower fuel heat structures
c
c LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL LOWER FUEL
c
c IF THIS HEAT STRUCTURE IS IN THE LOWER FUEL
          if(arec(3:3).eq.'1') then
c average fuel heat structure
           if(arec(2:5).eq.'5101') then
            w2 = (0.405*0.90757/5.)*mavgl*pdlcac(n)/avpdla
            w3 = 0.00777/5.*vl/(vannl+vl)*mavgl*pdlcac(n)/avpdla
            w4 = 0.0
            sumlf = sumlf+w2
            sumcll = sumcll+w3+w4
c inner side plate heat structure
           else if(arec(2:5).eq.'5102') then
            w2 = 2.2155d-4*mavgl*pdlcac(n)/avpdla
            w3 = 5.6000d-4*mavgl*pdlcac(n)/avpdla
            w4 = 0.0
            sumlsp = sumlsp+w2
            sumcll = sumcll+w3+w4
c outer side plate heat structure
           else if(arec(2:5).eq.'5103') then
            w2 = 3.0445d-4*mavgl*pdlcac(n)/avpdla
            w3 = 0.0
            w4 = 6.5800d-4*mavgl*pdlcac(n)/avpdla
            sumlsp = sumlsp+w2
            sumcll = sumcll+w3+w4
c 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95%
c hot channel fuel plate
           else if(arec(2:5).eq.'5151') then
            w2 = (0.405*0.90757/5.)*ml95*pdlchc(n)/avpdlh
            w3 = 0.00777/5.*vl/(vannl+vl)*ml95*pdlchc(n)/avpdlh
            w4 = 0.0
            sumlf = sumlf+w2
            sumcll = sumcll+w3+w4
c hot channel inner side plate heat structure
           else if(arec(2:5).eq.'5152') then
            w2 = 2.2155d-4*ml95*pdlchc(n)/avpdlh
            w3 = 5.6000d-4*ml95*pdlchc(n)/avpdlh
            w4 = 0.0
            sumlsp = sumlsp+w2
            sumcll = sumcll+w3+w4
c hot channel outer side plate heat structure
           else if(arec(2:5).eq.'5153') then
            w2 = 3.0445d-4*ml95*pdlchc(n)/avpdlh
            w3 = 0.0
            w4 = 6.5800d-4*ml95*pdlchc(n)/avpdlh
            sumlsp = sumlsp+w2
            sumcll = sumcll+w3+w4
c CHF hot stripe heat structure
           else if(arec(2:5).eq.'5154') then
            a1 = ml95/5.*0.405*0.90757/100.
            a2 = (pdlchs(1,1)*pf95hs(1,1)+
     .            pdlchs(2,1)*pf95hs(2,1)+
     .            pdlchs(3,1)*pf95hs(3,1)+
     .            pdlchs(4,1)*pf95hs(4,1)+
     .            pdlchs(5,1)*pf95hs(5,1))/5.
            a3 = (pdlchc(1)*pf95hc(1)+
     .            pdlchc(2)*pf95hc(2)+
```

```
     .            pdlchc(3)*pf95hc(3)+
     .            pdlchc(4)*pf95hc(4)+
     .            pdlchc(5)*pf95hc(5))/5.
          w2 = pdlchs(n,1)/avpdls(1)*a1*a2/a3
          w3 = 0.
          w4 = 0.
          sumlf = sumlf+w2
          sumcll = sumcll+w3+w4
c FE hot stripe heat structure
         else if(arec(2:5).eq.'5155') then
          a1 = ml95/5.*0.405*0.90757/100.
          a2 = (pdlchs(1,2)*pf95hs(1,2)+
     .          pdlchs(2,2)*pf95hs(2,2)+
     .          pdlchs(3,2)*pf95hs(3,2)+
     .          pdlchs(4,2)*pf95hs(4,2)+
     .          pdlchs(5,2)*pf95hs(5,2))/5.
          a3 = (pdlchc(1)*pf95hc(1)+
     .          pdlchc(2)*pf95hc(2)+
     .          pdlchc(3)*pf95hc(3)+
     .          pdlchc(4)*pf95hc(4)+
     .          pdlchc(5)*pf95hc(5))/5.
          w2 = pdlchs(n,2)/avpdls(2)*a1*a2/a3
          w3 = 0.
          w4 = 0.
          sumlf = sumlf+w2
          sumcll = sumcll+w3+w4
c 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9%
c hot channel fuel plate
         else if(arec(2:5).eq.'5161') then
          w2 = (0.405*0.90757/5.)*ml99*pdlchc(n)/avpdlh
          w3 = 0.00777/5.*vl/(vannl+vl)*ml99*pdlchc(n)/avpdlh
          w4 = 0.0
          sumlf = sumlf+w2
          sumcll = sumcll+w3+w4
c hot channel inner side plate heat structure
         else if(arec(2:5).eq.'5162') then
          w2 = 2.2155d-4*ml99*pdlchc(n)/avpdlh
          w3 = 5.60004d-4*ml99*pdlchc(n)/avpdlh
          w4 = 0.0
          sumlsp = sumlsp+w2
          sumcll = sumcll+w3+w4
c hot channel outer side plate heat structure
         else if(arec(2:5).eq.'5163') then
          w2 = 3.0445d-4*ml99*pdlchc(n)/avpdlh
          w3 = 0.0
          w4 = 6.5800d-4*ml99*pdlchc(n)/avpdlh
          sumlsp = sumlsp+w2
          sumcll = sumcll+w3+w4
c CHF hot stripe heat structure
         else if(arec(2:5).eq.'5164') then
          a1 = ml99/5.*0.405*0.90757/100.
          a2 = (pdlchs(1,1)*pf99hs(1,1)+
     .          pdlchs(2,1)*pf99hs(2,1)+
     .          pdlchs(3,1)*pf99hs(3,1)+
     .          pdlchs(4,1)*pf99hs(4,1)+
     .          pdlchs(5,1)*pf99hs(5,1))/5.
          a3 = (pdlchc(1)*pf99hc(1)+
     .          pdlchc(2)*pf99hc(2)+
     .          pdlchc(3)*pf99hc(3)+
     .          pdlchc(4)*pf99hc(4)+
     .          pdlchc(5)*pf99hc(5))/5.
          w2 = pdlchs(n,1)/avpdls(1)*a1*a2/a3
          w3 = 0.
          w4 = 0.
          sumlf = sumlf+w2
          sumcll = sumcll+w3+w4
c FE hot stripe heat structure
         else if(arec(2:5).eq.'5165') then
          a1 = ml99/5.*0.405*0.90757/100.
          a2 = (pdlchs(1,2)*pf99hs(1,2)+
     .          pdlchs(2,2)*pf99hs(2,2)+
     .          pdlchs(3,2)*pf99hs(3,2)+
     .          pdlchs(4,2)*pf99hs(4,2)+
     .          pdlchs(5,2)*pf99hs(5,2))/5.
          a3 = (pdlchc(1)*pf99hc(1)+
     .          pdlchc(2)*pf99hc(2)+
     .          pdlchc(3)*pf99hc(3)+
     .          pdlchc(4)*pf99hc(4)+
     .          pdlchc(5)*pf99hc(5))/5.
          w2 = pdlchs(n,2)/avpdls(2)*a1*a2/a3
          w3 = 0.
          w4 = 0.
          sumlf = sumlf+w2
          sumcll = sumcll+w3+w4
         endif
c
         write(arec(9:80),9988)iw1,w2,w3,w4,iw5
         do 12 ii=1,80
          if(arec(ii:ii).eq.'D')arec(ii:ii)='d'
   12     if(arec(ii:ii).eq.'E')arec(ii:ii)='e'
*
c UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL
c
c                    Upper fuel heat structures
c
c UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL UPPER FUEL
*
c IF THIS HEAT STRUCTURE IS IN THE UPPER FUEL
         else if(arec(3:3).eq.'4') then
c average fuel heat structure
          if(arec(2:5).eq.'5401') then
           w2 = (0.443*0.90757/5.)*mavgu*pducac(n)/avpdua
           w3 = 0.00660/5.*vu/(vannu+vu)*mavgu*pducac(n)/avpdua
           w4 = 0.0
           sumuf = sumuf+w2
           sumclu = sumclu+w3+w4
c inner side plate heat structure
          else if(arec(2:5).eq.'5402') then
           w2 = 2.2926d-4*mavgu*pducac(n)/avpdua
           w3 = 7.7600d-4*mavgu*pducac(n)/avpdua
           w4 = 0.0
           sumusp = sumusp+w2
           sumclu = sumclu+w3+w4
c outer side plate heat structure
          else if(arec(2:5).eq.'5403') then
           w2 = 2.8674d-4*mavgu*pducac(n)/avpdua
           w3 = 0.0
           w4 = 8.0160d-6*mavgu*pducac(n)/avpdua
           sumusp = sumusp+w2
           sumclu = sumclu+w3+w4
c 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95%
c hot channel fuel plate
          else if(arec(2:5).eq.'5451') then
           w2 = (0.443*0.90757/5.)*mu95*pduchc(n)/avpduh
           w3 = 0.00660/5.*vu/(vannu+vu)*mu95*pduchc(n)/avpduh
           w4 = 0.0
           sumuf = sumuf+w2
           sumclu = sumclu+w3+w4
c hot channel inner side plate heat structure
          else if(arec(2:5).eq.'5452') then
```

```
            w2 = 2.2926d-4*mu95*pduchc(n)/avpduh
            w3 = 7.7600d-4*mu95*pduchc(n)/avpduh
            w4 = 0.0
            sumusp = sumusp+w2
            sumclu = sumclu+w3+w4
c hot channel outer side plate heat structure
          else if(arec(2:5).eq.'5453') then
            w2 = 2.8674d-4*mu95*pduchc(n)/avpduh
            w3 = 0.0
            w4 = 8.0160d-6*mu95*pduchc(n)/avpduh
            sumusp = sumusp+w2
            sumclu = sumclu+w3+w4
c CHF hot stripe heat structure
          else if(arec(2:5).eq.'5454') then
            a1 = mu95/5.*0.443*0.90757/100.
            a2 = (pduchs(1,1)*pf95hs(1,1)+
     .            pduchs(2,1)*pf95hs(2,1)+
     .            pduchs(3,1)*pf95hs(3,1)+
     .            pduchs(4,1)*pf95hs(4,1)+
     .            pduchs(5,1)*pf95hs(5,1))/5.
            a3 = (pduchc(1)*pf95hc(1)+
     .            pduchc(2)*pf95hc(2)+
     .            pduchc(3)*pf95hc(3)+
     .            pduchc(4)*pf95hc(4)+
     .            pduchc(5)*pf95hc(5))/5.
            w2 = pduchs(n,1)/avpdus(1)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumuf = sumuf+w2
            sumclu = sumclu+w3+w4
c FE hot stripe heat structure
          else if(arec(2:5).eq.'5455') then
            a1 = mu95/5.*0.443*0.90757/100.
            a2 = (pduchs(1,2)*pf95hs(1,2)+
     .            pduchs(2,2)*pf95hs(2,2)+
     .            pduchs(3,2)*pf95hs(3,2)+
     .            pduchs(4,2)*pf95hs(4,2)+
     .            pduchs(5,2)*pf95hs(5,2))/5.
            a3 = (pduchc(1)*pf95hc(1)+
     .            pduchc(2)*pf95hc(2)+
     .            pduchc(3)*pf95hc(3)+
     .            pduchc(4)*pf95hc(4)+
     .            pduchc(5)*pf95hc(5))/5.
            w2 = pduchs(n,2)/avpdus(2)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumuf = sumuf+w2
            sumclu = sumclu+w3+w4
c 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9%
c hot channel fuel plate
          else if(arec(2:5).eq.'5461') then
            w2 = (0.443*0.90757/5.)*mu99*pduchc(n)/avpduh
            w3 = 0.00660/5.*vu/(vannu+vu)*mu99*pduchc(n)/avpduh
            w4 = 0.0
            sumuf = sumuf+w2
            sumclu = sumclu+w3+w4
c hot channel inner side plate heat structure
          else if(arec(2:5).eq.'5462') then
            w2 = 2.2926d-4*mu99*pduchc(n)/avpduh
            w3 = 7.7600d-4*mu99*pduchc(n)/avpduh
            w4 = 0.0
            sumusp = sumusp+w2
            sumclu = sumclu+w3+w4
c hot channel outer side plate heat structure
          else if(arec(2:5).eq.'5463') then
            w2 = 2.8674d-4*mu99*pduchc(n)/avpduh
            w3 = 0.0
            w4 = 8.0160d-6*mu99*pduchc(n)/avpduh
            sumusp = sumusp+w2
            sumclu = sumclu+w3+w4
c CHF hot stripe heat structure
          else if(arec(2:5).eq.'5464') then
            a1 = mu99/5.*0.443*0.90757/100.
            a2 = (pduchs(1,1)*pf99hs(1,1)+
     .            pduchs(2,1)*pf99hs(2,1)+
     .            pduchs(3,1)*pf99hs(3,1)+
     .            pduchs(4,1)*pf99hs(4,1)+
     .            pduchs(5,1)*pf99hs(5,1))/5.
            a3 = (pduchc(1)*pf99hc(1)+
     .            pduchc(2)*pf99hc(2)+
     .            pduchc(3)*pf99hc(3)+
     .            pduchc(4)*pf99hc(4)+
     .            pduchc(5)*pf99hc(5))/5.
            w2 = pduchs(n,1)/avpdus(1)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumuf = sumuf+w2
            sumclu = sumclu+w3+w4
c FE hot stripe heat structure
          else if(arec(2:5).eq.'5465') then
            a1 = mu99/5.*0.443*0.90757/100.
            a2 = (pduchs(1,2)*pf99hs(1,2)+
     .            pduchs(2,2)*pf99hs(2,2)+
     .            pduchs(3,2)*pf99hs(3,2)+
     .            pduchs(4,2)*pf99hs(4,2)+
     .            pduchs(5,2)*pf99hs(5,2))/5.
            a3 = (pduchc(1)*pf99hc(1)+
     .            pduchc(2)*pf99hc(2)+
     .            pduchc(3)*pf99hc(3)+
     .            pduchc(4)*pf99hc(4)+
     .            pduchc(5)*pf99hc(5))/5.
            w2 = pduchs(n,2)/avpdus(2)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumuf = sumuf+w2
            sumclu = sumclu+w3+w4
          endif
c
          write(arec(9:80),9988)iw1,w2,w3,w4,iw5
          do 22 ii=1,80
           if(arec(ii:ii).eq.'D')arec(ii:ii)='d'
   22      if(arec(ii:ii).eq.'E')arec(ii:ii)='e'
c
c INNER FUEL INNER FUEL INNER FUEL INNER FUEL INNER FUEL INNER FUEL
c
c                Inner fuel heat structures
c
c INNER FUEL INNER FUEL INNER FUEL INNER FUEL INNER FUEL INNER FUEL
c
c IF THIS HEAT STRUCTURE IS IN THE INNER FUEL
         else if(arec(3:3).eq.'7') then
c average fuel heat structure
           if(arec(2:5).eq.'5701') then
            w2 = (0.152*0.90757/5.)*mavgi*pdicac(n)/avpdia
            w3 = 0.00561/5.*vi/(vanni+vi)*mavgi*pdicac(n)/avpdia
            w4 = 0.0
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c inner side plate heat structure
           else if(arec(2:5).eq.'5702') then
```

