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International Agreement Report

An Assessment of TRACE V4.160 Code Against PACTEL LOF-10 Experiment

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ABSTRACT

This report has been written as an International Agreement Report under the Thermal Hydraulic Code Applications and Maintenance Program (CAMP) coordinated by the United States Nuclear Regulatory Commission. The calculations presented in the report comprise an assessment case which is a part of the in-kind contribution of Finland to the CAMP program. The assessed case was to first build up a TRACE thermal hydraulic code simulation model for horizontal steam generator of the Parallel Channel Test Loop (PACTEL) facility. Secondly, the case consisted of calculations to test the TRACE code capabilities. A loss-of feedwater, LOF-10, experiment was chosen for this assessment. The calculation results showed that the TRACE code is capable in simulating the horizontal steam generator behavior both in steady state and during loss-of feedwater transient. Three models with different nodalization were introduced. The calculation results differed from experiment to some extent. At the final state the calculated secondary side collapsed level decrease was more than in the experiment. The heat transfer from primary to the secondary side degraded gradually during the uncovery of the heat exchange tubes. The calculations overestimated this heat transfer. In the experiment the steam started to superheat immediately when the uppermost tube layer had uncovered. The steam superheating in the calculations was possible only after the uppermost cell on the secondary side had voided thoroughly. Because of the use of lumped pipe representation of the heat exchange pipes in the calculations the timing of the superheating initiation was much later than in the experiment with the coarse nodalization models. More detailed representation of the heat exchange tubes gave more accurate results.

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1 INTRODUCTION

This report has been written as an International Agreement Report under the Thermal Hydraulic Code Applications and Maintenance Program (CAMP) coordinated by the United States Nuclear Regulatory Commission. The calculations presented in the report comprise an assessment case which is a part of the in-kind contribution of Finland to the CAMP program.

The Parallel Channel Test Loop (PACTEL) facility (Tuunanen et al. 1998), constructed in 1990, is one of the largest facilities of its kind. It was originally designed to model the thermal hydraulic behavior of the VVER-440 type pressurized water reactors (PWR) currently used in Finland.

A new TRACE V4.160 thermal hydraulic code has been recently implemented in the Laboratory of Nuclear Engineering at Lappeenranta University of Technology (LUT) in Finland. The first modeling exercise in the way towards whole model of the PACTEL facility was to prepare a model for horizontal steam generator of the PACTEL facility using the Symbolic Nuclear Analysis Package (SNAP) model editor. One of the many loss-of-feedwater experiments carried out with the PACTEL facility the LOF-10 experiment (Kouhia and Puustinen, 1998) was chosen to test the modeling capabilities of TRACE code. The TRACE/SNAP modeling of the steam generator was based on the guidelines of previous RELAP5 model of PACTEL steam generator (Riikonen, 1994). Three different nodalization cases; 4, 5 and 8 layers of heat exchange pipes were prepared. All cases showed a good performance achieving the stabilized state. The actual transient results of the four and five calculation cases agreed also fairly well with the experiment without departing significantly from each other. The most detailed nodalization with eight heat exchange pipe layers produced the best calculation results.

2 TEST FACILITY AND EXPERIMENT

2.1 PACTEL Facility Description

Parallel Channel Test Loop, PACTEL, is a volumetrically scaled (1:305) out-of-pile model of the VVER-440 type nuclear power plants located at Loviisa and managed by Fortum Power and Heat. All the main parts of the reference reactor primary loop are included in PACTEL: a pressure vessel, main circulation loops, steam generators and a pressurizer. Besides the emergency core cooling systems are simulated in PACTEL. The original elevations have been kept to preserve the natural circulation pressure heads.

The maximum primary side pressure is 8.0 MPa, and on the secondary side the peak pressure is 5.0 MPa. The core consists of 144 electrically heated fuel rod simulators. The maximum heating power in the core is 1000 kW which is roughly 20% of the scaled down nominal power (nominal thermal power of reference reactor after modernization is now 1500 MW). The PACTEL test facility consists of three primary loops while the reference reactor has six primary loops. The PACTEL test loop is shown in Figure 1.

The steam generators of PACTEL contain 118 horizontal heat exchange U-tubes in 14 layers. The average length of the tubes is 2.8 m (about 9 m in the power plant). The inner diameter of the tubes is 13.0 mm whereas the inner diameter of the reference tubes is 13.2 mm. The 16 mm outer diameter of the reference tubes has been kept and the space between tubes in horizontal direction is the same as in the reference steam generator (horizontal pitch 30 mm). The distance between the tubes in vertical direction is widened from the original 24 mm to 48 mm to increase the height of the tube cluster. That creates an oversize scaled down secondary side volume. The heat transfer area of the tube bundles and the volume of each steam generator is scaled down so that one steam generator in PACTEL corresponds to two steam generators in the reference reactor. A side-view of the PACTEL steam generator is presented in Figure 2. Figure 3 shows a cross-sectional view of the steam generator. Figure 4 shows the thermocouple locations in axial direction in the heat exchange tubes.

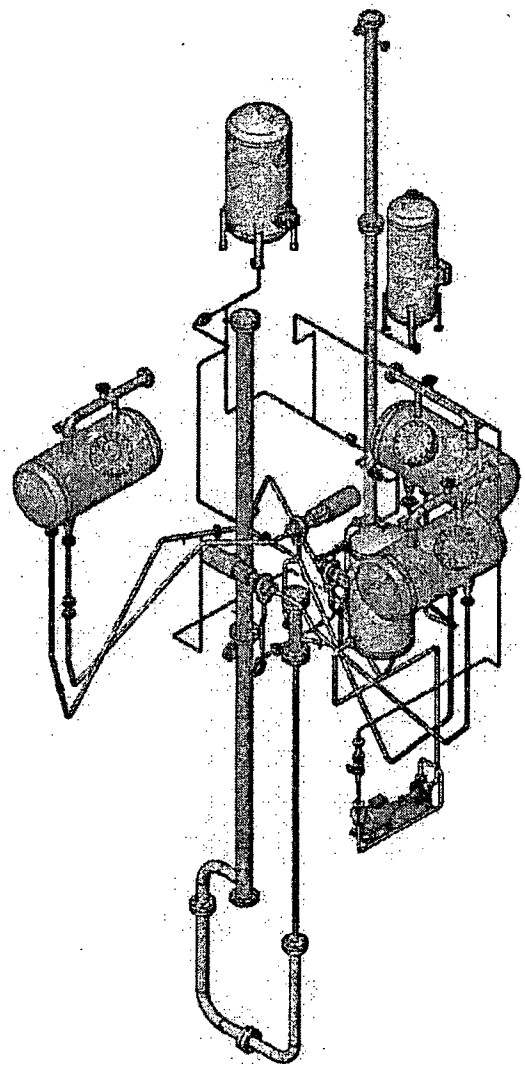

Figure 1. The PACTEL facility.

Table 1. The PACTEL facility characteristics compared with the Loviisa VVER-440.

	PACTEL	Loviisa VVER-440
Reference Power Plant	VVER-440	-
Volumetric scaling ratio	1:305	-
Scaling factor of component heights and elevations	1:1	-
Number of primary loops	3	6
Maximum heating power/thermal power	1 MW	1500 MW (1375 MW)
Number of rods	144	39438
Outer diameter of fuel rod simulators	9.1 mm	9.1 mm
Fuel rod pitch	12.2 mm	12.2 mm
Heated length of fuel rod simulators	2.42 m	2.42 m
Axial power distribution	Chopped cosine	-
Max. cladding temperature	800 °C	-
Max operating pressure	8.0 MPa	12.3 MPa
Max operating temperature	300 °C	300 °C
Max secondary pressure	5.0 MPa	5.0 MPa
Max secondary temperature	260 °C	260 °C
Feedwater tank pressure	2.5 MPa	2.5 MPa
Feedwater tank temperature	225 °C	225 °C
Accumulator pressure	5.5 MPa	5.5 MPa
Low-pressure ECC-water pressure	0.7 MPa	0.7 MPa
High-pressure ECC-water pressure	8.0 MPa	8.0 MPa
ECC-water temperature	30-50 °C	30-50 °C

2.2 PACTEL Horizontal Steam Generator

The horizontal steam generator used in the experiment is presented in Fig. 2. The primary side of the steam generator contains vertical primary collectors and horizontal heat exchange tubes. The 118 U-shape tubes are arranged in 14 layers and 9 vertical columns. The height of the tube bundle is 624 mm. The horizontal pitch of the tubes is the same as in the reference steam generator (30 mm) but the vertical pitch (48 mm) is doubled. The outer diameter of the tubes is 16 mm. Although the average tube length (2.8 m) is much smaller than in the reference steam generator (9.0 m), the heat transfer area of the tube bundle corresponds to two steam generators of the reference reactor. The secondary side differs from the reference steam generator more that the primary side. Although the height of the shell is only 0.95 m (reference 3.21 m) and the length is reduced to 2.2 m (reference 11.8 m), the volume of the secondary side is larger than it should be according to the scaling factor. So, the coolant inventory is larger and the transients in the steam generator are slower than in the reference steam generator. This has to be taken into account when the results are scales to the full scale.

The structure of the secondary side differs also slightly from the reference steam generator, which has two primary tube bundles and collector between them in the middle of the steam generator. The PACTEL steam generator has only one tube bundle. This means more empty space in the vicinity of the primary collectors. The scaling and the dimensions of the steam generator cause extra volume on the both sides of the tube bundle. The effect of this volume has been reduced by steel plates.

The instrumentation of the steam generator contains mainly temperature measurements. The primary and secondary side temperatures are measured in several tubes. The inlet and outlet temperature of the primary coolant are measured as well as the primary mass flow rate, mass flow rate of the feed water and the differential pressure on the secondary side. The collapsed level is based on the differential pressure measurement. The uncertainties of the temperature and mass flow rate measurements are ± 1.5 °C and 2.5 %, respectively. The accuracy of the determined secondary side collapsed level is ± 25 mm.

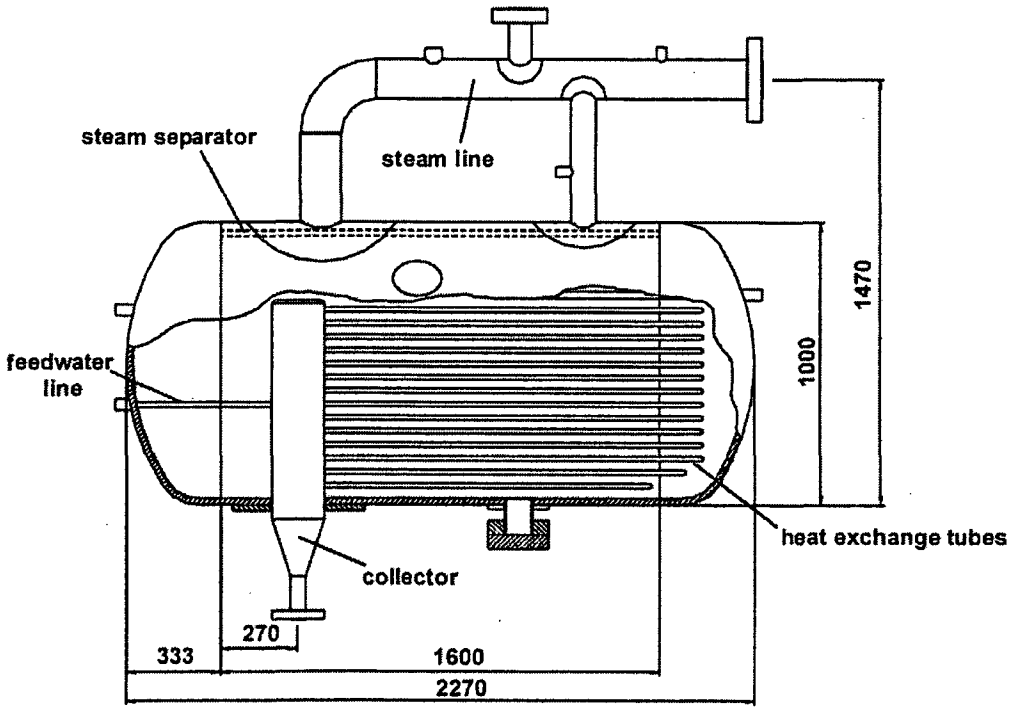

Figure 2. Steam generator model of PACTEL, side-view.

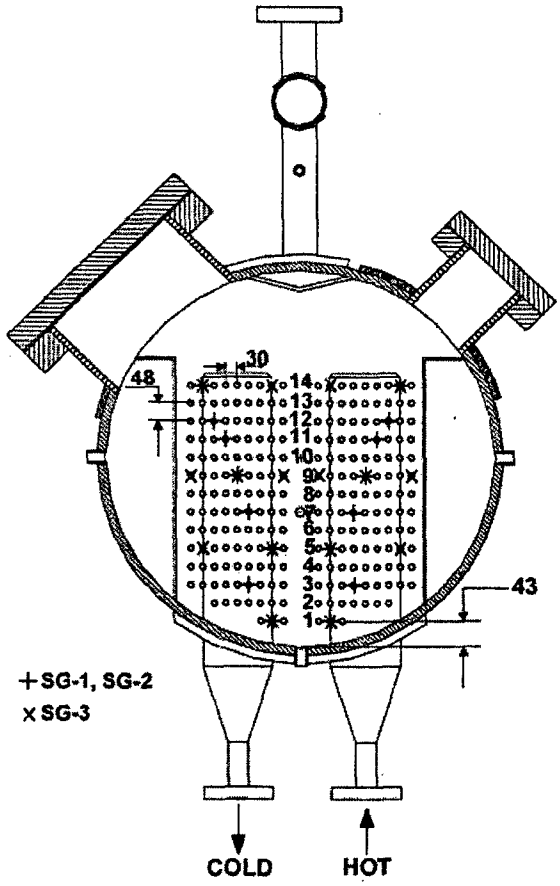

Figure 3. Cross-section of the PACTEL steam generator. Tubes marked with X-signs have thermocouples in steam generator 3, which was used in LOF-10. The other signs (+) refer to the other two loops.

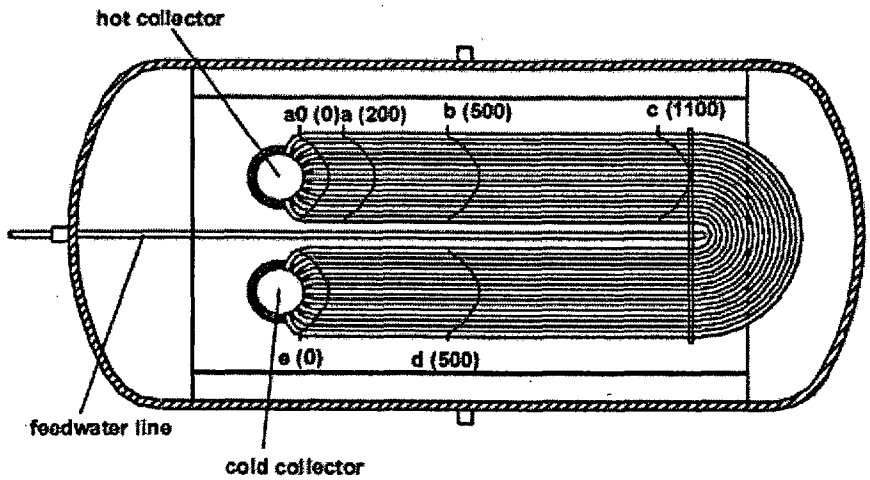

Figure 4. Thermocouple measurement locations in the PACTEL steam generator. Locations 'a0' and 'e' were not used in loop 3. The distance from the collector is presented in brackets (mm).

2.3 PACTEL Experiment LOF-10

Experiment LOF-10 was performed to study behavior of VVER reactor geometry during a loss-of feedwater transient. The main objective was to provide data for validation of safety analysis computer codes. LOF-10 was a single loop test where low core power was used throughout the experiment. So, the test did not simulate what we normally call a loss-of-feedwater transient, but it was a boil-off experiment. However, the test data is useful for verification of the steam generator models used in thermal hydraulic computer codes. Only one primary loop was used (Loop 3) in the experiment. The operators closed the primary loop isolation valves in the other two loops. Although the pressurizer was connected to loop 1, it was operable, because a pressurizer surge line connection is situated before the isolation valve in direction of the loop flow.

LOF-10 was started from steady-state conditions which lasted 1,000 seconds. The water-level in the steam generator secondary side was above the entire heat exchange tube bundle. The primary circulating pump was running during the equilibrium. After 1,000 seconds the PACTEL operators stopped the pump and no feedwater was injected to the secondary side. The pressurizer heaters were used to maintain the primary pressure. No operator actions were taken during the test. The experiment was terminated at 16,000 seconds. The heating power in this test was 75 kW, corresponding to 1.5 % power in the reference reactor. Table 2 lists the initial conditions in LOF-10.

Table 2. Initial conditions in experiment LOF-10.

Parameter	Value
Core power:	75 kW
Upper plenum pressure	7.3 MPa
Secondary side pressure	4.0 MPa
Level in SG	71.2 cm
Core outlet temperature	255 °C
Loop mass flow rate	4.99 kg/s

The 2 kW pressurizer heater was on during the whole experiment. The 4 kW heater was switched on and off according to the pressure limits. The primary pressure controller turned the 4 kW heater on when the primary pressure was 7.29 MPa and the heater was switched off when pressure increased up to 7.42 MPa. The oscillating secondary pressure caused the fluctuation in the temperature measurements. The steam flow rate through a secondary pressure control valve was so low that the control valve opened and closed periodically. The closing and opening of the pressure control valve had the most eye-catching effect on the steam generator level measurement. The secondary level was determined with a differential pressure transducer. Steam flow caused pressure loss in the steam separator and in the steam line entrance, when the valve was open. The pressure loss increased the calculated secondary level.

The main primary loop parameters started to change when the main circulating pump was halted and natural circulation flow was established at 1000 s. The loop fluid temperatures reached a new equilibrium when about 2500 s was elapsed. The constant temperatures were observed until

the uppermost layer of heat exchange tubes in the steam generator secondary side uncovered, that is the swell level in the steam generator secondary side dropped below these tubes. The temperature measurements in the uppermost tube layer shows how heat transfer started to degrade at 5000 s, and the tube was uncovered at 5500 s. The temperature distribution in the tube became almost uniform, which suggested that the heat transfer from the primary to the secondary side was lost.

When the uppermost layer of tubes in the steam generator secondary side was no longer covered by water, steam in the secondary side started to superheat. At the end of the experiment, steam in the top of steam generator secondary side was about 10 °C superheated.

3 TRACE MODEL

The TRACE model was constructed from scratch. The new input deck was prepared with the SNAP graphical model editor tool by using newest updates as they appeared (recent SNAP version 0.25.1). The main intention was to maintain the structure of the RELAP5 input deck, which had been prepared already on 1997 for the PACTEL facility and its steam generators.

The steam generator input deck was modeled using mainly the pipe components of TRACE. The structure of the models is listed in Table 3. The ASCII format input files for the TRACE code are listed in Appendices I-III. The primary side tubing was described first with four pipe layers each pipe corresponding (from highest to lowest) 27, 36, 36 and 19 tubes in the PACTEL steam generator. The schematic view of the four pipe layer input deck is shown in Fig. 5. More detailed input decks with five and eight pipe layers were also prepared (Figures 7 and 8). In the five pipe case the uppermost pipe layer, which corresponded 27 tubes in the four pipe model, was divided to 9 (uppermost row solely) and 18 tubes. In the eight pipe case the four pipe model was modified by dividing the uppermost pipe into three pipes, where each divided pipe corresponded 9 tubes. The next two pipes were divided in two corresponding 18 pipes in PACTEL steam generator. The upper part of the secondary side of the steam generator was modeled in all cases with the separator component (number 1546). In all cases each primary pipe had corresponding heat sink cell in the secondary side component (643). The number of cells in the hot and cold collectors also corresponded to the number of heat exchange pipes.

Table 3. Structure of the TRACE steam generator models.

Component	4 pipe layers	5 pipe layers	8 pipe layers
Pipe	11	12	15
Separator	1	1	1
Fill	2	2	2
Break	2	2	2
Heat structures	15	17	15
Pipe walls	6	6	10
Signal variables	25	28	24
Control blocks	9	12	6

Since the steam generator was modeled separately, the inlet and outlet boundary conditions had to be modeled both in primary and secondary side. The boundaries were modeled with FILL and BREAK components. At the primary inlet the mass flow was set constant and at outlet the pressure was set constant (7.3 MPa). The secondary inlet mass flow was adjusted with PI controller in order to achieve constant collapsed level in the secondary side. The PI-controller received input from the combined water level signal values from pipe components 643 and 1546. The second input parameter was the constant value representing the wanted set point value.

The heat transfer from primary side to secondary was modeled using the pipe wall functionality. The heat transfers mostly via tube walls to secondary, minor part of the heat transfers from hot and cold tube collectors (241, 122). The heat transfer from secondary to the environment was

lead via separate heat structure components. The heat structures were prepared with built-in material stainless steel 304. A special user defined material was introduced for modeling the insulating mineral wool of the PACTEL facility.

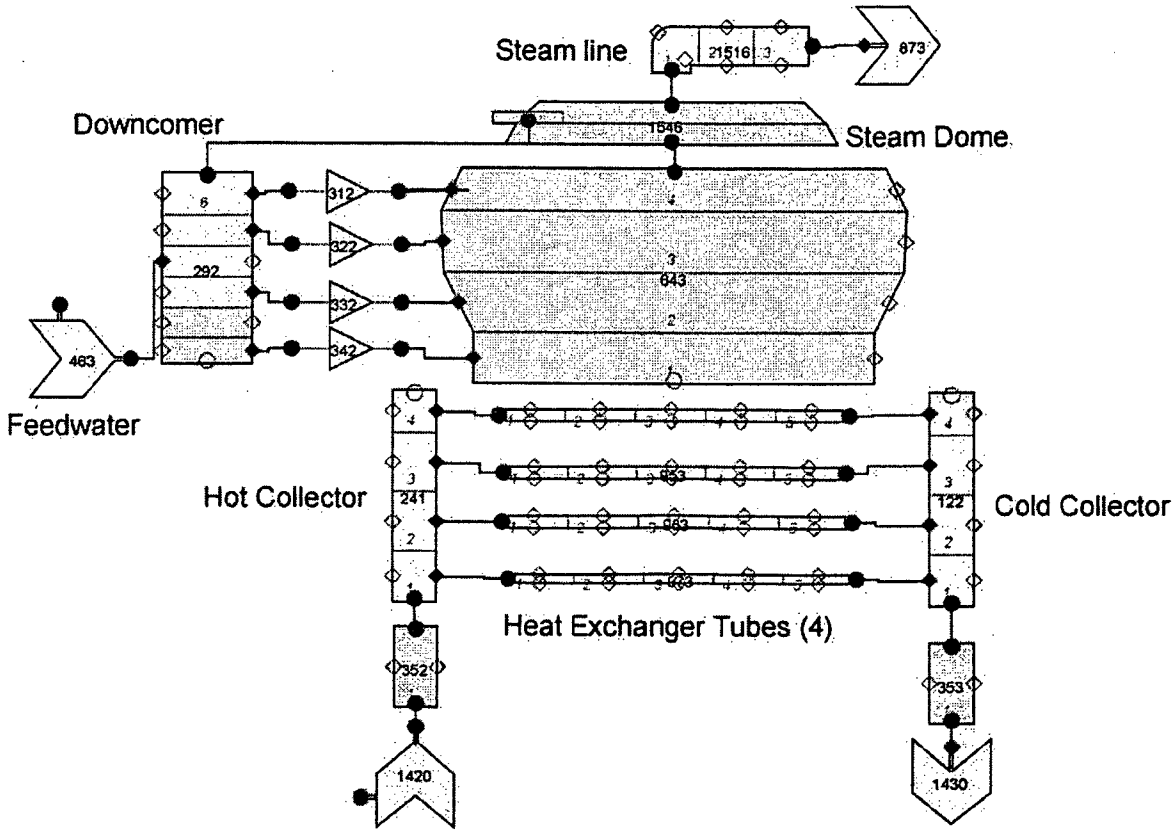

Figure 5. The SNAP scheme of PACTEL steam generator with 4 pipe layers.

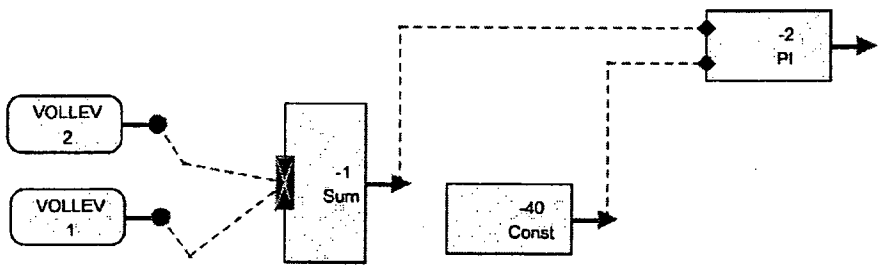

Figure 6. The SNAP scheme of the control system of secondary side collapsed level with feed water.

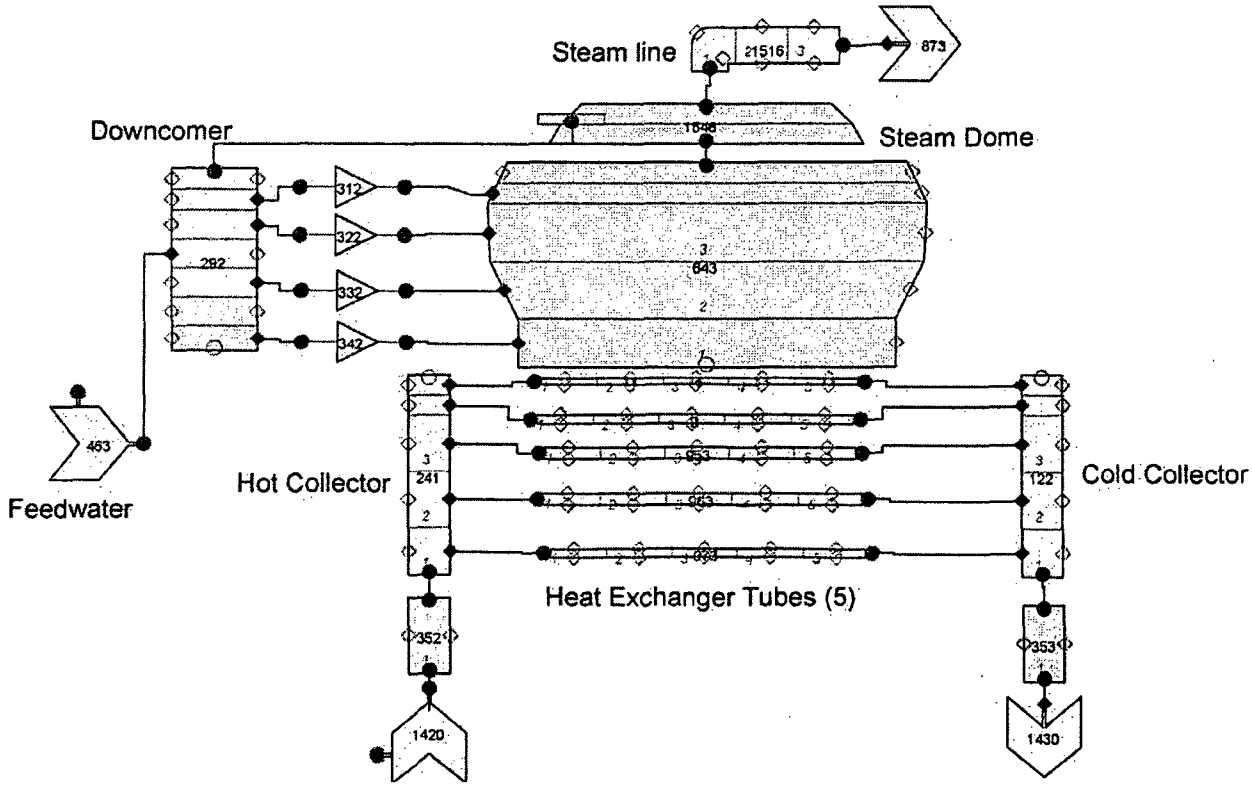

Figure 7. The SNAP scheme of PACTEL steam generator with 5 pipe layers.

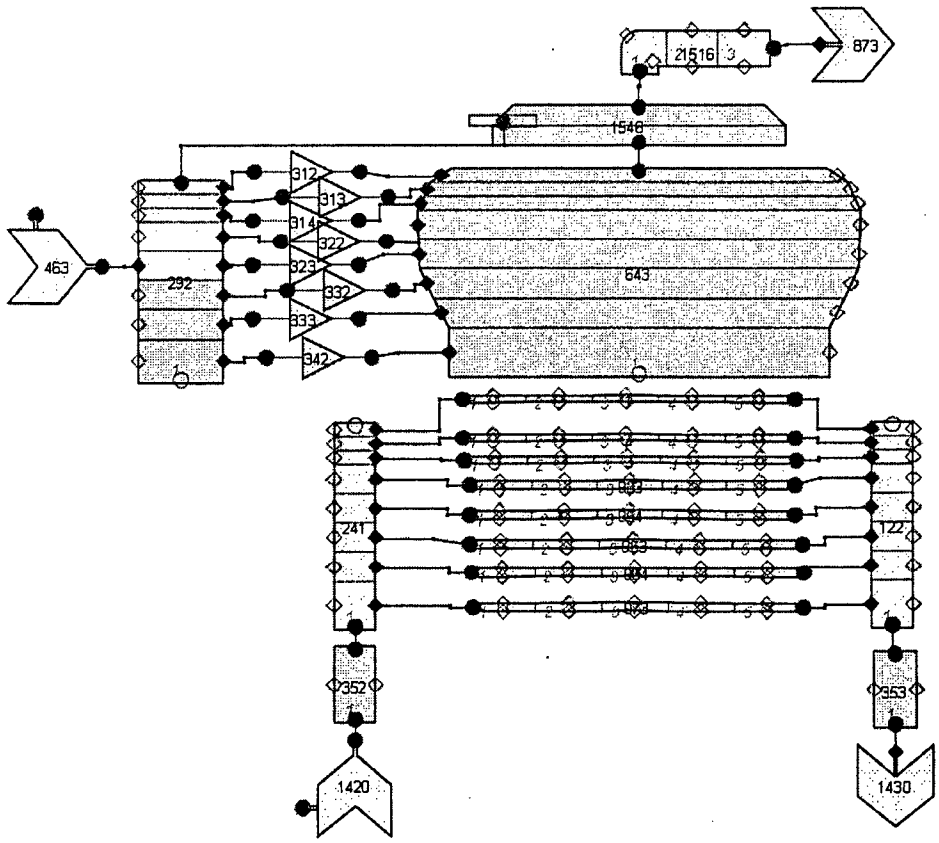

Figure 8. The SNAP scheme of PACTEL steam generator with 8 pipe layers.

4 CALCULATION RESULTS

4.1 Steady state

Before actual transient calculation a stabilizing calculation of 10000 s was performed in order to achieve the average conditions at the time 0 s of the experiment. However, no steady state options of the TRACE were used. Calculations with these options were tried at first. Since oscillations of the feedwater were in some degree large and caused that no steady state could be found by the time of 10000 s, the use of steady state options were abandoned. The calculation using PI-controlled feedwater was stabilizing to such extent that at 10000 s the thermal hydraulic conditions could be considered as steady state. By the time of 10000 s calculation all the main parameters had reached the initial state of the LOF-10 experiment. At the primary inlet the mass flow was set to constant 5 kg/s and at outlet the pressure was set to constant 7.3 MPa. At the secondary inlet, the feed water mass flow was induced by PI-controller and at the outlet the pressure was set to constant 4 MPa.

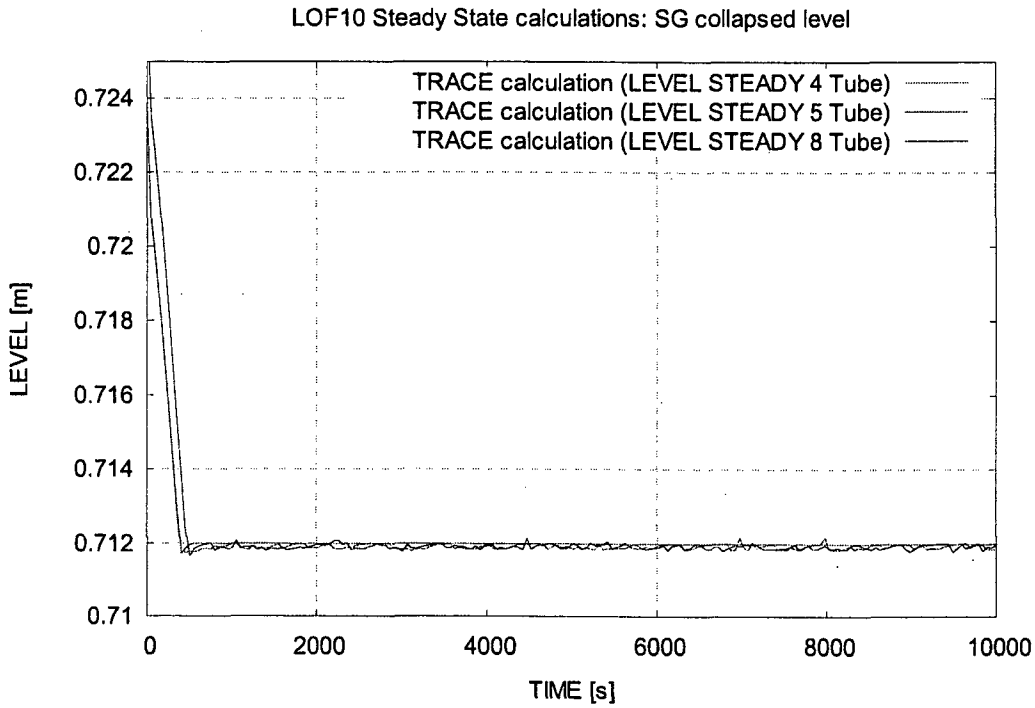

Figure 9. Steam generator collapsed level in stabilizing steady state calculations.

