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K-FIX: A Computer Program for Transient, Two-Dimensional, Two-Fluid Flow

THREED: An Extension of the K-FIX Code for Three-Dimensional Calculations

University of California

LOS ALAMOS SCIENTIFIC LABORATORY
Post Office Box 1663 Los Alamos, New Mexico 87545

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W. C. Rivard
M. D. Torrey

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by

W. C. Rivard and M. D. Torrey

ABSTRACT

The transient, two-dimensional, two-fluid code K-FIX has been extended to perform three-dimensional calculations. This capability is achieved by adding five modification sets of FORTRAN statements to the basic two-dimensional code. The modifications are listed and described, and a complete listing of the three-dimensional code is provided. Results of an example problem are provided for verification.

I. INTRODUCTION

Analysis of two-phase flow dynamics in reactor safety applications often requires three-dimensional calculations. Examples of such applications are blowdowns into the drywell containment or suppression pool and the asymmetric dynamics in the reactor vessel itself.[1] Also, three-dimensional calculations often provide a foundation for the development of lower dimensional models (see Ref. 1 for example). To obtain a three-dimensional computational capability, we have extended the transient, two-dimensional, two-fluid code K-FIX[2] within the framework of the UPDATE system. FORTRAN statements are added and deleted within the basic two-dimensional code so that users already familier with K-FIX will not have to learn a new code.

With the three-dimensional code, referred to as K-FIX(3D), calculations in Cartesian and cylindrical geometries can be performed. Obstacles built from the computing cells can be specified within the computing volume. In cylindrical geometry, calculations can be performed in the full 360° or any angular segment. To enhance the computing efficiency, we implemented a new cell indexing scheme that reduces the time required to determine neighboring cell indexes by a factor of 5 and the overall computing time by about 15%. To reduce computing time further, the viscous stress and heat conduction terms are deleted from the momentum and energy equations. To facilitate implementation of the three-dimensional update, modifications for writing and plotting of data on film are segregated from the other changes. Section II describes the five categories of modifications. (1) Changes that relate directly to the field equations. (2) Changes that relate to input and printed output. (3) Changes that relate to the new indexing procedure. (4) Changes that relate to removal of viscous and heat conduction terms. (5) Changes that relate

to writing and plotting of data on film. Detailed modifications for each category are listed in Sec. III. UPDATE system notations are used where *INSERT, KFIXCC.# means to insert the following statements after statement KFIXCC.#; *DELETE, KFIXCC.# means to delete statement KFIXCC.#; and *BEFORE, KFIXCC.# means to insert the following statements before statement KFIXCC.#. The KFIXCC statements refer to those in the basic two-dimensional code listed in Ref. 2. A simple example problem for verification is given in Sec. IV, and a complete listing of K-FIX(3D) is given in the Appendix.

II. MODIFICATIONS TO THE BASIC CODE

A. Changes to the Field Equations

Modifications to the basic K-FIX code that relate to changes in the field equations are described first. To conserve space, we frequently reference the equations in the K-FIX report (Ref. 2) rather than repeat them. The two-dimensional K-FIX code operates in the Cartesian (x,y) and axisymmetric cylindrical (r,z) coordinate systems. The three-dimensional code adds the Z-direction to the Cartesian system and the azimuthal (ϕ)-direction to the cylindrical system. Computational cells are distinguished along the x- or r-axis by subscript i, along the y- or z-axis by subscript j, and along the Z- or ϕ-axis by subscript k. The velocity components w_ℓ and w_g for the liquid and gas fields in the Z- or ϕ-directions are centered on the cell face perpendicular to the Z- or ϕ-directions, similar to the locations of the u and v components (see Fig. 1). There are no new quantities located at the cell center.

To the right side of the gas continuity equation, Eq. (3.1), is added the aximuthal flux term

$$\delta t \left[- < (\rho_g')^{n+1} \, w_g^{n+1} >_{i,j,k} / (r_i \delta\phi) \right],$$

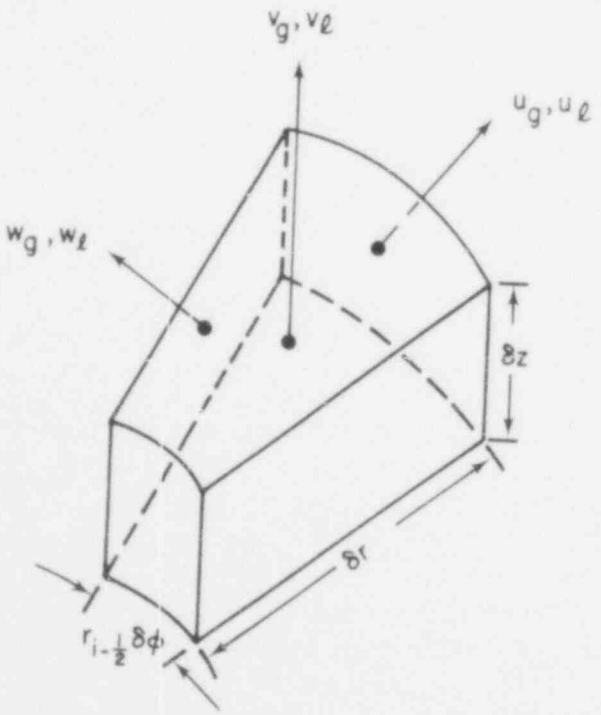

Fig. 1.
Locations of velocity components for a typical cell in cylindrical geometry.

which is evaluated in subroutines MASFG and THGAS. Similarly, to the right side of the liquid continuity equation, Eq. (3.5), is added

$$\delta t \left[- < (\rho_\ell')^{n+1} \; w_\ell^{n+1} >_{i,j,k} / (r_i \delta\phi) \right] ,$$

which is evaluated in subroutine MASFL. The radial and axial momentum equations are modified to account for azimuthal fluxes of radial and axial momentum and centrifugal acceleration by adding the following right-side terms to Eqs. (3.9)-(3.12), respectively,

$$\delta t \left[- < (\rho_g')^n \; u_g^n \; w_g^n > / \delta\phi + (\rho_g')^n \; (w_g^n)^2 \right]_{i+\frac{1}{2},j,k} / r_{i+\frac{1}{2}} ,$$

$$\delta t \left[- < (\rho_g')^n \; v_g^n \; w_g^n >_{i,j+\frac{1}{2},k} / r_i \delta\phi \right] ,$$

$$\delta t \left[- < (\rho_\ell')^n \; u_\ell^n \; w_\ell^n > / \delta\phi + (\rho_\ell')^n \; (w_\ell^n)^2 \right]_{i+\frac{1}{2},j,k} / r_{i+\frac{1}{2}} ,$$

and

$$\delta t \left[- < (\rho_\ell')^n \; v_\ell^n \; w_\ell^n >_{i,j+\frac{1}{2},k} / r_i \delta\phi \right] .$$

The momentum flux terms for the gas field are evaluated in subroutines UGMØMF and VGMØMF, whereas those for the liquid field are evaluated in subroutines ULMØMF and VLMØMF. The centrifugal acceleration terms are evaluated in subroutine TILDE for both fields. The azimuthal momentum equations for each phase are evaluated in subroutine VELS as

$$(\rho_g' w_g)^{n+1}_{i,j,k+\frac{1}{2}} = (\tilde{\rho_g' w_g})_{i,j,k+\frac{1}{2}} + \delta t \left\{ - \theta^{n+1}_{i,j,k+\frac{1}{2}} \left(p^{n+1}_{i,j,k+1} - p^{n+1}_{i,j,k} \right) / r_i \delta\phi \right.$$

$$+ K^n_{i,j,k+\frac{1}{2}} \left[(w_\ell)^{n+1}_{i,j,k+\frac{1}{2}} - (w_g)^{n+1}_{i,j,k+\frac{1}{2}} \right]$$

$$\left. + (\bar{J}_e)_{i,j,k+\frac{1}{2}} \; (w_\ell)^{n+1}_{i,j,k+\frac{1}{2}} - (\bar{J}_c)_{i,j,k+\frac{1}{2}} \; (w_g)^{n+1}_{i,j,k+\frac{1}{2}} \right\} ,$$

and

$$(\rho_\ell' w_\ell)^{n+1}_{i,j,k+\frac{1}{2}} = (\tilde{\rho_\ell' w_\ell})_{i,j,k+\frac{1}{2}} + \delta t \left\{ - \left(1 - \theta^{n+1}_{i,j,k+\frac{1}{2}} \right) \left(p^{n+1}_{i,j,k+1} \right. \right.$$

$$\left. - p^{n+1}_{i,j,k} \right) / r_i \delta\phi + K^n_{i,j,k+\frac{1}{2}} \left[(w_g)^{n+1}_{i,j,k+\frac{1}{2}} - (w_\ell)^{n+1}_{i,j,k+\frac{1}{2}} \right]$$

$$\left. - (\bar{J}_e)_{i,j,k+\frac{1}{2}} \; (w_\ell)^{n+1}_{i,j,k+\frac{1}{2}} + (\bar{J}_c)_{i,j,k+\frac{1}{2}} \; (w_g)^{n+1}_{i,j,k+\frac{1}{2}} \right\} .$$

The momentum density quantities denoted by a tilde account for momentum convection and Coriolis effects. The viscous stress effects are omitted from the three-dimensional code, although they could be included easily if necessary. The tilde momentum densities are calculated in subroutine TILDE as

$$(\rho_g' w_g)^{\sim}_{i,j,k+\frac{1}{2}} = (\rho_g' w_g)^n_{i,j,k+\frac{1}{2}} + \delta t \left\{ - < (\rho_g')^n u_g^n w_g^n r >_{i,j,k+\frac{1}{2}} / (r_i \delta r) \right.$$

$$- < (\rho_g')^n v_g^n w_g^n >_{i,j,k+\frac{1}{2}} / \delta z - < (\rho_g')^n w_g^n w_g^n >_{i,j,k+\frac{1}{2}} / (r_i \delta \phi)$$

$$\left. - \left[(\rho_g')^n u_g^n w_g^n \right]_{i,j,k+\frac{1}{2}} / r_i \right\} ,$$

and

$$(\rho_\ell' w_\ell)^{\sim}_{i,j,k+\frac{1}{2}} = (\rho_\ell' w_\ell)^n_{i,j,k+\frac{1}{2}} + \delta t \left\{ - < (\rho_\ell')^n u_\ell^n w_\ell^n r >_{i,j,k+\frac{1}{2}} / (r_i \delta r) \right.$$

$$- < (\rho_\ell')^n v_\ell^n w_\ell^n >_{i,j,k+\frac{1}{2}} / \delta z - < (\rho_\ell')^n w_\ell^n w_\ell^n >_{i,j,k+\frac{1}{2}} / (r_i \delta \phi)$$

$$\left. - \left[(\rho_\ell')^n u_\ell^n w_\ell^n \right]_{i,j,k+\frac{1}{2}} / r_i \right\} .$$

The momentum flux terms are calculated in two new subroutines WGMØMF and WLMØMF for the gas and liquid fields, respectively. During the pressure iteration the specific internal energies are updated for each field in subroutine IGIL to account for the rate effects of mass, momentum, and energy exchange. The relative velocity of the fields, which is needed to evaluate the frictional heating, is calculated in subroutine VRELS and includes the effect of the azimuthal velocity component. This is the only modification required in Eqs. (3.23) and (3.24). The final calculation of specific internal energies in subroutine ICØNV requires modifications to Eqs.(3.33) and (3.34) to account for the azimuthal flux of energy densities and the azimuthal contribution to the pressure work term. The heat conduction and viscous work terms are deleted from the three-dimensional version as were the viscous stress terms in the momentum equations. Terms added to the right side of Eq. (3.33) are

$$- [\delta t / (r_i \delta \phi)] \left\{ < (\rho_g')^{n+1} I_g^n w_g^{n+1} >_{i,j,k} + p^{n+1}_{i,j,k} < \theta^{n+1} w_g^{n+1} >_{i,j,k} \right\} .$$

Terms added to the right side of Eq. (3.34) are

$$- [\delta t / (r_i \delta \phi)] \left\{ < (\rho_\ell')^{n+1} I_\ell^n w_\ell^{n+1} >_{i,j,k} \right.$$

$$\left. + p^{n+1}_{i,j,k} < \left(1 - \theta^{n+1}\right) w_\ell^{n+1} >_{i,j,k} \right\} .$$

The azimuthal energy density flux terms are evaluated in subroutines SIEGF and SIELF for the gas and liquid fields, respectively. The void fraction fluxes for the pressure work terms are evaluated in subroutine THF.

This completes the changes to the field equations required to extend the basic code to three dimensions. In Cartesian coordinates the cell dimension $r_i \delta\phi$ is identified as δZ. Flow across the axis in cylindrical coordinates is treated as flow around a rigid tube of radius $\simeq \delta r/2$ for radial flux evaluation of radial momentum. Evaluation of mass and energy flux for flow across the axis is handled correctly by the basic algorithm. The flow perturbation associated with the momentum flux treatment can be diminished by increasing the radial resolution, that is, by reducing δr. Figure 2 shows the results of calculations for $\delta r = 1.0$ and 0.5 cm for a single-phase, incompressible liquid flow in an axial plane where the fluid enters from the left side with constant velocity and leaves on the right side. The velocity vectors originate at the cell centers. The innermost ring of vectors shows the flow deflection around the axis tube. The next ring of vectors shows a more parallel flow for $\delta r = 0.5$ cm.

To improve the convergence of the pressure iteration, we modified the analytic estimate of dD/dp, evaluated in subroutine BETAS, to account for the azimuthal dependence in the continuity equations. The right side of Eq. (3.21) includes the term

$$(\delta t/r_i \delta\phi)^2 \left(2 + \theta^n_{i,j,k} (\rho_\ell)^n_{i,j,k} \left\{ \theta^n_{i,j,k+\frac{1}{2}} \Big/ \left[(\rho'_\ell)^n_{i,j,k+\frac{1}{2}} + \delta t \, K^n_{i,j,k+\frac{1}{2}} \right] + \theta^n_{i,j,k-\frac{1}{2}} \Big/ \left[(\rho'_g)^n_{i,j,k-\frac{1}{2}} + \delta t \, K^n_{i,j,k-\frac{1}{2}} \right] \right\} \right),$$

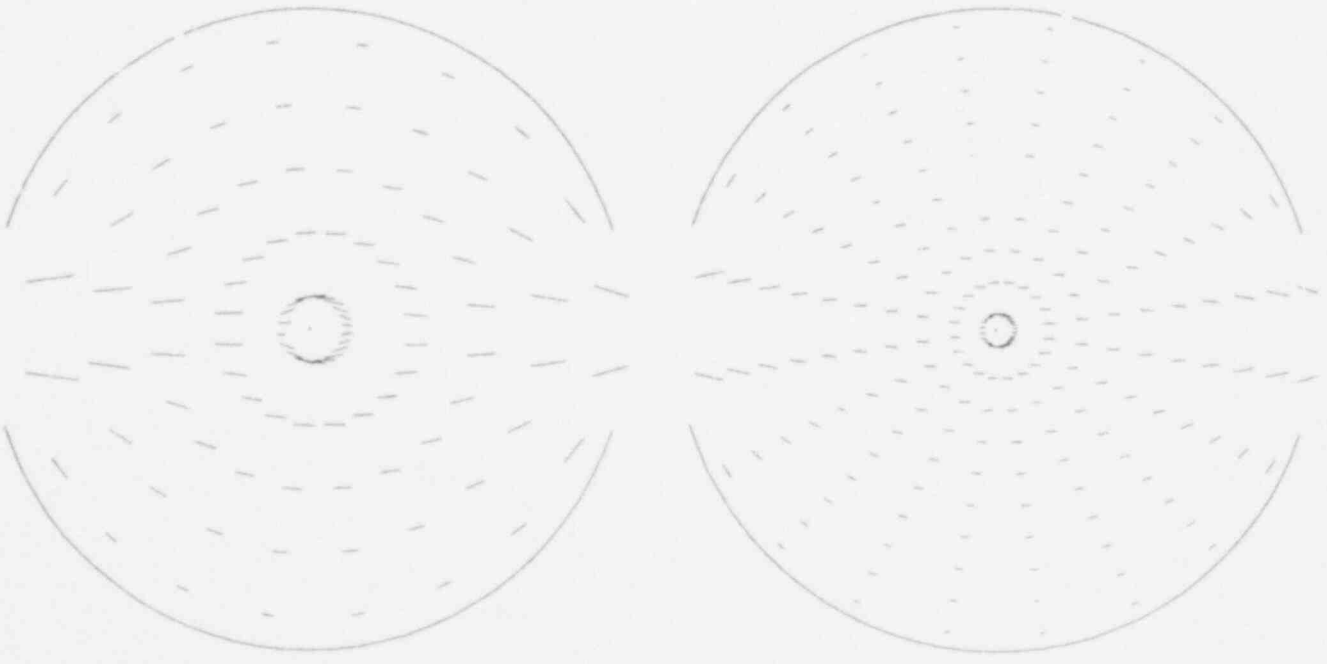

Fig. 2.
Flow of an incompressible liquid in the r,ϕ plane for δr = 1.0 cm (left) and δr = 0.5 cm (right). The flow enters from the left side and leaves on the right side. Results show the diminished effect of the axis tube treatment for flow across the axis as δr is reduced by a factor of 2.

and the right side of Eq. (3.22) includes the term

$$1/2 \left\{ (\delta t/r_i \delta\phi)^2 \left[\left(\theta^n_{i,j,k} + \theta^n_{i,j,k+1} \right) + \left(\theta^n_{i,j,k} + \theta^n_{i,j,k-1} \right) \right] \right\} .$$

B. Changes to Input and Output

Input data specifications that are different from those given for the basic two-dimensional code are described by card. To retain the card numbers referred to in Ref. 2, new cards that follow card No. N are denoted as Na-z. Replacement cards are denoted by the number of the card being replaced. Whereas the two-dimensional code nominally requires 20 input data cards, the three-dimensional code nominally requires 38.

Card No. 1. IB2, JB2, KB2, MTYPE (Format 4I12)

IB2 = number of cells in the radial direction, including two fictitious columns at the right and left boundaries.

JB2 = number of cells in the axial direction, including two fictitious rows at the top and bottom boundaries.

KB2 = number of cells in the azimuthal direction, including two fictitious columns at the fore and aft boundaries.

MTYPE = indicator for specifying the storage device on which the cell data blocks are to be assigned; for example, MTYPE = 0 for SCM and MTYPE = 1 for LCM.

Card No. 7. ITC, DR, DZ, DPH (Format I12, 3F12.4)

ITC = 2 for one-dimensional spherical coordinates.
= 1 for cylindrical coordinates.
= 0 for Cartesian coordinates.

DR = $\delta r(\delta x)$, the cell dimension in the radial direction.

DZ = $\delta z(\delta y)$, the cell dimension in the axial direction.

DPH = $\delta\phi(\phi Z)$, the cell dimension in the aximuthal direction.

Card No. 8a. (FLØA(M), M = 1,16) (Format 4F12.4)

FLØA(M) = azimuthal coordinates of the flow openings along the bottom, left, top, and right computing mesh boundaries, respectively. Coordinates of the openings must be integral multiples of $\delta\phi(\delta Z)$. The azimuthal extension of each opening is defined by two coordinates, the first of which is the smaller. For example, the first opening on the bottom boundary of the computing mesh is described by its inner and outer radial coordinates, FLØ(1) and FLØ(2), and its smaller and larger azimuthal coordinates, FLØA(1) and FLØA(2). Note that flow openings are not permitted in azimuthal planes. Specifications of flow openings are printed with the input data in the following format.

Inflow Openings

Bottom	FLØ(1)	FLØ(2)	FLØ(3)	FLØ(4)
	FLØA(1)	FLØA(2)	FLØA(3)	FLØA(4)
Left	FLØ(5)	FLØ(6)	FLØ(7)	FLØ(8)
	FLØA(5)	FLØA(6)	FLØA(7)	FLØA(8)

Outflow Openings

Top	FLØ(9)	FLØ(10)	FLØ(11)	FLØ(12)
	FLØA(9)	FLØA(10)	FLØA(11)	FLØA(12)
Right	FLØ(13)	FLØ(14)	FLØ(15)	FLØ(16)
	FLØA(13)	FLØA(14)	FLØA(15)	FLØA(16)

Card No. 9. (NSL(M), M = 1,6) (Format 4I12)

NSL(M) = free-slip or no-slip boundary condition flag for rigid walls around the computing mesh perimeter. Values of 0 for free slip or 1 for no slip are assigned to the bottom, left, top, right, fore, and aft boundaries, in that order. The assigned values are ignored across inflow or outflow openings.

Card No. 11a. (ØB(M,N), M = 5,6) (Format 2F12.4)

ØB(5,N) = azimuthal coordinate of the fore side (smaller angle) of the obstacle.

ØB(6,N) = azimuthal coordinate of the aft side (larger angle) of the obstacle.

Card No. 11b. GRAV (Format F12.4)

GRAV = gravitational acceleration in the axial z(y)-direction.

Card No. 12. UØ, VØ, WØ, PØ, THØ, TEMPØ (Format 6F12.4)

This card specifies the uniform initial data used to begin the calculation. Nonuniform initial values may be specified by modifying the subroutine SETUP.

UØ = initial radial velocity of the liquid and gas.

VØ = initial axial velocity of the liquid and gas.

WØ = initial azimuthal velocity of the liquid and gas.

PØ = initial pressure.

THØ = initial void fraction.

TEMPØ = initial temperature of the liquid and gas.

Card No. 13. UINL, VINL, WINL, PINL, THINL, TEMPINL (Format 6F12.4)

UINL = radial velocity of the liquid and gas entering the left inflow opening along the bottom computing mesh boundary.

VINL = axial velocity of the liquid and gas entering the same opening.

WINL = azimuthal velocity of the liquid and gas entering the same opening.

PINL = pressure of the incoming fluid.

THINL = void fraction.

TEMPINL = temperature of the inflowing liquid and gas.

Card No. 14. UINR, VINR, WINR, PINR, THINR, TEMPINR (Format 6F12.4)

UINR = radial velocity of the liquid and gas entering the right inflow opening along the bottom computing mesh boundary.

VINR = axial velocity of the liquid and gas entering the same opening.

WINR = azimuthal velocity of the liquid and gas entering the same opening.

PINR = pressure of the incoming fluid.

THINR = void fraction.

TEMPINR = temperature of the inflowing liquid and gas.

Card No. 15. UINB, VINB, WINB, PINB, THINB, TEMPINB (Format 6F12.4)

UINB = radial velocity of the liquid and gas entering the bottom (lower) inflow opening along the left computing mesh boundary.

VINB = axial velocity of the liquid and gas entering the same opening.

WINB = azimuthal velocity of the liquid and gas entering the same opening.

PINB = pressure of the incoming fluid.

THINB = void fraction.

TEMPINB = temperature of the inflowing liquid and gas.

Card No. 16. UINT, VINT, WINT, PINT, THINT, TEMPINT (Format 6F12.4)

UINT = radial velocity of the liquid and gas entering the top (upper) inflow opening along the left computing mesh boundary.

VINT = axial velocity of the liquid and gas entering the same opening.

WINT = azimuthal velocity of the liquid and gas entering the same opening.

PINT = pressure of the incoming fluid.

THINT = void fraction.

TEMPINT = temperature of the inflowing liquid and gas.

Card No. 20. IP1, IP2, JP1, JP2, KP1, KP2 (Format 6I12)

This card defines the three-dimensional region for printing data. When blank, the entire computing region I = 1,IB2, J = 1,JB2,and K = 1,KB2 is used.

IP1 = starting value of I for printing data.

IP2 = final value of I for printing data.

JP1 = starting value of J for printing data.

JP2 = final value of J for printing data.

KP1 = starting value of K for printing data.

KP2 = final value of K for printing data.

Card Nos. 20a-e. [(IJPLØT(L,M), L = 1,12), M = 1,5] (Format 12I6)

IJPLØT(L,M) is the plot control parameter for plots in the (r,z) plane for a constant azimuthal coordinate specified through the cell index K. IJPLØT(1,M) contains the desired value of K. If K > 0, velocity vector plots are made for the gas, liquid, and mixture. If K = 0, no plots are made. Five azimuthal planes can be specified. When a contour plot is desired, IJPLØT(L,M) = 1; otherwise, IJPLØT(L,M) = 0. Contour plots can be obtained for the following quantities.

IJPLØT(2,M) = gas macroscopic density, ρ'_g.

(3,M) = liquid macroscopic density, ρ'_ℓ.

(4,M) = void fraction, θ.

(5,M) = pressure, p.

(6,M) = gas temperature, T_g.

(7,M) = liquid temperature, T_ℓ.

(8,M) = saturation temperature, T_s.

(9,M) = gas specific internal energy, I_g.

(10,M) = liquid specific internal energy, I_ℓ.

(11,M) = mass exchange rate, $(J_e - J_c)$.

(12,M) = momentum exchange rate, K.

Card Nos. 20f-j. [(IKPLØT(L,M), L = 1,12), M = 1,5] (Format 12I6)

IKPLØT(L,M) is the plot control parameter for plots in the (r,ϕ) plane for a constant axial coordinate specified through the cell index J. IKPLØT(1,M) contains the desired value of J. If J > 0, velocity vector plots are made for the gas, liquid, and mixture. If J = 0, no plots are made. Five axial planes can be specified. When a contour plot is desired, IKPLØT(L,M) = 1; otherwise, IKPLØT (L,M) = 0. Contour plots in the (r,ϕ) plane can be obtained for the same quantities as in the (r,z) plane.

Card Nos. 20k-o. [(JKPLØT(L,M), L = 1,12), M = 1,5] (Format 12I6)

JKPLØT(L,M) is the plot control parameter for plots in the (z,ϕ) plane for a constant radial coordinate specified through the cell index I. JKPLØT(1,M) contains the desired value of I. If I > 0, velocity vector plots are made for the gas, liquid, and mixture. If I = 0, no plots are made. Five radial planes can be specified. When a contour plot is desired, JKPLØT(L,M) = 1; otherwise, JKPLØT(L,M) = 0. Contour plots in the (z,ϕ) plane can be obtained for the same quantities as in the (r,z) plane.

The only modification to the printed data output is to include the azimuthal velocity components for the liquid and gas fields.

C. Improved Procedure for Determination of Neighboring Cell Indexes

The basic two-dimensional code solves a set of two-fluid equations with transport effects. The complete finite difference equations given in Ref. 2 for cell (i,j) contain numerous references to variables in neighboring cells. These references require no special consideration in the solution algorithm if the neighboring cells are all fluid cells. However, if one of the neighboring cells is an obstacle cell, no values exist for that cell because none have been computed. Subroutine BDRY sets values for the tangential velocity components based on the free-slip or no-slip specification, but it does not set values for centered quantities because they cannot be uniquely specified in many geometries. To obtain values for centered quantities in an obstacle cell, values in an appropriate nearby fluid cell are used. Figure 3 shows the fluid and solid regions around an obstacle corner cell. Calculation of viscous stress terms in Eq. (3.10) requires the value of θ at points A and B, and in Eq. (3.9), the value of θ at point C. To obtain values at these points, values in the surrounding four cells are averaged, and in each case cell i+1,j is involved. The value assigned to $\theta_{i+1,j}$ is different in each case; for point A, $\theta_{i+1,j} \equiv \theta_{i,j}$; for point B, $\theta_{i+1,j} \equiv \theta_{i,j+1}$; and for point C, $\theta_{i+1,j} \equiv \theta_{i+1,j+1}$. These assignments are made in subroutine INDEX by setting the value of the index (i+1,j) to be (i,j), (i,j+1), and (i+1,j+1), respectively.

The logic by which neighboring cell indexes are assigned values is based on geometric considerations only and, thus, can be done only once at setup time. The basic code does not take advantage of this fact, but rather goes through the necessary logic several times each cycle. Although this is a minor inefficiency for two-dimensional calculations, this is not the case for three-dimensional calculations. The new procedure developed for use with the THREED update determines neighboring cell indexes five times faster than is possible with a natural extension of the basic code logic. This typically results in a 15% decrease in computer time.

The new procedure adds or subtracts increments to a fluid cell index (i,j,k) in a revised subroutine INDEX. The increments are computed at setup time in the new subroutine SETIND and stored in columns in matrix MFL. Subroutine SETIND is the three-dimensional counterpart of

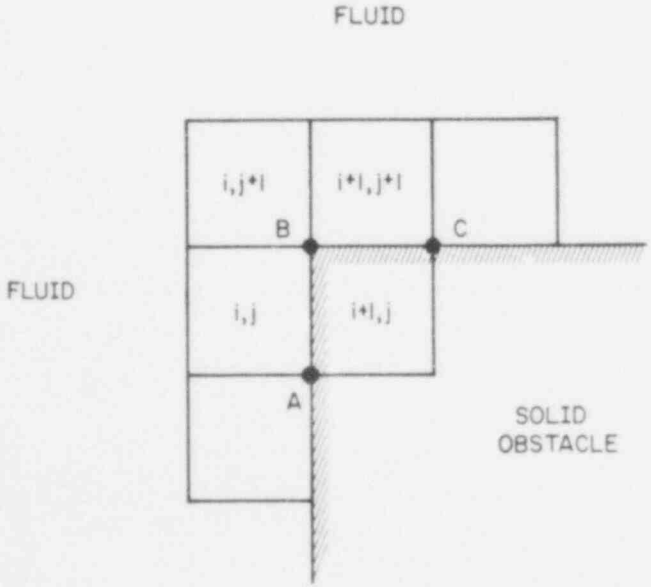

Fig. 3.
Fluid and solid regions around an obstacle corner cell.

the logic in the basic code's subroutine INDEX. The number of columns in MFL is at most equal to the number of fluid cells, and the length of the columns (number of rows) is equal to the number of neighboring cells whose indexes we wish to define. For three-dimensional calculations, the number of neighboring cells is 18. Because many cells have neighbors whose indexes differ from (i,j,k) by the same increments, the number of columns in the matrix MFL can be substantially less than the number of fluid cells. To know which column of increments to use with cell (i,j,k), the column number for each cell is stored in matrix LFL. The integers stored in the LFL and MFL matrices are printed as part of the standard input data.

D. Deletion of Transport Terms

Deletion of the viscous stress, viscous work, and single-phase heat conduction terms from the basic code enhances the computational efficiency. For many applications, the effects of these terms are unimportant and, in fact, increase the computational effort significantly. For problems in which viscosity and heat conduction are important, this modification, identified as INVIS, should be omitted. Omission of this modification will restore the two-dimensional viscous and heat conduction terms, and the appropriate three-dimensional terms can then be added in a straightforward manner. The modification set INVIS also can be used with the basic code to simplify two-dimensional calculations, if desired. This modification, which deletes subroutines HEATCG, HEATCL, IGVS, ILVS, UGVS, ULVS, VGVS, VLVS, VWØRKG, and VWØRKL and all references to them, removes 262 FORTRAN statements, which represent 10% of the basic code.

E. Modifications to Film Plotting and Printing

Modifications to the basic code's routines to provide for plotting and printing of the three-dimensional data on film are noted collectively by the identifier FILM. No detailed discussion of these modifications is given because they involve only straightforward, but logically complex, extensions of the two-dimensional routines. Also, these routines often are not appropriate for direct use at installations other than the Los Alamos Scientific Laboratory. If film output capabilities are not desired, this modification set can be omitted. In addition, the input data cards 20a-o and their corresponding READ and WRITE statements can be omitted. The READ and WRITE statements are included in the modification set INØUT and denoted specifically as *DELETE, KFIXCC.40 and *DELETE, KFIXCC.71.

