AFWL-TR-69-114, Vol. I (Supp.)

AFWL-TR-69-114, Vol. I (Supp.)

AD734744

USER'S MANUAL

Volume I

Boundary Layer Integral Matrix Procedure (BLIMP)

Larry W. Anderson Howard L. Morse

Aerotherm Corporation

TECHNICAL REPORT NO. AFWL-TR-69-114, Vol. I (Supp.)

October 1971

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base
New Mexico

Vol. #1
AD 868862

D D C
RECEIVED
NOV 3 1971
C

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield, Va. 22151

Approved for public release; distribution unlimited.

273

ACCESSION for
CFSTI WHITE SECTION ☑
DDC BUFF SECTION ☐
UNANNOUNCED ☐
JUSTIFICATION .....
BY .....
DISTRIBUTION/AVAILABILITY CODES
DIST. | AVAIL. and/or SPECIAL
A

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base
New Mexico 87117

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report is made available for study with the understanding that proprietary interests in and relating thereto will not be impaired. In case of apparent conflict or any other questions between the Government's rights and those of others, notify the Judge Advocate, Air Force Systems Command, Andrews Air Force Base, Washington, DC 20331.

DO NOT RETURN THIS COPY. RETAIN OR DESTROY.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Aerotherm Corporation 485 Clyde Avenue Mountain View, California 94040	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE
USER'S MANUAL, VOLUME I: BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE (BLIMP)

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
May 1970 through March 1971

5. AUTHOR(S) *(First name, middle initial, last name)*
Larry W. Anderson
Howard L. Morse

6. REPORT DATE October 1971	7a. TOTAL NO. OF PAGES 272	7b. NO. OF REFS 0
8a. CONTRACT OR GRANT NO. F29601-70-C-0055 b. PROJECT NO. 5791 c. Task 27 d.	9a. ORIGINATOR'S REPORT NUMBER(S) AFWL-TR-69-114, Vol I (Supp.) 9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*	

10. DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY AFWL (SYT) Kirtland AFB, NM 87117

13. ABSTRACT (Distribution Limitation Statement A)

A supplement to the BLIMP computer program report is presented. Major new additions in the input section describe the data start procedure and the entropy layer option. For convenience, however, an entire new input section is included in this supplement. Also a new Fortran Variables List, a complete listing of the code, and two new check cases are included.

DD FORM 1 NOV 65 1473

UNCLASSIFIED
Security Classification

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Boundary layer						
Turbulent						
Turbulent model						

UNCLASSIFIED
Security Classification

AFWL-TR-69-114, Vol I (Supp.)

USER'S MANUAL

Volume I

BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE (BLIMP)

Larry W. Anderson Howard L. Morse

Aerotherm Corporation

TECHNICAL REPORT NO. AFWL-TR-69-114, Vol I (Supp.)

Approved for public release; distribution unlimited.

FOREWORD

This report was prepared by the Aerotherm Corporation, Mountain View, California, under Contract F29601-70-C-0055. The research was performed under Program Element 62301F, Project 5791, Task 27.

Inclusive dates of research were May 1970 through March 1971. The report was submitted 1 September 1971 by the Air Force Weapons Laboratory Project Officer, Sergeant Dennis W. Lankford (SYT).

This technical report has been reviewed and is approved.

Dennis W. Lankford

DENNIS W. LANKFORD
Sergeant USAF
Project Officer

Jay R. Roland

JAY R. ROLAND
Major USAF
Chief, Theoretical Branch

Carl B. Hilland

CARL B. HILLAND
Lt Colonel USAF
Chief, Technology Division

ABSTRACT

(Distribution Limitation Statement A)

A supplement to the BLIMP computer program report is presented. Major new additions in the input section describe the data start procedure and the entropy layer option. For convenience, however, an entire new input section is included in this supplement. Also a new Fortran Variables List, a complete listing of the code, and two new check cases are included.

CONTENTS

Section		Page
I	INPUT	1
II	FORTRAN VARIABLES LIST	31
III	LISTING OF FORTRAN V SOURCE DECKS	72
IV	CHECK CASES	218
	Check Case 1 - Sphere-Cone on Rocket Sled	220
	Check Case 2 - Conventional Reentry Vehicle Analysis	243

SECTION I

INPUT

The revised input instructions are contained in this section.

GROUP 1 CONTROL CARD, TITLE, AND IDENTIFICATION (CALLED FROM RECASE)

CARD 1, FORMAT(20I1,15A4), KR

FIELD 1 (COLUMNS 1-20) THIS IS THE VARIABLE KR(DIMENSIONED 20) WHICH IS USED TO CONTROL THE VARIOUS PROGRAM OPTIONS

COLUMN 1 DETERMINES WHETHER A NEW SET OF ETA VALUES IS TO BE INPUT FOR PRESENT CASE (SEE GROUP 4)

0 USES RESIDENT VALUES FROM PREVIOUS CASE

1 VALUES INPUT BY USER (MANDATORY FOR FIRST CASE)

COLUMN 2 DESIGNATES TYPE OF FIRST GUESSES TO BE UTILIZED FOR PRIMARY VARIABLES (SEE GROUP 9)

0 USES BUILT-IN RELATIONS TO CALCULATE FIRST GUESSES (REQUIRES READING ONLY GUESS FOR ENTHALPY OF THE GAS AT THE WALL). RECOMMENDED FOR MOST SITUATIONS.

1 FIRST GUESSES INPUT BY USER

2 USES RESIDENT VALUES FROM PREVIOUS CASE (CANNOT BE USED FOR FIRST CASE OR WHEN COMPOSITION OF EDGE GAS IS DIFFERENT FROM PREVIOUS CASE)

3 FIRST GUESSES INPUT BY USER ARE ACCEPTED AS SOLUTION AT FIRST TIME AND FIRST OR SUBSEQUENT (FOR RESTART) STATION. USE THIS OPTION FOR DATA START AND RESTART (SEE GROUP 9).

COLUMN 3 DETERMINES TREATMENT OF STREAMWISE DERIVATIVES. SEE REFERENCE 1, SECTION III FOR EXPLANATION OF DIFFERENCE RELATIONS.

0 PERFORMS SIMILAR SOLUTION AT EACH STREAMWISE STATION

1 CONSIDERS TWO-POINT DIFFERENCE RELATIONS AT ALL STATIONS WITH THE FOLLOWING EXCEPTIONS (A SIMILAR SOLUTION IS PERFORMED AT THE FIRST STATION FOR NON-BLUNT BODIES AND AT THE FIRST TWO STATIONS FOR BLUNT BODIES)

2 CONSIDERS THREE POINT DIFFERENCE RELATIONS AT ALL STATIONS WITH THE FOLLOWING EXCEPTIONS (A SIMILAR SOLUTION IS PERFORMED AT THE FIRST STATION AND A TWO-POINT SOLUTION IS PERFORMED AT THE SECOND STATION FOR NON-BLUNT BODIES, SIMILAR SOLUTIONS ARE PERFORMED AT THE FIRST AND SECOND STATIONS AND A TWO-POINT SOLUTION IS PERFORMED AT THE THIRD STATION FOR BLUNT BODIES, AND A TWO-POINT SOLUTION IS PERFORMED FOR THE FIRST STATION AFTER A DISCONTINUITY - SEE CARD SET 4 OF GROUP 3).

COLUMN 4 DETERMINES WHEN OUTPUT BLOCK IS TO BE PRINTED

0 OUTPUT BLOCK PRINTED FOR CONVERGED SOLUTION OR FOR NONCONVERGED SOLUTION AFTER 50 ITERATIONS (WITH APPROPRIATE COMMENT)

1 OUTPUT BLOCK PRINTED AFTER EACH ITERATION

COLUMN 5 DETERMINES TREATMENT OF ENTROPY LAYER (SEE CARD SET 1 AND CARD 2 OF GROUP 15). KR(7) =0 OR 2 ONLY.

0 A ISENTROPIC EXPANSION AROUND THE BODY IS PERFORMED (IN THE CASE OF A BLUNT BODY, THE ENTROPY CORRESPONDS TO THAT BEHIND A NORMAL SHOCK)

1 NOT USED

2 AXISYMMETRIC SHOCK LAYER

3 ENTROPY LAYER - INVISCID FLOW FIELD ENTROPY GRADIENTS ARE CONSIDERED (SEE GROUP 15)

4 ENTROPY AND ENERGY LAYER - BOTH INVISCID FLOW FIELD ENTROPY AND ENERGY GRADIENTS ARE CONSIDERED (SEE GROUP 15). NOT USED IN THIS VERSION

5 A NONISENTROPIC EXPANSION AROUND THE BODY IS PERFORMED. THE USER SUPPLYTHE ENTROPY CHANGES BETWEEN STREAMWISE STATIONS (THIS IS A ZEROTH APPROXIMATION TO AN ENTROPY LAYER. THE VELOCITY GRADIENT AT THE BOUNDARY LAYER EDGE BEING NEGLECTED)

COLUMN 6 DESIGNATES BODY SHAPE (IN THE CASE OF AXISYMMETRIC SHARP BODIES AND AXISYMMETRIC AND PLANAR BLUNT BODIES, A TRANSFORMATION OF STREAMWISE DISTANCE, S, TO S**3, S**4, AND S**2, RESPECTIVELY, IS UTILIZED TO PERFORM STREAMWISE INTEGRATIONS IN ORDER TO TAKE ADVANTAGE OF THE WAY THAT EDGE VELOCITY AND LOCAL BODY RADIUS VARY WITH S IN THE VICINITY OF THE TIP OR STAGNATION REGION. THEREFORE, A 4 OR 9 IN COL. 6 IS REQUIRED IF THE SOLUTION DOES NOT START FROM A SHARP TIP OR STAGNATION POINT. FURTHERMORE, IN THE CASE OF SHARP OR BLUNT BODIES, A DISCONTINUITY INTRODUCED AT A DOWNSTREAM STATION REVERTS TO INTEGRATION WITH RESPECT TO S STARTING AT THAT STATION. IT IS RECOMMENDED THAT THIS BE DONE AFTER AN APPRECIABLE CHANGE OF SURFACE INCLINATION WITH RESPECT TO THE FREE-STREAM VELOCITY FROM THAT AT THE TIP OR STAGNATION POINT. THE OPTIMUM SWITCH-OVER POINT DEPENDS ON THE SPECIFIC BODY SHAPE. IT IS LEFT TO THE USER TO ESTABLISH THIS FOR THE BODY SHAPE OF INTEREST. THE METHOD FOR IMPLEMENTING A DISCONTINUITY IS DISCUSSED UNDER CARD SET 4 OF GROUP 3).

0 AXISYMMETRIC BLUNT BODY

1 PLANAR BLUNT BODY

2 AXISYMMETRIC SHARP BODY

3 PLANAR SHARP BODY

4 AXISYMMETRIC SHAPE WHICH HAS NO BLUNT STAGNATION POINT, FOR EXAMPLE, A NOZZLE

5 AXISYMMETRIC BLUNT BODY WITH TRANSVERSE CURVATURE

6 . NOT USED

7 AXISYMMETRIC SHARP BODY WITH TRANSVERSE CURVATURE

8 AXISYMMETRIC SHAPE WITH INTERNAL FLOW AND TRANSVERSE CURVATURE

9 EXTERNAL FLOW OVER AXISYMMETRIC SHAPE WHICH HAS NO SHARP TIP OR BLUNT STAGNATION POINT AND WITH TRANSVERSE CURVATURE

COLUMN 7 DESIGNATES WHETHER OR NOT TURBULENT FLOW WILL BE CONSIDERED.

0 LAMINAR FLOW ONLY

1 NOT USED IN PRESENT VERSION OF PROGRAM

2 TURBULENT FLOW WILL BE COMPUTED IF TRANSITION CRITERIA IS EXCEEDED (SEE GROUP 8).

COLUMN 8 DESIGNATES FORM IN WHICH WALL MASS FLUXES ARE INPUT. (KR(8) IS NOT UTILIZED IF WALL FLUXES ARE NOT INPUT. THE FLUX NORMALIZING PARAMETER IS NOT GENERALLY KNOWN IN ADVANCE SO KR(8)=0 IS NORMALLY USED WHEN FLUXES ARE INPUT). UTILIZED IN CARD SETS 7 AND 11 IN GROUPS 16, 17, 18, ...

0 WALL FLUXES INPUT IN LBS/SEC FT**2

1 WALL FLUXES INPUT IN NORMALIZED FORM (I.E., DIVIDED BY -ALPHASTAR, SEE EQUATION 44 OF NASA CR-1062)

COLUMN 9 TOGETHER WITH COLUMN 11, THIS SPECIFIES THE TYPE OF WALL BOUNDARY CONDITIONS. THE USER IS URGED TO FAMILIARIZE HIMSELF WITH THE DISCUSSION IN APPENDIX I BEFORE CHOOSING THESE OPTIONS.

0 NOT GENERALLY USED. ASSIGNED ELEMENTAL MASS FRACTIONS AND STREAM FUNCTION AT THE WALL (REQUIRES KR(11) = 0 OR 1).

1 NOT GENERALLY USED. ASSIGNED ELEMENTAL MASS FRACTIONS AND TOTAL MASS FLUX AT THE WALL (REQUIRES KR(11) = 0 OR 1).

2 ASSIGNED COMPONENT MASS FLUXES AT THE WALL (MDOT FOGE GAS, MDOT PYROLYSIS GAS, MDOT CHAR-- REQUIRES KR(11) = 0, 1, OR 2).

3 NOT USED

4 WALL STEADY STATE ENERGY BALANCE WHILE SATISFYING WALL MASS BALANCES AND LIMITED SURFACE EQUILIBRIUM (USE KR(11) = 0, KR(7) = 0 OR 2.

COLUMN 10 DETERMINES TYPE OF CURVE FITS EMPLOYED TO REPRESENT THE PRIMARY VARIABLES OF VELOCITY RATIO, TOTAL ENTHALPY, AND ELEMENTAL MASS FRACTIONS (KR(10)=0 IS RECOMMENDED FOR ACCURACY FOR MOST PROBLEMS, HOWEVER, KR(10)=1 IS BETTER FOR SEVERE PROBLEMS (E.G., NEARLY BLOWN OFF BOUNDARY LAYERS) FOR WHICH CUBICS CAN BECOME POORLY BEHAVED)

0 UTILIZES CONNECTED CUBICS

1 UTILIZES CONNECTED QUADRATICS EXCEPT FOR OUTERMOST SEGMENT WHERE CONNECTED CUBICS ARE EMPLOYED

2 UTILIZES CONNECTED QUADRATICS EVERYWHERE.

COLUMN 11 TOGETHER WITH COLUMN 9, THIS DESIGNATES THE TYPE OF WALL BOUNDARY CONDITION (SEE APPENDIX I). SEE GROUPS 16, 17, 18,...

0 ASSIGNED WALL TEMPERATURE. ALSO USED WITH KR(9)=4. THIS OPTION TOGETHER WITH KR(9)=2 WILL YIELD SURFACE EQUILIBRIUM OR KINETIC SURFACE SOLUTION IF THE ASSIGNED TEMPERATURE IS GREATER THAN THE ASSIGNED ABLATION TEMPERATURE (SEE GROUP 11, CARD 1, FIELD 7). THE PROGRAM WILL CALCULATE THE APPROPRIATE CHAR FLUX. ASSIGNED CHAR FLUX SHOULD BE SET TO ZERO (SEE GROUP 16, CARD SET 11).

1 ASSIGNED WALL ENTHALPY.

2 SURFACE EQUILIBRIUM WITH ASSIGNED COMPONENT MASS FLUXES (REQUIRES KR(9) = 2). THE PROBLEM IS WELL-POSED AND WILL CONVERGE ONLY IF THERE EXISTS A TEMPERATURE ABOVE 250K GIVING SURFACE EQUILIBRIUM FOR THE ASSIGNED COMPONENT MASS FLUXES. USE WITH CAUTION FOR ANALYSES OF MATERIALS WITH PLATEAU-LIKE BEHAVIOR.

3 CABLE SOLUTIONS ONLY. ASSIGNED WALL TEMPERATURE.

4 CABLE SOLUTIONS ONLY. SURFACE EQUILIBRIUM.

COLUMN 12 DETERMINES WHETHER OR NOT NEW DATA FOR THERMODYNAMIC AND TRANSPORT PROPERTIES ARE TO BE USED AND WHETHER OR NOT SURFACE KINETIC DATA ARE TO BE CONSIDERED (SEE GROUPS 11, 12, 13, AND 14). APPLIES ONLY FOR KR(7)=0 OR 2. (KR(12) MUST BE 0, 2, 5, OR 7 FOR FIRST CASE). IN THE FOLLOWING, X=5 FOR KINETIC DATA AND X=0 FOR NO KINETIC DATA.

X USER INPUTS NEW DATA FOR ELEMENTS AND MOLECULAR, ATOMIC, AND IONIC SPECIES. THERMOCHEMICAL DATA NOT PRINTED IN OUTPUT.

1+X USES RESIDENT ELEMENTAL AND SPECIES DATA.

2+X SAME AS KR(12)=X EXCEPT THERMOCHEMICAL DATA ARE PRINTED IN OUTPUT. (WHEN X=5 KINETIC DATA ALWAYS PRINTED IN OUTPUT).

COLUMN 13 PERMITS THE ASSIGNMENT OF A CONVERGENCE DAMPING FACTOR (THIS IS OVERRIDDEN IF A SMALLER DAMPING FACTOR IS COMPUTED INTERNALLY BY SOME CONSTRAINT)

0 NO DAMPING FACTOR IS ASSIGNED

J IF J IS GREATER THAN ZERO, CORRECTIONS ARE DAMPED UNIFORMLY BY J/10 THIS PROCEDURE IS NOT RECOMMENDED AS IT IS VERY INEFFICIENT AND THE DAMPING COMPUTED BY THE PROGRAM IS USUALLY ADEQUATE

COLUMN 14 DETERMINES MODEL TO BE EMPLOYED FOR MULTICOMPONENT TRANSPORT PROPERTIES. APPLIES ONLY FOR KR(7) = 0 OR 2. CONSIDERING UNEQUAL DIFFUSION COEFFICIENTS CAN SUBSTANTIALLY INCREASE THE NUMBER OF ITERATIONS (AND SOMETIMES CONVERGENCE DOES NOT OCCUR IN THE ALLOWED NUMBER OF ITERATIONS) DUE TO THE USE OF INEXACT DERIVATIVES IN THE NEWTON-RAPHSON ITERATION PROCEDURE

0 CONSIDERS UNEQUAL DIFFUSION AND THERMAL DIFFUSION COEFFICIENTS FOR ALL SPECIES

1 CONSIDERS UNEQUAL DIFFUSION COEFFICIENTS FOR ALL SPECIES BUT NEGLECTS THERMAL DIFFUSION

2 CONSIDERS EQUAL DIFFUSION COEFFICIENTS AND NEGLECTS THERMAL DIFFUSION

COLUMN 15 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR FIRST GUESSES AND LINEAR MATRICES (SEE DEBUG INSTRUCTIONS FOR MORE DETAILED INFORMATION ON COLUMNS 15 THROUGH 20)

0 NO DEBUG

1 FIRST GUESSES ARE DUMPED

2 LINEAR MATRICES BEFORE AND AFTER INVERSION ARE ALSO DUMPED

COLUMN 16 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR WALL FLUXES AND SURFACE EQUILIBRIUM ITERATION (SOME OF THE TESTS ARE ACTUALLY MADE ON KR(7). SEE DEBUG INSTRUCTIONS)

0 NO DEBUG

X FOR X GREATER THAN ZERO, THE DERIVATIVES OF WALL ENERGY AND MASS FLUXES WITH RESPECT TO REDUCED NONLINEAR VARIABLES (DQJRNL), AND THE ASSOCIATED ERRORS (WALLQJ AND DELQJW) ARE DUMPED. ALSO, THE MATRIX OF WALL RELATIONS BEFORE AND AFTER MATRIX INVERSION IS DUMPED FOR KP(11)=2 PROBLEMS.

Y FOR Y GREATER THAN UNITY, SURFACE EQUILIBRIUM ITERATION INFORMATION IS ALSO DUMPED (AS IN KR(18)) AND IF KR(17) IS GREATER THAN ZERO, THE DERIVATIVES OF WALL ENERGY AND MASS FLUXES WITH RESPECT TO ALL NONLINEAR VARIABLES (DQJNL) ARE ALSO DUMPED.

COLUMN 17 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR COEFFICIENTS IN NON-LINEAR EQUATIONS AND FOR STREAMWISE DERIVATIVES

0 NO DEBUG

X FOR X GREATER THAN ZERO, STREAMWISE DERIVATIVE INFORMATION IS DUMPED.

Y FOR (Y+1-ITS) GREATER THAN ZERO, WHERE ITS IS THE NUMBER OF THE CURRENT BOUNDARY LAYER ITERATION, THE COEFFICIENTS WHICH COMBINE TO MAKE UP THE NONLINEAR EQUATIONS (COEEQV ARRAY) AND CERTAIN LINEAR AND NONLINEAR ERROR INFORMATION ARE DUMPED AND THE DERIVATIVES OF THE NONLINEAR EQUATIONS WITH RESPECT TO THE NONLINEAR VARIABLES (AM ARRAY) ARE DUMPED BEFORE AND AFTER INVERSION.

COLUMN 18 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR CHEMISTRY ITERATION (KR(7) = 0 OR 2 ONLY). (THE TESTS ARE ACTUALLY MADE ON KR(7). SEE DEBUG INSTRUCTIONS).

0 NO DEBUG

1 DUMPS CHEMISTRY ITERATIONS IN DETAIL FOR ITS GREATER THAN 45 WHERE ITS IS THE COUNTER ON CHEMISTRY ITERATIONS

2 DUMPS ONE LINE PER ITERATION DURING EACH CHEMISTRY ITERATION

Y FOR Y OF 3 THROUGH 6, DUMPS CHEMISTRY ITERATIONS IN DETAIL WHEN (5*(Y-2)-ITS) IS GREATER THAN ZERO.

X FOR X OF 7 THROUGH 9, DUMPS CHEMISTRY ITERATIONS IN DETAIL WHEN ITS IS GREATER THAN 10X-50.

COLUMN 19 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR LINEAR AND NONLINEAR ERRORS

0 NO DEBUG

1 DUMPS (FOR EACH ITERATION) THE FOLLOWING. ERRORS FOR NONLINEAR

COLUMN 20 NON-ZERO ENTRY PROVIDES DEBUG OUTPUT FOR THERMODYNAMIC AND TRANSPORT PROPERTIES (KR(7) = 0 OR 2 ONLY).

0 NO DEBUG

X FOR X GREATER THAN ZERO, GIVES THERMODYNAMIC AND TRANSPORT PROPERTY INFORMATION FOR EACH CHEMISTRY SOLUTION

2 GIVES MATRIX OF PROPERTY DERIVATIVES BEFORE AND AFTER INVERSION

FIELD 2 (COLUMNS 21-80), CASE

TITLE OF CASE (ALPHANUMERIC). USED FOR IDENTIFICATION OF PRINTED OUTPUT)

CARD 2

INSERT A BLANK CARD HERE

GROUP 2 NUMBER OF ELEMENTS (CALLED FROM RECASE)

CARD 1. FORMAT(I2,8X,40I1)

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), NSP

NUMBER OF ELEMENTS IN THE SYSTEM NOT INCLUDING ELECTRONS (MAX. OF 9)

FIELDS 2-51 (COLUMNS 11-60), KS(M), M=1,NS ***** USED ONLY FOR KR(9) OR ANY OF THE KR9 = 2 OR 4 *****

THE SURFACE MATERIAL IS SPECIFIED IN ADVANCE BY THE USER FOR KR(9) = 3 OR 4. UP TO THREE MATERIAL COMBINATIONS ARE ALLOWED. EACH COMBINATION MAY HAVE A SEPARATE PYROLYSIS GAS AND CHAR MATERIAL SPECIFIED IN GROUP 11, FIELD 5. ENTER A 1, 2, OR 3 TO DENOTE MATERIAL COMBINATION 1, 2, OR 3 STARTING WITH THE STATION 1 ENTRY IN COLUMN 11, STATION 2 IN COLUMN 12, ETC. SEE ALSO GROUP 6, CARDS 1 AND 2.

GROUP 3 TIMES AND STATIONS (CALLED FROM RECASE)

CARD 1. FORMAT(I2)

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), NITEM

NUMBER OF TIMES (OR SUBCASES) BEING CONSIDERED IN PRESENT CASE. (MAXIMUM OF 50). A SERIES OF PROBLEMS CAN BE CONSIDERED AS A SEQUENCE OF TIMES (OR SUBCASES) IN THE SAME CASE AS LONG AS THE FOLLOWING ARE UNCHANGED, NUMBER OF ELEMENTS (GROUP 2), STREAMWISE STATIONS (CARD 3 AND CARD SET 4 OF THIS GROUP), NODAL SPACING (GROUP 4), BODY SHAPE (GROUP 5), AND ELEMENTAL AND SPECIES DATA (GROUP 10 OR 11 THRU 14) (AND THUS EDGE GAS AND WALL MATERIAL). CALCULATIONS ARE PERFORMED FOR ALL TIMES AT A GIVEN STATION BEFORE PROCEEDING TO NEXT STATION AND THUS APPEAR IN THIS ORDER IN THE PRINTED AND PUNCHED CARD OUTPUT.

CARD SET 2. FORMAT(8F10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
TIME(M), M=1,NITEM (SEE CARD 1 OF THIS GROUP)

TIME, SEC. THIS VARIABLE SERVES ONLY TO IDENTIFY SOLUTIONS SINCE TIME DOES NOT ENTER INTO THE SOLUTION OF THE PROBLEM. USE A NEGATIVE ENTRY FOR TIME(1) IF IT IS DESIRED THAT THESE IDENTIFICATION NUMBERS BE CALLED CASES IN THE OUTPUT FORMAT (OTHERWISE, THEY ARE IDENTIFIED AS TIMES).

CARD 3. FORMAT(I2,8X,40I1)

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), NS

NUMBER OF STREAMWISE STATIONS (MAXIMUM OF 40)

FIELD 2 (COLUMNS 11-50), KR9

VALUES TO BE ASSIGNED TO KR(9) WHEN WALL BOUNDARY CONDITIONS ARE TO BE CHANGED AT DOWNSTREAM STATIONS (SEE CARD 1 OF GROUP 1). COLUMN 11 CORRESPONDS TO STATION S(1), COLUMN 12 TO STATION S(2), AND SO ON. IF WALL BOUNDARY CONDITIONS ARE NOT TO BE CHANGED AT DOWNSTREAM STATIONS, THIS FIELD SHOULD BE LEFT BLANK. WHEN THE KR9( ) ARE EMPLOYED, KR(9) SHOULD BE GIVEN THE VALUE NECESSARY TO READ ALL APPROPRIATE WALL DATA (GROUP 16). AT THE PRESENT TIME, IT IS POSSIBLE TO CONSIDER ANY COMBINATIONS KR9 OF 2, 3, AND 4 COMPRISING REGIONS OF AN ABLATION MATERIAL AND REGIONS WHERE THERE IS NO ABLATION (THESE NON-ABLATING REGIONS ARE OBTAINED BY USE OF KR9( ) = 2 WHILE ASSIGNING ZERO COMPONENT MASS FLUXES, SEE CARD SET 11 OF GROUP 16)

CARD SET 4. FORMAT(8E10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
S(L), I=1,NS (SEE CARD 3 OF THIS GROUP)

STREAMWISE DISTANCE UPON WHICH BOUNDARY-LAYER SOLUTION IS BASED, FEET. A BLUNT-BODY PROBLEM (KR(6) = 0,1 OR 5) SHOULD START WITH AN S(1) OF 0. A SHARP-BODY PROBLEM (KR(6) = 2,3 OR 7) OR A NOZZLE-TYPE PROBLEM (KR(6)= 4 OR 8) MUST NOT START WITH A S(1) OF 0. BUT MUST START WITH SOME FINITE DISTANCE. THE BOUNDARY LAYER IS ASSUMED TO BE SIMILAR UP TO AND INCLUDING THIS FIRST STATION. A NEGATIVE ENTRY FOR S(L) SIGNIFIES A DISCONTINUITY AT THAT STATION. THIS PRODUCES A TWO-POINT DIFFERENCE SOLUTION AT THE FIRST STATION AFTER THE DISCONTINUITY AND THUS HAS AN EFFECT ONLY FOR THREE-POINT SOLUTIONS (KR(3)=2). ALSO, FOR BLUNT BODIES, A MINUS SIGN AT A STATION CAUSES STREAMWISE INTEGRATIONS TO REVERT TO S AS THE INDEPENDENT VARIABLE - SEE DISCUSSION UNDER CARD 1, COLUMN 6 OF GROUP 1. FOR DATA START OPTION (SEE GROUP 9) IT IS SUGGESTED THAT THE SECOND STATION BE 0.01 FEET DOWNSTREAM OF THE FIRST AND THE THIRD, ABOUT 0.05 FEET DOWNSTREAM.

GROUP 4 NODAL DATA (CALLED FROM RECASE) *** SKIP THIS GROUP FOR KR(1)=0 ***

CARD 1. FORMAT(I2) ***** USED ONLY IF KR(1)=1 *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), NETA

NUMBER OF NODAL POINTS ACROSS THE BOUNDARY LAYER INCLUDING WALL AND BOUNDARY LAYER EDGE (MAXIMUM OF 15).

CARD SET 2. FORMAT(8E10.4) ***** USED ONLY IF KR(1)=1 *****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
ETA(I), I=1,NETA (SEE CARD 1 OF THIS GROUP)

ETA STATIONS ACROSS THE BOUNDARY LAYER, STARTING AT THE WALL (ETA = 0.0). NOTE THAT THESE ARE ACTUALLY η VALUES, AS DEFINED BY EQUATION NO. 33, NASA CR 1062. OTHER REFERENCES TO ETA IN THE INPUT SECTION OF THIS MANUAL ALSO REFER TO η. IT IS RECOMMENDED THAT THE VALUE OF ETA AT THE BOUNDARY-LAYER EDGE BE GIVEN A VALUE OF ABOUT 5.0 SO THAT THE STRETCHING PARAMETER WILL BE NEAR UNITY. ALSO, THERE SHOULD NOT BE MUCH MORE THAN A TWO-FOLD CHANGE IN DISTANCE BETWEEN TWO NEIGHBORING NODES. BEST ACCURACY FOR A GIVEN NUMBER OF NODES IS OBTAINED IF THE NODES ARE CLOSER TOGETHER NEAR THE WALL. FOR LAMINAR PROBLEMS, 7 NODES ARE OFTEN SUFFICIENT WITH A TYPICAL SPACING BEING 0.0, 0.5, 1.0, 1.5, 2.0, 3.0, 5.0 AND WITH KAPPA = 5, CHAR = 0.8 (SEE CARD 3, FIELDS 1 AND 2 OF THIS GROUP). FOR TURBULENT BOUNDARY LAYERS, MORE NODES ARE NEEDED CLOSE TO THE WALL DUE TO THE STEEP GRADIENTS THERE. A TYPICAL SPACING WOULD BE 0.0, 0.024, 0.040, 0.072, 0.120, 0.200, 0.320, 0.480, 0.800, 1.400, 2.000, 3.200, 5.000, WITH KAPPA = 11 AND CHAR = 0.95. WHATEVER THE NODE SPACING THE

USER MUST EXAMINE THE SOLUTIONS TO BE SURE THAT A REASONABLE CURVEFIT IS OBTAINED NEAR THE WALL. THIS CAN BE A PROBLEM FOR LARGE STREAMWISE DISTANCES IN TURBULENT FLOWS. IN CHECKING THE RESULTS, FOR TURBULENT BOUNDARY LAYERS, THE DIMENSIONLESS EDDY VISCOSITY SHOULD BE LESS THAN 0.05 (RHOSQ*EPS/RHOE*MUE IN THE OUTPUT) FOR THE SECOND ETA NODE TO INSURE GOOD WALL CURVEFITS. OPTIMUM MODELING OF THE TRANSITION REGION OF THE PROFILE REQUIRES SUFFICIENT ETA SPACING BETWEEN THE VISCOSITY RATIO VALUES OF 0.1 TO 10. IT IS SUGGESTED THIS INTERVAL CONTAIN AT LEAST SEVEN NODES.

CARD 3. FORMAT(I2,E10.4) ***** USED ONLY IF KR(1)=1 *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED). KAPPA

THE VARIABLE KAPPA IS ASSOCIATED WITH THE CONSTRAINT WHICH IS UTILIZED TO EFFECT A STRETCHING OF ETA, THE BOUNDARY-LAYER COORDINATE NORMAL TO THE SURFACE, IN ORDER TO EFFECTIVELY USE THE ASSIGNED NODAL SPACING (SEE CARDS 1 AND 2 OF THIS GROUP). KAPPA IS THE INDEX FOR THE NODAL POINT AT WHICH THE VELOCITY RATIO IS FIXED. TO ILLUSTRATE, IF KAPPA IS 5, THEN THE FIFTH NODAL POINT COUNTING FROM THE WALL AND INCLUDING THE WALL WILL HAVE A VALUE OF CRAR (A QUANTITY WHICH IS INPUT IN THE SECOND FIELD OF THIS CARD).

FIELD 2 (COLUMNS 3-12). CRAR

CRAR IS THE VALUE OF THE VELOCITY RATIO AT THE BOUNDARY-LAYER NODE DESIGNATED KAPPA (SEE DISCUSSION UNDER FIELD 1 OF THIS CARD). FOR EDGE VORTICITY, THE VELOCITY AT KAPPA IS RATIOD TO THE LINEAR EXTRAPOLATION OF THE EDGE VELOCITY TO THE KAPPA NODE.

GROUP 5 BODY SHAPE DATA (CALLED FROM RECASE)

CARD 1. FORMAT(2E10.4) ***** USED ONLY IF BLUNT BODY, KR(6)=0.1, OR 5 *****

FIELD 1 (COLUMNS 1-10). CONE

CONE HALF-ANGLE IN SPHERE-CONE SHAPE BODIES, LEAVE BLANK FOR OTHER BODY SHAPES.

FIELD 2 (COLUMNS 11-20). RNOSE

EFFECTIVE NOSE RADIUS, FEET. THE VALUE READ INTO THIS FIELD IS OVERRIDDEN IF THE PRESSURE RATIO AT THE FIRST STATION, PRE(1), IS READ IN AS A ZERO (SEE CARD SET 3 OF GROUP 15). IF PRE(1) IS NON-ZERO, THEN A NON-ZERO ENTRY IN THE CURRENT FIELD IS USED IN THE CALCULATION OF STAGNATION POINT VELOCITY GRADIENT FROM THE NEWTONIAN RELATION

DUES = SQRT(2./RHOE * PE * 32.1740 * 2116.) / RNOSE

WHERE DUES IS THE STAGNATION POINT VELOCITY GRADIENT AND RHOE AND PE ARE LOCAL STAGNATION DENSITY (LB/FT3) AND PRESSURE (ATM), RESPECTIVELY. THIS LATTER APPROACH IS REQUIRED FOR BLUNT-BODY PROBLEMS IF THERE IS ONLY ONE STATION (NS = 1, SEE CARD 3 OF GROUP 3). WHEN RNOSE IS READ INTO THE CURRENT FIELD AND NOT BEING OVERRIDDEN (I.E., WHEN PRE(1) IS NOT SET EQUAL TO ZERO) A MACH NUMBER CORRECTION (IMPORTANT FOR LOW FREE-STREAM MACH NUMBERS) CAN BE MADE BY INPUTTING

RNOSE = REFF / SQRT(1. - PINF / PE)

WHERE REFF IS THE TRUE EFFECTIVE NOSE RADIUS (FEET) AND PINF IS THE FREE STREAM STATIC PRESSURE (LB/FT2). (IF THE CURRENT FIELD IS LEFT BLANK AND PRE(1) IS NON-ZERO, THE STAGNATION-POINT VELOCITY GRADIENT IS COMPUTED FROM A CURVE FIT OF THE PRE AROUND THE BODY. IN ANY EVENT, A CURVE FIT OF PRESSURE IS USED TO COMPUTE VELOCITY GRADIENT FOR STATIONS 2 AND BEYOND).

CARD SET 2. FORMAT(8F10.4) ***** NOT USED IF KR(6)=1 OR 3 *****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
ROKAP(L), L=1, NS (SEE CARD 3 OF GROUP 3)

THIS IS THE LOCAL BODY RADIUS IN FEET NORMAL TO THE BODY CENTERLINE RAISED TO THE KAPPA POWER WHERE KAPPA IS UNITY FOR AXISYMMETRIC BODIES AND ZERO FOR PLANAR BODIES. THEREFORE, ROKAP IS UNITY FOR PLANAR BODIES AND LOCAL BODY RADIUS FOR AXISYMMETRIC BODIES. TWO SPECIAL INPUT FORMATS CAN BE USED. FOR SPHERE CONE BODIES, SET ROKAP(1) EQUAL TO MINUS THE NOSE RADIUS. THE NOSE RADIUS IS THEN SET TO - ROKAP(1) AND ROKAP(1) IS SET TO ZERO. IF SUBSEQUENT ROKAP( ) ARE INPUT AS ZEROES, THE PROGRAM COMPUTES ROKAP FROM S FOR A SPHERICAL NOSE. THE FIRST NON-ZERO ENTRY IS THE ROKAP AT THE CONE TANGENT POINT. IF THIS IS AGAIN FOLLOWED BY ZEROES, LINEAR INTERPOLATION IS USED TO THE NEXT NONZERO ENTRY TO YIELD ROKAP ALONG A CONICAL AFTERBODY.

FOR SHARP CONES, KR(6) = 2 OR 7, SET ROKAP(1) EQUAL TO MINUS THE CONE HALF ANGLE IN DEGREES. ROKAP(1) IS THEN SET TO ZERO AND THE PROGRAM COMPUTES ROKAP FROM S FOR A SHARP CONE OF THE SPECIFIED HALF ANGLE.

GROUP 6 MATERIAL PROPERTY DATA NEEDED FOR WALL QUASI-STEADY ENERGY BALANCE (CALLED FROM RECASE) *****CONSIDER THIS GROUP ONLY IF KR(9) OR ANY OF THE KR9 IS EQUAL TO 3 OR GREATER*****

CARD 1. FORMAT(9F8.3) ** USED ONLY IF KR(9) OR ANY OF THE KR9 IS 3 OR 4 **

FIELDS 1,4,7 (COLUMNS 1-8, 25-32, 49-56), EMIV(I),I=1,3

SURFACE EMITTANCE OF THE MATERIAL COMBINATIONS BEING CONSIDERED UNDER KR(9) OR KR9 OF 3 OR 4.

FIELDS 2,5,8 (COLUMNS 9-16, 33-40, 57-64), HCARB(I),I=1,3

HEAT OF FORMATION (BTU/LB) OF THE VIRGIN STATE OF THE ABLATION MATERIALS BEING CONSIDERED UNDER KR(9) OR KR9 OF 3 OR 4.

FIELDS 3,6,9 (COLUMNS 17-24, 41-48, 65-72), HPG(I),I=1,3

HEAT OF FORMATION (BTU/LB) OF THE TRANSPIRANTS BEING CONSIDERED UNDER KR(9) OR KR9 OF 3 OR 4.

CARD 2. FORMAT(6A4) ** USED ONLY WITH CARD 1 **

FIELDS 1,2, AND 3 (COLUMNS 1-8, 9-16, 17-24)

NAMES OF SURFACE SPECIES FOR MATERIAL COMBINATIONS 1,2, AND 3 EXACTLY AS THEY APPEAR IN THE THERMODYNAMIC DATA TABLES (GROUP 13), LEFT JUSTIFIED.

GROUP 7 FUNCTION-OF-TIME DATA (CALLED FROM RECASE)

CARD SET 1. FORMAT(8F10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, PTET(M), M=1,NITEM (SEE CARD 1 OF GROUP 3)

LOCAL STAGNATION PRESSURE FOR EACH TIME BEING CONSIDERED, ATMOSPHERES

CARD SET 2. FORMAT(8E10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
GE(M), M=1,NITEM (SEE CARD 1 OF GROUP 3)

STAGNATION ENTHALPY FOR EACH TIME BEING CONSIDERED, BTU/LB

CARD SET 3. FORMAT(8F10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
RADFL(M), M=1,NITEM (SEE CARD 1 OF GROUP 3)

INCIDENT RADIATION FLUX ABSORBED BY THE SURFACE AT STATION S(1) FOR EACH TIME BEING CONSIDERED, BTU/SEC FT2 (IF A SURFACE ABSORPTIVITY LESS THAN UNITY IS TO BE CONSIDERED, THESE ENTRIES SHOULD BE CORRECTED FOR SURFACE ABSORPTIVITY). THIS INFORMATION IS USED ONLY FOR KR(9) OR KR9 OF 4 OR 6. INPUT BLANKS IN THIS FIELD FOR OTHER TYPES OF PROBLEMS. RADIATION FLUX AT OTHER STATIONS WILL BE INPUT AS RATIOS IN GROUP 15.

GROUP 8 TURBULENT FLOW PARAMETERS (CALLED FROM TREMBL) **** CONSIDER THIS GROUP ONLY IF KR(7)=2 OR 3 ****

CARD 1. FORMAT(6F10.3)

FIELDS 1-6. (COLUMNS 1-10, 11-20, 21-30, 31-40, 41-50, 51-60) ELCON, YAP, CLNUM, SCT, PRT, RETR

ELCON IS THE PRANDTL MIXING LENGTH CONSTANT (0.44 IS A TYPICAL VALUE).

YAP IS A CONSTANT OF PROPORTIONALITY IN THE MIXING LENGTH EXPRESSION (11.823 IS A TYPICAL VALUE).

CLNUM IS THE CLAUSER CONSTANT OF PROPORTIONALITY IN WAKE REGION (0.018 IS A TYPICAL VALUE).

SCT IS THE TURBULENT SCHMIDT NUMBER.

PRT IS THE TURBULENT PRANDTL NUMBER.

RETR IS THE TRANSITION REYNOLDS NUMBER BASED ON MOMENTUM THICKNESS. IF RETR IS EXCEEDED, TURBULENCE TERMS WILL BE INCLUDED IN THE GOVERNING EQUATIONS.

GROUP 9 FIRST GUESS OR RESTART INFORMATION (CALLED FROM FIRSTG) **** SKIP THIS GROUP FOR KR(2)=2. CONSIDER ONLY CARD 6 FOR KR(2)=0 ****

CARD 1. FORMAT(3E10.4,5X,I5) **** USED ONLY FOR KR(2)=1 OR 3 ****

FIELD 1 (COLUMN 1-10) ALPH (NON-DIMENSIONAL)

FIRST GUESS, RESTART, OR DATA START (INPUT OF A MEASURED PROFILE) VALUE FOR THE BOUNDARY LAYER NORMALIZING PARAMETER, ALPHA. FOR A DATA START, THE VALUE OF ALPHA MUST BE CONSISTENT WITH THE INPUTS IN FIELDS 2 AND 3 OF THIS CARD AND OF CARD 3 OF THIS GROUP. MAY BE CALCULATED FROM EQUATION 61 OF REFERENCE 1.

FIELD 2 (COLUMNS 11-20) F(1,1) (NON-DIMENSIONAL)

FIRST GUESS, RESTART, OR DATA START VALUE FOR THE STREAM FUNCTION AT THE WALL. THE VALUE OF THIS PARAMETER MUST BE EQUAL TO THE VALUE OF EQUATION 63 OF REFERENCE 1 ASSUMING A CONSTANT INTEGRAND WITH ALL QUANTITIES EVALUATED AT THE INPUT STATION. THE VALUE OF THE INTEGRATION VARIABLE, XI, IS FOUND IN EQUATION 61 OF REFERENCE 1 BY AGAIN SETTING THE INTEGRAND CONSTANT AT THE VALUE OF THE INPUT STATION WITH THE INTEGRATION VARIABLE, S, SET EQUAL TO THE FIRST ASSIGNED STREAMWISE DISTANCE (SEE CARD SET 4 OF GROUP 3). THE ABOVE PROCEDURE IS ESSENTIAL BECAUSE BLIMP CALCULATES THESE QUANTITIES AT THE FIRST STATION ASSUMING THAT ALL UPSTREAM QUANTITIES ARE CONSTANT AND EQUAL TO THE ASSIGNED VALUES AT THE FIRST STATION: TO INPUT VALUES OF ALPH, AND F(1,1) INCONSISTENT WITH THESE VALUES MAY RESULT IN NON-CONVERGENCE AT THE SECOND STREAMWISE STATION.

FIELD 3 (COLUMNS 21-30) F(3,1) (NON-DIMENSIONAL)

FIRST GUESS, RESTART, OR DATA START VALUE FOR NORMALIZED VELOCITY GRADIENT AT THE WALL. THE CORRECT FORM OF THIS TERM IS

$$\left.\frac{\partial (u/u_e)}{\partial \eta}\right|_{wall}$$

THIS IS EQUIVALENT TO

$$\left.\frac{1}{\alpha_H}\frac{\partial (u/u_e)}{\partial \bar{\eta}}\right|_{wall}$$

WHERE $\bar{\eta}$ IS DEFINED BY EQUATION 33 OF NASA CR 1062. FOR RESTART PURPOSES, THE FPP NUMERICAL VALUE PRINTED OUT BY BLIMP AT THE WALL NODE IS CORRECT. THE BLIMP FP- G, AND ELEMENTAL MASS FRACTION OUTPUT IS ALSO IN THE CORRECT FORM FOR INPUT IN CARD SETS 2, 3, AND 4.

FIELD 4 (COLUMN 36-40, RIGHT JUSTIFIED) IST

STATION NUMBER FOR RESTART. MEANINGFUL ONLY FOR KR(2)=3.

CARD SET 2. FORMAT(8F10.4) **** USED ONLY FOR KR(2)=1 OR 3 ****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, F(2,I), I=1,NETA.

FIRST GUESSES, RESTART, OR DATA START VALUES FOR VELOCITY RATIO F(2,I) ACROSS THE BOUNDARY LAYER. THE VALUES MUST BE CONSISTENT WITH THE INPUT ETA DISTRIBUTION OF GROUP 4. THAT IS, THEY MUST BE RELATED TO THE ETA DISTRIBUTION BY A CURVE FIT PROCEDURE IDENTICAL TO THAT SPECIFIED BY KR(10) IN GROUP 1.

CARD SET 3. FORMAT(8F10.4) **** USED ONLY FOR KR(2)=1 OR 3 ****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, G(2,I), G(1,I), I=1,NETA

FIRST GUESSES, RESTART, OR DATA START VALUES FOR THE TOTAL ENTHALPY GRADIENT AT THE WALL DIVIDED BY ALPH (G(2,1)) AND THE TOTAL ENTHALPY G(1,I) ACROSS THE BOUNDARY LAYER.

CARD SET 4. FORMAT(8F10.4) **** USED ONLY FOR KR(2)=1 OR 3 AND NSP GREATER THAN 1 ****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, (SP(2,1,K), SP(1,I,K), I=1,NETA) K=1, NSP-1

FIRST GUESSES, RESTART, OR DATA START VALUES FOR ELEMENTAL MASS FRACTION GRADIENT AT THE WALL SP(2,1,K) AND ELEMENTAL MASS FRACTION VALUES SP(1,I,K) ACROSS THE BOUNDARY LAYER. READ IN WALL GRADIENT AND VALUES AT NODES FOR EACH SPECIES BEFORE GOING ON TO NEXT SPECIES. START EACH SPECIES ON A NEW CARD.

CARD SET 5. FORMAT(40I2) **** USED ONLY FOR KR(2)=1 OR 3 AND NSP GREATER THAN 1 ****

FIELD 1 (COLUMNS 1-2, RIGHT JUSTIFIED), FIELD 2 (COLUMNS 3-4, RIGHT JUSTIFIED), ETC., (LEF(K), K=1,NSP) (SEE CARD 1 OF GROUP 2)

ENTRIES IN THESE FIELDS MUST INDIVIDUALLY CORRESPOND TO THE ELEMENTS AS THEY ARE SELECTED FROM THE THERMODYNAMIC DATA (SEE DISCUSSION UNDER GROUP 13) ACCORDING TO WHETHER, FOR THE FIRST STATION, THE ELEMENT IS

0 NOT PRESENT

1 PRESENT DUE TO LOCAL INJECTION

2 PRESENT DUE TO UPSTREAM INJECTION (NOT POSSIBLE AT FIRST STATION)

3 PRESENT FROM THE EDGE GAS

CARD 6. FORMAT(F10.4) ***** USED ONLY FOR KR(2)=0 *****

FIELD 1 (COLUMNS 1-10). GW

FIRST GUESS FOR ENTHALPY OF THE GAS AT THE WALL, BTU/LB

GROUP 10 THIS CARD GROUP NOT USED IN THE PRESENT VERSION OF THE PROGRAM

GROUP 11 ELEMENTAL DATA (CALLED FROM INPUT)
**** SKIP THIS GROUP FOR KR(12)=1 OR 6 OR FOR KR(7)=1 OR 3 ****

CARD 1. FORMAT(I3,F7.0,7F10.4) **** USED ONLY FOR KR(12)=0,2,5, OR 7

FIELD 1 (COLUMNS 1-3, RIGHT-JUSTIFIED). IS

NUMBER OF ELEMENTS IN THE SYSTEM INCLUDING ELECTRONS IF CONSIDERED (THIS ENTRY WILL BE THE SAME AS CARD 1 OF GROUP 2 (EXCEPT FOR THE DIFFERENT FORMAT) FOR SYSTEMS NOT CONTAINING ELECTRONS BUT WILL BE ONE GREATER FOR SYSTEMS CONTAINING ELECTRONS)

FIELDS 2 AND 3 (COLUMNS 4-10,11-20) FFAR, FITMOL

CONSTANTS IN THE CURVEFIT OF FF(J) IN TERMS OF MOLECULAR WEIGHT..

FF(J)=(WTM(J)/FITMOL)**FFAR

FFAR AND FITMOL ARE PRESUMED TO BE 0.431 AND 23.4 IF NO ENTRY IS MADE.

FIELDS 4, 5, AND 6 (COLUMNS 21-30, 31-40, 41-50) BASMOL, SIGMA, EPOVRK

THESE VARIABLES DEFINE THE REFERENCE SPECIES PROPERTIES FOR FF(J) (REF. 5). BASMOL IS THE MOLECULAR WEIGHT OF THE REFERENCE SPECIES. SIGMA AND EPOVRK ARE THE SPECIES SIGMA AND EPSILON/K AS DEFINED BY REFERENCE 6. FOR THE CONVENIENCE OF THE USER, A TABLE OF SIGMA AND EPOVRK REPRODUCED FROM REFERENCE 6 IS INCLUDED AS APPENDIX II TO THIS MANUAL. STANDARD VALUES DESCRIBED IN REFERENCE 5 ARE USED IF NO ENTRIES ARE MADE.

FIELD 7 (COLUMNS 71-80) TF(N+1) **** USED ONLY FOR KR(9) = 2 WITH KR(11) = 0 ****

ABLATION TEMPERATURE, ABOVE WHICH EQUILIBRIUM CHAR REMOVAL RATE WILL BE DETERMINED. BELOW THIS TEMPERATURE, SURFACE EQUILIBRIUM IS SUPPRESSED. AUTOMATICALLY SET TO 50,000 K IF NO ENTRY. AN ABLATION TEMPERATURE MUST BE ENTERED HERE IF SURFACE CHEMISTRY IS TO BE CONSIDERED.

CARDS 2,3,...,IS (ONE FOR EACH ELEMENT, SEE CARD 1, FIELD 1 OF THIS GROUP), FORMAT(I3,3A4,F9.3,7E8.3) **** USED ONLY FOR KR(12)=0,2,5, OR 7 ***

FIELD 1 (COLUMNS 1-3, RIGHT-JUSTIFIED), KAT(K)

ATOMIC NUMBER OF ELEMENT (99 FOR ELECTRON). CARDS MUST BE ORDERED WITH THIS NUMBER ASCENDING WITH ELECTRON LAST (WHEN CONSIDERED).

FIELD 2, (COLUMNS 4-15) ATA(K), ATB(K), ATC(K)

NAME OF ELEMENT (USED FOR OUTPUT ONLY). FOR BEST LOOKING OUTPUT, ELEMENTS WITH 3 OR 4 LETTERS (e.g., IRON) SHOULD START IN COLUMN 6, ELEMENTS WITH 5, 6, OR 7 LETTERS (e.g., CARBON) SHOULD START IN COLUMN 5, AND ELEMENTS WITH 8 OR MORE LETTERS (e.g., NITROGEN) SHOULD START IN COL. 4.

FIELD 3 (COLUMNS 16-24), WAT(K)

ATOMIC WEIGHT OF ELEMENT

FIELD 4 (COLUMNS 25-32) TK(K,1)

AMOUNT OF ELEMENT IN BOUNDARY-LAYER EDGE GAS. SEE BELOW FOR UNITS.

FIELDS 5 TO 10 (COLUMNS 33-40, 41-48, 49-56, 57-64, 65-72, 73-80) TK(K,J) J=2,7

AMOUNT OF ELEMENT IN PYROLYSIS GAS AND CHAR FOR EACH OF THE THREE ALLOWABLE MATERIALS. FIELDS 5 AND 6 ARE FOR MATERIAL 1, FIELDS 7 AND 8 FOR MATERIAL 2, ETC. NEGATIVE VALUES ARE USED TO DESIGNATE RELATIVE MASSES OF ELEMENTS, WHEREAS POSITIVE VALUES ARE USED TO DESIGNATE RELATIVE NUMBERS OF ATOMS. AS AN EXAMPLE OF THE LATTER, THE ENTRIES FOR A SILICA CHAR COULD BE 1. FOR THE ELEMENT SILICON AND 2. FOR OXYGEN.

```
GROUP 12 DIFFUSION FACTOR DATA (CALLED FROM INPUT)
         **** SKIP THIS GROUP FOR KR(7)=1 OR 3 OR FOR KR(12)=1 OR 6 OR IF IT
              IS DESIRED TO USE THE MOLECULAR WEIGHT APPROXIMATION FOR
              DIFFUSION FACTORS (SEE FIELDS  2 AND 3 OF CARD 1 OF GROUP 11).
              ALWAYS SKIP FOR KR(7)=1 OR 3. ****
-----------------------------------------------------------------------------

  CARD  1. FORMAT(I3) ***** USED ONLY FOR KR(12)=0, 2, 5 OR 7 AND THEN ONLY IF
                            IT IS DESIRED TO READ IN DIFFUSION FACTOR DATA FOR
                            ONE OR MORE SPECIES *****

    FIELD  1 (COLUMNS 1-3, RIGHT-JUSTIFIED)  NFF

      NUMBER OF MOLECULES FOR WHICH DIFFUSION FACTOR DATA ARE TO BE READ
      (SEE FIELDS 2 AND 3 OF CARD 1 OF GROUP 11).


  CARDS 2, 3,...., AS REQUIRED (DIFFUSION FACTOR DATA REQUESTED BY CARD 1 OF
          THIS GROUP ARE ENTERED HERE 4 TO A CARD) FORMAT(4(2A4,E12.4))
          ***** USED ONLY FOR KR(12)=0, 2, 5 OR 7 AND THEN ONLY IF THE CON-
                DITIONS OF CARD 1 OF THIS GROUP ARE MET *****

    FIELDS 1, 3, 5, AND 7 (COLUMNS 1-8, 21-28, 41-48, AND 61-68, RESPECTIVELY)
                          NFIA(J) AND NFIB(J) IN EACH FIELD

      NAME OF MOLECULE AS IT APPEARS IN COLUMNS 73-80 ON FIRST CARD OF 3-CARD
      THERMODYNAMIC DATA SET FOR THE MOLECULE (SEE GROUP 13, CARDS 1, 4, 7, .)


    FIELDS 2, 4, 6, AND 8 (COLUMNS 9-20, 29-40, 49-60, AND 69-80 RESPECTIVELY)
           FFIN(J) IN EACH FIELD

      A SET OF FF(J) ARE INCLUDED IN THE PROGRAM.  IF ANY OF THESE ARE TO BE
      CHANGED, THE NEW VALUES FOR EACH OF THE SPECIES NAMED IN FIELDS 1,3,5
      ETC. ARE ENTERED HERE UNDER THE VARIABLE NAME FFIN(J). THEY ARE THEN
      SORTED BY SPECIES NAME AND ENTERED INTO THE PROPER SLOTS IN THE FF(J)
      ARRAY.  THESE DIFFUSION FACTORS ARE REFERENCED TO OXYGEN (O2) OR OTHER
      REFERENCE SPECIES INDICATED IN GROUP 11.  TO OBTAIN ACCURATE VISCOSITY
      CALCULATIONS USE

          FF(J)=(SIGMA(J)*WTM(J)**.25*EPOVRK(J)**.0795)/(SIGMA(REF)*WTM(REF)
                    **.25*EPOVRK(REF)**.0795)
```

GROUP 13 THERMOCHEMICAL DATA (CALLED FROM INPUT)
***** SKIP THIS GROUP FOR KR(12)=1 OR 6 OR KR(7)=1 OR 3 ****

THERE ARE THREE CARDS FOR EACH MOLECULAR, ATOMIC, CONDENSED, OR IONIC SPECIES. A TOTAL OF 70 SPECIES OF ALL TYPES ARE ALLOWED. THE NUMBER OF ALLOWABLE CONDENSED-PHASE MATERIALS WHICH CAN BE SIMULTANEOUSLY PRESENT IN ANY SOLUTION IS 4. ANY NUMBER OF CONDENSED PHASE SPECIES CAN BE INCLUDED IN THE THERMOCHEMICAL DATA DECK. (NOTE... CONDENSED SPECIES ARE REQUIRED IN SURFACE EQUILIBRIUM CALCULATIONS FOR CONSIDERATION AS CANDIDATE SURFACE MATERIALS BUT ARE NOT PRESENTLY CONSIDERED AS CANDIDATE SPECIES WITHIN THE BOUNDARY LAYER). A BLANK CARD AFTER THE LAST SET CONCLUDES THE THERMODYNAMIC DATA. THE ARRANGEMENT OF THESE CARD SETS IS OF CONSEQUENCE IN SO FAR AS IT DETERMINES THE BASE SPECIES UPON WHICH MASS BALANCES ARE PERFORMED. THE FIRST INDEPENDENT SET OF BASE SPECIES BEING SELECTED. SINGULAR MATRICES CAN RESULT FROM CERTAIN SETS OF THEORETICALLY ACCEPTABLE BASE SPECIES DUE TO ROUND-OFF ERRORS. FURTHERMORE, MASS BALANCES, ETC. FOR THE (NSP)TH BASE SPECIES (SEE CARD 1 OF GROUP 2) IS OBTAINED BY DIFFERENCE. THEREFORE, THE ELEMENT REPRESENTED BY THIS BASE SPECIES SHOULD BE PRESENT IN APPRECIABLE QUANTITIES THROUGHOUT THE BOUNDARY LAYER. FOR EXAMPLE, FOR ABLATION IN AIR, MOLECULAR NITROGEN IS A GOOD CHOICE FOR THE (NSP)TH BASE SPECIES. FINALLY, THE ORDER OF THE BASE SPECIES DETERMINES THE REACTANTS FOR KINETICS PROBLEMS (SEE GROUP 14, CARD 3) EXCEPT FOR THESE CONSIDERATIONS, ATOMIC, MOLECULAR, AND CONDENSED SPECIES CAN BE ARRANGED IN ANY ORDER. WHEN IONIZED FLOWS ARE CONSIDERED, THE ATOMIC, MOLECULAR AND CONDENSED SPECIES DATA MUST APPEAR FIRST AND BE FOLLOWED BY, FIRST, ELECTRON SPECIES DATA, AND THEN THE IONIC SPECIES DATA (WHICH CAN BE IN ANY ORDER). THE DATA FORMAT ACCEPTED BY THE PROGRAM (DESCRIBED BELOW) IS AS GENERATED BY THE AEROTHERM TCDATA PROGRAM AND IS THE SAME AS THAT USED IN NAVWEPS REPORT 7043. THERMOCHEMICAL DATA DECKS HAVE BEEN GENERATED FOR ABOUT 600 SPECIES, BASED MOSTLY ON CURVE FITS OF JANAF DATA.

CARDS 1, 4, 7, ..., ONE FOR EACH MOLECULE FORMAT(7(F3.0,I3),30X,2A4)
***** USED ONLY FOR KR(12)=0, 2, 5 OR 7 *****

FIELDS 1, 3, 5, ..., ONE FOR EACH ELEMENT IN MOLECULE (COLUMNS 1-3, 7-9, 13-15, ...), ALPT(N) IN EACH FIELD

NUMBER OF ATOMS (OF ATOMIC NUMBER GIVEN IN SUBSEQUENT FIELD) IN A MOLECULE OF THIS SPECIES. IF FIELD ONE IS ZERO THIS CARD IS PRESUMED TO BE THE END OF THE THERMODYNAMIC DATA.

FIELDS 2, 4, 6, ..., ONE FOR EACH ELEMENT IN MOLECULE (COLUMNS 4-6, 10-12, 16-18, ...), JAT(N) IN EACH FIELD

ATOMIC NUMBERS OF ELEMENTS IN MOLECULES (LISTED IN ASCENDING SEQUENCE).

LAST FIELD (COLUMNS 73-80)

MOLECULAR DESIGNATION (e.g., SIO2) FOR OUTPUT AND AS IDENTIFIER FOR DIFFUSION FACTOR DATA.

```
CARDS 2, 5, 8, ...., ONE FOR EACH MOLECULE    FORMAT(6E9.6,6X,F6.0,I1)
        ***** USED ONLY FOR KR(12)=0, 2, 5 OR 7 *****

  FIELD  1 (COLUMNS 1-9), HA(J)

    HEAT OF FORMATION OF MOLECULE AT 298 DEG K FROM JANAF BASE STATE
    (ELEMENTS IN MOST NATURAL FORM AT 298 DEG. K), CAL/MOLE.

  FIELDS  2-6 (COLUMNS 10-18, 19-27, 28-36, 37-45, AND 46-54), CH(J,1),
              RC(J,1),RD(J,1),RE(J,1), RF(J,1)

    CONSTANTS APPROPRIATE TO LOWER TEMPERATURE RANGE OF THERMODYNAMIC DATA,
    TAKING F2, F3, ...., AS FIELDS 2, 3, ETC., THE CURVE FITS ARE AS FOLLOWS
    WITH T IN DEG K, H IN CAL/MOLE, AND S IN CAL/MOLE DEG K.


          HEAT CAPACITY, CP=F3+F4*T+F5/T**2

          ENTHALPY, H-H298=F2+F3*(T-3000)+0.5*F4*(T**2-3000**2)
                           -F5*(1/T-1/3000)

          ENTROPY, S=F6+F3*LN(T/3000)+F4*(T-3000)-0.5*F5*(1/T**2-1/3000**2)

  FIELD  7 (COLUMNS 61-66), TU(J,1)

    UPPER LIMIT OF LOWER TEMPERATURE RANGE IN DEG K. (FOR CONDENSED-PHASE
    MATERIALS WHICH MELT, IT IS APPROPRIATE TO USE MELT TEMPERATURES).

  FIELD  8 (COLUMN 67), KPHA(1)

      1 SIGNIFIES GASEOUS SPECIES

      2 SIGNIFIES SOLID SPECIES

      3 SIGNIFIES LIQUID SPECIES


CARDS 3, 6, 9,   ., ONE FOR EACH MOLECULE    FORMAT(6E9.6,6X,F6.0,I1)
        ***** USED ONLY FOR KR(12)=0, 2, 5 OR 7 *****

  FIELDS 1-8 (COLUMNS 1-67)

    SAME AS CARDS 2, 5, 8, ...., EXCEPT USE CONSTANTS FOR UPPER TEMPERATURE
    RANGE AND FIELD 7 IS THE FAIL TEMPERATURE OF THIS SPECIES AS A SURFACE.


LAST CARD .... AS MENTIONED PREVIOUSLY, A BLANK CARD IS USED TO SIGNIFY THE
        END OF THERMOCHEMICAL DATA
```

GROUP 14 SURFACE KINETIC DATA (CALLED FROM INPUT)
**** SKIP THIS GROUP FOR KR(12)=0,1, OR 2 OR KR(7)= 1 OR 3 ****

REACTIONS OF THE SURFACE MATERIALS WITH ADJACENT BOUNDARY LAYER GASES CAN BE KINETICALLY CONTROLLED ACCORDING TO AN ARRHENIUS TYPE RELATION. FOR EXAMPLE, IN THE REACTION

C* + 1/2 O2 CO

THE MASS FLUX RELATION IS

$$\frac{\dot{m}_c}{\mathfrak{M}_c} = FKF*\exp\left(EAK/(1.9869*T)\right)*\left(P_{O_2}^{\frac{1}{2}} - \frac{P_{CO}}{K_p}\right)^{EXK}$$

WHERE $\dot{m}_c$ = CARBON MASS FLUX
$\mathfrak{M}_c$ = CARBON MOLECULAR WEIGHT
FKF = PRE-EXPONENTIAL FACTOR
EAK = ACTIVATION ENERGY
T = TEMPERATURE
P = PARTIAL PRESSURE OF THE SUBSCRIPTED SPECIES
K = EQUILIBRIUM CONSTANT
EXK = REACTION ORDER

THESE CONSTANTS AND FACTORS ARE INPUT ON THE CARDS DESCRIBED BELOW. FURTHER DISCUSSION OF KINETIC MODELS FOR ABLATION CAN BE FOUND IN REFERENCE 7. FOR EXAMPLE-

CARD 1. FORMAT(I3)

FIELD 1 (COLUMNS 1-3,RIGHT JUSTIFIED), MT

NUMBER OF KINETICALLY CONTROLLED REACTIONS TO BE CONSIDERED. IF TWO PROBLEMS ARE STACKED TOGETHER SEPARATED BY A COMMA (SEE CARD 1 OF LAST GROUP) AND IF THE FIRST IS A KINETICS PROBLEM AND THE SECOND IS TO BE EQUILIBRIUM, THEN FOR THE SECOND, KINETICS MUST BE TURNED OFF USING KR(12)=5,6 OR 7 AND MT=0.

CARDS 2,5,8,... ONE FOR EACH KINETICALLY CONTROLLED REACTION, FORMAT(8E10.4)

FIELD 1 (COLUMNS 1-10), FKF(N)

PRE-EXPONENTIAL FACTOR FOR SURFACE MASS BALANCES IN LB-MOLES OF REACTANT PER FT**2 PER SECOND.

FIELD 2 (COLUMNS 11-20), EAK(N)

ACTIVATION ENERGY FOR THE FORWARD REACTION IN CALORIES PER GRAM-MOLE

FIELD 3 (COLUMNS 21-30), EXK(N)

REACTION EXPONENT; THE DRIVING POTENTIAL AS OBTAINED FROM THE REACTION STOICHIOMETRY IS RAISED TO THIS POWER IN EVALUATING THE REACTION RATE. EXK = 1.0 IS RECOMMENDED.

CARDS 3,6,9,..., ONE FOR EACH KINETICALLY CONTROLLED REACTION, FORMAT(8E10.4)

FIELDS 1,2,3,..., ONE FOR EACH BASE SPECIES (COLUMNS 1-10,11-20,...), RMU(K,N)

STOICHIOMETRIC COEFFICIENTS ON REACTANTS. IN THE PRESENT FORMULATION ONLY BASE SPECIES MAY BE USED AS REACTANTS. THUS SOME CARE MUST BE USED IN ESTABLISHING THE ORDER OF GROUP 13.

CARDS 4,7,10,..., ONE FOR EACH KINETICALLY CONTROLLED REACTION, FORMAT(8E10.4)

FIELDS 1,2,3,..., ONE FOR EACH BASE SPECIES (COLUMNS 1-10,11-20,...), PMU(K,N)

STOICHIOMETRIC COEFFICIENTS ON THE PRODUCTS, OR ON THEIR EQUILIBRIUM BASE SPECIES EQUIVALENTS IF THEY ARE NOT BASE SPECIES. FOR EXAMPLE IF THE BASE SPECIES ARE CO, H2O, H2, AND C* FOR A SYSTEM WHERE C* IS THE ONLY ISOLATED (NONEQUILIBRIUM) SPECIES, A REACTION WRITTEN AS

$$H2 + 2C^* = C2H2$$

COULD EQUIVALENTLY BE WRITTEN

$$H2 + 2C^* = 2CO + 3H2 - 2H2O$$

AND THIS IS THE MANNER IN WHICH THE PRODUCT COEFFICIENTS WOULD BE INPUT. THIS EQUIVALENT REPRESENTATION CAN NOT BE USED FOR REACTANTS.

GROUP 15 STREAMWISE DISTRIBUTIONS FOR EDGE CONDITIONS (CALLED FROM REFCON)

CARD SET 1. FORMAT(8E10.4) *.**** USED ONLY FOR KR(5)=5 *****

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
DSIP(L), L=1,NS (SEE CARD 3 OF GROUP 3)

DECREASE IN EDGE ENTROPY FROM PREVIOUS STATION TO CURRENT STATION, CAL/GM DEG K (THE STAGNATION POINT ENTROPY IS COMPUTED BY THE PROGRAM. DSIP IS USED TO DECREMENT THE ENTROPY AT DOWNSTREAM STATIONS TO TAKE INTO ACCOUNT SHOCK CURVATURE. DSIP(1) SHOULD BE SET EQUAL TO ZERO.)

CARD 2. FORMAT (I2,E8.5,7E10.5) ***** USED ONLY FOR KR(5) = 2,3 OR 4*****

FIELD 1-5 (COLUMN 1-2, 3-10, 11-20, 21-30, 31-40) NEN, UINF, RHOINF, HINF, PINF

NEN NUMBER OF ENTROPY OR SHOCK LAYER POINTS (MAXIMUM OF 20)

*.UINF FREE STREAM VELOCITY, FT/SEC

*.RHOINF FREE STREAM DENSITY, LB/FT3

.HINF FREE STREAM ENTHALPY, BTU/LB

.PINF STATIC PRESSURE, ATMOSPHERES

* ENTRY REQUIRED IF FREE STREAM STREAM FUNCTION POSITION GIVEN
. ENTRY REQUIRED IF ENTROPY DATA GIVEN IN TERMS OF SHOCK ANGLE (SEE CARD SET 3 AND 4)

CARD SET 3. FORMAT (A1,E9.4,7E10.4/8E10.4) ***** USED ONLY IF KR(5) = 2,3 OR 4 AND NEN > 0

FIELD 1 (COLUMN 1) IRED,

ALPHABETIC CHARACTER DESCRIPTIVE OF DATA IN SUBSEQUENT FIELDS:

I	FREE STREAM STREAM FUNCTION POSITION IN INCHES (NORMAL TO CENTERLINE)
F	FREE STREAM STREAM FUNCTION POSITION IN FEET (NORMAL TO CENTERLINE)
BLANK	STREAM FUNCTION VALUE IN LB/SEC/RAD FOR AXISYMMETRIC BODIES OR LB/SEC/FT FOR PLANAR BODIES

FIELDS 2,3, ... NEN+1 (COLUMNS 2-10, 11-20, 21-30 ETC. 8 TO A CARD)
SF(I), I=1,NEN

WHERE THE SF ARE AS DESCRIBED ABOVE

CARD SET 4. FORMAT (A1, E9.4,7E10.4/8E10.4) ***** USED ONLY IF KR(5) =2,3 OR 4

FIELD 1 (COLUMN 1) IKED

ALPHANETIC CHARACTER DESCRIPTIVE OF DATA IN SUBSEQUENT FIELDS:

D	SHOCK ANGLE* IN DEGREES
R	SHOCK ANGLE* IN RADIANS
BLANK	ENTROPY (BTU/LB DEG R) RELATIVE TO CENTERLINE VALUE

*THE SHOCK ANGLE IS DEFINED RELATIVE TO THE CENTERLINE.

FIELDS 2,3, ... NEN+1 (COLUMNS 2-10, 11-20, 21-30, ETC 8 TO A CARD0
CS(I), I=1,NEN

WHERE THE CS ARE AS DESCRIBED ABOVE, CORRESPONDING TO STREAM FUNCTION DATA OF CARD SET 3. IF NEN ENTERED AS ZERO ON CARD 2, NEN SET TO NUMBER OF STATIONS AND STREAM FUNCTIONS CORRESPOND TO ROKAP VALUES OF CARD SET 2 OF GROUP 5.

CARD SET 5. FORMAT (8E10.4) ***** USED ONLY IF KR(5) = 4

FIELDS 1,2, ... NEN

TOTAL ENTHALPY, BTU/LB, RELATIVE TO CENTERLINE VALUE CORRESPONDING TO STREAM FUNCTION DATA OF CARD SET 3.

CARD 6. FORMAT(I2) ***** USED ONLY IF CARD SET 1 OR 2 IS USED *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IDSIP

ITEM WHEN DATA ABOVE (CARD SET 1 TO 5) IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE) USE BLANK CARD IF DATA IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

CARD SET 7. FORMAT(8E10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD,
PRE(L), L=1,NS (SEE CARD 3 OF GROUP 3)

RATIO OF LOCAL STATIC TO STAGNATION PRESSURE. IN ADDITION TO DEFINING THE LOCAL PRESSURE, THIS DATA IS USED TO FORM THE LOCAL VELOCITY GRADIENT AT THE STAGNATION POINT AND OTHER BODY STATIONS. DUE TO THE SENSITIVITY OF THE PROGRAM TO THE VELOCITY GRADIENT IN THE STAGNATION REGION, TWO OPTIONS HAVE BEEN INCORPORATED TO ALLOW A SMOOTHER VELOCITY GRADIENT DISTRIBUTION THAN IS TYPICALLY OBTAINED BY READING NUMBERS FROM A SET OF CURVES. FOR EXAMPLE. THE VARIOUS OPTIONS ARE CONTROLLED BY THE ENTRIES IN THIS PRESSURE TABLE AND THE EFFECTIVE NOSE RADIUS ENTRY (GROUP 5, CARD 1, FIELD 2).

1) PRE(1) IS READ IN BUT RNOSE IS NOT

THE INPUT PRESSURES ARE CURVE FITTED AND PRESSURE AND VELOCITY GRADIENTS ARE EVALUATED DIRECTLY FROM THE RESULTING CURVE.

2) PRE(1) AND RNOSE BOTH READ IN.

STAGNATION POINT VELOCITY GRADIENT EVALUATED FROM

```
DUES = 1./RNOSE*SQRT(2.*PE/RHOE*32.174*2116.)
```

3) PRE(1) NOT READ IN, AND PRE ( ) NOT READ IN FOR AN ARBITRARY NUMBER OF STATIONS.

IN THIS INSTANCE HE VELOCITY GRADIENT IS ASSUMED TO BE LINEAR AND A NEWTONIAN PRESSURE DISTRIBUTION FOR SMALL S/R IS ASSUMED AT THOSE STATIONS FOR WHICH NO PRESSURE IS INPUT. FIRST, AN EFFECTIVE NOSE RADIUS, RNOSE, IS COMPUTED FROM THE FIRST NONZERO PRESSURE ENTRY FROM THE RELATION

```
RNOSE = S(L)/SQRT(1-PRE(L))
```

THE STAGNATION POINT VELOCITY GRADIENT IS THEN FOUND AS IN OPTION (2) ABOVE. PRESSURE FOR STATION LL LESS THAN L IS FOUND FROM

```
PRE(LL) = 1. - (S(LL)/RNOSE)**2
```

CARD 8. FORMAT(I2) ***** USED ONLY IF CARD SET 3 IS USED *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IPRE

ITEM WHEN PRE IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE) USE BLANK CARD IF PRE IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

CARD SET 9. FORMAT(8E10.4)

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, RADR(L), L=1,NS (SEE CARD 3 OF GROUP 3)

RATIO OF LOCAL TO STAGNATION POINT INCIDENT RADIATION. THIS INFORMATION IS USED ONLY FOR KR(9) OR KR9 OF 4. INPUT BLANKS INTO THIS FIELD FOR OTHER TYPES OF PROBLEMS.

CARD 10. FORMAT(I2)

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IRAD

ITEM WHEN RADR IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE) USE BLANK CARD IF RADR IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

```
GROUP 16 STREAMWISE DISTRIBUTIONS FOR INPUT WALL CONDITIONS
         (CALLED FROM REFCON)
-------------------------------------------------------------------------------

  CARD SET 1, FORMAT(8F10.4) *** USED ONLY FOR KR(11)=1 AND KR(9)=0,1, OR 2 **

    FIELD  1 (COLUMNS 1-10), FIELD  2 (COLUMNS 11-20), ETC., 8 TO A CARD,
             HW(L,1), L=1,NS  (SEE CARD 3 OF GROUP 3)

      ENTHALPY OF THE GAS AT THE WALL, BTU/LB

  CARD  2, FORMAT(I2) ***** USED ONLY IF CARD SET 1 IS USED *****

    FIELD  1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IHW

      ITEM WHEN HW IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE).
      USE BLANK CARD IF HW IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR
      IF NO MORE TIMES ARE TO BE CONSIDERED.

  CARD SET 3, FORMAT(8F10.4) ***** USED ONLY IF KR(11)=0 AND KR(9)=0,1, OR 2,
                                   IF KR(9)=3 OR IF ANY OF THE KR9=2 OR 3 ****

    FIELD  1 (COLUMNS 1-10), FIELD  2 (COLUMNS 11-20), ETC., 8 TO A CARD,
             TW(L,1), L=1,NS  (SEE CARD 3 OF GROUP 3)

      WALL TEMPERATURE, DEG R

  CARD  4, FORMAT(I2) ***** USED ONLY IF CARD SET 3 IS USED *****

    FIELD  1 (COLUMNS 1-2, RIGHT-JUSTIFIED), ITW

      ITEM WHEN TW IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE).
      USE BLANK CARD IF TW IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR
      IF NO MORE TIMES ARE TO BE CONSIDERED.

  CARD SET 5, FORMAT(8F10.4) ***** USED ONLY FOR KR(9)=0 AND KR(11)=0 OR 1 ***

    FIELD  1 (COLUMNS 1-10), FIELD  2 (COLUMNS 11-20), ETC., 8 TO A CARD,
             FW(L,1), L=1,NS  (SEE CARD 3 OF GROUP 3)

      WALL STREAM-FUNCTION (NEGATIVE FOR MASS ADDITION)
```

CARD 6, FORMAT(I2) ***** USED ONLY IF CARD SET 5 IS USED *****

FIELD 1 (COLUMNS, 1-2, RIGHT-JUSTIFIED), IFW

ITEM WHEN FW IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE). USE BLANK CARD IF FW IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

CARD SET 7, FORMAT(8F10.4) ***** USED ONLY FOR KR(9)=1 AND KR(11)=0 OR 1 ***

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, RHOVW(L,1), L=1,NS (SEE CARD 3 OF GROUP 3)

TOTAL MASS FLUX AT THE WALL (LB/SEC FT2 O DIMENSIONLESS FOR KR(8)=0 OR 1, RESPECTIVELY, POSITIVE FOR MASS INJECTION)

CARD 8, FORMAT(I2) ***** USED ONLY IF CARD SET 7 IS USED *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IRHOVW

ITEM WHEN RHOVW IS TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE). USE BLANK CARD IF RHOVW IS TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

CARD SET 9, FORMAT(8F10.4) **** USED ONLY FOR KR(7)=0 OR 2, KR(9)=0 OR 1, AND KR(11)=0 OR 1.

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, DO K=1,NSPM1 SPW(K,L,1), L=1,NS NSPM1=NSP-1 (SEE CARD 1 OF GROUP 2 AND CARD 3 OF GROUP 3)

WALL ELEMENTAL MASS FRACTIONS IN THE SAME ORDER THAT THEY ARE SELECTED FROM THE THERMODYNAMIC DATA (SEE DISCUSSION UNDER GROUP 13)

CARD 10, FORMAT(I2) ***** USED ONLY IF CARD SET 9 IS USED *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), ISPW

ITEM WHEN THE SPW ARE TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE). USE BLANK CARD IF THE SPW ARE TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

CARD SET 11, FORMAT(8F10.4) **** USED ONLY FOR KR(7)=0 OR 2 WITH KR(9)=2 AND KR(11)=0,1, OR 2, OR WITH ANY OF THE KR9=2

FIELD 1 (COLUMNS 1-10), FIELD 2 (COLUMNS 11-20), ETC., 8 TO A CARD, DO N=1,3 FLUXJ(N,L,1), L=1,NS (SEE CARD 3 OF GROUP 3)

WALL MASS FLUXES OF BOUNDARY LAYER EDGE GAS, PYROLYSIS GAS, AND CHAR, RESPECTIVELY (SEE GROUP 11, CARDS 2,3, ..., FIELD 4), LB/SEC FT2 OR DIMENSIONLESS FOR KR(8) = 0 OR 1, RESPECTIVELY. POSITIVE FOR MASS INJECTION WHEN KR(8) = 0 AND NEGATIVE FOR MASS INJECTION WHEN KR(8)=1. READ IN ALL EDGE GAS VALUES, THEN START PYROLYSIS GAS VALUES ON A NEW CARD AND READ ALL PYROLYSIS GAS VALUES, ETC.

CARD 12 FORMAT(I2) ***** USED ONLY IF CARD SET 11 IS USED *****

FIELD 1 (COLUMNS 1-2, RIGHT-JUSTIFIED), IFLUXJ

ITEM WHEN THE FLUXJ ARE TO BE UPDATED WHERE ITEM IS INDEX ON TIME (OR SUBCASE). USE BLANK CARD IF THE FLUXJ ARE TO REMAIN UNCHANGED FOR ALL REMAINING TIMES OR IF NO MORE TIMES ARE TO BE CONSIDERED.

GROUPS 17,18,19, ..., (13+NITEM) SEE CARD 1 OF GROUP 3 (CALLED FROM REFCON)

UPDATING INFORMATION FOR STREAMWISE DISTRIBUTIONS OF EDGE AND WALL CONDITIONS FOR TIMES 1,2,3, ..., NITEM-1. NO ADDITIONAL INFORMATION AFTER GROUP 16 IS REQUIRED FOR NITEM = 1 OR IF CARDS 2,4,6,... OF GROUPS 15 AND 16 ARE ALL BLANK. DATA ARE SUPPLIED FOR EACH SET AND ONLY EACH SET OF STREAMWISE INFORMATION FOR WHICH THE CURRENT TIME HAS BEEN DESIGNATED IN A PREVIOUS GROUP (E.G. CONSIDER TW AT TIME 4 (GROUP 19). TW DATA (I.E., CARD SET 3 AND CARD 4 OF GROUP 16 WOULD BE REQUIRED IF A 4 HAS APPEARED IN CARD 4 OF GROUP 18,17 OR 16) ALL DATA REQUIRED AT TIME 2 (IF ANY) ARE SUPPLIED. FIRST (GROUP 17), THEN FOR TIME 3 (GROUP 18), TIME 4 (GROUP 19), ETC. FOR EACH TIME, THESE DATA ARE SUPPLIED IN THE SAME ORDER AS LISTED UNDER GROUPS 15 AND 16. FORMATS ARE THE SAME AS IN GROUPS 15 AND 16. IN PARTICULAR, IT SHOULD BE NOTED THAT EACH ODD-NUMBERED CARD MUST BE FOLLOWED BY THE APPROPRIATE EVEN-NUMBERED CARD SIGNIFYING FOR WHAT TIME (IF ANY) DATA OF THIS SAME TYPE IS TO BE UPDATED AGAIN.

LAST GROUP (CALLED FROM BLIMP)

CARD 1 FORMAT(A1)

FIELD 1 (COLUMN 1), JAST

THE PURPOSE OF THIS ENTRY IS TO PERMIT A TEST ON WHETHER OR NOT A NEW CASE IS TO FOLLOW. IN THE EVENT A CASE DOES NOT CONVERGE IN THE ALLOTTED NUMBER OF ITERATIONS, ANY REMAINING CARDS FOR THAT CASE ARE READ AND THEN IGNORED UNTIL A COMMA (,) OR A PERIOD (.) IS ENCOUNTERED IN COLUMN 1. A COMMA SIGNIFIES ANOTHER CASE, WHILE A PERIOD SIGNIFIES THAT THERE ARE NO CASES TO FOLLOW.

SECTION II

FORTRAN VARIABLES LIST

The revised Fortran Variables List is contained in this section.

FORTRAN VARIABLES LIST

A(N,NN)	ERROR COEFFICIENT ARRAY IN CHEMISTRY SOLUTION, N PERTAINS TO EQUATION WHEREAS NN PERTAINS TO VARIABLE.	C EQTCOM
AA	PRODUCT OF PRESSURE TIMES MOLECULAR WEIGHT.	C EQTCOM
AAA	DEFUNCT VARIABLE, SET TO UNITY.	C EQPCOM
AB	LOCALLY DEFINED VARIABLE	L SLOPQ
ABB	LOCALLY DEFINED VARIABLE	L SLOPQ
ABER	ABSOLUTE VALUE OF RATIO OF A MASS BALANCE ERROR TO LARGEST TERM IN THAT MASS BALANCE.	L MATER
ABSVA	ABSOLUTE VALUE OF CONTRIBUTION OF A SPCIES TO A MASS BALANCE.	L MATER
ABX	ABSOLUTE VALUE OF LOG CORRECTION ON TEMPERATURE.	L CRECT
AC	LOCALLY DEFINED VARIABLE	L SLOPQ
ACC	LOCALLY DEFINED VARIABLE	L SLOPQ
ACH	MACH NUMBER	L OUTPUT
ADUM	COEFFICIENT IN SURFACE KINETIC LATION FOR MATERIAL BEING CONSIDERED UNDER KR(9) = 5 OR EE INPUT INSTRUCTIONS).	C CRBCOM
AF	LOCALLY DEFINED VARIABLE	L TRMBL
ALF	DERIVATIVE OF LOG MOLECULAR WEIGHT WITH RESPECT TO LOG TEMPERATURE AT CONSTANT PRESSURE.	L EQUIL
ALP(K)	INPUT MASS QUANTITY OF ELEMENTS, EQ(25) OF NASA CR-1064.	C EQTCOM
ALPH	NORMALIZING PARAMETER FOR BOUNDARY LAYER NORMAL COORDINATE, SEE EQ. (33) OF NASA CR-1062.	C VARCOM
ALPHD	D1*ALPH + D2*HALPH WHERE D1 AND D2 ARE DEFINED BY EQ(88) OR (89) OF NASA CR-1062.	C HISCOM
ALPT(N)	NUMBER OF ATOMS OF AN ELEMENT WITH ATOMIC NUMBER JAT(N) IN A SPECIES.	L INPUT
ALSQ	ALPH**2	L FIRSTG

AM(N,NN)	COEFFICIENTS IN THE MATRIX DEFINED AS (BNL) IN EQ(150) OF NASA CR-1062.	C NONCOM
AMOA	ALPHANUMERIC VARIABLE, FIRST OF TWO PORTIONS OF SPECIES NAME.	L INPUT
AMOB	ALPHANUMERIC VARIABLE, SECOND OF TWO PORTIONS OF SPECIES NAME.	L INPUT
AMUS	VN(J) * WTM(J)/(FF(J) * (WOZ-VN(J) * FF(J) * WD7)) SUMMED OVER ALL SPECIES N *.	L PROPS
APE(N,NN)	SAVED ARRAY A(N,NN) DURING IVERSION.	L EQUIL
AR	WEIGHTING FACTOR IN LINEARIZING EQUILIBRIUM ASPECT OF KINETICALLY CONTROLLED MASS BALANCE.	L KINET
AREA	AREA PER UNIT MASS FLOW DURING EXPANSION.	L EQUIL
ARPH	ELEMENTAL MASS FRACTION OF ATOM.	L EQUIL
ARPHM	MAXIMUM CONTRIBUTION TO CALCULATION OF AN ARPH.	L EQUIL
ASTAR	A* USED IN TRANSPORT PROPERTIES	L PROPS
ASU	FIRST FOUR CHARACTERS OF ALPHAMERIC NAME OF ASSIGNED SURFACE SPECIES	C CRBCOM
ATA(K)	ALPHANUMERIC VARIABLE, FIRST OF THREE PORTIONS OF ELEMENT NAME.	C EQPCOM
ATB(K)	ALPHANUMERIC VARIABLE, SECOND OF THREE PORTIONS OF ELEMENT NAME.	C EQPCOM
ATC(K)	ALPHANUMERIC VARIABLE, THIRD OF THREE PORTIONS OF ELEMENT NAME.	C EQPCOM
ATEMP	ABSOLUTE VALUE OF DTEMP	L NONCER
B(N)	ERRORS USED WITH COEFFICIENTS TO YIELD CORRECTIONS IN CHEMISTRY ITERATIONS, IDENTICAL TO BB*.	C EQTCOM
B(N)	ARRAY OF CONSTANTS DEFINED IN BLIMP, IDENTICAL TO BB*.	C INTCOM
B1	SAVED VALUE OF B(1) DURING INVERSION. EQUALS SURFACE EQUILIBRIUM ERROR FOR THAT OPTION.	L EQUIL
B1(I)	DSQ(I-1)/6	C ETACOM
B2(I)	DSQ(I-1)/3	C ETACOM
BA1(N,NN)	MATRIX (BLFF) DEFINED BY FIGURE (3) OF NASA CR-1062 PREMULTIPLIED BY INVERSE OF (ALFF).	C ETACOM

BA2(N,NN)	MATRIX (BLHH) OR (BLKK) DEFINED BY FIGURE (3) OF NASA CR 1062 PREMULTIPLIED BY INVERSE OF (ALHH) OR (ALKK), RESPECTIVELY.	C ETACOM
BASMOL	MOLECULAR WEIGHT OF REFERENCE SPECIES IN DIFFUSION FACTOR CALCULATIONS	C EQTCOM
BDUM	COEFFICIENT IN SURFACE KINETIC RELATION FOR MATERIAL BEING CONSIDERED UNDER KR(9) = 5 OR 6 (SEE INPUT INSTRUCTIONS).	C CRBCOM
BETA	BETAM(L)	C HISCOM
BETAM(L)	STREAMWISE PRESSURE GRADIENT PARAMETER DEFINED BY EQ(53) OF NASA CR-1062.	C HISCOM
BETH	DERIVATIVE OF LOG MOLECULAR WEIGHT WITH RESPECT TO LOG PRESSURE AT CONSTANT TEMPERATURE.	L EQUIL
BF	LOCALLY DEFINED VARIABLE	L TRMBL
BIP	NOMINALLY ZERO. SET TO 1. TO PREVENT PREMATURE CONVERGENCE	L NONCER
BLOW	BLOWING PARAMETER BASED ON GAS MASS FLUX GIVEN BY RHOVW(IS,1)/(C3 * CH).	C OUTCOM
BLOWCH	CHAR FLUX NORMALIZED BY HEAT TRANSFER COEFFICIENT	L OUTPUT
BLOWPG	PYROLYSIS GAS FLUX NORMALIZED BY HEAT TRANSFER COEFFICIENT	L OUTPUT
BLQEQV	VARIABLE EQUIVALENCED TO BLQCOM FOR DUMPING PURPOSES	L DUMCOM
BS(N)	SAVED ARRAY OF B(N) DURING INVERSION	L EQUIL
BSU	SECOND FOUR CHARACTERS OF ALPHAMERIC VALUE OF ASSIGNED SURFACE SPECIES	C CRBCOM
BULP	LOG (BUMP)	L CRECT
BUMEQV	VARIABLE EQUIVALENCED TO BUMCOM FOR DUMPING PURPOSES	L DUMCOM
BUMP	CONTRIBUTION TO DAMPING FACTOR EASE RESULTING FROM SIGN CHANGES IN CRITICAL ERRORS.	C BUMCOM
BUMP	10**4 * P. CONSTRAINTS ON CORRECTIONS ARE RELAXED FOR PARTIAL PRESSURES BELOW THIS VALUE.	L CRECT
C(K)	GRAM ATOMS OF ELEMENT K IN A MOLECULE.	L INPUT
C1	1. + DZ WHERE DZ IS DEFINED BY EQ(88) OR (89) OF NASA CR-1062.	C HISCOM
C2	-(1+2*DZ) WHERE DZ IS DEFINED BY EQ(88) OR (89) OF NASA CR-1062.	C HISCOM

C3	C3M(L)	C HISCOM
C3M(L)	-1/ALPHASTAR WHERE ALPHASTAR IS THE FLUX NORMALIZING PARAMETER DEFINED BY EQ (44) OF NASA CR-1062.	C HISCOM
C4	BETA + 1 + D7 WHERE D7 IS DEFINED BY EQ(88) OR (89) OF NASA CR-1062.	C HISCOM
C5	1./ALPH	C COECOM
C6	BETA * ALPH**2	C COECOM
C7	-(UE(L)**2)/((ALPH**2)*25036.5)	C COECOM
C8	ALPHD/ALPH	C COECOM
C9	BETA+1.+D7 - ALPHD/ALPH	C COECOM
C10	C7*F(2,I)	C COECOM
C11	DEFINED IN ICOEFF	C COECOM
C12	DEFINED IN ICOEFF	C COECOM
C13	C7 * F(3,I)	C COECOM
C14	(1.+D7)*F(1,I)+HF(I,5)	C COECOM
C15	PR(I)-1	C COECOM
C16	1./PR(I)	C COECOM
C17	1./SC(I)	C COECOM
C18	CTR*T(I)	C COECOM
C19	CAPC(I)/(ALPH*SC(I))	C COECOM
C20	CAPC(I)/(ALPH*PR(I))	C COECOM
C21	DEFINED IN ICOEFF	C COECOM
C22	DEFINED IN ICOEFF	C COECOM
C23	DEFINED IN ICOEFF	C COECOM
C24	DEFINED IN ICOEFF	C COECOM
C25	DEFINED IN ICOEFF	C COECOM
C26	RHOE(L)/RHO(I)	C COECOM
C28	DEFINED IN ICOEFF	C COECOM

C31	DEFINED IN ICOEFF	C COECOM
C32	NORMALIZED DIFFUSIVE HEAT FLUX CALCULATED IN ICOEFF	C COECOM
C43	DEFINED IN ICOEFF	C COECOM
C53	RHOP(I)/RHO(I)	C COECOM
C56	F(2,I)/ALPH	C COECOM
C73	(1.+DZ) * F(2,I)	C COECOM
C74	DEFINED IN ICOEFF	C COECOM
C75	DEFINED IN ICOEFF	C COECOM
C76	(1.+DZ) * G(1,I)	C COECOM
C77	DEFINED IN ICOEFF	C COECOM
C78	DEFINED IN ICOEFF	C COECOM
C79	DEFINED IN ICOEFF	C COECOM
C80	DEFINED IN ICOEFF	C COECOM
C81	DEFINED IN ICOEFF	C COECOM
C82	DEFINED IN ICOEFF	C COECOM
C83	DEFINED IN ICOEFF	C COECOM
C84	DEFINED IN ICOEFF	C COECOM
C85	DEFINED IN ICOEFF	C COECOM
C86	DEFINED IN ICOEFF	C COECOM
C87	DEFINED IN ICOEFF	C COECOM
C88	DEFINED IN ICOEFF	C COECOM
C89	BETA * (ALPH **2) * CRHO1	L IONLY
C89	-C3 * ALPH * VMUF(L)	L OUTPUT
CAPC(I)	PRODUCT OF DENSITY AND VISCOSITY NORMALIZED BY EDGE VALUE.	C PRPCOM
CASE(N)	ALPHANUMERIC NAME OF CASE.	C INTCOM
CBAR	VALUE OF THE VELOCITY RATIO AT BOUNDARY LAYER NODE KAPPA.	C INTCOM

CDUM	COEFFICIENT IN SURFACE KINETIC RELATION FOR MATERIAL BEING CONSIDERED UNDER KR(9) = 5 OR 6 (SEE INPUT INSTRUCTIONS).	C CRBCOM
CF	MOMENTUM TRANSFER COEFFICIENT GIVEN BY CAPC(1)/ALPH * VMUF(IS)/CH9*F(3,1)	C OUTCOM
CG(MS)	TOTAL ENTHALPY CORRESPONDING TO SF(MS)	C EDGCOM
CGP(MS)	DERIVATIVE OF CG(MS) WITH RESPECT TO ETA	C EDGCOM
CH	HEAT TRANSFER COEFFICIENT BASED ON ENTHALPY POTENTIAL. GIVEN BY -WALLQ/(C3*(G(1,NETA)-G(1,1)))	C OUTCOM
CHA	HEAT-TRANSFER COEFFICIENT CALCULATED BY EQ (21) OF REFERENCE 6 FOR THE SPECIAL CASE OF EQUAL DIFFUSION COEFFICIENTS	L FELTRU
CHE(N)	HEAT-TRANSFER COEFFICIENT CALCULATED FROM EQ (21) OF REFERENCE 6	L FELTRU
CHFLUX	LESS THAN ZERO VALUE IMPLIES PRESENCE OF CHAR ELEMENTS IN SURFACE CHEMISTRY	L EQUIL
CHL	VALUE OF HEAT-TRANSFER COEFFICIENT CALCULATED USING LEWIS NUMBER CORRELATION (EQ (22) OF REFERENCE 6)	L FELTRU
CH(N)	CURVE FIT CONSTANTS FOR THERMODYNAMIC DATA (THE QUANTITY F2 + H298 DISCUSSED IN GROUP 12 OF INPUT INSTRUCTIONS) N=1 FOR LOW AND 2 FOR HIGH TEMPERATURE RANGE, IDENTICAL TO CCHH.	C EQPCOM
CIJ(K,KK)	GRAM ATOM OF ELEMENT K IN BASE SPECIES KK.	E EQPCOM
CK1(K)	CALCULATED IN ICOEFF	C COECON
CK6(K)	NORMALIZED ELEMENTAL MASS FLUX CALCULATED IN ICOEFF	C COECON
CK9(K)	DEFINED IN ICOEFF	C COECON
CK13(K)	DEFINED IN ICOEFF	C COECON
CK17(K)	DEFINED IN ICOEFF	C COECON
CK18(K)	DEFINED IN ICOEFF	C COECON
CK19(K)	DEFINED IN ICOEFF	C COECON
CK21(K)	DEFINED IN ICOEFF	C COECON
CK22(K)	DEFINED IN ICOEFF	C COECON
CK23(K)	DSQ(I-1) * DPHIKH(K) / 3.	L IONLY

CK24(K)	C7 * F(3,I) * CK23(K)	L IONLY
CK25(K)	DETA(I-1) * DPHIKH(K)	L IONLY
CK26(K)	C7 * F(2,I) * CK25(K)	L IONLY
CKK1(K,KK)	DEFINED IN ICOEFF	C COECON
CKK2(K,KK)	DEFINED IN ICOEFF	C COECON
CKK3(K,KK)	DEFINED IN ICOEFF	C COECON
CL	L(I) IN MIXING LENGTH FORMULATION.	C EPSCOM
CLNUM	CLAUSER NUMBER USED IN DEFINING EDDY VISCOSITY IN THE WAKE PORTION OF THE BOUNDARY LAYER.	C EPSCOM
CMCHL	RATIO CM(K) TO CHL	L FELTRU
CME(N)	AVERAGE OF THE CMK(N)	L FELTRU
CM(K)	ELEMENTAL MASS TRANSFER COEFFICIENTS BASED ON MASS FRACTION POTENTIAL, GIVEN BY VJKW(K)/(DUM(K)*WAT(K)) WHERE DUM(K) IS THE SUMMATION OVER KK OF (SP(I,NETA,KK) - SP(I,1,KK))/WTM(KK)*CIJ(K,KK)	L OUTPUT
CMF	THE FACTOR BY WHICH ALL CORRECTIONS ARE DAMPED DURING CHEMISTRY ITERATIONS.	L CRECT
CMFF(J)	THE VALUE OF CMF AFTER CONSIDERATION OF CONSTRAINTS ON THE CORRECTION TO BE APPLIED TO THE PARTIAL PRESSURE OF THE JTH SPECIES.	L CRECT
CMK(N)	ELEMENTAL MASS-TRANSFER COEFFICIENT CALCULATED BY EQ (16) OF REFERENCE 6	C EQTCOM
COEFQV(N)	GLOBAL SET OF COEFFICIENTS C5,C6,C7, ETC.	C COECOM
COEFQV(N)	GLOBAL SET OF COEFFICIENTS CK1,CK2, ETC.	E COECON
COND	THERMAL CONDUCTIVITY	L OUTPUT
CONE	CONE HALF-ANGLE FOR SPHERE-CONE SHAPED BODIES.	C PRMCOM
CONFQV	VARIABLE EQUIVALENCED TO COECON FOR DUMPING PURPOSES	L DUMCOM
CORAR(N)	CORRECTION ARRAY, COMPOSED OF CORRECTIONS IN H(I), I=1 TO NETA, AND SP(I,J,K), I=1,NETA, K=1,NSPM1.	E NONCOM
CORMA	THE VALUE OF THE MAXIMUM CORAR.	C RUNCOM
CP(J)	SPECIFIC HEAT.	C EQTCOM

CPA	LOCALLY DEFINED VARIABLE	L MATER
CPBAR(I)	FROZEN SPECIFIC HEAT OF THE MIXTURE.	C PRPCOM
CPF	FROZEN SPECIFIC HEAT, IDENTICAL TO CCPF*.	C EQTCOM
CPG	FROZEN SPECIFIC HEAT OF GAS, IDENTICAL TO CCPG*.	C EQTCOM
CPT	FROZEN SPECIFIC HEAT OF GAS.	L STATE
CPTIL	PROPERTY OF THE GAS MIXTURE WHICH REDUCES TO CPBAR FOR EQUAL DIFFUSION COEFFICIENTS, SEE EQ(28) OF NASA CR-1062.	C PRPCOM
CRBFOV	VARIABLE EQUIVALENCED TO CRBCOM FOR DUMPING PURPOSES	L DUMCOM
CRHO(I-1)	C26 * DETA(I-1) * (1.-(RHOP(I)/RHO(I)) * DETA(I-1)/6)	C PRPCOM
CRHO1	(RHOP(I) / RHO(I)) * DETA(I-1) * (1.+DETA(I-1) * RHOP(I) / (RHO(I) * 6.))	L IONLY
CS(MS)	ENTROPY CORRESPONDING TO SF(MS)	C EDGCOM
CSPR(MS)	ENTROPY DERIVATIVE WITH RESPECT TO SF(MS)	C EDGCOM
CSP	EQUILIBRIUM SPECIFIC HEAT OF GAS.	L EQUIL
CT	COEFFICIENT APPEARING IN THE APPROXIMATION FOR THERMAL DIFFUSION COEFFICIENTS, SEE EQ(26) OF NASA CR-1062, NUMERICALLY EQUAL TO -0.5, SET EQUAL TO ZERO WHEN THERMAL DIFFUSION NEGLECTED.	C PRPCOM
CTR	CT * UNIVERS GAS CONSTANT.	C PRPCOM
CXM	LOCALLY DEFINED VARIABLE	L IONLY
CYM	LOCALLY DEFINED VARIABLE	L IONLY
CYSP	LOCALLY DEFINED VARIABLE	L IONLY
D	SET OF CONSTANT VECTORS CONVERTED TO SOLUTION VECTORS	L RERAY
D	ARGUMENT REPRESENTING DELTA ETA	L TAYLOR
D1	THE D SUB ONE OF EQ[89] IN NASA CR-1062.	L HISTXI
D2	THE D SUB TWO OF EQ[89] IN NASA CR-1062.	L HISTXI
D2UEDG	SECOND DERIVATIVE OF UEDGE WITH RESPECT TO STREAM FUNCTION, SEE EQ(68) OF NASA CR-1062 (SET EQUAL TO ZERO IN PRESENT PROGRAM).	C EDGCOM

DBAR	REFERENCE DIFFUSION COEFFICIENT INTRODUCED IN APPROXIMATION FOR UNEQUAL DIFFUSION COEFFICIENTS, NUMERICALLY EQUAL TO 4.16E-8 * T * SQRT(T) / (OMEGA * P).	L PROPS
DCAPCH	DERIVATIVE OF CAPC WITH RESPECT TO H.	C PRPCOM
DCAPCK(K)	DERIVATIVE OF CAPC WITH RESPECT TO MASS FRACTION OF ELEMENT K	C PRPCOM
DCLL	DERIVATIVE OF CL AT I WITH RESPECT TO CL AT I-1	L TRMBL
DCLPI	DERIVATIVE OF CL AT I WITH RESPECT TO PI AT I	L TRMBL
DCLPM	DERIVATIVE OF CL AT I WITH RESPECT TO PIM AT I-1	L TRMBL
DCPBH	DERIVATIVE OF CPBAR WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DCPBK(K)	DERIVATIVE OF CPBAR WITH RESPECT TO MASS FRACTION OF ELEMENT K, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DCPTH	DERIVATIVE OF CPTIL WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DCPTK(K)	DERIVATIVE OF CPTIL WITH RESPECT TO MASS FRACTION OF ELEMENT K, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DCU(I)	(DETA(I))**3	C ETACOM
DELJW(K)	ERROR IN DIFFUSIVE MASS FLUX, WALLJ(K), INTRODUCED DURING NEWTON-RAPHSON ITERATION.	C FLXCOM
DELQJW(N)	GLOBAL SET DELQW AND DELJW(K).	E FLXCOM
DELQW	ERROR IN DIFFUSIVE HEAT FLUX, WALLQ, INTRODUCED DURING NEWTON-RAPHSON ITERATION	C FLXCOM
DELST	DISPLACEMENT THICKNESS GIVEN BY Y(NETA)-C89*(F(1,NETA) -F(1,1))/ALPH.	C OUTCOM
DERC	CONSTANT IN CORRECTION COEFFICIENTS ON EPSA(I) RESULTING FROM LINEAR CORRECTION COEFFICIENTS	C EPSCOM
DEPS(I)	DERIVATIVE OF EPSA(I) WITH RESPECT TO NONLINEAR VARIABLES	C EPSCOM
DER(L)	DIMENSIONED VARIABLE USED IN VARIOUS SUBROUTINES BUT NOT USED FOR TRANSMITTING INFORMATION BETWEEN SUBROUTINES.	C TEMCOM
DETA(I)	ETA(I+1) - ETA(I)	C ETACOM
DHTILH	DERIVATIVE OF HTIL WITH RESPECT TO H.	C PRPCOM

DHTTLK(K)	DERIVATIVE OF HTTL WITH RESPECT TO MASS FRACTION OF ELEMENT K.	C PRPCOM
DTV	ROW NORMALIZING FACTOR IN GAUSSIAN ELIMINATION.	L RERAY
DTVC	PRODUCT OF 'DTV' AND ELEMENT OF ROW.	L RERAY
DKPT(MK)	DERIVATIVE OF LOG KP WITH RESPECT TO LOG TEMPERATURE.	C KINCOM
DLI(I)	DERIVATIVE OF EL(I) WITH RESPECT TO NONLINEAR VARIABLES	C EPSCOM
DLPH	A(3,I) EVALUATED AT THE WALL.	C NONCOM
DLPK(K)	A(3,K+2) EVALUATED AT THE WALL.	C NONCOM
DLXI	ALOG(XI(L) / XI(L-1))	L HISTXI
DLX2	STORED (HISTORIC) VALUE FOR DLOGXI DEFINED BY EQ(90) OF NASA CR-1062.	C HISCOM
DMU12H	DERIVATIVE OF VMU12 WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DMU12K(K)	DERIVATIVE OF VMU12 WITH RESPECT TO MASS FRACTION OF ELEMENT K. SET EQUAL TO ZERO IN PRESENT PROGRAM.	C PRPCOM
DMU3H	DERIVATIVE OF VMU3 WITH RESPECT TO H.	C PRPCOM
DMU3K(K)	DERIVATIVE OF VMU3 WITH RESPECT TO MASS FRACTION OF ELEMENT K.	C PRPCOM
DMU4H	DERIVATIVE WITH RESPECT TO H OF THE COEFFICIENT MU4 DEFINED IN EQ(28) OF NASA CR-1062.	C PRPCOM
DMU4K(K)	DERIVATIVE WITH RESPECT TO MASS FRACTION OF ELEMENT K OF THE COEFFICIENT MU4 DEFINED IN EQ(28) OF NASA CR-1062.	C PRPCOM
DPHIKH(K)	DERIVATIVE OF PHIK WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DPHIKK(K,KK)	DERIVATIVE OF K TH PHIK WITH RESPECT TO MASS FRACTION OF ELEMENT KK, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DPI(3+K,2)	(ARRAY OF DERIVATIVES OF PI WITH RESPECT TO PRIMARY VARIABLES)/TREF	C EPSCOM
DPRH	DERIVATIVE OF PR WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DPRK(K)	DERIVATIVE OF PR WITH RESPECT TO MASS FRACTION OF ELEMENT K. SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DQJNL(N)	GLOBAL SET OF DQNL AND DJNL(K).	E FLXCOM

DQJRNL(N)	DERIVATIVE OF DIFFUSIVE HEAT AND MASS FLUXES, WALLQJ WITH RESPECT TO NTH REDUCED NONLINEAR VARIABLE.	E NONCOM
DQNL(N)	DERIVATIVE OF DIFFUSIVE HEAT FLUX, WALLQ, WITH RESPECT TO N TH NONLINEAR VARIABLE.	C FLXCOM
DQRH	DERIVATIVE OF QR WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DQRK(K)	DERIVATIVE OF QR WITH RESPECT TO MASS FRACTION OF ELEMENT K, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DRHOH	DERIVATIVE OF RHO WITH RESPECT TO H.	C PRPCOM
DRHOI	DERIVATIVE OF VELOCITY DEFECT THICKNESS WITH RESPECT TO RHO AT I	L TRMBL
DRHOK(K)	DERIVATIVE OF RHO WITH RESPECT TO MASS FRACTION OF ELEMENT K.	C PRPCOM
DRNL(N)	REDUCED NONLINEAR ERRORS BEFORE MATRIX INVERSION, CORRECTIONS OF VARIABLES IN REDUCED NONLINEAR SET AFTER MATRIX INVERSION.	C ERRCOM
DSCH	DERIVATIVE OF SC WITH RESPECT TO H, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DSCK(K)	DERIVATIVE OF SC WITH RESPECT TO MASS FRACTION OF ELEMENT K, SET EQUAL TO ZERO IN CURRENT PROGRAM.	C PRPCOM
DSIP(L)	DECREASE IN ENTROPY FROM PREVIOUS STATION TO CURRENT STATION L AT BOUNDARY LAYER EDGE DUE TO SHOCK CURVATURE (DSIP(1) = 0 BY DEFINITION).	C EDGCOM
DSQ(I)	(DETA(I))**2	C ETACOM
DSV	LOCALLY DEFINED VARIABLE	L MATS1
DTD	DOWNWARD TEMPERATURE STEP USED IN SEEKING SURFACE EQUILIBRIUM SOLUTION.	L EQUIL
DTEMP	PREDICTED CHANGE IN SURFACE TEMPERATURE FOR THE CURRENT ITERATION DURING A KR(9) = 6 PROBLEM.	L NONCER
DTH	DERIVATIVE OF T WITH RESPECT TO H.	C PRPCOM
DTHW	DTH EVALUATED AT THE WALL.	C NONCOM
DTK(K)	DERIVATIVE OF T WITH RESPECT TO MASS FRACTION OF ELEMENT K	C PRPCOM
DTKW(K)	DTK EVALUATED AT THE WALL.	C NONCOM
DTM	LIMIT VALUE OF DELTA (1./T) IN CHEMISTRY SOLUTION.	L CRECT

DTU	UPWARD TEMPERATURE STEP USED IN SEEKING SURFACE EQUILIBRIUM SOLUTION.	L EQUIL
DUB2	-	L INPUT
DUB3	LOCALLY INPUT VARIABLES, IF NON-ZERO ASSIGNED TO FITMOL,	L INPUT
DUB4	BASMOL, SIGMA AND EPOVRK, RESPECTIVELY	L INPUT
DUB5	-	L INPUT
DUDS(L)	DERIVATIVE OF EDGE VELOCITY WITH RESPECT TO S IN REFCON, TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM
DUEDGE	DERIVATIVE UEDGE WITH RESPECT TO STREAM FUNCTION, SEE EQ (69) OF NASA CR-1062 (SET EQUAL TO ZERO IN PRESENT PROG).	C EDGCOM
DUES	DERIVATIVE OF EDGE VELOCITY WITH RESPECT TO STREAMWISE COORDINATE S.	C EDGCOM
DUM	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM1	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM2	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM3	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM4	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM5	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM6	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM7	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUM8	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
DUMP	P * 10**7, LIMIT PRESSURE IN CONTROLLING DAMPING OF CHEMISTRY SOLUTION.	L CRECT
DU7	LOCALLY DEFINED VARIABLE	L OUTPUT
DVNL(N)	DAMPED NONLINEAR CORRECTIONS (GIVEN BY EQ(156) OF NASA CR-1062 MULTIPLIED BY EASE).	C NONCOM
DVS	VELOCITY DEFECT THICKNESS OVER DEL.	C EPSCOM
DY(J)	CORRECTION ON VARIABLE Y(J)* IN CHEMISTRY SOLUTION.	C EQTCOM
DYT	DAMPED CORRECTION ON VARIABLE Y(J)* IN CHEMISTRY SOLUTION.	L CRECT
DZ	THE D SUB ZERO OF EQ(89) IN NASA CR-1062.	L HISTXI