```
            w2 = 1.5155d-4*mavgi*pdicac(n)/avpdia
            w3 = 6.540d-4*mavgi*pdicac(n)/avpdia
            w4 = 0.0
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c outer side plate heat structure
           else if(arec(2:5).eq.'5703') then
            w2 = 1.0645d-4*mavgi*pdicac(n)/avpdia
            w3 = 0.0
            w4 = 7.7600d-4*mavgi*pdicac(n)/avpdia
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95% 95%
c hot channel fuel plate
           else if(arec(2:5).eq.'5751') then
            w2 = (0.152*0.90757/5.)*mi95*pdichc(n)/avpdih
            w3 = 0.00561/5.*vi/(vanni+vi)*mi95*pdichc(n)/avpdih
            w4 = 0.0
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c hot channel inner side plate heat structure
           else if(arec(2:5).eq.'5752') then
            w2 = 1.5155d-4*mi95*pdichc(n)/avpdih
            w3 = 6.540d-4*mi95*pdichc(n)/avpdih
            w4 = 0.0
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c hot channel outer side plate heat structure
           else if(arec(2:5).eq.'5753') then
            w2 = 1.0645d-4*mi95*pdichc(n)/avpdih
            w3 = 0.0
            w4 = 7.7600d-4*mi95*pdichc(n)/avpdih
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c CHF hot stripe heat structure
           else if(arec(2:5).eq.'5754') then
            a1 = mi95/5.*0.152*0.90757/100.
            a2 = (pdichs(1,1)*pf95hs(1,1)+
     .           pdichs(2,1)*pf95hs(2,1)+
     .           pdichs(3,1)*pf95hs(3,1)+
     .           pdichs(4,1)*pf95hs(4,1)+
     .           pdichs(5,1)*pf95hs(5,1))/5.
            a3 = (pdichc(1)*pf95hc(1)+
     .           pdichc(2)*pf95hc(2)+
     .           pdichc(3)*pf95hc(3)+
     .           pdichc(4)*pf95hc(4)+
     .           pdichc(5)*pf95hc(5))/5.
            w2 = pdichs(n,1)/avpdis(1)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c FE hot stripe heat structure
           else if(arec(2:5).eq.'5755') then
            a1 = mi95/5.*0.152*0.90757/100.
            a2 = (pdichs(1,2)*pf95hs(1,2)+
     .           pdichs(2,2)*pf95hs(2,2)+
     .           pdichs(3,2)*pf95hs(3,2)+
     .           pdichs(4,2)*pf95hs(4,2)+
     .           pdichs(5,2)*pf95hs(5,2))/5.
            a3 = (pdichc(1)*pf95hc(1)+
     .           pdichc(2)*pf95hc(2)+
     .           pdichc(3)*pf95hc(3)+
     .           pdichc(4)*pf95hc(4)+
     .           pdichc(5)*pf95hc(5))/5.
            w2 = pdichs(n,2)/avpdis(2)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9% 99.9%
c hot channel fuel plate
           else if(arec(2:5).eq.'5761') then
            w2 = (0.152*0.90757/5.)*mi99*pdichc(n)/avpdih
            w3 = 0.00561/5.*vi/(vanni+vi)*mi99*pdichc(n)/avpdih
            w4 = 0.0
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c hot channel inner side plate heat structure
           else if(arec(2:5).eq.'5762') then
            w2 = 1.5155d-4*mi99*pdichc(n)/avpdih
            w3 = 6.540d-4*mi99*pdichc(n)/avpdih
            w4 = 0.0
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c hot channel outer side plate heat structure
           else if(arec(2:5).eq.'5763') then
            w2 = 1.0645d-4*mi99*pdichc(n)/avpdih
            w3 = 0.0
            w4 = 7.7600d-4*mi99*pdichc(n)/avpdih
            sumisp = sumisp+w2
            sumcli = sumcli+w3+w4
c CHF hot stripe heat structure
           else if(arec(2:5).eq.'5764') then
            a1 = mi99/5.*0.152*0.90757/100.
            a2 = (pdichs(1,1)*pf99hs(1,1)+
     .           pdichs(2,1)*pf99hs(2,1)+
     .           pdichs(3,1)*pf99hs(3,1)+
     .           pdichs(4,1)*pf99hs(4,1)+
     .           pdichs(5,1)*pf99hs(5,1))/5.
            a3 = (pdichc(1)*pf99hc(1)+
     .           pdichc(2)*pf99hc(2)+
     .           pdichc(3)*pf99hc(3)+
     .           pdichc(4)*pf99hc(4)+
     .           pdichc(5)*pf99hc(5))/5.
            w2 = pdichs(n,1)/avpdis(1)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
c FE hot stripe heat structure
           else if(arec(2:5).eq.'5765') then
            a1 = mi99/5.*0.152*0.90757/100.
            a2 = (pdichs(1,2)*pf99hs(1,2)+
     .           pdichs(2,2)*pf99hs(2,2)+
     .           pdichs(3,2)*pf99hs(3,2)+
     .           pdichs(4,2)*pf99hs(4,2)+
     .           pdichs(5,2)*pf99hs(5,2))/5.
            a3 = (pdichc(1)*pf99hc(1)+
     .           pdichc(2)*pf99hc(2)+
     .           pdichc(3)*pf99hc(3)+
     .           pdichc(4)*pf99hc(4)+
     .           pdichc(5)*pf99hc(5))/5.
            w2 = pdichs(n,2)/avpdis(2)*a1*a2/a3
            w3 = 0.
            w4 = 0.
            sumif = sumif+w2
            sumcli = sumcli+w3+w4
           endif
c
```

```
          write(arec(9:80),9988)iw1,w2,w3,w4,iw5
          do 32 ii=1,80
           if(arec(ii:ii).eq.'D')arec(ii:ii)='d'
   32      if(arec(ii:ii).eq.'E')arec(ii:ii)='e'
         else
          sumoth = sumoth+w2
          sumclo = sumclo+w3+w4
c ENDIF THE SOURCE TERM is 1000
         endif
         write(6,9987)arec(2:5),iw1,w2,w3,w4,iw5
       else if(iw1.eq.10775) then
         sum775 = sum775 +  w2*222733./3.44d8
         sumcpc = sumcpc + (w3 + w4)*222733./3.44d8
       else if(iw1.eq.10774) then
         sum774 = sum774 +  w2*213703./3.44d8
         sumcpc = sumcpc + (w3 + w4)*213703./3.44d8
       else if(iw1.eq.10773) then
         sum773 = sum773 +  w2*196644./3.44d8
         sumcpc = sumcpc + (w3 + w4)*196644./3.44d8
       else if(iw1.eq.10772) then
         sum772 = sum772 +  w2*186613./3.44d8
         sumcpc = sumcpc + (w3 + w4)*186613./3.44d8
       else if(iw1.eq.10771) then
         sum771 = sum771 +  w2*183603./3.44d8
         sumcpc = sumcpc + (w3 + w4)*183603./3.44d8
       else if(iw1.eq.10735) then
         sum735 = sum735 +  w2*148160./3.44d8
         sumcpc = sumcpc + (w3 + w4)*148160./3.44d8
       else if(iw1.eq.10734) then
         sum734 = sum734 +  w2*182970./3.44d8
         sumcpc = sumcpc + (w3 + w4)*182970./3.44d8
       else if(iw1.eq.10733) then
         sum733 = sum733 +  w2*188323./3.44d8
         sumcpc = sumcpc + (w3 + w4)*188323./3.44d8
       else if(iw1.eq.10732) then
         sum732 = sum732 +  w2*187432./3.44d8
         sumcpc = sumcpc + (w3 + w4)*187432./3.44d8
       else if(iw1.eq.10731) then
         sum731 = sum731 +  w2*185646.5/3.44d8
         sumcpc = sumcpc + (w3 + w4)*185646.5/3.44d8
       else if(iw1.eq.10641) then
         sum641 = sum641 +  w2*168656.3/3.44d8
         sumcpc = sumcpc + (w3 + w4)*168656.3/3.44d8
       else if(iw1.eq.10642) then
         sum642 = sum642 +  w2*301664./3.44d8
         sumcpc = sumcpc + (w3 + w4)*301664./3.44d8
       else if(iw1.eq.10643) then
         sum643 = sum643 +  w2*794812./3.44d8
         sumcpc = sumcpc + (w3 + w4)*794812./3.44d8
       else if(iw1.eq.10613) then
         sum613 = sum613 +  w2*73585./3.44d8
         sumcpc = sumcpc + (w3 + w4)*73585./3.44d8
       else if(iw1.eq.10671) then
         sum671 = sum671 +  w2*429622./3.44d8
         sumcpc = sumcpc + (w3 + w4)*429622./3.44d8
       else if(iw1.eq.10672) then
         sum672 = sum672 +  w2*433784./3.44d8
         sumcpc = sumcpc + (w3 + w4)*433784./3.44d8
       else if(iw1.eq.10673) then
         sum673 = sum673 +  w2*435848./3.44d8
         sumcpc = sumcpc + (w3 + w4)*435848./3.44d8
       else if(iw1.eq.10674) then
         sum674 = sum674 +  w2*423464./3.44d8
         sumcpc = sumcpc + (w3 + w4)*423464./3.44d8
       else if(iw1.eq.10675) then
         sum675 = sum675 +  w2*342903./3.44d8
         sumcpc = sumcpc + (w3 + w4)*342903./3.44d8
       else if(iw1.ne.0) then
         write(6,9994)iw1
       endif
      endif
      write(22,9998)arec
      go to 10
  999 continue
      sumcpb = sum775+sum774+sum773+sum772+sum771+sum735+
     . sum734+sum733+sum732+sum731
      totlk = sumif+sumlf+sumuf+sumoth+sumisp+sumlsp+sumusp
      write(6,9999) sumif,sumisp,sumlf,sumlsp,sumuf,sumusp,
     .sumoth,totlk,sumcli,sumcll,sumclu,sumclo
      write(6,9996) sumcpb,sum641,sum642,sum643,sum613,sum671,
     .sum672,sum673,sum674,sum675,sumcpc
      write(6,9995) totlk+sumcpb+sum641+sum642+sum643+sum613
     . +sumcll+sumclu+sumclo+sumcpc
 9999 format(/' Inner Fuel Heating        = ',f10.7,/
     .        ' Inner Side-Plate Heating  = ',f10.7,/
     .        ' Lower Fuel Heating        = ',f10.7,/
     .        ' Lower Side-Plate Heating  = ',f10.7,/
     .        ' Upper Fuel Heating        = ',f10.7,/
     .        ' Upper Side-Plate Heating  = ',f10.7,/
     .        ' Other Heating (1000)      = ',f10.7,/
     .        '                           ----------',/
     .        ' Total Heating for 1000    = ',f10.7,//
     .        ' Inner Fuel Coolant        = ',f10.7,/
     .        ' Lower Fuel Coolant        = ',f10.7,/
     .        ' Upper Fuel Coolant        = ',f10.7,/
     .        ' CPBT Coolant              = ',f10.7)
 9998 format(a80)
 9997 format(2x,a4,'-00',a1,3(1x,d14.4))
 9996 format(/' CPBT  Heating             = ',f10.7,/
     .        ' CR CV641 Heating (Al)     = ',f10.7,/
     .        ' CR CV642 Heating (Hf)     = ',f10.7,/
     .        ' CR CV643 Heating (Hf)     = ',f10.7,/
     .        ' Structures for Gamma Heating in CR Region  ',/
     .        '                      CV613  = ',f10.7,/
     .        '                      CV671  = ',f10.7,/
     .        '                      CV672  = ',f10.7,/
     .        '                      CV673  = ',f10.7,/
     .        '                      CV674  = ',f10.7,/
     .        '                      CV675  = ',f10.7,/
     .        ' Control Rod Coolant       = ',f10.7)
 9995 format(//' GRAND TOTAL =             = ',f10.7)
 9994 format(' ***** WARNING ***** SOURCE ',i6,' ASSUMED TO BE ZERO AT S
     .TEADY-STATE')
 9993 format(f10.7)
 9992 format(i5,4f10.7)
 9989 format(' Input factor by which to multiply hot channel fuel heat s
     .tructures')
 9988 format(1x,i6,3(1x,1pd14.7),1x,i6,8x)
 9987 format(1x,a4,1x,i5,3(1x,d12.6),1x,i3)
      end
c
c Function to read a real number
c
      function dread(iptr,arec)
c
c Finds the first real number on the record after the iptr character
c
      character*80 arec
      character*8 format
      data format /'(      )'/
```