III. LISTING OF MODIFICATIONS

The FORTRAN statements for the five modification sets follow their identifying titles THREED, INØUT, INDEX, INVIS, and FILM, respectively. The statements are listed in accord with standard UPDATE notations for insertions and deletions. Statement numbers referred to as KFIXCC are as given in the basic K-FIX code.[2]

```
*IDENT THREED
*I,KFIXCC.80
      KB=KB2-2                                                    THREED     1
      KB1=KB2-1                                                   THREED     2
      IB2XJB2=IB2*JB2                                             THREED     3
*D,KFIXCC.159,161
      CALL START(1)                                               THREED     4
      DO 300 K=KS,KL                                              THREED     5
      IJ=IJ+INCK                                                  THREED     6
      DO 300 J=JS,JL                                              THREED     7
      IJ=IJ+INCJ                                                  THREED     8
      DO 300 I=IS,IL                                              THREED     9
      IJ=IJ+1                                                     THREED    10
*D,KFIXCC.180
      L=(N-1)*INCN                                                THREED    11
*B,KFIXCC.187
      IPKP=IJ+1+IB2XJB2                                           THREED    12
      IF(FL(IPKP).GE.4) WG(N2)=WG(N1)                             THREED    13
      IF(FL(IPKP).GE.4) WL(N2)=WL(N1)                             THREED    14
*D,KFIXCC.196
      L=(N-1)*INCN                                                THREED    15
*I,KFIXCC.202
      JPKP=IJ+IB2+IB2XJB2                                         THREED    16
      IF(FL(JPKP).GE.4) WG(N2)=WG(N1)                             THREED    17
      IF(FL(JPKP).GE.4) WL(N2)=WL(N1)                             THREED    18
*I,KFIXCC.209
      WG(IPJ)=WG(IJ)                                              THREED    19
      WL(IPJ)=WL(IJ)                                              THREED    20
*I,KFIXCC.216
      WG(IPJ)=-WG(IJ)                                             THREED    21
      WL(IPJ)=-WL(IJ)                                             THREED    22
*I,KFIXCC.223
      WL(IJP)= WL(IJ)                                             THREED    23
      WG(IJP)= WG(IJ)                                             THREED    24
*I,KFIXCC.230
      WG(IJP)=-WG(IJ)                                             THREED    25
      WL(IJP)=-WL(IJ)                                             THREED    26
*I,KFIXCC.240
      WG(IMJ)= WG(IJ)                                             THREED    27
      WL(IMJ)= WL(IJ)                                             THREED    28
*I,KFIXCC.247
      WG(IMJ)=-WG(IJ)                                             THREED    29
      WL(IMJ)=-WL(IJ)                                             THREED    30
*I,KFIXCC.256
      WG(IJM)= WG(IJ)                                             THREED    31
      WL(IJM)= WL(IJ)                                             THREED    32
*I,KFIXCC.263
      WG(IJM)=-WG(IJ)                                             THREED    33
      WL(IJM)=-WL(IJ)                                             THREED    34
*I,KFIXCC.264
      NFLA=FL(IKP)                                                THREED    35
      NFLAR=FL(IPKP)                                              THREED    36
      IF(NFLA.LT.1) NFLA=1                                        THREED    37
      IF(NFLAR.LT.1) NFLAR=1                                      THREED    38
      GO TO (225,205,215,225,225),NFLA                            THREED    39
  205 GO TO (225,210,210,225,225),NFLAR                           THREED    40
C                                                                 THREED    41
C     FREE SLIP WALL AFT                                          THREED    42
```

```
C                                                                       THREED     43
  210 VG(IKP)=VG(IJ)                                                    THREED     44
      VL(IKP)=VL(IJ)                                                    THREED     45
      UG(IKP)=UG(IJ)                                                    THREED     46
      UL(IKP)=UL(IJ)                                                    THREED     47
      GO TO 225                                                         THREED     48
  215 GO TO (225,220,220,225,225),NFLAR                                 THREED     49
C                                                                       THREED     50
C     NO SLIP WALL AFT                                                  THREED     51
C                                                                       THREED     52
  220 VG(IKP)=-VG(IJ)                                                   THREED     53
      VL(IKP)=-VL(IJ)                                                   THREED     54
      UL(IKP)=-UL(IJ)                                                   THREED     55
      UG(IKP)=-UG(IJ)                                                   THREED     56
  225 NFLF=FL(IKM)                                                      THREED     57
      NFLFR=FL(IPKM)                                                    THREED     58
      IF(NFLF.LT.1) NFLF=1                                              THREED     59
      IF(NFLFR.LT.1) NFLFR=1                                            THREED     60
      GO TO(250,230,240 250,250),NFLF                                   THREED     61
  230 GO TO (250,235,235,250,250),NFLFR                                 THREED     62
C                                                                       THREED     63
C     FREE SLIP WALL FORE                                               THREED     64
C                                                                       THREED     65
  235 VG(IKM)=VG(IJ)                                                    THREED     66
      VL(IKM)=VL(IJ)                                                    THREED     67
      UG(IKM)=UG(IJ)                                                    THREED     68
      UL(IKM)=UL(IJ)                                                    THREED     69
      GO TO 250                                                         THREED     70
  240 GO TO (250,245,245,250,250),NFLFR                                 THREED     71
C                                                                       THREED     72
C     NO SLIP WALL FORE                                                 THREED     73
C                                                                       THREED     74
  245 VG(IKM)=-VG(IJ)                                                   THREED     75
      VL(IKM)=-VL(IJ)                                                   THREED     76
      UG(IKM)=-UG(IJ)                                                   THREED     77
      UL(IKM)=-UL(IJ)                                                   THREED     78
  250 CONTINUE                                                          THREED     79
  300 CONTINUE                                                          THREED     80
*D,KF1XCC.276,278
      CALL START(1)                                                     THREED     81
      DO 10 K=KS,KL                                                     THREED     82
      IJ=IJ+INCK                                                        THREED     83
      DO 10 J=JS,JL                                                     THREED     84
      IJ=IJ+INCJ                                                        THREED     85
      DO 10 I=IS,IL                                                     THREED     86
      IJ=IJ+1                                                           THREED     87
*D,KF1XCC.271
      DIMENSION CS(7)                                                   THREED     88
*I,KF1XCC.284
      AFT=1.                                                            THREED     89
      FORE=1.                                                           THREED     90
*I,KF1XCC.288
      NFLA=FL(IKP)                                                      THREED     91
      IF(NFLA.EQ.0) NFLA=1                                              THREED     92
      NFLF=FL(IKM)                                                      THREED     93
      IF(NFLF.EQ.0) NFLF=1                                              THREED     94
*D,KF1XCC.297
    8 GO TO (13,11,11,13,11),NFLA                                       THREED     95
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   11 AFT=0.                                                                    THREED    96
   13 GO TO (17,15,15,17,15),NFLF                                               THREED    97
   15 FORE=0.                                                                   THREED    98
   17 IF(THSF(IJ).EQ.1) GO TO 9                                                 THREED    99
*I,KFIXCC.301
     3+0.5*((TH(IJ)+TH(IJA))*AFT+(TH(IJ)+TH(IJF))*FORE)*DTORDPH(I)**2           THREED   100
*D,KFIXCC.322,323
   18 CS(6)=0.                                                                  THREED   101
      IF(AFT.LT.0.5) GO TO 20                                                   THREED   102
      CS(6)=1.+CS(1)*(TH(IJ)+TH(IJA))/(RGP(IJ)+RGP(IJA)+DT*(KDRAG(IJ)+         THREED   103
     1 KDRAG(IJA)))                                                            THREED   104
   20 CS(7)=0.                                                                  THREED   105
      IF(FORE.LT.0.5) GO TO 22                                                  THREED   106
      CS(7)=1.+CS(1)*(TH(IJ)+TH(IJF))/(RGP(IJ)+RGP(IJF)+DT*(KDRAG(IJ)+         THREED   107
     1 KDRAG(IJF)))                                                            THREED   108
   22 RBETA=(1.-TH(IJ))*RALS+CS(1)*RAGS/ROG(IJ)+(DTODZ**2)*(CS(2)+CS(3))       THREED   109
     1 +DTORDR(I)*DTODR*(CS(4)+CS(5))+(DTORDPH(I)**2)*(CS(6)+CS(7))             THREED   110
*D,KFIXCC.631
     1 -RLFT(IJM))+DTORDPH(I)*(RLFA(IJ)-RLFA(IKM))+DT*(ERATE(IJ)-               THREED   111
     1 CRATE(IJ))                                                              THREED   112
*D,KFIXCC.663
     1 -RGFT(IJM))+DTORDPH(I)*(RGFA(IJ)-RGFA(IKM))-DT*(ERATE(IJ)-               THREED   113
     1 CRATE(IJ))                                                              THREED   114
*I,KFIXCC.692
      PAX=KB*DPH                                                               THREED   115
      PTS=-.5*DPH                                                              THREED   116
      DO 150 K=1,KB2                                                           THREED   117
      PTE=PTS+DPH*(K-1)                                                        THREED   118
*D,KFIXCC.707
      FL(I,J,K)=1                                                              THREED   119
      IF(PTE.LT.0.) GO TO 2                                                    THREED   120
      IF(PTE.GT.PAX) GO TO 4                                                   THREED   121
*I,KFIXCC.712
C                                                                              THREED   122
C     SET FLAGS FOR THE FORE FACE (K=1)                                        THREED   123
C                                                                              THREED   124
    2 FL(I,J,K)=2                                                              THREED   125
      IF(NSL(5).EQ.1) FL(I,J,K)=3                                              THREED   126
      IF((KB*DPH.GE.6.283185-0.5*DPH).AND.ITC.EQ.1)FL(I,J,K)=0                 THREED   127
      GO TO 150                                                                THREED   128
C                                                                              THREED   129
C     SET FLAGS FOR THE AFT  FACE (K=KB2)                                      THREED   130
C                                                                              THREED   131
    4 FL(I,J,K)=2                                                              THREED   132
      IF(NSL(6).EQ.1) FL(I,J,K)=3                                              THREED   133
      IF((KB*DPH.GE.6.283185-0.5*DPH).AND.ITC.EQ.1)FL(I,J,K)=0                 THREED   134
      GO TO 150                                                                THREED   135
*D,KFIXCC.716,720
   10 IF(YTE.GT.FLO(J2).AND.YTE.LT.FLO(J2+1).AND.PTE.GT.FLOA(J2).AND.          THREED   136
     1 PTE.LT.FLOA(J2+1)) GO TO 18                                             THREED   137
      IF(YTE.GT.FLO(J2+2).AND.YTE.LT.FLO(J2+3).AND.PTE.GT.FLOA(J2+2).AND       THREED   138
     1.PTE.LT.FLOA(J2+3)) GO TO 18                                             THREED   139
*D,KFIXCC.722
      FL(I,J,K)=2                                                              THREED   140
*D,KFIXCC.724
   14 FL(I,J,K)=3                                                              THREED   141
*D,KFIXCC.726
   18 FL(I,J,K)=5                                                              THREED   142
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*D,KFIXCC.731,735
   30 IF(YTE.GT.FLO(J4).AND.YTE.LT.FLO(J4+1).AND.PTE.GT.FLOA(J4).AND.      THREED  143
     1 PTE.LT.FLOA(J4+1)) GO TO 60                                        THREED  144
      IF(YTE.GT.FLO(J4+2).AND.YTE.LT.FLO(J4+3).AND.PTE.GT.FLOA(J4+2).AND  THREED  145
     1.PTE.LT.FLOA(J4+3)) GO TO 60                                        THREED  146
*D,KFIXCC.737
      FL(I,J,K)=2                                                         THREED  147
*D,KFIXCC.739
   50 FL(I,J,K)=3                                                         THREED  148
*D,KFIXCC.741
   60 FL(I,J,K)=4                                                         THREED  149
*D,KFIXCC.746,750
   70 IF(XTE.GT.FLO(J3).AND.XTE.LT.FLO(J3+1).AND.PTE.GT.FLOA(J3).AND.     THREED  150
     1 PTE.LT.FLOA(J3+1)) GO TO 100                                       THREED  151
      IF(XTE.GT.FLO(J3+2).AND.XTE.LT.FLO(J3+3).AND.PTE.GT.FLOA(J3+2).AND  THREED  152
     1.PTE.LT.FLOA(J3+3)) GO TO 100                                       THREED  153
*D,KFIXCC.752
      FL(I,J,K)=2                                                         THREED  154
*D,KFIXCC.754
   90 FL(I,J,K)=3                                                         THREED  155
*D,KFIXCC.756
  100 FL(I,J,K)=4                                                         THREED  156
*D,KFIXCC 761,765
  110 IF(XTE.GT.FLO(J1).AND.XTE.LT.FLO(J1+1).AND.PTE.GT.FLOA(J1).AND.     THREED  157
     1 PTE.LT.FLOA(J1+1)) GO TO 140                                       THREED  158
      IF(XTE.GT.FLO(J1+2).AND.XTE.LT.FLO(J1+3).AND.PTE.GT.FLOA(J1+2).AND  THREED  159
     1.PTE.LT.FLOA(J1+3)) GO TO 140                                       THREED  160
*D,KFIXCC.767
      FL(I,J,K)=2                                                         THREED  161
*D,KFIXCC.769
  130 FL(I,J,K)=3                                                         THREED  162
*D,KFIXCC.771
  140 FL(I,J,K)=5                                                         THREED  163
*D,KFIXCC.773
      DO 160 K=1,KB2                                                      THREED  164
      IF(FL(IB1,JB2,K).EQ.4.AND.FL(IB2,JB1,K).EQ.4) FL(IB2,JB2,K)=4       THREED  165
      IF(FL(IB1,JB2,K).EQ.7.AND.FL(IB2,JB1,K).EQ.7) FL(IB2,JB2,K)=7       THREED  166
  160 CONTINUE                                                            THREED  167
*D,KFIXCC.774
      IF(NO.LE.0) GO TO 400                                               THREED  168
*D,KFIXCC.778,782
      DO 300 L=1,NO                                                       THREED  169
      X1=OB(1,L)                                                          THREED  170
      X2=OB(2,L)                                                          THREED  171
      Y1=OB(3,L)                                                          THREED  172
      Y2=OB(4,L)                                                          THREED  173
      Z1=OB(5,L)                                                          THREED  174
      Z2=OB(6,L)                                                          THREED  175
      PTS=.5*DPH                                                          THREED  176
      DO 290 K=2,KB1                                                      THREED  177
      PTE=PTS+DPH*FLOAT(K-2)                                              THREED  178
*D,KFIXCC.793,796
      IF (PTE.LT.Z1) GO TO 290                                            THREED  179
      IF (PTE.GT.Z2) GO TO 290                                            THREED  180
      FL(I,J,K)=2                                                         THREED  181
      IF(NSO(L).EQ.0) GO TO 290                                           THREED  182
      FL(I,J,K)=3                                                         THREED  183
*D,KFIXCC.952,954
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521 162

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      CALL START(I)                                                    THREED   184
      DO 100 K=KS,KL                                                   THREED   185
      IJ=IJ+INCK                                                       THREED   186
      DO 100 J=JS,JL                                                   THREED   187
      IJ=IJ+INCJ                                                       THREED   188
      DO 100 I=IS,IL                                                   THREED   189
      IJ=IJ+1                                                          THREED   190
*D,KF IXCC.968
      CS(11)=(DTODZ*(OMTFT-OMTFB(I))+DTORDR(I)*(OMTFR-OMTFL)+          THREED   191
     1 DTORDPH(I)*(OMTFA-OMTFF(ICJ)))*P(IJ)                            THREED   192
*D,KF IXCC.971
      CS(12)=DTODZ*(ELFT-ELFB(I))+DTORDR(I)*(ELFR-ELFL)+DTORDPH(I)*    THREED   193
     1 (ELFA-ELFF(ICJ))                                                THREED   194
*D,KF IXCC.976
      CS(7)=(DTODZ*(THFT-THFB(I))+DTORDR(I)*(THFR-THFL)+DTORDPH(I)*    THREED   195
     1 (THFA-THFF(ICJ)))*P(IJ)                                         THREED   196
*D,KF IXCC.979
      CS(8)=DTODZ*(EGFT-EGFB(I))+DTORDR(I)*(EGFR-EGFL)+DTORDPH(I)*     THREED   197
     1 (EGFA-EGFF(ICJ))                                                THREED   198
*I,KF IXCC.996
      EGFF(ICJ)=EGFA                                                   THREED   199
      ELFF(ICJ)=ELFA                                                   THREED   200
      THFF(ICJ)=THFA                                                   THREED   201
      OMTFF(ICJ)=OMTFA                                                 THREED   202
*D,KF IXCC.1131,1133
C     SET LIMITS OF DO LOOPS                                           THREED   203
      CALL START(I)                                                    THREED   204
      DO 102 K=KS,KL                                                   THREED   205
      IJ=IJ+INCK                                                       THREED   206
      DO 101 J=JS,JL                                                   THREED   207
      IJ=IJ+INCJ                                                       THREED   208
      DO 100 I=IS,IL                                                   THREED   209
      IJ=IJ+1                                                          THREED   210
*D,KF IXCC.1192
     1 RLFT(IJM))+DTORDPH(I)*(RLFA(IJ)-RLFA(IKM))-DT*(ERATE(IJ)-       THREED   211
     1 CRATE(IJ))                                                      THREED   212
*D,KF IXCC.1214
     1 RGFT(IJM))+DTORDPH(I)*(RGFA(IJ)-RGFA(IKM))+DT*(ERATE(IJ)-       THREED   213
     1 CRATE(IJ))                                                      THREED   214
*I,KF IXCC.1234
  101 CONTINUE                                                         THREED   215
  102 CONTINUE                                                         THREED   216
*I,KF IXCC.1256
      IF(WG(IKM).GE.0.) RGFA(IKM)=WG(IKM)*RGP(IJF)                     THREED   217
      IF(WG(IKM).LT.0.) RGFA(IKM)=WG(IKM)*RGP(IJ)                      THREED   218
*I,KF IXCC.1263
      IF(WG(IJ).GE.0.) RGFA(IJ)=WG(IJ)*RGP(IJ)                         THREED   219
      IF(WG(IJ).LT.0.) RGFA(IJ)=WG(IJ)*RGP(IJA)                        THREED   220
*I,KF IXCC.1275
      IF(WL(IKM).GE.0.) RLFA(IKM)=WL(IKM)*RLP(IJF)                     THREED   221
      IF(WL(IKM).LT.0.) RLFA(IKM)=WL(IKM)*RLP(IJ)                      THREED   222
*I,KF IXCC.1282
      IF(WL(IJ).GE.0.) RLFA(IJ)=WL(IJ)*RLP(IJ)                         THREED   223
      IF(WL(IJ).LT.0.) RLFA(IJ)=WL(IJ)*RLP(IJA)                        THREED   224
*D,KF IXCC.1316,1318
      CALL START(I)                                                    THREED   225
      DO 10 K=KS,KL                                                    THREED   226
      IJ=IJ+INCK                                                       THREED   227
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      DO 10 J=JS,JL                                                    THREED   228
      IJ=IJ+INCJ                                                       THREED   229
      DO 10 I=IS,IL                                                    THREED   230
      IJ=IJ+1                                                          THREED   231
*I,KFIXCC.1655
      RDPH=1./DPH                                                      THREED   232
      DTODPH=DT*RDPH                                                   THREED   233
*I,KFIXCC.1672
      DTORDPH(I)=DT*RDPH/R(I)                                          THREED   234
      DTORBDP(I)=DT*RDPH/RB(I)                                         THREED   235
*I,KFIXCC.1682
      DTORDPH(I)=DT*RDPH                                               THREED   236
*I,KFIXCC.1695
C                                                                      THREED   237
      DO 80 K=2,KBI                                                    THREED   238
*D,KFIXCC.1698
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                     THREED   239
*I,KFIXCC.1706
      IF(FL(IKP).NE.2.AND.FL(IKP).NE.3) WG(IJ)=WL(IJ)=WO               THREED   240
*D,KFIXCC.1711
      IJ=I+(J-1)*IB2+(K-1)*IB2*JB2                                     THREED   241
*I,KFIXCC.1720
      WG(IJ)=WL(IJ)=0.                                                 THREED   242
*I,KFIXCC.1727
      WG(IJ)=WL(IJ)=0.                                                 THREED   243
*I,KFIXCC.1730
      IJA=IJ+IB2XJB2                                                   THREED   244
*D,KFIXCC.1737
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                     THREED   245
*I,KFIXCC.1746
      WG(IJ)=WL(IJ)=0.                                                 THREED   246
*I,KFIXCC.1754
      WG(IJ)=WL(IJ)=0.                                                 THREED   247
*I,KFIXCC.1757
      IJA=IJ+IB2XJB2                                                   THREED   248
*I,KFIXCC.1762
   80 CONTINUE                                                         THREED   249
*D,KFIXCC.1771
      IKM=IJ-IB2XJB2                                                   THREED   250
*I,KFIXCC.1792
      IF(WG(IJ).GE.0.) EGFA=RGP(IJ)*SIEGN(IJ)*WG(IJ)                   THREED   251
      IF(WG(IJ).LT.0.) EGFA=RGP(IJA)*SIEGN(IJA)*WG(IJ)                 THREED   252
*I,KFIXCC.1794
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                               THREED   253
*I,KFIXCC.1799
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                               THREED   254
*I,KFIXCC.1803
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                               THREED   255
*I,KFIXCC.1809
    3 IF(WG(IKM).GE.0.) EGFF(ICJ)=RGP(IJF)*SIEGN(IJF)*WG(IKM)          THREED   256
      IF(WG(IKM).LT.0.) EGFF(ICJ)=RGP(IJ)*SIEGN(IJ)*WG(IKM)            THREED   257
      RETURN                                                           THREED   258
*I,KFIXCC.1820
      IF(WL(IJ).GE.0.) ELFA=RLP(IJ)*SIELN(IJ)*WL(IJ)                   THREED   259
      IF(WL(IJ).LT.0.) ELFA=RLP(IJA)*SIELN(IJA)*WL(IJ)                 THREED   260
*I,KFIXCC.1822
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                               THREED   261
*I,KFIXCC.1827
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      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED  262
*I,KF!XCC.1831
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED  263
*I,KF!XCC.1837
    3 IF(WL(IKM).GE.0.) ELFF(ICJ)=RLP(IJF)*SIELN(IJF)*WL(IKM)           THREED  264
      IF(WL(IKM).LT.0.) ELFF(ICJ)=RLP(IJ)*SIELN(IJ)*WL(IKM)             THREED  265
      RETURN                                                            THREED  266
*I,KF!XCC.1838
      SUBROUTINE START(N)                                               THREED  267
*CALL GCOM1
*CALL GCOM2
      NTRAN=N                                                           THREED  268
      GO TO (10,20,30,40),NTRAN                                         THREED  269
C                                                                       THREED  270
C     I=2,IB1     J=2,JB1     K=2,KB1                                   THREED  271
C                                                                       THREED  272
   10 IS=2                                                              THREED  273
      IL=IB1                                                            THREED  274
      JS=2                                                              THREED  275
      JL=JB1                                                            THREED  276
      KS=2                                                              THREED  277
      KL=KB1                                                            THREED  278
      GO TO 50                                                          THREED  279
   20 CONTINUE                                                          THREED  280
   30 CONTINUE                                                          THREED  281
   40 CONTINUE                                                          THREED  282
   50 INCJ=IB1-IL+IS                                                    THREED  283
      INCK=(JB1-JL+JS)*IB2                                              THREED  284
      IJ=(KS-1)*IB2XJB2-(JB2-JL)*IB2-(IB2-IL)                           THREED  285
      RETURN                                                            THREED  286
      END                                                               THREED  287
*I,KF!XCC.1894
      IF(WL(IJ).GE.0.) OMTFA=(1.-TH(IJ))*WL(IJ)                         THREED  288
      IF(WL(IJ).LT.0.) OMTFA=(1.-TH(IJA))*WL(IJ)                        THREED  289
      IF(WG(IJ).GE.0.) THFA=TH(IJ)*WG(IJ)                               THREED  290
      IF(WG(IJ).LT.0.) THFA=TH(IJA)*WG(IJ)                              THREED  291
*I,KF!XCC.1898
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED  292
*D,KF!XCC.1904
      IF(FL(IJM).NE.1) GO TO 2                                          THREED  293
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED  294
      RETURN                                                            THREED  295
*I,KF!XCC.1908
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED  296
      RETURN                                                            THREED  297
    3 IF(WL(IKM).GE.0.) OMTFF(ICJ)=(1.-TH(IJF))*WL(IKM)                 THREED  298
      IF(WL(IKM).LT.0.) OMTFF(ICJ)=(1.-TH(IJ))*WL(IKM)                  THREED  299
      IF(WG(IKM).GE.0.) THFF(ICJ)=TH(IJF)*WG(IKM)                       THREED  300
      IF(WG(IKM).LT.0.) THFF(ICJ)=TH(IJ)*WG(IKM)                        THREED  301
*I,KF!XCC.1938
      IF(WG(IJ).GT.0.) CS(2)=CS(2)-DTORDPH(I)*WG(IJ)                    THREED  302
      IF(WG(IJ).LE.0.) CS(1)=CS(1)-DTORDPH(I)*WG(IJ)*RGP(IJA)           THREED  303
      IF(WG(IKM).GT.0.) CS(1)=CS(1)+DTORDPH(I)*WG(IKM)*RGP(IKM)         THREED  304
      IF(WG(IKM).LE.0.) CS(2)=CS(2)+DTORDPH(I)*WG(IKM)                  THREED  305
*D,KF!XCC.1946,1948
      CALL START(1)                                                     THREED  306
      DO 10 K=KS,KL                                                     THREED  307
      IJ=IJ+INCK                                                        THREED  308
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      DO 10 J=JS,JL                                                     THREED   309
      IJ=IJ+INCJ                                                        THREED   310
      DO 10 I=IS,IL                                                     THREED   311
      IJ=IJ+1                                                           THREED   312
*I,KFIXCC.1950
      CS(1)=0.                                                          THREED   313
      CS(2)=0.                                                          THREED   314
      CS(3)=0.                                                          THREED   315
      CS(4)=0.                                                          THREED   316
      IF(ITC.EQ.0) GO TO 5                                              THREED   317
      CS(5)=0.03125*DT*RRB(I)                                           THREED   318
      CS(1)=CS(5)*(RLP(IJ)+RLP(IJR))*(WL(IJ)+WL(IKM)+WL(IPJ)+WL(IPKM))  THREED   319
     1 **2                                                              THREED   320
      CS(2)=CS(5)*(RGP(IJ)+RGP(IJR))*(WG(IJ)+WG(IKM)+WG(IPJ)+WG(IPKM))  THREED   321
     1 **2                                                              THREED   322
      CS(5)=0.125*DT/R(I)                                               THREED   323
      CS(3)=(UL(IJ)+UL(IMJ)+UL(IKP)+UL(IMKP))*(RLP(IJ)+RLP(IKP))*CS(5)  THREED   324
     1 *WL(IJ)                                                          THREED   325
      CS(4)=(UG(IJ)+UG(IMJ)+UG(IKP)+UG(IMKP))*(RGP(IJ)+RGP(IKP))*CS(5)  THREED   326
     1 *WG(IJ)                                                          THREED   327
    5 CONTINUE                                                          THREED   328
*B,KFIXCC.1954
     2  -DTORBDP(I)*(UGFA-UGFF(ICJ)) + CS(2)                           THREED   329
*I,KFIXCC.1955
      UGFF(ICJ)=UGFA                                                    THREED   330
*D,KFIXCC.1958
     1 VGFL)-DTODZ*(VGFT-VGFB(I))-DTORDPH(I)*(VGFA-VGFF(ICJ))           THREED   331
*I,KFIXCC.1960
      VGFF(ICJ)=VGFA                                                    THREED   332
      CALL WGMOMF                                                       THREED   333
      RWG(IJ)=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)-DTORDR(I)*(WGFR-WGFL)-      THREED   334
     1 DTODZ*(WGFT-WGFB(I))-DTORDPH(I)*(WGFA-WGFF(ICJ))-CS(4)           THREED   335
      WGFL=WGFR                                                         THREED   336
      WGFB(I)=WGFT                                                      THREED   337
      WGFF(ICJ)=WGFA                                                    THREED   338
*B,KFIXCC.1964
     2  -DTORBDP(I)*(ULFA-ULFF(ICJ)) + CS(1)                           THREED   339
*I,KFIXCC.1965
      ULFF(ICJ)=ULFA                                                    THREED   340
*D,KFIXCC.1968
     1 VLFL)-DTODZ*(VLFT-VLFB(I))-DTORDPH(I)*(VLFA-VLFF(ICJ))           THREED   341
*I,KFIXCC.1970
      VLFF(ICJ)=VLFA                                                    THREED   342
      CALL WLMOMF                                                       THREED   343
      RWL(IJ)=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)-DTORDR(I)*(WLFR-WLFL)-DTODZ* THREED   344
     1 (WLFT-WLFB(I))-DTORDPH(I)*(WLFA-WLFF(ICJ))-CS(3)                 THREED   345
      WLFL=WLFR                                                         THREED   346
      WLFB(I)=WLFT                                                      THREED   347
      WLFF(ICJ)=WLFA                                                    THREED   348
*D,KFIXCC.1980,1982
      CALL START(1)                                                     THREED   349
      DO 20 K=KS,KL                                                     THREED   350
      IJ=IJ+INCK                                                        THREED   351
      DO 20 J=JS,JL                                                     THREED   352
      IJ=IJ+INCJ                                                        THREED   353
      DO 20 I=IS,IL                                                     THREED   354
      IJ=IJ+1                                                           THREED   355
*D,KFIXCC.2004
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      DIMENSION CS(6)                                                    THREED  356
*I,KFIXCC.2013
      CS(5)=0.5*(WG(IJ)+WG(IPJ))                                         THREED  357
      IF(CS(5).GE.0.) UGFA=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(5)           THREED  358
      IF(CS(5).LT.0.) UGFA=0.5*(RGP(IJA)+RGP(IJAR))*UG(IKP)*CS(5)        THREED  359
*I,KFIXCC.2015
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED  360
*I,KFIXCC.2021
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED  361
*I,KFIXCC.2026
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED  362
*I,KFIXCC.2032
    3 CS(6)=0.5*(WG(IKM)+WG(IPKM))                                       THREED  363
      IF(CS(6).GE.0.) UGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJFR))*UG(IKM)*CS(6)   THREED  364
      IF(CS(6).LT.0.) UGFF(ICJ)=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(6)      THREED  365
      RETURN                                                             THREED  366
*D,KFIXCC.2068
      DIMENSION CS(6)                                                    THREED  367
*I,KFIXCC.2077
      CS(5)=0.5*(WL(IJ)+WL(IPJ))                                         THREED  368
      IF(CS(5).GE.0.) ULFA=0.5*(RLP IJ)+RLP(IJR))*UL(IJ)*CS(5)           THREED  369
      IF(CS(5).LT.0.) ULFA=0.5*(RLF IJA)+RLP(IJAR))*UL(IKP)*CS(5)        THREED  370
*I,KFIXCC.2079
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO ,  3                                 THREED  371
*I,KFIXCC.2085
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED  372
*I,KFIXCC.2090
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED  373
*I,KFIXCC.2096
    3 CS(6)=0.5*(WL(IKM)+WL(IPKM))                                       THREED  374
      IF(CS(6).GE.0.) ULFF(ICJ)=0.5*(RLP(IJF)+RLP(IJFR))*UL(IKM)*CS(6)   THREED  375
      IF(CS(6).LT.0.) ULFF(ICJ)=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(6)      THREED  376
      RETURN                                                             THREED  377
*D,KFIXCC.2132
      DIMENSION CS(24)                                                   THREED  378
*D,KFIXCC.2134
C     CALCULATES (12) VELOCITIES ON THE 6 BOUNDARIES OF THE CELL         THREED  379
*D,KFIXCC.2152
      IF(FLB.EQ.2.OR.FLB.EQ.3.OR.FLB.EQ.5) GO TO 5                       THREED  380
*I,KFIXCC.2155
    5 FLF=FL(IKM)                                                        THREED  381
      IF(FLF.EQ.2.OR.FLF.EQ.3) GO TO 2                                   THREED  382
      THETF=0.5*(TH(IJ)+TH(IJF))                                         THREED  383
      DTKF=0.5*DT*(KDRAG(IJ)+KDRAG(IJF))                                 THREED  384
      DTKEF=DTKF+0.5*DT*(ERATE(IJ)+ERATE(IJF))                           THREED  385
      DTKCF=DTKF+0.5*DT*(CRATE(IJ)+CRATE(IJF))                           THREED  386
      PGRAD=DTORDPH(I)*(P(IJ)-P(IJF))                                    THREED  387
      RLF=0.5*(RLP(IJ)+RLP(IJF))                                         THREED  388
      RGF=0.5*(RGP(IJ)+RGP(IJF))                                         THREED  389
      CS(21)=RWL(IKM)-(1.-THETF)*PGRAD                                   THREED  390
      CS(22)=RWG(IKM)-THETF*PGRAD                                        THREED  391
      CS(23)=RLF+DTKEF                                                   THREED  392
      CS(24)=1.0/(RGF*CS(23)+DTKCF*RLF)                                  THREED  393
      WL(IKM)=(CS(21)*(RGF+DTKCF)+DTKCF*CS(22))*CS(24)                   THREED  394
      WG(IKM)=(CS(22)*CS(23)+DTKEF*CS(21))*CS(24)                        THREED  395
*D,KFIXCC.2185
      IF(FLT.EQ.2.OR.FLT.EQ.3) GO TO 4                                   THREED  396
*I,KFIXCC.2198
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    4 FLA=FL(IKP)                                                          THREED   397
      IF(FLA.EQ.2.OR.FLA.EQ.3) RETURN                                      THREED   398
      THETA=0.5*(TH(IJ)+TH(IJA))                                           THREED   399
      DTKA=0.5*DT*(KDRAG(IJ)+KDRAG(IJA))                                   THREED   400
      DTKEA=DTKA+0.5*DT*(ERATE(IJ)+ERATE(IJA))                             THREED   401
      DTKCA=DTKA+0.5*DT*(CRATE(IJ)+CRATE(IJA))                             THREED   402
      PGRAD=DTORDPH(I)*(P(IJA)-P(IJ))                                      THREED   403
      RLA=0.5*(RLP(IJ)+RLP(IJA))                                           THREED   404
      RGA=0.5*(RGP(IJ)+RGP(IJA))                                           THREED   405
      CS(17)=RWL(IJ)-(1.-THETA)*PGRAD                                      THREED   406
      CS(18)=RWG(IJ)-THETA*PGRAD                                           THREED   407
      CS(19)=RLA+DTKEA                                                     THREED   408
      CS(20)=1.0/(R[illegible] CS(19)+DTKCA*RL/                            THREED   409
      WL(IJ)=(C  17   (RGA+DTKCA)+DTKCA*CS(18))*CS(20)                     THREED   410
      WG(IJ)=(CS(18)*CS(19)+DTKEA*CS(17))*CS(20)                           THREED   411
*D,KFIXCC.2204
      DIMENSION CS(6)                                                      THREED   412
*I,KFIXCC.2213
      CS(5)=0.5*(WG(IJ)+WG(IJP))                                           THREED   413
      IF(CS(5).GE.0.) VGFA=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(5)             THREED   414
      IF(CS(5).LT.0.) VGFA=0.5*(RGP(IJA)+RGP(IJTA))*VG(IKP)*CS(5)          THREED   415
*I,KFIXCC.2215
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   416
*I,KFIXCC.2221
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   417
*I,KFIXCC.2226
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   418
*I,KFIXCC.2232
    3 CS(6)=0.5*(WG(IKM)+WG(JPKM))                                         THREED   419
      IF(CS(6).GE.0.) VGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJTF))*VG(IKM)*CS(6)     THREED   420
      IF(CS(6).LT.0.) VGFF(ICJ)=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(6)        THREED   421
      RETURN                                                               THREED   422
*D,KFIXCC.2272
      DIMENSION CS(6)                                                      THREED   423
*I,KFIXCC.2281
      CS(5)=0.5*(WL(IJ)+WL(IJP))                                           THREED   424
      IF(CS(5).GE.0.) VLFA=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(5)             THREED   425
      IF(CS(5).LT.0.) VLFA=0.5*(RLP(IJA)+RLP(IJTA))*VL(IKP)*CS(5)          THREED   426
*I,KFIXCC.2283
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   427
*I,KFIXCC.2289
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   428
*I,KFIXCC.2294
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                   THREED   429
*I,KFIXCC.2300
    3 CS(6)=0.5*(WL(IKM)+WL(JPKM))                                         THREED   430
      IF(CS(6).GE.0.) VLFF(ICJ)=0.5*(RLP(IJF)+RLP(IJTF))*VL(IKM)*CS(6)     THREED   431
      IF(CS(6).LT.0.) VLFF(ICJ)=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(6)        THREED   432
      RETURN                                                               THREED   433
*D,KFIXCC.2472
      DIMENSION CS(3)                                                      THREED   434
*D,KFIXCC.2475
      CS(3)=0.5*(WG(IJ)+WG(IKM)-WL(IJ)-WL(IKM))                            THREED   435
      VREL=SQRT(CS(1)**2+CS(2)**2+CS(3)**2)                                THREED   436
*I,KFIXCC.2478
C     CS(3)= PHI COMPONENT OF RELATIVE VELOCITY                            THREED   437
*I,KFIXCC.2479
      SUBROUTINE WGMOMF                                                    THREED   438
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*CALL GCOM1
*CALL GCOM2
      DIMENSION CS(6)                                                    THREED   439
      CS(1)=0.5*(WG(IJ)+WG(IKP))                                         THREED   440
      IF(CS(1).GE.0.) WGFA=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(1)           THREED   441
      IF(CS(1).LT.0.) WGFA=0.5*(RGP(IJAA)+RGP(IJA))*WG(IKP)*CS(1)        THREED   442
      CS(2)=0.5*(VG(IJ)+VG(IKP))                                         THREED   443
      IF(CS(2).GE.0.) WGFT=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(2)           THREED   444
      IF(CS(2).LT.0.) WGFT=0.5*(RGP(IJT)+RGP(IJTA))*WG(IJP)*CS(2)        THREED   445
      CS(3)=0.5*(UG(IJ)+UG(IKP))                                         THREED   446
      IF(CS(3).GE.0.) WGFR=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(3)*RB(I)     THREED   447
      IF(CS(3).LT.0.) WGFR=0.5*(RGP(IJR)+RGP(IJAR))*WG(IPJ)*CS(3)*RB(I)  THREED   448
      IF(FL(IMJ).NE.1) GO TO 1                                           THREED   449
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   450
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   451
      RETURN                                                             THREED   452
    1 CS(4)=0.5*(UG(IMJ)+UG(IMKP))                                       THREED   453
      IF(CS(4).GE.0.)WGFL=0.5*(RGP(IJL)+RGP(IJAL))*WG(IMJ)*CS(4)*RB(I-1) THREED   454
      IF(CS(4).LT.0.)WGFL=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(4)*RB(I-1)    THREED   455
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   456
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   457
      RETURN                                                             THREED   458
    2 CS(5)=0.5*(VG(IJM)+VG(JMKP))                                       THREED   459
      IF(CS(5).GE.0.) WGFB(I)=0.5*(RGP(IJB)+RGP(IJBA))*WG(IJM)*CS(5)     THREED   460
      IF(CS(5).LT.0.) WGFB(I)=0.5*(RGP(IJA)+RGP(IJ))*WG(IJ)*CS(5)        THREED   461
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   462
      RETURN                                                             THREED   463
    3 CS(6)=0.5*(WG(IKM)+WG(IJ))                                         THREED   464
      IF(CS(6).GE.0.) WGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJ))*WG(IKM)*CS(6)     THREED   465
      IF(CS(6).LT.0.) WGFF(ICJ)=0.5*(RGP(IJA)+RGP(IJ))*WG(IJ)*CS(6)      THREED   466
      RETURN                                                             THREED   467
      END                                                                THREED   468
      SUBROUTINE WLMOMF                                                  THREED   469
*CALL GCOM1
*CALL GCOM2
      DIMENSION CS(6)                                                    THREED   470
      CS(1)=0.5*(WL(IJ)+WL(IKP))                                         THREED   471
      IF(CS(1).GE.0.) WLFA=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(1)           THREED   472
      IF(CS(1).LT.0.) WLFA=0.5*(RLP(IJAA)+RLP(IJA))*WL(IKP)*CS(1)        THREED   473
      CS(2)=0.5*(VL(IJ)+VL(IKP))                                         THREED   474
      IF(CS(2).GE.0.) WLFT=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(2)           THREED   475
      IF(CS(2).LT.0.) WLFT=0.5*(RLP(IJT)+RLP(IJTA))*WL(IJP)*CS(2)        THREED   476
      CS(3)=0.5*(UL(IJ)+UL(IKP))                                         THREED   477
      IF(CS(3).GE.0.) WLFR=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(3)*RB(I)     THREED   478
      IF(CS(3).LT.0.) WLFR=0.5*(RLP(IJR)+RLP(IJAR))*WL(IPJ)*CS(3)*RB(I)  THREED   479
      IF(FL(IMJ).NE.1) GO TO 1                                           THREED   480
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   481
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   482
      RETURN                                                             THREED   483
    1 CS(4)=0.5*(UL(IMJ)+UL(IMKP))                                       THREED   484
      IF(CS(4).GE.0.)WLFL=0.5*(RLP(IJL)+RLP(IJAL))*WL(IMJ)*CS(4)*RB(I-1) THREED   485
      IF(CS(4).LT.0.)WLFL=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(4)*RB(I-1)    THREED   486
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   487
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO                                      THREED   488
      RETURN                                                             THREED   489
    2 CS(5)=0.5*(VL(IJM)+VL(JMKP))                                       THREED   490
      IF(CS(5).GE.0.) WLFB(I)=0.5*(RLP(IJB)+RLP(IJBA))*WL(IJM)*CS(5)     THREED   491
      IF(CS(5).LT.0.) WLFB(I)=0.5*(RLP(IJA)+RLP(IJ))*WL(IJ)*CS(5)        THREED   492
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      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED   493
      RETURN                                                            THREED   494
    3 CS(6)=0.5*(WL(IKM)+WL(IJ))                                        THREED   495
      IF(CS(6).GE.0.) WLFF(ICJ)=0.5*(RLP(IJF)+RLP(IJ))*WL(IKM)*CS(6)    THREED   496
      IF(CS(6).LT.0.) WLFF(ICJ)=0.5*(RLP(IJA)+RLP(IJ))*WL(IJ)*CS(6)     THREED   497
      RETURN                                                            THREED   498
      END                                                               THREED   499

*IDENT INOUT
*D,KFIXCC.26
      READ (10,120)ITC,DR,DZ,DPH                                        INOUT     1
*I,KFIXCC.27
      READ (10,110)(FLOA(M),M=1,16)                                     INOUT     2
*D,KFIXCC.28
      READ (10,140)(NSL(M),M=1,6)                                       INOUT     3
*D,KFIXCC.32
   20 READ (10,150)NSO(N),(OB(M,N),M=1,6)                               INOUT     4
*D,KFIXCC.33
   25 READ (10,180) GRAV                                                INOUT     5
      READ (10,180) UO,VO,WO,PO,THO,TEMPO                               INOUT     6
*D,KFIXCC.34,36
      READ (10,160) UINL,VINL,WINL,PINL,THINL,TEMPINL,                  INOUT     7
     1          UINR,VINR,WINR,PINR,THINR,TEMPINR,                     INOUT     8
     1          UINB,VINB,WINB,PINB,THINB,TEMPINB,                     INOUT     9
     1          UINT,VINT,WINT,PINT,THINT,TEMPINT                      INOUT    10
*D,KFIXCC.40
      READ (10,140) IP1,IP2,JP1,JP2,KP1,KP2                            INOUT    11
      IF(IP1.EQ.0) IP1=1                                                INOUT    12
      IF(IP2.EQ.0) IP2=IB2                                              INOUT    13
      IF(JP1.EQ.0) JP1=1                                                INOUT    14
      IF(JP2.EQ.0) JP2=JB2                                              INOUT    15
      IF(KP1.EQ.0) KP1=1                                                INOUT    16
      IF(KP2.EQ.0) KP2=KB2                                              INOUT    17
      READ (10,170)((IJPLOT(I,J),I=1,12),J=1,5)                         INOUT    18
      READ (10,170)((IKPLOT(I,J),I=1,12),J=1,5)                         INOUT    19
      READ (10,170)((JKPLOT(I,J),I=1,12),J=1,5)                         INOUT    20
*D,KFIXCC.54
      WRITE(KTAPE,220) ITC,IB2,JB2,KB2,DR,DZ,DPH                        INOUT    21
*D,KFIXCC.55
      WRITE(KTAPE,230) (FLO(M),M=1,4),(FLOA(M),M=1,4),(FLO(M),M=5,8),   INOUT    22
     1(FLOA(M),M=5,8),(FLO(M),M=9,12),(FLOA(M),M=9,12),(FLO(M),M=13,16),INOUT    23
     2 (FLOA(M),M=13,16)                                                INOUT    24
*D,KFIXCC.56
      WRITE(KTAPE,240) (NSL(M),M=1,6)                                   INOUT    25
*D,KFIXCC.62
   40 WRITE(KTAPE,254) NSO(N),(OB(M,N),M=1,6)                           INOUT    26
*D,KFIXCC.64
      WRITE(KTAPE,260) UO,VO,WO,PO,THO,TEMPO                            INOUT    27
*D,KFIXCC.65,67
      WRITE(KTAPE,270) UINL,VINL,WINL,PINL,THINL,TEMPINL,               INOUT    28
     1          UINR,VINR,WINR,PINR,THINR,TEMPINR,                     INOUT    29
     1          UINB,VINB,WINB,PINB,THINB,TEMPINB                      INOUT    30
     1          UINT,VINT,WINT,PINT THINT,TEMPINT                      INOUT    31
*D,KFIXCC.71
      WRITE(KTAPE,325) IP1,IP2,JP1,JP2,KP1,KP2                          INOUT    32
      WRITE(KTAPE,315)((IJPLOT(I,J),I=1,12),J=1,5)                      INOUT    33
      WRITE(KTAPE,320)((IKPLOT(I,J),I=1,12),J=1,5)                      INOUT    34
      WRITE(KTAPE,330) ((JKPLOT(I,J),I=1,12),J=1,5)                     INOUT    35
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*D,KFIXCC.100
  120 FORMAT( I12,3F12.4)                                                    INOUT     36
*D,KFIXCC.103
  150 FORMAT(I12,4F12.4/(6F12.4))                                            INOUT     37
*D,KFIXCC.104
  160 FORMAT(6F12.4)                                                         INOUT     38
*D,KFIXCC.111,142
  220 FORMAT(9H0GEOMETRY/1H0,6X,34H1. COORDINATES (CART=0, CYLIND=1, ,       INOUT     39

     (11HSPHERE=2) =,I3/1H0,6X,21H2. MESH SIZE,     IB2=,I3,14X,4HJB2=,     INOUT     40
     2I3,14X,4HKB2=,I3/1H0,6X,13H3. CELL SIZE.,5X,3HDR=,1PE11.4,4X,          INOUT     41
     33HDZ=,1PE11.4,4X,4HDPH=,1PE11.4)                                       INOUT     42
  230 FORMAT(*0       4. INFLOW OPENINGS*/*0*12X*A. BOTTOM*10X,1P4E11.4/     INOUT     43
     132X,1P4E11.4/*0*12X*B. LEFT*12X,1P4E11.4/32X,1P4E11.4/                 INOUT     44
     2*0       5. OUTFLOW OPENINGS*/*0*12X,*A. TOP*13X,1P4E11.4/             INOUT     45
     332X,1P4E11.4/*0*12X*B. RIGHT*11X,1P4E11.4/32X,1P4E11.4   )             INOUT     46
  240 FORMAT(47H0       6. BOUNDARIES, (FREE-SLIP=0   NO-SLIP=1)  / 1H0,    INOUT     47
     1 14X,7HBOTTOM=,I3,9H    LEFT=,I3,8H    TOP=,I3,10H    RIGHT=,I3,       INOUT     48
     29H    FORE=,I3,8H    AFT=,I3)                                          INOUT     49
  250 FORMAT(27H0       7. OBSTACLES,     NO=,I3)                           INOUT     50
  251 FORMAT(29H0       8. GRAVITY,       GRAV=,1PE15.7)                    INOUT     51
  252 FORMAT(17H0            SLIP,22X,23H------COORDINATES------)           INOUT     52
  254 FORMAT(1H0,12X,I3,6X,1P6E14.4)                                         INOUT     53
  260 FORMAT(31H0INITIAL DATA    GAS AND LIQUID/13H0       1. UO=,         INOUT     54
     11PE11.4,7H    VO=,1PE11.4,7H    WO=,1PE11.4,7H    PO=,               INOUT     55
     21PE11.4,8H    THO=,1PE11.4,7H    TO=,1PE11.4)                        INOUT     56
  270 FORMAT(12H0INFLOW DATA/16H0       1. BOTTOM ,8H0            UINL=,   INOUT     57
     11PE11.4,7H  VINL=,1PE11.4,7H  WINL=,1PE11.4,7H  PINL=,1PE11.4,       INOUT     58
     28H  THINL=,1PE11.4,10H  TEMPINL=,1PE11.4/18H0            UINR=,      INOUT     59
     31PE11.4,7H  VINR=,1PE11.4,7H  WINR=,1PE11.4,7H  PINR=,1PE11.4,       INOUT     60
     48H  THINR=,1PE11.4,10H  TEMPINR=,1PE11.4/14H0       2. LEFT/8X,       INOUT     61
     510H     UINB=,1PE11.4,7H  VINB=,1PE11.4,7H  WINB=,1PE11.4,           INOUT     62
     67H  PINB=,1PE11.4,8H  THINB=,1PE11.4,10H  TEMPINB=,1PE11.4/          INOUT     63
     718H0            UINT=,1PE11.4,7H  VINT=,1PE11.4,7H  WINT=,1PE11.4,   INOUT     64
     87H  PINT=,1PE11.4,8H  THINT=,1PE11.4,10H  TEMPINT=,1PE11.4)          INOUT     65
  280 FORMAT(8H0CONTROL/35H0       1. DUMP AND RESTART,     ITD=,I3,       INOUT     66
     17H   NTD=,I3,9H   NSDMP=,I3,9H   NFILE=,I3,9H   NNDMP=,I3)           INOUT     67
  290 FORMAT(34H0       2. TIME AND CYCLE   TSTART=,1PE11.4,9H   TSTOP=,   INOUT     68
     11PE11.4,6H   DT=,1PE11.4,9H   CYCLE=,1PE11.4)                        INOUT     69
  300 FORMAT(42H0       3. PRINTING AND PLOTTING,       LPR=,I3,7H   TPR=,  INOUT     70
     11PE11.4,6H  TPL=,1PE11.4,9H    TPLD=,1PE11.4)                        INOUT     71
  310 FORMAT(9H1CASE NO.,I3,13H     CP TIME=,F8.1)                           INOUT     72
  315 FORMAT(55H0       4. CONTOUR PLOT FLAGS           RGP   RLP   TH      INOUT     73
     146H  P    TG    TL    TS    IG    IL     G     K,//(14X,               INOUT     74
     214H1JPLOT FOR K =,I2,4X,1116))                                         INOUT     75
  320 FORMAT(14X,14H1KPLOT FOR J =,I2,4X,1116)                               INOUT     76
  325 FORMAT(1H0,13X,20HPRINT LIMITS     I1=,I3,5H  I2=,I3,5H  J1=,I3,      INOUT     77
     15H  J2=,I3,5H  K1=,I3,5H  K2=,I3)                                      INOUT     78
  330 FORMAT(14X,14HJKPLOT FOR I =,I2,4X,1116)                               INOUT     79
*D,KFIXCC.1467,1468
      DO 340 K=KP1,KP2                                                       INOUT     80
      DO 340 J=JP1,JP2                                                       INOUT     81
      DO 340 I=IP1,IP2                                                       INOUT     82
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                           INOUT     83
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*D,KFIXCC.1474,1477
  330 WRITE (KTAPE,520)I,J,K,FL(IJ),TH(IJ),UG(IJ),VG(IJ),SIEG(IJ),          INOUT     84
     1 RGP(IJ),KDRAG(IJ),WG(IJ),CG(IJ),RL(IJ),UL(IJ),VL(IJ),                INOUT     85
     2 SIEL(IJ),RLP(IJ),RHEAT(IJ),WL(IJ),CL(IJ),ROG(IJ),                    INOUT     86
     3 ERATE(IJ),CRATE(IJ),ASURF(IJ),TS(IJ),TL(IJ),TG(IJ),P(IJ)             INOUT     87
*D,KFIXCC.1500,1502
      WRITE(5) NWDMP,IB2,JB2,KB2                                           INOUT     88
      WRITE(5) (((P(I,J,K),TG(I,J,K),TH(I,J,K),TL(I,J,K),UG(I,J,K),        INOUT     89
     1UL(I,J,K),VG(I,J,K),VL(I,J,K),WG(I,J,K),WL(I,J,K),I=1,IB2),          INOUT     90
     2 J=1,JB2),K=1,KB2)                                                   INOUT     91
*D,KFIXCC.1523
      GRINDS=CPTG/(IB*JB*KB)                                               INOUT     92
*D,KFIXCC.1533,1539

  510 FORMAT(48H0 I  J  K  FL     TH             UG             VG ,10X,    INOUT     93
     159H SIEG          RGP           KDRAG          WG             CG  /   INOUT     94
     218X,46HROL            UL             VL             SIEL,           INOUT     95
     354H          RLP            RHEAT          WL             CL /        INOUT     96
     419X,47HROG            ERATE          CRATE          ASURF,          INOUT     97
     552H          TS             TL             TG             P  )        INOUT     98
*D,KFIXCC.1539
  520 FORMAT(1X,413,2X,8(2X,1PE12.5)/15X,8(2X,1PE12.5)/15X,8(2X,           INOUT     99
*D,KFIXCC.1558
   10 READ (5) NTDMP,IB2,JB2,KB2                                           INOUT    100
*D,KFIXCC.1565,1566
   20 READ (5) (((P(I,J,K),TG(I,J,K),TH(I,J,K),TL(I,J,K),UG(I,J,K),       INOUT    101
     1UL(I,J,K),VG(I,J,K),VL(I,J,K),WG(I,J,K),WL(I,J,K),I=1,IB2),          INOUT    102
     1 J=1,JB2),K=1,KB2)                                                   INOUT    103
*B,KFIXCC.1687
      DO 35 K=1,KB2                                                        INOUT    104
      IF(LPR.GE.2) WRITE(9,640) K                                          INOUT    105
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,640) K                             INOUT    106
*D,KFIXCC.1689,1690
      IF(LPR.GE.2)                                                         INOUT    107
     1WRITE( 9,650) (FL(I,KPR,K),I=1,IB2)                                  INOUT    108
      IF(LPR.EQ.1.OR.LPR.EQ.3)                                             INOUT    109
     1WRITE(12,650) (FL(I,KPR,K),I=1,IB2)                                  INOUT    110
   30 CONTINUE                                                             INOUT    111
*I,KFIXCC.1692
   35 CONTINUE                                                             INOUT    112
C                                                                          INOUT    113
*I,KFIXCC.1763
  630 FORMAT(1H0,4413)                                                     INOUT    114
  640 FORMAT(39H          CELL FLAG MAP  FL(I,J) FOR K=,I3 ///)            INOUT    115
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*IDENT INDEX
*I,KFIXCC.798
C                                                                       INDEX     1
C     CALCULATE AND STORE THE CELL INCREMENTS AND ACCESS INDICES        INDEX     2
C                                                                       INDEX     3
  400 CONTINUE                                                          INDEX     4
      M=1                                                               INDEX     5
      CALL START(1)                                                     INDEX     6
      DO 475 K=KS,KL                                                    INDEX     7
      IJ=IJ+INCK                                                        INDEX     8
      DO 470 J=JS,JL                                                    INDEX     9
      IJ=IJ+INCJ                                                        INDEX    10
      DO 465 I=IS,IL                                                    INDEX    11
      IJ=IJ+1                                                           INDEX    12
      IF(FL(IJ).NE.1) GO TO 465                                         INDEX    13
C                                                                       INDEX    14
C     SET CELL IJ INDICES ACCOUNTING FOR OBSTACLES AND CELL BOUNDARIES  INDEX    15
      CALL SETIND                                                       INDEX    16
C                                                                       INDEX    17
C     STORE THE CELL CENTER INCREMENTS  IN THE MFL ARRAY                INDEX    18
      MFL(1,M)=IJTL -IJ                                                 INDEX    19
      MFL(2,M)=IJBR -IJ                                                 INDEX    20
      MFL(3,M)=IJTR -IJ                                                 INDEX    21
      MFL(4,M)=IJRR -IJ                                                 INDEX    22
      MFL(5,M)=IJTT -IJ                                                 INDEX    23
      MFL(6,M)=IJAL -IJ                                                 INDEX    24
      MFL(7,M)=IJFR -IJ                                                 INDEX    25
      MFL(8,M)=IJAR -IJ                                                 INDEX    26
      MFL(9,M)=IJAA -IJ                                                 INDEX    27
      MFL(10,M)=IJTF-IJ                                                 INDEX    28
      MFL(11,M)=IJBA-IJ                                                 INDEX    29
      MFL(12,M)=IJTA-IJ                                                 INDEX    30
      MFL(13,M)=IJL -IJ                                                 INDEX    31
      MFL(14,M)=IJB -IJ                                                 INDEX    32
      MFL(15,M)=IJR -IJ                                                 INDEX    33
      MFL(16,M)=IJT -IJ                                                 INDEX    34
      MFL(17,M)=IJA -IJ                                                 INDEX    35
      MFL(18,M)=IJF -IJ                                                 INDEX    36
C                                                                       INDEX    37
C     COMPARE THIS SET WITH THOSE PREVIOUSLY STORED                     INDEX    38
      IF(M.EQ.1) GO TO 450                                              INDEX    39
      LUP=M-1                                                           INDEX    40
      DO 445 L=1,LUP                                                    INDEX    41
      KTEST=0                                                           INDEX    42
      DO 430 N=1,18                                                     INDEX    43
      IF(MFL(N,M).NE.MFL(N,L)) KTEST=1                                  INDEX    44
  430 CONTINUE                                                          INDEX    45
      IF(KTEST.EQ.1) GO TO 440                                          INDEX    46
C                                                                       INDEX    47
C     THE SET M MATCHES SET L                                           INDEX    48
      LFL(IJ)=L                                                         INDEX    49
      GO TO 460                                                         INDEX    50
  440 CONTINUE                                                          INDEX    51
  445 CONTINUE                                                          INDEX    52
C                                                                       INDEX    53
C     THE SET M DOES NOT MATCH ANY PREVIOUSLY STORED                    INDEX    54
  450 LFL(IJ)=M                                                         INDEX    55
      MAXM=M                                                            INDEX    56
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      M=M+1                                                              INDEX      57
  460 CONTINUE                                                           INDEX      58
  465 CONTINUE                                                           INDEX      59
  470 CONTINUE                                                           INDEX      60
  475 CONTINUE                                                           INDEX      61
*D,KFIXCC.1075,1115
C     COMPLETE SET                                                       INDEX      62
      ICJ=I+(J-1)*IB2                                                    INDEX      63
      IPJ=IJ+1                                                           INDEX      64
      IMJ=IJ-1                                                           INDEX      65
      IJP=IJ+IB2                                                         INDEX      66
      IJM=IJ-IB2                                                         INDEX      67
      IKP=IJ+IB2XJB2                                                     INDEX      68
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                                INDEX      69
      IKM=IJ-IB2XJB2                                                     INDEX      70
      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                                INDEX      71
      IMJP=IJP-1                                                         INDEX      72
      IPJP=IJP+1                                                         INDEX      73
      IPJM=IJM+1                                                         INDEX      74
      IPKM=IKM+1                                                         INDEX      75
      IMKP=IKP-1                                                         INDEX      76
      IPKP=IKP+1                                                         INDEX      77
      JMKM=IKM-IB2                                                       INDEX      78
      JMKP=IKP-IB2                                                       INDEX      79
      JPKM=IKM+IB2                                                       INDEX      80
      JPKP=IKP+IB2                                                       INDEX      81
      N=LFL(IJ)                                                          INDEX      82
      IJTL=IJ+MFL(N)                                                     INDEX      83
      IJBR=IJ+MFL(N+1)                                                   INDEX      84
      IJTR=IJ+MFL(N+2)                                                   INDEX      85
      IJRR=IJ+MFL(N+3)                                                   INDEX      86
      IJTT=IJ+MFL(N+4)                                                   INDEX      87
      IJAL=IJ+MFL(N+5)                                                   INDEX      88
      IJFR=IJ+MFL(N+6)                                                   INDEX      89
      IJAR=IJ+MFL(N+7)                                                   INDEX      90
      IJAA=IJ+MFL(N+8)                                                   INDEX      91
      IJTF=IJ+MFL(N+9)                                                   INDEX      92
      IJBA=IJ+MFL(N+10)                                                  INDEX      93
      IJTA=IJ+MFL(N+11)                                                  INDEX      94
      IJL=IJ+MFL(N+12)                                                   INDEX      95
      IJB=IJ+MFL(N+13)                                                   INDEX      96
      IJR=IJ+MFL(N+14)                                                   INDEX      97
      IJT=IJ+MFL(N+15)                                                   INDEX      98
      IJA=IJ+MFL(N+16)                                                   INDEX      99
      IJF=IJ+MFL(N+17)                                                   INDEX     100
      RETURN                                                             INDEX     101
C                                                                        INDEX     102
      ENTRY INDEXA                                                       INDEX     103
C                                                                        INDEX     104
C     NEAREST NEIGHBORS                                                  INDEX     105
      ICJ=I+(J-1)*IB2                                                    INDEX     106
      IPJ=IJ+1                                                           INDEX     107
      IJP=IJ+IB2                                                         INDEX     108
      IMJ=IJ-1                                                           INDEX     109
      IJM=IJ-IB2                                                         INDEX     110
      IKP=IJ+IB2XJB2                                                     INDEX     111
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                                INDEX     112
      IKM=IJ-IB2XJB2                                                     INDEX     113
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      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                              INDEX    114
      N=LFL(IJ)                                                        INDEX    115
      IJL=IJ+MFL(N+12)                                                 INDEX    116
      IJB=IJ+MFL(N+13)                                                 INDEX    117
      IJR=IJ+MFL(N+14)                                                 INDEX    118
      IJT=IJ+MFL(N+15)                                                 INDEX    119
      IJA=IJ+MFL(N+16)                                                 INDEX    120
      IJF=IJ+MFL(N+17)                                                 INDEX    121
*I,KFIXCC.1640
      SUBROUTINE SETIND                                                INDEX    122
*CALL GCOM1
*CALL GCOM2
C                                                                      INDEX    123
C     CALCULATE INDICES FOR ARRAY QUANITIES                            INDEX    124
C                                                                      INDEX    125
      IPJ=IJ+1                                                         INDEX    126
      IJP=IJ+IB2                                                       INDEX    127
      IMJ=IJ-1                                                         INDEX    128
      IJM=IJ-IB2                                                       INDEX    129
      IMJP=IJP-1                                                       INDEX    130
      IPJP=IJP+1                                                       INDEX    131
      IPJM=IJM+1                                                       INDEX    132
      IKM=IJ-IG2XJB2                                                   INDEX    133
      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                              INDEX    134
      IPKM=IKM+1                                                       INDEX    135
      IKP=IJ+IB2XJB2                                                   INDEX    136
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                              INDEX    137
      IMKP=IKP-1                                                       INDEX    138
      IPKP=IKP+1                                                       INDEX    139
      JMKM=IKM-IB2                                                     INDEX    140
      JMKP=IKP-IB2                                                     INDEX    141
      JPKM=IKM+IB2                                                     INDEX    142
      JPKP=IKP+IB2                                                     INDEX    143
      IJL=IMJ                                                          INDEX    144
      IJB=IJM                                                          INDEX    145
      IJT=IJP                                                          INDEX    146
      IJR=IPJ                                                          INDEX    147
      IJF=IKM                                                          INDEX    148
      IJA=IKP                                                          INDEX    149
      IJTL=IMJP                                                        INDEX    150
      IJBR=IPJM                                                        INDEX    151
      IJRR=IJ+2                                                        INDEX    152
      IJTT=IJP+IB2                                                     INDEX    153
      IJTR=IPJP                                                        INDEX    154
      IF(I.EQ.IB1.AND.J.EQ.JB1) IJTR=IJ                                INDEX    155
      IJFR=IPKM                                                        INDEX    156
      IJAL=IMKP                                                        INDEX    157
      IJAR=IPKP                                                        INDEX    158
      IJAA=IKP+IB2XJB2                                                 INDEX    159
      IF(FL(IJAA).EQ.0) IJAA=IJAA-KB*IB2XJB2                           INDEX    160
      IJBA=JMKP                                                        INDEX    161
      IJTF=JPKM                                                        INDEX    162
      IJTA=JPKP                                                        INDEX    163
      IF((FL(IPJ).EQ.2).OR.(FL(IPJ).EQ.3)) IJR=IJ                      INDEX    164
      IF((FL(IMJ).EQ.2).OR.(FL(IMJ).EQ.3)) IJL=IJ                      INDEX    165
      IF((FL(IJP).EQ.2).OR.(FL(IJP).EQ.3)) IJT=IJ                      INDEX    166
      IF((FL(IJM).EQ.2).OR.(FL(IJM).EQ.3)) IJB=IJ                      INDEX    167
      IF((FL(IKP).EQ.2).OR.(FL(IKP).EQ.3)) IJA=IJ                      INDEX    168
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      IF((FL(IKM).EQ.2).OR.(FL(IKM).EQ.3)) IJF=IJ                                  INDEX   169
      IF((FL(IPJP).NE.2.AND.FL(IPJP).NE.3)) GO TO 110                              INDEX   170
      IJTR=IJ                                                                      INDEX   171
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                                      INDEX   172
     1   (FL(IJP).EQ.2.OR.FL(IJP).EQ.3)) IJTR=IPJ                                 INDEX   173
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                                       INDEX   174
     1   (FL(IJP).NE.2.AND.FL(IJP).NE.3)) IJTR=IJP                                 INDEX   175
  110 IF((FL(IPJM).NE.2.AND.FL(IPJM).NE.3)) GO TO 120                              INDEX   176
      IJBR=IJ                                                                      INDEX   177
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                                      INDEX   178
     1   (FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) IJBR=IPJ                                 INDEX   179
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                                       INDEX   180
     1   (FL(IJM).NE.2.AND.FL(IJM).NE.3)) IJBR=IJM                                 INDEX   181
  120 IF((FL(IMJP).NE.2.AND.FL(IMJP).NE.3)) GO TO 140                              INDEX   182
      IJTL=IJ                                                                      INDEX   183
      IF((FL(IMJ).NE.2.AND.FL(IMJ).NE.3).AND.                                      INDEX   184
     1   (FL(IJP).EQ.2.OR.FL(IJP).EQ.3)) IJTL=IMJ                                 INDEX   185
      IF((FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3).AND.                                       INDEX   186
     1   (FL(IJP).NE.2.AND.FL(IJP).NE.3)) IJTL=IJP                                 INDEX   187
  140 IF((FL(IJRR).EQ.2.OR.FL(IJRR).EQ.3).OR.(I.EQ.IB1)) IJRR=IJR                  INDEX   188
      IF((FL(IJTT).EQ.2.OR.FL(IJTT).EQ.3).OR.(J.EQ.JB1)) IJTT=IJT                  INDEX   189
      IF((FL(IPKP).NE.2.AND.FL(IPKP).NE.3)) GO TO 150                              INDEX   190
      IJAR=IJ                                                                      INDEX   191
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                                      INDEX   192
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJAR=IPJ                                 INDEX   193
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                                       INDEX   194
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJAR=IKP                                 INDEX   195
  150 IF((FL(IPKM).NE.2.AND.FL(IPKM).NE.3)) GO TO 160                              INDEX   196
      IJFR=IJ                                                                      INDEX   197
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                                      INDEX   198
     1   (FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) IJFR=IPJ                                 INDEX   199
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                                       INDEX   200
     1   (FL(IKM).NE.2.AND.FL(IKM).NE.3)) IJFR=IKM                                 INDEX   201
  160 IF((FL(IMKP).NE.2.AND.FL(IMKP).NE.3)) GO TO 180                              INDEX   202
      IJAL=IJ                                                                      INDEX   203
      IF((FL(IMJ).NE.2.AND.FL(IMJ).NE.3).AND.                                      INDEX   204
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJAL=IMJ                                 INDEX   205
      IF((FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3).AND.                                       INDEX   206
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJAL=IKP                                 INDEX   207
  180 IF(FL(IJAA).EQ.2.OR.FL(IJAA).EQ.3) IJAA=IJA                                  INDEX   208
      IF(FL(IKP).EQ.2.OR.FL(IKP).EQ.3) IJAA=IJA                                    INDEX   209
      IF(FL(IKP).EQ.2.OR.FL(IKP).EQ.3) IJAA=IJA                                    INDEX   210
      IF((FL(JPKP).NE.2.AND.FL(JPKP).NE.3)) GO TO 190                              INDEX   211
      IJTA=IJ                                                                      INDEX   212
      IF((FL(IJP).NE.2.AND.FL(IJP).NE.3).AND                                       INDEX   213
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJTA=IJP                                 INDEX   214
      IF((FL(IJP).EQ.2.OR.FL(IJP).EQ.3).AND.                                       INDEX   215
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJTA=IKP                                 INDEX   216
  190 IF((FL(JPKM).NE.2.AND.FL(JPKM).NE.3)) GO TO 200                              INDEX   217
      IJTF=IJ                                                                      INDEX   218
      IF((FL(IJP).NE.2.AND.FL(IJP).NE.3).AND.                                      INDEX   219
     1   (FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) IJTF=IJP                                 INDEX   220
      IF((FL(IJP).EQ.2.OR.FL(IJP).EQ.3).AND.                                       INDEX   221
     1   (FL(IKM).NE.2.AND.FL(IKM).NE.3)) IJTF=IKM                                 INDEX   222
  200 IF((FL(JMKP).NE.2.AND.FL(JMKP).NE.3)) GO TO 220                              INDEX   223
      IJBA=IJ                                                                      INDEX   224
      IF((FL(IJM).NE.2.AND.FL(IJM).NE.3).AND.                                      INDEX   225
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJBA=IJM                                 INDEX   226
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      IF((FL(IJM).EQ.2.OR.FL(IJM).EQ.3).AND.                            INDEX    227
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJBA=IKP                      INDEX    228
  220 RETURN                                                            INDEX    229
      END                                                               INDEX    230
*I,KFIXCC.1647
      DIMENSION NAMIX(18)                                               INDEX    231
      DATA NAMIX / 4HIJTL,4HIJBR,4HIJTR,4HIJRR,4HIJTT,4HIJAL,4HIJFR,    INDEX    232
     14HIJAR,4HIJAA,4HIJTF,4HIJBA,4HIJTA,3HIJL                          INDEX    233
     13HIJB,3HIJR,3HIJT,3HIJA,3HIJF /                                   INDEX    234
*I,KFIXCC.1693
      DO 41 K=2,KB1                                                     INDEX    235
      IF(LPR.GE.2) WRITE(9,670) K                                       INDEX    236
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,670) K                          INDEX    237
      DO 40 J=1,JB2                                                     INDEX    238
      KPR=JB2-J+1                                                       INDEX    239
      IF(LPR.GE.2)                                                      INDEX    240
     1WRITE(9,630) (LFL(I,KPR,K),I=1,IB2)                               INDEX    241
      IF(LPR.EQ.1.OR.LPR.EQ.3)                                          INDEX    242
     1WRITE(12,630) (LFL(I,KPR,K),I=1,IB2)                              INDEX    243
   40 CONTINUE                                                          INDEX    244
      IF(LPR.GE.2) WRITE(9,660)                                         INDEX    245
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,660)                            INDEX    246
   41 CONTINUE                                                          INDEX    247
      IF(LPR.GE.2) WRITE(9,680)                                         INDEX    248
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE( 2,680)                            INDEX    249
      DO 42 M=1,MAXM,20                                                 INDEX    250
      ILOW=M                                                            INDEX    251
      IUP=ILOW+19                                                       INDEX    252
      IUP=MINO(MAXM,IUP)                                                INDEX    253
      DO 47 J=1,18                                                      INDEX    254
      IF(LPR.GE.2)                                                      INDEX    255
     1WRITE(9,700) NAMIX(J),(MFL(J,I),I=ILOW,IUP)                       INDEX    256
      IF(LPR.EQ.1.OR.LPR.EQ.3)                                          INDEX    257
     1WRITE(12,700) NAMIX(J),(MFL(J,I),I=ILOW,IUP)                      INDEX    258
   47 CONTINUE                                                          INDEX    259
      IF(LPR.GE.2) WRITE(9,690)                                         INDEX    260
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,690)                            INDEX    261
   42 CONTINUE                                                          INDEX    262
      CALL START(1)                                                     INDEX    263
      DO 46 K=KS,KL                                                     INDEX    264
      IJ=IJ+INCK                                                        INDEX    265
      DO 43 J=JS,JL                                                     INDEX    266
      I J=IJ+INCJ                                                       INDEX    267
      DO 44 I=IS,IL                                                     INDEX    268
      IJ=IJ+1                                                           INDEX    269
      LFL(IJ)=(LFL(IJ)-1)*18+1                                          INDEX    270
   44 CONTINUE                                                          INDEX    271
   43 CONTINUE                                                          INDEX    272
   46 CONTINUE                                                          INDEX    273
*I,KFIXCC.1764
  670 FORMAT(46H           CELL INDEX MAP   LFL(I,J,K)  FOR K=,I3 ///)  INDEX    274
  680 FORMAT(51H         INDEX INCREMENTS ARRAY   MFL(M,LFL(I,J,K)) ///) INDEX    275
  690 FORMAT(1H  ///)                                                   INDEX    276
  700 FORMAT(1H ,A7,2016)                                               INDEX    277
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*IDENT INVIS
*D,KFIXCC.907,942
*D,KFIXCC.969,970
*D,KFIXCC.977,978
*D,KFIXCC.1037,1068
*D,KFIXCC.1795,1796
      RETURN                                                    INVIS     1
*D,KFIXCC.1800,1801
      RETURN                                                    INVIS     2
*D,KFIXCC.1804,1808
*D,KFIXCC.1823,1824
      RETURN                                                    INVIS     3
*D,KFIXCC.1828,1829
      RETURN                                                    INVIS     4
*D,KFIXCC.1832,1836
*D,KFIXCC.1953
     1   (UGFT-UGFB(I))                                         INVIS     5
*D,KFIXCC.1963
     1   (ULFT-ULFB(I))                                         INVIS     6
*D,KFIXCC.2016,2017
      RETURN                                                    INVIS     7
*D,KFIXCC.2022,2023
      RETURN                                                    INVIS     8
*D,KFIXCC.2027,2031
*D,KFIXCC.2034,2064
*D,KFIXCC.2080,2081
      RETURN                                                    INVIS     9
*D,KFIXCC.2086,2087
      RETURN                                                    INVIS    10
*D,KFIXCC.2091,2095
*D,KFIXCC.2098,2128
*D,KFIXCC.2216,2217
      RETURN                                                    INVIS    11
*D,KFIXCC.2222,2223
      RETURN                                                    INVIS    12
*D,KFIXCC.2227,2231
*D,KFIXCC.2234,2260
*D,KFIXCC.2284,2285
      RETURN                                                    INVIS    13
*D,KFIXCC.2290,2291
      RETURN                                                    INVIS    14
*D,KFIXCC.2295,2299
*D,KFIXCC.2302,2328
*D,KFIXCC.2480,2511
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*IDENT FILM
*D,KFIXCC.336
      SUBROUTINE CNPLOT(KKK,JSP)                                          FILM        1
*D,KFIXCC.343
      KK=KKK+1                                                            FILM        2
*I,KFIXCC.382
      DANGLE=DPH*(FLOAT(K)-1.5)                                           FILM        3
      WRITE(12,870) DANGLE                                                FILM        4
*I,KFIXCC.385
      PTE=DPH*(FLOAT(K)-1.5)                                              FILM        5
*I,KFIXCC.387
      IF(PTE.LT.FLOA(1).OR.PTE.GT.FLOA(2)) CALL DRV(KFLO(1),IYB,          FILM        6
     1 KFLO(2),IYB)                                                       FILM        7
*I,KFIXCC.389
      IF(PTE.LT.FLOA(3).OR.PTE.GT.FLOA(4)) CALL DRV(KFLO(3),IYB,          FILM        8
     1 KFLO(4),IYB)                                                       FILM        9
*I,KFIXCC.396
      IF(PTE.LT.FLOA(5).OR.PTE.GT.FLOA(6)) CALL DRV(IXL,KFLO(5),          FILM       10
     1 IXL,KFLO(6))                                                       FILM       11
*I,KFIXCC.398
      IF(PTE.LT.FLOA(7).OR.PTE.GT.FLOA(8)) CALL DRV(IXL,KFLO(7),          FILM       12
     1 IXL,KFLO(8))                                                       FILM       13
*I,KFIXCC.405
      IF(PTE.LT.FLOA(9).OR.PTE.GT.FLOA(10)) CALL DRV(KFLO(9),IYT,         FILM       14
     1 KFLO(10),IYT)                                                      FILM       15
*I,KFIXCC.407
      IF(PTE.LT.FLOA(11).OR.PTE.GT.FLOA(12)) CALL DRV(KFLO(11),IYT,       FILM       16
     1 KFLO(12),IYT)                                                      FILM       17
*I,KFIXCC.414
      IF(PTE.LT.FLOA(13).OR.PTE.GT.FLOA(14)) CALL DRV(IXR,KFLO(13),       FILM       18
     1 IXR,KFLO(14))                                                      FILM       19
*I,KFIXCC.416
      IF(PTE.LT.FLOA(15).OR.PTE.GT.FLOA(16)) CALL DRV(IXR,KFLO(15),       FILM       20
     1 IXR,KFLO(16))                                                      FILM       21
*I,KFIXCC.428
      IF(PTE.LT.OB(5,N).OR.PTE.GT.OB(6,N)) GO TO 270                      FILM       22
*D,KFIXCC.444,445
      IF(FL(I,J,K).NE.1) GO TO 300                                        FILM       23
      QMN=QMX=CQ(I,J,K)                                                   FILM       24
*D,KFIXCC.451
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) GO TO 320                     FILM       25
*D,KFIXCC.453,454
      IF(CQ(I,J,K).LT.QMN) QMN=CQ(I,J,K)                                  FILM       26
      IF(CQ(I,J,K).GT.QMX) QMX=CQ(I,J,K)                                  FILM       27
*D,KFIXCC.503,506
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) L12=L13=1                     FILM       28
      IF(FL(I+1,J,K).GT.1.AND.FL(I+1,J,K).LT.4) L12=L24=1                 FILM       29
      IF(FL(I,J+1,K).GT.1.AND.FL(I,J+1,K).LT.4) L13=L34=1                 FILM       30
      IF(FL(I+1,J+1,K).GT.1.AND.FL(I+1,J+1,K).LT.4) L24=L34=1             FILM       31
*D,KFIXCC.511,514
      IF(CON(M).LE.CQ(I,J,K)) K1=0                                        FILM       32
      IF(CON(M).LE.CQ(I+1,J,K)) K2=0                                      FILM       33
      IF(CON(M).LE.CQ(I,J+1,K)) K3=0                                      FILM       34
      IF(CON(M).LE.CQ(I+1,J+1,K)) K4=0                                    FILM       35
*D,KFIXCC.550
      YX(IC)=YD+DZ*((CON(M)-CQ(III,J,K))/(CQ(III,J+1,K)-CQ(III,J,K)))     FILM       36
*D,KFIXCC.554
      XY(IC)=XD+DR*((CON(M)-CQ(I,JJJ,K))/(CQ(I+1,JJJ,K)-CQ(I,JJJ,K)))     FILM       37
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*D,KFIXCC.570,586
  800 RETURN                                                                    FILM      38
*I,KFIXCC.601
  870 FORMAT(40X,25HAZIMUTHAL ANGLE (DEPTH) =,1PE12.5)                          FILM      39
*I,KFIXCC.602
      SUBROUTINE CNPLTIK                                                        FILM      40
*CALL GCOM1
*CALL GCOM2
      DIMENSION CON(11),XY(2),YX(2)                                             FILM      41
      DIMENSION CS(10),JX(20),JY(20)                                            FILM      42
C                                                                               FILM      43
C     PLOT  CONTOURS AT CONSTANT VALUES OF J                                    FILM      44
C                                                                               FILM      45
C                                                                               FILM      46
      DO 1000 MM=1,5                                                            FILM      47
      J=IKPLOT(1,MM)                                                            FILM      48
      IF(J.EQ.0) GO TO 1000                                                     FILM      49
C     PLOT ONLY THOSE SPECIFIED                                                 FILM      50
C                                                                               FILM      51
      DO 900 L=1,11                                                             FILM      52
      IF(IKPLOT(1+L,MM).EQ.0) GO TO 900                                         FILM      53
      IF(ITC.EQ.0) GO TO 50                                                     FILM      54
C                                                                               FILM      55
C     GENERATE GRID FOR CYLINDRICAL IKPLOT                                      FILM      56
C                                                                               FILM      57
      IF(LPR.LE.0) GO TO 10                                                     FILM      58
      CALL ADV(1)                                                               FILM      59
      CALL LINCNT(60)                                                           FILM      60
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                         FILM      61
   10 CONTINUE                                                                  FILM      62
      HEIGHT=DZ*(FLOAT(J)-1.5)                                                  FILM      63
      XR=RB(IB1)                                                                FILM      64
      XL=-XR                                                                    FILM      65
      YT=XR                                                                     FILM      66
      YB=-XR                                                                    FILM      67
      IXL=61                                                                    FILM      68
      IXR=961                                                                   FILM      69
      IYT=31                                                                    FILM      70
      IYB=931                                                                   FILM      71
      DO 19 II=1,IB1                                                            FILM      72
      X1=RB(II)                                                                 FILM      73
      CALL CONVRT(X1,IX,XL,XR,IXL,IXR)                                          FILM      74
      JX(II)=IX                                                                 FILM      75
      JY(II)=481                                                                FILM      76
   19 CONTINUE                                                                  FILM      77
      IF(FL(1).EQ.2.OR.FL(1).EQ.3) CALL DRV(JX(1),JY(1),JX(IB1),JY(IB1))        FILM      78
      NANG=DPH/0.08726646 + .5                                                  FILM      79
      DPHN=DPH/FLOAT(NANG)                                                      FILM      80
      CS(1)=SIN(DPHN)                                                           FILM      81
      CS(2)=COS(DPHN)                                                           FILM      82
      CS(3)=0.                                                                  FILM      83
      CS(4)=1.                                                                  FILM      84
      DO 25 K=2,KB1                                                             FILM      85
      DO 24 N=1,NANG                                                            FILM      86
      CS(6)=CS(2)*CS(3)+CS(1)*CS(4)                                             FILM      87
      CS(7)=CS(2)*CS(4)-CS(1)*CS(3)                                             FILM      88
      CS(3)=CS(6)                                                               F         89
      CS(4)=CS(7)                                                               FILM      90
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      DO 22 II=1,IB1                                                    FILM    91
      CS(8)=RB(II)                                                      FILM    92
      CS(6)=CS(3)*CS(8)                                                 FILM    93
      CS(7)=CS(4)*CS(8)                                                 FILM    94
      CALL CONVRT(CS(7),IX,XL,XR,IXL,IXR)                               FILM    95
      CALL CONVRT(CS(6),IY,YB,YT,IYB,IYT)                               FILM    96
      IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                    FILM    97
      IPJ=IJ+1                                                          FILM    98
      IF(II.EQ.IB1.AND.FL(IPJ).LT.4) GO TO 27                           FILM    99
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IPJ).NE.2.AND.FL(IPJ).NE.3)FILM   100
     1 GO TO 27                                                         FILM   101
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3))FILM   102
     1 GO TO 27                                                         FILM   103
      GO TO 21                                                          FILM   104
   27 CALL DRV(JX(II),JY(II),IX,IY)                                     FILM   105
   21 JX(II)=IX                                                         FILM   106
      JY(II)=IY                                                         FILM   107
   22 CONTINUE                                                          FILM   108
   24 CONTINUE                                                          FILM   109
      DO 25 II=2,IB1                                                    FILM   110
      IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                    FILM   111
      IKP=IJ+IB2XJB2                                                    FILM   112
      IF(FL(IKP).EQ.0) GO TO 25                                         FILM   113
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKP).NE.2.AND.FL(IKP).NE.3)FILM   114
     1 GO TO 23                                                         FILM   115
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))FILM   116
     1 GO TO 23                                                         FILM   117
      IF(KK.EQ.KB1.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))GO TO 23          FILM   118
      GO TO 25                                                          FILM   119
   23 CALL DRV(JX(II-1),JY(II-1),JX(II),JY(II))                         FILM   120
   25 CONTINUE                                                          FILM   121
   26 CONTINUE                                                          FILM   122
      GO TO 100                                                         FILM   123
C                                                                       FILM   124
C     GENERATE BACKGROUND FOR CARTESIAN IKPLOTS                         FILM   125
C                                                                       FILM   126
   50 CONTINUE                                                          FILM   127
      IYB=916                                                           FILM   128
      XL=0.                                                             FILM   129
      XR=IB*DR                                                          FILM   130
      YT=KB*DPH                                                         FILM   131
      YB=0.                                                             FILM   132
      IF(XR.LE.1.13556*YT) GO TO 920                                    FILM   133
      IXL=0                                                             FILM   134
      IXR=1022                                                          FILM   135
      IYT=916-YT*1022/XR                                                FILM   136
      GO TO 930                                                         FILM   137
  920 X=XR*450/YT                                                       FILM   138
      IXL=511-X                                                         FILM   139
      IXR=511+X                                                         FILM   140
      IYT=16                                                            FILM   141
  930 CONTINUE                                                          FILM   142
      IF(LPR.LE.0) GO TO 940                                            FILM   143
      CALL ADV(1)                                                       FILM   144
      CALL LINCNT(60)                                                   FILM   145
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                 FILM   146
  940 CONTINUE                                                          FILM   147
      HEIGHT=DZ*(FLOAT(J)-1.5)                                          FILM   148
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      DO 960 K=2,KB2                                                    FILM  149
      DO 960 I=2,IB2                                                    FILM  150
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                      FILM  151
      IMJ=IJ-1                                                          FILM  152
      IKM=IJ-IB2XJB2                                                    FILM  153
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 945                                  FILM  154
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))FILM  155
     1 GO TO 945                                                        FILM  156
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)FILM  157
     1 GO TO 945                                                        FILM  158
      GO TO 950                                                         FILM  159
  945 XX3=DR*FLOAT(I-2)                                                 FILM  160
      YY3=DPH*FLOAT(K-2)                                                FILM  161
      XX4=XX3+DR                                                        FILM  162
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                FILM  163
      CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                FILM  164
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                FILM  165
      CALL DRV(IX1,IY1,IX2,IY1)                                         FILM  166
  950 CONTINUE                                                          FILM  167
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IMJ).NE.2.AND.FL(IMJ).NE.3)FILM  168
     1 GO TO 955                                                        FILM  169
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3))FILM  170
     1 GO TO 955                                                        FILM  171
      IF(I.EQ.2.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) GO TO 955           FILM  172
      IF(I.EQ.IB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 955           FILM  173
      GO TO 960                                                         FILM  174
  955 XX3=DR*FLOAT(I-2)                                                 FILM  175
      YY3=DPH*FLOAT(K-2)                                                FILM  176
      YY4=YY3+DPH                                                       FILM  177
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                FILM  178
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                FILM  179
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                FILM  180
      CALL DRV(IX1,IY1,IX1,IY2)                                         FILM  181
  960 CONTINUE                                                          FILM  182
C                                                                       FILM  183
  100 XS=DR/2.                                                          FILM  184
      YS=DPH/2.                                                         FILM  185
      QMN=1.E50                                                         FILM  186
      QMX=-1.E50                                                        FILM  187
      DO 200 I=2,IB1                                                    FILM  188
      DO 200 K=2,KB1                                                    FILM  189
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                      FILM  190
      GO TO(101,102,103,104,105,106,107,108,109,110,111),L              FILM  191
C                                                                       FILM  192
  101 CQ(IJ)=RGP(IJ)                                                    FILM  193
      GO TO 190                                                         FILM  194
  102 CQ(IJ)=RLP(IJ)                                                    FILM  195
      GO TO 190                                                         FILM  196
  103 CQ(IJ)=TH(IJ)                                                     FILM  197
      GO TO 190                                                         FILM  198
  104 CQ(IJ)=P(IJ)                                                      FILM  199
      GO TO 190                                                         FILM  200
  105 CQ(IJ)=TG(IJ)                                                     FILM  201
      GO TO 190                                                         FILM  202
  106 CQ(IJ)=TL(IJ)                                                     FILM  203
      GO TO 190                                                         FILM  204
  107 CQ(IJ)=TS(IJ)                                                     FILM  205
      GO TO 190                                                         FILM  206
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108 CQ(IJ)=SIEG(IJ)                                                    FILM    207
    GO TO 190                                                          FILM    208
109 CQ(IJ)=SIEL(IJ)                                                    FILM    209
    GO TO 190                                                          FILM    210
110 CQ(IJ)=ERATE(IJ)-CRATE(IJ)                                         FILM    211
    GO TO 190                                                          FILM    212
111 CQ(IJ)=KDRAG(IJ)                                                   FILM    213
    GO TO 190                                                          FILM    214
190 CONTINUE                                                           FILM    215
    IF (CQ(IJ).LT.QMN) QMN=CQ(IJ)                                      FILM    216
    IF (CQ(IJ).GT.QMX) QMX=CQ(IJ)                                      FILM    217
200 CONTINUE                                                           FILM    218
    DQ=(QMX-QMN)/10.                                                   FILM    219
    SUM=QMN                                                            FILM    220
    CC=0.                                                              FILM    221
    MINQ=2                                                             FILM    222
    DO 330 N=1,11                                                      FILM    223
    CON(N)=SUM+(N-1)*DQ                                                FILM    224
    IF (CC.GT.0.) GO TO 330                                            FILM    225
    IF (CON(N).LE.QMN) GO TO 330                                       FILM    226
    CC=1.                                                              FILM    227
    MINQ=N                                                             FILM    228
330 CONTINUE                                                           FILM    229
    IF (LPR.LE.0) GO TO 480                                            FILM    230
332 CONTINUE                                                           FILM    231
    CALL LINCNT(61)                                                    FILM    232
    GO TO (335,340,345,350,355,360,365,370,375,380,385),L              FILM    233
335 WRITE (12,720) HEIGHT                                              FILM    234
    GO TO 470                                                          FILM    235
340 WRITE (12,725) HEIGHT                                              FILM    236
    GO TO 470                                                          FILM    237
345 WRITE (12,730) HEIGHT                                              FILM    238
    GO TO 470                                                          FILM    239
350 WRITE (12,735) HEIGHT                                              FILM    240
    GO TO 470                                                          FILM    241
355 WRITE (12,740) HEIGHT                                              FILM    242
    GO TO 470                                                          FILM    243
360 WRITE (12,745) HEIGHT                                              FILM    244
    GO TO 470                                                          FILM    245
365 WRITE (12,750) HEIGHT                                              FILM    246
    GO TO 470                                                          FILM    247
370 WRITE (12,755) HEIGHT                                              FILM    248
    GO TO 470                                                          FILM    249
375 WRITE (12,760) HEIGHT                                              FILM    250
    GO TO 470                                                          FILM    251
380 WRITE (12,765) HEIGHT                                              FILM    252
    GO TO 470                                                          FILM    253
385 WRITE (12,770) HEIGHT                                              FILM    254
470 CONTINUE                                                           FILM    255
    IF(LPR.LE.0) GO TO 480                                             FILM    256
    CALL LINCNT (59)                                                   FILM    257
    WRITE (12,860)QMX,QMN,CON(10),CON(MINQ),DQ                         FILM    258
480 DO 710 K=2,KB1                                                     FILM    259
    YD=YS+(K-2)*DPH                                                    FILM    260
    DO 700 I=2,IB                                                      FILM    261
    IKP=I+(J-1)*IB2+K*IB2XJB2                                          FILM    262
    IF(K.EQ.KB1.AND.FL(IKP).NE.0) GO TO 700                            FILM    263
    XD=XS+(I-2)*DR                                                     FILM    264
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C     BYPASSES OBSTACLE                                                    FILM    265
      L12=L13=L24=L34=0.                                                   FILM    266
      KK1=K+1                                                              FILM    267
      IF(K.EQ.KB1.AND.FL(IKP).EQ.0) KK1=2                                  FILM    268
      IF(FL(I,J,K).GT.1.AND.FL(I  ,K).LT.4) L12=L13=1                      FILM    269
      IF(FL(I,J,KK1).GT.1.ANC .L(I,J,KK1).LT.4) L12=L24=1                  FILM    270
      IF(FL(I+1,J,K).GT. .AND.FL(I+1,J,K).LT.4) L13=L34=1                  FILM    271
      IF(FL(I+1,J,KK1).G1 1.AND.FL(I+1,J,KK1).LT.4) L24=L34=1              FILM    272
      DO 690 N=2,10                                                        FILM    273
C     IF CON.GT.CQ SETS KN=1----IF CON.LE.CQ SETS KN=0                     FILM    274
      M=12-N                                                               FILM    275
      K1=K2=K3=K4=1                                                        FILM    276
      IF (CON(M).LE.CQ(I,J,K)) K1=0                                        FILM    277
      IF (CON(M).LE.CQ(I,J,KK1)) K2=0                                      FILM    278
      IF (CON(M).LE.CQ(I+1,J,K)) K3=0                                      FILM    279
      IF (CON(M).LE.CQ(I+1,J,KK1)) K4=0                                    FILM    280
      IF (K1*K2*K3*K4.NE.0) GO TO 690                                      FILM    281
      IF ((K1+K2+K3+K4).NE.0) GO TO 610                                    FILM    282
      GO TO 690                                                            FILM    283
C     FINDS TWO INTERSECTION POINTS OF FOUR CELL REGION                    FILM    284
  610 IC=0                                                                 FILM    285
      IF ((K1+K3).NE.1) GO TO 620                                          FILM    286
      IF (L13.EQ.1) GO TO 620                                              FILM    287
      DY=0.                                                                FILM    288
      KK2=K                                                                FILM    289
      IC=IC+1                                                              FILM    290
      ASSIGN 620 TO KR1                                                    FILM    291
      GO TO 660                                                            FILM    292
  620 IF ((K1+K2).NE.1) GO TO 630                                          FILM    293
      IF (L12.EQ.1) GO TO 630                                              FILM    294
      DX=0.                                                                FILM    295
      III=I                                                                FILM    296
      IC=IC+1                                                              FILM    297
      ASSIGN 630 TO KR1                                                    FILM    298
      GO TO 670                                                            FILM    299
  630 IF ((K2+K4).NE.1) GO TO 640                                          FILM    300
      IF (L24.EQ.1) GO TO 640                                              FILM    301
      DY=DPH                                                               FILM    302
      KK2=KK1                                                              FILM    303
      IC=IC+1                                                              FILM    304
      ASSIGN 640 TO KR1                                                    FILM    305
      GO TO 6                                                              FILM    306
  640 IF ((K3+K ).NE.1) GO TO 650                                          FILM    307
      IF (L34.EQ.1) GO TO 650                                              FILM    308
      DX=DR                                                                FILM    309
      III=I+1                                                              FILM    310
      IC=IC+1                                                              FILM    311
      ASSIGN 650 TO KR1                                                    FILM    312
      GO TO 670                                                            FILM    313
  650 GO TO 690                                                            FILM    314
  660 YC=YD+DY                                                             FILM    315
      XC=XD+DR*((CON(M)-CQ(I,J,KK2))/(CQ(I+1,J,KK2)-CQ(I,J,KK2)))         FILM    316
      XY(IC)=XC                                                            FILM    317
      YX(IC)=YC                                                            FILM    318
      IF(ITC.EQ.0) GO TO 665                                               FILM    319
      XY(IC)=XC*COS(YC)                                                    FILM    320
      YX(IC)=XC*SIN(YC)                                                    FILM    321
  665 IF (IC.EQ.2) GO TO 680                                               FILM    322
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      GO TO KR1                                                          FILM     323
  670 XC=XD+DX                                                           FILM     324
      YC=YD+DPH*((CON(M)-CQ(III,J,K))/(CQ(III,J,KK1)-CQ(III,J,K)))       FILM     325
      XY(IC)=XC                                                          FILM     326
      YX(IC)=YC                                                          FILM     327
      IF(ITC.EQ.0) GO TO 675                                             FILM     328
      XY(IC)=XC*COS(YC)                                                  FILM     329
      YX(IC)=XC*SIN(YC)                                                  FILM     330
  675 IF (IC.EQ.2) GO TO 680                                             FILM     331
      GO TO KR1                                                          FILM     332
C     CONVERTS AND PLOTS CONTOURS FOR FOUR REAL CELLS----K=2             FILM     333
  680 CALL CONVRT (XY(1),IX1,XL,XR,IXL,IXR)                              FILM     334
      CALL CONVRT (XY(2),IX2,XL,XR,IXL,IXR)                              FILM     335
      CALL CONVRT (YX(1),IY1,YB,YT,IYB,IYT)                              FILM     336
      CALL CONVRT (YX(2),IY2,YB,YT,IYB,IYT)                              FILM     337
      IF (M.EQ.10) CALL PLT (IX1,IY1,24)                                 FILM     338
      IF (M.EQ.MINQ) CALL PLT (IX1,IY1,35)                               FILM     339
      CALL DRV (IX1,IY1,IX2,IY2)                                         FILM     340
      IC=0                                                               FILM     341
      GO TO KR1                                                          FILM     342
  690 CONTINUE                                                           FILM     343
  700 CONTINUE                                                           FILM     344
  710 CONTINUE                                                           FILM     345
  900 CONTINUE                                                           FILM     346
 1000 CONTINUE                                                           FILM     347
      RETURN                                                             FILM     348
C                                                                        FILM     349
  720 FORMAT(4X,25HGAS MACROSCOPIC DENSITY    ,40X,7HHEIGHT=,1PE14.7)    FILM     350
  725 FORMAT(4X,26HLIQUID MACROSCOPIC DENSITY,40X,7HHEIGHT=,1PE14.7)     FILM     351
  730 FORMAT(4X,25HVOID FRACTION              ,40X,7HHEIGHT=,1PE14.7)    FILM     352
  735 FORMAT(4X,25HPRESSURE                   ,40X,7HHEIGHT=,1PE14.7)    FILM     353
  740 FORMAT(4X,25HGAS TEMPERATURE            ,40X,7HHEIGHT=,1PE14.7)    FILM     354
  745 FORMAT(4X,25HLIQUID TEMPERATURE         ,40X,7HHEIGHT=,1PE14.7)    FILM     355
  750 FORMAT(4X,25HSATURATION TEMPERATURE     ,40X,7HHEIGHT=,1PE14.7)    FILM     356
  755 FORMAT(4X,25HGAS INTERNAL ENERGY        ,40X,7HHEIGHT=,1PE14.7)    FILM     357
  760 FORMAT(4X,25HLIQUID INTERNAL ENERGY     ,40X,7HHEIGHT=,1PE14.7)    FILM     358
  765 FORMAT(4X,25HMASS EXCHANGE RATE         ,40X,7HHEIGHT=,1PE14.7)    FILM     359
  770 FORMAT(4X,25HMOMENTUM EXCHANGE RATE     ,40X,7HHEIGHT=,1PE14.7)    FILM     360
  850 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                  FILM     361
  860 FORMAT(4X,4HQMX=,1PE12.4,7H   QMN=,1PE12.4,16H   MAX.CON.LINE=,    FILM     362
     1 1PE12.4,16H   MIN.CON.LINE=,1PE12.4,12H   INTERVAL=,1PE12.4)      FILM     363
      END                                                                FILM     364
      SUBROUTINE CNPLTJK                                                 FILM     365
*CALL GCOM1
*CALL GCOM2
      DIMENSION CON(11),XY(2),YX(2)                                      FILM     366
C                                                                        FILM     367
      DO 1000 MM=1,5                                                     FILM     368
      I=JKPLOT(1,MM)                                                     FILM     369
      IF(I.EQ.0) GO TO 1000                                              FILM     370
C     PLOT ONLY THOSE SPECIFIED                                          FILM     371
C                                                                        FILM     372
      DO 900 L=1,11                                                      FILM     373
      IF(JKPLOT(I+L,MM).EQ.0) GO TO 900                                  FILM     374
C     GENERATE BACKGROUND GRID FOR JKPLOTS                               FILM     375
C                                                                        FILM     376
      RADIUS=DR*(FLOAT(I)-1.5)                                           FILM     377
      DA=RADIUS*DPH                                                      FILM     378
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      IF(ITC.EQ.0) DA=DPH                                                FILM     379
      IYB=916                                                            FILM     380
      XL=0.                                                              FILM     381
      XR=KB*DA                                                           FILM     382
      YT=JB*DZ                                                           FILM     383
      YB=0.                                                              FILM     384
      IF(XR.LE.1.13556*YT) GO TO 20                                      FILM     385
      IXL=0                                                              FILM     386
      IXR=1022                                                           FILM     387
      IYT=916-YT*1022/XR                                                 FILM     388
      GO TO 30                                                           FILM     389
   20 X=XR*450/YT                                                        FILM     390
      IXL=511-X                                                          FILM     391
      IXR=511+X                                                          FILM     392
      IYT=16                                                             FILM     393
   30 CONTINUE                                                           FILM     394
      CALL ADV(1)                                                        FILM     395
      IF(LPR.LE.0) GO TO 40                                              FILM     396
      CALL LINCNT(60)                                                    FILM     397
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                  FILM     398
   40 CONTINUE                                                           FILM     399
      DO 65 J=2,JB2                                                      FILM     400
      DO 60 K=2,KB2                                                      FILM     401
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                       FILM     402
      IJM=IJ-IB2                                                         FILM     403
      IKM=IJ-IB2XJB2                                                     FILM     404
      IF(FL(IKM).EQ.0) GO TO 50                                          FILM     405
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 45                                    FILM     406
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))FILM     407
     1 GO TO 45                                                          FILM     408
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)FILM     409
     1 GO TO 45                                                          FILM     410
      GO TO 50                                                           FILM     411
   45 XX3=DA*(FLOAT(K)-2.)                                               FILM     412
      YY3=DZ*(FLOAT(J)-2.)                                               FILM     413
      YY4=YY3+DZ                                                         FILM     414
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                 FILM     415
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                 FILM     416
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                 FILM     417
      CALL DRV(IX1,IY1,IX1,IY2)                                          FILM     418
   50 CONTINUE                                                           FILM     419
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IJM).NE.2.AND.FL(IJM).NE.3)FILM     420
     1 GO TO 55                                                          FILM     421
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3))FILM     422
     1 GO TO 55                                                          FILM     423
      IF(J.EQ.2.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) GO TO 55             FILM     424
      IF(J.EQ.JB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 55             FILM     425
      GO TO 60                                                           FILM     426
   55 XX3=DA*(FLOAT(K)-2.)                                               FILM     427
      XX4=XX3+DA                                                         FILM     428
      YY3=DZ*(FLOAT(J)-2.)                                               FILM     429
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                 FILM     430
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                 FILM     431
      CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                 FILM     432
      CALL DRV(IX1,IY1,IX2,IY1)                                          FILM     433
   60 CONTINUE                                                           FILM     434
   65 CONTINUE                                                           FILM     435
      XS=XL+DA/2.                                                        FILM     436
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      YS=YB+DZ/2.                                                        FILM     437
      QMN=1.E50                                                          FILM     438
      QMX=-1.E50                                                         FILM     439
      DO 200 J=2,JB1                                                     FILM     440
      DO 200 K=2,KB1                                                     FILM     441
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                       FILM     442
      GO TO(101,102,103,104,105,106,107,108,109,110,111),L               FILM     443
C                                                                        FILM     444
  101 CQ(IJ)=RGP(IJ)                                                     FILM     445
      GO TO 190                                                          FILM     446
  102 CQ(IJ)=RLP(IJ)                                                     FILM     447
      GO TO 190                                                          FILM     448
  103 CQ(IJ)=TH(IJ)                                                      FILM     449
      GO TO 190                                                          FILM     450
  104 CQ(IJ)=P(IJ)                                                       FILM     451
      GO TO 190                                                          FILM     452
  105 CQ(IJ)=TG(IJ)                                                      FILM     453
      GO TO 190                                                          FILM     454
  106 CQ(IJ)=TL(IJ)                                                      FILM     455
      GO TO 190                                                          FILM     456
  107 CQ(IJ)=TS(IJ)                                                      FILM     457
      GO TO 190                                                          FILM     458
  108 CQ(IJ)=SIEG(IJ)                                                    FILM     459
      GO TO 190                                                          FILM     460
  109 CQ(IJ)=SIEL(IJ)                                                    FILM     461
      GO TO 190                                                          FILM     462
  110 CQ(IJ)=ERATE(IJ)-CRATE(IJ)                                         FILM     463
      GO TO 190                                                          FILM     464
  111 CQ(IJ)=KDRAG(IJ)                                                   FILM     465
      GO TO 190                                                          FILM     466
  190 CONTINUE                                                           FILM     467
      IF (CQ(IJ).LT.QMN) QMN=CQ(IJ)                                      FILM     468
      IF (CQ(IJ).GT.QMX) QMX=CQ(IJ)                                      FILM     469
  200 CONTINUE                                                           FILM     470
      DQ=(QMX-QMN)/10.                                                   FILM     471
      SUM=QMN                                                            FILM     472
      CC=0.                                                              FILM     473
      MINQ=2                                                             FILM     474
      DO 330 N=1,11                                                      FILM     475
      CON(N)=SUM+(N-1)*DQ                                                FILM     476
      IF (CC.GT.0.) GO TO 330                                            FILM     477
      IF (CON(N).LE.QMN) GO TO 330                                       FILM     478
      CC=1.                                                              FILM     479
      MINQ=N                                                             FILM     480
  330 CONTINUE                                                           FILM     481
      IF (LPR.LE.0) GO TO 480                                            FILM     482
  332 CONTINUE                                                           FILM     483
      CALL LINCNT(61)                                                    FILM     484
      GO TO (335,340,345,350,355,360,365,370,375,380,385),L              FILM     485
  335 WRITE (12,720) RADIUS                                              FILM     486
      GO TO 470                                                          FILM     487
  340 WRITE (12,725) RADIUS                                              FILM     488
      GO TO 470                                                          FILM     489
  345 WRITE (12,730) RADIUS                                              FILM     490
      GO TO 470                                                          FILM     491
  350 WRITE (12,735) RADIUS                                              FILM     492
      GO TO 470                                                          FILM     493
  355 WRITE (12,740) RADIUS                                              FILM     494
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      GO TO 470                                                          FILM    495
  360 WRITE (12,745) RADIUS                                              FILM    496
      GO TO 470                                                          FILM    497
  365 WRITE (12,750) RADIUS                                              FILM    498
      GO TO 470                                                          FILM    499
  370 WRITE (12,755) RADIUS                                              FILM    500
      GO TO 470                                                          FILM    501
  375 WRITE (12,760) RADIUS                                              FILM    502
      GO TO 470                                                          FILM    503
  380 WRITE (12,765) RADIUS                                              FILM    504
      GO TO 470                                                          FILM    505
  385 WRITE (12,770) RADIUS                                              FILM    506
  470 CONTINUE                                                           FILM    507
      CALL LINCNT (59)                                                   FILM    508
      WRITE (12,860)QMX,QMN,CON(10),CON(MINQ),DQ                         FILM    509
  480 DO 710 J=2,JB                                                      FILM    510
      YD=YS+(J-2)*DZ                                                     FILM    511
      DO 700 K=2,KB                                                      FILM    512
      XD=XS+(K-2)*DA                                                     FILM    513
C     BYPASSES OBSTACLE                                                  FILM    514
      L12=L13=L24=L34=0.                                                 FILM    515
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) L12=L13=1                    FILM    516
      IF(FL(I,J,K+1).GT.1.AND.FL(I,J,K+1).LT.4) L12=L24=1                FILM    517
      IF(FL(I,J+1,K).GT.1.AND.FL(I,J+1,K).LT.4) L13=L34=1                FILM    518
      IF(FL(I,J+1,K+1).GT.1.AND.FL(I,J+1,K+1).LT.4) L24=L34=1            FILM    519
      DO 690 N=2,10                                                      FILM    520
C     IF CON.GT.CQ SETS KN=1----IF CON.LE.CQ SETS KN=0                   FILM    521
      M=12-N                                                             FILM    522
      K1=K2=K3=K4=1                                                      FILM    523
      IF (CON(M).LE.CQ(I,J,K)) K1=0                                      FILM    524
      IF (CON(M).LE.CQ(I,J,K+1)) K2=0                                    FILM    525
      IF (CON(M).LE.CQ(I,J+1,K)) K3=0                                    FILM    526
      IF (CON(M).LE.CQ(I,J+1,K+1)) K4=0                                  FILM    527
      IF (K1*K2*K3*K4.NE.0) GO TO 690                                    FILM    528
      IF ((K1+K2+K3+K4).NE.0) GO TO 610                                  FILM    529
      GO TO 690                                                          FILM    530
C     FINDS TWO INTERSECTION POINTS OF FOUR CELL REGION                  FILM    531
  610 IC=0                                                               FILM    532
      IF ((K1+K3).NE.1) GO TO 620                                        FILM    533
      IF (L13.EQ.1) GO TO 620                                            FILM    534
      DX=0.                                                              FILM    535
      KK1=K                                                              FILM    536
      IC=IC+1                                                            FILM    537
      ASSIGN 620 TO KR1                                                  FILM    538
      GO TO 660                                                          FILM    539
  620 IF ((K1+K2).NE.1) GO TO 630                                        FILM    540
      IF (L12.EQ.1) GO TO 630                                            FILM    541
      DY=0.                                                              FILM    542
      JJ1=J                                                              FILM    543
      IC=IC+1                                                            FILM    544
      ASSIGN 630 TO KR1                                                  FILM    545
      GO TO 670                                                          FILM    546
  630 IF ((K2+K4).NE.1) GO TO 640                                        FILM    547
      IF (L24.EQ.1) GO TO 640                                            FILM    548
      DX=DA                                                              FILM    549
      KK1=K+1                                                            FILM    550
      IC=IC+1                                                            FILM    551
      ASSIGN 640 TO KR1                                                  FILM    552
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      GO TO 660                                                          FILM     553
  640 IF ((K3+K4).NE.1) GO TO 650                                        FILM     554
      IF (L34.EQ.1) GO TO 650                                            FILM     555
      DY=DZ                                                              FILM     556
      JJ1=J+1                                                            FILM     557
      IC=IC+1                                                            FILM     558
      ASSIGN 650 TO KR1                                                  FILM     559
      GO TO 670                                                          FILM     560
  650 GO TO 690                                                          FILM     561
  660 XY(IC)=XD+DX                                                       FILM     562
      YX(IC)=YD+DZ*((CON(M)-CQ(I,J,KK1))/(CQ(I,J+1,KK1)-CQ(I,J,KK1)))   FILM     563
      IF (IC.EQ.2) GO TO 680                                             FILM     564
      GO TO KR1                                                          FILM     565
  670 YX(IC)=YD+DY                                                       FILM     566
      XY(IC)=XD+DA*((CON(M)-CQ(I,JJ1,K))/(CQ(I,JJ1,K+1)-CQ(I,JJ1,K)))   FILM     567
      IF (IC.EQ.2) GO TO 680                                             FILM     568
      GO TO KR1                                                          FILM     569
C     CONVERTS AND PLOTS CONTOURS FOR FOUR REAL CELLS----K=2             FILM     570
  680 CALL CONVRT (XY(1),IX1,XL,XR,IXL,IXR)                              FILM     571
      CALL CONVRT (XY(2),IX2,XL,XR,IXL,IXR)                              FILM     572
      CALL CONVRT (YX(1),IY1,YB,YT,IYB,IYT)                              FILM     573
      CALL CONVRT (YX(2),IY2,YB,YT,IYB,IYT)                              FILM     574
      IF (M.EQ.10) CALL PLT (IX1,IY1,24)                                 FILM     575
      IF (M.EQ.MINQ) CALL PLT (IX1,IY1,35)                               FILM     576
      CALL DRV (IX1,IY1,IX2,IY2)                                         FILM     577
      IC=0                                                               FILM     578
      GO TO KR1                                                          FILM     579
  690 CONTINUE                                                           FILM     580
  700 CONTINUE                                                           FILM     581
  710 CONTINUE                                                           FILM     582
  900 CONTINUE                                                           FILM     583
 1000 CONTINUE                                                           FILM     584
      RETURN                                                             FILM     585
C                                                                        FILM     586
  720 FORMAT(4X,25HGAS MACROSCOPIC DENSITY    ,40X,7HRADIUS=,1PE14.7)    FILM     587
  725 FORMAT(4X,26HLIQUID MACROSCOPIC DENSITY,40X,7HRADIUS=,1PE14.7)     FILM     588
  730 FORMAT(4X,25HVOID FRACTION              ,40X,7HRADIUS=,1PE14.7)    FILM     589
  735 FORMAT(4X,25HPRESSURE                   ,40X,7HRADIUS=,1PE14.7)    FILM     590
  740 FORMAT(4X,25HGAS TEMPERATURE            ,40X,7HRADIUS=,1PE14.7)    FILM     591
  745 FORMAT(4X,25HLIQUID TEMPERATURE         ,40X,7HRADIUS=,1PE14.7)    FILM     592
  750 FORMAT(4X,25HSATURATION TEMPERATURE     ,40X,7HRADIUS=,1PE14.7)    FILM     593
  755 FORMAT(4X,25HGAS INTERNAL ENERGY        ,40X,7HRADIUS=,1PE14.7)    FILM     594
  760 FORMAT(4X,25HLIQUID INTERNAL ENERGY     ,40X,7HRADIUS=,1PE14.7)    FILM     595
  765 FORMAT(4X,25HMASS EXCHANGE RATE         ,40X,7HRADIUS=,1PE14.7)    FILM     596
  770 FORMAT(4X,25HMOMENTUM EXCHANGE RATE     ,40X,7HRADIUS=,1PE14.7)    FILM     597
  850 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                  FILM     598
  860 FORMAT(4X,4HQMX=,1PE12.4,7H   QMN=,1PE12.4,16H   MAX.CON.LINE=,    FILM     599
     1 1PE12.4,16H   MIN.CON.LINE=,1PE12.4,12H   INTERVAL=,1PE12.4)      FILM     600
      END                                                                FILM     601
*D,KFIXCC.634,655
*D,KFIXCC.801,906
*D,KFIXCC.1307
      DIMENSION VELMX(6)                                                 FILM     602
*I,KFIXCC.1355
      VELMX(4)=0.                                                        FILM     603
      VELMX(5)=0.                                                        FILM     604
      VELMX(6)=0.                                                        FILM     605
      DO 65 K=2,KB1                                                      FILM     606
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*D,KF!XCC.1358,1366
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                    FILM    607
      IF(FL(IJ).EQ.2.OR.FL(IJ).EQ.3) GO TO 65                         FILM    608
      VELMX(1)=AMAX1(VELMX(1),ABS(UG(IJ)),ABS(VG(IJ)))                FILM    609
      VELMX(2)=AMAX1(VELMX(2),ABS(UL(IJ)),ABS(VL(IJ)))                FILM    610
      VELMX(3)=AMAX1(VELMX(3),ABS(UG(IJ)),ABS(WG(IJ)))                FILM    611
      VELMX(4)=AMAX1(VELMX(4),ABS(UL(IJ)),ABS(WL(IJ)))                FILM    612
      VELMX(5)=AMAX1(VELMX(5),ABS(VG(IJ)),ABS(WG(IJ)))                FILM    613
      VELMX(6)=AMAX1(VELMX(6),ABS(VL(IJ)),ABS(WL(IJ)))                FILM    614
*D,KF!XCC.1368
      DO 145 M=1,5                                                    FILM    615
      K=IJPLOT(1,M)                                                   FILM    616
      IF(K.EQ.0) GO TO 145                                            FILM    617
      DO 145 L=1,2                                                    FILM    618
*D,KF!XCC.1372
*D,KF!XCC.1374,1378
      CALL VPLOT(0,L,XX1,YY1,XX2,YY2)                                 FILM    619
*D,KF!XCC.1382
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                    FILM    620
      IF(FL(IJ).NE.1) GO TO 140                                       FILM    621
*D,KF!XCC.1385,1388
      IMJ=IJ-1                                                        FILM    622
      IJM=IJ-IB2                                                      FILM    623
      GO TO (110,120),L                                               FILM    624
  110 XX2=XX1+0.5*(UG(IMJ)+UG(IJ))*DROU                               FILM    625
      YY2=YY1+0.5*(VG(IJM)+VG(IJ))*DROU                               FILM    626
*D,KF!XCC.1390,1391
  120 XX2=XX1+0.5*(UL(IMJ)+UL(IJ))*DROU                               FILM    627
      YY2=YY1+0.5*(VL(IJM)+VL(IJ))*DROU                               FILM    628
*D,KF!XCC.1392,1394
*I,KF!XCC.1397
C                                                                     FILM    629
C     DO VECTOR IK AND JK PLOTS                                       FILM    630
      CALL VECIKJK(VELMX)                                             FILM    631
*D,KF!XCC.1405
*D,KF!XCC.1410,1411
      DO 290 M=1,5                                                    FILM    632
      K=IJPLOT(1,M)                                                   FILM    633
      IF(K.EQ.0) GO TO 290                                            FILM    634
      DO 290 L=1,11                                                   FILM    635
      IF(IJPLOT(1+L,M).EQ.0) GO TO 290                                FILM    636
*I,KF!XCC.1413
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                    FILM    637
*D,KF!XCC.1415
  170 CQ(IJ)=RGP(IJ)                                                  FILM    638
*D,KF!XCC.1417
  172 CQ(IJ)=RLP(IJ)                                                  FILM    639
*D,KF!XCC.1419
  174 CQ(IJ)= TH(IJ)                                                  FILM    640
*D,KF!XCC.1421
  176 CQ(IJ)=  P(IJ)                                                  FILM    641
*D,KF!XCC.1423
  178 CQ(IJ)= TG(IJ)                                                  FILM    642
*D,KF!XCC.1425
  180 CQ(IJ)= TL(IJ)                                                  FILM    643
*D,KF!XCC.1427
  182 CQ(IJ)= TS(IJ)                                                  FILM    644
*D,KF!XCC.1429
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  184 CQ(IJ)=SIEG(IJ)                                                    FILM     645
*D,KFIXCC.1431
  186 CQ(IJ)=SIEL(IJ)                                                    FILM     646
*D,KFIXCC.1433
  188 CQ(I,J)=ERATE(IJ)-CRATE(IJ)                                        FILM     647
*D,KFIXCC.1435
  190 CQ(IJ)=KDRAG(IJ)                                                   FILM     648
*D,KFIXCC.1440,1442
*I,KFIXCC.1447
C                                                                        FILM     649
C      DO CONTOUR PLOT FOR INDICATED IK AND JK SURFACES                  FILM     650
      CALL CNPLTIK                                                       FILM     651
      CALL CNPLTJK                                                       FILM     652
C                                                                        FILM     653
C      END OF CONTOUR PLOT SECTION                                       FILM     654
C                                                                        FILM     655
*D,KFIXCC.1581,1625
*D,KFIXCC.1839,1872
*BEFORE,KFIXCC.2129
      SUBROUTINE VECIKJK(VELMX)                                          FILM     656
*CALL GCOM1
*CALL GCOM2
      DIMENSION VELMX(6),CS(10)                                          FILM     657
C                                                                        FILM     658
      IF(ITC.EQ.0) GO TO 150                                             FILM     659
C     GENERATE POLAR IKPLOT                                              FILM     660
      CS(1)=SIN(DPH)                                                     FILM     661
      CS(2)=COS(DPH)                                                     FILM     662
      CS(3)=SIN(-.5*DPH)                                                 FILM     663
      CS(4)=COS(-.5*DPH)                                                 FILM     664
      DO 149 M=1,5                                                       FILM     665
      J=IKPLOT(1,M)                                                      FILM     666
      IF(J.EQ.0) GO TO 149                                               FILM     667
      DO 149 L=1,2                                                       FILM     668
      IF(VELMX(L+2).LT.1.E-10) GO TO 149                                 FILM     669
      DROU=DR/VELMX(L+2)                                                 FILM     670
      DROU=0.45*DROU                                                     FILM     671
      CALL ADV(1)                                                        FILM     672
      CALL VPLTBGD(1,L,XX1,YY1,XX2,YY2)                                  FILM     673
      CS(5)=CS(3)                                                        FILM     674
      CS(6)=CS(4)                                                        FILM     675
      DO 148 K=2,KB1                                                     FILM     676
      CS(7)=CS(2)*CS(5)+CS(1)*CS(6)                                      FILM     677
      CS(8)=CS(2)*CS(6)-CS(1)*CS(5)                                      FILM     678
      CS(5)=CS(7)                                                        FILM     679
      CS(6)=CS(8)                                                        FILM     680
      DO 148 I=2,IB1                                                     FILM     681
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                       FILM     682
      IF(FL(IJ).NE.1) GO TO 148                                          FILM     683
      IMJ=IJ-1                                                           FILM     684
      IKM=IJ-IB2XJB2                                                     FILM     685
      CS(9)=R(I)                                                         FILM     686
      XX1=CS(9)*CS(6)                                                    FILM     687
      YY1=CS(9)*CS(5)                                                    FILM     688
      GO TO(142,144),L                                                   FILM     689
  142 UBAR=(UG(IMJ)+UG(IJ))*DROU                                         FILM     690
      WBAR=(WG(IKM)+WG(IJ))*DROU                                         FILM     691
      XX2=XX1+UBAR*CS(6)-WBAR*CS(5)                                      FILM     692
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      YY2=YY1+UBAR*CS(5)+WBAR*CS(6)                                    FILM     693
      GO TO 146                                                        FILM     694
  144 UBAR=(UL(IMJ)+UL(IJ))*DROU                                       FILM     695
      WBAR=(WL(IKM)+WL(IJ))*DROU                                       FILM     696
      XX2=XX1+UBAR*CS(6)-WBAR*CS(5)                                    FILM     697
      YY2=YY1+UBAR*CS(5)+WBAR*CS(6)                                    FILM     698
  146 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                FILM     699
  148 CONTINUE                                                         FILM     700
  149 CONTINUE                                                         FILM     701
      GO TO 159                                                        FILM     702
C                                                                      FILM     703
C     GENERATE CARTESIAN IKPLOT                                        FILM     704
  150 CONTINUE                                                         FILM     705
      DO 158 M=1,5                                                     FILM     706
      J=IKPLOT(1,M)                                                    FILM     707
      IF(J.EQ.0) GO TO 158                                             FILM     708
      DO 158 L=1,2                                                     FILM     709
      IF(VELMX(L+2).LT.1.E-10) GO TO 158                               FILM     710
      DROU=0.45*AMIN1(DR,DPH)/VELMX(L+2)                               FILM     711
      CALL ADV(1)                                                      FILM     712
      CALL VPLTBGD(2,L,XX1,YY1,XX2,YY2)                                FILM     713
      DO 156 K=2,KB1                                                   FILM     714
      DO 156 I=2,IB1                                                   FILM     715
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                     FILM     716
      IF(FL(IJ).NE.1) GO TO 156                                        FILM     717
      XX1=(I-1.5)*DR                                                   FILM     718
      YY1=(K-1.5)*DPH                                                  FILM     719
      IMJ=IJ-1                                                         FILM     720
      IKM=IJ-IB2XJB2                                                   FILM     721
      GO TO (152,153),L                                                FILM     722
  152 XX2=XX1+(UG(IMJ)+UG(IJ))*DROU                                    FILM     723
      YY2=YY1+(WG(IKM)+WG(IJ))*DROU                                    FILM     724
      GO TO 154                                                        FILM     725
  153 XX2=XX1+(UL(IMJ)+UL(IJ))*DROU                                    FILM     726
      YY2=YY1+(WL(IKM)+WL(IJ))*DROU                                    FILM     727
  154 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                FILM     728
  156 CONTINUE                                                         FILM     729
  158 CONTINUE                                                         FILM     730
C                                                                      FILM     731
C     GENERATE JKPLOTS                                                 FILM     732
C                                                                      FILM     733
  159 CONTINUE                                                         FILM     734
      DO 650 M=1,5                                                     FILM     735
      I=JKPLOT(1,M)                                                    FILM     736
      IF(I.EQ.0) GO TO 650                                             FILM     737
      RADIUS=(FLOAT(I)-1.5)*DR                                         FILM     738
      IF(ITC.EQ.0) RADIUS=1.                                           FILM     739
      DO 650 L=1,2                                                     FILM     740
      IF(VELMX(L+4).LT.1.E-10) GO TO 650                               FILM     741
      DROU=.45*DZ/VELMX(L+4)                                           FILM     742
      CALL ADV(1)                                                      FILM     743
      CALL VPLTBGD(3,L,XX1,YY1,XX2,YY2)                                FILM     744
      DO 640 J=2,JB1                                                   FILM     745
      DO 640 K=2,KB1                                                   FILM     746
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                     FILM     747
      IF(FL(IJ).NE.1) GO TO 640                                        FILM     748
      XX1=(FLOAT(K)-1.5)*DPH*RADIUS                                    FILM     749
      YY1=(FLOAT(J)-1.5)*DZ                                            FILM     750
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      IJM=IJ-IB2                                                        FILM    751
      IKM=IJ-IB2XJB2                                                    FILM    752
      GO TO (625,630),L                                                 FILM    753
  625 XX2=XX1+(WG(IKM)+WG(IJ))*DROU                                     FILM    754
      YY2=YY1+(VG(IJM)+VG(IJ))*DROU                                     FILM    755
      GO TO 635                                                         FILM    756
  630 XX2=XX1+(WL(IKM)+WL(IJ))*DROU                                     FILM    757
      YY2=YY1+(VL(IJM)+VL(IJ))*DROU                                     FILM    758
  635 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                 FILM    759
  640 CONTINUE                                                          FILM    760
  650 CONTINUE                                                          FILM    761
      RETURN                                                            FILM    762
      END                                                               FILM    763
*D,KFIXCC.2329
      SUBROUTINE VPLOT(KKK,L,XX1,YY1,XX2,YY2)                           FILM    764
*I,KFIXCC.2337
      DIMENSION JX(20),JY(20),CS(8)                                     FILM    765
*D,KFIXCC.2338
      KK=KKK+1                                                          FILM    766
*D,KFIXCC.2339
      GO TO (10,100,290),KK                                             FILM    767
*D,KFIXCC.2377,2378
      DANGLE=DPH*(FLOAT(K)-1.5)                                         FILM    768
      WRITE(12,310) JNM,NAME,TIME,CYCLE                                 FILM    769
      WRITE(12,300) TYPE(L),DANGLE                                      FILM    770
*D,KFIXCC.2380
      GO TO (280,115,280,280,280,280),KK                                FILM    771
*I,KFIXCC.2381
      PTE=DPH*(FLOAT(K)-1.5)                                            FILM    772
*I,KFIXCC.2383
      IF(PTE.LT.FLOA(1).OR.PTE.GT.FLOA(2)) CALL DRV(KFLO(1),IYB,K     ),  FILM    773
     1 IYB)                                                             FILM    774
*I,KFIXCC.2385
      IF(PTE.LT.FLOA(3).OR.PTE.GT.FLOA(4)) CALL DRV(KFLO(3),IYB,KFLO(4),  FILM    775
     1 IYB)                                                             FILM    776
*I,KFIXCC.2392
      IF(PTE.LT.FLOA(5).OR.PTE.GT.FLOA(6)) CALL DRV(IXL,KFLO(5),IXL,    FILM    777
     1 KFLO(6))                                                         FILM    778
*I,KFIXCC.2394
      IF(PTE.LT.FLOA(7).OR.PTE.GT.FLOA(8)) CALL DRV(IXL,KFLO(7),IXL,    FILM    779
     1 KFLO(8))                                                         FILM    780
*I,KFIXCC.2401
      IF(PTE.LT.FLOA(9).OR.PTE.GT.FLOA(10)) CALL DRV(KFLO(9),IYT,       FILM    781
     1 KFLO(10),IYT)                                                    FILM    782
*I,KFIXCC.2403
      IF(PTE.LT.FLOA(11).OR.PTE.GT.FLOA(12)) CALL DRV(KFLO(11),IYT,     FILM    783
     1 KFLO(12),IYT)                                                    FILM    784
*I,KFIXCC.2410
      IF(PTE.LT.FLOA(13).OR.PTE.GT.FLOA(14)) CALL DRV(IXR,KFLO(13),     FILM    785
     1 IXR,KFLO(14))                                                    FILM    786
*I,KFIXCC.2412
      IF(PTE.LT.FLOA(15).OR.PTE.GT.FLOA(16)) CALL DRV(IXR,KFLO(15),     FILM    787
     1 IXR,KFLO(16))                                                    FILM    788
*I,KFIXCC.2424
      IF(PTE.LT.OB(5,N).OR.PTE.GT.OB(6,N)) GO TO 270                    FILM    789
*D,KFIXCC.2460
  840 CONTINUE                                                          FILM    790
*D,KFIXCC.2463,2464
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  300 FORMAT(4X,25H VELOCITY VECTOR PLOT FOR ,A10,                    FILM    791
     1 29H     AZIMUTHAL ANGLE(DEPTH) =,1PE12.5)                     FILM    792
  310 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)               FILM    793
*1,KF1XCC,24F
      SUBROUTINE VPLOTBGD(KKK,L,XX1,YY1,XX2,YY2)                     FILM    794
*CALL GCOM1
*CALL GCOM2
      DIMENSION CS(10),TYPE(3),JX(20),JY(20)                         FILM    795
      DATA TYPE / 3HGAS, 6HLIQUID, 7HMIXTURE /                       FILM    796
      GO TO (850,900,600,1000),KKK                                   FILM    797
  600 CONTINUE                                                       FILM    798
      IYB=916                                                        FILM    799
      XL=0.                                                          FILM    800
      DIST=DR*(FLOAT(I)-1.5)                                         FILM    801
      RADIUS=DIST                                                    FILM    802
      IF(ITC.EQ.0) RADIUS=1.                                         FILM    803
      XR=KB*DPH*RADIUS                                               FILM    804
      YT=JB*DZ                                                       FILM    805
      YB=0.                                                          FILM    806
      IF(XR.LE.1.13556*YT) GO TO 620                                 FILM    807
      IXL=0                                                          FILM    808
      IXR=1022                                                       FILM    809
      IYT=916-YT*1022/XR                                             FILM    810
      GO TO 630                                                      FILM    811
  620 X=XR*450/YT                                                    FILM    812
      IXL=511-X                                                      FILM    813
      IXR=511+X                                                      FILM    814
      IYT=16                                                         FILM    815
  630 CONTINUE                                                       FILM    816
      CALL ADV(1)                                                    FILM    817
      IF(LPR.LE.0) GO TO 640                                         FILM    818
      CALL LINCNT(55)                                                FILM    819
      WRITE(12,310) JNM,NAME,TIME,CYCLE                              FILM    820
      WRITE(12,325) TYPE(L),DIST                                     FILM    821
  640 CONTINUE                                                       FILM    822
      DO 665 J=2,JB2                                                 FILM    823
      DO 660 K=2,KB2                                                 FILM    824
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                   FILM    825
      IJM=IJ-IB2                                                     FILM    826
      IKM=IJ-IB2XJB2                                                 FILM    827
      IF(FL(IKM).EQ.0) GO TO 650                                     FILM    828
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 645                               FILM    829
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))  FILM    830
     1 GO TO 645                                                     FILM    831
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)  FILM    832
     1 GO TO 645                                                     FILM    833
      GO TO 650                                                      FILM    834
  645 XX3=DPH*RADIUS*(FLOAT(K)-2.)                                   FILM    835
      YY3=DZ*(FLOAT(J)-2.)                                           FILM    836
      YY4=YY3+DZ                                                     FILM    837
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                             FILM    838
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                             FILM    839
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                             FILM    840
      CALL DRV(IX1,IY1,IX1,IY2)                                      FILM    841
  650 CONTINUE                                                       FILM    842
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IJM).NE.2.AND.FL(IJM).NE.3)  FILM    843
     1 GO TO 655                                                     FILM    844
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3))  FILM    845
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     1 GO TO 655                                                                    FILM  846
       IF(J.EQ.2.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) GO TO 655                      FILM  847
       IF(J.EQ.JB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 655                      FILM  848
       GO TO 660                                                                    FILM  849
   655 XX3=DPH*RADIUS*(FLOAT(K)-2.)                                                 FILM  850
       YY3=DZ*(FLOAT(J)-2.)                                                         FILM  851
       XX4=XX3+DPH*RADIUS                                                           FILM  852
       CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                           FILM  853
       CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                           FILM  854
       CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                           FILM  855
       CALL DRV(IX1,IY1,IX2,IY1)                                                    FILM  856
   660 CONTINUE                                                                     FILM  857
   655 CONTINUE                                                                     FILM  858
       RETURN                                                                       FILM  859
C                                                                                   FILM  860
C      GENERATE GRID FOR CYLINDRICAL IKPLOT                                         FILM  861
C                                                                                   FILM  862
   850 CONTINUE                                                                     FILM  863
       IF(LPR.LE.0) GO TO 860                                                       FILM  864
       CALL LINCNT(60)                                                              FILM  865
       HEIGHT=DZ*(FLOAT(J)-1.5)                                                     FILM  866
       WRITE(12,310) JNM,NAME,TIME,C.CLE                                            FILM  867
       WRITE(12,320) TYPE(L),HEIGHT                                                 FILM  868
   860 CONTINUE                                                                     FILM  869
       XR=RB(IB1)                                                                   FILM  870
       XL=-XR                                                                       FILM  871
       YT=XR                                                                        FILM  872
       YB=-XR                                                                       FILM  873
       IXL=61                                                                       FILM  874
       IXR=961                                                                      FILM  875
       IYT=31                                                                       FILM  876
       IYB=931                                                                      FILM  877
       DO 19 II=1,IB1                                                               FILM  878
       X1=RB(II)                                                                    FILM  879
       CALL CONVRT(X1,IX,XL,XR,IXL,IXR)                                             FILM  880
       JX(II)=IX                                                                    FILM  881
       JY(II)=481                                                                   FILM  882
    19 CONTINUE                                                                     FILM  883
       IF(FL(1).EQ.2.OR.FL(1).EQ.3) CALL DRV(JX(1),JY(1),JX(IB1),JY(IB1))           FILM  884
       NANG=DPH/0.08726646 + .5                                                     FILM  885
       DPHN=DPH/FLOAT(NANG)                                                         FILM  886
       CS(1)=SIN(DPHN)                                                              FILM  887
       CS(2)=COS(DPHN)                                                              FILM  888
       CS(3)=0.                                                                     FILM  889
       CS(4)=1.                                                                     FILM  890
       DO 26 KK=2,KB1                                                               FILM  891
       DO 24 N=1,NANG                                                               FILM  892
       CS(6)=CS(2)*CS(3)+CS(1)*CS(4)                                                FILM  893
       CS(7)=CS(2)*CS(4)-CS(1)*CS(3)                                                FILM  894
       CS(3)=CS(6)                                                                  FILM  895
       CS(4)=CS(7)                                                                  FILM  896
       DO 22 II=1,IB1                                                               FILM  897
       CS(8)=RB(II)                                                                 FILM  898
       CS(6)=CS(3)*CS(8)                                                            FILM  899
       CS(7)=CS(4)*CS(8)                                                            FILM  900
       CALL CONVRT(CS(7),IX,XL,XR,IXL,IXR)                                          FILM  901
       CALL CONVRT(CS(6),IY,YB,YT,IYB,IYT)                                          FILM  902
       IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                               FILM  903
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      IPJ=IJ+1                                                                  FILM  904
      IF(II.EQ.IB1.AND.FL(IPJ).LT.4) GO TO 27                                   FILM  905
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IPJ).NE.2.AND.FL(IPJ).NE.3)        FILM  906
     1 GO TO 27                                                                 FILM  907
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3))        FILM  908
     1 GO TO 27                                                                 FILM  909
      GO TO 21                                                                  FILM  910
   27 CALL DRV(JX(II),JY(II),IX,IY)                                             FILM  911
   21 JX(II)=IX                                                                 FILM  912
      JY(II)=IY                                                                 FILM  913
   22 CONTINUE                                                                  FILM  914
   24 CONTINUE                                                                  FILM  915
      DO 25 II=2,IB1                                                            FILM  916
      IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                            FILM  917
      IKP=IJ+IB2XJB2                                                            FILM  918
      IF(FL(IKP).EQ.0) GO TO 25                                                 FILM  919
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKP).NE.2.AND.FL(IKP).NE.3)        FILM  920
     1 GO TO 23                                                                 FILM  921
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))        FILM  922
     1 GO TO 23                                                                 FILM  923
      IF(KK.EQ.KB1.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))GO TO 23                  FILM  924
      GO TO 25                                                                  FILM  925
   23 CALL DRV(JX(II-1),JY(II-1),JX(II),JY(II))                                 FILM  926
   25 CONTINUE                                                                  FILM  927
   26 CONTINUE                                                                  FILM  928
      RETURN                                                                    FILM  929
C                                                                               FILM  930
C     GENERATE BACKGROUND FOR CARTESIAN IKPLOTS                                 FILM  931
C                                                                               FILM  932
  900 CONTINUE                                                                  FILM  933
      IYB=916                                                                   FILM  934
      XL=0.                                                                     FILM  935
      XR=IB*DR                                                                  FILM  936
      YT=KB*DPH                                                                 FILM  937
      YB=0.                                                                     FILM  938
      IF(XR.LE.1.13556*YT) GO TO 920                                            FILM  939
      IXL=0                                                                     FILM  940
      IXR=1022                                                                  FILM  941
      IYT=916-YT*1022/XR                                                        FILM  942
      GO TO 930                                                                 FILM  943
  920 X=XR*450/YT                                                               FILM  944
      IXL=511-X                                                                 FILM  945
      IXR=511+X                                                                 FILM  946
      IYT=16                                                                    FILM  947
  930 CONTINUE                                                                  FILM  948
      IF(LPR.LE.0) GO TO 940                                                    FILM  949
      CALL ADV(1)                                                               FILM  950
      HEIGHT=DZ*(FLOAT(J)-1.5)                                                  FILM  951
      CALL LINCNT(60)                                                           FILM  952
      WRITE(12,310) JNM,NAME,TIME,CYCLE                                         FILM  953
      WRITE(12,320) TYPE(L),HEIGHT                                              FILM  954
  940 CONTINUE                                                                  FILM  955
      DO 960 K=2,KB2                                                            FILM  956
      DO 960 I=2,IB2                                                            FILM  957
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                              FILM  958
      IMJ=IJ-1                                                                  FILM  959
      IKM=IJ-IB2XJB2                                                            FILM  960
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 945                                          FILM  961
```