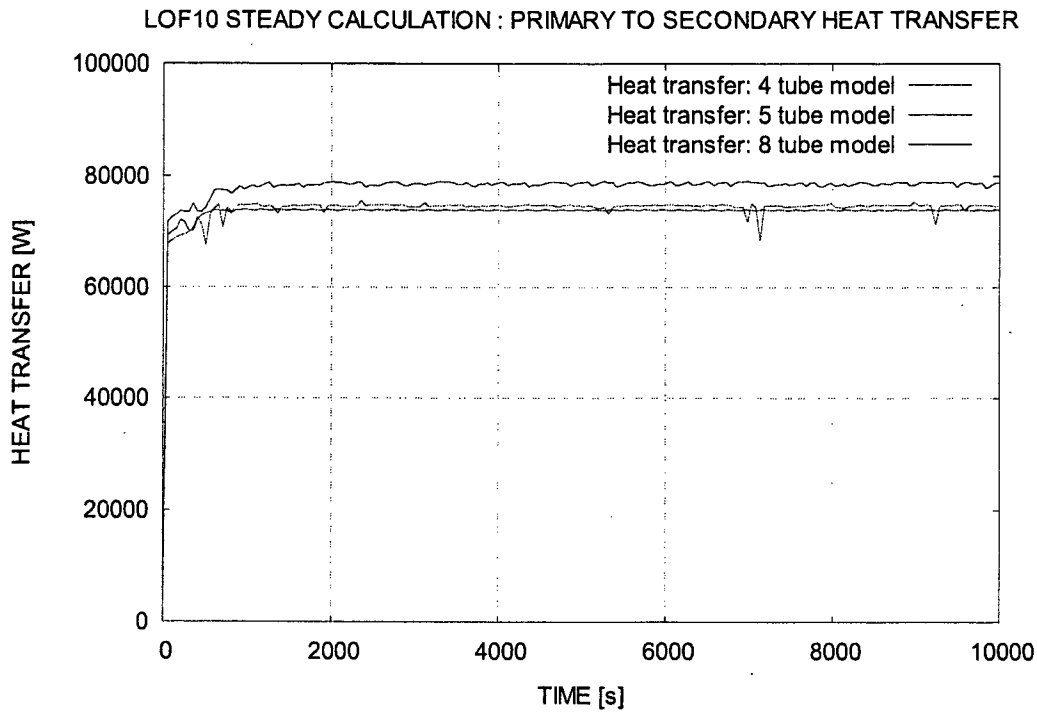

Figure 10. Heat transfer from primary to secondary side in stabilizing steady state calculations.

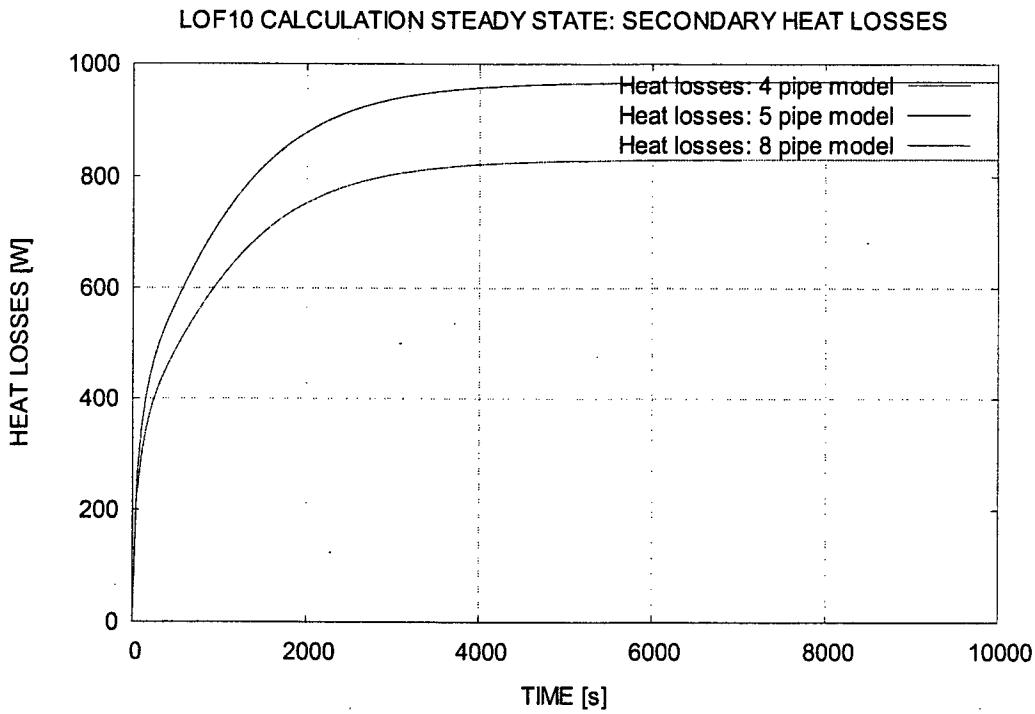

Figure 11. Secondary side heat losses in stabilizing steady state calculations.

4.2 Transient calculations

The actual transient calculation was a restart calculation from the stabilizing calculation. The restart calculation was performed by using text editor jEdit and its SNAP plug-in. The transient calculation followed the experiment procedure. After 1000 s the steady state period the primary flow changed to natural circulation. Hence, at this point the primary inlet flow in the calculation was changed from 5 kg/s to 0.6055 kg/s changing linearly towards the end of the transient to 0.5965 kg/s. The evolution of the primary flow is illustrated in Figure 12. The primary inlet temperature was also let to change at this moment according to the experiment data (see Figures 14, 15 and 16). In the beginning of the restart run the set point of the secondary feed water PI-controller was changed from constant component (number 40, see Fig. 6) to a function. With this change it was possible to vary the set point value to reach zero immediately after 1000 s run. Since there was no feed water injected after 1000 s of the start the remaining water in the secondary side started to boil-off and the collapsed level started to decrease similarly with the experiment. Figure 13 provide a comparison between the evolution of collapsed levels in all three calculation cases and in the experiment. The calculated levels agreed well with the experiment until 5000 s. Since that the four and five pipe cases stayed together but separating from the experiment more than the eight pipe case, which remained closest to the experiment. Later on at 10000 s the four and five pipe case collapsed levels separated from each other also. At the end of the transient the discrepancy of the collapsed levels from the experiment was approximately 7 cm in the four pipe case and 10 cm in the five pipe case and less than 5 cm in the eight pipe case.

In the four tube layer model the uppermost pipe corresponded three layers (total 27) of tubes in the PACTEL steam generator. In the five tube layer model the uppermost pipe of four tube layer model was divided in two pipes corresponding 9 and 18 tubes in the PACTEL steam generator. When in the experiment the uppermost tube layer started to uncover, the heat transfer started to degrade simultaneously at 5000 s, and was uncovered at 5500 s. When the uppermost layer of tubes in the steam generator secondary side was no longer covered by water in the experiment, steam in the secondary side started to superheat continuously. Obviously, this phenomenon was not taking place at the same time neither of the four nor five pipe calculation cases. In the calculations the superheating of the steam (see Figures 22, 23, 24) was possible only after the uppermost cell on the secondary side had voided thoroughly (Figures 25, 26, 27). In the eight pipe case the superheating of the steam started almost simultaneously with the experiment, but with stepwise manner and it was even slightly overestimated (Fig. 24).

The primary outlet temperature in the four pipe model (Fig. 13) followed the rising trend of the experiment while in the five pipe model (Fig. 14) the temperature remained constant until increasing step at the last moment of the transient. The best calculation result was achieved with the eight pipe model, where the simulated outlet temperature followed slightly stepwise but still quite accurately the experiment (Fig. 16). Similar phenomena took place also in the uppermost pipe temperatures illustrated in Figures 17, 18 and 19, which are picked from point c in experiment and middle (3^{rd}) cell in the calculations. The temperature stepped up after 8000 s in four pipe model while in five pipe model the temperature did not increase at all. In the eight pipe model the uppermost pipe temperature jump was observed almost at the same time as in experiment, but the increase was too fast and too high. However, in the five pipe model the third

row temperature increased just before the end of the simulation and in the eight pipe model the corresponding temperature rose already at 2000 s before the end (Fig. 20). So, this temperature rise was just a sign of the degraded heat transfer from primary to secondary side. This heat transfer in all three calculation cases is illustrated in Figure 21.

The calculations were performed with a PC of 1.6 GHz processor with 1024 MB memory. An example of the time step behavior in calculation of five pipe model is illustrated in Figure 27. The maximum time step was set to 1 s and time step went below 0.1 s only occasionally. The CPU time and time step history used for each calculation case is presented in Table 4. The calculation histories show opposite behaviour than was expected. The more pipes in the model the quicker the calculation and less time steps to calculate. Probably cause for this unecpected tendency was that when the model was more detailed described the changes and gradients in the thermal parameters are smoother and smaller and therefore longer time step could be used.

Table 4. Used CPU and time step history in the calculations.

Number of heat exchange pipes	4	5	8
CPU time used	1425.5 s	1063.9 s	638.8s
Number of time steps	111459	75095	30116

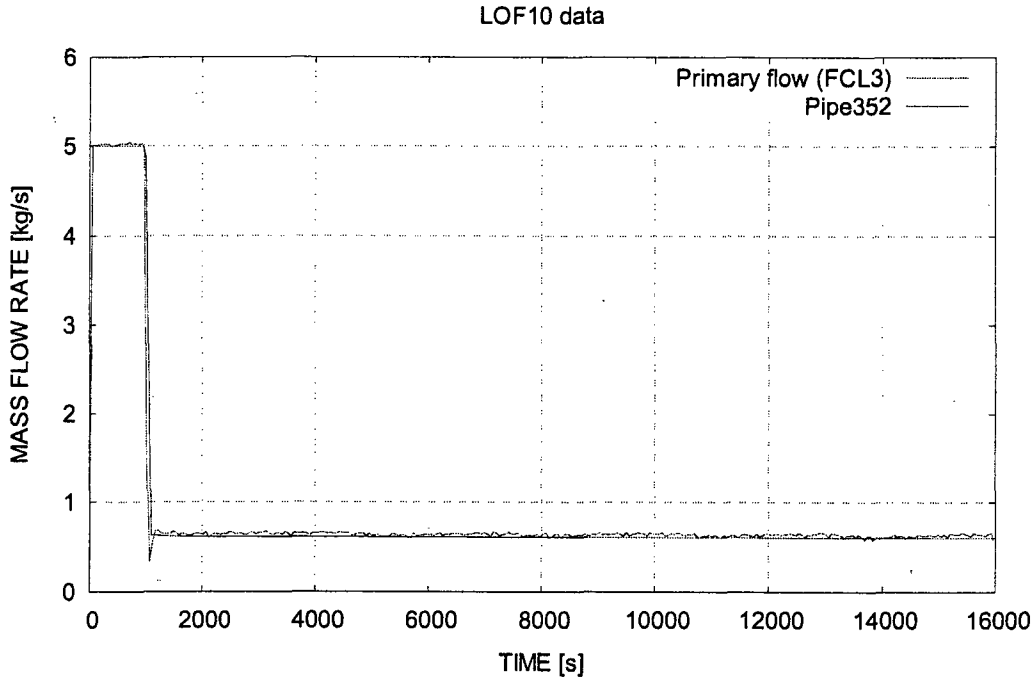

Figure 12. Primary mass flow in experiment LOF-10 and TRACE calculations.

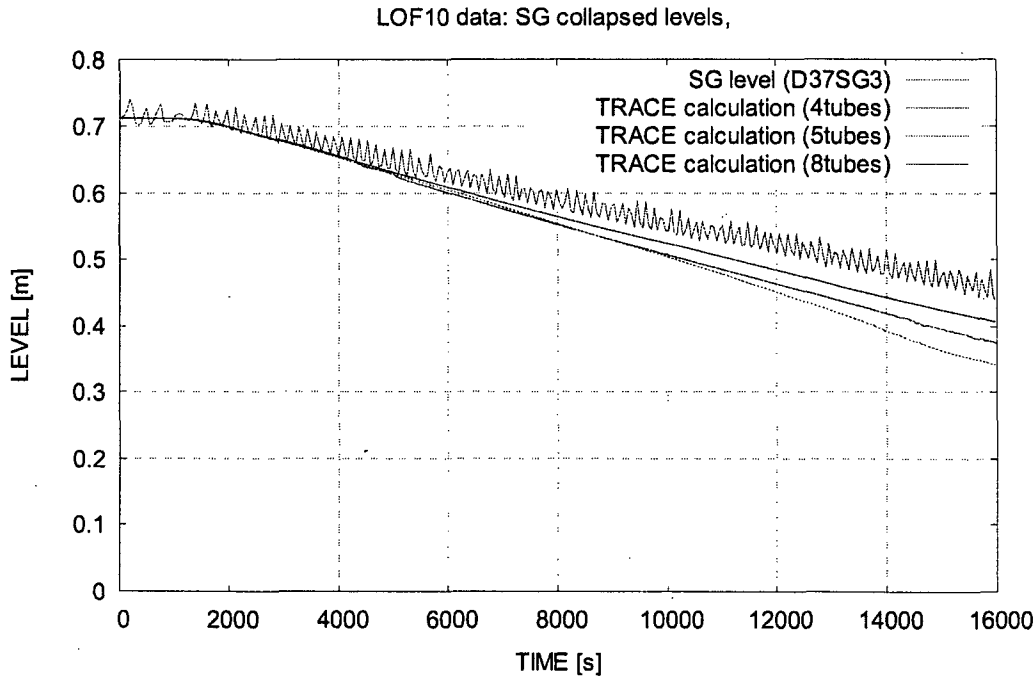

Figure 13. Steam generator collapsed levels.

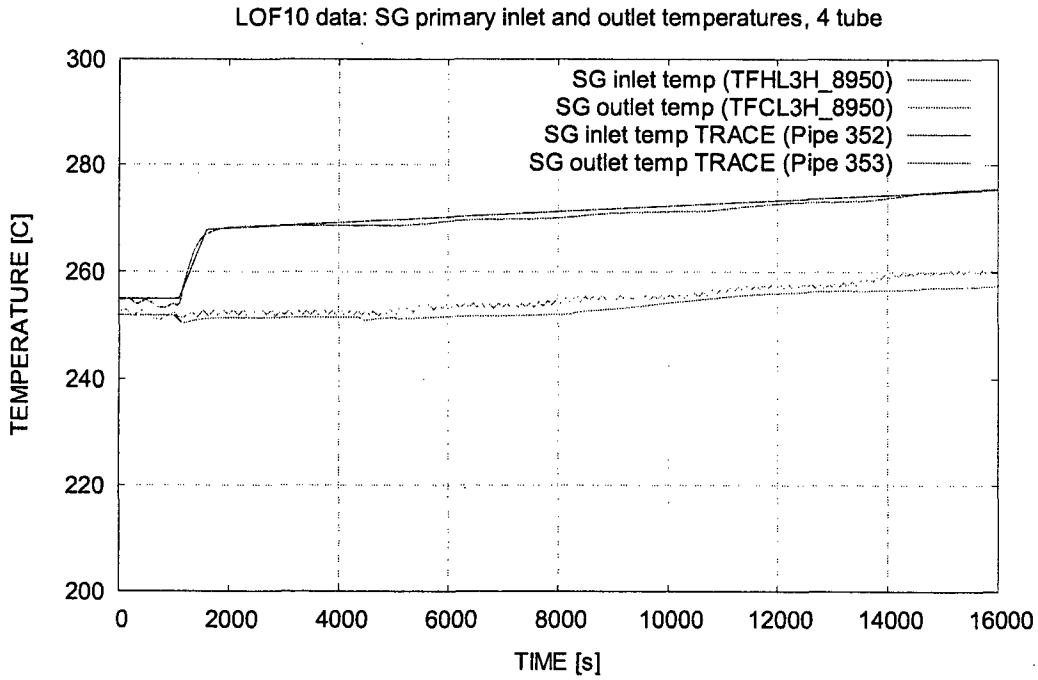

Figure 14. Primary inlet and outlet temperatures in experiment and in 4 pipe layer model.

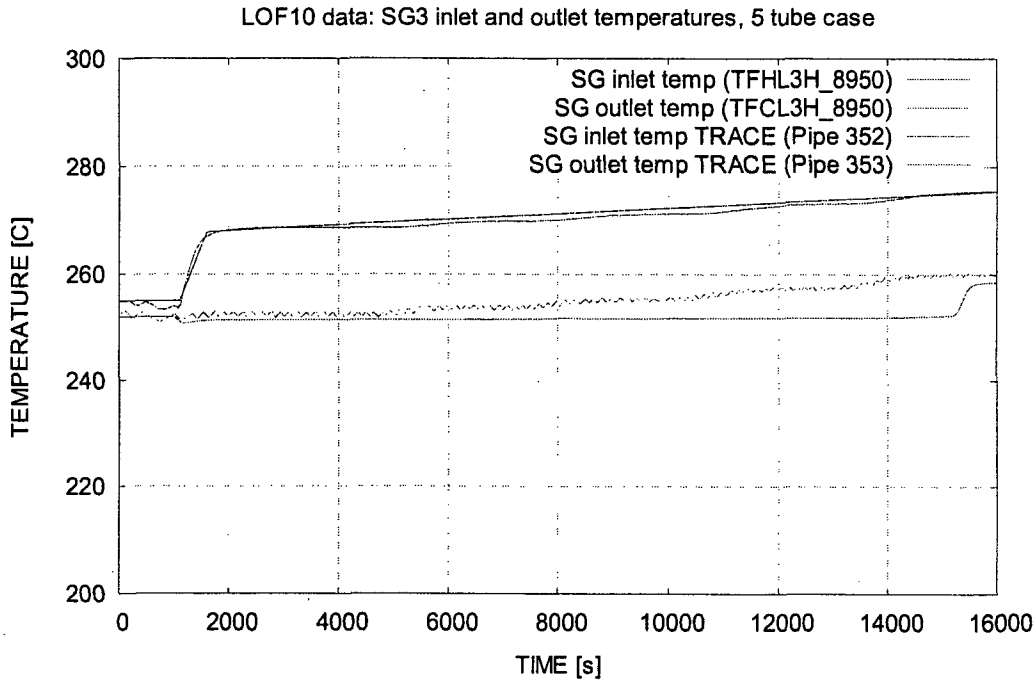

Figure 15. Primary inlet and outlet temperatures in experiment and in 5 pipe layer model.

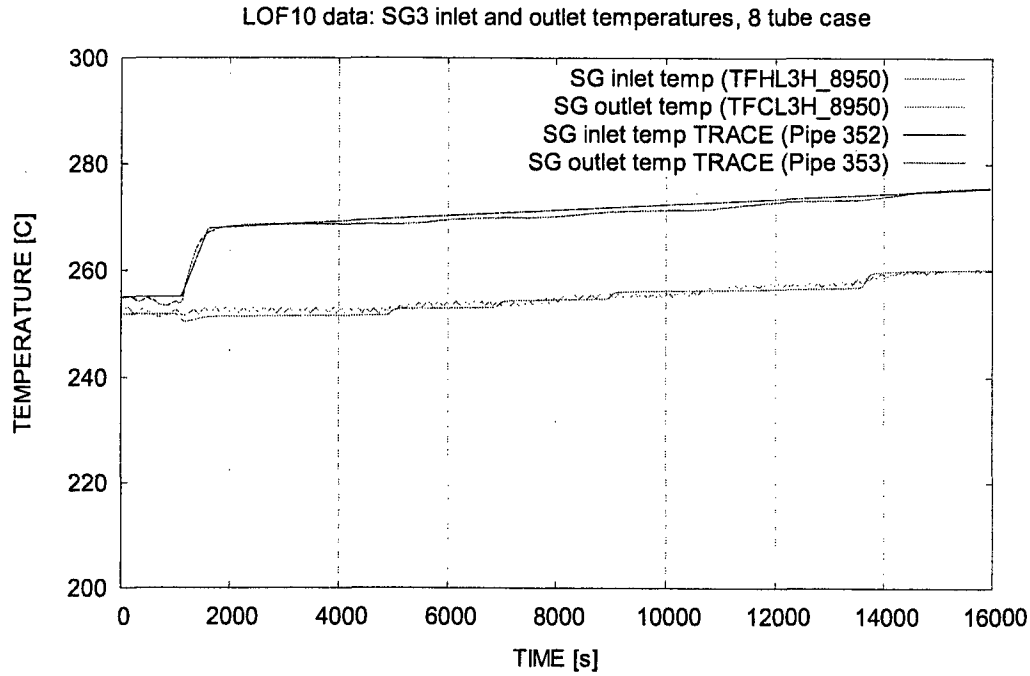

Figure 16. Primary inlet and outlet temperatures in experiment and in 8 pipe layer model.

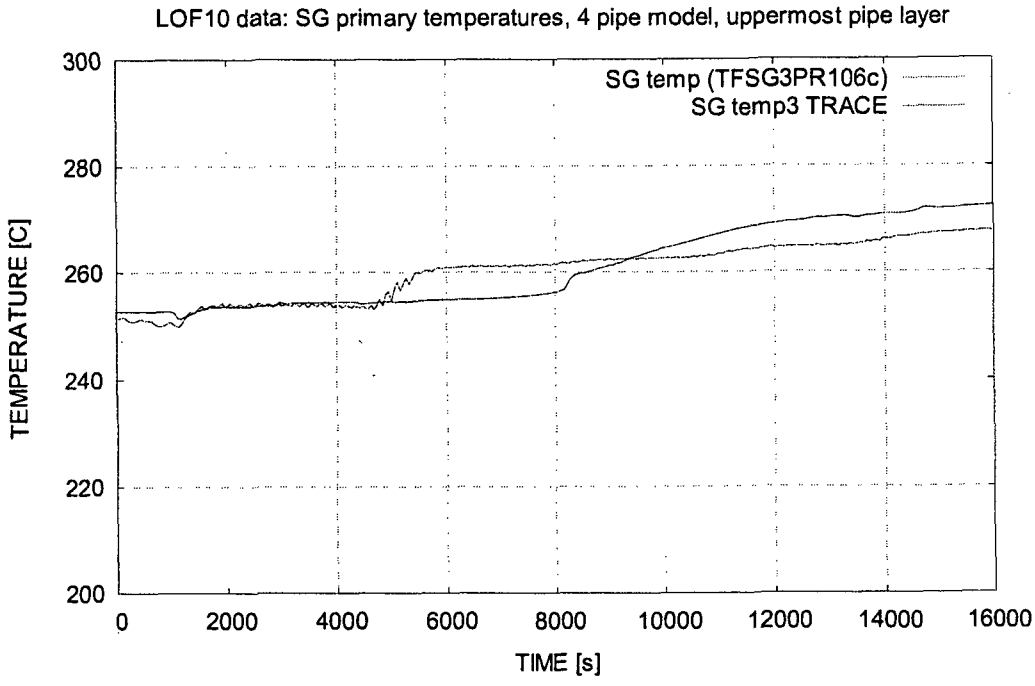

Figure 17. Primary temperatures, uppermost pipe layer, experiment vs. 4 pipe model.

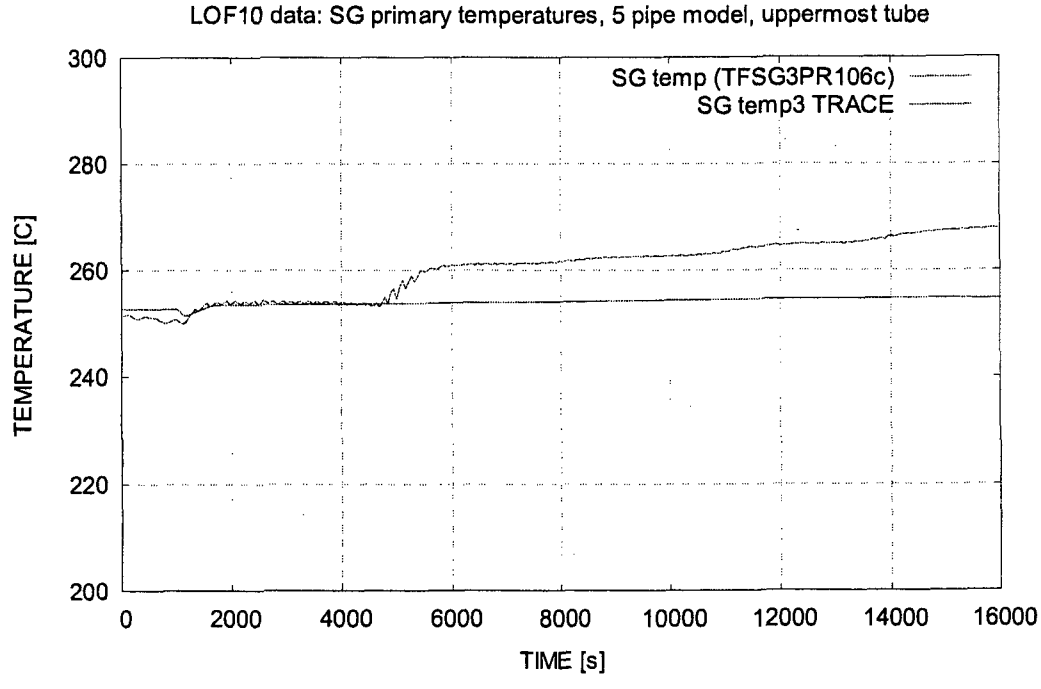

Figure 18. Primary temperatures, uppermost pipe layer, experiment vs. 5 pipe model.

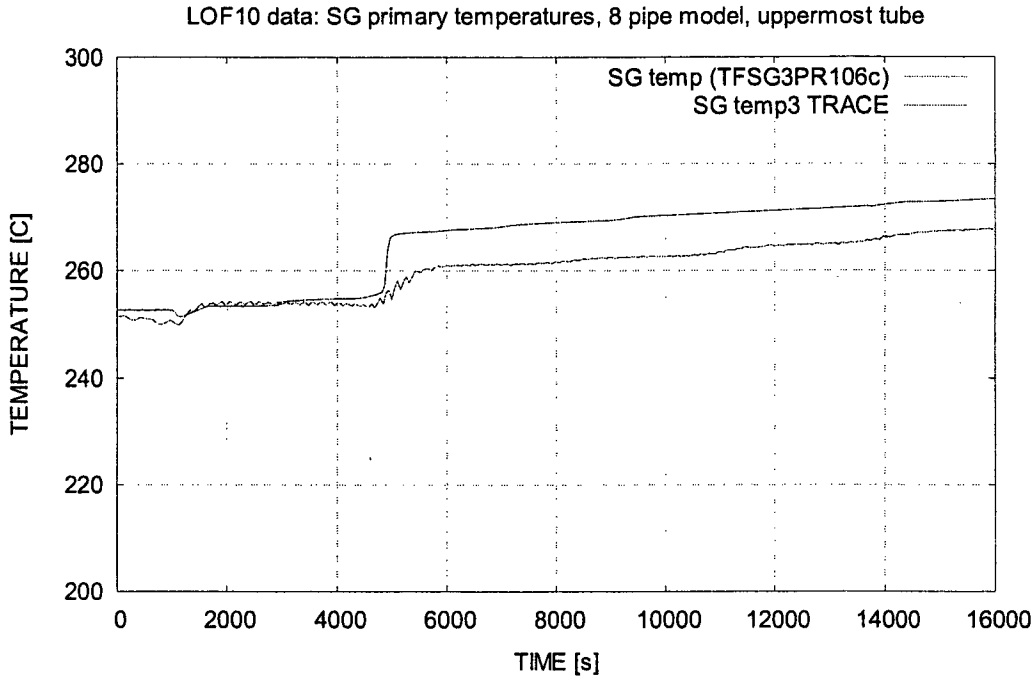

Figure 19. Primary temperatures, uppermost pipe layer, experiment vs. 8 pipe model.

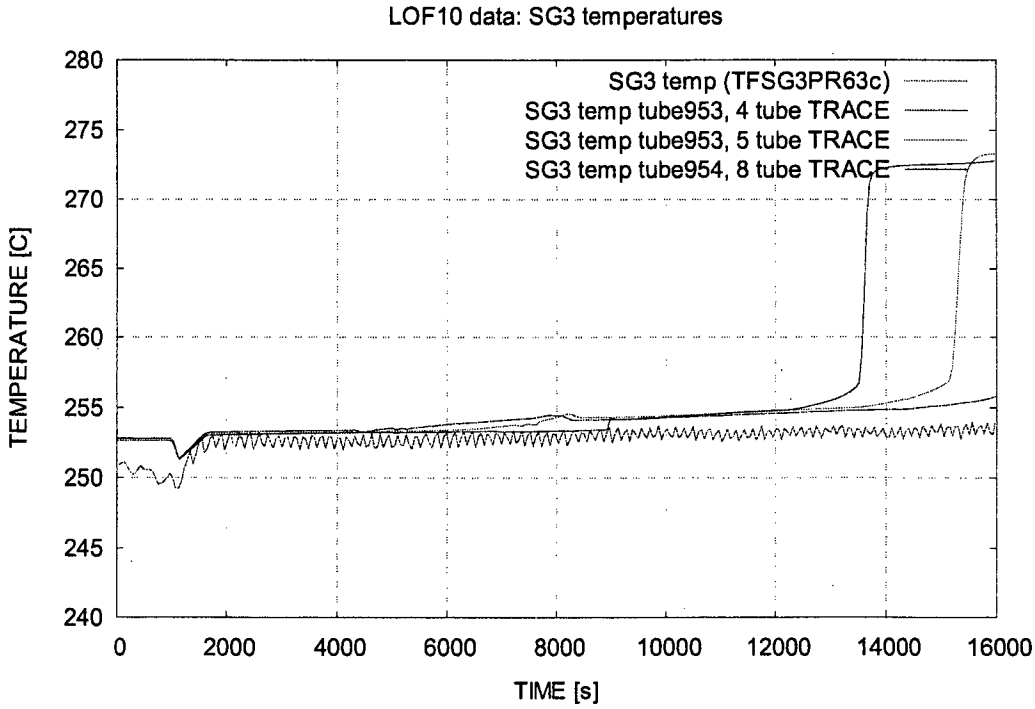

Figure 20. Primary tube temperatures in the experiment and in calculations at the middle of the tubebank.

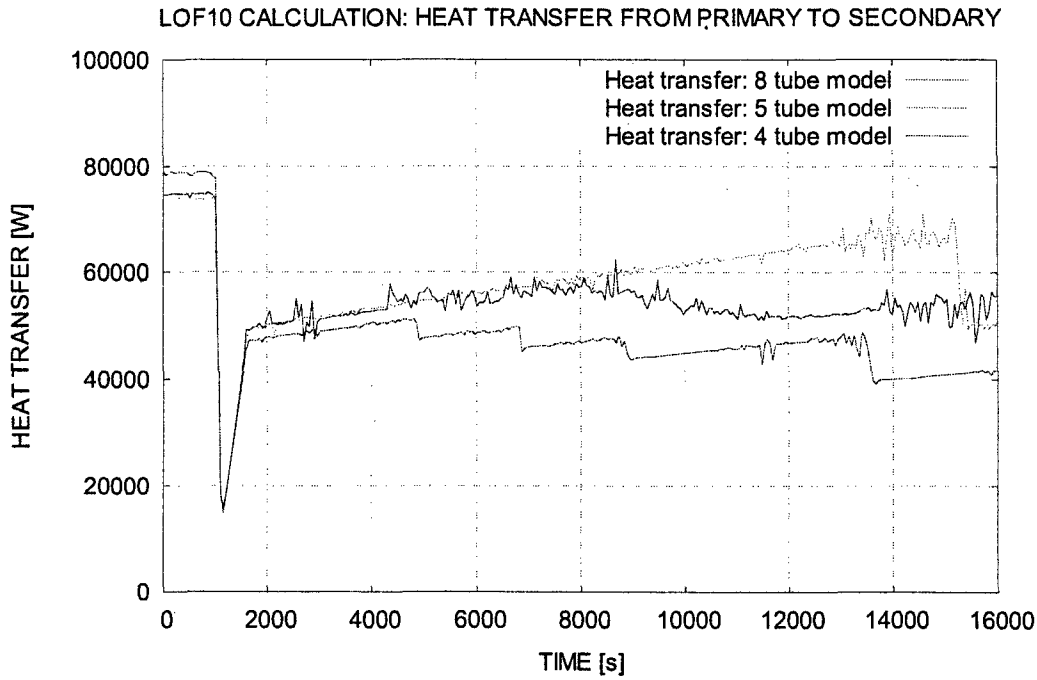

Figure 21. Calculated heat transfer from primary to secondary side in 4 and five pipe models.

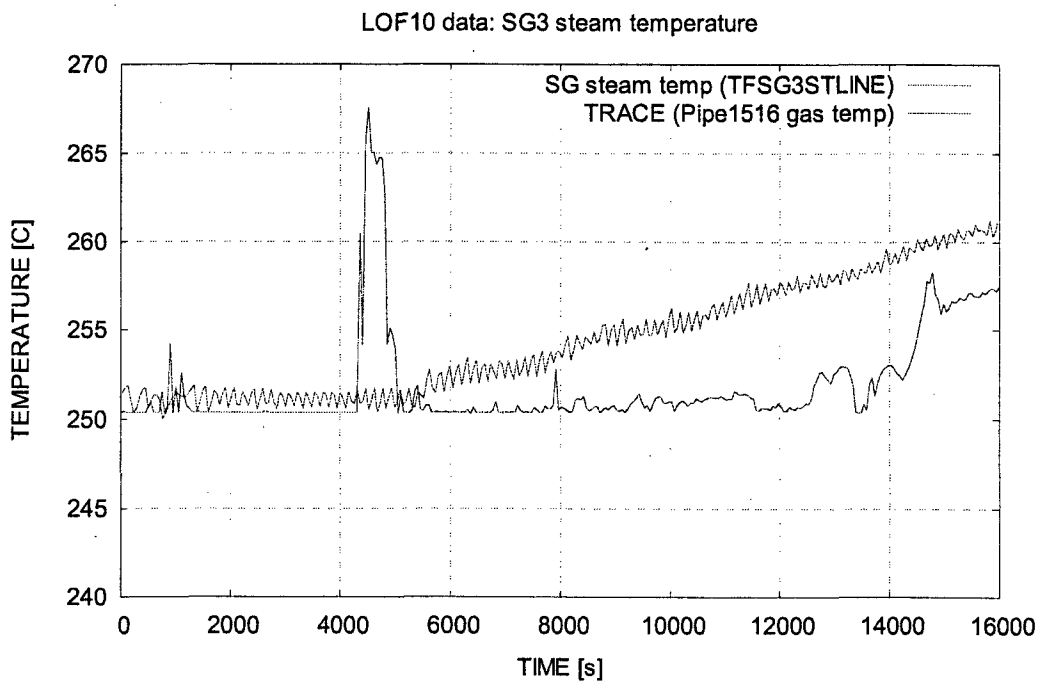

Figure 22. Steam outlet temperature, 4 pipe layer model.

