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AFWL-TR-69-114, Vol II

USER'S MANUAL

Volume II

Volume II Boundary Layer Integral Matrix Procedure (BLIMP)

Larry W. Anderson

Robert M. Kendall

TECHNICAL REPORT NO. AFWL-TR-69-114, Vol II

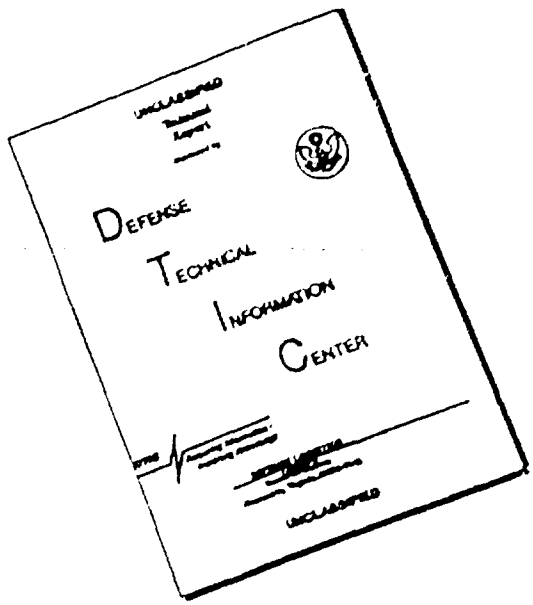
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(BLIMP)

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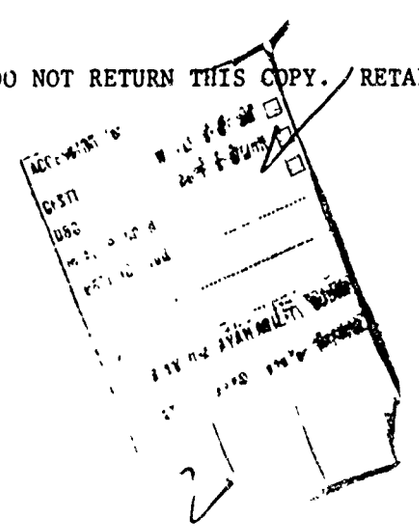
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FOREWORD

This report was prepared by the Aerotherm Corporation, Mountain View, California, under Contract F29601-68-C-0062. The research was performed under Program Element 62601F, Project 5791, Task 27.

Inclusive dates of research were March 1968 through October 1969. The report was submitted 11 February 1970 by the Air Force Weapons Laboratory Project Officer, Captain Ronald H. Aungier (WLEE).

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This technical report has been reviewed and is approved.

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ABSTRACT

Listings and flow charts for the Boundary Layer Integral Matrix Procedure (BLIMP) computer program are given, along with comments on the function of each program or subroutine. In addition, input instructions, output description, a sample problem, flow charts and listings are given for the CABLE program, which couples BLIMP to an in-depth charring ablation analysis program.

(Distribution Limitation Statement No. 2)

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SECTION I

INTRODUCTION

This report (AFWL-TR-69-114, Vol. II) contains flow charts and listings for the BLIMP and CABLE computer programs, and also input instructions, output descriptions, and a sample problem for the CABLE program. The BLIMP program solves the laminar or turbulent, nonsimilar multicomponent, equilibrium boundary layer for axisymmetric or planar bodies and for general chemical systems. The theoretical development and computational procedures which form the basis for this computer program are discussed in reference 1. The bulk of the user's manual material (input, output, operating instructions, dimensions, etc.) for the BLIMP program is contained in Volume I of this report.

The CABLE program is a coupled boundary layer and in-depth material response calculational tool which uses the BLIMP code in combination with the CMA (reference 2) program to analyze the complete thermodynamic response of ablating bodies. A discussion of the coupling of the two basic computer codes is given in reference 1 as is a sample problem. The CMA program is completely documented in references 2-5, and will be only briefly discussed here.

Section II of this volume is devoted to flow charts and listings for the BLIMP code. Section III contains descriptions of the CABLE input, output, preparation of a sample problem, and flow charts.

SECTION II

BLIMP LISTINGS AND FLOW CHARTS

The BLIMP subroutines are all numbered and are presented in this section in numerical order. The numbers reflect the approximate order in which the routines are called.

1. PROGRAM BLIMP - BO2A

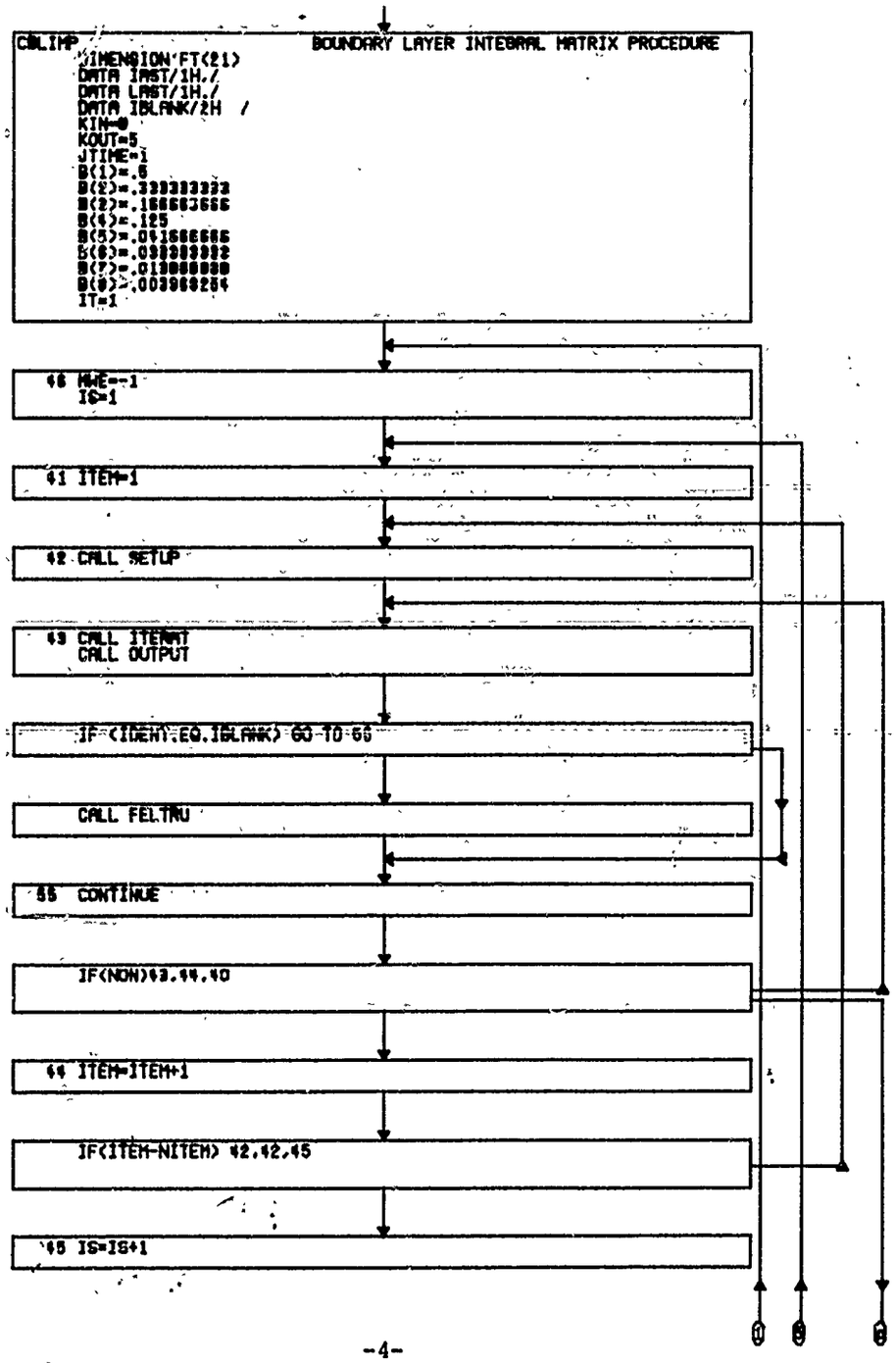
   a. Function

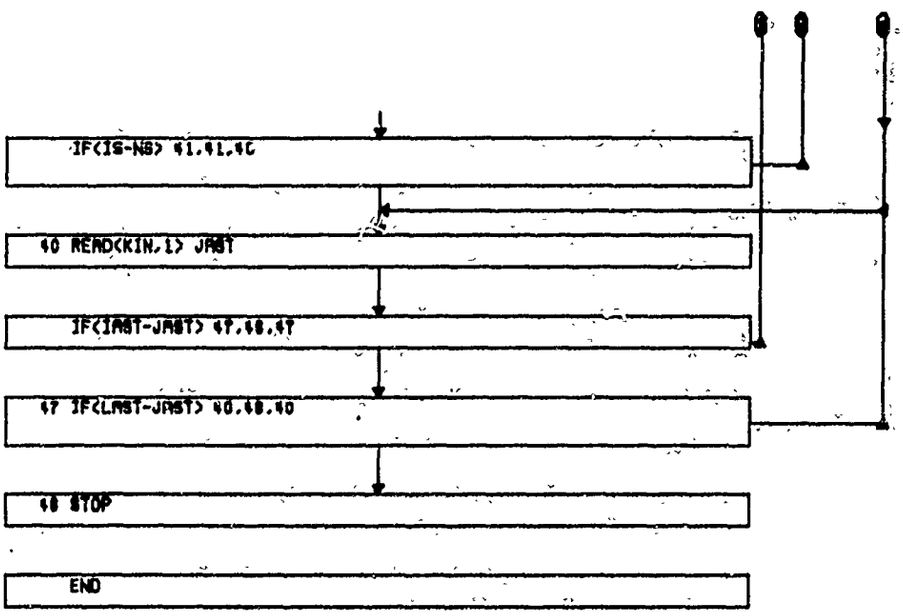
      Master Program. Calls SETUP, ITERAT, OUTPUT.

b. Listing

```
000001          CRLIMP                          BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE   BLIM 001
000002               DIMENSION FT(21)
000003               COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB02A    3*NEW
000004              1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CHAR,CASE(15) B02A    4*NEW
000005              2,B(8),      MWE,NON,K9(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B02A    5*NEW
000006              3,KAUXC,JTIME,JSPEC,MD(3)                                          B02A    6*NEW
000007               COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B02A    7*NEW
000008              1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      B02A    8*NEW
000009             1 FORMAT(A1)                                                                 *-11
000010               DATA IAST/1H,/
000011               DATA LAST/1H,/
000012               DATA IBLANK/2H  /
000013               CALL SETIO(8,1)
000014               CALL SETIO(5,2)
000015               CALL SETDR(13,1100000,500000,FT(8))
000016               CALL SETDR(14,600000,500000,FT(15))
000017               KIN=5                                                              BLIM 013
000018               KOUT=6                                                             BLIM 014
000019               JTIME=1
000020               B(1)=.5                                                            BLIM 015
000021               B(2)=.333333333                                                    BLIM 016
000022               B(3)=.166666666                                                    BLIM 017
000023               B(4)=.125                                                          BLIM 018
000024               B(5)=.041666666                                                    BLIM 019
000025               B(6)=.033333333                                                    BLIM 020
000026               B(7)=.013888888                                                    BLIM 021
000027               B(8)=.003968254                                                    BLIM 022
000028               IT=1                                                               BLIM 023
000029            46 MWE=-1
000030               IS=1                                                               BLIM 025
000031            41 ITEM=1                                                             BLIM 026
000032            42 CALL SETUP                                                         BLIM 027
000033            43 CALL ITERAT                                                        BLIM 031
000034               CALL OUTPUT                                                        BLIM 032
000035               IF (IDENT.EQ.IBLANK) GO TO 55
000036               CALL FELTRU
000037            55 CONTINUE
000038               IF(NON)43,44,40                                                    BLIM 033
000039            44 ITEM=ITEM+1                                                        BLIM 034
000040               IF(ITEM-NITEM) 42,42,45                                            BLIM 035
000041            45 IS=IS+1                                                            BLIM 036
000042               IF(IS-NS) 41,41,40                                                 BLIM 037
000043            40 READ(KIN,1) JAST
000044               IF(IAST-JAST) 47,46,47
000045            47 IF(LAST-JAST) 40,48,40
000046            48 STOP
000047               END                                                                BLIM 038
```

c. Flow Chart


CBLIMP
BOUNDARY LAYER INTEGRAL MATRIX PROCEDURE
DIMENSION FT(21)
DATA IAST/1H./
DATA LAST/1H./
DATA IBLANK/2H /
KIN=0
KOUT=5
JTIME=1
B(1)=.6
B(2)=.333333333
B(3)=.166666666
B(4)=.125
B(5)=.041666666
B(6)=.008333333
B(7)=.013888888
B(8)=.003968254
IT=1
46 NWE=-1
IS=1
41 ITEM=1
42 CALL SETUP
43 CALL ITERAT
CALL OUTPUT
IF(IDENT.EQ.IBLANK) GO TO 60
CALL FELTRU
55 CONTINUE
IF(NON)43,44,40
44 ITEM=ITEM+1
IF(ITEM-NITEM) 42,42,45
45 IS=IS+1


IF(IS-NS) 41,41,40
40 READ(KIN,1) JAST
IF(IAST-JAST) 47,48,47
47 IF(LAST-JAST) 40,48,40
48 STOP
END

2. SUBROUTINE SETUP - B03A

a. Function

Control program for setting up boundary layer edge conditions and streamwise derivatives for a new time (or subcase), a new station, or a new case. Called by BLIMP. Calls FIRSTG, LINMAT, RECASE.

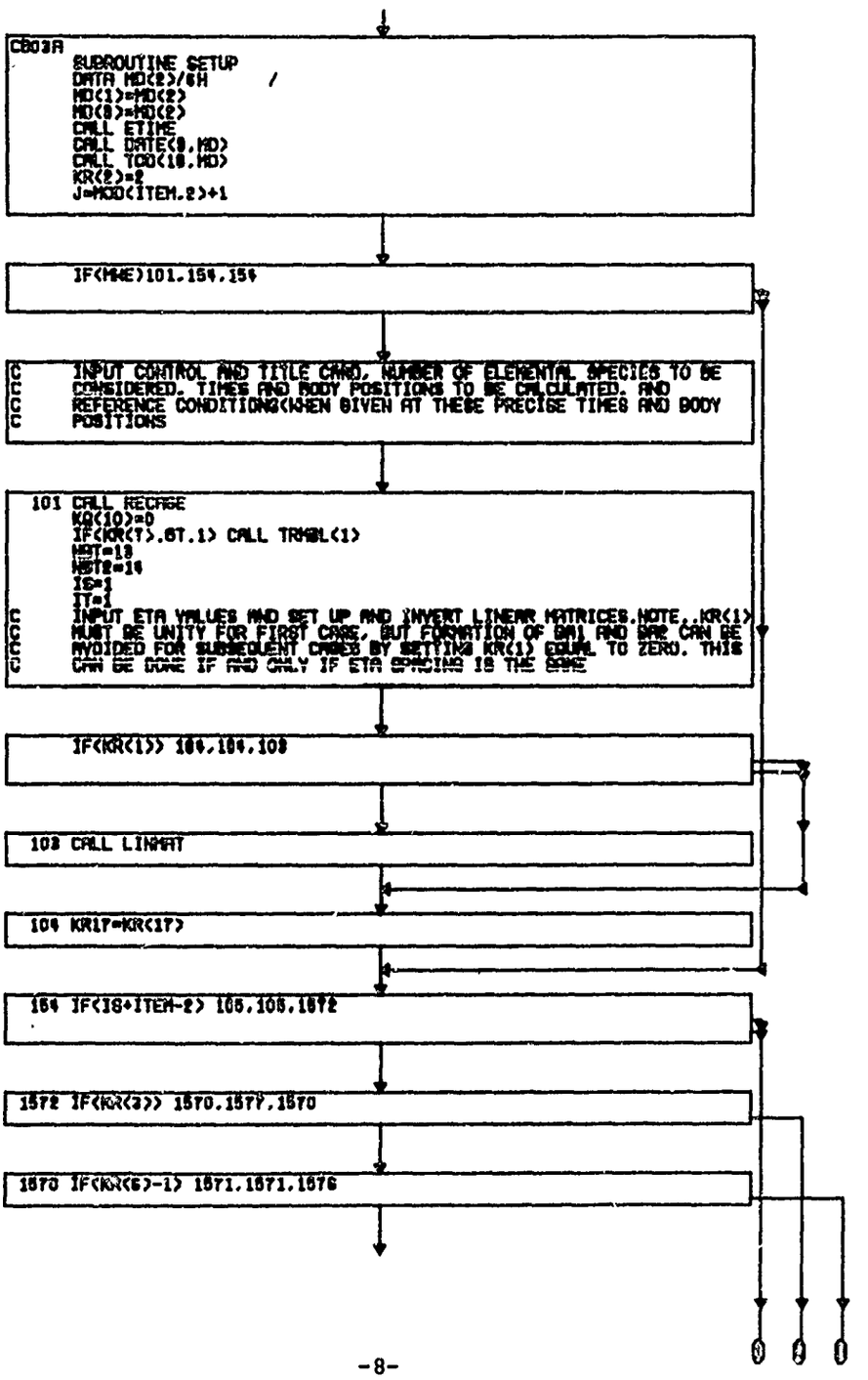
b. Listing

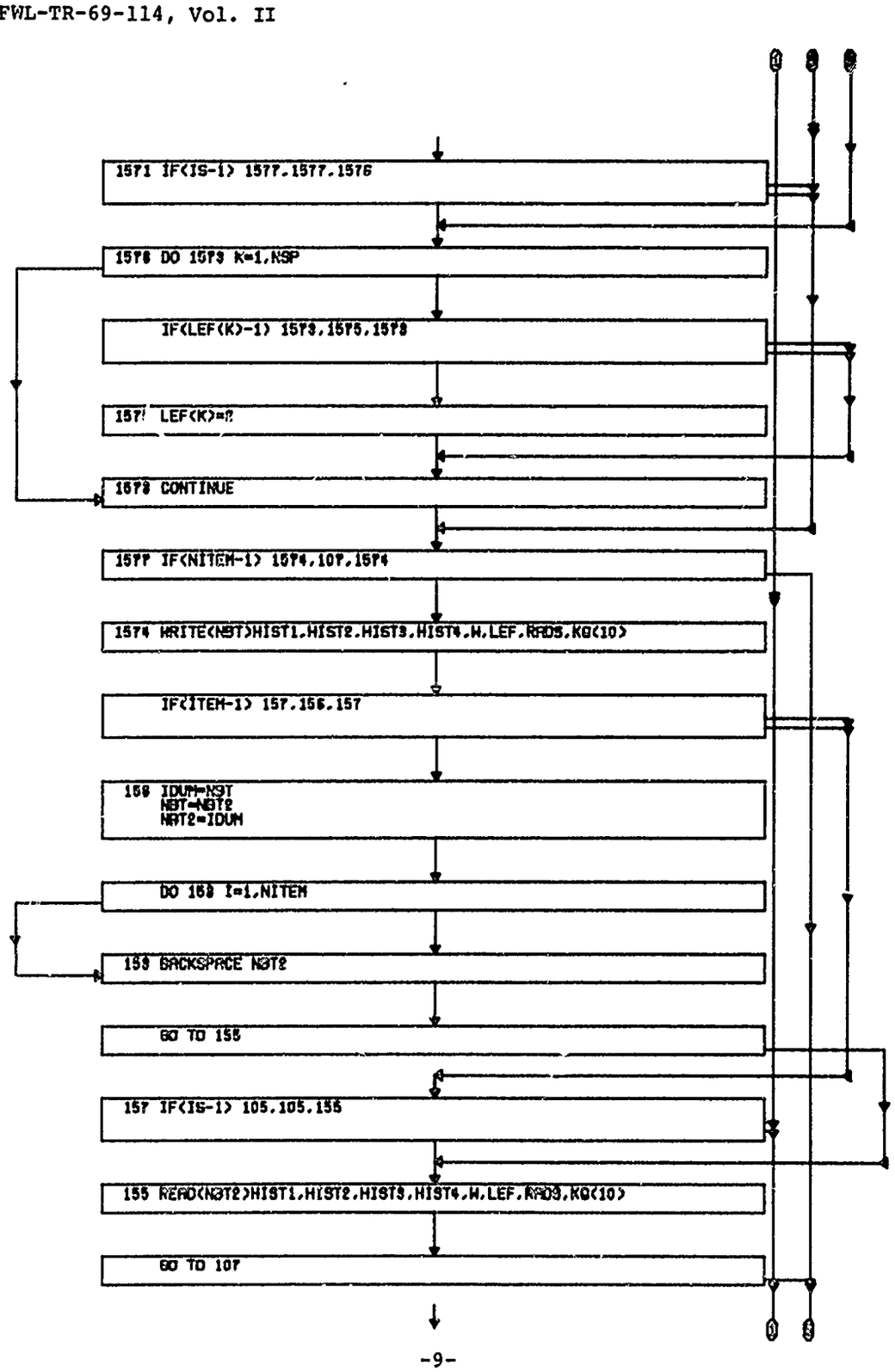
```
CB03A
      SUBROUTINE SETUP
      DIMENSION HIST1(605),HIST2(607),HIST3(511),VMAT(566),HIST4(600)
      COMMON/BLQCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10)
     1,LEFS(10),PLEASE,LEFW(10)
      COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,
     1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90
     2 ,DSIP(40),IDSIP,TTVC,TVCC(40)
      COMMON/FLPCOM/TX(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)
     2,THF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KQT(2)
      COMMON/HISCOM/C1,C2,C3,C4,ALPHQ,BETA,ZM(4,14),ZG(4,14),ZSP(4,14,
     1 ),XI(40),HF(15,5),HG(15,3),HSP(19,3, 8),HALPH,HUE,HHUE,HFW,DLX2
     2,C3M(40),BETAM(40)
      COMMON/INTCOM/ KR(20),KIN,KOUT,MAT11,MAT21,MAT1J,MAT2J,NETA,I,IS,N
     1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15)
     2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40)
     3,KAUXO,JTIME,JSPEC,MD(3)
      COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 30),GE( 50),S(40),ROKAP(40)
     1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,
     2CONE,RADFL( 50),RADR(40),RADS(40),IRAD
      COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH
      COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)
     1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ
      EQUIVALENCE(HIST1,XI),(HIST2, PE),(HIST3,F),(VMAT,C1),(HIST4,FW)
     2 FORMAT(1H1,8X4HTIME,E12.5,56H SECONDS - - - - - - - - - - - - - - -
     1- - - - - - - - - -,2X3A6)
     3 FORMAT(/1H1,7X4HTIME,E12.5,35H SECONDS - - - STREAMWISE DIMENSION,E12
     1.5,11HFEET - - -,2X3A6)
     4 FORMAT(1H1,8X4HCASE,I3,32(2H -),2X3A6)
     5 FORMAT(1H1,7X4HCASE,I3,11(2H -),21H STREAMWISE DIMENSION,E12.5,13H FEE
     1T - - - -,3A6)
 9901 FORMAT(I3,7E10.3)
      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
      IF(MWE)101,154,154
C     INPUT CONTROL AND TITLE CARD, NUMBER OF ELEMENTAL SPECIES TO BE
C     CONSIDERED, TIMES AND BODY POSITIONS TO BE CALCULATED, AND
C     REFERENCE CONDITIONS(WHEN GIVEN AT THESE PRECISE TIMES AND BODY
C     POSITIONS
  101 CALL RECASE
      KQ(10)=0
      IF(KR(7).GT.1) CALL TRMBL(1)
      NBT=13
```

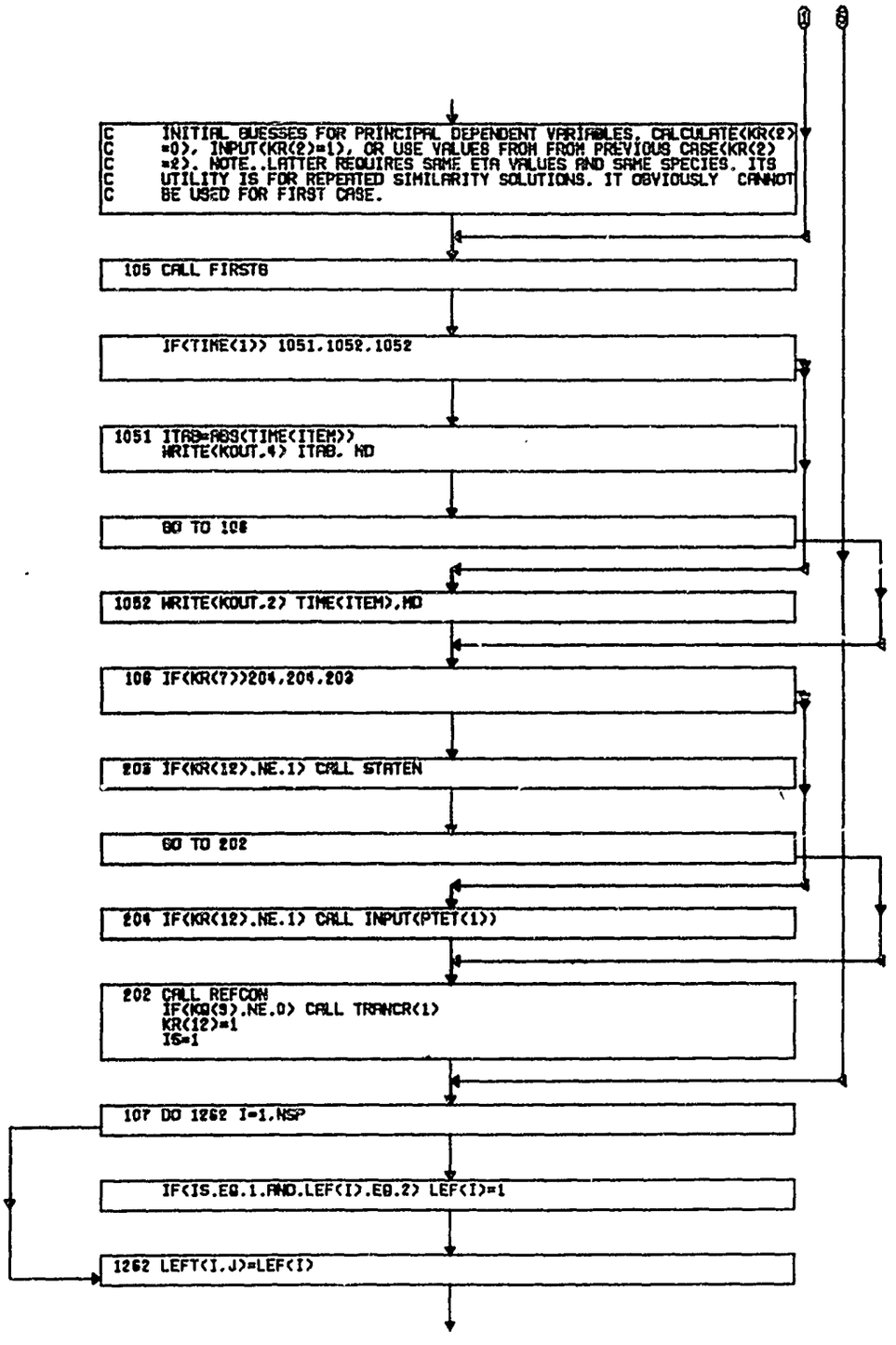
```
      NBT2=14
      IS=1
      IT=1
      IF(KR(1)) 104,104,103
  103 CALL LINMAT
  104 KR17=KR(17)
  154 IF(IS+ITEM-2) 105,105,1572
 1572 IF(KR(3)) 1570,1577,1570
 1570 IF(KR(6)-1) 1571,1571,1576
 1571 IF(IS-1) 1577,1577,1576
 1576 DO 1573 K=1,NSP
      IF(LEF(K)-1) 1573,1575,1573
 1575 LEF(K)=2
 1573 CONTINUE
 1577 IF(NITEM-1) 1574,107,1574
 1574 WRITE(NBT)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KQ(10)
      IF(ITEM-1) 157,156,157
  156 IDUM=NBT
      NBT=NBT2
      NBT2=IDUM
      DO 153 I=1,NITEM
  153 BACKSPACE NBT2
      GO TO 155
  157 IF(IS-1) 105,105,155
  155 READ(NBT2)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KQ(10)
      GO TO 107
  105 CALL FIRSTG
      IF(TIME(1)) 1051,1052,1052
 1051 ITAB=ABS(TIME(ITEM))
      WRITE(KOUT,4) ITAB, MD
      GO TO 106
 1052 WRITE(KOUT,2) TIME(ITEM),MD
  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
      IS=1
  107 DO 1262 I=1,NSP
      IF(IS.EQ.1.AND.LEF(I).EQ.2) LEF(I)=1
 1262 LEFT(I,J)=LEF(I)
C-----COMPUTE HISTORIC INFORMATION
      CALL HISTXI
      IF(TIME(1)) 1053,1054,1054
 1053 ITAB=ABS(TIME(ITEM))
      WRITE(KOUT,5) ITAB, S(IS), MD
      GO TO 126
 1054 WRITE(KOUT,3)TIME(ITEM),S(IS),MD
  126 DO 1261 I=1,NETA
 1261 THF(I,J)=HF(I,5)
      TXI(J)=XI(IS)
      TRADS(J)=RADS(IS)
      TDSIP(J)=DSIP(IS)
      TUE(J)=UE(IS)
      TRHOE(J)=RHOE(IS)
      TTE(J)=TE(IS)
      KQT(J)=KQ(10)
      TVMUE(J)=VMUE(IS)
```

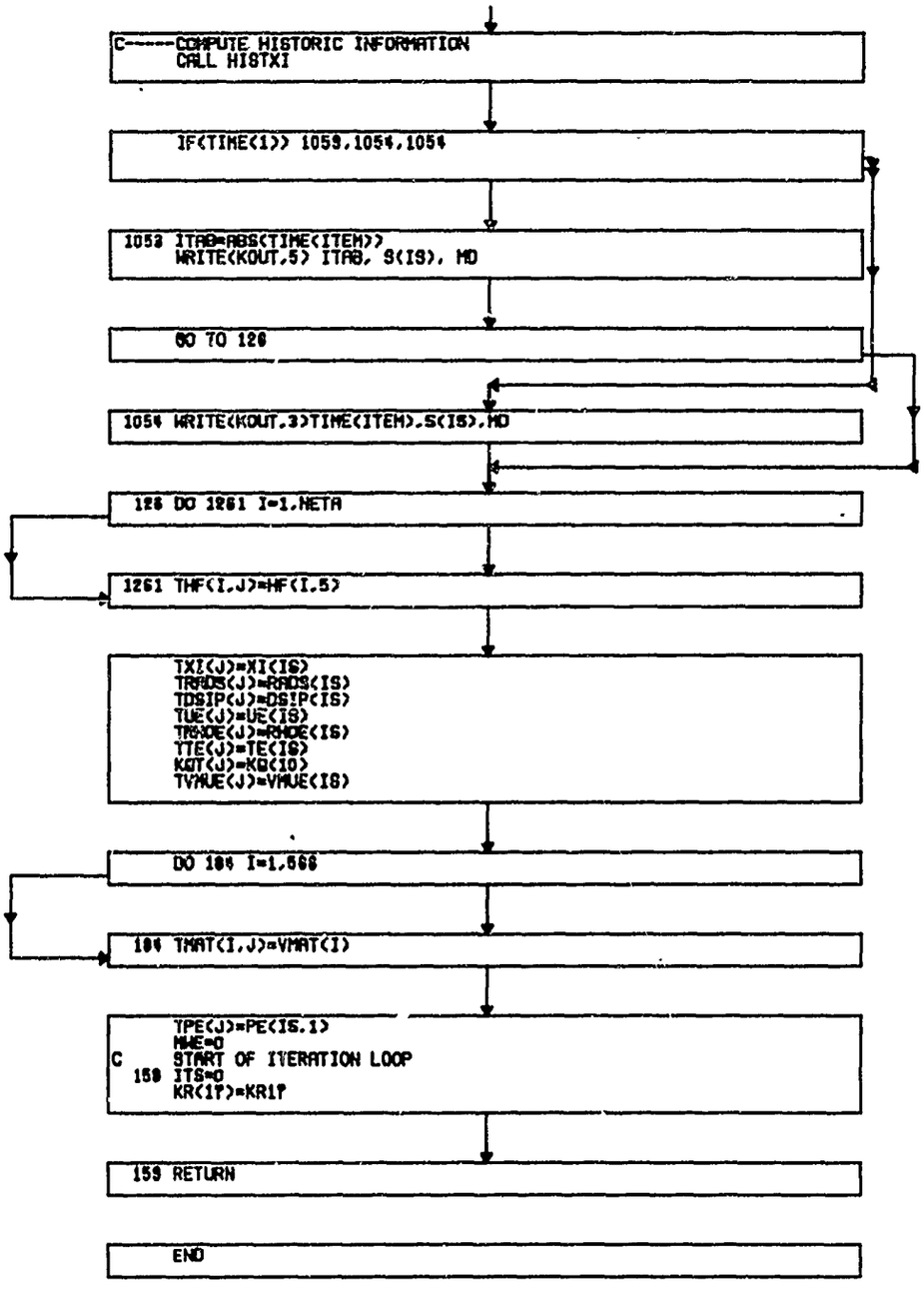
```
      DO 184 I=1,566
  184 TMAT(I,J)=VMAT(I)
      TPE(J)=PE(IS,1)
      MWE=0
C     START OF ITERATION LOOP
  158 ITS=0
      KR(17)=KR17
  159 RETURN
      END
```

c. Flow Chart




1571 IF(IS-1) 1577,1577,1576
1578 DO 1579 K=1,NSP
IF(LEF(K)-1) 1579,1575,1579
1571 LEF(K)=0
1579 CONTINUE
1577 IF(NITEM-1) 1574,107,1574
1574 WRITE(NBT)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KQ(10)
IF(ITEM-1) 157,156,157
159 IDUM=NBT
NBT=NBT2
NBT2=IDUM
DO 159 I=1,NITEM
159 BACKSPACE NBT2
GO TO 155
157 IF(IS-1) 105,105,156
155 READ(NBT2)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KQ(10)
GO TO 107


C INITIAL GUESSES FOR PRINCIPAL DEPENDENT VARIABLES. CALCULATE(KR(2)
C =0), INPUT(KR(2)=1), OR USE VALUES FROM FROM PREVIOUS CASE(KR(2)
C =2). NOTE..LATTER REQUIRES SAME ETA VALUES AND SAME SPECIES. ITS
C UTILITY IS FOR REPEATED SIMILARITY SOLUTIONS. IT OBVIOUSLY CANNOT
C BE USED FOR FIRST CASE.
105 CALL FIRSTB
IF(TIME(1)) 1051,1052,1052
1051 ITAB=ABS(TIME(ITEM))
WRITE(KOUT,4) ITAB, MD
GO TO 106
1052 WRITE(KOUT,2) TIME(ITEM),MD
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
IS=1
107 DO 1262 I=1,NSP
IF(IS.EQ.1.AND.LEF(I).EQ.2) LEF(I)=1
1262 LEFT(I,J)=LEF(I)


C-----COMPUTE HISTORIC INFORMATION
CALL HISTXI
IF(TIME(1)) 1059,1054,1054
1053 ITAB=ABS(TIME(ITEM))
WRITE(KOUT,5) ITAB, S(IS), MD
GO TO 126
1054 WRITE(KOUT,3)TIME(ITEM),S(IS),MD
126 DO 1261 I=1,NETA
1261 THF(I,J)=HF(I,5)
TXI(J)=XI(IS)
TRADS(J)=RADS(IS)
TDSIP(J)=DSIP(IS)
TUE(J)=UE(IS)
TRHDE(J)=RHDE(IS)
TTE(J)=TE(IS)
KQT(J)=KQ(IO)
TVMUE(J)=VMUE(IS)
DO 104 I=1,666
104 TMAT(I,J)=VMAT(I)
TPE(J)=PE(IS,1)
MWE=0
C START OF IVERATION LOOP
158 ITS=0
KR(IT)=KRIT
159 RETURN
END

3. SUBROUTINE ITERAT - B04A

a. Function

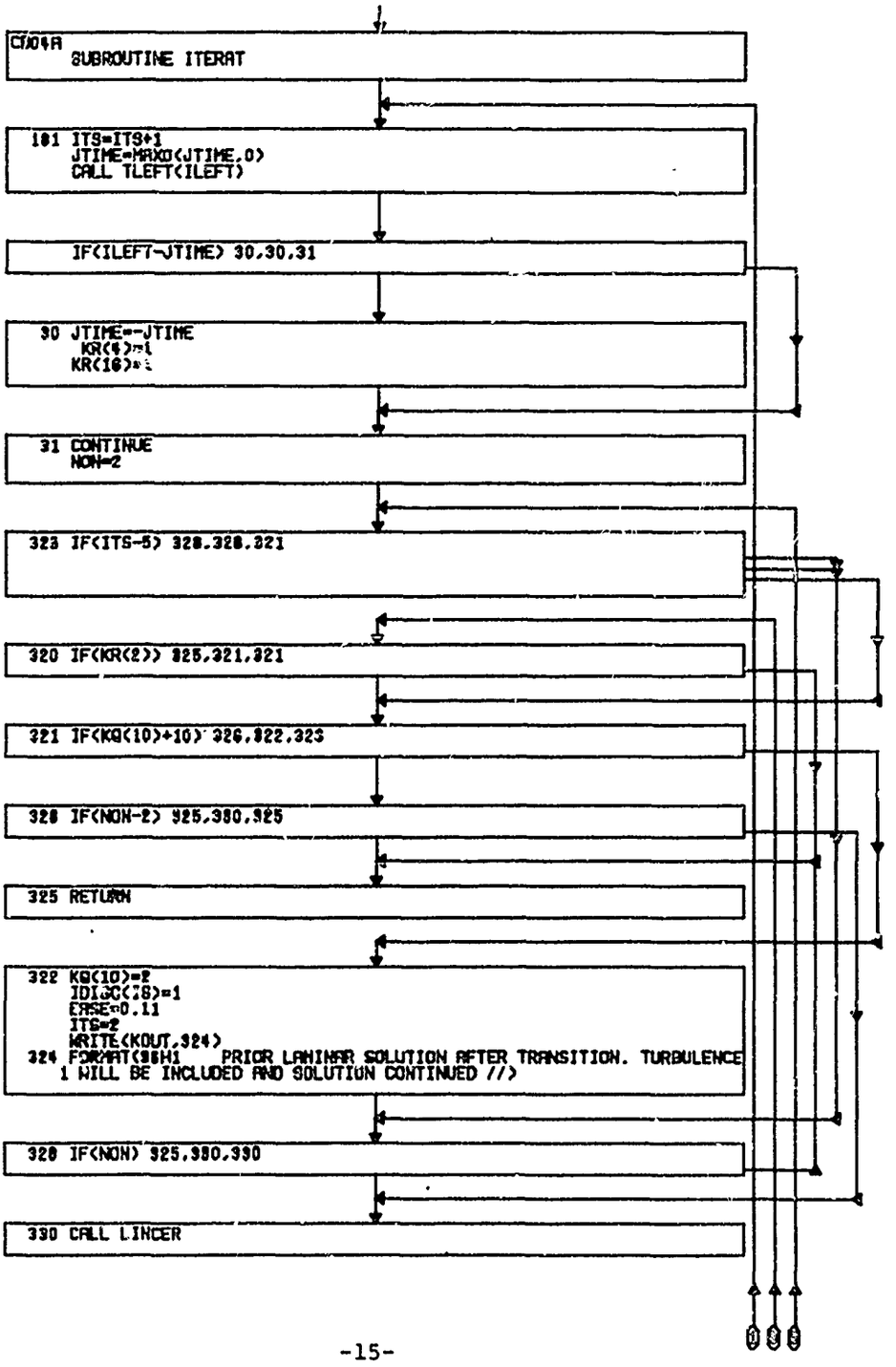
Control program for performing boundary layer iteration and tests maximum errors for convergence. Called by BLIMP. Calls LINCER, NONCER.

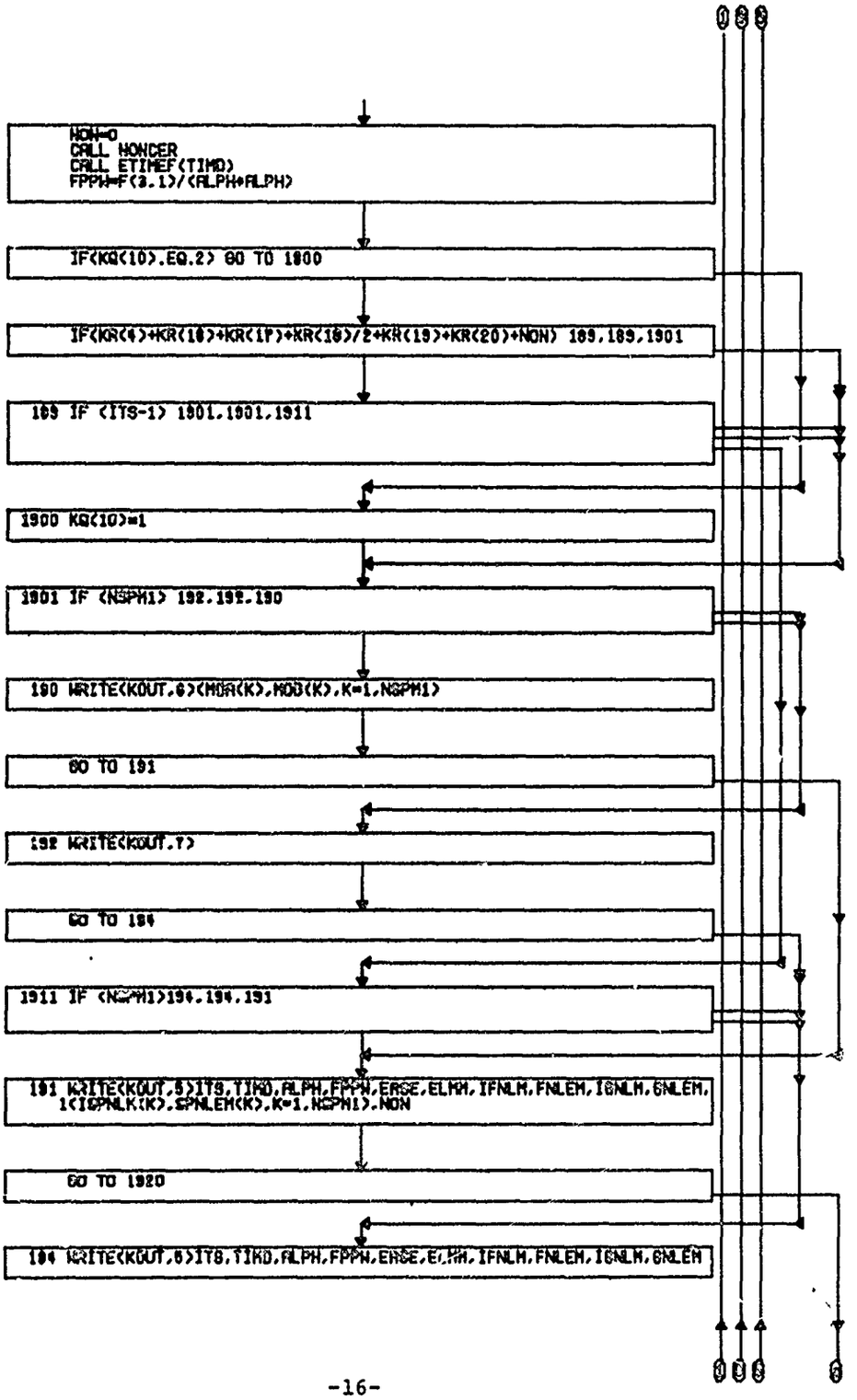
b. Listing

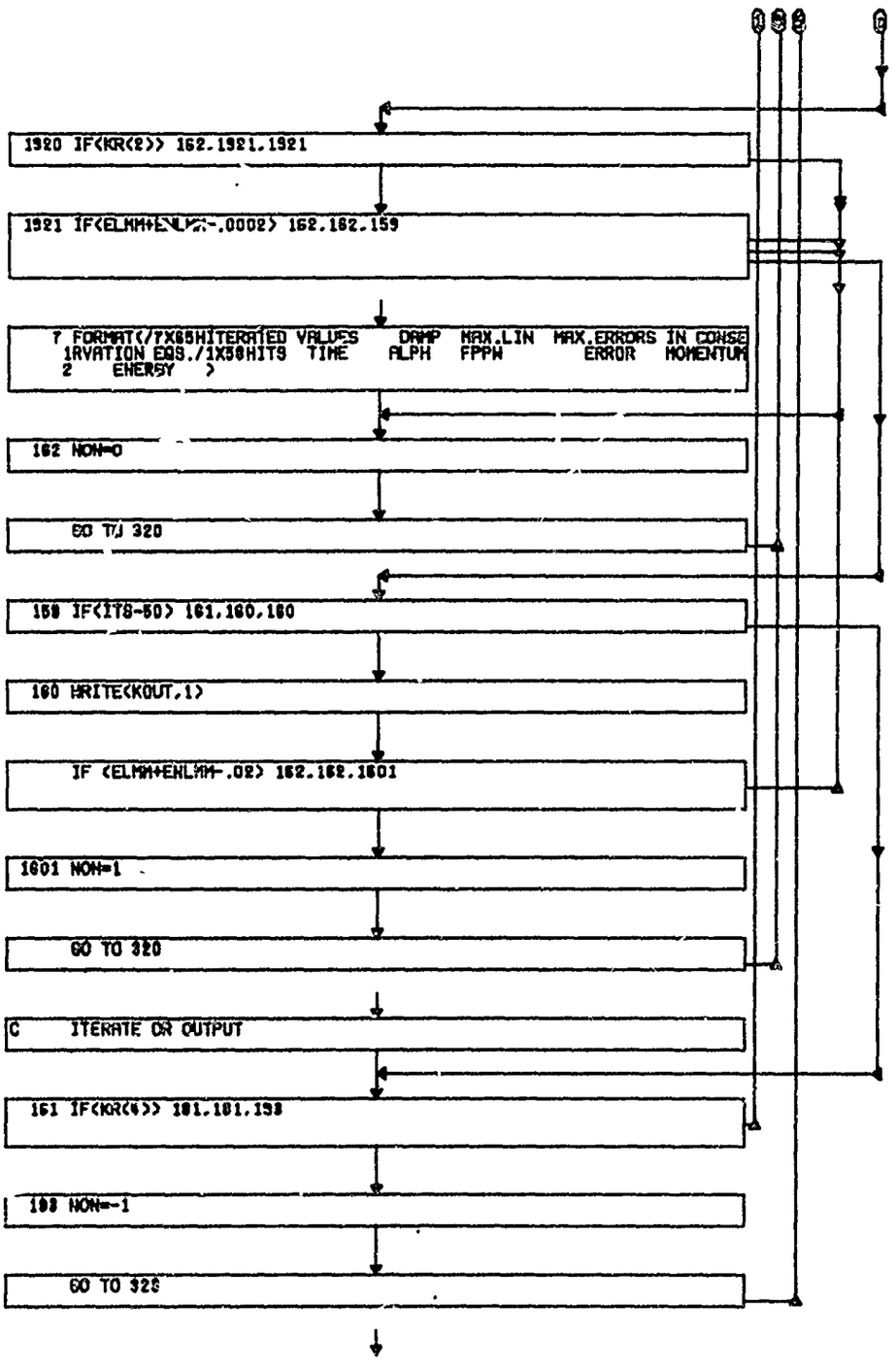
```
000001      CB04A                                                          B04A 001
000002            SUBROUTINE ITERAT                                        B04A 002
000003            COMMON/BLOCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B04A   3
000004           1,LEFS(10),PIEASE,LEFW(10)                                B04A   4
000005            COMMON/BUMCOM/    BUMP,CORMA,EASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IXB04A   5
000006            COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM  B04A   6
000007           1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43) B04A   7
000008           2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)  B04A   8
000009           3,FNLEM,GNLEM,SPNLEM( 8),         ENLMM,IFNLM,IGNLM,ISPNLM( 8) B04A   9
000010           4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)          B04A  10
000011            COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB04A  11
000012           1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B04A  12
000013           2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B04A  13
000014           3,KAUXO,JTIME,JSPEC,MD(3)                                 B04A  14
000015            COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B04A  15
000016           1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B04A  16
000017           2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                    B04A  17
000018            COMMON/VARCOM/F(4,15),G(3,15),SP(3,19, 9),ALPH             B04A  18
000019          5 FORMAT(I3,1X,F8.3,F6.3,F7.4,F6.4,1PE7.0,8(I3,E8.1))
000020          6 FORMAT(/1X15HITERATED VALUES11X47HDAMP  MAX.LIN   MAX.ERRORS IN CO
000021           1NSERVATION EQS,/1X56HITS   TIME   ALPH   FPPW         ERROR  MOMEN
000022           1TUM    ENERGY 6(5XA4,A2))
000023            1 FORMAT(22H NON-CONVERGENT OUTPUT)                        B04A 018
000024          181 ITS=ITS+1                                                B04A 019
000025              JTIME=MAXO(JTIME,0)
000026              CALL TLEFT(ILEFT)                                        RDG
000027              IF(ILEFT-JTIME) 30,30,31
000028           30 JTIME=-JTIME
000029               KR(4)=1                                                 RDG
000030              KR(16)=1                                                 RDG
000031           31 CONTINUE                                                 RDG
000032              NON=2
000033          323 IF(ITS-5) 328,328,321
000034          320 IF(KR(2)) 325,321,321
000035          321 IF(KQ(10)+10) 326,322,326
000036          326 IF(NON-2) 325,330,325
000037          325 RETURN
000038          322 KQ(10)=2
000039              IDISC(IS)=1
000040              EASE=0.11
000041              ITS=2
000042              WRITE(KOUT,324)
000043          324 FORMAT(96H1    PRIOR LAMINAR SOLUTION AFTER TRANSITION, TURBULENCE
000044             1 WILL BE INCLUDED AND SOLUTION CONTINUED //)
000045          328 IF(NON) 325,330,330
000046          330 CALL LINGER
000047              NON=0
000048              CALL NONCER                                              B04A 021
000049              CALL ETIMEF(TIMD)
000050              FPPW=F(3,1)/(ALPH*ALPH)                                  B04A 022
000051              IF(KQ(10),EQ.2) GO TO 1900
000052              IF(KR(4)+KR(16)+KR(17)+KR(18)/2+KR(19)+KR(20)+NON) 189,189,1901
000053          189 IF (ITS-1) 1901,1901,1911                                B04A
000054         1900 KQ(10)=1
000055         1901 IF (NSPM1) 192,192,190                                   B04A
000056          190 WRITE(KOUT,6)(MOA(K),MOB(K),K=1,NSPM1)                   B04A 025
000057              GO TO 191
000058          192 WRITE(KOUT,7)
```

```
000059                GO TO 194
000060             1911 IF (NSPM1)194,194,191
000061              191 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,EASE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM,
000062                 1(ISPNLM(K),SPNLEM(K),K=1,NSPM1),NON
000063                GO TO 1920
000064              194 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,EASE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM
000065             1920 IF(KR(2)) 162,1921,1921
000066             1921 IF(ELMM+ENLMM-.0002) 162,162,159                                    *NEW
000067                7 FORMAT(/7X65HITERATED VALUES    DAMP  MAX.LIN  MAX.ERRORS IN CONSE    **-1
000068                 1RVATION EQS./1X58HITS  TIME    ALPH   FPPW        ERROR   MOMENTUM
000069                 2    ENERGY   )
000070              162 NON=0                                                          B04A 029
000071                GO TO 320
000072              159 IF(ITS-50) 161,160,160                                         B04A 031
000073              160 WRITE(KOUT,1)                                                  B04A 032
000074                IF (ELMM+ENLMM-.02) 162,162,1601                                 B04A 033
000075             1601 NON=1                                                          B04A 034
000076                GO TO 320
000077           C    ITERATE OR OUTPUT                                               B04A 036
000078              161 IF(KR(4)) 181,181,193                                          B04A 037
000079              193 NON=-1                                                         B04A 038
000080                GO TO 323
000081                END                                                            B04A 040
```

c. Flow Chart


C*0*A
SUBROUTINE ITERAT
101 ITS=ITS+1
JTIME=MAXO(JTIME,0)
CALL TLEFT(ILEFT)
IF(ILEFT-JTIME) 30,30,31
30 JTIME=-JTIME
KR(4)=1
KR(16)=1
31 CONTINUE
NON=2
323 IF(ITS-5) 328,328,321
320 IF(KR(2)) 325,321,321
321 IF(KQ(10)+10) 326,322,323
328 IF(NON-2) 325,380,325
325 RETURN
322 KQ(10)=2
IDIAGC(78)=1
EPSE=0.11
ITS=2
WRITE(KOUT,324)
324 FORMAT(38H1 PRIOR LAMINAR SOLUTION AFTER TRANSITION. TURBULENCE
1 WILL BE INCLUDED AND SOLUTION CONTINUED //)
328 IF(NON) 325,380,390
330 CALL LINCER


NON=0
CALL NONCER
CALL ETIMEF(TIMD)
FPPW=F(3.1)/(ALPH+ALPH)
IF(KQ(10).EQ.2) GO TO 1900
IF(KR(4)+KR(18)+KR(17)+KR(16)/2+KR(19)+KR(20)+NON) 189,189,1901
189 IF (ITS-1) 1901,1901,1911
1900 KQ(10)=1
1901 IF (NSPM1) 192,192,190
190 WRITE(KOUT,6)(MOM(K),MOD(K),K=1,NSPM1)
GO TO 191
192 WRITE(KOUT,7)
GO TO 194
1911 IF (NSPM1)194,194,191
191 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,ERSE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM,
1(IGPNLK(K),SPNLEM(K),K=1,NSPM1),NON
GO TO 1920
194 WRITE(KOUT,5)ITS,TIMD,ALPH,FPPW,ERSE,ELMM,IFNLM,FNLEM,IGNLM,GNLEM


1920 IF(KR(2)) 162.1921.1921
1921 IF(ELMM+ENLMM-.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
GO TJ 320
159 IF(ITS-50) 161.160.160
160 WRITE(KOUT,1)
IF (ELMM+ENLMM-.02) 162.162.1601
1601 NON=1
GO TO 320
C ITERATE OR OUTPUT
161 IF(KR(4)) 181.181.198
198 NON=-1
GO TO 320


END

b. Listing

```
000001      C     B05B
000002            SUBROUTINENONCER                                                    B05A0020
000003            INTEGER ASU,BSU
000004            DIMENSIONDQJRNL( 71,1)                                              B05B 004
000005            DIMENSIONDELQJW(1) ,DQJNL(153,1) ,WALLQJ(1)                         B05B 005
000006            DIMENSIONCOEEQV(84),COEPQV(423)                                     B05B 006
000007            COMMON/BLOCOM/  MOA( 71),  MOB( 71),NSPEC,ER( 71,15),W(3),LEF(10) B05B   7
000008           1,LEFS(10),PIEASE,LEFW(10)                                           B05B   8
000009            COMMON/BUMCOM/     BUMP,CORMA,EASE,ICORM,WUOT,TFZ,I777,DYEMP,KIP,IXB05B   9
000010            COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B05B  10
000011           1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB05B  11
000012           232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C4BB05B  12
000013           3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB05B  13
000014           465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B05B  14
000015           5,C82,C83,C84,C85,C86,C87,C88                                        B05B  15
000016            COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)      B05B  16
000017           1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)       B05B  17
000018           2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)    B05B  18
000019           3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),X8P(5, 9)  B05B  19
000020           4,CKK3( 8, 8)                                                        B05B  20
000021            COMMON/CRBCOM/HCARB,EMIS,STEF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMISTB05B  21
000022           1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),K8(40),ISU              B05B  22
000023            COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B05B  23
000024           1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90     B05B  24
000025           2 ,D8IP(40),IDSIP,TTVC,TVCC(40)                                      B05B  25
000026            COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,      B05B  26
000027           1EPSA(15),EPS1,EL(15),DPI(15,2),DLI(153),DEPS(153),DEPC,TREF,RETR    B05B  27
000028            COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B05B  28
000029           1 TU( 71,2),FF( 71),FFA,IPC( 71),ATA(10),ATB(10),ATC(10),WAT(10),   B05B  29
000030           2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),         B05B  30
000031           3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),YYY( 71),YW( 71),GG( 71)B05B  31
000032           4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                     B05B  32
000033            COMMON/EQTCOM/SIP,HIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B05B  33
000034           1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,SX,ISP2,ISPQ,    B05B  34
000035           2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CHF,EP,RV,IPCJC,WPG,WTL,JC,HHG, B05B  35
000036           3 CCPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),BB(16),     B05B  36
000037           4 IP( 71),ALP(10),PNU(10),GAMM(10),GAMP(10),ELAM(10),DY( 71),RVS,   B05B  37
000038           5 CP( 71),HH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B05B  38
000039           6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                       B05B  39
000040            COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM       B05B  40
000041           1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)      B05B  41
000042           2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)       B05B  42
000043           3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)     B05B  43
000044           4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                B05B  44
000045            COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)        B05B  45
000046           1,LAR(153),BA1(43,18),BA2(30,15)                                     B05B  46
000047            COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ          B05B  47
000048           1,WALLJ( 8),QW,VJKW( 9),TPWALL                                       B05B  48
000049            COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZQ(4,14),ZSP(4,14, 8)B05B  49
000050           1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2   B05B  50
000051           2,C3M(40),BETAM(40)                                                  B05B  51
000052            COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB05B  52
000053           1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B05B  53
000054           2,S(8),     MWE,NON,KQ(10),ITEM,NITEM,KR17,NST,NST2,IDENT,KR9(40)   B05B  54
000055           3,KAUXO,JTIME,JSPEC,MD(3)                                            B05B  55
000056            COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                            B05B  56
000057           1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                B05B  57
000058            COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),GR(15),H(15)     B05B  58
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```
000059              1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKW( 8),  DB09B  59
000060              2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B059B  60
000061              3,DHTILK( 8),DGRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B059B  61
000062              4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B059B  62
000063              5,VMU3,DTH,DCAPCH,DPRH,DSCH,DGRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B059B  63
000064              6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B059B  64
000065               COMMON/VARCOM/F(4,15),G(3,15),BP(3,15, 9),ALPH                    B059B  65
000066               COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),BPW( 8,40, 1)         B059B  66
000067              1,RHOVW(40, 1),FLUXJ( 3,40, 1),IWW,ITW,IFW,IBPW,IRHOVW,IFLUXJ     B059B  67
000068               DIMENSION ENLM(1),IENLM(1)
000069               EQUIVALENCE (ENLM(1),FNLEM),(IENLM(1),IFNLM)
000070               EQUIVALENCE(DELQW,DELQJW),(DQNL,DQJNL),(WALLQ,WALLQJ)             B05AC380
000071               DIMENSIONCORAR(1)                                                 B05A0470
000072               EQUIVALENCE(CORAR(1),AM(1))                                       B05A0480
000073               EQUIVALENCE(AM,DQJRNL)                                            B05A0490
000074               DIMENSION PREQ(1)
000075               DIMENSION ZEIT(9)
000076               EQUIVALENCE(PREQ(1),DRHOH)                                        B05B
000077               EQUIVALENCE(CS,COEEQV),(CK1(1),COEFQV)                            B05A0680
000078          C**NB***NOTE 240+1,540+1,729,730+1 WHEN REDIMENSIONING                 B05A0690
000079               EASE=AMIN1(EASE*2.,1.0)
000080               IF(ITS-1) 11,5,11
000081             5 EASE = .3333                                                      B05A0730
000082               SPNEW = 0.
000083               BUMP = 1.0                                                        B05A0740
000084               IF(ITEM+IS-2) 3,3,2
000085             2 IF(WDOT) 4,3,3
000086             3 WDOT=-.12/C1
000087             4 PLEASE=1.
000088               ICORM = 1                                                         B05A0760
000089               CORMA = 1.E + 10                                                  B05A0770
000090               TFZ = 0.                                                          B05A0780
000091               IF (KR9(IS)) 8,8,7
000092             7 KR(9)=KR9(IS)
000093             8 DO 17 I=1,NETA
000094            17 EPSA(I)=0.
000095               IF(KR(9)-2) 11,10,9
000096             9 FLUXJ(3,IS,IT)=-1.                                                B05A0785
000097            10 IBP=IZ+1
000098               KK=MAXO(1,KG(IS))
000099               W(1) = FLUXJ(1,IS, IT)
000100               W(2)=FLUXJ(2,IS,IT)                                                    *NEW
000101               W(3)=FLUXJ(3,IS,IT)                                                    *NEW
000102               L2=2*KK                                                                **-2
000103               L3=L2+1
000104               IF(KR(9)-2) 11,11,16
000105            16 HPG=HPYG(KK)
000106               EMISC=EMIV(KK)
000107               HCARB=HCHAR(KK)
000108               DO 12 J=ISP,NSPEC
000109               IF(MOA(J)-ASU(KK)) 12,13,12
000110            13 IF(MOB(J)-BSU(KK)) 12,14,12
000111            14 ISU=J
000112               GO TO 11
000113            12 CONTINUE
000114               ISU=ISP
000115            11 KIP=0
000116               IX = 0                                                            B05A0810
000117          C---- EVALUATE COEFFICIENTS AND ERRORS FOR NONLINEAR EQUATIONS         B05A0830
000118          C     INITIALIZE AM MATRIX                                            B05A0840
```

```
000119                DO 15 I=1,NNLEQ                                          B05A0850
000120                ENL(I)=0.
000121                DO 15 J=1,NNLEQ                                          B05A0860
000122             15 AM(I,J) = 0.                                             B05A0870
000123          C     EVAL. GROUPINGS WHICH CHANGE DURING ITERATION BUT ARE NOT F(ETA)  B05A0880
000124             40 C5 = 1. / ALPH                                           B05A0940
000125                DUM1 = ALPH * ALPH                                       B05A0950
000126                C6 = BETA * DUM1                                         B05A0960
000127                C7 = - UE(IS) / DUM1 * UE(IS) / 25036.5                  B05A0970
000128                C8 = ALPHD * C5                                          B05A0980
000129                C9 = C4 - C8                                             B05A0990
000130                C90 = ALPH * DUEDGE                                      B05A1000
000131                UKAP=UEDGE
000132          C---- EVAL COEFS, AM, AND ERRORS FOR EDGE BOUN CONDS AND ALPH CONSTRAINT  B05A1010
000133          C     FIRST, COMPUTE UEDGE IF THERE IS AN ENTROPY LAYER          B05A1020
000134          COMMENT-----PERFORM TABLE LOOKUP FOR UEDGE (WHICH IS A FUNCTION OF  B05A1030
000135          COMMENT-----F(1,NETA),IS,AND IT), DIFFERENTIATE TO GET DUEDGE, AND  B05A1040
000136          COMMENT-----DIFFERENTIATE AGAIN TO GET D2UEDG                       B05A1050
000137          C     NEXT,  EVALUATE NONLINEAR ERRORS                           B05A1060
000138             45 ENL(4)=-(ALPH*UEDGE-F(2,NETA))
000139                ENL(5)=-F(2,1)
000140                IF(KR(10)-2) 41,41,42
000141             41 ENL(2)=-(F(2,KAPPA)-CBAR*ALPH*UKAP)
000142                AM(2,KAPPA+3)=1.
000143                AM(2,1)=-CBAR*UKAP
000144                GO TO 43
000145             42 ENL(2)=-F(3,NETA)
000146                CALL LIAD(-1,2,NETA*NETA-2,1,)
000147             43 AM(4,1)=UEDGE
000148                AM(4,MAT1J)=-1
000149                AM(3,4)=1.
000150          C     FINALLY, EVAL CONTRIBUTIONS TO AM AND ERRORS FROM OTHER COEFFS  B05A1140
000151                CALL LIAD(-1,NETA+1,NETA-1,C90)
000152          C---- START OF MAJOR DO LOOP FOR EVAL OF COEFFS AND ERRORS AT EACH ETA  B05A1290
000153                KQ(1)=2
000154                KQ(5)=0
000155                CALL ETIMEF(ZEIT(1))
000156                DO 49 I=1,NETA
000157                H(I)=G(1,I)+0.5*F(2,I)*C7*F(2,I)
000158                HP=G(2,I)+F(2,I)*C7*F(3,I)
000159                IF(KR(7)) 47,47,46
000160             46 CALL STATE
000161                GO TO 48
000162             47 CALL EQUIL(KQ,H(I),PE(IS,IT))
000163             48 IF(I-1) 50,50,54
000164             50 IF(NSPM1) 53,53,51
000165             51 DO 52 K=1,NOPM1
000166                DO 31 KK=1,NSP
000167             31 DLPK(K,KK) = A(KK+2, K+2)
000168             52 DTKW(K)= DTK(K)
000169                DO 32 KK=1,NSP
000170             32 DLPH(KK)= A(KK+2,1)
000171                VLNKW=VLNK(ISU)
000172                TCW=TC(ISU)
000173                HCWAL = WW(ISU)/WYM(ISU)+1.8
000174             53 DTHW=DTH
000175             54 RHOP(I)=DRHOH*HP
000176                IF(NSPM1) 56,56,56
000177             56 DO 57 K=1,NSPM1
000178             57 RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)
```

```
000179              58 L=0                                                          
000180                 M=MAT1J+I-MAT2J                                              
000181                                                                              
000182                 DO 49 MM=1, 9                                                B058
000183                 M=M+MAT2J                                                    
000184                                                                              
000185                                                                              
000186                 DO 49 N=124,153                                              B058
000187                 L=L+1                                                        
000188              49 AM(M,N)=PREQ(L)                                              
000189                 CALL ETIMEF(ZEIT(2))                                         
000190                 IF(KQ(10).GT.0) CALL TRMBL(2)                                
000191                 CALL ETIMEF(ZEIT(3))                                         
000192                 TTVC=1.0                                                     
000193                 DO 120 I=1,NETA                                              B05A1300
000194                 L=0                                                          
000195                 M=MAT1J+I-MAT2J                                              
000196                                                                              
000197                 DO 59 MM=1, 9                                                B058
000198                 M=M+MAT2J                                                    
000199                                                                              
000200                                                                              
000201                 DO 59 N=124,153                                              B058
000202                 L=L+1                                                        
000203                 PREQ(L)=AM(M,N)                                              
000204              59 AM(M,N)=0.                                                   
000205           C     TEST TO BYPASS COMMANDS THAT CANNOT BE PERFORMED AT ETA(1)    B05A1310
000206                 IF (I - 1) 60,60,55                                          B05A1320
000207              55 CALL IMONE                                                   B05A1330
000208                 IF(KQ(9).NE.0) CALL TRANCR(3)                                
000209                 IF(KQ(10).GT.0) CALL TRMBL(4)                                
000210           C     COMPUTE STATIC ENTHALPY AND DETERMINE STATE OF GAS            B05A1340
000211              60 C10 = C7 * F(2,I)                                            B05A1350
000212                 C13 = C7 * F(3,I)                                            B05A1370
000213                 HP = G(2,I) + F(2,I) * C13                                   B05A1380
000214           C---- EVAL GROUPINGS WHICH ARE USED AT I-1 AS WELL AS AT I         B05A1460
000215              75 CALL ICOEFF                                                  B05A1470
000216                 IF(KQ(9).NE.0) CALL TRANCR(2)                                
000217                 IF(KQ(10).GT.0) CALL TRMBL(3)                                
000218                 IF (I - 1) 100,80,100                                        B05A1480
000219           C     DLPK,TCW,VLNKW,DLPH, AND Y1 NEEDED ONLY FOR CARBON PROBLEM    B05A1490
000220              80 IF (NSPM1) 95,95,85                                          B05A1500
000221              85 DO 90 K=1,NSPM1                                              B05A1510
000222                 WALLJ(K) = CK6(K)                                            B05A1520
000223                 VJKW(K) = CK6(K) / C3                                        B05A1530
000224              90 CONTINUE                                                     
000225              95 WALLQ = C32                                                  B05A1620
000226                 QW = C32 / C3                                                B05A1630
000227                 TPWALL = TP                                                  
000228                 GOTO 105                                                     B05A1640
000229           C---- BACK TO CONSERVATION EQUATIONS                               B05A1650
000230             100 CALL IONLY                                                   B05A1660
000231                 IF(KQ(10).GT.0) CALL TRMBL(5)                                
000232                 IF(KQ(9).NE.0) CALL TRANCR(4)                                
000233             105 IF (KR(17)) 120,120,110                                      B05A1670
000234             110 FORMAT(21H ALL THE COEFFICIENTS/(1X1P12E10.3))               B05A1680
000235             115 WRITE(KOUT,110)C1,C2,C3,C4,COEEQV,COEFQV                     B05A1690
000236                 IX = -2                                                      B05A1700
000237             120 CONTINUE                                                     B05A1710
000238                 CALL ETIMEF(ZEIT(4))
```

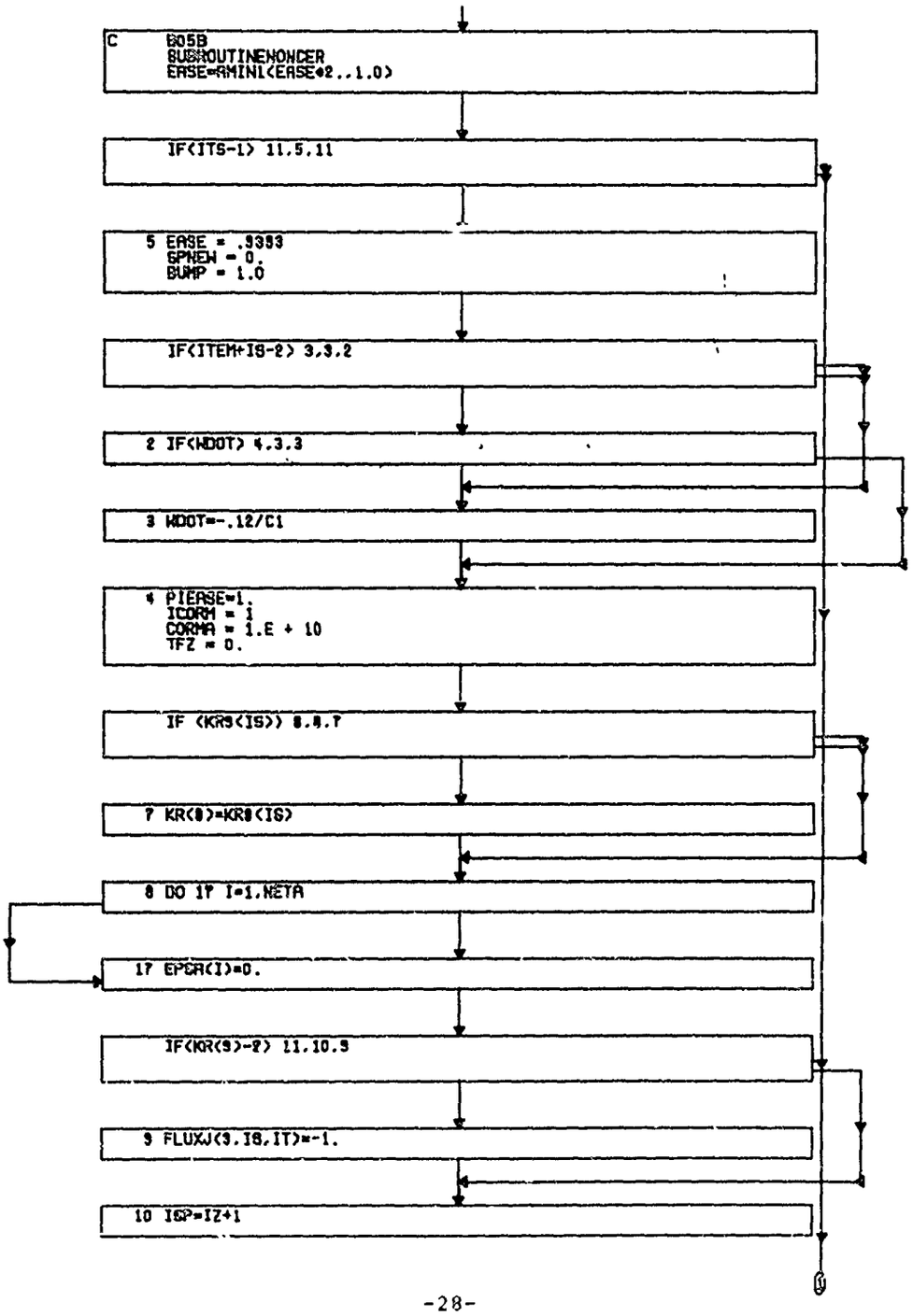
```
000239                IF (ITS - 1) 125,125,145                                  B05A1720
000240              125 DO 140 K=1,NSP                                          B05A1730
000241                  IF (LEFS(K)) 130,130,140                                B05A1740
000242              130 IF(LEF(K)) 140,140,135
000243              135 EASE = .05                                              B05A1760
000244                  SPNEW = .14
000245              140 CONTINUE                                                B05A1770
000246              145 IF(KR(19)) 170,190,170                                  B05A1850
000247              170 CONTINUE                                                B05A1860
000248                  WRITE(KOUT,175)                                         B05A1870
000249              175 FORMAT(2X21HDEBUG FNLE,GNLE,SPNLE)                      B05A1880
000250              180 FORMAT(/2X1P11E10.3/(12X1P10E10.3))                     B05A1890
000251                  WRITE (KOUT,180) (ENL(I),I=1,NNLEQ)
000252            C     SEEK MAXIMUM ERROR FOR EACH CONSERVED QUANTITY
000253              190 M=2
000254                  MM=MAT1J
000255                  DO 200 I=1,NRNL
000256                  CALL ABMAX(MM-1,ENL(M),ENLM(I),IENLM(I))
000257                  IENLM(I) = IENLM(I)+1
000258                  M=M+MM
000259              200 MM=MAT2J
000260            C     SOLVE REDUCED SET OF EQUATIONS                          B05A2070
000261                  IF (KR(2),LT.0) RETURN
000262            C     SCRUNTCH DEFINED ROWS OF AM MATRIX TO THE TOP           B05A2090
000263                  LSKIP=MAT1J+1                                           B05A2100
000264                  L=1                                                     B05A2110
000265                  LL=0
000266                  DO 240 M=1,NAM                                          B05A2130
000267                  L=L+1                                                   B05A2140
000268                  IF(L-LSKIP) 235,230,235
000269              230 LSKIP=LSKIP+MAT2J
000270                  LL=LL+1
000271                  DO 231 J=1,NNLEQ
000272              231 DQJNL(J,LL)=AM(L,J)
000273                  DELQJW(LL)=-ENL(L)
000274                  L=L+1
000275              235 ENL(M)=ENL(L)
000276                  DO 240 J=1,NNLEQ
000277              240 AM(M,J)=AM(L,J)                                         B05A2180
000278            C     THE FOLLOWING ROUTINE REARRANGES COLUMNS OF THE NOW RECTANGULAR  B05A2250
000279            C     AM MATRIX,ACCORDING TO LAR,INVERTS((AM(I,J),J=2,NAM),I=1,NAM) AND B05A2260
000280            C     MULTIPLIES THE INVERSE TIMES THE REMAINING COLUMNS OF AM MATRIX  B05A2270
000281            C     AND TIMES THE ENL.                                      B05A2280
000282                  CALL ETIMEF(ZEIT(5))
000283                  CALL RERAY(NAM,AM,NSP + 1,ENL,1,LAR,IX,153)             B05A2290
000284                  CALL ETIMEF(ZEIT(6))
000285                  DO 243 I=1,NAM
000286              243 AM(I,NAM)=AM(I,1)
000287              244 IF(KR(17)) 245,265,245
000288              245 CONTINUE                                                B05A2310
000289              250 FORMAT(2X1P11E10.3)                                     B05A2320
000290                  WRITE(KOUT,255)                                         B05A2330
000291              255 FORMAT(2X10HDEBUG FLE,GLE,SPLE)                         B05A2340
000292                  WRITE(KOUT,250)FLE,GLE                                  B05A2350
000293                  IF (NSPM1) 265,265,260                                  B05A2360
000294              260 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2J)        B05A2370
000295            C*****SURFACE OPTIONS TREATED IN RNLCER WITH REDUCED NONLINEAR SET
000296              265 CALL ETIMEF(ZEIT(7))
000297                  CALL RNLCER
000298                  CALL ETIMEF(ZEIT(8))
```

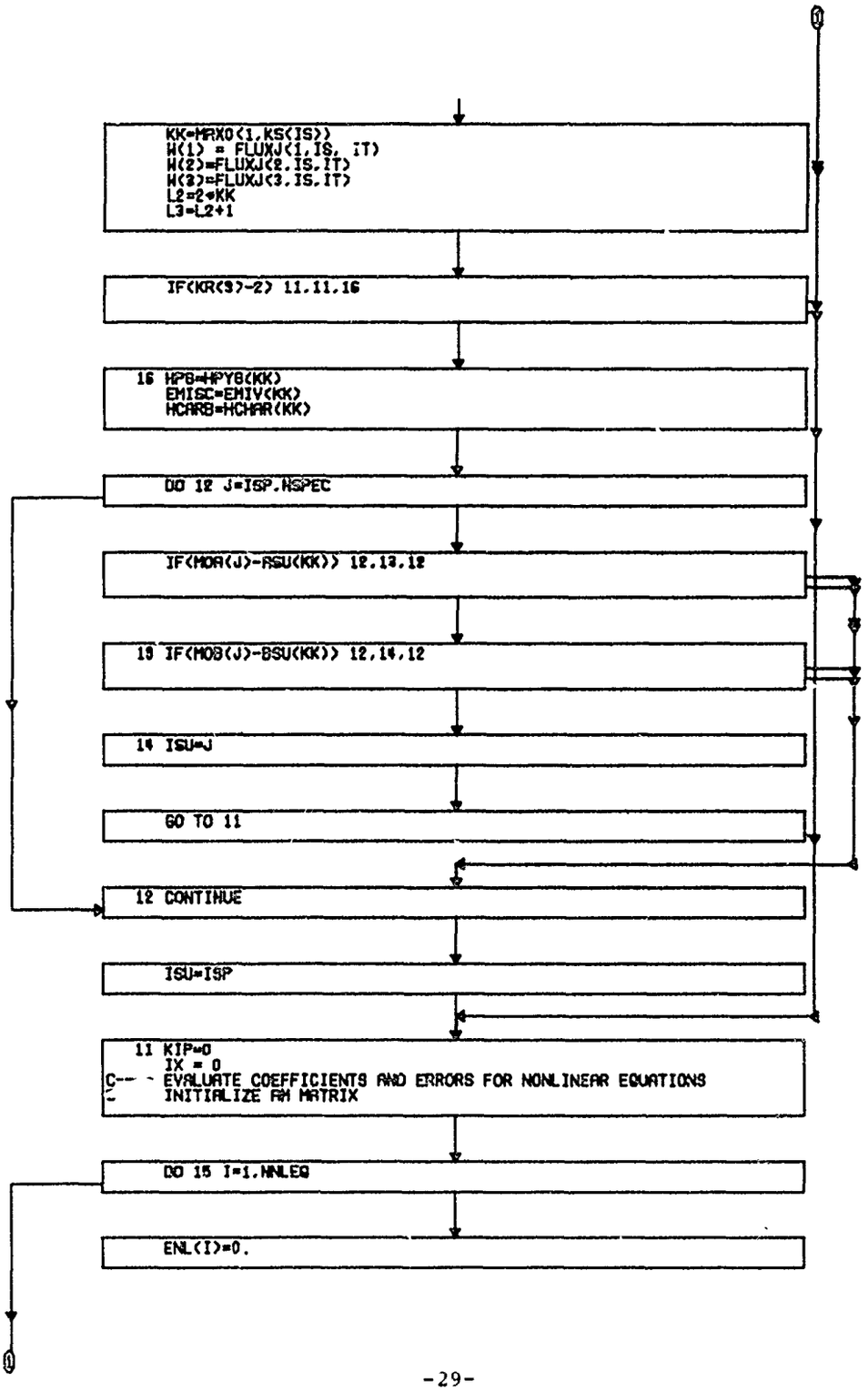
```
000299          C     DETERMINE MAXIMUM NONLINEAR ERRORS                                  B05A4010
000300          C     EQUIVALENCE ENLM TO FNLEM, GNLEM, AND SPNLEM                        B05A4020
000301            595 DO 605 I=1,NRNL
000302                IF(ABS(ENLM(I))-ABS(DRNL(I))) 600,605,605
000303            600 ENLM(I) = DRNL(I)
000304                IENLM(I) = 1
000305            605 CONTINUE
000306                ENLM(1)=ENLM(1)*10.
000307                ENLM(2)=ENLM(2)/1000.                                                *NEW
000308                CALL ABMAX(NRNL,ENLM,ENLMM,INLMM)                                    **-1
000309                ENLMM=ENLMM/10.
000310                ENLM(1)=ENLM(1)/10.
000311                ENLM(2)=ENLM(2)*1000.                                                *NEW
000312                ELMM = ABS(ELMM)                                                  B05A4160**-1
000313                BIP = KIP
000314                ENLMM = ABS(ENLMM) + 3. * BIP
000315          C     EVALUATE NONLINEAR CORRECTIONS FROM THE REDUCED SET                 B05A4180
000316                DO 615 I=1,NAM                                                    B05A4190
000317                L = LAR(I)                                                        B05A4200
000318                DVNL(L) = ENL(I)                                                  B05A4210
000319                DO 615 K=1,NRNL                                                   B05A4220
000320                J = K + NAM                                                       B05A4230
000321            615 DVNL(L) = DVNL(L) - DRNL(K) * AM(I,J)                             B05A4240
000322                DO 620 K=1,NRNL                                                   B05A4250
000323                I = NAM + K                                                       B05A4260
000324                J = LAR(I)                                                        B05A4270
000325            620 DVNL(J) = DRNL(K)                                                 B05A4280
000326          C-----RECYCLE IF ALPH WANTS TO GO NEGATIVE
000327                IF(DVNL(1)+0.9*ALPH) 626,626,629
000328            626 DELGJW(1)=0.
000329                DO 627 K=1,NSPM1
000330                WALLJ(K)=VJKW(K)*C3
000331            627 DELGJW(K+1)=0.
000332                LIM=NAM+1
000333                DO 628 I=2,NNLEQ
000334                DUM=AM(I,NAM)/AM(1,NAM)
000335                ENL(I)=ENL(I)-ENL(1)*DUM
000336                DO 628 J=LIM,NNLEQ
000337            628 AM(I,J)=AM(I,J)-DUM*AM(1,J)
000338                ENL(1)=0.
000339                DO 631 J=LIM,NNLEQ
000340            631 AM(1,J)=0.
000341                IT8=IT8+1
000342                EASE=0.2
000343                IF(IT8-51) 244,244,850
000344            629 CONTINUE
000345          C-----EVALUATE LINEAR CORRECTIONS                                        B05A4300
000346                DO 630 I=1,MAT1I                                                  B05A4310
000347                DO 630 J=1,MAT1J                                                  B05A4320
000348            630 FLE(I) = FLE(I) - DVNL(J) * BA1(I,J)                              B05A4330
000349                JJ = MAT1J                                                        B05A4340
000350                DO 635 J=1,MAT2J                                                  B05A4350
000351                JJ = JJ + 1                                                       B05A4360
000352                DO 635 I=1,MAT2I                                                  B05A4370
000353            635 GLE(I) = GLE(I) - DVNL(JJ) * BA2(I,J)                             B05A4380
000354                CORAR(1)=DVNL(1)/ALPH*0.5
000355                L=NETA
000356                J=MAT1J+2
000357                DO 640 I=2,NETA
000358                CORAR(I)=DVNL(J)/10000.
```

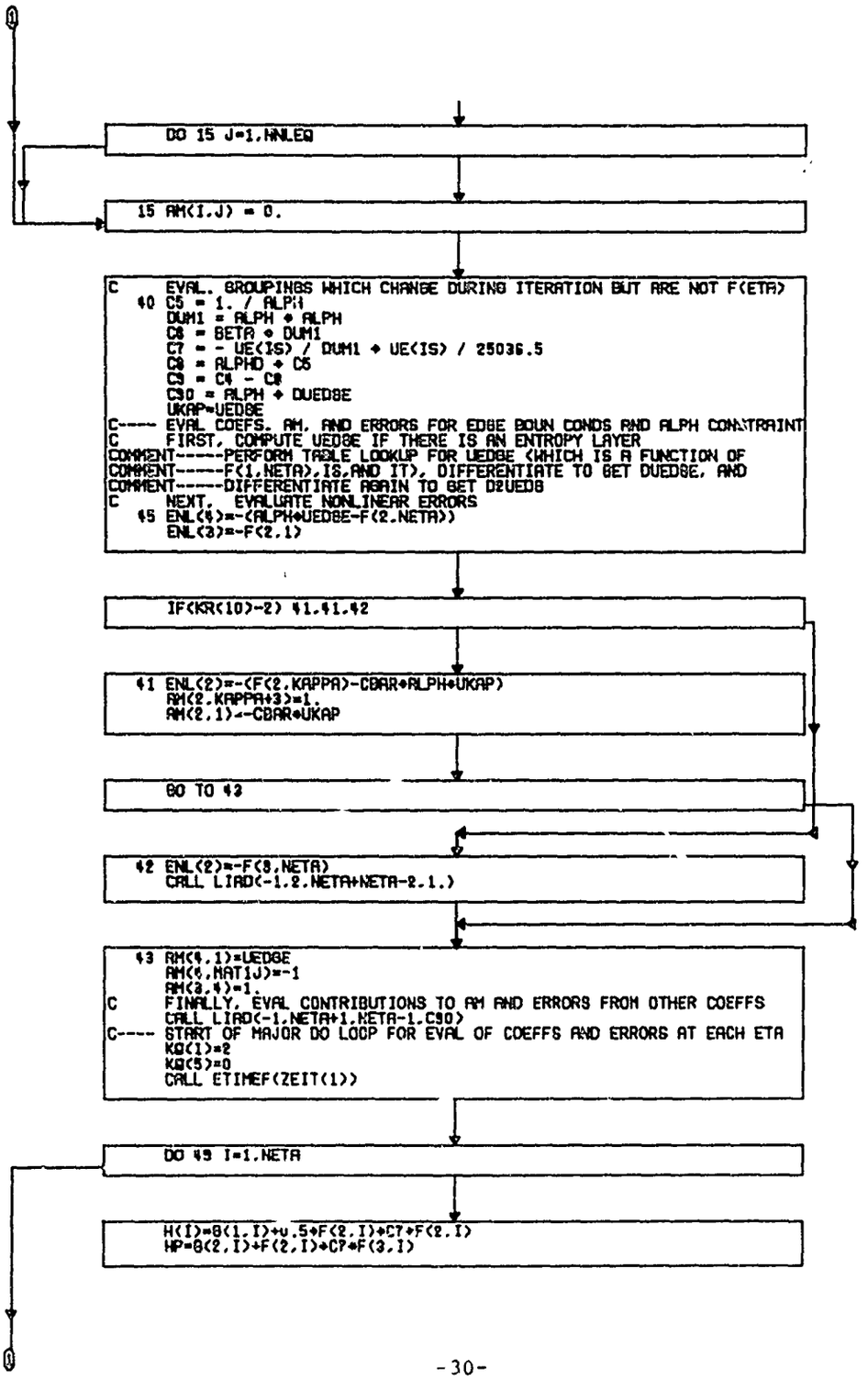
```
000359          640 J=J+1
000360              IF (NSPM1) 665,665,645                                  B05A4430
000361          645 DO 660 K=1,NSPM1                                        B05A4440
000362              DO 650 J=1,MAT2J                                        B05A4450
000363              JJ = JJ + 1                                             B05A4460
000364              DO 650 I=1,MAT2I                                        B05A4470
000365          650 SPLE(I,K) = SPLE(I,K) - DVNL(JJ) * BA2(I,J)             B05A4480
000366              J=MAT1J+K*MAT2J+2
000367              DO 655 I=2,NETA                                         B05A4510
000368              L = L + 1                                               B05A4520
000369              CORAR(L)=DVNL(J)
000370          655 J=J+1
000371          660 CONTINUE                                                B05A4540
000372          665 CONTINUE                                                B05A4550
000373              IF(EASE-0.2) 673,670,670
000374          670 IF(0.33*CORAR(ICORM)/CORMA) 671,675,675
000375          671 BUMP=BUMP*2.0
000376              GO TO 675
000377          673 IF(ABS(1.0-CORAR(ICORM)/CORMA)-0.25) 674,674,675
000378          674 BUMP=BUMP/2.
000379          675 CALL ABMAX(L,CORAR,CORMA,ICORM)                         B05A4580
000380              IF (KR(17)) 680,680,685                                 B05A4590
000381          680 IF (KR(19)) 690,705,690                                 B05A4600
000382          685 CONTINUE                                                B05A4610
000383              KR(17) = KR(17) - 1                                     B05A4620
000384          690 CONTINUE                                                B05A4630
000385          695 FORMAT(2X38HDEBUG CORRECTIONS RNL,NL,FL AND GL,8PL)     B05A4640
000386              CALL ETIMEF(ZEIT(9))
000387              WRITE(KOUT,696) ZEIT
000388          696 FORMAT(5X33HTIMES BEFOR AND AFTER . . . . . ./6X 9HCHEMISTRY9X
000389             1  13HERRORS*MATRIX9X9HINVERSION12X6HRNLCER11X3HNOW/10F10.4)
000390              WRITE(KOUT,695)                                         B05A4650
000391              WRITE(KOUT,250)DRNL                                     B05A4660
000392              WRITE(KOUT,250)DVNL                                     B05A4670
000393              WRITE(KOUT,250)FLE,GLE                                  B05A4680
000394              IF (NSPM1) 705,705,700                                  B05A4690
000395          700 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2I)        B05A4700
000396          705 CONTINUE                                                B05A4710
000397        C     CORRECT PRIMARY VARIABLES                               B05A4720
000398              DUM = .05 / BUMP                                        B05A4730
000399              EASE=AMIN1(1.5*EASE,1.0,DUM/ABS(CORMA))
000400              IF(ITS.EQ.2) BUMP=AMAX1(BUMP,.02/ABS(CORMA))                    *NEW
000401          710 IF (KR(13)) 720,720,715                                 B05A4750
000402          715 DUM = KR(13)                                            B05A4760
000403              EASE = AMIN1(DUM / 10.,EASE)                            B05A4770
000404          720 IF (EASE - 1.0) 725,740,740                             B05A4780
000405          725 DO 730 I=1,313                                          B05A4790
000406          730 FLE(I) = FLE(I) * EASE                                  B05A4800
000407              DO 735 I=1,153                                          B05A4810
000408          735 DVNL(I) = DVNL(I) * EASE                                B05A4820
000409          740 CONTINUE                                                B05A4830
000410              PIEASE = PIEASE * (1. - EASE)                           B05A4840
000411              IF (TFZ) 745,750,750                                    B05A4850
000412          745 TFZ = EASE * DTEMP - TFZ                                B05A4860
000413          750 NUL=0
000414              DO 790 I=1,NETA
000415              NI=NETA+I
000416              N2I=NETA+NI-2
000417              F(2,I)=F(2,I)+DVNL(I+3)
000418              F(4,I)=F(4,I)+FLE(N2I)
```

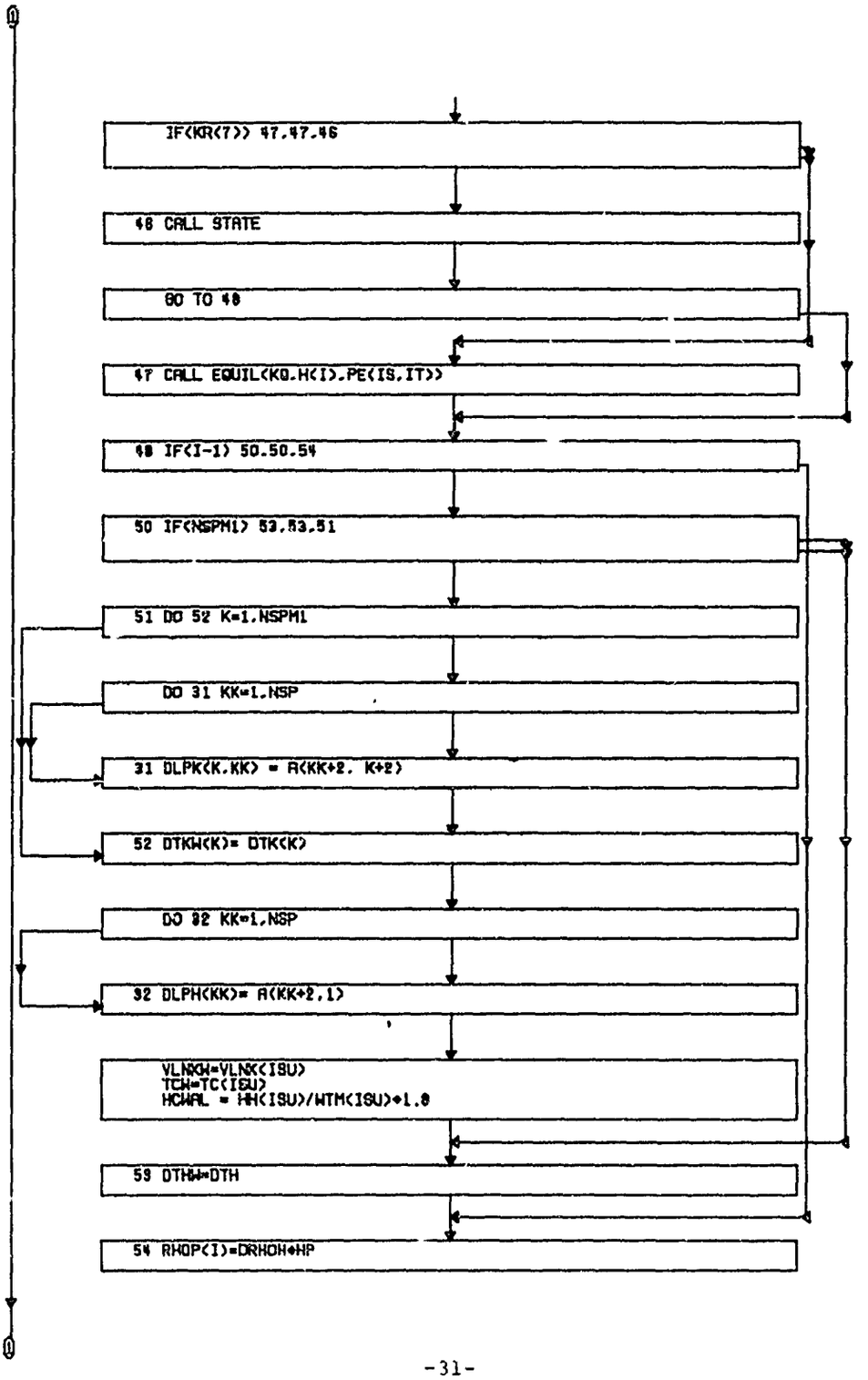
```
000419              IF(I-1) 760,760,765
000420          760 F(1,1)=F(1,1) + DVNL(2)
000421              F(3,1)=F(3,1)+DVNL(3)
000422              GO TO 770
000423          765 F(1,I)= F(1,I)+FLE(I-1)
000424              F(3,I)=F(3,I)+FLE(NI-2)
000425          770 LPI=MAT1J+I+1
000426              DO 785 K=NUL,NSPM1
000427              IF(I-NETA) 772,771,772
000428          771 SP(1,I,K)=SP(1,I,K)+SPLE(1,K)
000429              GO TO 773
000430          772 SP(1,I,K)=SP(1,I,K)+DVNL(LPI)
000431          773 SP(3,I,K)=SP(3,I,K)+SPLE(NI,K)
000432              IF(I-1) 775,775,780
000433          775 SP(2,1,K)= SP(2,1,K) + DVNL(LPI-1)
000434              GO TO 785
000435          780 SP(2,I,K)=SP(2,I,K)+SPLE(I,K)
000436          785 LPI=LPI+MAT2J
000437          790 CONTINUE
000438              ALPH=ALPH+DVNL(1)
000439              IF (ITS - 49) 850,840,850                                   B05AD300
000440          840 IF (I777 - 777) 845,850,845                                 B05A5310
000441          845 I777 = 777                                                  B05A5320
000442              ITS = 30                                                    B05A5330
000443          850 CONTINUE                                                    B05A5340
000444              IF(KQ(10),GT.-1) RETURN
000445              RETHMO=-C3*RHOE(I6)*UE(I6)*(F(1,NETA)-F(1,1)-XM(5)/ALPH)
000446              IF(RETHMO.GT.RETR) KQ(10)=-10
000447              IF(RETHMO.LT.RETR) KQ(10)=-1
000448              RETURN                                                      B05A5350
000449              END                                                         B05A5360
```

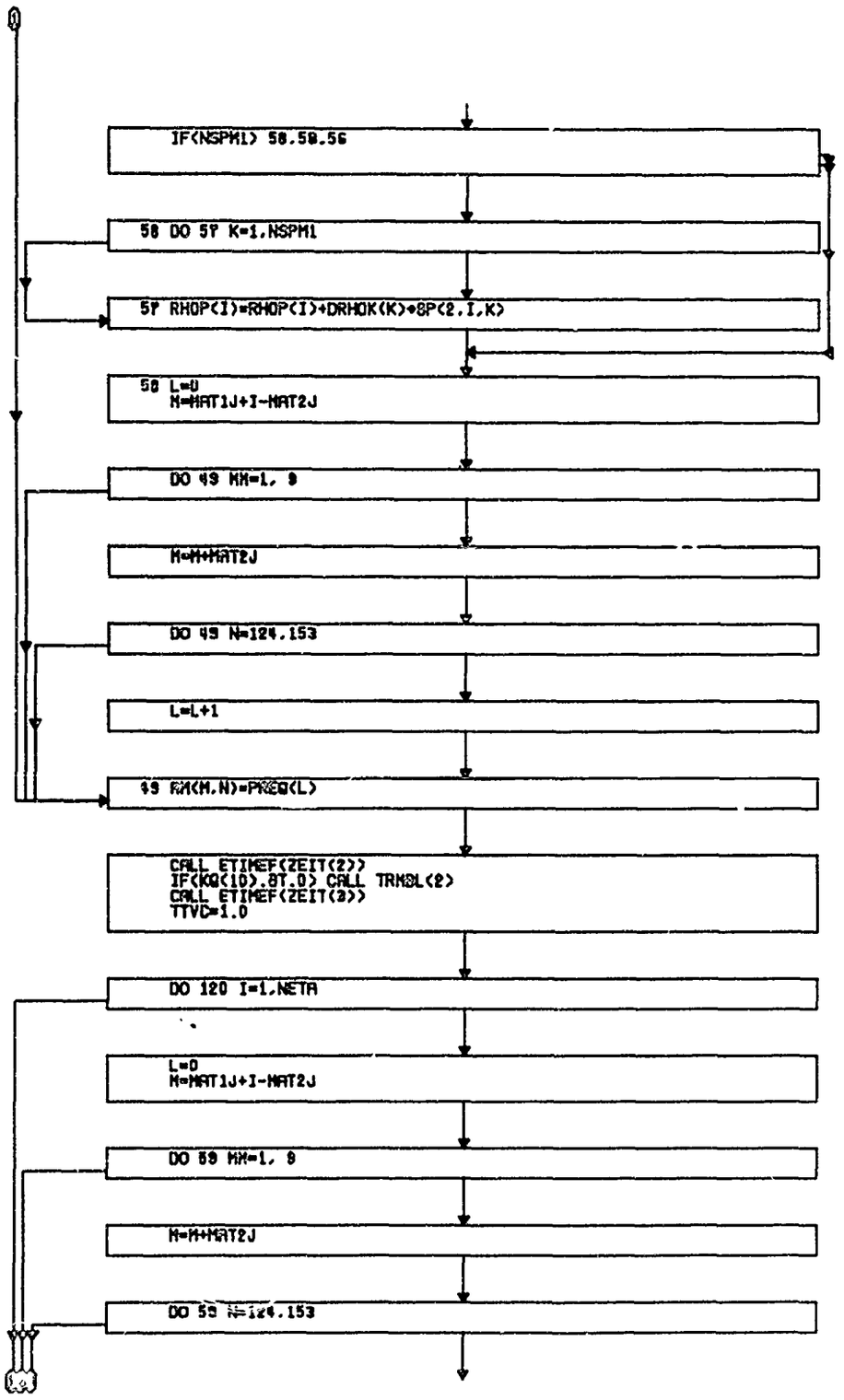
c. Flow Chart

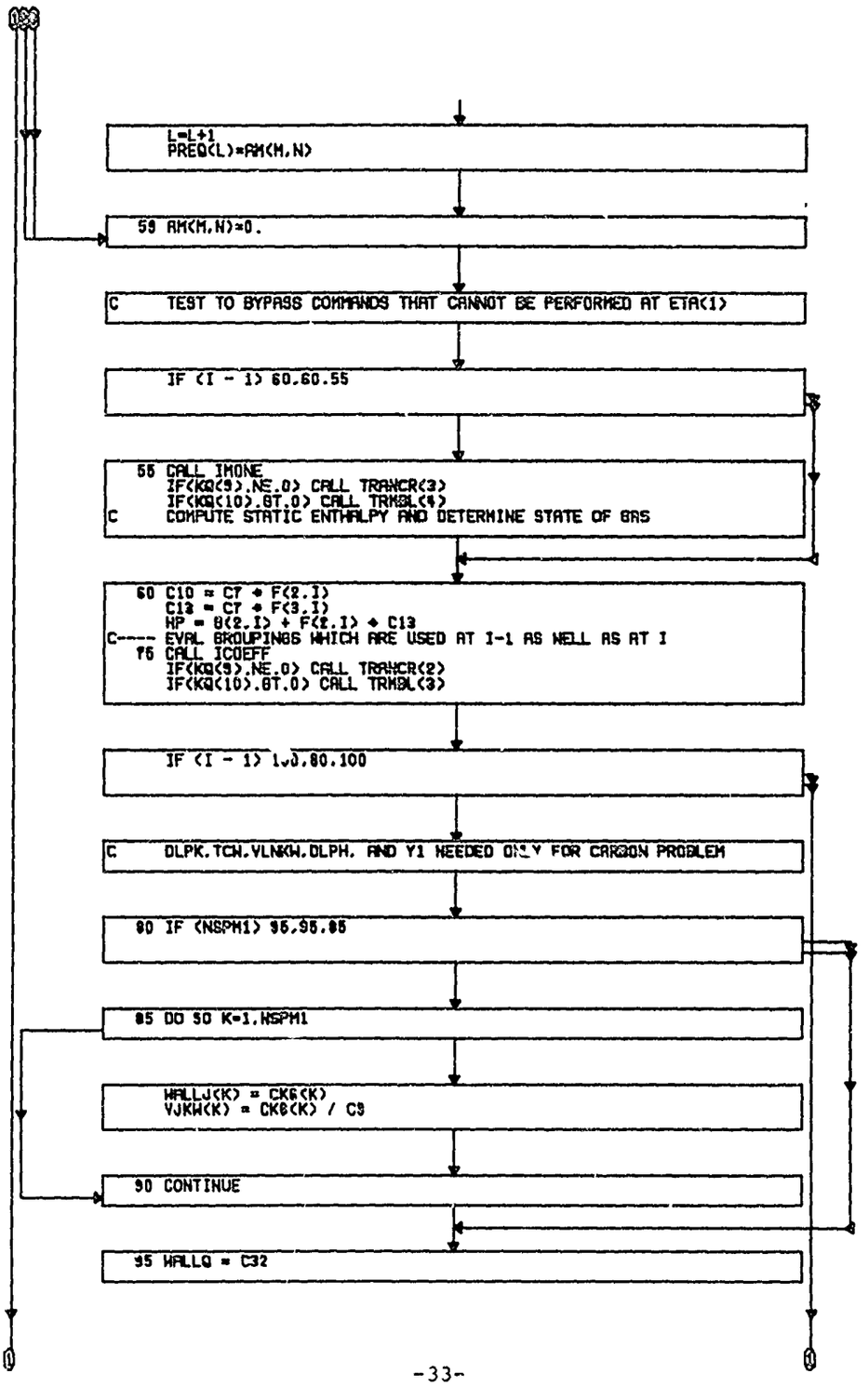

C 605B
SUBROUTINENONCER
EASE=AMIN1(EASE*2.,1.0)
IF(ITS-1) 11,5,11
5 EASE = .9393
SPNEW = 0.
BUMP = 1.0
IF(ITEM+IS-2) 3,3,2
2 IF(WDOT) 4,3,3
3 WDOT=-.12/C1
4 PIEASE=1.
ICORM = 1
CORMA = 1.E + 10
TFZ = 0.
IF (KR9(IS)) 8,8,7
7 KR(0)=KR9(IS)
8 DO 1? I=1,NETA
1? EPSR(I)=0.
IF(KR(9)-2) 11,10,9
9 FLUXJ(3,IS,IT)=-1.
10 ISP=IZ+1

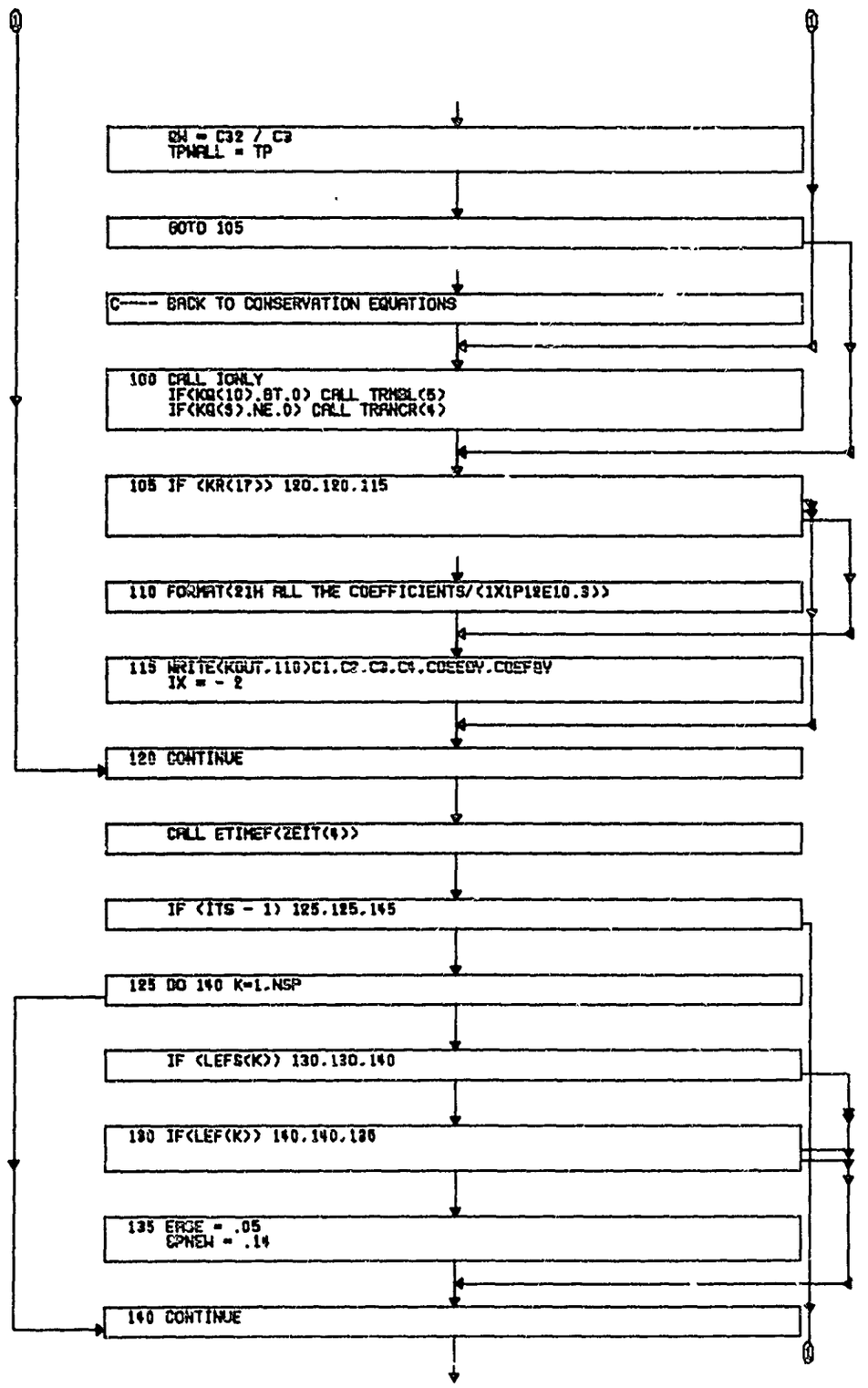

KK=MRX0(1,KS(IS))
W(1) = FLUXJ(1,IS, IT)
W(2)=FLUXJ(2,IS,IT)
W(3)=FLUXJ(3,IS,IT)
L2=2*KK
L3=L2+1
IF(KR(3)-2) 11,11,16
16 HPB=HPY8(KK)
EMISC=EMIV(KK)
HCARB=HCHAR(KK)
DO 12 J=ISP,NSPEC
IF(MOA(J)-BSU(KK)) 12,13,12
13 IF(MOB(J)-BSU(KK)) 12,14,12
14 ISU=J
GO TO 11
12 CONTINUE
ISU=ISP
11 KIP=0
IX = 0
C-- - EVALUATE COEFFICIENTS AND ERRORS FOR NONLINEAR EQUATIONS
C INITIALIZE AM MATRIX
DO 15 I=1,NNLEQ
ENL(I)=0.