D7KH(K)	DERIVATIVE OF ZK WITH RESPECT TO H.	C PRPCOM
D7KK(K,KK)	DERIVATIVE OF K TH ZK WITH WITH RESPECT TO MASS FRACTION OF ELEMENT KK.	C PRPCOM
E(N)	ERRORS IN CHEMISTRY EQUATIONS (MASS BALANCE ERRORS FOR N EQUAL TO OR LESS THAN IS*. EQUILIBRIUM ERRORS FOR N GREATER THAN IS*. WHERE IS* IS NUMBER OF ELEMENTS INCLUDING ELECTRON).	C EQTCOM
EAR	ABSOLUTE VALUE OF EQUILIBRIUM ERROR FOR A SPECIES IN CHEMISTRY SOLUTION.	L MATER
EAK(MK)	ACTIVATION ENERGY.	C KINCOM
EASE	DAMPING FACTOR, APPLIED UNIFORMLY TO ALL CORRECTIONS.	C BUMCOM
EB(K)	MAGNITUDE OF LARGEST CONTRIBUTION TO K TH MASS BALANCE.	C EQTCOM
EBL(K)	MINIMUM CONTRIBUTION ACCEPTED TO K TH MASS BALANCE, =EB/(10**8)	C EQTCOM
ECD(N)	RESIDUAL ERROR IN CONDENSED EQUILIBRIUM IMPOSED IN CHEMISTRY SOLUTION AS A CONSEQUENCE OF BOUNDARY LAYER DAMPING.	L MATER
ECRP	LIMIT CHANGE OF CONDENSED SPECIES QUANTITIES DURING CHEMISTRY ITERATION.	C EQTCOM
ECRT	NOT CURRENTLY USED.	C EQTCOM
EDGEOV	VARIABLE EQUIVALENCED TO EDGCOM FOR DUMPING PURPOSES	L DUMCOM
EER	EQUILIBRIUM ERROR OF CONDENSED SPECIES BEING INTRODUCED DURING CURRENT ITERATION.	L MATER
EESE(N)	RESIDUAL ERROR IN MASS BALANCE IMPOSED IN CHEMISTRY SOLUTION AS A CONSEQUENCE OF BOUNDARY LAYER DAMPING.	L MATER
EG2	CONTRIBUTION TO THERMAL FLUX DUE TO INEQUALITY OF TURBULENT PRANDTL AND SCHMIDT NUMBERS	L TRMBL
EG3	CONTRIBUTION TO THERMAL FLUX DUE TO TURBULENT VISCOUS DISSIPATION	L TRMBL
EHS	ERROR IN ENTHALPY OR ENTROPY FOR ASSIGNED ENTHALPY OR ENTROPY CHEMISTRY SOLUTIONS.	L MATER
EL	MAXIMUM EQUILIBRIUM ERROR, IDENTICAL TO EEL+.	C EQTCOM
EL(I)	MIXING LENGTH NORMALIZED BY DEL.	C EPSCOM
ELCON	MIXING LENGTH CONSTANT AS IN L = ELCON*Y.	C EPSCOM

ELK	LOG OF EQUILIBRIUM IMBALANCE OF KINETIC REACTION.	L KINET
ELKM	LOG OF NON-EQUILIBRIUM OF KINETIC RELATION	L KINET
ELM(N)	GLOBAL SET OF MAXIMUM VALUES OF ERRORS FOR VARIOUS SETS OF TAYLOR SERIES EXPANSIONS.	C ERRCOM
ELMM	MAXIMUM VALUE OF ELM(N).	C ERRCOM
EMIS	SURFACE EMITTANCE OF THE MATERIAL BEING CONSIDERED UNDER KR(9) = 3,4,5 OR 6.	C CRBCOM
EMISC	SURFACE EMITTANCE OF THE MATERIAL BEING CONSIDERED UNDER KR(9) = 3 OR 4.	C CRBCOM
EMIST	SURFACE EMITTANCE OF THE MATERIAL BEING CONSIDERED UNDER KR(9) = 5 OR 6.	C CRBCOM
EMIV	SURFACE EMISSIVITY	C CRBCOM
ENL	MAXIMUM MASS BALANCE ERROR, IDENTICAL TO EENL+.	C EQTCOM
ENL(N)	GLOBAL SET OF ERRORS FOR LINEARIZED CONSERVATION EQUATIONS AND BOUNDARY CONDITIONS.	C ERRCOM
ENLM(N)	GLOBAL SET OF MAXIMUM VALUES OF ERRORS FOR THE VARIOUS SETS OF LINEARIZED CONSERVATION EQUATIONS AND BOUNDARY CONDITIONS.	C ERRCOM
ENLMM	LARGEST VALUE OF ENLM.	C ERRCOM
EOL	MULTIPLYING FACTOR USED TO SMOOTHLY TRANSFORM KINETIC MASS BALANCE TO EQUIVALENT EQUILIBRIUM EQUATION.	L KINET
EP	ERROR IN OVERALL PRESSURE BALANCE.	L MATER
EPSA(I)	RHO(I)**2*(EDDY VISCOSITY)/(RHOE(L)*VMUE(L)).	C EPSCOM
EPT	LOCALLY DEFINED VARIABLE	L TRMBL
EPOVRK	EPSILON/K. OF REFERENCE SPECIES IN DIFFUSION CALCULATIONS	C EQTCOM
EPS	KINEMATIC EDDY VISCOSITY	L TRMBL
EPS1	KINEMATIC EDDY VISCOSITY IN WALL REGION	C EPSCOM
EPS2	KINEMATIC EDDY VISCOSITY IN WAKE REGION	L TRMBL
EPSOUT	VARIABLE EQUIVALENCED TO EPSCOM FOR OUTPUT PURPOSES	L TRMBL
EQPEQV	VARIABLE EQUIVALENCED TO EQPCOM FOR DUMPING PURPOSES	L DUMCOM
EQTEQV	VARIABLE EQUIVALENCED TO EQTCOM FOR DUMPING PURPOSES	L DUMCOM

EP	ERROR IN MASS BALANCE RELATION.	L MATER
ERPP1	DERIVATIVE OF DAWSON FUNCTION WITH RESPECT TO ITS ARGUMENT AT I	L TRMBL
ERPP2	DERIVATIVE OF DAWSON FUNCTION WITH RESPECT TO ITS ARGUMENT AT I-1	L TRMBL
ERP1	DAWSON FUNCTION OF ARGUMENT AT I	L TRMBL
ERP2	DAWSON FUNCTION OF ARGUMENT AT I-1	L TRMBL
ERREQV	VARIABLE EQUIVALENCED TO ERRCOM FOR DUMPING PURPOSES	L DUMCOM
ETA(I)	TRANSFORMED COORDINATE IN A DIRECTION NORMAL TO THE SURFACE DEFINED BY EQ (33) OF NASA CR-1062.	C ETACOM
ETAEQV	VARIABLE EQUIVALENCED TO ETACOM FOR DUMPING PURPOSES	L DUMCOM
ETAT	LOCALLY DEFINED VARIABLE	L FIRSTG
EXEL	RATIO OF FORWARD TO REVERSE DRIVING POTENTIAL IN KINETIC EQUATIONS.	L KINET
EXK(MK)	ALWAYS SET TO 1.0, (REACTION EXPONENT).	C KINCOM
F(N,I)	STREAM FUNCTION (N=1), VELOCITY RATIO (N=2) AND DERIVATIVES OF ORDER N-2 OF VELOCITY RATIO WITH RESPECT TO ETA.	C VARCOM
FAMOA(J)	ALPHANUMERIC VARIABLE, FIRST OF TWO PORTIONS OF SPECIES NAME. IDENTICAL TO MOA+.	C BLQCOM
FAMOB(J)	ALPHANUMERIC VARIABLE, SECOND OF TWO PORTIONS OF SPECIES NAME. IDENTICAL TO MOB+.	C BLQCOM
FD(N)	D1 * F(N+1,I) + D2 * HF(I,N+1) FOR N=1 THROUGH 3, D1 * F(4,I-1)+D2 * HF(I-1,4) FOR N=4.	L HISTXI
FF(J)	DIFFUSION FACTOR INTRODUCED BY THE APPROXIMATION FOR DIFFUSION COEFFICIENTS BY EQ(19) OF NASA CR-1062.	C EQPCOM
FFA	POWER ON MOLECULAR WEIGHT IF IT IS ASSUMED THAT THE DIFFUSION FACTORS, FF(J), ARE PROPORTIONAL TO SPECIES MOLECULAR WEIGHTS, WTM(J),RAISED TO A POWER.	C EQPCOM
FFAR	POWER ON MOLECULAR WEIGHT READ IN IF IT IS ASSUMED THAT THE DIFFUSION FACTORS, FF(J), ARE PROPORTIONAL TO SPECIES MOLECULAR WEIGHTS, WTM(J), RAISED TO A POWER OTHER THAN 0.5.	L INPUT
FFF	RATIO OF GAS MOLECULAR WEIGHT TO 'VMU2'.	L MATER
FFIN(J)	DIFFUSION FACTOR, FF(J), WHICH IS READ IN.	L INPUT

FFK2	PARAMETER SET EQUAL TO WM/VMU2 FOR EQUAL DIFFUSION COEFFICIENTS (KKR(14)=2) AND TO FF(K) FOR UNEQUAL DIFFUSION COEFFICIENTS (KKR(14)=0 OR 1).	L PROPS
FITMOL	CONSTANT IN CURVE FIT OF DIFFUSION FACTORS BASED ON MOLECULAR WEIGHTS	L INPUT
FKF(MK)	PRE-EXPONENTIAL FACTOR,POUND MOLES OF REACTANT PER SECOND PER FT**2.	C KINCOM
FLD(N,NN)	CURVE FIT CONSTANT; FOR THERMODYNAMIC DATA FOR THE FLUID MIXTURE IN KR(7)=1 OPTION (SIMILAR TO THE QUANTITIES DISCUSSED IN GROUP 12 OF THE INPUT INSTRUCTIONS). NN= 1,2 OR 3 FOR TEMPERATURE RANGES LESS THAN 3600 DEG R, EQUAL TO OR GREATER THAN 3600 DEG R BUT LESS THAN 5400 DEG R, OR, EQUAL TO OR GREATER THAN 5400 DEG R, RESPECTIVELY. N REFERS TO COMPONENT OF THE NONREACTING FLUID MIXTURE.	C STTCOM
FLE(N)	ERROR FOR THE TAYLOR SERIES EXPANSIONS INVOLVING F(1,I) AND THEIR DERIVATIVES.	C ERRCOM
FLEM	MAXIMUM VALUE OF FLE(N).	C ERRCOM
FLIQ	FRACTION OF A SPECIES WHICH IS LIQUID.	C EQTCOM
FLPEQV	VARIABLE EQUIVALENCED TO FLPCOM FOR DUMPING PURPOSES	L DUMCOM
FLUXJ(N,L,1)	CONVERGED VALUE FOR MASS FLUX OF COMPONENT N INTO THE BOUNDARY LAYER AT THE WALL. N = 1 TO 3 FOR EDGE GAS, PYROLYSIS GAS AND CHAR, RESPECTIVELY.	C WALCOM
FLXEQV	VARIABLE EQUIVALENCED TO FLXCOM FOR DUMPING PURPOSES	L DUMCOM
FM(J)	3 IF UNIMPORTANT SPECIES (NOT SIGNIFICANT IN ANY MASS BALANCE). OTHERWISE 1.	C EQTCOM
FN	LOCALLY DEFINED VARIABLE	L ERP
FNLFM	ERROR FOR THE LINEARIZED MOMENTUM EQUATIONS AND BOUNDARY CONDITIONS.	C ERRCOM
FNU(K)	VNU(J,K) FOR CURRENT J.	C EQTCOM
FPPW	F(3,1) PRINTED IN ONE-LINE-PER-ITERATION OUTPUT.	L ITERAT
FR(J,I)	MOLE FRACTION.	C BLQCOM
FW(L,1)	CONVERGED VALUE OF STREAM FUNCTION AT SURFACE OF BODY.	C WALCOM
FWCON(L)	INTEGRAND IN CALCULATION OF FW IN REFCON. TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM

FWDUM(L)	FW * SQRT(2*XI) IN REFCON. TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM
G(N,I)	TOTAL ENTHALPY (N=1) AND ITS DERIVATIVES OF ORDER N-1 WITH RESPECT TO ETA.	C VARCOM
GAM	ISENTROPIC EXPONENT.	L EQUIL
GAM(N)	PARAMETER GAMMA APPEARING IMPLICITYLY IN EQ (17) OF REF. 6	L FELTRU
GAMI	ISENTROPIC EXPONENT FOR HOMOGENEOUS MIXTURE	C STTCOM
GAMF(K)	DEFINED BY EQ(79) OF NASA CR-1064.	C EQTCOM
GAMH(K)	DEFINED BY EQ(80) OF NASA CR-1064.	C EQTCOM
GAMK(K,KK)	DEFINED BY EQ(81) OF NASA CR-1064.	E NONCOM
GD(N)	D1 * G(N,I) + D2 * HG(I,N) FOR N=1 THROUGH 3, D1 * G(3, I-1) + D2 * HG(I-1,3) FOR N=4.	L HISTXI
GE(M)	STAGNATION ENTHALPY AT BOUNDARY LAYER EDGE.	C PRMCOM
GEP	DERIVATIVE OF TOTAL ENTHALPY AT BOUNDARY-LAYER EDGE WITH RESPECT TO ETA	
GLE(N)	ERROR FOR THE TAYLOR SERIES EXPANSIONS INVOLVING G(1,I) AND THEIR DERIVATIVES.	C ERRCOM
GLEM	MAXIMUM VALUE OF GLE(N).	C ERRCOM
GMR	ISENTROPIC EXPONENT FROM EQUILIBRIUM CALCULATION	C PRPCOM
GNLEM	ERROR FOR THE LINEARIZED ENERGY CONSERVATION EQUATIONS.	C ERRCOM
GPADRO	NORMAL-TO-PITCH-PLANE STAGNATION-POINT VELOCITY GRADIENT RATIO	C PRMCOM
GW	FIRST GUESS FOR WALL ENTHALPY WHICH IS READ IN WHEN KR(2)=0	L FIRSTG
H(I)	STATIC ENTHALPY OF THE MIXTURE. IDENTICAL TO HH*.	C PRPCOM
H(J)	ENTHALPY. IDENTICAL TO HH*.	C EQTCOM
HALPH	STORED (HISTORIC) VALUE OF ALPH ONE STATION UPSTREAM.	C HISCOM
HCARB	HEAT OF FORMATION AT 298 DEG. K OF THE SURFACE MATERIAL BEING CONSIDERED UNDER KR(9) = 3 OR 4.	C CRBCOM
HCH	CHAMBER (OR STAGNATION) ENTHALPY	L EQUIL
HCHAR	CHAR ENTHALPY	C CRBCOM

HCWAL	ENTHALPY OF SURFACE SPECIES DURING KR(9) = 3 OR 4 OPTIONS.	C EQPCOM
HF	STATIC ENTHALPY OF GAS AT BOUNDARY-LAYER EDGE.	C EDGCOM
HFA(L)	STATIC ENTHALPY DISTRIBUTION AT BOUNDARY-LAYER EDGE	C EDGCOM
HFT	TOTAL ENTHALPY OF GAS AT BOUNDARY-LAYER EDGE.	L STATE
HF(I,N)	STORED (HISTORIC) VALUE OF F(N,I) ONE STATION UPSTREAM FOR N=1 THROUGH 4. HF(I,5) = D1*F(1,I) + D2*HF(I,1) WHERE D1 AND D2 ARE DEFINED BY EQ(88) OR (89) OF NASA CR-1062.	C HISCOM
HG	ENTHALPY OF GAS, IDENTICAL TO HHG*.	C EQTCOM
HG(I,N)	STORED (HISTORIC) VALUE OF G(N,I) ONE STATION UPSTREAM.	C HISCOM
HH(I)	STATIC ENTHALPY OF THE MIXTURE, IDENTICAL TO H*.	C PRPCOM
HH(J)	ENTHALPY, INDENTICAL TO H(J)*.	C EQTCOM
HINF	FREE-STREAM STATIC ENTHALPY	C EDGCOM
HIP	ENTHALPY INPUT.	C EQTCOM
HISEQV	VARIABLE EQUIVALENCED TO HISCOM FOR DUMPING PURPOSES	L DUMCOM
HIST1(N)	SET OF VARIABLES STARTING WITH XI(1) TO BE STORED ON TAPE.	E HISCOM
HIST2(N)	SET OF VARIABLES STARTING WITH PE(1,1) TO BE STORED ON TAPE	E EDGCOM
HIST3(N)	SET OF VARIABLES STARTING WITH F(1,1) TO BE STORED ON TAPE	E VARCOM
HIST4(N)	SET OF VARIABLES STARTING WITH FW(1,1) TO BE STORED ON TAPE	E WALCOM
HM(J)	ENTHALPY OF FUSION.	C EQPCOM
HMAT	HEAT OF FORMATION AT 298 DEG. K OF THE MATERIAL BEING CONSIDERED UNDER KR(9) = 3,4,5 OR 6.	C CRBCOM
HMELT	HM(J) IF J TH SPECIES IS CHANGING PHASE, OTHERWISE 0.	C EQTCOM
HOS	ENTHALPY OR ENTROPY OF SPECIES IN ASSIGNED ENTHALPY OR ENTROPY CHEMISTRY SOLUTION.	L MATER
HP	DERIVATIVE OF H WITH RESPECT TO ETA.	C PRPCOM
HPG	HEAT OF FORMATION AT 298 DEG. K OF THE PYROLYSIS GAS BEING CONSIDERED UNDER KR(9) = 3 OR 4.	C CRBCOM
HPYG	PYROLYSIS GAS ENTHALPY	C CRBCOM

HSP(I,N,K)	STORED (HISTORIC) VALUE OF SP(N,I,K) ONE STATION UPSTREAM.	C HISCOM
HTEF	HEAT OF FORMATION AT 298 DEG. K OF THE MATERIAL BEING CONSIDERED UNDER KR(9) = 5 OR 6.	C CRBCOM
HTIL	PROPERTY OF THE GAS MIXTURE WHICH REDUCES TO H(I) FOR EQUAL DIFFUSION COEFFICIENTS. SEE EQ(2A) OF NASA CR-1062.	C PRPCOM
HTILP	DERIVATIVE OF HTIL WITH RESPECT TO ETA.	C PRPCOM
HW(L,I)	CONVERGED ENTHALPY OF GAS AT THE WALL.	C WALCOM
I	INDEX ON ETA. I=1 AT WALL. IDENTICAL TO II*.	
II	LOCAL INDEX	L KINET
I777	VARIABLE TO CHECK IF SUBROUTINE HAS PREVIOUSLY BEEN ENTERED	C BUMCOM
IAST	ASSIGNED THE VALUE COMMA (,) THROUGH A DATA STATEMENT FOR USE IN TEST OF WHETHER THERE IS TO BE ANOTHER CASE.	L BLIMP
IB(K)	INDEX ON SPECIES WITH LARGEST CONTRIBUTION TO K TH MASS BALANCE. SUBSEQUENTLY ORDERED ON IB WITH DUPLICATES SET TO 1000.	C EQTCOM
IBLANK	ASSIGNED THE VALUE BLANK ( ) THROUGH A DATA STATEMENT FOR USE IN TEST OF WHETHER THERE IS TO BE ANY PUNCHED CARD OUTPUT.	L OUTPUT
IC(K)	NEGATIVE INDEX OF ELEMENT CORRESPONDING TO KTH BASE SPECIES	L INPUT
ICORA	INDEX CORRESPONDING TO CORMA IN THE CORAR ARRAY.	C BUMCOM
ICT	CYCLE COUNTER ON POST INVERSION MODIFICATION IN CHEMISTRY SOLUTION	L EQUIL
IDENT	ALPHANUMERIC IDENTIFICATION SYMBOL APPEARING ON PUNCHED CARD DATA (NO CARDS PUNCHED IF IDENT IS INPUT AS A BLANK).	C INTCOM
IDISC(L)	CONTROL VARIABLE FOR DISCONTINUITY (1 IF DISCONTINUITY, OTHERWISE 0).	C PRMCOM
IDSIP	ITEM WHEN DSIP IS TO BE UPDATED.	C EDGCOM
IDUM	LOCALLY DEFINED VARIABLE	L SETUP
IE	EQUATION INDEX FOR CONDENSED SPECIES.	L MATER
IERMN	INDICIES ON MAXIMUM NON-LINEAR ERRORS FOR EACH SET OF CONSERVATION EQUATIONS	L RMLCER
IERMX	INDICIES OF MAXIMUM NON-LINEAR ERRORS FOR EACH SET OF CONSERVATION EQUATIONS	L NONCER

IFR	EQUATION NUMBER TO REPRESENT NEWLY APPEARING CONDENSED SPE- CIES.	C EQTCOM
IFC(J)	CONTROL FLAG (0 GAS, -1 NONPRESENT CONDENSED, +1 PRESENT CONDENSED. PRIOR FLAGS DECREMENTED BY _ IF SPECIES CONTAINS NONPRESENT ELEMENT OR INCREMENTED BY 3 IF IT IS A BASE SPE- CIES REPRESENTING A NONPRESENT ELEMENT).	C EQPCOM
IFLM	INDEX OF THE SET OF LINEAR EQUATIONS WHICH HAS THE LARGEST ERROR FLEM.	C ERRCOM
IFLUXJ	ITEM WHEN FLUXJ IS TO BE UPDATED.	C WALCOM
IFN	INDEX ON LINEAR VARIABLE F(1,I)	L IMONE
IFN	INDEX ON LINEAR VARIABLE F(1,I)	L IONLY
IFNLM	INDEX OF THE LINEARIZED MOMENTUM EQUATION WHICH HAS THE LARGEST ERROR FNLEM.	C ERRCOM
IFP	INDEX ON NON-LINEAR VARIABLE F(2,I)	L IMONE
IFP	INDEX ON NON-LINEAR VARIABLE F(2,I)	L IONLY
IFPP	INDEX ON LINEAR VARIABLE F(3,I)	L IMONE
IFPP	INDEX ON LINEAR VARIABLE F(3,I)	L IONLY
IFPPP	INDEX ON LINEAR VARIABLE F(4,I)	L IMONE
IFPPP	INDEX ON LINEAR VARIABLE F(4,I)	L IONLY
IFW	ITEM WHEN FW IS TO BE UPDATED.	C WALCOM
IG	NOMINALLY ZERO, EQUALS ONE ON FIRST SET OF BOUNDARY LAYER CHEMISTRY SOLUTIONS. FIRST GUESS AT I+ IS SOLUTION AT I-IG.	L EQUIL
IG	ELIMINATION INDEX IN BASE SPECIES-ELEMENT CORRESPONDENCE LOGIC.	L INPUT
IGLM	INDEX OF THE SET OF LINEAR EQUATIONS WHICH HAS THE LARGEST ERROR GLEM.	C ERRCOM
IGNLM	INDEX OF THE LINEARIZED ENERGY CONSERVATION EQUATION WHICH HAS THE LARGEST ERROR GNLEM.	C ERRCOM
IHW	ITEM WHEN HW IS TO BE UPDATED.	C WALCOM
IT	INDEX ON ETA, IT=1 AT WALL, IDENTICAL TO I+.	C INTCOM
ITS	LOCAL INDEX	L RECASE

IJ	LOCAL INDEX	L PROPS
IK	LOCAL INDEX	L PROPS
IL	INDEX ON FIRST CHEMISTRY EQUATION TO BE SOLVED (1 FOR UNKNOWN T AND 2 FOR KNOWN T).	C EQTCOM
ILMM	INDEX OF THE LINEAR EQUATION WHICH HAS THE LARGEST ERROR FLMM.	C ERRCOM
IM(K)	ROW AND COLUMN INDEX IN INVERSION OF CIJ TO UM.	L INPUT
IMI	LOCAL INDEX	L INPUT
IMJ	LOCAL INDEX	L INPUT
IML	LOCAL INDEX	L INPUT
IN	NUMBER OF EQUATIONS BEING SOLVED (HAS THE VALUE OF THE LOCAL VARIABLE ISPQ IF TEMPERATURE IS UNKNOWN OR ISPQ-1 IF TEMPERATURE IS KNOWN).	C EQTCOM
INLMM	INDEX OF THE NONLINEAR EQUATION WHICH HAS THE LARGEST ERROR FNLMM.	C ERRCOM
INP	IN+2	L CRECT
IPRF	ITEM WHEN PRE IS TO BE UPDATED.	C PRMCOM
INTEQV	VARIABLE EQUIVALENCED TO INTCOM (EXCEPT KR(20)) FOR DUMPING PURPOSES	L DUMCOM
INV	FLAG ON RESTART OF CHEMISTRY (PERMITS ONLY ONE RESTART)	L EQUIL
IQ	FOR EACH NON-BASE GASEOUS SPECIES INITIALIZED TO ZERO, SET TO ONE IF SPECIES IS SIGNIFICANT IN ANY MASS BALANCE.	L MATER
IQQ	DEBUG(-2) AND NONCONVERGENT(-1) FLAG ON CALL TO AND RETURN FROM RERAY, RESPECTIVELY.	L EQUIL
IR(K)	CORRESPONDENCE VECTOR BETWEEN BASE SPECIES AND ELEMENTS.	C EQPCOM
IRAD	ITEM WHEN RADP IS TO BE UPDATED.	C PRMCOM
IRE	INDEX ON NEWLY APPEARING CONDENSED SPECIES.	C EQTCOM
IRHOVW	ITEM WHEN RHOVW IS TO BE UPDATED.	C WALCOM
IS	NUMBER OF ELEMENTS INCLUDING ELECTRON, IDENTICAL TO IZ+.	C EQPCOM
IS	INDEX ON S, IS=1 AT STAGNATION POINT OR LEADING EDGE, IDENTICAL TO ISS*.	C INTCOM

ISH	VALUE OF IS AT PREVIOUS STREAMWISE STATION AT WHICH A BOUNDARY-LAYER SOLUTION HAS BEEN OBTAINED	C INTCOM
ISM	NSP-1	L PROPS
ISP	NUMBER OF ELEMENTS INCLUDING ELECTRON PLUS ONE.	C BUMCOM
ISP	SAME AS ISP IN INPUT.	L EQUIL
ISP	(IS*) + 1 WHERE IS* IS THE NUMBER OF ELEMENTS INCLUDING ELECTRONS.	L INPUT
ISP	NSP + 1	L PROPS
ISP2	NUMBER OF ELEMENTS INCLUDING ELECTRON PLUS TWO.	C KINCOM
ISP2	NSP + 2	L PROPS
ISPLM(K)	INDEX OF THE SET OF LINEAR EQUATIONS WHICH HAS THE LARGEST ERROR SPLEM(K).	C ERRCOM
ISPN	INDEX ON NON-LINEAR VARIABLE (G(1,I) OR SP(1,I,K))	L IMONE
ISPN	INDEX ON NON-LINEAR VARIABLE (G(1,I) OR SP(1,I,K))	L IONLY
ISPNLM(K)	INDEX OF THE LINEARIZED ELEMENTAL CONSERVATION EQUATION WHICH HAS THE LARGEST ERROR SPNLEM(K).	C ERRCOM
ISPP	INDEX ON LINEAR VARIABLE (G(2,I) OR SP(2,I,K))	L IMONE
ISPP	INDEX ON LINEAR VARIABLE (G(2,I) OR SP(2,I,K))	L IONLY
ISPPP	INDEX ON LINEAR VARIABLE (G(3,I) OR SP (3,I,K))	L IMONE
ISPI	INDEX ON LINEAR VARIABLE (G(3,I) OR SP (3,I,K))	L IONLY
ISPO	ISP2 + NUMBER OF PRESENT CONDENSED SPECIES.	C KINCOM
ISPO	NUMBER OF EQUATIONS SOLVED IN CHEMISTRY SOLUTIONS, IS+2+ NUMBER OF PRESENT CONDENSED SPECIES.	L EQUIL
ISPW	ITEM WHEN SPW IS TO BE UPDATED.	C WALCOM
ISS	INDEX ON S, ISS=1 AT STAGNATION POINT OR LEADING EDGE, IDENTICAL TO IS+.	C INTCOM
IST	LOCAL INDEX	L FIRSTG
ISU	INDEX OF SPECIES REPRESENTATIVE OF SURFACE	C CRBCON
ISV	ISV IS SET EQUAL TO IS* NEAR BEGINNING OF SUBROUTINE PROPS IS* THEN BEING SET TO NSP. IS* RESTORED TO ISV AT THE END OF PROPS.	L PROPS

ISV2	LOCALLY DEFINED VARIABLE	L PROPS
ISVP	ISV+1	L PROPS
IT	NOT USED IN CURRENT VERSION, IDENTICAL TO IIT+.	C EQTCOM
IT	CURRENTLY SET TO UNITY, IDENTICAL TO ITT*.	C INTCOM
ITEM	TIME (OR SUBCASE).	C INTCOM
ITFF	NEGATIVE COUNT ON SUCCEEDING CHEMISTRY SOLUTIONS WHICH WILL ACCEPT RESIDENT SOLUTION AS FIRST GUESS.	L EQUIL
ITS	COUNTER FOR CHEMISTRY ITERATIONS, IDENTICAL TO IITS+.	C EQTCOM
ITS	COUNTER FOR BOUNDARY LAYER ITERATIONS, IDENTICAL TO MITS*.	C INTCOM
ITT	CURRENTLY SET TO UNITY, IDENTICAL TO IT+.	C INTCOM
ITW	ITEM WHEN TW IS TO BE UPDATED.	C WALCOM
IU	COUNTER ON NUMBER OF STREAMWISE STATIONS AT WHICH BOUNDARY LAYER SOLUTIONS HAVE BEEN OBTAINED	C INTCOM
IX	VARIABLE IN RERAY CALL SEQUENCE HAVING TO DO WITH PRINTING OF DEBUG OUTPUT, -2 GIVES DEBUG, COMES BACK 3 IF INVERSION SUCCEEDED, 1 IF SINGULAR.	C BUMCOM
IX	DIAGNOSTIC FLAG PREVIOUSLY USED TO INDICATE TYPE OF BAD INPUT DETECTED.	L INPUT
IX	DEBUG FLAG.	L RERAY
IZ	NUMBER OF ELEMENTS INCLUDING ELECTRON, IDENTICAL TO IS*.	C EQPCOM
J	LOCAL INDEX (VARIOUS ROUTINES)	
JAST	READ IN AS COMMA (,) OR PERIOD (.) FOR TEST OF WHETHER THERE IS TO BE ANOTHER CASE (SEE INPUT INSTRUCTIONS).	L BLIMP
JAT(N)	ATOMIC NUMBER OF AN ELEMENT WHICH CONTAINS ALPT(N) ATOMS IN A SPECIES.	L INPUT
JB	LOCAL INDEX	L MATS1
JC	INDEX ON SURFACE CONDENSED SPECIES.	C EQTCOM
JJ	LOCAL INDEX (VARIOUS ROUTINES)	
JL	LOCAL INDEX	L TRMBL
JM	J-1, WHERE 'J' IS BASE SPECIES COUNT.	L INPUT

JRHOVW	SET EQUAL TO UNITY IF RHOVW OR FLUXJ ARE READ IN FOR CURRENT TIME. OTHERWISE ZERO.	L REFCON
JT	LOCAL INDEX	L EQUIL
KAPPA	INDEX OF THE NODAL POINT AT WHICH THE VELOCITY RATIO IS FIXED.	C INTCOM
KAT(K)	ATOMIC NUMBER.	C EQPCOM
KIN	NUMBER OF TAPE FROM WHICH DATA IS READ.	C INTCOM
KINEQV	VARIABLE EQUIVALENCED TO KINCOM FOR DUMPING PURPOSES	L DUMCOM
KIP	CONTROL VARIABLE 0 UNLESS PERFORMING ASSIGNED TEMPERATURE CALCULATION DURING KR(9)=6 ENERGY BALANCE PROBLEMS (SEE DEFINITION OF TEZ).	C BUMCOM
KK	LOCAL INDEX (VARIOUS ROUTINES)	
KKR(N)	ARRAY OF INPUT INTEGERS WHICH CONTROL THE VARIOUS OPTIONS OF THE PROGRAM. IDENTICAL TO KR+.	C INTCOM
KOUT	NUMBER OF TAPE ONTO WHICH DATA IS WRITTEN.	C INTCOM
KPHA(N)	PHASE INDEX FOR A SPECIES, 1=GAS, 2=SOLID, 3=LIQUID.	L INPUT
KQ(N)	IDENTICAL TO KR(N)* BY TRANSMITTAL THROUGH CALL LISTS OF PROGRAMS EQUIL AND INPUT. ALSO IDENTICAL TO KD(N)*.	C INTCOM
KR(N)	CONTROL CARD FOR CHEMISTRY CALCULATION (KR(1) = 0 FOR ASSIGNED TEMPERATURE, 1 FOR SURFACE EQUILIBRIUM, 2 FOR ASSIGNED ENTHALPY, KR(2) AND KR(3) ARE 1 IF ELEMENT AND SPECIES DATA ARE TO BE READ IN, OTHERWISE 0, KR(4) IS NOT USED, KR(5) IS 0 IF IT IS NOT A BOUNDARY LAYER EDGE SOLUTION, 1 FOR EXPANSION, 2 FOR STAGNATION, KR(6) IS 0 FOR BOUNDARY LAYER CALCULATION, 2 FOR SURFACE MASS BALANCE, KR(7) CONTROLS DEBUG, IDENTICAL TO KZ(N)+.	C EQPCOM
KR(N)	ARRAY OF INPUT INTEGERS WHICH CONTROL THE VARIOUS OPTIONS OF THE PROGRAM, IDENTICAL TO KKR*.	C INTCOM
KR2	KKR(2) (FIRST GUESS FLAG) PRESERVES VALUE SINCE KKR(2) IS RESET TO ZERO IN SETUP.	L EQUIL
KR9(L)	VALUES OF KR(9) WHEN WALL BOUNDARY CONDITIONS ARE TO BE CHANGED AT DOWNSTREAM STATIONS, CURRENT KR(9) ASSIGNMENT MADE NEAR BEGINNING OF SUBROUTINE NONCER.	C INTCOM
KR17	SAVED VALUE FOR KR(17).	C INTCOM
KS	SURFACE MATERIAL INDEX (FOR EACH STATION)	C CRBCOM

L(N)	INDEX ON COLUMNS DURING INVERSION.	L RERAY
LAM(K,J)	UNITY IF J TH SPECIES CONTAINS K TH ELEMENT, OTHERWISE ZERO	C EQPCOM
LAR(N)	INDEX USED FOR REARRANGING ELEMENTS IN MATRIX OF NONLINEAR EQUATIONS (AM).	C ETACOM.
LAST	ASSIGNED THE VALUE PERIOD (.) THROUGH A DATA STATEMENT FOR USE IN TEST OF WHETHER THERE IS TO BE ANOTHER CASE.	L BLIMP
LEF(K)	FLAG REGARDING MISSING ELEMENTS FOR CURRENT SOLUTION, 3 ALWAYS PRESENT FROM EDGE, 2 ALWAYS PRESENT DUE TO UPSTREAM INJECTION, 1 PRESENT DUE TO LOCAL INJECTION, 0 NOT PRESENT.	C BLOCOM
LEFS(K)	FLAG REGARDING MISSING ELEMENTS FROM PRIOR SOLUTION, SEE LEF FOR NUMERICAL VALUES.	C BLOCOM
LEFT(K,N)	TEMPORARY STORAGE FOR LEF(K) DURING TAPE FLIP-FLOP FOR N = 1 AND 2.	C FLPCOM
LEFUP	UPDATE LEF IF EQUAL TO ZERO (=MITS+II-2 FOR BOUNDARY LAYER SOLUTION, OTHERWISE=1).	L EQUIL
LEFW(K)	FLAG REGARDING MISSING ELEMENTS FOR CURRENT WALL SOLUTION, SEE LEF FOR NUMERICAL VALUES.	C BLOCOM
LI	LOCAL INDEX	L LINMAT
LIM(K,KK)	LAM(K,KK) FOR KKTH BASE SPECIES.	L INPUT
LL(MK)	INDEX ON MASS BALANCE WHICH IS CONTROLLED BY N TH KINETIC REACTION.	C KINCOM
LL(N)	ROW INDEX OF PIVOT FOR NTH COLUMN.	L RERAY
LLL(N)	COLUMN INDEX OF PIVOT FOR NTH ROW.	L RERAY
LNZ	LOCAL INDEX	L RECASE
LPT	LOCAL INDEX (VARIOUS ROUTINES)	
LR	LOCAL INDEX	L TRMBL
LRK	LOCAL INDEX	L TRMBL
LS	INDEX USED TO REARRANGE COLUMNS IN RERAY (SEE LAR)	L RERAY
LSKIP	LOCAL INDEX	L NONCER
L2	INDEX ON PYROLYSIS GAS COMPONENT	C EQTCOM
L3	INDEX ON CHAR COMPONENT	C EQTCOM

M	LOCAL INDEX (VARIOUS ROUTINES)	
M1	COUNT ON PRINCIPAL SPECIES AFTER ORDERING IB.	L CRECT
MA(MK)	ORDERING VECTOR BASED ON HAVING RAT IN DESCENDING SEQUENCE	C KINCOM
MAT1I	3 * NETA - 2. NUMBER OF TAYLOR SERIES EXPANSIONS AND LINEAR BOUNDARY CONDITIONS INVOLVING F(1,I) AND ITS DERIVATIVES.	C INTCOM
MAT1J	NETA + 3. NUMBER OF LINEARIZED MOMENTUM EQUATIONS AND BOUNDARY CONDITIONS.	C INTCOM
MAT2I	2 * NETA. NUMBER OF TAYLOR SERIES EXPANSIONS AND LINEAR BOUNDARY CONDITIONS INVOLVING G(1,I) AND ITS DERIVATIVES OR THE K TH SPECIES. SP(1,I,K). AND ITS DERIVATIVES.	C INTCOM
MAT2J	NETA. NUMBER OF LINEARIZED ENERGY OR K TH ELEMENTAL CONSERVATION EQUATIONS AND BOUNDARY CONDITIONS.	C INTCOM
MELT	INDEX ON PHASE CHANGING SPECIES.	C EQTCOM
MT	MA(K)	L KINET
MITS	COUNTER FOR BOUNDARY LAYER ITERATIONS. IDENTICAL TO ITS*.	C INTCOM
MM	LOCAL INDEX (VARIOUS ROUTINES)	
MOA(J)	ALPHANUMERIC VARIABLE. FIRST OF TWO PORTIONS OF SPECIES NAME. IDENTICAL TO FAMOA*.	C BLQCOM
MOB(J)	ALPHANUMERIC VARIABLE. SECOND OF TWO PORTIONS OF SPECIES NAME. IDENTICAL TO FAMOB*.	C BLQCOM
MODE	STORED VALUE FOR KR(1)*.	C EQTCOM
MOE	FLAG SET IN EQUIL AND USED IN CRECT. ZERO RESULTS IN EMPHASIZING EQUILIBRIUM EQUATIONS DURING CHEMISTRY CONVERGENCE. ONE RESULTS IN EMPHASIZING MASS BALANCES.	L EQUIL
MP	INDICES USED IN REARRANGING REACTIVE MASS BALANCES ACCORDING TO CONTROLLING REACTIONS.	L KINET
MPI	LOCAL INDEX (VARIOUS ROUTINES)	L IMONE
MPJ	LOCAL INDEX (VARIOUS ROUTINES)	L IMONE
MSD(N)	HAS THE VALUE OF IS AT THE BEGINNING OF N TH REGION BOUNDED BY DISCONTINUITIES (MSD(1)=1 BY DEFINITION) WHERE IS IS THE INDEX ON S.	C PRMCOM
MT	NUMBER OF KINETICALLY CONTROLLED REACTIONS.	C KINCOM

MWF	CONTROL VARIABLE (=1 FOR NEW CASE, SET TO ZERO AT THE END OF SUBROUTINE SETUP).	C INTCOM
N1	NUMBER OF ROWS + 1	L RERAY
NAM	NUMBER OF NONLINEAR EQUATIONS NOT INCLUDING NONLINEAR WALL BOUNDARY CONDITIONS, NNLEQ-NRNL.	C INTCOM
NAT	NUMBER OF ONE OF TWO TAPES USED IN FLIP-FLOP.	C INTCOM
NAT2	NUMBER OF ONE OF TWO TAPES USED IN FLIP-FLOP.	C INTCOM
NC	NUMBER OF COMPONENTS OF THE NONREACTING FLUID MIXTURE IN KR(7)=1 OPTION.	C STTCOM
NCV	NONCONVERGENCE COUNT, INITIALLY ZERO, INCREMENTED BY ONE FOR EACH NONCONVERGENT CHEMISTRY SOLUTION.	L EQUIL
ND	DIMENSION TRANSMITTED THROUGH CALL	L RERAY
NDISC	NUMBER OF DISCONTINUITIES.	C PRMCOM
NELM	NUMBER OF MAXIMUM LINEAR ERRORS ELM.	C ERRCOM
NEN	NUMBER OF ENTRIES IN ENTROPY TABLE	C EDGCOM
NENLM	NUMBER OF MAXIMUM NONLINEAR ERRORS ENLM.	C ERRCOM
NETA	NUMBER OF NODAL POINTS ACROSS BOUNDARY LAYER INCLUDING WALL AND EDGE.	C INTCOM
NFF	NUMBER OF SPECIES FOR WHICH DIFFUSION FACTORS, FF(J), ARE TO BE READ IN.	L INPUT
NFTA(J)	FIRST OF TWO PORTIONS OF NAME OF MOLECULE FOR WHICH DIFFUSION FACTOR, FF(J), IS BEING READ IN.	L INPUT
NFTB(J)	SECOND OF TWO PORTIONS OF NAME OF MOLECULE FOR WHICH DIFFUSION FACTOR, FF(J), IS BEING READ IN.	L INPUT
NFM	NUMBER OF SIGNIFICANT SPECIES PLUS NUMBER OF NONPRESENT ELEMENTS.	L MATER
NITEM	NUMBER OF TIMES (OR SUBCASES).	C INTCOM
NLEQ	NUMBER OF LINEAR EQUATIONS, MAT1I+NSP*MAT2I.	C INTCOM
NM	NUMBER OF ROWS LESS ONE	L RERAY
NN	NUMBER BY WHICH COLUMNS EXCEED ROWS IN PRINCIPAL ARRAY	L RERAY
NNLEQ	MAT1J + NSP * MAT2J, TOTAL NUMBER OF NONLINEAR EQUATIONS.	C INTCOM

NNN	NUMBER OF COLUMN VECTORS IN SECONDARY ARRAY	L RERAY
NON	CONTROL VARIABLE USED AFTER RETURNING FROM SUBROUTINE OUTPUT (-1 WHEN RERUNNING FROM OUTPUT DURING ITERATIONS, 0 WHEN CONVERGED, +1 WHEN NONCONVERGED AFTER ALLOWED NUMBER OF ITERATIONS).	C INTCOM
NP	NUMBER OF COLUMNS IN PRIMARY ARRAY.	L RERAY
NPR	NUMBER OF DERIVATIVE PROPERTIES TO BE EVALUATED	L PROPS
NRNL	NSP + 1, NUMBER OF REDUCED NONLINEAR EQUATIONS.	C INTCOM
NS	NUMBER OF STREAMWISE STATIONS.	C INTCOM
NSD(N)	NUMBER OF STATIONS CONTAINED IN N TH REGION BOUNDED BY DISCONTINUITIES (S(1) CONSIDERED A DISCONTINUITY IN THIS DEFINITION).	C PRMCOM
NSP	NUMBER OF ELEMENTS IN THE SYSTEM, NOT INCLUDING ELECTRONS.	C INTCOM
NSPEC	NUMBER OF SPECIES, IDENTICAL TO N*.	C BLQCOM
NSPM1	NSP-1	C INTCOM
NTIME	CURRENTLY SET TO UNITY.	C INTCOM
NUL	ZERO.	L HISTXI
N2I	LOCAL INDEX	L NONCER
N7	ITERATION AT WHICH DIAGNOSTIC OUTPUT WILL COMMENCE	L EQUIL
OMEGA	PARAMETER OF THIS NAME USED IN TRANSPORT PROPERTY CALCULATIONS INTRODUCED IN EQ(4) OF NASA CR-1063, NUMERICALLY EQUAL TO 1.07/(T/106.7) ** 0.159	L PROPS
OUTEQV	VARIABLE EQUIVALENCED TO OUTCOM FOR DUMPING PURPOSES	L DUMCOM
P	PRESSURE.	C EQPCOM
PA(K,KK)	PARTIAL DERIVATIVE OF PROPERTY K WITH RESPECT TO LOG T, LOG AA, LOG(Y(KK-2)).	L PROPS
PE(L,1)	STATIC PRESSURE.	C EDGCOM
PHIK(I,K)	SOURCE TERM FOR KTH ELEMENT (EQUAL TO ZERO IN MIXED EQUILIBRIUM-FROZEN BOUNDARY LAYER).	C PRPCOM
PHIKPI(K)	DERIVATIVE OF PHIK WITH RESPECT TO ETA.	C PRPCOM
PI	P(I) IN MIXING LENGTH FORMULATION.	C EPSCOM

PID	LOCALLY DEFINED VARIABLE	L THMBL
PIFASF	PRODUCT OF DAMPING FACTORS.	C BLOCOM
PIM	P AT NODE I-1	L THMBL
PIN	P * (10**(-5)) USED TO INITIALIZE PARTIAL PRESSURES.	L EQUIL
PIN	SAME AS IN EQUIL.	L WATER
PINF	FREE-STREAM STATIC PRESSURE	C EDGCOM
PINL	LOG (PIN).	L EQUIL
PKF(MK)	FORWARD RATE OF REACTION.	C KINCOM
PKR(MK)	REVERSE RATE OF REACTION.	C KINCOM
PLM	SUMMATION VN(J)*WTM(J) FOR ALL CONDENSED SPECIES.	L EQUIL
PMR(MK)	NET FORWARD RATE OF REACTION.	C KINCOM
PMU(K,MK)	STOICHIOMETRIC PRODUCT COEFFICIENT ON K TH BASE SPECIES.	C KINCOM
PMU1	VN(J) * FF(J) SUMMED OVER ALL GASEOUS SPECIES (=VMU1 *P).	L PROPS
PMU2	VN(J) * WTM(J) / FF(J) SUMMED OVER ALL SPECIES N* (=VMU2 * P).	L PROPS
PMU6	VN(J)/(FF(J) * (WD4-VN(J) * FF(J) * WD8)) SUMMED OVER ALL SPECIES N*.	L PROPS
PNUS(K)	SUMMATION VNU(J,K) * VN(J) OVER ALL GASES J.	L WATER
PR(T)	PRANDTL NUMBER.	C PRPCOM
PRA	CONSTANT IN THE PRANDTL NUMBER RELATION DEFINING PR (SEE PRDUM).	C STTCOM
PRB	CONSTANT IN THE PRANDTL NUMBER RELATION DEFINING PR (SEE PRDUM).	C STTCOM
PRC	CONSTANT IN THE PRANDTL NUMBER RELATION DEFINING PR (SEE PRDUM).	C STTCOM
PRD	CONSTANT IN THE PRANDTL NUMBER RELATION DEFINING PR (SEE PRDUM).	C STTCOM
PRDUM	PRANDTL NUMBER IF CONSIDERED CONSTANT, OTHERWISE, IT IS A CONSTANT IN THE RELATION/ PR=PRDUM+PRA * T ** PRB+PRC*T ** PRD. USED IN NR(7)= 1 OPTION ONLY.	C STTCOM
PRF(L)	RATIO OF LOCAL STATIC PRESSURE TO STAGNATION PRESSURE PTET	C CHACOM

PREO	VARIABLE EQUIVALENCED TO PORTION OF PRPCOM FOR STORAGE TRANSFER	L NONCER
PRF	LOCALLY DEFINED VARIABLE	L TRMBL
PRMEQV	VARIABLE EQUIVALENCED TO PRMCOM FOR DUMPING PURPOSES	L DUMCOM
PRMU(K,MK)	PMU-RMU	C KINCOM
PRP	LOCALLY DEFINED VARIABLE RELATIVE TO ARRAY OF DERIVATIVE PROPERTIES BEING CALCULATED	L PROPS
PRPEQV	VARIABLE EQUIVALENCED TO PRPCOM FOR DUMPING PURPOSES	L DUMCOM
PRR	ARGUMENT REPRESENTING PRESSURE	L EQUIL
PRT	TURBULENT PRANDTL NUMBER	C EPSCOM
PTE(L,1)	LOCAL TOTAL PRESSURE.	C EDGCOM
PTET(M)	STAGNATION PRESSURE.	C PRMCOM
PV(N,NN)	DERIVATIVES OF VMU3 (NN=1), VMU4(NN=2),HTIL(NN=3) AND ZK(K) (NN=3+K) WITH RESPECT TO ENTHALPY (N=1), PRESSURE (N=2) AND K TH ELEMENTAL MASS FRACTION (N=2+K).	L PROPS
QA	LOCALLY DEFINED VARIABLE	L SLOPQ
QB	LOCALLY DEFINED VARIABLE	L SLOPQ
QC	LOCALLY DEFINED VARIABLE	L SLOPQ
QCHEM(N)	DIFFERENCE BETWEEN DIFFUSIVE HEAT FLUX AND THAT CALCULATED USING CHL FOR HEAT-TRANSFER COEFFICIENT	L FELTRU
QI	NUMBER INTRODUCED INTO CALCULATION OF BETAM (WHICH DIFFERS FOR VARIOUS BODY SHAPES) DUE TO CHANGE IN MANNER OF INTEGRATION IN THE VICINITY OF THE STAGNATION POINT OR LEADING EDGE.	L REFCON
QR(I)	NET RADIATION FLUX TOWARD THE SURFACE (SET EQUAL TO ZERO IN BLTMP, COMPUTED BY SUBROUTINE RAD IN RABLE).	C PRPCOM
QS	LOCALLY DEFINED VARIABLE	L TRMBL
QW	DIFFUSIVE HEAT FLUX AT THE WALL, C32/C3 EVALUATED AT WALL.	C FLXCOM
R	LOCALLY DEFINED VARIABLE	L ERP
RA(N)	HEAT OF FORMATION OF MOLECULE AT 298 DEG K FROM JANAF BASE STATE, CAL/MOLE. N=1 OR 2 FOR LOW AND HIGH TEMPERATURE RANGES, RESPECTIVELY.	L INPUT

RADFL(M)	INCIDENT RADIATION FLUX ABSORBED BY THE SURFACE AT STATION S(1).	C PRMCOM
RADNO	ACTUAL NOSE RADIUS OF A SPHERICALLY TIPPED BODY.	C PRMCOM
RADR(L)	RATIO OF INCIDENT RADIATION FLUX ABSORBED BY THE SURFACE TO THE VALUE AT STATION S(1). RADFL.	C PRMCOM
RADS(L)	INCIDENT RADIATION FLUX ABSORBED BY THE SURFACE.	C PRMCOM
RAT1(N)	FRACTIONAL CONTRIBUTION OF RHOE UE CM TERM TO DIFFUSIVE HEAT FLUX	L FELTRU
RAT2(N)	FRACTIONAL CONTRIBUTION OF RHOE UE CH TERM TO DIFFUSIVE HEAT FLUX	L FELTRU
RAT3(N)	RATIO OF MASS TO HEAT-TRANSFER COEFFICIENTS	L FELTRU
RAT(MK)	LARGEST OF PKP, PKR, PMR. MEASURE OF REACTION IMPORTANCE.	C KINCOM
RC(J,N)	CURVE FIT CONSTANT FOR THERMODYNAMIC DATA (THE QUANTITY F3 DISCUSSED IN GROUP 12 OF INPUT INSTRUCTIONS), N=1 OR 2 FOR LOW AND HIGH TEMPERATURE RANGES,RESPECTIVELY.	C EQPCOM
RD(J,N)	CURVE FIT CONSTANT FOR THERMODYNAMIC DATA (THE QUANTITY F4 DISCUSSED IN GROUP 12 OF INPUT INSTRUCTIONS), N=1 OR 2 FOR LOW AND HIGH TEMPERATURE RANGES,RESPECTIVELY.	C EQPCOM
RE(J,N)	CURVE FIT CONSTANT FOR THERMODYNAMIC DATA (THE QUANTITY F5 DISCUSSED IN GROUP 12 OF INPUT INSTRUCTIONS). N=1 OR 2 FOR LOW AND HIGH TEMPERATURE RANGES,RESPECTIVELY.	C EQPCOM
RED	REYNOLDS NUMBER ON DEL WHERE DEL IS THE Y DIMENSION NORMALIZING PARAMETER. ALSO, RED=VMUE(L)/ALPHASTAR WHERE ALPHASTAR IS THE FLUX NORMALIZING PARAMETER DEFINED BY EQ. 44 OF NASA CR 1062.	C EPSCOM
REF2	LOCALLY DEFINED VARIABLE	L OUTPUT
REF3	LOCALLY DEFINED VARIABLE	L OUTPUT
REF4	LOCALLY DEFINED VARIABLE	L OUTPUT
REG2	LOCALLY DEFINED VARIABLE	L OUTPUT
REG3	LOCALLY DEFINED VARIABLE	L OUTPUT
RERAD	RADIATION FLUX FROM WALL	L OUTPUT
RES	REYNOLDS NUMBER BASED ON DISTANCE S.	C OUTCOM
RETA	LOCALLY DEFINED VARIABLE	L OUTPUT

RETHMO	REYNOLDS NUMBER BASED ON MOMENTUM THICKNESS	L OUTPUT
RETR	TRANSITION REYNOLDS NUMBER BASED ON MOMENTUM THICKNESS.	C EPSCOM
RF(J,N)	CURVE FIT CONSTANT FOR THERMODYNAMIC DATA (THE QUANTITY F6 DISCUSSED IN GROUP 13 OF INPUT INSTRUCTIONS), N=1 OR 2 FOR LOW AND HIGH TEMPERATURE RANGES,RESPECTIVELY.	C EQPCOM
RHO(I)	DENSITY OF GAS MIXTURE.	C PRPCOM
RHOE(L)	DENSITY OF BOUNDARY LAYER EDGE GAS.	C EDGCOM
RHOINF	FREE-STREAM DENSITY	C EDGCOM
RHOP(I)	DERIVATIVE OF RHO WITH RESPECT TO ETA.	C PRPCOM
RHOVS	-RHOVW(L,1)/ALPHASTAR. SEE NASA CR 1062 FOR ALPHASTAR.	C EPSCOM
RHOVW(L,1)	CONVERGED VALUE FOR SURFACE ABLATION RATE.	C WALCOM
RHR	DENSITY.	L EQUIL
RI	LOCALLY DEFINED VARIABLE	L TRMBL
RMMG	RATIO OF MOLECULAR WEIGHT OBTAINED BY SUMMING PARTIAL PRESSURES OVER ALL SPECIES TO THE MOLECULAR WEIGHT OBTAINED BY SUMMING OVER GAS PHASE SPECIES ONLY.	C EQTCOM
RMMGS	RMMG*RMMG	L MATER
RMU(K,MK)	STOICHIOMETRIC REACTAN. COEFFICIENT ON K TH BASE SPECIES.	C KINCOM
RNOSE	EFFECTIVE NOSE RADIUS.	C PRMCOM
ROKAP(L)	1 FOR PLANAR BODIES. LOCAL BODY RADIUS FOR AXISYMMETRIC BODIES, SPREADING FACTOR WHEN USING AXISYMMETRIC ANALOGY (SEE REFERENCE 6) BODIES.	C PRMCOM
RR	DENSITY RATIO	L TRMBL
RRFD	LOCALLY DEFINED VARIABLE	L TRMBL
RRP	LOCALLY DEFINED VARIABLE	L TRMBL
RRPD	LOCALLY DEFINED VARIABLE	L TRMBL
RSIG(MK)	RELATIVE SIGNIFICANCE OF KINETIC REACTION IN MASS BALANCE.	C KINCOM
RSQA	RMMGS*FEE/AA	L MATER
RT	PERFECT GAS CONSTANT, R, TIMES TEMPERATURE, T.	L KINET

S(L)	STREAMWISE COORDINATE ALONG BODY.	C PRMCOM
S(N)	LARGEST CONTRIBUTION TO TERM IN N TH COLUMN.	L RERAY
SALPH	SIGNED VALUE OF ALPH	L TRMBL
SB(J)	ENTROPY.	C EQTCOM
SC(I)	REFERENCE SCHMIDT NUMBER. SEE EQ(46) OF NASA CR-1062.	C PRPCOM
SCT	TURBULENT SCHMIDT NUMBER	C EPSCOM
SD(N)	RATIO OF RESIDUAL TERM IN N TH COLUMN TO S(N).	L RERAY
SDUM1(L)	VARIABLE OF INTEGRATION IN CALCULATION OF XI IN REFCON, TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM
SDUM2(L)	VARIABLE OF INTEGRATION IN CALCULATION OF FW IN REFCON, TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM
SDY	LOCALLY DEFINED VARIABLE	L TRMBL
SF(MS)	STREAMFUNCTION IN ENTROPY LAYER TABLE	C EDGCOM
SHAPE	DELST/THMOM, SHAPE FACTOR.	C OUTCOM
SHEAR	WALL SHEAR GIVEN BY CAPC(1)/ALPH * VMUE(IS) * UE(IS)/C89 * F(3,1)/32.1740	C OUTCOM
SHIP	SAVED VALUE OF INPUT ENTHALPY.	L EQUIL
SHMELT	ENTHALPY OR ENTROPY OF FUSION OF A SPECIES IF TEMPERATURE EQUALS FUSION TEMPERATURE OF THAT SPECIES.	L MATER
SIGMA	COLLISION CROSS SECTION FOR REFERENCE SPECIES	C EQTCOM
SIP	ENTROPY INPUT.	C EQTCOM
SLAM(K)	DEFINED BY EQ(83) OF NASA CR-1064.	C EQTCOM
SM(J)	ENTROPY OF FUSION.	C EQPCOM
SMELT	SM(J) IF J TH SPECIES IS CHANGING PHASE, OTHERWISE 0.	C EQTCOM
SP(N,I,K)	ELEMENTAL MASS FRACTION (N=1) AND ITS DERIVATIVES OF ORDER N-1 WITH RESPECT TO ETA.	C VARCOM
SPEASE	SAVED VALUE OF PIEASE	L EQUIL
SPD(N)	D1 * SP(N,I,K) * D2 * HSP(I,N,K) FOR N=1 THROUGH 3, D1 * SP(3,I-1,K) * D2 * HSP(I-1,3,K) FOR N=4.	L HISTXI

SPDUM(K)	DIMENSIONED VARIABLE USED IN VARIOUS SUBROUTINES BUT NOT USED FOR TRANSMITTING INFORMATION BETWEEN SUBROUTINES.	C TEMCOM
SPE(K,L,1)	ELEMENTAL MASS FRACTION AT BOUNDARY LAYER EDGE.	C EDGCOM
SPLE(N,K)	ERROR FOR THE TAYLOR SERIES EXPANSIONS INVOLVING SP(1,I,K) AND THEIR DERIVATIVES.	C ERRCOM
SPLEM(K)	MAXIMUM VALUE OF SPLE(N,K).	C ERRCOM
SPNEW	VARIABLE USED TO DENOTE PRESENCE OF NEW ELEMENT IN SYSTEM	L RNLCER
SPNEW	VARIABLE USED TO DENOTE PRESENCE OF NEW ELEMENT IN SYSTEM	L NONCER
SPNLEM(K)	ERROR FOR THE LINEARIZED ELEMENTAL CONSERVATION EQUATIONS.	C ERRCOM
SPW(K,L,1)	CONVERGED VALUE FOR ELEMENTAL MASS FRACTION OF BOUNDARY LAYER GAS AT THE WALL.	C WALCOM
SREF	ENTROPY OF REFERENCE STREAMLINE	C EDGCOM
SS	LOCALLY DEFINED VARIABLE	L SLOPQ
SSTP	SAVED VALUE OF INPUT ENTROPY.	L EQUIL
SSTAG	STAGNATION ENTROPY BASED ON 1 ATM PRESSURE.	L STATE
SSTAGA	STAGNATION ENTROPY BASED ON ACTUAL PRESSURE.	L STATE
STEF	STEFAN-BOLTZMANN CONSTANT.	C CRBCOM
STTEQV	VARIABLE EQUIVALENCED TO STTCOM FOR DUMPING PURPOSES	L DUMCOM
SUMD	RT*D LOG KP/D LOG T OF KINETIC REACTION.	L KINET
SUMG	OFF-DIAGONAL COLUMN SUMS OF GAMK USED TO STRENGTHEN DIAGONAL DOMINANCE OF ARRAY.	L EQUIL
SUMK	LOG KP OF KINETIC REACTION.	L KINET
SUML	LOG (SUMN/P)	C EQTCOM
SUMN	SUMMATION OF PARTIAL PRESSURES FOR ALL GAS PHASE SPECIES.	C EQTCOM
SUMP	SUM OF PRODUCT Y(N)	L KINET
SUMR	SUM OF REACTANT Y(N)	L KINET
T	STATIC TEMPERATURE IN DEG K. IDENTICAL TO Z+	C EQPCOM
T(T)	STATIC TEMPERATURE IN DEG R. IDENTICAL TO TT*.	C PRPCOM
TAU(K,KK)	INTERMEDIATE ARRAY USED IN FORMING UM.	L INPUT

TC(J)	-D LOG KP / D LOG T FOR FORMATION REACTION OF J TH SPECIES	C EQTCOM
TCW	TC EVALUATED AT THE WALL FOR THE (ISP)TH ELEMENT.	C NONCOM
TE(L)	TEMPERATURE AT BOUNDARY LAYER EDGE.	C EDGCOM
TEMEQV	VARIABLE EQUIVALENCED TO TEMCOM FOR DUMPING PURPOSES	L DUMCOM
TF(J)	FAIL TEMPERATURE OF SPECIES J.	E EQPCOM
TFMAX	MAXIMUM FAIL TEMPERATURE OF CANDIDATE SURFACE SPECIES.	L INPUT
TFZ	SURFACE TEMPERATURE TO WHICH CONVERGENCE IS TEMPORARILY ATTEMPTED DURING ENERGY BALANCE PROBLEMS USING KR(9)=6.	C BUMCOM
THCOND	ENTHALPY THICKNESS	L OUTPUT
THELEM(K)	MASS THICKNESSES GIVEN BY DUZ(K)/DUM(K) WHERE DUZ(K) IS THE SUMMATION OVER KK OF C89/ALPH * ((F(1,NETA)-F(1,1)) * SP(1,NETA,KK)-XSP(5,KK))/ WTM(KK) * CIJ(K,KK) AND DUM(K) IS THE SUMMATION OVER KK OF (SP(1,NETA,KK)-SP(1,1,KK)/WTM(KK) * CIJ(K,KK).	L OUTPUT
THENGY	ENERGY THICKNESS GIVEN BY C89/ALPH * ((F(1,NETA)-F(1,1)) * G(1,NETA)-XG(5))/(G(1,NETA)-G(1,1))	C OUTCOM
THMOM	MOMENTUM THICKNESS GIVEN BY C89/ALPH * ((F(1,NETA)-F(1,1)) -XM(5)/ALPH)	C OUTCOM
TIMD	REAL ELAPSED TIME SINCE BEGINNING OF SOLUTION	L ITERAT
TIME(M)	TIME (OR SUBCASE)	C PRMCOM
TION	TEMPERATURE BELOW WHICH IONIZATION WILL BE SUPPRESSED	L EQUIL
TITL(N)	TYPE OF AVERAGING EMPLOYED TO CMK(N)	L FELTRU
TK(K,N)	GRAM ATOMS OF ELEMENT K PER UNIT MASS OF COMPONENT N.	C EQPCO
TM	MAXIMUM OR MINIMUM TEMPERATURE IF DELTA T IS POSITIVE OR NEGATIVE. RESPECTIVELY.	L CRECT
TMAX	MAXIMUM TEMPERATURE ALLOWED FOR CURRENT ITERATION.	C EQTCOM
TMIN	MINIMUM TEMPERATURE ALLOWED FOR CURRENT ITERATION.	C EQTCOM
TMU3	VN(J) / FF(J) SUMMED OVER ALL SPECIES N*. (=VMU3 * VMU2 * P).	L PROPS
TP	DERIVATIVE OF T WITH RESPECT TO ETA.	C PRPCOM
TQ(K,N)	GRAM ATOMS OF BASE SPECIES K PER UNIT MASS OF COMPONENT N. SEE W(N) FOR DEFINITION OF COMPONENTS	C EQPCOM

TREF	GROUP OF TERMS WHICH APPEARS IN DERIVATIVES OF PI. (REYNOLDS NUMBER ON DELST)/C26/(2.*CAPC(I)**2*YAP**2*PI).	C EPSCOM
TS	PHASE CHANGE TEMPERATURE.	L INPUT
TT(I)	STATIC TEMPERATURE IN DEG R, IDENTICAL TO T+.	C PRPCOM
TTMAX	MAXIMUM TEMPERATURE ALLOWED FOR THIS SOLUTION.	C EQTCOM
TTMIN	MINIMUM TEMPERATURE ALLOWED FOR THIS SOLUTION.	C EQTCOM
TTVC	VARIABLE T USED IN TRANSVERSE CURVATURE CALCULATIONS	C EDGCOM
TU(J,N)	UPPER TEMPERATURE OF TEMPERATURE RANGE FOR INPUTTING THERMODYNAMIC PROPERTY DATA FOR SPECIES J. N=1 OR 2 FOR LOWER AND UPPER TEMPERATURE RANGES, RESPECTIVELY.	C EQPCOM
TVCC(IS)	CONSTANT USED IN TVC CALCULATIONS	C EDGCOM
TW(L,1)	CONVERGED VALUE OF SURFACE TEMPERATURE.	C WALCOM
TWC(N)	BASE TEMPERATURE USED IN HEAT-TRANSFER-COEFFICIENT CALCULATION	L FELTRU
UE(L)	BOUNDARY-LAYER EDGE VELOCITY.	C EDGCOM
UEDGE	PARAMETER ENTERING INTO ENTROPY LAYER OPTION. SEE EQ(68) OF NASA CR-1062 (SET EQUAL TO UNITY IN PRESENT PROGRAM).	C EDGCOM
UGH	NORMALIZING FACTOR IN GAUSSIAN ELIMINATION.	L INPUT
UINF	FREE-STREAM VELOCITY	C EDGCOM
UKAP	EDGE VELOCITY NORMALIZED BY REFERENCE VELOCITY	L NONCER
UM(K,KK)	MOLECULES OF BASE SPECIES K IN ELEMENT KK.	L INPUT
UNIT(N)	COMPLEX FACTOR HAVING TO DO WITH DAMPING OF KINETICALLY CONTROLLED MASS BALANCES.	C KINCOM
UNIT(N)	SMOOTHING FACTOR RELATED TO IMPOSING RESIDUAL ERROR INTO REACTIVE MASS BALANCES AS A RESULT OF BOUNDARY LAYER DAMPING.	L KINET
V	LOCALLY DEFINED VARIABLE	L INPUT
VA	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
VARDV	VARIABLE EQUIVALENCED TO VARCOM FOR DUMPING PURPOSES	L DUMCOM
VB	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
VC	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	

VD	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
VF	LOCALLY DEFINED VARIABLE (VARIOUS ROUTINES)	
VFL	VELOCITY.	L EQUIL
VELSQ	SQUARE OF VELOCITY.	L EQUIL
VINT	P * 10**(-6)	L INPUT
VJKW(K)	DIFFUSIVE MASS FLUX OF BASE SPECIES AT THE WALL. CK6(K)/C3 EVALUATED AT THE WALL (IN OUTPUT, VJKW(K) IS MODIFIED TO REPRESENT DIFFUSIVE MASS FLUXES OF ELEMENTS AT THE WALL.	C FLXCOM
VX(K)	SP(I,J,K)	L PROPS
VKAP	FLAG FOR BODY SHAPE (0 FOR PLANAR, 1 FOR AXISYMMETRIC).	C PRKCOM
VK1	LOCALLY DEFINED VARIABLE	L KINET
VK2	LOCALLY DEFINED VARIABLE	L KINET
VK3	LOCALLY DEFINED VARIABLE	L KINET
VLAM	MIXTURE THERMAL CONDUCTIVITY GIVEN BY RHO(I) * DBAR * VMU6 * 1.9869 / (WM * VMU1).	L PROPS
VLAM(J,K)	LAMBDA, DEFINED IN EQ(83) OF NASA CR-1064	E NONCOM
VLNK(J)	LOG KP FOR FORMATION REACTION OF J TH SPECIES	C EQTCOM
VLNKW	VLNK EVALUATED AT THE WALL FOR THE (ISP)TH ELEMENT.	C NONCOM
VMACH	MACH NUMBER	L EQUIL
VMACH	MACH NUMBER.	L STATE
VMAT(N)	SET OF VARIABLES STARTING WITH C1 TO BE STORED ON TAPE.	E MISCOM
VMECH	SURFACE MASS LOSS RATE DUE TO LIQUID LAYER FLOW	L OUTPUT
VMU(I)	VISCOSITY OF MIXTURE, COMPUTED IN SUBROUTINE PROPS AS RHO(I) * DBAR * VMU5/VMU1	C PRPCOM
VMU1	COEFFICIENT MU1 DEFINED IN EQ(22) OF NASA CR-1062.	L PROPS
VMU2	SAME AS VMU2 IN PROPS.	L WATER
VMU2	COEFFICIENT MU2 DEFINED IN EQ(22) OF NASA CR-1062.	L PROPS
VMU4	PROPERTY OF THE GAS MIXTURE WHICH REDUCES TO 1/WM FOR EQUAL DIFFUSION COEFFICIENTS. SEE EQ(28) OF NASA CR-1062	C PRPCOM

VMU3P	DERIVATIVE OF VMU3 WITH RESPECT TO ETA.	C PRPCOM
VMU4P	DERIVATIVE OF VMU4 WITH RESPECT TO ETA.	C PRPCOM
VMU5	CONTRIBUTION TO MIXTURE VISCOSITY GIVEN BY AMU5 * RMMG/AA.	L PROPS
VMU6	CONTRIBUTION TO MIXTURE THERMAL CONDUCTIVITY GIVEN BY (PMU6 + CPTTI/1.9869-2.5 * TMU3) / P	L PROPS
VMU12	PRODUCT OF THE TWO COEFFICIENTS MU1 AND MU2 DEFINED IN EQ (22) OF NASA CR-1062	C PRPCOM
VMUA	CONSTANT IN THE VISCOSITY RELATION MU=(VMUA*T**VMUB)/(VMUC* T+VMUD). USED IN KR(7)=1 OPTION ONLY	C STTCOM
VMUB	CONSTANT IN THE VISCOSITY RELATION DEFINED UNDER VMUA.	C STTCOM
VMUC	CONSTANT IN THE VISCOSITY RELATION DEFINED UNDER VMUA.	C STTCOM
VMUD	CONSTANT IN THE VISCOSITY RELATION DEFINED UNDER VMUA.	C STTCOM
VMUE(I)	VISCOSITY AT BOUNDARY LAYER EDGE.	C EDGCOM
VMW(I)	MOLECULAR WEIGHT OF THE MIXTURE.	C PRPCOM
VMWE	MOLECULAR WEIGHT OF GAS AT BOUNDARY LAYER EDGE.	C EDGCOM
VN(J)	PARTIAL PRESSURE.	C EQPCOM
VNU(J,K)	STOICHIOMETRIC COEFFICIENT ON K TH BASE SPECIES IN FORMATION OF J TH SPECIES.	C EQPCOM
VVOL	LOCALLY DEFINED VARIABLE	L REFCON
W(N)	COMPONENT MASS FLUX AT WALL. W(1) IS EDGE GAS, W(2) IS PYROLYSIS GAS, W(3) IS CHAR	C BLOCOM
WALEQV	VARIABLE EQUIVALENCED TO WALCOM FOR DUMPING PURPOSES	L DUMCOM
WALLJ(K)	NORMALIZED DIFFUSIVE MASS FLUX AT WALL (DEFINED BY EQ(48) OF NASA CR-1062). CK6(K) EVALUATED AT THE WALL	C FLXCOM
WALLQ	NORMALIZED DIFFUSIVE HEAT FLUX AT THE WALL (DEFINED BY EQ (50) OF NASA CR(1062). C32 EVALUATED AT THE WALL	C FLXCOM
WALLQJ(N)	GLOBAL SET OF WALLQ AND WALLJ.	E FLXCOM
WAT(K)	ATOMIC WEIGHT.	C EQPCOM
WD2	1.2 * AISTAR / PMU1	L PROPS
WD4	0.2*A * WD2	L PROPS

WD5	0.32 * AISTAR / PMU1	L PROPS
WD7	WDZ/PMU1 - WD2	L PROPS
WD8	WD4/PMU1-WD5	L PROPS
WDOT	ABLATION RATE IN THE CONVERGED SOLUTION OF MATERIAL CONSIDERED UNDER KR(9) = 3 THROUGH 6	C BUMCOM
WDZ	CONSTANT 1.385 WHICH ENTERS INTO CALCULATION OF MIXTURE TRANSPORT PROPERTIES.	L PROPS
WM	MOLECULAR WEIGHT OF MIXTURE.	C EQPCOM
WS	SUM OF PYROLYSIS AND CHAR MASS RATES.	L MATER
WSUM	W(1) + W(2) + W(3)	L NONCER
WT	MOLECULAR WEIGHT AS SUMMED.	L INPUT
WTG	PRESSURE * GAS MOLECULAR WEIGHT.	L MATER
WTL	SUMMATION OF VN(J) * WTM(J) FOR ALL CONDENSED SPECIES.	L MATER
WTM(J)	MOLECULAR WEIGHT OF SPECIES J.	C EQPCOM
X(N)	CORRECTIONS OF NONLINEAR VARIABLES IN CHEMISTRY SOLUTION.	E EQTCOM
X1	DAMPED VALUE OF DELTA LN T.	L CRECT
XD	LOCALLY DEFINED VARIABLE	L SLOPQ
XG(N)	DEFINED BY EQ(86) OF NASA CR-1062 EVALUATED FOR P=G(1,I), N= 1 TO 4. XG(5) IS THE INTEGRAL OF (F(2,I)*G(1,I)*DETA) GIVEN BY EQ (85).	C COECON
XI(L)	TRANSFORMED STREAMWISE COORDINATE DEFINED BY EQS(31) AND (33) OF NASA CR-1052	C MISCOM
XICON(L)	INTEGRAND IN CALCULATION OF XI IN REFCON. TEMPORARY STORAGE AREA IN OTHER ROUTINES.	C TEMCOM
XJ	LOCALLY DEFINED VARIABLE	L MATS1
XK	LOCALLY DEFINED VARIABLE	L MATS1
XKP	LOCALLY DEFINED VARIABLE	L MATS1
XM(N)	DEFINED BY EQ(86) OF NASA CR-1062 EVALUATED FOR P=F(2,I), N= 1 TO 4. XM(5) IS THE INTEGRAL OF (F(2,I)*F(2,I)*DETA) GIVEN BY EQ(85)	C COECON
XOT	LOCALLY DEFINED VARIABLE	L SLOPQ

XDTT	LOCALLY DEFINED VARIABLE	L SLOPO
XS	LOCALLY DEFINED VARIABLE	L MATS1
XSP(N,K)	DEFINED BY EQ(86) OF NASA CR-1062 EVALUATED FOR P=SP(1,I,K) N=1 TO 4. XSP(5,K) IS THE INTEGRAL OF (F(2,I)*SP(1,I,K) *DETA) GIVEN BY EQ(85)	C COECON
XT	LOCALLY DEFINED VARIABLE	L ABMAX
XTO	LOCALLY DEFINED VARIABLE	L SLOPO
XTT	LOCALLY DEFINED VARIABLE	L SLOPO
Y(I)	ACTUAL DISTANCE FROM BODY MEASURED NORMAL TO SURFACE.	C OUTCOM
Y(J)	NATURAL LOG OF PARTIAL PRESSURE (=0 FOR PRESENT CONDENSED SPECIES). IDENTICAL TO YYY(J).	C EQPCOM
YAP	CONSTANT IN MIXING LENGTH EQUATION.	C EPSCOM
YC	INITIAL VALUE OF Y(J)	L INPUT
YDI	LOCALLY DEFINED VARIABLE	L TRMBL
YDIQ	LOCALLY DEFINED VARIABLE	L TRMBL
YDSD	LOCALLY DEFINED VARIABLE	L TRMBL
YDS	LOCALLY DEFINED VARIABLE	L TRMBL
YINT	ALOG(VINT)	L INPUT
YS	LOCALLY DEFINED VARIABLE	L SLOPO
YW(K)	VALUE OF YYY(J) AT WALL (SAVED)	C EQPCOM
Z	STATIC TEMPERATURE IN DEG K. IDENTICAL TO T*.	C EQPCOM
ZG(N,I)	DEFINED BY EQ(94) OF NASA CR-1062 EVALUATED FOR P=G(1,I). N = 1 TO 4	C HISCOM
ZK(K)	QUANTITY FOR ELEMENT K WHICH IS INTRODUCED AS A RESULT OF THE APPROXIMATION FOR BINARY DIFFUSION COEFFICIENTS AND REDUCES TO SP(1,I,K) FOR EQUAL DIFFUSION COEFFICIENTS (SEE EQ(95) OF NASA CR-1062)	C PRPCOM
ZKP(K)	DERIVATIVE OF ZK WITH RESPECT TO ETA.	C PRPCOM
ZM(N,I)	DEFINED BY EQ(94) OF NASA CR-1062 EVALUATED FOR P=F(2,I). N = 1 TO 4.	C HISCOM

```
ZSP(N,I,K)    DEFINED BY EQ(94) OF NASA CR-1062 EVALUATED FOR P=SP(1,I,K) C HISCOH
              N = 1 TO 4
```

SECTION III

LISTING OF FORTRAN V SOURCE DECKS

Listings of Fortran V source code decks for BLIMP are presented in this section. The various subroutines are listed numerically in terms of their file code names.

