TRAC Code Modifications Made for APT Blanket Safety Analyses

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TRAC CODE MODIFICATIONS MADE FOR APT BLANKET SAFETY ANALYSES

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TRAC CODE MODIFICATIONS MADE FOR APT BLANKET SAFETY ANALYSES

SAVANNAH RIVER TECHNOLOGY CENTER

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1 Introduction

This report provides documentation of the necessary source code modifications made to the TRAC-PF1/MOD2 code version 5.4.28a [1] developed at Los Alamos National Laboratory (LANL). Functionally, the code modifications impact only a relatively small number of the FORTRAN subroutines and have no effect on the physical models or numerics contained within this version of TRAC. These modifications add one additional output file to a TRAC run in the form of an ASCII graphical data set. Verification testing was performed to ensure that no unwanted side effects resulted from the source code modifications. The modifications made are independent of computing platform and were tested on both IBM RS/6000 580's and 590's, and the SRS CRAY J90 computing machines.

2 Background

The original TRAC code has built-in output features in the form of: (1) an ASCII printout of results tabulated on a component-by-component basis; and (2) graphics files where post-processing using special purpose LANL algorithms are employed. Within the Savannah River Technology Center (SRTC), personnel have a great deal of experience using the commercially available software package named "TecPlot™" [2]. TecPlot™ is a widely used scientific and engineering data visualization software package for interactively creating multi-dimensional graphics. Based on scheduling, training, and purchasing considerations, it was determined that implementing minor source code modifications to TRAC in order to make it TecPlot™ compatible would be more expedient than pursuing the special purpose software that already existed at LANL for TRAC.

The modifications were made to the standard output routines in order to generate an ASCII output file called "tecsum.grf". This output file contains results at each requested graphics point (i.e. TRAC component and specified cell number) written out at a specified time frequency. In a post-processing mode, the ASCII graphic output file is split into individual ASCII data set files for each graphics point using a special purpose FORTRAN program named "TSPLIT". The output from TSPLIT was formatted to be TecPlot™ ready.

Implementation and verification testing was performed on TRAC and TSPLIT to ascertain that no unwanted side effects had been incorporated into TRAC and that correct graphical data sets were being produced. Identical test problems were run using both the original TRAC code and its modified version. The resulting "trcout" printed output files were then compared for potential differences. The only differences observed were those associated with the writing of a notice to the user that a "tecsum.grf" file had been created. Also, the results from the post-processing of the "tecsum.grf" file using TSPLIT were compared with those contained directly within the "trcout" file. No errors were identified in either test.

3 TRAC Code

3.1 TRAC Source Modifications

The following is a listing of the TRAC subroutines affected by the above source code modifications:

clean.f	ecomp.f	wbreak.f	wcomp.f
wfill.f	whtstr.f	wpipe.f	wplen.f
wprizr.f	wpump.f	wtee.f	wturb.f
wvlve.f			

A listing of each FORTRAN subroutine is provide in Appendix A. Note that limitations exist within the current set of modifications. Due to TRAC's staggered mesh (i.e. state variables at cell centers and kinematic variables at cell faces) and the need to donor properties across cell faces, special logic is required to locate incoming material into a component's edge from its neighboring component. The current modifications do not handle this condition properly since no attempt is made to locate potential neighboring components. As a result, certain quantities at cell faces associated with a component's ends may not be correctly computed. This will occur for incoming material flowing into a given component and when the graphics point selected corresponds to that component's first or last cell, respectively. At present, this limitation is handled by only looking at those cell's where incoming material crossing that cell is contained within the existing component. By avoiding such edges, the Blanket Safety Analyses performed were not impacted. Future upgrades can eliminate such limitations.

3.2 Post-Processing Code

As stated above, a special purpose FORTRAN program was written to split out the "tecsum.grf" file generated at the end of a TRAC run. The code was named "TSPLIT" and a source listing of the program is provided in Appendix B. The graphics points selected are read into TRAC from the file named "graphin". This same file is also read into TSPLIT along with the "tecsum.grf" file. TSPLIT then splits the graphics dataset file into the various graphics files associated with each specified graphics point.

The program "tsplit" takes as input the TRAC code generates and writes out to the "tecsum.grf" file and splits it out into separate "tecplot" compatible files consistent with the requested graphics points inputted to TRAC through the "graphin" file. First the data within the "tecsum.grf" file is read in and stored within appropriate arrays consistent with component type.

Then, each individual component graph point data set is written to its own unique file:

- "tecNNN-XX.dat" files for graphics points in components that are not plenums or heat structures.
- "tecpNNN-XX.dat" files for graphics points in plenum components.
- "tecphiNNN-XX.dat" files for graphics points on inner surfaces of heat structures.
- "tecphoNNN-XX.dat" files for graphics points on outer surfaces of heat structures.

Where NNN - represents TRAC component number (0 to 999) and XX - represents cell location within component (1-99).

TRAC CODE MODIFICATIONS

The following is a listing of the variables employed in TSPLIT and a brief description of each, including units assumed:

tsec	- Time into simulation (sec)
psia	- Cell center pressure (psia)
qfgpm	- Liquid volumetric flowrate at cell face (gpm)
tf	- Bulk liquid phase temperature (C)
tsub	- Bulk liquid subcooling (C)
tsat	- Bulk liquid saturation temperature (C)
denf	- Liquid phase density (kg/m ³)
vf	- Liquid phasic velocity at cell face (m/s)
pa	- Cell center pressure (Pa)
qfmas	- Liquid mass flowrate at cell face (kg/s)
void	- Gas void fraction (-)
qggpm	- Gas volumetric flowrate at cell face (gpm)
qgmas	- Gas mass flowrate at cell face (ks/s)
tg	- Bulk gas phase temperature (C)
deng	- Gas phase density (kg/m ³)
vg	- Gas phasic velocity at cell face (m/s)
pair	- Partial pressure non-condensable in gas phase (psia)
power	- Component total deposited power at time tsec (W)
tsurf	- Inner or Outer surface temperature (C)
fluxf	- Surface liquid phase heat flux (W/m ²)
fluxg	- Surface gas phase heat flux (W/m ²)
hf	- Liquid phase film coefficient (W/m ² -K)
hg	- Gas phase film coefficient (W/m ² -K)
tsurf	- Inner or Outer surface temperature (C)
tsurf	- Inner or Outer surface temperature (C)
index	- index providing the order in which TRAC writes out the requested graphics point data.

3.3 Graphics Point Selection

Appendix C contains an example of a typical "graphin" file used during Blanket System accident analysis runs with TRAC. The basic input to a "graphin" file consists of:

- npoints - number of locations (points) within TRAC model where graphics requested.
- component - component id number containing specified graph point.
- cell - cell number within component where graphics requested (number second leg of tee sequentially from end cell number on first leg) (If a heat structure then cell number is axial row of nodes where point resides).
- ictype - type of component: (0 for fill, pipe, pressurizer, pump, turb, value); (1 for plenum); (2 for tee); or (3 for heat structure).
- id_leg - which leg of component cell is located in: (1 always for fill, pipe, pressurizer, pump, plenum, turb, value); (1 or 2 for tee's); (for a heat structure 1 implies inner surface and 2 for outer surface).

3.4 Configuration Management Control

Two separate versions of TRAC are being used: (1) an IBM RS/6000 compatible version; and (2) a CRAY J90 compatible version. Separate makefile's were necessary. The modified subroutines presented above are identical on each platform and only one version of the TSPLIT program was used. The TSPLIT executable was created and run on SGI Indy's and Indigo's. Test runs have been made and verified on both platforms. Currently, the source codes are stored on the SRS 'AFS' (Andrew File System). These files will be stored and protected from modification until placed under specific software configuration control.

4 Conclusions

The choice to modify TRAC in order to accommodate the commercial graphics package Tecplot™ has been very successful - due to the relatively short time required to make the code modifications and the flexibility obtained in viewing TRAC results. Future upgrades will be performed as time permits.

5 References

1. Safety Code Development Group, "TRAC-PF1/MOD2: An Advanced Best Estimate Computer Program for Pressurized Water Reactor Thermal-Hydraulic Analysis," Los Alamos National Laboratory report LA-12031-M, Vol. 1 (NUREG/CR-5673), (July 21, 1993).
2. "Tecplot User's Manual - Version 7," Amtec Engineering, Inc., Bellevue, Washington, August 1996.

Appendix A: Listing of Modified TRAC Subroutines for Graphical Output Purposes

The files listed below represents the entire source code modifications made to the TRAC-P code.

Fortran file clean.f:

```

      subroutine clean
c
c      closes trac output files.
c
ctmp *****
c
      common /tecplot/iicomp(500),iicell(500),ictype(500),
&          id_leg(500),npoints,iin1
c
ctmp *****
      common/units/ ibfadd,ibfaddg,ibfadr,
* ibflnd,ibflng,ibflnr,idout, ieee, igout ,
* ikeybd,imout ,in ,inlab,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
      common /cunits/card
      character*100 card
c
      common/codebk/ max1lv,
* maxlen,maxln3,mlnvmt
c
c
      call endgrf
      call enddmp
c
      close(itty)
      close(imout)
      close(igout)
      close(idout)
      close(irstrt)
      close(iout)
c
ctmp *****
c
c close component graph files:
c
      iunit = iin1
      close (iunit)
c
ctmp *****
c
      return
      end

```

Fortran file ecomp.f:

```

      subroutine ecomp(num,jstrt,jstop,iflgw,nodes,cfmass,xpintg,
&          cener,tsec,itee)
c
c      subroutine ecomp writes one-dimensional component

```

TRAC CODE MODIFICATIONS

```

c      thermal-hydraulic solution parameters to file trcout
c
      parameter      (ifxsiz=5000000)
      common a(ifxsiz)
      dimension alcm(1)
      equivalence (a(1),alcm(1))
      dimension ia(ifxsiz)
      character*8 ach(ifxsiz)
      equivalence (a(1),ach(1))
      equivalence (a(1),ia(1))
c
      common/contrl/ cpuflg,dammc ,damx ,delt ,
* deltht,difmin,dprmx ,dtlmx ,dtmax ,
* dtmin ,dto ,dtrat ,dtrmx ,dtsmx ,
* dtvmx ,encmax,eps1 ,eps2 ,epso ,
* ercemx,epss ,etime ,htlosi,htloso,
* odelt ,powerc,pssmn ,pssmx ,rfat ,
* rvmax ,tend ,tercmx,timec ,timet ,
* tmmx ,varer ,vcmn ,vcmx ,vmxo ,
* vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
* vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
* omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
* yvsm,zvsm,rmatm(3,3),omsm(3),wsm(3),
* wdsm(3),errsm,dtsm
      common/contrl/ dstep ,iadded,iblaus,iccmx ,
* icmp ,icpmx,icp ,idiag ,idiags,ieccpx,ieos ,iff3d ,
* ifprep,igeom3,im100 ,im100x,imfr ,
* invan ,iofftk,ipak ,ipak3d,ipakon,ipkmp,
* ireset,irsflg,irstfl,isolut,issflg,istdy ,
* isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
* lcmptr,levstg,llvflg,ncmn ,ncmx ,
* ncontr,nconts,ncontt,ncrg ,ndial ,nencl,
* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nspl ,nspu ,nsso ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
      integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm
c
      dimension ld(3),ldn(3)
      common/ptab/ lalp ,lalpn ,lalpd ,
* lalpdn,lalv ,lalvn ,lalve ,lalven,
* lara ,larn ,larel ,lareln,larev ,
* larevn,larl ,larln ,larv ,larvn ,
* lbit ,lbitn ,lcti ,lctin,lctia,
* lctan,lcif ,lcifn ,lconc ,lconcn,
* ld ,ldn ,lea ,lean ,lel ,
* leln ,lev ,levn ,lgam ,lgamn ,
* lhig ,lhigo ,lhil ,lhilo ,lhiv ,
* lhivo ,lp ,lpn ,lpa ,lpan ,
* lqppc ,lqppco,lroa ,lroan ,lrol ,
* lroln ,lrov ,lrovn ,ls ,lsn ,
* ltce ,ltcen ,ltd ,ltdn ,ltl ,
* ltln ,ltv ,ltvn ,ltw ,ltwn ,
* ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
* lvlt ,lvlto ,lvm ,lvmn ,lvv ,
* lvvn ,lvvt ,lvvto
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian

```

TRAC CODE MODIFICATIONS

```

c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c-----
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
c      parameter (iptsiz=300)
c      integer pt(iptsiz)
c-----
c      equivalence (pt(1),lalp)
c
c      dimension lh(3)
c      common/ptab/ lalpmn,lalpmx,lalpo ,
c      * lam ,larc ,lcfz ,lcl ,lcpl ,
c      * lcpv ,lcv ,ldalva,ldfldp,ldfvdp,
c      * ldriv ,ldx ,lelev ,lfa ,lfavol,
c      * lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
c      * lh ,lhd ,lhdht ,lhfg ,lhgam ,
c      * lhla ,lhlatw,lhva ,lhvatw,
c      * lqrl ,lqrv ,lqp3f ,
c      * lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
c      * lrarl ,lrary ,
c      * lxsm,lysm,lzsm,lrsm,lr0sm,
c      * lnfvsm,lnflsm,luvsm,lnfcvsm,lnfclsm,lvvsm,lvlsml,
c      * lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
c      * lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
c      * ltssn ,lvisl ,lvisv ,lvlalp,lvlv ,
c      * lvvvol,lvlx ,lvol ,lvr ,lvrv ,
c      * lvvvol,lvvx ,lwa ,lwat ,lwfl ,
c      * lwfv ,lwfmfl,lwfmfv
c
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c      in case new pointers are added after lwfmfv, then the coding in
c      subroutine aicomp (third executable statement) for evaluation of
c      the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c      must be changed to use the name of the new pointer at the end
c      of this section of the common block / ptab /.
c-----
c      common/ptab/ lldr ,lmatid,lnff ,llccfl
c
c      common/ptab/ lcpw ,lcw ,ldr ,
c      * lemis ,lhol ,lhov ,lrn ,lrn2 ,
c      * lrow ,ltchf ,ltol ,ltov
c
c      common/units/ ibfadd,ibfadg,ibfadr,
c      * ibflnd,ibflng,ibflnr,idout,ieeeg,igout ,
c      * ikeybd,imout ,in ,inlab,inproc,
c      * ioall ,iodone,ioerr ,iogrf ,ioinp ,
c      * iolab ,ioout ,ioskip,iout ,irstrt,
c      * itty ,iunlab,iunout,lcmcpd,nittab,
c      * npwtab,nrddy
c      common /cunits/card
c      character*100 card
c
c      common/labelv/factor(150),offset(150)
c      common/labelv/ih(26),itls(777),itsv(105),

```

TRAC CODE MODIFICATIONS

```

1      ils,ilu,ilun,iold
      common/labelv/labels(777),labsv(2,105),labun(150),
1      lunch(2,150),lupcb(2,150),runchb(2,150)
      common/labelv/alphet,luar,lucp,lud,ludh,lue,luen,
1      luh,luha,luhx,luid,luis,lum,lumf,lup,
2      lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3      lut,lutc,lutm,lutp,luv,luvf,luvo,luz
      character*2 lud,lutp,lus
      character*3 lut,luz
      character*4 luar,lue,lum,luvo
      character*5 lup,lupd,luv,luvf
      character*6 luis
      character*7 luen,lumf,lupt,lupw
      character*8 labels,labun,luid,lur,lusp,lusz,lutm
      character*9 luha
      character*10 lucp
      character*11 luph
      character*12 luhx,lutc,runchb
      character*13 luh,lunch,lupcb
      character*14 labsv
      character*19 ludh
      character*26 alphet
c
ctmp *****
c
      common /tecplot/iicomp(500),iicell(500),ictype(500),
&      id_leg(500),npoints,iinl
c
ctmp *****
c
      common/twostp/ npsfe ,npsme ,ntsprn
c
      dimension tmp(10,24)
      integer getbit
c
ctmp *****
c
      conv_p = 14.696/101325.0
      conv_t = 273.15
      conv_q = 264.17*60.0
c
ctmp *****
c
c      print out hydraulic-solution parameters
c
      write(iout,100) lup,lup,lud,lutp,lutp,lutp,lur,lur,luv,luv,lud
100 format(/19x,'ncd-gas'/7x,'pressure pressure void fr. temp',
1      '.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq',
2      '. vel.gas wf.liq.'/' cell',3x,a,7x,a,7x,a,8x,a,8x,a,
3      8x,a,5x,a,2x,a,5x,a,6x,a,6x,a)
      nn=1+(jstop-jstrt)/10
      jn=0
      do 130 n=1,nn
      j1=jstrt+(n-1)*10
      j2=min0(j1+9,jstop)
      j0=j1-1
      j3=j2-j0
      do 110 j=j1,j2
      jj=j-j0
      jml=j-1
      tmp(jj,1) =a(lpn +jml)
      tmp(jj,2) =a(lpan +jml)

```


TRAC CODE MODIFICATIONS

```

      tmp(jj,3) =a(lalpn+jm1)
      tmp(jj,4) =a(ltsat+jm1)
      tmp(jj,5) =a(ltln +jm1)
      tmp(jj,6) =a(ltvn +jm1)
      tmp(jj,7) =a(lroln+jm1)
      tmp(jj,8) =a(lrovn+jm1)
      tmp(jj,9) =a(lvln +jm1)
      tmp(jj,10)=a(lvvv +jm1)
      if (getbit(a(lbitn+jm1),33).ne.0) a(lwfl+jm1)=-1.111e-11
      tmp(jj,11)=a(lwfl +jm1)
      cfmass=cfmass+a(lvol+jm1)*(a(larv +jm1)+a(larl +jm1))
      cener =cener +a(lvol+jm1)*(a(larev+jm1)+a(larel+jm1))
110 continue
      if (ioout.eq.1) then
        call uncvt('pn' ,tmp(1,1) ,j3,1,-1)
        call uncvt('pan' ,tmp(1,2) ,j3,1,-1)
        call uncvt('tsat',tmp(1,4) ,j3,1,-1)
        call uncvt('tln' ,tmp(1,5) ,j3,1,-1)
        call uncvt('tvn' ,tmp(1,6) ,j3,1,-1)
        call uncvt('roln',tmp(1,7) ,j3,1,-1)
        call uncvt('rovn',tmp(1,8) ,j3,1,-1)
        call uncvt('vln' ,tmp(1,9) ,j3,1,-1)
        call uncvt('vvv' ,tmp(1,10),j3,1,-1)
      endif
      j1=j1-j0
      j2=j2-j0
      write(iout,120) (jn+j,(tmp(j,k),k=1,11),j=j1,j2)
120 format(1x,i3,1p,2e12.5,6e10.3,2e11.3,e10.3)
      jn=jn+10
c
c tmp *****
c
c Write to tecplot file data for component point if requested
c and component not a plenum component or heat structure.
c
c Check for tee component and if a tee check that requested
c cell is in first or second leg.
c
      iunit = iin1
      do ipt=1,npoints
        jcell = icell(ipt)
        if ((ictype(ipt).eq.0 .and. itee.eq.0)
&
& .or.
& (ictype(ipt).eq.2 .and. itee.eq.1 .and.
& id_leg(ipt).eq.1)
&
& .or.
& (ictype(ipt).eq.2 .and. itee.eq.2 .and.
& id_leg(ipt).eq.2)
&
& ) then
          icomp = icomp(ipt)
          if (icomp.eq.num) then
            ngrps = 1 + (jcell - jstrt)/10
            if (ngrps.eq.n) then
              loc = (jcell-jstrt+1) - 10*(ngrps-1)
c
c Compute phasic volumetric and mass flowrates.
c
          void = tmp(loc,3)
          denf = tmp(loc,7)
          if (jcell.gt.jstrt .and. tmp(loc,9).ge.0.0) then
            void = tmp(loc-1,3)
            denf = tmp(loc-1,7)

```

TRAC CODE MODIFICATIONS

```

        endif
        qf = a(lfa+jcell-1)*(1.0-void)*tmp(loc,9)
        qmasf = qf*denf
c
        void = tmp(loc,3)
        deng = tmp(loc,8)
        if (jcell.gt.jstrt .and. tmp(loc,10).ge.0.0) then
            void = tmp(loc-1,3)
            deng = tmp(loc-1,8)
        endif
        qg = a(lfa+jcell-1)*void*tmp(loc,10)
        qmasg = qg*deng
c
        write (iunit,2666) ipt,
&          tsec,conv_p*tmp(loc,1)      ,conv_q*qf      ,
&          tmp(loc,5)-conv_t           ,
&          tmp(loc,4)-tmp(loc,5) ,tmp(loc,4)-conv_t,
&          tmp(loc,7)                  ,tmp(loc,9)
&          tmp(loc,1)                   ,qmasf
&          tmp(loc,3)                   ,conv_q*qg
&          qmasg
&          tmp(loc,6)-conv_t           ,tmp(loc,8)
&          tmp(loc,10)                  ,conv_p*tmp(loc,2)
2666      format (i5,17e15.7)
c
cc2666 format (i5,8x,f8.1,7f10.2,2x,f10.1,2f10.4,2x,e12.4,f10.4,
cc      &      3f10.1,f10.4)
        endif
        endif
        enddo
c
ctmp *****
c
130 continue
c
        tmp(1,1)=a(lvln+jstop)
        tmp(2,1)=a(lvvln+jstop)
        if (ioout.eq.1) then
            call uncnvt('vln',tmp,2,1,-1)
        endif
        if (getbit(a(lbitn+jstop),33).ne.0) a(lwfl+jstop)=-1.111e-11
        jn=jstop-jstrt+2
        write(iout,140) jn,tmp(1,1),tmp(2,1),a(lwfl+jstop)
140 format(1x,i3,84x,1p,2e11.3,e10.3)
c
c      print out heat-transfer solution parameters
c
        if (nodes.ne.0) then
            write(iout,200) lud,ludh,luha,lupw,lupw,lutp,lutp
200      format(/6x,'idr liq.htc vap.htc if.htc*a liq.htfx ',
1          ' vap.htfx temp.chf node-wise wall temperatures'/
2          ' cell ',a,3x,a,2x,a,3x,a,4x,a,6x,a,10x,a)
            k2=min0(6+nodes,24)
            jn=0
            do 280 n=1,nn
                j1=jstrt+(n-1)*10
                j2=min0(j1+9,jstop)
                j0=j1-1
                j3=j2-j0
                do 220 j=j1,j2
                    jml=j-1

```

TRAC CODE MODIFICATIONS

```

      jj=j-j0
      tmp(jj,1)=a(lhil +jml)
      tmp(jj,2)=a(lhiv +jml)
      tmp(jj,3)=a(lchti+jml)
      tmp(jj,4)=a(lhil +jml)*(a(ltwn+nodes*jml)-a(ltln+jml))
      tmp(jj,5)=a(lhiv +jml)*(a(ltwn+nodes*jml)-a(ltvn+jml))
      tmp(jj,6)=a(ltchf+jml)
      do 210 k=7,k2
      tmp(jj,k)=a(ltwn+nodes*jml+k-7)
210  continue
220  continue
      if (ioout.eq.1) then
        call uncvt('hil' ,tmp(1,1),j3,1,-1)
        call uncvt('hiv' ,tmp(1,2),j3,1,-1)
        call uncvt('chti',tmp(1,3),j3,1,-1)
        call uncvt('qppl',tmp(1,4),j3,1,-1)
        call uncvt('qppv',tmp(1,5),j3,1,-1)
        call uncvt('tchf',tmp(1,6),j3,1,-1)
        do 230 k=7,k2
        call uncvt('tw' ,tmp(1,k),j3,1,-1)
230  continue
      endif
      j1=j1-j0
      j2=j2-j0
      if (k2.eq.12) then
        do 250 j=j1,j2
        write(iout,240) jn+j,a(lidr+j+j0-1),(tmp(j,k),k=1,12)
240  format(1x,i3,f5.1,1x,1p,6e10.3,2x,0p,6f8.2,/(72x,6f8.2))
250  continue
      else
        do 270 j=j1,j2
        write(iout,260) jn+j,a(lidr+j+j0-1),(tmp(j,k),k=1,k2)
260  format(1x,i3,f5.1,1x,1p,6e10.3,2x,0p,6f8.2,/(72x,6f8.2))
270  continue
      endif
      jn=jn+10
280  continue
    endif
  c
    do 290 j=jstrt,jstop
    - if ((a(lhla-1+j).ne.0.0).or.(a(lhva-1+j).ne.0.0)) go to 300
290  continue
    go to 330
300  continue
    tmp(2,1)=0.0
    tmp(3,1)=0.0
    do 310 j=jstrt,jstop
    tmp(2,1)=tmp(2,1)+a(lhlatw+j-1)-a(lhla+j-1)*a(ltln+j-1)
    tmp(3,1)=tmp(3,1)+a(lhvatw+j-1)-a(lhva+j-1)*a(ltvn+j-1)
310  continue
    tmp(1,1)=tmp(2,1)+tmp(3,1)
    if (ioout.eq.1) then
      call uncvt('tpow',tmp(3,1),-1)
    endif
    write(iout,320) (tmp(j,1),lupw,j=1,3)
  c
    tmp(1,1)=a(ltcen)
    tmp(2,1)=a(ltwan)
    tmp(3,1)=a(ltwen)
    xepintg=xpintg
    if (ioout.eq.1) then
      call uncvt('enin1',tmp(3,1),-1)

```

TRAC CODE MODIFICATIONS

```

        call uncvt('tpow',xepintg,1,1,-1)
    endif
    if(iflgw.ne.0.and.nodes.gt.0) write(iout,325) tmp(1,1),lue,
1  xepintg,lue,tmp(2,1),lue,tmp(3,1),lue
320 format(/' total power to the component from all heat-transfer',
1  ' surfaces is',1p,e14.6,a/' total power to the liquid is',
2  e14.6,a,' and total power to the gas is',e14.6,a)
325 format(/,1x,'total convective energy transported to the fluid',
1  ' from component wall:',1pe15.7,a/,1x,
2  'total energy input into the component wall=',1pe15.7,
3  a/,19x,'inside convective energy error: absolute='
4  ,1pe13.5,a,5x,'effective=',1pe13.5,a)
330 continue
c
    if (ntsprn.ne.0) then
        if (idiags.eq.0) then
            write(iout,150) lur,lud,luid,lutp,luha,luha,
1  lumf,lumf,luv,luv,lud
150  format(/5x,'dis.sol. p.o.sol. fr.new if.drag temp.ss. ',
1  'evap. cond. mfw.liq. mfw.vap. ',
2  'velt.liq velt.gas wf.gas'/' cell ratio ' ,
3  a,3x,a,3x,a,5x,a,4x,a,1x,a,2x,a,3x,a,5x,a,6x,a,6x,a)
        else if (idiags.eq.1) then
c-----For IDIAGS.EQ.1 print stabilizer variables arln and arvn,
c-----instead of liquid and vapor mass flows.
            write(iout,155) lur,lud,luid,lutp,luha,luha,
1  lur,lur,luv,luv,lud
155  format(/5x,'dis.sol. p.o.sol. fr.new if.drag temp.ss. ',
1  'evap. cond. arln arvn ',
2  'velt.liq velt.gas wf.gas'/' cell ratio ' ,
3  a,3x,a,3x,a,5x,a,4x,a,1x,a,2x,a,2x,a,4x,a,6x,a,6x,a)
        endif
        jn=0
        do 420 n=1,nn
            j1=jstrt+(n-1)*10
            j2=min0(j1+9,jstop)
            j0=j1-1
            j3=j2-j0
            do 400 j=j1,j2
                jj=j-j0
                jml=j-1
                if (idiags.eq.0) then
c-----IDIAGS.EQ.0
                    if (isolut.eq.0) then
                        tmp(jj,1)=0.0
                        tmp(jj,2)=0.0
                    else
                        tmp(jj,1)=a(lconcn+jml)
                        tmp(jj,2)=a(lsn +jml)
                    endif
                    tmp(jj,3) =a(lrhs +jml)
                    tmp(jj,4) =a(lcifn +jml)
                    tmp(jj,5) =a(ltssn +jml)
                    tmp(jj,6) =a(lalven+jml)
                    tmp(jj,7) =a(lchtin+jml)
                    tmp(jj,8) =a(lrmvm +jml)-a(lrvmf+jml)
                    tmp(jj,9) =a(lrvmf +jml)
                    tmp(jj,10)=a(lvlt +jml)
                    tmp(jj,11)=a(lvvt +jml)
                    tmp(jj,12)=a(lwfv +jml)
                else if (idiags.eq.1) then
c-----IDIAGS.EQ.1

