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TASK COMPLETION REPORT FOR UPDATE FXFILL

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**TASK COMPLETION REPORT
FOR UPDATE FXFILL**

by

Robert G. Steinke

September 2, 1997

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TASK COMPLETION REPORT FOR UPDATE FXFILL

Robert G. Steinke

ABSTRACT

Five errors related to phasic-density donoring into a FILL- or BREAK-component cell are corrected by update FXFILL. Seven versions of a new test problem test these corrections and show that the errors of trouble reports 189 and 190 no longer exist in TRAC-P.

1.0. INTRODUCTION

The FILL component in TRAC-P defines a phasic-velocities boundary condition or total-mass-flow boundary condition. FILL option IFTY = 10 defines the total-mass flow and its composition for flow donoring from the FILL to its adjacent component by signal variables and/or control blocks. For flow from the adjacent component to the FILL component, the phasic densities of the adjacent-component cell need to be upstream donored by the IFTY = 10 option total-mass flow. Instead, the FILL-cell phasic densities are being downstream donored incorrectly by the IFTY = 10 option total-mass flow in determining the FILL-junction phasic velocities. Using the wrong donored phasic densities caused the phasic velocities determined from the total-mass flow to be evaluated incorrectly. This incorrect donoring of the phasic densities for flow from the adjacent component to the FILL component by option IFTY = 10 will be corrected by an update programmed and tested by this task.

2.0. UPDATE FXFILL

Update FXFILL, a listing of which is shown in Appendix A, corrects the phasic-density donoring error for flow from the adjacent component to the FILL component for FILL option IFTY = 10. The correction that is evaluated during the prep stage of TRAC-P is made in subroutine FILLX.

During testing for both liquid and gas (vapor) mass flow, further corrections needed to be made to subroutines IFILL, FILLX, FILL1, BREAK1, and BREAK3. Subroutine IFILL did not initialize the no-slip velocities based on FLOWIN for FILL option IFTY = 10 and did not define the A(LFA) junction flow area to evaluate the A(LRVMF) gas and A(LRMVM) total-mass flows correctly. Subroutine FILLX did not evaluate the A(LRVMF) gas-mass flow that is used to define the gas-mass flow for signal variables.

Subroutines FILLX, FILL1, BREAK1, and BREAK3 defined their FILL- and BREAK-junction gas and total-mass flows by the A(LARV) and A(LARL) smeared fluid densities evaluated by the stabilizer mass equations. These smeared fluid densities

are slightly different from the product of their phasic volume fractions and densities. The phasic volume fractions and densities are the accepted timestep solution after the A(LALP) gas volume fraction is adjusted by TRAC-P to give better agreement between the outer-iteration and mass- and energy-stabilizer solutions. This is due to the smeared fluid densities generally defining inconsistent phasic volume fractions because their phasic densities are defined from the temperature solution of the stabilizer energy equations.

Corrections were made in these four areas to complete the testing of the original phasic-density donoring error.

3.0. TESTING

None of the standard test problems, even with modification, are appropriate for testing the correct directional phasic-density donoring for flow across a FILL-component junction. A new test problem in four versions was created to do this testing. Test problem versions 1 and 2 are for liquid, and 3 and 4 are for gas. A listing of the version 1 TRACIN input-data file TEST1IN is shown in Appendix B. Two FILL components and one BREAK component connect to the three flow-channel junctions of a TEE component. Component FILL 1 with option IFTY = 10 defines its total-mass flow to vary linearly from 1.0 kg s^{-1} at time 0.0 s, to -1.0 kg s^{-1} at time 10.0 s by control block -1. Component FILL 2 with option IFTY = 2 defines a constant total-mass flow of 1.0 kg s^{-1} in versions 1 and 3, and -1.0 kg s^{-1} in versions 2 and 4. Thus, both FILL components donor the phasic density from both adjacent cells of the FILL junction for both liquid and gas in the testing of these four problem versions. These transient calculations start from steady-state conditions at time 0.0 s and reach steady-state conditions at time 12.0 s after the FILL 1 total-mass flow is held constant from time 10.0 to 12.0 s.

For each of these four test problems, Appendix C shows the timestep behavior of the terminal output and the signal variable and control block TRCOUT-file output at times 0.0, 5.9, 6.0, 11.9, and 12.0 s. Hand calculations, based on signal-variable values, show that TRAC-P applies the correct phasic-density donoring to determine the FILL-junction phasic velocity from the total-mass flow. The product of the phasic density, phasic velocity, and flow area is shown to evaluate the correct total-mass flow defined by the FILL component for beginning-of-timestep conditions. During transient conditions at times 6.0 and 12.0 s, the FILL-junction beginning-of-timestep velocities from the 6.0- and 12.0-s edits were determined by TRAC from the FILL-defined beginning-of-timestep total-mass flows using the end-of-timestep densities from the previous timestep 5.9- and 11.9-s edits. These signal-variable densities are labeled as SV#o to indicate their values are from the 5.9- and 11.9-s edits. Correct phasic-density donoring is shown for the BREAK junction as well. The BREAK-junction velocities and donored densities are both end-of-timestep values taken from the 6.0 and 12.0 s edits.

An add-on specification for this task is to correct the FILL errors in Trouble-Report TSHOOTER items 189 and 190 as well. Their error descriptions are as follows:

TR#	Date	Originator	Description
-----	------	------------	-------------

189	10/04/96	Rich Smith
KAPL	For Version 5.4.15, when IFTY = 10 for a FILL component and the input values are VLIN < 0.0 or FLOWIN < 0.0, there is a core dump in subroutine FILLX.
190	10/04/96	Rich Smith
KAPL	For Version 5.4.15 for a FILL component where IFTY = 2, ALPIN = 1.0, and the flow is a negative value, the TRCOUT FILL component prints out a void fraction of 0.0.

The testing that follows shows that both these errors are not present (or may have been corrected earlier) when executing TRAC-P Versions 5.4.15, 5.4.28, and 5.4.28 with all pending updates on a SUN workstation.

TSHOOTER item 189 was tested on a modified version 5 of the above test problem 1. The control block -1 defined total-mass flow for FILL 1 with IFTY = 10 was changed from 1.0 to -1.0 kg s⁻¹ at time 0.0 s and from -1.0 to 1.0 kg s⁻¹ at time 10.0 s. Initial steady-state conditions are redefined in TEE 4 for this modified initial flow condition. FILL 1 now has VLIN < 0.0 and FLOWIN < 0.0 initial-condition input values. As shown in Appendix C on pages C-12 through C17, all three versions of TRAC-P run this test problem correctly without generating a core dump in subroutine FILLX.

TSHOOTER item 190 was tested on modified versions 6 and 7 of the above test problems 2 and 4, respectively, for both liquid and gas flow from TEE 4 to FILL 2 with IFTY = 2. For FILL 2, this flow is negative valued. In version 6, the FILL 2 initial value of ALPIN was changed from 0.0 to 1.0. As shown in Appendix C on pages C17 through C-24 for liquid flow into FILL 2, and on pages C-24 through C31 for gas flow into FILL 2, all three versions of TRAC-P evaluate both these test problems correctly without outputting a gas volume fraction (void fraction) of 0.0 in the FILL 2 cell. The expected FILL 2 gas volume fraction of 1.0 is highlighted in bold type in the TRCOUT-file output of the input-data echo and four large edits from all six runs (three TRAC-P executables on these two test problems).

4.0. FUTURE IMPROVEMENT

The FILL-component phasic-velocities or total-mass-flow boundary condition is assumed to be constant over each timestep at the beginning-of-timestep value. This is not necessarily true for the total-mass flow because TRAC-P converts the beginning-of-timestep total-mass flow to beginning-of-timestep no-slip phasic velocities that are then held constant over the timestep. When donored phasic densities from the FILL's adjacent component vary from the beginning to the end of a timestep, the phasic mass flow varies proportionally. In this situation, if the total-mass flow is the defined boundary condition, it is not constant over the timestep as assumed.

There are two improvements that could be done. First, for the total-mass-flow boundary condition, the FILL-junction, no-slip phasic velocities could be reevaluated at the end of each outer iteration to keep the beginning-of-timestep total-mass flow constant over the timestep. The other improvement would remove

the assumption that the phasic-velocities boundary condition or total-mass-flow boundary condition is constant over each timestep at the beginning-of-timestep value. Either of these boundary conditions would be reevaluated at the end of each outer iteration based on the iterate end-of-timestep condition. The boundary condition would be assumed to vary linearly over the timestep based on beginning-of-timestep and estimated end-of-timestep conditions. In this later situation, a similar improvement should be done for the BREAK-component pressure boundary condition, which also is assumed to have a pressure that is constant over each timestep at its beginning-of-timestep value.

5.0. CONCLUSIONS

Update FXFILL corrects five errors in TRAC-P Version 5.4.28. The correct phasic densities are now donored in subroutine FILLX across the FILL-component junction from the adjacent-component cell when mass flow, defined by the IFTY = 10 option, is to the FILL cell. These donored phasic densities to a FILL- or BREAK-component cell are now defined by the product of the phasic volume fraction and density rather than the smeared phasic density evaluated by the stabilizer mass equation. Testing the above resulted in making further corrections to evaluate the A(LRVMF) gas-mass flow in subroutine FILLX, initialize no-slip velocities based on FLOWIN from the IFTY = 10 option in subroutine IFILL, and define the A(LFA) junction flow area to evaluate the gas and total-mass flows in subroutine IFILL.

These corrections were tested on four versions of a new test problem that donors the phasic densities of both gas and liquid across a FILL- or BREAK-component junction from both adjacent cells. Three additional version of this test problem were used to show that the reported errors in trouble reports 189 and 190 no longer exist in TRAC-P Versions 5.4.15, 5.4.28, and 5.4.28 with all pending updates.

ACKNOWLEDGMENT

The author wishes to thank Richard J. Smith for valuable discussions during the development and testing of this TRAC-P update.

Appendix A

Listing of Update FxFILL

```

1 *ident fxfill
2 */ -----Update Header Rev. 02-01-96-----
3 */
4 */   File & Update Ident name (must be the same): fxfill
5 */   TSHOOTER identifier: 189 and 190
6 */
7 */   Code developer: Bob Steinke           Date developed: 6/10/97
8 */   Acknowledgements: KAPL reported this density-donoring error
9 */   Update reviewer: Rich Smith           Date reviewed: 9/xx/97
10 */
11 */   Update to be applied to MOD2 _X_ or other :
12 */
13 */   CFS file path: /073417
14 */
15 */   Purpose of update: Update fxfill (FiX FILL) corrects the
16 */                       phasic density donored across the FILL
17 */                       component junction by the total mass flow
18 */                       of the IFTY = 10 option.  In addition,
19 */                       the following corrections were made
20 */                       during the testing of this change:
21 */                       1) The gas mass flow is defined in sub-
22 */                          routine FILLX for evaluating signal
23 */                          variables.
24 */                       2) The IFTY = 10 option input total mass
25 */                          flow is used in subroutine IFILL to
26 */                          initialize the no-slip velocities with
27 */                          correct mixture-density donoring.
28 */                       3) Density donoring in subroutines BREAK1,
29 */                          BREAK3, FILL1, and FILLX is changed
30 */                          from being based on ARV, ARA, and ARL
31 */                          and their new-time BD-array equivalents
32 */                          to being based on ALP, ROV, ROA, and
33 */                          ROL and their new-time BD-array equiva-
34 */                          lents (the timestep solution is defined
35 */                          by the later because the former do not
36 */                          have a consistent ALP value among the
37 */                          two phases).
38 */                       4) the new-time mixture density of the
39 */                          adjacent-component cell is defined by
40 */                          BD(15,JS1)*BD(16,JS1)+(1.0-BD(15,JS1))
41 */                          *BD(17,JS1) rather than BD(3,JS1) in
42 */                          subroutine FILLX.
43 */                       TSHOOTER items 189 and 190 were examined
44 */                       with TRAC-P versions 5.4.15, 5.4.28, and
45 */                       5.4.28 with all pending updates without
46 */                       finding their documented errors.
47 */
48 */   Basis for update: For FILL-junction negative mass flows
49 */                       (flow into the FILL cell), the phasic
50 */                       density from the FILL cell rather than
51 */                       the density from the adjacent component
52 */                       cell was used to evaluate the junction
53 */                       phasic velocity.
54 */
55 */   Dependencies on other updates: none