521 196

```
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))      FILM      962
     1 GO TO 945                                                               FILM      963
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)      FILM      964
     1 GO TO 945                                                               FILM      965
      GO TO 950                                                                FILM      966
  945 XX3=DR*FLOAT(I-2)                                                        FILM      967
      YY3=DPH*FLOAT(K-2)                                                       FILM      968
      XX4=XX3+DR                                                               FILM      969
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                       FILM      970
      CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                       FILM      971
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                       FILM      972
      CALL DRV(IX1,IY1,IX2,IY1)                                                FILM      973
  950 CONTINUE                                                                 FILM      974
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IMJ).NE.2.AND.FL(IMJ).NE.3)       FILM      975
     1 GO TO 955                                                               FILM      976
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3))      FILM      977
     1 GO TO 955                                                               FILM      978
      IF(I.EQ.2.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) GO TO 955                  FILM      979
      IF(I.EQ.IB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 955                  FILM      980
      GO TO 960                                                                FILM      981
  955 XX3=DR*FLOAT(I-2)                                                        FILM      982
      YY3=DPH*FLOAT(K-2)                                                       FILM      983
      YY4=YY3+DPH                                                              FILM      984
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                       FILM      985
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                       FILM      986
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                       FILM      987
      CALL DRV(IX1,IY1,IX1,IY2)                                                FILM      988
  960 CONTINUE                                                                 FILM      989
      RETURN                                                                   FILM      990
C                                                                              FILM      991
C     DRAW VECTORS                                                             FILM      992
 1000 CONTINUE                                                                 FILM      993
      CALL CONVRT(XX1,IX1,XL,XR,IXL,IXR)                                       FILM      994
      CALL CONVRT(XX2,IX2,XL,XR,IXL,IXR)                                       FILM      995
      CALL CONVRT(YY1,IY1,YB,YT,IYB,IYT)                                       FILM      996
      CALL CONVRT(YY2,IY2,YB,YT,IYB,IYT)                                       FILM      997
      CALL DRV(IX1,IY1,IX2,IY2)                                                FILM      998
      RETURN                                                                   FILM      999
  310 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                        FILM     1000
  320 FORMAT(4X,25H VELOCITY VECTOR PLOT FOR ,A10,13H     HEIGHT = ,           FILM     1001
     1 1PE12.5)                                                                FILM     1002
  325 FORMAT(4X,26H VELOCITY VECTOR PLOT FOR ,A10,13H     RADIUS = ,           FILM     1003
     1 1PE12.5)                                                                FILM     1004
      END                                                                      FILM     1005
```

IV. EXAMPLE PROBLEM

We have provided an example problem that focuses on azimuthal flow to verify that the three-dimensional modification set has been correctly included in the basic K-FIX code. The problem involves the single-phase flow in the annulus between two cylinders when the inner cylinder moves periodically perpendicular to its axis, as shown in Fig. 4. The added mass of the inner cylinder can be determined from its prescribed motion and the numerically calculated pressure field acting on it. The calculated result is then compared with the known analytic solution.[3] The inner cylinder's radius, a, is equal to 1.0 m and its motion is given by $x(t) = 0.1(b-a)\sin(2\pi t)$, where the outer radius, b, is 1.1 m. The circumference is resolved by 40 cells in the azimuthal direction and the gap width and cylinder height each are resolved by 1 cell. The force per unit length (force/length) acting on the inner cylinder in the direction of its motion is determined by the surrounding fluid pressure p(3,2,k) as

$$F(t) = \frac{2\pi a}{40} \sum_{k=2}^{k=41} p(3,2,k) \cos\left[(k - 1.5)\ 2\pi/40\right] ,$$

where the summation is over the 40 azimuthal cells. The sinusoidal behavior of F(t) is plotted in Fig. 5. The added mass per unit length (mass/length) of the inner cylinder is determined from the ratio of the maximum force/length (F = 1.309 MPa-cm) to the maximum acceleration ($\ddot{x}$ = 39.48

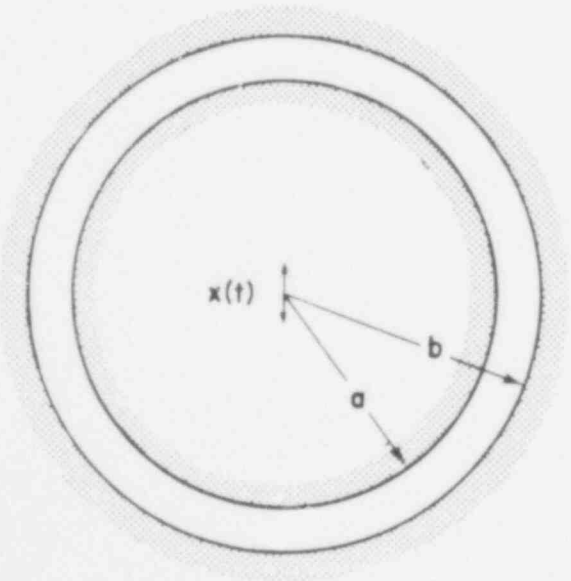

Fig. 4.
Geometry for the calculation of the added mass of the inner oscillating cylinder.

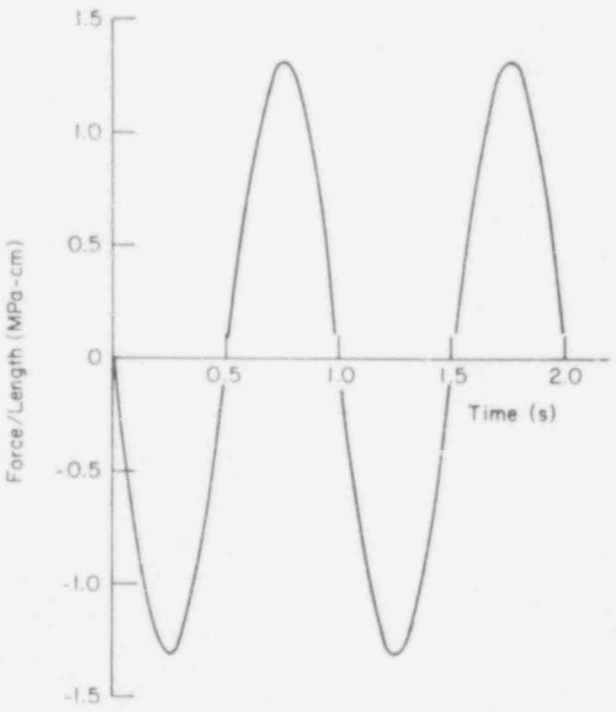

Fig. 5.
History of the force/length acting on the inner cylinder produced by the surrounding fluid pressure.

cm-s^{-2}), which yields 331.6 kg/cm. This value is 10.55 times the mass/length of the fluid displaced by the inner cylinder. For comparison, the analytic solution gives a value of 10.52 for this factor, which differs from the calculated result by 0.28%. The calculation requires about 85 s of CDC 7600 time.

Table I lists the statements that specify the state equations, the modifications that permit nonuniform radial zoning, and the expressions used to calculate the inner cylinder motion and force/length F. The input data in Table II include the cell flag map (FL array), the cell index map (LFL array), and the index increments array (MFL). Table III shows the initial data at cycle −1, and Table IV shows the solution after the first time step. The solution obtained at 2 s is given in Table V.

TABLE I

CODE MODIFICATIONS FOR EXAMPLE PROBLEM

```
*IDENT ADDMAS
*I,KFIXCC.617
C                                                                       ADDMAS     1
C     ADDITIONS TO SUBROUTINE CONVERT                                   ADDMAS     2
C                                                                       ADDMAS     3
      DIMENSION CI(4)                                                   ADDMAS     4
      CI(1)=P(IJ)                                                       ADDMAS     5
      CI(2)=TG(IJ)                                                      ADDMAS     6
      CI(3)=TH(IJ)                                                      ADDMAS     7
      CI(4)=TL(IJ)                                                      ADDMAS     8
      ROG(IJ)=1.0                                                       ADDMAS     9
      RGP(IJ)=ROG(IJ)*CI(3)                                             ADDMAS    10
      RL(IJ)=1.0                                                        ADDMAS    11
      RLP(IJ)=RL(IJ)*(1.-CI(3))                                         ADDMAS    12
      CG(IJ)=1.0                                                        ADDMAS    13
      SIEG(IJ)=1.0                                                      ADDMAS    14
      CL(IJ)=4.2E6                                                      ADDMAS    15
      SIEL(IJ)=CL(IJ)*CI(4)                                             ADDMAS    16
*I,KFIXCC.672
C                                                                       ADDMAS    17
C     ADDITIONS TO SUBROUTINE EOSG TO SPECIFY THE STEAM EQUATION OF     ADDMAS    18
C     STATE                                                             ADDMAS    19
C                                                                       ADDMAS    20
      CG(IJ)=1.0                                                        ADDMAS    21
      TG(IJ)=TL(IJ)                                                     ADDMAS    22
      ROG(IJ)=1.0                                                       ADDMAS    23
*I,KFIXCC.682
C                                                                       ADDMAS    24
C     ADDITIONS TO SUBROUTINE EOSL TO SPECIFY THE WATER EQUATION OF     ADDMAS    25
C     STATE                                                             ADDMAS    26
C                                                                       ADDMAS    27
      CL(IJ)=4.2E6                                                      ADDMAS    28
      TL(IJ)=TEMPO                                                      ADDMAS    29
      RL(IJ)=1.0                                                        ADDMAS    30
      RALS=0.                                                           ADDMAS    31
```

TABLE I (cont)

```
*I,KFIXCC.1244
C                                                                       ADDMAS     32
C     ADDITION TO SUBROUTINE KDRAGS TO SPECIFY INTERFACIAL FRICTION     ADDMAS     33
C                                                                       ADDMAS     34
      KDRAG(IJ)=1.0E10                                                  ADDMAS     35
*I,KFIXCC.1550
C                                                                       ADDMAS     36
C     ADDITION TO SUBROUTINE RHEATS TO SPECIFY THE INTERFACIAL HEAT     ADDMAS     37
C     TRANSFER RATE                                                     ADDMAS     38
C                                                                       ADDMAS     39
      RHEAT(IJ)=1.0E20                                                  ADDMAS     40
*I,KFIXCC.1578
C                                                                       ADDMAS     41
C     ADDITIONS TO SUBROUTINE SAT TO SPECIFY THE SATURATION             ADDMAS     42
C     TEMPERATURE AND LATENT HEAT                                       ADDMAS     43
C                                                                       ADDMAS     44
      TS(IJ)=1.0                                                        ADDMAS     45
      LHEAT(IJ)=1.0                                                     ADDMAS     46
*I,KFIXCC.1668
      IF(I.EQ.IB1)R(,B1)=RB(IB)  + 5.0                                  ADDMAS     47
      IF(I.EQ.IB1)RB(IB1)=R(IB1) + 5.0                                  ADDMAS     48
      IF(I.EQ.IB2)R(IB2)=RB(IB1) + 5.0                                  ADDMAS     49
      IF(I.EQ.IB2)RB(IB2)=R(IB2) + 5.0                                  ADDMAS     50
*B,KFIXCC.1673
      IF(I.GE.IB1) DTORDR(I)=DTORDR(I)*DR/10.                           ADDMAS     51
      IF(I.EQ.IB1) DTORBDR(I)=DTORBDR(I)*DR/10.                         ADDMAS     52
*I,KFIXCC.1979
C                                                                       ADDMAS     53
C     ADDITION TO TILDE FOR PRESCRIBED FLUXES                           ADDMAS     54
C                                                                       ADDMAS     55
      F1=0.                                                             ADDMAS     56
      XSUBC=SIN(6.2831853*(TIME+DT))                                    ADDMAS     57
      XDOT=6.2831853*COS(6.2831853*(TIME+DT))                           ADDMAS     58
      DO 15 K=2,KB1                                                     ADDMAS     59
      IJ=3 + IB2 + (K-1)*IB2XJB2                                        ADDMAS     60
      CALL INDEXA                                                       ADDMAS     61
      COSANG=COS((K-1.5)*DPH)                                           ADDMAS     62
      F1=F1+P(IJ)*RB(2)*DPH*COSANG                                      ADDMAS     63
      UL(IMJ)=XDOT*COSANG                                               ADDMAS     64
      UG(IMJ)=UL(IMJ)                                                   ADDMAS     65
      WL(IMJ)=-XDOT*SIN((K-1.0)*DPH)                                    ADDMAS     66
      WG(IMJ)=WL(IMJ)                                                   ADDMAS     67
      CALL MASFL                                                        ADDMAS     68
   15 CONTINUE                                                          ADDMAS     69
      IF(LPR.GT.1) PRINT 1001,CYCLE,TIME,F1,XDOT,XSUBC                  ADDMAS     70
 1001 FORMAT( I10,1P4E18.7)                                             ADDMAS     71
```

TABLE II

INPUT DATA

CODE NAME - KFIX PROBLEM IDENTIFIER - ADDED MASS PROBLEM K-FIX(3D) 08/07/78

SCALING LENGTH(CM)=1.00E+00 VELOCITY(CM/SEC)=1.00E+00 DENSITY(GM/CC)=1.00E+00 TEMPERATURE(DEG.K)=1.00E+00

GEOMETRY

1. COORDINATES (CART=0, CYLIND=1, SPHERE=2) = 1

2. MESH SIZE, IB2= 4 JB2= 3 KB2= 42

3. CELL SIZE, DR= 1.0000E+02 DZ= 1.0000E+00 DPH= 1.5708E-01

4. INFLOW OPENINGS

A. BOTTOM	-0.	-0.	-0.	-0.
	-0.	-0.	-0.	-0.
B. LEFT	-0.	-0.	-0.	-0.
	-0.	-0.	-0.	-0.

5. OUTFLOW OPENINGS

A. TOP	-0.	-0.	-0.	-0.
	-0.	-0.	-0.	-0.
B. RIGHT	-0.	-0.	-0.	-0.
	-0.	-0.	-0.	-0.

6. BOUNDARIES, (FREE-SLIP=0 NO-SLIP=1)

BOTTOM= -0 LEFT= -0 TOP= -0 RIGHT= -0 FORE= 0 AFT= -0

7. OBSTACLES, NO= 1

SLIP	------COORDINATES------				
0	0.	1.0000E+02	0.	1.0000E+00	0.	6.2832E+00

8. GRAVITY, GRAV= -0.

INITIAL DATA GAS AND LIQUID

1. UO= 0. VO= 0. WO= 0. PO= 1.0000E+08 THO= 0. TO= 3.0000E+02

INFLOW DATA

1. BOTTOM

UINL=-0.	VINL=-0.	WINL=-0.	PINL=-0.	THINL=-0.	TEMPINL=-0.
UINR=-0.	VINR=-0.	WINR=-0.	PINR=-0.	THINR=-0.	TEMPINR=-0.

2. LEFT

UINB=-0.	VINB=-0.	WINB=-0.	PINB=-0.	THINB=-0.	TEMPINB=-0.
UINT=-0.	VINT=-0.	WINT=-0.	PINT=-0.	THINT=-0.	TEMPINT=-0.

CONTROL

1. DUMP AND RESTART, ITD= -0 NTD= -0 NSDMP= -0 NFILE= -0 NNDMP= -0

TABLE II (cont)

2\. TIME AND CYCLE TSTART= 0. TSTOP= 2.0000E+00 DT= 1.0000E-02 CYCLE=-0.

3\. PRINTING ANC PLOTTING, LPR= 2 TPR= 2.0000E+00 TPL= 2.0000E+00 TPLD= 2.0000E+00

PRINT LIMITS I1= 2 I2= 3 J1= 2 J2= 2 K1= 2 K2= 21

4. CONTOUR PLOT FLAGS	RGP	RLP	TH	P	TG	TL	TS	IG	IL	G	K.
IJPLOT FOR K =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IJPLOT FOR K =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IJPLOT FOR K =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IJPLOT FOR K =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IJPLOT FOR K =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IKPLOT FOR J =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IKPLOT FOR J =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IKPLOT FOR J =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IKPLOT FOR J =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
IKPLOT FOR J =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
JKPLOT FOR I =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
JKPLOT FOR I =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
JKPLOT FOR I =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
JKPLOT FOR I =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
JKPLOT FOR I =-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0

CELL FLAG MAP	FL(I,J,K)			
K=1	0	0	0	0
	0	0	0	0
	0	0	0	0
K=2 through 41	2	2	2	2
	2	2	1	2
	2	2	2	2
K=42	0	0	0	0
	0	0	0	0
	0	0	0	0

CELL INDEX MAP	LFL(I,J,K)			
K=2	0	0	0	0
	0	0	1	0
	0	0	0	0
K=3 through 39	0	0	0	0
	0	0	2	0
	0	0	0	0
K=40	0	0	0	0
	0	0	3	0
	0	0	0	0
K=41	0	0	0	0
	0	0	4	0
	0	0	0	0

521 202

TABLE II (cont)

INDEX INCREMENTS ARRAY	MFL(M,LFL(I,J,K))			
IJTL	0	0	0	0
IJBR	0	0	0	0
IJTR	0	0	0	0
IJRR	0	0	0	0
IJTT	0	0	0	0
IJAL	12	12	12	-468
IJFR	468	-12	-12	-12
IJAR	12	12	12	-468
IJAA	24	24	-456	-456
IJTF	468	-12	-12	-12
IJBA	12	12	12	-468
IJTA	12	12	12	-468
IJL	0	0	0	0
IJB	0	0	0	0
IJR	0	0	0	0
IJT	0	0	0	0
IJA	12	12	12	-468
IJF	468	-12	-12	-12

TABLE III

INITIAL CONDITIONS

CYCLE= -1 TIME= 0.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH	UG	VG	SIEG	ROP	KDRAG	WG	CG
				ROL	UL	VL	SIEL	RLP	RHEAT	WL	CL
				ROG	ERATE	CRATE	ASURF	TS	TL	TG	P
2	2	2	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	2	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	3	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	3	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	4	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	4	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	5	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	5	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	6	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	6	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	7	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	7	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	8	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	8	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	9	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.