File Code Name	Routine	Page
B01A	DUMCOM	73
B02A	BLIMP	74
B03A	SETUP	75
B04A	ITERAT	77
B05B	NONCER	79
B05C	RNLCER	87
B06A	LINCER	91
B07A	REFCON	93
B08B	ICOEFF	99
B09A	RECASE	101
B10A	HISTXI	104
B11A	OUTPUT	106
B11B	FELTRU	111
B12B	IMONE	117
B13B	IONLY	121
B14A	STATE	123
B14B	STATEN	126
B15B	RERAY	127
B16A	SLOPQ	130
B17A	ABMAX	131
B18A	MATS1	131
B18B	MATS2	133
B19A	TRMBL	133
B19T	TRANCR	138
B20A	EQUIL	141
B21A	THERM	151
B22A	MATER	153
B23A	CRECT	162
B24A	INPUT	165
B25A	PROPS	172
B26A	TAYLOR	177
B27A	LINMAT	178
B28A	KINET	179
B29A	FIRSTG	183
B30A	ERP	185
B30B	ETIMEF	185
B30C	LIAD	186
B30D	TLEFT	186
B30E	DATE	186
B30F	TOD	186
B36A	OGLE	186

```
C801A                                                                   B01A 001
      SUBROUTINE DUMCOM(ICK)                                            B01A 002
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B01A   3
     1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                  ENTR-MOD
      COMMON/BUMCOM/     BUMP,CORMA,EASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IXB01A   5
      COMMON/COECOM/                C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B01A   6
     1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C3.,C B01A   7
     232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C4 B01A   8
     3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,C B01A   9
     465,C66,C67,C68,C69,C70,C71,C72,C73,C74-C75,C76,C77,C78,C79,C80,C81B01A  10
     5,C82,C83,C84,C85,C86,C87,C88                                      B01A  11
      COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)    B01A  12
     1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)      B01A  13
     2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)   B01A  14
     3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9)  B01A  15
     4,CKK3( 8, 8)                                                      B01A  16
      COMMON/CRBCOM/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMIST B01A  17
     1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU            B01A  18
      COMMON/EDCCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B01A  19
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,NEN,UINF,RHCINF,HINF,PINF                 ENTR-MOD
      COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,    B01A  22
     1 EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,TREF,RETR,VINTR(15)          ENTR-MOD
      COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B01A  24
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),HAT(10),  B01A  25
     2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),        B01A  26
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,HM,WTM( 71),YYY( 71),YW( 71),GG( 71)B01A  27
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B01A  28
      COMMON/EQTCOM/SIP,HIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B01A  29
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,BX,ISP2,ISPQ,   B01A  30
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,HTG,HTL,JC,HHG, B01A  31
     3 CCPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),BB(16),    ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,  B01A  33
     5 CP( 71),HH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),       B01A  34
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                     B01A  35
      COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM     B01A  36
     1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)     B01A  37
     2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)      B01A  38
     3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)    B01A  39
     4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)              B01A  40
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B01A  41
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B01A  42
      COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)  B01A  43
     2,THF(15,2),LEFT(10,2),TPE(2),TRACS(2),TDSIP(2),KQT(2)             B01A  44
      COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ        B01A  45
     1,WALLJ( 8),QW,VJKW( 9),TPWALL                                     B01A  46
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B01A  47
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  B01A  48
     2,C3M(40),BETAM(40)                                                B01A  49
      COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB01A  50
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B01A  51
     2,B(8),       MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B01A  52
     3,KAUXO,JTIME,JSPEC,MD(3),IU,ISH                                   ENTR-MOD
      COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),   B01A  54
     1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),MA(10),LL(10),PMR(10), B01A  55
     2 PRMU(10,10),EESE(10)                                             B01A  56
      COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                          B01A  57
```

```
     1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                B01A  58
      COMMON/OUTCOM/Y(15),RES,DELST,THENGY,THMOM,CH,BLOW,SHEAR,CF,SHAPE B01A  59
     1 ,CM( 9),THELEM( 9)                                                B01A  60
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B01A  61
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B01A  62
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                             B01A  63
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B01A  64
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB01A  65
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B01A  66
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B01A  67
     4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B01A  68
     5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B01A  69
     6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B01A  70
      COMMON/STTCOM/GAM1,PRDUM,PRA,PRB,PRC,PRD,VMUA,VMUB,VMUC,VMUD,NC,  B01A  71
     1 FLD(6,3),VMWD                                                     B01A  72
      COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)     B01A  73
     1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)     B01A  74
     2,XIINIT( 1),DUDS( 40)                                              B01A  75
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B01A  76
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B01A  77
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B01A  78
      EQUIVALENCE (FLPEQV,TXI),(BLQEQV,MOA),(BUMEQV,BUMP),(COEEQV,C5),
     1(CONEQV,CK1),(CRBEQV,HCARB),(EDGEQV,PE),(EQPEQV,RB),(EPSEQV,ELCON)
     2,(KINEQV,MT),(EQTEQV,SIP),(ERREQV,FLE),(ETAEQV,ETA),(HISEQV,C1),
     3 (INTEQV,KIN),(NONEQV,AM),(PRMEQV,TIME),(PRPEQV,PR),(STTEQV,GAM1),
     4 (TEMEQV,SPDUM),(VAREQV,F),(WALEQV,FW),(FLXEQV,DELQW),(OUTEQV,Y)
      DIMENSION BLQEQV( 1242),BUMEQV(   10),COEEQV(   84),CONEQV(  423)
     1          ,CRBEQV(   67),EDGEQV(  649),EPSEQV(  381),EQPEQV( 2352)
     2          ,EQTEQV( 1033),ERREQV( 1468),ETAEQV( 1463),FLPEQV( 1200)
     3          ,FLXEQV( 1406),HISEQV( 1171),INTEQV(  108),KINEQV(  421) ENTR-MOD
     4          ,NONEQV(23663),OUTEQV(   42),PRMEQV(  517),PRPEQV(  608)
     5          ,STTEQV(   30),TEMEQV(  335),VAREQV(  511),WALEQV(  606)
      DATA ATA(1),ATB(1),ATC(1)/4H    ,4H    ,4H    /
      IF (ICK-101) 70,10,40
   10 READ( 12 )  FLPEQV,BLQEQV,BUMEQV,COEEQV,CONEQV,CRBEQV,EPSEQV,
     1            EDGEQV, EQPEQV, KINEQV, EQTEQV, ERREQV, ETAEQV,
     2            FLXEQV, HISEQV, INTEQV, NONEQV, OUTEQV, PRMEQV,
     3            PRPEQV, STTEQV, TEMEQV, VAREQV, WALEQV
      GO TO 70
   40 WRITE(12 )  FLPEQV,BLQEQV,BUMEQV,COEEQV,CONEQV,CRBEQV,EPSEQV,
     1            EDGEQV, EQPEQV, KINEQV, EQTEQV, ERREQV, ETAEQV,
     2            FLXEQV, HISEQV, INTEQV, NONEQV, OUTEQV, PRMEQV,
     3            PRPEQV, STTEQV, TEMEQV, VAREQV, WALEQV
   70 CONTINUE
    5 RETURN                                                            C01A 067
      END                                                               C01A 068
CBLIMP                        BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE  BLIM 001
      DIMENSION FT(21)
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB02A   3
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B02A   4
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NET2,IDENT,KR9(40) B02A   5
     3,KAUXO,JTIME,JSPEC,MD(3),IU,ISH                                   ENTR-MOD
      COMMON/PRMCOM/TIME(50),PRE(40),PTET(50),GE(50),S(40),ROKAP(40)    ENTR-MOD
     1 ,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF(50),IPRE,RADNO   ENTR-MOD
     2 ,CONE,RADFL(50),RADR(40),RADS(40),IRAD                           ENTR-MOD
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B02A   7
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B02A   8
    1 FORMAT(A1)
```

```
      DATA IAST/1H,/
      DATA LAST/1H./
      DATA IBLANK/2H  /
      KIN=5                                                          ENTR-MOD
      KOUT=6                                                         ENTR-MOD
      JTIME=1
      B(1)=.5                                                        BLIM 015
      B(2)=.333333333                                                BLIM 016
      B(3)=.166666666                                                BLIM 017
      B(4)=.125                                                      BLIM 018
      B(5)=.041666666                                                BLIM 019
      B(6)=.033333333                                                BLIM 020
      B(7)=.013888888                                                BLIM 021
      B(8)=.003968254                                                BLIM 022
      IT=1                                                           BLIM 023
   46 MWE=-1
      NBT=13                                                         ENTR-MOD
      NBT2=14                                                        ENTR-MOD
      IS=1                                                           BLIM 025
      IU=1                                                           ENTR-MOD
   41 ITEM=1                                                         BLIM 026
   42 CALL SETUP                                                     BLIM 027
   43 CALL ITERAT                                                    BLIM 031
      CALL OUTPUT                                                    BLIM 032
      IF (IDENT.EQ.IBLANK) GO TO 55
      CALL FELTRU
   55 CONTINUE
      IF(NON)43,44,40                                                BLIM 033
   44 ITEM=ITEM+1                                                    BLIM 034
      IF(ITEM-NITEM) 42,42,45                                        BLIM 035
   45 ISH=IS                                                         ENTR-MOD
      IU=IU+1                                                        ENTR-MOD
   49 IS=IS+1                                                        ENTR-MOD
      IF(KQ(10)+IS.EQ.-10)KQ(10)=1                                   ENTR-MOD
      IF(IDISC(IS).EQ.2)GO TO 49                                     ENTR-MOD
      IF(IS-NS) 41,41,40                                             BLIM 037
   40 READ(KIN,1) JAST
      IF(IAST-JAST) 47,46,47
   47 IF(LAST-JAST) 40,48,40
   48 STOP
      END                                                            BLIM 038
CB03A                                                                B03A 001
      SUBROUTINE SETUP                                               B03A 002
      DIMENSION HIST1(605),HIST2(607),HIST3(511),VMAT(566),HIST4(600)  B03A 003
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B03A   4
     1,LEFS(10),PIEASE,LEFW(10)                                      B03A   5
      COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B03A   6
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,NEN,UINF,RHOINF,HINF,PINF                 ENTR-MOD
      COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)  B03A   9
     2,THF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KGT(2)             B03A  10
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B03A  11
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HMUE,HFW,DLX2  B03A  12
     2,C3M(40),BETAM(40)                                                B03A  13
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB03A  14
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B03A  15
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B03A  16
```

```
      3,KAUXO,JTIME,JSPEC,MD(3),IU,ISH                                  ENTR-MOD
       COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B03A  18
      1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B03A  19
      2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B03A  20
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B03A  21
       COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B03A  22
      1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ     B03A  23
       EQUIVALENCE(HIST1,XI),(HIST2, PE),(HIST3,F),(VMAT,C1),(HIST4,FW)  C03A 008
     2 FORMAT(1H18X4HTIMEE12.5,56H SECONDS - - - - - - - - - - - - - - - C03A 022
      1- - - - - - - - - -,2X3A6)
     3 FORMAT(/1H17X4HTIMEE12.5,35H SECONDS - - - STREAMWISE DIMENSI(NE12C03A 024
      1.5,11HFEET - - -,2X3A6)
     4 FORMAT(1H18X4HCASEI3,32(2H -)2X3A6)
     5 FORMAT(1H17X4HCASEI3,11(2H -)21H STREAMWISE DIMENSIONE12.5,13H FEE
      1T - - - -3A6)
  9901 FORMAT(I3,7E10.3)                                                C03A 026
       DATA MD(2)/6H      /
       MD(1)=MD(2)
       MD(3)=MD(2)
       CALL ETIME
       CALL DATE(9,MD)
       CALL TOD(18,MD)
       KR(2)=2
       J=MOD(ITEM,2)+1                                                  C03A 028
       IF(MWE)101,154,154                                               C03A 029
C      INPUT CONTROL AND TITLE CARD, NUMBER OF ELEMENTAL SPECIES TO BE  C03A 030
C      CONSIDERED, TIMES AND BODY POSITIONS TO BE CALCULATED, AND       C03A 031
C      REFERENCE CONDITIONS(WHEN GIVEN AT THESE PRECISE TIMES AND BODY  C03A 032
C      POSITIONS                                                        C03A 033
  101 CALL RECASE                                                       C03A 034
       KQ(10)=0
       IF(KR(7).GT.1) CALL TRMBL(1)
       IS=1                                                             C03A 037
       IT=1                                                             C03A 038
C      INPUT ETA VALUES AND SET UP AND INVERT LINEAR MATRICES.NOTE..KR(1)C03A 039
C      MUST BE UNITY FOR FIRST CASE, BUT FORMATION OF BA1 AND BA2 CAN BE C03A 040
C      AVOIDED FOR SUBSEQUENT CASES BY SETTING KR(1) EQUAL TO ZERO. THIS C03A 041
C      CAN BE DONE IF AND ONLY IF ETA SPACING IS THE SAME               C03A 042
       IF(KR(1)) 104,104,103                                            C03A 043
  103 CALL LINMAT                                                       C03A 044
  104 KR17=KR(17)                                                       C03A 045
  154 IF(IS+ITEM-2) 105,105,1572
 1572 IF(KR(3)) 1570,1577,1570
 1570 DO 1573 K=1,10                                                    ENTR-MOD
       IF(LEF(K)-1) 1573,1575,1573                                      C03A 049
 1575 LEF(K)=2                                                          C03A 050
 1573 CONTINUE                                                          C03A 051
 1577 IF(NITEM-1) 1574,107,1574                                         C03A 052
 1574 WRITE(NBT)HIST1,HIST2,HIST3,HIST4,M,LEF,RADS,KQ(10)
       IF(ITEM-1) 157,156,157                                           C03A 054
  156 IDUM=NBT                                                          C03A 055
       NBT=NBT2                                                         C03A 056
       NBT2=IDUM                                                        C03A 057
       DO 153 I=1,NITEM
  153 BACKSPACE NBT2
       GO TO 155                                                        C03A 060
  157 IF(IS-1) 105,105,155
  155 READ(NBT2)HIST1,HIST2,HIST3,HIST4,M,LEF,RADS,KQ(10)
```

```
      GO TO 107                                                         C03A 063
C     INITIAL GUESSES FOR PRINCIPAL DEPENDENT VARIABLES. CALCULATE(KR(2)C03A 066
C     =0), INPUT(KR(2)=1), OR USE VALUES FROM FROM PREVIOUS CASE(KR(2)  C03A 067
C     =2). NOTE..LATTER REQUIRES SAME ETA VALUES AND SAME SPECIES. ITS  C03A 068
C     UTILITY IS FOR REPEATED SIMILARITY SOLUTIONS. IT OBVIOUSLY  CANNOTC03A 069
C     BE USED FOR FIRST CASE.                                           C03A 070
  105 CALL FIRSTG                                                       C03A 071
      IF(TIME(1)) 1051,1052,1052
 1051 ITAB=ABS(TIME(ITEM))
      WRITE(KOUT,4) ITAB, MO
      GO TO 106
 1052 WRITE(KOUT,2) TIME(ITEM),MO
  106 IF(KR(7))204,204,203
  203 IF(KR(12).NE.1) CALL STATEN
      GO TO 202
  204 IF(KR(12).NE.1) CALL INPUT(PTET(1))
  202 CALL REFCON
      IF(KQ(9).NE.0) CALL TRANCR(1)
      KR(12)=1                                                          C03A 076
      IS=1                                                              C03A 077
  107 DO 1262 I=1,10                                                    ENTR-MOD
      IF(IS.EQ.1.AND.LEF(I).EQ.2.AND.KR(2).GE.0)LEF(I)=1                ENTR-MOD
 1262 LEFT(I,J)=LEF(I)                                                  C03A 080
C-----COMPUTE HISTORIC INFORMATION
      CALL HISTXI
      IF(TIME(1)) 1053,1054,1054
 1053 ITAB=ABS(TIME(ITEM))
      WRITE(KOUT,5) ITAB, S(IS), MO
      GO TO 126
 1054 WRITE(KOUT,3)TIME(ITEM),S(IS),MO
  126 DO 1261 I=1,META
 1261 THF(I,J)=HF(I,5)                                                  C03A 085
      TXI(J)=XI(IS)                                                     C03A 086
      TRADS(J)=RADS(IS)
      TDSIP(J)=DSIP(IS)
      TUE(J)=UE(IS)                                                     C03A 087
      TRHOE(J)=RHOE(IS)                                                 C03A 088
      TTE(J)=TE(IS)                                                     C03A 089
      KQT(J)=KQ(10)
      TVMUE(J)=VMUE(IS)                                                 C03A 090
      DO 104 I=1,966                                                    C03A 091
  104 TMAT(I,J)=VMAT(I)                                                 C03A 092
      TPE(J)=PE(IS,1)                                                   C03A 093
      NME=0                                                             C03A 094
C     START OF ITERATION LOOP                                           C03A 095
  158 ITS=0                                                             C03A 096
      KR(17)=KR17                                                       C03A 097
  159 RETURN                                                            C03A 098
      END                                                               C03A 099
C804A                                                                   804A 001
      SUBROUTINE ITERAT                                                 804A 002
      COMMON/BLOCON/  MDA( 71),  MDB( 71),NSPEC,FR( 71,15),N(3),LEF(10) 804A   3
     1,LEFS(10),PIEASE,LEFN(10)                                         804A   4
      COMMON/BURCON/    BUMP,CORRA,EASE,ICORN,MDOT,TFZ,I777,DTEMP,KIP,IX804A   5
      COMMON/ERRCON/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEN,GLEN     804A   6
     1,SPLEN( 8),ELN(14),ELNN,IFLN,IGLN,ISPLN( 8),NELN,ILNN,DFL(43)     804A   7
     2,DGL(30),DSPL(30, 8),FNLE(10),GNLE(15),SPNLE(15, 8),ENL(153)      804A   8
     3,FNLEN,GNLEN,SPNLEN( 8),          ENLNN,IFNLN,IGNLN,ISPNLN( 8)    804A   9
```

```
      4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                B04A  10
       COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB04A  11
      1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B04A  12
      2,B(8),       MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B04A  13
      3,KAUXO,JTIME,JSPEC,MD(3)                                            B04A  14
       COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B04A  15
      1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B04A  16
      2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                              B04A  17
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                      B04A  18
    5 FORMAT(I3,1X,F8.3,F6.3,F7.4,F6.4,1PE7.0,8(I3,E8.1))
    6 FORMAT(/1X15HITERATED VALUES11X47HDAMP  MAX.LIN   MAX.ERRORS IN CO
      1NSERVATION EQS./1X58HITS    TIME   ALPH   FPPW         ERROR  MOMEN
      1TUM    ENERGY 6(5XA4,A2))
    1 FORMAT(22H NON-CONVERGENT OUTPUT)                                    B04A 018
  101 ITS=ITS+1                                                            B04A 019
       JTIME=MAX0(JTIME,0)
       CALL TLEFT(ILEFT)                                                   RDG
       IF(ILEFT-JTIME) 30,30,31
   30 JTIME=-JTIME
        KR(4)=1                                                            RDG
       KR(16)=1                                                            RDG
       KR(18)=1                                                            ENTR-MOD
       KR(19)=1                                                            ENTR-MOD
   31 CONTINUE                                                             RDG
       NON=2
  323 IF(ITS-5) 328,328,321
  320 IF(KR(2)) 325,321,321
  321 IF(KQ(10)+10) 326,322,326
  326 IF(NON-2) 325,330,325
  325 RETURN
  322 KQ(10)=2
       IDISC(IS)=1
       EASE=0.11
       ITS=2
       WRITE(KOUT,324)
  324 FORMAT(96H1     PRIOR LAMINAR SOLUTION AFTER TRANSITION. TURBULENCE
     1 WILL BE INCLUDED AND SOLUTION CONTINUED //)
  328 IF(NON) 325,330,330
  330 NON=0                                                                ENTR-MOD
       CALL NONCER                                                         B04A 021
       CALL ETIMEF(TIMD)
       FPPW=F(3,1)/(ALPH*ALPH)                                             B04A 022
       IF(KQ(18).EQ.2) GO TO 1900
       IF(KR(4)+KR(16)+KR(17)+KR(18)/2+KR(19)+KR(28)+NON) 189,189,1901
  189 IF (ITS-1) 1901,1901,1911                                            B04A
 1900 KQ(10)=1
 1901 IF (NSPM1) 192,192,190                                               B04A
  190 WRITE(KOUT,6)(MOA(K),MOB(K),K=1,NSPM1)                               B04A 025
       GO TO 191
  192 WRITE(KOUT,7)
       GO TO 194
 1911 IF (NSPM1)194,194,191
  191 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,EASE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM,
     1(ISPNLM(K),SPNLEM(K),K=1,NSPM1),NON
       GO TO 1920
  194 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,EASE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM
 1920 IF(KR(2)) 162,1921,1921
 1921 IF(ENLMM+ELMM-0.0002) 162,162,159
```

```
      7 FORMAT(/7X65HITERATED VALUES    DAMP  MAX.LIN  MAX.ERRORS IN CONSE
     1RVATION EQS./1X58HITS  TIME    ALPH   FPPW        ERROR   MOMENTUM
     2    ENERGY   )
    162 NON=0                                                           B04A 029
        GO TO 329
    159 IF(ITS-50) 161,160,160                                          B04A 031
    160 WRITE(KOUT,1)                                                   B04A 032
        IF (ELMM+ENLMM-.02) 162,162,1601                                B04A 033
   1601 NON=1                                                           B04A 034
        GO TO 320
C       ITERATE OR OUTPUT                                               B04A 036
    161 IF(KR(4)) 181,181,193                                           B04A 037
    193 NON=-1                                                          B04A 038
        GO TO 323
        END                                                             B04A 040
C       B05B
        SUBROUTINENONCER                                                B05A0020
        INTEGER ASU,BSU
        DIMENSIONDQJNL( 71,1)                                           B05B 004
        DIMENSIONDELQJN(1) ,DQJNL(153,1) ,WALLCJ(1)                     B05B 005
        DIMENSIONCOEEQV(84),COEFQV(423)                                 B05B 006
        COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B05B   7
       1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                ENTR-MOD
        COMMON/BUNCOM/     BUNP,CORNA,EASE,ICORN,WDOT,TFZ,I777,DYEMP,KIP,IXB05B   9
        COMMON1/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B05B  10
       1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB05B  11
       232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B05B  12
       3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB05B  13
       465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B05B  14
       5,C82,C83,C84,C85,C86,C87,C88                                    B05B  15
        COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B05B  16
       1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B05B  17
       2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B05B  18
       3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B05B  19
       4,CKK3( 8, 8)                                                    B05B  20
        COMMON/CRBCON/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMISTB05B  21
       1,HPG,ASU(3),BSU(3),HPVG(3),HCHAR(3),EMIV(3),KS(48),ISU          B05B  22
        COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B05B  23
       1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMNE,CGE,C90 ENTR-MOD
       2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),   ENTR-MOD
       3CG(20),CGP(20),SREF,GEP,HEN,UINF,RHOINF                         ENTR-MOD
        COMMON/EPSCON/ELCON,YAP,CLNLM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,  B05B  26
       1 EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,TREF,RETR,VINTR(15)        ENTR-MOD
        COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B05B  28
       1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10), B05B  29
       2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VW( 71),      B05B  30
       3 VWU( 71,10),ITFF,KR2,HCM,HCV,HN,HTM( 71),YYY( 71),VM( 71),GG( 71)B05B  31
       4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                 B05B  32
        COMMON/EQTCOM/SIP,HIP,EEL,EEML,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B05B  33
       1 MODE,HMELT,SMELT,TMAX,TMIN,HELT,SUMM,SUML,WS,WSS,BX,ISP2,ISPQ, B05B  34
       2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CRF,EP,RV,IFCJC,WTG,WTL,JC,HMG, B05B  35
       3 CCPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),BB(16),  ENTR-MOD
       4 IP( 71),ALP(10),FMU(10),GAMP(10),GAMF(10),SLAM(10),DY( 71),RVS, B05B  37
       5 CP( 71),HH( 71),SB( 71),TC( 71),VLMK( 71),E( 71),PMUS(10),     B05B  38
       6 UC(10),BLMK(10),BV(10),IBC(10),BE(10),JZ( 4)                   B05B  39
        COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEP   B05B  40
       1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),HELM,ILMM,DFL(43)   B05B  41
       2,DGL(30),DSPL(30, 8),FMLE(12),GMLE(15),SPMLE(15, 8),ENL(153)    B05B  42
```

```
     3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)      B05B  43
     4,NEMLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                B05B  44
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)        B05B  45
     1,LAR(153),BA1(43,18),BA2(30,15)                                     B05B  46
      COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ          B05B  47
     1,WALLJ( 8),QW,VJKW( 9),TPWALL                                       B05B  48
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZN(4,14),ZG(4,14),ZSP(4,14, 8B05B  49
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2    B05B  50
     2,C3M(40),BETAM(40)                                                  B05B  51
      COMMON/INTCOM/ KR(20),XIN.KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB05B  52
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B05B  53
     2,B(8),      MWE,NON,KO(10),ITEM,NITEM,KR17,NOT,NBT2,IDENT,KR9(40) B05B  54
     3,KAUXO,JTIME,JSPEC,MO(3),IU,ISW                                     ENTR-MOD
      COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                            B05B  56
     1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                 B05B  57
      COMMON/PRMCOM/TIME(50),PRE(40),PTET(50),GE(50),S(40),ROKAP(40)      ENTR-MOD
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)     B05B  58
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOM,DRHOK( 8),ZK( 8),DZKH( 8),  DB05B  59
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B05B  60
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)    B05B  61
     4,DPHIKK( 8, 8),       DMU4M,DMU3M,DHTILM,VMU12,CT,CTR,CPTIL,HTIL   B05B  62
     5,VMU3,DTM,DCAPCM,DPRM,DSCM,DQRM,DCPBM,DCPTM,DMU12M,VMU(15),   RHOF B05B  63
     6(15),PHIKP(15),MP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)    B05B  64
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                      B05B  65
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)           B05B  66
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ        B05B  67
      DIMENSION ENLM(1),IENLM(1)
      EQUIVALENCE (ENLM(1),FNLEM),(IENLM(1),IFNLM)
      EQUIVALENCE(DELQW,DELQJW),(DQNL,DQJNL),(WALLQ,WALLQJ)               B05A0380
      DIMENSIONCORAR(1)                                                   B05A0470
      EQUIVALENCE(CORAR(1),AM(1))                                         B05A0480
      EQUIVALENCE(AM,DQJRNL)                                              B05A0490
      DIMENSION PREQ(1)
      DIMENSION ZEIT(9)
      EQUIVALENCE(PREQ(1),DRHOM)                                          B05B
      EQUIVALENCE(C5,COEEQV),(CK1(1),COEFQV)                              B05A0680
C**NB***NOTE 240+1,549+1,725,730+1 WHEN REDIMENSIONING                    B05A0690
      EASE=AMIN1(EASE*2.,1.0)
      IF(ITS-1) 11,5,11
    5 EASE=0.05
      BUMP = 1.8                                                          B05A0740
      IF(ITEM+IL-2) 3,3,2                                                 ENTR-MOD
    2 IF(MOOT) 4,3,3
    3 MOOT=-.12/C1
    4 PIEASE=1.
      ICORM = 1                                                           B05A0760
      CORMA = 1.E + 10                                                    B05A0770
      TFZ = 8.                                                            B05A0780
      IF (KR9(IS)) 8,8,7
    7 KR(9)=KR9(IS)
    8 DO 17 I=1,NETA
   17 EPSA(I)=0.
      IF(KR(9)-2) 11,10,9
    9 FLUXJ(3,IS,IT)=-1.                                                  B05A0705
   10 ISP=IZ+1
      KK=MAX0(1,KS(IS))
      W(1) = FLUXJ(1,IS, IT)
      W(2)=FLUXJ(2,IS,IT)
```

```
      H(3)=FLUXJ(3,IS,IT)
      L2=2*KK
      L3=L2+1
      IF(KR(9)-2) 11,11,16
   16 HPG=HPYG(KK)
      EMISC=EMIV(KK)
      HCARB=HCHAR(KK)
      DO 12 J=ISP,NSPEC
      IF(MOA(J)-ASU(KK)) 12,13,12
   13 IF(MOB(J)-BSU(KK)) 12,14,12
   14 ISU=J
      GO TO 11
   12 CONTINUE
      ISU=ISP
   11 KIP=0
      IX = 0
C---- EVALUATE COEFFICIENTS AND ERRORS FOR NONLINEAR EQUATIONS                 805A0810
C     INITIALIZE AM MATRIX                                                     805A0830
      DO 15 I=1,NNLEQ                                                          805A0840
      ENL(I)=0.                                                                805A0850
      DO 15 J=1,NNLEQ
   15 AM(I,J) = 0.                                                             805A0860
C     EVAL. GROUPINGS WHICH CHANGE DURING ITERATION BUT ARE NOT F(ETA)         805A0870
   48 C5 = 1. / ALPH                                                           805A0880
      DUM1 = ALPH * ALPH                                                       805A0940
      C6 = BETA * DUM1                                                         805A0950
      C7 = - UE(IS) / DUM1 * UE(IS) / 25036.5                                  805A0960
      C8 = ALPHO * C5                                                          805A0970
      C9 = C4 - C8                                                             805A0980
C     FINALLY, EVAL CONTRIBUTIONS TO AM AND ERRORS FROM OTHER COEFFS           805A0990
C---- START OF MAJOR DO LOOP FOR EVAL OF COEFFS AND ERRORS AT EACH ETA         805A1140
      KQ(1)=2                                                                  805A1290
      KQ(5)=0
      CALL ETIMEF(ZEIT(1))
      DO 49 I=1,NETA
      H(I)=G(1,I)+0.5*F(2,I)*C7*F(2,I)
      HP=G(2,I)+F(2,I)*C7*F(3,I)
      IF(KR(7)) 47,47,46
   46 CALL STATE
      GO TO 48
   47 CALL EQUIL(KQ,H(I),PE(IS,IT))
   48 IF(I-1) 50,50,54
   50 IF(NSPM1) 53,53,51
   51 DO 52 K=1,NSPM1
      DO 31 KK=1,IZ
   31 DLPK(K,KK) = A(KK+2, K+2)                                               ENTR-MOD
   52 DTKW(K)= DTK(K)
      DO 32 KK=1,IZ
   32 DLPW(KK)= A(KK+2,1)                                                     ENTR-MOD
      VLNKW=VLNK(ISU)
      TCW=TC(ISU)
      MCWAL = MN(ISU)/MTN(ISU)*1.0
   53 DTHW=DTH
   54 RHOP(I)=-DRHOH*HP
      IF(NSPM1) 58,58,56
   56 DO 57 K=1,NSPM1
   57 RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)
   58 L=0
```

```
      M=MAT1J+I-MAT2J
C-----UPPER LIMIT IS MAX NUMBER OF SPECIES (MXNSP) =LAST DIM ON SP
      DO 49 MM=1, 9                                                     B058
      M=M+MAT2J
C-----UPPER LIMIT CORRESPONDS TO DIMENSIONS ON AM ARRAY
      DO 49 N=124,153                                                   B058
      L=L+1
   49 AM(M,N)=PREQ(L)
      CONJ=25836.5                                                      ENTR-MOD
      UEDGE=1.                                                          ENTR-MOD
      DUEDGE=0.                                                         ENTR-MOD
      GEP=0.                                                            ENTR-MOD
      CGE=0.                                                            ENTR-MOD
      CGEP=0.                                                           ENTR-MOD
      DUM=-RHOE(IS)*ROKAP(IS)*C3*VMUE(IS)                               ENTR-MOD
      SFE=DUM*F(1,NETA)*UE(IS)                                          ENTR-MOD
      IF(KR(5)-2) 486,487,486                                           ENTR-MOD
  487 IF(XI(IS)) 488,489,488                                            ENTR-MOD
  489 FEDGE=-RHOINF/2.*UINF/(RHOE(IS)*C3*VMUE(IS)*DUES)                 ENTR-MOD
      GO TO 497                                                         ENTR-MOD
  488 FEDGE=RHOINF/DUM*UINF/UE(IS)*(ROKAP(IS))**2/2.                    ENTR-MOD
  497 SFE=FEDGE*DUM*UE(IS)                                              ENTR-MOD
  486 IF(KR(5)-4) 498,496,499                                           ENTR-MOD
  498 IF(KR(5)-2) 499,491,491                                           ENTR-MOD
  496 CALL OGLE (1,SFE,CGE,CGEP,NEN,SF,CG,CGP)                          ENTR-MOD
  491 CALL OGLE (1,SFE,CSE,CSEP,NEN,SF,CS,CSPR)                         ENTR-MOD
      DUB=CSE+SREF-SIP                                                  ENTR-MOD
      CHE=1.8*HIP+T(NETA)*DUB*(1.+0.5*DTH*DUB)-HEA(IS)                  ENTR-MOD
      CTE=T(NETA)*(1.+DTH*DUB)                                          ENTR-MOD
      CHEP=CTE*CSEP                                                     ENTR-MOD
      IF (XI(IS)) 492,492,495                                           ENTR-MOD
  492 IF(KR(6)-1) 493,494,494                                           ENTR-MOD
  493 DUEDGE=-RHOE(IS)/DUES*(CGEP-CHEP)*C3*VMUE(IS)*CONJ                ENTR-MOD
      UEDGE=SQRT(1.+2.*DUEDGE*F(1,NETA))                                ENTR-MOD
      GEP=0.                                                            ENTR-MOD
      GO TO 499                                                         ENTR-MOD
  494 GPP=(CGP(2)-CGP(1)+CTE*(CSPR(2)-CSPR(1)))/(SF(2)-SF(1))           ENTR-MOD
      DUEDGE=GPP*DUM*DUM*F(1,NETA)*CONJ                                 ENTR-MOD
      UEDGE=SQRT(1.+DUEDGE*F(1,NETA))                                   ENTR-MOD
      GEP=0.                                                            ENTR-MOD
      GO TO 499                                                         ENTR-MOD
  495 UEDGE=SQRT(1.+2.*CONJ/UE(IS)*(CGE-CHE)/UE(IS))                    ENTR-MOD
      GEP=DUM*UE(IS)*CGEP*UEDGE                                         ENTR-MOD
      DUEDGE=DUM/UE(IS)*(CGEP-CHEP)*CONJ                                ENTR-MOD
  499 DUF=DUEDGE/UEDGE                                                  ENTR-MOD
      CGE=CGE+GE(ITEM)                                                  ENTR-MOD
      CALL LINCER                                                       ENTR-MOD
      CALL ETIMEF(ZEIT(2))
      IF(KQ(18).GT.0) CALL TRNDL(2)
      CALL ETIMEF(ZEIT(3))
      TTVC=1.0
      DO 120 I=1,NETA                                                   B0541300
      L=0
      M=MAT1J+I-MAT2J
C-----UPPER LIMIT IS MAX NUMBER OF SPECIES   (MXNSP) LAST DIM ON SP
      DO 59 MM=1, 9                                                     B058
      M=M+MAT2J
C-----UPPER LIMIT CORRESPONDS TO DIMENSIONS ON AM ARRAY
```

```
      DO 59 N=124,153                                                   B05B
      L=L+1
      PREQ(L)=AM(M,N)
   59 AM(M,N)=0.
C     TEST TO BYPASS COMMANDS THAT CANNOT BE PERFORMED AT ETA(1)        B05A1310
      IF (I - 1) 60,60,55                                               B05A1320
   55 CALL IMONE                                                        B05A1330
      IF(KQ(9).NE.0) CALL TRANCR(3)
      IF(KQ(10).GT.0) CALL TRMBL(4)
C     COMPUTE STATIC ENTHALPY AND DETERMINE STATE OF GAS                B05A1340
   60 C10 = C7 * F(2,I)                                                 B05A1350
      C13 = C7 * F(3,I)                                                 B05A1370
      HP = G(2,I) + F(2,I) * C13                                        B05A1380
C---- EVAL GROUPINGS WHICH ARE USED AT I-1 AS WELL AS AT I              B05A1460
   75 CALL ICOEFF                                                       B05A1470
      IF(KQ(9).NE.0) CALL TRANCR(2)
      IF(KQ(10).GT.0) CALL TRMBL(3)
      IF (I - 1) 100,80,100                                             B05A1480
C     DLPK,TCM,VLNKM,DLPM, AND Y1 NEEDED ONLY FOR CARBON PROBLEM        B05A1490
   80 IF (NSPM1) 95,95,85                                               B05A1500
   85 DO 90 K=1,NSPM1                                                   B05A1510
      WALLJ(K) = CK6(K)                                                 B05A1520
      VJKW(K) = CK6(K) / C3                                             B05A1530
   90 CONTINUE
   95 WALLQ = C32                                                       B05A1620
      QW = C32 / C3                                                     B05A1630
      TPWALL = TP
      GOTO 105                                                          B05A1640
C---- BACK TO CONSERVATION EQUATIONS                                    B05A1650
  100 CALL IONLY                                                        B05A1660
      IF(KQ(10).GT.0) CALL TRMBL(5)
      IF(KQ(9).NE.0) CALL TRANCR(4)
  105 IF (KR(17)) 120,120,115                                           B05A1670
  110 FORMAT(21H ALL THE COEFFICIENTS/(1X1P12E10.3))                    B05A1680
  115 WRITE(KOUT,110)C1,C2,C3,C4,COEEQV,COEFQV                          B05A1690
      IX = - 2                                                          B05A1700
  120 CONTINUE                                                          B05A1710
      DO 122 I=2,4                                                      ENTR-MOD
      DO 122 J=1,NMLEQ                                                  ENTR-MOD
  122 AM(I,J)=0.                                                        ENTR-MOD
      ENL(4)=-(ALPH*UEDGE-F(2,NETA))                                    ENTR-MOD
      AM(4,1)=UEDGE                                                     ENTR-MOD
      AM(4,NAT1J)=-1.                                                   ENTR-MOD
      CALL LIAD(-1,4,NETA-1,ALPH*DUF)                                   ENTR-MOD
      ENL(3)=-F(2,1)                                                    ENTR-MOD
      AM(3,4)=1.                                                        ENTR-MOD
      IF(KR(5)-2) 123,121,123                                           ENTR-MOD
  121 ENL(2)=F(1,NETA)-FEDGE*TTVC                                       ENTR-MOD
      CALL LIAD(-1,2,NETA-1,-1.)                                        ENTR-MOD
      GO TO 124                                                         ENTR-MOD
  123 ENL(2)=CBAR*F(2,NETA)-F(2,KAPPA)                                  ENTR-[illegible]
      IF(KR(5).GT.1.AND.KR(5).NE.5)ENL(2)=ENL(2)-CBAR*F(3,NETA)*(ETA(NET[illegible]
     1A)-ETA(KAPPA))                                                    [illegible]
      AM(2,KAPPA+3)=1.                                                  [illegible]
      AM(2,NAT1J)=-CBAR                                                 [illegible]
      IF(KR(5).GT.1.AND.KR(5).NE.5)CALL LIAD(-1,2,NETA+NETA-2,CBAR*(ETA([illegible]
     1NETA)-ETA(KAPPA)))                                                [illegible]
  124 CALL ETIMEF(ZEIT(6))                                              [illegible]
```

```
      IF (ITS - 1) 125,125,145                                          B05A1720
  125 DO 140 K=1,NSP                                                    B05A1730
      IF (LEFS(K)) 130,130,140                                          B05A1740
  130 IF(LEF(K)) 140,140,135
  135 EASE = .05                                                        B05A1760
  140 CONTINUE                                                          B05A1770
  145 IF(KR(19)) 170,190,170                                            B05A1850
  170 CONTINUE                                                          B05A1860
      WRITE(KOUT,175)                                                   B05A1870
  175 FORMAT(2X21HDEBUG FNLE,GNLE,SPNLE)                                B05A1880
  180 FORMAT(/2X1P11E10.3/(12X1P10E10.3))                               B05A1890
      WRITE (KOUT,180) (ENL(I),I=1,NNLEQ)
C     SEEK MAXIMUM ERROR FOR EACH CONSERVED QUANTITY
  190 M=2
      MM=MAT1J
      DO 200 I=1,NRNL
      CALL ABMAX(MM-1,ENL(M),ENLM(I),IENLM(I))
      IENLM(I) = IENLM(I)+1
      M=M+MM
  200 MM=MAT2J
C     SOLVE REDUCED SET OF EQUATIONS                                    B05A2070
      IF (KR(2).LT.0) RETURN
C     SCRUNTCH DEFINED ROWS OF AM MATRIX TO THE TOP                     B05A2090
      LSKIP=MAT1J+1                                                     B05A2100
      L=1                                                               B05A2110
      LL=0
      DO 240 M=1,NAM                                                    B05A2130
      L=L+1                                                             B05A2140
      IF(L-LSKIP) 235,230,235
  230 LSKIP=LSKIP+MAT2J
      LL=LL+1
      DO 231 J=1,NNLEQ
  231 DQJNL(J,LL)=AM(L,J)
      DELQJW(LL)=-ENL(L)
      L=L+1
  235 ENL(M)=ENL(L)
      DO 240 J=1,NNLEQ
  240 AM(M,J)=AM(L,J)                                                   B05A2180
C     THE FOLLOWING ROUTINE REARRANGES COLUMNS OF THE NOW RECTANGULAR   B05A2250
C     AM MATRIX,ACCORDING TO LAR,INVERTS((AM(I,J),J=2,NAM),I=1,NAM) AND B05A2260
C     MULTIPLIES THE INVERSE TIMES THE REMAINING COLUMNS OF AM MATRIX   B05A2270
C     AND TIMES THE ENL.                                                B05A2280
      CALL ETIMEF(ZEIT(5))
      CALL RERAY(NAM,AM,NSP - 1,ENL,1,LAR,IX,153)                       B05A2290
      CALL ETIMEF(ZEIT(6))
      DO 243 I=1,NAM
  243 AM(I,NAM)=AM(I,1)
  244 IF(KR(17)) 245,265,245
  245 CONTINUE                                                          B05A2310
  250 FORMAT(2X1P11E10.3)                                               B05A2320
      WRITE(KOUT,255)                                                   B05A2330
  255 FORMAT(2X18HDEBUG FLE,GLE,SPLE)                                   B05A2340
      WRITE(KOUT,250)FLE,GLE                                            B05A2350
      IF (NSPM1) 265,265,260                                            B05A2360
  260 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2I)                  B05A2370
C*****SURFACE OPTIONS TREATED IN RNLCER WITH REDUCED NONLINEAR SET
  265 CALL ETIMEF(ZEIT(7))
      CALL RNLCER
```

```
      CALL ETIMEF(ZEIT(8))
C     DETERMINE MAXIMUM NONLINEAR ERRORS                                B05A4010
C     EQUIVALENCE ENLM TO FNLEM, GNLEM, AND SPNLEM                      B05A4020
  595 DO 605 I=1,NRNL
      IF(ABS(ENLM(I))-ABS(DRNL(I))) 600,605,605
  600 ENLM(I) = DRNL(I)
      IENLM(I) = 1
  605 CONTINUE
      ENLM(1)=ENLM(1)*10.
      ENLM(2)=ENLM(2)/1000.
      CALL ABMAX(NRNL,ENLM,ENLMM,INLMM)
      ENLMM=ENLMM/10.
      ENLM(1)=ENLM(1)/10.
      ENLM(2)=ENLM(2)*1000.
      ELMM = ABS(ELMM)                                                  B05A4160
      BIP = KIP
      ENLMM = ABS(ENLMM) + 3. * BIP
C     EVALUATE NONLINEAR CORRECTIONS FROM THE REDUCED SET               B05A4180
      DO 615 I=1,NAM                                                    B05A4190
      L = LAR(I)                                                        B05A4200
      DVNL(L) = ENL(I)                                                  B05A4210
      DO 615 K=1,NRNL                                                   B05A4220
      J = K + NAM                                                       B05A4230
  615 DVNL(L) = DVNL(L) - DRNL(K) * AM(I,J)                             B05A4240
      DO 620 K=1,NRNL                                                   B05A4250
      I = NAM + K                                                       B05A4260
      J = LAR(I)                                                        B05A4270
  620 DVNL(J) = DRNL(K)                                                 B05A4280
C-----RECYCLE IF ALPH WANTS TO GO NEGATIVE
      IF(DVNL(1)+0.9*ALPH) 626,626,629
  626 NUL=0                                                             ENTR-MOD
      DO 627 K=NUL,NSPM1                                                ENTR-MOD
      WALLJ(K)=VJKW(K)*C3
  627 DELQJW(K+1)=0.
      LIM=NAM+1
      DO 628 I=2,NNLEQ
      DUM=AM(I,NAM)/AM(1,NAM)
      ENL(I)=ENL(I)-ENL(1)*DUM
      DO 628 J=LIM,NNLEQ
  628 AM(I,J)=AM(I,J)-DUM*AM(1,J)
      ENL(1)=0.
      DO 631 J=LIM,NNLEQ
  631 AM(1,J)=0.
      ITS=ITS+1
      EASE=AMIN1(EASE,0.2)                                              ENTR-MOD
      IF(ITS-51) 244,244,850
  629 CONTINUE
C-----EVALUATE LINEAR CORRECTIONS                                       B05A4300
      DO 630 I=1,MAT1I                                                  B05A4310
      DO 630 J=1,MAT1J                                                  B05A4320
  630 FLE(I) = FLE(I) - DVNL(J) * BA1(I,J)                              B05A4330
      JJ = MAT1J                                                        B05A4340
      DO 635 J=1,MAT2J                                                  B05A4350
      JJ = JJ + 1                                                       B05A4360
      DO 635 I=1,MAT2I                                                  B05A4370
  635 GLE(I) = GLE(I) - DVNL(JJ) * BA2(I,J)                             B05A4380
      CORAR(1)=DVNL(1)/ALPH*0.5
      L=NETA
```

```
      J=MAT1J+2
      DO 640 I=2,NETA
      CORAR(I)=DVNL(J)/10000.
  640 J=J+1
      IF (NSPM1) 665,665,645
  645 DO 660 K=1,NSPM1                                              B05A4430
      DO 650 J=1,MAT2J                                              B05A4440
      JJ = JJ + 1                                                   B05A4450
      DO 650 I=1,MAT2I                                              B05A4460
  650 SPLE(I,K) = SPLE(I,K) - DVNL(JJ) * BA2(I,J)                   B05A4470
      J=MAT1J+K*MAT2J+2                                             B05A4480
      DO 655 I=2,NETA
      L = L + 1                                                     B05A4510
      CORAR(L)=DVNL(J)                                              B05A4520
  655 J=J+1
  660 CONTINUE
  665 CONTINUE                                                      B05A4540
      IF(EASE-0.2) 673,670,670                                      B05A4550
  670 IF(0.33+CORAR(ICORM)/CORMA) 671,675,675
  671 BUMP=BUMP*2.0
      GO TO 675
  673 IF(ABS(1.0-CORAR(ICORM)/CORMA)-0.25) 674,674,675
  674 BUMP=BUMP/2.
  675 CALL ABMAX(L,CORAR,CORMA,ICCRM)
      IF (KR(17)) 680,680,685                                       B05A4580
  680 IF (KR(19)) 690,705,690                                       B05A4590
  685 CONTINUE                                                      B05A4600
      KR(17) = KR(17) - 1                                           B05A4610
  690 CONTINUE                                                      B05A4620
  695 FORMAT(2X38HDEBUG CORRECTIONS RNL,NL,FL AND GL,SPL)           B05A4630
      CALL ETIMEF(ZEIT(9))                                          B05A4640
      WRITE(KOUT,696) ZEIT
  696 FORMAT(5X33HTIMES BEFOR AND AFTER . . . . . ./6X 9HCHEMISTRY9X
     1  13HERRORS+MATRIX9X9HINVERSION12X6HRNLCER11X3HNOW/10F10.4)
      WRITE(KOUT,695)
      WRITE(KOUT,250)DRNL                                           B05A4650
      WRITE(KOUT,250)DVNL                                           B05A4660
      WRITE(KOUT,250)FLE,GLE                                        B05A4670
      IF (NSPM1) 705,705,700                                        B05A4680
  700 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2I)              B05A4690
  705 CONTINUE                                                      B05A4700
C     CORRECT PRIMARY VARIABLES                                     B05A4710
      DUM = .05 / BUMP                                              B05A4720
      EASE=AMIN1(1.5*EASE,1.0,DUM/ABS(CORMA))                       B05A4730
      IF(ITS.EQ.2) BUMP=AMAX1(BUMP,.02/ABS(CORMA))
      IF(KQ(10).GT.0)EASE=AMIN1(EASE,ABS(F(3,1))/ABS(DVNL(3)+1.E-30)*.5)
  710 IF (KR(13)) 720,720,715
  715 DUM = KR(13)                                                  B05A4750
      EASE = AMIN1(DUM / 10.,EASE)                                  B05A4760
  720 IF (EASE - 1.0) 725,740,740                                   B05A4770
  725 DO 730 I=1,313                                                B05A4780
  730 FLE(I) = FLE(I) * EASE                                        B05A4790
      DO 735 I=1,153                                                B05A4800
  735 DVNL(I) = DVNL(I) * EASE                                      B05A4810
  740 CONTINUE                                                      B05A4820
      PIEASE = PIEASE * (1. - EASE)                                 B05A4830
      IF (TFZ) 745,750,750                                          B05A4840
  745 TFZ = EASE * DTEMP - TFZ                                      B05A4850
                                                                    B05A4860
```

```
      750 NUL=0
          DFWE=F(1,NETA)-F(1,1)-XM(5)/ALPH                                ENTR-MOD
          DO 790 I=1,NETA
          NI=NETA+I
          N2I=NETA+NI-2
          F(2,I)=F(2,I)+DVNL(I+3)
          F(4,I)=F(4,I)+FLE(N2I)
          IF(I-1) 760,760,765
      760 F(1,1)=F(1,1) + DVNL(2)
          F(3,1)=F(3,1)+DVNL(3)
          GO TO 770
      765 F(1,I)= F(1,I)+FLE(I-1)
          F(3,I)=F(3,I)+FLE(NI-2)
      770 LPI=MAT1J+I+1
          DO 785 K=NUL,NSPM1
          IF(I-NETA) 772,771,772
      771 SP(1,I,K)=SP(1,I,K)+SPLE(1,K)
          GO TO 773
      772 SP(1,I,K)=SP(1,I,K)+DVNL(LPI)
      773 SP(3,I,K)=SP(3,I,K)+SPLE(NI,K)
          IF(I-1) 775,775,780
      775 SP(2,1,K)= SP(2,1,K) + DVNL(LPI-1)
          GO TO 785
      780 SP(2,I,K)=SP(2,I,K)+SPLE(I,K)
      785 LPI=LPI+MAT2J
      790 CONTINUE
          ALPH=ALPH+DVNL(1)
          IF(KR(19).GT.0)WRITE(KOUT,250)(F(2,J),J=1,NETA),(G(1,J),J=1,NETA),ENTR-MOD
         1((SP(1,J,K),J=1,NETA),K=1,NSPM1),ALPH                           ENTR-MOD
          IF (ITS - 49) 850,840,850                                       B05A5300
      840 IF (I777 - 777) 845,850,845                                     B05A5310
      845 I777 = 777                                                      B05A5320
          ITS = 30                                                        B05A5330
      850 CONTINUE                                                        B05A5340
          IF(KQ(10).GT.-1) RETURN
          IF(KQ(10).LT.-10) RETURN                                        ENTR-MOD
          RETHMO=-C3*RHOE(IS)*UE(IS)*DFWE                                 ENTR-MOD
          IF(RETHMO.GT.RETR) KQ(10)=-10
          IF(RETHMO.LT.RETR) KQ(10)=-1
          RETURN                                                          B05A5350
          END                                                             B05A5360
C         B05C
          SUBROUTINE RNLCER
          DIMENSIONDQJRNL( 71,1)                                          B05C 003
          DIMENSIONDELQJW(1) ,DQJNL(153,1) ,WALLQJ(1)                     B05C 004
          COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B05C   5
         1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                ENTR-MOD
          COMMON/BUMCOM/     BUMP,CORMA,EASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IXB05C   7
          COMMON/CRBCOM/HCARB,EMIS,STEF,AOUM,BOUM,COUM,HTEF,HMAT,EMISC,EMISTB05C   8
         1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU          B05C   9
          COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B05C  A9
         1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
         2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),    ENTR-MOD
         3CG(20),CGP(20),SREF,GEP,NEN,UINF,RHOINF,MINF,PINF               ENTR-MOD
          COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,   B05C  10
         1 EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,TREF,RETR,VINTR(15)        ENTR-MOD
          COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B05C  12
         1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),HAT(10),  B05C  13
```

```
      2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),          B05C  14
      3 VNU( 71,10),ITFF,KR2,MCH,NCV,MM,WTM( 71),YYY( 71),YW( 71),GG( 71) B05C  15
      4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                     B05C  16
       COMMON/EQTCOM/SIP,HIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT, B05C  17
      1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,MS,MSS,BX,ISP2,ISPO,    B05C  18
      2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MMG, B05C  19
      3 CCPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),BB(16),     ENTR-MOD
      4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,   B05C  21
      5 CP( 71),HH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PWUS(10),        B05C  22
      6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                      B05C  23
       COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM      B05C  24
      1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)      B05C  25
      2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)       B05C  26
      3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)     B05C  27
      4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)               B05C  28
       COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),D2(14)       B05C  29
      1,LAR(153),BA1(43,18),BA2(30,15)                                    B05C  30
       COMMON/FLXCOM/DELQM,DELJM( 8),DQNL(153),DJNL(153, 8),WALLQ         B05C  31
      1,WALLJ( 8),QM,VJKM( 9),TPWALL                                      B05C  32
       COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8 B05C  33
      1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HMJE,HFM,DLX2   B05C  34
      2,C3M(40),BETAM(40)                                                 B05C  35
       COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,N B05C  36
      1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B05C  37
      2,B(8),       MWE,MCN,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B05C  38
      3,KAUXO,JTIME,JSPEC,MO(3)                                           B05C  39
       COMMON/NONCOM/AM(153,153),DVNL(153),TCN,                           B05C  40
      1VLNKN,DLPH( 9),DLPK( 8, 9),DTHN,DTKN( 8),FLUXJB( 9)                B05C  41
       COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B05C  42
      1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,   B05C  43
      2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                             B05C  44
       COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),N(15)    B05C  45
      1,CPBAR(15),VMN(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB05C  46
      2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B05C  47
      3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)    B05C  48
      4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL    B05C  49
      5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP  B05C  50
      6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)    B05C  51
       COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)      B05C  52
      1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)      B05C  53
      2,XIINIT( 1),DUDS( 40)                                              B05C  54
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                     B05C  55
       COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)          B05C  56
      1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ       B05C  57
       EQUIVALENCE(DELQM,DELQJM),(DQNL,DQJNL),(WALLQ,WALLQJ)              B05A0380
       DIMENSIONCORAR(1)                                                  B05A0470
       EQUIVALENCE(CORAR(1),AM(1))                                        B05A0480
       EQUIVALENCE(AM,DQJRNL)                                             B05A0490
C      EVALUATES REDUCED SET OF DQNL AND DJNL. NOTE...DQNL FOLLOWED BY    B05A2390
C      DJNL IS EQUIVALENCED TO DQJNL FOR CONVENIENCE OF FOLLOWING LOOP.   B05A2400
C      ALSO, THE REDUCED SET DQJRNL IS EQUIV. TO AM(1) FOR STORAGE ECON.  B05A2410
       DO 275 I=1,NRNL                                                    B05A2420
       M = I + NAM                                                        B05A2430
       L = LAR(M)                                                         B05A2440
       DO 275 K=1,NSP                                                     B05A2450
       DQJRNL(I,K) = DQJNL(L,K)                                           B05A2460
       DO 275 J=1,NAM                                                     B05A2470
       JJ = LAR(J)                                                        B05A2480
```

```
      IF (I - 1) 275,278,275                                            B05A2490
  270 DELQJW(K) = DELQJW(K) + DQJNL(JJ,K) * ENL(J)                      B05A2500
  275 DQJRNL(1,K) = DQJRNL(I,K) - DQJNL(JJ,K) * AP(J,M)                 B05A2510
      RHOVS = C1 * F(1,1) + HF(1,5)                                     B05A2520
      DO 278 K=1,NSP                                                    ENTR-MOD
  278 WALLQJ(K)=WALLQJ(K)+DELQJW(K)
      IF(KR(9)-2) 315,285,315                                           ENTR-MOD
  285 DO 290 L=1,3                                                      B05A2550
  290 W(L) = FLUXJ(L,IS,IT)                                             B05A2560
C     PREPARE DQJRNL AND WALLQJ FOR SURFACE MASS BALANCE                B05A2570
  295 WSUM = W(1) + W(2) + W(3)                                         B05A2580
      DO 310 K=2,NSP                                                    B05A2590
      DQJRNL(1,K) = DQJRNL(1,K) / C1                                    B05A2610
      WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(1,K) * RHOVS - DQJRNL(2,K) * B05A2670
     1G(1,1)                                                            B05A2680
      DO 310 KK=3,NRNL                                                  B05A2690
  310 WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(KK,K) * SP(1,1,KK - 2)       B05A2700
  315 IF (KR(16) - 1) 345,340,320                                       B05A2710
  320 IF (KR(17)) 340,340,335                                           B05A2720
  325 FORMAT(52H  DEBUG DQJRNL(NRNL,NSP) BY ROWS, DELQW(5),WALLQJ(5)/   B05A2730
     1 (8X1P10E10.3))                                                   B05A2740
  330 FORMAT(35H  DEBUG DQJNL(NNLEQ,NSP) ROW BY ROW /(8X1P10E10.3))     B05A2750
  335 WRITE(KOUT,330)((DQJNL(I,K),K=1,NSP),I=1,NNLEQ)                   B05A2760
  340 WRITE(KOUT,325)((DQJRNL(I,K),K=1,NSP),I=1,NRNL),DELQW,DELJW,WALLQ,B05A2770
     1WALLJ                                                             B05A2780
      IX = - 2                                                          B05A2790
  345 CONTINUE                                                          B05A2800
      IF(KIP) 346,346,375
  346 IF(KR(9)-2) 347,355,395
  347 DRNL(1)=FW(IS,IT)-F(1,1)
      DRNL(2)=0.
      IF(NSPM1) 350,350,348
  348 DO 349 K=1,NSPM1
      DRNL(K+2)=SPW(K,IS,IT)-SP(1,1,K)
  349 DRNL(2)=DRNL(2)+DRNL(K+2)*DTKW(K)
  350 IF(KR(11)) 351,351,352
  351 DRNL(2)=(TW(IS,IT)-T(1)-DRNL(2))/DTHW
      GO TO 595
  352 DRNL(2)=HW(IS,IT)-G(1,1)
      GO TO 595
  355 IF (KR(11) - 1) 375,365,360                                       B05A2830
  360 IF (KR(11) - 3) 370,375,370                                       B05A2840
  365 KQ(1) = 2                                                         B05A2850
      DRNL(2)=HW(IS,IT)-G(1,1)
      HIP=(G(1,1)+EASE*(HW(IS,IT)-G(1,1)))/1.0
      GO TO 380
  370 KQ(1)=1
      IF(T(1)-1800.) 374,374,372
  372 IF(EASE-.85) 380,374,380                                          ENTR-MOD
  374 TW(IS,IT)=AMAX1(T(1),1500.)
  375 T(1)=T(1)+EASE*(TW(IS,IT)-T(1))
      KIP=MAX0(KIP-1,0)
  376 KQ(1)=0
  380 KQ(6) = 2                                                         B05A2910
      KQ(4) = 6                                                         B05A2920
      IF (KR(7))385,385,390
  385 CALL EQUIL(KQ,0.,PE(IS,IT))                                       B05A2930
  390 KQ(6) = 0                                                         B05A2940
```

```
      FW(IS,IT) = (RHOVW(IS,IT) - HF(1,5)) / C1                         B05A2950
      IF(KR(11)-1) 391,392,391
  391 DRNL(2)=(HW(IS,IT)-G(1,1))/EASE
  392 DRNL(1)=FW(IS,IT)-F(1,1)
      IF(NSPM1) 595,595,393
  393 DO 394 K=1,NSPM1
  394 DRNL(K+2)=(SPW(K,IS,IT)-SP(1,1,K))/EASE
      GO TO 595
C     KIP=1 IF USING ASSIGNED TEMPERATURE ON ENERGY BALANCE FOR TEFLON  B05A2970
  395 KIP = 0                                                           B05A2980
      W(3)=RHOVS-W(2)
      K9R=KR(9)-2                                                       ENTR-MOD
      GO TO (450,460,490,400),K9R                                       ENTR-MOD
  400 HMAT = HTEF
      EMIS = EMIST
      IF (ITS - 1) 465,465,405                                          B05A3070
  405 IF (TFZ) 465,465,410                                              B05A3080
  410 IF (ABS(T(1) - TFZ) - 10.) 465,435,435                            B05A3090
  415 IF (DTEMP * DUM2) 440,440,420                                     B05A3100
  420 IF (DUM1 * 20. + WDCT) 425,425,430                                B05A3110
  425 TFZ = T(1) - 50. / DTEMP * ATEMP                                  B05A3120
      BUMP = 1.                                                         B05A3130
      GOTO 435                                                          B05A3140
  430 TFZ = T(1)
  435 TW(IS,IT) = TFZ                                                   B05A3160
      GOTO 445                                                          B05A3170
  440 TW(IS,IT) = T(1) + 50. / DTEMP * ATEMP                            B05A3180
      BUMP = 1.                                                         B05A3190
  445 KIP = 1                                                           B05A3200
      GO TO 490                                                         ENTR-MOD
  450 DRNL(1) = TW(IS,IT) - T(1)                                        ENTR-MOD
      AM(1,4) = 0.                                                      ENTR-MOD
      AM(2,5) = DTHW                                                    ENTR-MOD
      DO 455 K=1,NSPM1                                                  ENTR-MOD
  455 AM(1,K + 5) = DTKW(K)                                             ENTR-MOD
  460 HMAT=HCARB
      EMIS=EMISC
  465 TFZ = 0.
      DUM1 = STEF * EMIS * (T(1)) * * 3. * C3                           B05A3330
      DRNL(2) = - WALLQ + RHOVS * (HMAT - G(1,1)) - DUM1 * T(1) + RADS(
     1IS)*C3+W(2)*(HPG-HMAT)
      DUM2 = DRNL(2)                                                    B05A3360
      AM(2,4) = DQJRNL(1,1) + C1 * (G(1,1) - HMAT)
      DUM1 = DUM1 * 4.                                                  B05A3380
      AM(2,5) = DQJRNL(2,1) + DUM1 * DTHW + RHOVS                       B05A3390
      DO 470 K=1,NSPM1                                                  B05A3400
  470 AM(2,K + 5) = DQJRNL(K + 2,1) + DUM1 * DTKW(K)                    B05A3410
      IF(KR(9)-4) 510,475,495                                           ENTR-MOD
  475 DRNL(1)= VLNKW
      DO 472 K=1,IZ                                                     ENTR-MOD
      J=-IR(K)
      FNU(J)=VNU(ISU,J)
      IF (LEF(K)+LEFW(K)) 471,471,472
  471 FNU(J)=0.
  472 CONTINUE
      DO 476 K=1,IZ                                                     ENTR-MOD
  476 DRNL(1)=DRNL(1)+YW(K)*FNU(K)
      AM(1,4) = 0.                                                      B05A3440
```

```
      DUM1 = TCW / T(1)                                                 B05A3450
      AM(1,5) = DUM1 * DTHW
      DO 477 K=1,IZ                                                     ENTR-MOD
  477 AM(1,5)=AM(1,5)-DLPH(K)*FNU(K)
      DO 480 K=1,NSPM1                                                  B05A3470
      AM(1,K+5) = DUM1*DTKW(K)
      DO 480 KK=1,IZ                                                    ENTR-MOD
  480 AM(1,K+5)=AM(1,K+5)-DLPK(K,KK)*FNU(KK)                            ENTR-MOD
      GOTO 510                                                          B05A3490
  490 WDOT = C3 * EXP( (ADUM * TW(IS,IT) + BDUM) * TW(IS,IT) + CDUM)    B05A3510
      KIP=KIP+1
      W(3) = WDOT                                                       B05A3540
      W(2) = 0.                                                         B05A3550
      W(1) = 0.                                                         B05A3560
      GOTO 295                                                          B05A3570
  495 WDOT = C3 * EXP( (ADUM * T(1) + BDUM) * T(1) + CDUM)              B05A3580
      AM(1,5) = WDOT * (ADUM * 2. * T(1) + BDUM)                        B05A3590
  500 DRNL(1) = RHOVS - WDOT                                            B05A3600
      DUM1 = ABS(DRNL(1))                                               B05A3610
      AM(1,4) = - C1                                                    B05A3620
      DO 505 K=1,NSPM1                                                  B05A3630
  505 AM(1,K + 5) = AM(1,5) * DTKW(K)                                   B05A3640
      AM(1,5) = AM(1,5) * DTHW                                          B05A3650
  510 DO 520 K=1,NSPM1                                                  B05A3660
      DRNL(K+2)=-WALLJ(K)-RHOVS*(SP(1,1,K)-TQ(K,L3)*WTM(K))+W(2)*WTM(K)*
     1 (TQ(K,L2)-TQ(K,L3))
      DO 515 KK=1,NRNL                                                  B05A3680
  515 AM(K + 2,KK + 3) = DQJRNL(KK,K + 1)                               B05A3690
      AM(K+2,4)=AM(K+2,4)+C1*(SP(1,1,K)-TQ(K,L3)*WTM(K))
  520 AM(K + 2,K + 5) = AM(K + 2,K + 5) + RHCVS                         B05A3710
      II = 0                                                            B05A3720
      IF(KR(9)-3) 525,540,525                                           ENTR-MOD
  525 IF(W(3)) 540,530,530
  530 DRNL(1)=(WDOT-W(3))/C1
      W(3)=WDOT
      DO 535 K=2,NRNL                                                   B05A3760
  535 DRNL(K) = DRNL(K) - DRNL(1) * AM(K,4)                             B05A3770
      II = 1                                                            B05A3780
  540 IXX = IX                                                          B05A3790
      CALL RERAY(NRNL-II,AM(II+1,II+4),0,DRNL(II+1),1,0,IXX,153)        B05C3800
      IF (KR(9) + KIP - 6) 560,545,560                                  B05A3820
  545 DTEMP = DRNL(2) * DTHW                                            B05A3830
      DO 550 K=1,NSPM1                                                  B05A3840
  550 DTEMP = DTEMP + DTKW(K) * DRNL(K + 2)                             B05A3850
      ATEMP = ABS(DTEMP)                                                B05A3860
      IF (ATEMP - 50.) 555,560,415                                      B05A3870
  555 TFZ = - T(1)                                                      B05A3880
  560 CONTINUE                                                          B05A3890
      WDOT=W(3)
  595 RETURN
      END                                                               B05A5360
C006A                                                                   B06A 001
      SUBROUTINE LINCER                                                 B06A 002
      COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B06A   3
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMNE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,NEN                                       ENTR-MOD
      COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM     B06A   6
```

```
     1,SPLEM( 8),ELM(14),ELMM,IFLP,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)      806A   7
     2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)       806A   8
     3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)     806A   9
     4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(18)               806A  10
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)       806A  11
     1,LAR(153),BA1(43,18),BA2(38,15)                                    806A  12
      COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,N806A  13
     1S,IT,DTIME,NSP,NSPM1,NAN,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) 806A  14
     2,B(8),      NWE,NON,KQ(10),ITEM,MITEM,KR17,NBT,NBT2,IDENT,KR9(40) 806A  15
     3,KAUXO,JTIME,JSPEC,ND(3)                                           806A  16
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROXAP(40) 806A  17
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  806A  18
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                             806A  19
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                     806A  20
C     EVALUATE LINEAR ERRORS FOR MOMENTUM AND ENERGY                     806A 018
      NELM=NSP+1                                                         806A 019
      NENLM=NELM                                                         806A 020
      NUL=0
      DO 400 I=1,MAT1I                                                   ENTR-MOD
  400 BA1(I,1)=9.                                                        ENTR-MOD
      DO 401 I=2,NETA
      IF(I-2) 4004,4003,4004
 4003 IF(KR(10)) 4000,4000,4001
 4004 IF(I-NETA) 4002,4005,4002
 4005 IF(KR(10)-1) 4002,4000,4002
 4000 DUM1=B(4)
      DUM2=B(5)
      DUM3=B(2)
      DUM4=B(3)
      DUM5=B(1)
      DUM6=1.0
      GO TO 4002
 4001 DUM1=B(3)
      DUM2=0.
      DUM3=B(1)
      DUM4=0.
      DUM5=1.0
      DUM6=0.
 4002 CONTINUE
      FLE(I-1)=-(F(1,I-1)+DETA(I-1)*F(2,I-1)+DSQ(I-1)/2.*F(3,I-1)+DCU(
     1I-1)*(DUM1*F(4,I-1)+DUM2*F(4,I))-F(1,I))
      M=I+NETA-2
      FLE(M)=-(F(2,I-1)+DETA(I-1)*F(3,I-1)+DSQ(I-1)*(DUM3*F(4,I-1)+DUM4*
     1F(4,I))-F(2,I))
      M=M+1
      DO 403 K=NUL,NSPM1
      SPLE(I,K)=-(SP(1,I-1,K)+DETA(I-1)*SP(2,I-1,K)+DSQ(I-1)*(DUM3*SP(3,
     1           I-1,K)+DUM4*SP(3,I,K))-SP(1,I,K))
  403 SPLE(M,K)=-(SP(2,I-1,K)+DETA(I-1)*DUM5*(SP(3,I-1,K)+DUM6*SP(3,I,K)
     1           )-SP(2,I,K))
      M=I+2*NETA-3
  401 FLE(M)=-(F(3,I-1)+DETA(I-1)*DUM5*(F(4,I-1)+DUM6*F(4,I))-F(3,I))
      FLE(MAT1I)=-DUM6*(F(3,NETA)-ALPH*ALPH*DUEDGE)                      ENTR-MOD
      BA1(MAT1I,1)=-2.*DUM6*DUEDGE*ALPH                                  ENTR-MOD
      IF(ABS(BA1(MAT1I,1)).GT.0.) CALL MATS1(BA1)                        ENTR-MOD
      GLE(1)=-(G(1,NETA)-CGE)                                            ENTR-MOD
      GLE(MAT2I)=-DUM6*(G(2,NETA)-ALPH*GEP)                              ENTR-MOD
      IF(NSPM1)404,404,405
```

```
  405 DO 402 K=1,NSPM1
      SPLE(1,K)=-(SP(1,NETA,K)-SPE(K,IS,IT))                          B06A 044
      SPLE(MAT2I,K)=-SP(2,NETA,K) * DUM6
C     DETERMINE MAXIMUM LINEAR ERRORS                                 B06A 046
  402 CALL ABMAX(MAT2I,SPLE(1,K),SPLEM(K),ISPLM(K))                   B06A 047
  404 CALL ABMAX(MAT1I,FLE,FLEM,IFLM)                                 B05A 048
      CALL ABMAX(MAT2I,GLE,GLEM,IGLM)                                 B06A 049
      ELM(1)=FLEM                                                     B06A 051
      ELM(2)=GLEM*.001                                                B06A 052
      IF(NSPM1)406,406,407                                            B06A 053
  407 DO 406 K=3,NELM                                                 B06A 054
  406 ELM(K)=SPLEM(K-2)*.1                                            B06A 055
  406 CALL ABMAX(NELM,ELM,ELMM,ILMM)                                  B06A 056
C     FORM PRODUCT OF A**-1 AND LINEAR ERRORS                         B06A 057
  469 CALL MATS1(FLE)                                                 B06A 058
      DO 474 K=MUL,NSPM1
  474 CALL MATS2(SPLE(1,K))                                           B06A 062
      RETURN                                                          B06A 065
      END                                                             B06A 065
CB07A                                                                 B07A 001
      SUBROUTINE REFCON                                               B07A 002
      COMMON/EDGCOM/          PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B07A   3
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,HEN,UINF,RHOINF,HINF,PINF                 ENTR-MOD
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, B007A   6
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HMUE,HFN,DLX2  B07A   7
     2,C3M(40),BETAM(40)                                               B07A   8
      COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB07A   9
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CA*E(15) B07A  10
     2,B(8),       NWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B07A  11
     3,KAUXO,JTIME,JSPEC,MD(3)                                         B07A  12
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B07A  13
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),HSD(10),ITF( 50),IPRE,RADNO,  B07A  14
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                           B07A  15
      COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)     B07A  16
     1,SDUM1(40),SDUM2(40),FMDUM(40),XICON(40),FMCON(40),FMINIT( 1)     B07A  17
     2,XIINIT( 1),DUDS( 40)                                            B07A  18
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B07A  19
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B07A  20
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B07A  21
      DATA IHR,IHD,IHI,IHF/1HR,1HD,1HI,1HF/                             ENTR-MOD
 7007 FORMAT(8E10.4)                                                    B07A 024
 7008 FORMAT(A1,E9.4,7E10.4/(8E10.4))                                   ENTR-MOD
 9901 FORMAT(I3,7E13.3)                                                 B07A 925
  186 FORMAT(I2,E8.3,7E10.5)                                            ENTR-MOD
   15 FORMAT(1H1)
   16 FORMAT (/,1X,23HDISTANCE,FT            ,8E12.5/(24X,8E12.5))      B07A 027
   17 FORMAT (/,1X,23HPRESSURE RATIO         ,8E12.5/(24X,8E12.5))      B07A 028
   18 FORMAT (/,1X,23HENTROPY DROP,BTU/LB R  ,8E12.5/(24X,8E12.5))      B07A 029
   19 FORMAT (/,1X,23HWALL ENTHALPY,BTU/LB   ,8E12.5/(24X,8E12.5))      B07A 030
   20 FORMAT (/,1X,23HWALL TEMPERATURE,DEG R ,8E12.5/(24X,8E12.5))      B07A 031
   21 FORMAT (/,1X,23HWALL STREAM FUNCTION   ,8E12.5/(24X,8E12.5))      B07A 032
   22 FORMAT (/,1X,23HMASS FLUX,LB/SEC FT**2 ,8E12.5/(24X,8E12.5))      B07A 033
   23 FORMAT (/,1X,23HELEMENTAL MASS FRACTION,8E12.5/(24X,8E12.5))      B07A 034
   24 FORMAT (/,1X,23HCOMP FLUX,LB/SEC FT**2 ,8E12.5/(24X,8E12.5))      B07A 035
   25 FORMAT (/,1X,23HSTATIC PRESSURE,ATM    ,8E12.5/(24X,8E12.5))      B07A 036
   26 FORMAT (/,1X,23HXI,(LB/SEC)**2         ,8E12.5/(24X,8E12.5))      B07A 037
```

```
   27 FORMAT (/,1X,23HBETA                          ,8E12.5/(24X,8E12.5))      B07A 038
   28 FORMAT (/,1X,23HROKAP                         ,8E12.5/(24X,8E12.5))      B07A 039
   29 FORMAT (/,1X,23HEDGE VELOCITY,FT/SEC          ,8E12.5/(24X,8E12.5))      B07A 040
   30 FORMAT (/,1X,23HNORMALIZED MASS FLUX          ,8E12.5/(24X,8E12.5))      B07A 041
   31 FORMAT (/,1X,23HNORMALIZED COMP FLUX          ,8E12.5/(24X,8E12.5))      B07A 042
   32 FORMAT (/,1X,23HINCIDENT RADIATION FLUX,8E12.5/(24X,8E12.5))
   33 FORMAT(/,1X,23H-1/FLUX NORM.PARAMETER ,8E12.5/(24X,8E12.5))              B07A 044
   34 FORMAT(//1X,23HSTREAM FUNCTION,LB/SEC ,8E12.5/(24X8E12.5))               ENTR-MOD
   35 FORMAT(/,1X,23HENTROPY CHANGE,BTU/LB R,8E12.5/(24X,8E12.5))              ENTR-MOD
   36 FORMAT(/,1X,23HENTHALPY CHANGE,BTU/LB ,8E12.5/(24X,8E12.5))              ENTR-MOD
   37 FORMAT(/24H SHOCK ANGLE,DEGREES     8E12.5/(24X8E12.5))                  ENTR-MOD
   38 FORMAT(/24H SHOCK ANGLE,RADIANS     8E12.5/(24X8E12.5))                  ENTR-MOD
 1532 IF (ITEM-1) 1539,1538,1539                                               B07A 051
 1538 IDSIP=1                                                                  B07A 052
      IPRE=1                                                                   B07A 053
      IRAD=1
      NEN=0                                                                    ENTR-MOD
      DO 1540 I=1,NS                                                           B07A 054
 1540 DSIP(I)=0.                                                               B07A 055
 1539 IF (IDSIP-ITEM) 1536,1537,1536                                           ENTR-MOD
 1537 IF(KR(5)-5) 1522,1535,1536                                               ENTR-MOD
 1522 IF(KR(5)-2) 1536,1524,1524                                               ENTR-MOD
 1524 READ(KIN, 106) NEN,UINF,RHOINF,HINF,PINF                                 ENTR-MOD
      HINF=HINF/1.8                                                            ENTR-MOD
      IF(NEN) 1527,1527,1526                                                   ENTR-MOD
 1526 READ(KIN,7008) IRED,(SF(I),I=1,NEN)                                      ENTR-MOD
      IF(IRED.NE.IMI.AND.IRED.NE.IMF) GO TO 1530                               ENTR-MOD
      DO 1547 I=1,NEN                                                          ENTR-MOD
      IF(IRED.EQ.IMI) SF(I)=SF(I)/12.                                          ENTR-MOD
      DUM=RHOINF*UINF*SF(I)                                                    ENTR-MOD
      IF(ABS(KR(6)-2).EQ.1)GO TO 1547                                          ENTR-MOD
      DUM=DUM/2.*SF(I)                                                         ENTR-MOD
 1547 SF(I)=DUM                                                                ENTR-MOD
      GO TO 1538                                                               ENTR-MOD
 1527 NEN=NS                                                                   ENTR-MOD
      DO 1528 I=1,NS                                                           ENTR-MOD
 1528 SF(I)=RHOINF*UINF/2.*ROKAP(I)**2                                         ENTR-MOD
 1538 READ(KIN,7008)IRED,(CS(I),I=1,NEN)                                       ENTR-MOD
      WRITE(KOUT,34)(SF(I),I=1,NEN)                                            ENTR-MOD
      IF(IRED.NE.IMD) GO TO 1548                                               ENTR-MOD
      WRITE (KOUT,37)(CS(I),I=1,NEN)                                           ENTR-MOD
      DO 1551 I=1,NEN                                                          ENTR-MOD
 1551 CS(I)=CS(I)/57.29577                                                     ENTR-MOD
      IRED=IMR                                                                 ENTR-MOD
      GO TO 1549                                                               ENTR-MOD
 1549 IF(IRED.NE.IMR) GO TO 1550                                               ENTR-MOD
      WRITE(KOUT,38)(CS(I),I=1,NEN)                                            ENTR-MOD
      GO TO 1549                                                               ENTR-MOD
 1550 WRITE(KOUT,35) (CS(I),I=1,NEN)                                           ENTR-MOD
 1549 IF(KR(5)-4) 1529,1525,1529                                               ENTR-MOD
 1525 READ (KIN,7007) (CG(I),I=1,NEN)                                          ENTR-MOD
      CALL SLOPG (NEN,SF,CG,CGP,DER)                                           ENTR-MOD
      WRITE(KOUT,36)(CG(I),I=1,NEN)                                            ENTR-MOD
      GO TO 1529                                                               ENTR-MOD
 1535 READ (KIN,7007) (DSIP(I),I=1,NS)                                         B07A 058
 1529 READ (KIN,106) IDSIP                                                     ENTR-MOD
 1536 IF (IPRE-ITEM) 1534,1533,1534                                            B07A 060
 1533 READ (KIN,7007) (PRE(I),I=1,NS)                                          B07A 061
```

```
      READ (KIN,106) IPRE
 1534 IF(PRE(1)) 1541,1542,1541                                          807A 062
 1542 DO 1543 I=2,NS
      IF(PRE(I)) 1544,1543,1544
 1544 L=I
      GO TO 1545
 1543 CONTINUE
 1545 RNOSE=S(L)/SQRT(1.-PRE(L))
      DO 1546 I=2,L
 1546 PRE(I-1)=1.-S(I-1)/RNOSE*S(I-1)/RNOSE
 1541 DO 1531 I=1,NS
      PTE(I ,1)=PTET(ITEM)
 1531 PE(I ,1)=PTE(I ,1)*PRE(I )                                         807A 064
      IF (IRAD-ITEM)1554,1552,1554                                       807A 065
 1552 READ (KIN,7007) (RADR(I),I=1,NS)
      READ (KIN,106) IRAD
 1554 DO 1553 I=1,NS
 1553 RADS(I)=RADFL(ITEM)*RADR(I)
  105 DO 104 IS=1,NS
  201 IF (IS-1) 207,207,203                                              807A 066
  207 KQ(1)=2                                                            807A 068
      KQ(5)=2                                                            807A 070
      KQ(6)=0                                                            807A 071
      KQ(4)=0                                                            807A 072
      IF (KR(7))8003,8003,8002                                           807A 073
 8002 CALL STATE                                                         807A
      WRITE(KOUT,992)
      WRITE(KOUT,994)
  992 FORMAT(1H1,10X20HISENTROPIC EXPANSION /12X15HEDGE CONDITIONS //)
  994 FORMAT(5X117HSTREAMWISE      TEMP          CP          STATIC      DENS
     1ITY     VISCOSITY     VELOCITY     ENTHALPY     ENTROPY     MACH NO. /
     25X45HDIMENSION                          FROZEN      PRESSURE /7X101H(FEET)
     3     (DEG R)      (BTU/          (ATM)      (LB/CU FT)  (LB/SEC FT)  (FT
     4/SEC      (BTU/LB)      (BTU/  /30X18HLB DEG R) 62X10HLB DEG R)  /)
      GO TO 8004
 8003 CALL EQUIL(KQ,GE(ITEM),PTE(1,IT))                                  807A
 8004 KQ(1)=3                                                            807A
      KQ(2)=8                                                            807A
      KQ(3)=6                                                            807A 076
      KQ(5)=1                                                            807A 077
      IF(KR(6)-2) 210,203,203                                            807A 078
  203 IF (KR(7))8006,8006,8005
 8005 CALL STATE                                                         807A
      GO TO 210
 8006 CALL EQUIL(KQ,0.,PE(IS,IT))
  210 IF (NSPM1)205,205,215                                              807A
  215 DO 216 K=1,NSPM1
  216 SPE(K,IS,IT)=SP(1,NETA,K)                                          807A 084
  205 IF(KR(15)) 9903,9904,9903                                          807A 085
 9903 WRITE(KOUT,9901) IS,MEA(IS),UE(IS),PTE(IS,1),TE(IS),RHOE(IS)       807A 096
     1 ,VMUE(IS)                                                         ENTR-MOO
 9904 CONTINUE                                                           ENTR-MOO
  104 CONTINUE                                                           807A 099
      IF(IRED.NE.IMR)GO TO 103                                           807A 100
      KQ(1)=2                                                            ENTR-MOO
      KQ(5)=3                                                            ENTR-MOO
      DO 102I=1,MEN                                                      ENTR-MOO
      CALL EQUIL(KQ,CS(I),PTE(1,1))                                      ENTR-MOO
                                                                         ENTR-MOO
```

```
      IF(I.EQ.1) CS1=CS(1)                                              ENTR-MOD
  102 CS(I)=CS(I)-CS1                                                   ENTR-MOD
  103 IF(NEN.GT.0)CALL SLOPQ(NEN,SF,CS,CSPR,DER)                        ENTR-MOD
C     END OF EDGE PROPERTY LOOP, START OF BETA AND XI CALCULATION       ENTR-MOD
  605 XI(1)=0.                                                          B07A 105
      J=NDISC+1                                                         B07A 106
      DO 111 II=1,J                                                     B07A 107
      K=NSD(II)                                                         B07A 108
      M=MSD(II)                                                         B07A 109
      MM=M+1
      LL=K+M-1                                                          B07A 110
      IF (II-1) 6052,6052, 402                                          B07A 111
 6052 IF (KR(6)-1) 400,401,402                                          B07A 112
C     AXISYMETRIC BLUNT                                                 B07A 113
  400 DO 403 I=M,LL                                                     B07A 114
      SDUM2(I)=S(I)*S(I)                                                B07A 115
      IF(S(I)) 403,403,4031                                             B07A 116
 4031 DUM1=ROKAP(I)/S(I)                                                B07A 117
      XICON(I)=UE(I)/S(I)*RHOE(I)/4.*VMUE(I)*DUM1*DUM1                  B07A 118
  403 SDUM1(I)=SDUM2(I)*SDUM2(I)                                        B07A 119
      QI=4.                                                             B07A 120
      BETAM(1)=0.5                                                      B07A 121
      GO TO 406                                                         B07A 122
C     PLANAR BLUNT                                                      B07A 123
  401 DO 404 I=M,LL                                                     B07A 124
      SDUM2(I)=S(I)                                                     B07A 125
      IF(S(I)) 404,404,4041                                             B07A 126
 4041 XICON(I)=UE(I)/S(I)*RHOE(I)/2.*VMUE(I)                            B07A 127
  404 SDUM1(I)=S(I)*S(I)                                                B07A 128
      QI=2.                                                             B07A 129
      BETAM(1)=1.                                                       B07A 130
      GO TO 406                                                         B07A 131
  402 IF (KR(6)-2) 408,407,408                                          B07A 132
C     AXISYMETRIC SHARP                                                 B07A 133
  407 DO 409 I=M,LL                                                     B07A 134
      SDUM2(I)=S(I)*S(I)                                                B07A 135
      DUM1=ROKAP(I)/S(I)                                                B07A 136
      XICON(I)=RHOE(I)*UE(I)*VMUE(I)*DUM1/3.*DUM1                       B07A 137
  409 SDUM1(I)=S(I)*SDUM2(I)                                            B07A 138
      XI(1)      =XICON(1)*S(1)*S(1)*S(1)                               B07A 139
      QI=3.                                                             B07A 140
      IF (II-1) 4051,4051,406
C     PLANAR SHARP                                                      B07A 142
  408 DO 405 I=M,LL                                                     B07A 143
      SDUM2(I)=S(I)                                                     B07A 144
      XICON(I)=RHOE(I)*UE(I)*VMUE(I)*ROKAP(I)*ROKAP(I)                  B07A 145
  405 SDUM1(I)=S(I)                                                     B07A 146
      QI=1.                                                             B07A 147
      IF (II-1) 4052,4052,406
 4052 XI(1)      =XICON(1)*S(1)                                         B07A 149
 4051 MM=M
  406 CONTINUE                                                          B07A 152
      CALL SLOPQ(K,S(M),UE(M),DUDS(M),DER(M))                           B07A 153
      IF (KR(6)-2) 4066,4062,4062                                       B07A 154
 4066 IF (M-1) 4061,4061,4062                                           B07A 155
 4061 IF (RNOSE) 4063,4063,4064                                         B07A 156
COMMENT...DUES COMPUTED BY SLOPQ                                        B07A 157
 4063 DUES=DUDS(1)                                                      B07A 158
```

```
      GO TO 4065                                                        B07A 159
COMMENT...DUES FROM EFFECTIVE NOSE RADIUS USING NEWTONIAN FLOW          B07A 160
 4064 DUES=SQRT(2./RHOE(1)*PE(1,IT)*32.1740*2116.)/RNOSE                B07A 161
 4065 XICON( 1)=RHOE( 1)*VMUE( 1)/(2.*VKAP+2.)*DUES                     B07A 162
 4062 CALL SLOPQ(K,SDUM1(M),XICON(M),DER(M),XI(M))                      B07A 163
      IF (LL-MM) 111,4101,4101                                          B07A 165
 4101 DO 410 L=MM,LL                                                    B07A 166
  410 BETAM(L)=2./QI*XI(L)/UE(L)*S(L)/SDUM1(L)*DUDS(L)/XICON(L)         B07A 167
  111 CONTINUE                                                          B07A 168
 9803 FORMAT(8E10.4)                                                    B07A 172
      WRITE(KOUT,15)
      WRITE(KOUT,16)(    S(I),I=1,NS)
      WRITE(KOUT,28)(ROKAP(I),I=1,NS)
      WRITE(KOUT,26)(   XI(I),I=1,NS)
      WRITE(KOUT,17)(  PRE(I),I=1,NS)
      WRITE(KOUT,25)( PE(I,1),I=1,NS)
      WRITE(KOUT,29)(   UE(I),I=1,NS)
      WRITE(KOUT,27)(BETAM(I),I=1,NS)
      WRITE(KOUT,32)( RADS(I),I=1,NS)
      WRITE(KOUT,18)( DSIP(I),I=1,NS)
C     CALCULATION OF C3 MATRIX                                          B07A 173
      DO 138 I=1,NS                                                     B07A 174
      IF (KR(6)-1) 137,137,158                                          B07A 175
  137 IF (I-1) 139,139,158                                              B07A 176
  139 C3M(I)=-SQRT (BETAM(I)/(DUES*RHOE( I)*VMUE( I)))                  B07A 177
      GO TO 138                                                         B07A 178
  158 C3M(I)=-SQRT(2.*XI( I))/(RHOE( I)*ROKAP( I)*UE( I)*VMUE( I))      B07A 179
  138 CONTINUE                                                          B07A 180
      WRITE (KOUT,33)(C3M(I),I=1,NS)
C     READ WALL CONDITIONS IF UNCOUPLED                                 B07A 189
      JRHOVW=0
      IF (ITEM-1) 108,108,7004
  108 IHW=1                                                             B07A 191
      ITW=1                                                             B07A 192
      IFW=1                                                             B07A 193
      IRHOVW=1                                                          B07A 194
      ISPW=1                                                            B07A 195
      IFLUXJ=1                                                          B07A 196
      DO 49 I=1,NS
      DO 49 L=1,3
   49 FLUXJ(L,I,1) = 0.
  107 IF (KR(9)-3) 7054,7005,1071
 1071 IF(KR(9)-5) 7047,7005,7047
 7054 IF(KR(11)-2) 7062,7040,7047                                       B07A 198
 7062 IF(KR(11)) 7004,7005,7004                                         B07A 199
 7004 IF (IHW-ITEM) 1091,109,1091                                       B07A 200
 1091 IF(   IHW-1) 1201,7005,1201
  109 READ(KIN,7007)((HW(J,JJ),JJ=1,NTIME),J=1,NS)                      B07A 201
      READ (KIN,106) IHW                                                B07A 202
 1201 WRITE (KOUT,19)(HW(I,1),I=1,NS)
      IF (ITEM-1) 7038,7038,7060
 7005 IF (ITW-ITEM)1092,110,1092                                        B07A 205
 1092 IF(   ITW-1) 1202,7060,1202
  110 READ(KIN,7007)((TW(J,JJ),JJ=1,NTIME),J=1,NS)                      B07A 206
      READ (KIN,106) ITW                                                B07A 207
 1202 WRITE (KOUT,20)(TW(I,1),I=1,NS)
      IF (ITEM-1) 117,117,7060
  117 IF (KR(9)-3) 7038,7047,7047                                       B07A 209
```

```
 7038 IF(KR(9)-1) 7060,7061,7040                                    B07A 210
 7060 IF (IFW-ITEM) 1093,112,1093                                   B07A 211
 1093 IF(   IFW-1) 1203,7061,1203
  112 READ(KIN,7007)((FW(J,JJ),JJ=1,NTIME),J=1,NS)                  B07A 212
      READ (KIN,106) IFW                                            B07A 213
 1203 WRITE (KOUT,21)(FW(I,1),I=1,NS)
      GO TO 7006                                                    B07A 215
 7061 IF (IRHOVW-ITEM) 1094,118,1094                                B07A 216
 1094 IF(IRHOVW-1) 1204,7006,1204
  118 READ(KIN,7007)((RHOVW(J,JJ),JJ=1,NTIME),J=1,NS)               B07A 217
      READ (KIN,106) IRHOVW                                         B07A 218
      JRHOVW=1
 1204 IF(KR(8)-JRHOVW) 1102,1101,1101
 1102 WRITE (KOUT,22)(RHOVW(I,1),I=1,NS)                            B07A 220
      GO TO 7006                                                    B07A 221
 1101 WRITE (KOUT,30)(RHOVW(I,1),I=1,NS)                            B07A 222
 7006 IF(NSPM1) 7043,7043,7015                                      B07A 223
 7015 IF (ISPW-ITEM) 1095,114,1095                                  B07A 224
 1095 IF(  ISPW-1) 1205,7040,1205
  114 DO 7014 K=1,NSPM1                                             B07A 225
 7014 READ(KIN,7007)((SPW(K,J,JJ),JJ=1,NTIME),J=1,NS)               B07A 226
      READ (KIN,106) ISPW                                           B07A 227
 1205 DO 1097 K=1,NSPM1
 1097 WRITE (KOUT,23)( SPW(K,I,1),I=1,NS)                           B07A 229
      GO TO 7043                                                    B07A 230
 7040 IF (IFLUXJ-ITEM)1096,115,1096                                 B07A 231
 1096 IF(IFLUXJ-1) 1206,7043,1206
  115 DO 7041 K=1,3                                                 B07A 232
 7041 READ(KIN,7007) ((FLUXJ(K,J,JJ),JJ=1,NTIME),J=1,NS)            B07A 233
      READ (KIN,106) IFLUXJ                                         B07A 234
      JRHOVW=1
 1206 DO 1098 K=1,3
      IF(KR(8)-JRHOVW) 1104,1103,1103
 1104 WRITE (KOUT,24)(FLUXJ(K,I,1),I=1,NS)                          B07A 237
      DO 7039 J=1,NS
 7039 FLUXJ(K,J,1)=FLUXJ(K,J,1) * C3M(J)
      GO TO 1098                                                    B07A 238
 1103 WRITE (KOUT,31)(FLUXJ(K,I,1),I=1,NS)                          B07A 239
 1098 CONTINUE                                                      B07A 240
      GO TO 7047
 7043 IF(JRHOVW) 7047,7047,7045
C     CALCULATE FW IF RHOVW GIVEN                                   B07A 253
 7045 J=NDISC+1                                                     B07A 254
      DO 7046 II=1,J                                                B07A 255
      K=NSD(II)                                                     B07A 256
      M=MSD(II)                                                     B07A 257
      LL=K+M-1                                                      B07A 258
      DO 209 I=M,LL                                                 B07A 259
      IF(I.EQ.M.AND.II.NE.1) GO TO 209                              ENTR-MOD
      IF (KR(8)) 7049,7049,2291                                     B07A 260
 7049 RHOVW(I,IT)=RHOVW(I,IT)*C3M(I)                                B07A 261
 2291 IF (II-1) 7048,7048, 230                                      B07A 262
 7048 IF (KR(6)) 229,229,230                                        B07A 263
C     VALID AT AXISYMETRIC STAGNATION POINT ONLY                    B07A 264
  229 FWCON(I)=-RHOVW(I,IT)/(2.*C3M(I))                             B07A 265
      IF( I-1) 209,209,232                                          B07A 266
C     MODIFICATION FOR AXISYMETRIC BLUNT AWAY FROM STAGNATION POINT B07A 267
  232 FWCON( I)=FWCON( I)/S( I)*RCKAP( I)                           B07A 268
```

```
1509          GO TO 209                                                    B07A 269
1510    C     VALID FOR ALL PLANAR                                         B07A 270
1511      230 FWCON(I)=-RHOVW(I,IT)/C3M(I)*ROKAP(I)                        ENTR-MOD
1512          IF(KR(6)-2) 209,236,209                                      B07A 272
1513    C     MODIFICATION FOR AXISYMETRIC SHARP                           B07A 273
1514      236 FWCON( I)=FWCON( I)/S( I)*ROKAP( I)/2.                       B07A 274
1515      209 FLUXJ(2,I,1)=RHOVW(I,1)
1516          FWDUM(1)=FWCON(1)*S(1)                                       B07A 276
1517          IF(KR(6)-2) 241,237,241                                      B07A 277
1518    C     MODIFICATION FOR AXISYMETRIC SHARP                           B07A 278
1519      237 FWDUM(1)=FWDUM(1)*S(1)                                       B07A 279
1520      241 CONTINUE                                                     B07A 280
1521     7046 CALL SLOPQ(K,SDUM2(M),FWCON(M),DER(M),FWDUM(M))              B07A 281
1522          DO 126 I =1,NS                                               B07A 282
1523          IF(I -1) 124,124,123                                         B07A 283
1524      124 IF (KR(6)-1) 133,133,123                                     B07A 284
1525      133 IF (S(I)) 113,113,123                                        B07A 285
1526      113 FW(1,IT)=RHOVW(1,IT)                                         B07A 286
1527          GO TO 126                                                    B07A 287
1528      123 FW(I ,IT)=FWDUM(I )/SQRT (2.*XI(I ))                         B07A 288
1529      126 CONTINUE                                                     B07A 289
1530     7047 RETURN                                                       B07A 290
1531          END                                                          B07A 291
1532    C808A                                                              B08A 001
1533          SUBROUTINE ICOEFF                                            B08A 002
1534          COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B08B   3
1535         1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB08B   4
1536         232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B08B   5
1537         3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB08B   6
1538         465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B08B   7
1539         5,C82,C83,C84,C85,C86,C87,C88                                 B08B   8
1540          COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)   B08B   9
1541         1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B08B  10
1542         2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B08B  11
1543         3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B08B  12
1544         4,CKK3( 8, 8)                                                 B08B  13
1545          COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B08B  14
1546         1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
1547         2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
1548         3CG(20),CGP(20),SREF,GEP,NEN                                  ENTR-MOD
1549          COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)     B08B  17
1550         1,LAR(153),BA1(43,18),BA2(30,15)                              B08B  18
1551          COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B08B  19
1552         1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2 B08B  20
1553         2,C3M(40),BETAM(40)                                           B08B  21
1554          COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB08B  22
1555         1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B08B  23
1556         2,B(8),       MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B08B  24
1557         3,KAUXO,JTIME,JSPEC,MD(3)                                     B08B  25
1558          COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)  B08B  26
1559         1,CPBAR(15),VKW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB08B  27
1560         2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8) B08B  28
1561         3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)  B08B  29
1562         4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B08B  30
1563         5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B08B  31
1564         6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)  B08B  32
1565          COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                   B08B  33
1566    C     FIRST, EVAL DERIVATIVES OF STATE PROPERTIES WITH RESPECT TO ETA  B08A 028
```

```
      VMU4P=DMU4H*HP                                                    B08A 029
      VMU3P=DMU3H*HP                                                    B08A 030
      HTILP=DHTILH*HP                                                   B08A 031
      TP=DTH*HP                                                         B08A 032
      RHOP(I)=DRHOH*HP                                                  B08A 033
      IF(NSPM1)401,401,402                                              B08A 034
  402 DO 408 K=1,NSPM1                                                  B08A 035
      ZKP(K)=DZKH(K)*HP                                                 B08A 036
      PHIKP(K)=DPHIKH(K)*HP                                             B08A 037
      VMU4P=VMU4P+DMU4K(K)*SP(2,I,K)                                    B08A 038
      VMU3P=VMU3P+DMU3K(K)*SP(2,I,K)                                    B08A 039
      HTILP=HTILP+DHTILK(K)*SP(2,I,K)                                   B08A 040
      TP=TP+DTK(K)*SP(2,I,K)                                            B08A 041
      RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)                                B08A 042
      DO 408 J=1,NSPM1                                                  B08A 043
      ZKP(K)=ZKP(K)+DZKK(K,J)*SP(2,I,J)                                 B08A 044
  408 PHIKP(K)=PHIKP(K)+DPHIKK(K,J)*SP(2,I,J)                           B08A 045
C     NEXT, EVALUATE OTHER GROUPINGS FOR USE AT I AND I-1               B08A 046
C   C≠S DEFINED IN HISTXI -  C1=1.+DZ,C2=-C1-DZ,C3=-1./ALPHA*,C4=BETA+C1ENTR-MOD
C   C≠S DEFINED IN NONCER - C5=1./ALPH,C6=BETA*ALPH**2,               1ENTR-MOD
C      C7=-(UE(IS)/ALPH)**2*25036.5,C8=ALPHD/ALPH,C9=C4-C8,            ENTR-MOD
C      C10=C7*F(2,I),C13=C7*F(3,I)                                     ENTR-MOD
  401 C11=C5 * F(3,I) * TTVC
      C12 = C5 * CAPC(I)* TTVC
      C14=C1*F(1,I)+HF(I,5)                                             B08A 049
      C15=PR(I)-1.                                                      B08A 050
      C16=1./PR(I)                                                      B08A 051
      C17=1./SC(I)                                                      B08A 052
      C18=CTR*T(I)                                                      B08A 053
      C19=C17*C12                                                       B08A 054
      C20=C16*C12                                                       B08A 055
      C21 = C13 * C15
      C22 = C21*C20
      C23 = DCAPCH/CAPC(I)
      C24 = C20 * (G(2,I)-C21*F(2,I))
      C25= C20 * C16 * (G(2,I)+C13*F(2,I))
      C26 = RHOE(IS)/RHO(I)
      C28 = C12 * F(3,I)
      C31 = HTILP-(CPTIL+CT/VMU12*CTR)*TP+C18 * VMU3P+(HTIL-H(I)+CTR*
     1 VMU3* T(I)) *VMU4P
      C32 = (-F(2,I)*C13+TP/PR(I)*CPBAR(I)+C31/SC(I)) * C12 - C3*QR(I)
     1 *TTVC
      C43=C24*C23-C25*DPRH-C3*DQRH*TTVC
      C53=RHOP(I)/RHO(I)
      C56 = F(2,I)/ALPH
      C73 = C1 * F(2,I)
      C74 = C11 * C10 * DCAPCH + C14
      C75=C11*DCAPCH                                                    B08A 100
      C76=C1*G(1,I)                                                     B08A 101
      C77=-C22+C43*C10
      C78=-C20*C15*C10
      C79=C43
      C80=C20
      C81=-C28*(C10*C56*C23+C5)
      C82=-C20*C5*G(2,I)+3.0*C22*C56-C43*C10*C56
      C83=C28+C14 * F(2,I)
  412 C84=C32+G(1,I)*C14                                                B08A 109
      C85 = -C6/RHO(I)*C26/2.
```

```
      C86=C85*C10*DRHOH
      C87=BETA*ALPH*C26-C86*C56
      C88=C85*DRHOH
      DUM1=C23-DSCH/SC(I)
      IF(NSPM1)403,403,404                                              B08A 110
  404 DO 406 K=1,NSPM1
      CK3(K) = DCAPCK(K)/CAPC(I)
  406 CK4(K)=CK3(K)-DSCK(K)/SC(I)
      DO 410 K=1,NSPM1
      DUM2=C19 * SP(2,I,K)
      CK1(K)=C24*CK3(K)-C25*DPRK(K)-C3*DQRK(K)*TTVC
      CK2(K)=0.
      CK5(K)=0.
      DUM3=ZK(K)-SP(1,I,K)
      CK6(K)=C19*(ZKP(K)+VMU4P*DUM3)
      CK9(K)= DUM2*DUM1
      CK13(K)=C85*DRHOK(K)
      CK14(K)=0.
      CK15(K)=0.
      CK16(K)=0.
      CK17(K)=C11*DCAPCK(K)                                             B08A 125
      CK18(K)=C1*SP(1,I,K)                                              B08A 126
      CK19(K)=CK9(K)*C10
      CK20(K)=0.
      CK21(K)=-CK19(K)*C56-DUM2/ALPH
  414 CK22(K)=CK6(K)+SP(1,I,K)*C14                                      B08A 130
      DO 410 KK=1,NSPM1                                                 B08A 131
      CKK1(K,KK)=C19*(DZKK(K,KK)+DUM3*DMU4K(KK))
      CKK3(K,KK)=DPHIKK(K,KK)
  410 CKK2(K,KK)=DUM2*CK4(KK)
  403 CONTINUE                                                          B08A 135
      RETURN                                                            B08A 136
      END                                                               B08A 137
CB09A                                                                   B09A 001
      SUBROUTINE RECASE                                                 B09A 002
      COMMON/CRBCOM/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMIST B09A   3
     1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU            B09A   4
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B09A   5
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B09A   6
      COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,N B09A   7
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B09A   8
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B09A   9
     3,KAUXO,JTIME,JSPEC,MD(3)                                          B09A  10
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B09A  11
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B09A  12
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B09A  13
    1 FORMAT(20I1,15A4)                                                 B09A 016
    2 FORMAT(I2)                                                        B09A 017
    3 FORMAT(I2/(8E10.4))                                               B09A 018
    4 FORMAT(1H114X56HBOUNDARY LAYER INTEGRAL MATRIX PROGRAM (BLIMP)    B09A 019
     1      //8X47HAEROTHERM CORPORATION,PALO ALTO,CALIF (RMK,EPB)     B09A 020
     1,2X3A6  //1X,                                                   5H
     2CASE ,15A4,//,8X,75HCONTROL NUMBERS  1  2  3  4  5  6  7  8  9 10 B09A 022
     311 12 13 14 15 16 17 18 19 20,//,23X,20I3//8X14HPUNCH CONTROL  /8X
     412HIDENT  JSPEC/10XA2,7XI2/)
    5 FORMAT(8E10.4)                                                    B09A 025
    6 FORMAT(I2,E10.4)                                                  B09A 027
    7 FORMAT(/9X20HVISCOSITY LAW   MU=(E10.3,4H*T**E10.3,3H)/(E10.3,3H*T B09A 028
```

```
      1+E10.3,1H)//9X19HENTHALPY LAW     T=E10.3,1H+E10.3,4H*H**E10.3,1H+B09A 029
      2/42X2H((E10.3,7H+1.)*H/E10.3,8H)**(1./(E10.3, 5H+1.))//9X19HPRANDTB09A 030
      3L NUMBER  PR=E10.3,1H+E10.3,4H*T**E10.3,1H+E10.3,4H*T**E10.3/)     B09A 031
    9 FORMAT(21I1)                                                        B09A 032
   10 FORMAT    (/,10X70HU/UE TO  NODAL PT.   GAMMA   MOLECULAR           B09A 033
      1                        /9X18HNORM. ETA AT WHICH13X40HWEIGHT       B09A 034
      2                            /19X9HETA NORM.)                       B09A 035
    8 FORMAT(3X1PE10.3,9XI2,6X9E10.3/(30X9E10.3))
   11 FORMAT     (/,5X70HU/UE TO       NODAL PT.                          B09A 037
      1     ETA VALUES        /4X23HNORM. ETA      AT WHICH               B09A 038
      2                            /19X9HETA NORM.)                       B09A 039
   12 FORMAT (/2X,15HNOSE RADIUS,FT ,1PE12.5,5X,16HCONE HALF ANGLE ,1PE1B09A 040
      12.5,8H DEGREES)                                                    B09A 041
   13 FORMAT (/,1X,23HTIME,SEC                ,1P8E12.5/(24X,1P8E12.5))   B09A 042
   14 FORMAT (/,1X,23HTOTAL ENTHALPY,BTU/LB   ,1P8E12.5/(24X,1P8E12.5))   B09A 043
   18 FORMAT (/,1X,23HCASE                    ,1P8E12.5/(24X,1P8E12.5))
   15 FORMAT (/,1X,23HTOTAL PRESSURE,ATM      ,1P8E12.5/(24X,1P8E12.5))   B09A 044
   16 FORMAT(A2,I2,I6)
   17 FORMAT (/,1X,23HINCIDENT RAD FLUX,B/SF2,1P8E12.5/(24X,1P8E12.5))
   20 FORMAT(/,1X,56HSURFACE RECESSION - WALL TEMPERATURE RELATION FOR T
      1EFLON//5X,43HSURFACE RECESSION RATE, LB/SEC FT2 = EXP(((,1P E12.5,
      26H)*TW+(,1P E12.5,7H))*TW+(,1P E12.5,2H)),//5X,37HWHERE TW IS WALL
      3 TEMPERATURE IN DEG R)
C     NOTE...KR(5)=4 FOR EQUIL,3 FOR EQUIL WITH ENTROPY LAYER, 1          B09A 046
C     FOR NONEQUIL, AND 2 FOR NONEQUIL WITH ENTROPY LAYER...ROKAP=1 FOR B09A 047
C     PLANAR..(KR(6)=1 AND 3 FOR BLUNT AND SHARP, RESP) AND IS EQUAL TO B09A 048
C     DISTANCE FROM AXIS OF SYMMETRY TO BODY SURFACE FOR AXISYM..         B09A 049
C     (KR(6)=0 AND 2 FOR BLUNT AND SHARP, RESPECTIVELY)... KR(7)=0 FOR   B09A 050
C     MULTICOMPONENT B.L. AND=1 FOR HOMOGENEOUS B.L..IDISC=0 FOR NO       B09A 051
C     DISCONTINUITY AND UNITY FOR DISC. IN ROKAP,FW, OR RHOWVW            B09A 052
      DATA MD(2)/6H       /
      CALL DATE (9,MD)
       CALL TOD ( 18, MD)
      READ(KIN,1)KR,CASE                                                  B09A 053
      READ(KIN,16) IDENT,JSPEC,JTIME
      WRITE(KOUT,4) MD,CASE,KR,IDENT,JSPEC
      KQ(9)=0
      IF(KR(6)-8) 245,240,245
  240 KQ(9)=-1
      KR(6)=4
      GO TO 255
  245 IF(KR(6)-4) 255,255,250
  250 KQ(9)=1
      KR(6)=KR(6)-5
  255 READ(KIN,24) NSP,KS
   24 FORMAT(I2,8X70I1)
      NSPM1=NSP-1                                                         B09A 057
      READ(KIN,24)NTIME,IDISC                                             ENTR-MOD
      READ(KIN,5)(TIME(IT),IT=1,NTIME)                                    ENTR-MOD
      NITEM=NTIME                                                         B09A 059
      NTIME=1                                                             B09A 060
      READ(KIN,24) NS,KR9
      READ(KIN,5)(S(IS),IS=1,NS)
      KAUXO=1                                                             ROG
      IF(KR (14)-2) 303,303,302                                           ROG
  302 KAUXO=KR (14)-1                                                     ROG
      KR (14)=KR (14)-3                                                   ROG
C     COMPUTE INFORMATION NEEDED TO CONSIDER DISCONTINUITIES              B09A 062
```

```
  303 J=1                                                          B09A 063
  102 MSD(1)=1                                                     B09A 064
      IDISC(1)=MAX0(IDISC(1),1)                                    ENTR-MOD
      S(1)=ABS(S(1))                                               B09A 066
      IF (NS-1) 105,105,1021                                       B09A 067
 1021 DO 101 IS=2,NS                                               B09A 068
      IF(S(IS)) 103,101,101                                        B09A 070
  103 NSD(J)=IS-MSD(J)+1                                           B09A 071
      S(IS )=-S(IS)                                                B09A 072
      IDISC(IS)=MAX0(IDISC(IS),1)                                  ENTR-MOD
      J=J+1                                                        B09A 074
      MSD(J)=IS                                                    B09A 075
  101 CONTINUE                                                     B09A 076
  105 NSD(J)=NS-MSD(J)+1                                           B09A 077
      NDISC=J-1                                                    B09A 078
      IF (KR(1)) 1051,1051,1052                                    B09A 080
 1052 READ (KIN,3) NETA,(ETA(I),I=1,NETA)                          B09A 081
      READ (KIN,6) KAPPA,CBAR                                      B09A 079
 1051 CONTINUE                                                     B09A
  605 WRITE (KOUT,11)                                              B09A 091
      WRITE (KOUT,8) CBAR,KAPPA,(ETA(I),I=1,NETA)                  B09A 092
  606 IF(KR(6)-1) 203,203,204                                      B09A 093
  203 READ (KIN,5)  CONE,          RNOSE                           B09A 094
  204 IF(IABS(KR(6)-2)-1) 207,208,207                              B09A 095
  207 READ (KIN,5)(ROKAP(IS),IS=1,NS)                              B09A 096
      IF (NS-1) 234,234,2071                                       B09A 097
 2071 IIS=2                                                        B09A 099
      LNZ=1                                                        B09A 099
      IF(ROKAP(1)) 223,226,226                                     B09A 100
  223 RADNO=-ROKAP(1)                                              B09A 101
      WRITE (KOUT, 12) RADNO,CONE                                  B09A 102
      ROKAP(1)=0.                                                  B09A 103
      DO 229 IS=1,NS
      IF(ROKAP(IS)) 224,224,225                                    B09A 105
  224 IF(KR(6)) 221,221,222                                        B09A 106
  222 ROKAP(IS)=S(IS)*SIN(RADNO/57.29578)                          B09A 107
      GO TO 229                                                    B09A 108
  221 ROKAP(IS)=RADNO*SIN(S(IS)/RADNO)                             B09A 109
  229 CONTINUE                                                     B09A 110
      GO TO 234                                                    B09A 111
  225 IF (IS-NS) 2251,234,234                                      B09A 112
 2251 IIS=IS+1                                                     B09A 113
      LNZ=IS                                                       B09A 114
  226 DO233 IS=IIS,NS                                              B09A 115
      IF(ROKAP(IS)) 233,233,227                                    B09A 116
  227 IF(IS-1-LNZ) 232,232,228                                     B09A 117
  228 LNZ=LNZ+1                                                    B09A 118
      ROKAP(LNZ)=ROKAP(LNZ-1)+(S(LNZ)-S(LNZ-1))/(S(IS)-S(LNZ-1))*(ROKAP(B09A 119
     1IS)-ROKAP(LNZ-1))                                            B09A 120
      GO TO 227                                                    B09A 121
  232 LNZ=IS                                                       B09A 122
  233 CONTINUE                                                     B09A 123
  234 VKAP=1.                                                      B09A 124
      GO TO 210                                                    B09A 125
  208 DO 209 IS=1,NS                                               B09A 126
  209 ROKAP(IS)=1.                                                 B09A 127
      VKAP=0.                                                      B09A 128
  210 CONTINUE                                                     B09A
```

```
  181 STEF = .481E-12
      IF (KR(9)-3) 197,193,198
  198 IF (KR(9)-4) 193,193,197
  197 DO 191 J=1,NS
      IF (KR9(J)-3) 191,193,192
  192 IF (KR9(J)-4) 191,193,191
  191 CONTINUE
      GO TO 199
  193 READ(KIN,21) (EMIV(I),HCHAR(I), HPYG(I), I=1,3)
      READ(KIN,22) (ASU(I),BSU(I), I=1,3)
   22 FORMAT(6A4)
   21 FORMAT(9E8.3)
   19 FORMAT(/1X39HQUASI-STEADY ENERGY BALANCE AT THE WALL//5X14HSURFACE
     1 NUMBER28X1H114X1H214X1H3/5X17HSURFACE EMITTANCE17X1P3E14.5/5X34HE
     2NTHALPY OF CHAR AT REFERENCE TEMP3E15.5/5X34HENTHALPY OF PYROLYSIS
     3 GAS (BTU/LB)3E15.5/5X27HEQUILIBRIUM SURFACE SPECIES5X3(7X2A4))
      WRITE(KOUT,19) EMIV, HCHAR, HPYG,(ASU(I), BSU(I), I=1,3)
  199 IF (KR(9)-5) 194,196,196
  194 DO 195 J=1,NS
      IF (KR9(J)-5) 195,196,196
  195 CONTINUE
      GO TO 182
  196 READ (KIN,5) EMIST,HTEF,ADUM,BDUM,CDUM
      WRITE (KOUT,20) ADUM,BDUM,CDUM
      WRITE (KOUT,19) EMIST,HTEF
  182 READ(KIN,5)(PTET(IT),IT=1,NITEM)
      READ(KIN,5)(GE(IT),IT=1,NITEM)                                    B09A 131
      READ(KIN,5)(RADFL(IT),IT=1,NITEM)                                 B09A 132
 2200 IF(TIME(1)) 2201,220,220
 2201 TIME(1)=-TIME(1)
      WRITE (KOUT,18)(TIME(I),I=1,NITEM)
      TIME(1)=-TIME(1)
      GO TO 2202
  220 WRITE (KOUT,13)(TIME(I),I=1,NITEM)                                B09A 137
 2202 WRITE (KOUT,14)(  GE(I),I=1,NITEM)
      WRITE (KOUT,15)(PTET(I),I=1,NITEM)                                B09A 139
      WRITE (KOUT,17)(RADFL(I),I=1,NITEM)
      RETURN                                                            B09A 140
      END                                                               B09A 141
C B10A                                                                  B10A 001
      SUBROUTINE HISTXI                                                 B10A 002
      COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,ENTR-MOD
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,NEN                                       ENTR-MOD
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B10A   3
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B10A   4
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B10A   5
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFN,DLX2  B10A   6
     2,C3M(40),BETAM(40)                                                B10A   7
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,META,I,IS,NB10A   8
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B10A   9
     2,B(8),      HWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B10A  1
     3,KAUXO,JTIME,JSPEC,MD(3),IU,ISH                                   ENTR-MOD
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B10A  12
     1,RHOSE,VKAP,NOISC,IDISC(40),MSD(10),MSC(10),ITF( 50),IPRE,RADNO,  B10A  13
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B10A  14
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B10A  15
```

```
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)          ENTR-MOD
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ       ENTR-MOD
      DIMENSION FD(4),GD(4),SPD(4)                                       B10A 018
C     INITIALIZE AXIAL VARIATION TERMS                                   B10A 019
      NUL=0                                                              B10A 020
      IF(IS.NE.1)GO TO 399                                               ENTR-MOD
  398 IF(IDISC(IS).NE.2)GO TO 399                                        ENTR-MOD
      IS=IS+1                                                            ENTR-MOD
      GO TO 398                                                          ENTR-MOD
  399 IF(KR(3).EQ.0)GO TO 154                                            ENTR-MOD
      IF(IU-2) 154,152,155                                               ENTR-MOD
  152 DLX1=2.3                                                           ENTR-MOD
      IF(KR(6).EQ.0)DLX1=3.5                                             ENTR-MOD
      IF(XI(ISM)) 157,157,155                                            ENTR-MOD
  154 DZ=0.                                                              B10A 030
      D1=0.                                                              B10A 031
      D2=0.                                                              B10A 032
      IF(KR(2).LT.0)  IS=-KR(2)
      IF(KR(2).LT.0)  IDISC(IS)=1
      M=NETA-1                                                           B10A 033
      DO 140 I=1,M                                                       B10A 034
      DO 140 J=1,4                                                       B10A 035
      ZM(J,I)=0.                                                         B10A 036
  139 DO 140 K=NUL,MSPM1                                                 B10A 037
      ZSP(J,I,K)=0.                                                      B10A 038
  140 CONTINUE                                                           B10A 039
      DO 141 I=1,NETA                                                    B10A 040
      DO 142 J=1,3                                                       B10A 041
      HF(I,J)=0.                                                         B10A 042
  159 DO 142 K=NUL,MSPM1                                                 B10A 043
      HSP(I,J,K)=0.                                                      B10A 044
  142 CONTINUE                                                           B10A 045
      HF(I,4)=0.                                                         B10A 046
  141 HF(I,5)=0.                                                         B10A 047
      ALPHD=0.                                                           B10A 048
      HALPH=0.                                                           B10A 049
      DLX2=0.                                                            B10A 050
      GO TO 130                                                          B10A 051
C     COMPUTE TWO- OR THREE-POINT DIFFERENCE RELATIONS                   B10A 052
  155 DLX1=ALOG(XI(IS)/XI(ISM))                                          ENTR-MOD
      IF(IU.GT.2.AND.KR(3).EQ.2.AND.IDISC(ISM).NE.1) GO TO 121           ENTR-MOD
  157 DZ=2./DLX1                                                         ENTR-MOD
      D1=-DZ                                                             B10A 054
      D2=0.                                                              B10A 055
      GO TO 145                                                          B10A 056
  121 DZ=DLX1+DLX2                                                       B10A 059
      D1=-DZ/(DLX1*DLX2)*2.                                              B10A 060
      D2=DLX1/(DZ*DLX2)*2.                                               B10A 061
      DZ=-D1-D2                                                          B10A 062
  145 DLX2=DLX1                                                          B10A 063
      ALPHD=D1*ALPH+D2*HALPH                                             B10A 064
      HALPH=ALPH                                                         B10A 065
  122 FD(3)=D1*F(4,1)+D2*HF(1,4)                                         B10A 066
      GD(3)=D1*G(3,1)+D2*HG(1,3)                                         B10A 067
      DO 147 I=2,NETA                                                    B10A 068
      FD(1)=D1*F(2,I)+D2*HF(I,2)                                         B10A 069
      FD(2)=D1*F(3,I)+D2*HF(I,3)                                         B10A 070
      FD(4)=FD(3)                                                        B10A 071
```

```
      FD(3)=D1*F(4,I)+D2*HF(I,4)                                        B10A 072
      CALL TAYLOR(DETA(I-1),FD(2),FD(1),ZM(1,I-1))                      B10A 073
      GD(1)=D1*G(1,I)+D2*HG(I,1)                                        B10A 074
      GD(2)=D1*G(2,I)+D2*HG(I,2)                                        B10A 075
      GD(4)=GD(3)                                                       B10A 076
      GD(3)=D1*G(3,I)+D2*HG(I,3)                                        B10A 077
  147 CALL TAYLOR(DETA(I-1),GD(2),GD(1),ZG(1,I-1))                      B10A 078
      IF(NSPM1) 162,162,166                                             B10A 079
  166 DO 151 K=1,NSPM1                                                  B10A 080
      SPD(3)=D1*SP(3,1,K)+D2*HSP(1,3,K)                                 B10A 081
      DO 151 I=2,NETA                                                   B10A 082
      SPD(1)=D1*SP(1,I,K)+D2*HSP(I,1,K)                                 B10A 083
      SPD(2)=D1*SP(2,I,K)+D2*HSP(I,2,K)                                 B10A 084
      SPD(4)=SPD(3)                                                     B10A 085
      SPD(3)=D1*SP(3,I,K)+D2*HSP(I,3,K)                                 B10A 086
  151 CALL TAYLOR (DETA(I-1),SPD(2),SPD(1),ZSP(1,I-1,K))                B10A 087
C-----SAVE HISTORIC VALUES                                              B10A 088
  162 DO 164 I=1,NETA                                                   B10A 089
      HF(I,4)=F(4,I)                                                    B10A 090
      HF(I,5)=D1*F(1,I)+D2*HF(I,1)                                      B10A 091
      DO 164 J=1,3                                                      B10A 092
      HF(I,J)=F(J,I)                                                    B10A 093
      HG(I,J)=G(J,I)                                                    B10A 094
      IF(NSPM1) 164,164,165                                             B10A 095
  165 DO 149 K=1,NSPM1                                                  B10A 096
  149 HSP(I,J,K)=SP(J,I,K)                                              B10A 097
  164 CONTINUE                                                          B10A 098
C     COMPUTE GROUPINGS WHICH DEPEND ON DZ                              B10A 099
  130 C1=1.+DZ                                                          B10A 100
      C2=-C1-DZ                                                         B10A 101
      C3=C3M(IS)                                                        B10A 102
      BETA=BETAM(IS)                                                    B10A 103
      C4=BETA+C1                                                        B10A 104
 9904 FORMAT(6XI2/8X1P18E10.3/8X8E10.3/(8X10E10.3))                     B10A 105
      IF(KR(17)) 9905,9906,9905                                         B10A 106
 9905 CONTINUE                                                          B10A 107
      WRITE(KOUT,9907)                                                  B10A 108
 9907 FORMAT(2X27HDEBUG IS,DLX1...ZM,ZG,HF,HG)                          B10A 109
      WRITE(KOUT,9904) IS,DLX1,DLX2,DZ,D1,D2,ALPHC,HALPH,C1,C2,C4,    FOB10A 110