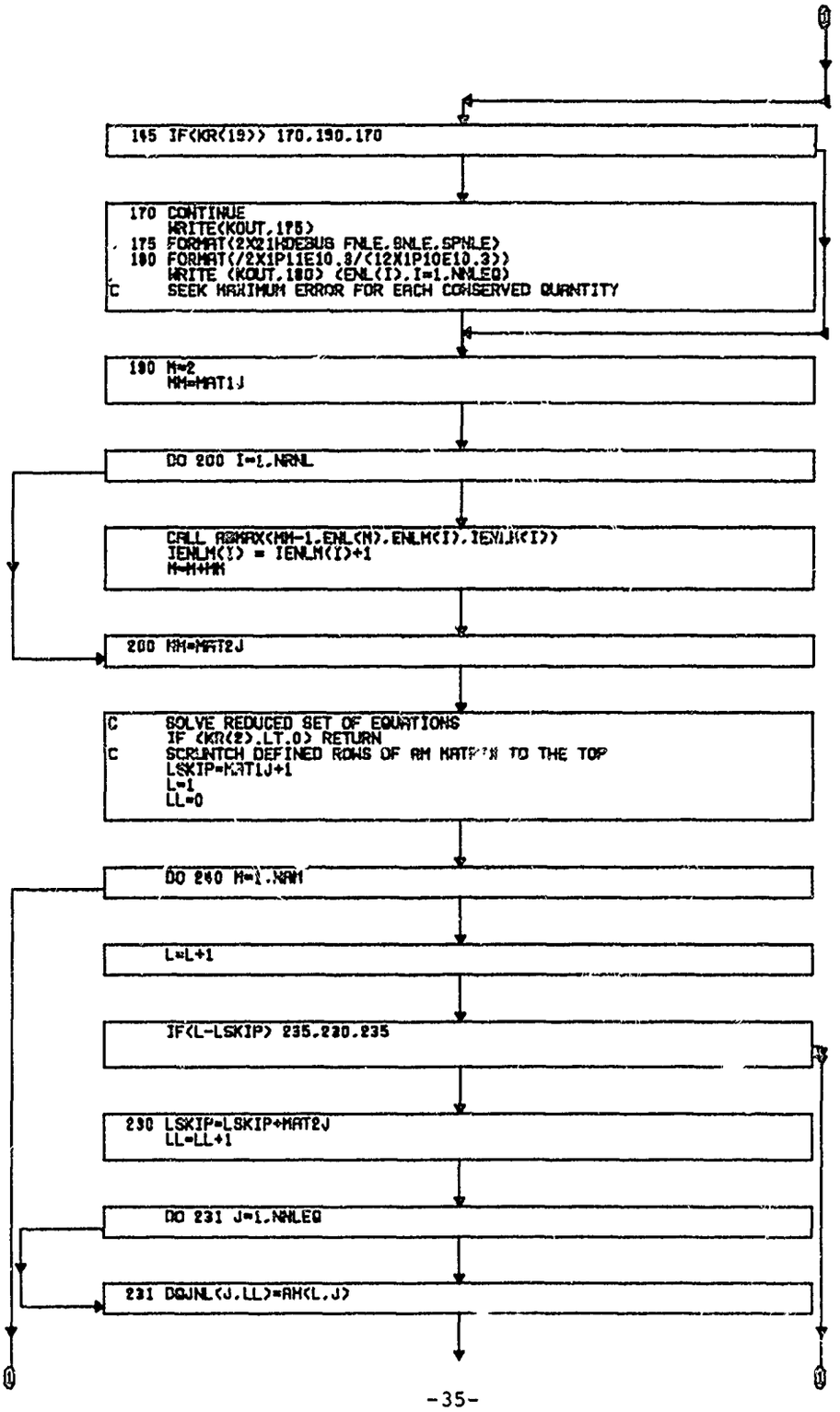

A
DO 15 J=1,NNLEQ
15 AM(I,J) = 0.
C EVAL. GROUPINGS WHICH CHANGE DURING ITERATION BUT ARE NOT F(ETA)
40 C5 = 1. / ALPH
DUM1 = ALPH * ALPH
C8 = BETA * DUM1
C7 = - UE(IS) / DUM1 * UE(IS) / 25036.5
C9 = ALPHD * C5
C6 = C4 - C8
C10 = ALPH * DUEDSE
UKAP=UEDGE
C---- EVAL COEFS. AM, AND ERRORS FOR EDGE BOUN CONDS AND ALPH CONSTRAINT
C FIRST, COMPUTE UEDGE IF THERE IS AN ENTROPY LAYER
COMMENT-----PERFORM TABLE LOOKUP FOR UEDGE (WHICH IS A FUNCTION OF
COMMENT-----F(1,NETA),IS,AND IT), DIFFERENTIATE TO GET DUEDGE, AND
COMMENT-----DIFFERENTIATE AGAIN TO GET D2UEDG
C NEXT, EVALUATE NONLINEAR ERRORS
45 ENL(4)=-(ALPH*UEDGE-F(2,NETA))
ENL(3)=-F(2,1)
IF(KR(10)-2) 41,41,42
41 ENL(2)=-(F(2,KAPPA)-CBAR*ALPH*UKAP)
AM(2,KAPPA+3)=1.
AM(2,1)=-CBAR*UKAP
GO TO 43
42 ENL(2)=-F(3,NETA)
CALL LIAD(-1.2,NETA+NETA-2,1.)
43 AM(4,1)=UEDGE
AM(4,MATIJ)=-1
AM(3,4)=1.
C FINALLY, EVAL CONTRIBUTIONS TO AM AND ERRORS FROM OTHER COEFFS
CALL LIAD(-1,NETA+1,NETA-1,C10)
C---- START OF MAJOR DO LOOP FOR EVAL OF COEFFS AND ERRORS AT EACH ETA
KQ(1)=2
KQ(5)=0
CALL ETIMEF(ZEIT(1))
DO 49 I=1,NETA
H(I)=B(1,I)+0.5*F(2,I)*C7*F(2,I)
HP=B(2,I)+F(2,I)*C7*F(3,I)

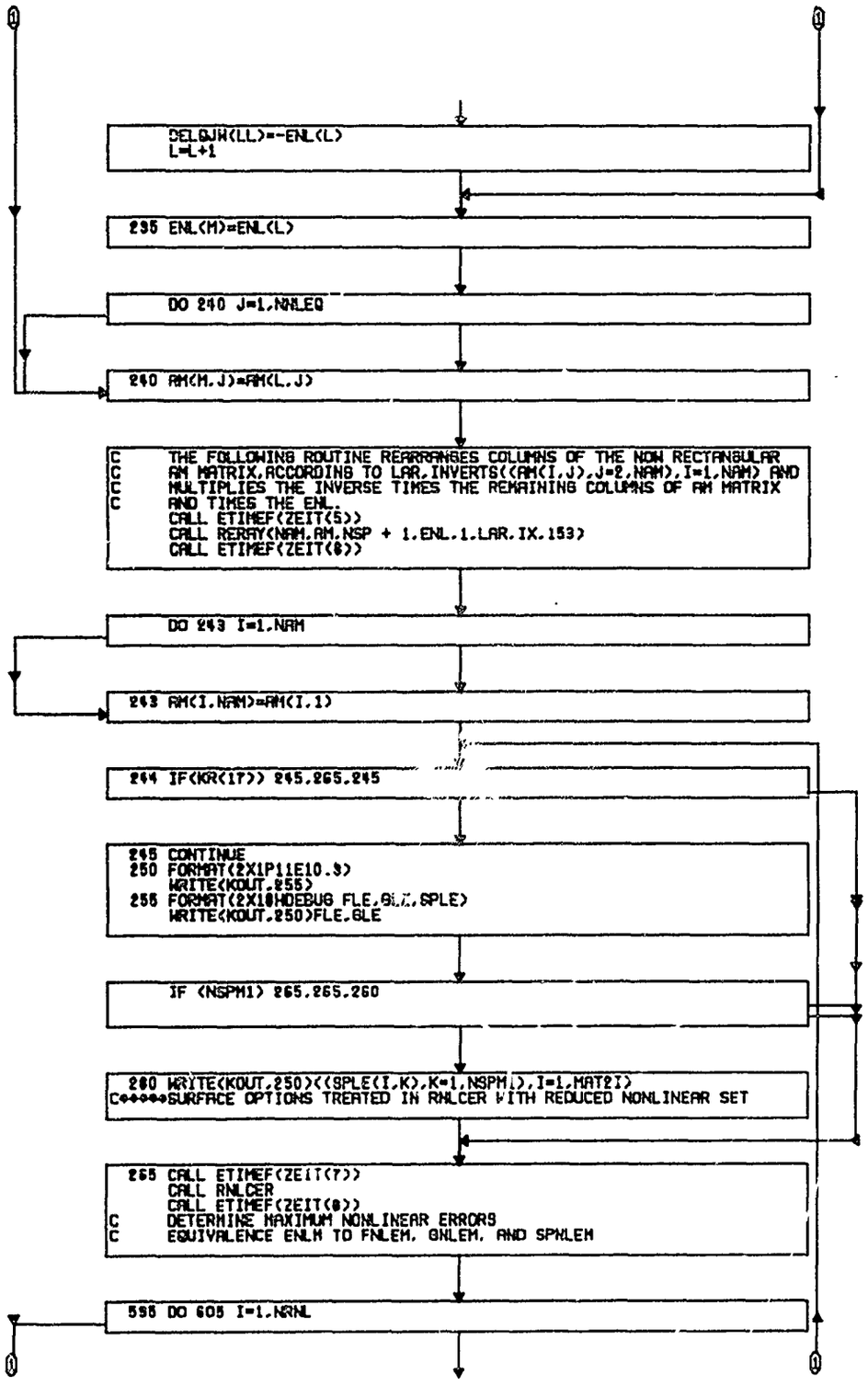

IF(KR(7)) 47,47,46
46 CALL STATE
GO TO 48
47 CALL EQUIL(KQ,H(I),PE(IS,IT))
48 IF(I-1) 50,50,54
50 IF(NSPM1) 53,53,51
51 DO 52 K=1,NSPM1
DO 31 KK=1,NSP
31 DLPK(K,KK) = A(KK+2, K+2)
52 DTKW(K)= DTK(K)
DO 32 KK=1,NSP
32 DLPH(KK)= A(KK+2,1)
VLNKW=VLNK(ISU)
TCW=TC(ISU)
HCWAL = HH(ISU)/WTM(ISU)*1.8
53 DTHW=DTH
54 RHOP(I)=DRHOH*HP

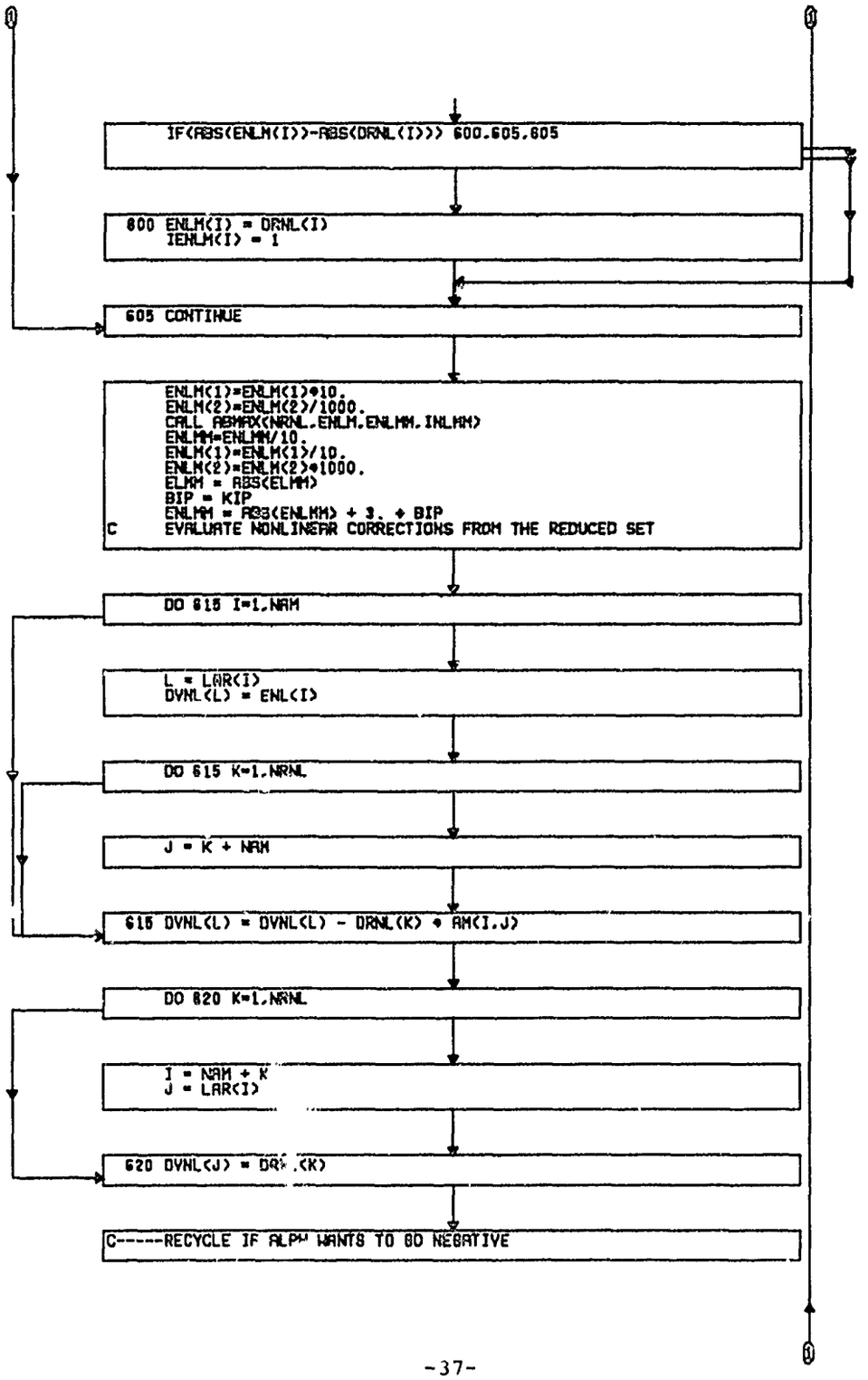

IF(NSPM1) 58,58,56
58 DO 57 K=1,NSPM1
57 RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)
58 L=0
M=MAT1J+I-MAT2J
DO 49 MX=1, 9
M=M+MAT2J
DO 49 N=124,153
L=L+1
49 RM(M,N)=PMEQ(L)
CALL ETIMEF(ZEIT(2))
IF(KQ(10).GT.0) CALL TRM3L(2)
CALL ETIMEF(ZEIT(3))
TTVC=1.0
DO 120 I=1,NETA
L=0
M=MAT1J+I-MAT2J
DO 59 MX=1, 9
M=M+MAT2J
DO 59 N=124,153

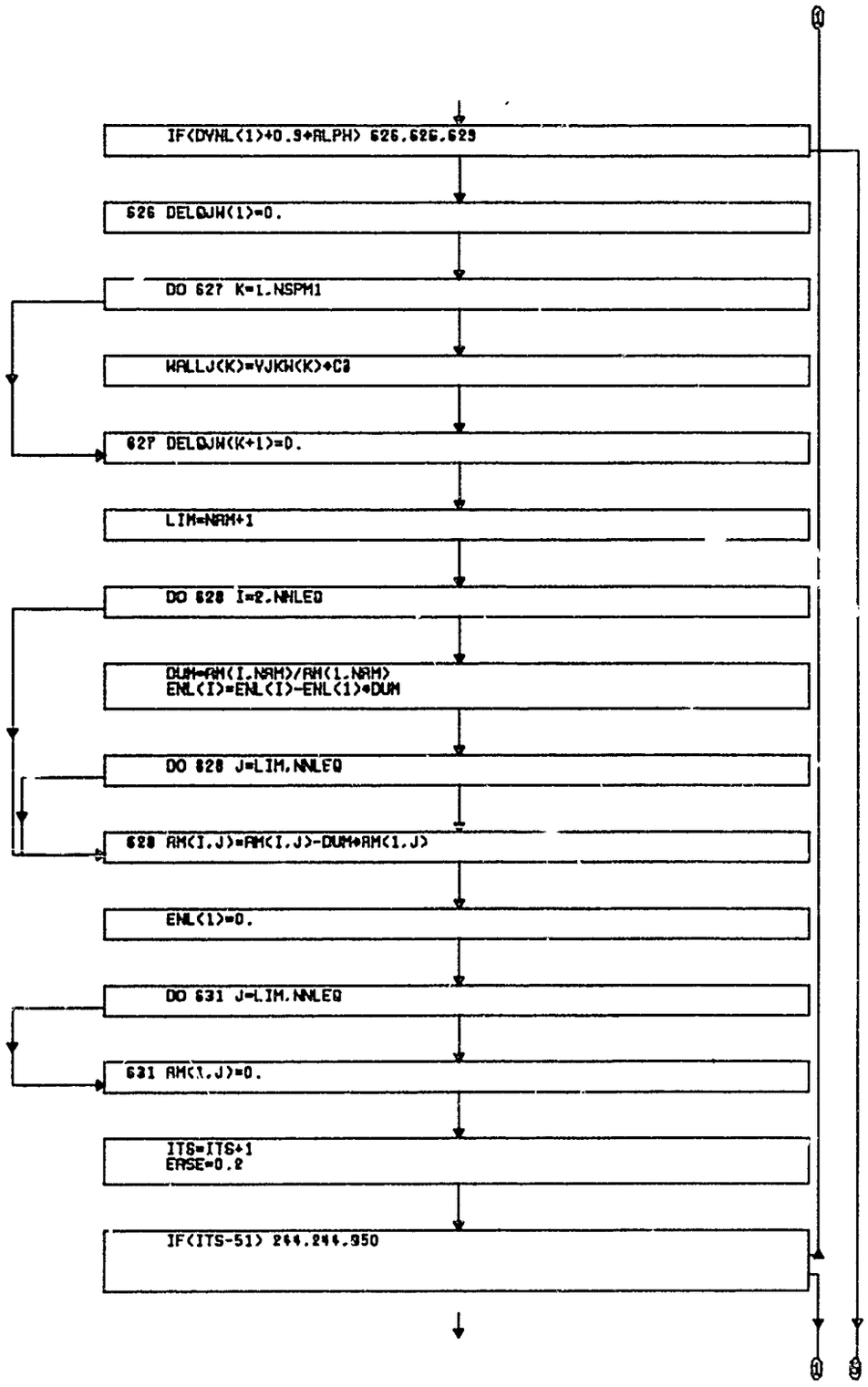

L=L+1
PREQ(L)=AM(M,N)
59 AM(M,N)=0.
C TEST TO BYPASS COMMANDS THAT CANNOT BE PERFORMED AT ETA(1)
IF (I - 1) 60,60,55
55 CALL IMONE
IF(KQ(9).NE.0) CALL TRANCR(3)
IF(KQ(10).GT.0) CALL TRM3L(4)
C COMPUTE STATIC ENTHALPY AND DETERMINE STATE OF GAS
60 C10 = CT * F(2,I)
C13 = CT * F(3,I)
HP = B(2,I) + F(1,I) * C13
C---- EVAL GROUPINGS WHICH ARE USED AT I-1 AS WELL AS AT I
75 CALL ICOEFF
IF(KQ(9).NE.0) CALL TRANCR(2)
IF(KQ(10).GT.0) CALL TRM3L(3)
IF (I - 1) 100,80,100
C DLPK,TCW,VLNKW,DLPH, AND Y1 NEEDED ONLY FOR CARBON PROBLEM
80 IF (NSPM1) 95,95,85
85 DO 90 K=1,NSPM1
WALLJ(K) = CK6(K)
VJKW(K) = CK6(K) / C9
90 CONTINUE
95 WALLQ = C32

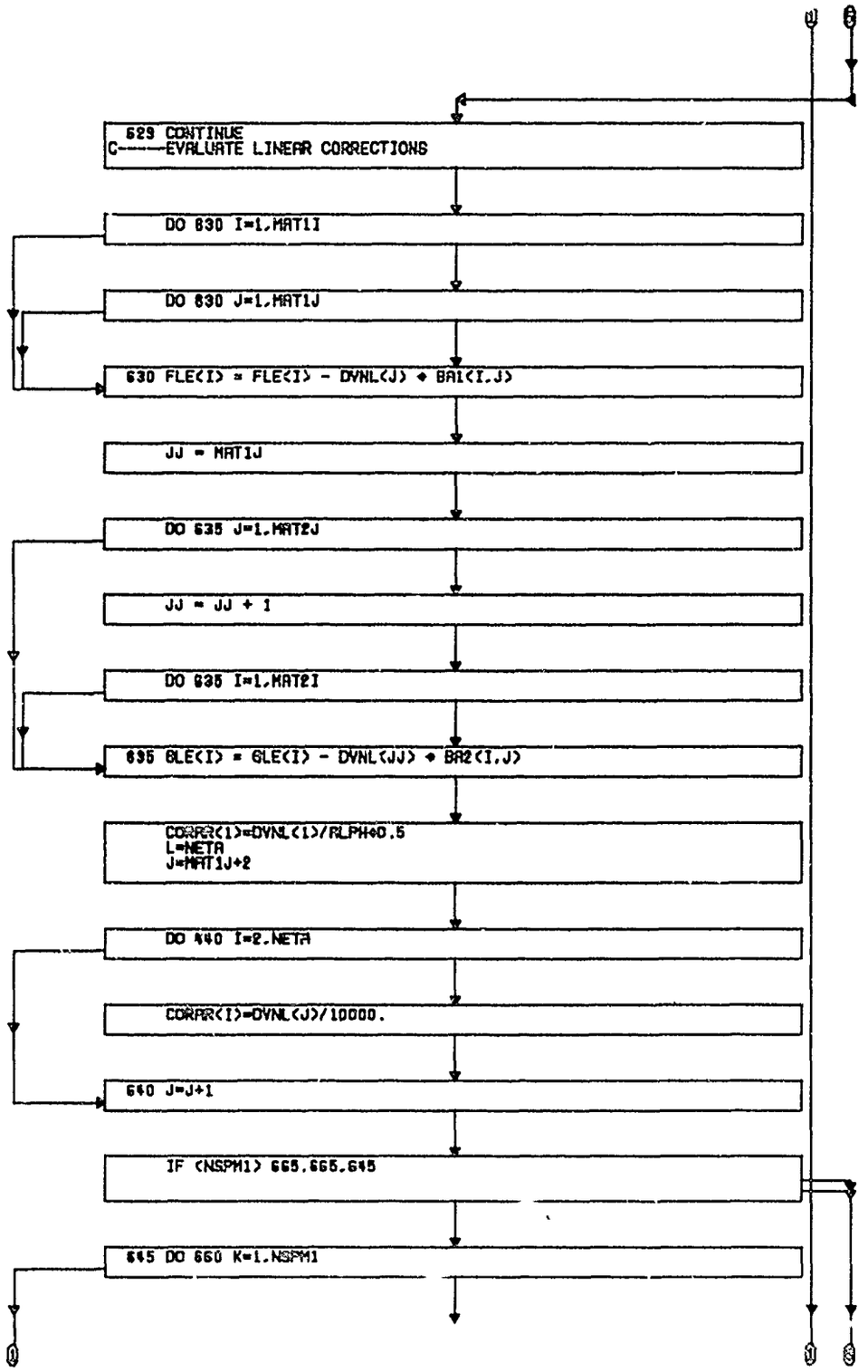

BW = C32 / C3
TPWALL = TP
GOTO 105
C---- BACK TO CONSERVATION EQUATIONS
100 CALL ICNLY
IF(KQ(10).GT.0) CALL TRMSL(5)
IF(KQ(9).NE.0) CALL TRANCR(4)
105 IF (KR(17)) 120.120.115
110 FORMAT(21H ALL THE COEFFICIENTS/(1X1P12E10.3))
115 WRITE(KOUT.110)C1.C2.C3.C4.COEEQV.COEFBV
IX = - 2
120 CONTINUE
CALL ETIMEF(ZEIT(4))
IF (ITS - 1) 125.125.145
125 DO 140 K=1.NSP
IF (LEFS(K)) 130.130.140
130 IF(LEF(K)) 140.140.135
135 ERGE = .05
GPNEW = .14
140 CONTINUE

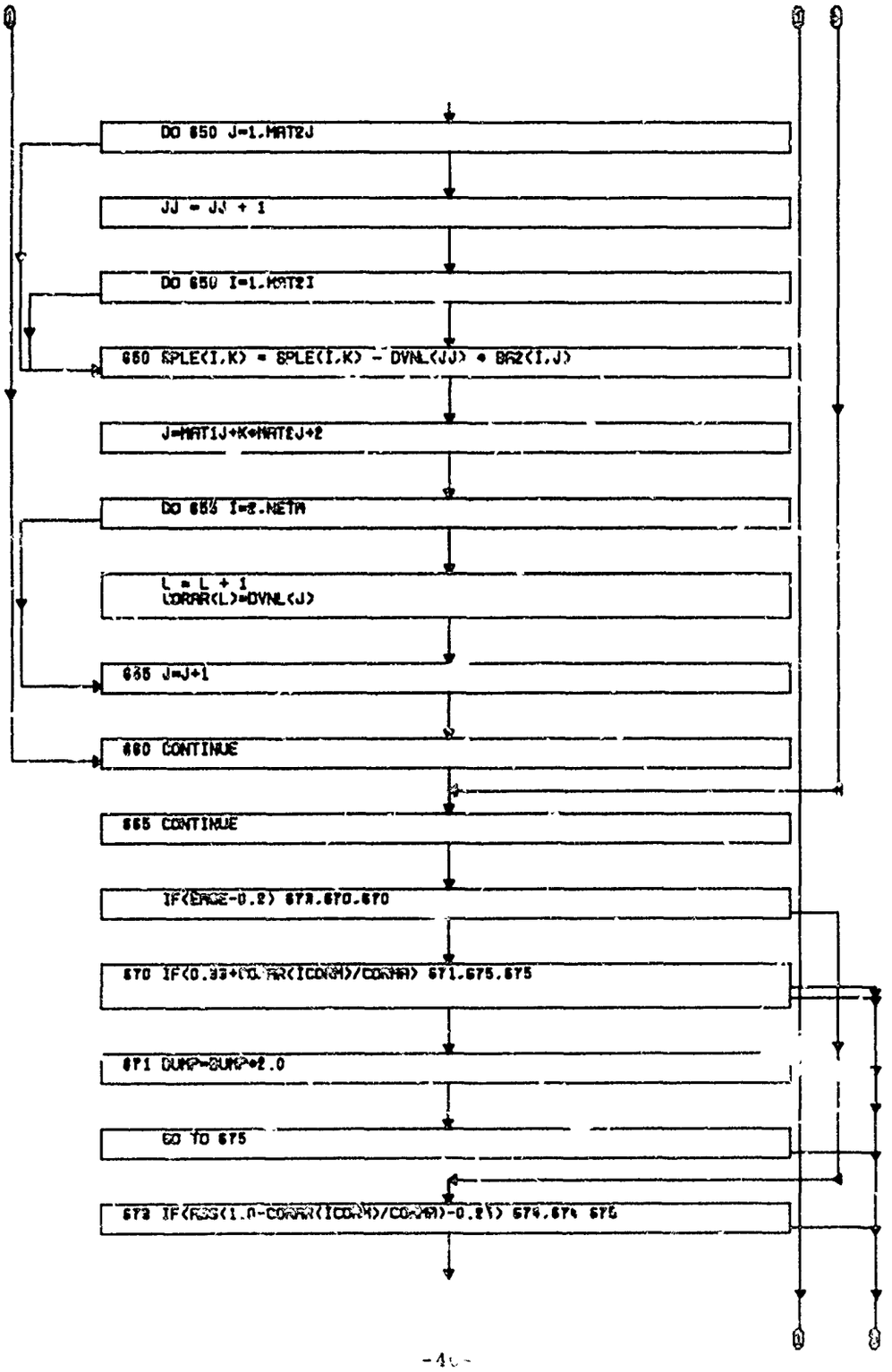

165 IF(KR(19)) 170,190,170
170 CONTINUE
WRITE(KOUT,175)
175 FORMAT(2X21HDEBUG ENLE,8NLE,SPNLE)
180 FORMAT(/2X1P11E10.3/(12X1P10E10.3))
WRITE (KOUT,180) (ENL(I),I=1,NNLEQ)
C SEEK MAXIMUM ERROR FOR EACH CONSERVED QUANTITY
190 M=2
MM=MAT1J
DO 200 I=1,NRNL
CALL RSMAX(MM-1,ENL(M),ENLM(I),IENLM(I))
IENLM(I) = IENLM(I)+1
M=M+MM
200 MM=MAT2J
C SOLVE REDUCED SET OF EQUATIONS
IF (KR(2).LT.0) RETURN
C SCRUNTCH DEFINED ROWS OF AM MATRIX TO THE TOP
LSKIP=MAT1J+1
L=1
LL=0
DO 240 M=1,NRM1
L=L+1
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)

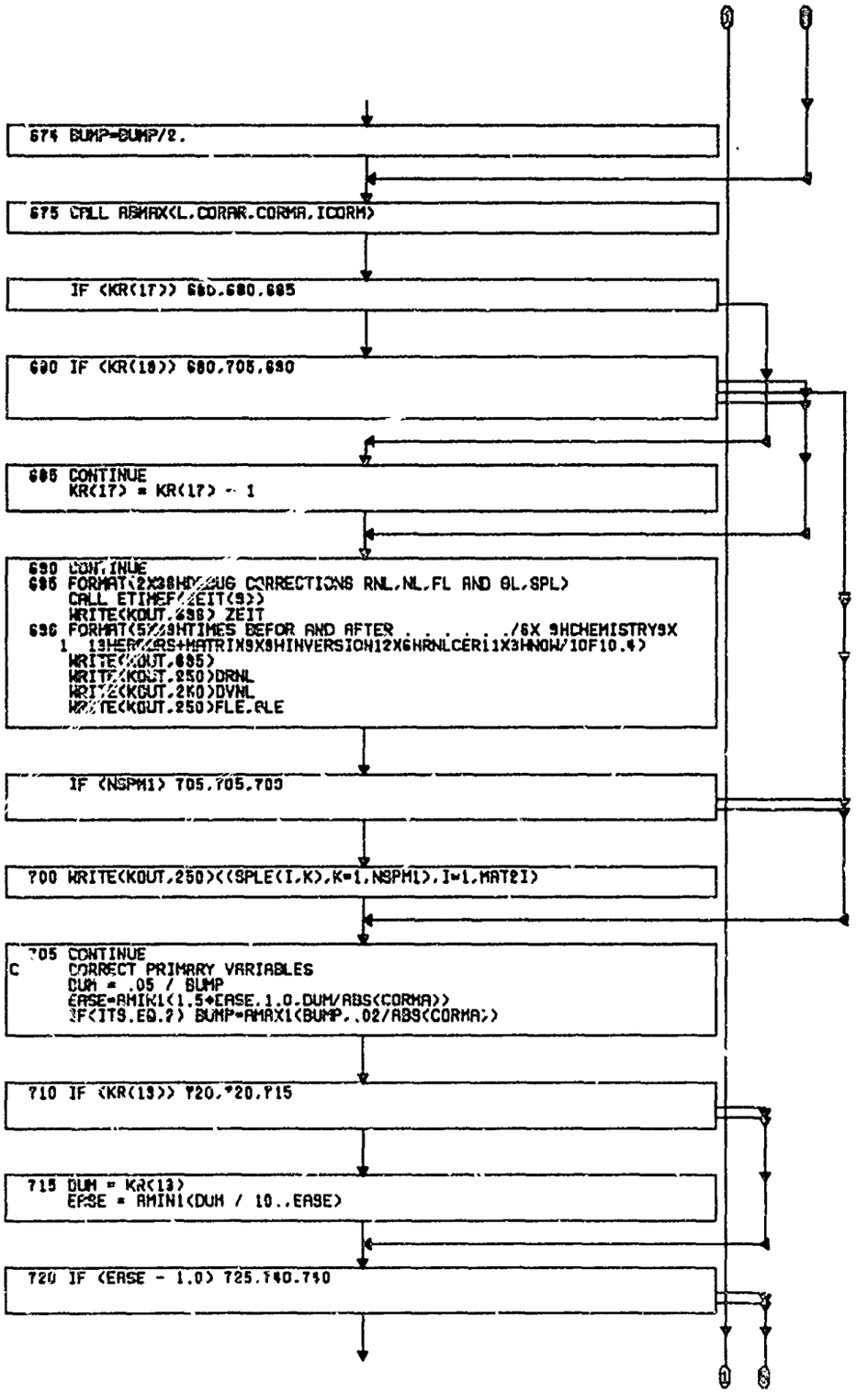

DELBJW(LL)=-ENL(L)
L=L+1
295 ENL(M)=ENL(L)
DO 240 J=1,NNLEQ
240 AM(M,J)=AM(L,J)
C THE FOLLOWING ROUTINE REARRANGES COLUMNS OF THE NOW RECTANGULAR
C AM MATRIX,ACCORDING TO LAR,INVERTS((AM(I,J),J=2,NAM),I=1,NAM) AND
C MULTIPLIES THE INVERSE TIMES THE REMAINING COLUMNS OF AM MATRIX
C AND TIMES THE ENL.
CALL ETIMEF(ZEIT(5))
CALL RERAY(NAM,AM,NSP + 1,ENL,1,LAR,IX,153)
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
250 FORMAT(2X1P11E10.3)
WRITE(KOUT,255)
255 FORMAT(2X18HDEBUG FLE,GLE,SPLE)
WRITE(KOUT,250)FLE,GLE
IF (NSPM1) 265,265,260
260 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2I)
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
C EQUIVALENCE ENLM TO FNLEM, GNLEM, AND SPNLEM
595 DO 605 I=1,NRNL

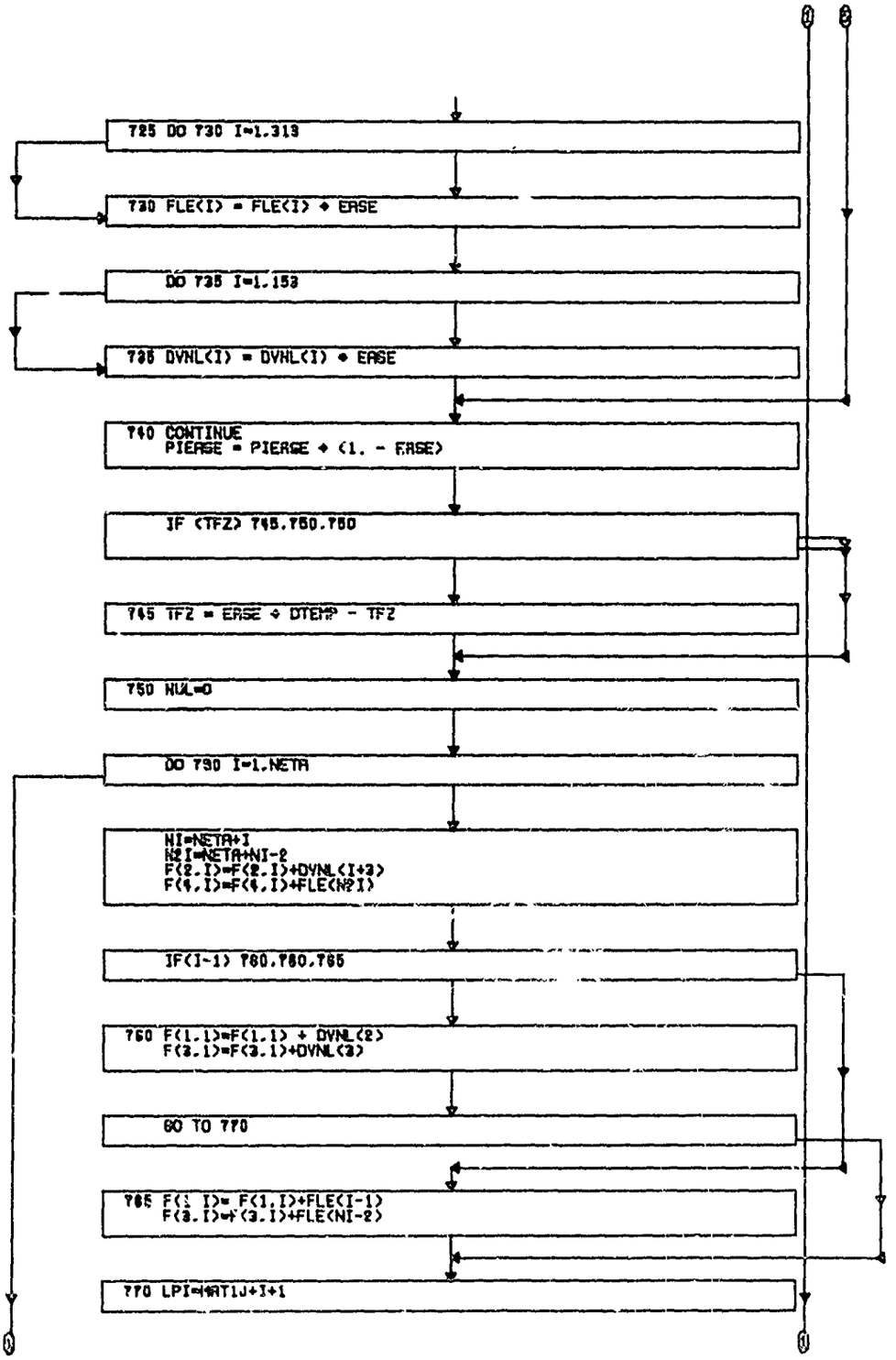

IF(ABS(ENLM(I))-ABS(DRNL(I))) 600,605,605
600 ENLM(I) = DRNL(I)
IENLM(I) = 1
605 CONTINUE
ENLM(1)=ENLM(1)*10.
ENLM(2)=ENLM(2)/1000.
CALL ABMAX(NRNL,ENLM,ENLMM,INLMM)
ENLMM=ENLMM/10.
ENLM(1)=ENLM(1)/10.
ENLM(2)=ENLM(2)*1000.
ELMM = ABS(ELMM)
BIP = KIP
ENLMM = ABS(ENLMM) + 3. * BIP
C EVALUATE NONLINEAR CORRECTIONS FROM THE REDUCED SET
DO 615 I=1,NAM
L = LAR(I)
DVNL(L) = ENL(I)
DO 615 K=1,NRNL
J = K + NAM
615 DVNL(L) = DVNL(L) - DRNL(K) * AM(I,J)
DO 620 K=1,NRNL
I = NAM + K
J = LAR(I)
620 DVNL(J) = DR
C-----RECYCLE IF ALPH WANTS TO GO NEGATIVE

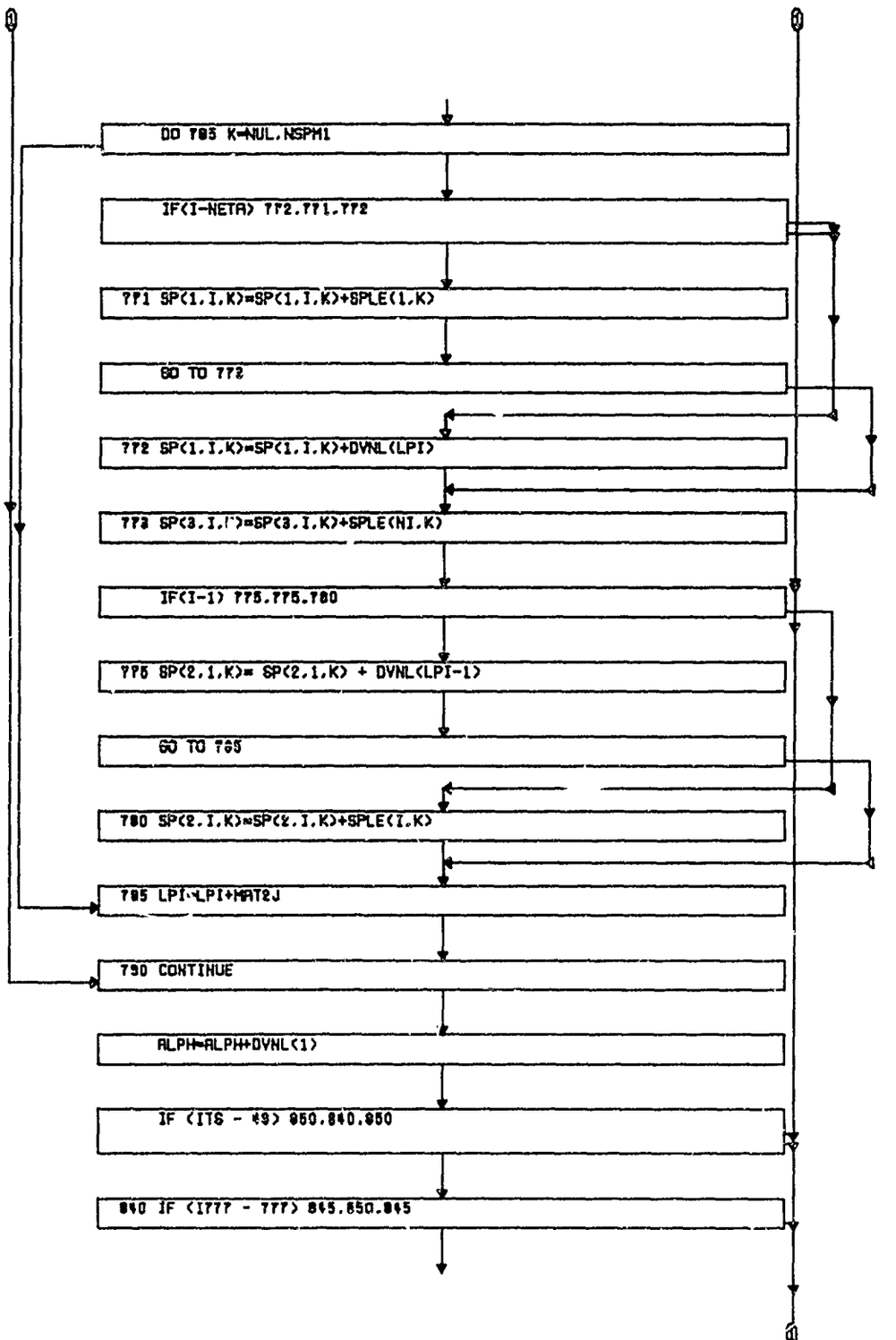

IF(DYNL(1)+0.9+ALPH) 626,626,629
626 DELQJW(1)=0.
DO 627 K=1,NSPM1
WALLJ(K)=VJKW(K)+C3
627 DELQJW(K+1)=0.
LIM=NRM+1
DO 628 I=2,NNLEQ
DUM=RM(I,NRM)/RM(1,NRM)
ENL(I)=ENL(I)-ENL(1)+DUM
DO 628 J=LIM,NNLEQ
628 RM(I,J)=RM(I,J)-DUM+RM(1,J)
ENL(1)=0.
DO 631 J=LIM,NNLEQ
631 RM(1,J)=0.
ITS=ITS+1
ERSE=0.2
IF(ITS-51) 244,244,950

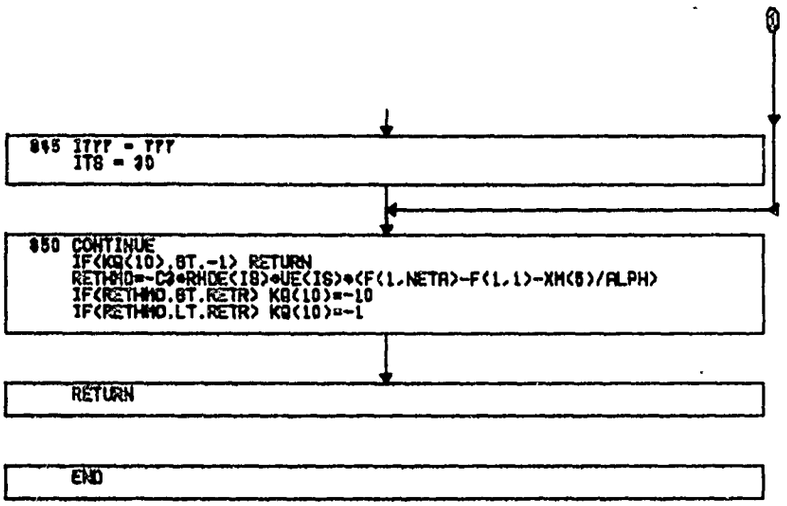

629 CONTINUE
C-----EVALUATE LINEAR CORRECTIONS
DO 630 I=1,MAT1I
DO 630 J=1,MAT1J
630 FLE(I) = FLE(I) - DVNL(J) * BA1(I,J)
JJ = MAT1J
DO 635 J=1,MAT2J
JJ = JJ + 1
DO 635 I=1,MAT2I
635 GLE(I) = GLE(I) - DVNL(JJ) * BA2(I,J)
CORR2(1)=DVNL(1)/RLPH+0.5
L=NETA
J=MAT1J+2
DO 640 I=2,NETA
CORR2(I)=DVNL(J)/10000.
640 J=J+1
IF (NSPM1) 665,665,645
645 DO 660 K=1,NSPM1


DO 650 J=1,MAT2J
JJ = JJ + 1
DO 650 I=1,MAT2I
650 SPLE(I,K) = SPLE(I,K) - DVNL(JJ) * BA2(I,J)
J=MAT1J+K+MAT2J+2
DO 655 I=2,NETA
L = L + 1
CORAR(L)=DVNL(J)
655 J=J+1
660 CONTINUE
665 CONTINUE
IF(ERGE-0.2) 673,670,670
670 IF(0.33+CO RR(ICONM)/CONMA) 671,675,675
671 DUMP=DUMP+2.0
GO TO 675
673 IF(ABS(1.0-CORAR(ICONM)/CONMA)-0.2) 674,674,675


674 BUMP=BUMP/2.
675 CALL ABMAX(L,CORAR,CORMA,ICORM)
IF (KR(17)) 680,680,685
680 IF (KR(18)) 680,705,680
685 CONTINUE
KR(17) = KR(17) - 1
690 CONTINUE
695 FORMAT(2X38HDEBUG CORRECTIONS RNL,NL,FL AND BL,SPL)
CALL ETIME(ZEIT(9))
WRITE(KOUT,696) ZEIT
696 FORMAT(5X,9HTIMES BEFOR AND AFTER . . . . . ./6X,9HCHEMISTRY9X
1 13HERRORS+MATRIX9X8HINVERSION12X6HRNLCER11X3HNOW/10F10.4)
WRITE(KOUT,695)
WRITE(KOUT,250)DRNL
WRITE(KOUT,250)DVNL
WRITE(KOUT,250)FLE,BLE
IF (NSPM1) 705,705,700
700 WRITE(KOUT,250)((SPLE(I,K),K=1,NSPM1),I=1,MAT2I)
705 CONTINUE
C CORRECT PRIMARY VARIABLES
DUM = .05 / BUMP
EASE=AMIN1(1.5+EASE,1.0,DUM/ABS(CORMA))
IF(ITS.EQ.2) BUMP=AMAX1(BUMP,.02/ABS(CORMA))
710 IF (KR(19)) 720,720,715
715 DUM = KR(13)
EASE = AMIN1(DUM / 10.,EASE)
720 IF (EASE - 1.0) 725,740,740


725 DO 730 I=1,313
730 FLE(I) = FLE(I) + ERSE
DO 735 I=1,153
735 DVNL(I) = DVNL(I) + ERSE
740 CONTINUE
PIERSE = PIERSE + (1. - ERSE)
IF (TFZ) 745,750,750
745 TFZ = ERSE + DTEMP - TFZ
750 NUL=0
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) 780,780,765
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=MATIJ+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 772
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 (ITS - 9) 850,840,850
840 IF (I777 - 777) 845,850,845


845 ITTF = TTT
ITS = 30
850 CONTINUE
IF(KQ(10),GT.-1) RETURN
RETHMD=-C3*RHOE(IS)*UE(IS)*(F(1,NETA)-F(1,1)-XM(5)/ALPH)
IF(RETHMD.GT.RETR) KQ(10)=-10
IF(RETHMD.LT.RETR) KQ(10)=-1
RETURN
END

5. SUBROUTINE RNLCER - B05C

a. Function

Further reduces nonlinear equations to reduced nonlinear set of wall variables. Introduces wall boundary conditions and solves for new values of this set. Called by NONCER. Calls RERAY.

b. Listing

```
000001      C     B05C
000002            SUBROUTINE RNLCER                                                    B05C 003
000003            DIMENSION DQJNL( 71,1)                                               B05C 004
000004            DIMENSION DELQJW(1) ,DQJNL(153,1) ,WALLQJ(1)                         B05C   5
000005            COMMON/BLQCOM/  WOA( 71),  MOR( 71),NSPEC,FR( 71,15),W(3),LEF(10)    B05C   6
000006           1,LEFS(10),PLEASE,LEFW(10)                                            B05C   7
000007            COMMON/BUMCOM/     BUMP,CORMA,FASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IXB05C   8
000008            COMMON/CRRCOM/HCARB,EMIS,STFF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMISTB05C   9
000009           1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU               B05C  A9
000010            COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 5),DUES,B05C  B9
000011           1UF(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,ME,C90     B05C  C9
000012           2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                       B05C  10
000013            COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,       B05C  11
000014           1EPSA(15),EPS1,EL(15),DPI(15,2),DLI(153),DEPS(153),DEPC,TREF,RETR     B05C  12
000015            COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B05C  13
000016           1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),    B05C  14
000017           2 KAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),          B05C  15
000018           3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),YYY( 71),YW( 71),GG( 71)B05C  16
000019           4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                      B05C  17
000020            COMMON/EQTCOM/SIP,HIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B05C  18
000021           1 MODE,AMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,BX,ISP2,ISPQ,     B05C  19
000022           2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HHG,B05C  20
000023           3 CCPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),BB(16),      B05C  21
000024           4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,    B05C  22
000025           5 CP( 71),HH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),         B05C  23
000026           6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                        B05C  24
000027            COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM       B05C  25
000028           1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)      B05C  26
000029           2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)       B05C  27
000030           3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)     B05C  28
000031           4,FENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                B05C  29
000032            COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)        B05C  30
000033           1,LAR(153),BA1(43,18),BA2(30,15)                                      B05C  31
000034            COMMON/FLXCOM/DELQW,DELQW( 8),DQNL(153),DJNL(153, 8),WALLQ          B05C  32
000035           1,WALLJ( 8),QW,VJKW( 9),TPWALL                                        B05C  33
000036            COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8)B05C  34
000037           1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2    B05C  35
000038           2,C3M(40),BETAM(40)                                                   B05C  36
000039            COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB05C  37
000040           1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B05C  38
000041           2,R(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40)   B05C  39
000042           3,KAUXO,JTIME,JSPEC,MD(3)                                             B05C  40
000043            COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                             B05C  41
000044           1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                 B05C  42
000045            COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B05C  43
000046           1,GNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,    B05C  44
000047           2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                               B05C  45
000048            COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),GR(15),H(15)      B05C  46
000049           1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKH( 8),  DB05C  47
000050           2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B05C  48
000051           3,DHTILK( 8),DGRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)     B05C  49
000052           4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL    B05C  50
000053           5,VMU3,DTH,DCAPCH,DPRH,DSCH,DGRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B05C  51
000054           6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)     B05C  52
000055            COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)       B05C  53
000056           1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)       B05C  54
000057           2,YIINIT( 1),DUDS( 40)                                                B05C  55
000058            COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH
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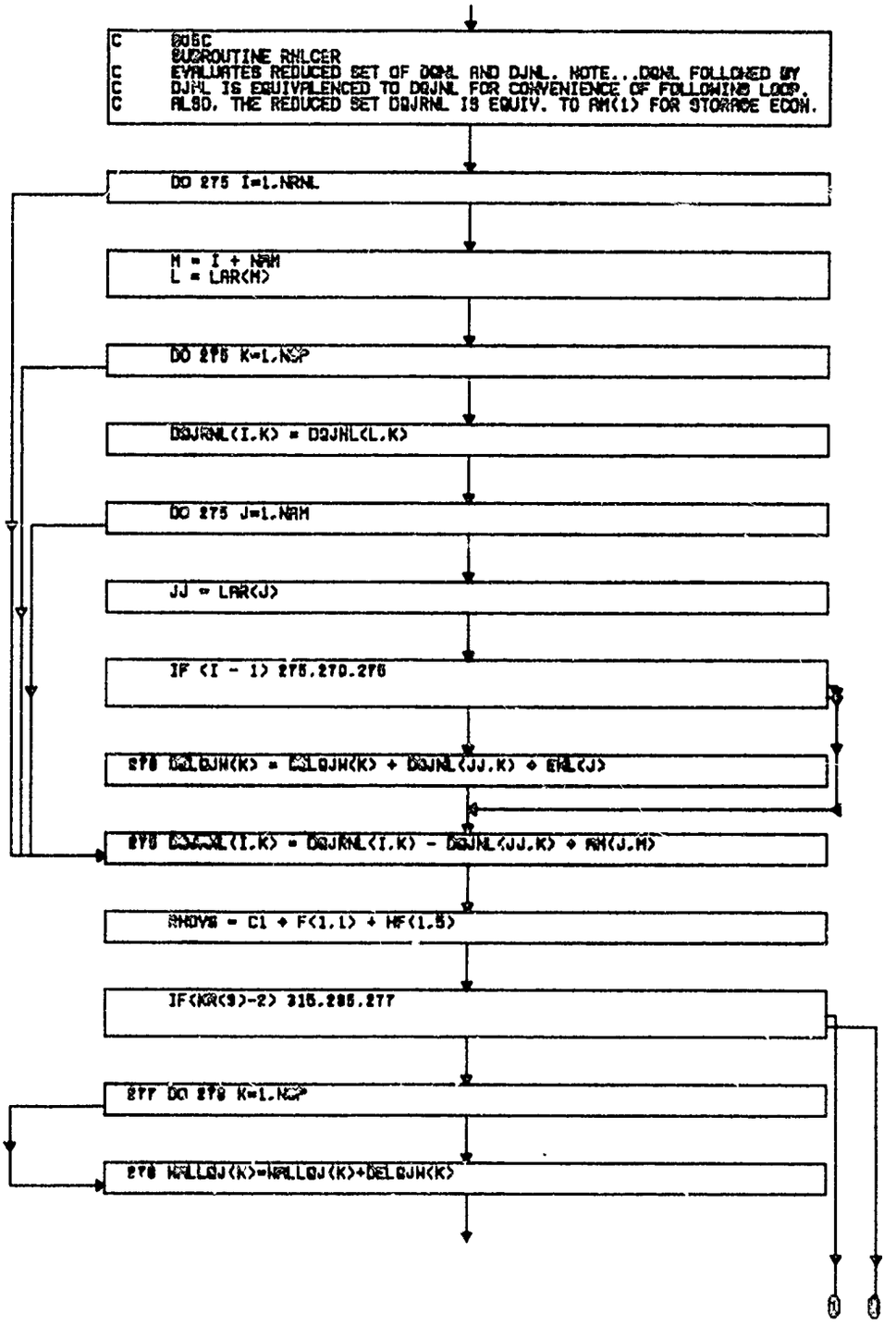
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000056                COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)          B05C  56
000060               1,RHOVW(40, 1),FLUXJ( 3,40, 1),IWW,ITW,IFW,ISPW,IRHOVW,IFLUXJ       B05C  57
000061                EQUIVALENCE(DELQW,DELQJW),(DQNL,DQJNL),(WALLQ,WALLQJ)              B05A0380
000062                DIMENSION CORAR(1)                                                 B05A0470
000063                EQUIVALENCE(CORAR(1),AM(1))                                        B05A0480
000064                EQUIVALENCE(AM,DQJRNL)                                             B05A0490
000065          C     EVALUATES REDUCED SET OF DQNL AND DJNL. NOTE...DQNL FOLLOWED BY    B05A2390
000066          C     DJNL IS EQUIVALENCED TO DQJNL FOR CONVENIENCE OF FOLLOWING LOOP,   B05A2400
000067          C     ALSO, THE REDUCED SET DQJRNL IS EQUIV. TO AM(1) FOR STORAGE ECON,  B05A2410
000068                DO 275 I=1,NRNL                                                    B05A2420
000069                I = I + JAM                                                        B05A2430
000070                L = LAR(I)                                                         B05A2440
000071                DO 275 K=1,NSP                                                     B05A2450
000072                DQJRNL(I,K) = DQJNL(L,K)                                           B05A2460
000073                DO 275 J=1,NAM                                                     B05A2470
000074                JJ = LAR(J)                                                        B05A2480
000075                IF (I - 1) 275,270,275                                             B05A2490
000076            270 DELQJW(K) = DELQJW(K) + DQJNL(JJ,K) * ENL(J)                       B05A2500
000077            275 DQJRNL(I,K) = DQJRNL(I,K) - DQJNL(JJ,K) * AM(J,I)                  B05A2510
000078                RHOVS = C1 * F(1,1) + HF(1,5)                                      B05A2520
000079                IF(KR(9)-2) 315,285,277                                                    *NEW
000080            277 DO 278 K=1,NSP                                                             *NEW
000081            278 WALLQJ(K)=WALLQJ(K)+DELQJW(K)                                              *NEW
000082                GO TO 315                                                                  *NEW
000083            285 DO 290 L=1,3                                                       B05A2550***1
000084            290 W(L) = FLUXJ(L,IS,IT)                                              B05A2560
000085          C     PREPARE DQJRNL AND WALLQJ FOR SURFACE MASS BALANCE                 B05A2570
000086            295 WSUM = W(1) + W(2) + W(3)                                          B05A2580
000087                DO 310 K=2,NSP                                                     B05A2590
000088                WALLJ(K - 1) = WALLJ(K - 1) + DELQJW(K)                            B05A2600
000089                DQJRNL(1,K) = DQJRNL(1,K) / C1                                     B05A2610
000090                WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(1,K) * RHOVS - DQJRNL(2,K) *  B05A2620
000091               1G(1,1)                                                             B05A2630
000092                DO 310 KK=3,NRNL                                                   B05A2640
000093            310 WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(KK,K) * SP(1,1,KK - 2)        B05A2700
000094            315 IF (KR(16) - 1) 345,340,320                                        B05A2710
000095            320 IF (KR(17)) 340,340,335                                            B05A2720
000096            325 FORMAT(52H  DEBUG DQJRNL(NRNL,NSP) BY ROWS, DELQW(5),WALLQJ(5)/    B05A2730
000097               1 (8X1P10E10.3))                                                    B05A2740
000098            330 FORMAT(35H  DEBUG DQJNL(NNLEQ,NSP) ROW BY ROW /(8X1P10E10.3))      B05A2750
000099            335 WRITE(KOUT,330)((DQJNL(I,K),K=1,NSP),I=1,NNLEQ)                    B05A2760
000100            340 WRITE(KOUT,325)((DQJRNL(I,K),K=1,NSP),I=1,NRNL),DELQW,DELJW,WALLQ,B05A2770
000101               1WALLJ                                                              B05A2780
000102                IX = - 2                                                           B05A2790
000103            345 CONTINUE                                                           B05A2800
000104                IF(KIP) 346,346,375
000105            346 IF(KR(9)-2) 347,355,395
000106            347 DRNL(1)=FW(IS,IT)-F(1,1)
000107                DRNL(2)=0.
000108                IF(NSPM1) 350,350,348
000109            348 DO 349 K=1,NSPM1
000110                DRNL(K+2)=SPW(K,IS,IT)-SP(1,1,K)
000111            349 DRNL(2)=DRNL(2)+DRNL(K+2)*DTKW(K)
000112            350 IF(KR(11)) 351,351,352
000113            351 DRNL(2)=(TW(IS,IT)-T(1)-DRNL(2))/DTHW
000114                GO TO 595
000115            352 DRNL(2)=HW(IS,IT)-G(1,1)
000116                G  TO 595
000117            355 IF (KR(11) - 1) 375,365,360                                        B05A2830
000118            360 IF (KR(11) - 3) 370,375,370                                        B05A2840
```

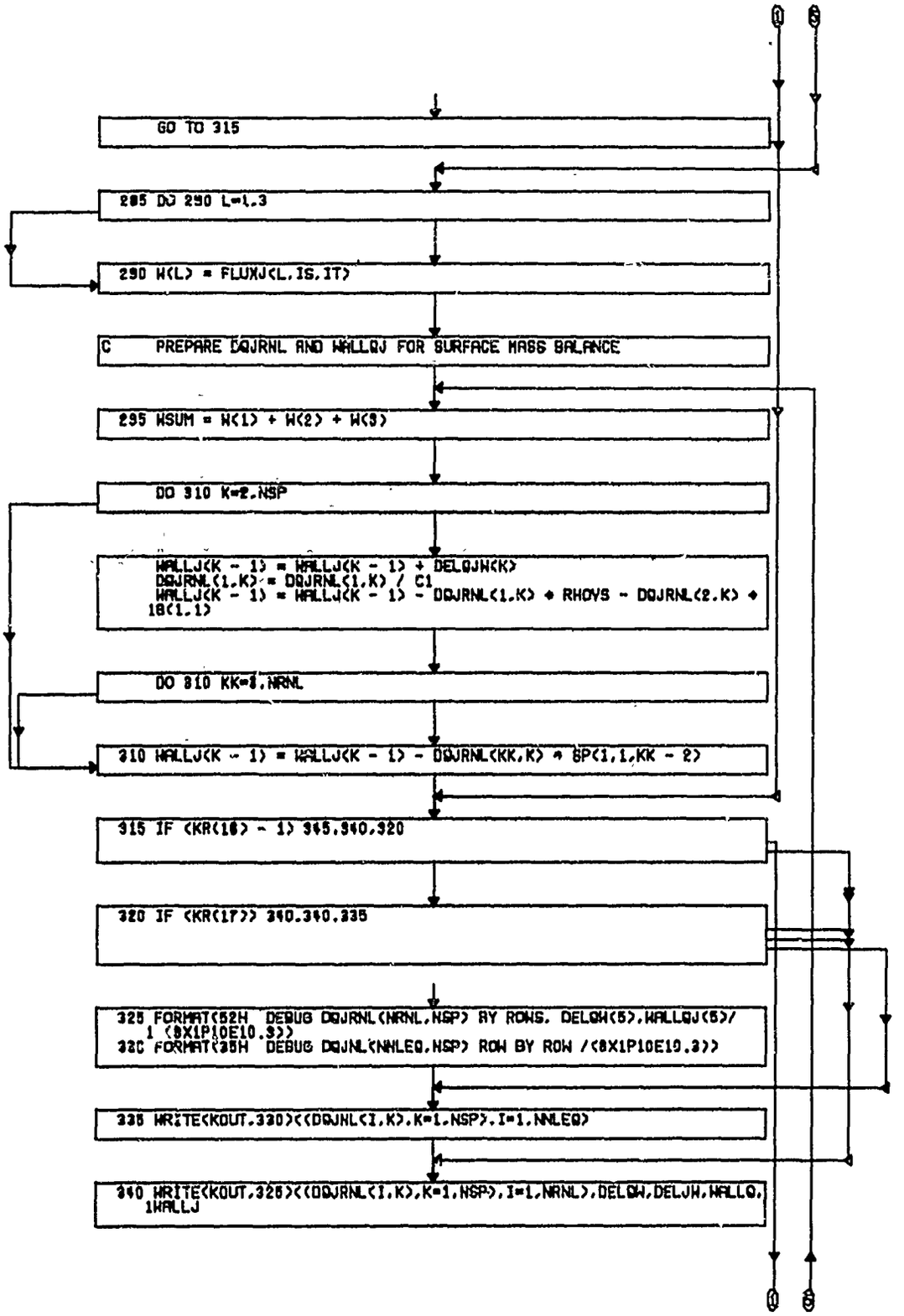
```
000119          365 KQ(1) = 2                                                   B05A2850
000120              DRNL(2)=HW(IS,IT)-G(1,1)
000121              HIP=(G(1,1)+EASE*(HW(IS,IT)-G(1,1)))/1.8
000122              GO TO 380
000123          370 KQ(1)=1
000124              IF(T(1)-1000.) 374,374,372
000125          372 IF (EASE-SPNEW) 374,374,380
000126          374 TW(IS,IT)=AMAX1(T(1),1500.)
000127          375 T(1)=T(1)+EASE*(TW(IS,IT)-T(1))
000128              KIP=MAXO(KIP-1,0)
000129          376 KQ(1)=0
000130          380 KQ(6) = 2                                                   B05A2910
000131              SPNEW=0.
000132              KQ(4) = 0                                                   B05A2920
000133              IF (KR(7))385,385,390
000134          385 CALL EQUIL(KQ,0.,PE(IS,IT))                                 B05A2930
000135          390 KQ(6) = 0                                                   B05A2940
000136              FW(IS,IT) = (RHOVW(IS,IT) - MF(1,5)) / C1                   B05A2950
000137              IF(KR(11)-1) 391,392,391
000138          391 DRNL(2)=(HW(IS,IT)-G(1,1))/EASE
000139          392 DRNL(1)=FW(IS,IT)-F(1,1)
000140              IF(NSPM1) 395,395,393
000141          393 DO 394 K=1,NSPM1
000142          394 DRNL(K+2)=(SPW(K,IS,IT)-SP(1,1,K))/EASE
000143              GO TO 395
000144      C       KIP=1 IF USING ASSIGNED TEMPERATURE ON ENERGY BALANCE FOR TEFLON B05A2970
000145          395 KIP = 0                                                     B05A2980
000146              W(3)=RHOVS-W(2)
000147              IF (IABS(KR(9) - 4) - 1) 450,450,400                        B05A3040
000148          400 HMAT = HTEF
000149              EMIS = EMIST
000150              IF (ITS - 1) 465,465,405                                    B05A3070
000151          405 IF (TFZ) 465,465,410                                        B05A3080
000152          410 IF (ABS(T(1) - TFZ) - 10.) 465,435,435                      B05A3090
000153          415 IF (DTEMP * DUM2) 440,440,420                               B05A3100
000154          420 IF (DUM1 * 20. + WDOT) 425,425,430                          B05A3110
000155          425 TFZ = T(1) - 50. / DTEMP * ATEMP                            B05A3120
000156              BUMP = 1.                                                   B05A3130
000157              GOTO 435                                                    B05A3140
000158          430 TFZ = T(1)
000159          435 TW(IS,IT) = TFZ                                             B05A3160
000160              GOTO 445                                                    B05A3170
000161          440 TW(IS,IT) = T(1) + 50. / DTEMP * ATEMP                      B05A3180
000162              BUMP = 1.                                                   B05A3190
000163          445 KIP = 1                                                     B05A3200
000164          450 DRNL(2) = TW(IS,IT) - T(1)                                  B05A3210
000165              AM(2,4) = 0.                                                B05A3220
000166              AM(2,5) = DTHW                                              B05A3230
000167              DO 455 K=1,NSPM1                                            B05A3240
000168          455 AM(2,K + 5) = DTKW(K)                                       B05A3250
000169              IF (KR(9) - 4) 475,475,465                                  B05A3260
000170          460 HMAT=HCARB
000171              EMIS=EMISC
000172          465 TFZ = 0.
000173              DUM1 = STEF * EMIS * (T(1)) * * 3. * C3                     B05A3330
000174              DRNL(2) = - WALLQ + RHOVS * (HMAT - G(1,1)) - DUM1 * T(1) + RADS(
000175             1IS)*C3+W(2)*(HPG-HMAT)
000176              DUM2 = DRNL(2)                                              B05A3360
000177              AM(2,4) = DQJRNL(1,1) + C1 * (G(1,1) - HMAT)
000178              DUM1 = DUM1 * 4.                                            B05A3380
```

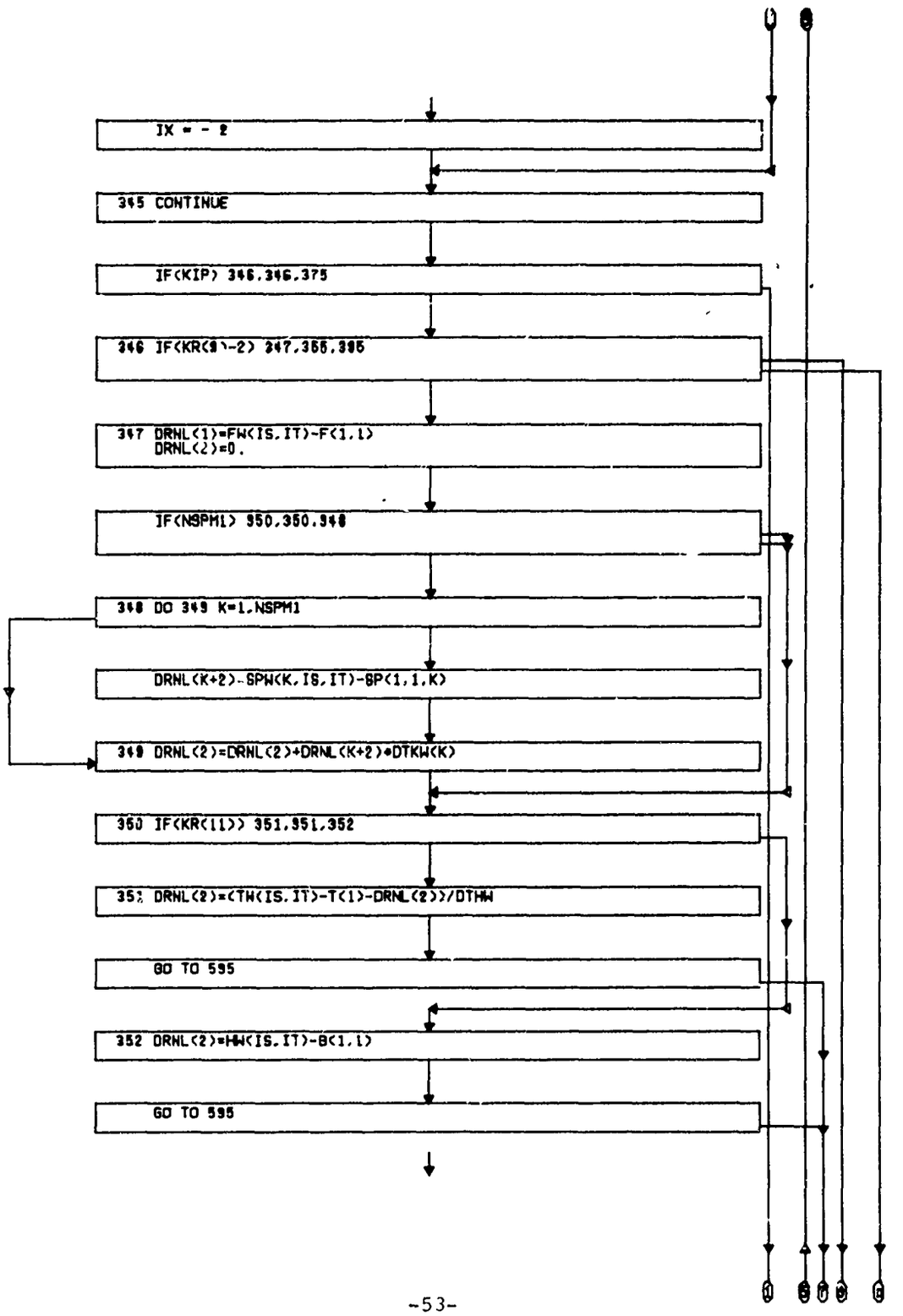
```
000179                AM(2,5) = DQJRNL(2,1) + DUM1 * DTHW + RHOVS                                    B05A3390
000180                DO 470 K=1,NSPM1                                                               B05A3400
000181           470  AM(2,K + 5) = DQJRNL(K + 2,1) + DUM1 * DTKW(K)                                B05A3410
000182                IF (KR(9) - 4) 475,475,485                                                     B05A3420
000183           475  DRNL(1)= VLNKW
000184                DO 472 K=1,NSP
000185                J=-IR(K)
000186                FNU(J)=VNU(ISU,J)
000187                IF (LEF(K) + LEFW(K))  471,471,472                                                    *NEW
000188           471  FNU(J)=0.                                                                            **-1
000189           472  CONTINUE
000190                DO 476 K=1,NSP
000191           476  DRNL(1)=DRNL(1)+YW(K)*FNU(K)
000192                AM(1,4) = 0.                                                                   B05A3440
000193                DUM1 = TCW / T(1)                                                              B05A3450
000194                AM(1,5) = DUM1 * DTHW
000195                DO 477 K=1,NSP
000196           477  AM(1,5)=AM(1,5)-DLPH(K)*FNU(K)
000197                DO 480 K=1,NSPM1                                                               B05A3470
000198                AM(1,K+5) = DUM1*DTKW(K)
000199                DO 480 KK=1,NSP
000200           480  AM(1,K+5)=AM(1,K+5)-DLPK(K,KK)*FNU(K)
000201                GOTO 510                                                                       B05A3490
000202           485  IF (KR(9) - KIP - 5) 495,490,495                                               B05A3500
000203           490  WDOT = C3 * EXP( (ADUM * TW(IS,IT) + BDUM) * TW(IS,IT) + CDUM)                 B05A3510
000204                AM(1,5) = 0.                                                                   B05A3520
000205                KIP=KIP+1
000206                W(3) = WDOT                                                                    B05A3540
000207                W(2) = 0.                                                                      B05A3550
000208                W(1) = 0.                                                                      B05A3560
000209                GOTO 295                                                                       B05A3570
000210           495  WDOT = C3 * EXP( (ADUM * T(1) + BDUM) * T(1) + CDUM)                          B05A3580
000211                AM(1,5) = WDOT * (ADUM * 2. * T(1) + BDUM)                                     B05A3590
000212           500  DRNL(1) = RHOVS - WDOT                                                         B05A3600
000213                DUM1 = ABS(DRNL(1))                                                            B05A3610
000214                AM(1,4) = - C1                                                                 B05A3620
000215                DO 505 K=1,NSPM1                                                               B05A3630
000216           505  AM(1,K + 5) = AM(1,5) * DTKW(K)                                                B05A3640
000217                AM(1,5) = AM(1,5) * DTHW                                                       B05A3650
000218           510  DO 520 K=1,NSPM1                                                               B05A3660
000219                DRNL(K+2)=-WALLJ(K)-RHOVS*(SP(1,1,K)-TQ(K,L3)*WTM(K))+W(2)*WTM(K)*
000220               1 (TQ(K,L2)-TQ(K,L3))
000221                DO 515 KK=1,NRNL                                                               B05A3680
000222           515  AM(K + 2,KK + 3) = DQJRNL(KK,K + 1)                                            B05A3690
000223                AM(K+2,4)=AM(K+2,4)+C1*(SP(1,1,K)-TQ(K,L3)*WTM(K))
000224           520  AM(K + 2,K + 5) = AM(K + 2,K + 5) + RHOVS                                      B05A3710
000225                II = 0                                                                         B05A3720
000226           525  IF(W(3)) 540,530,530
000227           530  DRNL(1)=(WDOT-W(3))/C1
000228                W(3)=WDOT
000229                DO 535 K=2,NRNL                                                                B05A3760
000230           535  DRNL(K) = DRNL(K) - DRNL(1) * AM(K,4)                                          B05A3770
000231                II = 1                                                                         B05A3780
000232           540  IXX = IX                                                                       B05A3790
000233                CALL RERAY(NRNL-II,AM(II+1,II+4),0,DRNL(II+1),1,0,IXX,153)                     B05C3800
000234                IF (KR(9) + KIP - 6) 560,545,560                                               B05A3820
000235           545  DTEMP = DRNL(2) * DTHW                                                         B05A3830
000236                DO 550 K=1,NSPM1                                                               B05A3840
000237           550  DTEMP = DTEMP + DTKW(K) * DRNL(K + 2)                                          B05A3850
000238                ATEMP = ABS(DTEMP)                                                             B05A3860
```

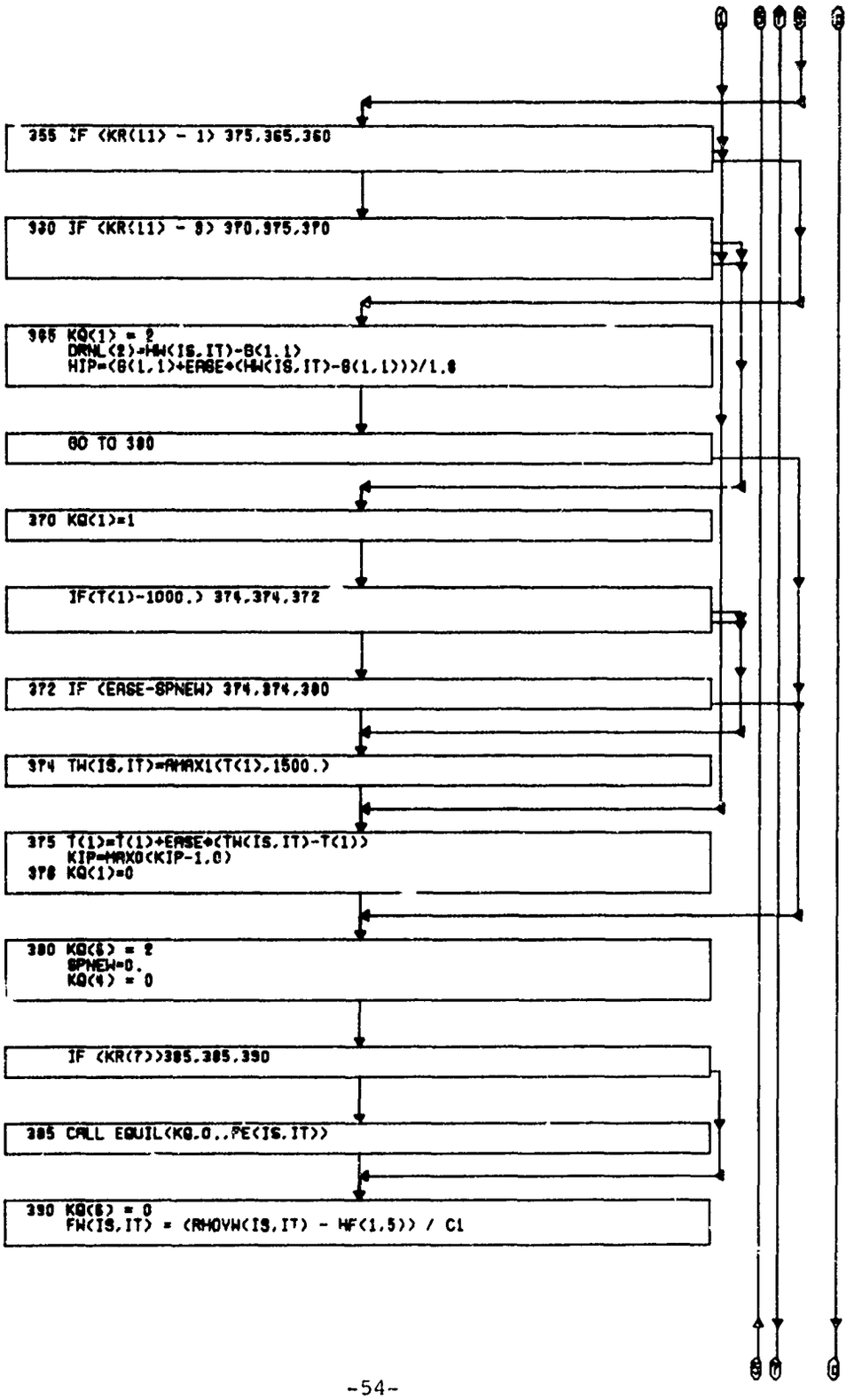
```
000239                IF (ATEMP - 50.) 555,560,415                    B05A3870
000240          555 TFZ = - T(1)                                      B05A3880
000241          560 CONTINUE                                          B05A3890
000242              WOOT=W(3)
000243          595 RETURN
000244              END                                               B05A5360
```

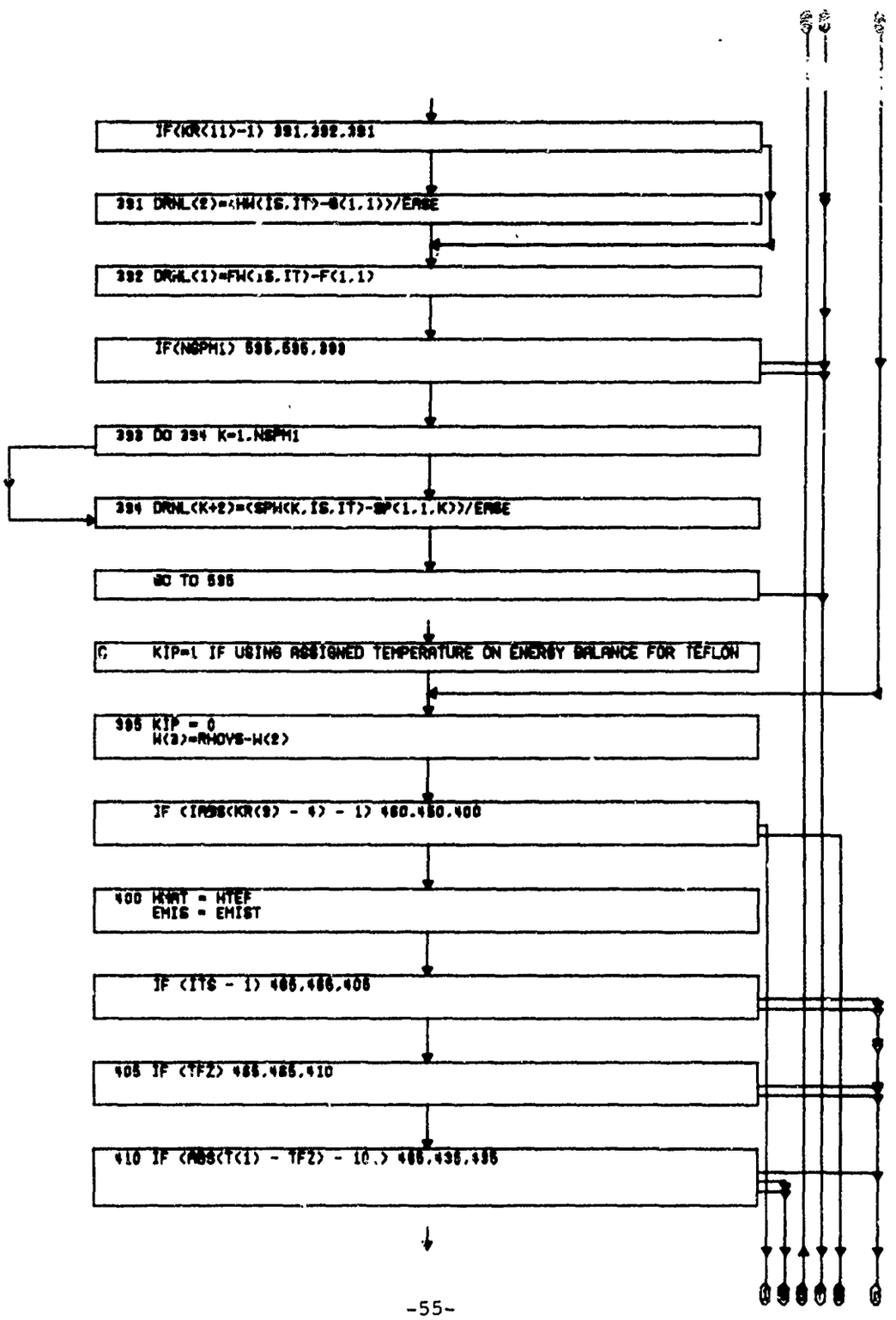
c. Flow Chart

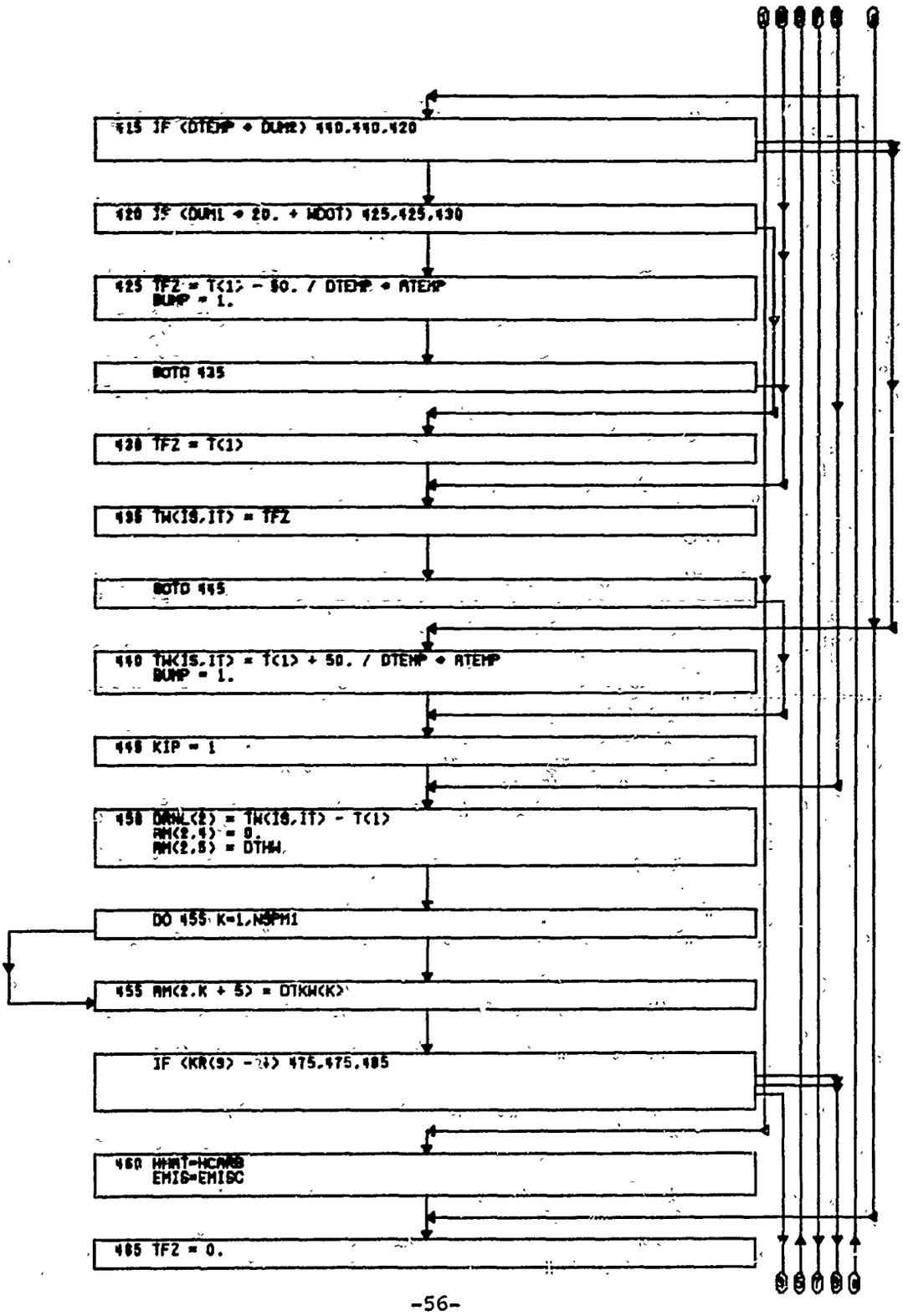

C 005C
SUBROUTINE RHLCER
C EVALUATES REDUCED SET OF DQHL AND DJHL. NOTE...DQHL FOLLOWED BY
C DJHL IS EQUIVALENCED TO DQJNL FOR CONVENIENCE OF FOLLOWING LOOP.
C ALSO, THE REDUCED SET DQJRNL IS EQUIV. TO RH(1) FOR STORAGE ECON.
DO 275 I=1,NRNL
M = I + NRH
L = LAR(M)
DO 275 K=1,NSP
DQJRNL(I,K) = DQJHL(L,K)
DO 275 J=1,NRH
JJ = LAR(J)
IF (I - 1) 275,270,275
270 DELQJH(K) = DELQJH(K) + DQJNL(JJ,K) * EHL(J)
275 DQJRNL(I,K) = DQJRNL(I,K) - DQJNL(JJ,K) * RH(J,M)
RHOVB = C1 * F(1,1) + HF(1,5)
IF(KR(9)-2) 315,285,277
277 DO 278 K=1,NSP
278 WALLQJ(K)=WALLQJ(K)+DELQJH(K)

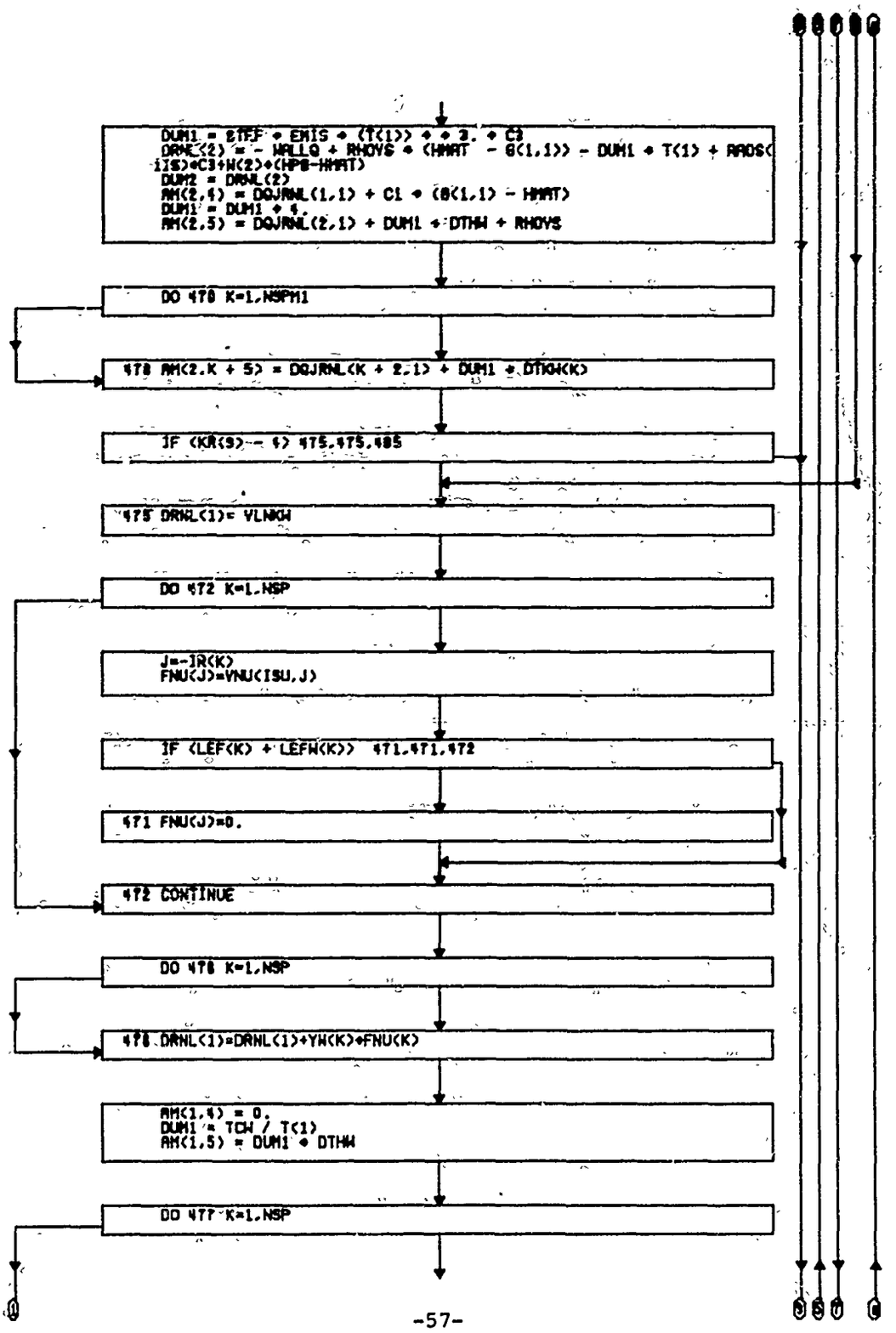

GO TO 315
285 DO 290 L=1,3
290 W(L) = FLUXJ(L,IS,IT)
C PREPARE DQJRNL AND WALLQJ FOR SURFACE MASS BALANCE
295 WSUM = W(1) + W(2) + W(3)
DO 310 K=2,NSP
WALLJ(K - 1) = WALLJ(K - 1) + DELQJW(K)
DQJRNL(1,K) = DQJRNL(1,K) / C1
WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(1,K) * RHOVS - DQJRNL(2,K) *
1B(1,1)
DO 310 KK=3,NRNL
310 WALLJ(K - 1) = WALLJ(K - 1) - DQJRNL(KK,K) * BP(1,1,KK - 2)
315 IF (KR(16) - 1) 345,340,320
320 IF (KR(17)) 340,340,335
325 FORMAT(52H DEBUG DQJRNL(NRNL,NSP) BY ROWS. DELQW(5),WALLQJ(5)/
1 (8X1P10E10.3))
330 FORMAT(35H DEBUG DQJNL(NNLEQ,NSP) ROW BY ROW /(8X1P10E10.3))
335 WRITE(KOUT,330)((DQJNL(I,K),K=1,NSP),I=1,NNLEQ)
340 WRITE(KOUT,325)((DQJRNL(I,K),K=1,NSP),I=1,NRNL),DELQW,DELJW,WALLQ,
1WALLJ

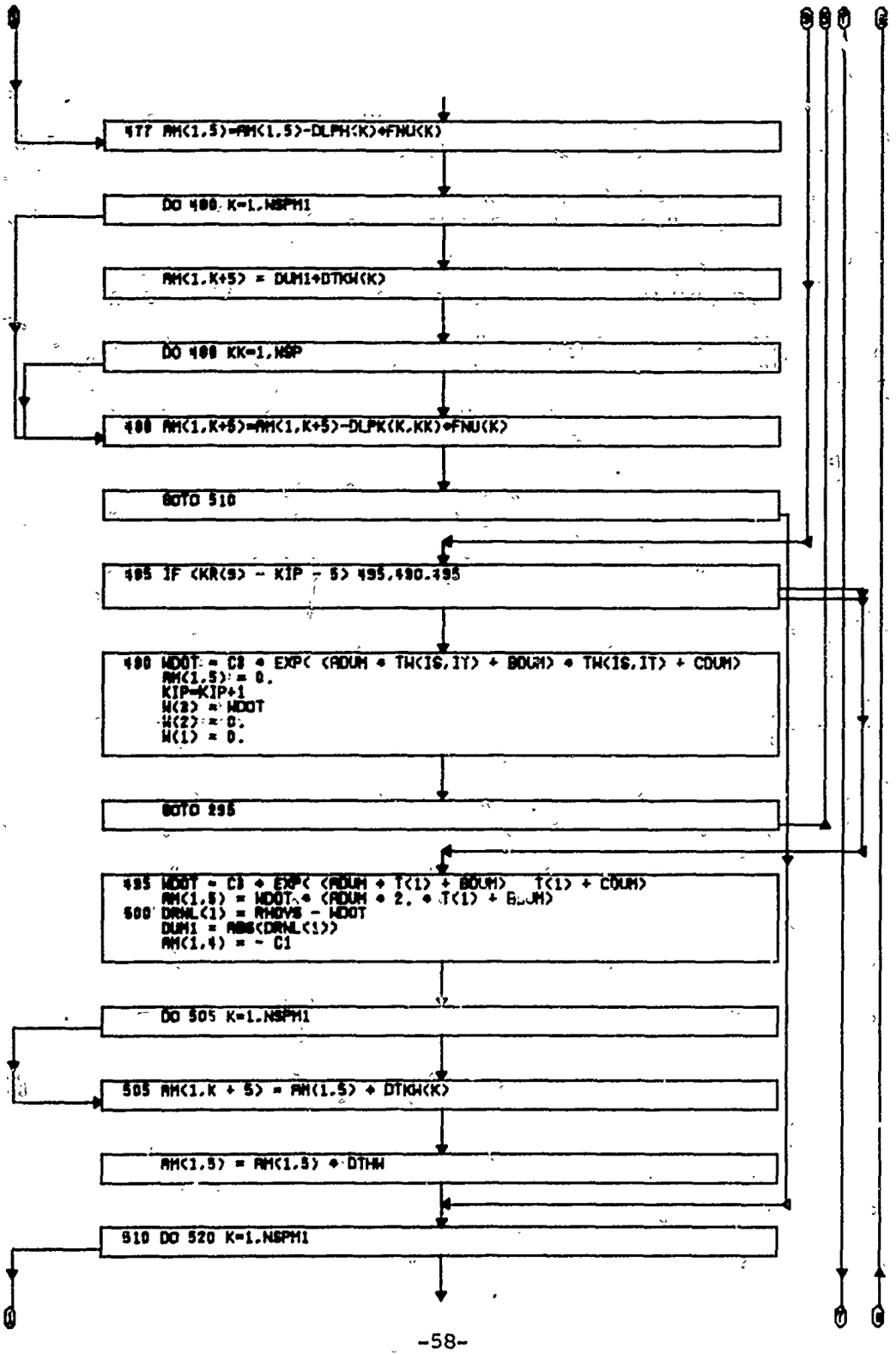

IX = - 2
345 CONTINUE
IF(KIP) 346,346,375
346 IF(KR(9)-2) 347,355,355
347 DRNL(1)=FW(IS,IT)-F(1,1)
DRNL(2)=0.
IF(NSPM1) 350,350,348
348 DO 349 K=1,NSPM1
DRNL(K+2)=SPW(K,IS,IT)-SP(1,1,K)
349 DRNL(2)=DRNL(2)+DRNL(K+2)*DTKW(K)
350 IF(KR(11)) 351,351,352
351 DRNL(2)=(TW(IS,IT)-T(1)-DRNL(2))/DTHW
GO TO 595
352 DRNL(2)=HW(IS,IT)-B(1,1)
GO TO 595

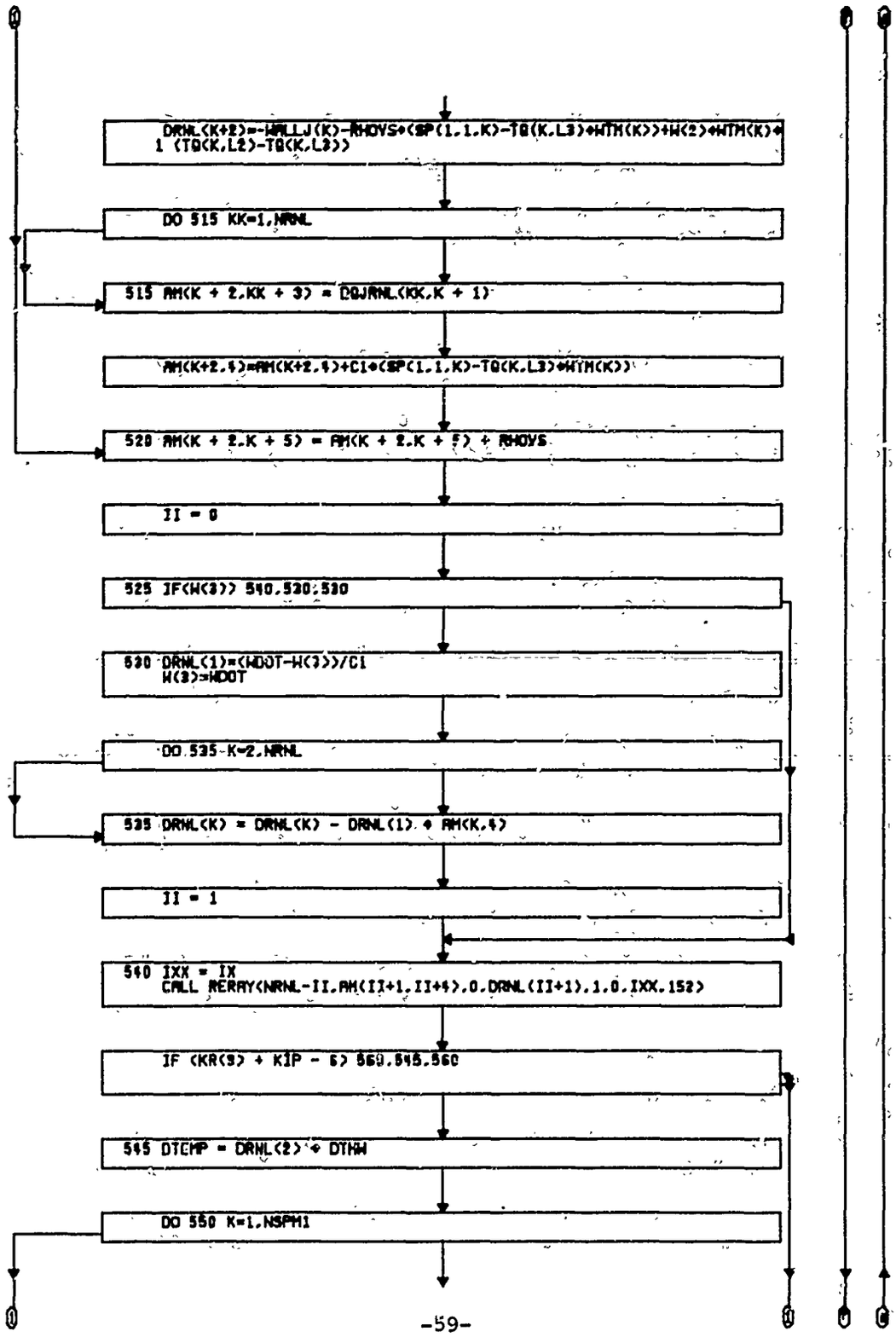

355 IF (KR(11) - 1) 375,365,360
360 IF (KR(11) - 8) 370,375,370
365 KQ(1) = 2
DRNL(2)=HW(IS,IT)-B(1,1)
HIP=(B(1,1)+EASE*(HW(IS,IT)-B(1,1)))/1.8
GO TO 380
370 KQ(1)=1
IF(T(1)-1000.) 374,374,372
372 IF (EASE-SPNEW) 374,374,380
374 TW(IS,IT)=AMAX1(T(1),1500.)
375 T(1)=T(1)+EASE*(TW(IS,IT)-T(1))
KIP=MAXO(KIP-1,0)
378 KQ(1)=0
380 KQ(6) = 2
SPNEW=0.
KQ(4) = 0
IF (KR(7))385,385,390
385 CALL EQUIL(KQ,0,,PE(IS,IT))
390 KQ(6) = 0
FW(IS,IT) = (RHOVW(IS,IT) - HF(1,5)) / C1

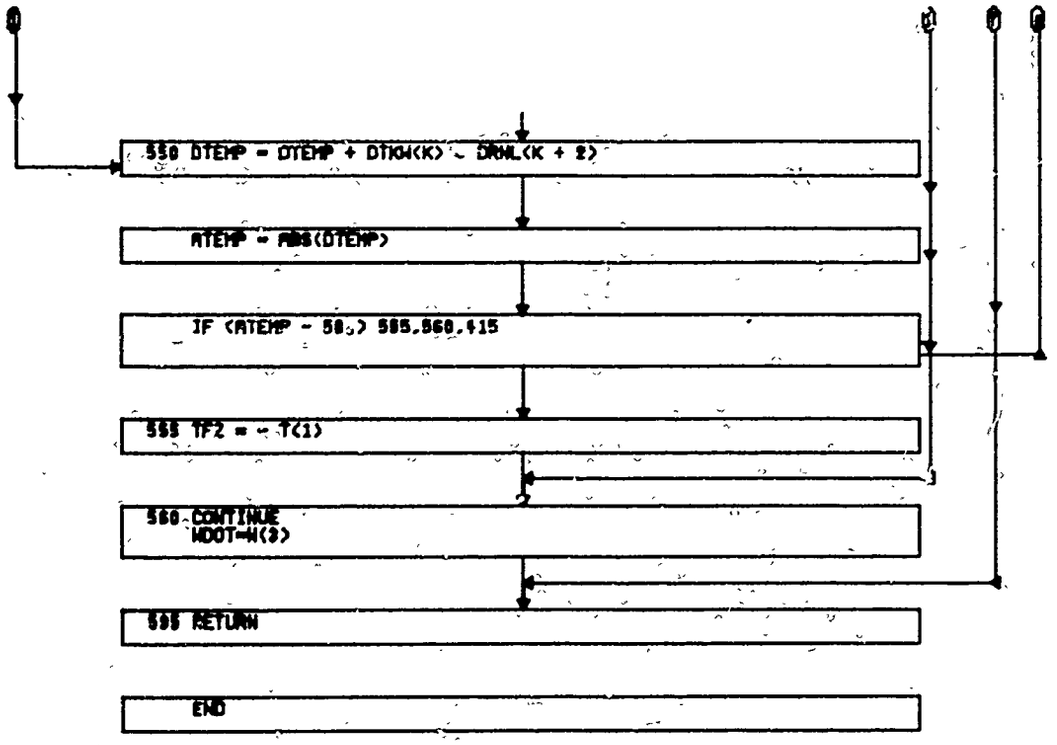

IF(KR(11)-1) 391,392,391
391 DRNL(2)=(HW(IS,IT)-W(1,1))/ERSE
392 DRNL(1)=FW(IS,IT)-F(1,1)
IF(NSPH1) 595,595,393
393 DO 394 K=1,NSPH1
394 DRNL(K+2)=(SPW(K,IS,IT)-SP(1,1,K))/ERSE
GO TO 595
C KIP=1 IF USING ASSIGNED TEMPERATURE ON ENERGY BALANCE FOR TEFLON
595 KIP = 0
W(2)=RHOVS-W(2)
IF (IABS(KR(9) - 4) - 1) 400,450,400
400 HMAT = HTEF
EMIS = EMIST
IF (ITS - 1) 405,405,405
405 IF (TFZ) 405,405,410
410 IF (ABS(T(1) - TFZ) - 10.) 405,435,435


415 IF (DTEMP + DUM2) 440,440,420
420 IF (DUM1 + 20. + MDOT) 425,425,430
425 TF2 = T(1) - 50. / DTEMP + ATEMP
BUMP = 1.
GOTO 435
430 TF2 = T(1)
435 TW(18,IT) = TF2
GOTO 445
440 TW(18,IT) = T(1) + 50. / DTEMP + ATEMP
BUMP = 1.
445 KIP = 1
450 DRW(2) = TW(18,IT) - T(1)
AM(2,4) = 0.
AM(2,5) = DTHW
DO 455 K=1,NSPM1
455 AM(2,K + 5) = DTKW(K)
IF (KR(9) -
460 HMAT=HCARB
EMIS=EMISC
465 TF2 = 0.


DUM1 = STEF * EMIS * (T(1))** 3. * C3
DRNL(2) = - WALLQ + RHOVS * (HMAT - G(1,1)) - DUM1 * T(1) + RADS(
1IS)*C3+H(2)*(HPB-HMAT)
DUM2 = DRNL(2)
AM(2,4) = DQJRNL(1,1) + C1 * (G(1,1) - HMAT)
DUM1 = DUM1 * 4.
AM(2,5) = DQJRNL(2,1) + DUM1 * DTHW + RHOVS
DO 478 K=1,NSPM1
478 AM(2,K + 5) = DQJRNL(K + 2,1) + DUM1 * DTKW(K)
IF (KR(9) - 4) 475,475,485
475 DRNL(1)= VLNKW
DO 472 K=1,NSP
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,NSP
476 DRNL(1)=DRNL(1)+YW(K)*FNU(K)
AM(1,4) = 0.
DUM1 = TCW / T(1)
AM(1,5) = DUM1 * DTHW
DO 477 K=1,NSP


477 AM(1,5)=AM(1,5)-DLPH(K)*FNU(K)
DO 480 K=1,NSPM1
AM(1,K+5) = DUM1*DTKW(K)
DO 480 KK=1,NSP
480 AM(1,K+5)=AM(1,K+5)-DLPK(K,KK)*FNU(K)
GOTO 510
495 IF (KR(9) - KIP - 5) 495,490,495
490 WDOT = C8 * EXP((ADUM * T(IS,IT) + BDUM) * T(IS,IT) + CDUM)
AM(1,5) = 0.
KIP=KIP+1
W(3) = WDOT
W(2) = 0.
W(1) = 0.
GOTO 295
495 WDOT = C8 * EXP((ADUM * T(1) + BDUM) * T(1) + CDUM)
AM(1,5) = WDOT-* (ADUM * 2. * T(1) + BDUM)
500 DRNL(1) = RHOVS - WDOT
DUM1 = ABS(DRNL(1))
AM(1,4) = - C1
DO 505 K=1,NSPM1
505 AM(1,K + 5) = AM(1,5) * DTKW(K)
AM(1,5) = AM(1,5) * DTHW
510 DO 520 K=1,NSPM1


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
515 AM(K + 2,KK + 3) = DQJRNL(KK,K + 1)
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) + RHOVS
II = 0
525 IF(W(3)) 540,530,530
530 DRNL(1)=(WDOT-W(3))/C1
W(3)=WDOT
DO 535 K=2,NRNL
535 DRNL(K) = DRNL(K) - DRNL(1) * AM(K,4)
II = 1
540 IXX = IX
CALL RERAY(NRNL-II,AM(II+1,II+4),0.,DRNL(II+1),1.0,IXX,152)
IF (KR(9) + KIP - 6) 560,545,560
545 DTEMP = DRNL(2) * DTHW
DO 550 K=1,NSPM1


550 DTEMP = DTEMP + DTKW(K) - DKNL(K + 2)
ATEMP = ABS(DTEMP)
IF (ATEMP - 50.) 585,560,415
555 TF2 = - T(1)
560 CONTINUE
MDOT=M(3)
595 RETURN
END

6. SUBROUTINE LINCER - B06A

a. Function

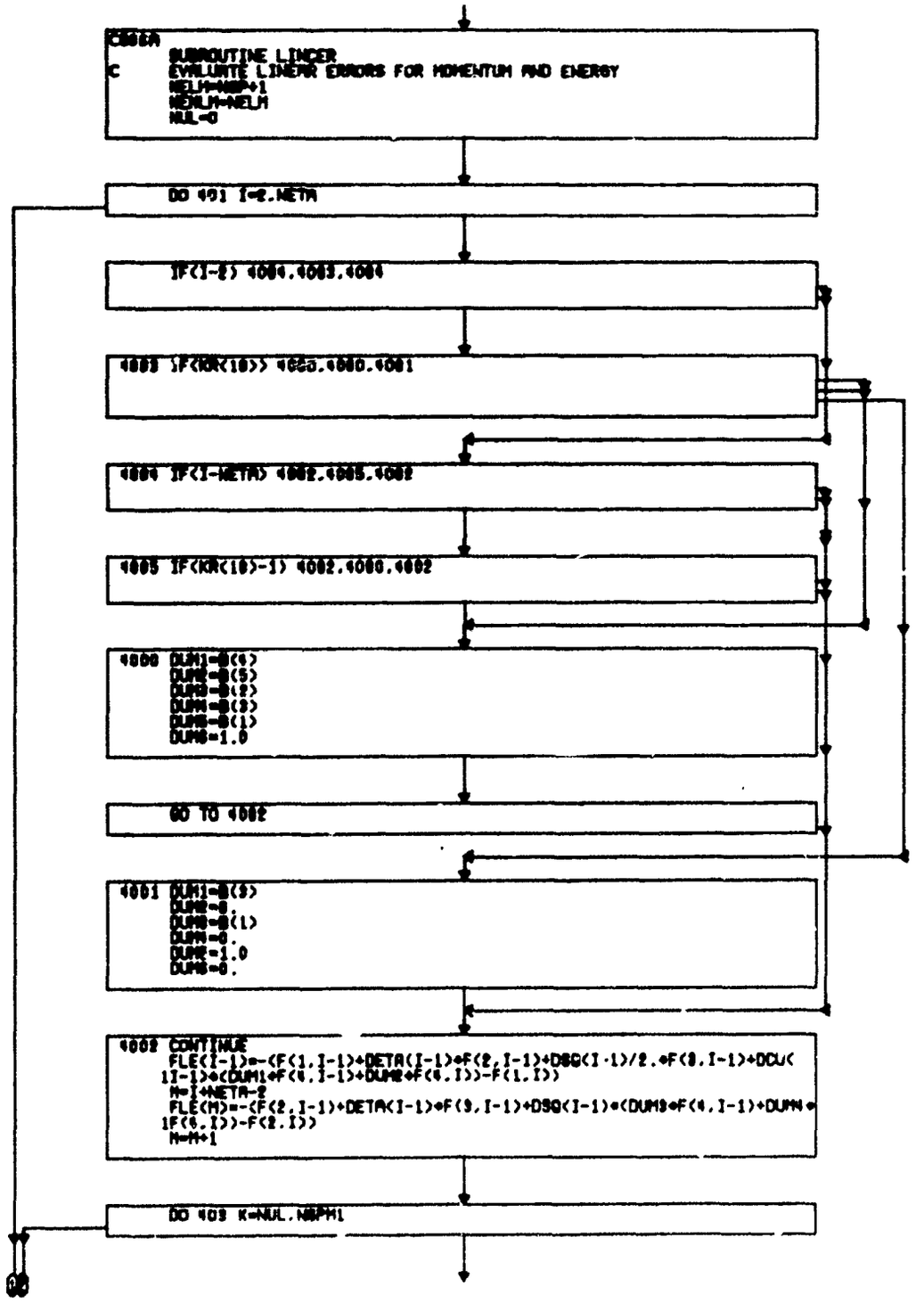
Evaluates errors for linear equations (i.e., Taylor series expansions and linear boundary conditions) and with the aid of its subroutines, determines maximum errors of linear equations and corrects errors for these linear equations for the matrix reduction which is performed on the linear equations (see discussion under subroutine MATS1). Called by ITERAT. Calls ABMAX, MATS1, MATS2.