```

TRAC CODE MODIFICATIONS

```

      if (isolut.eq.0) then
        tmp(jj,1)=0.0
        tmp(jj,2)=0.0
      else
        tmp(jj,1)=a(lconcn+jm1)
        tmp(jj,2)=a(lsn +jm1)
      endif
      tmp(jj,3) =a(lrhs +jm1)
      tmp(jj,4) =a(lcifn +jm1)
      tmp(jj,5) =a(ltssn +jm1)
      tmp(jj,6) =a(lalven+jm1)
      tmp(jj,7) =a(lchtin+jm1)
      tmp(jj,8) =a(larln +jm1)
      tmp(jj,9) =a(larvn +jm1)
      tmp(jj,10)=a(lvlt +jm1)
      tmp(jj,11)=a(lvvt +jm1)
      tmp(jj,12)=a(lwfv +jm1)
    endif
400    continue
      if (ioout.eq.1) then
        if (idiags.eq.0) then
c-----IDIAGS.EQ.0
          call uncvt('s'      ,tmp(1,2) ,j3,1,-1)
          call uncvt('cifn'   ,tmp(1,4) ,j3,1,-1)
          call uncvt('tssn ' ,tmp(1,5) ,j3,1,-1)
          call uncvt('alven' ,tmp(1,6) ,j3,1,-1)
          call uncvt('chtin' ,tmp(1,7) ,j3,1,-1)
          call uncvt('rmvm'   ,tmp(1,8) ,j3,1,-1)
          call uncvt('rvmf'   ,tmp(1,9) ,j3,1,-1)
          call uncvt('vltm'   ,tmp(1,10),j3,1,-1)
          call uncvt('vvtm'   ,tmp(1,11),j3,1,-1)
        else if (idiags.eq.1) then
c-----IDIAGS.EQ.1
          call uncvt('s'      ,tmp(1,2) ,j3,1,-1)
          call uncvt('cifn'   ,tmp(1,4) ,j3,1,-1)
          call uncvt('tssn ' ,tmp(1,5) ,j3,1,-1)
          call uncvt('alven' ,tmp(1,6) ,j3,1,-1)
          call uncvt('chtin' ,tmp(1,7) ,j3,1,-1)
          call uncvt('arln'   ,tmp(1,8) ,j3,1,-1)
          call uncvt('arvn'   ,tmp(1,9) ,j3,1,-1)
          call uncvt('vltm'   ,tmp(1,10),j3,1,-1)
          call uncvt('vvtm'   ,tmp(1,11),j3,1,-1)
        endif
      endif
      j1=j1-j0
      j2=j2-j0
      write(iout,410) (jn+j,(tmp(j,k),k=1,12),j=j1,j2)
410    format(1x,i3,1p,2e9.2,0p,f6.3,1p,6e10.3,2e11.3,e10.3)
      jn=jn+10
420    continue
c
      if (idiags.eq.0) then
c-----IDIAGS.EQ.0
        tmp(1,1)=a(lcifn+jstop)
        tmp(2,1)=a(lrmvm+jstop)-a(lrvmf+jstop)
        tmp(3,1)=a(lrvmf+jstop)
        tmp(4,1)=a(lvlt +jstop)
        tmp(5,1)=a(lvvt +jstop)
        if (ioout.eq.1) then
          call uncvt('cifn',tmp(1,1),1,1,-1)
          call uncvt('rmvm',tmp(2,1),2,1,-1)
          call uncvt('vltm',tmp(4,1),2,1,-1)

```

TRAC CODE MODIFICATIONS

```

        endif
        jn=jstop-jstrt+2
        write(iout,430) jn,(tmp(j,1),j=1,5),a(lwfv+jstop)
430      format(1x,i3,24x,1p,e10.3,30x,2e10.3,2e11.3,e10.3)
        else if (idiags.eq.1) then
c-----IDIAGS.EQ.1
        tmp(1,1)=a(lcifn+jstop)
        tmp(2,1)=a(lvlt +jstop)
        tmp(3,1)=a(lvlt +jstop)
        if (ioout.eq.1) then
            call uncvt('cifn',tmp(1,1),1,1,-1)
            call uncvt('vlt',tmp(2,1),2,1,-1)
        endif
        jn=jstop-jstrt+2
        write(iout,435) jn,(tmp(j,1),j=1,3),a(lwfv+jstop)
435      format(1x,i3,24x,1p,e10.3,50x,2e11.3,e10.3)
        endif
    endif
c
    return
end

```

Fortran file wbreak.f:

```

subroutine wbreak(cmbkr,tsec)
c
c
c  subroutine wbreak writes thermal-hydraulic solution
c  parameters to file trcout for the break component
c
    parameter      (ifxsiz=5000000)
    common a(ifxsiz)
    dimension alcm(1)
    equivalence (a(1),alcm(1))
    dimension ia(ifxsiz)
    character*8 ach(ifxsiz)
    equivalence (a(1),ach(1))
    equivalence (a(1),ia(1))
c
c  fixed length table
c
    integer flt(1)
    real rflt(1)
    equivalence (flt(1),rflt(1))
    character type*8,title*32,ctitle*8
    common/fltab/  htlsci,htlsco,coild ,pinteg
    common/fltab/  ctitle(4),icflg ,id
    * irest ,lenarr,lenfv ,lenfv2,lenptr,
    * lenvlt,lextra,lfv ,lfvn ,ncellt,
    * numbm1,numbm2,numbm3,numbn1,numbn2,
    * numbn3,nodes ,num ,nrvt ,ctype
    equivalence (flt(1),htlsco),(type,ctype),(ctitle(1),title)
c
c  break variable length table
c
    common/vltab/  aal111,alpoft,bsa ,bsmass,
    * bxa ,bxmass,conoff,delt1 ,deltv ,paoff ,poff ,
    * poffs ,rbmx ,tin ,tloff ,tvoff ,
    * z11111
    common/vltab/  ial111,ibasv ,ibcns,ibf ,ibp ,ibpasv,ibpsv ,
    * ibsv ,ibtlsv,ibtr ,ibtvsv,ibty ,icj ,inexti,ioff ,
    * ionoff,isat ,js1 ,jun1 ,nbrf ,
    * nbsv ,nbtb ,type1 ,
    * z11111
    integer vlt,type1,z11111

```

TRAC CODE MODIFICATIONS

```

c-----comdeck vltldim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vltldim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.

```

```

    parameter(ivltsz=270)
    dimension vlt(ivltsz)
    equivalence (vlt(1),aall111)

```

```

c-----

```

```

c

```

```

c    break pointer table
    dimension ld(3),ldn(3)
    common/ptab/  lalp ,lalpn ,lalpd ,
*   lalpdn,lalv ,lalvn ,lalve ,lalven,
*   lara ,laran ,larel ,lareln,larev ,
*   larevn,larl ,larln ,larv ,larvn ,
*   lbit ,lbitn ,lcti ,lctin,lctia ,
*   lctan,lcif ,lcifn ,lconc ,lconcn,
*   ld ,ldn ,lea ,lean ,lel ,
*   leln ,lev ,levn ,lgam ,lgamn ,
*   lhig ,lhigo ,lhil ,lhilo ,lhiv ,
*   lhivo ,lp ,lpn ,lpa ,lpan ,
*   lqppc ,lqppco,lroa ,lroan ,lrol ,
*   lroln ,lrov ,lrovn ,ls ,lsn ,
*   ltce ,ltcen ,ltd ,ltdn ,ltl ,
*   ltln ,ltv ,ltvn ,ltw ,ltwn ,
*   ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
*   lvlt ,lvlto ,lvn ,lvnm ,lvv ,
*   lvvn ,lvvt ,lvvto

```

```

c-----
c    if the list of pointers is increased, must also increase (if
c    necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c    than or equal to the total number of pointers defined in historian
c    comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c    total number of pointers is 77(dualpt) + 82(hydropt) = 159.

```

```

c-----
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for ld components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
    parameter (iptsiz=300)
    integer pt(iptsiz)

```

```

c-----

```

```

    equivalence (pt(1),lalp)

```

```

c

```

```

    dimension lh(3)
    common/ptab/  lalpmn,lalpmx,lalpo ,
*   lam ,larc ,lcfz ,lcl ,lcpl ,
*   lcpv ,lcv ,ldalva,ldfldp,ldfvd ,
*   ldri ,ldx ,lelev ,lfa ,lfavol,
*   lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
*   lh ,lhd ,lhdht ,lhfg ,lhgam ,
*   lhla ,lhlatw,lhva ,lhvatw,
*   lqrl ,lqrv ,lqp3f ,
*   lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
*   lrarl ,lrarv ,
*   lxsm,lysm,lzsm,lrsm,lr0sm,
*   lnfvsm,lnflsm,luvs ,lnfcvsm,lnfclsm,lvvsm,lvls ,
*   lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
*   lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
*   ltssn ,lvisl ,lvisv ,lvlalp,lvlv ,
*   lvlvol,lvlx ,lvol ,lvv ,lvrv ,
*   lvvvol,lvvx ,lwa ,lwat ,lwfl ,

```

TRAC CODE MODIFICATIONS

```

      * lwfv ,lwfmfl,lwfmfv
c
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c      in case new pointers are added after lwfmfv, then the coding in
c      subroutine aicomp (third executable statement) for evaluation of
c      the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c      must be changed to use the name of the new pointer at the end
c      of this section of the common block / ptab /.
c-----
      common/ptab/   lalptb,lcontb,lpatb ,
      * lptb ,lrftb ,ltltb ,ltvtb
c
c
      common/contrl/ cpuflg,damnc ,damx ,delt ,
      * deltht,difmin,dprmx ,dtlmx ,dtmax ,
      * dtmin ,dto ,dtrat ,dtrmx ,dtsmx ,
      * dtvmx ,encmax,eps1 ,eps2 ,epso ,
      * ercemx,epss ,etime ,htlosi,htloso,
      * odelt ,powerc,pssmn ,pssmx ,rfat ,
      * rvmax ,tend ,tercmx,timec ,timet ,
      * tmmx ,varer ,vcmn ,vcmx ,vmxo ,
      * vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
      * vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
      * omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
      * yvsm,zvsm,rmat3(3,3),omsm(3),wsm(3),
      * wds3(3),errsm,dt3sm
      common/contrl/ dstep ,iadded,iblaus,iccmx ,
      * icmp ,icpmx,icp ,idiag ,idiags,iectpx,ieos ,iff3d ,
      * ifprep,igeom3,im100 ,im100x,imfr ,
      * invan ,iofftk,ipak ,ipak3d,ipakon,ipkmp,
      * ireset,irsflg,irstfl,isolut,issflg,istdy ,
      * isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
      * lcmptr,levstg,llvflg,ncmn ,ncmx ,
      * ncontr,nconts,ncontt,ncrg ,ndial ,nencl,
      * newrfd,nfrcl ,nfr3 ,nitav ,nitmn ,
      * nitmx ,nloopp,nosets,nsend ,nseo ,
      * nsmn ,nsmx ,nspl ,nspu ,nsso ,
      * nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
      * stdyst,transi,motsm,statsm,saxsm
      integer dstep ,oitmax,sitmax,stdyst,
      * transi,statsm,saxsm
c
      common/units/   ibfadd,ibfadg,ibfadr,
      * ibflnd,ibflng,ibflnr,idout, ieee, igout ,
      * ikeybd,imout ,in ,inlab ,inproc,
      * ioall ,iodone,ioerr ,iogrf ,ioinp ,
      * iolab ,ioout ,ioskip,iout ,irstrt,
      * itty ,iunlab,iunout,lcmcpd,nittab,
      * npwtab,nrdy
      common /cunits/card
      character*100 card
c
      common/labelv/factor(150),offset(150)
      common/labelv/ih(26),itls(777),itsv(105),
1      ils,ilu,ilun,iold
      common/labelv/labels(777),labsv(2,105),labun(150),

```


TRAC CODE MODIFICATIONS

```

1          lunch(2,150),lupcb(2,150),runch(2,150)
common/labelv/alpbet,luar,lucp,lud,ludh,lue,luen,
1          luh,luha,luhx,luid,luis,lum,lumf,lup,
2          lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3          lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runch
character*13 luh,lunch,lupcb
character*14 labsv
character*19 ludh
character*26 alpbet
c          warning - ptrs common block variables
c          i11111 to nzzzzz are zero initialized
c
common/ptrs/ i11111,lbd ,lcntl ,
* lcompt,lcontp,lcontr,ldra ,ldrc ,
* licvs ,liitno,lijvs ,lilcmp,liou ,lisvf ,
* livcon,livljn,ljout ,ljseq ,ljun ,
* llcmhs,llcon ,lloopn,lmatb ,lmcsh,
* lmsct ,lnbr ,lnjn ,lnsig ,lnsigp,
* lnvcnl,lorder,lprptb,lptbln,ltitle,
* lvsi ,lwp
common/ptrs/ laol ,laou ,laov ,
* ldpvc ,ldpvcv,ldrel ,ldrev ,ldrl ,
* ldrv ,ldvb ,lidpcv,lod ,lvrh ,
* jaol ,jaov ,jdrv ,jdr1 ,jod ,
* jdrel ,jdrev ,jdra ,jdrc ,jnjun ,
* lilprb,livlfc,livvto,livlto
common/ptrs/ lbvec ,lbw ,ldmat ,
* lemat ,lenfxd,lfxd ,lrmat ,lvmat ,
* lvssc ,lvssip,nclear,nmat ,nvcell,
* nzzzzz
dimension ipt(76)
equivalence(ipt(1),i11111)
c
c
c          dimension tmp(4)
c
write(iout,100) num, jun1
100 format(/' the component type is a break, component number is',
1          i4,', and junction number is',i4)
cf=0.0
ce=0.0
c
iflgw=0
xxpow=0.0
itee = 0
call ecomp(num,1,1,iflgw,0,cf,xxpow,ce,tsec,itee)
c
if (((stdyst.eq.2).or.(stdyst.eq.4)).and.(ia(lcontp).gt.0)) then
do 160 i=1,ia(lcontp)
j2=lcontp+20*i
j1=j2-17

```

TRAC CODE MODIFICATIONS

```

      do 110 j=j1,j2
      if (ia(j).eq.num) go to 120
110   continue
      go to 160
120   continue
      do 130 n=1,ncontr
      if (ia(j1-2).eq.ia(lcontr-5+5*n)) go to 140
130   continue
      go to 160
140   continue
      k=lcntl+10+6*ia(lcntl+5)+7*ia(lcntl+1)
      1   +17*(ia(lcntl+2)-ncontr-ncontt+n)
      write(iout,150) a(k),ia(j1-2)
150   format(/' the pressure of this break component has been',
      1   ' adjusted by the factor',1p,e12.5/' by a constrained',
      2   ' steady-state controller applied to component',i4)
160   continue
      endif
c
      cmbrk=bsmass
      tmp(1)=bxmass
      tmp(2)=bxa
      tmp(3)=bsmass
      tmp(4)=bsa
      if (ioout.eq.1) then
        call uncvt('bxmass',tmp(1),2,1,-1)
        call uncvt('bsmass',tmp(3),2,1,-1)
      endif
      write(iout,170) tmp(2),lumf,tmp(4),lum
170   format(/' ncd-gas mass inflow to the break is',1p,e13.5,a,
      1   ' and total ncd-gas mass in to the break is',e13.5,a)
      write(iout,180) tmp(1),lumf,tmp(3),lum
180   format(' coolant mass inflow to the break is',1p,e13.5,a,
      1   ' and total coolant mass in to the break is',e13.5,a)
c
      return
      end

```

Fortran file wcomp.f:

```

      subroutine wcomp(comptr)
c
c      subroutine wcomp writes the control-parameter data to file
c      trcout and calls the w-subroutines which write out selected
c      component thermal-hydraulic solution data to file trcout
c
c      common block variables used:
c      comptr = pointer to component data
c      ifree = first location in a array available for use
c      lenptr = length of the pointer common block
c      lentbl = length of the fixed-length common block
c      lenvlt = length of the variable-length common block
c      ncomp = number of components
c      nstep = time-step number
c
      character*8 nm(5,11)
      data (nm(i,11),i=1,5)/' ',' ',' ',' ',' ','/'
      data (nm(i,1),i=1,5)/' 1 ',' 11 ',' 1 ',' 1 ',' 111 '/'
      data (nm(i,2),i=1,5)/' 22222',' 2 ',' 22222',' 2 ',' 22222 '/'
      data (nm(i,3),i=1,5)/' 33333',' 3 ',' 33333',' 3 ',' 33333 '/'
      data (nm(i,4),i=1,5)/' 4 4',' 4 4 ',' 44444',' 4 ',' 4 '/'
      data (nm(i,5),i=1,5)/' 55555',' 5 ',' 55555',' 5 ',' 55555 '/'

```

TRAC CODE MODIFICATIONS

```

data (nm(i,6),i=1,5) /'66666','6','66666','6','66666'/
data (nm(i,7),i=1,5) /'77777','7','77777','7','77777'/
data (nm(i,8),i=1,5) /'88888','8','88888','8','88888'/
data (nm(i,9),i=1,5) /'99999','9','99999','9','99999'/
data (nm(i,10),i=1,5) /'00000','0','00000','0','00000'/

c
ctmp *****
character*10 filename
character*80 commnt
logical first
save first
parameter (maxgpts=500)
common /tecplot/iicomp(maxgpts),iicell(maxgpts),ictype(maxgpts),
& id_leg(maxgpts),npoints,iinl
ctmp *****
c
common/ctrl/ cpuflg,dammc,damx,delt,
* deltht,difmin,dprmx,dtlrmx,dtmax,
* dtmin,dtor,dtrrmx,dtsmx,
* dtvmx,encmax,eps1,eps2,epso,
* ercemx,epss,etime,htlosi,htloso,
* odelt,powerc,pssmn,pssmx,rfat,
* rvmax,tend,tercmx,timec,timet,
* tnmmax,varer,vcmn,vcmx,vmaxo,
* vmxt3,vmx3,vmcon,vmnew,vmold,
* vmxt3o,xtable,x0sm,y0sm,z0sm,
* omsasm,wsasm,wdsasm,t0sm(3),xvsm,
* yvsm,zvsm,rmatm(3,3),omsm(3),wsm(3),
* wds(3),errsm,dtm
common/ctrl/ dstep,iaddd,iblaus,iccmx,
* icmp,icpmx,icp,idiag,idiags,iectpx,ieos,iff3d,
* ifprep,igeom3,iml100,iml100x,imfr,
* invan,iofftk,ipak,ipak3d,ipakon,ipkpmp,
* ireset,irsflg,irstfl,isolut,issflg,istdy,
* isttc,ithd,itmin,itpako,jfat,kccmx,
* lcmptr,levstg,llvflg,ncmn,ncmx,
* ncontr,nconts,ncontt,ncrg,ndial,nencl,
* newrfd,nfrcl,nfrc3,nitav,nitmn,
* nitmx,nloopp,nosets,nsend,nseo,
* nsmn,nsmx,nspl,nspu,nso,
* nstab,nstp,nvgrav,nvpow,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

c
common/dimen/ ifree,jnvss1,kvel1t,
* kvel2t,kvel3t,last,ldim,lenbd,lendim,
* lentbl,lfree,llast,lmdp,lndpv,lndpdt,
* locrdp,lstart,lstrdp,lver,mdim,
* memflg,moff,ncomp,ncompt,
* nhtstr,njnm,njnt,njun,nloops,
* nmvss1,npx,nstgj,nthm,nthmld,
* nthm3d,numtcr,nvcon,nvelx,nvely,
* nvelz,nwrda

c
parameter (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))

```

TRAC CODE MODIFICATIONS

```

      equivalence (a(1),ia(1))
c
c      fixed length table
      integer flt(1)
      real rflt(1)
      equivalence (flt(1),rflt(1))
      character type*8,title*32,ctitle*8
      common/fltab/  htlscl,htlsco,coild ,pinteg
      common/fltab/  ctitle(4),icflg ,id
      * irest ,lenarr,lenfv ,lenfv2,lenptr,
      * lenvlt,lextra,lfv ,lfvn ,ncellt,
      * numbm1,numbm2,numbm3,numbn1,numbn2,
      * numbn3,nodes ,num ,nrvlt ,ctype
      equivalence (flt(1),htlscl),(type,ctype),(ctitle(1),title)
c
c      graphics variable length table
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
      parameter(ivltsz=270)
      dimension vlt(ivltsz),ivlt(ivltsz)
      common/vltab/ ivlt
      equivalence (ivlt(1),vlt(1))
c
c      graphics pointer table
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
      parameter (iptsiz=300)
      integer pt(iptsiz)
c-----
      common/ptab/  pt
c
c
c      common/holl/  accumh,breakh,coreh ,
      * ctainh,fillh ,pipeh ,plenh ,prizrh,pumph ,
      * stgenh,teeh ,turbh ,valveh,vsslh
      * ,rodh,slabh,sepdh
      character*8 rodh,slabh,accumh,breakh,coreh,ctainh,fillh,pipeh
      1,plenh,prizrh,pumph,stgenh,teeh,turbh,valveh,vsslh
      * ,sepdh
c
c      common/units/  ibfadd,ibfadg,ibfadr,
      * ibflnd,ibflng,ibflnr,idout,  ieeeg, igout ,
      * ikeybd,imout ,in ,inlab ,inproc,
      * ioall ,iodone,ioerr ,iogrf ,ioinp ,
      * iolab ,ioout ,ioskip,iout ,irstrt,
      * itty ,iunlab,iunout,lcmcpd,nittab,
      * npwtab,nrdy
      common /cunits/card
      character*100 card
c
c      common/istat/  varerm,verr
      common/istat/  iott ,nstep ,oitno
      integer oitno
c
c      common/labelv/factor(150),offset(150)
      common/labelv/ih(26),itls(777),itsv(105),
      1      ils,ilu,ilun,iold
      common/labelv/labels(777),labsv(2,105),labun(150),
      1      luncb(2,150),lupcb(2,150),runcb(2,150)
      common/labelv/alpbet,luar,lucp,lud,ludh,lue,luen,
      1      luh,luha,luhx,luid,luis,lum,lumf,lup,

```

TRAC CODE MODIFICATIONS

```

2          lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3          lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runch
character*13 luh,lunch,lupch
character*14 labsv
character*19 ludh
character*26 alpbet
common/timer/  adate ,atime ,cput ,
* timcpu,timei ,timiom,timsys,timtot
common/timer/  nstept
c
c  warning - ptrs common block variables
c  i11111 to nzzzzz are zero initialized
c
common/ptrs/  i11111,ldb ,lcntl ,
* lcompt,lcontp,lcontr,ldra ,ldrc ,
* licvs ,liitno,lijvs ,lilcmp,liou ,lisvf ,
* livcon,livljn,ljout ,ljseq ,ljun ,
* llcmhs,llcon ,lloopn,lmatb ,lmcmsb,
* lmsct ,lnbr ,lnjn ,lnsig ,lnsigp,
* lncnl,lorder,lprptb,lptbln,ltitle,
* lvsi ,lwp
common/ptrs/  laol ,laou ,laov ,
* ldpcv ,ldpvcv,ldrel ,ldrev ,ldrl ,
* ldrv ,ldvb ,ldpcv,lod ,lvrh ,
* jaol ,jaov ,jdrv ,jdr1 ,jod ,
* jdrel ,jdrev ,jdra ,jdrc ,jnjun ,
* lilprb,livlfc,livvto,livlto
common/ptrs/  lbvec ,lbw ,ldmat ,
* lemat ,lenfxd,lfxd ,lrm1 ,lvmat ,
* lvssc ,lvssip,nclear,nmat ,nvcell,
* nzzzzz
dimension ipt(76)
equivalence(ipt(1),i11111)
c
common /stncom/ stnmax,tmstnu,tldmin,tmld
common /stncom/ istnu,jstnu,kstnu,nstnu
common /stncom/ itldm,jtldm,ktldm,ntldm
c
character*8 lun,status(2,3)
character*14 rl(5),sp
equivalence (n1,numbn1),(n2,numbn2),(n3,numbn3)
equivalence (m1,numbm1),(m2,numbm2),(m3,numbm3)
dimension comptr(1),tmp(6)
integer arptr,comptr
data status/' on-r','everse ',' o','ff ','
1          ' on-f','orward '/,sp/' /'
c
c
c
ctmp *****
data first /.true./

```

TRAC CODE MODIFICATIONS

```

c
      if (first) then
        iin1 = 40
        first = .false.
c
c Open and read in the selected point where graphical data
c requested.
c
      open (iin1,file='graphin',status='old')
      read (iin1,'(a80)') commnt
      read (iin1,*) npoints
c
c If requested number of graphics points greater than maxgpts,
c then write error message and terminate.
c
      if (npoints.gt.maxgpts) then
        write (*,2090) maxgpts
        write (iout,2090) maxgpts
2090      format(//,
& '-----',/,
& ' *** ERROR ***',/,
& ' No. of graphics points requested in graphin file exceeds',/,
& ' maximum allowed (',i3,'). Program terminated.',/,
& ' *** ERROR ***',/,
& '-----')
        stop
      endif
c
      read (iin1,'(a80)') commnt
      do ipts=1,npoints
        read (iin1,*) iicomp(ipts), icell(ipts), ictype(ipts),
& id_leg(ipts)
      enddo
c
c Open summary tecplot graphics file (one file will contain all
c component graphics; external routine "tecsplit" is required
c to split out the graphics into multiple tecplot files for
c each requested graphics point):
c
      write (*,2100)
      write (iout,2100)
2100      format(//,
& '-----',/,
& ' Tecplot graphics summary file generated: "tecsum.grf" ',/,
& '-----')
      iunit = iin1
      filename = 'tecsum.grf'
      open (iunit,file=filename,status='unknown')
      write (iin1,2105)
2105      format(
& 'This file contains graphics input from TRAC for tecsplot')
c
c Adjust cell id up one when component is a tee to be consistent
c with storage scheme used in TRAC when cell is in the second
c leg of that tee.
c
      do ipts=1,npoints
        if (ictype(ipts).eq.2 .and. id_leg(ipts).eq.2) then
          icell(ipts) = iicell(ipts) + 1
        endif
      enddo
c