```

```

56 */
57 */ Justification of non-ANSI coding: N.A.
58 */
59 */ Is this a NULL update? YES___ NO _X_
60 */
61 */ Does this update generate new unit labels? YES___ NO_X_
62 */ If yes, path and /name of LABNEW file: N.A.
63 */
64 */ Does the TRAC I/O change because of this update? YES _X_ NO ___
65 */ TRAC I/O includes input, dump, output, and graphics files. If
66 */ yes, then submit the necessary manual changes.
67 */
68 */ Change the FILL-component input-data format description for
69 */ Card Number 6, Word 3 from "2 or 8" to "2, 8, or 10".
70 */
71 */ Does this change require that any of the TRAC support codes, e.g.
72 */ EXTRACT, GOCNVRT, or EXCON, be changed? YES ___ NO _X_
73 */ If yes, then include a description of the necessary changes.
74 */ This description will be passed onto the custodian of the TRAC
75 */ support codes.
76 */
77 */ Does the TRAC User's Guide, Theory Manual, or Programmer's Guide
78 */ change because of this update? YES _X_ NO ___
79 */ If yes, then submit the necessary manual changes.
80 */
81 */ See TRAC I/O change above.
82 */
83 */ NAME OF
84 */ SUBROUTINE
85 */ OR COMDECK
86 */ CHANGED DESCRIPTION OF CHANGE
87 */
88 */ BREAK1 Defines the phasic mass flows based on alp, rov,
89 */ roa, and rol and their bd-array equivalents rather
90 */ than based on arv, ara, and arl and their bd-array
91 */ equivalents.
92 */ BREAK3 Defines the phasic mass flows based on alpn, rovn,
93 */ roan, and roln and their bd-array equivalents
94 */ rather than based on arvn, aran, and arln and
95 */ their bd-array equivalents.
96 */ FILL1 Defines the phasic mass flows based on alp, rov,
97 */ and rol and their bd-array equivalents rather
98 */ than based on arv and arl and their bd-array
99 */ equivalents.
100 */ FILLX Defines the correct phasic density for donoring
101 */ mass flow across the FILL-component junction when
102 */ the total mass flow is defined by the IFTY = 10
103 */ option; defines the gas mass flow that is used
104 */ to evaluate signal variables; defines the phasic
105 */ mass flows based on alp, rov, and rol and their
106 */ bd-array equivalents rather than based on arv
107 */ and arl and their bd-array equivalents.
108 */ IFILL Considers the fluid flow input by option IFTY = 10
109 */ to be the total mass flow (FLOWIN) rather than the
110 */ phasic velocities (VLIN and VVIN); Evaluates the
111 */ no-slip velocities based on the input total mass
112 */ flow with correct donoring of the mixture density;
113 */ Defines the gas and total mass flows based on ALP,

```



```

114 */          ROV, and ROL rather than ARV and ARL and their
115 */          BD-array equivalents; Defines A(LFA)=BD(32,JS1).
116 */
117 */ -----
118 */
119 */ subroutine break1 changes
120 *delete break1.29,break1.31                                break1
121     fl=w1*(1.0-bd(15,js1))*bd(17,js1)+w11*(1.0-a(lalp))*a(lrol)
122     fv=wv*bd(15,js1)*bd(16,js1)+wv1*a(lalp)*a(lrov)
123     fac=wv*bd(15,js1)*bd(39,js1)+wv1*a(lalp)*a(lroa)
124 *delete break1.66,break1.69                                break1
125     a(lrvmf)=fv*a(lvv)*a(lfa)
126     a(lrmvm)=a(lrvmf)+fl*a(lvln)*a(lfa)
127 */
128 */ subroutine break3 changes
129 *delete break3.16                                          break3
130     fl=w1*(1.0-bd(15,js1))*bd(17,js1)+
131     1      (1.0-w1)*(1.0-a(lalpn))*a(lroln)
132     fv=wv*bd(15,js1)*bd(16,js1)+(1.0-wv)*a(lalpn)*a(lrovn)
133 c****     fac=mv*bd(15,js1)*bd(39,js1)+(1.0-wv)*a(lalpn)*a(lroan)
134 c****     bxa=fac*a(lvv)*a(lfa)
135 *delete break3.18,break3.19                                break3
136     a(lrvmf)=fv*a(lvv)*a(lfa)
137     a(lrmvm)=a(lrvmf)+fl*a(lvln)*a(lfa)
138 */
139 */ subroutine fill1 changes
140 *delete fill1.24,fill1.26                                  fill1
141     fl=w11*(1.0-bd(15,js1))*bd(17,js1)+w1*(1.0-a(lalp))*a(lrol)
142     fv=wv1*bd(15,js1)*bd(16,js1)+wv*a(lalp)*a(lrov)
143     fmxmass=(fv*a(lvv)+fl*a(lvl))*bd(32,js1)
144 */
145 */ subroutine fillx changes
146 *delete fillx.21                                          fillx
147 *insert fillx.32                                          fillx
148     oldrf=a(lrvmf)
149     oldvl=a(lvln)
150 *delete ykfxmf.1,ykfxmf.2                                  fillx
151     if (flowin.ge.0.0) then
152         rom=a(lrom)
153     else
154         rom=bd(15,js1)*bd(16,js1)+(1.0-bd(15,js1))*bd(17,js1)
155     endif
156 *delete fillx.210                                          fillx
157     232 continue
158     dum=1.0
159 *delete fillx.213,fillx.214                                fillx
160     if (a(lvl).ge.0.0) then
161         ral=(1.0-a(lalp))*a(lrol)
162     else
163         ral=(1.0-bd(7,js1))*bd(9,js1)
164     endif
165     if (a(lvv).ge.0.0) then
166         rav=a(lalp)*a(lrov)
167     else
168         rav=bd(7,js1)*bd(8,js1)
169     endif
170     fl=fa*ral*a(lvl)
171     fv=fa*rav*a(lvv)

```

```

172 *delete ykfxmf.13,ykfxmf.15 fillx
173 *delete fillx.248 fillx
174 *delete fillx.249 fillx
175     if (a(lvl).ge.0.0) then
176         ral=(1.0-a(lalp))*a(lrol)
177     else
178         ral=(1.0-bd(15,js1))*bd(17,js1)
179     endif
180     if (a(lvv).ge.0.0) then
181         rav=a(lalp)*a(lrov)
182     else
183         rav=bd(15,js1)*bd(16,js1)
184     endif
185     if (fa.lt.1.0e-10) go to 243
186     if (ifty.ne.10) go to 245
187     if (fl.ge.0.0) then
188         rala=amax1(1.0-a(lalp),1.0e-06)*a(lrol)
189     else
190         rala=amax1(1.0-bd(15,js1),1.0e-06)*bd(17,js1)
191     endif
192     if (fv.ge.0.0) then
193         rava=amax1(a(lalp),1.0e-06)*a(lrov)
194     else
195         rava=amax1(bd(15,js1),1.0e-06)*bd(16,js1)
196     endif
197     a(lvl)=fl/(fa*rala)
198     a(lvv)=fv/(fa*rava)
199     go to 245
200 243 continue
201     a(lvl)=0.0
202     a(lvv)=0.0
203 245 continue
204     a(lvm)=(rav*a(lvv)+ral*a(lvl))/(rav+ral)
205     a(lvr)=a(lvv)-a(lvl)
206     a(lrvmf)=rav*a(lvv)*fa
207     a(lrmvm)=ral*a(lvl)*fa+a(lrvmf)
208     if (0.0.ge.twtold) go to 260
209 *insert fillx.266 fillx
210     a(lrvmf)=twtold*oldrf +twtnew*a(lrvmf)
211 *insert fillx.275 fillx
212     a(lrvmf+1)=a(lrvmf)
213 */
214 */ subroutine ifill changes
215 *delete ifill.52,ifill.55 ifill
216     a(lfa)=bd(32,js1)
217     if ((mod(ifty,3).ne.2).and.(ifty.ne.10)) go to 110
218     if (flowin.ge.0.0) then
219         rom=a(lrom)
220     else
221         rom=bd(3,js1)
222     endif
223     if (a(lfa).ne.0.0) then
224         a(lvm)=flowin/(rom*a(lfa))
225     else
226         a(lvm)=0.0
227     endif
228 *delete ifill.66,ifill.68 ifill
229     a(lrvmf)=(wv*a(lalp)*a(lrov)+(1.0-wv)*bd(7,js1)*bd(8,js1))

```



```

230      1      *a(lvv)*a(lfa)
231      a(lrmvm)=a(lrvmf)+(wl*(1.0-a(lalp))*a(lrol)+(1.0-wl)
232      1      *(1.0-bd(7,js1))*bd(9,js1))*a(lvl)*a(lfa)
233      if ((mod(ifty,3).eq.2).or.(ifty.eq.10)) a(lrmvm)=flowin
234 */
235 *compile break1,break3,fill1,fillx,ifill
236 */
237 */      NOTE: To return to using A(LARV), A(LARA), and A(LARL) rather
238 */      than A(LALP), A(LROV), A(LROA), and A(LROL) and their
239 */      equivalent BD-array parameters for null testing:
240 */      delete lines 118-126 for BREAK1, lines 127-137 for
241 */      BREAK3, lines 138-143 for FILL1, replace ykfxmf.13 with
242 */      fillx.238 in line 172 and delete lines 175-184 for
243 */      FILLX, and delete line 216 for IFILL.
244 */
245 */ -----

```

Appendix B **Listing of the TRACIN file named TEST1IN for Test Problem 1**

```

1 free format
2 *****
3 * main data *
4 *****
5 *
6 *          numtcr          ieos          inopt          nmat          id2o
7 *              2              0              1              0              0
8 *--*Test Problem Filltest 1, Time = 12.0 s
9 Test donoring of the phase density at the junctions of Fills 1 and 2
10 *
11 *          #####
12 *          # fill# tl=400k
13 *          # 2 # mf=1kg/s
14 *          #####
15 *          2
16 *          #####
17 *          # cell#
18 *          # 7 #
19 *          #.....#
20 *          tl=300k          # cell#          tl=500k
21 *          mf=1to-1kg/s          # 6 #          p=10mpa
22 *          ##### .....#####
23 *          # fill# # cell: cell: cell: cell: cell# #break#
24 *          # 1 #1# 1 : 2 : 3 : 4 : 5 #3# 3 #
25 *          ##### .....#####
26 *          tee 4
27 *
28 *****
29 * namelist data *
30 *****
31 *
32 &inopts
33 iadded=10, iolab=1
34 &end
35 *
36 *          dstep          timet
37 *              0          0.0000e+00
38 *          stdyst          transi          ncomp          njun          ipak
39 *              0              1              4              3              0
40 *          epso          epss
41 *          1.0000e-04          1.0000e-04
42 *          oitmax          sitmax          isolut          ncontr          nccfl
43 *              10              10              0              0              0
44 *          ntsv          ntcb          ntcf          ntrp          ntcp
45 *              13              1              6              0              1
46 *
47 *****
48 * component-number data *
49 *****
50 *
51 * iorder*          1s          fill inlet/outlet mass-flow bc
52 * iorder*          2s          fill inlet mass-flow bc
53 * iorder*          3s          break outlet pressure bc
54 * iorder*          4e          tee flow paths
55 *

```

```

56 *****
57 * control-parameter data *
58 *****
59 *
60 * signal variables
61 *
62 *      idsv      isvn      ilcn      icn1      icn2
63 * time *      1      0      0      0      0
64 * mflow1*     2      32      1      2      0
65 * mflow2*     3      32      2      2      0
66 * mflow3*     4      32      3      1      0
67 * mvel1 *     5      38      1      2      0
68 * mvel2 *     6      38      2      2      0
69 * mvel3 *     7      38      3      1      0
70 * mden1 *     8      75      1      1      0
71 * mden14*     9      75      4      1      0
72 * mden2 *    10      75      2      1      0
73 * mden24*    11      75      4      7      0
74 * mden3 *    12      75      3      1      0
75 * mden34*    13      75      4      5      0
76 *
77 * control blocks
78 *
79 * mass flow vs time
80 *      idcb      icbn      icb1      icb2      icb3
81 *      -1      101      1      3      0
82 *      lugain      luxmin      luxmax      lucon1      lucon2
83 *      lunounit      lumassfw      lumassfw      lunounit      lunounit
84 *      cbgain      cbxmin      cbxmax      cbcon1      cbcon2
85 *      1.0000e+00      -1.0000e+00      1.0000e+00      0.0000e+00      0.0000e+00
86 *      luytab      luxtab
87 *      lumassfw      luptime
88 *
89 *cbftab*      0.0000e+00      1.0000e+00s
90 *cbftab*      1.0000e+01      -1.0000e+00s
91 *cbftab*      1.2000e+01      -1.0000e+00e
92 *
93 *
94 *****
95 * component data *
96 *****
97 *
98 *****      type      num      id      ctitle
99 fill      1      1      1      inlet/outlet mass flow bc
100 *      jun2      ifty      ioff
101 *      1      10      0
102 *      iftr      ifsv      nftb      nfsv      nfrf
103 *      0      0      0      0      0
104 *      twtold      rfmix      concin      felv
105 *      0.0000e+00      2.0000e-01      0.0000e+00      0.0000e+00
106 *      dxin      volin      alpin      vlin      tlin
107 *      1.0000e-01      1.0000e-04      0.0000e+00      9.9866e-01      3.0000e+02
108 *      pin      pain      flowin      vvin      tvin
109 *      1.0000e+07      0.0000e+00      1.0000e+00      9.9866e-01      3.0000e+02
110 *      ifmlsv      ifmvsv      iftlsv      iftvsv      ifasv
111 *      -1      0      0      0      0
112 *      ifpsv      ifpasv      ifcnsv
113 *      0      0      0