     1,GD,((ZM(I,J),J=1,6),I=1,4),((ZG(I,J),J=1,6),I=1,4),((HF(I,J),   B10A 111
     2 J=1,5),I=1,7),((HG(I,J),J=1,3),I=1,7)                            B10A 112
      IF(NSPM1) 9906,9906,9908                                          B10A 113
 9908 WRITE(KOUT,9909)(((ZSP(I,J,K),K=1,NSPM1),J=1,6),I=1,4),(((HSP(I,J,B10A 114
     1 K),K=1,NSPM1),J=1,3),I=1,7)                                      B10A 115
 9909 FORMAT(2X13HDEBUG ZSP,HSP/(2X10E10.3))                            B10A 116
 9906 CONTINUE                                                          B10A 117
      RETURN                                                            B10A 118
      END                                                               B10A 119
C B11A                                                                  B11A 001
      SUBROUTINE OUTPUT                                                 B11A 002
      DIMENSION CIJ( 71,1)                                              B11A  03
      COMMON/BLOCOM/  MOA( 71),  MOB( 71),MSPEC,FR( 71,15),W(3),LEF(10) B11A   4
     1 ,LEFS(10),PIEASE,LEFN(10),L2,L3                                  ENTR-MO
      COMMON/COECOM/                C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B11A   6
     1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB11A   7
     232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B11A   8
     3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB11A   9
     465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B11A  10
```

```
     5,C82,C83,C84,C85,C86,C87,C88                                      B11A  11
      COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)    B11A  12
     1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)      B11A  13
     2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)   B11A  14
     3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XCP(5, 9)  B11A  15
     4,CKK3( 8, 8)                                                      B11A  16
      COMMON/CRBCOM/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMIST B11A  17
     1,HPG,ASU(3),BSU(3),HPYG(3,3),HCHAR(3),EMIV(3),KS(40),ISU          B11A  18
      COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B11A  19
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,NEM                                       ENTR-MOD
      COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,    B11A  22
     1EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,TREF,RETR                     ENTR-MOD
      COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B11A  24
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B11A  25
     2 KAT(10),IR(10),IZ,KZ(10),LAPI( 71),P,Z,TK(10, 7),VN( 71),        B11A  26
     3 VMU( 71,10),ITFF,KR2,HCM,NCV,WM,WTM( 71),YYY( 71),YW( 71),GG( 71)B11A  27
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B11A  28
      COMMON/EQTCOM/SIP,HIP,EEL,EEML,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B11A  29
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,NS,NSS,BX,ISP2,ISPQ,   B11A  30
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SURC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HMG, B11A  31
     3 CCPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),BB(16),    ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMN(10),GAMF(10),SLAM(10),DY( 71),RVS,  B11A  33
     5 CP( 71),HM( 71),SB( 71),TC( 71),VLNK( 71),E( 71),FNUS(10),       B11A  34
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                     B11A  35
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B11A  36
     1,LAR(153),BA1(43,10),BA2(30,15)                                   B11A  37
      COMMON/FLXCOM/DELQW,DELJW( 9),DQNL(153),DJNL(153, 8),WALLQ        B11A  38
     1,WALLJ( 8),GN,VJKN( 9),TPWALL                                     B11A  39
      COMMON/HISCOM/C1,C2,C3,C4,ALPHO,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8)B11A  40
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DL(2  B11A  41
     2,C3M(40),BETAM(40)                                                B11A  42
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB11A  43
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B11A  44
     2,B(8),      NWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B11A  45
     3,KAUXO,JTIME,JSPEC,ND(3)                                          B11A  46
      COMMON/OUTCOM/Y(15),RES,DELST,THENGI,THMOM,CH,BLOW,SHEAR,CF,SHAPE B11A  47
     1 ,CM( 9),THELEM( 9)                                               B11A  48
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),CE( 50),S(40),ROKAP(40) B11A  49
     1,RHOSE,VKAP,NDISC,IDISC(40),NSD(10),NSD(10),ITF( 50),IPRE,RADNO,  B11A  50
     2COME,RADFL( 50),RADR(40),RADS(40),IRAD                            B11A  51
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B11A  52
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOK( 8),ZK( 8),DZKK( 8),  DB11A  53
     2HU3K( 8),DHUAK( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B11A  54
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DHU12K( 8),DZKK( 8, 8)   B11A  55
     4,DPHIKK( 8, 8),       DHUAH,DHU3H,DHTILH,VHU12,CT,CTR,CPTIL,HTIL  B11A  56
     5,VHU3,DTH,DCAPCH,DPRH,DSCH,CORH,DCPBH,DCPTH,DHU12H,VMU(15),  RHOP B11A  57
     6(15),PHIKP(15),HP,TP,ZKP( 8),VHU3P,VHU4P,HTILP,CRHO(14),GHR(15)   B11A  58
      COMMON/TENCOM/SPDUM( 8),DER(40),DUMN1(15),SLOPE(15),REDUM(15)     B11A  59
     1,SDUN1(40),SDUN2(40),FWDUM(40),XICOM(40),FWCOM(40),FWINIT( 1)     B11A  60
     2,XIINIT( 1),DUDS( 40)                                             B11A  61
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B11A  62
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B11A  63
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B11A  64
      EQUIVALENCE              (VMU,CIJ)                                B11A 037
    1 FORMAT(/6X189H ALPHA        XI       ROKAP     PRESSURE    EDGE  B11A 057
     10ETA     FLUX NOR-            HEAT FLUXES                    /5X110H
```

```
      2          (LB          (FT)      (ATM)     VELOCITY              MALIZINB11A 059
      3G DIFFUSIONAL TOT ENTH  RERAD        QCOND /5X110H              /SEC)
      4**2                        (FT/SEC)              PARAMETER
      5(BTU/SEC SQ FT)                 /5X1P11E10.3)
     2 FORMAT(/6X109H  WALL                    MASS FLUXES                 ELB11A 069
      1EMENTAL MASS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR          /5X 50H  B11A 070
      2SHEAR    MECH REM  PYROL GAS   CHAR    TOTAL GAS 8(1X2A4,1X))
    16 FORMAT                                          (5X 50H(LB/SQ FT) B11A 073
      3            (LB/SEC SQ FT)                        )                B11A 074
     3 FORMAT(5X1P12E10.3)
    18 FORMAT(/5X109HMOM TRANS HEAT TRANS     BLOWING PARAMETERS          ELB11A 076
      1EMENTAL MASS TRANSFER COEFFICIENTS,                        /5X110H  B11A 077
      2COEFF,    COEFF,          (BASED ON CH) FOR            RHOE*UE*CM (LB11A 078
      2B/SEC SQ FT) FOR                                  /4X51HRHO*UE*CF/2 B11A 079
      3RHO*UE*CH PYROL GAS   CHAR    TOTAL GAS                            B11A 080
      4 8(1X2A4,1X))
     4 FORMAT(5X110H MOMENTUM  DISPLACE. EFFECTIVE ENTHALPY  REYNOLDS  MA
      1SS THICKNESSES (FT) FOR                                   /5X110HTHB11A 083
      2ICKNESS,THICKNESS,   BODY   THICKNESS,  NUMBER
      3                                          /5X 50H  THETA    DELSTAB11A 085
      4R   DISPLACE.  LAMBDA   PER FOOT 8(1X2A4,1X))
    20 FORMAT(2X,4(6X,4H(FT))/5X1P12E10.3)
     5 FORMAT(/2X17HNODAL INFORMATION)                                    B11A 091
     6 FORMAT(5X9HDISTANCE,4X3HETA,8X1HF,9X2HFP,7X3HFPP,7X5HSHEAR,2X11HTO
      1TAL ENTH-,3X2HGP,7X3HGPP,6X6HSTATIC 5X4HTEMP,5X8HELECTRON/
      25X9HFROM WALL,23X7H(=U/UE),23X7HHALPY,G,23X8HENTHALPY,12X9HCOLL FR
      3EQ/8X4H(FT),44X9H(LB/FTSQ),2X8H(BTU/LB),2X8H(BTU/LB),2X8H(BTU/LB),
      42X8H(BTU/LB),2X7H(DEG R),4X7H(1/SEC))
     7 FORMAT(5X110H DISTANCE  DENSITY, VISCOSITY,  RHO*MU   SPECIFIC  THB11A 098
      1ERMAL   PRANDTL   MODIFIED MOLECULAR  RHOSQ*EPS    MACH  /5X110HFR
      2OM WALL    RHO         MU     /RHOE*MUE,    HEAT    COND (BTU  NUMBERB11A 100
      3   SCHMIDT    WEIGHT   /RHOE*MUE   NUMBER /5X110H   (FT)    (LB/CU
      4FT) LB/SEC FT     C      (BTU/LB R)  SEC FT R)          NUMBER     B11A 10
      5                                )                                   B11A 103
     8 FORMAT (/2X78HELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVB11A 104
      1ATIVES WITH RESPECT TO ETA,/)                                      B11A 105
    12 FORMAT(/)                                                          B11A 126
    13 FORMAT(/   43X21HDISTANCE FROM WALL,FT/(15X,1P10E10.3/20X,
      1 1P9E10.3))
    14 FORMAT(6X,2A4,1X,1P10E10.3/20X,1P9E10.3/(15X,1P10E10.3/20X,1P
      1 9E10.3))
    15 FORMAT (15X,1P10E10.3/20X1P9E10.3)
    16 FORMAT (/2X14HMOLE FRACTIONS,/)                                    B11A 130
    17 FORMAT(/23H    SURFACE SPECIES IS 2A4)
   310 FORMAT(A2,3I2,1P6E12.5)                                            B11A 131
   312 FORMAT(A2,3I2,1P6E12.5/(8X,1P6E12.5))                              B11A 132
   313 FORMAT (A2,6X,18A4/(20A4))                                         B11A 133
       DATA IBLANK/2H  /
       TVCF(X)=(SQRT(AMAX1(0.,1.+2.*COSOR*X))-1.)/COSOR
       IF (KR(11)-1) 300,300,301                                          B11A 134
   300 IF(KR(9)) 302,302,307                                              B11A 135
   307 IF(KR(9)-2) 301,301,302                                            B11A 136
   302 RHOVW(IS,IT)= C1*F(1,1)    +HF(1,5)                                B11A 137
   301 C89=-C3*ALPH*VMUE(IS)                                              B11A 140
       DUM1=-1./C3                                                        B11A 141
       DUM2=RHOVW(IS,IT)/C3                                               B11A 142
       IF (UE(IS)-1.0) 3012,3011,3012                                     B11A 143
  3011 UE(IS)=0.                                                          B11A 144
```

```
 3012 CONTINUE                                                          B11A
      WALLQ=-WALLQ/C3                                                   B11A 147
      DER(3)=WALLQ-DUM2*G(1,1)                                          B11A 148
      WALLJ(NSP)=0.                                                     B11A 149
      IF (NSPM1) 3051,3051,3050                                         B11A
 3050 DO 305 K=1,NSPM1                                                  B11A
      WALLJ(K)=VJKW(K)                                                  B11A 151
  305 WALLJ(NSP)=WALLJ(NSP)-WALLJ(K)                                    B11A 152
 3051 CONTINUE                                                          B11A
      DER(1)=W(2)/C3                                                    B11A 153
      DER(2)=W(3)/C3                                                    B11A 154
      VMECH=DER(1)+DER(2)-DUM2                                          B11A 155
      DUM4=VMECH*100.                                                   B11A 156
      IF (DUM4-DUM2) 1901,190,190                                       B11A 157
 1901 VMECH=0.                                                          B11A 158
  190 IF(ABS(BETA)-.0001) 303,304,304                                   B11A 159
  303 BETA=0.                                                           B11A 160
  304 Y(1)=0.                                                           B11A 161
      SHFAC=-UE(IS)/(C3*ALPH*ALPH*32.174)
      DUDS(1)=(CAPC(1)+EPSA(1))*F(3,1)*SHFAC
      DO 182 I=2,NETA                                                   B11A 162
      DUDS(I)=(CAPC(I)+EPSA(I))*F(3,I)*SHFAC
  182 Y(I)=Y(I-1)+C89*CRHO(I-1)                                         B11A 163
      QCOND=VMUE(IS)/PR(1)*CAPC(1)/C89*G(2,1)+DUM2*G(1,1)               B11A 164
      SHEAR=DUDS(1)
      IF (KR(9)-3) 2101,2102,2102
 2101 EMIS=0.
 2102 RERAD=(.481E-12)*(T(1))**4.*EMIS
      QDIFU=-CAPC(1)/ALPH*CPBAR(1)/PR(1)*TPWALL/C3
      WRITE (KOUT,1) ALPH,XI(IS),ROKAP(IS),PE(IS,IT),UE(IS),BETA,DUM1,
    1 WALLQ,DER(3),RERAD,QDIFU
  212 DUM1=RHOE(IS)*UE(IS)/VMUE(IS)                                     B11A 179
      CH= WALLQ  /       (G(1,NETA)-G(1,1))                             B11A 180
      CF=CAPC(1)/ALPH*VMUE(IS)/C89*F(3,1)                               B11A 181
  213 WRITE(KOUT,2) (ATA(K),ATB(K),K=1,NSP)                             B11A 183
      WRITE (KOUT,19)                                                   B11A 184
      DUM4=ALPH*ALPH                                                    B11A 185
      DO 203 I=1,NETA                                                   B11A 186
      SP(1,I,NSP)=1.0                                                   B11A 187
      SP(2,I,NSP)=0.                                                    B11A 188
  203 SP(3,I,NSP)=0.                                                    B11A 189
      IF (NSPM1) 2021,2021,2020                                         B11A
 2020 DO 202 K=1,NSPM1                                                  B11A
      DO 202 I=1,NETA                                                   B11A 191
      SP(1,I,NSP)=SP(1,I,NSP)-SP(1,I,K)                                 B11A 192
      SP(2,I,K)=SP(2,I,K)/ALPH                                          B11A 193
      SP(2,I,NSP)=SP(2,I,NSP)-SP(2,I,K)                                 B11A 194
      SP(3,I,K)=SP(3,I,K)/DUM4                                          B11A 195
  202 SP(3,I,NSP)=SP(3,I,NSP)-SP(3,I,K)                                 B11A 196
 2021 CONTINUE                                                          B11A
      XSP(5,NSP)=F(1,NETA)-F(1,1)                                       B11A 197
      IF(NSPM1) 2138,2138,2135
 2138 VJKW(1)=0.
      CM(1)=0.
      THELEM(1)=0.
      GO TO 2137
 2135 DO 2136 I=1,NSPM1                                                 B11A
 2136 XSP(5,NSP)=XSP(5,NSP)-XSP(5,I)                                    B11A 199
```

```
      DO 2131 I=1,NSP                                                   B11A 200
      VJKW(I)=0.                                                        B11A 201
      DO 2132 K=1,NSF                                                   B11A 202
 2132 VJKW(I)=VJKW(I)-WALLJ(K)/WTM(K)*CIJ(I,K)                          B11A 203
 2131 VJKW(I)=VJKW(I)*WAT(I)                                            B11A 204
 2137 CONTINUE
      WRITE(KOUT,3) SHEAR,VMECH,DER(1),DER(2),DUM2,   (VJKW(I),I=1,NSP) B11A 205
  214 RES=DUM1*S(IS)                                                    B11A 206
      DUM3=C89*(F(1,NETA)-F(1,1))/ALPH                                  B11A 207
      DELST=Y(NETA)-DUM3                                                B11A 208
      REDELS=DUM1*DELST                                                 B11A 209
      THENGY=(DUM3*G(1,NETA)-C89/ALPH*XG(5))/(G(1,NETA)-G(1,1))         B11A 210
      RETHEN=DUM1*THENGY                                                B11A 211
      THMOM=DUM3-C89/ALPH*XM(5)/ALPH                                    B11A 212
      RETHMO=DUM1*THMOM                                                 B11A 213
      DELBD=Y(NETA)-C89/ALPH*F(1,NETA)
      THCOND=CPBAR(1)/RHO(1)*RHOE(IS)/G(2,1)*C89*(T(NETA)-T(1))         B11A 215
      BLOW=DUM2/CH                                                      B11A 216
  207 BLOWPG=DER(1)/CH                                                  B11A 218
      BLOWCH=DER(2)/CH                                                  B11A 219
      IF(NSPM1) 2074,2074,2070
 2070 DO 2071 I=1,NSP
      THELEM(I)=0.                                                      B11A 221
      DUZ=0.
      DO 2072 K=1,NSP                                                   B11A 223
      DUZ=DUZ+(DUM3*SP(1,NETA,K)-C89/ALPH*XSP(5,K))/WTM(K)*CIJ(I,K)
 2072 THELEM(I)=THELEM(I)+(SP(1,NETA,K)-SP(1,1,K))/WTM(K)*CIJ(I,K)      B11A 226
      CM(I)=VJKW(I)/(THELEM(I)*WAT(I))
 2071 THELEM(I)=DUZ/THELEM(I)
 2074 IF(KQ(9)) 2075,2078,2075
 2075 COSOR=-TVCC(IS)/VMUE(IS)*0.5/C3*FLOAT(KQ(9))
      DO 2076 I=1,NETA
      Y(I)=TVCF(Y(I))
 2076 DUDS(I)=DUDS(I)*(1.+COSOR*Y(I))
      DELST=TVCF(DELST)
      DELBD=TVCF(DELBD)
      THMOM=TVCF(THMOM)
      THENGY=TVCF(THENGY)
      DO 2077 K=1,NSP
 2077 THELEM(K)=TVCF(THELEM(K))
 2078 CONTINUE
      WRITE(KOUT,18) (ATA(K),ATB(K),K=1,NSP)                            B11A 228
      WRITE (KOUT,3) CF,CH,BLOWPG,BLOWCH,BLOW,(CM(I),I=1,NSP)           B11A 229
      WRITE(KOUT,12)                                                    B11A 232
      WRITE(KOUT,4) (ATA(K),ATB(K),K=1,NSP)                             B11A 233
      WRITE(KOUT,20) THMOM,DELST,DELBD,THENGY,DUM1,(THELEM(K),K=1,NSP)
  209 WRITE(KOUT,5)                                                     B11A 238
      WRITE(KOUT,6)                                                     B11A 239
      DO 183 I=1,NETA                                                   B11A 240
C     COMPUTE TRUE VALUES OF F(I,J) AND ETA                             B11A 241
      DER(1)=F(1,I)
      DER(2)=F(2,I)/ALPH
      DER(3)=F(3,I)/DUM4
      DER(4)=DUDS(I)
      DER(5)=G(1,I)
      DER(6)=G(2,I)/ALPH
      DER(7)=G(3,I)/DUM4
      RETA=ETA(I)*ALPH
```

```
      DER(8)=5.814E+12*PE(IS,IT)/SQRT(T(I)/1.8)
  183 WRITE(KOUT,3) Y(I),RETA,(DER(J),J=1,7),
     1 H(I),T(I),DER(8)
      WRITE(KOUT,12)                                                    B11A 250
  216 WRITE(KOUT,7)                                                     B11A 258
      DO 184 I=1,NETA                                                   B11A 259
      COND=CPBAR(I)/PR(I)*VMU(I)                                        B11A 260
      GMR(I)=ABS(GMR(I))
      ACH=F(2,I)/ALPH*UE(IS)/SQRT(GMR(I)/VMW(I)*T(I)*49732.)
  184 WRITE(KOUT,3)Y(I),RHO(I),VMU(I),CAPC(I),CPBAR(I),COND,PR(I),SC(I),B11A 261
     1 VMW(I),EPSA(I),ACH
      IF (KR(7).EQ.1) GO TO 193
      WRITE(KOUT,13)(Y(I),I=1,NETA)                                     B11A 263
      WRITE(KOUT, 8)                                                    B11A 264
      DO 201 K=1,NSP                                                    B11A 265
      WRITE (KOUT,14) MOA(K),MOB(K),(SP(1,I,K),I=1,NETA)                B11A 266
      WRITE (KOUT,15)(SP(2,I,K),I=1,NETA)                               B11A 267
  201 WRITE (KOUT,15)(SP(3,I,K),I=1,NETA)                               B11A 268
      IF (NSPM1) 2041,2041,2040                                         B11A
 2040 DO 204 K=1,NSPM1                                                  B11A
      DO 204 I=1,NETA                                                   B11A 270
      SP(2,I,K)=SP(2,I,K)*ALPH                                          B11A 271
  204 SP(3,I,K)=SP(3,I,K)*DUM4                                          B11A 272
 2041 CONTINUE                                                          B11A
      WRITE (KOUT,16)                                                   B11A 273
      DO 196 J=1,NSPEC                                                  B11A 274
  196 WRITE(KOUT,14) MOA(J),MOB(J),(FR(J,I),I=1,NETA)                   B11A 275
      IF(KR(9).EQ.3.OR.KR(9).EQ.4) WRITE(KOUT,17) MOA(ISU),MOB(ISU)
  193 CONTINUE                                                          B11A 276
  325 WALLQ=-WALLQ*C3
      RETURN
      END                                                               B11A 307
C B11B
      SUBROUTINE FELTRU                                                 B11B 002
      DIMENSION HIW( 71,3),VKIE( 71),VKIW( 71),ZIE( 71),ZIW( 71),       B11B 003
     1ZIESTR( 71),ZIWSTR( 71),ZKWSRT( 9),ZKESRT( 9),ZKWSTT( 9),ZKESTT( 9B11B 004
     2),ZISDIF( 71),ZKDIF( 9),ZKTDIF( 9),CMK( 9)                        B11B 005
      DIMENSION CIJ( 71,1)                                              B11B  06
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B11B   7
     1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                  ENTR-MOD
      COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)    B11B   9
     1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)      B11B  10
     2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)   B11B  11
     3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XH(5),XG(5),XSP(5, 9)  B11B  12
     4,CKK3( 8, 8)                                                      B11B  13
      COMMON/CRBCOM/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMIST B11B  14
     1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU            B11B  15
      COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B11B  16
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90   B11B  17
     2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                    B11B  18
      COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHCVS,PI,PIM,CL,    B11B  19
     1 EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,YREF,RETR,VINTR(15)          ENTR-MOD
      COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B11B  21
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B11B  22
     2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),        B11B  23
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTN( 71),YYY( 71),YW( 71),GG( 71)B11B  24
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B11B  25
      COMMON/EQTCOM/SIP,HIF,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B11B  26
```

```
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,BX,ISP2,ISPQ,    B11B  27
     2 ISP,KKJ,SVA,SVD,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HHG, B11B  28
     3 CCPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),BB(16),    ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,  B11B  30
     5 CP( 71),HH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),       B11B  31
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                     B11B  32
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B11B  33
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B11B  34
      COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ        B11B  35
     1,WALLJ( 8),QW,VJKW( 9),TPWALL                                     B11B  36
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B11B  37
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  B11B  38
     2,C3M(40),BETAM(40)                                                B11B  39
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB11B  40
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B11B  41
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B11B  42
     3,KAUXO,JTIME,JSPEC,MD(3)                                          B11B  43
      COMMON/OUTCOM/Y(15),RES,DELST,THENGY,THMOM,CH,BLOW,SHEAR,CF,SHAPE B11B  44
     1 ,CM( 9),THELEM( 9)                                               B11B  45
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B11B  46
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B11B  47
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B11B  48
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B11B  49
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB11B  50
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B11B  51
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B11B  52
     4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B11B  53
     5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B11B  54
     6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B11B  55
      COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)     B11B  56
     1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)     B11B  57
     2,XIINIT( 1),DUDS( 40)                                             B11B  58
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B11B  59
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B11B  60
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B11B  61
      DIMENSION GAM(10),TWC(3),SHWFP(3),SHWFE(3),SDPTIL(3),SDP(3),CHA(3)B11B
     1,CME(3),CHE(3),RAT1(3),RAT2(3),RAT3(3),TITL(3),QCHEM(3)           B11B
      EQUIVALENCE              (VNU,CIJ)                                B11A 037
  310 FORMAT(A2,3I2,1P6E12.5)                                           B11A 131
  312 FORMAT(A2,3I2,1P6E12.5/(8X,1P6E12.5))                             B11A 132
  313 FORMAT (A2,6X,18A4/(20A4))                                        B11A 133
  316 FORMAT(E12.4,3X3A6,2X2A4,3X13HMASS FRACTION /(35X2A4) )           RDG
  317 FORMAT(40I2)                                                      RDG
  318 FORMAT(E12.4,3X3A6,2X2A4,3X13HMOLE FRACTION )                     RDG
  319 FORMAT(3(13X9(2H**),14HNON-CONVERGENT 9(2H**)/))                  RDG
  320 FORMAT(F12.4,3X3A6,2X11A4)                                        RDG
  321 FORMAT(5X65(1H*)/20X27HFOLLOWING CARDS FOR RESTART  )             RDG
  322 FORMAT(5X65(1H*)/10X27HFOLLOWING -NTH SPECIES DATA/5X65(1H*))     RDG
  323 FORMAT(5X65(1H*)/30X17HEND RESTART CARDS)                         RDG
  324  FORMAT(5X65(1H*)/30X21HFOLLOWING SPECIE DATA/5X65(1H*)/E12.4,3X3ARDG
     16,2X11A4)                                                         RDG
  325 FORMAT(3E10.3,5X,I5,22X,3A6)                                      ENTR-MOD
  481 FORMAT(//38X43HELEMENTAL MASS TRANSPORT DRIVING POTENTIALS//19X 7HRDG
     1ELEMENT 5X8HZKETILDA8X8HZKWTILDA7X10HDIFFERENCE5X11HMOLE-ZKETIL5X1RDG
     21HMOLE-ZKWTIL 5X10HDIFFERENCE/(/4XI5,9X2A4,6(3X1PE12.4)) )        RDG
  482 FORMAT(/9XA4,2X0PF6.0,2X7(2X1PE12.4))                             RDG
  483 FORMAT(//10X3HAVG3X4HBASE 9X3HCME11X3HCHE 9X7HCME/CHE             RDG
     19X8HRATIO-CM 6X8HRATIO-CH 8X                                      RDG
```

```
      23HCHL10X5HQCHEM/16X4HTEMP//)                                     RDG
  490 FORMAT(1H148X24HUNEQUAL DIFFUSION OUTPUT///17X20HDIFFUSIVE HEAT FLRDG
      1UX=1PE12.4,11X9HBASE TEMP16X5HSHBFE16X6HSHDBFE/3(61X0PF6.0,14X2(1PRDG
      1E12.4,10X)/                                                      RDG
      2)///2X2(6HSPECIE18X8HENTHALPY33X)/2(18X3HTB=0PF6.0,6X3HTB=F6.0,6X3RDG
      3HTB=F6.0,10X)                                                    RDG
      4         //(3X2A4,2X3(    2X1PE12.4),13X2A4,2X3(2X1PE12.4)))     RDG
  491 FORMAT (1H142X33HEQUAL DIFFUSION ADDITIONAL OUTPUT ///10X6HSPECIE3RDG
      10X8HENTHALPY24X9HWALL MASS 8X9HEDGE MASS/27X3HTB=F6.0,9X3HTB=F6.0,RDG
      29X3HTB=F6.0, 8X8HFRACTION9X8HFRACTION                            RDG
      3         //(11X2A4,5(5X1PE12.4)))                                RDG
  492 FORMAT(//10X9HBASE TEMP8X9HRHO UE CH  X8HRATIO-CM10X8HRATIO-CH11X5RDG
      2HCM/CH11X5HQCHEM//(11X0PF6.0,3X5(5X1PE12.4)))                    RDG
  494 FORMAT(                                //42X36HGAMMA DEPENDENT TRRDG
      1ANSPORT PROPERTIES//55X 6HGAMMA=F4.2///48X23HFILM DRIVING POTENTIARDG
      2LS//2X2(   6HSPECIE10X6HZIESTR10X6HZIWSTR6X10HDIFFERENCE11X)//(3X2RDG
      3A4,2X3(2X1PE12.4),13X2A4,2X3(2X1PE12.4)))                        RDG
  496 FORMAT(//47X9HBASE TEMP16X5HSCMDP//3(48X0PF6.0,12X1PE12.4/)//35X9HRDG
      3LEWIS-2/34X6HSMDIF1                                              RDG
      2    6X6HSMDIF2 6X 6HSUMZDF//32X4(1PE12.4)                        RDG
      1         //46X36HELEMENTAL MASS TRANSPORT COEFFICIENT  //       RDG
      249X7HELEMENT10X14H RHOE UE CM(K)/                                RDG
      4         (/ 34XI5,9X2A4,1(10X1PE12.4)))                          RDG
  497 FORMAT(//(20X2I5,5X1PE12.4))                                      RDG
  498 FORMAT(E12.4,1X3A6,1X4(1PE12.4)/(2X,2A4,5X1PE12.4))               RDG
  499 FORMAT(E12.4,3X3A6,2I5,2(1PE12.4))                                RDG
  514 FORMAT(E12.4,3X3A6,2X3I5/(8(1PE10.4)))                            RDG
  515 FORMAT(8E10.3)                                                    ENTR-MOD
  516 FORMAT(E12.4,1X3A6,1X4(1PE12.4)/6X6(1PE12.4))                     RDG
  517 FORMAT(//31X2HCM15X3HCHL11X6HCM/CHL11X5HQWALL//19X4(5X(1PE12.4))//RDG
      1)                                                                RDG
  518 FORMAT(27X9HBASE TEMP10X5HSCMDP12X5HSHBFE11X6HSHDBFE//(30X0PF6.0,3RDG
      1(5X1PE12.4)))                                                    RDG
       DATA GAM(1),GAM(2),GAM(3),GAM(4),GAM(5),GAM(6),GAM(7),NGAM/0.0,0.2RDG
      1,0.4,0.6,0.8,1.0,1.5,7/                                          RDG
       DATA TITL(1),TITL(2),TITL(3)/4HMEAN,4HMASS,4HMOLE  /             RDG
       DATA IFG/2HFG/,IBO/2HBO/                                         RDG
       DATA IBLANK/2H  /
       NUL=0
       WALLQ=-WALLQ/C3
       VLEX=(PR(1)/SC(1))**(2./3.)
       RERAD = (.481E-12) * (T(1))**4. * EMIS
       DUM1 = RHOE(IS)*UE(IS)/VMUE(IS)
       DUM2 = RHOVW(IS,IT)/C3
       TIMEO=ABS(TIME(ITEM) )
       IF(NON) 621,622,611
  621 IF(JTIME) 611,405,405
  622 IF(IDENT-IBLANK) 194,309,194
  194 IF(IDENT-IFG) 308, 607,308
  611 PUNCH 319
       GO TO 607
  308 DUM3=RHOE(IS)*UE(IS)                                              B11A 278
       DUM4=-1./C3                                                      B11A 279
       PUNCH 320,TIMEO,MD,(CASE(I),I=1,11)
       L=0                                                              B11A 280
       PUNCH 310,IDENT,L,IS,ITEM,RADNO,CONE,GE(ITEM),PTET(ITEM),S(IS),  B11A 281
      1 TIME(ITEM)                                                      B11A 282
       IF (IS+ITEM-2) 315,314,315                                       B11A 283
```

```
  314 PUNCH 313, IDENT,(MOA(J),MOB(J),J=1,NSPEC),(ATA(J),ATB(J),J=1,NSP)B11A 284
  315 L=1                                                              B11A 285
      PUNCH 310,IDENT,L,IS,ITEM,DUM2,T(1),PE(IS,1),BLOW,CH,CF          B11A 286
      L=2                                                              B11A 287
      PUNCH 310,IDENT,L,IS,ITEM,WALLQ,DER(3),RERAD
      L=3                                                              B11A 289
      PUNCH 310,IDENT,L,IS,ITEM,DUM4,DUM3,DUM1,UE(IS),PR(1),SC(1)      B11A 290
      L=4                                                              B11A 291
      PUNCH 310,IDENT,L,IS,ITEM,CAPC(1),SHEAR,DELST,THMOM,SHAPE,THENGY B11A 292
      IF (KR(7)) 309,311,309                                           B11A 293
  311 L=5                                                              B11A 294
      PUNCH 310,IDENT,L,IS,ITEM,(VJKW(J),J=1,NSP)                      B11A 295
      L=6                                                              B11A 296
      PUNCH 310,IDENT,L,IS,ITEM,(  CM(J),J=1,NSP)                      B11A 297
      L=7                                                              B11A 298
      PUNCH 310,IDENT,L,IS,ITEM,(THELEM(J),J=1,NSF)                    B11A 299
      L=8                                                              B11A 300
      PUNCH 312,IDENT,L,IS,ITEM,(FR(J,1),J=1,NSPEC)                    B11A 301
      L=9                                                              B11A 302
      PUNCH 312,IDENT,L,IS,ITEM,(FR(J,NETA),J=1,NSPEC)                 B11A 303
      IF(IDENT-IBO) 606,607,606
  606 IF(IDENT-IFG) 608,607,608
  607 IF(IDISC(IS)) 608,608,609
  609 PUNCH 320,TIMEO,MD,(CASE(I),I=1,11)
      PUNCH 514,TIMEO,MD,NSP,NSPEC,NETA,(Y(I),I=1,NETA)
      PUNCH 316,TIMEO,MD,(MOA(K),MOB(K),K=1,NSP)
      PUNCH 321
      ALSQ=ALPH*ALPH
      DER(1)=F(3,1)/ALSQ
      PUNCH 325,ALPH,F(1,1),DER(1),IS,MD
      DO 603 J=1,NETA
  603 DER(J)=F(2,J)/ALPH
      PUNCH 515,(DER(J),J=1,NETA)
      DO 601 K=NUL,NSPM1
      DER(1)=SP(2,1,K)/ALPH
  601 PUNCH 515,DER(1),(SP(1,J,K),J=1,NETA)
      PUNCH 317,SLEF(K),K=1,NSP)
      PUNCH 323
  608 IF(NON) 405,309,405
  309 IF(JSFEC) 624,623,624
  624 PUNCH 324,TIMEO,MD,(CASE(I),I=1,11)
      PUNCH 514,TIMEO,MD,NSP,NSPEC,NETA,(Y(I),I=1,NETA)
      DO 602 J=1,NSPEC
      PUNCH 318,TIMEO,MD,MOA(J),MOB(J)
  602 PUNCH 515, (FR(J,I),I=1,NETA)
  623 GO TO (405,404,404,404),KAUXO
  404 TWC(1)=T(1) / 1.8
      TWC(3)=T(NETA)/1.8
      TWC(2)=(TWC(1)+TWC(3))/2.0
      SOP(1 )=0.
      SOP(2 )=0.
      SOP(3 )=0.
      SUME=0.
      SUMW=0.
      SUMZIE=0.0
      SUMZIW=0.0
      DO 1001 LT=1,3
      TB = TWC(LT)-3000.0
```

```
      TCC=(TWC(LT)+3000.0)/2.0
      TO = TWC(LT)* 3000.0
      SHWFE (LT)= 0.0
        SHWFP(LT)=0.0
      DO 400 I=1,NSPEC
       IF(IFC(I)) 419,418,419
  419 IF(IABS(IFC(I)) - 3) 420,418,420
  420 ZIW(I)=0.0
      ZIE(I)=0.0
      GO TO 400
  418 VKIE(I) = WTM(I) * FR(I,NETA)/VMW(NETA)
      VKIW(I) = WTM(I) * FR(I,1)/VMW(1)
      IF(TU(I,1)-TWC(LT)) 401,402,402
  401 KT=2
      GO TO 403
  402 KT=1
  403 HIW(I,LT)=(RB(I,KT)+TB*(RC(I,KT)+RD(I,KT)*TCC+RE(I,KT
     1)/TD))* 1.8/WTM(I)
      SDP(LT) = SDP(LT) + (VKIE(I)-VKIW(I)) * HIW(I,LT)
        SHWFP(LT)=SHWFP(LT)+VKIW(I)*(HIW(I,1)-HIW(I,LT))
      SHWFE(LT) = SHWFE(LT) + HIW(I,LT) * VKIE(I)
      GO TO (400,406,406,400),KAUXO
  406 ZIE(I)=VKIE(I)*VMW(NETA)/FF(I)
      SUMZIE=SUMZIE + ZIE(I)
      ZIW(I) = VKIW(I)*VMW(1)/FF(I)
      SUMZIW = SUMZIW + ZIW(I)
  400 CONTINUE
 1001 CONTINUE
      IF(KAUXO-4) 408,417,405
  417 CHL=CM(NSP)/VLEX
      DO 1417 LT=1,3
      QCHEM(LT)=WALLQ-CM(NSP)*SDP(LT)-CHL*(G(1,NETA)-SHWFE(LT)-SHWFP(LT)
     1)
      CHA(LT) = (WALLQ-CM(NSP) * SDP(LT))/(G(1,NETA)-SHWFE(LT)-SHWFP(LT)
     1)
      RAT1(LT)=SDP(LT)/WALLQ*CM(NSP)
       RAT2(LT)=(G(1,NETA)-SHWFE(LT)-SHWFP(LT))/WALLQ*CHA(LT)
 1417 RAT3(LT)=CM(NSP)/CHA(LT)
      WRITE (KOUT,491)(TWC(LT),LT=1,3), (MOA(I),MOB(I),(HIW(I,LT),LT=1,3
     1),VKIW(I),VKIE(I),I=1,NSPEC)
      CMCHL=CM(NSP)/CHL
      WRITE(KOUT,517) CM(NSP),CHL,CMCHL, WALLQ
       WRITE(KOUT,518)(TWC(LT),SDP(LT),SHWFE(LT),SHWFP(LT),LT=1,3)
      WRITE (KOUT,492)(TWC(LT),CHA(LT),RAT1(LT),RAT2(LT),RAT3(LT),QCHEM(
     1LT),LT=1,3)
      GO TO 405
  408 DO 409 I=1,NSPEC
      ZIE(I) = ZIE(I) / SUMZIE
      ZIW(I) = ZIW(I)/SUMZIW
      SUME=SUME+ZIE(I)
  409 SUMW=SUMW+ZIW(I)
      PUNCH 320,TIMEO,MD,(CASE(I),I=1,11)
      PUNCH 499,TIMEO,MD,NGAM,NSP,PE(IS,IT),H(NETA)
      WRITE(KOUT,490) WALLQ,(TWC(LT),SHWFE(LT),SHWFP(LT),LT=1,3),(TWC(LT
     1),LT=1,3),(TWC(LT),LT=1,3),(MOA(I),MOB(I),
     2(HIW(I,LT),LT=1,3),I=1,NSPEC)
      ISP=IZ+1
      DO 410 L=1,NGAM
```

```
      SUME=0.
      SUMW=0.
      SUMZIE=0.0
      SUMZIW=0.0
      BETS= 1-GAM(L)
      DO 411 I=1,NSPEC
      ZIESTR(I)=ZIE(I) ** GAM(L) * VKIE(I)   ** BETS
      ZIWSTR(I)=ZIW(I) ** GAM(L) * VKIW(I) ** BETS
      SUMZIE=SUMZIE+ZIESTR(I)
  411 SUMZIW=SUMZIW + ZIWSTR(I)
      SDPTIL(1) = 0.0
      SDPTIL(2) = 0.0
      SDPTIL(3) = 0.0
      CMKA=0.0
       CMKB=0.0
      SUMELT = 0.0
      SUMSDF=0.0
      DO 414 I=1,NSPEC
      ZIESTR(I) = ZIESTR(I)/SUMZIE
      ZIWSTR(I)=ZIWSTR(I) / SUMZIW
      ZISDIF(I)=ZIESTR(I)-ZIWSTR(I)
      SUMSDF=SUMSDF+ZISDIF(I)
      DO 414  LT=1,3
  414 SDPTIL(LT) = SDPTIL(LT) +(ZIESTR(I)-ZIWSTR(I)) * HIW(I,LT)
      SMDIF1=0.0
      SMDIF2=0.0
      DO 413 KK=1,NSP
      IF (LEF(KK)-0) 416,416,415
  416 CMK(KK)=0.0
      GO TO 413
  415 ZKESRT(KK)=0.0
      ZKWSRT(KK)=0.0
      ZKESTT(KK)=0.0
      ZKWSTT(KK)=0.0
      DO 421 I=1,NSP
      BETS=CIJ(KK,I)/WTM(I)*WAT(KK)
      ZKESRT(KK)=ZKESRT(KK)+BETS*ZIESTR(I)
  421 ZKWSRT(KK)=ZKWSRT(KK)+BETS* ZIWSTR(I)
      DO 412 I=ISP,NSPEC
      DO 412 K=1,NSP
      BETS=VNU(I,K)*CIJ(KK,K)/WTM(I)*WAT(KK)
      ZKESRT(KK) = ZKESRT(KK) + BETS * ZIESTR(I)
  412 ZKWSRT(KK)=ZKWSRT(KK) + BETS*ZIWSTR(I)
      ZKDIF(KK)=ZKESRT(KK)-ZKWSRT(KK)
      SMDIF1=SMDIF1+ABS(ZKESRT(KK)-ZKWSRT(KK))
      ZKESTT(KK)=ZKESRT(KK)/WAT(KK)*VMW(NETA)
      ZKWSTT(KK)=ZKWSRT(KK)/WAT(KK)*VMW(1)
      ZKTDIF(KK)=ZKESTT(KK)-ZKWSTT(KK)
      SMDIF2=SMDIF2+ABS(ZKESTT(KK)-ZKWSTT(KK))
      CMK(KK)=VJKW(KK)/(ZKESRT(KK)-ZKWSRT(KK))
      CMKA=CMKA+CMK(KK)
      SUMELT=SUMELT + 1.0
  413 CONTINUE
      WRITE(KOUT,494) GAM(L),(  MCA(I),MOB(I),ZIESTR(I),ZIWSTR(I),ZISDIF
     1(I),I=1,NSPEC)
      WRITE(KOUT,481) (K,ATA(K),ATB(K),ZKESRT(K),ZKWSRT(K),ZKDIF(K),ZKES
     1TT(K),ZKWSTT(K),ZKTDIF(K)        ,K=1,NSP)
      WRITE(KOUT,496)(TWC(LT),SDPTIL(LT),LT=1,3),VLEX,SMDIF1,SMDIF2,SUMS
```

```
      1DF,(K,ATA(K),ATB(K),CMK(K),K=1,NSP)
       WRITE(KOUT,483)
       DO 680 LL=1,3
       CME(LL)=0.0
       GO TO (643,    645,646),LL
  643  CME(LL)=CMKA/SUMELT
       GO TO 647
  645  DO 667 K=1,NSP
       IF(LEF(K)) 667,667,666
  666  CME(LL)=CME(LL)+ABS(VJKH(K)  )
  667  CONTINUE
       CME(LL)=CME(LL)/SMDIF1
       GO TO 647
  646  DO 668 K=1,NSP
       IF(LEF(K)) 668,668,665
  665  CME(LL  )=CMK(K )* ABS(ZKESTT(K)-ZKWSTT(K))  +CME(LL)
  668  CONTINUE
       CME(LL)=CME(LL)/SMDIF2
  647  CHL=CME(LL)/VLEX
       DO 1009 LT=1,3
        QCHEM(LL)=WALLQ-CME(LL)*SDPTIL(LT) -CHL*(G(1,NETA)-SHWFE(LT)-SHWF
      1P(LT))
       CHE(LL)=(WALLQ-CME(LL) * SDPTIL(LT))/(G(1,NETA)-SHWFE(LT)-SHWFP(LT
      1))
       RAT1(LL)= SDPTIL(LT)/WALLQ*CME(LL)
       RAT2(LL)= (G(1,NETA) -SHWFE(LT)-SHWFP(LT))/WALLQ*CHE(LL)
       RAT3(LL)=CME(LL)/CHE(LL)
       WRITE (KOUT,482)TITL(LL),TWC(LT), CME(LL),CHE(LL),RAT3(LL),
      1RAT1(LL),RAT2(LL),CHL,QCHEM(LL)
       IF (IDENT-IBLANK) 1410,1009,1410
 1410  PUNCH 516,TIMEO,MD,PE(IS,IT),H(NETA),GAM(L),CME(LL),CHE(LL),RAT3(L
      1L),RAT1(LL),RAT2(LL),CHL,QCHEM(LL)
 1009  CONTINUE
  680  CONTINUE
       IF (IDENT-IBLANK) 1411,410,1411
 1411  PUNCH 498,TIMEO,MD,PE(IS,IT),H(NETA),GAM(L),CME(1),(ATA(K).ATB(K),
      1CMK(K),K=1 ,NSP)
  410  CONTINUE
  405  WALLQ=-WALLQ*C3
       RETURN                                                          B11A 306
       END                                                             B11A 307
C B128                                                                 B128 001
       SUBROUTINE IMONE                                                B128 002
       COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B128   3
      1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C3A,CB128   4
      232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B128   5
      3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB128   6
      465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B128   7
      5,C82,C83,C84,C85,C86,C87,C88                                    B128   8
       COMMON/COECOM/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B128   9
      1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B128  10
      2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B128  11
      3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B128  12
      4,CKK3( 8, 8)                                                    B128  13
       COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM   B128  14
      1,SPLEM( 8),ELM(14),ELMK,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)   B128  15
      2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 9),ENL(153)    B128  16
      3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)  B128  17
```

```
      4,NEWLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                B128  18
       COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)        B128  19
      1,LAR(153),BA1(43,18),BA2(30,15)                                     B128  20
       COMMON/HISCOM/C1,C2,C3,C4,ALPHO,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B128  21
      1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2   B128  22
      2,C3M(40),BETAM(40)                                                  B128  23
       COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,MB128  24
      1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B128  25
      2,B(8),      MHE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B128  26
      3,KAUXO,JTIME,JSPEC,MO(3)                                            B128  27
       COMMON/NONCOM/AM(153,153),DVNL(153),TCH,                            B128  28
      1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLLXJB( 9)                B128  29
       COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)    B128  30
      1,CPBAR(15),VMW(15),PHIK(15, 8),ORHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB128  31
      2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),CPRK( 8),DSCK( 8),DCAPCK( 8)B128  32
      3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZXK( 8, 8)   B128  33
      4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B128  34
      5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B128  35
      6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B128  36
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                     B128  37
C      EVALUATE GROUPINGS WHICH CONTRIBUTE TO (I-1) PORTION OF COEFFS     B128 041
C      VARIABLES WITH DIMENSION (NETA-1)                                  B128 042
 4000 CRHO(I-1)=C26*DETA(I-1)*(1.-C53/6.0*DETA(I-1))                      B128 044
       C63=C6*CRHO(I-1)                                                   B128 045
       IF (I-2) 4001,4002,4001                                            B128 052
 4002 XM(5)=0.                                                            B128 053
       XG(5)=0.                                                           B128 054
       IF (NSPM1) 401,401,4003                                            B128 055
 4003 DO 4004 K=1,NSPM1                                                   B128 056
 4004 XSP(5,K)=0.                                                         B128 057
 4001 CONTINUE
C      EVALUATE XM,XG,AND XSP (WHICH CONTRIBUTE TO ERRORS AND TO COEFFS   B128 065
C      AT (I) AND AT (I-1))                                               B128 066
  401 CALL TAYLOR (DETA(I-1),F(2,I-1),F(2,I),XM)                          B128 067
       CALL TAYLOR (DETA(I-1),G(1,I-1),G(1,I),XG)                         B128 068
       IF(NSPM1)403,403,404                                               B128 069
  404 DO 414 K=1,NSPM1                                                    B128 070
  414 CALL TAYLOR (DETA(I-1),SP(1,I-1,K),SP(1,I,K),XSP(1,K))              B128 071
C      EVAL PORTION OF NLE DEPENDENT ON XM,... AND GROUPINGS EVAL AT I-1 B128 072
  403 C72=F(2,I)*XM(1)     +F(3,I)*XM(2)     +F(4,I)*XM(3) +F(4,I-1)*XM(4)B128 073
       XM(5)=XM(5)+C72                                                    B128 074
       ENL(I+3)=-(-C33+C63/2.-C9*C72-2.*(F(2,I)*ZM(1,I-1)+F(3,I)*ZM(2
      1,I-1)+F(4,I)*ZM(3,I-1)+F(4,I-1)*ZM(4,I-1)))                        B128 076
       DUM1=F(2,I)*XG(1)+F(3,I)*XG(2)+F(4,I)*XG(3)+F(4,I-1)*XG(4)         B128 077
       XG(5)=XG(5)+DUM1                                                   B128 078
       MPI=MAT1J+I
       ENL(MPI)=-(-C84+C2*DUM1-(F(2,I)*ZG(1,I-1)+F(3,I)*ZG(2,I-1)+F(4,I)*
      1ZG(                                                                B128 080
      23,I-1)+F(4,I-1)*ZG(4,I-1))-(G(1,I)*ZM(1,I-1)+G(2,I)*ZM(2,I-1)+G(3,B128 081
      3I)*ZM(3,I-1)+G(3,I-1)*ZM(4,I-1)))                                  B128 082
       IF(NSPM1)405,405,406                                               B128 085
  406 DO 407 K=1,NSPM1
       MPI=MPI+MAT2J
       DUM1=F(2,I)*XSP(1,K)+F(3,I)*XSP(2,K)+F(4,I)*XSP(3,K)+F(4,I-1)* XSPB128 087
      1(4,K)                                                              B128 088
       XSP(5,K)=XSP(5,K)+DUM1                                             B128 089
       ENL(MPI)=-(-CK22(K)+C2*DUM1-(F(2,I)*ZSP(1,I-1,K)+F(
      23,I)*ZSP(2,I-1,K)+F(4,I)*ZSP(3,I-1,K)+F(4,I-1)*ZSP(4,I-1,K))-(SP(1B128 091
```

```
          3,I,K)*ZM(1,I-1)+SP(2,I,K)*ZM(2,I-1)+SP(3,I,K)*ZM(3,I-1)+SP(3,I-1,KB128 092
          4)*ZM(4,I-1)))
      407 CONTINUE                                                          B128 093
C         EVAL PORTION OF ORIG COEFFS OF AM DEPENDENT UPON PARAM EVAL AT I-1B128 096
C**** ESTABLISH INDICES ON VARIABLES
      405 NUL=0
          IFN=I-2
          IFP=I+2
          IFPP=NETA+I-3
          IFPPP=IFPP+NETA
          ISPN=I
          ISPP=I-1
          ISPPP=IFPP+2
C**** MOMENTUM EQUATION CORRECTION COEFFICIENTS
          AM(I+3,1)=-C81+C87*DETA(I-1)
          AM(I+3,IFP)=-C74+C86*DETA(I-1)
          IF(I-2) 410,410,415
      410 AM(I+3,2)=-C73
          AM(I+3,3)=-C12
          GO TO 420
      415 CALL LIAD(-1,I+3,IFN,-C73)
          CALL LIAD(-1,I+3,IFPP,-C12)
      420 CALL LIAD(-1,I+3, IFPPP,-2.*(C9 * XM(4)+ZM(4,I-1)))
          LPI=ISPN+MAT1J
          DO 450 K=NUL, NSPM1
          IF(K) 425,425,430
      425 DUM1=C88*CETA(I-1)-C75
          DUM2=0.
          GO TO 435
      430 DUM1=CK13(K)*DETA(I-1)-CK17(K)
          DUM2=0.
      435 AM(I+3,LPI)=DUM1
          IF(I-2) 440,440,445
      440 AM(I+3,LPI-1) = DUM2
          GO TO 450
      445 CALL LIAD(K,I+3, ISPP, DUM2)
      450 LPI=LPI+MAT2J
C**** ENERGY AND SPECIES EQUATIONS
          MPJ=MAT1J+I
          DO 535 K=NUL, NSPM1
C* *  ALF, F, FP, FPP, FPP ERROR DERIVITIVES ARE DUM1 TO DUM5. DUM6 TO
C* *  DUM8 ARE FLUX DERIVITIVES FOR ALF, FP, FPP.
          IF(K) 455,455,460
C- -  ENERGY EQUATIONS
      455 DUM1=-C82
          DUM2=-C76
          DUM3=-C77
          DUM4=-C78
          DUM6=C82
          DUM7=C77
          DUM8=C78
          GO TO 465
C- -  SPECIES EQUATIONS
      460 DUM1=-(CK21(K)+2.*C56 *CK15(K))
          DUM2=-CK15(K)
          DUM3=-CK1*(K)+CK15(K)
          DUM4=-CK28(K)+C10*CK14(K)
          DUM6=CK21(K)
```

```
      DUM7=CK19(K)
      DUM8=CK20(K)
  465 DUM5=C2 *XSP(4,K)-ZSP(4,I-1,K)
      AM(MPJ,1)=DUM1
      AM(MPJ,IFP)= DUM3
      IF(I-2) 470,470,472
  470 AM(MPJ,2)=DUM2
      AM(MPJ,3)= DUM4
      AM(MPJ-1,1)= DUM6
      AM(MPJ-1, IFP)= DUM7
      AM(MPJ-1,3)= DUM9
      GO TO 475
  472 CALL LIAD(-1,MPJ,IFN,DUM2)
      CALL LIAD(-1, MPJ, IFPP, DUM4)
  475 CALL LIAD(-1,MPJ, IFPPP, DUM5)
      LPI= ISPN+MAT1J
      DO 530 KK=NUL, NSPM1
C * * DUM1/DUM4 AND DUM2/DUM5 ARE ERROR/FLUX DERIVATIVES WRT G OR SP AND
C * * GP OR SPP, RESP.
      IF(K-KK) 480,480,485
C - - ENERGY EQ. G VARIABLES
  480 DUM2=-C80
      DUM4=C43
      DUM5=C80
      GO TO 515
  485 IF(K) 490,490,495
C - - ENERGY EQUATION, SP VARIABLES
  490 DUM1=-CK1(KK)
      DUM2=-CK2(KK)
      DUM4=-DUM1
      DUM5=-DUM2
      GO TO 508
  495 IF(KK) 500,500,505
C - - SPECIES EQS., G VARIABLES
  500 DUM1=-CK9(K)
      DUM2=-CK5(K) + CK14(K)
      DUM4=CK9(K)
      DUM5=CK5(K)
      GO TO 508
C - - SPECIES EQS., SP VARIABLES
  505 DUM1=-CKK2(K,KK)
      DUM2=-CKK1(K,KK)+B1(I-1)*CKK3(K,KK)
      DUM4=-DUM1
      DUM5=CKK1(K,KK)
      IF(K-KK) 508,515,508
  515 DUM1= -DUM4-C14
  508 AM(MPJ,LPI)=DUM1
      IF(I-2) 510,510,525
  510 AM(MPJ, LPI-1)= DUM2
  520 AM(MPJ-1, LPI) =DUM4
      AM(MPJ-1,LPI-1)=DUM5
      GO TO 530
  525 CALL LIAD(KK,MPJ, ISPP, DUM2)
  530 LPI=LPI+MAT2J
      CALL LIAD(K,MPJ,ISPPP,C2 *XM(4)-ZM(4,I-1))
  535 MPJ=MPJ+MAT2J
      RETURN
      END
```

```
CB13B                                                                   B13B 001
      SUBROUTINE IONLY                                                  B13B 002
      DIMENSION CK23( 8),CK24( 8),CK25( 8),CK26( 8)                     B13B 003
      COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B13B   4
     1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB13B   5
     232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B13B   6
     3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB13B   7
     465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B13B   8
     5,C82,C83,C84,C85,C86,C87,C88                                      B13B   9
      COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)    B13B  10
     1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)      B13B  11
     2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)   B13B  12
     3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9)  B13B  13
     4,CKK3( 8, 8)                                                      B13B  14
      COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM     B13B  15
     1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)     B13B  16
     2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)      B13B  17
     3,FNLEM,GNLEM,SPNLEM( 8),          FNLMM,IFNLM,IGNLM,ISPNLM( 8)    B13B  18
     4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)              B13B  19
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B13B  20
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B13B  21
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B13B  22
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  B13B  23
     2,C3M(40),BETAM(40)                                                B13B  24
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB13B  25
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B13B  26
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B13B  27
     3,KAUXO,JTIME,JSPEC,MD(3)                                          B13B  28
      COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                          B13B  29
     1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)               B13B  30
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B13B  31
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHCH,DRHOK( 8),ZK( 8),DZKH( 8),  DB13B  32
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B13B  33
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B13B  34
     4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B13B  35
     5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B13B  36
     6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B13B  37
      DIMENSION CYM(3),CXM(3),CYSP(3)
C     ADD CONTRIBUTIONS OF I TO NONLINEAR ERRORS                         B13B 038
C     EVALUATE GROUPINGS WHICH ARE USED ONLY AT I (NOT AT I-1)           B13B 039
 4000 CRHO1= C26*DETA(I-1)*(1.+C53/6.0*DETA(I-1))                        B13B 041
      C89=C6*CRHO1                                                      B13B 042
      CRHO(I-1)=(CRHO(I-1)+CRHO1)/2.                                    B13B 043
      ENL(I+3)=ENL(I+3)-(C83+C89/2.)
      MPI=MAT1J+I
      ENL(MPI)=ENL(MPI)-C84
      IF(NSPM1)403,403,402                                              B13B 051
  402 DO 436 K=1,NSPM1                                                  B13B 052
      MPI=MPI+MAT2J
      ENL(MPI) =ENL(MPI) -(CK22(K)-(PHIK(I,K)*DETA(I-1)-PHIKP(K)*B2(I-1)
     1-CK16(K)))
  436 CONTINUE
  404 DO 467 K=1,NSPM1                                                  B13B 057
      CK23(K)=B2(I-1)*DPHIKH(K)                                         B13B 058
      CK24(K)=C13*CK23(K)                                               B13B 059
      CK25(K)=DETA(I-1)*DPHIKH(K)                                       B13B 060
  467 CK26(K)=C10*CK25(K)                                               B13B 061
C     EVAL PORTION OF ORIG COEFFS OF AM DEPENDENT UPON PARAM EVAL AT I  B13B 062
```

```
C**** ESTABLISH INDICES FOR VARIABLES
  403 NUL=C
      IFN=I-1
      IFP=I+3
      IFPP=NETA+I-2
      IFPPP=IFPP+NETA
      ISPN=I+1
      ISPP=I
      ISPPP=IFPP+2
      DO 405 L=1,3
      CYM(L)=C2*XM(L)-ZM(L,I-1)
  405 CXM(L)=-(C9*XM(L) + ZM(L,I-1))*2.
C**** MOMENTUM EQUATION
      AM(I+3,1)=AM(I+3,1)+C81-C5*C8*C72+C87*DETA(I-1)
      AM(I+3,IFP)=AM(I+3,IFP)+C74+C86*DETA(I-1)+CXM(1)
      CALL LIAD(-1,I+3,IFN,C73)
      CALL LIAD(-1,I+3,IFPP,C12+CXM(2))
      CALL LIAD(-1,I+3,IFPPP,CXM(3))
      LPI= ISPN+MAT1J
      DO 425 K=NUL, NSPM1
      IF(K) 410,410,415
  410 DUM1=C75+C88*DETA(I-1)
      DUM2=0.
      GO TO 416
  415 DUM1=CK13(K)*DETA(I-1)+CK17(K)
      DUM2=0.
  416 IF(I-NETA) 420,417,420
  417 CALL LIAD(K,I+3,1,DUM1)
      GO TO 421
  420 AM(I+3,LPI)=AM(I+3,LPI)+DUM1
  421 CALL LIAD (K,I+3,ISPP,DUM2)
  425 LPI=LPI+MAT2J
C**** ENERGY AND SPECIES EQUATIONS
      MPJ=MAT1J+I
      DO 490 K=NUL, NSPM1
      DO 428 L=1,3
  428 CYSP(L)=C2*XSP(L,K)-ZSP(L,I-1,K)
C * * ALF, F, FP, FPP, FPPP ERROR DERIVITIVES ARE DUM1 TO DUM5.
      IF(K) 430,430,435
C - - ENERGY EQ.
  430 DUM1=C82
      DUM2=C76
      DUM3=C77+CYSP(1)
      DUM4=C78+CYSP(2)
      GO TO 440
C - - SPECIES EQS.
  435 DUM1= CK21(K) +C56 *(CK26(K)-2. *CK24(K))
      DUM2=CK18(K)
      DUM3=CK19(K) + CK24(K)-CK26(K)+CYSP(1)
      DUM4=C10*(CK5(K)+CK23(K)) + CYSP(2)
  440 DUM5= CYSP(3)
      AM(MPJ,1)= AM(MPJ,1) + DUM1
      AM(MPJ, IFP)= AM(MPJ, IFP) + DUM3
      CALL LIAD(-1, MPJ, IFN,DUM2)
      CALL LIAD(-1, MPJ, IFPP, DUM4)
      CALL LIAD(-1, MPJ, IFPPP, DUM5)
      LPI= ISPN+MAT1J
      DO 485 KK=NUL,NSPM1
```

```
C * * DUM1 AND DUM2 ARE ERROR DERIVITIVES WRT G OR SP AND GP OR SPP
      IF(K+KK) 445,445,450
C - - ENERGY EQ., G VARIABLES
  445 DUM1=C43
      DUM2=C80
      GO TO 475
  450 IF(K) 455,455,460
C - - ENERGY EQ., SP VARIABLES
  455 DUM1=CK1(KK)
      DUM2=CK2(KK)
      GO TO 480
  460 IF(KK) 465,465,470
C - - SPECIES EQS., G VARIABLES
  465 DUM1= CK9(K)-CK25(K)
      DUM2=CK5(K)+CK23(K)
      GO TO 480
C - - SPECIES EQS., SPECIES VARIABLES
  470 DUM1=CKK2(K,KK)-DPHIKK(K,KK)*DETA(I-1)
      DUM2=CKK1(K,KK)+B2(I-1) * DPHIKK(K,KK)
      IF(K-KK) 480,475,480
  475 DUM1=DUM1+CYM(1)+C14
      DUM2=DUM2+CYM(2)
  480 IF(I-NETA) 483,482,483
  482 CALL LIAD(KK,MPJ,1,DUM1)
      GO TO 484
  483 AM(MPJ,LPI)=AM(MPJ,LPI)+DUM1
  484 CALL LIAD(KK,MPJ,ISPP,DUM2)
  485 LPI= LPI+MAT2J
      CALL LIAD(K,MPJ,ISPPP, CYM(3))
  490 MPJ=MPJ+MAT2J
      RETURN
      END                                                              B13B 307
CB14A                                                                  B14A 001
      SUBROUTINE STATE
      COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B14A   3
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90   B14A   4
     2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                    B14A   5
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB14A   6
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B14A   7
     2,B(8),       MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B14A   8
     3,KAUXO,JTIME,JSPEC,MD(3)                                          B14A   9
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B14A  10
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B14A  11
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B14A  12
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B14A  13
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB14A  14
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B14A  15
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B14A  16
     4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B14A  17
     5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B14A  18
     6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B14A  19
      COMMON/STTCOM/GAM1,PRDUM,PRA,PRB,PRC,PRD,VMUA,VMUB,VMUC,VMUD,NC,  B14A  20
     1 FLD(6,3),VMWD                                                    B14A  21
      VMWE=VMWD
      KQ(6)=KQ(6)-1                                                     B14A 025
      KQ(7)=IABS(KR(18)*5)-4                                            B14A 026
      IF (KQ(5)-1 100,200,100
  100 TE(IS)=3000.
```

```
      WRITE(KOUT,991)
      IHET=50
      IJK=3
      HE=GE(ITEM)
  110 HET=FLD(1,IJK)+FLD(2,IJK)+FLD(3,IJK)*(TE(IS)-5400.)+.5*FLD(4,IJK)*
     1(TE(IS)**2.-5400.**2.)-FLD(5,IJK)*(1./TE(IS)-1./5400.)
      CPT=FLD(3,IJK)+FLD(4,IJK)*TE(IS)+FLD(5,IJK)/TE(IS)**2.
      ERC=(HET-HE     )/CPT
      ITER=51-IHET
      ERC=SIGN(AMIN1(ABS(ERC),700.),ERC)
      TE(IS)=TE(IS)-ERC
      IF(TE(IS).LT.3600.) GO TO 120
      IF(TE(IS).GE.5400.) GO TO 125
      IJK=2
      GO TO 130
  120 IJK=1
      GO TO 130
  125 IJK=3
  130 CONTINUE
      IHET=IHET-1
      IF (IHET) 400,400,140
  140 IF (ABS(ERC)-.1)150,150,110
  150 SSTAG=FLD(6,IJK)+FLD(3,IJK)*ALOG(TE(IS)/5400.)+FLD(4,IJK)*(TE(IS)-
     15400.)-.5*FLD(5,IJK)*((1./TE(IS))**2.-(1./5400.)**2.)
      DO 155 II=1,NS
  155 TE(II)=TE(IS)
      VMACH=0.
  160 RHOE(IS)=PE(IS,IT)/TE(IS)*VMWE/0.7303
      UE(IS)=SQRT((GE(ITEM)-HE     )*50073.)
      VMUE(IS)=(VMUA*TE(IS)**VMUB)/(VMUC*TE(IS)+VMUD)
      GAM1=CPT/(CPT-1.9869/VMWE)
      IF (KQ(5).EQ.2) GO TO 165
      WRITE(KOUT,995)S(IS),TE(IS),CPT,PE(IS,IT),RHOE(IS),VMUE(IS),UE(IS)
     1,HE,SSTAGA,VMACH
      GO TO 166
  165 WRITE(KOUT,993)TE(IS),PE(IS,IT),UE(IS),VMACH,GAM1,HET,SSTAG,CPT,
     1RHOE(IS),VMUE(IS)
  166 KQ(6)=-1
  170 RETURN
  200 SSTAG=SSTAG-DSIP(IS)
      SSTAGA=SSTAG+1.9869/VMWE*ALOG(1./PTET(ITEM))
      DUM1=SSTAG+1.9869/VMWE*ALOG(PRE(IS))
      IST=50
  210 DS=-DUM1+FLD(6,IJK)+FLD(3,IJK)*ALOG(TE(IS)/5400.)+FLD(4,IJK)*(TE(I
     1S)-5400.)-.5*FLD(5,IJK)*((1./TE(IS))**2.-(1./5400.)**2.)
      CPT=FLD(3,IJK)+FLD(4,IJK)*TE(IS)+FLD(5,IJK)/TE(IS)**2.
      ERC=DS*TE(IS)/CPT
      ITER=51-IST
      ERC=SIGN(AMIN1(ABS(ERC),700.),ERC)
      TE(IS)=TE(IS)-ERC
      IF(TE(IS).LT.3600.) GO TO  212
      IF(TE(IS).GE.5400.) GO TO 214
      IJK=2
      GO TO 216
  212 IJK=1
      GO TO 216
  214 IJK=3
  216 CONTINUE
```

```
      IST=IST-1
      IF (IST) 400,400,220
  220 IF (ABS(ERC)-.1)230,230,210
  230 HE=FLD(1,IJK)+FLD(2,IJK)+FLD(3,IJK)*(TE(IS)-5400.)+.5*FLD(4,IJK)*(
     1TE(IS)**2.-5400.**2.)-FLD(5,IJK)*(1./TE(IS)-1./5400.)
      VMACH=SQRT(2.*(GE(ITEM)-HE)*VMWE/GAM1/TE(IS)/1.9869)
      GO TO 160
  300 IHT=50
      IF (IS+ITEM-2)301,301,302
  301 T(I)=3000.
  302 HT=FLD(1,IJK)+FLD(2,IJK)+FLD(3,IJK)*(T(I)-5400.)+.5*FLD(4,IJK)*(T(
     1I)**2.-5400.**2.)-FLD(5,IJK)*(1./T(I)-1./5400.)
      CPBAR(I)=FLD(3,IJK)+FLD(4,IJK)*T(I)+FLD(5,IJK)/T(I)**2.
      ERC=(HT-H(I))/CPBAR(I)
      ERC=SIGN(AMIN1(ABS(ERC),700.),ERC)
      T(I)=T(I)-ERC
      IF(T(I).LT.3600.) GO TO 305
      IF(T(I).GE.5400.) GO TO 306
      IJK=2
      GO TO 307
  305 IJK=1
      GO TO 307
  306 IJK=3
  307 CONTINUE
      IHT=IHT-1
      IF(IHT)400,400,310
  310 IF(ABS(ERC)-.1)320,320,302
  320 CPTIL=CPBAR(I)
      DTH=1./CPBAR(I)
      DCPBH=DTH*(FLD(4,IJK)-2.*FLD(5,IJK)/T(I)**3.)
      DCPTH=DCPBH
      PR(I)=PRDUM+PRA*T(I)**PRB+PRC*T(I)**PRD
      DPRH=DTH*(PRA*PRB*T(I)**(PRB-1.)+PRC*PRD*T(I)**(PRD-1.))          B14A 048
      SC(I)=PR(I)                                                       B14A 049
      DSCH=DPRH                                                         B14A 050
      RHO(I)=RHOE(IS)/T(I)*TE(IS)
      DRHOH=-RHO(I)/T(I)*DTH                                            B14A 052
      VMU(I)=(VMUA*T(I)**VMUB)/(VMUC*T(I)+VMUD)
      VMW(I)=VMWE
      CAPC(I)=(T(I)/TE(IS))**(VMUB-1.)/(VMUC*T(I)+VMUD)*                B14A 053
     1(VMUC*TE(IS)+VMUD)                                                B14A 054
      DCAPCH=CAPC(I)*DTH*((VMUB-1.)/T(I)-VMUC/(VMUC*T(I)+VMUD))         B14A 055
      HTIL=H(I)                                                         B14A 056
      GMR(I)=CPBAR(I)/(CPBAR(I)-1.9869/VMWE)
      DHTILH=1.
      VMU12=VMWE                                                        B14A 058
      DMU12H=0.                                                         B14A 059
      VMU3=1./VMWE                                                      B14A 060
      DMU3H=0.                                                          B14A 061
      DMU4H=0.                                                          B14A 062
      QR(I)=0.                                                          B14A 063
      DQRH=0.                                                           B14A 064
      CT=0.                                                             B14A 065
      CTR=0.                                                            B14A 066
      RETURN                                                            B14A 067
  400 WRITE(KOUT,99)KQ(5)
   99 FORMAT(//40H***** STATE DOES NOT CONVERGE FOR KQ(5)=I2,6H *****//)
  991 FORMAT(1H1,10X19HSTAGNATION SOLUTION /12X15HEDGE CONDITIONS //)
```

```
  993 FORMAT(5X14HTEMPERATURE = E10.4,14H DEG R          //5X14HPRESSURE
     1   = E10.4,14H ATMOSPHERES    //5X14HVELOCITY     = E10.4,14H FT/SEC
     2          //5X14HMACH NUMBER = E10.4,//5X14HGAMMA        = E10.4,//5X
     314HENTHALPY     = E10.4,14H BTU/LB          //5X14HENTROPY      = E10.
     44,14H BTU/LB DEG R  //5X14HCP-FROZEN    = E10.4,14H BTU/LB DEG R  /
     5/5X14HDENSITY      = E10.4,14H LB/CU FT       //5X14HVISCOSITY    =
     6E10.4,14H LB/SEC FT      )
  995 FORMAT(3X10(2XE10.4))
      STOP
      END                                                                B14A 068
CB14B
      SUBROUTINE STATEN
      COMMON/STTCOM/GAM1,PRDUM,PRA,PRB,PRC,PRD,VMUA,VMUB,VMUC,VMUD,NC,   B14B   3
     1 FLD(6,3),VMWO                                                     B14B   4
      COMMON/INTCOM/ KR(20),KIN,XCUT
      DIMENSION TK(20,2),VMW(20),EF(6,20,3),ETMIN(20,3),ETMAX(20,3),
     1PVMW(20),PVOL(20),BTA(20),BTB(20),BTC(20),BTD(20),BTE(20)
 8000 READ (KIN,5) PRDUM,PRA,PRB,PRC,PRD
      READ (KIN,6)VMUA,VMUB,VMUC,VMUD
      READ (KIN,2) NC
    2 FORMAT(I3)
      DO 8105 JJ=1,NC
      READ(KIN,74)BTA(JJ),BTB(JJ),BTC(JJ),BTD(JJ),BTE(JJ),VMW(JJ),TK(JJ,
     11),IFRAC
      DO 8101 JK=1,2
 8101 READ(KIN,75)(EF(JI,JJ,JK),JI=1,6),ETMIN(JJ,JK),ETMAX(JJ,JK)
 8113 IF(ETMIN(JJ,2).LE.2500.) GO TO 8103
      DO 8102 JI=1,6
      EF(JI,JJ,3)=EF(JI,JJ,2)
 8102 EF(JI,JJ,2)=EF(JI,JJ,1)
      GO TO 8105
 8103 DO 8104 JI=1,6
 8104 EF(JI,JJ,3)=EF(JI,JJ,2)
 8105 CONTINUE
      IF (IFRAC.EQ.1) GO TO 8111
      DO 801 I=1,NC
  801 PVOL(I)=TK(I,1)/VMW(I)
      VVOL=0.
      DO 802 I=1,NC
  802 VVOL=VVOL+PVOL(I)
      DO 803 I=1,NC
  803 TK(I,2)=PVOL(I)/VVOL
      GO TO 8112
 8111 DO 804 I=1,NC
  804 TK(I,2)=TK(I,1)
 8112 DO 805 I=1,NC
  805 PVMW(I)=TK(I,2)*VMW(I)
      VMWE=0.
      DO 806 I=1,NC
  806 VMWE=VMWE+PVMW(I)
      VMWO=VMWE
      IF (IFRAC.EQ.2) GO TO 808
      DO 807 I=1,NC
  807 TK(I,1)=PVMW(I)/VMWE
  808 DO 8106 JI=1,6
      DO 8106 JJ=1,3
 8106 FLD(JI,JJ)=0.
      DO 8107 JK=1,3
```

```
      DO 8107 JJ=1,NC
      DO 8107 JI=1,6
 8107 FLD(JI,JK)=FLD(JI,JK)+EF(JI,JJ,JK)*TK(JJ,2)
      DO 8108 JK=1,3
      FLD(1,JK)=FLD(1,JK)*1.8/VMWE
      FLD(2,JK)=FLD(2,JK)*1.8/VMWE
      FLD(3,JK)=FLD(3,JK)/VMWE
      FLD(4,JK)=FLD(4,JK)/1.8/VMWE
      FLD(5,JK)=FLD(5,JK)*1.8*1.8/VMWE
 8108 FLD(6,JK)=FLD(6,JK)/VMWE
    1 FORMAT(6E9.6)
    5 FORMAT(5E10.4)
    6 FORMAT(4E10.4)
    7 FORMAT(/9X20HVISCOSITY LAW   MU=(E10.3,4H*T**E10.3,3H)/(E10.3,3H*T
     1+E10.3,1H)//9X19HPRANDTL NUMBER  PR=E10.3,1H+E10.3,4H*T**E10.3,1H+
     2E10.3,4H*T**E10.3,/)
   71 FORMAT(/9X34HTEMPERATURE LESS THAN 3600 DEG R.  /)
   72 FORMAT(/9X75HTEMPERATURE EQUAL TO OR GREATER THAN 3600 DEG R, BUT
     1LESS THAN 5400 DEG R.  /)
   73 FORMAT(/9X49HTEMPERATURE EQUAL TO OR GREATER THAN 5400 DEG R.  /)
   74 FORMAT(5A4,2E10.4 I2)
   75 FORMAT(6E9.6,2F6.1)
   77 FORMAT(/9X19HENTHALPY LAW     H=E10.3,1H+E10.3,1H+E10.3,11H*(T-540
     10.)+/40X3H.5*E10.3,17H*(T**2-5400.**2)-E10.3,16H*(1./T-1./5400.)//
     29X19HENTROPY LAW      S=E10.3,1H+E10.3,15H*ALOG(T/5400.)+E10.3,11H
     3*(T-5400.)-/40X3H.5*E10.3,22H*(1./T**2-1./5400.**2) /)
      WRITE(KOUT,7)VMUA,VMUB,VMUC,VMUD,PRDUM,PRA,PRB,PRC,PRD
      WRITE(KOUT,71)
      WRITE(KOUT,77)(FLD(JI,1),JI=1,6),(FLD(JJ,1),JJ=3,5)
      WRITE(KOUT,72)
      WRITE(KOUT,77)(FLD(JI,2),JI=1,6),(FLD(JJ,2),JJ=3,5)
      WRITE(KOUT,73)
      WRITE(KOUT,77)(FLD(JI,3),JI=1,6),(FLD(JJ,3),JJ=3,5)
      WRITE(KOUT,78)
      DO 1500 JJ=1,NC
 1500 WRITE(KOUT,79)BTA(JJ),BTB(JJ),BTC(JJ),BTD(JJ),BTE(JJ),TK(JJ,2),
     1TK(JJ,1)
   78 FORMAT(1H1/////21X13HFLUID MIXTURE ///11X9HCOMPONENT 10X4HMOLE
     18X4HMASS /28X9HFRACTION 4X8HFRACTION /)
   79 FORMAT(1H0,5X5A4,2(2XE10.4))
      WRITE(KOUT,80)VMWE
   80 FORMAT(//5X18HMOLECULAR WEIGHT = F12.7//)
      RETURN
      END                                                               807A 29
      SUBROUTINE RERAY(N,C,NQ,D,NQN,LS,IS,ND)
C     DIRECT INVERSION PROCEDURE -- C IS REPLACED BY C**-1
      DIMENSION D(ND,1),SD(153),C(ND,1),L(153),S(153),LL(153),LLL(153),  8158 003
     1LS(1)                                                              8158 004
      NNN=IABS(NQN)
      NN = IABS(NQ)
      KOUT=6
      M1 = N + 1                                                        RERA0070
      NP = N + NN                                                       RERA0080
      DO 15 I=1,NP                                                      RERA0090
      LLL(I) = I                                                        RERA0100
      IF (LS(1)) 10,10,5                                                RERA0120
    5 L(I) = LS(I)                                                      RERA0130
      GOTO 15                                                           RERA0140
```

```
   10 L(I) = I                                                          RERA0150
   15 CONTINUE                                                          RERA0160
      IX = - 1                                                          RERA0170
      IF (IS + 2) 45,35,45                                              RERA0180
   20 FORMAT(11H  L(I),I=1,I3,5X (30I3))                                RERA0190
   25 FORMAT(15H  ((C(I,J),J=1,I3,12H),(D(J),J=1,I3, 6H),I=1,I3,15H)  BERERA0200
     1FORE RERAY)                                                       RERA0210
   30 FORMAT(2X  11E10.3/(12X  10E10.3))                                RERA0220
   35 WRITE(KOUT,25)NP,NNN,N                                            RERA0230
      WRITE(KOUT,20)NP,(L(I),I=1,NP)                                    RERA0240
      IX = 0                                                            RERA0250
      DO 40 I=1,N                                                       RERA0260
   40 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NNN)                    RERA0270
   45 IS = - 1                                                          RERA0280
C     TRIANGULATE MATRIX                                                RERA0290
      DO 130 I=1,N                                                      RERA0300
      DO 50 M=1,NP
   50 S(M)=ABS(C(I,M))
      IF (IS) 55,60,60                                                  RERA0330
   55 IS = 0                                                            RERA0340
      GOTO 90                                                           RERA0350
C     REDUCE ROW I BY PRECEEDING ROWS                                   RERA0360
   60 DO 85 J=2,I                                                       RERA0370
      K = L(J - 1)                                                      RERA0380
      DIV = - C(I,K)                                                    RERA0390
      IF (DIV) 65,85,65                                                 RERA0400
   65 C(I,K) = 0.                                                       RERA0410
      DO 70 M=1,NP                                                      RERA0420
      DIVC = DIV * C(J - 1,M)                                           RERA0430
      S(M)=AMAX1(S(M),ABS(DIVC))
   70 C(I,M) = C(I,M) + DIVC                                            RERA0450
      IF (NNN) 85,85,75                                                 RERA0460
   75 DO 80 M=1,NNN                                                     RERA0470
   80 D(I,M) = D(I,M) + DIV * D(J - 1,M)                                RERA0480
   85 CONTINUE                                                          RERA0490
C     SEEK MAXIMUM PIVOT                                                RERA0500
   90 DIV = 0.                                                          RERA0510
      DO 100 JJ=I,N                                                     RERA0520
      M = L(JJ)                                                         RERA0530
      IF (ABS(C(I,M)) - DIV) 100,100,95                                 RERA0540
   95 DIV = ABS(C(I,M))                                                 RERA0550
      K = M                                                             RERA0560
      J = JJ                                                            RERA0570
      IF(I.LE.4) GO TO 100                                              ENTR-MOD
      IF(ND-20)  100,100,101
  100 CONTINUE                                                          RERA0580
  101 SD(I)=DIV/S(K)
      L(J)=L(I)
      L(I)=K
      IF(SD(I)-1.E-9) 104,104,110
  104 C(I,K)=0.
      IF(SD(I)) 105,105,90
C     SINGULAR MATRIX RETURN
  105 IS=-1
      WRITE(KOUT,135) (II,L(II),SD(II),II  ,I)
      RETURN
  110 DIV = C(I,K)                                                      RERA0670
      C(I,K) = 1.0                                                      RERA0680
```

```
      K = LLL(J)                                                        RERA0690
      LLL(J) = LLL(I)                                                   RERA0700
      LLL(I) = K                                                        RERA0710
      LL(K) = I                                                         RERA0720
C     NORMALIZE ROW                                                     RERA0730
      IF (NNN) 125,125,115                                              RERA0740
  115 DO 120 J=1,NNN                                                    RERA0750
  120 D(I,J) = D(I,J) / DIV                                             RERA0760
  125 DO 130 J=1,NP                                                     RERA0770
  130 C(I,J) = C(I,J) / DIV                                             RERA0780
      IF (IX) 145,140,145                                               RERA0790
  135 FORMAT(24H PIVOT ROW/COL/RES.RATIO 5(I4,1H/I3,1H/E9.2,1H,))       RERA0800
  140 WRITE(KOUT,135)(I,L(I),SO(I),I=1,NP)                              RERA0810
C     DIAGONALIZE MATRIX                                                RERA0820
  145 NM = N - 1                                                        RERA0830
C     INTERCHANGE COLUMNS                                               RERA0960
      DO 225 II=1,NP                                                    RERA0970
      I = II                                                            RERA0980
  180 J = L(I)                                                          RERA0990
      L(I) = I                                                          RERA1000
      IF (J - I) 185,225,185                                            RERA1010
  185 IF (IS) 200,190,200                                               RERA1020
  190 DO 195 M=1,N                                                      RERA1030
      S(M) = C(M,I)                                                     RERA1040
  195 C(M,I) = C(M,J)                                                   RERA1050
      IS = I                                                            RERA1060
      I = J                                                             RERA1070
      GOTO 180                                                          RERA1080
  200 IF (IS - J) 205,215,205                                           RERA1090
  205 DO 210 M=1,N                                                      RERA1100
  210 C(M,I) = C(M,J)                                                   RERA1110
      I = J                                                             RERA1120
      GOTO 180                                                          RERA1130
  215 DO 220 M=1,N                                                      RERA1140
  220 C(M,I) = S(M)                                                     RERA1150
      IS = 0                                                            RERA1160
  225 CONTINUE                                                          RERA1170
      IF(NQN + NQ) 149,149,144
  144 IF(NQN+NQ-NN-NNN) 149,147,149
C*****SOLUTION VECTOR ONLY
  147 K=N
      DO 153 I=1,NM
      K=K-1
      DO 153 IL=K,NM
      DUM=C(K,IL+1)
      IF (NN) 152,152,151
  151 DO 146 M=N1,NP
  146 C(K,M) = C(K,M) - DUM * C(IL+1,M)
      C(K,1)=C(K,1)-DUM*C(IL+1,1)
      IF (NNN) 153,153,152
  152 DO 148 M=1,NNN
  148 D(K,M)=D(K,M)-DUM*D(IL+1,M)
  153 CONTINUE
      GO TO 176
C*****FULL INVERSION AND SOLUTION VECTOR
  149 DO 175 I=1,NM                                                     RERA[illegible]
      DO 175 J=1,I                                                      RERA[illegible]
      DIV = - C(J,I+1)
```

```
      IF (DIV) 150,175,150                                              RERA0880
  150 C(J,I+1) = 0.
      IF (NNN) 165,165,155                                              RERA0900
  155 DO 160 M=1,NNN                                                    RERA0910
  160 D(J,M) = D(J,M) + DIV * D(I + 1,M)                                RERA0920
  165 DO 170 M=1,NP                                                     RERA0930
  170 C(J,M) = C(J,M) + DIV * C(I + 1,M)                                RERA0940
  175 CONTINUE                                                          RERA0950
C     INTERCHANGE ROWS                                                  RERA1180
  176 DO 320 II=1,N                                                     RERA1190
      I = II                                                            RERA1200
  230 J = LL(I)                                                         RERA1210
      LL(I) = I                                                         RERA1220
      IF (J - I) 235,320,235                                            RERA1230
  235 IF (IS) 265,240,265                                               RERA1240
  240 DO 245 M=1,NP                                                     RERA1250
      S(M) = C(I,M)                                                     RERA1260
  245 C(I,M) = C(J,M)                                                   RERA1270
      IF (NNN) 260,260,250                                              RERA1280
  250 DO 255 M=1,NNN                                                    RERA1290
      SD(M) = D(I,M)                                                    RERA1300
  255 D(I,M) = D(J,M)                                                   RERA1310
  260 IS = I                                                            RERA1320
      I = J                                                             RERA1330
      GOTO 230                                                          RERA1340
  265 IF (IS - J) 270,295,270                                           RERA1350
  270 DO 275 M=1,NP                                                     RERA1360
  275 C(I,M) = C(J,M)                                                   RERA1370
      IF (NNN) 280,290,280                                              RERA1380
  280 DO 285 M=1,NNN                                                    RERA1390
  285 D(I,M) = D(J,M)                                                   RERA1400
  290 I = J                                                             RERA1410
      GOTO 230                                                          RERA1420
  295 DO 300 M=1,NP                                                     RERA1430
  300 C(I,M) = S(M)                                                     RERA1440
      IF (NNN) 315,315,305                                              RERA1450
  305 DO 310 M=1,NNN                                                    RERA1460
  310 D(I,M) = SD(M)                                                    RERA1470
  315 IS = 0                                                            RERA1480
  320 CONTINUE                                                          RERA1490
      IF (IX) 340,330,340                                               RERA1500
  325 FORMAT(15H  ((C(I,J),J=1,I3,12H),(D(J),J=1,I3, 6H),I=1,I3,15H)  AFRERA1510
     1TER RERAY  )                                                      RERA1520
  330 WRITE(KOUT,325)NP,NNN,N                                           RERA1530
      DO 335 I=1,N                                                      RERA1540
  335 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NNN)                    RERA1550
  340 RETURN                                                            RERA1560
      END
CB16A                                                                   B16A 001
      SUBROUTINE SLOPQ(N,X,Y,S,Z)                                       B16A 002
      DIMENSION X(1),Y(1),S(1),Z(1)                                     B16A 003
      IF(N-1) 9,9,8                                                     B16A 004
    8 S(2)=(Y(2)-Y(1))/(X(2)-X(1))                                      B16A 005
      S(1)=S(2)                                                         B16A 006
      QC=S(2)                                                           B16A 007
      DO 7 I=1,N                                                        B16A 008
      IF(I+1-N)2,1,6                                                    B16A 009
    1 QB=QC                                                             B16A 010
```

```
      IF (I-2)7,6,5                                                     B16A 011
    2 XOT=X(I)-X(I+1)                                                   B16A 012
      XTT=X(I+1)-X(I+2)                                                 B16A 013
      XTO=X(I+2)-X(I)                                                   B16A 014
      AA=Y(I)/(XOT*XTO)                                                 B16A 015
      XOTT=XOT*XTT                                                      B16A 016
      AB=Y(I+1)/XOTT                                                    B16A 017
      AC=Y(I+2)/(XTT*XTO)                                               B16A 018
      AAA=AA*XTT                                                        B16A 019
      ABB=AB*XTO                                                        B16A 020
      ACC=AC*XOT                                                        B16A 021
      QA=QC                                                             B16A 022
      QB=S(I)                                                           B16A 023
      QC=S(I+1)                                                         B16A 024
      S(I)=AA*(XTO-XOT)+ABB-ACC                                         B16A 025
      S(I+1)=AB*(XOT-XTT)+ACC-AAA                                       B16A 026
      S(I+2)=AC*(XTT-XTO)+AAA-ABB                                       B16A 027
    3 IF(I-2)7,5,4                                                      B16A 028
    4 S(I)=(S(I)+QA)/2.                                                 B16A 029
    5 S(I)=(S(I)+QB)/2.                                                 B16A 030
    6 XD=X(I)-X(I-1)                                                    B16A 031
      YS=Y(I)+Y(I-1)                                                    B16A 032
      SD=S(I)-S(I-1)                                                    B16A 033
      SS=S(I)                                                           B16A 034
      Z(I)=Z(I-1)+XD/2.*(YS-XD/6.*SD)                                   B16A 035
      S(I)=SS                                                           B16A 036
    7 CONTINUE                                                          B16A 037
    9 RETURN                                                            B16A 038
      END                                                               B16A 039
CB17A                                                                   B17A 001
      SUBROUTINE ABMAX(N,X,XM,I)                                        B17A 002
      DIMENSION X(1)                                                    B17A 003
      I=1                                                               B17A 004
      XM=ABS (X(1))                                                     B17A 005
      IF (N-1) 4,4,5                                                    B17A 006
    5 DO 3 J=2,N                                                        B17A 007
      XT=ABS (X(J))                                                     B17A 008
      IF(XM-XT) 2,3,3                                                   B17A 009
    2 XM=XT                                                             B17A 010
      I=J                                                               B17A 011
    3 CONTINUE                                                          B17A 012
    4 XM=X(I)                                                           B17A 013
      RETURN                                                            B17A 014
      END                                                               B17A 015
CB18A                                                                   B18A 001
      SUBROUTINE MATS1(X)
      COMMON/INTCOM/KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA
      COMMON/ETACOM/ETA(15),DETA(15)                                    B18A 004
      DIMENSION X(1),A(14),B(14),C(14)                                  B18A 005
      IF(KR(1).LT.-50) GO TO 16
      JB=NETA
      IF(KR(10)-1) 11,18,19
   16 KR(1)=KR(1)+100
      JB=2
      X(NETA)=X(NETA)+X(1)
      IF(KR(10)-1) 11,18,19
   18 LIM=NETA-2
      GO TO 20
```

```
   19 LIM=NETA-1
   20 J=JB
      K=JB+NETA-1
      XJ=0.
      DO 25 I=1,LIM
      XK=(X(J)/DETA(I)-XJ)*2.
      X(J)=-X(K)+XK
      X(K)=XK/DETA(I)
      IF(JB-2) 21,23,21
   23 IF(I+1-NETA) 24,27,27
   21 X(I)=(XJ/2.+XK/6.)*DETA(I)*DETA(I)-X(I)
      IF(I+1-NETA) 22,27,27
   22 X(I+1)=X(I+1)-X(I)
   24 XJ=X(J)
      X(K+1)=X(K+1)-XJ
      J=J+1
   25 K=K+1
      I=NETA-1
      XK=(3.*(X(J)/DETA(I)-XJ)-X(K)-X(K+1))*2.
      XKP=X(K)*2.-XK
      X(J)=X(K+1)
      X(K+1)=XKP/DETA(I)
      X(K)=XK/DETA(I)
      IF(JB-2) 26,27,26
   26 X(I)=(XJ/2.+XK/8.+XKP/24.)*DETA(I)*DETA(I)-X(I)
   27 RETURN
   11 DSV=DETA(NETA)
      DETA(NETA)=0.
    1 B(1)=.5
      A(1)=DETA(1)/4.+DETA(2)/2.
      DO 2 I=3,NETA
      C(I-2)=DETA(I-1)/(6.*A(I-2))
      B(I-1)=.5-C(I-2)*B(I-2)
    2 A(I-1)=(1./3.-C(I-2)*B(I-2))*DETA(I-1)+B(I-1)*DETA(I)
   12 J=NETA-1
      K=J+JB-1
      L=K+J
      X(L)=X(L)+X(L+1)
    3 X(L-1)=X(L-1)+X(L)
      X(L)=X(L)-X(K)/DETA(J)
      L=L-1
      K=K-1
      J=J-1
      IF (J-1) 4,4,3
    4 X(L)=X(L)-X(K)/DETA(1)*1.5
      J=L
      DO 5 I=3,NETA
      X(J+1)=X(J+1)-C(I-2)*X(J)
    5 J=J+1
      XS=X(J+1)
      I=NETA-1
      GO TO 8
    6 M=L
      DUM=X(J+1)*(DETA(I+1)+DETA(I+2))
      DO 7 K=1,I
      X(M)=X(M)-DUM*B(K)
    7 M=M+1
       J=J-1
```

```
      8 X(J+1)=X(J)/A(I)
        I=I-1
        IF (I) 9,9,6
      9 DUM=DETA(1)*DETA(1)
        X(J)=X(JB)/DUM*3.-.5*X(J+1)
        IF(JB-2) 13,14,13
     13 X(1)=DUM*DETA(1)*(X(J)/8.+X(J+1)/24.)-X(1)
     14 L=JB
        DO 10 I=3,NETA
        J=J+1
        X(L)=X(L+1)/DETA(I-1)-DETA(I-1)/3.*(X(J)+.5*X(J+1))
        IF(JB-2) 15,10,15
     15 DUM=DETA(I-1)*DETA(I-1)
        X(I-1)=X(I-2)-X(I-1)+DUM*(X(L)/2.+DETA(I-1)*(X(J)/8.+X(J+1)/24.))
     10 L=L+1
        X(L)=XS
        DETA(NETA)=DSV
        RETURN
        END
CB18B
        SUBROUTINE MATS2(X)
        COMMON /INTCOM/ KR(20)
        KR(1)=KR(1)-100
        CALL MATS1(X)
        RETURN
        END
CB19A
        SUBROUTINE TRMBL(ILK)
        DIMENSION EPSOUT(379)                                           B19A 003
        DIMENSION XP(4)                                                 ENTR-MOD
        COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B19A   4
       1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB19A   5
       232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B19A   6
       3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB19A   7
       465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B19A   8
       5,C82,C83,C84,C85,C86,C87,C88                                    B19A   9
        COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B19A  10
       1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B19A  11
       2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B19A  12
       3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B19A  13
       4,CKK3( 8, 8)                                                    B19A  14
        COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B19A  15
       1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
       2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40), SF(20),CS(20),CSPR(20),    ENTR-MOD
       3CG(20),CGP(20),SREF,GEP,NEN,UINF,RHOINF,HINF,PINF               ENTR-MOD
        COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHCVS,PI,PIM,CL,  B19A  18
       1 EPSA(15),EPS1,EL(15),DPI(15,2),DEPC,TREF,RETR,VINTR(15)        ENTR-MOD
        COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM   B19A  20
       1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)   B19A  21
       2,DGL(30),CSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)    B19A  22
       3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)  B19A  23
       4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)            B19A  24
        COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)    B19A  25
       1,LAR(153),BA1(43,18),BA2(30,15)                                 B19A  26
        COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B19A  27
       1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2 B19A  28
       2,C3M(40),BETAM(40)                                              B19A  29
        COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB19A  30
```

```
      1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B19A  31
      2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B19A  32
      3,KAUXO,JTIME,JSPEC,MD(3)                                          B19A  33
       COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                          B19A  34
      1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)               B19A  35
       COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B19A  36
      1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB19A  37
      2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B19A  38
      3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B19A  39
      4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B19A  40
      5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B19A  41
      6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B19A  42
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B19A  43
       EQUIVALENCE(EPSOUT(1),ELCON)
       GO TO (1001,1002,1003,1004,1005),ILK
 1001  CONTINUE
    1  FORMAT(8E10.3)
    2  FORMAT(/30H     MIXING LENGTH CONSTANT  =1PE11.4
     1        /30H     SUBLAYER CONSTANT, YA+  =1PE11.4
     2        /30H     CLAUSER NUMBER          =1PE11.4
     3        /30H     TURBULENT SCHMIDT NUMBER=1PE11.4
     4        /30H     TURBULENT PRANDTL NUMBER=1PE11.4
     5        /30H     TRANSITION MOM.THICK.RE =1PE11.4//)
       READ(KIN,1)  ELCON,YAP,CLNUM,SCT,PRT,RETR
       WRITE(KOUT,2)ELCON,YAP,CLNUM,SCT,PRT,RETR
       KQ(10)=1
       KR(7)=KR(7)-2
       IF(RETR.GT.0.) KQ(10)=-1
       IF(RETR.LT.-1.999) KQ(10)=-10.01+RETR                             ENTR-MOD
       CONE=NETA-KAPPA                                                   ENTR-MOD
       RNOSE=FLOAT(KAPPA)                                                ENTR-MOD
       DO 13 I=1,NETA                                                    ENTR-MOD
       IF(I.LT.KAPPA.OR.YAP.GE.0.) GO TO 12                              ENTR-MOD
       VINTR(I)=1.-(FLOAT(I)-RNOSE)/CONE                                 ENTR-MOD
       GO TO 13                                                          ENTR-MOD
   12  VINTR(I)=1.                                                       ENTR-MOD
   13  CONTINUE                                                          ENTR-MOD
       YAP=ABS(YAP)                                                      ENTR-MOD
       RETURN
 1002  CONTINUE
C**** CALCULATES EPS2/NUE AND ITS DERIVITIVES AS DVS AND AM(1,...)
       NUL=0
COMMENT  ..  C3=-DEL/VMUE  , RHOVS=-DEL/VMUE*RHOV=-RED*RHOV/(RHOE*UE)
       RED=-C3 *RHOE(IS) *UE(IS)
       RC=RED*CLNUM
       P1=0.
       EPS1=0.
       DEPC=0.
       RHOVS=C1*F(1,1)+HF(1,5)
       IF(RC)75,4,4                                                      ENTR-MOD
    4  RR=RHOE(IS)/RHO(1)                                                ENTR-MOD
       RRP=RR/RHO(1)*RHOP(1)
       YDI=0.
       QI=0.
       SDY=0.
       YDIQ=0.
       DVS=0.
       DO 66 I=1,NETA
```

```
      RRPD=-RRP
      RI=RR
      YDS=YDI
      QS=QI
      YDQD=-YDIQ
      IF(I-NETA) 5,15,15
    5 RR=RHOE(IS)/RHO(I+1)
      RRP=RR/RHO(I+1)*RHOP(I+1)
      RRFD=F(3,I)/RI-F(3,I+1)/RR
      RRPD=RRPD+RRP
      YDI=DETA(I)/2.*(RR+RI+DETA(I)/6.*RRPD)
      SDY=SDY+YDI
      DUM1=YDI/6.*RRFD
      DUM2=F(2,NETA)-(F(2,I)+F(2,I+1))*0.5
      DVS=DVS+YDI*(DUM2-DUM1/2.)
      YDIQ=YDI*YDI
      YDQD=YDQD+YDIQ
      QI=DETA(I)/2.*(DUM2-DUM1)
      QS=QS+QI
      YDS=YDS+YDI
   15 DRHOI=-QS*RI/RHO(I)-F(3,I)/12.*YDQD/RHOE(IS)
      LR=MAT1J+I                                                        B19A
      DUM=AM(LR,124)* DRHOI* RC                                         B19A
      AM(1,I+3)=AM(1,I+3)-0.5*RC*YDS+C7*DUM*F(2,I)
      IF(I-1) 20,20,25
   20 AM(1,3)=AM(1,3)-RC/RI*YDQD/12.
      GO TO 30
   25 CALL LIAD(-1,1,NETA-2+I,-RC/RI*YDQD/12.)
   30 AM(1,1)=AM(1,1)-DUM*C7*F(2,I)*F(2,I)/ALPH
      MPJ=MAT1J+1+I
      DO 60 K=NUL, NSPM1
      IF(K) 40,40,35
   35 LRK=MAT1J+MAT2J+I
      DUM=AM(LR,K+124)* DRHOI* RC                                       B19A
   40 IF(I-NETA) 50,55,50
   50 AM(1,MPJ)=AM(1,MPJ)+DUM
      GO TO 60
   55 CALL LIAD(K,1,1,DUM)
   60 MPJ=MPJ+MAT2J
      IF(KR(17)) 66,66,65
   65 WRITE (KOUT,640) RC,RR,SDY,RRP,RRPD,RRFD,YDI,YDS,DUM1,DUM2,DVS
     1,YDIQ,YDQD,QI,QS,DRHOI,AM(LR,104),(AM(LRK,K+107),K=1,NSPM1),
     2(AM(1,J), J=1,NNLEQ), ENL(1)
   66 CONTINUE
      DVS=AMAX1(0.,RC*DVS)
      AM(1,MAT1J)=AM(1,MAT1J)+SDY*RC
      RETURN
   75 RC=-R(                                                            ENTR-MOD
      DVS=0.                                                            ENTR-MOD
      DO 80 I=2,NETA                                                    ENTR-MOD
      CALL TAYLOR(DETA(I-1),F(2,I-1),F(2,I),XP)                         ENTR-MOD
      DVS=DVS+(F(2,I)*XP(1)+F(3,I)*XP(2)+F(4,I)*XP(3)+F(4,I-1)*XP(4))   ENTR-MOD
      IFP=I+3                                                           ENTR-MOD
      IFPP=NETA+I-2                                                     ENTR-MOD
      IFPPP=IFPP+NETA                                                   ENTR-MOD
      AM(1,IFP)=XP(1)+AM(1,IFP)                                         ENTR-MOD
      CALL LIAD(-1,1,IFPP,XP(2))                                        ENTR-MOD
      CALL LIAD(-1,1,IFPPP,XP(3))                                       ENTR-MOD
```

```
      CALL LIAD(-1,1,IFPPP-1,XP(4))                                     ENTR-MOD
   80 CONTINUE                                                          ENTR-MOD
      DVS=DVS*RC/F(2,NETA)                                              ENTR-MOD
      DO 85 I=1,NNLEQ                                                   ENTR-MOD
   85 AM(1,I)=-AM(1,I)*RC*2./F(2,NETA)                                  ENTR-MOD
      AM(1,2)=AM(1,2)-RC                                                ENTR-MOD
      AM(1,MAT1J)=AM(1,MAT1J)+DVS/F(2,NETA)                             ENTR-MOD
      CALL LIAD(-1,1,NETA-1,RC)                                         ENTR-MOD
      DVS=AMAX1(RC*(F(1,NETA)-F(1,1))-DVS,0.)                           ENTR-MOD
      RETURN                                                            ENTR-MOD
 1003 CONTINUE
C**** CALCULATES MIXING LENGTH AND ITS DERIVITIVES
  100 PIM=PI
      PI=SQRT(ABS(RED/C26*(CAPC(1)*F(3,1)-ALPH*RHCVS*F(2,I))))/
     1   (CAPC(I)*YAP)
      IF(I-1) 305,305,101
  101 EPI=EXP(-(PI+PIM)/2.*DETA(I-1))
      PID=PI-PIM
      IF(PID/PI-.0001) 102,102,103
  102 PI=AMAX1(PI,PIM)
      PID=1.0
      AF=1.0
      ERP1=1./PI
      ERPP1=-2./(PI*PI)
      ERP2=1./PIM
      ERPP2=-2./(PIM*PIM)
      GO TO 104
  103 AF=SQRT(2./PID*DETA(I-1))
      ERP1=ERP(AF/2.*PI)
      ERPP1=1.-AF*PI*ERP1
      ERP2=ERP(AF/2.*PIM)
      ERPP2=1.-AF*PIM*ERP2
  104 BF=ERP1-EPI*ERP2
      DCLL=EPI
      DUM1=DETA(I-1)/2.*EPI*(AF*ERP2-CL)
      CL=CL*EPI+AF*BF
      EL(I)=ALPH*ELCON*(ETA(I)-CL)
      DUM2=AF/PID*(BF/2.+ERPP1/4.*AF*PI-EPI*ERPP2/4.*AF*PIM)
      DUM3=AF/2.*AF
      DCLPI=DUM1-DUM2+DUM3*ERPP1
      DCLPM=DUM1+DUM2-DUM3*ERPP2*EPI
      IF(I-2) 305,330,320
  305 EL(1)=0.
      DO 307 J=1,NNLEQ
  307 AM(2,J)=0.                                                        ENTR-MOD
      CL=0.
      DPI(1,2)= CAPC(1)
      DPI(3,1)= F(3,1)*DCAPCH
      IF(NSPM1) 350,350,310
  310 DO 315 K=1,NSPM1
  315 DPI(K+3,1)= F(3,1) * DCAPCK(K)
      GO TO 350
  320 DO 325 J=1,NNLEQ
  325 AM(2,J)=AM(2,J)*DCLL                                              ENTR-MOD
  330 DUM=-TREF*DCLPM*ELCON*ALPH
      AM(2,1)=AM(2,1)+(EL(I)-DCLL*EL(I-1))/ALPH                         ENTR-MOD
      L=I-1
  331 AM(2,1)=AM(2,1)+DPI(1,1)*DUM                                      ENTR-MOD
```

```
      AM(2,2)=AM(2,2)+DPI(2,1)*DUM
      AM(2,3)=AM(2,3)+DPI(1,2)*DUM                                      ENTR-MOD
      AM(2,L+3)=AM(2,L+3)+DPI(2,2)*DUM                                  ENTR-MOD
      J=MAT1J+2                                                         ENTR-MOD
      DO 340 K=NUL,NSPM1
      AM(2,J)=AM(2,J)+DPI(K+3,1)*DUM
      JL=J+L-1                                                          ENTR-MOD
      AM(2,JL)=AM(2,JL)+DPI(K+3,2)*DUM
  340 J=J+MAT2J                                                         ENTR-MOD
  345 IF(L-I) 350,400,400
  350 TREF= RED/C26 /(2.*CAPC(I)*YAP*PI*YAP*CAPC(I))
      DPI(3,2)=-PI/TREF*(DCAPCH/CAPC(I)-DRHOH/(2.*RHO(I)))
      DPI(2,2)= C10*DPI(3,2)-RHOVS*ALPH
      DPI(1,1)=-C56*C10*DPI(3,2)-RHOVS*F(2,I)
      DPI(2,1)=-ALPH*C1*F(2,I)
      IF(NSPM1) 362,362,355
  355 DO 360 K=1,NSPM1
  360 DPI(K+3,2)=-PI/TREF*(DCAPCK(K)/CAPC(I)-DRHOK(K)/(2.*RHO(I)))
  362 L=I
      DUM=-TREF*DCLPI*ELCON*ALPH
      IF(I-1) 445,445,365
  365 IF(I-NETA) 331,400,400
C**** CALCULATES EPS1 AND EPS2 -- COMPARES TO GET EPS -- CALCULATES EPS
C                                                        DERIVITIVES
  400 DUM1=EL(I)/ALPH*EL(I)/ALPH*RED/C26
      C26S=C26*C26
      EPS1=AMAX1(DUM1*F(3,I),EPS1)
      EPS2=DVS/C26S
      IF(EPS1-EPS2) 405,401,401
  401 EPS=EPS2*VINTR(I)
      ENL(3)=ZNL(1)/C26S*VINTR(I)                                       ENTR-MOD
      DO 402 J=1,NNLEQ                                                  ENTR-MOD
  402 AM(3,J)=AM(1,J)/C26S*VINTR(I)                                     ENTR-MOD
      DUM1=2.0*EPS/RHO(I)                                               ENTR-MOD
      GO TO 415
  405 EPS=EPS1*VINTR(I)
      ENL(3)=0.                                                         ENTR-MOD
      DO 410 J=1,NNLEQ                                                  ENTR-MOD
  410 AM(3,J)=2.*EPS/EL(I)*AM(2,J)
      AM(3,1)=AM(3,1)-2./ALPH*EPS                                       ENTR-MOD
      CALL LIAD(-1,3,NETA+I-2,DUM1)                                     ENTR-MOD
      DUM1=EPS/RHO(I)                                                   ENTR-MOD
  415 DUM=DUM1*DRHOH
      EPSA(I)=EPS
      AM(3,1)=AM(3,1)-C56*C10*DUM
      AM(3,I+3)=AM(3,I+3)+DUM*C10                                       ENTR-MOD
      J=MAT1J+I+1                                                       ENTR-MOD
      L=MAT1J
      DO 420 K=NUL,NSPM1
      IF(I-NETA) 418,416,416
  416 CALL LIAD(K,3,1,DUM)
      GO TO 419                                                         ENTR-MOD
  418 AM(3,J)=AM(3,J)+DUM                                               ENTR-MOD
  419 J=J+MAT2J                                                         ENTR-MOD
  420 DUM=DUM1*DRHOK(K+1)
      DEPC=ENL(3)
  445 RETURN                                                            ENTR-MOD
 1024 CONTINUE
```

```
C**** MODIFIES ENL AND AM AFTER IMONE
      L=I-1
      SALPH=-ALPH/TTVC
      IF(I-2) 650,650,600
 1005 CONTINUE
C**** MODIFIES ENL AND AM AFTER ICNLY
      L=I
      SALPH= ALPH/TTVC
  600 IFPP=L+NETA-2
      ISPP=L
      DUM=F(3,L)/SALPH
      ENL(I+3)=ENL(I+3)-DUM*(EPS-DEPC)
      AM(I+3,1)=AM(I+3,1)-DUM*EPS/ALPH
      C28=C28+DUM*EPS
      DO 605 J=1,NNLEQ
  605 AM(I+3,J)=AM(I+3,J)+DUM*AM(3,J)                                ENTR-MOD
      CALL LIAD(-1,I+3,IFPP,EPS/SALPH)
      MPJ=MAT1J+I
      PRF=1.-1./PRT
      EG1=G(2,L)/(SALPH*PRT)
      EG4=-PRF/SALPH*C13*F(2,L)                                      ENTR-MOD
      EG3=EG4*EPS                                                    ENTR-MOD
      EG4=EG4+EG1                                                    ENTR-MOD
      EG2=EPS/SALPH*(1./SCT-1./PRT)*(HP-CPBAR(L)*TP)
      ENL(MPJ)=ENL(MPJ)-EG1*(EPS-DEPC)-EG2-EG3
      C32=C32+EG1*EPS+EG2+EG3
      AM(MPJ,1)=AM(MPJ,1)-EG1/ALPH*EPS-3.0/ALPH*EG3
      DO 610 J=1,NNLEQ
  610 AM(MPJ,J)=AM(MPJ,J)+EG4*AM(3,J)                                ENTR-MOD
      AM(MPJ,L+3)=AM(MPJ,L+3)-PRF*C13/SALPH*EPS
      CALL LIAD(-1,MPJ,NETA+L-2,-PRF*C10/SALPH*EPS)
      CALL LIAD(0,MPJ,ISPP,EPS/(SALPH*PRT))
      IF(NSPM1) 650,650,615
  615 DO 630 K=1,NSPM1
      DUM=SP(2,L,K)/(SALPH*SCT)
      MPJ=MPJ+MAT2J
      CK6(K)=CK6(K)+DUM*EPS
      ENL(MPJ)=ENL(MPJ)-DUM*(EPS-DEPC)
      AM(MPJ,1)=AM(MPJ,1)-DUM/ALPH*EPS
      DO 620 J=1,NNLEQ
  620 AM(MPJ,J)=AM(MPJ,J)+DUM*AM(3,J)                                ENTR-MOD
  630 CALL LIAD(K,MPJ,ISPP,EPS/(SALPH*SCT))
  650 IF(KR(17)) 660,660,655
  655 WRITE(KOUT,640) EPSOUT
  640 FORMAT(/(1P10E12.5))
  660 RETURN
      END
C819T
      SUBROUTINE TRANCR(IGO)
      COMMON/COECOM/                C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15819T   4
     1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,C819T   5
     232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48819T   6
     3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,C819T   7
     465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C819T   8
     5,C82,C83,C84,C85,C86,C87,C88                                    819T   9
      COMMON/COECOM/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)   819T  10
     1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    819T  11
     2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) 819T  12
```

```
      3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9)  B19T  13
      4,CKK3( 8, 8)                                                      B19T  14
       COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B19T  15
      1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
      2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),SF(20),CS(20),CSPR(20),     ENTR-MOD
      3CG(20),CGP(20),SREF,GEP,MEN                                       ENTR-MOD
       COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B19T  18
      1,LAR(153),BA1(43,18),BA2(30,15)                                   B19T  19
       COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B19T  20
      1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  B19T  21
      2,C3M(40),BETAM(40)                                                B19T  22
       COMMON/INTCOM/ KR(20),KIN,KCUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,MB19T  23
      1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B19T  24
      2,B(8),       MNE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B19T  25
      3,KAUXO,JTIME,JSPEC,MD(3)                                          B19T  26
       COMMON/NONCOM/AM(153,153),DVNL(153),TCN,                          B19T  27
      1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)               B19T  28
       COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B19T  29
      1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MOD(10),ITF( 50),IPRE,RADNO,  B19T  30
      2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            B19T  31
       COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   B19T  32
      1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKW( 8),  DB19T  33
      2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKW( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B19T  34
      3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 6),DZKK( 8, 8)   B19T  35
      4,DPHIKK( 8, 8),       DMU4W,DMU3W,DHTILW,VMU12,CT,CTR,CPTIL,HTIL  B19T  36
      5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMJ(15),  RHOP B19T  37
      6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B19T  38
       COMMON/TEPCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)     B19T  39
      1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)     B19T  40
      2,XIINIT( 1),DUDS( 40)                                             B19T  41
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B19T  42
       GO TO (1001,1002,1003,1004), IGO
 1001  LOW=1
       IF(KR(6)) 20,20,35
   20  LIM= NSD(1)
       DO 25 IS=2,LIM
       SDUM1(IS) = S(IS) * S(IS)
   25  SDUM2(IS) = 1.-ROKAP(IS)/S(IS)
       SDUM1(1)=0.
       SDUM2(1)=0.
       CALL SLOPC(LIM, SDUM1, SDUM2, DER, DER)
       DO 30 IS=2,LIM
       DUM=1. - SDUM2(IS)
   30  TVCC(IS) = SQRT(4.*DER(IS)*(DUM-SDUM1(IS)*DER(IS))+ SDUM2(IS)/SDUM
     11(IS)*(1.+DUM))/DUM
       TVCC(1) = SQRT(6.*DER(1))
       LOW=2
       IL=1
       IF(NDISC) 50,50,40
   35  IL=0
   40  LIM=NDISC+1
       DO 45 II=LOW,LIM
       M=NSD(II)
       CALL SLOPO(NSD(II), S(M), ROKAP(M), DER(M), DER(M))
       MM=M+IL
       IL=1
       IGM=M+NSD(II)-1
       DO 45 IS=MM,IGM
```

```
   45 TVCC(IS) = SQRT(1.-DER(IS)*DER(IS))/ROKAP(IS)
   50 DO 55 IS=1,NS                                                    ENTR-MOD
   55 TVCC(IS)=-TVCC(IS)*2.*C3M(IS)*VMUE(IS)
      RETURN
 1002 CONTINUE
CALLED IMMEDIATELY AFTER ICOEFF
      IF(I-1) 115,115,125
  115 RHS=0.
      DO 120 J=1,NNLEQ
  120 AM(4,J)=0.                                                       ENTR-MOD
      GO TO 130
  125 IND=I-1
      SIX=-6.
      GO TO 140
  130 IND=I
      SIX=6.
      C27=DRHOH
      DO 135 K=1,NSPM1
  135 CK11(K)=DRHOK(K)
      IF(I-1) 165,165,140
  140 DUM=DETA(I-1)/2. *RHOE(IS)/RHO(IND)
      IF(KQ(9).LT.0) DUM=-DUM
      RHS=RHS+DUM*(1.+RHOP(IND)/RHO(IND)*DETA(I-1)/SIX)
      DUM=-DUM/RHO(IND)
      LPS=MAT1J+IND+1
      IF(NSPM1) 155,155,145
  145 LPI=LPS
      DO 150 K=1,NSPM1
      LPI=LPI+MAT2J
  150 AM(4,LPI)=AM(4,LPI)+DUM*CK11(K)                                  ENTR-MOD
  155 DUM=DUM*C27
      AM(4,LPS)=AM(4,LPS) + DUM                                        ENTR-MOD
      DUM=DUM*C7*F(2,IND)
      AM(4,IND+3) = AM(4,IND+3) + DUM                                  ENTR-MOD
      AM(4,1)= AM(4,1)-DUM/ALPH*F(2,IND)                               ENTR-MOD
      IF(IND-I) 130,160,160
  160 TTVC=AMAX1(1.+RHS*ALPH*TVCC(IS),0.0001)
  165 RETURN
 1003 CONTINUE
CALLED IMMEDIATELY AFTER IMONE
      IND=I-1
      DUM1=-TVCC(IS)/TTVC
      GO TO 285
 1004 CONTINUE
      IND=I
      DUM1=TVCC(IS)/TTVC
  285 DUM2=DUM1*C28
      DUM3=DUM1* C32
      AM(I+3,1)=AM(I+3,1)+DUM2*RHS
      M= MAT1J+I
      AM(M,1)=AM(M,1)+DUM3*RHS
      DUM2=DUM2*ALPH
      DUM3=DUM3* ALPH
      DO 210 J=1,NNLEQ
      AM(I+3,J)=AM(I+3,J)+DUM2*AM(4,J)                                 ENTR-MOD
  210 AM(M,J)=AM(M,J)+DUM3*AM(4,J)                                     ENTR-MOD
      IF(NSPM1) 225,225,215
  215 DO 220 K=1,NSPM1
```

```
      DUM3=DUM1*CK6(K)
      M=MOMAT2J
      AM(M,1)=AM(M,1)+DUM3*RHS
      DUM3=DUM3*ALPH
      DO 220 J=1,MMLEQ
  220 AM(M,J) = AM(M,J) + DUM3*AM(4,J)                                  ENTR-MOD
  225 RETURN
      END
B28A
      SUBROUTINE EQUIL(KQ,Z,PRR)                                        B28A 001
      INTEGER FAMOA,FAMOB                                               B28A 002
      EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                                 B28A 004
      DIMENSION CIJ( 71,1),TF(1)                                        B28A 005
      COMMON/TENCOM/APE(16,16),BS(16)                                   B28A 007
      DIMENSION VLAM( 71,1),  X(16),GAMK( 71,1),KQ(10),DQJRNL( 71,1)    ENTR-MOD
      EQUIVALENCE(AM( 74),DQJRNL( 76),GAMK,VLAM)                        B28A 009
      COMMON /BLOCOM/FAMOA( 71),FAMOB( 71),M     ,FR( 71,15),W(3),LEF(10) B28A 010
     1,LEFS(10),PIEASE,LEFW(10),L2,L3                                   B28A  11
      COMMON/BUMCOM/     BUMP,CORMA,EASE,ICORN,MDOT,TFZ,I777,DTEMP,KIP,IX ENTR-MOD
      COMMON/EDGCOM/                PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES, B28A  13
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,DZUEDG,VMWE,CGE,C90  B28A  14
     2,DSIP(40),IDSIP,TTVC,TVCC(40),HEA(40),  SF(20),CS(20),CSPR(20),   ENTR-MOD
     3CG(20),CGP(20),SREF,GEP,MEN,UINF,RHOINF,HINF,PINF                 ENTR-MOD
      COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2), B28A  17
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),MAT(10),  B28A  18
     2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VM( 71),        B28A  19
     3 VMU( 71,10),ITFF,KR2,MCM,MCV,MM,MTM( 71),Y( 71),YM( 71),GG( 71)  B28A  20
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B28A  21
      COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIU,CPF,IRE,IER,AA,ITS,IN,IL,IT,   B28A  22
     1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,NS,NSS,D1,ISP2,ISPQ,   B28A  23
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,MTG,MTL,JC,MG,  B28A  24
     3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),D(16),      ENTR-MOD
     4 IP( 71),ALP(10),FMU(10),GAMM(10),GAMF(10),SLAM(10),DV( 71),RVS,  B28A  26
     5 CP( 71),H( 71),SB( 71),TC( 71),VLMK( 71),E( 71),PMUS(10),        B28A  27
     6 BC(10),BLMK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B28A  28
      COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)  B28A  29
     2,TMF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KOT(2)             B28A  30
      COMMON/FLXCOM/DELQN,DELJN( 8),DQNL(153),DJNL(153, 8),MALLQ        B28A  31
     1,MALLJ( 8),QN,VJKN( 9),TPMALL                                     B28A  32
      COMMON /INTCOM/KKR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,META,II,  B28A  33
     1ISS,NS,ITT,NTIME,NSP,NSPM1,KAM,MLEQ,MMLEQ,MPNL,MITS,KAPPA,CBAR,   B28A  34
     2CASE(15),BB(8),  MNE,MCM,KQ(10),ITER,MITER,KR17,MBT,MBT2,IDENT,   B28A  35
     3KRS(40),KAUXO,JTIME,JSPEC,MD(3),IU,ISM                            ENTR-MOD
      COMMON/MOMCOM/AM(153,153),DVML(153),TCM,                          B28A  37
     1VLMKM,DLPM( 9),DLPK( 8, 9),DTMM,DTKM( 8),FLUXJB( 9)               B28A  38
      COMMON /PRPCOM/PR(15),TT(15),RHO(15),SC(15),CAPC(15),QR(15),MM(15) B28A  39
     1,CPBAR(15),VMM(15),PHIX(15, 8),DRMOM,DRMOK( 8),ZK( 8),DZKM( 8),  B28A  40
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKM( 8),DPRK( 8),DSCK( 8),DCAPCK( 8) B28A  41
     3,DMTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B28A  42
     4,DPHIKK( 8, 8),       DMU4M,DMU3M,DMTILM,VMU12,CT,CTR,CPTIL,MTIL  B28A  43
     5,VMU3,DTM,DCAPCM,DPRM,DSCM,DQRM,DCPBM,DCPTM,DMU12M,VMU(15),  RHOP B28A  44
     6(15),PHIKP(15),MP,TP,ZKP( 8),VMU3P,VMU4P,MTILP,CRMO(14),GMR(15)   B28A  45
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B28A  46
      COMMON/MALCOM/FM(40, 1),TM(40, 1),MM(40, 1),SPM( 8,40, 1)         B28A  47
     1,RHOVM(40, 1),FLUXJ( 3,40, 1),IMM,ITM,IFM,ISPM,IRHOVM,IFLUXJ      B28A  48
      EQUIVALENCE(B,X)                                                  B28A 046
    1 FORMAT(10I1,3F10.5)                                               B28A 047
    2 FORMAT(/9X6HTEMP =F10.4,17H DEG-K      PRES =F8.4,17H ATM      MOL M B28A 048
```

```
      1T =F11.7)                                                        B20A 049
    3 FORMAT( /87H  SPECIES  PAR.PRES.     D-LOG-PP      LOG-PP       LOB20A 050
      1G-KP     FLAG   ERROR          CP  /(1X2A4,4E13.5,I5,2E13.5))    B20A 051
    4 FORMAT(/10X60H CP-FROZEN    CP-EQUIL   DLNM/DLNT   DLNM/DLNP     GB20A 052
      1AMMA        /10X5E12.5)                                          B20A 053
    7 FORMAT(I3,F8.2,11E10.3/91X3E10.3)
    8 FORMAT(10X10HENTHALPY =E14.7,20H CAL/GM    ENTROPY =E12.5,13H CAL/B20A 055
      1GM-DEG K/10X 9HDENSITY =E13.6, 8H LB/CUFT)                       B20A 056
    6 FORMAT(//)                                                        B20A 057
    9 FORMAT(5X 5HVEL =E10.3,16H FT/SEC   MACH =E10.3,  9H   AREA =E10.3B20A 058
      1,12H SQFT/LB/SEC)                                                B20A 059
   10 FORMAT(10X17HFRACTION LIQUID =F8.5)                               B20A 060
   42 FORMAT(8F10.4)                                                    B20A 061
      DTU=500.
      DTD=DTU
      LEFUP=1                                                           B20A 063
      TTMIN=100.                                                        ENTR-MOD
      TTMAX=100000.                                                     ENTR-MOD
      IQQ=0                                                             ENTR-MOD
      MELT=1                                                            ENTR-MOD
      FLIQ=0.                                                           ENTR-MOD
      HMELT=0.                                                          ENTR-MOD
      ITS=0                                                             B20A 065
      IG=0
      INV=0
      SPEASE=PIEASE
      TION=1000.                                                        ENTR-MOD
      IF(II.NE.NETA.AND.KR(5).EQ.0) TION=1000.                          ENTR-MOD
      ISP=IS+1                                                          B20A 066
      DO 302 I=1,6
  302 KR(I)=KQ(I)                                                       B20A 068
      MODE=KR(1)                                                        B20A 069
      IF(KR(5).NE.3)P=PRR                                               ENTR-MOD
      KKJ=0                                                             ENTR-MOD
      KR(8)=0
      KR(6)=KR(6)-1                                                     B20A 071
      IF(KKR(18)-6) 3021,3021,3022
 3021 KR(7)=KKR(18)*5-9
      N7=51-KKR(18)*5
      GO TO 3023
 3022 KR(7)=0
      N7=KKR(18)*10-50
 3023 IF(KR(5)-1) 310,304,306
C*****ISENTROPIC EXPANSION                                              B20A 074
  304 SIP=SIP-DSIP(ISS)                                                 B20A 075
      IEW=2                                                             B20A 076
      II=NETA                                                           B20A 077
      GO TO 324                                                         B20A 078
C*****STAGNATION POINT AND INITIALIZATION                               B20A 079
  306 IF(KR(5).EQ.3) GO TO 307                                          ENTR-MOD
      KR(8)=0
      ITFF=0
      PIEASE=0.
      KQ(6)=0                                                           B20A 081
      HIP=Z/1.8                                                         B20A 082
      MITS=1                                                            B20A 083
      II=NETA                                                           B20A 084
      VHW(NETA)=VMWE                                                    ENTR-MOD
```

```
      T=3000.                                                           B20A 085
      WM=20.                                                            B20A 086
      AA=P*WM                                                           B20A 087
      DO 309 I=1,IS
  309 ALP(I)=TQ(I,1)                                                    B20A 089
      KR(6)=-1                                                          B20A 090
      IF(ITEM-1) 350,308,350
  308 IF(KKR(2)-2) 311,350,311
  310 IF(KR(6)) 312,330,330                                             B20A 092
  311 LEFUP = -1
      IF (KKR(12)-1) 384,350,384
C*****SHOCK ENTROPY CALCULATION                                         ENTR-MOD
  307 SA1=Z                                                             ENTR-MOD
      KKJ=-1                                                            ENTR-MOD
      SVA=(1.3146*RHOINF*UINF*COS(SA1))**2/90108.                       ENTR-MOD
      SVB=SVA*2./1.9869                                                 ENTR-MOD
      SVC=(UINF*COS(SA1))**2/90108.+HINF                                ENTR-MOD
      SVD=PINF+SVB/(1.3146*RHOINF)                                      ENTR-MOD
      IF(SA1.GT.0.0001)GO TO 324                                        ENTR-MOD
      P=PTE(1,1)                                                        ENTR-MOD
      T=TCH                                                             ENTR-MOD
      GO TO 324                                                         ENTR-MOD
C*****BOUNDARY LAYER                                                    B20A 093
  312 DO 3120 K=NSP,IS                                                  ENTR-MOD
 3120 ALP(K)=0.                                                         ENTR-MOD
      LEFUP=MITS+II-2
      HIP=Z/1.8                                                         B20A 096
      ALP(NSP)=1.0                                                      B20A 097
      IF(NSPM1) 3141,3141,313
  313 DO 314 K=1,NSPM1
      ALP(K)=SP(1,II,K)/WTM(K)                                          B20A 099
  314 ALP(NSP)=ALP(NSP)-SP(1,II,K)                                      B20A 100
 3141 ALP(NSP)=ALP(NSP)/WTM(NSP)
      DO 319 I=1,IS                                                     ENTR-MOD
      IF(KAT(I).EQ.99) GO TO 319                                        ENTR-MOD
      ARPH=0.                                                           B20A 103
      ARPHM=0.                                                          B20A 104
      DO 315 K=1,NSP                                                    B20A 105
      DUM=CIJ(I,K)*ALP(K)                                               B20A 106
      ARPHM=AMAX1(ARPHM,ABS(DUM))                                       B20A 107
  315 ARPH=ARPH+DUM                                                     B20A 108
      IF(II.EQ.1.AND.LEFW(I).EQ.1.AND.LEF(I).LE.0) LEF(I)=1             ENTR-MOD
      IF(ARPH-.0001*ARPHM) 316,316,319
  316 IF(II.EQ.1.AND.LEF(I).EQ.1) LEF(I)=0
      LEF(I)=-IABS(LEF(I))
      LEFS(I)=-IABS(LEFS(I))
  319 CONTINUE                                                          B20A 111
  320 IF(ITFF) 326,350,350                                              B20A 112
C*****ACCEPT RESIDENT VALUES AS FIRST GUESSES                           B20A 113
  324 IF(T-TION) 328,398,398
  326 ITFF=ITFF+1                                                       B20A 115
      IF(II-1) 323,323,322
  322 IG=1
      GO TO 350
  323 IF (ITFF) 327,329,329
  327 IF(KR2-1) 328,329,328
  329 GO TO 350
  328 IF(KAT(IS).EQ.99) LEF(IS)=-IABS(LEF(IS))                          ENTR-MOD
```

```
      IF(LEFUP) 393,364,393
C*****WALL SOLUTION                                                    B20A 118
  330 IEW=1                                                            B20A 119
      ITFF=-1                                                          B20A 120
      II=1                                                             B20A 122
      CHFLUX=W(3)
      PIEASE=PIEASE*0.989*(1.0-EASE)
      KR(7)=MAX0(KR(7),KKR(16)*5-4)
      IF(TT(1)/1.8.GT.TF(N+1)) KR(8)=1
      IF(MODE-1) 333,331,333                                           B20A 123
  331 TTMIN=TT(1)/1.8-500.
      TTMAX=TT(1)/1.8+500.
      KR(8)=0
  333 IF(KR(8).EQ.1) CHFLUX=-1.
      DO 332 K=1,IS
      IF(LEF(K)) 332,3331,332
 3331 IF(W(2)*TK(K,L2)+CHFLUX*TK(K,L3).LT.0.) LEF(K)=1
  332 ALP(K)=TQ(K,L2)*AMIN1(0.,W(2))+TQ(K,L3)*AMIN1(0.,W(3))+TQ(K,1)*
     1 AMIN1(0.,W(1))
      WS=-W(1)-W(2)-W(3)
      WSS=-AMIN1(0.,W(1))-AMIN1(0.,W(2))-AMIN1(0.,W(3))
      DO 335  L=NSP,IS                                                 B20A 129
      DO 334 K=1,IS                                                    B20A 130
      GAMK(K,L)=0.                                                     B20A 131
  334 GAMK (L,K)=0.                                                    B20A 132
      GAMH(L)=0.                                                       B20A 133
  335 GAMF(L)=0.                                                       B20A 134
      IF(NSPM1) 3361,3361,3351
 3351 DO 336 K=2,NSP
      GAMH(NSP)=GAMH(NSP)-DQJRNL(2,K)/WTM(NSP)*1.8                     B20A 136
      GAMF(NSP)=GAMF(NSP)-DQJRNL(1,K)/WTM(NSP)                         B20A 137
      ALP(NSP)=ALP(NSP)+WALLJ(K-1)/WTM(NSP)                            B20A 138
      ALP(K-1)=ALP(K-1)-WALLJ(K-1)/WTM(K-1)                            B20A 139
      GAMH(K-1)=DQJRNL(2,K)/WTM(K-1)*1.8                               B20A 140
      GAMF(K-1)=DQJRNL(1,K)/WTM(K-1)                                   B20A 141
      DO 336 KK=2,NSP                                                  B20A 142
  336 GAMK(KK-1,NSP)=GAMK(KK-1,NSP)-GAMK(KK-1,K-1)                     B20A 143
 3361 DO 3362 K=1,IS
      DO 3362 J=ISP,N
 3362 VLAM(J,K)=WS*WTM(J)*GAMF(K)
      DUM1=NSPM1                                                       B20A 144
      DO 340 K=1,NSP                                                   B20A 145
      GAMH(K)=-GAMH(K)
      SUMG=0.                                                          B20A 146
      IF(NSPM1) 3392,3392,3391
 3391 DO 339 KK=1,NSP
      IF(KK-K) 337,339,337                                             B20A 148
  337 SUMG=SUMG+GAMK(KK,K)                                             B20A 149
  339 CONTINUE                                                         B20A 150
      SUMG=SUMG/DUM1                                                   B20A 151
      ALP(K)=-ALP(K)+SUMG/WTM(K)
 3392 DO 338 KK=1,NSP
  338 GAMK(KK,K)=-(GAMK(KK,K)-SUMG)/WTM(K)*WTM(KK)
      DO 340 KK=1,NSP                                                  B20A 157
      DO 3401 J=ISP,N
 3401 VLAM(J,K)=VLAM(J,K)+GAMK(KK,K)*VNU(J,KK)
  340 GAMK(KK,K)=GAMK(KK,K)+WTM(KK)*GAMF(K)*WS
C******RECALL STORED VALUES OF BOUNDARY LAYER SOLUTION AND              B20A 159
```

```
C     RE-INITIALIZED OMITTED SPECIES                                    B20A 160
  350 II=II-IG
      PIN=1.E-4*P
      PINL=ALOG(PIN)
      LIM=N+KR(8)
      DO 354 I=1,LIM
      IF(IFC(I)-1) 342,342,341                                          B20A 165
  341 IFC(I)=IFC(I)-3                                                   B20A 166
      GO TO 345                                                         B20A 167
  342 IF(IFC(I)+1) 343,345,345                                          B20A 168
  343 IFC(I)=IFC(I)+3                                                   B20A 169
  345 IF (IFC(I)) 346,349,346                                           B20A 170
  346 VN(I)=FR(I,II)*P
      IFC(I)=1                                                          B20A 172
      Y(I)=0.                                                           B20A 173
      IF(VN(I)) 347,347,354                                             B20A 175
  347 IFC(I)=-1                                                         B20A 176
      IF (I-IS) 348,348,354                                             B20A 177
  348 Y(J)=PINL                                                         B20A 178
      GO TO 3530
  349 IF(FR(I,II))357,357,352                                           B20A 180
  357 IF(VN(I)) 351,351,358
  358 IF(II-1) 353,351,353
  351 VN(I)=PIN                                                         B20A 183
      GO TO 353                                                         B20A 184
  352 VN(I)=FR(I,II)*P
  353 Y(I)=ALOG(VN(I)+1.E-35)
 3530 IF(II-1) 354,3531,354
 3531 IF(IS-I) 354,3532,3532
 3532 Y(I)=YW(I)
      IF(FR(I,1)-1.E-30) 354,3533,354
 3533 VN(I)=EXP(Y(I))
  354 CONTINUE                                                          B20A 187
      T=TT(II)/1.8                                                      B20A 188
      IF(T.GT.TION.OR.KAT(IS).NE.99) GO TO 356                          ENTR-MOD
      LEF(IS)=-IABS(LEF(IS))                                            ENTR-MOD
  356 WM=VMW(II)
      II=II+IG
      IF(LEFUP) 384,364,393
C*****REEVALUATE ABSENT ATOM ARRAY                                      B20A 193
  364 JT=MOD(ITEM,2)+1
      DO 382 K=1,IS                                                     ENTR-MOD
      LEFW(K)=0
      LEFS(K)=LEF(K)
      LEF(K)=ISIGN(LEFT(K,JT),LEF(K))
      IF(LEF(K)-2) 369,365,382                                          B20A 198
  365 IF(IU-1)369,369,367                                               ENTR-MOD
  367 IF(KKR(3)) 369,369,382
  369 LEF(K)=MIN0(LEF(K),0)                                             B20A 200
      IF (KKR(9)-2) 370,382,381
  370 DUM1=1.0                                                          B20A 202
      DUM2=0.                                                           B20A 203
      IF(NSPM1) 3721,3721,3701
 3701 DO 372 J=1,NSPM1
      DUM1=DUM1-SPW(J,ISS,ITT)                                          B20A 205
  372 DUM2=DUM2+SPW(J,ISS,ITT)*CIJ(K,J)                                 B20A 206
 3721 IF(ABS(DUM1)-1.E-7) 376,374,374
  374 DUM2=DUM2+DUM1*CIJ(K,NSP)                                         B20A 208
```

```
      376 IF(DUM2) 382,382,380                                          B20A 209
      380 LEF(K)=1
          GO TO 382
    381   IF (W(2)*TK(K,L2)+W(3)*TK(K,L3).LT.0.0) LEFW(K)=1
      382 CONTINUE                                                      B20A 212
          GO TO 393                                                     B20A 213
C*****INITIALIZE SP(,,) AND VN() ON FIRST STAGNATION SOLUTION           B20A 214
      384 ITFF=-NETA                                                    B20A 215
          NCV=0                                                         B20A 216
          TT(1)=3000.
          VMW(1)=20.
          KR2=KKR(2)
          IF(KR2.LT.0) KR2=1
          IF(KR2.EQ.1) GO TO 387
      385 DO 386 K=1,NSP
          DO 386 I=1,NETA                                               B20A 220
          SP(1,I,K)=ALP(K)*WTM(K)                                       B20A 221
          SP(2,I,K)=0.                                                  B20A 222
      386 SP(3,I,K)=0.                                                  B20A 223
          W(1)=0.
          W(2)=0.
          W(3)=0.
          DO 3868 I=1,IS                                                ENTR-MOD
          IF(KAT(I).EQ.99) GO TO 3867                                   ENTR-MOD
          LEF(I)=0                                                      B20A 226
          IF(TK(I,1)) 3868,3868,3867                                    B20A 227
     3867 LEF(I)=3                                                      B20A 228
     3868 CONTINUE                                                      B20A 229
      387 DO 388 I=1,IS                                                 B20A 230
          IF(ALP(I)) 393,388,388                                        B20A 231
      388 CONTINUE                                                      B20A 232
          DO 3881 J=1,N
          SB(J)=0.                                                      ENTR-MOD
          H(J)=0.                                                       ENTR-MOD
          DO 3881 I=1,NETA                                              ENTR-MOD
     3881 FR(J,I)=0.
          DO 392 I=1,IS                                                 B20A 233
          VN(I)=AMAX1(VN(I)/P*.1,ALP(I)*AA)                             B20A 234
          IF(IFC(I)) 390,391,390                                        B20A 235
      390 IFC(I)=1                                                      B20A 236
          Y(I)=0.                                                       B20A 237
          GO TO 392                                                     B20A 238
      391 Y(I)=ALOG(VN(I))                                              B20A 239
      392 CONTINUE                                                      B20A 240
C*****DELETE MOLECULES BASED ON AESENT ATOM ARRAY                       B20A 241
      393 LAMD=1
          DO 3971 K=1,IS
          IF(LEF(K)) 394,3930,3934
     3934 IF(PIEASE-.99) 3931,3931,3933
     3930 IF(PIEASE-.01) 394,394,3933
    3933  IF (LEFS(K)) 3932,394,3931
     3931 IF(II-NETA) 397,3932,397                                      B20A 244
     3932 IF(LEF(K)-3) 394,397,394                                      B20A 245
      394 DO 396 J=1,N                                                  B20A 246
          IF(IABS(IFC(J))-1) 389,389,396                                B20A 247
      389 IF(MOD(LAMI(J)/LAMD,2)) 395,396,395
      395 VN(J)=0.
          IFC(J)=IFC(J)-3                                               B20A 250
```

```
  396 CONTINUE                                                          B20A 251
      J=-IR(K)                                                          B20A 253
      IF(IFC(J)-1) 3961,3961,397                                        B20A 254
 3961 IFC(J)=IFC(J)+6                                                   B20A 255
  397 LAMD=LAMD+LAMD
      LEF(K)=IABS(LEF(K))
3971  LEFS(K)=IABS(LEFS(K))
C*****DELETE CONDENSED SPECIES FROM BOUNDARY LAYER
      IF(KR(6)) 3980,398,398
 3980 DO 3984 J=1,N
      IF(IABS(IFC(J))-1) 3984,3981,3984
 3981 IFC(J)=IFC(J)-3
      VN(J)=0.
 3984 CONTINUE
  398 IF(KR(7)-1) 21,21,1902                                            B20A 258
C*****EVALUATE PROPERTIES                                               B20A 259
  170 CPF=CPF/AA
      IF(KR(5).EQ.3) GO TO 19                                           ENTR-MOD
      HG=0.                                                             ENTR-MOD
      HL=0.                                                             ENTR-MOD
      WTL=0.                                                            ENTR-MOD
      SIP=0.                                                            ENTR-MOD
      DO 1703 J=1,N                                                     ENTR-MOD
      SIP=SIP+VN(J)*(SB(J)-1.9869*Y(J))                                 ENTR-MOD
      IF(IFC(J)) 1703,1704,1705                                         ENTR-MOD
 1704 HG=HG+VN(J)*H(J)                                                  ENTR-MOD
      GO TO 1703                                                        ENTR-MOD
 1705 HL=HL+VN(J)*H(J)                                                  ENTR-MOD
      WTL=WTL+VN(J)*WTM(J)                                              ENTR-MOD
 1703 CONTINUE                                                          ENTR-MOD
      SIP=SIP/AA                                                        ENTR-MOD
      HIP=(HG+HL)/AA                                                    ENTR-MOD
      IF(KR(6)) 1701,1932,1702
 1702 RV=RVS+(RV-RVS)/EASE                                              ENTR-MOD
      IF(KR(8).GT.0) W(3)=W(3)-VN(N+1)/AA
      WS=-W(1)-W(2)-W(3)+1.E-38
      HIP=(HG+(HL-WTL/AA*HG)/WS)/AA
      GO TO 1932
 1701 IN=IS+2
      IG=MIN0(IQQ,-KKR(20))
      CALL RERAY(IW,A,0,0,0,0,IG,16)                                    B20A 263
      ALF=A(2,1)/A(1,1)                                                 B20A 265
      CSP=1./(A(1,1)*AA)                                                B20A 266
      BETH=P*(A(2,2)-A(1,2)*ALF)-1.                                     B20A 267
      IF(MODE-3) 1931,1932,1931                                         B20A 268
 1931 CSP=CSP/T                                                         B20A 269
 1932 CALL PROPS                                                        B20A 270
      WM=AA/P
      GAM=1.-ALF
      GAM=1./(1.+BETH-1.9869/AA*GAM/CSP*GAM*P)
      GAR(II)=GAM
      IF(KR(5))195,195,194                                              B20A 271
  195 IF(KR(7))  11,11,194                                              B20A 272
  194 WRITE (KOUT,4) CPF,CSP,ALF,BETH,GAM
      ITS=-1                                                            B20A 276
C*****OUTPUT PACKAGE                                                    B20A 277