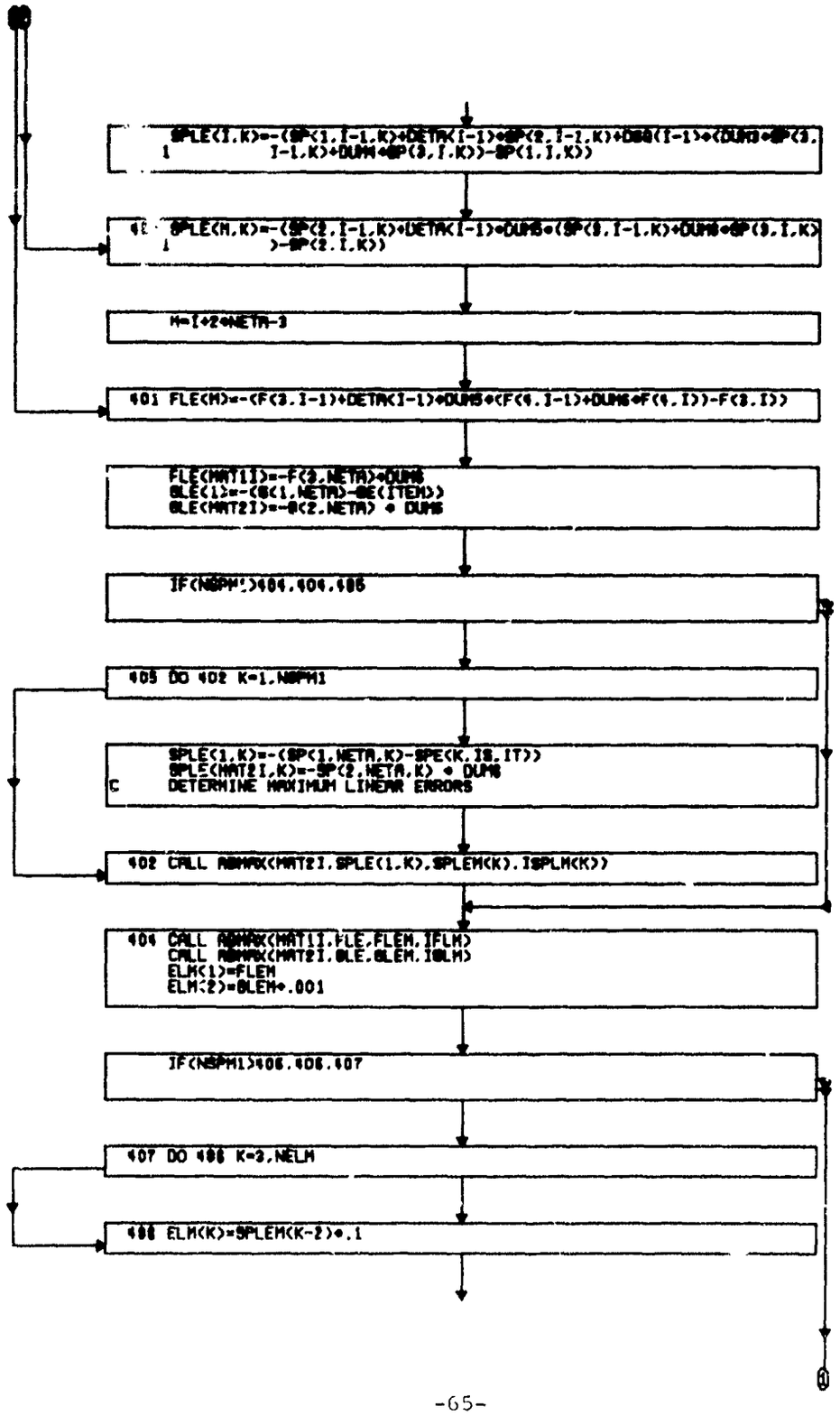
b. Listing

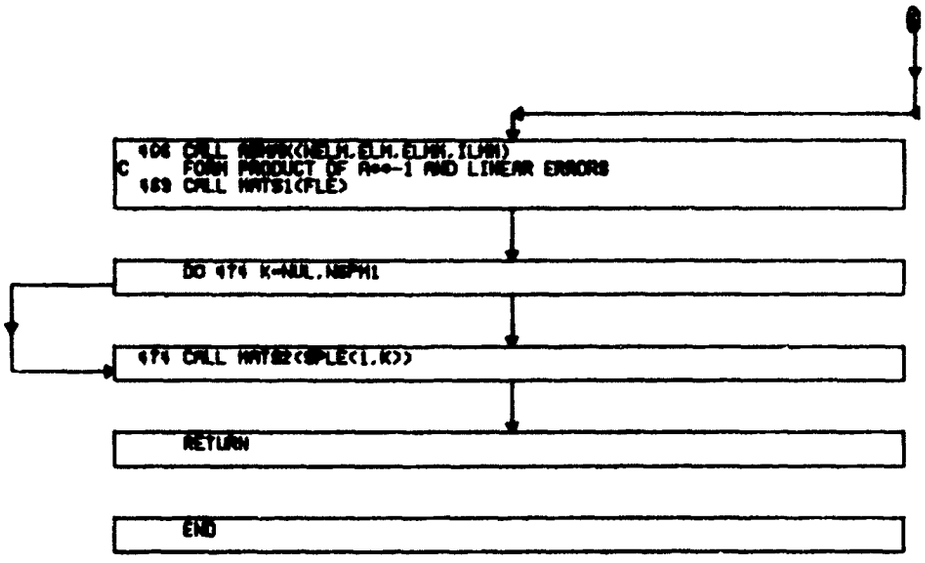
```
000001          CH06A                                                          B06A 001
000002                SUBROUTINE LINCER                                        B06A 002
000003                COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B06A   3*NEW
000004               1R(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,ME,C90   B06A   4*NEW
000005               2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                           B06A   5*NEW
000006                COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM    B06A   6*NEW
000007               1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)   B06A   7*NEW
000008               2,DGL(30),DSPL(30, 8),ENLE(10),GNLE(15),SPNLE(15, 8),ENL(153)    B06A   8*NEW
000009               3,ENLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)   B06A   9*NEW
000010               4, ENLM,INLMM,DFNL(10),DGNL(15),DSPNL(15, 8),DRNL(10)          B06A  10*NEW
000011                COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)   B06A  11*NEW
000012               1,BAR(153),BA1(43,10),BA2(30,10)                          B06A  12*NEW
000013                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB06A  13*NEW
000014               1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CHAR,CASE(15) B06A  14*NEW
000015               2,R(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B06A  15*NEW
000016               3,KAUXO,JTIME,JSPEC,MD(3)                                 B06A  16*NEW
000017                COMMON/PRCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(NJ),ROKAP(40) B06A  17*NEW
000018               1,PROSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITE( 50),IPRE,RADNO,  B06A  18*NEW
000019               2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                   B06A  19*NEW
000020                COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH            B06A  20*NEW
000021          C     EVALUATE LINEAR ERRORS FOR MOMENTUM AND ENERGY            B06A 018*-18
000022                NELM=NSP+1                                                B06A 019
000023                NENL=NELM                                                 B06A 020
000024                NIL=0
000025                DO 401 I=2,NETA
000026                IF(I-2) 4004,4003,4004
000027           4003 IF(KR(10)) 4000,4000,4001
000028           4004 IF(I-NETA) 4002,4005,4002
000029           4005 IF(KR(10)-1) 4002,4000,4002
000030           4000 DUM1=B(4)
000031                DUM2=B(5)
000032                DUM3=B(2)
000033                DUM4=B(3)
000034                DUM5=B(1)
000035                DUM6=1.0
000036                GO TO 4002
000037           4001 DUM1=B(3)
000038                DUM2=0.
000039                DUM3=B(1)
000040                DUM4=0.
000041                DUM5=1.0
000042                DUM6=0.
000043           4002 CONTINUE
000044                FLE(I-1)=-(F(1,I-1)+DETA(I-1)*F(2,I-1)+DSQ(I-1)/2.*F(3,I-1)+DCU(
000045               1I-1)*(DUM1*F(4,I-1)+DUM2*F(4,I))-F(1,I))
000046                M=I+NETA-2
000047                FLE(M)=-(F(2,I-1)+DETA(I-1)*F(3,I-1)+DSQ(I-1)*(DUM3*F(4,I-1)+DUM4*
000048               1F(4,I))-F(2,I))
000049                M=M+1
000050                DO 403 K=NUL,NSPM1
000051                SPLE(I,K)=-(SP(1,I-1,K)+DETA(I-1)*SP(2,I-1,K)+DSQ(I-1)*(DUM3*SP(3,
000052               1          I-1,K)+DUM4*SP(3,I,K))-SP(1,I,K))
000053           403  SPLE(M,K)=-(SP(2,I-1,K)+DETA(I-1)*DUM5*(SP(3,I-1,K)+DUM6*SP(3,I,K)
000054               1          )-SP(2,I,K))
000055                M=I+2*NETA-3
000056           401  FLE(M)=-(F(3,I-1)+DETA(I-1)*DUM5*(F(4,I-1)+DUM6*F(4,I))-F(3,I))
000057                FLE(NAT1)=-F(3,NETA)*DUM6
000058                GLE(1)=-(G(1,NETA)-GE(ITEM))
```

```
000059                 SLE(MAT2I)=-G(2,NETA) * DUM6
00005C                 IF(NSPM1)404,404,405
00005D               4 5 DO 402 K=1,NSP41
00005E                 SPLE(1,K)=-(SPE(1,NETA,K)-SPE(K,IS,IT))                    B06A 044
00005F                 SPLE(MAT2I,K)=-SP(2,NETA,K) * DUM6
000064           C     DETERMINE MAXIMUM LINEAR ERRORS                            B06A 046
000065             402 CALL ABMAX(MAT2I,SPLE(1,K),SPLEM(K),ISPLM(K))              B06A 047
000066             404 CALL ABMAX(MAT1I,FLE,FLEM,IFLM)                            B06A 048
000067                 CALL ABMAX(MAT2I,GLE,GLEM,IGLM)                            B06A 049
00006E                 ELM(1)=FLEM                                                B06A 051
00006F                 ELM(2)=GLEM*.001                                           B06A 052
000070                 IF(NSPM1)406,406,407                                       B06A 053
000071             407 DO 406 K=3,NELM                                            B06A 054
000072             406 ELM(K)=SPLEM(K-2)*.1                                       B06A 055
000073                 CALL ABMAX(NELM,ELM,ELMM,ILMM)                             B06A 056
000074           C     FORM PRODUCT OF A**-1 AND LINEAR ERRORS                    B06A 057
000075             469 CALL MATS1(FLE)                                            B06A 058
000076                 DO 474 K=LL,NSPM1
000077             474 CALL MATS2(SPLE(1,K))                                      B06A 062
00007A                 RETURN                                                     B06A 065
000079                 END                                                        B06A 066
```

c. Flow Chart


C9SEA
SUBROUTINE LINCER
C EVALUATE LINEAR ERRORS FOR MOMENTUM AND ENERGY
NELM=NBP+1
NEXLM=NELM
NUL=0
DO 491 I=2,METR
IF(I-2) 4004,4003,4004
4003 IF(KR(18)) 4005,4000,4001
4004 IF(I-METR) 4002,4005,4002
4005 IF(KR(18)-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(5,I))-F(1,I))
M=I+METR-2
FLE(M)=-(F(2,I-1)+DETA(I-1)*F(3,I-1)+DSQ(I-1)*(DUM3*F(4,I-1)+DUM4*
1F(5,I))-F(2,I))
M=M+1
DO 493 K=NUL,NBPM1
GO


SPLE(I,K)=-(SP(1,I-1,K)+DETAK(I-1)*SP(2,I-1,K)+DUM3*(SP(3,I-1,K)+DUM4*SP(3,I,K))-SP(1,I,K))
SPLE(M,K)=-(SP(2,I-1,K)+DETAK(I-1)*DUM5*(SP(3,I-1,K)+DUM6*SP(3,I,K))-SP(2,I,K))
M=I+2*NETA-3
401 FLE(M)=-(F(3,I-1)+DETAK(I-1)*DUM5*(F(4,I-1)+DUM6*F(4,I))-F(3,I))
FLE(MAT1I)=-F(3,NETA)*DUM6
BLE(1)=-(B(1,NETA)-BE(ITEM))
BLE(MAT2I)=-B(2,NETA) * DUM6
IF(NSPM1)404,404,405
405 DO 402 K=1,NSPM1
SPLE(1,K)=-(SP(1,NETA,K)-SPE(K,IS,IT))
SPLE(MAT2I,K)=-SP(2,NETA,K) * DUM6
C DETERMINE MAXIMUM LINEAR ERRORS
402 CALL ABMAX(MAT2I,SPLE(1,K),SPLEM(K),ISPLM(K))
404 CALL ABMAX(MAT1I,FLE,FLEM,IFLM)
CALL ABMAX(MAT2I,BLE,BLEM,IBLM)
ELM(1)=FLEM
ELM(2)=BLEM*.001
IF(NSPM1)406,406,407
407 DO 406 K=3,NELM
406 ELM(K)=SPLEM(K-2)*.1


406 CALL ABWAX(NELM,ELM,ELMX,ILMX)
C FORM PRODUCT OF A**-1 AND LINEAR ERRORS
469 CALL MATSI(FLE)
DO 474 K=NUL,NSPHI
474 CALL MATBX(SPLE(1,K))
RETURN
END

7. SUBROUTINE REFCON - B07A

a. Function

Calculates boundary layer edge conditions and sets up wall boundary conditions for uncoupled problems. Called by SETUP. Calls INPUT, EQUIL, SLOPQ.

b. Listing

```
000001          CH07A                                                                  B07A 001
000002                SUBROUTINE REFCON                                                B07A 002
000003                COMMON/EDGCOM/          PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B07A   3*NEW
000004               1 (40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,WE,C90   B07A   4*NEW
000005               2 ,USIP(40),IDSIP,TTVC,TVCC(40)                                   B07A   5*NEW
000006                COMMON/MISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, *B07A   6*NEW
000007               1 ),XI(40),HF(15,5),HG(15,5),HSP(15,5, 8),HALPH,HUE,HMUE,HFW,DLX2 B07A   7*NEW
000008               2,F3M(40),METAM(40)                                               B07A   8*NEW
000009                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,*B07A   9*NEW
000010               1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NALEQ,NRNL, ITS,KAPPA,CHAR,CASE(15) B07A  10*NEW
000011               2,F(3),      WE,MON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B07A  11*NEW
000012               3,ZAUX0,JTIME,JSPEC,MD(3)                                         B07A  12*NEW
000013                COMMON/PWRCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B07A  13*NEW
000014               1,PNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B07A  14*NEW
000015               2CONF,RADFL( 50),RADR(40),RADS(40),IRAD                            B07A  15*NEW
000016                COMMON/TESCOM/SPSUM( 8),DFR(40),DUMM1(15),SLOPE(15),REDUM(15)     B07A  16*NEW
000017               1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)     B07A  17*NEW
000018               2,XIINIT( 1),DUDB( 40)                                            B07A  18*NEW
000019                COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                   B07A  19*NEW
000020                COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)        B07A  20*NEW
000021               1,RHOVW(40, 1),FLUXJ( 3,40, 1),IWW,ITW,IFW,ISPW,IRHOVW,IFLUXJ     B07A  21*NEW
000022           7007 FORMAT(8E10.4)                                                   B07A 0240*19
000023           9901 FORMAT(I5,7E10.3)                                                B07A 025
000024            106 FORMAT(I2)                                                       B07A 026
000025             15 FORMAT(1H1)
000026             16 FORMAT (/,1X,23HDISTANCE,FT              ,8E12.5/(24X,8E12.5))  B07A 027
000027             17 FORMAT (/,1X,23HPRESSURE RATIO           ,8E12.5/(24X,8E12.5))  B07A 028
000028             18 FORMAT (/,1X,23HENTROPY DROP,BTU/LB R    ,8E12.5/(24X,8E12.5))  B07A 029
000029             19 FORMAT (/,1X,23HWALL ENTHALPY,BTU/LB     ,8E12.5/(24X,8E12.5))  B07A 030
000030             20 FORMAT (/,1X,23HWALL TEMPERATURE,DEG R   ,8E12.5/(24X,8E12.5))  B07A 031
000031             21 FORMAT (/,1X,23HWALL STREAM FUNCTION     ,8E12.5/(24X,8E12.5))  B07A 032
000032             22 FORMAT (/,1X,23HMASS FLUX,LB/SEC FT**2   ,8E12.5/(24X,8E12.5))  B07A 033
000033             23 FORMAT (/,1X,23HELEMENTAL MASS FRACTION,8E12.5/(24X,8E12.5))    B07A 034
000034             24 FORMAT (/,1X,23HCOMP FLUX,LB/SEC FT**2   ,8E12.5/(24X,8E12.5))  B07A 035
000035             25 FORMAT (/,1X,23HSTATIC PRESSURE,ATM      ,8E12.5/(24X,8E12.5))  B07A 036
000036             26 FORMAT (/,1X,23HXI,(LB/SEC)**2           ,8E12.5/(24X,8E12.5))  B07A 037
000037             27 FORMAT (/,1X,23HBETA                     ,8E12.5/(24X,8E12.5))  B07A 038
000038             28 FORMAT (/,1X,23HROKAP                    ,8E12.5/(24X,8E12.5))  B07A 039
000039             29 FORMAT (/,1X,23HEDGE VELOCITY,FT/SEC     ,8E12.5/(24X,8E12.5))  B07A 040
000040             30 FORMAT (/,1X,23HNORMALIZED MASS FLUX     ,8E12.5/(24X,8E12.5))  B07A 041
000041             31 FORMAT (/,1X,23HNORMALIZED COMP FLUX     ,8E12.5/(24X,8E12.5))  B07A 042
000042             32 FORMAT (/,1X,23HINCIDENT RADIATION FLUX,8E12.5/(24X,8E12.5))
000043             33 FORMAT(/,1X,23H-1/FLUX NORM,PARAMETER ,8E12.5/(24X,8E12.5))     B07A 044
000044           1532 IF (ITEM-1) 1539,1538,1539                                       B07A 051
000045           1538 IDSIP=1                                                          B07A 052
000046                IPRE=1                                                           B07A 053
000047                IRAD=1
000048                DO 1540 I=1,NS                                                   B07A 054
000049           1540 DSIP(I)=0.                                                       B07A 055
000050           1539 IF (KR(5)-5) 1536,1537,1536                                      B07A 056
000051           1537 IF (IDSIP-ITEM) 1536,1535,1536                                   B07A 057
000052           1535 READ (KIN,7007) (DSIP(I),I=1,NS)                                 B07A 058
000053                READ (KIN,106) IDSIP                                             B07A 059
000054           1536 IF (IPRE-ITEM) 1534,1533,1534                                    B07A 060
000055           1533 READ (KIN,7007) (PRE(I),I=1,NS)                                  B07A 061
000056                READ (KIN,106) IPRE                                              B07A 062
000057           1534 IF(PRE(1)) 1541,1542,1541
000058           1542 DO 1543 I=2,NS
```

```
000056                IF(PRE(I)) 1544,1543,1544
000060          1544  L=I                                                          B07A 063
000061                GO TO 1545
000062          1543  CONTINUE
000063          1545  RHOSE=S(L)/SQRT(1.-PRE(L))
000064                DO 1546 I=2,L
000065          1546  PRE(I-1)=1.-S(I-1)/RNOSE*S(I-1)/RNOSE
000066          1541  DO 1531 I=1,NS
000067                PTE(I ,1)=PTET(ITEM)                                         B07A 064
000068          1531  PRE(I ,1)=PTE(I ,1)*PRE(I )                                  B07A 065
000069                IF (IRAD-ITEM)1554,1552,1554
000070          1552  READ (KIN,7007) (RADR(I),I=1,NS)
000071                READ (KIN,105) IRAD
000072          1554  DO 1553 I=1,NS
000073          1553  RADS(I)=RADFL(ITEM)*RADR(I)
000074           105  DO 104 I=1,NS                                               B07A 066
000075           201  IF (IS-1) 207,207,203                                       B07A 068
000076             C  THE FOLLOWING PROCEDURE DOES NOT APPLY FOR NONEQUIL OR ENTROPY LA.B07A 069
000077           207  KQ(1)=2                                                     B07A 070
000078                KQ(5)=2                                                     B07A 071
000079                KQ(6)=0                                                     B07A 072
000080                KQ(4)=0                                                     B07A 073
000081                IF (KR(7))8003,8003,8002                                    B07A
000082          8002  CALL STATE
000083                WRITE(KOUT,992)
000084                WRITE(KOUT,994)
000085           992  FORMAT(1H1,10X20HISENTROPIC EXPANSION /12X15HEDGE CONDITIONS //)
000086           994  FORMAT(5X11HSTREAMWISE     TEMP          CP          STATIC      DENS
000087              1ITY     VISCOSITY     VELOCITY     ENTHALPY     ENTROPY      MACH NO. /
000088              25X45HDIMENSION                        FROZEN      PRESSURE /7X10IH(FEET)
000089              3     (DEG R)      (BTU/        (ATM)      (LB/CU FT)  (LB/SEC FT)  (FT
000090              4/SEC     (BTU/LB)      (BTU/  /30X10HLB DEG R) 62X10HLB DEG R)  /)
000091                GO TO 8004
000092          8003  CALL EQUIL(KQ,GF(ITEM),PTE(1,IT))                          B07A
000093          8004  KQ(1)=3                                                     B07A
000094                KQ(2)=0                                                     B07A 076
000095                KQ(3)=6                                                     B07A 077
000096                KQ(5)=1                                                     B07A 078
000097                IF(KR(6)-2) 210,203,203
000098           203  IF (KR(7))8004,8006,8005                                    B07A
000099          8005  CALL STATE
000100                GO TO 210
000101          8006  CALL EQUIL(KQ,0.,PE(IS,IT))                                B07A
000102           210  IF (NSPM1)205,205,215
000103           215  DO 216 K=1,NSPM1                                            B07A 084
000104           216  SPE(K,IS,IT)=SP(1,NETA,K)                                   B07A 085
000105           205  IF(KR(15)) 9903,9904,9903                                   B07A 086
000106          9903  CONTINUE                                                    B07A 087
000107                WRITE(KOUT,9901)IS,ME,GF(IS),PTE(IS,1),TE(IS),RHOE(IS),VMUE(IS)  B07A 088
000108          9904  CONTINUE                                                    B07A 089
000109           104  CONTINUE                                                    B07A 100
000110             C  END OF EDGE PROPERTY LOOP, START OF BETA AND XI CALCULATION  B07A 101
000111                NEDGE=1,C                                                   B07A 102
000112                DUEDGE=0.                                                   B07A 103
000113                D2UEDG=0.                                                   B07A 104
000114           605  XI(1)=0.                                                    B07A 105
000115                JENDISC+1                                                   B07A 106
000116                DO 111 II=1,J                                               B07A 107
000117                K=NSD(II)                                                   B07A 108
000118                M=MSD(II)                                                   B07A 109
```

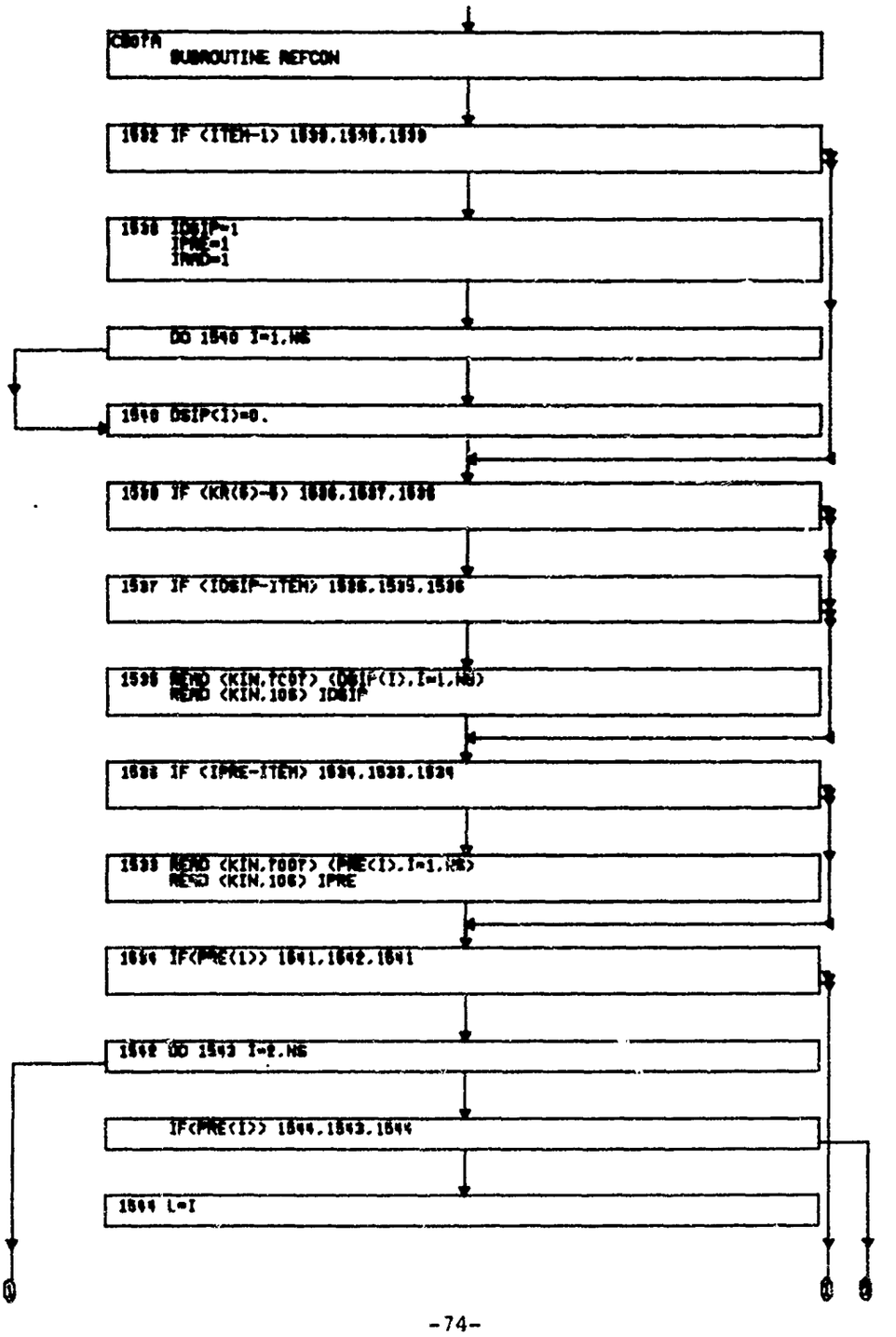
```
000119          MM=M+1
000120          LL=K-M-1                                                    807A 110
000121          IF (II-1) 6052,6052, 402                                    807A 111
000122     4052 IF (KR(6)-1) 400,401,402                                    807A 112
000123     C    AXISYMETRIC BLUNT                                          807A 113
000124       400 DO 403 I=M,LL                                              807A 114
000125          SDUM2(I)=S(I)*S(I)                                          807A 115
000126          IF(S(I)) 403,403,4031                                       807A 116
000127      4031 DUM1=ROKAP(I)/S(I)                                         807A 117
000128          XICON(I)=UE(I)/S(I)*RHOE(I)/4.*VMUE(I)*DUM1*DUM1            807A 118
000129       403 SDUM1(I)=SDUM2(I)*SDUM2(I)                                 807A 119
000130          QI=4.                                                       807A 130
000131          BETAM(1)=0.5                                                807A 121
000132          GO TO 406                                                   807A 122
000133     C    PLANAR BLUNT                                               807A 123
000134       401 DO 404 I=M,LL                                              807A 124
000135          SDUM2(I)=S(I)                                               807A 125
000136          IF(S(I)) 404,404,4041                                       807A 126
000137      4041 XICON(I)=UE(I)/S(I)*RHOE(I)/2.*VMUE(I)                     807A 127
000138       404 SDUM1(I)=S(I)*S(I)                                         807A 128
000139          QI=2.                                                       807A 129
000140          BETAM(1)=1.                                                 807A 130
000141          GO TO 406                                                   807A 131
000142       402 IF (KR(6)-2) 408,407,408                                   807A 132
000143     C    AXISYMETRIC SHARP                                          807A 133
000144       407 DO 409 I=M,LL                                              807A 134
000145          SDUM2(I)=S(I)*S(I)                                          807A 135
000146          DUM1=ROKAP(I)/S(I)                                          807A 136
000147          XICON(I)=RHOE(I)*UE(I)*VMUE(I)*SDUM1/3.*DUM1                807A 137
000148       409 SDUM1(I)=S(I)*SDUM2(I)                                     807A 138
000149          XI(1)      =XICON(1)*S(1)*S(1)*S(1)                         807A 139
000150          QI=3.                                                       807A 140
000151          IF (II-1) 4051,4051,406
000152     C    PLANAR SHARP                                               807A 142
000153       408 DO 405 I=M,LL                                              807A 143
000154          SDUM2(I)=S(I)                                               807A 144
000155          XICON(I)=RHOE(I)*UE(I)*VMUE(I)*JKAP(I)*ROKAP(I)             807A 145
000156       405 SDUM1(I)=S(I)                                              807A 146
000157          QI=1.                                                       807A 147
000158          IF (II-1) 4052,4052,406
000159      4052 XI(1)      =XICON(1)*S(1)                                  807A 149
000160      4051 MM=M
000161       406 CONTINUE                                                   807A 152
000162          CALL SLOPQ(K,S(M),UE(M),RJ,S(M),DER(M))                     807A 153
000163          IF (KR(6)-2) 4066,4062,4062                                 807A 154
000164      4066 IF (M-1) 4061,4061,4062                                    807A 155
000165      4061 IF (RNOSE) 4063,4063,4064                                  807A 156
000166     COMMENT,,,DUES COMPUTED BY SLOPQ                                 807A 157
000167      4063 DUES=DUDS(1)                                               807A 158
000168          GO TO 4065                                                  807A 159
000169     COMMENT,,,DUES FROM EFFECTIVE NOSE RADIUS USING NEWTONIAN FLOW   807A 160
000170      4064 DUES=SQRT(2./RHOE(1)*PE(1,IT)*32.1740*2116.)/RNOSE         807A 161
000171      4065 XICON( 1)=RHOE( 1)*VMUE( 1)/(2.*VKAP+2.)*DUES              807A 162
000172      4062 CALL SLOPQ(K,SDUM1(M) XICON(M),DER(M),XI(M))               807A 163
000173          IF (LL-MM) 111,4101,4101                                    807A 165
000174      4101 DO 410 L=MM,LL                                             807A 166
000175       410 BETAM(L)=2./QI*XI(L)/UE(L)*S(L)/SDUM1(L)*DUDS(L)/XICON(L)  807A 167
000176       111 CONTINUE                                                   807A 168
000177      9803 FORMAT(8E10.4)                                             807A 172
000178          WRITE(KOUT,15)
```

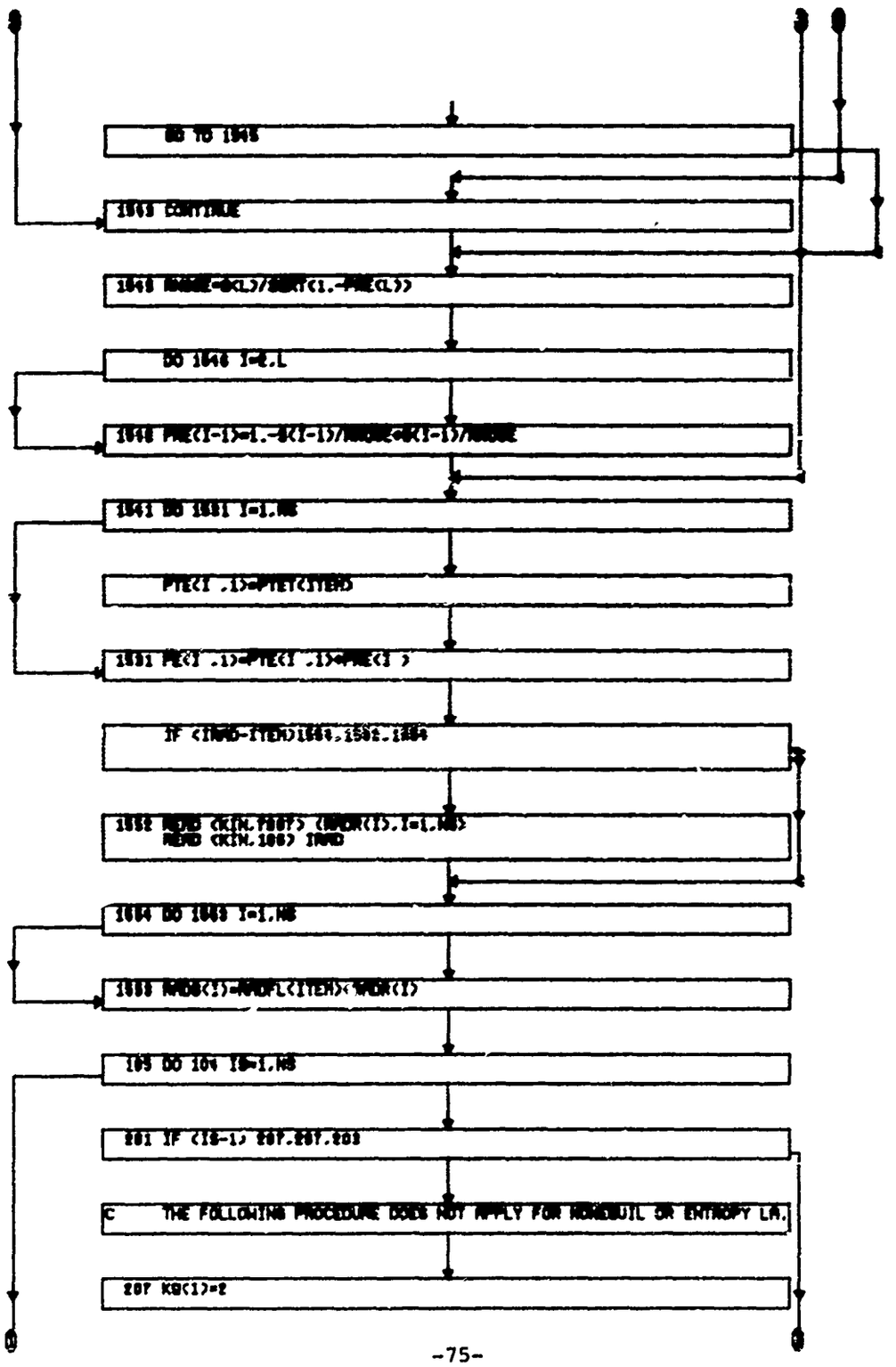
```
      WRITE(KOUT,16)(    S(I),I=1,NS)
      WRITE(KOUT,28)(ROKAP(I),I=1,NS)
      WRITE(KOUT,26)(   XI(I),I=1,NS)
      WRITE(KOUT,17)(  PRE(I),I=1,NS)
      WRITE(KOUT,25)( PE(I,1),I=1,NS)
      WRITE(KOUT,29)(   UE(I),I=1,NS)
      WRITE(KOUT,27)(BETAM(I),I=1,NS)
      WRITE(KOUT,32)( RADS(I),I=1,NS)
      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) 137,137,156                                          B07A 175
  137 IF (I-1) 139,139,150                                              B07A 176
  139 C3M(I)=-SQRT (BETAM(I)/(DUES*RHOE( I)*VMUE( I)))                  B07A 177
      GO TO 138                                                         B07A 178
  150 C3M(I)=-SQRT(2.*XI( I))/(RHO( 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) 106,106,7004
  106 IHW=1                                                             B07A 191
      ITW=1                                                             B07A 192
      IEW=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
 7042 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) 7060,7041,7040                                        B07A 210
 7060 IF (IEW-ITEM) 1093,112,1093                                       B07A 211
 1093 IF(   IEW-1) 1203,7041,1203
  112 READ(KIN,7007)((EW(J,JJ),JJ=1,NTIME),J=1,NS)                      B07A 212
      READ (KIN,106) IEW                                                B07A 213
 1203 WRITE (KOUT,21)(EW(I,1),I=1,NS)
      GO TO 7004                                                        B07A 215
 7041 IF (IRHOVW-ITEM) 1094,118,1094                                    B07A 216
 1094 IF(IRHOVW-1) 1204,7004,1204
  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
```

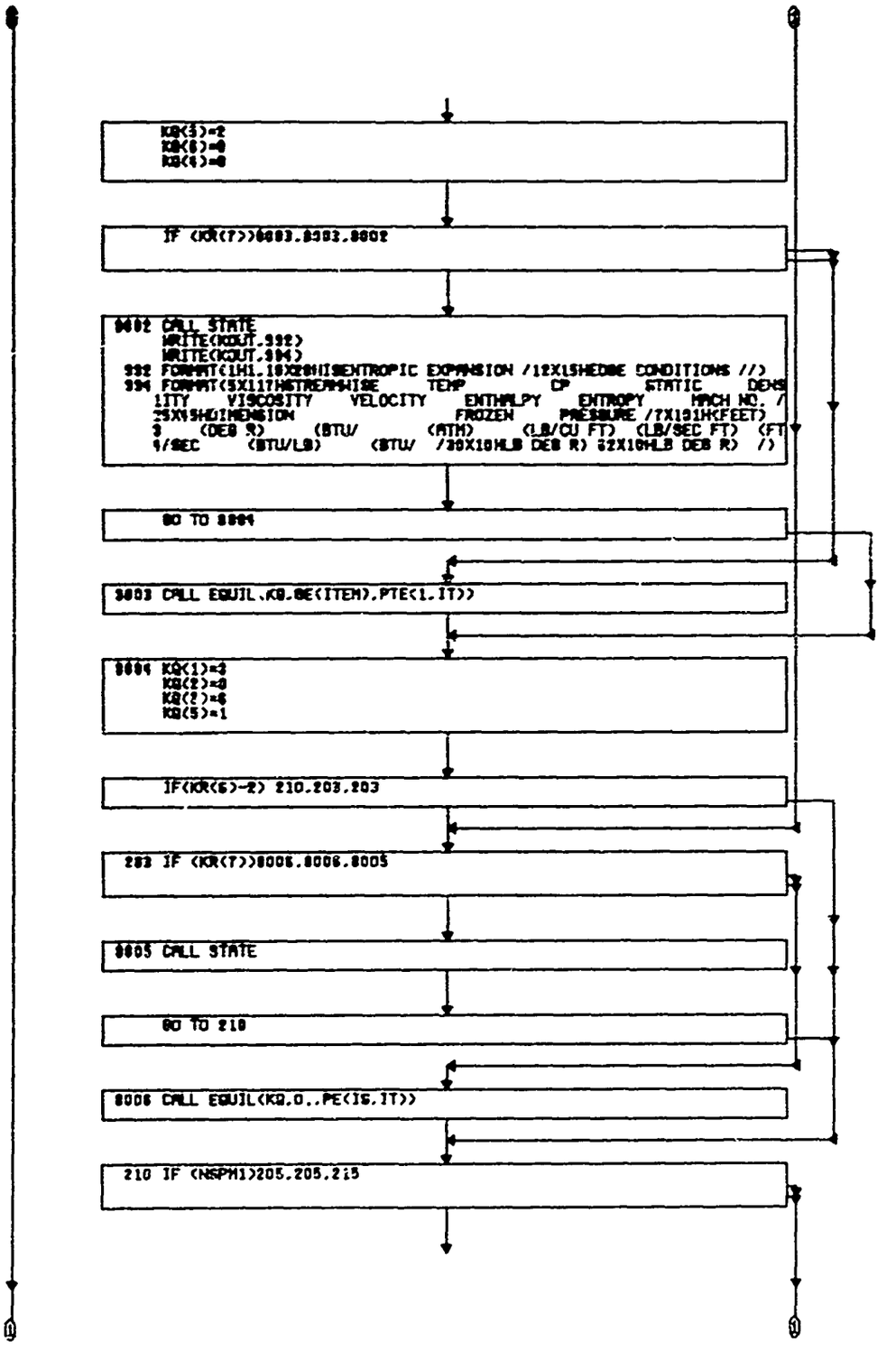
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000239          1102 WRITE (KOUT,22)(RHOVW(I,1),I=1,NS)                          B07A 220
000240               GO TO 7006                                                  B07A 221
000241          1101 WRITE (KOUT,30)(RHOVW(I,1),I=1,NS)                          B07A 222
000242          7006 IF(NSPM1) 7043,7043,7015                                    B07A 223
000243          7015 IF (ISPW-ITEM) 1095,114,1095                                B07A 224
000244          1095 IF(  ISPW-1) 1205,7040,1205
000245           114 DO 7014 K=1,NSPM1                                           B07A 225
000246          7014 READ(KIN,7007)((SPW(K,J,JJ),JJ=1,NTIME),J=1,NS)             B07A 226
000247               READ (KIN,106) ISPW                                         B07A 227
000248          1205 DO 1097 K=1,NSPM1
000249          1097 WRITE (KOUT,23)( SPW(K,I,1),I=1,NS)                         B07A 229
000250               GO TO 7043                                                  B07A 230
000251          7040 IF (IFLUXJ-ITEM)1096,115,1096                               B07A 231
000252          1096 IF(IFLUXJ-1) 1206,7043,1206
000253           115 DO 7041 K=1,3                                               B07A 232
000254          7041 READ(KIN,7007) ((FLUXJ(K,J,JJ),JJ=1,NTIME),J=1,NS)          B07A 233
000255               READ (KIN,106) IFLUXJ                                       B07A 234
000256               JRHOVW=1
000257          1206 DO 1098 K=1,3
000258               IF(KR(8)-JRHOVW) 1104,1103,1103
000259          1104 WRITE (KOUT,24)(FLUXJ(K,I,1),I=1,NS)                        B07A 237
000260               DO 7039 J=1,NS
000261          7039 FLUXJ(K,J,1)=FLUXJ(K,J,1) * C3M(J)
000262               GO TO 1098                                                  B07A 238
000263          1103 WRITE (KOUT,31)(FLUXJ(K,I,1),I=1,NS)                        B07A 239
000264          1098 CONTINUE                                                    B07A 240
000265               GO TO 7047
000266          7043 IF(JRHOVW) 7047,7047,7045
000267             C     CALCULATE FW IF RHOVW GIVEN                             B07A 253
000268          7045 J=NDISC+1                                                   B07A 254
000269               DO 7046 II=1,J                                              B07A 255
000270               K=NSD(II)                                                   B07A 256
000271               M=MSD(II)                                                   B07A 257
000272               LL=K+M-1                                                    B07A 258
000273               DO 209 I=M,LL                                               B07A 259
000274               IF (KR(8)) 7049,7049,2291                                   B07A 260
000275          7049 RHOVW(I,IT)=RHOVW(I,IT)*C3M(I)                              B07A 261
000276          2291 IF (II-1) 7048,7048, 230                                    B07A 262
000277          7048 IF (KR(6)) 229,229,230                                      B07A 263
000278             C     VALID AT AXISYMETRIC STAGNATION POINT ONLY               B07A 264
000279           229 FWCON(I)=-RHOVW(I,IT)/(2.*C3M(I))                          B07A 265
000280               IF( I-1) 209,209,232                                        B07A 266
000281             C     MODIFICATION FOR AXISYMETRIC BLUNT AWAY FROM STAGNATION POINT  B07A 267
000282           232 FWCON( I)=FWCON( I)/S( I)*ROKAP( I)                        B07A 268
000283               GO TO 209                                                   B07A 269
000284             C     VALID FOR ALL PLANAR                                    B07A 270
000285           230 FWCON(I)=-RHOVW(I,IT)/C3M(I)                               B07A 271
000286               IF(KR(6)-2) 209,236,209                                     B07A 272
000287             C     MODIFICATION FOR AXISYMETRIC SHARP                      B07A 273
000288           236 FWCON( I)=FWCON( I)/S( I)*ROKAP( I)/2.                     B07A 274
000289           209 FLUXJ(2,I,1)=RHOVW(I,1)
000290               FWDUM(1)=FWCON(1)*S(1)                                      B07A 276
000291               IF(KR(6)-2) 241,237,241                                     B07A 277
000292             C     MODIFICATION FOR AXISYMETRIC SHARP                      B07A 278
000293           237 FWDUM(1)=FWDUM(1)*S(1)                                     B07A 279
000294           241 CONTINUE                                                    B07A 280
000295          7046 CALL SLOPQ(K,SDUM2(M),FWCON(M),DER(M),FWDUM(M))             B07A 281
000296               DO 126 I =1,NS                                              B07A 282
000297               IF(I -1) 124,124,123                                        B07A 283
000298           124 IF (KR(6)-1) 133,133,123                                    B07A 284
```

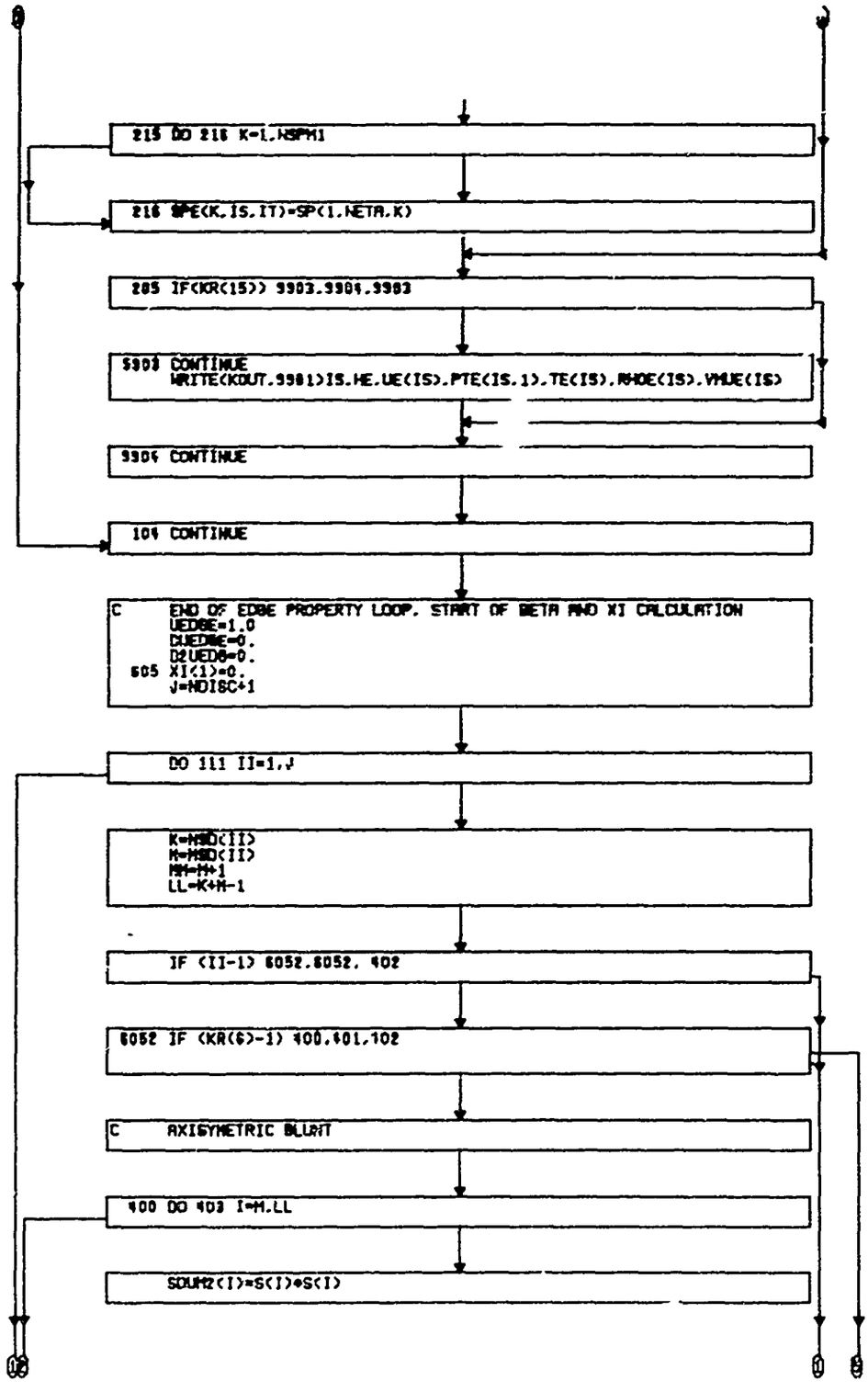
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000299          133 IF (S(I)) 113,113,123                                   B07A 285
000300          113 FV(1,IT)=RHOVW(1,IT)                                    B07A 286
000301              GO TO 126                                               B07A 287
000302          123 FV(I ,IT)=FWDUM(I )/SQRT (2.*XI(I ))                    B07A 288
000303          126 CONTINUE                                                B07A 289
000304         7047 RETURN                                                  B07A 290
000305              END                                                     B07A 291
```

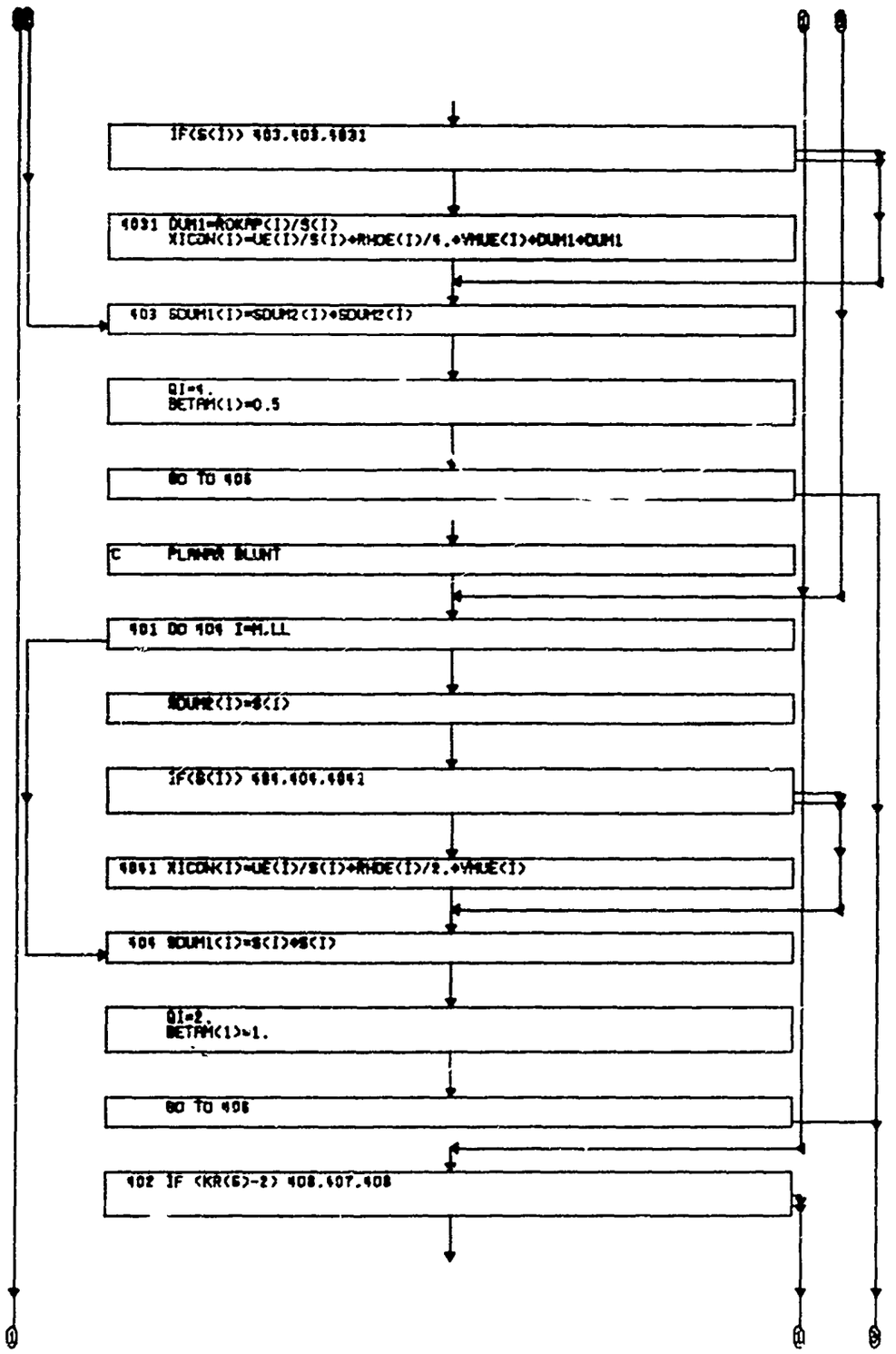
c. Flow Chart

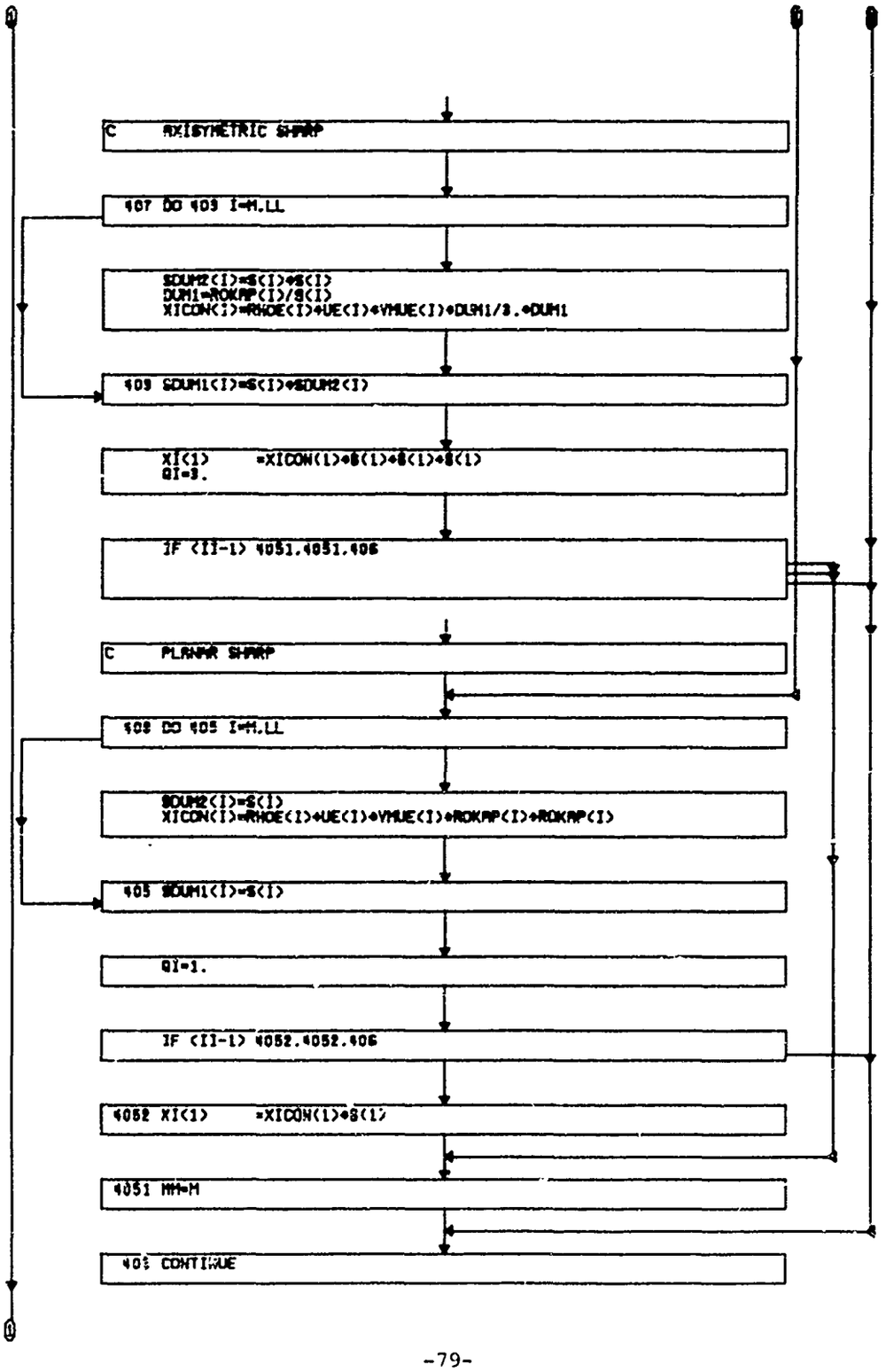

C80FA
SUBROUTINE REFCON
1532 IF (ITEM-1) 1538,1536,1539
1536 IOGIP=1
IPRE=1
INRD=1
DO 1540 I=1,NG
1540 OGIP(I)=0.
1538 IF (KR(6)-6) 1586,1587,1586
1587 IF (IOGIP-ITEM) 1586,1535,1586
1535 READ (KIN,FOOF) (OGIP(I),I=1,NG)
READ (KIN,106) IOGIP
1586 IF (IPRE-ITEM) 1534,1533,1534
1533 READ (KIN,FOOF) (PRE(I),I=1,NG)
READ (KIN,106) IPRE
1534 IF(PRE(1)) 1541,1542,1541
1542 DO 1543 I=2,NG
IF(PRE(I)) 1544,1543,1544
1544 L=I

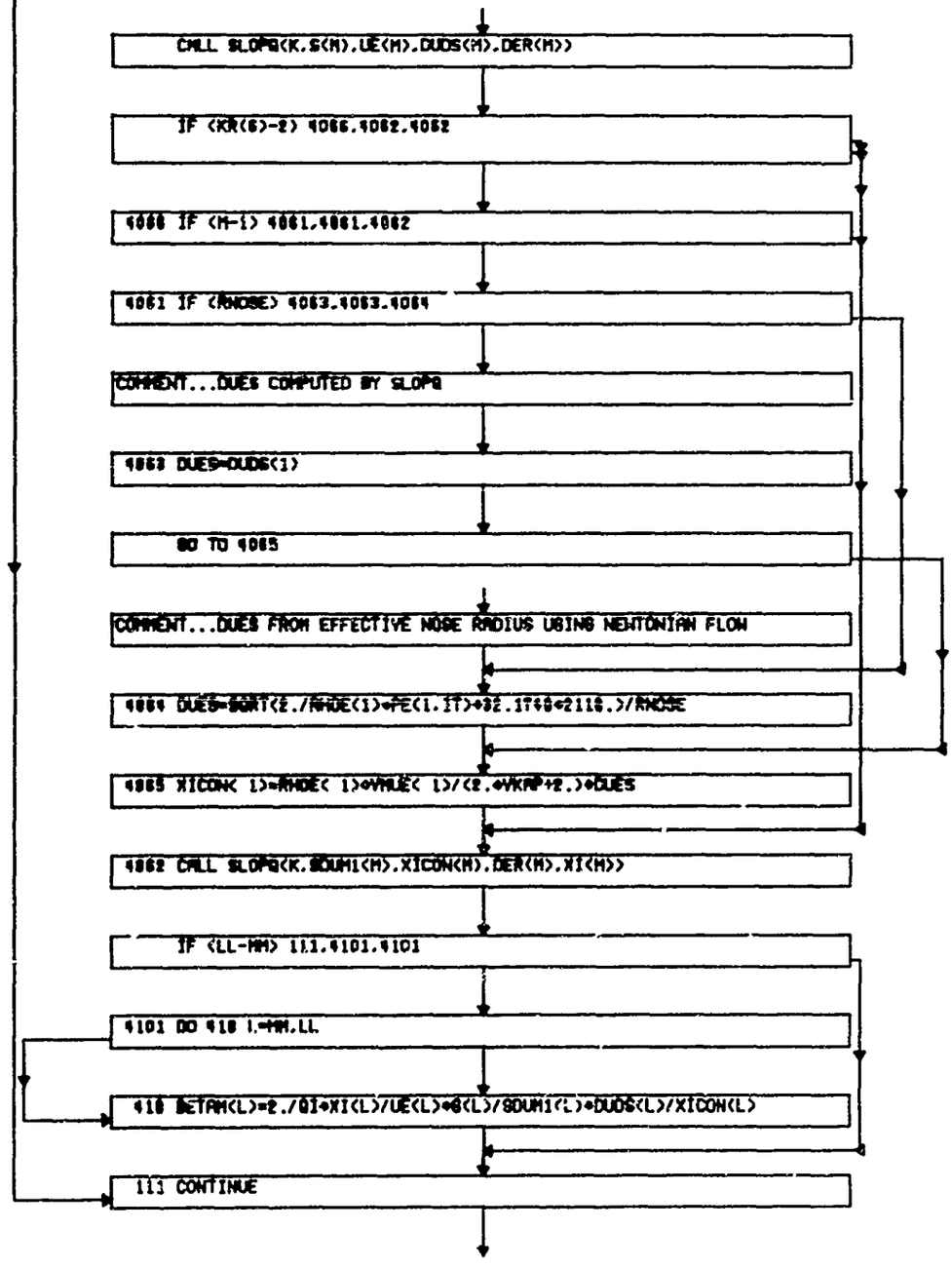

GO TO 1045
1043 CONTINUE
1048 PRE(I-1)=1.-R(I-1)/RNORM<R(I-1)/RNORM
DO 1048 I=2,L
1041 DO 1051 I=1,NB
PTE(I ,1)=PTET(ITEM)
1051 PTE(I ,1)=PTE(I ,1)+PRE(I)
IF (IRND-ITEM)1054,1052,1054
1052 READ (KIN,FORM) (RNORM(I),I=1,NB)
READ (KIN,100) IRND
1054 DO 1043 I=1,NB
1053 RNORM(I)=RNORMFL(ITEM)*RNORM(I)
105 DO 104 IB=1,NB
201 IF (IB-1) 207,207,203
C THE FOLLOWING PROCEDURE DOES NOT APPLY FOR NORMBUIL OR ENTROPY LA.
207 KB(1)=2

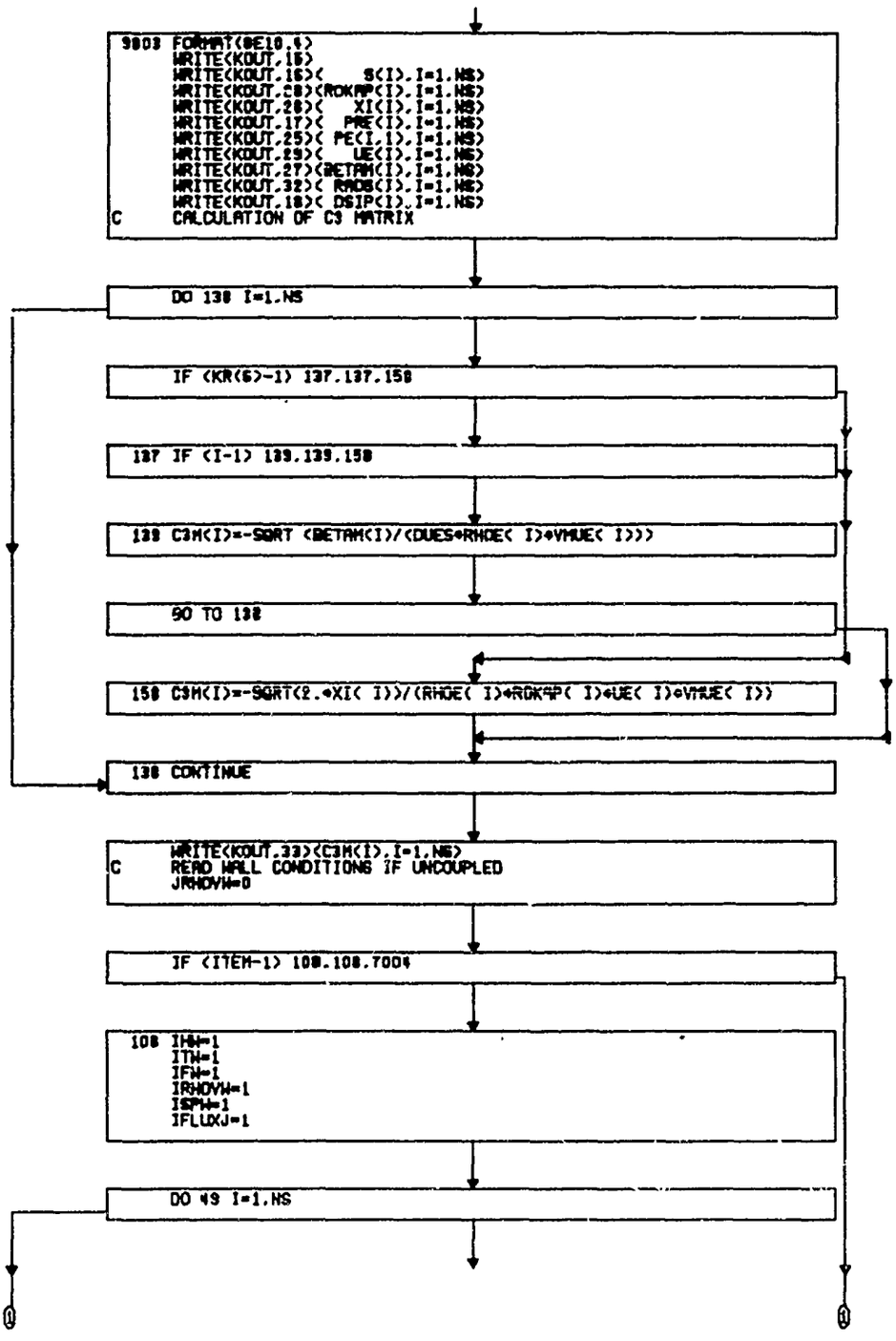

KQK(3)=2
KQK(8)=0
KQK(4)=0
IF (KQK(7))8003,8003,8002
8002 CALL STATE
WRITE(KOUT,992)
WRITE(KOUT,994)
992 FORMAT(1H1,18X20HISENTROPIC EXPANSION /12X15HEDGE CONDITIONS //)
994 FORMAT(5X11HSTREAMWISE TEMP CP STATIC DENS
1ITY VISCOSITY VELOCITY ENTHALPY ENTROPY MACH NO. /
25X19HDIMENSION FROZEN PRESSURE /7X19IH(FEET)
3 (DEG R) (BTU/ (ATM) (LB/CU FT) (LB/SEC FT) (FT
4/SEC (BTU/LB) (BTU/ /39X10HLB DEG R) 32X10HLB DEG R) /)
GO TO 8004
8003 CALL EQUIL,KQ.GE(ITEM),PTE(1,IT))
8004 KQK(1)=3
KQK(2)=0
KQK(7)=6
KQK(5)=1
IF(KQK(6)-2) 210,203,203
203 IF (KQK(7))8006,8006,8005
8005 CALL STATE
GO TO 210
8006 CALL EQUIL(KQ,O,,PE(IG,IT))
210 IF (NSPH1)205,205,215

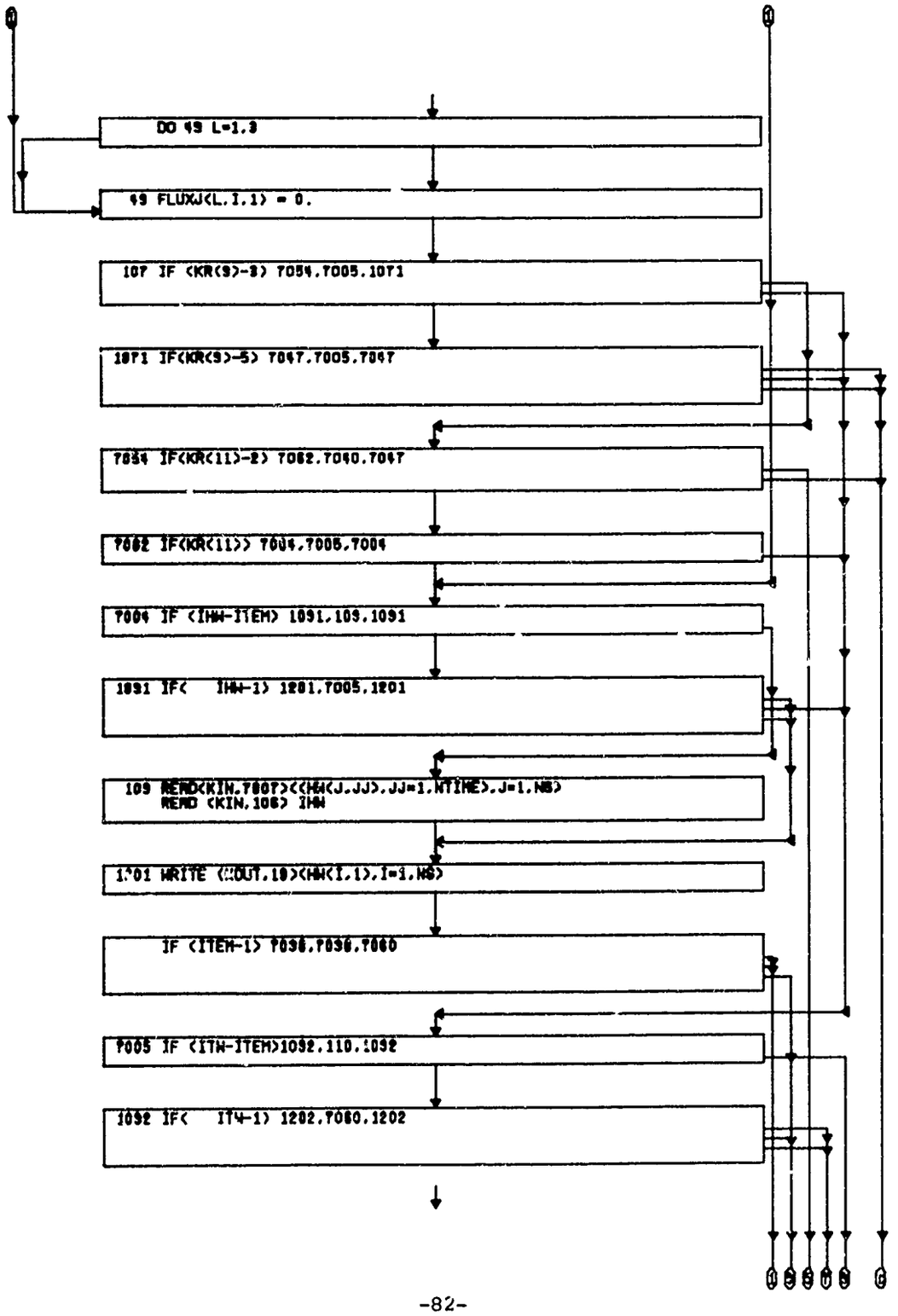

215 DO 216 K=1,NSPM1
216 SPE(K,IS,IT)=SP(1,NETA,K)
205 IF(KR(15)) 9903,9904,9903
9903 CONTINUE
WRITE(KOUT,9901)IS,HE,UE(IS),PTE(IS,1),TE(IS),RHOE(IS),VMUE(IS)
9904 CONTINUE
104 CONTINUE
C EDGE OF EDGE PROPERTY LOOP, START OF BETA AND XI CALCULATION
UEDGE=1.0
DUEDGE=0.
D2UEDG=0.
605 XI(1)=0.
J=NDISC+1
DO 111 II=1,J
K=MSD(II)
M=MSD(II)
MM=M+1
LL=K+M-1
IF (II-1) 6052,6052, 402
6052 IF (KR(6)-1) 400,401,102
C AXISYMETRIC BLUNT
400 DO 403 I=M,LL
SUM2(I)=S(I)*S(I)

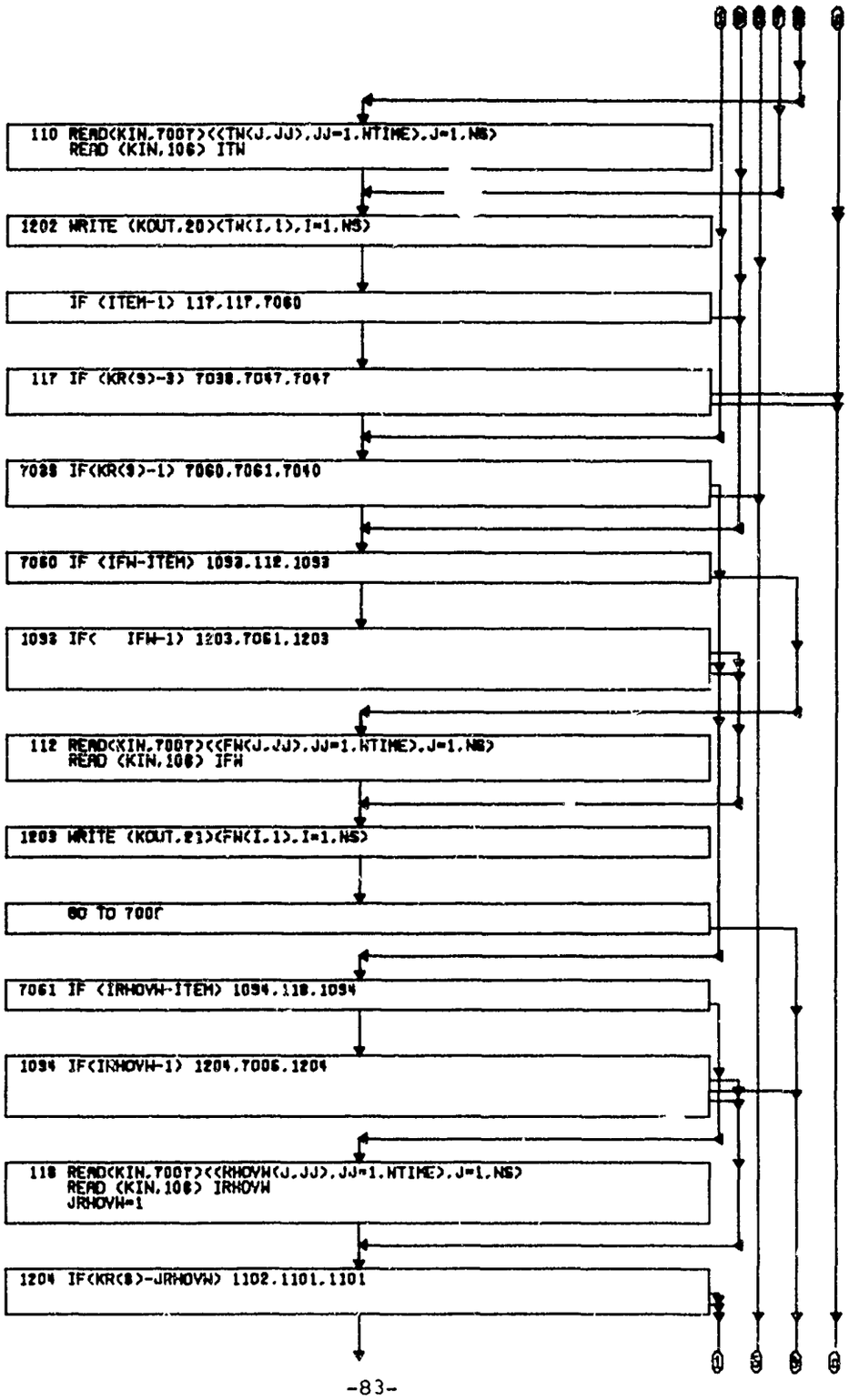

IF(S(I)) 403,403,4031
4031 DUM1=ROKAP(I)/S(I)
XICON(I)=UE(I)/S(I)+RHOE(I)/4.*VMUE(I)*DUM1*DUM1
403 SDUM1(I)=SDUM2(I)+SDUM2(I)
QI=4.
BETAM(I)=0.5
GO TO 406
C PLANAR BLUNT
401 DO 404 I=M,LL
SDUM2(I)=S(I)
IF(S(I)) 404,404,4041
4041 XICON(I)=UE(I)/S(I)+RHOE(I)/2.*VMUE(I)
404 SDUM1(I)=S(I)+S(I)
QI=2.
BETAM(I)=1.
GO TO 406
402 IF (KR(5)-2) 408,407,408

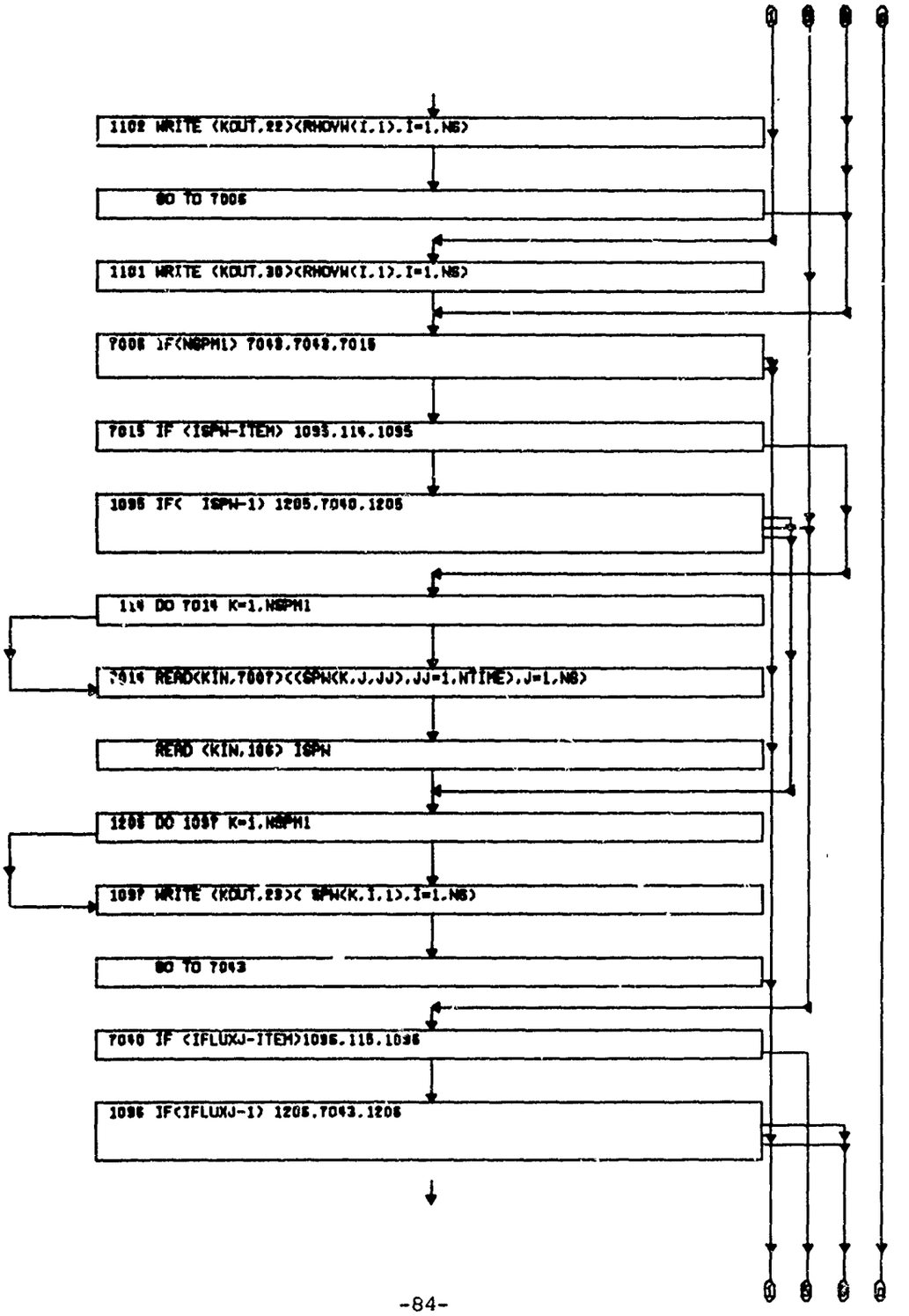

C AXISYMETRIC SHARP
407 DO 409 I=M,LL
SDUM2(I)=S(I)*S(I)
DUM1=ROKAP(I)/S(I)
XICON(I)=RHOE(I)*UE(I)*VMUE(I)*DUM1/3.*DUM1
409 SDUM1(I)=S(I)*SDUM2(I)
XI(1) =XICON(1)*S(1)*S(1)*S(1)
QI=3.
IF (II-1) 4051,4051,406
C PLANAR SHARP
408 DO 405 I=M,LL
SDUM2(I)=S(I)
XICON(I)=RHOE(I)*UE(I)*VMUE(I)*ROKAP(I)*ROKAP(I)
405 SDUM1(I)=S(I)
QI=1.
IF (II-1) 4052,4052,406
4052 XI(1) =XICON(1)*S(1)
4051 MM=M
406 CONTINUE

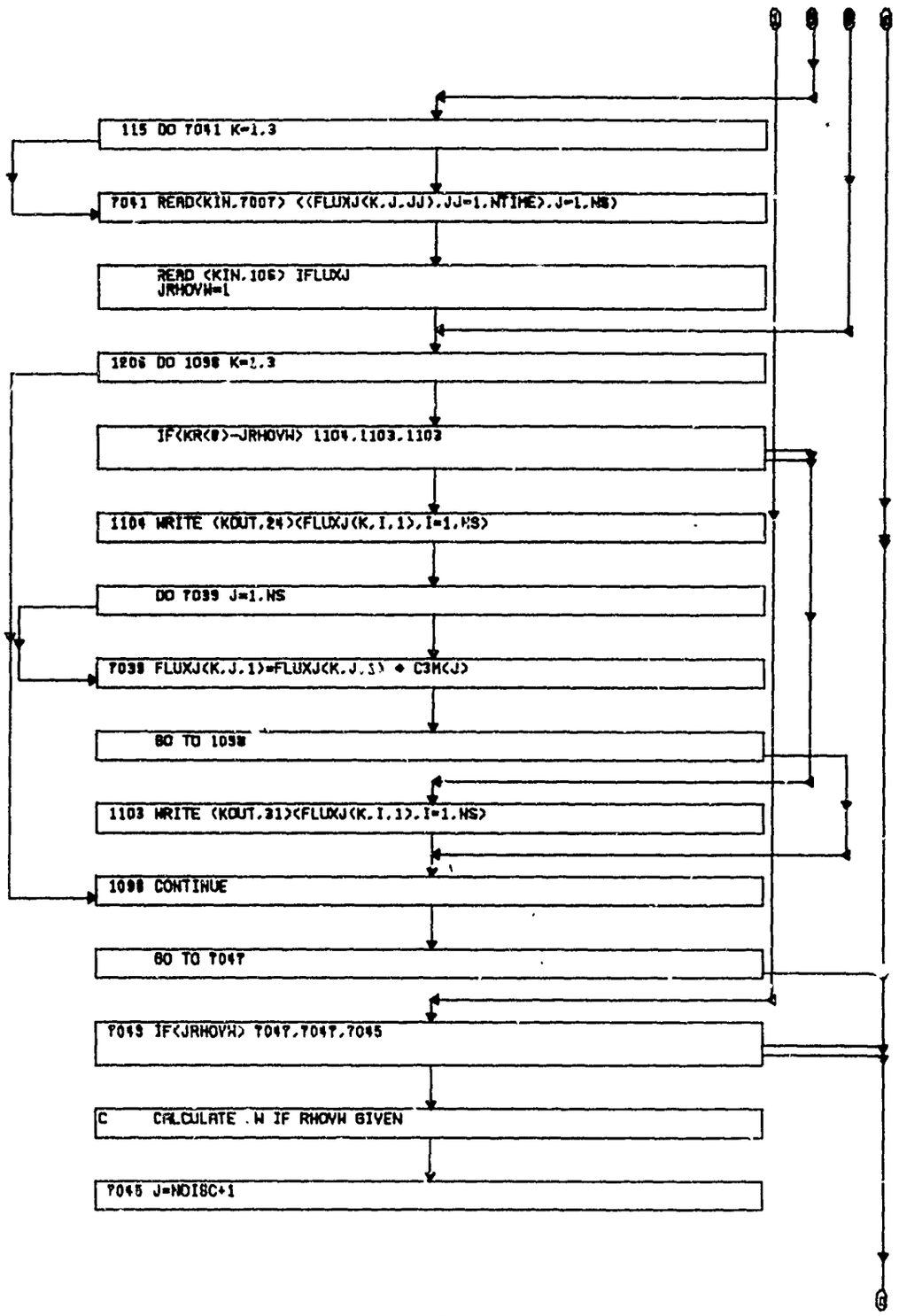

CALL SLOPB(K,S(M),UE(M),DUDS(M),DER(M))
IF (KR(6)-2) 4066,4062,4062
4066 IF (M-1) 4061,4061,4062
4061 IF (RNOSE) 4063,4063,4064
COMMENT...DUES COMPUTED BY SLOPB
4063 DUES=DUDS(1)
GO TO 4065
COMMENT...DUES FROM EFFECTIVE NOSE RADIUS USING NEWTONIAN FLOW
4064 DUES=SQRT(2./RNOE(1)*PE(1,IT)+32.1740*2116.)/RNOSE
4065 XICON(1)=RNOE(1)*VNUE(1)/(2.*VKMP+2.)*DUES
4062 CALL SLOPB(K,SOUM1(M),XICON(M),DER(M),XI(M))
IF (LL-MM) 111,4101,4101
4101 DO 418 I,MM,LL
418 BETAM(L)=2./QI*XI(L)/UE(L)*G(L)/SOUM1(L)*DUDS(L)/XICON(L)
111 CONTINUE

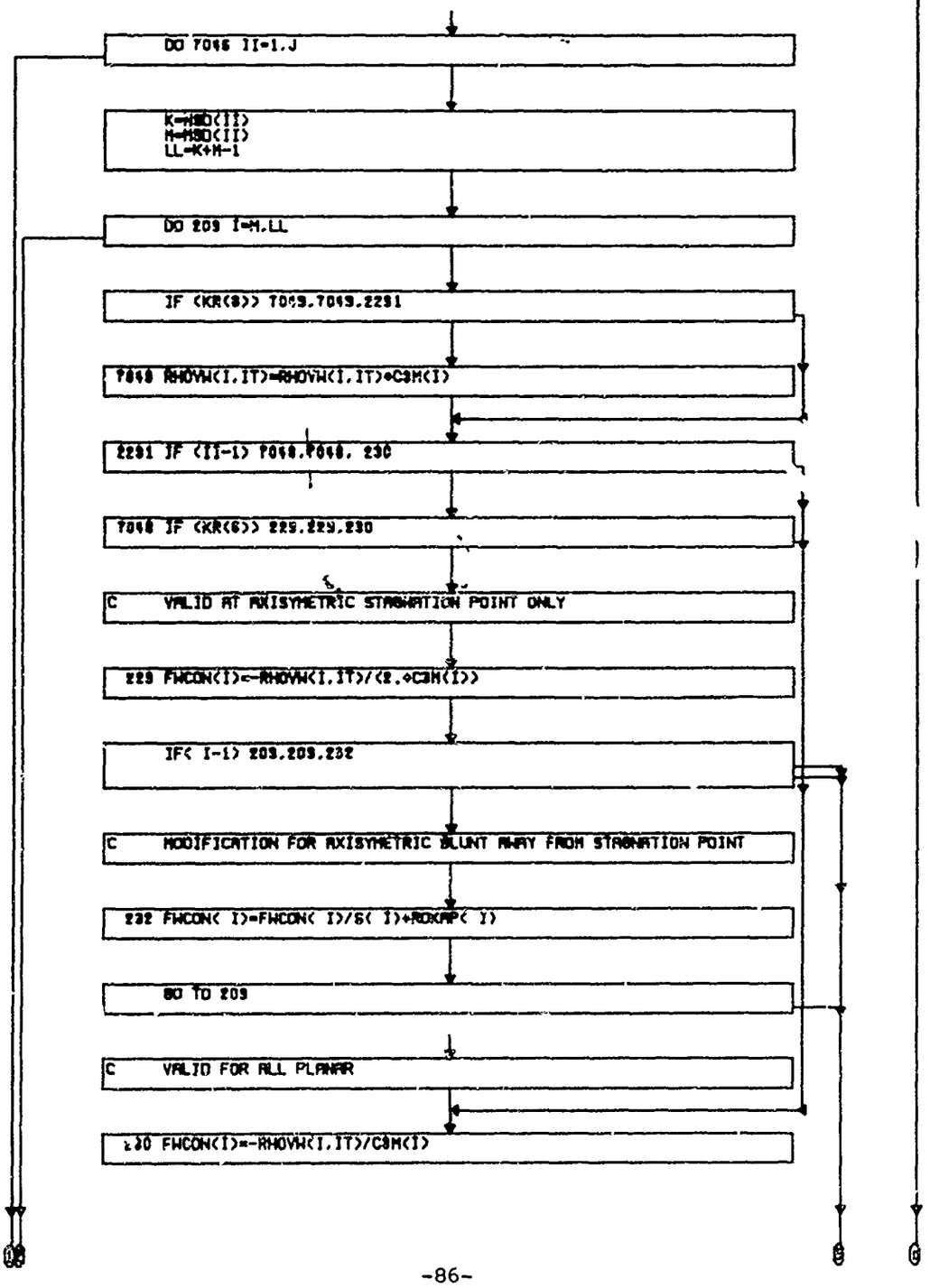

9003 FORMAT(8E10.4)
WRITE(KOUT,16)
WRITE(KOUT,16)(S(I),I=1,NS)
WRITE(KOUT,28)(ROKAP(I),I=1,NS)
WRITE(KOUT,26)(XI(I),I=1,NS)
WRITE(KOUT,17)(PRE(I),I=1,NS)
WRITE(KOUT,25)(PE(I,1),I=1,NS)
WRITE(KOUT,29)(UE(I),I=1,NS)
WRITE(KOUT,27)(BETAM(I),I=1,NS)
WRITE(KOUT,32)(RADS(I),I=1,NS)
WRITE(KOUT,18)(DSIP(I),I=1,NS)
C CALCULATION OF C3 MATRIX
DO 138 I=1,NS
IF (KR(6)-1) 137,137,158
137 IF (I-1) 139,139,158
139 C3M(I)=-SQRT (BETAM(I)/(DUES*RHOE(I)*VMUE(I)))
GO TO 138
158 C3M(I)=-SQRT(2.*XI(I))/(RHOE(I)*ROK*P(I)*UE(I)*VMUE(I))
138 CONTINUE
WRITE(KOUT,33)(C3M(I),I=1,NS)
C READ WALL CONDITIONS IF UNCOUPLED
JRHOVW=0
IF (ITEM-1) 108,108,7004
108 IHW=1
ITW=1
IFW=1
IRHOVW=1
ISPW=1
IFLUXJ=1
DO 49 I=1,NS
Q
Q

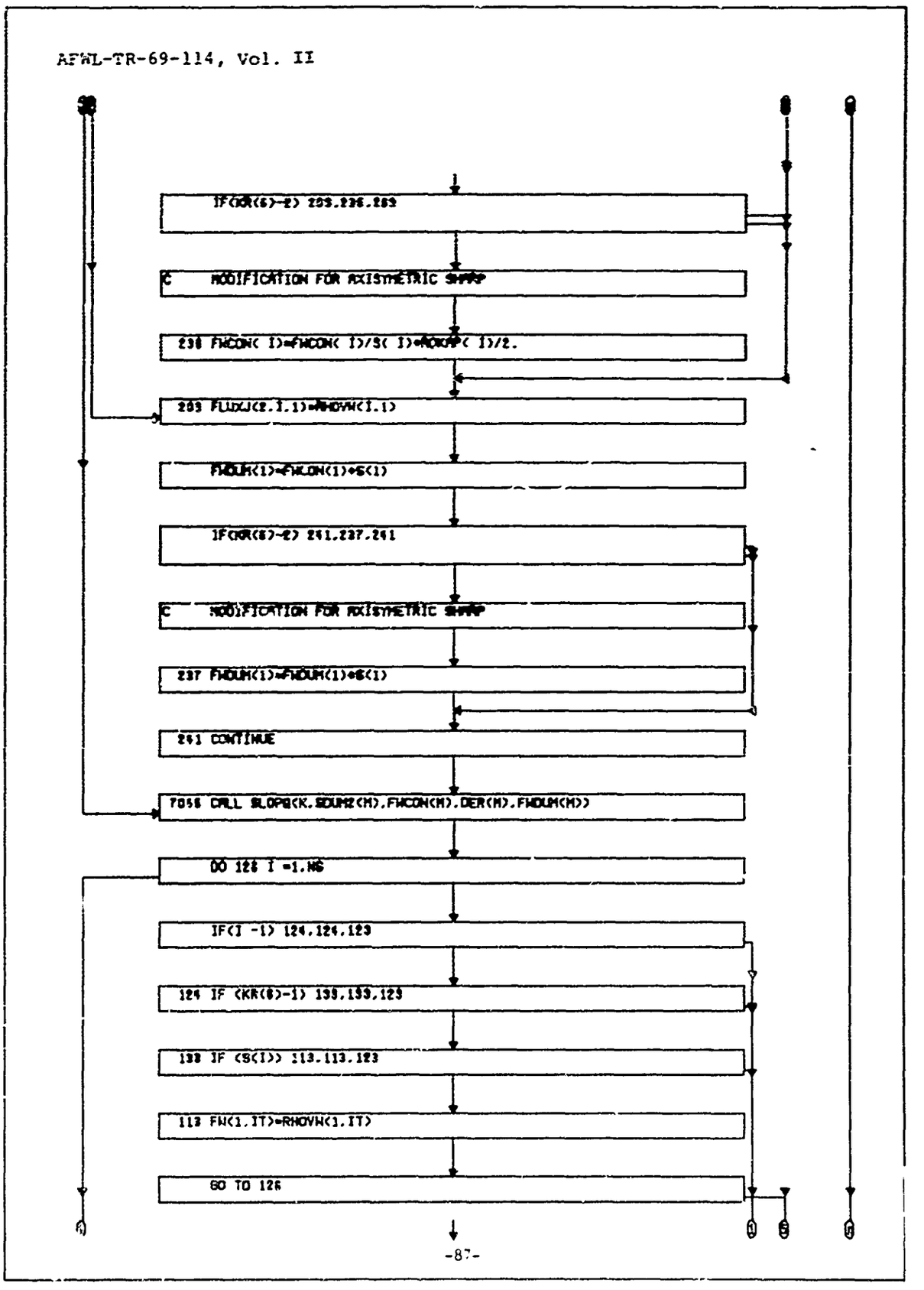

DO 49 L=1,3
49 FLUXJ(L,I,1) = 0.
107 IF (KR(9)-3) 7054,7005,1071
1071 IF(KR(9)-5) 7047,7005,7047
7054 IF(KR(11)-2) 7062,7040,7047
7062 IF(KR(11)) 7004,7005,7004
7004 IF (IHW-ITEM) 1091,109,1091
1091 IF(IHW-1) 1201,7005,1201
109 READ(KIN,7007)((HW(J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,108) IHW
1201 WRITE (NOUT,18)(HW(I,1),I=1,NS)
IF (ITEM-1) 7038,7038,7060
7005 IF (ITW-ITEM)1092,110,1092
1092 IF(ITW-1) 1202,7060,1202

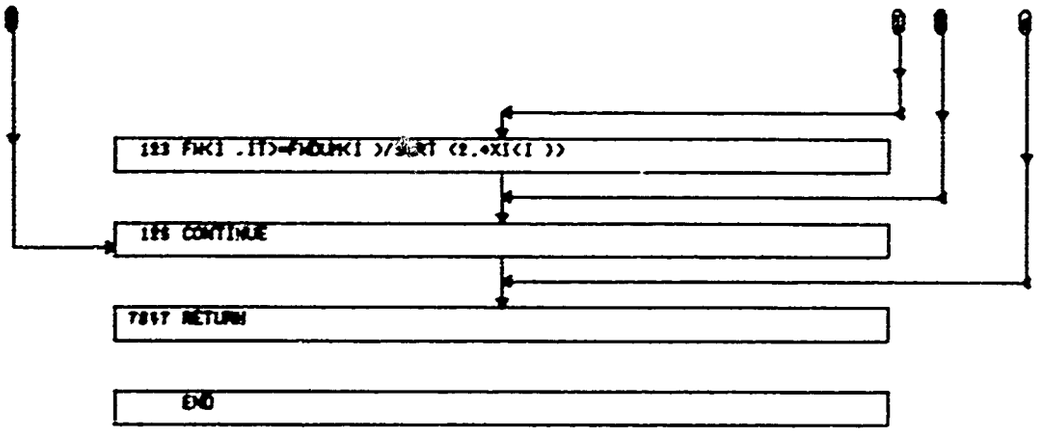

110 READ(KIN,7007)((TW(J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,106) ITW
1202 WRITE (KOUT,20)(TW(I,1),I=1,NS)
IF (ITEM-1) 117,117,7060
117 IF (KR(9)-8) 7038,7047,7047
7038 IF(KR(9)-1) 7060,7061,7040
7060 IF (IFW-ITEM) 1093,112,1093
1093 IF(IFW-1) 1203,7061,1203
112 READ(KIN,7007)((FW(J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,106) IFW
1203 WRITE (KOUT,21)(FW(I,1),I=1,NS)
GO TO 7007
7061 IF (IRHOVW-ITEM) 1094,118,1094
1094 IF(IRHOVW-1) 1204,7006,1204
118 READ(KIN,7007)((RHOVW(J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,106) IRHOVW
JRHOVW=1
1204 IF(KR(8)-JRHOVW) 1102,1101,1101


1102 WRITE (KOUT,22)(RHOVH(I,1),I=1,NS)
GO TO 7006
1101 WRITE (KOUT,30)(RHOVH(I,1),I=1,NS)
7006 IF(NSPM1) 7043,7043,7015
7015 IF (ISPW-ITEM) 1095,114,1095
1095 IF(ISPW-1) 1205,7040,1205
114 DO 7014 K=1,NSPM1
7014 READ(KIN,7007)((SPW(K,J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,106) ISPW
1205 DO 1097 K=1,NSPM1
1097 WRITE (KOUT,23)(SPW(K,I,1),I=1,NS)
GO TO 7043
7040 IF (IFLUXJ-ITEM)1096,115,1096
1096 IF(IFLUXJ-1) 1205,7043,1205


115 DO 7041 K=1,3
7041 READ(KIN,7007) ((FLUXJ(K,J,JJ),JJ=1,NTIME),J=1,NS)
READ (KIN,106) IFLUXJ
JRHOVW=1
1206 DO 1098 K=1,3
IF(KR(0)-JRHOVW) 1104,1103,1103
1104 WRITE (KOUT,24)(FLUXJ(K,I,1),I=1,NS)
DO 7039 J=1,NS
7039 FLUXJ(K,J,1)=FLUXJ(K,J,1) * C3M(J)
GO TO 1098
1103 WRITE (KOUT,31)(FLUXJ(K,I,1),I=1,NS)
1098 CONTINUE
GO TO 7047
7043 IF(JRHOVW) 7047,7047,7045
C CALCULATE .W IF RHOVW GIVEN
7045 J=NOISC+1


DO 7046 II=1,J
K=MSO(II)
M=MSO(II)
LL=K+M-1
DO 209 I=M,LL
IF (KR(8)) 7049,7049,2291
7048 RHOVW(I,IT)=RHOVW(I,IT)*C8M(I)
2291 IF (II-1) 7048,7048, 230
7049 IF (KR(6)) 229,229,230
C VALID AT AXISYMETRIC STAGNATION POINT ONLY
229 FWCON(I)=-RHOVW(I,IT)/(2.*C8M(I))
IF(I-1) 209,209,232
C MODIFICATION FOR AXISYMETRIC BLUNT AWAY FROM STAGNATION POINT
232 FWCON(I)=FWCON(I)/6(I)+ROKAP(I)
GO TO 209
C VALID FOR ALL PLANAR
230 FWCON(I)=-RHOVW(I,IT)/C8M(I)


IF(KR(6)-2) 233,236,233
C MODIFICATION FOR AXISYMETRIC SHAPE
236 FWCON(I)=FWCON(I)/S(I)+ROKAP(I)/2.
233 FLUX1(2,I,1)=RHOVW(I,1)
FWSUM(1)=FWCON(1)+S(1)
IF(KR(6)-2) 241,237,241
C MODIFICATION FOR AXISYMETRIC SHAPE
237 FWSUM(1)=FWSUM(1)+S(1)
241 CONTINUE
7056 CALL SLOPE(K,SSUM2(M),FWCON(M),DER(M),FWSUM(M))
DO 128 I =1,NS
IF(I -1) 124,124,129
124 IF (KR(6)-1) 133,133,129
133 IF (S(I)) 113,113,129
113 FW(1,IT)=RHOVW(1,IT)
GO TO 128


123 FMKI .IT)=FMDUMKI >/SQRT (2.*XI(I))
125 CONTINUE
7847 RETURN
END

8. SUBROUTINE ICOEFF - B08B

a. Function

Calculates groupings which contribute to the error equations and influence coefficients for the nonlinear (conservation) equations. Called by NONCER.