```

```

114 *
115 ***** type          num          id          ctitle
116 fill                2              2 inlet mass flow bc
117 *                  jun2          ifty          ioff
118                    2              2              0
119 *                  twtold          rfmv          concin          felv
120          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00
121 *                  dxin          volin          alpin          vlin          tlin
122          1.0000e-01          1.0000e-04          0.0000e+00          1.0612e+00          4.0000e+02
123 *                  pin          pain          flowin          vvin          tvin
124          1.0000e+07          0.0000e+00          1.0000e+00          1.0612e+00          4.0000e+02
125 *
126 ***** type          num          id          ctitle
127 break                3              3 break outlet pressure bc
128 *                  jun1          ibty          isat          ioff
129                    3              0              0              0
130 *                  dxin          volin          alpin          tin          pin
131          1.0000e-01          1.0000e-04          0.0000e+00          5.0000e+02          1.0000e+07
132 *                  pain          concin          rbmv          poff          belv
133          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00
134 *
135 ***** type          num          id          ctitle
136 tee                  4              4 flow paths betw fills/break
137 *                  jcell          nodes          ichf          cost          epsw
138                    3              0              0          0.0000e+00          0.0000e+00
139 *                  iconc1          ncell1          jun1          jun2          ipow1
140                    0              5              1              3              0
141 *                  radin1          th1          hout11          houtv1          tout11
142          1.7841e-02          1.0000e-03          0.0000e+00          0.0000e+00          4.0000e+02
143 *                  toutv1          pwin1          pwoff1          rpwmv1          pwscl1
144          4.0000e+02          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00
145 *                  iconc2          ncell2          jun3          ipow2
146                    0              2              2              0
147 *                  radin2          th2          hout12          houtv2          tout12
148          1.7841e-02          1.0000e-03          0.0000e+00          0.0000e+00          4.0000e+02
149 *                  toutv2          pwin2          pwoff2          rpwmv2          pwscl2
150          4.0000e+02          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00
151 *
152 * dx          * f          1.0000e-01e
153 * vol          * f          1.0000e-04e
154 * fa          * f          1.0000e-03e
155 * fric          * f          0.0000e-00e
156 * grav          * f          0.0000e+00e
157 * hd          * f          3.5682e-02e
158 * nff          * f          0e
159 * alp          * f          0.0000e+00e
160 * vl          * r03 9.9866e-01r03 2.0444e+00e
161 * vv          * r03 9.9866e-01r03 2.0444e+00e
162 * tl          * r02 3.0000e+02r03 3.5000e+02e
163 * tv          * r02 3.0000e+02r03 3.5000e+02e
164 * p          * f          1.0000e+07e
165 * pa          * f          0.0000e+00e
166 *
167 * dx          * f          1.0000e-01e
168 * vol          * f          1.0000e-04e
169 * fa          * f          1.0000e-03e
170 * fric          *          1.0000e-04r02 0.0000e-00e
171 * grav          * f          0.0000e+00e

```

```

172 * hd      * f    3.5682e-02e
173 * nff     * f          0e
174 * alp     * f    0.0000e+00e
175 * vl      * f   -1.0612e+00e
176 * vv      * f   -1.0612e+00e
177 * tl      * f    4.0000e+02e
178 * tv      * f    4.0000e+02e
179 * p       * f    1.0000e+07e
180 * pa      * f    0.0000e+00e
181 *
182 end
183 *
184 *****
185 * time-step data *
186 *****
187 *
188 *          dtmin          dtmax          tend          rtwfp
189 *    1.0000e-03    1.0000e-01    5.9000e+00    1.0000e+00
190 *          edint          gfint          dmpint          sedint
191 *    5.9000e+00    1.0000e+00    6.0000e+00    5.9000e+00
192 *
193 *          dtmin          dtmax          tend          rtwfp
194 *    1.0000e-03    1.0000e-01    6.0000e+00    1.0000e+00
195 *          edint          gfint          dmpint          sedint
196 *    1.0000e-01    1.0000e-01    2.0000e-01    1.0000e-01
197 *
198 *          dtmin          dtmax          tend          rtwfp
199 *    1.0000e-03    1.0000e-01    1.1900e+01    1.0000e+00
200 *          edint          gfint          dmpint          sedint
201 *    5.9000e+00    1.0000e+00    6.0000e+00    5.9000e+00
202 *
203 *          dtmin          dtmax          tend          rtwfp
204 *    1.0000e-03    1.0000e-01    1.2000e+01    1.0000e+00
205 *          edint          gfint          dmpint          sedint
206 *    1.0000e-01    1.0000e-01    2.0000e-01    1.0000e-01
207 *
208 *          endflag
209 *    -1.0000e+00

```

Appendix C

Results from Test Problems 1 Through 7

Test Problem 1 Timestep Behavior

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp	location cell
0	0.000000	0.001000	2	0.115	0.0204	0.0000	1	4	6
10	0.012578	0.001629	1	0.152	0.0333	0.0000	1	4	4
20	0.033066	0.002653	1	0.188	0.0541	0.0000	1	4	4
30	0.066439	0.004322	1	0.224	0.0878	0.0000	1	4	4
40	0.120800	0.007040	1	0.259	0.1422	0.0000	1	4	4
50	0.209348	0.011467	1	0.295	0.2297	0.0000	1	4	4
60	0.353584	0.018679	1	0.331	0.3690	0.0000	1	4	4
70	0.588529	0.030426	1	0.367	0.5873	0.0000	1	4	4
80	0.971229	0.049561	1	0.402	0.9209	0.0000	1	4	4
90	1.594607	0.080730	1	0.439	1.4065	0.0000	1	4	4
100	2.540694	0.100000	1	0.475	1.5642	0.0000	1	4	1
110	3.540694	0.100000	1	0.512	1.5642	0.0000	1	4	1
120	4.540694	0.100000	1	0.548	1.5642	0.0000	1	4	1
130	5.540694	0.100000	2	0.591	1.5642	0.0000	1	4	1
134	5.940694	0.100000	2	0.608					

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp	location cell
135	6.040694	0.100000	2	0.623					

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp	location cell

140	6.540694	0.100000	2	0.661	1.5642	0.0000	1	4	1
150	7.540694	0.100000	1	0.704	1.5642	0.0000	1	4	1
160	8.540694	0.100000	1	0.740	1.5642	0.0000	1	4	1
170	9.540694	0.100000	1	0.780	1.5642	0.0000	1	4	1
180	10.540694	0.100000	1	0.816	1.5642	0.0000	1	4	1
190	11.540694	0.100000	1	0.853	1.5642	0.0000	1	4	1
194	11.940694	0.100000	1	0.865					

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	0.880				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 8.9100E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout testlout

TEST1OUT (TRCOUT) File Results

```

510 trac large edit
511
512 problem time is 0.000000E+00 s, time-step size is 1.0000E-03 s, time-step number is 0, outer-iteration number is 0
534 ***** signal-variable values at time 0.00000 s *****
535
536 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
537
538 1 0.000000E+00 2 1.000000E+00 3 1.000000E+00 4 2.000042E+00 5 9.986561E-01
539 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s)
540 6 1.061192E+00 7 2.044400E+00 8 1.001346E+03 9 1.001346E+03 10 9.423367E+02
541 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
542 11 9.423367E+02 12 8.405192E+02 13 9.783026E+02
543 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
544
545 ***** control-block output values at time 0.00000 s *****
546
547 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
548
549 -1 1.000000E+00
550 kg/s

FILL1 RVA = SV8 *SV5*FA = 1001.346*0.9986561*0.001 = 1.000000 = SV2 OK
FILL2 RVA = SV10*SV6*FA = 942.3367*1.061192*0.001 = 1.000000 = SV3 OK
BRK3 RVA = SV13*SV7*FA = 978.3026*2.044400*0.001 = 2.000042 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*0.0/10.0 = 1.000000 = CB-1 OK

668 trac large edit
669
670 problem time is 5.940694E+00 s, time-step size is 1.0000E-01 s, time-step number is 134, outer-iteration number is 2
692 ***** signal-variable values at time 5.84069 s *****
693

```

```

694 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
695
696 1 5.840694E+00 2 -1.481387E-01 3 1.000000E+00 4 8.585447E-01 5 -1.482974E-01
697 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s)
698 6 1.061192E+00 7 9.109028E-01 8 1.001346E+03 9 9.973235E+02 10 9.423367E+02
699 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
700 11 9.423370E+02 12 8.405192E+02 13 9.425206E+02
701 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
702
703 ***** control-block output values at time 5.84069 s *****
704
705 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
706
707 -1 -1.681387E-01
708 kg/s

832 trac large edit
833
834 problem time is 6.040694E+00 s, time-step size is 1.0000E-01 s, time-step number is 135, outer-iteration number is 2

856 ***** signal-variable values at time 5.94069 s *****
857
858 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
859
860 1 5.940694E+00 2 -1.681387E-01 3 1.000000E+00 4 8.394435E-01 5 -1.685899E-01
861 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s)
862 6 1.061192E+00 7 8.907055E-01 8 1.001346E+03 9 9.951032E+02 10 9.423367E+02
863 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
864 11 9.423370E+02 12 8.405192E+02 13 9.424479E+02
865 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
866
867 ***** control-block output values at time 5.94069 s *****
868
869 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
870
871 -1 -1.881387E-01
872 kg/s

FILL1 RVA = SV9o *SV5*FA = 997.3235*-0.1685899*0.001 = -0.1681387 = SV2 OK
FILL2 RVA = SV10o*SV6*FA = 942.3367* 1.061192 *0.001 = 1.000000 = SV3 OK
BRK3 RVA = SV13 *SV7*FA = 942.4479* 0.8907055*0.001 = 0.8394435 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*5.940694/10.0 = -0.1881388 = CB-1 OK

1008 trac large edit
1009
1010 problem time is 1.194069E+01 s, time-step size is 1.0000E-01 s, time-step number is 194, outer-iteration number is 1

1032 ***** signal-variable values at time 11.84069 s *****
1033
1034 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1035
1036 1 1.184069E+01 2 -1.000000E+00 3 1.000000E+00 4 1.130804E-10 5 -1.061192E+00
1037 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s)
1038 6 1.061192E+00 7 1.200000E-10 8 1.001346E+03 9 9.423362E+02 10 9.423367E+02
1039 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1040 11 9.423367E+02 12 8.405192E+02 13 9.423366E+02
1041 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1042
1043 ***** control-block output values at time 11.84069 s *****
1044
1045 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1046
1047 -1 -1.000000E+00
1048 kg/s

1172 trac large edit
1173
1174 problem time is 1.204069E+01 s, time-step size is 1.0000E-01 s, time-step number is 195, outer-iteration number is 1

1196 ***** signal-variable values at time 11.94069 s *****
1197
1198 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1199
1200 1 1.194069E+01 2 -1.000000E+00 3 1.000000E+00 4 1.130804E-10 5 -1.061192E+00
1201 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s)
1202 6 1.061192E+00 7 1.200000E-10 8 1.001346E+03 9 9.423362E+02 10 9.423367E+02
1203 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1204 11 9.423367E+02 12 8.405192E+02 13 9.423366E+02
1205 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1206
1207 ***** control-block output values at time 11.94069 s *****
1208
1209 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1210
1211 -1 -1.000000E+00
1212 kg/s

```


FILL1 RVA = SV9o *SV5*FA = 942.3362*-1.061192*0.001 = -1.000000 = SV2 OK
 FILL2 RVA = SV10o*SV6*FA = 942.3367* 1.061192*0.001 = 1.000000 = SV3 OK
 BRK3 RVA = SV13 *SV7*FA = 942.3366*1.200000E-10*0.001 = 1.130804E-10 = SV4 OK
 MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*10.0/10.0 = -1.000000 = CB-1 OK

Test Problem 2 Timestep Behavior

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

minimum		maximum		time domain data to be used			dump		short	
time	time	time	time	long	graphics	edit	edit	edit	edit	edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	1.000E+00	6.000E+00	5.900E+00			

convective energy-error controller is 1.0000E+20 w

time-step	problem	time-step	outer-it.	cpu	courant	numbers	sets	location
number	time (s)	size (s)	number	time (s)	1-d	3-d	flag	cmp cell
0	0.000000	0.001000	1	0.110	0.0145	0.0000	1	4 1
10	0.012578	0.001629	1	0.146	0.0240	0.0000	1	4 1
20	0.033066	0.002653	1	0.181	0.0391	0.0000	1	4 1
30	0.066439	0.004322	1	0.217	0.0636	0.0000	1	4 1
40	0.120800	0.007040	1	0.252	0.1036	0.0000	1	4 1
50	0.209348	0.011467	1	0.288	0.1688	0.0000	1	4 1
60	0.353584	0.018679	2	0.325	0.2750	0.0000	1	4 1
70	0.588529	0.030426	2	0.372	0.4479	0.0000	1	4 1
80	0.971229	0.049561	2	0.418	0.7302	0.0000	1	4 1
90	1.594607	0.080730	2	0.466	1.1996	0.0000	1	4 1
100	2.540694	0.100000	2	0.513	1.5374	0.0000	1	4 1
110	3.540694	0.100000	2	0.560	1.6026	0.0000	1	4 1
120	4.540694	0.100000	2	0.607	1.6772	0.0000	1	4 1
130	5.540694	0.100000	2	0.654	1.7498	0.0000	1	4 1
134	5.940694	0.100000	2	0.670				

minimum		maximum		time domain data to be used			dump		short	
time	time	time	time	long	graphics	edit	edit	edit	edit	edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	1.000E-01	2.000E-01	1.000E-01			

convective energy-error controller is 1.0000E+20 w

time-step	problem	time-step	outer-it.	cpu	courant	numbers	sets	location
number	time (s)	size (s)	number	time (s)	1-d	3-d	flag	cmp cell
135	6.040694	0.100000	2	0.685				

minimum		maximum		time domain data to be used			dump		short	
time	time	time	time	long	graphics	edit	edit	edit	edit	edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00				