```
      idec1 = 0
      idec2 = 0
      do 10 i=iptr+1,80
       if(arec(i:i).ne.' ') then
        i1 = i
        go to 15
       endif
   10 continue
      dread = 0.d0
      return
   15 do 20 i=i1+1,80
       if(arec(i:i).eq.' ') then
        length = i-i1
        iptr = i
        go to 25
       endif
   20 continue
   25 do 30 i=i1,i1+length
       if(arec(i:i).eq.'.') then
        idec1 = i+1
       else if(arec(i:i).eq.'d'.or.arec(i:i).eq.'e'.or.i.eq.i1+length
     & .or.arec(i:i).eq.'+'.or.arec(i:i).eq.'-') then
        idec2 = i-1
       endif
   30 continue
      if(idec2.eq.0) then
       dread = 0.
       return
      endif
      ndec = idec2-idec1+1
      write(format(2:7),'(a1,i2,a1,i2)') 'd',length,'.',ndec
      read(arec(i1:i1+length-1),format)dread
      return
      end
c
c Function to read integer data
c
      function iread(iptr,arec)
c
c Finds the first integer on the record after the iptr character
c
      character*80 arec
      character*4 format
      data format /'(  )'/
      do 10 i=iptr+1,80
       if(arec(i:i).ne.' ') then
        i1 = i
        go to 15
       endif
   10 continue
      iread = 0
      return
   15 do 20 i=i1+1,80
       if(arec(i:i).eq.' ') then
        length = i-i1
        iptr = i
        go to 25
       endif
   20 continue
   25 continue
      write(format(2:3),'(a1,i1)') 'i',length
      read(arec(i1:i1+length-1),format)iread
      return
      end
c
```

```
c Function to read alphanumeric data
c
      function aread(iptr,arec,length)
c
c Finds the first alphanumeric on the record after the iptr character
c
      character*10 aread
      character*80 arec
      character*5 format
      format = '(   )'
      do 10 i=iptr+1,80
       if(arec(i:i).ne.' ') then
        i1 = i
        go to 15
       endif
   10 continue
      return
   15 do 20 i=i1+1,80
       if(arec(i:i).eq.' ') then
        length = i-i1
        iptr = i
        go to 25
       endif
   20 continue
   25 continue
      if(length.lt.10) then
       write(format(3:4),'(a1,i1)') 'a',length
      else
       write(format(2:4),'(a1,i2)') 'a',length
      endif
      read(arec(i1:i1+length-1),format)aread
      return
      end
```

```
c
c This program reads a RELAP5 generated strip file and creates a
c TECPLOT-readable ASCII data file.
c
c Written by M. W. Wendel (615-574-2825)
c
c.....1.....2.....3.....4.....5.....6.....7..
      implicit double precision (a-h,o-z)
      dimension calc(600,10000),calc1(600,10000)
      dimension costar(30),chfavr(15),chfr(30),szmodr(30),suphtr(30),
     .          vel(30),szr(30)
      real ibr(20), ibmin
      common /pool/  pool(4,138)
      dimension qmhxp(10000),qehxp(10000),qhll(10000),qhlc(10000),
     .          qcl(10000)
      character*8 names(600),adummy
      character*5 tecnam(600)
      character*10 nums(600),filnam
      character*40 title
      real al1, al2, al3
c dimension peaking factors corresponding to three standard deviation levels
      dimension pfsz95(3),pfsz99(3),pftw95(3),pftw99(3),pfib95(3),
     .          pfib99(3)
c
c Peaking factors for Costa, Saha-Zuber, and Twall = Tsat
c For Costa, a standard deviation of 10% was assumed.
c For Saha-Zuber and Twall=Tsat, three standard deviations are used:
c
c                                          Saha-Zuber    Twall=Tsat
c     Pe > 70,000 and velocity > 8 m/s       16%           3.3% (3)
c     Pe > 70,000 and velocity < 8 m/s       30% (1)       3.3%
c     Pe < 70,000 and velocity < 8 m/s       75% (2)       3.3%
c
c (1) not applied for 99.9% probability due to very large peaking factor.
c (2) not applied for either probability due to very large peaking factor.
c (3) not applied for 95% probability.
c
c  For 95% probability level in the Costa correlation
      data pfco95 /1.305/
c  For 99.9% probability level in the Costa correlation
      data pfco99 /1.592/
c
c  Saha Zuber peaking factors (used only for Pe > 70,000)
c  95% probability
      data pfsz95 /1.52,2.08,1.d6/
c  99.9% probability
      data pfsz99 /2.30,1.d6,1.d6/
c
c  Twall=Tsat  peaking factors
c  95% probability
      data pftw95 /1.16,1.16,1.16/
c  99.9% probability
      data pftw99 /1.25,1.25,1.25/
c
c  Incipient boiling peaking factors  (same as for chf)
c  95% probability
      data pfib95 /1.30,1.30,1.30/
c  99.9% probability
      data pfib99 /1.59,1.59,1.59/
c
c  Critical Heat Flux peaking factors
c  95% probability
      data pfg95a /1.631/
      data pfg95b /1.554/
c  99.9% probability
      data pfg99a /1.995/
      data pfg99b /1.899/
c
      data dh /0.0025/
conversion=conversion=conversion=conversion=conversion=conversion=conver
c
c Conversion factors from SI to British
c
c   Pressure
      data cpres /1.0/
c   Mass
      data cmass /1.0/
c   Internal energy
      data cu /1.0/
c   Temperature
      data ctemp1,ctemp2 /1.0,1.0/
c   Heat flux
      data chtflx /1.0/
c   Pump velocity
      data cpmpv /1.0/
c   Power
      data cpower /1.0/
c   Density
      data cdens /1.0/
c   Velocity
      data cvel /1.0/
c   Interfacial area heat transfer coeff. density
      data chi /1.0/
conversion=conversion=conversion=conversion=conversion=conversion=conver
c
      open(unit=21,file='strip.dat',status='old',form='formatted')
      open(unit=22,file='tecdat',status='unknown',form='formatted')
      open(unit=23,file='chf4dat',status='unknown')
      open(unit=24,file='chf5dat',status='unknown')
      open(unit=28,file='twalldat',status='unknown')
      open(unit=29,file='ibdat',status='unknown')
c      open(unit=26,file='axialldat',status='unknown')
c      open(unit=27,file='axialudat',status='unknown')
c      open(unit=17,file='debug',status='unknown',form='formatted')
      write(28,9100)
 9100 format('time,qlim,hflx,sbcool,hlim')
      write(29,9101)
 9101 format('time,qib,hflx,twalib,hib')
      pi = 4.*atan(1.0)
      write(6,985)
      read(6,979) title
      if(title(1:1).eq.'-') then
        copf95 = pfco95
        copf99 = pfco99
        do 3 m=1,3
          pfsz95(m) = 1.0
          pfsz99(m) = 1.0
          pfib95(m) = 1.0
          pfib99(m) = 1.0
          pftw95(m) = 1.0
          pftw99(m) = 1.0
    3   continue
      else
        copf95 = 1.0
        copf99 = 1.0
      endif
    5 continue
      zero = 0.d0
      ithin = 1
      nn = 0
```

```
c
c Read list of variables from strip file
c
      read(21,990)adummy
      read(21,990)adummy
      read(21,999) nt
      nt=nt-1
      ntw = nt
      nl = nt/8
      last = min(nt,7)
      read(21,998)(names(i),i=1,last)
      if(nl.gt.0) then
       do 10 j=1,nl
        last = min(nt,7+j*8)
        ifirst = 8*j
        read(21,988)(names(i),i=ifirst,last)
   10  continue
       endif
       read(21,991)(nums(i)(2:10),i=1,nt)
c
c Read time-dependent data for requested variables
c
       do 20 i=1,10000
        n1 = 1
        n2 = 4
        n2 = min(nt,n2)
        read(21,982,end=30)(calc(j,i),j=n1,n2)
        n1 = 5
        do 25 ii=1,2000
         if(n2.ge.nt) go to 21
         n2 = n1+4
         read(21,986,end=30)(calc(j,i),j=n1,n2)
         n1 = n1+5
   25   continue
   21   if(mod(i,100).eq.0)write(6,984)i
   20  continue
   30  ilst=i-1
       write(6,994)ilst
c
c Scan the data, change some names, define pointers
c
       do 40 n=1,nt
        conv1 = 1.
        conv2 = 0.
        if(names(n).eq.'p       ')then
         tecnam(n) = ' p   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = cpres
        else if(names(n).eq.'hig     '). then
         tecnam(n) = 'hi   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = 1.0
         conv2 = 0.
        else if(names(n).eq.'floreg  ') then
         tecnam(n) = 'fr   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = 1.0
         conv2 = 0.
        else if(names(n).eq.'tempf   ') then
         if(nums(n)(2:6).eq.'51501') ltempf = n-1
         tecnam(n) = 'tf   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = ctemp1
         conv2 = ctemp2
        else if(names(n).eq.'httemp  ') then
         if(nums(n)(2:10).eq.'550100204') lh=n-1
         if(nums(n)(2:10).eq.'515500501') lhstr=n-1
         tecnam(n) = 't    '
         tecnam(n)(2:5) = nums(n)(2:5)
         conv1 = ctemp1
         conv2 = ctemp2
        else if(names(n).eq.'hthtc   ') then
         tecnam(n) = 'h    '
         tecnam(n)(3:5) = nums(n)(2:5)
         conv1 = 1.0
         conv2 = 0.0
        else if(names(n).eq.'htmode  ') then
         tecnam(n) = 'hm   '
         tecnam(n)(3:5) = nums(n)(3:5)
         conv1 = 1.0
         conv2 = 0.0
        else if(names(n).eq.'hthtc   ') then
         tecnam(n) = 'hm   '
         tecnam(n)(3:5) = nums(n)(3:5)
         conv1 = 1.0
         conv2 = 0.0
        else if(names(n).eq.'htvat   ') then
         tecnam(n) = 'ha   '
         tecnam(n)(3:5) = nums(n)(3:5)
         conv1 = ctemp1
         conv2 = ctemp2
        else if(names(n).eq.'tempg   ') then
         tecnam(n) = 'tg   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = ctemp1
         conv2 = ctemp2
        else if(names(n).eq.'sattemp ')then
         tecnam(n) = 'st   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = ctemp1
         conv2 = ctemp2
         if(nums(n)(2:6).eq.'51501') lsat = n-1
        else if(names(n).eq.'mflowj  ') then
         tecnam(n) = 'mf   '
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = cmass
        else if(names(n).eq.'emass   ') then
         tecnam(n) = 'emass'
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = cmass
        else if(names(n).eq.'tmass   ') then
         tecnam(n) = 'tmass'
         tecnam(n)(3:5) = nums(n)(2:4)
         conv1 = cmass
        else if(names(n).eq.'htchf   ') then
         if(nums(n)(2:8).eq.'5101001') lchfav=n-1
         if(nums(n)(2:8).eq.'5154001') lchfht=n-1
         tecnam(n) = 'c    '
         tecnam(n)(2:5) = nums(n)(2:5)
         conv1 = chtflx
        else if(names(n).eq.'htrnr   ') then
         if(nums(n)(2:8).eq.'5101001') lflxav=n-1
         if(nums(n)(2:8).eq.'5155001') lflxht=n-1
         if(nums(n)(2:8).eq.'5154001') lflchf=n-1
         if(nums(n)(2:8).eq.'1081001') lpool=n-1
         if(nums(n)(2:8).eq.'1083001') lmhx=n-1
         if(nums(n)(2:5).eq.'1083'.or.nums(n)(2:5).eq.'2083'.
            or.nums(n)(2:5).eq.'3083') then
           nmhx = nmhx+1
           conv1 = 433.9405
```