```

TRAC CODE MODIFICATIONS

```

        endif
ctmp *****
c
c
        if (nstep.eq.0) then
            told=amax1(0.0,etime)
        else
            told=etime-delt
        endif
        k2=lcntl+10+6*ia(lcntl+5)
c
c    signal variable values
c
        if (ia(lcntl+1).lt.1) go to 170
        write(iout,100) told,lut
100 format(/1x,37('*'),' signal-variable values at time',f11.5,
1 a,37('*'))//5(5x,'id',5x,'sig.var.',4x)//
        kk=k2+7*(ia(lcntl+1)-1)
        nn=(ia(lcntl+1)+4)/5
        do 160 n=1,nn
            k1=k2
            k2=min0(k1+28,kk)
            do 110 k=k1,k2,7
                tmp(1+(k-k1)/7)=a(k+7)
                if (ioout.eq.1) then
                    j=itsv(iabs(ia(k+2))+1)
                    if ((j.eq.3).and.(ia(k+2).lt.0)) j=4
                    tmp(1+(k-k1)/7)=tmp(1+(k-k1)/7)*factor(j)+offset(j)
                endif
110 continue
                write(iout,120) (ia(k+1),tmp(1+(k-k1)/7),k=k1,k2,7)
120 format(5(i7,1p,e15.6,2x))
                if (iunout.eq.1) then
                    do 140 k=k1,k2,7
                        j=15
130 continue
                        j=j-1
                        if (labsv(ioout+1,iabs(ia(k+2))+1)(j:j).eq.sp(1:1)) go to 130
                        if (j.eq.14) then
                            rl(1+(k-k1)/7)=labsv(ioout+1,iabs(ia(k+2))+1)
                        else
                            rl(1+(k-k1)/7)=sp(1:14-j)//labsv(ioout+1,iabs(ia(k+2))+1)(1:j)
                        endif
140 continue
                        write(iout,150) (rl(1+(k-k1)/7),k=k1,k2,7)
150 format(5(8x,a,2x))
                    endif
                    k2=k2+7
160 continue
c
c    control block values
c
170 continue
        if (ia(lcntl+2).lt.1) go to 210
        write(iout,180) told,lut
180 format(/1x,34('*'),' control-block output values at time',
1 f11.5,a,35('*'))//5(5x,'id',5x,'con.blk.',4x)//
        kk=k2+17*(ia(lcntl+2)-1)
        ll=kk+17+ia(lcntl+3)
        nn=(ia(lcntl+2)+4)/5
        do 200 n=1,nn
            k1=k2

```

TRAC CODE MODIFICATIONS

```

      k2=min0(k1+68, kk)
      do 190 k=k1, k2, 17
        tmp(1+(k-k1)/17)=a(k+17)
        if ((ioout.eq.1).or.(iunout.eq.1)) then
          lun=ach(11+2)
          call uncnvt(lun, tmp(1+(k-k1)/17), 1, 1, -ioout)
          rl(1+(k-k1)/17)=sp(1:2)//runcb(ioout+1, itls(iold))
        endif
        ll=ll+6
190    continue
        write(iout, 120) (ia(k+1), tmp(1+(k-k1)/17), k=k1, k2, 17)
        if (iunout.eq.1) then
          write(iout, 150) (rl(1+(k-k1)/17), k=k1, k2, 17)
        endif
        k2=k2+17
200    continue
        k2=ll
c
c      trip set status values
c
210    continue
        if (ia(lcntl+4).lt.1) go to 270
        ll=k2
        k2=k2+ia(lcntl+4)+5*ia(lcntl+6)
        write(iout, 220) told, lut
220    format(/1x, 41('*'), ' trip set status at time', f11.5, a,
1 40('*'))//5(5x, 'id', 4x, 'set status', 3x)//
        k1=k2
        k2=k1+80*(ia(lcntl+4)-1)
        write(iout, 230) (ia(k+1), (status(i, ia(k+3)+2), i=1, 2), k=k1, k2, 80)
230    format(i7, 2a, i8, 2a, i8, 2a, i8, 2a, i8, 2a)
c
c      trip signal values
c
        write(iout, 240) told, lut
240    format(/1x, 39('*'), ' trip signal values at time', f11.5, a,
1 39('*'))//5(5x, 'id', 5x, 'trp.sig.', 4x)//
        kk=k2
        k2=k1
        nn=(ia(lcntl+4)+4)/5
        do 260 n=1, nn
          k1=k2
          k2=min0(k1+320, kk)
          do 250 k=k1, k2, 80
            tmp(1+(k-k1)/80)=a(k+19)
            if ((ioout.eq.1).or.(iunout.eq.1)) then
              lun=ach(11+1)
              call uncnvt(lun, tmp(1+(k-k1)/80), 1, 1, -ioout)
              rl(1+(k-k1)/80)=sp(1:2)//runcb(ioout+1, itls(iold))
            endif
            ll=ll+1
250          continue
          write(iout, 120) (ia(k+1), tmp(1+(k-k1)/80), k=k1, k2, 80)
          if (iunout.eq.1) then
            write(iout, 150) (rl(1+(k-k1)/80), k=k1, k2, 80)
          endif
          k2=k2+80
260        continue
c
270    continue
        if (stnmax.ne.0.0) then
          if (istnu.eq.0) then

```


TRAC CODE MODIFICATIONS

```

        write(imout,280) tmstnu,lus,nstnu,jstnu,stmmax
        write( iout,280) tmstnu,lus,nstnu,jstnu,stmmax
280    format(/' at time',f11.4,a,' in component number',i4,' at',
1      ' cell',i4,', the maximum Stanton number is',1p,e13.6)
    else
        write(imout,290) tmstnu,lus,nstnu,istnu,jstnu,kstnu,stmmax
        write( iout,290) tmstnu,lus,nstnu,istnu,jstnu,kstnu,stmmax
290    format(/' at time',f11.4,a,' in component number',i4,' at',
1      ' cell (i=',i3,',j=',i3,',k=',i3,')', the maximum',
2      ' Stanton number is',1p,e13.6)
    endif
    tmp(1)=tldmin
    if (ioout.eq.1) then
        call uncvt('t1',tmp(1),1,1,-1)
    endif
    if (itldm.eq.0) then
        write(imout,300) tmtld,lus,ntldm,jtldm,tmp(1),lutp
        write( iout,300) tmtld,lus,ntldm,jtldm,tmp(1),lutp
300    format(' at time',f11.4,a,' in component number',i4,' at',
1      ' cell',i4,', the minimum tld is',1p,e13.6,a/
2      ' 14x, where tld is the liquid temperature at bubble',
3      ' detachment from a heated surface')
    else
        write(imout,310) tmtld,lus,ntldm,itldm,jtldm,ktldm,tmp(1),lutp
        write( iout,310) tmtld,lus,ntldm,itldm,jtldm,ktldm,tmp(1),lutp
310    format(' at time',f11.4,a,' in component number',i4,' at',
1      ' cell (i=',i3,',j=',i3,',k=',i3,')', the minimum',
2      ' tld is',1p,e13.6,a/30x,' where tld is the liquid',
3      ' temperature at bubble detachment from a heated',
4      ' surface')
    endif
    nittab=0
    npwtab=0
    endif
c
    tfmass=0.0
    tener =0.0
    tmbrk =0.0
    tmfill=0.0
    do 380 i = 1, ncomp
        write(iout,320)
320    format(/1x,119('-'))
        cfmass=0.0
        cener =0.0
        cmbrk =0.0
        cmfill=0.0
c
c    read the fixed-length table and find the component type
c
        call rd1cm ( flt(1), comptr(i), lentbl )
c
        if (nstep.eq.0) then
            if (i.lt.10) then
                numbn1=11
                numbn2=11
                numbn3=i
            else
                if (i.lt.100) then
                    numbn1=11
                    numbn2=i/10
                    numbn3=i-numbn2*10
                    if (numbn3.eq.0) numbn3=10
                
```

TRAC CODE MODIFICATIONS

```

        else
            numbn1=i/100
            numbn2=(i-numbn1*100)/10
            numbn3=(i-numbn1*100)-numbn2*10
            if (numbn2.eq.0) numbn2=10
            if (numbn3.eq.0) numbn3=10
        endif
    endif
    call wrldcm(flt,comptr(i),lentbl)
endif
write(iout,330) nm(1,numbn1),nm(1,numbn2),nm(1,numbn3),
1          nm(1,numbm1),nm(1,numbm2),nm(1,numbm3)
330 format(1x,3(a5,1x),84x,2(a5,1x),a5)
write(iout,340) nm(2,numbn1),nm(2,numbn2),nm(2,numbn3),etime,lus,
1          delt,lus,nstep,nm(2,numbm1),nm(2,numbm2),nm(2,numbm3)
340 format(1x,3(a5,1x),'time is ',f13.6,a,', time-step size is ',
1          f11.6,a,', time-step number is ',i5,1x,2(a5,1x),a5)
write(iout,330) nm(3,numbn1),nm(3,numbn2),nm(3,numbn3),
1          nm(3,numbm1),nm(3,numbm2),nm(3,numbm3)
write(iout,350) nm(4,numbn1),nm(4,numbn2),nm(4,numbn3),
1          ctitle,nm(4,numbm1),nm(4,numbm2),nm(4,numbm3)
350 format(1x,3(a5,1x),26x,4a8,26x,2(a5,1x),a5)
write(iout,330) nm(5,numbn1),nm(5,numbn2),nm(5,numbn3),
1 nm(5,numbm1),nm(5,numbm2),nm(5,numbm3)
write(iout,360)
360 format(1x,119('-'))
if (type.eq.vsslh) then
    call cwvssl(comptr(i),cfmass,cener)
else
c
c     read variable-length table
c
c     call rdldcm(vlt(1),comptr(i)+lentbl,lelvlt)
c
c     read pointer table
c
c     call rdldcm(pt(1),comptr(i)+lentbl+lelvlt,lenptr)
c
c     read arrays
c
c     arptr = comptr(i) + lentbl + lelvlt + lenptr
c
c     ifree=arptr
c     call rdldcm(a(ifree),arptr,lenarr)
c
c     do 370 j = 1, lenptr
c         pt(j) = pt(j) + ifree - 1
370     continue
c
c     if (type.eq.pipeh) then
c         call wpipe(cfmass,cener,etime)
c     elseif (type.eq.teeh) then
c         call wtee(cfmass,cener,etime)
c     elseif (type.eq.pumph) then
c         call wpump(cfmass,cener,etime)
c     elseif (type.eq.fillh) then
c         call wfill(cmfll,etime)
c     elseif (type.eq.prizrh) then
c         call wprizr(cfmass,cener,cnbrk,etime)
c     elseif (type.eq.turbh) then
c         call wturb(cfmass,cener,etime)
c     elseif (type.eq.valveh) then

```

TRAC CODE MODIFICATIONS

```

        call wvlve(cfmass,cener,etime)
    elseif (type.eq.sepdh) then
        call wtee(cfmass,cener,etime)
    elseif (type.eq.breakh) then
        call wbreak(cmbrk,etime)
    elseif (type.eq.plenh) then
        call wplen(cfmass,cener,a(lbd),lenbd,etime)
    endif
endif
tfmass=tfmass+cfmass
tener=tener+cener
tmbrk=tmbrk+cmbrk
tmfill=tmfill+cmfill
380 continue
    if (nhtstr.gt.0) call whtstr
c
    write(iout,390)
390 format('/// system results')
    tmp(1)=tfmass
    tmp(2)=tmbrk
    tmp(3)=tmfill
    tmp(4)=tener
    i=1
    if (nstep.gt.0) then
        i=3
        tmp(5)=htlosi
        tmp(6)=htloso
    endif
    if (ioout.eq.1) then
        call uncvt('tfmass',tmp(1),3,1,-1)
        call uncvt('tener',tmp(4),i,1,-1)
    endif
    if (nstep.gt.0) then
        write(iout,400) tmp(5),lue,tmp(6),lue
400    format(' total power loss by 1-d comp.wall is',1p,e14.6,a,
1        ' on the inner surface and',e14.6,a,' on the outer',
2        ' surface')
    endif
    write(iout,410) tmp(4),lue,tmp(1),lum
410 format(/23x,'system total coolant energy is',1p,e14.6,a//
-1    25x,'system total coolant mass is',e14.6,a)
    write(iout,420) tmp(2),lum
420 format(/' total coolant mass discharged by break components is',
1    1p,e14.6,a)
    write(iout,430) tmp(3),lum
430 format(/4x,'total coolant mass injected by fill components is',
1    1p,e14.6,a)
    tmtot = tmp(1) + tmp(2) - tmp(3)
    write(iout,440) tmtot,lum
440 format(/8x,'system computed initial total coolant mass is',
1    1p,e14.6,a/)
c
    return
end

```

Fortran file wfill.f:

```

subroutine wfill(cmfill,tsec)
c
c    subroutine wfill writes thermal-hydraulic solution
c    parameters to file trcout for the fill component
c

```

TRAC CODE MODIFICATIONS

```

parameter      (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
c   fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/  htlscl,htlsco,coild ,pinteg
common/fltab/  ctitle(4),icflg ,id
*  irest ,lenarr,lenfv ,lenfv2,lenptr,
*  lenvlt,lextra,lfv ,lfvn ,ncellt,
*  numbm1,numbm2,numbm3,numbn1,numbn2,
*  numbn3,nodes ,num ,nrvt ,ctype
equivalence (flt(1),htlscl),(type,ctype),(ctitle(1),title)

c
c   fill variable length table
common/vltab/  aa1111,alpoff,conoff,flowin,
*  flwoff,fsmass,fxmass,paoff ,poff ,
*  rfmx ,tloff ,tvoff ,twtoold,vloff ,
*  vvoff ,
*  z11111
common/vltab/  ia1111,icj ,iff ,ifp ,
*  ifsv ,iftr ,ifty ,inexti,ioff ,
*  ifmlsv,ifmvsv,iftlsv,iftvsv,ifasv ,
*  ifpsv ,ifpasv,ifcnsv,
*  ionoff,js1 ,jun1 ,nfrf ,nfsv ,
*  nftb ,typel ,
*  z11111
integer vlt,typel,z11111
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aa1111)

c-----
c
c   fill pointer table
dimension ld(3),ldn(3)
common/ptab/  lalp ,lalpn ,lalpd ,
*  lalpdn,lalv ,lalvn ,lalve ,lalven,
*  lara ,larn ,lare ,lareln,larev ,
*  larevn,larl ,larln ,larv ,larvn ,
*  lbit ,lbitn ,lcti ,lctin,lctia,
*  lctan,lcif ,lcifn ,lconc ,lconcn,
*  ld ,ldn ,lea ,lean ,lel ,
*  leln ,lev ,levn ,lgam ,lgamn ,
*  lhig ,lhigo ,lhil ,lhilo ,lhiv ,
*  lhivo ,lp ,lpn ,lpa ,lpan ,
*  lqppc ,lqppco,lroa ,lroan ,lrol ,
*  lroln ,lrov ,lrovn ,ls ,lsn ,
*  ltce ,ltcen ,ltd ,ltdn ,ltl ,
*  ltln ,ltv ,ltvn ,ltw ,ltwn ,

```

TRAC CODE MODIFICATIONS

```

* ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvlm ,
* lvlm ,lvlto ,lvn ,lvnm ,lvv ,
* lvnm ,lvvt ,lvvto

```

```

-----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c   than or equal to the total number of pointers defined in historian
c   comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c   total number of pointers is 77(dualpt) + 82(hydropt) = 159.
-----

```

```

c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.

```

```

    parameter (iptsiz=300)

```

```

    integer pt(iptsiz)

```

```

c-----

```

```

    equivalence (pt(1),lalp)

```

```

c

```

```

    dimension lh(3)

```

```

    common/ptab/ lalpmn,lalpmx,lalpo ,

```

```

* lam ,larc ,lcfz ,lcl ,lcpl ,

```

```

* lcpv ,lcv ,ldalva,ldfldp,ldfvd ,

```

```

* ldriv ,ldx ,lelev ,lfa ,lfavol ,

```

```

* lfinan,lfric ,lfsmlt,lgrav ,lgrvol ,

```

```

* lh ,lhd ,lhdht ,lhfg ,lhgam ,

```

```

* lhla ,lhlatw,lhva ,lhvatw ,

```

```

* lqrl ,lqrv ,lqp3f ,

```

```

* lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,

```

```

* lrarl ,lrarv ,

```

```

* lxxsm,lysm,lzsm,lrsn,lrsom ,

```

```

* lnfvsm,lnflsm,luvsu,lnfcvsm,lnfcclsm,lvvsm,lvlsm ,

```

```

* lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm ,

```

```

* lrom ,lrvmf ,lsig ,ltrid ,ltsat ,

```

```

* ltssn ,lvisl ,lvisv ,lvlalp,lvlvc ,

```

```

* lvlvol,lvlx ,lvol ,lvv ,lvrv ,

```

```

* lvvvol,lvvx ,lwa ,lwat ,lwfl ,

```

```

* lwfv ,lwfmfl,lwfmfv

```

```

c

```

```

-----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c   than or equal to the total number of pointers defined in historian
c   comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c   total number of pointers is 77(dualpt) + 82(hydropt) = 159.

```

```

c
c   in case new pointers are added after lwfmfv, then the coding in
c   subroutine aicomp (third executable statement) for evaluation of
c   the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c   must be changed to use the name of the new pointer at the end
c   of this section of the common block / ptab /.

```

```

c-----

```

```

    common/ptab/ lalptb,lcontb,lpatb ,

```

```

* lptb ,lrftb ,ltltb ,ltvtb ,lvmtb ,

```

```

* lvvtb

```

```

c

```

```

c

```

```

    common/units/ ibfadd,ibfadg,ibfadr ,

```

```

* ibflnd,ibflng,ibflnr,idout ,ieeeg ,igout ,

```

```

* ikeybd,imout ,in ,inlab ,inproc ,

```

```

* ioall ,iodone,ioerr ,iogrf ,ioinp ,

```

```

* iolab ,ioout ,ioskip,iout ,irstrt ,

```

```

* itty ,iunlab,iunout,lcmcpd,nittab ,

```

TRAC CODE MODIFICATIONS

```

      * npwtab,nrdy
      common /cunits/card
      character*100 card

c
      common/labelv/factor(150),offset(150)
      common/labelv/ih(26),itls(777),itsv(105),
1      ils,ilu,ilun,iold
      common/labelv/labels(777),labsv(2,105),labun(150),
1      luncb(2,150),lupcb(2,150),runcb(2,150)
      common/labelv/alpbat,luar,lucp,lud,ludh,lue,luen,
1      luh,luha,luhx,luid,luis,lum,lumf,lup,
2      lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3      lut,lutc,lutm,lutp,luv,luvf,luvo,luz
      character*2 lud,lutp,lus
      character*3 lut,luz
      character*4 luar,lue,lum,luvo
      character*5 lup,lupd,luv,luvf
      character*6 luis
      character*7 luen,lumf,lupt,lupw
      character*8 labels,labun,luid,lur,lusp,lusz,lutm
      character*9 luha
      character*10 lucp
      character*11 luph
      character*12 luhx,lutc,runcb
      character*13 luh,luncb,lupcb
      character*14 labsv
      character*19 ludh
      character*26 alpbat

c
      dimension tmp(2)

c
      write (iout,100) num, junl
100 format(/' the component type is a fill, component number is',
1      i4,', and junction number is',i4)
      cf=0.0
      ce=0.0

c
      iflgw=0
      xpow=0.0
      itee = 0
      call ecomp(num,1,1,iflgw,0,cf,xpow,ce,tsec,itee)

c
      cmfill=fsmass
      tmp(1)=fxmass
      tmp(2)=fsmass
      if (ioout.eq.1) then
         call uncnvt('fxmass',tmp(1),1,1,-1)
         call uncnvt('fsmass',tmp(2),1,1,-1)
      endif
      write(iout,110) tmp(1),lumf,tmp(2),lum
110 format(/' fill coolant mass outflow is',1p,e13.5,a,
1      ' and total mass from the fill is',e13.5,a)

c
      return
      end

```

Fortran file whtstr.f:

```

      subroutine whtstr

c
c      subroutine whtstr writes thermal-hydraulic solution
c      parameters to file trcout for the heat-structure component

```

TRAC CODE MODIFICATIONS

```

c
character*8 nm(5,11)
data (nm(i,11),i=1,5) /'      ' , '      ' , '      ' , '      ' /
data (nm(i,1),i=1,5) /' 1 ' , ' 11 ' , ' 1 ' , ' 1 ' , ' 111 ' /
data (nm(i,2),i=1,5) /'22222' , ' 2 ' , '22222' , ' 2 ' , '22222' /
data (nm(i,3),i=1,5) /'33333' , ' 3 ' , '33333' , ' 3 ' , '33333' /
data (nm(i,4),i=1,5) /'4 4 ' , '4 4 ' , '44444' , ' 4 ' , ' 4 ' /
data (nm(i,5),i=1,5) /'55555' , ' 5 ' , '55555' , ' 5 ' , '55555' /
data (nm(i,6),i=1,5) /'66666' , ' 6 ' , '66666' , ' 6 ' , '66666' /
data (nm(i,7),i=1,5) /'77777' , ' 7 ' , ' 7 ' , ' 7 ' , ' 7 ' /
data (nm(i,8),i=1,5) /'88888' , ' 8 ' , '88888' , ' 8 ' , '88888' /
data (nm(i,9),i=1,5) /'99999' , ' 9 ' , '99999' , ' 9 ' , '99999' /
data (nm(i,10),i=1,5) /'00000' , ' 0 ' , ' 0 ' , ' 0 ' , '00000' /
parameter (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

```

```

c
common/contrl/ cpuflg,dammc,damx,delt ,
* deltht,difmin,dprmx,dtltx,dtmax ,
* dtmin,dto ,dtrat,dtmrx,dtsmx ,
* dtvmx,encmax,eps1 ,eps2 ,epso ,
* ercemx,epss ,etime,htlosi,htloso,
* odelt ,powerc,pssmn ,pssmx,rfat ,
* rvmax,tend ,tercmx,timec,timet ,
* tmmx,varer ,vcmn ,vcmx ,vmxo ,
* vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
* vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
* omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
* yvsm,zvsm,rmat3(3,3),omsm(3),wsm(3),
* wds3(3),errsm,dtsm
common/contrl/ dstep ,iadded,iblaus,iccmx ,
* icmp ,icpmx,icp ,idiag,idiags,ieccpx,ieos ,iff3d ,
* ifprep,igeom3,iml00 ,iml00x,imfr ,
* invan ,iofftk,ipak ,ipak3d,ipakon,ipkmp,
* ireset,irsflg,irstfl,isolut,issflg,istdy ,
* isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
* lcmptr,levstg,llvflg,ncmn ,ncmx ,
* ncontr,nconts,ncontt,ncrg ,ndial ,nenc1,
* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nspl ,nspu ,nsso ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

```

```

c
common/dimen/ ifree ,jnvssl,kvel1t,
* kvel2t,kvel3t,last ,ldim ,lenbd ,lendim,
* lentbl,lfree ,llast ,lmldp ,lnldpv,lnrdpt,
* locrdp,lstart,lstrdp,lver ,mdim ,
* memflg,moff ,ncomp ,ncompt,
* nhtstr,njnmx ,njnt ,njun ,nloops,
* nmvssl,npx ,nstgj ,nthm ,nthmld,
* nthm3d,numtcr,nvcon ,nvelx ,nvely ,
* nvelz ,nwrda

```

```

c
c fixed length table

```

TRAC CODE MODIFICATIONS

```

integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/ htlsci,htlsco,coild ,pinteg
common/fltab/ ctitle(4),icflg ,id
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num ,nrvt ,ctype
equivalence (flt(1),htlsci),(type,ctype),(ctitle(1),title)

c
common/units/ ibfadd,ibfadg,ibfadr,
* ibflnd,ibflng,ibflnr,idout, ieeeg, igout ,
* ikeybd,imout ,in ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1 ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1 luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alphbet,luar,lucp,lud,ludh,lue,luen,
1 luh,luha,luhx,luid,luis,lum,lumf,lup,
2 lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3 lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alphbet
c warning - ptrs common block variables
c i11111 to nzzzzz are zero initialized
c
c
c
ctmp *****
c
common /tecplot/iicomp(500),iicell(500),ictype(500),
& id_leg(500),npoints,iinl

c
dimension tsurfi(50),tsurfo(50)
dimension qsg(50),qsgo(50),qsfi(50),qsfo(50)
dimension filmfi(50),filmfo(50),filmgi(50),filmgo(50)

```


TRAC CODE MODIFICATIONS

```

        dimension tfi(50),tfo(50),tgi(50),tgo(50)
c
c
c
c
        common/ptrs/  i11111,lbd  ,lcnt1 ,
* lcompt,lcontp,lcontr,ldra ,ldrc ,
* licvs ,liitno,lijvs ,lilcmp,liou ,lisvf ,
* livcon,livljn,ljout ,ljseq,ljun ,
* llcmhs,llcon ,lloopn,lmatb ,lcmsh,
* lmsct ,lnbr ,lnjn ,lnsig ,lnsigp,
* lnvcnl,lorder,lprptb,lptbln,ltitle,
* lvsi ,lwp
        common/ptrs/  laol ,laou ,laov ,
* ldpvc ,ldpvcv,ldrel ,ldrev ,ldrl ,
* ldrv ,ldvb ,lidpcv,lod ,lvrh ,
* jaol ,jaov ,jdrv ,jdrl ,jod ,
* jdrel ,jdrev ,jdra ,jdrc ,jnjun ,
* lilprb,livlfc,livvto,livlto
        common/ptrs/  lbvec ,lbw ,ldmat ,
* lemat ,lenfxd,lfxd ,lrmat ,lvmat ,
* lvssc ,lvssip,nclear,nmat ,nvcell,
* nzzzzz
        dimension ipt(76)
        equivalence(ipt(1),i11111)
c
c
c
c
        rod data

        dimension dtnht(2),dtxht(2),sa(2),tk(3),
* ibu(4),irc(4),ircjfm(4),ircjtb(4,4)
        common/vltab/  aa1111,amh2 ,bcr0 ,
* bcr1 ,beff ,bpp0 ,bpp1 ,drfb ,
* dri ,drio ,dtnht ,dtpk ,dtxht ,
* dznht ,eneff ,extsou,fsi ,fso ,ftci ,
* ftcn ,ftco ,fucrac,hdri ,hdro ,hgapo ,
* hli ,hlo ,hvi ,hvo ,pdrat ,
* pldr ,powexp,qrdtot,react ,reacn ,
* react ,rmck ,rmckn ,rpower,rpowpf,rpowr ,
* rpowri,rpowrn,rpowro,rpowto,rpwoff,
* rpwscl,rrpwm,xzppwm,sa ,saf ,
* sdt ,shelv ,shtd ,stimet,tk ,
* tli ,tlo ,tneut ,tpowi ,tpowo ,
* tramax,trhmax,tvi ,tvo ,watlev,
* width ,zpin ,zpowoff,zuptop,zupbot,
* zlptop,zlbot,zl1111
        common/vltab/  ia1111,iaf ,iaxcnd,ibu ,
* idbci ,idbco ,iext ,ionoff,ipatch,
* ipwdep,ipwrad,irc ,ircjfm,ircjtb,irf ,
* irftr ,irftr2,irp ,irpwsv,irpwtr,
* irpwty,isnotb,ittcs ,izf ,izp ,izpwsv,
* izpwtr,lenrd ,lfvnr ,lfvnr1,lfvr ,
* lfvr1 ,liqlv,lndrd ,lnfvr ,lnfvr1,
* lnptrr,locrod,mld ,mldt ,ncrx ,ncrz ,ndg ,
* ndgx ,ndh ,ndhx ,nfbpwt,nfci ,
* nfcil ,nfuel ,nhist ,nint ,nmwrx ,
* nonoff,nopowr,nramax,nrfd ,nrhmax,
* nrldr ,nrods ,nrpwi ,nrpwr ,nrpwrfr,
* nrpwsv,nrpwtb,nrts ,nset ,nset2 ,
* nzmax ,nzpwrfr,nzpwsv,nzpwtb,nzpwi ,
* nzpwz ,nzznhc,zl1111
        integer zl1111