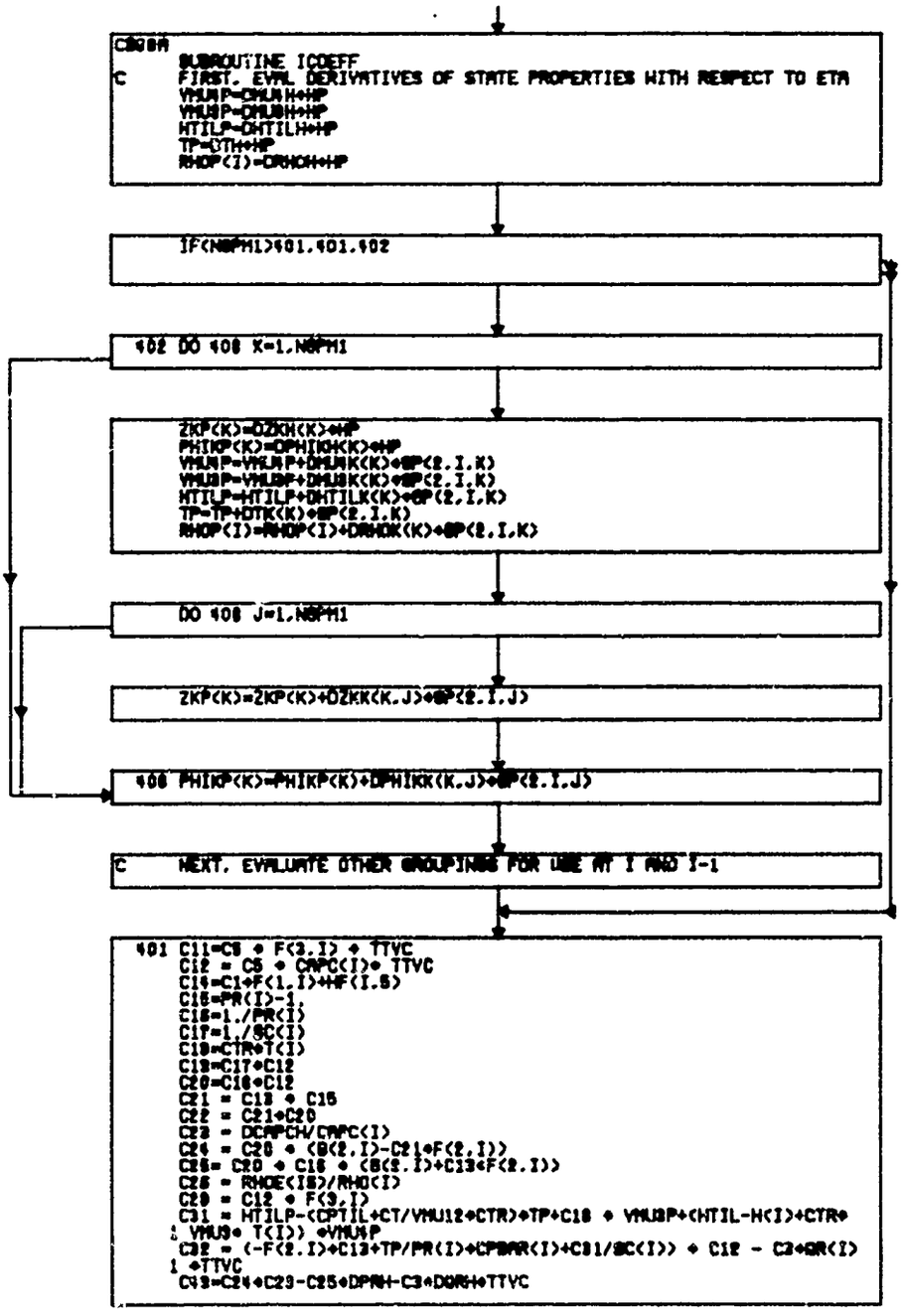
b. Listing

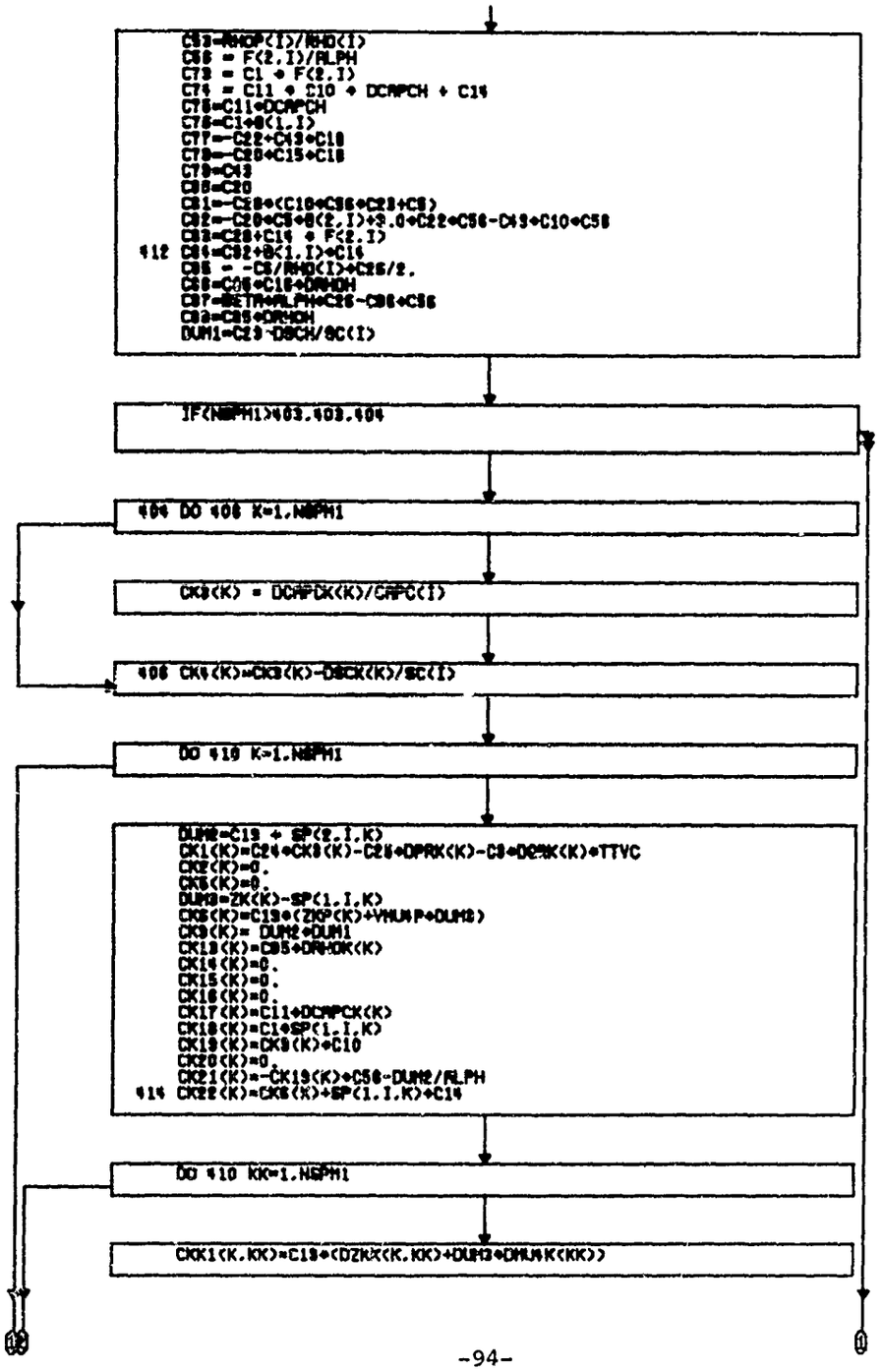
```
0C0001          CROSS                                                          B08A 001
0C0002                SUBROUTINE ICOEFF                                        B08A 002
0C0003                COMMON/COFCOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B08AR   3*NEW
0C0004               1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB08AR   4*NEW
0C0005               232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B08AR   5*NEW
0C0006               3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB08AR   6*NEW
0C0007               465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B08AR   7*NEW
0C0008               5,C82,C83,C84,C85,C86,C87,C88                            B08AR   8*NEW
0C0009                COMMON/COECOM/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)   B08AB   9*NEW
0C0010               1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B08AR  10*NEW
0C0011               2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B08AR  11*NEW
0C0012               3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B08AR  12*NEW
0C0013               4,CKK3( 8, 8)                                            B08AR  13*NEW
0C0014                COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B08AB  14*NEW
0C0015               1UF(40),RHOF(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,WE,C90 B08AR  15*NEW
0C0016               2 ,USIP(40),IDSIP,TTVC,TVCC(40)                          B08AB  16*NEW
0C0017                COMMON/ETACOM/ETA(15),DETA(15),DS0(14),DCU(14),B1(14),B2(14)   B08AB  17*NEW
0C0018               1,LAR(153),BA1(43,18),BA2(30,15)                         B08AR  18*NEW
0C0019                COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B08AR  19*NEW
0C0020               1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2 B08AR  20*NEW
0C0021               2,C3M(40),BETAM(40)                                      B08AR  21*NEW
0C0022                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB08AR  22*NEW
0C0023               1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NALEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B08AR  23*NEW
0C0024               2,A(8),      HWE,HON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B08AR  24*NEW
0C0025               3,KAUXO,JTIME,JSPEC,MD(3)                                B08AB  25*NEW
0C0026                COMMON/PROCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),GR(15),H(15)   B08AB  26*NEW
0C0027               1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKH( 8),  B08AR  27*NEW
0C0028               2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B08AB  28*NEW
0C0029               3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B08AR  29*NEW
0C0030               4,DPHIKK( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B08AR  30*NEW
0C0031               5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B08AR  31*NEW
0C0032               6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)   B08AB  32*NEW
0C0033                COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH           B08AB  33*NEW
0C0034          C     FIRST, EVAL DERIVATIVES OF STATE PROPERTIES WITH RESPECT TO ETA   B08AA 028*-31
0C0035                VMU4P=DMU4H*HP                                           B08AA 029
0C0036                VMU3P=DMU3H*HP                                           B08AA 030
0C0037                HTILP=DHTILH*HP                                          B08AA 031
0C0038                TP=DTH*HP                                                B08AA 032
0C0039                RHOP(I)=DRHOH*HP                                         B08AA 033
0C0040                IF(NSPM1)401,401,402                                     B08AA 034
0C0041              402 DO 408 K=1,NSPM1                                       B08AA 035
0C0042                ZKP(K)=DZKH(K)*HP                                        B08AA 036
0C0043                PHIKP(K)=DPHIKH(K)*HP                                    B08AA 037
0C0044                VMU4P=VMU4P+DMU4K(K)*SP(2,I,K)                           B08AA 038
0C0045                VMU3P=VMU3P+DMU3K(K)*SP(2,I,K)                           B08AA 039
0C0046                HTILP=HTILP+DHTILK(K)*SP(2,I,K)                          B08AA 040
0C0047                TP=TP+DTK(K)*SP(2,I,K)                                   B08AA 041
0C0048                RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)                       B08AA 042
0C0049                DO 408 J=1,NSPM1                                         B08AA 043
0C0050                ZKP(K)=ZKP(K)+DZKK(K,J)*SP(2,I,J)                        B08AA 044
0C0051              408 PHIKP(K)=PHIKP(K)+DPHIKK(K,J)*SP(2,I,J)                B08AA 045
0C0052          C     NEXT, EVALUATE OTHER GROUPINGS FOR USE AT I AND I-1      B08AA 046
0C0053              401 C11=C5 * F(3,I) * TTVC
0C0054                C12 = C5 * CAPC(I)* TTVC
0C0055                C14=C1*F(1,I)+HF(I,5)                                    B08AA 049
0C0056                C15=PR(I)-1.                                             B08AA 050
0C0057                C16=1./PR(I)                                             B08AA 051
0C0058                C17=1./SC(I)                                             B08AA 052
```

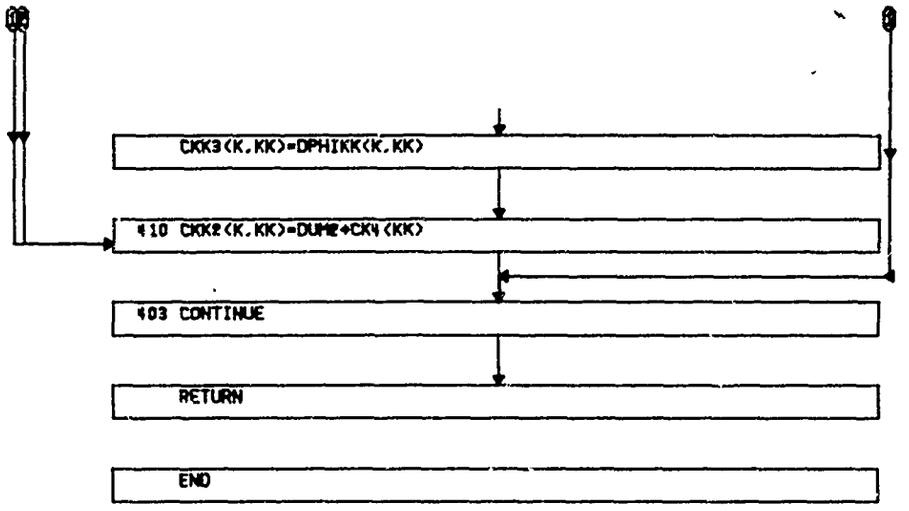
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000059                C16=CTR*T(I)                                                    B08A 053
000060                C19=C17*C12                                                     B08A 054
000061                C20=C16*C12                                                     B08A 055
000062                C21 = C13 * C15
000063                C22 = C21*C20
000064                C23 = DCAPCH/CAPC(I)
000065                C24 = C20 * (G(2,I)-C21*F(2,I))
000066                C25= C20 * C16 * (G(2,I)+C13*F(2,I))
000067                C26 = RHOF(IS)/RHO(I)
000068                C28 = C12 * F(3,I)
000069                C31 = HTILP-(CPTIL+CT/VMU12*CTR)*TP+C18 * VMU3P*(HTIL-H(I)+CTR*
000070               1 VMU3* T(I)) *VMU4P
000071                C32 = (-F(2,I)*C13+TP/PR(I)*CPBAR(I)+C31/SC(I)) * C12 - C3*QR(I)
000072               1 *TTVC
000073                C43=C24*C23-C25*DPRH-C3*DQRH*TTVC
000074                C53=RHOP(I)/RHO(I)
000075                C56 = F(2,I)/ALPH
000076                C73 = C1 * F(2,I)
000077                C74 = C11 * C10 * DCAPCH + C14
000078                C75=C11*DCAPCH                                                  B08A 100
000079                C76=C1*G(1,I)                                                   B08A 101
000080                C77=-C22+C43*C10
000081                C78=-C20*C15*C10
000082                C79=C43
000083                CAC=C20
000084                C91=-C28*(C10*C56*C23+C5)
000085                C92=-C20*C5*G(2,I)+3.D*C22*C56-C43*C10*C56
000086                C83=C28*C14 * F(2,I)
000087           412  CA4=C32+G(1,I)*C14                                              B08A 109
000088                C85 = -C6/RHO(I)-C26/2.
000089                C86=C85*C10*DRHOH
000090                CA7=BETA*ALPH*C26-C86*C56
000091                C88=C85*DRHOH
000092                DUM1=C23-DSCH/SC(I)
000093                IF(NSPM1)403,403,404                                            B08A 110
000094           404  DO 406 K=1,NSPM1
000095                CK3(K) = DCAPCK(K)/CAPC(I)
000096           406  CK4(K)=CK3(K)-DSCK(K)/SC(I)
000097                DO 410 K=1,NSPM1
000098                DUM2=C19 * SP(2,I,K)
000099                CK1(K)=C24*CK3(K)-C25*DPRK(K)-C3*DQRK(K)*TTVC
000100                CK2(K)=0.
000101                CK5(K)=0.
000102                DUM3=ZK(K)-SP(1,I,K)
000103                CK6(K)=C19*(ZKP(K)+VMU4P*DUM3)
000104                CK9(K)= DUM2*DUM1
000105                CK13(K)=C85*DRHOK(K)
000106                CK14(K)=0.
000107                CK15(K)=0.
000108                CK16(K)=0.
000109                CK17(K)=C11*DCAPCK(K)                                           B08A 125
000110                CK18(K)=C1*SP(1,I,K)                                            B08A 126
000111                CK19(K)=CK9(K)*C10
000112                CK20(K)=0.
000113                CK21(K)=-CK19(K)*C56-DUM2/ALPH
000114           414  CK22(K)=CK6(K)+SP(1,I,K)*C14                                   B08A 130
000115                DO 410 KK=1,NSPM1                                               B08A 131
000116                CKK1(K,KK)=C19*(DZKK(K,KK)+DUM3*DMU4K(KK))
000117                CKK3(K,KK)=DPHI(KK(K,KK)
000118           410  CKK2(K,KK)=DUM2*CK4(KK)
```

```
000119                403 CONTINUE                                          B084 135
000120                    RETURN                                            B084 136
000121                    END                                               B084 137
```

c. Flow Chart


C9999
SUBROUTINE ICOEFF
C FIRST, EVAL DERIVATIVES OF STATE PROPERTIES WITH RESPECT TO ETA
VMUP=DMUH*HP
VMUBP=DMUBH*HP
HTILP=DHTILH*HP
TP=DTH*HP
RHOP(I)=DRHOH*HP
IF(NSPM1)401,401,402
402 DO 408 K=1,NSPM1
ZKP(K)=DZKH(K)*HP
PHIKP(K)=DPHIKH(K)*HP
VMUP=VMUP+DMUK(K)*SP(2,I,K)
VMUBP=VMUBP+DMUBK(K)*SP(2,I,K)
HTILP=HTILP+DHTILK(K)*SP(2,I,K)
TP=TP+DTK(K)*SP(2,I,K)
RHOP(I)=RHOP(I)+DRHOK(K)*SP(2,I,K)
DO 408 J=1,NSPM1
ZKP(K)=ZKP(K)+DZKK(K,J)*SP(2,I,J)
408 PHIKP(K)=PHIKP(K)+DPHIKK(K,J)*SP(2,I,J)
C NEXT, EVALUATE OTHER GROUPINGS FOR USE AT I AND I-1
401 C11=C8 * F(3,I) * TTVC
C12 = C8 * DRPC(I)* TTVC
C14=C1*F(1,I)+HF(I,8)
C16=PR(I)-1.
C16=1./PR(I)
C17=1./SC(I)
C19=CTR*T(I)
C13=C17*C12
C20=C16*C12
C21 = C13 * C15
C22 = C21+C20
C23 = DCPPCH/CPPC(I)
C24 = C20 * (B(2,I)-C21*F(2,I))
C25= C20 * C16 * (B(2,I)+C13*F(2,I))
C26 = RHOE(IE)/RHO(I)
C29 = C12 * F(3,I)
C31 = HTILP-(DPTIL+CT/VMU12*CTR)*TP+C18 * VMUBP+(HTIL-H(I)+CTR*
1 VMU8* T(I)) *VMUMP
C32 = (-F(2,I)+C13+TP/PR(I)+CPBAR(I)+C31/SC(I)) * C12 - C2*GR(I)
1 *TTVC
C33=C24+C23-C25*DPNH-C3*DGR+TTVC


C53=RHOP(I)/RHO(I)
C56 = F(2,I)/RLPH
C73 = C1 + F(2,I)
C74 = C11 + C10 + DCAPCH + C14
C75=C11+DCAPCH
C76=C1+G(1,I)
C77=-C22+C19+C18
C78=-C20+C15+C18
C79=C43
C80=C20
C81=-C20+(C18+C56+C23+C5)
C82=-C20+C5+G(2,I)+9.0+C22+C56-C43+C10+C58
C83=C20+C14 + F(2,I)
412 C84=C82+G(1,I)+C16
C85 = -C5/RHO(I)+C25/2.
C86=C05+C18+DRHOH
C87=BETM+RLPH+C25-C86+C56
C88=C85+DRHOH
DUM1=C29-DSCH/SC(I)
IF(NSPM1)403,403,404
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+DC2K(K)+TTVC
CK2(K)=0.
CK5(K)=0.
DUM3=ZK(K)-SP(1,I,K)
CK6(K)=C19+(ZKP(K)+VHUMP+DUM3)
CK7(K)= DUM2+DUM1
CK12(K)=C85+DRHOK(K)
CK14(K)=0.
CK15(K)=0.
CK16(K)=0.
CK17(K)=C11+DCAPCK(K)
CK18(K)=C1+SP(1,I,K)
CK19(K)=CK3(K)+C10
CK20(K)=0.
CK21(K)=-CK19(K)+C56-DUM2/RLPH
414 CK22(K)=CK6(K)+SP(1,I,K)+C14
DO 410 KK=1,NSPM1
CKK1(K,KK)=C19+(DZKK(K,KK)+DUM3+DMUMK(KK))


CKK3(K,KK)=DPHIKK(K,KK)
410 CKK2(K,KK)=DUME+CK4(KK)
403 CONTINUE
RETURN
END

9. SUBROUTINE RECASE - B09A

a. Function

Reads in most of boundary layer input data. Called by SETUP.

b. Listing

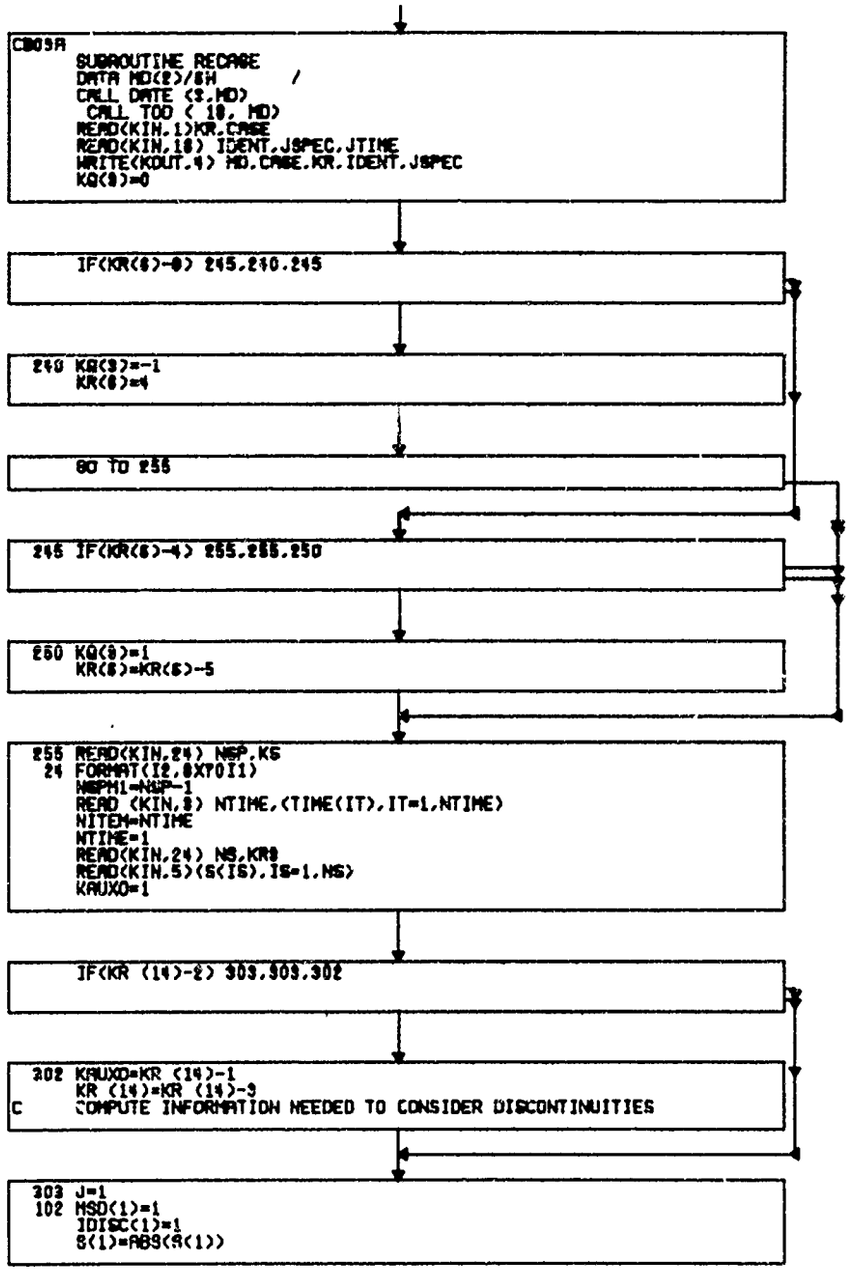
```
      CRK09A                                                                 B09A 001
            SUBROUTINE RECASE                                                B09A 002
            COMMON/CRKCOM/HCARH,ENIS,STFF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMIST B09A   3*NEW
           1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU            B09A   4*NEW
            COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)      B09A   5*NEW
           1,LAR(153),BA1(43,14),BA2(30,15)                                   B09A   6*NEW
            COMMON/ITCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB09A   7*NEW
           1S,IT,NTIME,NSP,NSPM1,NAM,NLFQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B09A   8*NEW
           2,R(8),      MAE,MON,KQ(10),ITEM,NITEM,KR17,NRT,NRT2,IDENT,KR9(40) B09A   9*NEW
           3,MAUXO,JTIME,JSPEC,MD(3)                                          B09A  10*NEW
            COMMON/RHCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40)  B09A  11*NEW
           1,RNOSE,VMAP,NDISC,IDISC(40),MSD(10),MSD(10),ITE( 50),IPRE,RADNO,  B09A  12*NEW
           2CONE,RADEL( 50),RADR(40),RADS(40),ISAD                            B09A  13*NEW
          1 FORMAT(20I1,15A4)                                                 B09A 016**-14
          2 FORMAT(I2)                                                        B09A 017
          3 FORMAT(I2/(8E10.4))                                               B09A 018
          4 FORMAT(1H1114X56HBOUNDARY 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 026
          6 FORMAT(I2,E10.4)                                                  B09A 027
          7 FORMAT(/9X20HVISCOSITY LAW   MU=(E10.3,4H*T**E10.3,3H)/(E10.3,3H*TB09A 028
           .1+E10.3,1H)//9X19HENTHALPY LAW   H=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(3X1PE10.3,9X12,6X9E10.3/(30X9E10.3))                       B09A 036
         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(42,I2,16)
         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, IN/SEC FT2 = EXP(((,1P E12.5,
           26H)*TW+(,1P E12.5,7H))*TW+(,1P E12.5,2H)),//8X,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,RW, OR RHOWVW          B09A 052
            DATA MD(2)/6H      /
            CALL DATE (9,MD)
            CALL TOD ( 18, MD)
```

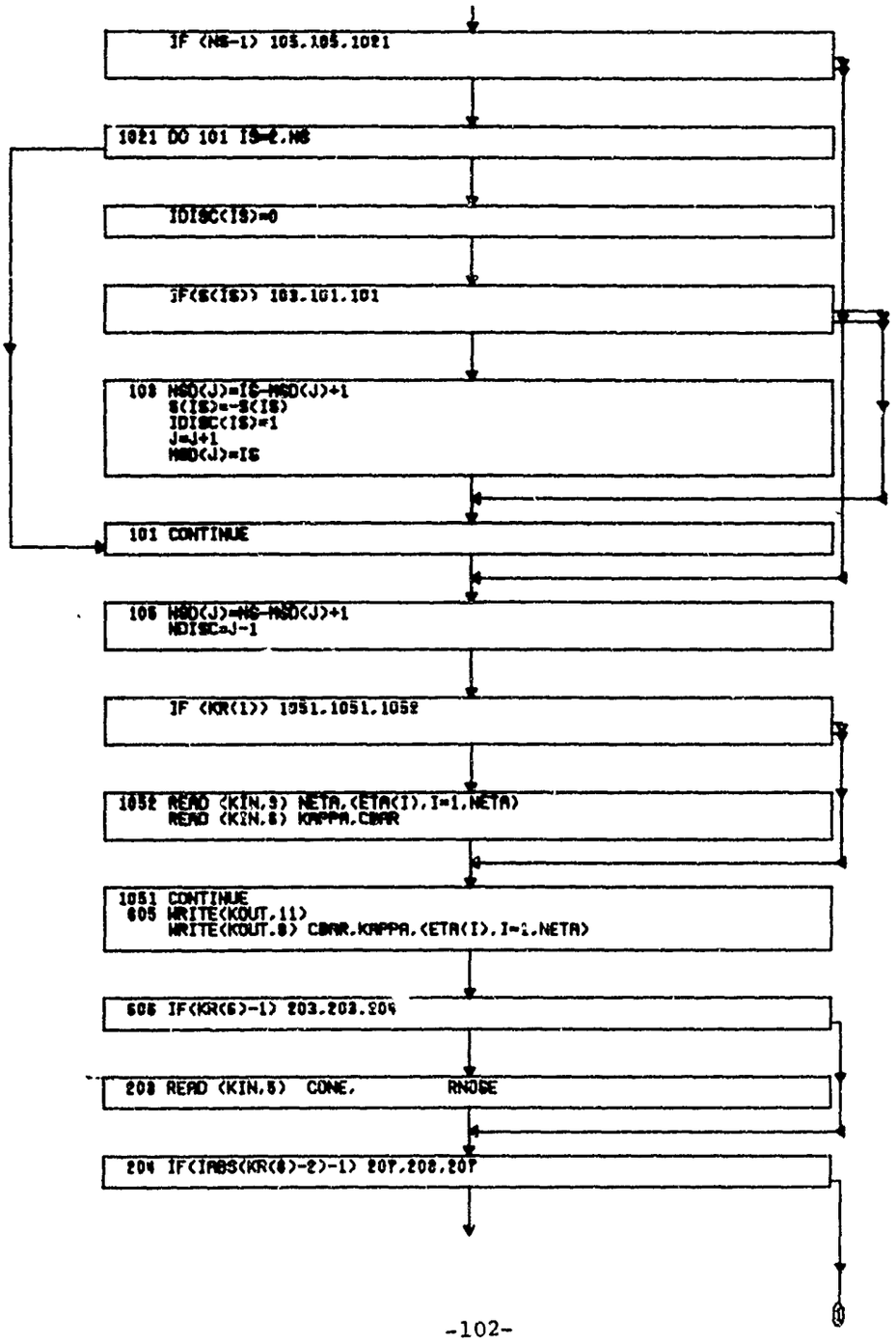
```
000059                READ(KIN,1)KR,CASE                                    B09A 053
000060                READ(KIN,16) IDENT,JSPEC,JTIME
000061                WRITE(KOUT,4) MD,CASE,KR,IDENT,JSPEC
000062                KQ(9)=0
000063                IF(KR(6)-8) 245,240,245
000064             240 KQ(9)=-1
000065                KR(6)=4
000066                GO TO 255
000067             245 IF(KR(6)-4) 255,255,250
000068             250 KQ(9)=1
000069                KR(6)=KR(6)-5
000070             255 READ(KIN,24) NSP,KS
000071              24 FORMAT(I2,3X70I1)
000072                NSPM1=NSP-1                                           B09A 057
000073                READ (KIN,3) NTIME,(TIME(IT),IT=1,NTIME)              B09A 058
000074                NITEM=NTIME                                           B09A 059
000075                NTIME=1                                               B09A 060
000076                READ(KIN,24) NS,KR9
000077                READ(KIN,5)(S(IS),IS=1,NS)
000078                KAUXO=1                                               RDG
000079                IF(KR (14)-2) 303,303,302                             RDG
000080             302 KAUXO=KR (14)-1                                      RDG
000081                KR (14)=KR (14)-3                                     RDG
000082          C     COMPUTE INFORMATION NEEDED TO CONSIDER DISCONTINUITIES B09A 062
000083             303 J=1                                                  B09A 063
000084             102 MSD(1)=1                                             B09A 064
000085                 IDISC(1)=1
000086                 S(1)=ABS(S(1))                                       B09A 066
000087                 IF (NS-1) 105,105,1021                               B09A 067
000088            1021 DO 101 IS=2,NS                                       B09A 068
000089                 IDISC(IS)=0                                          B09A 069
000090                 IF(S(IS)) 103,101,101                                B09A 070
000091              103 MSD(J)=IS-MSD(J)+1                                  B09A 071
000092                 S(IS)=-S(IS)                                         B09A 072
000093                 IDISC(IS)=1                                          B09A 073
000094                 J=J+1                                                B09A 074
000095                 MSD(J)=IS                                            B09A 075
000096              101 CONTINUE                                            B09A 076
000097              105 NSD(J)=NS-MSD(J)+1                                  B09A 077
000098                  NDISC=J-1                                           B09A 078
000099                  IF (KR(1)) 1051,1051,1052                           B09A 080
000100             1052 READ (KIN,3) NETA,(ETA(I),I=1,NETA)                 B09A 081
000101                  READ (KIN,6) KAPPA,CBAR                             B09A 079
000102             1051 CONTINUE                                            B09A
000103              605 WRITE(KOUT,11)                                      B09A 091
000104                  WRITE(KOUT,8) CBAR,KAPPA,(ETA(I),I=1,NETA)          B09A 092
000105              606 IF(KR(6)-1) 203,203,204                             B09A 093
000106              203 READ (KIN,5)  CONE,          RNOSE                  B09A 094
000107              204 IF(IABS(KR(6)-2)-1) 207,208,207                     B09A 095
000108              207 READ (KIN,5)(ROKAP(IS),IS=1,NS)                     B09A 096
000109                  IF (NS-1) 234,234,2071                              B09A 097
000110             2071 IIS=2                                               B09A 098
000111                  LNZ=1                                               B09A 099
000112                  IF(ROKAP(1)) 223,226,226                            B09A 100
000113              223 RADNO=-ROKAP(1)                                     B09A 101
000114                  WRITE (KOUT, 12) RADNO,CONE                         B09A 102
000115                  ROKAP(1)=0.                                         B09A 103
000116                  DO 229 IS=1,NS
000117                  IF(ROKAP(IS)) 224,224,225                           B09A 105
000118              224 IF(KR(6)) 221,221,222                               B09A 106
```

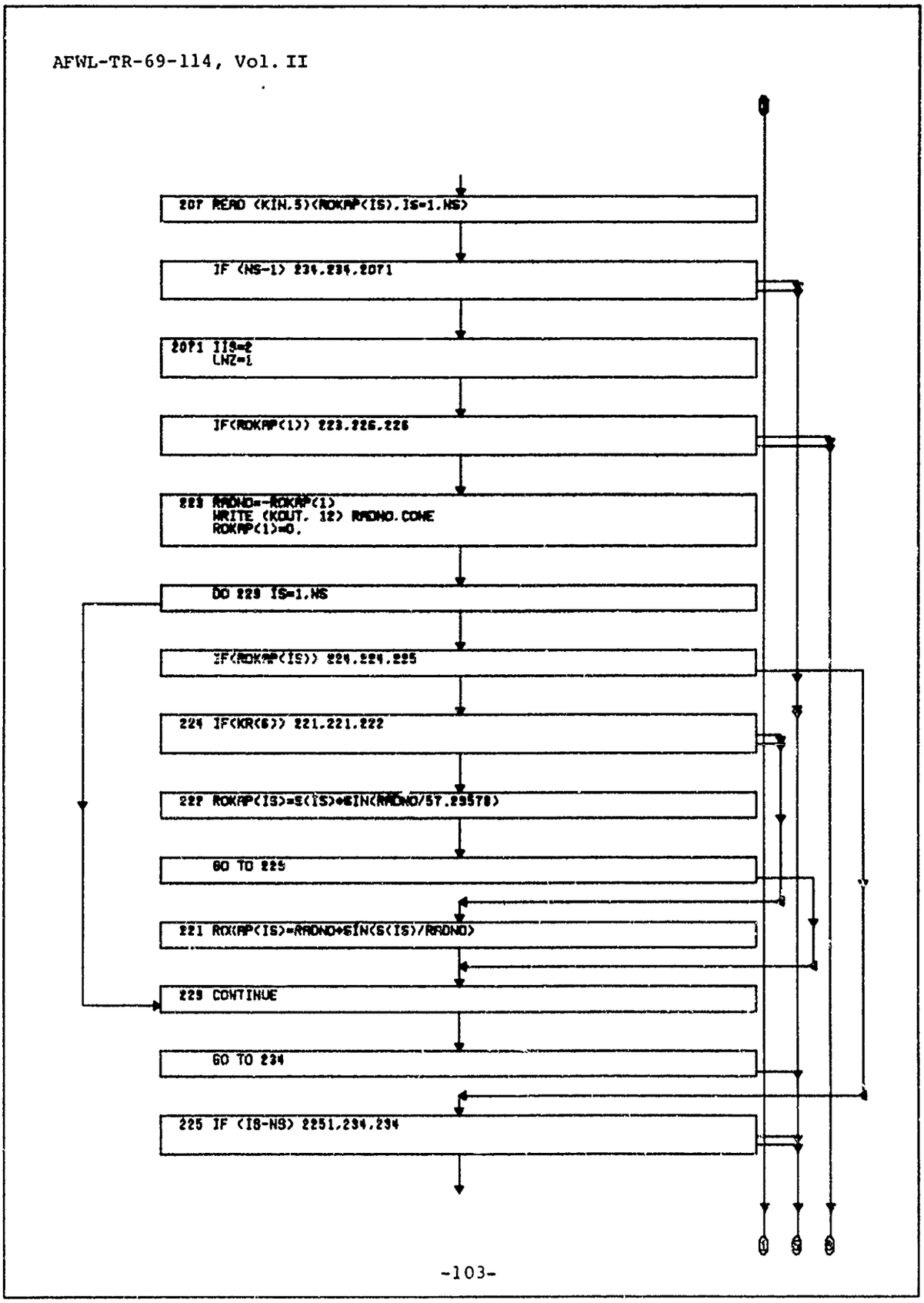
```
                222 ROKAP(IS)=S(IS)*SIN(RADNO/57.2957A)                                 B09A 107
                    GO TO 229                                                           B09A 108
                221 ROKAP(IS)=RADNO*SIN(S(IS)/RADNO)                                    B09A 109
                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 DO 233 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(LN7)=ROKAP(LNZ-1)+(S(LN7)-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 = .4A1E-12
                    IF (KR(9)-3) 197,193,198
                196 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 EMITTANCE17X1P3E14.5/5X34HF
                   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)
```

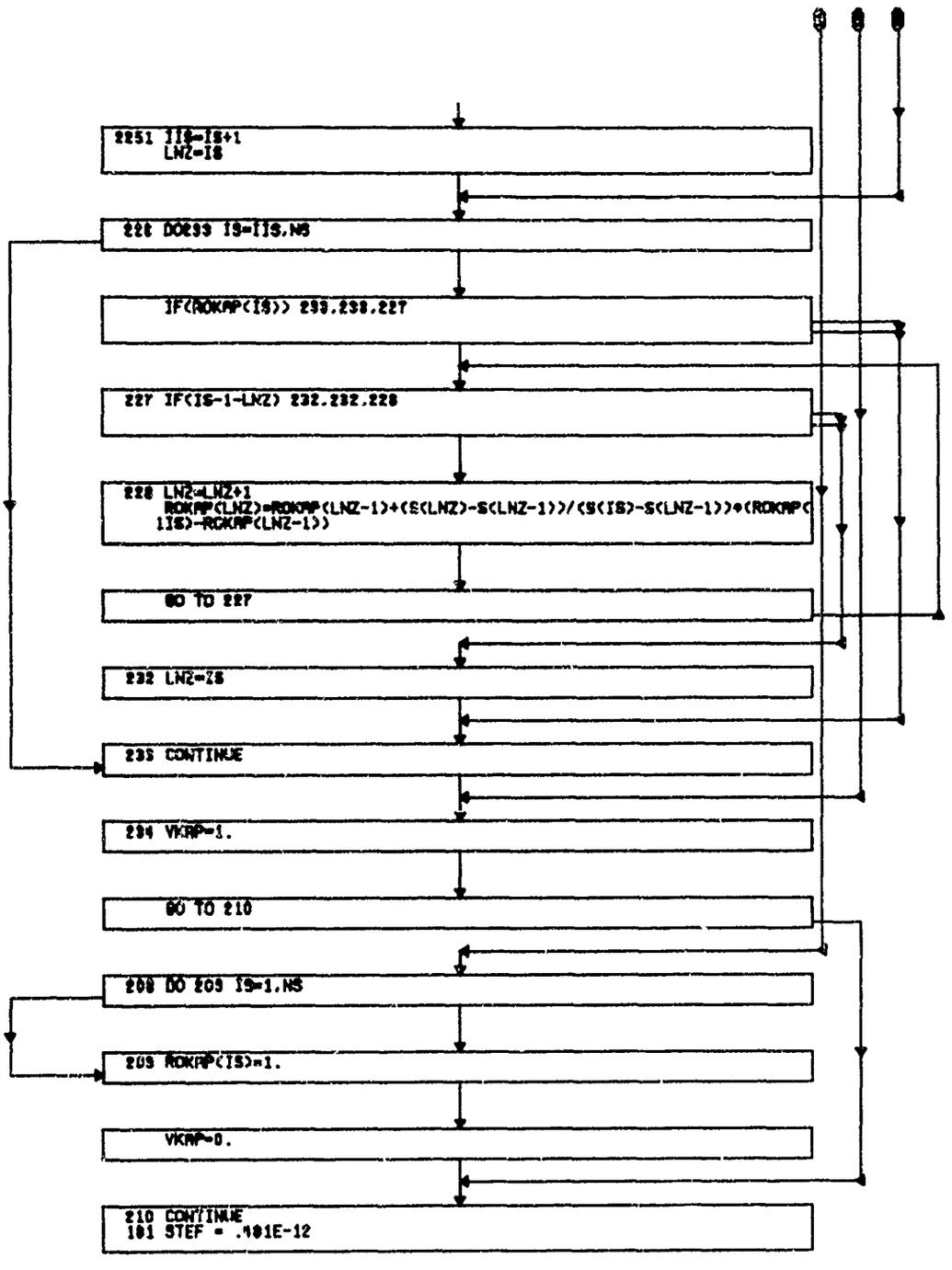
```
000179                  RETURN                                  B09A 140
000180                  END                                     B09A 141
```

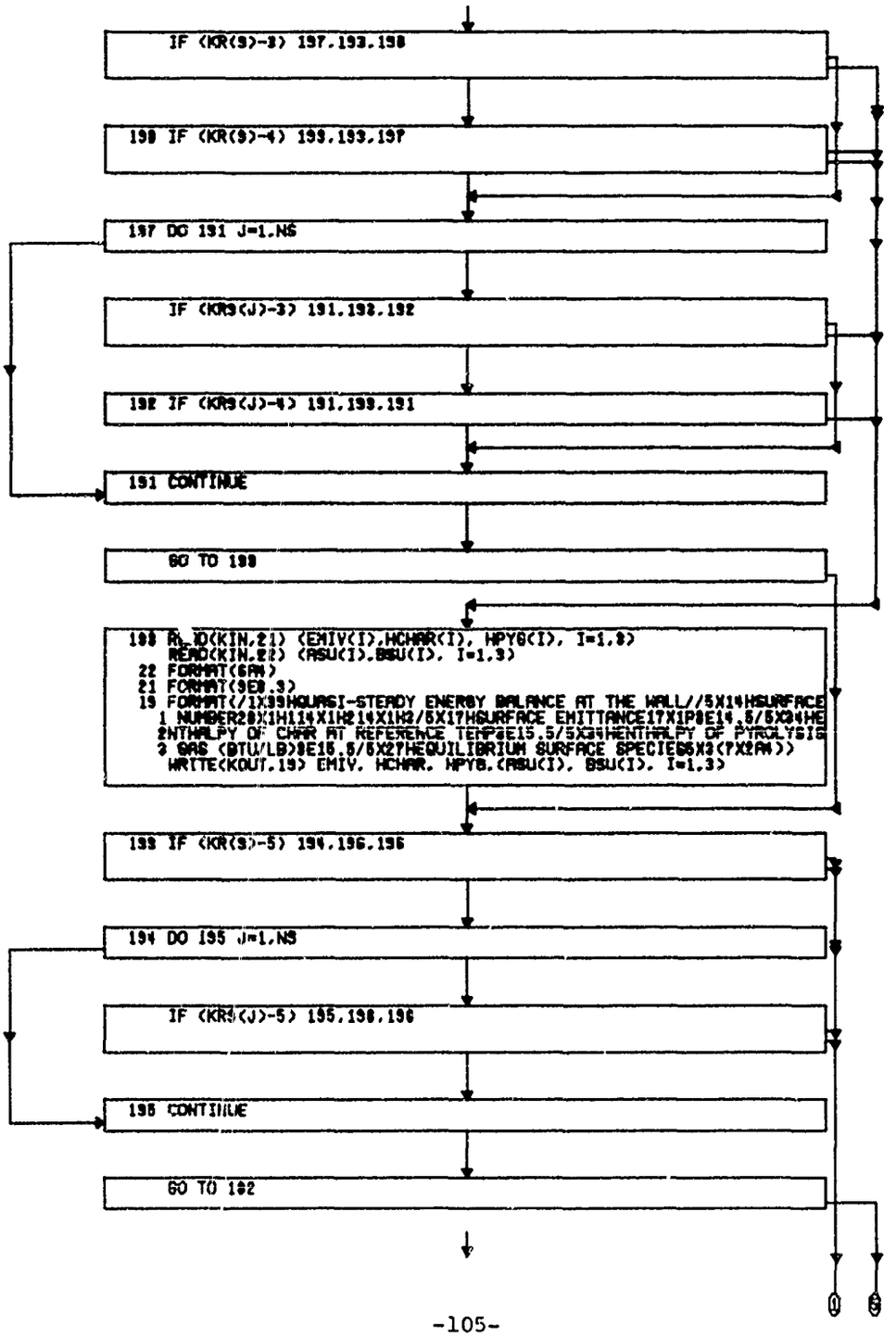
c. Flow Chart

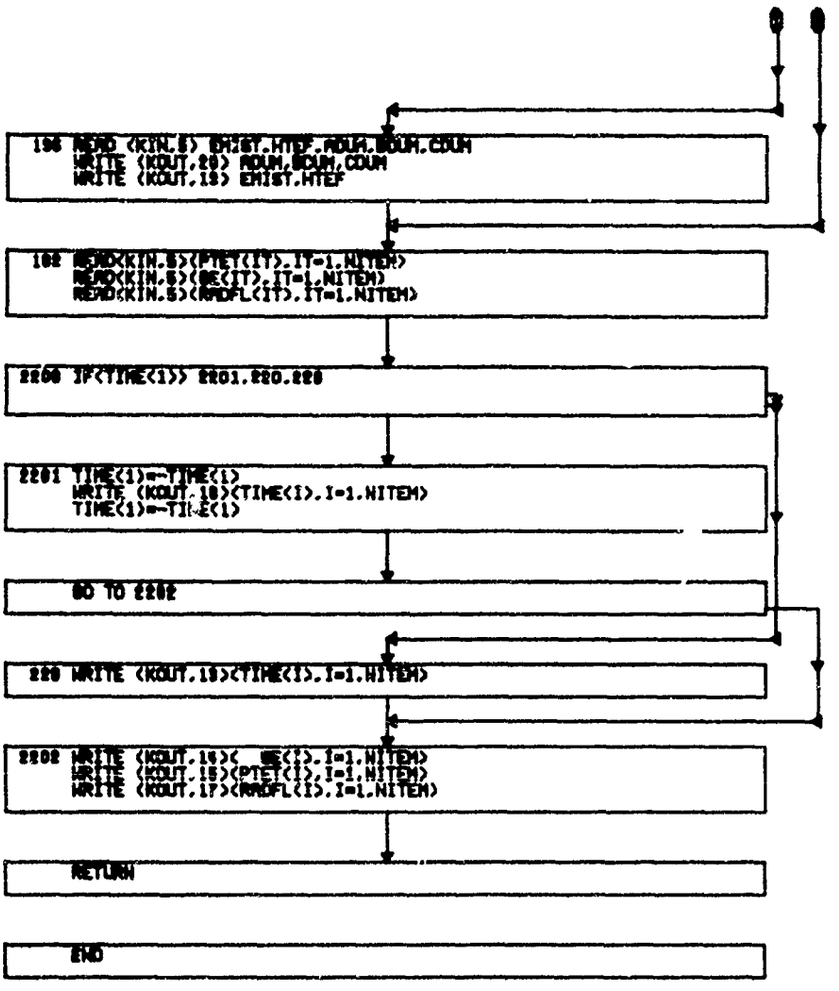

CB09A
SUBROUTINE RECASE
DATA MD(2)/8H /
CALL DATE (S,MD)
CALL TOD (10, MD)
READ(KIN,1)KR,CASE
READ(KIN,16) IDENT,JSPEC,JTIME
WRITE(KOUT,4) MD,CASE,KR,IDENT,JSPEC
KQ(8)=0
IF(KR(6)-8) 245,240,245
240 KQ(8)=-1
KR(6)=4
GO TO 255
245 IF(KR(6)-4) 255,255,250
250 KQ(8)=1
KR(6)=KR(6)-5
255 READ(KIN,24) NSP,KS
24 FORMAT(I2,8X70I1)
NSPM1=NSP-1
READ (KIN,8) NTIME,(TIME(IT),IT=1,NTIME)
NITEM=NTIME
NTIME=1
READ(KIN,24) NS,KR8
READ(KIN,5)(S(IS),IS=1,NS)
KAUXO=1
IF(KR (14)-2) 303,303,302
302 KAUXO=KR (14)-1
KR (14)=KR (14)-3
C COMPUTE INFORMATION NEEDED TO CONSIDER DISCONTINUITIES
303 J=1
102 MSO(1)=1
IDISC(1)=1
S(1)=ABS(S(1))


IF (NS-1) 105.105.1021
1021 DO 101 IS=2,NS
IDISC(IS)=0
IF(S(IS)) 103.101.101
103 MSD(J)=IS-MSD(J)+1
S(IS)=-S(IS)
IDISC(IS)=1
J=J+1
MSD(J)=IS
101 CONTINUE
105 MSD(J)=NS-MSD(J)+1
NDISC=J-1
IF (KR(1)) 1051.1051.1052
1052 READ (KIN,9) NETA,(ETA(I),I=1,NETA)
READ (KIN,8) KAPPA,CBAR
1051 CONTINUE
605 WRITE(KOUT,11)
WRITE(KOUT,8) CBAR,KAPPA,(ETA(I),I=1,NETA)
606 IF(KR(6)-1) 203,203,204
208 READ (KIN,8) CONE, RNOSE
204 IF(IABS(KR(6)-2)-1) 207,208,207


207 READ (KIN,5)(ROKAP(IS),IS=1,NS)
IF (NS-1) 234,234,2071
2071 IIS=2
LNZ=1
IF(ROKAP(1)) 223,226,226
223 RRDNO=-ROKAP(1)
WRITE (KOUT, 12) RRDNO,CONE
ROKAP(1)=0.
DO 229 IS=1,NS
IF(ROKAP(IS)) 224,224,225
224 IF(KR(6)) 221,221,222
222 ROKAP(IS)=S(IS)*SIN(RRDNO/57.29578)
GO TO 225
221 ROKAP(IS)=RRDNO*SIN(S(IS)/RRDNO)
229 CONTINUE
GO TO 234
225 IF (IS-NS) 2251,234,234


2251 IIS=IS+1
LNZ=IS
226 DO233 IS=IIS,NS
IF(ROKAP(IS)) 233,238,227
227 IF(IS-1-LNZ) 232,232,228
228 LNZ=LNZ+1
ROKAP(LNZ)=ROKAP(LNZ-1)+(S(LNZ)-S(LNZ-1))/(S(IS)-S(LNZ-1))*(ROKAP(
1IS)-ROKAP(LNZ-1))
GO TO 227
232 LNZ=IS
233 CONTINUE
234 VKAP=1.
GO TO 210
208 DO 209 IS=1,NS
209 ROKAP(IS)=1.
VKAP=0.
210 CONTINUE
101 STEP = .101E-12


IF (KR(9)-3) 197,193,198
198 IF (KR(9)-4) 199,193,197
197 DO 191 J=1,NS
IF (KR9(J)-3) 191,192,192
192 IF (KR9(J)-4) 191,199,191
191 CONTINUE
GO TO 198
198 READ(KIN,21) (EMIV(I),HCHAR(I), HPYB(I), I=1,8)
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 NUMBER20X1H114X1H214X1H3/5X17HSURFACE EMITTANCE17X1P8E14.5/5X24HE
2NTHALPY OF CHAR AT REFERENCE TEMP8E15.5/5X34HENTHALPY OF PYROLYSIS
3 GAS (BTU/LB)8E15.5/5X27HEQUILIBRIUM SURFACE SPECIES5X3(7X2A4))
WRITE(KOUT,19) EMIV, HCHAR, HPYB,(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 192
Q
S


100 READ (KIN,5) EMIST,HTEF,MDUM,BDUM,CDUM
WRITE (KOUT,20) MDUM,BDUM,CDUM
WRITE (KOUT,19) EMIST,HTEF
102 READ(KIN,5)(PTET(IT),IT=1,NTYER)
READ(KIN,5)(BE(IT),IT=1,NITEM)
READ(KIN,5)(RMDFL(IT),IT=1,NITEM)
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,18)(TIME(I),I=1,NITEM)
2202 WRITE (KOUT,16)(BE(I),I=1,NITEM)
WRITE (KOUT,15)(PTET(I),I=1,NITEM)
WRITE (KOUT,17)(RMDFL(I),I=1,NITEM)
RETURN
END

10. SUBROUTINE HISTXI - B10A

a. Function

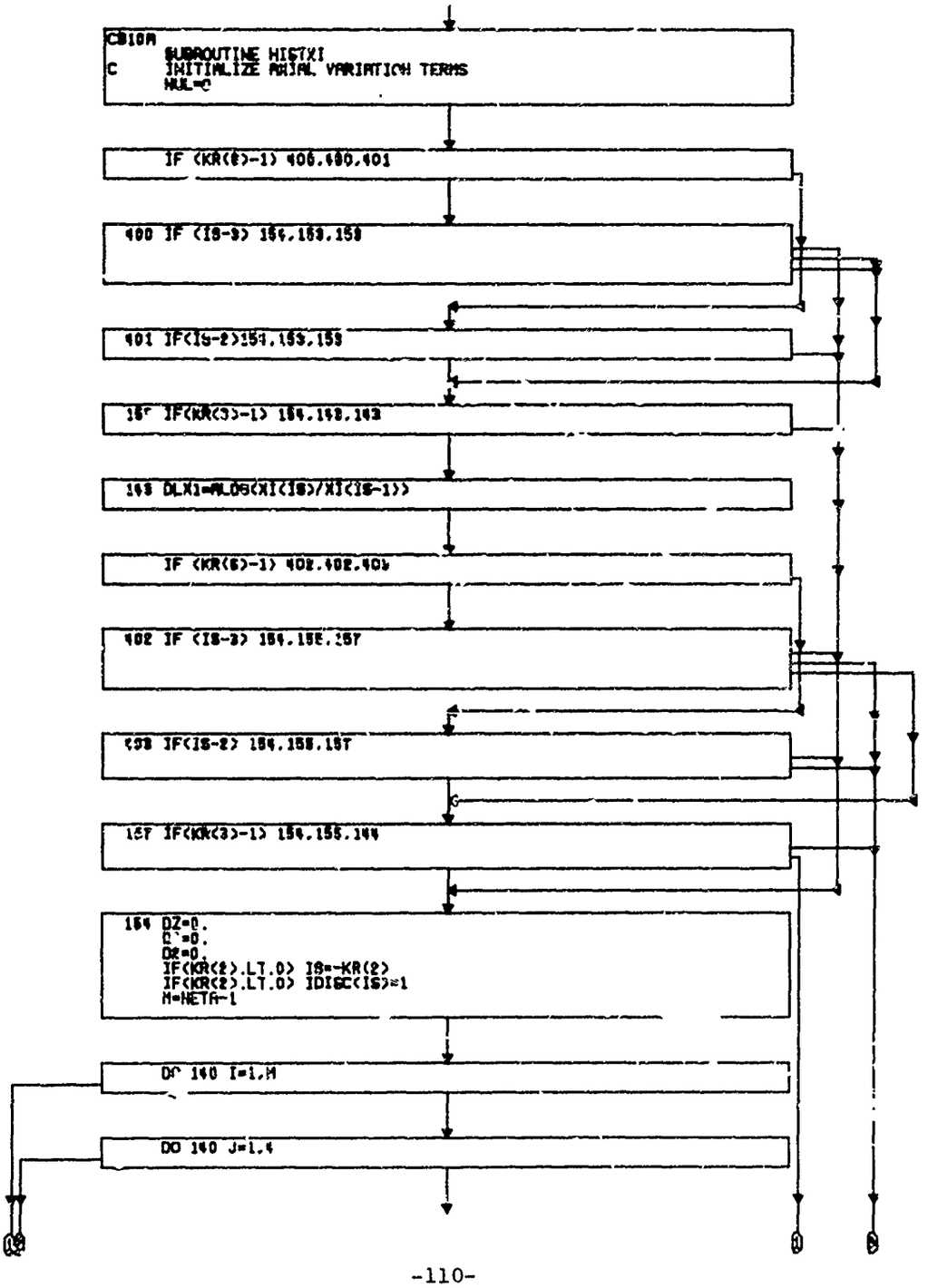
Computes terms involving derivatives with respect to XI (i.e., non-similar terms) and stores those upstream quantities needed for these difference relations. Called by SETUP. Calls TAYLOR.

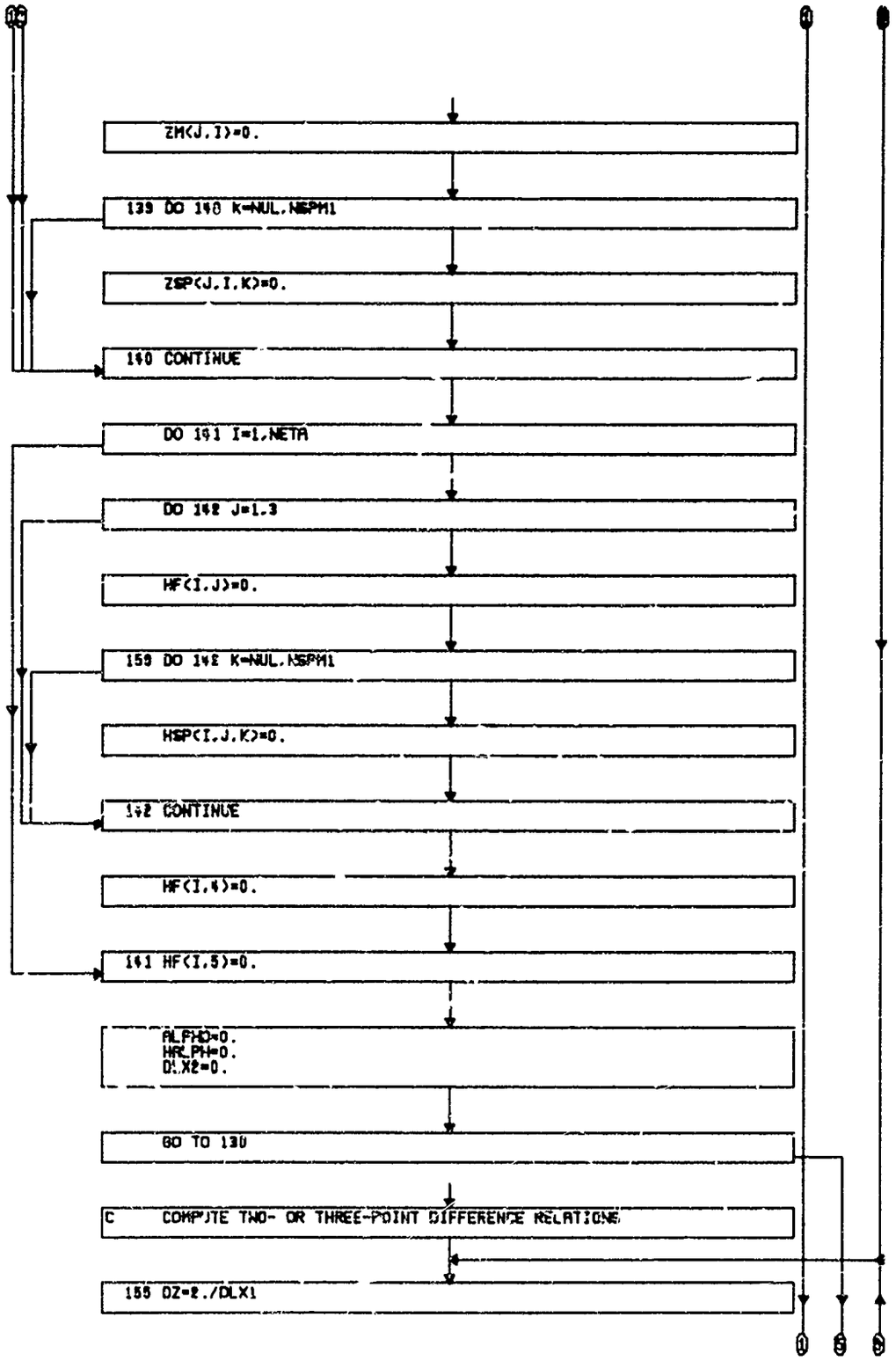
b. Listing

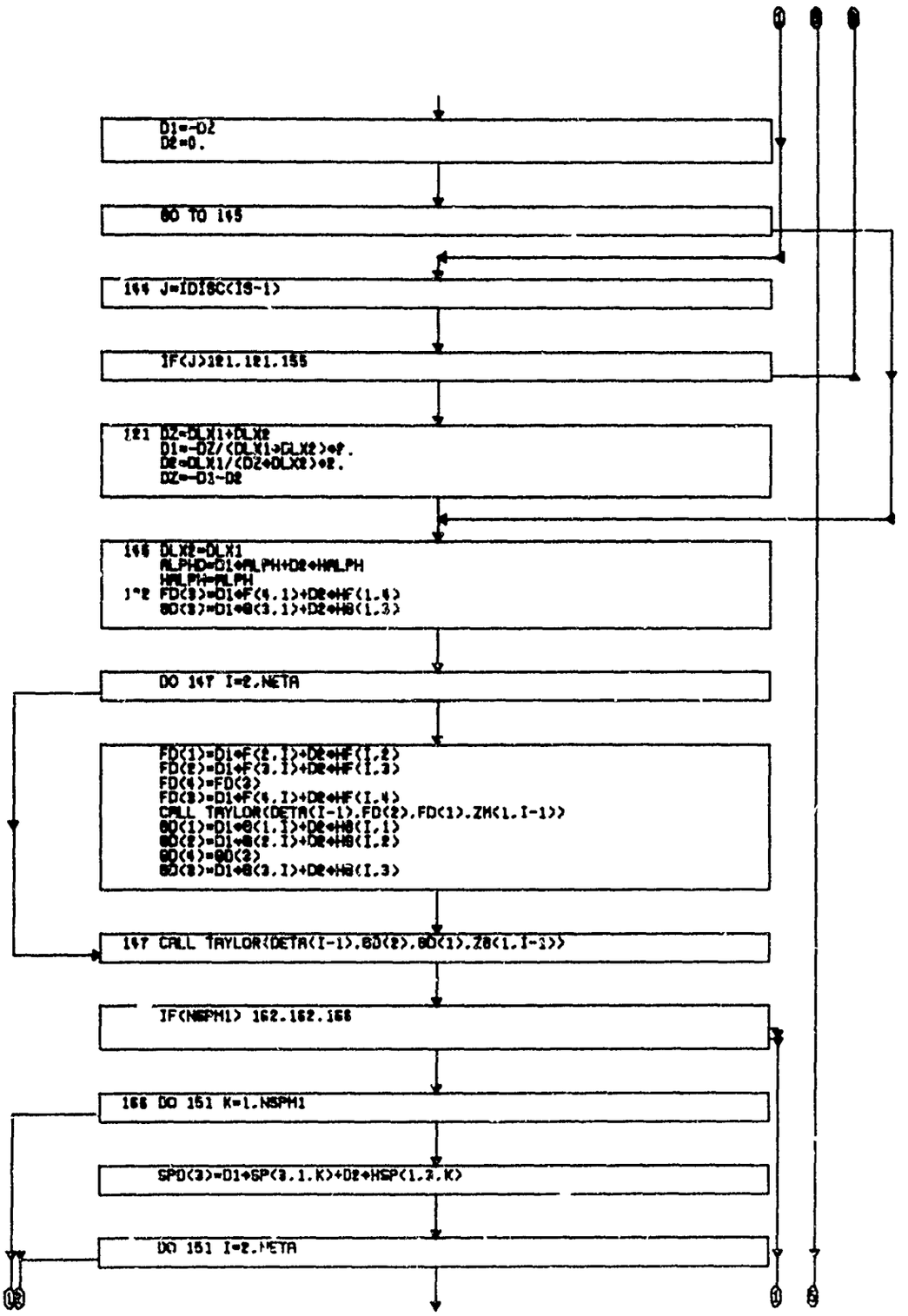
```
000001      CB10A                                                          B10A 001
000002            SUBROUTINE HISTXI                                        B10A 002
000003            COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),R1(14),B2(14)   B10A   3*NEW
000004           1,LAR(153),BA1(43,18),BA2(30,15)                          B10A   4*NEW
000005            COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, *B10A   5*NEW
000006           1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFH,DLX2  B10A   6*NEW
000007           2,G3Y(40),BETAM(40)                                       B10A   7*NEW
000008            COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB10A   8*NEW
000009           1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B10A   9*NEW
000010           2,B(8),      NWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,ICENT,KR9(40) B10A  10*NEW
000011           3,KAUXQ,JTIMF,JSPEC,MD(3)                                 B10A  11*NEW
000012            COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B10A  12*NEW
000013           1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO,  B10A  13*NEW
000014           2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                   B10A  14*NEW
000015            COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH            B10A  15*NEW
000016            DIMENSION FD(4),GD(4),SPD(4)                              B10A 016*-18
000017      C     INITIALIZE AXIAL VARIATION TERMS                          B10A 019
000018            NUL=0                                                     B10A 020
000019            IF (KR(6)-1) 400,400,401                                  B10A 021
000020       400  IF (IS-3) 154,153,153                                     B10A 022
000021       401  IF(IS-2)154,153,153                                       B10A 023
000022       153  IF(KR(3)-1) 154,143,143                                   B10A 024
000023       143  DLX1=ALOG(XI(IS)/XI(IS-1))                               B10A 025
000024            IF (KR(6)-1) 402,402,403                                  B10A 026
000025       402  IF (IS-3) 154,155,157                                     B10A 027
000026       403  IF(IS-2) 154,155,157                                      B10A 028
000027       157  IF(KR(3)-1) 154,155,144                                   B10A 029
000028       154  D2=0.                                                     B10A 030
000029            D1=0.                                                     B10A 031
000030            D2=0.                                                     B10A 032
000031            IF(KR(2),LT.0) IS=-KR(2)
000032            IF(KR(2),LT.0) IDISC(IS)=1
000033            M=NETA-1                                                  B10A 033
000034            DO 140 I=1,M                                              B10A 034
000035            DO 140 J=1,4                                              B10A 035
000036            ZM(J,I)=0.                                                B10A 036
000037       139  DO 140 K=NUL,NSPM1                                        B10A 037
000038            ZSP(J,I,K)=0.                                             B10A 038
000039       140  CONTINUE                                                  B10A 039
000040            DO 141 I=1,NETA                                           B10A 040
000041            DO 142 J=1,3                                              B10A 041
000042            HF(I,J)=0.                                                B10A 042
000043       159  DO 142 K=NUL,NSPM1                                        B10A 043
000044            HSP(I,J,K)=0.                                             B10A 044
000045       142  CONTINUE                                                  B10A 045
000046            HF(I,4)=0.                                                B10A 046
000047       141  HF(I,5)=0.                                                B10A 047
000048            ALPHD=0.                                                  B10A 048
000049            HALPH=0.                                                  B10A 049
000050            DLX2=0.                                                   B10A 050
000051            GO TO 130                                                 B10A 051
000052      C     COMPUTE TWO- OR THREE-POINT DIFFERENCE RELATIONS           B10A 052
000053       155  D2=2./DLX1                                                B10A 053
000054            D1=-D2                                                    B10A 054
000055            D2=0.                                                     B10A 055
000056            GO TO 145                                                 B10A 056
000057       144  J=IDISC(IS-1)                                             B10A 057
000058            IF(J)121,121,155                                          B10A 058
```

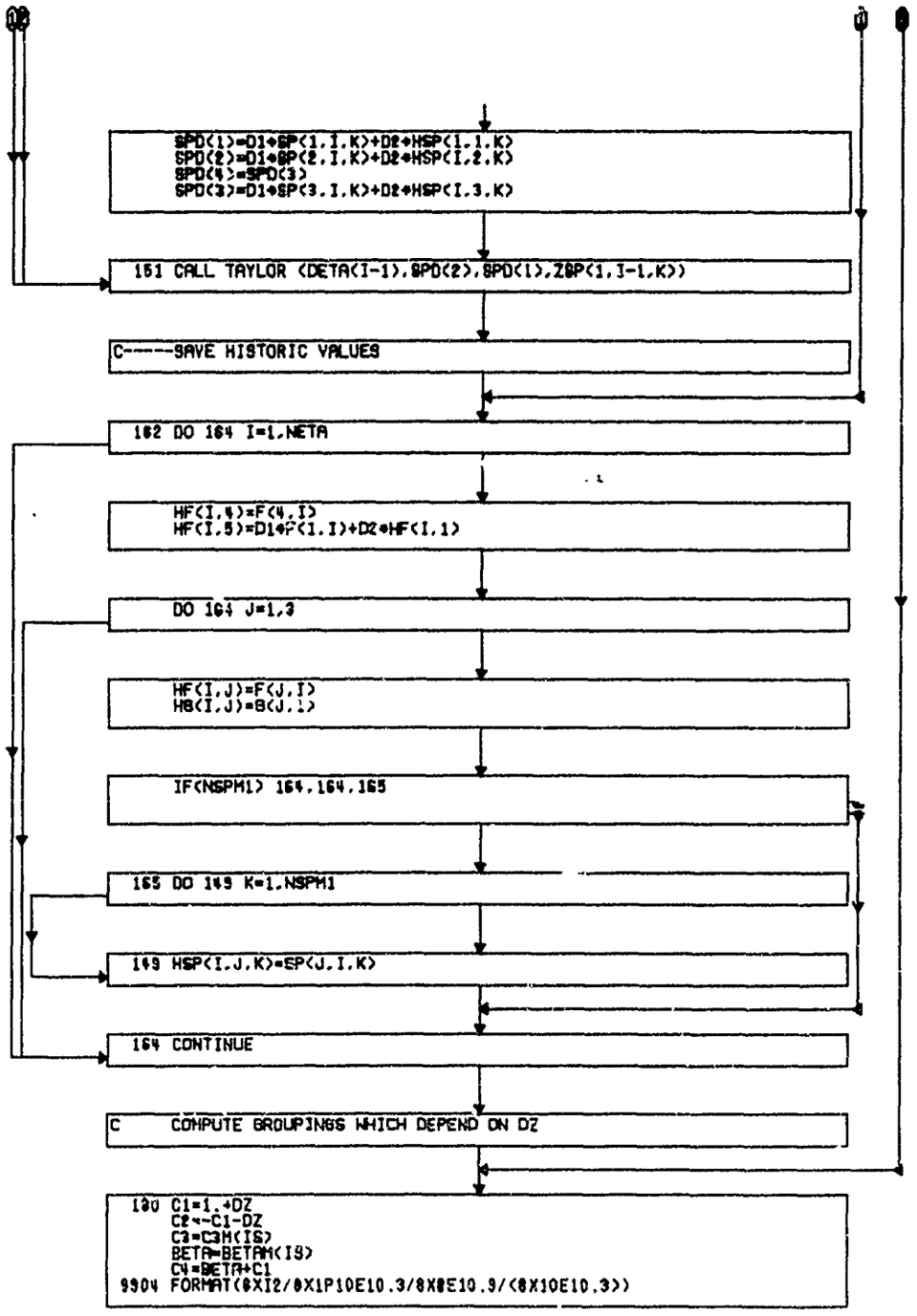
```
000059              171 D7=DLX1+DLX2                                                B10A 059
000060                  D1=-DZ/(DLX1*DLX2)*2.                                       B10A 060
000061                  D2=DLX1/(DZ*DLX2)*2.                                        B10A 061
000062                  D7=-D1-D2                                                   B10A 062
000063              145 DLX2=DLX1                                                   B10A 063
000064                  ALPHD=D1*ALPH+D2*HALPH                                      B10A 064
000065                  HALPH=ALPH                                                  B10A 065
000066              172 FD(3)=D1*F(4,1)+D2*HF(1,4)                                  B10A 066
000067                  GD(3)=D1*G(3,1)+D2*HG(1,3)                                  B10A 067
000068                  DO 147 I=2,NETA                                             B10A 068
000069                  FD(1)=D1*F(2,I)+D2*HF(I,2)                                  B10A 069
000070                  FD(2)=D1*F(3,I)+D2*HF(I,3)                                  B10A 070
000071                  FD(4)=FD(3)                                                 B10A 071
000072                  FD(3)=D1*F(4,I)+D2*HF(I,4)                                  B10A 072
000073                  CALL TAYLOR(DETA(I-1),FD(2),FD(1),ZM(1,I-1))                B10A 073
000074                  GD(1)=D1*G(1,I)+D2*HG(I,1)                                  B10A 074
000075                  GD(2)=D1*G(2,I)+D2*HG(I,2)                                  B10A 075
000076                  GD(4)=GD(3)                                                 B10A 076
000077                  GD(3)=D1*G(3,I)+D2*HG(I,3)                                  B10A 077
000078              147 CALL TAYLOR(DETA(I-1),GD(2),GD(1),ZG(1,I-1))                B10A 078
000079                  IF(NSPM1) 162,162,166                                       B10A 079
000080              166 DO 151 K=1,NSPM1                                            B10A 080
000081                  SPD(3)=D1*SP(3,1,K)+D2*HSP(1,3,K)                           B10A 081
000082                  DO 151 I=2,NETA                                             B10A 082
000083                  SPD(1)=D1*SP(1,I,K)+D2*HSP(I,1,K)                           B10A 083
000084                  SPD(2)=D1*SP(2,I,K)+D2*HSP(I,2,K)                           B10A 084
000085                  SPD(4)=SPD(3)                                               B10A 085
000086                  SPD(3)=D1*SP(3,I,K)+D2*HSP(I,3,K)                           B10A 086
000087              151 CALL TAYLOR (DETA(I-1),SPD(2),SPD(1),ZSP(1,I-1,K))          B10A 087
000088             C-----SAVE HISTORIC VALUES                                       B10A 088
000089              162 DO 164 I=1,NETA                                             B10A 089
000090                  HF(I,4)=F(4,I)                                              B10A 090
000091                  HF(I,5)=D1*F(1,I)+D2*HF(I,1)                                B10A 091
000092                  DO 164 J=1,3                                                B10A 092
000093                  HF(I,J)=F(J,I)                                              B10A 093
000094                  HG(I,J)=G(J,I)                                              B10A 094
000095                  IF(NSPM1) 164,164,165                                       B10A 095
000096              165 DO 149 K=1,NSPM1                                            B10A 096
000097              149 HSP(I,J,K)=SP(J,I,K)                                        B10A 097
000098              164 CONTINUE                                                    B10A 098
000099             C    COMPUTE GROUPINGS WHICH DEPEND ON DZ                        B10A 099
000100              130 C1=1.+DZ                                                    B10A 100
000101                  C2=-C1-DZ                                                   B10A 101
000102                  C3=C3M(IS)                                                  B10A 102
000103                  BETA=BETAM(IS)                                              B10A 103
000104                  C4=BETA+C1                                                  B10A 104
000105               9904 FORMAT(6X12/8X1P10E10.3/8X8E10.3/(8X10E10.3))             B10A 105
000106                  IF(KR(17)) 9905,9906,9905                                   B10A 106
000107               9905 CONTINUE                                                  B10A 107
000108                  WRITE(KOUT,9907)                                            B10A 108
000109               9907 FORMAT(2X27HDEBUG IS,DLX1...,ZM,ZG,HF,HG)                 B10A 109
000110                  WRITE(KOUT,9904) IS,DLX1,DLX2,DZ,D1,D2,ALPHD,HALPH,C1,C2,C4,    FOB10A 110
000111                 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
000112                 2 J=1,5),I=1,7),((HG(I,J),J=1,3),I=1,7)                     B10A 112
000113                  IF(NSPM1) 9906,9906,990°                                    B10A 113
000114               9908 WRITE(KOUT,9909)(((ZSP(I,J,K),K=1,NSPM1),J=1,6),I=1,4),(((HSP(I,J,B10A 114
000115                 1 K),K=1,NSPM1),J=1,3),I=1,7)                               B10A 115
000116               9909 FORMAT(2X13HDEBUG ZSP,HSP/(2X10F10.3))                    B10A 116
000117               9906 CONTINUE                                                  B10A 117
000118                  RETURN                                                      B10A 118
000119                  END                                                         B10A 119
```

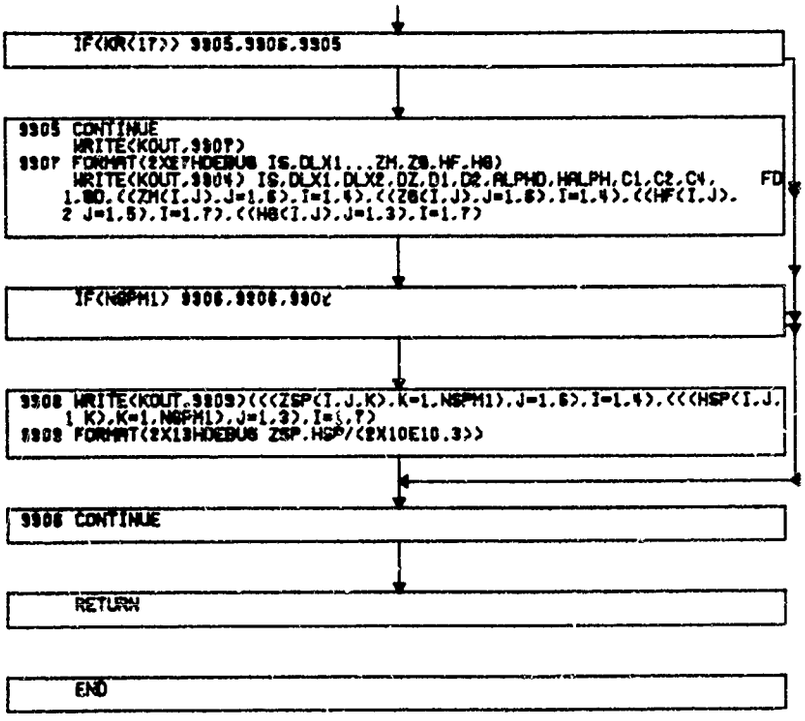
c. Flow Chart


C$IBM
SUBROUTINE HISTXI
C INITIALIZE AXIAL VARIATION TERMS
HUL=0
IF (KR(2)-1) 400,400,401
400 IF (IS-3) 154,153,153
401 IF(IS-2)154,153,153
15? IF(KR(3)-1) 154,152,152
152 DLX1=ALOG(XI(IS)/XI(IS-1))
IF (KR(6)-1) 402,402,404
402 IF (IS-3) 154,155,157
155 IF(IS-2) 154,155,157
157 IF(KR(3)-1) 154,155,144
154 DZ=0.
DY=0.
DX=0.
IF(KR(2).LT.0) IS=-KR(2)
IF(KR(2).LT.0) IDISC(IS)=1
M=NETA-1
DO 140 I=1,M
DO 140 J=1,4


ZM(J,I)=0.
139 DO 140 K=NUL,NSPM1
ZSP(J,I,K)=0.
140 CONTINUE
DO 141 I=1,NETA
DO 142 J=1,3
HF(I,J)=0.
159 DO 142 K=NUL,NSPM1
HSP(I,J,K)=0.
142 CONTINUE
HF(I,4)=0.
141 HF(I,5)=0.
ALPHO=0.
HRLPH=0.
DLX2=0.
GO TO 130
C COMPUTE TWO- OR THREE-POINT DIFFERENCE RELATIONS
155 DZ=2./DLX1


D1=-DZ
D2=0.
GO TO 165
144 J=IDISC(IS-1)
IF(J)121.121.155
121 DZ=DLX1+DLX2
D1=-DZ/(DLX1*DLX2)*2.
D2=DLX1/(DZ*DLX2)*2.
DZ=-D1-D2
146 DLX2=DLX1
ALPHD=D1*ALPH+D2*HALPH
HALPH=ALPH
142 FD(3)=D1*F(4.1)+D2*HF(1.4)
GD(3)=D1*G(3.1)+D2*HG(1.3)
DO 147 I=2.NETA
FD(1)=D1*F(2.I)+D2*HF(I.2)
FD(2)=D1*F(3.I)+D2*HF(I.3)
FD(4)=FD(3)
FD(3)=D1*F(4.I)+D2*HF(I.4)
CALL TAYLOR(DETA(I-1).FD(2).FD(1).ZM(1.I-1))
GD(1)=D1*G(1.I)+D2*HG(I.1)
GD(2)=D1*G(2.I)+D2*HG(I.2)
GD(4)=GD(3)
GD(3)=D1*G(3.I)+D2*HG(I.3)
147 CALL TAYLOR(DETA(I-1).GD(2).GD(1).ZG(1.I-1))
IF(NSPM1) 162.162.166
166 DO 151 K=1.NSPM1
SPD(3)=D1*SP(3.1.K)+D2*HSP(1.2.K)
DO 151 I=2.NETA


SPD(1)=D1*SP(1,I,K)+D2*HSP(1,I,K)
SPD(2)=D1*SP(2,I,K)+D2*HSP(I,2,K)
SPD(4)=SPD(3)
SPD(3)=D1*SP(3,I,K)+D2*HSP(I,3,K)
151 CALL TAYLOR (DETA(I-1),SPD(2),SPD(1),ZSP(1,I-1,K))
C-----SAVE HISTORIC VALUES
162 DO 164 I=1,NETA
HF(I,4)=F(4,I)
HF(I,5)=D1*F(1,I)+D2*HF(I,1)
DO 164 J=1,3
HF(I,J)=F(J,I)
HB(I,J)=B(J,I)
IF(NSPM1) 164,164,165
165 DO 169 K=1,NSPM1
169 HSP(I,J,K)=SP(J,I,K)
164 CONTINUE
C COMPUTE GROUPINGS WHICH DEPEND ON DZ
180 C1=1.+DZ
C2=-C1-DZ
C3=C3M(IS)
BETA=BETAM(IS)
CV=BETA+C1
9904 FORMAT(8X12/8X1P10E10.3/8X8E10.9/(8X10E10.3))


IF(KR(17)) 9905,9906,9905
9905 CONTINUE
WRITE(KOUT,9907)
9907 FORMAT(2XE7HDEBUG IS,DLX1...ZM,ZB,HF,HB)
WRITE(KOUT,9904) IS,DLX1,DLX2,DZ,D1,D2,ALPHD,HALPH,C1,C2,C4,
1,80,((ZM(I,J),J=1,6),I=1,4),((ZB(I,J),J=1,6),I=1,4),((HF(I,J),
2 J=1,5),I=1,7),((HB(I,J),J=1,3),I=1,7)
IF(NSPM1) 9908,9908,9902
9908 WRITE(KOUT,9909)(((ZSP(I,J,K),K=1,NSPM1),J=1,6),I=1,4),(((HSP(I,J,
1 K),K=1,NSPM1),J=1,3),I=1,7)
9909 FORMAT(2X13HDEBUG ZSP,HSP/(2X10E10.3))
9906 CONTINUE
RETURN
END

11. SUBROUTINE OUTPUT - B11A

a. Function

Prints standard boundary layer output block for converged solution or, if requested, at the end of each iteration. Called by BLIMP.

b. Listing

```
000001        CH11A                                                                 B11A 001
000002              SUBROUTINE OUTPUT                                               B11A 002
000003              DIMENSION CIJ( 71,1)                                            B11A  03*NEW
000004              COMMON/BLOCOM/ ROA( 71),  ROR( 71),NSPEC,FR( 71,15),W(3),LEF(10) B11A   4*NEW
000005             1,LEFS(10),PLEASE,LEFW(10)                                       B11A   5*NEW
000006              COMMON/COECOM/                 C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B11A   6*NEW
000007             1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB11A   7*NEW
000008             232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C4BB11A   8*NEW
000009             3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB11A   9*NEW
000010             465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B11A  10*NEW
000011             5,C82,C83,C84,C85,C86,C87,C88                                    B11A  11*NEW
000012              COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B11A  12*NEW
000013             1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B11A  13*NEW
000014             2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B11A  14*NEW
000015             3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 5)B11A  15*NEW
000016             4,CKK3( 8, 8)                                                    B11A  16*NEW
000017              COMMON/CHRCOM/HCARB,EMIS,STFF,ADUM,BDUM,CDUM,HTEF,HMAT,EMISC,EMISTB11A  17*NEW
000018             1,HPG,ASU(3),BSU(3),HPYG(3),HCHAR(3),EMIV(3),KS(40),ISU          B11A  18*NEW
000019              COMMON/EDGCOM/              PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B11A  19*NEW
000020             1UF(40),RHOE(40),VMUF(40),TE(40),UFDGE,DUEDGE,D2UEDG,VMWE,HE,C90 B11A  20*NEW
000021             2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                  B11A  21*NEW
000022              COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,   B11A  22*NEW
000023             1EPSA(15),EPS1,EL(15),CPI(15,2),DLI(153),DEPS(153),DEPC,TREF,RETR B11A  23*NEW
000024              COMMON/EQPCOM/  RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B11A  24*NEW
000025             1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10), B11A  25*NEW
000026             2 AAT(10),IR(10),IZ,KZ(10),LAMI( 71),P,Z,TK(10, 7),VN( 71),      B11A  26*NEW
000027             3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),YYY( 71),YW( 71),GG( 71)B11A  27*NEW
000028             4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                 B11A  28*NEW
000029              COMMON/EGTCOM/SIP,HIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B11A  29*NEW
000030             1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,BX,ISP2,ISPQ, B11A  30*NEW
000031             2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HHG,B11A  31*NEW
000032             3 CCPG,TTMIN,TTMAX,L2,L3,IR(11),FH(10),EBL(10),A(16,16),BB(16),  B11A  32*NEW
000033             4 TH( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),SLAM(10),DY( 71),RVS,B11A  33*NEW
000034             5 CP( 71),HH( 71),SR( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),     B11A  34*NEW
000035             6 RC(10),BLNK(10),AY(10),IBC(10),BE(10),JZ( 4)                   B11A  35*NEW
000036              COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)    B11A  36*NEW
000037             1,LAR(153),BA1(43,18),BA2(30,15)                                 B11A  37*NEW
000038              COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ      B11A  38*NEW
000039             1,WALLJ( 8),QW,VJKW( 9),TPWALL                                   B11A  39*NEW
000040              COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA ZM(4,14),ZG(4,14),ZSP(4,14, 8B11A  40*NEW
000041             1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2B11A  41*NEW
000042             2,C3M(40),BETAM(40)                                              B11A  42*NEW
000043              COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB11A  43*NEW
000044             1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B11A  44*NEW
000045             2,R(8),      MNE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B11A  45*NEW
000046             3,KAUXO,JTIME,JSPEC,MD(3)                                        B11A  46*NEW
000047              COMMON/OUTCOM/Y(15),RES,DELST,THENGY,THMOM,CH,BLOW,SHEAR,CF,SHAPE B11A  47*NEW
000048             1 ,CM( 9),THELEN( 9)                                             B11A  48*NEW
000049              COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B11A  49*NEW
000050             1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO, B11A  50*NEW
000051             2CONF,RADFL( 50),RADR(40),RADS(40),IRAD                          B11A  51*NEW
000052              COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)  B11A  52*NEW
000053             1,CPBAR(15),VMU(15),PHIK(15, 8),DRHOM,DPHOK( 8),ZK    ),DZKH( 8), DB11A  53*NEW
000054             2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DS     ),DCAPCK( 8)B11A  54*NEW
000055             3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K(       KK( 8, 8)  B11A  55*NEW
000056             4,DPHIKK( 8, 8),          DMU4H,DMU3H,DHTILH,VMU12,CP,CPR,CPTIL,HTIL B11A  56*NEW
000057             5, MU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B11A  57*NEW
000058             6, 5),PHIHP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15) B11A  58*NEW
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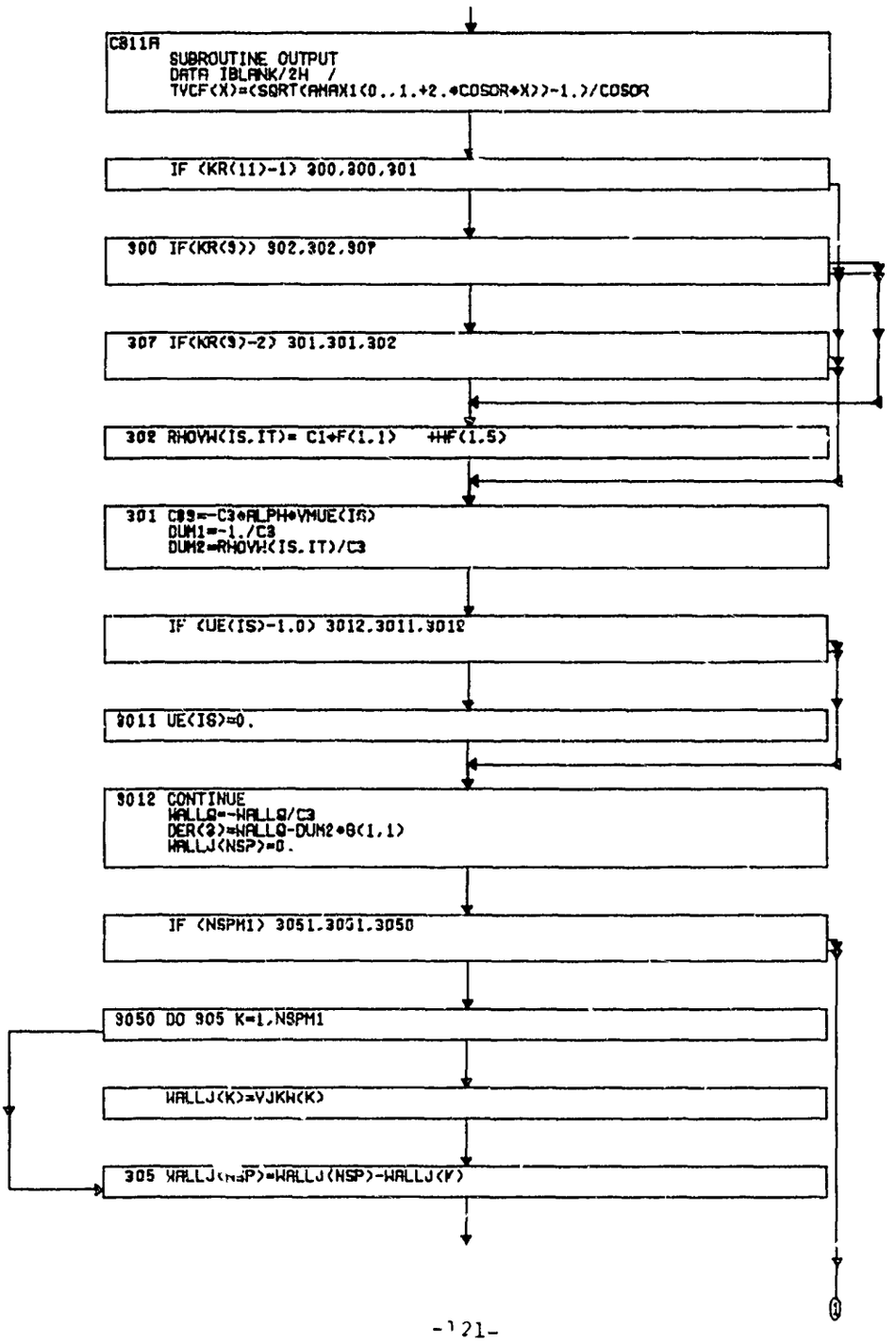
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000059          COMMON/TERCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)      B11A  58*NEW
000060         1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)      B11A  59*NEW
000061         2,XIINIT( 1),DUMS( 40)                                              B11A  60*NEW
000062          COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                     B11A  62*NEW
000063          COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8 ,  )            B11A  63*NEW
000064         1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHO  ,  )          B11A  64*NEW
000065          EQUIVALENCE           (VNU,CIJ)                                    B11A 0370-62
000066        1 FORMAT(/6X109H ALPHA        XI       ROKAP    PRESSURE      DUE  B11A 067
000067         1BETA     FLUX NOR=          HEAT FLUXES                  /3X110H
000068         2          (LB         (FT)     (ATM)    VELOCITY              MALIZINB11A 069
000069         3G DIFFUSIONAL TOT ENTH  RERAD       GCOND /3X11 H              /SEC)
000070         4**2                    (FT/SEC)            PARAMETER
000071         5(BTU/SEC SQ FT)                 /5X1P11E10.3)
000072        2 FORMAT / X109H  WALL                    MASS FLUXES              ELB11A 069
000073         1FUENTAL   SS DIFFUSIVE FLUXES (LB/SEC SQ FT) FOR          /5X 50H  B11A 070
000074         2SHEAR     ECH REM  PYROL GAS   CHAR    TOTAL GAS 8(1X2A4,1X))
000075       19 FORMAT                                                  (5X 50H(LB/SQ FT) B11A 073
000076         3            (LB/SEC SQ FT)                             )          B11A 074
000077        3 FORMAT(3X1P12E10.3)
000078       16 FORMAT(/6X109HMOM TRANS HEAT TRANS     BLOWING PARAMETERS       ELB11A 076
000079         1ENTAL MASS TRANSFER COEFFICIENTS,                        /5X110H  B11A 077
000080         2COEFF,    COEFF,          (BASED ON CH) FOR           RHOE*UE*CM (LB11A 078
000081         2B/SEC SQ FT) FOR                                      /4X51HRHO*UE*CF/2 B11A 079
000082         3RHO*UE*CH PYROL GAS   CHAR    TOTAL GAS                          B11A 080
000083         4 8(1X2A4,1X))
000084        4 FORMAT(5X110H MOMENTUM  DISPLACE  EFFECTIVE ENTHALPY  REYNOLDS  MA
000085         1SS THICKNESSES (FT) FOR                                  /5X110HTHB11A 083
000086         2ICKNESS,THICKNESS,   BODY   THICKNESS   NUMBER
000087         3                                                  /5X 50H  THETA    DELSTAB11A 085
000088         4R   DISPLACE,  LAMBDA   PER FOOT 8(1X2A4,1X))
000089       20 FORMAT(2X,4(6X,4H(FT))/5X1P12E10.3)
000090        5 FORMAT(/2X17HNODAL INFORMATION)                                  B11A 091
000091        6 FORMAT(9X9HDISTANCE,4X3HETA,8X1HF,9X2HFP,7X3HGPP,7X5HSHEAR,2X11HTA
000092         1TAL ENTH-,3X2HGP,7X3HGPP,6X6HSTATIC,5X4HTEMP,5X8HELECTRON/
000093         25X9HFROM WALL,23X7H(=U/UE),23X7HHALPY,G,23X8HENTHALPY,12X9HCOLL FR
000094         3ED/8X4H(FT),44X9H(LB/FTSQ),2X8H(BTU/LB),2X8H(BTU/LB),2X8H(BTU/LB),
000095         42X8H(BTU/LB),2X7H(DEG R),4X7H(1/SEC))
000096        7 FORMAT(5X110H DISTANCE  DENSITY, VISCOSITY, RHO*MU   SPECIFIC  THB11A 098
000097         1FRMAL   PRANDTL   MODIFIED MOLECULAR RHOSQ*EPS    MACH  /5X110HFR
000098         20M WALL    RHO         MU     /RHOE*MUE,   HEAT    COND (BTU  NUMBERB11A 100
000099         3   SCHMIDT    WEIGHT   /RHOE*MUE   NUMBER /3X110H   (FT)   (LB/CU
000100         4FT) LB/SEC FT    C      (BTU/LB R) /SEC FT R)            NUMBER     B11A 102
000101         5                        )                                          B11A 103
000102        8 FORMAT (/2X78HELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVB11A 104
000103         A TIVES WITH RESPECT TO ETA,/)                                     B11A 105
000104       12 FORMAT(/)                                                         B11A 126
000105       13 FORMAT(/   43X21HDISTANCE FROM WALL,FT/(15X,1P10E10.3/20X,
000106         1 1P9E10.3))
000107       14 FORMAT(6X,2A4,1X,1P10E10.3/20X,1P9E10.3/(15X,1P10E10.3/20X,
000108         1 9E10.3))
000109       15 FORMAT (15X,1P10E10.3/20X1P9E10.3)
000110       16 FORMAT (/2X14HMOLE FRACTIONS,/)                                   B 4 130
000111       17 FORMAT(/23H    SURFACE SPECIES IS 2A4)
000112      310 FORMAT(A2,3I2,1P6E12.5)                                           B11A 131
000113      312 FORMAT(A2,3I2,1P6E12.5/(8X,1P6E12.5))                             B11A 132
000114      313 FORMAT (A2,6X,18A4/(20A4))                                        B11A 133
000115          DATA IBLANK/2H  /
000116          TVCF(X)=(SQRT(AMAX1(0.,1.+2.*COSOR*X))-1.)/COSOR
000117          IF (KR(11)-1) 300,300,301                                         B11A 134
000118      300 IF(KR(9)) 302,302,307                                             B11A 135
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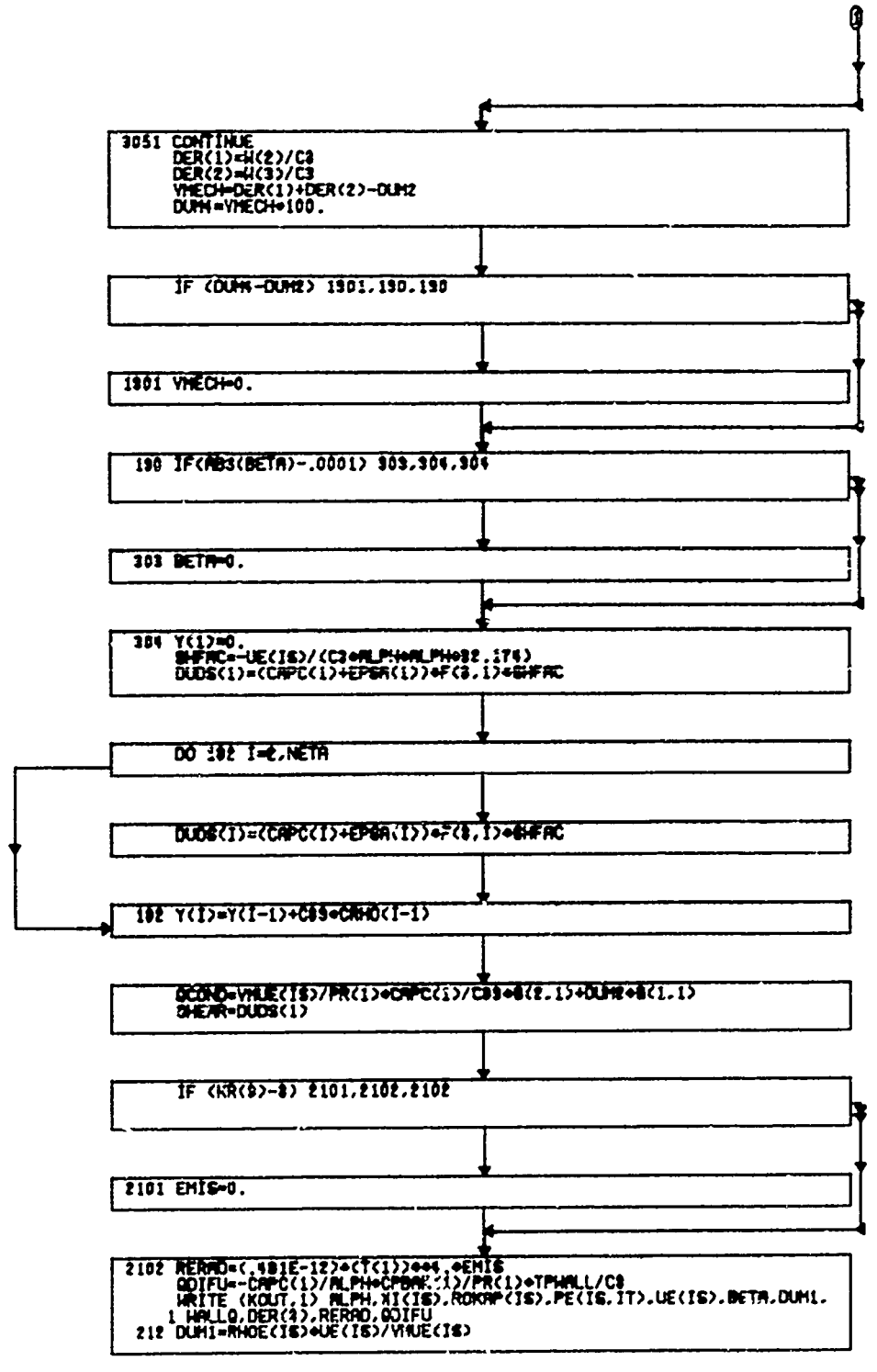
```
000119          307 IF(KR(9)-2) 301,301,302                                   B11A 136
000120          302 RHOVA(IS,IT)= C1*F(1,1)   +HF(1,5)                        B11A 137
000121          301 C89=-C3*ALPH*VMUE(IS)                                     B11A 140
000122              DUM1=-1./C3                                               B11A 141
000123              DUM2=RHOVA(IS,IT)/C3                                      B11A 142
000124              IF (UE(IS)-1.0) 3012,3011,3012                            B11A 143
000125          3011 UF(IS)=0.                                                B11A 144
000126          3012 CONTINUE                                                 B11A
000127              WALLG=-WALLQ/C3                                           B11A 147
000128              DER(3)=WALLQ-DUM2*G(1,1)                                  B11A 148
000129              WALLJ(NSP)=0.                                             B11A 149
000130              IF (NSPM1) 3051,3051,3050                                 B11A
000131          3050 DO 305 K=1,NSPM1                                         B11A
000132              WALLJ(K)=VJKW(K)                                          B11A 151
000133           305 WALLJ(NSP)=WALLJ(NSP)-WALLJ(K)                           B11A 152
000134          3051 CONTINUE                                                 B11A
000135              DER(1)=W(2)/C3                                            B11A 153
000136              DER(2)=W(3)/C3                                            B11A 154
000137              VMECH=DER(1)+DER(2)-DUM2                                  B11A 155
000138              DUM4=VMECH*100.                                           B11A 156
000139              IF (DUM4-DUM2) 1901,190,190                               B11A 157
000140          1901 VMECH=0.                                                 B11A 158
000141           190 IF(ABS(BETA)-.0001) 303,304,304                          B11A 159
000142           303 BETA=0.                                                  B11A 160
000143           304 Y(1)=0.                                                  B11A 161
000144              SHEAC=-UE(IS)/(C3*ALPH*ALPH*32.174)
000145              DUDS(1)=(CAPC(1)+EPSA(1))*F(3,1)*SHEAC
000146              DO 182 I=2,NETA                                           B11A 162
000147              DUDS(I)=(CAPC(I)+EPSA(I))*F(3,I)*SHEAC
000148           182 Y(I)=Y(I-1)+CR9*CRHO(I-1)                                B11A 163
000149              GCOND=VMUE(IS)/PR(1)*CAPC(1)/C89*G(2,1)+DUM2*G(1,1)       B11A 164
000150              SHEAR=DUDS(1)
000151              IF (KR(9)-3) 2101,2102,2102
000152          2101 EMIS=0.
000153          2102 RERAD=(.481E-12)*(T(1))**4,*EMIS
000154              QDIFU=-CAPC(1)/ALPH*CPBAR(1)/PR(1)*TPWALL/C3
000155              WRITE (KOUT,1) ALPH,XI(IS),ROKAP(IS),PE(IS,IT),UE(IS),BETA,DUM1,
000156             1 WALLQ,DER(3),RERAD,QDIFU
000157           212 DUM1=RHOE(IS)*UE(IS)/VMUE(IS)                            B11A 179
000158              CH= WALLQ  /       (G(1,NETA)-G(1,1))                     B11A 180
000159              CF=CAPC(1)/ALPH*VMUE(IS)/C89*F(3,1)                       B11A 181
000160           213 WRITE(KOUT,2) (ATA(K),ATB(K),K=1,NSP)                    B11A 183
000161              WRITE (KOUT,19)                                           B11A 184
000162              DUM4=ALPH*ALPH                                            B11A 185
000163              DO 203 I=1,NETA                                           B11A 186
000164              SP(1,I,NSP)=1.0                                           B11A 187
000165              SP(2,I,NSP)=0.                                            B11A 188
000166           203 SP(3,I,NSP)=0.                                           B11A 189
000167              IF (NSPM1) 2021,2021,2020                                 B11A
000168          2020 DO 202 K=1,NSPM1                                         B11A
000169              DO 202 I=1,NETA                                           B11A 191
000170              SP(1,I,NSP)=SP(1,I,NSP)-SP(1,I,K)                         B11A 192
000171              SP(2,I,K)=SP(2,I,K)/ALPH                                  B11A 193
000172              SP(2,I,NSP)=SP(2,I,NSP)-SP(2,I,K)                         B11A 194
000173              SP(3,I,K)=SP(3,I,K)/DUM4                                  B11A 195
000174           202 SP(3,I,NSP)=SP(3,I,NSP)-SP(3,I,K)                        B11A 196
000175          2021 CONTINUE                                                 B11A
000176              XSP(5,NSP)=F(1,NETA)-F(1,1)                               B11A 197
000177              IF(NSPM1) 2138,2138,2135
000178          2138 VJKW(1)=1.
```

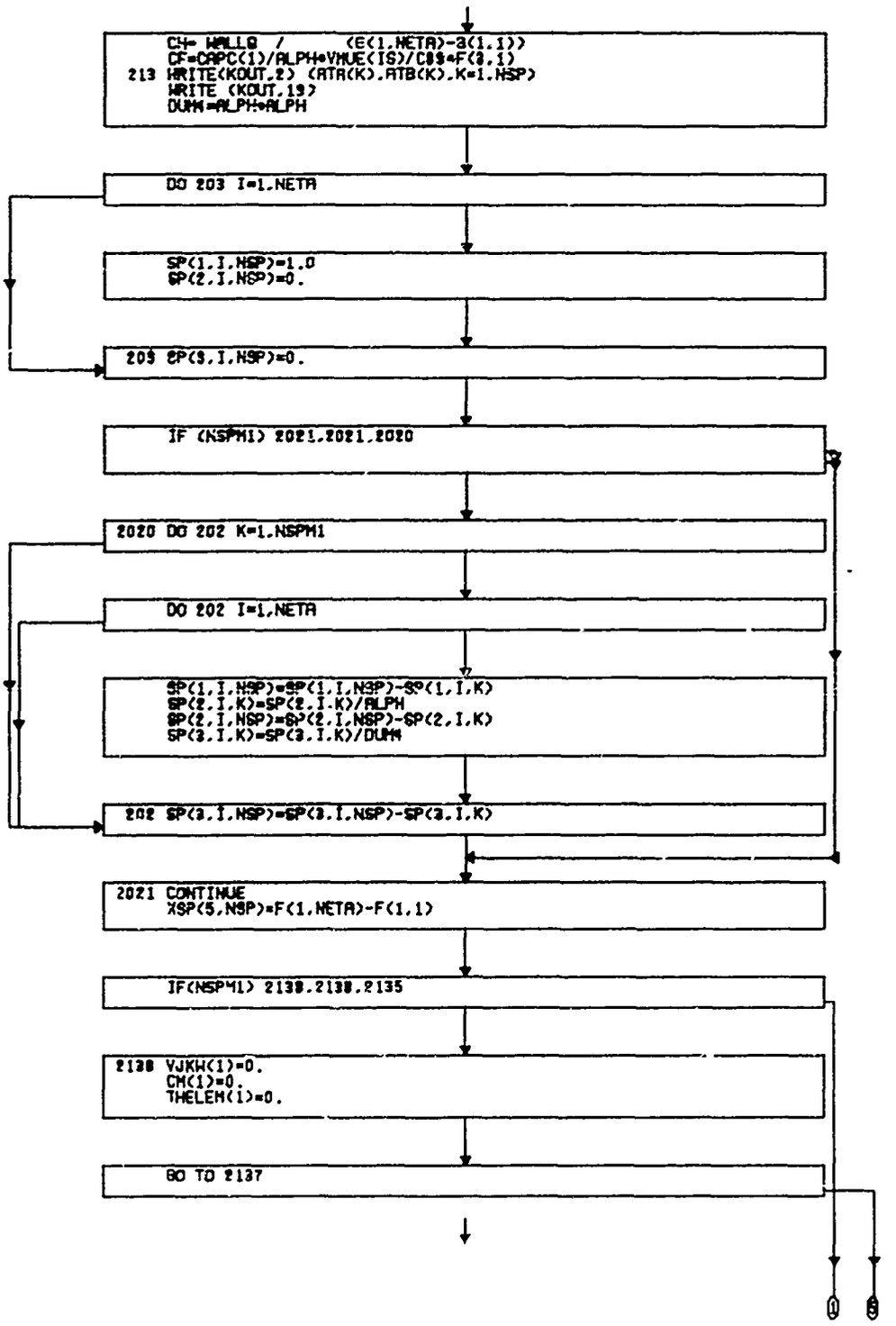
```
000179                CM(1)=0.
000180                THELEM(1)=0.
000181                GO TO 2137
000182           2135 DO 2136 I=1,NSPM1                                          B11A
000183           2136 XSP(5,NSP)=XSP(5,NSP)-XSP(5,I)                             B11A 199
000184                DO 2131 I=1,NSP                                            B11A 200
000185                VJKW(I)=0.                                                 B11A 201
000186                DO 2132 K=1,NSP                                            B11A 202
000187           2132 VJKW(I)=VJKW(I)-WALLJ(K)/WTM(K)*CIJ(I,K)                   B11A 203
000188           2131 VJKW(I)=VJKW(I)*WAT(I)                                     B11A 204
000189           2137 CONTINUE
000190                WRITE(KOUT,3) SHEAR,VMECH,DER(1),DER(2),DUM2,   (VJKW(I),I=1,NSP) B11A 205
000191            214 RES=DUM1*S(IS)                                             B11A 206
000192                DUM3=C89*(F(1,NETA)-F(1,1))/ALPH                           B11A 207
000193                DELST=Y(NETA)-DUM3                                         B11A 208
000194                RDELS=DUM1*DELST                                           B11A 209
000195                THENGY=(DUM3*G(1,NETA)-C89/ALPH*XG(5))/(G(1,NETA)-G(1,1))  B11A 210
000196                RETHEN=DUM1*THENGY                                         B11A 211
000197                THMOM=DUM3-C89/ALPH*XM(5)/ALPH                             B11A 212
000198                RETHMO=DUM1*THMOM                                          B11A 213
000199                DELBD=Y(NETA)-C89/ALPH*F(1,NETA)
000200                THCOND=CPBAR(1)/RHO(1)*RHOE(IS)/G(2,1)*C89*(T(NETA)-T(1))  B11A 215
000201                BLOW=DUM2/CH                                               B11A 216
000202            207 BLOWPG=DER(1)/CH                                           B11A 218
000203                BLOWCH=DER(2)/CH                                           B11A 219
000204                IF(NSPM1) 2074,2074,2070
000205           2070 DO 2071 I=1,NSP
000206                THELEM(I)=0.                                               B11A 221
000207                DUZ=0.
000208                DO 2072 K=1,NSP                                            B11A 223
000209                DUZ=DUZ+(DUM3*SP(1,NETA,K)-C89/ALPH*XSP(5,K))/WTM(K)*CIJ(I,K)
000210           2072 THELEM(I)=THELEM(I)+(SP(1,NETA,K)-SP(1,1,K))/WTM(K)*CIJ(I,K) B11A 226
000211                CM(I)=VJKW(I)/(THELEM(I)*WAT(I))
000212           2071 THELEM(I)=DUZ/THELEM(I)
000213           2074 IF(KG(9)) 2075,2078,2075
000214           2075 COSOR=-TVCC(IS)/VMUE(IS)*0.5/C3*FLOAT(KG(9))
000215                DO 2076 I=1,NETA
000216                Y(I)=TVCF(Y(I))
000217           2076 DUDS(I)=DUDS(I)*(1.+COSOR*Y(I))
000218                DELST=TVCF(DELST)
000219                DELBD=TVCF(DELBD)
000220                THMOM=TVCF(THMOM)
000221                THENGY=TVCF(THENGY)
000222                DO 2077 K=1,NSP
000223           2077 THELEM(K)=TVCF(THELEM(K))
000224           2078 CONTINUE
000225                WRITE(KOUT,18) (ATA(K),ATB(K),K=1,NSP)                     B11A 228
000226                WRITE (KOUT,3) CF,CH,BLOWPG,BLOWCH,BLOW,(CM(I),I=1,NSP)    B11A 229
000227                WRITE(KOUT,12)                                             B11A 232
000228                WRITE(KOUT,4) (ATA(K),ATB(K),K=1,NSP)                      B11A 233
000229                WRITE(KOUT,20) THMOM,DELST,DELBD,THENGY,DUM1,(THELEM(K),K=1,NSP)
000230            209 WRITE(KOUT,5)                                              B11A 238
000231                WRITE(KOUT,6)                                              B11A 239
000232                DO 183 I=1,NETA                                            B11A 240
000233           C    COMPUTE TRUE VALUES OF F(I,J) AND ETA                      B11A 241
000234                DER(1)=F(1,I)
000235                DER(2)=F(2,I)/ALPH
000236                DER(3)=F(3,I)/DUM4
000237                DER(4)=DUDS(I)
000238                DER(5)=G(1,I)
```

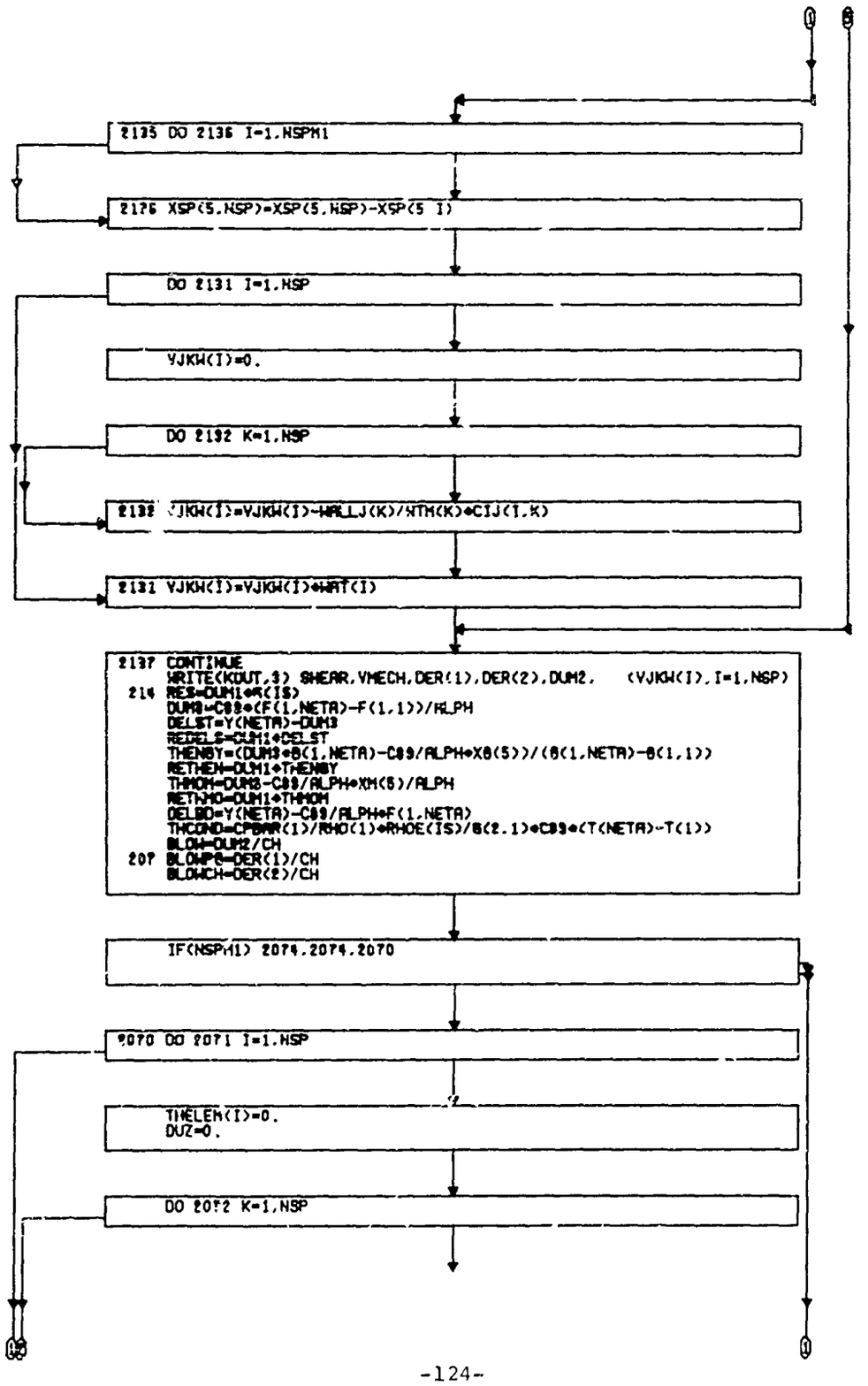
```
000239                 DER(6)=G(2,I)/ALPH
000240                 DER(7)=G(3,I)/DUM4
000241                 BETA=BETA(I)*ALPH
000242                 DER(8)=5.514E+12*PR(IS,IT)/SQRT(T(I)/1.8)
000243           183   WRITE(KOUT,3) Y(I),BETA,(DER(J),J=1,7),
000244                1 R(I),T(I),DER(8)
000245                 WRITE(KOUT,12)                                          B11A 256
000246           216   WRITE(KOUT,7)                                           B11A 258
000247                 DO 184 I=1,NETA                                         B11A 259
000248                 COND=CPBAR(I)/PR(I)*VMU(I)                              B11A 260
000249                 GMR(I)=ABS(GMR(I))
000250                 ACH=P(2,I)/ALPH*UE(IS)/SQRT(GMR(I)/VMW(I)*T(I)*49732.)
000251           184   WRITE(KOUT,3)Y(I),RHO(I),VMU(I),CAPC(I),CPBAR(I),COND,PR(I),SC(I),B11A 261
000252                1 VMW(I),EPSA(I),ACH
000253                 IF (KR(7).EQ.1) GO TO 193
000254                 WRITE(KOUT,13)(Y(I),I=1,NETA)                           B11A 263
000255                 WRITE(KOUT, 8)                                          B11A 264
000256                 DO 201 K=1,NSP                                          B11A 265
000257                 WRITE (KOUT,14) MOA(K),MOB(K),(SP(1,I,K),I=1,NETA)      B11A 266
000258                 WRITE (KOUT,15)(SP(2,I,K),I=1,NETA)                     B11A 267
000259           201   WRITE (KOUT,15)(SP(3,I,K),I=1,NETA)                     B11A 268
000260                 IF (NSPM1) 2041,2041,2040                               B11A
000261           2040  DO 204 K=1,NSPM1                                        B11A 270
000262                 DO 204 I=1,NETA                                         B11A 271
000263                 SP(2,I,K)=SP(2,I,K)*ALPH                                B11A 272
000264           204   SP(3,I,K)=SP(3,I,K)*DUM4                                B11A
000265           2041  CONTINUE                                                B11A 273
000266                 WRITE (KOUT,16)                                         B11A 274
000267                 DO 196 J=1,NSPEC                                        B11A 275
000268           196   WRITE(KOUT,14) MOA(J),MOB(J),(FR(J,I),I=1,NETA)
000269                 IF(KR(9).EQ.3.OR.KR(9).EQ.4) WRITE(KOUT,17) MOA(ISU),MOB(ISU)
000270           193   CONTINUE                                                B11A 276
000271           325   WALLG=-WALLQ*C3
000272                 RETURN
000273                 END                                                     B11A 307
```

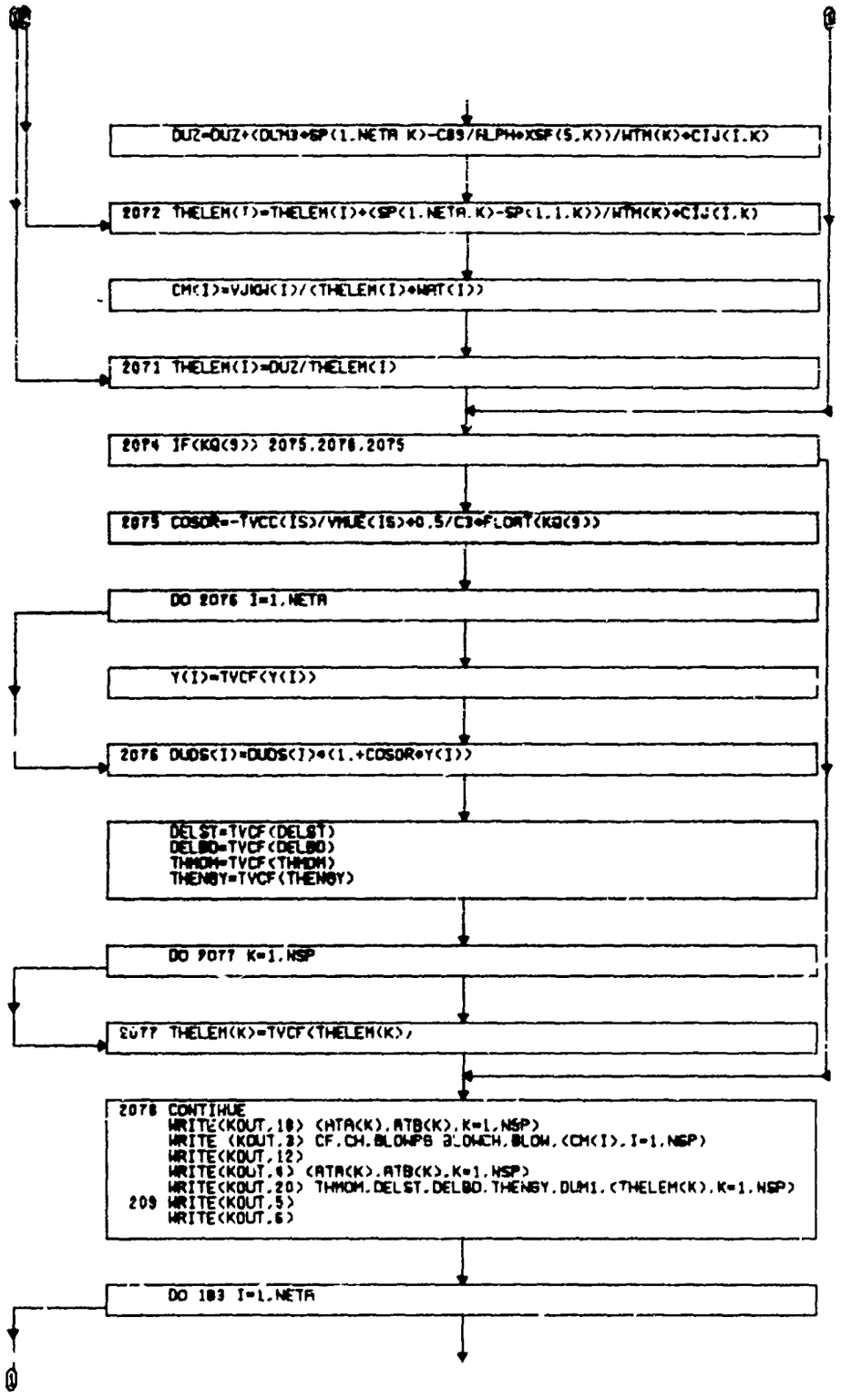
c. Flow Chart

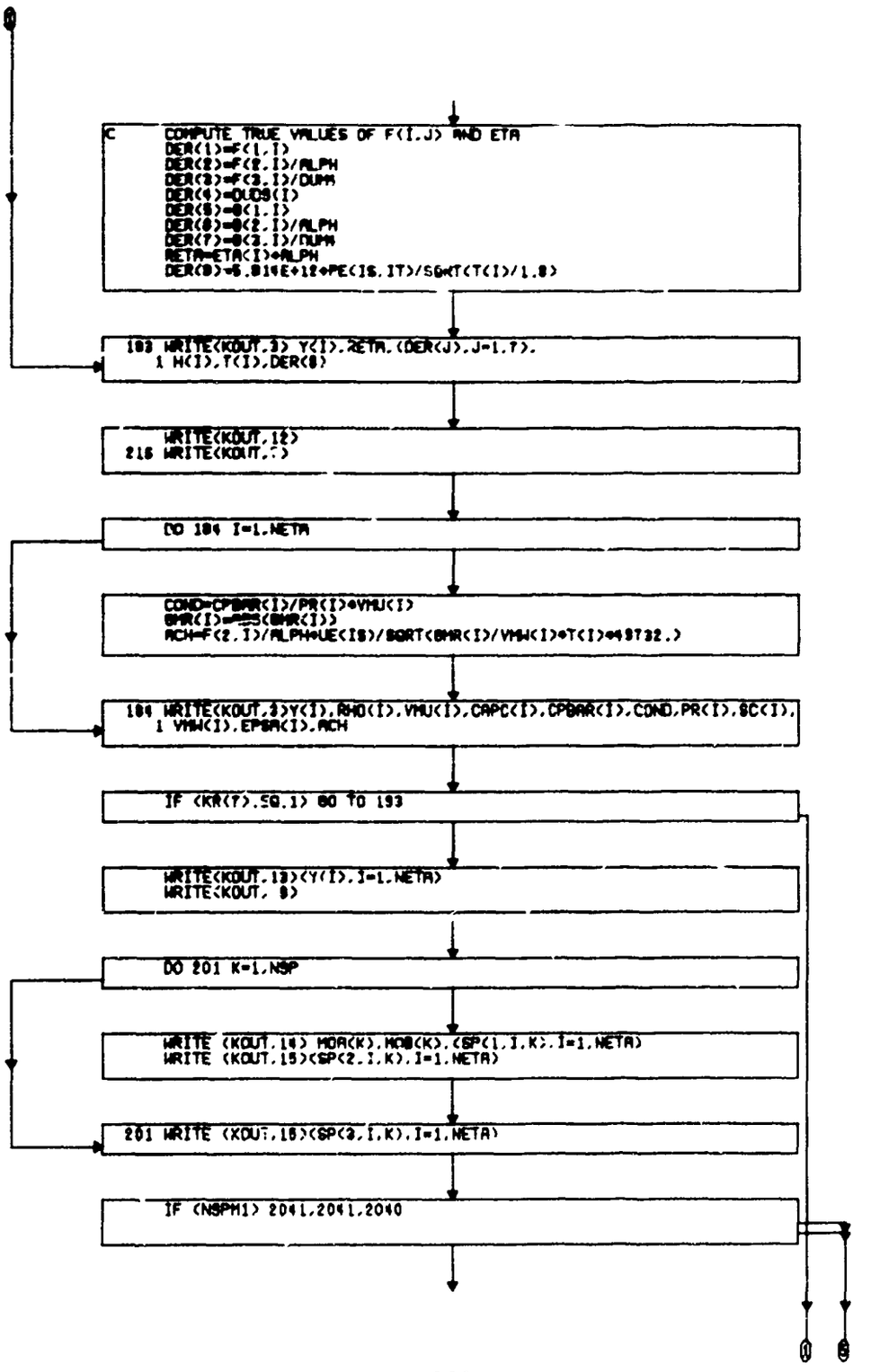

C811A
SUBROUTINE OUTPUT
DATA IBLANK/2H /
TVCF(X)=(SQRT(AMAX1(0.,1.+2.*COSOR*X))-1.)/COSOR
IF (KR(11)-1) 300,300,301
300 IF(KR(9)) 302,302,307
307 IF(KR(9)-2) 301,301,302
302 RHOVW(IS,IT)= C1*F(1,1) +HF(1,5)
301 C89=-C3*ALPH*VMUE(IS)
DUM1=-1./C3
DUM2=RHOVW(IS,IT)/C3
IF (UE(IS)-1.0) 3012,3011,3012
3011 UE(IS)=0.
3012 CONTINUE
WALLQ=-WALLQ/C3
DER(2)=WALLQ-DUM2*B(1,1)
WALLJ(NSP)=0.
IF (NSPM1) 3051,3051,3050
3050 DO 305 K=1,NSPM1
WALLJ(K)=VJKW(K)
305 WALLJ(NSP)=WALLJ(NSP)-WALLJ(K)
A