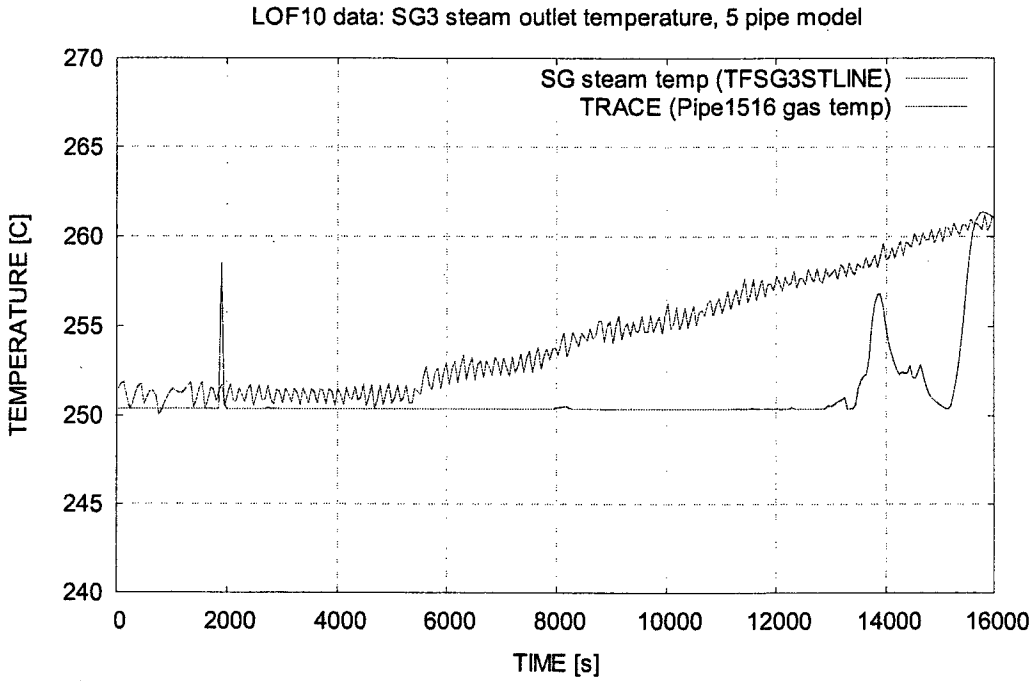

Figure 23. Steam outlet temperature, 5 pipe layer model.

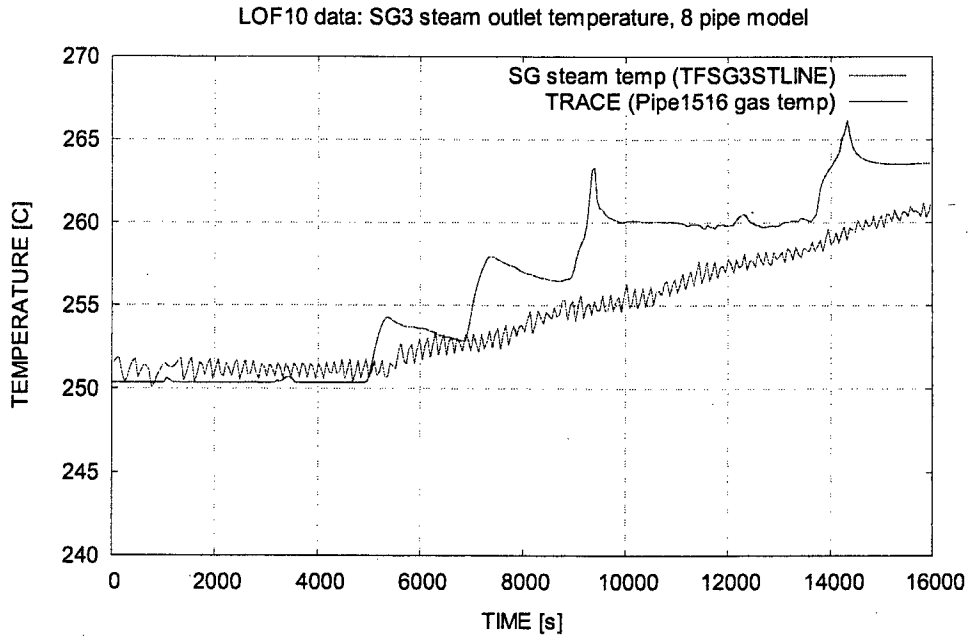

Figure 24. Steam outlet temperature, 8 pipe layer model.

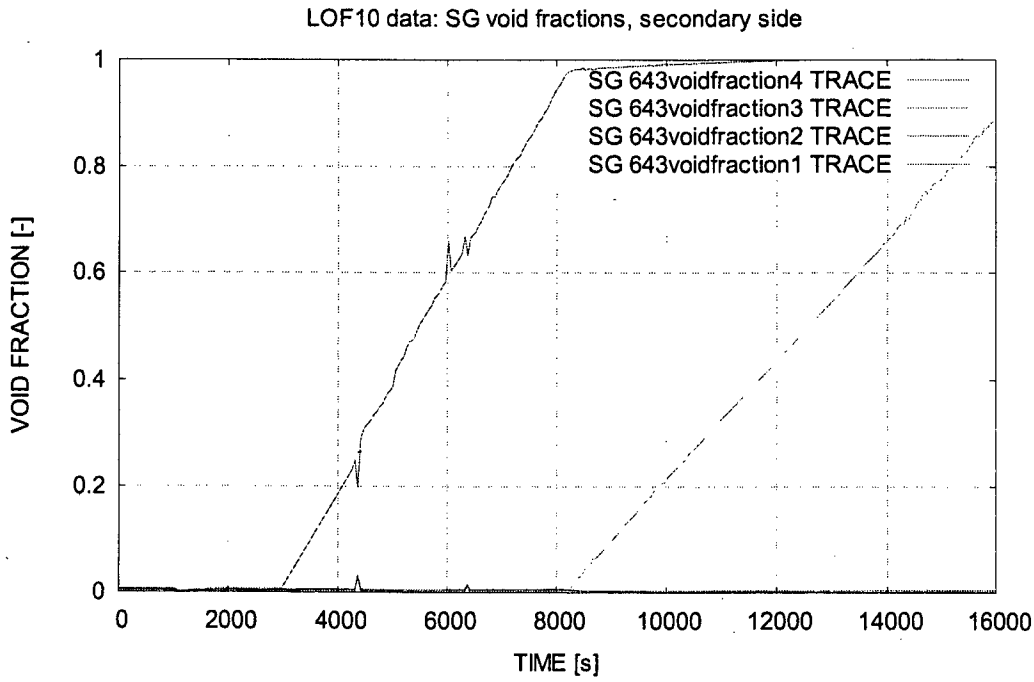

Figure 25. Calculated void fractions in secondary side in 4 pipe layer model.

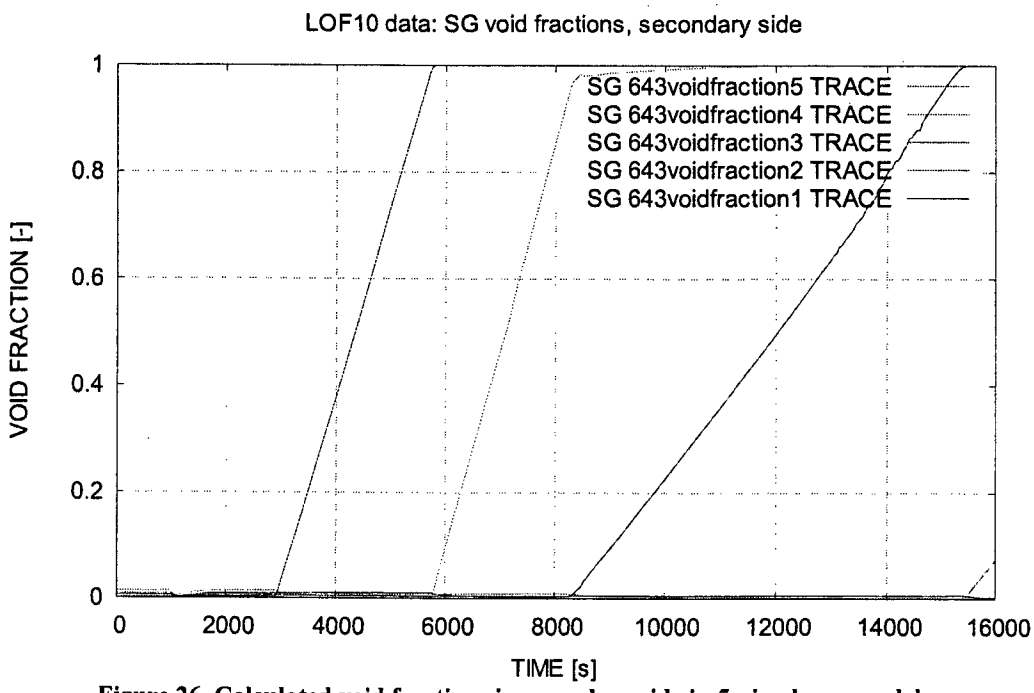

Figure 26. Calculated void fractions in secondary side in 5 pipe layer model.

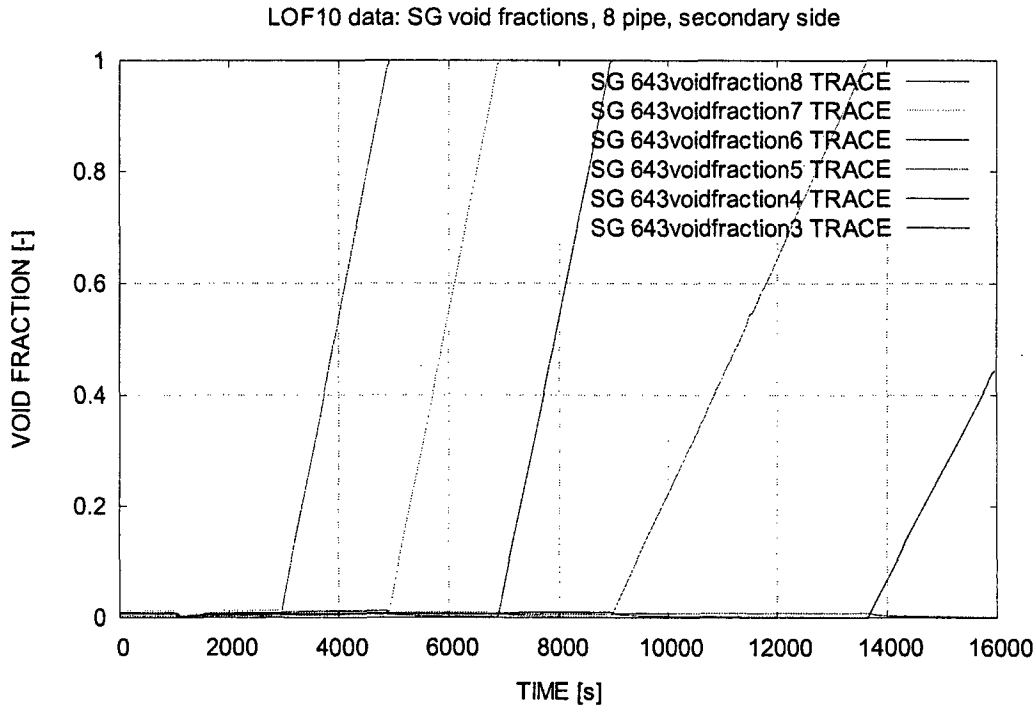

Figure 27. Calculated void fractions in secondary side in 8 pipe layer model.

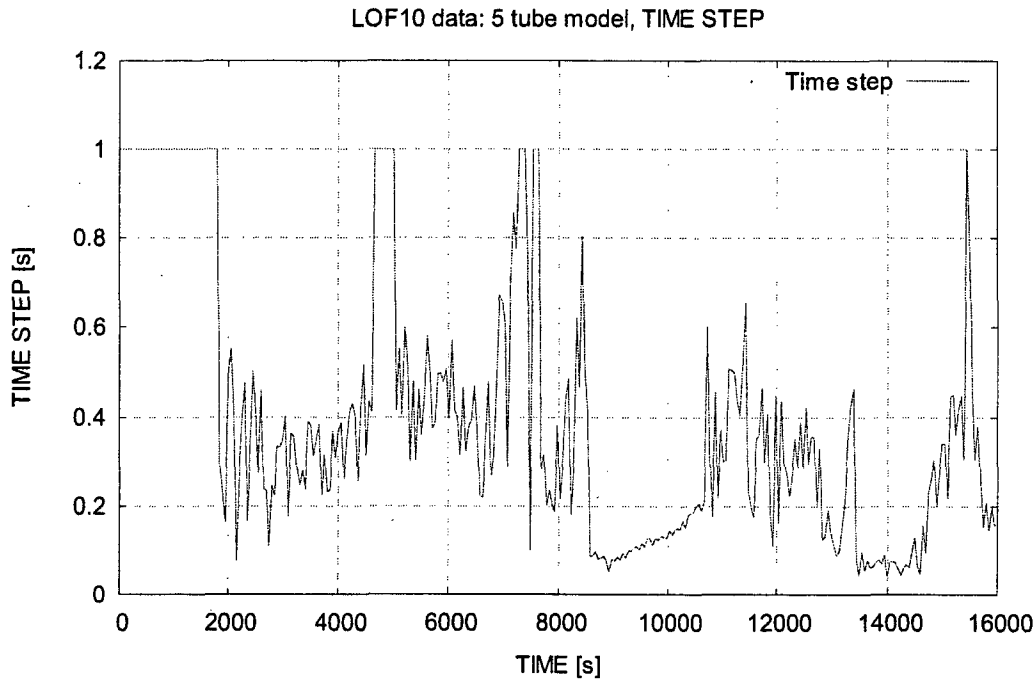

Figure 28. Transient calculation, time step in 5 pipe layer model.

5 CONCLUSIONS

The TRACE thermal hydraulic code with the SNAP model editor was used for preparing simulation model for the PACTEL horizontal steam generator. The calculation results showed that TRACE code is capable of modeling the behavior of the horizontal steam generator in steady state operation and in some transitory situations also. In the simulation of PACTEL loss of feedwater experiment LOF-10 the main parameters of the calculations followed the experiment with rather good accuracy. Three different models with nodalizations of 4, 5 and 8 pipe layers were implemented to describe the heat exchange tube rows of the PACTEL facility.

From the results of different tube layer models can be concluded that 5 tube layer model did not bring any significant approach towards experiment compared to the 4 tube layer model. On the contrary the results were not as good as with the four pipe model. It seemed that the overall behavior was satisfying already with 4 tube layers. However, to improve the modeling more detailed representation was introduced. The renodalized model with eight pipe layers modeling the heat exchange tubes. All three upper tube rows of heat exchange tubes were modeled separately resulting to more congruence with the experiment results.

The calculation results departed from experiment to some extent. At the final state the calculated secondary side collapsed level differed from the experiment less than 5 cm at the best case and 10 cm at the worst case. The heat transfer from primary to the secondary side degraded gradually during the uncovery of the heat exchange tubes. The calculations with four and five pipe layers overestimated this heat transfer. In the experiment the steam started to superheat almost immediately, when the uppermost tube layer had uncovered. The steam superheating in the calculations was possible only after the uppermost cell on the secondary side had voided thoroughly. Because of the use of lumped pipe representation of the heat exchange pipes in the calculations the timing of the superheating initiation was much later than in the experiment. Remarkable improvement with timing of the events was achived, when the model was renodalized in more detail.

The next step in TRACE/SNAP implementation at LUT is to build up a model containing whole PACTEL facility.

6 REFERENCES

Kouhia, J., Puustinen, M., 1998, Experimental Data Report on LOF-10, VTT Energy, Technical Report TEKOJA 7/98, 11.12.1998.

Riikonen, V., 1994, RELAP5/MOD3.1 Analysis of the PACTEL Loss of Secondary Side Feed Water Experiment, VTT Energy Technical Report, PROPA 8/94, 25.10.1994.

Tuunanen, J., Kouhia, J., Purhonen, H., Riikonen, V., Puustinen, M., Semken, R.S., Partanen, H., Saure, I., Pylkkö, H. 1998. General description of the PACTEL test facility. Espoo, VTT, VTT Tiedote – Research Note No. 1929. 35 p. ISBN 951-38-5338-1.

TRACE V4.160 User's Manual. Volume 1: Input Specification. 2005. USNRC, Division of System Analysis and Regulatory Effectiveness. Washington DC. 600 p.