```

TRAC CODE MODIFICATIONS

```

c-----comdeck vltldim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vltldim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
      parameter(ivltsz=270)
      dimension vlt(ivltsz)
      equivalence (vlt(1),aa1111)
c-----
c
c   general rod-data pointers
c
      common/ptab/  lbeta ,lcdg ,lcdgn ,
*   lcdh ,lcdhn ,lcldn ,lcldnn,lcpowr,
*   ledh ,lfpuo2,lftd ,lgmix ,lgmles,
*   lgravr,lhceli,lhcelo,lhcomi,lhcomo,
*   lhigh ,lhs ,lhtmli,lhtmlo,lhtmlvi,
*   lhtmlvo,lidrod,llamda,llamdh,
*   llchci,llchco,lmatrd,lntfax ,lnrdx ,
*   lntsx,x,lpgapt,lplvol,lpowli,lpowlo,
*   lpowvi,lpowvo,lpulen,lradrd,lrcal ,
*   lrcbm ,lrcn ,lrcfc ,lrcf ,lrdpwr,
*   lrdz ,lrpkf ,lrpwr,f,lrpwr,t,lrpwr,tb,
*   lrs ,lsrp ,ltc ,lxn ,lxo ,
*   lzpwr ,lzpwr,f,lzpwr,fb,lzpwr,f,lpwr,tb,
*   lzpwr,t,lzs ,lzzrd
c
c   rod-data pointers
c
      common/ptab/  lalpr ,lalvr ,lbitr ,
*   lbitrn,lburn ,lcepw,n,lcepw,o,
*   lchtir,lclr ,lcnd ,
*   lcndr ,lconcr,lcpdr ,lcpdr ,lcpnd ,
*   lcpvr ,lcvr ,ldrldt,ldrldt,ldr ,
*   ldrzn ,lear ,lelr ,lemis ,levr ,
*   lfinar,lhdr ,lhfr ,lhgamr,lhgap ,
*   lhlar ,lhlatr,lhlsr ,lhfrg ,lhfrgo,
*   lhrfl ,lhrfl,o,lhrfv ,lhrfv,o,lhrlg ,
*   lhrlgo,lhrl ,lhrllo,lhrlv ,lhrlvo, lhgrad, lhgrdo,
*   lhvar ,lhvatr,lhvsr ,lidht ,lidrgr,
*   lihtf ,lnoht ,lpar ,lpgap ,lpint ,
*   lpldv ,lpr ,lqchff,lqchfo,lqchfr,
*   lqchro,lqwr,x,lradr ,lradrn,lrdhlo,
*   lrdhlr,lrdhvo,lrdhvr,lrft ,lrftn ,
*   lrlqlv,lrnd ,lrndr ,lroar ,lrolr ,
*   lromr ,lrovr ,lrpow,f,lsigr ,lsr ,
*   lstnu ,ltcefn,ltcefo,ltwaen,ltwaeo,
*   ltween,ltweeo,ltchff,ltchfr,ltld ,
*   ltlr ,ltlnr
c
      common/ptab/  ltsatr,ltssnr,ltvr ,
*   ltvnr ,lvislr,lvisvr,lvlcr ,lvlzr ,
*   lvmzr ,lvolr ,lvocr ,lvvzr ,lwatr ,
*   lzht
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
      parameter (iptsiz=300)
      integer pt(iptsiz)
c-----
      equivalence (pt(1),lbeta)
      dimension fmax(7),lok(7,2)

```

TRAC CODE MODIFICATIONS

```

      real maxfln
      common/sscon/ cf ,eps ,epspow,
* fflw ,fmax ,maxfln,rcpf ,rtwfp ,
* stime ,tpowr
      common/sscon/ ipovel,ipowr ,isscvt,
* lok ,ncores,nef ,net ,nopow
c
      dimension ceoslp(40)
      common/tsatcn/ aeos14,ceos1 ,ceos2 ,
* ceos3 ,ceoslp
      common/tsatcn/ igas ,iliq
c
c
      integer org
      dimension tmp(10)
      character*1 il
      character*25 taf(10)
      data taf/'inner-surface pressure ', 'outer-surface pressure ',
1          'inner-surface area ', 'outer-surface area ',
2          'inner and outer sf. areas', 'inner-surface th.conduct.',
3          'outer-surface th.conduct.', 'inner & outer sf.th.cond.',
4          'wall thermal conductivity', 'sf.areas & wall th.cond. '/
c
c
c
ctmp *****
c
      conv_t = 273.15
c
ctmp *****
c
c
      do 510 icmp=1,nhtstr
c
      lcmhs=ia(11cmhs+icmp-1)
      call rdlcm(flt,lcmhs,lentbl)
      lcmh=lcmhs
      call rrdlcm(lcmh)
c
      write(iout,100)
100 format(/lx,119('-'))
      if (nstep.eq.0) then
          i=icmp+ncomp
          if (i.lt.10) then
              numbn1=11
              numbn2=11
              numbn3=i
          else
              if (i.lt.100) then
                  numbn1=11
                  numbn2=i/10
                  numbn3=i-numbn2*10
                  if (numbn3.eq.0) numbn3=10
              else
                  numbn1=i/100
                  numbn2=(i-numbn1*100)/10
                  numbn3=(i-numbn1*100)-numbn2*10
                  if (numbn2.eq.0) numbn2=10
                  if (numbn3.eq.0) numbn3=10
              endif
          endif
          call wrldcm(flt,lcmhs,lentbl)

```

```

endif
write(iout,110) nm(1,numbn1),nm(1,numbn2),nm(1,numbn3),
1 nm(1,numbm1),nm(1,numbm2),nm(1,numbm3)
110 format(1x,3(a5,1x),84x,2(a5,1x),a5)
write(iout,120) nm(2,numbn1),nm(2,numbn2),nm(2,numbn3),etime,lus,
1 delt,lus,nstep,nm(2,numbm1),nm(2,numbm2),nm(2,numbm3)
120 format(1x,3(a5,1x),'time is ',f13.6,a,', time-step size is ',
1 f11.6,a,', time-step number is ',i5,1x,2(a5,1x),a5)
write(iout,110) nm(3,numbn1),nm(3,numbn2),nm(3,numbn3),
1 nm(3,numbm1),nm(3,numbm2),nm(3,numbm3)
write(iout,130) nm(4,numbn1),nm(4,numbn2),nm(4,numbn3),
1 ctitle,nm(4,numbm1),nm(4,numbm2),nm(4,numbm3)
130 format(1x,3(a5,1x),26x,4a8,26x,2(a5,1x),a5)
write(iout,110) nm(5,numbn1),nm(5,numbn2),nm(5,numbn3),
1 nm(5,numbm1),nm(5,numbm2),nm(5,numbm3)
write(iout,140)
140 format(1x,119('-'))
c
write(iout,150) type,num
150 format(/' the heat-structure component type is a ',a4,
1 ' and the component number is',i4)
c
if (nopowr.eq.0) then
tmp(1)=rpower
if (ioout.eq.1) then
call uncvt('rpower',tmp,1,1,-1)
endif
tpower = tmp(1)
if (irpwt.ge.11) then
write(iout,160) tmp(1),lupw,rmckn,(a(1srp+i-1),i=1,5)
160 format(/' reactor-core power is',1p,e12.5,a,' and neutron',
1 ' multiplication constant keff is',0p,f9.6/' prg',
2 ' .rho is',f9.6,', tf.fdbk.rho is',f9.6,', tc.fdbk',
3 ' .rho is',f9.6,', vf.fdbk.rho is',f9.6,', sl.fdbk',
4 ' .rho is',f9.6)
else
if (irpwt.lt.5) then
write(iout,170) tmp(1),lupw,rmckn
170 format(/' reactor-core power is',1p,e13.6,a,' and neutron',
1 ' multiplication constant keff is',0p,f9.6)
else
write(iout,180) tmp(1),lupw
180 format(/' total power generated is',1p,e13.6,a)
endif
endif
endif
c
call manage(a,-nrods,lenrd,locrod,icp,-20)
c
do 460 ncr=1,nrods
c
call manage(a,ncr,org,1,1,2)
c
ncraz = ia(lnoht+org)
ncr1 = ncr-1
ni=0
no=0
if (idbci.eq.2) ni=ia(lidrod+ncr1)
if ((idbci.ne.2).and.(idbco.eq.2)) no=ia(lidrod+ncr1)
if ((idbci.eq.2).and.(idbco.eq.2)) no=ia(lidrod+ncr1+nrods)
if (nopowr.ne.0) then
write(iout,190) type,ncr,ni,no

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190  format(/1x,a4,i3,3x,'plane (perpendicular to z direction)',
1      ' coupled to cells',i4,' (inner) and',i4,' (outer)')
      else
          write(iout,200) type,ncr,ni,no,a(lrpkf+ncr1)
200  format(/1x,a4,i3,3x,'plane (perpendicular to z direction)',
1      ' coupled to cells',i4,' (inner) and',i4,' (outer)',
2      ', peaking factor is',f9.4)
      endif
      if (iunout.eq.0) then
          write(iout,210)
210  format(/' id row',6x,'z',5x,'heat-structure temperatures')
      else
          write(iout,220) lupcb(ioout+1,5)(1:5),lupcb(ioout+1,3)(1:4)
220  format(/' id row z',a,' heat-structure temperatures ',a)
      endif
      zcrl=a(lzht+org)
      do 280 nc=1,ncraz
          ncog=org+nc-1
          idz=ia(lidht+ncog)
          if (idz.lt.0) go to 280
          zlev=a(lzht+ncog)-zcrl
          nat=org+(nc-1)*nodes-1
          nds=min0(nodes,9)
          do 230 j=1,nds
              tmp(j)=a(lrftn+nat+j)
230  continue
          if (ioout.eq.1) then
              call uncnvt('z',zlev,1,1,-1)
              call uncnvt('rftn',tmp,nds,1,-1)
          endif
c
ctmp *****
          tsurfi(nc) = tmp(1)
          tsurfo(nc) = tmp(nds)
ctmp *****
c
          write(iout,240) idz,nc,zlev,(tmp(j),j=1,nds)
240  format(1x,2i4,1x,1p,10e11.4)
          if (nodes.lt.10) go to 280
          ii=(nodes-1)/9
          do 270 i=1,ii
              j0=i*9
              j1=j0+1
              j2=min0(j1+8,nodes)
              do 250 j=j1,j2
                  tmp(j-j0)=a(lrftn+nat+j)
250  continue
              if (ioout.eq.1) then
                  call uncnvt('rftn',tmp,j2-j0,1,-1)
              endif
              write(iout,260) (tmp(j-j0),j=j1,j2)
260  format(21x,1p,9e11.4)
270  continue
280  continue
c
          write(iout,290)
290  format(/' id idi hliqi',7x,'tliqi',7x,'hvapi',7x,'tvapi',
1      5x,'ido hliqo',7x,'tliqo',7x,'hvapo',7x,'tvapo',
2      8x,'hgap')
          if (iunout.eq.1) then
              write(iout,300) (luh,lutp,j=1,4),luh
300  format(2(8x,a,4x,a,5x,a,4x,a,1x),4x,a)

```

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```
endif
jbd=1
delzp=0.0
do 370 nc=1,ncraz
ncog=org+nc-1
delzm=delzp
delzp=a(lzht+min0(ncog+1,org+ncraz-1))-a(lzht+ncog)
rdzmp=1.0/(delzm+delzp)
idz=ia(lidht+ncog)
if (idz.lt.0) go to 370
if (idbci.eq.2) then
  tmp(1)=a(lhrfl+ncog+lndrd)
  tmp(3)=a(lhrfv+ncog+lndrd)
  tmp(2)=amax1(ceoslp(32),a(ltlr+org+jbd+lndrd))
  tmp(4)=amax1(ceoslp(34),a(ltvnr+org+jbd+lndrd))
  idhti=a(lihtf+ncog+lndrd)+0.01
else
  tmp(1)=hli
  tmp(3)=hvi
  tmp(2)=amax1(ceoslp(32),tli)
  tmp(4)=amax1(ceoslp(34),tvi)
  idhti=0
endif
if (idbco.eq.2) then
  tmp(5)=a(lhrfl+ncog)
  tmp(7)=a(lhrfv+ncog)
  tmp(6)=amax1(ceoslp(32),a(ltlr+org+jbd))
  tmp(8)=amax1(ceoslp(34),a(ltvnr+org+jbd))
  idhto=a(lihtf+ncog)+0.01
else
  tmp(5)=hlo
  tmp(7)=hvo
  tmp(6)=amax1(ceoslp(32),tlo)
  tmp(8)=amax1(ceoslp(34),tvo)
  idhto=0
endif
if (idz.lt.1000) go to 310
jbd=idz-1000
if (idbci.eq.2) then
  hdzm=a(lhrll+org+jbd-1+lndrd)*delzm
  hdzp=tmp(1)*delzp
  hdzmp=hdzm+hdzp
  tmp(1)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(2)
    hdzp=hdzp*amax1(ceoslp(32),a(ltlr+org+jbd+lndrd))
    tmp(2)=(hdzm+hdzp)/hdzmp
  endif
  hdzm=a(lhrlv+org+jbd-1+lndrd)*delzm
  hdzp=tmp(3)*delzp
  hdzmp=hdzm+hdzp
  tmp(3)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(4)
    hdzp=hdzp*amax1(ceoslp(34),a(ltvnr+org+jbd+lndrd))
    tmp(4)=(hdzm+hdzp)/hdzmp
  endif
endif
if (idbco.eq.2) then
  hdzm=a(lhrll+org+jbd-1)*delzm
  hdzp=tmp(5)*delzp
  hdzmp=hdzm+hdzp
```

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```

        tmp(5)=hdzmp*rdzmp
        if (hdzmp.gt.0.0) then
            hdzm=hdzm*tmp(6)
            hdzp=hdzp*amax1(ceoslp(32),a(ltlr+org+jbd))
            tmp(6)=(hdzm+hdzp)/hdzmp
        endif
        hdzm=a(lhrlv+org+jbd-1)*delzm
        hdzp=tmp(7)*delzp
        hdzmp=hdzm+hdzp
        tmp(7)=hdzmp*rdzmp
        if (hdzmp.gt.0.0) then
            hdzm=hdzm*tmp(8)
            hdzp=hdzp*amax1(ceoslp(34),a(ltvnr+org+jbd))
            tmp(8)=(hdzm+hdzp)/hdzmp
        endif
    endif
    tmp(9)=a(lhgap+org+jbd-1)
    if (ioout.eq.1) then
        call uncnvt('hgap',tmp(9),1,1,-1)
    endif
310 continue
    if (ioout.eq.1) then
        call uncnvt('hli',tmp(1),8,2,-1)
        call uncnvt('tli',tmp(2),8,2,-1)
    endif
c
ctmp *****
        filmfi(nc) = tmp(1)
        tfi(nc)    = tmp(2)
        filmgi(nc) = tmp(3)
        tgi(nc)    = tmp(4)
        filmfo(nc) = tmp(5)
        tfo(nc)    = tmp(6)
        filmgo(nc) = tmp(7)
        tgo(nc)    = tmp(8)
ctmp *****
c
        write(iout,320) idz,idhti,(tmp(j),j=1,4),
1          idhto,(tmp(j),j=5,9)
320 format(1x,i4,i3,1p,4e12.4,i4,5e12.4)
370 continue
c
        write(iout,380)
380 format(/' heat flux to the hydro cells'/' idz  gliqi',7x,
1          'qvapi',7x,'qtoti',7x,'qchfi  qchfi/qtoti  gliqi',
2          7x,'qvapo',7x,'qtoto',7x,'qchfo  qchfo/qtoto')
        if (iunout.eq.1) then
            write(iout,390) (luhx,j=1,4),lud,(luhx,j=1,4),lud
390 format(6x,4a,4x,a,4x,4a,4x,a)
        endif
        jbd=1
        delzp=0.0
        do 410 nc=1,ncraz
            ncog=org+nc-1
            delzm=delzp
            delzp=a(lzht+min0(ncog+1,org+ncraz-1))-a(lzht+ncog)
            rdzmp=1.0/(delzm+delzp)
            idz=ia(lidht+ncog)
            if (idz.lt.0) go to 410
            if (idbci.eq.2) then
                tmp(1)=a(lhrfl+ncog+lnrd)
                tmp(3)=a(lhrfv+ncog+lnrd)
            endif
        enddo

```

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```
tmp(2)=amax1(ceoslp(32),a(ltlnr+org+jbd+lndrd))
tmp(4)=amax1(ceoslp(34),a(ltvnr+org+jbd+lndrd))
qchfi=a(lqchfr+org+jbd-1+lndrd)
else
  tmp(1)=hli
  tmp(3)=hvi
  tmp(2)=amax1(ceoslp(32),tli)
  tmp(4)=amax1(ceoslp(34),tvi)
  qchfi=0.0
endif
if (idbco.eq.2) then
  tmp(5)=a(lhrfl+ncog)
  tmp(7)=a(lhrfv+ncog)
  tmp(6)=amax1(ceoslp(32),a(ltlnr+org+jbd))
  tmp(8)=amax1(ceoslp(34),a(ltvnr+org+jbd))
  qchfo=a(lqchfr+org+jbd-1)
else
  tmp(5)=hlo
  tmp(7)=hvo
  tmp(6)=amax1(ceoslp(32),tlo)
  tmp(8)=amax1(ceoslp(34),tvo)
  qchfo=0.0
endif
if (idz.lt.1000) go to 395
jbd=idz-1000
if (idbci.eq.2) then
  hdzm=a(lhrll+org+jbd-1+lndrd)*delzm
  hdzp=tmp(1)*delzp
  hdzmp=hdzm+hdzp
  tmp(1)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(2)
    hdzp=hdzp*amax1(ceoslp(32),a(ltlnr+org+jbd+lndrd))
    tmp(2)=(hdzm+hdzp)/hdzmp
  endif
  hdzm=a(lhrlv+org+jbd-1+lndrd)*delzm
  hdzp=tmp(3)*delzp
  hdzmp=hdzm+hdzp
  tmp(3)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(4)
    hdzp=hdzp*amax1(ceoslp(34),a(ltvnr+org+jbd+lndrd))
    tmp(4)=(hdzm+hdzp)/hdzmp
  endif
  qchfi=(qchfi*delzm+a(lqchfr+org+jbd-1+lndrd)*delzp)*rdzmp
endif
if (idbco.eq.2) then
  hdzm=a(lhrll+org+jbd-1)*delzm
  hdzp=tmp(5)*delzp
  hdzmp=hdzm+hdzp
  tmp(5)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(6)
    hdzp=hdzp*amax1(ceoslp(32),a(ltlnr+org+jbd))
    tmp(6)=(hdzm+hdzp)/hdzmp
  endif
  hdzm=a(lhrlv+org+jbd-1)*delzm
  hdzp=tmp(7)*delzp
  hdzmp=hdzm+hdzp
  tmp(7)=hdzmp*rdzmp
  if (hdzmp.gt.0.0) then
    hdzm=hdzm*tmp(8)
```


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```

      hdzp=hdzp*amax1(ceoslp(34),a(ltvnr+org+jbd))
      tmp(8)=(hdzm+hdzp)/hdzmp
    endif
    qchfo=(qchfo*delzm+a(lqchfr+org+jbd-1)*delzp)*rdzmp
  endif
395 continue
    tmp(9)=a(lrftn+org+nc*nodes-nodes)
    tmp(10)=a(lrftn+org+nc*nodes-1)
    tmp(1)=tmp(1)*(tmp(9)-tmp(2))
    tmp(2)=tmp(3)*(tmp(9)-tmp(4))
    tmp(3)=tmp(1)+tmp(2)
    tmp(4)=qchfi
    tmp(5)=tmp(5)*(tmp(10)-tmp(6))
    tmp(6)=tmp(7)*(tmp(10)-tmp(8))
    tmp(7)=tmp(5)+tmp(6)
    tmp(8)=qchfo
    tmp(9)=tmp(4)/amax1(1.0e-10,tmp(3))
    tmp(10)=tmp(8)/amax1(1.0e-10,tmp(7))
    if (ioout.eq.1) then
      call uncvt('qchf',tmp(1),8,1,-1)
    endif
  c
c tmp *****
    qsfi(nc) = tmp(1)
    qsgi(nc) = tmp(2)
    qsfo(nc) = tmp(5)
    qsgo(nc) = tmp(6)
c tmp *****
  c
    write(iout,400) idz,(tmp(j),j=1,4),tmp(9),
1      (tmp(j),j=5,8),tmp(10)
400 format(1x,i4,1p,4e12.4,e10.2,4e12.4,e10.2)
410 continue
  c
  c
c tmp *****
  c
c Write to tecplot file data for component point if requested
c and component is a heat structure.
  c
    iunit = iin1
    do ipts=1,npoints
      if (ictype(ipts).eq.3) then
        icomp = iicomp(ipts)
        if (icomp.eq.num) then
          jzrow = iicell(ipts)
          isurf = id_leg(ipts)
          if (isurf.eq.1) then
c print inner surface point
            write (iunit,2666)
              & ipts, etime,tpower, ,tsurfi(jzrow)-conv_t ,
              & qsfi(jzrow), ,qsgi(jzrow) ,
              & filmfi(jzrow), ,tfi(jzrow)-conv_t ,
              & filmgi(jzrow), ,tgi(jzrow)-conv_t
2666      format (i5,9e15.7)
  c
cc2666 format(i5,8x,f8.1,e12.4,f10.1,2x,2e12.4,f12.3,f10.1,f12.3,f10.1)
          elseif (isurf.eq.2) then
c print outer surface point
            write (iunit,2666)
              & ipts, etime,tpower, ,tsurfo(jzrow)-conv_t ,
              & qsfo(jzrow), ,qsgo(jzrow) ,

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```

&          filmfo(jzrow)          ,tfo(jzrow)-conv_t ,
&          filmgo(jzrow)          ,tgo(jzrow)-conv_t
      endif
    endif
  endif
enddo
ctmp *****
c
c
c
      write(iout,420)
420 format(/4x,2(5x,'stanton',5x,'liq.temp.))/
      1      5x,2(5x,'number',4x,'bubble det.)/
      2      2x,'id ',2(2x,'inner surf. '),2(2x,'outer surf. '))
      if (iunout.eq.1) then
        write(iout,430) lud,lutp,lud,lutp
430 format(4(11x,a))
      endif
      do 450 nc=1,ncraz
        ncog=org+nc-1
        idz=ia(lidht+ncog)
        if (idz.lt.0) go to 450
        if (idbci.eq.2) then
          stnui=a(1stnu+ncog+lndrd)
          tmp(1)=amax1(ceoslp(32),a(1tld+ncog+lndrd))
        else
          stnui=0.0
          tmp(1)=ceoslp(32)
        endif
        if (idbco.eq.2) then
          stnuo=a(1stnu+ncog)
          tmp(2)=amax1(ceoslp(32),a(1tld+ncog))
        else
          stnuo=0.0
          tmp(2)=ceoslp(32)
        endif
        if (ioout.eq.1) then
          call uncnvt('tl',tmp,2,1,-1)
        endif
        write(iout,440) idz,stnui,tmp(1),stnuo,tmp(2)
440 format(1x,i4,1p,4e13.5)
450 continue
c
      if(ncr.le.ncrx) then
        tmp(1)=0.0
        tmp(2)=0.0
        tmp(3)=0.0
        tmp(4)=0.0
        tmp(5)=0.0
        tmp(6)=0.0
        if(idbci.eq.2) then
          tmp(1)=a(1tcefn+org+lndrd)
          tmp(3)=a(1twaen+org+lndrd)
          tmp(5)=a(1tween+org+lndrd)
        endif
        if(idbco.eq.2) then
          tmp(2)=a(1tcefn+org)
          tmp(4)=a(1twaen+org)
          tmp(6)=a(1tween+org)
        endif
        if(ioout.eq.1) then
          call uncnvt('enin1',tmp,6,1,-1)

```

TRAC CODE MODIFICATIONS

```

      endif
      write(iout,415) tmp(1),lue,tmp(2),lue,tmp(3),lue,
1      tmp(5),lue,tmp(4),lue,tmp(6),lue
      endif
415 format(/1x,'total convective energy to the fluid during hydro',
1      ' solution:',/,19x,'inside surface=',1pe15.7,a,
2      ' outside surface=',1pe15.7,a,
3      //1x,'errors in conservation of convective energy at ',
4      'the wall between hydro and conduction solutions:',
5      /12x,'inside convective energy error: absolute=',
6      1pe13.5,a,5x,'effective=',1pe13.5,a,
7      /11x,'outside convective energy error: absolute=',
8      1pe13.5,a,5x,'effective=',1pe13.5,a)
c
460 continue
c
      if ((iaf.ge.5).and.(iaf.le.14)) then
        write(iout,462) saf,taf(iaf-4)
462 format(/' constrained steady-state type-5 controller adjust',
1      'ment factor is',f10.5/' which was applied to the ',a)
      endif
c
      tmp(1)=tk(1)
      tmp(2)=tk(2)
      tmp(3)=tk(3)
      if (ioout.eq.1) then
        call uncnvt('tk',tmp,3,1,-1)
      endif
      if (type.eq.'slab') then
        il='x'
      else
        il='r'
      endif
      write(iout,464) tmp(1),lutc,tmp(2),lutc,il,tmp(3),lutc,ncrx,type
464 format(/' inner-surface node-interval thermal conductivity is',
1      1p,e13.5,a/' outer-surface node-interval thermal conduc',
2      'tivity is',e13.5,a/' effective ',a,'-direction wall',
3      ' thermal conductivity is',e13.5,a/' which have been',
4      ' axially averaged over all',i4,' average-power ',a4,'s')
c
      tmp(1)=sa(1)
      tmp(2)=sa(2)
      if (ioout.eq.1) then
        call uncnvt('sa',tmp,2,1,-1)
      endif
      write(iout,466) tmp(1),luar,tmp(2),luar,ncrx,type
466 format(/' total inner surface area is',1p,e13.5,a,' and/'
1      ' total outer surface area is',e13.5,a,' of all',i4,
2      ' average-power ',a4,'s')
c
      tmp(1)=tpowi
      tmp(2)=tpowo
      if (ioout.eq.1) then
        call uncnvt('tpow',tmp,2,1,-1)
      endif
      write(iout,470) tmp(1),lupw,tmp(2),lupw
470 format(/' total power from the heat-structure inner surface is',
1      1p,e13.5,a,' and outer surface is',e13.5,a)
c
      if (nstep.eq.0) go to 510
      tmp(1)=tramax
      if (ioout.eq.1) then