   19 WM=AA/P                                                           B20A 278
 1962 WRITE(KOUT,  2)T,P,WM                                             B20A 279
```

```
      WRITE(KOUT,1901)W                                                 B20A 280
 1901 FORMAT(5X40HRELATIVE MASSES OF COMPONENTS 1,2 AND 3  3E12.5)      B20A 281
      SHIP=HIP                                                          B20A 282
      SSIP=SIP                                                          B20A 283
      HIP=0.                                                            B20A 284
      SIP=0.                                                            B20A 285
      DO 20 J=1,N                                                       B20A 286
      HIP=HIP+H(J)*SIGN(VN(J),WTM(J))
   20 SIP=SIP+ VN(J)*(SB(J)-1.9869*Y(J))                                B20A 288
      N=N+KR(8)
      HIP=(HIP+VN(MELT)*FLIQ*HMELT)/AA                                  B20A 289
      SIP=(SIP+VN(MELT)*FLIQ*SMELT)/AA                                  B20A 290
      RHR=P/T*WM/1.3146                                                 C20A 291
      WRITE(KOUT,8) HIP,SIP,RHR                                         B20A 292
      IF(FLIQ) 204,205,204                                              B20A 293
  204 WRITE(KOUT,10) FLIQ                                               B20A 294
  205 IF(ITS) 2051,203,203                                              B20A 295
 2051 IF(KR(5)-1) 203,202,201                                           B20A 296
  201 IF(KR(5).EQ.2)GO TO 200                                           ENTR-MOD
      Z=SIP                                                             ENTR-MOD
      GO TO 203                                                         ENTR-MOD
  200 HCH=HIP                                                           ENTR-MOD
      TCH=T                                                             ENTR-MOD
      SREF=SIP                                                          ENTR-MOD
  202 VELSQ=(HCH-HIP)*2.                                                B20A 298
      VMACH=SQRT(VELSQ/GAM*WM/(1.9869*T))                               B20A 299
      VEL=SQRT(VELSQ*45054.)                                            B20A 300
      UE(ISS)=VEL                                                       B20A 301
      HEA(ISS)=1.8*HIP                                                  ENTR-MOD
      IF (VEL) 2021,2021,2022
 2021 AREA=0.
      GO TO 2623
 2022 AREA=1./(VEL*RHR)
 2023 WRITE(KOUT,9) VEL,VMACH,AREA
  203 IF(IQQ) 2036,1203,1203
 1203 IF(ITS) 2031,2036,2036                                            B20A 305
 2031 DO 2033 I=1,N                                                     B20A 306
 2033 VN(I)=VN(I)/P                                                     B20A 307
      WRITE(KOUT,2032)(FAMOA(I),FAMOB(I),VN(I),I=1,N)                   B20A 308
      DO 2035 I=1,N                                                     B20A 309
 2035 VN(I)=VN(I)*P                                                     B20A 310
      IF(MODE-1) 2034,2037,2034                                         B20A 311
 2037 WRITE(KOUT,2038)  FAMOA(JC),FAMOB(JC)                             B20A 312
 2038 FORMAT(22H   SURFACE SPECIES IS 2A4)                              B20A 313
 2032 FORMAT(/3(5X7HSPECIES3X8HMOLE FR.2X)/(5X2A4,E12.5,5X2A4,E12.5,5X2A B20A 314
     14,E12.5))                                                         B20A 315
      GO TO 2034                                                        B20A 316
 2036 WRITE(KOUT,3) (FAMOA(I),FAMOB(I),VN(I),DY(I),Y(I),VLNK(I),IFC(I),E B20A 317
     1(I),CP(I),I=1,N)                                                  B20A 318
 2034 WRITE(KOUT,6)                                                     B20A 320
      N=N-KR(8)
      IF(ITS) 11,1021,1021                                              B20A 321
 1021 HIP=SHIP                                                          B20A 322
      SIP=SSIP                                                          B20A 323
C*****PRINCIPAL ITERATIVE LOOP                                          B20A 324
   21 IF(ITS)  109,110,109                                              B20A 325
  109 IF(MODE) 111,111,110                                              B20A 326
 1091 ITS=ITS+1
```

```
  110 CALL THERM
  111 MODE=KR(1)                                                        820A 327
      IQQ=0                                                             820A 328
      FLIQ=0.
      CALL MATER                                                        820A 329
      B1=B(1)                                                           820A 331
  211 MOE=1                                                             820A 332
      IF(KR(7)-1) 2101,210,2102                                         820A 333
 2102 IQQ=-2                                                            820A 334
      WRITE(KOUT,2108)(I,I=1,IS)                                        820A 335
  210 WRITE(KOUT,7) ITS,T,AA,EL,ENL,CMF,(E(I),I=1,IS)
 2108 FORMAT (50H1ITS TEMP   PRES*MWT  EQUIL ER  MASBAL ER  SCALE  7(I3,
     17H MASBAL)/90X3(I3,7H MASBAL))
 2101 IF(ITS) 2103,221,221
 2103 IF(MODE-1) 170,2104,170                                           820A 337
 2104 TWALG=T                                                           820A 338
      GO TO 170                                                         820A 339
  221 ITS=ITS+1                                                         820A 340
      IF(ITS-50) 2219,2219,222                                          820A 341
 2219 IF(ITS-N7) 22 2222,2222
  222 IF(KKR(18)) 2226,2226,2225
 2225 WRITE(KOUT,2000)
 2000 FORMAT (///2X,50H-----FOLLOWING OUTPUT NON-CONVERGENT-------------820A 344
     1-/70H  ISS,ITEM,II,MITS,ITS,IQQ,KR(6),HIP,SIP,TT(II)/ALP(I)/LEF(I)
     2/FR(I,II))
      WRITE(KOUT,3017)ISS,ITEM,II,MITS,ITS,IQQ,KR(6),HIP,SIP,TT(II)
      WRITE(KOUT,3018) ALP
      WRITE(KOUT,3019) LEF
      WRITE(KOUT,3018) (FR(I,II),I=1,N)
 3017 FORMAT(7I5,2X1P3E12.5)
 3018 FORMAT(2X1P10E11.4)
 3019 FORMAT(2X10I5)
      IQQ=-2
      KR(7)=1                                                           820A 350
 2226 ITS=-1                                                            820A 352
      NCV=NCV+1
      NON=NCV                                                           820A 353
      IF(NCV-20) 170,170,2220
 2220 MITS=100                                                          820A 354
      GO TO 170
 2222 KR(7)=3
      IQQ=-2
      GO TO 22
   22 ISPQ=IN+IL-1
      ICT=10                                                            820A 356
      DUM1=0.
      DO 2205 I=1,ISPQ
 2205 BS(I)=B(I)                                                        820A 357
      GO TO 2208                                                        820A 358
 2207 DO 2206I=IL,ISPQ                                                  820A 359
 2206 B(I)=BS(I)                                                        820A 360
 2208 DO 2204 I=1,ISPQ                                                  820A 361
      DO 2200 J=1,ISPQ                                                  820A 362
 2200 APE(I,J)=A(I,J)                                                   820A 363
      IF(I-2) 2204,2204,2201                                            820A 364
 2201 IF(IFC(I-2)-1) 2204,2204,2202                                     820A 365
 2202 B(I)=0.                                                           820A 366
      DO 2203 J=1,ISPQ                                                  820A 367
                                                                        820A 368
```

```
      APE(J,I)=0.
 2203 APE(I,J)=0.                                                    B20A 369
      APE(I,I)=1.0                                                   B20A 370
 2204 CONTINUE                                                       B20A 371
      IG=IQQ
      CALL RERAY(IN,APE(IL,IL),0,B(IL),1,0,IG,16)                    B20A 373
      ICT=ICT-1
      IF(ICT-IQQ) 222,2209,2210
 2209 IQQ=-2
 2210 IF(IG) 2212,2221,2221
 2212 IF(INV) 2216,2213,222
 2213 IF(KR(6)) 2227,2230,2230
 2230 LAMD=1
      DO 2229 K=1,IS
      J=-IR(K)
      IF(IFC(J).GT.1) GO TO 2229
      DO 2228 J=1,N
      IF(VN(J).GT.1.E-30 .AND. MOD(LAMI(J)/LAMD,2).NE.0) GO TO 2229
 2228 CONTINUE
      LEF(K)=-IABS(LEF(K))
      LEFN(K)=-IABS(LEFN(K))
      INV=-1
      ITS=1
      GO TO 393
 2229 LAMD=LAMD+LAMD
 2227 INV=-1
      PIN=P*1.E-5
      DO 2215 I=1,N
      IF(IFC(I)) 2215,2214,2215
 2214 VN(I)=VN(I)+PIN
      Y(I)=ALOG(VN(I))
 2215 CONTINUE
      GO TO 111
 2216 IF(KR(6)) 2217,222,222
 2217 ITS=999
      GO TO 111
C*****IF TRYING TO PUSH THROUGH TMIN OR TMAX -- REINVERT AND DT TO ZERO B20A 374
 2221 IF(T-TMIN) 2223,227,228
 2223 T=TMIN
      GO TO 1891
  227 IF (X(1)) 228,228,228
  228 IF (T-TMAX) 223,229,2224
 2224 T=TMAX
      GO TO 1891
  229 IF(X(1)) 223,223,228                                           B20A 378
C*****IF NEW CONDENSED HAS NEG CORRECTION, DELETE AFTER REINVERT      B20A 379
  223 IF(IER) 226,212,226                                            B20A 380
  226 IF(X(IER)+1.E-4) 225,212,212                                   B20A 381
  225 DO 2252 I=1,ISPQ
      A(IER,I)=0.
 2252 A(I,IER)=0.
      BS(IER)=-1.E-8
      A(IER,IER)=1.8
      GO TO 2207                                                     B20A 384
C*****IF S.E. ERROR AND CORRECTION ON T OF CONFLICTING SIGN,REINVERT  B20A 385
  212 IF(MODE-1) 224,213,224                                         B20A 386
  213 IF(X(1)*01+.00001) 224,218,218
C*****ON S.E. IF DELTA LN T .GT. .9 REINVERT NO DT IF EL AND ENL ARE SMAB20A 3
```

```
      218 IF(ABS(X(1))-0.9)224,224,228
C*****IF CONVERGED EXCEPT FOR T ON H OR S OPTIONS  --  NON CONVERGENT   B20A 393
      228 IF(MODE-1) 2281,214,2280                                      B20A 394
     2280 IF(EL+100.*ENL-1.E-4) 222,222,2281                            B20A 395
C*****ON S.E. OPTION RESULTIN IN CONFLICTING ERROR/CORRECTION OR T PUSH B20A 396
C*****IF OTHER BALANCES RELATIVELY GOOD, SET T TO TMIN/TMAX AS PER ERRORB20A 397
C*****AND GO TO THERM (IF T ALREADY THERE - NONCONVERGE) ELSE DT TO ZEROB20A 398
      214 IF(ABS(B1)-100.*(EL+ENL)) 2281,215,215                        B20A 399
      215 TTMIN=TT(1)/1.8-500.
          TTMAX=TTMIN+1000.
          IF(B1) 216,216,217
      216 IF(T-TMIN) 170,170,2161                                       B20A 401
     2161 T=AMAX1(T-DTD,TMIN)
          TTMAX=T
          DTU=DTD/2.
          GO TO 1091
      217 IF(T-TMAX) 2171,170,170
     2171 T=AMIN1(TMAX,T+DTU)
          TTMIN=T
          DTD=DTU/2.
          GO TO 1091
     2281 X(1)=0.                                                       B20A 407
          MODE=0                                                        B20A 408
          IN=IN-1                                                       B20A 411
          IL=2                                                          B20A 412
          GO TO 2207                                                    B20A 413
      224 IF(X(2)+1.0)2240,2249,2249
     2240 BS(2)=0.
          A(2,2)=1.E25
          GO TO 2207
     2249 CALL CRECT(MODE)
          TMIN=TTMIN
          TMAX=TTMAX
          IF(KR(7)-1) 21,21,19                                          B20A 415
       11 PIEASE=SPEASE
          RETURN
          END                                                           B20A 417
CB21A                                                                   B21A 001
          SUBROUTINE THERM                                              B21A 002
          DIMENSION CIJ( 71,1),TF(1)                                    B21A 003
          EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                             B21A 004
          COMMON /BLOCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),N(3),LEF(10)B21A   5
         1 ,LEFS(10),PIEASE,LEFN(10),L2,L3                              ENTR-MOD
          COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B21A   7
         1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),NAT(10),  B21A   8
         2 KAT(10),IR(10),IS,KP(10),LAMI( 71),P,T,TK(10, 7),VM( 71),        B21A   9
         3 VNU( 71,10),ITFF,KRZ,NCM,NCV,NN,NTM( 71),Y( 71),YM( 71),GG( 71)  B21A  10
         4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B21A  11
          COMMON /EQTCOM/SIP,NIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,   B21A  12
         1 MODE,MMELT,SMELT,TMAX,TMIN,KELT,SUMN,SUML,NS,NSS,B1,ISP2,ISPC,   B21A  13
         2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,NTG,NTL,JC,NG,  B21A  14
         3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),B(16),      ENTR-MOD
         4 IP( 71),ALP(10),FMU(10),GAMM(10),GAMF(10),SLAM(10),DV( 71),RVS,  B21A  16
         5 CP( 71),W( 71),SB( 71),TC( 71),VLMK( 71),E( 71),PMUS(10),        B21A  17
         6 BC(10),BLMK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B21A  18
          COMMON/INTCOM/KKR(20),KIN,KOUT
    5     MODE=KR(1)                                                        29
          IF (IIS) 50,10,50                                                 30
```

```
   10    WTG=0.
         WTL=0.
         IF (KR(8)) 40,40,15
   15    IF (IFC(N+1)-1) 25,20,25
   20    IF (T+.001-TF(N+1)) 25,25,30
   25    IFC(N+1)=-1
         VN(N+1)=0.
   30    DO 35 K=1,IS
      35 VNU(N+1,K)=-TQ(K,L3)
         WTL=-VN(N+1)
   40    DUM2=0.
         SUMN=0.
         DO 45 I=1,IS
         PNUS(I)=0.
   45    SLAM(I)=0.
   50    HMELT=0.
         FLIQ=0.
         SMELT=0.
         MELT=1
         TMIN=TTMIN
         TMAX=TTMAX
         TFMAX=500.
         VA=ALOG(T/3000.)
         VB=T-3000.
         VC=(T+3000.)/2.
         VD=T*3000.
         VE=VC/(VD*VD)
         RT=1.9869*T
         I=1
         DO 235 IK=1,N
         J=2
         IF (IFC(I)+1) 165,85,85
   85    IF (IFC(I)) 90,95,120
   90    IF (MODE-1) 165,160,165
   95    IF (ITS) 165,100,165
  100    SUMN=SUMN+VN(I)
         DUM1=WTM(I)*VN(I)
         WTG=WTG+DUM1
         DUM2=DUM2+DUM1/FF(I)
         IF(VN(I).GT.1.E-29) Y(I)=ALOG(VN(I))
         IF (IK-IS) 105,105,110
  105    PNUS(I)=VN(I)
         SLAM(I)=VN(I)/FF(I)
         GO TO 165
  110    DO 115 K=1,IS
         DUM1=VNU(I,K)*VN(I)
         PNUS(K)=PNUS(K)+DUM1
  115    SLAM(K)=SLAM(K)+DUM1/FF(I)
         GO TO 165
  120    IF (IFC(I)-1) 125,125,165
  125    IF (ITS) 150,130,150
  130    IF (KR(6)) 145,135,135
  135    IF (T-TF(I)+.001) 140,140,145
  140    IFC(I)=-1
         VN(I)=0.
         GO TO 90
  145    WTL=WTL+VN(I)*WTM(I)
  150    IF (MODE-1) 165,155,165
```

```
155   TMIN=AMAX1(TMIN,TF(I))                                          100
160   TFMAX=AMAX1(TF(I),TFMAX)                                        101
165   IF (T-ABS(TU(I,1))) 170,175,175                                 102
170   J=1                                                             103
175   CP(I)=RC(I,J)+T*RD(I,J)+RE(I,J)/(T*T)                           104
      H(I)=RB(I,J)+VB*(RC(I,J)+RD(I,J)*VC+RE(I,J)/VD)                 105
      SB(I)=RF(I,J)+RC(I,J)*VA+VB*(RD(I,J)+RE(I,J)*VE)                106
      IF (MODE-2) 210,180,180                                         107
180   IF (IFC(I)-1) 210,185,210                                       108
185   IF (TU(I,1)) 190,210,210                                        109
190   IF (T+TU(I,1)) 200,195,205                                      110
195   HMELT=-H(I)-HMELT                                               111
      SMELT=-SB(I)-SMELT                                              112
      MELT=I                                                          113
      IF (J-2) 210,170,210                                            114
200   TMAX=AMIN1(TMAX,-TU(I,1))                                       115
      GO TO 210                                                       116
205   TMIN=AMAX1(TMIN,-TU(I,1))                                       117
210   TC(I)=-H(I)/RT                                                  118
      VLNK(I)=TC(I)+SB(I)/1.9869                                      119
      IF (IK-IS) 215,215,220                                          120
215   BLNK(I)=VLNK(I)                                                 121
      IBC(I)=IFC(I)                                                   122
      BC(I)=TC(I)                                                     123
      GO TO 235                                                       124
220   DO 230 K=1,IS                                                   125
      IF (IBC(K)+1) 230,225,225                                       126
225   VLNK(I)=VLNK(I)-VNU(I,K)*BLNK(K)                                127
      TC(I)=TC(I)-VNU(I,K)*BC(K)                                      128
230   CONTINUE                                                        129
235   I=I+1                                                           130
      IF (MODE-1) 250,240,250                                         132
240   IF (TFMAX-T) 245,250,250                                        133
245   T=TFMAX                                                         134
      IF(T-500.) 240,240,5
  240 WRITE(KOUT,249)
      STOP
  249 FORMAT(///38H NO AVAILABLE SURFACE SPECIES. . .STOP)
250   IF (ITS) 385,255,385                                            136
255   AA=P*WM                                                         137
365   SUMN=SUMN/P                                                     180
      SUML=ALOG(SUMN)                                                 181
      FFF=WTG/DUM2                                                    182
      WTG=WTG/SUMN                                                    183
      WTL=WTL/SUMN                                                    184
      SUMC=1.0
      IF(KR(6)) 385,369,369
  369 DO 370 I=1,IS
      PNUS(I)=PNUS(I)/SUMN                                            186
370   SLAM(I)=SLAM(I)/SUMN*FFF                                        187
375   IF (WTL/WTG-WS) 385,385,380                                     191
380   SUMC=WTL/(WTG*WS)                                               192
      WTL=WTL/SUMC                                                    193
385   RETURN                                                          194
      END                                                             195-
CB22A                                                              B22A 001
      SUBROUTINE MATER                                             B22A 002
      DIMENSION VLAM( 71,1),  X(16)                                B22A 005
```

```
      EQUIVALENCE(AM( 74),VLAM)                                         B22A 006
      DIMENSION CIJ( 71,1),TF(1)                                        B22A 007
      DIMENSION ECD( 71)                                                B22A 008
      EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                                 B22A 009
      COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),W(3),LEF(10) B22A  10
     1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                  ENTR-MOD
      COMMON/BUMCOM/     BUMP,CORMA,EASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IX B22A  12
      COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2), B22A  13
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),   B22A  14
     2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),         B22A  15
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)   B22A  16
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                    B22A  17
      COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,    B22A  18
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ,    B22A  19
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HG,   B22A  20
     3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),B(16),       ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,   B22A  22
     5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),         B22A  23
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                      B22A  24
      COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),    B22A  25
     1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),MA(10),LL(10),PMR(10),  B22A  26
     2 PRMU(10,10),EESE(10)                                              B22A  27
      COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                           B22A  28
     1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                B22A  29
      COMMON/INTCOM/KKR(20),KIN,KCUT
      EQUIVALENCE(B,X)                                                   B22A 021
      WSS=WS                                                                  28
      DO 5 I=1,IS                                                             29
5     IBC(I)=IFC(I)                                                           30
      IF(KR(6)) 40,20,20
20    IF (ITS) 25,40,40                                                       36
25    DO 35 I=1,IS                                                            37
      IF (IBC(I)-1) 35,30,35                                                  38
30    IBC(I)=-1                                                               39
35    CONTINUE                                                                40
40    RV=WSS-WTL/WTG                                                          41
      IF(ITS.EQ.0) RVS =RV
      IF (KR(7)-1) 70,45,50                                                   42
45    IF (ITS) 70,60,70                                                       43
50    WRITE (KOUT,55) FFF,WTL,WTG,AA,RV,ALP,PNUS,SLAM                         44
55    FORMAT (32H FFF,WTL,WTG,AA,RV/ALP/PNUS/SLAM/1X5E12.5/(1X10E12.5))       45
      KR(7)=KR(7)-1                                                           46
      IF (KR(7)-1) 70,60,70                                                   47
60    WRITE (KOUT,65) (I,I=1,IS)                                              48
65    FORMAT (50H1ITS TEMP   PRES*MWT  EQUIL ER  MASBAL ER  SCALE  7(I3,       49
     17H MASBAL)/90X3(I3,7H MASBAL))                                          50
C     INITIALIZE                                                              51
70    EL=0.                                                                   52
      CPG=0.                                                                  53
      EP=0                                                                    54
      CPF=0.                                                                  55
      JC=0                                                                    56
      JCS=0                                                                   57
      ISP=IS+1
      ISPQ=IS+2                                                               58
      B(1)=0.                                                                 59
      B(2)=0.                                                                 60
      A(1,1)=0.                                                               61
```

```
      A(1,2)=0.
      A(2,1)=0.
      A(2,2)=0.
C     -----INITIALIZE CONTRIBUTICN OF MOST SIGNIFICANT SPECIES IN EACH M
      DO 75 I=1,IS
      EB(I)=0.
75    E(I)=AA*ALP(I)
      ISP2=ISPQ
C     - - - MAIN BASE SPECIES LOOP
      DO 325 IK=1,IS
      I=2-IR(IK)
      IF (KAT(IK)-99) 85,80,85
80    PNUS(I-2)=0.
C     ZERO MATRIX
85    DO 90 K=1,ISPQ
90    A(K,I)=0.
      IF (ITS) 110,95,110
C     NORMALIZE ON PRESSURE ON FIRST PASS
95    VN(I-2)=VN(I-2)/SUMN
      ECD(I-2)=(1.-EASE)*Y(I-2)
      EBL(I-2)=0.
      IF (IBC(I-2)) 110,100,105
100   Y(I-2)=Y(I-2)-SUML
      GO TO 110
105   VN(I-2)=VN(I-2)/SUMC
C     INITIALIZE SOME MORE
110   B(I)=0.
      A(I,1)=0.
      IP(I-2)=0.
C     SET FLAG INDICATING SIGNIFICANCE OF SPECIES IN MASS
C     BALANCE(S) AND INCREMENT COUNT ON SIGNIFICANT SPECIES
      IF (VN(I-2)-EBL(I-2)) 120,120,115
115   IP(I-2)=-1
C     TREAT BASE SPECIES CONTAINING BUT NOT REPRESENTING NON-PRESENT
C     ELEMENTS IN SAME MANNER AS NON-PRESENT CONDENSED SPECIES
120   IF (IBC(I-2)+1) 325,125,125
125   IF (IBC(I-2)) 180,215,130
130   A(I,I)=1.
      VA=VN(I-2)
      IF (IABS(IBC(I-2)-3)-1) 135,280,140
135   A(2,I)=1.0
      GO TO 280
140   IF (EB(I-2)-ABS(VA)) 145,150,150
145   EB(I-2)=ABS(VA)
      IB(I-2)=I-2
150   E(I-2)=E(I-2)-VA
      IF (KR(6)) 155,160,160
155   IF (MODE-1) 280,170,280
160   DO 165 K=1,IS
165   A(K+2,I)=-WTM(I-2)*(PNUS(K)/WTG+GAMF(K))
      A(I,I)=A(I,I)+1.
170   TMIN=AMAX1(TMIN,TF(I-2))
      IF (T-TF(I-2)+.001) 175,175,180
175   A(I,I)=1.0E+10
      E(I-2)=-VN(I-2)*1.001E+10
      MODE=0
180   IF (MODE-1) 185,190,185
185   IF (KR(8)) 280,280,190
```

```
190   IF (TF(I-2)+.001-T) 325,195,195
195   IF (JC) 205,205,200
200   IF (Y(I-2)-BJC) 325,325,205
  205 BJC=Y(I-2)-ECO(I-2)
      JCS=JC
      TMAX=TF(I-2)
      JC=I-2
      IFCJC=IBC(I-2)
      IF (KR(8)) 210,210,280
210   A(1,JCS+2)=0.
      A(1,I)=-1.0
      B(1)=BJC
      GO TO 325
C     -----GAS PHASE
215   VA=VN(I-2)
      CPG=CPG+VA*CP(I-2)
      A(I,I)=VA
      A(2,I)=VA
      EP=EP-VA
      IF (KAT(IK)-99) 220,275,220
220   IF (KR(6)) 275,250,225
225   DO 230 K=1,IS
  230 A(K+2,I)=(VLAM(I-2,K)+GAMH(K)*H(I-2))*VA
      A(I,I)=A(I,I)+VA*RV
      DUM2=WTM(I-2)/WTG*WTL/WTG*VA
      DO 245 K=1,IS
          IF(EBL(K).GT.ABS(A(K+2,I))) GO TO 240
      IP(I-2)=-1
      IF (EB(K)-ABS(A(K+2,I))) 235,240,240
235   EB(K)=ABS(A(K+2,I))
      IB(K)=I-2
240   E(K)=E(K)-A(K+2,I)
245   A(K+2,I)=A(K+2,I)+DUM2*PNUS(K)
      GO TO 280
250   DUM1=WTM(I-2)/WTG*VA
      DUM2=WTL/WTG*DUM1
      IF (KR(4)) 255,255,260
255   DUM1=0.
      VA=(RV+1.)*VA
      GO TO 265
260   DUM1=DUM1*(1.-FFF/FF(I-2))
      VA=(RV+FFF/FF(I-2))*VA
265   DO 270 K=1,IS
270   A(K+2,I)=DUM1*SLAM(K)+DUM2*PNUS(K)
      A(I,I)=A(I,I)+VA
275   EB(I-2)=ABS(VA)
      IB(I-2)=I-2
      E(I-2)=E(I-2)-VA
280   IF (MODE-2) 320,300,285
285   IF (IBC(I-2)) 325,295,290
290   HOS=SB(I-2)
      GO TO 305
295   HOS=SB(I-2)-1.9869*Y(I-2)-1.9869
      GO TO 310
300   HOS=H(I-2)
      IF (IBC(I-2)) 325,310,305
305   A(1,I)=HOS
      GO TO 315
```

```
4873      310   A(1,I)=HOS*VN(I-2)
4874      315   A(1,2)=A(1,2)-HOS*VN(I-2)                                  174
4875      320   CPF=CPF+CP(I-2)*VN(I-2)                                    175
4876      325   CONTINUE                                                   176
4877            DO 330 I=1,IS                                              177
4878            BE(I)=E(I)                                                 178
4879      330   BY(I)=Y(I)                                                 179
4880            IER=0                                                      180
4881            IRE=0                                                       30
4882            EER=0.                                                      31
4883      C     - - - MAIN NON-BASE SPECIES LOOP                            32
4884      350   LIM=N+KR(8)                                                 33
4885            IF (LIM-ISP) 730,355,355                                    36
4886      355   J=ISP                                                       37
4887            DO 725 IK=ISP,LIM                                           38
4888            IF (IK-N) 365,365,360                                       39
4889      360   E(J)= 1.E-10                                                40
4890            IF (IFC(J)) 410,725,445                                     41
4891      365   IF (IFC(J)+1) 725,370,370                                   42
4892      370   IF (ITS) 390,375,390                                        43
4893      375   VN(J)=VN(J)/SUMN                                            44
4894            IF (IFC(J)) 390,385,380                                     45
4895      380   VN(J)=VN(J)/SUMC                                            46
4896            GO TO 390                                                   47
4897      385   Y(J)=Y(J)-SUML                                              48
4898      390   E(J)=VLNK(J)-Y(J)                                           49
4899            DO 405 I=1,IS                                               50
4900            IF (IBC(I)) 400,400,395                                     51
4901      395   FNU(I)=0.                                                   52
4902            GO TO 405                                                   53
4903      400   FNU(I)=VNU(J,I)                                             54
4904            E(J)=E(J)+FNU(I)*BY(I)                                      55
4905      405   CONTINUE                                                    56
4906            IF(KR(6)) 409,409,406                                       57
4907        406 IF(ITS) 408,407,408
4908        407 ECD(J)=(1.-EASE)*E(J)
4909        408 E(J)=E(J)-ECD(J)
4910        409 EAB=ABS(E(J))
4911            IF (IFC(J)) 410,590,445
4912      C     CONDENSED SPECIES                                           59
4913      410   EAB=E(J)                                                    60
4914            IF (KR(6)) 425,415,415                                      61
4915      415   IF (T-TF(J)+.001) 420,425,425                               62
4916      420   EAB=0.                                                      63
4917            IF (KR(8)) 535,535,545                                      64
4918      425   IF (E(J)-EER) 535,535,430                                   65
4919      430   EER=E(J)                                                    66
4920            IF (IER) 435,435,440                                        67
4921      435   ISPQ=ISPQ+1                                                 68
4922            IER=ISPQ                                                    69
4923      440   IE=IER                                                      70
4924            IRE=IK                                                      71
4925            GO TO 450                                                   72
4926      445   ISPQ=ISPQ+1                                                 73
4927            IE=ISPQ                                                     74
4928      450   WTR=0.                                                      75
4929            IF (KR(6)) 460,455,455                                      76
4930      455   TMIN=AMAX1(TF(J),TMIN)                                      77
                                                                            78
```

```
4931          WTR=WTM(J)/WTG
4932     460  DO 465 I=1,ISPG
4933          A(I,IE)=0.
4934     465  A(IE,I)=0.
4935          DO 480 K=1,IS
4936          DUM1=VNU(J,K)
4937          IF (IBC(K)-1) 470,470,480
4938     470  VA=DUM1*VN(J)
4939          A(K+2,IE)=DUM1-WTR*(PNUS(K)+GAMF(K)*WTG)
4940          BE(K)=BE(K)-VA
4941          IF (ABS(VA)-EB(K)) 480,480,475
4942     475  EB(K)=ABS(VA)
4943          IB(K)=IK
4944     480  CONTINUE
4945          K=IE-ISP2
4946          IF (IK-N) 505,505,485
4947     485  JJ(K)=JC
4948          B(IE)=Y(JC)
4949          IF (JC-IS) 495,495,490
4950     490  A(IE,1)=TC(JC)
4951          B(IE)=E(JC)
4952     495  EAB=-B(IE)
4953          IF (IFCJC) 715,715,500
4954     500  EAB=ABS(EAB)
4955          GO TO 715
4956     505  JJ(K)=J
4957          A(IE,1)=TC(J)
4958          B(IE)=E(J)
4959          IF (T+.001-TF(J)) 515,510,510
4960     510  IF (KR(8)) 530,530,540
4961     515  IF (MODE-1) 520,525,520
4962     520  IF (KR(6)) 530,525,525
4963     525  A(IE,IE)=1.E+10
4964          B(IE)=-VN(J)*1.001E+10
4965          MODE=0
4966     530  IF (MODE-2) 535,575,580
4967     535  IF (MODE-1) 715,540,715
4968     540  IF (T-TF(J)-.001) 545,545,560
4969     545  IF (JC) 555,555,550
4970     550  IF (E(J)-BJC) 725,725,555
4971     555  BJC=E(J)
4972          JC=IK
4973          IFCJC=IFC(JC)
4974          TMAX=TF(J)
4975          IF (KR(8)) 565,565,560
4976     560  IF (MODE-2) 725,575,580
4977     565  B(1)=BJC
4978          DO 570 K=1,IS
4979     570  A(1,K+2)=-FNU(K)
4980          A(1,1)=TC(J)
4981          GO TO 725
4982     575  HOS=H(J)
4983          GO TO 585
4984     580  HOS=SB(J)
4985     585  A(1,IE)=HOS
4986          A(1,2)=A(1,2)-VN(J)*HOS
4987          CPF=CPF+CP(J)*VN(J)
4988          GO TO 715
```

```
C     GAS PHASE SPECIES
590   IP(J)=0
      IF (VN(J)) 595,715,595
595   IQ=0
      CPG=CPG+VN(J)*CP(J)
      IF (KR(6)) 625,600,605
600   FFJ=FFF/FF(J)
605   DUM1=WTM(J)/WTG*VN(J)
      DUM2=DUM1/WTG*WTL
      IF (KR(6)) 610,610,625
610   IF (KR(4)) 615,615,620
615   DUM1=0.
      FFJ=1.0
      GO TO 625
620   DUM1=DUM1*(1.-FFJ)
625   DO 680 KI=1,IS
      I=2-IR(KI)
      VA=VNU(J,I-2)*VN(J)
      IF (KAT(KI)-99) 630,645,630
630   IF (KR(6)) 645,640,635
635   VA=VA*RV+VN(J)*(VLAM(J,I-2)+GAMM(I-2)*H(J))
      BE(I-2)=BE(I-2)-VA
      ABSVA=ABS(VA)
      VA=VA+PNUS(I-2)*DUM2
      GO TO 650
640   VB=VA*FFJ
      VA=RV*VA+VB
      BE(I-2)=BE(I-2)-VA
      ABSVA=ABS(VA)
      VA=VA+SLAM(I-2)*DUM1+DUM2*PNUS(I-2)
      GO TO 650
645   BE(I-2)=BE(I-2)-VA
      ABSVA=ABS(VA)
650   IF (ABSVA-EBL(I-2)) 660,660,655
655   IQ=1
      IF (ABSVA-EB(I-2)) 670,670,665
660   IF (ABS(VA)-EBL(I-2)) 680,680,670
665   EB(I-2)=ABSVA
      IB(I-2)=IK
670   DO 675 K=3,ISP2
675   A(I,K)=A(I,K)+VA*FNU(K-2)
      B(I)=B(I)-VA*E(J)
      A(I,1)=A(I,1)-VA*TC(J)
      A(2,I)=A(2,I)+VN(J)*FNU(I-2)
680   CONTINUE
      IF (IQ) 715,715,685
685   EP=EP-VN(J)
      IP(J)=-1
      B(2)=B(2)-VN(J)*E(J)
      A(2,1)=A(2,1)-VN(J)*TC(J)
      IF (MODE-2) 710,690,695
690   MOS=H(J)*VN(J)
      GO TO 700
695   MOS=VN(J)*(SB(J)-1.9869*Y(J)-1.9869)
700   DO 705 I=3,ISP2
705   A(1,I)=MOS*FNU(I-2)+A(1,I)
      A(1,2)=A(1,2)-MOS
      A(1,1)=A(1,1)-MOS*TC(J)
```

```
5047            B(1)=B(1)-HOS*E(J)
5048      710   CPF=CPF+VN(J)*CP(J)                                    196
5049      715   IF (EL-EAB) 720,725,725                                197
5050      720   EL=EAB                                                 198
5051      725   J=J+1                                                  199
5052      730   CONTINUE                                               200
5053            ISP3=IS+3                                              201
5054            IF (MODE-2) 785,735,760                                 29
5055      735   CPA=CPF*T                                               30
5056            SHMLT=HMELT*VN(MELT)                                    31
5057            EHS=AA*HIP+A(1,2)                                       32
5058            IF (KKJ+1) 750,740,750                                  33
5059      740   DUM1=SVA/AA*T*T                                         34
5060            EHS=AA*SVC-DUM1+A(1,2)                                  35
5061            HIP=-A(1,2)/AA                                          36
5062            A(1,2)=-AA*SVC-DUM1                                     37
5063            CPA=(CPF+2.*DUM1/T)*T                                   38
5064            DUM2=SVB/AA*T                                           39
5065            P=P-EP                                                  40
5066            EP=0.                                                   41
5067            IF (ABS(EHS/AA)-10.) 745,745,750                        42
5068      745   EP=-P+SVD-DUM2                                          43
5069            A(2,1)=A(2,1)+DUM2                                      44
5070            A(2,2)=-DUM2                                            45
5071      750   IF (KR(2)-MODE) 765,755,765                             46
5072      755   A(1,2)=-AA*HIP                                          47
5073            GO TO 765                                               48
5074      760   CPA=CPF                                                 49
5075            SHMLT=SMELT*VN(MELT)                                    50
5076            EHS=AA*SIP+A(1,2)-1.9869*(P-EP)                         51
5077            A(1,2)=-AA*SIP                                          52
5078      765   B(1)=B(1)+EHS                                           53
5079            A(1,1)=A(1,1)+CPA                                       54
5080            IF (SHMLT) 785,785,770                                  55
5081      770   IF (EHS) 785,785,775                                    56
5082      775   EHS=EHS-SHMLT                                           57
5083            B(1)=B(1)-SHMLT                                         58
5084            IF (EHS) 780,785,785                                    59
5085      780   FLIQ=1.+EHS/SHMLT                                       60
5086            MODE=0                                                  61
5087            A(1,1)=1.E+10                                           62
5088            TMIN=500.                                               63
5089            TMAX=5000.                                              64
5090      785   ENL=ABS(EP)/P*100.                                      65
5091            DO 810 I=3,ISP2                                         66
5092            E(I-2)=BE(I-2)                                          67
5093            EBL(I-2)=EB(I-2)*1.E-7                                  69
5094            A(I,2)=-AA*ALP(I-2)                                     70
5095            IF (IFC(I-2)-1) 795,795,790                             71
5096      790   NFM=NFM+1                                               72
5097            GO TO 810                                               73
5098      795   IF (KR(6)) 805,805,800                                  74
5099      800   A(I,1)=A(I,1)+GAMM(I-2)*T*CPG                           75
5100            E(I-2)=E(I-2)+MTL*GAMF(I-2)                             76
5101      805   ER=E(I-2)                                               77
5102            ABER=ABS(ER)/(EB(I-2)+1.E-20)                           78
5103            ENL=AMAX1(ABER,ENL)                                     79
5104            B(I)=B(I)+ER                                            80
                                                                        81
```

```
810   CONTINUE                                                    82
      IF (ISP2-ISPQ) 815,680,880                                  83
815   IV=0                                                        84
      JZ=0                                                        85
C     ADD CONDENSED NONBASE SPECIES TO ARRAY                      86
      DO 840 IE=ISP3,ISPQ                                         87
      J=IE-ISP2                                                   88
      J=JJ(J)                                                     89
      IF (J-IS) 820,820,830                                       90
820   DO 825 K=1,IS                                               91
825   A(IE,K+2)=0.                                                92
      A(IE,J+2)=-1.0                                              93
      GO TO 840                                                   94
830   DO 835 K=1,IS                                               95
835   A(IE,K+2)=-VNU(J,K)                                         96
840   CONTINUE                                                    97
C     ELIMINATE TERMS CORRESPONDING TO PRESENT BASE CONDENSED     98
      DO 855 K=1,IS                                               99
      IF (IFC(K)) 855,855,845                                    100
845   DO 850 IE=ISP3,ISPQ                                        101
850   A(IE,K+2)=0.                                               102
855   CONTINUE                                                   103
880   B(2)=EP+B(2)                                               111
      IF(KR(6)) 5979,5979,5976
 5976 ENL=ABS(EP)/P*100.
      IF(MT) 5973,5973,5974
 5974 CALL KINET
 5973 CONTINUE
      DO 5975 I=1,IS
      IF(EB(I)) 5986,5986,5985
 5985 EB(I)=AMAX1(EB(I),ABS(E(I)))
      IF(ITS) 5978,5977,5978
 5977 EESE(I)=E(I)*(1.-EASE)
 5978 E(I)=E(I)-EESE(I)
      B(I+2)=B(I+2)-EESE(I)
 5986 EB(I)=ABS(EB(I))
      IF(IFC(I)-1) 5971,5971,5975
 5971 ENL=AMAX1(ENL,ABS(E(I)/(EB(I)+1.E-28)))
 5975 CONTINUE
 5979 CONTINUE
      IF (MODE-1) 910,890,885                                    112
885   IF (ABS(EMS/A(1,1))-.0001) 910,910,920                     113
890   IF (IFCJC) 895,900,905                                     114
895   IF (JC-IRE) 900,905,900                                    115
905   MODE=0                                                     117
      TMIN=TTMIN                                                 118
      TMAX=TTMAX                                                 119
900   IF (ABS(B(1))-1.E-4) 910,910,920                           116
910   IF (EL-1.E-4) 915,915,920                                  121
915   IF (ENL-1.E-5) 935,935,920                                 122
920   IN=ISPQ                                                    123
      IL=1                                                       124
      IF (MODE) 925,925,930                                      125
925   IN=ISPQ-1                                                  126
      IL=2                                                       127
      X(1)=0.                                                    128
930   RETURN                                                     129
935   IT=ITS+1                                                   130
```

```
      ITS=-1
      GO TO 930                                                         132
      END                                                               133-

C823A                                                                 B23A 001
      SUBROUTINE CRECT(MOE)                                           B23A 002
      INTEGER FAMOA,FAMOB                                             B23A 004
      COMMON/INTCOM/KKR(20),KIN,KOUT
      DIMENSION CIJ( 71,1),TF(1)                                      B23A 005
      EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                               B23A 006
      DIMENSION X(16)                                                 B23A 007
      DIMENSION CMFF( 71)                                             B23A 008
      COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),W(3),LEF(10)B23A   9
     1 ,LEFS(10),PIEASE,LEFW(10),L2,L3                                ENTR-MOD
      COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B23A  11
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B23A  12
     2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B23A  13
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B23A  14
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                 B23A  15
      COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,   B23A  16
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ,   B23A  17
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HG,  B23A  18
     3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),B(16),      ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,  B23A  20
     5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B23A  21
     6 BC(10),BLNK(10),BY(10),IBC(10),EE(10),JJ( 4)                    B23A  22
      EQUIVALENCE(DYA,DY)
      DIMENSION DYA(1,1)
      EQUIVALENCE(B,X)                                                B23A 010
      CLIM=AMAX1(1.,W(2)+W(3))*0.2*WTG                                   31
      DWTL=0.                                                            32
      DWTG=0.                                                            33
      BUMP=P*1.E-7                                                       34
      BUMP=P*1.E-4                                                       35
      BULP=ALOG(BUMP)                                                    36
      CMF=1.                                                             37
    5 K=0                                                                38
      DO 20 J=2,IS                                                       39
      IF (IB(J)-IB(J-1)) 10,15,20                                        40
   10 JA=IB(J)                                                           41
      IB(J)=IB(J-1)                                                      42
      IB(J-1)=JA                                                         43
      K=1                                                                44
      GO TO 20                                                           45
   15 IB(J)=1000                                                         46
   20 CONTINUE                                                           47
      IF (K) 25,25,5                                                     48
   25 IB(IS+1)=1000                                                      49
      M=IB(1)                                                            50
      M1=1                                                               51
      L=IS+2                                                             52
      I=0                                                                53
      LL=1                                                               54
      LIM=M+KR(8)                                                        55
      DO 200 IK=1,LIM                                                    56
      I=I+1                                                              57
      IF (IK-IS) 30,30,45                                                58
   30 SLAM(I)=0.                                                         59
```

```
5221          IBC(I)=IFC(I)
5222          PNUS(I)=0.
5223          IF (IFC(I)-1) 35,35,75
5224     35   DYI=X(I+2)
5225          IF (IFC(I)+1) 275,40,40
5226     40   IF (IFC(I)) 205,95,230
5227     45   IF (IFC(I)+1) 75,50,50
5228     50   IF (IFC(I)) 70,55,85
5229     55   VA=E(I)-TC(I)*X(1)
5230          DO 65 J=1,IS
5231          IF (IBC(J)) 60,60,65
5232     60   VA=VA+VNU(I,J)*X(J+2)
5233     65   CONTINUE
5234          DYI=VA
5235          GO TO 95
5236     70   IF (IK-IRE) 75,80,75
5237     75   DYI=0.
5238          GO TO 275
5239     80   IFC(I)=1
5240          DYI=X(IER)
5241          GO TO 230
5242     85   L=L+1
5243          IF (L-IER) 90,85,90
5244     90   DYI=X(L)
5245          GO TO 230
5246     95   DWTG=DWTG+VN(I)*DYI*WTM(I)
5247          IF (IP(I)) 100,195,100
5248    100   IF (IK-M) 105,145,105
5249    105   IF (VN(I)-DUMP) 110,140,140
5250    110   IF (MOE) 195,195,115
5251    115   IF (DYI) 120,275,125
5252    120   IF (VN(I)/BUMP-.9999995-CMF*DYI) 275,275,130
5253    125   IF (BUMP/VN(I)-1.-CMF*DYI) 135,275,275
5254    130   CMF=(VN(I)/BUMP-.9999995)/DYI
5255          GO TO 275
5256    135   CMF=(BUMP/VN(I)-1.)/DYI
5257          GO TO 275
5258    140   IF (MOE) 175,175,150
5259    145   M1=M1+1
5260          M=IB(M1)
5261    150   IF (DYI) 155,275,160
5262    155   IF (DYI*CMF+.999) 165,275,275
5263    160   IF (DYI*CMF-9.) 275,275,170
5264    165   CMF=-.999/DYI
5265          GO TO 275
5266    170   CMF=9./DYI
5267          GO TO 275
5268    175   IF (DYI*CMF-2.303) 180,190,190
5269    180   IF (DYI*CMF+6.909) 185,275,275
5270    185   CMF=-6.909/DYI
5271          GO TO 275
5272    190   CMF=2.303/DYI
5273          GO TO 275
5274    195   IF (Y(I)-BULP+ABS(DYI)*CMF) 275,200,200
5275    200   CMF=-(Y(I)-BULP)/ABS(DYI)
5276          GO TO 275
5277    C     NON-PRESENT BASE
5278    205   IF (KR(6)) 215,210,210
```

```
5279      210    IF (T-TF(I)+.001) 275,215,215
5280      215    IF (Y(I)+CMF*DYI-0.1) 275,220,220
5281      220    DUM1=(.1-Y(I))/DYI
5282             IF (DUM1-.001) 275,275,225
5283      225    CMF=DUM1
5284             GO TO 275
5285      230    DWTL=DWTL+DYI*WTN(I)
5286             IF (DYI) 235,275,250
5287      235    IF (VN(I)) 250,250,240
5288      240    IF (VN(I)+DYI*CMF) 245,250,250
5289      245    CMF=-VN(I)/DYI*1.00001
5290      250    IF (KR(6)) 265,255,255
5291      255    CLIP=ABS(CLIM/WTN(I))
5292             IF (ABS(CMF*DYI)-CLIP) 275,275,260
5293      260    CMF=CLIP/ABS(DYI)
5294             GO TO 275
5295      265    IF (ABS(CMF*DYI)-P) 275,275,270
5296      270    CMF=P/ABS(DYI)
5297      275    CMFF(I)=CMF
5298      280    DY(IK)=DYI
5299             IF (KR(6)) 290,285,285
5300      285    RVL=AMAX1(.1,RV/2.)
5301             CMF=AMIN1(CMF,WTG/ABS(ABS(DWTL-DWTG/WTG*WTL)/RVL-DWTG))
5302      290    IF (KR(7)-1) 315,315,300
5303      295    FORMAT (1X2(8X2HVN9X1HY8X2HDY7X5HSCALE7X1HE4X6HIFC IP)/(1XA4,5E10.
5304            13,I3,I2,1X,A4,5E10.3,I3,I2))
5305      300    NQ=I
5306             WRITE (KOUT,295) (FAMOA(J),VN(J),Y(J),DYA(J,LL),CMFF(J),E(J),IFC(J
5307            1),IP(J),J=1,NQ)
5308             WRITE (KOUT,310) (EB(I),I=1,IS)
5309             WRITE (KOUT,310) (X(I),I=1,ISPQ)
5310             WRITE (KOUT,305) (IB(I),I=1,IS)
5311      305    FORMAT (10I5)
5312      310    FORMAT (8E12.4)
5313      315    CONTINUE
5314             IF (X(1)) 320,360,320
5315      320    X1=X(1)*CMF
5316             ABX=ABS(X(1))
5317             IF (ABS(X1)-.5) 330,330,325
5318      325    CMF=.5/ABX
5319             X1=CMF*X(1)
5320      330    IF (X1) 340,360,335
5321      335    TM=TMAX
5322             X1=AMIN1(.2,X1)
5323             GO TO 345
5324      340    TM=TMIN
5325             X1=AMAX1(-0.2,X1)
5326      345    DTM=(TM-T)/(TM*X1)
5327             IF (DTM-1.) 350,355,355
5328      350    CMF=DTM*CMF
5329             T=TM
5330             GO TO 360
5331      355    T=T/(1.-X1)
5332      360    AA=AA*EXP(CMF*X(2))
5333             M1=1
5334             M=IB(1)
5335             WTL=0.
5336             WTG=0.
```

```
      DUM2=0.
      I=1
      LIM=KR(8)+N
      DO 495 IK=1,LIM
      DYI=CMF*DY(IK)
      IF (DYI) 395,390,395
390   IF (IFC(I)) 495,435,485
395   IF (IFC(I)) 455,400,400
400   IF (IP(I)) 485,430,405
405   IF (M-IK) 410,415,410
410   IF (MOE) 430,430,420
415   M1=M1+1
      M=IB(M1)
420   VN(I)=VN(I)*(1.+DYI)
      IF (VN(I)) 430,430,425
425   Y(I)=ALOG(VN(I))
      GO TO 435
430   Y(I)=Y(I)+DYI
      VN(I)=EXP(Y(I))
435   VA=WTN(I)*VN(I)
      WTG=WTG+VA
      DUM2=DUM2+VA/FF(I)
      IF (IK-IS) 440,440,445
440   PNUS(I)=VN(I)
      SLAM(I)=VN(I)/FF(I)
      GO TO 495
445   DO 450 K=1,IS
      VA=VNU(I,K)*VN(I)
      PNUS(K)=PNUS(K)+VA
450   SLAM(K)=SLAM(K)+VA/FF(I)
      GO TO 495
C     NON-PRESENT BASE CORRECTIONS AND TESTS
455   Y(I)=Y(I)+DYI
      IF (Y(I)) 495,460,460
460   IF (IFC(I)+1) 495,465,465
465   IF (KR(6)) 475,470,470
470   IF (T-TF(I)+.001) 495,475,475
475   Y(I)=0.
      IFC(I)=+1
      GO TO 495
480   VN(I)=VN(I)+DYI
      IF (VN(I)) 490,490,485
485   WTL=WTL+VN(I)*WTN(I)
      GO TO 495
490   VN(I)=0.
      IFC(I)=-1
495   I=I+1
      FFF=WTG/DUM2
      DO 500 I=1,IS
500   SLAM(I)=SLAM(I)*FFF
      RETURN
      END
CB24A                                                          B24A 001
      SUBROUTINE INPUT(PP)
      INTEGER FAMOA,FAMOB,CHAR,BLANK
      INTEGER AMOA,AMOB,ATA,ATB,ATC                            B24A 005
      COMMON/INTCOM/KKR(20),KIN,KOUT
      DIMENSION CIJ( 71,1),TF(1)                               B24A 006
```

```
      DIMENSION UM(10,10)                                               B24A 007
      EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                                 B24A 008
      DIMENSION C(10),KPHA(2),RA(2), IM(10),JAT(8),ALPT(8),TAU(10,10)   B24A 009
      DIMENSION IC( 10),LIM(10,10)                                      B24A 010
      DIMENSION FFIN( 71),NFIA( 71),NFIB( 71)                           B24A 011
      DIMENSION TFMET( 71),IGMET( 71),ZIGEPS(2),SORCE(8)                B24A 012
      COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),W(3),LEF(10)B24A  13
     1 ,LEFS(10),PIEASE,LEFH(10),L2,L3                                  ENTR-MOD
      COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B24A  15
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B24A  16
     2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B24A  17
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B24A  18
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B24A  19
      COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,   B24A  20
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ,   B24A  21
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HG,  B24A  22
     3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),B(16),      ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMF(10),GAMF(10),SLAM(10),DY( 71),RVS,  B24A  24
     5 CP( 71),K( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B24A  25
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B24A  26
      COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),   B24A  27
     1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),MA(10),LL(10),FMR(10), B24A  28
     2 PRMU(10,10),EESE(10)                                             B24A  29
  301   FORMAT (I3,F7.0,7F10.4)
  302 FORMAT(6E9.6,2F6.0,I1)
 3020 FORMAT(1X6E12.5,F10.4,F11.4,I2/1X6E12.5,F10.4,F11.4,I2)
 3021 FORMAT(2A4,E12.4,2A4,E12.4,2A4,E12.4,2A4,E12.4)                   B24A 029
  303 FORMAT(1H /1H )                                                   B24A 030
  304 FORMAT(I3,3A4,E9.3,7E8.3)
  305 FORMAT(54HORELATIVE ELEMENTAL COMPOSITIONS, ATOMIC WTS/UNIT MASS  B24A 032
     1/6X6HAT.NO.3X7HELEMENT4X9HATOMIC WT5X8HEDGE GAS4X10HPYRO.GAS 15X
     2 6HCHAR 15X10HPYRO.GAS 25X6HCHAR 25X10HPYRO.GAS 35X6HCHAR 3/
     3 (7XI3,3X3A4,F10.5,7F13.7))
  306 FORMAT(7(F3.0,I3), A2,9A4)
      DATA CHAR,BLANK/4HCHAR,4H    /
      P=PP
      KR(3)=2
      KR(2)=KKR(12)+1
      IF(KR(2).EQ.3.OR.KR(2).EQ.8) KR(3)=6
      IF(KR(2).EQ.7) GO TO 3751
 3062 MT=0
      FFA=0.489
      FITMOL=26.7
      FITGMW=24.3
      GGA = 0.454
      BASMOL=32.0
      SIGMA=3.467
      EPOVRK=106.7
      NFF=0                                                             B24A 042
      VINT=P*1.E-6                                                      B24A 043
      YINT=ALOG(VINT)                                                   B24A 044
      RMMG=1.                                                           B24A 045
      IF (KR(2)) 334,334,321                                            B24A 046
  321 READ(KIN,301) IS,FFAR,DUB2,DUB3,DUB4,DUB5,DUB6,DUB7,DUB8
      IF (DUB2.GT.0.) FITMOL=DUB2
      IF (DUB3.GT.0.) BASMOL=DUB3
      IF (DUB4.GT.0.) SIGMA=DUB4
      IF (DUB5.GT.0.) EPOVRK=DUB5
```

```
      IF (DUB6.GT.0.) GGA =DUB6
      IF (DUB7.GT.0.) FITSMW=DUB7
      IF(FFAR) 3213,3212,3211                                           B24A 048
 3213 FFA=0.                                                            B24A 049
      GO TO 3212                                                        B24A 050
 3211 FFA=FFAR                                                          B24A 051
 3212 CONTINUE                                                          B24A 052
      JAT(6)=0                                                          B24A 053
      IX=3                                                              B24A 054
      IF (IS-10) 311,311,399                                            B24A 055
  311 READ(KIN,304) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J,I),
     1  I=1,7),J=1,IS)
      DO 327 K=1,7
      VA=0.                                                             B24A 059
      DO 322 J=1,IS                                                     B24A 060
      IF(KAT(J)-99) 3111,325,3111                                       B24A 061
 3111 IF(TK(J,K)) 324,322,325                                           B24A 062
  324 VA=VA-TK(J,K)                                                     B24A 063
      TK(J,K)=-TK(J,K)/WAT(J)                                           B24A 064
      GO TO 322                                                         B24A 065
  325 VA=VA+TK(J,K)*WAT(J)                                              B24A 066
  322 CONTINUE                                                          B24A 067
      IF(VA) 326,327,325
  326 DO 323 J=1,IS
  323 TK(J,K)=TK(J,K)/VA                                                B24A 069
  327 CONTINUE
      WRITE(KOUT,305) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J,I),
     1  I=1,7),J=1,IS)
      WRITE (KOUT,308)
  308 FORMAT(//3X61HTHERMODYNAMIC PROPERTY CURVE-FIT DATA (SEE MANUAL FO
     1R FORMAT)//)
      ISP=IS+1                                                          B24A 072
      IF(KR(3)) 399,399,334                                             B24A 073
  334 TFMAX=0.                                                          B24A 074
      AAA=0.                                                            B24A 075
      N=0                                                               B24A 076
      II=ISP                                                            B24A 077
      J=1                                                               B24A 078
  342 READ(KIN,306)(ALPT(K),JAT(K),K=1,7),SORCE,AMOA,AMOB
      IF(ALPT(1)) 3421,399,3420
 3420 IF(JAT(1)) 344,3421,344
 3421 NFF=ABS(ALPT(1))
      READ(KIN,3021)(NFIA(I),NFIB(I),FFIN(I),I=1,NFF)                   B24A 082
      GO TO 342                                                         B24A 083
  344 DO 345 K=1,IS
  345 C(K)=0.
      DO 349 I=1,7
      IF(JAT(I)) 346,349,346
  346 DO 347 K=1,IS
      IF(JAT(I)-KAT(K)) 347,348,347
  347 CONTINUE
      READ(KIN,303)
      GO TO 342
  348 C(K)=ALPT(I)
  349 CONTINUE
      WT=0.
      L=1
      LAMKK=0
```

```
      DO 388 I=1,IS
      IF(C(I)) 387,388,387
  387 LAMKK=LAMKK+L
      WT=WT+C(I) * WAT(I)
  388 L=L+L
      IF(J-IS) 360,360,369
  360 JM=J-1                                                    B24A 099
      DO 3601 L=1,IS                                            B24A 100
 3601 CIJ(L,J)=C(L)                                             B24A 101
      LAMI(J) = LAMKK
      IF (JM) 320,320,313
  313 DO 314 L=1,JM                                             B24A 104
      IML=IM(L)                                                 B24A 105
      UGH=C(IML)                                                B24A 106
      UM(L,J)=0.                                                B24A 107
      IF(UGH) 353,314,353                                       B24A 108
  353 DO 393 I=1,L                                              B24A 109
  393 UM(I,J)=UM(I,J)-UM(I,L)*UGH                               B24A 110
      DO 394 I=IML,IS                                           B24A 111
  394 C(I)=C(I)-.AU(I,L)*UGH                                    B24A 112
  314 UM(J,L)=0.                                                B24A 113
  320 DO 316 I=1,IS                                             B24A 114
      IF(ABS (C(I))-.001)316,316,317                            B24A 115
  316 TAU(I,J)=0.                                               B24A 116
      DO 396 I=1,JM                                             B24A 117
  396 VNU(II,I)=-UM(I,J)                                        B24A 118
      DO 397 I=J,IS                                             B24A 120
  397 VNU(II,I)=0.                                              B24A 121
      LAMI(II)=LAMKK                                            B24A 123
      GO TO 370
  317 IM(J)=I                                                   B24A 124
      UM(J,J)=1.                                                B24A 125
      DO 398 L=1,J                                              B24A 126
  398 UM(L,J)=UM(L,J)/C(I)                                      B24A 127
      DO 328 L=I,IS                                             B24A 128
  328 TAU(L,J)=C(L)/C(I)                                        B24A 129
      YC=YINT                                                   B24A 130
      KK=J                                                      B24A 131
      J=J+1                                                     B24A 132
      IF(J-IS) 372,372,329                                      B24A 133
  329 DO 330 L=2,IS                                             B24A 134
      JM=ISP-L                                                  B24A 135
      IMJ=IM(JM+1)                                              B24A 136
      DO 330 K=1,JM                                             B24A 137
      UGH=TAU(IMJ,K)                                            B24A 138
      DO 330 I=1,IS                                             B24A 139
  330 UM(I,K)=UM(I,K)-UGH*UM(I,JM+1)                            B24A 140
      DO 333 I=1,IS                                             B24A 141
  337 IMI=IM(I)                                                 B24A 142
      IF(IMI-I) 336,333,336                                     B24A 143
  336 DO 338 K=1,IS                                             B24A 144
      V=UM(K,IMI)                                               B24A 145
      UM(K,IMI)=UM(K,I)                                         B24A 146
  338 UM(K,I)=V                                                 B24A 147
      IM(I)=IM(IMI)                                             B24A 148
      IM(IMI)=IMI                                               B24A 149
      GO TO 337                                                 B24A 150
  333 CONTINUE                                                  B24A 151
                                                                B24A 152
```

```
C-----ELEMENT -- BASE GAS CORRESPONDENCE                                B24A 153
C     INITIALIZE ROW AND COLUMN SUMS                                    B24A 154
      IG=IS                                                             B24A 155
      DO 401 I=1,IS                                                     B24A 156
      IR(I)=-1                                                          B24A 157
  401 IC(I)=-1                                                          B24A 158
C     EVALUATE INITIAL SUMS                                             B24A 159
      LAMD=1
      DO 402 I=1,IS
      DO 403 J=1,IS
      LIM(I,J)=MOD(LAMI(J)/LAMD,2)
      IC(J) = IC(J) + LIM(I,J)
  403 IR(I)= IR(I) + LIM(I,J)
  402 LAMD=LAMD+LAMD
C     CHECK FOR ZEROS                                                   B24A 167
  426 IZ=0                                                              B24A 168
  404 DO 412 I=1,IS                                                     B24A 169
      IF(IC(I)-IZ) 408,405,408                                          B24A 170
  405 DO 406 J=1,IS                                                     B24A 171
      IF(LIM(J,I)) 407,406,407                                          B24A 172
  406 CONTINUE                                                          B24A 173
  407 IC(I)=-J                                                          B24A 174
      IR(J)=-I                                                          B24A 175
      DO 428 K=1,IS                                                     B24A 176
      LIM(J,I)=0                                                        B24A 177
      IF(LIM(J,K)) 425,427,425                                          B24A 178
  425 IC(K)=IC(K)-1                                                     B24A 179
      LIM(J,K)=0                                                        B24A 180
  427 IF(LIM(K,I)) 422,428,422                                          B24A 181
  422 LIM(K,I)=0                                                        B24A 182
      IR(K)=IR(K)-1                                                     B24A 183
  428 CONTINUE                                                          B24A 184
      GO TO 413                                                         B24A 185
  408 IF(IR(I)-IZ)  412,409,412                                         B24A 186
  409 DO 410 J=1,IS                                                     B24A 187
      IF(LIM(I,J)) 411,410,411                                          B24A 188
  411 IC(J)=-I                                                          B24A 189
      IR(I)=-J                                                          B24A 190
      LIM(I,J)=0                                                        B24A 191
      GO TO 4101                                                        B24A 192
  410 CONTINUE                                                          B24A 193
 4101 DO 430 K=1,IS                                                     B24A 194
      IF(LIM(K,J))424,429,424                                           B24A 195
  424 IR(K)=IR(K)-1                                                     B24A 196
      LIM(K,J)=0                                                        B24A 197
  429 IF(LIM(I,K)) 423,430,423                                          B24A 198
  423 LIM(I,K)=0                                                        B24A 199
      IC(K)=IC(K)-1                                                     B24A 200
  430 CONTINUE                                                          B24A 201
      GO TO 413                                                         B24A 202
  412 CONTINUE                                                          B24A 203
      IZ=IZ+1                                                           B24A 204
      GO TO 404                                                         B24A 205
  413 IG=IG-1                                                           B24A 206
      J=IS+1                                                            B24A 207
      IF(IG) 414,414,426                                                B24A 208
  414 FAMOA(IS)=AMOA                                                    ENTR-MOD
      FAMOB(IS)=AMOB                                                    B24A 211
```

```
      DO 416 I=1,IS                                                     B24A 212
      K=-IR(I)                                                          B24A 213
      IC(I)=FAMOA(K)                                                    B24A 214
  416 IM(I)=FAMOB(K)                                                    B24A 215
  417 FORMAT(///5X9HELEMENT  ,18A4)
  418 FORMAT( 5X9HBASE SP   6(4X2A4))                                   B24A 219
      GO TO 372                                                         B24A 220
  369 DO 361 L=1,IS                                                     B24A 221
      VNU(II,L)=0.                                                      B24A 223
      DO 361 I=1,IS                                                     B24A 224
  361 VNU(II,L)=VNU(II,L)+C(I)*UM(L,I)                                  B24A 225
      LAMI(II)=LAMKK
  370 KK=II                                                             B24A 226
      II=II+1                                                           B24A 227
      YC= 0.                                                            B24A 228
  372 READ(KIN,302) (RA(K),RB(KK,K), RC(KK,K), RD(KK,K), RE(KK,K),
     1RF(KK,K), ZIGEPS(K), TU(KK,K),KPHA(K),K=1,2)
      IF(KPHA(1)-KPHA(2)) 3733,3736,3734
 3733 IF(KPHA(1)+KPHA(2)-5) 3734,3737,3734
 3734 WRITE(KOUT,3735) AMOA,AMOB
 3735 FORMAT(////25H BAD PHASE NUMBERING FOR 2A4)
      STOP
 3736 IF(KPHA(1)-1) 3734,3727,3728
 3737 TU(KK,1)=-TU(KK,1)
 3728 FF(KK) = 1.E+10
      GG(KK) = 1.E+10
      GO TO 3729
 3727 FF(KK)=(WT/FITMOL) **FFA
      IFMET(KK)=2
      GG(KK) = -1.
 3729 IF(NFF) 3726,3449,3730
 3730 DO 3723 I=1,NFF                                                   B24A 233
      IF(NFIA(I)-AMOA) 3723,3724,3723                                   B24A 234
 3724 IF(NFIB(I)-AMOB) 3723,3720,3723
 3720 IF(FFIN(I)-100.) 3725,3731,3731
 3725 IF (FFIN(I)) 3480,3480,3481
 3480 GG(KK) = -FFIN(I)
      IGMET(KK)=1
      GO TO 3723
 3481 FF(KK) = FFIN(I)
      IFMET(KK)=1
      GO TO 3723
 3731 TF(KK)=FFIN(I)
 3723 CONTINUE
      IF (GG(KK)) 3449,3449,3455
 3449 IF (ZIGEPS(1)-100.) 3453,3452,3452
 3453 IF  (ZIGEPS(1)) 3452,3452,3441
 3441 IF (ZIGEPS(2)) 3452,3452,3443
 3443 GG(KK) = ZIGEPS(1)/SIGMA  *  (ZIGEPS(2)/EPOVRK)**.0795    *
     1  (WT/BASMOL)**.25
      IGMET(KK)=3
      GO TO 3455
 3452 IF (KPHA(1)-1)3456,3457,3456
 3456 GG(KK) = 1.E+10
      GO TO 3455
 3457 GG(KK) = (WT/FITGMW)**GGA
      IGMET(KK)=2
 3455 CONTINUE
```

```
 3726 IF(KR(3)-6) 3722,3721,3722                                        B24A 243
 3721 WRITE(KOUT,306)(ALPT(K),JAT(K), K=1,7), SORCE,AMOA,AMOB
      WRITE(KOUT,3020)(RA(K), RB(KK,K), RC(KK,K), RD(KK,K), RE(KK,K),
     1RF(KK,K),ZIGEPS(K),TU(KK,K),KPHA(K),K=1,2)
 3722 FAMOA(KK)=AMOA                                                    B24A 247
      FAMOB(KK)=AMOB                                                    B24A 248
      WTM(KK)=WT                                                        B24A 251
      RB(KK,1)= RB(KK,1) + RA(1)
      RB(KK,2) = RB(KK,2) + RA(2)
      N=N+1                                                             B24A 254
      IF(KPHA(1)-1)3734,362,364
  364 IFC(KK)=-1                                                        B24A 267
      VN(KK)=0.                                                         B24A 268
      Y(KK)=YC                                                          B24A 269
      IF(TF(KK)-TFMAX) 342,342,371                                      B24A 270
  371 TFMAX=TF(KK)                                                      B24A 271
      GO TO 342                                                         B24A 272
  362 IFC(KK)=0                                                         B24A 273
      VN(KK)=VINT                                                       B24A 274
      Y(KK)=YINT                                                        B24A 275
      GO TO 342                                                         B24A 276
  399 WRITE (KOUT,417) (ATA(I),ATB(I),ATC(I),I=1,IS)
      WRITE (KOUT,418) (IC(I),IM(I),I=1,IS)
 5001 WRITE(KOUT,110) SIGMA,EPOVRK,BASMOL
  110 FORMAT(///3X30HMOLECULAR TRANSPORT PROPERTIES/5X75HVISCOSITY .....
     1 BUDDENBERG - WILKE MIXTURE FORMULA WITH MU(I) CALCULATED ON/21X34
     2HTHE BASIS OF D(I,I) = DBAR/G(I)**2//5X80HTHERMAL CONDUCTIVITY ...
     3.. MASON - SAXENA MIXTURE FORMULA WITH EUCKEN CORRECTION//5X73HDIF
     4FUSION COEFFICIENTS ..... D(I,J) = DBAR/(F(I)*F(J)) WITH DBAR BASE
     5D ON/21X8HSIGMA = ,F8.4,11H, EPOVRK = ,F9.4,13H, AND MREF = ,F8.4)
      WRITE (KOUT,111) FITMOL,FFA,FITGMW,GGA
  111 FORMAT(///7X16HMETHODS EMPLOYED//8X63H0 CONDENSED PHASE, VALUES FOR
     1 F(I) AND G(I) SET EQUAL TO 1.E+10//8X42H1 VALUES FOR F(I) (OR G(I
     2)) INPUT DIRECTLY//8X71H2 VALUES FOR F(I)    ? G(I)) CALCULATED BY
     3 F(I) =(M(I)/FITMOL)**FFA AND/10X65HG(I)     '(I)/FITGMW)**GGA WHER
     4E M(I) IS SPECIES MOLECULAR WEIGHT,/10X,S    MOL = ,F8.4,12H, AND
     5FFA = ,F6.4,11H, FITGMW = F8.4,12H, AND GGA = ,F6.4)
      WRITE (KOUT,112)
  112 FORMAT(/8X79H3 VALUES FOR G(I) CALCULATED BY G(I) = SQRT(DBAR/D(I,
     1I)) = (SIGMA(I)/SIGMA)     /10X73H* (EPS(I)/EPOVRK) **0.0795 * (M(I
     2)/MREF) **0.25 WHERE SIGMA(I) AND EPS(I)/10X33HARE GIVEN WITH THER
     3MODYNAMIC DATA//7X73HSPECIES   F(I) METHOD G(I) METHOD       SPECI
     4ES   F(I) METHOD G(I) METHOD)
      WRITE (KOUT,113)((FAMOA(KK),FAMOB(KK),FF(KK),IFMET(KK),GG(KK),IGME
     1T(KK)),KK=1,N)
  113 FORMAT(7X,2A4,1X,F5.3,3X,I1,3X,F5.3,3X,I1,10X,2A4,1X,F5.3,3X,I1,3X
     1,F5.3,3X,I1)
      WRITE (KOUT,419)
  419 FORMAT (//3X61HSTAGNATION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE
     1 EXPANSION/)
      DO 375 L=1,7
      DO 375 I=1,IS                                                     B24A 278
      TQ(I,L)=0.                                                        B24A 279
      DO 375 K=1,IS                                                     B24A 280
  375 TQ(I,L)=TQ(I,L)+UM(I,K)*TK(K,L)                                   B24A 281
      IF(KR(2)-5) 3752,3752,3751
 3751 CONTINUE
  240 FORMAT(8F10.6)                                                    THER1330
```

```
  245 FORMAT (2I3)                                                      THER1340
  250 FORMAT(3E10.4)                                                    THER1350
  255 READ(KIN,245)MT                                                   THER1370
      IF(MT) 3752,3752,256
  256 DO 260 M=1,MT                                                     THER1380
      READ(KIN,250)FKF(M),EAK(M),EXK(M)                                 THER1390
      READ(KIN,240)(RMU(I,M),I=1,IS)                                    THER1400
  260 READ(KIN,240)(PMU(I,M),I=1,IS)                                    THER1410
  265 FORMAT (//3X,7HKINETIC)
  270 FORMAT (3X,11HREACTION---,I7,9I10)
  275 FORMAT (/3X,8HREACTANT)
  280 FORMAT (5X,12HCOEFFICIENTS/)
  285 FORMAT (8X,2A4,F8.2,9F10.2)                                       THER1460
  290 FORMAT (/3X,7HPRODUCT)
  295 FORMAT (/3X,12HPRE-EXPONENT)
  200 FORMAT (5X,6HFACTOR,4X,10E10.3)
  205 FORMAT (/3X,10HACTIVATION)
  210 FORMAT (5X,6HENERGY,4X,10E10.3)
  215 FORMAT (/3X,8HREACTION)
  220 FORMAT (5X,5HORDER,5X,10E10.3)
      WRITE(KOUT,265)
      WRITE(KOUT,270)(M,M=1,MT)                                         THER1
      WRITE(KOUT,275)
      WRITE(KOUT,280)
      DO 225 I=1,IS
  225 WRITE(KOUT,285)FAMOA(I),FAMOB(I),(RMU(I,M),M=1,MT)
      WRITE(KOUT,290)
      WRITE(KOUT,280)
      DO 230 I=1,IS
  230 WRITE(KOUT,285)FAMOA(I),FAMOB(I),(PMU(I,M),M=1,MT)
      WRITE(KOUT,295)
      WRITE(KOUT,200)(FKF(M),M=1,MT)
      WRITE(KOUT,205)
      WRITE(KOUT,210)(EAK(M),M=1,MT)
      WRITE(KOUT,215)
      WRITE(KOUT,220)(EXK(M),M=1,MT)
 3752 VN(N+1)=0.
      IFC(N+1)=-1
      WTM(N+1)=-1.
      FAMOA(N+1)=CHAR
      FAMOB(N+1)=BLANK
      TF(N+1)=50000.
      IF(DUB8.GT.0.) TF(N+1) = DUB8
      RETURN
      END                                                               B24A 283
C825A                                                                   B25A 001
      SUBROUTINE PROPS                                                  B25A 002
      INTEGER FAMOA,FAMOB                                               B25A 004
      DIMENSION VK(10),PA(12,12),PV(11,12)                              B25A 005
      COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),W(3),LEF(10)B25A   5
     1 ,LEFS(10),PIEASE,LEFW(19),L2,L3                                  ENTR-MOD
      COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B25A   7
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDCE,D2UEDG,VMWE,CGE,C90  ENTR-MOD
     2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                    B25A   9
      COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B25A  10
     1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B25A  11
     2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B25A  12
     3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B25A  13
```

```
     4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B25A  14
      COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,   B25A  15
     1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ,   B25A  16
     2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MG,  B25A  17
     3 CPG,TTMIN,TTMAX,L7,L8,IB(11),EB(10),EBL(10),A(16,16),B(16),      ENTR-MOD
     4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,  B25A  19
     5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B25A  20
     6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B25A  21
      COMMON /INTCOM/KKR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,II,  B25A  22
     1ISS,NS,ITT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL,MITS,KAPPA,CBAR,   B25A  23
     2CASE(10),BB(8),  MWE,NON,KD(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,   B25A  24
     3 KR9(40),KAUXO,JTIME,JSPEC,MO(3)                                  B25A  25
      COMMON /PRPCO /PR(15),TT(15),RHO(15),SC(15),CAPC(15),QR(15),HH(15)B25A  26
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DB25A  27
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B25A  28
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B25A  29
     4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B25A  30
     5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B25A  31
     6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B25A  32
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B25A  33
     1,RHOVW(40, 1),FLUXJ( 3,48, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B25A  34
      DIMENSION PRP(1)
      EQUIVALENCE (PRP(1),PV(1))
      IF(II-1) 310,300,310                                              B25A 032
  300 IF(KKR(14)-10) 310,302,302                                        B25A 033
  302 KKR(14)=KKR(14)-10                                                B25A 034
  310 IF(T-300.001) 312,312,320                                         B25A 035
  312 KKR(14)=KKR(14)+10                                                B25A 036
  320 WM=AA/P
      ISV=IS                                                            B25A 038
      IS=NSP                                                            B25A 039
      ISVP=ISV+1                                                        B25A 040
  543 ISV2=ISV+2
      CT=-0.5                                                           B25A 041
      ISM=IS-1                                                          B25A 042
      ISP=IS+1                                                          B25A 043
      ISP2=IS+2                                                         B25A 044
      TT(II)=T*1.8                                                      B25A 046
      RHO(II)=AA/(1.3146*T)
      CTR=CT*1.9876                                                     B25A 049
C     FORM NECESSARY SUMMATIONS                                         B25A 051
      PMU2=0.                                                           B25A 052
      CPTIL=0.                                                          B25A 053
      WTG=0.
      MG=0.
      CPG=0.
      HTIL=0.                                                           B25A 054
      PMU1=0.                                                           B25A 055
      TMU3=0.                                                           B25A 056
      I=1
      DO 451 IK=1,N
      IF(KAT(ISV)-99) 544,541,544                                       ENTR-MOD
  541 IF(IK-ISV) 544,451,542
  542 H(I)=H(I)-VMU(I,ISV)*H(ISV)
      WTM(I)=WTM(I)-VMU(I,ISV)*WTM(ISV)
      CP(I)=CP(I)-VMU(I,ISV)*CP(ISV)
  544 IF(IFC(I)) 451,4550,451
 4550 PMU1=PMU1+VM(I)*FF(I)                                             B25A 060
```

```
  451 I=I+1
      VMU1=PMU1/P                                                       B25A 062
      AMU5=0.                                                           B25A 063
      PMU6=0.                                                           B25A 064
      WDZ=1.385                                                         B25A 065
      WD4 = 0.284*WDZ
      I = 1
      DO 454 IK = 1,N
      IF(IK-IS) 4510,4510,4509                                          ENTR-MOD
 4510 VK(I)=0.                                                          ENTR-MOD
      ZK(I)=0.                                                          ENTR-MOD
 4509 IF(IFC(I).NE.0) GO TO 454                                         ENTR-MOD
      ASTAR = 1.13 * GG(I)/FF(I) * GG(I)/FF(I)
      WD2=1.2*ASTAR/PMU1
      WD7=WDZ/PMU1-WD2
      WD5=.32*ASTAR/PMU1
      WD8=WD4/PMU1-WD5
      VA=VN(I)/FF(I)                                                    B25A 074
      VB=VA*WTM(I)                                                      B25A 075
      VC=VN(I)*FF(I)                                                    B25A 076
      IF(IK-IS) 4511,4511,4560                                          ENTR-MOD
 4511 VK(I)=VN(I)                                                       B25A 081
  452 ZK(I)=VA                                                          B25A 082
      GO TO 457                                                         B25A 083
 4560 IF(IK-ISV) 4562,4552,456                                          ENTR-MOD
 4562 IF(KAT(I).NE.99) GO TO 457                                        ENTR-MOD
      WTM(I)=0.                                                         ENTR-MOD
      CP(I)=0.
      H(I)=0.
      GO TO 454
  456 DO 453 K=1,ISM                                                    ENTR-MOD
      VK(K)=VK(K)+VN(I)*VNU(I,K)                                        B25A 087
  453 ZK(K)=ZK(K)+VA*VNU(I,K)                                           B25A 088
  457 PMU2=PMU2+VB                                                      B25A 089
      TMU3=TMU3+VA                                                      B25A 090
      CPTIL=VA*CP(I)+CPTIL                                              B25A 091
      HTIL=HTIL+VA*H(I)                                                 B25A 092
      WTG=WTG+VN(I)*WTM(I)
      HG=HG+VN(I)*H(I)
      CPG=CPG+VN(I)*CP(I)
      AMU5=AMU5+VB/(WDZ-VC*WD7)
      PMU6=PMU6+VA/(WD4-VC*WD8)
  454 I=I+1
      VMU5=AMU5/WTG
      VMU6=(PMU6  +CPTIL/1.9869-2.5*TMU3)/P                             B25A 097
      VMU2=PMU2/P                                                       B25A 098
      VMU3=TMU3/PMU2                                                    B25A 099
      CPTIL = CPTIL / PMU2                                              PROP1110
      HTIL = HTIL / PMU2 * 1.8                                          PROP1120
      HG=HG/WTG
      CPG=CPG/WTG
      WM=WTG/P
      ZKS = 1.0                                                         PROP1020
      VKS=1.0
      DO 95 K=1,ISM                                                     PROP1030
      VK(K)=VK(K)/WTG*WTM(K)
   95 ZK(K) = ZK(K) / PMU2 * WTM(K)                                     PROP1050
      OMEGA=1.07/(T/EPOVRK) **0.159
```

```
      DBAR = 2.82861E-6/(SIGMA * SIGMA) *T/P*SQRT(T/BASMOL)/OMEGA
      VMU(II)=RHO(II)*DBAR *VMU5/VMU1                                   B25A 107
      IF(KR(5)) 461,461,460                                             B25A 108
  460 RHOE(ISS)=RHO(II)                                                 B25A 109
      VMUE(ISS)=VMU (II)                                                B25A 110
      VMWE=WM                                                           B25A 111
      IS=ISV                                                            B25A 112
      RETURN                                                            B25A 113
  461 CONTINUE                                                          B25A 114
      CAPC(II)=RHO(II)/RHOE(ISS)*VMU(II)/VMUE(ISS)                      B25A 115
      VMW(II)=WM                                                        B25A 116
      VLAM=RHO(II)*DBAR/WM*VMU6/VMU1*1.9869                             B25A 117
      SC(II)=VMU5/VMU2*WM                                               B25A 118
      IF (KKR(14)-1) 4613,4612,4611                                     B25A 122
 4611 FFK2=WM/VMU2                                                      B25A 123
      VMU1=FFK2                                                         B25A 124
      VMU3=1./WM                                                        B25A 125
      CPTIL=CPG
      HTIL=HG*1.8
      DO 4614 K=1,ISM                                                   B25A 128
 4614 ZK(K)=VK(K)                                                       B25A 129
 4612 CT=0.                                                             B25A 130
      CTR=0.                                                            B25A 131
 4613 VMU12=VMU1*VMU2                                                   B25A 132
      IF(KKR(20)) 9004,9005,9004                                        B25A 133
 9004 WRITE(KOUT,9006)OMEGA,DBAR,     VLAM,SC(II),PR(II),VMU1,VMU2,VMU3,TB25A 134
     1T(II),VMU5,VMU6,FF(1),FF(2),FF(3),CPTIL,HTIL,(VK (I),WTM(I),ZK(I),B25A 135
     2I=1,ISM),VMU(II)                                                  B25A 136
 9005 CONTINUE                                                          B25A 137
      IF(KR(6)) 5000,5340,5340                                          B25A 139
 5000 CPBAR(II)=CPG
      PR(II)=CPG/VMU6*VMU5/1.9869*WM
      NPR=ISP2
      DO 501 I=1,NPR
      DO 501 J=1,ISV2
  501 PA(I,J)=0.                                                        B25A 142
      PA(3,1)=PMU2*CPTIL*T                                              B25A 143
      DO 502 K=3,ISV2                                                   ENTR-MOD
      IF (KKR(14)-1) 5016,5016,5017                                     B25A 145
 5016 FFK2=FF(K-2)                                                      B25A 146
 5017 IF(IFC(K-2)) 502,5011,5014                                        ENTR-MOD
 5011 PA(1,K)=VN(K-2)/FFK2                                              B25A 148
      GO TO 5013                                                        B25A 149
 5014 PA(1,K)=1./FFK2
 5013 PA(2,K)=PA(1,K)*WTM(K-2)                                          B25A 154
      PA(3,K)=PA(1,K)*H(K-2)                                            B25A 155
      IF(K-ISP)5018,5018,5019
 5018 PA(K+1,K)=PA(1,K)
 5019 CONTINUE
  502 CONTINUE                                                          B25A 157
      J=ISVP
      IF(ISVP.GT.N) GO TO 5078
      DO 507 IJ=ISVP,N
      IF(IFC(J)) 507,5021,507                                           B25A 159
 5021 PRP(1)=VN(J)/FFK2
      IF (KKR(14)-1) 5022,5022,5023                                     B25A 161
 5022 PRP(1)=VN(J)/FF(J)
 5323 PRP(2)=PRP(1)*WTM(J)
```

```
      PRP(3)=PRP(1)*K(J)
      DO 5024 I=4,ISP2
 5024 PRP(I)=PRP(1)*VNU(J,I-3)
      DO 505 I=1,NPR
      PA(I,1)=PA(I,1)-TC(J)*PRP(I)
      DO 505 K=1,ISV
      IF(IFC(K)) 506,506,505
  506 PA(I,K+2)=PA(I,K+2)+PRP(I)*VNU(J,K)
  505 CONTINUE
  507 J=J+1
 5070 VA=AA/WTM(IS)
      DO 511 I=1,ISV2
      A(I,1)=A(I,1)*AA/1.8                                          B25A 182
  511 A(I,ISP2)=A(I,ISP2)*VA                                        B25A 183
      DO 512 J=3,ISP                                                B25A 184
      VA=AA/WTM(J-2)                                                B25A 185
      DO 512 I=1,ISV2
  512 A(I,J)=A(I,J)*VA-A(I,ISP2)                                    B25A 187
C     FORM PA,A PRODUCT AND TRANSPOSE (TO ESTABLISH EQUIVALENCE     B25A 188
      DO 521 I=1,NPR
      DO 521 J=1,ISP                                                B25A 190
      PV(J,I)=PA(I,1)*A(1,J)                                        B25A 191
      DO 521 L=3,ISV2
  521 PV(J,I)=PV(J,I)+PA(I,L)*A(L,J)                                B25A 193
      DO 533 K=1,ISP                                                B25A 194
      PV(K,1)=(PV(K,1)-VMU3*PV(K,2))/PMU2                           B25A 195
      PV(K,3)=(PV(K,3)*1.8-MTIL*PV(K,2))/PMU2                       B25A 196
      DO 531 J=1,ISM                                                B25A 197
  531 PV(K,J+3)=(PV(K,J+3)*WTM(J)-ZK(J)*PV(K,2))/PMU2               B25A 198
  533 PV(K,2)=CT*A(1,K)+PV(K,2)/PMU2                                B25A 199
      PV(2,2)=PV(2,2)-1./P                                          B25A 200
C     POOR MAN-S EQUIVALENCE                                        B25A 201
      QR(II)=0.                                                     B25A 202
      DCAPCH=CAPC(II)*(2.*A(2,1)-0.341*A(1,1))                      B25A 203
      DPRH=0.                                                       B25A 204
      DSCH=0.                                                       B25A 205
      DQRH=0.                                                       B25A 206
      DCPBH=0.                                                      B25A 207
      DCPTH=0.                                                      B25A 208
      DMU12H=0.                                                     B25A 209
      DRHOH=RHO(II)*(A(2,1)-A(1,1))                                 B25A 210
      DTH=T*A(1,1)*1.8                                              B25A 211
      DMU3H=PV(1,1)                                                 B25A 212
      DMU4H=PV(1,2)                                                 B25A 213
      DMTILH=PV(1,3)                                                B25A 214
      IF (NSPM1)5340,5340,5320
 5320 DO 534 K=1,ISM
      PHIK(II,K)=0.                                                 B25A 216
      DPHIKH(K)=0.                                                  B25A 217
      DRHOK(K)=RHO(II)*(A(2,K+2)-A(1,K+2))                          B25A 218
      DPRK(K)=0.                                                    B25A 219
      DSCK(K)=0.                                                    B25A 220
      DTK(K)=T*A(1,K+2)*1.8                                         B25A 221
      DCAPCK(K)=CAPC(II)*(2.*A(2,K+2)-0.341*A(1,K+2))               B25A 222
      DQRK(K)=0.                                                    B25A 223
      DCPBK(K)=0.                                                   B25A 224
      DCPTK(K)=0.                                                   B25A 225
      DMU12K(K)=0.                                                  B25A 226
```

```
      DMU3K(K)=PV(K+2,1)                                                825A 227
      DMU4K(K)=PV(K+2,2)                                                825A 228
      DHTILK(K)=PV(K+2,3)                                               825A 229
      DZKH(K)=PV(1,K+3)                                                 825A 230
      DO 532 I=1,ISM                                                    825A 231
      DPHIKK(I,K)=0.                                                    825A 232
  532 DZKK(I,K)=PV(K+2,I+3)                                             825A 233
  534 CONTINUE                                                          825A 234
 5340 LIM=N+KR(8)
      DO 535 I=1,LIM
      IF(KR(6)) 5343,5344,5344
 5343 IF(MOD(IFC(I),3)) 535,5344,535
 5344 FR(I,II)=VN(I)/P
      IF(VN(I)) 5341,5341,535                                           825A 237
 5341 IF(IFC(I)) 535,5342,535                                           825A 238
 5342 FR(I,II)=1.E-30                                                   825A 239
  535 CONTINUE                                                          825A 240
      IF(KR(6)) 538,538,5358
 5358 IF (KR(1)-1) 536,5361,5360
 5361 Y(JC)=0.
  536 HW(ISS,ITT)=HG*1.8
 5360 DO 537 K=2,IS
  537 SPW(K-1,ISS,ITT)=VK(K-1)                                          825A 244
      RHOVW(ISS,ITT)=-RV
  538 CONTINUE                                                          825A 246
      IF(KR(20)) 9001,9002,9001                                         825A 247
 9001 WRITE(KOUT,9006)DMU3M,DMU3K,DMU4M,DMU4K,DHTILM,DHTILK,DTM,DTK,DRHO825A 248
     1M,DRHOK,DZKH,DZKK,HG,VK
 9002 CONTINUE                                                          825A 250
      IS=ISV                                                            825A 251
 9006 FORMAT(/(1X1P10E12.5))
      ISP=ISVP
      ISP2=IS+2
      IF(II-1) 551,539,551
  539 DO 540 I=1,IS
  540 YW(I)=Y(I)
  551 RETURN
      END                                                               825A 253
C826A                                                                   826A 001
      SUBROUTINE TAYLOR (D,FM,F,P)                                      826A 002
      DIMENSION FM(1),F(1),P(1)                                         826A 003
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,META,I     826A 004
      D2=D*D                                                            826A 005
      IF(KR(10)-1) 1,2,4
    2 IF(I-META) 4,1,4
    4 FD=0.
      P(1)=(((FM(3)/6.-FD/24.)*D-F(2)/2.)*D+F(1))*D                     826A 009
      P(2)=(((FD/30.-FM(3)/8.)*D+F(2)/3.)*D-F(1)/2.)*D2                 826A 010
      P(3)=0.                                                           826A 011
      P(4)=(((FM(3)/20.-FD/72.)*D-F(2)/8.)*D+F(1)/6.)*D2*D-P(3)         826A 012
      GO TO 3                                                           826A 013
    1 FD=F(3)-FM(3)                                                     826A 014
      P(1)=(((F(3)/6.-FD/24.)*D-F(2)/2.)*D+F(1))*D                      826A 015
      P(2)=(((FD/30.-F(3)/8.)*D+F(2)/3.)*D-F(1)/2.)*D2                  826A 016
      P(4)=-(((FD/252.-F(3)/72.)*D+F(2)/30.)*D-F(1)/24.)*D2*D           826A 017
      P(3)=(((F(3)/20.-FD/72.)*D-F(2)/8.)*D+F(1)/6.)*D2*D-P(4)          826A 018
    3 CONTINUE                                                          826A 019
      RETURN                                                            826A 020
```

```
      END                                                               B26A 021
C B27A                                                                  B27A 001
      SUBROUTINE LINMAT                                                 B27A 002
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B27A   3
     1,LAR(153),BA1(43,18),BA2(30,15)                                   B27A   4
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB27A   5
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B27A   6
     2,B(8) ,      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B27A   7
     3,KAUXC,JTIME,JSPEC,MD(3)                                          B27A   8
      DO 104 I=2,NETA                                                   B27A 008
      DETA(I-1)=ETA(I)-ETA(I-1)                                         B27A 009
      DSQ(I-1)=DETA(I-1)*DETA(I-1)                                      B27A 010
      B1(I-1)=B(3)*DSQ(I-1)                                             B27A 011
      B2(I-1)=2.*B1(I-1)                                                B27A 012
  104 DCU(I-1)=DETA(I-1)*DSQ(I-1)                                       B27A 013
      MAT1I=3*NETA-2                                                    B27A 014
      MAT2I=2 * NETA
      MAT1J= NETA+3
      MAT2J= NETA
      DO 108 I=1,MAT2I
      DO 108 J=1,MAT2J
  108 BA2(I,J)=0.
      DO 105 I=1,MAT1I                                                  B27A 017
      DO 105 J=1,MAT1J                                                  B27A 018
  105 BA1(I,J)=0.                                                       B27A 019
      BA1(1,2)=1.                                                       B27A 020
      BA1(1,3)= DSQ(1)/2.
      BA1(NETA,3) = DETA(1)
      BA1(MAT2I-1,3)=1.
      BA2(2,1)=DETA(1)
      BA2(NETA+1,1)=1.
      J=NETA
      DO 106 I=2,NETA                                                   B27A 022
      BA1(I-1,I+2)=DETA(I-1)
      BA1(J,I+2)=1.
      BA1(J,I+3)=-1.
      BA2(I,I)=1.
      IF(I-NETA) 103,106,106
  103 BA2(I,I+1)=-1.
  106 J=J+1
 9060 FORMAT(2X1P12E10.3)                                               B27A 031
 9064 FORMAT(2X37HLINEAR MATRIX FOR MOMENTUM EQUATIONS,I3,2H XI3,       B27A 032
     127H, BEFORE AND AFTER SOLUTION)                                   B27A 033
 9079 FORMAT(2X44HLINEAR MATRIX FOR MASS AND ENERGY EQUATIONS,I3,2H XI3,B27A 034
     127H, BEFORE AND AFTER SOLUTION)                                   B27A 035
      IF(KR(15)-1) 9062,9062,9061                                       B27A 036
 9061 WRITE(KOUT,9064) MAT1I,MAT1J                                      B27A 037
      DO 9063 I=1,MAT1I                                                 B27A 038
 9063 WRITE(KOUT,9060)(BA1(I,J),J=1,MAT1J)                              B27A 039
 9062 DO 107 LI=2,MAT1J
  107 CALL MATS1(BA1(1,LI))
      IF(KR(15)-1) 9069,9069,9066                                       B27A 055
 9066 DO 9067 I=1,MAT1I                                                 B27A 056
 9067 WRITE(KOUT,9060)(BA1(I,J),J=1,MAT1J)                              B27A 057
      WRITE(KOUT,9079) MAT2I,MAT2J                                      B27A 058
      DO 9068 I=1,MAT2I                                                 B27A 059
 9068 WRITE(KOUT,9060)(BA2(I,J),J=1,MAT2J)                              B27A 060
 9069 DO 110 LI=1,MAT2J
```

```
      110 CALL MATS2(BA2(1,LI))
          IF(KR(15)-1) 9072,9072,9071                                   B27A 063
     9071 DO 9073 I=1,MAT2I                                             B27A 064
     9073 WRITE(KOUT,9060)(BA2(I,J),J=1,MAT2J)                          B27A 065
     9072 NLEQ=MAT1I+NSP*MAT2I                                          B27A 066
          NNLEQ=MAT1J+NSP*MAT2J                                         B27A 067
          NAM=NNLEQ-(NSPM1+2)                                           B27A 068
          NRNL=NSP+1                                                    B27A 069
          LAR(NAM+1)=2
          J=2+MAT1J
          LL=NAM+2
          DO 111 L=LL,NNLEQ
          LAR(L)=J
      111 J=J+MAT2J
          L=NAM+1
          J=0
          DO 113 I=1,NAM
          J=J+1
          IF(LAR(L)-J) 113,112,113
      112 L=L+1
          J=J+1
      113 LAR(I)=J
          IF(KR(15)) 9901,9902,9901                                     B27A 085
     9901 CONTINUE                                                      B27A 086
     9999 FORMAT(2X16HDEBUG LAR INDICE/(8X20I4))                        B27A 087
          WRITE(KOUT,9999) LAR                                          B27A 088
     9902 CONTINUE                                                      B27A 089
          RETURN                                                        B27A 090
          END                                                           B27A 091
    CB28A
          SUBROUTINEKINET                                               KINE0010
          COMMON /HISCOM/ C1,C2,C3
          COMMON /BUMCOM/ BUMP,CORMA,EASE
          COMMON/INTCOM/KKR(20),KIN,KOUT
          DIMENSION ELKM(10),DELK(10)                                   B28A 004
          COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B28A   5
        1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B28A   6
        2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B28A   7
        3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YH( 71),GG( 71)  B28A   8
        4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B28A   9
          COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,  B28A  10
        1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ,   B28A  11
        2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CNF,EP,RV,IFCJC,WTG,WTL,JC,HG,  B28A  12
        3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      B28A  13
        4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,  B28A  14
        5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B28A  15
        6 BC(10),BLNK(10),CY(10),IBC(10),BE(10),JJ( 4)                     B28A  16
          COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),  B28A  17
        1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),PA(10),LL(10),PMR(10), B28A  18
        2 PRMU(10,10),EESE(10)                                             B28A  19
      5 FORMAT(13I3)                                                       KINE0320
     10 RT = 1.9869 * T                                                    KINE0330
          DO 40 M=1,MT                                                     KINE0340
          SUMD = 0.                                                        KINE0350
          SUMK = 0.                                                        KINE0360
          SUMR = 0.                                                        KINE0370
          SUMP = 0.                                                        KINE0380
          DO 15 I=1,IS                                                     KINE0390
```

```
      PRMU(I,M) = PMU(I,M) - RMU(I,M)                                   KINE0400
      SUMK = SUMK + PRMU(I,M) * VLNK(I)                                 KINE0410
      SUMR = SUMR + RMU(I,M) * Y(I)                                     KINE0420
      SUMP = SUMP + PMU(I,M) * Y(I)                                     KINE0430
   15 SUMD = SUMD + PRMU(I,M) * H(I)                                    KINE0440
C     EQUILIBRIUM CONSTANTS FOR KINETIC REACTIONS IN TERMS OF BASE SPECIKINE0450
C          LOG KP-S                                                    KINE0460
C     DERIVATIVES OF LOGS OF ABOVE KP-S WITH RESPECT TO LOG T           KINE0480
      DKPT(M) = SUMD / RT                                               KINE0490
C     RIGHT HAND SIDE (OR REVERSE PART) OF DRIVING POTENTIAL            KINE0500
      IF(ITS  ) 19,14,16
   14 DELK(M)=0.
   16 IF(DELK(M)) 17,19,18
   17 SUMP=SUMP-DELK(M)
      GO TO 19
   18 SUMR=SUMR+DELK(M)
   19 ELKM(M)=SUMP-SUMK-SUMR
      PKP(M) = EXP(SUMP - SUMK)                                         KINE0510
C     LEFT HAND SIDE (OR FORWARD PART) OF DRIVING POTENTIAL             KINE0520
      PKR(M) = EXP(SUMR)                                                KINE0530
      VK1 = PKR(M) - PKP(M)                                             KINE0540
      IF (VK1) 25,20,25                                                 KINE0550
   20 VK1 = 1.E - 9 * PKR(M)                                            KINE0560
   25 CONTINUE
      VK2 = AA * FKF(M) * (ABS(VK1)) * * (EXK(M) - 1.) * EXP( - EAK(M) /KINE0580
    1 RT)*(-C3)
      VK3 = VK2                                                         KINE0600
      IF (EXK(M) - 1.) 35,30,30                                         KINE0610
   30 VK3 = VK2 * EXK(M)                                                KINE0620
C     PM TIMES FORWARD RATE OF REACION I  (PM=AA)                       KINE0630
   35 PMR(M) = VK2 * VK1                                                KINE0640
      PKP(M) = PKP(M) * VK3                                             KINE0650
      PKR(M) = PKR(M) * VK3                                             KINE0660
      RAT(M)=AMAX1(ABS(PKP(M)),ABS(PKR(M)))
      RSIG(M)=RAT(M)
      IF(KR(7)-1) 40,40,36
   36 IF(M-1) 37,37,39
   37 WRITE(KOUT,38)
   38 FORMAT(2X1HM7X3HLKP6X8HDLKP/DLT6X4HPMRR8X4HPMRP9X3HPMR9X3HRAT)
   39 WRITE(KOUT,41) M,SUMK,DKPT(M),PKR(M),PKP(M),PMR(M),RAT(M)
    1 ,ELKM(M),DELK(M)
   40 CONTINUE
   41 FORMAT(I3,2X8E12.5)
   45 FORMAT(1X26HA(I,J),B(I),I=1,8,J=1,8 IN)                           KINE0690
   50 FORMAT(1X12E10.3)                                                 KINE0700
   55 FORMAT(1X27HA(I,J),B(I),I=1,8,J=1,8 OUT)                          KINE0710
      IF (KR(7) - 1) 80,80,65                                           KINE0730
   65 CONTINUE
      WRITE(KOUT,50)PRMU                                                KINE0810
      WRITE(KOUT,215)                                                   KINE0820
      WRITE(KOUT,50)(EB(I),I=1,IS)                                      KINE0830
      WRITE(KOUT,50)(E(I),I=1,IS)
   70 WRITE(KOUT,45)                                                    KINE0840
      DO 75 I=1,ISP2                                                    KINE0850
   75 WRITE(KOUT,50)(A(I,J),J=1,ISPQ),B(I)
   80 CONTINUE                                                          KINE0870
      IF(ITS) 105,85,105
C*****ORDER REACTIONS                                                   KINE0880
```

```
   85 DO 86 M=1,MT
   86 MA(M)=M
      IF(MT-1) 105,105,90                                              KINE0900
   90 K = 0                                                            KINE0910
      DO 100 M=2,MT
      IF(RSIG(M)-RSIG(M-1)) 100,100,95                                 KINE0930
   95 K = MA(M)                                                        KINE0940
      MA(M) = MA(M - 1)                                                KINE0950
      MA(M - 1) = K
      DUM1=RSIG(M)
      RSIG(M)=RSIG(M-1)
      RSIG(M-1)=DUM1
  100 CONTINUE                                                        KINE0990
      IF (K) 105,105,85                                               KINE1000
C*****START SECOND MAJOR LOOP ON REACTIONS                            KINE1010
  105 DO 200 MM=1,MT
      RSIG(MM)=0.
      M = MA(MM)                                                      KINE1030
C*****IS IT A CONTROLLING REACTION                                     KINE1040
      IF(ITS) 106,108,106
  106 L=LL(MM)
      IF(L) 126,126,107
  107 DUM=ABS(PRMU(L,M)*RAT(M))
      GO TO 130
  108 LL(MM)=0
      DO 125 L=1,IS                                                   KINE1060
      IF (PRMU(L,M)) 110,125,110                                      KINE1070
  110 DO 115 K=1,MM                                                   KINE1080
      IF (L - LL(K)) 115,125,115                                      KINE1090
  115 CONTINUE                                                        KINE1100
      DUM=ABS(PRMU(L,M)*RAT(M))
      IF(ABS(PRMU(L,M))-.001) 125,125,120
C* * * YES,IT IS FOR MASS BALANCE L                                   KINE1120
  120 LL(MM) = L                                                      KINE1130
      GOTO 130                                                        KINE1140
  125 CONTINUE                                                        KINE1150
C* * *NO, IT IS NOT, ADD INTO ALL MASS BALANCES                        KINE1160
  126 I1=1
      I2 = IS                                                         KINE1180
      GOTO 170                                                        KINE1190
C*****REARRANGE ACCORDING TO CONTROLLING REACTION                      KINE1200
  130 RSIG(MM)=DUM/EB(L)*0.1
      DUM1=PRMU(L,M)
      PRMU(L,M) = 0.                                                  KINE1220
      DO 165 I=1,IS                                                   KINE1230
      IF (PRMU(I,M)) 135,165,135                                      KINE1240
  135 DUM2 = PRMU(I,M) / DUM1                                         KINE1250
      IP(1)=1
      MP = MM + 1                                                     KINE1260
      IF (MT - MP) 155,140,140                                        KINE1270
  140 DO 150 K=MP,MT                                                  KINE1280
      MI = MA(K)                                                      KINE1290
      PRMU(I,MI) = PRMU(I,MI) - DUM2 * PRMU(L,MI)                     KINE1300
      IF (ABS(PRMU(I,MI)) - .001) 145,150,150                         KINE1310
  145 PRMU(I,MI) = 0.                                                 KINE1320
  150 CONTINUE                                                        KINE1330
  155 DO 160 K=1,ISPQ                                                 KINE1340
  160 A(I + 2,K) = A(I + 2,K) - DUM2 * A(L + 2,K)                     KINE1350
```

```
      B(I + 2) = B(I + 2) - DUM2 * B(L + 2)                              KINE1360
      E(I)=E(I)-DUM2*E(L)
      DUM2 = ABS(DUM2)                                                   KINE1370
      EB(I) = AMAX1(EB(I) ,DUM2 * EB(L))                                 KINE1380
  165 CONTINUE                                                           KINE1390
      PRMU(L,M) = DUM1                                                   KINE1400
C*****ADD CONTROLLING REACTION INTO ITS MASS BALANCE                     KINE1410
      I1 = L                                                             KINE1420
      I2 = L                                                             KINE1430
      EOL=E(L)+PMR(M)*PRMU(L,M)
      IF(ITS) 170,230,170
  230 DELK(M)=(1.-EASE)*ELKM(M)*AMIN1(1.,ABS(EOL/EB(L)))
      ELKM(M)=ELKM(M)-DELK(M)
      IF(PKR(M)-PKP(M)) 240,170,235
  235 PKP(M)=PKP(M)*EXP(-DELK(M))
      GO TO 245
  240 PKR(M)=PKR(M)*EXP(DELK(M))
  245 PMR(M)=PKR(M)-PKP(M)
  170 DO 176 J=1,IS
      IF(IFC(J)) 171,171,176
  171 SUMD = RMU(J,M) * PKR(M) - FMU(J,M) * PKP(M)                       KINE1450
      DO 175 I=I1,I2                                                     KINE1460
  175 A(I + 2,J + 2) = A(I + 2,J + 2) - SUMD * PRMU(I,M)                 KINE1470
  176 CONTINUE
      SUMD = - PKP(M) * DKPT(M) - EAK(M) / RT * PMR(M)                   KINE1480
      DO 180 I=I1,I2                                                     KINE1490
      DUM1 = PMR(M) * PRMU(I,M)                                          KINE1500
      A(I+2,2)=A(I+2,2)-DUM1
      A(I + 2,1) = A(I + 2,1) + SUMD * PRMU(I,M)                         KINE1510
      E(I)=E(I)+DUM1
      B(I + 2) = B(I + 2) + DUM1                                         KINE1520
  180 EB(I) = AMAX1(EB(I) ,ABS(PRMU(I,M) * RAT(M)))
      EB(I) =AMAX1(EB(I),ABS(E(I)))
      IF (KR(7) - 1) 200,200,185                                         KINE1540
  185 WRITE(KOUT,215)                                                    KINE1550
      WRITE(KOUT,50) (EB(I),I=1,IS)                                      KINE1560
      WRITE(KOUT,50) (E(I),I=1,IS)
  190 WRITE(KOUT,55)                                                     KINE1570
      DO 195 I=1,ISP2                                                    KINE1580
      WRITE(KOUT,50) (A(I,J),J=1,ISPQ),B(I)
  195 CONTINUE                                                           KINE1600
      WRITE(KOUT,5)M,I1,I2,L,LL,MM,MA                                    KINE1610
      WRITE(KOUT,50)PRMU                                                 KINE1620
  200 CONTINUE                                                           KINE1630
C*****MODIFY COEFFICIENTS TO ACHIEVE LINEARITY AS EQUIL IS APPROACHED
      DO 206 MM=1,MT
      L=LL(MM)
      IF(L) 201,206,201
  201 M=MA(MM)
      DUM2=RSIG(MM)
      IF(ITS) 250,248,250
  248 EESE(L)=E(L)*(1.-EASE)/(1.+DUM2)
  250 E(L)=E(L)-EESE(L)
      B(L+2)=B(L+2)-EESE(L)
      EB(L)=-EB(L)
      AR=1.
      EXEL=PKR(M)/PKP(M)
      IF(EXEL) 191,191,193
```

```
  191 EXEL=1.E-35
      IF(PKP(M)-PKR(M)) 192,193,193
  192 EXEL=1.E+35
  193 CONTINUE
      EOL=E(L)*DUM2/(DUM2+1.)
      DUM1=(1.+DUM2)/(1.+RSIG(MM))
      EB(L)=EB(L)*ABS(DUM1)
      IF(ABS(EXEL-1.)-.1) 204,204,202
  202 DUM1=E(L)/(ELKM(M)*PRMU(L,M))
      AR=(DUM1+PKR(M))/PMR(M)
      AR=AMAX1(AR,0.)
      AR=AMIN1(1.,AR)
  204 DO 205 J=1,IS
      IF(IFC(J)) 203,203,205
  203 A(L+2,J+2)=A(L+2,J+2)+ EOL*(PMU(J,M)*(1.-AR)+AR*RMU(J,M))
  205 CONTINUE
      A(L+2,1)=A(L+2,1)-EOL*(DKPT(M)*(1.-AR)-ELK(M)/RT)
      A(L+2,2)=A(L+2,2)+EOL
  206 CONTINUE
  215 FORMAT(1X12HEB(I),I=1,IS)
      IF(KR(7)-1) 225,225,220
  220 WRITE(KOUT,55)
      DO 221 I=1,ISP2
  221 WRITE(KOUT,50) (A(I,J),J=1,ISPQ),B(I)
      WRITE(KOUT,50) (E(I),I=1,IS)
  225 RETURN                                                          KINE1710
      END                                                             KINE1720
CB29A                                                                 B29A 001
      SUBROUTINE FIRSTG                                               B29A 002
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B29A   3
     1,LEFS(10),PIEASE,LEFW(10)                                       B29A   4
      COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)    B29A   5
     1,LAR(153),BA1(43,18),BA2(30,15)                                 B29A   6
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB29A   7
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B29A   8
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B29A   9
     3,KAUXO,JTIME,JSPEC,MD(3)                                        B29A  10
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B29A  11
     1,RNOSE,VKAP,NOISC,IDTSC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO, B29A  12
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                          B29A  13
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                  B29A  14
    3 FORMAT(8E10.4)                                                  B29A 011
4     FORMAT (3E10.4,5XI5,E10.4)                                      ENTR-MOD
    5 FORMAT(40I2)
      NUL=0
      IF(IABS(KR(2)-2)-1) 110,111,112
  110 DUM1=(GE(ITEM)-G(1,1))/(G(1,NETA)-G(1,1))                       B29A 013
      DO 113 I=1,NETA                                                 B29A 014
      G(3,I)=G(3,I)*DUM1                                              B29A 015
      G(2,I)=G(2,I)*DUM1                                              B29A 016
  113 G(1,I)=G(1,1)+DUM1*(G(1,I)-G(1,1))                              B29A 017
      GO TO 152                                                       B29A 018
  111 READ(KIN,4) ALPH,F(1,1),F(3,1),IST,F(3,NETA)                    ENTR-MOD
      IF(KR(2).EQ.3) KR(2)=MIN0(-IST,-1)
      ALSQ=ALPH*ALPH
      F(3,1)=F(3,1)*ALSQ
      READ(KIN,3)(F(2,I),I=1,NETA)
      BA1(MAT1I,1) = F(3,NETA)*ALSQ                                   ENTR-MOD
```

```
      CALL MATS1(BA1(1,1))
      DO 131 I=1,NETA                                                   ENTR-MOD
  131 F(2,I)=F(2,I)*ALPH
      LL=2
      L=1
      I=1
      DO 134 M=1,MAT1I
      I=I+1
      IF(I-NETA) 133,133,132
  132 I=LL
      L=L+LL
      LL=1
  133 F(L,I)=BA1(M,1)-BA1(M,2)*F(1,1)-BA1(M,3)*F(3,1)
      DO 134 J=4,MAT1J                                                  ENTR-MOD
  134 F(L,I)=F(L,I)-BA1(M,J)*F(2,J-3)
      DO 130 M=1,MAT1I
  130 BA1(M,1)=0                                                        ENTR-MOD
      BA1(1,1)=1.0                                                      ENTR-MOD
      CALL MATS2(BA1)
      DO 138 K=NUL,NSPM1
      READ(KIN,3) SP(2,1,K),(SP(1,I,K),I=1,NETA)
      SP(2,1,K)=SP(2,1,K)*ALPH
      L=2
      I=1
      DO 138 M=2,MAT2I
      I=I+1
      IF(I-NETA) 136,136,135
  135 I=1
      L=L+1
  136 SP(L,I,K)=BA1(M,1)*SP(1,NETA,K)-BA2(M,1)*SP(2,1,K)
      DO 138 J=2,MAT2J
  138 SP(L,I,K)=SP(L,I,K)-BA2(M,J)*SP(1,J-1,K)
      DO 140 M=1,MAT2I
  140 BA1(M,1)=0.
      IF(NSPM1.GT.0) READ(KIN,5) LEF
      GO TO 152                                                         ENTR-MOD
  112 READ (KIN,3)GW                                                    B29A 038
  195 ALPH= 4./ETA(KAPPA)                                               B29A 039
      F(1,1)=0.
      F(2,1)=0.                                                         ENTR-MOD
      F(3,1)= ALPH/ETA(KAPPA)*(CBAR+CBAR+1.)                            ENTR-MOD
      DUM1=ALPH/ETA(KAPPA)*(CBAR-0.5)
      ETAT=ALPH/(F(3,1)-DUM1)
      DUM2=0.5/ETAT*ALPH/ETAT
      DUM3=ALPH/(ETA(KAPPA)-ETA(NETA))**2*(1.-CBAR)
      F(4,1)=-2.*DUM2
      DO 114 I=3,KAPPA
      IF(ETA(I-1)-ETAT) 108,109,109
  108 F(2,I-1)=(F(3,1)-DUM2*ETA(I-1))*ETA(I-1)
      F(3,I-1)=F(3,1)-2.*DUM2*ETA(I-1)
      F(4,I-1)=-2.*DUM2
      GO TO 114
  109 F(2,I-1)=ALPH/2.+DUM1*ETA(I-1)
      F(3,I-1)=DUM1
      F(4,I-1)=0.
  114 F(1,I-1)=F(1,I-2)+(F(2,I-2)+F(2,I-1))/2.*DETA(I-2)
      DO 107 I=KAPPA,NETA
      F(2,I)=ALPH-DUM3*(ETA(NETA)-ETA(I))**2
```

```
      F(3,I)=2.*DUM3*(ETA(NETA)-ETA(I))
      F(4,I)=-2.*DUM3
  107 F(1,I)=F(1,I-1)+(F(2,I)+F(2,I-1))/2.*DETA(I-1)
      DUM=(GE(ITEM)-GW)/ALPH
      DO 115 I=1,NETA
      G(1,I)=F(2,I)*DUM+GW
      G(2,I)=F(3,I)*DUM
  115 G(3,I)=F(4,I)*DUM
  152 CONTINUE                                                          B29A 059
 9901 FORMAT(1X1P12E10.3)
 9904 FORMAT(2X19HDEBUG FIRST GUESSES)                                  B29A 061
      IF(KR(15)) 9902,9903,9902                                         B29A 062
 9902 CONTINUE                                                          B29A 063
      WRITE(KOUT,9904)                                                  B29A 064
      DO 9906 I=1,4
 9906 WRITE(KOUT,9901) (F(I,J),J=1,NETA)
      DO 9905 K=NUL,NSPM1
      DO 9905 I=1,3
 9905 WRITE(KOUT,9901) (SP(I,J,K),J=1,NETA)
 9903 CONTINUE                                                          B29A 067
      RETURN                                                            B29A 068
      END                                                               B29+ 0
      FUNCTION ERP(X)
      TXS=2.*X*X
      IF(X-2.) 5,5,15
    5 R=0.8
      FN=31
      DO 10 I=1,15
      R=1.-R*TXS/FN
   10 FN=FN-2.
      ERP=R*X
      RETURN
C     SEMI CONVERGENT SERIES FOR LARGE X --  INCLUDE 0 TO RAT OF
C        SMALLEST TERM AND RAT TO 1. OF PRIOR TERM IF SMALLEST TERM IS
C        SEVENTH OR PRIOR TERM.
   15 IN=(TXS-1.)/2.
      RAT=0.68
      IF(IN-6) 20,20,25
   20 FN=IN+IN-1
      R= (TXS-FN-2.)/2.*RAT
      R=R/TXS*(FN+2.)+R/RAT-R+RAT
      GO TO 30
   25 IN=7
      R=1.0
      FN=13
   30 DO 35 I=1,IN
      R=1.+R*FN/TXS
   35 FN=FN-2.
      ERP=R/(2.*X)
      RETURN
      END
C830B
      SUBROUTINE ETIME
      COMMON/START/TZ
      CALL SECOND(TZ)
      RETURN
      END
      SUBROUTINE ETIMEF(T)
```

```
      COMMON/START/TZ
      CALL SECOND(T)
      T=T-TZ
      RETURN
      END
C     B30C
      SUBROUTINE LIAD(L,I,J,C)
      COMMON/ERRCON/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM      B30C   3
     1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)      B30C   4
     2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)       B30C   5
     3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)    B30C   6
     4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)               B30C   7
      COMMON/ETACOM/ETA(15),DETA(15),DSG(14),DGU(14),B1(14),B2(14)       B30C   8
     1,LAR(153),BA1(43,18),BA2(30,15)                                    B30C   9
      COMMON/NONCOM/AM(153,153),DVNL(153),TCK,                           B30C  10
     1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)               B30C  11
      COMMON/INTCOM/KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA
      IF(L) 1,3,3
    1 ENL(I) = ENL(I) -C*FLE(J)
      DO 2 K=1,MAT1J                                                     ENTR-MOD
    2 AM(I,K)=AM(I,K)-C*BA1(J,K)
      RETURN
    3 ENL(I)=ENL(I)-C*SPLE(J,L)
      KK=L*MAT2J+MAT1J
      DO 4 K=1,MAT2J
      KK=KK+1
    4 AM(I,KK)=AM(I,KK)-C*BA2(J,K)
      RETURN
      END                                                                B05A5360
CB30D
      SUBROUTINE TLEFT(I)
      I=100000
      RETURN
      END
CB30E
      SUBROUTINE DATE(I,J)
      RETURN
      END
CB30F
      SUBROUTINE TOD(I,J)
      RETURN
      END
      SUBROUTINE OGLE(N,XAM,PRM,DPDIM,NUMX,X,P,EM)                       ENTR-MOD
      DIMENSION XAM(1),X(1),P(1),EM(1),PRM(1),DPDIM(1)                   ENTR-MOD
      XDIF=X(NUMX)-X(1)                                                  ENTR-MOD
      IS=1                                                               ENTR-MOD
    2 DO 600 J=1,N                                                       ENTR-MOD
      XA=XAM(J)                                                          ENTR-MOD
   59 IO=1                                                               ENTR-MOD
      IT=1                                                               ENTR-MOD
   61 IF(XDIF) 72,60,71                                                  ENTR-MOD
   71 IF(XA-X(IS)) 62,63,64                                              ENTR-MOD
   72 IF(X(IS)-XA) 62,63,64                                              ENTR-MOD
   62 IF(IS-1) 671,671,68                                                ENTR-MOD
   68 IS=IS-1                                                            ENTR-MOD
      IT=2                                                               ENTR-MOD
      GO TO (61,66),IO                                                   ENTR-MOD
  672 IS=NUMX                                                            ENTR-MOD
```

```
  671 I=IS                                                          ENTR-MOD
      H=0.                                                          ENTR-MOD
      DPDI=EM(I)                                                    ENTR-MOD
      GO TO 67                                                      ENTR-MOD
   63 PR=P(IS)                                                      ENTR-MOD
      DPDI=EM(IS)                                                   ENTR-MOD
      GO TO 601                                                     ENTR-MOD
   64 IS=IS+1                                                       ENTR-MOD
      IF(IS-NUMX) 69,69,672                                         ENTR-MOD
   69 IO=2                                                          ENTR-MOD
      GO TO (61,65),IT                                              ENTR-MOD
   65 IS=IS-1                                                       ENTR-MOD
   66 I=IS                                                          ENTR-MOD
      DX=X(I+1)-X(I)                                                ENTR-MOD
      XD=XA-X(I)                                                    ENTR-MOD
      G=(((P(I+1)-P(I))/DX)-EM(I))/DX                               ENTR-MOD
      F=(((EM(I+1)-EM(I))/DX)-2.*G)/DX                              ENTR-MOD
      H=(F*(XA-X(I+1))+G)*XD                                        ENTR-MOD
      DPDI=H+H+EM(I)+F*XD*XD                                        ENTR-MOD
   67 PR=(H+EM(I))*XD+P(I)                                          ENTR-MOD
  601 CONTINUE                                                      ENTR-MOD
      PRM(J)=PR                                                     ENTR-MOD
  600 DPDIM(J)=DPDI                                                 ENTR-MOD
   60 CONTINUE                                                      ENTR-MOD
    4 RETURN                                                        ENTR-MOD
      END                                                           ENTR-MOD
CB31A                                                               B31A 001
      SUBROUTINE CMA                                                B31A 002
C       TWO MOVING BOUNDARY INTERNAL CONDUCTION PACKAGE             B31A 003
C       AEROTHERM CORPORATION    RM KENDALL  C MOYER                B31A 004
      COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  B31A 005
     1NLO(20),NMI(20),KHI(20),JCMA,IMG,IMC,NMG,                     B31A 006
     2TCH(2),TPR(2),TRAD(2),IAB                                     B31A 007
     3,TT2(20,2),THZ(20,2),TT1(30),TMG(30),DH12(2),TA(39),DELMG,I1,I2,CHB31A 008
     4,CMD,BPRMG,KCM(10)                                            B31A 009
      EQUIVALENCE (NCLASS,JCMA)                                     B31A 010
      COMMON/LOOCOM/KOUT,IEX,DEN,VR,IMI(23),ILO(23),IR(23)          B31A 011
      COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                B31A 012
     3,RHO(2),MATL(38),DEL(39),SO(20),H(38),RC(38),RA(38),RECORD(36),   B31A 013
     4AREA(38),EMA(38),RAV(38),                                     B31A 014
     5ROA(152),ROB(152),ROC(152),                                   B31A 015
     6    TPI(30),VFZ,CMH,NPR,                                      B31A 016
     7LCT,NPG,II,NBM,NUMN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA  B31A 017
     8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,B31A 018
     9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,NT B31A 019
      COMMON/CMACOM/EPSM,TRES,                                      B31A 020
     1TMWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFMP,JFM,INPUT,     DTMIN,BRP,HCONV,B31A 021
     2INCM,DTMB,NN,NI,NOI,CMCRI,PYCRI,NCON,     NW,TX(38),F1(38),F2(30) B31A 022
      COMMON/SBCP/BF,CMMA,CMMI,DERR,DMIV,EMIV,ERFX,ERRC,ERM,ERRS,I3,I4, B31A 023
     1VRM,VRP, IPR,IRA,IRB,IRC,IRD,ITL,PMI,QQ,TABC,TEMP,TSMA,TSMI,TSSQ B31A 024
      COMMON/SBCP/ TMXT,    DMCP(3),CPE(3),TO(28),VITER(51),EITER(51) B31A 025
      COMMON/SBCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)            B31A 026
      COMMON/SBCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50),  B31A 027
     1KAT( 50),ROT( 50),RO( 50),X( 50),ROM( 50),CMOG( 50),RR ( 50),  B31A 028
     2CNC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50),CMO( 50)        B31A 029
      COMMON/SBCP/BR,    CMZ,     CMOL,     DEDT,DEDTT,DSDTB,CTH,GSMS,HW,  B31A 030
     1HE,     ITS,PRES,QCHEM,QCHEMT,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP,  B31A 031
     2QRPT,RAD,RADT,RSU,SIG,    TSAVE,VF,XP1,ASU                    B31A 032
```

```
      COMMON/MISC/      BPRH,CMT,CCLD,CP1,CPGAS,CPNL,CZ,DCDT,DECOM,      B31A 033
     1DECOMT,DELCR,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DRCAC, B31A 034
     2DROAT,DROBC,DROCT,DROCC,DROCT,DROOTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHS B31A 035
     3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSM,GSMT, B31A 036
     4GZ,H1,HAPHB,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,  B31A 037
     5NDR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SA B31A 038
     6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,THPRT,TN,TOP1,TOP2,TOP3,T, B31A 039
     7TT,VOL,X1                                                          B31A 040
      EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                    B31A 041
  542 FORMAT(/33X14H----OUTPUT----)                                      B31A 042
  543 FORMAT(//6X14(2H- )F11.4,9H SECONDS 14(2H -))
  544 FORMAT(6X,4HTIME,2X,4HSURF,2X,4HPROB,2X,7HSURFACE,5X,6HH WALL,     B31A 045
     14X,6HH EDGE,6X,10HHEAT COEFF,6X,6HCH/CHO/6X,4HSTEP,2X,4HITER,2X,4H B31A 046
     2OPTN,2X,8HRAD (IN),3X,8H(BTU/LB),2X,6H(BTU/LB),3X,14H(LB/SQ FT-SEC B31A 047
     3))                                                                 B31A 048
  545 FORMAT(6X,I4,2I6,F10.4,F11.2,F10.2,F12.4,7X,F8.5/1H )              B31A 049
  546 FORMAT(33X,20H---ABLATION RATES---)                                B31A 050
  547 FORMAT(8X,7HB PRIME,3X,9HB PRIME G,3X,10HH DOT CHAR,3X,9HH DOT GAS B31A 051
     16X,6HH CHAR,7X,5HH GAS/34X,14H(LB/SQ FT-SEC),11X,15H(LB/ORIG SQ FT B31A 052
     2))                                                                 B31A 053
  548 FORMAT(8X,F8.5,2X,F8.5,4(3X,F10.6)/1H )                            B31A 054
 5480 FORMAT(27X,32H---RECESSIONS/RECESSION RATES---/                    B31A 055
     133X,19H(IN)    /    (IN/SEC)/                                     B31A 056
     2  16X,7HSURFACE,16X,6HCHAR (,F4.2,1H),11X,11HPYROLYSIS (,F4.2,1H)) B31A 057
 5481 FORMAT(5X,3(4X,F10.7,1H/,F9.7)/1H )                                B31A 058
 5482 FORMAT(27X,31H---SURFACE ENERGY FLUX TERMS---/25X,37HCURRENT RATES B31A 059
     1 (BTU/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SQ B31A 060
     2 FT)/                                                              B31A 061
     3    13X,10HCONVECTED ,4X,10H RADIATED ,4X,10H RADIATED ,4X,10H CHE B31A 062
     4MICAL ,4X,10HCONDUCTION/17X,2HIN,12X,2HIN,11X,3HOUT,8X,10HGENERATI B31A 063
     5ON,7X,4HAWAY)                                                      B31A 064
 5483 FORMAT (6X,4HRATE,3X,5(E10.3,4X)/6X,5HTOTAL,2X,5(E10.3,4X)/1H )    B31A 065
 5484 FORMAT(30X,27H---INTERIOR ENERGY TERMS---/25X,37HCURRENT RATES (BT B31A 066
     1U/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SQ FT) B31A 067
     2/                                                                  B31A 068
     3       13X,9HPYROL GAS,7X,6HDECOMP,6X,10HCONVECTION,6X,7HSTORAGE, B31A 069
     47X,7HLOSS AT/14X,7HPICK UP,6X,10HABSORPTION,3X,11HWITH SOLIDS,5X, B31A 070
     58HIN SOLID,6X,9HREAR FACE)                                         B31A 071
 5485 FORMAT (6X,4HRATE,3X,5(E10.3,4X)/6X,5HTOTAL,2X,5(E10.3,4X)/1H )    B31A 072
  549 FORMAT (6XAHNODE MAT3X4HTEMP3X7HDENSITY3X8HENTHALPY2X8HNODE MAT3X4 B31A 073
     1HTEMP3X7HDENSITY3X8HENTHALPY/15X7H(DEG R)11H (LB/CU FT)9H (BTU/LB) B31A 074
     211X7H(DEG R)11H (LB/CU FT)9H (BTU/LB:)                             B31A 075
 5490 FORMAT(6X,8HNODE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU/,2X,8HNO B31A 076
     1DE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU//)5X,7H(DEG R),11H (LB B31A 077
     2/CU FT),9H FT SC F),11X,7H(DEG R),11H (LB/CU FT),9H FT SC F))      B31A 078
  550 FORMAT (5X2I4,F9.2,F10.3,2XF8.2,1X2I4,F9.2,F10.3,F10.2)            B31A 079
 5500 FORMAT(5X,2I4,F9.2,F10.3,2X,F8.6,1X,2I4,F9.2,F10.3,F10.6)          B31A 080
  551 FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND A B31A 081
     1BLATION PROGRAM/73X4HPAGEI3/1H 67X2A6)                             B31A 082