APPENDIX A

TRACE steady state input of four layer pipe model for LOF-10 experiment

```
free format
*************
* main data *
*************
*
*     numtcr       ieos       inopt       nmat       id2o
          1          0          1          1          0
*
*****************
* namelist data *
*****************
*
 &inopts
  dtstrt=-1.0,
  nfrc1=2,
  usesjc=3,
  nhtstr=15
 &end
*
***************
* Model Flags *
***************
*
*       dstep       timet
          0         0.0
*      stdyst      transi       ncomp        njun        ipak
          0           1          35          25           0
*        epso        epss
       1.0E-4      1.0E-4
*      oitmax      sitmax      isolut      ncontr       nccfl
          10          10           0           0           0
*        ntsv        ntcb        ntcf        ntrp        ntcp
          25           9          34           0           0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                          +      1    121
* PIPE    *   122 s * SG3-coldcol                +     52      0
* PIPE    *   241 s * SG3-hotcol                 +     51      0
* PIPE    *   292 s *                            +      0    150
* PIPE    *   312 s *                            +    142     85
* PIPE    *   322 s *                            +    141     86
* PIPE    *   332 s *                            +    140     87
* PIPE    *   342 s *                            +    139     88
* PIPE    *   352 s * SG3-inlet                  +    128     51
* PIPE    *   353 s *                            +    129     52
* FILL    *   463 s *                            +    151
* PIPE    *   643 s *                            +      0    148
* BREAK   *   873 s *                            +    146
* PIPE    *   953 s *                            +    122    123
* PIPE    *   963 s *                            +    124    125
```

```
* PIPE    *   973 s *                    +   126   127
* HTSTR   *  1375 s * HL1-col-bot          +
* HTSTR   *  1380 s * CL1-col-bot          +
* HTSTR   *  1411 s * SG1-pool-wall1        +
* HTSTR   *  1412 s * SG1-pool-wall2        +
* HTSTR   *  1413 s * SG1-pool-wall3        +
* HTSTR   *  1414 s * SG1-pool-wall4        +
* FILL    *  1420 s *                    +   128
* HTSTR   *  1421 s * SG1-wallend1         +
* HTSTR   *  1422 s * SG1-wallend2         +
* HTSTR   *  1423 s * SG1-wallend3         +
* HTSTR   *  1424 s * SG1-wallend4         +
* BREAK   *  1430 s *                    +   129
* HTSTR   *  1506 s * Downcomer wall       +
* PIPE    *  1516 s *                    +   149   146
* HTSTR   *  1531 s * Steamdomewall1       +
* HTSTR   *  1532 s * Steamdomewall2       +
* HTSTR   *  1541 s * Steamdomewallend1     +
* HTSTR   *  1542 s * Steamdomewallend2     +
* SEPD    *  1546 e *                    +   148   149   150
*
**********************
* material properties *
**********************
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp      cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
************************************************
* Starting Signal Variable Section of Model     *
************************************************
*
*       idsv       isvn       ilcn       icn1       icn2
          1         20        643          1          4
*
*       idsv       isvn       ilcn       icn1       icn2
          2         20       1546          1          2
*
*       idsv       isvn       ilcn       icn1       icn2
        105        103       1506          0          0
*n: PriHotcolbot
*
*       idsv       isvn       ilcn       icn1       icn2
        107        103       1375          0          0
*n: PriColdcolbot
*
*       idsv       isvn       ilcn       icn1       icn2
        108        103       1380          0          0
*
*       idsv       isvn       ilcn       icn1       icn2
```

```
      109       103       1411        0         0
*n: FWmassflow
*
*     idsv      isvn      ilcn      icn1      icn2
      110        31       463          1         0
*
*     idsv      isvn      ilcn      icn1      icn2
      111         0         0         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      112       103      1412         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      113       103      1413         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      114       103      1414         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      115       103      1421         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      116       103      1422         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      117       103      1423         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      118       103      1424         0         0
*n: tubelayer 1
*
*     idsv      isvn      ilcn      icn1      icn2
      120       103         1         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      121       103       953         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      122       103       963         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      123       103       973         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      124       103       241         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      125       103       122         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      131       103      1531         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      132       103      1532         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
```

```
      141        103        1541          0          0
*
*     idsv       isvn       ilcn        icn1       icn2
      142        103        1542          0          0
************************************************
* Finished Signal Variable Section of Model    *
************************************************
*
*********************************************
* Starting Control System Section of Model  *
*********************************************
****** Control Blocks ******
*
*     idcb       icbn       icb1        icb2       icb3
       -1          3          1           2          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
       1.0    -1.0E20     1.0E20         0.0        0.0
*
*
*     idcb       icbn       icb1        icb2       icb3
       -2        200         -1         -40          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
      160.0        0.0        0.6       0.712        0.0
*     cbdt       cbtau
      100.0        0.05
*
*n: Secheatlosses
*
*     idcb       icbn       icb1        icb2       icb3
       -3         103         13          0          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
       1.0    -1.0E20     1.0E20         0.0        0.0
* ids  *       109        115         117        105s
* ids  *       118        112         113        114s
* ids  *       116        131         132        141s
* ids  *       142e
*
*
*     idcb       icbn       icb1        icb2       icb3
       -4          9          0           0          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
       1.0    -1.0E20     1.0E20        60.0        0.0
*
*     idcb       icbn       icb1        icb2       icb3
       -5         39         110         -4          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
       1.0    -1.0E20     1.0E20         0.0        0.0
*
*n: tubelayers
*
*     idcb       icbn       icb1        icb2       icb3
       -6         103         4           0          0
*    cbgain     cbxmin      cbmax      cbcon1     cbcon2
       1.0    -1.0E20     1.0E20         0.0        0.0
* ids  *       120        121         122        123e
*
```

```
*n: collectors
*
*       idcb        icbn        icb1        icb2        icb3
          -7           3         124         125           0
*      cbgain      cbxmin       cbmax      cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
*
*n: tubesandcoll
*
*       idcb        icbn        icb1        icb2        icb3
          -8           3          -6          -7           0
*      cbgain      cbxmin       cbmax      cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
*
*
*       idcb        icbn        icb1        icb2        icb3
         -40           9           0           0           0
*      cbgain      cbxmin       cbmax      cbcon1      cbcon2
         1.0     -1000.0      1000.0       0.712         0.0
*
*********************************************
* Finished Control System Section of Model  *
*********************************************
*******  type         num       userid             component name
pipe                   1          1                  unnamed
*      ncells       nodes        jun1        jun2        epsw
           5           4           1         121      2.0E-6
*      nsides
           0
*       ichf       iconc     pipetype        ipow       npipes
           1           0           0           0          27
*      iqptr       iqpsv       nqptb       nqpsv       nqprf
           0           0           0           0           0
*       radin          th       houtl       houtv       toutl
       6.5E-3      1.5E-3         0.0         0.0       300.0
*       toutv        pwin       pwoff       rpwmx        pwscl
       300.0         0.0         0.0      1.0E20          1.0
*        qpin       qpoff       rqpmx       qpscl        nhcom
         0.0         0.0         0.0         1.0         643
* dx   *      0.558      0.558      0.558      0.558s
* dx   *      0.558e
* vol  *  7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *  1.32732E-4  1.32732E-4e
* fric *        0.5        0.0        0.0       0.35s
* fric *        0.0      0.998e
* fricr *       0.0        0.0        0.0        0.0s
* fricr *       0.0        0.0e
* grav *        0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3        0.0e
* hd   *      0.013      0.013      0.013      0.013s
* hd   *      0.013      0.013e
* nff  *       -100       -100       -100       -100s
* nff  *       -100       -100e
* alp  *        0.0        0.0        0.0        0.0s
```

```
* alp  *       0.0e
* vl   *       0.7      0.7      0.7      0.7s
* vl   *       0.7      0.7e
* vv   *       0.7      0.7      0.7      0.7s
* vv   *       0.7      0.7e
* tl   *     528.0    528.0    528.0    528.0s
* tl   *     528.0e
* tv   *     528.0    528.0    528.0    528.0s
* tv   *     528.0e
* p    *     7.3E6    7.3E6    7.3E6    7.3E6s
* p    *     7.3E6e
* pa   *       0.0      0.0      0.0      0.0s
* pa   *       0.0e
* qpp  *       1.0      1.0      1.0      1.0      1.0s
* qpp  *       1.0      1.0      1.0      1.0      1.0s
* qpp  *       1.0      1.0      1.0      1.0      1.0s
* qpp  *       1.0      1.0      1.0      1.0      1.0e
*  matr *  f 6e
* tw   *     528.0    528.0    528.0    528.0    528.0s
* tw   *     528.0    528.0    528.0    528.0    528.0s
* tw   *     528.0    528.0    528.0    528.0    528.0s
* tw   *     528.0    528.0    528.0    528.0    528.0e
* idrod *       0e
* nhcel *       4        4        4        4        4e
*
******* type        num       userid            component name
pipe              122         1               SG3-coldcol
*     ncells      nodes       jun1       jun2       epsw
        4         3          52          0      2.0E-6
*     nsides
        4
*      nclk       junlk      ncmpto      nclkto      nlevto
        4         121          0          0          0
*     theta       ientrn
      90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
        3         123          0          0          0
*     theta       ientrn
      90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
        2         125          0          0          0
*     theta       ientrn
      90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
        1         127          0          0          0
*     theta       ientrn
      90.0          0
*      ichf       iconc     pipetype       ipow       npipes
        1          0          0          0          1
*     iqptr       iqpsv      nqptb      nqpsv      nqprf
        0          0          0          0          0
*     radin         th       houtl      houtv      toutl
      0.07        0.02         0.0        0.0      300.0
*     toutv       pwin       pwoff      rpwmx      pwscl
     300.0         0.0        0.0      1.0E20       1.0
*      qpin       qpoff      rqpmx      qpscl      nhcom
```

```
        0.0       0.0       0.0       1.0       643
* dx   *      0.163     0.192     0.192     0.135e
* vol  *     2.5E-3    2.95E-3    2.95E-3    2.0E-3e
* fa   * 0.015393804   0.015394   0.015394   0.015394s
* fa   *    0.015394e
* fric *       0.0       0.0       0.0       0.0s
* fric *       0.0e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0e
* grav  *      1.0       1.0       1.0       1.0s
* grav  *      1.0e
* hd   *      0.14      0.14      0.14      0.14s
* hd   *      0.14e
* nff  *      -100      -100      -100      -100s
* nff  *      -100e
* alp  *       0.0       0.0       0.0       0.0e
* vl   *     0.195     0.164     0.105     0.047s
* vl   *       0.0e
* vv   *     0.195     0.164     0.105     0.047s
* vv   *       0.0e
* tl   *     528.0     528.0     528.0     528.0e
* tv   *     528.0     528.0     528.0     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6e
* pa   *       0.0       0.0       0.0       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0e
*  matr *   f 6e
* tw   *     526.0     526.0     526.0     526.0     526.0s
* tw   *     526.0     526.0     526.0     526.0     526.0s
* tw   *     526.0     526.0e
* idrod *        0e
* nhcel *        1         2         3         4e
*
******* type        num       userid            component name
pipe              241          1               SG3-hotcol
*     ncells      nodes       jun1       jun2       epsw
          4          3         51          0      2.0E-6
*     nsides
          4
*      nclk       junlk      ncmpto      nclkto      nlevto
          4          1          0          0          0
*     theta      ientrn
         90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
          3        122          0          0          0
*     theta      ientrn
         90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
          2        124          0          0          0
*     theta      ientrn
         90.0          0
*      nclk       junlk      ncmpto      nclkto      nlevto
          1        126          0          0          0
*     theta      ientrn
         90.0          0
```

```
*       ichf       iconc     pipetype        ipow       npipes
          1          0          0          0          1
*       iqptr      iqpsv      nqptb      nqpsv      nqprf
          0          0          0          0          0
*       radin        th       houtl      houtv      toutl
        0.07       0.02        0.0        0.0      300.0
*       toutv      pwin       pwoff      rpwmx      pwscl
        300.0       0.0        0.0     1.0E20        1.0
*       qpin       qpoff      rqpmx      qpscl      nhcom
        0.0         0.0        0.0        1.0        643
* dx   *       0.163     0.192     0.192     0.135e
* vol  *      2.5E-3    2.95E-3   2.95E-3    2.0E-3e
* fa   *    0.015394  0.015394  0.015394  0.015394s
* fa   *    0.015394e
* fric *         0.0       0.0       0.0       0.0s
* fric *         0.0e
* fricr*         0.0       0.0       0.0       0.0s
* fricr*         0.0e
* grav *         1.0       1.0       1.0       1.0s
* grav *         1.0e
* hd   *        0.14      0.14      0.14      0.14s
* hd   *        0.14e
* nff  *        -100      -100      -100      -100s
* nff  *        -100e
* alp  *         0.0       0.0       0.0       0.0e
* vl   *       0.195     0.164     0.105     0.047s
* vl   *         0.0e
* vv   *       0.195     0.164     0.105     0.047s
* vv   *         0.0e
* tl   *       528.0     528.0     528.0     528.0e
* tv   *       528.0     528.0     528.0     528.0e
* p    *       7.3E6     7.3E6     7.3E6     7.3E6e
* pa   *         0.0       0.0       0.0       0.0e
* qpp  *         1.0       1.0       1.0       1.0       1.0s
* qpp  *         1.0       1.0       1.0       1.0       1.0s
* qpp  *         1.0       1.0e
*  matr*   f 6e
* tw   *       528.0     528.0     526.0     528.0     528.0s
* tw   *       526.0     528.0     528.0     526.0     528.0s
* tw   *       528.0     526.0e
* idrod*         0e
* nhcel*         1         2         3         4e
*
******* type        num       userid            component name
pipe              292         1                 unnamed
*       ncells      nodes       jun1        jun2        epsw
          6          0          0         150       2.0E-6
*       nsides
          5
*       nclk       junlk      ncmpto      nclkto      nlevto
          1         139          0          0          0
*       theta      ientrn
        90.0          0
*       nclk       junlk      ncmpto      nclkto      nlevto
          3         140          0          0          0
*       theta      ientrn
```

```
      90.0         0
*      nclk       junlk       ncmpto       nclkto       nlevto
         5         141           0            0            0
*     theta       ientrn
      90.0         0
*      nclk       junlk       ncmpto       nclkto       nlevto
         6         142           0            0            0
*     theta       ientrn
      90.0         0
*      nclk       junlk       ncmpto       nclkto       nlevto
         4         151           0            0            0
*     theta       ientrn
      90.0         0
*      ichf       iconc     pipetype         ipow       npipes
         1           0           0            0            1
*     radin          th       houtl        houtv        toutl
      0.0         0.0         0.0          0.0          0.0
*     toutv        pwin       pwoff        rpwmx        pwscl
      0.0         0.0         0.0          0.0          0.0
* dx   *      0.0815      0.096       0.096       0.096s
* dx   *       0.096      0.135e
* vol  *   5.3975E-3     6.3E-3      6.3E-3      6.3E-3s
* vol  *      6.3E-3     8.8E-3e
* fa   *       0.065     0.0656      0.0656      0.0656s
* fa   *      0.0656     0.0652    0.065185e
* fric *         0.0        0.0         0.0         0.0s
* fric *         0.0        0.0        10.0e
* fricr*         0.0        0.0         0.0         0.0s
* fricr*         0.0        0.0         0.0e
* grav *         1.0        1.0         1.0         1.0s
* grav *         1.0        1.0         1.0e
* hd   *       0.288      0.289       0.289       0.289s
* hd   *       0.289 0.28809047  0.28809047e
* nff  *        -100       -100        -100        -100s
* nff  *        -100       -100          -1e
* alp  *         0.0        0.0         0.0         0.0s
* alp  *         0.0        0.0e
* vl   *         0.0        0.0         0.0         0.0s
* vl   *         0.0        0.0         0.0e
* vv   *         0.0        0.0         0.0         0.0s
* vv   *         0.0        0.0         0.0e
* tl   *     523.504    523.504     523.504     523.504s
* tl   *     523.504    523.504e
* tv   *     523.504    523.504     523.504     523.504s
* tv   *     523.504    523.504e
* p    *      4.0E6      4.0E6       4.0E6       4.0E6s
* p    *      4.0E6      4.0E6e
* pa   *         0.0        0.0         0.0         0.0s
* pa   *         0.0        0.0e
*
******* type         num        userid              component name
* single junction
pipe                312           1                   unnamed
*     ncells       nodes        jun1        jun2        epsw
         0           0          142          85       2.0E-6
*      ichf       iconc     pipetype         ipow       npipes
```

```
        1         0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff     rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.3105e
* fric * f       2.5e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.44460144e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num      userid            component name
* single junction
pipe              322         1                 unnamed
*      ncells      nodes      jun1      jun2      epsw
         0         0        141        86      2.0E-6
*       ichf      iconc    pipetype     ipow     npipes
         1         0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff     rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.4416e
* fric * f       2.6e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f     0.7498e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num      userid            component name
* single junction
pipe              332         1                 unnamed
*      ncells      nodes      jun1      jun2      epsw
         0         0        140        87      2.0E-6
*       ichf      iconc    pipetype     ipow     npipes
```

```
        1         0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *   f 0.0000e+00
* vol  *   f 0.0000e+00
* fa   * f     0.4416e
* fric * f      2.6e
* fricr * f     10.0e
* grav * f      0.0e
* hd   * f     0.7498e
* nff  * f      -1e
* alp  *   f 0.0000e+00
* vl   * f      0.0e
* vv   * f      0.0e
* tl   *   f 0.0000e+00
* tv   *   f 0.0000e+00
* p    *   f 0.0000e+00
* pa   *   f 0.0000e+00
*
******* type        num       userid             component name
* single junction
pipe              342         1                  unnamed
*      ncells      nodes      jun1       jun2       epsw
         0          0        139         88      2.0E-6
*       ichf      iconc    pipetype      ipow      npipes
         1          0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *   f 0.0000e+00
* vol  *   f 0.0000e+00
* fa   * f     0.3726e
* fric * f      2.4e
* fricr * f     10.0e
* grav * f      0.0e
* hd   * f     0.6688e
* nff  * f      -1e
* alp  *   f 0.0000e+00
* vl   * f      0.0e
* vv   * f      0.0e
* tl   *   f 0.0000e+00
* tv   *   f 0.0000e+00
* p    *   f 0.0000e+00
* pa   *   f 0.0000e+00
*
*
******* type        num       userid             component name
pipe              352         1                  SG3-inlet
*      ncells      nodes      jun1       jun2       epsw
         1          0        128         51      2.0E-6
*      nsides
         0
*       ichf      iconc    pipetype      ipow      npipes
```

```
        1         0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff     rpwmx     pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *      0.255e
* vol  *   3.92542E-3e
* fa   *    0.015394   0.015394e
* fric *       0.0       0.0e
* fricr *      0.0       0.0e
* grav  *      1.0       1.0e
* hd   *      0.14      0.14e
* nff  *      -100      -100e
* alp  *       0.0e
* vl   *     0.195     0.195e
* vv   *     0.195     0.195e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *       0.0e
*
*
******* type        num      userid            component name
pipe              353         1                 unnamed
*     ncells      nodes      jun1      jun2      epsw
        1         0        129        52      2.0E-6
*     nsides
        0
*      ichf      iconc    pipetype      ipow      npipes
        1         0         0         0         1
*      radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin     pwoff     rpwmx     pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *      0.255e
* vol  *   3.92542E-3e
* fa   *  0.015393804 0.015393804e
* fric *      0.448       0.0e
* fricr *      0.0       0.0e
* grav  *      1.0       1.0e
* hd   *      0.14      0.14e
* nff  *      -100      -100e
* alp  *       0.0e
* vl   *       0.0     0.195e
* vv   *       0.0     0.195e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *       0.0e
*
*
******* type        num      userid            component name
fill              463         1                 unnamed
*      jun1       ifty      ioff
       151          5         0
*      iftr       ifsv      nftb      nfsv      nfrf
```

```
        0       -2        0        0        0
*     twtold      rfmx      concin      felv
        0.0     1.0E20      0.0       0.0
*      dxin      volin      alpin      vlin      tlin
      0.192     0.0126      0.0       0.0      298.0
*       pin       pain      flowin      vvin      tvin
      4.0E6       0.0       0.3       0.0      298.0
*
*
******* type        num       userid            component name
pipe              643         1                 unnamed
*     ncells      nodes       jun1      jun2      epsw
        4         0           0         148       2.0E-6
*     nsides
        4
*      nclk       junlk      ncmpto      nclkto      nlevto
         4         85          0         0           0
*      theta      ientrn
       90.0         0
*      nclk       junlk      ncmpto      nclkto      nlevto
         3         86          0         0           0
*      theta      ientrn
       90.0         0
*      nclk       junlk      ncmpto      nclkto      nlevto
         2         87          0         0           0
*      theta      ientrn
       90.0         0
*      nclk       junlk      ncmpto      nclkto      nlevto
         1         88          0         0           0
*      theta      ientrn
       90.0         0
*      ichf       iconc     pipetype      ipow      npipes
         1         0           0         0           1
*      radin        th       houtl       houtv      toutl
       0.0         0.0       0.0         0.0        0.0
*      toutv       pwin       pwoff      rpwmx      pwscl
       0.0         0.0        0.0        0.0        0.0
* dx   *      0.163     0.192     0.192     0.135e
* vol  *     0.1362    0.2748    0.3163    0.2114e
* fa   *    1.29195   1.29195     1.707   1.74759s
* fa   *  1.4477071e
* fric *        0.0       0.0       0.0       0.0s
* fric *       0.0e
* fricr*       0.0       0.0       0.0       0.0s
* fricr*       5.0e
* grav *        1.0       1.0       1.0       1.0s
* grav *       1.0e
* hd   *   1.314779   1.314779   1.314779   1.314779s
* hd   *  1.3576737e
* nff  *      -100      -100      -100      -100s
* nff  *       -1e
* alp  *        0.0       0.0       0.0       0.0e
* vl   *        0.0       0.0       0.0       0.0s
* vl   *       0.0e
* vv   *        0.0       0.0       0.0       0.0s
* vv   *       0.0e
```

```
* tl   *      523.0      523.0      523.0      523.0e
* tv   *      523.0      523.0      523.0      523.0e
* p    *      4.0E6      4.0E6      4.0E6      4.0E6e
* pa   *        0.0        0.0        0.0        0.0e
*
*
******* type        num       userid            component name
break              873          1                 unnamed
*       jun1       ibty       isat       ioff     adjpress
        146          0          0          0          0
*       dxin       volin      alpin        tin        pin
    2.127995       0.027        1.0      523.0      4.0E6
*       pain       concin     rbmx       poff       belv
        0.0        0.0      1.0E20       0.0        0.0
*
*
******* type        num       userid            component name
pipe               953          1                 unnamed
*      ncells      nodes      jun1       jun2       epsw
         5          4         122        123       1.0E-6
*      nsides
         0
*       ichf       iconc     pipetype       ipow       npipes
         1          0          0          0          36
*      iqptr       iqpsv      nqptb      nqpsv      nqprf
         0          0          0          0          0
*       radin        th       houtl       houtv       toutl
      6.5E-3       1.5E-3       0.0        0.0       300.0
*       toutv       pwin       pwoff      rpwmx      pwscl
      300.0        0.0        0.0       1.0E20       1.0
*       qpin       qpoff      rqpmx      qpscl      nhcom
        0.0        0.0        0.0        1.0         643
* dx   *      0.558      0.558      0.558      0.558s
* dx   *      0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *        0.5        0.0        0.0        0.35s
* fric *        0.0      0.998e
* fricr*        0.0        0.0        0.0        0.0s
* fricr*        0.0        0.0e
* grav *        0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav * -7.37993E-3        0.0e
* hd   *      0.013      0.013      0.013      0.013s
* hd   *      0.013      0.013e
* nff  *          1          1          1          1s
* nff  *          1          1e
* alp  *        0.0        0.0        0.0        0.0s
* alp  *        0.0e
* vl   *        0.7        0.7        0.7        0.7s
* vl   *        0.7        0.7e
* vv   *        0.7        0.7        0.7        0.7s
* vv   *        0.7        0.7e
* tl   *      528.0      528.0      528.0      528.0s
* tl   *      528.0e
```

```
* tv   *      528.0      528.0      528.0      528.0s
* tv   *      528.0e
* p    *      7.3E6      7.3E6      7.3E6      7.3E6s
* p    *      7.3E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0e
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0e
*  matr *   f 6e
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0e
* idrod *         0e
* nhcel *         3          3          3          3          3e
*
*
******* type        num       userid            component name
pipe              963          1                 unnamed
*     ncells       nodes       jun1       jun2       epsw
          5           4        124        125       1.0E-6
*     nsides
          0
*      ichf       iconc     pipetype       ipow       npipes
          1           0           0          0           36
*     iqptr       iqpsv       nqptb      nqpsv       nqprf
          0           0           0          0           0
*     radin         th        houtl      houtv       toutl
       6.5E-3      1.5E-3        0.0        0.0       300.0
*     toutv        pwin       pwoff      rpwmx       pwscl
       300.0        0.0         0.0      1.0E20        1.0
*      qpin        qpoff      rqpmx      qpscl       nhcom
        0.0         0.0         0.0        1.0         643
* dx   *       0.558      0.558      0.558      0.558s
* dx   *       0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *         0.5        0.0        0.0        0.35s
* fric *         0.0      0.998e
* fricr *        0.0        0.0        0.0        0.0s
* fricr *        0.0        0.0e
* grav *         0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3        0.0e
* hd   *       0.013      0.013      0.013      0.013s
* hd   *       0.013      0.013e
* nff  *           1          1          1          1s
* nff  *           1          1e
* alp  *         0.0        0.0        0.0        0.0s
* alp  *         0.0e
* vl   *         0.7        0.7        0.7        0.7s
* vl   *         0.7        0.7e
* vv   *         0.7        0.7        0.7        0.7s
```

```
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *        0e
* nhcel *        2         2         2         2         2e
*
*
******* type        num       userid            component name
pipe              973          1                 unnamed
*     ncells       nodes       jun1       jun2       epsw
          5           4        126        127      1.0E-6
*     nsides
          0
*      ichf       iconc     pipetype       ipow      npipes
          1           0           0          0          19
*      iqptr      iqpsv       nqptb      nqpsv      nqprf
          0           0           0          0          0
*      radin         th       houtl      houtv      toutl
      6.5E-3      1.5E-3         0.0        0.0      300.0
*      toutv       pwin       pwoff      rpwmx      pwscl
      300.0        0.0        0.0      1.0E20        1.0
*      qpin       qpoff      rqpmx      qpscl      nhcom
       0.0         0.0        0.0        1.0         643
* dx   *      0.542     0.542     0.542     0.542s
* dx   *      0.542e
* vol  *  7.19409E-5  7.19409E-5  7.19409E-5  7.19409E-5s
* vol  *  7.19409E-5e
* fa   *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *  1.32732E-4  1.32732E-4e
* fric *       0.5       0.0       0.0       0.35s
* fric *       0.0     0.998e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       0.0e
* grav *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3       0.0e
* hd   *      0.013     0.013     0.013     0.013s
* hd   *      0.013     0.013e
* nff  *       -100      -100      -100      -100s
* nff  *       -100      -100e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
```

```
* vl   *       0.7       0.7       0.7       0.7s
* vl   *       0.7       0.7e
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *        0e
* nhcel *        1         1         1         1         1e
*
*
******* type        num       userid            component name
fill              1420          1                 unnamed
*       jun1        ifty        ioff
        128           5           0
*       iftr        ifsv        nftb        nfsv        nfrf
          0         111           2           0           0
*     twtold         rfmx       concin        felv
        0.0      1.0E20         0.0         0.0
*       dxin        volin       alpin        vlin        tlin
        1.0     0.015394         0.0         0.0       528.0
*        pin         pain       flowin        vvin        tvin
      7.3E6         0.0         5.0         0.0       528.0
*      vmscl        vvscl
        1.0         1.0
*
* vmtbv *       0.0       5.0s
* vmtbv *     1.0E4       5.0e
*
*
******* type        num       userid            component name
break             1430          1                 unnamed
*       jun1        ibty        isat        ioff     adjpress
        129           0           0           0           0
*       dxin        volin       alpin         tin         pin
        1.0     0.015394         0.0       528.0       7.3E6
*       pain       concin        rbmx        poff        belv
        0.0         0.0      1.0E20         0.0         0.0
*
*
******* type        num       userid            component name
pipe              1516          1                 unnamed
```

```
*     ncells      nodes       jun1       jun2       epsw
        3          0         149        146       2.0E-6
*     nsides
        0
*      ichf       iconc     pipetype       ipow      npipes
        1          0          0          0          1
*      radin        th       houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*      toutv       pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *  0.70933333 0.70933333 0.70933333e
* vol  *  8.99977E-3 8.99977E-3 8.99977E-3e
* fa   *    0.91399 0.012687644 0.012687644 0.012687644e
* fric *       3.0       0.0       0.0       3.0e
* fricr*       0.0       0.0       0.0       0.0e
* grav *       1.0       1.0       1.0       1.0e
* hd   *   1.2632607    0.1271    0.1271    0.1271e
* nff  *        -1         1         1         1e
* alp  *       1.0       1.0       1.0e
* vl   *       0.0       0.0       0.0       0.0e
* vv   *       0.0       0.0       0.0       0.0e
* tl   *     523.0     523.0     523.0e
* tv   *     523.0     523.0     523.0e
* p    *     4.0E6     4.0E6     4.0E6e
* pa   *       0.0       0.0       0.0e
*
*
* type           num        id         ctitle
sepd             1546         0                unnamed
*      jcell      nodes       ichf       cost       epsw
         2          0          1       -1.0        0.0
*      nseps      ndryr      istage       xco        xcu
         1          0          0        0.0        1.0
*     alpsmn      alpsmx
        0.0        1.0
*     iconc1      ncell1       jun1       jun2       ipow1
         0          2        148        149          0
*      radin        th       houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*      toutv       pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
*     iconc2      ncell2       jun3       ipow2
         0          1        150          0
*      radin2       th2       houtl2      houtv2      toutl2
       0.0        0.0        0.0        0.0        0.0
*      toutv2      pwin2      pwoff2      rpwmx2      pwscl2
       0.0        0.0        0.0        0.0        0.0
* dx1  *      0.134      0.134e
* vol1 *   0.211153  0.1247487e
* fa1  *  1.4477071    1.25336    0.91399e
* fric1*       0.0        0.0        3.0e
* fricr1*      5.0        0.0        0.0e
* grav1*       1.0        1.0        1.0e
* hd1  *  1.3576737  1.2632607  1.2632607e
* nff1 *        -1         -1         -1e
* alp1 *     0.687        1.0e
```

```
* vl1  *       0.0       0.0       0.0e
* vv1  *       0.0       0.0       0.0e
* tl1  *     523.0     523.0e
* tv1  *     523.0     523.0e
* p1   *     4.0E6     4.0E6e
* pa1  *       0.0       0.0e
* dx2  *     0.067e
* vol2 *  3.25925E-3e
* fa2  *  0.065185  0.065185e
* fric2 *      0.0       0.0e
* fricr2*      0.0      10.0e
* grav2 *     -1.0      -1.0e
* hd2  *  0.28809047  0.28809047e
* nff2 *        -1        -1e
* alp2 *       1.0e
* vl2  *       0.0       0.0e
* vv2  *       0.0       0.0e
* tl2  *     523.0e
* tv2  *     523.0e
* p2   *     4.0E6e
* pa2  *       0.0e
*
*****************************************
* Starting Heat Structure Section of Model *
*****************************************
*
******* type        num       userid            component name
htstr             1375          0               HL1-col-bot
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)      dznht      hgapo
        2.0         10.0      1.0E-3      6300.0
*
*  idbcin *        2e
*  idbcon *        1e
* hcomon1  *      352        1        0        0e
*   htc2  *     3.44     298.0e
* dhtstrz *    0.255e
*    rdx *      1.0e
* radrd *     0.07 0.076666667 0.083333333      0.09     0.105s
* radrd *     0.12     0.135      0.15e
* matrd *        6         6         6       50s
* matrd *       50        50        50e
*    nfax *       1e
*    rftn *    528.0     528.0     500.0     400.0s
*    rftn *    350.0     330.0     310.0     300.0e
*
******* type        num       userid            component name
htstr             1380          0               CL1-col-bot
*     nzhstr       ittc       hscyl       ichf
```

```
        1         0         1         1
*   nofuelrod     plane     liqlev    iaxcnd
        1         3         0         0
*      nmwrx      nfci      nfcil     hdri      hdro
        0         0         0        0.0       0.0
*      nhot       nodes     fmno      nzmax     reflood
        0         8         0        100        0
*    dtxht(1)    dtxht(2)    dznht     hgapo
       2.0        10.0      1.0E-3    6300.0
*
*  idbcin *        2e
*  idbcon *        1e
* hcomon1 *       353        1         0         0e
*   htc2  *      3.44      298.0e
* dhtstrz *      0.255e
*   rdx   *       1.0e
* radrd *      0.07 0.076666667 0.083333333      0.09      0.105s
* radrd *      0.12      0.135      0.15e
* matrd *        6         6         6         50s
* matrd *       50        50        50e
*    nfax *      1e
*    rftn *    520.0     520.0     500.0     400.0s
*    rftn *    350.0     330.0     310.0     300.0e
*
******* type        num       userid            component name
htstr             1411         0              SG1-pool-wall1
*      nzhstr      ittc      hscyl      ichf
        1         0         1         1
*   nofuelrod     plane     liqlev    iaxcnd
        1         3         0         0
*      nmwrx      nfci      nfcil     hdri      hdro
        0         0         0        0.0       0.0
*      nhot       nodes     fmno      nzmax     reflood
        0         8         0        100        0
*    dtxht(1)    dtxht(2)    dznht     hgapo
       2.0        10.0      1.0E-3    6300.0
*
*  idbcin *        2e
*  idbcon *        1e
* hcomon1 *       643        1         0         0e
*   htc2  *       7.0      298.0e
* dhtstrz *      0.163e
*   rdx   *     1.29996e
* radrd *      0.475 0.48333333 0.49166667      0.5       0.525s
* radrd *      0.55      0.575      0.6e
* matrd *        6         6         6         50s
* matrd *       50        50        50e
*    nfax *      1e
*    rftn *    523.0     521.0     510.0     470.0s
*    rftn *    450.0     400.0     350.0     300.0e
*
******* type        num       userid            component name
htstr             1412         0              SG1-pool-wall2
*      nzhstr      ittc      hscyl      ichf
        1         0         1         1
*   nofuelrod     plane     liqlev    iaxcnd
```

```
        1         3         0         0
*      nmwrx       nfci      nfcil      hdri      hdro
        0         0         0       0.0       0.0
*       nhot      nodes       fmno      nzmax    reflood
        0         8         0       100         0
*    dtxht(1)    dtxht(2)     dznht      hgapo
       2.0        10.0      1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643        2         0        0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *     0.75802e
* radrd *     0.475  0.48333333  0.49166667      0.5     0.525s
* radrd *      0.55      0.575       0.6e
* matrd *         6         6          6       50s
* matrd *        50        50         50e
*   nfax *        1e
*   rftn *    523.0     521.0      510.0     470.0s
*   rftn *    450.0     400.0      350.0     300.0e
*
******* type        num       userid            component name
htstr              1413          0              SG1-pool-wall3
*     nzhstr       ittc       hscyl       ichf
        1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
        1          3          0          0
*      nmwrx       nfci      nfcil      hdri      hdro
        0         0         0       0.0       0.0
*       nhot      nodes       fmno      nzmax    reflood
        0         8         0       100         0
*    dtxht(1)    dtxht(2)     dznht      hgapo
       2.0        10.0      1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643        3         0        0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *     0.66983e
* radrd *     0.475  0.48333333  0.49166667      0.5     0.525s
* radrd *      0.55      0.575       0.6e
* matrd *         6         6          6       50s
* matrd *        50        50         50e
*   nfax *        1e
*   rftn *    523.0     521.0      510.0     470.0s
*   rftn *    450.0     400.0      350.0     300.0e
*
******* type        num       userid            component name
htstr              1414          0              SG1-pool-wall4
*     nzhstr       ittc       hscyl       ichf
        1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
        1          3          0          0
*      nmwrx       nfci      nfcil      hdri      hdro
```

```
        0         0         0        0.0        0.0
*       nhot      nodes      fmno      nzmax     reflood
        0         8          0         100        0
*    dtxht(1)    dtxht(2)    dznht      hgapo
       2.0        10.0      1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643       4         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *      0.4905e
* radrd *      0.475  0.48333333  0.49166667      0.5      0.525s
* radrd *      0.55      0.575       0.6e
* matrd *        6         6         6         50s
* matrd *       50        50         50e
*   nfax *       1e
*   rftn *     523.0     521.0      510.0      470.0s
*   rftn *     450.0     400.0      350.0      300.0e
*
******* type        num       userid            component name
htstr             1421         0                SG1-wallend1
*     nzhstr       ittc       hscyl       ichf
         1         0          1           1
*   nofuelrod      plane      liqlev      iaxcnd
         1         3          0           0
*      nmwrx        nfci       nfcil       hdri       hdro
         0         0          0          0.0        0.0
*       nhot       nodes       fmno       nzmax     reflood
         0         8          0         100        0
*    dtxht(1)    dtxht(2)    dznht      hgapo
       2.0        10.0      1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643       1         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *      0.09176e
* radrd *       0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *      0.873      0.898      0.923e
* matrd *        6         6         6         50s
* matrd *       50        50         50e
*   nfax *       1e
*   rftn *     523.0     520.0      500.0      420.0s
*   rftn *     400.0     350.0      330.0      300.0e
*
******* type        num       userid            component name
htstr             1422         0                SG1-wallend2
*     nzhstr       ittc       hscyl       ichf
         1         0          1           1
*   nofuelrod      plane      liqlev      iaxcnd
         1         3          0           0
*      nmwrx        nfci       nfcil       hdri       hdro
         0         0          0          0.0        0.0
*       nhot       nodes       fmno       nzmax     reflood
```

```
        0        8        0       100        0
*    dtxht(1)    dtxht(2)      dznht       hgapo
       2.0        10.0      1.0E-3       6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643        2        0        0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *     0.04955e
* radrd *       0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *     0.873      0.898      0.923e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *        1e
*   rftn *     523.0      520.0      500.0      420.0s
*   rftn *     400.0      350.0      330.0      300.0e
*
******* type         num       userid            component name
htstr              1423          0               SG1-wallend3
*     nzhstr        ittc       hscyl        ichf
         1           0          1           1
*   nofuelrod       plane      liqlev       iaxcnd
         1           3          0           0
*      nmwrx         nfci       nfcil        hdri        hdro
         0           0          0          0.0         0.0
*      nhot         nodes        fmno       nzmax      reflood
         0           8          0         100           0
*    dtxht(1)    dtxht(2)      dznht       hgapo
       2.0        10.0      1.0E-3       6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643        3        0        0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *     0.04378e
* radrd *       0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *     0.873      0.898      0.923e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *        1e
*   rftn *     523.0      520.0      500.0      420.0s
*   rftn *     400.0      350.0      330.0      300.0e
*
******* type         num       userid            component name
htstr              1424          0               SG1-wallend4
*     nzhstr        ittc       hscyl        ichf
         1           0          1           1
*   nofuelrod       plane      liqlev       iaxcnd
         1           3          0           0
*      nmwrx         nfci       nfcil        hdri        hdro
         0           0          0          0.0         0.0
*      nhot         nodes        fmno       nzmax      reflood
         0           8          0         100           0
*    dtxht(1)    dtxht(2)      dznht       hgapo
```

```
      2.0       10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      643        4        0        0e
*  htc2  *      7.0     298.0e
* dhtstrz *     0.163e
*  rdx *     0.03206e
* radrd *       0.8 0.80766667 0.81533333     0.823     0.848s
* radrd *     0.873     0.898     0.923e
* matrd *         6         6         6        50s
* matrd *        50        50        50e
*   nfax *        1e
*   rftn *     523.0     520.0     500.0     420.0s
*   rftn *     400.0     350.0     330.0     300.0e
*
******* type        num      userid            component name
htstr             1506         0              Downcomer wall
*     nzhstr       ittc      hscyl       ichf
          2          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)     dznht      hgapo
       2.0        10.0      1.0E-3      6300.0
*
* idbcin *        2        2e
* idbcon *        1        1e
* hcomon1 *      292        1        0        0e
* hcomon1 *      292        2        0        0e
*  htc2  *      7.0     298.0e
*  htc2  *      7.0     298.0e
* dhtstrz *     0.163    0.096e
*  rdx *     0.10387e
* radrd *       0.475 0.48279133 0.49058266       0.5 0.52378049s
* radrd * 0.54918699 0.5745935       0.6e
* matrd *         6         6         6        50s
* matrd *        50        50        50e
*   nfax *        1        1e
*   rftn *     523.0     500.0     450.0     400.0s
*   rftn *     380.0     350.0     320.0     300.0s
*   rftn *     523.0     500.0     450.0     400.0s
*   rftn *     380.0     350.0     320.0     300.0e
*
*d: Top of steam generator Separator wall node 1 (cylinder part)
******* type        num      userid            component name
htstr             1531         0              Steamdomewall1
*     nzhstr       ittc      hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
```

```
*       nhot       nodes        fmno       nzmax      reflood
          0          9           0         108           0
*    dtxht(1)    dtxht(2)       dznht       hgapo
         2.0        10.0      1.0E-3      6300.0
*
* idbcin *         2e
* idbcon *         1e
* hcomon1 *       1546         1         0         0e
*  htc2  *        7.0      298.0e
* dhtstrz *      0.134e
*  rdx *     0.552462e
* radrd *      0.475  0.48279133  0.49058266       0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748       0.6e
* matrd *         6         6         6         50s
* matrd *        50        50        50         50e
*   nfax *         1e
*   rftn *     523.0     523.0     520.0     500.0s
*   rftn *     500.0     400.0     350.0     330.0s
*   rftn *     310.0e
*
*d: Top of steam generator Separator wall node 2 (cylinder part)
*******  type         num       userid              component name
htstr              1532          0              Steamdomewall2
*      nzhstr        ittc        hscyl        ichf
           1           0           1           1
*    nofuelrod       plane       liqlev       iaxcnd
           1           3           0           0
*       nmwrx         nfci        nfcil        hdri        hdro
           0           0           0         0.0         0.0
*       nhot        nodes        fmno       nzmax      reflood
           0           9           0         108           0
*    dtxht(1)    dtxht(2)       dznht       hgapo
         2.0        10.0      1.0E-3      6300.0
*
* idbcin *         2e
* idbcon *         1e
* hcomon1 *       1546         2         0         0e
*  htc2  *        7.0      298.0e
* dhtstrz *      0.134e
*  rdx *     1.289078e
* radrd *      0.475  0.48279133  0.49058266       0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748       0.6e
* matrd *         6         6         6         50s
* matrd *        50        50        50         50e
*   nfax *         1e
*   rftn *     523.0     523.0     520.0     500.0s
*   rftn *     500.0     400.0     350.0     330.0s
*   rftn *     310.0e
*
*d: Top of steam generator Separator wall node 1 (end part)
*******  type         num       userid              component name
htstr              1541          0              Steamdomewallend1
*      nzhstr        ittc        hscyl        ichf
           1           0           1           1
*    nofuelrod       plane       liqlev       iaxcnd
           1           3           0           0
```

```
*      nmwrx       nfci       nfcil       hdri       hdro
         0          0          0          0.0         0.0
*       nhot       nodes       fmno       nzmax      reflood
         0          9          0          108          0
*    dtxht(1)    dtxht(2)     dznht       hgapo
       2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      1546        1          0          0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.134e
*  rdx *    0.036114e
* radrd *       0.8  0.80766667  0.81533333     0.823      0.843s
* radrd *      0.863      0.883      0.903      0.923e
* matrd *        6          6          6          50s
* matrd *       50         50         50          50e
*   nfax *       1e
*   rftn *     523.0      523.0      520.0      500.0s
*   rftn *     500.0      400.0      350.0      330.0s
*   rftn *     310.0e
*
*d: Top of steam generator Separator wall node 2 (end part)
*******  type        num        userid              component name
htstr               1542          0              Steamdomewallend2
*      nzhstr       ittc       hscyl       ichf
         1          0          1          1
*   nofuelrod       plane      liqlev      iaxcnd
         1          3          0          0
*      nmwrx       nfci       nfcil       hdri       hdro
         0          0          0          0.0         0.0
*       nhot       nodes       fmno       nzmax      reflood
         0          9          0          108          0
*    dtxht(1)    dtxht(2)     dznht       hgapo
       2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      1546        2          0          0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.134e
*  rdx *    0.084266e
* radrd *       0.8  0.80766667  0.81533333     0.823      0.843s
* radrd *      0.863      0.883      0.903      0.923e
* matrd *        6          6          6          50s
* matrd *       50         50         50          50e
*   nfax *       1e
*   rftn *     523.0      523.0      520.0      500.0s
*   rftn *     500.0      400.0      350.0      330.0s
*   rftn *     310.0e
*****************************************
* Finished Heat Structure Section of Model *
*****************************************
*
end
*
```

```
*****************
* Timestep Data *
*****************
*      dtmin       dtmax        tend       rtwfp
      1.0E-6        1.0        1.0E4       10.0
*      edint       gfint       dmpint      sedint
       100.0        50.0        500.0       10.0
*
*     endflag
        -1.0
```

APPENDIX B

TRACE transient input of four layer pipe model for LOF-10 experiment

```
free format
*
*************
* main data *
*************
*      numtcr        ieos        inopt        nmat        id2o
         1             0           1            1           0
*
******************
* namelist data *
******************
*
 &inopts
  dtstrt=1.0,
  nfrc1=2,
  usesjc=3,
  nhtstr=15
 &end
*
***************
* Model Flags *
***************
*
*       dstep       timet
       31483         0.0
*      stdyst      transi       ncomp       njun        ipak
         0           1          35          25          0
*       epso        epss
       1.0E-4      1.0E-4
*      oitmax      sitmax       isolut      ncontr       nccfl
         10          10          0           0           0
*       ntsv        ntcb        ntcf        ntrp        ntcp
         25          9           34          0           0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                          +      1    121
* PIPE    *   122 s * SG3-coldcol                +     52     0
* PIPE    *   241 s * SG3-hotcol                 +     51     0
* PIPE    *   292 s *                            +      0   150
* PIPE    *   312 s *                            +    142    85
* PIPE    *   322 s *                            +    141    86
* PIPE    *   332 s *                            +    140    87
* PIPE    *   342 s *                            +    139    88
* PIPE    *   352 s * SG3-inlet                  +    128    51
* PIPE    *   353 s *                            +    129    52
* FILL    *   463 s *                            +    151
* PIPE    *   643 s *                            +      0   148
* BREAK   *   873 s *                            +    146
* PIPE    *   953 s *                            +    122   123
* PIPE    *   963 s *                            +    124   125
* PIPE    *   973 s *                            +    126   127
```

```
* HTSTR   *  1375 s * HL1-col-bot              +
* HTSTR   *  1380 s * CL1-col-bot              +
* HTSTR   *  1411 s * SG1-pool-wall1            +
* HTSTR   *  1412 s * SG1-pool-wall2            +
* HTSTR   *  1413 s * SG1-pool-wall3            +
* HTSTR   *  1414 s * SG1-pool-wall4            +
* FILL    *  1420 s *                      +   128
* HTSTR   *  1421 s * SG1-wallend1            +
* HTSTR   *  1422 s * SG1-wallend2            +
* HTSTR   *  1423 s * SG1-wallend3            +
* HTSTR   *  1424 s * SG1-wallend4            +
* BREAK   *  1430 s *                     +   129
* HTSTR   *  1506 s * Downcomer wall          +
* PIPE    *  1516 s *                     +   149   146
* HTSTR   *  1531 s * Steamdomewall1          +
* HTSTR   *  1532 s * Steamdomewall2          +
* HTSTR   *  1541 s * Steamdomewallend1        +
* HTSTR   *  1542 s * Steamdomewallend2        +
* SEPD    *  1546 e *                     +   148   149   150
*
**********************
* material properties *
**********************
*
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp       cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
*
************************************************
* Starting Signal Variable Section of Model    *
************************************************
**
*       idsv       isvn       ilcn       icn1       icn2
          1         20        643          1          4
*
*       idsv       isvn       ilcn       icn1       icn2
          2         20       1546          1          2
*
*       idsv       isvn       ilcn       icn1       icn2
        105        103       1506          0          0
*n: PriHotcolbot
*
*       idsv       isvn       ilcn       icn1       icn2
        107        103       1375          0          0
*n: PriColdcolbot
*
*       idsv       isvn       ilcn       icn1       icn2
        108        103       1380          0          0
*
```

```
*      idsv      isvn      ilcn      icn1      icn2
       109       103       1411       0         0
*n: FWmassflow
*
*      idsv      isvn      ilcn      icn1      icn2
       110       31        463        1         0
*
*      idsv      isvn      ilcn      icn1      icn2
       111        0         0         0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       112       103       1412       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       113       103       1413       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       114       103       1414       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       115       103       1421       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       116       103       1422       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       117       103       1423       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       118       103       1424       0         0
*n: tubelayer 1
*
*      idsv      isvn      ilcn      icn1      icn2
       120       103        1         0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       121       103       953        0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       122       103       963        0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       123       103       973        0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       124       103       241        0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       125       103       122        0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       131       103       1531       0         0
*
*      idsv      isvn      ilcn      icn1      icn2
       132       103       1532       0         0
*
```

```
*       idsv        isvn        ilcn        icn1        icn2
        141         103         1541          0           0
*
*       idsv        isvn        ilcn        icn1        icn2
        142         103         1542          0           0
************************************************
* Finished Signal Variable Section of Model     *
************************************************
*
*****************************************
* Starting Control System Section of Model *
*****************************************
*
****** Control Blocks ******
*
*       idcb        icbn        icb1        icb2        icb3
         -1          3           1           2           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
*
*
*       idcb        icbn        icb1        icb2        icb3
         -2         200          -1         -40           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
       160.0         0.0         0.6       0.712         0.0
*       cbdt        cbtau
       100.0         0.05
*
*n: Secheatlosses
*
*       idcb        icbn        icb1        icb2        icb3
         -3         103          13           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
* ids   *         109         115         117         105s
* ids   *         118         112         113         114s
* ids   *         116         131         132         141s
* ids   *         142e
*
*       idcb        icbn        icb1        icb2        icb3
         -4          9           0           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
         1.0     -1.0E20      1.0E20        60.0         0.0
*
*       idcb        icbn        icb1        icb2        icb3
         -5         39          110          -4           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
*
*n: tubelayers
*
*       idcb        icbn        icb1        icb2        icb3
         -6         103          4           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
         1.0     -1.0E20      1.0E20         0.0         0.0
* ids   *         120         121         122         123e
```

```
*
*n: collectors
*
*      idcb        icbn        icb1        icb2        icb3
         -7           3         124         125           0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
         1.0    -1.0E20      1.0E20         0.0         0.0
*
*n: tubesandcoll
*
*      idcb        icbn        icb1        icb2        icb3
         -8           3          -6          -7           0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
         1.0    -1.0E20      1.0E20         0.0         0.0
*
*      idcb        icbn        icb1        icb2        icb3
         -40         101         111           4         0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
         1.0    -1.0E20      1.0E20         0.0         0.0
* cbtbl *       0.0      0.712s
* cbtbl *    1000.0      0.712s
* cbtbl *    1001.0      0.000s
* cbtbl *     2.0E4      0.000e
*
*******************************************
* Finished Control System Section of Model *
*******************************************
*
******* type         num       userid            component name
fill              1420          1                 unnamed
*       jun1        ifty        ioff
         128           6           0
*       iftr        ifsv        nftb        nfsv        nfrf
           0         111           5           0           0
*      twtold        rfmx       concin        felv
         0.0      1.0E20         0.0         0.0
*       dxin        volin       alpin        vlin        tlin
         1.0     0.015394         0.0         0.0       528.0
*        pin        pain       flowin        vvin        tvin
       7.3E6         0.0         0.0         0.0       528.0
*      vmscl       vvscl
         1.0         1.0
*      tlscl       tvscl        pscl       pascl       conscl
         1.0         1.0         1.0         1.0         1.0
*
* vmtbl *      0.0   0.40607s
* vmtbl *   1000.0   0.40607s
* vmtbl *   1100.0   0.05075875s
* vmtbl *   1600.0   0.05075875s
* vmtbl *   16000.0  0.05075875e
*
* vvtb *       0.0   0.40607s
* vvtb *    1000.0   0.40607s
* vvtb *    1100.0   0.05075875s
* vvtb *    1600.0   0.05075875s
* vvtb *    16000.0  0.05075875e
```

```
*
* tltb *      0.0    528.0s
* tltb *    1000.0    528.0s
* tltb *    1100.0    528.0s
* tltb *    1600.0    541.0s
* tltb *   16000.0   548.5e
*
* tvtb *      0.0    528.0s
* tvtb *    1000.0    528.0s
* tvtb *    1100.0    528.0s
* tvtb *    1600.0    541.0s
* tvtb *   16000.0   548.5e
*
* alptb *      0.0     0.0s
* alptb *    1000.0     0.0s
* alptb *    1100.0     0.0s
* alptb *    1600.0.    0.0s
* alptb *   16000.0    0.0e
*
* ptb  *       0.0    7.3E6s
* ptb  *    1000.0    7.3E6s
* ptb  *    1100.0    7.3E6s
* ptb  *    1600.0    7.3E6s
* ptb  *   16000.0    7.3E6e
*
* patb *       0.0     0.0s
* patb *    1000.0     0.0s
* patb *    1100.0     0.0s
* patb *    1600.0     0.0s
* patb *   16000.0     0.0e
*
end
*
*****************
* Timestep Data *
*****************
*      dtmin       dtmax        tend       rtwfp
      1.0E-6        1.0       1.6E4        10.0
*      edint      gfint      dmpint      sedint
       100.0       50.0       500.0        10.0
*
*     endflag
        -1.0
```