```

TRAC CODE MODIFICATIONS

```

        call uncvt('rftn',tmp,1,1,-1)
      endif
      write(iout,480) type,nramax,tmp(1),lntp
480 format(/' average-power ',a4,i3,' has the peak surface',
1       ' temperature of',1p,e13.5,a)
      if (ncrx.lt.nrods) then
        tmp(1)=trhmax
        if (ioout.eq.1) then
          call uncvt('rftn',tmp,1,1,-1)
        endif
        write(iout,490) type,nrhmax,tmp(1),lntp
490 format(' supplemental ',a4,i3,' has the peak surface',
1       ' temperature of',1p,e13.5,a)
      endif
c
      tmp(1)=amh2
      if (ioout.eq.1) then
        call uncvt('amh2',tmp,1,1,-1)
      endif
      write(iout,500) type,tmp(1),lum
500 format(/' total mass of hydrogen (based on the average temper',
1       ' ature of all average-power ',a4,'s) is',1p,e13.5,a)
510 continue
c
      return
    end

```

Fortran file wpipe.f:

```

      subroutine wpipe(cfmass,cener,tsec)
c
c      subroutine wpipe writes thermal-hydraulic solution
c      parameters to file trcout for the pipe component
c
      parameter (ifxsiz=5000000)
      common a(ifxsiz)
      dimension alcm(1)
      equivalence (a(1),alcm(1))
      dimension ia(ifxsiz)
      character*8 ach(ifxsiz)
      equivalence (a(1),ach(1))
      equivalence (a(1),ia(1))
c
      common/contrl/ cpuflg,damnc ,damx ,delt ,
      * deltht,difmin,dprmx ,dtlhx ,dtmax ,
      * dtmin ,dto ,dtrat ,dtrmx ,dtsmx ,
      * dtvmx ,encmax,eps1 ,eps2 ,epso ,
      * ercemx,epss ,etime ,htlosi,htloso,
      * odelt ,powerc,pssmn ,pssmx ,rfat ,
      * rvmax ,tend ,tercmx,timec ,timet ,
      * tmmx ,varer ,vcmn ,vcmx ,vmxo ,
      * vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
      * vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
      * omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
      * yvsm,zvsm,rmat(3,3),omsm(3),wsm(3),
      * wds(3),errsm,dtsm
      common/contrl/ dstep ,iadded,iblaus,iccmx ,
      * icmp ,icpmx,icp ,idiag ,idiags,ieccpx,ieos ,iff3d ,
      * ifprep,igeom3,iml00 ,iml00x,imfr ,
      * invan ,iofftk,ipak ,ipak3d,ipakon,ipkpmp,
      * ireset,irsflg,irstfl,isolut,issflg,istdy ,
      * isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,

```

TRAC CODE MODIFICATIONS

```

* lcmptr,levstg,llvflg,ncmn ,ncmx ,
* ncontr,nconts,ncontt,ncrg ,ndial ,nenc1,
* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nspl ,nspu ,nsso ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

c
c fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/ htlsci,htlsco,coild ,pinteg
common/fltab/ ctitle(4),icflg ,id ,
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num ,nrvlt ,ctype
equivalence (flt(1),htlsci),(type,ctype),(ctitle(1),title)

c
common/units/ ibfadd,ibfadg,ibfadr,
* ibflnd,ibflng,ibflnr,idout, ieeeeg, igout ,
* ikeybd,imout ,in ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1 ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1 luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbet,luar,lucp,lud,ludh,lue,luen,
1 luh,luha,luhx,luid,luis,lum,lumf,lup,
2 lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3 lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alpbet

c pipe variable length table

```

TRAC CODE MODIFICATIONS

```

dimension fl(2),fv(2)
common/vltab/ aa1111,bsmass,cpow ,eninp ,epsw ,
* fl ,fv ,houtl ,houtv ,plent ,
* powin ,powoff,qint ,qout ,qp3in ,
* qp3off,radin ,rpowmx,rqp3mx,th ,
* toutl ,toutv ,vflow ,z ,
* z11111
common/vltab/ ia1111,iacc ,ichf ,icj1 ,
* icj2 ,iconc ,ionoff,ipf ,ipow ,
* ipowsv,ipowtr,ipp ,iqf ,iqp ,
* iqp3sv,iqp3tr,isollb,isolrb,js1 ,
* js2 ,jun1 ,jun2 ,ncells,
* nonoff,npowrf,npowsv,npowtb,nqp3rf,
* nqp3sv,nqp3tb,type1 ,type2 ,
* z11111
integer vlt,type1,type2,z1111
c-----comdeck vlt,dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt,dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aa1111)
c-----
c
c
c
dimension tmp(3)
c
write(iout, 100) num,jun1,jun2
100 format(/' the component type is a pipe, component number is',
1 i4,', first junction number is',i4,', and second',
2 ' junction number is',i4)
cfmass=0.0
cener=0.0
c
iflgw=1
itee = 0
call ecomp(num,1,ncells,iflgw,nodes,cfmass,pinteg,cener,tsec,
& . itee)
c
if (ipow.eq.1) then
tmp(1)=cpow
tmp(2)=eninp+delt*cpow
if (ioout.eq.1) then
call uncvt('cpow',tmp(1),1,1,-1)
call uncvt('eninp',tmp(2),1,1,-1)
endif
write(iout,110) tmp(1),lupw,tmp(2),lue
110 format(/' power deposited in the pipe coolant is',1p,e13.5,a,
1 ' and total energy deposited in the pipe coolant is',
2 e13.5,a)
endif
c
if (iacc.ne.0) then
tmp(1)=vflow
tmp(2)=qout
tmp(3)=amax1(0.0,z)
if (ioout.eq.1) then
call uncvt('vflow',tmp(1),1,1,-1)
call uncvt('qout',tmp(2),1,1,-1)

```

TRAC CODE MODIFICATIONS

```

      call uncnvt('z'      ,tmp(3),1,1,-1)
    endif
    write(iout,120) tmp(1),luvf,tmp(2),luvo,tmp(3),luz
120   format(/' pipe liquid volumetric outflow is',1p,e13.5,a,
1      ', volume out is',e13.5,a,', and level is',e13.5,a)
    endif
c
    if ((nodes.ne.0).and.(nstep.gt.0)) then
      tmp(1)=htlsci
      tmp(2)=htlsco
      if (ioout.eq.1) then
        call uncnvt('htlsci',tmp,2,1,-1)
      endif
      write(iout,130) tmp(1),lupw,tmp(2),lupw
130   format(/' pipe wall total power loss on the inner surface is',
1      '1p,e13.5,a,' and on the outer surface is',e13.5,a)
    endif
c
    omass=cfmass-bsmass
    tmp(1)=cfmass
    tmp(2)=omass
    tmp(3)=cener
    if (ioout.eq.1) then
      call uncnvt('cfmass',tmp(1),2,1,-1)
      call uncnvt('cener' ,tmp(3),1,1,-1)
    endif
    write(iout,140) tmp(1),lum,tmp(3),lue,tmp(2),lum
140   format(/' pipe component total coolant mass is',1p,e13.5,
1      'a,', total coolant energy is',e13.5,a,', and'/
2      ' computed initial total coolant mass is',e13.5,a)
c
    return
  end

```

Fortran file wplen.f:

```

      subroutine wplen(cfmass,cener,bd,lenbdd,tsec)
c
c      subroutine wplen writes thermal-hydraulic solution
c      parameters to file trcout for the plenum component
c
      common/contrl/ cpuflg,dammc ,damx ,delt ,
      * deltht,difmin,dprmx ,dtlmx ,dtmax ,
      * dtmin ,dto ,dtrat ,dtrmx ,dtsmx ,
      * dtvmx ,encmax,eps1 ,eps2 ,eps0 ,
      * ercemx,epss ,etime ,htlosi,htloso,
      * odelt ,powerc,pssmn ,pssmx ,rfat ,
      * rvmax ,tend ,tercmx,timec ,timet ,
      * tmmx ,varer ,vcmn ,vcmx ,vmx0 ,
      * vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
      * vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
      * omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
      * yvsm,zvsm,rmat(3,3),omsm(3),wsm(3),
      * wds(3),errsm,dtsm
      common/contrl/ dstep ,iadded,iblaus,iccmx ,
      * icmp ,icpmx,icp ,idiag ,idiags,ieccpx,ieos ,iff3d ,
      * ifprep,igeom3,im100 ,im100x,imfr ,
      * invan ,iofftk,ipak ,ipak3d,ipakon,ipkmp,
      * ireset,irsflg,irstfl,isolut,issflg,istdy ,
      * isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
      * lcmpt,levstg,llvflg,ncmn ,ncmx ,
      * ncontr,nconts,ncontt,ncrg ,ndial ,nencl,

```

TRAC CODE MODIFICATIONS

```

* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nsp1 ,nspu ,nsso ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1      ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1      luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbt,luar,lucp,lud,ludh,lue,luen,
1      luh,luha,luhx,luid,luis,lum,lumf,lup,
2      lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3      lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alpbt

c
ctmp *****
c
common /tecplot/iicomp(500),iicell(500),ictype(500),
&      id_leg(500),npoints,iinl

c
ctmp *****
c
c      plenum data
c
c      parameter      (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
common/dimen/ ifree ,jnvssl,kvel1t,
* kvel2t,kvel3t,last ,ldim ,lenbd ,lendim,
* lentbl,lfree ,llast ,lmldp ,lnldpv,lnrdpt,
* locrdp,lstart,lstrdp,lver ,mdim ,
* memflg,moff ,ncomp ,ncompt,
* nhtstr,njnmx ,njnt ,njun ,nloops,
* nmvssl,npx ,nstgj ,nthm ,nthmld,

```


TRAC CODE MODIFICATIONS

```

* nthm3d,numtcr,nvcon ,nvelx ,nvely ,
* nvelz ,nwrda
c
common/units/  ibfadd,ibfadg,ibfadr,
* ibflnd,ibflng,ibflnr,idout,  ieee,  igout ,
* ikeybd,imout ,in      ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty  ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card
c
common/junct/jptr,jmatch
c
c fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/  htlscl,htlsco,coild ,pinteg
common/fltab/  ctitle(4),icflg ,id      ,
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv  ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num  ,nrvlt ,ctype
equivalence (flt(1),htlscl),(type,ctype),(ctitle(1),title)
c
dimension ld(3),ldn(3)
common/ptab/  lalp ,lalpn ,lalpd ,
* lalpdn,lalv ,lalvn ,lalve ,lalven,
* lara ,larn ,larel ,lareln,larev ,
* larevn,larl ,larln ,larv ,larvn ,
* lbit ,lbitn ,lcti ,lctin,lctia,
* lctan,lcif ,lcifn ,lconc ,lconcn,
* ld  ,ldn ,lea ,lean ,lel ,
* leln ,lev ,levn ,lgam ,lgamn ,
* lhig ,lhigo ,lhil ,lhilo ,lhiv ,
* lhivo ,lp  ,lpn ,lpa ,lpan ,
* lqppc ,lqppco,lroa ,lroan ,lrol ,
* lroln ,lrov ,lrovn ,ls  ,lsn ,
* ltce ,ltcen ,ltd ,ltdn ,ltl ,
* ltln ,ltv ,ltvn ,ltw ,ltwn ,
* ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
* lvlt ,lvlto ,lvm ,lvmn ,lvv ,
* lvvn ,lvvt ,lvvto
c-----
c if the list of pointers is increased, must also increase (if
c necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c than or equal to the total number of pointers defined in historian
c comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c-----
c-----ptsiz is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter ptsiz.
parameter (ptsiz=300)
integer pt(ptsiz)
c-----
equivalence (pt(1),lalp)
c
dimension lh(3)

```

TRAC CODE MODIFICATIONS

```

common/ptab/  lalpmn,lalpmx,lalpo ,
* lam ,larc ,lcfz ,lcl ,lcpl ,
* lcpv ,lcv ,ldalva,ldfldp,ldfvdp,
* ldriv ,ldx ,lelev ,lfa ,lfavol,
* lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
* lh ,lhd ,lhdht ,lhfg ,lhgam ,
* lhla ,lhlatw,lhva ,lhvatw,
* lqrl ,lqrv ,lqp3f ,
* lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
* lrarl ,lrarv ,
* lxsm,lysm,lzsm,lrsm,lr0sm,
* lnfvsm,lnflsm,luvsm,lnfcvsm,lnfclsm,lvvsm,lvlsn,
* lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
* lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
* ltssn ,lvisl ,lviv ,lvlalp,lvlv ,
* lvlvol,lvlx ,lvol ,lvrv ,lvrv ,
* lvvvol,lvvx ,lwa ,lwat ,lwfl ,
* lwfv ,lwfmfl,lwfmfv
c
c-----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c   than or equal to the total number of pointers defined in historian
c   comdecks dualpt and hydropt.  currently, kpttmp = 300, while the
c   total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c   in case new pointers are added after lwfmfv, then the coding in
c   subroutine aicomp (third executable statement) for evaluation of
c   the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c   must be changed to use the name of the new pointer at the end
c   of this section of the common block / ptab /.
c-----
common/ptab/  lalw ,lavw ,ldbnd ,
* ldnfl ,ldnfv ,li0j ,ljns ,ljunj ,
* lpak ,lsgn ,lzzzzz
c
common/vltab/  aal111,b1 ,bsmass,
* bv ,epsw ,fas1 ,fas2 ,flxa ,
* flxal ,flxav ,flxc ,flxel ,flxe ,
* flxl ,flxv ,rxcl ,rxcv ,xl ,
* xv ,z11111
common/vltab/  ial111,k ,iconc ,
* ipow ,juns1 ,juns2 ,ncells,npljn ,
* z11111
integer vlt,z11111
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz.  comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aal111)
c-----
c
dimension      alp(1) ,alv(1) ,alve(1) ,ara(1) ,arel(1) ,
1      arev(1) ,arl(1) ,arv(1) ,bor(1) ,eva(1) ,el(1) ,
2      ev(1) ,cti(1) ,ctia(1) ,gam(1) ,p(1) ,pa(1) ,
3      rova(1) ,rol(1) ,rov(1) ,solid(1) ,tl(1) ,tv(1) ,
4      bit(1) ,hil(1) ,hiv(1) ,
5      alpn(1) ,alvn(1) ,alven(1) ,aran(1) ,areln(1) ,arevn(1) ,
6      arln(1) ,arvn(1) ,born(1) ,evan(1) ,eln(1) ,evn(1) ,

```

TRAC CODE MODIFICATIONS

```

7      chtin(1) , chtan(1) , gamn(1) , pn(1) , pan(1) , rovan(1) ,
8      roln(1) , rovn(1) , solidn(1) , tln(1) , tvn(1) , bitn(1) ,
9      hln(1) , hlvn(1)
      dimension      cl(1) , cpl(1) , cpv(1) , cv(1) ,
1      alpo(1) , am(1) , arc(1) , hfg(1) , dalp(1) , rom(1) ,
2      sig(1) , tsat(1) , tssn(1) , visl(1) , visv(1) , vol(1) ,
3      wa(1) , elev(1) , qp3f(1) , dalva(1) , dxvol(1) , favol(1) ,
4      vlvol(1) , vvvol(1) , gravol(1) , alpmn(1) , alpmx(1) , vlvc(1) ,
5      fasmlt(1) , vlalp(1) ,
6      dtsdp(1) , deldp(1) , devdp(1) , deldt(1) , devdt(1) , drovp(1) ,
7      drovp(1) , drovt(1) , drovt(1) , hvst(1) , hlst(1) , dhvsp(1) ,
8      dhvsp(1) , dtssp(1) , devat(1) , devap(1) , drvap(1) , drvat(1) ,
9      hgam(1) , hla(1) , hva(1) , hlatw(1) , hvatw(1) , finan(1) ,
1      wat(1) , vrvpl(1) , xsm(1) , ysm(1) , zsm(1)

```

C

```

      equivalence      (a(01),alp(1) ), (a(02),alv(1) ),
1      (a(03),alve(1) ), (a(04),ara(1) ), (a(05),arel(1) ),
2      (a(06),arev(1) ), (a(07),arl(1) ), (a(08),arv(1) ),
3      (a(09),bor(1) ), (a(10),eva(1) ), (a(11),el(1) ),
4      (a(12),ev(1) ), (a(13),cti(1) ), (a(14),ctia(1) ),
5      (a(15),gam(1) ), (a(16),p(1) ), (a(17),pa(1) ),
6      (a(18),rova(1) ), (a(19),rol(1) ), (a(20),rov(1) ),
7      (a(21),solid(1) ), (a(22),tl(1) ), (a(23),tv(1) ),
8      (a(24),bit(1) ), (a(25),hil(1) ), (a(26),hiv(1) )
      equivalence      (a(27),alpn(1) ), (a(28),alvn(1) ),
1      (a(29),alven(1) ), (a(30),aran(1) ), (a(31),areln(1) ),
2      (a(32),arevn(1) ), (a(33),arln(1) ), (a(34),arvn(1) ),
3      (a(35),born(1) ), (a(36),evan(1) ), (a(37),eln(1) ),
4      (a(38),evn(1) ), (a(39),ctin(1) ), (a(40),ctan(1) ),
5      (a(41),gamn(1) ), (a(42),pn(1) ), (a(43),pan(1) ),
6      (a(44),rovan(1) ), (a(45),roln(1) ), (a(46),rovn(1) ),
7      (a(47),solidn(1) ), (a(48),tln(1) ), (a(49),tvn(1) ),
8      (a(50),bitn(1) ), (a(51),hln(1) ), (a(52),hlvn(1) )
      equivalence      (a(53),cl(1) ), (a(54),cpl(1) ),
1      (a(55),cpv(1) ), (a(56),cv(1) ), (a(57),alpo(1) ),
2      (a(58),am(1) ), (a(59),arc(1) ), (a(60),hfg(1) ),
3      (a(61),dalp(1) ), (a(62),rom(1) ), (a(63),sig(1) ),
4      (a(64),tsat(1) ), (a(65),tssn(1) ), (a(66),visl(1) ),
5      (a(67),visv(1) ), (a(68),vol(1) ), (a(69),wa(1) ),
6      (a(70),elev(1) ), (a(71),qp3f(1) ), (a(72),dalva(1) ),
7      (a(73),dxvol(1) ), (a(74),favol(1) ), (a(75),vlvol(1) ),
8      (a(76),vvvol(1) ), (a(77),gravol(1) ), (a(78),alpmn(1) ),
9      (a(79),alpmx(1) ), (a(80),vlvc(1) ), (a(81),fasmlt(1) )
      equivalence      (a(82),vlalp(1) ), (a(83),dtsdp(1) ),
1      (a(84),deldp(1) ), (a(85),devdp(1) ), (a(86),deldt(1) ),
2      (a(87),devdt(1) ), (a(88),drovp(1) ), (a(89),drovp(1) ),
3      (a(90),drovt(1) ), (a(91),drovt(1) ), (a(92),hvst(1) ),
4      (a(93),hlst(1) ), (a(94),dhvsp(1) ), (a(95),dhvsp(1) ),
5      (a(96),dtssp(1) ), (a(97),devat(1) ), (a(98),devap(1) ),
6      (a(99),drvap(1) ), (a(100),drvat(1) ), (a(101),hgam(1) ),
7      (a(102),hla(1) ), (a(103),hva(1) ), (a(104),hlatw(1) ),
8      (a(105),hvatw(1) ), (a(106),finan(1) ), (a(107),wat(1) ),
9      (a(108),vrvpl(1) ), (a(109),xsm(1) ), (a(110),ysm(1) ),
1      (a(111),zsm(1))

```

C

C

```

      common/twostp/ npsfe , npsme , ntsprn

```

C

```

      dimension bd(lenbdd,1),tmp(8)

```

C

```

      ctmp *****

```

C

TRAC CODE MODIFICATIONS

```

      conv_p = 14.696/101325.0
      conv_t = 273.15
      conv_q = 264.17*60.0
c
ctmp *****
c
      write(iout,100) num,(ia(ljunj+i-1),i=1,npljn)
100 format(/' the component type is a plenum, component number is',
1      i4,', and junction numbers are',7i5/(82x,7i5))
c
c      write out hydro information
c
      write(iout,110) lup,lup,lud,lutp,lutp,lutp,lur,lur
110 format(/10x,'pressure ncd-gas press. void fr. temp.sat.',
1      ' temp.liq. temp.gas den.liq. den.vap.'/
2      ' cell',6x,a,8x,a,8x,a,11x,a,10x,a,10x,a,6x,a,4x,a)
      tmp(1)=pn(k)
      tmp(2)=pan(k)
      tmp(3)=tsat(k)
      tmp(4)=tln(k)
      tmp(5)=tvn(k)
      tmp(6)=roln(k)
      tmp(7)=rovn(k)
      if (ioout.eq.1) then
        call uncnvt('pn' ,tmp(1),2,1,-1)
        call uncnvt('tsat',tmp(3),3,1,-1)
        call uncnvt('rho',tmp(6),2,1,-1)
      endif
      write(iout,120) tmp(1),tmp(2),alpn(k),tmp(3),
1      tmp(4),tmp(5),tmp(6),tmp(7)
120 format(3x,'1',2x,1p,2e13.5,6e12.4)
c
ctmp *****
c
c Write to tecplot file data for component point if requested
c and component a plenum component.
c
      iunit = iin1
      do ipt=1,npoints
        if (ictype(ipt).eq.1) then
          icomp = icomp(ipt)
          if (icomp.eq.num) then
c
              write (iunit,2666)
&          ipt, tsec, conv_p*tmp(1), tmp(4)-conv_t,
&          tmp(3)-tmp(4), tmp(3)-conv_t,
&          tmp(6) , tmp(1) , alpn(k),
&          tmp(5)-conv_t, tmp(7) ,
&          conv_p*tmp(2)
2666          format (i5,11e15.7)
c
cc2666 format (i5,8x,f8.2,5f10.2,2x,f10.1,f10.4,f10.1,2f10.4)
          endif
        endif
      enddo
c
ctmp *****
c
      if (ntsprn.ne.0) then
        write(iout,130) lur,lud,lutp,luha,luha
130 format(/10x,'dis.sol. p.o.sol. fr.new temp.ss. evap.',
1      'a*htc cond.a*htc'/' cell',6x,'ratio',4x,a,5x,a,8x,

```

TRAC CODE MODIFICATIONS

```

2      a,6x,a,3x,a)
      tmp(1)=solidn(k)
      tmp(2)=tssn(k)
      tmp(3)=alve(k)
      tmp(4)=chtin(k)
      if (ioout.eq.1) then
        call uncvt('sn' ,tmp(1),1,1,-1)
        call uncvt('tssn',tmp(2),1,1,-1)
        call uncvt('alve',tmp(3),2,1,-1)
      endif
      write(iout,140) born(k),tmp(1),dalp(k),tmp(2),tmp(3),tmp(4)
140    format(3x,'1',2x,1p,1e13.5,2x,0p,f7.3,1p,4e11.4)
c
      write(iout,150) (luv,i=1,8)
150    format(/16x,'junction velocities (negative in to the plenum',
1      ' cell and positive out of the plenum cell)'/4(8x,
2      'vel.liq.   vel.gas   ')/4(' jun.',3x,a,7x,a,4x))
      ii=(npljn+3)/4
      do 180 i=1,ii
        j0=(i-1)*4
        j1=j0+1
        j2=min0(j1+3,npljn)
        j3=j0+j2-j2
        do 160 j=j1,j2
          is=ia(ljsn-1+j)
          tmp(j-j0)=bd(6,is)*bd(23,is)
          tmp(j-j3)=bd(6,is)*bd(24,is)
160        continue
        if (ioout.eq.1) then
          call uncvt('vl',tmp,j2-j3,1,-1)
        endif
        write(iout,170) (ia(ljunj+j-1),tmp(j-j0),tmp(j-j3),j=j1,j2)
170      format(1x,4(i4,1p,2e12.4,2x))
180      continue
c
      write(iout,190) (luv,i=1,8)
190    format(/13x,'junction tilde velocities (negative in to the',
1      ' plenum cell and positive out of the plenum cell)'/4(8x,
2      'velt.liq.   velt.gas   ')/4(' jun.',3x,a,7x,a,4x))
      do 210 i=1,ii
        j0=(i-1)*4
        j1=j0+1
        j2=min0(j1+3,npljn)
        j3=j0+j2-j2
        do 200 j=j1,j2
          is=ia(ljsn+i-1)
          tmp(j-j0)=bd(6,is)*bd(62,is)
          tmp(j-j3)=bd(6,is)*bd(63,is)
200        continue
        if (ioout.eq.1) then
          call uncvt('vl',tmp,j2-j3,1,-1)
        endif
        write(iout,170) (ia(ljunj+j-1),tmp(j-j0),tmp(j-j3),j=j1,j2)
210      continue
c
      write(iout,220) (lumf,i=1,8)
220    format(/16x,'junction mass flows (negative in to the plenum',
1      ' cell and positive out of the plenum cell)'/4(8x,
2      'mfw.liq.   mfw.vap.   ')/4(' jun.',2x,a,5x,a,3x))
      do 240 i=1,ii
        j0=(i-1)*4
        j1=j0+1

```

TRAC CODE MODIFICATIONS

```

      j2=min0(j1+3,npljn)
      j3=j0+j0-j2
      do 230 j=j1,j2
        tmp(j-j0)=a(lrmvm+j-1)-a(lrvmf+j-1)
        tmp(j-j3)=a(lrvmf+j-1)
230    continue
      if (ioout.eq.1) then
        call uncvt('rmvm',tmp,j2-j3,1,-1)
      endif
      write(iout,170) (ia(ljunj+j-1),tmp(j-j0),tmp(j-j3),j=j1,j2)
240    continue
      endif
c
      cfmass=vol(k)*(arv(k)+arl(k))
      cener=vol(k)*(arev(k)+arel(k))
      omass=cfmass-bsmass
      tmp(1)=cfmass
      tmp(2)=omass
      tmp(3)=cener
      if (ioout.eq.1) then
        call uncvt('cfmass',tmp(1),2,1,-1)
        call uncvt('cener',tmp(3),1,1,-1)
      endif
      write(iout,250) tmp(1),lum,tmp(3),lue,tmp(2),lum
250 format(/' plenum component total coolant mass is',1p,e13.5,
1      a,', total coolant energy is',e13.5,a,', and'/
2      ' computed initial total coolant mass is',e13.5,a)
c
      return
      end