TABLE III (cont)

CYCLE= -1 TIME= 0.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROD	UG UL ERATE	VG VL CRATE	SIEG SIEL ASURF	ROP RLP TS	KDRAG RHEAT TL	WG WL TG	CG CL P
3	2	9	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	10	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	10	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	11	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	11	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	12	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	12	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	13	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	13	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	14	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	14	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	15	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	15	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	16	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	16	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	17	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	17	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08

TABLE III (cont)

CYCLE= -1 TIME= 0.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROG	UG UL ERATE	VG VL CRATE	SIEG SIEL ASURF	RGP RLP TS	KDRAG RHEAT TL	WG HL TG	CG CL P
2	2	18	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	18	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	19	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	19	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	20	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	20	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	21	2	0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	21	1	0.	0.	0.	1.00000E+00	0.	0.	0.	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	0.	0.	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08

TABLE IV

SOLUTION DATA AT CYCLE 0

CYCLE= 0 TIME= .01000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROG	UG UL ERATE	VG VL CRATE	SIEG SIEL ASURF	RGP RLP TS	KDRAG RHEAT TL	WG WL TG	CG CL P
2	2	2	2	0.	6.25146E+00	0.	0.	0.	0.	9.81663E+00	0.
				0.	6.25146E+00	0.	0.	0.	0.	9.81663E+00	0.
				0.	0.	0.	0.	0.	0	0.	0.
3	2	2	1	0.	0.	0.	1.00075E+00	0.	1.00000E+10	9.81663E+00	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	9.81663E+00	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00658E+08
2	2	3	2	0.	6.09752E+00	0.	0.	0.	0.	1.94020E+01	0.
				0.	6.09752E+00	0.	0.	0.	0.	1.94020E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	3	1	0.	0.	0.	9.98551E-01	0.	1.00000E+10	1.94020E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	1.94020E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00642E+08
2	2	4	2	0.	5.79345E+00	0.	0.	0.	0.	2.84983E+01	0.
				0.	5.79345E+00	0.	0.	0.	0.	2.84983E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	4	1	0.	0.	0.	1.00079E+00	0.	1.00000E+10	2.84983E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	2.84983E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00610E+08
2	2	5	2	0.	5.34672E+00	0.	0.	0.	0.	3.69046E+01	0.
				0.	5.34672E+00	0.	0.	0.	0.	3.69046E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	5	1	0.	0.	0.	9.98475E-01	0.	1.00000E+10	3.69046E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	3.69046E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00563E+08
2	2	6	2	0.	4.76834E+00	0.	0.	0.	0.	4.44024E+01	0.
				0	4.76834E+00	0.	0.	0.	0.	4.44024E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	6	1	0.	0.	0.	9.98501E-01	0.	1.00000E+10	4.44024E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	4.44024E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00502E+08
2	2	7	2	0.	4.07255E+00	0.	0.	0.	0.	5.08071E+01	0.
				0.	4.07255E+00	0.	0.	0.	0.	5.08071E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	7	1	0.	0.	0.	9.98505E-01	0.	1.00000E+10	5.08071E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	5.08071E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00429E+08
2	2	8	2	0.	3.27848E+00	0.	0.	0.	0.	5.59614E+01	0.
				0.	3.27848E+00	0.	0.	0.	0.	5.59614E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	8	1	0.	0.	0.	9.98516E-01	0.	1.00000E+10	5.59614E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	5.59614E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00345E+08

TABLE IV (cont)

CYCLE= 0 TIME= .01000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROG	UG UL ERATE	VG VL CRATE	SIEG SIEL ASURF	RGP RLP TS	KDRAG RHEAT TL	WG WL TG	CG CL P
2	2	9	2	0.	2.39973E+00	0.	0.	0.	0.	5.97383E+01	0.
				0.	2.39973E+00	0.	0.	0.	0.	5.97383E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	9	1	0.	0.	0.	9.98532E-01	0.	1.00000E+10	5.97383E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	5.97383E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00253E+08
2	2	10	2	0.	1.46389E+00	0.	0.	0.	0.	6.20452E+01	0.
				0.	1.46389E+00	0.	0.	0.	0.	6.20452E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	10	1	0.	0.	0.	9.98553E-01	0.	1.00000E+10	6.20452E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	6.20452E+01	4.20000E+06
				1.00000E+00	0.	0.	[illegible]	1.00000E+00	3.00000E+02	3.00000E+02	1.00154E+08
2	2	11	2	0.	4.92000E-01	0.	0.	0.	0.	6.28249E+01	0.
				0.	4.92000E-01	0.	0.	0.	0.	6.28249E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	11	1	0.	0.	0.	9.98648E-01	0.	1.00000E+10	6.28249E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	6.28249E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00052E+08
2	2	12	2	0.	-4.92000E-01	0.	[illegible]	0.	0.	6.20598E+01	0.
				0.	-4.92000E-01	0.	[illegible]	0.	0.	6.20598E+01	0.
				0.	0.	0.	[illegible]	0.	0.	0.	0.
3	2	12	1	0.	0.	0.	9.98485E-01	0.	1.00000E+10	6.20598E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	6.20598E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99483E+07
2	2	13	2	0.	-1.46389E+00	0.	0.	0.	0.	5.97588E+01	0.
				0.	-1.46389E+00	0.	0.	0.	0.	5.97588E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	13	1	0.	0.	0.	1.00030E+00	0.	1.00000E+10	5.97588E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	5.97588E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.98459E+07
2	2	14	2	0.	-2.39973E+00	0.	0.	0.	0.	5.59832E+01	0.
				0.	-2.39973E+00	0.	0.	0.	0.	5.59832E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	14	1	0.	0.	0.	1.00121E+00	0.	1.00000E+10	5.59832E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	5.59832E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.97474E+07
2	2	15	2	0.	-3.27648E+00	0.	0.	0.	0.	5.08297E+01	0.
				0.	-3.27648E+00	0.	0.	0.	0.	5.08297E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.

TABLE IV (cont)

CYCLE= 0 TIME= .01000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROO	UO UL ERATE	VO VL CRATE	SIEO SIEL ASURF	ROP RLP TS	KDRAG RHEAT TL	WO WL TG	CO CL P
3	2	15	1	0.	0.	0.	1.00133E+00	0.	1.00000E+10	5.08297E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	5.08297E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.96550E+07
2	2	16	2	0.	-4.07255E+00	0.	0.	0.	0.	4.44253E+01	0.
				0.	-4.07255E+00	0.	0.	0.	0.	4.44253E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	16	1	0.	0.	0.	1.00144E+00	0.	1.00000E+10	4.44253E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	4.44253E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.95712E+07
2	2	17	2	0.	-4.76834E+00	0.	0.	0.	0.	3.69274E+01	0.
				0.	-4.76834E+00	0.	0.	0.	0.	3.69274E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	17	1	0.	0.	0.	1.00153E+00	0.	1.00000E+10	3.69274E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	3.69274E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.94979E+07
2	2	18	2	0.	-5.34672E+00	0.	0.	0.	0.	2.85207E+01	0.
				0.	-5.34672E+00	0.	0.	0.	0.	2.85207E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	18	1	0.	0.	0.	1.00158E+00	0.	1.00000E+10	2.85207E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	2.85207E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.94370E+07
2	2	19	2	0.	-5.79345E+00	0.	0.	0.	0.	1.94122E+01	0.
				0.	-5.79345E+00	0.	0.	0.	0.	1.94122E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	19	1	0.	0.	0.	1.00160E+00	0.	1.00000E+10	1.94122E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	1.94122E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.93900E+07
2	2	20	2	0.	-6.09752E+00	0.	0.	0.	0.	9.83741E+00	0.
				0.	-6.09752E+00	0.	0.	0.	0.	9.83741E+00	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	20	1	0.	0.	0.	9.99377E-01	0.	1.00000E+10	9.83741E+00	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	9.83741E+00	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.93579E+07
2	2	21	2	0.	-6.25146E+00	0.	0.	0.	0.	9.94602E-03	0.
				0.	-6.25146E+00	0.	0.	0.	0.	9.94602E-03	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	21	1	0.	0.	0.	1.00151E+00	0.	1.00000E+10	9.94602E-03	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	9.94602E-03	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.93417E+07

TABLE V

SOLUTION DATA AT CYCLE 199

CYCLE= 199 TIME= 2.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH	UG	VG	SIEG	ROP	KDRAG	WG	CG
				ROL	UL	VL	SIEL	RLP	RHEAT	WL	CL
				ROG	ERATE	CRATE	ASURF	TS	TL	TG	P
2	2	2	2	0.	6.26382E+00	0.	0.	0.	0.	9.87617E+00	0.
				0.	6.26382E+00	0.	0.	0.	0.	9.87617E+00	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	2	1	0.	0.	0.	1.00903E+00	0.	1.00000E+10	9.87617E+00	1.00000E+00
				1.00000E+00	0.	0.	1.26004E+09	1.00000E+00	1.00000E+20	9.87617E+00	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00002E+08
2	2	3	2	0.	6.10958E+00	0.	0.	0.	0.	1.94820E+01	0.
				0.	6.10958E+00	0.	0.	0.	0.	1.94820E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	3	1	0.	0.	0.	1.00785E+00	0.	1.00000E+10	1.94820E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26003E+09	1.00000E+00	1.00000E+20	1.94820E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00002E+02	1.00002E+08
2	2	4	2	0.	5.80491E+00	0.	0.	0.	0.	2.86094E+01	0.
				0.	5.80491E+00	0.	0.	0.	0.	2.86094E+01	0
				0.	0.	0.	0.	0.	0.	0.	-.
3	2	4	1	0.	0.	0.	1.00888E+00	0.	1.00000E+10	2.86094E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	2.86094E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00002E+08
2	2	5	2	0.	5.35730E+00	0.	0.	0.	0.	3.70333E+01	0.
				0.	5.35730E+00	0.	0.	0.	0.	3.70333E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	5	1	0.	0.	0.	1.00557E+00	0.	1.00000E+10	3.70333E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26002E+09	1.00000E+00	1.00000E+20	3.70333E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00002E+08
2	2	6	2	0.	4.77777E+00	0.	0.	0.	0.	4.45477E+01	0.
				0.	4.77777E+00	0.	0.	0.	0.	4.45477E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	6	1	0.	0.	0.	1.00311E+00	0.	1.00000E+10	4.45477E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	4.45477E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00001E+08
2	2	7	2	0.	4.08060E+00	0.	0.	0.	0.	5.09543E+01	0.
				0.	4.08060E+00	0.	0.	0.	0.	5.09543E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	7	1	0.	0.	0.	1.00328E+00	0.	1.00000E+10	5.09543E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	5.09543E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00001E+08
2	2	8	2	0.	3.28296E+00	0.	0.	0.	0.	5.61042E+01	0.
				0.	3.28296E+00	0.	0.	0.	0.	5.61042E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	8	1	0.	0.	0.	9.97077E-01	0.	1.00000E+10	5.61042E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	5.61042E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08

TABLE V (cont)

CYCLE= 199 TIME= 2.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH / ROL / ROG	UG / UL / ERATE	VG / VL / CRATE	SIEG / SIEL / ASURF	ROP / RLP / TS	KDRAG / RHEAT / TL	HG / HL / TG	CG / CL / P
2	2	9	2	0.	2.40447E+00	0.	0.	0.	0.	5.98741E+01	0.
				0.	2.40447E+00	0.	0.	0.	0.	5.98741E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	9	1	0.	0.	0.	1.00010E+00	0.	1.00000E+10	5.98741E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	5.98741E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	1.00000E+08
2	2	10	2	0.	1.46678E+00	0.	0.	0.	0.	6.21708E+01	0.
				0.	1.46678E+00	0.	0.	0.	0.	6.21708E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	10	1	0.	0.	0.	1.00270E+00	0.	1.00000E+10	6.21708E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	6.21708E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99996E+07
2	2	11	2	0.	4.92973E-01	0.	0.	0.	0.	6.29380E+01	0.
				0.	4.92973E-01	0.	0.	0.	0.	6.29380E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	11	1	0.	0.	0.	1.00232E+00	0.	1.00000E+10	6.29380E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26001E+09	1.00000E+00	1.00000E+20	6.29380E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99993E+07
2	2	12	2	0.	-4.92973E-01	0.	0.	0.	0.	6.21563E+01	0.
				0.	-4.92973E-01	0.	0.	0.	0.	6.21563E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	12	1	0.	0.	0.	9.97898E-01	0.	1.00000E+10	6.21563E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	6.21563E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99990E+07
2	2	13	2	0.	-1.46678E+00	0.	0.	0.	0.	5.98450E+01	0.
				0.	-1.46678E+00	0.	0.	0.	0.	5.98450E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	13	1	0.	0.	0.	9.96302E-01	0.	1.00000E+10	5.98450E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25998E+09	1.00000E+00	1.00000E+20	5.98450E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99989E+07
2	2	14	2	0.	-2.40447E+00	0.	0.	0.	0.	5.60607E+01	0.
				0.	-2.40447E+00	0.	0.	0.	0.	5.60607E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	14	1	0.	0.	0.	9.97684E-01	0.	1.00000E+10	5.60607E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	5.60607E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99989E+07
2	2	15	2	0.	-3.28296E+00	0.	0.	0.	0.	5.09074E+01	0.
				0.	-3.28296E+00	0.	0.	0.	0.	5.09074E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	15	1	0.	0.	0.	1.00113E+00	0.	1.00000E+10	5.09074E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	5.09074E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99989E+07
2	2	16	2	0.	-4.08060E+00	0.	0.	0.	0.	4.44904E+01	0.
				0.	-4.08060E+00	0.	0.	0.	0.	4.44904E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.

TABLE V (cont)

CYCLE= 199 TIME= 2.00000000 DT= .01000000 ADDED MASS PROBLEM K-FIX(3D) 08/07/78

I	J	K	FL	TH ROL ROG	UG UL ERATE	VG VL CRATL	SIEG SIEL ASURF	RGP RLP TS	KDRAG RHEAT TL	HG HL TG	CG CL P
3	2	16	1	0.	0.	0.	1.00734E+00	0.	1.00000E+10	4.44904E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26003E+09	1.00000E+00	1.00000E+20	4.44904E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99990E+07
2	2	17	2	0.	-4.77777E+00	0.	0.	0.	0.	3.69698E+01	0.
				0.	-4.77777E+00	0.	0.	0.	0.	3.69698E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	17	1	0.	0.	0.	9.97425E-01	0.	1.00000E+10	3.69698E+01	1.00000E+00
				1.00000E+00	0.	0.	1.25999E+09	1.00000E+00	1.00000E+20	3.69698E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99992E+07
2	2	18	2	0.	-5.35730E+00	0.	0.	0.	0.	2.85668E+01	0.
				0.	-5.35730E+00	0.	0.	0.	0.	2.85668E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	18	1	0.	0.	0.	1.00917E+00	0.	1.00000E+10	2.85668E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26004E+09	1.00000E+00	1.00000E+20	2.85668E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99994E+07
2	2	19	2	0.	-5.80491E+00	0.	0.	0.	0.	1.94410E+01	0.
				0.	-5.80491E+00	0.	0.	0.	0.	1.94410E+01	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	19	1	0.	0.	0.	9.99054E-01	0.	1.00000E+10	1.94410E+01	1.00000E+00
				1.00000E+00	0.	0.	1.26000E+09	1.00000E+00	1.00000E+20	1.94410E+01	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99996E+07
2	2	20	2	0.	-6.10958E+00	0.	0.	0.	0.	9.83669E+00	0.
				0.	-6.10958E+00	0.	0.	0.	0.	9.83669E+00	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	20	1	0.	0.	0.	9.95369E-01	0.	1.00000E+10	9.83669E+00	1.00000E+00
				1.00000E+00	0.	0.	1.25998E+09	1.00000E+00	1.00000E+20	9.83669E+00	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99997E+07
2	2	21	2	0.	-6.26382E+00	0.	0.	0.	0.	-9.87991E-03	0.
				0.	-6.26382E+00	0.	0.	0.	0.	-9.87991E-03	0.
				0.	0.	0.	0.	0.	0.	0.	0.
3	2	21	1	0.	0.	0.	1.00783E+00	0.	1.00000E+10	-9.87991E-03	1.00000E+00
				1.00000E+00	0.	0.	1.26003E+09	1.00000E+00	1.00000E+20	-9.87991E-03	4.20000E+06
				1.00000E+00	0.	0.	0.	1.00000E+00	3.00000E+02	3.00000E+02	9.99998E+07

APPENDIX

LISTING OF THREE-DIMENSIONAL CODE

A listing of the three-dimensional version of the K-FIX code, KFIX(3D), is provided. The program PREP that prepares the COMMON storage block is listed first, followed by its output generated for the example problem. This PREP program differs from that listed in Ref. 2 because of the additional data arrays it must generate. The code KFIX(3D) consists of the basic K-FIX code listed in Ref. 2, the five modification sets listed in Sec. III, and certain changes identified as PERM[4] to correct errors in the basic code.

```
PROGRAM PREP (INP,OUT,FSET7,FSET8,FSET9=OUT)                    PREP3D     1
WRITE (7,10)                                                    PREP3D     2
WRITE (7,20)                                                    PREP3D     3
WRITE (7,260)                                                   PREP3D     4
WRITE (7,270)                                                   PREP3D     5
WRITE (7,280)                                                   PREP3D     6
WRITE (7,230)                                                   PREP3D     7
WRITE (7,300)                                                   PREP3D     8
WRITE (7,310)                                                   PREP3D     9
WRITE (7,320)                                                   PREP3D    10
WRITE (7,330)                                                   PREP3D    11
WRITE (7,340)                                                   PREP3D    12
WRITE (7,350)                                                   PREP3D    13
WRITE (7,360)                                                   PREP3D    14
WRITE (7,370)                                                   PREP3D    15
WRITE (7,380)                                                   PREP3D    16
WRITE (7,390)                                                   PREP3D    17
WRITE (7,400)                                                   PREP3D    18
WRITE (7,410)                                                   PREP3D    19
WRITE (7,420)                                                   PREP3D    20
WRITE (7,430)                                                   PREP3D    21
WRITE (7,440)                                                   PREP3D    22
WRITE (7,450)                                                   PREP3D    23
WRITE (7,460)                                                   PREP3D    24
WRITE (7,470)                                                   PREP3D    25
READ 30, IB2,JB2,KB2,MTYPE                                      PREP3D    26
LENA=18*IB2*JB2*KB2                                             PREP3D    27
LENB=18*IB2*JB2*KB2                                             PREP3D    28
LENC=16*IB2*JB2*KB2                                             PREP3D    29
LENE=10*IB2*JB2+18*IB2                                          PREP3D    30
MAX=MAX0(IB2,JB2)                                               PREP3D    31
LEND=2*MAX                                                      PREP3D    32
WRITE (7,40)                                                    PREP3D    33
IF (MTYPE.EQ.0) WRITE (7,110)                                   PREP3D    34
IF (MTYPE.EQ.1) WRITE (7,120)                                   PREP3D    35
WRITE (7,160)((IB2,JB2,KB2),I=1,9)                              PREP3D    36
WRITE (7,170)((IB2,JB2,KB2),I=1,9)                              PREP3D    37
IF (MTYPE.EQ.0) WRITE (7,110)                                   PREP3D    38
IF (MTYPE.EQ.1) WRITE (7,130)                                   PREP3D    39
WRITE (7,180)((IB2,JB2,KB2),I=1,9)                              PREP3D    40
WRITE (7,190)((IB2,JB2,KB2),I=1,9)                              PREP3D    41
IF (MTYPE.EQ.0) WRITE (7,110)                                   PREP3D    42
IF (MTYPE.EQ.1) WRITE (7,140)                                   PREP3D    43
```

```
      WRITE (7,200)((IB2,JB2,KB2),I=1,9)                                PREP3D     44
      WRITE (7,210)((IB2,JB2,KB2),I=1,7)                                PREP3D     45
      IF (MTYPE.EQ.0) WRITE (7,110)                                     PREP3D     46
      IF (MTYPE.EQ.1) WRITE (7,150)                                     PREP3D     47
      WRITE (7,220)((IB2,JB2),I=1,9)                                    PREP3D     48
      WRITE (7,230)((IB2,JB2),I=1,1),((IB2),I=1,8)                      PREP3D     49
      WRITE (7,240)((IB2),I=1,11)                                       PREP3D     50
      WRITE (7,110)                                                     PREP3D     51
      WRITE (7,250)((MAX),I=1,2)                                        PREP3D     52
      WRITE (7,50)                                                      PREP3D     53
      WRITE (7,60)                                                      PREP3D     54
      WRITE (7,70)IB2,JB2,KB2,LENA,LENB,LENC,LEND,LENE                  PREP3D     55
      WRITE (7,80)                                                      PREP3D     56
      NVAR=46                                                           PREP3D     57
      IFL=9                                                             PREP3D     58
      INCN=IB2*JB2*KB2                                                  PREP3D     59
      WRITE (7,90)NVAR,IFL,INCN                                         PREP3D     60
      IF (MTYPE.EQ.1) WRITE (7,100)                                     PREP3D     61
      END FILE 7                                                        PREP3D     62
      REWIND 7                                                          PREP3D     63
      CALL COPY (5LFSET7,5LFSET8)                                       PREP3D     64
      END FILE 8                                                        PREP3D     65
      REWIND 8                                                          PREP3D     66
      STOP                                                              PREP3D     67
C                                                                       PREP3D     68
   10 FORMAT (22H*PURDECK GCOM1,GCOM2  )                                PREP3D     69
   20 FORMAT (20H*BEFORE,KFIXCC.1     )                                 PREP3D     70
   30 FORMAT (4I12)                                                     PREP3D     71
   40 FORMAT (15H*COMDECK,GCOM2 )                                       PREP3D     72
   50 FORMAT (*       INTEGER CYCLE,FL,THSF *)                          PREP3D     73
   60 FORMAT (*       REAL KAPG,KAPL,KDRAG,LEFT,LHEAT,MUG,MUL      *)   PREP3D     74
   70 FORMAT (13H*I,KFIXCC.13 /*       DATA IB2,JB2,KB2,LENA,LENB,LENC,LE  PREP3D     75
     IND,LENE /*15*,*15*,*15*,*/*      1*18*,*18*,*18*,*18*,*17*/*)      PREP3D     76
   80 FORMAT (12H*I,KFIXCC.18/*       DO 2 K=1,LENA*/*     2 ABETA(K)=0.*/  PREP3D     77
     *       DO 3 K=1,LENB*/*     3 RGFR(K)=0.*/*       DO 4 K=1,LENC    */  PREP3D     78
     *     4 SIEG(K)=0. */*       DO 5 K=1,LENE */*     5 EGFF(K)=0. *)   PREP3D     79
   90 FORMAT (14H*I,KFIXCC.155 /*       DATA NVAR,IFL,INCN  /*,I3,*,*I3,*  PREP3D     80
     I,*I6,*/*)                                                         PREP3D     81
  100 FORMAT (14H*I,KFIXCC.179 /*       IF(N.LE.18) GO TO 14 */*       IF(  PREP3D     82
     1N.LE.36) GO TO 12 */26H      L=(N-37)*INCN        /*       SIEG(N2+L  PREP3D     83
     2)=SIEG(N1+L) */*       GO TO 15 */26H    12 L=(N-19)*INCN        /*   PREP3D     84
     3    RGFR(N2+L)=RGFR(N1+L) */*       GO TO 15 */*    14 CONTINUE */14  PREP3D     85
     4H*I,KFIXCC.195 /*       IF(N.LE.18) GO TO 24 */*       IF(N.LE.36) G  PREP3D     86
     50 TO 22 */26H      L=(N-37)*INCN        /*       SIEG(N2+L)=SIEG(N1+  PREP3D     87
     6L) */*       GO TO 25 */26H    22 L=(N-19)*INCN        /*       RGFR(N  PREP3D     88
     72+L)=RGFR(N1+L) */*       GO TO 25 */*    24 CONTINUE *)           PREP3D     89
  110 FORMAT (*       COMMON*)                                          PREP3D     90
  120 FORMAT (*       LCM / CELLD1 /*)                                  PREP3D     91
  130 FORMAT (*       LCM / CELLD2 /*)                                  PREP3D     92
  140 FORMAT (*       LCM / CELLD3 /*)                                  PREP3D     93
  150 FORMAT (*       LCM / CELLD4 /*)                                  PREP3D     94
  160 FORMAT (*      1*,* ABETA(*I3*,*I3*,*I3*),*,* ASURF(*I3*,*I3*,*I3*)  PREP3D     95
     1,*,* CG    (*I3*,*I3*,*I3*),*,/*      1*,* CL    (*I3*,*I3*,*I3*),*,*  PREP3D     96
     2 CONV (*I3*,*I3*,*I3*),*,* CQ    (*I3*,*I3*,*I3*),*,/*      1*,* CRA  PREP3D     97
     3TE(*I3*,*I3*,*I3*),*,* ERATE(*I3*,*I3*,*I3*),*,* FL    (*I3*,*I3*,*  PREP3D     98
     4I3*),*,)                                                          PREP3D     99
  170 FORMAT (*      1*,* KAPG (*I3*,*I3*,*I3*),*,* KAPL (*I3*,*I3*,*I3*)  PREP3D    100
     1,*,* KDRAG(*I3*,*I3*,*I3*),*,/*      1*,* LFL   (*I3*,*I3*,*I3*),*,*  PREP3D    101
     2 LHEAT(*I3*,*I3*,*I3*),*,* MUG   (*I3*,*I3*,*I3*),*,/*      1*,* MUL  PREP3D    102
     3  (*I3*,*I3*,*I3*),*,* P     (*I3*,*I3*,*I3*),*,* RGFA (*I3*,*I3*,*  PREP3D    103
     4I3*) *,)                                                          PREP3D    104
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180 FORMAT (*     1*,* RGFR (*I3*,*I3*,*I3*),*,* RGFT (*I3*,*I3*,*I3*)      PREP3D   105
   1,*,* RGP  (*I3*,*I3*,*I3*),*,/*     1*,* RPN (*I3*,*I3*,*I3*),*,*       PREP3D   106
   2 RHEAT(*I3*,*I3*,*I3*),*,* RL   (*I3*,*I3*,*I3*),*,/*     1*,* RLF      PREP3D   107
   3A (*I3*,*I3*,*I3*),*,* RLFR (*I3*,*I3*,*I3*),*,* RLFT (*I3*,*I3*,*      PREP3D   108
   4I3*),*,)                                                                 PREP3D   109
190 FORMAT (*     1*,* RLP  (*I3*,*I3*,*I3*),*,* RLPN (*I3*,*I3*,*I3*)      PREP3D   110
   1,*,* ROG  (*I3*,*I3*,*I3*),*,/*     1*,* RUG  (*I3*,*I3*,*I3*),*,*       PREP3D   111
   2 RUL  (*I3*,*I3*,*I3*),*,* RVG  (*I3* *I3*,*I3*),*,/*     1*,* RVL       PREP3D   112
   3  (*I3*,*I3*,*I3*),*,* RWG  (*I3*,*I3*,*I3*),*,* RWL  (*I3*,*I3*,*       PREP3D   113
   4I3*) *,)                                                                 PREP3D   114
200 FORMAT (*     1*,* SIEG (*I3*,*I3*,*I3*),*,* SIEGN(*I3*,*I3*,*I3*)      PREP3D   115
   1,*,* SIEL (*I3*,*I3*,*I3*),*,/*     1*,* SIELN(*I3*,*I3* *I3*),*,*       PREP3D   116
   2 TG   (*I3*,*I3*,*I3*),*,* TH   (*I3*,*I3*,*I3*),*,/*     1*,* THN       PREP3D   117
   3  (*I3*,*I3*,*I3*),*,* THSF (*I3*,*I3*,*I3*),*,* TL   (*I3*,*I3*,*       PREP3D   118
   4I3*),*,)                                                                 PREP3D   119
210 FORMAT (*     1*,* TS   (*I3*,*I3*,*I3*),*,* UG   (*I3*,*I3*,*I3*)      PREP3D   120
   1,*,* UL   (*I3*,*I3*,*I3*),*,/*     1*,* VG   (*I3*,*I3*,*I3*),*,*       PREP3D   121
   2 VL   (*I3*,*I3*,*I3*),*,* WG   (*I3*,*I3*,*I3*),*,/*     1*,* WL        PREP3D   122
   3  (*I3*,*I3*,*I3*) *,)                                                   PREP3D   123
220 FORMAT (*     1*,* EGFF (*I4*,*I4*),*,* ELFF (*I4*,*I4*),*,* OMTFF      PREP3D   124
   1(*I4*,*I4*),*,/*     1*,* THFF (*I4*,*I4*),*,* UGFF (*I4*,*I4*),*,       PREP3D   125
   2* ULFF (*I4*,*I4*),*,/*     1*,* VGFF (*I4*,*I4*),*,* VLFF (*I4*,*       PREP3D   126
   3I4*),*,* WGFF (*I4*,*I4*),*,)                                            PREP3D   127
230 FORMAT (*     1*,* WLFF (*I4*,*I4*),*,* DA       (*I5*),*,* DTORBD      PREP3D   128
   1P  (*I5*),*,/*     1*,* DTORBDR  (*I5*),*,* DTORDPH  (*I5*),*,* DT       PREP3D   129
   2ORDR   (*I5*),*,/*     1*,* EGFB     (*I5*),*,* ELFB     (*I5*),*,       PREP3D   130
   3* OMTFB    (*I5*),*,)                                                    PREP3D   131
240 FORMAT (*     1*,* R        (*I5*),*,* RB       (*I5*),*,* RRB          PREP3D   132
   1  (*I5*),*,/*     1*,* RRIDR    (*I5*),*,* THFB     (*I5*),*,* UGF       PREP3D   133
   2B     (*I5*),*,/*     1*,* ULFB     (*I5*),*,* VGFB     (*I5*),*,*       PREP3D   134
   3 VLFB     (*I5*),*,/*     1*,* WGFB     (*I5*),*,* WLFB     (*I5*)       PREP3D   135
   4 *,)                                                                     PREP3D   136
250 FORMAT (*     1*,* ZA       (*I5*),*,* ZB       (*I5*) *,)              PREP3D   137
260 FORMAT (15H*COMDECK,GCOM1 )                                             PREP3D   138
270 FORMAT (*      COMMON / PARAM1 /*)                                      PREP3D   139
280 FORMAT (*     1*,* BUBRAD,   *,* CYCLE,    *,* DG,       *,* DL,       PREP3D   140
   1     *,* DPH,      *,* DR,       *,/*     1*,* DT,       *,* DTODA     PREP3D   141
   2,    *,* DTODR,    *,* DTODZ,    *,*  Z,       *,* D1,       *,)       PREP3D   142
290 FORMAT (*     1*,* D2,       *,* D3,       *,* EGFA,     *,* EGFL,     PREP3D   143
   1     *,* EGFR,     *,* EGFT,     *,/*     1*,* ELFA,     *,* ELFL,     PREP3D   144
   2     *,* ELFR,     *,* ELFT,     *,* GRAV,     *,* HFGA,     *,)       PREP3D   145
300 FORMAT (*     1*,* HFGB,     *,* HFGF,     *,* HFGL,     *,* HFGR,     PREP3D   146
   1     *,* HFGT,     *,* HFLA,     *,/*     1*,* HFLB,     *,* HFLF,     PREP3D   147
   2     *,* HFLL,     *,* HFLR,     *,* HFLT,     *,* I,        *,)       PREP3D   148
310 FORMAT (*     1*,* IB,       *,* IB1,      *,* IB2,      *,* IB2XJ     PREP3D   149
   1B2,  *,* ICJ,      *,* IJ,       *,/*     1*,* IJA,      *,* IJAA,     PREP3D   150
   2     *,* IJAL,     *,* IJAR,     *,* IJB ,     *,* IJBA,     *,)       PREP3D   151
320 FORMAT (*     1*,* IJBR,     *,* IJF,      *,* IJFR,     *,* IJL,      PREP3D   152
   1     *,* IJM,      *,* IJP,      *,/*     1*,* IJR,      *,* IJRR,     PREP3D   153
   2     *,* IJT,      *,* IJTA,     *,* IJTF,     *,* IJTL,     *,)       PREP3D   154
330 FORMAT (*     1*,* IJTR,     *,* IJTT,     *,* IKM,      *,* IKP,      PREP3D   155
   1     *,* IL,       *,* IMJ,      *,/*     1*,* IMJP,     *,* IMKP,     PREP3D   156
   2     *,* INCJ,     *,* INCK,     *,* IPJ,      *,* IPJM,     *,)       PREP3D   157
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340 FORMAT (*     1*,' IPJP,     *,* IPKM,     *,* IPKP,     *,* IP1,     PREP3D   158
   1     *,* IP2,      *,* IS,       *,/*     1*,* ITC,     *,* ITD,     PREP3D   159
   2     *,* J ,       *,* JB,       *,* JB1,      *,* JB2,      *,)     PREP3D   160
350 FORMAT (*     1*,* JL,       *,* JNM,      *,* JPKM,     *,* JPKP,    PREP3D   161
   1     *,* JMKM,     *,* JMKP,     * /*     1*,* JS,      *,* JP1,     PREP3D   162
   2     *,* JP2,      *,* K,        *,* KB,       *,* KB1,      *,)     PREP3D   163
360 FORMAT (*     1*,* KB2,      *,* KL,       *,* KS,       *,* KP1,     PREP3D   164
   1     *,* KP2,      *,* LPR,      *,/*     1*,* MAXM,    *,* NCYDM    PREP3D   165
   2P,   *,* NFILE,    *,* NIT,      *,* NO,       *,* NSDMP     *,)     PREP3D   166
370 FORMAT (*       COMMON / PARAM2 /*)                                    PREP3D   167
380 FORMAT (*     1*,* NTD,      *,* NWDMP,    *,* OMTFA,    *,* OMTFL    PREP3D   168
   1,    *,* OMTFR,    * * OMTFT,    *,/*     1*,* PINB,    *,* PINL,    PREP3D   169
   2     *,* PINR,     *,* PINT,     *,* PO,       *,* P1,       *,)     PREP3D   170
390 FORMAT (*     1*,* P2,       *,* P3,       *,* RAGS,     *,* RALS,    PREP3D   171
   1     *,* RDA,      *,* RDA2,     -,)                                  PREP3D   172
400 FORMAT (*     1*,* RDR,      *,* RDR2,     *,* RDZ,      *,* RDZ2,    PREP3D   173
   1     *,* SECREQ,   *,* TARGET,   *,/*     1*,* TEMPINT, *,* TBEG,    PREP3D   174
   2     *,* TEMPINB,  *,* TEMPINL,  *,* TEMPINR,  *,* TEMPO,    *,)     PREP3D   175
410 FORMAT (*     1*,* THFA,     *,* THFL,     *,* THFR,     *,* THFT,    PREP3D   176
   1     *,* THINB,    *,* THINL,    *,/*     1*,* THINR,   *,* THINT    PREP3D   177
   2,    *,* THO,      *,* THSTAR,   *,* TIME,     *,* TPL,      *,)     PREP3D   178
420 FORMAT (*     1*,* TPLD,     *,* TPR,      *,* TSTOP,    *,* UGFA,    PREP3D   179
   1     *,* UGFL,     *,* UGFR,     *,/*     1*,* UGFT,    *,* UINB,    PREP3D   180
   2     *,* UINL,     *,* UINR,     *,* UINT,     *,* ULFA,     *,)     PREP3D   181
430 FORMAT (*     1*,* ULFL,     *,* ULFR,     *,* ULFT,     *,* UO,      PREP3D   182
   1     *,* VGFA,     *,* VGFL,     *,/*     1*,* VGFR,    *,* VGFT,    PREP3D   183
   2     *,* VLFA,     *,* VLFL,     *,* VLFR,     *,* VLFT,     *,)     PREP3D   184
440 FORMAT (*     1*,* VINB,     *,* VINL,     *,* VINR,     *,* VINT,    PREP3D   185
   1     *,* VO,       *,* VREL,     *,/*     1*,* WGFA,    *,* WGFL,    PREP3D   186
   2     *,* WGFR,     *,* WGFT,     *,* WINB,     *,* WINL,     *,)     PREP3D   187
450 FORMAT (*     1*,* WINR,     *,* WINT,     *,* WLFA,     *,* WLFL,    PREP3D   188
   1     *,* WLFR,     *,* WLFT,     *,/*     1*,* WO       *,)          PREP3D   189
460 FORMAT (*       COMMON / PARAM3 /*)                                    PREP3D   190
470 FORMAT (*     1*,* C(100), *,* FLO(16), *,* FLOA(16),*,* IJPLOT(12     PREP3D   191
   1,5),*,* IKPLOT(12,5),*,/*     1*,* JKPLOT(12,5),*,* MFL(18,200),*,    PREP3D   192
   2* NAME(10),*,* NSL(4),   *,* NSO(20),  *,/*     1*,* OB(6,20), *,*   PREP3D   193
   3 SCALE(4)  *,)                                                        PREP3D   194
    END                                                                   PREP3D   195
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*PURDECK GCOM1,GCOM2
*BEFORE,KFIXCC.I
*COMDECK,GCOM1
      COMMON / PARAM1 /
     1 BUBRAD,     CYCLE,     DG,        DL,        DPH,       DR,
     1 DT,         DTODA,     DTODR,     DTODZ,     DZ,        D1,
     1 D2,         D3,        EGFA,      EGFL,      EGFR,      EGFT,
     1 ELFA,       ELFL,      ELFR,      ELFT,      GRAV,      HFGA,
     1 HFGB,       HFGF,      HFGL,      HFGR,      HFGT,      HFLA,
     1 HFLB,       HFLF,      HFLL,      HFLR,      HFLT,      I,
     1 IB,         IB1,       IB2,       IB2XJB2,   ICJ,       IJ,
     1 IJA,        IJAA,      IJAL,      IJAR,      IJB ,      IJBA,
     1 IJBR,       IJF,       IJFR,      IJL,       IJM,       IJP,
     1 IJR,        IJRR,      IJT,       IJTA,      IJTF,      IJTL,
     1 IJTR,       IJTT,      IKM,       IKP,       IL,        IMJ,
     1 IMJP,       IMKP,      INCJ,      INCK,      IPJ,       IPJM,
     1 IPJP,       IPKM,      IPKP,      IP1,       IP2,       IS,
     1 ITC,        ITD,       J ,        JB,        JB1,       JB2,
     1 JL,         JNM,       JPKM,      JPKP,      JMKM,      JMKP,
     1 JS,         JP1,       JP2,       K,         KB,        KB1,
     1 KB2,        KL,        KS,        KP1,       KP2,       LPR,
     1 MAXM,       NCYDMP,    NFILE,     NIT,       NO,        NSDMP
      COMMON / PARAM2 /
     1 NTD,        NWDMP,     OMTFA,     OMTFL,     OMTFR,     OMTFT,
     1 PINB,       PINL,      PINR,      PINT,      PO,        P1,
     1 P2,         P3,        RAGS,      RALS,      RDA,       RDA2,
     1 RDR,        RDR2,      RDZ,       RDZ2,      SECREQ,    TARGET,
     1 TEMPINT,    TBEG,      TEMPINB,   TEMPINL,   TEMPINR,   TEMPO,
     1 THFA,       THFL,      THFR,      THFT,      THINB,     THINL,
     1 THINR,      THINT,     THO,       THSTAR,    TIME,      TPL,
     1 TPLD,       TPR,       TSTOP,     UGFA,      UGFL,      UGFR,
     1 UGFT,       UINB,      UINL,      UINR,      UINT,      ULFA,
     1 ULFL,       ULFR,      ULFT,      UO,        VGFA,      VGFL,
     1 VGFR,       VGFT,      VLFA,      VLFL,      VLFR,      VLFT,
     1 VINB,       VINL,      VINR,      VINT,      VO,        VREL,
     1 WGFA,       WGFL,      WGFR,      WGFT,      WINB,      WINL,
     1 WINR,       WINT,      WLFA,      WLFL,      WLFR,      WLFT,
     1 WO
      COMMON / PARAM3 /
     1 C(100),  FLO(16),  FLOA(16), IJPLOT(12,5), IKPLOT(12,5),
     1 JKPLOT(12,5), MFL(18,200), NAME(10), NSL(4),    NSO(20),
     1 OB(6,20),  SCALE(4)
*COMDECK,GCOM2
      LCM / CELLD1 /
     1 ABETA(  4,  3, 42), ASURF(  4,  3, 42), CG   (  4,  3, 42),
     1 CL   (  4,  3, 42), CONV (  4,  3, 42), CQ   (  4,  3, 42),
     1 CRATE(  4,  3, 42), ERATE(  4,  3, 42), FL   (  4,  3, 42),
     1 KAPG (  4,  3, 42), KAPL (  4,  3, 42), KDRAG(  4,  3, 42),
     1 LFL  (  4,  3, 42), LHEAT(  4,  3, 42), MUG  (  4,  3, 42),
     1 MUL  (  4,  3, 42), P    (  4,  3, 42), RGFA (  4,  3, 42)
      LCM / CELLD2 /
     1 RGFR (  4,  3, 42), RGFT (  4,  3, 42), RGF  (  4,  3, 42),
     1 RGPN (  4,  3, 42), RHEAT(  4,  3, 42), RL   (  4,  3, 42),
     1 RLFA (  4,  3, 42), RLFR (  4,  3, 42), RLFT (  4,  3, 42),
     1 RLP  (  4,  3, 42), RLPN (  4,  3, 42), ROG  (  4,  3, 42),
     1 RUG  (  4,  3, 42), RUL  (  4,  3, 42), RVG  (  4,  3, 42),
     1 RVL  (  4,  3, 42), RWG  (  4,  3, 42), RWL  (  4,  3, 42)
      LCM / CELLD3 /
```

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FSETB      1
FSETB      2
FSETB      3
FSETB      4
FSETB      5
FSETB      6
FSETB      7
FSETB      8
FSETB      9
FSETB     10
FSETB     11
FSETB     12
FSETB     13
FSETB     14
FSETB     15
FSETB     16
FSETB     17
FSETB     18
FSETB     19
FSETB     20
FSETB     21
FSETB     22
FSETB     23
FSETB     24
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FSETB     50
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FSETB     56
FSETB     57
FSETB     58
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     1 SIEG    (   4,   3,  42), SIEGN(   4,   3,  42), SIGL (   4,   3,  42),
     1 SIEL    (   4,   3,  42), TG    (   4,   3,  42), TH   (   4,   3,  42),
     1 THN     (   4,   3,  42), THSF  (   4,   3,  42), TL   (   4,   3,  42),
     1 TS      (   4,   3,  42), UG    (   4,   3,  42), UL   (   4,   3,  42),
     1 VG      (   4,   3,  42), VL    (   4,   3,  42), WG   (   4,   3,  42),
     1 WL      (   4,   3,  42)
      LCM / CELLD4 /
     1 EGFF (   4,   3), ELFF (   4,   3), OMTFF(   4,   3),
     1 THFF (   4,   3), UGFF (   4,   3), ULFF (   4,   3),
     1 VGFF (   4,   3), VLFF (   4,   3), WGFF (   4,   3),
     1 WLFF (   4,   3), DA     (   4), DTORBDP (   4),
     1 DTORBDR  (   4), DTORDPH (   4), DTORDR  (   4),
     1 EGFB     (   4), ELFB    (   4), OMTFB   (   4),
     1 R        (   4), RB      (   4), RRB     (   4),
     1 RRIDR    (   4), THFB    (   4), UGFB    (   4),
     1 ULFB     (   4), VGFB    (   4), VLFB    (   4),
     1 WGFB     (   4), WLFB    (   4)
      COMMON
     1 ZA       (   4), ZB      (   4)
      INTEGER CYCLE,FL,THSF
      REAL KAPG,KAPL,KDRAG,LEFT,LHEAT,MUG,MUL
*I,KFIXCC. 3
      DATA IB2,JB2,KB2,LENA,LENB,LENC,LEND,LENE /    4,    3,   42,
     1    9072,    9072,    8064,       8,    192/
*I,KFIXCC.18
      DO 2 K=1,LENA
    2 ABETA(K)=0.
      DO 3 K=1,LENB
    3 RGFR(K)=0.
      DO 4 K=1,LENC
    4 SIEG(K)=0.
      DO 5 K=1,LENE
    5 EGFF(K)=0.
*I,KFIXCC.155
      DATA NVAR,IFL,INCN  / 46,  9,  504/
*I,KFIXCC.179
      IF(N.LE.18) GO TO 14
      IF(N.LE.36) GO TO 12
      L=(N-37)*INCN
      SIEG(N2+L)=SIEG(N1+L)
      GO TO 15
   12 L=(N-19)*INCN
      RGFR(N2+L)=RGFR(N1+L)
      GO TO 15
   14 CONTINUE
*I,KFIXCC.195
      IF(N.LE.18) GO TO 24
      IF(N.LE.36) GO TO 22
      L=(N-37)*INCN
      SIEG(N2+L)=SIEG(N1+L)
      GO TO 25
   22 L=(N-19)*INCN
      RGFR(N2+L)=RGFR(N1+L)
      GO TO 25
   24 CONTINUE
```

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FSET8      59
FSET8      60
FSET8      61
FSET8      62
FSET8      63
FSET8      64
FSET8      65
FSET8      66
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FSET8      68
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FSET8     102
FSET8     103
FSET8     104
FSET8     105
FSET8     106
FSET8     107
FSET8     108
FSET8     109
FSET8     110
FSET8     111
FSET8     112
FSET8     113
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```
      PROGRAM KFIX(INP,OUT,FILM,FSET12=FILM,FSET5,FSET9=OUT,FSET10=INP)  KFIXCC      2
*CALL GCOM1                                                             KFIXCC      3
*CALL GCOM2                                                             KFIXCC      4
C     ITD=0--DOES NOT READ OR WRITE TAPE (5)                            KFIXCC      5
C     ITD=1--DOES NOT READ TAPE (5) BUT WRITES TAPE(5)                  KFIXCC      6
C     ITD=2--READS TAPE,DOES NOT WRITE TAPE                             KFIXCC      7
C     ITD=3--READS AND WRITES TAPE (5)                                  KFIXCC      8
C     NTD= NO. ON TAPE -5- TO READ DATA AT---------                     KFIXCC      9
C     NSDMP= FREQUENCY AT WHICH DATA IS WRITTEN ON TAPE-5- (CYCLE-INTERV KFIXCC     10
C     NFILE = NO. ON TAPE5 OF LAST DUMP TAKEN FROM A PREVIOUS RUN       KFIXCC     11
C     NWDMP = NUMBER OF FIRST DUMP TO BE WRITTEN ON TAPE5               KFIXCC     12
C                                                                       KFIXCC     13
      CALL SECOND (TBEG)                                                KFIXCC     14
      CALL GETQ (4LKTLM,NCREQ)                                          KFIXCC     15
      SECREQ=NCREQ*27.5E-9                                              KFIXCC     16
C                                                                       KFIXCC     17
C     CLEAR DATA STORAGE                                                KFIXCC     18
      DO 6 K=1,LEND                                                     KFIXCC     19
    6 ZA(K)=0.                                                          KFIXCC     20
C                                                                       KFIXCC     21
C     START OF -READ- INPUT DATA                                        KFIXCC     22
C                                                                       KFIXCC     23
   10 READ 100, NAME                                                    KFIXCC     24
      READ 110, (SCALE(I),I=1,4)                                        KFIXCC     25
      READ (10,120)ITC,DR,DZ,DTH                                        INOUT      1
      READ 110, (FLO(M),M=1,16)                                         KFIXCC     27
      READ (10,110)(FLOA(M),M=1,16)                                     INOUT      2
      READ (10,140)(NSL(M),M=1,6)                                       INOUT      3
      READ 140, NO                                                      KFIXCC     29
      IF(NO.EQ.0) GO TO 25                                              KFIXCC     30
      DO 20 N=1,NC                                                      KFIXCC     31
   20 READ (10,150)VSO(N),(OB(M,N),M=1,6)                               INOUT      4
   25 READ (10,180) GRAV                                                INOUT      5
      READ (10,180) UO,VO,WO,PO,THO,TEMPO                               INOUT      6
      READ (10,160) UINL,VINL,WINL,PINL,THINL,TEMPINL,                  INOUT      7
     1           UINR,VINR,WINR,PINR,THINR,TEMPINR,                    INOUT      8
     1           UINB,VINB,WINB,PINB,THINB,TEMPINB,                    INOUT      9
     1           UINT,VINT,WINT,PINT,THINT,TEMPINT                     INOUT     10
      READ 140, ITD,NTD,NSDMP,NFILE,NWDMP                               KFIXCC     37
      READ 130, TIME,TSTOP,DT,CYCLE                                     KFIXCC     38
      READ 150, LPR,TPR,TPL,TPLD                                        KFIXCC     39
      READ (10,140) IP1,IP2,JP1,JP2,KP1,KP2                             INOUT     11
      IF(IP1.EQ.0) IP1=1                                                INOUT     12
      IF(IP2.EQ.0) IP2=IB2                                              INOUT     13
      IF(JP1.EQ.0) JP1=1                                                INOUT     14
      IF(JP2.EQ.0) JP2=JB2                                              INOUT     15
      IF(KP1.EQ.0) KP1=1                                                INOUT     16
      IF(KP2.EQ.0) KP2=KB2                                              INOUT     17
      READ (10,170)((IJPLOT(I,J),I=1,12),J=1,5)                         INOUT     18
      READ (10,170)((IKPLOT(I,J),I=1,12),J=1,5)                         INOUT     19
      READ (10,170)((JKPLOT(I,J),I=1,12),J=1,5)                         INOUT     20
      NCYDMP=NSDMP+CYCLE                                                KFIXCC     41
      NCASE=0                                                           KFIXCC     42
C                                                                       KFIXCC     43
C     OBTAINS FLUID VARIABLES FROM TAPE5 IF(ITD.GE.2)                   KFIXCC     44
      IF (ITD.GE.2) CALL RTAPE5                                         KFIXCC     45
      CALL GETQ(4LKJBN,JNM)                                             PERM1277    1
      IF(LPR.LE.1) GO TO 55                                             KFIXCC     48
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      KTAPE=9                                                                  KFIXCC     50
C     PRINTS ALL INPUT DATA (TAPE-9),THEN COPIES ON FILM (TAPE-12) * * *       KFIXCC     51
   30 WRITE(KTAPE,200) NAME                                                    KFIXCC     52
      WRITE(KTAPE,210) (SCALE(I),I=1,4)                                        KFIXCC     53
      WRITE(KTAPE,220) ITC,IB2,JB2,KB2,DR,DZ,DPH                               INOUT      21
      WRITE(KTAPE,230) (FLO(M),M=1,4),(FLOA(M),M=1,4),(FLO(M),M=5,8),          INOUT      22
     1(FLOA(M),M=5,8),(FLO(M),M=9,12),(FLOA(M),M=9,12),(FLO(M),M=13,16),       INOUT      23
     2 (FLOA(M),M=13,16)                                                       INOUT      24
      WRITE(KTAPE,240) (NSL(M),M=1,6)                                          INOUT      25
      WRITE(KTAPE,250) NO                                                      KFIXCC     57
      IF(NO.EQ.0) GO TO 50                                                     KFIXCC     59
      WRITE(KTAPE,252)                                                         KFIXCC     60
      DO 40 N=1,NO                                                             KFIXCC     61
   40 WRITE(KTAPE,254) NSO(N),(OB(M,N),M=1,6)                                  INOUT      26
   50 WRITE(KTAPE,251) GRAV                                                    PERM1277    2
      WRITE(KTAPE,260) UO,VO,WO,PO,THO,TEMPO                                   INOUT      27
      WRITE(KTAPE,270) UINL,VINL,WINL,PINL,THINL,TEMPINL,                      INOUT      28
     1          UINR,VINR,WINR,PINR,THINR,TEMPINR,                           INOUT      29
     1          UINB,VINB,WINB,PINB,THINB,TEMPINB,                           INOUT      30
     1          UINT,VINT,WINT,PINT,THINT,TEMPINT                            INOUT      31
      WRITE(KTAPE,280) NTD,NTD,NSDMP,NFILE,NWDMP                               KFIXCC     68
      WRITE(KTAPE,290) TIME,TSTOP,DT,CYCLE                                     KFIXCC     69
      WRITE(KTAPE,300) LPR,TPR,TPL,TPLD                                        KFIXCC     70
      WRITE(KTAPE,325) IP1,IP2,JP1,JP2,KP1,KP2                                 INOUT      32
      WRITE(KTAPE,315)((IJPLOT(I,J),I=1,12),J=1,5)                             INOUT      33
      WRITE(KTAPE,320)((IKPLOT(I,J),I=1,12),J=1,5)                             INOUT      34
      WRITE(KTAPE,330) ((JKPLOT(I,J),I=1,12),J=1,5)                            INOUT      35
      IF (KTAPE.NE.9) GO TO 60                                                 KFIXCC     72
   55 IF(LPR.EQ.1.OR.LPR.EQ.3) CALL ADV(1)                                     KFIXCC     73
      KTAPE=12                                                                 KFIXCC     74
      IF(LPR.EQ.1.OR.LPR.EQ.3) GO TO 30                                        KFIXCC     75
   60 CONTINUE                                                                 KFIXCC     76
      IB=IB2-2                                                                 KFIXCC     77
      IB1=IB2-1                                                                KFIXCC     78
      JB=JB2-2                                                                 KFIXCC     79
      JB1=JB2-1                                                                KFIXCC     80
      KB=KB2-2                                                                 THREED      1
      KB1=KB2-1                                                                THREED      2
      IB2XJB2=IB2*JB2                                                          THREED      3
C     CONVERTS ALL GRID DATA TO 4020 NUMBERS IN ALL PLOT ROUTINES  * * *       KFIXCC     81
      IF(LPR.EQ.1.OR.LPR.EQ.3) CALL VPLOT(0)                                   KFIXCC     82
      IF(LPR.EQ.1.OR.LPR.EQ.3) CALL CNPLOT(0)                                  KFIXCC     83
      CALL FLIC                                                                KFIXCC     84
C     FLIC---SETS ALL CELL FLAGS                                               KFIXCC     85
C                                                                              KFIXCC     86
C     SETUP---SETS UP INITIAL CONDITIONS FOR FLUID VARIABLES FROM INPUT        KFIXCC     87
C     DATA                                                                     KFIXCC     88
      CALL SETUP                                                               KFIXCC     89
C     TRANSFERS TO CONTROL PROGRAM FOR TIME DEPENDENT CALC.  * * * * * *       KFIXCC     90
      CALL PROG                                                                KFIXCC     91
      CALL SECOND (TEND)                                                       KFIXCC     92
      NCASE=NCASE+1                                                            KFIXCC     93
      TCASE=TEND-TBEG                                                          KFIXCC     94
      IF(LPR.GE.2) WRITE(9,310) NCASE,TCASE                                    KFIXCC     95
      STOP                                                                     KFIXCC     96
C                                                                              KFIXCC     97
  100 FORMAT(10A8)                                                             KFIXCC     98
  110 FORMAT(4F12.4)                                                           KFIXCC     99
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120 FORMAT( I12,3F12.4)                                                  INOUT      36
130 FORMAT(3F12.4,I12)                                                   KFIXCC    101
140 FORMAT(6I12)                                                         KFIXCC    102
150 FORMAT(I12,4F12.4/(6F12.4))                                          INOUT      37
160 FORMAT(6F12.4)                                                       INOUT      38
170 FORMAT(12I6)                                                         KFIXCC    105
180 FORMAT(6F12.4)                                                       KFIXCC    106
200 FORMAT(*1CODE NAME - KFIX   PROBLEM IDENTIFIER -  *10A8)             KFIXCC    107
210 FORMAT(*0SCALING     LENGTH(CM)=*1PE8.2   *  VELOCITY*               KFIXCC    108
   1 *(CM/SEC)=*1PE 8.2  *  DENSITY(GM/CC)=*1PE 8.2    *  TEMPERATURE(  KFIXCC    10
   2DEG.K)=*1PE 8.2  )                                                   KFIXCC    1
220 FORMAT(9HOGEOMETRY/1H0,6X,34H1. COORDINATES (CART=0, CYLIND=1, ,     INOUT      39
   111HSPHERE=2) =,I3/1H0,6X,21H2. MESH SIZE,    IB2=,I3,14X,4HJB2=,     INOUT      40
   2I3,14X,4HKB2=,I3/1H0,6X,13H3. CELL SIZE,,5X,3HDR=,1PE11.4,4X,        INOUT      41
   33HDZ=,1PE11.4,4X,4HDPH=,1PE11.4)                                     INOUT      42
230 FORMAT(*0      4. INFLOW OPENINGS*/*0*12X*A. BOTTOM*10X,1P4E11.4/    INOUT      43
   132X,1P4E11.4/*0*12X*B. LEFT*12X,1P4E11.4/32X,1P4E11.4/               INOUT      44
   2*0      5. OUTFLOW OPENINGS*/*0*12X,*A. TOP*13X,1P4E11.4/            INOUT      45
   332X,1P4E11.4/*0*12X*B. RIGHT*11X,1P4E11.4/32X,1P4E11.4  )            INOUT      46
240 FORMAT(47H0       6. BOUNDARIES, (FREE-SLIP=0   NO-SLIP=1)  / 1H0,   INOUT      47
   1 14X,7HBOTTOM=,I3,9H    LEFT=,I3,8H    TOP=,I3,10H    RIGHT=,I3,     INOUT      48
   29H    FORE=,I3,8H    AFT=,I3)                                        INOUT      49
250 FORMAT(27H0       7. OBSTACLES,      NO=,I3)                         INOUT      50
251 FORMAT(29H0       8. GRAVITY,       GRAV=,1PE15.7)                   INOUT      51
252 FORMAT(17H0              SLIP,22X,23H------COORDINATES------)        INOUT      52
254 FORMAT(1H0,12X,I3,6X,1P6E14.4)                                       INOUT      53
260 FORMAT(31H0INITIAL DATA    GAS AND LIQUID/13H0       1. U0=,         INOUT      54
   11PE11.4,7H    V0=,1PE11.4,7H    W0=,1PE11.4,7H    P0=,               INOUT      55
   21PE11.4,8H    TH0=,1PE11.4,7H    T0=,1PE11.4)                        INOUT      56
270 FORMAT(12H0INFLOW DATA/16H0      1. BOTTOM/18H0           UINL=,     INOUT      57
   11PE11.4,7H  VINL=,1PE11.4,7H  WINL=,1PE11.4,7H  PINL=,1PE11.4,       INOUT      58
   28H  THINL=,1PE11.4,10H  TEMPINL=,1PE11.4/18H0           UINR=,       INOUT      59
   31PE11.4,7H  VINR=,1PE11.4,7H  WINR=,1PE11.4,7H  PINR=,1PE11.4,       INOUT      60
   48H  THINR=,1PE11.4,10H  TEMPINR=,1PE11.4/14H0      2. LEFT/8X,       INOUT      61
   510H     UINB=,1PE11.4,7H  VINB=,1PE11.4,7H  WINB=,1PE11.4,           INOUT      62
   67H  PINB=,1PE11.4,8H  THINB=,1PE11.4,10H  TEMPINB=,1PE11.4/          INOUT      63
   718H0           UINT=,1PE11.4,7H  VINT=,1PE11.4,7H  WINT=,1PE11.4,    INOUT      64
   87H  PINT=,1PE11.4,8H  THINT=,1PE11.4,10H  TEMPINT=,1PE11.4)          INOUT      65
280 FORMAT(8H0CONTROL/35H0       1. DUMP AND RESTART,    ITD=,I3,        INOUT      66
   17H   NTD=,I3,9H   NSDMP=,I3,9H   NFILE=,I3,9H   NNDMP=,I3)           INOUT      67
290 FORMAT(34H0       2. TIME AND CYCLE   TSTART=,1PE11.4,9H   TSTOP=,   INOUT      68
   11PE11.4,6H   DT=,1PE11.4,9H   CYCLE=,1PE11.4)                        INOUT      69
300 FORMAT(42H0       3. PRINTING AND PLOTTING,      LPR=,I3,7H   TPR=,  INOUT      70
   11PE11.4,6H  TPL=,1PE11.4,9H    TPLD=,1PE11.4)                        INOUT      71
310 FORMAT(9H1CASE NO.,I3,13H     CP TIME=,F8.1)                         INOUT      72
315 FORMAT(55H0       4. CONTOUR PLOT FLAGS          RGP   RLP   TH   ,  INOUT      73
   146H  P    TG    TL    TS    IG    IL    G    K,//(14X,               INOUT      74
   214HIJPLOT FOR K =,I2,4X,11I6))                                       INOUT      75
320 FORMAT(14X,14HIKPLOT FOR J =,I2,4X,11I6)                             INOUT      76
325 FORMAT(1H0,13X,20HPRINT LIMITS      I1=,I3,5H  I2=,I3,5H  J1=,I3,    INOUT      77
   15H  J2=,I3,5H  K1=,I3,5H  K2=,I3)                                    INOUT      78
330 FORMAT(14X,14HJKPLOT FOR I =,I2,4X,11I6)                             INOUT      79
    END                                                                  KFIXCC    143
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      SUBROUTINE ASURFS                                                 KFIXCC   144
*CALL GCOM1                                                             KFIXCC   145
*CALL GCOM2                                                             KFIXCC   146
C                                                                       KFIXCC   147
C     CALCULATE  INTERFACIAL SURFACE AREA PER UNIT OF MIXTURE VOLUME    KFIXCC   148
C                                                                       KFIXCC   149
      RETURN                                                            KFIXCC   150
      END                                                               KFIXCC   151
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      SUBROUTINE BDRY                                                   KFIXCC   152
*CALL GCOM1                                                             KFIXCC   153
*CALL GCOM2                                                             KFIXCC   154
C                                                                       KFIXCC   155
C                                                                       KFIXCC   156
C   SETS VELOCITY BOUNDARY CONDITIONS --- REFLECTS CELL CENTER QUANITIES KFIXCC  157
C                                                                       KFIXCC   158
      CALL START(1)                                                     THREED     4
      DO 300 K=KS,KL                                                    THREED     5
      IJ=IJ+INCK                                                        THREED     6
      DO 300 J=JS,JL                                                    THREED     7
      IJ=IJ+INCJ                                                        THREED     8
      DO 300 I=IS,IL                                                    THREED     9
      IJ=IJ+1                                                           THREED    10
C        SKIP IF NOT A FLUID CELL                                       KFIXCC   162
      IF(FL(IJ).NE.1) GO TO 200                                         KFIXCC   163
      CALL INDEX                                                        KFIXCC   164
C     CHECK CELLS ON RIGHT AND TOP                                      KFIXCC   165
      NFLR=FL(IPJ)                                                      KFIXCC   166
      NFLTR=FL(IPJP)                                                    KFIXCC   167
      NFLT=FL(IJP)                                                      KFIXCC   168
      IF(NFLR.EQ.4)GOTO10                                               KFIXCC   169
      IF(NFLT.EQ.4)GOTO20                                               KFIXCC   170
      GOTO30                                                            KFIXCC   171
C                                                                       KFIXCC   172
C        CONTINUOUS OUTFLOW ON THE RIGHT                                KFIXCC   173
C                                                                       KFIXCC   174
   10 CONTINUE                                                          KFIXCC   175
      N1=IJ                                                             KFIXCC   176
      N2=IPJ                                                            KFIXCC   177
      DO 15 N=1,NVAR                                                    KFIXCC   178
      IF(N.EQ.IFL) GO TO 15                                             KFIXCC   179
      L=(N-1)*INCN                                                      THREED    11
      ABETA(N2+L)=ABETA(N1+L)                                           KFIXCC   181
   15 CONTINUE                                                          KFIXCC   182
      IF(NFLTR.GE.4) VG(N2)=VG(N1)                                      PERM1277   3
      IF(NFLTR.GE.4) VL(N2)=VL(N1)                                      PERM1277   4
      UL(N2)=((R(I+1)+R(I))*RB(I)*UL(N1)-R(I+1)*RB(I-1)*UL(N1-1))       PERM1277   5
     1  *RRB(I+1)/R(I)                                                  PERM1277   6
      UG(N2)=((R(I+1)+R(I))*RB(I)*UG(N1)-R(I+1)*RB(I-1)*UG(N1-1))       PERM1277   7
     1  *RRB(I+1)/R(I)                                                  PERM1277   8
      IPKP=IJ+1+IB2XJB2                                                 THREED    12
      IF(FL(IPKP).GE.4) WG(N2)=WG(N1)                                   THREED    13
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      IF(FL(IPKP).GE.4) WL(N2)=WL(N1)                                   THREED    14
      IF(NFLT.NE.4) GO TO 30                                            KFIXCC   187
C                                                                       KFIXCC   188
C        CONTINUOUS OUTFLOW ON THE TOP                                  KFIXCC   189
C                                                                       KFIXCC   190
   20 CONTINUE                                                          KFIXCC   191
      N1=IJ                                                             KFIXCC   192
      N2=IJP                                                            KFIXCC   193
      DO 25 N=1,NVAR                                                    KFIXCC   194
      IF(N.EQ.IFL) GO TO 25                                             KFIXCC   195
      L=(N-1)*NCN                                                       THREED    15
      ABETA(N2+L)=ABETA(N1+L)                                           KFIXCC   197
   25 CONTINUE                                                          KFIXCC   198
      IF(NFLTR.GE.4) UG(N2)=UG(N1)                                      PERM1277   9
      IF(NFLTR.GE.4) UL(N2)=UL(N1)                                      PERM1277  10
      VG(N2)=2.*VG(N1)-VG(N1-IB2)                                       KFIXCC   201
      VL(N2)=2.*VL(N1)-VL(N1-IB2)                                       KFIXCC   202
      JPKP=IJ+IB2+IB2XJB2                                               THREED    16
      IF(FL(JPKP).GE.4) WG(N2)=WG(N1)                                   THREED    17
      IF(FL(JPKP).GE.4) WL(N2)=WL(N1)                                   THREED    18
   30 GOTO(60,35,45,60,60)NFLR                                          KFIXCC   203
   35 GOTO(60,40,40,60,60)NFLTR                                         KFIXCC   204
C                                                                       KFIXCC   205
C     FREE SLIP WALL ON THE RIGHT                                       KFIXCC   206
C                                                                       KFIXCC   207
   40 VG(IPJ)=VG(IJ)                                                    KFIXCC   208
      VL(IPJ)=VL(IJ)                                                    KFIXCC   209
      WG(IPJ)=WG(IJ)                                                    THREED    19
      WL(IPJ)=WL(IJ)                                                    THREED    20
      GOTO60                                                            KFIXCC   210
   45 GOTO(60,50,50,60,60)NFLTR                                         KFIXCC   211
C                                                                       KFIXCC   212
C     NO SLIP WALL ON THE RIGHT                                         KFIXCC   213
C                                                                       KFIXCC   214
   50 VG(IPJ)=-VG(IJ)                                                   KFIXCC   215
      VL(IPJ)=-VL(IJ)                                                   KFIXCC   216
      WG(IPJ)=-WG(IJ)                                                   THREED    21
      WL(IPJ)=-WL(IJ)                                                   THREED    22
   60 GOTO(90,65,75,90,90)NFLT                                          KFIXCC   217
   65 GOTO(90,70,70,90,90)NFLTR                                         KFIXCC   218
C                                                                       KFIXCC   219
C     FREE SLIP WALL ABOVE                                              KFIXCC   220
C                                                                       KFIXCC   221
   70 UG(IJP)=UG(IJ)                                                    KFIXCC   222
      UL(IJP)=UL(IJ)                                                    KFIXCC   223
      WL(IJP)= WL(IJ)                                                   THREED    23
      WG(IJP)= WG(IJ)                                                   THREED    24
      GOTO90                                                            KFIXCC   224
   75 GOTO(90,80,80,90,90)NFLTR                                         KFIXCC   225
C                                                                       KFIXCC   226
C     NO SLIP WALL ABOVE                                                KFIXCC   227
C                                                                       KFIXCC   228
   80 UG(IJP)=-UG(IJ)                                                   KFIXCC   229
      UL(IJP)=-UL(IJ)                                                   KFIXCC   230
      WG(IJP)=-WG(IJ)                                                   THREED    25
      WL(IJP)=-WL(IJ)                                                   THREED    26
   90 CONTINUE                                                          KFIXCC   231
  100 NALL=FL(IMJ)                                                      KFIXCC   232
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      NFLTL=FL(IMJP)                                                    KFIXCC   233
      GO TO (130,105,115,130,130),NFLL                                  KFIXCC   234
  105 GO TO (130,110,110,130,130),NFLTL                                 KFIXCC   235
C                                                                       KFIXCC   236
C     FREE SLIP WALL ON THE LEFT                                        KFIXCC   237
C                                                                       KFIXCC   238
  110 VG(IMJ)=VG(IJ)                                                    KFIXCC   239
      VL(IMJ)=VL(IJ)                                                    KFIXCC   240
      WG(IMJ)= WG(IJ)                                                   THREED    27
      WL(IMJ)= WL(IJ)                                                   THREED    28
      GO TO 130                                                         KFIXCC   241
  115 GO TO (130,120,120,130,130),NFLTL                                 KFIXCC   242
C                                                                       KFIXCC   243
C     NO SLIP WALL ON THE LEFT                                          KFIXCC   244
C                                                                       KFIXCC   245
  120 VG(IMJ)=-VG(IJ)                                                   KFIXCC   246
      VL(IMJ)=-VL(IJ)                                                   KFIXCC   247
      WG(IMJ)=-WG(IJ)                                                   THREED    29
      WL(IMJ)=-WL(IJ)                                                   THREED    30
  130 NFLB=FL(IJM)                                                      KFIXCC   248
      NFLBR=FL(IPJM)                                                    KFIXCC   249
      GO TO (200,135,145,200,200),NFLB                                  KFIXCC   250
  135 GO TO (200,140,140,200,200),NFLBR                                 KFIXCC   251
C                                                                       KFIXCC   252
C     FREE SLIP WALL BELOW                                              KFIXCC   253
C                                                                       KFIXCC   254
  140 UG(IJM)=UG(IJ)                                                    KFIXCC   255
      UL(IJM)=UL(IJ)                                                    KFIXCC   256
      WG(IJM)= WG(IJ)                                                   THREED    31
      WL(IJM)= WL(IJ)                                                   THREED    32
      GO TO 200                                                         KFIXCC   257
  145 GO TO (200,150,150,200,200),NFLBR                                 KFIXCC   258
C                                                                       KFIXCC   259
C     NO SLIP WALL BELOW                                                KFIXCC   260
C                                                                       KFIXCC   261
  150 UG(IJM)=-UG(IJ)                                                   KFIXCC   262
      UL(IJM)=-UL(IJ)                                                   KFIXCC   263
      WG(IJM)=-WG(IJ)                                                   THREED    33
      WL(IJM)=-WL(IJ)                                                   THREED    34
  200 CONTINUE                                                          KFIXCC   264
      NFLA=FL(IKP)                                                      THREED    35
      NFLAR=FL(IPKP)                                                    THREED    36
      IF(NFLA.LT.1) NFLA=1                                              THREED    37
      IF(NFLAR.LT.1) NFLAR=1                                            THREED    38
      GO TO (225,205,215,225,225),NFLA                                  THREED    39
  205 GO TO (225,210,210,225,225),NFLAR                                 THREED    40
C                                                                       THREED    41
C     FREE SLIP WALL AFT                                                THREED    42
C                                                                       THREED    43
  210 VG(IKP)=VG(IJ)                                                    THREED    44
      VL(IKP)=VL(IJ)                                                    THREED    45
      UG(IKP)=UG(IJ)                                                    THREED    46
      UL(IKP)=UL(IJ)                                                    THREED    47
      GO TO 225                                                         THREED    48
  215 GO TO (225,220,220,225,225),NFLAR                                 THREED    49
C                                                                       THREED    50
C     NO SLIP WALL AFT                                                  THREED    51
C                                                                       THREED    52
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  220 VG(IKP)=-VG(IJ)                                                    THREED     53
      VL(IKP)=-VL(IJ)                                                    THREED     54
      UL(IKP)=-UL(IJ)                                                    THREED     55
      UG(IKP)=-UG(IJ)                                                    THREED     56
  225 NFLF=FL(IKM)                                                       THREED     57
      NFLFR=FL(IPKM)                                                     THREED     58
      IF(NFLF.LT.1) NFLF=1                                               THREED     59
      IF(NFLFR.LT.1) NFLFR=1                                             THREED     60
      GO TO(250,230,240,250,250),NFLF                                    THREED     61
  230 GO TO (250,235,235,250,250),NFLFR                                  THREED     62
C                                                                        THREED     63
C     FREE SLIP WALL FORE                                                THREED     64
C                                                                        THREED     65
  235 VG(IKM)=VG(IJ)                                                     THREED     66
      VL(IKM)=VL(IJ)                                                     THREED     67
      UG(IKM)=UG(IJ)                                                     THREED     68
      UL(IKM)=UL(IJ)                                                     THREED     69
      GO TO 250                                                          THREED     70
  240 GO TO (250,245,245,250,250),NFLFR                                  THREED     71
C                                                                        THREED     72
C     NO SLIP WALL FORE                                                  THREED     73
C                                                                        THREED     74
  245 VG(IKM)=-VG(IJ)                                                    THREED     75
      VL(IKM)=-VL(IJ)                                                    THREED     76
      UG(IKM)=-UG(IJ)                                                    THREED     77
      UL(IKM)=-UL(IJ)                                                    THREED     78
  250 CONTINUE                                                           THREED     79
  300 CONTINUE                                                           THREED     80
      RETURN                                                             KFIXCC    265
      END                                                                KFIXCC    266
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      SUBROUTINE BETAS                                                   KFIXCC    267
*CALL GCOM1                                                              KFIXCC    268
*CALL GCOM2                                                              KFIXCC    269
      DATA EPSG, EPSL / .00001, .00001  /                                KFIXCC    270
      DIMENSION CS(7)                                                    THREED     81
C                                                                        KFIXCC    272
C     CALCULATES RECIPROCAL DERIVATIVES OF D WRT P , ABETA(IJ), FOR      KFIXCC    273
C     ITERATION                                                          KFIXCC    274
C                                                                        KFIXCC    275
      CALL START(1)                                                      THREED     82
      DO 10 K=KS,KL                                                      THREED     83
      IJ=IJ+INCK                                                         THREED     84
      DO 10 J=JS,JL                                                      THREED     85
      IJ=IJ+INCJ                                                         THREED     86
      DO 10 I=IS,IL                                                      THREED     87
      IJ=IJ+1                                                            THREED     88
      IF(FL(IJ).NE.1) GO TO 10                                           KFIXCC    279
      CALL INDEXA                                                        KFIXCC    280
      RAGS=ROG(IJ)/P(IJ)                                                 PERM1277   11
      RIGHT=1.                                                           KFIXCC    281
      LEFT=1.                                                            KFIXCC    282
      TOP=1.                                                             KFIXCC    283
```