  552 FORMAT(9X,67HOPTIONAL OUTPUT OF THERMOCOUPLE TEMPERATURES AND/OR I B31A 083
     1SOTHERM DEPTHS/24X,37HDEPTHS MEASURED FROM ORIGINAL SURFACE/24X,   B31A 084
     231HTEMPERATURES IN DEGREES RANKINE//6X,77HEACH OUTPUT BLOCK SHOWS B31A 085
     3THE TIME IN SECONDS, THE CURRENT SURFACE TEMPERATURE,/6X,20HTHE TE B31A 086
     4MPERATURES OF ,I2,44H THERMOCOUPLES, AND THE DEPTHS IN INCHES OF ,B31A 087
     5I2,10H ISOTHERMS//6X,74HTHE FIRST BLOCK SHOWS A SAMPLE TIME AND SUR B31A 088
     6FACE TEMPERATURE, THE SPECIFIED/6X,73HDEPTHS OF THE THERMOCOUPLES B31A 089
     7 (IF ANY) AND THE ISOTHERM TEMPERATURES.   THE/6X,76HARRANGEMENT O B31A 090
     8F THIS BLOCK CORRESPONDS TO THE ARRANGEMENT OF THE OUTPUT DATA,// B31A 091
```

```
     9(10(2X,F10.4)))                                                   B31A 092
  553 FORMAT (//6X,11HOUTPUT DATA//)                                    B31A 093
  554 FORMAT (10(2X,F10.4))                                             B31A 094
  581 FORMAT(8F10.4/(10X7F10.4))                                        B31A 095
  582 FORMAT(12E10.3)                                                   B31A 096
C                                                                       B31A 097
C                                                                       B31A 098
 7600 GO TO (7601,6061,761,761,761),JCMA                                B31A 099
 7601 CONTINUE                                                          B31A 100
      DNCP(3)=99999.                                                    B31A 101
      SIG=.481E-12                                                      B31A 102
C     CHAR AND PYROLYSIS ZONE CRITERIAL DENSITIES                       B31A 103
      DNCP(1)=RHO(2)+CHCRI*(RHO(1)-RHO(2))                              B31A 104
      DNCP(2)=RHO(2)+PYCRI*(RHO(1)-RHO(2))                              B31A 105
C                                                                       B31A 106
C     INITIAL VALUES FOR TIME LOOP                                      B31A 107
C                                                                       B31A 108
 1390 ITER=-1                                                           B31A 109
      DTHC=DTHB                                                         B31A 110
      CMH=1.0                                                           B31A 111
      THZRO=TPR(2)                                                      B31A 112
      TNXT=TPR(2)                                                       B31A 113
      TPR2=TPR2+THZRO                                                   B31A 114
      TPR3=TPR3+THZRO                                                   B31A 115
      THFIN=TPR(1)                                                      B31A 116
      IAB=0                                                             B31A 117
      ITS=0                                                             B31A 118
      SA=0.0                                                            B31A 119
      GSMT=0.0                                                          B31A 120
      GSMS=0.                                                           B31A 121
      CMD=0.0                                                           B31A 122
      CMT=0.                                                            B31A 123
      DSDTB=0.0                                                         B31A 124
      DSDT=0.                                                           B31A 125
      DSI=0.                                                            B31A 126
      DIDT=0.                                                           B31A 127
      CPE(1)=0.                                                         B31A 128
      CPE(2)=0.                                                         B31A 129
      COLD=0.                                                           B31A 130
      POLD=0.                                                           B31A 131
      DCDT=0.                                                           B31A 132
      DPDT=0.                                                           B31A 133
      QCOND=0.                                                          B31A 134
      QCONV=0.                                                          B31A 135
      QCHEM=0.                                                          B31A 136
      RAD=0.                                                            B31A 137
      QRP=0.                                                            B31A 138
      QCONVT=0.                                                         B31A 139
      QRPT=0.                                                           B31A 140
      RADT=0.                                                           B31A 141
      QCHEMT=0.                                                         B31A 142
      QCONDT=0.                                                         B31A 143
      PGPUT=0.                                                          B31A 144
      DECOMT=0.                                                         B31A 145
      DEDTT=0.                                                          B31A 146
      QLOSST=0.                                                         B31A 147
      TT=0.                                                             B31A 148
      TB=0.                                                             B31A 149
```

```
      SOEGR=0.                                                          B31A 150
      GSEGR=0.                                                          B31A 151
      PGPU=0.                                                           B31A 152
      DECOM=0.                                                          B31A 153
      EGO=0.                                                            B31A 154
      HW=0.                                                             B31A 155
      BR=0.                                                             B31A 156
      KK=0                                                              B31A 157
      TH=THZRO                                                          B31A 158
      THDS=THZRO-DTHIN                                                  B31A 159
      THPRT=TH                                                          B31A 160
      REWIND 3                                                          B31A 161
      CALL LCOUNT (-2,LCT,NPG,RECORD(35))                               B31A 162
      WRITE (KOUT,542)                                                  B31A 163
      IS=0                                                              B31A 164
      DTH=DTHIN                                                         B31A 165
      RSU=ABS(RSV)                                                      B31A 166
      DELCR=AMIN1(DEL(1),DELM)/5.0                                      B31A 167
      TSAVE=TA(1)+1.0                                                   B31A 168
      FA=(1.-PSIA)*BA*(RHOOA**(1.-PSIA))                                B31A 169
      FB=(1.-PSIB)*BB*(RHOOB**(1.-PSIB))                                B31A 170
      FC=(1.-PSIC)*BC*(RHOOC**(1.-PSIC))                                B31A 171
C                                                                       B31A 172
C     BEGINNING OF TIME LOOP                                            B31A 173
C                                                                       B31A 174
  410 ITER=ITER+1                                                       B31A 175
      JCMA=1                                                            B31A 176
C                                                                       B31A 177
C     CALCULATION OF NODAL PROPERTIES                                   B31A 178
C                                                                       B31A 179
      DO 108 N=2,NL                                                     B31A 180
  108 RA(N-1)=RA(N-1)+DSI                                               B31A 181
      RA(NL)=RA(NL)+DSI/2.                                              B31A 182
      CALL OGLE(NL,RA,RR,NUMN,RAV,AREA,EMA)                             B31A 183
      ASU=RR(1)                                                         B31A 184
      J=1-JFH-JF                                                        B31A 185
  100 DO 105 N=1,NL                                                     B31A 186
      J=J+JF                                                            B31A 187
      RR(N)=RR(N)/ASU                                                   B31A 188
      CALL LOOK (3,TA(N),TT2,TCP,TKP,THZ,0,Y2,Y2(4),3)                  B31A 189
      CN(N)=Y2(2)                                                       B31A 190
      CPV(N)=Y2(1)                                                      B31A 191
      HP(N)=Y2(3)+DH1                                                   B31A 192
      CALL LOOK (4,TA(N),TT2(1,2),TCP(1,2),TKP(1,2),THZ(1,2),0,Y2,D2,3) B31A 193
      CNC(N)=Y2(2)                                                      B31A 194
      CPC(N)=Y2(1)                                                      B31A 195
      HC(N)=Y2(3)+DH2                                                   B31A 196
      IF (HATL(N)-1) 103,101,102                                        B31A 197
  101 X(N)=1.                                                           B31A 198
      CP(N)=CPV(N)                                                      B31A 199
      H(N)=HP(N)                                                        B31A 200
      RO(N)=RHO(1)                                                      B31A 201
      ROT(N)=RHO(1)                                                     B31A 202
      GO TO 105                                                         B31A 203
  102 X(N)=0.                                                           B31A 204
      CN(N)=Y2(2)                                                       B31A 205
      H(N)=HC(N)                                                        B31A 206
      CP(N)=CPC(N)                                                      B31A 207
```

```
      RO(N)=RHO(2)                                                      B31A 208
      ROT(N)=RHO(2)                                                     B31A 209
      GO TO 105                                                         B31A 210
  103 X(N) = PETE-PET/RO(N)                                             B31A 211
      H(N)=X(N)*HP(N)+(1.-X(N))*HC(N)                                   B31A 212
      CP(N)=X(N)*CPV(N)+(1.-X(N))*CPC(N)                                B31A 213
      IF(N-1) 109,109,104                                               B31A 214
  109 ROT(1)=GAMA*(ROA(1)+ROB(1))+OMG*ROC(1)                            B31A 215
      GO TO 105                                                         B31A 216
  104 ROT(N)=(ROA(J)+ROB(J))*GAMA+OMG*(ROC(J))                          B31A 217
  105 CONTINUE                                                          B31A 218
      IF (NUMN-NBM) 112,106,106                                         B31A 219
  106 DO 107 N=NBM,NUMN                                                 B31A 220
      RR(N)=AREA(N)/ASU                                                 B31A 221
      KT=MATL(N)                                                        B31A 222
      CALL LOOK(KT+2,TA(N),TT2(1,KT),TCP(1,KT),TKP(1,KT),0,0,Y2,D2,2)   B31A 223
      CP(N)=Y2(1)                                                       B31A 224
      CN(N)=Y2(2)                                                       B31A 225
      RAT(N)=DEL(N)/(CN(N)*RR(N))                                       B31A 226
  107 RO(N)=RHO(KT)                                                     B31A 227
  112 HRES=SIG*EPSW*(TA(NUMN)+TRES)*(TA(NUMN)**2+TRES**2)+HCONV+1.E-30
      RAT(NUMN+1)=1./(HRES*RR(NUMN)+.00000001)                          B31A 229
      QLOSS=(TA(NL)-TA(NBM))/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL))     B31A 230
      QLOSST=QLOSST+QLOSS*DTH/AREA(1)*ASU                               B31A 231
      CMT=CMT+RHO(2)*DSDT*ASU/AREA(1)*DTH                               B31A 232
      DEL(NUMN+1)=CN(NUMN)/HRES                                         B31A 233
      RR(NUMN+1)=RR(NUMN)                                               B31A 234
      DTHS=DTH                                                          B31A 235
      DTS=TSAVE-TA(1)                                                   B31A 236
      IF(ITER) 151,113,151                                              B31A 237
  113 DEDT=0.                                                           B31A 238
      ITER=1                                                            B31A 239
      CH=TCH(2)                                                         B31A 240
      JCMA=2                                                            B31A 241
      GO TO 3000                                                        B31A 242
C                                                                       B31A 243
C     OUTPUT                                                            B31A 244
C                                                                       B31A 245
  151 JCMA=2                                                            B31A 246
      IF(TH-TNXT+.00001) 700,3000,3000                                  B31A 247
  700 JCMA=1                                                            B31A 248
      IF(TH-THPRT+.00001) 3410,3000,3000                                B31A 249
 3410 IDUMP=1                                                           B31A 250
      IF(KCM(4)) 4410,4410,3411                                         B31A 251
 3000 IDUMP=0                                                           B31A 252
 3411 DIDT=12.*DSDTB                                                    B31A 253
      NDR=NBM-NL-1                                                      B31A 254
      NLI=(NUMN-NDR+1)/2                                                B31A 255
      CALL LCOUNT(33+NLI,LCT,NPG,RECORD(35))                            B31A 256
  322 WRITE (KOUT,543)TH                                                B31A 257
      WRITE (KOUT,544)                                                  B31A 258
      WRITE (KOUT,545) ITER,ITS,II    ,RSU,HW,HE,CH,BR                  B31A 259
      WRITE (KOUT,546)                                                  B31A 260
      WRITE (KOUT,547)                                                  B31A 261
      BPRM=(GSMS+CMD)/CH                                                B31A 262
      BPRMG=GSMS/CH                                                     B31A 263
      WRITE (KOUT,548) BPRM,BPRMG,CMD,GSMS,CMT,GSMT                     B31A 264
      WRITE (KOUT,5480) CHCRI,PYCRI                                     B31A 265
```

```
      WRITE (KOUT,5481) SA,DIDT,CPE(1),DCDT,CPE(2),DPDT                 B31A 266
      WRITE (KOUT,5482)                                                 B31A 267
 3224 WRITE (KOUT,5483) QCONV,QRP,RAD,QCHEM,QCOND,QCONVT,QRPT,RADT,QCHEMB31A 268
     1T,QCONDT                                                          B31A 269
      WRITE (KOUT,5484)                                                 B31A 270
      WRITE (KOUT,5485)PGPU,DECOM, TB,DEDT,QLOSS,PGPUT,DECOMT, TT,DEDTT,B31A 271
     1QLOSST                                                            B31A 272
      IF (NCON) 3020,3020,3021                                          B31A 273
 3021 WRITE(KOUT,5490)                                                  B31A 274
      GO TO 3022                                                        B31A 275
 3020 WRITE(KOUT,549)                                                   B31A 276
 3022 CONTINUE                                                          B31A 277
      IF(IDUMP) 3023,3023,190                                           B31A 278
 3023 IF(NOI) 190,190,183                                               B31A 279
  183 CALL SLOPQ (NL,RA(1),TA(1),EMO(1),EMO(1))                         B31A 280
      IF(NO) 182,182,184                                                B31A 281
  184 CALL OGLE (NO,SO,TO(1),NL,RA(1),TA(1),EMO(1))                     B31A 282
  182 IF (NI) 189,189,185                                               B31A 283
  185 DO 186 I=1,NL                                                     B31A 284
  186 EMO(I)=1./EMO(I)                                                  B31A 285
      CALL OGLE (NI,SO(NO+1),TO(NC+1),NL,TA,RA,EMO)                     B31A 286
  189 IF (NN) 188,188,187                                               B31A 287
  187 WRITE (7,581) TH,TS,(TO(I), I=1,NOI)                              B31A 288
  188 WRITE (3) TH,TS, (TO(I), I=1,NOI)                                 B31A 289
      KK=KK+1                                                           B31A 290
  190 CONTINUE                                                          B31A 291
      IF (NCON) 3012,3012,3006                                          B31A 292
 3006 DO 3009 I=1,NL                                                    B31A 293
      IF (WT) 3007,3007,3008                                            B31A 294
 3008 CALL LOOK(11,X(I),TX,F1,F2,C,O,Y1,D1,2)                           B31A 295
      CNO(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                                   B31A 296
      GO TO 3009                                                        B31A 297
 3007 CNO(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                               B31A 298
 3009 CONTINUE                                                          B31A 299
 3012 CONTINUE                                                          B31A 300
      DO 3011 J=1,NLI                                                   B31A 301
      K=NLI                                                             B31A 302
      L=J                                                               B31A 303
      IF (L-NL) 3002,3002,3001                                          B31A 304
 3001 L=L+NDR                                                           B31A 305
      GO TO 3003                                                        B31A 306
 3002 IF (L+NLI-NL) 3003,3003,3005                                      B31A 307
 3005 K=NLI+NDR                                                         B31A 308
 3003 N=MIN0(NUMN,K+L)                                                  B31A 309
      IF (NCON) 3004,3004,3010                                          B31A 310
 3004 WRITE (KOUT,550) (I,MATL(I),TA(I),RO(I),H(I), I=L,N,K)            B31A 311
      GO TO 3011                                                        B31A 312
 3010 WRITE(KOUT,5500)(I,MATL(I),TA(I),RO(I),CNO(I),I=L,N,K)            B31A 313
 3011 CONTINUE                                                          B31A 314
      IF(IDUMP) 3225,3225,4410                                          B31A 315
 3225 IF(TH-THFIN+0.00001)1151,2    ,2                                  B31A 316
    2 JCMA=JCMA-1                                                       B31A 317
      IF (NOI) 1,1,3                                                    B31A 318
    3 REWIND 3                                                          B31A 319
      CALL LCOUNT (-1,LCT,NPG,RECORD(35))                               B31A 320
      WRITE (KOUT,552) NO,NI,TH,TS,(SO(I), I=1,NOI)                     B31A 321
      WRITE (KOUT,553)                                                  B31A 322
      DO 4 K=1,KK                                                       B31A 323
```

```
      READ (3) TH,TS, (TO(I), I=1,NOI)                                  B31A 324
    4 WRITE (KOUT,554) TH,TS, (TO(I), I=1,NOI)                          B31A 325
      GO TO 1                                                           B31A 326
 1151 IF(JCMA-2) 606,799,606                                            B31A 327
 6061 TNXT=AMAX1(TPR(1),TPR(2))                                          B31A 328
  606 IF(TH-TPR2+0.00001)  154,158,158                                  B31A 329
  158 DTPRT=DTPR2                                                       B31A 330
      DTPR2=DTPR3                                                       B31A 331
      TPR2=TPR3                                                         B31A 332
      TPR3=THFIN                                                        B31A 333
  154 THPRT=AMIN1(THPRT+DTPRT,TPR2,TNXT)                                B31A 334
 4410 DTH=AMIN1(DTHB,DELCR/(DSDTB+.0000001),TH-THDS, 50.0/(ABS(TSAVE-TA(B31A 335
     11))+.1)*DTH)                                                      B31A 336
      TSAVE=TA(1)                                                       B31A 337
      DTH=(THPRT-TH)/(AINT((THPRT-TH)/DTH+1.0))                         B31A 338
  144 TH=TH+DTH                                                         B31A 339
  610 IF(DTH-.000001) 162,162,608                                       B31A 340
  162 WRITE (KOUT,582) TH,DTH,DTHS,DTHB,THDS,DTS,DELCR,DSDTB            B31A 341
      TH=THFIN                                                          B31A 342
      JCMA=0                                                            B31A 343
      GO TO 3000                                                        B31A 344
C                                                                       B31A 345
C     INTERNAL DECOMPOSITION  --  DENSITY CALCULATION                   B31A 346
  608 N=-JFH                                                            B31A 347
C                                                                       B31A 348
C     SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL                 B31A 349
      DSDT=DSDTB                                                        B31A 350
      DS=DSDT*DTH                                                       B31A 351
      DSI=12.0*DS                                                       B31A 352
      SA=SA+DSI                                                         B31A 353
      RSU=ABS(RSV+SA)                                                   B31A 354
      DTHB=DTHC                                                         B31A 355
      DEL(NL)=DEL(NL)-DS                                                B31A 356
      FK=0.0                                                            B31A 357
      FJF=FJFH                                                          B31A 358
      J1=JFHP                                                           B31A 359
      DENOLD=RHO(2)                                                     B31A 360
      COLD=CPE(1)                                                       B31A 361
      POLD=CPE(2)                                                       B31A 362
      CPE(1)=SA                                                         B31A 363
      CPE(2)=SA                                                         B31A 364
      IE=1                                                              B31A 365
      ROOZ=0.0                                                          B31A 366
      DTA=0.
      TA(NL+1)=TA(NBM)                                                  B31A 369
      DEL(NL+1)=DEL(NBM)                                                B31A 370
      RR(NL+1)=RR(NBM)                                                  B31A 371
      DO 252 I=1,NL                                                     B31A 372
      ISV=MIN0(NL,I+1)
      DMDG(I)=0.0                                                       B31A 373
      ROW(I)=ROOZ                                                       B31A 374
      DSS=FJF/DEL(I)*DSDT                                               B31A 375
      J2=J1                                                             B31A 376
      DO 255 J=J2,JF                                                    B31A 377
      N=N+J1-1                                                          B31A 378
      IF (J-JFHP) 253,259,253                                           B31A 379
  259 IF(MATL(I)+MATL(ISV)-4) 263,260,263
  263 IF(AMAX1(TA(I),TA(I+1))-TRACM)261,261,262                         B31A 381
```

```
7019      261 IF(MATL(I)+MATL(I)+MATL(ISV)-3) 262,260,262
7020      260 J1=JFHP                                                    B31A 383
7021          ROOZ=FJFH*RO(I+1)                                          B31A 384
7022          RON(I)=RON(I)+FJFH*RO(I)                                   B31A 385
7023          N=N+JFH                                                    B31A 386
7024          GO TO 264                                                  B31A 387
7025      262 ROOZ=0.0                                                   B31A 388
7026          J1=1                                                       B31A 389
7027          DTA=(TA(I+1)-TA(I))/(FJFS+FJF/DEL(I)*DEL(I+1)/RR(I)*RR(I+1))  B31A 390
7028          TAS=TA(I)                                                  B31A 391
7029      253 N=N+1                                                      B31A 392
7030          IF(ABS(DSS)-.000001) 1016,1016,1017                        B31A 393
7031     1016 DROAC=0.                                                   B31A 394
7032          DROBC=0.                                                   B31A 395
7033          DROCC=0.                                                   B31A 396
7034          GO TO 1021                                                 B31A 397
7035     1017 IF(I-NL) 1015,1018,1015                                    B31A 398
7036     1018 FK=FK-1.0                                                  B31A 399
7037          IF(FK) 1019,1016,1020                                      B31A 400
7038     1019 FK=FJF-1.0                                                 B31A 401
7039     1020 DSS=DSDT/DEL(I)*FK                                         B31A 402
7040     1015 IF (N-1) 1115,1215,1115                                    B31A 403
7041     1115 DROAC=(ROA(N+1)-ROA(N))*DSS                                B31A 404
7042          DROBC=(ROB(N+1)-ROB(N))*DSS                                B31A 405
7043          DROCC=(ROC(N+1)-ROC(N))*DSS                                B31A 406
7044          GO TO 1021                                                 B31A 407
7045     1215 CONTINUE                                                   B31A 408
7046     1315 DROAC=(ROA(N+1)-RHORA)*DSS                                 B31A 409
7047          DROBC=(ROB(N+1)-RHORB)*DSS                                 B31A 410
7048          DROCC=(ROC(N+1)-RHORC)*DSS                                 B31A 411
7049          ROT(1)=RHO(2)                                              B31A 412
7050     1021 TAS=TAS+DTA                                                B31A 413
7051          IF(TAS-TRACM) 227,227,229                                  B31A 414
7052      229 IF(TAS  -TRACA) 201,201,202                                B31A 415
7053      201 DROAT=0.0                                                  B31A 416
7054          GO TO 2113                                                 B31A 417
7055      202 IF(RHORA-ROA(N)) 211,201,201                               B31A 418
7056      211 RD=ROA(N)-RHORA                                            B31A 419
7057          POW=1.-PSIA                                                B31A 420
7058          IF(POW)2111,2112,2111                                      B31A 421
7059     2111 DROAT=(-RD+((RD**POW)-                FA*EXP(-EA/TAS)*DTH)**  B31A 422
7060         1(1./POW))/DTH                                              B31A 423
7061          GO TO 2113                                                 B31A 424
7062     2112 DROAT=RD*(EXP(-EA*DTH*EXP(-EA/TAS))-1.)/DTH                B31A 425
7063     2113 ROA(N)=ROA(N)+(DROAT+DROAC)*DTH                            B31A 426
7064      221 IF(TAS  -TRACB)203,203,204                                 B31A 427
7065      203 DROBT=0.0                                                  B31A 428
7066          GO TO 2133                                                 B31A 429
7067      204 IF(RHORB-ROB(N))213,203,203                                B31A 430
7068      213 RD=ROB(N)-RHORB                                            B31A 431
7069          POW=1.-PSIB                                                B31A 432
7070          IF(POW)2131,2132,2131                                      B31A 433
7071     2131 DROBT=(-RD+((RD**POW)-                FB*EXP(-EB/TAS)*DTH)**  B31A 43
7072         1(1./POW))/DTH                                              B31A 435
7073          GO TO 2133                                                 B31A 436
7074     2132 DROBT=RD*(EXP(-BB*DTH*EXP(-EB/TAS))-1.)/DTH                B31A 437
7075     2133 ROB(N)=ROB(N)+(DROBT+DROBC)*DTH                            B31A 438
7076      223 IF(TAS  -TRACC) 205,205,206                                B31A 439
```

```
  205 DROCT=0.0                                                          831A 440
      GO TO 2153                                                         831A 441
  206 IF(RHORC-ROC(N))215,205,205                                        831A 442
  215 RD=ROC(N)-RHORC                                                    831A 443
      POW=1.-PSIC                                                        831A 444
      IF (POW) 2151,2152,2151                                            831A 445
 2151 DROCT=(-RD+((RD**POW)-                    FC*EXP(-EC/TAS)*DTH)**   831A 446
     1(1./POW))/DTH                                                      831A 447
      GO TO 2153                                                         831A 448
 2152 DROCT=RD*(EXP(-BC*DTH*EXP(-EC/TAS))-1.)/DTH                        831A 449
 2153 ROC(N)=ROC(N)+(DROCT+DROCC)*DTH                                    831A 450
  225 DMDG(I)=DMDG(I)-DEL(I)*((DROAT+DROBT)*GAMA+CMG*DROCT)              831A 451
  227 DNS=(ROA(N)+ROB(N))*GAMA+OMG*ROC(N)                                831A 452
      RON(I)=RON(I)+DNS                                                  831A 453
      IF(N-1) 2251,2253,2251                                             831A 454
 2251 IF(DNS-DNCP(IE)) 2253,2252,2252                                    831A 455
 2252 CPE(IE)=DEL(I)*((FLOAT(N)-0.5)/FJF+1.-FLOAT(I))*12.+RA(I)          831A 456
      CPE(IE)=CPE(IE)-DEL(I)/(DNS-DENOLD+1.E-36)*(DNS-DNCP(IE))/FJF*12.
      CPE(IE)=AMAX1(CPE(IE),SA)                                          831A 458
      IE=IE+1                                                            831A 459
 2253 DENOLD=DNS                                                         831A 460
  255 TAS=TAS+DTA                                                        831A 461
  264 DMDG(I)=DMDG(I)/FJF*RR(I)                                          831A 462
      RON(I)=RON(I)/FJF                                                  831A 463
      IF(I-1) 257,257,254                                                831A 464
  257 FJF=FJFS                                                           831A 465
      DTA=DTA/DEL(1)*DEL(2)/2.*RR(2)                                     831A 466
      GO TO 252                                                          831A 467
  254 DTA=DTA/DEL(I)*DEL(I+1)/RR(I)*RR(I+1)                              831A 468
  252 CONTINUE                                                           831A 469
C     NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES            831A 470
      J=JFHP                                                             831A 471
      DO 85 I=1,NL                                                       831A 472
      IF(ABS(RON(I)-RHO(1))-.01) 81,81,82                                831A 473
   81 MATL(I)=1                                                          831A 474
      X(I)=1.0                                                           831A 475
      GO TO 85                                                           831A 476
   82 IF (ABS(RON(I)-RHO(2))-.01) 83,83,84                               831A 477
   83 MATL(I)=2                                                          831A 478
      X(I)=0.                                                            831A 479
      CN(I)=CNC(I)                                                       831A 480
      GO TO 85                                                           831A 481
   84 MATL(I)=0                                                          831A 482
      X(I)=PETE-PET/RON(I)                                               831A 483
      IF (WT) 8500,8500,8501                                             831A 484
 8501 CALL LOOK(11,X(I),TX,F1,F2,0,0,Y1,D1,2)                            831A 485
      CN(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                                     831A 486
      GO TO 85                                                           831A 487
 8500 CN(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                                 831A 488
   85 RAT(I)=DEL(I)/(CN(I)*RR(I))                                        831A 489
      GSM=0.0                                                            831A 491
      DO 122 I=1,NL                                                      831A 492
  122 GSM=GSM+DMDG(I)                                                    831A 493
      GSMS=GSM                                                           831A 494
      GSMT=GSMT+GSMS*ASU/AREA(1)*DTH                                     831A 495
      DCDT=(CPE(1)-COLD)/DTH                                             831A 496
      DPDT=(CPE(2)-POLD)/DTH                                             831A 497
C                                                                        831A 498
```

```
C         CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS                 B31A 499
C         AND INTERNAL ENERGY RATE TERMS                                   B31A 500
C      MAIN BLOCK                                                          B31A 501
       DVB=0.                                                              B31A 502
       SOEGR=0.                                                            B31A 503
       GSEGR=0.                                                            B31A 504
       TB=0.                                                               B31A 505
       RAT(1)=2.*RAT(1)                                                    B31A 506
       CPNL=CP(NL)                                                         B31A 507
       NLM=NL-1                                                            B31A 508
       IMIN=0                                                              B31A 509
       DO 30 I=IMIN,NLM                                                    B31A 510
       IF (I) 15,15,14                                                     B31A 511
    14 GSM=GSM-DMDG(I)                                                     B31A 512
       DRODTD=-DMDG(I)/(RR(I)*DEL(I))                                      B31A 513
       FACT1=DTH/(DEL(I)*RR(I))                                            B31A 514
       FACT2=GSM/(DEL(I)*RR(I))                                            B31A 515
       A(I)=-FACT1*DVB                                                     B31A 516
       DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))                         B31A 517
       TERM2=RON(I)*CP(I)-DTH*(CPGAS*(DRODTD-FACT2)                        B31A 518
      1          -DSDT*RO1*CP1/DEL(I))                                    B31A 519
       TERM1=FACT1*DVB                                                     B31A 520
       B(I)=TERM2-A(I)+TERM1                                               B31A 521
       C(I)=-TERM1                                                         B31A 522
       D(I)=TA(I)*TERM2+(HGAS*DRODTD-HBAR*(RON(I)                          B31A 523
      1       -RO(I))/DTH-FACT2*HGAS-DSDT*RO1*H1/DEL(I))*DTH               B31A 524
    15 RO1=ROT(I+1)                                                        B31A 525
       X1=PETE-PET/RO1                                                     B31A 526
       CP1=CPV(I+1)*X1+CPC(I+1)*(1.0-X1)                                   B31A 527
       H1=HP(I+1)*X1+HC(I+1)*(1.0-X1)                                      B31A 528
       CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))                       B31A 529
       TN=-RO1*HBAR+RO1*H1+T                                               B31A 530
       HBAR=PETE*HP(I+1)-PET/RHO(1)*HC(I+1)                                B31A 531
       T=-RO1*H1+RO1*HBAR                                                  B31A 532
    20 CALL LOOK (2,TA(I+1),TT1,THG,0,0,0,HGAS,CPGAS,1)                    B31A 533
       HGAS=HGAS+DELHG                                                     B31A 534
       GSEGR=GSEGR+HGAS*DMDG(I+1)                                          B31A 535
       SOEGR=SOEGR+HBAR*DMDG(I+1)                                          B31A 536
       IF (I) 24,24,25                                                     B31A 537
    24 EGO=GSMS*HGAS                                                       B31A 538
       HW=HGAS                                                             B31A 539
       GO TO 30                                                            B31A 540
    25 TERM3=(-FACT2*CPGAS-DSDT*RO1*CP1/DEL(I))*DTH                        B31A 541
       C(I)=C(I)+TERM3                                                     B31A 542
       D(I)=D(I)+TA(I+1)*TERM3+(FACT2*HGAS+DSDT*RO1*H1/DEL(I))*DTH         B31A 543
       TB=TB-TN*DSDT*RR(I)                                                 B31A 544
    30 CONTINUE                                                            B31A 545
       A(1)=DTH/DEL(1)                                                     B31A 546
       TT=TT+TB*DTH/AREA(1)*ASU                                            B31A 547
C      NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT             B31A 548
       DRODTD=-DMDG(NL)/(RR(NL)*DEL(NL))                                   B31A 549
       FACT1=DTH/(DEL(NL)*RR(NL))                                          B31A 550
       A(NL)=-FACT1*DVB                                                    B31A 551
       DVB=1.0/(0.5*(RAT(NL)+RAT(NEM))+RC(NL)/RR(NL))                      B31A 552
       C(NL)=-FACT1*DVB                                                    B31A 553
       TERM2=RON(NL)*CP(NL)-(CPGAS*DRODTD+(DSDT/DEL(NL))*                  B31A 554
      1         (RO (NL)*CPNL  -RO1*CP1))*DTH                             B31A 555
       B(NL)=TERM2-C(NL)-A(NL)                                             B31A 556
```

```
      D(NL)=TA(NL)*TERM2+DTH*(HGAS*DROOTD-HBAR*(RCN(NL)-                B31A 557
     1          RO(NL))/DTH+DSDT*(RO (NL)*H(NL)-RO1*H1)/DEL(NL))         B31A 558
C     NOW FOR BACK UPS IF ANY                                           B31A 559
      K = NL                                                            B31A 560
      IF(NUMN-NBM) 60,40,40                                             B31A 561
   40 DO 50 I=NBM,NUMN                                                  B31A 562
      K=K+1                                                             B31A 563
      FACT1=DTH/(DEL(I)*RR(I))                                          B31A 564
      A(K) = -FACT1*DVB                                                 B31A 565
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))                       B31A 566
      C(K)=-FACT1*DVB                                                   B31A 567
      B(K)=RO(I)*CP(I)-C(K)-A(K)                                        B31A 568
   50 D(K)=TA(I)*RO(I)*CP(I)                                            B31A 569
C     NOW IF THE LAST NODE WAS INSULATED WE MUST REPAIR LAST B AND C    B31A 570
   60 IF(HRES) 80,70,80                                                 B31A 571
   70 B(K)=B(K)+C(K)                                                    B31A 572
      C(K)=0.                                                           B31A 573
C     NOW BEFORE GAUSS REDUCTION REWRITE LAST LINE OF MATRIX            B31A 574
   80 D(K)=D(K)-C(K)*TRES                                               B31A 575
      L=K                                                               B31A 576
      DO 90 I=2,K                                                       B31A 577
      L=L-1                                                             B31A 578
      D(L)=D(L)-C(L)/B(L+1)*D(L+1)                                      B31A 579
   90 B(L)=B(L)-C(L)/B(L+1)*A(L+1)                                      B31A 580
      B(1)=B(1)/A(1)                                                    B31A 581
      D(1)=D(1)/A(1)                                                    B31A 582
      PGPU=EGO-GSEGR                                                    B31A 583
      PGPUT=PGPUT+PGPU*DTH/AREA(1)*ASU                                  B31A 584
      DECOM=GSEGR-SOEGR                                                 B31A 585
      DECOMT=DECOMT+DECOM*DTH/AREA(1)*ASU                               B31A 586
C                                                                       B31A 587
C     SURFACE BOUNDARY CONDITION PACKAGE                                B31A 588
  761 CALL SBCPKG                                                       B31A 589
C                                                                       B31A 590
      IF(JCMA-2) 780,780,799                                            B31A 591
  780 IF(JCMA) 148,3000,148                                             B31A 592
  148 CONTINUE                                                          B31A 593
C                                                                       B31A 594
C     SHRINK (AND DROP) OF LAST ABLATING NODE                           B31A 595
C                                                                       B31A 596
C     DEL(NL)=DEL(NL)-DS (SEE INT DECOMP)                               B31A 597
      IF(DEL(NL)-DELM) 149,149,150                                      B31A 598
  149 DRLP=DEL(NL)*RO(NL)*RR(NL)                                        B31A 599
      DRLCP=DRLP*CP(NL)                                                 B31A 600
      NL=NL-1                                                           B31A 601
      RC(NL)=RC(NL+1)                                                   B31A 602
      DRL=DEL(NL)*RO(NL)*RR(NL)                                         B31A 603
      DRLC=DRL*CP(NL)                                                   B31A 604
      HAPHB=DRL*H(NL)+DRLP*H(NL+1)                                      B31A 605
      TOP1=DRL+DRLP                                                     B31A 606
      TOP2=DRLC+DRLCP                                                   B31A 607
      TOP3=DRLC*TA(NL) +DRLCP*TA(NL+1)                                  B31A 608
      VOL=DEL(NL)*RR(NL)+DEL(NL+1)*RR(NL+1)                             B31A 609
      DEL(NL)=DEL(NL)+DEL(NL+1)                                         B31A 610
      RO(NL)=TOP1/VOL                                                   B31A 611
      CP(NL)=TOP2/TOP1                                                  B31A 612
      TA(NL)=TOP3/TOP2                                                  B31A 613
      H(NL)=HAPHB/TOP1                                                  B31A 614
```

```
      DELR=DEL(NL+1)*RR(NL+1)/VOL                                       B31A 615
      CZ=1.0-DELR                                                       B31A 616
      DZ=0.0                                                            B31A 617
      GZ=CZ                                                             B31A 618
      NZ=JF*NL-JFH                                                      B31A 619
      N=NZ-JF+1                                                         B31A 620
      K=N                                                               B31A 621
      FZ=DELR                                                           B31A 622
      EZ=GZ                                                             B31A 623
      GO TO 179                                                         B31A 624
  172 DZ=DZ+1.0                                                         B31A 625
  173 FZ=DZ-CZ                                                          B31A 626
      IF(K-NZ) 175,174,175                                              B31A 627
  174 GZ=DELR                                                           B31A 628
  175 K=K+1                                                             B31A 629
      CZ=CZ+GZ                                                          B31A 630
  176 EZ=CZ-DZ                                                          B31A 631
      IF(EZ)178,177,177                                                 B31A 632
  177 ROA(N)=ROA(N)+FZ*ROA(K)                                           B31A 633
      ROB(N)=ROB(N)+FZ*ROB(K)                                           B31A 634
      ROC(N)=ROC(N)+FZ*ROC(K)                                           B31A 635
      IF(N-NZ) 171,150,171                                              B31A 636
  171 N=N+1                                                             B31A 637
  179 ROA(N)=ROA(K)*EZ                                                  B31A 638
      ROB(N)=ROB(K)*EZ                                                  B31A 639
      ROC(N)=ROC(K)*EZ                                                  B31A 640
      GO TO 172                                                         B31A 641
  178 ROA(N)=ROA(N)+ROA(K)*GZ                                           B31A 642
      ROB(N)=ROB(N)+ROB(K)*GZ                                           B31A 643
      ROC(N)=ROC(N)+ROC(K)*GZ                                           B31A 644
      GO TO 173                                                         B31A 645
C                                                                       B31A 646
  150 GO TO 410                                                         B31A 647
    1 RETURN                                                            B31A 648
  799 CONTINUE                                                          B31A 649
      RETURN                                                            B31A 650
      END                                                               B31A 651
CB32A                                                                   B32A 001
      SUBROUTINE INPOUT                                                 B32A 002
      COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  B32A 003
     1NLO(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                         B32A 004
     2TCH(2),TPR(2),TRAD(2),IAB                                         B32A 005
     3,TT2(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELHG,I1,I2,CHB32A 006
     4,CMD,BPRMG,KCM(10)                                                B32A 007
      EQUIVALENCE (NCLASS,JCMA)                                         B32A 008
      COMMON/LOOCOM/KOUT,IEX,DEN,NR,IHI(23),ILO(23),IR(23)              B32A 009
      COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                    B32A 010
     3,RHO(2),MATL(33),DEL(39),SO(20),H(38),RC(38),RA(38),RECORD(36),   B32A 011
     4AREA(38),EMA(38),RAV(38),                                         B32A 012
     5ROA(152),ROB(152),ROC(152),                                       B32A 013
     6    TPI(38),VFZ,CMH,NPR,                                          B32A 014
     7LCT,NPG,II,NBM,NUHN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA      B32A 015
     8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC, B32A 016
     9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT B32A 017
      COMMON/CMACOM/EPSW,TRES,                                          B32A 018
     1TMWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFMP,JFH,INPUT,      DTMIN,BRP,NCONV, B32A 019
     2INCH,DTHB,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  B32A 020
      COMMON/MISC/       BPRM,CMT,COLD,CP1,CPGAS,CPNL,CZ,DCDT,DECCH,     B32A 021
```

```
      1DECOMT,DELCR,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DRCAC,  832A 022
      2DROAT,DROBC,DROBT,DROCC,DROCT,DRODTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHS 832A 023
      3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSH,GSMT,  832A 024
      4GZ,H1,HAPHB,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,   832A 025
      5NDR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,PON,QLOSS,QLOSST,RD,RO1,ROO4,SA832A 026
      6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THOS,TH,THPRT,TN,TOP1,TOP2,TOP ,T,832A 027
      /TT,VOL,X1                                                         832A 028
       EQUIVALENCE (OH1,OH12(1)),(OH2,OH12(2)),(TS,TA)                   832A 029
       DIMENSION TNRY(20)                                                832A 030
  497 FORMAT(I2,3F10.5)                                                  832A 033
  498 FORMAT(//7X,66HTABLE OF OPTIONAL MASS-FRACTION FUNCTIONS FOR THERM832A 034
      1AL CONDUCTIVITY/25X,23HK = F1(X)*KP + F2(X)*KC//25X,1HX,12X,      832A 035
      25HF1(X),10X,5HF2(X)//(13X,3(5X,F10.4)))                           832A 036
  499 FORMAT(12A6)                                                       832A 037
  502 FORMAT (6X12A6)                                                    832A 038
  503 FORMAT(//24X31H---REACTION KINETIC EQUATION---/1H )                832A 039
  504 FORMAT(15X67HDRHO/DTIME = GAMMA ( BA*EXP(-EA/T)RHOOA((RHOA-RHOWA)/832A 040
      1RHOOA)**PSIA )/   21X56H+ GAMMA ( BB*EXP(-EB/T)RHOOB((RHOB-RHORB)/832A 041
      2RHOOB)**PSIB )/ 19X58H+(1-GAMMA)( BC*EXP(-EC/T)RHOOC((RHOC-RHOPC)/832A 042
      3RHOOC)**PSIC ))                                                   832A 043
  505 FORMAT (24X32H---REACTION KINETIC CONSTANTS---/1H )                832A 044
  506 FORMAT (11X8HREACTION2X4HRHOO5X4HRHOR8X1HB7X3HPSI8X1HE6X6HT REFC/2832A 045
      13X10H(LB/CU FT)6X7H(1/SEC)12X7H(DEG R)3X7H(DEG R))                832A 046
  507 FORMAT (14XA1,2X2F9.2,2XE10.4,F7.2,2XE10.4,F8.0)                   832A 047
  510 FORMAT(12X31HRESIN VOLUME FRACTION, GAMMA = F5.3,17H(MASS FRACTION832A 048
      1 = F5.3,1H)/1H )                                                  832A 049
  511 FORMAT (24X32H---TIME INCREMENT INFORMATION---/1H )                832A 050
  512 FORMAT (6X18HINITIAL TIME (SEC)F7.3,26X16HFINAL TIME (SEC)F7.2)    832A 051
  513 FORMAT (1H /6X17HOUTPUT INTERVAL =F6.3,1X27HSEC FROM INITIAL TIME 832A 052
      1UNTIL F7.3,4H SEC)                                                832A 053
  514 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1X8HSEC FROMF7.3,1X9HSEC UNTILF832A 054
      17.3,4H SEC)                                                       832A 055
  515 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1X8HSEC FROMF7.3,1X20HSEC UNTIL832A 056
      1 FINAL TIME/1H )                                                  832A 057
  516 FORMAT (6X,19HMAXIMUM TIME STEP =,F4.2,8H SECONDS)                 832A 058
  517 FORMAT(/29X16H---NODAL DATA---/1H )                                832A 059
  518 FORMAT(6X74HNODE  MATL  TEMPERATURE  RELATIVE  THICKNESS  NODAL DE832A 060
      1PTH  CONT.RESISTANCE)                                             832A 061
  519 FORMAT(7X73HNO.   NO. (DEG.RANKINE)   AREA    (INCHES)    (INCHES)832A 062
      1    (SQFT-S-DEG/BTU))                                             832A 063
  520 FORMAT(3X2I6,F12.2,E13.4,F9.5,F12.6,A1,E15.4)                      832A 064
  521 FORMAT (    14X47HMINIMUM THICKNESS OF LAST ABLATOR NODE (INCHES)F832A 065
      17.4/14X,10HTHERE ARE ,I2,40H NODELETS ASSIGNED TO EACH ABLATING NO832A 066
      2DE)                                                               832A 067
  522 FORMAT(/18X48H---HEAT OF FORMATION OF MATERIAL CONSTITUENTS---/1X832A 068
      18H(BTU/LB)/21X7HPLASTIC11X4HCHAR17X3HGAS)                         832A 069
  523 FORMAT (28XF9.2,7XF9.2,11XF9.2)                                    832A 070
  524 FORMAT(/7X28HENTHALPY DATUM TEMPERATURE =F9.3,1X11HDEG RANKINE)    832A 071
  525 FORMAT    (//22X36H---MATERIAL THERMAL PROPERTY DATA---//6X14HMATER832A 072
      1IAL NO. 118X14HMATERIAL NO. 218X26HMATERIAL NOS. 3 THROUGH 18/6X14832A 073
      2HVIRGIN PLASTIC15X4HCHAR23X7HBACK-UP)                             832A 074
  526 FORMAT(/6X12HMATERIAL NO.I2,38X9HDENSITY =F8.3,1X8HLB/CU FT/       832A 075
      1         7X11HTEMPERATURES13HSPECIFIC HEATS12HCONDUCTIVITYS8HEM832A 076
      2SIBLE4X18HEMISSIVITY/50X8HENTHALPY/9X7H(DEG R)7X12H(BTU/LB-DEG)4X1832A 077
      36H(BTU/FT-SEC-DEG)3X8H(BTU/LB)/                                   832A 078
      4        (8XF8.2,8XF7.4,9XF18.7,7XF9.2,4XF7.4))                    832A 079
  527 FORMAT(/6X12HMATERIAL NO.I2,38X9HDENSITY =F8.3,1X8HLB/CU FT/       832A 080
      1         7X11HTEMPERATURES13HSPECIFIC HEATS12HCONDUCTIVITY/9X7H(D832A 081
```

```
      2EG R)7X12H(BTU/LB-DEG)4X16H(BTU/FT-SEC-DEG)/                     B32A 082
      3        (8XF8.2,8XF7.4,9XF10.7))                                 B32A 083
  528 FORMAT(39H  BAD SURFACE STATE TABLE  --  QUIT JOB  )              B32A 084
  531 FORMAT (1H /6X19HTEMPERATURE (DEG R)5F11.2)                       B32A 085
  532 FORMAT    (//20X47H---RESIN DECOMPOSITICN GAS SENSIBLE ENTHALPY---)B32A 086
  533 FORMAT      (6X19HENTHALPY    (BTU/LB)5F11.2)                     B32A 087
  534 FORMAT (1H //23X40H---TIME DEPENDENT BOUNDARY CONDITIONS---/1H )  B32A 088
  535 FORMAT (9X,4HTIME,8X,4HPROB,3X,8HRECOVERY,3X,9HRADIATION,4X,4HHEATB32A 089
      15X,8HPRESSURE,3X,7HBLOWING/9X,5H(SEC),7X,4HOPTN,3X,8HENTHALPY,3X, B32A 090
      29HHEAT RATE,4X,5HCOEFF,14X,9HREDUCTION/28X,8H(BTU/LB),2X,11H(BTU/SB32A 091
      3Q FT-,1X,10H(LB/SQ FT-,3X,5H(ATM),3X,9HPARAMETER /40X,7HSECOND),  B32A 092
      44X,7HSECOND))                                                    B32A 093
  536 FORMAT (6X,F8.2,8X,I2,4X,2(F8.2,3X),F8.4,3X,F8.5,3X,F8.3)         B32A 094
  537 FORMAT (1H /9X,69HCH/CHO = PHI/(EXP(PHI)-1.) WHERE PHI = 2.*BRP*M B32A 095
      1DOT/CHO. BRP IN TABLE)                                           B32A 096
  538 FORMAT(//27X30H---SURFACE EQUILIBRIUM DATA---)                    B32A 097
  539 FORMAT (1H /6X12HM DOT G/CM =F7.4/1H )                            B32A 098
  540 FORMAT(2(7X4HTEMP8X3HLOG7X3H(H WALL).3X)/2(6X7H(DEG R)3X10HM-DOT-CB32A 099
      1/CM2X11H(1+B PRIME)2X)/2(29X8H(BTU/LB)4X))                       B32A 100
  541 FORMAT (5XF8.2,4XF7.4,5XF9.2,8XF8.2,4XF7.4,5XF9.2)                B32A 101
  551 FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND AB32A 102
      1BLATION PROGRAM/73X4HPAGEI3/1H 67X2A6)                           B32A 103
  552 FORMAT (9X,4HTIME,8X,4HPROB,3X,7HSURFACE,4X,7HSURFACE/9X,5H(SEC), B32A 104
      17X,4HOPTN,5X,4HTEMP,5X,9HRECESSION/28X,7H(DEG R),6X,4HRATE/38X,  B32A 105
      210H(MILS/SEC))                                                   B32A 106
  553 FORMAT(8X24H*INITIAL INTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP.TO RAB32A 107
      1DIUS**F4.2)                                                      B32A 108
  554 FORMAT(8X24H*INITIAL EXTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP.TO RAB32A 109
      1DIUS**F4.2)                                                      B32A 110
  555 FORMAT(8X15H*PLANAR SURFACE)                                      B32A 111
  556 FORMAT (9X,4HTIME,8X,4HPROB,5X,4HVIEW,5X,9HRADIATION/9X,5H(SEC),  B32A 112
      17X,4HOPTN,4X,6HFACTOR,4X,9HHEAT RATE/38X,11H(BTU/SQ FT-/40X,     B32A 113
      27HSECOND))                                                       B32A 114
  560 FORMAT(I2,5E10.0)                                                 B32A 115
  561 FORMAT (I2,F8.4)                                                  B32A 116
  563 FORMAT (I2,I3,I1,I2,I2,7F10.5/8F10.5)                             B32A 117
  564 FORMAT (A1,9X2F10.5,E10.3,F10.5,E10.3,F10.5)                      B32A 118
  571 FORMAT(I2,F10.5,F10.5,F10.8,F10.5)                                B32A 119
  575 FORMAT(I1,F9.5,7F10.5/8F10.5)                                     B32A 120
  577 FORMAT(I1,F9.5,5F10.5)                                            B32A 121
  578 FORMAT(12X2E12.5,2E13.6,I1)                                       B32A 122
 5790 FORMAT (6X,26HNO RADIUS CORRECTION ON CH)                         B32A 123
 5791 FORMAT (3F8.5,F9.4,F5.3,2F9.3,I2,A6)                              B32A 124
 5792 FORMAT(//6X,3HP =,F9.4,4H ATM//6X,3(25HTEMPERATURE  EDGE ENTH   )/B32A 125
      16X,3(25H  (DEG R)    AT T-WALL   ))                              B32A 126
 5793 FORMAT (//6X,37HBAD SURFACE EQUILIBRIUM TABLE OF TYPE,I2)         B32A 127
 5794 FORMAT (//6X,74HEQUAL MASS AND HEAT TRANSFER COEFFICIENTS AND EQUAB32A 128
      1L DIFFUSION COEFFICIENTS/6X,29HNOMINAL SURFACE VIEW FACTOR =,    B32A 129
      2F6.3)                                                            B32A 130
 5789 FORMAT(//6X,14HM-DOT-GAS/CM =,F7.4,8X,10HPRESSURE =,F9.4,4H ATM// B32A 131
      17X,2(4HTEMP,5X,26HM-DOT-  CHEM.PROD  SURFACE,3X)/6X,2(36H(DEG R) B32A 132
      2CHAR/CM   (BTU/LB)  SPECIES,2X))                                 B32A 133
 5795 FORMAT(5X,F8.2,2X,F7.4,2X,F8.2,4X,A6,1X,F8.2,2X,F7.4,2X,F8.2,4X,A6B32A 134
      1)                                                                B32A 135
 5796 FORMAT (2F10.0,9X,I1)                                             B32A 13
 5797 FORMAT(//6X,45HRATIO OF MASS TO HEAT TRANSFER COEFFICIENTS =,F6.3/B32A 137
      1 6X,28HUNEQUAL DIFFUSION EXPONENT =,F6.3/6X,29HNOMINAL SURFACE VIEB32A 138
      2W FACTOR =,F6.3,11H (OPTION 1))                                  B32A 139
```

```
 5798 FORMAT                                  (6X,F9.2,4X,F9.2,3X,F9.2,4X,F9.B32A 140
     22,3X,F9.2,4X,F9.2)                                                     B32A 141
 5799 FORMAT (6X,66HHEAT TRANSFER COEFFICIENT MULTIPLIED BY (R INITIAL/RB32A 142
     1 CURRENT)**1.8)                                                        B32A 143
  580 FORMAT (8F10.5)                                                        B32A 144
  581 FORMAT(/14X20HBACK WALL CONVECTION10X9HBACK WALL10X9HRESERVOIR/       B32A 145
     113X23HCOEF BTU/FTSQ-SEC-DEG R8X10HEMISSIVITY8X11HTEMPERATURE/         B32A 146
     217XF10.4,18XF6.3,10XF10.2)                                             B32A 147
  582 FORMAT(5F10.5,9X,I1)                                                   B32A 148
      DATA  BLANK,ASTER/ 1H ,1H*/                                            B32A 149
      KOUT=5                                                                 B32A 150
      INPUT=8                                                                B32A 151
      NMG=0                                                                  B32A 152
      INCH=8                                                                 B32A 153
      WT=0.0                                                                 B32A 154
C     INPUT/OUTPUT                                                           B32A 155
C                                                                            B32A 156
    1 NPG=1                                                                  B32A 157
      WRITE  (KOUT,551)NPG                                                   B32A 158
      READ   (INPUT,499)(RECORD(I),I=1,36)                                   B32A 159
C                                                                      EUNITNB32A 160
C                                                                         FOB32A 161
C                                                          8999,9999 )TUPNI,FOE(B32A 162
      WRITE  (KOUT,502)(RECORD(I),I=1,36)                                    B32A 163
      WRITE  (KOUT,503)                                                      B32A 164
      WRITE  (KOUT,504)                                                      B32A 165
      WRITE  (KOUT,505)                                                      B32A 166
      WRITE  (KOUT,506)                                                      B32A 167
      READ   (INPUT,564)A9,RHOOA,RHORA,BA,PSIA,EA,TRACA,B9,RHOOB ,RHORB,BB32A 168
     1B,PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC                      B32A 169
      WRITE  (KOUT,507)A9,RHOOA,RHORA,BA,PSIA,EA,TRACA,B9,RHOOB,RHORB,BB,B32A 170
     1PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC                        B32A 171
      READ (INPUT,563) JF,NUMN,NN,NO,NI,THZRO,THFIN,DTPRT,DTPR2,DTPR3,       B32A 172
     1DTHB,BRP,TPR2,TPR3,DELM,DH1,DH2,DELHG,GAMA,TZ                          B32A 173
      IF(JF-1) 171,170,172                                                   B32A 174
  170 JF=2                                                                   B32A 175
      GO TO 172                                                              B32A 176
  171 JF=10                                                                  B32A 177
  172 JFH=JF/2                                                               B32A 178
      JF=JFH+JFH                                                             B32A 179
      JFHP=JFH+1                                                             B32A 180
      FJFS=JF                                                                B32A 181
      FJFH=FJFS/2.0                                                          B32A 182
      NOI=NO+NI                                                              B32A 183
      IF (NO) 181,181,182                                                    B32A 184
  182 READ  (INPUT,580)(SO(I),I=1,NO)                                        B32A 185
  181 CONTINUE                                                               B32A 186
      IF (NI) 184,184,183                                                    B32A 187
  183 NOP=NO+1                                                               B32A 188
      READ (INPUT,580) (SO(I), I=NOP,NOI)                                    B32A 189
  184 IF(GAMA) 408,409,409                                                   B32A 190
  408 GAMA=RHOOC/(RHOOC-(RHOOA+RHOOB)-(RHOOA+RHOOB)/GAMA)                    B32A 191
  409 OMG=1.0-GAMA                                                           B32A 192
      RHO(1)=GAMA*(RHOOA+RHOOB)+OMG*RHOOC                                    B32A 193
      RHO(2)=GAMA*(RHORA+RHORB)+OMG*RHORC                                    B32A 194
       GAMAM=GAMA/RHO(1)*(RHOOA+RHOOB)                                       B32A 195
      WRITE (KOUT,510)GAMA,GAMAM                                             B32A 196
      IF(DTHB) 412,410,412                                                   B32A 197
```

```
  410 DTHB=5.                                                          B32A 198
  412 DTHIN=.01                                                        B32A 199
  413 IF(TPR2)414,414,415                                              B32A 200
  414 TPR2=THFIN                                                       B32A 201
  415 IF(TPR3)416,416,417                                              B32A 202
  416 TPR3=THFIN                                                       B32A 203
      IF(TPR2-THZRO) 418,418,417                                       B32A 204
  418 DTPRT=DTPR2                                                      B32A 205
      DTPR2=DTPR3                                                      B32A 206
      TPR2=TPR3                                                        B32A 207
      GO TO 416                                                        B32A 208
  417 WRITE (KOUT,511)                                                 B32A 209
      THFIN=AMAX1(THFIN,TPR2,TPR3)                                     B32A 210
      WRITE (KOUT,512)THZRO,THFIN                                      B32A 211
      WRITE (KOUT,513)DTPRT,TPR2                                       B32A 212
      WRITE (KOUT,514)DTPR2,TPR2,TPR3                                  B32A 213
      WRITE (KOUT,515)DTPR3,TPR3                                       B32A 214
      WRITE (KOUT,516) DTHB                                            B32A 215
C481                                    )CCART,BCART,ACART(F1NIM=MCAB32A 216
      TRACM=AMIN1(TRACA,TRACB,TRACC)                                   B32A 217
      PETE=RHO(1)/(RHO(1)-RHO(2))                                      B32A 218
      PET=PETE*RHO(2)                                                  B32A 219
C     ---------- NODAL PROPERTIES                                      B32A 220
      N=0                                                              B32A 221
      J1=JFH                                                           B32A 222
      CALL LCOUNT (-NUMN-8,LCT,NPG,RECORD(35))                         B32A 223
  302 WRITE (KOUT,517)                                                 B32A 224
      WRITE (KOUT,518)                                                 B32A 225
      WRITE (KOUT,519)                                                 B32A 226
      B=ASTER                                                          B32A 227
      READ(INPUT,560)(MATL(I),TA(I),AREA(I),DEL(I),RA(I),RC(I),I=1,NUMN)B32A 228
      AE=RA(2)                                                         B32A 229
      RSV=RA(1)                                                        B32A 230
      RA(1)=0.0                                                        B32A 231
      DO 400 I=1,NUMN                                                  B32A 232
      IF(I-2) 4541,452,453                                             B32A 233
  453 RA(I)=RA(I-1)+(DEL(I-1)+DEL(I))/2.0                              B32A 234
      GO TO 461                                                        B32A 235
  452 RA(2)=DEL(1)+DEL(2)/2.                                           B32A 236
      B=BLANK                                                          B32A 237
  461 DEL(I-1)=DEL(I-1)/12.                                            B32A 238
 4541 RAV(I)=RA(I)                                                     B32A 239
      IF(AE) 4542,4543,4542                                            B32A 240
 4542 AREA(I)=(ABS(RSV+RA(I)))**AE                                     B32A 241
      GO TO 454                                                        B32A 242
 4543 IF(AREA(I)) 4544,4544,454                                        B32A 243
 4544 IF(RSV) 4545,4546,4545                                           B32A 244
 4545 AREA(I)=ABS(RSV+RA(I))                                           B32A 245
      AE=1.0                                                           B32A 246
      GO TO 454                                                        B32A 247
 4546 AREA(I)=1.                                                       B32A 248
  454 WRITE(KOUT,520)I,MATL(I),TA(I),AREA(I),DEL(I),RA(I),B,RC(I)      B32A 249
      IF(MATL(I)-2) 401,405,400                                        B32A 250
  401 NL=I                                                             B32A 251
      DO 404 J=1,J1                                                    B32A 252
      N=N+1                                                            B32A 253
      ROA(N)=RHOOA                                                     B32A 254
      ROB(N)=RHOOB                                                     B32A 255
```

```
  404 ROC(N)=RHOOC                                                      B32A 256
      J1=JF                                                             B32A 257
      GO TO 400                                                         B32A 258
  405 NL=I                                                              B32A 259
      DO 406 J=1,J1                                                     B32A 260
      N=N+1                                                             B32A 261
      ROA(N)=RHORA                                                      B32A 262
      ROB(N)=RHORB                                                      B32A 263
  406 ROC(N)=RHORC                                                      B32A 264
      J1=JF                                                             B32A 265
  400 CONTINUE                                                          B32A 266
  403 DEL(NUMN)=DEL(NUMN)/12.                                           B32A 267
      CALL SLOPC(NUMN,RA,AREA,EMA,EMA)                                  B32A 268
      NBM=NL+1                                                          B32A 269
      IF(RSV) 4031,4032,4033                                            B32A 270
 4031 RSVN=-RSV                                                         B32A 271
      WRITE(KOUT,554)RSVN,AE                                            B32A 272
      GO TO 304                                                         B32A 273
 4032 WRITE(KOUT,555)                                                   B32A 274
      GO TO 304                                                         B32A 275
 4033 WRITE(KOUT,553)RSV,AE                                             B32A 276
  304 WRITE (KOUT,521) DELM,JF                                          B32A 277
      DELM=DELM/12.0                                                    B32A 278
      READ(INPUT,582) HCONV,EPSW,TRES,CHCRI,PYCRI,NCON                  B32A 279
      IF (CHCRI) 305,305,306                                            B32A 280
  305 CHCRI=0.02                                                        B32A 281
  306 IF (PYCRI) 307,307,308                                            B32A 282
  307 PYCRI=0.98                                                        B32A 283
  308 TA(NUMN+1)=TRES                                                   B32A 284
      CALL LCOUNT(4            ,LCT,NPG,RECORD(35))                     B32A 285
      WRITE(KOUT,581) HCONV,EPSW,TRES                                   B32A 286
      CALL LCOUNT(5            ,LCT,NPG,RECORD(35))                     B32A 287
      WRITE (KOUT,522)                                                  B32A 288
      WRITE (KOUT,523)DH1,DH2,DELHG                                     B32A 289
      CALL LCOUNT(2            ,LCT,NPG,RECORD(35))                     B32A 290
      WRITE (KOUT,524)TZ                                                B32A 291
C     --------- MATERIAL PROPERTIES                                     B32A 292
      CALL LCOUNT(6            ,LCT,NPG,RECORD(35))                     B32A 293
  310 WRITE (KOUT,525)                                                  B32A 294
      IT=0                                                              B32A 295
      ILO(3)=1                                                          B32A 296
      ILO(4)=1                                                          B32A 297
      KT=1                                                              B32A 298
  350 IT=IT+1                                                           B32A 299
      READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT),TEP(IT,KT)   B32A 300
      IF(NC)351,350,351                                                 B32A 301
  351 IHI(KT+2)=ILO(KT+2)+IT-1                                          B32A 302
      IR(KT+2)=ILO(KT+2)                                                B32A 303
      THZ(1,KT)=0.                                                      B32A 304
      IF (IT-2) 2357,1357,1357                                          B32A 305
 1357 DO 357 I=2,IT                                                     B32A 306
  357 THZ(I,KT)=THZ(I-1,KT)+(TCP(I,KT)+TCP(I-1,KT))/2.*(TT2(I,KT)-TT2(I-B32A 307
     11,KT))                                                            B32A 308
 2357 CONTINUE                                                          B32A 309
      CALL LOOK (KT+2,TZ,TT2(1,KT),THZ(1,KT),0,0,0,HSH,DUM,1)           B32A 310
      DO 359 I=1,IT                                                     B32A 311
  359 THZ(I,KT)=THZ(I,KT)-HSH                                           B32A 312
      CALL LCOUNT(6+IT         ,LCT,NPG,RECORD(35))                     B32A 313
```

```
  312 IF (IT-1) 2312,1312,1312                                          B32A 314
 1312 WRITE(KOUT,526)KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),THZ(I,KT) B32A 315
     1,TEP(I,KT),I=1,IT)                                                B32A 316
 2312 CONTINUE                                                          B32A 317
      KT=KT+1                                                           B32A 318
      IT=0                                                              B32A 319
      IF(NC) 356,353,353                                                B32A 320
  356 IF(KT-2) 350,350,411                                              B32A 321
  411 READ (INPUT,561) KT,RHO(KT)                                       B32A 322
      IF (RHO(KT)) 3550,3550,355                                        B32A 323
 3550 WT=1.0                                                            B32A 324
      IX=0                                                              B32A 325
 3551 IX=IX+1                                                           B32A 326
      READ (INPUT,497) NC,TX(IX), F1(IX),F2(IX)                         B32A 327
      IF (NC) 3552,3551,3552                                            B32A 328
 3552 ILO(11)=1                                                         B32A 329
      IHI(11)=IX                                                        B32A 330
      IR(11)=1                                                          B32A 331
      CALL LCOUNT(8+IX,LCT,NPG,RECORD(35))                              B32A 332
      IF (IX-1) 6001,6000,6000                                          B32A 333
 6000 WRITE(KOUT,498) (TX(I),F1(I),F2(I),I=1,IX)                        B32A 334
 6001 CONTINUE                                                          B32A 335
      IF (NC) 411,411,353                                               B32A 336
  355 IT=IT+1                                                           B32A 337
      READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT)              B32A 338
      IF(NC) 354,355,354                                                B32A 339
  354 ILO(KT+2)=1                                                       B32A 340
      IHI(KT+2)=ILO(KT+2)+IT-1                                          B32A 341
      IR(KT+2)=ILO(KT+2)                                                B32A 342
      CALL LCOUNT(5+IT          ,LCT,NPG,RECORD(35))                    B32A 343
  314 IF (IT-1) 2314,1314,1314                                          B32A 344
 1314 WRITE (KOUT,527) KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),I=1,IT) B32A 345
 2314 CONTINUE                                                          B32A 346
      IT=0                                                              B32A 347
      IF(NC) 411,411,353                                                B32A 348
C     ---------- PYROLYSIS GAS ENTHALPY                                 B32A 349
  353 NT1=0                                                             B32A 350
  361 IN=1+NT1                                                          B32A 351
      NT1=8+NT1                                                         B32A 352
      IF (NT1-IN) 6003,6002,6002                                        B32A 353
 6002 READ  (INPUT,575)NC,(TT1(I),I=IN,NT1),(THG(I),I=IN,NT1)           B32A 354
 6003 CONTINUE                                                          B32A 355
      IF(NC)361,361,362                                                 B32A 356
  364 NT1=NT1-1                                                         B32A 357
  362 IF(TT1(NT1)) 364,364,365                                          B32A 358
  365 ILO(2)=1                                                          B32A 359
      IR(2)=1                                                           B32A 360
      IHI(2)=NT1                                                        B32A 361
      CALL LCOUNT(3*((NT1+9)/5),LCT,NPG,RECORD(35))                     B32A 362
  316 WRITE (KOUT,532)                                                  B32A 363
      IFN=0                                                             B32A 364
  368 IN=IFN+1                                                          B32A 365
      IFN=MIN0(NT1,IFN+5)                                               B32A 366
      IF (IFN-IN) 6005,6004,6004                                        B32A 367
 6004 WRITE (KOUT,531)(TT1(I),I=IN,IFN )                                B32A 36
      WRITE (KOUT,533)(THG(I),I=IN,IFN)                                 B32A 369
 6005 CONTINUE                                                          B32A 370
      IF(NT1-IFN) 367,367,368                                           B32A 371
```

```
      367 K=1                                                           B32A 372
     2803 READ(INPUT,583) BPG,(TNRY(I),I=1,19)                          B32A 373
          IF(TNRY(1)) 2804,2804,2805                                    B32A 374
     2805 TMG(K)=BPG                                                    B32A 375
          DO 2802 I=1,19                                                B32A 376
          IF(TNRY(I)-99.) 2800,2800,2801                                B32A 377
     2801 TTS(I,K,1)=TNRY(I)                                            B32A 378
          KHI(K)=I                                                      B32A 379
          NHI(K)=I
          GO TO 2802                                                    B32A 380
     2800 IF(TNRY(I)) 2811,[illegible],2810                             B32A 381
     2810 TLMC(I,K,1) = TNRY(I)                                         B32A 382
          NHI(K)=I                                                      B32A 383
     2802 CONTINUE                                                      B32A 384
     2811 K=K+1                                                         B32A 385
          GO TO 2803                                                    B32A 386
     2804 NMG=K-1                                                       B32A 387
          IHI(12)=NMG                                                   B32A 388
          ILO(12)=1                                                     B32A 389
          IR(12)=1                                                      B32A 390
          DO 2818 K=1,NMG
          NLO(K)=KHI(K)+1                                               B32A 392
          KHIK=KHI(K)                                                   B32A 393
          NLOK=NLO(K)                                                   B32A 394
          NHIK=NHI(K)                                                   B32A 395
          DO 2807 I=1,KHIK                                              B32A 396
     2807 TTS(I,K,2)=TTS(I,K,1)                                         B32A 397
          IF(NHIK-NLOK) 2818,2809,2809
     2809 DO 2808 I=NLOK,NHIK
          TLMC(I,K,1)=ALOG(AMAX1(TLMC(I,K,1),.00001))                   B32A 399
     2808 TLMC(I,K,2)=TLMC(I,K,1)                                       B32A 400
     2818 CONTINUE
      583 FORMAT(20F4.0)                                                B32A 401
          VFZ=1.0
          IF(BPG.GT.0.) VFZ=BPG
          RETURN
          END
    CB33A                                                               B33A 001
          SUBROUTINE LOOK(II,XL,X,A,B,C,E,Y,D,IDN)                      B33A 002
          COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)          B33A 003
          DIMENSION  X(1),Y(1),D(1)                                     B33A 004
          DIMENSION A(1),B(1),C(1),E(1)                                 B33A 005
          IH=IHI(II)                                                    B33A 006
          IL=ILO(II)                                                    B33A 007
          IEX=0                                                         B33A 008
          IF(X(IH)-X(IL)) 30,30,29                                      B33A 009
       30 IEX=1                                                         B33A 010
          IF (XL-X(IH)) 3,2,31                                          B33A 011
       31 IF (XL-X(IL)) 6,5,4                                           B33A 012
       29 IF(XL-X(IH))1,2,3                                             B33A 013
        1 IF(XL-X(IL))4,5,6                                             B33A 014
        6 I=IR(II)                                                      B33A 015
          I=MIN0(I,IH)                                                  B33A 016
          I=MAX0(I,IL)                                                  B33A [illegible]
          IS=1                                                          B33A 018
          IT=1                                                          B33A 019
          GO TO 8                                                       B33A 020
       11 I=I+1                                                         B33A 021
```

```
      IS=0                                                              B33A 022
    8 IF(IEX) 28,28,38                                                  B33A 023
   28 IF(XL-X(I)) 7,10,9                                                B33A 024
   38 IF(XL-X(I)) 9,10,7                                                B33A 025
    7 I=I-1                                                             B33A 026
      IT=0                                                              B33A 027
      IF(IS)10,10,8                                                     B33A 028
    9 IF(IT)10,10,11                                                    B33A 029
    3 IEX=3                                                             B33A 030
    2 I=IH-1                                                            B33A 031
      GO TO 10                                                          B33A 032
    4 IEX=2                                                             B33A 033
    5 I=IL                                                              B33A 034
   10 DEN=X(I+1)-X(I)                                                   B33A 035
      IR(II)=I                                                          B33A 036
      VR=XL-X(I)                                                        B33A 037
      IF(IDN) 13,13,14                                                  B33A 038
   14 GO TO (21,22,23,24),IDN                                           B33A 039
   24 Y(4)=E(I)                                                         B33A 040
      D(4)=E(I+1)-E(I)                                                  B33A 041
   23 Y(3)=C(I)                                                         B33A 042
      D(3)=C(I+1)-C(I)                                                  B33A 043
   22 Y(2)=B(I)                                                         B33A 044
      D(2)=B(I+1)-B(I)                                                  B33A 045
   21 Y(1)=A(I)                                                         B33A 046
      D(1)=A(I+1)-A(I)                                                  B33A 047
      DO 12  J=1,IDN                                                    B33A 048
   20 D(J)=D(J)/DEN                                                     B33A 049
   12 Y(J)=Y(J)+D(J)*VR                                                 B33A 050
   13 VR=VR/DEN                                                         B33A 051
      RETURN                                                            B33A 052
      END                                                               B33A 053
CB34A                                                                   B34A 001
      SUBROUTINE COMP(X,Y,VOID,IFLAG)
      DIMENSION Y(20,10,2)
      DIMENSION X(20,10,2)                                              B34A 003
      IFLAG=0                                                           B34A 004
      DO 3 I=1,2                                                        B34A 005
      DO 3 K=1,2                                                        B34A 007
      IF(Y(I,1,K)-VOID) 1,2,1
    1 IF(X(I,1,K)-VOID) 3,2,3
    3 CONTINUE                                                          B34A 009
      GO TO 4                                                           B34A 010
    2 IFLAG=1                                                           B34A 011
    4 RETURN                                                            B34A 012
      END                                                               B34A 013
CB36A                                                                   B36A 001
      SUBROUTINE OGLE(N,XAM,PRM,NUMX,X,P,EM)                            B36A 002
      DIMENSION XAM(1),X(1),P(1),EM(1),PRM(1),DPDIM(1)                  B36A 003
      XDIF=X(NUMX)-X(1)                                                 B36A 004
      IS=1                                                              B36A 005
    2 DO 600 J=1,N                                                      B36A 006
      XA=XAM(J)                                                         B36A 007
   59 IO=1                                                              B36A 008
      IT=1                                                              B36A 009
   61 IF(XDIF) 72,60,71                                                 B36A 010
   71 IF(XA-X(IS)) 62,63,64                                             B36A 011
   72 IF(X(IS)-XA) 62,63,64                                             B36A 012
```

```
   62 IF(IS-1)671,671,68                                                B36A 013
   68 IS=IS-1                                                           B36A 014
      IT=2                                                              B36A 015
      GO TO (61,66),IO                                                  B36A 016
  672 IS=NUMX                                                           B36A 017
  671 I=IS                                                              B36A 018
      H=0.                                                              B36A 019
      DPDI=EM(I)                                                        B36A 020
      GO TO 67                                                          B36A 021
   63 PR=P(IS)                                                          B36A 022
      DPDI=EM(IS)                                                       B36A 023
      GO TO 601                                                         B36A 024
   64 IS=IS+1                                                           B36A 025
      IF(IS-NUMX)69,69 ,672                                             B36A 026
   69 IO=2                                                              B36A 027
      GO TO (61,65),IT                                                  B36A 028
   65 IS=IS-1                                                           B36A 029
   66 I=IS                                                              B36A 030
      G=(((P(I+1)-P(I))/(X(I+1)-X(I)))-EM(I))/(X(I+1)-X(I))             B36A 031
      F=(((EM(I+1)-EM(I))/(X(I+1)-X(I)))-2.*G)/(X(I+1)-X(I))            B36A 032
      H=(F*(XA-X(I+1))+G)*(XA-X(I))                                     B36A 033
      DPDI=(H+H+EM(I)+F*(XA-X(I))*(XA-X(I)))                            B36A 034
   67 PR=(H+EM(I))*(XA-X(I))+P(I)                                       B36A 035
  601 CONTINUE                                                          B36A 036
      PRM(J)=PR                                                         B36A 037
  600 CONTINUE                                                          B36A 038
   60 CONTINUE                                                          B36A 039
    4 RETURN                                                            B36A 040
      END                                                               B36A 041
CB37A                                                                   B37A 001
      SUBROUTINE LCOUNT (J,LCT,NPG,R)                                   B37A 002
      COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)              B37A 003
      I=J                                                               B37A 004
      DIMENSION R(2)                                                    B37A 005
  551 FORMAT(1H112X61HAEROTHERM COUPLED ABLATION BOUNDARY LAYER ENVIRONM
     1ENT PROGRAM/73X4HPAGEI3/68X2A6)
      IF(I) 2,2,3                                                       B37A 008
    2 I=-I                                                              B37A 009
      GO TO 4                                                           B37A 010
    3 LCT=LCT-I                                                         B37A 011
      IF (LCT) 4,5,5                                                    B37A 012
    4 NPG=NPG+1                                                         B37A 013
      LCT=55-I                                                          B37A 014
      WRITE (KOUT,551) NPG,R                                            B37A 015
    5 RETURN                                                            B37A 016
      END                                                               B37A 017
CB38A                                                                   B38A 001
      SUBROUTINE SBCPKG                                                 B38A 002
      COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  B38A 003
     1NLO(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                         B38A 004
     2TCH(2),TPR(2),TRAD(2),IAB                                         B38A 005
     3,TT2(20,2),TMZ(20,2),TT1(30),TMG(30),DM12(2),TA(39),DELMG,I1,I2,CM B38A 006
     4,CMD,BPRMG,KCM(10)                                                B38A 007
      EQUIVALENCE (MCLASS,JCMA)                                         B38A 008
      COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)              B38A 009
      COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                    B38A 010
     3,RHO(2),MATL(38),DEL(39),SO(20),M(38),RC(38),RA(38),RECORD(36),   B38A 011
     4AREA(38),EMA(38),RAV(38),                                         B38A 012
```

```
      5ROA(152),ROB(152),ROC(152),                                      B38A 013
      6    TPI(30),VFZ,CMH,NPR,                                         B38A 014
      7LCT,NPG,II,NBM,NUMN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA     B38A 015
      8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,B38A 016
      9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT B38A 017
       COMMON/CMACOM/EPSW,TRES,                                         B38A 018
      1THWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFHP,JFH,INPUT,     DTHIN,BRP,HCONV,B38A 019
      2INCH,DTHB,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30) B38A 020
       COMMON/SBCP/BF,CMMA,CMMI,DERR,DMIV,EMIV,ERFX,ERRC,ERR,ERRS,I3,I4, B38A 021
      1VRM,VRP, IPR,IRA,IRB,IRC,IRD,ITL,PHI,QQ,TABC,TEMP,TSMA,TSMI,TSSQ B38A 022
       COMMON/SBCP/ TNXT,    DNCP(3),CPE(3),TO(20),VITER(51),EITER(51)  B38A 023
       COMMON/SBCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)               B38A 024
       COMMON/SBCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50), B38A 025
      1RAT( 50),ROT( 50),RO( 50),X( 50),RON( 50),DMDG( 50),RR ( 50),    B38A 026
      2CNC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50),CNO( 50)           B38A 027
       COMMON/SBCP/BR,    CHZ,     CMOL,     DEDT,DEDTT,DSDTB,DTH,GSMS,HW, B38A 028
      1HE,     ITS,PRES,QCHEM,QCHEMT,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP, B38A 029
      2QRPT,RAD,RADT,RSU,SIG,    TSAVE,VF,XP1,ASU                       B38A 030
       COMMON/MISC/       BPRM,CMT,COLD,CP1,CPGAS,CPML,CZ,DCDT,DECOM,   B38A 031
      1DECOMT,DELCR,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DRCAC, B38A 032
      2DROAT,DROBC,DROBT,DROCC,DROCT,DRODTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHS B38A 033
      3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSM,GSMT, B38A 034
      4GZ,H1,HAPHB,HBAR,HGAS,HRES,IE,INTA,I,IS,ISV,ITER,J1,J,KK,K,KT,L, B38A 035
      5NDR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SA B38A 036
      6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,THPRT,TN,TOP1,TOP2,TOP3,T, B38A 037
      7TT,VOL,X1                                                        B38A 038
       EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                  B38A 039
       DATA VOID/4HVOID/                                                B38A 040
  529 FORMAT(17H  ITERATION STOP  )                                     B38A 041
  582 FORMAT(1P12E10.3)                                                 B38A 042
      IF(JCMA-2) 771,771,770                                            B38A 043
  770 IF(JCMA-4) 2513,744,753                                           B38A 044
  771 CONTINUE                                                          B38A 045
      XP1=X(1)                                                          B38A 046
      VF=VFZ
      ITL=10                                                            B38A 047
      ITS=1                                                             B38A 048
      VRP=(TH-TPR(1))/(TPR(2)-TPR(1))                                   B38A 049
      TNXT=AMAX1(TPR(2),TPR(1))                                         B38A 050
      CH = TCH(1)+VRP*(TCH(2)-TCH(1))                                   B38A 051
      QRA=TRAD(1)+VRP*(TRAD(2)-TRAD(1))                                 B38A 052
      CHZ=CH                                                            B38A 053
      IPR=1                                                             B38A 054
      ERFX=D(1)                                                         B38A 055
      CALL LOOK(12,GSMS/CH,TMG,0,0,0,0,Y2,D2,0)                         B38A 056
      IMG=IR(12)                                                        B38A 057
      VRM=VR                                                            B38A 058
 2510 ILO(14)=NLO(IMG)                                                  B38A 059
      IHI(14)=NHI(IMG)                                                  B38A 060
      ILO(15)=NLO(IMG+1)                                                B38A 061
      IHI(15)=NHI(IMG+1)                                                B38A 062
      I1=ILO(14)                                                        B38A 063
      I2=ILO(15)                                                        B38A 064
      L1=I1
      L2=I2
      ERRM=1.0
      IF(IHI(14)-ILO(14)) 420,420,729
  729 CONTINUE
```

```
      IF(TCHEM(I2,IMG+1,1)-VOID) 730,731,730                            838A 065
  730 IF(TCHEM(I1,IMG,1)-VOID) 732,731,732                              838A 066
  732 IF(TCHEM(I2,IMG+1,2)-VOID) 733,731,733                            838A 067
  733 IF(TCHEM(I1,IMG,2)-VOID) 2513,731,2513                            838A 068
  731 JCMA-3                                                            838A 069
      RETURN                                                            838A 070
 2513 TABC=TTS(I1,IMG,1)+VRM*(TTS(I2,IMG+1,1)-TTS(I1,IMG,1))            838A 071
 2515 TABC=TABC+VRP*(TTS(I1,IMG,2)+VRM*(TTS(I2,IMG+1,2)-TTS(I1,IMG+1,2))838A 072
     1-TABC)                                                            838A 073
 2503 IF(TSAVE-TABC+.0001) 420,420,421
C     ---------- ABLATING SURFACE                                       838A 075
  421 IF(IAB) 422,422,423                                               838A 076
  422 CMDL=TLMC(I1,IMG,1)-VRM*(TLMC(I1,IMG,1)-TLMC(I2,IMG+1,1))         838A 077
      CMD=EXP(CMDL)*CH                                                  838A 078
      IAB=1                                                             838A 079
  423 CALL LOOK(14,CMDL,TLMC(1,IMG,1),0,0,0,0,0,0,0)                    838A 080
      IRA=IR(14)                                                        838A 081
      I1=IRA                                                            838A 082
      CALL LOOK(15,CMDL,TLMC(1,IMG+1,1),0,0,0,0,0,0,0)                  838A 083
      IRB=IR(15)                                                        838A 084
      I2=IRB                                                            838A 085
      CALL COMP (TCHEM(I1,IMG,1),TCHEM(I2,IMG+1,1),VOID,IFLAG)
      IF(IFLAG-1) 740,741,740                                           838A 087
  741 JCMA=4                                                            838A 088
      RETURN                                                            838A 089
  740 CONTINUE                                                          838A 090
  744 CALL LOOK(14,CMDL,TLMC(1,IMG,1),TTS(1,IMG,1),TCHEM(1,IMG,1),0,0,  838A 091
     1Y2(1),Y2(3),2)                                                    838A 092
      CALL LOOK(15,CMDL,TLMC(1,IMG+1,1),TTS(1,IMG+1,1),TCHEM(1,IMG+1,1),838A 093
     10,0,Y2(5),Y2(7),2)                                                838A 094
      CALL LOOK(14,CMDL,TLMC(1,IMG,2),TTS(1,IMG,2),TCHEM(1,IMG,2),0,0,  838A 095
     1Y2(9),Y2(11),2)                                                   838A 096
      CALL LOOK(15,CMDL,TLMC(1,IMG+1,2),TTS(1,IMG+1,2),TCHEM(1,IMG+1,2),838A 097
     10,0,Y2(13),Y2(15),2)                                              838A 098
      IIX=IEX-2
      DO 4232 I=1,8                                                     838A 099
 4232 Y2(I)=Y2(I)+VRP*(Y2(I+8)-Y2(I))                                   838A 100
 4233 DO 426 I=1,4                                                      838A 101
  426 Y2(I)=Y2(I)+ (Y2(I+4)-Y2(I))*VRM                                  838A 102
      IF(Y2(1)) 4260,4260,4261                                          838A 103
 4260 ITL=ITS                                                           838A 104
      GO TO 4356                                                        838A 105
 4261 CONTINUE                                                          838A 106
      CALL LOOK(4,Y2(1),TT2(1,2),TEP(1,2),0,0,0,EMIV,DMIV,1)            838A 107
      IF(MATL(1)-2) 428,427,428                                         838A 108
  428 CALL LOOK(3,Y2(1),TT2(1,1),TEP(1,1),0,0,0,Y3,D3,1)                838A 109
      EMIV=EMIV+XP1*(Y3(1)-EMIV)
      DMIV=DMIV+XP1*(D3(1)-DMIV)
  427 TSSQ=Y2(1)*Y2(1)                                                  838A 112
      TS=Y2(1)                                                          838A 113
      RAD=SIG*EMIV*TSSQ*TSSQ*VF                                         838A 114
  436 ERR=CH*Y2(2)+EMIV*QRA-RAD-B(1)*TS+ERFX                            838A 115
      ERRM=AMAX1(ABS(CH*Y2(2)),ABS(EMIV*QRA),ABS(RAD),ABS(B(1)*TS),
     1  ABS(ERFX))
      DERR=CH*Y2(4)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))*Y2(3)          838A 116
      IF(DERR) 4365,4365,4362
 4362 IF(IIX) 4365,4368,4365
 4368 ITL=ITS
```

```
      GO TO 4356
 4365 CONTINUE
      ERRC=ERR/DERR                                                     B38A 117
      VITER(ITS)=CMDL                                                   B38A 118
      EITER(ITS)=ERR                                                    B38A 119
      CMDL=CMDL-ERRC                                                    B38A 120
      CMMI=-1.E+30                                                      B38A 121
      CMMA=+1.E+30                                                      B38A 122
      IF(ILO(14)-IRA) 4361,4363,4363                                    B38A 123
 4361 IF(ILO(15)-IRB) 4270,4363,4363                                    B38A 124
 4270 CMMI=AMAX1(CMMI,TLMC(IRA,IMG,IPR)+TLMC(IRA-1,IMG,IPR),TLMC(IRB,IMGB38A 125
     1+1,IPR)+TLMC(IRB-1,IMG+1,IPR))/2.                                 B38A 126
      CMDL=AMAX1(CMDL,CMMI)                                             B38A 127
 4363 IF(IMI(14)-IRA-1) 4369,4369,4364
 4364 IF(IMI(15)-IRB-1) 4369,4369,4275
 4369 IF(ITS-ITL) 4366,4366,4360
 4360 IF(ERRS) 420,4367,4367
 4275 CMMA=AMIN1(CMMA,TLMC(IRA+1,IMG,IPR)+TLMC(IRA+2,IMG,IPR),TLMC(IRB+1B38A 130
     1,IMG+1,IPR)+TLMC(IRB+2,IMG+1,IPR))/2.                             B38A 131
      CMDL=AMIN1(CMDL,CMMA)                                             B38A 132
      IF(ITS-ITL-1) 4366,4351,4352                                      B38A 133
 4351 ERRS=ERR                                                          B38A 134
      CMDL=CMMA                                                         B38A 135
      GO TO 4278
 4352 IF(ERR*ERRS) 4354,4367,4353                                       B38A 137
 4353 CMDL=CMMA                                                         B38A 138
      GO TO 4278
 4354 ITL=55                                                            B38A 140
      IF(ERRC) 4355,4367,4367                                           B38A 141
 4355 CMDL=CMMI                                                         B38A 142
      GO TO 4278
 4366 IF(ITS-ITL) 4367,4356,436)                                        B38A 144
 4356 CMDL=AMIN1(TLMC(L1,IMG,IPR),TLMC(L2,IMG+1,IPR))
 4279 CMDL=AMIN1(CMDL,TLMC(L1,IMG,IPR+1),TLMC(L2,IMG+1,IPR+1))
 4278 ERR=1.E+20
 4367 CMD=EXP(CMDL)*CM                                                  B38A 147
      IF(ITS-50) 440,440,998                                            B38A 148
  440 ITS=ITS+1                                                         B38A 149
      IF(ABS(ERR/ERRM)-.01) 4372,4372,423
C     ----------  NON-ABLATING SURFACE                                  B38A 151
  420 TS=TSAVE                                                          B38A 152
      IAB=0                                                             B38A 153
      CMD=0.0                                                           B38A 154
 4382 ILO(18)=1                                                         B38A 155
      IMI(18)=KMI(IMG)                                                  B38A 156
      ILO(19)=1                                                         B38A 157
      IMI(19)=KMI(IMG+1)                                                B38A 158
  430 CONTINUE                                                          B38A 159
      CALL LOOK(18,TS,TTS(1,IMG,1),0,0,0,0,0,0,0)                       B38A 160
      CALL LOOK(19,TS,TTS(1,IMG+1,1),0,0,0,0,0,0,0)                     B38A 161
      IRA=IR(18)                                                        B38A 162
      I1=IRA                                                            B38A 163
      IRB=IR(19)                                                        B38A 164
      I2=IRB                                                            B38A 1
      CALL COMP (TCHEM(I1,IMG,1),TCHEM(I2,IMG+1,1),VOID,IFLAG)
      IF(IFLAG-1) 742,743,742                                           B38A 167
  743 JCMA=5                                                            B38A 168
      RETURN                                                            B38A 169
```

```
      742 CONTINUE                                                      B38A 170
      753 CALL LOOK(18,TS,TTS(1,IMG  ,1),TCHEM(1,IMG  ,1),TLMC(1,IMG  ,1),
        1 0,0,Y2(1),Y2(3),2)
          CALL LOOK(18,TS,TTS(1,IMG+1,1),TCHEM(1,IMG+1,1),TLMC(1,IMG+1,1),
        1 0,0,Y2(5),Y2(7),2)
          CALL LOOK(18,TS,TTS(1,IMG  ,2),TCHEM(1,IMG  ,2),TLMC(1,IMG  ,2),
        1 0,0,Y2(9),Y2(11),2)
          CALL LOOK(18,TS,TTS(1,IMG+1,2),TCHEM(1,IMG+1,2),TLMC(1,IMG+1,2),
        1 0,0,Y2(13),Y2(15),2)
          DO 4321 I=1,8
     4321 Y2(I)=Y2(I)+VRM*(Y2(I+8)-Y2(I))
     4322 DO 4323 I=1,4
     4323 Y2(I)=Y2(I)+VRM*(Y2(I+4)-Y2(I))
      433 CALL LOOK (4,TS,TT2(1,2),TEP(1,2),0,0,0,EMIV,DMIV,1)          B38A 181
          IF(MATL(1)-2) 434,442,434                                     B38A 182
      434 CALL LOOK (3,TS,TT2(1,1),TEP(1,1),0,0,0,Y3,D3,1)              B38A 183
          EMIV=EMIV+XP1*(Y3(1)-EMIV)
          DMIV=DMIV+XP1*(D3(1)-DMIV)
      442 TSSQ=TS*TS                                                    B38A 186
     4422 RAD=SIG*EMIV*TSSQ*TSSQ*VF                                     B38A 187
      439 ERR=CH*Y2(1)+EMIV*QRA-RAD-B(1)*TS+ERFX                        B38A 188
          ERRM=AMAX1(ABS(CH*Y2(1)),ABS(EMIV*QRA),ABS(RAD),ABS(B(1)*TS),
        1   ABS(ERFX))
          DERR=CH*Y2(3)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))
          ERRC=ERR/DERR                                                 B38A 190
          VITER(ITS)=TS                                                 B38A 191
          EITER(ITS)=ERR                                                B38A 192
          TS=TS-ERRC                                                    B38A 193
     4391 TSMI=-1.E+30                                                  B38A 194
          TSMA=+1.E+30                                                  B38A 195
          IF(ILO(18)-IRA) 4509,4501,4501                                B38A 196
     4508 IF(ILO(19)-IRB) 4503,4501,4501                                B38A 197
     4503 TSMI=AMAX1(TSMI,TTS(IRB,IMG+1,IPR)+TTS(IRB-1,IMG+1,IPR),      B38A 198
        1TTS(IRA,IMG,IPR)+TTS(IRA-1,IMG,IPR))/2.                        B38A 199
          TS=AMAX1(TS,TSMI)                                             B38A 200
     4501 IF(IMI(18)-IRA-1) 4507,4507,4508                              B38A 201
     4508 IF(IMI(19)-IRB-1) 4507,4507,4510                              B38A 202
     4510 TSMA=AMIN1(TSMA,TTS(IRB+1,IMG+1,IPR)+TTS(IRB+2,IMG+1,IPR),    B38A 203
        1TTS(IRA+1,IMG,IPR)+TTS(IRA+2,IMG,IPR))/2.                      B38A 204
          TS=AMIN1(TS,TSMA)                                             B38A 205
     4507 CONTINUE                                                      B38A 206
          IF(ITS-50) 441,441,998                                        B38A 207
      441 ITS=ITS+1                                                     B38A 208
          IF(ABS(ERR/ERRM)-.01) 4390,4390,430
      998 WRITE (KOUT,529)                                              B38A 210
          WRITE(KOUT,582)(VITER(I),EITER(I),I=1,51)                     B38A 211
          WRITE(KOUT,582) TM,DTM,VRM,ERFX,TABC,EMIV,DMIV,RAD,B(1),CH,PMI,  B38A 212
        1 D(1),ME,XP1,QRA,Y2(1),Y2(2),Y2(3),Y2(4)                       B38A 213
          TM=TMFIN                                                      B38A 214
          JCMA=0                                                        B38A 215
          RETURN                                                        B38A 216
C         ----------  POST ITERATION                                   B38A 217
     4390 CONTINUE                                                      B38A 218
          IF(IAZ) 4371,4371,4372                                        B38A 219
     4371 CHO=EXP(Y2(2))*CH
          Y2(2)=Y2(1)
     4372 QCONV=CH*Y2(2)                                                B364 221
          IF(XCM(4)) 4376,4375,4376
```

```
 4376 WRITE(KOUT,582) (VITER(I),EITER(I),I=1,ITS)
      WRITE(KOUT,582) TH,DTH,VRM,ERFX,TABC,EMIV,DMIV,RAD,B(1),CH,PHI,
     1 D(1),HE,XP1,QRA,Y2,DERK,VRP
 4375 CONTINUE
      QCHEM=0.                                                          B38A 222
      DSDTB=CMD/RHO(2)                                                  B38A 223
 1437 RO(1)=RON(1)                                                      B38A 224
      BR=CH/CHZ                                                         B38A 225
      QRP=EMIV*QRA                                                      B38A 226
      QCOND=-D(1)+B(1)*TA(1)                                            B38A 227
      QCONVT=QCONVT+QCONV*DTH/AREA(1)*ASU                               B38A 228
      QCHEMT=QCHEMT+QCHEM*DTH/AREA(1)*ASU                               B38A 229
      QCONDT=QCONDT+QCOND*DTH/AREA(1)*ASU                               B38A 230
      QRPT=QRPT+QRP*DTH/AREA(1)*ASU                                     B38A 231
      RADT=RADT+RAD*DTH/AREA(1)*ASU                                     B38A 232
C                                                                       B38A 233
      DEDT=RON(1)*CP(1)*(TS-TSAVE)*DEL(1)/DTH                           B38A 234
      DO 95 I=2,NL                                                      B38A 235
      RO(I) = RON(I)                                                    B38A 236
      TEMP =(D(I  )-A(I  )*TA(I-1))/B(I  )                              B38A 237
      DEDT=DEDT+RON(I)*CP(I)*(TEMP-TA(I))*DEL(I)*RR(I)/DTH              B38A 238
   95 TA(I)=TEMP                                                        B38A 239
      IF (NUMN-NBM) 97,96,96                                            B38A 240
   96 K=NL                                                              B38A 241
      TA(NBM-1) = TA(NL)                                                B38A 242
      DO 98 I = NBM,NUMN                                                B38A 243
      K = K+1                                                           B38A 244
   98 TA(I) = (D(K)-A(K)*TA(I-1))/B(K)                                  B38A 245
   97 DEDTT=DEDTT+DEDT*DTH/AREA(1)*ASU                                  B38A 246
      JCMA=1                                                            B38A 247
      RETURN                                                            B38A 248
      END                                                               B38A 249
CC00A                                                                   C00A 001
      DIMENSION FT(21)
      COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  C00A 002
     1NLC(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                         C00A 003
     2TCH(2),TPR(2),TRAD(2),IAB                                         C00A 004
     3,T72(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELHG,I1,I2,CHC00A 005
     4,CMD,BPRMG,KCM(10)                                                C00A 006
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) C00A   7
     1,LEFS(10),PIEASE,LEFW(10)                                         C00A   8
      COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ        C00A   9
     1,WALLJ( 8),QW,VJKW( 9),TPWALL                                     C00A  10
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8C00A  11
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  C00A  12
     2,C3M(40),BETAM(40)                                                C00A  13
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NC00A  14
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) C00A  15
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) C00A  16
     3,KAUXO,JTIME,JSPEC,MD(3)                                          C00A  17
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) C00A  18
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  C00A  19
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            C00A  20
      COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)   C00A  21
     1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  DC00A  22
     2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)C00A  23
     3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   C00A  24
     4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   C00A  25
```

```
      5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),   RHOP  C00A  26
      6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)    C00A  27
       COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                     C00A  28
       COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)          C00A  29
      1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ       C00A  30
       COMMON/EQTCOM/SIP,HIP
       DATA VOID/4HVOID/
       DATA SEG1/6HSEG1  /                                                C00A  0[illegible]
       DATA SEG2/6HSEG2  /                                                C00A  024
       DATA SEG3/6HSEG3  /                                                C00A  025
       DATA SEG4/6HSEG4  /                                                C00A  026
 7234 FORMAT(10I1,3I5,35X,20I1)                                           C00A  027
C++N.B.++ALSO DEFINED IN INPOUT,INPUT,CRECT AND RERAY
       KIN=8
       KOUT=5
       READ(KIN,7234) KCM,ITEM,IS,NITEM,KR
       KR(12)=1
       KR(2)=2
       KR17=KR(17)
C      IF KCM(10) = 0, DO NOTHING
C      IF KCM(10) = 1, SAVE
C      IF KCM(10) = 2, RESTART -- NO SAVE
C      IF KCM(10) = 3, RESTART -- SAVE
       IF (KCM(10)) 90,90,93
90     CONTINUE
       GO TO 95
   93 REWIND 12
   95 REWIND 13
      REWIND 14
      B(1)=.5
      B(2)=.333333333                                                     C00A  031
      B(3)=.166666666                                                     C00A  032
      B(4)=.125                                                           C00A  033
      B(5)=.041666666                                                     C00A  034
      B(6)=.033333333                                                     C00A  035
      B(7)=.013888888                                                     C00A  036
      B(8)=.003968254                                                     C00A  037
      IF (KCM(10) - 2) 102,100,100                                        C00A  038
C     RESTART
  100 NBT=13
      DO 107 IRW=1,2
      LIM=((IS-IRW+2)/2-1)*NITEM+ITEM-MOD(IS-1+IRW,2)
      IF(LIM) 107,107,109
  109 DO 108 I=1,LIM
  108 READ(NBT) HSTEQV
  107 NBT=14
      LIM=((IS-1)*NITEM+ITEM-1)*2
      DO 103 I=1,LIM
  103 READ(12) DUMEQV
      CALL DUMCOM(101)
      CALL DM2COM(101)
      GO TO 147
  102 NS=1
      IT=1
  105 IS=0                                                                C00A  041
      MWE=-1                                                              C00A  042
      JCM4=1                                                              C00A  043
  110 IS=IS+1                                                             C00A  044
                                                                          C00A  045
```

```
8179          IF (IS-NS) 115,115,105
8180      115 CONTINUE
8181    C     CALL LOAD(SEG3)                                          C00A 047
8182          CALL INPOUT                                              C00A 048
8183          ITEM=1                                                   C00A 049
8184      120 J=MOD(ITEM,2)+1                                          C00A 050
8185          DO 129 IMG=1,NMG                                         C00A 051
8186          LIMC=NHI(IMG)                                            C00A 052
8187          DO 129 IMC=1,LIMC                                        C00A 053
8188      129 TCHEM(IMC,IMG,J)=VOID                                    C00A 054
8189    C     CALL LOAD (SEG4)                                         C00A 055
8190    C     REWIND 10                                                C00A 056
8191          CALL SETUP                                               C00A 057
8192          TPR(J)=TIME(ITEM)                                        C00A 058
8193          TCH(J)=-1./C3M(IS)                                       C00A 059
8194          TRAD(J)=RADS(IS)
8195          IF(ITEM-1) 128,128,130                                   C00A 061
8196      128 TPR(1)=TIME(NITEM)                                       C00A 062
8197      130 CONTINUE
8198    C     CALL LOAD(SEG1)                                          C00A 063
8199          CALL CMA                                                 C00A 064
8200    C     CALL LOAD(SEG2)                                          C00A 065
8201          KR(11)=3+IAB                                             C00A 066
8202          LIM=8                                                    C00A 067
8203          IF(JCMA-3) 140,150,160                                   C00A 068
8204      140 IF(JCMA) 141,141,142                                     C00A 069
8205      141 WRITE(NBT)  KCM                                          C00A 070
8206          STOP                                                     C00A 071
8207      142 FLUXJ(1,IS,IT)=0.
8208          FLUXJ(2,IS,IT)=-BPRMG
8209          FLUXJ(3,IS,IT)=-CMD/CH
8210          TW(IS,IT)=TA(1)                                          C00A 075
8211          KR(11)=3
8212          CALL BLIMP                                               C00A 076
8213      145 IF (IABS(KCM(10)-2)-1) 147,146,147
8214      146 CALL DUMCOM(102)
8215          CALL DM2COM(102)
8216      147 ITEM = ITEM+1
8217          IF(JCMA-1) 110,110,120                                   C00A 078
8218      150 LIM=4                                                    C00A 079
8219          KR(11)=4                                                 C00A 080
8220      160 II=I1                                                    C00A 081
8221    C     REWIND 10                                                C00A 082
8222          J=MOD(ITEM,2)+1                                          C00A 083
8223          DO 280 K=1,LIM                                           C00A 084
8224          IF(TCHEM(II,IMG,J)-VOID) 209,170,209                     C00A 085
8225      170 FLUXJ(1,IS,IT)=0.
8226          FLUXJ(2,IS,IT)=-TMG(IMG)
8227          IF(JCMA-4) 180,180,190                                   C00A 088
8228      180 FLUXJ(3,IS,IT)=-EXP(TLMC(II,IMG,J))
8229          GO TO 200                                                C00A 090
8230      190 FLUXJ(3,IS,IT)=0.
8231          TW(IS,1)=TTS(II,IMG,J)                                   C00A 092
8232      200 CALL BLIMP                                               C00A 093
8233          CALL LOOK(2,T(1),TT1,THG,0,0,0,HGA,CT1,1)                C00A 094
8234          HGA=HGA+DELHG                                            C00A 095
8235          CALL LOOK(4,T(1),TT2(1,2),THZ(1,2),0,0,0,HCH,CT2,1)      C00A 096
8236          HCH=HCH+DH12(2)                                          C00A 097
```

```
8237          IF(JCMA.GT.4) TLMC(II,IMG,J)=ALOG(AMAX1(-W(3),0.00001))
8238          TCHEM(II,IMG,J)=(W(2)+W(3))*HIP*1.8+HALLQ-W(2)*HGA-W(3)*HCH
8239          TTS(II,IMG,J)=T(1)                                          C00A 099
8240      209 GO TO (210,220,260,250,210,230,260,250),K                   C00A 100
8241      210 ITEM=ITEM-1                                                 C00A 101
8242          GO TO 270                                                   C00A 102
8243      220 II=I2                                                       C00A 103
8244          GO TO 240                                                   C00A 104
8245      230 II=I2+1                                                     C00A 105
8246      240 IMG=IMG+1                                                   C00A 106
8247          GO TO 280                                                   C00A 107
8248      250 IMG=IMG-1                                                   C00A 108
8249          II=I1+1                                                     C00A 109
8250          GO TO 280                                                   C00A 110
8251      260 ITEM=ITEM+1                                                 C00A 111
8252      270 J=3-J                                                       C00A 112
8253      280 CONTINUE                                                    C00A 113
8254          GO TO 130                                                   C00A 114
8255          END                                                         C00A 115
8256     CC01B                                                            C01B 001
8257          SUBROUTINE DM2COM(ICK)                                      C01B 002
8258          COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  C01B 003
8259         1NLO(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                   C01B 004
8260         2TCH(2),TPR(2),TRAD(2),IAB                                   C01B 005
8261         3,TT2(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELHG,I1,I2,CHC01B 006
8262         4,CMD,BPRMG,KCM(10)                                          C01B 007
8263          EQUIVALENCE (NCLASS,JCMA)                                   C01B 008
8264          COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)        C01B 009
8265          COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)              C01B 010
8266         3,RHO(2),MATL(38),DEL(39),SC(20),H(38),RC(38),RA(38),RECORD(36),  C01B 011
8267         4AREA(38),EMA(38),RAV(38),                                   C01B 012
8268         5ROA(152),ROB(152),ROC(152),                                 C01B 013
8269         6     TPI(30),VFZ,CMH,NPR,                                   C01B 014
8270         7LCT,NPG,II,NBM,NUMN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA  C01B 015
8271         8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,C01B 016
8272         9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT C01B 017
8273          COMMON/CMACOM/EPSW,TRES,                                    C01B 018
8274         1TMWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFHP,JFH,INPUT,     DTHIN,BRP,HCONV,C01B 019
8275         2INCH,DTHB,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  C01B 020
8276          COMMON/SBCP/BF,CMMA,CMMI,DERR,DMIV,EMIV,ERFX,ERRC,ERR,ERRS,I3,I4,  C01B 021
8277         1VRM,VRP, IPR,IRA,IRB,IRC,IRD,ITL,PHI,QQ,TABC,TEMP,TSMA,TSMI,TSSQ  C01B 022
8278          COMMON/SBCP/ TNXT,   DNCP(3),CPE(3),TO(20),VITER(51),EITER(51)  C01B 023
8279          COMMON/SBCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)          C01B 024
8280          COMMON/SBCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50),  C01B 025
8281         1RAT( 50),ROT( 50),RO( 50),X( 50),RON( 50),DMDG( 50),RR ( 50),  C01B 026
8282         2CNC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50),CNO( 50)     C01B 027
8283          COMMON/SBCP/BR,   CHZ,    CMDL,    DEDT,DEDTT,DSDTB,DTH,GSMS,HW,  C01B 028
8284         1HE,     ITS,PRES,QCHEM,QCHEMT,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP,  C01B 029
8285         2QRPT,RAD,RADT,RSU,SIG,   TSAVE,VF,XP1,ASU                   C01B 030
8286          COMMON/MISC/      BPRM,CMT,COLD,CP1,CPGAS,CFNL,CZ,DCDT,DECOM,  C01B 031
8287         1DECOMT,DELCR,DELR,DENOLD,DIET,DNS,DPDT,DRLCF,DRLC,DRLP,DRL,DROAC, C01B 032
8288         2DROAT,DROBC,DROBT,DROCC,DROCT,DRODTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHSC01B 033
8289         3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSM,GSMT, C01B 034
8290         4GZ,H1,HAPHB,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,  C01B 035
8291         5NDR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SAC01B 036
8292         6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,THPRT,TN,TOP1,TOP2,TOP3,T,C01B 037
8293         7TT,VOL,X1                                                   C01B 038
8294          EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)             C01B 039
```

```
      DIMENSION CAMEQV(1478),LOOEQV( 73),CMAEQV(1125),SBCEQV(1237),
     1          MISEQV(101)
      EQUIVALENCE (CAMEQV,TLMC),(LOOEQV,KOUT),(CMAEQV,TEP),
     1            (SBCEQV,BF),(MISEQV,BPRM)
      IF (ICK - 101) 40,10,20
   10 READ ( 12 ) CAMEQV, LOOEQV, CMAEQV, SBCEQV, MISEQV
      GO TO 40
   20 WRITE( 12 ) CAMEQV, LOOEQV, CMAEQV, SBCEQV, MISEQV
   40 RETURN
      END                                                               C01B 041
CC02A                                                                   C02A 001
      SUBROUTINE BLIMP                                                  C02A 002
      DIMENSION HIST1(605),HIST2(607),HIST3(511),VMAT(566),HIST4(600)   C02A 003
      COMMON/BLQCOM/  MOA( 71),   MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) C02A   4
     1,LEFS(10),PIEASE,LEFW(10)                                         C02A   5
      COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,C02A   6
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90   C02A   7
     2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                    C02A   8
      COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)  C02A   9
     2,THF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KQT(2)             C02A  10
      COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8C02A  11
     1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2  C02A  12
     2,C3M(40),BETAM(40)                                                C02A  13
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NC02A  14
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) C02A  15
     2,B(8),       MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) C02A  16
     3,KAUXO,JTIME,JSPEC,MD(3)                                          C02A  17
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) C02A  18
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  C02A  19
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                            C02A  20
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    C02A  21
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         C02A  22
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      C02A  23
      EQUIVALENCE(HIST1,XI),(HIST2, PE),(HIST3,F),(VMAT,C1),(HIST4,FW)  C02A 008
    3 FORMAT(/1H17X4HTIMEE12.5,35H SECONDS - - - STREAMWISE DIMENSICNE12C02A 023
     1.5,11H FEET - - - 3A6)
      CALL DATE(9,MD)
      CALL TOD(18,MD)
      WRITE(KOUT,3) TIME(ITEM),S(IS),MD
  140 J=MOD(ITEM,2)+1                                                   C02A 027
      DO 142 I=1,NETA                                                   C02A 028
  142 HF(I,5)=THF(I,J)                                                  C02A 029
      XI(IS)=TXI(J)                                                     C02A 030
      RADS(IS)=TRADS(J)
      DSIP(IS)=TDSIP(J)
      UE(IS)=TUE(J)                                                     C02A 031
      RHOE(IS)=TRHOE(J)                                                 C02A 032
      TE(IS)=TTE(J)                                                     C02A 033
      VMUE(IS)=TVMUE(J)                                                 C02A 034
      KQ(10)=KQT(J)
      DO 141 I=1,566                                                    C02A 035
  141 VMAT(I)=TMAT(I,J)                                                 C02A 036
      PTE(IS,1)=PTET(ITEM)                                              C02A 037
      PE(IS,1)=TPE(J)                                                   C02A 038
      DUM1=(GE(ITEM)-G(1,1))/(G(1,NETA)-G(1,1))                         C02A 039
      DO 113 I=1,NETA                                                   C02A 040
      G(3,I)=G(3,I)*DUM1                                                C02A 041
      G(2,I)=G(2,I)*DUM1                                                C02A 042
```

```
  113 G(1,I)=G(1,1)+DUM1*(G(1,I)-G(1,1))                          C02A 043
      ITS=0                                                       C02A 044
      KR(17)=KR17                                                 C02A 045
   43 CALL ITERAT                                                 C02A 046
      CALL OUTPUT                                                 C02A 047
      IF(NON) 43,40,41
   41 STOP 5050
   40 RETURN                                                      C02A 049
      END                                                         C02A 050
```