```

Fortran file wprizr.f:

```

      subroutine wprizr(cfmass,cener,cmbkr,tsec)
c
c      subroutine wprizr writes thermal-hydraulic solution
c      parameters to file trcout for the prizer component
c
      common/contrl/ cpuflg,dammc,damx,delt,
      * deltht,difmin,dprmx,dtlmx,dtmax,
      * dtmin,dto,dtrat,dtrmx,dtsmx,
      * dtvmx,encmax,eps1,eps2,epso,
      * ercemx,epss,etime,htlosi,htloso,
      * odelt,powerc,pssmn,pssmx,rfat,
      * rvmax,tend,tercmx,timec,timet,
      * tmmx,varer,vcmn,vcmx,vmaxo,
      * vmxt,vmxt3,vmcon,vmnew,vmold,
      * vmxt3o,xtable,x0sm,y0sm,z0sm,
      * omsasm,wsasm,wdsasm,t0sm(3),xvsm,
      * yvsm,zvsm,rmat(3,3),omsm(3),wsm(3),
      * wds(3),errsm,dtsm
      common/contrl/ dstep,iadded,iblaus,iccmx,
      * icmp,icpmx,icp,idiag,idiags,iectpx,ieos,iff3d,
      * ifprep,igeom3,iml00,iml00x,imfr,
      * invan,iofftk,ipak,ipak3d,ipakon,ipkmp,
      * ireset,irsflg,irstfl,isolut,issflg,istdy,
      * isttc,ithd,itmin,itpako,jfat,kccmx,
      * lcmpt,levstg,llvflg,ncmn,ncmx,
      * ncontr,nconts,ncontt,ncrg,ndial,nencl,
      * newrfd,nfrc1,nfrc3,nitav,nitmn,
      * nitmx,nloopp,nosets,nsend,nseo,
      * nsmn,nsmx,nspl,nspu,nsso,

```

TRAC CODE MODIFICATIONS

```

* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

c
common/units/ ibfadd,ibfaddg,ibfadr,
* ibflnd,ibflng,ibflnr,idout,ieeeg,igout ,
* ikeybd,imout,in ,inlab,inproc,
* ioall,iodone,ioerr,iogrf,ioinp ,
* iolab,ioout,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1 iis,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1 luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbet,luar,lucp,lud,ludh,lue,luen,
1 luh,luha,luhx,luid,luis,lum,lumf,lup,
2 lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3 lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alpbet
parameter (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
c fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/ htlsco,htlsco,coild ,pinteg
common/fltab/ ctitle(4),icflg ,id ,
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,

```

TRAC CODE MODIFICATIONS

```

      * numbn3,nodes ,num ,nrslt ,ctype
      equivalence (flt(1),htlsci),(type,ctype),(ctitle(1),title)
c
c      prizer variable length table
      dimension fl(2),fv(2)
      common/vltab/ aa1111,bsmass,bsmssp,bxmass,
      * dpmx ,epsw ,fl ,flow ,fv ,hout1 ,
      * houtv ,pset ,qheat ,qin ,qint ,
      * gout ,qp3in ,radin ,th ,tout1 ,
      * toutv ,z ,zhtr ,z11111
      common/vltab/ ia1111,ichf ,icj ,iconc ,
      * ict1 ,iuv1 ,iuv2 ,js1 ,js2 ,
      * jun1 ,jun2 ,ncells,type1 ,
      * type2 ,
      * z11111
      character*8 type1,type2
      integer vlt,z11111
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
      parameter(ivltsz=270)
      dimension vlt(ivltsz)
      equivalence (vlt(1),aa1111)
c-----
c
      dimension ld(3),ldn(3)
      common/ptab/ lalp ,lalpn ,lalpd ,
      * lalpdn,lalv ,lalvn ,lalve ,lalven,
      * lara ,larn ,lare1 ,lareln,larev ,
      * larevn,larl ,larln ,larv ,larvn ,
      * lbit ,lbitn ,lcti ,lctin,lctia,
      * lctan,lcif ,lcifn ,lconc ,lconcn,
      * ld ,ldn ,lea ,lean ,lel ,
      * leln ,lev ,levn ,lgam ,lgamn ,
      * lhig ,lhigo ,lhil ,lhilo ,lhiv ,
      * lhivo ,lp ,lpn ,lpa ,lpan ,
      * lqppc ,lqppco,lroa ,lroan ,lrol ,
      * lroln ,lrov ,lrovn ,ls ,lsn ,
      * ltce ,ltcen ,ltd ,ltdn ,ltl ,
      * ltl ,ltv ,ltvn ,ltw ,ltwn ,
      * ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
      * lvl ,lvlto ,lvm ,lvmn ,lvv ,
      * lvvn ,lvvt ,lvvto
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c-----
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for 1d components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
      parameter (iptsiz=300)
      integer pt(iptsiz)
c-----
      equivalence (pt(1),lalp)
c
      dimension lh(3)
      common/ptab/ lalpmn,lalpmx,lalpo ,

```


TRAC CODE MODIFICATIONS

```

* lam ,larc ,lcfz ,lcl ,lcpl ,
* lcpv ,lcv ,ldalva,ldfldp,ldfvdp,
* ldriv ,ldx ,lelev ,lfa ,lfavol,
* lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
* lh ,lhd ,lhdht ,lhfg ,lhgam ,
* lhla ,lhlatw,lhva ,lhvatw,
* lqrl ,lqrv ,lqp3f ,
* lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
* lrarl ,lrarv ,
* lxsm,lysm,lzsm,lrsm,lr0sm,
* lnfvsm,lnflsm,luvsmlnfcvsm,lnfcslm,lvvsm,lvlsml,
* lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
* lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
* ltssn ,lvisl ,lvisv ,lvlalp,lvlvcl,
* lvlvol,lvlx ,lvol ,lvrl ,lvrv ,
* lvvvol,lvvx ,lwa ,lwat ,lwfl ,
* lwfv ,lwfmfl,lwfmfv
c
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt.  currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c      in case new pointers are added after lwfmfv, then the coding in
c      subroutine aicomp (third executable statement) for evaluation of
c      the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c      must be changed to use the name of the new pointer at the end
c      of this section of the common block / ptab /.
c-----
c      common/ptab/  lldr ,lmatid,lnff ,llccfl
c
c      common/ptab/  lcpw ,lcw ,ldr ,
c      * lemis ,lhol ,lhov ,lrn ,lrn2 ,
c      * lrow ,ltchf ,ltol ,ltov
c
c
c
c      dimension tmp(4)
c
c      write(iout,100) num,jun1,jun2
100 format(/' the component type is a prizer, component number is',
1      i4,', first junction number is',i4,' and second',
2      ' junction number is',i4)
c      cfmass=0.0
c      cener=0.0
c
c      iflgw=1
c      itee = 0
c      call ecomp(num,1,ncells,iflgw,nodes,cfmass,pinteg,cener,tsec,
c      &          itee)
c
c      if a steady-state calculation was or is being evaluated prior
c      to a transient calculation, the mass checker must account for
c      the increase in the volume of the component by a factor of
c      1.0e+35 during the steady-state calculation.  This is done by
c      assigning the fraction 1.0e-35 of the junction mass flow dur-
c      ing the steady-state calculation to the component itself and
c      the remainder to the total break flow; this logic assumes that
c      a steady-state calculation may only be run before a transient

```

TRAC CODE MODIFICATIONS

```

c      calculation
c
      if (stdyst.eq.0) then
        omass = cfmass - bsmssp - 1.0e-35*bsmass
      else
        qout = 1.0e-35*qout
        cfmass=1.0e-35*cfmass
        cener = 1.0e-35*cener
        omass = cfmass-1.0e-35*bsmass
      endif
c
      tmp(1)=flow
      tmp(2)=qout
      tmp(3)=amax1(0.0,z)
      tmp(4)=qin
      if (ioout.eq.1) then
        call uncnvt('flow',tmp(1),1,1,-1)
        call uncnvt('qout',tmp(2),1,1,-1)
        call uncnvt('z' ,tmp(3),1,1,-1)
        call uncnvt('qin' ,tmp(4),1,1,-1)
      endif
      write(iout,110) tmp(1),luvf,tmp(2),luvo,tmp(3),luz,tmp(4),lupw
110 format(/' prizer liquid volumetric outflow is',lp,e13.5,a,
1         ', volume out is',e13.5,a,', and level is',e13.5,a//
2         ' prizer heater/sprayer power is',e13.5,a)
c
      if ((nodes.ne.0).and.(nstep.gt.0)) then
        tmp(1)=htlsci
        tmp(2)=htlsco
        if (ioout.eq.1) then
          call uncnvt('htlsci',tmp,2,1,-1)
        endif
        write(iout,120) tmp(1),lue,tmp(2),lue
120 format(/' prizer wall total power loss on the inside',
1         ' surface is',lp,e13.5,a,' and on the outside',
2         ' surface is',e13.5,a)
      endif
c
      cmbrk=bsmass
      tmp(1)=cfmass
      tmp(2)=omass
      tmp(3)=cener
      if (ioout.eq.1) then
        call uncnvt('cfmass',tmp(1),2,1,-1)
        call uncnvt('cener' ,tmp(3),1,1,-1)
      endif
      write(iout,130) tmp(1),lum,tmp(3),lue,tmp(2),lum
130 format(/' prizer component total coolant mass is',lp,e13.5,
1         a,', total coolant energy is',e13.5,a,', and'/
2         ' computed initial total coolant mass is',e13.5,a)
c
      return
      end

```

Fortran file wpump.f:

```

      subroutine wpump(cfmass,cener,tsec)
c
c      subroutine wpump writes thermal-hydraulic solution
c      parameters to file trcout for the pump component
c
      parameter      (ifxsiz=5000000)

```

TRAC CODE MODIFICATIONS

```

common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
c fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/ htlsci,htlsco,coild ,pinteg
common/fltab/ ctitle(4),icflg ,id ,
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num ,nrvlt ,ctype
equivalence (flt(1),htlsci),(type,ctype),(ctitle(1),title)

c
common/units/ ibfadd,ibfadr,ibfadr,
* ibflnd,ibflng,ibflnr,idout,ieeeg,igout ,
* ikeybd,imout ,in ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1 ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1 luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbet,luar,lucp,lud,ludh,lue,luen,
1 luh,luha,luhx,luid,luis,lum,lumf,lup,
2 lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3 lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alpbet

c
pump variable length table
dimension fl(2),fv(2)
common/vltab/ aa1111,aeffmi,alpha ,

```

TRAC CODE MODIFICATIONS

```

* alphao,beffmi,bsmass,ceffmi,delp ,
* dsmom ,effmi ,effmi1,eps w ,fl ,flow ,
* fv ,head ,hout1 ,houtv ,mflow ,
* omega ,omegan,omgoff,omtest,qp3in ,
* qp3off,radin ,rflow ,rhead ,rho ,
* rome ga,romgm x,rqp3mx,rrho ,rtork ,
* smom ,tfr0 ,tfr1 ,tfr2 ,tfr3 ,
* tfrb ,tfr10 ,tfr11 ,tfr12 ,tfr13 ,
* th ,torque,tout1 ,toutv ,
* z11111
dimension ndata(16)
common/vltab/ ial111,ichf ,icj1 ,icj2 ,
* iconc ,indxhm,indxtm,ionoff,ipf ,
* ipm ,ipmps ,ipmps2,ipmpsv,ipmptr,
* ipmpty,ipp ,iqf ,iqp ,iqp3sv,
* iqp3tr,irp ,isol1 ,isol2 ,js1 ,
* js2 ,jun1 ,jun2 ,ncells,ndata ,
* ndmax ,nhdm ,nonoff,npmp rf,npmpsd,
* npmpsv,npmp tb,nqp3rf,nqp3sv,nqp3tb,
* ntdm ,option,type1 ,type2 ,
* z11111
integer vlt,type1,type2,z11111,option
real mflow
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aa1111)
c-----
c
c
dimension tmp(8)
c
write(iout,100) num,jun1,jun2
100 format(' the component type is a pump, component number is',
1 i4,', first junction number is',i4,', and second',
2 ' junction number is',i4)
c
write(iout,110)
110 format('/ trip',4x,'impeller',5x,'liquid',5x,'volumetric',6x,
1 'mass',8x,'void',6x,'momentum',7x,'pump',8x,'delta',8x,
2 'pump/' status',5x,'speed',6x,'density',7x,'flow',9x,
3 'flow',6x,'fraction',5x,'source',8x,'head',7x,'pressure',
4 5x,'torque')
if (iunout.eq.1) then
write(iout,120) luis,lur,luvf,lumf,lud,luph,luph,lupd,lupt
120 format(11x,a,5x,a,6x,a,7x,a,8x,a,5x,a,2x,a,5x,a,6x,a)
endif
iset=0
if (ipmptr.ne.0) call trip(ipmptr,iset,tlaps,delsv)
tmp(1)=omegan
tmp(2)=rho
tmp(3)=flow
tmp(4)=mflow
tmp(5)=smom
tmp(6)=head
tmp(7)=delp
tmp(8)=torque
if (ioout.eq.1) then

```

TRAC CODE MODIFICATIONS

```

      call uncvt('omegan',tmp(1),1,1,-1)
      call uncvt('rho1',tmp(2),1,1,-1)
      call uncvt('rflow',tmp(3),1,1,-1)
      call uncvt('mflow',tmp(4),1,1,-1)
      call uncvt('smom',tmp(5),1,1,-1)
      call uncvt('head',tmp(6),1,1,-1)
      call uncvt('deltap',tmp(7),1,1,-1)
      call uncvt('torque',tmp(8),1,1,-1)
    endif
    write(iout,130) iset,(tmp(i),i=1,4),alpha,(tmp(i),i=5,8)
130 format(i5,1p,e14.4,3e13.5,0p,f10.6,1p,4e13.5)
c
      cfmass=0.0
      cener=0.0
c
      iflgw=1
      itee = 0
      call ecomp(num,1,ncells,iflgw,nodes,cfmass,pinteg,cener,tsec,
&               itee)
c
      if ((nodes.ne.0).and.(nstep.gt.0)) then
        tmp(1)=htlsci
        tmp(2)=htlsco
        if (ioout.eq.1) then
          call uncvt('htlsci',tmp(2),1,-1)
        endif
        write(iout,140) tmp(1),lupw,tmp(2),lupw
140 format(/' pump wall total power loss on the inner surface is',
1         1p,e13.5,a,' and on the outer surface is',e13.5,a)
      endif
c
      omass=cfmass-bsmass
      tmp(1)=cfmass
      tmp(2)=omass
      tmp(3)=cener
      if (ioout.eq.1) then
        call uncvt('cfmass',tmp(1),2,1,-1)
        call uncvt('cener',tmp(3),1,1,-1)
      endif
      write(iout,150) tmp(1),lum,tmp(3),lue,tmp(2),lum
150 format(/' pump component total coolant mass is',1p,e13.5,
1         a,', total coolant energy is',e13.5,a,', and'/
2         ' computed initial total coolant mass is',e13.5,a)
c
      return
    end

```

Fortran file wtee.f:

```

      subroutine wtee(cfmass,cener,tsec)
c
c      subroutine wtee writes thermal-hydraulic solution
c      parameters to file trcout for the tee component
c
      common/contrl/ cpuflg,dammc,damx,delt,
* deltht,difmin,dprmx,dtlmax,dtmax,
* dtmin,dto,dtrat,dtrmx,dtsmx,
* dtvmx,encmax,eps1,eps2,epso,
* ercemx,epss,etime,htlosi,htloso,
* odelt,powerc,pssmn,pssmx,rfat,
* rvmax,tend,tercmx,timec,tinet,
* tmmx,varer,vcmn,vcmx,vmaxo,

```

TRAC CODE MODIFICATIONS

```

* vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
* vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
* omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
* yvsm,zvsm,rmatm(3,3),omsm(3),wsm(3),
* wdsm(3),errsm,dtm
common/contrl/ dstep ,iadded,iblaus,iccmx ,
* icmp ,icmptmx,icp ,idiag ,idiags,ieccpx,ieos ,iff3d ,
* ifprep,igeom3,iml00 ,iml00x,imfr ,
* invan ,iofftk,ipak ,ipak3d,ipakon,ipkmp,
* ireset,irsflg,irstfl,isolut,issflg,istdy ,
* isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
* lcmptr,levstg,llvflg,ncmn ,ncmx ,
* ncontr,nconts,ncontt,ncrg ,ndial ,nencl,
* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nsp1 ,nspu ,nss0 ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm
c
common/holl/ accumh,breakh,coreh ,
* ctainh,fillh ,pipeh ,plenh ,prizrh,pumph ,
* stgenh,teeh ,turbh ,valveh,vsslh
* ,rodh,slabh,sepdh
character*8 rodh,slabh,accumh,breakh,coreh,ctainh,fillh,pipeh
1,plenh,prizrh,pumph,stgenh,teeh,turbh,valveh,vsslh
* ,sepdh
c
common/units/ ibfadd,ibfadg,ibfadr,
* ibflnd,ibflng,ibflnr,idout ,ieeeg ,igout ,
* ikeybd,imout ,in ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card
c
common/istat/ varerm,verr
common/istat/ iott ,nstep ,oitno
integer oitno
c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1 ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1 luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbat,luar,lucp,lud,ludh,lue,luen,
1 luh,luha,luhx,luid,luis,lum,lumf,lup,
2 lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3 lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha
character*10 lucp
character*11 luph

```

TRAC CODE MODIFICATIONS

```

character*12 luhx,lutc,runch
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alpbet
parameter      (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
c   fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/  htlscl,htlsco,coild ,pinteg
common/fltab/  ctitle(4),icflg ,id
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num ,nrvlt ,ctype
equivalence (flt(1),htlscl),(type,ctype),(ctitle(1),title)

c
c
c   tee variable length table
dimension fl(4),fv(4)
common/vltab/  aa1111,ai ,alpot ,alpotn,alpoto,alpd ,
* alps ,an ,bsmass,ca ,cal ,
* calv ,cav ,cost ,deldim,dpsep ,
* dpss ,epsw ,enin1 ,enin2 ,
* fl ,fv ,houtl1,houtl2,houtv1,
* houtv2,powr1 ,powr2 ,pwin1 ,pwin2 ,
* pwoff1,pwoff2,qpin1 ,qpin2 ,qpoff1,
* qpoff2,radin1,radin2,rh ,rpwmxl,
* rpwmx2,rqpmx1,rqpmx2,
* rrl ,rt11 ,rtlv ,rt21 ,rt2v ,
* th1 ,th2 ,theta ,tlen1 ,tlen2 ,
* toutl1,toutl2,toutv1,toutv2,vdry1 ,
* vdryu ,wli0 ,xco ,xcu ,
* z11111
common/vltab/  ia1111,icbs1 ,icbs2 ,
* ichf ,icj1 ,icj2 ,icj3 ,iconc1,
* iconc2,idry ,ientrn,ionof1,ionof2,
* ipf1 ,ipf2 ,ipow1 ,ipow2 ,ipp1 ,
* ipp2 ,ipwsv1,ipwsv2,ipwtr1,ipwtr2,
* iqf1 ,iqf2 ,iqp1 ,iqp2 ,iqpsv1,
* iqpsv2,iqptr1,iqptr2,isep ,isol1 ,
* isol2 ,isol3 ,isoln ,istage,jcell ,
* js1 ,js2 ,js3 ,
* jun1 ,jun2 ,jun3 ,ncell1,
* ncell2,ncells,ncsep ,ndryr ,nonof1,
* nonof2,npwrf1,npwrf2,npwsv1,npwsv2,
* npwtb1,npwtb2,nqprf1,nqprf2,nqpsv1,
* nqpsv2,nqptb1,nqptb2,nseps ,type1 ,
* type2 ,type3 ,
* z11111
integer vlt,type1,type2,type3,z11111
c-----comdeck vlt dim sets an upper limit to all variable length tables

```

TRAC CODE MODIFICATIONS

c-----via parameter ivltsz. comdeck genvlt calls vltldim directly, thus
 c-----providing all variable length tables with a uniform length.
 c-----parameter ivltsz is used to set a uniform length to all
 c-----variable length tables.

```
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aa1111)
```

c-----

```
c      tee pointer table
      dimension ld(3),ldn(3)
      common/ptab/  lalp ,lalpn ,lalpd ,
* lalpdn,lalv ,lalvn ,lalve ,lalven,
* lara ,larn ,larel ,lareln,larev ,
* larevn,larl ,larln ,larv ,larvn ,
* lbit ,lbitn ,lchti ,lchtin,lchtia,
* lchtan,lcif ,lcifn ,lconc ,lconcn,
* ld ,ldn ,lea ,lean ,lel ,
* leln ,lev ,levn ,lgam ,lgamn ,
* lhig ,lhigo ,lhil ,lhilo ,lhiv ,
* lhivo ,lp ,lpn ,lpa ,lpan ,
* lqppc ,lqppco,lroa ,lroan ,lrol ,
* lroln ,lrov ,lrovn ,ls ,lsn ,
* ltce ,ltcen ,ltd ,ltdn ,ltl ,
* ltln ,ltv ,ltvn ,ltw ,ltwn ,
* ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
* lvlt ,lvlto ,lvm ,lvmn ,lvv ,
* lvn ,lvvt ,lvvto
```

c-----
 c if the list of pointers is increased, must also increase (if
 c necessary) kpttmp in subroutine aicomp such that kpttmp is greater
 c than or equal to the total number of pointers defined in historian
 c comdecks dualpt and hydropt. currently, kpttmp = 300, while the
 c total number of pointers is 77(dualpt) + 82(hydropt) = 159.

c-----
 c-----ptsiz is called by genpt, roddat, vsslpt, and all component
 c-----pointer tables (via dualpt for ld components). it sets a uniform
 c-----length for all pointer tables via parameter iptsiz.

```
parameter (iptsiz=300)
integer pt(iptsiz)
```

c-----

```
equivalence (pt(1),lalp)
```

c

```
dimension lh(3)
common/ptab/  lalpmn,lalpmx,lalpo ,
* lam ,larc ,lcfz ,lcl ,lcpl ,
* lcpv ,lcv ,ldalva,ldfldp,ldfvdv,
* ldriv ,ldx ,lelev ,lfa ,lfavol,
* lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
* lh ,lhd ,lhdht ,lhfg ,lhgam ,
* lhla ,lhlatw,lhva ,lhvatw,
* lqrl ,lqrv ,lqp3f ,
* lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
* lrarl ,larv ,
* lxxsm,lysm,lzsm,lrsn,lrosm,
* lnfvsm,lnflsm,luvsm,lnfcvsm,lnfcism,lvvsm,lvism,
* lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
* lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
* ltssn ,lvisl ,lvisv ,lvialp,lvivc ,
* lvlvol,lvlx ,lvol ,lvv ,lvrv ,
* lvvvol,lvvx ,lwa ,lwat ,lwfl ,
* lwfv ,lwfmfl,lwfmfv
```

c

TRAC CODE MODIFICATIONS

```

c -----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c   than or equal to the total number of pointers defined in historian
c   comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c   total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c   in case new pointers are added after lwfmfv, then the coding in
c   subroutine aicomp (third executable statement) for evaluation of
c   the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c   must be changed to use the name of the new pointer at the end
c   of this section of the common block / ptab /.
c -----

```

```

c   common/ptab/  lldr ,lmatid,lfff ,llccfl
c
c   common/ptab/  lcpw ,lcw ,ldr ,
c   * lemis ,lhol ,lhov ,lrn ,lrn2 ,
c   * lrow ,ltchf ,ltol ,ltov
c
c   common/ptab/  laa, lads, lbb,
c   & lbd4, lcks, ldds, leffld, lhbs,
c   & lnsk, lpowrf, lpowtb,
c   & lrws, lrrs,
c   * lqp3rf,lqp3tb
c
c
c
c   dimension tmp(3)
c
c   write(iout,100) num,jun1,jun2,jun3,jcell
c 100 format(/' the component type is a tee, component number is',i4,
c   1      ', first junction number is',i4,', second junction',
c   2      ' number is',i4,', '/' third junction number is',i4,
c   3      ', and internal-junction main-tube cell number is',i4)
c
c   write(iout,110)
c 110 format(/' tee primary side')
c
c   cfmass= 0.0
c   cener = 0.0
c
c   iflgw=1
c   itee = 1
c   call ecomp(num,1,ncell1,iflgw,nodes,cfmass,pinteg,cener,tsec,
c   &          itee)
c
c   if (ipow1.eq.1) then
c       tmp(1)=powr1
c       tmp(2)=enin1+delt*powr1
c       if (ioout.eq.1) then
c           call uncvt('powr1',tmp(1),1,1,-1)
c           call uncvt('enin1',tmp(2),1,1,-1)
c       endif
c       write(iout,120) tmp(1),lupw,tmp(2),lue
c 120 format(/' power deposited in the tee-primary coolant is',lp,
c   1      'e13.5,a,' and total energy deposited in the tee-pri',
c   2      'mary coolant is',e13.5,a)
c   endif
c
c   write(iout,130)
c 130 format(/' tee secondary side')
c

```

TRAC CODE MODIFICATIONS

```

      iflgw=0
      itee = 2
      call ecomp(num,ncell1+2,ncells,iflgw,nodes,cfmass,pinteg,cener,
&          tsec,itee)
c
      if (ipow2.eq.1) then
        tmp(1)=powr2
        tmp(2)=enin2+delt*powr2
        if (ioout.eq.1) then
          call uncnvt('powr2',tmp(1),1,1,-1)
          call uncnvt('enin2',tmp(2),1,1,-1)
        endif
        write(iout,140) tmp(1),lupw,tmp(2),lue
140    format(/' power deposited in the tee-secondary coolant is',
1          lp,e13.5,a,' and total energy deposited in the tee-',
2          'secondary coolant is',e13.5,a)
      endif
c
      if (type.eq.sepdh) then
        write(iout,150) xco,xcu
150    format(/' tee separator carryover is',lp,e13.5,
1          ' and carryunder is',e13.5)
      endif
c
      if ((nodes.ne.0).and.(nstep.gt.0)) then
        tmp(1)=htlsci
        tmp(2)=htlsco
        if (ioout.eq.1) then
          call uncnvt('htlsci',tmp(2),1,-1)
        endif
        write(iout,160) tmp(1),lupw,tmp(2),lupw
160    format(/' tee wall total power loss on the inner surface is',
1          lp,e13.5,a,' and on the outer surface is',e13.5,a)
      endif
c
      omass=cfmass-bsmass
      tmp(1)=cfmass
      tmp(2)=omass
      tmp(3)=cener
      if (ioout.eq.1) then
        call uncnvt('cfmass',tmp(1),2,1,-1)
        call uncnvt('cener',tmp(3),1,1,-1)
      endif
      write(iout,170) tmp(1),lum,tmp(3),lue,tmp(2),lum
170    format(/' tee component total coolant mass is',lp,e13.5,
1          a,', total coolant energy is',e13.5,a,', and'/
2          ' computed initial total coolant mass is',e13.5,a)
c
      return
      end