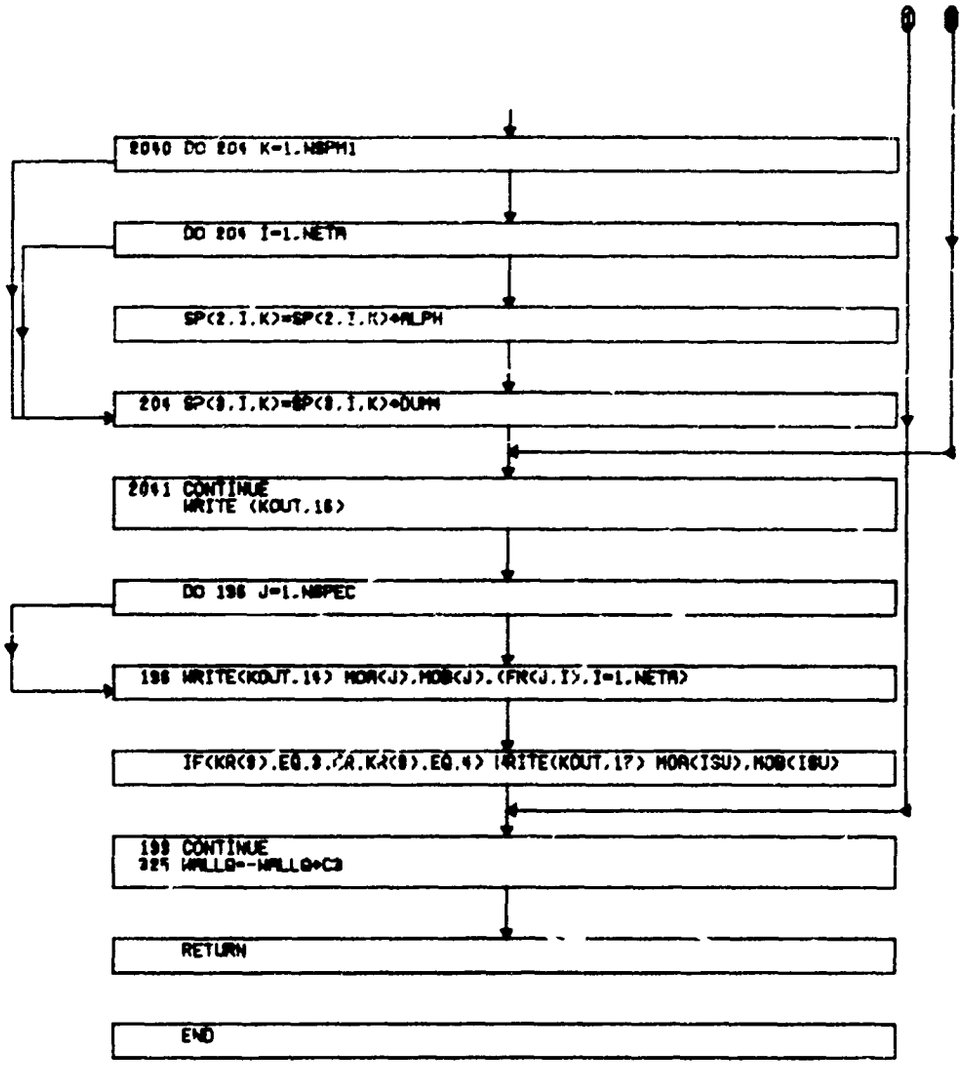

3051 CONTINUE
DER(1)=W(2)/C8
DER(2)=W(3)/C8
VMECH=DER(1)+DER(2)-DUM2
DUMM=VMECH*100.
IF (DUMM-DUM2) 1901,190,190
1901 VMECH=0.
190 IF(ABS(BETA)-.0001) 303,304,304
303 BETA=0.
304 Y(1)=0.
SHFRC=-UE(IS)/(C8*ALPH*ALPH*32.174)
DUDS(1)=(CAPC(1)+EPSR(1))*F(8,1)*SHFRC
DO 102 I=2,NETA
DUDS(I)=(CAPC(I)+EPSR(I))*F(8,I)*SHFRC
102 Y(I)=Y(I-1)+C85*CMHO(I-1)
QCOND=VMUE(IS)/PR(1)*CAPC(1)/C85*B(2,1)+DUM2*B(1,1)
SHEAR=DUDS(1)
IF (KR(9)-8) 2101,2102,2102
2101 EMIS=0.
2102 RERAD=(.481E-12)*(T(1))**4.*EMIS
QDIFU=-CAPC(1)/ALPH*CPBAR(1)/PR(1)*TPWALL/C8
WRITE (KOUT,1) ALPH,XI(IS),ROKAP(IS),PE(IS,IT),UE(IS),BETA,DUM1,
1 WALLQ,DER(4),RERAD,QDIFU
212 DUM1=RHOE(IS)*UE(IS)/VMUE(IS)


CH= WALLQ / (E(1,NETA)-E(1,1))
CF=CAPC(1)/ALPH*VMUE(IS)/CHS*F(3,1)
213 WRITE(KOUT,2) (ATA(K),ATB(K),K=1,NSP)
WRITE (KOUT,19)
DUMM=ALPH*ALPH
DO 203 I=1,NETA
SP(1,I,NSP)=1.0
SP(2,I,NSP)=0.
203 SP(3,I,NSP)=0.
IF (NSPM1) 2021,2021,2020
2020 DO 202 K=1,NSPM1
DO 202 I=1,NETA
SP(1,I,NSP)=SP(1,I,N3P)-SP(1,I,K)
SP(2,I,K)=SP(2,I,K)/ALPH
SP(2,I,NSP)=SP(2,I,NSP)-SP(2,I,K)
SP(3,I,K)=SP(3,I,K)/DUMM
202 SP(3,I,NSP)=SP(3,I,NSP)-SP(3,I,K)
2021 CONTINUE
XSP(5,NSP)=F(1,NETA)-F(1,1)
IF(NSPM1) 2138,2138,2135
2138 VJKH(1)=0.
CM(1)=0.
THELEM(1)=0.
GO TO 2137


2135 DO 2136 I=1,NSPM1
2136 XSP(5,NSP)=XSP(5,NSP)-XSP(5 I)
DO 2131 I=1,NSP
VJKW(I)=0.
DO 2132 K=1,NSP
2132 VJKW(I)=VJKW(I)-WRLLJ(K)/WTH(K)*CIJ(I,K)
2131 VJKW(I)=VJKW(I)+WRT(I)
2137 CONTINUE
WRITE(KOUT,3) SHEAR,VMECH,DER(1),DER(2),DUM2, (VJKW(I),I=1,NSP)
214 RES=DUM1*R(IS)
DUM3=C89*(F(1,NETA)-F(1,1))/ALPH
DELST=Y(NETA)-DUM3
REDELS=CUM1*DELST
THENBY=(DUM3*B(1,NETA)-C89/ALPH*X8(5))/(B(1,NETA)-B(1,1))
RETHEN=DUM1*THENBY
THMOM=DUM3-C89/ALPH*XM(5)/ALPH
RETHMO=DUM1*THMOM
DELBO=Y(NETA)-C89/ALPH*F(1,NETA)
THCOND=CPBAR(1)/RHO(1)*RHOE(IS)/B(2,1)*C89*(T(NETA)-T(1))
BLOW=DUM2/CH
207 BLOWPS=DER(1)/CH
BLOWCH=DER(2)/CH
IF(NSPM1) 2074,2074,2070
2070 DO 2071 I=1,NSP
TWELEM(I)=0.
DUZ=0.
DO 2072 K=1,NSP


DUZ=DUZ+(DLM3*SP(1,NETA K)-C89/ALPH*XSF(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)
CM(I)=VJUGW(I)/(THELEM(I)*WAT(I))
2071 THELEM(I)=DUZ/THELEM(I)
2074 IF(KQ(9)) 2075,2076,2075
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,10) (ATA(K),ATB(K),K=1,NSP)
WRITE (KOUT,3) CF,CH,BLOWPS,BLOWCH,BLOW,(CM(I),I=1,NSP)
WRITE(KOUT,12)
WRITE(KOUT,4) (ATA(K),ATB(K),K=1,NSP)
WRITE(KOUT,20) THMOM,DELST,DELBD,THENGY,DLM1,(THELEM(K),K=1,NSP)
209 WRITE(KOUT,5)
WRITE(KOUT,6)
DO 103 I=1,NETA


C COMPUTE TRUE VALUES OF F(I,J) AND ETA
DER(1)=F(1,I)
DER(2)=F(2,I)/ALPH
DER(3)=F(3,I)/DUMM
DER(4)=OLDS(I)
DER(5)=G(1,I)
DER(6)=G(2,I)/ALPH
DER(7)=G(3,I)/DUMM
RETA=ETA(I)*ALPH
DER(8)=6.814E+12*PE(IS,IT)/SQRT(T(I)/1.8)
193 WRITE(KOUT,3) Y(I),RETA,(DER(J),J=1,7),
1 H(I),T(I),DER(8)
WRITE(KOUT,12)
216 WRITE(KOUT,*)
DO 194 I=1,NETA
COND=CPBAR(I)/PR(I)*VMU(I)
BMR(I)=ABS(BMR(I))
RCH=F(2,I)/ALPH*UE(IS)/SQRT(BMR(I)/VMW(I)*T(I)*49732.)
194 WRITE(KOUT,3)Y(I),RHO(I),VMU(I),CAPC(I),CPBAR(I),COND,PR(I),SC(I),
1 VMW(I),EPSR(I),RCH
IF (KR(7).EQ.1) GO TO 193
WRITE(KOUT,13)(Y(I),I=1,NETA)
WRITE(KOUT, 8)
DO 201 K=1,NSP
WRITE (KOUT,14) MOR(K),MOB(K),(SP(1,I,K),I=1,NETA)
WRITE (KOUT,15)(SP(2,I,K),I=1,NETA)
201 WRITE (KOUT,16)(SP(3,I,K),I=1,NETA)
IF (NSPM1) 2041,2041,2040


2040 DO 204 K=1,NSPM1
DO 204 I=1,NETA
SP(2,I,K)=SP(2,I,K)+ALPH
204 SP(3,I,K)=SP(3,I,K)+DUMM
2041 CONTINUE
WRITE (KOUT,16)
DO 198 J=1,NSPEC
198 WRITE(KOUT,14) MOA(J),MOB(J),(FR(J,I),I=1,NETA)
IF(KR(8).EQ.3.OR.KR(8).EQ.4) WRITE(KOUT,17) MOA(ISU),MOB(ISU)
199 CONTINUE
325 WALLG=-WALLG+C3
RETURN
END

12. SUBROUTINE IMONE - B12B

a. Function

Evaluates the coefficients of the (I-1) th corrections for the I nonlinear (conservation) equations, where I is the I th nodal point in the boundary layer. Called by NONCER. Calls TAYLOR.

b. Listing

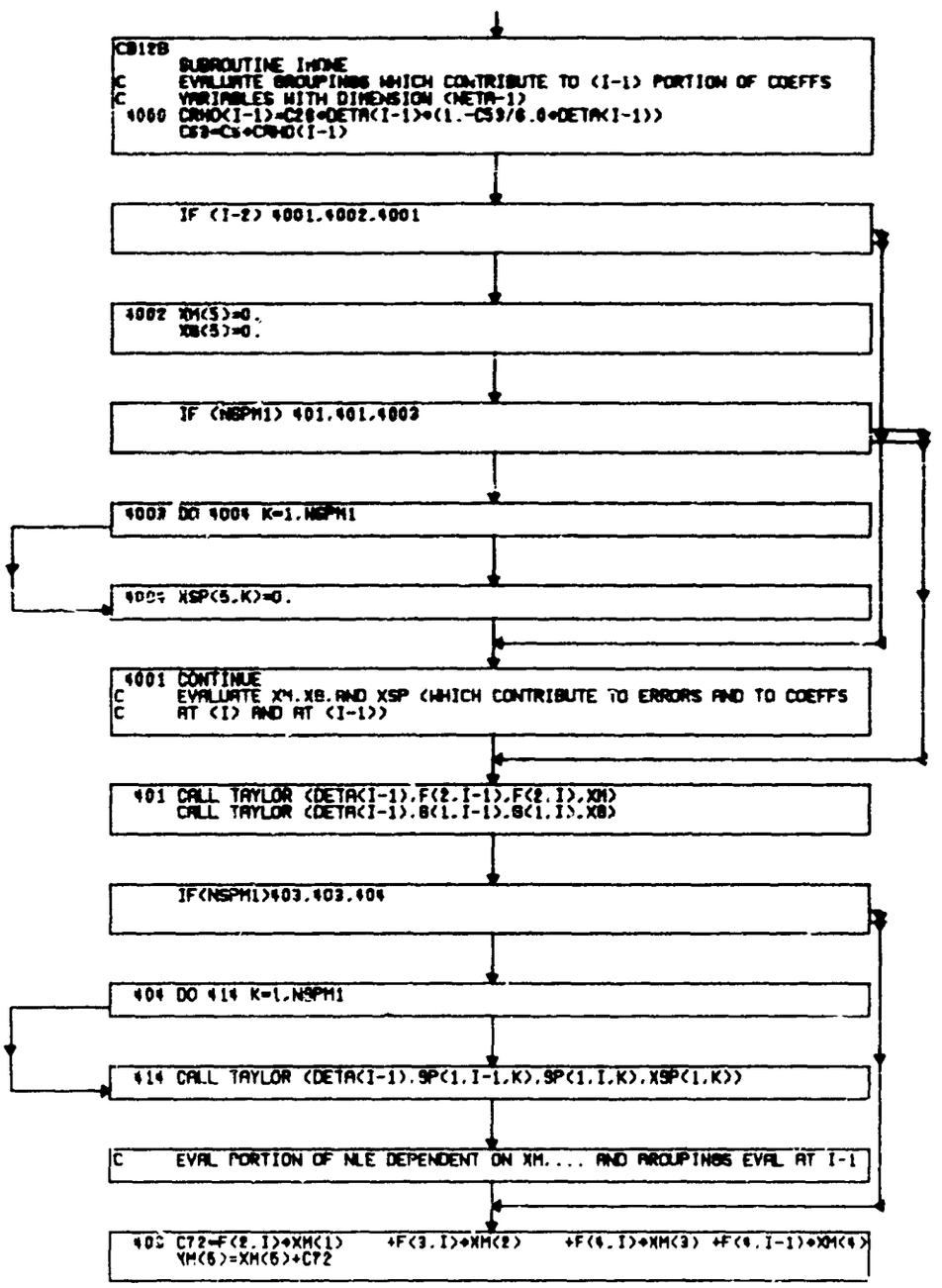
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000001      C912d                                                                 B17A 001
000002            S UBROUTI E IMONE                                               B12A 002
000003            COMMON/COEFCOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B12A   3*NEW
000004           1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB12A   4*NEW
000005           23,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B12A   5*NEW
000006           3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB12A   6*NEW
000007           46B,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B12A   7*NEW
000008           5,CB2,CB3,CB4,CB5,CB6,CB7,CB8                                    B12A   8*NEW
000009            COMMON/CKCOM/ CK1( B),CK2( B),CK3( B),CK4( B),CK5( B),CK6( B)    B12A   9*NEW
000010           1,CK7( B),CK8( B),CK9( B),CK10( B),CK11( B),CK12( B),CK13( B)     B12A  10*NEW
000011           2,CK14( B),CK15( B),CK16( B),CK17( B),CK18( B),CK19( B),CK20( B)   B12A  11*NEW
000012           3,CK21( B),CK22( B),CKK1( B, B),CKK2( B, B),X1(5),XG(5),XSP(5, 9)  B12A  12*NEW
000013           4,CKK3( B, B)                                                     B12A  13*NEW
000014            COMMON/ELCOM/ELE( 43),GLE(30),SPLE(30, B),ELA(313),FLEM,GLEM     B12A  14*NEW
000015           1,SPLEM( B),ELM(14),FLM,TFLM,IGLM,ISPLM( B),NELM,ILMM,DEL(43)     B12A  15*NEW
000016           2,TGL(30),ESPL(30, B),ENLE(18),GNLE(15),SPNLE(15, B),ENL(153)     B12A  16*NEW
000017           3,ENLEM,GNLEM,SPNLEM( B),          ENLM,TENLM,IGNLM,ISPNLM( B)    B12A  17*NEW
000018           4,TENLM,ILNM,DENL(18),DGNL(15),DSPNL(15, B),DRNL(13)              B12A  18*NEW
000019            COMMON/ETACOM/ETA(15),DETA(15),DS2(14),DCU(14),B1(14),B2(14)     B12A  19*NEW
000020           1,LAR(153),BA1(43,18),BA2(30,15)                                  B12A  20*NEW
000021            COMMON/MISCOM/C1,C2,C3,C4,ALPHD,BETA,PI(4,14),ZG(4,14),ZSP(4,14, *B12A  21*NEW
000022           1 ),XI(40),WF(15,5),WG(15,3),WSP(15, 5, B),WALPH,WUE,WHUE,WFW,DLX2  B12A  22*NEW
000023           2,C3M(40),ETAM(40)                                                B12A  23*NEW
000024            COMMON/ITCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB12A  24*NEW
000025           1S,IT,NTI B,NSP,NSPM1,NAM,ALFQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B12A  25*NEW
000026           2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B12A  26*NEW
000027           3,KAUXO,JTIME,JSPEC,MD(3)                                         B12A  27*NEW
000028            COMMON/NOICOM/AM(153,153),DVNL(153),TCH,                         B12A  28*NEW
000029           1VLNKW,DLPH( 9),DLPK( B, 9),DTHW,DTKW( B),FLUXJB( 9)              B12A  29*NEW
000030            COMMON/PHPCOM/PP(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),W(15)   B12A  30*NEW
000031           1,CPBAR(15),VM4(15),PHIK(13, B),DRHOH,DRHOK( B),ZK( B),DZKH( B),  B12A  31*NEW
000032           24U3K( B),DMU4K( B),DTK( B),DPHIKH( B),DPRK( B),DSCK( B),DCAPCK( B)B12A  32*NEW
000033           3,DHTILK( B),DQRK( B),DCPBK( B),DCPTK( B),DMU12K( B),DZKK( B, B)   B12A  33*NEW
000034           4,DPHIKP( B, B),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL  B12A  34*NEW
000035           5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B12A  35*NEW
000036           6(15),PHIKP(15),HP,TP,ZKP( B),VMU3P,VMU4P,HTILP,CRHO(14),GWR(15)   B12A  36*NEW
000037            COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                   B12A  37*NEW
000038      C     EVALUATE GROUPINGS WHICH CONTRIBUTE TO (I-1) PORTION OF COEFFS    B12A 041*-35
000039      C     VARIABLES WITH DIMENSION (NETA-1)                                 B12A  042
000040       4000 CRHO(I-1)=C26*DETA(I-1)*(1.-C93/6.0*DETA(I-1))                    B12A  044
000041            CA3=CA*CRHO(I-1)                                                  B12A  045
000042            IF (I-2) 4001,4002,4001                                           B12A  052
000043       4002 XM(5)=0.                                                          B12A  053
000044            XG(5)=0.                                                          B12A  054
000045            IF (NSPM1) 401,401,4003                                           B12A  055
000046       4003 DO 4004 K=1,NSPM1                                                 B12A  056
000047       4004 XSP(5,K)=0.                                                       B12A  057
000048       4001 CONTINUE
000049      C     EVALUATE XM,XG,AND XSP  WHICH CONTRIBUTE TO ERRORS AND TO COEFFS  B12A  065
000050      C     AT (I) AND AT (I-1))                                              B12A  066
000051        401 CALL TAYLOR (DETA(I-1),F(2,I-1),F(2,I),XM)                        B12A  067
000052            CALL TAYLOR (DETA(I-1),G(1,I-1),G(1,I),XG)                        B12A  068
000053            IF(NSPM1)403,403,404                                              B12A  069
000054        404 DO 414 K=1,NSPM1                                                  B12A  070
000055        414 CALL TAYLOR (DETA(I-1),SP(1,I-1,K),SP(1,I,K),XSP(1,K))           B12A  071
000056      C     EVAL PORTION OF ALE DEPENDENT ON XM,... AND GROUPINGS EVAL AT I-1 B12A  072
000057        403 C72=F(2,I)*XM(1)    +F(3,I)*XM(2)    +F(4,I)*XM(3) +F(4,I-1)*XM(4)B12A  073
000058            XM(5)=XM(5)+C72                                                   B12A  074
```

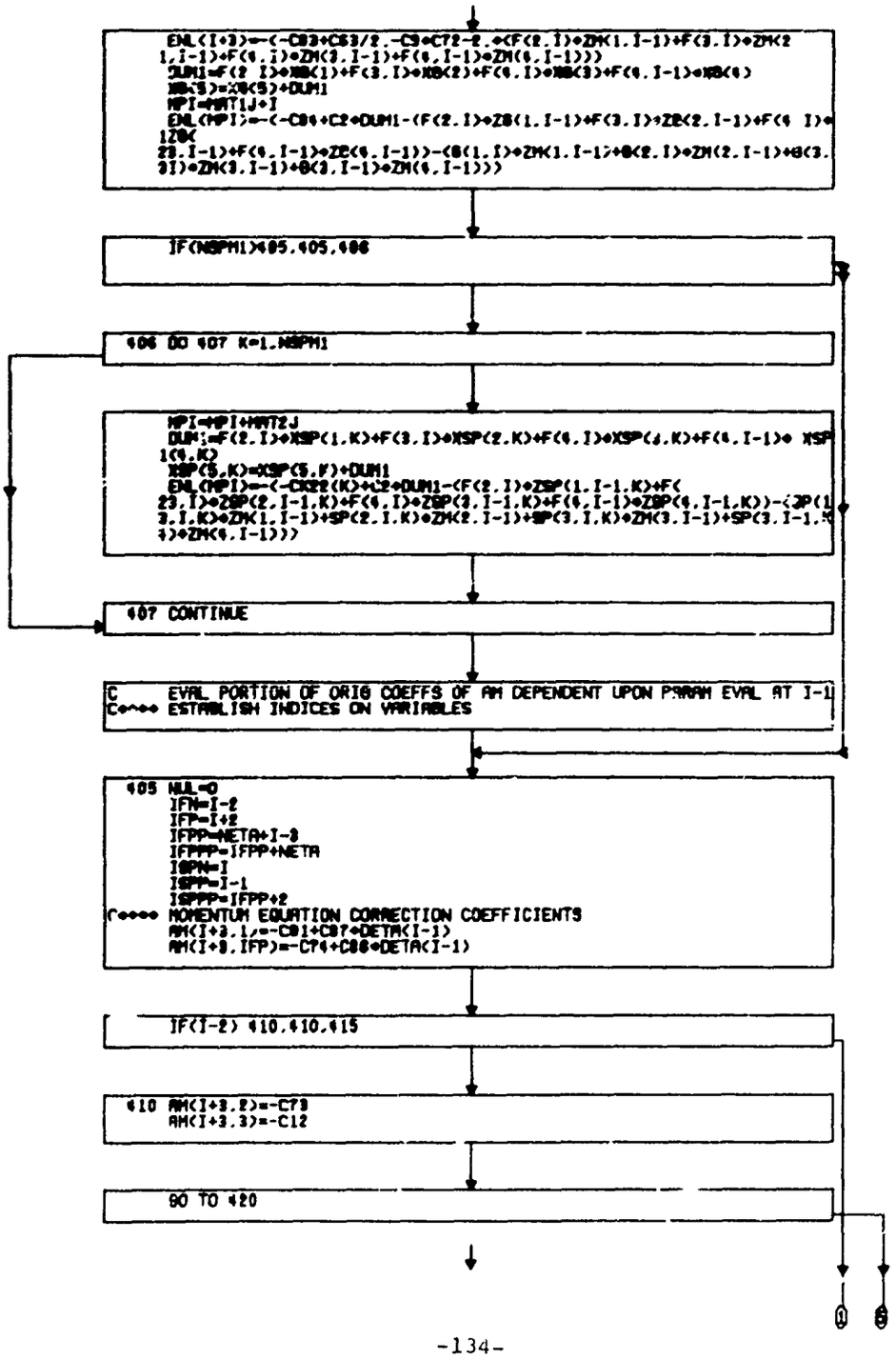
```
000059                 ENL(I+3)=-(-CR3+C(3/2,-C9+C72-2.+(F(2,I)+ZM(1,I-1)+F(3,I)+ZM(2
000060                1,I-1)+F(4,I)+ZM(3,I-1)+F(4,I-1)+ZM(4,I-1)))                    B12R 076
000061                 DUM1=F(2,I)+XG(1)+F(3,I)+XG(2)+F(4,I)+XG(3)+F(4,I-1)+XG(4)      B12R 077
000062                 XG(5)=XG(5)+DUM1                                                B12R 078
000063                 MPI=MAT1J+I
000064                 ENL(MPI)=-(-CR4+C2+DUM1-(F(2,I)+ZG(1,I-1)+F(3,I)+ZG(2,I-1)+F(4,I)+
000065                1ZG(                                                            B12R 080
000066                2,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,B12R 081
000067                3I)+ZM(3,I-1)+G(3,,-1)+ZM(4,I-1)))                              B12R 082
000068                 IF(NSPM1)405,405,406                                            B12R 085
000069               406 DO 407 K=1,NSPM1
000070                 MPI=MPI+MAT2J
000071                 DUM1=F(2,I)+XSP(1,K)+F(3,I)+XSP(2,K)+F(4,I)+XSP(3,K)+F(4,I-1)+ XSPB12R 087
000072                1(4,K)                                                          B12R 088
000073                 XSP(5,K)=XSP(5,K)+DUM1                                          B12R 089
000074                 ENL(MPI)=-(-CK22(K)+C2+DUM1-(F(2,I)+ZSP(1,I-1,K)+F(
000075                2,I)+ZSP(2,I-1,K)+F(4,I)+ZSP(3,I-1,K)+F(4,I-1)+ZSP(4,I-1,K))-(SP(1B12R 091
000076                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,KB12R 092
000077                4)+ZM(4,I-1)))                                                  B12R 093
000078               407 CONTINUE
000079             C     EVAL PORTION OF ORIG COEFFS OF AM DEPENDENT UPON PARAM EVAL AT I-1B12R 096
000080             C**** ESTABLISH INDICES ON VARIABLES
000081               405 NUL=0
000082                   IFN=I+2
000083                   IFP=I+2
000084                   IFPP=NETA+I-3
000085                   IFPPP=IFPP+NETA
000086                   ISPN=I
000087                   ISPP=I-1
000088                   ISPPP=IFPP-2
000089             C**** MOMENTUM EQUATION CORRECTION COEFFICIENTS
000090                   AM(I+3,1)=-C81+C87+DETA(I-1)
000091                   AM(I+3,IFP)=-C74+C86+DETA(I-1)
000092                   IF(I-2) 410,410,415
000093               410 AM(I+3,2)=-C73
000094                   AM(I+3,3)=-C12
000095                   GO TO 420
000096               415 CALL LIAD(-1,I+3,IFN,-C73)
000097                   CALL LIAD(-1,I+3,IFPP,-C12)
000098               420 CALL LIAD(-1,I+3, IFPPP,-2.*(C9 * XM(4)+ZM(4,I-1)))
000099                   LPI=ISPN+MAT1J
000100                   DO 450 K=NUL, NSPM1
000101                   IF(K) 425,425,430
000102               425 DUM1=C88+DETA(I-1)-C75
000103                   DUM2=0.
000104                   GO TO 435
000105               430 DUM1=CK13(K)+DETA(I-1)-CK17(K)
000106                   DUM2=0.
000107               435 AM(I+3,LPI)=DUM1
000108                   IF(I-2) 440,440,445
000109               440 AM(I+3,LPI-1) = DUM2
000110                   GO TO 450
000111               445 CALL LIAD(K,I+3, ISPP, DUM2)
000112               450 LPI=LPI+MAT2J
000113             C**** ENERGY AND SPECIES EQUATIONS
000114                   MPJ=MAT1J+1
000115                   DO 535 K=NUL, NSPM1
000116             C* *  ALF, F, FP, FPP, FPP ERROR DERIVITIVES ARE DUM1 TO DUM5, DUM6 TO
000117             C* *  DUM8 ARE FLUX DERIVITIVES FOR ALF, FP, FPP.
000118                   IF(K) 455,455,460
```

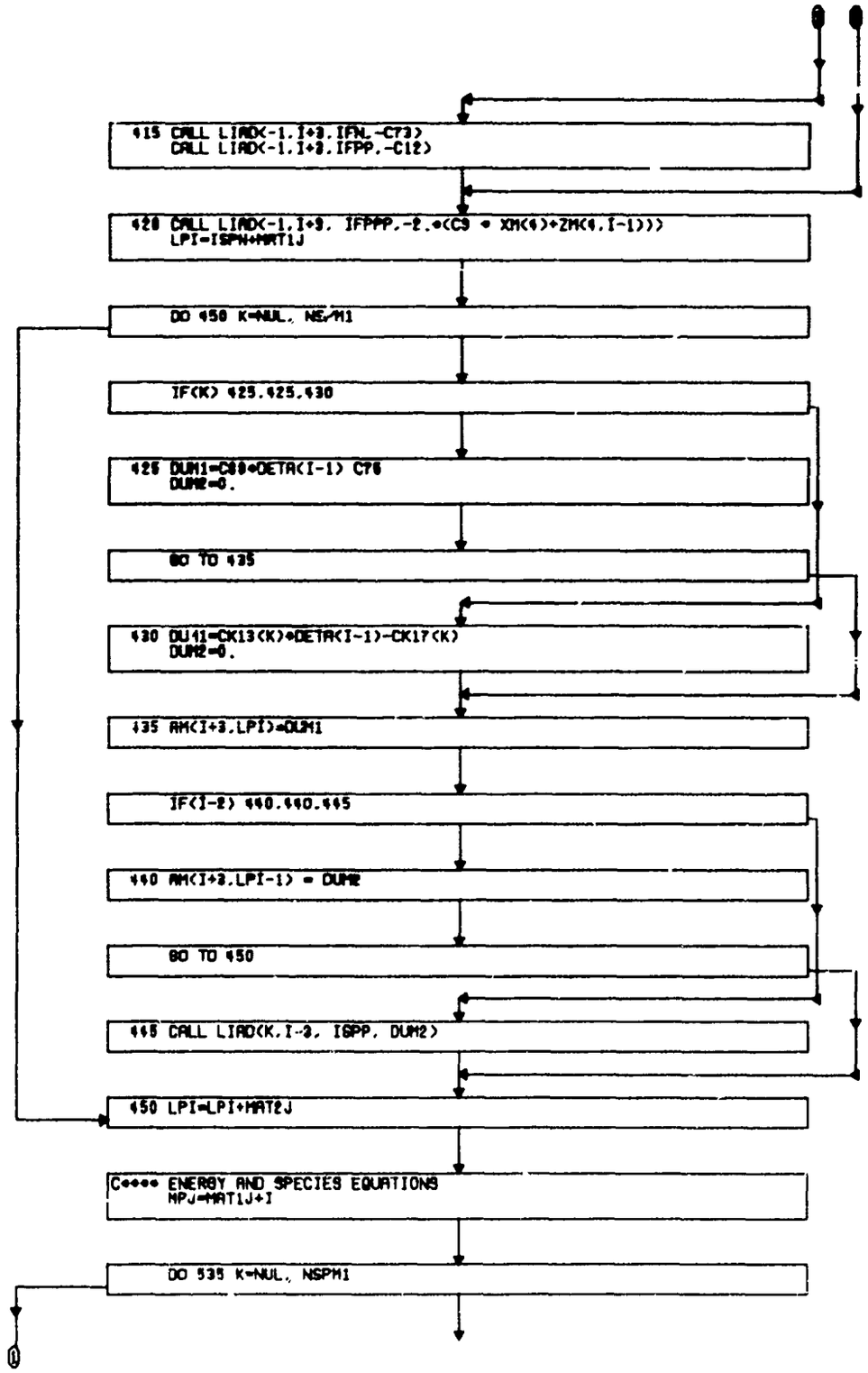
```
000119          C- -  ENERGY - EQUATIONS
000120            455 DUM1=CK21(K)+2.*CK6 *CK15(K)
000121                DUM2=CK14(K)
000122                DUM3=CK19(K)+CK15(K)
000123                DUM4=CK21(K)+CK14(K)
000124                DUM6=CK21(K)
000125                DUM7=CK19(K)
000126                DUM8=CK2 (K)
000127                GO TO 485
000128          C- -  SPECIES - EQUATIONS
000129            460 DUM1=(CK21(K)+2.*CK6 *CK15(K))
000130                DUM2=CK14(K)
000131                DUM3=CK19(K)+CK15(K)
000132                DUM4=CK21(K)+CK14(K)
000133                DUM6=CK21(K)
000134                DUM7=CK19(K)
000135                DUM8=CK2 (K)
000136            465 DUM5=C2 *ZSP(4,K)-ZSP(4,I-1,K)
000137                A*(MPJ,1)=DUM1
000138                A*(MPJ,IFP)= DUM3
000139                IF(I-2) 470,470,472
000140            470 A*(MPJ,2)=DUM2
000141                A*(MPJ,3)= DUM4
000142                A*(MPJ-1,1)= DUM6
000143                A*(MPJ-1, IFP)= DUM7
000144                A*(MPJ-1,3)= DUM8
000145                GO TO 475
000146            472 CALL LIAD(-1,MPJ,IFN,DUM2)
000147                CALL LIAD(-1, MPJ, IFPP, DUM4)
000148            475 CALL LIAD(-1,MPJ, IFPPP, DUM5)
000149                LOC= ISP+MAT1J
000150                DO 530 KK=NUL, NSPM1
000151          C * * DUM1/DUM4 AND DUM2/DUM5 ARE ERROR/FLUX DERIVATIVES WRT G OR SP AND
000152          C * * GO OR SPP, RESP.
000153                IF(K+KK) 480,480,485
000154          C - - ENERGY EQ. G VARIABLES
000155            480 DUM2=CK0
000156                DUM4=CK3
000157                DUM5=CK0
000158                GO TO 515
000159            485 IF(K) 490,490,495
000160          C - - ENERGY EQUATION, SP VARIABLES
000161            490 DUM1=CK1(KK)
000162                DUM2=CK2(KK)
000163                DUM4=DUM1
000164                DUM5=DUM2
000165                GO TO 508
000166            495 IF(KK) 500,500,505
000167          C - - SPECIES EQS , G VARIABLES
000168            500 DUM1=CK9(K)
000169                DUM2=CK5(K) + CK14(K)
000170                DUM4=CK9(K)
000171                DUM5=CK5(K)
000172                GO TO 508
000173          C - - SPECIES EQS., SP VARIABLES
000174            505 DUM1=-CKK2(K,KK)
000175                DUM2=-CKK1(K,KK)+B1(I-1)*CKK3(K,KK)
000176                DUM4=DUM1
000177                DUM5=CKK1(K,KK)
000178                IF(K-KK) 508,515,508
```

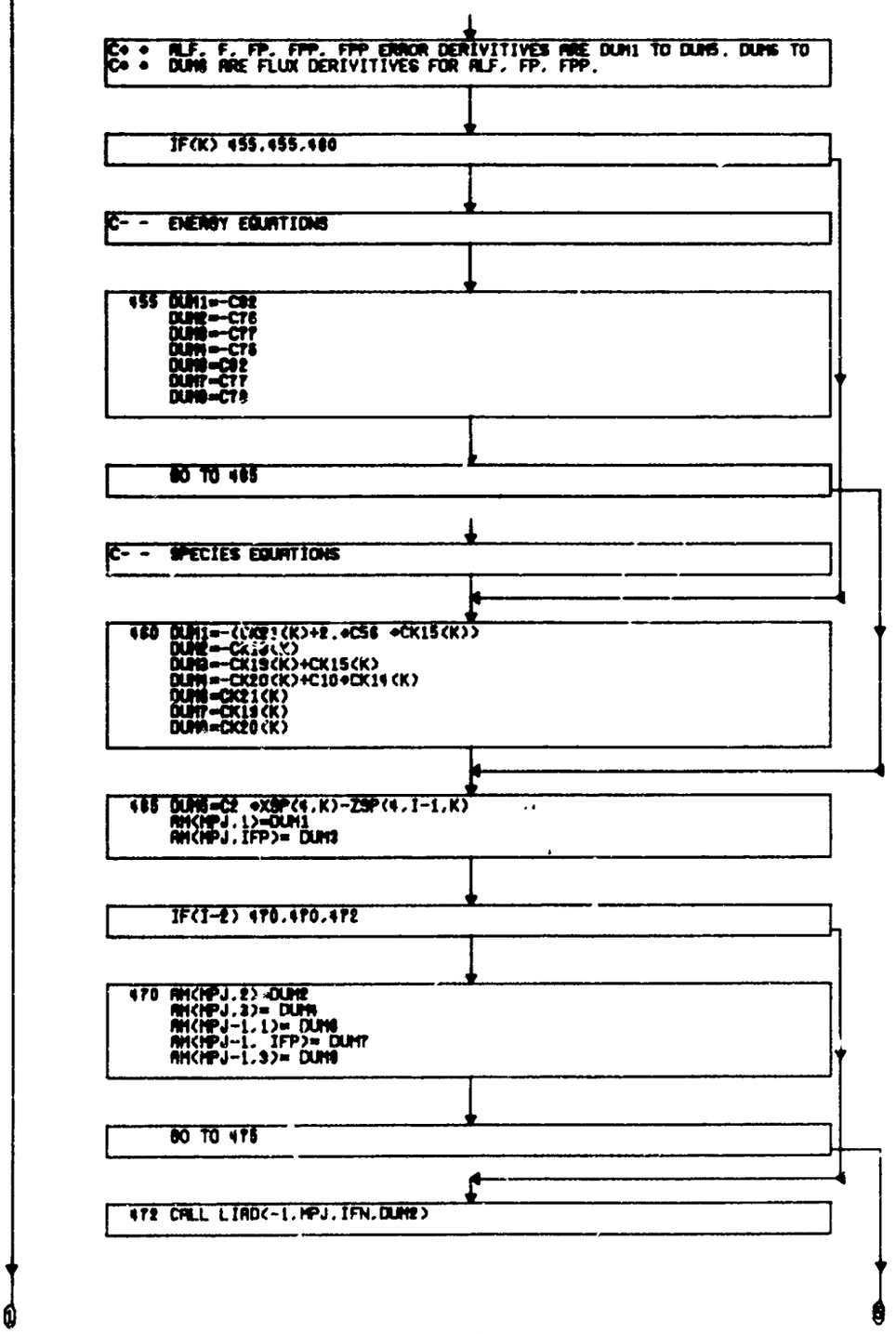
```
000179          515 D[illegible]
0001A0          5[illegible] A[illegible]
0001A1              IF(I-2) 510,510,525
0001A2          510 A[illegible]
0001A3          520 A[illegible]
0001A4              A[illegible]
0001A5              GO TO 530
0001A6          525 CALL LIA[illegible]
0001A7          530 LPI=LPI+ AT2J
0001A8              CALL LIAD(K,MPJ,ISPPP,C2 *XM(4)-ZM(4,I-1))
0001A9          535 MPJ=MPJ+*AT2J
000190              RETURN
000191              END
```

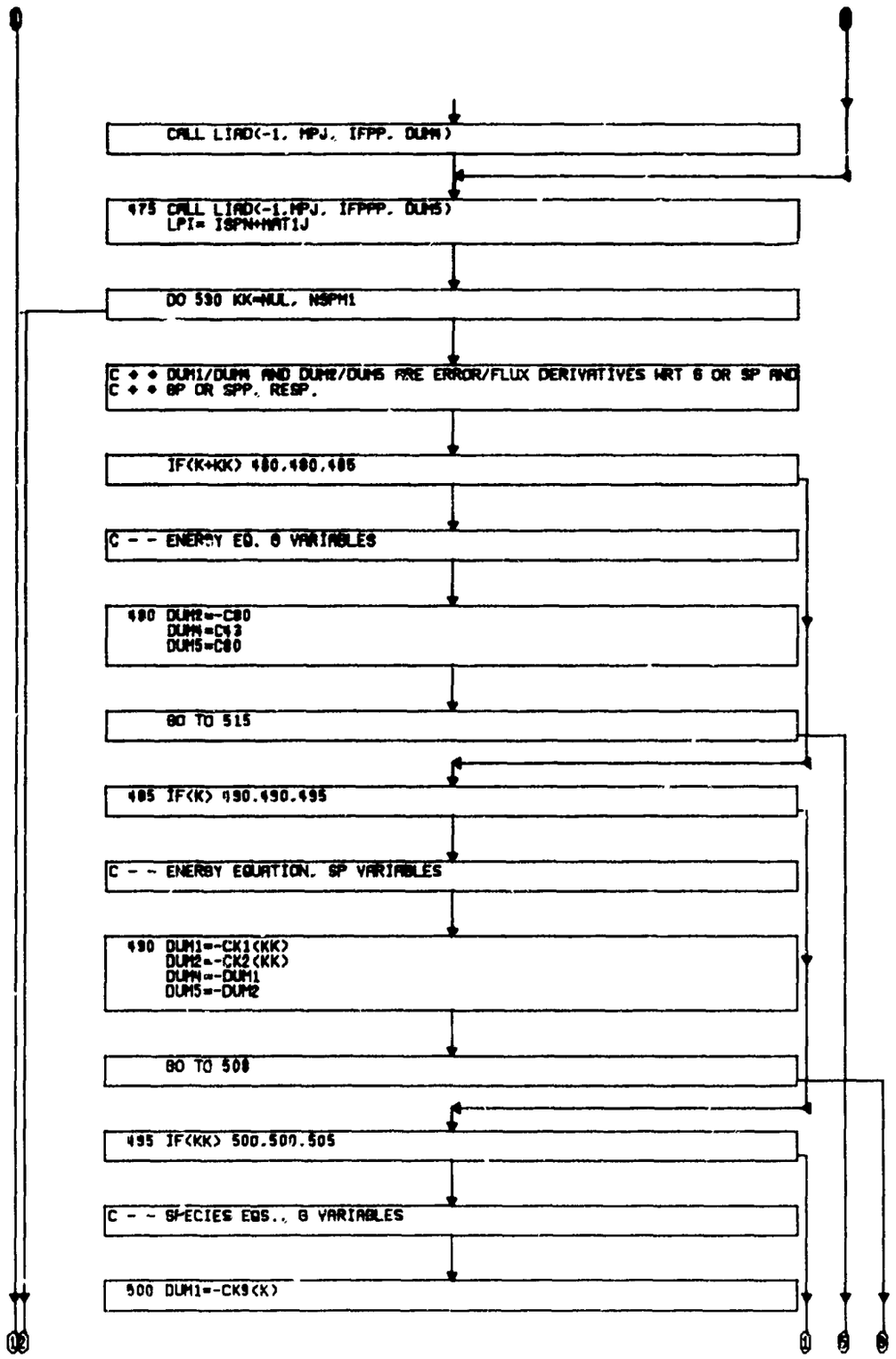
c. Flow Chart

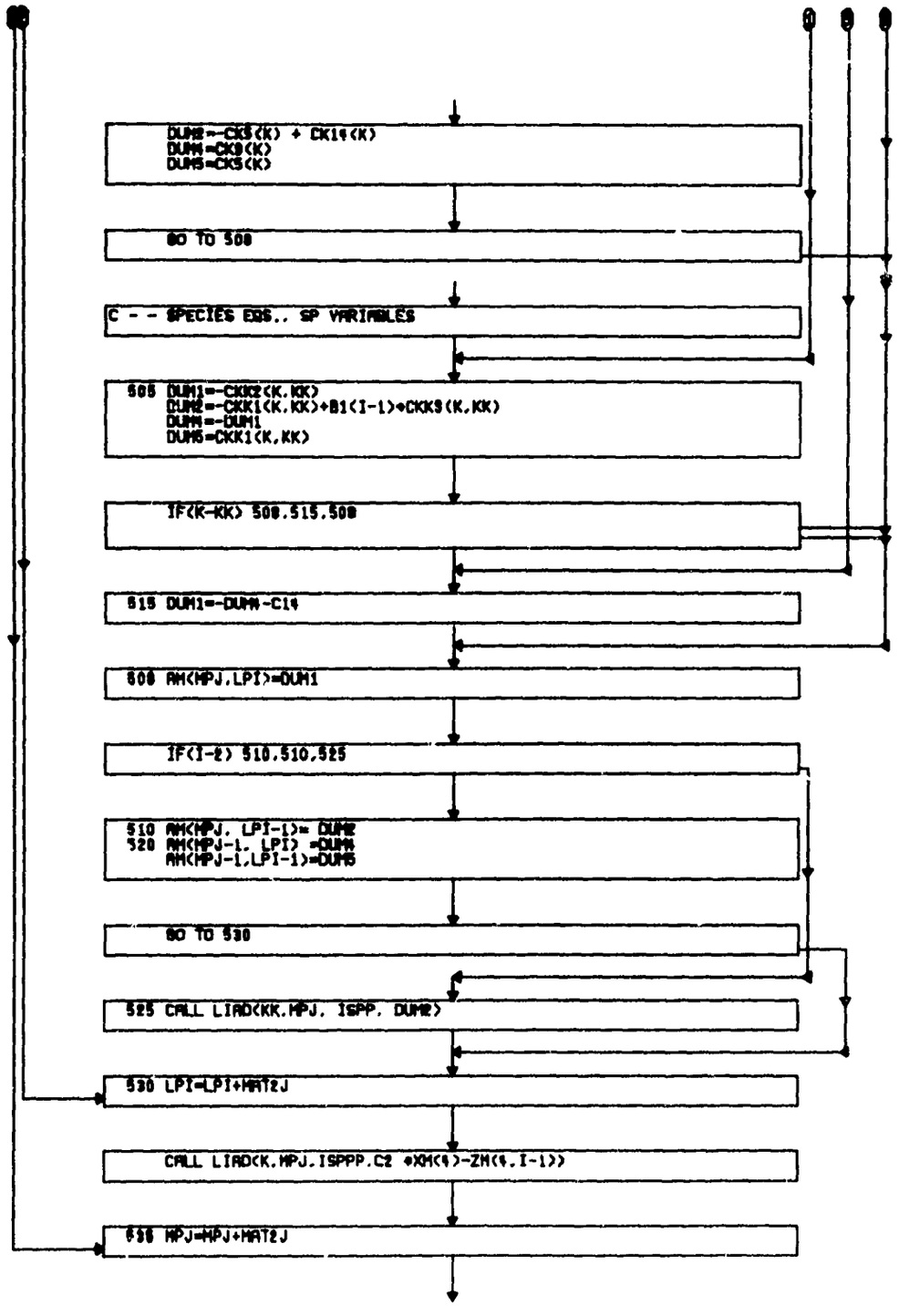

CB12B
SUBROUTINE IHONE
C EVALUATE GROUPINGS WHICH CONTRIBUTE TO (I-1) PORTION OF COEFFS
C VARIABLES WITH DIMENSION (METR-1)
4000 CRHO(I-1)=C26*DETA(I-1)*(1.-C59/6.0*DETA(I-1))
C59=Cs*CRHO(I-1)
IF (I-2) 4001,4002,4001
4002 XM(5)=0.
XB(5)=0.
IF (NSPM1) 401,401,4003
4003 DO 4004 K=1,NSPM1
4004 XSP(5,K)=0.
4001 CONTINUE
C EVALUATE XM,XB,AND XSP (WHICH CONTRIBUTE TO ERRORS AND TO COEFFS
C AT (I) AND AT (I-1))
401 CALL TAYLOR (DETA(I-1),F(2,I-1),F(2,I),XM)
CALL TAYLOR (DETA(I-1),B(1,I-1),B(1,I),XB)
IF(NSPM1)403,403,404
404 DO 414 K=1,NSPM1
414 CALL TAYLOR (DETA(I-1),SP(1,I-1,K),SP(1,I,K),XSP(1,K))
C EVAL PORTION OF NLE DEPENDENT ON XM.... AND GROUPINGS EVAL AT I-1
403 C72=F(2,I)*XM(1) +F(3,I)*XM(2) +F(4,I)*XM(3) +F(4,I-1)*XM(4)
XM(6)=XM(6)+C72

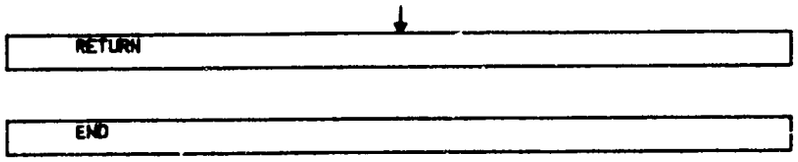

ENL(I+2)=-(-CB2+CB3/2.-C9*C72-2.*(F(2,I)*ZM(1,I-1)+F(3,I)*ZM(2
1,I-1)+F(4,I)*ZM(3,I-1)+F(4,I-1)*ZM(4,I-1)))
DUM1=F(2,I)*XB(1)+F(3,I)*XB(2)+F(4,I)*XB(3)+F(4,I-1)*XB(4)
XB(5)=XB(5)+DUM1
MPI=MAT1J+I
ENL(MPI)=-(-CB4+C2*DUM1-(F(2,I)*ZB(1,I-1)+F(3,I)*ZB(2,I-1)+F(4,I)*
1ZB(
2,I-1)+F(4,I-1)*ZB(4,I-1))-(B(1,I)*ZM(1,I-1)+B(2,I)*ZM(2,I-1)+B(3,
3I)*ZM(3,I-1)+B(3,I-1)*ZM(4,I-1)))
IF(NSPM1)405,405,406
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)* XSP
1(4,K)
XSP(5,K)=XSP(5,K)+DUM1
ENL(MPI)=-(-CKE2(K)+C2*DUM1-(F(2,I)*ZSP(1,I-1,K)+F(
2,I)*ZSP(2,I-1,K)+F(4,I)*ZSP(3,I-1,K)+F(4,I-1)*ZSP(4,I-1,K))-(SP(1
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,K
4)*ZM(4,I-1)))
407 CONTINUE
C EVAL PORTION OF ORIG COEFFS OF AM DEPENDENT UPON PARAM EVAL AT I-1
C*** ESTABLISH INDICES ON VARIABLES
405 NUL=0
IFM=I-2
IFP=I+2
IFPP=NETA+I-3
IFPPP=IFPP+NETA
ISPM=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
Q
B


415 CALL LIAD(-1.I+3.IFN.-C73)
CALL LIAD(-1.I+3.IFPP.-C12)
420 CALL LIAD(-1.I+3. IFPPP.-2.*(C3 * XM(4)+ZM(4.I-1)))
LPI=ISPN+MAT1J
DO 450 K=NUL. NE/M1
IF(K) 425.425.430
425 DUM1=C80*DETA(I-1) C76
DUM2=0.
GO TO 435
430 DU41=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
NPJ=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
DUM5=C82
DUM7=C77
DUM8=C79
GO TO 465
C- - SPECIES EQUATIONS
460 DUM1=-(CK2!(K)+2.•C56 •CK15(K))
DUM2=-CK19(K)
DUM3=-CK19(K)+CK15(K)
DUM4=-CK20(K)+C10•CK14(K)
DUM5=CK21(K)
DUM7=CK19(K)
DUM8=CK20(K)
465 DUM6=C2 •XSP(4,K)-ZSP(4,I-1,K)
AM(MPJ,1)=DUM1
AM(MPJ,IFP)= DUM2
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)= DUM8
GO TO 475
472 CALL LIAD(-1,MPJ,IFN,DUM2)


CALL LIAD(-1, MPJ, IFPP, DUMM)
475 CALL LIAD(-1,MPJ, IFPPP, DUM5)
LPI= ISPN+MAT1J
DO 590 KK=NUL, NSPM1
C ◆ ◆ DUM1/DUMM AND DUM2/DUM5 ARE ERROR/FLUX DERIVATIVES WRT G OR SP AND
C ◆ ◆ GP OR SPP, RESP.
IF(K+KK) 480,490,485
C - - ENERGY EQ. G VARIABLES
490 DUM2=-C80
DUMM=C43
DUM5=C80
GO TO 515
485 IF(K) 490,490,495
C - - ENERGY EQUATION, SP VARIABLES
490 DUM1=-CK1(KK)
DUM2=-CK2(KK)
DUMM=-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=CK8(K)
DUM5=CK5(K)
GO TO 500
C - - SPECIES EQS.. SP VARIABLES
505 DUM1=-CKK2(K,KK)
DUM2=-CKK1(K,KK)+B1(I-1)*CKK9(K,KK)
DUM4=-DUM1
DUM5=CKK1(K,KK)
IF(K-KK) 500,515,500
515 DUM1=-DUM4-C14
500 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

13. SUBROUTINE IONLY - B13B

a. Function

Evaluates the coefficients of the I th corrections for the I th nonlinear (conservation) equations, where I is the i th nodal point in the boundary layer. Called by NONCER.

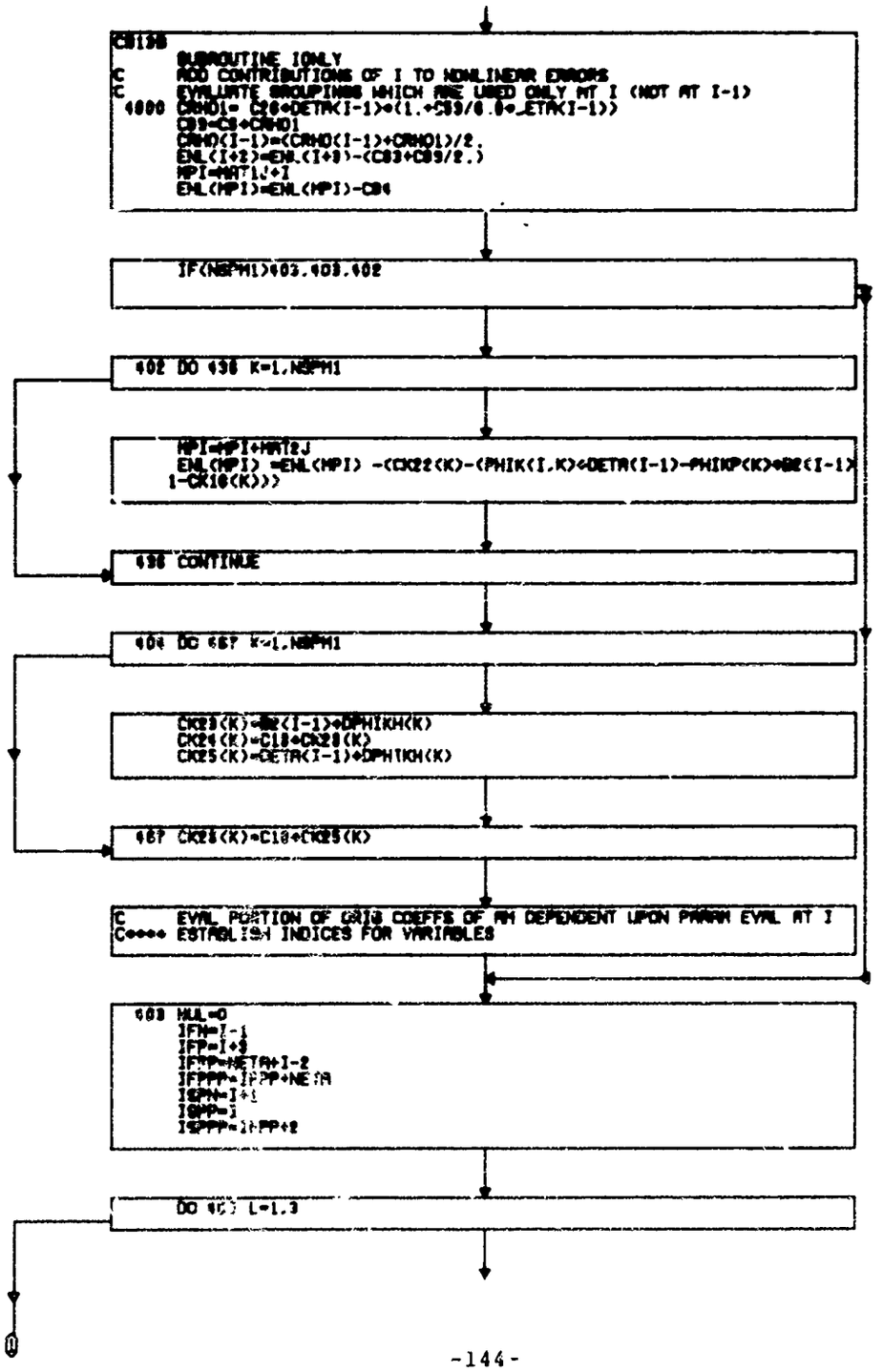
L. Listing

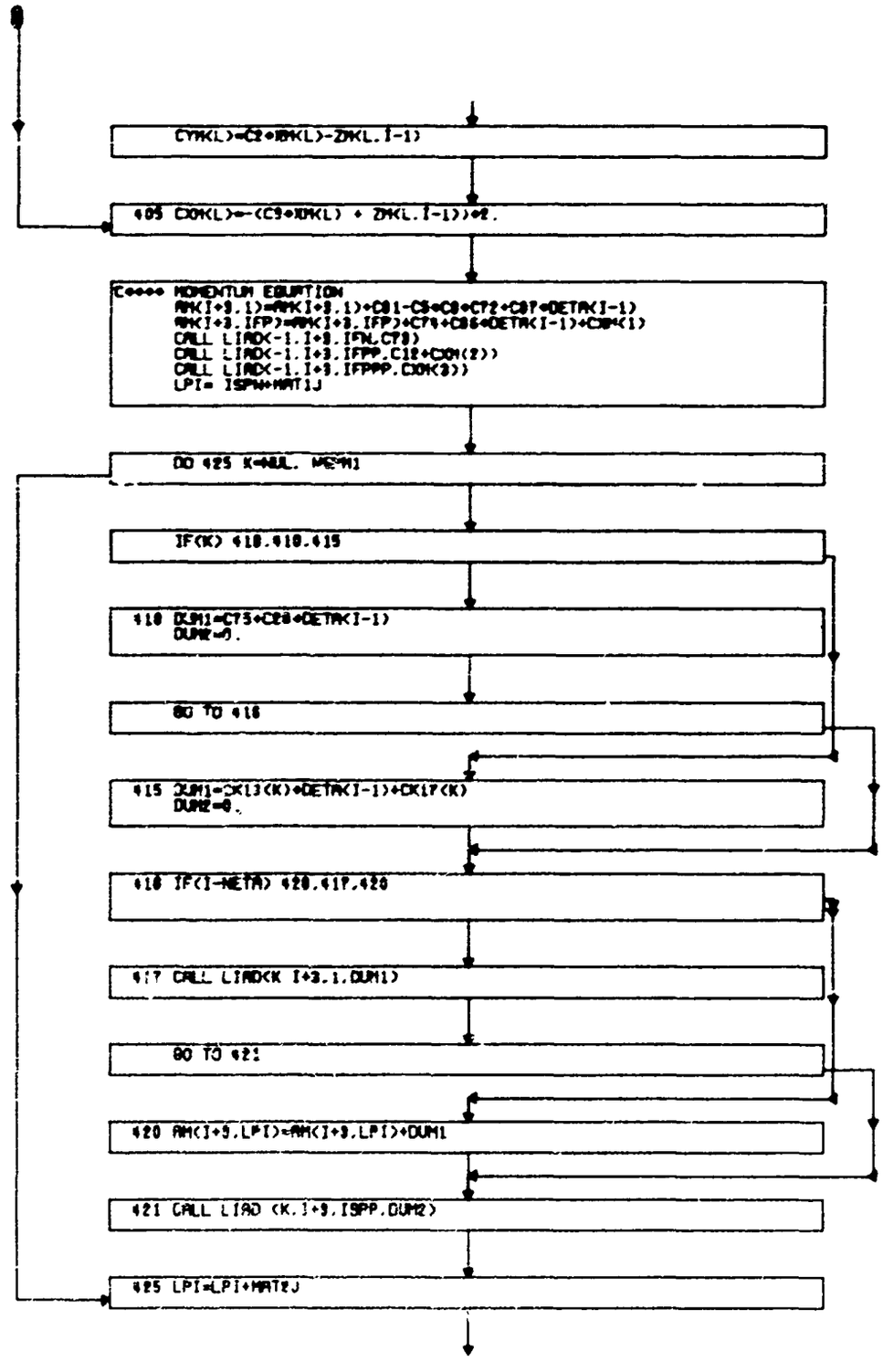
```
000001          CH13B                                                                 B13A 001
000002                SUBROUTINE 1ONLY                                                B13A 002
000003                DIMENSION CK23( 8),CK24( 8),CK25( 8),CK26( 8)                   B13A 003•NEW
000004                COMMON/COECON/          C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B13A   4•NEW
000005               1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB13A   5•NEW
000006               232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B13A   6•NEW
000007               3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB13A   7•NEW
000008               465,C66,C67 C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B13A   8•NEW
000009               5,C82,C83,C84,C85,C86,C87,C88                                   B13A   9•NEW
000010                COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B13A  10•NEW
000011               1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B13A  11•NEW
000012               2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B13A  12•NEW
000013               3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B13A  13•NEW
000014               4,CKK3( 8, 8)                                                   B13A  14•NEW
000015                COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),FLA(313),FLEM,GLEM   B13A  15•NEW
000016               1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)  B13A  16•NEW
000017               2,DGL(30),DSPL(30, 8),ENLE(18),GNLE(15),SPNLE(15, 8),ENL(153)   B13A  17•NEW
000018               3,ENLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8) B13A  18•NEW
000019               4,NENLM,INLMM,DENL(18),DGNL(15),DSPNL(15, 8),DRNL(10)           B13A  19•NEW
000020                COMMON/ETACOM/ETA(15),DETA(15),DS0(14),DCU(14),B1(14),B2(14)    B13A  20•NEW
000021               1,LAR(193),BA1(43,18),HA2(30,7)                                 B13A  21•NEW
000022                COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B13A  22•NEW
000023               1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUL,HHUE,HFW,DLX2 B13A  23•NEW
000024               2,C3M(40),BETAM(40)                                             B13A  24•NEW
000025                COMMON/INTCOM/ KW(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,B13A  25•NEW
000026               1S,IT,NTIME,NSP,NSPM1,NAM,NLEG,NNLEG,NRNL, ITS,KAPPA,CHAR,CASE(15) B13A  26•NEW
000027               2,R(8),      MWE,NON,KG(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B13A  27•NEW
000028               3,KAUXO,JTIME,JSPEC,MD(3)                                       B13A  28•NEW
000029                COMMON/NONCOM/AM(153,153),DVNL(153),TCK,                        B13A  29•NEW
000030               1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)            B13A  30•NEW
000031                COMMON/PRPCOM/DR(15),T(15),RHO(15),SC(15),CAPC(15),GR(15),H(15)  B13A  31•NEW
000032               1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKW( 8),  DB13A  32•NEW
000033               2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKW( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B13A  33•NEW
000034               3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)  B13A  34•NEW
000035               4,DPHIKK( 8, 8),       DMU4W,DMU3W,DHTILW,VMU12,CT,CTR,CPTIL,HTIL  B13B  35•NEW
000036               5,VMU3,DTW,DCAPCW,DPRW,DSCW,DQRW,DCPBW,DCPTW,DMU12W,VMU(15),  RHOP B13A  36•NEW
000037               6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)  B13A  37•NEW
000038                DIMENSION CYM(3),CXM(3),CYSP(3)                                 •-36
000039          C     AND CONTRIBUTIONS OF I TO NONLINEAR ERRORS                      B13A 038
000040          C     EVALUATE GROUPINGS WHICH ARE USED ONLY AT I (NOT AT I-1)        B13A 039
000041           4000 CRHO1= C26•DETA(I-1)•(1.+C53/6.0•DETA(I-1))                     B13A 041
000042                C9=C6•CRHO1                                                     B13B 042
000043                CRHO(I-1)=(CRHO(I-1)+CRHO1)/2.                                  B13A 043
000044                ENL(I+3)=ENL(I+3)-(C83+C89/2.)
000045                MPI=MAT1J+I
000046                ENL(MPI)=ENL(MPI)-C84
000047                IF(NSPM1)403,403,402                                            B13A 051
000048             402 DO 436 K=1,NSPM1                                               B13A 052
000049                MPI=MPI+MAT2J
000050                ENL(MPI) =ENL(MPI) -(CK22(K)-(PHIK(I,K)•DETA(I-1)-PHIKP(K)•B2(I-1)
000051               1-CK16(K)))
000052             436 CONTINUE
000053             403 DO 467 K=1,NSPM1                                               B13A 057
000054                CK23(K)=B2(I-1)•DPHIKW(K)                                       B13A 058
000055                CK24(K)=C13•CK23(K)                                             B13A 059
000056                CK25(K)=DETA(I-1)•DPHIKW(K)                                     B13A 060
000057             467 CK26(K)=C10•CK25(K)                                            B13A 061
000058          C     EVAL PORTION OF ORIG COEFFS OF AM DEPENDENT UPON PARAM EVAL AT I B13A 062
```

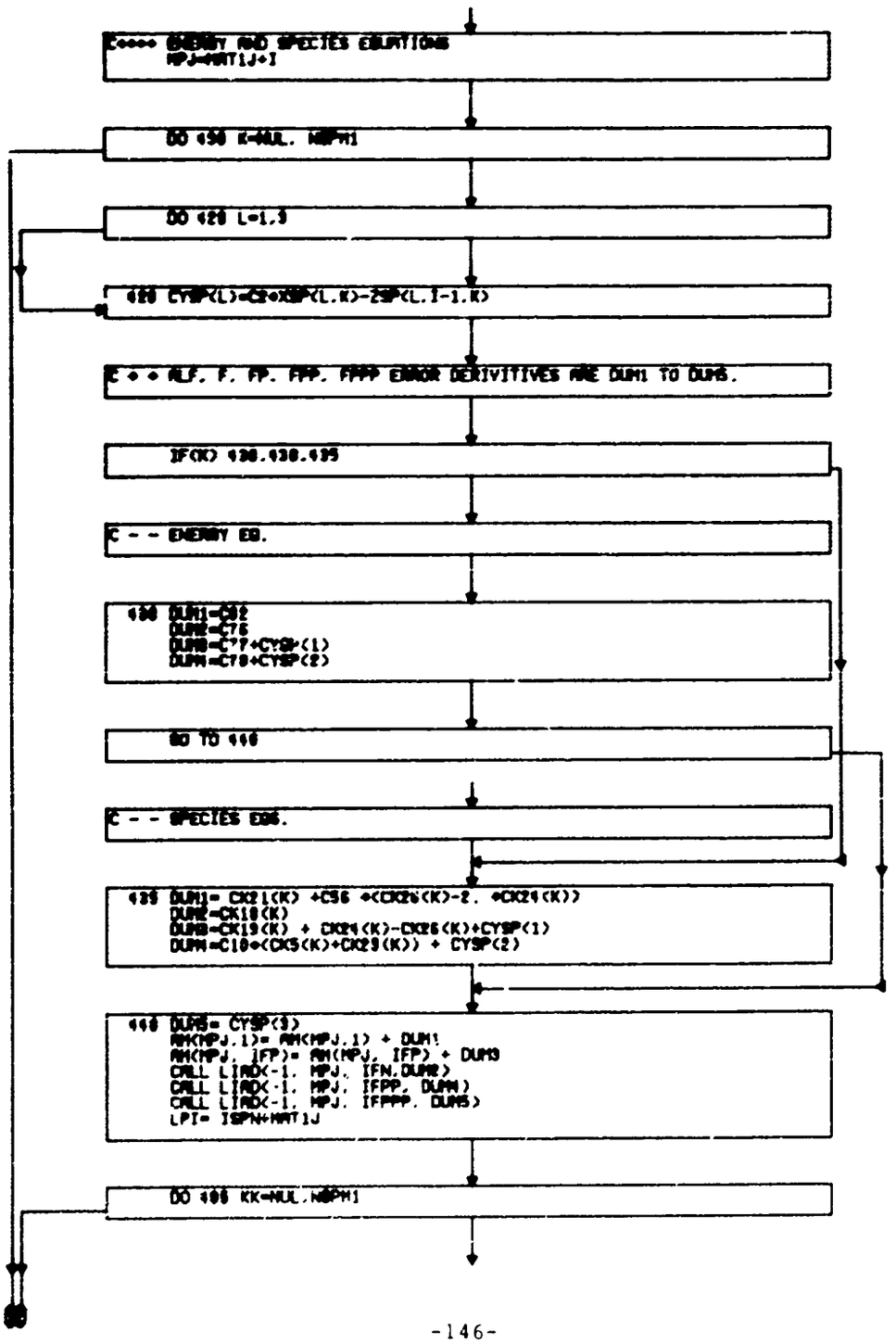
```
000059          C**** ESTABLISH INDICES FOR VARIABLES
000060            423 NUL=0
000061                IFN=I-1
000062                IFP=I+3
000063                IFPP=NETA+I-2
000064                IFPPP=IFPP+NETA
000065                ISPN=I+1
000066                ISPP=I
000067                ISPPP=IFPP+2
000068                DO 405 L=1,3
000069                CYM(L)=C2*XM(L)-ZM(L,I-1)
000070            405 CYM(L)=-(C0*XM(L) + ZM(L,I-1))*2.
000071          C**** MOMENTUM EQUATION
000072                AM(I+3,1)=AM(I+3,1)+C91-C5*CR*C72+C87*DETA(I-1)
000073                AM(I+3,IFP)=AM(I+3,IFP)+C74+CR6*DETA(I-1)+CXM(1)
000074                CALL LIAD(-1,I+3,IFN,C73)
000075                CALL LIAD(-1,I+3,IFPP,C12+CXM(2))
000076                CALL LIAD(-1,I+3,IFPPP,CXM(3))
000077                LPI= ISPN+MAT1J
000078                DO 425 K=NUL, NSPM1
000079                IF(K) 410,410,415
000080            410 DUM1=C75+C8R*DETA(I-1)
000081                DUM2=0.
000082                GO TO 416
000083            415 DUM1=CK13(K)*DETA(I-1)+CK17(K)
000084                DUM2=0.
000085            416 IF(I-NETA) 420,417,420
000086            417 CALL LIAD(K,I+3,1,DUM1)
000087                GO TO 421
000088            420 AM(I+3,LPI)=AM(I+3,LPI)+DUM1
000089            421 CALL LIAD (K,I+3,ISPP,DUM2)
000090            425 LPI=LPI+MAT2J
000091          C**** ENERGY AND SPECIES EQUATIONS
000092                MPJ=MAT1J+1
000093                DO 490 K=NUL, NSPM1
000094                DO 428 L=1,3
000095            428 CYSP(L)=C2*XSP(L,K)-ZSP(L,I-1,K)
000096          C * * ALF, F, FP, FPP, FPPP ERROR DERIVITIVES ARE DUM1 TO DUM5.
000097                IF(K) 430,430,435
000098          C - - ENERGY EQ.
000099            430 DUM1=C82
000100                DUM2=C76
000101                DUM3=C77+CYSP(1)
000102                DUM4=C78+CYSP(2)
000103                GO TO 440
000104          C - - SPECIES EQS.
000105            435 DUM1= CK21(K) +C56 *(CK26(K)-2. *CK24(K))
000106                DUM2=CK18(K)
000107                DUM3=CK19(K) + CK24(K)-CK20(K)+CYSP(1)
000108                DUM4=C10*(CK5(K)+CK23(K)) + CYSP(2)
000109            440 DUM5= CYSP(3)
000110                AM(MPJ,1)= AM(MPJ,1) + DUM1
000111                AM(MPJ, IFP)= AM(MPJ, IFP) + DUM3
000112                CALL LIAD(-1, MPJ, IFN,DUM2)
000113                CALL LIAD(-1, MPJ, IFPP, DUM4)
000114                CALL LIAD(-1, MPJ, IFPPP, DUM5)
000115                LPI= ISPN+MAT1J
000116                DO 485 KK=NUL,NSPM1
000117          C * * DUM1 AND DUM2 ARE ERROR DERIVITIVES WRT G OR SP AND GP OR SPP
000118                IF(K+KK) 445,445,450
```

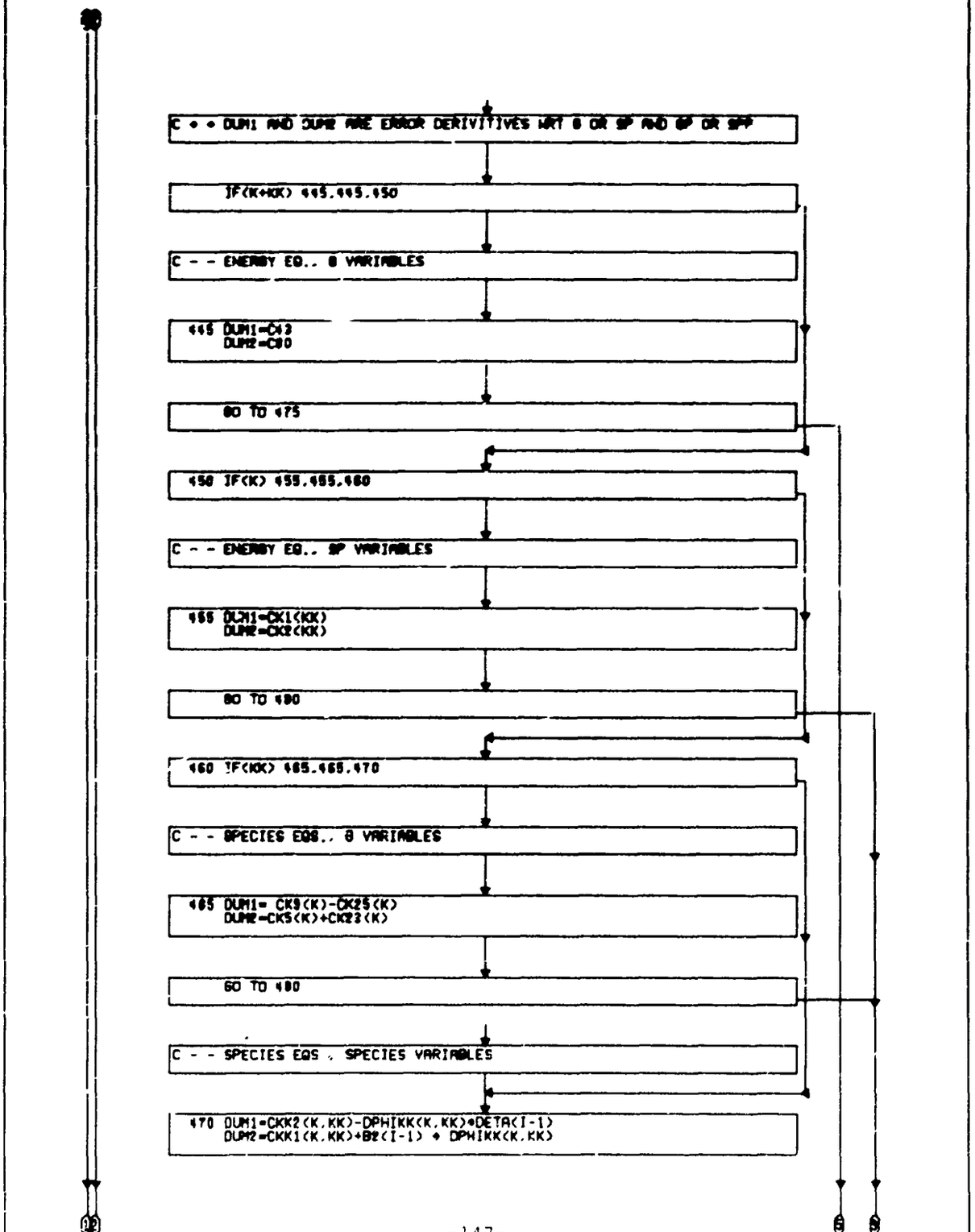
```
000119          C - - E ERGY E.., G VARIABLES
000120            445 DUM1=C43
000121                DUM2=C80
000122                GO TO 475
000123            450 IF(K) 455,455,460
000124          C - - E ERGY E.., SP VARIABLES
000125            455 DUM1=CK1(KK)
000126                DUM2=CK2(KK)
000127                GO TO 480
000128            460 IF(KK) 465,465,470
000129          C - - SPECIES EQS., G VARIABLES
000130            465 DUM1= CK9(K)-CK25(K)
000131                DUM2=CK5(K)+CK23(K)
000132                GO TO 480
000133          C - - SPECIES EQS., SPECIES VARIABLES
000134            470 DUM1=CKK2(K,KK)-DPHIKK(K,KK)*ETA(I-1)
000135                DUM2=CKK1(K,KK)+B2(I-1) * DPHIKK(K,KK)
000136                IF(K-KK) 480,475,480
000137            475 DUM1=DUM1+CYM(1)+C14
000138                DUM2=DUM2+CYM(2)
000139            480 IF(I-NETA) 483,482,483
000140            482 CALL LIAD(KK,MPJ,1,DUM1)
000141                GO TO 484
000142            483 AM(MPJ,LPI)=AM(MPJ,LPI)+DUM1
000143            484 CALL LIAD(KK,MPJ,ISPP,DUM2)
000144            485 LPI= LPI+MAT2J
000145                CALL LIAD(K,MPJ,ISPPP, CYM(3))
000146            490 MPJ=MPJ+MAT2J
000147                RETURN
000148                END
```

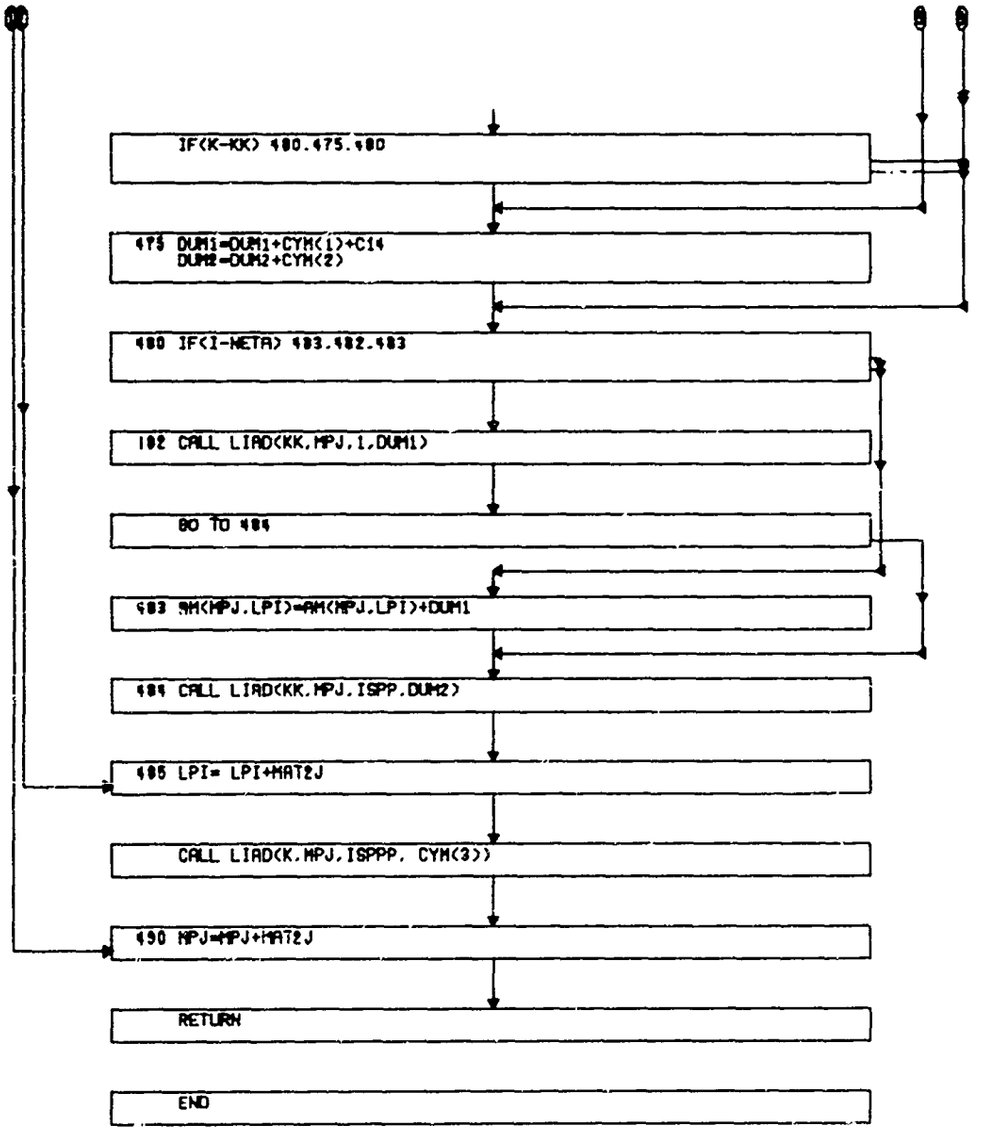
c. Flow Chart


C0158
SUBROUTINE IONLY
C ADD CONTRIBUTIONS OF I TO NONLINEAR ERRORS
C EVALUATE GROUPINGS WHICH ARE USED ONLY AT I (NOT AT I-1)
4000 CRHO1= C26*DETA(I-1)*((1.+C39/6.0*ETA(I-1))
C39=C3+CRHO1
CRHO(I-1)=(CRHO(I-1)+CRHO1)/2.
ENL(I+2)=ENL(I+3)-(C33+C39/2.)
MPI=MAT1J+I
ENL(MPI)=ENL(MPI)-C34
IF(NEPH1)403,403,402
402 DO 498 K=1,NEPH1
MPI=MPI+MAT2J
ENL(MPI) =ENL(MPI) -(CK22(K)-(PHIK(I,K)*DETA(I-1)-PHIKP(K)*B2(I-1)
1-CK16(K)))
498 CONTINUE
404 DO 487 K=1,NEPH1
CK23(K)=B2(I-1)*DPHIKH(K)
CK24(K)=C18*CK23(K)
CK25(K)=DETA(I-1)*DPHIKH(K)
487 CK26(K)=C18*CK25(K)
C EVAL PORTION OF GAIN COEFFS OF RH DEPENDENT UPON PARAM EVAL AT I
C**** ESTABLISH INDICES FOR VARIABLES
403 NUL=0
IFM=I-1
IFP=I+3
IFMP=METAI-2
IFPPP=IFPP+NEPH
ISPM=I+1
ISMP=1
ISPPP=1+PP+2
DO 40 L=1,3


CYM(L)=C2*RM(L)-ZM(L,I-1)
405 CDM(L)=-(C9*RM(L) + ZM(L,I-1))*2.
C**** MOMENTUM EQUATION
RM(I+3,1)=RM(I+3,1)+C81-C5*C8*C72+C87*DETA(I-1)
RM(I+3,IFP)=RM(I+3,IFP)+C74+C86*DETA(I-1)+CDM(1)
CALL LIAD(-1,I+3,IFM,C78)
CALL LIAD(-1,I+3,IFPP,C12+CDM(2))
CALL LIAD(-1,I+3,IFPPP,CDM(3))
LPI= ISPM+MAT1J
DO 425 K=NUL, ME-M1
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 RM(I+3,LPI)=RM(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 498 K=NUL, NBPH1
DO 428 L=1,3
428 CYSP(L)=C2*XSP(L,K)-2SP(L,I-1,K)
C * * ALF, F, FP, FPP, FPPP ERROR DERIVITIVES ARE DUM1 TO DUM5.
IF(K) 438,438,435
C - - ENERGY EQ.
438 DUM1=C12
DUM2=C16
DUM3=C17*CYSP(1)
DUM4=C18*CYSP(2)
GO TO 448
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=C18*(CK5(K)+CK29(K)) + CYSP(2)
448 DUM5= CYSP(3)
AM(MPJ,1)= AM(MPJ,1) + DUM1
AM(MPJ, IFP)= AM(MPJ, IFP) + DUM3
CALL LIRDX(-1, MPJ, IFN,DUM2)
CALL LIRDX(-1, MPJ, IFPP, DUM4)
CALL LIRDX(-1, MPJ, IFPPP, DUM5)
LPI= ISPN+MAT1J
DO 498 KK=NUL,NBPH1

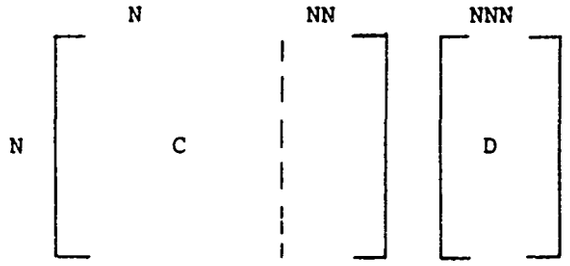

C • • DUM1 AND DUM2 ARE ERROR DERIVITIVES WRT θ OR SP AND θP OR SPP
IF(K+KK) 445,445,450
C - - ENERGY EQ.. θ VARIABLES
445 DUM1=CK3
DUM2=CK0
GO TO 475
450 IF(K) 455,465,460
C - - ENERGY EQ.. SP VARIABLES
455 DUM1=CK1(KK)
DUM2=CK2(KK)
GO TO 480
460 IF(KK) 465,465,470
C - - SPECIES EQS.. θ VARIABLES
465 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)+Bz(I-1) • DPHIKK(K,KK)


IF(K-KK) 480.475.480
475 DUM1=DUM1+CYM(1)+C14
DUM2=DUM2+CYM(2)
480 IF(I-METR) 483.482.483
482 CALL LIRD(KK.MPJ.1.DUM1)
GO TO 484
483 AM(MPJ.LPI)=AM(MPJ.LPI)+DUM1
484 CALL LIRD(KK.MPJ.ISPP.DUM2)
485 LPI= LPI+MAT2J
CALL LIRD(K.MPJ.ISPPP. CYM(3))
490 MPJ=MPJ+MAT2J
RETURN
END

14. SUBROUTINE RERAY (N,C,NN,D,NNN,LS,IS,ND) - B15B

a. Function

Replaces rectangular matrix (C) with N rows and N+NN columns by the product of the inverse of an N by N submatrix and the remaining columns of C. The inverse is also permitted to act on additional columns (Matrix (D) with N rows and NNN columns) from another portion of memory. Also, routine rearranges columns according to arbitrary specification given by LS.



Called by EQUIL, NONCER, RNLCER.

N = Number of rows in rectangular matrix (see sketch)

C = Elements of rectangular matrix (see sketch)

NN = Number of columns in matrix C in excess of those contributing to square matrix (see sketch)

D = Elements of matrix of additional columns (see sketch)

NNN = Number of additional columns (see sketch)

LS = Sequence to which columns of C are rearranged (LS(1)=0 signifies no rearrangement)

IS = Flag, yields debug output if RERAY entered with IS=-2, signifies singular matrix if RERAY yields IS less than zero.

ND = Dimension on rows of C from calling program

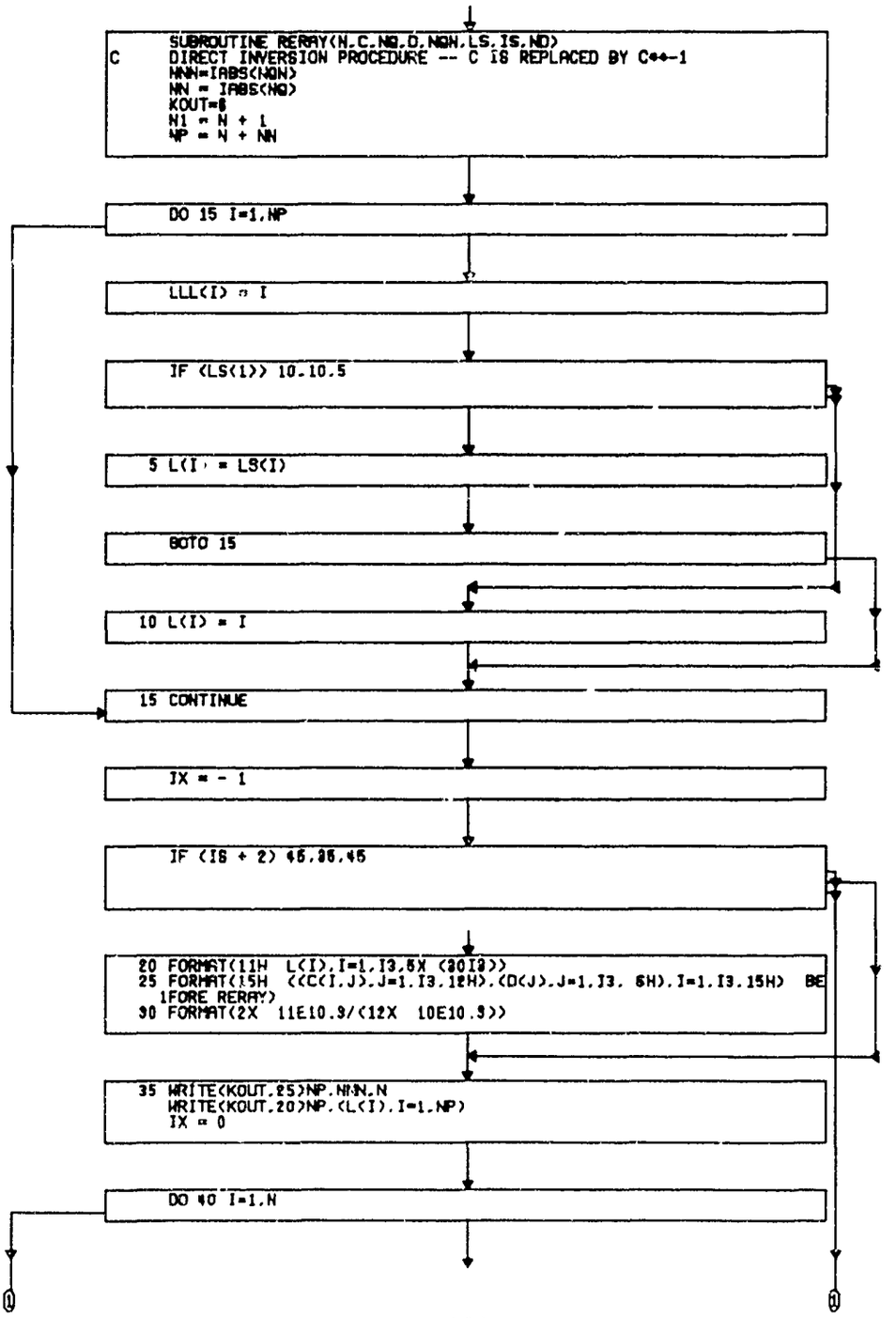
b. Listing

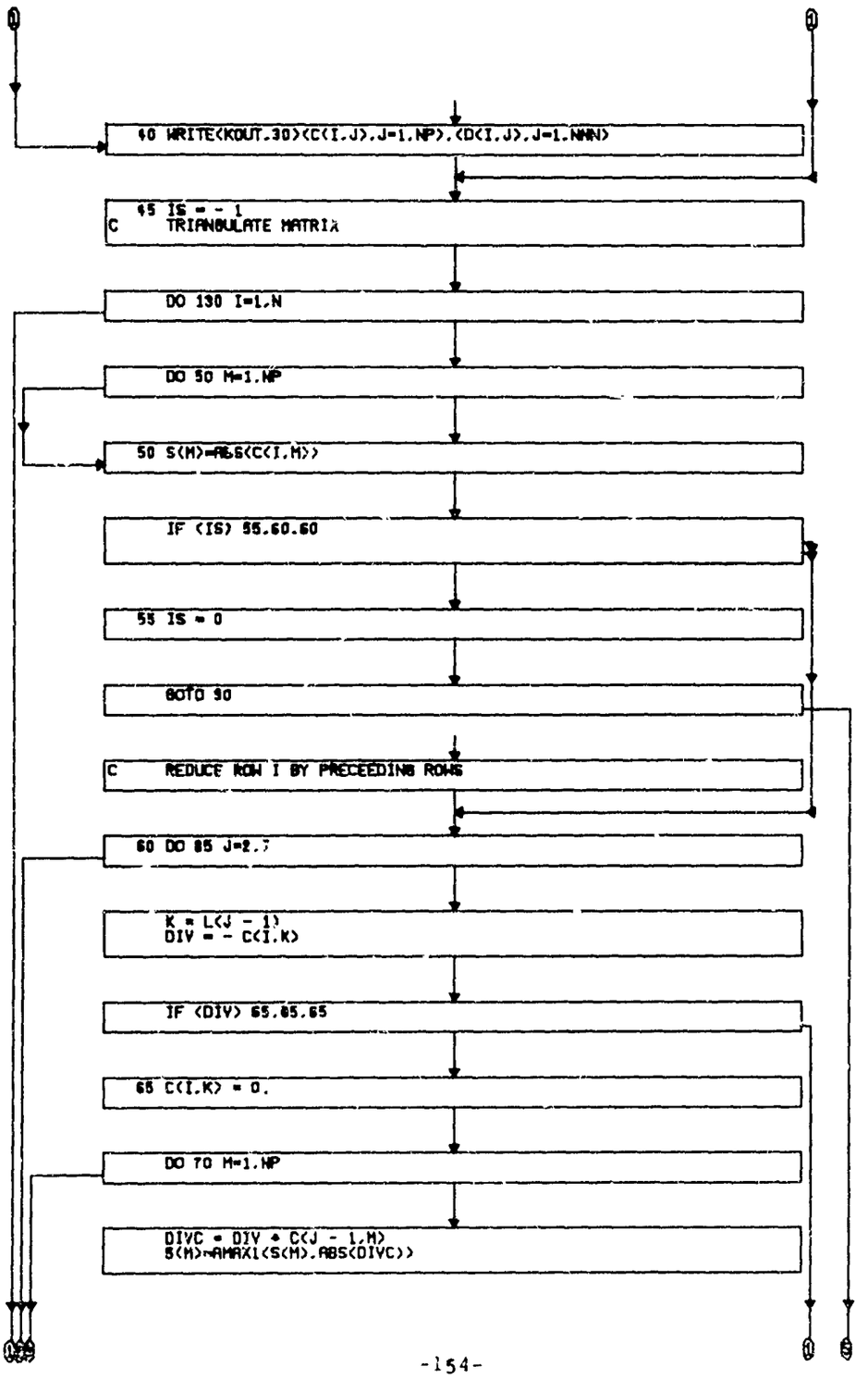
```
000001                SUBROUTINE RERAY(N,C,N3,D,NQN,LS,IS,ND)
000002          C     DIRECT INVERSION PROCEDURE -- C IS REPLACED BY C**-1
000003                DIMENSION D(ND,1),SD(153),C(ND,1),L(153),S(153),LL(153),LLL(153), 8158 003*NEW
000004               1LS(1)                                                           8158 004*NEW
000005                NNN=IABS(NQN)                                                        **-2
000006                NN = IABS(NQ)
000007                KOUT=6
000008                N1 = N - 1                                                      RERA0070
000009                NP = N + NN                                                     RERA0080
000010                DO 15 I=1,NP                                                    RERA0090
000011                LLL(I) = I                                                      RERA0110
000012                IF (LS(1)) 10,10,5                                              RERA0120
000013              5 L(I) = LS(I)                                                    RERA0130
000014                GOTO 15                                                         RERA0140
000015             10 L(I) = I                                                        RERA0150
000016             15 CONTINUE                                                       RERA0160
000017                IX = -1                                                         RERA0170
000018                IF (IS + 2) 40,35,45                                            RERA0180
000019             20 FORMAT(11H  L(I),I=1,I3,9X (3013))                            RERA0190
000020             25 FORMAT(15H  ((C(I,J),J=1,I3,12H),(D(J),J=1,I3, 6H),I=1,I3,15H)  85RERA0200
000021               1FORE RERAY)                                                   RERA0210
000022             30 FORMAT(2X  11E10.3/(12X  10E10.3))                            RERA0220
000023             35 WRITE(KOUT,25)NP,NNN,N                                        RERA0230
000024                WRITE(KOUT,20)NP,(L(I),I=1,NP)                                RERA0240
000025                IX = 0                                                        RERA0250
000026                DO 40 I=1,N                                                   RERA0260
000027             40 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NNN)                RERA0270
000028             45 IS = -1                                                       RERA0280
000029          C     TRIANGULATE MATRIX                                            RERA0290
000030                DO 130 I=1,N                                                  RERA0300
000031                DO 50 M=1,NP
000032             50 S(M)=ABS(C(I,M))
000033                IF (I3) 55,60,60                                              RERA0330
000034             55 IS = 0                                                        RERA0340
000035                GOTO 90                                                       RERA0350
000036          C     REDUCE ROW I BY PRECEEDING ROWS                               RERA0360
000037             60 DO 85 J=2,I                                                   RERA0370
000038                K = L(J - 1)                                                  RERA0380
000039                DIV = - C(I,K)                                                RERA0390
000040                IF (DIV) 65,85,65                                             RERA0400
000041             65 C(I,K) = 0.                                                   RERA0410
000042                DO 70 M=1,NP                                                  RERA0420
000043                DIVC = DIV * C(J - 1,M)                                       RERA0430
000044                S(M)=AMAX1(S(M),ABS(DIVC))
000045             70 C(I,M) = C(I,M) + DIVC                                        RERA0450
000046                IF (NNN) 85,85,75                                             RERA0460
000047             75 DO 80 M=1,NNN                                                 RERA0470
000048             80 D(I,M) = D(I,M) + DIV * D(J - 1,M)                            RERA0480
000049             85 CONTINUE                                                      RERA0490
000050          C     SEEK MAXIMUM PIVOT                                            RERA0500
000051             90 DIV = 0.                                                      RERA0510
000052                DO 100 JJ=I,N                                                 RERA0520
000053                M = L(JJ)                                                     RERA0530
000054                IF (ABS(C(I,M)) - DIV) 100,100,95                             RERA0540
000055             95 DIV = ABS(C(I,M))                                             RERA0550
000056                K = M                                                         RERA0560
000057                J = JJ                                                        RERA0570
000058                IF(ND-20)  100,100,101
```

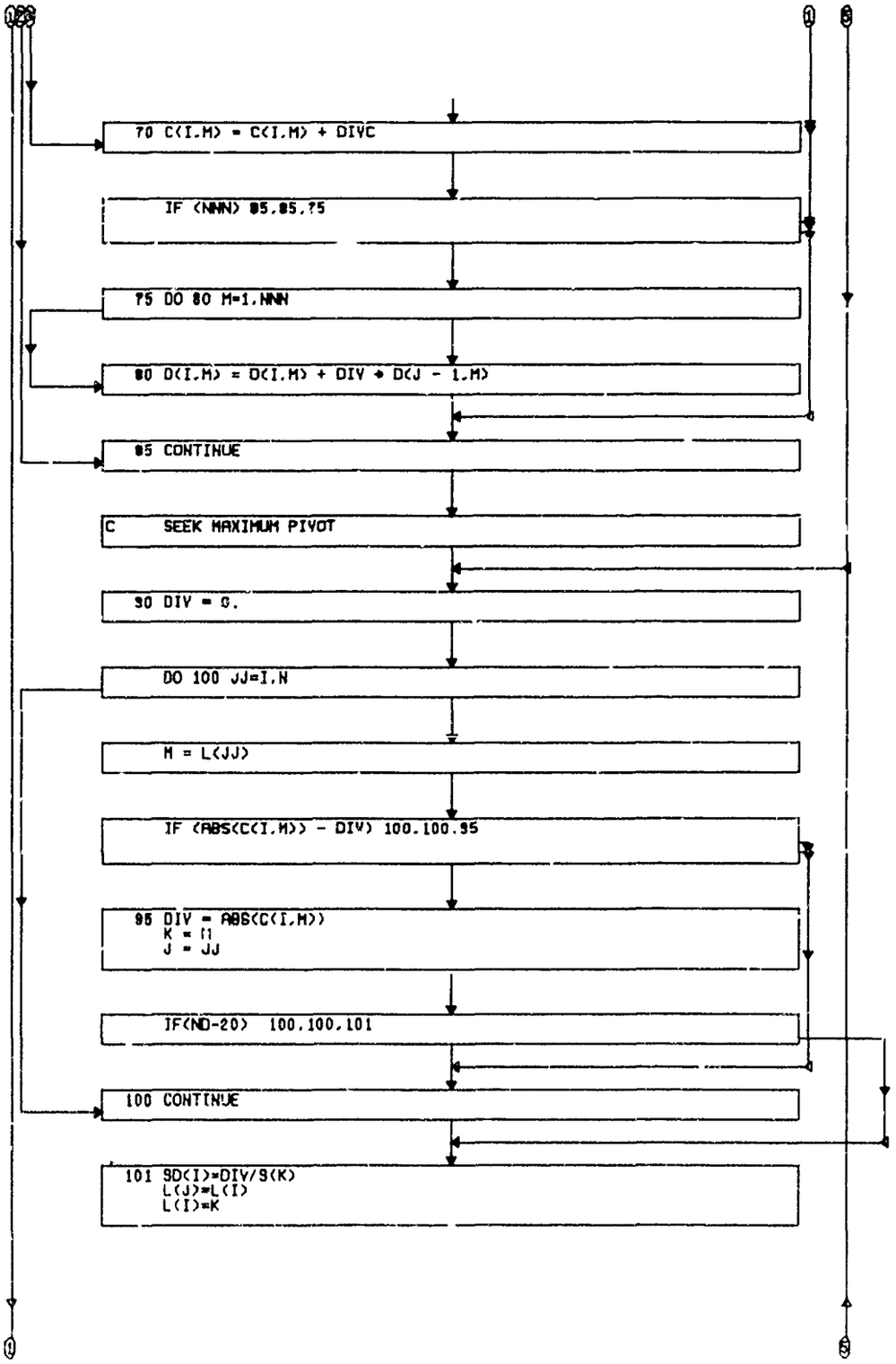
```
000059          100 CONTINUE                                                    RERA0580
000060          101 SD(I)=DIV/S(K)
000061              L(J)=L(I)
000062              L(I)=K
000063              IF(SD(I)-1.E-A) 104,104,110
000064          104 C(I,K)=0.
000065              IF(SD(I)) 105,105,90
000066          C   SINGULAR MATRIX RETURN
000067          105 IS=-1
000068              WRITE(KOUT,135) (II,L(II),SD(II),II=1,I)
000069              RETURN
000070          110 DIV = C(I,K)                                                RERA0670
000071              C(I,K) = 1.0                                                RERA0680
000072              K = LLL(J)                                                  RERA0690
000073              LLL(J) = LLL(I)                                             RERA0700
000074              LLL(I) = K                                                  RERA0710
000075              LL(K' = I                                                   RERA0720
000076          C   NORMALIZE ROW                                               RERA0730
000077              IF (NNN) 125,125,115                                        RERA0740
000078          115 DO 120 J=1,NNN                                              RERA0750
000079          120 D(I,J) = D(I,J) / DIV                                       RERA0760
000080          125 DO 130 J=1,NP                                               RERA0770
000081          130 C(I,J) = C(I,J) / DIV                                       RERA0780
000082              IF (IX) 145,140,145                                         RERA0790
000083          135 FORMAT(24H PIVOT ROW/COL/RE3,RATIO 5(I4,1H/I3,1H/E9.2,1H,))  RERA0800
000084          140 WRITE(KOUT,135)(I,L(I),SD(I),I=1,NP)                        RERA0810
000085          C   DIAGONALIZE MATRIX                                          RERA0820
000086          145 NM = N - 1                                                  RERA0830
000087          C   INTERCHANGE COLUMNS                                         RERA0960
000088              DO 225 II=1,NP                                              RERA0970
000089              I = II                                                      RERA0980
000090          180 J = L(I)                                                    RERA0990
000091              L(I) = I                                                    RERA1000
000092              IF (J - I) 185,225,185                                      RERA1010
000093          185 IF (IS) 200,190,200                                         RERA1020
000094          190 DO 195 M=1,N                                                RERA1030
000095              S(M) = C(M,I)                                               RERA1040
000096          195 C(M,I) = C(M,J)                                             RERA1050
000097              IS = I                                                      RERA1060
000098              I = J                                                       RERA1070
000099              GOTO 180                                                    RERA1080
000100          200 IF (IS - J) 205,215,205                                     RERA1090
000101          205 DO 210 M=1,N                                                RERA1100
000102          210 C(M,I) = C(M,J)                                             RERA1110
000103              I = J                                                       RERA1120
000104              GOTO 180                                                    RERA1130
000105          215 DO 220 M=1,N                                                RERA1140
000106          220 C(M,I) = S(M)                                               RERA1150
000107              IS = 0                                                      RERA1160
000108          225 CONTINUE                                                    RERA1170
000109              IF(NQN + NQ) 149,149,144
000110          144 IF(NQN+NQ-NN-NNN) 149,147,149
000111          C*****SOLUTION VECTOR ONLY
000112          147 K=N
000113              DO 153 I=1,NM
000114              K=K-1
000115              DO 153 IL=K,NM
000116              DUM=C(K,IL+1)
000117              IF (NN) 152,152,151
000118          151 DO 146 M=N1,NP
```

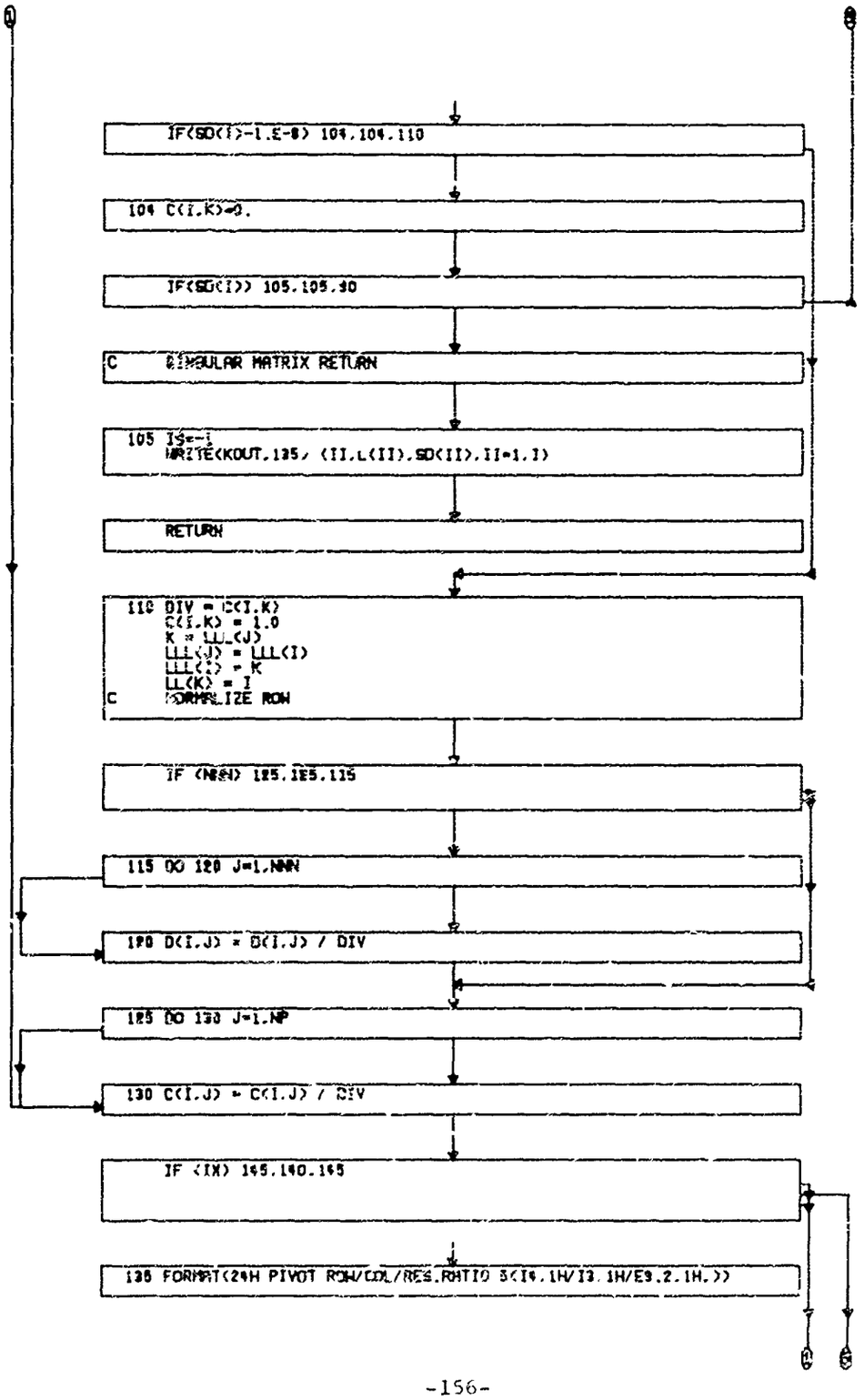
```
000119          146 C(K,M) = C(K,M) - DUM * C(IL+1,M)
000120              C(K,1)=C(K,1)-DUM*C(IL+1,1)
000121              IF (NNN) 153,153,152
000122          152 DO 148 M=1,NNN
000123          148 D(K,M)=D(K,M)-DUM*D(IL+1,M)
000124          153 CONTINUE
000125              GO TO 176
000126        C*****FULL INVERSION AND SOLUTION VECTOR
000127          149 DO 175 I=1,NM                                              RERA0840
000128              DO 175 J=1,I                                               RERA0860
000129              DIV = - C(J,I+1)
000130              IF (DIV) 150,175,150                                       RERA0880
000131          150 C(J,I+1) = 0.
000132              IF (NNN) 165,165,155                                       RERA0900
000133          155 DO 160 M=1,NNN                                             RERA0910
000134          160 D(J,M) = D(J,M) + DIV * D(I + 1,M)                         RERA0920
000135          165 DO 170 M=1,NP                                              RERA0930
000136          170 C(J,M) = C(J,M) + DIV * C(I + 1,M)                         RERA0940
000137          175 CONTINUE                                                   RERA0950
000138        C     INTERCHANGE ROWS                                           RERA1180
000139          176 DO 320 II=1,N                                              RERA1190
000140              I = II                                                     RERA1200
000141          230 J = LL(I)                                                  RERA1210
000142              LL(I) = I                                                  RERA1220
000143              IF (J - I) 235,320,235                                     RERA1230
000144          235 IF (IS) 265,240,265                                        RERA1240
000145          240 DO 245 M=1,NP                                              RERA1250
000146              S(M) = C(I,M)                                              RERA1260
000147          245 C(I,M) = C(J,M)                                            RERA1270
000148              IF (NNN) 260,260,250                                       RERA1280
000149          250 DO 255 M=1,NNN                                             RERA1290
000150              SD(M) = D(I,M)                                             RERA1300
000151          255 D(I,M) = D(J,M)                                            RERA1310
000152          260 IS = 1                                                     RERA1320
000153              I = J                                                      RERA1330
000154              GOTO 230                                                   RERA1340
000155          265 IF (IS - J) 270,295,270                                    RERA1350
000156          270 DO 275 M=1,NP                                              RERA1360
000157          275 C(I,M) = C(J,M)                                            RERA1370
000158              IF (NNN) 290,290,280                                       RERA1380
000159          280 DO 285 M=1,NNN                                             RERA1390
000160          285 D(I,M) = D(J,M)                                            RERA1400
000161          290 I = J                                                      RERA1410
000162              GOTO 230                                                   RERA1420
000163          295 DO 300 M=1,NP                                              RERA1430
000164          300 C(I,M) = S(M)                                              RERA1440
000165              IF (NNN) 315,315,305                                       RERA1450
000166          305 DO 310 M=1,NNN                                             RERA1460
000167          310 D(I,M) = SD(M)                                             RERA1470
000168          315 IS = 0                                                     RERA1480
000169          320 CONTINUE                                                   RERA1490
000170              IF (IX) 340,330,340                                        RERA1500
000171          325 FORMAT(15H  ((C(I J),J=1,I3,12H);(D(J),J=1,I3, 6H),I=1,I3,15H)  AFRERA1510
000172             1TER RERAY  )                                               RERA1520
000173          330 WRITE(KOUT,325)NP,NNN,N                                    RERA1530
000174              DO 335 I=1,N                                               RERA1540
000175          335 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NNN)             RERA1550
000176          340 RETURN                                                     RERA1560
000177              END
```

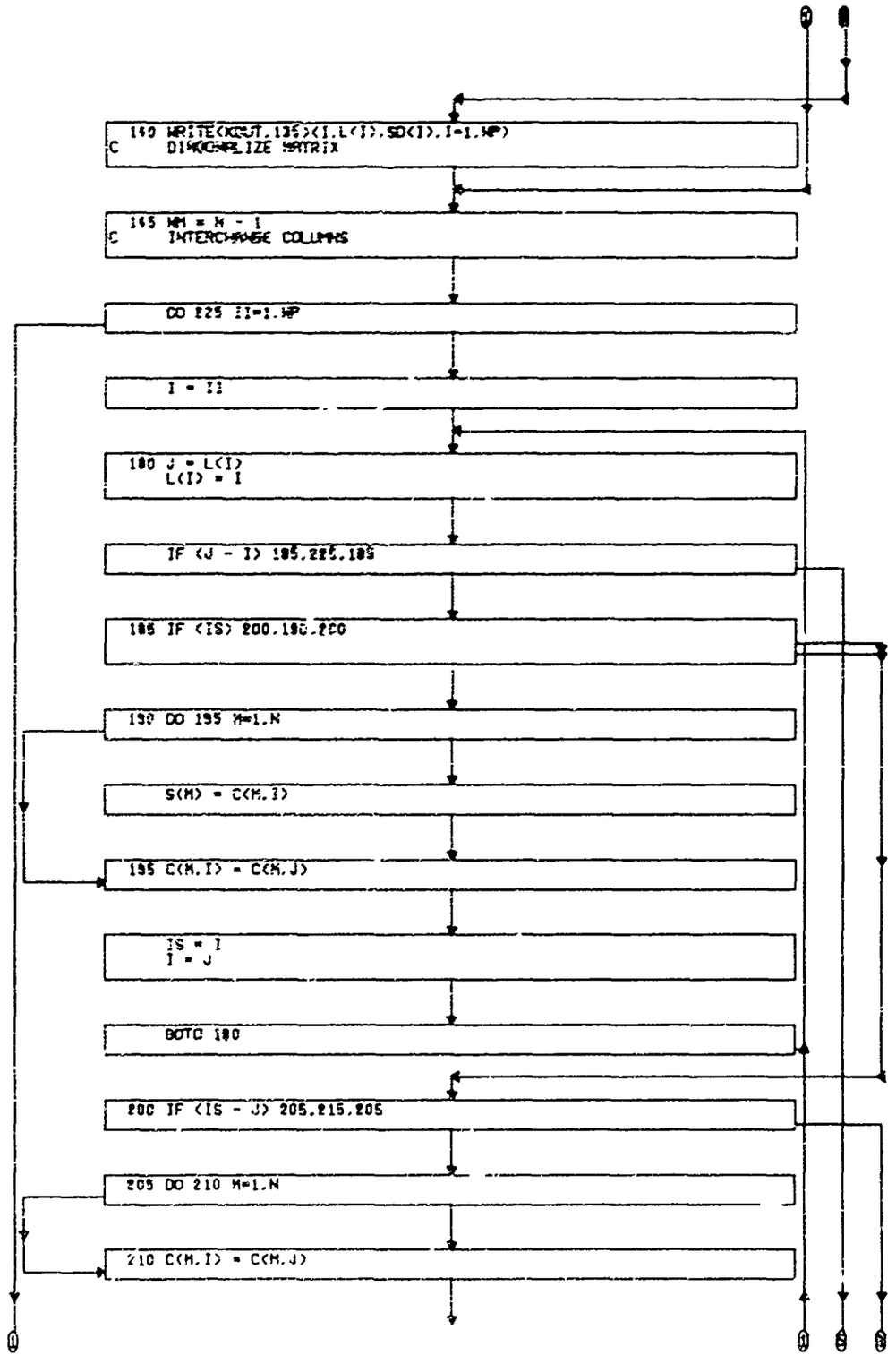
c. Flow Chart

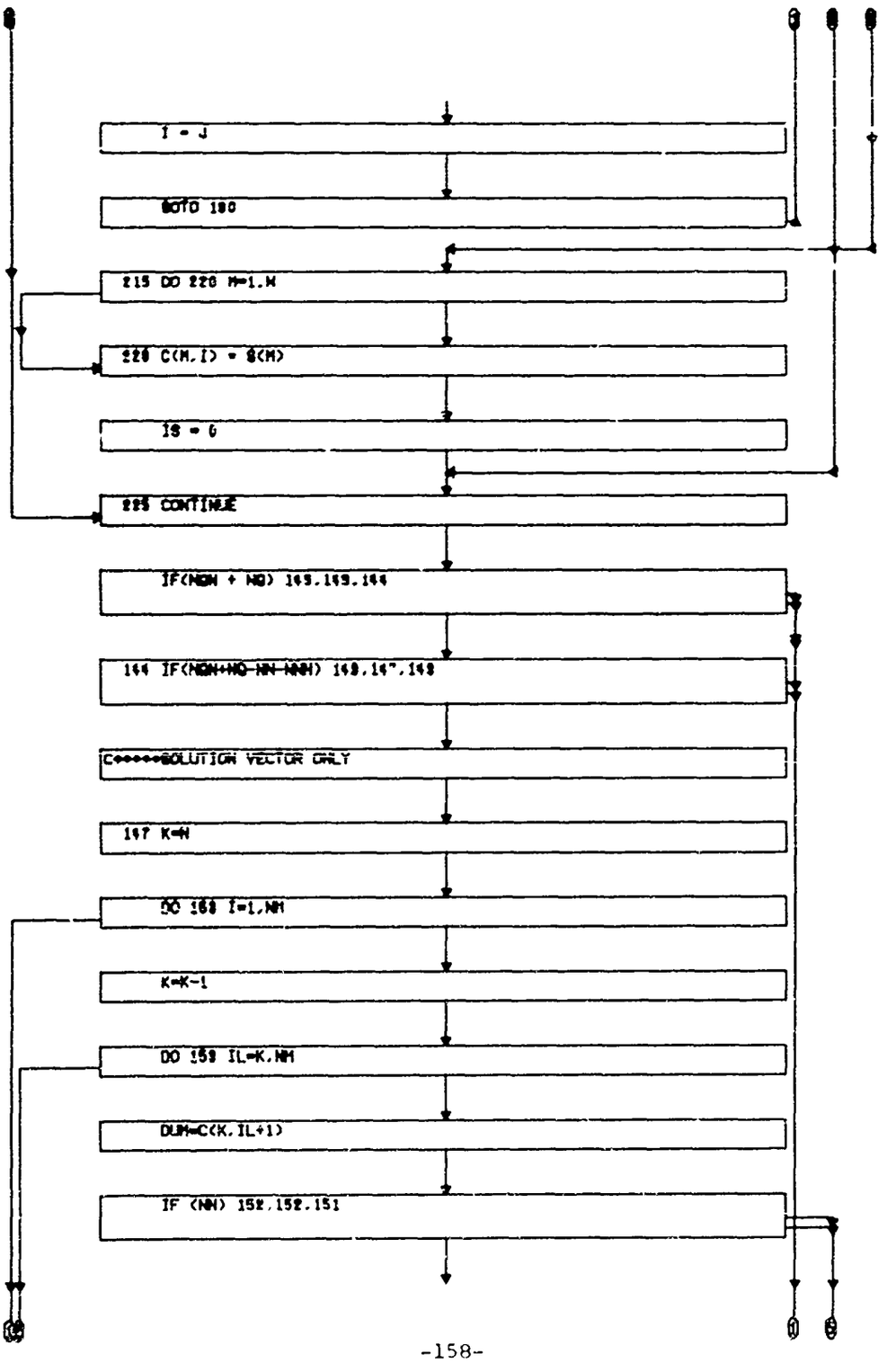

SUBROUTINE RERAY(N,C,NO,D,NON,LS,IS,ND)
C DIRECT INVERSION PROCEDURE -- C IS REPLACED BY C**-1
NNN=IABS(NON)
NN = IABS(NO)
KOUT=6
N1 = N + 1
NP = N + NN
DO 15 I=1,NP
LLL(I) = I
IF (LS(1)) 10,10,5
5 L(I) = LS(I)
GOTO 15
10 L(I) = I
15 CONTINUE
IX = - 1
IF (IS + 2) 45,35,45
20 FORMAT(11H L(I),I=1,I3,5X (30I3))
25 FORMAT(15H ((C(I,J),J=1,I3,12H),(D(J),J=1,I3, 6H),I=1,I3,15H) BE
1FORE RERAY)
30 FORMAT(2X 11E10.9/(12X 10E10.9))
35 WRITE(KOUT,25)NP,NNN,N
WRITE(KOUT,20)NP,(L(I),I=1,NP)
IX = 0
DO 40 I=1,N

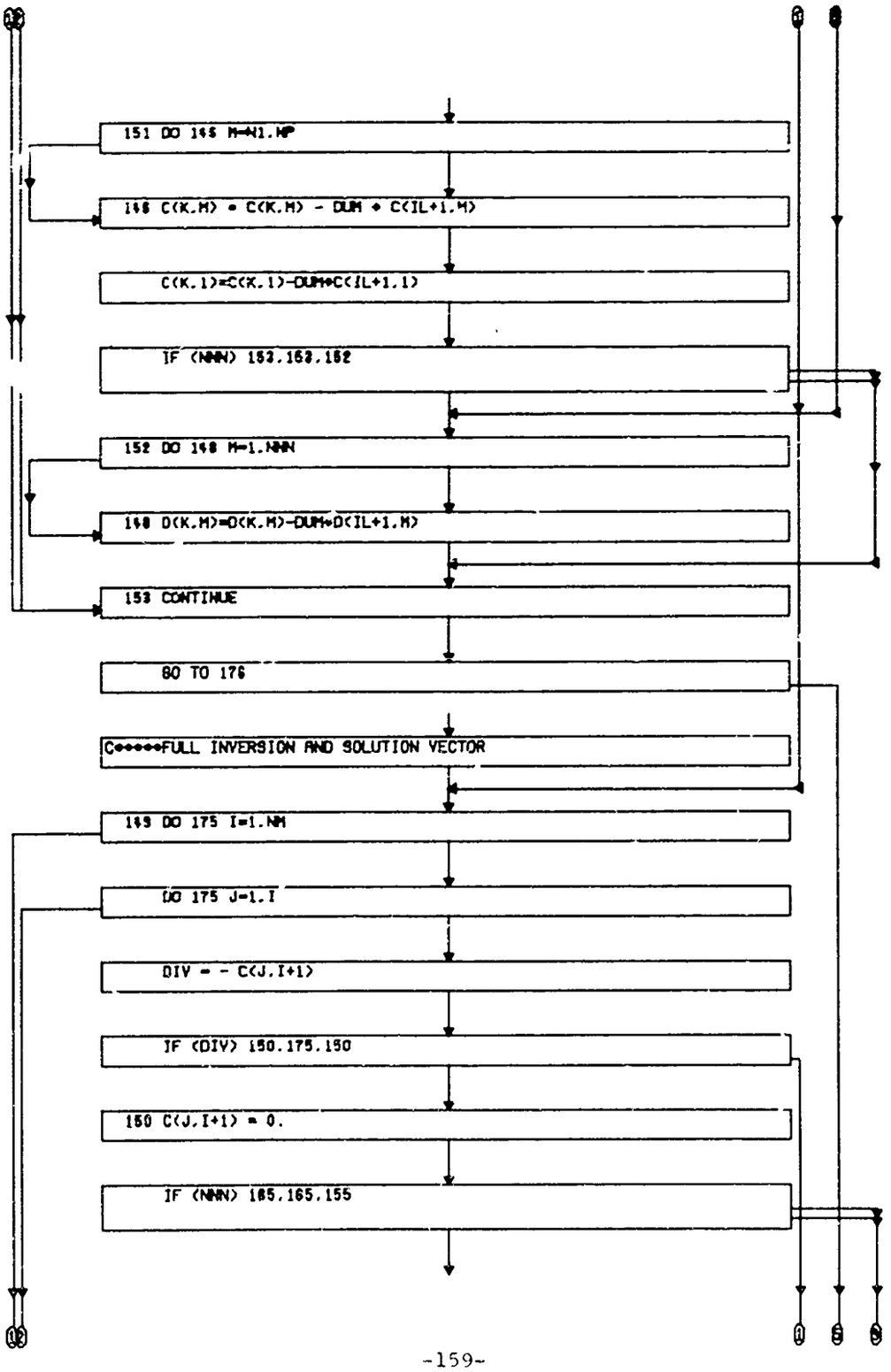

40 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NRN)
45 IS = -1
C TRIANGULATE MATRIX
DO 130 I=1,N
DO 50 M=1,NP
50 S(M)=ABS(C(I,M))
IF (IS) 55,60,60
55 IS = 0
GOTO 90
C REDUCE ROW I BY PRECEEDING ROWS
60 DO 85 J=2,
K = L(J - 1)
DIV = - C(I,K)
IF (DIV) 65,85,65
65 C(I,K) = 0.
DO 70 M=1,NP
DIVC = DIV * C(J - 1,M)
S(M)=AMAX1(S(M),ABS(DIVC))

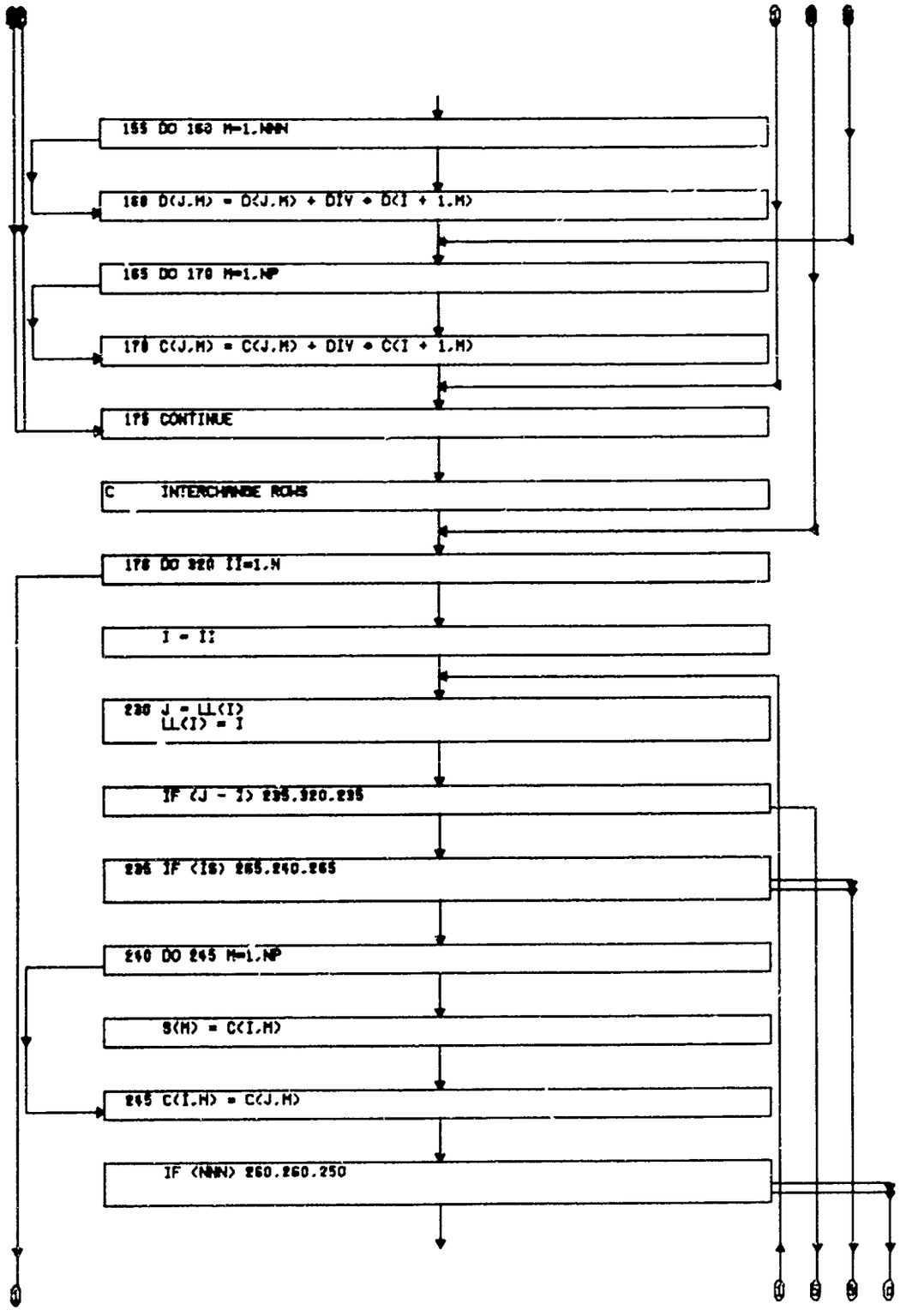

70 C(I,M) = C(I,M) + DIVC
IF (NNN) 85,85,75
75 DO 80 M=1,NNN
80 D(I,M) = D(I,M) + DIV * D(J - 1,M)
85 CONTINUE
C SEEK MAXIMUM PIVOT
90 DIV = 0.
DO 100 JJ=I,N
M = L(JJ)
IF (ABS(C(I,M)) - DIV) 100,100,95
95 DIV = ABS(C(I,M))
K = M
J = JJ
IF(NO-20) 100,100,101
100 CONTINUE
101 SD(I)=DIV/S(K)
L(J)=L(I)
L(I)=K

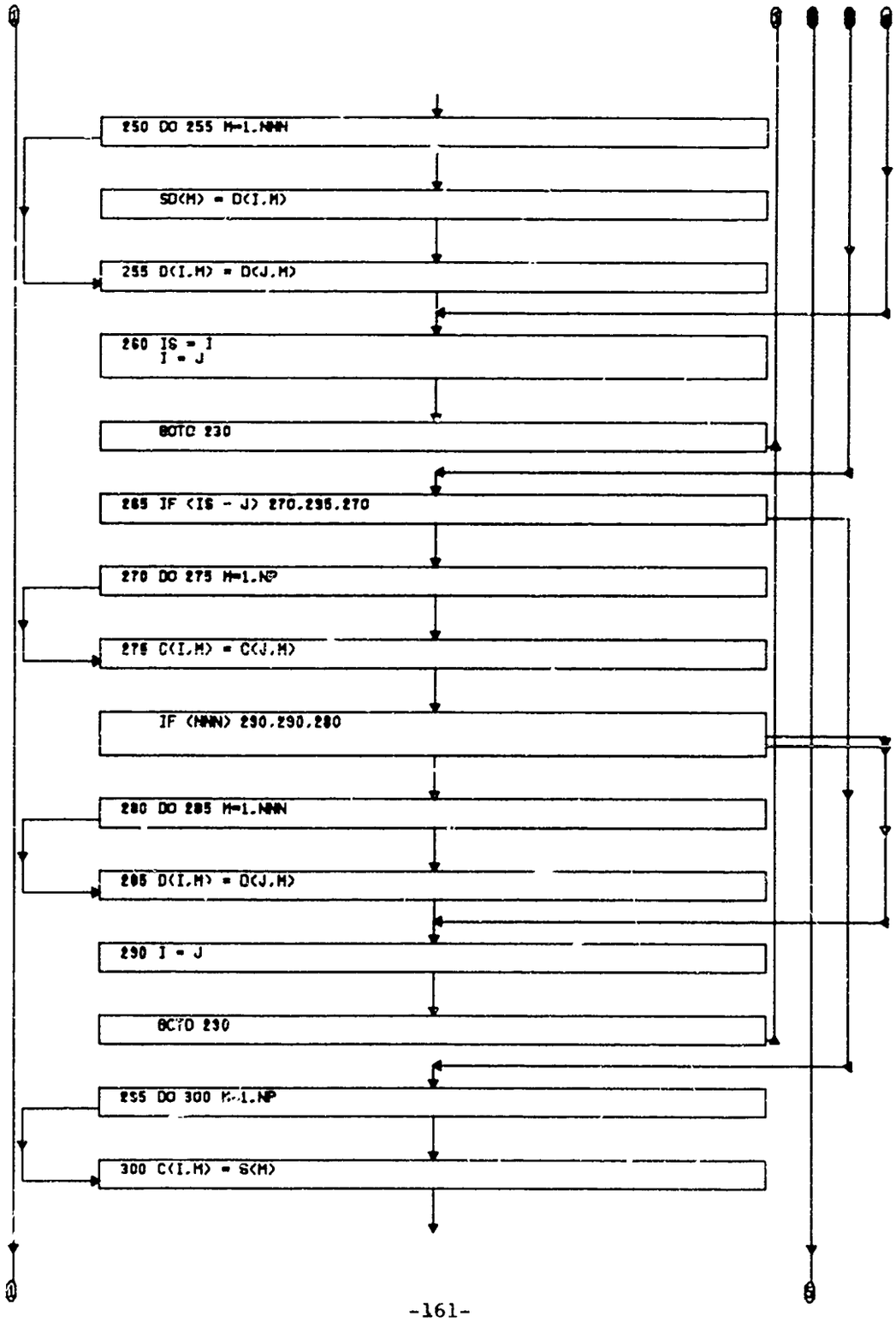

IF(SD(I)-1.E-8) 104,104,110
104 C(I,K)=0.
IF(SD(I)) 105,105,90
C SINGULAR MATRIX RETURN
105 IS=1
WRITE(KOUT,135) (II,L(II),SD(II),II=1,I)
RETURN
110 DIV = C(I,K)
C(I,K) = 1.0
K = LLL(J)
LLL(J) = LLL(I)
LLL(I) = K
LL(K) = I
C NORMALIZE ROW
IF (N&N) 125,125,115
115 DO 120 J=1,NNN
120 D(I,J) = D(I,J) / DIV
125 DO 130 J=1,NP
130 C(I,J) = C(I,J) / DIV
IF (IX) 145,140,145
135 FORMAT(24H PIVOT ROW/COL/RES.RATIO 3(I9,1H/I3,1H/E9.2,1H,))

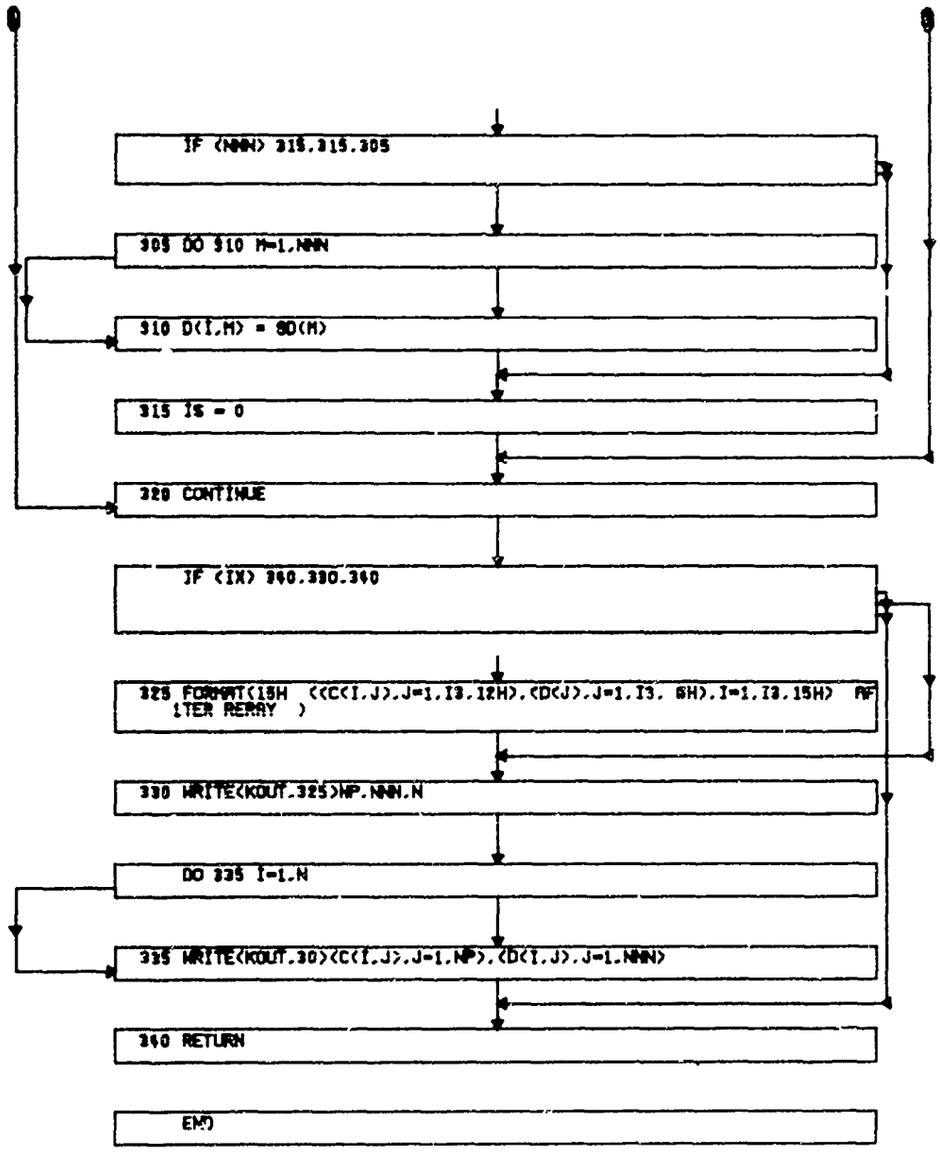

160 WRITE(KOUT,165)(I,L(I),SD(I),I=1,NP)
C DIAGONALIZE MATRIX
165 MM = N - 1
C INTERCHANGE COLUMNS
DO 225 II=1,NP
I = II
180 J = L(I)
L(I) = I
IF (J - I) 185,225,185
185 IF (IS) 200,190,200
190 DO 195 M=1,N
S(M) = C(M,I)
195 C(M,I) = C(M,J)
IS = I
I = J
GOTO 180
200 IF (IS - J) 205,215,205
205 DO 210 M=1,N
210 C(M,I) = C(M,J)


I = J
GOTO 180
215 DO 220 M=1,M
220 C(M,I) = B(M)
IS = 0
225 CONTINUE
IF(NBN + NB) 149,149,144
144 IF(NBN+NB-NN-NNN) 148,147,148
C*****SOLUTION VECTOR ONLY
147 K=N
DO 150 I=1,NM
K=K-1
DO 153 IL=K,NM
DUM=C(K,IL+1)
IF (NN) 152,152,151


151 DO 148 M=N1.MP
148 C(K.M) = C(K.M) - DUM * C(IL+1.M)
C(K.1)=C(K.1)-DUM*C(IL+1.1)
IF (NNN) 153.152.152
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
DO 175 J=1.I
DIV = - C(J.I+1)
IF (DIV) 150.175.150
150 C(J.I+1) = 0.
IF (NNN) 165.165.155


155 DO 160 M=1,NNN
160 D(J,M) = D(J,M) + DIV * D(I + 1,M)
165 DO 170 M=1,NP
170 C(J,M) = C(J,M) + DIV * C(I + 1,M)
175 CONTINUE
C INTERCHANGE ROWS
176 DO 220 II=1,N
I = II
230 J = LL(I)
LL(I) = I
IF (J - I) 235,220,235
236 IF (IS) 265,240,265
240 DO 245 M=1,NP
S(M) = C(I,M)
245 C(I,M) = C(J,M)
IF (NNN) 260,260,250


250 DO 255 M=1.NNN
SD(M) = D(I.M)
255 D(I.M) = D(J.M)
260 IS = I
I = J
GOTO 230
265 IF (IS - J) 270.295.270
270 DO 275 M=1.NP
275 C(I.M) = C(J.M)
IF (NNN) 290.290.280
280 DO 285 M=1.NNN
285 D(I.M) = D(J.M)
290 I = J
GOTO 230
295 DO 300 M=1.NP
300 C(I.M) = S(M)


IF (NNN) 315,315,305
305 DO 310 M=1,NNN
310 D(I,M) = BD(M)
315 IS = 0
320 CONTINUE
IF (IX) 340,330,340
325 FORMAT(15H ((C(I,J),J=1,I3,12H),(D(J),J=1,I3, 8H),I=1,I3,15H) AF
ITER RERAY)
330 WRITE(KOUT,325)NP,NNN,N
DO 335 I=1,N
335 WRITE(KOUT,30)(C(I,J),J=1,NP),(D(I,J),J=1,NNN)
340 RETURN
END

15. SUBROUTINE SLOPQ (N,X,Y,S,Z) - B16A

a. Function

Based on a sequence of quadratic (3-point) fits of a set of points calculates average slope at each point and integrates the cubic equation thus defined between each pair of points. Called by REFCON.

N = number of points to be considered

X = abscissa at each point

Y = ordinate at each point

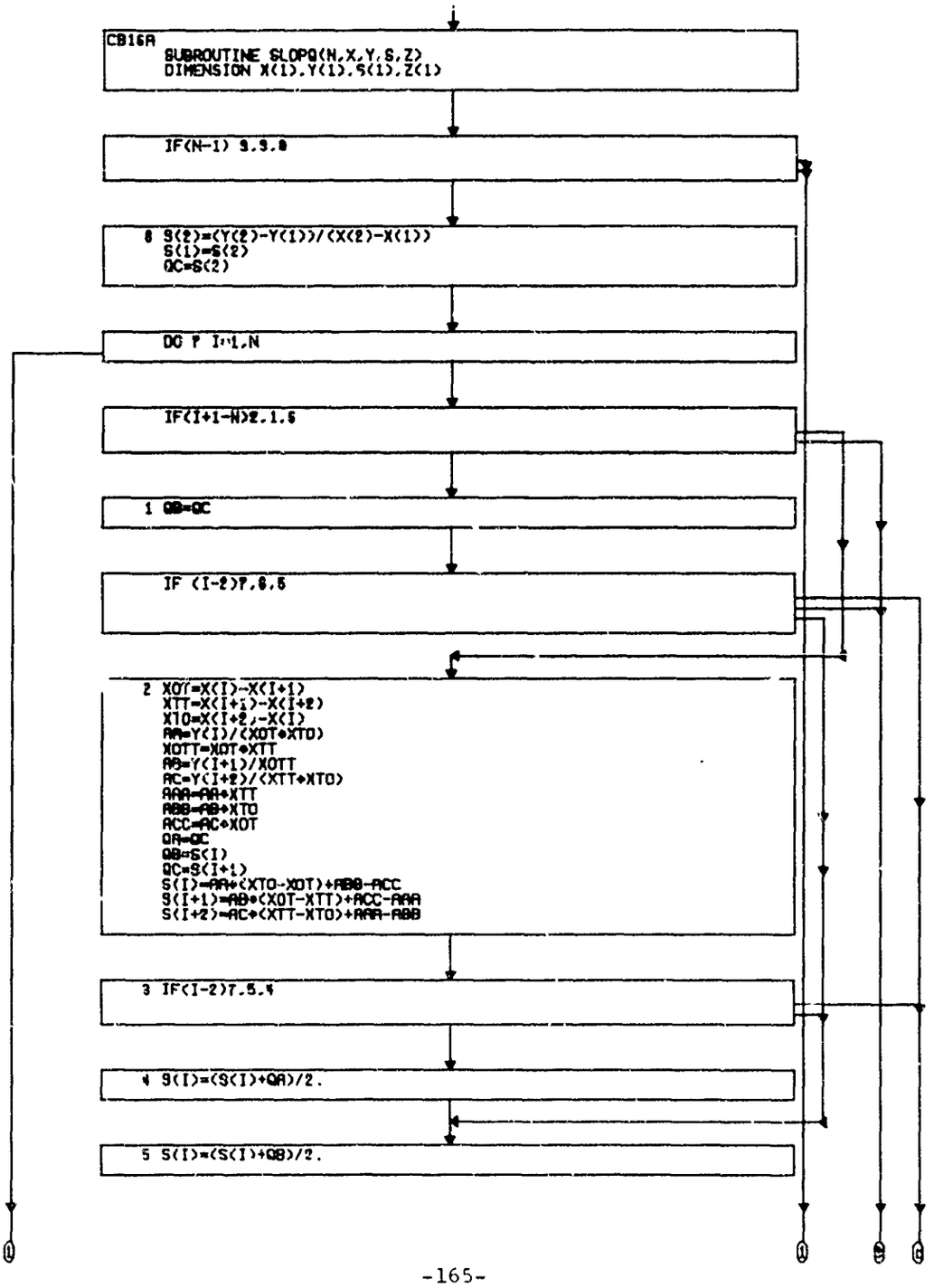
S = derivative at each point

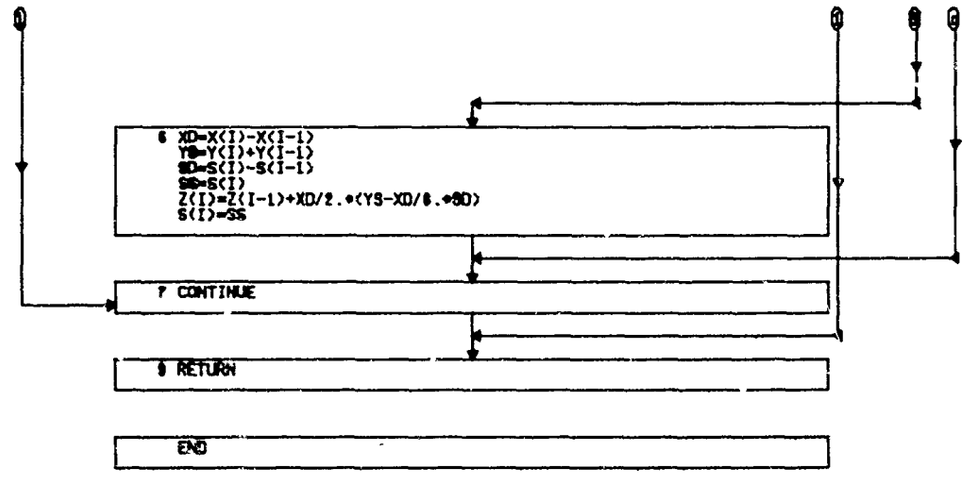
Z = integral up to each point

b. Listing