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	0.722	1.7537	0.0000	1	4 1
150	7.540694	0.100000	1	0.769	1.7926	0.0000	1	4 4
160	8.540694	0.100000	1	0.805	2.0321	0.0000	1	4 4
170	9.540694	0.100000	1	0.844	2.2702	0.0000	1	4 4
180	10.540694	0.100000	1	0.880	2.3870	0.0000	1	4 5
190	11.540694	0.100000	1	0.916	2.3797	0.0000	1	4 5
194	11.940694	0.100000	1	0.929				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	0.942				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 9.5300E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test2out

TEST2OUT (TRCOUT) File Results

```
510 trac large edit
511
512 problem time is 0.000000E+00 s, time-step size is 1.0000E-03 s, time-step number is 0, outer-iteration number is 0

534 ***** signal-variable values at time 0.00000 s *****
535
536 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
537
538 1 0.000000E+00 2 1.000000E+00 3 -1.000000E+00 4 0.000000E+00 5 9.986561E-01
539 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq vel (m/s)
540 6 -9.986561E-01 7 0.000000E+00 8 1.001346E+03 9 1.001346E+03 10 9.423367E+02
541 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
542 11 1.001346E+03 12 8.405192E+02 13 1.001346E+03
543 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
544
545 ***** control-block output values at time 0.00000 s *****
546
547 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
548
549 -1 1.000000E+00
550 kg/s
```

FILL1 RVA = SV8 *SV5*FA = 1001.346 * 0.9986561*0.001 = 1.000000 = SV2 OK
FILL2 RVA = SV11*SV6*FA = 1001.346 *-0.9986561*0.001 = -1.000000 = SV3 OK
BRK3 RVA = SV12*SV7*FA = 840.5192* 0.000000 *0.001 = 0.000000 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*0.0/10.0 = 1.000000 = CB-1 OK

```

668 trac large edit
669
670 problem time is 5.940694E+00 s, time-step size is 1.0000E-01 s, time-step number is 134, outer-iteration number is 2

692 ***** signal-variable values at time 5.84069 s *****
693
694 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
695
696 1 5.840694E+00 2 -1.481387E-01 3 -1.000000E+00 4 -1.131288E+00 5 -1.487218E-01
697 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq vel (m/s)
698 6 -1.189487E+00 7 -1.345939E+00 8 1.001346E+03 9 9.922322E+02 10 9.423367E+02
699 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
700 11 8.406000E+02 12 8.405192E+02 13 8.405182E+02
701 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
702
703 ***** control-block output values at time 5.84069 s *****
704
705 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
706
707 -1 -1.681387E-01
708 kg/s

```

```

832 trac large edit
833
834 problem time is 6.040694E+00 s, time-step size is 1.0000E-01 s, time-step number is 135, outer-iteration number is 2

856 ***** signal-variable values at time 5.94069 s *****
857
858 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
859
860 1 5.940694E+00 2 -1.681387E-01 3 -1.000000E+00 4 -1.148519E+00 5 -1.694550E-01
861 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq vel (m/s)
862 6 -1.189626E+00 7 -1.366440E+00 8 1.001346E+03 9 9.866752E+02 10 9.423367E+02
863 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
864 11 8.405541E+02 12 8.405192E+02 13 8.405182E+02
865 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
866
867 ***** control-block output values at time 5.94069 s *****
868
869 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
870
871 -1 -1.881387E-01
872 kg/s

```

FILL1 RVA = SV9o *SV5*FA = 992.2322*-0.1694550*0.001 = -0.1681387 = SV2 OK
 FILL2 RVA = SV11o*SV6*FA = 840.6000*-1.189626 *0.001 = -1.000000 = SV3 OK
 BRK3 RVA = SV12 *SV7*FA = 840.5192*-1.366440 *0.001 = -1.148519 = SV4 OK
 MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*5.940694/10.0 = -0.1881388 = CB-1 OK

```

1008 trac large edit
1009
1010 problem time is 1.194069E+01 s, time-step size is 1.0000E-01 s, time-step number is 194, outer-iteration number is 1

1032 ***** signal-variable values at time 11.84069 s *****
1033
1034 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1035
1036 1 1.184069E+01 2 -1.000000E+00 3 -1.000000E+00 4 -2.000000E+00 5 -1.189744E+00
1037 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq vel (m/s)
1038 6 -1.189746E+00 7 -2.379482E+00 8 1.001346E+03 9 8.405170E+02 10 9.423367E+02
1039 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1040 11 8.405155E+02 12 8.405192E+02 13 8.405162E+02
1041 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1042
1043 ***** control-block output values at time 11.84069 s *****
1044
1045 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1046
1047 -1 -1.000000E+00
1048 kg/s

```

```

1172 trac large edit
1173
1174 problem time is 1.204069E+01 s, time-step size is 1.0000E-01 s, time-step number is 195, outer-iteration number is 1

1196 ***** signal-variable values at time 11.94069 s *****
1197
1198 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1199
1200 1 1.194069E+01 2 -1.000000E+00 3 -1.000000E+00 4 -2.000000E+00 5 -1.189744E+00
1201 time (s) z lq mf (kg/s) z lq mf (kg/s) z lq mf (kg/s) z lq vel (m/s)
1202 6 -1.189746E+00 7 -2.379482E+00 8 1.001346E+03 9 8.405170E+02 10 9.423367E+02
1203 z lq vel (m/s) z lq vel (m/s) lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)
1204 11 8.405155E+02 12 8.405192E+02 13 8.405162E+02
1205 lq den (kg/m3) lq den (kg/m3) lq den (kg/m3)

```

```

1206 ***** control-block output values at time 11.94069 s *****
1207
1208
1209 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1210
1211 -1 -1.000000E+00
1212 kg/s

FILL1 RVA = SV9o *SV5*FA = 840.5170*-1.189744*0.001 = -1.000000 = SV2 OK
FILL2 RVA = SV11o*SV6*FA = 840.5155*-1.189746*0.001 = -1.000000 = SV3 OK
BRK3 RVA = SV12 *SV7*FA = 840.5192*-2.379482*0.001 = -2.000000 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*10.0/10.0 = -1.000000 = CB-1 OK

```

Test Problem 3 Timestep Behavior

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.113	0.0463	0.0000	1	4 6
10	0.012578	0.001629	1	0.150	0.0752	0.0000	1	4 6
20	0.033066	0.002653	1	0.187	0.1222	0.0000	1	4 5
30	0.066439	0.004322	1	0.223	0.1983	0.0000	1	4 4
40	0.120800	0.007040	1	0.260	0.3210	0.0000	1	4 4
50	0.209348	0.011467	1	0.297	0.5173	0.0000	1	4 4
60	0.353584	0.018679	1	0.334	0.8282	0.0000	1	4 4
70	0.588529	0.030426	1	0.370	1.3112	0.0000	1	4 4
80	0.971229	0.049561	1	0.407	2.0367	0.0000	1	4 4
90	1.594607	0.080730	1	0.445	3.0567	0.0000	1	4 4
100	2.540694	0.100000	1	0.483	3.2835	0.0000	1	4 4
110	3.540694	0.100000	2	0.526	2.7256	0.0000	1	4 4
120	4.540694	0.100000	2	0.574	2.7234	0.0000	1	4 1
130	5.512185	0.088252	2	0.623	2.4034	0.0000	1	4 1
135	5.990399	0.100000	2	0.644				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
136	6.090399	0.100000	2	0.659				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.490399	0.100000	2	0.693	2.7234	0.0000	1	4 1
150	7.490399	0.100000	1	0.732	2.7234	0.0000	1	4 1
160	8.490399	0.100000	1	0.769	2.7234	0.0000	1	4 1
170	9.490399	0.100000	1	0.810	2.7234	0.0000	1	4 1
180	10.490399	0.100000	1	0.849	2.7234	0.0000	1	4 1
190	11.490399	0.100000	1	0.886	2.7234	0.0000	1	4 1
195	11.990399	0.100000	1	0.903				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
196	12.090399	0.100000	1	0.917				

restart dump generated at problem time 12.090399 s after 196 time steps

end of problem

computative timing statistics
cpu time is 9.2800E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test3out

TEST3OUT (TRCOUT) File Results

```

510 trac large edit
511
512 problem time is 0.000000E+00 s, time-step size is 1.0000E-03 s, time-step number is 0, outer-iteration number is 0
534 ***** signal-variable values at time 0.00000 s *****
535
536 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
537
538 1 0.000000E+00 2 1.000000E+00 3 1.000000E+00 4 1.999989E+00 5 2.777849E+00
539 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
540 6 1.847589E+00 7 4.626900E+00 8 3.599907E-01 9 3.599907E-01 10 5.412460E-01
541 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
542 11 5.412460E-01 12 4.322525E-01 13 4.322525E-01
543 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
544
545 ***** control-block output values at time 0.00000 s *****
546
547 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
548
549 -1 1.000000E+00
550 kg/s

```

FILL1 RVA = SV8 *SV5*FA = 0.3599907*2.777849*1.0 = 1.000000 = SV2 OK
 FILL2 RVA = SV10*SV6*FA = 0.5412460*1.847589*1.0 = 1.000000 = SV3 OK
 BRK3 RVA = SV13*SV7*FA = 0.4322525*4.626900*1.0 = 1.999989 = SV4 OK
 MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*0.0/10.0 = 1.000000 = CB-1 OK

668 trac large edit

669
 670 problem time is 5.990399E+00 s, time-step size is 1.0000E-01 s, time-step number is 135, outer-iteration number is 2

692 ***** signal-variable values at time 5.89040 s *****
 693

id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.
696	1 5.890399E+00	2 -1.580797E-01	3 1.000000E+00	4 8.029080E-01	5 -3.640401E-01				
697	time (s)	z vp mf (kg/s)	z vp mf (kg/s)	z vp mf (kg/s)	z gs vel (m/s)				
698	6 1.847589E+00	7 1.483547E+00	8 3.599907E-01	9 4.545301E-01	10 5.412460E-01				
699	z gs vel (m/s)	z gs vel (m/s)	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)				
700	11 5.412518E-01	12 4.322525E-01	13 5.412083E-01						
701	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)						

702
 703 ***** control block output values at time 5.89040 s *****
 704

id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.
707	-1 -1.780797E-01								
708	kg/s								

832 trac large edit

833
 834 problem time is 6.090399E+00 s, time-step size is 1.0000E-01 s, time-step number is 136, outer-iteration number is 2

856 ***** signal-variable values at time 5.99040 s *****
 857

id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.
860	1 5.990399E+00	2 -1.780797E-01	3 1.000000E+00	4 7.879199E-01	5 -3.917886E-01				
861	time (s)	z vp mf (kg/s)	z vp mf (kg/s)	z vp mf (kg/s)	z gs vel (m/s)				
862	6 1.847589E+00	7 1.455799E+00	8 3.599907E-01	9 4.729462E-01	10 5.412460E-01				
863	z gs vel (m/s)	z gs vel (m/s)	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)				
864	11 5.412517E-01	12 4.322525E-01	13 5.412286E-01						
865	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)						

866
 867 ***** control-block output values at time 5.99040 s *****
 868

id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.
869	-1 -1.980797E-01								
870	kg/s								

FILL1 RVA = SV9o *SV5*FA = 0.4545301*-0.3917886*1.0 = -0.1780797 = SV2 OK
 FILL2 RVA = SV10o*SV6*FA = 0.5412460* 1.847589 *1.0 = 1.000000 = SV3 OK
 BRK3 RVA = SV13 *SV7*FA = 0.5412286* 1.455799 *1.0 = 0.7879200 = SV4 OK
 MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*5.990399/10.0 = -0.1980798 = CB-1 OK

1008 trac large edit

1009
 1010 problem time is 1.199040E+01 s, time-step size is 1.0000E-01 s, time-step number is 195, outer-iteration number is 1

1032 ***** signal-variable values at time 11.89040 s *****
 1033

id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.
1036	1 1.189040E+01	2 -1.000000E+00	3 1.000000E+00	4 3.391576E-10	5 -1.847615E+00				
1037	time (s)	z vp mf (kg/s)	z vp mf (kg/s)	z vp mf (kg/s)	z gs vel (m/s)				
1038	6 1.847589E+00	7 6.266241E-10	8 3.599907E-01	9 5.412384E-01	10 5.412460E-01				
1039	z gs vel (m/s)	z gs vel (m/s)	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)				
1040	11 5.412460E-01	12 4.322525E-01	13 5.412458E-01						
1041	vp den (kg/m3)	vp den (kg/m3)	vp den (kg/m3)						