SECTION IV

CHECK CASES

Two check cases were run on the AFWL CDC 6600 computer using the modified BLIMP code with the entropy layer swallowing option. Check Case I was a rocket sled boundary layer which simulates a reentry plasma. Edge conditions for this case have in the past been difficult to obtain using mass balancing techniques external to BLIMP. Check Case II was the boundary layer on a typical reentry vehicle.

Definition, input, and output of Case I and of Case II follow. The complete output is not included due to its large volume. Only the first and last points of the boundary layer edge and shock thermodynamic state output are presented. The boundary layer solutions for the stagnation point and for one station on the after body are presented for each case.

1. CHECK CASE 1 - SPHERE-CONE ON ROCKET SLED

   a. Vehicle Configuration

      1) Geometry: Sphere-cone

         a) Nose Radius: 1/2-inch

         b) Cone half angle: 9 degrees

         c) Length (streamwise): 1.9639 feet

      2) Heatshield:

         a) Location: Between streamwise distances of .10686 feet and 1.5520 feet.

         b) Material: Avcoat 8024 (epoxy urethane)-$C_{567}H_{950}O_{113}N_{35}$

         c) From 0 to .10686 feet (streamwise) and from 1.5520 to 1.9639 the cone is considered nonablating.

         d) Contamination: Heatshield contains 20 pct by weight $CsNO_3$.

   b. Wall Boundary Conditions

      1) Mass Ablation Rate: See Case I input cards.

      2) Wall Temperature: See Case I input cards.

c. Free Stream Properties

1) Altitude: 4,000 feet

2) Velocity: 8,000 feet/second

3) Density: .06792 lb/ft^3

4) Enthalpy: 120.435 Btu/lb (ref. to 0°K).
(static, -7.761 Btu/lb, ref. to 298°K)

5) Pressure: 0.86384 atm

6) Mach No.: 7.2661

d. Shock Data

1) Local Pressure Ratio: See Case I input cards

2) Stagnation Conditions (from inviscid flow solution):

a) Pressure: 59.114 atm

b) Enthalpy: 1270.5 Btu/lb (ref. to 298°K)

3) Freestream stream function position vs. shock angle: See Case I input cards

e. Input cards

```
1020302020020000 1  CHECK CASE 1 - 8000 FPS ROCKET SLED
blank card
 5
 1
 1.
30
0.          .004        .008        .012        .017        .027        .038        .045
.058205     .069        .080        .09         -.1065      -.10686     .19206      .27643
.36080      .44518      .61392      .78267      .95141      1.2045      1.400       -1.552
-1.5628     1.62345     1.6961      1.76775     1.83930     1.96390
15
0.          .002        .004        .007        .012        .02         .03         .05
.1          .2          .35         .5          1.0         1.6         2.5
13 .95
0.0         .04166667
-.04166667
.041154
blank card
                                                            .33916
52.114
1270.5
 .
0.44        11.023      0.018       0.0         0.0         300.
1610.
  6
  1HYDROGEN     1.008                         755.003
  6 CARBON      12.011                        450.618
  7NITROGEN     14.008    -.765               38.077
  8 OXYGEN      16.000    -.235               120.588
 55 CESIUM      132.91                        10.261
 99ELECTRON     0.00055
  1 55                                        JANAF 06/68        AFWL - JEF   CS
 183100+5 140420+5 338117+1 953465-3 363865+6 536529+2   500  30001     OCS
 183100+5 140420+5-177453+2 621867-2 483422+8 536529+2  3000  60001     OCS
  2  1  0  0  0  0  0                        JANAF 03/61                    H2
       -  212100+5 711963+1 621050-3-712694+6 484650+2  500. 3000.1    0.H2
       -  212100+5 691704+1 580954-3 265106+7 484650+2 3000. 5000.1    0.H2
  1  6  1  8  0  0  0  0  0                  JANAF 03/61                    CO
-264170+5 223570+5 065040+1 117021-3-398211+6 653700+2  500. 3000.1    0.CO
-264170+5 223570+5 115406+2-424139-3-131563+3 653700+2 3000. 5000.1    0.CO
  1  6  2  8  0  0  0  0  0  0               JANAF 03/61                    CO2
-940540+5 365350+5 144559+2 210386-3-182392+7 798480+2  500. 3000.1    0.CO2
-940540+5 365350+5 156451+2-381561-4-602768+7 798480+2 3000. 5000.1    0.CO2
  2  7  0  0  0  0  0                        ASBETT LOW TEMP                N2
      0+0 281718+5 5.2936  .00308              66552 +2       500.  1   -0N2
      0+0 221640+5 793097+1 319649-3-314095+6 637650+2       3000. 1    N2
  1 99                                        JANAF   05/65    AFWL - JEF   E-
 0         134230+5 426800+1 215333-5 262840-6 164590+2   500  30001     E-
 0         134230+5 496800+1-232369-6-986224-6 164590+2  3000  50001     E-
  1  6  0  0  0  0  0                        JANAF 03/61                    C
 170886+6 125500+5 444432+1 226125-3 409330+6 492870+2  500. 3000.1    0.C
 170886+6 125500+5 412212+1 261908-3 262086+7 492870+2 3000. 5000.1    0.C
  1  1  0  0  0  0  0                        JANAF 12/60                    H
 521020+5 134230+5 480223+1 555160-4 173095+6 388620+2  500. 3000.1    0.H
 521020+5 134230+5 308752+1 315025-3 929744+7 388620+2 3000. 5000.1    0.H
  1  8  0  0  0  0  0                        JANAF 06/62                    O
```

```
595590+5 135220+5 497228+1 380768-5 154749+5 500960+2  500. 3000.1   0.O
595590+5 135220+5 657489+1-224268-3-891732+7 500960+2 3000. 5000.1   0.O
 1  7  0  0  0  0  0                    JANAF 03/61                    N
112965+6 134370+5 486944+1 383516-4 958460+5 480900+2  500. 3000.1   0.N
112965+6 134370+5 428957+1 240844-3-417273+6 480900+2 3000. 5000.1   0.N
 3  6  0  0  0  0  0     *              JANAF 12/60                    C3
189670+6 366220+5 146441+2 622536-4-168227+7 798410+2  500. 3000.1   0.C3
189670+6 366220+5 144782+2 792232-4-646877+6 798410+2 3000. 5000.1   0.C3
 4  1  1  6  0  0  0  0  0  0  *        JANAF 03/61                    CH4
-178950+5 530790+5 230948+2 677896-3-755061+7 825970+2  500. 3000.1   0.CH4
-178950+5 530790+5 236053+2 374323-3-368234+7 825970+2 3000. 5000.1   0.CH4
 1  6  1  7  0  0  0  0  0  0  0        JANAF 12/62                    CN
109000+6 232490+5 655906+1 115326-2 479517+6 669760+2  500. 3000.1   0.CN
109000+6 232490+5 988013+1 313855-3-649453+7 669760+2 3000. 5000.1   0.CN
 1  1  1  6  0  0  0  0  0  0           JANAF 03/61                    CH
142006+6 221300+5 826079+1 302211-3-100184+7 616120+2  500. 3000.1   0.CH
142006+6 221300+5 707091+1 463281-3 552860+7 616120+2 3000. 5000.1   0.CH
 1  1  1  6  1  7  0  0  0  0  0  0  0  0JANAF 03/61                    CHN
312000+5 355930+5 137023+2 552243-3-228955+7 758620+2  500. 3000.1   0.CHN
312000+5 355930+5 178895+2-295052-3-183671+8 758620+2 3000. 5000.1   0.CHN
 1  1  1  6  1  8  0  0  0  0  0  0  0  0JANAF 03/61                    CHO
-290000+4 323670+5 128033+2 300638-3-201721+7 789830+2  500. 3000.1   0.CHO
-290000+4 323670+5 102028+2 633312-3 121615+8 789830+2 3000. 5000.1   0.CHO
 2  6  0  0  0  0  0                    JANAF 9/61                     C2
198990+6 246990+5 776612+1 696081-3 185649+6 685519+2  500. 3000.1   0.C2
198990+6 246990+5 104162+2 566841-4-640205+7 685519+2 3000. 5000.1   0.C2
 2  1  2  6  0  0  0  0  0  0           JANAF 03/61                    C2H2
541900+5 482570+5 189960+2 769044-3-409039+7 849690+2  500. 3000.1   0.C2H2
541900+5 482570+5 203952+2 389062-3-645297+7 849690+2 3000. 5000.1   0.C2H2
 2 55                                   JANAF 06/68       AFWL-JEF     CS2
253999+5 273409+5 794214+1 122378-2 220339+6 903289+2   500  30001    OCS2
253999+5 273409+5 110929+2 827707-3-174425+  903289+2  3000  60001    OCS2
 1  1  1  8  1 55                        ATLANTIC RESEARCH  AFWL-NV    CSOH
-560999+5 369869+5 129799+2 539249-3-222031+6 913640+2   500  30001    OCSOH
-560999+5 369869+5 148089+2 477010-4-341184+7 913640+2  3000  60001    OCSOH
 1  1  1  7  2  8  0  0  0  0  0  0  0  0JANAF  06/63      AFWL - WRS   HNO2 CIS
-183400+5 468800+5 168879+2 915578-3-107976+7 962540+2   500  30001    HNO2 CIS
-183400+5 468800+5 183435+2 221282-3 386246+7 962540+2  3000  50001    HNO2 CIS
 1  1  1  7  2  8  0  0  0  0  0  0  0  0JANAF  06/63      AFWL - WRS   HNO2 TRA
-188400+5 468840+5 168223+2 926502-3-102717+7 962880+2   500  30001    HNO2 TRA
-188400+5 468840+5 122227+2 224085-2 378011+7 962880+2  3000  50001    HNO2 TRA
 1  1  1  8  0  0  0  0  0  0  0        JANAF 12/60                    HO
933000+4 214040+5 773193+1 394386-3-973561+6 613820+2  500. 3000.1   0.HO
933000+4 214040+5 965144+1-443528-4-586115+7 613820+2 3000. 5000.1   0.HO
 2  1  1  8  0  0  0  0  0  0  0        JANAF 03/61                    H2O
-577980+5 302010+5 112254+2 811397-3-260800+7 684210+2  500. 3000.1   0.H2O
-577980+5 302010+5 157278+2-191543-3-173599+8 684210+2 3000. 5000.1   0.H2O
 1  7  1  8  0  0  0  0  0  0  0        JANAF 06/63                    NO
215800+5 227000+5 877623+1 899031-4-789656+6 688490+2  500. 3000.1   0.NO
215800+5 227000+5 916260+1 657885-5-212519+7 688490+2 3000. 5000.1   0.NO
 2  8  0  0  0  0  0                    ABBETT LOW TEMP                O2
     0+0 146500+5 8.1987  -.00167            63228 +2       500.  1   -002
     0+0 224459+5 808690+1 497028-3-242932+6 679729 2       3000. 1   -002
 1 55 -1 99                             JANAF 06/68       AFWL-JEF     CS+1
108099+6 134229+5 496799+1 000000-9 215212-6 520350+2   500  30001    OCS+1
108099+6 134229+5 496800+1 000000-9-623513-4 520350+2  3000  60001    OCS+1
```

```
  1  6 -1 99  0  0  0  0  0  0  0          CONVAIR ZPH-122 12/61          C+
+429925+6+150120+5+489657+1+180700-4+340000+5+484232+22000. 10000.1      C+
+429925+6+150120+5+489657+1+180700-4+340000+5+484232+22000. 10000.1      C+
  1  1 -1 99                                AFWL TDR 64-44 NOR  TO 298 JEFH+1
 367161+6 194226+5 496793+1-596238-5-304069-6 374820+2   500  30001      H+1
 367161+6 194226+5 496793+1-267224-5-113416-4 374820+2  3000  50001      H+1
  1  7 -1 99  0  0  0  0  0  0  *          CONVAIR ZPH-122 12/61          N+
+446641+6+151310+5+501751+1+617100-4-184100+7+496847+22000. 10000.1      N+
+446641+6+151310+5+501751+1+617100-4-184100+7+496847+22000. 10000.1      N+
  2  8  1 99  0  0  0  0  0                CONVAIR ZPH-122 12/61          O2-
-205250+5+267570+5+111480+2-656700-4-779100+7+699149+22000. 10000.1      O2-
-205250+5+267570+5+111480+2-656700-4-779100+7+699149+22000. 10000.1      O2-
  1  6  1  8 -1 99  0  0  0  0  0  0  0  0CONVAIR ZPH-122 12/61          CO+
+294283+6+243330+5+893619+1+378000-4-150900+7+666595+22000. 10000.1      CO+
+294283+6+243330+5+893619+1+378000-4-150900+7+666595+22000. 10000.1      CO+
  1  7  1  8 -1 99  0  0  0  0  0  0  0  0CONVAIR ZPH-122 12/61          NO+
+232919+6+241970+5+910216+1+277400-4-316600+7+654379+22000. 10000.1      NO+
+232919+6+241970+5+910216+1+277400-4-316600+7+654379+22000. 10000.1      NO+
  1  8 -1 99  0  0  0  0  0  0             +ONVAIR ZPH-122 12/61          O+
+371999+6+149290+5+336271+1+306710-3+590200+7+484849+22000. 10000.1      O+
+371999+6+149290+5+336271+1+306710-3+590200+7+434849+22000. 10000.1      O+
```

blank card

20.8000.	0.06792	-7.761	0.86384				
F 0.	.020022	.040044	.059622	.080267	.10229	.12122	.14190
.17047	.20533	.25116	.29886	.39531	.50475	.59883	.70431
.80563	1.0149	1.4094	1.8017				
R 0.	.3554	.6859	.9353	1.0980	1.1971	1.2488	1.2862
1.3196	1.3451	1.3587	1.3692	1.3809	1.3737	1.3631	1.3587
1.3566	1.3545	1.3537	1.3535				

blank card

1.0	.9893	.95708	.90543	.81812	.59897	.35254	.22746
.075363	.071960	.067962	.064438	.059230	.059126	.043652	.037947
.035854	.035302	.036110	.037829	.039577	.041609	.042712	.043350
.043353	.043601	.043828	.044029	.044211	.044487		

six blank cards

5400.	5200.	5000.	4700.	4400.	4000.	3700.	3200.
2800.	2600.	2400.	2000.	1600.	1522.	1513.	1506.
1501.	1499.	1498.	1502.	1505.	1509.	1510.	1510.
1500.	1500.	1500.	1500.	1500.	1500.		

nine blank cards

0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	.65	.585	.55
.52	.49	.482	.495	.518	.539	.549	.55

```
0.        0.        0.        0.        0.        0.
blank card
.
:
(end of file card)
```

f. Computer output

The first and last points of the boundary layer edge and shock thermodynamic state output are presented. The boundary layer solutions for the stagnation point and for one station on the afterbody are also included.

```
          BOUNDARY LAYER INTEGRAL MATRIX PROGRAM (BLIMP)

     AEROTHERM CORPORATION,PALO ALTO,CALIF (RMK,EPB)

CASE CHECK CASE 1 - 8000 FPS ROCKET SLED

     CONTROL NUMBERS  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20

                      1  0  2  0  3  0  2  0  2  0  0  2  0  0  0  0 -0  1  0 -0

     PUNCH CONTROL
     IDENT  JSPEC
                -0

   U/UE TO        NODAL PT.                                ETA VALUES
  NORM. ETA       AT WHICH
                  ETA NORM.
  9.500E-01          13        0.E+00    2.000E-03 4.000E-03 7.000E-03 1.200E-02 2.000E-02 3.000E-02 5.000E-02 1.000E-01
                                2.000E-01 3.500E-01 5.000E-01 1.000E+00 1.600E+00 2.500E+00

 NOSE RADIUS,FT  4.16667E-02     CONE HALF ANGLE  9.00000E+00 DEGREES

CASE                      1.00000E+00

TOTAL ENTHALPY,BTU/LB     1.27050E+03

TOTAL PRESSURE,ATM        5.91140E+01

INCIDENT RAD FLUX,B/SF2  0.E+00

    MIXING LENGTH CONSTANT   = 4.4000E-01
    SUBLAYER CONSTANT, YA+   = 1.1823E+01
    CLAUSER NUMBER           = 1.8000E-02
    TURBULENT SCHMIDT NUMBER= 9.0000E-01
    TURBULENT PRANDTL NUMBER= 9.0000E-01
    TRANSITION MOM.THICK.RE = 3.0000E+02
```

CASE 1 -

RELATIVE ELEMENTAL COMPOSITIONS, ATOMIC WTS/UNIT MASS

AT.NO.	ELEMENT	ATOMIC WT	EDGE GAS	PYRO.GAS 1	CHAR 1	PYRO.GAS 2	CHAR 2	PYRO.GAS 3	CHAR 3
1	HYDROGEN	1.00800	0.0000000	-0.0000000	00.0755003	-0.0000000	-0.0000000	-0.0000000	-0.0000000
6	CARBON	12.01100	0.0000000	-0.0000000	00.0450618	-0.0000000	-0.0000000	-0.0000000	-0.0000000
7	NITROGEN	14.00800	00.0546117	-0.0000000	00.0038077	-0.0000000	-0.0000000	-0.0000000	-0.0000000
8	OXYGEN	16.00000	00.1146875	-0.0000000	00.0120588	-0.0000000	-0.0000000	-0.0000000	-0.0000000
55	CESIUM	132.91000	0.0000000	-0.0000000	00.0010261	-0.0000000	-0.0000000	-0.0000000	-0.0000000
99	ELECTRON	00.00055	0.0000000	-0.0000000	0.0000000	-0.0000000	-0.0000000	-0.0000000	-0.0000000

THERMODYNAMIC PROPERTY CURVE-FIT DATA (SEE MANUAL FOR FORMAT)

```
1. 55-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/68        AFWL - JEF  CS
 0.18320E+05 0.14043E+05 0.38812E+01 0.95347E-03 0.36387E+06 0.53653E+02  500.0000  3000.0000 1
 0.18320E+05 0.14043E+05-0.17745E+02 0.62187E-02 0.48342E+08 0.53653E+02 3000.0000  6000.0000 1
2.  1 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     H2
 0.E+00      0.21210E+05 0.71196E+01 0.62195E-03-0.71259E+06 0.48465E+02  500.0000  3000.0000 1
 0.E+00      0.21210E+05 0.68179E+01 0.58985E-03 0.26511E+07 0.48465E+02 3000.0000  5000.0000 1
1.  6 1.  8 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     CO
-0.26417E+05 0.22357E+05 0.86504E+01 0.11702E-03-0.89821E+06 0.65370E+02  500.0000  3000.0000 1
-0.26417E+05 0.22357E+05 0.11550E+02-0.42414E-03-0.13156E+08 0.65370E+02 3000.0000  5000.0000 1
1.  6 2.  8 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     CO2
-0.94054E+05 0.36535E+05 0.14456E+02 0.21039E-03-0.18239E+07 0.79848E+02  500.0000  3000.0000 1
-0.94054E+05 0.36535E+05 0.15645E+02-0.38156E-04-0.60277E+07 0.79848E+02 3000.0000  5000.0000 1
2.  7 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0ABBETT LOW TEMP                  N2
 0.E+00      0.28172E+05 0.52936E+01 0.30800E-02-0.E+00      0.66552E+02   -0.0000   500.0000 1
 0.E+00      0.22165E+05 0.79310E+01 0.31965E-03-0.31429E+06 0.63765E+02   -0.0000  3000.0000 1
1. 99-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF   05/65    AFWL - JEF   E-
 0.E+00      0.13423E+05 0.49680E+01 0.21533E-05 0.26284E-06 0.16459E+02  500.0000  3000.0000 1
 0.E+00      0.13423E+05 0.49680E+01-0.23237E-06-0.98622E-06 0.16459E+02 3000.0000  5000.0000 1
1.  6 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     C
 0.17089E+06 0.13550E+05 0.44443E+01 0.22813E-03 0.40983E+06 0.49287E+02  500.0000  3000.0000 1
 0.17089E+06 0.13550E+05 0.41221E+01 0.26191E-03 0.26289E+07 0.49287E+02 3000.0000  5000.0000 1
1.  1 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 12/60                     H
 0.52102E+05 0.13423E+05 0.48022E+01 0.55547E-04 0.17310E+06 0.38862E+02  500.0000  3000.0000 1
 0.52102E+05 0.13423E+05 0.3.875E+01 0.31503E-03 0.92974E+07 0.38862E+02 3000.0000  5000.0000 1
1.  8 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 06/62                     O
 0.59559E+05 0.13522E+05 0.49723E+01 0.38077E-05 0.15475E+05 0.50096E+02  500.0000  3000.0000 1
 0.59559E+05 0.13522E+05 0.65749E+01-0.22427E-03-0.89178E+07 0.50096E+02 3000.0000  5000.0000 1
1.  7 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     N
 0.11297E+06 0.13437E+05 0.48694E+01 0.38352E-04 0.95846E+05 0.48090E+02  500.0000  3000.0000 1
 0.11297E+06 0.13437E+05 0.42896E+01 0.24084E-03-0.41727E+06 0.48090E+02 3000.0000  5000.0000 1
3.  6 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 12/60                     C3
 0.18967E+06 0.36622E+05 0.14644E+02 0.62254E-04-0.16823E+07 0.79841E+02  500.0000  3000.0000 1
 0.18967E+06 0.36622E+05 0.14478E+02 0.79223E-04-0.64608E+06 0.79841E+02 3000.0000  5000.0000 1
4.  1 1.  6 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     CH4
-0.17895E+05 0.53079E+05 0.23195E+02 0.67790E-03-0.75506E+07 0.82597E+02  500.0000  3000.0000 1
-0.17895E+05 0.53079E+05 0.23605E+02 0.37432E-03-0.36823E+07 0.82597E+02 3000.0000  5000.0000 1
1.  6 1.  7 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 12/62                     CN
 0.10900E+06 0.23249E+05 0.65591E+01 0.11533E-02 0.47952E+06 0.66976E+02  500.0000  3000.0000 1
 0.10900E+06 0.23249E+05 0.98801E+01 0.31386E-03-0.64945E+07 0.66976E+02 3000.0000  5000.0000 1
1.  1 1.  6 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     CH
 0.14201E+06 0.22130E+05 0.82608E+01 0.30221E-03-0.10018E+07 0.61612E+02  500.0000  3000.0000 1
 0.14201E+06 0.22130E+05 0.70709E+01 0.46328E-03 0.55286E+07 0.61612E+02 3000.0000  5000.0000 1
1.  1 1.  6 1.  7 0.  0 0.  0 0.  0 0.  0JANAF 03/61                     CHN
 0.31200E+05 0.35593E+05 0.13702E+02 0.55224E-03-0.22895E+07 0.75862E+02  500.0000  3000.0000 1
 0.31200E+05 0.35593E+05 0.17689E+02-0.29505E-03-0.18367E+08 0.75862E+02 3000.0000  5000.0000 1
```

```
1.  1 1.  6 1.  8 0.  0 0.  0 0.  0 0.  0JANAF 03/61                    CHO
-0.29000E+04 0.32367E+05 0.12303E+02 0.30064E-03-0.20172E+07 0.78983E+02  500.0000  3000.0000 1
-0.29000E+04 0.32367E+05 0.10303E+02 0.63331E-03 0.12161E+08 0.78983E+02 3000.0000  5000.0000 1
2.  6 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 9/61                     C2
 0.19900E+06 0.24699E+05 0.77661E+01 0.69608E-03 0.13565E+06 0.68552E+02  500.0000  3000.0000 1
 0.19900E+06 0.24699E+05 0.10416E+02 0.56684E-04-0.64023E+07 0.68552E+02 3000.0000  5000.0000 1
2.  1 2.  6 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                    C2H2
 0.54190E+05 0.48257E+05 0.18396E+02 0.76904E-03-0.40904E+07 0.84969E+02  500.0000  3000.0000 1
 0.54190E+05 0.48257E+05 0.20395E+02 0.38906E-03-0.64530E+07 0.84969E+02 3000.0000  5000.0000 1
2. 55-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/68        AFWL-JEF     CS2
 0.25400E+05 0.27341E+05 0.79421E+01 0.12238E-02 0.22034E+06 0.90329E+02  500.0000  3000.0000 1
 0.25400E+05 0.27341E+05 0.11093E+02 0.82771E-03-0.17443E+08 0.90329E+02 3000.0000  6000.0000 1
1.  1 1.  8 1. 55-0. -0-0. -0-0. -0-0. -0ATLANTIC RESEARCH  AFWL-NV     CSOH
-0.56100E+05 0.36987E+05 0.12980E+02 0.53925E-03-0.22203E+06 0.91364E+02  500.0000  3000.0000 1
-0.56100E+05 0.36987E+05 0.14809E+02 0.47701E-04-0.34118E+07 0.91364E+02 3000.0000  6000.0000 1
1.  1 1.  7 2.  8 0.  0 0.  0 0.  0 0.  0JANAF  06/63       AFWL - WRS   HNO2 CIS
-0.18340E+05 0.46880E+05 0.16383E+02 0.91558E-03-0.10798E+07 0.96254E+02  500.0000  3000.0000 1
-0.18340E+05 0.46880E+05 0.18343E+02 0.22128E-03 0.38625E+07 0.96254E+02 3000.0000  5000.0000 1
1.  1 1.  7 2.  8 0.  0 0.  0 0.  0 0.  0JANAF  06/63       AFWL - WRS   HNO2 TRA
-0.18840E+05 0.46884E+05 0.16322E+02 0.92650E-03-0.10272E+07 0.96288E+02  500.0000  3000.0000 1
-0.18840E+05 0.46884E+05 0.18323E+02 0.22408E-03 0.37801E+07 0.96288E+02 3000.0000  5000.0000 1
1.  1 1.  8 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 12/60                     HO
 0.93300E+04 0.21404E+05 0.77319E+01 0.39439E-03-0.97356E+06 0.61382E+02  500.0000  3000.0000 1
 0.93300E+04 0.21404E+05 0.96514E+01-0.44353E-04-0.68611E+07 0.61382E+02 3000.0000  5000.0000 1
2.  1 1.  8 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 03/61                    H2O
-0.57793E+05 0.30201E+05 0.11225E+02 0.81140E-03-0.26080E+07 0.68421E+02  500.0000  3000.0000 1
-0.57793E+05 0.30201E+05 0.15728E+02-0.19155E-03-0.17360E+08 0.68421E+02 3000.0000  5000.0000 1
1.  7 1.  8 0.  0 0.  0 0.  0 0.  0 0.  0JANAF 06/63                     NO
 0.21580E+05 0.22700E+05 0.87762E+01 0.89903E-04-0.78966E+06 0.68849E+02  500.0000  3000.0000 1
 0.21580E+05 0.22700E+05 0.91626E+01 0.65788E-05-0.21252E+07 0.68849E+02 3000.0000  5000.0000 1
2.  8 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0ABBETT LOW TEMP                 O2
 0.E+00      0.14650E+05 0.81987E+01-0.16790E-02-0.E+00      0.63228E+02   -0.0000   500.0000 1
 0.E+00      0.23446E+05 0.80869E+01 0.49703E-03-0.24293E+06 0.67973E+02   -0.0000  3000.0000 1
1. 55-1. 99-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/68        AFWL-JEF     CS+1
 0.10810E+06 0.13423E+05 0.49680E+01 0.E+00      0.21521E-06 0.52035E+02  500.0000  3000.0000 1
 0.10810E+06 0.13423E+05 0.49680E+01 0.E+00     -0.62351E-04 0.52035E+02 3000.0000  6000.0000 1
1.  6-1. 99 0.  0 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          C+
 0.42899E+06 0.15012E+05 0.48366E+01 0.18070E-04 0.34000E+05 0.48423E+02 2000.0000 10000.0000 1
 0.42899E+06 0.15012E+05 0.48366E+01 0.18070E-04 0.34000E+05 0.48423E+02 2000.0000 10000.0000 1
1.  1-1. 99-0. -0-0. -0-0. -0-0. -0-0. -0AFWL TDR 64-44 NORM TO 298 JEFH+1
 0.36716E+06 0.13423E+05 0.49679E+01-0.59624E-05-0.30407E-06 0.37482E+02  500.0000  3000.0000 1
 0.36716E+06 0.13423E+05 0.49673E+01-0.26722E-05-0.11342E-04 0.37482E+02 3000.0000  5000.0000 1
1.  7-1. 99 0.  0 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          N+
 0.44664E+06 0.15131E+05 0.50175E+01 0.61710E-04-0.18410E+07 0.49685E+02 2000.0000 10000.0000 1
 0.44664E+06 0.15131E+05 0.50175E+01 0.61710E-04-0.18410E+07 0.49685E+02 2000.0000 10000.0000 1
2.  8 1. 99 0.  0 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          O2-
-0.20525E+05 0.26757E+05 0.11148E+02-0.65670E-04-0.77910E+07 0.69915E+02 2000.0000 10000.0000 1
-0.20525E+05 0.26757E+05 0.11148E+02-0.65670E-04-0.77910E+07 0.69915E+02 2000.0000 10000.0000 1
1.  6 1.  8-1. 99 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          CO+
 0.29424E+06 0.24393E+05 0.89362E+01 0.37800E-04-0.15090E+07 0.66660E+02 2000.0000 10000.0000 1
 0.29424E+06 0.24393E+05 0.89362E+01 0.37800E-04-0.15090E+07 0.66660E+02 2000.0000 10000.0000 1
1.  7 1.  8-1. 99 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          NO+
 0.23292E+06 0.24197E+05 0.91022E+01 0.27740E-04-0.31660E+07 0.65438E+02 2000.0000 10000.0000 1
 0.23292E+06 0.24197E+05 0.91022E+01 0.27740E-04-0.31660E+07 0.65438E+02 2000.0000 10000.0000 1
1.  8-1. 99 0.  0 0.  0 0.  0 0.  0 0.  0CONVAIR ZPH-122 12/61          O+
 0.37200E+06 0.14920E+05 0.33627E+01 0.30671E-03 0.59020E+07 0.48485E+02 2000.0000 10000.0000 1
 0.37200E+06 0.14920E+05 0.33627E+01 0.30671E-03 0.59020E+07 0.48485E+02 2000.0000 10000.0000 1
```

ELEMENT	HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM	ELECTRON
BASE SP	H2	CO	N2	CO2	CS	E-

MOLECULAR TRANSPORT PROPERTIES

VISCOSITY ..... BUDDENBERG - WILKE MIXTURE FORMULA WITH MU(I) CALCULATED ON THE BASIS OF D(I,I) = DBAR/G(I)**2

THERMAL CONDUCTIVITY ..... MASON - SAXENA MIXTURE FORMULA WITH EUCKEN CORRECTION

DIFFUSION COEFFICIENTS ..... D(I,J) = DBAR/(F(I)*F(J)) WITH DBAR BASED ON SIGMA = 3.4670, EPOVRK = 106.7000, AND MREF = 32.0000

METHODS EMPLOYED

0 CONDENSED PHASE, VALUES FOR F(I) AND G(I) SET EQUAL TO 1.E+10

1 VALUES FOR F(I) (OR G(I)) INPUT DIRECTLY

2 VALUES FOR F(I) (OR G(I)) CALCULATED BY F(I) =(M(I)/FITMOL)**FFA AND G(I) = (M(I)/FITGMW)**GGA WHERE M(I) IS SPECIES MOLECULAR WEIGHT, FITMOL = 26.7000, AND FFA = 0.4890, FITGMW = 24.3000, AND GGA = 0.4560

3 VALUES FOR G(I) CALCULATED BY G(I) = SQRT(DBAR/D(I,I)) = (SIGMA(I)/SIGMA) * (EPS(I)/EPOVRK) **0.0795 * (M(I)/MREF) **0.25 WHERE SIGMA(I) AND EPS(I) ARE GIVEN WITH THERMODYNAMIC DATA

SPECIES	F(I)	METHOD	G(I)	METHOD	SPECIES	F(I)	METHOD	G(I)	METHOD
CS	2.192	2	2.163	2	H2	0.283	2	0.323	2
CO	1.024	2	1.067	2	CO2	1.277	2	1.310	2
N2	1.024	2	1.067	2	E-	0.005	2	0.008	2
C	0.677	2	0.726	2	H	0.201	2	0.236	2
O	0.778	2	0.827	2	N	0.729	2	0.779	2
C3	1.158	2	1.196	2	CH4	0.780	2	0.828	2
CN	0.987	2	1.032	2	CH	0.704	2	0.753	2
CHN	1.086	2	1.049	2	CHO	1.042	2	1.084	2
C2	0.950	2	0.995	2	C2H2	0.988	2	1.032	2
CS2	3.077	2	2.963	2	CSOH	2.325	2	2.284	2
HNO2 CIS	1.319	2	1.349	2	HNO2 TRA	1.319	2	1.349	2
HO	0.902	2	0.953	2	H2O	0.825	2	0.873	2
NO	1.059	2	1.101	2	O2	1.093	2	1.133	2
CS+1	2.192	2	2.163	2	C+	0.677	2	0.726	2
H+1	0.201	2	0.236	2	N+	0.729	2	0.779	2
C2-	1.093	2	1.133	2	CO+	1.024	2	1.067	2
NO+	1.059	2	1.101	2	O+	0.778	2	0.827	2

STAGNATION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE EXPANSION

STREAM FUNCTION,LB/SEC	0.E+00	0.10891E+00	0.43564E+00	0.96576E+00	0.17504E+01	0.28427E+01	0.39921E+01	0.54704E+01
	0.74930E+01	0.11510E+02	0.17138E+02	0.24266E+02	0.42455E+02	0.69217E+02	0.97424E+02	0.13477E+03
	0.17533E+03	0.27934E+03	0.53967E+03	0.88191E+03				
SHOCK ANGLE,RADIANS	0.E+00	0.35540E+00	0.68590E+00	0.93530E+00	0.10980E+01	0.11971E+01	0.12488E+01	0.12862E+01
	0.13126E+01	0.13451E+01	0.13587E+01	0.13692E+01	0.13809E+01	0.13737E+01	0.13631E+01	0.13587E+01
	0.13566E+01	0.13545E+01	0.13537E+01	0.13535E+01				

```
      CP-FROZEN    CP-EQUIL    DLNM/DLNT    DLNM/DLNP      GAMMA
      0.30755E+00 0.35756E+00-0.10782E-01 0.47496E-03 0.12444E+01

    TEMP = 2681.4493 DEG-K      PRES = 59.1140 ATM      MOL WT = 28.8329163
RELATIVE MASSES OF COMPONENTS 1,2 AND 3  0.E+00       0.E+00       0.E+00
     ENTHALPY = 0.7059333E+03 CAL/GM    ENTROPY = 0.19727E+01 CAL/GM-DEG K
     DENSITY = 0.483521E+00 LB/CUFT
VEL = 0.E+00    FT/SEC    MACH = 0.E+00       AREA = 0.E+00    SQFT/LB/SEC

SPECIES    MOLE FR.        SPECIES    MOLE FR.        SPECIES    MOLE FR.
CS         0.E+00          H2         0.E+00          CO         0.E+00
CO2        0.E+00          N2         0.77186E+00     E-         0.19994E-09
C          0.E+00          H          0.E+00          O          0.19032E-02
N          0.15888E-06     C3         0.E+00          CH4        0.E+00
CN         0.E+00          CH         0.E+00          CHN        0.E+00
CHO        0.E+00          C2         0.E+00          C2H2       0.E+00
CS2        0.E+00          CSOH       0.E+00          HNO2 CIS   0.E+00
HNO2 TRA   0.E+00          HO         0.E+00          H2O        0.E+00
NO         0.30384E-01     O2         0.19535E+00     CS+1       0.E+00
C+         0.E+00          H+1        0.E+00          N+         0.44648E-23
O2-        0.48007E-09     CO+        0.E+00          NO+        0.68000E-09
O+         0.50525E-18
```

TEMP = 374.3826 DEG-K PRES = 2.3974 ATM MOL WT = 28.8603826
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.2099507E+02 CAL/GM ENTROPY = 0.16422E+01 CAL/GM-DEG K
DENSITY = 0.140584E+00 LB/CUFT

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
CS	0.E+00	H2	0.E+00	CO	0.E+00
CO2	0.E+00	N2	0.78806E+00	E-	0.E+00
C	0.E+00	H	0.E+00	O	0.57611E-32
N	0.71343E-63	C3	0.E+00	CH4	0.E+00
CN	0.E+00	CH	0.E+00	CHN	0.E+00
CHO	0.E+00	C2	0.E+00	C2H2	0.E+00
CS2	0.E+00	CSOH	0.E+00	HNO2 CIS	0.E+00
HNO2 TRA	0.E+00	HO	0.E+00	H2O	0.E+00
NO	0.40173E-12	O2	0.21194E+00	CS+1	0.E+00
C+	0.E+00	H+1	0.E+00	N+	0.E+00
O2-	0.E+00	CO+	0.E+00	NO+	0.E+00
O+	0.E+00				

TEMP = 2637.8300 DEG-K PRES = 55.2652 ATM MOL WT = 28.8368324
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.6904347E+03 CAL/GM ENTROPY = 0.19715E+01 CAL/GM-DEG K
DENSITY = 0.459577E+00 LB/CUFT

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
CS	0.E+00	H2	0.E+00	CO	0.E+00
CO2	0.E+00	N2	0.77292E+00	E-	0.13934E-09
C	0.E+00	H	0.E+00	O	0.16321E-02
N	0.11503E-06	C3	0.E+00	CH4	0.E+00
CN	0.E+00	CH	0.E+00	CHN	0.E+00
CHC	0.E+00	C2	0.E+00	C2H2	0.E+00
CS2	0.E+00	CSOH	0.E+00	HNO2 CIS	0.E+00
HNO2 TRA	0.E+00	HO	0.E+00	H2O	0.E+00
NO	0.28989E-01	O2	0.19646E+00	CS+1	0.E+00
C+	0.E+00	H+1	0.E+00	N+	0.16821E-23
O2-	0.34581E-09	CO+	0.E+00	NO+	0.48575E-09
O+	0.28874E-18				

```
CP-FROZEN     CP-EQUIL    DLNM/DLNT    DLNM/DLNP      GAMMA
0.28712E+00 0.28987E+00-0.14991E-05 0.33329E-07 0.13115E+01

TEMP = 1357.8166 DEG-K      PRES =  2.6298 ATM      MOL WT = 28.8603807
RELATIVE MASSES OF COMPONENTS 1,2 AND 3   0.E+00      0.E+00      0.E+00
ENTHALPY = 0.2843753E+03 CAL/GM     ENTROPY = 0.19727E+01 CAL/GM-DEG K
DENSITY = 0.425448E-01 LB/CUFT
VEL = 0.616E+04 FT/SEC    MACH = 0.262E+01    AREA = 0.381E-02 SQFT/LB/SEC
```

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
CS	0.E+00	H2	0.E+00	CO	0.E+00
CO2	0.E+00	N2	0.78774E+00	E-	0.11214E-18
C	0.E+00	H	0.E+00	O	0.13332E-06
N	3.5847 Z-15	O3	0.E+00	CH4	0.E+00
CN	0.E+00	CH	0.E+00	CHN	0.E+00
CHO	0.E+00	C2	0.E+00	C2H2	0.E+00
CS2	0.E+00	CSOH	0.E+00	HNO2 CIS	0.E+00
HNC2 TRA	0.E+00	HO	0.E+00	H2O	0.E+00
NO	0.62382E-03	O2	0.21165E+00	CS+1	0.E+00
C+	0.E+00	H+1	0.E+00	N+	0.31599E-40
O2-	0.13359E-17	CO+	0.E+00	NO+	0.14481E-17
O+	0.46186E-37				

DISTANCE,FT	0.E+00	0.40000E-02	0.80000E-02	0.12000E-01	0.17000E-01	0.27000E-01	0.38000E-01	0.45000E-01
	0.54915E-01	0.69000E-01	0.80000E-01	0.90000E-01	0.10650E+00	0.13686E+00	0.19206E+00	0.27643E+00
	0.36[illegible]48E+00	0.44518E+00	0.61392E+00	0.78267E+00	0.95141E+00	0.12045E+01	0.14000E+01	0.15920E+01
	0.15[illegible]70E+01	0.16234E+01	0.16961E+01	0.17677E+01	0.18393E+01	0.19639E+01		
ROKAP	0.E+00	0.39939E-02	0.79509E-02	0.11835E-01	0.16532E-01	0.25150E-01	0.32947E-01	0.36748E-01
	0.41154E-01	0.42733E-01	0.44454E-01	0.46018E-01	0.44599E-01	0.48656E-01	0.61984E-01	0.75162E-01
	0.88381E-01	0.10158E+00	0.12798E+00	0.15438E+00	0.18077E+00	0.22836E+00	0.25095E+00	0.27472E+00
	0.27641E+00	0.28590E+00	0.29727E+00	0.30848E+00	0.31967E+00	0.33916E+00		
XI,(LB/SEC)**2	0.E+00	0.14929E-09	0.25435E-08	0.11027E-07	0.42910E-07	0.21506E-06	0.58324E-06	0.85299E-06
	0.12536E-05	0.14638E-05	0.17307E-05	0.19548E-05	0.23303E-05	0.23308E-05	0.46040E-05	0.75149E-05
	0.11354E-04	0.16393E-04	0.31191E-04	0.54259E-04	0.87993E-04	0.16352E-03	0.24630E-03	0.32760E-03
	0.33749E-03	0.37137E-03	0.41977E-03	0.47146E-03	0.52716E-03	0.63435E-03		
PRESSURE RATIO	0.1[illegible]3E+01	0.98938E+00	0.95708E+00	0.90543E+00	0.81812E+00	0.59897E+00	0.35254E+00	0.22746E+00
	0.75363E-01	0.71960E-01	0.67962E-01	0.64438E-01	0.59238E-01	0.59126E-01	0.43652E-01	0.37947E-01
	0.35154E-01	0.35302E-01	0.36110E-01	0.37829E-01	0.39577E-01	0.41609E-01	0.42712E-01	0.43350E-01
	0.43153E-01	0.43601E-01	0.43828E-01	0.44029E-01	0.44211E-01	0.44487E-01		
STATIC PRESSURE,ATM	0.59114E+02	0.58461E+02	0.56577E+02	0.53524E+02	0.48362E+02	0.35408E+02	0.20840E+02	0.13446E+02
	0.44358E+01	0.42538E+01	0.40175E+01	0.38042E+01	0.35013E+01	0.34952E+01	0.25884E+01	0.22432E+01
	0.21195E+01	0.20868E+01	0.21345E+01	0.22362E+01	0.23396E+01	0.24597E+01	0.25249E+01	0.25626E+01
	0.25678E+01	0.25774E+01	0.25908E+01	0.26027E+01	0.26135E+01	0.26298E+01		
EDGE VELOCITY,FT/SEC	0.E+00	0.42289E+03	0.85278E+03	0.12798E+04	0.18102E+04	0.28483E+04	0.39565E+04	0.46129E+04
	0.57644E+04	0.58043E+04	0.59502E+04	0.58921E+04	0.59568E+04	0.59581E+04	0.61754E+04	0.62682E+04
	0.63345E+04	0.63143E+04	0.63088E+04	0.62702E+04	0.62408E+04	0.62077E+04	0.61901E+04	0.61801E+04
	0.61[illegible]15E+04	0.61762E+04	0.61727E+04	0.61696E+04	0.61668E+04	0.61625E+04		
BETA	0.50000E+00	0.49295E+00	0.53162E+00	0.48883E+00	0.52990E+00	0.60778E+00	0.76728E+00	0.10233E+01
	0.81938E+00	-0.10374E+03	0.11466E+00	0.12160E+00	0.12443E+00	0.12264E+00	0.80745E-01	0.37907E-01
	0.14281E-01	0.35259E-03	-0.14841E-01	-0.19938E-01	-0.19138E-01	-0.15258E-01	-0.12171E-01	-0.10807E-01
	-0.78864E-03	-0.10155E-01	-0.87094E-02	-0.83966E-02	-0.78907E-02	-0.69349E-02		
INCIDENT RADIATION FLUX	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00		
ENTROPY DROP,BTU/LB R	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00		
-1/FLUX NORM. PARAMETER	-0.47128E+00	-0.44950E+00	-0.47671E+00	-0.46795E+00	-0.51352E+00	-0.64329E+00	-0.95102E+00	-0.13274E+01
	-0.31962E+01	-0.34382E+01	-0.37582E+01	-0.40233E+01	-0.44461E+01	-0.44552E+01	-0.62573E+01	-0.73854E+01
	-0.42184E+01	-0.85640E+01	-0.92046E+01	-0.96892E+01	-0.10156E+02	-0.10905E+02	-0.115[illegible]	-0.11976E+02
	-0.12318E+02	-0.12196E+02	-0.12418E+02	-0.12636E+02	-0.12850E+02	-0.13220E+02		
WALL TEMPERATURE,DEG R	0.54[illegible]10E+04	0.52000E+04	0.50030E+04	0.47360E+04	0.44000E+04	0.40000E+04	0.37000E+04	0.32000E+04
	0.26[illegible]10E+04	0.26000E+04	0.24000E+04	0.23000E+04	0.16000E+04	0.15220E+04	0.15130E+04	0.15000E+04
	0.15[illegible]10E+04	0.14990E+04	0.14980E+04	0.15020E+04	0.15050E+04	0.15090E+04	0.15100E+04	0.15100E+04
	0.15000E+04	0.15000E+04	0.15000E+04	0.15000E+04	0.15000E+04	0.15000E+04		

COMP FLUX,LB/SEC FT**2	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
COMP FLUX,LB/SEC FT**2	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
COMP FLUX,LB/SEC FT**2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.52000E+00	0.49000E+00	0.48200E+00	0.49500E+00	0.51000E+00	0.65000E+00	0.50500E+00	0.55000E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.53900E+00	0.54900E+00	0.55000E+00
						0.E+00		

CASE 1 - - - - - - - - - - - - STREAMWISE DIMENSION 3.E+00 FEET - - - -

ITERATED VALUES DATA MAX.LIN MAX.ERRORS IN CONSERVATION EQS.

ITS	TIME	ALPH	FPPW	ERROR	MOMENTUM	ENERGY	CS	HZ	CO	CO2	
1	13.941	3.633	0.72578.2144	1E+00	16-2.9E+00	13 1.3E+02	2 0.E+00	2 0.E+00	1 2.0E-03	1-4.3E-03	0
2	19.342	3.240	0.73516.2154	1E+00	16-2.1E+00	13 9.1E+01	2 0.E+00	2 0.E+00	1 2.1E-03	1-3.4E-03	0
3	24.447	2.916	0.75718.2666	9E-01	16-1.4E+00	1-7.2E+01	2 0.E+00	2 0.E+00	1 1.2E-03	1-1.9E-03	0
4	29.612	2.624	0.79670.3224	7E-01	16-9.4E-01	1-5.6E+01	2 0.E+00	2 0.E+00	1 6.3E-04	1-9.0E-04	0
5	34.758	2.362	0.85013.4195	4E-01	16-6.2E-01	1-4.1E+01	2 0.E+00	2 0.E+00	14 3.2E-04	14-5.0E-04	0
6	39.834	2.126	0.92720.6311	3E-01	16-3.4E-01	1-2.6E+01	2 0.E+00	2 0.E+00	11-3.0E-04	11 4.7E-04	0
7	45.914	1.946	3.99491.30	9E-02	16-1.2E-01	1-1.0E+01	2 0.E+00	2 0.E+00	11-2.2E-04	11 3.4E-04	0
8	50.316	1.943	0.99741.0000	6E-05	16-2.5E-03	15-6.1E-01	2 0.E+00	2 0.E+00	13-7.9E-05	13 1.2E-04	0
9	54.754	1.943	0.99741.0000	1E-08	17-3.6E-05	11-1.1E-02	2 0.E+00	2 0.E+00	14-6.8E-06	14 1.1E-05	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	DIFFUSIONAL	HEAT FLUXES TOT EMTH (BTU/SEC SQ FT)	RERAD	QCOND
1.143E+00	0.E+00	0.E+00	5.911E+01	0.E+00	5.000E-01	2.122E+00	-3.131E+02	-3.131E+02	0.E+00	-2.412E+02

WALL SHEAR (LB/SQ FT)	MECH REM	MASS FLUXES PYROL GAS (LB/SEC SQ FT)	CHAR	TOTAL GAS	ELEMENTAL MASS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	1.433E-14	1.705E-05	-1.705E-05	0.E+00

MOM TRANS COEFF, RHO*UE*CF/2	HEAT TRANS COEFF, RHO*UE*CH	BLOWING PARAMETERS (BASED ON CH) FOR PYROL GAS	CHAR	TOTAL GAS	ELEMENTAL MASS TRANSFER COEFFICIENTS, RHOE*UE*CM (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
2.234E-01	1.459E+03	0.E+00	0.E+00	0.E+00	IIIII	5.834E+01	-1.685E-02	-1.685E-02	IIIII

MOMENTUM THICKNESS, THETA (FT)	DISPLACE. THICKNESS, DELSTAR (FT)	EFFECTIVE BODY DISPLACE. (FT)	ENTHALPY THICKNESS, LAMBDA (FT)	REYNOLDS NUMBER PER FOOT	MASS THICKNESSES (FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
6.190E-04	1.978E-05	1.978E-05	1.542E-05	0.E+00	IIIII	-2.166E-04	-6.078E-07	-6.078E-07	IIIII

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FTSQ)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
1.0+00	1.E+00	0.E+00	0.E+00	9.374E-01	0.E+00	1.485E+03	-1.028E+02	-3.998E-01	1.485E+03	5.400E+03	6.275E+12
9.967E-00	3.967E-03	7.844E-04	3.952E-03	9.350E-01	0.E+00	1.485E+03	-1.028E+02	2.188E+00	1.485E+03	5.399E+03	6.275E+12
1.993E-07	7.934E-03	3.134E-05	7.894E-03	9.926E-01	0.E+00	1.484E+03	-1.028E+02	-3.893E-01	1.484E+03	5.399E+03	6.275E+12
3.984E-07	1.369E-02	9.544E-05	1.379E-02	9.490E-01	0.E+00	1.484E+03	-1.028E+02	2.196E+00	1.484E+03	5.396E+03	6.272E+12
5.977E-07	2.384E-02	2.812E-04	2.357E-02	9.831E-01	0.E+00	1.483E+03	-1.028E+02	-3.694E-01	1.483E+03	5.394E+03	6.270E+12
9.954E-07	3.967E-02	7.745E-04	3.969E-02	9.735E-01	0.E+00	1.481E+03	-1.028E+02	2.240E+00	1.481E+03	5.390E+03	6.281E+12
1.497E-06	5.553E-02	1.745E-03	5.524E-02	9.617E-01	0.E+00	1.479E+03	-1.027E+02	-2.681E-01	1.479E+03	5.384E+03	5.284E+12
2.484E-06	9.917E-02	5.417E-03	9.597E-02	3.340E-01	0.E+00	1.475E+03	-1.027E+02	2.534E+00	1.475E+03	5.374E+03	6.294E+12
4.969E-06	1.983E-01	1.414E-02	1.460E-01	4.791E-01	0.E+00	1.465E+03	-1.025E+02	8.947E-01	1.465E+03	5.345E+03	6.305E+12
9.948E-06	3.967E-01	7.224E-02	3.495E-01	7.633E-01	0.E+00	1.444E+03	-1.017E+02	7.086E+00	1.444E+03	5.296E+03	6.336E+12
1.914E-05	6.944E-01	2.274E-01	6.138E-01	5.972E-01	0.E+00	1.415E+03	-9.866E+01	1.356E+01	1.415E+03	5.218E+03	6.384E+12
2.483E-05	9.917E-01	3.914E-01	7.[illegible]E-01	4.453E-01	0.E+00	1.346E+03	-9.253E+01	2.767E+01	1.386E+03	5.142E+03	6.43[illegible]E+12
4.969E-05	1.983E+00	1.240E+00	9.736E-01	1.111E-01	0.E+00	1.312E+03	-5.320E+01	5.201E+01	1.312E+03	4.941E+03	6.564E+12
7.447E-05	3.074E+00	2.424E+00	1.[illegible]E+00	7.973E-03	0.E+00	1.277E+03	-1.263E+01	1.587E+01	1.277E+03	4.845E+03	6.625E+12
1.145E-04	4.959E+00	4.227E+00	1.[illegible]13E+00	3.099E-03	0.E+00	1.270E+03	0.E+00	-1.725E+00	1.270E+03	4.827E+03	6.637E+12

DISTANCE FROM WALL (FT)	DENSITY, RHO (LB/CU FT)	VISCOSITY, MU LB/SEC FT	RHO*MU /RHOE*MUE	SPECIFIC HEAT C (BTU/LB R)	THERMAL COND (BTU /SEC FT R)	PRANDTL NUMBER	MODIFIED SCHMIDT NUMBER	MOLECULAR WEIGHT	RHO*D*EPS /RHOE*MUE	MACH NUMBER

```
0.E+00     4.312E-01 5.124E-05 9.410E-01 3.116E-01 2.320E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
9.467E-04  4.313E-01 5.123E-05 9.410E-01 3.116E-01 2.319E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
1.993E-07  4.313E-01 5.123E-05 9.411E-01 3.116E-01 2.319E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
3.488E-07  4.315E-01 5.122E-05 9.412E-01 3.116E-01 2.318E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
5.977E-07  4.317E-01 5.122E-05 9.414E-01 3.116E-01 2.317E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
9.958E-07  4.320E-01 5.117E-05 9.416E-01 3.115E-01 2.316E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
1.493E-06  4.325E-01 5.114E-05 9.420E-01 3.115E-01 2.314E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
2.486E-06  4.333E-01 5.107E-05 9.427E-01 3.114E-01 2.311E-05 6.883E-01 6.950E-01 2.877E+01 0.E+00     0.E+00
4.959E-06  4.355E-01 5.096E-05 9.444E-01 3.112E-01 2.302E-05 6.883E-01 6.950E-01 2.878E+01 0.E+00     0.E+00
9.869E-06  4.399E-01 5.054E-05 9.478E-01 3.109E-01 2.285E-05 6.882E-01 6.957E-01 2.878E+01 0.E+00     0.E+00
1.714E-05  4.467E-01 5.000E-05 9.738E-01 3.103E-01 2.259E-05 6.881E-01 6.957E-01 2.879E+01 0.E+00     0.E+00
2.438E-05  4.534E-01 4.960E-05 9.781E-01 3.098E-01 2.233E-05 6.880E-01 6.956E-01 2.880E+01 0.E+00     0.E+00
4.749E-05  4.722E-01 4.839E-05 9.919E-01 3.084E-01 2.165E-05 6.878E-01 6.954E-01 2.883E+01 0.E+00     0.E+00
7.447E-05  4.917E-01 4.767E-05 9.987E-01 3.077E-01 2.133E-05 6.877E-01 6.953E-01 2.883E+01 0.E+00     0.E+00
1.145E-04  4.835E-01 4.755E-05 1.000E+00 3.076E-01 2.127E-05 6.876E-01 6.953E-01 2.883E+01 0.E+00     0.E+00
```

DISTANCE FROM WALL,FT

```
0.E+00     9.957E-08 1.993E-07 3.488E-07 5.977E-07 9.958E-07 1.493E-06 2.486E-06 4.959E-06 9.869E-06
1.714E-05 2.438E-05 4.749E-05 7.447E-05 1.145E-04
```

ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA

```
CS         0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
HZ         0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
CO        -4.096E-01-4.096E-01-4.097E-01-4.097E-01-4.097E-01-4.097E-01-4.098E-01-4.099E-01-4.102E-01
          -4.107E-01-4.110E-01-4.116E-01-4.116E-01-4.114E-01
          -1.567E-03-1.566E-03-1.565E-03-1.563E-03-1.561E-03-1.557E-03-1.552E-03-1.543E-03-1.517E-03-1.453E-03
          -1.318E-03-1.097E-03-2.806E-04 1.620E-04 0.E+00
          -2.252E-05 5.031E-04-1.980E-05 5.030E-04-1.903E-05 5.036E-04-1.708E-05 5.101E-04 1.213E-05 6.313E-04
           3.297E-04 1.100E-03 7.083E-04-9.743E-05-8.502E-05
CO2        6.436E-01 6.436E-01 6.436E-01 6.437E-01 6.437E-01 6.437E-01 6.438E-01 6.439E-01 6.441E-01 6.446E-01
           6.452E-01 6.458E-01 6.467E-01 6.466E-01 6.464E-01
           2.462E-03 2.461E-03 2.459E-03 2.457E-03 2.453E-03 2.447E-03 2.429E-03 2.424E-03 2.383E-03 2.283E-03
           2.058E-03 1.724E-03 3.152E-04-2.559E-04 0.E+00
           3.530E-05-7.993E-04 2.986E-05-7.903E-04 2.989E-05-7.913E-04 2.684E-05-8.014E-04-1.905E-05-9.919E-04
          -9.141E-04-1.728E-03-1.113E-03 1.531E-04 1.336E-04
HZ         7.660E-01 7.660E-01 7.660E-01 7.660E-01 7.660E-01 7.660E-01 7.659E-01 7.658E-01 7.657E-01
           7.656E-01 7.652E-01 7.649E-01 7.649E-01 7.650E-01
          -8.958E-04-8.944E-04-8.939E-04-8.931E-04-8.917E-04-8.895E-04-8.867E-04-8.811E-04-8.664E-04-8.299E-04
          -7.483E-04-6.268E-04-1.146E-04 9.302E-05 0.E+00
          -1.246E-05 2.874E-04-1.086E-05 2.873E-04-1.087E-05 2.877E-04-9.758E-06 2.914E-04 6.926E-06 3.606E-04
           1.004E-04 6.283E-04 4.046E-04-5.565E-05-4.856E-05
```

MOLE FRACTIONS

```
CS         0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
HZ         0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
CO         0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
           0.E+00     0.E+00     0.E+00     0.E+00     0.E+00
```

CO2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
N2	7.636E-01	7.636E-01	7.636E-01	7.637E-01	7.637E-01	7.638E-01	7.638E-01	7.640E-01	7.644E-01	7.651E-01
	7.663E-01	7.673E-01	7.701E-01	7.715E-01	7.719E-01					
E-	2.832E-09	2.827E-09	2.808E-09	2.790E-09	2.761E-09	2.714E-09	2.656E-09	2.544E-09	2.282E-09	1.828E-09
	1.302E-09	9.279E-10	3.577E-10	2.199E-10	1.999E-10					
C	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
O	6.275E-03	6.263E-03	6.251E-03	6.233E-03	6.203E-03	6.156E-03	6.097E-03	5.980E-03	5.696E-03	5.156E-03
	4.428E-03	3.803E-03	2.475E-03	1.997E-03	1.903E-03					
N	1.571E-06	1.565E-06	1.559E-06	1.550E-06	1.536E-06	1.513E-06	1.485E-06	1.431E-06	1.302E-06	1.074E-06
	8.035E-07	5.970E-07	2.622E-07	1.725E-07	1.589E-07					
C3	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CH4	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CN	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CH	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CHN	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CHO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C2H2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CS2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CSOH	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HNO2 CIS	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HNO2 TRA	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H2O	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
NO	4.581E-02	4.578E-02	4.575E-02	4.571E-02	4.564E-02	4.553E-02	4.539E-02	4.510E-02	4.440E-02	4.299E-02
	4.091E-02	3.691E-02	3.374E-02	3.134E-02	3.088E-02					
O2	1.843E-01	1.843E-01	1.843E-01	1.844E-01	1.844E-01	1.845E-01	1.847E-01	1.849E-01	1.855E-01	1.867E-01
	1.884E-01	1.900E-01	1.937E-01	1.951E-01	1.953E-01					
CS+1	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C+	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H+1	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
N+	3.202E-21	3.168E-21	3.135E-21	3.085E-21	3.003E-21	2.877E-21	2.727E-21	2.448E-21	1.865E-21	1.072E-21
	4.602E-22	1.982E-22	1.873E-23	5.645E-24	4.465E-24					
O2-	3.535E-09	3.524E-09	3.513E-09	3.497E-09	3.469E-09	3.426E-09	3.372E-09	3.266E-09	3.014E-09	2.557E-09
	1.986E-09	1.541E-09	7.493E-10	5.166E-10	4.801E-10					
CO+	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
NO+	6.368E-09	6.344E-09	6.321E-09	6.287E-09	6.230E-09	6.139E-09	6.028E-09	5.810E-09	5.296E-09	4.385E-09
	3.288E-09	2.469E-09	1.107E-09	7.365E-10	6.800E-10					
O+	9.429E-17	9.352E-17	9.275E-17	9.162E-17	8.976E-17	8.685E-17	8.335E-17	7.673E-17	6.227E-17	4.071E-17
	2.129E-17	1.115E-17	1.822E-18	7.249E-19	6.052E-19					

CASE 1 - - - - - - - - - - - - STREAMWISE DIMENSION 0.18393E+01 FEET - - - -

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX.LIN ERROR	MAX ERRORS IN CONSERVATION EQS. MOMENTUM	ENERGY	CS	H2	CO	CO2	
1	7.25431	0.211	3.84000	0.4999	5E-02	17-5.9E+01	2 1.6E+03	11 2.2E-01	11 1.2E-01	11 4.2E+00	11-3.4E+00	0
2	15.75529	0.998	3.77561	0.0000	2E-02	17-2.9E+01	2 1.3E+03	11 1.1E-01	3-7.8E-02	11 2.1E+00	11-1.7E+00	0
3	24.09829	0.984	3.65081	0.0000	5E-03	6-3.6E+00	3-8.5E+02	3 1.4E-02	3-1.8E-01	3 1.9E-01	3-7.2E-02	0
4	32.33629	0.957	3.67021	0.0000	1E-03	5 9.0E+00	3-3.8E+02	3 9.4E-03	3-5.1E-02	2-9.9E-02	2 1.4E-01	0
5	39.87629	0.948	3.66701	0.0000	1E-03	6 1.1E+00	2-3.1E+02	3 3.3E-03	3-2.4E-02	2-6.6E-02	2 8.4E-02	0
6	47.18729	0.944	3.67051	0.0000	5E-04	6 4.5E-01	2-1.7E+02	2 2.2E-03	2 9.6E-03	2-4.9E-02	2 6.5E-02	0
7	54.32429	0.943	3.67301	0.0000	2E-04	6 1.0E-01	2-5.9E+01	2 1.4E-03	2 4.0E-03	2-2.2E-02	2 2.9E-02	0
8	61.42629	0.942	3.67381	0.0000	8E-05	18-3.9E-02	2-8.9E+00	2 5.1E-04	2 1.4E-03	2-6.3E-03	2 7.9E-03	0
9	68.52929	0.942	3.67391	0.0000	3E-05	18-1.6E-02	2 2.8E+00	2 9.4E-05	3 2.5E-04	2-5.9E-04	2 5.5E-04	0
10	75.63129	0.942	3.67391	0.0000	1E-05	18-6.4E-03	2 2.5E+00	2-1.4E-05	3 8.6E-05	2 4.9E-04	2-7.1E-04	0
11	82.69829	0.942	3.67381	0.0000	6E-06	18-2.6E-03	2 9.7E-01	2-1.8E-05	2-5.9E-05	2 3.3E-04	2-4.4E-04	0
12	89.72729	0.942	3.67381	0.0000	2E-06	18-1.1E-03	2 2.1E-01	2-7.9E-06	2-2.3E-05	2 1.1E-04	2-1.4E-04	0
13	96.79329	0.942	3.67381	0.0000	9E-07	18-4.3E-04	3-8.2E-03	2-2.0E-06	2-5.2E-06	2 1.9E-05	2-2.3E-05	0
14	103.82329	0.942	3.67381	0.0000	4E-07	18-1.7E-04	2-2.8E-02	3 1.4E-07	3-1.3E-06	2-3.0E-06	2 4.9E-06	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	DIFFUSIONAL	HEAT FLUXES TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
2.994E+01	5.272E-04	3.197E-01	2.613E+00	6.167E+03	-7.891E-03	7.782E-02	7.993E+02	7.993E+02	0.E+00	1.985E+02

WALL SHEAR (LB/SQ FT)	MECH REM	MASS FLUXES PYROL GAS (LB/SEC SQ FT)	CHAR	TOTAL GAS	ELEMENTAL MASS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
6.522E+01	0.E+00	0.E+00	0.E+00	0.E+00	-8.991E-08	3.285E-08	-9.819E-08	1.524E-07	2.893E-09

MOM TRANS COEFF, RHO*UE*CF/2	HEAT TRANS COEFF, RHO*UE*CH	BLOWING PARAMETERS (BASED ON CH) PYROL GAS	CHAR	TOTAL GAS	ELEMENTAL MASS TRANSFER COEFFICIENTS, RHOE*UE*CM (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
3.403E-01	3.554E-01	0.E+00	0.E+00	0.E+00	6.681E-06	-2.905E-07	-5.836E-07	-2.225E-05	-8.304E-09

MOMENTUM THICKNESS, THETA (FT)	DISPLACE. THICKNESS, DELSTAR (FT)	EFFECTIVE BODY DISPLACE. (FT)	ENTHALPY THICKNESS, LAMBDA (FT)	REYNOLDS NUMBER PER FOOT	MASS THICKNESSES (FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	CESIUM
-4.561E-03	-1.609E-03	-1.277E-04	1.971E-03	8.626E+06	8.435E-03	7.137E-03	6.309E-03	-9.166E-03	5.840E-03

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FTSQ)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.E+00	0.E+00	-3.803E+00	0.E+00	3.674E+00	6.522E+01	-9.783E+02	6.021E+03	5.301E+04	-9.783E+02	1.500E+03	5.264E+11
1.670E-05	5.988E-02	-3.813E+00	2.067E-01	2.790E+00	6.522E+01	-5.960E+02	5.524E+03	-6.959E+04	-6.284E+02	1.865E+03	4.721E+11
3.905E-05	1.198E-01	-3.786E+00	3.227E-01	1.336E+00	6.522E+01	-3.622E+02	2.745E+03	-2.322E+04	-4.413E+02	2.306E+03	4.245E+11
7.931E-05	2.096E-01	-3.753E+00	4.067E-01	6.594E-01	6.525E+01	-1.873E+02	1.396E+03	-6.817E+03	-3.129E+02	2.648E+03	3.962E+11
1.551E-04	3.593E-01	-3.686E+00	4.772E-01	3.421E-01	6.535E+01	-3.653E+01	7.383E+02	-1.973E+03	-2.095E+02	2.935E+03	3.763E+11
2.379E-04	5.988E-01	-3.564E+00	5.383E-01	1.930E-01	6.559E+01	9.608E+01	4.205E+02	-6.801E+02	-1.240E+02	3.180E+03	3.615E+11
4.650E-04	8.983E-01	-3.395E+00	5.847E-01	1.260E-01	6.595E+01	1.974E+02	2.755E+02	-2.885E+02	-6.232E+01	3.363E+03	3.515E+11
8.409E-04	1.497E+00	-3.027E+00	6.423E-01	7.551E-02	6.681E+01	3.229E+02	1.642E+02	-8.309E+01	9.613E+00	3.587E+03	3.404E+11
1.850E-03	2.994E+00	-1.938E+00	7.232E-01	3.385E-02	6.933E+01	4.965E+02	8.153E+01	-2.742E+01	9.929E+01	3.908E+03	3.261E+11
4.011E-03	5.988E+00	3.015E-01	8.034E-01	2.055E-02	7.500E+01	6.571E+02	3.890E+01	-1.061E+00	1.669E+02	4.244E+03	3.129E+11
7.431E-03	1.048E+01	4.113E+00	8.973E-01	2.230E-02	8.197E+01	8.237E+02	3.590E+01	-2.728E-01	2.122E+02	4.646E+03	2.991E+11
1.289E-02	1.497E+01	8.379E+00	9.986E-01	2.062E-02	8.240E+01	9.741E+02	2.923E+01	-2.701E+00	2.168E+02	4.676E+03	2.981E+11
1.945E-02	2.994E+01	2.431E+01	1.162E+00	5.019E-03	6.630E+01	1.189E+03	4.818E+00	-5.597E-01	1.642E+02	2.588E+03	4.007E+11
2.541E-02	4.791E+01	4.631E+01	1.219E+00	1.580E-03	5.302E+01	1.225E+03	1.367E+00	1.755E-01	9.698E+01	1.765E+03	4.853E+11
3.384E-02	7.485E+01	7.951E+01	1.247E+00	5.479E-04	4.455E+01	1.270E+03	0.E+00	-2.770E-01	8.894E+01	8.906E+02	6.831E+11

DISTANCE FROM WALL (FT)	DENSITY, RHO (LB/CU FT)	VISCOSITY, MU LB/SEC FT	RHO*MU /RHOE*MUE, C	SPECIFIC HEAT (BTU/LB R)	THERMAL COND (BTU /SEC FT R)	PRANDTL NUMBER	MODIFIED SCHMIDT NUMBER	MOLECULAR WEIGHT	RHOSQ*EPS /RHOE*MUE	MACH NUMBER
0.E+00	6.846E-02	2.228E-05	1.190E+00	2.978E-01	1.116E-05	5.948E-01	7.037E-01	2.870E+01	0.E+00	0.E+00
1.670E-05	5.048E-02	2.565E-05	1.010E+00	3.181E-01	1.495E-05	5.458E-01	7.032E-01	2.630E+01	5.571E-01	6.042E-01
3.905E-05	3.999E-02	2.949E-05	9.201E-01	3.327E-01	1.800E-05	5.452E-01	7.030E-01	2.577E+01	2.353E+00	8.324E-01
7.931E-05	3.456E-02	3.230E-05	8.709E-01	3.406E-01	2.014E-05	5.461E-01	7.030E-01	2.557E+01	5.703E+00	9.752E-01
1.551E-04	3.109E-02	3.456E-05	8.384E-01	3.455E-01	2.180E-05	5.479E-01	7.029E-01	2.551E+01	1.197E+01	1.086E+00
2.879E-04	2.869E-02	3.643E-05	8.155E-01	3.489E-01	2.311E-05	5.501E-01	7.029E-01	2.550E+01	2.197E+01	1.178E+00
4.650E-04	2.716E-02	3.780E-05	8.007E-01	3.510E-01	2.402E-05	5.523E-01	7.029E-01	2.552E+01	3.428E+01	1.246E+00
8.409E-04	2.553E-02	3.944E-05	7.855E-01	3.532E-01	2.503E-05	5.564E-01	7.028E-01	2.559E+01	5.853E+01	1.329E+00
1.850E-03	2.366E-02	4.173E-05	7.701E-01	3.549E-01	2.612E-05	5.671E-01	7.026E-01	2.584E+01	1.189E+02	1.446E+00
4.011E-03	2.224E-02	4.405E-05	7.642E-01	3.548E-01	2.655E-05	5.865E-01	7.023E-01	2.637E+01	2.439E+02	1.568E+00
7.431E-03	2.119E-02	4.673E-05	7.726E-01	3.514E-01	2.605E-05	6.293E-01	7.014E-01	2.751E+01	2.457E+02	1.742E+00
1.089E-02	2.209E-02	4.686E-05	8.077E-01	3.411E-01	2.403E-05	6.662E-01	6.997E-01	2.887E+01	2.671E+02	2.019E+00
1.945E-02	4.021E-02	3.158E-05	9.906E-01	2.983E-01	1.379E-05	6.832E-01	6.962E-01	2.908E+01	8.847E+02	2.995E+00
2.541E-02	5.877E-02	2.45 E-05	1.123E+00	2.810E-01	1.006E-05	6.844E-01	6.953E-01	2.898E+01	1.890E+03	3.755E+00
3.084E-02	1.160E-01	1.553E-05	1.410E+00	2.403E-01	5.472E-06	6.844E-01	6.940E-01	2.886E+01	5.450E+03	5.245E+00

DISTANCE FROM WALL,FT

0.E+00 1.670E-05 3.905E-05 7.931E-05 1.551E-04 2.879E-04 4.650E-04 8.409E-04 1.850E-03 4.011E-03
7.431E-03 1.089E-02 1.945E-02 2.541E-02 3.084E-02

ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA

CS
3.483E-02 3.044E-02 2.897E-02 2.858E-02 2.841E-02 2.826E-02 2.809E-02 2.775E-02 2.677E-02 2.481E-02
2.076E-02 1.493E-02 4.724E-03 2.645E-03 0.E+00
-7.544E-02-5.241E-02-9.563E-03-1.904E-03-7.596E-04-5.660E-04-5.551E-04-5.927E-04-6.645E-04-6.997E-04
-1.161E-03-1.256E-03-2.760E-04-8.021E-05 0.E+00
-5.610E-01 1.330E+00 1.345E-01 1.373E-02 1.556E-03 6.122E-05 1.101E-05-1.363E-04 4.033E-05-6.383E-05
-1.415E-04 9.916E-05 3.175E-05-9.953E-06 1.591E-05

H2
1.346E-02 1.346E-02 1.468E-02 1.523E-02 1.544E-02 1.549E-02 1.545E-02 1.532E-02 1.483E-02 1.377E-02
1.156E-02 8.338E-03 2.654E-03 1.491E-03 0.E+00
-7.826E-02 3.185E-02 1.190E-02 2.774E-03 5.377E-04-1.844E-05-1.772E-04-2.745E-04-3.487E-04-3.867E-04
-6.374E-04-6.966E-04-1.545E-04-4.509E-05 0.E+00
4.166E+00-4.890E-01-1.772E-01-2.608E-02-3.797E-03-8.472E-04-2.134E-04-1.113E-04 1.205E-05-3.339E-05
-8.094E-05 5.460E-05 1.781E-05-5.625E-06 8.971E-06

CO
1.041E-01 1.241E-01 1.276E-01 1.277E-01 1.268E-01 1.248E-01 1.220E-01 1.159E-01 9.766E-02 6.051E-02
-1.619E-02-1.270E-01-3.213E-01-3.609E-01-4.114E-01
5.838E-01 1.443E-01 1.097E-02-4.423E-03-7.417E-03-8.759E-03-9.720E-03-1.095E-02-1.252E-02-1.325E-02
-2.202E-02-2.387E-02-5.263E-03-1.531E-03 0.E+00
-1.049E+01-4.15[illegible]E+00-3.089E-01-3.394E-02-6.057E-03-5.142E-03-1.282E-03-2.[illegible]0E-03 7.095E-04-1.202E-03
-2.704E-03 1.880E-03 6.057E-04-1.902E-04 3.039E-04

CO2
2.508E-01 2.203E-01 2.126E-01 2.113E-01 2.118E-01 2.132E-01 2.155E-01 2.204E-01 2.351E-01 2.651E-01
3.271E-01 4.166E-01 5.736E-01 6.056E-01 6.464E-01
-7.025E-01-2.939E-01-3.647E-02-9.124E-04 5.143E-03 6.871E-03 7.779E-03 8.818E-03 1.011E-02 1.071E-02
1.780E-02 1.929E-02 4.252E-03 1.237E-03 0.E+00
5.765E+00 7.879E+00 7.203E-01 7.134E-02 9.553E-03 4.878E-03 1.183E-03 2.289E-03-5.697E-04 9.707E-04
2.187E-03-1.520E-03-4.893E-04 1.537E-04-2.455E-04

N2
5.963E-01 6.117E-01 6.162E-01 6.171E-01 6.176E-01 6.182E-01 6.190E-01 6.207E-01 6.256E-01 6.358E-01
6.568E-01 6.871E-01 7.403E-01 7.511E-01 7.650E-01
2.724E-01 1.696E-01 2.215E-02 4.465E-03 2.496E-03 2.472E-03 2.674E-03 2.994E-03 3.424E-03 3.628E-03
6.025E-03 5.531E-03 1.442E-03 4.197E-04 0.E+00
1.124E+00-4.556E+00-3.688E-01-2.505E-02-1.255E-03 1.049E-03 3.011E-04 7.673E-04-1.922E-04 3.285E-04
7.389E-04-5.138E-04-1.660E-04 5.217E-05-8.333E-05

MOLE FRACTIONS

CS
1.977E-04 8.570E-04 1.792E-03 2.475E-03 2.952E-03 3.270E-03 3.450E-03 3.599E-03 3.636E-03 3.404E-03
2.679E-03 1.413E-03 9.200E-07 5.030E-10 0.E+00

H2	7.024E-02	1.242E-01	1.222E-01	1.194E-01	1.162E-01	1.128E-01	1.096E-01	1.043E-01	9.157E-02	6.869E-02	
	3.031E-02	4.857E-03	4.791E-08	1.483E-12	0.E+00						
CO	7.780E-02	1.676E-01	1.847E-01	1.919E-01	1.958E-01	1.978E-01	1.981E-01	1.967E-01	1.889E-01	1.086E-01	
	1.147E-01	3.150E-02	1.333E-07	1.135E-12	0.E+00						
CO2	1.540E-01	7.936E-02	5.719E-02	4.748E-02	4.231E-02	3.938E-02	3.799E-02	3.730E-02	3.917E-02	4.722E-02	
	7.385E-02	1.109E-01	4.548E-02	2.541E-02	0.E+00						
N2	6.113E-01	5.742E-01	5.668E-01	5.634E-01	5.623E-01	5.626E-01	5.638E-01	5.669E-01	5.770E-01	5.984E-01	
	6.444E-01	7.042E-01	7.680E-01	7.770E-01	7.881E-01						
E-	0.E+00	2.847E-11	3.296E-09	4.345E-08	2.383E-07	7.940E-07	1.736E-06	4.052E-06	1.136E-05	2.739E-05	
	6.148E-05	4.729E-05	2.313E-10	0.E+00	0.E+00						
C	2.771E-37	1.236E-29	4.171E-24	4.252E-21	4.133E-19	1.047E-17	8.463E-17	7.945E-16	1.104E-14	8.414E-14	
	2.955E-13	1.752E-14	7.532E-34	4.900E-53	0.E+00						
K	1.785E-12	1.239E-09	1.755E-07	2.621E-06	1.568E-05	5.564E-05	1.266E-04	3.076E-04	8.897E-04	2.089E-03	
	3.808E-03	1.631E-03	1.084E-09	9.937E-16	0.E+00						
O	1.302E-26	1.576E-20	1.518E-15	7.876E-13	4.974E-11	9.509E-10	6.597E-09	5.586E-08	8.594E-07	1.196E-05	
	2.875E-04	1.840E-03	3.939E-07	2.200E-11	1.723E-24						
N	1.535E-27	1.014E-21	4.077E-17	1.321E-14	6.088E-13	9.228E-12	5.440E-11	3.760E-10	4.106E-09	3.433E-08	
	2.982E-07	3.595E-07	6.230E-15	5.162E-23	7.840E-48						
C3	6.683E-39	1.275E-32	3.412E-29	2.461E-27	4.075E-26	2.866E-25	9.721E-25	3.305E-24	1.014E-23	1.130E-23	
	1.171E-24	1.628E-28	1.815E-64	6.048E-99	0.E+00						
CH4	3.948E-02	7.054E-04	3.551E-06	1.919E-07	2.702E-08	6.539E-09	2.509E-09	8.255E-10	1.613E-10	2.018E-11	
	3.953E-13	4.742E-16	2.539E-32	8.016E-47	0.E+00						
CN	9.848E-24	2.587E-19	2.486E-16	1.035E-14	1.210E-13	6.824E-13	2.073E-12	6.714E-12	2.525E-11	6.129E-11	
	6.920E-11	3.965E-12	3.533E-27	6.701E-42	0.E+00						
CH	2.627E-32	4.683E-26	9.695E-22	2.131E-19	7.433E-18	9.043E-17	4.509E-16	2.476E-15	1.715E-14	6.463E-14	
	8.569E-14	1.958E-15	3.036E-35	1.454E-54	0.E+00						
CHN	3.125E-07	1.096E-06	7.418E-07	5.965E-07	5.121E-07	4.535E-07	4.112E-07	3.549E-07	2.536E-07	1.307E-07	
	2.387E-08	4.981E-10	2.387E-22	8.357E-34	0.E+00						
CHO	1.657E-10	6.995E-09	6.339E-08	2.058E-07	4.434E-07	7.570E-07	1.063E-06	1.511E-06	2.182E-06	2.560E-06	
	1.766E-06	1.997E-07	7.560E-17	8.763E-26	0.E+00						
C2	3.895E-42	3.452E-34	6.121E-29	4.333E-26	3.268E-24	6.809E-23	4.762E-22	3.632E-21	3.535E-20	1.446E-19	
	1.226E-19	3.600E-22	4.263E-51	2.798E-79	0.E+00						
C2H2	5.897E-12	2.983E-11	6.502E-12	2.791E-12	1.562E-12	1.004E-12	7.231E-13	4.647E-13	1.953E-13	4.269E-14	
	1.126E-15	4.439E-19	3.499E-43	1.601E-65	0.E+00						
CS2	1.983E-08	1.962E-07	1.588E-07	1.713E-07	1.668E-07	1.565E-07	1.462E-07	1.314E-07	1.059E-07	7.518E-08	
	3.758E-08	1.031E-08	2.586E-14	4.870E-20	0.E+00						
CSOH	7.334E-03	5.156E-03	3.826E-03	3.024E-03	2.499E-03	2.149E-03	1.940E-03	1.740E-03	1.557E-03	1.491E-03	
	1.558E-03	1.782E-03	1.033E-03	5.769E-04	0.E+00						
HNO2 CIS	1.344E-28	9.376E-24	1.952E-19	4.376E-17	1.592E-15	2.075E-14	1.134E-13	7.555E-13	9.302E-12	1.227E-10	
	3.710E-09	5.350E-08	2.453E-08	3.395E-09	0.E+00						
HNO2 TRA	1.812E-28	1.139E-23	2.395E-19	5.249E-17	1.881E-15	2.426E-14	1.316E-13	8.699E-13	1.061E-11	1.367E-10	
	4.156E-09	5.991E-08	2.953E-08	4.393E-09	0.E+00						
HO	5.166E-16	1.433E-12	1.141E-09	4.267E-08	4.675E-07	2.562E-06	7.822E-06	2.682E-05	1.306E-04	6.013E-04	
	3.636E-03	8.727E-03	2.038E-05	2.827E-08	0.E+00						
H2O	4.071E-02	4.736E-02	6.347E-02	7.231E-02	7.793E-02	8.200E-02	8.499E-02	8.908E-02	9.714E-02	1.094E-01	
	1.230E-01	1.085E-01	3.775E-02	2.114E-02	0.E+00						
NO	6.363E-19	5.548E-15	1.414E-11	1.009E-09	1.711E-08	1.287E-07	4.863E-07	2.126E-06	1.455E-05	9.984E-05	
	1.197E-03	7.627E-03	8.039E-04	2.619E-05	5.282E-10						
O2	6.565E-27	3.264E-21	3.887E-16	2.241E-13	1.521E-11	3.087E-10	2.253E-09	2.071E-08	3.886E-07	8.001E-06	
	4.816E-04	1.695E-02	1.469E-01	1.758E-01	2.119E-01						
CS+1	0.E+00	2.847E-11	3.296E-09	4.345E-08	2.383E-07	7.940E-07	1.736E-06	4.052E-06	1.136E-05	2.739E-05	
	6.150E-05	4.781E-05	1.417E-09	0.E+00	0.E+00						
C+	0.E+00	8.161E-73	1.113E-58	5.831E-51	7.665E-46	3.290E-42	7.590E-40	2.778E-37	3.630E-34	1.601E-31	
	3.706E-29	3.996E-30	2.360E-62	0.E+00	0.E+00						
H+1	0.E+00	1.277E-64	1.264E-51	1.601E-44	8.281E-40	1.849E-36	2.839E-34	6.830E-32	5.865E-29	2.200E-26	
	7.360E-24	6.141E-24	9.753E-47	0.E+00	0.E+00						
N+	0.E+00	2.1 7E-80	4.304E-64	3.384E-55	2.690E-49	4.178E-45	2.280E-42	2.202E-39	1.090E-35	2.115E-32	
	4.909E-29	1.182E-28	1.994E-54	0.E+00	0.E+00						
O2-	0.E+00	5.895E-29	1.165E-22	2.328E-19	4.769E-17	1.802E-15	1.950E-14	2.712E-13	8.240E-12	2.480E-10	
	1.988E-08	5.193E-07	1.186E-09	0.E+00	0.E+00						

CO+	0.E+00	1.581E-57	2.500E-46	3.259E-40	3.720E-36	2.837E-33	2.158E-31	2.415E-29	8.073E-27	1.325E-24	
	1.906E-22	1.029E-22	3.136E-45	0.E+00	0.E+00						
NO+	0.E+00	6.553E-49	9.347E-39	3.292E-33	1.595E-29	6.717E-27	3.533E-25	2.746E-23	6.706E-21	1.132E-18	
	3.773E-16	4.125E-15	8.657E-26	0.E+00	0.E+00						
O+	0.E+00	3.216E-75	1.693E-59	6.726E-51	3.465E-45	4.017E-41	1.837E-38	1.505E-35	6.689E-32	1.453E-28	
	6.266E-25	7.801E-24	5.029E-44	0.E+00	0.E+00						

2. CHECK CASE 2 - CONVENTIONAL REENTRY VEHICLE ANALYSIS

a. Vehicle Configuration

1) Geometry: Sphere-cone

a) Nose Radius: 1/2-inch

b) Cone half angle: 8 degrees

c) Length (streamwise): 7.0922 feet

2) Heatshield

a) ATJ graphite from nose tip to .864 feet streamwise distance

b) Phenolic carbon (composition as specified in NASA CR-72301, Aerotherm Report No. 67-15) between streamwise distances of .865 feet and 7.0922 feet

c) Contamination: 100 PPM by weight sodium Na in graphite and phenolic carbon

b. Wall Boundary Conditions

1) Mass Ablation Rate: See Case II input cards

2) Wall Temperature: See Case II input cards

c. Free Stream Properties

1) Altitude: 10,000 feet

2) Velocity: 14,000 feet/second

3) Density: .05648 lb/ft^3

4) Enthalpy: 115.364 Btu/lb (ref. to 0°K)
(static, -12.832 Btu/lb, ref. to 298°K)

5) Pressure: .6880 atm

6) Mach No.: 12.994

d. Shock Data

1) Local Pressure Ratio: See Case II input cards

2) Stagnation Conditions (from inviscid flow solution):

a) Pressure: 149.91 atm

b) Enthalpy: 3903.3 Btu/lb (ref. to 298°K)

3) Freestream stream function position vs. shock angle: See Case II input cards

e. Input Cards

```
10203020210202      CHECK CASE 2 - REENTRY VEHICLE
blank card
 5        1111111111111111111111122222222222222222
 1
 1.
39
0.        .004      .008      .013      .017      .025      .035      .045
.055      .059632   .063      .068      .075      .086      .098      .120
.150      .21       .31       .4417     .60       -.864     -.865     1.0
1.2857    1.50      1.7065    2.1272    2.548     2.9687    3.3895    3.8103
4.231     5.0725    5.9141    6.75      6.80      6.9239    7.0922
15
0.        .002      .004      .007      .012      .020      .030      .050
.10       .2        .35       .5        1.0       1.6       2.5
13 .95
8.0       .04166667
-.04166667
          .04126

2 blank cards
                                                                1.02
149.91
3903.3
 .
0.44      11.823    .018      .9        .9        300.
1000.
  6
  1HYDROGEN    1.008                                    -.0209+6
  6 CARBON     12.011                    -1.    +6      -.9236+6
  7NITROGEN    14.008    -.765
  8 OXYGEN     16.000    -.235                          -.0554+6
 11 SODIUM     22.991                    -1.            -1.
 99ELECTRON    0.00055
  1001                                    JANAF 12/60                    H
 521020+5 134230+5 480223+1 555469-4 173095+6 388620+2  500. 3000.1   0.H
 521020+5 134230+5 308752+1 315025-3 929744+7 388620+2 3000. 5000.1   0.H
  1006                                    JANAF 03/61                    C
 170886+6 135500+5 444433+1 228125-3 409830+6 492870+2  500. 3000.1   0.C
 170886+6 135500+5 412212+1 261908-3 262886+7 492870+2 3000. 5000.1   0.C
  1 11  0  0  0  0  0                     JANAF  06/62      AFWL - WRS  NA
 257350+5 134670+5 481002+1 916143-4 372315+5 482000+2   500  30001     NA
 257350+5 134670+5-122836+2 344219-2 634141+8 482000+2  3000  60001     NA
  2008                                    JANAF 03/61                    O2
      -  234460+5 804370+1 510872-3-152718+6 679730+2  500. 3000.1   0.O2
      -  234460+5 103071+2 290991-4-783079+7 679730+2 3000. 5000.1   0.O2
  2007                                    JANAF 03/61                    N2
      -  221650+5 862699+1 116090-3-103715+7 637650+2  500. 3000.1   0.N2
      -  221650+5 984175+1-116232-3-612728+7 637650+2 3000. 5000.1   0.N2
 01001 01 06                              JANAF 03/61                    CH
 142006+6 221300+5 826079+1 302211-3-100184+7 616120+2  500. 3000.1   0.CH
 142006+6 221300+5 707091+1 463281-3 552860+7 616120+2 3000. 5000.1   0.CH
  1001 01 06 01 07                        JANAF 03/61                    CHN
 312000+5 355930+5 137023+2 552243-3-228955+7 758620+2  500. 3000.1   0.CHN
 312000+5 355930+5 178895+2-295052-3-183671+8 758620+2 3000. 5000.1   0.CHN
  1001 01 06 01 07 01 08                  JANAF 12/60                    CHNO
```

```
-279000+5 461930+5 179701+2 469024-3-200904+7 928990+2  500. 3000.1   0.CHNO
-279000+5 461930+5 210167+2-229915-3-105568+8 928990+2 3000. 5000.1   0.CHNO
  1001 01 06 01 08                          JANAF 03/61                   CHO
-290000+4 323670+5 128033+2 300638-3-201721+7 789830+2  500. 3000.1   0.CHO
-290000+4 323670+5 103028+2 633312-3 121615+8 789830+2 3000. 5000.1   0.CHO
  2001 01 06                                JANAF 12/62                   CH2
 950000+5 329960+5 132894+2 413822-3-290273+7 684940+2  500. 3000.1   0.CH2
 950000+5 329960+5 140728+2 132150-3-239493+7 684940+2 3000. 5000.1   0.CH2
  2001 01 06 01 08                          JANAF 03/61                   CH2O
-277000+5 437910+5 184022+2 379921-3-431982+7 848830+2  500. 3000.1   0.CH2O
-277000+5 437910+5 189628+2 161963-3-372770+7 848880+2 3000. 5000.1   0.CH2O
  4001 01 06                                JANAF 03/61                   CH4
-178950+5 530790+5 230948+2 677896-3-755061+7 825970+2  500. 3000.1   0.CH4
-178950+5 530790+5 236053+2 374323-3-368234+7 825970+2 3000. 5000.1   0.CH4
  1006 01 07                                JANAF 12/62                   CN
 109000+6 232490+5 655906+1 115326-2 479517+6 669760+2  500. 3000.1   0.CN
 109000+6 232490+5 988013+1 313855-3-649453+7 669760+2 3000. 5000.1   0.CN
  1  6  1  7  1 11  0  0  0  0  0  *  0  0JANAF  03/66      AFWL - WRS  CNNA
 225300+5 380100+5 138804+2 331050-3-381026+6 894600+2   500  30001     CNNA
 225300+5 380100+5 143691+2 778244-4 167248+7 894600+2  3000  50001     CNNA
  1006 01 08                                JANAF 03/61                   CO
-264170+5 223570+5 865040+1 117021-3-898211+6 653700+2  500. 3000.1   0.CO
-264170+5 223570+5 115496+2-424139-3-131563+8 653700+2 3000. 5000.1   0.CO
  1006 02 08                                JANAF 03/61                   CO2
-940540+5 365350+5 144559+2 210386-3-182392+7 798480+2  500. 3000.1   0.CO2
-940540+5 365350+5 156451+2-381561-4-602768+7 798480+2 3000. 5000.1   0.CO2
002006                                      JANAF 9/61                    C2
 198999+6 246990+5 776612+1 696081-3 185649+6 685519+2  500. 3000.1   0.C2
 198999+6 246990+5 104162+2 566841-4-640205+7 685519+2 3000. 5000.1   0.C2
  10 1  2  6                                DUFF BAUER 6/61               C2H
 117395+6 349620+5 134210+2 469100-3-187509+7 781140+2  500. 3000.1   0.C2H
 117395+6 349620+5 148516+2 109402-3-503862+7 781140+2 3000. 5000.1   0.C2H
  2001 02 06                                JANAF 03/61                   C2H2
 541900+5 482570+5 189960+2 769044-3-409039+7 849690+2  500. 3000.1   0.C2H2
 541900+5 482570+5 203952+2 389062-3-645297+7 849690+2 3000. 5000.1   0.C2H2
  4001 02 06                                JANAF 12/60                   C2H4
 124960+5 676830+5 294887+2 526568-3-865313+7 101790+3  500. 3000.1   0.C2H4
 124960+5 676830+5 313872+2 616238-4-131858+8 101790+3 3000. 5000.1   0.C2H4
002006002007                                JANAF 3/61                    C2N2
 738699+5 511070+5 188740+2 559856-3-896273+6 985479+2  500. 3000.1   0.C2N2
 738699+5 511070+5 208204+2 630229-5-346865+7 985479+2 3000. 5000.1   0.C2N2
  3006                                      JANAF 12/60                   C3
 189670+6 366220+5 146441+2 622536-4-168227+7 798410+2  500. 3000.1   0.C3
 189670+6 366220+5 144782+2 792232-4-646877+6 798410+2 3000. 5000.1   0.C3
  1001 01 07                                JANAF 12/60                   HN
 792000+5 217660+5 823133+1 281555-3-126695+7 609290+2  500. 3000.1   0.HN
 792000+5 217660+5 765457+1 359853-3 180773+7 609290+2 3000. 5000.1   0.HN
  1  1  1 11  0  0  0  0  0  0  *          JANAF  03/63      AFWL - WRS  HNA
 297000+5 242590+5 874435+1 298020-3-260114+6 648020+2   500  30001     HNA
 297000+5 242590+5 849472+1 295812-3 234538+7 648020+2  3000  50001     HNA
  1  1  1  8  1 11  0  0  0  0  0  *  0  0JANAF  03/66      AFWL - WRS  HNAO
-504000+5 331100+5 114447+2 722585-3-402755+6 830870+2   500  30001     HNAO
-504000+5 331100+5 127321+2 169608-3 257273+7 830870+2  3000  50001     HNAO
  1001 01 07 01 08                          JANAF 12/60                   HNO
 238000+5 327550+5 133320+2 122061-3-232403+7 783850+2  500. 3000.1   0.HNO
 238000+5 327550+5 141523+2-470424-4-469135+7 783850+2 3000. 5000.1   0.HNO
```

```
  1001 01 08                                  JANAF 12/60                    HO
 933000+4 214040+5 773193+1 394386-3-973561+6 613820+2  500. 3000.1   0.HO
 933000+4 214040+5 965144+1-443528-4-686115+7 613820+2 3000. 5000.1   0.HO
  2001                                        JANAF 03/61                    H2
       -  212100+5 711963+1 621950-3-712694+6 484650+2  500. 3000.1   0.H2
       -  212100+5 681794+1 589854-3 265106+7 484650+2 3000. 5000.1   0.H2
002001001007                                  JANAF 12/65                    H2N
 400999+5 305799+5 975862+1 114401-2-518970+6 701550+2  500. 3000.1   0.H2N
 400999+5 305799+5 137419+2 229493-4-610024+7 7 1580+2 3000. 5000.1   0.H2N
  2  1  2  7  0  0  0  0  0  *                T666 LIBRARY                   H2N2
 509000+5 437709+5 173547+2 682286-3-325379+7 851033+2   500  30001     H2N2
 509000+5 437709+5 186269+2 195007-3-154736+7 851033+2  3000  50001     H2N2
  2001 01 08                                  JANAF 03/61                    H2O
-577980+5 302010+5 112254+2 811397-3-260800+7 684210+2  500. 3000.1   0.H2O
-577980+5 302010+5 157278+2-191548-3-173599+8 684210+2 3000. 5000.1   0.H2O
003001001007                                  JANAF 09/65                    H3N
-109700+5 416309+5 125186+2 219670-2-978531+6 769080+2  500. 3000.1   0.H3N
-109700+5 416309+5 166320+2 923148-3-361337+7 769080+2 3000. 5000.1   0.H3N
004001002007                                  JANAF 12/65                    H4N2
 227899+5 685359+5 229856+2 241933-2-195931+7 108099+3  500. 3000.1   0.H4N2
 227899+5 685359+5 314319+2 437945-4-139705+8 108099+3 3000. 5000.1   0.H4N2
  1  8  1 11  0  0  0  0  0                  JANAF  12/60      AFWL - WRS   NAO
 132000+5 243470+5 891381+1 138113-3-123218+6 743820+2   500  30001     NAO
 132000+5 243470+5 873051+1 159255-3 116133+7 743820+2  3000  50001     NAO
  2 11  0  0  0  0  0                         JANAF  06/62      AFWL - WRS   NA2
 549980+5 258510+5 894240+1 385123-3-845826+4 766340+2   500  30001     NA2
 549980+5 258510+5 840237+1 464003-3 334031+7 766340+2  3000  50001     NA2
  1007                                        JANAF 03/61                    N
 112965+6 134370+5 486944+1 383516-4 958460+5 480900+2  500. 3000.1   0.N
 112965+6 134370+5 428957+1 240844-3-417273+6 480900+2 3000. 5000.1   0.N
  1007 01 08                                  JANAF 06/63                    NO
 215800+5 227000+5 877623+1 899031-4-789656+6 688490+2  500. 3000.1   0.NO
 215800+5 227000+5 916260+1 657885-5-212519+7 688490+2 3000. 5000.1   0.NO
  1007 02 08                                  JANAF 06/63                    NO2
 801100+4 345800+5 137819+2 315611-4-133765+7 848890+2  500. 3000.1   0.NO2
 801100+4 345800+5 130154+2 172586-3 175340+7 848890+2 3000. 5000.1   0.NO2
001007003008                                  JANAF 12/64                    NO3
 170000+5 498219+5 192301+2 191161-3-112129+7 998970+2  500. 3000.1   0.NO3
 170000+5 498219+5 198709+2 577142-7-172913+7 998970+2 3000. 5000.1   0.NO3
  2007 01 08                                  JANAF 12/60                    N2O
 195000+5 365450+5 144686+2 120489-3-153478+7 815900+2  500. 3000.1   0.N2O
 195000+5 365450+5 123036+2 459018-3 942382+7 815900+2 3000. 5000.1   0.N2O
002007003008                                  JANAF 12/64                    N2O3
 197999+5 617799+5 232121+2 477580-3-124103+7 123217+3  500. 3000.1   0.N2O3
 197999+5 617799+5 248304+2 102872-5-293892+7 123217+3 3000. 5000.1   0.N2O3
002007004008                                  JANAF 9/64                     N2O4
 216999+4 785969+5 297734+2 594431-3-178833+7 134908+3  500. 3000.1   0.N2O4
 216999+4 785969+5 317815+2 175630-5-385969+7 134908+3 3000. 5000.1   0.N2O4
002007005008                                  JANAF 12/64                    N2O5
 216999+4 915759+5 353051+2 147295-3-163850+7 156719+3  500. 3000.1   0.N2O5
 216999+4 915759+5 357365+2 624545-5-171267+7 156719+3 3000. 5000.1   0.N2O5
  1008                                        JANAF 06/62                    O
 595590+5 135220+5 497228+1 380768-5 154749+5 500960+2  500. 3000.1   0.O
 595590+5 135220+5 657489+1-224268-3-891782+7 500960+2 3000. 5000.1   0.O
  1 99                                        JANAF   05/65     AFWL - JEF   O-
 0        134230+5 496800+1 215333-5 262860-6 164590+2   500  30001     O-
```

```
 0          134230+5 496800+1-232368-6-986224-6 164590+2  3000  50001      E-
  1  6 -1 99  0  0  0  0  0  0              AFWL TDR 64-44 NORM TO 298 JEFC+1
 432426+6 134352+5 496355+1-130999-6 338973+4 484318+2   500  30001    C+1
 432426+6 134352+5 495164+1 323814-5 646115+5 484318+2  3000  50001    C+1
 01 11 -1 99                                                              NA+
+14383 +6+134231+5+49681 +1                    +468068+2 00500 060001      NA+
+14383 +6+134231+5+49681 +1                    +468068+2 00500 060001      NA+
  1  7  1  8 -1 99                          JANAF  06/66       AFWL - WRS  NO+
 236660+6 221500+5 774529+1 418339-3-269762+6 653320+2   500  30001      NO+
 236660+6 221500+5 829583+1 130026-3 219401+7 653320+2  3000  50001      NO+
  1  8  1 99                                JANAF  06/65       AFWL - WRS  O-
 243000+5 134820+5 496695+1 691566-6 198781+5 492850+2   500  30001      O-
 243000+5 134820+5 496947+1-180032-6 138583+5 492850+2  3000  50001      O-
  1  6  1 99  0 -0  0 -0  0 --    -     - JANAF   09-65      AFWL-NV     C-
 140500+6 134370+5 491212+1 321368-4 132546+5 476310+2   500  30001      C-
 140500+6 134370+5 244233+1 573167-3 763348+7 476310+2  3000  60001      C-
  1  1 -1 99  0 -0  0 -0  0 -0  * -     - AFWL TDR 64-44 NORM TO 298 JEFH+1
 367161+6 134226+5 496793+1-596238-5-304069-6 374820+2   500  30001      H+1
 367161+6 134226+5 496793+1-267224-5-113416-4 374820+2  3000  50001      H+1
  1  1  1  8  1 99  0 -0  0 -0  0 -0  0 -0JANAF   3-66       AFWL-NV     HO-1
-344000+5 213240+5 674982+1 719851-3-638922+5 585820+2   500  30001      HO-1
-344000+5 213240+5 781605+1 250452-3 287562+7 585820+2  3000  60001      HO-1
  3  1  1  8 -1 99  0  0  0  0  0  0  0  0JANAF  06/66       AFWL - WRS  H3O+1
 138900+6 402930+5 118547+2 235311-2-916440+6 759010+2   500  30001      H3O+1
 138900+6 402930+5 163099+2 505835-3 773556+7 759010+2  3000  60001      H3O+1
  1  7 -1 99  0  0  0  0  0  0  *          AFWL TDR 64-44 NORM TO 298 JEFN+1
 449589+6 134721+5 489332+1 338126-4 563287+5 497019+2   500  30001      N+1
 449589+6 134721+5 451805+1 137668-3 629698+6 497019+2  3000  50001      N+1
  1  7  2  8  1 99  0 -0  0 -0  0 -0  0 -0JANAF   12-65      AFWL-NV     NO2-
-859000+5 350150+5 133480+2 190394-3-710004+6 845930+2   500  30001      NO2-
-859000+5 350150+5 135346+2 548795-4 105301+7 845930+2  3000  60001      NO2-
  2  7 -1 99  0 -0  0 -0  0 -0    -     - BROWNE  EPTM-3 SWAG AFWL-NV   N2+1
 359306+6 252240+5 695358+1 103235-2-983877+5 656860+2   500  30001      N2+1
 359306+6 252240+5 106438+2 903548-4-518734+7 656860+2  3000  50001      N2+1
  1  8 -1 99  0  0  0  0  0  0  *          AFWL TDR 64-44 NORM TO 298 JEFO+1
 375070+6 134238+5 496452+1 154756-5 240632+4 484812+2   500  30001      O+1
 375070+6 134238+5 426730+1 146410-3 236616+7 484812+2  3000  50001      O+1
  2  8 -1 99                                BROWNE  EPTM-3     AFWL-NV     O2+1
 231480+6 237199+5 821253+1 295407-3-317905+6 677520+2   500  30001      O2+1
 231480+6 237199+5 759256+1 307058-3 439516+7 677520+2  3000  50001      O2+1
  2  8  1 99                                JANAF  12/66       AFWL - WRS  O2-
-113900+5 235850+5 874295+1 147731-3-260657+6 693050+2   500  30001  15 O2-
-113900+5 235850+5 848680+1 160340-3 168458+7 693050+2  3000  60001  15 O2-
blank card
18 14300. .05648    -12.832   .6880
F 0.      .019571   .039142   .059170   .08009    .10147    .12165    .13936
.17072    .20123    .24552    .30143    .39947    .49975    .60781    .80271
.99494    1.4552
R 0.      .3563     .6931     .9471     1.1387    1.2418    1.3012    1.3370
1.3768    1.3933    1.4109    1.4249    1.4323    1.4166    1.4065    1.4011
1.4009    1.4011
blank card
1.00      .9891     .95637    .88795    .81501    .63932    .40627    .21039
.099156   .065578   .063805   .061907   .059205   .055102   .051021   .044704
.038409   .030425   .023982   .020536   .019076   .019064   .019048   .019511
.021154   .022582   .023870   .026026   .027384   .027964   .027971   .027[illegible]
```

.027754	.027659	.027633	.027647	.027649	.027652	.027656

7 blank cards

7986.	7999.	7974.	7956.	7913.	7798.	7766.	7552.
7251.	7083.	7055.	7028.	6995.	6956.	6919.	6836.
6748.	6595.	6362.	6255.	6176.	6155.	5994.	5955.
5990.	6031.	6066.	6106.	6085.	6102.	6109.	6071.
6076.	6083.	6089.	6040.	6041.	6043.	6046.	