```

Fortran file wturb.f:

```

      subroutine wturb(cfmass,cener,tsec)
c
c      subroutine wturb writes thermal-hydraulic solution
c      parameters to file trcout for the turb component
c
      common/contrl/ cpuflg,dammc ,damx ,delt ,
      * deltht,difmin,dprmx ,dtltx ,dtmax ,
      * dtmin ,dto ,dtrat ,dtrmx ,dtsmx ,
      * dtvmx ,encmax,eps1 ,eps2 ,epso ,

```

TRAC CODE MODIFICATIONS

```

* ercemx,epss ,etime ,htlosi,htloso,
* odelt ,powerc,pssmn ,pssmx ,rfat ,
* rvmax ,tend ,tercmx,timec ,timet ,
* tmmx ,varer ,vcmn ,vcmx ,vmxo ,
* vmxt ,vmxt3,vmcon ,vmnew ,vmold ,
* vmxt3o,xtable,x0sm ,y0sm ,z0sm ,
* omsasm,wsasm ,wdsasm,t0sm(3),xvsm ,
* yvsm,zvsm,rmatm(3,3),omsm(3),wsm(3),
* wdsm(3),errsm,dtm
common/contrl/ dstep ,iadded,iblaus,iccmx ,
* icmp ,icmptmx,icp ,idiag ,idiags,ieccpx,ieos ,iff3d ,
* ifprep,igeom3,im100 ,im100x,imfr ,
* invan ,iofftk,ipak ,ipak3d,ipakon,ipkpmp,
* ireset,irsflg,irstfl,isolut,issflg,istdy ,
* isttc ,ithd ,itmin ,itpako,jfat ,kccmx ,
* lcmptr,levstg,llvflg,ncmn ,ncmx ,
* ncontr,nconts,ncontt,ncrg ,ndial ,nencl,
* newrfd,nfrc1 ,nfrc3 ,nitav ,nitmn ,
* nitmx ,nloopp,nosets,nsend ,nseo ,
* nsmn ,nsmx ,nsp1 ,nspu ,nso ,
* nstab ,nstp ,nvgrav,nvpow ,oitmax,sitmax,
* stdyst,transi,motsm,statsm,saxsm
integer dstep ,oitmax,sitmax,stdyst,
* transi,statsm,saxsm

```

c

```

common/dimen/ ifree ,jnvssl,kvel1t,
* kvel2t,kvel3t,last ,ldim ,lenbd ,lendim,
* lentbl,lfree ,llast ,lmlp ,lnldpv,lnrdpt,
* locrdp,lstart,lstrdp,lver ,mdim ,
* memflg,moff ,ncomp ,ncompt,
* nhtstr,njnmx ,njnt ,njun ,nloops,
* nmvssl,npx ,nstgj ,nthm ,nthmid,
* nthm3d,numtcr,nvcon ,nvelx ,nvely ,
* nvelz ,nwrda

```

c

```

common/units/ ibfadd,ibfadg,ibfadr,
* ibflnd,ibflng,ibflnr,idout,ieeeg,igout ,
* ikeybd,imout ,in ,inlab ,inproc,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

```

c

```

common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1      ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1      luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alpbat,luar,lucp,lud,ludh,lue,luen,
1      luh,luha,luhx,luid,luis,lum,lumf,lup,
2      lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3      lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2 lud,lutp,lus
character*3 lut,luz
character*4 luar,lue,lum,luvo
character*5 lup,lupd,luv,luvf
character*6 luis
character*7 luen,lumf,lupt,lupw
character*8 labels,labun,luid,lur,lusp,lusz,lutm
character*9 luha

```

TRAC CODE MODIFICATIONS

```

character*10 lucp
character*11 luph
character*12 luhx,lutc,runch
character*13 luh,lunch,lupcb
character*14 labsv
character*19 ludh
character*26 alpbat

c
parameter      (ifxsiz=5000000)
common a(ifxsiz)
dimension alcm(1)
equivalence (a(1),alcm(1))
dimension ia(ifxsiz)
character*8 ach(ifxsiz)
equivalence (a(1),ach(1))
equivalence (a(1),ia(1))

c
c   fixed length table
integer flt(1)
real rflt(1)
equivalence (flt(1),rflt(1))
character type*8,title*32,ctitle*8
common/fltab/  htlscl,htlsco,coild ,pinteg
common/fltab/  ctitle(4),icflg ,id
* irest ,lenarr,lenfv ,lenfv2,lenptr,
* lenvlt,lextra,lfv ,lfvn ,ncellt,
* numbm1,numbm2,numbm3,numbn1,numbn2,
* numbn3,nodes ,num ,nrvlt ,ctype
equivalence (flt(1),htlscl),(type,ctype),(ctitle(1),title)

c
c   turbine stage variable length table
dimension fl(2),fv(2)
common/vltab/  aa1111,alpha1,alpha2,
* ar ,bsmass,coef1 ,
* coef2 ,cof3sq,cp ,cpow ,dia ,
* dsmom ,effdsn,effstg,eninp ,epsw ,fl ,
* flodir,flow ,fv ,gamma ,phirem,plent ,
* powin ,powoff,powdsn,powstg,pres1 ,
* pres2 ,quality,reactn,rhol1 ,rhol2 ,
* rhom1 ,rhom2 ,rhov1 ,rhov2 ,rpowmx,
* smom ,suprht,temp11,temp12,tempv1,
* tempv2,vell1 ,vell2 ,velm1 ,velm2 ,
* velv1 ,velv2 ,vstag ,
* z11111
common/vltab/  ia1111,icj1 ,icj2 ,iconc ,
* ionoff,ipf ,ipow ,ipowsv,ipowtr,
* ipp ,isollb,isolrb,istg ,js1 ,
* js2 ,jun1 ,jun2 ,lentr,ncells,
* nefcon,npowrf,npowsv,npowtb,nrows ,
* type1 ,type2 ,
* z11111
integer vlt,type1,type2,z1111
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.
parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aa1111)

c-----
c

```

TRAC CODE MODIFICATIONS

```

c      turbine stage pointer table
c      dimension ld(3),ldn(3)
c      common/ptab/   lalp ,lalpn ,lalpd ,
*      lalpdn,lalv ,lalvn ,lalve ,lalven,
*      lara ,larn ,lare ,lareln,larev ,
*      larevn,larl ,larln ,larv ,larvn ,
*      lbit ,lbitn ,lchti ,lchtin,lchtia,
*      lchtan,lcif ,lcifn ,lconc ,lconcn,
*      ld ,ldn ,lea ,lean ,lel ,
*      leln ,lev ,levn ,lgam ,lgamn ,
*      lhig ,lhigo ,lhil ,lhilo ,lhiv ,
*      lhivo ,lp ,lpn ,lpa ,lpan ,
*      lqppc ,lqppco,lroa ,lroan ,lrol ,
*      lroln ,lrov ,lrovn ,ls ,lsn ,
*      ltce ,ltcen ,ltd ,ltdn ,ltl ,
*      ltln ,ltv ,ltvn ,ltw ,ltwn ,
*      ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
*      lvlt ,lvlto ,lvn ,lvnn ,lvv ,
*      lvvn ,lvvt ,lvvto
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c-----
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for ld components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
c      parameter (iptsiz=300)
c      integer pt(iptsiz)
c-----
c      equivalence (pt(1),lalp)
c
c      dimension lh(3)
c      common/ptab/   lalpmn,lalpmx,lalpo ,
*      lam ,larc ,lcfz ,lcl ,lclp ,
*      lcpv ,lcv ,ldalva,ldfldp,ldfvd ,
*      ldri ,ldx ,lelev ,lfa ,lfavol,
*      lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
*      lh ,lhd ,lhdht ,lhfg ,lhgam ,
*      lhla ,lhlatw,lhva ,lhvatw,
*      lqrl ,lqrv ,lqp3f ,
*      lqppp ,lregnm,lrhs ,lrnm ,lrnmv ,
*      lrarl ,lrv ,
*      lxsm,lysm,lzsm,lrsn,lrs0sm,
*      lnfvsm,lnflsm,luvs ,lnfcvsm,lnfclsm,lvvsm,lvls ,
*      lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnf14sm,
*      lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
*      ltssn ,lvisl ,lvisv ,lvlalp ,lvlvc ,
*      lvlvol ,lvlx ,lvol ,lvr ,lvrv ,
*      lvvvol ,lvvx ,lwa ,lwat ,lwfl ,
*      lwfv ,lwfmfl ,lwfmfv
c
c-----
c      if the list of pointers is increased, must also increase (if
c      necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c      in case new pointers are added after lwfmfv, then the coding in

```

TRAC CODE MODIFICATIONS

```

c      subroutine aicomp (third executable statement) for evaluation of
c      the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c      must be changed to use the name of the new pointer at the end
c      of this section of the common block / ptab /.
c      -----
c      common/ptab/   lldr ,lmatid,lnff ,llccfl
c
c      common/ptab/   lcpw ,lcw ,ldr ,
c      * lemis ,lhol ,lhov ,lrn ,lrn2 ,
c      * lrow ,ltchf ,ltol ,ltov
c
c      common/ptab/   langl ,lpowrf,lpowtb,lturb
c
c
c      character*8 lsvcb
c      dimension tmp(3)
c
c      write(iout,100) num,jun1,jun2
100 format(/' component type is a turb, component number is',i4,
1      ' , first junction number is',i4,', and second junction',
2      ' number is',i4)
c      cfmass=0.0
c      cener=0.0
c
c      iflgw=0
c      xpow=0.0
c      itee = 0
c      call ecomp(num,1,ncells,iflgw,nodes,cfmass,xpow,cener,tsec,
c      &         itee)
c
c      write direct power to the fluid
c
c      if (ipow.eq.1) then
c         tmp(1)=cpow
c         tmp(2)=eninp+delt*cpow
c         if (ioout.eq.1) then
c            call uncnvt('cpow' ,tmp(1),1,1,-1)
c            call uncnvt('eninp',tmp(2),1,1,-1)
c         endif
c         write(iout,110) tmp(1),lupw,tmp(2),lue
110 format(/' power deposited in the turbine coolant is',1p,e13.5,
1      a,' and total energy deposited in the turbine coolant',
2      ' is',e13.5,a)
c      endif
c
c      write total component quantities
c
c      tmp(1)=powstg
c      tmp(2)=flow
c      if (ioout.eq.1) then
c         call uncnvt('powstg',tmp(1),1,1,-1)
c         call uncnvt('rmvm' ,tmp(2),1,1,-1)
c      endif
c      write(iout,120) effstg,tmp(1),lupw,tmp(2),lumf
120 format(/' stage efficiency is',f9.6,', stage power is',1p,e13.5,a,
1      ' , and coolant mass flow is',e13.5,a)
c
c      write quantities associated with the entire
c      turbine-generator assembly (common/sum all stages)
c
c      if (istg.eq.1) then

```

TRAC CODE MODIFICATIONS

```

        lturb=lturb-ifree+1
        tmp(1)=a(ifree+lenarr+10)
        tmp(2)=a(ifree+lenarr+12)
        tmp(3)=a(ifree+lenarr+20)
        call unsvcb(itrpsv,lsvcb,iun)
        if (ioout.eq.1) then
            call uncnvt('powd' ,tmp(1),1,1,-1)
            call uncnvt('omegd',tmp(2),1,1,-1)
            call uncnvt('lsvcb' ,tmp(3),1,1,-1)
        endif
        write(iout,130) tmp(1),lupw,tmp(2),luis,
1          tmp(3),luncb(ioout+1,iun)
130  format(/' the following quantities are associated with the',
1          ' entire turbine assembly'/' generator power is',1p,
2          e13.5,a,', turbine speed is',e13.5,a,', and turbine',
3          ' signal value is',e13.5,a)
        endif
c
        omass=cfmass-bsmass
        tmp(1)=cfmass
        tmp(2)=omass
        tmp(3)=cener
        if (ioout.eq.1) then
            call uncnvt('cfmass',tmp(1),2,1,-1)
            call uncnvt('cener' ,tmp(3),1,1,-1)
        endif
        write(iout,140) tmp(1),lum,tmp(3),lue,tmp(2),lum
140  format(/' turb component total coolant mass is',1p,e13.5,
1          a,', total coolant energy is',e13.5,a,', and'/'
2          ' computed initial total coolant mass is',e13.5,a)
c
        return
    end

```

Fortran file wvlve.f:

```

        subroutine wvlve(cfmass,cener,tsec)
c
c      subroutine wvlve writes thermal-hydraulic solution
c      parameters to file trcout for the valve component
c
        parameter (ifxsiz=5000000)
        common a(ifxsiz)
        dimension alcm(1)
        equivalence (a(1),alcm(1))
        dimension ia(ifxsiz)
        character*8 ach(ifxsiz)
        equivalence (a(1),ach(1))
        equivalence (a(1),ia(1))
c
c      fixed length table
        integer flt(1)
        real rflt(1)
        equivalence (flt(1),rflt(1))
        character type*8,title*32,ctitle*8
        common/fltab/ htlsci,htlsco,coild ,pinteg
        common/fltab/ ctitle(4),icflg ,id
        * irest ,lenarr,lenfv ,lenfv2,lenptr,
        * lenvlt,lextra,lfv ,lfvn ,ncellt,
        * numbm1,numbm2,numbm3,numbn1,numbn2,
        * numbn3,nodes ,num ,nrvlt ,ctype
        equivalence (flt(1),htlsci),(type,ctype),(ctitle(1),title)

```

TRAC CODE MODIFICATIONS

```

c
common/units/  ibfadd,ibfaddg,ibfadr,
* ibflnd,ibflng,ibflnr,idout,  ieeeeg, igout ,
* ikeybd,imout ,in      ,inlab ,inproc ,
* ioall ,iodone,ioerr ,iogrf ,ioinp ,
* iolab ,ioout ,ioskip,iout ,irstrt,
* itty ,iunlab,iunout,lcmcpd,nittab,
* npwtab,nrdy
common /cunits/card
character*100 card

c
common/istat/  varerm,verr
common/istat/  iott ,nstep ,oitno
integer oitno

c
common/labelv/factor(150),offset(150)
common/labelv/ih(26),itls(777),itsv(105),
1      ils,ilu,ilun,iold
common/labelv/labels(777),labsv(2,105),labun(150),
1      luncb(2,150),lupcb(2,150),runcb(2,150)
common/labelv/alphbet,luar,lucp,lud,ludh,lue,luen,
1      luh,luha,luhx,luid,luis,lum,lumf,lup,
2      lupd,luph,lupt,lupw,lur,lus,lusp,lusz,
3      lut,lutc,lutm,lutp,luv,luvf,luvo,luz
character*2  lud,lutp,lus
character*3  lut,luz
character*4  luar,lue,lum,luvo
character*5  lup,lupd,luv,luvf
character*6  luis
character*7  luen,lumf,lupt,lupw
character*8  labels,labun,luid,lur,lusp,lusz,lutm
character*9  luha
character*10 lucp
character*11 luph
character*12 luhx,lutc,runcb
character*13 luh,luncb,lupcb
character*14 labsv
character*19 ludh
character*26 alphbet
c
valve variable length table
dimension fl(2),fv(2)
common/vltab/  aal111,avlve ,bsmass,epsw ,favlve,
* fl      ,fmaxov,fminov,fric0 ,fric0r,fv      ,hdrdx , houtl,
* houtv ,hvlve ,qp3in ,qp3off,radin ,
* rqp3mx,rvmx ,rvov ,th      ,toutl ,
* toutv ,xpos ,
* z11111
common/vltab/  ial111,ichf ,icj1 ,icj2 ,
* iconc ,ionoff,iqf ,iqp ,iqp3sv,
* iqp3tr,isol1b,isolrb,ivf ,ivp1 ,
* ivp2 ,ivps ,ivsv ,ivtr ,ivtrov,
* ivty ,ivtyov,js1 ,js2 ,jun1 ,
* jun2 ,mode ,ncells,nonoff,
* nqp3rf,nqp3sv,nqp3tb,nvrf ,nvsv ,
* nvtb1 ,nvtb2 ,type1 ,type2 ,
* z11111
integer vlt,type1,type2,z1111
c-----comdeck vlt dim sets an upper limit to all variable length tables
c-----via parameter ivltsz. comdeck genvlt calls vlt dim directly, thus
c-----providing all variable length tables with a uniform length.
c-----parameter ivltsz is used to set a uniform length to all
c-----variable length tables.

```


TRAC CODE MODIFICATIONS

```

parameter(ivltsz=270)
dimension vlt(ivltsz)
equivalence (vlt(1),aal111)

c-----
c
c   vlive pointer table
c   dimension ld(3),ldn(3)
c   common/ptab/   lalp ,lalpn ,lalpd ,
*   lalpdn,lalv ,lalvn ,lalve ,lalven,
*   lara ,larn ,lare ,lareln,larev ,
*   larevn,larl ,larln ,larv ,larvn ,
*   lbit ,lbitn ,lcti ,lctin,lctia ,
*   lctan,lcif ,lcifn ,lconc ,lconcn,
*   ld ,ldn ,lea ,lean ,lel ,
*   leln ,lev ,levn ,lgam ,lgamn ,
*   lhig ,lhigo ,lhil ,lhilo ,lhiv ,
*   lhivo ,lp ,lpn ,lpa ,lpan ,
*   lqppc ,lqppco,lroa ,lroan ,lrol ,
*   lroln ,lrov ,lrovn ,ls ,lsn ,
*   ltce ,ltcen ,ltd ,ltdn ,ltl ,
*   ltl ,ltv ,ltvn ,ltw ,ltwn ,
*   ltwa ,ltwan ,ltwe ,ltwen ,lvl ,lvln ,
*   lvlt ,lvlt ,lvn ,lvnm ,lvv ,
*   lvvn ,lvvt ,lvvto

c-----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater
c   than or equal to the total number of pointers defined in historian
c   comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c   total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c-----
c-----ptsize is called by genpt, roddat, vsslpt, and all component
c-----pointer tables (via dualpt for ld components). it sets a uniform
c-----length for all pointer tables via parameter iptsiz.
c   parameter (iptsiz=300)
c   integer pt(iptsiz)

c-----
c   equivalence (pt(1),lalp)

c
c   dimension lh(3)
c   common/ptab/   lalpmn,lalpmx,lalpo ,
*   lam ,larc ,lcfz ,lcl ,lcpl ,
*   lcpv ,lcv ,ldalva,ldfldp,ldfvd ,
*   ldri ,ldx ,lelev ,lfa ,lfavol,
*   lfinan,lfric ,lfsmlt,lgrav ,lgrvol,
*   lh ,lhd ,lhdht ,lhfg ,lhgam ,
*   lhla ,lhlatw,lhva ,lhvatw,
*   lqrl ,lqrv ,lqp3f ,
*   lqppp ,lregnm,lrhs ,lrmem ,lrmvm ,
*   lrarl ,lrv ,
*   lxsm,lysm,lzsm,lrs ,lr0sm,
*   lnfvsm,lnflsm,lrvsm,lnfcvsm,lnfclsm,lrvsm,lvlsm,
*   lnflsm,lnf2sm,lnf3sm,lnfv4sm,lnfl4sm,
*   lrom ,lrvmf ,lsig ,ltrid ,ltsat ,
*   ltssn ,lvisl ,lvisv ,lvlalp ,lvlvc ,
*   lvlvol ,lvlx ,lvol ,lvr ,lvrv ,
*   lvvvol ,lvvx ,lwa ,lwat ,lwfl ,
*   lwfv ,lwfmfl ,lwfmfv

c
c-----
c   if the list of pointers is increased, must also increase (if
c   necessary) kpttmp in subroutine aicomp such that kpttmp is greater

```

TRAC CODE MODIFICATIONS

```

c      than or equal to the total number of pointers defined in historian
c      comdecks dualpt and hydropt. currently, kpttmp = 300, while the
c      total number of pointers is 77(dualpt) + 82(hydropt) = 159.
c
c      in case new pointers are added after lwfmfv, then the coding in
c      subroutine aicomp (third executable statement) for evaluation of
c      the local variable lenpt1 = locf (lwfmfv) - locf (pt(1)) + 1
c      must be changed to use the name of the new pointer at the end
c      of this section of the common block / ptab /.
c -----
c      common/ptab/  lldr ,lmatid,lnff ,llccfl
c
c      common/ptab/  lcpw ,lcw ,ldr ,
c      * lemis ,lhol ,lhov ,lrn ,lrn2 ,
c      * lrow ,ltchf ,ltol ,ltov
c
c      common/ptab/  lqp3rf,lqp3tb,lvrf ,
c      * lvtb1 ,lvtb2
c
c      character*9 lmode
c      dimension tmp(3)
c
c      write(iout,100) num,jun1,jun2
100 format(/' the component type is a valve, component number is',
1      i4,', first junction number is',i4,', and second',
2      ' junction number is',i4)
c      cfmass = 0.0
c      cener = 0.0
c
c      iflgw=1
c      itee = 0
c      call ecomp(num,1,ncells,iflgw,nodes,cfmass,pinteg,cener,tsec,
c      &          itee)
c
c      tmp(1)=a(lfa+ivps-1)
c      tmp(2)=a(lhd+ivps-1)
c      if ((ioout.eq.1).or.(iunout.eq.1)) then
c          call uncnvt('hd',tmp(2),1,1,-ioout)
c          call uncnvt('fa',tmp(1),1,1,-ioout)
c      endif
c      write(iout,110) tmp(1),lunb(ioout+1,itls(iold))(1:4),tmp(2),luz
110 format(/' valve adjustable area open is',lp,e13.5,a,
1      ' and valve hydraulic diameter is',e13.5,a)
c      write(iout,120) favlve,xpos
120 format(/' valve adjustable area fraction open is',f9.6,
1      ' and valve-stem fraction withdrawn is',f9.6)
c      if (mode.eq.-1) then
c          lmode=' closing '
c      elseif (mode.eq.0) then
c          lmode='unchanged'
c      else
c          lmode=' opening '
c      endif
c      write(iout,130) lmode
130 format(/' valve adjustable area was ',a,
1      ' during the last time step')
c
c      if ((nodes.ne.0).and.(nstep.gt.0)) then
c          tmp(1)=htlsci
c          tmp(2)=htlsco
c          if (ioout.eq.1) then

```

TRAC CODE MODIFICATIONS

```
        call uncvt('htlsci',tmp,2,1,-1)
      endif
      write(iout,140) tmp(1),lupw,tmp(2),lupw
140   format(/' valve wall total power loss on the inner surface is',
1       1p,e13.5,a,' and on the outer surface is',e13.5,a)
      endif
c
      omass=cfmass-bsmass
      tmp(1)=cfmass
      tmp(2)=omass
      tmp(3)=cener
      if (ioout.eq.1) then
        call uncvt('cfmass',tmp(1),2,1,-1)
        call uncvt('cener' ,tmp(3),1,1,-1)
      endif
      write(iout,150) tmp(1),lum,tmp(3),lue,tmp(2),lum
150   format(/' valve component  total coolant mass is',1p,e13.5,
1       a,', total coolant energy is',e13.5,a,', and'/
2       ' computed initial total coolant mass is',e13.5,a)
c
      return
    end
```

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TRAC CODE MODIFICATIONS

Appendix B: Listing of Post-Processing Program TSPLIT

The file listed below represents the entire source code for the TSPLIT algorithm. TSPLIT contains only a main program with no subroutines.