```
    tecnam(n) = 'Q    '
    tecnam(n)(2:5) = nums(n)(2:5)
  else if(nums(n)(2:5).eq.'1081'.or.npool.ne.0) then
    npool=npool+1
    rad = pool(2,npool)
    xfac = pool(3,npool)
    geo = pool(4,npool)
    if(geo.gt.1) then
     conv1 = xfac*2*pi*rad*chtflx
    endif
    if(geo.lt.1.5) conv1 = xfac*chtflx
    tecnam(n) = 'Q    '
    tecnam(n)(2:5) = nums(n)(2:5)
  else
    tecnam(n) = 'Q    '
    tecnam(n)(2:5) = nums(n)(2:5)
    conv1 = chtflx
  endif
 else if(names(n).eq.'Costa fl') then
  tecnam(n) = 'Co   '
  tecnam(n)(3:5) = nums(n)(3:5)
  conv1 = chtflx
 else if(names(n).eq.'rhofj   ') then
  tecnam(n) = 'rj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'vapgen  ') then
  tecnam(n) = 'vg   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'rhog    ') then
  tecnam(n) = 'rg   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'rhof    ') then
  tecnam(n) = 'rf   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'rhogj   ') then
  tecnam(n) = 'rj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'thconf  ') then
  tecnam(n) = ' k   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = 1.0
  if(nums(n)(2:6).eq.'51501') lk = n-1
 else if(names(n).eq.'viscf   ') then
  tecnam(n) = 'mu   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = 1.0
  if(nums(n)(2:6).eq.'51501') lvis = n-1
 else if(names(n).eq.'rho     ') then
  tecnam(n) = ' r   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'gammaw  ') then
  tecnam(n) = 'ga   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cdens
 else if(names(n).eq.'hif     ') then
  tecnam(n) = 'hf   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = chi
 else if(names(n).eq.'hig     ') then
  tecnam(n) = 'hg   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = chi
 else if(names(n).eq.'pmphead ') then
  tecnam(n) = 'ph   '
  tecnam(n)(3:5) = nums(n)(8:10)
  conv1 = cpres
 else if(names(n).eq.'pmpvel  ') then
  tecnam(n) = 'pv   '
  tecnam(n)(3:5) = nums(n)(8:10)
  conv1 = cpmpv
 else if(names(n).eq.'uf      ') then
  tecnam(n) = 'uf   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cu
 else if(names(n).eq.'ug      ') then
  tecnam(n) = 'ug   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cu
 else if(names(n).eq.'ufj     ') then
  tecnam(n) = 'uj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cu
 else if(names(n).eq.'ugj     ') then
  tecnam(n) = 'uj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cu
 else if(names(n).eq.'q       ') then
  tecnam(n) = ' q   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cpower
 else if(names(n).eq.'qwg     ') then
  tecnam(n) = 'qw   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cpower
 else if(names(n).eq.'velfj   ') then
  tecnam(n) = 'vj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cvel
 else if(names(n).eq.'velgj   ') then
  tecnam(n) = 'vj   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cvel
 else if(names(n).eq.'velf    ') then
  if(nums(n)(2:10).eq.'515010000') lvel = n-1
  tecnam(n) = 'vf   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cvel
 else if(names(n).eq.'velg    ') then
  tecnam(n) = 'vg   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cvel
 else if(names(n).eq.'sounde  ') then
  tecnam(n) = 'so   '
  tecnam(n)(3:5) = nums(n)(2:4)
  conv1 = cvel
 else if(names(n).eq.'voidg   ') then
  tecnam(n) = 'vd   '
  tecnam(n)(3:5) = nums(n)(2:4)
 else if(names(n).eq.'voidf   ') then
  if(nums(n)(2:6).eq.'15601') lp = n-1
  tecnam(n) = 'vl   '
  tecnam(n)(3:5) = nums(n)(2:4)
 else if(names(n).eq.'quals   ') then
  tecnam(n) = 'qs   '
```

```
        tecnam(n)(3:5) = nums(n)(2:4)
       else if(names(n).eq.'quale   ') then
        tecnam(n) = 'qe   '
        tecnam(n)(3:5) = nums(n)(2:4)
       else if(names(n).eq.'quala   ') then
        tecnam(n) = 'qa   '
        tecnam(n)(3:5) = nums(n)(2:4)
       else if(names(n).eq.'cputime ') then
        tecnam(n) = 'cpu-s'
       else if(names(n).eq.'acvliq  ') then
        tecnam(n) = 'ac   '
        tecnam(n)(3:5) = nums(n)(2:4)
       else if(names(n).eq.'rkfipow ') then
        tecnam(n) = 'rkfis'
       else if(names(n).eq.'rkfipow ') then
        tecnam(n) = 'rkfis'
       else if(names(n).eq.'rkgapow ') then
        tecnam(n) = 'rkgam'
       else if(names(n).eq.'rkreac  ') then
        tecnam(n) = 'react'
       else if(names(n).eq.'rktpow  ') then
        tecnam(n) = 'rktpw'
       else if(names(n).eq.'cntrlvar') then
        tecnam(n) = 'cv   '
        if(nums(n)(8:10).eq.'203') lco = n-1
        if(nums(n)(8:10).eq.'321') then
          lpe = n-1
          tecnam(n) = 'pe   '
        endif
        if(nums(n)(8:10).eq.'445') lpr = n-1
        if(nums(n)(8:10).eq.'202') lsc = n-1
        if(nums(n)(8:10).eq.'827') lpexl = n-1
        if(nums(n)(8:10).eq.'829') lpexu = n-1
        if(nums(n)(8:10).eq.'831') lpexi = n-1
        tecnam(n)(3:5) = nums(n)(8:10)
        if(nums(n)(8:10).eq.'218') tecnam(n) = '195sc'
        if(nums(n)(8:10).eq.'238') tecnam(n) = '199sc'
       endif
        nn = nn+1
         do 35 i=1,ilst
          calc1(nn,i) = conv1*calc(n,i)-conv2
   35    continue
   40 continue
c.......1.........2.........3.........4.........5.........6.........7..
c
c Write tecdat information
c
      tecnam(1) = ' time'
      write(22,992) title,tecnam(1)
      write(23,992) title,tecnam(1)
      write(24,992) title,tecnam(1)
      do 11 i=2,ntw
        if((i.lt.lpool+1.or.i.gt.lpool+npool+nmhx+1) .and.
     .    (i.lt.lvis+1.or.i.gt.lvis+180)) write(22,997)tecnam(i)
   11 continue
      write(22,997) 'alev1'
      write(22,997) 'alev2'
      write(22,997) 'alev3'
      write(22,997) 'accfl'
      write(22,997) 'CPBTM'
      write(22,997) 'CRAlM'
      write(22,997) 'CRHfM'
      write(22,997) 'CPBTS'
      write(22,997) 'CRAlS'
      write(22,997) 'CRHfS'

c Thermal Limits in Hot Channels
      write(22,997) 'tL5-1'
      write(22,997) 'iL5-1'
      write(22,997) 'cL5-1'
      write(22,997) 'mL5-1'
      write(22,997) 'zL5-1'
      write(22,997) 'fL5-1'
      write(22,997) 'tL5-2'
      write(22,997) 'iL5-2'
      write(22,997) 'cL5-2'
      write(22,997) 'mL5-2'
      write(22,997) 'zL5-2'
      write(22,997) 'fL5-2'
      write(22,997) 'tL5-3'
      write(22,997) 'iL5-3'
      write(22,997) 'cL5-3'
      write(22,997) 'mL5-3'
      write(22,997) 'zL5-3'
      write(22,997) 'fL5-3'
      write(22,997) 'tL5-4'
      write(22,997) 'iL5-4'
      write(22,997) 'cL5-4'
      write(22,997) 'mL5-4'
      write(22,997) 'zL5-4'
      write(22,997) 'fL5-4'
      write(22,997) 'tL5-5'
      write(22,997) 'iL5-5'
      write(22,997) 'cL5-5'
      write(22,997) 'mL5-5'
      write(22,997) 'zL5-5'
      write(22,997) 'fL5-5'
      write(22,997) 'tL9-1'
      write(22,997) 'iL9-1'
      write(22,997) 'cL9-1'
      write(22,997) 'mL9-1'
      write(22,997) 'zL9-1'
      write(22,997) 'fL9-1'
      write(22,997) 'tL9-2'
      write(22,997) 'iL9-2'
      write(22,997) 'cL9-2'
      write(22,997) 'mL9-2'
      write(22,997) 'zL9-2'
      write(22,997) 'fL9-2'
      write(22,997) 'tL9-3'
      write(22,997) 'iL9-3'
      write(22,997) 'cL9-3'
      write(22,997) 'mL9-3'
      write(22,997) 'zL9-3'
      write(22,997) 'fL9-3'
      write(22,997) 'tL9-4'
      write(22,997) 'iL9-4'
      write(22,997) 'cL9-4'
      write(22,997) 'mL9-4'
      write(22,997) 'zL9-4'
      write(22,997) 'fL9-4'
      write(22,997) 'tL9-5'
      write(22,997) 'iL9-5'
      write(22,997) 'cL9-5'
      write(22,997) 'mL9-5'
      write(22,997) 'zL9-5'
      write(22,997) 'fL9-5'
* upper core
      write(22,997) 'tU5-1'
      write(22,997) 'iU5-1'
      write(22,997) 'cU5-1'
```