APPENDIX C

TRACE steady state input of five layer pipe model for LOF-10 experiment

```
free format
*
*************
* main data *
*************
*     numtcr      ieos      inopt      nmat      id2o
        1         0         1          1         0
*
*****************
* namelist data *
*****************
*
 &inopts
  dtstrt=-1.0,
  nfrc1=2,
  usesjc=3,
  nhtstr=17
 &end
*
***************
* Model Flags *
***************
*
*      dstep      timet
         0        0.0
*     stdyst     transi      ncomp      njun      ipak
         0          1         38         27         0
*      epso       epss
      1.0E-4     1.0E-4
*     oitmax     sitmax      isolut     ncontr     nccfl
        10         10          0          0          0
*      ntsv       ntcb       ntcf       ntrp       ntcp
        28         12         46          0          0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                        +     1    153
* PIPE    *     2 s *                        +   152    154
* PIPE    *   122 s * SG3-coldcol              +    52      0
* PIPE    *   241 s * SG3-hotcol               +    51      0
* PIPE    *   292 s *                        +     0    150
* PIPE    *   312 s *                        +   155     85
* PIPE    *   322 s *                        +   141     86
* PIPE    *   332 s *                        +   140     87
* PIPE    *   342 s *                        +   139     88
* PIPE    *   352 s * SG3-inlet              +   128     51
* PIPE    *   353 s *                        +   129     52
* FILL    *   463 s *                        +   156
* PIPE    *   643 s *                        +     0    148
* BREAK   *   873 s *                          +   146
* PIPE    *   953 s *                        +   122    123
* PIPE    *   963 s *                        +   124    125
```

```
* PIPE    *   973 s *                    +   126   127
* HTSTR   *  1375 s * HL1-col-bot          +
* HTSTR   *  1380 s * CL1-col-bot          +
* HTSTR   *  1411 s * SG1-pool-wall1        +
* HTSTR   *  1412 s * SG1-pool-wall2        +
* HTSTR   *  1413 s * SG1-pool-wall3        +
* HTSTR   *  1414 s * SG1-pool-wall4        +
* HTSTR   *  1415 s * SG1-pool-wall5        +
* FILL    *  1420 s *                    +   128
* HTSTR   *  1421 s * SG1-wallend1         +
* HTSTR   *  1422 s * SG1-wallend2         +
* HTSTR   *  1423 s * SG1-wallend3         +
* HTSTR   *  1424 s * SG1-wallend4         +
* HTSTR   *  1425 s * SG1-wallend5         +
* BREAK   *  1430 s *                    +   129
* HTSTR   *  1506 s * Downcomer wall        +
* PIPE    *  1516 s *                    +   149   146
* HTSTR   *  1531 s * Steamdomewall1        +
* HTSTR   *  1532 s * Steamdomewall2        +
* HTSTR   *  1541 s * Steamdomewallend1      +
* HTSTR   *  1542 s * Steamdomewallend2      +
* SEPD    *  1546 e *                    +   148   149   150
*
**********************
* material properties *
**********************
*
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp      cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
*
*
*
************************************************
* Starting Signal Variable Section of Model    *
************************************************
*
*      idsv      isvn      ilcn      icn1      icn2
         1        20       643         1         5
*
*      idsv      isvn      ilcn      icn1      icn2
         2        20      1546         1         2
*n: FWmassflow
*
*      idsv      isvn      ilcn      icn1      icn2
       110        31       463         1         0
*
*      idsv      isvn      ilcn      icn1      icn2
       111         0         0         0         0
```

```
*n: tubelayer1
*
*     idsv      isvn      ilcn      icn1      icn2
      119       103         1         0         0
*n: tubelayer2
*
*     idsv      isvn      ilcn      icn1      icn2
      120       103         2         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      121       103       953         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      122       103       963         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      123       103       973         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      124       103       241         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      125       103       122         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      375       103      1375         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      380       103      1380         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      411       103      1411         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      412       103      1412         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      413       103      1413         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      414       103      1414         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      415       103      1415         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      421       103      1421         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      422       103      1422         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      423       103      1423         0         0
*
*     idsv      isvn      ilcn      icn1      icn2
      424       103      1424         0         0
```

```
*
*      idsv       isvn       ilcn       icn1       icn2
       425        103        1425          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
       506        103        1506          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
       531        103        1531          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
       532        103        1532          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
       541        103        1541          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
       542        103        1542          0          0
************************************************
* Finished Signal Variable Section of Model     *
************************************************
*
*******************************************
* Starting Control System Section of Model *
*******************************************
*
****** Control Blocks ******
*
*      idcb       icbn       icb1       icb2       icb3
         -1          3          1          2          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
        1.0    -1.0E20      1.0E20         0.0        0.0
*
*
*      idcb       icbn       icb1       icb2       icb3
         -2        200         -1        -40          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
       160.0         0.0        0.6      0.712        0.0
*      cbdt       cbtau
       100.0        0.05
*
*n: Secheatlosses
*
*      idcb       icbn       icb1       icb2       icb3
         -3        103          4          0          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
        1.0    -1.0E20      1.0E20         0.0        0.0
* ids  *       531        532        541        542e
*
*
*      idcb       icbn       icb1       icb2       icb3
         -4          9          0          0          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
        1.0    -1.0E20      1.0E20        60.0        0.0
*
*
```

```
*       idcb        icbn        icb1        icb2        icb3
        -5          39          110         -4          0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
*
*n: tubelayers
*
*       idcb        icbn        icb1        icb2        icb3
        -6          103         5           0           0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
* ids   *         120         121         122         123s
* ids   *         119e
*
*n: collectors
*
*       idcb        icbn        icb1        icb2        icb3
        -7          3           124         125         0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
*
*n: tubesandcoll
*
*       idcb        icbn        icb1        icb2        icb3
        -8          3           -6          -7          0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
*
*n: Secheatlosses
*
*       idcb        icbn        icb1        icb2        icb3
        -9          103         5           0           0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
* ids   *         411         412         413         414s
* ids   *         415e
*
*n: Secheatlosses
*
*       idcb        icbn        icb1        icb2        icb3
        -10         103         5           0           0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
* ids   *         421         422         423         424s
* ids   *         425e
*
*n: Secheatlosses
*
*       idcb        icbn        icb1        icb2        icb3
        -11         103         4           0           0
*     cbgain      cbxmin      cbmax       cbcon1      cbcon2
        1.0      -1.0E20      1.0E20        0.0         0.0
* ids   *         -3          -10         -9          506e
*
*
*       idcb        icbn        icb1        icb2        icb3
```

```
      -40         9         0         0         0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
       1.0      -1000.0      1000.0      0.712         0.0
*
*******************************************
* Finished Control System Section of Model *
*******************************************
*
******* type         num       userid            component name
pipe                  1          1                  unnamed
*     ncells       nodes        jun1        jun2        epsw
        5           4           1         153       2.0E-6
*     nsides
        0
*      ichf       iconc     pipetype        ipow       npipes
         1          0          0          0          9
*      iqptr       iqpsv       nqptb       nqpsv       nqprf
         0          0          0          0          0
*      radin         th       houtl       houtv       toutl
      6.5E-3      1.5E-3         0.0         0.0       300.0
*      toutv       pwin       pwoff       rpwmx       pwscl
      300.0         0.0         0.0       1.0E20         1.0
*      qpin       qpoff       rqpmx       qpscl       nhcom
       0.0         0.0         0.0         1.0         643
* dx   *       0.558      0.558      0.558      0.558s
* dx   *       0.558e
* vol  *   7.40646E-5 7.40646E-5 7.40646E-5 7.40646E-5s
* vol  *   7.40646E-5e
* fa   *  1.32732E-4 1.32732E-4 1.32732E-4 1.32732E-4s
* fa   *  1.32732E-4 1.32732E-4e
* fric *        0.5        0.0        0.0       0.35s
* fric *        0.0      0.998e
* fricr*        0.0        0.0        0.0        0.0s
* fricr*        0.0        0.0e
* grav *        0.0 7.37993E-3 7.37993E-3 -7.37993E-3s
* grav * -7.37993E-3        0.0e
* hd   *      0.013      0.013      0.013      0.013s
* hd   *      0.013      0.013e
* nff  *       -100       -100       -100       -100s
* nff  *       -100       -100e
* alp  *        0.0        0.0        0.0        0.0s
* alp  *        0.0e
* vl   *        0.7        0.7        0.7        0.7s
* vl   *        0.7        0.7e
* vv   *        0.7        0.7        0.7        0.7s
* vv   *        0.7        0.7e
* tl   *      528.0      528.0      528.0      528.0s
* tl   *      528.0e
* tv   *      528.0      528.0      528.0      528.0s
* tv   *      528.0e
* p    *      7.3E6      7.3E6      7.3E6      7.3E6s
* p    *      7.3E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0e
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
```

```
* qpp  *      1.0      1.0      1.0      1.0      1.0s
* qpp  *      1.0      1.0      1.0      1.0      1.0e
*  matr *   f 6e
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0e
* idrod *       0e
* nhcel *       1        1        1        1        1e
*
*
******* type        num      userid           component name
pipe              2        1                unnamed
*     ncells      nodes      jun1      jun2      epsw
        5         4        152       154      2.0E-6
*     nsides
        0
*      ichf      iconc    pipetype      ipow      npipes
        1         0        0         0         18
*      iqptr     iqpsv     nqptb     nqpsv     nqprf
        0         0        0         0         0
*      radin       th      houtl      houtv      toutl
     6.5E-3     1.5E-3       0.0       0.0      300.0
*      toutv      pwin      pwoff      rpwmx      pwscl
      300.0       0.0       0.0     1.0E20        1.0
*      qpin      qpoff      rqpmx      qpscl      nhcom
       0.0       0.0        0.0        1.0        643
* dx   *     0.558     0.558     0.558     0.558s
* dx   *     0.558e
* vol  *  7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *  1.32732E-4  1.32732E-4e
* fric *       0.5       0.0       0.0       0.35s
* fric *       0.0     0.998e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       0.0e
* grav *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3       0.0e
* hd   *     0.013     0.013     0.013     0.013s
* hd   *     0.013     0.013e
* nff  *      -100      -100      -100      -100s
* nff  *      -100      -100e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *       0.7       0.7       0.7       0.7s
* vl   *       0.7       0.7e
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
```

```
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *       0e
* nhcel *       2         2         2         2         2e
*
******* type        num       userid            component name
pipe              122         1               SG3-coldcol
*     ncells      nodes       jun1        jun2        epsw
          5          3          52           0       2.0E-6
*     nsides
          5
*      nclk       junlk       ncmpto      nclkto      nlevto
          3         123          0           0           0
*     theta       ientrn
         90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
          2         125          0           0           0
*     theta       ientrn
         90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
          1         127          0           0           0
*     theta       ientrn
         90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
          5         153          0           0           0
*     theta       ientrn
         90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
          4         154          0           0           0
*     theta       ientrn
         90.0         0
*      ichf       iconc     pipetype        ipow       npipes
          1          0          0           0           1
*     iqptr       iqpsv       nqptb       nqpsv       nqprf
          0          0          0           0           0
*     radin         th        houtl       houtv       toutl
         0.07       0.02        0.0         0.0        300.0
*     toutv        pwin        pwoff       rpwmx       pwscl
        300.0        0.0         0.0       1.0E20        1.0
*      qpin        qpoff       rqpmx       qpscl       nhcom
          0.0        0.0         0.0         1.0         643
* dx   *       0.163     0.192     0.192     0.0675s
* dx   *       0.0675e
* vol  *       2.5E-3    2.95E-3   2.95E-3   1.0E-3s
* vol  *       1.0E-3e
* fa   *  0.015393804   0.015394   0.015394   0.015394s
* fa   *     0.015394   0.015394e
* fric *         0.0       0.0       0.0       0.0s
```

```
* fric *      0.0      0.0e
* fricr *     0.0      0.0      0.0      0.0s
* fricr *     0.0      0.0e
* grav *      1.0      1.0      1.0      1.0s
* grav *      1.0      1.0e
* hd   *      0.14     0.14     0.14     0.14s
* hd   *      0.14     0.14e
* nff  *      -100     -100     -100     -100s
* nff  *      -100     -100e
* alp  *      0.0      0.0      0.0      0.0s
* alp  *      0.0e
* vl   *      0.195    0.164    0.105    0.047s
* vl   *      0.047    0.0e
* vv   *      0.195    0.164    0.105    0.047s
* vv   *      0.047    0.0e
* tl   *      528.0    528.0    528.0    528.0s
* tl   *      528.0e
* tv   *      528.0    528.0    528.0    528.0s
* tv   *      528.0e
* p    *      7.3E6    7.3E6    7.3E6    7.3E6s
* p    *      7.3E6e
* pa   *      0.0      0.0      0.0      0.0s
* pa   *      0.0e
* qpp  *      1.0      1.0      1.0      1.0      1.0s
* qpp  *      1.0      1.0      1.0      1.0      1.0s
* qpp  *      1.0      1.0      1.0      1.0      1.0e
*  matr *   f 6e
* tw   *      526.0    526.0    526.0    526.0    526.0s
* tw   *      526.0    526.0    526.0    526.0    526.0s
* tw   *      526.0    526.0    526.0    526.0    526.0e
* idrod *     0e
* nhcel *     1        2        3        4        5e
*
*
******* type        num       userid          component name
pipe              241         1               SG3-hotcol
*     ncells      nodes       jun1      jun2      epsw
        5         3          51         0      2.0E-6
*     nsides
        5
*      nclk       junlk      ncmpto     nclkto     nlevto
        5          1          0          0          0
*      theta      ientrn
       90.0        0
*      nclk       junlk      ncmpto     nclkto     nlevto
        3         122         0          0          0
*      theta      ientrn
       90.0        0
*      nclk       junlk      ncmpto     nclkto     nlevto
        2         124         0          0          0
*      theta      ientrn
       90.0        0
*      nclk       junlk      ncmpto     nclkto     nlevto
        1         126         0          0          0
*      theta      ientrn
       90.0        0
```

```
*      nclk      junlk      ncmpto      nclkto      nlevto
         4        152          0          0           0
*     theta      ientrn
      90.0          0
*      ichf      iconc     pipetype       ipow       npipes
         1          0          0          0           1
*     iqptr      iqpsv      nqptb      nqpsv       nqprf
         0          0          0          0           0
*     radin         th      houtl      houtv       toutl
      0.07       0.02        0.0        0.0       300.0
*     toutv       pwin      pwoff      rpwmx       pwscl
     300.0        0.0        0.0     1.0E20         1.0
*      qpin      qpoff      rqpmx      qpscl       nhcom
       0.0        0.0        0.0        1.0         643
* dx   *      0.163     0.192     0.192     0.0675s
* dx   *     0.0675e
* vol  *     2.5E-3    2.95E-3   2.95E-3    1.0E-3s
* vol  *     1.0E-3e
* fa   *    0.015394  0.015394  0.015394  0.015394s
* fa   *    0.015394  0.015394e
* fric *       0.0       0.0       0.0       0.0s
* fric *       0.0       0.0e
* fricr*       0.0       0.0       0.0       0.0s
* fricr*       0.0       0.0e
* grav *       1.0       1.0       1.0       1.0s
* grav *       1.0       1.0e
* hd   *      0.14      0.14      0.14      0.14s
* hd   *      0.14      0.14e
* nff  *      -100      -100      -100      -100s
* nff  *      -100      -100e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *     0.195     0.164     0.105     0.047s
* vl   *     0.047       0.0e
* vv   *     0.195     0.164     0.105     0.047s
* vv   *     0.047       0.0e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr*   f 6e
* tw   *     528.0     528.0     526.0     528.0     528.0s
* tw   *     526.0     528.0     528.0     526.0     528.0s
* tw   *     528.0     526.0     528.0     528.0     526.0e
* idrod*        0e
* nhcel*         1         2         3         4         5e
*
*
******* type        num       userid            component name
```

```
pipe              292        1                unnamed
*     ncells      nodes      jun1      jun2      epsw
        7         0          0         150       2.0E-6
*     nsides
        5
*      nclk       junlk      ncmpto    nclkto    nlevto
        1         139        0         0         0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto    nclkto    nlevto
        3         140        0         0         0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto    nclkto    nlevto
        5         141        0         0         0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto    nclkto    nlevto
        6         155        0         0         0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto    nclkto    nlevto
        4         156        0         0         0
*      theta      ientrn
       90.0       0
*      ichf       iconc      pipetype  ipow      npipes
        1         0          0         0         1
*      radin      th         houtl     houtv     toutl
       0.0        0.0        0.0       0.0       0.0
*      toutv      pwin       pwoff     rpwmx     pwscl
       0.0        0.0        0.0       0.0       0.0
* dx   *      0.0815     0.096     0.096     0.096s
* dx   *      0.096      0.0675    0.0675e
* vol  *    5.3975E-3    6.3E-3    6.3E-3    6.3E-3s
* vol  *      6.3E-3     4.4E-3    4.4E-3e
* fa   *      0.065      0.0656    0.0656    0.0656s
* fa   *      0.0656     0.0652    0.0652    0.065185e
* fric *        0.0        0.0       0.0       0.0s
* fric *        0.0        0.0       0.0       10.0e
* fricr*        0.0        0.0       0.0       0.0s
* fricr*        0.0        0.0       0.0       0.0e
* grav *        1.0        1.0       1.0       1.0s
* grav *        1.0        1.0       1.0       1.0e
* hd   *      0.288      0.289     0.289     0.289s
* hd   *      0.289   0.28809047 0.28809047 0.28809047e
* nff  *       -100       -100      -100      -100s
* nff  *       -100       -100      -100       -1e
* alp  *        0.0        0.0       0.0       0.0s
* alp  *        0.0        0.0       0.0e
* vl   *        0.0        0.0       0.0       0.0s
* vl   *        0.0        0.0       0.0       0.0e
* vv   *        0.0        0.0       0.0       0.0s
* vv   *        0.0        0.0       0.0       0.0e
* tl   *    523.504    523.504    523.504    523.504s
* tl   *    523.504    523.504    523.504e
* tv   *    523.504    523.504    523.504    523.504s
```

```
* tv   *    523.504    523.504    523.504e
* p    *     4.0E6      4.0E6      4.0E6     4.0E6s
* p    *     4.0E6      4.0E6      4.0E6e
* pa   *       0.0        0.0        0.0       0.0s
* pa   *       0.0        0.0        0.0e
*
*
******* type         num       userid             component name
* single junction
pipe                312          1                  unnamed
*     ncells        nodes        jun1        jun2        epsw
        0            0          155          85       2.0E-6
*      ichf        iconc      pipetype        ipow       npipes
        1            0           0           0           1
*     radin          th        houtl        houtv        toutl
       0.0          0.0         0.0          0.0          0.0
*     toutv         pwin        pwoff        rpwmx        pwscl
       0.0          0.0         0.0          0.0          0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.3105e
* fric * f       2.5e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.44460144e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type         num       userid             component name
* single junction
pipe                322          1                  unnamed
*     ncells        nodes        jun1        jun2        epsw
        0            0          141          86       2.0E-6
*      ichf        iconc      pipetype        ipow       npipes
        1            0           0           0           1
*     radin          th        houtl        houtv        toutl
       0.0          0.0         0.0          0.0          0.0
*     toutv         pwin        pwoff        rpwmx        pwscl
       0.0          0.0         0.0          0.0          0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.4416e
* fric * f       2.6e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f     0.7498e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
```

```
* vv   * f       0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num       userid            component name
* single junction
pipe              332         1                 unnamed
*     ncells      nodes       jun1      jun2      epsw
        0         0         140         87      2.0E-6
*      ichf       iconc     pipetype      ipow      npipes
        1         0         0         0         1
*      radin        th       houtl      houtv      toutl
       0.0        0.0       0.0       0.0        0.0
*      toutv       pwin      pwoff      rpwmx      pwscl
       0.0        0.0       0.0       0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.4416e
* fric * f       2.6e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f     0.7498e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num       userid            component name
* single junction
pipe              342         1                 unnamed
*     ncells      nodes       jun1      jun2      epsw
        0         0         139         88      2.0E-6
*      ichf       iconc     pipetype      ipow      npipes
        1         0         0         0         1
*      radin        th       houtl      houtv      toutl
       0.0        0.0       0.0       0.0        0.0
*      toutv       pwin      pwoff      rpwmx      pwscl
       0.0        0.0       0.0       0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f     0.3726e
* fric * f       2.4e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f     0.6688e
* nff  * f       -1e
* alp  *   f 0.0000e+00e
* vl   * f       0.0e
```

```
* vv   * f        0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num      userid            component name
pipe              352         1                SG3-inlet
*     ncells      nodes       jun1       jun2       epsw
        1         0        128         51      2.0E-6
*     nsides
        0
*      ichf      iconc    pipetype       ipow      npipes
        1         0         0         0         1
*      radin       th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin      pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *      0.255e
* vol  *  3.92542E-3e
* fa   *   0.015394   0.015394e
* fric *       0.0       0.0e
* fricr *      0.0       0.0e
* grav *       1.0       1.0e
* hd   *      0.14      0.14e
* nff  *      -100      -100e
* alp  *       0.0e
* vl   *     0.195     0.195e
* vv   *     0.195     0.195e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *       0.0e
*
*
******* type        num      userid            component name
pipe              353         1                unnamed
*     ncells      nodes       jun1       jun2       epsw
        1         0        129         52      2.0E-6
*     nsides
        0
*      ichf      iconc    pipetype       ipow      npipes
        1         0         0         0         1
*      radin       th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*      toutv      pwin      pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *      0.255e
* vol  *  3.92542E-3e
* fa   *  0.015393804 0.015393804e
* fric *      0.448       0.0e
* fricr *      0.0       0.0e
* grav *       1.0       1.0e
* hd   *      0.14      0.14e
* nff  *      -100      -100e
```

```
* alp  *      0.0e
* vl   *      0.0     0.195e
* vv   *      0.0     0.195e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *      0.0e
*
*
******* type        num      userid           component name
fill              463        1                unnamed
*      jun1       ifty       ioff
       156        5          0
*      iftr       ifsv       nftb       nfsv       nfrf
       0          -2         0          0          0
*     twtold      rfmx       concin     felv
       0.0        1.0E20     0.0        0.0
*      dxin       volin      alpin      vlin       tlin
      0.192       0.0126     0.0        0.0        298.0
*      pin        pain       flowin     vvin       tvin
      4.0E6       0.0        0.3        0.0        298.0
*
******* type        num      userid           component name
pipe              643        1                unnamed
*      ncells     nodes      jun1       jun2       epsw
       5          0          0          148        2.0E-6
*      nsides
       4
*      nclk       junlk      ncmpto     nclkto     nlevto
       4          85         0          0          0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto     nclkto     nlevto
       3          86         0          0          0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto     nclkto     nlevto
       2          87         0          0          0
*      theta      ientrn
       90.0       0
*      nclk       junlk      ncmpto     nclkto     nlevto
       1          88         0          0          0
*      theta      ientrn
       90.0       0
*      ichf       iconc      pipetype   ipow       npipes
       1          0          0          0          1
*      radin      th         houtl      houtv      toutl
       0.0        0.0        0.0        0.0        0.0
*      toutv      pwin       pwoff      rpwmx      pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *      0.163     0.192     0.192     0.0675s
* dx   *      0.0675e
* vol  *      0.1362    0.2748    0.3163    0.1057s
* vol  *      0.1057e
* fa   *     1.29195   1.29195    1.707     1.74759s
* fa   *    1.5941227  1.4477071e
```

```
* fric *       0.0       0.0       0.0       0.0s
* fric *       0.0       0.0e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       5.0e
* grav *       1.0       1.0       1.0       1.0s
* grav *       1.0       1.0e
* hd   *    1.314779  1.314779  1.314779  1.314779s
* hd   *   1.3362264  1.3576737e
* nff  *      -100      -100      -100      -100s
* nff  *      -100       -1e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *       0.0       0.0       0.0       0.0s
* vl   *       0.0       0.0e
* vv   *       0.0       0.0       0.0       0.0s
* vv   *       0.0       0.0e
* tl   *     523.0     523.0     523.0     523.0s
* tl   *     523.0e
* tv   *     523.0     523.0     523.0     523.0s
* tv   *     523.0e
* p    *     4.0E6     4.0E6     4.0E6     4.0E6s
* p    *     4.0E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
*
******* type       num      userid           component name
break             873         1                unnamed
*       jun1       ibty       isat       ioff     adjpress
          146          0          0          0          0
*       dxin       volin      alpin        tin        pin
     2.127995      0.027        1.0      523.0      4.0E6
*       pain      concin       rbmx       poff       belv
          0.0        0.0     1.0E20        0.0        0.0
*
*
******* type       num      userid           component name
pipe              953         1                unnamed
*      ncells      nodes       jun1       jun2       epsw
           5          4        122        123     1.0E-6
*      nsides
           0
*       ichf      iconc    pipetype       ipow      npipes
           1          0          0          0         36
*       iqptr      iqpsv      nqptb      nqpsv      nqprf
           0          0          0          0          0
*       radin        th      houtl      houtv      toutl
      6.5E-3     1.5E-3        0.0        0.0      300.0
*       toutv      pwin      pwoff      rpwmx      pwscl
      300.0        0.0        0.0     1.0E20        1.0
*       qpin       qpoff      rqpmx      qpscl      nhcom
          0.0        0.0        0.0        1.0        643
* dx   *       0.558     0.558     0.558     0.558s
* dx   *       0.558e
* vol  *  7.40646E-5 7.40646E-5 7.40646E-5 7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4 1.32732E-4 1.32732E-4 1.32732E-4s
```

```
* fa   *  1.32732E-4  1.32732E-4e
* fric *       0.5       0.0       0.0       0.35s
* fric *       0.0      0.998e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       0.0e
* grav *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3       0.0e
* hd   *      0.013     0.013     0.013     0.013s
* hd   *      0.013     0.013e
* nff  *        1         1         1         1s
* nff  *        1         1e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *       0.7       0.7       0.7       0.7s
* vl   *       0.7       0.7e
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *        0e
* nhcel *        3         3         3         3         3e
*
******* type        num       userid            component name
pipe              963          1                 unnamed
*     ncells      nodes       jun1       jun2       epsw
          5          4        124        125      1.0E-6
*     nsides
          0
*       ichf      iconc     pipetype       ipow      npipes
          1          0          0          0          36
*       iqptr     iqpsv      nqptb      nqpsv      nqprf
          0          0          0          0          0
*       radin       th       houtl      houtv      toutl
       6.5E-3     1.5E-3       0.0        0.0       300.0
*       toutv      pwin      pwoff      rpwmx      pwscl
       300.0       0.0        0.0      1.0E20       1.0
*       qpin      qpoff      rqpmx      qpscl      nhcom
        0.0        0.0        0.0        1.0        643
* dx   *      0.558     0.558     0.558     0.558s
* dx   *      0.558e
* vol  *  7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
```

```
* vol   *  7.40646E-5e
* fa    *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa    *  1.32732E-4  1.32732E-4e
* fric  *       0.5       0.0       0.0       0.35s
* fric  *       0.0     0.998e
* fricr *       0.0       0.0       0.0       0.0s
* fricr *       0.0       0.0e
* grav  *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav  *  -7.37993E-3       0.0e
* hd    *     0.013     0.013     0.013     0.013s
* hd    *     0.013     0.013e
* nff   *         1         1         1         1s
* nff   *         1         1e
* alp   *       0.0       0.0       0.0       0.0s
* alp   *       0.0e
* vl    *       0.7       0.7       0.7       0.7s
* vl    *       0.7       0.7e
* vv    *       0.7       0.7       0.7       0.7s
* vv    *       0.7       0.7e
* tl    *     528.0     528.0     528.0     528.0s
* tl    *     528.0e
* tv    *     528.0     528.0     528.0     528.0s
* tv    *     528.0e
* p     *     7.3E6     7.3E6     7.3E6     7.3E6s
* p     *     7.3E6e
* pa    *       0.0       0.0       0.0       0.0s
* pa    *       0.0e
* qpp   *       1.0       1.0       1.0       1.0       1.0s
* qpp   *       1.0       1.0       1.0       1.0       1.0s
* qpp   *       1.0       1.0       1.0       1.0       1.0s
* qpp   *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw    *     528.0     528.0     528.0     528.0     528.0s
* tw    *     528.0     528.0     528.0     528.0     528.0s
* tw    *     528.0     528.0     528.0     528.0     528.0s
* tw    *     528.0     528.0     528.0     528.0     528.0e
* idrod *         0e
* nhcel *         2         2         2         2         2e
*
******* type        num       userid            component name
pipe              973          1                 unnamed
*      ncells       nodes       jun1       jun2       epsw
         5           4          126        127       1.0E-6
*      nsides
         0
*       ichf       iconc     pipetype       ipow       npipes
          1          0          0          0          19
*       iqptr      iqpsv      nqptb      nqpsv      nqprf
          0          0          0          0          0
*       radin        th       houtl      houtv      toutl
       6.5E-3      1.5E-3       0.0        0.0       300.0
*       toutv      pwin       pwoff      rpwmx      pwscl
       300.0       0.0        0.0       1.0E20      1.0
*       qpin       qpoff      rqpmx      qpscl      nhcom
        0.0        0.0        0.0        1.0        643
* dx   *      0.542     0.542     0.542     0.542s
```

```
* dx   *      0.542e
* vol  *  7.19409E-5 7.19409E-5 7.19409E-5 7.19409E-5s
* vol  *  7.19409E-5e
* fa   *  1.32732E-4 1.32732E-4 1.32732E-4 1.32732E-4s
* fa   *  1.32732E-4 1.32732E-4e
* fric *       0.5       0.0       0.0       0.35s
* fric *       0.0      0.998e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       0.0e
* grav *       0.0 7.37993E-3 7.37993E-3 -7.37993E-3s
* grav * -7.37993E-3       0.0e
* hd   *     0.013     0.013     0.013     0.013s
* hd   *     0.013     0.013e
* nff  *      -100      -100      -100      -100s
* nff  *      -100      -100e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *       0.7       0.7       0.7       0.7s
* vl   *       0.7       0.7e
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *      0e
* nhcel *      1         1         1         1         1e
*
******* type        num       userid            component name
fill             1420          1                 unnamed
*       jun1       ifty       ioff
        128           5          0
*       iftr       ifsv       nftb       nfsv       nfrf
          0        111          2          0          0
*     twtold       rfmx      concin       felv
        0.0     1.0E20        0.0        0.0
*       dxin       volin      alpin       vlin       tlin
        1.0    0.015394        0.0        0.0      528.0
*        pin       pain      flowin       vvin       tvin
      7.3E6        0.0        5.0        0.0      528.0
*      vmscl      vvscl
        1.0        1.0
*
```

```
* vmtbv *       0.0       5.0s
* vmtbv *      1.0E4       5.0e
*
******* type        num       userid             component name
break              1430          1                  unnamed
*       jun1        ibty        isat        ioff     adjpress
        129          0           0           0          0
*       dxin        volin       alpin        tin        pin
        1.0      0.015394         0.0       528.0       7.3E6
*       pain       concin        rbmx        poff        belv
        0.0         0.0       1.0E20         0.0         0.0
*
******* type        num       userid             component name
pipe               1516          1                  unnamed
*      ncells       nodes       jun1        jun2        epsw
         3           0          149         146       2.0E-6
*      nsides
         0
*       ichf       iconc     pipetype        ipow       npipes
          1          0           0           0           1
*       radin        th        houtl       houtv       toutl
        0.0         0.0         0.0         0.0         0.0
*       toutv       pwin        pwoff       rpwmx       pwscl
        0.0         0.0         0.0         0.0         0.0
* dx   *  0.70933333  0.70933333  0.70933333e
* vol  *  8.99977E-3  8.99977E-3  8.99977E-3e
* fa   *    0.91399 0.012687644 0.012687644 0.012687644e
* fric *        3.0         0.0         0.0         3.0e
* fricr *       0.0         0.0         0.0         0.0e
* grav *        1.0         1.0         1.0         1.0e
* hd   *   1.2632607      0.1271      0.1271      0.1271e
* nff  *         -1           1           1           1e
* alp  *        1.0         1.0         1.0e
* vl   *        0.0         0.0         0.0         0.0e
* vv   *        0.0         0.0         0.0         0.0e
* tl   *      523.0       523.0       523.0e
* tv   *      523.0       523.0       523.0e
* p    *      4.0E6       4.0E6       4.0E6e
* pa   *        0.0         0.0         0.0e
*
*
* type              num         id          ctitle
sepd               1546          0                  unnamed
*       jcell       nodes        ichf        cost        epsw
          2           0           1          -1.0         0.0
*       nseps       ndryr       istage        xco         xcu
          1           0           0          0.0         1.0
*      alpsmn       alpsmx
        0.0         1.0
*      iconc1       ncell1       jun1        jun2        ipow1
          0           2          148         149           0
*       radin        th        houtl       houtv       toutl
        0.0         0.0         0.0         0.0         0.0
*       toutv       pwin        pwoff       rpwmx       pwscl
        0.0         0.0         0.0         0.0         0.0
*      iconc2       ncell2       jun3        ipow2
```

```
        0         1        150         0
*      radin2        th2      houtl2      houtv2      toutl2
       0.0         0.0        0.0         0.0         0.0
*      toutv2      pwin2      pwoff2      rpwmx2      pwscl2
       0.0         0.0        0.0         0.0         0.0
* dx1  *      0.134     0.134e
* vol1  *    0.211153  0.1247487e
* fa1  *   1.4477071    1.25336    0.91399e
* fric1 *       0.0       0.0       3.0e
* fricr1*       5.0       0.0       0.0e
* grav1 *       1.0       1.0       1.0e
* hd1  *   1.3576737  1.2632607  1.2632607e
* nff1  *        -1        -1        -1e
* alp1  *     0.687       1.0e
* vl1  *       0.0       0.0       0.0e
* vv1  *       0.0       0.0       0.0e
* tl1  *     523.0     523.0e
* tv1  *     523.0     523.0e
* p1  *     4.0E6     4.0E6e
* pa1  *       0.0       0.0e
* dx2  *     0.067e
* vol2  *  3.25925E-3e
* fa2  *   0.065185   0.065185e
* fric2 *       0.0       0.0e
* fricr2*       0.0      10.0e
* grav2 *      -1.0      -1.0e
* hd2  *  0.28809047  0.28809047e
* nff2  *        -1        -1e
* alp2  *       1.0e
* vl2  *       0.0       0.0e
* vv2  *       0.0       0.0e
* tl2  *     523.0e
* tv2  *     523.0e
* p2  *     4.0E6e
* pa2  *       0.0e
*
*****************************************
* Starting Heat Structure Section of Model *
*****************************************
*******  type         num       userid              component name
htstr              1375          0                HL1-col-bot
*      nzhstr        ittc      hscyl        ichf
         1           0         1            1
*    nofuelrod       plane      liqlev       iaxcnd
         1           3         0            0
*       nmwrx         nfci       nfcil        hdri         hdro
         0           0         0          0.0          0.0
*        nhot        nodes        fmno        nzmax      reflood
         0           8         0          100           0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0       1.0E-3       6300.0
*
* idbcin *         2e
* idbcon *         1e
* hcomon1  *       352         1         0         0e
*   htc2  *      3.44      298.0e
```

```
* dhtstrz *      0.255e
*  rdx *        1.0e
* radrd *       0.07 0.076666667 0.083333333      0.09      0.105s
* radrd *       0.12      0.135       0.15e
* matrd *        6         6         6         50s
* matrd *        50        50        50e
*   nfax *       1e
*   rftn *     528.0     528.0     500.0     400.0s
*   rftn *     350.0     330.0     310.0     300.0e
*
******* type        num       userid            component name
htstr             1380         0                CL1-col-bot
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx        nfci       nfcil       hdri       hdro
          0          0          0         0.0        0.0
*      nhot       nodes        fmno       nzmax      reflood
          0          8          0         100          0
*    dtxht(1)    dtxht(2)      dznht      hgapo
        2.0        10.0       1.0E-3     6300.0
*
* idbcin *       2e
* idbcon *       1e
* hcomon1 *      353        1         0         0e
*  htc2  *      3.44      298.0e
* dhtstrz *     0.255e
*  rdx *        1.0e
* radrd *       0.07 0.076666667 0.083333333      0.09      0.105s
* radrd *       0.12      0.135       0.15e
* matrd *        6         6         6         50s
* matrd *        50        50        50e
*   nfax *       1e
*   rftn *     520.0     520.0     500.0     400.0s
*   rftn *     350.0     330.0     310.0     300.0e
*
******* type        num       userid            component name
htstr             1411         0              SG1-pool-wall1
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx        nfci       nfcil       hdri       hdro
          0          0          0         0.0        0.0
*      nhot       nodes        fmno       nzmax      reflood
          0          8          0         100          0
*    dtxht(1)    dtxht(2)      dznht      hgapo
        2.0        10.0       1.0E-3     6300.0
*
* idbcin *       2e
* idbcon *       1e
* hcomon1 *      643        1         0         0e
*  htc2  *      7.0       298.0e
* dhtstrz *     0.163e
*  rdx *     1.29996e
```

```
* radrd *     0.475  0.48333333  0.49166667       0.5      0.525s
* radrd *      0.55      0.575       0.6e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *         1e
*   rftn *     523.0      521.0      510.0      470.0s
*   rftn *     450.0      400.0      350.0      300.0e
*
******* type         num       userid            component name
htstr              1412          0              SG1-pool-wall2
*     nzhstr        ittc       hscyl        ichf
          1           0           1           1
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0           0
*      nmwrx         nfci        nfcil        hdri        hdro
          0           0           0         0.0         0.0
*       nhot        nodes         fmno        nzmax      reflood
          0           8           0         100           0
*    dtxht(1)     dtxht(2)       dznht        hgapo
         2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       643         2         0         0e
*   htc2   *       7.0       298.0e
* dhtstrz *      0.163e
*   rdx *      0.75802e
* radrd *      0.475  0.48333333  0.49166667       0.5      0.525s
* radrd *       0.55      0.575       0.6e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *         1e
*   rftn *     523.0      521.0      510.0      470.0s
*   rftn *     450.0      400.0      350.0      300.0e
*
******* type         num       userid            component name
htstr              1413          0              SG1-pool-wall3
*     nzhstr        ittc       hscyl        ichf
          1           0           1           1
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0           0
*      nmwrx         nfci        nfcil        hdri        hdro
          0           0           0         0.0         0.0
*       nhot        nodes         fmno        nzmax      reflood
          0           8           0         100           0
*    dtxht(1)     dtxht(2)       dznht        hgapo
         2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       643         3         0         0e
*   htc2   *       7.0       298.0e
* dhtstrz *      0.163e
*   rdx *      0.66983e
* radrd *      0.475  0.48333333  0.49166667       0.5      0.525s
* radrd *       0.55      0.575       0.6e
```

```
* matrd *        6        6        6       50s
* matrd *       50       50       50e
*   nfax *        1e
*   rftn *    523.0    521.0    510.0    470.0s
*   rftn *    450.0    400.0    350.0    300.0e
*
******* type        num      userid           component name
htstr            1414         0             SG1-pool-wall4
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev     iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)   dtxht(2)      dznht      hgapo
         2.0       10.0     1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      643        4        0       0e
*  htc2  *      7.0    298.0e
* dhtstrz *    0.163e
*   rdx *       0.1e
* radrd *    0.475 0.48333333 0.49166667      0.5    0.525s
* radrd *     0.55    0.575      0.6e
* matrd *        6        6        6       50s
* matrd *       50       50       50e
*   nfax *        1e
*   rftn *    523.0    521.0    510.0    470.0s
*   rftn *    450.0    400.0    350.0    300.0e
*
******* type        num      userid           component name
htstr            1415         0             SG1-pool-wall5
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev     iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)   dtxht(2)      dznht      hgapo
         2.0       10.0     1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      643        5        0       0e
*  htc2  *      7.0    298.0e
* dhtstrz *    0.163e
*   rdx *     0.3905e
* radrd *    0.475 0.48333333 0.49166667      0.5    0.525s
* radrd *     0.55    0.575      0.6e
* matrd *        6        6        6       50s
* matrd *       50       50       50e
```

```
*   nfax *        1e
*   rftn *     523.0     521.0     510.0     470.0s
*   rftn *     450.0     400.0     350.0     300.0e
*
******* type        num       userid            component name
htstr             1421          0               SG1-wallend1
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)      dznht       hgapo
        2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      .643         1         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*   rdx *    0.09176e
* radrd *       0.8 0.80766667 0.81533333     0.823     0.848s
* radrd *     0.873     0.898     0.923e
* matrd *         6         6         6       50s
* matrd *        50        50        50e
*    nfax *        1e
*    rftn *    523.0     520.0     500.0     420.0s
*    rftn *    400.0     350.0     330.0     300.0e
*
******* type        num       userid            component name
htstr             1422          0               SG1-wallend2
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)      dznht       hgapo
        2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643         2         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*   rdx *    0.04955e
* radrd *       0.8 0.80766667 0.81533333     0.823     0.848s
* radrd *     0.873     0.898     0.923e
* matrd *         6         6         6       50s
* matrd *        50        50        50e
*    nfax *        1e
*    rftn *    523.0     520.0     500.0     420.0s
```

```
*   rftn *      400.0      350.0      330.0      300.0e
*
******* type          num        userid              component name
htstr               1423          0                 SG1-wallend3
*      nzhstr        ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri         hdro
          0           0           0          0.0          0.0
*       nhot        nodes         fmno        nzmax       reflood
          0           8           0          100            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0        1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *        643         3          0          0e
*   htc2   *       7.0       298.0e
* dhtstrz *      0.163e
*   rdx *      0.04378e
* radrd *        0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *      0.873       0.898       0.923e
* matrd *          6           6           6         50s
* matrd *         50          50          50e
*    nfax *         1e
*    rftn *     523.0       520.0       500.0       420.0s
*    rftn *     400.0       350.0       330.0       300.0e
*
******* type          num        userid              component name
htstr               1424          0                 SG1-wallend4
*      nzhstr        ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri         hdro
          0           0           0          0.0          0.0
*       nhot        nodes         fmno        nzmax       reflood
          0           8           0          100            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0        1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *        643         4          0          0e
*   htc2   *       7.0       298.0e
* dhtstrz *      0.163e
*   rdx *        0.01e
* radrd *        0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *      0.873       0.898       0.923e
* matrd *          6           6           6         50s
* matrd *         50          50          50e
*    nfax *         1e
*    rftn *     523.0       520.0       500.0       420.0s
*    rftn *     400.0       350.0       330.0       300.0e
*
```

```
******* type        num      userid            component name
htstr             1425         0              SG1-wallend5
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci       nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)      dznht      hgapo
        2.0        10.0     1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       643        5          0          0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163e
*  rdx *     0.02206e
* radrd *       0.8 0.80766667 0.81533333      0.823      0.848s
* radrd *     0.873      0.898      0.923e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *        1e
*   rftn *     523.0      520.0      500.0      420.0s
*   rftn *     400.0      350.0      330.0      300.0e
*
******* type        num      userid            component name
htstr             1506         0              Downcomer wall
*     nzhstr       ittc       hscyl       ichf
          2          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci       nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)      dznht      hgapo
        2.0        10.0     1.0E-3     6300.0
*
* idbcin *        2         2e
* idbcon *        1         1e
* hcomon1 *       292         1          0          0e
* hcomon1 *       292         2          0          0e
*  htc2  *       7.0      298.0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.163      0.096e
*  rdx *     0.10387e
* radrd *       0.475 0.48279133 0.49058266        0.5 0.52378049s
* radrd * 0.54918699  0.5745935        0.6e
* matrd *         6          6          6        50s
* matrd *        50         50         50e
*   nfax *        1         1e
*   rftn *     523.0      500.0      450.0      400.0s
*   rftn *     380.0      350.0      320.0      300.0s
*   rftn *     523.0      500.0      450.0      400.0s
```

```
*   rftn *      380.0      350.0      320.0      300.0e
*
*d: Top of steam generator Separator wall node 1 (cylinder part)
*******  type          num        userid              component name
htstr               1531          0                Steamdomewall1
*      nzhstr         ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod        plane       liqlev        iaxcnd
          1           3           0            0
*       nmwrx          nfci        nfcil         hdri         hdro
          0           0           0          0.0          0.0
*       nhot         nodes         fmno         nzmax       reflood
          0           9           0          108            0
*    dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       1546         1          0          0e
*   htc2   *        7.0       298.0e
* dhtstrz *       0.134e
*   rdx *      0.552462e
* radrd *       0.475  0.48279133  0.49058266        0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748        0.6e
* matrd *          6          6          6         50s
* matrd *         50         50         50         50e
*    nfax *         1e
*    rftn *      523.0      523.0      520.0      500.0s
*    rftn *      500.0      400.0      350.0      330.0s
*    rftn *      310.0e
*
*d: Top of steam generator Separator wall node 2 (cylinder part)
*******  type          num        userid              component name
htstr               1532          0                Steamdomewall2
*      nzhstr         ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod        plane       liqlev        iaxcnd
          1           3           0            0
*       nmwrx          nfci        nfcil         hdri         hdro
          0           0           0          0.0          0.0
*       nhot         nodes         fmno         nzmax       reflood
          0           9           0          108            0
*    dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       1546         2          0          0e
*   htc2   *        7.0       298.0e
* dhtstrz *       0.134e
*   rdx *      1.289078e
* radrd *       0.475  0.48279133  0.49058266        0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748        0.6e
* matrd *          6          6          6         50s
* matrd *         50         50         50         50e
*    nfax *         1e
```

```
*   rftn *      523.0      523.0      520.0      500.0s
*   rftn *      500.0      400.0      350.0      330.0s
*   rftn *      310.0e
*
*d: Top of steam generator Separator wall node 1 (end part)
*******  type         num        userid              component name
htstr               1541          0             Steamdomewallend1
*      nzhstr        ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri         hdro
          0           0           0          0.0          0.0
*       nhot         nodes         fmno        nzmax       reflood
          0           9           0          108            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       1546         1          0          0e
*   htc2   *        7.0       298.0e
* dhtstrz *       0.134e
*   rdx *     0.036114e
* radrd *        0.8  0.80766667  0.81533333      0.823      0.843s
* radrd *      0.863      0.883      0.903      0.923e
* matrd *          6          6          6         50s
* matrd *         50         50         50         50e
*    nfax *         1e
*    rftn *      523.0      523.0      520.0      500.0s
*    rftn *      500.0      400.0      350.0      330.0s
*    rftn *      310.0e
*
*d: Top of steam generator Separator wall node 2 (end part)
*******  type         num        userid              component name
htstr               1542          0             Steamdomewallend2
*      nzhstr        ittc        hscyl         ichf
          1           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri         hdro
          0           0           0          0.0          0.0
*       nhot         nodes         fmno        nzmax       reflood
          0           9           0          108            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0         10.0       1.0E-3       6300.0
*
*  idbcin *         2e
*  idbcon *         1e
* hcomon1  *       1546         2          0          0e
*   htc2   *        7.0       298.0e
* dhtstrz *       0.134e
*   rdx *     0.084266e
* radrd *        0.8  0.80766667  0.81533333      0.823      0.843s
* radrd *      0.863      0.883      0.903      0.923e
* matrd *          6          6          6         50s
```

```
* matrd *       50       50       50       50e
*   nfax *       1e
*   rftn *    523.0    523.0    520.0    500.0s
*   rftn *    500.0    400.0    350.0    330.0s
*   rftn *    310.0e
*******************************************
* Finished Heat Structure Section of Model *
*******************************************
*
end
*
*****************
* Timestep Data *
*****************
*      dtmin       dtmax        tend       rtwfp
      1.0E-6         1.0      1.0E4        10.0
*      edint       gfint      dmpint      sedint
       100.0        50.0       500.0        10.0
*
*     endflag
        -1.0
```