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      BOT=1.                                                            KFIXCC   284
      AFT=1.                                                            THREED    89
      FORE=1.                                                           THREED    90
      NFLR=FL(IPJ)                                                      KFIXCC   285
      NFLL=FL(IMJ)                                                      KFIXCC   286
      NFLT=FL(IJP)                                                      KFIXCC   287
      NFLB=FL(IJM)                                                      KFIXCC   288
      NFLA=FL(IKP)                                                      THREED    91
      IF(NFLA.EQ.0) NFLA=1                                              THREED    92
      NFLF=FL(IKM)                                                      THREED    93
      IF(NFLF.EQ.0) NFLF=1                                              THREED    94
      GO TO (2,1,1,2,1), NFLR                                           KFIXCC   289
    1 RIGHT=0.                                                          KFIXCC   290
    2 GO TO (4,3,3,4,3), NFLL                                           KFIXCC   291
    3 LEFT=0.                                                           KFIXCC   292
    4 GO TO (6,5,5,6,5), NFLT                                           KFIXCC   293
    5 TOP=0.                                                            KFIXCC   294
    6 GO TO (8,7,7,8,7), NFLB                                           KFIXCC   295
    7 BOT=0.                                                            KFIXCC   296
    8 GO TO (13,11,11,13,11), NFLA                                      THREED    95
   11 AFT=0.                                                            THREED    96
   13 GO TO (17,15,15,17,15), NFLF                                      THREED    97
   15 FORE=0.                                                           THREED    98
   17 IF(THSF(IJ).EQ.1) GO TO 9                                         THREED    99
      CONV(IJ)=EPSG*RLG(IJ)                                             KFIXCC   298
      RBETA=TH(IJ)*RAGS+0.5*(DTODZ*DTODZ*((TH(IJ)+TH(IJT))*TOP+         KFIXCC   299
     1(TH(IJ)+TH(IJB))*BOT)+DTORDR(I)*DTODR*(RB(I)*(TH(IJ)+TH(IJR))*    KFIXCC   300
     2RIGHT+RB(I-1)*(TH(IJ)+TH(IJL))*LEFT))                             KFIXCC   301
     3+0.5*((TH(IJ)+TH(IJA))*AFT+(TH(IJ)+TH(IJF))*FORE)*DTORDPH(I)**2   THREED   100
      ABETA(IJ)=1./RBETA                                                KFIXCC   302
      GOTO10                                                            KFIXCC   303
    9 CONV(IJ)=EPSL*RLP(IJ)                                             KFIXCC   304
      CS(1)=RL(IJ)*TH(IJ)                                               KFIXCC   305
      CS(2)=0.                                                          KFIXCC   306
      IF(TOP.LT.0.5) GO TO 12                                           KFIXCC   307
      CS(2)=1.+CS(1)*(TH(IJ)+TH(IJT))/(RGP(IJ)+RGP(IJT)+DT*(KDRAG(IJ)+ KFIXCC   308
     1KDRAG(IJT)))                                                      KFIXCC   309
   12 CS(3)=0.                                                          KFIXCC   310
      IF(BOT.LT.0.5) GO TO 14                                           KFIXCC   311
      CS(3)=1.0+CS(1)*(TH(IJ)+TH(IJB))/(RGP(IJ)+RGP(IJB)+DT*(KDRAG(IJ)+ KFIXCC   312
     1 KDRAG(IJB)))                                                     KFIXCC   313
   14 CS(4)=0.                                                          KFIXCC   314
      IF(RIGHT.LT.0.5) GO TO 16                                         KFIXCC   315
      CS(4)=RB(I)*(1.+CS(1)*(TH(IJ)+TH(IJR))/(RGP(IJ)+RGP(IJR)+DT*     KFIXCC   316
     1(KDRAG(IJ)+KDRAG(IJR))))                                          KFIXCC   317
   16 CS(5)=0.                                                          KFIXCC   318
      IF(LEFT.LT.0.5) GO TO 18                                          KFIXCC   319
      CS(5)=RB(I-1)*(1.+CS(1)*(TH(IJ)+TH(IJL))/(RGP(IJ)+RGP(IJL)+      KFIXCC   320
     1 DT*(KDRAG(IJ)+KDRAG(IJL))))                                      KFIXCC   321
   18 CS(6)=0.                                                          THREED   101
      IF(AFT.LT.0.5) GO TO 20                                           THREED   102
      CS(6)=1.+CS(1)*(TH(IJ)+TH(IJA))/(RGP(IJ)+RGP(IJA)+DT*(KDRAG(IJ)+ THREED   103
     1 KDRAG(IJA)))                                                     THREED   104
   20 CS(7)=0.                                                          THREED   105
      IF(FORE.LT.0.5) GO TO 22                                          THREED   106
      CS(7)=1.+CS(1)*(TH(IJ)+TH(IJF))/(RGP(IJ)+RGP(IJF)+DT*(KDRAG(IJ)+ THREED   107
     1 KDRAG(IJF)))                                                     THREED   108
   22 RBETA=(1.-TH(IJ))*RALS+CS(1)*RAGS/ROG(IJ)+(DTODZ**2)*(CS(2)+CS(3)) THREED   109
```

```
     1 +DTORDR(I)*DTODR*(CS(4)+CS(5))+(DTORDPH(I)**2)*(CS(6)+CS(7))
       ABETA(IJ)=1./RBETA
    10 CONTINUE
       RETURN
       END
```

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```
      SUBROUTINE BOIL
*CALL GCOM1
*CALL GCOM2
C
C     CALCULATE BOILING RATE
C
      RETURN
      END
```

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```
      SUBROUTINE CNPLOT(KKK,JSP)
*CALL GCOM1
*CALL GCOM2
C      K=0 CONVERT GRID,K=1 PLOTS GRID,K=2 CONVERTS AND PLOTS CONTOUR
      DIMENSION CON(11),KFLO(16),KOB(4,20),XY(2),YX(2)
      DIMENSION IXY(4),XYZ(4)
      DATA (IXY(I),I=1,4) / 100,900,100,900 /
      KK=KKK+1
      GO TO (10,100,290,100),KK
   10 IYB=916
      XL=0.
      XR=IB*DR
      YT=JB*DZ
      YB=0.
      IF (XR.LE.1.13556*YT) GO TO 20
      IXL=0
      IXR=1022
      IYT=916-YT*1022/XR
      GO TO 30
   20 X=XR*450/YT
      IXL=511-X
      IXR=511+X
      IYT=16
C     CONVERTS GRID TO 4020 COORDINATES---K=0
   30 CONTINUE
      DO 50 J=1,16
      IF(J.LE.4) GO TO 40
      IF(J.GE.9.AND.J.LE.12) GO TO 40
      CALL CONVRT (FLO(J),KFLO(J),YB,YT,IYB,IYT)
      GO TO 50
   40 CALL CONVRT (FLO(J),KFLO(J),XL,XR,IXL,IXR)
   50 CONTINUE
      IF (NO.LE.0) RETURN
```

```
      DO 90 N=1,NO                                                    KFIXCC   369
      DO 60 J=1,2                                                     KFIXCC   370
   60 CALL CONVRT (OB(J,N),KOB(J,N),XL,XR,IXL,IXR)                    KFIXCC   371
      DO 70 J=3,4                                                     KFIXCC   372
   70 CALL CONVRT (OB(J,N),KOB(J,N),YB,YT,IYB,IYT)                    KFIXCC   373
   90 CONTINUE                                                        KFIXCC   374
      RETURN                                                          KFIXCC   375
C     PLOTS GRID USING DRV---K=1                                      KFIXCC   376
  100 CONTINUE                                                        KFIXCC   377
      CALL ADV (1)                                                    KFIXCC   378
      NGR=0                                                           KFIXCC   379
      IF (LPR.LE.0) GO TO 110                                         KFIXCC   380
      CALL LINCNT (60)                                                KFIXCC   381
      WRITE(12,850) JNM,NAME,TIME,CYCLE                               KFIXCC   382
      DANGLE=DPH*(FLOAT(K)-1.5)                                       FILM       3
      WRITE(12,870) DANGLE                                            FILM       4
  110 CONTINUE                                                        KFIXCC   383
      GO TO (280,115,280,332),KK                                      KFIXCC   384
  115 CONTINUE                                                        KFIXCC   385
      PTE=DPH*(FLOAT(K)-1.5)                                          FILM       5
      IF (FLO(2).LE.FLO(1)) GO TO 130                                 KFIXCC   386
      CALL DRV(IXL,IYB,KFLO(1),IYB)                                   KFIXCC   387
      IF(PTE.LT.FLOA(1).OR.PTE.GT.FLOA(2)) CALL DRV(KFLO(1),IYB,      FILM       6
     1 KFLO(2),IYB)                                                   FILM       7
      IF (FLO(3).LE.FLO(2)) GO TO 120                                 KFIXCC   388
      CALL DRV(KFLO(2),IYB,KFLO(3),IYB)                               KFIXCC   389
      IF(PTE.LT.FLOA(3).OR.PTE.GT.FLOA(4)) CALL DRV(KFLO(3),IYB,      FILM       8
     1 KFLO(4),IYB)                                                   FILM       9
      CALL DRV(KFLO(4),IYB,IXR,IYB)                                   KFIXCC   390
      GO TO 140                                                       KFIXCC   391
  120 CALL DRV(KFLO(2),IYB,IXR,IYB)                                   KFIXCC   392
      GO TO 140                                                       KFIXCC   393
  130 CALL DRV(IXL,IYB,IXR,IYB)                                       KFIXCC   394
  140 IF (FLO(6).LE.FLO(5)) GO TO 160                                 KFIXCC   395
      CALL DRV(IXL,IYB,IXL,KFLO(5))                                   KFIXCC   396
      IF(PTE.LT.FLOA(5).OR.PTE.GT.FLOA(6)) CALL DRV(IXL,KFLO(5),      FILM      10
     1 IXL,KFLO(6))                                                   FILM      11
      IF (FLO(7).LE.FLO(6)) GO TO 150                                 KFIXCC   397
      CALL DRV(IXL,KFLO(6),IXL,KFLO(7))                               KFIXCC   398
      IF(PTE.LT.FLOA(7).OR.PTE.GT.FLOA(8)) CALL DRV(IXL,KFLO(7),      FILM      12
     1 IXL,KFLO(8))                                                   FILM      13
      CALL DRV(IXL,KFLO(8),IXL,IYT)                                   KFIXCC   399
      GO TO 170                                                       KFIXCC   400
  150 CALL DRV(IXL,KFLO(6),IXL,IYT)                                   KFIXCC   401
      GO TO 170                                                       KFIXCC   402
  160 CALL DRV(IXL,IYB,IXL,IYT)                                       KFIXCC   403
  170 IF (FLO(10).LE.FLO(9)) GO TO 190                                KFIXCC   404
      CALL DRV(IXL,IYT,KFLO(9),IYT)                                   KFIXCC   405
      IF(PTE.LT.FLOA(9).OR.PTE.GT.FLOA(10)) CALL DRV(KFLO(9),IYT,     FILM      14
     1 KFLO(10),IYT)                                                  FILM      15
      IF (FLO(11).LE.FLO(10)) GO TO 180                               KFIXCC   406
      CALL DRV(KFLO(10),IYT,KFLO(11),IYT)                             KFIXCC   407
      IF(PTE.LT.FLOA(11).OR.PTE.GT.FLOA(12)) CALL DRV(KFLO(11),IYT,   FILM      16
     1 KFLO(12),IYT)                                                  FILM      17
      CALL DRV(KFLO(12),IYT,IXR,IYT)                                  KFIXCC   408
      GO TO 200                                                       KFIXCC   409
  180 CALL DRV(KFLO(10),IYT,IXR,IYT)                                  KFIXCC   410
      GO TO 200                                                       KFIXCC   411
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190 CALL DRV(IXL,IYT,IXR,IYT)                                                KFIXCC   412
200 IF(FLO(14).LE.FLO(13)) GO TO 206                                         KFIXCC   413
    CALL DRV(IXR,IYB,IXR,KFLO(13))                                           KFIXCC   414
    IF(PTE.LT.FLOA(13).OR.PTE.GT.FLOA(14)) CALL DRV(IXR,KFLO(13),            FILM      18
   1 IXR,KFLO(14))                                                           FILM      19
    IF(FLO(15).LE.FLO(14)) GO TO 204                                         KFIXCC   415
    CALL DRV(IXR,KFLO(14),IXR,KFLO(15))                                      KFIXCC   416
    IF(PTE.LT.FLOA(15).OR.PTE.GT.FLOA(16)) CALL DRV(IXR,KFLO(15),            FILM      20
   1 IXR,KFLO(16))                                                           FILM      21
    CALL DRV(IXR,KFLO(16),IXR,IYT)                                           KFIXCC   417
    GO TO 208                                                                KFIXCC   418
204 CALL DRV(IXR,KFLO(14),IXR,IYT)                                           KFIXCC   419
    GO TO 208                                                                KFIXCC   420
206 CALL DRV(IXR,IYB,IXR,IYT)                                                KFIXCC   421
208 CONTINUE                                                                 KFIXCC   422
    IF (NO.LE.0) RETURN                                                      KFIXCC   423
    DO 270 N=1,NO                                                            KFIXCC   424
    KX1=KOB(1,N)                                                             KFIXCC   425
    KX2=KOB(2,N)                                                             KFIXCC   426
    KY1=KOB(3,N)                                                             KFIXCC   427
    KY2=KOB(4,N)                                                             KFIXCC   428
    IF(PTE.LT.OB(5,N).OR.PTE.GT.OB(6,N)) GO TO 270                           FILM      22
    CALL DRV (KX1,KY1,KX1,KY2)                                               KFIXCC   429
    CALL DRV (KX1,KY2,KX2,KY2)                                               KFIXCC   430
210 CALL DRV (KX1,KY1,KX2,KY1)                                               KFIXCC   431
    CALL DRV (KX2,KY1,KX2,KY2)                                               KFIXCC   432
270 CONTINUE                                                                 KFIXCC   433
    IF (NGR.EQ.1) GO TO 280                                                  KFIXCC   434
    NGR=1                                                                    KFIXCC   435
    GO TO 110                                                                KFIXCC   436
280 CONTINUE                                                                 KFIXCC   437
    RETURN                                                                   KFIXCC   438
290 CONTINUE                                                                 KFIXCC   439
    XS=XL+DR/2.                                                              KFIXCC   440
    YS=YB+DZ/2.                                                              KFIXCC   441
    DO 300 J=2,JB1                                                           KFIXCC   442
    DO 300 I=2,IB1                                                           KFIXCC   443
    IF(FL(I,J,K).NE.1) GO TO 300                                             FILM      23
    QMN=QMX=CQ(I,J,K)                                                        FILM      24
    GO TO 310                                                                KFIXCC   446
300 CONTINUE                                                                 KFIXCC   447
310 CONTINUE                                                                 KFIXCC   448
    DO 320 J=2,JB1                                                           KFIXCC   449
    DO 320 I=2,IB1                                                           KFIXCC   450
    IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) GO TO 320                          FILM      25
C   CALCULATES -SPACING BETWEEN CONTOUR LINES (DQ)-MAX.CQ (QMX)-MIN.CQ       KFIXCC   452
    IF(CQ(I,J,K).LT.QMN) QMN=CQ(I,J,K)                                       FILM      26
    IF(CQ(I,J,K).GT.QMX) QMX=CQ(I,J,K)                                       FILM      27
320 CONTINUE                                                                 KFIXCC   455
    DQ=(QMX-QMN)/10.                                                         KFIXCC   456
    SUM=QMN                                                                  KFIXCC   457
    CC=0.                                                                    KFIXCC   458
    MINQ=2                                                                   KFIXCC   459
    DO 330 I=1,11                                                            KFIXCC   460
    CON(I)=SUM+(I-1)*DQ                                                      KFIXCC   461
    IF (CC.GT.0.) GO TO 330                                                  KFIXCC   462
    IF (CON(I).LE.QMN) GO TO 330                                             KFIXCC   463
    CC=1.                                                                    KFIXCC   464
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      MINQ=I                                                                  KFIXCC   465
  330 CONTINUE                                                                KFIXCC   466
      IF (LPR.LE.0) GO TO 480                                                 KFIXCC   467
  332 CONTINUE                                                                KFIXCC   468
      CALL LINCNT(61)                                                         KFIXCC   469
      GO TO (335,340,345,350,355,360,365,370,375,380,385),JSP                 KFIXCC   470
  335 WRITE (12,720)                                                          KFIXCC   471
      GO TO 470                                                               KFIXCC   472
  340 WRITE (12,725)                                                          KFIXCC   473
      GO TO 470                                                               KFIXCC   474
  345 WRITE (12,730)                                                          KFIXCC   475
      GO TO 470                                                               KFIXCC   476
  350 WRITE (12,735)                                                          KFIXCC   477
      GO TO 470                                                               KFIXCC   478
  355 WRITE (12,740)                                                          KFIXCC   479
      GO TO 470                                                               KFIXCC   480
  360 WRITE (12,745)                                                          KFIXCC   481
      GO TO 470                                                               KFIXCC   482
  365 WRITE (12,750)                                                          KFIXCC   483
      GO TO 470                                                               KFIXCC   484
  370 WRITE (12,755)                                                          KFIXCC   485
      GO TO 470                                                               KFIXCC   486
  375 WRITE (12,760)                                                          KFIXCC   487
      GO TO 470                                                               KFIXCC   488
  380 WRITE (12,765)                                                          KFIXCC   489
      GO TO 470                                                               KFIXCC   490
  385 WRITE (12,770)                                                          KFIXCC   491
  470 CONTINUE                                                                KFIXCC   492
      GO TO (280,280,475,800),KK                                              KFIXCC   493
  475 CONTINUE                                                                KFIXCC   494
      CALL LINCNT (59)                                                        KFIXCC   495
      WRITE (12,860)QMX,QMN,CON(10),CON(MINQ),DQ                              KFIXCC   496
  480 DO 710 J=2,JB                                                           KFIXCC   497
      YD=YS+(J-2)*DZ                                                          KFIXCC   498
      DO 700 I=2,IB                                                           KFIXCC   499
      XD=XS+(I-2)*DR                                                          KFIXCC   500
C     BYPASSES OBSTACLE                                                       KFIXCC   501
      L12=L13=L24=L34=0.                                                      KFIXCC   502
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) L12=L13=1                         FILM      28
      IF(FL(I+1,J,K).GT.1.AND.FL(I+1,J,K).LT.4) L12=L24=1                     FILM      29
      IF(FL(I,J+1,K).GT.1.AND.FL(I,J+1,K).LT.4) L13=L34=1                     FILM      30
      IF(FL(I+1,J+1,K).GT.1.AND.FL(I+1,J+1,K).LT.4) L24=L34=1                 FILM      31
      DO 690 N=2,10                                                           KFIXCC   507
C     IF CON.GT.CQ SETS KN=1----IF CON.LE.CQ SETS KN=0                        KFIXCC   508
      M=12-N                                                                  KFIXCC   509
      K1=K2=K3=K4=1                                                           KFIXCC   510
      IF(CON(M).LE.CQ(I,J,K)) K1=0                                            FILM      32
      IF(CON(M).LE.CQ(I+1,J,K)) K2=0                                          FILM      33
      IF(CON(M).LE.CQ(I,J+1,K)) K3=0                                          FILM      34
      IF(CON(M).LE.CQ(I+1,J+1,K)) K4=0                                        FILM      35
      IF (K1*K2*K3*K4.NE.0) GO TO 690                                         KFIXCC   515
      IF ((K1+K2+K3+K4).NE.0) GO TO 610                                       KFIXCC   516
      GO TO 690                                                               KFIXCC   517
C     FINDS TWO INTERSECTION POINTS OF FOUR CELL REGION                       KFIXCC   518
  610 IC=0                                                                    KFIXCC   519
      IF ((K1+K3).NE.1) GO TO 620                                             KFIXCC   520
      IF (L13.EQ.1) GO TO 620                                                 KFIXCC   521
      DX=0.                                                                   KFIXCC   522
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      III=I                                                                  KFIXCC    523
      IC=IC+1                                                                KFIXCC    524
      ASSIGN 620 TO KR1                                                      KFIXCC    525
      GO TO 660                                                              KFIXCC    526
  620 IF ((K1+K2).NE.1) GO TO 630                                            KFIXCC    527
      IF (L12.EQ.1) GO TO 630                                                KFIXCC    528
      DY=0.                                                                  KFIXCC    529
      JJ1=J                                                                  KFIXCC    530
      IC=IC+1                                                                KFIXCC    531
      ASSIGN 630 TO KR1                                                      KFIXCC    532
      GO TO 670                                                              KFIXCC    533
  630 IF ((K2+K4).NE.1) GO TO 640                                            KFIXCC    534
      IF (L24.EQ.1) GO TO 640                                                KFIXCC    535
      DX=DR                                                                  KFIXCC    536
      III=I+1                                                                KFIXCC    537
      IC=IC+1                                                                KFIXCC    538
      ASSIGN 640 TO KR1                                                      KFIXCC    539
      GO TO 660                                                              KFIXCC    540
  640 IF ((K3+K4).NE.1) GO TO 650                                            KFIXCC    541
      IF (L34.EQ.1) GO TO 650                                                KFIXCC    542
      DY=DZ                                                                  KFIXCC    543
      JJ1=J+1                                                                KFIXCC    544
      IC=IC+1                                                                KFIXCC    545
      ASSIGN 650 TO KR1                                                      KFIXCC    546
      GO TO 670                                                              KFIXCC    547
  650 GO TO 690                                                              KFIXCC    548
  660 XY(IC)=XD+DX                                                           KFIXCC    549
      YX(IC)=YD+DZ*((CON(M)-CQ(III,J,K))/(CQ(III,J+1,K)-CQ(III,J,K)))        FILM       36
      IF (IC.EQ.2) GO TO 680                                                 KFIXCC    551
      GO TO KR1                                                              KFIXCC    552
  670 YX(IC)=YD+DY                                                           KFIXCC    553
      XY(IC)=XD+DR*((CON(M)-CQ(I,JJ1,K))/(CQ(I+1,JJ1,K)-CQ(I,JJ1,K)))       FILM       37
      IF (IC.EQ.2) GO TO 680                                                 KFIXCC    555
      GO TO KR1                                                              KFIXCC    556
C     CONVERTS AND PLOTS CONTOURS FOR FOUR REAL CELLS----K=2                 KFIXCC    557
  680 CALL CONVRT (XY(1),IX1,XL,XR,IXL,IXR)                                  KFIXCC    558
      CALL CONVRT (XY(2),IX2,XL,XR,IXL,IXR)                                  KFIXCC    559
      CALL CONVRT (YX(1),IY1,YB,YT,IYB,IYT)                                  KFIXCC    560
      CALL CONVRT (YX(2),IY2,YB,YT,IYB,IYT)                                  KFIXCC    561
      IF (M.EQ.10) CALL PLT (IX1,IY1,24)                                     KFIXCC    562
      IF (M.EQ.MINQ) CALL PLT (IX1,IY1,35)                                   KFIXCC    563
      CALL DRV (IX1,IY1,IX2,IY2)                                             KFIXCC    564
      IC=0                                                                   KFIXCC    565
      GO TO KR1                                                              KFIXCC    566
  690 CONTINUE                                                               KFIXCC    567
  700 CONTINUE                                                               KFIXCC    568
  710 CONTINUE                                                               KFIXCC    569
  800 RETURN                                                                 FILM       38
C                                                                            KFIXCC    587
  720 FORMAT(4X,*GAS MACROSCOPIC DENSITY*)                                   KFIXCC    588
  725 FORMAT(4X,*LIQUID MACROSCOPIC DENSITY*)                                KFIXCC    589
  730 FORMAT (4X,*VOID FRACTION*)                                            KFIXCC    590
  735 FORMAT (4X,*PRESSURE*)                                                 KFIXCC    591
  740 FORMAT (4X,*GAS TEMPERATURE*)                                          KFIXCC    592
  745 FORMAT (4X,*LIQUID TEMPERATURE*)                                       KFIXCC    593
  750 FORMAT (4X,*SATURATION TEMPERATURE*)                                   KFIXCC    594
  755 FORMAT (4X,*GAS INTERNAL ENERGY*)                                      KFIXCC    595
  760 FORMAT (4X,*LIQUID INTERNAL ENERGY*)                                   KFIXCC    596
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  765 FORMAT (4X,*MASS EXCHANGE RATE*)                                    KFIXCC    597
  770 FORMAT (4X,*MOMENTUM EXCHANGE RATE*)                                KFIXCC    598
  850 FORMAT(4X,A10,2X,10A8* T=*1PE12.5* CYCLE=*I5)                       KFIXCC    599
  860 FORMAT(4X,*QMX=*1PE12.4,*   QMN=*,1PE12.4,*   MAX.CON.LINE=*,      KFIXCC    600
     1 1PE12.4,*   MIN.CON.LINE=*,1PE12.4,*   INTERVAL=*1PE12.4)         KFIXCC    601
  870 FORMAT(40X,25HAZIMUTHAL ANGLE (DEPTH) =,1PE12.5)                    FILM       39
      END                                                                 KFIXCC    602


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      SUBROUTINE CNPLTIK                                                  FILM       40
*CALL GCOM1                                                               FILM       41
*CALL GCOM2                                                               FILM       42
      DIMENSION CON(11),XY(2),YX(2)                                       FILM       43
      DIMENSION CS(10),JX(20),JY(20)                                      FILM       44
C                                                                         FILM       45
C     PLOT  CONTOURS AT CONSTANT VALUES OF J                              FILM       46
C                                                                         FILM       47
C                                                                         FILM       48
      DO 1000 MM=1,5                                                      FILM       49
      J=IKPLOT(1,MM)                                                      FILM       50
      IF(J.EQ.0) GO TO 1000                                               FILM       51
C     PLOT ONLY THOSE SPECIFIED                                           FILM       52
C                                                                         FILM       53
      DO 900 L=1,11                                                       FILM       54
      IF(IKPLOT(1+L,MM).EQ.0) GO TO 900                                   FILM       55
      IF(ITC.EQ.0) GO TO 50                                               FILM       56
C                                                                         FILM       57
C     GENERATE GRID FOR CYLINDRICAL IKPLOT                                FILM       58
C                                                                         FILM       59
      IF(LPR.LE.0) GO TO 10                                               FILM       60
      CALL ADV(1)                                                         FILM       61
      CALL LINCNT(60)                                                     FILM       62
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                   FILM       63
   10 CONTINUE                                                            FILM       64
      HEIGHT=DZ*(FLOAT(J)-1.5)                                            FILM       65
      XR=RB(IB1)                                                          FILM       66
      XL=-XR                                                              FILM       67
      YT=XR                                                               FILM       68
      YB=-XR                                                              FILM       69
      IXL=61                                                              FILM       70
      IXR=961                                                             FILM       71
      IYT=31                                                              FILM       72
      IYB=931                                                             FILM       73
      DO 19 II=1,IB1                                                      FILM       74
      XI=RB(II)                                                           FILM       75
      CALL CONVRT(XI,IX,XL,XR,IXL,IXR)                                    FILM       76
      JX(II)=IX                                                           FILM       77
      JY(II)=481                                                          FILM       78
   19 CONTINUE                                                            FILM       79
      IF(FL(1).EQ.2.OR.FL(1).EQ.3) CALL DRV(JX(1),JY(1),JX(IB1),JY(IB1)) FILM       80
      NANG=DPH/0.08726646 + .5                                            FILM       81
      DPHN=DPH/FLOAT(NANG)                                                FILM       82
      CS(1)=SIN(DPHN)                                                     FILM       83
      CS(2)=COS(DPHN)                                                     FILM       84
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      CS(3)=0.                                                          FILM    85
      CS(4)=1.                                                          FILM    86
      DO 26 KK=2,KB1                                                    FILM    87
      DO 24 N=1,NANG                                                    FILM    88
      CS(5)=CS(2)*CS(3)+CS(1)*CS(4)                                     FILM    89
      CS(7)=CS(2)*CS(4)-CS(1)*CS(3)                                     FILM    90
      CS(3)=CS(6)                                                       FILM    91
      CS(4)=CS(7)                                                       FILM    92
      DO 22 II=1,IB1                                                    FILM    93
      CS(8)=RB(II)                                                      FILM    94
      CS(6)=CS(3)*CS(8)                                                 FILM    95
      CS(7)=CS(4)*CS(8)                                                 FILM    96
      CALL CONVRT(CS(7),IX,XL,XR,IXL,IXR)                               FILM    97
      CALL CONVRT(CS(6),IY,YB,YT,IYB,IYT)                               FILM    98
      IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                    FILM    99
      IPJ=IJ+1                                                          FILM   100
      IF(II.EQ.IB1.AND.FL(IPJ).LT.4) GO TO 27                           FILM   101
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IPJ).NE.2.AND.FL(IPJ).NE.3) FILM  102
     1 GO TO 27                                                         FILM   103
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3)) FILM  104
     1 GO TO 27                                                         FILM   105
      GO TO 21                                                          FILM   106
   27 CALL DRV(JX(II),JY(II),IX,IY)                                     FILM   107
   21 JX(II)=IX                                                         FILM   108
      JY(II)=IY                                                         FILM   109
   22 CONTINUE                                                          FILM   110
   24 CONTINUE                                                          FILM   111
      DO 25 II=2,IB1                                                    FILM   112
      IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                    FILM   113
      IKP=IJ+IB2XJB2                                                    FILM   114
      IF(FL(IKP).EQ.0) GO TO 25                                         FILM   115
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKP).NE.2.AND.FL(IKP).NE.3) FILM  116
     1 GO TO 23                                                         FILM   117
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) FILM  118
     1 GO TO 23                                                         FILM   119
      IF(KK.EQ.KB1.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))GO TO 23          FILM   120
      GO TO 25                                                          FILM   121
   23 CALL DRV(JX(II-1),JY(II-1),JX(II),JY(II))                         FILM   122
   25 CONTINUE                                                          FILM   123
   26 CONTINUE                                                          FILM   124
      GO TO 100                                                         FILM   125
C                                                                       FILM   126
C     GENERATE BACKGROUND FOR CARTESIAN IKPLOTS                         FILM   127
C                                                                       FILM   128
   50 CONTINUE                                                          FILM   129
      IYB=916                                                           FILM   130
      XL=0.                                                             FILM   131
      XR=IB*DR                                                          FILM   132
      YT=KB*DPH                                                         FILM   133
      YB=0.                                                             FILM   134
      IF(XR.LE.1.13556*YT) GO TO 920                                    FILM   135
      IXL=0                                                             FILM   136
      IXR=1022                                                          FILM   137
      IYT=916-YT*1022/XR                                                FILM   138
      GO TO 930                                                         FILM   139
  920 X=XR*450/YT                                                       FILM   140
      IXL=511-X                                                         FILM   141
      IXR=511+X                                                         FILM   142
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      IY1=16                                                                    FILM      143
  930 CONTINUE                                                                  FILM      144
      IF(LPR.LE.0) GO TO 940                                                    FILM      145
      CALL ADV(1)                                                               FILM      146
      CALL LINCNT(60)                                                           FILM      147
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                         FILM      148
  940 CONTINUE                                                                  FILM      149
      HEIGHT=DZ*(FLOAT(J)-1.5)                                                  FILM      150
      DO 960 K=2,KB2                                                            FILM      151
      DO 960 I=2,IB2                                                            FILM      152
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                              FILM      153
      IMJ=IJ-1                                                                  FILM      154
      IKM=IJ-IB2XJB2                                                            FILM      155
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 945                                          FILM      156
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) FILM   157
     1 GO TO 945                                                                FILM      158
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3) FILM   159
     1 GO TO 945                                                                FILM      160
      GO TO 950                                                                 FILM      161
  945 XX3=DR*FLOAT(I-2)                                                         FILM      162
      YY3=DPH*FLOAT(K-2)                                                        FILM      163
      XX4=XX3+DR                                                                FILM      164
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                        FILM      165
      CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                        FILM      166
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                        FILM      167
      CALL DRV(IX1,IY1,IX2,IY1)                                                 FILM      168
  950 CONTINUE                                                                  FILM      169
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IMJ).NE.2.AND.FL(IMJ).NE.3) FILM   170
     1 GO TO 955                                                                FILM      171
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) FILM   172
     1 GO TO 955                                                                FILM      173
      IF(I.EQ.2.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) GO TO 955                   FILM      174
      IF(I.EQ.IB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 955                   FILM      175
      GO TO 960                                                                 FILM      176
  955 XX3=DR*FLOAT(I-2)                                                         FILM      177
      YY3=DPH*FLOAT(K-2)                                                        FILM      178
      YY4=YY3+DPH                                                               FILM      179
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                        FILM      180
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                        FILM      181
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                        FILM      182
      CALL DRV(IX1,IY1,IX1,IY2)                                                 FILM      183
  960 CONTINUE                                                                  FILM      184
C                                                                               FILM      185
  100 XS=DR/2.                                                                  FILM      186
      YS=DPH/2.                                                                 FILM      187
      QMN=1.E50                                                                 FILM      188
      QMX=-1.E50                                                                FILM      189
      DO 200 I=2,IB1                                                            FILM      190
      DO 200 K=2,KB1                                                            FILM      191
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                              FILM      192
      GO TO(101,102,103,104,105,106,107,108,109,110,111),L                      FILM      193
C                                                                               FILM      194
  101 CQ(IJ)=RGP(IJ)                                                            FILM      195
      GO TO 190                                                                 FILM      196
  102 CQ(IJ)=RLP(IJ)                                                            FILM      197
      GO TO 190                                                                 FILM      198
  103 CQ(IJ)=TH(IJ)                                                             FILM      199
      GO TO 190                                                                 FILM      200
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104 CQ(IJ)=P(IJ)                                                        FILM    201
    GO TO 190                                                           FILM    202
105 CQ(IJ)=TG(IJ)                                                       FILM    203
    GO TO 190                                                           FILM    204
106 CQ(IJ)=TL(IJ)                                                       FILM    205
    GO TO 190                                                           FILM    206
107 CQ(IJ)=TS(IJ)                                                       FILM    207
    GO TO 190                                                           FILM    208
108 CQ(IJ)=SIEG(IJ)                                                     FILM    209
    GO TO 190                                                           FILM    210
109 CQ(IJ)=SIEL(IJ)                                                     FILM    211
    GO TO 190                                                           FILM    212
110 CQ(IJ)=ERATE(IJ)-CRATE(IJ)                                          FILM    213
    GO TO 190                                                           FILM    214
111 CQ(IJ)=KDRAG(IJ)                                                    FILM    215
    GO TO 190                                                           FILM    216
190 CONTINUE                                                            FILM    217
    IF (CQ(IJ).LT.QMN) QMN=CQ(IJ)                                       FILM    218
    IF (CQ(IJ).GT.QMX) QMX=CQ(IJ)                                       FILM    219
200 CONTINUE                                                            FILM    220
    DQ=(QMX-QMN)/10.                                                    FILM    221
    SUM=QMN                                                             FILM    222
    CC=0.                                                               FILM    223
    MINQ=2                                                              FILM    224
    DO 330 N=1,11                                                       FILM    225
    CON(N)=SUM+(N-1)*DQ                                                 FILM    226
    IF (CC.GT.0.) GO TO 330                                             FILM    227
    IF (CON(N).LE.QMN) GO TO 330                                        FILM    228
    CC=1.                                                               FILM    229
    MINQ=N                                                              FILM    230
330 CONTINUE                                                            FILM    231
    IF (LPR.LE.0) GO TO 480                                             FILM    232
332 CONTINUE                                                            FILM    233
    CALL LINCNT(6)                                                      FILM    234
    GO TO (335,340,345,350,355,360,365,370,375,380,385),L               FILM    235
335 WRITE (12,720) HEIGHT                                               FILM    236
    GO TO 470                                                           FILM    237
340 WRITE (12,725) HEIGHT                                               FILM    238
    GO TO 470                                                           FILM    239
345 WRITE (12,730) HEIGHT                                               FILM    240
    GO TO 470                                                           FILM    241
350 WRITE (12,735) HEIGHT                                               FILM    242
    GO TO 470                                                           FILM    243
355 WRITE (12,740) HEIGHT                                               FILM    244
    GO TO 470                                                           FILM    245
360 WRITE (12,745) HEIGHT                                               FILM    246
    GO TO 470                                                           FILM    247
365 WRITE (12,750) HEIGHT                                               FILM    248
    GO TO 470                                                           FILM    249
370 WRITE (12,755) HEIGHT                                               FILM    250
    GO TO 470                                                           FILM    251
375 WRITE (12,760) HEIGHT                                               FILM    252
    GO TO 470                                                           FILM    253
380 WRITE (12,765) HEIGHT                                               FILM    254
    GO TO 470                                                           FILM    255
385 WRITE (12,770) HEIGHT                                               FILM    256
470 CONTINUE                                                            FILM    257
    IF(LPR.LE.0) GO TO 480                                              FILM    258
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      CALL LINCNT (59)                                                    FILM  259
      WRITE (12,860)QMX,QMN,CON(10),CON(11INQ),DQ                         FILM  260
  480 DO 710 K=2,KB1                                                      FILM  261
      YD=YS+(K-2)*DPH                                                     FILM  262
      DO 700 I=2,IB                                                       FILM  263
      IKP=I+(J-1)*IB2+K*IB2XJB2                                           FILM  264
      IF(K.EQ.KB1.AND.FL(IKP).NE.0) GO TO 700                             FILM  265
      XD=XS+(I-2)*DR                                                      FILM  266
C     BYPASSES OBSTACLE                                                   FILM  267
      L12=L13=L24=L34=0.                                                  FILM  268
      KK1=K+1                                                             FILM  269
      IF(K.EQ.KB1.AND.FL(IKP).EQ.0) KK1=2                                 FILM  270
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) L12=L13=1                     FILM  271
      IF(FL(I,J,KK1).GT.1.AND.FL(I,J,KK1).LT.4) L12=L24=1                 FILM  272
      IF(FL(I+1,J,K).GT.1.AND.FL(I+1,J,K).LT.4) L13=L34=1                 FILM  273
      IF(FL(I+1,J,KK1).GT.1.AND.FL(I+1,J,KK1).LT.4) L24=L34=1             FILM  274
      DO 690 N=2,10                                                       FILM  275
C     IF CON.GT.CQ SETS KN=1----IF CON.LE.CQ SETS KN=0                    FILM  276
      M=12-N                                                              FILM  277
      K1=K2=K3=K4=1                                                       FILM  278
      IF (CON(M).LE.CQ(I,J,K)) K1=0                                       FILM  279
      IF (CON(M).LE.CQ(I,J,KK1)) K2=0                                     FILM  280
      IF (CON(M).LE.CQ(I+1,J,K)) K3=0                                     FILM  281
      IF (CON(M).LE.CQ(I+1,J,KK1)) K4=0                                   FILM  282
      IF (K1*K2*K3*K4.NE.0) GO TO 690                                     FILM  283
      IF ((K1+K2+K3+K4).NE.0) GO TO 610                                   FILM  284
      GO TO 690                                                           FILM  285
C     FINDS TWO INTERSECTION POINTS OF FOUR CELL REGION                   FILM  286
  610 IC=0                                                                FILM  287
      IF ((K1+K3).NE.1) GO TO 620                                         FILM  288
      IF (L13.EQ.1) GO TO 620                                             FILM  289
      DY=0.                                                               FILM  290
      KK2=K                                                               FILM  291
      IC=IC+1                                                             FILM  292
      ASSIGN 620 TO KR1                                                   FILM  293
      GO TO 660                                                           FILM  294
  620 IF ((K1+K2).NE.1) GO TO 630                                         FILM  295
      IF (L12.EQ.1) GO TO 630                                             FILM  296
      DX=0.                                                               FILM  297
      III=I                                                               FILM  298
      IC=IC+1                                                             FILM  299
      ASSIGN 630 TO KR1                                                   FILM  300
      GO TO 670                                                           FILM  301
  630 IF ((K2+K4).NE.1) GO TO 640                                         FILM  302
      IF (L24.EQ.1) GO TO 640                                             FILM  303
      DY=DPH                                                              FILM  304
      KK2=KK1                                                             FILM  305
      IC=IC+1                                                             FILM  306
      ASSIGN 640 TO KR1                                                   FILM  307
      GO TO 660                                                           FILM  308
  640 IF ((K3+K4).NE.1) GO TO 650                                         FILM  309
      IF (L34.EQ.1) GO TO 650                                             FILM  310
      DX=DR                                                               FILM  311
      III=I+1                                                             FILM  312
      IC=IC+1                                                             FILM  313
      ASSIGN 650 TO KR1                                                   FILM  314
      GO TO 670                                                           FILM  315
  650 GO TO 690                                                           FILM  316
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  660 YC=YD+DY                                                                  FILM     317
      XC=XD+DR*((CON(M)-CQ(I,J,KK2))/(CQ(I+1,J,KK2)-CQ(I,J,KK2)))               FILM     318
      XY(IC)=XC                                                                 FILM     319
      YX(IC)=YC                                                                 FILM     320
      IF(ITC.EQ.0) GO TO 665                                                    FILM     321
      XY(IC)=XC*COS(YC)                                                         FILM     322
      YX(IC)=XC*SIN(YC)                                                         FILM     323
  665 IF (IC.EQ.2) GO T  680                                                    FILM     324
      GO TO KR1                                                                 FILM     325
  670 XC=XD+DX                                                                  FILM     326
      YC=YD+DPH*((CON(M)-CQ(III,J,K))/(CQ(III,J,KK1)-CQ(III,J,K)))              FILM     327
      XY(IC)=XC                                                                 FILM     328
      YX(IC)=YC                                                                 FILM     329
      IF(ITC.EQ.0) GO TO 675                                                    FILM     330
      XY(IC)=XC*COS(YC)                                                         FILM     331
      YX(IC)=XC*SIN(YC)                                                         FILM     332
  675 IF (IC.EQ.2) GO TO 680                                                    FILM     333
      GO TO KR1                                                                 FILM     334
C     CONVERTS AND PLOTS CONTOURS FOR FOUR REAL CELLS----K=2                    FILM     335
  680 CALL CONVRT (XY(1),IX1,XL,XR,IXL,IXR)                                     FILM     336
      CALL CONVRT (XY(2),IX2,XL,XR,IXL,IXR)                                     FILM     337
      CALL CONVRT (YX(1),IY1,YB,YT,IYB,IYT)                                     FILM     338
      CALL CONVRT (YX(2),IY2,YB,YT,IYB,IYT)                                     FILM     339
      IF (M.EQ.10) CALL PLT (IX1,IY1,24)                                        FILM     340
      IF (M.EQ.MINQ) CALL PLT (IX1,IY1,35)                                      FILM     341
      CALL DRV (IX1,IY1,IX2,IY2)                                                FILM     342
      IC=0                                                                      FILM     343
      GO TO KR1                                                                 FILM     344
  690 CONTINUE                                                                  FILM     345
  700 CONTINUE                                                                  FILM     346
  710 CONTINUE                                                                  FILM     347
  900 CONTINUE                                                                  FILM     348
 1000 CONTINUE                                                                  FILM     349
      RETURN                                                                    FILM     350
C                                                                               FILM     351
  720 FORMAT(4X,25HGAS MACROSCOPIC DENSITY    ,40X,7HHEIGHT=,1PE14.7)           FILM     352
  725 FORMAT(4X,26HLIQUID MACROSCOPIC DENSITY,40X,7HHEIGHT=,1PE14.7)            FILM     353
  730 FORMAT(4X,25HVOID FRACTION              ,40X,7HHEIGHT=,1PE14.7)           FILM     354
  735 FORMAT(4X,25HPRESSURE                   ,40X,7HHEIGHT=,1PE14.7)           FILM     355
  740 FORMAT(4X,25HGAS TEMPERATURE            ,40X,7HHEIGHT=,1PE14.7)           FILM     356
  745 FORMAT(4X,25HLIQUID TEMPERATURE         ,40X,7HHEIGHT=,1PE14.7)           FILM     357
  750 FORMAT(4X,25HSATURATION TEMPERATURE     ,40X,7HHEIGHT=,1PE14.7)           FILM     358
  755 FORMAT(4X,25HGAS INTERNAL ENERGY        ,40X,7HHEIGHT=,1PE14.7)           FILM     359
  760 FORMAT(4X,25HLIQUID INTERNAL ENERGY     ,40X,7HHEIGHT=,1PE14.7)           FILM     360
  765 FORMAT(4X,25HMASS EXCHANGE RATE         ,40X,7HHEIGHT=,1PE14.7)           FILM     361
  770 FORMAT(4X,25HMOMENTUM EXCHANGE RATE     ,40X,7HHEIGHT=,1PE14.7)           FILM     362
  850 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                         FILM     363
  860 FORMAT(4X,4HQMX=,1PE12.4,7H   QMN=,1PE12.4,16H   MAX.CON.LINE=,           FILM     364
     1 1PE12.4,16H   MIN.CON.LINE=,1PE12.4,12H   INTERVAL=,1PE12.4)             FILM     365
      END                                                                       FILM     366