```
      write(22,997) 'mU5-1'
      write(22,997) 'zU5-1'
      write(22,997) 'fU5-1'
      write(22,997) 'tU5-2'
      write(22,997) 'iU5-2'
      write(22,997) 'cU5-2'
      write(22,997) 'mU5-2'
      write(22,997) 'zU5-2'
      write(22,997) 'fU5-2'
      write(22,997) 'tU5-3'
      write(22,997) 'iU5-3'
      write(22,997) 'cU5-3'
      write(22,997) 'mU5-3'
      write(22,997) 'zU5-3'
      write(22,997) 'fU5-3'
      write(22,997) 'tU5-4'
      write(22,997) 'iU5-4'
      write(22,997) 'cU5-4'
      write(22,997) 'mU5-4'
      write(22,997) 'zU5-4'
      write(22,997) 'fU5-4'
      write(22,997) 'tU5-5'
      write(22,997) 'iU5-5'
      write(22,997) 'cU5-5'
      write(22,997) 'mU5-5'
      write(22,997) 'zU5-5'
      write(22,997) 'fU5-5'
      write(22,997) 'tU9-1'
      write(22,997) 'iU9-1'
      write(22,997) 'cU9-1'
      write(22,997) 'mU9-1'
      write(22,997) 'zU9-1'
      write(22,997) 'fU9-1'
      write(22,997) 'tU9-2'
      write(22,997) 'iU9-2'
      write(22,997) 'cU9-2'
      write(22,997) 'mU9-2'
      write(22,997) 'zU9-2'
      write(22,997) 'fU9-2'
      write(22,997) 'tU9-3'
      write(22,997) 'iU9-3'
      write(22,997) 'cU9-3'
      write(22,997) 'mU9-3'
      write(22,997) 'zU9-3'
      write(22,997) 'fU9-3'
      write(22,997) 'tU9-4'
      write(22,997) 'iU9-4'
      write(22,997) 'cU9-4'
      write(22,997) 'mU9-4'
      write(22,997) 'zU9-4'
      write(22,997) 'fU9-4'
      write(22,997) 'tU9-5'
      write(22,997) 'iU9-5'
      write(22,997) 'cU9-5'
      write(22,997) 'mU9-5'
      write(22,997) 'zU9-5'
      write(22,997) 'fU9-5'
• inner core
      write(22,997) 'tI5-1'
      write(22,997) 'iI5-1'
      write(22,997) 'cI5-1'
      write(22,997) 'mI5-1'
      write(22,997) 'zI5-1'
      write(22,997) 'fI5-1'
      write(22,997) 'tI5-2'
      write(22,997) 'iI5-2'
      write(22,997) 'cI5-2'
      write(22,997) 'mI5-2'
      write(22,997) 'zI5-2'
      write(22,997) 'fI5-2'
      write(22,997) 'tI5-3'
      write(22,997) 'iI5-3'
      write(22,997) 'cI5-3'
      write(22,997) 'mI5-3'
      write(22,997) 'zI5-3'
      write(22,997) 'fI5-3'
      write(22,997) 'tI5-4'
      write(22,997) 'iI5-4'
      write(22,997) 'cI5-4'
      write(22,997) 'mI5-4'
      write(22,997) 'zI5-4'
      write(22,997) 'fI5-4'
      write(22,997) 'tI5-5'
      write(22,997) 'iI5-5'
      write(22,997) 'cI5-5'
      write(22,997) 'mI5-5'
      write(22,997) 'zI5-5'
      write(22,997) 'fI5-5'
      write(22,997) 'tI9-1'
      write(22,997) 'iI9-1'
      write(22,997) 'cI9-1'
      write(22,997) 'mI9-1'
      write(22,997) 'zI9-1'
      write(22,997) 'fI9-1'
      write(22,997) 'tI9-2'
      write(22,997) 'iI9-2'
      write(22,997) 'cI9-2'
      write(22,997) 'mI9-2'
      write(22,997) 'zI9-2'
      write(22,997) 'fI9-2'
      write(22,997) 'tI9-3'
      write(22,997) 'iI9-3'
      write(22,997) 'cI9-3'
      write(22,997) 'mI9-3'
      write(22,997) 'zI9-3'
      write(22,997) 'fI9-3'
      write(22,997) 'tI9-4'
      write(22,997) 'iI9-4'
      write(22,997) 'cI9-4'
      write(22,997) 'mI9-4'
      write(22,997) 'zI9-4'
      write(22,997) 'fI9-4'
      write(22,997) 'tI9-5'
      write(22,997) 'iI9-5'
      write(22,997) 'cI9-5'
      write(22,997) 'mI9-5'
      write(22,997) 'zI9-5'
      write(22,997) 'fI9-5'
c critical heat flux ratio limits at average channels
      write(22,997) 'favL1'
      write(22,997) 'favL2'
      write(22,997) 'favL3'
      write(22,997) 'favL4'
      write(22,997) 'favL5'
      write(22,997) 'favU1'
      write(22,997) 'favU2'
      write(22,997) 'favU3'
      write(22,997) 'favU4'
      write(22,997) 'favU5'
      write(22,997) 'favI1'
```

```
      write(22,997) 'favI2'
      write(22,997) 'favI3'
      write(22,997) 'favI4'
      write(22,997) 'favI5'
      write(22,997) 'COmin'
      write(22,997) 'SZmin'
      write(22,997) 'CFmin'
      write(22,997) 'shmin'
      write(22,997) 'ibmin'
      write(22,997) 'SHmax'
      if(lpool.gt.0) then
        write(22,997) 'qpool'
        write(22,997) 'qmhx'
        write(22,997) 'qmhxp'
        write(22,997) 'qehxp'
        write(22,997) 'qhll'
        write(22,997) 'qhlc'
        write(22,997) 'qcl'
      endif
      write(23,997) 'CHFL4'
      write(24,997) 'CHFL5'
c
c sum heat transfer components from piping to pool
c
c  qpool = total heat from piping and heat exchanger shells to pool
c  qmhx  = heat removal from main heat exchanger primary to secondary system
c  qmhxp = heat removal from main heat exchanger shell to pool
c  qehxp = heat removal from emergency heat exchanger shell to pool
c  qhll  = heat removal from all four hot leg loop piping to pool
c  qhlc  = heat removal from common hot leg to pool
c  qcl   = total heat removal from all four cold legs to pool
c          (including CPBT inlet volumes)
c
      do 143 i=1,ilst
      qmhxp(i) = 0.
      qehxp(i) = 0.
      qhll(i) = 0.
      qhlc(i) = 0.
      qcl(i) = 0.
       do 144 ih=1,11
        qmhxp(i) = qmhxp(i) + calc1(lpool+ih,i)
  144  continue
       do 145 ih=12,19
        qehxp(i) = qehxp(i) + calc1(lpool+ih,i)
  145  continue
       do 146 ih=20,30
        qmhxp(i) = qmhxp(i) + calc1(lpool+ih,i)
  146  continue
       do 147 ih=31,38
        qehxp(i) = qehxp(i) + calc1(lpool+ih,i)
  147  continue
       do 148 ih=39,49
        qmhxp(i) = qmhxp(i) + calc1(lpool+ih,i)
  148  continue
       do 149 ih=50,57
        qehxp(i) = qehxp(i) + calc1(lpool+ih,i)
  149  continue
       do 150 ih=58,63
        qhll(i) = qhll(i) + calc1(lpool+ih,i)
  150  continue
       do 151 ih=64,78
        qcl(i) = qcl(i) + calc1(lpool+ih,i)
  151  continue
       do 160 ih=79,84
        qhll(i) = qhll(i) + calc1(lpool+ih,i)
  160  continue
       do 161 ih=85,97
        qcl(i) = qcl(i) + calc1(lpool+ih,i)
  161  continue
       do 170 ih=98,101
        qhll(i) = qhll(i) + calc1(lpool+ih,i)
  170  continue
       do 171 ih=102,114
        qcl(i) = qcl(i) + calc1(lpool+ih,i)
  171  continue
       qhll(i) = qhll(i) + calc1(lpool+115,i)
       do 172 ih=116,126
       qcl(i) = qcl(i) + calc1(lpool+ih,i)
  172  continue
       do 173 ih=127,138
       qhlc(i) = qhlc(i) + calc1(lpool+ih,i)
  173  continue
  143 continue
c
      ii = 0
      write(22,995)
      do 45 i=1,ilst
       ii = ii+1
        l1 = lp
        comin = 1.d6
        szmin = 1.d6
        shmax = -900.
        shmin = 1.d6
        chfmin = 1.d6
        do 39 m=1,30
          vel(m) = calc1(lvel+m,i)
   39   continue
c
c translate time variable backwards by 10 s (start transient at time=0)
c
        calc1(1,i) = calc1(1,i)-10.
        if(calc1(1,i).lt.0.d0) go to 45
        if(calc1(1,i).eq.0.d0) calc1(1,i)=1.d-6
        al1 = calc1(l1+1,i)*4.09+(calc1(l1+2,i)+calc1(l1+3,i)+
     .        calc1(l1+4,i)+calc1(l1+5,i))*0.12-4.88*(1.-calc(l1+6,i))
c
        l1 = lp+6
        al2 = calc1(l1+1,i)*4.09+(calc1(l1+2,i)+calc1(l1+3,i)+
     .        calc1(l1+4,i)+calc1(l1+5,i))*0.12-4.88*(1.-calc(l1+6,i))
c
        l1 = lp+12
        al3 = calc1(l1+1,i)*4.09+(calc1(l1+2,i)+calc1(l1+3,i)+
     .        calc1(l1+4,i)+calc1(l1+5,i))*0.12-4.88*(1.-calc(l1+6,i))
c
        accfl = calc1(2,i)+calc1(3,i)+calc1(4,i)
        qpool = 0.
        qmhx = 0.
        do 43 ih= 1,30
         qmhx = qmhx+calc1(lmhx+ih,i)
   43   continue
        do 44 ih= 1,npool
         qpool = qpool+calc1(lpool+ih,i)
   44   continue
c
c.....1.....2.....3.....4.....5.....6.....7..
c
c  Costa ratios
c lower core 95%
        do 46 m = 1,5
        costar(m) = max(0.00001d0,copf95*calc1(lco+m,i)/
```

```
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   46   continue
c lower core 99.9%
        do 47 m = 6,10
        costar(m) = max(0.00001d0,copf99*calc1(lco+m,i)/
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   47   continue
c upper core 95%
        do 48 m = 11,15
        costar(m) = max(0.00001d0,copf95*calc1(lco+m,i)/
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   48   continue
c upper core 99.9%
        do 49 m = 16,20
        costar(m) = max(0.00001d0,copf99*calc1(lco+m,i)/
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   49   continue
c inner core 95%
        do 50 m = 21,25
        costar(m) = max(0.00001d0,copf95*calc1(lco+m,i)/
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   50   continue
c inner core 99.9%
        do 51 m = 26,30
        costar(m) = max(0.00001d0,copf99*calc1(lco+m,i)/
     .                    calc1(lflxht+m,i))
        if(costar(m).lt.comin) then
          comin = costar(m)
        endif
        if(costar(m).lt.1.0) icowrn = icowrn+1
   51   continue
c
c........1.........2.........3.........4.........5.........6.........7..
c
c Calculate Modified and Unmodified Saha-Zuber thermal limit ratio
        do 56 m=1,30
          pe = abs(calc1(lpe+m,i))
          pr = calc1(lpr+m,i)
          ckb = calc1(lk+m,i)
          re = pe/pr
          sbcool = calc1(lsc+m,i)
          dh = 0.002236
          if(m.gt.10) dh = 0.0022299
          if(m.gt.20) dh = 0.0022429
          fact = 0.55 + 11.21/sbcool
c
c Determine peaked heat flux
c
          if(pe.ge.70000.) then
            qlim = 0.0065*re*pr*ckb/dh*sbcool*fact
            if(vel(m).gt.8.) then
              if(mod(m-1,10).le.4) then
                pf = pfsz95(1)
                hflx = pf*calc1(lflxht+m,i)/pfco95
              else
                pf = pfsz99(1)
                hflx = pf*calc1(lflxht+m,i)/pfco99
              endif
            else
              if(mod(m-1,10).le.4) then
                pf = pfsz95(2)
                hflx = pf*calc1(lflxht+m,i)/pfco95
              else
                pf = pfsz99(2)
                hflx = pf*calc1(lflxht+m,i)/pfco99
              endif
            endif
          else
            qlim = 455.*ckb/dh*sbcool*fact
            if(mod(m-1,10).le.4) then
              pf = pfsz95(3)
              hflx = pf*calc1(lflxht+m,i)/pfco95
            else
              hflx = pf*calc1(lflxht+m,i)/pfco99
              pf = pfsz99(3)
            endif
          endif
c
          szmodr(m) = max(0.00001d0,qlim/hflx)
          szr(m) = max(0.00001d0,qlim/hflx/fact)
          if(szmodr(m).lt.shmin.and.szmodr(m).gt.0.0001d0) then
            szmin  = szmodr(m)
          endif
          if(szmodr(m).lt.1.0) iszwrn = iszwrn+1
   56   continue
c
c........1.........2.........3.........4.........5.........6.........7..
c
c  CHF ratios
c
c Average Fuel
        do 70 m = 1,15
        chfavr(m) = max(0.00001d0,calc1(lchfav+m,i)/calc1(lflxav+m,i))
        if(chfavr(m).lt.chfmin.and.chfavr(m).gt.0.000011d0) then
          chfmin = chfavr(m)
        endif
        if(chfavr(m).gt.100.) ichwrn = ichwrn+1
   70   continue
c Hot Fuel
        do 75 m = 1,30
        fp = 1.
c divide out the peaking factor from CHF hot stripe flux if requested
        if(title(1:1).eq.'-') then
          if(mod(m-1,10).le.4) then
            if(mod(m,10).eq.1.or.mod(m,10).eq.5) then
              fp = 1./pfg95a
            else
              fp = 1./pfg95b
            endif
          else
```