APPENDIX D

TRACE transient input of five layer pipe model for LOF-10 experiment

```
free format
*************
* main data *
*************
*
*     numtcr        ieos        inopt        nmat        id2o
          1           0           1           1           0
*
*****************
* namelist data *
*****************
*
 &inopts
  dtstrt=1.0,
  nfrc1=2,
  usesjc=3,
  nhtstr=17
 &end
*
***************
* Model Flags *
***************
*       dstep       timet
        10264         0.0
*       stdyst      transi       ncomp        njun        ipak
          0           1          38          27           0
*        epso        epss
       1.0E-4      1.0E-4
*      oitmax      sitmax      isolut      ncontr       nccfl
          10          10           0           0           0
*        ntsv        ntcb        ntcf        ntrp        ntcp
          28          12          46           0           0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                          +     1    153
* PIPE    *     2 s *                          +   152    154
* PIPE    *   122 s * SG3-coldcol                +    52      0
* PIPE    *   241 s * SG3-hotcol                 +    51      0
* PIPE    *   292 s *                          +     0    150
* PIPE    *   312 s *                          +   155     85
* PIPE    *   322 s *                          +   141     86
* PIPE    *   332 s *                          +   140     87
* PIPE    *   342 s *                          +   139     88
* PIPE    *   352 s * SG3-inlet                  +   128     51
* PIPE    *   353 s *                          +   129     52
* FILL    *   463 s *                          +   156
* PIPE    *   643 s *                          +     0    148
* BREAK   *   873 s *                            +   146
* PIPE    *   953 s *                          +   122    123
* PIPE    *   963 s *                          +   124    125
```

```
* PIPE    *   973 s *                    +   126   127
* HTSTR   *  1375 s * HL1-col-bot          +
* HTSTR   *  1380 s * CL1-col-bot          +
* HTSTR   *  1411 s * SG1-pool-wall1        +
* HTSTR   *  1412 s * SG1-pool-wall2        +
* HTSTR   *  1413 s * SG1-pool-wall3        +
* HTSTR   *  1414 s * SG1-pool-wall4        +
* HTSTR   *  1415 s * SG1-pool-wall5        +
* FILL    *  1420 s *                  +   128
* HTSTR   *  1421 s * SG1-wallend1         +
* HTSTR   *  1422 s * SG1-wallend2         +
* HTSTR   *  1423 s * SG1-wallend3         +
* HTSTR   *  1424 s * SG1-wallend4         +
* HTSTR   *  1425 s * SG1-wallend5         +
* BREAK   *  1430 s *                  +   129
* HTSTR   *  1506 s * Downcomer wall        +
* PIPE    *  1516 s *                  +   149   146
* HTSTR   *  1531 s * Steamdomewall1        +
* HTSTR   *  1532 s * Steamdomewall2        +
* HTSTR   *  1541 s * Steamdomewallend1      +
* HTSTR   *  1542 s * Steamdomewallend2      +
* SEPD    *  1546 e *                  +   148   149   150
*
**********************
* material properties *
**********************
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp      cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
************************************************
* Starting Signal Variable Section of Model     *
************************************************
*       idsv      isvn      ilcn      icn1      icn2
          1        20       643         1         5
*
*       idsv      isvn      ilcn      icn1      icn2
          2        20      1546         1         2
*n: FWmassflow
*
*       idsv      isvn      ilcn      icn1      icn2
        110        31       463         1         0
*
*       idsv      isvn      ilcn      icn1      icn2
        111         0         0         0         0
*n: tubelayer1
*
*       idsv      isvn      ilcn      icn1      icn2
        119       103         1         0         0
*n: tubelayer2
```

```
*
*    idsv     isvn     ilcn     icn1     icn2
     120      103       2        0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     121      103      953       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     122      103      963       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     123      103      973       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     124      103      241       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     125      103      122       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     375      103     1375       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     380      103     1380       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     411      103     1411       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     412      103     1412       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     413      103     1413       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     414      103     1414       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     415      103     1415       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     421      103     1421       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     422      103     1422       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     423      103     1423       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     424      103     1424       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
     425      103     1425       0        0
*
*    idsv     isvn     ilcn     icn1     icn2
```

```
      506       103       1506        0        0
*
*     idsv      isvn      ilcn       icn1      icn2
      531       103       1531        0        0
*
*     idsv      isvn      ilcn       icn1      icn2
      532       103       1532        0        0
*
*     idsv      isvn      ilcn       icn1      icn2
      541       103       1541        0        0
*
*     idsv      isvn      ilcn       icn1      icn2
      542       103       1542        0        0
************************************************
* Finished Signal Variable Section of Model    *
************************************************
*
*******************************************
* Starting Control System Section of Model *
*******************************************
****** Control Blocks ******
*
*      idcb      icbn      icb1      icb2      icb3
        -1         3         1         2         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
       1.0    -1.0E20     1.0E20       0.0       0.0
*
*      idcb      icbn      icb1      icb2      icb3
        -2       200        -1       -40         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
     160.0        0.0       0.6     0.712       0.0
*     cbdt      cbtau
     100.0       0.05
*
*n: Secheatlosses
*
*      idcb      icbn      icb1      icb2      icb3
        -3       103         4         0         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
       1.0    -1.0E20     1.0E20       0.0       0.0
* ids  *       531       532       541       542e
*
*      idcb      icbn      icb1      icb2      icb3
        -4         9         0         0         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
       1.0    -1.0E20     1.0E20      60.0       0.0
*
*      idcb      icbn      icb1      icb2      icb3
        -5        39       110        -4         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
       1.0    -1.0E20     1.0E20       0.0       0.0
*
*n: tubelayers
*
*      idcb      icbn      icb1      icb2      icb3
        -6       103         5         0         0
```

```
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
* ids  *       120      121      122      123s
* ids  *       119e
*
*n: collectors
*
*       idcb       icbn       icb1       icb2       icb3
          -7          3        124        125          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
*
*n: tubesandcoll
*
*       idcb       icbn       icb1       icb2       icb3
          -8          3         -6         -7          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
*
*n: Secheatlosses
*
*       idcb       icbn       icb1       icb2       icb3
          -9        103          5          0          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
* ids  *       411      412      413      414s
* ids  *       415e
*
*n: Secheatlosses
*
*       idcb       icbn       icb1       icb2       icb3
         -10        103          5          0          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
* ids  *       421      422      423      424s
* ids  *       425e
*
*n: Secheatlosses
*
*       idcb       icbn       icb1       icb2       icb3
         -11        103          4          0          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
* ids  *        -3       -10        -9       506e
*
*       idcb       icbn       icb1       icb2       icb3
         -40        101        111          4          0
*     cbgain      cbxmin      cbmax      cbcon1      cbcon2
        1.0     -1.0E20      1.0E20       0.0         0.0
* cbtbl *        0.0      0.712s
* cbtbl *     1000.0      0.712s
* cbtbl *     1001.0      0.000s
* cbtbl *      2.0E4      0.000e
*
*********************************************
* Finished Control System Section of Model  *
```

```
*****************************************
******* type        num      userid            component name
fill              1420         1                 unnamed
*      jun1       ifty       ioff
       128          6          0
*      iftr       ifsv       nftb       nfsv       nfrf
         0        111          5          0          0
*     twtold       rfmx      concin       felv
       0.0      1.0E20         0.0        0.0
*      dxin       volin      alpin       vlin       tlin
       1.0     0.015394         0.0        0.0      528.0
*       pin       pain      flowin       vvin       tvin
     7.3E6          0.0        0.0        0.0      528.0
*      vmscl      vvscl
       1.0          1.0
*      tlscl      tvscl      pscl       pascl      conscl
       1.0          1.0        1.0        1.0        1.0
*
* vmtbl *      0.0   0.40607s
* vmtbl *    1000.0   0.40607s
* vmtbl *    1100.0   0.05075875s
* vmtbl *    1600.0   0.05075875s
* vmtbl *    16000.0  0.05075875e
*
* vvtb *       0.0   0.40607s
* vvtb *     1000.0   0.40607s
* vvtb *     1100.0   0.05075875s
* vvtb *     1600.0   0.05075875s
* vvtb *     16000.0  0.05075875e
*
* tltb *       0.0   528.0s
* tltb *     1000.0   528.0s
* tltb *     1100.0   528.0s
* tltb *     1600.0   541.0s
* tltb *     16000.0  548.5e
*
* tvtb *       0.0   528.0s
* tvtb *     1000.0   528.0s
* tvtb *     1100.0   528.0s
* tvtb *     1600.0   541.0s
* tvtb *     16000.0  548.5e
*
* alptb *      0.0    0.0s
* alptb *    1000.0    0.0s
* alptb *    1100.0    0.0s
* alptb *    1600.0    0.0s
* alptb *    16000.0   0.0e
*
* ptb  *       0.0   7.3E6s
* ptb  *     1000.0   7.3E6s
* ptb  *     1100.0   7.3E6s
* ptb  *     1600.0   7.3E6s
* ptb  *    16000.0   7.3E6e
*
* patb *       0.0    0.0s
* patb *     1000.0    0.0s
```

```
* patb *     1100.0    0.0s
* patb *     1600.0    0.0s
* patb *    16000.0    0.0e
*
end
*
*****************
* Timestep Data *
*****************
*      dtmin       dtmax        tend       rtwfp
      1.0E-6         1.0       1.6E4        10.0
*      edint       gfint      dmpint      sedint
       100.0        50.0       500.0        10.0
*
*     endflag
        -1.0
```