Fortran file tsplit.f:

```

      program tsplit
c
c *****
c *
c * Program "tsplit" takes as input the TRAC code generated
c * "tecsum.grf" file and splits it out into separate "tecplot" files
c * consistent with the requested graphics points inputted to TRAC
c * thru the "graphin" file.
c *
c * First the data within the "tecsum.grf" file is read in and stored
c * within appropriate arrays consistent with component type. Then,
c * each individual component graph point data set is written to its
c * own unique file (see output below).
c *
c * INPUT: "graphin"   file
c *        "tecsum.grf" file
c *
c * INTERMEDIATE:
c *
c * OUTPUT:
c *      "tec???-xx.dat" files   for graphics points in components
c *                          that are not plenums or heat
c *                          structures.
c *
c *      "tecp???-xx.dat" files  for graphics points in plenum
c *                          components.
c *
c *      "tecphi???-xx.dat" files for graphics points on inner
c *                          surfaces of heat structures.
c *
c * where   ??? - represents TRAC component number
c *          xx - represents cell location within component
c *
c * graphin arrays:
c * -----
c *
c * npoints   - number of locations (points) within TRAC model
c *             where graphics requested
c * component - component id number containing specified graph point
c * cell       - cell number within component where graphics requested
c *             (number second leg of tee sequentially from end
c *             cell number on first leg)
c *             (If a heat structure then cell number is axial row of
c *             nodes where point resides)
c * ictype     - type of component:
c *             (0 for fill, pipe, pressurizer, pump, turb, value)
c *             (1 for plenum)
c *             (2 for tee)
c *             (3 for heat structure)
c * id_leg     - which leg of component cell is located in:
c *             (1 always for fill, pipe, pressurizer, pump,
```

TRAC CODE MODIFICATIONS

```

c *          plenum, turb, value) *
c *          (1 or 2 for tee's) *
c *          (for a heat structure 1 implies inner surface and *
c *          2 for outer surface) *
c * *
c * tecsum.grf arrays: *
c * ----- *
c * *
c * tsec      - Time into simulation (sec) *
c * psia      - Cell center pressure (psia) *
c * qfgpm     - Liquid volumetric flowrate at cell face (gpm) *
c * tf        - Bulk liquid phase temperature (C) *
c * tsub      - Bulk liquid subcooling (C) *
c * tsat      - Bulk liquid saturation temperature (C) *
c * denf      - Liquid phase density (kg/m^3) *
c * vf        - Liquid phasic velocity at cell face (m/s) *
c * pa        - Cell center pressure (Pa) *
c * qfmas     - Liquid mass flowrate at cell face (kg/s) *
c * void      - Gas void fraction (-) *
c * qggpm     - Gas volumetric flowrate at cell face (gpm) *
c * qgmas     - Gas mass flowrate at cell face (kg/s) *
c * tg        - Bulk gas phase temperature (C) *
c * deng      - Gas phase density (kg/m^3) *
c * vg        - Gas phasic velocity at cell face (m/s) *
c * pair      - Partial pressure non-condensable in gas phase (psia) *
c * power     - Component total deposited power at time tsec (W) *
c * tsurf     - Inner or Outer surface temperature (C) *
c * fluxf     - Surface liquid phase heat flux (W/m^2) *
c * fluxg     - Surface gas phase heat flux (W/m^2) *
c * hf        - Liquid phase film coefficient (W/m^2-K) *
c * hg        - Gas phase film coefficient (W/m^2-K) *
c * tsurf     - Inner or Outer surface temperature (C) *
c * tsurf     - Inner or Outer surface temperature (C) *
c * *
c * internal arrays: *
c * ----- *
c * *
c * index     - index providing the order in which TRAC writes out *
c *            the requested graphics point data. *
c * *
c *****
c
c      implicit real (a-h,o-z), integer (i-n)
c      character*10 filename
c      character*13 filepipe
c      character*14 fileplen
c      character*15 filehstr
c      character*80 title
c
c      parameter (maxgpts=500, maxsteps=301)
c      parameter (maxpipe=200, maxplen=200, maxhstr=200)
c
c      dimension index(maxgpts), icheck(maxgpts)
c      dimension iicomp(maxgpts), iicell(maxgpts), ictype(maxgpts),
c      &          id_leg(maxgpts)
c
c      Storage for pipes, valve, tees, etc. (1)
c
c      dimension timel(maxpipe,maxsteps) , psial(maxpipe,maxsteps) ,
c      &          qfgpm1(maxpipe,maxsteps), tfl(maxpipe,maxsteps) ,
c      &          tsubl(maxpipe,maxsteps) , tsatl(maxpipe,maxsteps) ,
c      &          denfl(maxpipe,maxsteps) , vfl(maxpipe,maxsteps) ,

```

TRAC CODE MODIFICATIONS

```

&      pal(maxpipe,maxsteps) , qmasf1(maxpipe,maxsteps) ,
&      void1(maxpipe,maxsteps) , qggpm1(maxpipe,maxsteps) ,
&      qmasg1(maxpipe,maxsteps) , tgl(maxpipe,maxsteps) ,
&      deng1(maxpipe,maxsteps) , vgl(maxpipe,maxsteps) ,
&      pair1(maxpipe,maxsteps)
c
c Storage for plenums (2)
c
      dimension time2(maxplen,maxsteps) , psia2(maxplen,maxsteps) ,
&      tf2(maxplen,maxsteps) , tsub2(maxplen,maxsteps) ,
&      tsat2(maxplen,maxsteps) , denf2(maxplen,maxsteps) ,
&      pa2(maxplen,maxsteps) , void2(maxplen,maxsteps) ,
&      tg2(maxplen,maxsteps) , deng2(maxplen,maxsteps) ,
&      pair2(maxplen,maxsteps)
c
c Storage for heat structures (3)
c
      dimension time3(maxhstr,maxsteps) , power3(maxhstr,maxsteps) ,
&      tsurf3(maxhstr,maxsteps) , fluxf3(maxhstr,maxsteps) ,
&      fluxg3(maxhstr,maxsteps) , hf3(maxhstr,maxsteps) ,
&      tf3(maxhstr,maxsteps) , hg3(maxhstr,maxsteps) ,
&      tg3(maxhstr,maxsteps)
c
c === Open filenames =====
c
      iin1 = 10
      iin2 = 9
c
      iout1 = 7
      iout2 = 8
c
      open(unit=iout1,file='tecsplit.out' ,form='formatted',
&          status='unknown')
c
c === Read in requested graphic locations =====
c
c Open and read in the selected points where graphical data was
c requested in TRAC thru graphin file.
c
      open (iin1,file='graphin',status='old')
      read (iin1,'(a80)') title
      title = title
      read (iin1,*) npoints
c
c If requested number of graphics points greater than maxgpts,
c then write error message and terminate.
c
      if (npoints.gt.maxgpts) then
        write (*,2090) maxgpts
        write (iout1,2090) maxgpts
2090      format(//,
& '-----',//,
& ' *** ERROR ***',//,
& ' No. of graphics points requested in graphin file exceeds',//,
& ' maximum allowed (' ,i3,') . Program terminated.',//,
& ' *** ERROR ***',//,
& '-----')
        stop
      endif
c
      read (iin1,'(a80)') title
      do ipt=1,npoints

```

TRAC CODE MODIFICATIONS

```

        read (iin1,*) iicomp(ipt), iicell(ipt), ictype(ipt),
&            id_leg(ipt)
        enddo
c
cc      write (*,2200)
        write (iout1,2200)
2200    format(//,
& '-----',/,
& ' graphics point request file to TRAC opened: "graphin"',/,
& '-----')
c
c Adjust cell id up one when component is a tee to be consistent
c with storage scheme used in TRAC when cell is in the second
c leg of that tee.
c
        do ipt=1,npoints
            if (ictype(ipt).eq.2 .and. id_leg(ipt).eq.2) then
                iicell(ipt) = iicell(ipt) + 1
            endif
        enddo
c
c === Open tecplot summary graphic data sets =====
c
c Open summary tecplot graphics file (one file will contain all
c component graphics; external routine "tectsplt" is required
c to split out the graphics into multiple tecplot files for
c each requested graphics point):
c
        filename = 'tecsum.grf'
        open (iin2,file=filename,status='unknown')
c
cc      write (*,2000)
        write (iout1,2000)
2000    format(//,
& '-----',/,
& ' Tecplot graphics summary file opened: "tecsum.grf"',/,
& '-----')
c
c === Extract from tecsum.grf file indexing =====
c
c TRAC writes out the results for each requested graphics point in a
c potentially different order that originally requested. Extract out
c the ordering (indexing) from the first time step data set and then
c rewind file for followon reading.
c
        write (iout1,'(//,"file unit indexing for components",//)')
        read (iin2,'(a80)') title
        do ipt=1,npoints
            read (iin2,*) jpt
            index(ipt) = jpt
            write (iout1,1101) ipt, jpt
        enddo
1101    format(2x,' TRAC no. ',i3,'      graphin no. = ',i3)
c
        rewind (iin2)
        read (iin2,'(a80)') title
c
c Check indexing for repeated numbers and terminate if found.
c
        istop = 0
        iskip = 0
        if (iskip.eq.0) then

```


TRAC CODE MODIFICATIONS

```

write (iout1, '//, "Checking for repeated graphic points", //')
do ipt=1,npoints
  do jpt=1,npoints
    if (ipt.ne.jpt) then
      if (index(ipt).eq.index(jpt)) then
        write (iout1,1201) ipt,jpt
1201      format (' graphic point ',i3,' repeated at graphic',
&          ' point ',i3,/, 'ERROR program terminated')
        istop = 1
      endif
    endif
  enddo
enddo

c
c Check indexing for missing number and terminate if found.
c
write (iout1, '//, "Checking for missing graphic points", //')
do ipt=1,npoints
  icheck(ipt) = 0
enddo
do ipt=1,npoints
  jpt = index(ipt)
  icheck(jpt) = 1
enddo
do ipt=1,npoints
  if (icheck(ipt).eq.0) then
    write (iout1,1211) ipt
1211    format (' graphic point ',i3,' missing',
&          ' ,', 'ERROR program terminated')
    write (iout1,1221) iicomp(ipt), iicell(ipt), ictype(ipt),
&          id_leg(ipt)
1221    format (' iicomp = ',i3,' iicel = ',i2,' ictype = ',i2,
&          ' id_leg = ',i2)
    istop = 1
  endif
enddo
endif
if (istop.ne.0) stop

c
c === Read each graphic point data to storage arrays =====
c
c Read in each graphic point for each time data set and store its
c data into the appropriately defined storage arrays.
c
  itime = 0
8000 continue
  ipipe = 0
  iplen = 0
  ihstr = 0
  itime = itime + 1

c
c If requested number of time steps greater than maxgpts-1,
c then write error message and terminate.
c
  if (itime.gt.maxgpts-1) then
    write (*,2092) maxgpts-1
    write (iout1,2092) maxgpts-1
2092    format(//,
& '-----',//,
& ' *** ERROR ***',//,
& ' No. of time step data sets in tecsum.grf file exceeds',//,
& ' maximum allowed (',i3,'). Program terminated.',//,

```

TRAC CODE MODIFICATIONS

```

& ' *** ERROR ***',/,
& '-----')
      stop
    endif
c
    do ipt=1,npoints
      jpt = index(ipt)
      if (ictype(jpt).eq.0 .or. ictype(jpt).eq.2) then
c
c Read data if component is not a plenum component or heat structure.
c
        ipipe = ipipe + 1
        read (iin2,*,end=9000) idum,
&          time1(ipipe,itime) , psia1(ipipe,itime) ,
&          qfgpm1(ipipe,itime) , tf1(ipipe,itime) ,
&          tsub1(ipipe,itime) , tsat1(ipipe,itime) ,
&          denf1(ipipe,itime) , vf1(ipipe,itime) ,
&          pal(ipipe,itime) , qmasf1(ipipe,itime),
&          void1(ipipe,itime) , qggpm1(ipipe,itime),
&          qmasg1(ipipe,itime) , tgl(ipipe,itime) ,
&          deng1(ipipe,itime) , vgl(ipipe,itime) ,
&          pair1(ipipe,itime)
        idum = idum
c
c Read data if component is a plenum component.
c
        elseif (ictype(jpt).eq.1) then
          iplen = iplen + 1
          read (iin2,*,end=9000) idum,
&          time2(iplen,itime) , psia2(iplen,itime) ,
&          tf2(iplen,itime) , tsub2(iplen,itime) ,
&          tsat2(iplen,itime) , denf2(iplen,itime) ,
&          pa2(iplen,itime) , void2(iplen,itime) ,
&          tg2(iplen,itime) , deng2(iplen,itime) ,
&          pair2(iplen,itime)
c
c Read data if component is a heat structure.
c
        elseif (ictype(jpt).eq.3) then
          ihstr = ihstr + 1
          read (iin2,*,end=9000) idum,
&          time3(ihstr,itime) , power3(ihstr,itime),
&          tsurf3(ihstr,itime) , fluxf3(ihstr,itime),
&          fluxg3(ihstr,itime) , hf3(ihstr,itime) ,
&          tf3(ihstr,itime) , hg3(ihstr,itime) ,
&          tg3(ihstr,itime)
        endif
      enddo
      goto 8000
c
c End of data sets reached.
c
9000 continue
      ntime = itime - 1
      if (ntime.gt.maxsteps) then
        write (iout1,1311) ntime, maxsteps
1311 format (' No. time steps = ',i3,' exceeds limit = ',i3,
&          /,'ERROR program terminated')
        stop
      endif
c
c === Write to each tecplot file for each graphic point =====

```

TRAC CODE MODIFICATIONS

```

c
c For each graphic point requested in graphin file open file setting
c its filename consistent with requested graphic point's component
c and cell location. Write out a header to file. Write graphic
c point's time data to this opened
c file and then close file. Loop over each graphic point and perform
c the above operations.
c
      write (iout1,2001)
2001 format(//,' Tecplot graphics filenames/unit numbers:',/,
&          '-----',/)
c
      ipipe = 0
      iplen = 0
      ihstr = 0
      do ipt=1,npoints
        jpt = index(ipt)
        if (ictype(jpt).eq.0 .or. ictype(jpt).eq.2) then
c
c Write data if component is not a plenum component or heat structure.
c
c Open file and write header:
c
          ipipe      = ipipe + 1
          icomp      = iicomp(jpt)
          ihun       = icomp/100 + 48
          iten       = (icomp - (icomp/100)*100)/10 + 48
          ione       = (icomp - (icomp/10)*10) + 48
          icell      = iicell(jpt)
          iten2      = icell/10 + 48
          ione2      = (icell - (icell/10)*10) + 48
          filepipe   = 'tec'//char(ihun)//char(iten)//char(ione)//'--'
&                  //char(iten2)//char(ione2)//'.dat'
          open (iout2,file=filepipe,status='unknown')
          write (iout1,2101) jpt, filepipe
2101 format(2x,' Graphin No. ',i3,'      filename = ',a13)
c
          write (iout2,991)
991 format (
&          'VARIABLES = tsec,      Psia,      qfgpm,      tf,      ',
&          'tsub,      tsat,      denf,      vf,      Pa,      ',
&          'qmasf,      void,      qggpm,      qmasg,      tg, ',
&          'deng,      vg,      pair')
c
c Write out graphic point time data set:
c
      do itime=1,ntime
        write (iout2,2661)
&          timel(ipipe,itime) , psial(ipipe,itime) ,
&          qfgpm1(ipipe,itime), tf1(ipipe,itime) ,
&          tsub1(ipipe,itime) , tsat1(ipipe,itime) ,
&          denf1(ipipe,itime) , vf1(ipipe,itime) ,
&          pal(ipipe,itime) , qmasf1(ipipe,itime),
&          void1(ipipe,itime) , qggpm1(ipipe,itime),
&          qmasg1(ipipe,itime), tg1(ipipe,itime) ,
&          deng1(ipipe,itime) , vg1(ipipe,itime) ,
&          pair1(ipipe,itime)
        enddo
c
c Close graphics file:
c
      close (iout2)

```

TRAC CODE MODIFICATIONS

```

        elseif (ictype(jpt).eq.1) then
c
c Write data if component is a plenum component.
c
c Open file and write header:
c
        iplen      = iplen + 1
        icomp       = iicomp(jpt)
        ihun        = icomp/100 + 48
        iten        = (icomp - (icomp/100)*100)/10 + 48
        ione        = (icomp - (icomp/10)*10) + 48
        icell       = iicell(jpt)
        iten2       = icell/10 + 48
        ione2       = (icell - (icell/10)*10) + 48
        fileplen = 'tecpl'//char(ihun)//char(iten)//char(ione)//'- '
        &          //char(iten2)//char(ione2)//'.dat'
        open (iout2,file=fileplen,status='unknown')
        write (iout1,2102) jpt, filepipe
2102      format(2x,' Graphin No.  ',i3,'      filename = ',a14)
c
        write (iout2,992)
992      format (
        &      'VARIABLES = tsec,      Psia,      tf,      tsub,      ',
        &      'tsat,      denf,      Pa,      void,      tg,      ',
        &      ' deng,      pair')
c
c Write out graphic point time data set:
c
        do itime=1,ntime
            write (iout2,2662)
            &      time2(iplen,itime) , psia2(iplen,itime) ,
            &      tf2(iplen,itime) , tsub2(iplen,itime) ,
            &      tsat2(iplen,itime) , denf2(iplen,itime) ,
            &      pa2(iplen,itime) , void2(iplen,itime) ,
            &      tg2(iplen,itime) , deng2(iplen,itime) ,
            &      pair2(iplen,itime)
        enddo
c
c Close graphics file:
c
        close (iout2)
        elseif (ictype(jpt).eq.3) then
c
c Write data if component is a heat structure.
c
c Open file and write header:
c
        ihstr      = ihstr + 1
        isurf       = id_leg(jpt)
        icomp       = iicomp(jpt)
        ihun        = icomp/100 + 48
        iten        = (icomp - (icomp/100)*100)/10 + 48
        ione        = (icomp - (icomp/10)*10) + 48
        icell       = iicell(jpt)
        iten2       = icell/10 + 48
        ione2       = (icell - (icell/10)*10) + 48
        if (isurf.eq.1) then
            filehstr = 'techi'//char(ihun)//char(iten)//char(ione)//'- '
            &          //char(iten2)//char(ione2)//'.dat'
            open (iout2,file=filehstr,status='unknown')
        elseif (isurf.eq.2) then
            filehstr = 'techo'//char(ihun)//char(iten)//char(ione)//'- '

```

TRAC CODE MODIFICATIONS

```

&          //char(iten2)//char(ione2)//'.dat'
      open (iout2,file=filehstr,status='unknown')
    endif
    write (iout1,2103) jpt, filepipe
2103    format(2x,' Graphin No. ',i3,'      filename = ',a15)
c
      write (iout2,993)
993    format (
&      'VARIABLES = tsec,      Power,      Tsurf,      fluxf, ',
&      '      fluxg,      Hf,      Tf,      Hg,      ',
&      '      Tg')
c
c Write out graphic point time data set:
c
      do itime=1,ntime
        write (iout2,2663)
&        time3(ihstr,itime) , power3(ihstr,itime),
&        tsurf3(ihstr,itime), fluxf3(ihstr,itime),
&        fluxg3(ihstr,itime), hf3(ihstr,itime) ,
&        tf3(ihstr,itime) , hg3(ihstr,itime) ,
&        tg3(ihstr,itime)
      enddo
c
c Close graphics file:
c
      close (iout2)
    endif
  enddo
c
c === FORMAT STATEMENTS =====
c
2661 format (8x,f8.2,f10.2,f12.3,4f10.2,f10.4,f13.1,f12.3,f10.4,e14.4,
&          f12.3,f10.2,2f10.4,f10.2)
2662 format (8x,f8.2,5f10.2,f13.1,f10.4,f10.2,f10.4,f10.2)
2663 format (8x,f8.2,e14.5,f10.2,2e14.5,f12.3,f10.2,f12.3,f10.2)
c
      stop
    end

```

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TRAC CODE MODIFICATIONS**Appendix C: Listing of Example "graphin" File**

The file listed below represents an example "graphin" file typically used during a Blanket System accident analysis TRAC run. Also provided at the end of the file is a legend.

Input file graphin:

```

/ npoints /
182
/ component      cell      ictype      id_leg/
340              1          1          1      Fixed outlet header
380              1          1          1      Fixed inlet header

454              2          0          1      Module 1 pipe before break
173              2          0          1      Module 2 pipe before break
415              2          0          1      Module 3 pipe before break
485              2          0          1      Module 4 pipe before break
513              2          0          1      Module 5 pipe before break
541              2          0          1      Module 6 pipe before break

375              1          0          1      Module 1 pipe after break
82               1          0          1      Module 2 pipe after break
86               1          0          1      Module 3 pipe after break
88               1          0          1      Module 4 pipe after break
90               1          0          1      Module 5 pipe after break
84               1          0          1      Module 6 pipe after break

300              1          0          1      Module 1 Row1
102              1          0          1      Module 2 Row2
409              1          0          1      Module 3 Row1
412              1          0          1      Module 4 Row1
500              1          0          1      Module 5 Row2
528              1          0          1      Module 6 Low Power

300              3          0          1      Module 1 Row1
102              3          0          1      Module 2 Row2
409              3          0          1      Module 3 Row1
412              3          0          1      Module 4 Row1
500              3          0          1      Module 5 Row2
528              3          0          1      Module 6 Low Power

300              5          0          1      Module 1 Row1
102              6          0          1      Module 2 Row2
409              5          0          1      Module 3 Row1
412              6          0          1      Module 4 Row1
500              6          0          1      Module 5 Row2
528              5          0          1      Module 6 Low Power

370              1          1          1      Module 1 Inlet Plenum
350              1          1          1      Module 1 Middle Plenum
330              1          1          1      Module 1 Outlet Plenum
172              1          1          1      Module 2 Inlet Plenum
147              1          1          1      Module 2 middle Plenum
133              1          1          1      Module 2 Outlet Plenum
479              1          1          1      Module 3 Inlet Plenum
418              1          1          1      Module 3 Middle Plenum
423              1          1          1      Module 3 Outlet Plenum
489              1          1          1      Module 4 Inlet Plenum
419              1          1          1      Module 4 Middle Plenum
483              1          1          1      Module 4 Outlet Plenum

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TRAC CODE MODIFICATIONS

510	1	1	1	Module 5 Inlet Plenum
503	1	1	1	Module 5 Middle Plenum
508	1	1	1	Module 5 Outlet Plenum
538	1	1	1	Module 6 Inlet Plenum
531	1	1	1	Module 6 Middle Plenum
536	1	1	1	Module 6 Outlet Plenum
26	1	0	1	Hot leg pump suction line
22	7	0	1	Hot leg pump suction line near break
20	1	0	1	Hot leg pump suction line near break
30	1	0	1	PCL Pump 1 Suction
30	2	0	1	PCL Pump 1 Discharge
31	1	0	1	PCL Pump 2 Suction
31	2	0	1	PCL Pump 2 Discharge
32	2	0	1	PCL Pump 1 check valve
33	2	0	1	PCL Pump 2 check valve
37	1	0	1	PCL Pump to HX
48	3	0	1	PCL Hx 1 inlet
52	2	0	1	PCL Hx 1 middle
56	1	0	1	PCL Hx 1 outlet
49	2	0	1	PCL Hx 2 inlet
53	2	0	1	PCL Hx 2 middle
57	3	0	1	PCL Hx 2 outlet
713	4	0	1	PCL Hx 1 secondary side outlet
710	1	0	1	PCL Hx 1 secondary side inlet fill
733	4	0	1	PCL Hx 2 secondary side outlet
730	1	0	1	PCL Hx 2 secondary side inlet fill
62	1	0	1	Cold leg Hx discharge line
66	1	0	1	Cold leg Hx discharge line near break
67	1	1	1	Cold leg Hx discharge line near break
854	1	0	1	Cold leg Hx discharge line near break
854	2	0	1	Cold leg Hx discharge line near break
68	2	0	1	Cold leg Hx discharge line near break
630	1	0	1	RHR Pump Suction
630	2	0	1	RHR Pump Discharge
640	3	0	1	RHR Hx inlet
660	1	0	1	RHR Hx outlet
671	4	0	1	RHR Hx secondary side outlet
672	1	0	1	RHR Hx secondary side inlet fill
761	1	0	1	Pzr Pressure Signal
766	1	0	1	Pzr Bottom Pressure
951	1	3	1	Hot Module (1) upflow inside
951	3	3	1	Hot Module (1) upflow inside
951	5	3	1	Hot Module (1) upflow inside
951	1	3	2	Hot Module (1) upflow outside
951	3	3	2	Hot Module (1) upflow outside
951	5	3	2	Hot Module (1) upflow outside
955	1	3	1	Hot Module (2) upflow inside
955	3	3	1	Hot Module (2) upflow inside
955	6	3	1	Hot Module (2) upflow inside
955	1	3	2	Hot Module (2) upflow outside
955	3	3	2	Hot Module (2) upflow outside
955	6	3	2	Hot Module (2) upflow outside

TRAC CODE MODIFICATIONS

961	1	3	1	Hot Module (3) upflow inside
961	3	3	1	Hot Module (3) upflow inside
961	5	3	1	Hot Module (3) upflow outside
961	1	3	2	Hot Module (3) upflow outside
961	3	3	2	Hot Module (3) upflow outside
961	5	3	2	Hot Module (3) upflow outside
962	1	3	1	Hot Module (4) upflow inside
962	3	3	1	Hot Module (4) upflow inside
962	6	3	1	Hot Module (4) upflow inside
962	1	3	2	Hot Module (4) upflow outside
962	3	3	2	Hot Module (4) upflow outside
962	6	3	2	Hot Module (4) upflow outside
963	1	3	1	Hot Module (5) upflow inside
963	3	3	1	Hot Module (5) upflow inside
963	6	3	1	Hot Module (5) upflow inside
963	1	3	2	Hot Module (5) upflow outside
963	3	3	2	Hot Module (5) upflow outside
963	6	3	2	Hot Module (5) upflow outside
965	1	3	1	Hot Module (6) upflow inside
965	3	3	1	Hot Module (6) upflow inside
965	5	3	1	Hot Module (6) upflow inside
965	1	3	2	Hot Module (6) upflow outside
965	3	3	2	Hot Module (6) upflow outside
965	5	3	2	Hot Module (6) upflow outside
820	1	0	1	Flood valve pool side
820	2	0	1	Flood valve vessel side
821	1	0	1	Flood horizontal line
821	3	0	1	Flood horizontal line
821	6	0	1	Flood horizontal line
822	1	0	1	Flood vertical line
822	3	0	1	Flood vertical line
822	6	0	1	Flood vertical line
823	1	0	1	Cavity vessel lower 1
823	2	0	1	Cavity vessel lower 2
823	3	0	1	Cavity vessel lower 3
823	4	0	1	Cavity vessel lower 4
823	6	0	1	Cavity vessel lower 6
823	8	0	1	Cavity vessel lower 8
823	10	0	1	Cavity vessel lower 10
823	11	0	1	Cavity vessel lower 11
840	1	0	1	Cavity line to Hot module loc. 1
840	2	0	1	Cavity line to Hot module loc. 2
824	1	1	1	Cavity vessel Hot module loc.
825	1	0	1	Cavity vessel middle 1
825	4	0	1	Cavity vessel middle 1
826	1	1	1	Cavity vessel HR line loc.
850	1	0	1	Cavity line to HR line (HR side)
850	2	0	1	Cavity line to HR line (HR side)
852	1	0	1	Cavity line to HR line (Header side)
852	2	0	1	Cavity line to HR line (Header side)
828	3	0	1	Vent Line break side
811	1	1	1	Cavity Pool flood line plenum
810	1	0	1	Cavity pool upper 1
810	4	0	1	Cavity pool upper 4
810	7	0	1	Cavity pool upper 7
810	10	0	1	Cavity pool upper 10

984	1	3	2	Module 1 downflow A1 1
984	3	3	2	Module 1 downflow A1 3
984	5	3	2	Module 1 downflow A1 5
901	1	3	2	Module 1 upflow A1 1
901	3	3	2	Module 1 upflow A1 3
901	5	3	2	Module 1 upflow A1 5
916	1	3	2	Module 2 downflow A1 1
916	3	3	2	Module 2 downflow A1 3
916	6	3	2	Module 2 downflow A1 6
905	1	3	2	Module 2 upflow A1 1
905	3	3	2	Module 2 upflow A1 3
905	6	3	2	Module 2 upflow A1 6
988	1	3	2	Module 3 downflow A1 1
988	3	3	2	Module 3 downflow A1 3
988	5	3	2	Module 3 downflow A1 5
911	1	3	2	Module 3 upflow A1 1
911	3	3	2	Module 3 upflow A1 3
911	5	3	2	Module 3 upflow A1 5
931	1	3	2	Module 4 downflow A1 1
931	3	3	2	Module 4 downflow A1 3
931	6	3	2	Module 4 downflow A1 6
912	1	3	2	Module 4 upflow A1 1
912	3	3	2	Module 4 upflow A1 3
912	6	3	2	Module 4 upflow A1 6
932	1	3	2	Module 5 downflow A1 1
932	3	3	2	Module 5 downflow A1 3
932	6	3	2	Module 5 downflow A1 6
913	1	3	2	Module 5 upflow A1 1
913	3	3	2	Module 5 upflow A1 3
913	6	3	2	Module 5 upflow A1 6

INPUT NOTES:

npoints - number of locations (points) within TRAC model graphics requested
 component - component id number containing specified graph point
 cell - cell number within component where graphics requested
 (number second leg of tee sequentially from end cell number on first leg)
 ictype - type of component:
 (0 for fill, pipe, pressurizer, pump, turb, value)
 (1 for plenum)
 (2 for tee)
 id_leg - which leg of component cell is located in:
 (1 always for fill, pipe, pressurizer, pump, plenum, turb, value)
 (1 or 2 for tee's)

OUTPUT NOTES:

tsec - Time into simulation (sec)
 Psia - Cell center pressure (psia)
 Qf - Liquid volumetric flowrate at cell face (gpm)
 tl - Liquid phase temperature (C)
 tsub - Liquid subcooling (C)
 tsat - Liquid saturation temperature (C)
 rol - Liquid phase density (kg/m³)
 vl - Liquid phasic velocity at cell face (m/s)
 Pa - Cell center pressure (Pa)
 qf - Liquid volumetric flowrate at cell face (m³/s)
 void - Gas void fraction (-)
 Qg - Gas volumetric flowrate at cell face (gpm)
 qg - Gas volumetric flowrate at cell face (m³/s)
 tv - Gas phase temperature (C)

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rov	- Gas phase density (kg/m ³)
vv	- Gas phasic velocity at cell face (m/s)
pair	- Partial pressure of non-condensable in gas phase (psia)

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