```
            if(mod(m,10).eq.1.or.mod(m,10).eq.5) then
              fp = 1./pfg99a
            else
              fp = 1./pfg99b
            endif
          endif
        endif
c.......1.........2.........3.........4.........5.........6.........7..
        chfr(m) = max(0.00001d0,calc1(lchfht+m,i)/
     .                  (calc1(lflchf+m,i)*fp))
        if(chfr(m).lt.chfmin.and.chfr(m).gt.0.000011d0) then
          chfmin = chfr(m)
        endif
        if(chfr(m).gt.100.) ichwrn = ichwrn+1
   75   continue
c
c Calculate Petukhov heat flux based on Tbulk and Tsat
c at hot channel exit locations only
        do 76 m=1,30
          pe = abs(calc1(lpe+m,i))
          pr = calc1(lpr+m,i)
          re = pe/pr
          tsat = calc1(lsat+m,i)
          sbcool = calc1(lsc+m,i)
          const = 1.0875 - 0.1125*(1.143/87.35)
          dh = 0.002498
          vissat = d2ovis(tsat)
          visrat = calc1(lvis+m,i)/vissat
* THIS APPEARS TO BE AN ERROR!, m.gt.10 is write I think ... MWW 8-3-95
          if(m.gt.2) then
            const = 1.0875 - 0.1125*(1.143/70.29)
            dh = 0.002494
          endif
          fd = const/(1.82*log10(re)-1.64)**2
          hturb = fd/8.*calc1(lk+m,i)/dh*pe*visrat**0.11/
     .            ((1+3.4*fd)+(11.7+1.8/pr**0.3333)*(fd/8.)**0.5*
     .            (pr**0.6667-1.))
          hlam = 7.63*calc1(lk+m,i)/dh
          if(hlam.gt.hturb) then
            write(6,962)calc1(1,i),m,re
            hlim = hlam
          else
            hlim = hturb
          endif
          qlim = hlim*sbcool
c
c Determine peaked heat flux
c
          if(pe.ge.70000.) then
            if(vel(m).gt.8.) then
              if(mod(m-1,10).le.4) then
                pf = pftw95(1)
                hflx = pf*calc1(lflxht+m,i)/pfco95
              else
                pf = pftw99(1)
                hflx = pf*calc1(lflxht+m,i)/pfco99
              endif
            else
              if(mod(m-1,10).le.4) then
                pf = pftw95(2)
                hflx = pf*calc1(lflxht+m,i)/pfco95
              else
                pf = pftw99(2)
                hflx = pf*calc1(lflxht+m,i)/pfco99
              endif
            endif
          else
            if(mod(m-1,10).le.4) then
              pf = pftw95(3)
              hflx = pf*calc1(lflxht+m,i)/pfco95
            else
              pf = pftw99(3)
              hflx = pf*calc1(lflxht+m,i)/pfco99
            endif
          endif
c
        if(m.eq.10) write(28,9102) calc1(1,i),qlim,hflx,sbcool,hlim
          suphtr(m) = max(0.00001d0,qlim/hflx)
          if(suphtr(m).lt.shmin.and.suphtr(m).gt.0.0001d0) then
            shmin  = suphtr(m)
          endif
   76   continue
c
c.......1.........2.........3.........4.........5.........6........7..
c
c Calculate Bergles-Rohsenow heat flux at hot channel exit locations only
        do 77 m=1,30
          pe = abs(calc1(lpe+m,i))
          pr = calc1(lpr+m,i)
          ckb = calc1(lk+m,i)
          tsat = calc1(lsat+m,i)
          sbcool = calc1(lsc+m,i)
          visblk = calc1(lvis+m,i)
          re = pe/pr
          if(m.le.10) then
            const = 1.0875 - 0.1125*(1.143/63.95)
            dh = 0.0022236
            pexit = calc1(lpexl+1,i)
          else if(m.le.20) then
            const = 1.0875 - 0.1125*(1.143/55.41)
            dh = 0.0022299
            pexit = calc1(lpexu+1,i)
          else
            const = 1.0875 - 0.1125*(1.143/77.65)
            dh = 0.0024937
            pexit = calc1(lpexi+1,i)
          endif
          call incip(tsat-sbcool,tsat,pexit,re,pr,dh,visblk,const,
     .               ckb,qib,hib,twalib,ilam,ierr)
          if(ierr.eq.1) write(6,970)twalib,qib,calc1(1,i),m
          if(ilam.eq.1) write(6,963)calc1(1,i),m,re
c
c Determine peaked heat flux
c
          if(mod(m-1,10).le.4) then
            pf = pfib95(1)
            hflx = pf*calc1(lflxht+m,i)/pfco95
          else
            pf = pfib99(1)
            hflx = pf*calc1(lflxht+m,i)/pfco99
          endif
          ibr(m) = max(0.00001d0,qib/hflx)
          if(ibr(m).lt.ibmin.and.ibr(m).gt.0.0001d0) then
            ibmin  = ibr(m)
            xibmin = float(m)
          endif
        if(m.eq.10) write(29,9102) calc1(1,i),qib,hflx,twalib,hib
 9102 format(5(1X,e15.7))
   77   continue
c
```

```
c........1.........2.........3.........4.........5.........6........7..
      if(lpool.eq.0) then
       write(22,993)(calc1(j,i),j=1,lvis),(calc1(j,i),j=lvis+181,ntw),
     .al1,al2,al3,accfl,(calc1(lh+ih,i)-calc1(lh+ih,1),ih=1,6),
     .(suphtr(m),ibr(m),costar(m),szmodr(m),szr(m),chfr(m),m=1,30),
     .(chfavr(m),m=1,15),comin,szmin,chfmin,shmin,ibmin,shmax
      else
       write(22,993)(calc1(j,i),j=1,lvis),
     .       (calc1(j,i),j=lvis+181,lpool),
     .(calc1(j,i),j=lpool+npool+nmhx+1,ntw),al1,al2,al3,accfl,
     .(calc1(lh+ih,i)-calc1(lh+ih,1),ih=1,6),
     .(suphtr(m),ibr(m),costar(m),szmodr(m),szr(m),chfr(m),m=1,30),
     .(chfavr(m),m=1,15),
     .comin,szmin,chfmin,shmin,ibmin,shmax,
     . qpool,qmhx,qmhxp(i),qehxp(i),qhll(i),qhlc(i),qcl(i)
      endif
c
      if(chfr(4).gt.1.d-4)then
        if(ichf4.eq.0) write(23,995)
        ichf4 = 1
        write(23,993) calc1(1,i),chfr(4)
      else
        ichf4 = 0
      endif
      if(chfr(5).gt.1.d-4)then
        if(ichf5.eq.0) write(24,995)
        ichf5 = 1
        write(24,993) calc1(1,i),chfr(5)
      else
        ichf5 = 0
      endif
*
   45 continue
      if(ichwrn.gt.0) write(6,975)ichwrn
      if(icowrn.gt.0) write(6,974)icowrn
      if(iszwrn.gt.0) write(6,973)iszwrn
c
c Formats
c
  999 format(17x,i3)
  998 format(10x,7(2x,a8))
  997 format(12x,('"',a5,'"'))
  995 format('ZONE T=" ", J=1, F=POINT')
  994 format(' number of records found =',i5)
  993 format(1x,1p,8(e12.5,2x))
  992 format('TITLE="',a40,'"',/,'VARIABLES="',a5,'"')
  991 format(10x,7(1x,a9)/(8(1x,a9)))
  990 format(a8)
  989 format(6(1x,a10,2x))
  988 format(8(2x,a8))
  987 format(7x,i3)
  986 format(5e15.6)
c........1.........2.........3.........4.........5.........6........7..
  985 format(' Input title for this case. ',/,' First character should
     .be "-" for no uncertainties')
  984 format(i5)
  982 format(15x,4e15.6)
  980 format(i5)
  979 format(a40)
  978 format(a10)
  977 format(i5)
  976 format(1x,i4,1x,d12.4,1x,a10,1x,a10)
  975 format(' WARNING: CHF RATIO ABOVE 100.',2x,i5)
  974 format(' WARNING: COSTA RATIO LESS THAN 1.0 ',2x,i5)
  973 format(' WARNING: SAHA-ZUBER RATIO LESS THAN 1.0 ',i5)
  971 format(' WARNING: convergence not obtained for limit')
  970 format(' NO IB SOLUTION: tw=',f9.3,' q=',e13.4,' time=',e13.4,
     .       ' ib index = ',i2)
  964 format(' WARNING: Low Pe regime is being used for Modified Saha-Zu
     .ber',/,'          with a high velocity (> 8 m/s)')
  963 format(' Laminar HTC for IB      at time,m,re =',f10.3,1x,i5,
     . f10.1)
  962 format(' Laminar HTC for Tw=Tsat at time,m,re =',f10.3,1x,i5,
     . f10.1)
  961 format('ZONE T="',f5.1,'"',5(/,5e14.6))
      stop
      end
      block data
      implicit double precision (a-h,o-z)
      common /pool/  pool(4,138)
      data pool  / 1081., 1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1082.,0.0445,     3.49,     1.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2082.,0.0445,     3.49,     1.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3082.,0.0445,     3.49,     1.,
     .3161.,0.5556,     1.6,      2.,
```

```
c........1.........2.........3.........4.........5.........6........7..
      if(lpool.eq.0) then
       write(22,993)(calc1(j,i),j=1,lvis),(calc1(j,i),j=lvis+181,ntw),
     .al1,al2,al3,accfl,(calc1(lh+ih,i)-calc1(lh+ih,1),ih=1,6),
     .(suphtr(m),ibr(m),costar(m),szmodr(m),szr(m),chfr(m),m=1,30),
     .(chfavr(m),m=1,15),comin,szmin,chfmin,shmin,ibmin,shmax
      else
       write(22,993)(calc1(j,i),j=1,lvis),
     .       (calc1(j,i),j=lvis+181,lpool),
     .(calc1(j,i),j=lpool+npool+nmhx+1,ntw),al1,al2,al3,accfl,
     .(calc1(lh+ih,i)-calc1(lh+ih,1),ih=1,6),
     .(suphtr(m),ibr(m),costar(m),szmodr(m),szr(m),chfr(m),m=1,30),
     .(chfavr(m),m=1,15),
     .comin,szmin,chfmin,shmin,ibmin,shmax,
     . qpool,qmhx,qmhxp(i),qehxp(i),qhll(i),qhlc(i),qcl(i)
      endif
c
      if(chfr(4).gt.1.d-4)then
        if(ichf4.eq.0) write(23,995)
        ichf4 = 1
        write(23,993) calc1(1,i),chfr(4)
      else
        ichf4 = 0
      endif
      if(chfr(5).gt.1.d-4)then
        if(ichf5.eq.0) write(24,995)
        ichf5 = 1
        write(24,993) calc1(1,i),chfr(5)
      else
        ichf5 = 0
      endif
*
   45 continue
      if(ichwrn.gt.0) write(6,975)ichwrn
      if(icowrn.gt.0) write(6,974)icowrn
      if(iszwrn.gt.0) write(6,973)iszwrn
c
c Formats
c
  999 format(17x,i3)
  998 format(10x,7(2x,a8))
  997 format(12x,('"',a5,'"'))
  995 format('ZONE T=" ", J=1, F=POINT')
  994 format(' number of records found =',i5)
  993 format(1x,1p,8(e12.5,2x))
  992 format('TITLE="',a40,'"',/,'VARIABLES="',a5,'"')
  991 format(10x,7(1x,a9)/(8(1x,a9)))
  990 format(a8)
  989 format(6(1x,a10,2x))
  988 format(8(2x,a8))
  987 format(7x,i3)
  986 format(5e15.6)
c........1.........2.........3.........4.........5.........6........7..
  985 format(' Input title for this case. ',/,' First character should
     .be "-" for no uncertainties')
  984 format(i5)
  982 format(15x,4e15.6)
  980 format(i5)
  979 format(a40)
  978 format(a10)
  977 format(i5)
  976 format(1x,i4,1x,d12.4,1x,a10,1x,a10)
  975 format(' WARNING: CHF RATIO ABOVE 100.',2x,i5)
  974 format(' WARNING: COSTA RATIO LESS THAN 1.0 ',2x,i5)
  973 format(' WARNING: SAHA-ZUBER RATIO LESS THAN 1.0 ',i5)
  971 format(' WARNING: convergence not obtained for limit')
  970 format(' NO IB SOLUTION: tw=',f9.3,' q=',e13.4,' time=',e13.4,
     .       ' ib index = ',i2)
  964 format(' WARNING: Low Pe regime is being used for Modified Saha-Zu
     .ber',/,'          with a high velocity (> 8 m/s)')
  963 format(' Laminar HTC for IB      at time,m,re =',f10.3,1x,i5,
     . f10.1)
  962 format(' Laminar HTC for Tw=Tsat at time,m,re =',f10.3,1x,i5,
     . f10.1)
  961 format('ZONE T="',f5.1,'"',5(/,5e14.6))
      stop
      end
      block data
      implicit double precision (a-h,o-z)
      common /pool/  pool(4,138)
      data pool  / 1081., 1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1081.,1.0540,     0.555,    2.,
     .1082.,0.0445,     3.49,     1.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1161.,0.008636,2672.,       2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .1501.,0.2541,     0.75,     2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2081.,1.0540,     0.555,    2.,
     .2082.,0.0445,     3.49,     1.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2161.,0.5556,     1.6,      2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .2501.,0.2541,     0.75,     2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3081.,1.0540,     0.555,    2.,
     .3082.,0.0445,     3.49,     1.,
     .3161.,0.5556,     1.6,      2.,
```