```
000001          C816.                                                   B16A 001
000002                SUBROUTINE SLOPG(N,X,Y,S,Z)                       B16A 002
000003                DIMENSION X(1),Y(1),S(1),Z(1)                     B16A 003
000004                IF(N-1) 9,9,8                                     B16A 004
000005              8 S(2)=(Y(2)-Y(1))/(X(2)-X(1))                      B16A 005
000006                S(1)=S(2)                                         B16A 006
000007                QC=S(2)                                           B16A 007
000008                DO 7 I=1,N                                        B16A 008
000009                IF(I+1-N)2,1,6                                    B16A 009
000010              1 QB=QC                                             B16A 010
000011                IF (I-2)7,6,5                                     B16A 011
000012              2 XOT=X(I)-X(I+1)                                   B16A 012
000013                XTT=X(I+1)-X(I+2)                                 B16A 013
000014                XTO=X(I+2)-X(I)                                   B16A 014
000015                AA=Y(I)/(XOT*XTO)                                 B16A 015
000016                XOTT=XOT*XTT                                      B16A 016
000017                AB=Y(I+1)/XOTT                                    B16A 017
000018                AC=Y(I+2)/(XTT*XTO)                               B16A 018
000019                AAA=AA*XTT                                        B16A 019
000020                ABB=AB*XTO                                        B16A 020
000021                ACC=AC*XOT                                        B16A 021
000022                QA=QC                                             B16A 022
000023                QB=S(I)                                           B16A 023
000024                QC=S(I+1)                                         B16A 024
000025                S(I)=AA*(XTO-XOT)+ABB+ACC                         B16A 025
000026                S(I+1)=AB*(XOT-XTT)+ACC+AAA                       B16A 026
000027                S(I+2)=AC*(XTT-XTO)+AAA+ABB                       B16A 027
000028              3 IF(I-2)7,5,4                                      B16A 028
000029              4 S(I)=(S(I)+QA)/2.                                 B16A 029
000030              5 S(I)=(S(I)+QB)/2.                                 B16A 030
000031              6 XD=X(I)-X(I-1)                                    B16A 031
000032                YS=Y(I)+Y(I-1)                                    B16A 032
000033                SD=S(I)-S(I-1)                                    B16A 033
000034                SS=S(I)                                           B16A 034
000035                Z(I)=Z(I-1)+XD/2.*(YS-XD/6.*SD)                   B16A 035
000036                S(I)=SS                                           B16A 036
000037              7 CONTINUE                                          B16A 037
000038              9 RETURN                                            B16A 038
000039                END                                               B16A 039
```

c. Flow Chart


CB16A
SUBROUTINE SLOPQ(N,X,Y,S,Z)
DIMENSION X(1),Y(1),S(1),Z(1)
IF(N-1) 9,9,8
8 S(2)=(Y(2)-Y(1))/(X(2)-X(1))
S(1)=S(2)
QC=S(2)
DO 7 I=1,N
IF(I+1-N)2,1,6
1 QB=QC
IF (I-2)7,6,5
2 XOT=X(I)-X(I+1)
XTT=X(I+1)-X(I+2)
XTO=X(I+2)-X(I)
AA=Y(I)/(XOT*XTO)
XOTT=XOT*XTT
AB=Y(I+1)/XOTT
AC=Y(I+2)/(XTT*XTO)
AAA=AA*XTT
ABB=AB*XTO
ACC=AC*XOT
QA=QC
QB=S(I)
QC=S(I+1)
S(I)=AA*(XTO-XOT)+ABB-ACC
S(I+1)=AB*(XOT-XTT)+ACC-AAA
S(I+2)=AC*(XTT-XTO)+AAA-ABB
3 IF(I-2)7,5,4
4 S(I)=(S(I)+QA)/2.
5 S(I)=(S(I)+QB)/2.


6 XD=X(I)-X(I-1)
YS=Y(I)+Y(I-1)
SD=S(I)-S(I-1)
SS=S(I)
Z(I)=Z(I-1)+XD/2.*(YS-XD/6.*SD)
S(I)=SS
7 CONTINUE
8 RETURN
END

16. SUBROUTINE ABMAX (N,X,XM,I) - B17A

a. Function

Searches an array for the entry with maximum value. Called by LINCER, NONCER.

N = number of entries in the array

X = coefficients in array under consideration

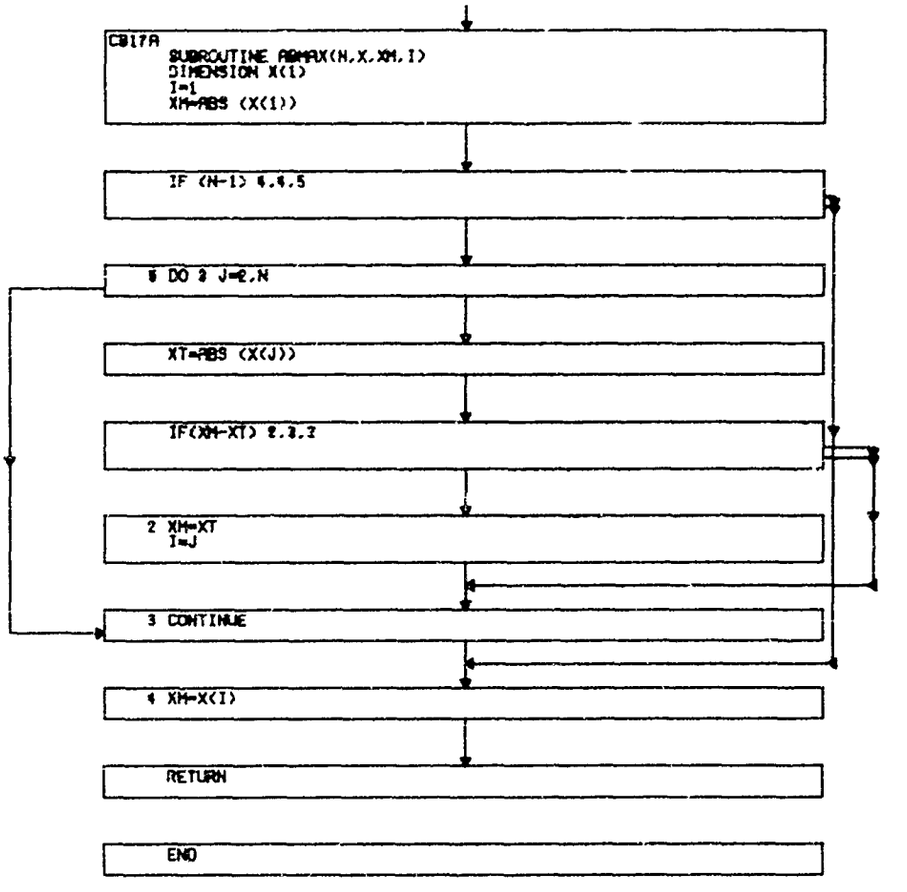
XM = entry with maximum absolute value

I = index on XM.

b. Listing

```
000001          C817A
000002                SUBROUTINE ABMAX(N,X,XM,I)                          B17A 001
000003                DIMENSION X(1)                                      B17A 002
000004                I=1                                                 B17A 003
000005                XM=ABS (X(1))                                       B17A 004
000006                IF (N-1) 4,4,5                                      B17A 005
000007              5 DO 3 J=2,N                                          B17A 006
000008                XT=ABS (X(J))                                       B17A 007
000009                IF(XM-XT) 2,3,3                                     B17A 008
000010              2 XM=XT                                               B17A 009
000011                I=J                                                 B17A 010
000012              3 CONTINUE                                            B17A 011
000013              4 XM=X(I)                                             B17A 012
000014                RETURN                                              B17A 013
000015                END                                                 B17A 014
                                                                          B17A 015
```

c. Flow Chart


CB17A
SUBROUTINE ABMAX(N,X,XM,I)
DIMENSION X(1)
I=1
XM=ABS (X(1))
IF (N-1) 4,4,5
5 DO 3 J=2,N
XT=ABS (X(J))
IF(XM-XT) 3,3,2
2 XM=XT
I=J
3 CONTINUE
4 XM=X(I)
RETURN
END

17. SUBROUTINE MATS1 - B18A

a. Function

Performs operations on a column of a matrix B or on a column of errors R (designated E in call list) such as to form A**(-1)*E where A**(-1) is the inverse of the sparse matrix formed from the Taylor series expansions of F(1,I) and their derivatives (in the case of MATS1) and of G(1,I) or SP(1,I,K) and their derivatives (in the case of MATS2), viz.,

Original matrix equation

$$(A + B)V = R$$

multiplying through by A**(-1)

$$(1 + A^{**}(-1)*B)V = A^{**}(-1)*R$$

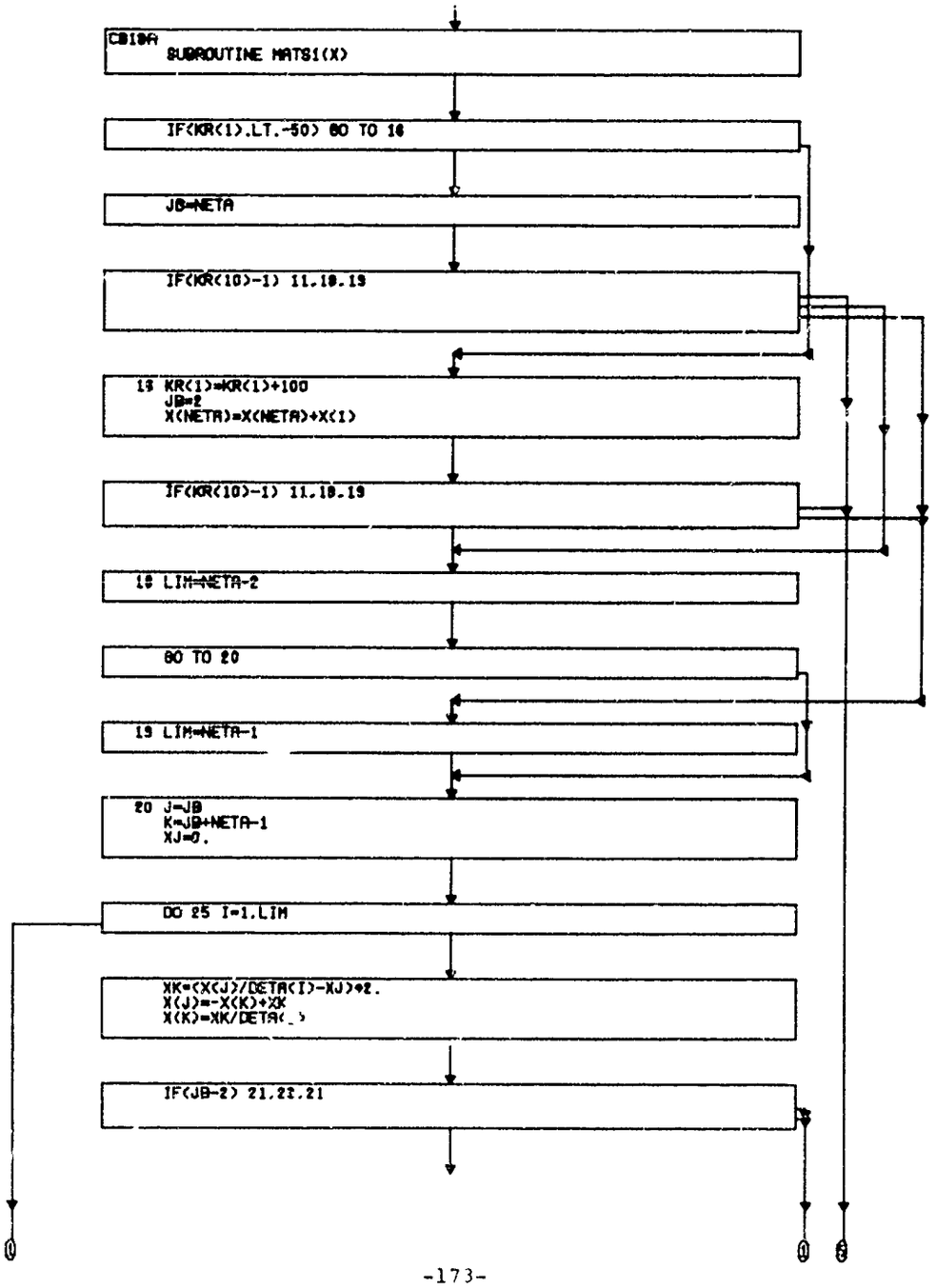
Called by LINCEP, LINMAT.

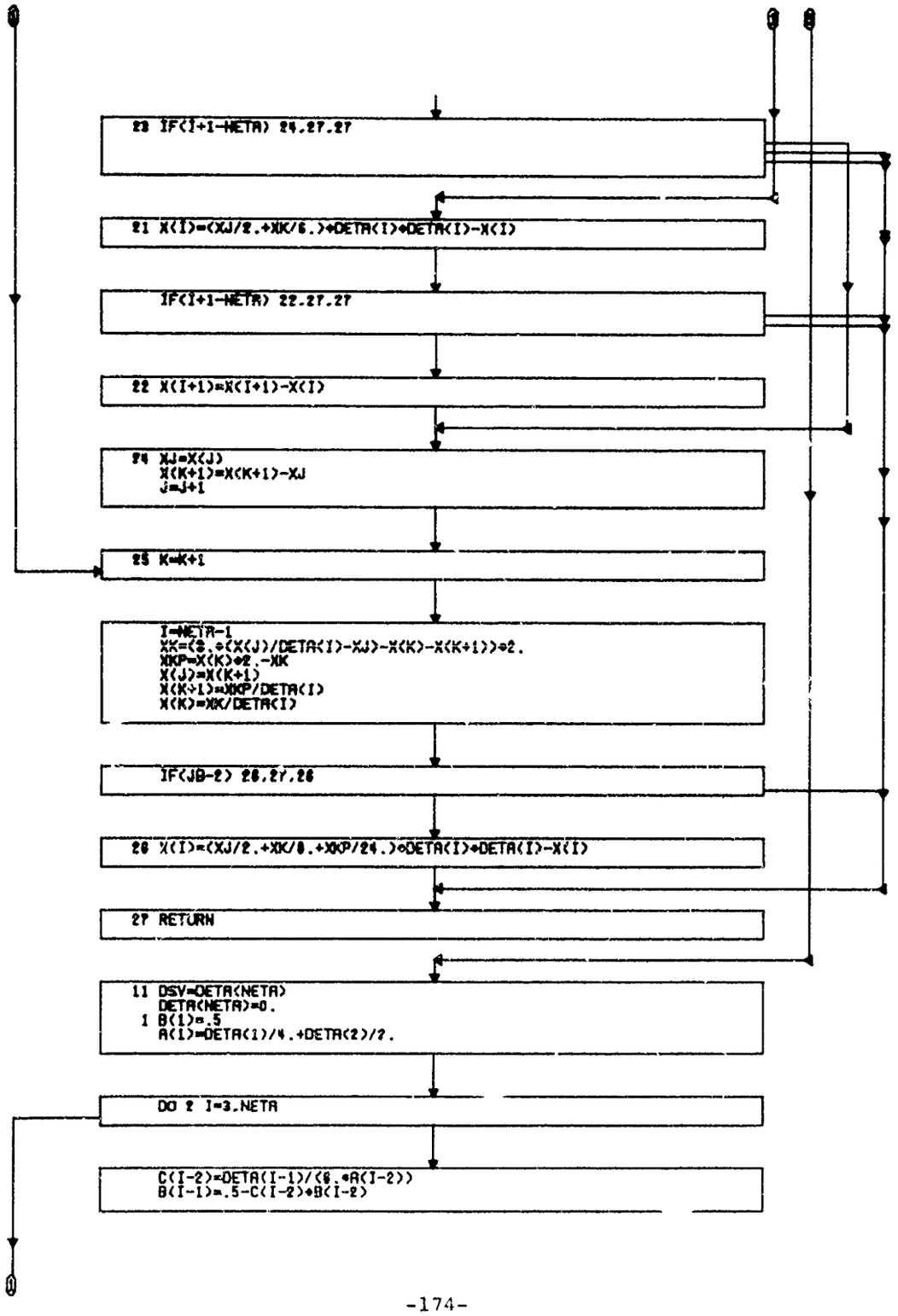
b. Listing

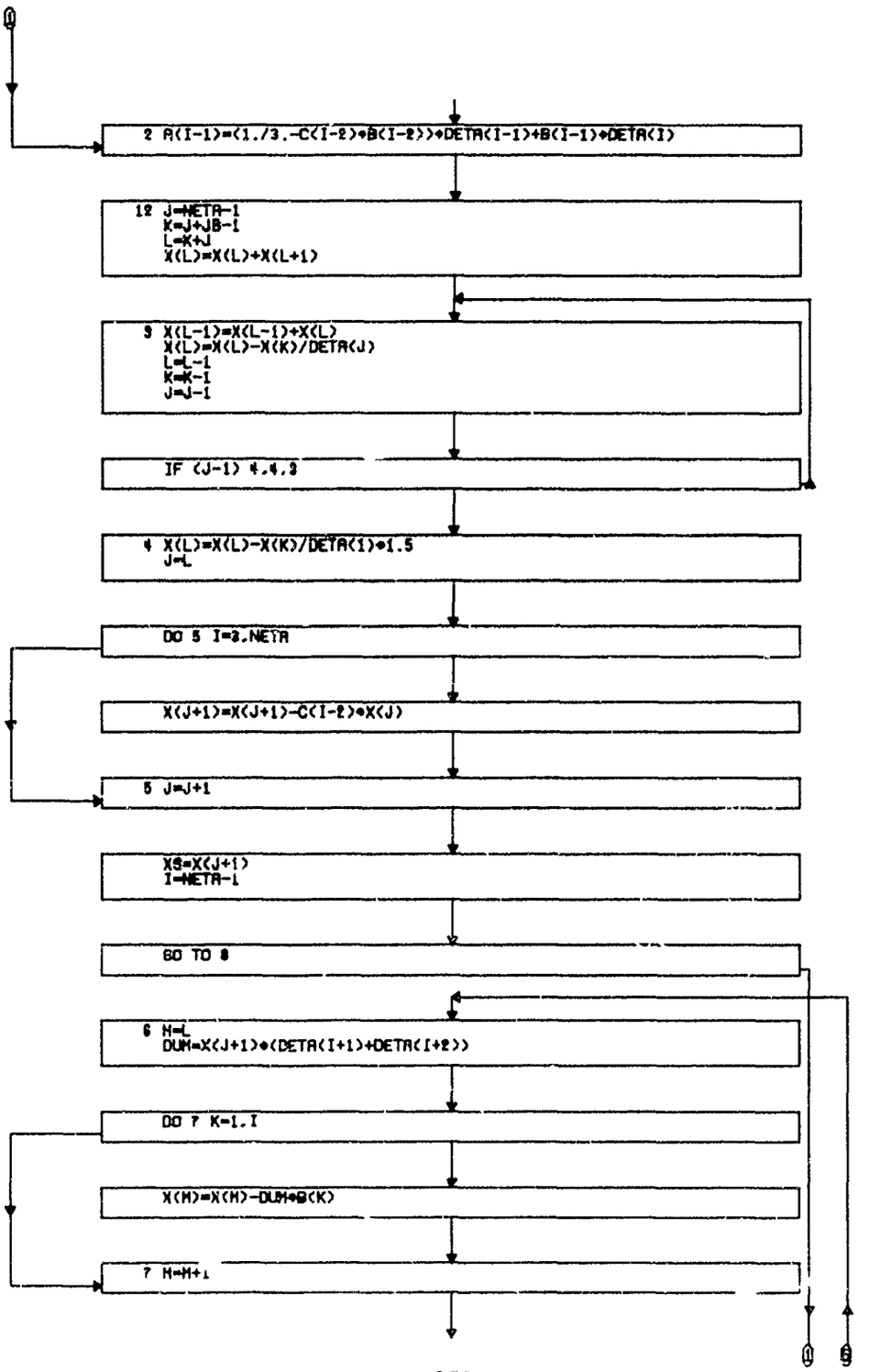
```
000001          CB18A                                                          B18A 001
000002                SUBROUTINE MATS1(X)
000003                COMMON/INTCOM/KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA
000004                COMMON/ETACOM/ETA(15),DETA(15)                           B18A 004*NEW
000005                DIMENSION X(1),A(14),B(14),C(14)                         B18A 005*NEW
000006                IF(KR(1),LT.-50) GO TO 16                                      *NEW
000007                JB=NETA
000008                IF(KR(10)-1) 11,18,19
000009             16 KR(1)=KR(1)+100                                                *NEW
000010                JB=2                                                           **-1
000011                X(NETA)=X(NETA)+X(1)
000012                IF(KR(10)-1) 11,18,19
000013             18 LIM=NETA-2
000014                GO TO 20
000015             19 LIM=NETA-1
000016             20 J=JB
000017                K=JB+NETA-1
000018                XJ=0.
000019                DO 25 I=1,LIM
000020                XK=(X(J)/DETA(I)-XJ)*2.
000021                X(J)=-X(K)+XK
000022                X(K)=XK/DETA(I)
000023                IF(JB-2) 21,23,21
000024             23 IF(I+1-NETA) 24,27,27
000025             21 X(I)=(XJ/2.+XK/6.)*DETA(I)*DETA(I)-X(I)
000026                IF(I+1-NETA) 22,27,27
000027             22 X(I+1)=X(I+1)-X(I)
000028             24 XJ=X(J)
000029                X(K+1)=X(K+1)-XJ
000030                J=J+1
000031             25 K=K+1
000032                I=NETA-1
000033                XK=(3.*(X(J)/DETA(I)-XJ)-X(K)-X(K+1))*2.
000034                XKP=X(K)*2.-XK
000035                X(J)=X(K+1)
000036                X(K+1)=XKP/DETA(I)
000037                X(K)=XK/DETA(I)
000038                IF(JB-2) 26,27,26
000039             26 X(I)=(XJ/2.+XK/8.+XKP/24.)*DETA(I)*DETA(I)-X(I)
000040             27 RETURN
000041             11 DSV=DETA(NETA)
000042                DETA(NETA)=0.
000043              1 B(1)=.5
000044                A(1)=DETA(1)/4.+DETA(2)/2.
000045                DO 2 I=3,NETA
000046                C(I-2)=DETA(I-1)/(6.*A(I-2))
000047                B(I-1)=.5-C(I-2)*B(I-2)
000048              2 A(I-1)=(1./3.-C(I-2)*B(I-2))*DETA(I-1)+B(I-1)*DETA(I)
000049             12 J=NETA-1
000050                K=J+JB-1
000051                L=K+J
000052                X(L)=X(L)+X(L+1)
000053              3 X(L-1)=X(L-1)+X(L)
000054                X(L)=X(L)-X(K)/DETA(J)
000055                L=L-1
000056                K=K-1
000057                J=J-1
000058                IF (J-1) 4,4,3
```

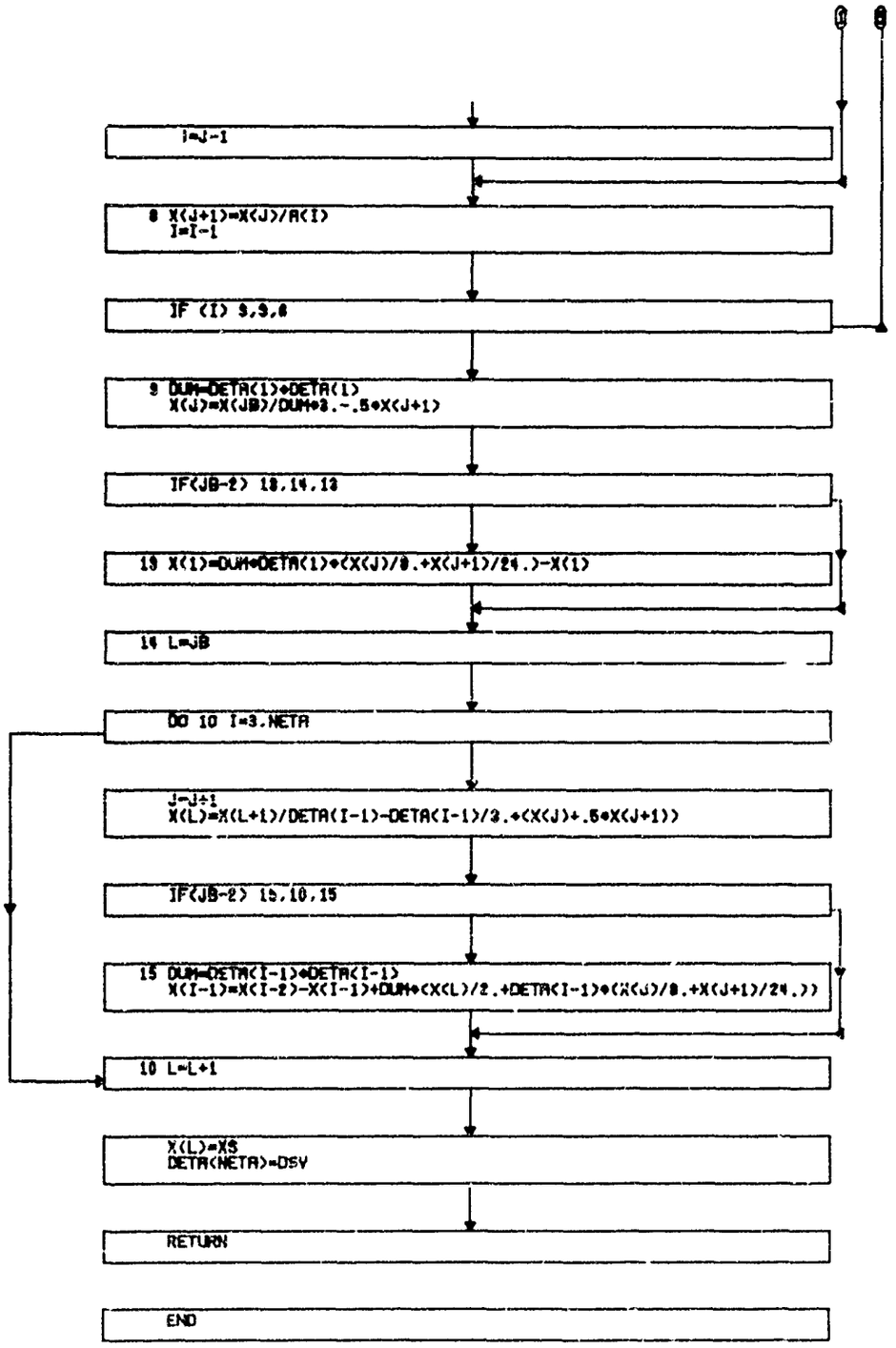
```
000059              4 X(L)=X(L)-X(K)/DETA(1)*1.5
000060                J=L
000061                DO 5 I=3,NETA
000062                X(J+1)=X(J+1)-C(I-2)*X(J)
000063              5 J=J+1
000064                XS=X(J+1)
000065                I=NETA-1
000066                GO TO 8
000067              6 M=L
000068                DUM=X(J+1)*(DETA(I+1)+DETA(I+2))
000069                DO 7 K=1,I
000070                X(M)=X(M)-DUM*B(K)
000071              7 M=M+1
000072                 J=J-1
000073              8 X(J+1)=X(J)/A(I)
000074                I=I-1
000075                IF (I) 9,9,6
000076              9 DUM=DETA(1)*DETA(1)
000077                X(J)=X(JB)/DUM*3.-.5*X(J+1)
000078                IF(JB-2) 13,14,13
000079             13 X(1)=DUM*DETA(1)*(X(J)/8.+X(J+1)/24.)-X(1)
000080             14 L=JB
000081                DO 10 I=3,NETA
000082                J=J+1
000083                X(L)=X(L+1)/DETA(I-1)-DETA(I-1)/3.*(X(J)+.5*X(J+1))
000084                IF(JB-2) 15,10,15
000085             15 DUM=DETA(I-1)*DETA(I-1)
000086                X(I-1)=X(I-2)-X(I-1)+DUM*(X(L)/2.+DETA(I-1)*(X(J)/8.+X(J+1)/24.))
000087             10 L=L+1
000088                X(L)=XS
000089                DETA(NETA)=DSV
000090                RETURN
000091                END
```

c. Flow Chart


C$IBM
SUBROUTINE MATS1(X)
IF(KR(1).LT.-50) GO TO 16
JB=NETA
IF(KR(10)-1) 11,18,19
18 KR(1)=KR(1)+100
JB=2
X(NETA)=X(NETA)+X(1)
IF(KR(10)-1) 11,18,19
19 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(_)
IF(JB-2) 21,22,21


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/3.+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)/(3.*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)
9 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) 4,4,9
4 X(L)=X(L)-X(K)/DETA(1)*1.5
J=L
DO 5 I=2,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
1
8


I=J-1
8 X(J+1)=X(J)/A(I)
I=I-1
IF (I) 9,9,8
9 DUM=DETA(1)+DETA(1)
X(J)=X(JB)/DUM+3.-.5*X(J+1)
IF(JB-2) 18,14,13
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

18. SUBROUTINE MATS2 - B18B

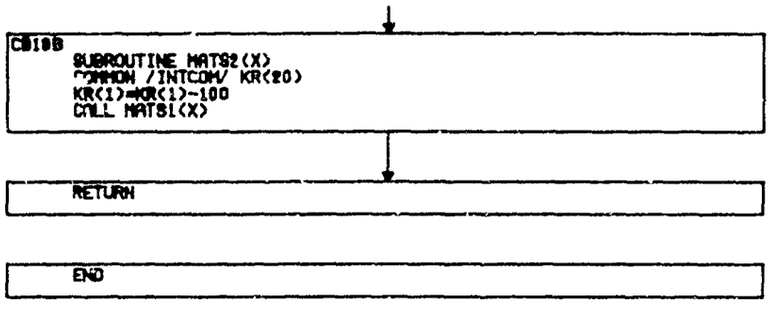
a. Function

See MATS1.

b. Listing

```
000001          CB168
000002                SUBROUTINE MATS2(X)
000003                COMMON /INTCOM/ KR(20)
000004                KR(1)=KR(1)+100
000005                CALL MATS1(X)
000006                RETURN
000007                END
```

c. Flow Chart


CB10B
SUBROUTINE MATS2(X)
COMMON /INTCOM/ KR(20)
KR(1)=KR(1)-100
CALL MATS1(X)
RETURN
END

19. SUBROUTINE TRMBL - B19A

a. Function

Evaluates turbulent transport properties and their derivatives with respect to nonlinear variables. Called by RECASE, NONCER. Calls LIAD.

b. Listing

```
      C8194
            SUBROUTINE TRANL(ILK)
            DIMENSION EPSOUT(379)                                          B19A 003*NEW
            COMMON/COMCOM/          C6,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B19A   4*NEW
           1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB19A   5*NEW
           232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C4CB19A   6*NEW
           3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB19A   7*NEW
           4A-,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B19A   8*NEW
           5,C82,C83,C84,C85,C86,C87,C88                                   B19A   9*NEW
            COMMON/CONCOM/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)  B19A  10*NEW
           1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)    B19A  11*NEW
           2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8) B19A  12*NEW
           3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B19A  13*NEW
           4,CKP3( 8, 8)                                                   B19A  14*NEW
            COMMON/ELCOM/           PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B19A  15*NEW
           1PE(40),RHOE(40),VMUE(40),TE(40),EDGE,DUEDGE,D2UEDG,VMWE,HE,C90 B19A  16*NEW
           2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                 B19A  17*NEW
            COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,RED,DVS,RHOVS,PI,PIM,CL,  B19A  18*NEW
           1EPSA(15),EPS1,EL(15),DPI(15,2),ALI(153),DEPS(153),DEPC,TREF,RETR B19A  19*NEW
            COMMON/ERRCOM/ELE( 43),GLE(30),SPLE(30, 8),ELA(313),ELEM,GLEM   B19A  20*NEW
           1,SPLEM( 8),ELM(14),ELMM,IELM,IGLM,ISPLM( 8),NELM,ILMM,DEL(43)   B19A  21*NEW
           2,DGL(30),DSPL(30, 8),ENLE(18),GNLE(15),SPNLE(15, 8),ENL(153)    B19A  22*NEW
           3,ENLEM,GNLEM,SPNLEM( 8),          ENLMM,IENLM,IGNLM,ISPNLM( 8)  B19A  23*NEW
           4,IENLM,IGNLMM,DENL(18),DGNL(15),DSPNL(15, 8),DRNL(10)           B19A  24*NEW
            COMMON/ETACOM/ETA(15),DETA(15),DS0(14),DCU(14),P1(14),B2(14)    B19A  25*NEW
           1,AAR(153),BA1(45,18),BA2(30,15)                                 B19A  26*NEW
            COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8B19A  27*NEW
           1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HWJE,HFW,DLX2 B19A  28*NEW
           2,C3M(40),BETAM(40)                                             B19A  29*NEW
            COMMON/ITCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,LB19A  30*NEW
           15,II,NII E,NSP,NSPM1,MAX,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B19A  31*NEW
           2,R(5),      MNE,MON,KQ(10),ITEM,SITEM,KR17,NBT,NBT2,IDENT,KR9(40) B19A  32*NEW
           3,KAUXQ,JTIME,JSPEC,MD(3)                                       B19A  33*NEW
            COMMON/NONCOM/AM(153,15),DVNL(153),FCW,                         B19A  34*NEW
           1VLNK,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)              B19A  35*NEW
            COMMON/PHPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),W(15) B19A  36*NEW
           1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  B19A  37*NEW
           2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B19A  38*NEW
           3,DHTILK( 8),DQRK( 8),DCPHK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8) B19A  39*NEW
           4,DPHIKK( 8, 8),       DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL B19A  40*NEW
           5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  PHOP B19A  41*NEW
           6(15),PHIP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)  B19A  42*NEW
            COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                  B19A  43*NEW
            EQUIVALENCE(EPSOUT(1),ELCON)                                     *-41
            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
            KR(10)=1
            KR(7)=KR(7)-2
            IF(RETR.GT.0.) KR(10)=-1
```

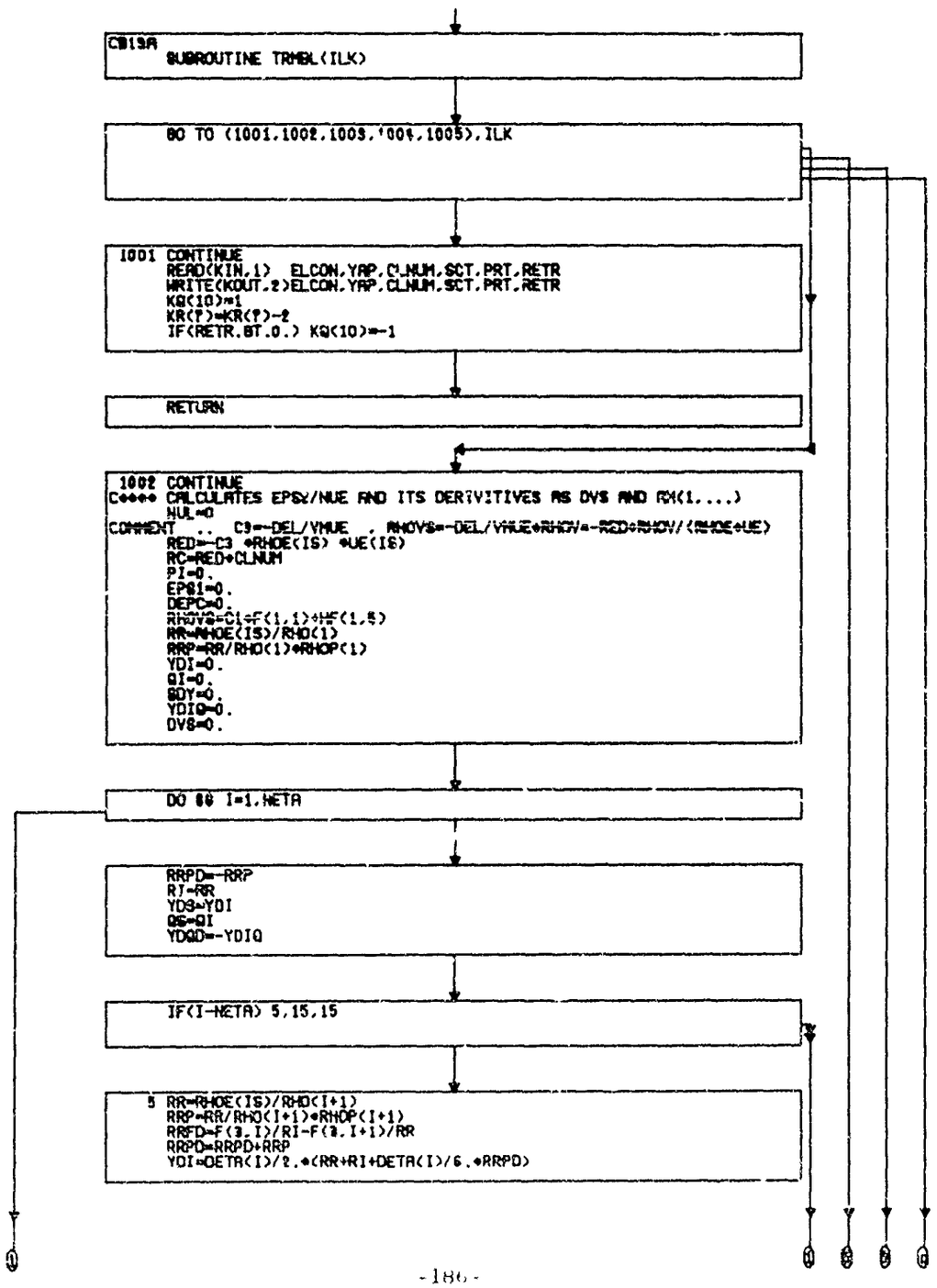
```
000059              RETURN
000060         1002 CONTINUE
000061        C**** CALCULATES EPS2/NUE AND ITS DERIVITIVES AS DVS AND AM(1,...)
000062              NUL=0
000063        COMMENT  ,,  C3=-DEL/VMUE  , RHOVS=-DEL/VMUE*RHOV=-RED*RHOV/(RHOE*UE)
000064              RED=-C3 *RHOE(IS) *UE(IS)
000065              RC=RED*CLNUM
000066              PI=0.
000067              EPSI=0.
000068              DEPC=0.
000069              RHOVS=C1*F(1,1)+HF(1,5)
000070              RR=RHOE('S)/RHO(1)
000071              RRP=RR/RHO(1)*RHOP(1)
000072              YDI=0.
000073              QI=0.
000074              SDY=0.
000075              YDIQ=0.
000076              DVS=0.
000077              DO 66 I=1,NETA
000078              RRPD=-RRP
000079              RI=RR
000080              YDS=YDI
000081              QS=QI
000082              YDQD=-YDIQ
000083              IF(I-NETA) 5,15,15
000084            5 RR=RHOE(IS)/RHO(I+1)
000085              RRP=RR/RHO(I+1)*RHOP(I+1)
000086              RRPD=F(3,I)/RI-F(3,I+1)/RR
000087              RRPD=RRPD+RRP
000088              YDI=DETA(I)/2.*(RR+RI+DETA(I)/6.*RRPD)
000089              SDY=SDY+YDI
000090              DUM1=YDI/6.*RRPD
000091              DUM2=F(2,NETA)-(F(2,I)+F(2,I+1))*0.5
000092              DVS=DVS+YDI*(DUM2-DUM1/2.)
000093              YDIQ=YDI*YDI
000094              YDQD=YDQD+YDIQ
000095              QI=DETA(I)/2.*(DUM2-DUM1)
000096              QS=QS+QI
000097              YDS=YDS+YDI
000098           15 DRHOI=-QS*RI/RHO(I)-F(3,I)/12.*YDQD/RHOE(IS)
000099              LR=MAT1J+I                                                    B19A
000100              DUM=AM(LR,124)* DRHOI* RC                                     B19A     *NEW
000101              AM(1,I+3)=AM(1,I+3)-0.5*RC*YDS+C7*DUM*F(2,I)                           **-1
000102              IF(I-1) 20,20,25
000103           20 AM(1,3)=AM(1,3)-RC/RI*YDQD/12.
000104              GO TO 30
000105           25 CALL LIAD(-1,1,NETA-2+1,-RC/RI*YDQD/12.)
000106           30 AM(1,1)=AM(1,1)-DUM*C7*F(2,I)*F(2,I)/ALPH
000107              MPJ=MAT1J+I+1
000108              DO 60 K=NUL, NSPM1
000109              IF(K) 40,40,35
000110           35 LRK=MAT1J+MAT2J+I
000111              DUM=AM(LR,K+124)* DRHOI* RC                                   B19A     *NEW
000112           40 IF(I-NETA) 50,55,50                                                   **-1
000113           50 AM(1,MPJ)=AM(1,MPJ)+DUM
000114              GO TO 60
000115           55 CALL LIAD(K,1,1,DUM)
000116           60 MPJ=MPJ+MAT2J
000117              IF(KR(17)) 66,66,65
000118           65 WRITE (KOUT,640) RC,RR,SDY,RRP,RRPD,RRPD,YDI,YDS,DUM1,DUM2,DVS
```

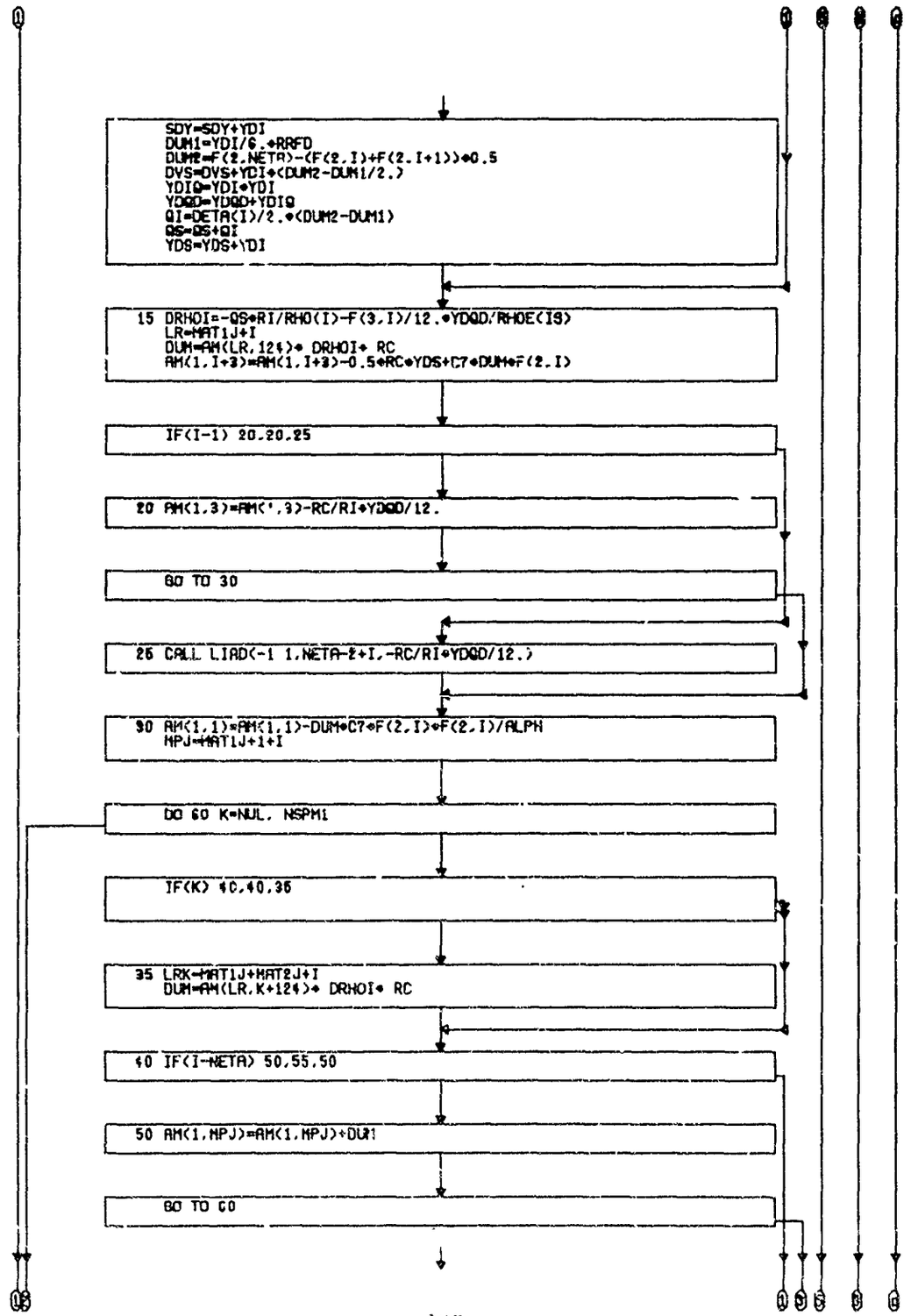
```
000119                1,YD1Q,YDQ*,3I,QS,DRHOI,AM(LR,104),(AM(LRK,K+107),K=1,NSPM1),
000120                2(AM(1,J), J=1,NNLEQ), ENL(1)
000121               66 CONTINUE
000122                  DVS=AMAX1(0.,RC*DVS)
000123                  AM(1,MAT1J)=AM(1,MAT1J)+SDY*RC
000124                  RETURN
000125             1003 CONTINUE
000126            C**** CALCULATES MIXING LENGTH AND ITS DERIVITIVES
000127              100 PIM=PI
000128                  PI=SQRT(ARS(RED/C26*(CAPC(1)*F(3,1)-ALPH*RHOVS*F(2,I)))/
000129                 1    (CAPC(I)*YAP)
000130                  IF(I-1) 305,305,101
000131              101 EPI=EXP(-(PI+PIM)/2.*DETA(I-1))
000132                  PID=PI-PIM
000133                  IF(PID/PI-.0001) 102,102,103
000134              102 PI=AMAX1(PI,PIM)
000135                  PID=1.0
000136                  AF=1.0
000137                  ERP1=1./PI
000138                  ERPP1=-2./(PI*PI)
000139                  ERP2=1./PIM
000140                  ERPP2=-2./(PIM*PIM)
000141                  GO TO 104
000142              103 AF=SQRT(2./PID*DETA(I-1))
000143                  ERP1=ERP(AF/2.,*PI)
000144                  ERPP1=1.-AF*PI*ERP1
000145                  ERP2=ERP(AF/2.,*PIM)
000146                  ERPP2=1.-AF*PIM*ERP2
000147              104 BF=ERP1-EPI*ERP2
000148                  DCLL=EPI
000149                  DUM1=DETA(I-1)/2.*EPI*(AF*ERP2-CL)
000150                  CL=CL*EPI+AF*BF
000151                  EL(I)=ALPH*ELCON*(ETA(I)-CL)
000152                  DUM2=AF/PID*(BF/2.+ERPP1/4.*AF*PI-EPI*ERPP2/4.*AF*PIM)
000153                  DUM3=AF/2.*AF
000154                  DCLPI=DUM1-DUM2+DUM3*ERPP1
000155                  DCLPM=DUM1+DUM2-DUM3*ERPP2*EPI
000156                  IF(I-2) 305,330,320
000157              305 EL(1)=0.
000158                  DO 307 J=1,NNLEQ
000159              307 DLI(J)=0.
000160                  CL=0.
000161                  DPI(1,2)= CAPC(1)
000162                  DPI(3,1)= F(3,1)*DCAPCH
000163                  IF(NSPM1) 350,350,310
000164              310 DO 315 K=1,NSPM1
000165              315 DPI(K+3,1)= F(3,1) * DCAPCK(K)
000166                  GO TO 350
000167              320 DO 325 J=1,NNLEQ
000168              325 DLI(J)= DLI(J) * DCLL
000169              330 DUM=-TREF*DCLPM*ELCON*ALPH
000170                  DLI(1)= DLI(1)+(EL(I)-DCLL*EL(I-1))/ALPH
000171                  L=I-1
000172              331 DLI(1)= DLI(1)+DPI(1,1)*DUM
000173                  DLI(2)= DLI(2) + DPI(2,1)* DUM
000174                  DLI(3)= DLI(3) + DPI(1,2)*DUM
000175                  DLI(L+3)= DLI(L+3)+DPI(2,2)*DUM
000176                  J=MAT1J+2
000177                  DO 340 K=NUL,NSPM1
000178                  DLI(J)= DLI(J) + DPI(K+3,1) * DUM
```

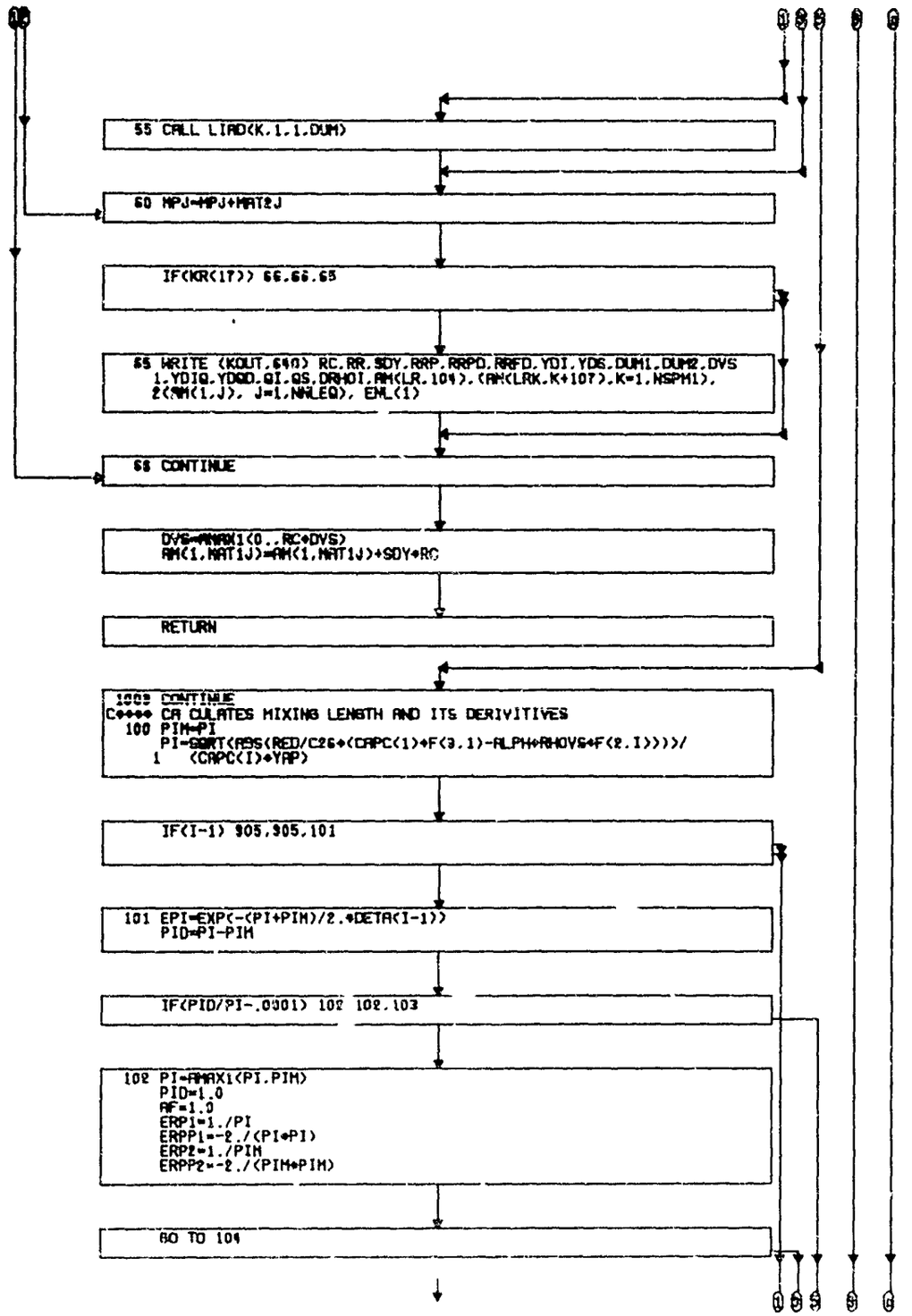
```
000179                JL=J+L-1
000180                DLI(JL)= DLI(JL) + DPI(K+3,2)*DUM
000181              340 J=J+MAT2J
000182              345 IF(L-1) 350,400,400
000183              350 TREF= RED/C26 /(2,*CAPC(I)*YAP*PI*YAP*CAPC(I))
000184                  DPI(3,2)=-PI/TREF*(DCAPCH/CAPC(I)-DRHOH/(2,*RHO(I)))
000185                  DPI(2,2)= C10*DPI(3,2)-RHOVS*ALPH
000186                  DPI(1,1)=-C56*C10*DPI(3,2)-RHOVS*F(2,I)
000187                  DPI(2,1)=-ALPH*C1*F(2,I)
000188                  IF(NSPM1) 362,362,355
000189              355 DO 360 K=1,NSPM1
000190              360 DPI(K+3,2)=-PI/TREF*(DCAPCK(K)/CAPC(I)-DRHOK(K)/(2,*RHO(I)))
000191              362 L=I
000192                  DUM=-TREF*DCLPI*ELCON*ALPH
000193                  IF(I-1) 445,445,365
000194              365 IF(I-NETA) 331,400,400
000195            C**** CALCULATES EPS1 AND EPS2 -- COMPARES TO GET EPS -- CALCULATES EPS
000196            C                                                        DERIVITIVES
000197              400 DUM1=EL(I)/ALPH+EL(I)/ALPH=RED/C26
000198                  C26S=C26*C26
000199                  EPS1=AMAX1(DUM1*F(3,I),EPS1)
000200                  EPS2=DVS/C26S
000201                  IF(EPS1-EPS2) 405,401,401
000202              401 EPS=EPS2
000203                  DEPC=ENL(1)/C26S
000204                  DO 402 J=1,NNLEQ
000205              402 DEPS(J)=AM(1,J)/C26S
000206                  DUM1=2,0*EPS/RHO(I)
000207                  GO TO 415
000208              405 EPS=EPS1
000209                  DO 410 J=1,NNLEQ
000210              410 DEPS(J)=2,*EPS / EL(I)*DLI(J)
000211                  DEPS(1)=DEPS(1)-2,0/ALPH*EPS
000212                  LPI=NETA+I-2
000213                  DEPC=-DUM1*PLE(LPI)
000214                  DO 414 J=2,MAT1J
000215              414 DEPS(J)=DEPS(J)-DUM1*BA1(LPI,J)
000216                  DUM1=EPS/RHO(I)
000217              415 DUM=DUM1*DRHOH
000218                  EPSA(I)=EPS
000219                  DEPS(1)=DEPS(1)-C56*C10*DUM
000220                  DEPS(I+3)= DEPS(I+3)+DUM*C10
000221                  J=MAT1J+I+1
000222                  L=MAT1J
000223                  DO 420 K=NUL,NSPM1
000224                  IF(I-NETA) 418,416,416
000225              416 DEPC=DEPC-DUM*SPLE(1,K)
000226                  DO 417 JJ=1,MAT2J
000227                  L=L+1
000228              417 DEPS(L)=DEPS(L)-DUM*BA2(1,JJ)
000229                  GO TO 419
000230              418 DEPS(J)=DEPS(J)+DUM
000231              419 J=J+MAT2J
000232              420 DUM=DUM1*DRHOK(K+1)
000233              445 RETURN
000234             1004 CONTINUE
000235            C**** MODIFIES ENL AND AM AFTER IMONE
000236                  L=I-1
000237                  $ALPH=-ALPH/TTVC
000238                  IF(I-2) 650,650,600
```

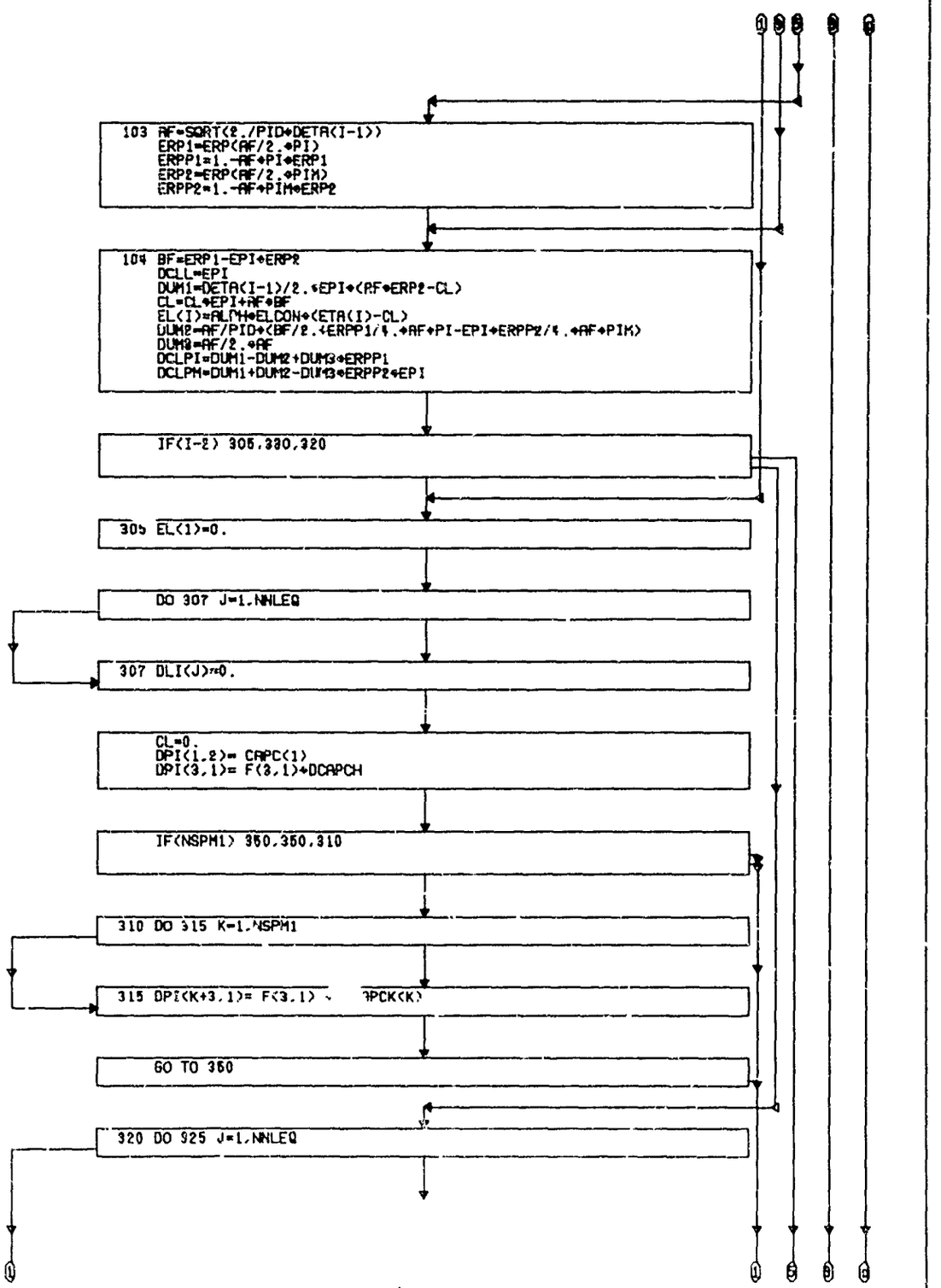
```
000239          1005 CONTINUE
000240         C**** MODIFIES ENL AND AM AFTER IONLY
000241               L=1
000242               SALPH= ALPH/TTVC
000243           600 IFPP=L+NETA-2
000244               ISPP=L
000245               DUM=F(3,L)/SALPH
000246               ENL(I+3)=ENL(I+3)-DUM*(EPS-DEPC)
000247               AM(I+3,1)=AM(I+3,1)-DUM*EPS/ALPH
000248               C28=C28+DUM*EPS
000249               DO 605 J=1,NNLEQ
000250           605 AM(I+3,J)=AM(I+3,J)+DUM*DEPS(J)
000251               CALL LIAD(-1,I+3,IFPP,EPS/SALPH)
000252               MPJ=MAT1J+I
000253               PRF=1,-1./PRT
000254               EG1=G(2,L)/(SALPH*PRT)
000255               EG3=-EPS/SALPH*PRF*C13*F(2,L)
000256               EG2=EPS/SALPH*(1,/SCT-1,/PRT)*(HP-CPBAR(L)*TP)
000257               ENL(MPJ)=ENL(MPJ)-EG1*(EPS-DEPC)-EG2-EG3
000258               C32=C32+EG1*EPS+EG2+EG3
000259               AM(MPJ,1)=AM(MPJ,1)-EG1/ALPH*EPS-3.D/ALPH*EG3
000260               DO 610 J=1,NNLEQ
000261           610 AM(MPJ,J)=AM(MPJ,J)+(EG1+EG3/EPS)*DEPS(J)
000262               AM(MPJ,L+3)=AM(MPJ,L+3)-PRF*C13/SALPH*EPS
000263               CALL LIAD(-1,MPJ,NETA+L-2,-PRF*C10/SALPH*EPS)
000264               CALL LIAD(0,MPJ,ISPP,EPS/(SALPH*PRT))
000265               IF(NSPM1) 650,650,615
000266           615 DO 630 K=1,NSPM1
000267               DUM=SP(2,L,K)/(SALPH*SCT)
000268               MPJ=MPJ+MAT2J
000269               CK6(K)=CK6(K)+DUM*EPS
000270               ENL(MPJ)=ENL(MPJ)-DUM*(EPS-DEPC)
000271               AM(MPJ,1)=AM(MPJ,1)-DUM/ALPH*EPS
000272               DO 620 J=1,NNLEQ
000273           620 AM(MPJ,J)=AM(MPJ,J)+DUM*DEPS(J)
000274           630 CALL LIAD(K,MPJ,ISPP,EPS/(SALPH*SCT))
000275           650 IF(KR(17)) 660,660,655
000276           655 WRITE(KOUT,640) EPSOUT
000277           640 FORMAT(/(1P10E12.5))
000278           660 RETURN
000279               END
```

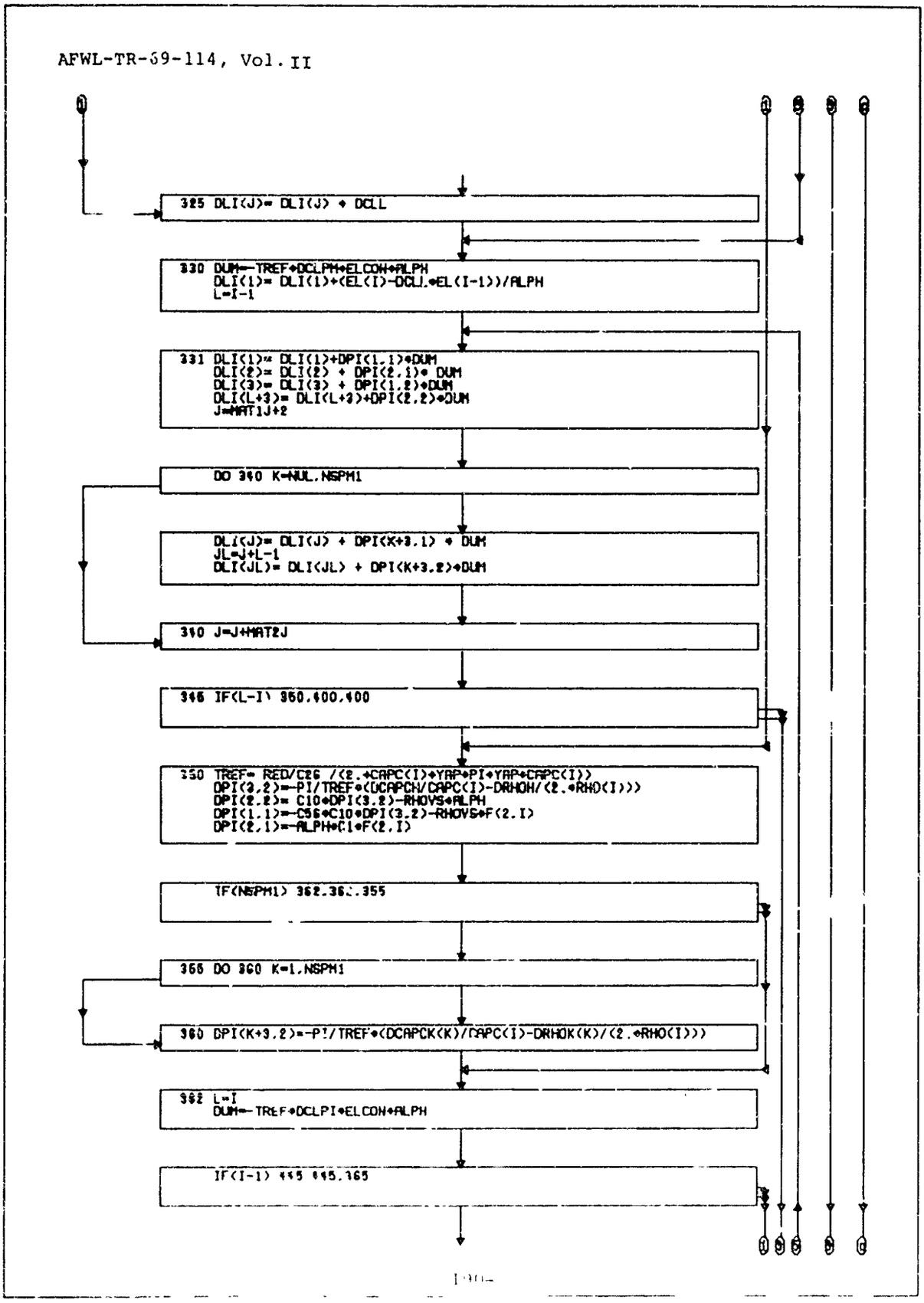
c. Flow Chart

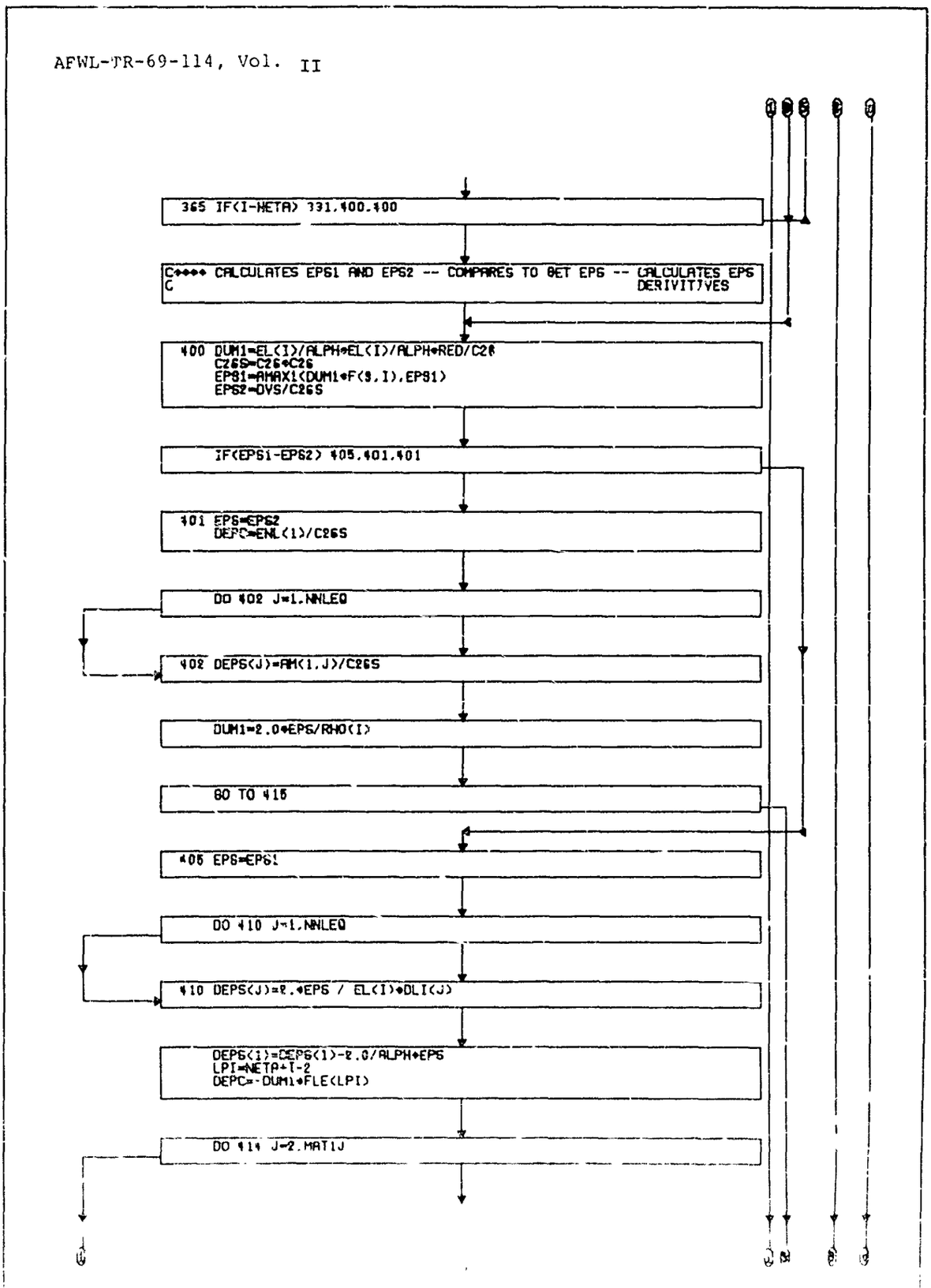

C819A
SUBROUTINE TRMBL(ILK)
GO TO (1001,1002,1003,1004,1005),ILK
1001 CONTINUE
READ(KIN,1) ELCON,YRP,CLNUM,SCT,PRT,RETR
WRITE(KOUT,2)ELCON,YRP,CLNUM,SCT,PRT,RETR
KQ(10)=1
KR(7)=KR(7)-2
IF(RETR.GT.0.) KQ(10)=-1
RETURN
1002 CONTINUE
C**** CALCULATES EPSV/NUE AND ITS DERIVITIVES AS DVS AND RX(1,...)
NUL=0
COMMENT .. C3=-DEL/VMUE , RHOVS=-DEL/VMUE*RHOV=-RED*RHOV/(RHOE*UE)
RED=-C3 *RHOE(IS) *UE(IS)
RC=RED*CLNUM
PI=0.
EPSI=0.
DEPC=0.
RHOVS=C1*F(1,1)+HF(1,5)
RR=RHOE(IS)/RHO(1)
RRP=RR/RHO(1)*RHOP(1)
YDI=0.
QI=0.
SDY=0.
YDIQ=0.
DVS=0.
DO 88 I=1,NETA
RRPD=-RRP
RI=RR
YD3=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)

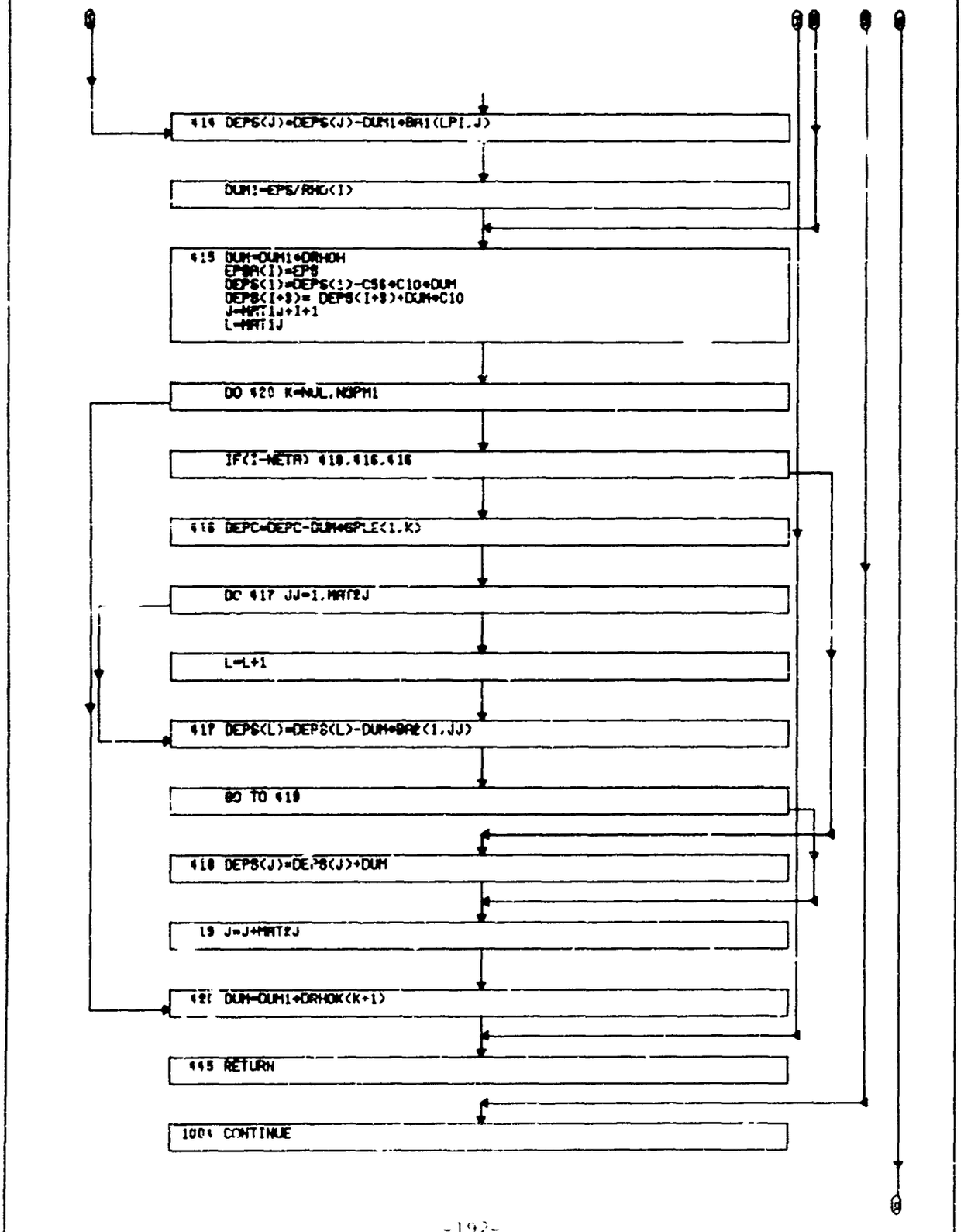

SDY=SDY+YDI
DUM1=YDI/6.*RRFD
DUM2=F(2,NETA)-(F(2,I)+F(2,I+1))*0.5
DVS=DVS+YDI*(DUM2-DUM1/2.)
YDI@=YDI*YDI
YDQD=YDQD+YDI@
QI=DETA(I)/2.*(DUM2-DUM1)
QS=QS+QI
YDS=YDS+YDI
15 DRHOI=-QS*RI/RHO(I)-F(3,I)/12.*YDQD/RHOE(IS)
LR=MAT1J+I
DUM=AM(LR,12&)* DRHOI* RC
AM(1,I+3)=AM(1,I+3)-0.5*RC*YDS+C7*DUM*F(2,I)
IF(I-1) 20,20,25
20 AM(1,3)=AM(',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
40 IF(I-NETA) 50,55,50
50 AM(1,MPJ)=AM(1,MPJ)+DUM
GO TO 60

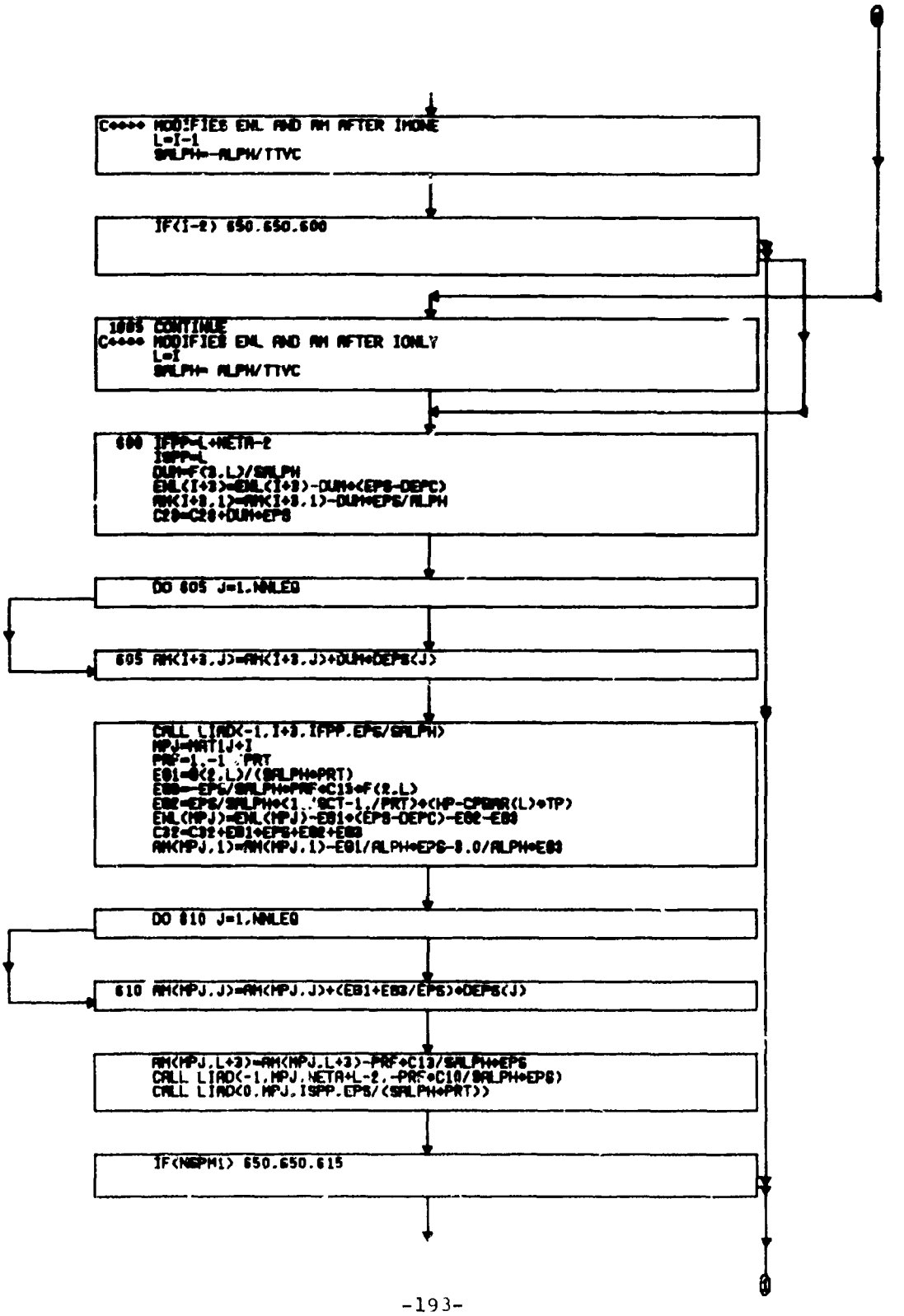

55 CALL LIAD(K,1,1,DUM)
60 MPJ=MPJ+MAT2J
IF(KR(17)) 66,66,65
65 WRITE (KOUT,640) RC,RR,SDY,RRP,RRPD,RRFD,YDI,YDS,DUM1,DUM2,DVS
1,YDIG,YDGD,QI,QS,DRHOI,AM(LR,104),(AM(LRK,K+107),K=1,NSPM1),
2(NM(1,J), J=1,NNLEQ), EML(1)
66 CONTINUE
DVS=AMAX1(0.,RC+DVS)
AM(1,MAT1J)=AM(1,MAT1J)+SDY+RC
RETURN
1000 CONTINUE
C++++ CALCULATES MIXING LENGTH AND ITS DERIVITIVES
100 PIM=PI
PI=SQRT(ABS(RED/C26+(CAPC(1)+F(3,1)-ALPH+RHOVS+F(2,I))))/
1 (CAPC(I)+YAP)
IF(I-1) 905,905,101
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
ERPI=1./PI
ERPP1=-2./(PI+PI)
ERPI=1./PIM
ERPP2=-2./(PIM+PIM)
GO TO 104

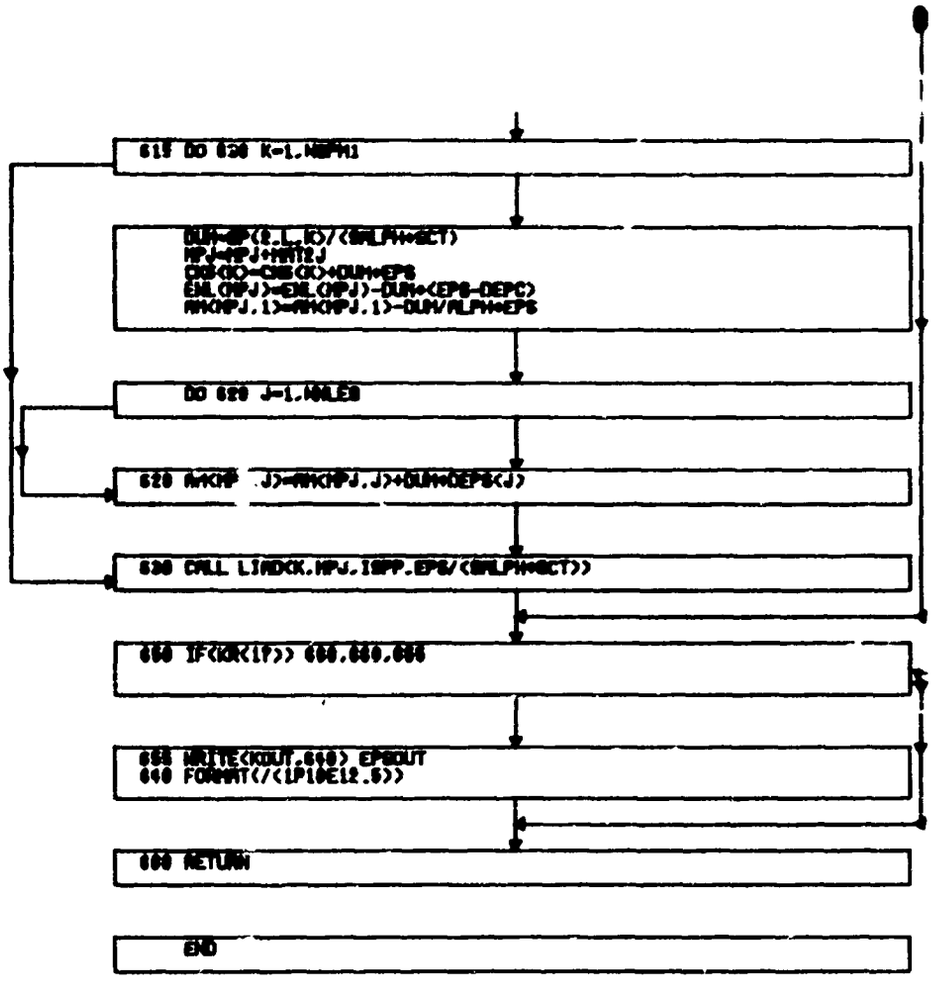

103 AF=SQRT(2./PID*DETA(I-1))
ERP1=ERP(AF/2.*PI)
ERPP1=1.-AF*PI*ERP1
ERP2=ERP(AF/2.*PIM)
ERPP2=1.-AF*PIM*ERP2
104 BF=ERP1-EPI*ERP2
DCLL=EPI
DUM1=DETA(I-1)/2.*EPI*(BF*ERP2-CL)
CL=CL*EPI+AF*BF
EL(I)=ALMH*ELCON*(ETA(I)-CL)
DUM2=AF/PID*(BF/2.*ERPP1/4.*AF*PI-EPI*ERPP2/4.*AF*PIM)
DUM3=AF/2.*AF
DCLPI=DUM1-DUM2+DUM3*ERPP1
DCLPM=DUM1+DUM2-DUM3*ERPP2*EPI
IF(I-2) 305,330,320
305 EL(1)=0.
DO 307 J=1,NNLEQ
307 DLI(J)=0.
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) * APCK(K)
GO TO 350
320 DO 925 J=1,NNLEQ


325 DLI(J)= DLI(J) + DCLL
330 DUM=-TREF*DCLPM*ELCON*ALPH
DLI(1)= DLI(1)+(EL(I)-DCLL*EL(I-1))/ALPH
L=I-1
331 DLI(1)= DLI(1)+DPI(1,1)*DUM
DLI(2)= DLI(2) + DPI(2,1)* DUM
DLI(3)= DLI(3) + DPI(1,2)*DUM
DLI(L+3)= DLI(L+3)+DPI(2,2)*DUM
J=MAT1J+2
DO 340 K=NUL,NSPM1
DLI(J)= DLI(J) + DPI(K+3,1) * DUM
JL=J+L-1
DLI(JL)= DLI(JL) + DPI(K+3,2)*DUM
340 J=J+MAT2J
346 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) 362,36[illegible],355
356 DO 360 K=1,NSPM1
360 DPI(K+3,2)=-P!/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 DERIVITIVES
C
400 DUM1=EL(I)/ALPH*EL(I)/ALPH*RED/C28
C26S=C26*C26
EPS1=AMAX1(DUM1*F(8,I),EPS1)
EPS2=OVS/C26S
IF(EPS1-EPS2) 405,401,401
401 EPS=EPS2
DEPC=ENL(1)/C26S
DO 402 J=1,NNLEQ
402 DEPS(J)=AM(1,J)/C26S
DUM1=2.0*EPS/RHO(I)
GO TO 415
405 EPS=EPS1
DO 410 J=1,NNLEQ
410 DEPS(J)=2.*EPS / EL(I)*DLI(J)
DEPS(1)=DEPS(1)-2.0/ALPH*EPS
LPI=NETA+I-2
DEPC=-DUM1*FLE(LPI)
DO 414 J=2,MATIJ


414 DEPS(J)=DEPS(J)-DUM1*BA1(LPI,J)
DUM1=EPS/RHO(I)
415 DUM=DUM1*DRHOH
EPSA(I)=EPS
DEPS(1)=DEPS(1)-CS6*C10*DUM
DEPS(I+3)= DEPS(I+3)+DUM*C10
J=MAT1J+I+1
L=MAT1J
DO 420 K=NUL,NSPM1
IF(I-METR) 418,416,416
416 DEPC=DEPC-DUM*GPLE(1,K)
DO 417 JJ=1,MAT2J
L=L+1
417 DEPS(L)=DEPS(L)-DUM*BA2(I,JJ)
GO TO 419
418 DEPS(J)=DEPS(J)+DUM
19 J=J+MAT2J
420 DUM=DUM1*DRHOK(K+1)
445 RETURN
1004 CONTINUE


C**** MODIFIES EML AND AM AFTER IMONE
L=I-1
SALPH=-ALPH/TTVC
IF(I-2) 650.650.600
1005 CONTINUE
C**** MODIFIES EML AND AM AFTER IONLY
L=I
SALPH= ALPH/TTVC
600 IFPP=L+NETA-2
ISPP=L
DUM=F(3,L)/SALPH
EML(I+3)=EML(I+3)-DUM*(EPS-DEPC)
AM(I+3,1)=AM(I+3,1)-DUM*EPS/ALPH
C20=C20+DUM*EPS
DO 605 J=1,NNLEQ
605 AM(I+3,J)=AM(I+3,J)+DUM*DEPS(J)
CALL LIAD(-1,I+3,IFPP,EPS/SALPH)
MPJ=MAT1J+I
PRF=1.-1./PRT
EB1=B(2,L)/(SALPH*PRT)
EB3=-EPS/SALPH*PRF*C13*F(2,L)
EB2=EPS/SALPH*(1./SCT-1./PRT)+(HP-CPBAR(L)*TP)
EML(MPJ)=EML(MPJ)-EB1*(EPS-DEPC)-EB2-EB3
C32=C32+EB1*EPS+EB2+EB3
AM(MPJ,1)=AM(MPJ,1)-EB1/ALPH*EPS-8.0/ALPH*EB3
DO 610 J=1,NNLEQ
610 AM(MPJ,J)=AM(MPJ,J)+(EB1+EB3/EPS)*DEPS(J)
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 620 K=1,NEPH1
DUM=EP(2,L,K)/(EPLPH*ECT)
MPJ=MPJ+MMT2J
CHR(K)=CHR(K)+DUM*EPS
EHL(MPJ)=EHL(MPJ)-DUM*(EPS-DEPC)
MMCMPJ,1)=MMCMPJ,1)-DUM/ALPH*EPS
DO 620 J=1,MALEB
620 MMCMP J)=MMCMPJ,J)+DUM*DEPS(J)
630 CALL LIMDCK,MPJ,IEPP,EPS/(EPLPH*ECT))
650 IF(KOK(IP)) 666,660,666
665 WRITE(KOUT,640) EPSOUT
640 FORMAT(/(LP10E12.5))
660 RETURN
END

20. SUBROUTINE TRANCR - B19T

a. Function

Evaluate terms required for consideration of transverse curvature. Called by SETUP, NONCER. Calls SLOPQ.

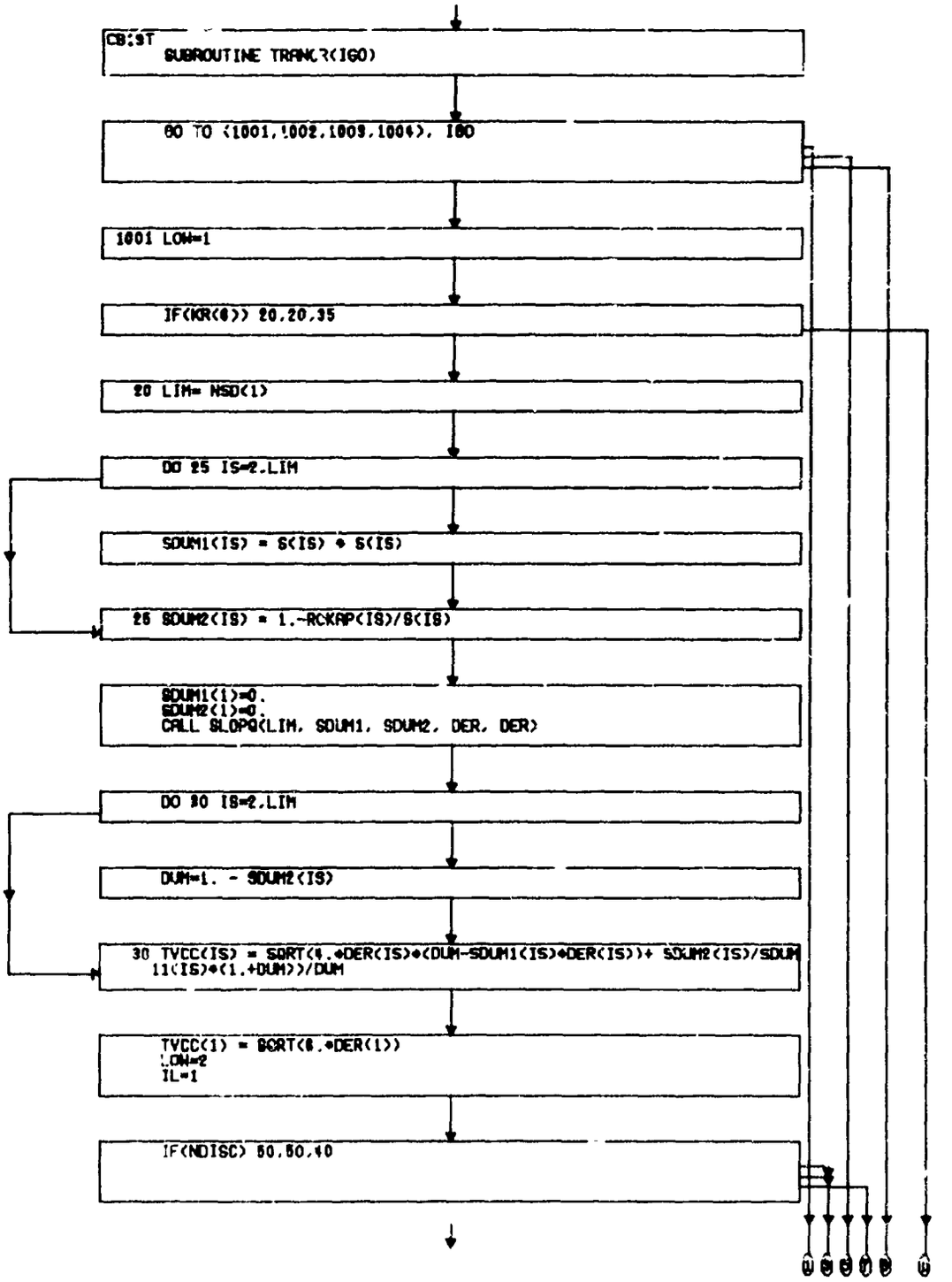
b. Listing

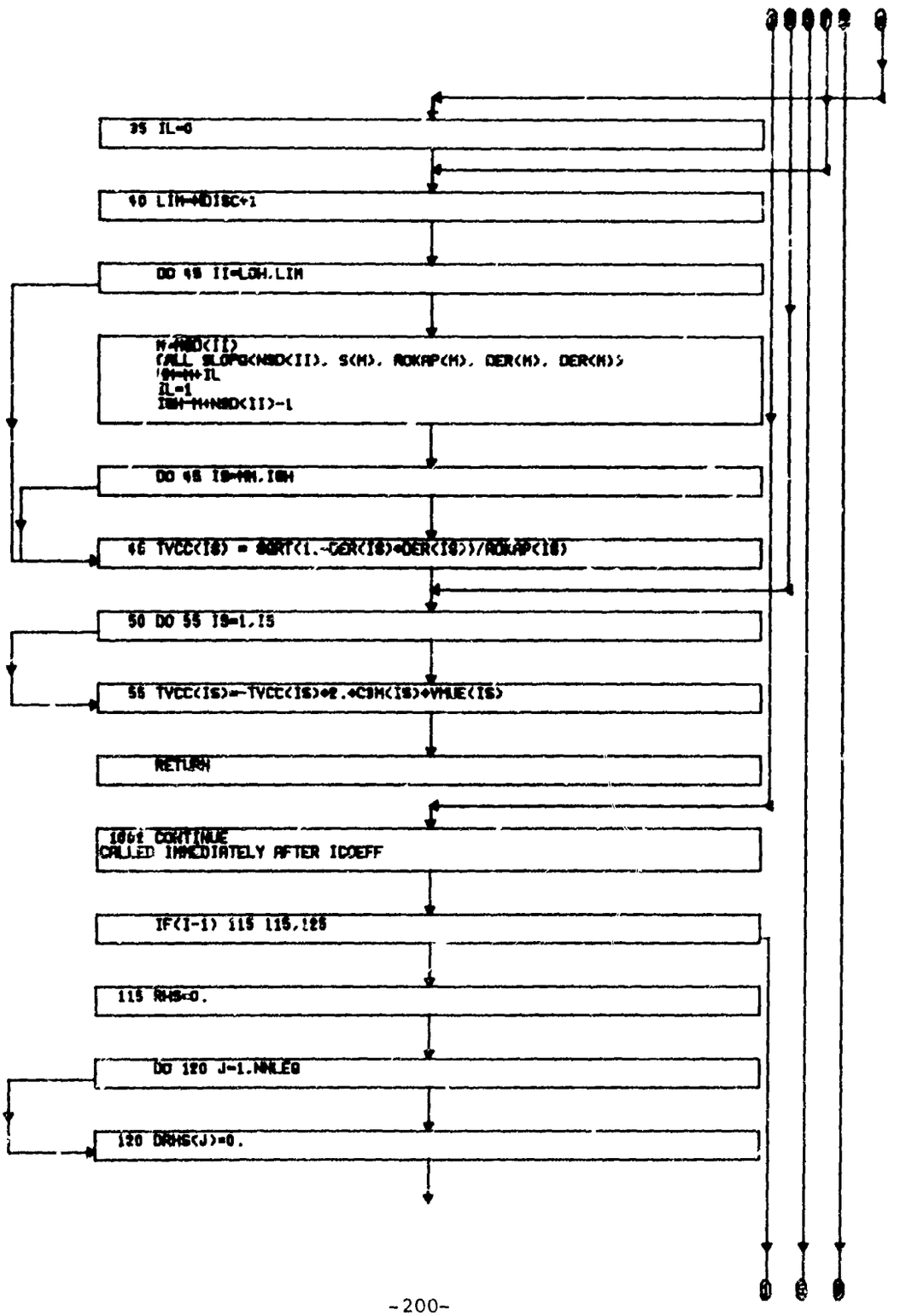
```
000001          CB19T
000002                SUBROUTINE TRANCR(IGO)                                                    *NEW
000003                DIMENSION DRH3(153)                                              B19T 003*NEW
000004                COMMON/COECOM/              C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15B19T   4*NEW
000005               1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB19T   5*NEW
000006               232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B19T   6*NEW
000007               3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB19T   7*NEW
000008               465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B19T   8*NEW
000009               5,C82,C83,C84,C85,C86,C87,C88                                    B19T   9*NEW
000010                COMMON/COECON/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)   B19T  10*NEW
000011               1,CK7( 8),CK8( 8),CK9( 8),CK10( 8),CK11( 8),CK12( 8),CK13( 8)     B19T  11*NEW
000012               2,CK14( 8),CK15( 8),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)  B19T  12*NEW
000013               3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XG(5),XSP(5, 9) B19T  13*NEW
000014               4,CKK3( 8, 8)                                                    B19T  14*NEW
000015                COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B19T  15*NEW
000016               1UE(40),RHOE(40),VMUE(40),TE(40),UFDGE,DUEDGE,D2UEDG,VMWE,WE,C9B  B19T  16*NEW
000017               2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                  B19T  17*NEW
000018                COMMON/ETACOM/ETA(15),DETA(15),DSG(14),DCU(14),B1(14),B2(14)     B19T  18*NEW
000019               1,LAR(153),BA1(43,18),BA2(30,15)                                 B19T  19*NEW
000020                COMMON/MISCOM/C1,C2,C3,C4,ALPWD,BETA,ZM(4,14) ZG(4,14),ZSP(4,14, AB19T  20*NEW
000021               1 ),XI(40),WF(15,5),WG(15,3),WSP(15,3, 8),WALPH,WUE,WWUE,WFW,DLX2 B19T  21*NEW
000022               2,C3M(40),BETAM(40)                                              B19T  22*NEW
000023                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT11,MAT21,MAT1J,MAT2J,NETA,I,IS,NB19T  23*NEW
000024               15,IT,NTIME,N3P,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B19T  24*NEW
000025               2,B(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B19T  25*NEW
000026               3,KAUXO,JTIME,JSPEC,MD(3)                                        B19T  26*NEW
000027                COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                        B19T  27*NEW
000028               1VLNKW,DLPW( 9),DLPK( 8, 9),DTWW,DTKW( 8),FLUXJB( 9)             B19T  28*NEW
000029                COMMON/PRPCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),Z(40),ROKAP(40) B19T  29*NEW
000030               1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO, B19T  30*NEW
000031               2CONE,RADFL( 50),RADR(40),RADS(40),IRAD                          B19T  31*NEW
000032                COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),GR(15),H(15)  B19T  32*NEW
000033               1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKW( 8),  DB19T  33*NEW
000034               2MU3K( 8),DMU4K( 8),DTK( 8),DPHIKW( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B19T  34*NEW
000035               3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)  B19T  35*NEW
000036               4,DPHIKK( 8, 8),      DMU4W,DMU3W,DHTILW,VMU12,CT,CTR,CPTIL,HTIL  B19T  36*NEW
000037               5,VMU3,DTW,DCAPCW,DPRW,DSCW,DQRW,DCPBW,DCPTW,DMU12W,VMU(15),  RHOP B19T  37*NEW
000038               6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)  B19T  38*NEW
000039                COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)    B19T  39*NEW
000040               1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),PWCON(40),PWINIT( 1)    B19T  40*NEW
000041               2,XIINIT( 1),DUDS( 40)                                           B19T  41*NEW
000042                COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                  B19T  42*NEW
000043                GO TO (1001,1002,1003,1004), IGO                                  *NEW
000044           1001 LOW=1                                                             *NEW
000045                IF(KR(6)) 20,20,35                                                *-43
000046             20 LIM= NSD(1)
000047                DO 25 IS=2,LIM
000048                SDUM1(IS) = S(IS) * S(IS)
000049             25 SDUM2(IS) = 1.-ROKAP(IS)/S(IS)
000050                SDUM1(1)=0.
000051                SDUM2(1)=0.
000052                CALL SLOPQ(LIM, SDUM1, SDUM2, DER, DER)
000053                DO 30 IS=2,LIM
000054                DUM=1. - SDUM2(IS)
000055             30 TVCC(IS) = SQRT(4.*DER(IS)*(DUM*SDUM1(IS)*DER(IS))+ SDUM2(IS)/SDUM
000056               1(IS)*(1.+DUM))/DUM
000057                TVCC(1) = SQRT(6.*DER(1))
000058                LOW=2
```

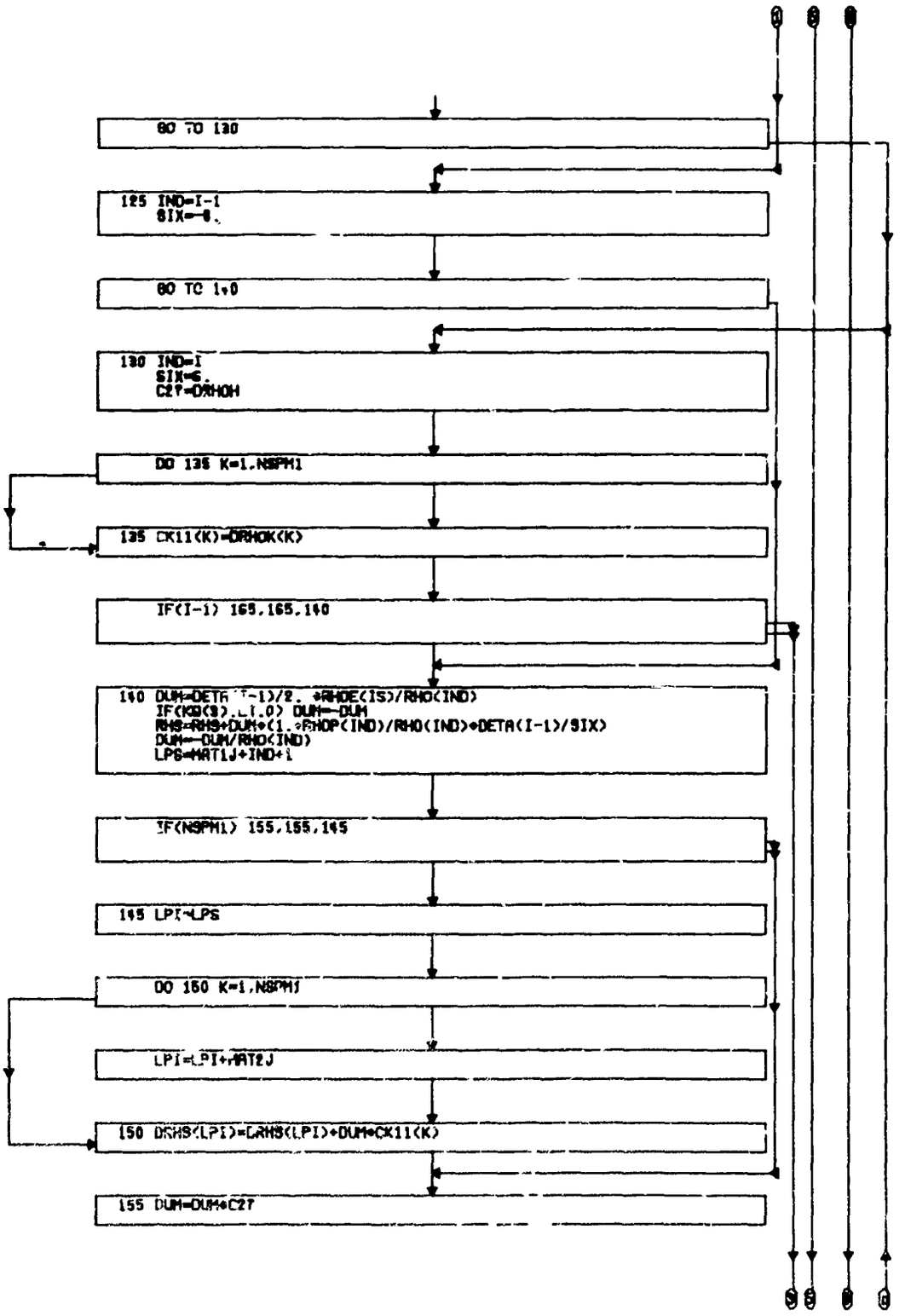
```
000059                IL=1
000060                IF(NDISC) 50,50,40
000061             35 IL=0
000062             40 LIM=NDISC+1
000063                DO 45 II=LOW,LIM
000064                M=NSD(II)
000065                CALL SLOPE(NSD(II), S(M), ROKAP(M), DER(M), DER(M))
000066                MM=M+IL
000067                IL=1
000068                IGH=M+NSD(II)-1
000069                DO 45 IS=MM,IGH
000070             45 TVCC(IS) = SQRT(1.-DER(IS)*DER(IS))/ROKAP(IS)
000071             50 DO 55 IS=1,IS
000072             55 TVCC(IS)=-TVCC(IS)*2.*C3M(IS)*VMUE(IS)
000073                RETURN
000074           1002 CONTINUE                                                    *NEW
000075          CALLED IMMEDIATELY AFTER ICOEFF                                  **-1
000076                IF(I-1) 115,115,125
000077            115 RHS=0.
000078                DO 120 J=1,NNLEQ
000079            120 DRHS(J)=0.
000080                GO TO 130
000081            125 IND=I-1
000082                SIX=-6.
000083                GO TO 140
000084            130 IND=I
000085                SIX=6.
000086                C27=DRHOH
000087                DO 135 K=1,NSPM1
000088            135 CK11(K)=DRHOK(K)
000089                IF(I-1) 165,165,140
000090            140 DUM=DETA(I-1)/2. *RHOE(IS)/RHO(IND)
000091                IF(KQ(9),LT,0) DUM=-DUM
000092                RHS=RHS+DUM*(1.+RHOP(IND)/RHO(IND:*DETA(I-1)/SIX)
000093                DUM=-DUM/RHO(IND)
000094                LPS=MAT1J+IND+1
000095                IF(NSPM1) 155,155,145
000096            145 LPI=LPS
000097                DO 150 K=1,NSPM1
000098                LPI=LPI+MAT2J
000099            150 DRHS(LPI)=DRHS(LPI)+DUM*CK11(K)
000100            155 DUM=DUM*C27
000101                DRHS(LPS) = DRHS(LPS) + DUM
000102                DUM=DUM*C7*F(2,IND)
000103                DRHS(IND+3) = DRHS(IND+3) + DUM
000104                DRHS(1)= DRHS(1)-DUM/ALPH*F(2,IND)
000105                IF(IND-I) 130,160,160
000106            160 TTVC=AMAX1(1.+RHS*ALPH*TVCC(IS),0.0001)
000107            165 RETURN
000108           1003 CONTINUE                                                    *NEW
000109          CALLED IMMEDIATELY AFTER IMONE                                   **-1
000110                IND=I-1
000111                DUM1=-TVCC(IS)/TTVC
000112                GO TO 205
000113
000114           1004 CONTINUE                                                    *NEW
000115                IND=I                                                     **-1
000116                DUM1=TVCC(IS)/TTVC
000117            205 DUM2=DUM1*C28
000118                DUM3=DUM1* C32
```

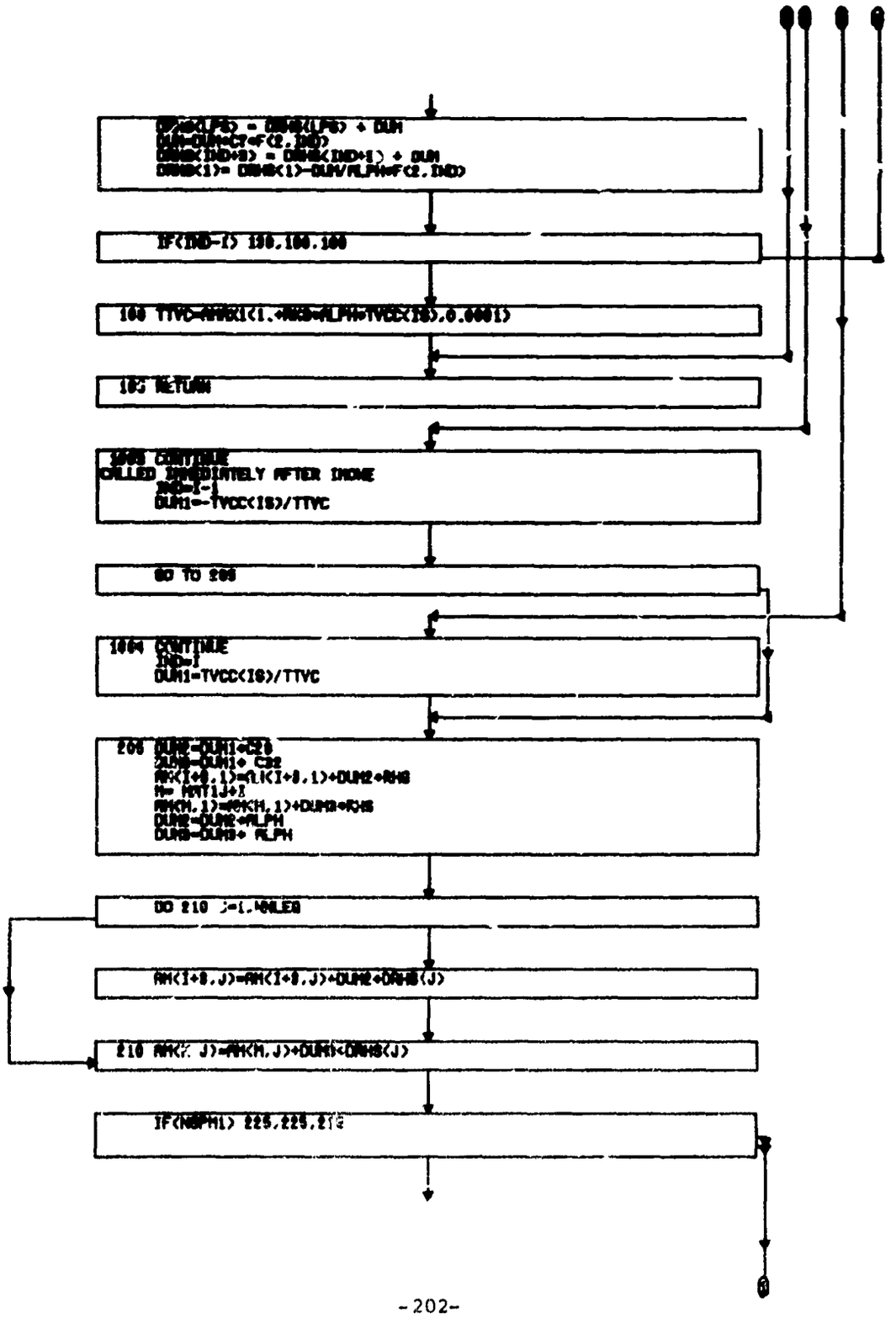
```
000119                  AM(I+3,1)=AM(I+3,1)+DUM2*RHS
000120                  M= MAT1J+I
000121                  AM(M,1)=AM(M,1)+DUM3*RHS
000122                  DUM2=DUM2*ALPH
000123                  DUM3=DUM3* ALPH
000124                  DO 210 J=1,NNLEQ
000125                  AM(I+3,J)=AM(I+3,J)+DUM2*DRHS(J)
000126              210 AM(M,J)=AM(M,J)+DUM3*DRHS(J)
000127                  IF(NSPM1) 225,225,215
000128              215 DO 220 K=1,NSPM1
000129                  DUM3=DUM1*CK6(K)
000130                  M=M+MAT2J
000131                  AM(M,1)=AM(M,1)+DUM3*RHS
000132                  DUM3=DUM3*ALPH
000133                  DO 220 J=1,NNLEQ
000134              220 AM(M,J) = AM(M,J) + DUM3*DRHS(J)
000135              225 RETURN
000136                  END
```

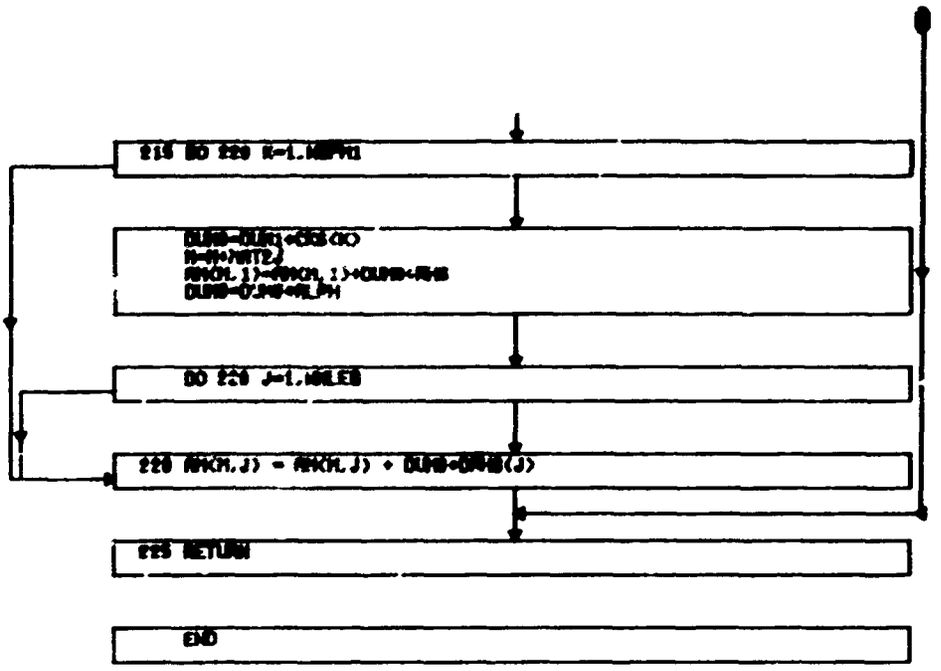
c. Flow Chart


CB:ST
SUBROUTINE TRANCR(IGO)
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.-RCKAP(IS)/S(IS)
SDUM1(1)=0.
SDUM2(1)=0.
CALL SLOPQ(LIM, SDUM1, SDUM2, DER, DER)
DO 30 IS=2,LIM
DUM=1. - SDUM2(IS)
30 TVCC(IS) = SQRT(6.*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 48 II=LOW,LIM
M=NBD(II)
CALL SLOPE(NBD(II), S(M), ROKAP(M), DER(M), DER(M))
IL=IL+1
IBM=M+NBD(II)-1
DO 46 IB=M,IBM
46 TVCC(IB) = SQRT(1.-DER(IB)*DER(IB))/ROKAP(IB)
50 DO 55 IS=1,IS
55 TVCC(IS)=-TVCC(IS)*2.*CSM(IS)*VALUE(IS)
RETURN
100 CONTINUE
CALLED IMMEDIATELY AFTER ICOEFF
IF(I-1) 115 115,125
115 RHS=0.
DO 120 J=1,NNLEQ
120 DRHS(J)=0.


GO TO 130
125 IND=I-1
SIX=-8.
GO TO 140
130 IND=I
SIX=8.
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(KB(3).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 DRHS(LPI)=DRHS(LPI)+DUM*CK11(K)
155 DUM=DUM*C27


IF(IND-1) 100,100,100
100 TTVC=AMAX1(1.+RKB*ALPH*TVCC(IS),0.0001)
105 RETURN
1000 CONTINUE
CALLED IMMEDIATELY AFTER INDME
IND=1
DUM1=TVCC(IS)/TTVC
GO TO 200
1004 CONTINUE
IND=1
DUM1=TVCC(IS)/TTVC
200
210 CONTINUE
IF(NSPH1) 225,225,215



21. SUBROUTINE EQUIL (KQ, Z, PRR) - B20A

a. Function

Control program for computation of chemical state of the system. Performs such complex functions as setting up for different types of solutions (isentropic expansion, stagnation point, boundary layer or wall), recalling stored values of boundary layer solutions and reinitializing omitted species, reevaluating absent atom array, deleting molecules based on absent atom array, and, with the aid of subroutines, evaluating properties, controlling principal iterative loop, and reinverting and attempting alternate paths when convergence problems occur. Called by NOSCER, REFCON. Calls CRECT, MATER, PROPS, RERAY, THERM, DUMCOM.

KQ = Flag which controls chemistry options (see Fortran variables list)

Z = Enthalpy (when used)

PRR = Pressure

b. Listing