1042
 1043 ***** control-block output values at time 11.89040 s *****
 1044

id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.	id	con.blk.
1045	-1 -1.000000E+00								
1046	kg/s								

1172 trac large edit

1173
 1174 problem time is 1.209040E+01 s, time-step size is 1.0000E-01 s, time-step number is 196, outer-iteration number is 1

1196 ***** signal-variable values at time 11.99040 s *****
 1197

id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.	id	sig.var.
1198									

```

1199
1200      1  1.199040E+01      2 -1.000000E+00      3  1.000000E+00      4 -5.187030E-11      5 -1.847615E+00
1201      time (s)      z vp mf (kg/s)      z vp mf (kg/s)      z vp mf (kg/s)      z gs vel (m/s)
1202      6  1.847589E+00      7 -1.200000E-10      8  3.599907E-01      9  5.412384E-01      10  5.412460E-01
1203      z gs vel (m/s)      z gs vel (m/s)      vp den (kg/m3)      vp den (kg/m3)      vp den (kg/m3)
1204      11  5.412460E-01      12  4.322525E-01      13  5.412458E-01
1205      vp den (kg/m3)      vp den (kg/m3)      vp den (kg/m3)
1206
1207 ***** control-block output values at time 11.99040 s *****
1208
1209      id      con.blk.      id      con.blk.      id      con.blk.      id      con.blk.      id      con.blk.
1210
1211      -1 -1.000000E+00
1212      kg/s

FILL1  RVA = SV9o *SV5*FA = 0.5412384*-1.847615*1.0 = -1.000000 = SV2  OK
FILL2  RVA = SV10o*SV6*FA = 0.5412460* 1.847589*1.0 = 1.000000 = SV3  OK
BRK3   RVA = SV12 *SV7*FA = 0.4322525*-1.200000E-10*1.0 = -5.187030E-10 = SV4  OK
MF1    1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*10.0/10.0 = -1.000000 = CB-1  OK

```

Test Problem 4 Timestep Behavior

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 5.900E+00 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.114	0.0393	0.0000	1	4 1
10	0.012578	0.001629	1	0.151	0.0667	0.0000	1	4 1
20	0.033066	0.002653	1	0.188	0.1086	0.0000	1	4 1
30	0.066439	0.004322	1	0.226	0.1770	0.0000	1	4 1
40	0.120800	0.007040	1	0.263	0.2883	0.0000	1	4 1
50	0.209348	0.011467	1	0.300	0.4695	0.0000	1	4 1
60	0.353584	0.018679	2	0.343	0.7647	0.0000	1	4 1
70	0.588529	0.030426	2	0.390	1.2429	0.0000	1	4 1
80	0.971229	0.049561	2	0.438	1.9966	0.0000	1	4 1
90	1.594607	0.080730	2	0.483	3.1594	0.0000	1	4 1
100	2.540694	0.100000	1	0.530	3.7843	0.0000	1	4 1
110	3.540694	0.100000	1	0.569	3.6488	0.0000	1	4 1
120	4.540694	0.100000	1	0.607	3.5135	0.0000	1	4 1
130	5.540694	0.100000	2	0.652	3.4111	0.0000	1	4 1
134	5.940694	0.100000	2	0.668				

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 6.000E+00 1.000E-01 1.000E-01 2.000E-01 1.000E-01
convective energy-error controller is 1.0000E+20 w

```


time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.683				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	1	0.721	3.4102	0.0000	1	4 1
150	7.540694	0.100000	1	0.760	3.4891	0.0000	1	4 4
160	8.540694	0.100000	1	0.798	3.9519	0.0000	1	4 4
170	9.540694	0.100000	1	0.839	4.4145	0.0000	1	4 4
180	10.540694	0.100000	1	0.877	4.6586	0.0000	1	4 5
190	11.540694	0.100000	1	0.914	4.6317	0.0000	1	4 5
194	11.940694	0.100000	1	0.927				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	0.941				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 9.5300E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test4out

TEST4OUT (TRCOUT) File Results

```

510 trac large edit
511
512 problem time is 0.000000E+00 s, time-step size is 1.0000E-03 s, time-step number is 0, outer-iteration number is 0
534 ***** signal-variable values at time 0.00000 s *****
535
536 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
537
538 1 0.000000E+00 2 1.000000E+00 3 -1.000000E+00 4 0.000000E+00 5 2.777849E+00
539 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
540 6 -2.777849E+00 7 0.000000E+00 8 3.599907E-01 9 3.599907E-01 10 5.412460E-01
541 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
542 11 3.599907E-01 12 4.322525E-01 13 3.599907E-01
543 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
544
545 ***** control-block output values at time 0.00000 s *****

```



```

546
547 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
548
549 -1 1.000000E+00
550 kg/s

FILL1 RVA = SV8 *SV5*FA = 0.3599907* 2.777849*1.0 = 1.000000 = SV2 OK
FILL2 RVA = SV11*SV6*FA = 0.3599907*-2.777849*1.0 = -1.000000 = SV3 OK
BRK3 RVA = SV12*SV7*FA = 0.4322525* 0.000000*1.0 = 0.000000 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*0.0/10.0 = 1.000000 = CB-1 OK

668 trac large edit
669
670 problem time is 5.940694E+00 s, time-step size is 1.0000E-01 s, time-step number is 134, outer-iteration number is 2

692 ***** signal-variable values at time 5.84069 s *****
693
694 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
695
696 1 5.840694E+00 2 -1.481387E-01 3 -1.000000E+00 4 -1.165821E+00 5 -3.837112E-01
697 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
698 6 -2.313483E+00 7 -2.697083E+00 8 3.599907E-01 9 3.950277E-01 10 5.412460E-01
699 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
700 11 4.322402E-01 12 4.322525E-01 13 4.322424E-01
701 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
702
703 ***** control-block output values at time 5.84069 s *****
704
705 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
706
707 -1 -1.681387E-01
708 kg/s

832 trac large edit
833
834 problem time is 6.040694E+00 s, time-step size is 1.0000E-01 s, time-step number is 135, outer-iteration number is 2

856 ***** signal-variable values at time 5.94069 s *****
857
858 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
859
860 1 5.940694E+00 2 -1.681387E-01 3 -1.000000E+00 4 -1.183963E+00 5 -4.256377E-01
861 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
862 6 -2.313529E+00 7 -2.739053E+00 8 3.599907E-01 9 4.034589E-01 10 5.412460E-01
863 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
864 11 4.322363E-01 12 4.322525E-01 13 4.322420E-01
865 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
866
867 ***** control-block output values at time 5.94069 s *****
868
869 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
870
871 -1 -1.881387E-01
872 kg/s

FILL1 RVA = SV9o *SV5*FA = 0.3950277*-0.4256377*1.0 = -0.1681387 = SV2 OK
FILL2 RVA = SV11o*SV6*FA = 0.4322402*-2.313529 *1.0 = -1.000000 = SV3 OK
BRK3 RVA = SV12 *SV7*FA = 0.4322525*-2.739053 *1.0 = -1.183963 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*5.940694/10.0 = -0.1881388 = CB-1 OK

1008 trac large edit
1009
1010 problem time is 1.194069E+01 s, time-step size is 1.0000E-01 s, time-step number is 194, outer-iteration number is 1

1032 ***** signal-variable values at time 11.84069 s *****
1033
1034 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1035
1036 1 1.184069E+01 2 -1.000000E+00 3 -1.000000E+00 4 -2.000000E+00 5 -2.313585E+00
1037 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
1038 6 -2.313666E+00 7 -4.626925E+00 8 3.599907E-01 9 4.322297E-01 10 5.412460E-01
1039 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
1040 11 4.322144E-01 12 4.322525E-01 13 4.322220E-01
1041 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
1042
1043 ***** control-block output values at time 11.84069 s *****
1044
1045 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1046
1047 -1 -1.000000E+00
1048 kg/s

1172 trac large edit

```

```

1173
1174 problem time is 1.204069E+01 s, time-step size is 1.0000E-01 s, time-step number is 195, outer-iteration number is 1
1196 ***** signal-variable values at time 11.94069 s *****
1197
1198 id sig.var. id sig.var. id sig.var. id sig.var. id sig.var.
1199
1200 1 1.194069E+01 2 -1.000000E+00 3 -1.000000E+00 4 -2.000000E+00 5 -2.313585E+00
1201 time (s) z vp mf (kg/s) z vp mf (kg/s) z vp mf (kg/s) z gs vel (m/s)
1202 6 -2.313666E+00 7 -4.626925E+00 8 3.599907E-01 9 4.322297E-01 10 5.412460E-01
1203 z gs vel (m/s) z gs vel (m/s) vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
1204 11 4.322144E-01 12 4.322525E-01 13 4.322220E-01
1205 vp den (kg/m3) vp den (kg/m3) vp den (kg/m3)
1206
1207 ***** control-block output values at time 11.94069 s *****
1208
1209 id con.blk. id con.blk. id con.blk. id con.blk. id con.blk.
1210
1211 -1 -1.000000E+00
1212 kg/s

```

FILL1 RVA = SV9o *SV5*FA = 0.4322297*-2.313585*1.0 = -1.000000 = SV2 OK
FILL2 RVA = SV11o*SV6*FA = 0.4322144*-2.313666*1.0 = -1.000000 = SV3 OK
BRK3 RVA = SV12 *SV7*FA = 0.4322525*-4.626925*1.0 = -2.000000 = SV4 OK
MF1 1.0-2.0*MIN(10.0,SV1)/10.0 = 1.0-2.0*10.0/10.0 = -1.000000 = CB-1 OK

TEST5IN (TRACIN) File For Examining TSHOOTER Item 189 (Shows only Block -1 and FILL 1 data with an initial negative mass flow)

castor:/export/castor1/rgs/trac> tedi test5in

test5in 209 Lines

*t80,113

```

80 * idcb icbn icb1 icb2 icb3
81 * -1 101 1 3 0
82 * lugain luxmin luxmax lucon1 lucon2
83 * lunounit lumassfw lumassfw lunounit lunounit
84 * cbgain cbxmin cbxmax cbcon1 cbcon2
85 * 1.0000e+00 -1.0000e+00 1.0000e+00 0.0000e+00 0.0000e+00
86 * luytab luxtab
87 * lumassfw lutime
88 *
89 *cbftab* 0.0000e+00 -1.0000e+00s
90 *cbftab* 1.0000e+01 1.0000e+00s
91 *cbftab* 1.2000e+01 1.0000e+00e
92 *
93 *
94 *****
95 * component data *
96 *****
97 *
98 ***** type num id ctitle
99 fill 1 1 inlet/outlet mass flow bc
100 * jun2 ifty ioff
101 * 1 10 0
102 * iftr ifsv nftb nfsv nfrf
103 * 0 0 0 0 0
104 * twtold rfmxc concin felv
105 * 0.0000e+00 2.0000e-01 0.0000e+00 0.0000e+00
106 * dxin volin alpin vlin tlin
107 * 1.0000e-01 1.0000e-04 0.0000e+00 -1.0612e+00 3.0000e+02
108 * pin pain flowin vvin tvin
109 * 1.0000e+07 0.0000e+00 -1.0000e+00 -1.0612e+00 3.0000e+02
110 * ifmlsv ifmvsv iftlsv iftvsv ifasv

```

```

111          -1          0          0          0          0
112 *        ifpsv      ifpasv      ifcnsv
113          0          0          0

```

Test Problem 5 Timestep Behavior from TRAC Versions 5.4.15, 5.4.28, and 5.4.28+updates

castor:/export/castor1/rgs/trac> trac15

.....

Change History

```

-----
5.4      Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01   Date Stamp Thu Jun 9 11:23:55 MDT 1994
.....
5.4.14   Date Stamp Wed Nov 29 09:26:17 MST 1995
5.4.15   Date Stamp Mon Dec 4 14:28:15 MST 1995
-----

```

Version 5.4.01 created from version 5.4 using the following updates:

```

.....
Version 5.4.15 created from version 5.4.14 using the following updates:
      fxflowin  fxrsudul  fxwhtstr  v5p4p15
-----

```

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

```

               time domain data to be used
      minimum   maximum   time      long   graphics   dump      short
      time      time      domain   edit    edit        edit      edit
      step (s)  step (s)  end (s)  step (s) step (s)  step (s)  step (s)
      1.000E-03 1.000E-01 5.900E+00 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	2	0.201	0.0156	0.0000	1	4 1
10	0.012578	0.001629	1	0.290	0.0255	0.0000	1	4 1
20	0.033066	0.002653	1	0.380	0.0415	0.0000	1	4 1
30	0.066439	0.004322	2	0.490	0.0676	0.0000	1	4 1
40	0.120800	0.007040	1	0.610	0.1101	0.0000	1	4 1
50	0.209348	0.011467	1	0.701	0.1794	0.0000	1	4 1
60	0.353584	0.018679	1	0.790	0.2922	0.0000	1	4 1
70	0.588529	0.030426	2	0.901	0.4759	0.0000	1	4 1
80	0.971229	0.049561	2	1.020	0.7753	0.0000	1	4 1
90	1.594607	0.080730	2	1.140	1.2628	0.0000	1	4 1
100	2.540694	0.100000	1	1.240	1.5642	0.0000	1	4 1
110	3.540694	0.100000	1	1.331	1.5642	0.0000	1	4 1
120	4.540694	0.100000	1	1.431	1.5642	0.0000	1	4 1
130	5.540694	0.100000	2	1.541	1.5642	0.0000	1	4 1
134	5.940694	0.100000	2	1.571				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	1.600				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	1.681	1.5642	0.0000	1	4 1
150	7.540694	0.100000	1	1.791	1.5642	0.0000	1	4 1
160	8.540694	0.100000	1	1.880	1.7557	0.0000	1	4 6
170	9.540694	0.100000	1	1.980	1.9532	0.0000	1	4 6
180	10.540694	0.100000	1	2.070	2.0483	0.0000	1	4 5
190	11.540694	0.100000	1	2.161	2.0442	0.0000	1	4 5
194	11.940694	0.100000	1	2.191				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	2.211				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 2.2210E+00 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test5out15

castor:/export/castor1/rgs/trac> trac28

.....