```
.3161.,0.5556,     1.6,      2.,
.3161.,0.5556,     1.6,      2.,
.3161.,0.5556,     1.6,      2.,
.3501.,0.2541,     0.75,     2.,
.3501.,0.2541,     0.75,     2.,
.3501.,0.2541,     0.75,     2.,
.3501.,0.2541,     0.75,     2.,
.1011.,0.1778,     1.07,     2 .,
.1011.,0.1778,     3.66,     2.,
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.1041.,0.1778,     0.69,     2.,
.1041.,0.1778,    12.96,     2.,
.1041.,0.1778,     2.51,     2.,
.1221.,0.1778,     2.31,     2.,
.1221.,0.1778,     2.13,     2.,
.1221.,0.1778,     0.762,    2.,
.1261.,0.1778,     0.9146,   2.,
.1291.,0.1778,     6.25,     2.,
.1581.,0.1778,     4.50,     2.,
.1581.,0.1778,     4.50,     2.,
.1621.,0.1778,     1.83,     2.,
.1621.,0.1778,     1.57,     2.,
.1621.,0.1778,     1.45,     2.,
.1621.,0.1778,    12.10439,  2.,
.1711.,0.1016,     0.300,    2.,
.1711.,0.1016,     2.000,    2.,
.1711.,0.1016,     2.280,    2.,
.1741.,0.1778,     0.50,     2.,
.2011.,0.1778,     1.07,     2.,
.2011.,0.1778,     3.66,     2.,
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.2041.,0.1778,     3.048,    2.,
.2041.,0.1778,     2.51,     2.,
.2221.,0.1778,     2.31,     2.,
.2221.,0.1778,     2.13,     2.,
.2221.,0.1778,     0.762,    2.,
.2261.,0.1778,     0.9146,   2.,
.2291.,0.1778,     6.25,     2.,
.2581.,0.1778,     4.50,     2.,
.2581.,0.1778,     4.50,     2.,
.2621.,0.1778,     0.64538,  2.,
.2621.,0.1778,    13.93439,  2.,
.2711.,0.1016,     0.300,    2.,
.2711.,0.1016,     0.290,    2.,
.2711.,0.1016,     0.940,    2.,
.2741.,0.1778,     0.50,     2.,
.3011.,0.1778,     3.28,     2.,
.3041.,0.1778,     0.69,     2.,
.3041.,0.1778,    12.96,     2.,
.3041.,0.1778,     2.51,     2.,
.3221.,0.1778,     2.31,     2.,
.3221.,0.1778,     2.13,     2.,
.3221.,0.1778,     0.762,    2.,
.3261.,0.1778,     0.9146,   2.,
.3291.,0.1778,     6.25,     2.,
.3581.,0.1778,     7.24,     2.,
.3581.,0.1778,     7.24,     2.,
.3621.,0.1778,     1.2166,   2.,
.3621.,0.1778,    13.93439,  2.,
.3711.,0.1016,     0.300,    2.,
.3711.,0.1016,     0.510,    2.,
.3711.,0.1016,     0.980,    2.,
.3741.,0.1778,     0.50,     2.,
.4011.,0.1778,     3.28,     2.,
.4291.,0.1778,     6.25,     2.,
.4581.,0.1778,     7.24,     2.,
.4581.,0.1778,     7.24,     2.,
.4621.,0.1778,     1.2166,   2.,
.4621.,0.1778,    13.93439,  2.,
.4711.,0.1016,     0.300,    2.,
.4711.,0.1016,     0.510,    2.,
.4711.,0.1016,     0.980,    2.,
.4741.,0.1778,     0.50,     2.,
.4951.,0.3165,     1.800,    2.,
.5001.,0.2465,     0.331,    2.,
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.6401.,0.3048,     0.91463,  2.,
.6401.,0.3048,     0.91463,  2.,
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.6401.,0.3048,     2.33667,  2.,
.6401.,0.3048,     2.33667,  2.,
.6451.,0.3048,     4.88,     2.,
.6451.,0.3048,     3.35,     2.,
.6501.,0.3048,     1.68,     2.,
.6501.,0.3048,     3.51,     2.,
.6501.,0.3048,     1.22,     2.,
.6501.,0.3048,     1.83,     2./
      end
      function d2ovis(t)
      implicit double precision (a-h,o-z)
      tf = (t-273.15)*1.8 + 32.
      d2ovis = -1.111606e-4 + 9.46e-8*tf + 0.0873655375/tf +
     .       0.4111103409/tf/tf
      end
c
c
c  This program calculates the incipient boiling heat flux
c  and wall superheat given the wall temperature, saturation
c  temperature and bulk coolant temperature.
c
c Uses the Bergles/Rohsenhow IB correlation to determine heat flux limit
c
c.......1.........2.........3.........4.........5.........6.........7..
      subroutine incip(tbulk,tsat,p,reb,prb,dh,vsb,const,ckb,qib,hfc,
     . twalib,ilam,ierr)
      implicit double precision (a-h,o-z)
      data eps /0.001/
      ierr = 0
      ilam = 0
c
      fd = const/(1.82*log10(reb)-1.64)**2
      imax = 2000
      tlow = tsat
      thi = tsat + 100.
c
      do 10 i=1,imax
      tw = tsat+float(i)
      visrat = vsb/d2ovis(tw)
      tw = 0.5*(thi+tlow)
c
c Calculate heat transfer coefficient
c
c
c heat transfer coefficient in kW/m^2-K
c
c dittus boelter
c
       hfcd = 0.023*ckb/dh*prb**.4*reb**.8
c
```

```
= strip file for  ans model
100 strip fmtout
103 0
104 noaction
*-----------------------------------------------------
----------------
1001    mflowj 157000000 * Accumulator 1
1002    mflowj 257000000 * Accumulator 2
1003    mflowj 357000000 * Accumulator 3
1004    mflowj 148000000 * EHX Chimney Flow
1005     mflowj 169000000 * Break Flow - Core Inlet (TD
only)
1006    mflowj 124010000 * pump mass flow - loop 1
1007    mflowj 224010000 * pump mass flow - loop 2
1008    mflowj 324010000 * pump mass flow - loop 3
1009    mflowj 567010400 * Total Core Flow
1010    mflowj 865010000 * Letdown Flow Rate
1011    mflowj 850010000 * Pressurizing Flow Rate
1012    mflowj 132000000 * Secondary
1013    rktpow  0
1014    rkfipow 0
1015    rkgapow 0
1016    rkreac  0
* Pressures
1017    cntrlvar 827 * lower core exit pressure
1018    cntrlvar 828 * lower core pressure drop
1019    cntrlvar 829 * upper core exit pressure
1020    cntrlvar 830 * upper core pressure drop
1021    cntrlvar 831 * inner core pressure drop
1022    cntrlvar 832 * inner core pressure drop
1023    p 490010000
1024    p 500010000
1025    p 505010000
1026    p 520010000
1027    p 535010000
1028    p 555010000
1029    p 515010000
1030    p 515020000
1031    p 515030000
1032    p 515040000
1033    p 515050000
1034    p 122260000 * pump suction pressure
1035    p 126010000 * pump suction pressure
1036    p 156010000
1037    p 104010000
1038    p 106010000
1039    p 650030000
1040    sattemp 650030000
1041    pmpvel 124
1042    pmpvel 224
1043    pmpvel 324
1044    pmpvel 815
1045    pmpvel 830
1055    tempf 490010000
1056    tempf 565010000
1057    tempf 645150000
1058    tempf 106010000
1059    tempf 650030000
1060    tempf 515050000
1061    tempf 516050000
1062    cntrlvar 218  * LC 95% hot channel exit subcooling
1063      cntrlvar 238   * LC 99.9% hot channel exit
subcooling
1066    velfj 507010300 * inner core 95% inlet velocity
1067    velfj 522010200 * inner core 95% exit velocity
1068    velfj 507010200 * inner average inlet velocity
1069    velfj 510040000
1070    velfj 515040000
1071    velfj 516040000
1072    velfj 540040000
1073    velfj 545040000
1074    velfj 546040000
1075    velfj 570040000
1076    velfj 575040000
1077    velfj 576040000
1085    voidg 515010000
1086    voidg 515020000
1087    voidg 515030000
1088    voidg 515040000
1089    voidg 515050000
1090    voidg 516010000
1091    voidg 516020000
1092    voidg 516030000
1093    voidg 516040000
1094    voidg 516050000
1095    voidg 545010000
```

```
    voidg 545020000
    voidg 545030000
    voidg 545040000
    voidg 545050000
    voidg 546010000
    voidg 546020000
    voidg 546030000
    voidg 546040000
    voidg 546050000
    voidg 575010000
    voidg 575020000
    voidg 575030000
    voidg 575040000
    voidg 575050000
    voidg 576010000
    voidg 576020000
    voidg 576030000
    voidg 576040000
    voidg 576050000
    voidg 650030000
    quala 106010000
    quala 126010000
    quala 490010000
    quala 515050000
    quala 645150000
    httemp 550100204 * Max CPBT Temp
    httemp 562100306 * Max CR- Al Temp
    httemp 562100307 * Max CR- Hf Temp
    httemp 550100201 * Sur CPBT Temp
    httemp 562100301 * Sur CR- Al Temp
    httemp 562100310 * Sur CR- Hf Temp
* Bulk Temperatures
    tempf 515010000
    tempf 515020000
    tempf 515030000
    tempf 515040000
    tempf 515050000
    tempf 516010000
    tempf 516020000
    tempf 516030000
    tempf 516040000
    tempf 516050000
    tempf 545010000
    tempf 545020000
    tempf 545030000
    tempf 545040000
    tempf 545050000
    tempf 546010000
    tempf 546020000
    tempf 546030000
    tempf 546040000
    tempf 546050000
    tempf 575010000
    tempf 575020000
    tempf 575030000
    tempf 575040000
    tempf 575050000
    tempf 576010000
    tempf 576020000
    tempf 576030000
    tempf 576040000
    tempf 576050000
    cputime 0
    voidf          156010000
    voidf          156020000
    voidf          156030000
    voidf          156040000
    voidf          156050000
    voidf          156060000
    voidf          256010000
    voidf          256020000
    voidf          256030000
    voidf          256040000
    voidf          256050000
    voidf          256060000
    voidf          356010000
    voidf          356020000
    voidf          356030000
    voidf          356040000
    voidf          356050000
    voidf          356060000
* heat fluxes at average and hot channels
    htrnr 510100100 * LC average channel fuel
    htrnr 510100200
    htrnr 510100300
    htrnr 510100400
```