APPENDIX E

TRACE steady state input of eight layer pipe model for LOF-10 experiment

```
free format
*
*************
* main data *
*************
*
*     numtcr       ieos       inopt       nmat       id2o
          1          0          1          1          0
*
*****************
* namelist data *
*****************
*
 &inopts
  dtstrt=0.1,
  nfrc1=2,
  usesjc=3,
  nhtstr=15,
  fluids='H2O'
 &end
*
***************
* Model Flags *
***************
*
*      dstep       timet
          0         0.0
*     stdyst      transi       ncomp        njun        ipak
          0           1          43          41           0
*       epso        epss
       1.0E-4      1.0E-4
*     oitmax      sitmax      isolut      ncontr       nccfl
          10          10           0           0           0
*       ntsv        ntcb        ntcf        ntrp        ntcp
          24           7          40           0           0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                        +     21     22
* PIPE    *     2 s *                        +     23     24
* PIPE    *     3 s *                        +     25     26
* PIPE    *   122 s * SG3-coldcol                  +     38      0
* PIPE    *   241 s * SG3-hotcol                   +     37      0
* PIPE    *   292 s *                        +      0      2
* PIPE    *   312 s *                        +      3      4
* PIPE    *   313 s *                        +      8      7
* PIPE    *   314 s *                        +     10      9
* PIPE    *   322 s *                        +     12     11
* PIPE    *   323 s *                        +     14     13
* PIPE    *   332 s *                        +     16     15
* PIPE    *   333 s *                        +     18     17
* PIPE    *   342 s *                        +     20     19
```

```
* PIPE    *   352 s * SG3-inlet              +    39    37
* PIPE    *   353 s *                      +    40    38
* FILL    *   463 s *                      +    41
* PIPE    *   643 s *                      +    0     1
* BREAK   *   873 s *                        +     6
* PIPE    *   953 s *                      +    27    28
* PIPE    *   954 s *                      +    29    30
* PIPE    *   963 s *                      +    31    32
* PIPE    *   964 s *                      +    33    34
* PIPE    *   973 s *                      +    35    36
* HTSTR   *  1375 s * HL1-col-bot             +
* HTSTR   *  1380 s * CL1-col-bot             +
* HTSTR   *  1411 s * SG1-pool-wall1           +
* HTSTR   *  1412 s * SG1-pool-wall2           +
* HTSTR   *  1413 s * SG1-pool-wall3           +
* HTSTR   *  1414 s * SG1-pool-wall4           +
* FILL    *  1420 s *                      +    39
* HTSTR   *  1421 s * SG1-wallend1            +
* HTSTR   *  1422 s * SG1-wallend2            +
* HTSTR   *  1423 s * SG1-wallend3            +
* HTSTR   *  1424 s * SG1-wallend4            +
* BREAK   *  1430 s *                      +    40
* HTSTR   *  1506 s * Downcomer wall           +
* PIPE    *  1516 s *                      +    5     6
* HTSTR   *  1531 s * Steamdomewall1          +
* HTSTR   *  1532 s * Steamdomewall2          +
* HTSTR   *  1541 s * Steamdomewallend1         +
* HTSTR   *  1542 s * Steamdomewallend2         +
* SEPD    *  1546 e *                      +    1     5     2
*
**********************
* material properties *
**********************
*
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp       cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
*
*
*
************************************************
* Starting Signal Variable Section of Model    *
************************************************
*
*      idsv       isvn       ilcn       icn1       icn2
         1          0          0          0          0
*
*      idsv       isvn       ilcn       icn1       icn2
         2         20       1546          1          2
```

```
*
*       idsv      isvn      ilcn      icn1      icn2
          3        20       643         1         8
*n: HTRPipe1
*
*       idsv      isvn      ilcn      icn1      icn2
         11       103         1         0         0
*n: HTRPipe2
*
*       idsv      isvn      ilcn      icn1      icn2
         12       103         2         0         0
*n: HTRPipe3
*
*       idsv      isvn      ilcn      icn1      icn2
         13       103         3         0         0
*n: HTRPipe4
*
*       idsv      isvn      ilcn      icn1      icn2
         14       103       953         0         0
*n: HTRPipe5
*
*       idsv      isvn      ilcn      icn1      icn2
         15       103       954         0         0
*n: HTRPipe6
*
*       idsv      isvn      ilcn      icn1      icn2
         16       103       963         0         0
*n: HTRPipe7
*
*       idsv      isvn      ilcn      icn1      icn2
         17       103       964         0         0
*n: HTRPipe8
*
*       idsv      isvn      ilcn      icn1      icn2
         18       103       973         0         0
*n: HLSEPD1
*
*       idsv      isvn      ilcn      icn1      icn2
         21       103      1531         0         0
*n: HLSEPD2
*
*       idsv      isvn      ilcn      icn1      icn2
         22       103      1532         0         0
*n: HLSEPD3
*
*       idsv      isvn      ilcn      icn1      icn2
         23       103      1541         0         0
*n: HLSEPD4
*
*       idsv      isvn      ilcn      icn1      icn2
         24       103      1542         0         0
*n: HLPOOL1
*
*       idsv      isvn      ilcn      icn1      icn2
         31       103      1411         0         0
*n: HLPOOL2
```

```
*
*      idsv       isvn       ilcn       icn1       icn2
         32        103       1412          0          0
*n: HLPOOL3
*
*      idsv       isvn       ilcn       icn1       icn2
         33        103       1413          0          0
*n: HLPOOL4
*
*      idsv       isvn       ilcn       icn1       icn2
         34        103       1414          0          0
*n: HLPOOL5
*
*      idsv       isvn       ilcn       icn1       icn2
         35        103       1421          0          0
*n: HLPOOL6
*
*      idsv       isvn       ilcn       icn1       icn2
         36        103       1422          0          0
*n: HLPOOL7
*
*      idsv       isvn       ilcn       icn1       icn2
         37        103       1423          0          0
*n: HLPOOL8
*
*      idsv       isvn       ilcn       icn1       icn2
         38        103       1424          0          0
*n: HLPOOL8
*
*      idsv       isvn       ilcn       icn1       icn2
         39        103       1506          0          0
************************************************
* Finished Signal Variable Section of Model     *
************************************************
*
*
*
*
*********************************************
* Starting Control System Section of Model  *
*********************************************
*
****** Control Blocks ******
*
*      idcb       icbn       icb1       icb2       icb3
         -1          3          2          3          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
        1.0     -1.0E20      1.0E20         0.0        0.0
*
*
*      idcb       icbn       icb1       icb2       icb3
         -2        200         -1        -40          0
*     cbgain      cbxmin      cbmax      cbcon1     cbcon2
       160.0         0.0        0.6      0.712        0.0
*      cbdt       cbtau
       100.0        0.05
```

```
*
*n: HTRPRtoSEC
*
*       idcb        icbn        icb1        icb2        icb3
          -3         103           8           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
          1.0     -1.0E20      1.0E20         0.0         0.0
* ids   *          11          12          13          14s
* ids   *          15          16          17          18e
*
*
*       idcb        icbn        icb1        icb2        icb3
          -4         103           4           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
          1.0     -1.0E20      1.0E20         0.0         0.0
* ids   *          21          22          23          24e
*
*
*       idcb        icbn        icb1        icb2        icb3
          -5         103           8           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
          1.0     -1.0E20      1.0E20         0.0         0.0
* ids   *          31          32          33          34s
* ids   *          35          36          37          38e
*
*n: HLSEC
*
*       idcb        icbn        icb1        icb2        icb3
          -6         57          -4          -5          39
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
          1.0     -1.0E20      1.0E20         0.0         0.0
*
*
*       idcb        icbn        icb1        icb2        icb3
         -40          9           0           0           0
*      cbgain      cbxmin      cbmax       cbcon1      cbcon2
          1.0     -1000.0      1000.0       0.712         0.0
*
*******************************************
* Finished Control System Section of Model *
*******************************************
*
*
*
*
******* type         num       userid              component name
pipe                  1          1                  unnamed
*      ncells       nodes        jun1        jun2        epsw
           5           4          21          22      2.0E-6
*      nsides
           0
*       ichf       iconc     pipetype        ipow       npipes
           1           0           0           0           9
*      iqptr       iqpsv       nqptb       nqpsv       nqprf
           0           0           0           0           0
*      radin          th       houtl       houtv       toutl
```

```
     6.5E-3       1.5E-3         0.0         0.0       300.0
*      toutv        pwin        pwoff        rpwmx       pwscl
     300.0         0.0         0.0       1.0E20         1.0
*       qpin        qpoff       rqpmx        qpscl       nhcom
        0.0         0.0         0.0          1.0         643
* dx   *      0.558     0.558     0.558     0.558s
* dx   *      0.558e
* vol  *  7.40646E-5 7.40646E-5 7.40646E-5 7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4 1.32732E-4 1.32732E-4 1.32732E-4s
* fa   *  1.32732E-4 1.32732E-4e
* fric *       0.5       0.0       0.0       0.35s
* fric *       0.0     0.998e
* fricr*       0.0       0.0       0.0       0.0s
* fricr*       0.0       0.0e
* grav *       0.0 7.37993E-3 7.37993E-3 -7.37993E-3s
* grav * -7.37993E-3       0.0e
* hd   *      0.013     0.013     0.013     0.013s
* hd   *      0.013     0.013e
* nff  *       -100      -100      -100      -100s
* nff  *       -100      -100e
* alp  *        0.0       0.0       0.0       0.0s
* alp  *        0.0e
* vl   *        0.7       0.7       0.7       0.7s
* vl   *        0.7       0.7e
* vv   *        0.7       0.7       0.7       0.7s
* vv   *        0.7       0.7e
* tl   *      528.0     528.0     528.0     528.0s
* tl   *      528.0e
* tv   *      528.0     528.0     528.0     528.0s
* tv   *      528.0e
* p    *      7.3E6     7.3E6     7.3E6     7.3E6s
* p    *      7.3E6e
* pa   *        0.0       0.0       0.0       0.0s
* pa   *        0.0e
* qpp  *        1.0       1.0       1.0       1.0       1.0s
* qpp  *        1.0       1.0       1.0       1.0       1.0s
* qpp  *        1.0       1.0       1.0       1.0       1.0s
* qpp  *        1.0       1.0       1.0       1.0       1.0e
*  matr*   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod*         0e
* nhcel*         8         8         8         8         8e
*
*
******* type         num       userid            component name
pipe                 2         1                 unnamed
*      ncells       nodes       jun1       jun2       epsw
         5           4          23         24       2.0E-6
*      nsides
         0
*       ichf       iconc     pipetype       ipow       npipes
         1          0          0          0          9
```

```
*      iqptr       iqpsv       nqptb       nqpsv       nqprf
         0           0           0           0           0
*      radin         th       houtl       houtv       toutl
      6.5E-3      1.5E-3         0.0         0.0       300.0
*      toutv       pwin       pwoff       rpwmx       pwscl
       300.0        0.0         0.0      1.0E20         1.0
*       qpin       qpoff       rqpmx       qpscl       nhcom
        0.0         0.0         0.0         1.0         643
* dx   *       0.558       0.558       0.558       0.558s
* dx   *       0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *         0.5         0.0         0.0        0.35s
* fric *         0.0       0.998e
* fricr*         0.0         0.0         0.0         0.0s
* fricr*         0.0         0.0e
* grav *         0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3         0.0e
* hd   *       0.013       0.013       0.013       0.013s
* hd   *       0.013       0.013e
* nff  *        -100        -100        -100        -100s
* nff  *        -100        -100e
* alp  *         0.0         0.0         0.0         0.0s
* alp  *         0.0e
* vl   *         0.7         0.7         0.7         0.7s
* vl   *         0.7         0.7e
* vv   *         0.7         0.7         0.7         0.7s
* vv   *         0.7         0.7e
* tl   *       528.0       528.0       528.0       528.0s
* tl   *       528.0e
* tv   *       528.0       528.0       528.0       528.0s
* tv   *       528.0e
* p    *       7.3E6       7.3E6       7.3E6       7.3E6s
* p    *       7.3E6e
* pa   *         0.0         0.0         0.0         0.0s
* pa   *         0.0e
* qpp  *         1.0         1.0         1.0         1.0         1.0s
* qpp  *         1.0         1.0         1.0         1.0         1.0s
* qpp  *         1.0         1.0         1.0         1.0         1.0s
* qpp  *         1.0         1.0         1.0         1.0         1.0e
*  matr*    f 6e
* tw   *       528.0       528.0       528.0       528.0       528.0s
* tw   *       528.0       528.0       528.0       528.0       528.0s
* tw   *       528.0       528.0       528.0       528.0       528.0s
* tw   *       528.0       528.0       528.0       528.0       528.0e
* idrod*         0e
* nhcel*         7           7           7           7           7e
*
*
******* type        num       userid            component name
pipe                3          1                 unnamed
*      ncells       nodes       jun1        jun2        epsw
         5           4          25          26        2.0E-6
*      nsides
```

```
          0
*       ichf       iconc     pipetype        ipow       npipes
          1          0          0          0          9
*       iqptr      iqpsv      nqptb      nqpsv      nqprf
          0          0          0          0          0
*       radin        th       houtl      houtv      toutl
      6.5E-3     1.5E-3        0.0        0.0      300.0
*       toutv      pwin      pwoff      rpwmx      pwscl
      300.0        0.0        0.0     1.0E20        1.0
*       qpin      qpoff      rqpmx      qpscl      nhcom
        0.0        0.0        0.0        1.0        643
* dx   *      0.558      0.558      0.558      0.558s
* dx   *      0.558e
* vol  *  7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *  1.32732E-4  1.32732E-4e
* fric *       0.5        0.0        0.0       0.35s
* fric *       0.0      0.998e
* fricr*       0.0        0.0        0.0        0.0s
* fricr*       0.0        0.0e
* grav *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav * -7.37993E-3        0.0e
* hd   *      0.013      0.013      0.013      0.013s
* hd   *      0.013      0.013e
* nff  *       -100       -100       -100       -100s
* nff  *       -100       -100e
* alp  *        0.0        0.0        0.0        0.0s
* alp  *        0.0e
* vl   *        0.7        0.7        0.7        0.7s
* vl   *        0.7        0.7e
* vv   *        0.7        0.7        0.7        0.7s
* vv   *        0.7        0.7e
* tl   *      528.0      528.0      528.0      528.0s
* tl   *      528.0e
* tv   *      528.0      528.0      528.0      528.0s
* tv   *      528.0e
* p    *      7.3E6      7.3E6      7.3E6      7.3E6s
* p    *      7.3E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0e
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0e
*  matr*   f 6e
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0e
* idrod*         0e
* nhcel*         6          6          6          6          6e
*
*
******* type        num       userid            component name
pipe              122          1              SG3-coldcol
```

```
*     ncells      nodes       jun1       jun2       epsw
        8          3          38          0       2.0E-6
*     nsides
        8
*      nclk       junlk       ncmpto      nclkto      nlevto
        8          22          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        7          24          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        6          26          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        5          28          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        4          30          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        3          32          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        2          34          0          0          0
*      theta      ientrn
       90.0         0
*      nclk       junlk       ncmpto      nclkto      nlevto
        1          36          0          0          0
*      theta      ientrn
       90.0         0
*      ichf       iconc     pipetype       ipow       npipes
        1          0          0          0          1
*      iqptr      iqpsv       nqptb       nqpsv       nqprf
        0          0          0          0          0
*      radin        th        houtl       houtv       toutl
       0.07        0.02        0.0         0.0        300.0
*      toutv        pwin       pwoff       rpwmx       pwscl
      300.0         0.0        0.0        1.0E20       1.0
*      qpin        qpoff       rqpmx       qpscl       nhcom
       0.0         0.0         0.0         1.0         643
* dx   *      0.163      0.096      0.096      0.096s
* dx   *      0.096      0.045      0.045      0.045e
* vol  *     2.5E-3    1.475E-3   1.475E-3   1.475E-3s
* vol  *    1.475E-3  6.66667E-4  6.66667E-4  6.66667E-4e
* fa   *  0.015393804 0.015393804 0.015393804 0.015393804s
* fa   *  0.015393804 0.015393804 0.015393804 0.015393804s
* fa   *  0.015393804e
* fric *        0.0        0.0        0.0        0.0s
* fric *        0.0        0.0        0.0        0.0s
* fric *        0.0e
```

```
* fricr *      0.0      0.0      0.0      0.0s
* fricr *      0.0      0.0      0.0      0.0s
* fricr *      0.0e
* grav  *      1.0      1.0      1.0      1.0s
* grav  *      1.0      1.0      1.0      1.0s
* grav  *      1.0e
* hd    *     0.14     0.14     0.14     0.14s
* hd    *     0.14     0.14     0.14     0.14s
* hd    *     0.14e
* nff   *     -100     -100     -100     -100s
* nff   *     -100     -100     -100     -100s
* nff   *     -100e
* alp   *      0.0      0.0      0.0      0.0s
* alp   *      0.0      0.0      0.0      0.0e
* vl    *    0.195    0.164    0.164    0.105s
* vl    *    0.105    0.047    0.047    0.047s
* vl    *      0.0e
* vv    *    0.195    0.164    0.164    0.105s
* vv    *    0.105    0.047    0.047    0.047s
* vv    *      0.0e
* tl    *    528.0    528.0    528.0    528.0s
* tl    *    528.0    528.0    528.0    528.0e
* tv    *    528.0    528.0    528.0    528.0s
* tv    *    528.0    528.0    528.0    528.0e
* p     *   7.3E6    7.3E6    7.3E6    7.3E6s
* p     *   7.3E6    7.3E6    7.3E6    7.3E6e
* pa    *      0.0      0.0      0.0      0.0s
* pa    *      0.0      0.0      0.0      0.0e
* qpp   *      1.0      1.0      1.0      1.0      1.0s
* qpp   *      1.0      1.0      1.0      1.0      1.0s
* qpp   *      1.0      1.0      1.0      1.0      1.0s
* qpp   *      1.0      1.0      1.0      1.0      1.0s
* qpp   *      1.0      1.0      1.0      1.0e
*  matr *   f 6e
* tw    *    526.0    526.0    526.0    526.0    526.0s
* tw    *    526.0    526.0    526.0    526.0    526.0s
* tw    *    526.0    526.0    526.0    526.0    526.0s
* tw    *    526.0    526.0    526.0    526.0    526.0s
* tw    *    526.0    526.0    526.0    526.0e
* idrod *       0e
* nhcel *        1        2        3        4        5s
* nhcel *        6        7        8e
*
*
******* type        num      userid          component name
pipe              241         1              SG3-hotcol
*     ncells      nodes      junl      jun2      epsw
        8         3         37          0      2.0E-6
*     nsides
        8
*      nclk      junlk      ncmpto      nclkto      nlevto
        8         21          0          0           0
*     theta      ientrn
      90.0          0
*      nclk      junlk      ncmpto      nclkto      nlevto
        7         23          0          0           0
```

```
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        6        25          0          0           0
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        5        27          0          0           0
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        4        29          0          0           0
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        3        31          0          0           0
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        2        33          0          0           0
*     theta     ientrn
      90.0        0
*     nclk      junlk      ncmpto      nclkto      nlevto
        1        35          0          0           0
*     theta     ientrn
      90.0        0
*     ichf      iconc     pipetype      ipow       npipes
        1         0          0          0           1
*     iqptr     iqpsv      nqptb      nqpsv       nqprf
        0         0          0          0           0
*     radin       th       houtl      houtv       toutl
      0.07       0.02       0.0        0.0        300.0
*     toutv      pwin       pwoff      rpwmx       pwscl
     300.0        0.0        0.0      1.0E20        1.0
*     qpin       qpoff      rqpmx      qpscl       nhcom
      0.0         0.0        0.0        1.0          643
* dx   *      0.163      0.096      0.096      0.096s
* dx   *      0.096      0.045      0.045      0.045e
* vol  *     2.5E-3    1.475E-3   1.475E-3   1.475E-3s
* vol  *    1.475E-3  6.66667E-4  6.66667E-4  6.66667E-4e
* fa   * 0.015393804 0.015393804 0.015393804 0.015393804s
* fa   * 0.015393804 0.015393804 0.015393804 0.015393804s
* fa   * 0.015393804e
* fric *        0.0        0.0        0.0        0.0s
* fric *        0.0        0.0        0.0        0.0s
* fric *        0.0e
* fricr*        0.0        0.0        0.0        0.0s
* fricr*        0.0        0.0        0.0        0.0s
* fricr*        0.0e
* grav *        1.0        1.0        1.0        1.0s
* grav *        1.0        1.0        1.0        1.0s
* grav *        1.0e
* hd   *       0.14       0.14       0.14       0.14s
* hd   *       0.14       0.14       0.14       0.14s
* hd   *       0.14e
* nff  *          1       -100       -100       -100s
```

```
* nff  *      -100      -100      -100      -100s
* nff  *      -100e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0       0.0       0.0       0.0e
* vl   *       0.0     0.164     0.164     0.105s
* vl   *     0.105     0.047     0.047     0.047s
* vl   *       0.0e
* vv   *       0.0     0.164     0.164     0.105s
* vv   *     0.105     0.047     0.047     0.047s
* vv   *       0.0e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0     528.0     528.0     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0     528.0     528.0     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6     7.3E6     7.3E6     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0       0.0       0.0       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     526.0     528.0     528.0s
* tw   *     526.0     528.0     528.0     526.0     528.0s
* tw   *     528.0     526.0     528.0     528.0     526.0s
* tw   *     528.0     528.0     526.0     528.0     528.0s
* tw   *     526.0     528.0     528.0     526.0e
* idrod *       0e
* nhcel *       1         2         3         4         5s
* nhcel *       6         7         8e
*
*
******* type        num       userid            component name
pipe              292         1                 unnamed
*     ncells      nodes       jun1        jun2        epsw
        8         0           0           2         2.0E-6
*     nsides
        9
*      nclk       junlk       ncmpto      nclkto      nlevto
        8          3           0           0           0
*      theta      ientrn
       90.0          0
*      nclk       junlk       ncmpto      nclkto      nlevto
        7          8           0           0           0
*      theta      ientrn
       90.0          0
*      nclk       junlk       ncmpto      nclkto      nlevto
        6         10           0           0           0
*      theta      ientrn
       90.0          0
*      nclk       junlk       ncmpto      nclkto      nlevto
        5         12           0           0           0
*      theta      ientrn
       90.0          0
```

```
*      nclk      junlk      ncmpto      nclkto      nlevto
         4         14          0          0           0
*     theta      ientrn
        90.0         0
*      nclk      junlk      ncmpto      nclkto      nlevto
         3         16          0          0           0
*     theta      ientrn
        90.0         0
*      nclk      junlk      ncmpto      nclkto      nlevto
         2         18          0          0           0
*     theta      ientrn
        90.0         0
*      nclk      junlk      ncmpto      nclkto      nlevto
         1         20          0          0           0
*     theta      ientrn
        90.0         0
*      nclk      junlk      ncmpto      nclkto      nlevto
         4         41          0          0           0
*     theta      ientrn
        90.0         0
*      ichf      iconc     pipetype       ipow      npipes
         1          0          0          0           1
*     radin         th      houtl      houtv       toutl
        0.0        0.0        0.0        0.0         0.0
*     toutv       pwin      pwoff      rpwmx       pwscl
        0.0        0.0        0.0        0.0         0.0
* dx   *      0.144      0.096      0.096      0.096s
* dx   *      0.096      0.045      0.045      0.045e
* vol  *  9.38074E-3  6.25383E-3  6.25383E-3  6.25383E-3s
* vol  *  6.25383E-3  2.93148E-3  2.93148E-3  2.93148E-3e
* fa   *  0.065144065 0.065144065 0.065144065 0.065144065s
* fa   *  0.065144065 0.065144065 0.065144065 0.065144065s
* fa   *    0.065185e
* fric *       0.0        0.0        0.0        0.0s
* fric *       0.0        0.0        0.0        0.0s
* fric *      10.0e
* fricr*       0.0        0.0        0.0        0.0s
* fricr*       0.0        0.0        0.0        0.0s
* fricr*       0.0e
* grav *       1.0        1.0        1.0        1.0s
* grav *       1.0        1.0        1.0        1.0s
* grav *       1.0e
* hd   *     0.288      0.288      0.288      0.288s
* hd   *     0.288      0.288      0.288      0.288s
* hd   *  0.28809047e
* nff  *      -100       -100       -100       -100s
* nff  *      -100       -100       -100       -100s
* nff  *        -1e
* alp  *       0.0        0.0        0.0        0.0s
* alp  *       0.0        0.0        0.0        0.0e
* vl   *       0.0        0.0        0.0        0.0s
* vl   *       0.0        0.0        0.0        0.0s
* vl   *       0.0e
* vv   *       0.0        0.0        0.0        0.0s
* vv   *       0.0        0.0        0.0        0.0s
* vv   *       0.0e
```

```
* tl   *    523.504    523.504    523.504    523.504s
* tl   *    523.504    523.504    523.504    523.504e
* tv   *    523.504    523.504    523.504    523.504s
* tv   *    523.504    523.504    523.504    523.504e
* p    *     4.0E6      4.0E6      4.0E6      4.0E6s
* p    *     4.0E6      4.0E6      4.0E6      4.0E6e
* pa   *       0.0        0.0        0.0        0.0s
* pa   *       0.0        0.0        0.0        0.0e
*
*
******* type        num       userid            component name
* single junction
pipe              312         1                 unnamed
*      ncells      nodes       jun1       jun2       epsw
         0          0          3          4       2.0E-6
*       ichf      iconc     pipetype      ipow      npipes
          1          0          0          0          1
*       radin        th       houtl      houtv      toutl
        0.0        0.0        0.0        0.0        0.0
*       toutv       pwin      pwoff      rpwmx      pwscl
        0.0        0.0        0.0        0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f    0.010177e
* fric * f        2.5e
* fricr * f      10.0e
* grav * f        0.0e
* hd   * f  0.11383215e
* nff  * f        -1e
* alp  *   f 0.0000e+00e
* vl   * f        0.0e
* vv   * f        0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num       userid            component name
* single junction
pipe              313         1                 unnamed
*      ncells      nodes       jun1       jun2       epsw
         0          0          8          7       2.0E-6
*       ichf      iconc     pipetype      ipow      npipes
          1          0          0          0          1
*       radin        th       houtl      houtv      toutl
        0.0        0.0        0.0        0.0        0.0
*       toutv       pwin      pwoff      rpwmx      pwscl
        0.0        0.0        0.0        0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f    0.010177e
* fric * f        2.5e
* fricr * f      10.0e
* grav * f        0.0e
* hd   * f  0.11383215e
```

```
* nff  * f       -1e
* alp  *  f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *  f 0.0000e+00e
* tv   *  f 0.0000e+00e
* p    *  f 0.0000e+00e
* pa   *  f 0.0000e+00e
*
*
******* type        num       userid            component name
* single junction
pipe              314         1                 unnamed
*     ncells       nodes       jun1       jun2       epsw
        0          0          10          9      2.0E-6
*      ichf       iconc     pipetype       ipow      npipes
        1          0          0          0          1
*      radin        th        houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*      toutv       pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *  f 0.0000e+00e
* vol  *  f 0.0000e+00e
* fa   * f   0.010177e
* fric * f       2.5e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.11383215e
* nff  * f       -1e
* alp  *  f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *  f 0.0000e+00e
* tv   *  f 0.0000e+00e
* p    *  f 0.0000e+00e
* pa   *  f 0.0000e+00e
*
*
******* type        num       userid            component name
* single junction
pipe              322         1                 unnamed
*     ncells       nodes       jun1       jun2       epsw
        0          0          12          11      2.0E-6
*      ichf       iconc     pipetype       ipow      npipes
        1          0          0          0          1
*      radin        th        houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*      toutv       pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *  f 0.0000e+00e
* vol  *  f 0.0000e+00e
* fa   * f   0.021715e
* fric * f       2.6e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.16627807e
```

```
* nff  * f        -1e
* alp  *   f 0.0000e+00e
* vl   * f        0.0e
* vv   * f        0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num       userid             component name
* single junction
pipe              323         1                  unnamed
*      ncells       nodes       jun1        jun2        epsw
         0          0          14          13       2.0E-6
*       ichf       iconc     pipetype        ipow       npipes
          1          0          0          0          1
*       radin         th       houtl       houtv       toutl
        0.0        0.0        0.0        0.0        0.0
*       toutv       pwin       pwoff       rpwmx       pwscl
        0.0        0.0        0.0        0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f    0.021715e
* fric * f        2.6e
* fricr * f       10.0e
* grav * f        0.0e
* hd   * f  0.16627807e
* nff  * f        -1e
* alp  *   f 0.0000e+00e
* vl   * f        0.0e
* vv   * f        0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num       userid             component name
* single junction
pipe              332         1                  unnamed
*      ncells       nodes       jun1        jun2        epsw
         0          0          16          15       2.0E-6
*       ichf       iconc     pipetype        ipow       npipes
          1          0          0          0          1
*       radin         th       houtl       houtv       toutl
        0.0        0.0        0.0        0.0        0.0
*       toutv       pwin       pwoff       rpwmx       pwscl
        0.0        0.0        0.0        0.0        0.0
* dx   *   f 0.0000e+00e
* vol  *   f 0.0000e+00e
* fa   * f    0.021715e
* fric * f        2.6e
* fricr * f       10.0e
* grav * f        0.0e
* hd   * f  0.16627807e
```

```
* nff  * f       -1e
* alp  *  f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *  f 0.0000e+00e
* tv   *  f 0.0000e+00e
* p    *  f 0.0000e+00e
* pa   *  f 0.0000e+00e
*
*
******* type        num      userid            component name
* single junction
pipe              333        1                 unnamed
*     ncells      nodes      jun1      jun2      epsw
        0         0         18        17      2.0E-6
*      ichf      iconc    pipetype      ipow      npipes
        1         0         0         0         1
*     radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*     toutv       pwin      pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *  f 0.0000e+00e
* vol  *  f 0.0000e+00e
* fa   * f   0.021715e
* fric * f       2.6e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.16627807e
* nff  * f       -1e
* alp  *  f 0.0000e+00e
* vl   * f       0.0e
* vv   * f       0.0e
* tl   *  f 0.0000e+00e
* tv   *  f 0.0000e+00e
* p    *  f 0.0000e+00e
* pa   *  f 0.0000e+00e
*
*
******* type        num      userid            component name
* single junction
pipe              342        1                 unnamed
*     ncells      nodes      jun1      jun2      epsw
        0         0         20        19      2.0E-6
*      ichf      iconc    pipetype      ipow      npipes
        1         0         0         0         1
*     radin        th      houtl      houtv      toutl
       0.0       0.0       0.0       0.0       0.0
*     toutv       pwin      pwoff      rpwmx      pwscl
       0.0       0.0       0.0       0.0       0.0
* dx   *  f 0.0000e+00e
* vol  *  f 0.0000e+00e
* fa   * f    0.03687e
* fric * f       2.4e
* fricr * f      10.0e
* grav * f       0.0e
* hd   * f  0.21666643e
```

```
* nff  * f        -1e
* alp  *   f 0.0000e+00e
* vl   * f        0.0e
* vv   * f        0.0e
* tl   *   f 0.0000e+00e
* tv   *   f 0.0000e+00e
* p    *   f 0.0000e+00e
* pa   *   f 0.0000e+00e
*
*
******* type        num      userid            component name
pipe              352          1                SG3-inlet
*     ncells       nodes       jun1       jun2       epsw
        1          0          39         37       2.0E-6
*     nsides
        0
*      ichf       iconc     pipetype       ipow       npipes
        1          0          0          0          1
*     radin         th       houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*     toutv        pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *      0.255e
* vol  *  3.92542E-3e
* fa   *  0.015393804 0.015393804e
* fric *       0.0        0.0e
* fricr *      0.0        0.0e
* grav *       1.0        1.0e
* hd   *      0.14       0.14e
* nff  *      -100         1e
* alp  *       0.0e
* vl   *     0.195        0.0e
* vv   *     0.195        0.0e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *       0.0e
*
*
******* type        num      userid            component name
pipe              353          1                unnamed
*     ncells       nodes       jun1       jun2       epsw
        1          0          40         38       2.0E-6
*     nsides
        0
*      ichf       iconc     pipetype       ipow       npipes
        1          0          0          0          1
*     radin         th       houtl       houtv       toutl
       0.0        0.0        0.0        0.0        0.0
*     toutv        pwin       pwoff       rpwmx       pwscl
       0.0        0.0        0.0        0.0        0.0
* dx   *      0.255e
* vol  *  3.92542E-3e
* fa   *  0.015393804 0.015393804e
* fric *      0.448        0.0e
* fricr *      0.0        0.0e
```

```
* grav *       1.0       1.0e
* hd   *      0.14      0.14e
* nff  *      -100      -100e
* alp  *       0.0e
* vl   *       0.0     0.195e
* vv   *       0.0     0.195e
* tl   *     528.0e
* tv   *     528.0e
* p    *     7.3E6e
* pa   *       0.0e
*
*
******* type        num      userid            component name
fill              463         1                 unnamed
*      jun1       ifty       ioff
         41          5          0
*      iftr       ifsv       nftb       nfsv       nfrf
          0         -2          0          0          0
*     twtold       rfmx      concin       felv
        0.0      1.0E20        0.0        0.0
*       dxin       volin      alpin       vlin       tlin
      0.192      0.0126        0.0        0.0      298.0
*       pin        pain      flowin       vvin       tvin
     4.0E6         0.0       0.027        0.0      298.0
*
*
******* type        num      userid            component name
pipe              643         1                 unnamed
*     ncells      nodes       jun1       jun2       epsw
          8          0          0          1     2.0E-6
*     nsides
          8
*       nclk      junlk      ncmpto      nclkto      nlevto
          8          4          0          0          0
*      theta      ientrn
       90.0          0
*       nclk      junlk      ncmpto      nclkto      nlevto
          7          7          0          0          0
*      theta      ientrn
       90.0          0
*       nclk      junlk      ncmpto      nclkto      nlevto
          6          9          0          0          0
*      theta      ientrn
       90.0          0
*       nclk      junlk      ncmpto      nclkto      nlevto
          5         11          0          0          0
*      theta      ientrn
       90.0          0
*       nclk      junlk      ncmpto      nclkto      nlevto
          4         13          0          0          0
*      theta      ientrn
       90.0          0
*       nclk      junlk      ncmpto      nclkto      nlevto
          3         15          0          0          0
*      theta      ientrn
       90.0          0
```

```
*      nclk      junlk      ncmpto      nclkto      nlevto
         2         17          0           0           0
*     theta      ientrn
      90.0          0
*      nclk      junlk      ncmpto      nclkto      nlevto
         1         19          0           0           0
*     theta      ientrn
      90.0          0
*      ichf      iconc     pipetype       ipow      npipes
         1          0          0          0           1
*     radin         th      houtl      houtv       toutl
      0.0         0.0        0.0        0.0         0.0
*     toutv       pwin      pwoff      rpwmx       pwscl
      0.0         0.0        0.0        0.0         0.0
* dx   *      0.163      0.096      0.096      0.096s
* dx   *      0.096      0.045      0.045      0.045e
* vol  *     0.1362     0.1374     0.1374     0.15815s
* vol  *    0.15815 0.070466667 0.070466667 0.070466667e
* fa   *    1.29195    1.29195    1.49226      1.707s
* fa   *  1.7272354    1.74759  1.6444949   1.544534s
* fa   *   1.25336e
* fric *        0.0        0.0        0.0        0.0s
* fric *        0.0        0.0        0.0        0.0s
* fric *       0.0e
* fricr*        0.0        0.0        0.0        0.0s
* fricr*        0.0        0.0        0.0        0.0s
* fricr*       0.0e
* grav *        1.0        1.0        1.0        1.0s
* grav *        1.0        1.0        1.0        1.0s
* grav *       1.0e
* hd   *   1.314779   1.314779   1.314779   1.314779s
* hd   *   1.314779   1.314779  1.3290772  1.3433755s
* hd   *  1.2632607e
* nff  *       -100       -100       -100       -100s
* nff  *       -100       -100       -100       -100s
* nff  *         1e
* alp  *        0.0        0.0        0.0        0.0s
* alp  *        0.0        0.0        0.0        0.0e
* vl   *        0.0        0.0        0.0        0.0s
* vl   *        0.0        0.0        0.0        0.0s
* vl   *       0.0e
* vv   *        0.0        0.0        0.0        0.0s
* vv   *        0.0        0.0        0.0        0.0s
* vv   *       0.0e
* tl   *      523.0      523.0      523.0      523.0s
* tl   *      523.0      523.0      523.0      523.0e
* tv   *      523.0      523.0      523.0      523.0s
* tv   *      523.0      523.0      523.0      523.0e
* p    *     4.0E6      4.0E6      4.0E6      4.0E6s
* p    *     4.0E6      4.0E6      4.0E6      4.0E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0        0.0        0.0        0.0e
*
*
******* type        num       userid            component name
break              873          1                 unnamed
```

```
*       jun1        ibty        isat        ioff     adjpress
          6           0           0           0           0
*       dxin       volin       alpin         tin         pin
    2.127995       0.027         1.0       523.0       4.0E6
*       pain      concin        rbmx        poff        belv
         0.0         0.0     1.0E20         0.0         0.0
*
*
*******  type        num      userid              component name
pipe               953          1                   unnamed
*     ncells       nodes       jun1       jun2        epsw
          5           4         27         28      1.0E-6
*     nsides
          0
*       ichf       iconc    pipetype        ipow       npipes
          1           0           0           0          18
*      iqptr       iqpsv       nqptb       nqpsv       nqprf
          0           0           0           0           0
*      radin          th       houtl       houtv       toutl
      6.5E-3      1.5E-3         0.0         0.0       300.0
*      toutv        pwin       pwoff       rpwmx        pwscl
      300.0         0.0         0.0     1.0E20          1.0
*       qpin        qpoff       rqpmx       qpscl        nhcom
        0.0         0.0         0.0         1.0         643
* dx   *       0.558       0.558       0.558       0.558s
* dx   *       0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *         0.5         0.0         0.0        0.35s
* fric *         0.0       0.998e
* fricr*         0.0         0.0         0.0         0.0s
* fricr*         0.0         0.0e
* grav *         0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3         0.0e
* hd   *       0.013       0.013       0.013       0.013s
* hd   *       0.013       0.013e
* nff  *           1           1           1           1s
* nff  *           1          1e
* alp  *         0.0         0.0         0.0         0.0s
* alp  *         0.0e
* vl   *         0.7         0.7         0.7         0.7s
* vl   *         0.7         0.7e
* vv   *         0.7         0.7         0.7         0.7s
* vv   *         0.7         0.7e
* tl   *       528.0       528.0       528.0       528.0s
* tl   *       528.0e
* tv   *       528.0       528.0       528.0       528.0s
* tv   *       528.0e
* p    *       7.3E6       7.3E6       7.3E6       7.3E6s
* p    *       7.3E6e
* pa   *         0.0         0.0         0.0         0.0s
* pa   *         0.0e
* qpp  *         1.0         1.0         1.0         1.0         1.0s
* qpp  *         1.0         1.0         1.0         1.0         1.0s
```

```
* qpp  *      1.0      1.0      1.0      1.0      1.0s
* qpp  *      1.0      1.0      1.0      1.0      1.0e
*  matr *  f 6e
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0s
* tw   *    528.0    528.0    528.0    528.0    528.0e
* idrod *       0e
* nhcel *       5        5        5        5        5e
*
*
******* type        num      userid           component name
pipe             954          1                 unnamed
*     ncells      nodes       jun1       jun2       epsw
          5          4         29         30     1.0E-6
*     nsides
            0
*      ichf      iconc    pipetype       ipow      npipes
            1          0          0          0         18
*      iqptr      iqpsv      nqptb      nqpsv      nqprf
            0          0          0          0          0
*      radin         th      houtl      houtv      toutl
        6.5E-3     1.5E-3        0.0        0.0      300.0
*      toutv      pwin       pwoff      rpwmx      pwscl
        300.0        0.0        0.0     1.0E20        1.0
*      qpin       qpoff      rqpmx      qpscl      nhcom
          0.0        0.0        0.0        1.0        643
* dx   *     0.558     0.558     0.558     0.558s
* dx   *     0.558e
* vol  *  7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *  7.40646E-5e
* fa   *  1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *  1.32732E-4  1.32732E-4e
* fric *       0.5       0.0       0.0      0.35s
* fric *       0.0     0.998e
* fricr *      0.0       0.0       0.0       0.0s
* fricr *      0.0       0.0e
* grav *       0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3       0.0e
* hd   *     0.013     0.013     0.013     0.013s
* hd   *     0.013     0.013e
* nff  *         1         1         1         1s
* nff  *         1         1e
* alp  *       0.0       0.0       0.0       0.0s
* alp  *       0.0e
* vl   *       0.7       0.7       0.7       0.7s
* vl   *       0.7       0.7e
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
```

```
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *        0e
* nhcel *        4         4         4         4         4e
*
*
******* type        num       userid          component name
pipe              963          1                 unnamed
*      ncells       nodes       jun1        jun2        epsw
         5           4          31          32       1.0E-6
*      nsides
         0
*       ichf       iconc     pipetype        ipow      npipes
         1           0          0          0          18
*       iqptr      iqpsv       nqptb       nqpsv       nqprf
         0           0          0          0          0
*       radin        th        houtl       houtv       toutl
      6.5E-3      1.5E-3        0.0         0.0        300.0
*       toutv       pwin       pwoff       rpwmx       pwscl
      300.0         0.0        0.0       1.0E20         1.0
*       qpin        qpoff       rqpmx       qpscl       nhcom
         0.0         0.0        0.0         1.0         643
* dx   *      0.558     0.558     0.558     0.558s
* dx   *      0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *        0.5       0.0       0.0       0.35s
* fric *        0.0      0.998e
* fricr *       0.0       0.0       0.0       0.0s
* fricr *       0.0       0.0e
* grav *        0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3       0.0e
* hd   *      0.013     0.013     0.013     0.013s
* hd   *      0.013     0.013e
* nff  *         1         1         1         1s
* nff  *         1         1e
* alp  *        0.0       0.0       0.0       0.0s
* alp  *        0.0e
* vl   *        0.7       0.7       0.7       0.7s
* vl   *        0.7       0.7e
* vv   *        0.7       0.7       0.7       0.7s
* vv   *        0.7       0.7e
* tl   *      528.0     528.0     528.0     528.0s
* tl   *      528.0e
* tv   *      528.0     528.0     528.0     528.0s
* tv   *      528.0e
```

```
* p    *      7.3E6      7.3E6      7.3E6      7.3E6s
* p    *      7.3E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0e
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0e
*  matr *   f 6e
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0e
* idrod *         0e
* nhcel *         3          3          3          3          3e
*
*
******* type        num       userid            component name
pipe              964          1                 unnamed
*      ncells       nodes        jun1        jun2        epsw
         5           4          33          34       1.0E-6
*      nsides
         0
*       ichf       iconc     pipetype         ipow       npipes
         1           0           0           0          18
*       iqptr      iqpsv       nqptb       nqpsv       nqprf
         0           0           0           0           0
*       radin         th       houtl       houtv       toutl
      6.5E-3      1.5E-3         0.0         0.0       300.0
*       toutv       pwin       pwoff       rpwmx       pwscl
       300.0        0.0         0.0      1.0E20         1.0
*       qpin       qpoff       rqpmx       qpscl       nhcom
        0.0         0.0         0.0         1.0         643
* dx   *       0.558       0.558       0.558       0.558s
* dx   *       0.558e
* vol  *   7.40646E-5  7.40646E-5  7.40646E-5  7.40646E-5s
* vol  *   7.40646E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *         0.5         0.0         0.0        0.35s
* fric *         0.0       0.998e
* fricr *        0.0         0.0         0.0         0.0s
* fricr *        0.0         0.0e
* grav *         0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3         0.0e
* hd   *       0.013       0.013       0.013       0.013s
* hd   *       0.013       0.013e
* nff  *           1           1           1           1s
* nff  *           1           1e
* alp  *         0.0         0.0         0.0         0.0s
* alp  *         0.0e
* vl   *         0.7         0.7         0.7         0.7s
* vl   *         0.7         0.7e
* vv   *         0.7         0.7         0.7         0.7s
* vv   *         0.7         0.7e
* tl   *       528.0       528.0       528.0       528.0s
```

```
* tl   *      528.0e
* tv   *      528.0      528.0      528.0      528.0s
* tv   *      528.0e
* p    *      7.3E6      7.3E6      7.3E6      7.3E6s
* p    *      7.3E6e
* pa   *        0.0        0.0        0.0        0.0s
* pa   *        0.0e
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0s
* qpp  *        1.0        1.0        1.0        1.0        1.0e
*  matr *   f 6e
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0s
* tw   *      528.0      528.0      528.0      528.0      528.0e
* idrod *         0e
* nhcel *         2          2          2          2          2e
*
*
******* type        num       userid            component name
pipe              973          1                 unnamed
*     ncells       nodes       jun1       jun2       epsw
          5           4          35         36      1.0E-6
*     nsides
          0
*      ichf       iconc     pipetype       ipow       npipes
          1           0          0          0          19
*     iqptr       iqpsv      nqptb      nqpsv      nqprf
          0           0          0          0          0
*     radin         th       houtl      houtv      toutl
      6.5E-3      1.5E-3        0.0        0.0      300.0
*     toutv       pwin       pwoff      rpwmx      pwscl
      300.0        0.0        0.0      1.0E20       1.0
*      qpin       qpoff      rqpmx      qpscl      nhcom
       0.0         0.0        0.0        1.0         643
* dx   *      0.542      0.542      0.542      0.542s
* dx   *      0.542e
* vol  *   7.19409E-5  7.19409E-5  7.19409E-5  7.19409E-5s
* vol  *   7.19409E-5e
* fa   *   1.32732E-4  1.32732E-4  1.32732E-4  1.32732E-4s
* fa   *   1.32732E-4  1.32732E-4e
* fric *        0.5        0.0        0.0        0.35s
* fric *        0.0      0.998e
* fricr *       0.0        0.0        0.0        0.0s
* fricr *       0.0        0.0e
* grav *        0.0  7.37993E-3  7.37993E-3 -7.37993E-3s
* grav *  -7.37993E-3        0.0e
* hd   *      0.013      0.013      0.013      0.013s
* hd   *      0.013      0.013e
* nff  *       -100       -100       -100       -100s
* nff  *       -100       -100e
* alp  *        0.0        0.0        0.0        0.0s
* alp  *        0.0e
* vl   *        0.7        0.7        0.7        0.7s
* vl   *        0.7        0.7e
```

```
* vv   *       0.7       0.7       0.7       0.7s
* vv   *       0.7       0.7e
* tl   *     528.0     528.0     528.0     528.0s
* tl   *     528.0e
* tv   *     528.0     528.0     528.0     528.0s
* tv   *     528.0e
* p    *     7.3E6     7.3E6     7.3E6     7.3E6s
* p    *     7.3E6e
* pa   *       0.0       0.0       0.0       0.0s
* pa   *       0.0e
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0s
* qpp  *       1.0       1.0       1.0       1.0       1.0e
*  matr *   f 6e
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0s
* tw   *     528.0     528.0     528.0     528.0     528.0e
* idrod *       0e
* nhcel *       1         1         1         1         1e
*
*
******* type        num      userid           component name
fill             1420          1                unnamed
*       jun1       ifty       ioff
         39         5          0
*       iftr       ifsv       nftb       nfsv       nfrf
          0         1          2          0          0
*      twtold      rfmx      concin      felv
         0.0      1.0E20      0.0        0.0
*       dxin       volin      alpin      vlin       tlin
         1.0     0.015394      0.0        0.0       528.0
*        pin       pain      flowin      vvin       tvin
       7.3E6       0.0        5.0        0.0       528.0
*       vmscl      vvscl
         1.0        1.0
*
* vmtbv *       0.0       5.0s
* vmtbv *      1.0E4      5.0e
*
*
******* type        num      userid           component name
break            1430          1                unnamed
*       jun1       ibty       isat       ioff     adjpress
         40         0          0          0          0
*       dxin       volin      alpin      tin        pin
         1.0     0.015394      0.0       528.0      7.3E6
*       pain       concin     rbmx       poff       belv
         0.0        0.0      1.0E20      0.0        0.0
*
*
******* type        num      userid           component name
pipe             1516          1                unnamed
*      ncells      nodes      jun1       jun2       epsw
          3          0          5          6       2.0E-6
```

```
*     nsides
        0
*      ichf       iconc     pipetype        ipow       npipes
         1          0          0          0          1
*      radin         th       houtl       houtv       toutl
        0.0        0.0        0.0        0.0        0.0
*      toutv        pwin       pwoff       rpwmx       pwscl
        0.0        0.0        0.0        0.0        0.0
* dx   *  0.70933333  0.70933333  0.70933333e
* vol  *  8.99977E-3  8.99977E-3  8.99977E-3e
* fa   *    0.91399 0.012687644 0.012687644 0.012687644e
* fric *        3.0        0.0        0.0        3.0e
* fricr*        0.0        0.0        0.0        0.0e
* grav *        1.0        0.0        0.0        0.0e
* hd   *  1.2632607     0.1271     0.1271     0.1271e
* nff  *         -1          1          1          1e
* alp  *        1.0        1.0        1.0e
* vl   *        0.0        0.0        0.0        0.0e
* vv   *        0.0        0.0        0.0        0.0e
* tl   *      523.0      523.0      523.0e
* tv   *      523.0      523.0      523.0e
* p    *      4.0E6      4.0E6      4.0E6e
* pa   *        0.0        0.0        0.0e
*
*
* type             num          id          ctitle
sepd               1546           0                 unnamed
*      jcell       nodes        ichf        cost        epsw
         2          0          1        -1.0         0.0
*      nseps       ndryr      istage         xco         xcu
         1          0          0         0.0         1.0
*      alpsmn      alpsmx
        0.0         1.0
*      iconc1      ncell1       jun1        jun2       ipow1
         0          2          1          5          0
*      radin         th       houtl       houtv       toutl
        0.0        0.0        0.0        0.0        0.0
*      toutv        pwin       pwoff       rpwmx       pwscl
        0.0        0.0        0.0        0.0        0.0
*      iconc2      ncell2       jun3       ipow2
         0          1          2          0
*      radin2        th2      houtl2      houtv2      toutl2
        0.0        0.0        0.0        0.0        0.0
*      toutv2       pwin2      pwoff2      rpwmx2      pwscl2
        0.0        0.0        0.0        0.0        0.0
* dx1  *      0.134      0.134e
* vol1 *    0.211153   0.1247487e
* fa1  *    1.25336    1.25336    0.91399e
* fric1*        0.0        0.0        3.0e
* fricr1*       0.0        0.0        0.0e
* grav1*        1.0        1.0        1.0e
* hd1  *  1.2632607  1.2632607  1.2632607e
* nff1 *          1         -1         -1e
* alp1 *       0.67        1.0e
* vl1  *        0.0        0.0        0.0e
* vv1  *        0.0        0.0        0.0e
```

```
* tl1  *      523.0      523.0e
* tv1  *      523.0      523.0e
* p1   *      4.0E6      4.0E6e
* pa1  *        0.0        0.0e
* dx2  *      0.067e
* vol2 *  3.25925E-3e
* fa2  *   0.065185   0.065185e
* fric2 *       0.0        0.0e
* fricr2*       0.0       10.0e
* grav2 *      -1.0       -1.0e
* hd2  *  0.28809047  0.28809047e
* nff2 *        -1         -1e
* alp2 *       1.0e
* vl2  *       0.0        0.0e
* vv2  *       0.0        0.0e
* tl2  *     523.0e
* tv2  *     523.0e
* p2   *     4.0E6e
* pa2  *       0.0e
*
*
*****************************************
* Starting Heat Structure Section of Model *
*****************************************
*
******* type         num       userid             component name
htstr              1375          0                HL1-col-bot
*      nzhstr        ittc        hscyl         ichf
           1           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
           1           3           0            0
*       nmwrx         nfci        nfcil         hdri         hdro
           0           0           0          0.0          0.0
*        nhot        nodes         fmno        nzmax      reflood
           0           8           0          100            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
         2.0         10.0       1.0E-3       6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *       352         1         0         0e
*  htc2  *       7.0       298.0e
* dhtstrz *     0.255e
*  rdx *         1.0e
* radrd *       0.07 0.076666667 0.083333333       0.09      0.105s
* radrd *       0.12      0.135       0.15e
* matrd *          6          6          6        50s
* matrd *         50         50         50e
*   nfax *         1e
*   rftn *      528.0      528.0      500.0      400.0s
*   rftn *      350.0      330.0      310.0      300.0e
*
******* type         num       userid             component name
htstr              1380          0                CL1-col-bot
*      nzhstr        ittc        hscyl         ichf
           1           0           1            1
```

```
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri        hdro
          0           0           0          0.0         0.0
*       nhot         nodes        fmno        nzmax       reflood
          0           8           0          100           0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0          10.0       1.0E-3       6300.0
*
* idbcin *          2e
* idbcon *          1e
* hcomon1 *         353          1           0          0e
*  htc2  *          7.0        298.0e
* dhtstrz *        0.255e
*  rdx *           1.0e
* radrd *        0.07 0.076666667 0.083333333       0.09       0.105s
* radrd *        0.12       0.135       0.15e
* matrd *          6           6           6         50s
* matrd *         50          50          50e
*   nfax *         1e
*   rftn *       520.0       520.0       500.0       400.0s
*   rftn *       350.0       330.0       310.0       300.0e
*
******* type          num         userid              component name
htstr              1411            0                SG1-pool-wall1
*      nzhstr        ittc        hscyl         ichf
          1           0           1            1
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
*       nmwrx         nfci        nfcil        hdri        hdro
          0           0           0          0.0         0.0
*       nhot         nodes        fmno        nzmax       reflood
          0           8           0          100           0
*     dtxht(1)     dtxht(2)       dznht        hgapo
        2.0          10.0       1.0E-3       6300.0
*
* idbcin *          2e
* idbcon *          1e
* hcomon1 *         643          1           0          0e
*  htc2  *          7.0        298.0e
* dhtstrz *       0.163e
*  rdx *        1.29996e
* radrd *        0.475 0.48333333 0.49166667       0.5       0.525s
* radrd *        0.55       0.575       0.6e
* matrd *          6           6           6         50s
* matrd *         50          50          50e
*   nfax *         1e
*   rftn *       523.0       521.0       510.0       470.0s
*   rftn *       450.0       400.0       350.0       300.0e
*
******* type          num         userid              component name
htstr              1412            0                SG1-pool-wall2
*      nzhstr        ittc        hscyl         ichf
          2           0           1            1
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0            0
```

```
*      nmwrx        nfci        nfcil        hdri        hdro
         0           0           0          0.0         0.0
*       nhot       nodes        fmno        nzmax      reflood
         0           8           0          100          0
*    dtxht(1)     dtxht(2)      dznht       hgapo
        2.0         10.0       1.0E-3      6300.0
*
* idbcin *         2          2e
* idbcon *         1          1e
* hcomon1  *       643        2          0          0e
* hcomon1  *       643        3          0          0e
*  htc2  *        7.0       298.0e
*  htc2  *        7.0       298.0e
* dhtstrz *      0.163      0.163e
*  rdx *      0.75802e
* radrd *       0.475  0.48333333  0.49166667       0.5      0.525s
* radrd *       0.55       0.575       0.6e
* matrd *         6          6          6         50s
* matrd *        50         50         50e
*   nfax *        1          1e
*    rftn *     523.0      521.0      510.0      470.0s
*    rftn *     450.0      400.0      350.0      300.0s
*    rftn *     523.0      521.0      510.0      470.0s
*    rftn *     450.0      400.0      350.0      300.0e
*
******* type          num        userid             component name
htstr               1413          0                SG1-pool-wall3
*      nzhstr        ittc        hscyl        ichf
         2           0           1           1
*    nofuelrod       plane       liqlev       iaxcnd
         1           3           0           0
*      nmwrx        nfci        nfcil        hdri        hdro
         0           0           0          0.0         0.0
*       nhot       nodes        fmno        nzmax      reflood
         0           8           0          107          0
*    dtxht(1)     dtxht(2)      dznht       hgapo
        2.0         10.0       1.0E-3      6300.0
*
* idbcin *         2          2e
* idbcon *         1          1e
* hcomon1  *       643        4          0          0e
* hcomon1  *       643        5          0          0e
*  htc2  *        7.0       298.0e
*  htc2  *        7.0       298.0e
* dhtstrz *      0.096      0.067e
*  rdx *      0.66983e
* radrd *       0.475  0.48333333  0.49166667       0.5      0.525s
* radrd *       0.55       0.575       0.6e
* matrd *         6          6          6         50s
* matrd *        50         50         50e
*   nfax *        1          1e
*    rftn *     523.0      521.0      510.0      470.0s
*    rftn *     450.0      400.0      350.0      300.0s
*    rftn *     523.0      521.0      510.0      470.0s
*    rftn *     450.0      400.0      350.0      300.0e
*
```

```
******* type        num      userid          component name
htstr            1414         0             SG1-pool-wall4
*     nzhstr       ittc       hscyl       ichf
          3          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        114          0
*    dtxht(1)    dtxht(2)     dznht      hgapo
        2.0       10.0      1.0E-3     6300.0
*
* idbcin *        2         2         2e
* idbcon *        1         1         1e
* hcomon1 *      643         6         0         0e
* hcomon1 *      643         7         0         0e
* hcomon1 *      643         8         0         0e
*  htc2  *      7.0     298.0e
*  htc2  *      7.0     298.0e
*  htc2  *      7.0     298.0e
* dhtstrz * 0.054333333 0.054333333 0.054333333e
*  rdx *      0.4905e
* radrd *     0.475 0.48333333 0.49166667       0.5      0.525s
* radrd *      0.55      0.575       0.6e
* matrd *         6         6         6        50s
* matrd *        50        50        50e
*   nfax *        1         1         1e
*   rftn *    523.0     521.0     510.0     470.0s
*   rftn *    450.0     400.0     350.0     300.0s
*   rftn *    523.0     521.0     510.0     470.0s
*   rftn *    450.0     400.0     350.0     300.0s
*   rftn *    523.0     521.0     510.0     470.0s
*   rftn *    450.0     400.0     350.0     300.0e
*
******* type        num      userid          component name
htstr            1421         0             SG1-wallend1
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci      nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          8          0        100          0
*    dtxht(1)    dtxht(2)     dznht      hgapo
        2.0       10.0      1.0E-3     6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      643         1         0         0e
*  htc2  *      7.0     298.0e
* dhtstrz *     0.163e
*  rdx *     0.09176e
* radrd *       0.8 0.80766667 0.81533333     0.823      0.848s
* radrd *     0.873     0.898     0.923e
```

```
* matrd *       6       6       6       50s
* matrd *      50      50      50e
*   nfax *      1e
*   rftn *   523.0    520.0    500.0    420.0s
*   rftn *   400.0    350.0    330.0    300.0e
*
******* type        num      userid          component name
htstr            1422         0              SG1-wallend2
*     nzhstr      ittc      hscyl      ichf
          2         0          1         1
*   nofuelrod     plane     liqlev     iaxcnd
          1         3          0         0
*      nmwrx      nfci      nfcil      hdri      hdro
          0         0          0       0.0       0.0
*       nhot     nodes      fmno      nzmax     reflood
          0         8          0       100         0
*    dtxht(1)   dtxht(2)     dznht      hgapo
        2.0       10.0     1.0E-3     6300.0
*
* idbcin *       2       2e
* idbcon *       1       1e
* hcomon1 *      643       2       0       0e
* hcomon1 *      643       3       0       0e
*  htc2  *      7.0    298.0e
*  htc2  *      7.0    298.0e
* dhtstrz *    0.163    0.163e
*  rdx *    0.04955e
* radrd *      0.8 0.80766667 0.81533333    0.823    0.848s
* radrd *    0.873    0.898    0.923e
* matrd *       6       6       6       50s
* matrd *      50      50      50e
*   nfax *      1       1e
*   rftn *   523.0    520.0    500.0    420.0s
*   rftn *   400.0    350.0    330.0    300.0s
*   rftn *   523.0    520.0    500.0    420.0s
*   rftn *   400.0    350.0    330.0    300.0e
*
******* type        num      userid          component name
htstr            1423         0              SG1-wallend3
*     nzhstr      ittc      hscyl      ichf
          2         0          1         1
*   nofuelrod     plane     liqlev     iaxcnd
          1         3          0         0
*      nmwrx      nfci      nfcil      hdri      hdro
          0         0          0       0.0       0.0
*       nhot     nodes      fmno      nzmax     reflood
          0         8          0       107         0
*    dtxht(1)   dtxht(2)     dznht      hgapo
        2.0       10.0     1.0E-3     6300.0
*
* idbcin *       2       2e
* idbcon *       1       1e
* hcomon1 *      643       4       0       0e
* hcomon1 *      643       5       0       0e
*  htc2  *      7.0    298.0e
*  htc2  *      7.0    298.0e
```

```
* dhtstrz *      0.096      0.067e
*   rdx *     0.04378e
* radrd *       0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *      0.873      0.898      0.923e
* matrd *          6          6          6        50s
* matrd *         50         50         50e
*    nfax *         1          1e
*    rftn *     523.0      520.0      500.0      420.0s
*    rftn *     400.0      350.0      330.0      300.0s
*    rftn *     523.0      520.0      500.0      420.0s
*    rftn *     400.0      350.0      330.0      300.0e
*
******* type         num       userid            component name
htstr              1424          0                SG1-wallend4
*      nzhstr        ittc        hscyl         ichf
           3           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
           1           3           0            0
*       nmwrx         nfci        nfcil         hdri         hdro
           0           0           0          0.0          0.0
*        nhot        nodes         fmno        nzmax       reflood
           0           8           0          114            0
*     dtxht(1)     dtxht(2)       dznht        hgapo
         2.0         10.0      1.0E-3       6300.0
*
*  idbcin *         2          2          2e
*  idbcon *         1          1          1e
* hcomon1  *      643          6          0          0e
* hcomon1  *      643          7          0          0e
* hcomon1  *      643          8          0          0e
*   htc2   *      7.0       298.0e
*   htc2   *      7.0       298.0e
*   htc2   *      7.0       298.0e
* dhtstrz * 0.054333333 0.054333333 0.054333333e
*   rdx *     0.03206e
* radrd *       0.8  0.80766667  0.81533333      0.823      0.848s
* radrd *      0.873      0.898      0.923e
* matrd *          6          6          6        50s
* matrd *         50         50         50e
*    nfax *         1          1          1e
*    rftn *     523.0      520.0      500.0      420.0s
*    rftn *     400.0      350.0      330.0      300.0s
*    rftn *     523.0      520.0      500.0      420.0s
*    rftn *     400.0      350.0      330.0      300.0s
*    rftn *     523.0      520.0      500.0      420.0s
*    rftn *     400.0      350.0      330.0      300.0e
*
******* type         num       userid            component name
htstr              1506          0              Downcomer wall
*      nzhstr        ittc        hscyl         ichf
           3           0           1            1
*    nofuelrod       plane       liqlev       iaxcnd
           1           3           0            0
*       nmwrx         nfci        nfcil         hdri         hdro
           0           0           0          0.0          0.0
*        nhot        nodes         fmno        nzmax       reflood
```

```
        0         8         0        100         0
*    dtxht(1)    dtxht(2)      dznht       hgapo
       2.0        10.0      1.0E-3      6300.0
*
* idbcin *        2         2         2e
* idbcon *        1         1         1e
* hcomon1 *      292         1         0         0e
* hcomon1 *      292         2         0         0e
* hcomon1 *      292         3         0         0e
*  htc2  *      7.0      298.0e
*  htc2  *      7.0      298.0e
*  htc2  *      7.0      298.0e
* dhtstrz *    0.163      0.096      0.096e
*  rdx *     0.10387e
* radrd *      0.475  0.48279133  0.49058266        0.5  0.52378049s
* radrd *  0.54918699   0.5745935        0.6e
* matrd *         6         6         6        50s
* matrd *        50        50        50e
*   nfax *        1         1         1e
*   rftn *    523.0     500.0     450.0     400.0s
*   rftn *    380.0     350.0     320.0     300.0s
*   rftn *    523.0     500.0     450.0     400.0s
*   rftn *    380.0     350.0     320.0     300.0s
*   rftn *    523.0     500.0     450.0     400.0s
*   rftn *    380.0     350.0     320.0     300.0e
*
*d: Top of steam generator Separator wall node 1 (cylinder part)
*******  type         num       userid             component name
htstr              1531          0              Steamdomewall1
*     nzhstr        ittc        hscyl        ichf
          1           0           1           1
*   nofuelrod       plane       liqlev       iaxcnd
          1           3           0           0
*      nmwrx         nfci        nfcil        hdri        hdro
          0           0           0         0.0         0.0
*       nhot        nodes         fmno        nzmax      reflood
          0           9           0         108           0
*    dtxht(1)    dtxht(2)      dznht       hgapo
       2.0        10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      1546         1         0         0e
*  htc2  *      7.0      298.0e
* dhtstrz *    0.134e
*  rdx *    0.552462e
* radrd *      0.475  0.48279133  0.49058266        0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748        0.6e
* matrd *         6         6         6        50s
* matrd *        50        50        50        50e
*   nfax *        1e
*   rftn *    523.0     523.0     520.0     500.0s
*   rftn *    500.0     400.0     350.0     330.0s
*   rftn *    310.0e
*
*d: Top of steam generator Separator wall node 2 (cylinder part)
```

```
******* type        num      userid            component name
htstr             1532         0             Steamdomewall2
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci       nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          9          0        108          0
*    dtxht(1)    dtxht(2)      dznht       hgapo
        2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      1546        2         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.134e
*  rdx *    1.289078e
* radrd *      0.475  0.48279133  0.49058266       0.5  0.51869919s
* radrd *  0.53902439  0.55934959   0.5796748       0.6e
* matrd *         6          6          6         50s
* matrd *        50         50         50         50e
*   nfax *        1e
*   rftn *     523.0      523.0      520.0      500.0s
*   rftn *     500.0      400.0      350.0      330.0s
*   rftn *     310.0e
*
*d: Top of steam generator Separator wall node 1 (end part)
******* type        num      userid            component name
htstr             1541         0             Steamdomewallend1
*     nzhstr       ittc       hscyl       ichf
          1          0          1          1
*   nofuelrod      plane      liqlev      iaxcnd
          1          3          0          0
*      nmwrx       nfci       nfcil       hdri       hdro
          0          0          0        0.0        0.0
*       nhot      nodes       fmno      nzmax     reflood
          0          9          0        108          0
*    dtxht(1)    dtxht(2)      dznht       hgapo
        2.0         10.0      1.0E-3      6300.0
*
* idbcin *        2e
* idbcon *        1e
* hcomon1 *      1546        1         0         0e
*  htc2  *       7.0      298.0e
* dhtstrz *     0.134e
*  rdx *    0.036114e
* radrd *       0.8  0.80766667  0.81533333     0.823     0.843s
* radrd *     0.863     0.883     0.903     0.923e
* matrd *         6         6         6         50s
* matrd *        50        50        50         50e
*   nfax *        1e
*   rftn *     523.0      523.0      520.0      500.0s
*   rftn *     500.0      400.0      350.0      330.0s
*   rftn *     310.0e
```

```
*
*d: Top of steam generator Separator wall node 2 (end part)
******* type        num       userid            component name
htstr             1542         0           Steamdomewallend2
*      nzhstr       ittc       hscyl       ichf
         1          0          1          1
*    nofuelrod      plane      liqlev      iaxcnd
         1          3          0          0
*       nmwrx       nfci       nfcil       hdri       hdro
         0          0          0         0.0        0.0
*       nhot       nodes       fmno       nzmax      reflood
         0          9          0         108          0
*     dtxht(1)    dtxht(2)     dznht       hgapo
        2.0        10.0      1.0E-3      6300.0
*
*  idbcin *        2e
*  idbcon *        1e
* hcomon1  *      1546        2        0        0e
*   htc2   *       7.0     298.0e
* dhtstrz *      0.134e
*   rdx *     0.084266e
* radrd *        0.8  0.80766667  0.81533333     0.823      0.843s
* radrd *      0.863      0.883      0.903      0.923e
* matrd *        6          6          6         50s
* matrd *       50         50         50         50e
*    nfax *       1e
*    rftn *     523.0      523.0      520.0      500.0s
*    rftn *     500.0      400.0      350.0      330.0s
*    rftn *     310.0e
*******************************************
* Finished Heat Structure Section of Model *
*******************************************
*
*
*
end
*
*****************
* Timestep Data *
*****************
*       dtmin       dtmax        tend        rtwfp
      1.0E-6         1.0        1.0E4        10.0
*       edint       gfint       dmpint      sedint
       100.0        50.0        500.0        10.0
*
*     endflag
        -1.0
```