Change History

5.4 Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01 Date Stamp Thu Jun 9 11:23:55 MDT 1994

5.4.28 Date Stamp Fri Nov 8 10:14:57 MST 1996

Version 5.4.01 created from version 5.4 using the following updates:

Version 5.4.28 created from version 5.4.27 using the following updates:
fx3dpak1 fixusd2 v5p4p28

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	2	0.137	0.0156	0.0000	1	4 1
10	0.012578	0.001629	1	0.187	0.0255	0.0000	1	4 1
20	0.033066	0.002653	1	0.234	0.0415	0.0000	1	4 1
30	0.066439	0.004322	2	0.294	0.0676	0.0000	1	4 1
40	0.120800	0.007040	1	0.353	0.1101	0.0000	1	4 1
50	0.209348	0.011467	1	0.400	0.1794	0.0000	1	4 1
60	0.353584	0.018679	1	0.446	0.2922	0.0000	1	4 1
70	0.588529	0.030426	2	0.507	0.4759	0.0000	1	4 1
80	0.971229	0.049561	2	0.569	0.7753	0.0000	1	4 1
90	1.594607	0.080730	2	0.632	1.2628	0.0000	1	4 1
100	2.540694	0.100000	1	0.684	1.5642	0.0000	1	4 1
110	3.540694	0.100000	1	0.732	1.5642	0.0000	1	4 1
120	4.540694	0.100000	1	0.779	1.5642	0.0000	1	4 1
130	5.540694	0.100000	2	0.836	1.5642	0.0000	1	4 1
134	5.940694	0.100000	2	0.856				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.873				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	0.920	1.5642	0.0000	1	4 1
150	7.540694	0.100000	1	0.977	1.5642	0.0000	1	4 1
160	8.540694	0.100000	1	1.025	1.7557	0.0000	1	4 6
170	9.540694	0.100000	1	1.076	1.9532	0.0000	1	4 6
180	10.540694	0.100000	1	1.124	2.0483	0.0000	1	4 5
190	11.540694	0.100000	1	1.172	2.0442	0.0000	1	4 5
194	11.940694	0.100000	1	1.188				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	1.203				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 1.2140E+00 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test5out28

castor:/export/castor1/rgs/trac> trac (Version 5.4.28 with pending updates)

.....

Change History

5.4 Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01 Date Stamp Thu Jun 9 11:23:55 MDT 1994
.....
5.4.28 Date Stamp Fri Nov 8 10:14:57 MST 1996

Version 5.4.01 created from version 5.4 using the following updates:

.....
Version 5.4.28 created from version 5.4.27 using the following updates:
fx3dpak1 fixusd2 v5p4p28

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	2	0.114	0.0156	0.0000	1	4 1
10	0.012578	0.001629	1	0.153	0.0255	0.0000	1	4 1
20	0.033066	0.002653	1	0.190	0.0415	0.0000	1	4 1
30	0.066439	0.004322	2	0.236	0.0676	0.0000	1	4 1
40	0.120800	0.007040	1	0.282	0.1101	0.0000	1	4 1
50	0.209348	0.011467	1	0.319	0.1794	0.0000	1	4 1
60	0.353584	0.018679	1	0.355	0.2922	0.0000	1	4 1
70	0.588529	0.030426	2	0.397	0.4759	0.0000	1	4 1
80	0.971229	0.049561	2	0.444	0.7753	0.0000	1	4 1
90	1.594607	0.080730	2	0.492	1.2628	0.0000	1	4 1
100	2.540694	0.100000	1	0.534	1.5642	0.0000	1	4 1
110	3.540694	0.100000	1	0.571	1.5642	0.0000	1	4 1
120	4.540694	0.100000	1	0.609	1.5642	0.0000	1	4 1
130	5.540694	0.100000	2	0.652	1.5642	0.0000	1	4 1
134	5.940694	0.100000	2	0.668				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.683				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	0.721	1.5642	0.0000	1	4 1
150	7.540694	0.100000	1	0.766	1.5642	0.0000	1	4 1
160	8.540694	0.100000	1	0.803	1.7557	0.0000	1	4 6
170	9.540694	0.100000	1	0.843	1.9532	0.0000	1	4 6
180	10.540694	0.100000	1	0.880	2.0483	0.0000	1	4 5
190	11.540694	0.100000	1	0.917	2.0442	0.0000	1	4 5
194	11.940694	0.100000	1	0.930				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	0.944				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 9.5600E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test5out

castor:/export/castor1/rgs/trac> tedi test5out15

test5out15 1257 Lines

*o/test5out28

test5out28 1329 Lines

*o/test5out

test5out 1330 Lines

*end

. Results from all three TRCOUT files differ slightly
because of update changes to each TRAC version

TEST6IN (TRACIN) File for Examining TSHOOTER Item 190 (Shows only FILL 2 input data for a liquid outflow system)

castor:/export/castor1/rgs/trac> cp test2in test6in

castor:/export/castor1/rgs/trac> tedi test6in

test6in 209 Lines

tp/fill

			# fill#	tl=400k	
12	*				
23	*	# fill# # cell: cell: cell: cell: cell# #break#			
51	*	iorder*	1s	fill inlet/outlet mass-flow bc	
52	*	iorder*	2s	fill outlet mass-flow bc	
99	fill		1	1 inlet/outlet mass flow bc	
116	fill		2	2 outlet mass flow bc	
136	tee		4	4 flow paths betw fills/break	
*t116,124					
116	fill		2	2 outlet mass flow bc	
117	*	jun2	ifty	ioff	
118		2	2	0	
119	*	twold	rfmx	concin	felv
120		0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
121	*	dxin	volin	alpin	vlin
122		1.0000e-01	1.0000e-04	0.0000e+00	-9.9866e-01
123	*	pin	pain	flowin	vvin
124		1.0000e+07	0.0000e+00	-1.0000e+00	-9.9866e-01
*rp122/0.0000e+00/1.0000e+00					
122		1.0000e-01	1.0000e-04	1.0000e+00	-9.9866e-01
					4.0000e+02

*end
test6in 209 Lines

castor:/export/castor1/rgs/trac> cp test6in tracin

castor:/export/castor1/rgs/trac> trac15

.....

Change History

5.4 Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**

5.4.01 Date Stamp Thu Jun 9 11:23:55 MDT 1994

.....

5.4.15 Date Stamp Mon Dec 4 14:28:15 MST 1995

Version 5.4.01 created from version 5.4 using the following updates:

Version 5.4.15 created from version 5.4.14 using the following updates:

fxflowin fxrsudul fxwhtstr v5p4p15

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

		time domain data to be used					
minimum	maximum	time	long	graphics	dump	short	
time	time	domain	edit	edit	edit	edit	
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00	

convective energy-error controller is 1.0000E+20 w

time-step	problem	time-step	outer-it.	cpu	courant	numbers	sets	location
number	time (s)	size (s)	number	time (s)	1-d	3-d	flag	cmp cell
0	0.000000	0.001000	1	0.169	0.0145	0.0000	1	4 1
10	0.012578	0.001629	1	0.260	0.0240	0.0000	1	4 1
20	0.033066	0.002653	1	0.350	0.0391	0.0000	1	4 1
30	0.066439	0.004322	1	0.440	0.0636	0.0000	1	4 1
40	0.120800	0.007040	1	0.529	0.1036	0.0000	1	4 1
50	0.209348	0.011467	1	0.630	0.1688	0.0000	1	4 1
60	0.353584	0.018679	2	0.719	0.2750	0.0000	1	4 1
70	0.588529	0.030426	2	0.839	0.4479	0.0000	1	4 1
80	0.971229	0.049561	2	0.959	0.7302	0.0000	1	4 1
90	1.594607	0.080730	2	1.079	1.1999	0.0000	1	4 1
100	2.540694	0.100000	2	1.209	1.5373	0.0000	1	4 1
110	3.540694	0.100000	2	1.329	1.6026	0.0000	1	4 1
120	4.540694	0.100000	2	1.450	1.6773	0.0000	1	4 1
130	5.540694	0.100000	2	1.570	1.7481	0.0000	1	4 1
134	5.940694	0.100000	2	1.609				

		time domain data to be used					
minimum	maximum	time	long	graphics	dump	short	
time	time	domain	edit	edit	edit	edit	
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01	

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	1.640				

time domain data to be used						
minimum time step (s)	maximum time step (s)	time domain end (s)	long edit step (s)	graphics edit step (s)	dump edit step (s)	short edit step (s)
1.000E-03	1.000E-01	1.200E+01	6.000E+00	1.000E+00	6.100E+00	6.000E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	1.719	1.7537	0.0000	1	4 1
150	7.540694	0.100000	1	1.839	1.7537	0.0000	1	4 1
160	8.540694	0.100000	1	1.930	1.8969	0.0000	1	4 4
170	9.540694	0.100000	1	2.029	2.0966	0.0000	1	4 4
180	10.540694	0.100000	1	2.120	2.1939	0.0000	1	4 5
190	11.540694	0.100000	1	2.219	2.1885	0.0000	1	4 5
195	12.040694	0.100000	1	2.259				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 2.2790E+00 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test6out15

castor:/export/castor1/rgs/trac> tedi test6out15
test6out15 1093 Lines

```
*tp*/ outlet mass flow bc
296
301 component number 2, type = fill outlet mass flow bc id = 2, ctitle = outlet mass flow bc 22222
581 4 outlet mass flow bc 2
727 4 outlet mass flow bc 2
891 4 outlet mass flow bc 2
1055 4 outlet mass flow bc 2
*t301,8
301 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
302 jun1 = 2, ifty = 2, ioff = 0
303 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
304 kg/s2
305 dxin = 1.0000E-01, volin = 1.0000E-04, alpin = 1.0000E+00, vlin = -9.9866E-01, tlin = 4.0000E+02
306 m m3 m/s k
307 pin = 1.0000E+07, pain = 0.0000E+00, flowin = -1.0000E+00, vvin = -9.9866E-01, tvin = 4.0000E+02
308 pa pa kg/s m/s k
309
*t584,10
584
585 the component type is a fill, component number is 2, and junction number is 2
586
587 ncd-gas
588 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
589 cell pa pa k k k kg/m3 kg/m3 m/s m/s -
590 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -9.987E-01 -9.987E-01 0.000E+00
591 2 -9.987E-01 -9.987E-01 0.000E+00
592
593 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.00000E-14 kg
594
*t730,10
730
```

```

731 the component type is a fill, component number is 2, and junction number is 2
732
733 ncd-gas
734 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
735 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
736 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.189E+00 -1.189E+00 0.000E+00
737 2 -1.189E+00 -1.189E+00 0.000E+00
738
739 fill coolant mass outflow is -9.99758E-01 kg/s and total mass from the fill is -5.82370E+00 kg
740
*t894,10
894
895 the component type is a fill, component number is 2, and junction number is 2
896
897 ncd-gas
898 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
899 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
900 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
901 2 -1.190E+00 -1.190E+00 0.000E+00
902
903 fill coolant mass outflow is -9.99866E-01 kg/s and total mass from the fill is -5.92369E+00 kg
904
*t1058,10
1058
1059 the component type is a fill, component number is 2, and junction number is 2
1060
1061 ncd-gas
1062 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1063 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
1064 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
1065 2 -1.190E+00 -1.190E+00 0.000E+00
1066
1067 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.19237E+01 kg
1068

```

castor:/export/castor1/rgs/trac> trac28

.....