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      SUBROUTINE CNPLTJK                                                        FILM     367
*CALL GCOM1                                                                     FILM     368
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*CALL GCOM2                                                                    FILM     369
      DIMENSION CON(11),XY(2),YX(2)                                            FILM     370
C                                                                              FILM     371
      DO 1000 MM=1,5                                                           FILM     372
      I=JKPLOT(1,MM)                                                           FILM     373
      IF(I.EQ.0) GO TO 1000                                                    FILM     374
C     PLOT ONLY THOSE SPECIFIED                                                FILM     375
C                                                                              FILM     376
      DO 900 L=1,11                                                            FILM     377
      IF(JKPLOT(1+L,MM).EQ.0) GO TO 900                                        FILM     378
C     GENERATE BACKGROUND GRID FOR JKPLOTS                                     FILM     379
C                                                                              FILM     380
      RADIUS=DR*(FLOAT(I)-1.5)                                                 FILM     381
      DA=RADIUS*DPH                                                            FILM     382
      IF(ITC.EQ.0) DA=DPH                                                      FILM     383
      IYB=916                                                                  FILM     384
      XL=0.                                                                    FILM     385
      XR=KB*DA                                                                 FILM     386
      YT=JB*DZ                                                                 FILM     387
      YB=0.                                                                    FILM     388
      IF(XR.LE.1.13556*YT) GO TO 20                                            FILM     389
      IXL=0                                                                    FILM     390
      IXR=1022                                                                 FILM     39
      IYT=916-YT*1022/XR                                                       FILM     392
      GO TO 30                                                                 FILM     393
   20 X=XR*450/YT                                                              FILM     394
      IXL=511-X                                                                FILM     395
      IXR=511+X                                                                FILM     396
      IYT=16                                                                   FILM     397
   30 CONTINUE                                                                 FILM     398
      CALL ADV(1)                                                              FILM     399
      IF(LPR.LE.0) GO TO 40                                                    FILM     400
      CALL LINCNT(60)                                                          FILM     401
      WRITE(12,850) JNM,NAME,TIME,CYCLE                                        FILM     402
   40 CONTINUE                                                                 FILM     403
      DO 65 J=2,JB2                                                            FILM     404
      DO 60 K=2,KB2                                                            FILM     405
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                             FILM     406
      IJM=IJ-IB2                                                               FILM     407
      IKM=IJ-IB2XJB2                                                           FILM     408
      IF(FL(IKM).EQ.0) GO TO 50                                                FILM     409
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 45                                          FILM     410
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))      FILM     411
     1 GO TO 45                                                                FILM     412
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)      FILM     413
     1 GO TO 45                                                                FILM     414
      GO TO 50                                                                 FILM     415
   45 XX3=DA*(FLOAT(K)-2.)                                                     FILM     416
      YY3=DZ*(FLOAT(J)-2.)                                                     FILM     417
      YY4=YY3+DZ                                                               FILM     418
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                       FILM     419
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                       FILM     420
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                       FILM     421
      CALL DRV(IX1,IY1,IX1,IY2)                                                FILM     422
   50 CONTINUE                                                                 FILM     423
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IJM).NE.2.AND.FL(IJM).NE.3)      FILM     424
     1 GO TO 55                                                                FILM     425
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3))      FILM     426
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      1 GO TO 55                                                        FILM    427
        IF(J.EQ.2.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) GO TO 55          FILM    428
        IF(J.EQ.JB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 55          FILM    429
        GO TO 60                                                        FILM    430
     55 XX3=DA*(FLOAT(K)-2.)                                            FILM    431
        XX4=XX3+DA                                                      FILM    432
        YY3=DZ*(FLOAT(J)-2.)                                            FILM    433
        CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                              FILM    434
        CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                              FILM    435
        CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                              FILM    436
        CALL DRV(IX1,IY1,IX2,IY1)                                       FILM    437
     60 CONTINUE                                                        FILM    438
     65 CONTINUE                                                        FILM    439
        XS=XL+DA/2.                                                     FILM    440
        YS=YB+DZ/2.                                                     FILM    441
        QMN=1.E50                                                       FILM    442
        QMX=-1.E50                                                      FILM    443
        DO 200 J=2,JB1                                                  FILM    444
        DO 200 K=2,KB1                                                  FILM    445
        IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                    FILM    446
        GO TO(101,102,103,104,105,106,107,108,109,110,111),L            FILM    447
C                                                                       FILM    448
    101 CQ(IJ)=RGP(IJ)                                                  FILM    449
        GO TO 190                                                       FILM    450
    102 CQ(IJ)=RLP(IJ)                                                  FILM    451
        GO TO 190                                                       FILM    452
    103 CQ(IJ)=TH(IJ)                                                   FILM    453
        GO TO 190                                                       FILM    454
    104 CQ(IJ)=P(IJ)                                                    FILM    455
        GO TO 190                                                       FILM    456
    105 CQ(IJ)=TG(IJ)                                                   FILM    457
        GO TO 190                                                       FILM    458
    106 CQ(IJ)=TL(IJ)                                                   FILM    459
        GO TO 190                                                       FILM    460
    107 CQ(IJ)=TS(IJ)                                                   FILM    461
        GO TO 190                                                       FILM    462
    108 CQ(IJ)=SIEG(IJ)                                                 FILM    463
        GO TO 190                                                       FILM    464
    109 CQ(IJ)=SIEL(IJ)                                                 FILM    465
        GO TO 190                                                       FILM    466
    110 CQ(IJ)=ERATE(IJ)-CRATE(IJ)                                      FILM    467
        GO TO 190                                                       FILM    468
    111 CQ(IJ)=KDRAG(IJ)                                                FILM    469
        GO TO 190                                                       FILM    470
    190 CONTINUE                                                        FILM    471
        IF (CQ(IJ).LT.QMN) QMN=CQ(IJ)                                   FILM    472
        IF (CQ(IJ).GT.QMX) QMX=CQ(IJ)                                   FILM    473
    200 CONTINUE                                                        FILM    474
        DQ=(QMX-QMN)/10.                                                FILM    475
        SUM=QMN                                                         FILM    476
        CC=0.                                                           FILM    477
        MINQ=2                                                          FILM    478
        DO 330 N=1,11                                                   FILM    479
        CON(N)=SUM+(N-1)*DQ                                             FILM    480
        IF (CC.GT.0.) GO TO 330                                         FILM    481
        IF (CON(N).LE.QMN) GO TO 330                                    FILM    482
        CC=1.                                                           FILM    483
        MINQ=N                                                          FILM    484
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  330 CONTINUE                                                          FILM     485
      IF (LPR.LE.0) GO TO 480                                           FILM     486
  332 CONTINUE                                                          FILM     487
      CALL LINCNT(61)                                                   FILM     488
      GO TO (335,340,345,350,355,360,365,370,375,380,385),L             FILM     489
  335 WRITE (12,720) RADIUS                                             FILM     490
      GO TO 470                                                         FILM     491
  340 WRITE (12,725) RADIUS                                             FILM     492
      GO TO 470                                                         FILM     493
  345 WRITE (12,730) RADIUS                                             FILM     494
      GO TO 470                                                         FILM     495
  350 WRITE (12,735) RADIUS                                             FILM     496
      GO TO 470                                                         FILM     497
  355 WRITE (12,740) RADIUS                                             FILM     498
      GO TO 470                                                         FILM     499
  360 WRITE (12,745) RADIUS                                             FILM     500
      GO TO 470                                                         FILM     501
  365 WRITE (12,750) RADIUS                                             FILM     502
      GO TO 470                                                         FILM     503
  370 WRITE (12,755) RADIUS                                             FILM     504
      GO TO 470                                                         FILM     505
  375 WRITE (12,760) RADIUS                                             FILM     506
      GO TO 470                                                         FILM     507
  380 WRITE (12,765) RADIUS                                             FILM     508
      GO TO 470                                                         FILM     509
  385 WRITE (12,770) RADIUS                                             FILM     510
  470 CONTINUE                                                          FILM     511
      CALL LINCNT (59)                                                  FILM     512
      WRITE (12,860)QMX,QMN,CON(10),CON(MING),DQ                        FILM     513
  480 DO 710 J=2,JB                                                     FILM     514
      YD=YS+(J-2)*DZ                                                    FILM     515
      DO 700 K=2,KE                                                     FILM     516
      XD=XS+(K-2)*DA                                                    FILM     517
C     BYPASSES OBSTACLE                                                 FILM     518
      L12=L13=L24=L34=0.                                                FILM     519
      IF(FL(I,J,K).GT.1.AND.FL(I,J,K).LT.4) L12=L13=1                   FILM     520
      IF(FL(I,J,K+1).GT.1.AND.FL(I,J,K+1).LT.4) L12=L24=1               FILM     521
      IF(FL(I,J+1,K).GT.1.AND.FL(I,J+1,K).LT.4) L13=L34=1               FILM     522
      IF(FL(I,J+1,K+1).GT.1.AND.FL(I,J+1,K+1).LT.4) L24=L34=1           FILM     523
      DO 690 N=2,10                                                     FILM     524
C     IF CON.GT.CQ SETS KN=1----IF CON.LE.CQ SETS KN=0                  FILM     525
      M=12-N                                                            FILM     526
      K1=K2=K3=K4=1                                                     FILM     527
      IF (CON(M).LE.CQ(I,J,K)) K1=0                                     FILM     528
      IF (CON(M).LE.CQ(I,J,K+1)) K2=0                                   FILM     529
      IF (CON(M).LE.CQ(I,J+1,K)) K3=0                                   FILM     530
      IF (CON(M).LE.CQ(I,J+1,K+1)) K4=0                                 FILM     531
      IF (K1*K2*K3*K4.NE.0) GO TO 690                                   FILM     532
      IF ((K1+K2+K3+K4).NE.0) GO TO 610                                 FILM     533
      GO TO 690                                                         FILM     534
C     FINDS TWO INTERSECTION POINTS OF FOUR CELL REGION                 FILM     535
  610 IC=0                                                              FILM     536
      IF ((K1+K3).NE.1) GO TO 620                                       FILM     537
      IF (L13.EQ.1) GO TO 620                                           FILM     538
      DX=0.                                                             FILM     539
      KK1=K                                                             FILM     540
      IC=IC+1                                                           FILM     541
      ASSIGN 620 TO KR1                                                 FILM     542
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      GO TO 660                                                                 FILM  543
  620 IF ((K1+K2).NE.1) GO TO 630                                               FILM  544
      IF (L12.EQ.1) GO TO 630                                                   FILM  545
      DY=0.                                                                     FILM  546
      JJ1=J                                                                     FILM  547
      IC=IC+1                                                                   FILM  548
      ASSIGN 630 TO KR1                                                         FILM  549
      GO TO 670                                                                 FILM  550
  630 IF ((K2+K4).NE.1) GO TO 640                                               FILM  551
      IF (L24.EQ.1) GO TO 640                                                   FILM  552
      DX=DA                                                                     FILM  553
      KK1=K+1                                                                   FILM  554
      IC=IC+1                                                                   FILM  555
      ASSIGN 640 TO KR1                                                         FILM  556
      GO TO 660                                                                 FILM  557
  640 IF ((K3+K4).NE.1) GO TO 650                                               FILM  558
      IF (L34.EQ.1) GO TO 650                                                   FILM  559
      DY=DZ                                                                     FILM  560
      JJ1=J+1                                                                   FILM  561
      IC=IC+1                                                                   FILM  562
      ASSIGN 650 TO KR1                                                         FILM  563
      GO TO 670                                                                 FILM  564
  650 GO TO 690                                                                 FILM  565
  660 XY(IC)=XD+DX                                                              FILM  566
      YX(IC)=YD+DZ*((CON(M)-CQ(I,J,KK1))  CQ(I,J+1,KK1)-CQ(I,J,KK1)))           FILM  567
      IF (IC.EQ.2) GO TO 680                                                    FILM  568
      GO TO KR1                                                                 FILM  569
  670 YX(IC)=YD+DY                                                              FILM  570
      XY(IC)=XD+DA*((CON(M)-CQ(I,JJ1,K))/(CQ(I,JJ1,K+1)-CQ(I,JJ1,K)))          FILM  571
      IF (IC.EQ.2) GO TO 680                                                    FILM  572
      GO TO KR1                                                                 FILM  573
C     CONVERTS AND PLOTS CONTOURS FOR FOUR REAL CELLS----K=2                    FILM  574
  680 CALL CONVRT (XY(1),IX1,XL,XR,IXL,IXR)                                     FILM  575
      CALL CONVRT (XY(2),IX2,XL,XR,IXL,IXR)                                     FILM  576
      CALL CONVRT (YX(1),IY1,YB,YT,IYB,IYT)                                     FILM  577
      CALL CONVRT (YX(2),IY2,YB,YT,IYB,IYT)                                     FILM  578
      IF (M.EQ.10) CALL PLT (IX1,IY1,24)                                        FILM  579
      IF (M.EQ.MINQ) CALL PLT (IX1,IY1,35)                                      FILM  580
      CALL DRV (IX1,IY1,IX2,IY2)                                                FILM  581
      IC=0                                                                      FILM  582
      GO TO KR1                                                                 FILM  583
  690 CONTINUE                                                                  FILM  584
  700 CONTINUE                                                                  FILM  585
  710 CONTINUE                                                                  FILM  586
  900 CONTINUE                                                                  FILM  587
 1000 CONTINUE                                                                  FILM  588
      RETURN                                                                    FILM  589
C                                                                               FILM  590
  720 FORMAT(4X,25HGAS MACROSCOPIC DENSITY    ,40X,7HRADIUS=,1PE14.7)           FILM  591
  725 FORMAT(4X,26HLIQUID MACROSCOPIC DENSITY,40X,7HRADIUS=,1PE14.7)            FILM  592
  730 FORMAT(4X,25HVOID FRACTION              ,40X,7HRADIUS=,1PE14.7)           FILM  593
  735 FORMAT(4X,25HPRESSURE                   ,40X,7HRADIUS=,1PE14.7)           FILM  594
  740 FORMAT(4X,25HGAS TEMPERATURE            ,40X,7HRADIUS=,1PE14.7)           FILM  595
  745 FORMAT(4X,25HLIQUID TEMPERATURE         ,40X,7HRADIUS=,1PE14.7)           FILM  596
  750 FORMAT(4X,25HSATUR  ION TEMPERATURE     ,40X,7HRADIUS=,1PE14.7)           FILM  597
  755 FORMAT(4X,25HGAS INTERNAL ENERGY        ,40X,7HRADIUS=,1PE14.7)           FILM  598
  760 FORMAT(4X,25HLIQUID INTERNAL  NERGY     ,40X,7HRADIUS=,1PE14.7)           FILM  599
  765 FORMAT(4X,25HMASS EXCHANGE RATE         ,40X,7HRADIUS=,1PE14.7)           FILM  600
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  770 FORMAT(4X,25HMOMENTUM EXCHANGE RATE     ,40X,7HRADIUS=,1PE14.7)      FILM      601
  850 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                    FILM      602
  860 FORMAT(4X,4HQMX=,1PE12.4,7H   QMN=,1PE12.4,16H   MAX.CON.LINE=,      FILM      603
     1 1PE12.4,16H   MIN.CON.LINE=,1PE12.4,12H   INTERVAL=,1PE12.4)        FILM      604
      END                                                                  FILM      605


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      SUBROUTINE COND                                                      KFIXCC    603
*CALL GCOM1                                                                KFIXCC    604
*CALL GCOM2                                                                KFIXCC    605
C                                                                          KFIXCC    606
C     CALCULATE CONDENSATION RATE                                          KFIXCC    607
C                                                                          KFIXCC    608
      RETURN                                                               KFIXCC    609
      END                                                                  KFIXCC    610


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      SUBROUTINE CONVERT                                                   KFIXCC    611
*CALL GCOM1                                                                KFIXCC    612
*CALL GCOM2                                                                KFIXCC    613
C                                                                          KFIXCC    614
C     CALCULATE INITIAL VALUES OF RG,P ,RGP,RLP,SIEG,SIEL FOR EACH CELL    KFIXCC    615
C     FROM SPECIFIED PRESSURE,TEMPERATURES AND VOID FRACTION               KFIXCC    616
C                                                                          KFIXCC    617
      RGPN(IJ)=RGP(IJ)                                                     KFIXCC    618
      RLPN(IJ)=RLP(IJ)                                                     KFIXCC    619
      SIEGN(IJ)=SIEG(IJ)                                                   KFIXCC    620
      SIELN(IJ)=SIEL(IJ)                                                   KFIXCC    621
      RETURN                                                               KFIXCC    622
      END                                                                  KFIXCC    623


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      SUBROUTINE DLIQ                                                      KFIXCC    624
*CALL GCOM1                                                                KFIXCC    625
*CALL GCOM2                                                                KFIXCC    626
C                                                                          KFIXCC    627
C     CALCULATES D FOR THE LIQUID CONTINUITY EQUATION                      KFIXCC    628
C                                                                          KFIXCC    629
      DL=RLP(IJ)-RLPN(IJ)+DTORDR(I)*(RLFR(IJ)-RLFR(IMJ))+DTODZ*(RLFT(IJ)   KFIXCC    630
     1 -RLFT(IJM))+DTORDPH(I)*(RLFA(IJ)-RLFA(IKM))+DT*(ERATE(IJ)-          THREED    111
     1 CRATE(IJ))                                                          THREED    112
      RETURN                                                               KFIXCC    632
      END                                                                  KFIXCC    633


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      SUBROUTINE DVAP                                                    KFIXCC    656
*CALL GCOM1                                                              KFIXCC    657
*CALL GCOM2                                                              KFIXCC    658
C                                                                        KFIXCC    659
C     CALCULATES D FOR THE GAS CONTINUITY EQUATION                       KFIXCC    660
C                                                                        KFIXCC    661
      DG=RGP(IJ)-RGP(IJ)+DTORDR(I)*(RGFR(IJ)-RGFR(IMJ))+DTODZ*(RGFT(IJ)  KFIXCC    662
     1 -RGFT(IJM))+DTORDPH(I)*(RGFA(IJ)-RGFA(IKM))-DT*(ERATE(IJ)-        THREED    113
     1 CRATE(IJ))                                                        THREED    114
      RETURN                                                             KFIXCC    664
      END                                                                KFIXCC    665

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      SUBROUTINE EOSG(NR,NT,NC)                                          KFIXCC    666
*CALL GCOM1                                                              KFIXCC    667
*CALL GCOM2                                                              KFIXCC    668
C     FOR NR,NT,AND NC NON ZERO                                          KFIXCC    669
C     CALCULATE MICROSCOPIC DENSITY, TEMPERATURE, AND SPECIFIC HEAT FROM KFIXCC    670
C     THE SPECIFIC INTERNAL ENERGY AND PRESSURE OF THE GAS               KFIXCC    671
C                                                                        KFIXCC    672
      RETURN                                                             KFIXCC    673
      END                                                                KFIXCC    674

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      SUBROUTINE EOSL(NR,NT,NC)                                          KFIXCC    675
*CALL GCOM1                                                              KFIXCC    676
*CALL GCOM2                                                              KFIXCC    677
C                                                                        KFIXCC    678
C     FOR NR,NT,AND NC NON ZERO                                          KFIXCC    679
C     CALCULATE MICROSCOPIC DENSITY, TEMPERATURE, AND SPECIFIC HEAT      KFIXCC    680
C     FROM THE SPECIFIC INTERNAL ENERGY AND PRESSURE OF THE LIQUID       KFIXCC    681
C                                                                        KFIXCC    682
      RETURN                                                             KFIXCC    683
      END                                                                KFIXCC    684

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      SUBROUTINE FLIC                                                    KFIXCC    685
*CALL GCOM1                                                              KFIXCC    686
*CALL GCOM2                                                              KFIXCC    687
C                                                                        KFIXCC    688
C     SETS CELL FLAGS BASED UPON INPUT DATA                              KFIXCC    689
C                                                                        KFIXCC    690
      RAD=DR*IB                                                          KFIXCC    691
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      ZAX=DZ*JB                                                          KFIXCC   692
      PAX=KB*DPH                                                         THREED   115
      PTS=-.5*DPH                                                        THREED   116
      DO 150 K=1,KB2                                                     THREED   117
      PT=PTS+DPH*(K-1)                                                   THREED   118
      J1=1                                                               KFIXCC   693
      J2=5                                                               KFIXCC   694
      J3=9                                                               KFIXCC   695
      J4=13                                                              KFIXCC   696
      YTS=-.5*DZ                                                         KFIXCC   697
      DO 150 J=1,JB2                                                     KFIXCC   698
      XTS=-.5*DR                                                         KFIXCC   699
      YTE=YTS+DZ*(J-1)                                                   KFIXCC   700
      DO 150 I=1,IB2                                                     KFIXCC   701
      XTE=XTS+DR*(I-1)                                                   KFIXCC   702
C                                                                        KFIXCC   703
C     SETS EACH CELL FLAG,FL(I,J)=1,CELL FLAG WILL BE CHANGED FOR OTHER  KFIXCC   704
C     TYPES                                                              KFIXCC   705
C                                                                        KFIXCC   706
      FL(I,J,K)=1                                                        THREED   119
      IF(PTE.LT.0.) GO TO 2                                              THREED   120
      IF(PTE.GT.PAX) GO TO 4                                             THREED   121
      IF (XTE.LT.0.) GO TO 10                                            KFIXCC   708
      IF (XTE.GT.RAD) GO TO 30                                           KFIXCC   709
      IF (YTE.GT.ZAX) GO TO 70                                           KFIXCC   710
      IF (YTE.LT.0.) GO TO 110                                           KFIXCC   711
      GO TO 150                                                          KFIXCC   712
C                                                                        THREED   122
C     SET FLAGS FOR THE FORE FACE (K=1)                                  THREED   123
C                                                                        THREED   124
    2 FL(I,J,K)=2                                                        THREED   125
      IF(NSL(5).EQ.1) FL(I,J,K)=3                                        THREED   126
      IF((KB*DPH.GE.6.283185-0.5*DPH).AND.ITC.EQ.1)FL(I,J,K)=0           THREED   127
      GO TO 150                                                          THREED   128
C                                                                        THREED   129
C     SET FLAGS FOR THE AFT  FACE (K=KB2)                                THREED   130
C                                                                        THREED   131
    4 FL(I,J,K)=2                                                        THREED   132
      IF(NSL(6).EQ.1) FL(I,J,K)=3                                        THREED   133
      IF((KB*DPH.GE.6.283195-0.5*DPH).AND.ITC.EQ.1)FL(I,J,K)=0           THREED   134
      GO TO 150                                                          THREED   135
C                                                                        KFIXCC   713
C     SETS FLAG FOR LEFT COLUMN (I=1)                                    KFIXCC   714
C                                                                        KFIXCC   715
   10 IF(YTE.GT.FLO(J2).AND.YTE.LT.FLO(J2+1).AND.PTE.GT.FLOA(J2).AND.    THREED   136
     1 PTE.LT.FLOA(J2+1)) GO TO 18                                       THREED   137
      IF(YTE.GT.FLO(J2+2).AND.YTE.LT.FLO(J2+3).AND.PTE.GT.FLOA(J2+2).AND THREED   138
     1.PTE.LT.FLOA(J2+3)) GO TO 18                                       THREED   139
   12 IF (NSL(2).EQ.1) GO TO 14                                          KFIXCC   721
      FL(I,J,K)=2                                                        THREED   140
      GO TO 150                                                          KFIXCC   723
   14 FL(I,J,K)=3                                                        THREED   141
      GO TO 150                                                          KFIXCC   725
   18 FL(I,J,K)=5                                                        THREED   142
      GO TO 150                                                          KFIXCC   727
C                                                                        KFIXCC   728
C     SETS FLAGS FOR RIGHT (I=IB2) COLUMN                                KFIXCC   729
C                                                                        KFIXCC   730
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   30 IF(YTE.GT.FLO(J4).AND.YTE.LT.FLO(J4+1).AND.PTE.GT.FLOA(J4).AND.     THREED   143
     1 PTE.LT.FLOA(J4+1)) GO TO 60                                        THREED   144
      IF(YTE.GT.FLO(J4+2).AND.YTE.LT.FLO(J4+3).AND.PTE.GT.FLOA(J4+2).AND THREED   145
     1.PTE.LT.FLOA(J4+3)) GO TO 60                                        THREED   146
   40 IF (NSL(4).EQ.1) GO TO 50                                           KFIXCC   736
      FL(I,J,K)=2                                                         THREED   147
      GO TO 150                                                           KFIXCC   738
   50 FL(I,J,K)=3                                                         THREED   148
      GO TO 150                                                           KFIXCC   740
   60 FL(I,J,K)=4                                                         THREED   149
      GO TO 150                                                           KFIXCC   742
C                                                                        KFIXCC   743
C     SETS FLAGS FOR TOP (J=JB2) ROW                                     KFIXCC   744
C                                                                        KFIXCC   745
   70 IF(XTE.GT.FLO(J3).AND.XTE.LT.FLO(J3+1).AND.PTE.GT.FLOA(J3).AND.     THREED   150
     1 PTE.LT.FLOA(J3+1)) GO TO 100                                       THREED   151
      IF(XTE.GT.FLO(J3+2).AND.XTE.LT.FLO(J3+3).AND.PTE.GT.FLOA(J3+2).AND THREED   152
     1.PTE.LT.FLOA(J3+3)) GO TO 100                                       THREED   153
   80 IF (NSL(3).EQ.1) GO TO 90                                           KFIXCC   751
      FL(I,J,K)=2                                                         THREED   154
      GO TO 150                                                           KFIXCC   753
   90 FL(I,J,K)=3                                                         THREED   155
      GO TO 150                                                           KFIXCC   755
  100 FL(I,J,K)=4                                                         THREED   156
      GO TO 150                                                           KFIXCC   757
C                                                                        KFIXCC   758
C     SETS FLAGS FOR BOTTOM (J=1) ROW                                    KFIXCC   759
C                                                                        KFIXCC   760
  110 IF(XTE.GT.FLO(J1).AND.XTE.LT.FLO(J1+1).AND.PTE.GT.FLOA(J1).AND.     THREED   157
     1 PTE.LT.FLOA(J1+1)) GO TO 140                                       THREED   158
      IF(XTE.GT.FLO(J1+2).AND.XTE.LT.FLO(J1+3).AND.PTE.GT.FLOA(J1+2).AND THREED   159
     1.PTE.LT.FLOA(J1+3)) GO TO 140                                       THREED   160
  120 IF (NSL(1).EQ.1) GO TO 130                                          KFIXCC   766
      FL(I,J,K)=2                                                         THREED   161
      GO TO 150                                                           KFIXCC   768
  130 FL(I,J,K)=3                                                         THREED   162
      GO TO 150                                                           KFIXCC   770
  140 FL(I,J,K)=5                                                         THREED   163
  150 CONTINUE                                                            KFIXCC   772
      DO 160 K=1,KB2                                                      THREED   164
      IF(FL(IB1,JB2,K).EQ.4.AND.FL(IB2,JB1,K).EQ.4) FL(IB2,JB2,K)=4       THREED   165
      IF(FL(IB1,JB2,K).EQ.7.AND.FL(IB2,JB1,K).EQ.7) FL(IB2,JB2,K)=7       THREED   166
  160 CONTINUE                                                            THREED   167
      IF(NO.LE.0) GO TO 400                                               THREED   168
C                                                                        KFIXCC   775
C     SET FLAGS FOR OBSTACLE CELLS                                       KFIXCC   776
C                                                                        KFIXCC   777
      DO 300 L=1,NO                                                       THREED   169
      X1=OB(1,L)                                                          THREED   170
      X2=OB(2,L)                                                          THREED   171
      Y1=OB(3,L)                                                          THREED   172
      Y2=OB(4,L)                                                          THREED   173
      Z1=OB(5,L)                                                          THREED   174
      Z2=OB(6,L)                                                          THREED   175
      PTS=.5*DPH                                                          THREED   176
      DO 290 K=2,KB1                                                      THREED   177
      PTE=PTS+DPH*FLOAT(K-2)                                              THREED   178
      YTS=.5*DZ                                                          KFIXCC   783
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      DO 290 J=2,JB1                                                    KFIXCC    784
      XTS=.5*DR                                                         KFIXCC    785
      YTE=YTS+DZ*FLOAT(J-2)                                             KFIXCC    786
      DO 290 I=2,IB1                                                    KFIXCC    787
      XTE=XTS+DR*FLOAT(I-2)                                             KFIXCC    788
      IF (XTE.LT.X1) GO TO 290                                          KFIXCC    789
      IF (XTE.GT.X2) GO TO 290                                          KFIXCC    790
      IF (YTE.LT.Y1) GO TO 290                                          KFIXCC    791
      IF (YTE.GT.Y2) GO TO 290                                          KFIXCC    792
      IF (PTE.LT.Z1) GO TO 290                                          THREED    179
      IF (PTE.GT.Z2) GO TO 290                                          THREED    180
      FL(I,J,K)=2                                                       THREED    181
      IF(NSO(L).EQ.0) GO TO 290                                         THREED    182
      FL(I,J,K)=3                                                       THREED    183
  290 CONTINUE                                                          KFIXCC    797
  300 CONTINUE                                                          KFIXCC    798
C                                                                       INDEX       1
C     CALCULATE AND STORE THE CELL INCREMENTS AND ACCESS INDICES        INDEX       2
C                                                                       INDEX       3
  400 CONTINUE                                                          INDEX       4
      M=1                                                               INDEX       5
      CALL START(1)                                                     INDEX       6
      DO 475 K=KS,KL                                                    INDEX       7
      IJ=IJ+INCK                                                        INDEX       8
      DO 470 J=JS,JL                                                    INDEX       9
      IJ=IJ+INCJ                                                        INDEX      10
      DO 465 I=IS,IL                                                    INDEX      11
      IJ=IJ+1                                                           INDEX      12
      IF(FL(IJ).NE.1) GO TO 465                                         INDEX      13
C                                                                       INDEX      14
C     SET CELL IJ INDICES ACCOUNTING FOR OBSTACLES AND CELL BOUNDARIES  INDEX      15
      CALL SETIND                                                       INDEX      16
C                                                                       INDEX      17
C     STORE THE CELL CENTER INCREMENTS  IN THE MFL ARRAY                INDEX      18
      MFL(1,M)=IJTL -IJ                                                 INDEX      19
      MFL(2,M)=IJBR -IJ                                                 INDEX      20
      MFL(3,M)=IJTR -IJ                                                 INDEX      21
      MFL(4,M)=IJRR -IJ                                                 INDEX      22
      MFL(5,M)=IJTT -IJ                                                 INDEX      23
      MFL(6,M)=IJAL -IJ                                                 INDEX      24
      MFL(7,M)=IJFR -IJ                                                 INDEX      25
      MFL(8,M)=IJAR -IJ                                                 INDEX      26
      MFL(9,M)=IJAA -IJ                                                 INDEX      27
      MFL(10,M)=IJTF-IJ                                                 INDEX      28
      MFL(11,M)=IJBA-IJ                                                 INDEX      29
      MFL(12,M)=IJTA-IJ                                                 INDEX      30
      MFL(13,M)=IJL -IJ                                                 INDEX      31
      MFL(14,M)=IJB -IJ                                                 INDEX      32
      MFL(15,M)=IJR -IJ                                                 INDEX      33
      MFL(16,M)=IJT -IJ                                                 INDEX      34
      MFL(17,M)=IJA -IJ                                                 INDEX      35
      MFL(18,M)=IJF -IJ                                                 INDEX      36
C                                                                       INDEX      37
C     COMPARE THIS SET WITH THOSE PREVIOUSLY STORED                     INDEX      38
      IF(M.EQ.1) GO TO 450                                              INDEX      39
      LUP=M-1                                                           INDEX      40
      DO 445 L=1,LUP                                                    INDEX      41
      KTEST=0                                                           INDEX      42
```

```
      DO 430 N=1,18                                                          INDEX     43
      IF(MFL(N,M).NE.MFL(N,L)) KTEST=1                                       INDEX     44
  430 CONTINUE                                                               INDEX     45
      IF(KTEST.EQ.1) GO TO 440                                               INDEX     46
C                                                                            INDEX     47
C     THE SET M MATCHES SET L                                                INDEX     48
      LFL(IJ)=L                                                              INDEX     49
      GO TO 460                                                              INDEX     50
  440 CONTINUE                                                               INDEX     51
  445 CONTINUE                                                               INDEX     52
C                                                                            INDEX     53
C     THE SET M DOES NOT MATCH ANY PREVIOUSLY STORED                         INDEX     54
  450 LFL(IJ)=M                                                              INDEX     55
      MAXM=M                                                                 INDEX     56
      M=M+1                                                                  INDEX     57
  460 CONTINUE                                                               INDEX     58
  465 CONTINUE                                                               INDEX     59
  470 CONTINUE                                                               INDEX     60
  475 CONTINUE                                                               INDEX     61
      RETURN                                                                 KFIXCC   799
      END                                                                    KFIXCC   800
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      SUBROUTINE ICONV                                                       KFIXCC   943
*CALL GCOM1                                                                  KFIXCC   944
*CALL GCOM2                                                                  KFIXCC   945
C                                                                            KFIXCC   946
C     UPDATE THE SPECIFIC INTERNAL ENERGIES TO ACCOUNT FOR THE AFFECTS       KFIXCC   947
C     OF CONVECTION, VISCOUS AND PRESSURE WORK, AND CONDUCTION (SEE ALSO     KFIXCC   948
C     SUBROUTINE IGIL)                                                       KFIXCC   949
C                                                                            KFIXCC   950
      DIMENSION CS(14)                                                       KFIXCC   951
      CALL START(1)                                                          THREED   184
      DO 100 K=KS,KL                                                         THREED   185
      IJ=IJ+INCK                                                             THREED   186
      DO 100 J=JS,JL                                                         THREED   187
      IJ=IJ+INCJ                                                             THREED   188
      DO 100 I=IS,IL                                                         THREED   189
      IJ=IJ+1                                                                THREED   190
      IF(FL(IJ).NE.1) GO TO 100                                              KFIXCC   955
      CS(14)=TL(IJ)-TG(IJ)+SIEG(IJ)/CG(IJ)-SIEL(IJ)/CL(IJ)                   KFIXCC   956
      CALL INDEX                                                             PERM1277  12
      CS(1)=DT*RHEAT(IJ)                                                     KFIXCC   958
      CS(2)=CL(IJ)*RLP(IJ)                                                   KFIXCC   959
      CS(3)=2.0*CS(2)+CS(1)                                                  KFIXCC   960
      CS(4)=CG(IJ)*RGP(IJ)                                                   KFIXCC   961
      CS(5)=CS(4)*CS(3)+CS(1)*CS(2)                                          KFIXCC   962
      CS(6)=P(IJ)*(TH(IJ)-THN(IJ))                                           KFIXCC   963
      CALL THF                                                               KFIXCC   964
      CALL SIELF                                                             KFIXCC   965
      CALL SIEGF                                                             KFIXCC   966
      CS(9)=0.5*DT*RHEAT(IJ)*CS(14)                                          KFIXCC   967
      CS(11)=(DTODZ*(OMTFT-OMTFB(I))+DTORDR(I)*(OMTFR-OMTFL)+                THREED   191
     1 DTORDPH(I)*(OMTFA-OMTFF(ICJ)))*P(IJ)                                  THREED   192
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      CS(12)=DTODZ*(ELFT-ELFB(I))+DTORDR(I)*(ELFR-ELFL)+DTORDPH(I)*       THREED    193
     1 (ELFA-ELFF(ICJ))                                                   THREED    194
      CS(13)=RLP(IJ)*SIEL(IJ)-SIELN(IJ)*(RLP(IJ)-RLPN(IJ))-CS(12)-CS(11) KFIXCC    972
      IF(TH(IJ).EQ.1.) CS(13)=0.                                         KFIXCC    973
      IF(TH(IJ).EQ.1.) CS(6)=0.                                          KFIXCC    974
      IF(CS(5).LE.0.) GO TO 10                                           KFIXCC    975
      CS(7)=(DTODZ*(THFT-THFB(I))+DTORDR(I)*(THFR-THFL)+DTORDPH(I)*      THREED    195
     1 (THFA-THFF(ICJ)))*P(IJ)                                            THREED    196
      CS(8)=DTODZ*(EGFT-EGFB(I))+DTORDR(I)*(EGFR-EGFL)+DTORDPH(I)*       THREED    197
     1 (EGFA-EGFF(ICJ))                                                   THREED    198
      CS(10)=RGP(IJ)*SIEG(IJ)-SIEGN(IJ)*(RGP(IJ)-RGPN(IJ))-CS(8)-CS(7)   KFIXCC    980
      IF(TH(IJ).EQ.0.) CS(10)=0.                                         KFIXCC    981
      IF(TH(IJ).EQ.0.) CS(6)=0.                                          KFIXCC    982
      SIEG(IJ)=CG(IJ)*(CS(10)*CS(3)+(CS(9)-CS(6))*2.*CS(2)+CS(13)*       KFIXCC    983
     1          CS(1))/CS(5)                                             KFIXCC    984
   10 IF(CS(3).LE.0.) GO TO 90                                           KFIXCC    985
      SIEL(IJ)=CL(IJ)*(2.*CS(13)-2.*(CS(9)-CS(6))+CS(1)*SIEG(IJ)/        KFIXCC    986
     1          CG(IJ))/CS(3)                                            KFIXCC    987
   90 CONTINUE                                                           KFIXCC    988
      EGFL=EGFR                                                          KFIXCC    989
      ELFL=ELFR                                                          KFIXCC    990
      THFL=THFR                                                          KFIXCC    991
      OMTFL=OMTFR                                                        KFIXCC    992
      EGFB(I)=EGFT                                                       KFIXCC    993
      ELFB(I)=ELFT                                                       KFIXCC    994
      THFB(I)=THFT                                                       KFIXCC    995
      OMTFB(I)=OMTFT                                                     KFIXCC    996
      EGFF(ICJ)=EGFA                                                     THREED    199
      ELFF(ICJ)=ELFA                                                     THREED    200
      THFF(ICJ)=THFA                                                     THREED    201
      OMTFF(ICJ)=OMTFA                                                   THREED    202
  100 CONTINUE                                                           KFIXCC    997
      RETURN                                                             KFIXCC    998
      END                                                                KFIXCC    999
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      SUBROUTINE IGIL                                                    KFIXCC   1000
*CALL GCOM1                                                              KFIXCC   1001
*CALL GCOM2                                                              KFIXCC   1002
C                                                                        KFIXCC   1003
C     UPDATE THE SPECIFIC INTERNAL ENERGIES TO ACCOUNT FOR THE AFFECTS   KFIXCC   1004
C     OF MASS, MOMENTUM, AND ENERGY EXCHANGE (SEE ALSO SUBROUTINE ICONV) KFIXCC   1005
C                                                                        KFIXCC   1006
      DIMENSION CS(11)                                                   KFIXCC   1007
      CALL VRELS                                                         KFIXCC   1008
      RIL=SIELN(IJ)*RLP(IJ)                                              KFIXCC   1009
      RIG=SIEGN(IJ)*RGP(IJ)                                              KFIXCC   1010
      SIEH=SIEG(IJ)                                                      KFIXCC   1011
      SIEG(IJ)=SIEGN(IJ)                                                 KFIXCC   1012
      CALL SAT(0)                                                        KFIXCC   1013
      CALL EOSG(0,1,1)                                                   KFIXCC   1014
      SIEG(IJ)=SIEH                                                      KFIXCC   1015
      SIEH=SIEL(IJ)                                                      KFIXCC   1016
      SIEL(IJ)=SIELN(IJ)                                                 KFIXCC   1017
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      CALL EOSL(0,1,1)                                                    KFIXCC  1018
      SIEL(IJ)=SIEH                                                       KFIXCC  1019
      CS(11)=TL(IJ)-TG(IJ)+SIEGN(IJ)/CG(IJ)-SIELN(IJ)/CL(IJ)              KFIXCC  1020
      CS(1)=DT*RHEAT(IJ)                                                  KFIXCC  1021
      CS(2)=CL(IJ)*RLP(IJ)                                                KFIXCC  1022
      CS(3)=2.0*CS(2)+CS(1)                                               KFIXCC  1023
      CS(4)=CG(IJ)*RGP(IJ)                                                KFIXCC  1024
      CS(5)=CS(4)*CS(3)+CS(1)*CS(2)                                       KFIXCC  1025
      CS(6)=(ERATE(IJ)-CRATE(IJ))*(P(IJ)/ROG(IJ)+SIEGN(IJ))               KFIXCC  1026
      CS(8)=0.5*RHEAT(IJ)*CS(11)                                          KFIXCC  1027
      CS(10)=RIL+DT*(-CS(6)-CS(8))                                        KFIXCC  1028
      IF(CS(5).EQ.0.) GO TO 1                                             KFIXCC  1029
      CS(7)=(KDRAG(IJ)+0.5*(ERATE(IJ)+CRATE(IJ)))*VREL**2                 KFIXCC  1030
      CS(9)=RIG+DT*(CS(6)+CS(7)+CS(8))                                    KFIXCC  1031
      SIEG(IJ)=CG(IJ)*(CS(9)*2.*CS(2)+CS(1)*(DT*CS(7)+RIL+RIG))/CS(5)     KFIXCC  1032
    1 IF(CS(3).EQ.0.) RETURN                                              KFIXCC  1033
      SIEL(IJ)=CL(IJ)*(2.0*CS(10)+CS(1)*SIEG(IJ)/CG(IJ))/CS(3)            KFIXCC  1034
      RETURN                                                              KFIXCC  1035
      END                                                                 KFIXCC  1036
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      SUBROUTINE INDEX                                                    KFIXCC  1069
*CALL GCOM1                                                               KFIXCC  1070
*CALL GCOM2                                                               KFIXCC  1071
C                                                                         KFIXCC  1072
C     CALCULATE INDICES FOR ARRAY QUANTITIES                              KFIXCC  1073
C                                                                         KFIXCC  1074
C     COMPLETE SET                                                        INDEX     62
      ICJ=I+(J-1)*IB2                                                     INDEX     63
      IPJ=IJ+1                                                            INDEX     64
      IMJ=IJ-1                                                            INDEX     65
      IJP=IJ+IB2                                                          INDEX     66
      IJM=IJ-IB2                                                          INDEX     67
      IKP=IJ+IB2XJB2                                                      INDEX     68
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                                 INDEX     69
      IKM=IJ-IB2XJB2                                                      INDEX     70
      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                                 INDEX     71
      IMJP=IJP-1                                                          INDEX     72
      IPJP=IJP+1                                                          INDEX     73
      IPJM=IJM+1                                                          INDEX     74
      IPKM=IKM+1                                                          INDEX     75
      IMKP=IKP-1                                                          INDEX     76
      IPKP=IKP+1                                                          INDEX     77
      JMKM=IKM-IB2                                                        INDEX     78
      JMKP=IKP-IB2                                                        INDEX     79
      JPKM=IKM+IB2                                                        INDEX     80
      JPKP=IKP+IB2                                                        INDEX     81
      N=LFL(IJ)                                                           INDEX     82
      IJTL=IJ+MFL(N)                                                      INDEX     83
      IJBR=IJ+MFL(N+1)                                                    INDEX     84
      IJTR=IJ+MFL(N+2)                                                    INDEX     85
      IJRR=IJ+MFL(N+3)                                                    INDEX     86
      IJTT=IJ+MFL(N+4)                                                    INDEX     87
      IJAL=IJ+MFL(N+5)                                                    INDEX     88
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      IJFR=IJ+MFL(N+6)                                                  INDEX      89
      IJAR=IJ+MFL(N+7)                                                  INDEX      90
      IJAA=IJ+MFL(N+8)                                                  INDEX      91
      IJTF=IJ+MFL(N+9)                                                  INDEX      92
      IJBA=IJ+MFL(N+10)                                                 INDEX      93
      IJTA=IJ+MFL(N+11)                                                 INDEX      94
      IJL=IJ+MFL(N+12)                                                  INDEX      95
      IJB=IJ+MFL(N+13)                                                  INDEX      96
      IJR=IJ+MFL(N+14)                                                  INDEX      97
      IJT=IJ+MFL(N+15)                                                  INDEX      98
      IJA=IJ+MFL(N+16)                                                  INDEX      99
      IJF=IJ+MFL(N+17)                                                  INDEX     100
      RETURN                                                            INDEX     101
C                                                                       INDEX     102
      ENTRY INDEXA                                                      INDEX     103
C                                                                       INDEX     104
C     NEAREST NEIGHBORS                                                 INDEX     105
      ICJ=I+(J-1)*IB2                                                   INDEX     106
      IPJ=IJ+1                                                          INDEX     107
      IJP=IJ+IB2                                                        INDEX     108
      IMJ=IJ-1                                                          INDEX     109
      IJM=IJ-IB2                                                        INDEX     110
      IKP=IJ+IB2XJB2                                                    INDEX     111
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                               INDEX     112
      IKM=IJ-IB2XJB2                                                    INDEX     113
      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                               INDEX     114
      N=LFL(IJ)                                                         INDEX     115
      IJL=IJ+MFL(N+12)                                                  INDEX     116
      IJB=IJ+MFL(N+13)                                                  INDEX     117
      IJR=IJ+MFL(N+14)                                                  INDEX     118
      IJT=IJ+MFL(N+15)                                                  INDEX     119
      IJA=IJ+MFL(N+16)                                                  INDEX     120
      IJF=IJ+MFL(N+17)                                                  INDEX     121
   20 RETURN                                                            KFIXCC   1116
      END                                                               KFIXCC   1117
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      SUBROUTINE ITER                                                   KFIXCC   1118
*CALL GCOM1                                                             KFIXCC   1119
*CALL GCOM2                                                             KFIXCC   1120
      DATA LMAX,OMEGA /5, 1.5 /                                         KFIXCC   1121
C                                                                       KFIXCC   1122
C     CALCULATES ITERATIVE SOLN. OF MASS, MOMENTUM, AND ENERGY EQS.     KFIXCC   1123
C                                                                       KFIXCC   1124
C     IF THSF(IJ)=1, ITERATE ON THE LIQUID CONTINUITY EQUATION          KFIXCC   1125
C                                                                       KFIXCC   1126
      NIT=0                                                             KFIXCC   1127
    1 NIT=NIT+1                                                         KFIXCC   1128
      MUSTIT=0                                                          KFIXCC   1129
      IF(NIT.EQ.1) MUSTIT=1                                             KFIXCC   1130
C     SET LIMITS OF DO LOOPS                                            THREED    203
      CALL START(1)                                                     THREED    204
      DO 102 K=KS,KL                                                    THREED    205
      IJ=IJ+INCK                                                        THREED    206
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      DO 101 J=JS,JL                                                    THREED   207
      IJ=IJ+INCJ                                                        THREED   208
      DO 100 I=IS,IL                                                    THREED   209
      IJ=IJ+1                                                           THREED   210
      IF(FL(IJ).NE.1) GO TO 100                                         KFIXCC  1134
      LOOP=0                                                            KFIXCC  1135
      KLOOP=0                                                           KFIXCC  1136
      KROS=-1                                                           KFIXCC  1137
      CALL INDEXA                                                       KFIXCC  1138
      IF(THSF(IJ).EQ.1) GO TO 50                                        KFIXCC  1139
      CALL DVAP                                                         KFIXCC  1140
      TARGET= (1.-OMEGA)*DG                                             KFIXCC  1141
      DGORIG=DG                                                         KFIXCC  1142
      IF(ABS(DG-TARGET).LE.CONV(IJ)) GO TO 78                           KFIXCC  1143
      MUSTIT=1                                                          KFIXCC  1144
      D3=DG                                                             KFIXCC  1145
      P3=P(IJ)                                                          KFIXCC  1146
      IF(NIT.GT.1)GOTO10                                                KFIXCC  1147
      GOTO55                                                            KFIXCC  1148
   50 CALL DLIQ                                                         KFIXCC  1149
      TARGET= (1.-OMEGA)*DL                                             KFIXCC  1150
      DLORIG=DL                                                         KFIXCC  1151
      IF(ABS(DL-TARGET).LE.CONV(IJ)) GO TO 90                           KFIXCC  1152
      MUSTIT=1                                                          KFIXCC  1153
      D3=DL                                                             KFIXCC  1154
      P3=P(IJ)                                                          KFIXCC  1155
      IF(NIT.GT.1)GOTO10                                                KFIXCC  1156
      GOTO55                                                            KFIXCC  1157
   10 IF(D3.GT.TARGET)GOTO11                                            KFIXCC  1158
      D2=D3                                                             KFIXCC  1159
      P2=P3                                                             KFIXCC  1160
      IF(KROS.EQ.-1)KROS=1                                              KFIXCC  1161
      IF(KROS.EQ.0)KROS=2                                               KFIXCC  1162
      GOTO12                                                            KFIXCC  1163
   11 D1=D3                                                             KFIXCC  1164
      P1=P3                                                             KFIXCC  1165
      IF(KROS.EQ. 1)KROS=0                                              KFIXCC  1166
      IF(KROS.EQ.2)KROS=2                                               KFIXCC  1167
   12 IF(KROS.EQ.3)GOTO54                                               KFIXCC  1168
      IF(KROS.EQ.2)GOTO13                                               KFIXCC  1169
      DP=(TARGET-D3)*ABETA(IJ)                                          KFIXCC  1170
      IF(-DP*SIGN(1.,(D3-TARGET)).GT.0.5*P  DP=-0.5*SIGN(1.,(D3-TARGET) KFIXCC  1171
     1   )*P3                                                           KFIXCC  1172
   53 P(IJ)=P(IJ) + DP                                                  KFIXCC  1173
      GOTO54                                                            KFIXCC  1174
   13 P(IJ)=(D1*P2-D2*P1+TARGET*(P1-P2))/(D1-D2)                        KFIXCC  1175
      ABETA(IJ)=(P1-P2)/(D1-D2)                                         KFIXCC  1176
      KROS=3                                                            KFIXCC  1177
   54 P3=P(IJ)                                                          KFIXCC  1178
   55 CALL IGIL                                                         KFIXCC  1179
      CALL EOSL(1,1,0)                                                  KFIXCC  1180
      CALL EOSG(1,1,0)                                                  KFIXCC  1181
      CALL SAT(0)                                                       KFIXCC  1182
      RGP(IJ)=TH(IJ)*ROG(IJ)                                            KFIXCC  1183
      RLP(IJ)=(1.-TH(IJ))*RL(IJ)                                        KFIXCC  1184
      CALL BOIL                                                         KFIXCC  1185
      CALL COND                                                         KFIXCC  1186
      IF(THSF(IJ).EQ.1) CALL THGAS                                      KFIXCC  1187
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      CALL VELS                                                          KFIXCC  1188
      IF(THSF(IJ).EQ.1) GO TO 89                                         KFIXCC  1189
      CALL MASFL                                                         KFIXCC  1190
   78 RLP(IJ)=RLPN(IJ)-DTORDR(I)*(RLFR(IJ)-RLFR(IMJ))-DTODZ*(RLFT(IJ)-   KFIXCC  1191
     1 RLFT(IJM))+DTORDPH(I)*(RLFA(IJ)-RLFA(IKM))-DT*(ERATE(IJ)-         THREED   211
     1 CRATE(IJ))                                                        THREED   212
      TH(IJ)=1.0-RLP(IJ)/RL(IJ)                                          KFIXCC  1193
      IF(TH(IJ).GE.0.0.AND.TH(IJ).LE.1.0) GO TO 80                       KFIXCC  1194
      IF(TH(IJ).LT.0.) TH(IJ)=0.                                         KFIXCC  1195
      IF(TH(IJ).GT.1.) TH(IJ)=1.                                         KFIXCC  1196
      RLP(IJ)=(1.-TH(IJ))*RL(IJ)                                         KFIXCC  1197
   80 RGP(IJ)=ROG(IJ)*TH(IJ)                                             KFIXCC  1198
      IF(ABS(DG-TARGET).LE.CONV(IJ))GOTO100                              KFIXCC  1199
      CALL MASFG                                                         KFIXCC  1200
      CALL DVAP                                                          KFIXCC  1201
      IF((ABS(DG-TARGET).LE.CONV(IJ)).AND.(ABS(DG).LT.ABS(DGORIG)))      KFIXCC  1202
     1   GO TO 100                                                       KFIXCC  1203
      IF((NIT.EQ.1).AND.(LOOP.EQ.0)) TARGET=(1.-OMEGA)*DG                KFIXCC  1204
      IF((NIT.EQ.1).AND.(LOOP.EQ.0)) DGORIG=DG                           KFIXCC  1205
      D3=DG                                                              KFIXCC  1206
      LOOP=LOOP+1                                                        KFIXCC  1207
      IF((KROS.LT.2).AND.(LOOP.EQ.LMAX)) ABETA(IJ)=.5*LMAX*ABETA(IJ)     KFIXCC  1208
      IF(LOOP.EQ.LMAX) GO TO 100                                         KFIXCC  1209
      IF(KROS.EQ.3)CALL NEWP                                             KFIXCC  1210
      GOTO10                                                             KFIXCC  1211
   89 CALL MASFG                                                         KFIXCC  1212
   90 RGP(IJ)=RGPN(IJ)-DTORDR(I)*(RGFR(IJ)-RGFR(IMJ))-DTODZ*(RGFT(IJ)-   KFIXCC  1213
     1 RGFT(IJM))+DTORDPH(I)*(RGFA(IJ)-RGFA(IKM))+DT*(ERATE(IJ)-         THREED   213
     1 CRATE(IJ))                                                        THREED   214
      TH(IJ)=RGP(IJ)/ROG(IJ)                                             KFIXCC  1215
      IF(TH(IJ).GE.0.0.AND.TH(IJ).LE.1.0) GO TO 91                       KFIXCC  1216
      IF(TH(IJ).LT.0.) TH(IJ)=0.                                         KFIXCC  1217
      IF(TH(IJ).GT.1.) TH(IJ)=1.                                         KFIXCC  1218
      RGP(IJ)=TH(IJ)*ROG(IJ)                                             KFIXCC  1219
   91 RLP(IJ)=(1.-TH(IJ))*RL(IJ)                                         KFIXCC  1220
      IF(ABS(DL-TARGET).LE.CONV(IJ))GOTO100                              KFIXCC  1221
      CALL MASFL                                                         KFIXCC  1222
      CALL DLIQ                                                          KFIXCC  1223
      IF((ABS(DL-TARGET).LE.CONV(IJ)).AND.(ABS(DL).LT.ABS(DLORIG)))      KFIXCC  1224
     1   GO TO 100                                                       KFIXCC  1225
      IF((NIT.EQ.1).AND.(LOOP.EQ.0)) TARGET=(1.-OMEGA)*DL                KFIXCC  1226
      IF((NIT.EQ.1).AND.(LOOP.EQ.0)) DLORIG=DL                           KFIXCC  1227
      D3=DL                                                              KFIXCC  1228
      LOOP=LOOP+1                                                        KFIXCC  1229
      IF((KROS.LT.2).AND.(LOOP.EQ.LMAX)) ABETA(IJ)=.5*LMAX*ABETA(IJ)     KFIXCC  1230
      IF(LOOP.EQ.LMAX) GO TO 100                                         KFIXCC  1231
      IF(KROS.EQ.3)CALL NEWP                                             KFIXCC  1232
      GOTO10                                                             KFIXCC  1233
  100 CONTINUE                                                           KFIXCC  1234
  101 CONTINUE                                                           THREED   215
  102 CONTINUE                                                           THREED   216
      IF(MUSTIT.EQ.0) RETURN                                             KFIXCC  1235
      IF(NIT.LT.1000) GO TO 1                                            KFIXCC  1236
      RETURN                                                             KFIXCC  1237
      END                                                                KFIXCC  1238
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      SUBROUTINE KDRAGS                                                KFIXCC  1239
*CALL GCOM1                                                            KFIXCC  1240
*CALL GCOM2                                                            KFIXCC  1241
C                                                                      KFIXCC  1242
C     CALCULATE MOMENTUM EXCHANGE COEFFICIENT                          KFIXCC  1243
C                                                                      KFIXCC  1244
      RETURN                                                           KFIXCC  1245
      END                                                              KFIXCC  1246
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      SUBROUTINE MASFG                                                 KFIXCC  1247
*CALL GCOM1                                                            KFIXCC  1248
*CALL GCOM2                                                            KFIXCC  1249
C                                                                      KFIXCC  1250
C     CALCULATES MASS FLUXES FOR THE GAS                               KFIXCC  1251
C                                                                      KFIXCC  1252
      IF(UG(IMJ).GE.0.) RGFR(IMJ)=UG(IMJ)*RGP(IJL)*RB(I-1)             KFIXCC  1253
      IF(UG(IMJ).LT.0.) RGFR(IMJ)=UG(IMJ)*RGP(IJ)*RB(I-1)              KFIXCC  1254
      IF(VG(IJM).GE.0.) RGFT(IJM)=VG(IJM)*RGP(IJB)                     KFIXCC  1255
      IF(VG(IJM).LT.0.) RGFT(IJM)=VG(IJM)*RGP(IJ)                      KFIXCC  1256
      IF(WG(IKM).GE.0.) RGFA(IKM)=WG(IKM)*RGP(IJF)                     THREED   217
      IF(WG(IKM).LT.0.) RGFA(IKM)=WG(IKM)*RGP(IJ)                      THREED   218
C                                                                      KFIXCC  1257
      ENTRY MASFGA                                                     KFIXCC  1258
C                                                                      KFIXCC  1259
      IF(UG(IJ).GE.0.) RGFR(IJ)=UG(IJ)*RGP(IJ)*RB(I)                   KFIXCC  1260
      IF(UG(IJ).LT.0.) RGFR(IJ)=UG(IJ)*RGP(IJR)*RB(I)                  KFIXCC  1261
      IF(VG(IJ).GE.0.) RGFT(IJ)=VG(IJ)*RGP(IJ)                         KFIXCC  1262
      IF(VG(IJ).LT.0.) RGFT(IJ)=VG(IJ)*RGP(IJT)                        KFIXCC  1263
      IF(WG(IJ).GE.0.) RGFA(IJ)=WG(IJ)*RGP(IJ)                         THREED   219
      IF(WG(IJ).LT.0.) RGFA(IJ)=WG(IJ)*RGP(IJA)                        THREED   220
      RETURN                                                           KFIXCC  1264
      END                                                              KFIXCC  1265
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      SUBROUTINE MASFL                                                 KFIXCC  1266
*CALL GCOM1                                                            KFIXCC  1267
*CALL GCOM2                                                            KFIXCC  1268
C                                                                      KFIXCC  1269
C     CALCULATES MASS FLUXES FOR THE LIQUID                            KFIXCC  1270
C                                                                      KFIXCC  1271
      IF(UL(IMJ).GE.0.) RLFR(IMJ)=UL(IMJ)*RLP(IJL)*RB(I-1)             KFIXCC  1272
      IF(UL(IMJ).LT.0.) RLFR(IMJ)=UL(IMJ)*RLP(IJ)*RB(I-1)              KFIXCC  1273
      IF(VL(IJM).GE.0.) RLFT(IJM)=VL(IJM)*RLP(IJB)                     KFIXCC  1274
      IF(VL(IJM).LT.0.) RLFT(IJM)=VL(IJM)*RLP(IJ)                      KFIXCC  1275
      IF(WL(IKM).GE.0.) RLFA(IKM)=WL(IKM)*RLP(IJF)                     THREED   221
      IF(WL(IKM).LT.0.) RLFA(IKM)=WL(IKM)*RLP(IJ)                      THREED   222
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C                                                                       KFIXCC   1276
      ENTRY MASFLA                                                      KFIXCC   1277
C                                                                       KFIXCC   1278
      IF(UL(IJ).GE.0.) RLFR(IJ)=UL(IJ)*RLP(IJ)*RB(I)                    KFIXCC   1279
      IF(UL(IJ).LT.0.) RLFR(IJ)=UL(IJ)*RLP(IJR)*RB(I)                   KFIXCC   1280
      IF(VL(IJ).GE.0.) RLFT(IJ)=VL(IJ)*RLP(IJ)                          KFIXCC   1281
      IF(VL(IJ).LT.0.) RLFT(IJ)=VL(IJ)*RLP(IJT)                         KFIXCC   1282
      IF(WL(IJ).GE.0.) RLFA(IJ)=WL(IJ)*RLP(IJ)                          THREED    223  *
      IF(WL(IJ).LT.0.) RLFA(IJ)=WL(IJ)*RLP(IJA)                         THREED    224
      RETURN                                                            KFIXCC   1283
      END                                                               KFIXCC   1284

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      SUBROUTINE NEWP                                                   KFIXCC   1285
*CALL GCOM1                                                             KFIXCC   1286
*CALL GCOM2                                                             KFIXCC   1287
C                                                                       KFIXCC   1288
C     CALCULATE NEW ESTIMATES OF ADVANCED TIME PRESSURE FROM THREE      KFIXCC   1289
C     (P,D) POINTS                                                      KFIXCC   1290
C                                                                       KFIXCC   1291
      IF(D1.NE.D3) PA=(D1*P3-D3*P1+TARGET*(P1-P3))/(D1-D3)              KFIXCC   1292
      IF((D1-TARGET)*(D3-TARGET).LE.0.) GO TO 1                         KFIXCC   1293
      IF(D1.EQ.D3)PA=0.5*(P2+P3)                                        KFIXCC   1294
      IF(PA.LT.P2.OR.PA.GT.P3)PA=0.5*(P2+P3)                            KFIXCC   1295
      PB=(D2*P3-D3*P2+TARGET*(P2-P3))/(D2-D3)                           KFIXCC   1296
      GOTO10                                                            KFIXCC   1297
    1 IF(D2.NE.D3) PB=(D2*P3-D3*P2+TARGET*(P2-P3))/(D2-D3)              KFIXCC   1298
      IF(D2.EQ.D3)PB=0.5*(P1+P3)                                        KFIXCC   1299
      IF(PB.LT.P3.OR.PB.GT.P1)PB=0.5*(P1+P3)                            KFIXCC   1300
   10 P(IJ)=0.5*(PA+PB)                                                 KFIXCC   1301
      RETURN                                                            KFIXCC   1302
      END                                                               KFIXCC   1303