APPENDIX F

TRACE transient input of eight layer pipe model for LOF-10 experiment

```
free format
*
*************
* main data *
*************
*
*     numtcr       ieos       inopt       nmat       id2o
          1          0          1          1          0
*
*****************
* namelist data *
*****************
*
 &inopts
  dtstrt=-1.0,
  nfrc1=2,
  usesjc=3,
  nhtstr=15,
  fluids='H2O'
 &end
*
***************
* Model Flags *
***************
*
*      dstep       timet
       28294         0.0
*     stdyst      transi       ncomp        njun        ipak
          0           1          43          41           0
*      epso        epss
      1.0E-4      1.0E-4
*     oitmax      sitmax      isolut      ncontr       nccfl
          10          10           0           0           0
*      ntsv        ntcb        ntcf        ntrp        ntcp
          24           7          48           0           0
*
*************************
* component-number data *
*************************
*
*  Component input order (IORDER)
*-- type ---- num ------------ name ---------------- +   jun1   jun2   jun3
* PIPE    *     1 s *                        +     21     22
* PIPE    *     2 s *                        +     23     24
* PIPE    *     3 s *                        +     25     26
* PIPE    *   122 s * SG3-coldcol                  +     38      0
* PIPE    *   241 s * SG3-hotcol                   +     37      0
* PIPE    *   292 s *                        +      0      2
* PIPE    *   312 s *                        +      3      4
* PIPE    *   313 s *                        +      8      7
* PIPE    *   314 s *                        +     10      9
* PIPE    *   322 s *                        +     12     11
* PIPE    *   323 s *                        +     14     13
* PIPE    *   332 s *                        +     16     15
* PIPE    *   333 s *                        +     18     17
* PIPE    *   342 s *                        +     20     19
```

```
* PIPE    *   352 s * SG3-inlet              +    39    37
* PIPE    *   353 s *                      +    40    38
* FILL    *   463 s *                      +    41
* PIPE    *   643 s *                      +     0     1
* BREAK   *   873 s *                        +     6
* PIPE    *   953 s *                      +    27    28
* PIPE    *   954 s *                      +    29    30
* PIPE    *   963 s *                      +    31    32
* PIPE    *   964 s *                      +    33    34
* PIPE    *   973 s *                      +    35    36
* HTSTR   *  1375 s * HL1-col-bot              +
* HTSTR   *  1380 s * CL1-col-bot              +
* HTSTR   *  1411 s * SG1-pool-wall1             +
* HTSTR   *  1412 s * SG1-pool-wall2             +
* HTSTR   *  1413 s * SG1-pool-wall3             +
* HTSTR   *  1414 s * SG1-pool-wall4             +
* FILL    *  1420 s *                      +    39
* HTSTR   *  1421 s * SG1-wallend1              +
* HTSTR   *  1422 s * SG1-wallend2              +
* HTSTR   *  1423 s * SG1-wallend3              +
* HTSTR   *  1424 s * SG1-wallend4              +
* BREAK   *  1430 s *                      +    40
* HTSTR   *  1506 s * Downcomer wall             +
* PIPE    *  1516 s *                      +     5     6
* HTSTR   *  1531 s * Steamdomewall1            +
* HTSTR   *  1532 s * Steamdomewall2            +
* HTSTR   *  1541 s * Steamdomewallend1           +
* HTSTR   *  1542 s * Steamdomewallend2           +
* SEPD    *  1546 e *                      +     1     5     2
*
**********************
* material properties *
**********************
*
*  matb*       50e
*  ptbln*      3e
*  User Defined Material : 50
*
*n: Mineral wool
*
*  prptb      temp      rho       cp      cond      emis
*  prptb*     283.0     120.0     800.0     0.099     0.76s
*  prptb*     373.0     120.0     800.0     0.12      0.76s
*  prptb*     573.0     120.0     800.0     0.213     0.76e
*
************************************************
* Starting Signal Variable Section of Model    *
************************************************
*
*      idsv      isvn      ilcn      icn1      icn2
         1         0         0         0         0
*
*      idsv      isvn      ilcn      icn1      icn2
         2        20      1546         1         2
*
*      idsv      isvn      ilcn      icn1      icn2
```

```
        3       20      643       1       8
*n: HTRPipe1
*
*       idsv    isvn    ilcn      icn1    icn2
        11      103      1        0       0
*n: HTRPipe2
*
*       idsv    isvn    ilcn      icn1    icn2
        12      103      2        0       0
*n: HTRPipe3
*
*       idsv    isvn    ilcn      icn1    icn2
        13      103      3        0       0
*n: HTRPipe4
*
*       idsv    isvn    ilcn      icn1    icn2
        14      103     953       0       0
*n: HTRPipe5
*
*       idsv    isvn    ilcn      icn1    icn2
        15      103     954       0       0
*n: HTRPipe6
*
*       idsv    isvn    ilcn      icn1    icn2
        16      103     963       0       0
*n: HTRPipe7
*
*       idsv    isvn    ilcn      icn1    icn2
        17      103     964       0       0
*n: HTRPipe8
*
*       idsv    isvn    ilcn      icn1    icn2
        18      103     973       0       0
*n: HLSEPD1
*
*       idsv    isvn    ilcn      icn1    icn2
        21      103     1531      0       0
*n: HLSEPD2
*
*       idsv    isvn    ilcn      icn1    icn2
        22      103     1532      0       0
*n: HLSEPD3
*
*       idsv    isvn    ilcn      icn1    icn2
        23      103     1541      0       0
*n: HLSEPD4
*
*       idsv    isvn    ilcn      icn1    icn2
        24      103     1542      0       0
*n: HLPOOL1
*
*       idsv    isvn    ilcn      icn1    icn2
        31      103     1411      0       0
*n: HLPOOL2
*
*       idsv    isvn    ilcn      icn1    icn2
```

```
       32        103       1412         0         0
*n: HLPOOL3
*
*      idsv      isvn      ilcn      icn1      icn2
       33        103       1413         0         0
*n: HLPOOL4
*
*      idsv      isvn      ilcn      icn1      icn2
       34        103       1414         0         0
*n: HLPOOL5
*
*      idsv      isvn      ilcn      icn1      icn2
       35        103       1421         0         0
*n: HLPOOL6
*
*      idsv      isvn      ilcn      icn1      icn2
       36        103       1422         0         0
*n: HLPOOL7
*
*      idsv      isvn      ilcn      icn1      icn2
       37        103       1423         0         0
*n: HLPOOL8
*
*      idsv      isvn      ilcn      icn1      icn2
       38        103       1424         0         0
*n: HLPOOL8
*
*      idsv      isvn      ilcn      icn1      icn2
       39        103       1506         0         0
************************************************
* Finished Signal Variable Section of Model    *
************************************************
*
*******************************************
* Starting Control System Section of Model *
*******************************************
*
****** Control Blocks ******
*
*      idcb      icbn      icb1      icb2      icb3
       -1         3         2         3         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
       1.0    -1.0E20    1.0E20       0.0       0.0
*
*
*      idcb      icbn      icb1      icb2      icb3
       -2       200        -1       -40         0
*    cbgain     cbxmin     cbmax     cbcon1    cbcon2
      160.0       0.0       0.6     0.712       0.0
*      cbdt     cbtau
      100.0      0.05
*
*n: HTRPRtoSEC
*
*      idcb      icbn      icb1      icb2      icb3
       -3        103         8         0         0
```

```
*     cbgain      cbxmin       cbmax      cbcon1      cbcon2
        1.0     -1.0E20       1.0E20         0.0         0.0
* ids  *         11          12           13          14s
* ids  *         15          16           17          18e
*
*       idcb        icbn        icb1        icb2        icb3
         -4         103           4           0           0
*     cbgain      cbxmin       cbmax      cbcon1      cbcon2
        1.0     -1.0E20       1.0E20         0.0         0.0
* ids  *         21          22           23          24e
*
*
*       idcb        icbn        icb1        icb2        icb3
         -5         103           8           0           0
*     cbgain      cbxmin       cbmax      cbcon1      cbcon2
        1.0     -1.0E20       1.0E20         0.0         0.0
* ids  *         31          32           33          34s
* ids  *         35          36           37          38e
*
*n: HLSEC
*
*       idcb        icbn        icb1        icb2        icb3
         -6         57          -4          -5          39
*     cbgain      cbxmin       cbmax      cbcon1      cbcon2
        1.0     -1.0E20       1.0E20         0.0         0.0
*
*       idcb        icbn        icb1        icb2        icb3
         -40        101           1           4           0
*     cbgain      cbxmin       cbmax      cbcon1      cbcon2
        1.0     -1000.0       1000.0         0.0         0.0
* cbtbl *        0.0       0.712s
* cbtbl *      1000.0       0.712s
* cbtbl *      1001.0        0.0s
* cbtbl *      2.0E4         0.0e
*
*********************************************
* Finished Control System Section of Model  *
*********************************************
*
******* type         num       userid            component name
fill              1420           1                 unnamed
*       jun1        ifty        ioff
          39           6           0
*       iftr        ifsv        nftb        nfsv        nfrf
           0           1           5           0           0
*     twtold        rfmx       concin        felv
         0.0      1.0E20         0.0         0.0
*       dxin        volin       alpin        vlin        tlin
         1.0    0.015394           0.0         0.0       528.0
*        pin        pain       flowin        vvin        tvin
       7.3E6         0.0         0.0         0.0       528.0
*       vmscl       vvscl
         1.0         1.0
*       tlscl       tvscl       pscl        pascl       conscl
         1.0         1.0         1.0         1.0         1.0
*
```

```
* vmtbm *       0.0    0.40607s
* vmtbm *     1000.0    0.40607s
* vmtbm *     1100.0  0.05075875s
* vmtbm *     1600.0  0.05075875s
* vmtbm *      1.6E4  0.05075875e
*
* vvtb  *       0.0    0.40607s
* vvtb  *     1000.0    0.40607s
* vvtb  *     1100.0  0.05075875s
* vvtb  *     1600.0  0.05075875s
* vvtb  *      1.6E4  0.05075875e
*
* tltb  *       0.0     528.0s
* tltb  *     1000.0     528.0s
* tltb  *     1100.0     528.0s
* tltb  *     1600.0     541.0s
* tltb  *      1.6E4     548.5e
*
* tvtb  *       0.0     528.0s
* tvtb  *     1000.0     528.0s
* tvtb  *     1100.0     528.0s
* tvtb  *     1600.0     541.0s
* tvtb  *      1.6E4     548.5e
*
* alptb *       0.0       0.0s
* alptb *     1000.0       0.0s
* alptb *     1100.0       0.0s
* alptb *     1600.0       0.0s
* alptb *      1.6E4       0.0e
*
* ptb   *       0.0     7.3E6s
* ptb   *     1000.0     7.3E6s
* ptb   *     1100.0     7.3E6s
* ptb   *     1600.0     7.3E6s
* ptb   *      1.6E4     7.3E6e
*
* patb  *       0.0       0.0s
* patb  *     1000.0       0.0s
* patb  *     1100.0       0.0s
* patb  *     1600.0       0.0s
* patb  *      1.6E4       0.0e
*
*****************************************
* Starting Heat Structure Section of Model *
*****************************************
* Finished Heat Structure Section of Model *
*****************************************
*
end
*
*****************
* Timestep Data *
*****************
*      dtmin       dtmax        tend       rtwfp
      1.0E-6        1.0       1.6E4        10.0
*      edint       gfint      dmpint      sedint
```

```
      100.0        50.0        500.0        10.0
*
*     endflag
       -1.0
```

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11. ABSTRACT *(200 words or less)*
This report has been written as an International Agreement Report under the Thermal Hydraulic Code Applications and Maintenance Program (CAMP) coordinated by the United States Nuclear Regulatory Commission. The calculations presented in the report comprise an assessment case which is a part of the in-kind contribution of Finland to the CAMP program. The assessed case was to first build up a TRACE thermal hydraulic code simulation model for horizontal steam generator of the Parallel Channel Test Loop (PACTEL) facility. Secondly, the case consisted of calculations to test the TRACE code capabilities. A loss-of feedwater, LOF-10, experiment was chosen for this assessment. The calculation results showed that the TRACE code is capable in simulating the horizontal steam generator behavior both in steady state and during loss-of feedwater transient. Three models with different nodalization were introduced. The calculation results differed from experiment to some extent. At the final state the calculated secondary side collapsed level decrease was more than in the experiment. The heat transfer from primary to the secondary side degraded gradually during the uncovery of the heat exchange tubes. The calculations overestimated this heat transfer. In the experiment the steam started to superheat immediately when the uppermost tube layer had uncovered. The steam superheating in the calculations was possible only after the uppermost cell on the secondary side had voided thoroughly. Because of the use of lumped pipe representation of the heat exchange pipes in the calculations the timing of the superheating initiation was much later than in the experiment with the coarse nodalization models.

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