Change History

```

-----
5.4      Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01   Date Stamp Thu Jun 9 11:23:55 MDT 1994
.....
5.4.28   Date Stamp Fri Nov 8 10:14:57 MST 1996
-----

```

Version 5.4.01 created from version 5.4 using the following updates:

```

.....
Version 5.4.28 created from version 5.4.27 using the following updates:
fx3dpak1 fixusd2 v5p4p28
-----

```

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 5.900E+00 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.133	0.0145	0.0000	1	4 1
10	0.012578	0.001629	1	0.180	0.0240	0.0000	1	4 1
20	0.033066	0.002653	1	0.226	0.0391	0.0000	1	4 1
30	0.066439	0.004322	1	0.272	0.0636	0.0000	1	4 1

40	0.120800	0.007040	1	0.318	0.1036	0.0000	1	4	1
50	0.209348	0.011467	1	0.364	0.1688	0.0000	1	4	1
60	0.353584	0.018679	2	0.414	0.2750	0.0000	1	4	1
70	0.588529	0.030426	2	0.475	0.4479	0.0000	1	4	1
80	0.971229	0.049561	2	0.537	0.7302	0.0000	1	4	1
90	1.594607	0.080730	2	0.600	1.1999	0.0000	1	4	1
100	2.540694	0.100000	2	0.663	1.5373	0.0000	1	4	1
110	3.540694	0.100000	2	0.725	1.6026	0.0000	1	4	1
120	4.540694	0.100000	2	0.788	1.6773	0.0000	1	4	1
130	5.540694	0.100000	2	0.850	1.7481	0.0000	1	4	1
134	5.940694	0.100000	2	0.871					

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.888				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	6.000E+00	1.000E+00	6.100E+00	6.000E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	0.934	1.7537	0.0000	1	4
150	7.540694	0.100000	1	0.996	1.7537	0.0000	1	4
160	8.540694	0.100000	1	1.043	1.8969	0.0000	1	4
170	9.540694	0.100000	1	1.093	2.0966	0.0000	1	4
180	10.540694	0.100000	1	1.140	2.1939	0.0000	1	4
190	11.540694	0.100000	1	1.188	2.1885	0.0000	1	4
195	12.040694	0.100000	1	1.209				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 1.2210E+00 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test6out28

castor:/export/castor1/rgs/trac> tedi test6out28
test6out28 1165 Lines

tp/ outlet mass flow bc
342
347 component number 2,
627 4

type = fill

outlet mass flow bc
id =
outlet mass flow bc

2, ctitle = outlet mass flow bc

22222
2

```

785          4          outlet mass flow bc          2
949          4          outlet mass flow bc          2
1125         4          outlet mass flow bc          2
*t347,8
347 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
348 jun1 = 2, ifty = 2, ioff = 0
349 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
350          kg/s2
351 dxin = 1.0000E-01, volin = 1.0000E-04, alpin = 1.0000E+00, vlin = -9.9866E-01, tlin = 4.0000E+02
352          m          m3          m/s          m/s          k
353 pin = 1.0000E+07, pain = 0.0000E+00, flowin = -1.0000E+00, vvin = -9.9866E-01, tvin = 4.0000E+02
354          pa          pa          kg/s          m/s          k
355
*t630,10
630
631 the component type is a fill, component number is 2, and junction number is 2
632
633 ncd-gas
634 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
635 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
636 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -9.987E-01 -9.987E-01 0.000E+00
637 2 -9.987E-01 -9.987E-01 0.000E+00
638
639 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.00000E-14 kg
640
*t788,10
788
789 the component type is a fill, component number is 2, and junction number is 2
790
791 ncd-gas
792 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
793 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
794 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.189E+00 -1.189E+00 0.000E+00
795 2 -1.189E+00 -1.189E+00 0.000E+00
796
797 fill coolant mass outflow is -9.99758E-01 kg/s and total mass from the fill is -5.82370E+00 kg
798
*t952,10
952
953 the component type is a fill, component number is 2, and junction number is 2
954
955 ncd-gas
956 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
957 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
958 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
959 2 -1.190E+00 -1.190E+00 0.000E+00
960
961 fill coolant mass outflow is -9.99866E-01 kg/s and total mass from the fill is -5.92369E+00 kg
962
*t1128,10
1128
1129 the component type is a fill, component number is 2, and junction number is 2
1130
1131 ncd-gas
1132 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1133 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
1134 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
1135 2 -1.190E+00 -1.190E+00 0.000E+00
1136
1137 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.19237E+01 kg

```

castor:/export/castor1/rgs/trac> trac

.....

Change History

5.4 Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**

5.4.01 Date Stamp Thu Jun 9 11:23:55 MDT 1994

.....

5.4.28 Date Stamp Fri Nov 8 10:14:57 MST 1996

Version 5.4.01 created from version 5.4 using the following updates:

.....

Version 5.4.28 created from version 5.4.27 using the following updates:

fx3dpak1 fixusd2 v5p4p28

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.110	0.0145	0.0000	1	4 1
10	0.012578	0.001629	1	0.146	0.0240	0.0000	1	4 1
20	0.033066	0.002653	1	0.183	0.0391	0.0000	1	4 1
30	0.066439	0.004322	1	0.219	0.0636	0.0000	1	4 1
40	0.120800	0.007040	1	0.254	0.1036	0.0000	1	4 1
50	0.209348	0.011467	1	0.290	0.1688	0.0000	1	4 1
60	0.353584	0.018679	2	0.328	0.2750	0.0000	1	4 1
70	0.588529	0.030426	2	0.375	0.4479	0.0000	1	4 1
80	0.971229	0.049561	2	0.422	0.7302	0.0000	1	4 1
90	1.594607	0.080730	2	0.469	1.1999	0.0000	1	4 1
100	2.540694	0.100000	2	0.517	1.5373	0.0000	1	4 1
110	3.540694	0.100000	2	0.564	1.6026	0.0000	1	4 1
120	4.540694	0.100000	2	0.611	1.6773	0.0000	1	4 1
130	5.540694	0.100000	2	0.658	1.7481	0.0000	1	4 1
134	5.940694	0.100000	2	0.674				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.688				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	6.000E+00	1.000E+00	6.100E+00	6.000E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	2	0.726	1.7537	0.0000	1	4 1
150	7.540694	0.100000	1	0.771	1.7926	0.0000	1	4 4
160	8.540694	0.100000	1	0.807	2.0321	0.0000	1	4 4
170	9.540694	0.100000	1	0.847	2.2702	0.0000	1	4 4
180	10.540694	0.100000	1	0.883	2.3870	0.0000	1	4 5
190	11.540694	0.100000	1	0.920	2.3797	0.0000	1	4 5
195	12.040694	0.100000	1	0.936				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 9.4700E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test6out

castor:/export/castor1/rgs/trac> tedi test6out
test6out 1330 Lines

```
*tp*/ outlet mass flow bc
344
349 component number 2, type = fill id = 2, ctitle = outlet mass flow bc 22222
629 4 outlet mass flow bc 2
787 4 outlet mass flow bc 2
951 4 outlet mass flow bc 2
1127 4 outlet mass flow bc 2
*t349,8
349 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
350 jun1 = 2, ifty = 2, ioff = 0
351 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
352 - kg/s2 - m
353 dxin = 1.0000E-01, volin = 1.0000E-04, alpin = 1.0000E+00, vlin = -9.9866E-01, tlin = 4.0000E+02
354 m m/s - k
355 pin = 1.0000E+07, pain = 0.0000E+00, flowin = -1.0000E+00, vvin = -9.9866E-01, tvin = 4.0000E+02
356 pa pa kg/s m/s k
357
*t632,10
632
633 the component type is a fill, component number is 2, and junction number is 2
634
635 ncd-gas
636 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
637 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
638 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -9.987E-01 -9.987E-01 0.000E+00
639 2 -1.190E+00 -1.190E+00 0.000E+00
640
641 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.00000E-14 kg
642
*t790,10
790
791 the component type is a fill, component number is 2, and junction number is 2
792
793 ncd-gas
794 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
795 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
796 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
797 2 -1.190E+00 -1.190E+00 0.000E+00
798
799 fill coolant mass outflow is -9.99883E-01 kg/s and total mass from the fill is -5.82367E+00 kg
800
*t954,10
954
955 the component type is a fill, component number is 2, and junction number is 2
956
957 ncd-gas
958 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
959 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
960 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
961 2 -1.190E+00 -1.190E+00 0.000E+00
962
963 fill coolant mass outflow is -9.99945E-01 kg/s and total mass from the fill is -5.92367E+00 kg
964
*t1130,10
1130
1131 the component type is a fill, component number is 2, and junction number is 2
1132
1133 ncd-gas
1134 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1135 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
1136 1 1.00000E+07 0.00000E+00 1.000E+00 5.842E+02 4.000E+02 4.000E+02 9.423E+02 5.417E+01 -1.190E+00 -1.190E+00 0.000E+00
1137 2 -1.190E+00 -1.190E+00 0.000E+00
1138
1139 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.18237E+01 kg
1140
```

TEST7IN (TRACIN) File for Examining TSHOOTER Item 190 (Shows only FILL 2 input data for a gas outflow system)

castor:/export/castor1/rgs/trac> cp test4in test7in

castor:/export/castor1/rgs/trac> tedi test7in

test7in 209 Lines

*t116,124

```

116 fill                2                2 outlet mass flow bc
117 *          jun2          ifty          ioff
118          2                2                0
119 *          twtold          rfmix          concin          felv
120          0.0000e+00          0.0000e+00          0.0000e+00          0.0000e+00
121 *          dxin          volin          alpin          vlin          tlin
122          1.0000e-01          1.0000e-01          1.0000e+00          -2.7778e+00          4.0000e+02
123 *          pin          pain          flowin          vvin          tvin
124          1.0000e+05          0.0000e+00          -1.0000e+00          -2.7778e+00          4.0000e+02
*end

```

castor:/export/castor1/rgs/trac> cp test7in tracin

castor:/export/castor1/rgs/trac> trac15

.....

Change History

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5.4      Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01   Date Stamp Thu Jun 9 11:23:55 MDT 1994
.....
5.4.15   Date Stamp Mon Dec 4 14:28:15 MST 1995
-----

```

Version 5.4.01 created from version 5.4 using the following updates:

Version 5.4.15 created from version 5.4.14 using the following updates:
fxflowin fxrsudul fxwhtstr v5p4p15

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 5.900E+00 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.180	0.0393	0.0000	1	4 1
10	0.012578	0.001629	1	0.281	0.0667	0.0000	1	4 1
20	0.033066	0.002653	1	0.371	0.1086	0.0000	1	4 1

30	0.066439	0.004322	1	0.460	0.1770	0.0000	1	4	1
40	0.120800	0.007040	1	0.561	0.2883	0.0000	1	4	1
50	0.209348	0.011467	1	0.661	0.4695	0.0000	1	4	1
60	0.353584	0.018679	2	0.760	0.7647	0.0000	1	4	1
70	0.588529	0.030426	2	0.890	1.2428	0.0000	1	4	1
80	0.971229	0.049561	2	1.011	1.9965	0.0000	1	4	1
90	1.594607	0.080730	2	1.131	3.1597	0.0000	1	4	1
100	2.540694	0.100000	1	1.250	3.7842	0.0000	1	4	1
110	3.540694	0.100000	1	1.340	3.6487	0.0000	1	4	1
120	4.540694	0.100000	1	1.441	3.5134	0.0000	1	4	1
130	5.540694	0.100000	2	1.561	3.4134	0.0000	1	4	1
134	5.940694	0.100000	2	1.600					

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	1.620				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.190E+01	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	1	1.700	3.4102	0.0000	1	4
150	7.540694	0.100000	1	1.801	3.7249	0.0000	1	4
160	8.540694	0.100000	1	1.891	4.2804	0.0000	1	4
170	9.540694	0.100000	1	1.980	4.8360	0.0000	1	4
180	10.540694	0.100000	1	2.081	5.1319	0.0000	1	4
190	11.540694	0.100000	1	2.171	5.0983	0.0000	1	4
194	11.940694	0.100000	1	2.200				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	2.220				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics
cpu time is 2.2400E+00 s

Note: IEEE floating-point exception traps enabled:
 overflow; division by zero; invalid operation;
 See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test7out15

castor:/export/castor1/rgs/trac> tedi test7out15
 test7out15 1257 Lines