```
000001          CB20A                                                                   B20A 001
000002                SUBROUTINE EQUIL(KQ,Z,PRR)                                        B20A 002
000003                INTEGER FAMOA,FAMOB                                               B20A 004
000004                EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                                 B20A 006
000005                DIMENSION CIJ( 71,1),TF(1)                                        B20A 007
000006                DIMENSION APE(16,16),BS(16)                                       B20A 008
000007                DIMENSION VLAM( 71,1),  X(14),GAMK( 71,1),KQ(10),DQJRNL( 71,1)    B20A 009
00000A                EQUIVALENCE(AM( 74),DQJRNL( 74),GAMK,VLAM)                        B20A 010
000009                COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N    ,FR( 71,15),W(3),LEF(10)B20A  11
000010               1,LEFS(10),PIEASE,LEFW(10)                                         B20A  12
000011                COMMON/BUMCOM/    BUMP,CORMA,EASE,ICORM,WDOT,TFZ,I777,DTEMP,KIP,IxB20A  13
000012                COMMON/EDGCOM/           PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B20A  14
000013               1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,DZUEDG,VMWE,ME,C90   B20A  15
000014               2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                    B20A  16
000015                COMMON /EQPCOM/ RS( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B20A  17
000016               1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B20A  18
000017               2 WAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B20A  19
000018               3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B20A  20
000019               4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   B20A  21
000020                COMMON /EQTCOM/SIP,WIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,    B20A  22
000021               1 MODE,MMELT,&MELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,81,ISP2,ISPQ,   B20A  23
000022               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IPCJC,WTG,WTL,JC,HG,  B20A  24
000023               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      B20A  25
000024               4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),BLAM(10),DY( 71),RVS,  B20A  26
000025               5 CP( 71),H( 71),BB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B20A  27
000026               6 RC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B20A  28
000027                COMMON/PLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(966,2)   B20A  29
000028               2,THF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KQT(2)             B20A  30
000029                COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ         B20A  31
000030               1,WALLJ( 8),QW,VJKW( 9),TPWALL                                     B20A  32
000031                COMMON /INTCOM/KKR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,II,   B20A  33
000032               1ISS,NS,ITT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL,MITS,KAPPA,CBAR,   B20A  34
000033               2CASE(15),BB(8),  MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT.    B20A  35
000034               3 KR9(40),KAUXQ,JTIME,JSPEC,MQ(3)                                  B20A  36
000035                COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                          B20A  37
000036               1VLNKW,DLPW( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)               B20A  38
000037                COMMON /PRPCOM/PR(15),TT(15),RHO(15),SC(15),CAPC(15),GR(15),HW(15)B20A  39
000038               1,CPBAR(15),VMW(15),PHIK(15, 8),DRHOM,DRHOK( 8),ZK( 8),DZKW( 8),  B20A  40
000039               2MU3K( 8),DMU4K( 8),DTK( 8),DPWIKM( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B20A  41
000040               3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)    B20A  42
000041               4,DPWIKK( 8, 8),      DMU4M,DMU3M,DHTILM,VMU12,CT,CTR,CPTIL,HTIL    B20A  43
000042               5,VMU3,DTM,DCAPCM,DPRM,DSCM,DQRM,DCPBM,DCPTM,DMU12M,VMU(15),  RHOP  B20A  44
000043               6(19),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)    B20A  45
000044                COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                    B20A  46
000045                COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         B20A  47
000046               1,RHOVW(40, 1),FLUXJ( 3,40, 1),IWW,ITH,IFW,ISPW,IRHOVW,IFLUXJ      B20A  48
000047                EQUIVALENCE(B,X)                                                  B20A 046
000048               1 FORMAT(1011,3F10,5)                                              B20A 047
000049               2 FORMAT(/9X6HTEMP =F10,4,17H DEG-K     PRES =F8,4,17H ATM     MOL WB20A 048
000050                1T =F11,7)                                                        B20A 049
000051               3 FORMAT( /87H  SPECIES  PAR,PRES,      D-LOG-PP       LOG-PP       LOB20A 050
000052                1G-KP     FLAG   ERROR          CP  /(1X2A4,4E13,5,I9,2E13,5))    B20A 051
000053               4 FORMAT(/10X60H CP-FROZEN    CP-EQUIL   DLNM/DLNT   DLNM/DLNP     GB20A 052
000054                1AMMA        /10X5E12,5)                                         B20: 053
000055               7 FORMAT(I3,F8,2,11E10,3/91X3E10,3)
000056              A  FORMAT(10X10HENTHALPY =E14,7,20H CAL/GM    ENTROPY =E12,5,13H CAL/B20A 055
000057                1G-DEG K/10X 9HDENSITY =E13,6, 4H LB/CUFT)                        B20A 056
000058               6 FORMAT(//)                                                       B20A 057
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000059          9 FORMAT(5X 5HVEL =E10.3,16H FT/SEC   MACH =E10.3,  9H   AREA =E10.3B20A 058
000060           1,12H SQFT/LB/SEC)                                              B20A 059
000061         10 FORMAT(10X17HFRACTION LIQUID =F8.5)                            B20A 060
000062         42 FORMAT(8F10.4)                                                 B20A 061
000063            DTU=500.
000064            DTD=DTU
000065            LEFUP=1                                                        B20A 063
000066            TTMIN=250.                                                     B20A 064
000067            TTMAX=20000.
000068            ITS=0                                                          B20A 065
000069            IC=0
000070            INV=0
000071            SPEASE=PIEASE
000072            TION=1500.
000073            ISP=IS+1                                                       B20A 066
000074            DO 302 I=1,6
000075       302  KR(I)=KQ(I)                                                    B20A 068
000076            MODE=KR(1)                                                     B20A 069
000077            P=PRR                                                          B20A 070
000078            KR(8)=0
000079            KR(6)=KR(6)-1                                                  B20A 071
000080            IF(KKR(18)-6) 3021,3021,3022
000081       3021 KR(7)=KKR(18)*5-9
000082            N7=51-KKR(18)*5
000083            GO TO 3023
000084       3022 KR(7)=0
000085            N7=KKR(18)*10-50
000086       3023 IF(KR(5)-1) 310,304,306
000087      C*****ISENTROPIC EXPANSION                                          B20A 074
000088         304 SIP=SIP-DSIP(188)                                           B20A 075
000089            IEW=2                                                        B20A 076
000090            II=NETA                                                      B20A 077
000091            GO TO 324                                                    B20A 078
000092      C*****STAGNATION POINT AND INITIAL...TION                          B20A 079
000093         306 IEW=2                                                       B20A 080
000094            KR(8)=0
000095            ITFF=0
000096            PIEASE=0.
000097            KQ(6)=0                                                      B20A 081
000098            HIP=Z/1.8                                                    B20A 082
000099            MITS=1                                                       B20A 083
000100            II=NETA                                                      B20A 084
000101            T=3000.                                                      B20A 085
000102            WM=20.                                                       B20A 086
000103            AA=P*WM                                                      B20A 087
000104            DO 309 I=1,18
000105         309 ALP(I)=TQ(I,1)                                              B20A 089
000106            KR(6)=-1                                                     B20A 090
000107            IF(ITEM-1) 350,308,350
000108         308 IF(KKR(2)-2) 311,350,311
000109         310 IF(KR(6)) 312,330,330                                       B20A 092
000110         311 LEFUP = -1
000111             IF (KKR(12)-1) 384,330,384
000112      C*****BOUNDARY LAYER                                               B20A 093
000113         312 ALP(IS)=0.                                                  B20A 094
000114            LEFUP=MITS+II-2
000115            HIP=Z/1.8                                                    B20A 096
000116            ALP(NSP)=1.0                                                 B20A 097
000117            IF(NSPM1) 3141,3141,313
000118         313 DO 314 K=1,NSPM1
```

```
000119                ALP(K)=SP(1,II,K)/WTM(K)                                  B20A 099
000120           314  ALP(NSP)=ALP(NSP)+SP(1,II,K)                              B20A 100
000121          3141  ALP(NSP)=ALP(NSP)/WTM(NSP)
000122                DO 319 I=1,NSP                                            B20A 102
000123                ARPH=0.                                                   B20A 103
000124                ARPHM=0.                                                  B20A 104
000125                DO 315 K=1,NSP                                            B20A 105
000126                DUM=CIJ(I,K)*ALP(K)                                       B20A 106
000127                ARPHM=AMAX1(ARPHM,ABS(DUM))                               B20A 107
000128           315  ARPH=ARPH+DUM                                             B20A 108
000129                IF(II.EQ.1.AND.LEFW(I).EQ.1) LEF(I)=1                                 *NEW
000130                IF(ARPH-.0001*ARPHM) 316,316,319
000131           316  IF(II.EQ.1.AND.LEF(I).EQ.1) LEF(I)=0
000132                LEF(I)=-IABS(LEF(I))
000133                LEFS(I)=-IABS(LEFS(I))
000134           319  CONTINUE                                                  B20A 111
000135           320  IF(ITFF) 326,390,390                                      B20A 112
000136          C*****ACCEPT RESIDENT VALUES AS FIRST GUESSES                   B20A 113
000137           324  IF(T-TION) 328,398,398
000138           326  ITFF=ITFF+1                                               B20A 115
000139                IF(II-1) 323,323,322
000140           322  II=1
000141                GO TO 390
000142           323  IF (ITFF) 327,329,329
000143           327  IF(KR2-1) 328,329,328
000144           329  GO TO 390
000145           328  LEF(NSP+1)=-IABS(LEF(NSP+1))                              B20A 116
000146                IF(LEFUP) 393,364,393
000147          C*****WALL SOLUTION                                             B20A 118
000148           330  IEW=1                                                     B20A 119
000149                ITFF=-1                                                   B20A 120
000150                II=1                                                      B20A 122
000151                CHFLUX=W(3)
000152                PLEASE=PLEASE+0.9A9*(1.0-EASE)
000153                KR(7)=MAXO(KR(7),KKR(16)+5-.)
000154                IF(TT(1)/1.8.GT.TF(N+1)) KR(8)=1
000155                IF(MODE-1) 333,331,333                                    B20A 123
000156           331  TTMIN=TT(1)/1.8-500.
000157                TTMAX=TT(1)/1.8+500.
000158                KR(8)=0
000159           333  IF(KR(8).EQ.1) CHFLUX=-1.
000160                DO 332 K=1,IS
000161                IF(LEF(K)) 332,3331,332
000162          3331  IF(W(2)*TK(K,L2)+CHFLUX*TK(K,L3).LT.0.) LEF(K)=1
000163           332  ALP(K)=TQ(K,L2)*AMIN1(0.,W(2))+TQ(K,L3)*AMIN1(0.,W(3))+TQ(K,1)*
000164              1 AMIN1(0.,W(1))
000165                WSS=W(1)-W(2)-W(3)
000166                WSS=AMIN1(0.,W(1))-AMIN1(0.,W(2))-AMIN1(0.,W(3))
000167                DO 335  L=NSP,IS                                          B20A 129
000168                DO 334 K=1,IS                                             B20A 130
000169                GAMK(K,L)=0.                                              B20A 131
000170           334  GAMK (L,K)=0.                                             B20A 132
000171                GAMH(L)=0.                                                B20A 133
000172           335  GAMF(L)=0.                                                B20A 134
000173                IF(NSPM1) 3361,3361,3351
000174          3351  DO 336 K=2,NSP
000175                GAMH(NSP)=GAMH(NSP)-DQJRNL(2,K)/WTM(NSP)*1.8              B20A 136
000176                GAMF(NSP)=GAMF(NSP)-DQJRNL(1,K)/WTM(NSP)                  B20A 137
000177                ALP(NSP)=ALP(NSP)+WALLJ(K-1)/WTM(NSP)                     B20A 138
000178                ALP(K-1)=ALP(K-1)-WALLJ(K-1)/WTM(K-1)                     B20A 139
```

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000179                GAMW(K-1)=DQJRNL(2,K)/WTM(K-1)*1.0                    B20A 140
000180                GAMF(K-1)=DQJRNL(1,K)/WTM(K-1)                        B20A 141
000181                DO 336 KK=2,NSP                                       B20A 142
000182           336  GAMK(KK-1,NSP)=GAMK(KK-1,NSP)-GAMK(KK-1,K-1)         B20A 143
000183          3361  DO 3362 K=1,IS
000184                DO 3362 J=ISP,N
000185          3362  VLAM(J,K)=WS*WTM(J)*GAMF(K)
000186                DUM1=NSPM1                                            B20A 144
000187                DO 340 K=1,NSP                                        B20A 145
000188                GAMW(K)=-GAMW(K)
000189                SUMG=0.                                               B20A 146
000190                IF(NSPM1) 3392,3392,3391
000191          3391  DO 339 KK=1,NSP
000192                IF(KK-K) 337,339,337                                  B20A 148
000193           337  SUMG=SUMG+GAMK(KK,K)                                 B20A 149
000194           339  CONTINUE                                             B20A 150
000195                SUMG=SUMG/DUM1                                        B20A 151
000196                ALP(K)=-ALP(K)+SUMG/WTM(K)
000197          3392  DO 338 KK=1,NSP
000198           338  GAMK(KK,K)=-(GAMK(KK,K)-SUMG)/WTM(K)*WTM(KK)
000199                DO 340 KK=1,NSP                                       B20A 157
000200                DO 3401 J=ISP,N
000201          3401  VLAM(J,K)=VLAM(J,K)+GAMK(KK,K)*VNU(J,KK)
000202           340  GAMK(KK,K)=GAMK(KK,K)*WTM(KK)*GAMF(K)*WS
000203          C******RECALL STORED VALUES OF BOUNDARY LAYER SOLUTION AND     B20A 159
000204          C     RE-INITIALIZED OMITTED SPECIES                          B20A 160
000205           350  II=II-IG
000206                PIN=1.E-4*P
000207                PINL=ALOG(PIN)
000208                LIM=N*KR(8)
000209                DO 354 I=1,LIM
000210                IF(IFC(I)-1) 342,342,341                              B20A 165
000211           341  IFC(I)=IFC(I)-3                                       B20A 166
000212                GO TO 345                                             B20A 167
000213           342  IF(IFC(I)+1) 343,345,345                              B20A 168
000214           343  IFC(I)=IFC(I)+3                                       B20A 169
000215           345  IF (IFC(I)) 346,349,346                               B20A 170
000216           346  VN(I)=FR(I,II)*P
000217                IFC(I)=1                                              B20A 172
000218                Y(I)=0.                                               B20A 173
000219                IF(VN(I)) 347,347,354                                 B20A 175
000220           347  IFC(I)=-1                                             B20A 176
000221                IF (I-IS) 348,348,354                                 B20A 177
000222           348  Y(J)=PINL                                             B20A 178
000223                GO TO 3530
000224           349  IF(FR(I,II))357,357,352                               B20A 180
000225           357  IF(VN(I)) 351,351,358
000226           358  IF(II-1) 353,351,353
000227           351  VN(I)=PIN                                             B20A 183
000228                GO TO 353                                             B20A 184
000229           352  VN(I)=FR(I,II)*P
000230           353  Y(I)=ALOG(VN(I)+1.E-35)
000231          3530  IF(II-1) 354,3531,354
000232          3531  IF(IS-I) 354,3532,3532
000233          3532  Y(I)=YW(I)
000234                IF(FR(I,1)-1.E-30) 354,3533,354
000235          3533  VN(I)=EXP(Y(I))
000236           354  CONTINUE                                              B20A 187
000237                T=TT(II)/1.8                                          B20A 188
000238                IF(T-TION) 355,356,356
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000239          355 LEF (NSP+1)=-IABS(LEF(NSP+1))                                   B20A 190
000240          356 WM=VMW(II)
000241              II=II+IG
000242              IF(LEFUP) 384,364,393
000243        C*****REEVALUATE ABSENT ATOM ARRAY                                    B20A 193
000244          364 JT=MOD(ITEM,2)+1
000245              DO 382 K=1,NSP                                                  B20A 196
000246              LEFW(K)=0                                                             *NEW
000247              LEFS(K)=LEF(K)
000248              LEF(K)=ISIGN(LEFT(K,JT),LEF(K))
000249              IF(LEF(K)-2) 369,365,382                                        B20A 198
000250          365 IF(ISS-2) 369,366,367
000251          366 IF(KKR(6)-1) 369,369,367
000252          367 IF(KKR(3)) 369,369,382
000253          369 LEF(K)=MIND(LEF(K),0)                                           B20A 200
000254              IF(KKR(9)-2) 370,382,381                                              *NEW
000255          370 DUM1=1.0                                                        B20A 202***i
000256              DUM2=0.                                                         B20A 203
000257              IF(NSPM1) 3721,3721,3701
000258         3701 DO 372 J=1,NSPM1
000259              DUM1=DUM1-SPW(J,ISS,ITT)                                        B20A 205
000260          372 DUM2=DUM2+SPW(J,ISS,ITT)*CIJ(K,J)                               B20A 206
000261         3721 IF(ABS(DUM1)-1.E-7) 376,374,374
000262          374 DUM2=DUM2+DUM1*CIJ(K,NSP)                                       B20A 209
000263          376 IF(DUM2) 382,382,380                                            B20A 209
000264          380 LEF(K)=1
000265              GO TO 382                                                             *NEW
000266          381 IF(W(2)*TK(K,L2)+W(3)*TK(K,L3).LT.0.) LEFW(K)=1                        *NEW
000267          382 CONTINUE                                                        B20A 212
000268              GO TO 393                                                       B20A 213
000269        C*****INITIALIZE SP(,,) AND VN() ON FIRST STAGNATION SOLUTION         B20A 214
000270          384 ITFF=NETA                                                       B20A 215
000271              NCV=0                                                           B20A 216
000272              TT(1)=3000.
000273              VMW(1)=20.
000274              KR2=KKR(2)
000275              IF(KR2.LT.0) KR2=1
000276              IF(KR2.EQ.1) GO TO 387
000277          385 DO 386 K=1,NSP
000278              DO 386 I=1,NETA                                                 B20A 220
000279              SP(1,I,K)=ALP(K)*WTM(K)                                         B20A 221
000280              SP(2,I,K)=0.                                                    B20A 222
000281          386 SP(3,I,K)=0.                                                    B20A 223
000282              W(1)=0.
000283              W(2)=0.
000284              W(3)=0.
000285              LEF(IS)=3                                                       B20A 224
000286              LEFS(IS)=3
000287              DO 3868 I=1,NSP                                                 B20A 225
000288              LEF(I)=0                                                        B20A 226
000289              IF(TK(I,1)) 3868,3868,3867                                      B20A 227
000290         3867 LEF(I)=3                                                        B20A 228
000291         3868 CONTINUE                                                        B20A 229
000292          387 DO 388 I=1,IS                                                   B20A 230
000293              IF(ALP(I)) 393,388,388                                          B20A 231
000294          388 CONTINUE                                                        B20A 232
000295              DO 3881 I=1,NETA
000296              DO 3881 J=1,N
000297         3881 FR(J,I)=0.
000298              DO 392 I=1,IS                                                   B20A 233
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000299              VN(I)=AMAX1(VN(I)/P*.1,ALP(I)*AA)                    B20A 234
000300              IF(IFC(I)) 390,391,390                               B20A 235
000301           390 IFC(I)=1                                            B20A 236
000302              Y(I)=0.                                              B20A 237
000303              GO TO 392                                            B20A 238
000304           391 Y(I)=ALOG(VN(I))                                    B20A 239
000305           392 CONTINUE                                            B20A 240
000306         C*****DELETE MOLECULES BASED ON ABSENT ATOM ARRAY          B20A 241
000307           393 LAMD=1
000308              DO 3971 K=1,IS                                                *NEW
000309              IF(LEF(K)) 394,3930,3934                                      **-1
000310          3934 IF(PIEASE-.99) 3931,3931,3933
000311          3930 IF(PIEASE-.01) 394,394,3933
000312          3933 IF(LEFS(K)) 3932,394,3931                                *NEW
000313          3931 IF(II-NETA) 397,3932,397                              B20A 244**-1
000314          3932 IF(LEF(K)-3) 394,397,394                              B20A 245**-1
000315           394 DO 396 J=1,N                                          B20A 246
000316              IF(IABS(IFC(J))-1) 389,389,396                         B20A 247
000317           389 IF(MOD(LAMI(J)/LAMD,2)) 395,396,395
000318           395 VN(J)=0.
000319              IFC(J)=IFC(J)-3                                        B20A 250
000320           396 CONTINUE                                              B20A 251
000321              J=-IR(K)                                               B20A 253**-1
000322              IF(IFC(J)-1) 3961,3961,397                             B20A 254
000323          3961 IFC(J)=IFC(J)+6                                       B20A 255
000324           397 LAMD=LAMD+LAMD
000325              LEF(K)=IABS(LEF(K))                                           *NEW
000326          3971 LEFS(K)=IABS(LEFS(K))                                        *NEW
000327         C*****DELETE CONDENSED SPECIES FROM BOUNDARY LAYER
000328              IF(KR(6)) 3980,398,398
000329          3980 DO 3984 J=1,N
000330              IF(IABS(IFC(J))-1) 3984,3981,3984
000331          3981 IFC(J)=IFC(J)-3
000332              VN(J)=0.
000333          3984 CONTINUE
000334           398 IF(KR(7)-1) 21,21,1902                                B20A 258
000335         C*****EVALUATE PROPERTIES                                   B20A 259
000336           170 CPF=CPF/AA
000337              IF(KR(6)) 1701,1932,1702
000338          1702 HG=0.
000339              HL=0.
000340              WTL=0.
000341              RV=RVS+(RV-RVS)/EASE
000342              DO 1703 J=1,N
000343              IF(IFC(J)) 1703,1704,1705
000344          1704 HG=HG+VN(J)*H(J)
000345              GO TO 1703
000346          1705 HL=HL+VN(J)*H(J)
000347              WTL=WTL+VN(J)*WTM(J)
000348          1703 CONTINUE
000349              HIP=(HG+(HL-WTL/AA*HG)/WS)/AA
000350              GO TO 1932
000351          1701 IN=IS+2
000352              IG=MIN0(IQQ,-KKR(20))
000353              CALL RERAY(IN,A,0,B,0,0,IG,16)                         B20A 263
000354              ALF=A(2,1)/A(1,1)                                      B20A 265
000355              CSP=1./(A(1,1)*AA)                                     B20A 266
000356              BETM=P*(A(2,2)-A(1,2)*ALF)+1.                          B20A 267
000357              IF(MODE-3) 1931,1932,1931                              B20A 268
000358          1931 CSP=CSP/T                                             B20A 269
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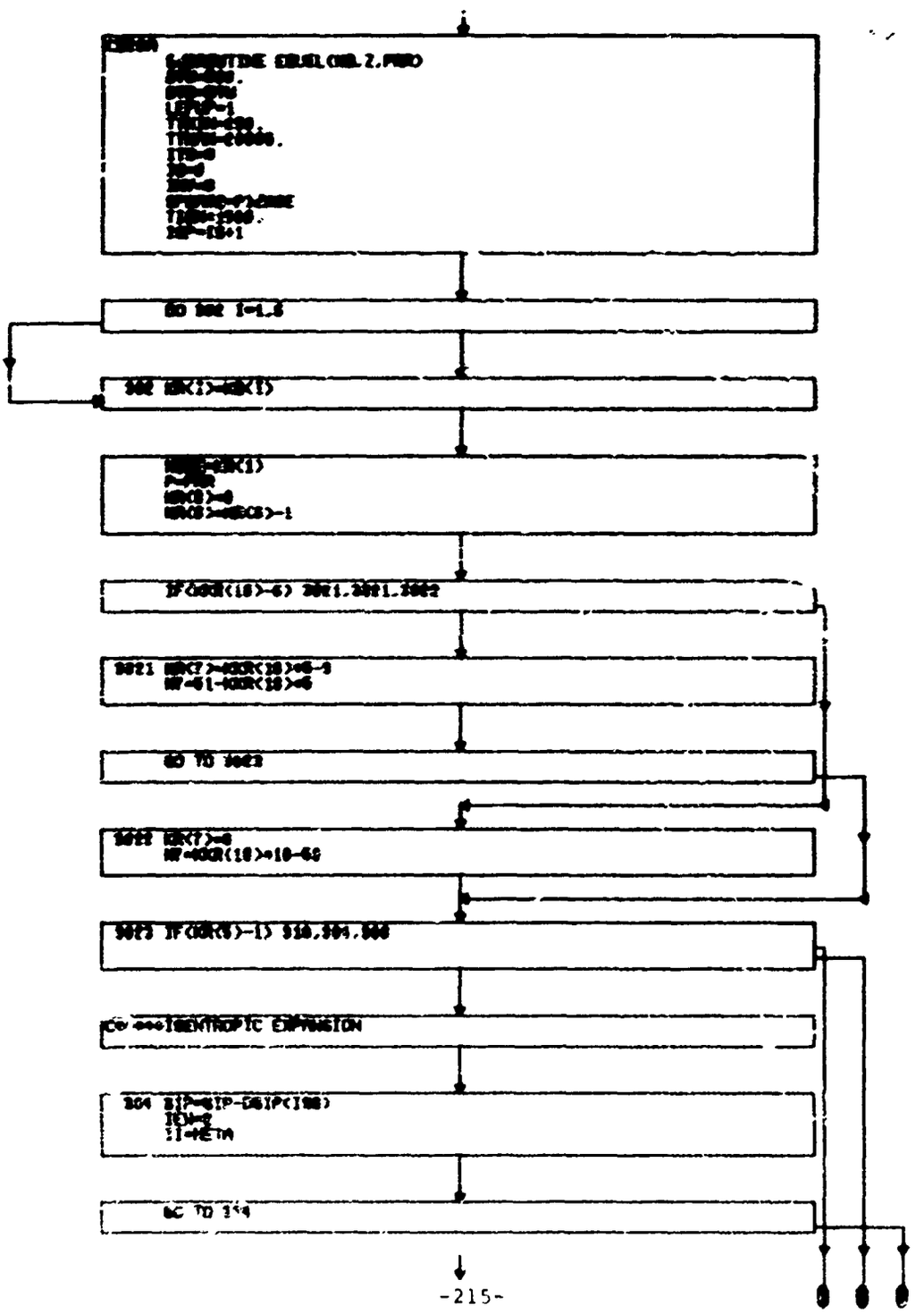
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000359          1932 CALL PROPS                                                  B20A 270
000360               WM=AA/P
000361               GAM=1,-ALF
000362               GAM=1,/(1,+BETH-1,9869/AA*GAM/CSP*GAM*P)
000363               GMR(II)=GAM
000364               IF(KR(5))195,195,194                                        B20A 271
000365           195 IF(KR(7))  11,11,194                                        B20A 272
000366           194 WRITE (KOUT,4) CPF,CSP,ALF,BETH,GAM
000367               ITS=-1                                                      B20A 276
000368          C*****OUTPUT PACKAGE                                             B20A 277
000369            19 WM=AA/P                                                    B20A 278
000370          1902 WRITE(KOUT,  2)T,P,WM                                      B20A 279
000371               WRITE(KOUT,1901)W                                          B20A 280
000372          1901 FORMAT(5X40HRELATIVE MASSES OF COMPONENTS 1,2 AND 3  3E12,5) B20A 281
000373               SHIP=HIP                                                   B20A 282
000374               SSIP=SIP                                                   B20A 283
000375               HIP=0,                                                     B20A 284
000376               SIP=0,                                                     B20A 285
000377               DO 20 J=1,N                                                B20A 286
000378               HIP=HIP+H(J)*SIGN(VN(J),WTM(J))
000379            20 SIP=SIP+ VN(J)*(SR(J)-1,9869*Y(J))                         B20A 288
000380               N=N+KR(8)
000381               HIP=(HIP+VN(MELT)*FLIQ*HMELT)/AA                           B20A 289
000382               SIP=(SIP+VN(MELT)*FLIQ*SMELT)/AA                           B20A 290
000383               RHR=P/T*WM/1,3146                                          B20A 291
000384               WRITE(KOUT,8) HIP,SIP,RHR                                  B20A 292
000385               IF(FLIQ) 204,205,204                                       B20A 293
000386           204 WRITE(KOUT,10) FLIQ                                        B20A 294
000387           205 IF(ITS) 2051,203,203                                       B20A 295
000388          2051 IF(KR(5)-1) 203,202,201                                    B20A 296
000389           201 HCH=HIP                                                    B20A 297
000390           202 VELSQ=(HCH-HIP)*2,                                         B20A 298
000391               VMACH=SQRT(VELSQ/GAM*WM/(1,9869*T))                        B20A 299
000392               VEL=SQRT(VELSQ*45054,)                                     B20A 300
000393               UE(ISS)=VEL                                                B20A 301
000394               IF (VEL) 2021,2021,2022
000395          2021 AREA=0,
000396               GO TO 2023
000397          2022 AREA=1./(VEL*RHR)
000398          2023 WRITE(KOUT,9) VEL,VMACH,AREA
000399           203 IF(IQQ) 2036,1203,1203
000400          1203 IF(ITS) 2031,2036,2036                                     B20A 305
000401          2031 DO 2033 I=1,N                                              B20A 306
000402          2033 VN(I)=VN(I)/P                                              B20A 307
000403               WRITE(KOUT,2032)(FAMOA(I),FAMOB(I),VN(I),I=1,N) ,          B20A 308
000404               DO 2035 I=1,N                                              B20A 309
000405          2035 VN(I)=VN(I)*P                                              B20A 310
000406               IF(MODE-1) 2034,2037,2034                                  B20A 311
000407          2037 WRITE(KOUT,2038)  FAMOA(JC),FAMOB(JC)                      B20A 312
000408          2038 FORMAT(22H   SURFACE SPECIES IS 2A4)                       B20A 313
000409          2032 FORMAT(/3(5X7HSPECIES3X8HMOLE FR,2X)/(5X2A4,E12,5,3X2A4,E12.5,3X2AB20A 314
000410              14,E12,5))                                                  B20A 315
000411               GO TO 2034                                                 B20A 316
000412          2036 WRITE(KOUT,3) (FAMOA(I),FAMOB(I),VN(I),DY(I),Y(I),VLNK(I),FC(I),EB20A 317
000413              1(I),CP(I),I=1,N)                                           B20A 318
000414          2034 WRITE(KOUT,8)                                              B20A 320
000415               N=N+KR(8)
000416               IF(ITS) 11,1021,1021                                       B20A 321
000417          1021 HIP=SHIP                                                   B20A 322
000418               SIP=SSIP                                                   B20A 323
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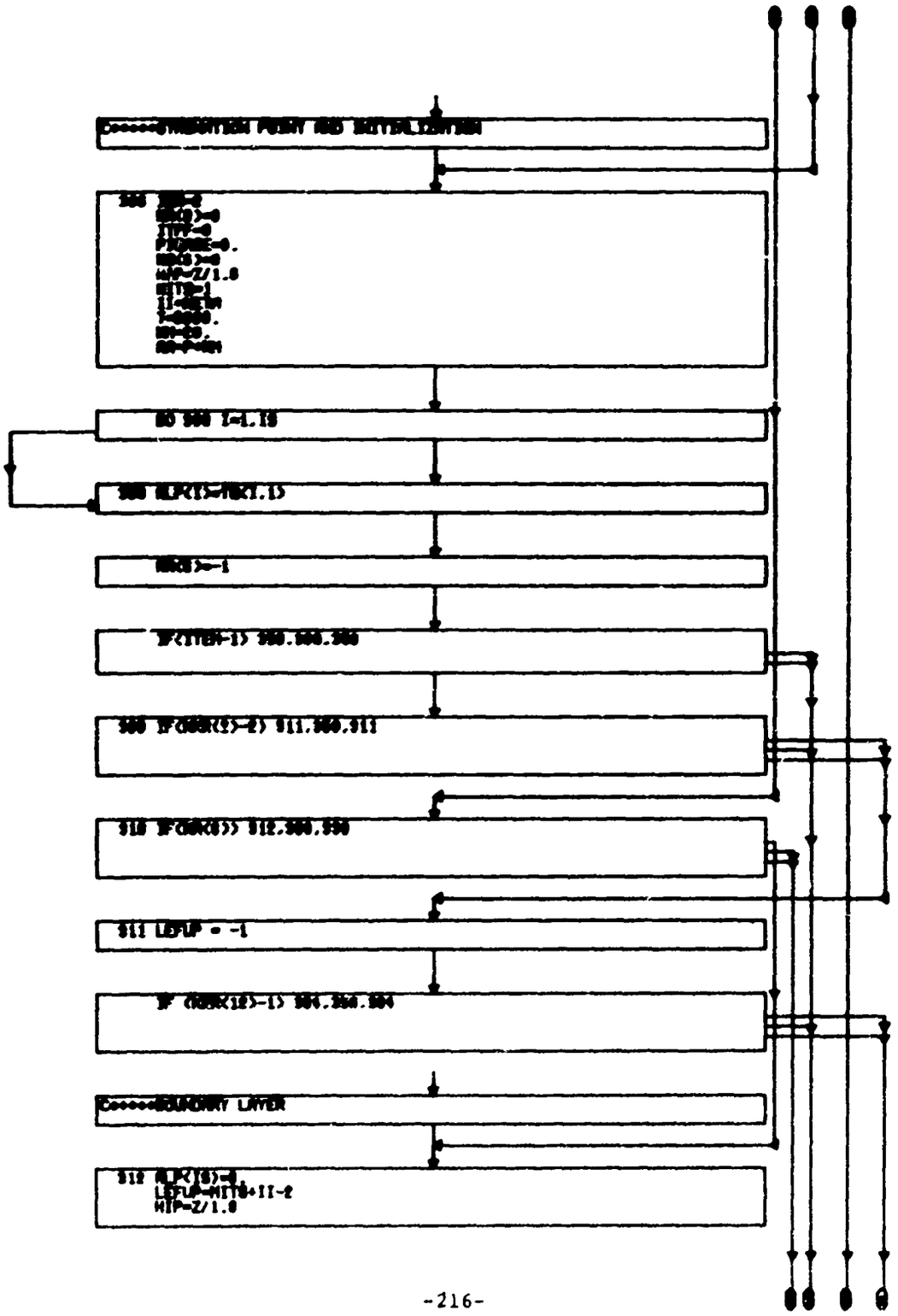
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000419          C*****PRINCIPAL ITERATIVE LOOP                                  B20A 324
000420            21 IF(ITS)  109,110,109                                       B20A 325
000421           109 IF(MODE) 111,111,110                                       B20A 326
000422          1091 ITS=ITS+1
000423           110 CALL THERM                                                 B20A 327
000424           111 MODE=KR(1)                                                 B20A 328
000425               IQQ=0
000426               FLIQ=0.                                                    B20A 329
000427               CALL MATER                                                 B20A 331
000428               B1=B(1)                                                    B20A 332
000429           211 MDE=1                                                      B20A 333
000430               IF(KR(7)-1) 2101,210,2102                                  B20A 334
000431          2102 IQQ=-2                                                     B20A 335
000432               WRITE(KOUT,2100)(I,I-1,IS)
000433           210 WRITE(KOUT,7) ITS,T,AA,EL,ENL,CMF,(F(I),I=1,IS)
000434          2100 FORMAT (50H1ITS TEMP   PRES*MWT  EQUIL ER  MASBAL ER  SCALE  7(I3,
000435             17H MASBAL)/90X3(I3,7H MASBAL))
000436          2101 IF(ITS) 2103,221,221                                       B20A 337
000437          2103 IF(MODE-1) 170,2104,170                                    B20A 338
000438          2104 TWALG=T                                                    B20A 339
000439               GO TO 170                                                  B20A 340
000440           221 ITS=ITS+1                                                  B20A 341
000441               IF(ITS-50) 2219,2219,222
000442          2219 IF(ITS-N7) 22,2222,2222
000443           222 IF(KKR(18)) 2226,2226,2225
000444          2225 WRITE(KOUT,2000)
000445          2000 FORMAT (///2X,90H*****FOLLOWING OUTPUT NON-CONVERGENT*************B20A 344
000446             1-/70H  ISS,ITEM,II,MITS,ITS,IQQ,KR(6),HIP,SIP,TT(II)/ALP(I)/LEP(I)
000447             2/FR(I,II))
000448               WRITE(KOUT,3017)ISS,ITEM,II,MITS,ITS,IQ,KR(6),HIP,SIP,TT(II)
000449               WRITE(KOUT,3018) ALP
000450               WRITE(KOUT,3019) LEP
000451               WRITE(KOUT,3018) (FR(I,II),I=1,N)
000452          3017 FORMAT(7I5,2X1P3E12.5)
000453          3018 FORMAT(2X1P10E11.4)
000454          3019 FORMAT(2710I5)
000455               IQQ=-2                                                     B20A 350
000456               KR(7)=1                                                    B20A 352
000457          2226 ITS=-1
000458               NCV=NCV+1                                                  B20A 353
000459               NON=NCV
000460               IF(NCV-20) 170,170,2220                                    B20A 354
000461          2220 MITS=100
000462               GO TO 170
000463          2222 KR(7)=3
000464               IQQ=-2
000465               GO TO 22
000466            22 ISPQ=IN+IL+1                                               B20A 356
000467               ICT=10
000468               DUM1=0.
000469               DO 2205 I=1,ISPQ                                           B20A 357
000470          2205 BS(I)=B(I)                                                 B20A 358
000471               GO TO 2208                                                 B20A 359
000472          2207 DO 2206 I=IL,ISPQ                                          B20A 360
000473          2206 B(I)=BS(I)                                                 B20A 361
000474          2208 DO 2204 I=1,ISPQ                                           B20A 362
000475               DO 2200 J=1,ISPQ                                           B20A 363
000476          2200 APE(I,J)=A(I,J)                                            B20A 364
000477               IF(I-2) 2204,2204,2201                                     B20A 365
000478          2201 IF(IFC(I-2)-1) 2204,2204,2202                              B20A 366
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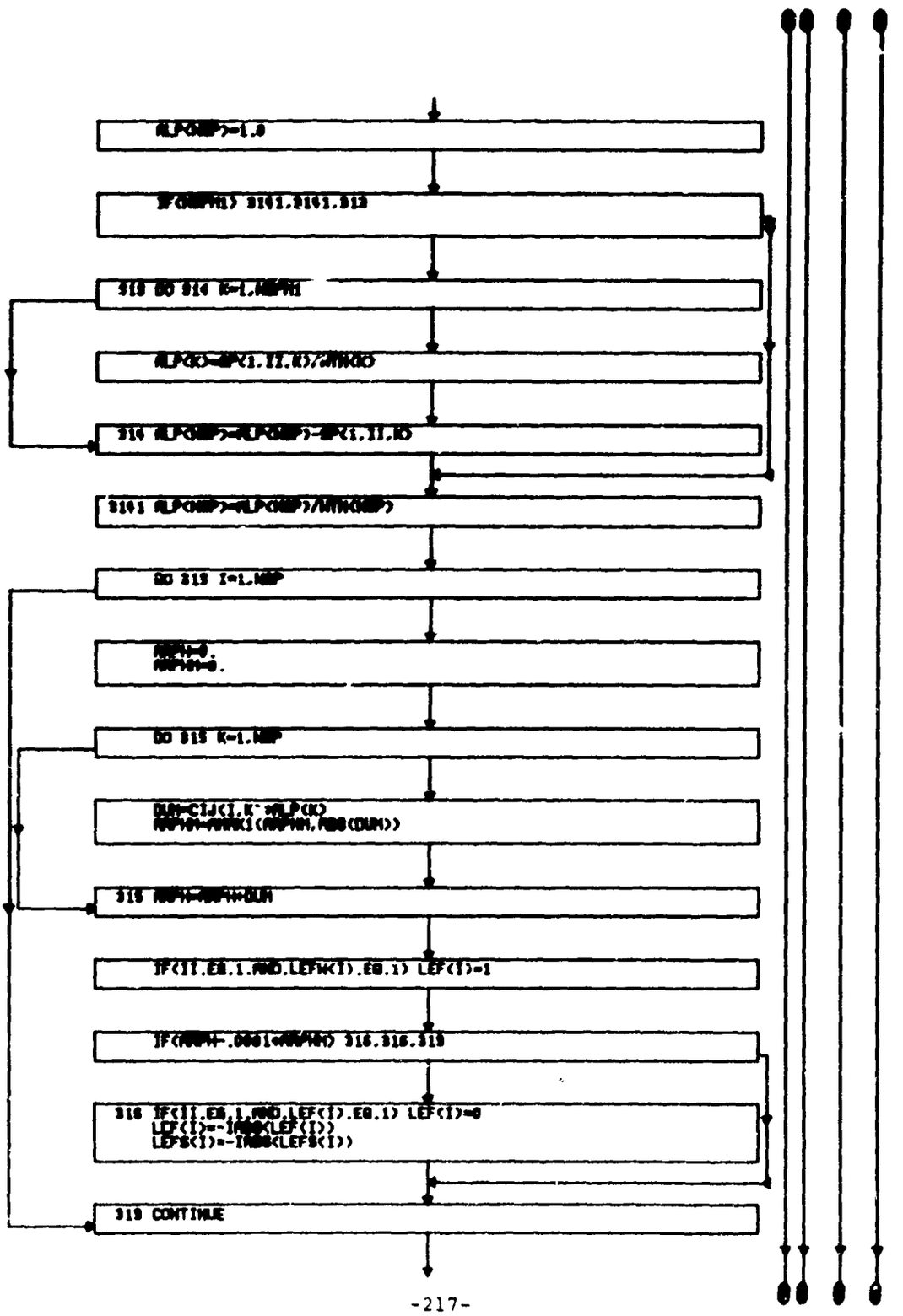
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000479          2202 B(I)=0.                                                    B20A 367
000480               DO 2203 J=1,ISPO                                           B20A 368
000481               APE(J,I)=0.
000482          2203 APE(I,J)=0.                                                B20A 369
000483               APE(I,I)=1.0                                               B20A 370
000484          2204 CONTINUE                                                   B20A 371
000485               IG=IQQ
000486               CALL RERAY(IN,APE(IL,IL),0,B(IL),1.0,IG,16)                B20A 373
000487               ICT=ICT-1
000488               IF(ICT-IQQ) 222,2209,2210
000489          2209 IQQ=-2
000490          2210 IF(IG) 2212,2221,2221
000491          2212 IF(INV) 2216,2213,222
000492          2213 IF(KR(6)) 2227,2230,2230
000493          2230 LAMD=1
000494               DO 2229 K=1,IS
000495               J=IR(K)
000496               IF(IFC(J).GT.1) GO TO 2229
000497               DO 2228 J=1,N
000498               IF(VN(J).GT.1.E-30 .AND. MOD(LAMI(J)/LAMD,2).NE.0) GO TO 2229
000499          2228 CONTINUE
000500               LEF(K)=-IABS(LEF(K))
000501               LEFW(K)=-IABS(LEFW(K))
000502               INV=-1
000503               ITS=1
000504               GO TO 393
000505          2229 LAMD=LAMD+LAMD
000506          2227 INV=-1
000507               PIN=P+1.E-5
000508               DO 2215 I=1,N
000509               IF(IFC(I)) 2215,2214,2215
000510          2214 VN(I)=VN(I)+PIN
000511               Y(I)=ALOG(VN(I))
000512          2215 CONTINUE
000513               GO TO 111
000514          2216 IF(KR(6)) 2217,222,222
000515          2217 ITS=999
000516               GO TO 111
000517          C*****IF TRYING TO PUSH THROUGH TMIN OR TMAX -- REINVERT AND DT TO ZERO B20A 374
000518           2221 IF(T-TMIN) 2223,227,220
000519           2223 T=TMIN
000520               GO TO 1091
000521            227 IF (X(1)) 228,220,220
000522            220 IF (T-TMAX) 223,229,2224
000523           2224 T=TMAX
000524               GO TO 1091
000525            229 IF(X(1)) 223,223,228                                      B20A 378
000526          C*****IF NEW CONDENSED HAS NEG CORRECTION, DELETE AFTER REINVERT B20A 379
000527            223 IF(IER) 226,212,226                                       B20A 380
000528            226 IF(X(IER)+1.E-4) 225,212,212                              B20A 381
000529            225 DO 2252 I=1,ISPO
000530               A(IER,I)=0.
000531           2252 A(I,IER)=0.
000532               BS(IER)=-1.E-8
000533               A(IER,IER)=1.0
000534               GO TO 2207                                                 B20A 384
000535          C*****IF S.E. ERROR AND CORRECTION ON T OF CONFLICTING SIGN,REINVERT B20A 385
000536            212 IF(MODE-1) 224,213,224                                    B20A 386
000537            213 IF(X(1)*81+.00001) 228,218,218
000538          C*****ON S.E. IF DELTA LN T .GT. .9 REINVERT NO DT IF EL AND ENL ARE SMAB20A 388
```

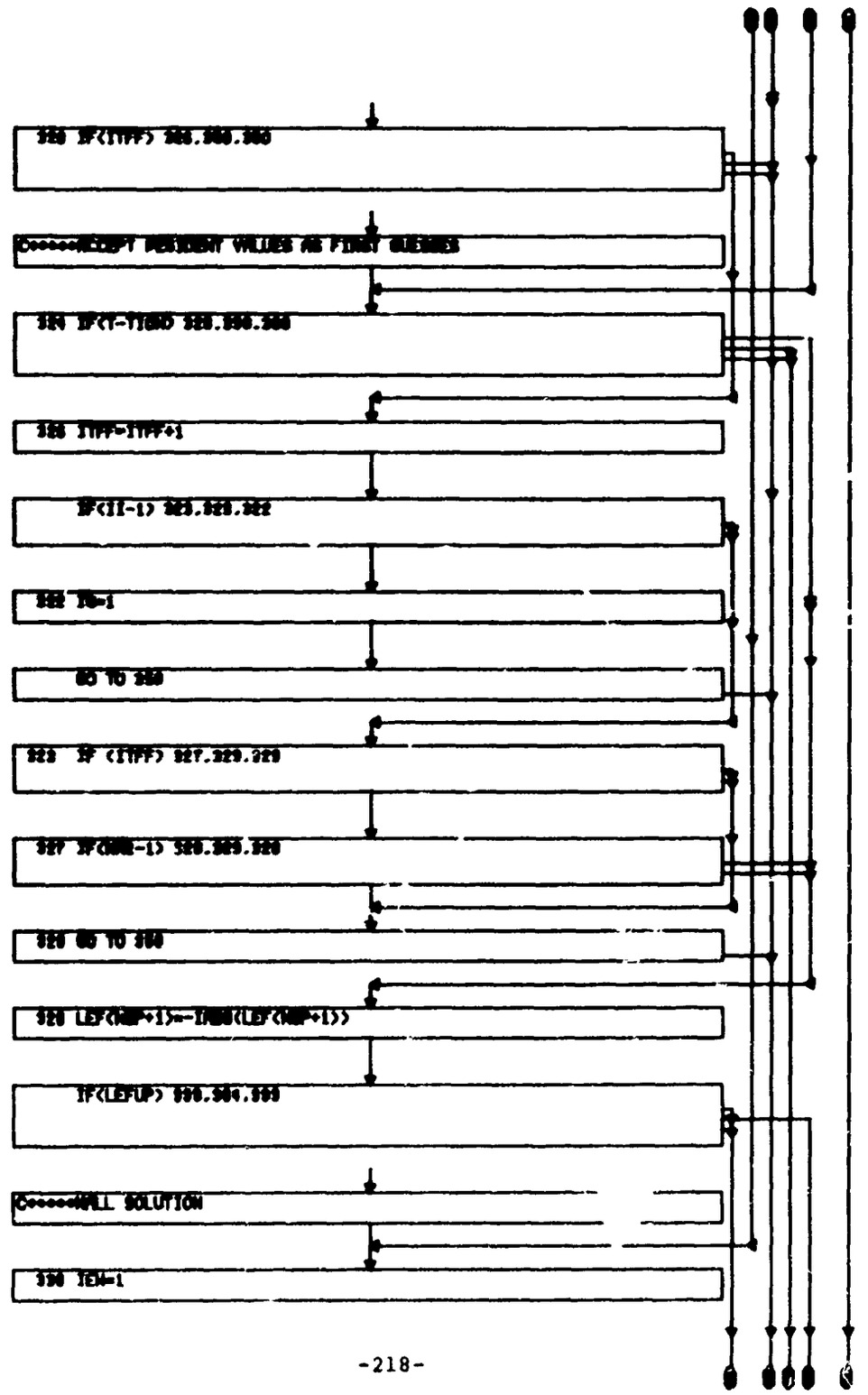
```
000539          218 IF(ABS(X(1))-0.9)224,224,228
000540        C     IF CONVERGED EXCEPT FOR T ON W OR S OPTIONS -- NON CONVERGENT    B20A 393
000541          228 IF(MODE-1) 2281,214,2280                                       B20A 394
000542         2280 IF(EL+100.*ENL-1.E-4) 222,222,2281                             B20A 395
000543        C     ON S.E. OPTION RESULTIN IN CONFLICTING ERROR/CORRECTION OR T PUSH B20A 396
000544        C     IF OTHER BALANCES RELATIVELY GOOD, SET T TO TMIN/TMAX AS PER ERRORB20A 397
000545        C     AND GO TO THERM (IF T ALREADY THERE - NONCONVERSE) ELSE DT TO ZERB20A 398
000546          214 IF(ABS(B1)-100.*(EL+ENL)) 2281,219,215                         B20A 399
000547          215 TTMIN=TT(1)/1.8-900.
000548              TTMAX=TTMIN+1000.
000549              IF(B1) 216,216,217
000550          216 IF(T-TMIN) 170,170,2161                                        B20A 401
000551         2161 T=AMAX1(T-DTD,TMIN)
000552              TTMAX=T
000553              DTU=DTD/2.
000554              GO TO 1091
000555          217 IF(T-TMAX) 2171,170,170
000556         2171 T=AMIN1(TMAX,T+DTU)
000557              TTMIN=T
000558              DTD=DTU/2.
000559              GO TO 1091
000560         2281 X(1)=0.                                                        B20A 407
000561              MODE=0                                                         B20A 408
000562              IN=IN+1                                                        B20A 411
000563              IL=2                                                           B20A 412
000564              GO TO 2207                                                     B20A 413
000565          224 IF(X(2)+1.0)2240,2249,2249
000566         2240 BS(2)=0.
000567              A(2,2)=1.E25
000568              GO TO 2207
000569         2249 CALL CRECT(MODE)
000570              TMIN=TTMIN
000571              TMAX=TTMAX
000572              IF(KR(7)-1) 21,21,19                                           B20A 415
000573           11 PLEASE=SWEARE
000574              RETURN
000575              END                                                            B20A 417
```

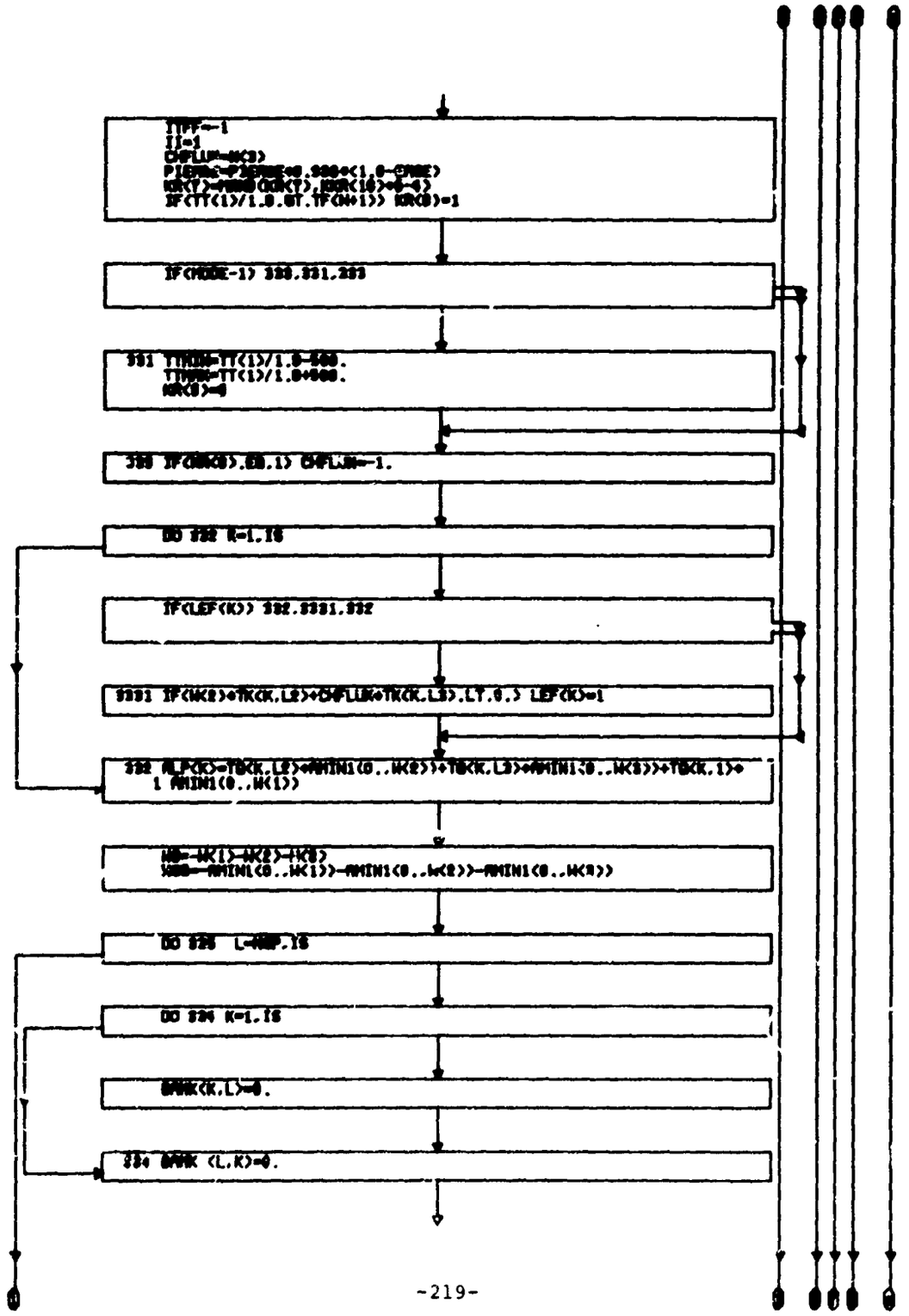
c. Flow Chart

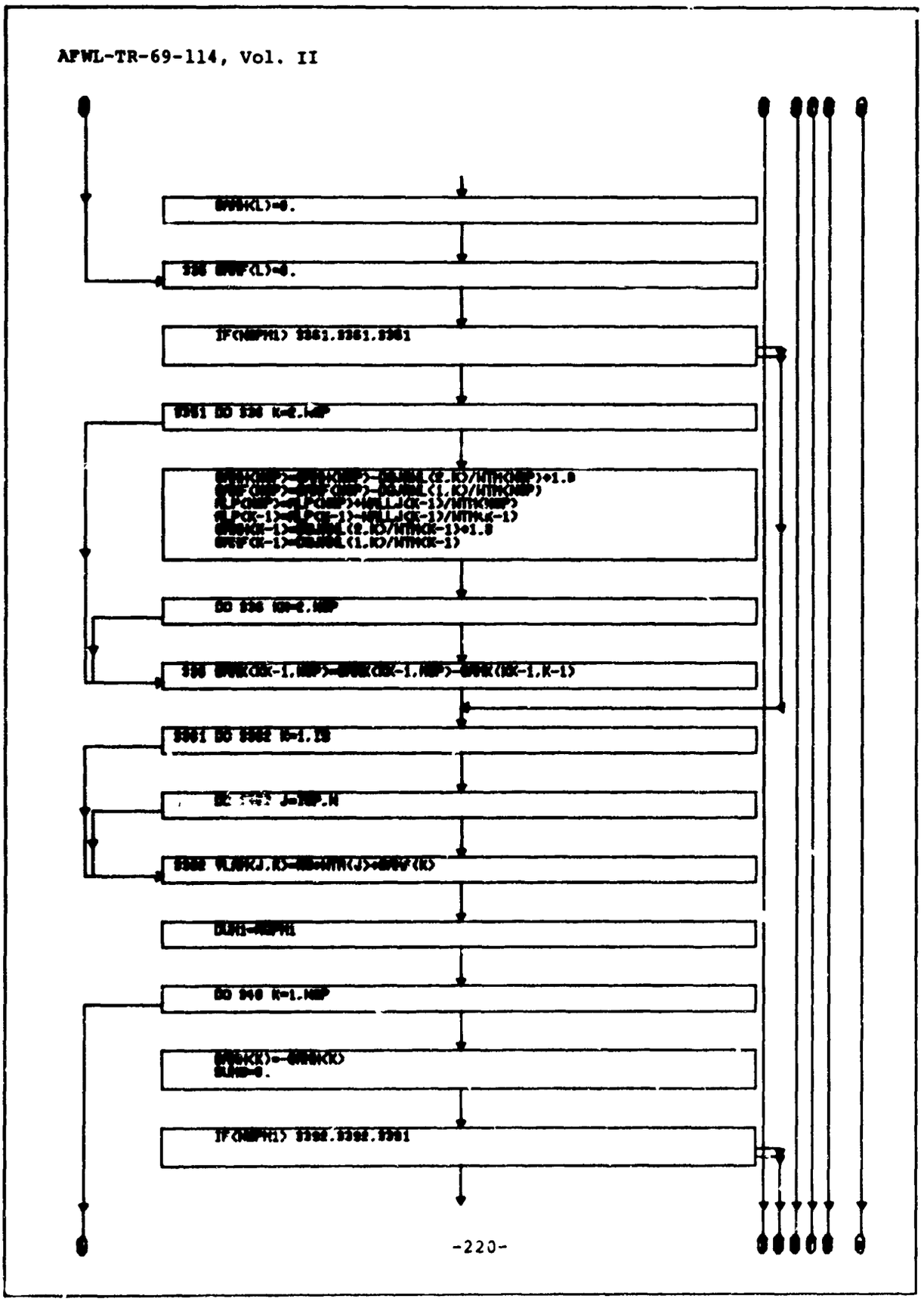


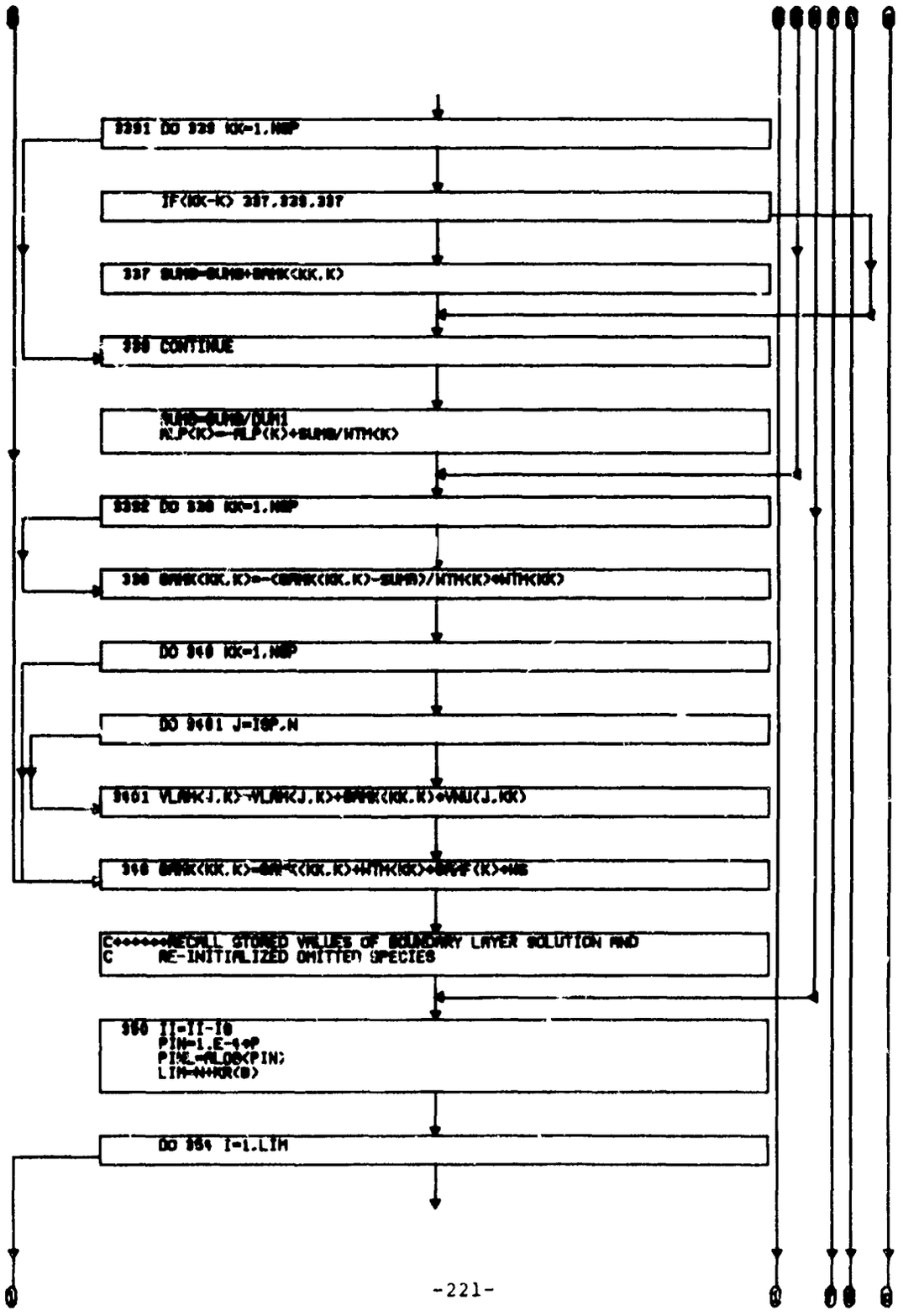


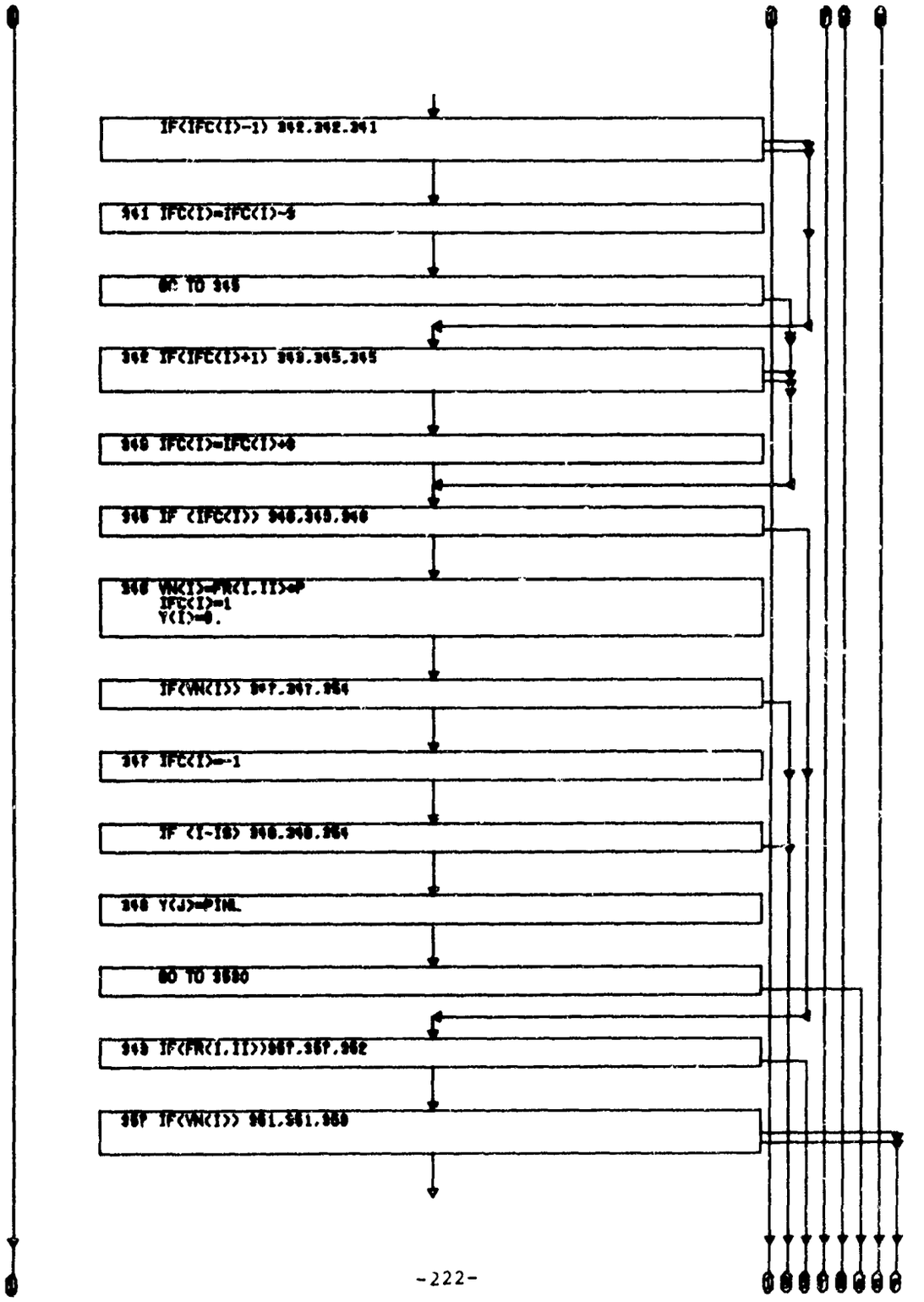

318 DO 316 K=1,NBPHI
316 CONTINUE
DO 315 I=1,NBP
DO 315 K=1,NBP
IF(II.EQ.1.AND.LEFW(I).EQ.1) LEF(I)=1
315 CONTINUE

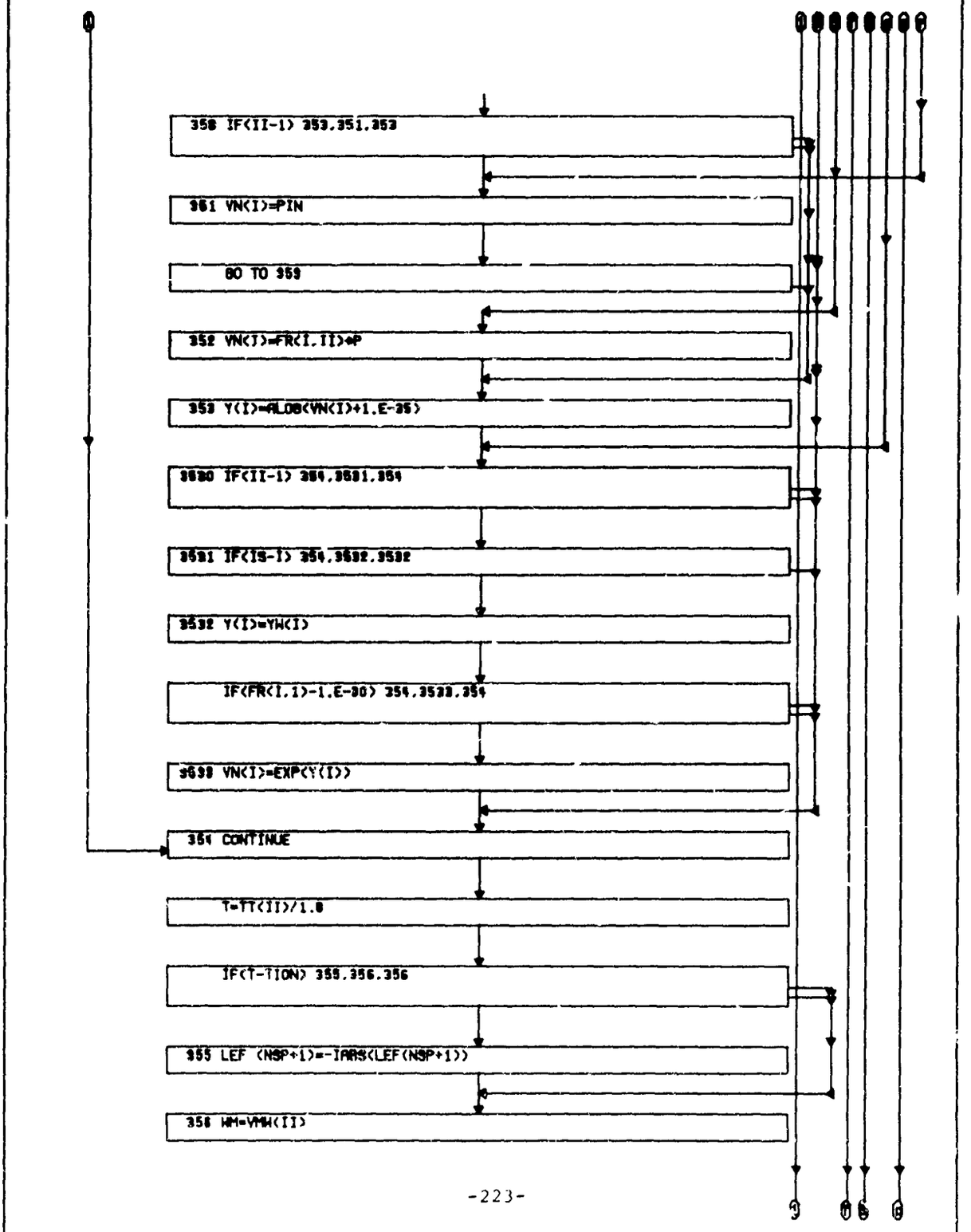


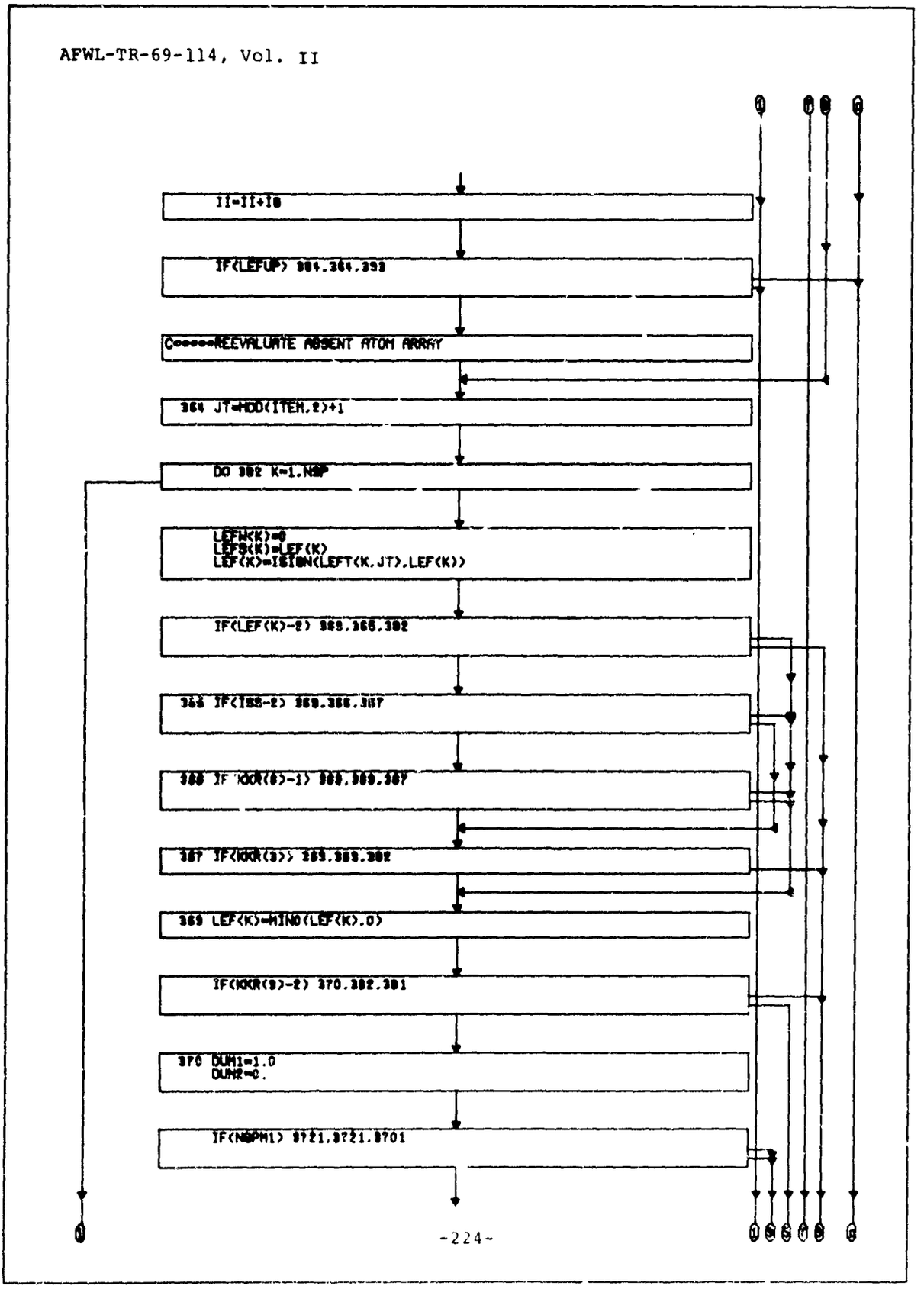

IFF=-1
II=1
IF(MODE-1) 333,331,333
331 CONTINUE
DO 332 K=1,15
IF(LEF(K)) 332,3331,332
3331 IF(WK2)+TK(K,L2)+CHFLIM+TK(K,L3).LT.0.) LEF(K)=1
332 CONTINUE
DO 334 K=1,15
334 CONTINUE

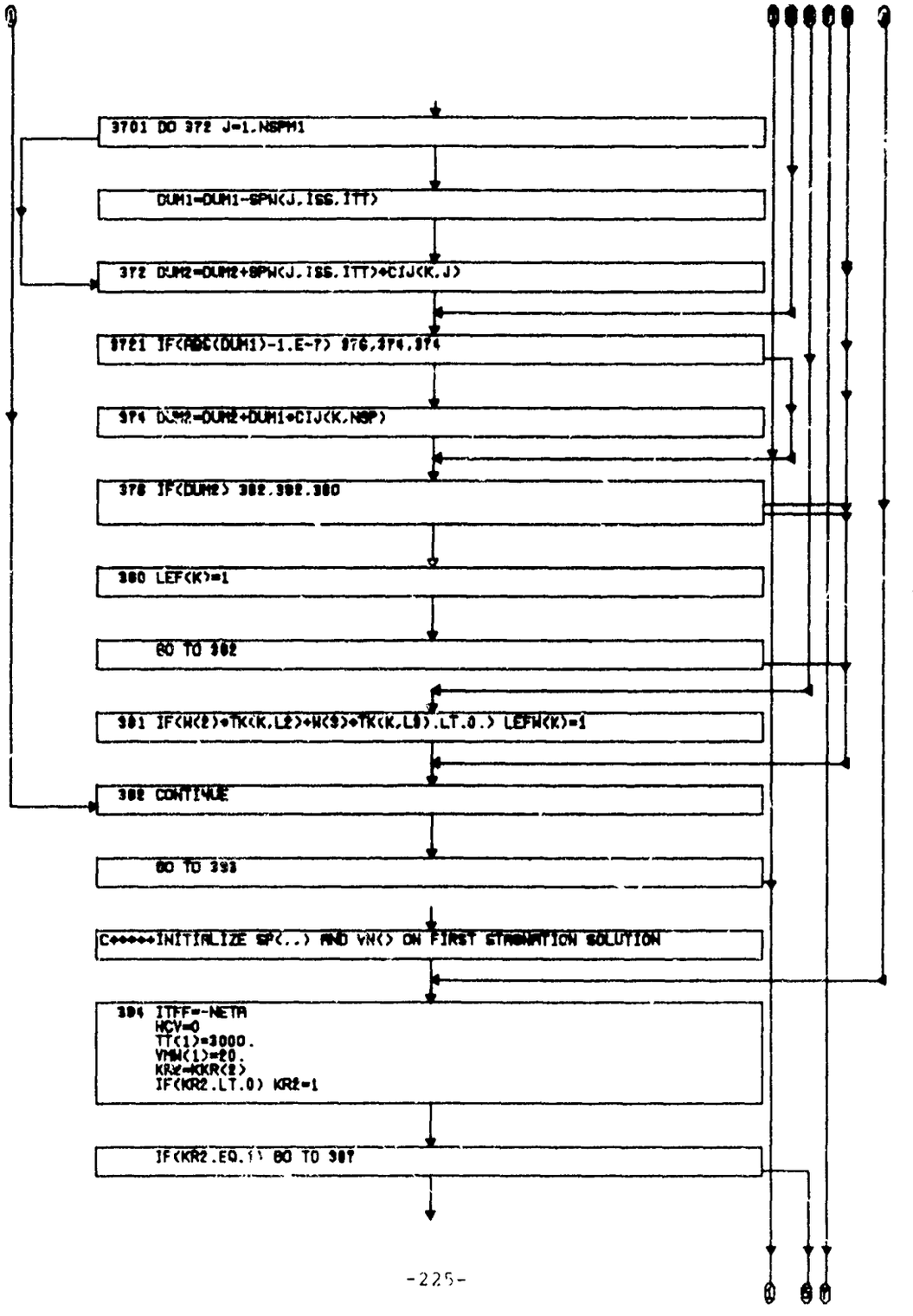


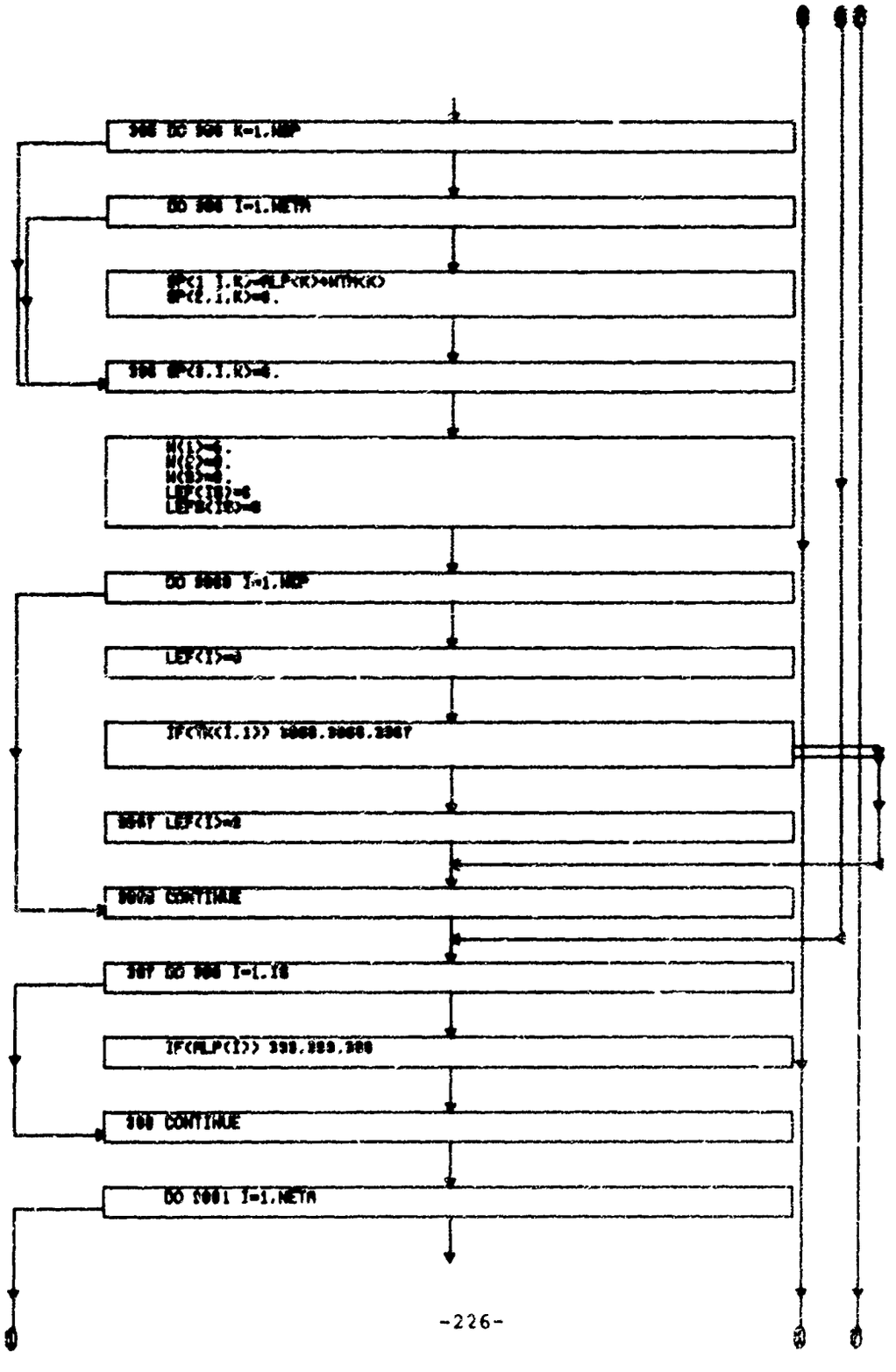

DO 330 KK=1,NBP
IF(KK-K) 337,338,337
SUMB=SUMB+BRNK(KK,K)
CONTINUE
SUMB=SUMB/DUM1
WLP(K)=WLP(K)+SUMB/WTM(K)
DO 330 KK=1,NBP
BRNK(KK,K)=(BRNK(KK,K)-SUMB)/WTM(K)*WTM(KK)
DO 340 KK=1,NBP
DO 9401 J=ISP,N
9401 VLAM(J,K)=VLAM(J,K)+BRNK(KK,K)*VNU(J,KK)
340 BRNK(KK,K)=BRN*(KK,K)*WTM(KK)*BRGF(K)*WB
C*****RECALL STORED VALUES OF BOUNDARY LAYER SOLUTION AND
C RE-INITIALIZED OMITTED SPECIES
350 II=II-IB
PIN=1.E-4*P
PIN=ALOG(PIN)
LIM=N+NOR(B)
DO 354 I=1,LIM