```
1180    htrnr 510100500
1181    htrnr 540100100 * UC average channel fuel
1182    htrnr 540100200
1183    htrnr 540100300
1184    htrnr 540100400
1185    htrnr 540100500
1186    htrnr 570100100 * IC average channel fuel
1187    htrnr 570100200
1188    htrnr 570100300
1189    htrnr 570100400
1190    htrnr 570100500
1191    htrnr 515500100 * LC FE 95% hot stripe
1192    htrnr 515500200
1193    htrnr 515500300
1194    htrnr 515500400
1195    htrnr 515500500
1196    htrnr 516500100 * LC FE 99.9% hot stripe
1197    htrnr 516500200
1198    htrnr 516500300
1199    htrnr 516500400
1200    htrnr 516500500
1201    htrnr 545500100 * UC FE 95% hot stripe
1202    htrnr 545500200
1203    htrnr 545500300
1204    htrnr 545500400
1205    htrnr 545500500
1206    htrnr 546500100 * UC FE 99.9% hot stripe
1207    htrnr 546500200
1208    htrnr 546500300
1209    htrnr 546500400
1210    htrnr 546500500
1211    htrnr 575500100 * IC FE 95% hot stripe
1212    htrnr 575500200
1213    htrnr 575500300
1214    htrnr 575500400
1215    htrnr 575500500
1216    htrnr 576500100 * IC FE 99.9% hot stripe
1217    htrnr 576500200
1218    htrnr 576500300
1219    htrnr 576500400
1220    htrnr 576500500
1226    htrnr 515400100 * LC CHF 95% hot stripe
1227    htrnr 515400200
1228    htrnr 515400300
1229    htrnr 515400400
1230    htrnr 515400500
1231    htrnr 516400100 * LC CHF 99.9% hot stripe
1232    htrnr 516400200
1233    htrnr 516400300
1234    htrnr 516400400
1235    htrnr 516400500
1236    htrnr 545400100 * UC CHF 95% hot stripe
1237    htrnr 545400200
1238    htrnr 545400300
1239    htrnr 545400400
1240    htrnr 545400500
1241    htrnr 546400100 * UC CHF 99.9% hot stripe
1242    htrnr 546400200
1243    htrnr 546400300
1244    htrnr 546400400
1245    htrnr 546400500
1246    htrnr 575400100 * IC CHF 95% hot stripe
1247    htrnr 575400200
1248    htrnr 575400300
1249    htrnr 575400400
1250    htrnr 575400500
1251    htrnr 576400100 * IC CHF 99.9% hot stripe
1252    htrnr 576400200
1253    htrnr 576400300
1254    htrnr 576400400
1255    htrnr 576400500
1256    cputime 0
1257    cputime 0
1258    cputime 0
1259    cputime 0
1260    cputime 0
* CHF indicated by RELAP5
1261    htchf 510100100 * LC average channel fuel
1262    htchf 510100200
1263    htchf 510100300
1264    htchf 510100400
1265    htchf 510100500
1266    htchf 540100100 * UC average channel fuel
1267    htchf 540100200
1268    htchf 540100300
1269    htchf 540100400
```

```
1270    htchf 540100500
1271    htchf 570100100 * IC average channel fuel
1272    htchf 570100200
1273    htchf 570100300
1274    htchf 570100400
1275    htchf 570100500
1276    htchf 515400100 * LC CHF 95% hot stripe
1277    htchf 515400200
1278    htchf 515400300
1279    htchf 515400400
1280    htchf 515400500
1281    htchf 516400100 * LC CHF 99.9% hot stripe
1282    htchf 516400200
1283    htchf 516400300
1284    htchf 516400400
1285    htchf 516400500
1286    htchf 545400100 * UC CHF 95% hot stripe
1287    htchf 545400200
1288    htchf 545400300
1289    htchf 545400400
1290    htchf 545400500
1291    htchf 546400100 * UC CHF 99.9% hot stripe
1292    htchf 546400200
1293    htchf 546400300
1294    htchf 546400400
1295    htchf 546400500
1296    htchf 575400100 * IC CHF 95% hot stripe
1297    htchf 575400200
1298    htchf 575400300
1299    htchf 575400400
1300    htchf 575400500
1301    htchf 576400100 * IC CHF 99.9% hot stripe
1302    htchf 576400200
1303    htchf 576400300
1304    htchf 576400400
1305    htchf 576400500
1306    cputime 0
1308    hthtc 515500500
1309    hthtc 545500500
1310    hthtc 575500500
* Costa heat flux limits
1316    cntrlvar 203 * LC 95% hot stripe
1317    cntrlvar 207
1318    cntrlvar 211
1319    cntrlvar 215
1320    cntrlvar 219
1321    cntrlvar 223 * LC 99.9% hot stripe
1322    cntrlvar 227
1323    cntrlvar 231
1324    cntrlvar 235
1325    cntrlvar 239
1326    cntrlvar 243 * UC 95% hot stripe
1327    cntrlvar 247
1328    cntrlvar 251
1329    cntrlvar 255
1330    cntrlvar 259
1331    cntrlvar 263 * UC 99.9% hot stripe
1332    cntrlvar 267
1333    cntrlvar 271
1334    cntrlvar 275
1335    cntrlvar 279
1336    cntrlvar 283 * IC 95% hot stripe
1337    cntrlvar 287
1338    cntrlvar 291
1339    cntrlvar 295
1340    cntrlvar 299
1341    cntrlvar 303 * IC 99.9% hot stripe
1342    cntrlvar 307
1343    cntrlvar 311
1344    cntrlvar 315
1345    cntrlvar 319
1346    cputime 0
* viscosities in hot channels
1371    viscf 515010000
1372    viscf 515020000
1373    viscf 515030000
1374    viscf 515040000
1375    viscf 515050000
1376    viscf 516010000
1377    viscf 516020000
1378    viscf 516030000
1379    viscf 516040000
1380    viscf 516050000
1381    viscf 545010000
1382    viscf 545020000
1383    viscf 545030000
```

```
1384    viscf 545040000
1385    viscf 545050000
1386    viscf 546010000
1387    viscf 546020000
1388    viscf 546030000
1389    viscf 546040000
1390    viscf 546050000
1391    viscf 575010000
1392    viscf 575020000
1393    viscf 575030000
1394    viscf 575040000
1395    viscf 575050000
1396    viscf 576010000
1397    viscf 576020000
1398    viscf 576030000
1399    viscf 576040000
1400    viscf 576050000
* thermal conductivities in hot channels
1401    thconf 515010000
1402    thconf 515020000
1403    thconf 515030000
1404    thconf 515040000
1405    thconf 515050000
1406    thconf 516010000
1407    thconf 516020000
1408    thconf 516030000
1409    thconf 516040000
1410    thconf 516050000
1411    thconf 545010000
1412    thconf 545020000
1413    thconf 545030000
1414    thconf 545040000
1415    thconf 545050000
1416    thconf 546010000
1417    thconf 546020000
1418    thconf 546030000
1419    thconf 546040000
1420    thconf 546050000
1421    thconf 575010000
1422    thconf 575020000
1423    thconf 575030000
1424    thconf 575040000
1425    thconf 575050000
1426    thconf 576010000
1427    thconf 576020000
1428    thconf 576030000
1429    thconf 576040000
1430    thconf 576050000
* velocities in hot channels
1431    velf 515010000
1432    velf 515020000
1433    velf 515030000
1434    velf 515040000
1435    velf 515050000
1436    velf 516010000
1437    velf 516020000
1438    velf 516030000
1439    velf 516040000
1440    velf 516050000
1441    velf 545010000
1442    velf 545020000
1443    velf 545030000
1444    velf 545040000
1445    velf 545050000
1446    velf 546010000
1447    velf 546020000
1448    velf 546030000
1449    velf 546040000
1450    velf 546050000
1451    velf 575010000
1452    velf 575020000
1453    velf 575030000
1454    velf 575040000
1455    velf 575050000
1456    velf 576010000
1457    velf 576020000
1458    velf 576030000
1459    velf 576040000
1460    velf 576050000
* Subcooling
1461    cntrlvar 202
1462    cntrlvar 206
1463    cntrlvar 210
1464    cntrlvar 214
1465    cntrlvar 218
1466    cntrlvar 222
```

```
1467    cntrlvar 226
1468    cntrlvar 230
1469    cntrlvar 234
1470    cntrlvar 238
1471    cntrlvar 242
1472    cntrlvar 246
1473    cntrlvar 250
1474    cntrlvar 254
1475    cntrlvar 258
1476    cntrlvar 262
1477    cntrlvar 266
1478    cntrlvar 270
1479    cntrlvar 274
1480    cntrlvar 278
1481    cntrlvar 282
1482    cntrlvar 286
1483    cntrlvar 290
1484    cntrlvar 294
1485    cntrlvar 298
1486    cntrlvar 302
1487    cntrlvar 306
1488    cntrlvar 310
1489    cntrlvar 314
1490    cntrlvar 318
* prandtl numbers
1496    cntrlvar  445 * lower core 95% hot channel
1497    cntrlvar  447
1498    cntrlvar  449
1499    cntrlvar  451
1500    cntrlvar  453
1501    cntrlvar  455 * lower core 99.9% hot channel
1502    cntrlvar  457
1503    cntrlvar  459
1504    cntrlvar  461
1505    cntrlvar  463
1506    cntrlvar  465 * upper core 95% hot channel
1507    cntrlvar  467
1508    cntrlvar  469
1509    cntrlvar  471
1510    cntrlvar  473
1511    cntrlvar  475 * upper core 99.9% hot channel
1512    cntrlvar  477
1513    cntrlvar  479
1514    cntrlvar  481
1515    cntrlvar  483
1516    cntrlvar  485 * inner core 95% hot channel
1517    cntrlvar  487
1518    cntrlvar  489
1519    cntrlvar  491
1520    cntrlvar  493
1521    cntrlvar  495 * inner core 99.9% hot channel
1522    cntrlvar  497
1523    cntrlvar  499
1524    cntrlvar  501
1525    cntrlvar  503
* Peclet numbers
1526    cntrlvar 321 * lower core 95% hot channel
1527    cntrlvar 323
1528    cntrlvar 325
1529    cntrlvar 327
1530    cntrlvar 329
1531    cntrlvar 331 * lower core 99.9% hot channel
1532    cntrlvar 333
1533    cntrlvar 335
1534    cntrlvar 337
1535    cntrlvar 339
1536    cntrlvar 341 * upper core 95% hot channel
1537    cntrlvar 343
1538    cntrlvar 345
1539    cntrlvar 347
1540    cntrlvar 349
1541    cntrlvar 351 * upper core 99.9% hot channel
1542    cntrlvar 353
1543    cntrlvar 355
1544    cntrlvar 357
1545    cntrlvar 359
1546    cntrlvar 361 * inner core 95% hot channel
1547    cntrlvar 363
1548    cntrlvar 365
1549    cntrlvar 367
1550    cntrlvar 369
1551    cntrlvar 371 * inner core 99.9% hot channel
1552    cntrlvar 373
1553    cntrlvar 375
1554    cntrlvar 377
1555    cntrlvar 379
```

```
* saturation temperatures in hot channels
1561    sattemp 515010000
1562    sattemp 515020000
1563    sattemp 515030000
1564    sattemp 515040000
1565    sattemp 515050000
1566    sattemp 516010000
1567    sattemp 516020000
1568    sattemp 516030000
1569    sattemp 516040000
1570    sattemp 516050000
1571    sattemp 545010000
1572    sattemp 545020000
1573    sattemp 545030000
1574    sattemp 545040000
1575    sattemp 545050000
1576    sattemp 546010000
1577    sattemp 546020000
1578    sattemp 546030000
1579    sattemp 546040000
1580    sattemp 546050000
1581    sattemp 575010000
1582    sattemp 575020000
1583    sattemp 575030000
1584    sattemp 575040000
1585    sattemp 575050000
1586    sattemp 576010000
1587    sattemp 576020000
1588    sattemp 576030000
1589    sattemp 576040000
1590    sattemp 576050000
* Fuel surface temperatures
1596    httemp 515500101
1597    httemp 515500201
1598    httemp 515500301
1599    httemp 515500401
1600    httemp 515500501
1601    httemp 516500101
1602    httemp 516500201
1603    httemp 516500301
1604    httemp 516500401
1605    httemp 516500501
1606    httemp 545500101
1607    httemp 545500201
1608    httemp 545500301
1609    httemp 545500401
1610    httemp 545500501
1611    httemp 546500101
1612    httemp 546500201
1613    httemp 546500301
1614    httemp 546500401
1615    httemp 546500501
1616    httemp 575500101
1617    httemp 575500201
1618    httemp 575500301
1619    httemp 575500401
1620    httemp 575500501
1621    httemp 576500101
1622    httemp 576500201
1623    httemp 576500301
1624    httemp 576500401
1625    httemp 576500501
*
. end of case
```

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