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      SUBROUTINE PROG                                                   KFIXCC   1304
*CALL GCOM1                                                             KFIXCC   1305
*CALL GCOM2                                                             KFIXCC   1306
      DIMENSION VELMX(6)                                                FILM      606
      TPRI=TPR+TIME                                                     KFIXCC   1308
      TPLO=TPL+TIME                                                     KFIXCC   1309
      TPLOD=TPLD+TIME                                                   KFIXCC   1310
      TRDISK=2100.                                                      KFIXCC   1311
      CALL SECOND (TCP)                                                 KFIXCC   1312
C                                                                       KFIXCC   1313
    1 CONTINUE                                                          KFIXCC   1314
      CALL SECOND(TNOW)                                                 KFIXCC   1315
      CALL START(1)                                                     THREED    225
      DO 10 K=KS,KL                                                     THREED    226
      IJ=IJ+INCK                                                        THREED    227
      DO 10 J=JS,JL                                                     THREED    228
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      IJ=IJ+INCJ                                                        THREED   229
      DO 10 I=IS,IL                                                     THREED   230
      IJ=IJ+1                                                           THREED   231
      IF(FL(IJ).NE.1) GO TO 10                                          KFIXCC  1319
      RLPN(IJ)=RLP(IJ)                                                  KFIXCC  1320
      RGPN(IJ)=RGP(IJ)                                                  KFIXCC  1321
      THN(IJ)=TH(IJ)                                                    KFIXCC  1322
      SIEGN(IJ)=SIEG(IJ)                                                KFIXCC  1323
      SIELN(IJ)=SIEL(IJ)                                                KFIXCC  1324
      THSF(IJ)=0                                                        KFIXCC  1325
      IF(TH(IJ).LT.THSTAR) THSF(IJ)=1                                   KFIXCC  1326
      CALL INDEXA                                                       KFIXCC  1327
C                                                                       KFIXCC  1328
C     CALCULATE EQUATION OF STATE QUANITIES                             KFIXCC  1329
C                                                                       KFIXCC  1330
      CALL SAT(1)                                                       KFIXCC  1331
      CALL EOSG(1,1,2)                                                  KFIXCC  1332
      CALL EOSL(1,1,2)                                                  KFIXCC  1333
      CALL TRANS                                                        KFIXCC  1334
   10 CONTINUE                                                          KFIXCC  1335
C                                                                       KFIXCC  1336
C     SET BOUNDARY AND  OBSTACLE CELLS                                  KFIXCC  1337
C                                                                       KFIXCC  1338
      CALL BDRY                                                         KFIXCC  1339
C                                                                       KFIXCC  1340
C     LPR= 0  OMITS ALL STANDARD OUTPUT  (FOR SPECIAL OUTPUT PROGRAMS)  KFIXCC  1341
C     LPR= 1  OMITS PAPER OUTPUT ALLOWS ALL FILM OUTPUT                 KFIXCC  1342
C     LPR= 2  OMITS ALL FILM OUTPUT ALLOWS PAPER OUTPUT                 KFIXCC  1343
C     LPR= 3  ALLOWS ALL PLOTTING AND PRINTING ON FILM,AND PAPER PRINTS KFIXCC  1344
      IF (LPR.EQ.0) GO TO 400                                           KFIXCC  1345
      IF (LPR.EQ.2) GO TO 295                                           KFIXCC  1346
      IF (CYCLE.LE.1) GO TO 60                                          KFIXCC  1347
      IF (TIME+.1*DT.LT.TPLO) GO TO 295                                 KFIXCC  1348
   60 CONTINUE                                                          KFIXCC  1349
C     VECTOR PLOT SECTION                                               KFIXCC  1350
C     IF PLOTTING SPECIFIED BY LPR,THEN PLOT ARE MADE WHEN TPLO.LE.TIME KFIXCC  1351
C                                                                       KFIXCC  1352
      VELMX(1)=0.0                                                      KFIXCC  1353
      VELMX(2)=0.0                                                      KFIXCC  1354
      VELMX(3)=0.0                                                      KFIXCC  1355
      VELMX(4)=0.                                                       FILM     607
      VELMX(5)=0.                                                       FILM     608
      VELMX(6)=0.                                                       FILM     609
      DO 65 K=2,KB1                                                     FILM     610
      DO 65 J=2,JB1                                                     KFIXCC  1356
      DO 65 I=2,IB1                                                     KFIXCC  1357
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                      FILM     611
      IF(FL(IJ).EQ.2.OR.FL(IJ).EQ.3) GO TO 65                           FILM     612
      VELMX(1)=AMAX1(VELMX(1),ABS(UG(IJ)),ABS(VG(IJ)))                  FILM     613
      VELMX(2)=AMAX1(VELMX(2),ABS(UL(IJ)),ABS(VL(IJ)))                  FILM     614
      VELMX(3)=AMAX1(VELMX(3),ABS(UG(IJ)),ABS(WG(IJ)))                  FILM     615
      VELMX(4)=AMAX1(VELMX(4),ABS(UL(IJ)),ABS(WL(IJ)))                  FILM     616
      VELMX(5)=AMAX1(VELMX(5),ABS(VG(IJ)),ABS(WG(IJ)))                  FILM     617
      VELMX(6)=AMAX1(VELMX(6),ABS(VL(IJ)),ABS(WL(IJ)))                  FILM     618
   65 CONTINUE                                                          KFIXCC  1367
      DO 145 M=1,5                                                      FILM     619
      K=IJPLOT(1,M)                                                     FILM     620
      IF(K.EQ.0) GO TO 145                                              FILM     621
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      DO 145 L=1,2                                                          FILM     622
      IF(VELMX(L).LT.1.E-10) GO TO 145                                      KFIXCC  1369
      DROU=AMIN1(DR,DZ)/VELMX(L)                                            KFIXCC  1370
      DROU=0.9*DROU                                                         KFIXCC  1371
      CALL ADV (1)                                                          KFIXCC  1373
      CALL VPLOT(0,L,XX1,YY1,XX2,YY2)                                       FILM     623
      CALL VPLOT(1,L)                                                       KFIXCC  1379
      DO 140 J=2,JB1                                                        KFIXCC  1380
      DO 140 I=2,IB1                                                        KFIXCC  1381
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                          FILM     624
      IF(FL(IJ).NE.1) GO TO 140                                             FILM     625
      XX1=(I-1.5)*DR                                                        KFIXCC  1383
      YY1=(J-1.5)*DZ                                                        KFIXCC  1384
      IMJ=IJ-1                                                              FILM     626
      IJM=IJ-IB2                                                            FILM     627
      GO TO (110,120),L                                                     FILM     628
  110 XX2=XX1+0.5*(UG(IMJ)+UG(IJ))*DROU                                     FILM     629
      YY2=YY1+0.5*(VG(IJM)+VG(IJ))*DROU                                     FILM     630
      GO TO 130                                                             KFIXCC  1389
  120 XX2=XX1+0.5*(UL(IMJ)+UL(IJ))*DROU                                     FILM     631
      YY2=YY1+0.5*(VL(IJM)+VL(IJ))*DROU                                     FILM     632
  130 CALL VPLOT (2,L,XX1,YY1,XX2,YY2)                                      KFIXCC  1395
  140 CONTINUE                                                              KFIXCC  1396
  145 CONTINUE                                                              KFIXCC  1397
C                                                                           FILM     633
C     DO VECTOR IK AND JK PLOTS                                             FILM     634
      CALL VECIKJK(VELMX)                                                   FILM     635
C                                                                           KFIXCC  1398
C     END OF VECTOR PLOT SECTION--------START OF CONTOUR PLOT SECTION* *   KFIXCC  1399
C                                                                           KFIXCC  1400
C     PLOTS---RHO,P,SIE,T,ETC.----FOR ALL REAL FLUID CELLS AS SPECIFIED     KFIXCC  1401
C  BY JPLOT(L),EACH ARRAY STORED IN DUMMY ARRAY--CQ--TO TRANSFER TO PLOT    KFIXCC  1402
C     ROUTINES                                                              KFIXCC  1403
C                                                                           KFIXCC  1404
      IF (CYCLE.LE.1) GO TO 160                                             KFIXCC  1406
      IF (TIME+.1*DT.LT.TPLO) GO TO 295                                     KFIXCC  1407
      TPLO=TPLO+TPL                                                         KFIXCC  1408
  160 CONTINUE                                                              KFIXCC  1409
      DO 290 M=1,5                                                          FILM     636
      K=IJPLOT(1,M)                                                         FILM     637
      IF(K.EQ.0) GO TO 290                                                  FILM     638
      DO 290 L=1,11                                                         FILM     639
      IF(IJPLOT(1+L,M).EQ.0) GO TO 290                                      FILM     640
      DO 280 J=1,JB2                                                        KFIXCC  1412
      DO 290 I=1,IB2                                                        KFIXCC  1413
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                          FILM     641
      GO TO (170,172,174,176,178,180,182,184,186,188,190,192),L             KFIXCC  1414
  170 CQ(IJ)=RGP(IJ)                                                        FILM     642
      GO TO 280                                                             KFIXCC  1416
  172 CQ(IJ)=RLP(IJ)                                                        FILM     643
      GO TO 280                                                             KFIXCC  1418
  174 CQ(IJ)= TH(IJ)                                                        FILM     644
      GO TO 280                                                             KFIXCC  1420
  176 CQ(IJ)=  P(IJ)                                                        FILM     645
      GO TO 280                                                             KFIXCC  1422
  178 CQ(IJ)= TG(IJ)                                                        FILM     646
      GO TO 280                                                             KFIXCC  1424
  180 CQ(IJ)= TL(IJ)                                                        FILM     647
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      GO TO 280                                                          KFIXCC   1426
  182 CQ(IJ)= TS(IJ)                                                     FILM      648
      GO TO 280                                                          KFIXCC   1428
  184 CQ(IJ)=SIEG(IJ)                                                    FILM      649
      GO TO 280                                                          KFIXCC   1430
  186 CQ(IJ)=SIEL(IJ)                                                    FILM      650
      GO TO 280                                                          KFIXCC   1432
  188 CQ(IJ)=ERATE(IJ)-CRATE(IJ)                                         FILM      651
      GO TO 280                                                          KFIXCC   1434
  190 CQ(IJ)=KDRAG(IJ)                                                   FILM      652
      GO TO 280                                                          KFIXCC   1436
C     NOT USED                                                           KFIXCC   1437
  192 CONTINUE                                                           KFIXCC   1438
  280 CONTINUE                                                           KFIXCC   1439
      CALL CNPLOT(1,L)                                                   KFIXCC   1444
      CALL CNPLOT (2,L)                                                  KFIXCC   1445
  290 CONTINUE                                                           KFIXCC   1446
C                                                                        KFIXCC   1447
C                                                                        FILM      653
C      DO CONTOUR PLOT FOR INDICATED IK AND JK SURFACES                  FILM      654
      CALL CNPLTIK                                                       FILM      655
      CALL CNPLTJK                                                       FILM      656
C                                                                        FILM      657
C      END OF CONTOUR PLOT SECTION                                       FILM      658
C                                                                        FILM      659
  295 CONTINUE                                                           KFIXCC   1448
      CALL SECOND (TNOW)                                                 KFIXCC   1449
C     RELEASES DISK DATA TO TAPE EVERY 35 MINUTES  . . . . . .           KFIXCC   1450
      IF (TNOW-TBEG.LT.TRDISK) GO TO 300                                 KFIXCC   1451
      TRDISK=TRDISK+2100.                                                KFIXCC   1452
      CALL DATAREL (5LFSET5)                                             KFIXCC   1453
  300 CONTINUE                                                           KFIXCC   1454
      KTAPE=9                                                            KFIXCC   1455
C     WRITES FLUID VARIABLES U,V,RHO,F,I,T,ETC.  (TAPE-9/12)             KFIXCC   1456
      IF(LPR.LE.1) GO TO 350                                             KFIXCC   1457
      IF((SECREQ-8.).LE.TNOW)GOTO310                                     KFIXCC   1458
      IF (CYCLE.LE.0) GO TO 310                                          KFIXCC   1459
      IF(TIME+.1*DT.LT.TPRI) GO TO 350                                   PERM1277   13
      TPRI=TPRI+TPR                                                      KFIXCC   1461
  310 CONTINUE                                                           KFIXCC   1462
      IF(LPR.EQ.1.OR.LPR.EQ.3) CALL ADV(2)                               KFIXCC   1463
  320 WRITE(KTAPE,500) CYCLE,TIME,DT,NAME                                KFIXCC   1464
      WRITE (KTAPE,510)                                                  KFIXCC   1465
      IJC=0                                                              KFIXCC   1466
      DO 340 K=KP1,KP2                                                   INOUT      80
      DO 340 J=JP1,JP2                                                   INOUT      81
      DO 340 I=IP1,IP2                                                   INOUT      82
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                       INOUT      83
      IJC=IJC+4                                                          KFIXCC   1469
      IF (IJC.LT.56) GO TO 330                                           KFIXCC   1470
      IJC=4                                                              KFIXCC   1471
      WRITE(KTAPE,500) CYCLE,TIME,DT,NAME                                KFIXCC   1472
      WRITE (KTAPE,510)                                                  KFIXCC   1473
  330 WRITE (KTAPE,520)I,J,K,FL(IJ),TH(IJ),UG(IJ),VG(IJ),SIEG(IJ),       INOUT      84
     1 RGP(IJ),KDRAG(IJ),WG(IJ),CG(IJ),RL(IJ),UL(IJ),VL(IJ),             INOUT      85
     2 SIEL(IJ),RLP(IJ),RHEAT(IJ),WL(IJ),CL(IJ),ROG(IJ),                 INOUT      86
     3 ERATE(IJ),CRATE(IJ),ASURF(IJ),TS(IJ),TL(IJ),TG(IJ),P(IJ)          INOUT      87
  340 CONTINUE                                                           KFIXCC   1478
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  350 IF(LPR.EQ.2) GO TO 370                                                    KFIXCC   1479
      IF((SECREQ-8.).LE.TNOW)GOTO360                                            KFIXCC   1480
      IF (CYCLE.LE.1) GO TO 360                                                 KFIXCC   1481
      IF(TIME+.1*DT.LT.TPLOD) GO TO 370                                         PERM1277   14
      TPLOD=TPLOD+TPLD                                                          KFIXCC   1483
  360 IF (KTAPE.EQ.12) GO TO 370                                                KFIXCC   1484
      CALL ADV (1)                                                              KFIXCC   1485
      KTAPE=12                                                                  KFIXCC   1486
      GO TO 320                                                                 KFIXCC   1487
  370 CONTINUE                                                                  KFIXCC   1488
      IF (ITD.EQ.1.OR.ITD.EQ.3) GO TO 380                                       KFIXCC   1489
      GO TO 400                                                                 KFIXCC   1490
  380 CONTINUE                                                                  KFIXCC   1491
      IF((SECREQ-8.).LE.TNOW)GOTO390                                            KFIXCC   1492
      IF(CYCLE.EQ.NCYDMP) GO TO 390                                             KFIXCC   1493
      GO TO 400                                                                 KFIXCC   1494
  390 IF(LPR.GE.2) WRITE(9,490) NWDMP,CYCLE,TIME                                KFIXCC   1495
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,490) NWDMP,CYCLE,TIME                   KFIXCC   1496
C     WRITE DATA ON DISK (FSET5) FOR RESTART IF ITD=1 OR 3                      KFIXCC   1497
C                                                                               KFIXCC   1498
      NCYDMP=NSDMP+CYCLE                                                        KFIXCC   1499
      WRITE(5) NWDMP,IB2,JB2,KB2                                               INOUT     88
      WRITE(5) (((P(I,J,K),TG(I,J,K),TH(I,J,K),TL(I,J,K),UG(I,J,K),            INOUT     89
     1UL(I,J,K),VG(I,J,K),VL(I,J,K),WG(I,J,K),WL(I,J,K),I=1,IB2),              INOUT     90
     2 J=1,JB2),K=1,KB2)                                                       INOUT     91
      IF((SECREQ-8.).LE.TNOW)CALL EXIT                                          KFIXCC   1503
      NWDMP=NWDMP+1                                                             KFIXCC   1504
  400 CONTINUE                                                                  KFIXCC   1505
      IF((SECREQ-8.).LE.TNOW)CALL EXIT                                          KFIXCC   1506
C                                                                               KFIXCC   1507
C     ***************END OF CYCLE,PRINT AND PLOT FINISHED**************         KFIXCC   1508
C     STOPS CALC. 8 SEC. BEFORE REQUESTED TIME ON JOB CARD USED TO              KFIXCC   1509
C     ALLOW TIME FOR OUTPUT                                                     KFIXCC   1510
C                                                                               KFIXCC   1511
      IF(TIME+.1*DT.GE.TSTOP) GO TO 480                                         KFIXCC   1512
      CALL TILDE                                                                KFIXCC   1513
      CALL BETAS                                                                KFIXCC   1514
      CALL ITER                                                                 KFIXCC   1515
      CALL ICONV                                                                KFIXCC   1516
      TIME=TIME+DT                                                              KFIXCC   1517
      CYCLE=CYCLE+1                                                             KFIXCC   1518
      TCPOLD=TCP                                                                KFIXCC   1519
      CALL SECOND (TCP)                                                         KFIXCC   1520
      CPT=TCP-TBEG                                                              KFIXCC   1521
      CPTG=TCP-TCPOLD                                                           KFIXCC   1522
      GRINDS=CPTG/(IB*JB*KB)                                                   INOUT     92
      IF(LPR.GE.2) WRITE(9,530) NIT,TIME,DT,CYCLE,CPT,GRINDS                    KFIXCC   1524
      KTAPE=12                                                                  KFIXCC   1525
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,530)NIT,TIME,DT,CYCLE,CPT,GRINDS        KFIXCC   1526
      GO TO 1                                                                   KFIXCC   1527
  480 CONTINUE                                                                  KFIXCC   1528
      RETURN                                                                    KFIXCC   1529
C                                                                               KFIXCC   1530
  490 FORMAT (*0TAPE 5 DUMP NO.=*I5*   CYCLE=*I5*   TIME=*F10.4)               KFIXCC   1531
  500 FORMAT(*1 CYCLE=*I5*   TIME=*F14.8*   DT=*F11.8,3X,10A8)                 KFIXCC   1532
  510 FORMAT(48H0 I  J  K  FL    TH            UG            VG ,10X,          INOUT     93
     159H SIEG          RGP          KDRAG          WG            CG  /       INOUT     94
     218X,46HROL           UL            VL            SIEL,                 INOUT     95
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     354H            RLP             RHEAT           WL              CL  /         INOUT      96
     419X,47HROG             ERATE           CRATE           ASURF,                INOUT      97
     552H            TS              TL              TG              P   )         INOUT      98
  520 FORMAT(1X,4I3,2X,8(2X,1PE12.5)/15X,8(2X,1PE12.5)/15X,8(2X,                   INOUT      99
     1 1PE12.5)/)                                                                  KFIXCC   1540
  530 FORMAT(*  ITER=*I4*   TIME=*F14.8*    DT=*F11.8*    CYCLE=*                  KFIXCC   1541
     1 I4*    CP=*1PE12.5*   GRINDS=*1PE12.5)                                      KFIXCC   1542
      END                                                                          KFIXCC   1543
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      SUBROUTINE RHEATS                                                            KFIXCC   1544
*CALL GCOM1                                                                        KFIXCC   1545
*CALL GCOM2                                                                        KFIXCC   1546
C                                                                                  KFIXCC   1547
C          HEAT EXCHANGE FUNCTION                                                  KFIXCC   1548
C   RHEAT MUST BE GREATER THAN ZERO IF THETA EQUAL TO ZERO OR ONE                  KFIXCC   1549
C                                                                                  KFIXCC   1550
      RETURN                                                                       KFIXCC   1551
      END                                                                          KFIXCC   1552
```

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```
      SUBROUTINE RTAPE5                                                            KFIXCC   1553
*CALL GCOM1                                                                        KFIXCC   1554
*CALL GCOM2                                                                        KFIXCC   1555
C                                                                                  KFIXCC   1556
C     READ INPUT DATA FROM TAPE5                                                   KFIXCC   1557
   10 READ (5) NTDMP,IB2,JB2,KB2                                                   INOUT     100
      IF(LPR.GE.2) WRITE(9,40) NTDMP,NTD                                           KFIXCC   1559
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,40) NTDMP,NTD                              KFIXCC   1560
      IF (NTD.EQ.NTDMP) GO TO 20                                                   KFIXCC   1561
      READ (5)                                                                     KFIXCC   1562
      IF (NTDMP.EQ.NFILE) GO TO 30                                                 KFIXCC   1563
      IF (EOF,5) 30,10                                                             KFIXCC   1564
   20 READ (5) (((P(I,J,K),TG(I,J,K),TH(I,J,K),TL(I,J,K),UG(I,J,K),                INOUT     101
     1UL(I,J,K),VG(I,J,K),VL(I,J,K),WG(I,J,K),WL(I,J,K),I=1,IB2),                  INOUT     102
     1 J=1,JB2),K=1,KB2)                                                           INOUT     103
      IF (NTDMP.NE.NFILE) GO TO 10                                                 KFIXCC   1567
   30 CONTINUE                                                                     KFIXCC   1568
      RETURN                                                                       KFIXCC   1569
   40 FORMAT (24I3)                                                                KFIXCC   1570
      END                                                                          KFIXCC   1571
```

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```
      SUBROUTINE SAT(NL)                                                           KFIXCC   1572
*CALL GCOM1                                                                        KFIXCC   1573
*CALL GCOM2                                                                        KFIXCC   1574
```

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```
C                                                                       KFIXCC   1575
C     CALCULATE THE SATURATED VAPOR TEMPERATURE AND LATENT HEAT         KFIXCC   1576
C     FROM THE PRESSURE                                                 KFIXCC   1577
C                                                                       KFIXCC   1578
      RETURN                                                            KFIXCC   1579
      END                                                               KFIXCC   1580
```

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```
      SUBROUTINE SETC                                                   KFIXCC   1626
*CALL GCOM1                                                             KFIXCC   1627
*CALL GCOM2                                                             KFIXCC   1628
C                                                                       KFIXCC   1629
C     SET THE C ARRAY   -- THE C ARRAY IS USED TO STORE EQUATION OF     KFIXCC   1630
C     STATE OR TRANSPORT PROPERTIES DATA, COEFFICIENTS OF FUNCTIONS     KFIXCC   1631
C     AND RELATED CONSTANTS                                             KFIXCC   1632
C                                                                       KFIXCC   1633
C     SCALE(1)=LENGTH FACTOR                                            KFIXCC   1634
C     SCALE(2)=VELOCITY FACTOR                                          KFIXCC   1635
C     SCALE(3)=DENSITY FACTOR                                           KFIXCC   1636
C     SCALE(4)=TEMPERATURE FACTOR                                       KFIXCC   1637
C                                                                       KFIXCC   1638
      RETURN                                                            KFIXCC   1639
      END                                                               KFIXCC   1640
```

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```
      SUBROUTINE SETIND                                                 INDEX    122
*CALL GCOM1                                                             INDEX    123
*CALL GCOM2                                                             INDEX    124
C                                                                       INDEX    125
C     CALCULATE INDICES FOR ARRAY QUANITIES                             INDEX    126
C                                                                       INDEX    127
      IPJ=IJ+1                                                          INDEX    128
      IJP=IJ+IB2                                                        INDEX    129
      IMJ=IJ-1                                                          INDEX    130
      IJM=IJ-IB2                                                        INDEX    131
      IMJP=IJP-1                                                        INDEX    132
      IPJP=IJP+1                                                        INDEX    133
      IPJM=IJM+1                                                        INDEX    134
      IKM=IJ-IB2XJB2                                                    INDEX    135
      IF(FL(IKM).EQ.0) IKM=IKM+KB*IB2XJB2                               INDEX    136
      IPKM=IKM+1                                                        INDEX    137
      IKP=IJ+IB2XJB2                                                    INDEX    138
      IF(FL(IKP).EQ.0) IKP=IKP-KB*IB2XJB2                               INDEX    139
      IMKP=IKP-1                                                        INDEX    140
      IPKP=IKP+1                                                        INDEX    141
      JMKM=IKM-IB2                                                      INDEX    142
      JMKP=IKP-IB2                                                      INDEX    143
      JPKM=IKM+IB2                                                      INDEX    144
      JPKP=IKP+IB2                                                      INDEX    145
      IJL=IMJ                                                           INDEX    146
```

```
      IJB=IJM                                                          INDEX   147
      IJT=IJP                                                          INDEX   148
      IJR=IPJ                                                          INDEX   149
      IJF=IKM                                                          INDEX   150
      IJA=IKP                                                          INDEX   151
      IJTL=IMJP                                                        INDEX   152
      IJBR=IPJM                                                        INDEX   153
      IJRR=IJ+2                                                        INDEX   154
      IJTT=IJP+IB2                                                     INDEX   155
      IJTR=IPJP                                                        INDEX   156
      IF(I.EQ.IB1.AND.J.EQ.JB1) IJTR=IJ                                INDEX   157
      IJFR=IPKM                                                        INDEX   158
      IJAL=IMKP                                                        INDEX   159
      IJAR=IPKP                                                        INDEX   160
      IJAA=IKP+IB2XJB2                                                 INDEX   161
      IF(FL(IJAA).EQ.0) IJAA=IJAA-KB*IB2XJB2                           INDEX   162
      IJBA=JMKP                                                        INDEX   163
      IJTF=JPKM                                                        INDEX   164
      IJTA=JPKP                                                        INDEX   165
      IF((FL(IPJ).EQ.2).OR.(FL(IPJ).EQ.3)) IJR=IJ                      INDEX   166
      IF((FL(IMJ).EQ.2).OR.(FL(IMJ).EQ.3)) IJL=IJ                      INDEX   167
      IF((FL(IJP).EQ.2).OR.(FL(IJP).EQ.3)) IJT=IJ                      INDEX   168
      IF((FL(IJM).EQ.2).OR.(FL(IJM).EQ.3)) IJB=IJ                      INDEX   169
      IF((FL(IKP).EQ.2).OR.(FL(IKP).EQ.3)) IJA=IJ                      INDEX   170
      IF((FL(IKM).EQ.2).OR.(FL(IKM).EQ.3)) IJF=IJ                      INDEX   171
      IF((FL(IPJP).NE.2.AND.FL(IPJP).NE.3)) GO TO 110                  INDEX   172
      IJTR=IJ                                                          INDEX   173
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                          INDEX   174
     1   (FL(IJP).EQ.2.OR.FL(IJP).EQ.3)) IJTR=IPJ                      INDEX   175
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                           INDEX   176
     1   (FL(IJP).NE.2.AND.FL(IJP).NE.3)) IJTR=IJP                     INDEX   177
  110 IF((FL(IPJM).NE.2.AND.FL(IPJM).NE.3)) GO TO 120                  INDEX   178
      IJBR=IJ                                                          INDEX   179
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                          INDEX   180
     1   (FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) IJBR=IPJ                      INDEX   181
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                           INDEX   182
     1   (FL(IJM).NE.2.AND.FL(IJM).NE.3)) IJBR=IJM                     INDEX   183
  120 IF((FL(IMJP).NE.2.AND.FL(IMJP).NE.3)) GO TO 140                  INDEX   184
      IJTL=IJ                                                          INDEX   185
      IF((FL(IMJ).NE.2.AND.FL(IMJ).NE.3).AND.                          INDEX   186
     1   (FL(IJP).EQ.2.OR.FL(IJP).EQ.3)) IJTL=IMJ                      INDEX   187
      IF((FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3).AND.                           INDEX   188
     1   (FL(IJP).NE.2.AND.FL(IJP).NE.3)) IJTL=IJP                     INDEX   189
  140 IF((FL(IJRR).EQ.2.OR.FL(IJRR).EQ.3).OR.(I.EQ.IB1)) IJRR=IJR      INDEX   190
      IF((FL(IJTT).EQ.2.OR.FL(IJTT).EQ.3).OR.(J.EQ.JB1)) IJTT=IJT      INDEX   191
      IF((FL(IPKP).NE.2.AND.FL(IPKP).NE.3)) GO TO 150                  INDEX   192
      IJAR=IJ                                                          INDEX   193
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                          INDEX   194
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJAR=IPJ                      INDEX   195
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                           INDEX   196
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJAR=IKP                     INDEX   197
  150 IF((FL(IPKM).NE.2.AND.FL(IPKM).NE.3)) GO TO 160                  INDEX   198
      IJFR=IJ                                                          INDEX   199
      IF((FL(IPJ).NE.2.AND.FL(IPJ).NE.3).AND.                          INDEX   200
     1   (FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) IJFR=IPJ                      INDEX   201
      IF((FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3).AND.                           INDEX   202
     1   (FL(IKM).NE.2.AND.FL(IKM).NE.3)) IJFR=IKM                     INDEX   203
  160 IF((FL(IMKP).NE.2.AND.FL(IMKP).NE.3)) GO TO 180                  INDEX   204
```

```
      IJAL=IJ                                                          INDEX    205
      IF((FL(IMJ).NE.2.AND.FL(IMJ).NE.3).AND.                          INDEX    206
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJAL=IMJ                     INDEX    207
      IF((FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3).AND.                           INDEX    208
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJAL=IKP                    INDEX    209
  180 IF(FL(IJAA).EQ.2.OR.FL(IJAA).EQ.3) IJAA=IJA                      INDEX    210
      IF(FL(IKP).EQ.2.OR.FL(IKP).EQ.3) IJAA=IJA                        INDEX    211
      IF(FL(IKP).EQ.2.OR.FL(IKP).EQ.3) IJAA=IJA                        INDEX    212
      IF((FL(JPKP).NE.2.AND.FL(JPKP).NE.3)) GO TO 190                  INDEX    213
      IJTA=IJ                                                          INDEX    214
      IF((FL(IJP).NE.2.AND.FL(IJP).NE.3).AND.                          INDEX    215
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJTA=IJP                     INDEX    216
      IF((FL(IJP).EQ.2.OR.FL(IJP).EQ.3).AND.                           INDEX    217
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJTA=IKP                    INDEX    218
  190 IF((FL(JPKM).NE.2.AND.FL(JPKM).NE.3)) GO TO 200                  INDEX    219
      IJTF=IJ                                                          INDEX    220
      IF((FL(IJP).NE.2.AND.FL(IJP).NE.3).AND.                          INDEX    221
     1   (FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) IJTF=IJP                     INDEX    222
      IF((FL(IJP).EQ.2.OR.FL(IJP).EQ.3).AND.                           INDEX    223
     1   (FL(IKM).NE.2.AND.FL(IKM).NE.3)) IJTF=IKM                    INDEX    224
  200 IF((FL(JMKP).NE.2.AND.FL(JMKP).NE.3)) GO TO 220                  INDEX    225
      IJBA=IJ                                                          INDEX    226
      IF((FL(IJM).NE.2.AND.FL(IJM).NE.3).AND.                          INDEX    227
     1   (FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) IJBA=IJM                     INDEX    228
      IF((FL(IJM).EQ.2.OR.FL(IJM).EQ.3).AND.                           INDEX    229
     1   (FL(IKP).NE.2.AND.FL(IKP).NE.3)) IJBA=IKP                    INDEX    230
  220 RETURN                                                           INDEX    231
      END                                                              INDEX    232
```

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```
      SUBROUTINE SETUP                                                 KFIXCC   1641
*CALL GCOM1                                                            KFIXCC   1642
*CALL GCOM2                                                            KFIXCC   1643
C                                                                      KFIXCC   1644
C     THIS SUBROUTINE SETS SOME PROBLEM CONSTANTS AND DEFINES THE      KFIXCC   1645
C     COMPUTING MESH FLUID VARIABLE INITIAL CONDITIONS FROM INPUT DATA KFIXCC   1646
C                                                                      KFIXCC   1647
      DIMENSION NAMIX(18)                                              INDEX    233
      DATA NAMIX / 4HIJTL,4HIJBR,4HIJTR,4HIJRR,4HIJTT,4HIJAL,4HIJFR,   INDEX    234
     14HIJAR,4HIJAA,4HIJTF,4HIJBA,4HIJTA,3HIJL,                        INDEX    235
     23HIJB,3HIJR,3HIJT,3HIJA,3HIJF /                                  INDEX    236
      IF(LPR.GE.2) WRITE(9,660)                                        KFIXCC   1648
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,660)                           KFIXCC   1649
C                                                                      KFIXCC   1650
      CALL SETC                                                        KFIXCC   1651
C                                                                      KFIXCC   1652
      THSTAR=0.50                                                      KFIXCC   1653
      RDR=1./DR                                                        KFIXCC   1654
      RDZ=1./DZ                                                        KFIXCC   1655
      RDPH=1./DPH                                                      THREED   232
      DTODPH=DT*RDPH                                                   THREED   233
      DTODZ=DT*RDZ                                                     KFIXCC   1656
      DTODR=DT*RDR                                                     KFIXCC   1657
      RDR2=RDR*RDR                                                     KFIXCC   1658
```