11 blank cards

.4759	.5058	.4733	.4896	.4399	.3586	.8041	.5501
.2908	.1919	.1789	.1711	.1621	.1519	.1420	.1245
.1085	.08643	.06598	.05764	.05383	.05393	.06729	.07112
.07794	.08571	.09429	.1110	.1161	.1218	.1226	.1157
.1160	.1157	.1148	.1071	.1074	.1078	.1032	

blank card

.

.

(end-of-file card)

f. Computer Output

The first and last points of the boundary layer edge and shock thermodynamic state output are presented. The boundary layer solutions for the stagnation point and for one station on the afterbody are also included.

```
          BOUNDARY LAYER INTEGRAL MATRIX PROGRAM (BLIMP)

      AEROTHERM CORPORATION,PALO ALTO,CALIF (RMK,EPB)

CASE CHECK CASE 2 - REENTRY VEHICLE

      CONTROL NUMBERS  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20

                       1  0  2  0  3  0  2  0  2  1  0  2  0  2 -0 -0 -0 -0 -0 -0

      PUNCH CONTROL
      IDENT  JSPEC
                -0

   U/UE TO        NODAL PT.                                  ETA VALUES
  NORM. ETA       AT WHICH
                  ETA NORM.
  9.500E-01          13        0.E+00    2.000E-03 4.000E-03 7.000E-03 1.200E-02 2.000E-02 3.000E-02 5.000E-02 1.000E-01
                               2.000E-01 3.500E-01 5.000E-01 1.000E+00 1.600E+00 2.500E+00

 NOSE RADIUS,FT  4.16667E-02     CONE HALF ANGLE  8.00000E+00 DEGREES

CASE                      2.00000E+00

TOTAL ENTHALPY,BTU/LB     3.90330E+03

TOTAL PRESSURE,ATM        1.49910E+02

INCIDENT RAD FLUX,B/SF2 0.E+00

    MIXING LENGTH CONSTANT  = 4.4000E-01
    SUBLAYER CONSTANT, YA+  = 1.1823E+01
    CLAUSER NUMBER          = 1.8000E-02
    TURBULENT SCHMIDT NUMBER= 9.0000E-01
    TURBULENT PRANDTL NUMBER= 9.0000E-01
    TRANSITION MOM.THICK.RE = 3.0000E+02
```

CASE 2 -

RELATIVE ELEMENTAL COMPOSITIONS, ATOMIC WTS/UNIT MASS

AT.NO.	ELEMENT	ATOMIC WT	EDGE GAS	PYRO.GAS 1	CHAR 1	PYRO.GAS 2	CHAR 2	PYRO.GAS 3	CHAR 3
1	HYDROGEN	1.00800	0.0000000	-0.0000000	0.0000000	-0.0000000	00.0207362	-0.0000000	-0.0000000
6	CARBON	12.01100	0.0000000	-0.0000000	00.0832559	-0.0000000	00.0769038	-0.0000000	-0.0000000
7	NITROGEN	14.00800	00.0546117	-0.0000000	0.0000000	-0.0000000	0.0000000	-0.0000000	-0.0000000
8	OXYGEN	16.00000	00.0146875	-0.0000000	0.0000000	-0.0000000	00.0034620	-0.0000000	-0.0000000
11	SODIUM	22.99100	0.0000000	-0.0000000	00.0000000	-0.0000000	00.0000000	-0.0000000	-0.0000000
99	ELECTRON	00.00055	0.0000000	-0.0000000	0.0000000	-0.0000000	0.0000000	-0.0000000	-0.0000000

THERMODYNAMIC PROPERTY CURVE-FIT DATA (SEE MANUAL FOR FORMAT)

```
1.  1-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    H
 0.52102E+05 0.13423E+05 0.48022E+01 0.55547E-04 0.17310E+06 0.38862E+02  500.0000  3000.0000 1
 0.52102E+05 0.13423E+05 0.30875E+01 0.31503E-03 0.92974E+07 0.38862E+02 3000.0000  5000.0000 1
1.  6-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    C
 0.17089E+06 0.13550E+05 0.44443E+01 0.22813E-03 0.40980E+06 0.49287E+02  500.0000  3000.0000 1
 0.17089E+06 0.13550E+05 0.41221E+01 0.26191E-03 0.26289E+07 0.49287E+02 3000.0000  5000.0000 1
1. 11 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF  06/62        AFWL - WRS  NA
 0.25735E+05 0.13467E+05 0.48100E+01 0.31614E-04 0.37231E+05 0.48200E+02  500.0000  3000.0000 1
 0.25735E+05 0.13467E+05-0.12284E+02 0.34422E-02 0.63414E+08 0.48200E+02 3000.0000  6000.0000 1
2.  8-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    O2
 0.E+00      0.23446E+05 0.80437E+01 0.51087E-03-0.15272E+06 0.67973E+02  500.0000  3000.0000 1
 0.E+00      0.23446E+05 0.10307E+02 0.29099E-04-0.78308E+07 0.67973E+02 3000.0000  5000.0000 1
2.  7-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    N2
 0.E+00      0.22165E+05 0.86270E+01 0.11609E-03-0.10371E+07 0.63765E+02  500.0000  3000.0000 1
 0.E+00      0.22165E+05 0.98417E+01-0.11623E-03-0.61273E+07 0.63765E+02 3000.0000  5000.0000 1
1.  1 1.  6-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61              CH
 0.14201E+06 0.22130E+05 0.82608E+01 0.30221E-03-0.10018E+07 0.61612E+02  500.0000  3000.0000 1
 0.14201E+06 0.22130E+05 0.70709E+01 0.46328E-03 0.55286E+07 0.61612E+02 3000.0000  5000.0000 1
1.  1 1.  6 1.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61              CHN
 0.31200E+05 0.35593E+05 0.13702E+02 0.55224E-03-0.22895E+07 0.75862E+02  500.0000  3000.0000 1
 0.31200E+05 0.35593E+05 0.17889E+02-0.29505E-03-0.18367E+08 0.75862E+02 3000.0000  5000.0000 1
1.  1 1.  6 1.  7 1.  8-0. -0-0. -0-0. -0JANAF 12/60                    CHNO
-0.27900E+05 0.46193E+05 0.17970E+02 0.46902E-03-0.20090E+07 0.92899E+02  500.0000  3000.0000 1
-0.27900E+05 0.46193E+05 0.21017E+02-0.22991E-03-0.10557E+08 0.92899E+02 3000.0000  5000.0000 1
1.  1 1.  6 1.  8-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    CHO
-0.29000E+04 0.32367E+05 0.12803E+02 0.30064E-03-0.20172E+07 0.78983E+02  500.0000  3000.0000 1
-0.29000E+04 0.32367E+05 0.10303E+02 0.63331E-03 0.12161E+08 0.78983E+02 3000.0000  5000.0000 1
2.  1 1.  6-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/62                    CH2
 0.95000E+05 0.32996E+05 0.13289E+02 0.41382E-03-0.29027E+07 0.68494E+02  500.0000  3000.0000 1
 0.95000E+05 0.32996E+05 0.14073E+02 0.13215E-03-0.23949E+07 0.68494E+02 3000.0000  5000.0000 1
2.  1 1.  6 1.  8-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    CH2O
-0.27700E+05 0.43791E+05 0.18402E+02 0.37992E-03-0.43198E+07 0.84888E+02  500.0000  3000.0000 1
-0.27700E+05 0.43791E+05 0.13963E+02 0.16196E-03-0.37277E+07 0.84888E+02 3000.0000  5000.0000 1
4.  1 1.  6-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    CH4
-0.17895E+05 0.53079E+05 0.23395E+02 0.67790E-03-0.75506E+07 0.82597E+02  500.0000  3000.0000 1
-0.17895E+05 0.53079E+05 0.23605E+02 0.37432E-03-0.36823E+07 0.82597E+02 3000.0000  5000.0000 1
1.  6 1.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/62                    CN
 0.10900E+06 0.23249E+05 0.65591E+01 0.11533E-02 0.47952E+06 0.66976E+02  500.0000  3000.0000 1
 0.10900E+06 0.23249E+05 0.98801E+01 0.31386E-03-0.64945E+07 0.66976E+02 3000.0000  5000.0000 1
1.  6 1.  7 1. 11 0.  0 0.  0 0.  0 0.  0JANAF  03/66        AFWL - WRS  CNNA
 0.22530E+05 0.38010E+05 0.13880E+02 0.33105E-03-0.38103E+06 0.89460E+02  500.0000  3000.0000 1
 0.22530E+05 0.38010E+05 0.14369E+02 0.77824E-04 0.16725E+07 0.89460E+02 3000.0000  5000.0000 1
1.  6 1.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    CO
-0.26417E+05 0.22357E+05 0.36504E+01 0.11702E-03-0.89821E+06 0.65370E+02  500.0000  3000.0000 1
-0.26417E+05 0.22357E+05 0.11550E+02-0.42414E-03-0.13156E+08 0.65370E+02 3000.0000  5000.0000 1
```

```
1.  6 2.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    CO2
-0.94054E+05 0.36535E+05 0.14456E+02 0.21039E-03-0.18239E+07 0.79848E+02  500.0000  3000.0000 1
-0.94054E+05 0.36535E+05 0.13645E+02-0.38156E-04-0.60277E+07 0.79848E+02 3000.0000  5000.0000 1
2.  6-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 9/61                     C2
 0.19900E+06 0.24699E+05 0.77561E+01 0.69608E-03 0.18565E+06 0.68552E+02  500.0000  3000.0000 1
 0.19900E+06 0.24699E+05 0.10416E+02 0.56684E-04-0.64020E+07 0.68552E+02 3000.0000  5000.0000 1
1.  1 2.  6-0. -0-0. -0-0. -0-0. -0-0. -0DUFF BAUER 6/61                C2H
 0.11740E+06 0.34962E+05 0.13421E+02 0.46910E-03-0.18751E+07 0.78114E+02  500.0000  3000.0000 1
 0.11740E+06 0.34962E+05 0.14852E+02 0.10940E-03-0.50386E+07 0.78114E+02 3000.0000  5000.0000 1
2.  1 2.  6-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    C2H2
 0.54190E+05 0.48257E+05 0.18996E+02 0.76904E-03-0.40904E+07 0.84969E+02  500.0000  3000.0000 1
 0.54190E+05 0.48257E+05 0.20395E+02 0.38906E-03-0.64530E+07 0.84969E+02 3000.0000  5000.0000 1
4.  1 2.  6-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    C2H4
 0.12496E+05 0.67683E+05 0.29489E+02 0.52657E-03-0.86531E+07 0.10179E+03  500.0000  3000.0000 1
 0.12496E+05 0.67683E+05 0.31387E+02 0.61624E-04-0.13186E+08 0.10179E+03 3000.0000  5000.0000 1
2.  6 2.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 3/61                     C2N2
 0.73870E+05 0.51107E+05 0.18874E+02 0.55986E-03-0.89687E+06 0.98548E+02  500.0000  3000.0000 1
 0.73870E+05 0.51107E+05 0.20820E+02 0.63023E-03-0.34686E+07 0.98548E+02 3000.0000  5000.0000 1
3.  6-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    C3
 0.18967E+06 0.36622E+05 0.14644E+02 0.62254E-04-0.16823E+07 0.79841E+02  500.0000  3000.0000 1
 0.18967E+06 0.36622E+05 0.14478E+02 0.79223E-04-0.64608E+06 0.79841E+02 3000.0000  5000.0000 1
1.  1 1.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    HN
 0.79200E+05 0.21766E+05 0.82313E+01 0.28155E-03-0.12690E+07 0.60929E+02  500.0000  3000.0000 1
 0.79200E+05 0.21766E+05 0.76546E+01 0.35985E-03 0.18078E+07 0.60929E+02 3000.0000  5000.0000 1
1.  1 1. 11 0.  0 0.  0 0.  0 0.  0 0.  0JANAF  03/63       AFWL - WRS  HNA
 0.29700E+05 0.24259E+05 0.87443E+01 0.29802E-03-0.26011E+06 0.64802E+02  500.0000  3000.0000 1
 0.29700E+05 0.24259E+05 0.84947E+01 0.29581E-03 0.23454E+07 0.64802E+02 3000.0000  5000.0000 1
1.  1 1.  8 1. 11 0.  0 0.  0 0.  0 0.  0JANAF  03/66       AFWL - WRS  HNAO
-0.50400E+05 0.33110E+05 0.11445E+02 0.72259E-03-0.40275E+06 0.83087E+02  500.0000  3000.0000 1
-0.50400E+05 0.33110E+05 0.12732E+02 0.16961E-03 0.25727E+07 0.83087E+02 3000.0000  5000.0000 1
1.  1 1.  7 1.  8-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    HNO
 0.23800E+05 0.32755E+05 0.13382E+02 0.12206E-03-0.23240E+07 0.78385E+02  500.0000  3000.0000 1
 0.23800E+05 0.32755E+05 0.14152E+02-0.47042E-04-0.46913E+07 0.78385E+02 3000.0000  5000.0000 1
1.  1 1.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    HO
 0.93300E+04 0.21404E+05 0.77319E+01 0.39439E-03-0.97356E+06 0.61382E+02  500.0000  3000.0000 1
 0.93300E+04 0.21404E+05 0.96514E+01-0.44353E-04-0.68611E+07 0.61382E+02 3000.0000  5000.0000 1
2.  1-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    H2
 0.E+00       0.21210E+05 0.71196E+01 0.62195E-03-0.71269E+06 0.48465E+02  500.0000  3000.0000 1
 0.E+00       0.21210E+05 0.68179E+01 0.58985E-03 0.26511E+07 0.48465E+02 3000.0000  5000.0000 1
2.  1 1.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/65                    H2N
 0.40100E+05 0.30580E+05 0.97586E+01 0.11440E-02-0.51897E+06 0.70158E+02  500.0000  3000.0000 1
 0.40100E+05 0.30580E+05 0.13742E+02 0.22949E-04-0.61002E+07 0.70158E+02 3000.0000  5000.0000 1
2.  1 2.  7 0.  0 0.  0 0.  0 0.  0 0.  0T666 LIBRARY                   H2N2
 0.50900E+05 0.43771E+05 0.17[illegible]E+02 0.68229E-03-0.32538E+07 0.85103E+02  500.0000  3000.0000 1
 0.50900E+05 0.43771E+05 0.18627E+02 0.19501E-03-0.15474E+07 0.85103E+02 3000.0000  5000.0000 1
2.  1 1.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    H2O
-0.57795E+05 0.30201E+05 0.11225E+02 0.81140E-03-0.26080E+07 0.68421E+02  500.0000  3000.0000 1
-0.57795E+05 0.30201E+05 0.15728E+02-0.19155E-03-0.17360E+08 0.68421E+02 3000.0000  5000.0000 1
3.  1 1.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 09/65                    H3N
-0.10970E+05 0.41631E+05 0.12519E+02 0.21967E-02-0.97853E+06 0.76908E+02  500.0000  3000.0000 1
-0.10970E+05 0.41631E+05 0.16632E+02 0.92315E-03-0.36134E+07 0.76908E+02 3000.0000  5000.0000 1
4.  1 2.  7-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/65                    H4N2
 0.22790E+05 0.68536E+05 0.22986E+02 0.24193E-02-0.19593E+07 0.10810E+03  500.0000  3000.0000 1
 0.22790E+05 0.68536E+05 0.3[illegible]432E+02 0.48794E-04-0.13970E+08 0.10810E+03 3000.0000  5000.0000 1
1.  8 1. 11 0.  9 0.  0 0.  0 0.  0 0.  0JANAF  12/60       AFWL - WRS  NAO
 0.13200E+05 0.24347E+05 0.89138E+01 0.13811E-03-0.12322E+06 0.74382E+02  500.0000  3000.0000 1
 0.13200E+05 0.24347E+05 0.87305E+01 0.15925E-03 0.11513E+07 0.74382E+02 3000.0000  5000.0000 1
2. 11 0.  0 0.  0 0.  0 0.  0 0.  0 0.  0JANAF  06/62       AFWL - WRS  NA2
 0.54998E+05 0.25351E+05 0.89424E+01 0.38512E-03-0.84583E+04 0.76634E+02  500.0000  3000.0000 1
 0.54998E+05 0.25351E+05 0.84024E+01 0.46400E-03 0.33403E+07 0.76634E+02 3000.0000  5000.0000 1
```

```
1.  7-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 03/61                    N
 0.11297E+06 0.13437E+05 0.49694E+01 0.38352E-04 0.95846E+05 0.48090E+02  500.0000  3000.0000 1
 0.11297E+06 0.13437E+05 0.42896E+01 0.24084E-03-0.41727E+06 0.48090E+02 3000.0000  5000.0000 1
1.  7 1.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/63                    NO
 0.21580E+05 0.22700E+05 0.87762E+01 0.89903E-04-0.78966E+06 0.68849E+02  500.0000  3000.0000 1
 0.21580E+05 0.22700E+05 0.91626E+01 0.65788E-05-0.21252E+07 0.68849E+02 3000.0000  5000.0000 1
1.  7 2.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/63                    NO2
 0.80110E+04 0.34580E+05 0.13782E+02 0.31561E-04-0.13376E+07 0.84889E+02  500.0000  3000.0000 1
 0.80110E+04 0.34580E+05 0.13015E+02 0.17259E-03 0.17534E+07 0.84889E+02 3000.0000  5000.0000 1
1.  7 3.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/64                    NO3
 0.17000E+05 0.49822E+05 0.13230E+02 0.19116E-03-0.11213E+07 0.99897E+02  500.0000  3000.0000 1
 0.17000E+05 0.49822E+05 0.19871E+02 0.57714E-07-0.17291E+07 0.99897E+02 3000.0000  5000.0000 1
2.  7 1.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/60                    N2O
 0.19500E+05 0.36545E+05 0.14469E+02 0.12049E-03-0.15348E+07 0.81590E+02  500.0000  3000.0000 1
 0.19500E+05 0.36545E+05 0.12304E+02 0.45902E-03 0.94238E+07 0.81590E+02 3000.0000  5000.0000 1
2.  7 3.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/64                    N2O3
 0.19800E+05 0.61780E+05 0.23212E+02 0.47758E-03-0.12410E+07 0.12322E+03  500.0000  3000.0000 1
 0.19800E+05 0.61780E+05 0.24830E+02 0.10287E-05-0.29389E+07 0.12322E+03 3000.0000  5000.0000 1
2.  7 4.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 9/64                     N2O4
 0.21700E+04 0.78597E+05 0.29773E+02 0.59443E-03-0.17883E+07 0.13491E+03  500.0000  3000.0000 1
 0.21700E+04 0.78597E+05 0.31782E+02 0.17563E-05-0.38597E+07 0.13491E+03 3000.0000  5000.0000 1
2.  7 5.  8-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 12/64                    N2O5
 0.21700E+04 0.91576E+05 0.35305E+02 0.14730E-03-0.16385E+07 0.15672E+03  500.0000  3000.0000 1
 0.21700E+04 0.91576E+05 0.35736E+02 0.62455E-05-0.17127E+07 0.15672E+03 3000.0000  5000.0000 1
1.  8-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF 06/62                    O
 0.59559E+05 0.13522E+05 0.49723E+01 0.38077E-05 0.15475E+05 0.50096E+02  500.0000  3000.0000 1
 0.59559E+05 0.13522E+05 0.65749E+01-0.22427E-03-0.89178E+07 0.50096E+02 3000.0000  5000.0000 1
1. 99-0. -0-0. -0-0. -0-0. -0-0. -0-0. -0JANAF   05/65     AFWL - JEF    E-
 0.E+00      0.13423E+05 0.49680E+01 0.21533E-05 0.26284E-06 0.16459E+02  500.0000  3000.0000 1
 0.E+00      0.13423E+05 0.49680E+01-0.23237E-06-0.98622E-06 0.16459E+02 3000.0000  5000.0000 1
1.  6-1. 99 0.  0 0.  0 0.  0 0.  0 0.  0AFWL TDR 64-44 NORM TO 298 JEFC+1
 0.43243E+06 0.13435E+05 0.49685E+01-0.13100E-06 0.33897E+04 0.48432E+02  500.0000  3000.0000 1
 0.43243E+06 0.13435E+05 0.49516E+01 0.32381E-05 0.64611E+05 0.48432E+02 3000.0000  5000.0000 1
1. 11-1. 99-0. -0-0. -0-0. -0-0. -0-0. -0                               NA+
 0.14383E+06 0.13423E+05 0.49681E+01-0.E+00      -0.E+00       0.46807E+02  500.0000  6000.0000 1
 0.14383E+06 0.13423E+05 0.49681E+01-0.E+00      -0.E+00       0.45807E+02  500.0000  6000.0000 1
1.  7 1.  8-1. 99-0. -0-0. -0-0. -0-0. -0JANAF   06/66      AFWL - WRS   NO+
 0.23666E+06 0.22150E+05 0.77453E+01 0.41834E-03-0.26976E+06 0.65332E+02  500.0000  3000.0000 1
 0.23666E+06 0.22150E+05 0.82958E+01 0.13003E-03 0.21840E+07 0.65332E+02 3000.0000  5000.0000 1
1.  8 1. 99-0. -0-0. -0-0. -0-0. -0-0. -0JANAF   06/65      AFWL - WRS   O-
 0.24300E+05 0.13482E+05 0.49669E+01 0.69157E-06 0.19878E+05 0.49285E+02  500.0000  3000.0000 1
 0.24300E+05 0.13482E+05 0.49695E+01-0.18003E-06 0.13858E+05 0.49285E+02 3000.0000  5000.0000 1
1.  6 1. 99 0. -0 0. -0 0. -0 0. -0 0. -0JANAF   09-65      AFWL-NV      C-
 0.14050E+06 0.13437E+05 0.49121E+01 0.32137E-04 0.13255E+05 0.47631E+02  500.0000  3000.0000 1
 0.14050E+06 0.13437E+05 0.24423E+01 0.57317E-03 0.76335E+07 0.47631E+02 3000.0000  6000.0000 1
1.  1-1. 99 0. -0 0. -0 0. -0 0. -0 0. -0AFWL TDR 64-44 NORM TO 298 JEFH+1
 0.36716E+06 0.13423E+05 0.49679E+01-0.59624E-05-0.30407E-06 0.37482E+02  500.0000  3000.0000 1
 0.36716E+06 0.13423E+05 0.49679E+01-0.26722E-05-0.11342E-04 0.37482E+02 3000.0000  5000.0000 1
1.  1 1.  8 1. 99 0. -0 0. -0 0. -0 0. -0JANAF   3-66      AFWL-NV      HO-1
-0.34400E+05 0.21324E+05 0.67498E+01 0.71985E-03-0.63892E+05 0.58582E+02  500.0000  3000.0000 1
-0.34400E+05 0.21324E+05 0.78160E+01 0.25045E-03 0.28756E+07 0.58582E+02 3000.0000  6000.0000 1
3.  1 1.  8-1. 99 0.  0 0.  0 0.  0 0.  0JANAF   06/66      AFWL - WRS   H3O+1
 0.13890E+06 0.40293E+05 0.11455E+02 0.23531E-02-0.91644E+06 0.75901E+02  500.0000  3000.0000 1
 0.13890E+06 0.40293E+05 0.15710E+02 0.50583E-03 0.77356E+07 0.75901E+02 3000.0000  6000.0000 1
1.  7-1. 99 0  0 0.  0 0.  0 0.  0 0.  0AFWL TDR 64-44 NORM TO 298 JEFN+1
 0.44959E+06 0.13472E+05 0.48933E+01 0.33813E-04 0.56329E+05 0.49702E+02  500.0000  3000.0000 1
 0.44959E+06 0.13472E+05 0.45180E+01 0.13767E-03 0.62970E+06 0.49702E+02 3000.0000  5000.0000 1
1.  7 2.  8 1. 99 0. -0 0. -0 0. -0 0. -0JANAF   12-65      AFWL-NV      NO2-
-0.85900E+05 0.35015E+05 0.13348E+02 0.19039E-03-0.71000E+06 0.84593E+02  500.0000  3000.0000 1
-0.85900E+05 0.35015E+05 0.13535E+02 0.54880E-04 0.10530E+07 0.84593E+02 3000.0000  6000.0000 1
```

```
2.  7-1. 99 0. -0 0. -0 0. -1 0. -0 0. -0BROWNE  EPTM-3 SWAG AFWL-NV   N2+1
 0.35931E+06 0.25224E+05 0.69536E+01 0.10324E-02-0.98388E+05 0.65686E+02  500.0000  3000.0000 1
 0.35931E+06 0.25224E+05 0 10644E+02 0.90355E-04-0.51873E+07 0.65685E+02 3000.0000  5000.0000 1
1.  8-1. 99 0.  0 0.  0 0.  0 0.  0 0.  0AFWL TDR 64-44 NORM TO 298 JEFO+1
 0.37507E+06 0.13424E+05 0.43645E+01 0.15476E-05 0.24063E+04 0.48481E+02  500.0000  3000.0000 1
 0.37507E+06 0.13424E+05 0.42673E+01 0.14641E-03 0.23662E+07 0.48481E+02 3000.0000  5000.0000 1
2.  8-1. 99-0. -0-0. -0-0. -0-0. -0-0. -0BROWNE  EPTM-3    AFWL-NV     O2+1
 0.23149E+06 0.22720E+05 0.82125E+01 0.29541E-03-0.31791E+06 0.67752E+02  500.0000  3000.0000 1
 0.23149E+06 0.22720E+05 0.75326E+01 0.30706E-03 0.43952E+07 0.67752E+02 3000.0000  5000.0000 1
2.  8 1. 99-0. -0-0. -0-0. -0-0. -0-0. -0JANAF  12/66       AFWL - WRS  O2-
-0.11399E+05 0.23585E+05 0.87430E+01 0.14773E-03-0.26066E+06 0.69305E+02  500.0000  3000.0000 1
-0.11399E+05 0.23585E+05 0.84368E+01 0.16034E-03 0.16846E+07 0.69305E+02 3000.0000  6000.0000 1
```

ELEMENT	HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM	ELECTRON
BASE SP	H	C	N2	O2	NA	E-

MOLECULAR TRANSPORT PROPERTIES

VISCOSITY ..... BUDDENBERG - WILKE MIXTURE FORMULA WITH MU(I) CALCULATED ON THE BASIS OF D(I,I) = DBAR/G(I)**2

THERMAL CONDUCTIVITY ..... MASON - SAXENA MIXTURE FORMULA WITH EUCKEN CORRECTION

DIFFUSION COEFFICIENTS ..... D(I,J) = DBAR/(F(I)*F(J)) WITH DBAR BASED ON SIGMA = 3.4670, EPOVRK = 106.7000, AND MREF = 32.0000

METHODS EMPLOYED

0 CONDENSED PHASE, VALUES FOR F(I) AND G(I) SET EQUAL TO 1.E+10

1 VALUES FOR F(I) (OR G(I)) INPUT DIRECTLY

2 VALUES FOR F(I) (OR G(I)) CALCULATED BY F(I) =(M(I)/FITMOL)**FFA AND G(I) = (M(I)/FITGMW)**GGA WHERE M(I) IS SPECIES MOLECULAR WEIGHT, FITMOL = 26.7000, AND FFA = 0.4890, FITGMW = 24.3000, AND GGA = 0.4540

3 VALUES FOR G(I) CALCULATED BY G(I) = SQRT(DBAR/D(I,I)) = (SIGMA(I)/SIGMA) * (EPS(I)/EPOVRK) **0.0795 * (M(I)/MREF) **0.25 WHERE SIGMA(I) AND EPS(I) ARE GIVEN WITH THERMODYNAMIC DATA

SPECIES	F(I)	METHOD	G(I)	METHOD	SPECIES	F(I)	METHOD	G(I)	METHOD
H	0.201	2	0.236	2	C	0.677	2	0.726	2
NA	0.929	2	0.975	2	O2	1.093	2	1.133	2
N2	1.024	2	1.067	2	E-	0.005	2	0.008	2
CH	0.704	2	0.753	2	CHN	1.006	2	1.049	2
CHNO	1.263	2	1.296	2	CHO	1.042	2	1.084	2
CH2	0.730	2	0.779	2	CH2O	1.059	2	1.101	2
CH4	0.788	2	.828	2	CN	0.987	2	1.032	2
CNNA	1.346	2	1.375	2	CO	1.024	2	1.067	2
CO2	1.277	2	1.310	2	C2	0.950	2	0.995	2
C2H	0.969	2	1.014	2	C2H2	0.988	2	1.032	2
C2H4	1.02	2	1.067	2	C2N2	1.386	2	1.413	2
C3	1.158	2	1.196	2	HN	0.755	2	0.804	2
HNA	0.949	2	0.994	2	HNAO	1.219	2	1.254	2
HNO	1.076	2	1.117	2	HO	0.802	2	0.850	2
H2	0.283	2	0.323	2	H2N	0.779	2	0.828	2

H2N2	1.059	2	1.101	2	H2O	0.825	2	0.873	2
H3N	0.803	2	0.851	2	H4N2	1.093	2	1.134	2
NAO	1.203	2	1.239	2	NA2	1.304	2	1.336	2
N	0.729	2	0.779	2	NO	1.059	2	1.101	2
NO2	1.305	2	1.336	2	NO3	1.513	2	1.530	2
N2O	1.277	2	1.310	2	N2O3	1.668	2	1.678	2
N2O4	1.831	2	1.830	2	N2O5	1.981	2	1.969	2
O	0.778	2	0.827	2	C+1	0.677	2	0.726	2
NA+	0.929	2	0.975	2	NO+	1.059	2	1.101	2
O-	0.778	2	0.827	2	C-	0.677	2	0.726	2
H+1	0.201	2	0.236	2	HO-1	0.802	2	0.850	2
H3O+1	0.847	2	0.895	2	N+1	0.729	2	0.779	2
NO2-	1.335	2	1.336	2	N2+1	1.024	2	1.067	2
O+1	0.778	2	0.827	2	O2+1	1.093	2	1.133	2
O2-	1.093	2	1.133	2					

STAGNATION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE EXPANSION

STREAM FUNCTION,LB/SEC 0.E+00 0.15143E+00 0.60573E+00 0.13842E+01 0.25360E+01 0.40707E+01 0.58508E+01 0.77336E+01
0.11523E+02 0.16010E+02 0.23832E+02 0.35922E+02 0.63090E+02 0.98741E+02 0.14606E+03 0.25475E+03
0.39137E+03 0.83722E+03

SHOCK ANGLE,RADIANS 0.E+00 0.35630E+00 0.69310E+00 0.94710E+00 0.11387E+01 0.12418E+01 0.13012E+01 0.13370E+01
0.13768E+01 0.13933E+01 0.14109E+01 0.14249E+01 0.14323E+01 0.14166E+01 0.14065E+01 0.14011E+01
0.14009E+01 0.14011E+01

CP-FROZEN	CP-EQUIL	DLNM/DLNT	DLNM/DLNP	GAMMA
0.31871E+00	0.60967E+00	-0.32204E+00	0.30799E-01	0.12339E+01

TEMP = 5518.0909 DEG-K PRES =149.9100 ATM MOL WT = 25.8520972
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.2168500E+04 CAL/GM ENTROPY = 0.22662E+01 CAL/GM-DEG K
DENSITY = 0.534249E+00 LB/CUFT
VEL = 0.E+00 FT/SEC MACH = 0.E+00 AREA = 0.E+00 SQFT/LB/SEC

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
H	0.E+00	C	0.E+00	NA	0.E+00
O2	0.39381E-01	N2	0.65319E+00	E-	0.25528E-04
CH	0.E+00	CHN	0.E+00	CHNO	0.E+00
CHO	0.E+00	CH2	0.E+00	CH2O	0.E+00
CH4	0.E+00	CN	0.E+00	CNNA	0.E+00
CO	0.E+00	CO2	0.E+00	C2	0.E+00
C2H	0.E+00	C2H2	0.E+00	C2H4	0.E+00
C2N2	0.E+00	C3	0.E+00	HN	0.E+00
HNA	0.E+00	HNAO	0.E+00	HNO	0.E+00
HO	0.E+00	H2	0.E+00	H2N	0.E+00
H2N2	0.E+00	H2O	0.E+00	H3N	0.E+00
H4N2	0.E+00	NAO	0.E+00	NA2	0.E+00
N	0.65671E-02	NO	0.98618E-01	NO2	0.96218E-04
NO3	0.57493E-08	N2O	0.66960E-14	N2O3	0.56400E-09
N2O4	0.66998E-13	N2O5	0.29821E-15	O	0.20201E+00
C+1	0.E+00	NA+	0.E+00	NO+	0.23661E-04
O-	0.74536E-05	C-	0.E+00	H+1	0.E+00
HO-1	0.E+00	H3O+1	0.E+00	N+1	0.30253E-09
NO2-	0.13940E-06	N2+1	0.38510E-08	O+1	0.12753E-07
O2+1	0.10733E-04	O2-	0.45972E-06		

CP-FROZEN	CP-EQUIL	DLNM/DLNT	DLNM/DLNP	GAMMA
0.31378E+00	0.65321E+00	-0.23399E+00	0.12891E-01	0.11794E+01

TEMP = 3303.3513 DEG-K PRES = 4.1459 ATM MOL WT = 28.0658265
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.1035973E+04 CAL/GM ENTROPY = 0.22662E+01 CAL/GM-DEG K
DENSITY = 0.267947E-01 LB/CUFT
VEL = 0.101E+05 FT/SEC MACH = 0.287E+01 AREA = 0.369E-02 SQFT/LB/SEC

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
H	0.E+00	C	0.E+00	NA	0.E+00
O2	0.15024E+00	N2	0.73803E+00	E-	0.10515E-06
CH	0.E+00	CHN	0.E+00	CHNO	0.E+00
CHO	0.E+00	CH2	0.E+00	CH2O	0.E+00
CH4	0.E+00	CN	0.E+00	CHNA	0.E+00
CO	0.E+00	CO2	0.E+00	C2	0.E+00
C2H	0.E+00	C2H2	0.E+00	C2H4	0.E+00
C2N2	0.E+00	C3	0.E+00	HN	0.E+00
HNA	0.E+00	HNAO	0.E+00	HNO	0.E+00
HO	0.E+00	H2	0.E+00	H2N	0.E+00
H2N2	0.E+00	H2O	0.E+00	H3N	0.E+00
H4N2	0.E+00	NAO	0.E+00	NA2	0.E+00
N	0.34502E-04	NO	0.56573E-01	NO2	0.41164E-04
NO3	0.34430E-09	N2O	0.58569E-05	N2O3	0.46282E-11
N2O4	0.33175E-15	N2O5	0.47099E-18	O	0.55074E-01
C+1	0.E+00	NA+	0.E+00	NO+	0.73026E-07
O-	0.66765E-08	C-	0.E+00	H+1	0.E+00
HO-1	0.E+00	H3O+1	0.E+00	N+1	0.48831E-17
NO2-	0.45736E-07	N2+1	0.24381E-14	O+1	0.39116E-13
O2+1	0.85910E-07	O2-	0.13713E-08		

TEMP = 5469.8950 DEG-K PRES =145.7704 ATM MOL WT = 25.9031093
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.2142874E+04 CAL/GM ENTROPY = 0.22637E+01 CAL/GM-DEG K
DENSITY = 0.525108E+00 LB/CUFT

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
H	0.E+00	C	0.E+00	NA	0.E+00
O2	0.41021E-01	N2	0.65459E+00	E-	0.23602E-04
CH	0.E+00	CHN	0.E+00	CHNO	0.E+00
CHO	0.E+00	CH2	0.E+00	CH2O	0.E+00
CH4	0.E+00	CN	0.E+00	CHNA	0.E+00
CO	0.E+00	CO2	0.E+00	C2	0.E+00
C2H	0.E+00	C2H2	0.E+00	C2H4	0.E+00
C2N2	0.E+00	C3	0.E+00	HN	0.E+00
HNA	0.E+00	HNAO	0.E+00	HNO	0.E+00
HO	0.E+00	H2	0.E+00	H2N	0.E+00
H2N2	0.E+00	H2O	0.E+00	H3N	0.E+00
H4N2	0.E+00	NAO	0.E+00	NA2	0.E+00
N	0.60670E-02	NO	0.99115E-01	NO2	0.98416E-04
NO3	0.58482E-08	N2O	0.65337E-04	N2O3	0.56421E-09
N2O4	0.67975E-13	N2O5	0.30428E-15	O	0.19898E+00
C+1	0.E+00	NA+	0.E+00	NO+	0.21809E-04
O-	0.69620E-05	C-	0.E+00	H+1	0.E+00
HO-1	0.E+00	H3O+1	0.E+00	N+1	0.23239E-09
NO2-	0.95076E-06	N2+1	0.31314E-08	O+1	0.10522E-07
O2+1	0.10136E-04	O2-	0.44413E-06		

TEMP = 441.2483 DEG-K PRES = 4.0131 ATM MOL WT = 28.8603830
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 0.E+00 0.E+00 0.E+00
ENTHALPY = 0.4994597E+02 CAL/GM ENTROPY = 0.16717E+01 CAL/GM-DEG K
DENSITY = 0.199666E+00 LB/CUFT

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
H	0.E+00	C	0.E+00	NA	0.E+00
O2	0.21194E+00	N2	0.78806E+00	E-	0.E+00
CH	0.E+00	CHN	0.E+00	CHNO	0.E+00
CHO	0.E+00	CH2	0.E+00	CH2O	0.E+00
CH4	0.E+00	CN	0.E+00	CNNA	0.E+00
CO	0.E+00	CO2	0.E+00	C2	0.E+00
C2H	0.E+00	C2H2	0.E+00	C2H4	0.E+00
C2N2	0.E+00	C3	0.E+00	HN	0.E+00
HNA	0.E+00	HNAO	0.E+00	HNO	0.E+00
HO	0.E+00	H2	0.E+00	H2N	0.E+00
H2N2	0.E+00	H2O	0.E+00	H3N	0.E+00
H4N2	0.E+00	NAO	0.E+00	NA2	0.E+00
N	0.56837E-53	NO	0.36064E-20	NO2	0.23792E-07
NO3	0.14441E-16	N2O	0.20801E-13	N2O3	0.95752E-20
N2O4	0.10479E-16	N2O5	0.86286E-20	O	0.83928E-27
C+1	0.E+00	NA+	0.E+00	NO+	0.E+00
O-	0.E+00	C-	0.E+00	H+1	0.E+00
HO-1	0.E+00	H3O+1	0.E+00	N+1	0.E+00
NO2-	0.E+00	N2+1	0.E+00	O+1	0.E+00
O2+1	0.E+00	O2-	0.E+00		

DISTANCE,FT	0.E+00	0.40000E-02	0.80000E-02	0.13000E-01	0.17000E-01	0.25000E-01	0.35000E-01	0.45000E-01
	0.55000E-01	0.59632E-01	0.63000E-01	0.68000E-01	0.75000E-01	0.86000E-01	0.96000E-01	0.12000E+00
	0.15000E+00	0.21000E+00	0.31000E+00	0.44170E+00	0.60000E+00	0.86400E+00	0.86500E+00	0.10000E+01
	0.12957E+01	0.15000E+01	0.17065E+01	0.21272E+01	0.25480E+01	0.29687E+01	0.33895E+01	0.38103E+01
	0.42310E+01	0.50725E+01	0.59141E+01	0.67500E+01	0.68000E+01	0.69239E+01	0.70922E+01	
MOMAP	0.E+00	0.39939E-02	0.79509E-02	0.12790E-01	0.16532E-01	0.23527E-01	0.31027E-01	0.36748E-01
	0.40363E-01	0.41260E-01	0.417[illegible]9E-01	0.42425E-01	0.43399E-01	0.44930E-01	0.46600E-01	0.49662E-01
	0.53837E-01	0.62187E-01	0.76[illegible]04E-01	0.94433E-01	0.11646E+00	0.15321E+00	0.15335E+00	0.17213E+00
	0.21149E+00	0.24172E+00	0.27[illegible]46E+00	0.32901E+00	0.38757E+00	0.44612E+00	0.50469E+00	0.56325E+00
	0.62180E+00	0.73891E+00	0.85604E+00	0.97238E+00	0.97933E+00	0.99658E+00	0.10200E+01	
A1,(LB/SEC)**2	0.E+00	0.40556E-09	0.69828E-08	0.38212E-07	0.11378E-06	0.45553E-06	0.12687E-05	0.22956E-05
	0.31598E-05	0.34325E-05	0.36018E-05	0.38594E-05	0.42209E-05	0.47944E-05	0.54295E-05	0.66097E-05
	0.82973E-05	0.12113E-04	0.23830E-04	0.52418E-04	0.84509E-04	0.16956E-03	0.16982E-03	0.26890E-03
	0.32975E-03	0.46405E-03	0.63764E-03	0.11548E-02	0.19353E-02	0.30218E-02	0.44451E-02	0.62357E-02
	0.84321E-02	0.14217E-01	0.22147E-01	0.32492E-01	0.33196E-01	0.34985E-01	0.37517E-01	
PRESSURE RATIO	0.10000E+01	0.98910E+00	0.95637E+00	0.88795E+00	0.81501E+00	0.63932E+00	0.40627E+00	0.21839E+00
	0.99156E-01	0.65578E-01	0.53805E-01	0.61907E-01	0.59205E-01	0.55102E-01	0.51021E-01	0.44784E-01
	0.38419E-01	0.30425E-01	0.23982E-01	0.20536E-01	0.19076E-01	0.19066E-01	0.19068E-01	0.19511E-01
	0.21154E-01	0.22582E-01	0.23890E-01	0.26026E-01	0.27384E-01	0.27964E-01	0.27971E-01	0.27848E-01
	0.27754E-01	0.27659E-01	0.27633E-01	0.27647E-01	0.27649E-01	0.27652E-01	0.27656E-01	
STATIC PRESSURE,ATM	0.14991E+03	0.14628E+03	0.14337E+03	0.13311E+03	0.12218E+03	0.95840E+02	0.60904E+02	0.32739E+02
	0.14864E+02	0.98308E+01	0.95650E+01	0.92805E+01	0.88754E+01	0.82603E+01	0.76486E+01	0.67136E+01
	0.57579E+01	0.45610E+01	0.35951E+01	0.30786E+01	0.28597E+01	0.28582E+01	0.28585E+01	0.29249E+01
	0.31712E+01	0.33853E+01	0.35813E+01	0.39016E+01	0.41051E+01	0.41921E+01	0.41931E+01	0.41747E+01
	0.41606E+01	0.41464E+01	0.41425E+01	0.41446E+01	0.41449E+01	0.41453E+01	0.41459E+01	
EDGE VELOCITY,FT/SEC	0.E+00	0.64682E+03	0.13029E+04	0.21191E+04	0.27691E+04	0.40494E+04	0.56301E+04	0.71250E+04
	0.85054E+04	0.90888E+04	0.91249E+04	0.91643E+04	0.92220E+04	0.93132E+04	0.94088E+04	0.95661E+04
	0.97444E+04	0.10001E+05	0.10248E+05	0.10401E+05	0.10472E+05	0.10472E+05	0.10472E+05	0.10450E+05
	0.10372E+05	0.10308E+05	0.10252E+05	0.10165E+05	0.10112E+05	0.10090E+05	0.10090E+05	0.10095E+05
	0.10098E+05	0.10102E+05	0.10103E+05	0.10102E+05	0.10102E+05	0.10102E+05	0.10102E+05	
BETA	0.50000E+00	0.48990E+00	0.54247E+00	0.46119E+00	0.51659E+00	0.59045E+00	0.72065E+00	0.96311E+00
	0.16197E+01	0.93771E+00	-0.42260E-01	0.12493E+00	0.14732E+00	0.16109E+00	0.16755E+00	0.16806E+00
	0.15872E+00	0.13105E+00	0.10135E+00	0.66422E-01	0.18488E-01	-0.35224E-01	-0.12705E-01	-0.27870E-01
	-0.37119E-01	-0.36284E-01	-0.32725E-01	-0.24483E-01	-0.14696E-01	-0.37530E-02	0.27564E-02	0.29995E-02
	0.19601E-02	0.78165E-03	0.34900E-04	-0.70439E-03	-0.59684E-03	-0.32882E-03	-0.42781E-03	
INCIDENT RADIATION FLUX	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	
ENTROPY DROP,BTU/LB R	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	
-1/FLOW NORM.PARAMETER	-0.28670E+00	-0.27160E+00	-0.28987E+00	-0.27749E+00	-0.30677E+00	-0.36887E+00	-0.51006E+00	-0.81299E+00
	-0.15146E+01	-0.21266E+01	-0.22011E+01	-0.22953E+01	-0.24311E+01	-0.26502E+01	-0.28923E+01	-0.33272E+01
	-0.38976E+01	-0.49409E+01	-0.69073E+01	-0.94081E+01	-0.10310E+02	-0.11106E+02	-0.11103E+02	-0.10760E+02
	-0.10256E+02	-0.10094E+02	-0.10087E+02	-0.10386E+02	-0.10939E+02	-0.11669E+02	-0.12508E+02	-0.13323E+02
	-0.14073E+02	-0.15422E+02	-0.16627E+02	-0.17723E+02	-0.17786E+02	-0.17941E+02	-0.18150E+02	

WALL TEMPERATURE,DEG R	0.79860E+04	0.79990E+04	0.79740E+04	0.79560E+04	0.79130E+04	0.77980E+04	0.77660E+04	0.75520E+04
	0.72510E+04	0.70830E+04	0.70550E+04	0.70280E+04	0.69950E+04	0.69560E+04	0.69190E+04	0.66360E+04
	0.67480E+04	0.65950E+04	0.63630E+04	0.62550E+04	0.61760E+04	0.61550E+04	0.59940E+04	0.59550E+04
	0.59900E+04	0.60310E+04	0.60660E+04	0.61060E+04	0.60850E+04	0.61020E+04	0.61090E+04	0.60710E+04
	0.60760E+04	0.60830E+04	0.60890E+04	0.60400E+04	0.60410E+04	0.60430E+04	0.60460E+04	
COMP FLUX,LB/SEC FT**2	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	
COMP FLUX,LB/SEC FT**2	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00
	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	-0.E+00	
COMP FLUX,LB/SEC FT**2	0.47530E+00	0.50580E+00	0.47330E+00	0.48960E+00	0.43990E+00	0.35860E+00	0.80410E+00	0.55010E+00
	0.29080E+00	0.19190E+00	0.17890E+00	0.17110E+00	0.16210E+00	0.15190E+00	0.14200E+00	0.12450E+00
	0.10850E+00	0.86430E-01	0.65980E-01	0.57640E-01	0.53830E-01	0.53930E-01	0.67290E-01	0.71120E-01
	0.77940E-01	0.85710E-01	0.94290E-01	0.11100E+00	0.11610E+00	0.12180E+00	0.12260E+00	0.11570E+00
	0.11530E+00	0.11570E+00	0.11480E+00	0.10710E+00	0.10740E+00	0.10780E+00	0.10820E+00	

CASE 2 - - - - - - - - - - - - - STREAMWISE DIMENSION 0.E+00 FEET - - - -

ITERATED VALUES ITS	TIME	ALPHA	FPPW	DAMP ERROR	MAX.LIN MOMENTUM	MAX.ERRORS IN CONSERVATION EQS. ENERGY	H	C	NA	O2
1	21.857	3.643	0.41020.2563	2E+00	16-3.2E+00	13-1.9E+03	2 0.E+00	1 1.8E-01	1 9.2E-04	1-4.1E-02 0
2	32.909	3.276	0.46890.3002	2E+00	16-2.2E+00	14 1.1E+03	2 0.E+00	1 1.3E-01	1-2.3E-04	1-3.1E-02 0
3	41.950	2.948	0.55000.3367	1E+00	16-1.4E+00	14 8.8E+02	2 0.E+00	1 9.4E-02	1-1.6E-04	1-2.2E-02 0
4	57.155	2.654	0.64380.4242	8E-01	16-8.8E-01	1 7.3E+02	2 0.E+00	1 6.8E-02	1-1.1E-04	1-1.6E-02 0
5	61.363	2.388	0.74940.6063	4E-01	16-4.8E-01	1 6.6E+02	2 0.E+00	1 4.2E-02	1-6.6E-05	1-9.8E-03 0
6	75.699	2.272	0.70001.0000	2E-01	18-2.1E-01	1 2.7E+02	2 0.E+00	1 1.6E-02	1-2.7E-05	1-3.7E-03 0
7	86.630	2.273	0.70721.0000	5E-03	12-2.3E-02	10-5.7E+01	2 0.E+00	14-1.2E-03	13 7.7E-07	15 2.8E-04 0
8	94.741	2.270	0.70721.0000	2E-05	14 5.1E-04	11 6.0E-01	2 0.E+00	11-3.0E-05	14 1.4E-09	11 7.1E-06 0
9	111.466	2.270	0.70721.0000	9E-07	14 7.0E-06	11 2.1E-02	2 0.E+00	11-5.3E-07	11-5.3E-13	11 1.2E-07 0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	DIFFUSIONAL	HEAT FLUXES TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
2.270E+03	0.E+00	0.E+00	1.499E+02	0.E+00	5.000E-01	3.483E+00	3.581E+03	2.536E+03	0.E+00	6.087E+03

WALL SHEAR (LB/SQ FT)	MECH REM	MASS FLUXES PYROL GAS (LB/SEC SQ FT)	CHAR	TOTAL GAS	ELEMENTAL MASS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
0.E+00	0.E+00	0.E+00	4.759E-01	4.759E-01	0.E+00	-3.875E-01	2.964E-01	9.106E-02	-3.875E-07

MCH TRANS COEFF, RHO*UE*CF/2	HEAT TRANS COEFF, RHO*UE*CH	BLOWING PARAMETERS (BASED ON CH) PYROL GAS	CHAR	TOTAL GAS	ELEMENTAL MASS TRANSFER COEFFICIENTS, RHOE*UE*CM (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
2.924E+00	2.097E+00	0.E+00	2.269E-01	2.269E-01	IIIII	2.086E+00	2.086E+00	2.086E+00	2.086E+00

MOMENTUM THICKNESS, THETA (FT)	DISPLACE. THICKNESS, DELSTAR (FT)	EFFECTIVE ENTHALPY BODY DISPLACE. (FT)	THICKNESS, LAMBDA (FT)	REYNOLDS NUMBER PER FOOT	MASS THICKNESSES (FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
7.0144-06	1.624E-05	1.923E-05	1.623E-05	0.E+00	IIIII	1.616E-05	1.616E-05	1.616E-05	1.615E-05

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FTSQ)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.E+00	0.E+00	-1.364E-01	0.E+00	7.572E-01	0.E+00	2.196E+03	5.980E+02	1.585E+02	2.196E+03	7.986E+03	1.309E+13
7.732E-03	4.543E-03	-1.364E-01	3.210E-03	7.369E-01	0.E+00	2.199E+03	5.987E+02	1.588E+02	2.199E+03	8.000E+03	1.307E+13
1.464E-02	9.382E-03	-1.364E-01	6.418E-03	7.365E-01	0.E+00	2.201E+03	5.994E+02	1.588E+02	2.201E+03	8.014E+03	1.306E+13
2.573E-02	1.589E-02	-1.364E-01	1.123E-02	7.060E-01	0.E+00	2.205E+03	6.009E+02	1.588E+02	2.205E+03	8.036E+03	1.304E+13
4.423E-02	2.724E-02	-1.362E-01	1.924E-02	7.051E-01	0.E+00	2.212E+03	6.023E+02	1.587E+02	2.212E+03	8.072E+03	1.302E+13
7.433E-02	4.574E-02	-1.357E-01	3.203E-02	7.037E-01	0.E+00	2.223E+03	6.052E+02	1.584E+02	2.223E+03	8.131E+03	1.297E+13
1.116E-01	6.[illegible]E-02	-1.343E-01	4.798E-02	7.017E-01	0.E+00	2.237E+03	6.078E+02	1.573E+02	2.237E+03	8.206E+03	1.291E+13
1.491E-01	1.[illegible]E-01	-1.[illegible]E-01	7.974E-02	6.975E-01	0.E+00	2.265E+03	6.159E+02	1.519E+02	2.265E+03	8.364E+03	1.279E+13
1.977E-01	2.277E-01	-1.[illegible]E-01	1.582E-01	6.847E-01	0.E+00	2.336E+03	6.332E+02	1.647E+02	2.336E+03	9.613E+03	1.246E+13
2.[illegible]E-01	4.5[illegible]E-01	-6.[illegible]E-02	3.[illegible]E-01	6.459E-01	0.E+00	2.484E+03	6.706E+02	9.995E+01	2.484E+03	1.091E+04	1.169E+13
3.[illegible]E-01	7.9[illegible]E-01	7.[illegible]E-02	5.[illegible]96E-01	5.314E-01	0.E+00	2.718E+03	7.043E+02	-5.736E+01	2.718E+03	1.327E+04	1.154E+13
5.[illegible]E-01	1.135E+00	2.[illegible]E-01	6.698E-01	4.097E-01	0.E+00	2.954E+03	6.847E+02	-2.435E+02	2.954E+03	1.017E+04	1.160E+13
9.[illegible]E-01	2.270E+00	1.274E+00	8.562E-01	9.485E-02	0.E+00	3.575E+03	4.084E+02	-2.681E+02	3.575E+03	9.992E+03	1.170E+13
2.[illegible]E-00	3.632E+00	2.[illegible]E+00	1.017E+00	-4.427E-03	0.E+00	3.882E+03	4.321E+01	-5.409E+01	3.882E+03	9.936E+03	1.173E+13
1.[illegible]E-04	5.675E+00	4.[illegible]76E+00	1.[illegible]25E+00	5.344E-03	0.E+00	3.903E+03	0.E+00	1.178E+01	3.903E+03	9.933E+03	1.173E+13

DISTANCE FROM WALL (FT)	DENSITY, RHO (LB/CU FT)	VISCOSITY, MU LB/SEC FT	RHO*MU /RHOE*MUE,	SPECIFIC HEAT C (BTU/LB R)	THERMAL COND (BTU /SEC FT R)	PRANDTL NUMBER	MODIFIED SCHMIDT NUMBER	MOLECULAR WEIGHT	RHOSQ*EPS /RHOE*MUE	MACH NUMBER
0.E+00	7.287E-01	6.441E-05	1.187E+00	3.240E-01	3.151E-05	6.956E-01	7.013E-01	2.835E+01	0.E+00	0.E+00
7.132E-04	7.272E-01	6.449E-05	1.186E+00	3.240E-01	3.154E-05	6.956E-01	7.013E-01	2.834E+01	0.E+00	0.E+00
1.449E-07	7.256E-01	6.696E-05	1.185E+00	3.240E-01	3.158E-05	6.955E-01	7.013E-01	2.833E+01	0.E+00	0.E+00
2.573E-07	7.233E-01	6.798E-05	1.183E+00	3.279E-01	3.163E-05	6.954E-01	7.013E-01	2.832E+01	0.E+00	0.E+00
4.423E-07	7.194E-01	6.727E-05	1.180E+00	3.278E-01	3.171E-05	6.953E-01	7.012E-01	2.829E+01	0.E+00	0.E+00
7.403E-07	7.133E-01	6.759E-05	1.176E+00	3.276E-01	3.185E-05	6.951E-01	7.011E-01	2.825E+01	0.E+00	0.E+00
1.116E-06	7.055E-01	6.796E-05	1.170E+00	3.273E-01	3.203E-05	6.948E-01	7.010E-01	2.821E+01	0.E+00	0.E+00
1.881E-06	6.901E-01	6.882E-05	1.158E+00	3.268E-01	3.239E-05	6.943E-01	7.008E-01	2.812E+01	0.E+00	0.E+00
3.872E-06	6.507E-01	7.116E-05	1.129E+00	3.252E-01	3.330E-05	6.931E-01	7.003E-01	2.794E+01	0.E+00	0.E+00
8.258E-06	5.704E-01	7.727E-05	1.075E+00	3.198E-01	3.573E-05	6.915E-01	6.990E-01	2.783E+01	0.E+00	0.E+00
1.551E-05	5.495E-01	7.463E-05	1.054E+00	3.182E-01	3.613E-05	6.924E-01	6.997E-01	2.749E+01	0.E+00	0.E+00
2.261E-05	5.471E-01	7.419E-05	1.043E+00	3.185E-01	3.591E-05	6.933E-01	7.006E-01	2.711E+01	0.E+00	0.E+00
4.736E-05	5.393E-01	7.721E-05	1.015E+00	3.188E-01	3.550E-05	6.933E-01	7.004E-01	2.627E+01	0.E+00	0.E+00
7.723E-05	5.346E-01	7.670E-05	1.001E+00	3.187E-01	3.535E-05	6.922E-01	6.993E-01	2.588E+01	0.E+00	0.E+00
1.222E-04	5.342E-01	7.615E-05	1.000E+00	3.187E-01	3.534E-05	6.921E-01	6.992E-01	2.585E+01	0.E+00	0.E+00

DISTANCE FROM WALL,FT

0.E+00 7.332E-08 1.468E-07 2.573E-07 4.423E-07 7.403E-07 1.116E-06 1.881E-06 3.872E-06 8.258E-06
1.551E-05 2.261E-05 4.736E-05 7.723E-05 1.222E-04

ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA

H	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C	1.854E-01	1.855E-01	1.852E-01	1.847E-01	1.840E-01	1.828E-01	1.813E-01	1.782E-01	1.704E-01	1.540E-01
	1.203E-01	1.027E-01	3.561E-02	2.307E-03	0.E+00					
	-6.562E-02	-6.571E-02	-6.579E-02	-6.593E-02	-6.615E-02	-6.650E-02	-6.695E-02	-6.785E-02	-7.013E-02	-7.454E-02
	-7.615E-02	-7.406E-02	-4.422E-02	-4.693E-03	0.E+00					
	-1.929E-02	-1.932E-02	-1.936E-02	-1.942E-02	-1.951E-02	-1.963E-02	-1.981E-02	-2.015E-02	-1.943E-02	-4.720E-03
	6.651E-03	2.629E-02	2.902E-02	5.872E-03	-1.278E-03					
NA	1.854E-07	1.855E-07	1.852E-07	1.847E-07	1.840E-07	1.828E-07	1.813E-07	1.782E-07	1.704E-07	1.540E-07
	1.203E-07	1.027E-07	3.561E-08	2.307E-09	0.E+00					
	-6.562E-08	-6.571E-08	-6.579E-08	-6.593E-08	-6.615E-08	-6.650E-08	-6.695E-08	-6.785E-08	-7.013E-08	-7.454E-08
	-7.615E-08	-7.406E-08	-4.422E-08	-4.693E-09	0.E+00					
	-1.929E-08	-1.932E-08	-1.936E-08	-1.942E-08	-1.951E-08	-1.963E-08	-1.981E-08	-2.015E-08	-1.943E-08	-4.720E-09
	6.651E-09	2.629E-08	2.902E-08	5.872E-09	-1.278E-09					
O2	1.913E-01	1.914E-01	1.915E-01	1.916E-01	1.918E-01	1.920E-01	1.924E-01	1.931E-01	1.950E-01	1.988E-01
	2.040E-01	2.189E-01	2.266E-01	2.345E-01	2.350E-01					
	1.542E-02	1.544E-02	1.546E-02	1.549E-02	1.554E-02	1.563E-02	1.573E-02	1.594E-02	1.649E-02	1.752E-02
	1.790E-02	1.740E-02	1.039E-02	1.103E-03	0.E+00					
	4.534E-03	4.541E-03	4.550E-03	4.563E-03	4.585E-03	4.613E-03	4.655E-03	4.735E-03	4.566E-03	1.109E-03
	-1.445E-03	-6.179E-03	-6.020E-03	-1.380E-03	3.094E-04					
N2	6.229E-01	6.231E-01	6.233E-01	6.237E-01	6.243E-01	6.252E-01	6.263E-01	6.287E-01	6.347E-01	6.472E-01
	6.649E-01	6.864E-01	7.378E-01	7.632E-01	7.650E-01					
	5.121E-02	5.127E-02	5.133E-02	5.143E-02	5.060E-02	5.047E-02	5.121E-02	5.190E-02	5.365E-02	5.703E-02
	5.126E-02	5.665E-02	3.382E-02	1.599E-03	0.E+00					
	1.474E-02	1.471E-02	1.481E-02	1.485E-02	1.492E-02	1.502E-02	1.515E-02	1.542E-02	1.486E-02	3.611E-03
	-4.766E-03	-7.011E-02	-2.228E-02	-4.492E-03	9.778E-04					

MOLE FRACTIONS

H	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					

C	2.837E-03	2.885E-03	2.932E-03	3.005E-03	3.123E-03	3.334E-03	3.600E-03	4.161E-03	5.558E-03	3.409E-03
	1.481E-04	4.513E-05	4.619E-06	2.092E-07	0.E+00					
NA	7.910E-09	7.758E-09	7.607E-09	7.386E-09	7.026E-09	6.483E-09	5.863E-09	4.841E-09	3.440E-09	3.391E-09
	1.179E-08	1.332E-08	6.518E-09	4.570E-10	0.E+00					
O2	1.293E-10	1.357E-10	1.425E-10	1.533E-10	1.734E-10	2.122E-10	2.753E-10	4.782E-10	2.520E-09	1.028E-06
	9.791E-04	4.525E-03	2.429E-02	3.833E-02	3.938E-02					
N2	5.994E-01	5.997E-01	5.999E-01	6.003E-01	6.010E-01	6.020E-01	6.033E-01	5.060E-01	6.136E-01	6.349E-01
	6.414E-01	6.425E-01	6.487E-01	6.529E-01	6.532E-01					
E-	2.056E-07	2.067E-07	2.079E-07	2.097E-07	2.127E-07	2.181E-07	2.259E-07	2.479E-07	3.876E-07	2.365E-06
	1.462E-05	1.927E-05	2.420E-05	2.545E-05	2.553E-05					
CH	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CHN	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CHNO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CHO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CH2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CH2O	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CH4	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
CN	2.848E-02	2.860E-02	2.872E-02	2.890E-02	2.917E-02	2.958E-02	3.001E-02	3.057E-02	2.921E-02	8.563E-03
	3.260E-04	1.048E-04	1.187E-05	5.565E-07	0.E+00					
CNNA	2.300E-08	2.215E-08	2.132E-08	2.013E-08	1.827E-08	1.550E-08	1.275E-08	8.481E-09	3.081E-09	2.154E-10
	2.188E-11	8.814E-12	5.876E-13	2.049E-15	0.E+00					
CO	3.390E-01	3.390E-01	3.390E-01	3.391E-01	3.391E-01	3.391E-01	3.392E-01	3.394E-01	3.404E-01	3.441E-01
	2.911E-01	2.279E-01	7.468E-02	4.712E-03	0.E+00					
CO2	4.350E-06	4.400E-06	4.451E-06	4.529E-06	4.665E-06	4.902E-06	5.233E-06	6.050E-06	9.831E-06	9.280E-05
	2.106E-03	3.743E-03	3.135E-03	2.565E-04	0.E+00					
C2	4.625E-03	4.642E-03	4.659E-03	4.682E-03	4.715E-03	4.754E-03	4.775E-03	4.711E-03	3.755E-03	2.327E-04
	3.155E-07	3.330E-08	4.401E-10	9.727E-13	0.E+00					
C2H	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C2H2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C2H4	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
C2N2	1.645E-02	1.613E-02	1.581E-02	1.534E-02	1.457E-02	1.336E-02	1.191E-02	9.227E-03	3.876E-03	5.820E-05
	6.117E-08	7.166E-09	1.151E-10	2.718E-13	0.E+00					
C3	8.668E-03	8.526E-03	8.384E-03	8.1[illegible]2E-03	7.811E-03	7.232E-03	6.506E-03	5.070E-03	1.964E-03	7.752E-06
	3.013E-10	1.138E-11	2.061E-14	2.266E-18	0.E+00					
HN	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HNA	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HNAO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HNO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HO	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H2N	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H2N2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					

H2O	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00				
H3N	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H4N2	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
NAO	9.708E-14	9.725E-14	9.742E-14	9.767E-14	9.812E-14	9.895E-14	1.004E-13	1.060E-13	1.589E-13	2.580E-12
	2.657E-10	6.560E-10	7.051E-10	6.799E-11	0.E+00					
NA2	3.419E-19	3.290E-19	3.165E-19	2.985E-19	2.705E-19	2.306E-19	1.890E-19	1.294E-19	6.581E-20	6.353E-20
	7.627E-19	9.772E-19	2.349E-19	1.156E-21	0.E+00					
N	4.693E-04	4.805E-04	4.920E-04	5.098E-04	5.409E-04	5.950E-04	6.710E-04	8.567E-04	1.640E-03	7.063E-03
	9.254E-03	8.357E-03	6.972E-03	6.590E-03	6.567E-03					
NO	3.415E-06	3.514E-06	3.616E-06	3.776E-06	4.061E-06	4.573E-06	5.327E-06	7.350E-06	1.904E-05	5.043E-04
	1.638E-02	3.463E-02	7.804E-02	9.733E-02	9.862E-02					
NO2	2.592E-13	2.725E-13	2.865E-13	3.090E-13	3.511E-13	4.325E-13	5.659E-13	1.000E-12	5.514E-12	2.488E-09
	2.417E-06	1.112E-05	5.936E-05	9.364E-05	9.622E-05					
NO3	6.443E-22	6.957E-22	7.515E-22	8.445E-22	1.028E-21	1.417E-21	2.142E-21	5.138E-21	7.035E-20	7.681E-16
	2.381E-11	2.324E-10	2.808E-09	5.522E-09	5.749E-09					
N2O	2.046E-09	2.117E-09	2.170E-09	2.268E-09	2.444E-09	2.760E-09	3.227E-09	4.485E-09	1.188E-08	3.340E-07
	1.101E-05	2.320E-05	5.221E-05	6.519E-05	6.606E-05					
N2O3	5.485E-23	5.929E-23	6.411E-23	7.216E-23	8.807E-23	1.219E-22	1.853E-22	4.496E-22	6.345E-21	7.455E-17
	2.348E-12	2.284E-11	2.752E-10	5.417E-10	5.640E-10					
N2O4	4.538E-31	5.015E-31	5.545E-31	6.455E-31	8.339E-31	1.267E-30	2.172E-30	6.812E-30	2.099E-28	4.499E-23
	4.300E-17	9.052E-16	2.557E-14	6.347E-14	6.700E-14					
N2O5	1.167E-37	1.321E-37	1.496E-37	1.907E-37	2.483E-37	4.173E-37	8.149E-37	3.369E-36	2.380E-34	1.022E-27
	3.008E-20	1.363E-18	8.936E-17	2.787E-16	2.982E-16					
O	2.942E-06	3.052E-06	3.162E-06	3.345E-06	3.671E-06	4.269E-06	5.178E-06	7.758E-06	2.502E-05	1.080E-03
	3.831E-02	7.805E-02	1.640E-01	1.997E-01	2.020E-01					
C+1	7.998E-09	8.538E-09	9.155E-09	1.013E-08	1.199E-08	1.566E-08	2.178E-08	4.128E-08	1.680E-07	5.671E-07
	7.615E-09	1.369E-09	7.088E-11	2.639E-12	0.E+00					
NA+	1.982E-07	1.987E-07	1.993E-07	2.000E-07	2.011E-07	2.025E-07	2.038E-07	2.046E-07	2.005E-07	1.828E-07
	1.413E-07	1.071E-07	3.338E-08	2.071E-09	0.E+00					
NO+	5.190E-10	5.563E-10	5.974E-10	6.641E-10	7.928E-10	1.054E-09	1.508E-09	3.097E-09	1.893E-08	1.561E-06
	1.412E-05	1.834E-05	2.249E-05	2.360E-05	2.366E-05					
O-	3.228E-12	3.329E-12	3.433E-12	3.597E-12	3.893E-12	4.433E-12	5.257E-12	7.679E-12	2.816E-11	3.543E-09
	6.749E-07	1.914E-06	5.572E-06	7.362E-06	7.484E-06					
C-	1.176E-09	1.189E-09	1.203E-09	1.225E-09	1.261E-09	1.320E-09	1.401E-09	1.594E-09	2.486E-09	4.718E-09
	1.113E-09	4.702E-10	6.615E-11	3.244E-12	0.E+00					
H+1	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
HO-1	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
H3O+1	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00
	0.E+00	0.E+00	0.E+00	0.E+00	0.E+00					
N+1	9.076E-13	9.930E-13	1.086E-12	1.243E-12	1.558E-12	2.234E-12	3.507E-12	8.591E-12	7.612E-11	4.593E-09
	2.208E-09	1.101E-09	4.119E-10	3.079E-10	3.025E-10					
NO2-	2.718E-16	2.818E-16	2.902E-16	3.050E-16	3.319E-16	3.819E-16	4.603E-16	7.032E-16	3.202E-15	2.060E-12
	9.432E-09	6.354E-08	5.151E-07	9.083E-07	9.394E-07					
N2+1	7.752E-11	8.333E-11	8.959E-11	9.988E-11	1.197E-10	1.600E-10	2.298E-10	4.699E-10	2.582E-09	5.405E-08
	2.247E-08	1.156E-08	4.986E-09	3.908E-09	3.851E-09					
O+1	1.248E-14	1.378E-14	1.520E-14	1.764E-14	2.260E-14	3.369E-14	5.565E-14	1.530E-13	2.032E-12	9.479E-10
	1.176E-08	1.348E-08	1.313E-08	1.278E-08	1.275E-08					
O2+1	1.605E-14	1.761E-14	1.933E-14	2.224E-14	2.815E-14	4.118E-14	6.664E-14	1.778E-13	2.400E-12	3.652E-09
	1.001E-06	2.808E-06	8.014E-06	1.056E-05	1.073E-05					
O2-	2.682E-17	2.811E-17	2.948E-17	3.167E-17	3.576E-17	4.367E-17	5.670E-17	1.008E-16	6.861E-16	1.080E-12
	5.815E-09	3.668E-08	2.633E-07	4.456E-07	4.597E-07					

CASE 2 - - - - - - - - - - - - STREAMWISE DIMENSION 0.42310E+01 FEET - - - -

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX.LIN ERROR	MAX.ERRORS IN CONSERVATION EQS. MOMENTUM	ENERGY	H	C	NA	O2	
1	8.36232.173	7.88400.4999			5E-02 18	4.1E+01 13	1.8E+03 13	-4.8E-03 13	-1.8E-01 13	-2.0E-07 15	5.2E-02	0
2	17.28232.707	8.07551.0000			3E-02 18	1.8E+01 13	8.8E+02 13	-2.4E-03 13	-9.1E-02 13	-1.0E-07 15	2.0E-02	0
3	26.08632.744	8.07401.0000			3E-02 18	-4.1E+00 15	-1.6E+02 15	6.6E-05 15	2.1E-03 15	2.3E-09 15	-7.4E-03	0
4	34.18832.737	8.07381.0000			5E-03 18	-1.4E+00 15	-2.4E+01 15	-1.4E-06 15	-6.4E-05 15	-6.9E-11 15	-1.7E-03	0
5	42.18132.735	8.07381.0000			5E-04 18	-2.1E-01 15	-1.5E+00 3	-1.9E-07 3	-8.4E-06 3	-9.1E-12 15	-1.8E-04	0
6	50.12032.735	8.07381.0000			5E-05 18	-6.4E-03 15	3.8E-01 3	-5.0E-08 3	-2.2E-06 3	-2.4E-12 15	8.2E-06	0
7	57.53832.735	8.07381.0000			2E-05 18	3.9E-03 15	1.2E-01 11	-1.1E-07 11	-5.1E-06 11	-5.5E-12 15	6.3E-06	0
8	64.95732.735	8.07381.0000			4E-06 18	1.0E-03 15	1.6E-02 10	8.5E-09 10	3.8E-07 10	4.1E-13 15	1.2E-06	0
9	72.37532.735	8.07381.0000			2E-07 18	1.2E-04 11	-1.4E-03 11	2.6E-09 11	1.2E-07 11	1.3E-13 15	9.3E-08	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	DIFFUSIONAL	HEAT FLUXES TOT ENTH	RERAD (BTU/SEC SQ FT)	QCOND
3.273E+01	8.432E-03	6.218E-01	4.161E+00	1.010E+04	1.960E-03	7.106E-02	1.081E+03	9.188E+02	0.E+00	1.253E+03

WALL SHEAR (LB/SQ FT)	MECH REM	MASS FLUXES PYROL GAS (LB/SEC SQ FT)	CHAR	TOTAL GAS	ELEMENTAL MASS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
1.713E+02	0.E+00	0.E+00	1.160E-01	1.160E-01	-1.970E-03	-8.694E-02	7.201E-02	1.690E-02	-9.414E-08

MOM TRANS COEFF, RHO*UE*CF/2	HEAT TRANS COEFF, RHO*UE*CH	BLOWING PARAMETERS (BASED ON CH) PYROL GAS	CHAR	TOTAL GAS	ELEMENTAL MASS TRANSFER COEFFICIENTS, RHOE*UE*CM (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
5.457E-01	4.309E-01	0.E+00	2.692E-01	2.692E-01	5.021E-01	4.990E-01	4.992E-01	4.983E-01	4.992E-01

MOMENTUM THICKNESS, THETA (FT)	DISPLACE. THICKNESS, DELSTAR (FT)	EFFECTIVE BODY DISPLACE. (FT)	ENTHALPY THICKNESS, LAMBDA (FT)	REYNOLDS NUMBER PER FOOT	MASS THICKNESSES (FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN	SODIUM
-2.224E-02	-5.340E-02	-5.249E-02	4.698E-03	4.963E+06	4.642E-03	4.851E-03	4.835E-03	4.894E-03	4.835E-03

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FTSQ)	TOTAL ENTHALPY,G (BTU/LB)	CP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.E+00	0.E+00	-1.189E+00	0.E+00	8.074E+00	1.713E+02	1.395E+03	0.901E+03	-4.340E+04	1.395E+03	6.076E+03	4.164E+11
5.954E-05	6.547E-02	-1.174E+00	3.874E-01	3.762E+00	1.853E+02	1.951E+03	7.000E+03	-6.406E+04	1.645E+03	6.753E+03	3.949E+11
1.194E-04	1.309E-01	-1.143E+00	5.577E-01	1.439E+00	1.915E+02	2.275E+03	2.866E+03	-1.535E+04	1.642E+03	6.608E+03	3.992E+11
2.057E-04	2.291E-01	-1.082E+00	6.612E-01	6.685E-01	1.951E+02	2.483E+03	1.359E+03	-4.011E+03	1.593E+03	6.460E+03	4.038E+11
3.445E-04	3.928E-01	-9.665E-01	7.438E-01	3.406E-01	1.978E+02	2.652E+03	7.021E+02	-1.179E+03	1.525E+03	6.309E+03	4.086E+11
5.985E-04	6.547E-01	-7.618E-01	8.130E-01	1.836E-01	1.999E+02	2.795E+03	3.934E+02	-4.288E+02	1.449E+03	6.157E+03	4.136E+11
8.174E-04	9.820E-01	-4.867E-01	8.636E-01	1.203E-01	2.012E+02	2.901E+03	2.530E+02	-1.625E+02	1.382E+03	6.030E+03	4.179E+11
1.316E-03	1.637E+00	1.003E-01	9.256E-01	6.908E-02	2.023E+02	3.032E+03	1.466E+02	-4.686E+01	1.287E+03	5.847E+03	4.244E+11
2.492E-03	3.277E+00	1.632E+00	1.009E+00	3.270E-02	2.020E+02	3.209E+03	6.991E+01	-1.088E+01	1.136E+03	5.535E+03	4.362E+11
4.657E-03	6.547E+00	3.140E+00	1.089E+00	1.612E-02	1.977E+02	3.379E+03	3.431E+01	-1.978E+00	9.652E+02	5.098E+03	4.545E+11
7.571E-03	1.146E+01	1.066E+01	1.157E+00	1.178E-02	1.877E+02	3.524E+03	2.459E+01	-1.632E+00	7.965E+02	4.492E+03	4.842E+11
1.010E-02	1.637E+01	1.607E+01	1.206E+00	8.157E-03	1.742E+02	3.625E+03	1.658E+01	-7.419E-01	6.619E+02	3.868E+03	5.218E+11
1.630E-02	3.273E+01	3.735E+01	1.293E+00	2.475E-03	1.269E+02	3.797E+03	4.437E+00	-1.496E-01	3.910E+02	2.474E+03	6.525E+11
2.155E-02	5.238E+01	6.234E+01	1.327E+00	9.828E-04	9.072E+01	3.855E+03	1.498E+00	1.280E-01	2.681E+02	1.836E+03	7.573E+11
2.[illegible]4E-02	8.184E+01	1.026E+02	1.366E+00	8.757E-05	1.300E+01	3.903E+03	0.E+00	-2.297E-01	1.054E+02	8.896E+02	1.088E+12

DISTANCE FROM WALL (FT)	DENSITY, RHO (LB/CU FT)	VISCOSITY, MU LB/SEC FT	RHO*MU /RHOE*MUE, C	SPECIFIC HEAT (BTU/LB R)	THERMAL COND (BTU /SEC FT R)	PRANDTL NUMBER	MODIFIED SCHMIDT NUMBER	MOLECULAR WEIGHT	RHOSQ*EPS /RHOE*MUE	MACH NUMBER
0.E+00	2.509E-02	5.572E-05	9.512E-01	3.396E-01	3.003E-05	6.305E-01	7.010E-01	2.676E+01	0.E+00	0.E+00
5.964E-05	2.224E-02	5.965E-05	9.028E-01	3.335E-01	3.210E-05	6.196E-01	7.002E-01	2.637E+01	1.306E+00	1.040E+00
1.194E-04	2.308E-02	5.885E-05	9.243E-01	3.306E-01	3.037E-05	6.406E-01	7.006E-01	2.677E+01	5.041E+00	1.479E+00
2.057E-04	2.392E-02	5.739E-05	9.441E-01	3.286E-01	2.916E-05	6.534E-01	7.006E-01	2.713E+01	1.214E+01	1.792E+00
3.445E-04	2.481E-02	5.710E-05	9.641E-01	3.268E-01	2.814E-05	6.631E-01	7.005E-01	2.748E+01	2.508E+01	2.059E+00
5.585E-04	2.574E-02	5.618E-05	9.839E-01	3.252E-01	2.725E-05	6.705E-01	7.002E-01	2.782E+01	4.656E+01	2.297E+00
8.174E-04	2.653E-02	5.543E-05	1.000E+00	3.240E-01	2.658E-05	6.753E-01	6.999E-01	2.808E+01	7.402E+01	2.480E+00
1.316E-03	2.770E-02	5.427E-05	1.023E+00	3.223E-01	2.570E-05	6.803E-01	6.994E-01	2.843E+01	1.303E+02	2.718E+00
2.492E-03	2.975E-02	5.229E-05	1.059E+00	3.193E-01	2.436E-05	6.854E-01	6.986E-01	2.891E+01	2.759E+02	3.067E+00
4.657E-03	3.274E-02	4.947E-05	1.102E+00	3.176E-01	2.281E-05	6.882E-01	6.975E-01	2.930E+01	5.490E+02	3.448E+00
7.571E-03	3.731E-02	4.545E-05	1.154E+00	3.127E-01	2.064E-05	6.886E-01	6.965E-01	2.942E+01	7.131E+02	3.845E+00
1.010E-02	4.321E-02	4.113E-05	1.210E+00	3.074E-01	1.838E-05	6.880E-01	6.957E-01	2.934E+01	9.565E+02	4.247E+00
1.636E-02	6.695E-02	3.059E-05	1.393E+00	2.902E-01	1.293E-05	6.865E-01	6.946E-01	2.907E+01	2.296E+03	5.559E+00
2.155E-02	8.987E-02	2.512E-05	1.536E+00	2.741E-01	1.004E-05	6.860E-01	6.943E-01	2.897E+01	4.137E+03	6.538E+00
2.644E-02	1.848E-01	1.557E-05	1.958E+00	1.775E-01	4.035E-06	6.852E-01	6.940E-01	2.886E+01	6.654E+03	8.715E+00

DISTANCE FROM WALL,FT

0.E+00 5.964E-05 1.194E-04 2.057E-04 3.445E-04 5.585E-04 8.174E-04 1.316E-03 2.492E-03 4.657E-03
7.571E-03 1.010E-02 1.636E-02 2.155E-02 2.644E-02

ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA

H 3.923E-03 2.904E-03 2.410E-03 2.095E-03 1.839E-03 1.623E-03 1.466E-03 1.273E-03 1.014E-03 7.683E-04
5.618E-04 4.181E-04 1.732E-04 8.963E-05 0.E+00
-2.043E-02-1.072E-02-4.358E-03-2.065E-03-1.059E-03-5.879E-04-3.750E-04-2.149E-04-1.011E-04-4.910E-05
-3.499E-05-2.356E-05-6.366E-06-2.143E-06 0.E+00
1.484E-01 9.712E-02 2.335E-02 6.141E-03 1.801E-03 6.505E-04 2.444E-04 6.955E-05 1.588E-05 2.874E-06
2.328E-06 1.056E-06 2.151E-07 7.287E-07 4.741E-07

C 1.742E-01 1.292E-01 1.075E-01 9.354E-02 8.225E-02 7.273E-02 6.577E-02 5.724E-02 4.580E-02 3.492E-02
2.573E-02 1.931E-02 8.272E-03 4.398E-03 0.E+00
-9.017E-01-4.730E-01-1.923E-01-9.114E-02-4.677E-02-2.596E-02-1.656E-02-9.497E-03-4.473E-03-2.179E-03
-1.561E-03-1.056E-03-2.923E-04-1.021E-04 0.E+00
6.548E+00 4.287E+00 1.031E+00 2.711E-01 7.949E-02 2.871E-02 1.079E-02 3.070E-03 7.007E-04 1.260E-04
1.027E-04 4.669E-05 9.684E-06-1.654E-05 2.347E-05

NA 1.886E-07 1.398E-07 1.163E-07 1.012E-07 8.897E-08 7.866E-08 7.112E-08 6.189E-08 4.951E-08 3.772E-08
2.779E-08 2.084E-08 8.904E-09 4.726E-09 0.E+00
-9.764E-07-5.122E-07-2.083E-07-9.869E-08-5.065E-08-2.811E-08-1.793E-08-1.028E-08-4.843E-09-2.359E-09
-1.689E-09-1.143E-09-3.156E-10-1.099E-10 0.E+00
7.091E-06 4.642E-06 1.116E-06 2.935E-07 8.607E-08 3.109E-08 1.168E-08 3.324E-09 7.588E-10 1.365E-10
1.112E-10 5.053E-11 1.047E-11-1.774E-11 2.520E-11

O2 2.011E-01 2.098E-01 2.141E-01 2.168E-01 2.190E-01 2.208E-01 2.222E-01 2.238E-01 2.261E-01 2.282E-01
2.300E-01 2.312E-01 2.334E-01 2.341E-01 2.350E-01
1.753E-01 9.195E-02 3.739E-02 1.772E-02 9.093E-03 5.043E-03 3.219E-03 1.847E-03 8.699E-04 4.241E-04
3.040E-04 2.060E-04 5.728E-05 2.015E-05 0.E+00
-1.273E+00-8.333E-01-2.003E-01-5.269E-02-1.545E-02-5.581E-03-2.097E-03-5.967E-04-1.362E-04-2.445E-05
-1.996E-05-9.089E-06-1.890E-06 3.297E-06-4.665E-06

N2 6.208E-01 6.599E-01 6.761E-01 6.876E-01 6.969E-01 7.048E-01 7.106E-01 7.177E-01 7.271E-01 7.361E-01
7.437E-01 7.491E-01 7.542E-01 7.614E-01 7.650E-01
7.469E-01 3.918E-01 1.593E-01 7.549E-02 3.874E-02 2.150E-02 1.372E-02 7.866E-03 3.704E-03 1.804E-03
1.292E-03 8.740E-04 2.414E-04 8.419E-05 0.E+00
-5.424E+00-3.551E+00-9.536E-01-2.245E-01-6.584E-02-2.378E-02-8.936E-03-2.543E-03-5.804E-04-1.044E-04
-8.506E-05-3.865E-05-8.009E-06 1.357E-05-1.928E-05

MOLE FRACTIONS

H 2.842E-02 4.532E-02 3.153E-02 2.305E-02 1.677E-02 1.207E-02 9.053E-03 5.885E-03 2.648E-03 7.462E-04
8.827E-05 4.946E-06 4.777E-11 8.808E-16 0.E+00

C	2.152E-04	4.363E-08	9.998E-09	3.319E-09	1.160E-09	4.073E-10	1.662E-10	4.417E-11	3.825E-12	7.941E-14
	9.188E-17	1.087E-20	2.181E-36	2.340E-51	0.E+00					
NA	2.318E-08	5.896E-09	7.113E-09	7.704E-09	8.101E-09	8.391E-09	8.585E-09	8.817E-09	9.056E-09	8.563E-09
	6.677E-09	3.535E-09	9.135E-12	1.578E-14	0.E+00					
O2	4.664E-13	3.023E-03	1.147E-02	2.053E-02	3.041E-02	4.074E-02	4.955E-02	6.197E-02	8.206E-02	1.067E-01
	1.344E-01	1.565E-01	1.904E-01	2.007E-01	2.119E-01					
N2	5.738E-01	6.137E-01	6.359E-01	6.530E-01	6.689E-01	6.839E-01	6.958E-01	7.114E-01	7.339E-01	7.557E-01
	7.716E-01	7.794E-01	7.864E-01	7.874E-01	7.881E-01					
E-	1.847E-07	4.178E-07	4.094E-07	3.336E-07	2.547E-07	1.868E-07	1.403E-07	8.991E-08	3.761E-08	7.941E-09
	4.429E-10	7.901E-12	2.087E-19	1.152E-26	0.E+00					
CH	1.449E-05	1.289E-09	2.644E-10	8.430E-11	2.866E-11	9.828E-12	3.933E-12	1.017E-12	8.411E-14	1.558E-15
	1.739E-18	1.834E-22	2.388E-38	1.859E-53	0.E+00					
CHN	3.304E-02	5.094E-07	1.744E-07	7.904E-08	3.903E-08	1.979E-08	1.118E-08	4.847E-09	1.048E-09	9.037E-11
	1.387E-12	5.181E-15	1.426E-24	1.444E-33	0.E+00					
CHNO	7.193E-08	4.315E-08	2.873E-08	2.111E-08	1.555E-08	1.130E-08	8.497E-09	5.470E-09	2.308E-09	5.281E-10
	3.830E-11	1.080E-12	8.598E-19	1.730E-24	0.E+00					
CHO	1.419E-05	1.136E-05	6.978E-06	4.728E-06	3.201E-06	2.132E-06	1.485E-06	8.532E-07	2.922E-07	4.818E-08
	2.008E-09	2.659E-11	9.053E-19	8.093E-26	0.E+00					
CH2	6.714E-07	2.087E-11	4.013E-12	1.288E-12	4.482E-13	1.584E-13	6.522E-14	1.765E-14	1.598E-15	3.475E-17
	5.248E-20	8.489E-24	7.138E-39	3.935E-53	0.E+00					
CH2O	1.352E-08	5.335E-09	2.870E-09	1.821E-09	1.168E-09	7.390E-10	4.931E-10	2.663E-10	8.178E-11	1.151E-11
	3.775E-13	3.689E-15	4.309E-23	1.655E-30	0.E+00					
CH4	3.651E-08	1.019E-13	1.826E-14	6.345E-15	2.478E-15	1.000E-15	4.648E-16	1.516E-16	1.969E-17	7.877E-19
	3.555E-21	2.623E-24	1.308E-36	4.466E-48	0.E+00					
CN	3.289E-03	2.695E-07	7.553E-08	3.098E-08	1.354E-08	6.004E-09	3.006E-09	1.086E-09	1.660E-10	8.073E-12
	4.538E-14	4.247E-17	3.599E-29	1.137E-40	0.E+00					
CNNA	1.153E-08	4.563E-14	2.136E-14	1.348E-14	8.997E-15	6.119E-15	4.430E-15	2.765E-15	1.146E-15	2.499E-16
	1.560E-17	2.851E-19	1.475E-27	1.153E-35	0.E+00					
CO	3.363E-01	2.731E-01	2.195E-01	1.837E-01	1.534E-01	1.267E-01	1.065E-01	8.098E-02	4.656E-02	1.739E-02
	2.858E-03	2.410E-04	1.380E-08	1.366E-12	0.E+00					
CO2	4.256E-07	1.061E-02	2.005E-02	2.753E-02	3.475E-02	4.173E-02	4.731E-02	5.451E-02	6.368E-02	6.777E-02
	6.018E-02	4.693E-02	2.002E-02	1.061E-02	0.E+00					
C2	1.326E-04	6.210E-13	4.988E-14	8.696E-15	1.731E-15	3.567E-16	9.334E-17	1.303E-17	3.480E-19	1.038E-21
	4.971E-26	7.737E-32	5.842E-55	5.718E-77	0.E+00					
C2H	4.498E-03	4.337E-12	3.520E-13	7.109E-14	1.631E-14	3.925E-15	1.180E-15	2.033E-16	8.093E-18	4.645E-20
	6.977E-23	5.201E-29	2.560E-49	1.508E-68	0.E+00					
C2H2	1.609E-03	4.457E-13	3.619E-14	7.456E-15	1.830E-15	4.755E-16	1.533E-16	2.943E-17	1.444E-18	1.182E-20
	3.370E-24	6.167E-29	1.414E-47	4.129E-65	0.E+00					
C2H4	9.261E-09	6.564E-19	4.046E-20	7.236E-21	1.576E-21	3.650E-22	1.058E-22	1.778E-23	6.761E-25	3.778E-27
	5.902E-31	4.892E-36	5.521E-56	1.182E-74	0.E+00					
C2N2	8.900E-04	7.425E-13	8.775E-14	2.293E-14	6.996E-15	2.253E-15	8.721E-16	2.187E-16	1.731E-17	2.904E-19
	2.610E-22	2.182E-26	1.963E-42	1.409E-57	0.E+00					
C3	3.492E-04	2.182E-17	6.845E-19	7.038E-20	9.026E-21	1.242E-21	2.338E-22	2.035E-23	2.310E-25	1.744E-28
	7.923E-34	5.395E-41	2.172E-69	2.453E-96	0.E+00					
HN	8.301E-06	1.963E-05	1.296E-05	8.894E-06	6.041E-06	4.037E-06	2.832E-06	1.662E-06	6.142E-07	1.247E-07
	8.281E-09	2.084E-10	7.218E-17	5.015E-23	0.E+00					
HNA	7.231E-11	1.371E-11	1.336E-11	1.242E-11	1.127E-11	1.006E-11	9.043E-12	7.661E-12	5.523E-12	3.000E-12
	9.302E-13	1.422E-13	2.598E-18	4.481E-23	0.E+00					
HNAO	8.760E-15	3.839E-11	9.304E-11	1.507E-10	2.204E-10	3.056E-10	3.928E-10	5.496E-10	9.433E-10	1.872E-09
	4.722E-09	1.136E-08	1.116E-08	5.954E-09	0.E+00					
HNO	1.214E-11	9.971E-07	1.511E-06	1.658E-06	1.656E-06	1.563E-06	1.440E-06	1.230E-06	8.549E-07	4.354E-07
	1.243E-07	2.092E-08	1.314E-11	1.168E-14	0.E+00					
HO	1.264E-07	8.033E-03	1.250E-02	1.418E-02	1.471E-02	1.447E-02	1.385E-02	1.253E-02	9.761E-03	6.023E-03
	2.417E-03	6.487E-04	2.655E-06	1.396E-08	0.E+00					
H2	1.746E-02	8.530E-03	5.705E-03	4.320E-03	3.314E-03	2.535E-03	2.009E-03	1.422E-03	7.538E-04	2.796E-04
	5.384E-05	5.857E-06	8.396E-10	2.204E-13	0.E+00					
H2O	5.221E-07	4.673E-07	2.845E-07	1.935E-07	1.321E-07	8.926E-08	6.333E-08	3.780E-08	1.458E-08	3.201E-09
	2.477E-10	7.738E-12	6.468E-19	1.153E-23	0.E+00					
H2O2	2.349E-11	2.669E-11	1.588E-11	1.047E-11	6.913E-12	4.502E-12	3.090E-12	1.755E-12	6.117E-13	1.138E-13
	6.615E-15	1.408E-16	2.848E-23	1.414E-29	0.E+00					

H2O	1.730E-07	2.747E-03	4.275E-03	5.246E-03	6.007E-03	6.590E-03	6.958E-03	7.317E-03	7.582E-03	7.499E-03	
	6.893E-03	5.752E-03	2.496E-03	1.288E-03	0.E+00						
H3N	4.048E-08	1.205E-08	6.933E-09	4.797E-09	3.391E-09	2.390E-09	1.764E-09	1.123E-09	4.890E-10	1.332E-10	
	1.537E-11	8.405E-13	7.892E-18	1.671E-22	0.E+00						
H4N2	1.811E-16	7.097E-17	3.621E-17	1.623E-17	8.890E-18	4.812E-18	2.819E-18	1.268E-18	2.894E-19	2.823E-20	
	5.781E-22	3.096E-24	2.979E-33	1.219E-41	0.E+00						
NAO	4.664E-15	7.794E-11	1.906E-10	2.884E-10	3.864E-10	4.859E-10	5.719E-10	6.997E-10	9.302E-10	1.210E-09	
	1.453E-09	1.269E-09	1.961E-11	1.750E-13	0.E+00						
NA2	7.429E-20	5.000E-21	7.219E-21	8.399E-21	9.205E-21	9.784E-21	1.016E-20	1.059E-20	1.093E-20	9.446E-21	
	5.412E-21	1.396E-21	6.453E-27	1.332E-32	0.E+00						
N	4.425E-05	2.577E-04	1.869E-04	1.315E-04	9.023E-05	6.066E-05	4.270E-05	2.513E-05	9.303E-06	1.571E-06	
	1.199E-07	2.865E-09	7.821E-16	3.982E-22	5.499E-48						
NO	9.423E-08	1.079E-02	2.010E-02	2.548E-02	2.922E-02	3.171E-02	3.300E-02	3.376E-02	3.272E-02	2.800E-02	
	1.895E-02	1.018E-02	6.483E-04	4.270E-05	5.114E-10						
NO2	1.158E-16	8.732E-07	3.295E-06	5.933E-06	8.518E-06	1.122E-05	1.343E-05	1.636E-05	2.051E-05	2.418E-05	
	2.532E-05	2.274E-05	9.645E-06	3.749E-06	6.458E-08						
NO3	1.783E-27	1.317E-12	9.311E-12	2.115E-11	3.598E-11	5.238E-11	6.641E-11	8.519E-11	1.100E-10	1.241E-10	
	1.092E-10	7.235E-11	8.057E-12	8.885E-13	1.201E-16						
N2O	8.648E-12	1.045E-06	1.973E-06	2.523E-06	2.915E-06	3.185E-06	3.321E-06	3.429E-06	3.348E-06	2.883E-06	
	1.960E-06	1.064E-06	7.732E-08	6.249E-09	2.273E-13						
N2O3	2.144E-29	1.736E-14	1.235E-13	2.807E-13	4.770E-13	6.927E-13	8.753E-13	1.115E-12	1.416E-12	1.540E-12	
	1.257E-12	7.484E-13	5.408E-14	3.972E-15	1.109E-19						
N2O4	2.610E-39	1.434E-19	2.053E-18	6.471E-18	1.391E-17	2.435E-17	3.520E-17	5.305E-17	8.620E-17	1.277E-16	
	1.607E-16	1.627E-16	9.756E-17	5.900E-17	1.454E-17						
N2O5	6.502E-48	2.942E-23	8.183E-22	3.442E-21	8.977E-21	1.813E-20	2.801E-20	4.832E-20	8.944E-20	1.484E-19	
	2.026E-19	2.110E-19	1.166E-19	6.326E-20	1.235E-20						
C	1.183E-07	2.386E-02	3.882E-02	4.278E-02	4.236E-02	3.947E-02	3.595E-02	3.016E-02	2.028E-02	9.779E-03	
	2.528E-03	3.729E-04	1.331E-07	6.243E-11	1.247E-24						
C+1	1.168E-12	6.617E-15	6.849E-16	1.161E-16	2.094E-17	3.770E-18	8.654E-19	9.840E-20	1.828E-21	3.615E-24	
	1.134E-28	1.095E-34	3.323E-58	1.374E-80	0.E+00						
NA+	1.847E-07	1.543E-07	1.280E-07	1.112E-07	9.762E-08	8.598E-08	7.732E-08	6.646E-08	5.132E-08	3.642E-08	
	2.271E-08	1.043E-08	6.802E-11	3.721E-13	0.E+00						
HO+	1.459E-13	2.318E-07	2.238E-07	1.680E-07	1.163E-07	7.633E-08	5.171E-08	2.818E-08	8.828E-09	1.464E-09	
	7.853E-11	1.585E-12	7.381E-19	7.033E-25	0.E+00						
O-	2.145E-14	4.533E-09	8.421E-09	8.908E-09	8.006E-09	6.549E-09	5.245E-09	3.568E-09	1.548E-09	3.111E-10	
	1.384E-11	1.590E-13	3.974E-22	1.586E-30	0.E+00						
C-	1.246E-11	2.841E-15	7.330E-16	2.301E-16	7.183E-17	2.178E-17	7.699E-18	1.623E-18	8.694E-20	6.681E-22	
	1.247E-25	9.813E-31	7.241E-52	3.555E-72	0.E+00						
H+1	3.989E-14	3.937E-12	1.065E-12	3.357E-13	1.052E-13	3.212E-14	1.147E-14	2.479E-15	1.497E-16	1.993E-18	
	1.681E-21	1.346E-25	1.675E-41	1.324E-56	0.E+00						
HO-1	2.996E-14	1.759E-09	3.202E-09	3.582E-09	3.470E-09	3.087E-09	2.667E-09	2.037E-09	1.102E-09	3.196E-10	
	2.707E-11	7.469E-13	6.558E-21	8.580E-27	0.E+00						
H3O+1	1.428E-15	1.683E-10	1.170E-10	7.[illegible]21E-11	5.028E-11	3.210E-11	2.013E-11	1.032E-11	2.953E-12	4.460E-13	
	2.229E-14	4.255E-16	1.990E-22	2.728E-28	0.E+00						
N+1	1.118E-17	5.609E-15	1.474E-15	4.175E-16	1.148E-16	3.032E-17	9.497E-18	1.681E-18	6.909E-20	4.849E-22	
	1.320E-25	2.234E-30	4.550E-49	6.408E-67	0.E+00						
NO2-	1.592E-19	5.279E-10	2.697E-09	5.503E-09	8.866E-09	1.259E-08	1.588E-08	2.060E-08	2.771E-08	3.081E-08	
	2.240E-08	1.042E-08	6.802E-11	3.721E-13	0.E+00						
N2+1	3.686E-15	5.352E-13	1.754E-13	6.665E-14	2.501E-14	9.154E-15	3.818E-15	1.038E-15	9.481E-17	2.376E-18	
	5.617E-21	1.775E-24	5.013E-38	5.955E-51	0.E+00						
O+1	1.400E-19	1.770E-12	1.110E-12	5.270E-13	2.245E-13	8.859E-14	3.837E-14	1.069E-14	9.615E-16	2.179E-17	
	3.983E-20	8.300E-24	3.640E-38	6.994E-52	0.E+00						
O2+1	3.370E-19	3.844E-08	7.214E-08	7.274E-08	5.167E-08	4.723E-08	3.558E-08	2.199E-08	8.173E-09	1.640E-09	
	1.106E-10	2.831E-12	2.854E-18	5.374E-24	0.E+00						
O2-	6.882E-21	6.669E-11	2.695E-10	4.296E-10	5.333E-10	5.767E-10	5.725E-10	5.191E-10	3.595E-10	1.391E-10	
	1.689E-11	6.960E-13	2.413E-19	1.001E-25	0.E+00						