```
*tp*/ outlet mass flow bc
296
301 component number 2, type = fill outlet mass flow bc id = 2, ctitle = outlet mass flow bc 22222
581 4 outlet mass flow bc 2
727 4 outlet mass flow bc 2
891 4 outlet mass flow bc 2
1055 4 outlet mass flow bc 2
1219 4 outlet mass flow bc 2
*t301,8
301 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
302 jun1 = 2, ifty = 2, ioff = 0
303 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
304 - kg/s2 - m
305 dxin = 1.0000E-01, volin = 1.0000E-01, alpin = 1.0000E+00, vlin = -2.7778E+00, tlin = 4.0000E+02
306 m m3 - m/s k
307 pin = 1.0000E+05, pain = 0.0000E+00, flowin = -1.0000E+00, vvin = -2.7778E+00, tvin = 4.0000E+02
308 pa pa kg/s m/s k
309
*t584,10
584
585 the component type is a fill, component number is 2, and junction number is 2
586
587 ncd-gas
588 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
589 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
590 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.778E+00 -2.778E+00 0.000E+00
591 2 -2.778E+00 -2.778E+00 0.000E+00
592
593 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.00000E-14 kg
594
*t730,10
730
731 the component type is a fill, component number is 2, and junction number is 2
732
733 ncd-gas
734 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
735 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
736 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
737 2 -2.314E+00 -2.314E+00 0.000E+00
738
739 fill coolant mass outflow is -1.00001E+00 kg/s and total mass from the fill is -5.85663E+00 kg
740
*t894,10
894
895 the component type is a fill, component number is 2, and junction number is 2
896
897 ncd-gas
898 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
899 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
900 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
901 2 -2.314E+00 -2.314E+00 0.000E+00
902
903 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -5.95663E+00 kg
904
*t1058,10
1058
1059 the component type is a fill, component number is 2, and junction number is 2
1060
1061 ncd-gas
1062 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1063 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
1064 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
1065 2 -2.314E+00 -2.314E+00 0.000E+00
1066
1067 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.18566E+01 kg
1068
```

castor:/export/castor1/rgs/trac> trac28

.....

Change History

5.4 Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
 5.4.01 Date Stamp Thu Jun 9 11:23:55 MDT 1994

5.4.28 Date Stamp Fri Nov 8 10:14:57 MST 1996

Version 5.4.01 created from version 5.4 using the following updates:

Version 5.4.28 created from version 5.4.27 using the following updates:

fx3dpak1 fixusd2 v5p4p28

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	5.900E+00	5.900E+00	1.000E+00	6.000E+00	5.900E+00

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.134	0.0393	0.0000	1	4 1
10	0.012578	0.001629	1	0.186	0.0667	0.0000	1	4 1
20	0.033066	0.002653	1	0.238	0.1086	0.0000	1	4 1
30	0.066439	0.004322	1	0.289	0.1770	0.0000	1	4 1
40	0.120800	0.007040	1	0.340	0.2883	0.0000	1	4 1
50	0.209348	0.011467	1	0.391	0.4695	0.0000	1	4 1
60	0.353584	0.018679	2	0.450	0.7647	0.0000	1	4 1
70	0.588529	0.030426	2	0.516	1.2428	0.0000	1	4 1
80	0.971229	0.049561	2	0.582	1.9965	0.0000	1	4 1
90	1.594607	0.080730	2	0.645	3.1597	0.0000	1	4 1
100	2.540694	0.100000	1	0.709	3.7842	0.0000	1	4 1
110	3.540694	0.100000	1	0.761	3.6487	0.0000	1	4 1
120	4.540694	0.100000	1	0.814	3.5134	0.0000	1	4 1
130	5.540694	0.100000	2	0.876	3.4134	0.0000	1	4 1
134	5.940694	0.100000	2	0.898				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	6.000E+00	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
135	6.040694	0.100000	2	0.915				

time domain data to be used						
minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)

1.000E-03 1.000E-01 1.190E+01 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
140	6.540694	0.100000	1	0.963	3.4102	0.0000	1	4 1
150	7.540694	0.100000	1	1.015	3.7249	0.0000	1	4 4
160	8.540694	0.100000	1	1.067	4.2804	0.0000	1	4 4
170	9.540694	0.100000	1	1.122	4.8360	0.0000	1	4 4
180	10.540694	0.100000	1	1.174	5.1319	0.0000	1	4 5
190	11.540694	0.100000	1	1.226	5.0983	0.0000	1	4 5
194	11.940694	0.100000	1	1.243				

time domain data to be used

minimum time	maximum time	time domain	long edit	graphics edit	dump edit	short edit
step (s)	step (s)	end (s)	step (s)	step (s)	step (s)	step (s)
1.000E-03	1.000E-01	1.200E+01	1.000E-01	1.000E-01	2.000E-01	1.000E-01

convective energy-error controller is 1.0000E+20 w

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
195	12.040694	0.100000	1	1.258				

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics

cpu time is 1.2690E+00 s

Note: IEEE floating-point exception traps enabled:

overflow; division by zero; invalid operation;

See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trcout test7out28

castor:/export/castor1/rgs/trac> tedi test7out28

test7out28 1329 Lines

```
*tp*/ outlet mass flow bc
342
347 component number 2, type = fill outlet mass flow bc 22222
627 4 outlet mass flow bc 2
785 4 outlet mass flow bc 2
949 4 outlet mass flow bc 2
1125 4 outlet mass flow bc 2
1289 4 outlet mass flow bc 2
*t347,8
347 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
348 jun1 = 2, ifty = 2, ioff = 0
349 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
350 - kg/s2 - m
351 dxin = 1.0000E-01, volin = 1.0000E-01, alpin = 1.0000E+00, vlin = -2.7778E+00, tlin = 4.0000E+02
352 m m/s k
353 pin = 1.0000E+05, pain = 0.0000E+00, flowin = -1.0000E+00, vvin = -2.7778E+00, tvin = 4.0000E+02
354 pa pa kg/s m/s k
355
*t630,10
630
631 the component type is a fill, component number is 2, and junction number is 2
632
633 ncd-gas
634 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
635 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
636 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.778E+00 -2.778E+00 0.000E+00
637 2 -2.778E+00 -2.778E+00 0.000E+00
638
639 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.00000E-14 kg
```

```

640
*t788,10
788
789 the component type is a fill, component number is 2, and junction number is 2
790
791 ncd-gas
792 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
793 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
794 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
795 2 -2.314E+00 -2.314E+00 0.000E+00
796
797 fill coolant mass outflow is -1.00001E+00 kg/s and total mass from the fill is -5.85663E+00 kg
798
*t952,10
952
953 the component type is a fill, component number is 2, and junction number is 2
954
955 ncd-gas
956 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
957 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
958 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
959 2 -2.314E+00 -2.314E+00 0.000E+00
960
961 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -5.95663E+00 kg
962
*t1128,10
1128
1129 the component type is a fill, component number is 2, and junction number is 2
1130
1131 ncd-gas
1132 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1133 cell pa pa - k k k kg/m3 kg/m3 m/s m/s -
1134 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
1135 2 -2.314E+00 -2.314E+00 0.000E+00
1136
1137 fill coolant mass outflow is -1.00000E+00 kg/s and total mass from the fill is -1.18566E+01 kg
1138

```

castor:/export/castor1/rgs/trac> trac

.....

Change History

```

5.4      Date Stamp Fri Apr 2 14:46:00 MDT 1993 **date not automated**
5.4.01   Date Stamp Thu Jun 9 11:23:55 MDT 1994
.....
5.4.28   Date Stamp Fri Nov 8 10:14:57 MST 1996

```

Version 5.4.01 created from version 5.4 using the following updates:

Version 5.4.28 created from version 5.4.27 using the following updates:
fx3dpak1 fixusd2 v5p4p28

.....

input data is being processed

h2o properties are used

restart dump generated at problem time 0.000000 s after 0 time steps

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 5.900E+00 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

time-step number	problem time (s)	time-step size (s)	outer-it. number	cpu time (s)	courant 1-d	numbers 3-d	sets flag	location cmp cell
0	0.000000	0.001000	1	0.112	0.0393	0.0000	1	4 1
10	0.012578	0.001629	1	0.151	0.0667	0.0000	1	4 1

20	0.033066	0.002653	1	0.190	0.1086	0.0000	1	4	1
30	0.066439	0.004322	1	0.231	0.1770	0.0000	1	4	1
40	0.120800	0.007040	1	0.270	0.2883	0.0000	1	4	1
50	0.209348	0.011467	1	0.309	0.4695	0.0000	1	4	1
60	0.353584	0.018679	2	0.353	0.7647	0.0000	1	4	1
70	0.588529	0.030426	2	0.402	1.2428	0.0000	1	4	1
80	0.971229	0.049561	2	0.451	1.9965	0.0000	1	4	1
90	1.594607	0.080730	2	0.498	3.1597	0.0000	1	4	1
100	2.540694	0.100000	1	0.545	3.7842	0.0000	1	4	1
110	3.540694	0.100000	1	0.585	3.6487	0.0000	1	4	1
120	4.540694	0.100000	1	0.624	3.5134	0.0000	1	4	1
130	5.540694	0.100000	2	0.671	3.4134	0.0000	1	4	1
134	5.940694	0.100000	2	0.687					

```

..
time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 6.000E+00 1.000E-01 1.000E-01 2.000E-01 1.000E-01
convective energy-error controller is 1.0000E+20 w

```

```

time-step problem time-step outer-it. cpu courant numbers sets location
number time (s) size (s) number time (s) 1-d 3-d flag cmp cell
135 6.040694 0.100000 2 0.702

```

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 1.190E+01 5.900E+00 1.000E+00 6.000E+00 5.900E+00
convective energy-error controller is 1.0000E+20 w

```

```

time-step problem time-step outer-it. cpu courant numbers sets location
number time (s) size (s) number time (s) 1-d 3-d flag cmp cell
140 6.540694 0.100000 1 0.740 3.4102 0.0000 1 4 1
150 7.540694 0.100000 1 0.779 3.4891 0.0000 1 4 4
160 8.540694 0.100000 1 0.818 3.9519 0.0000 1 4 4
170 9.540694 0.100000 1 0.861 4.4145 0.0000 1 4 4
180 10.540694 0.100000 1 0.900 4.6586 0.0000 1 4 5
190 11.540694 0.100000 1 0.939 4.6317 0.0000 1 4 5
194 11.940694 0.100000 1 0.953

```

```

time domain data to be used
minimum maximum time long graphics dump short
time time domain edit edit edit edit
step (s) step (s) end (s) step (s) step (s) step (s) step (s)
1.000E-03 1.000E-01 1.200E+01 1.000E-01 1.000E-01 2.000E-01 1.000E-01
convective energy-error controller is 1.0000E+20 w

```

```

time-step problem time-step outer-it. cpu courant numbers sets location
number time (s) size (s) number time (s) 1-d 3-d flag cmp cell
195 12.040694 0.100000 1 0.966

```

restart dump generated at problem time 12.040694 s after 195 time steps

end of problem

computative timing statistics

cpu time is 9.7800E-01 s

Note: IEEE floating-point exception traps enabled:
overflow; division by zero; invalid operation;
See the Numerical Computation Guide, ieee_handler(3M)

castor:/export/castor1/rgs/trac> mv trc0ut test7out

castor:/export/castor1/rgs/trac> tedi test7out
test7out 1330 Lines

```
*tp*/ outlet mass flow bc
344
349 component number 2, type = fill outlet mass flow bc 22222
629 4 outlet mass flow bc 2
787 4 outlet mass flow bc 2
951 4 outlet mass flow bc 2
1127 4 outlet mass flow bc 2
1291 4 outlet mass flow bc 2
*t349,8
349 component number 2, type = fill id = 2, ctitle = outlet mass flow bc
350 junl = 2, ifty = 2, ioff = 0
351 twtold = 0.0000E+00, rfmxm = 0.0000E+00, concin = 0.0000E+00, felv = 0.0000E+00
352 kg/s2
353 dxin = 1.0000E-01, volin = 1.0000E-01, alpin = 1.0000E+00, vlin = -2.7778E+00, tlin = 4.0000E+02
354 m m/s k
355 pin = 1.0000E+05, pain = 0.0000E+00, flowin = -1.0000E+00, vvlin = -2.7778E+00, tvlin = 4.0000E+02
356 pa kg/s m/s k
357
*t629,10
629 4 outlet mass flow bc 2
630 4 22222
631
632
633 the component type is a fill, component number is 2, and junction number is 2
634
635 ncd-gas
636 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
637 cell pa pa k k k kg/m3 kg/m3 m/s m/s -
638 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.778E+00 -2.778E+00 0.000E+00
639 2 -2.778E+00 -2.778E+00 0.000E+00
*t787,10
787 4 outlet mass flow bc 2
788 4 22222
789
790
791 the component type is a fill, component number is 2, and junction number is 2
792
793 ncd-gas
794 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
795 cell pa pa k k k kg/m3 kg/m3 m/s m/s -
796 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
797 2 -2.314E+00 -2.314E+00 0.000E+00
*t951,10
951 4 outlet mass flow bc 2
952 4 22222
953
954
955 the component type is a fill, component number is 2, and junction number is 2
956
957 ncd-gas
958 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
959 cell pa pa k k k kg/m3 kg/m3 m/s m/s -
960 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
961 2 -2.314E+00 -2.314E+00 0.000E+00
*t1127,10
1127 4 outlet mass flow bc 2
1128 4 22222
1129
1130
1131 the component type is a fill, component number is 2, and junction number is 2
1132
1133 ncd-gas
1134 pressure pressure void fr. temp.sat. temp.liq. temp.gas den.liq. den.vap. vel.liq. vel.gas wf.liq.
1135 cell pa pa k k k kg/m3 kg/m3 m/s m/s -
1136 1 1.00000E+05 0.00000E+00 1.000E+00 3.730E+02 4.000E+02 4.000E+02 9.373E+02 5.412E-01 -2.314E+00 -2.314E+00 0.000E+00
1137 2 -2.314E+00 -2.314E+00 0.000E+00
```