```
      RDZ2=RD_
C
      IF(ITC.EQ.0) GO TO 15
      EX=FLOAT(ITC)
      R(1)=-(0.5/EX)*DR**EX
      RB(1)=0.
      RRB(1)=0.
      DO 10 I=2,IB_
      R(I)=((FLOAT(I)-1.5)*DR)**EX
      RB(I)=((FLOAT(I)-1.0)*DR)**EX
      RRB(I)=1./RB(I)
      RRIDR(I)=RDR/R(I)
      DTORDR(I)=DT*RRIDR(I)
      DTORBDR(I)=DTODR*RRB(I)
      DTORDPH(I)=DT*RDPH/R(I)
      DTORBDP(I)=DT*RDPH/RB(I)
   10 CONTINUE
C
      GO TO 25
   15 DO 20 I=1,IB2
      R(I)=1.
      RB(I)=1.
      RRB(I)=1.
      RRIDR(I)=RDR
      DTORDR(I)=DT*RDR
      DTORBDR(I)=DTORDR(I)
      DTORDPH(I)=DT*RDPH
   20 CONTINUE
C
   25 CONTINUE
C
      DO 35 K=1,KB2
      IF(LPR.GE.2) WRITE(9,640) K
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,640) K
      DO 30 J=1,JB2
      KPR=JB2-J+1
      IF(LPR.GE.2)
     1WRITE( 9,650) (FL(I,KPR,K),I=1,IB2)
      IF(LPR.EQ.1.OR.LPR.EQ.3)
     1WRITE(12,650) (FL(I,KPR,K),I=1,IB2)
   30 CONTINUE
      IF(LPR.GE.2) WRITE(9,660)
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,660)
   35 CONTINUE
C
C                    -----PRINTS CELL FLAGS-----
      DO 41 K=2,KB1
      IF(LPR.GE.2) WRITE(9,670) K
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,670) K
      DO 40 J=1,JB2
      KPR=JB2-J+1
      IF(LPR.GE.2)
     1WRITE(9,630) (LFL(I,KPR,K),I=1,IB2)
      IF(LPR.EQ.1.OR.LPR.EQ.3)
     1WRITE(12,630) (LFL(I,KPR,K),I=1,IB2)
   40 CONTINUE
      IF(LPR.GE.2) WRITE(9,660)
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,660)
```

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KFIXCC   1659
KFIXCC   1660
KFIXCC   1661
KFIXCC   1662
KFIXCC   1663
KFIXCC   1664
KFIXCC   1665
KFIXCC   1666
KFIXCC   1667
KFIXCC   1668
KFIXCC   1669
KFIXCC   1670
KFIXCC   1671
KFIXCC   1672
THREED    234
THREED    235
KFIXCC   1673
KFIXCC   1674
KFIXCC   1675
KFIXCC   1676
KFIXCC   1677
KFIXCC   1678
KFIXCC   1679
KFIXCC   1680
KFIXCC   1681
KFIXCC   1682
THREED    236
KFIXCC   1683
KFIXCC   1684
KFIXCC   1685
KFIXCC   1686
INOUT     104
INOUT     105
INOUT     106
KFIXCC   1687
KFIXCC   1688
INOUT     107
INOUT     108
INOUT     109
INOUT     110
INOUT     111
KFIXCC   1691
KFIXCC   1692
INOUT     112
INOUT     113
KFIXCC   1693
INDEX     237
INDEX     238
INDEX     239
INDEX     240
INDEX     241
INDEX     242
INDEX     243
INDEX     244
INDEX     245
INDEX     246
INDEX     247
INDEX     248
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   41 CONTINUE                                                                  INDEX     249
      IF(LPR.GE.2) WRITE(9,680)                                                 INDEX     250
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,680)                                    INDEX     251
      DO 42 M=1,MAXM,20                                                         INDEX     252
      ILOW=M                                                                    INDEX     253
      IUP=ILOW+19                                                               INDEX     254
      IUP=MIN0(MAXM,IUP)                                                        INDEX     255
      DO 47 J=1,18                                                              INDEX     256
      IF(LPR.GE.2)                                                              INDEX     257
     1WRITE(9,700) NAMIX(J),(MFL(J,I),I=ILOW,IUP)                               INDEX     258
      IF(LPR.EQ.1.OR.LPR.EQ.3)                                                  INDEX     259
     1WRITE(12,700) NAMIX(J),(MFL(J,I),I=ILOW,IUP)                              INDEX     260
   47 CONTINUE                                                                  INDEX     261
      IF(LPR.GE.2) WRITE(9,690)                                                 INDEX     262
      IF(LPR.EQ.1.OR.LPR.EQ.3) WRITE(12,690)                                    INDEX     263
   42 CONTINUE                                                                  INDEX     264
      CALL START(1)                                                             INDEX     265
      DO 46 K=KS,KL                                                             INDEX     266
      IJ=IJ+INCK                                                                INDEX     267
      DO 43 J=JS,JL                                                             INDEX     268
      IJ=IJ+INCJ                                                                INDEX     269
      DO 44 I=IS,IL                                                             INDEX     270
      IJ=IJ+1                                                                   INDEX     271
      LFL(IJ)=(LFL(IJ)-1)*18+1                                                  INDEX     272
   44 CONTINUE                                                                  INDEX     273
   43 CONTINUE                                                                  INDEX     274
   46 CONTINUE                                                                  INDEX     275
C                                                                               KFIXCC   1634
C  SET DATA  ARRAYS----BYPASSES IF RESTART DATA READ FROM TAPE5                 KFIXCC   1695
C                                                                               THREED    237
      DO 80 K=2,KB1                                                             THREED    238
      DO 50 J=2,JB1                                                             KFIXCC   1696
      DO 50 I=2,IB1                                                             KFIXCC   1697
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                              THREED    239
      IF(FL(IJ).NE.1) GO TO 50                                                  KFIXCC   1699
      IF(ITD.GT.1) GO TO 45                                                     KFIXCC   1700
      IPJ=IJ+1                                                                  PERM1277   15
      IJP=IJ+IB2                                                                PERM1277   16
      P(IJ)=PO                                                                  KFIXCC   1701
      TG(IJ)=TEMPO                                                              KFIXCC   1702
      TH(IJ)=THO                                                                KFIXCC   1703
      TL(IJ)=TEMPO                                                              KFIXCC   1704
      IF(FL(IPJ).NE.2.AND.FL(IPJ).NE.3) UG(IJ)=UL(IJ)=UO                        PERM1277   17
      IF(FL(IJP).NE.2.AND.FL(IJP).NE.3) VG(IJ)=VL(IJ)=VO                        PERM1277   18
      IF(FL(IKP).NE.2.AND.FL(IKP).NE.3) WG(IJ)=WL(IJ)=WO                        THREED    240
   45 CALL CONVERT                                                              KFIXCC   1707
   50 CONTINUE                                                                  KFIXCC   1708
      DO 60 I=2,IB1                                                             KFIXCC   1709
      J=1                                                                       KFIXCC   1710
      IJ=I+(J-1)*IB2+(K-1)*IB2*JB2                                              THREED    241
      IF(FL(IJ).NE.5) GO TO 60                                                  KFIXCC   1712
      DIST=(I-1)*DR-0.1*DR                                                      KFIXCC   1713
      IF(DIST.GT.FLO(3).AND.DIST.LT.FLO(4)) GO TO 55                            KFIXCC   1714
      P(IJ)=PINL                                                                KFIXCC   1715
      TG(IJ)=TL(IJ)=TEMPINL                                                     KFIXCC   1716
      TH(IJ)=THINL                                                              KFIXCC   1717
      THN(IJ)=TH(IJ)                                                            KFIXCC   1718
      VG(IJ)=VL(IJ)=VINL                                                        KFIXCC   1719
```

```
      UG(IJ)=UL(IJ)=UINL                                                    KFIXCC  1720
      WG(IJ)=WL(IJ)=0.                                                      THREED   242
      GOTO57                                                                KFIXCC  1721
   55 P(IJ)=PINR                                                            KFIXCC  1722
      TG(IJ)=TL(IJ)=TEMPINR                                                 KFIXCC  1723
      TH(IJ)=THINR                                                          KFIXCC  1724
      THN(IJ)=TH(IJ)                                                        KFIXCC  1725
      VG(IJ)=VL(IJ)=VINR                                                    KFIXCC  1726
      UG(IJ)=UL(IJ)=UINR                                                    KFIXCC  1727
      WG(IJ)=WL(IJ)=0.                                                      THREED   243
   57 CALL CONVERT                                                          KFIXCC  1728
      IJR=IJ+1                                                              KFIXCC  1729
      IJT=IJ+IB2                                                            KFIXCC  1730
        JA=IJ+IB2XJB2                                                       THREED   244
      CALL MASFGA                                                           KFIXCC  1731
      CALL MASFLA                                                           KFIXCC  1732
      CALL SETXTRA                                                          KFIXCC  1733
   60 CONTINUE                                                              KFIXCC  1734
      DO 70 J=2,JB1                                                         KFIXCC  1735
      I=1                                                                   KFIXCC  1736
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                          THREED   245
      IF(FL(IJ).NE.5)GOTO70                                                 KFIXCC  1738
      DIST=(J-1)*DZ-0.1*DZ                                                  KFIXCC  1739
      IF(DIST.GT.FLO(7).AND.DIST.LT.FLO(8))GOTO65                           KFIXCC  1740
      P(IJ)=PINB                                                            KFIXCC  1741
      TG(IJ)=TL(IJ)=TEMPINB                                                 KFIXCC  1742
      TH(IJ)=THINB                                                          KFIXCC  1743
      THN(IJ)=TH(IJ)                                                        KFIXCC  1744
      VG(IJ)=VL(IJ)=VINB                                                    KFIXCC  1745
      UG(IJ)=UL(IJ)=UINB                                                    KFIXCC  1746
      WG(IJ)=WL(IJ)=0.                                                      THREED   246
      GOTO 67                                                               KFIXCC  1747
   65 P(IJ)=PINT                                                            KFIXCC  1748
      TG(IJ)=TL(IJ)=TEMPINT                                                 KFIXCC  1749
      TH(IJ)=THINT                                                          KFIXCC  1750
      VG(IJ)=VL(IJ)=VINT                                                    KFIXCC  1751
      THN(IJ)=TH(IJ)                                                        KFIXCC  1752
      UG(IJ)=UL(IJ)=UINT                                                    KFIXCC  1753
      WG(IJ)=WL(IJ)=0.                                                      THREED   247
   67 CALL CONVERT                                                          KFIXCC  1755
      IJR=IJ+1                                                              KFIXCC  1756
      IJT=IJ+IB2                                                            KFIXCC  1757
      IJA=IJ+IB2XJB2                                                        THREED   248
      CALL MASFGA                                                           KFIXCC  1758
      CALL MASFLA                                                           KFIXCC  1759
      CALL SETXTRA                                                          KFIXCC  1760
   70 CONTINUE                                                              KFIXCC  1761
C                                                                           KFIXCC  1762
   80 CONTINUE                                                              THREED   249
  650 FORMAT (1H06312)                                                      KFIXCC  1763
  630 FORMAT(1H0,44I3)                                                      INOUT    114
  640 FORMAT(39H           CELL FLAG MAP  FL(I,J) FOR K=,I3 ///)            INOUT    115
  660 FORMAT (1H1)                                                          KFIXCC  1764
  670 FORMAT(46H            CELL INDEX MAP   LFL(I,J,K)  FOR K=,I3 ///)     INDEX    276
  680 FORMAT(51H          INDEX INCREMENTS ARRAY   MFL(M,LFL(I,J,K)) ///)   INDEX    277
  690 FORMAT(1H  ///)                                                       INDEX    278
  700 FORMAT(1H ,A7,2016)                                                   INDEX    279
      RETURN                                                                KFIXCC  1765
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      END                                                               KFIXCC  1766
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      SUBROUTINE SETXTRA                                                KFIXCC  1767
*CALL GCOM1                                                             KFIXCC  1768
*CALL GCOM2                                                             KFIXCC  1769
C                                                                       KFIXCC  1770
      IKM=IJ-IB2XJB2                                                    THREED   250
      IMJ=IJ-1                                                          KFIXCC  1772
      IJM=IJ-IB2                                                        KFIXCC  1773
      THN(IJ)=TH(IJ)                                                    KFIXCC  1774
      CALL SAT(1)                                                       KFIXCC  1775
      CALL EOSG(1,1,1)                                                  KFIXCC  1776
      CALL EOSL(1,1,1)                                                  KFIXCC  1777
      CALL TRANS                                                        KFIXCC  1778
      CALL RHEATS                                                       KFIXCC  1779
      CALL KDRAGS                                                       KFIXCC  1780
      RETURN                                                            KFIXCC  1781
      END                                                               KFIXCC  1782
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      SUBROUTINE SIEGF                                                  KFIXCC  1783
*CALL GCOM1                                                             KFIXCC  1784
*CALL GCOM2                                                             KFIXCC  1785
C                                                                       KFIXCC  1786
C     CALCULATES FLUXES OF SPECIFIC INTERNAL ENERGY DENSITY FOR THE GAS KFIXCC  1787
C                                                                       KFIXCC  1788
      IF(UG(IJ).GE.0.)EGFR=RGP(IJ)*SIEGN(IJ)*UG(IJ)*RB(I)               KFIXCC  1789
      IF(UG(IJ).LT.0.)EGFR=RGP(IJR)*SIEGN(IJR)*UG(IJ)*RB(I)             KFIXCC  1790
      IF(VG(IJ).GE.0.)EGFT=RGP(IJ)*SIEGN(IJ)*VG(IJ)                     KFIXCC  1791
      IF(VG(IJ).LT.0.)EGFT=RGP(IJT)*SIEGN(IJT)*VG(IJ)                   KFIXCC  1792
      IF(WG(IJ).GE.0.) EGFA=RGP(IJ)*SIEGN(IJ)*WG(IJ)                    THREED   251
      IF(WG(IJ).LT.0.) EGFA=RGP(IJA)*SIEGN(IJA)*WG(IJ)                  THREED   252
      IF(FL(IMJ).NE.1) GO TO 1                                          KFIXCC  1793
      IF(FL(IJM).NE.1) GO TO 2                                          KFIXCC  1794
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED   253
      RETURN                                                            INVIS      1
    1 IF(UG(IMJ).GE.0.)EGFL=RGP(IJL)*SIEGN(IJL)*UG(IMJ)*RB(I-1)         KFIXCC  1797
      IF(UG(IMJ).LT.0.)EGFL=RGP(IJ)*SIEGN(IJ)*UG(IMJ)*RB(I-1)           KFIXCC  1798
      IF(FL(IJM).NE.1) GO TO 2                                          KFIXCC  1799
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED   254
      RETURN                                                            INVIS      2
    2 IF(VG(IJM).GE.0.)EGFB(I)=RGP(IJB)*SIEGN(IJB)*VG(IJM)              KFIXCC  1802
      IF(VG(IJM).LT.0.)EGFB(I)=RGP(IJ)*SIEGN(IJ)*VG(IJM)                KFIXCC  1803
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED   255
      RETURN                                                            KFIXCC  1809
    3 IF(WG(IKM).GE.0.) EGFF(ICJ)=RGP(IJF)*SIEGN(IJF)*WG(IKM)           THREED   256
      IF(WG(IKM).LT.0.) EGFF(ICJ)=RGP(IJ)*SIEGN(IJ)*WG(IKM)             THREED   257
      RETURN                                                            THREED   258
      END                                                               KFIXCC  1810
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      SUBROUTINE SIELF                                                  KFIXCC   1811
*CALL GCOM1                                                             KFIXCC   1812
*CALL GCOM2                                                             KFIXCC   1813
C                                                                       KFIXCC   1814
C     CALCULATES FLUXES OF SPECIFIC INTERNAL ENERGY DENSITY FOR THE LIQ. KFIXCC   1815
C                                                                       KFIXCC   1816
      IF(UL(IJ).GE.0.)ELFR=RLP(IJ)*SIELN(IJ)*UL(IJ)*RB(I)               KFIXCC   1817
      IF(UL(IJ).LT.0.)ELFR=RLP(IJR)*SIELN(IJR)*UL(IJ)*RB(I)             KFIXCC   1818
      IF(VL(IJ).GE.0.)ELFT=RLP(IJ)*SIELN(IJ)*VL(IJ)                     KFIXCC   1819
      IF(VL(IJ).LT.0.)ELFT=RLP(IJT)*SIELN(IJT)*VL(IJ)                   KFIXCC   1820
      IF(WL(IJ).GE.0.) ELFA=RLP(IJ)*SIELN(IJ)*WL(IJ)                    THREED    259
      IF(WL(IJ).LT.0.) ELFA=RLP(IJA)*SIELN(IJA)*WL(IJ)                  THREED    260
      IF(FL(IMJ).NE.1) GO TO 1                                          KFIXCC   1821
      IF(FL(IJM).NE.1) GO TO 2                                          KFIXCC   1822
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED    261
      RETURN                                                            INVIS       3
    1 IF(UL(IMJ).GE.0.)ELFL=RLP(IJL)*SIELN(IJL)*UL(IMJ)*RB(I-1)         KFIXCC   1825
      IF(UL(IMJ).LT.0.)ELFL=RLP(IJ)*SIELN(IJ)*UL(IMJ)*RB(I-1)           KFIXCC   1826
      IF(FL(IJM).NE.1) GO TO 2                                          KFIXCC   1827
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED    262
      RETURN                                                            INVIS       4
    2 IF(VL(IJM).GE.0.)ELFB(I)=RLP(IJB)*SIELN(IJB)*VL(IJM)              KFIXCC   1830
      IF(VL(IJM).LT.0.)ELFB(I)=RLP(IJ)*SIELN(IJ)*VL(IJM)                KFIXCC   1831
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                THREED    263
      RETURN                                                            KFIXCC   1837
    3 IF(WL(IKM).GE.0.) ELFF(ICJ)=RLP(IJF)*SIELN(IJF)*WL(IKM)           THREED    264
      IF(WL(IKM).LT.0.) ELFF(ICJ)=RLP(IJ)*SIELN(IJ)*WL(IKM)             THREED    265
      RETURN                                                            THREED    266
      END                                                               KFIXCC   1838
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      SUBROUTINE START(N)                                               THREED    267
*CALL GCOM1                                                             THREED    268
*CALL GCOM2                                                             THREED    269
      NTRAN=N                                                           THREED    270
      GO TO (10,20,30,40),NTRAN                                         THREED    271
C                                                                       THREED    272
C     I=2,IB1    J=2,JB1    K=2,KB1                                     THREED    273
C                                                                       THREED    274
   10 IS=2                                                              THREED    275
      IL=IB1                                                            THREED    276
      JS=2                                                              THREED    277
      JL=JB1                                                            THREED    278
      KS=2                                                              THREED    279
      KL=KB1                                                            THREED    280
      GO TO 50                                                          THREED    281
   20 CONTINUE                                                          THREED    282
   30 CONTINUE                                                          THREED    283
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   40 CONTINUE                                                              THREED   284
   50 INCJ=IB1-IL+IS                                                        THREED   285
      INCK=(JB1-JL+JS)*IB2                                                  THREED   286
      IJ=(KS-1)*IB2XJB2-(JB2-JL)*IB2-(IB2-IL)                               THREED   287
      RETURN                                                                THREED   288
      END                                                                   THREED   289

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      SUBROUTINE THERCON                                                    KFIXCC  1873
*CALL GCOM1                                                                 KFIXCC  1874
*CALL GCOM2                                                                 KFIXCC  1875
C                                                                           KFIXCC  1876
C     CALCULATE THERMAL CONDUCTIVITY OF THE GAS - KAPG(IJ)                  KFIXCC  1877
C     CALCULATE THERMAL CONDUCTIVITY OF THE LIQUID - KAPL(IJ)               KFIXCC  1878
C                                                                           KFIXCC  1879
      RETURN                                                                KFIXCC  1880
      END                                                                   KFIXCC  1881

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      SUBROUTINE THF                                                        KFIXCC  1882
*CALL GCOM1                                                                 KFIXCC  1883
*CALL GCOM2                                                                 KFIXCC  1884
C                                                                           KFIXCC  1885
C     CALCULATES FLUXES OF VOID FRACTION                                    KFIXCC  1886
C     THESE MUST BE COMPUTED THE SAME AS THE MASS FLUXES                    KFIXCC  1887
C                                                                           KFIXCC  1888
      IF(UL(IJ).GE.0.) OMTFR=(1.0-TH(IJ))*UL(IJ)*RB(I)                      KFIXCC  1889
      IF(UL(IJ).LT.0.)  OMTFR=(1.0-TH(IJR))*UL(IJ)*RB(I)                    KFIXCC  1890
      IF(UG(IJ).GE.0.) THFR=TH(IJ)*UG(IJ)*RB(I)                             KFIXCC  1891
      IF(UG(IJ).LT.0.) THFR=TH(IJR)*UG(IJ)*RB(I)                            KFIXCC  1892
      IF(VL(IJ).GE.0.) OMTFT=(1.0-TH(IJ))*VL(IJ)                            KFIXCC  1893
      IF(VL(IJ).LT.0.) OMTFT=(1.0-TH(IJT))*VL(IJ)                           KFIXCC  1894
      IF(WL(IJ).GE.0.) OMTFA=(1.-TH(IJ))*WL(IJ)                             THREED   290
      IF(WL(IJ).LT.0.) OMTFA=(1.-TH(IJA))*WL(IJ)                            THREED   291
      IF(WG(IJ).GE.0.) THFA=TH(IJ)*WG(IJ)                                   THREED   292
      IF(WG(IJ).LT.0.) THFA=TH(IJA)*WG(IJ)                                  THREED   293
      IF(VG(IJ).GE.0.) THFT=TH(IJ)*VG(IJ)                                   KFIXCC  1895
      IF(VG(IJ).LT.0.) THFT=TH(IJT)*VG(IJ)                                  KFIXCC  1896
      IF(FL(IMJ).NE.1) GO TO 1                                              KFIXCC  1897
      IF(FL(IJM).NE.1) GO TO 2                                              KFIXCC  1898
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                    THREED   294
      RETURN                                                                KFIXCC  1893
    1 IF(UL(IMJ).GE.0.) OMTFL=(1.0-TH(IJL))*UL(IMJ)*RB(I-1)                 KFIXCC  1900
      IF(UL(IMJ).LT.0.) OMTFL=(1.0-TH(IJ))*UL(IMJ)*RB(I-1)                  KFIXCC  1901
      IF(UG(IMJ).GE.0.) THFL=TH(IJL)*UG(IMJ)*RB(I-1)                        KFIXCC  1902
      IF(UG(IMJ).LT.0.) THFL=TH(IJ)*UG(IMJ)*RB(I-1)                         KFIXCC  1903
      IF(FL(IJM).NE.1) GO TO 2                                              THREED   295
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                    THREED   296
      RETURN                                                                THREED   297
    2 IF(VL(IJM).GE.0.) OMTFB(I)=(1.0-TH(IJB))*VL(IJM)                      KFIXCC  1905
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      IF(VL(IJM).LT.0.) OMTFB(I)=(1.0-TH(IJ))*VL(IJM)                    KFIXCC   1906
      IF(VG(IJM).GE.0.) THFB(I)=TH(IJB)*VG(IJM)                          KFIXCC   1907
      IF(VG(IJM).LT.0.) THFB(I)=TH(IJ)*VG(IJM)                           KFIXCC   1908
      IF(VL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED    298
      RETURN                                                             THREED    299
    3 IF(WL(IKM).GE.0.) OMTFF(ICJ)=(1.-TH(IJF))*WL(IKM)                  THREED    300
      IF(WL(IKM).LT.0.) OMTFF(ICJ)=(1.-TH(IJ))*WL(IKM)                   THREED    301
      IF(WG(IKM).GE.0.) THFF(ICJ)=TH(IJF)*WG(IKM)                        THREED    302
      IF(WG(IKM).LT.0.) THFF(ICJ)=TH(IJ)*WG(IKM)                         THREED    303
      RETURN                                                             KFIXCC   1909
      END                                                                KFIXCC   1910

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      SUBROUTINE THGAS                                                   KFIXCC   1911
*CALL GCOM1                                                              KFIXCC   1912
*CALL GCOM2                                                              KFIXCC   1913
C                                                                        KFIXCC   1914
C     CALCULATE IMPLICIT SOLUTION OF GAS CONTINUITY EQUATION TO          KFIXCC   1915
C     DETERMINE VOID FRACTION                                            KFIXCC   1916
C                                                                        KFIXCC   1917
      DIMENSION CS(4)                                                    KFIXCC   1918
      CS(1)=RGPN(IJ)                                                     KFIXCC   1919
      CS(2)=0.                                                           KFIXCC   1920
      IF(VG(IJ).GT.0.)CS(2)=CS(2)-DTODZ*VG(IJ)                           KFIXCC   1921
      IF(VG(IJ).LE.0.)CS(1)=CS(1)-DTODZ*VG(IJ)*RGP(IJT)                  KFIXCC   1922
      IF(VG(IJM).GT.0.)CS(1)=CS(1)+DTODZ*VG(IJM)*RGP(IJB)                KFIXCC   1923
      IF(VG(IJM).LE.0.)CS(2)=CS(2)+DTODZ*VG(IJM)                         KFIXCC   1924
      IF(UG(IJ).GT.0.)CS(2)=CS(2)-DTORDR(I)*RB(I)*UG(IJ)                 KFIXCC   1925
      IF(UG(IJ).LE.0.)CS(1)=CS(1)-DTORDR(I)*RB(I)*UG(IJ)*RGP(IJR)        KFIXCC   1926
      IF(UG(IMJ).GT.0.)CS(1)=CS(1)+DTORDR(I)*RB(I-1)*UG(IMJ)*RGP(IJL)    KFIXCC   1927
      IF(UG(IMJ).LE.0.)CS(2)=CS(2)+DTORDR(I)*RB(I-1)*UG(IMJ)             KFIXCC   1928
      IF(WG(IJ).GT.0.) CS(2)=CS(2)-DTORDPH(I)*WG(IJ)                     THREED    304
      IF(WG(IJ).LE.0.) CS(1)=CS(1)-DTORDPH(I)*WG(IJ)*RGP(IJA)            THREED    305
      IF(WG(IKM).GT.0.) CS(1)=CS(1)+DTORDPH(I)*WG(IKM)*RGP(IKM)          THREED    306
      IF(WG(IKM).LE.0.) CS(2)=CS(2)+DTORDPH(I)*WG(IKM)                   THREED    307
      CS(1)=CS(1)/ROG(IJ)                                                KFIXCC   1929
      CS(4)=DT/ROG(IJ)                                                   KFIXCC   1930
      CS(3)=(CS(1)+CS(4)*(ERATE(IJ)-CRATE(IJ)))/(1.-CS(2))               KFIXCC   1931
      IF(CS(3).LT.0.) CS(3)=0.                                           KFIXCC   1932
      IF(CS(3).GT.1.) CS(3)=1.                                           KFIXCC   1933
      TH(IJ)=CS(3)                                                       KFIXCC   1934
      RGP(IJ)=TH(IJ)*ROG(IJ)                                             KFIXCC   1935
      RLP(IJ)=(1.-TH(IJ))*RL(IJ)                                         KFIXCC   1936
      RETURN                                                             KFIXCC   1937
      END                                                                KFIXCC   1938

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      SUBROUTINE TILDE                                                   KFIXCC   1939
*CALL GCOM1                                                              KFIXCC   1940
*CALL GCOM2                                                              KFIXCC   1941
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C                                                                       KFIXCC   1942
C     CALCULATE MOMENTA DUE TO CONVECTION, GRAVITY, AND VISCOUS STRESS  KFIXCC   1943
C                                                                       KFIXCC   1944
      DIMENSION CS(5)                                                   KFIXCC   1945
      CALL START(1)                                                     THREED    308
      DO 10 K=KS,KL                                                     THREED    309
      IJ=IJ+INCK                                                        THREED    310
      DO 10 J=JS,JL                                                     THREED    311
      IJ=IJ+INCJ                                                        THREED    312
      DO 10 I=IS,IL                                                     THREED    313
      IJ=IJ+1                                                           THREED    314
      IF(FL(IJ).NE.1) GO TO 10                                          KFIXCC   1949
      CALL INDEX                                                        KFIXCC   1950
      CS(1)=0.                                                          THREED    315
      CS(2)=0.                                                          THREED    316
      CS(3)=0.                                                          THREED    317
      CS(4)=0.                                                          THREED    318
      IF(ITC.EQ.0) GO TO 5                                              THREED    319
      CS(5)=0.03125*DT*RRB(I)                                           THREED    320
      CS(1)=CS(5)*(RLP(IJ)+RLP(IJR))*(WL(IJ)+WL(IKM)+WL(IPJ)+WL(IPKM))  THREED    321
     1 **2                                                              THREED    322
      CS(2)=CS(5)*(RGP(IJ)+RGP(IJR))*(WG(IJ)+WG(IKM)+WG(IPJ)+WG(IPKM))  THREED    323
     1 **2                                                              THREED    324
      CS(5)=0.125*DT/R(I)                                               THREED    325
      CS(3)=(UL(IJ)+UL(IMJ)+UL(IKP)+UL(IMKP))*(RLP(IJ)+RLP(IKP))*CS(5)  THREED    326
     1 *WL(IJ)                                                          THREED    327
      CS(4)=(UG(IJ)+UG(IMJ)+UG(IKP)+UG(IMKP))*(RGP(IJ)+RGP(IKP))*CS(5)  THREED    328
     1 *WG(IJ)                                                          THREED    329
    5 CONTINUE                                                          THREED    330
      CALL UGMOMF                                                       KFIXCC   1951
      RUG(IJ)=.5*(PGP(IJ)+RGP(IJR))*UG(IJ)-DTORBDR(I)*(UGFR-UGFL)-DTODZ* KFIXCC   1952
     1  (UGFT-UGFB(I))                                                  INVIS      5
     2  -DTORBDP(I)*(UGFA-UGFF(ICJ)) + CS(2)                            THREED    331
      UGFL=UGFR                                                         KFIXCC   1954
      UGFB(I)=UGFT                                                      KFIXCC   1955
      UGFF(ICJ)=UGFA                                                    THREED    332
      CALL VGMOMF                                                       KFIXCC   1956
      RVG(IJ)=0.5*(PGP(IJ)+RGP(IJT))*(VG(IJ)+GRAV*DT)-DTORDR(I)*(VGFR-  KFIXCC   1957
     1 VGFL)-DTODZ*(VGFT-VGFB(I))-DTORDPH(I)*(VGFA-VGFF(ICJ))           THREED    333
      VGFL=VGFR                                                         KFIXCC   1959
      VGFB(I)=VGFT                                                      KFIXCC   1960
      VGFF(ICJ)=VGFA                                                    THREED    334
      CALL WGMOMF                                                       THREED    335
      RWG(IJ)=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)-DTORDR(I)*(WGFR-WGFL)-      THREED    336
     1 DTODZ*(WGFT-WGFB(I))-DTORDPH(I)*(WGFA-WGFF(ICJ))-CS(4)           THREED    337
      WGFL=WGFR                                                         THREED    338
      WGFB(I)=WGFT                                                      THREED    339
      WGFF(ICJ)=WGFA                                                    THREED    340
      CALL ULMOMF                                                       KFIXCC   1961
      RUL(IJ)=.5*(RLP(IJ)+RLP(IJR))*UL(IJ)-DTORBDR(I)*(ULFR-ULFL)-DTODZ* KFIXCC   1962
     1  (ULFT-ULFB(I))                                                  INVIS      6
     2  -DTORBDP(I)*(ULFA-ULFF(ICJ)) + CS(1)                            THREED    341
      ULFL=ULFR                                                         KFIXCC   1964
      ULFB(I)=ULFT                                                      KFIXCC   1965
      ULFF(ICJ)=ULFA                                                    THREED    342
      CALL VLMOMF                                                       KFIXCC   1966
      RVL(IJ)=0.5*(RLP(IJ)+RLP(IJT))*(VL(IJ)+GRAV*DT)-DTORDR(I)*(VLFR-  KFIXCC   1967
     1 VLFL)-DTODZ*(VLFT-VLFB(I))-DTORDPH(I)*(VLFA-VLFF(ICJ))           THREED    343
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      VLFL=VLFR                                                                KFIXCC   1969
      VLFB(I)=VLFT                                                             KFIXCC   1970
      VLFF(ICJ)=VLFA                                                           THREED    344
      CALL WLMOMF                                                              THREED    345
      RWL(IJ)=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)-DTORDR(I)*(WLFR-WLFL)-DTODZ*       THREED    346
     1 (WLFT-WLFB(I))-DTORDPH(I)*(WLFA-WLFF(ICJ)) -CS(3)                       THREED    347
      WLFL=WLFR                                                                THREED    348
      WLFB(I)=WLFT                                                             THREED    349
      WLFF(ICJ)=WLFA                                                           THREED    350
      CALL ASURFS                                                              KFIXCC   1971
      CALL RHEATS                                                              KFIXCC   1972
      CALL KDRAGS                                                              KFIXCC   1973
      CALL BOIL                                                                KFIXCC   1974
      CALL COND                                                                KFIXCC   1975
   10 CONTINUE                                                                 KFIXCC   1976
C                                                                              KFIXCC   1977
C     CALCULATE VELOCITY ESTIMATES                                             KFIXCC   1978
C                                                                              KFIXCC   1979
      CALL START(1)                                                            THREED    351
      DO 20 K=KS,KL                                                            THREED    352
      IJ=IJ+INCK                                                               THREED    353
      DO 20 J=JS,JL                                                            THREED    354
      IJ=IJ+INCJ                                                               THREED    355
      DO 20 I=IS,IL                                                            THREED    356
      IJ=IJ+1                                                                  THREED    357
      IF(FL(IJ).NE.1) GO TO 20                                                 KFIXCC   1983
      CALL INDEXA                                                              KFIXCC   1984
      CALL VELS2                                                               KFIXCC   1985
      CALL MASFGA                                                              KFIXCC   1986
      CALL MASFLA                                                              KFIXCC   1987
   20 CONTINUE                                                                 KFIXCC   1988
      RETURN                                                                   KFIXCC   1989
      END                                                                      KFIXCC   1990
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      SUBROUTINE TRANS                                                         KFIXCC   1991
*CALL GCOM1                                                                    KFIXCC   1992
*CALL GCOM2                                                                    KFIXCC   1993
C                                                                              KFIXCC   1994
C     CALCULATE SHEAR VISCOSITIES AND THERMAL CONDUCTIVITIES                   KFIXCC   1995
C                                                                              KFIXCC   1996
      CALL THERCON                                                             KFIXCC   1997
      CALL VISC                                                                KFIXCC   1998
      RETURN                                                                   KFIXCC   1999
      END                                                                      KFIXCC   2000
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      SUBROUTINE UGMOMF                                                        KFIXCC   2001
*CALL GCOM1                                                                    KFIXCC   2002
*CALL GCOM2                                                                    KFIXCC   2003
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      DIMENSION CS(6)                                                    THREED   358
C                                                                        KFIXCC  2005
C     CALCULATE FLUXES OF RADIAL MOMENTUM FOR THE GAS                    KFIXCC  2006
C                                                                        KFIXCC  2007
      CS(1)=0.5*(UG(IJ)+UG(IPJ))                                         KFIXCC  2008
      IF(CS(1).GE.0.) UGFR=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(1)*R(I+1)    KFIXCC  2009
      IF(CS(1).LT.0.) UGFR=0.5*(RGP(IJR)+RGP(IJRR))*UG(IPJ)*CS(1)*R(I+1) KFIXCC  2010
      CS(2)=0.5*(VG(IJ)+VG(IPJ))                                         KFIXCC  2011
      IF(CS(2).GE.0.) UGFT=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(2)           KFIXCC  2012
      IF(CS(2).LT.0.) UGFT=0.5*(RGP(IJT)+RGP(IJTR))*UG(IJP)*CS(2)        KFIXCC  2013
      CS(5)=0.5*(WG(IJ)+WG(IPJ))                                         THREED   359
      IF(CS(5).GE.0.) UGFA=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(5)           THREED   360
      IF(CS(5).LT.0.) UGFA=0.5*(RGP(IJA)+RGP(IJAR))*UG(IKP)*CS(5)        THREED   361
      IF(FL(IMJ).NE.1) GO TO 1                                           KFIXCC  2014
      IF(FL(IJM).NE.1) GO TO 2                                           KFIXCC  2015
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   362
      RETURN                                                             INVIS      7
    1 CS(3)=0.5*(UG(IJ)+UG(IMJ))                                         KFIXCC  2018
      IF(CS(3).GE.0.) UGFL=0.5*(RGP(IJ)+RGP(IJL))*UG(IMJ)*CS(3)*R(I)     KFIXCC  2019
      IF(CS(3).LT.0.) UGFL=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(3)*R(I)      KFIXCC  2020
      IF(FL(IJM).NE.1) GO TO 2                                           KFIXCC  2021
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   363
      RETURN                                                             INVIS      8
    2 CS(4)=0.5*(VG(IJM)+VG(IPJM))                                       KFIXCC  2024
      IF(CS(4).GE.0.) UGFB(I)=0.5*(RGP(IJB)+RGP(IJBR))*UG(IJM)*CS(4)     KFIXCC  2025
      IF(CS(4).LT.0.) UGFB(I)=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(4)        KFIXCC  2026
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   364
      RETURN                                                             KFIXCC  2032
    3 CS(6)=0.5*(WG(IKM)+WG(IPKM))                                       THREED   365
      IF(CS(6).GE.0.) UGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJFR))*UG(IKM)*CS(6)   THREED   366
      IF(CS(6).LT.0.) UGFF(ICJ)=0.5*(RGP(IJ)+RGP(IJR))*UG(IJ)*CS(6)      THREED   367
      RETURN                                                             THREED   368
      END                                                                KFIXCC  2033
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      SUBROUTINE ULMOMF                                                  KFIXCC  2065
*CALL GCOM1                                                              KFIXCC  2066
*CALL GCOM2                                                              KFIXCC  2067
      DIMENSION CS(6)                                                    THREED   369
C                                                                        KFIXCC  2069
C     CALCULATES FLUXES OF RADIAL MOMENTUM FOR THE LIQUID                KFIXCC  2070
C                                                                        KFIXCC  2071
      CS(1)=0.5*(UL(IJ)+UL(IPJ))                                         KFIXCC  2072
      IF(CS(1).GE.0.) ULFR=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(1)*R(I+1)    KFIXCC  2073
      IF(CS(1).LT.0.) ULFR=0.5*(RLP(IJR)+RLP(IJRR))*UL(IPJ)*CS(1)*R(I+1) KFIXCC  2074
      CS(2)=0.5*(VL(IJ)+VL(IPJ))                                         KFIXCC  2075
      IF(CS(2).GE.0.) ULFT=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(2)           KFIXCC  2076
      IF(CS(2).LT.0.) ULFT=0.5*(RLP(IJT)+RLP(IJTR))*UL(IJP)*CS(2)        KFIXCC  2077
      CS(5)=0.5*(WL(IJ)+WL(IPJ))                                         THREED   370
      IF(CS(5).GE.0.) ULFA=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(5)           THREED   371
      IF(CS(5).LT.0.) ULFA=0.5*(RLP(IJA)+RLP(IJAR))*UL(IKP)*CS(5)        THREED   372
      IF(FL(IMJ).NE.1) GO TO 1                                           KFIXCC  2078
      IF(FL(IJM).NE.1) GO TO 2                                           KFIXCC  2079
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   373
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      RETURN                                                              INVIS      9
    1 CS(3)=0.5*(UL(IJ)+UL(IMJ))                                          KFIXCC  2082
      IF(CS(3).GE.0.) ULFL=0.5*(RLP(IJ)+RLP(IJL))*UL(IMJ)*CS(3)*R(I)      KFIXCC  2083
      IF(CS(3).LT.0.) ULFL=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(3)*R(I)       KFIXCC  2084
      IF(FL(IJM).NE.1)GOTO2                                               KFIXCC  2085
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   374
      RETURN                                                              INVIS     10
    2 CS(4)=0.5*(VL(IJM)+VL(IPJM))                                        KFIXCC  2088
      IF(CS(4).GE.0.) ULFB(I)=0.5*(RLP(I,B)+RLP(IJBR))*UL(IJM)*CS(4)      KFIXCC  2089
      IF(CS(4).LT.0.) ULFB(I)=0.5*(RLP(I,J)+RLP(IJR))*UL(IJ)*CS(4)        KFIXCC  2090
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   375
      RETURN                                                              KFIXCC  2096
    3 CS(6)=0.5*(WL(IKM)+WL(IPKM))                                        THREED   376
      IF(CS(6).GE.0.) ULFF(ICJ)=0.5*(RLP(IJF)+RLP(IJFR))*UL(IKM)*CS(6)    THREED   377
      IF(CS(6).LT.0.) ULFF(ICJ)=0.5*(RLP(IJ)+RLP(IJR))*UL(IJ)*CS(6)       THREED   378
      RETURN                                                              THREED   379
      END                                                                 KFIXCC  2097
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      SUBROUTINE VECIKJK(VELMX)                                           FILM     660
*CALL GCOM1                                                               FILM     661
*CALL GCOM2                                                               FILM     662
      DIMENSION VELMX(6),CS(10)                                           FILM     663
C                                                                         FILM     664
      IF(ITC.EQ.0) GO TO 150                                              FILM     665
C     GENERATE POLAR IKPLOT                                               FILM     666
      CS(1)=SIN(DPH)                                                      FILM     667
      CS(2)=COS(DPH)                                                      FILM     668
      CS(3)=SIN(-.5*DPH)                                                  FILM     669
      CS(4)=COS(-.5*DPH)                                                  FILM     670
      DO 149 M=1,5                                                        FILM     671
      J=IKPLOT(1,M)                                                       FILM     672
      IF(J.EQ.0) GO TO 149                                                FILM     673
      DO 149 L=1,2                                                        FILM     674
      IF(VELMX(L+2).LT.1.E-10) GO TO 149                                  FILM     675
      DROU=DR/VELMX(L+2)                                                  FILM     676
      DROU=0.45*DROU                                                      FILM     677
      CALL ADV(1)                                                         FILM     678
      CALL VPLTBGD(1,L,XX1,YY1,XX2,YY2)                                   FILM     679
      CS(5)=CS(3)                                                         FILM     680
      CS(6)=CS(4)                                                         FILM     681
      DO 148 K=2,KB1                                                      FILM     682
      CS(7)=CS(2)*CS(5)+CS(1)*CS(6)                                       FILM     683
      CS(8)=CS(2)*CS(6)-CS(1)*CS(5)                                       FILM     684
      CS(5)=CS(7)                                                         FILM     685
      CS(6)=CS(8)                                                         FILM     686
      DO 148 I=2,IB1                                                      FILM     687
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                        FILM     688
      IF(FL(IJ).NE.1) GO TO 148                                           FILM     689
      IMJ=IJ-1                                                            FILM     690
      IKM=IJ-IB2XJB2                                                      FILM     691
      CS(9)=R(I)                                                          FILM     692
      XX1=CS(9)*CS(6)                                                     FILM     693
      YY1=CS(9)*CS(5)                                                     FILM     694
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      GO TO(142,144),L                                                  FILM     695
  142 UBAR=(UG(IMJ)+UG(IJ))*DROU                                        FILM     696
      WBAR=(WG(IKM)+WG(IJ))*DROU                                        FILM     697
      XX2=XX1+UBAR*CS(6)-WBAR*CS(5)                                     FILM     698
      YY2=YY1+UBAR*CS(5)+WBAR*CS(6)                                     FILM     699
      GO TO 146                                                         FILM     700
  144 UBAR=(UL(IMJ)+UL(IJ))*DROU                                        FILM     701
      WBAR=(WL(IKM)+WL(IJ))*DROU                                        FILM     702
      XX2=XX1+UBAR*CS(6)-WBAR*CS(5)                                     FILM     703
      YY2=YY1+UBAR*CS(5)+WBAR*CS(6)                                     FILM     704
  146 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                 FILM     705
  148 CONTINUE                                                          FILM     706
  149 CONTINUE                                                          FILM     707
      GO TO 159                                                         FILM     708
C                                                                       FILM     709
C     GENERATE CARTESIAN IKPLOT                                         FILM     710
  150 CONTINUE                                                          FILM     711
      DO 158 M=1,5                                                      FILM     712
      J=IKPLOT(1,M)                                                     FILM     713
      IF(J.EQ.0) GO TO 158                                              FILM     714
      DO 158 L=1,2                                                      FILM     715
      IF(VELMX(L+2).LT.1.E-10) GO TO 158                                FILM     716
      DROU=0.45*AMIN1(DR,DPH)/VELMX(L+2)                                FILM     717
      CALL ADV(1)                                                       FILM     718
      CALL VPLTBGD(2,L,XX1,YY1,XX2,YY2)                                 FILM     719
      DO 156 K=2,KB1                                                    FILM     720
      DO 156 I=2,IB1                                                    FILM     721
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                      FILM     722
      IF(FL(IJ).NE.1) GO TO 156                                         FILM     723
      XX1=(I-1.5)*DR                                                    FILM     724
      YY1=(K-1.5)*DPH                                                   FILM     725
      IMJ=IJ-1                                                          FILM     726
      IKM=IJ-IB2XJB2                                                    FILM     727
      GO TO (152,153),L                                                 FILM     728
  152 XX2=XX1+(UG(IMJ)+UG(IJ))*DROU                                     FILM     729
      YY2=YY1+(WG(IKM)+WG(IJ))*DROU                                     FILM     730
      GO TO 154                                                         FILM     731
  153 XX2=XX1+(UL(IMJ)+UL(IJ))*DROU                                     FILM     732
      YY2=YY1+(WL(IKM)+WL(IJ))*DROU                                     FILM     733
  154 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                 FILM     734
  156 CONTINUE                                                          FILM     735
  158 CONTINUE                                                          FILM     736
C                                                                       FILM     737
C     GENERATE JKPLOTS                                                  FILM     738
C                                                                       FILM     739
  159 CONTINUE                                                          FILM     740
      DO 650 M=1,5                                                      FILM     741
      I=JKPLOT(1,M)                                                     FILM     742
      IF(I.EQ.0) GO TO 650                                              FILM     743
      RADIUS=(FLOAT(I)-1.5)*DR                                          FILM     744
      IF(ITC.EQ.0) RADIUS=1.                                            FILM     745
      DO 650 L=1,2                                                      FILM     746
      IF(VELMX(L+4).LT.1.E-10) GO TO 650                                FILM     747
      DROU=.45*DZ/VELMX(L+4)                                            FILM     748
      CALL ADV(1)                                                       FILM     749
      CALL VPLTBGD(3,L,XX1,YY1,XX2,YY2)                                 FILM     750
      DO 640 J=2,JB1                                                    FILM     751
      DO 640 K=2,KB1                                                    FILM     752
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      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                      FILM     753
      IF(FL(IJ).NE.1) GO TO 640                                         FILM     754
      XX1=(FLOAT(K)-1.5)*DPH*RADIUS                                     FILM     755
      YY1=(FLOAT(J)-1.5)*DZ                                             FILM     756
      IJM=IJ-IB2                                                        FILM     757
      IKM=IJ-IB2XJB2                                                    FILM     758
      GO TO (625,630),L                                                 FILM     759
  625 XX2=XX1+(WG(IKM)+WG(IJ))*DROU                                     FILM     760
      YY2=YY1+(VG(IJM)+VG(IJ))*DROU                                     FILM     761
      GO TO 635                                                         FILM     762
  630 XX2=XX1+(WL(IKM)+WL(IJ))*DROU                                     FILM     763
      YY2=YY1+(VL(IJM)+VL(IJ))*DROU                                     FILM     764
  635 CALL VPLTBGD(4,L,XX1,YY1,XX2,YY2)                                 FILM     765
  640 CONTINUE                                                          FILM     766
  650 CONTINUE                                                          FILM     767
      RETURN                                                            FILM     768
      END                                                               FILM     769
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      SUBROUTINE VELS                                                   KFIXCC  2128
*CALL GCOM1                                                             KFIXCC  2130
*CALL GCOM2                                                             KFIXCC  2131
      DIMENSION CS(24)                                                  THREED   380
C                                                                       KFIXCC  2133
C     CALCULATES (12) VELOCITIES ON THE 6 BOUNDARIES OF THE CELL        THREED   381
C                                                                       KFIXCC  2135
      FLL=FL(IMJ)                                                       KFIXCC  2136
      IF(FLL.EQ.2.OR.FLL.EQ.3.OR.FLL.EQ.5) GO TO 1                      KFIXCC  2137
      THETL=0.5*(TH(IJ)+TH(IJL))                                        KFIXCC  2138
      DTKL=0.5*DT*(KDRAG(IJ)+KDRAG(IJL))                                KFIXCC  2139
      DTKEL=DTKL+0.5*DT*(ERATE(IJ)+ERATE(IJL))                          KFIXCC  2140
      DTKCL=DTKL+0.5*DT*(CRATE(IJ)+CRATE(IJL))                          KFIXCC  2141
      PGRAD=DTODR*(P(IJ)-P(IJL))                                        KFIXCC  2142
      RLL=0.5*(RLP(IJ)+RLP(IJL))                                        KFIXCC  2143
      RGL=0.5*(RGP(IJ)+RGP(IJL))                                        KFIXCC  2144
      CS(1)=RUL(IMJ)-(1.-THETL)*PGRAD                                   KFIXCC  2145
      CS(2)=RUG(IMJ)-THETL*PGRAD                                        KFIXCC  2146
      CS(3)=RLL+DTKEL                                                   KFIXCC  2147
      CS(4)=1.0/(RGL*CS(3)+DTKCL*RLL)                                   KFIXCC  2148
      UL(IMJ)=(CS(1)*(RGL+DTKCL)+DTKCL*CS(2))*CS(4)                     KFIXCC  2149
      UG(IMJ)=(CS(2)*CS(3)+DTKEL*CS(1))*CS(4)                           KFIXCC  2150
    1 FLB=FL(IJM)                                                       KFIXCC  2151
      IF(FLB.EQ.2.OR.FLB.EQ.3.OR.FLB.EQ.5) GO TO 5                      THREED   382
      THETB=0.5*(TH(IJ)+TH(IJB))                                        KFIXCC  2153
      DTKB=0.5*DT*(KDRAG(IJ)+KDRAG(IJB))                                KFIXCC  2154
      DTKEB=DTKB+0.5*DT*(ERATE(IJ)+ERATE(IJB))                          KFIXCC  2155
      DTKCB=DTKB+0.5*DT*(CRATE(IJ)+CRATE(IJB))                          KFIXCC  2156
      PGRAD=DTODZ*(P(IJ)-P(IJB))                                        KFIXCC  2157
      RLB=0.5*(RLP(IJ)+RLP(IJB))                                        KFIXCC  2158
      RGB=0.5*(RGP(IJ)+RGP(IJB))                                        KFIXCC  2159
      CS(5)=RVL(IJM)-(1.-THETB)*PGRAD                                   KFIXCC  2160
      CS(6)=RVG(IJM)-THETB*PGRAD                                        KFIXCC  2161
      CS(7)=RLB+DTKEB                                                   KFIXCC  2162
      CS(8)=1.0/(RGB*CS(7)+DTKCB*RLB)                                   KFIXCC  2163
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      VL(IJM)=(CS(5)*(RGB+DTKCB)+DTKCR*CS(6))*CS(8)                    KFIXCC  2164
      VG(IJM)=(CS(6)*CS(7)+DTKEB*CS(5))*CS(8)                          KFIXCC  2165
    5 FLF=FL(IKM)                                                      THREED   383
      IF(FLF.EQ.2.OR.FLF.EQ.3) GO TO 2                                 THREED   384
      THETF=0.5*(TH(IJ)+TH(IJF))                                       THREED   385
      DTKF=0.5*DT*(KDRAG(IJ)+KDRAG(IJF))                               THREED   386
      DTKEF=DTKF+0.5*DT*(ERATE(IJ)+ERATE(IJF))                         THREED   387
      DTKCF=DTKF+0.5*DT*(CRATE(IJ)+CRATE(IJF))                         THREED   388
      PGRAD=DTORDPH(I)*(P(IJ)-P(IJF))                                  THREED   389
      RLF=0.5*(RLP(IJ)+RLP(IJF))                                       THREED   390
      RGF=0.5*(RGP(IJ)+RGP(IJF))                                       THREED   391
      CS(21)=RWL(IKM)-(1.-THETF)*PGRAD                                 THREED   392
      CS(22)=RWG(IKM)-THETF*PGRAD                                      THREED   393
      CS(23)=RLF+DTKEF                                                 THREED   394
      CS(24)=1.0/(RGF+CS(23)+DTKCF*RLF)                                THREED   395
      WL(IKM)=(CS(21)*(RGF+DTKCF)+DTKCF*CS(22))*CS(24)                 THREED   396
      WG(IKM)=(CS(22)*CS(23)+DTKEF*CS(21))*CS(24)                      THREED   397
C                                                                      KFIXCC  2166
C                                                                      KFIXCC  2167
      ENTRY VEL52                                                      KFIXCC  2168
    2 FLR=FL(IPJ)                                                      KFIXCC  2169
      IF(FLR.EQ.2.OR.FLR.EQ.3) GO TO 3                                 KFIXCC  2170
      THETR=0.5*(TH(IJ)+TH(IJR))                                       KFIXCC  2171
      DTKR=0.5*DT*(KDRAG(IJ)+KDRAG(IJR))                               KFIXCC  2172
      DTKER=DTKR+0.5*DT*(ERATE(IJ)+ERATE(IJR))                         KFIXCC  2173
      DTKCR=DTKR+0.5*DT*(CRATE(IJ)+CRATE(IJR))                         KFIXCC  2174
      PGRAD=DTODR*(P(IJR)-P(IJ))                                       KFIXCC  2175
      RLR=0.5*(RLP(IJ)+RLP(IJR))                                       KFIXCC  2176
      RGR=0.5*(RGP(IJ)+RGP(IJR))                                       KFIXCC  2177
      CS(9)=RUL(IJ)-(1.-THETR)*PGRAD                                   KFIXCC  2178
      CS(10)=RUG(IJ)-THETR*PGRAD                                       KFIXCC  2179
      CS(11)=RLR+DTKER                                                 KFIXCC  2180
      CS(12)=1.0/(RGR*CS(11)+DTKCR*RLR)                                KFIXCC  2181
      UL(IJ)=(CS(9)*(RGR+DTKCR)+DTKCR*CS(10))*CS(12)                   KFIXCC  2182
      UG(IJ)=(CS(10)*CS(11)+DTKER*CS(9))*CS(12)                        KFIXCC  2183
    3 FLT=FL(IJP)                                                      KFIXCC  2184
      IF(FLT.EQ.2.OR.FLT.EQ.3) GO TO 4                                 THREED   398
      THETT=0.5*(TH(IJ)+TH(IJT))                                       KFIXCC  2185
      DTKT=0.5*DT*(KDRAG(IJ)+KDRAG(IJT))                               KFIXCC  2187
      DTKET=DTKT+0.5*DT*(ERATE(IJ)+ERATE(IJT))                         KFIXCC  2188
      DTKCT=DTKT+0.5*DT*(CRATE(IJ)+CRATE(IJT))                         KFIXCC  2189
      PGRAD=DTODZ*(P(IJT)-P(IJ))                                       KFIXCC  2190
      RLT=0.5*(RLP(IJ)+RLP(IJT))                                       KFIXCC  2191
      RGT=0.5*(RGP(IJ)+RGP(IJT))                                       KFIXCC  2192
      CS(13)=RVL(IJ)-(1.-THETT)*PGRAD                                  KFIXCC  2193
      CS(14)=RVG(IJ)-THETT*PGRAD                                       KFIXCC  2194
      CS(15)=RLT+DTKET                                                 KFIXCC  2195
      CS(16)=1.0/(RGT*CS(15)+DTKCT*RLT)                                KFIXCC  2196
      VL(IJ)=(CS(13)*(RGT+DTKCT)+DTKCT*CS(14))*CS(16)                  KFIXCC  2197
      VG(IJ)=(CS(14)*CS(15)+DTKET*CS(13))*CS(16)                       KFIXCC  2198
    4 FLA=FL(IKP)                                                      THREED   399
      IF(FLA.EQ.2.OR.FLA.EQ.3) RETURN                                  THREED   400
      THETA=0.5*(TH(IJ)+TH(IJA))                                       THREED   401
      DTKA=0.5*DT*(KDRAG(IJ)+KDRAG(IJA))                               THREED   402
      DTKEA=DTKA+0.5*DT*(ERATE(IJ)+ERATE(IJA))                         THREED   403
      DTKCA=DTKA+0.5*DT*(CRATE(IJ)+CRATE(IJA))                         THREED   404
      PGRAD=DTORDPH(I)*(P(IJA)-P(IJ))                                  THREED   405
      RLA=0.5*(RLP(IJ)+RLP(IJA))                                       THREED   406
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      RGA=0.5*(RGP(IJ)+RGP(IJA))                                          THREED   407
      CS(17)=RWL(IJ)-(1.-THETA)*PGRAD                                     THREED   408
      CS(18)=RWG(IJ)-THETA*PGRAD                                          THREED   409
      CS(19)=RLA+DTKEA                                                    THREED   410
      CS(20)=1.0/(RGA*CS(19)+DTKCA*RLA)                                   THREED   411
      WL(IJ)=(CS(17)*(RGA+DTKCA)+DTKCA*CS(18))*CS(20)                     THREED   412
      WG(IJ)=(CS(18)*CS(19)+DTKEA*CS(17))*CS(20)                          THREED   413
      RETURN                                                              KFIXCC  2199
      END                                                                 KFIXCC  2200

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      SUBROUTINE VGMOMF                                                   KFIXCC  2201
*CALL GCOM1                                                               KFIXCC  2202
*CALL GCOM2                                                               KFIXCC  2203
      DIMENSION CS(6)                                                     THREED   414
C                                                                         KFIXCC  2205
C     CALCULATES FLUXES OF AXIAL MOMENTUM FOR THE GAS                     KFIXCC  2206
C                                                                         KFIXCC  2207
      CS(1)=0.5*(VG(IJ)+VG(IJP))                                          KFIXCC  2208
      IF(CS(1).GE.0.) VGFT=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(1)            KFIXCC  2209
      IF(CS(1).LT.0.) VGFT=0.5*(RGP(IJT)+RGP(IJTT))*VG(IJP)*CS(1)         KFIXCC  2210
      CS(2)=0.5*(UG(IJ)+UG(IJP))                                          KFIXCC  2211
      IF(CS(2).GE.0.) VGFR=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(2)*RB(I)      KFIXCC  2212
      IF(CS(2).LT.0.) VGFR=0.5*(RGP(IJR)+RGP(IJTR))*VG(IPJ)*CS(2)*RB(I)   KFIXCC  2213
      CS(5)=0.5*(WG(IJ)+WG(IJP))                                          THREED   415
      IF(CS(5).GE.0.) VGFA=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(5)            THREED   416
      IF(CS(5).LT.0.) VGFA=0.5*(RGP(IJA)+RGP(IJTA))*VG(IKP)*CS(5)         THREED   417
      IF(FL(IMJ).NE.1) GO TO 1                                            KFIXCC  2214
      IF(FL(IJM).NE.1) GO TO 2                                            KFIXCC  2215
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   418
      RETURN                                                              INVIS    11
    1 CS(3)=0.5*(UG(IMJ)+UG(IMJP))                                        KFIXCC  2218
      IF(CS(3).GE.0.)VGFL=0.5*(RGP(IJL)+RGP(IJTL))*VG(IMJ)*CS(3)*RB(I-1)  KFIXCC  2219
      IF(CS(3).LT.0.) VGFL=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(3)*RB(I-1)    KFIXCC  2220
      IF(FL(IJM).NE.1)GOTO2                                               KFIXCC  2221
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   419
      RETURN                                                              INVIS    12
    2 CS(4)=0.5*(VG(IJM)+VG(IJ))                                          KFIXCC  2224
      IF(CS(4).GE.0.) VGFB(I)=0.5*(RGP(IJ)+RGP(IJB))*VG(IJM)*CS(4)        KFIXCC  2225
      IF(CS(4).LT.0.) VGFB(I)=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(4)         KFIXCC  2226
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   420
      RETURN                                                              KFIXCC  2232
    3 CS(6)=0.5*(WG(IKM)+WG(JPKM))                                        THREED   421
      IF(CS(6).GE.0.) VGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJTF))*VG(IKM)*CS(6)    THREED   422
      IF(CS(6).LT.0.) VGFF(ICJ)=0.5*(RGP(IJ)+RGP(IJT))*VG(IJ)*CS(6)       THREED   423
      RETURN                                                              THREED   424
      END                                                                 KFIXCC  2233

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      SUBROUTINE VISC                                                     KFIXCC  2261
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*CALL GCOM1                                                          KFIXCC   2262
*CALL GCOM2                                                          KFIXCC   2263
C                                                                    KFIXCC   2264
C     CALCULATE SHEAR VISCOSITIES FOR THE LIQUID AND GAS             KFIXCC   2265
C                                                                    KFIXCC   2266
      RETURN                                                         KFIXCC   2267
      END                                                            KFIXCC   2268
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      SUBROUTINE VLMOMF                                              KFIXCC   2269
*CALL GCOM1                                                          KFIXCC   2270
*CALL GCOM2                                                          KFIXCC   2271
      DIMENSION CS(6)                                                THREED    425
C                                                                    KFIXCC   2273
C     CALCULATES FLUXES OF AXIAL MOMENTUM FOR THE LIQUID             KFIXCC   2274
C                                                                    KFIXCC   2275
      CS(1)=0.5*(VL(IJ)+VL(IJF))                                     KFIXCC   2276
      IF(CS(1).GE.0.) VLFT=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(1)       KFIXCC   2277
      IF(CS(1).LT.0.) VLFT=0.5*(RLP(IJT)+RLP(IJTT))*VL(IJP)*CS(1)    KFIXCC   2278
      CS(2)=0.5*(UL(IJ)+UL(IJP))                                     KFIXCC   2279
      IF(CS(2).GE.0.) VLFR=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(2)*RB(I) KFIXCC   2280
      IF(CS(2).LT.0.) VLFR=0.5*(RLP(IJR)+RLP(IJTR))*VL(IPJ)*CS(2)*RB(I) KFIXCC 2281
      CS(5)=0.5*(WL(IJ)+WL(IJP))                                     THREED    426
      IF(CS(5).GE.0.) VLFA=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(5)       THREED    427
      IF(CS(5).LT.0.) VLFA=0.5*(RLP(IJA)+RLP(IJTA) *VL(IKP)*CS(5)    THREED    428
      IF(FL(IMJ).NE.1) GO TO 1                                       KFIXCC   2282
      IF(FL(IJM).NE.1) GO TO 2                                       KFIXCC   2283
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                             THREED    429
      RETURN                                                         INVIS      13
    1 CS(3)=0.5*(UL(IMJ)+UL(IMJP))                                   KFIXCC   2286
      IF(CS(3).GE.0.)VLFL=0.5*(RLP(IJL)+RLP(IJTL))*VL(IMJ)*CS(3)*RB(I-1) KFIXCC 2287
      IF(CS(3).LT.0.)VLFL=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(3)*RB(I-1) KFIXCC   2288
      IF(FL(IJM).NE.1)GOTO2                                          KFIXCC   2289
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                             THREED    430
      RETURN                                                         INVIS      14
    2 CS(4)=0.5*(VL(IJM)+VL(IJ))                                     KFIXCC   2292
      IF(CS(4).GE.0.) VLFB(I)= 0.5*(RLP(IJ)+RLP(IJB))*VL(IJM)*CS(4)  KFIXCC   2293
      IF(CS(4).LT.0.) VLFB(I)= 0.5*(RLP(IJ)+RLP(IJT))*VL(IJ )*CS(4)  KFIXCC   2294
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                             THREED    431
      RETURN                                                         KFIXCC   2300
    3 CS(6)=0.5*(WL(IKM)+WL(JPKM))                                   THREED    432
      IF(CS(6).GE.0.) VLFF(ICJ)=0.5*(RLP(IJF)+RLP(IJTF))*VL(IKM)*CS(6) THREED  433
      IF(CS(6).LT.0.) VLFF(ICJ)=0.5*(RLP(IJ)+RLP(IJT))*VL(IJ)*CS(6)  THREED    434
      RETURN                                                         THREED    435
      END                                                            KFIXCC   2301
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      SUBROUTINE VPLOT(KKK,L,XX1,YY1,XX2,YY2)                        FILM      770
*CALL GCOM1                                                          FILM      771
*CALL GCOM2                                                          FILM      772
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```
      DIMENSION KFLO(16),KOB(4,20)                                          KFIXCC  2332
      DIMENSION TYPE(3)                                                     KFIXCC  2333
      DATA TYPE / 3LGAS,6LLIQUID,7LMIXTURE /                                KFIXCC  2334
C      K=0 CONVERT GRID,K=1 PLOTS GRID,K=2 CONVERTS AND PLOTS VECTORS       KFIXCC  2335
      DIMENSION IXY(4),XY(4)                                                KFIXCC  2336
      DATA (IXY(I),I=1,4) / 100,900,100,900 /                               KFIXCC  2337
      DIMENSION JX(20),JY(20),CS(8)                                         FILM     771
      KK=KKK+1                                                              FILM     772
      GO TO (10,100,290),KK                                                 FILM     773
   10 IYB=916                                                               KFIXCC  2340
      XL=0                                                                  KFIXCC  2341
      XR=IB*DR                                                              KFIXCC  2342
      YT=JB*DZ                                                              KFIXCC  2343
      YB=0.                                                                 KFIXCC  2344
      IF (XR.LE.1.13556*YT) GO TO 20                                        KFIXCC  2345
      IXL=0                                                                 KFIXCC  2346
      IXR=1022                                                              KFIXCC  2347
      IYT=916-YT*1022./XR                                                   KFIXCC  2348
      GO TO 30                                                              KFIXCC  2349
   20 X=XR*450/YT                                                           KFIXCC  2350
      IXL=511-X                                                             KFIXCC  2351
      IXR=511+X                                                             KFIXCC  2352
      IYT=16                                                                KFIXCC  2353
C     CONVERTS GRID TO 4020 COORDINATES---K=0                               KFIXCC  2354
   30 CONTINUE                                                              KFIXCC  2355
      DO 50 J=1,16                                                          KFIXCC  2356
      IF(J.LE.4) GO TO40                                                    KFIXCC  2357
      IF(J.GE.9.AND.J.LE.12) GO TO 40                                       KFIXCC  2358
      CALL CONVRT (FLO(J),KFLO(J),YB,YT,IYB,IYT)                            KFIXCC  2359
      GO TO 50                                                              KFIXCC  2360
   40 CALL CONVRT (FLO(J),KFLO(J),XL,XR,IXL,IXR)                            KFIXCC  2361
   50 CONTINUE                                                              KFIXCC  2362
      IF (NO.LE.0) RETURN                                                   KFIXCC  2363
      DO 90 N=1,NO                                                          KFIXCC  2364
      DO 60 J=1,2                                                           KFIXCC  2365
   60 CALL CONVRT (OB(J,N),KOB(J,N),XL,XR,IXL,IXR)                          KFIXCC  2366
      DO 70 J=3,4                                                           KFIXCC  2367
   70 CALL CONVRT (OB(J,N),KOB(J,N),YB,YT,IYB,IYT)                          KFIXCC  2368
   90 CONTINUE                                                              KFIXCC  2369
      RETURN                                                                KFIXCC  2370
C     PLOTS GRID USING DRV---K=1                                            KFIXCC  2371
  100 CONTINUE                                                              KFIXCC  2372
      CALL ADV (1)                                                          KFIXCC  2373
      NGR=0                                                                 KFIXCC  2374
      IF (LPR.LE.0) GO TO 110                                               KFIXCC  2375
      CALL LINCNT (60)                                                      KFIXCC  2376
      DANGLE=DPH*(FLOAT(K)-1.5)                                             FILM     774
      WRITE(12,310) JNM,NAME,TIME,CYCLE                                     FILM     775
      WRITE(12,300) TYPE(L),DANGLE                                          FILM     776
  110 CONTINUE                                                              KFIXCC  2379
      GO TO (280,115,280,280,280,280),KK                                    FILM     777
  115 CONTINUE                                                              KFIXCC  2381
      PTE=DPH*(FLOAT(K)-1.5)                                                FILM     778
      IF (FLO(2).LE.FLO(1)) GO TO 130                                       KFIXCC  2382
      CALL DRV(IXL,IYB,KFLO(1),IYB)                                         KFIXCC  2383
      IF(PTE.LT.FLOA(1).OR.PTE.GT.FLOA(2)) CALL DRV(KFLO(1),IYB,KFLO(2),    FILM     779
     1 IYB)                                                                 FILM     780
      IF (FLO(3).LE.FLO(2)) GO TO 120                                       KFIXCC  2384
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      CALL DRV(KFLO(2),IYB,KFLO(3),IYB)                                  KFIXCC  2385
      IF(PTE.LT.FLOA(3).OR.PTE.GT.FLOA(4)) CALL DRV(KFLO(3),IYB,KFLO(4), FILM   781
     1 IYB)                                                              FILM   782
      CALL DRV(KF  (4),IYB,IX?,IYB)                                      KFIXCC  2386
      GO TO 140                                                          KFIXCC  2387
  120 CALL DRV(KFLO(2),IYB,IXR,IYB)                                      KFIXCC  2388
      GO TO 140                                                          KFIXCC  2389
  130 CALL DRV(IXL,IYB,IXR,IYB)                                          KFIXCC  2390
  140 IF (FLO(6).LE.FLO(5)) GO TO 150                                    KFIXCC  2391
      CALL DRV(IXL,IYB,IXL,KFLO(5))                                      KFIXCC  2392
      IF(PTE.LT.FLOA(5).OR.PTE.GT.FLOA(6)) CALL DRV(IXL,KFLO(5),IXL,      LM   783
     1 KFLO(6))                                                          ,.   784
      IF (FLO(7).LE.FLO(6)) GO TO 150                                    KFIXCC  2393
      CALL DRV(IXL,KFLO(6),IXL,KFLO(7))                                  KFIXCC  2394
      IF(PTE.LT.FLOA(7).OR.PTE.GT.FLOA(8)) CALL DRV(IXL,KFLO(7),IXL,     FILM   785
     1 KFLO(8))                                                          FILM   786
      CALL DRV(IXL,KFLO(8),IXL,IYT)                                      KFIXCC  2395
      GO TO 170                                                          KFIXCC  2396
  150 CALL DRV(IXL,KFLO(6),IXL,IYT)                                      KFIXCC  2397
      GO TO 170                                                          KFIXCC  2398
  160 CALL DRV(IXL,IYB,IXL,IYT)                                          KFIXCC  2399
  170 IF (FLO(10).LE.FLO(9)) GO TO 190                                   KFIXCC  2400
      CALL DRV(IXL,IYT,KFLO(9),IYT)                                      KFIXCC  2401
      IF(PTE.LT.FLOA(9).OR.PTE.GT.FLOA(10)) CALL DRV(KFLO(9),IYT,        FILM   787
     1 KFLO(10),IYT)                                                     FILM   788
      IF (FLO(11).LE.FLO(10)) GO TO 180                                  KFIXCC  2402
      CALL DRV(KFLO(10),IYT,KFLO(11),IYT)                                KFIXCC  2403
      IF(PTE.LT.FLOA(11).OR.PTE.GT.FLOA(12)) CALL DRV(KFLO(11),IYT,      FILM   789
     1 KFLO(12),IYT)                                                     FILM   790
      CALL DRV(KFLO(12),IYT,IXR,IYT)                                     KFIXCC  2404
      GO TO 200                                                          KFIXCC  2405
  180 CALL DRV(KFLO(10),IYT,IXR,IYT)                                     KFIXCC  2406
      GO TO 200                                                          KFIXCC  2407
  190 CALL DRV(IXL,IYT,IXR,IYT)                                          KFIXCC  2408
  200 IF(FLO(14).LE.FLO(13)) GO TO 206                                   KFIXCC  2409
      CALL DRV(IXR,IYB,IXR,KFLO(13))                                     KFIXCC  2410
      IF(PTE.LT.FLOA(13).OR.PTE.GT.FLOA(14)) CALL DRV(IXR,KFLO(13),      FILM   791
     1 IXR,KFLO(14))                                                     FILM   792
      IF(FLO(15).LE.FLO(14)) GO TO 204                                   KFIXCC  2411
      CALL DRV(IXR,KFLO(14),IXR,KFLO(15))                                KFIXCC  2412
      IF(PTE.LT.FLOA(15).OR.PTE.GT.FLOA(16)) CALL DRV(IXR,KFLO(15),      FILM   793
     1 IXR,KFLO(16))                                                     FILM   794
      CALL DRV(IXR,KFLO(16),IXR,IYT)                                     KFIXCC  2413
      GO TO 208                                                          KFIXCC  2414
  204 CALL DRV(IXR,KFLO(14),IXR,IYT)                                     KFIXCC  2415
      GO TO 208                                                          KFIXCC  2416
  206 CALL DRV(IXR,IYB,IXR,IYT)                                          KFIXCC  2417
  208 CONTINUE                                                           KFIXCC  2418
      IF (NO.LE.0) RETURN                                                KFIXCC  2419
      DO 270 N=1,NO                                                      KFIXCC  2420
      KX1=KOB(1,N)                                                       KFIXCC  2421
      KX2=KOB(2,N)                                                       KFIXCC  2422
      KY1=KOB(3,N)                                                       KFIXCC  2423
      KY2=KOB(4,N)                                                       KFIXCC  2424
      IF(PTE.LT.OB(5,N).OR.PTE.GT.OB(6,N)) GO TO 270                     FILM   795
      CALL DRV (KX1,KY1,K  1,KY2)                                        KFIXCC  2425
      CALL DRV (KX1,KY2,KX2,KY2)                                         KFIXCC  2426
      CALL DRV(KX1,KY1,KX2,KY1)                                          KFIXCC  2427
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      CALL DRV(KX2,KY1,KX2,KY2)                                          KFIXCC  2428
  270 CONTINUE                                                           KFIXCC  2429
      IF (NGR.EQ.1) GO TO 280                                            KFIXCC  2430
      NGR=1                                                              KFIXCC  2431
      GO TO 110                                                          KFIXCC  2432
  280 CONTINUE                                                           KFIXCC  2433
      RETURN                                                             KFIXCC  2434
C     CONVERTS AND PLOTS VEL.VECTORS FOR EACH REAL CELL---K=2            KFIXCC  2435
  290 CONTINUE                                                           KFIXCC  2436
      CALL CONVRT (XX1,IX1,XL,XR,IXL,IXR)                                KFIXCC  2437
      CALL CONVRT (XX2,IX2,XL,XR,IXL,IXR)                                KFIXCC  2438
      CALL CONVRT (YY1,IY1,YB,YT,IYB,IYT)                                KFIXCC  2439
      CALL CONVRT (YY2,IY2,YB,YT,IYB,IYT)                                KFIXCC  2440
      CALL DRV (IX1,IY1,IX2,IY2)                                         KFIXCC  2441
      RETURN                                                             KFIXCC  2442
  800 CONTINUE                                                           KFIXCC  2443
      IF(JB2.EQ.3) GO TO 820                                             KFIXCC  2444
      I=2                                                                KFIXCC  2445
      NP=JB                                                              KFIXCC  2446
      DO 810 J=2,JB1                                                     KFIXCC  2447
      ZA(J)=DZ*(FLOAT(J)-1.0)                                            KFIXCC  2448
      IF(L.EQ.1) ZB(J)=VG(I,J)                                           KFIXCC  2449
      IF(L.EQ.2) ZB(J)=VL(I,J)                                           KFIXCC  2450
  810 CONTINUE                                                           KFIXCC  2451
      GO TO 840                                                          KFIXCC  2452
  820 J=2                                                                KFIXCC  2453
      NP=IB                                                              KFIXCC  2454
      DO 830 I=2,IB1                                                     KFIXCC  2455
      ZA(I)=DR*(FLOAT(I)-1.0)                                            KFIXCC  2456
      IF(L.EQ.1) ZB(I)=UG(I,J)                                           KFIXCC  2457
      IF(L.EQ.2) ZB(I)=UL(I,J)                                           KFIXCC  2458
  830 CONTINUE                                                           KFIXCC  2459
  840 CONTINUE                                                           FILM     796
      RETURN                                                             KFIXCC  2461
C                                                                        KFIXCC  2462
  300 FORMAT(4X,25H VELOCITY VECTOR PLOT FOR ,A10,                       FILM     797
     129H      AZIMUTHAL ANGLE(DEPTH) =,1PE12.5)                         FILM     798
  310 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                  FILM     799
      END                                                                KFIXCC  2465
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      SUBROUTINE VPLTBGD(KKK,L,XX1,YY1,XX2,YY2)                          FILM     800
*CALL GCOM1                                                              FILM     801
*CALL GCOM2                                                              FILM     802
      DIMENSION CS(10),TYPE(3),JX(20),JY(20)                             FILM     803
      DATA TYPE / 3HGAS, 6HLIQUID, 7HMIXTURE /                           FILM     804
      GO TO (850,900,600,1000),KKK                                       FILM     805
  600 CONTINUE                                                           FILM     806
      IYB=916                                                            FILM     807
      XL=0.                                                              FILM     808
      DIST=DR*(FLOAT(I)-1.5)                                             FILM     809
      RADIUS=DIST                                                        FILM     810
      IF(ITC.EQ.0) RADIUS=1.                                             FILM     811
      XR=KB*DPH*RADIUS                                                   FILM     812
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      YT=JB*DZ                                                                  FILM     813
      YB=0.                                                                     FILM     814
      IF(XR.LE.1.13556*YT) GO TO 620                                            FILM     815
      IXL=0                                                                     FILM     816
      IXR=1022                                                                  FILM     817
      IYT=916-YT*1022/XR                                                        FILM     818
      GO TO 630                                                                 FILM     819
  620 X=XR*450/YT                                                               FILM     820
      IXL=511-X                                                                 FILM     821
      IXR=511+X                                                                 FILM     822
      IYT=16                                                                    FILM     823
  630 CONTINUE                                                                  FILM     824
      CALL ADV(1)                                                               FILM     825
      IF(LPR.LE.0) GO TO 640                                                    FILM     826
      CALL LINCNT(60)                                                           FILM     827
      WRITE(12,310) JNM,NAME,TIME,CYCLE                                         FILM     828
      WRITE(12,325) TYPE(L),DIST                                                FILM     829
  640 CONTINUE                                                                  FILM     830
      DO 665 J=2,JB2                                                            FILM     931
      DO 660 K=2,KB2                                                            FILM     832
      IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                              FILM     833
      IJM=IJ-IB2                                                                FILM     834
      IKM=IJ-IB2XJB2                                                            FILM     835
      IF(FL(IKM).EQ.0) GO TO 650                                                FILM     836
      IF(K.EQ.2.OR.K.EQ.KB2) GO TO 645                                          FILM     837
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3))       FILM     838
     1 GO TO 645                                                                FILM     839
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3)       FILM     840
     1 GO TO 645                                                                FILM     841
      GO TO 650                                                                 FILM     842
  645 XX3=DPH*RADIUS*(FLOAT(K)-2.)                                              FILM     843
      YY3=DZ*(FLOAT(J)-2.)                                                      FILM     844
      YY4=YY3+DZ                                                                FILM     845
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                        FILM     846
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                        FILM     847
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                                        FILM     848
      CALL DRV(IX1,IY1,IX1,IY2)                                                 FILM     849
  650 CONTINUE                                                                  FILM     850
      IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IJM).NE.2.AND.FL(IJM).NE.3)        FILM     851
     1 GO TO 655                                                                FILM     852
      IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3))       FILM     853
     1 GO TO 655                                                                FILM     854
      IF(J.EQ.2.AND.(FL(IJM).EQ.2.OR.FL(IJM).EQ.3)) GO TO 655                   FILM     855
      IF(J.EQ.JB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 655                   FILM     856
      GO TO 660                                                                 FILM     857
  655 XX3=DPH*RADIUS*(FLOAT(K)-2.)                                              FILM     858
      YY3=DZ*(FLOAT(J)-2.)                                                      FILM     859
      XX4=XX3+DPH*RADIUS                                                        FILM     860
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                        FILM     861
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                        FILM     862
      CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                        FILM     863
      CALL DRV(IX1,IY1,IX2,IY1)                                                 FILM     864
  660 CONTINUE                                                                  FILM     865
  665 CONTINUE                                                                  FILM     866
      RETURN                                                                    FILM     867
C                                                                               FILM     868
C     GENERATE GRID FOR CYLINDRICAL IKPLOT                                      FILM     869
C                                                                               FILM     870
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850 CONTINUE                                                                    FILM     871
    IF(LPR.LE.0) GO TO 860                                                      FILM     872
    CALL LINCNT(60)                                                             FILM     873
    HEIGHT=DZ*(FLOAT(J)-1.5)                                                    FILM     874
    WRITE(12,310) JNM,NAME,TIME,CYCLE                                           FILM     875
    WRITE(12,320) TYPE(L),HEIGHT                                                FILM     876
860 CONTINUE                                                                    FILM     877
    XR=RB(IB1)                                                                  FILM     878
    XL=-XR                                                                      FILM     879
    YT=XR                                                                       FILM     880
    YB=-XR                                                                      FILM     881
    IXL=61                                                                      FILM     882
    IXR=961                                                                     FILM     883
    IYT=31                                                                      FILM     884
    IYB=931                                                                     FILM     885
    DO 19 II=1,IB1                                                              FILM     886
    X1=RB(II)                                                                   FILM     887
    CALL CONVRT(X1,IX,XL,XR,IXL,IXR)                                            FILM     888
    JX(II)=IX                                                                   FILM     889
    JY(II)=481                                                                  FILM     890
 19 CONTINUE                                                                    FILM     891
    IF(FL(1).EQ.2.OR.FL(1).EQ.3) CALL DRV(JX(1),JY(1),JX(IB1),JY(IB1))          FILM     892
    NANG=DPH/0.08726646 + .5                                                    FILM     893
    DPHN=DPH/FLOAT(NANG)                                                        FILM     894
    CS(1)=SIN(DPHN)                                                             FILM     895
    CS(2)=COS(DPHN)                                                             FILM     896
    CS(3)=0.                                                                    FILM     897
    CS(4)=1.                                                                    FILM     898
    DO 26 KK=2,KB1                                                              FILM     899
    DO 24 N=1,NANG                                                              FILM     900
    CS(6)=CS(2)*CS(3)+CS(1)*CS(4)                                               FILM     901
    CS(7)=CS(2)*CS(4)-CS(1)*CS(3)                                               FILM     902
    CS(3)=CS(6)                                                                 FILM     903
    CS(4)=CS(7)                                                                 FILM     904
    DO 22 II=1,IB1                                                              FILM     905
    CS(8)=RB(II)                                                                FILM     906
    CS(6)=CS(3)*CS(8)                                                           FILM     907
    CS(7)=CS(4)*CS(8)                                                           FILM     908
    CALL CONVRT(CS(7),IX,XL,XR,IXL,IXR)                                         FILM     909
    CALL CONVRT(CS(6),IY,YB,YT,IYB,IYT)                                         FILM     910
    IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                              FILM     911
    IPJ=IJ+1                                                                    FILM     912
    IF(II.EQ.IB1.AND.FL(IPJ).LT.4) GO TO 27                                     FILM     913
    IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IPJ).NE.2.AND.FL(IPJ).NE.3)          FILM     914
   1 GO TO 27                                                                   FILM     915
    IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IPJ).EQ.2.OR.FL(IPJ).EQ.3))          FILM     916
   1 GO TO 27                                                                   FILM     917
    GO TO 21                                                                    FILM     918
 27 CALL DRV(JX(II),JY(II),IX,IY)                                               FILM     919
 21 JX(II)=IX                                                                   FILM     920
    JY(II)=IY                                                                   FILM     921
 22 CONTINUE                                                                    FILM     922
 24 CONTINUE                                                                    FILM     923
    DO 25 II=2,IB1                                                              FILM     924
    IJ=II+(J-1)*IB2+(KK-1)*IB2XJB2                                              FILM     925
    IKP=IJ+IB2XJB2                                                              FILM     926
    IF(FL(IKP).EQ.0) GO TO 25                                                   FILM     927
    IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND FL(IKP).NE.2.AND.FL(IKP).NE.3)          FILM     928
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```
     1 GO TO 23                                                                    FILM      929
       IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3)) FILM      930
     1 GO TO 23                                                                    FILM      931
       IF(KK.EQ.KB1.AND.(FL(IKP).EQ.2.OR.FL(IKP).EQ.3))GO TO 23                    FILM      932
       GO TO 25                                                                    FILM      933
    23 CALL DRV(JX(II-1),JY(II-1),JX(II),JY(II))                                   FILM      934
    25 CONTINUE                                                                    FILM      935
    26 CONTINUE                                                                    FILM      936
       RETURN                                                                      FILM      937
C                                                                                  FILM      938
C      GENERATE BACKGROUND FOR CARTESIAN IKPLOTS                                   FILM      939
C                                                                                  FILM      940
   900 CONTINUE                                                                    FILM      941
       IYB=916                                                                     FILM      942
       XL=0.                                                                       FILM      943
       XR=IB*DR                                                                    FILM      944
       YT=KB*DPH                                                                   FILM      945
       YB=0.                                                                       FILM      946
       IF(XR.LE.1.13556*YT) GO TO 920                                              FILM      947
       IXL=0                                                                       FILM      948
       IXR=1022                                                                    FILM      949
       IYT=916-YT*1022/XR                                                          FILM      950
       GO TO 930                                                                   FILM      951
   920 X=XR*450/YT                                                                 FILM      952
       IXL=511-X                                                                   FILM      953
       IXR=511+X                                                                   FILM      954
       IYT=16                                                                      FILM      955
   930 CONTINUE                                                                    FILM      956
       IF(LPR.LE.0) GO TO 940                                                      FILM      957
       CALL ADV(1)                                                                 FILM      958
       HEIGHT=DZ*(FLOAT(J)-1.5)                                                    FILM      959
       CALL LINCNT(60)                                                             FILM      960
       WRITE(12,310) JNM,NAME,TIME,CYCLE                                           FILM      961
       WRITE(12,320) TYPE(L),HEIGHT                                                FILM      962
   940 CONTINUE                                                                    FILM      963
       DO 960 K=2,KB2                                                              FILM      964
       DO 960 I=2,IB2                                                              FILM      965
       IJ=I+(J-1)*IB2+(K-1)*IB2XJB2                                                FILM      966
       IMJ=IJ-1                                                                    FILM      967
       IKM=IJ-IB2XJB2                                                              FILM      968
       IF(K.EQ.2.OR.K.EQ.KB2) GO TO 945                                            FILM      969
       IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IKM).EQ.2.OR.FL(IKM).EQ.3)) FILM      970
     1 GO TO 945                                                                   FILM      971
       IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IKM).NE.2.AND.FL(IKM).NE.3) FILM      972
     1 GO TO 945                                                                   FILM      973
       GO TO 950                                                                   FILM      974
   945 XX3=DR*FLOAT(I-2)                                                           FILM      975
       YY3=DPH*FLOAT(K-2)                                                          FILM      976
       XX4=XX3+DR                                                                  FILM      977
       CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                                          FILM      978
       CALL CONVRT(XX4,IX2,XL,XR,IXL,IXR)                                          FILM      979
       CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                                          FILM      980
       CALL DRV(IX1,IY1,IX2,IY1)                                                   FILM      981
   950 CONTINUE                                                                    FILM      982
       IF((FL(IJ).EQ.2.OR.FL(IJ).EQ.3).AND.FL(IMJ).NE.2.AND.FL(IMJ).NE.3) FILM      983
     1 GO TO 955                                                                   FILM      984
       IF(FL(IJ).NE.2.AND.FL(IJ).NE.3.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) FILM      985
     1 GO TO 955                                                                   FILM      986
```

```
      IF(I.EQ.2.AND.(FL(IMJ).EQ.2.OR.FL(IMJ).EQ.3)) GO TO 955          FILM     987
      IF(I.EQ.IB2.AND.(FL(IJ).EQ.2.OR.FL(IJ).EQ.3)) GO TO 955          FILM     988
      GO TO 960                                                        FILM     989
  955 XX3=DR*FLOAT(I-2)                                                FILM     990
      YY3=DPH*FLOAT(K-2)                                               FILM     991
      YY4=YY3+DPH                                                      FILM     992
      CALL CONVRT(XX3,IX1,XL,XR,IXL,IXR)                               FILM     993
      CALL CONVRT(YY3,IY1,YB,YT,IYB,IYT)                               FILM     994
      CALL CONVRT(YY4,IY2,YB,YT,IYB,IYT)                               FILM     995
      CALL DRV(IX1,IY1,IX1,IY2)                                        FILM     996
  960 CONTINUE                                                         FILM     997
      RETURN                                                           FILM     998
C                                                                      FILM     999
C     DRAW VECTORS                                                     FILM    1000
 1000 CONTINUE                                                         FILM    1001
      CALL CONVRT(XX1,IX1,XL,XR,IXL,IXR)                               FILM    1002
      CALL CONVRT(XX2,IX2,XL,XR,IXL,IXR)                               FILM    1003
      CALL CONVRT(YY1,IY1,YB,YT,IYB,IYT)                               FILM    1004
      CALL CONVRT(YY2,IY2,YB,YT,IYB,IYT)                               FILM    1005
      CALL DRV(IX1,IY1,IX2,IY2)                                        FILM    1006
      RETURN                                                           FILM    1007
  310 FORMAT(4X,A10,2X,10A8,3H T=,1PE12.5,7H CYCLE=,I5)                FILM    1008
  320 FORMAT(4X,25H VELOCITY VECTOR PLOT FOR ,A10,13H     HEIGHT = ,   FILM    1009
     1 1PE12.5)                                                        FILM    1010
  325 FORMAT(4X,26H VELOCITY VECTOR PLOT FOR ,A10,13H     RADIUS = ,   FILM    1011
     1 1PE12.5)                                                        FILM    1012
      END                                                              FILM    1013
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      SUBROUTINE VRELS                                                 KFIXCC   2466
*CALL GCOM1                                                            KFIXCC   2467
*CALL GCOM2                                                            KFIXCC   2468
C                                                                      KFIXCC   2469
C     CALCULATE  RELATIVE VELOCITY BETWEEN FIELDS                      KFIXCC   2470
C                                                                      KFIXCC   2471
      DIMENSION CS(3)                                                  HREED    436
      CS(1)=0.5*(UG(IJ)+UG(IMJ)-UL(IJ)-UL(IMJ))                        KFIXCC   2473
      CS(2)=0.5*(VG(IJ)+VG(IJM)-VL(IJ)-VL(IJM))                        KFIXCC   2474
      CS(3)=0.5*(WG(IJ)+WG(IKM)-WL(IJ)-WL(IKM))                        THREED   437
      VREL=SQRT(CS(1)**2+CS(2)**2+CS(3)**2)                            THREED   438
      RETURN                                                           KFIXCC   2476
C     CS(1)= R COMPONENT OF RELATIVE VELOCITY                          KFIXCC   2477
C     CS(2)= Z COMPONENT OF RELATIVE VELOCITY                          KFIXCC   2478
C     CS(3)= PHI COMPONENT OF RELATIVE VELOCITY                        THREED   439
      END                                                              KFIXCC   2479
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      SUBROUTINE WGMOMF                                                THREED   440
*CALL GCOM1                                                            THREED   441
*CALL GCOM2                                                            THREED   442
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      DIMENSION CS(6)                                                    THREED   443
      CS(1)=0.5*(WG(IJ)+WG(IKP))                                         THREED   444
      IF(CS(1).GE.0.) WGFA=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(1)           THREED   445
      IF(CS(1).LT.0.) WGFA=0.5*(RGP(IJAA)+RGP(IJA))*WG(IKP)*CS(1)        THREED   446
      CS(2)=0.5*(VG(IJ)+VG(IKP))                                         THREED   447
      IF(CS(2).GE.0.) WGFT=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(2)           THREED   448
      IF(CS(2).LT.0.) WGFT=0.5*(RGP(IJT)+RGP(IJTA))*WG(IJP)*CS(2)        THREED   449
      CS(3)=0.5*(UG(IJ)+UG(IKP))                                         THREED   450
      IF(CS(3).GE.0.) WGFR=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(3)*RB(I)     THREED   451
      IF(CS(3).LT.0.) WGFR=0.5*(RGP(IJR)+RGP(IJAR))*WG(IPJ)*CS(3)*RB(I)  THREED   452
      IF(FL(IMJ).NE.1) GO TO 1                                           THREED   453
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   454
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   455
      RETURN                                                             THREED   456
    1 CS(4)=0.5*(UG(IMJ)+UG(IMKP))                                       THREED   457
      IF(CS(4).GE.0.)WGFL=0.5*(RGP(IJL)+RGP(IJAL))*WG(IMJ)*CS(4)*RB(I-1) THREED   458
      IF(CS(4).LT.0.)WGFL=0.5*(RGP(IJ)+RGP(IJA))*WG(IJ)*CS(4)*RB(I-1)    THREED   459
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   460
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   461
      RETURN                                                             THREED   462
    2 CS(5)=0.5*(VG(IJM)+VG(JMKP))                                       THREED   463
      IF(CS(5).GE.0.) WGFB(I)=0.5*(RGP(IJB)+RGP(IJBA))*WG(IJM)*CS(5)     THREED   464
      IF(CS(5).LT.0.) WGFB(I)=0.5*(RGP(IJA)+RGP(IJ))*WG(IJ)*CS(5)        THREED   465
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   466
      RETURN                                                             THREED   467
    3 CS(6)=0.5*(WG(IKM)+WG(IJ))                                         THREED   468
      IF(CS(6).GE.0.) WGFF(ICJ)=0.5*(RGP(IJF)+RGP(IJ))*WG(IKM)*CS(6)     THREED   469
      IF(CS(6).LT.0.) WGFF(ICJ)=0.5*(RGP(IJA)+RGP(IJ))*WG(IJ)*CS(6)      THREED   470
      RETURN                                                             THREED   471
      END                                                                THREED   472
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      SUBROUTINE WLMOMF                                                  THREED   473
*CALL GCOM1                                                              THREED   474
*CALL GCOM2                                                              THREED   475
      DIMENSION CS(6)                                                    THREED   476
      CS(1)=0.5*(WL(IJ)+WL(IKP))                                         THREED   477
      IF(CS(1).GE.0.) WLFA=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(1)           THREED   478
      IF(CS(1).LT.0.) WLFA=0.5*(RLP(IJAA)+RLP(IJA))*WL(IKP)*CS(1)        THREED   479
      CS(2)=0.5*(VL(IJ)+VL(IKP))                                         THREED   480
      IF(CS(2).GE.0.) WLFT=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(2)           THREED   481
      IF(CS(2).LT.0.) WLFT=0.5*(RLP(IJT)+RLP(IJTA))*WL(IJP)*CS(2)        THREED   482
      CS(3)=0.5*(UL(IJ)+UL(IKP))                                         THREED   483
      IF(CS(3).GE.0.) WLFR=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(3)*RB(I)     THREED   484
      IF(CS(3).LT.0.) WLFR=0.5*(RLP(IJR)+RLP(IJAR))*WL(IPJ)*CS(3)*RB(I)  THREED   485
      IF(FL(IMJ).NE.1) GO TO 1                                           THREED   486
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   487
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   488
      RETURN                                                             THREED   489
    1 CS(4)=0.5*(UL(IMJ)+UL(IMKP))                                       THREED   490
      IF(CS(4).GE.0.)WLFL=0.5*(RLP(IJL)+RLP(IJAL))*WL(IMJ)*CS(4)*RB(I-1) THREED   491
      IF(CS(4).LT.0.)WLFL=0.5*(RLP(IJ)+RLP(IJA))*WL(IJ)*CS(4)*RB(I-1)    THREED   492
      IF(FL(IJM).NE.1) GO TO 2                                           THREED   493
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                 THREED   494
```

```
      RETURN                                                              THREED   495
    2 CS(5)=0.5*(VL(IJM)+VL(JMKP))                                        THREED   496
      IF(CS(5).GE.0.) WLFB(I)=0.5*(RLP(IJB)+RLP(IJBA))*WL(IJM)*CS(5)      THREED   497
      IF(CS(5).LT.0.) WLFB(I)=0.5*(RLP(IJA)+RLP(IJ))*WL(IJ)*CS(5)         THREED   498
      IF(FL(IKM).NE.1.OR.K.EQ.2) GO TO 3                                  THREED   499
      RETURN                                                              THREED   500
    3 CS(6)=0.5*(WL(IKM)+WL(IJ))                                          THREED   501
      IF(CS(6).GE.0.) WLFF(ICJ)=0.5*(RLP(IJF)+RLP(IJ))*WL(IKM)*CS(6)      THREED   502
      IF(CS(6).LT.0.) WLFF(ICJ)=0.5*(RLP(IJA)+RLP(IJ))*WL(IJ)*CS(6)       THREED   503
      RETURN                                                              THREED   504
      END                                                                 THREED   505
```

REFERENCES

1. W. C. Rivard and M. D. Torrey, "Fluid-Structure Response of a Pressurized Water Reactor Core Barrel During Blowdown," Los Alamos Scientific Laboratory report LA-7404 (NUREG/CR-0264) (September 1978).

2. W. C. Rivard and M. D. Torrey, "K-FIX: A Computer Program for Transient, Two-Dimensional, Two-Fluid Flow," Los Alamos Scientific Laboratory report LA-NUREG-6623 (April 1977).

3. C. Brenner, "On the Flow in an Annulus Surrounding a Whirling Cylinder," J. Fluid Mech. **75**, 173 (1976).

4. W. C. Rivard and M. D. Torrey, "PERM: Corrections to the K-FIX Code," Los Alamos Scientific Laboratory report LA-NUREG-6623, Suppl. (March 1978).

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