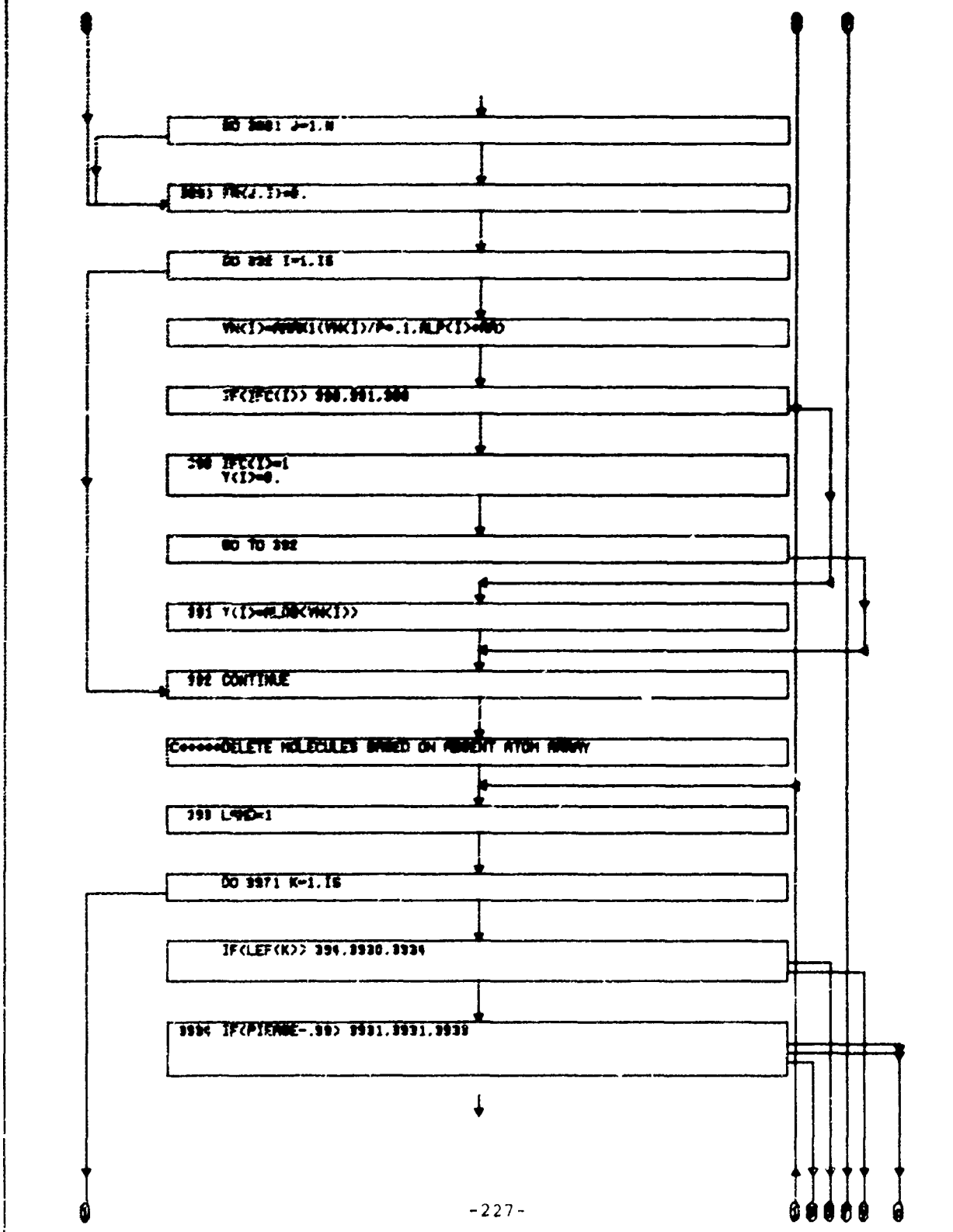

IF(IFC(I)-1) 942,942,941
941 IFC(I)=IFC(I)-5
GO TO 945
942 IF(IFC(I)+1) 943,945,945
943 IFC(I)=IFC(I)+6
945 IF (IFC(I)) 946,949,946
946 VN(I)=PR(I,II)*P
IFC(I)=1
V(I)=0.
IF(VN(I)) 947,947,954
947 IFC(I)=-1
IF (I-IS) 948,948,954
948 V(J)=PINL
GO TO 9550
949 IF(PR(I,II))950,950,952
950 IF(VN(I)) 951,951,959

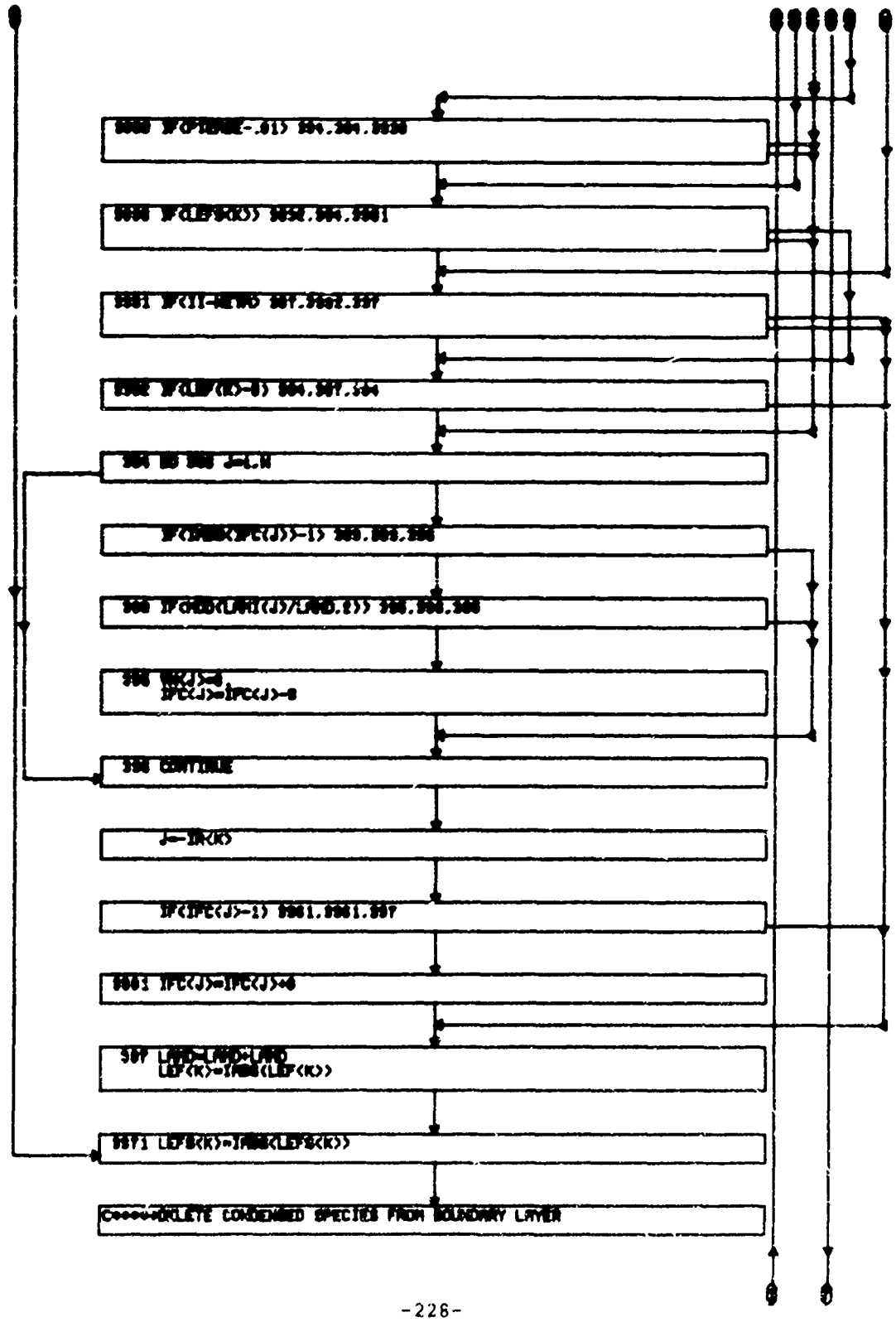

350 IF(II-1) 353,351,353
351 VN(I)=PIN
GO TO 359
352 VN(I)=FR(I,II)*P
353 Y(I)=ALOG(VN(I)+1.E-35)
3530 IF(II-1) 354,3531,354
3531 IF(IS-1) 354,3532,3532
3532 Y(I)=YW(I)
IF(FR(I,1)-1.E-30) 354,3533,354
3533 VN(I)=EXP(Y(I))
354 CONTINUE
T=TT(II)/1.0
IF(T-TION) 355,356,356
355 LEF (NSP+1)=-IABS(LEF(NSP+1))
356 WM=VMW(II)

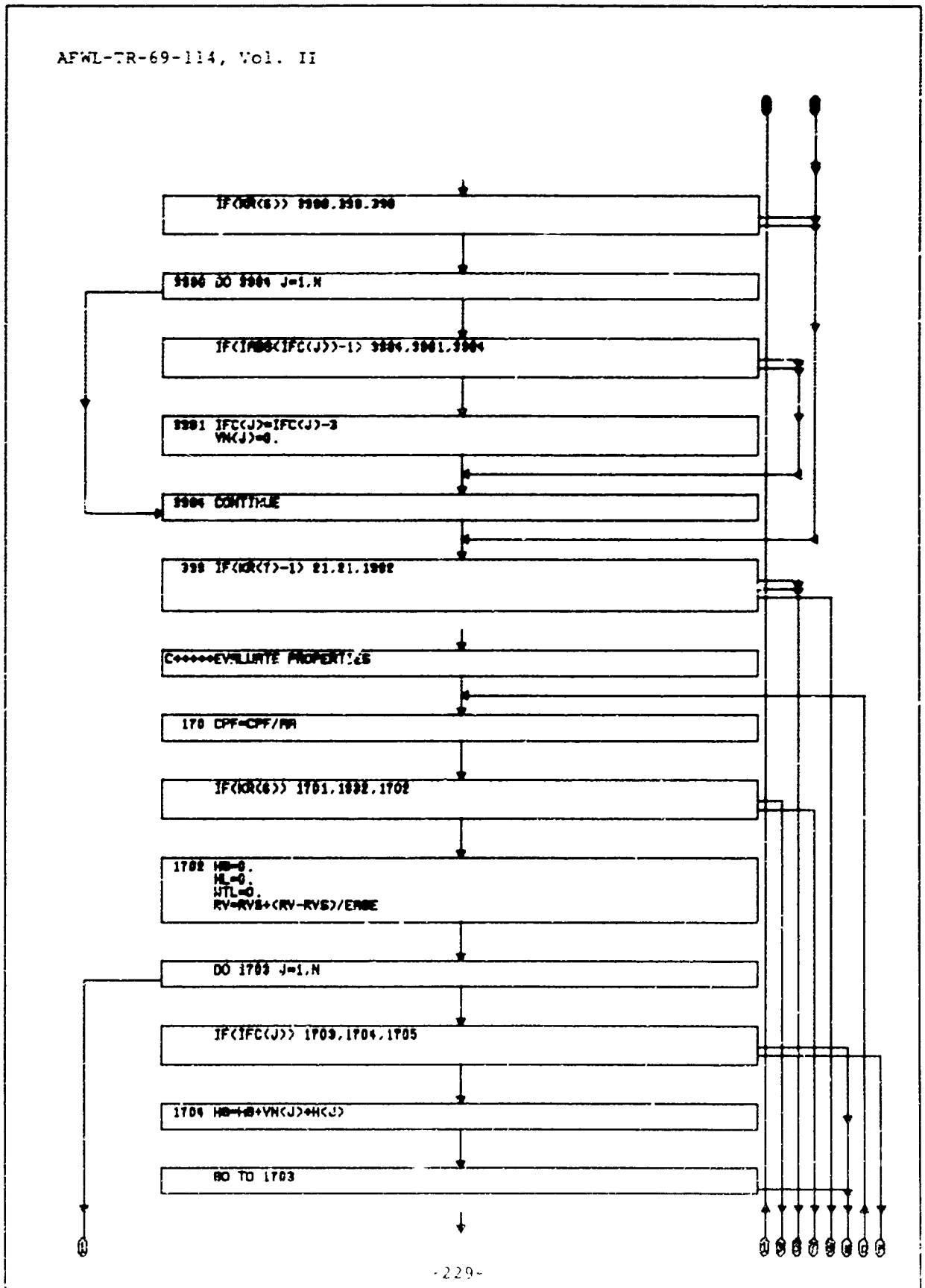

II=II+IB
IF(LEFUP) 384,364,393
C*****REEVALUATE ABSENT ATOM ARRAY
364 JT=HOD(ITEM,2)+1
DO 382 K=1,NBP
LEFN(K)=0
LEFS(K)=LEF(K)
LEF(K)=ISIGN(LEFT(K,JT),LEF(K))
IF(LEF(K)-2) 368,365,382
365 IF(ISS-2) 369,366,367
366 IF(KKR(8)-1) 368,369,367
367 IF(KKR(8)) 365,369,382
369 LEF(K)=MIN0(LEF(K),0)
IF(KKR(9)-2) 370,382,381
370 DUM1=1.0
DUM2=0.
IF(NBPM1) 8721,8721,8701

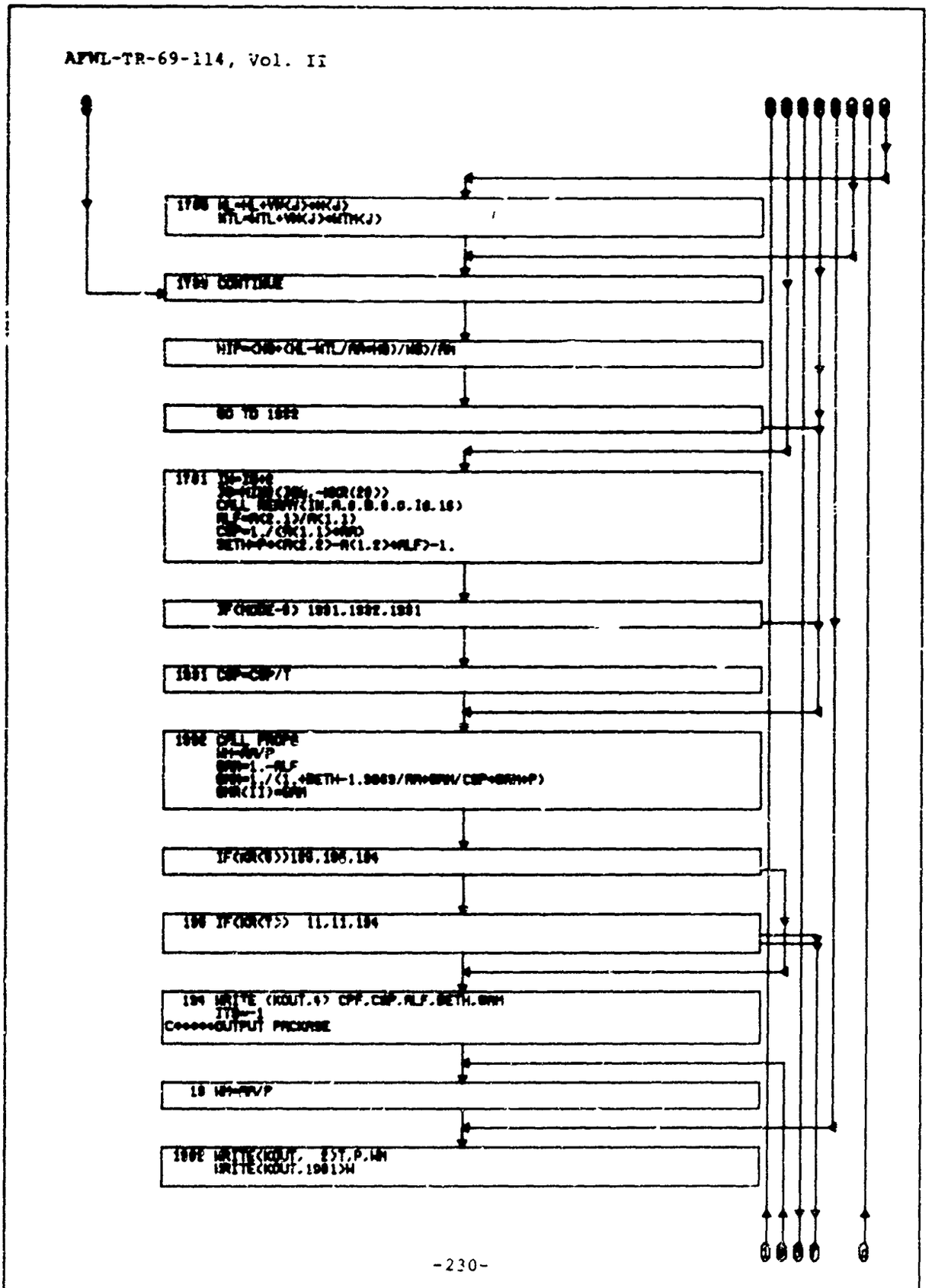

3701 DO 372 J=1,NSPM1
DUM1=DUM1-SPW(J,ISS,ITT)
372 DUM2=DUM2+SPW(J,ISS,ITT)*CIJ(K,J)
3721 IF(ABS(DUM1)-1.E-7) 376,374,374
374 DUM2=DUM2+DUM1*CIJ(K,NSP)
376 IF(DUM2) 382,382,380
380 LEF(K)=1
GO TO 382
381 IF(W(2)*TK(K,L2)+W(3)*TK(K,L3).LT.0.) LEFW(K)=1
382 CONTINUE
GO TO 383
C*****INITIALIZE SP(..) AND VN() ON FIRST STAGNATION SOLUTION
384 ITFF=-NETA
NCV=0
TT(1)=3000.
VMW(1)=20.
KR2=KKR(2)
IF(KR2.LT.0) KR2=1
IF(KR2.EQ.1) GO TO 387

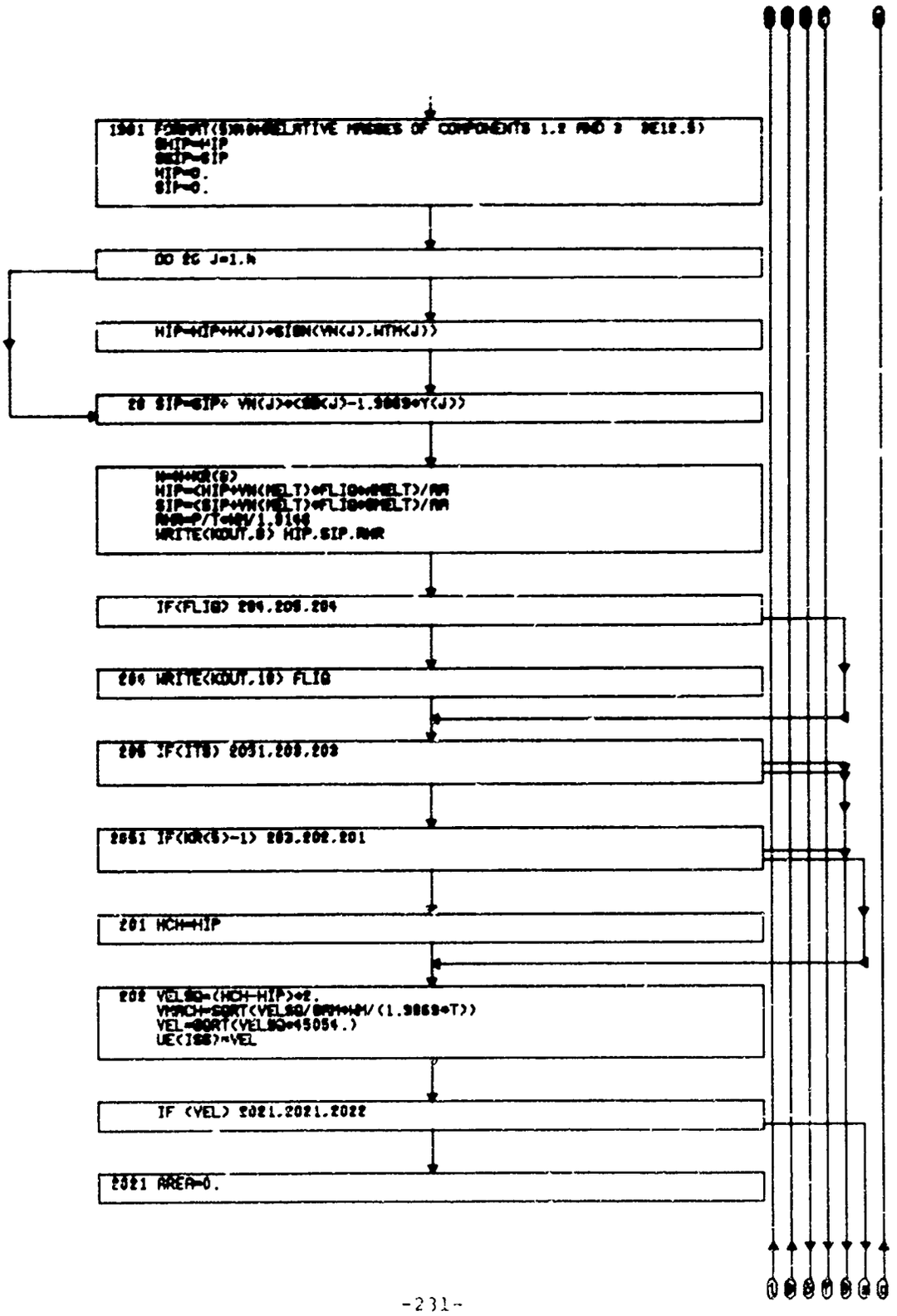


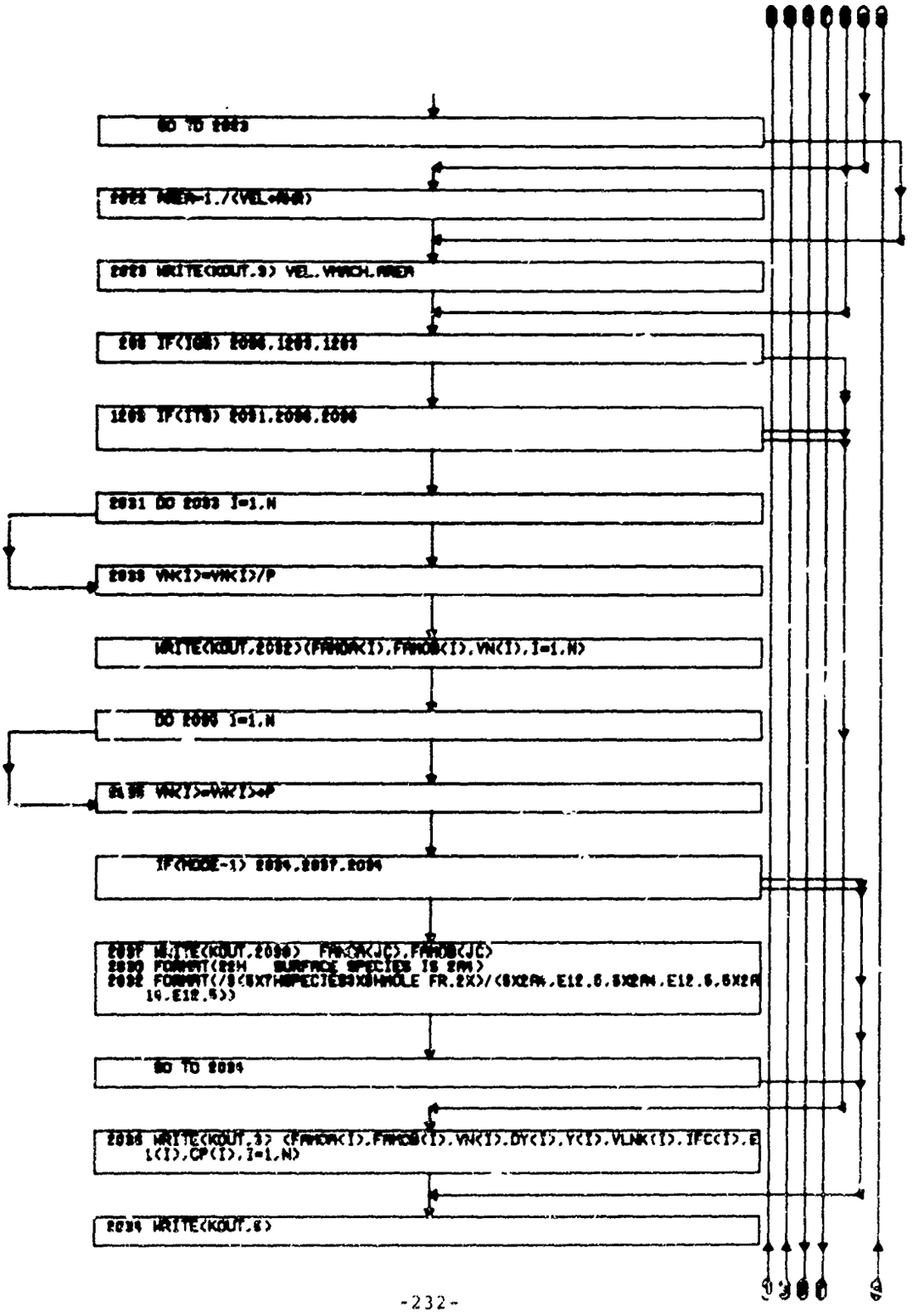

DO 3001 J=1,N
3001 PNK(J,I)=0.
DO 992 I=1,IS
VN(I)=AMAX1(VNK(I)/P=.1,ALP(I)=400)
IF(IPC(I)) 990,991,990
990 IPC(I)=1
V(I)=0.
GO TO 992
991 V(I)=ALOG(VNK(I))
992 CONTINUE
C=====DELETE MOLECULES BASED ON ABSENT ATOM ARRAY
999 L=0=1
DO 9971 K=1,IS
IF(LEF(K)) 994,9930,9934
9994 IF(PIERRE-.99) 9931,9931,9939

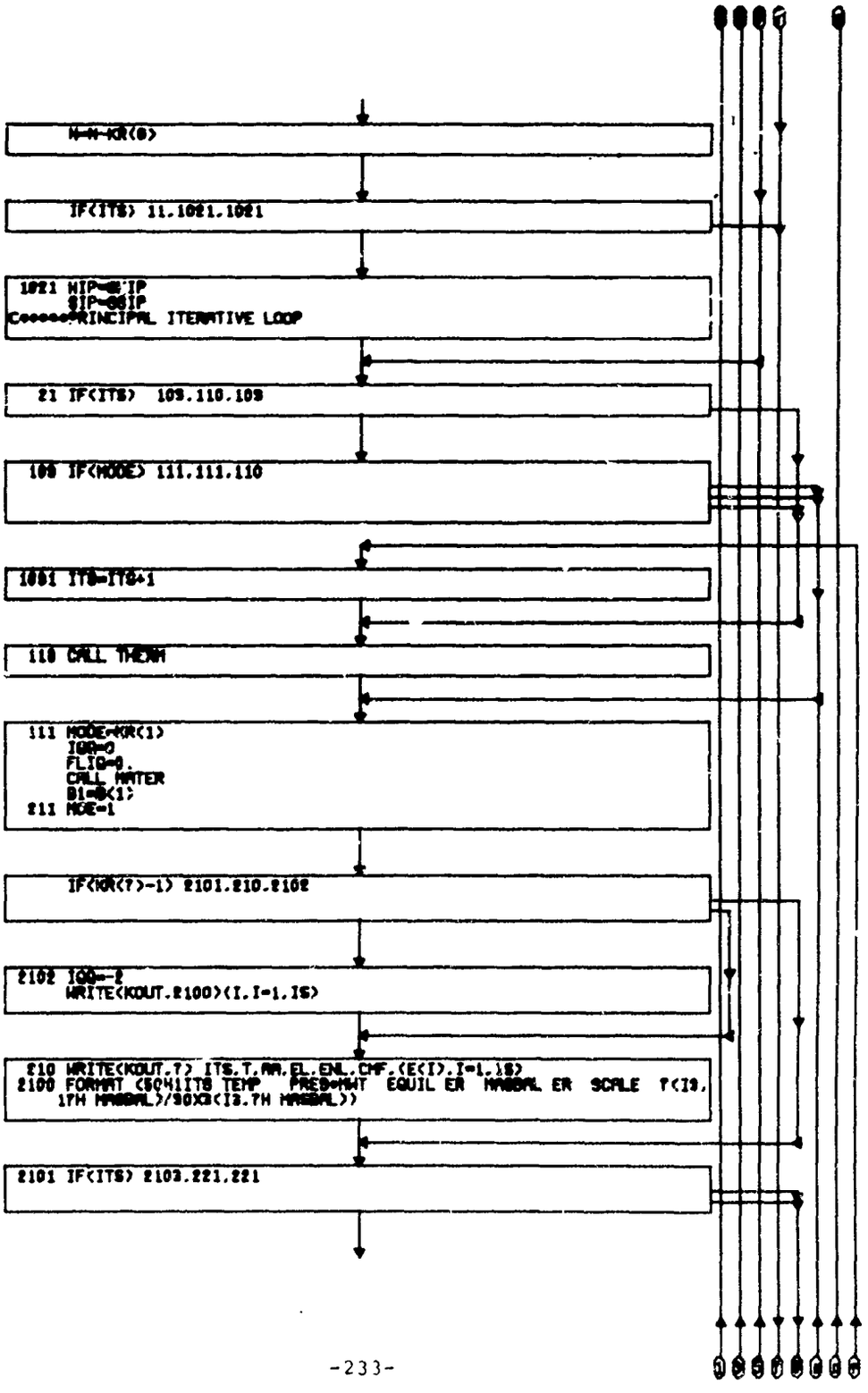

IF(DIFFUSE-.01) 994,994,9930
IF(LEFS(K)) 9952,994,9981
9981 IF(II-NEWS) 997,9982,997
IF(LEF(K)-0) 994,997,994
994 DO 998 J=1,N
IF(IPC(J)-1) 998,998,998
998 IF(ABS(LAM(J)/LAMD.E)) 998,998,998
IPC(J)=IPC(J)-8
998 CONTINUE
J=IR(K)
IF(IPC(J)-1) 9981,9981,997
9981 IPC(J)=IPC(J)+8
997 LAMD=LAMD+LAMD
LEF(K)=IABS(LEF(K))
9971 LEFS(K)=IABS(LEFS(K))
C-----DELETE CONDENSED SPECIES FROM BOUNDARY LAYER

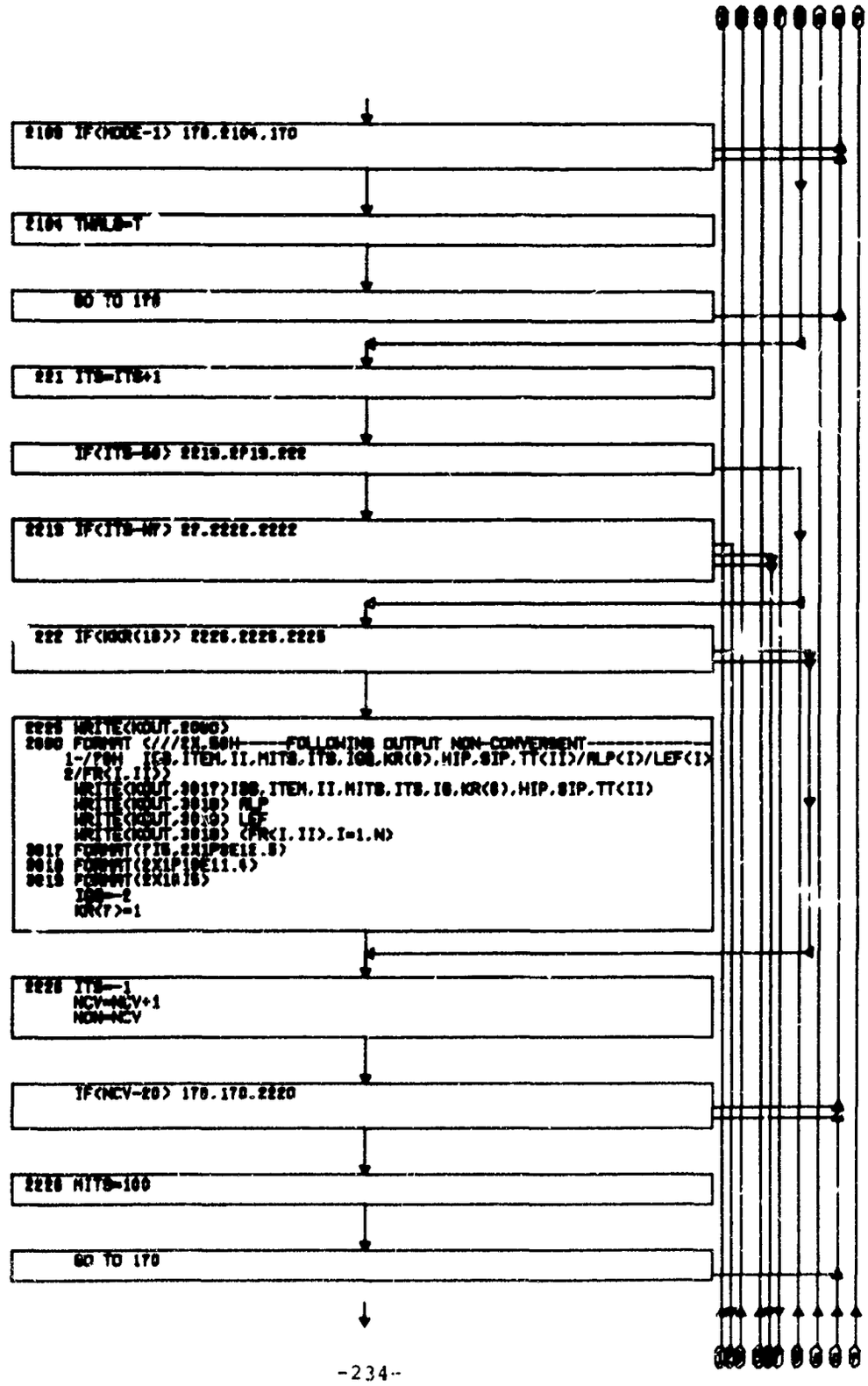

IF(KR(6)) 9900,950,990
9900 DO 9904 J=1,N
IF(IABS(IFC(J))-1) 9904,9901,9904
9901 IFC(J)=IFC(J)-3
VN(J)=0.
9904 CONTINUE
999 IF(KR(7)-1) 21,21,1002
C+++++EVALUATE PROPERTIES
170 CPF=CPF/RR
IF(KR(6)) 1701,1002,1702
1702 HB=0.
HL=0.
HTL=0.
RV=RVS+(RV-RVS)/ERBE
DO 1703 J=1,N
IF(IFC(J)) 1703,1704,1705
1704 HB=HB+VN(J)*H(J)
GO TO 1703

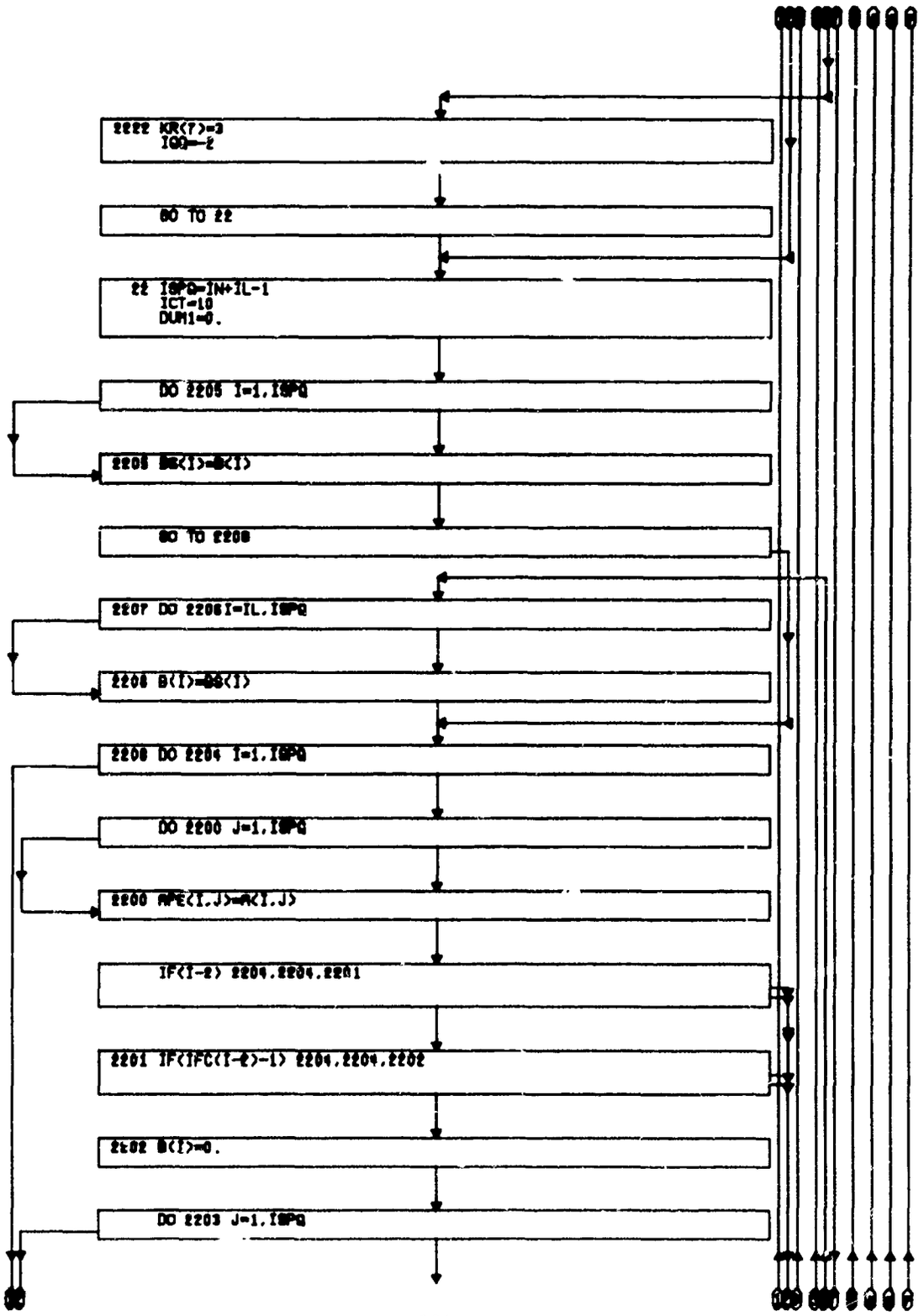


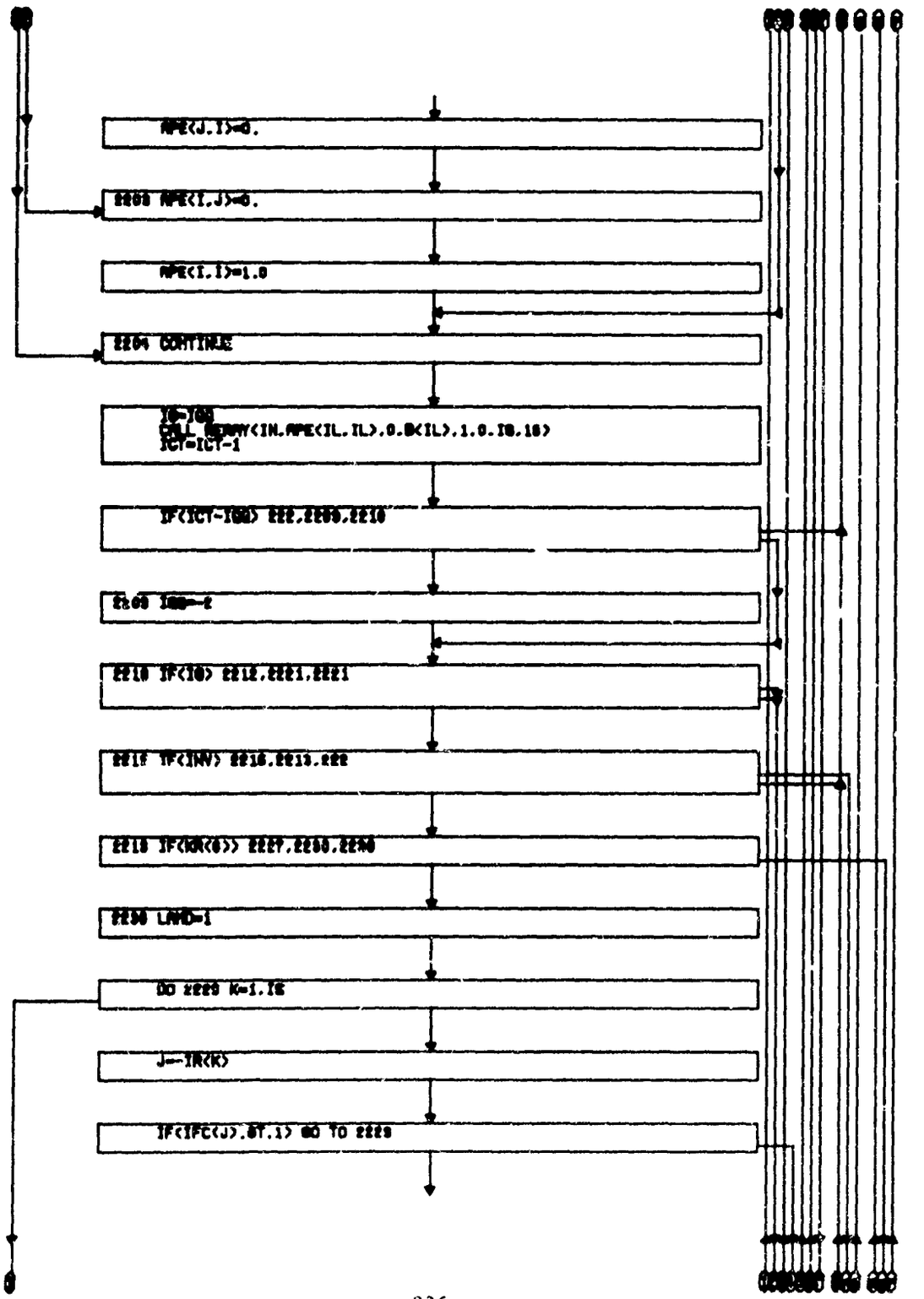

1501 FORMAT(5X,6HRELATIVE MASSES OF COMPONENTS 1,2 AND 3 3E12.5)
SHIP=HIP
SSIP=SIP
HIP=0.
SIP=0.
DO 20 J=1,N
HIP=HIP+HK(J)*SIGN(VN(J),WTHK(J))
20 SIP=SIP+ VN(J)*(SBK(J)-1.5869*Y(J))
N=N+NCR(8)
HIP=(HIP+VN(MELT)*FLIG*WMELT)/RM
SIP=(SIP+VN(MELT)*FLIG*WMELT)/RM
RMR=P/T*ADV/1.8144
WRITE(KOUT,8) HIP,SIP,RMR
IF(FLIG) 204,206,204
204 WRITE(KOUT,16) FLIG
206 IF(ITS) 2051,208,208
2051 IF(NCR(6)-1) 203,202,201
201 HCH=HIP
202 VELSQ=(HCH-HIP)*2.
VMACH=SQRT(VELSQ/GRM*RM/(1.9869*T))
VEL=SQRT(VELSQ+45054.)
UE(ISS)=VEL
IF (VEL) 2021,2021,2022
2021 AREA=0.

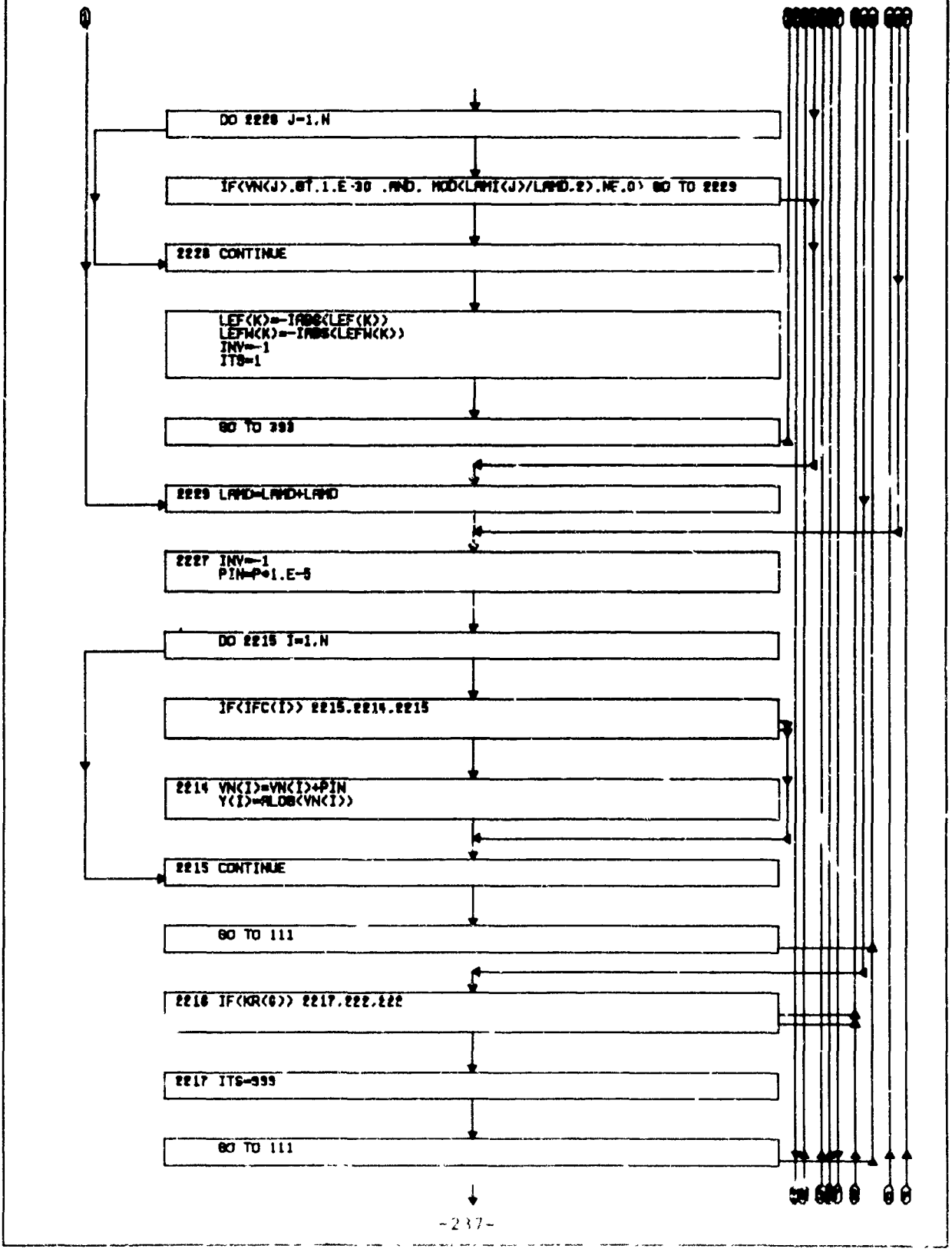

GO TO 2003
2002 AREA=1./(VEL*RHO)
2003 WRITE(KOUT,3) VEL,VINCH,AREA
200 IF(ICON) 2006,1203,1203
1203 IF(ITS) 2031,2006,2006
2031 DO 2033 I=1,N
2033 VN(I)=VN(I)/P
WRITE(KOUT,2032)(FANOA(I),FANOB(I),VN(I),I=1,N)
DO 2035 I=1,N
2035 VN(I)=VN(I)*P
IF(MODE-1) 2004,2007,2004
2007 WRITE(KOUT,2030) FN(NK),FANOB(JC)
2030 FORMAT(22H SURFACE SPECIES IS 2A4)
2032 FORMAT(/9(5X7HSPECIES5X3HMOLE FR.2X)/(6X2A4,E12.6,6X2A4,E12.6,6X2A
1 4,E12.6))
GO TO 2004
2006 WRITE(KOUT,3) (FANOA(I),FANOB(I),VN(I),DY(I),Y(I),VLNK(I),IFC(I),E
1(I),CP(I),I=1,N)
2004 WRITE(KOUT,6)

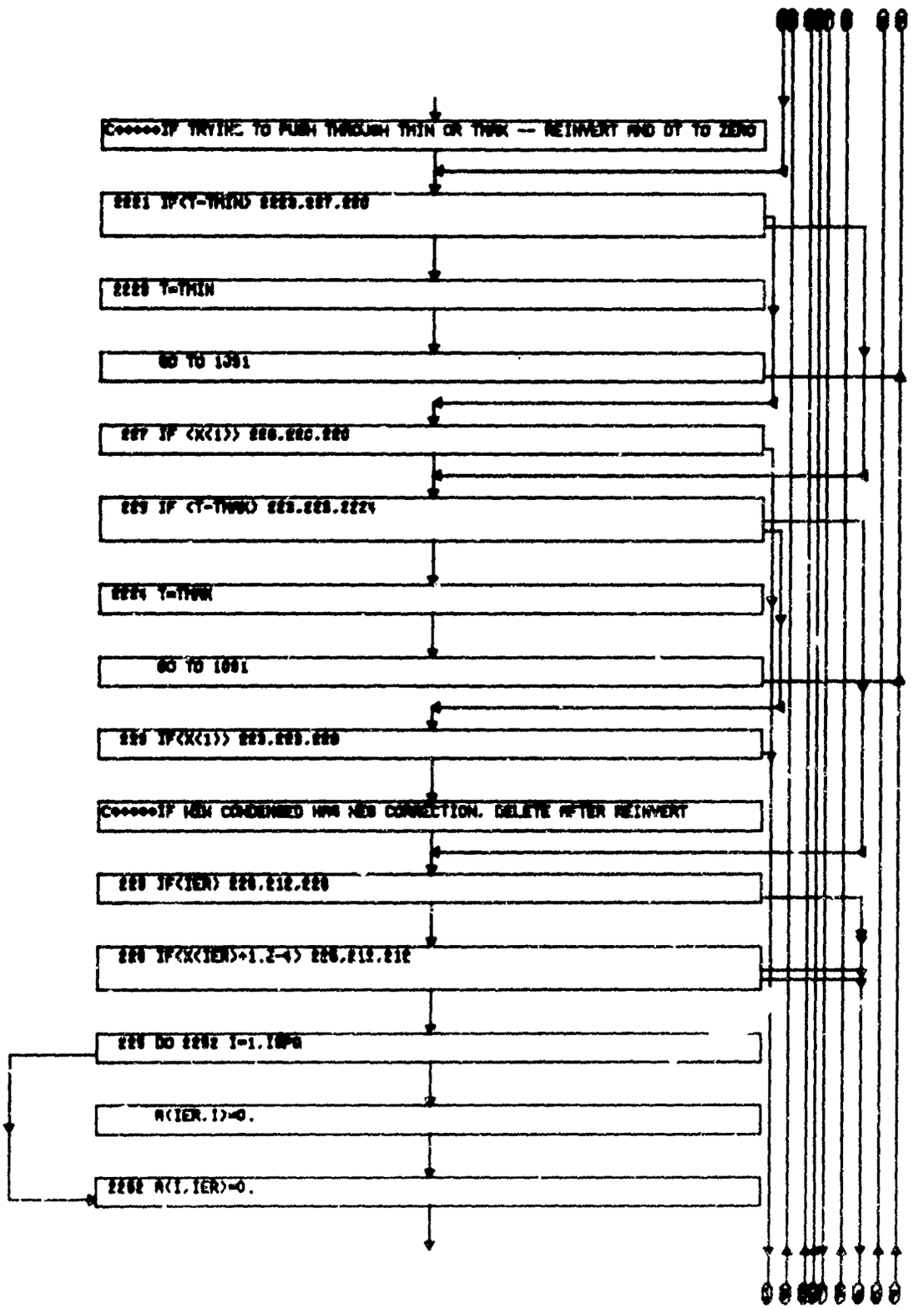

N=N-KR(6)
IF(ITS) 11.1021.1021
1021 HIP=6HIP
SIP=6SIP
C PRINCIPAL ITERATIVE LOOP
21 IF(ITS) 109.110.109
109 IF(MODE) 111.111.110
1001 ITS=ITS+1
110 CALL THERM
111 MODE=KR(1)
IGO=0
FLIG=0.
CALL WATER
B1=B(1)
211 MODE=1
IF(KR(7)-1) 2101.210.2102
2102 IGO=-2
WRITE(KOUT.2100)(I.I=1.15)
210 WRITE(KOUT.7) ITS.T.RR.EL.ENL.CHF.(E(I).I=1.15)
2100 FORMAT (5CH1ITS TEMP PRES=MWT EQUIL ER MASBAL ER SCALE Y(I3.
1PH MASBAL)/90X(I3.7H MASBAL))
2101 IF(ITS) 2103.221.221

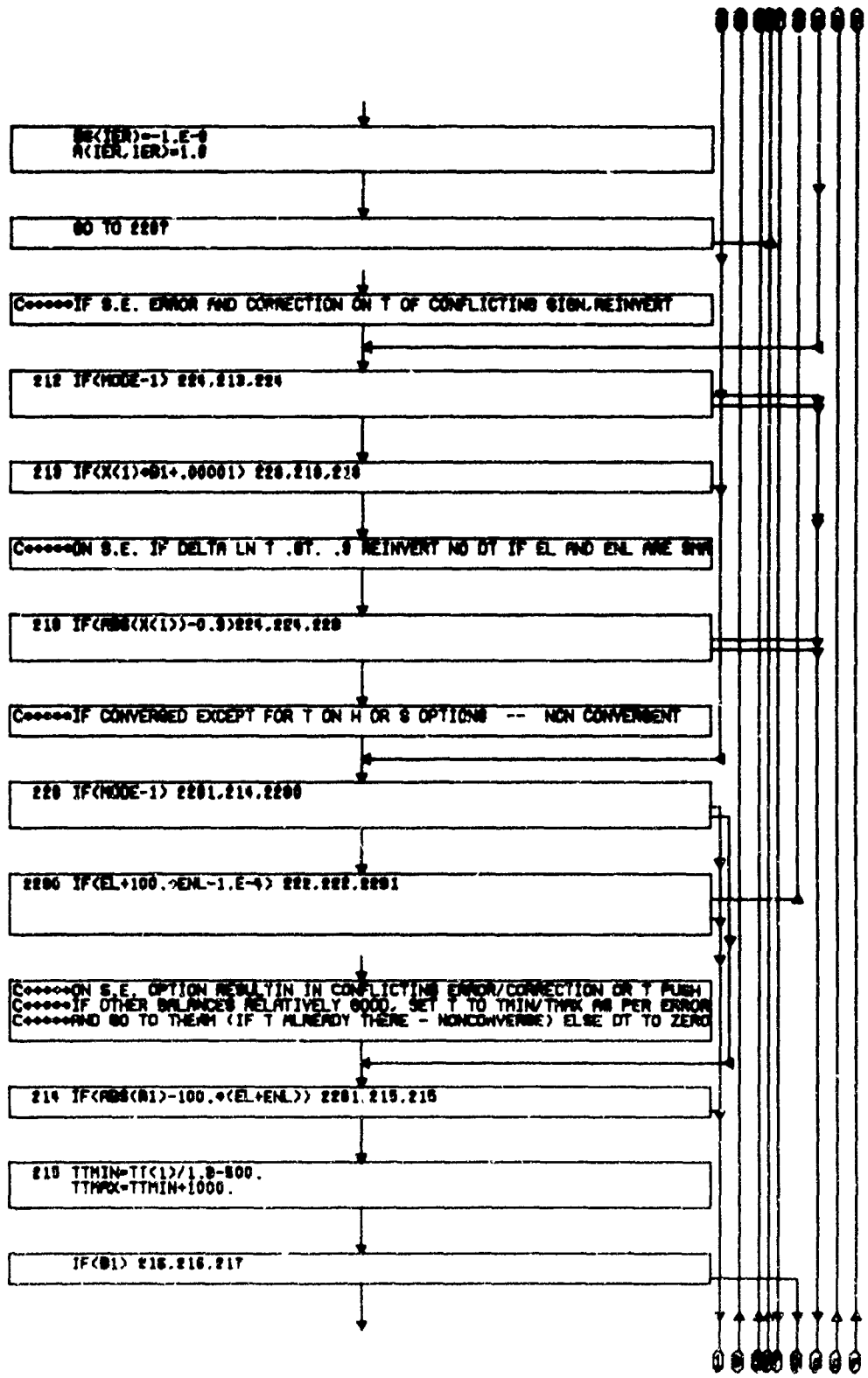

2100 IF(MODE-1) 170,2104,170
2104 TWALB=T
GO TO 176
221 ITB=ITB+1
IF(ITB-80) 2210,2210,222
2210 IF(ITB-NF) 22,2222,2222
222 IF(KKR(18)) 2226,2226,2226
2226 WRITE(KOUT,2000)
2000 FORMAT (///2X,80H-----FOLLOWING OUTPUT NON-CONVERGENT----------
1-/79H IER,ITEM,II,MITB,ITB,IGL,KR(6),HIP,SIP,TT(II)/ALP(I)/LEF(I)
2/FR(I,II))
WRITE(KOUT,2017)IER,ITEM,II,MITB,ITB,IG,KR(6),HIP,SIP,TT(II)
WRITE(KOUT,2018) ALP
WRITE(KOUT,2018) LEF
WRITE(KOUT,2018) (FR(I,II),I=1,N)
2017 FORMAT(7I6,2X1P2E16.8)
2018 FORMAT(2X1P10E11.4)
2019 FORMAT(2X16I5)
IER=-2
KR(7)=1
2226 ITB=-1
NCV=NCV+1
NON=NCV
IF(NCV-20) 170,170,2220
2226 MITB=100
GO TO 170

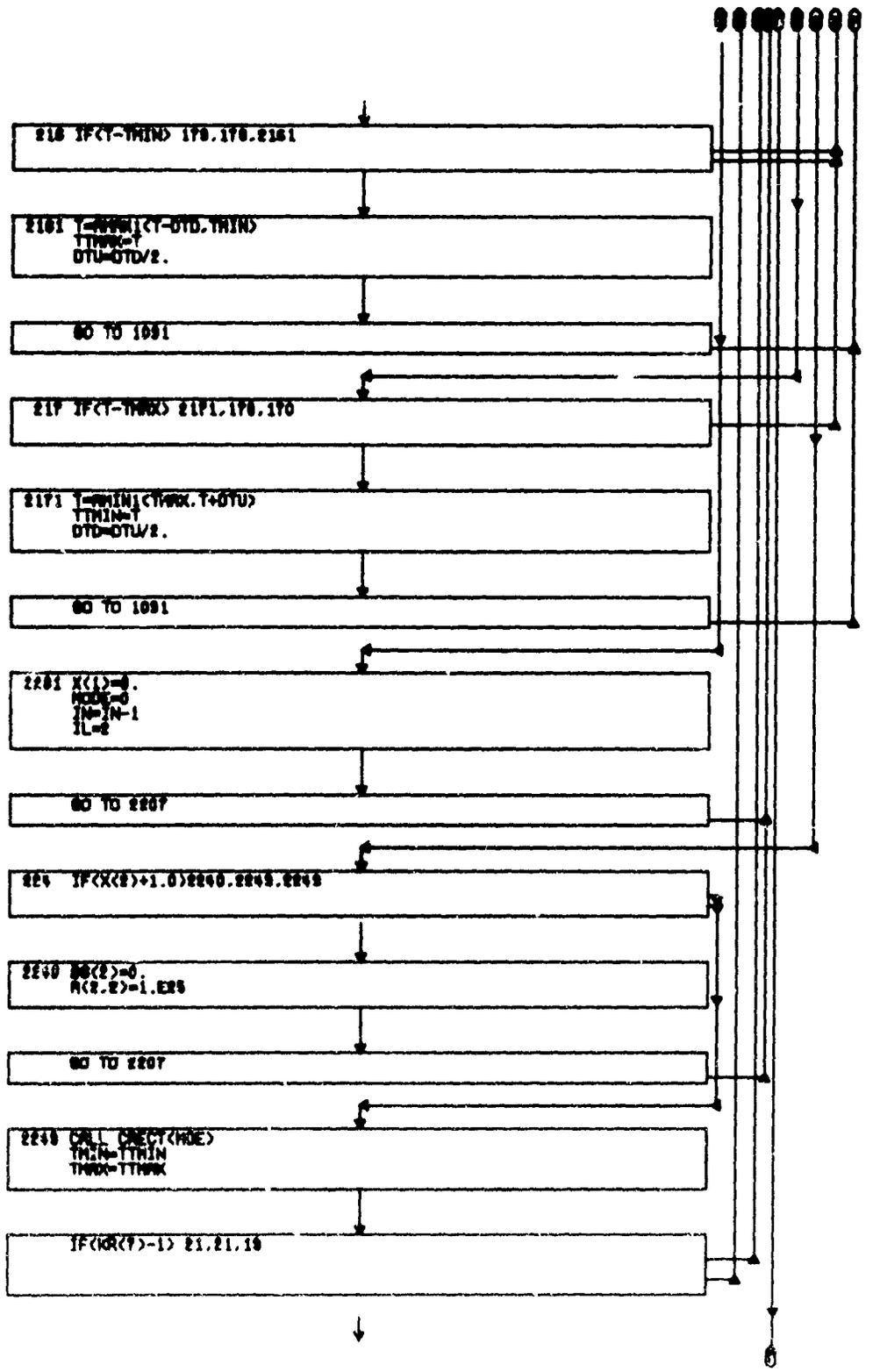

2222 KR(7)=3
IGQ=-2
GO TO 22
22 IGPQ=IN+IL-1
ICT=10
DUM1=0.
DO 2205 I=1,IGPQ
2205 BB(I)=B(I)
GO TO 2208
2207 DO 2206I=IL,IGPQ
2206 B(I)=BB(I)
2208 DO 2204 I=1,IGPQ
DO 2200 J=1,IGPQ
2200 APE(I,J)=A(I,J)
IF(I-2) 2204,2204,2201
2201 IF(IPC(I-2)-1) 2204,2204,2202
2202 B(I)=0.
DO 2203 J=1,IGPQ

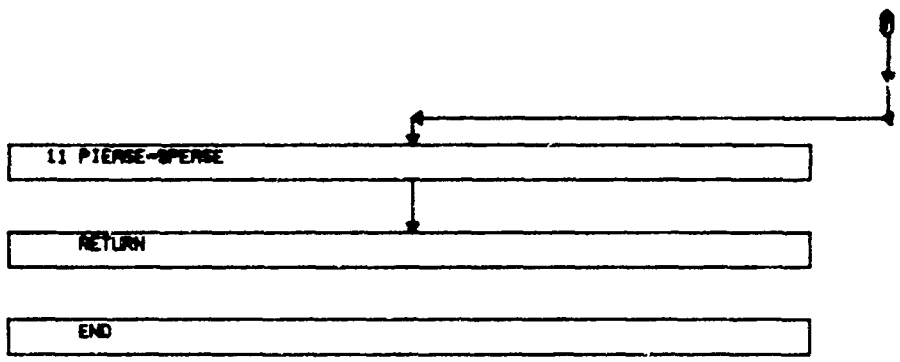

APE(J,I)=0.
2203 APE(I,J)=0.
APE(I,I)=1.0
2204 CONTINUE
IB=IBW
CALL RENRW(IN,APE(IL,IL),0.0,B(IL),1.0,IB,18)
ICT=ICT-1
IF(ICT-IBW) 222,2200,2210
2209 IBW=-2
2210 IF(IB) 2212,2221,2221
2211 IF(INV) 2216,2213,222
2218 IF(KR(6)) 2227,2250,2240
2230 LNVD=1
DO 2229 K=1,IB
J=IR(K)
IF(IFC(J).GT.1) GO TO 2229


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))
LEFW(K)=-IABS(LEFW(K))
INV=-1
ITS=1
GO TO 298
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 THIN OR THICK -- REINVERT AND DT TO ZERO
2221 IF(T-THIND) 2223,227,220
2220 T=THIN
GO TO 1381
227 IF (X(I)) 226,225,220
229 IF (T-THICK) 223,223,2224
2224 T=THICK
GO TO 1381
226 IF(X(I)) 223,223,220
C*****IF NEW CONDENSED WAS NEW CONNECTION. DELETE AFTER REINVERT
220 IF(IER) 220,212,220
220 IF(X(IER)+1.E-4) 226,212,212
220 DO 2202 I=1,IBP1
A(IER,I)=0.
2202 A(I,IER)=0.


BE(IER)=-1.E-6
A(IER,IER)=1.0
GO TO 2207
C.....IF S.E. ERROR AND CORRECTION ON T OF CONFLICTING SIGN,REINVERT
212 IF(MODE-1) 224,213,224
213 IF(X(1)+B1+.00001) 226,216,216
C.....ON S.E. IF DELTA LN T .GT. .5 REINVERT NO DT IF EL AND ENL ARE SMA
215 IF(ABS(X(1))-0.5)224,224,220
C.....IF CONVERGED EXCEPT FOR T ON H OR S OPTIONS -- NON CONVERGENT
220 IF(MODE-1) 2201,214,2200
2206 IF(EL+100.>ENL-1.E-4) 222,222,2201
C.....ON S.E. OPTION RESULTIN IN CONFLICTING ERROR/CORRECTION OR T PUSH
C.....IF OTHER BALANCES RELATIVELY GOOD, SET T TO TMIN/TMAX AS PER ERROR
C.....AND GO TO THERM (IF T ALREADY THERE - NONCONVERGE) ELSE DT TO ZERO
214 IF(ABS(B1)-100.*(EL+ENL)) 2201,215,215
218 TTMIN=TT(1)/1.D-800.
TTMAX=TTMIN+1000.
IF(B1) 216,216,217


218 IF(T-TMIN) 170,170,2161
2161 T=AMIN1(T-DTU,TMIN)
TTMAX=T
DTU=DTU/2.
GO TO 1091
217 IF(T-TMAX) 2171,170,170
2171 T=AMIN1(TMAX,T+DTU)
TTMIN=T
DTU=DTU/2.
GO TO 1091
2201 X(I)=0.
MODE=0
IN=IN-1
IL=2
GO TO 2207
224 IF(X(2)+1.0)2240,2240,2248
2240 KK(2)=0.
A(2,2)=1.E25
GO TO 2207
2248 CALL CHECT(MODE)
TMIN=TTMIN
TMAX=TTMAX
IF(KK(7)-1) 21,21,18


11 PIERCE-OPERSE
RETURN
END

22. SUBROUTINE THERM - B21A

a. Function

Evaluates current thermodynamic properties for each species, which data are required for evaluation of errors and correction coefficients in chemistry solution. Called by EQUIL.

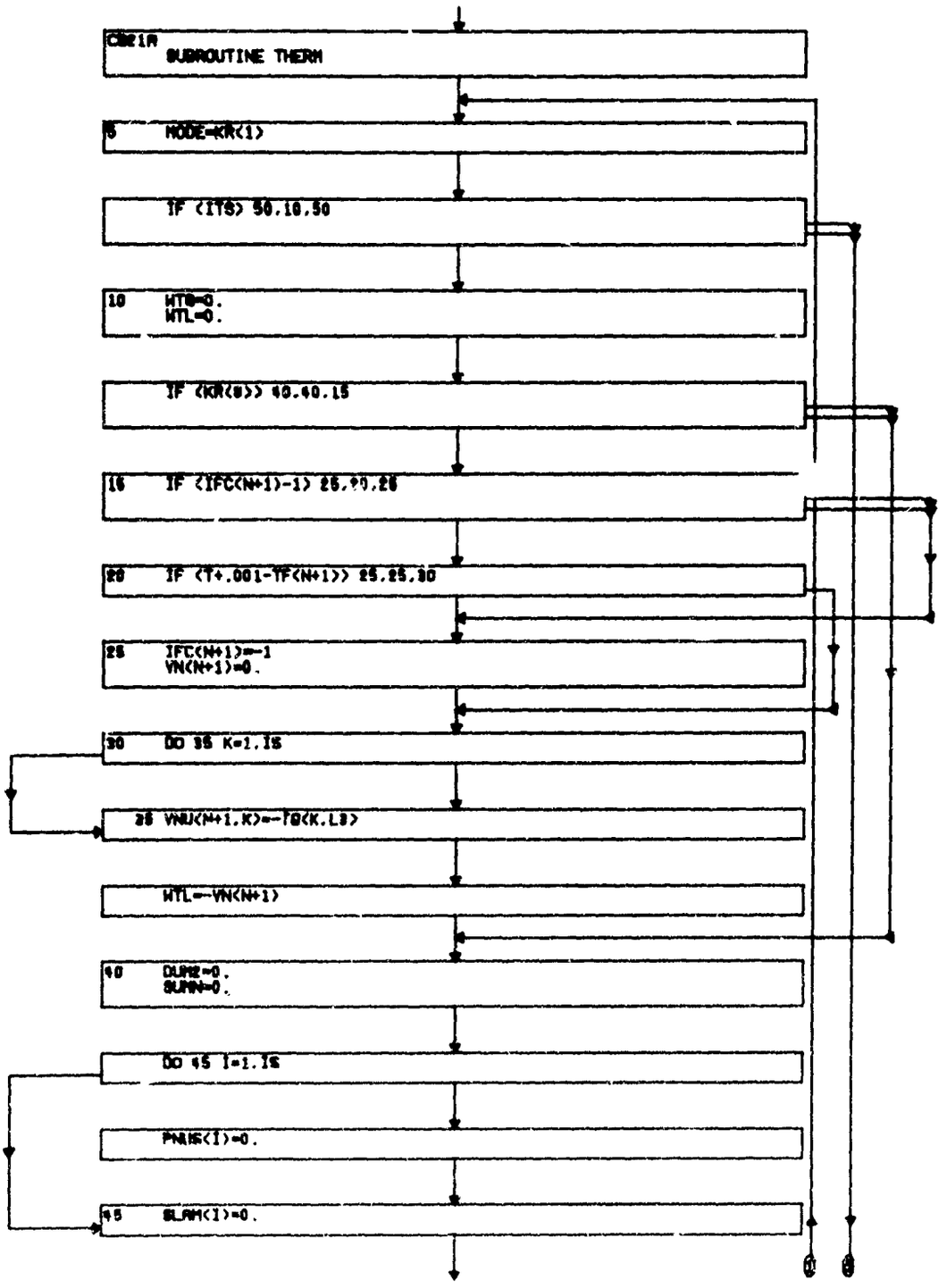
b. Listing

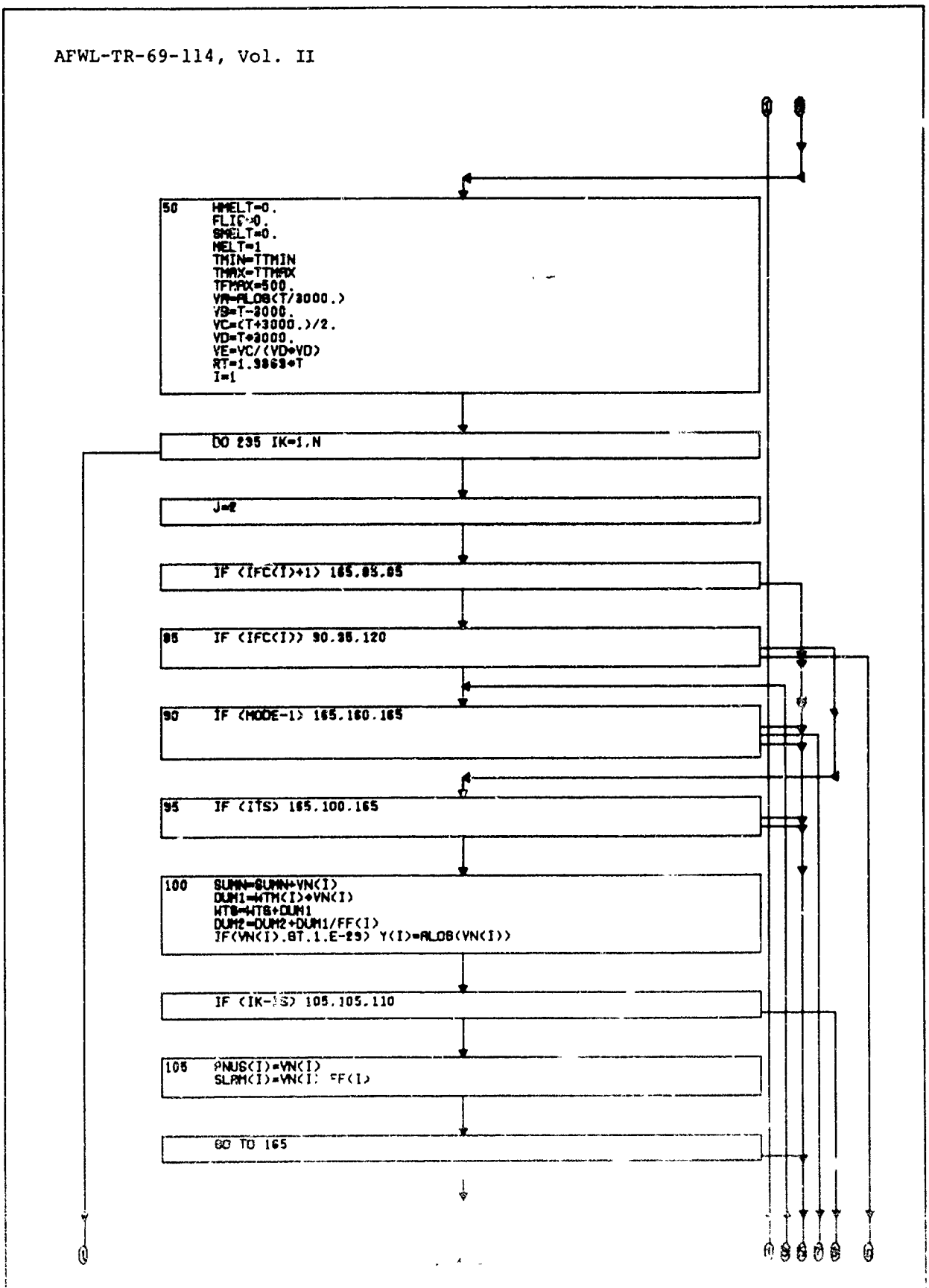
```
000001          CB21A                                                                 B21A 001
000002                SUBROUTINE THERM                                                B21A 002
000003                DIMENSION CIJ( 71,1),TF(1)                                      B21A 003•NEW
000004                EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                               B21A 004•NEW
000005                COMMON /BLOCOM/FAMOA( 71),FAMOB( 71),N     ,PR( 71,15),W(3),LEF(10)B21A   5•NEW
000006               1,LEFS(10),PIEASE,LEFW(10)                                       B21A   6•NEW
000007                COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B21A   7•NEW
000008               1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B21A   8•NEW
000009               2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B21A   9•NEW
000010               3 VNU( 71,10),ITFF,KR2,NCH,NCV,WM,WTM( 71,,V( 71),VW( 71),CG( 71)  B21A  10•NEW
000011               4 ,TG(10, 7),EPOVRK,SIGMA,BASMOL                                   B21A  11•NEW
000012                COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIG,CPF,IRE,IER,AA,ITS,IN,IL,IT,    B21A  12•NEW
000013               1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPG,   B21A  13•NEW
000014               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MG,  B21A  14•NEW
000015               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      B21A  15•NEW
000016               4 IP( 71),ALP(10),PNU(10),GAMM(10),GAMF(10),SLAM(10),DY( 71),RVS,  B21A  16•NEW
000017               5 CP( 71),M( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),        B21A  17•NEW
000018               6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                     B21A  18•NEW
000019                COMMON/INTCOM/KKR(20),KIN,KOUT                                                 •-16
000020          5     MODE=KR(1)                                                                    20
000021                IF (ITS) 50,10,50                                                             30
000022          10    WTG=0.                                                                        31
000023                WTL=0.                                                                        32
000024                IF (KR(8)) 40,40,15                                                           33
000025          15    IF (IFC(N+1)-1) 25,20,25                                                      34
000026          20    IF (T+.001-TF(N+1)) 25,25,30                                                  35
000027          25    IFC(N+1)=-1                                                                   36
000028                VN(N+1)=0.                                                                    37
000029          30    DO 35 K=1,18                                                                  38
000030             35 VNU(N+1,K)=-TG(K,L3)
000031                WTL=-VN(N+1)                                                                  40
000032          40    DUM2=0.                                                                       41
000033                SUMN=0.                                                                       42
000034                DO 45 I=1,18                                                                  43
000035                PNUS(I)=0.                                                                    44
000036          45    SLAM(I)=0.                                                                    45
000037          50    MMELT=0.                                                                      46
000038                FLIG=0.                                                                       47
000039                SMELT=0.                                                                      48
000040                MELT=1                                                                        49
000041                TMIN=TTMIN                                                                    50
000042                TMAX=TTMAX                                                                    51
000043                TFMAX=500.                                                                    52
000044                VA=ALOG(T/3000.)                                                              53
000045                VB=T-3000.                                                                    54
000046                VC=(T+3000.)/2.                                                               55
000047                VD=T-3000.                                                                    56
000048                VE=VC/(VD+VD)                                                                 57
000049                RT=1.9869+T                                                                   58
000050                I=1                                                                           64
000051                DO 235 IK=1,N                                                                 67
000052                J=2                                                                           68
000053                IF (IFC(I)+1) 165,85,85                                                       74
000054          85    IF (IFC(I)) 90,95,120                                                         75
000055          90    IF (MODE-1) 165,160,165                                                       76
000056          95    IF (ITS) 165,100,165                                                          77
000057          100   SUMN=SUMN+VN(I)                                                               78
000058                DUM1=WTM(I)+VN(I)                                                             79
```

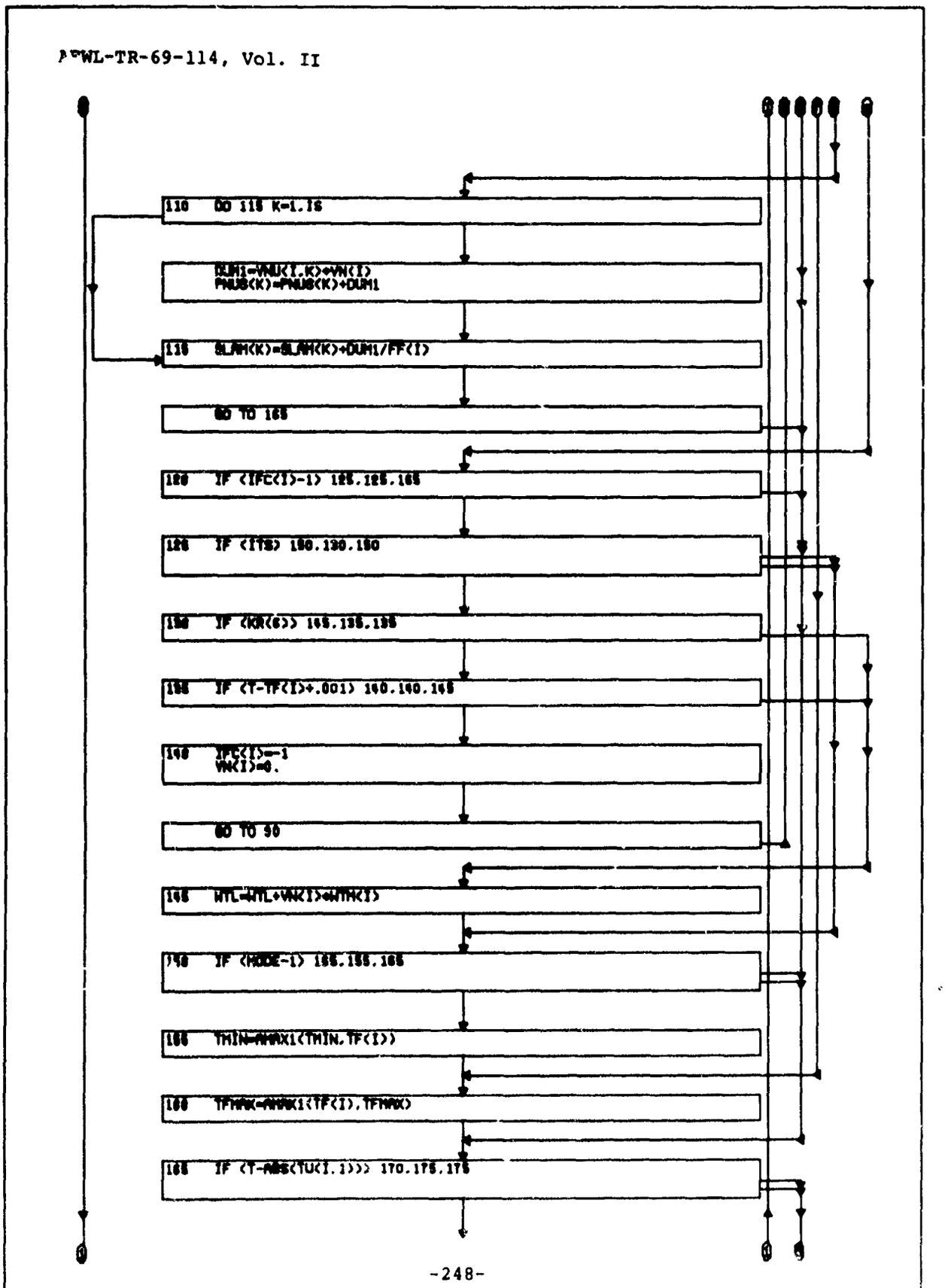
```
000059                  WTS=WTS+DUM1                                                    80
000060                  DUM2=DUM2+DUM1/FF(I)                                            81
000061                  IF(VN(I).GT.1.E-29) Y(I)=ALOG(VN(I))
000062                  IF (IK-18) 105,105,110                                          82
000063            105   PNUS(I)=VN(I)                                                   83
000064                  SLAM(I)=VN(I)/FF(I)                                             84
000065                  GO TO 165                                                       85
000066            110   DO 115 K=1,18                                                   86
000067                  DUM1=VNU(I,K)*VN(I)                                             87
000068                  PNUS(K)=PNUS(K)+DUM1                                            88
000069            115   SLAM(K)=SLAM(K)+DUM1/FF(I)                                      89
000070                  GO TO 165                                                       90
000071            120   IF (IFC(I)-1) 125,125,165                                       91
000072            125   IF (ITS) 130,130,150                                            92
000073            130   IF (KR(6)) 145,135,135                                          93
000074            135   IF (T-TP(I)+.001) 140,140,145                                   94
000075            140   IFC(I)=-1                                                       95
000076                  VN(I)=0.                                                        96
000077                  GO TO 90                                                        97
000078            165   VTL=VTL+VN(I)*WTM(I)                                            98
000079            170   IF (MODE-1) 169,155,165                                         99
000080            155   TMIN=AMAX1(TMIN,TP(I))                                         100
000081            160   TPMAX=AMAX1(TP(I),TPMAX)                                       101
000082            165   IF (T-ABS(TU(I,1))) 170,175,175                                102
000083            170   J=1                                                            103
000084            175   CP(I)=RC(I,J)+T+RD(I,J)+RE(I,J)/(T*T)                          104
000085                  H(I)=RB(I,J)+T*(RC(I,J)+T*(RD(I,J)+T*RE(I,J)/4.)/3.)           105
000086                  S0(I)=RA(I,J)+RC(I,J)*ALOG(T)+T*(RB(I,J)+T*(RD(I,J)/2.+T*RE(I,J)/6.))/2.  106
000087                  IF (MODE-2) 210,180,180                                        107
000088            180   IF (IFC(I)-1) 210,185,210                                      108
000089            185   IF (TU(I,1)) 190,210,210                                       109
000090            190   IF (T+TU(I,1)) 200,195,205                                     110
000091            195   HMELT=H(I)+HMELT                                               111
000092                  SMELT=S0(I)+SMELT                                              112
000093                  MELT=1                                                         113
000094                  IF (J-2) 210,170,210                                           114
000095            200   TMAX=AMIN1(TMAX,-TU(I,1))                                      115
000096                  GO TO 210                                                      116
000097            205   TMIN=AMAX1(TMIN,-TU(I,1))                                      117
000098            210   TC(I)=T-H(I)/RT                                                118
000099                  VLNK(I)=TC(I)+S0(I)/1.9869                                     119
000100                  IF (IK-18) 215,215,220                                         120
000101            215   SLNK(I)=VLNK(I)                                                121
000102                  IBC(I)=IFC(I)                                                  122
000103                  BC(I)=TC(I)                                                    123
000104                  GO TO 230                                                      124
000105            220   DO 230 K=1,18                                                  125
000106                  IF (IBC(K)+1) 230,225,225                                      126
000107            225   VLNK(I)=VLNK(I)-VNU(I,K)*SLNK(K)                               127
000108                  TC(I)=TC(I)-VNU(I,K)*BC(K)                                     128
000109            230   CONTINUE                                                       129
000110            235   I=I+1                                                          130
000111                  IF (MODE-1) 250,240,250                                        132
000112            240   IF (TPMAX-T) 245,250,250                                       133
000113            245   T=TPMAX                                                        134
000114                  IF(T-900.) 246,246,5
000115              246 WRITE(KOUT,249)
000116                  STOP
000117            249   FORMAT(///38H NO AVAILABLE SURFACE SPECIES. , 'TOP)            136
000118            250   IF (ITS) 385,255,385
```

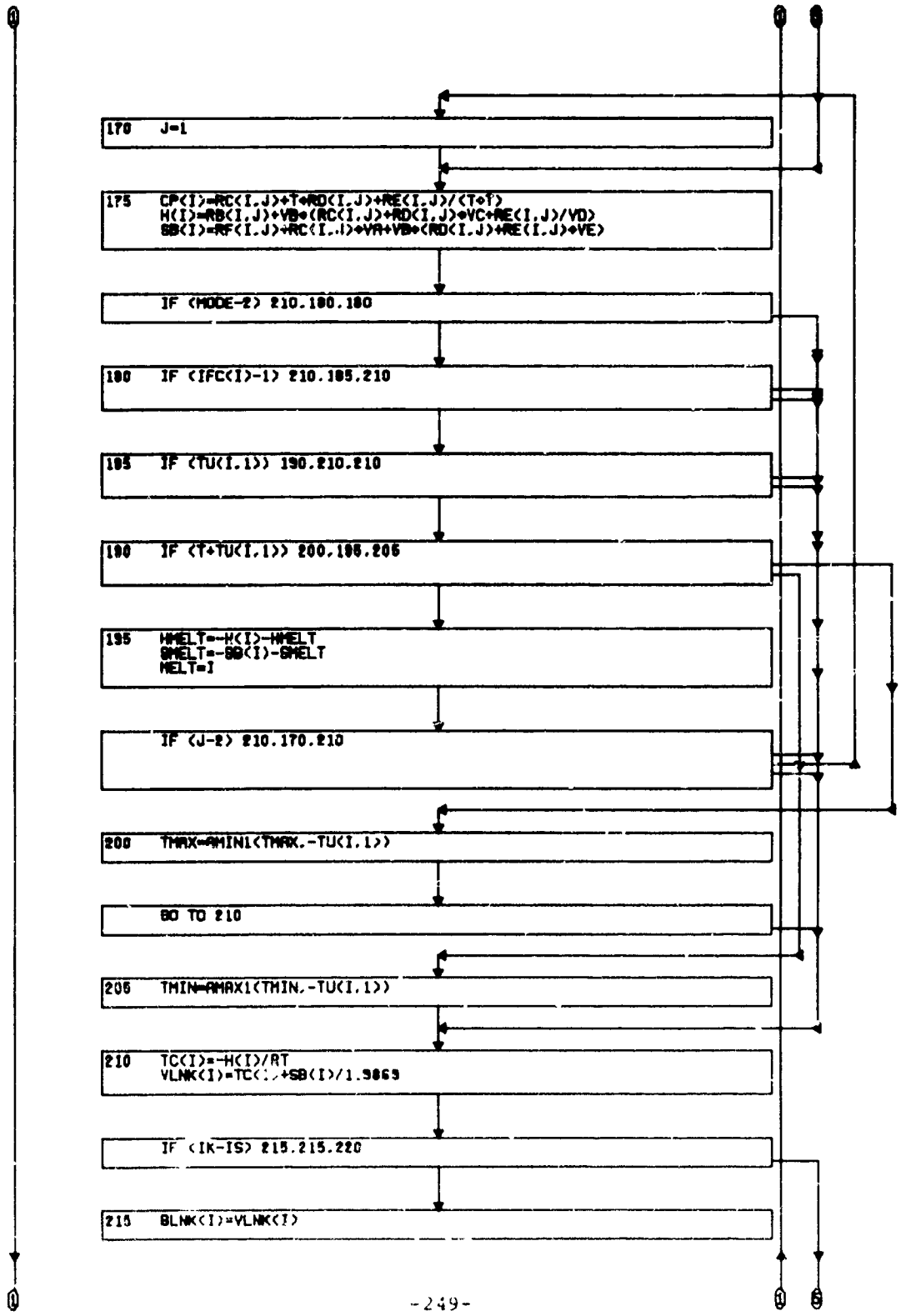
```
000119          255     AA=P*WM                                                 137
000120          365     SUMN=SUMN/P                                             180
000121                  SUML=ALOG(SUMN)                                         181
000122                  FFF=WTG/DUM2                                            182
000123                  WTG=WTG/SUMN                                            183
000124                  WTL=WTL/SUMN                                            184
000125                  SUMC=1.0
000126                  IF(KR(6)) 385,369,369
000127            369   DO 370 I=1,18
000128                  PNUS(I)=PNUS(I)/SUMN                                    186
000129          370     SLAM(I)=SLAM(I)/SUMN*FFF                                187
000130          375     IF (WTL/WTG-WS) 385,385,380                             191
000131          380     SUMC=WTL/(WTG*WS)                                       192
000132                  WTL=WTL/SUMC                                            193
000133          385     RETURN                                                  194
000134                  END                                                     195-
```

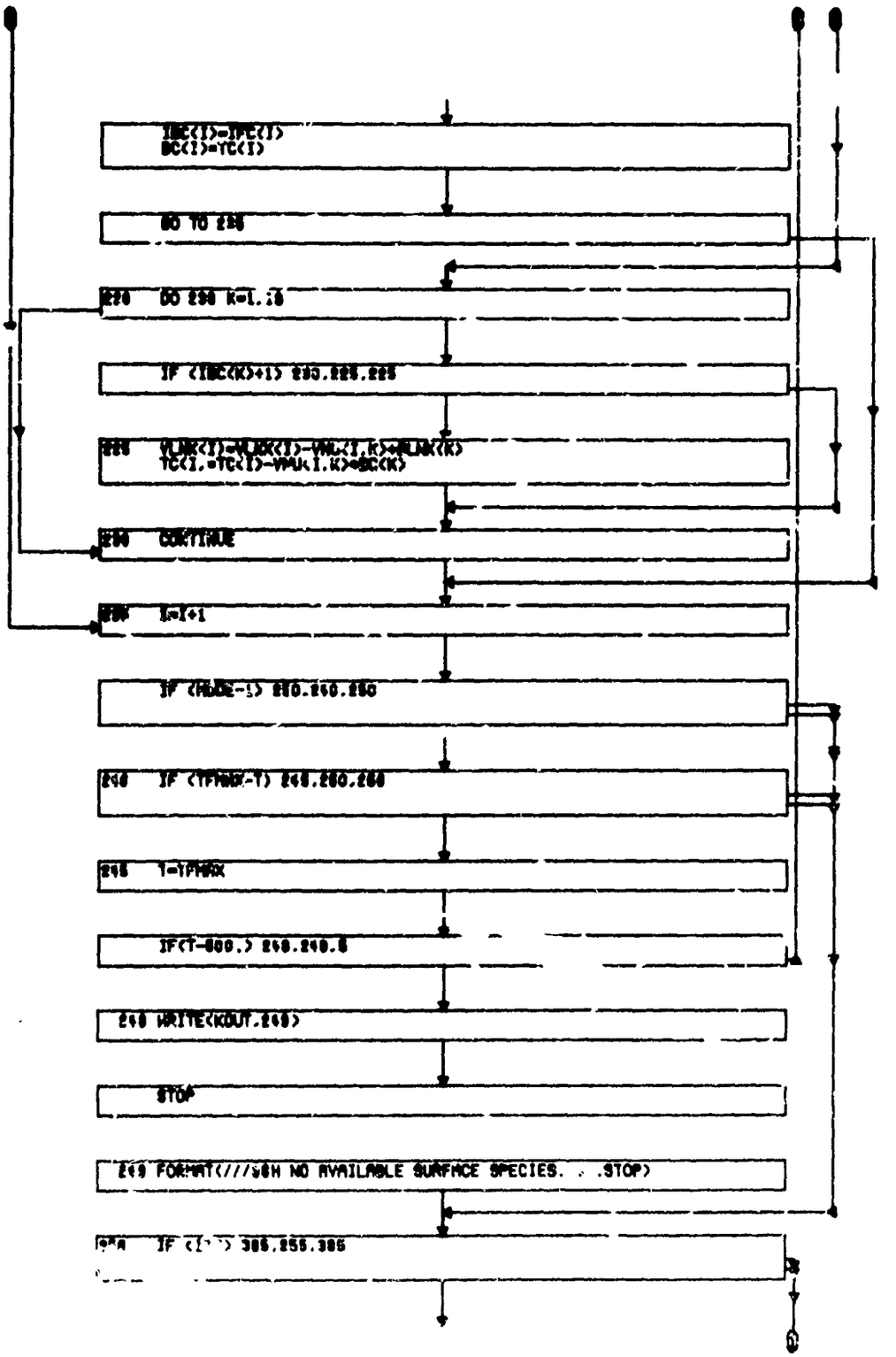
c. Flow Chart

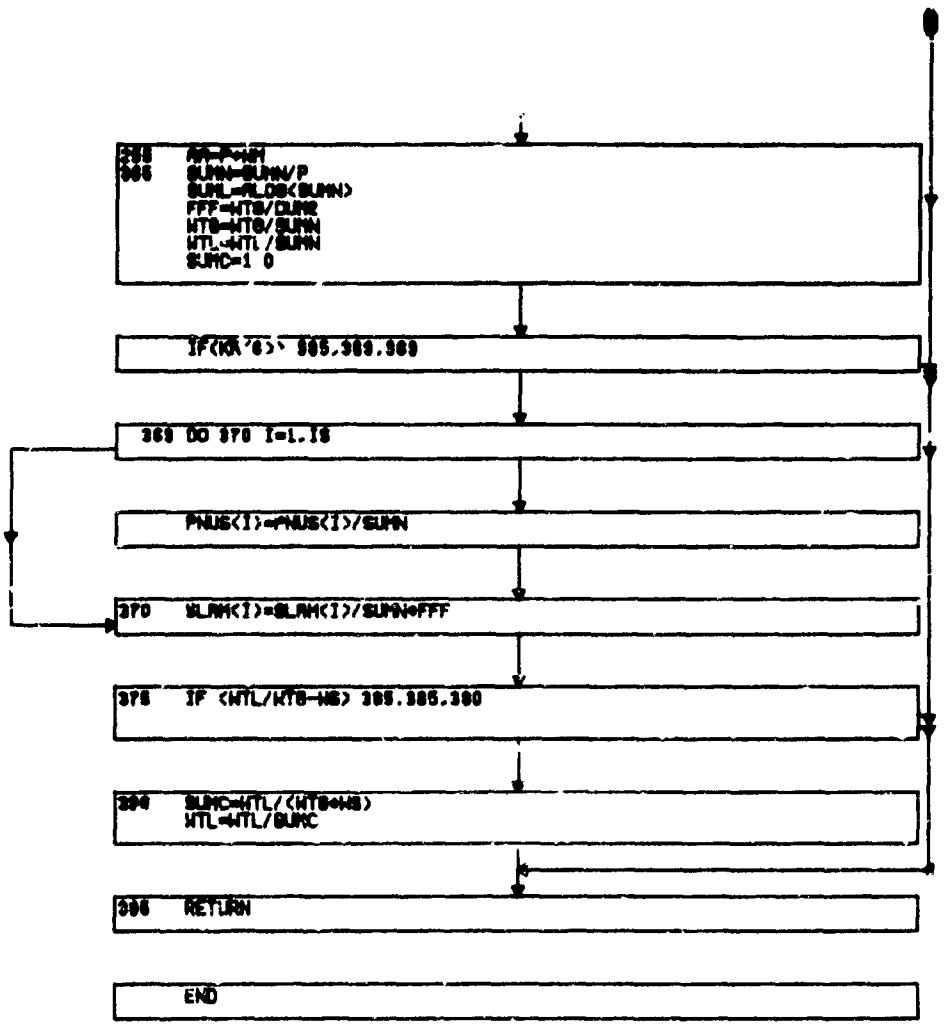

SUBROUTINE THERM
5 NODE=KR(1)
IF (ITS) 50,10,50
10 WTR=0.
WTL=0.
IF (KR(5)) 40,40,15
16 IF (IFC(N+1)-1) 25,20,25
20 IF (T+.001-TF(N+1)) 25,25,30
25 IFC(N+1)=-1
VN(N+1)=0.
30 DO 35 K=1,15
35 VNU(N+1,K)=-TQ(K,L3)
WTL=-VN(N+1)
40 DUM2=0.
SUM4=0.
DO 45 I=1,15
PMAS(I)=0.
45 SLAM(I)=0.


50 HMELT=0.
FLIC=0.
SMELT=0.
MELT=1
TMIN=TTMIN
TMAX=TTMAX
TFMAX=500.
VM=ALOG(T/3000.)
VB=T-3000.
VC=(T+3000.)/2.
VD=T+3000.
VE=VC/(VD*VD)
RT=1.9869*T
I=1
DO 295 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=WTH(I)*VN(I)
WTS=WTS+DUM1
DUM2=DUM2+DUM1/FF(I)
IF(VN(I).GT.1.E-29) Y(I)=ALOG(VN(I))
IF (IK-1S) 105,105,110
105 PNUS(I)=VN(I)
SLRM(I)=VN(I) FF(I)
GO TO 165


110 DO 115 K=1,IS
DUM1=VNU(I,K)+VN(I)
PNUB(K)=PNUB(K)+DUM1
115 SLAM(K)=SLAM(K)+DUM1/FF(I)
GO TO 165
120 IF (IFC(I)-1) 125,125,165
125 IF (ITS) 130,130,150
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
165 WTL=WTL+VN(I)+WTH(I)
IF (MODE-1) 185,185,165
THIN=AMAX1(THIN,TF(I))
TFMAX=AMAX1(TF(I),TFMAX)
IF (T-ABS(TU(I,1))) 170,175,175


170 J=1
175 CP(I)=RC(I,J)+T*RD(I,J)+RE(I,J)/(T*T)
H(I)=RB(I,J)+VB*(RC(I,J)+RD(I,J)*VC+RE(I,J)/VD)
SB(I)=RF(I,J)+RC(I,J)*VA+VB*(RD(I,J)+RE(I,J)*VE)
IF (MODE-2) 210,180,180
180 IF (IFC(I)-1) 210,185,210
185 IF (TU(I,1)) 190,210,210
190 IF (T+TU(I,1)) 200,195,205
195 HMELT=-H(I)-HMELT
SMELT=-SB(I)-SMELT
MELT=1
IF (J-2) 210,170,210
200 TMAX=AMIN1(TMAX,-TU(I,1))
GO TO 210
205 TMIN=AMAX1(TMIN,-TU(I,1))
210 TC(I)=-H(I)/RT
VLNK(I)=TC(I)+SB(I)/1.9869
IF (IK-IS) 215,215,220
215 BLNK(I)=VLNK(I)


IBC(I)=IPC(I)
BC(I)=TC(I)
GO TO 230
230 DO 290 K=1,18
IF (IBC(K)+1) 235,235,225
225 VLBC(I)=VLBC(I)-VAL(I,K)*VLBA(K)
TC(I)=TC(I)-VAL(I,K)*BC(K)
290 CONTINUE
295 K=K+1
IF (KLOOP-1) 210,240,240
240 IF (IPHOX-I) 245,250,250
245 I=IPHOX
IF(I-800.) 260,260,5
248 WRITE(KOUT,249)
STOP
249 FORMAT(///36H NO AVAILABLE SURFACE SPECIES. . .STOP)
IF (I-


SUMN=SUMN/P
SUMC=1.0
IF(KK.EQ.6) 365,369,369
369 DO 370 I=1,IS
PMUS(I)=PMUS(I)/SUMN
370 SUMM(I)=SUMM(I)/SUMN+FFF
375 IF (WTL/WTB-WS) 385,385,380
380 SUMC=WTL/(WTB+WS)
WTL=WTL/SUMC
386 RETURN
END

23. SUBROUTINE MATER - B22A

a. Function

Evaluates current errors in chemistry solution and sets up matrix of linearized correction equations. Called by EQUIL, calls KINET.

b. Listing

```
000001          CB22A                                                                 822A 001
000002                SUBROUTINE MATER                                                822A 002
000003                DIMENSION VLAM( 71,1),  X(16)                                   822A 005*NEW
000004                EQUIVALENCE(AM( 74),VLAM)                                       822A 006*NEW
000005                DIMENSION CIJ( 71,1),TF(1)                                      822A 007*NEW
000006                DIMENSION ECD( 71)                                              822A 008*NEW
000007                EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                               822A 009*NEW
000008                COMMON /BLQCOM/FAMOA( 71),FAMOB( 71),N    ,FR( 71,19),W(3),LEF(10)822A  10*NEW
000009               1,LEFS(10),PEASE,LEFW(10)                                        822A  11*NEW
000010                COMMON/BUMCOM/    BUMP,CORMA,EASE,ICORM,WDOT,TFZ,1777,DTEMP,KIP,IX822A  12*NEW
000011                COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),822A  13*NEW
000012               1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  822A  14*NEW
000013               2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        822A  15*NEW
000014               3 VNU( 71,10),ITFF,KR2,MCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  822A  16*NEW
000015               4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                   822A  17*NEW
000016                COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT,    822A  18*NEW
000017               1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WB,WSS,B1,ISP2,ISPQ,    822A  19*NEW
000018               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MG,   822A  20*NEW
000019               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),       822A  21*NEW
000020               4 IP( 71),ALP(10),PNU(10),GAMM(10),GAMP(10),BLAM(10),DY( 71),RVS,   822A  22*NEW
000021               5 CP( 71),M( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUB(10),        822A  23*NEW
000022               6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                     822A  24*NEW
000023                COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),    822A  25*NEW
000024               1 DKPT(10),PKP(10),PKR(10),RAT(10),RB10(10),MA(10),LL(10),PMM(10),  822A  26*NEW
000025               2 PRMU(10,10),EESE(10)                                             822A  27*NEW
000026                COMMON/ONCOM/AM(153,153),DVNL(153),TCW,                           822A  28*NEW
000027               1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)              822A  29*NEW
000028                COMMON/INTCOM/KKR(20),KIN,KOUT                                      *=25
000029                EQUIVALENCE(B,X)                                                  822A 021
000030                WSS=W3                                                              28
000031                DO 5 I=1,IS                                                         29
000032           5    IBC(I)=IFC(I)                                                       30
000033                IF(KR(6)) 40,20,20
000034           20   IF (ITS) 25,40,40                                                   36
000035           25   DO 35 I=1,IS                                                        37
000036                IF (IBC(I)-1) 35,30,35                                              38
000037           30   IBC(I)=-1                                                           39
000038           35   CONTINUE                                                            40
000039           40   RV=WSS-WTL/WTG                                                      41
000040                IF(ITS.EQ.0) RVS =RV
000041                IF (KR(7)-1) 70,45,50                                               42
000042           45   IF (ITS) 70,60,70                                                   43
000043           50   WRITE (KOUT,55) FFF,WTL,WTG,AA,RV,ALP,PNUB,BLAM                     44
000044           55   FORMAT (32H FFF,WTL,WTG,AA,RV/ALP/PNUB/BLAM/1X9E12.5/(1X10E12.5))   45
000045                KR(7)=KR(7)-1                                                       46
000046                IF (KR(7)-1) 70,60,70                                               47
000047           60   WRITE (KOUT,65) (I,I=1,IS)                                          48
000048           65   FORMAT (50H1ITS TEMP   PRES=MW?  EQUIL ER  MASBAL ER  SCALE  7(I3,  49
000049               17H MASBAL)/90X3(I3,7H MASBAL))                                     50
000050           C    INITIALIZE                                                          51
000051           70   EL=0.                                                               52
000052                CPG=0.                                                              53
000053                EP=P                                                                54
000054                CPF=0.                                                              55
000055                JC=0                                                                56
000056                JCS=0                                                               57
000057                ISP=IS+1
000058                ISPQ=IS+2                                                           58
```

```
000059                B(1)=0.                                                   59
000060                B(2)=0.                                                   60
000061                A(1,1)=0.                                                 61
000062                A(1,2)=0.                                                 62
000063                A(2,1)=0.                                                 63
000064                A(2,2)=0.                                                 64
000065          C     -----INITIALIZE CONTRIBUTION OF MOST SIGNIFICANT SPECIES IN EACH M   65
000066                DO 75 I=1,IS                                              66
000067                EB(I)=0.                                                  67
000068          75    E(I)=AA*ALP(I)                                            68
000069                ISP2=ISPG                                                 69
000070          C     - - - MAIN BASE SPECIES LOOP                              70
000071                DO 325 IK=1,IS                                            71
000072                I=2*IR(IK)                                                72
000073                IF (KAT(IK)-99) 85,80,85                                  73
000074          80    PNUS(I-2)=0.                                              74
000075          C     ZERO MATRIX                                               75
000076          85    DO 90 K=1,ISPG                                            76
000077          90    A(K,I)=0.                                                 77
000078                IF (ITS) 110,95,110                                       78
000079          C     NORMALIZE ON PRESSURE ON FIRST PASS                       79
000080          95    VN(I-2)=VN(I-2)/SUMN                                      80
000081                ECD(I-2)=(1.-EAGE)*Y(I-2)
000082                EBL(I-2)=0.                                               81
000083                IF (IBC(I-2)) 110,100,105                                 82
000084          100   Y(I-2)=Y(I-2)-SUML                                        83
000085                GO TO 110                                                 84
000086          105   VN(I-2)=VN(I-2)/SUMC                                      85
000087          C     INITIALIZE SOME MORE                                      86
000088          110   B(I)=0.                                                   87
000089                A(I,1)=0.                                                 88
000090                IP(I-2)=0.                                                89
000091          C     SET FLAG INDICATING SIGNIFICANCE OF SPECIES IN MASS       90
000092          C     BALANCE(S) AND INCREMENT COUNT ON SIGNIFICANT SPECIES     91
000093                IF (VN(I-2)-EBL(I-2)) 120,120,115                         92
000094          115   IP(I-2)=-1                                                93
000095          C     TREAT BASE SPECIES CONTAINING BUT NOT REPRESENTING NON-PRESENT   94
000096          C     ELEMENTS IN SAME MANNER AS NON-PRESENT CONDENSED SPECIES   95
000097          120   IF (IBC(I-2)+1) 325,125,125                               96
000098          125   IF (IBC(I-2)) 180,215,130                                 97
000099          130   A(I,I)=1.                                                 98
000100                VA=VN(I-2)                                                99
000101                IF (IABS(IBC(I-2)-3)-1) 135,280,140                       100
000102          135   A(2,I)=1.0                                                101
000103                GO TO 280                                                 102
000104          140   IF (EB(I-2)-ABS(VA)) 145,150,150                          103
000105          145   EB(I-2)=ABS(VA)                                           104
000106                IB(I-2)=I-2                                               105
000107          150   E(I-2)=E(I-2)-VA                                          106
000108                IF (KR(6)) 155,160,160                                    107
000109          155   IF (MODE-1) 280,170,280                                   108
000110          160   DO 165 K=1,IS                                             109
000111          165   A(K+2,I)=-WTM(I-2)*(PNUS(K)/WTG+GAMP(K))                  110
000112                A(I,I)=A(I,I)+1.                                          111
000113          170   TMIN=AMAX1(TMIN,TF(I-2))                                  112
000114                IF (T-TF(I-2)+.001) 175,175,180                           113
000115          175   A(I,I)=1.0E+10                                            114
000116                E(I-2)=-VN(I-2)*1.001E+10                                 115
000117                MODE=0                                                    116
000118          180   IF (MODE-1) 185,190,185                                   117
```

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000119          185   IF (KR(8)) 280,280,190                                  118
000120          190   IF (TF(I-2)+.001-T) 325,195,195                         119
000121          195   IF (JC) 205,205,200                                     120
000122          200   IF (Y(I-2)-BJC) 325,325,205                             121
000123            205 BJC=Y(I-2)-ECD(I-2)
000124                JCS=JC                                                  123
000125                TMAX=TF(I-2)                                            124
000126                JC=I-2                                                  125
000127                IFCJC=IBC(I-2)                                          126
000128                IF (KR(8)) 210,210,280                                  127
000129          210   A(1,JCS+2)=0.                                           128
000130                A(1,I)=-1.0                                             129
000131                B(1)=BJC
000132                GO TO 325                                               130
000133          C     -----GAS PHASE                                          131
000134          215   VA=VN(I-2)                                              132
000135                CPG=CPG+VA*CP(I-2)                                      133
000136                A(I,I)=VA                                               134
000137                A(2,I)=VA                                               135
000138                EP=EP+VA                                                136
000139                IF (KAT(IK)-99) 220,275,220                             137
000140          220   IF (KR(6)) 275,250,225                                  138
000141          225   DO 230 K=1,IS                                           139
000142            230 A(K+2,I)=(VLAM(I-2,K)+GAMM(K)*M(I-2))*VA
000143                A(I,I)=A(I,I)+VA*RV                                     141
000144                DUM2=WTM(I-2)/WTG*WTL/WTG*VA                            142
000145                DO 245 K=1,IS                                           143
000146                IF (EB(K)-ABS(A(K+2,I))) 235,240,240                    144
000147          235   ER(K)=ABS(A(K+2,I))                                     145
000148                IB(K)=I-2                                               146
000149          240   E(K)=E(K)-A(K+2,I)                                      147
000150          245   A(K+2,I)=A(K+2,I)+DUM2*PNUS(K)                          148
000151                GO TO 280                                               149
000152          250   DUM1=WTM(I-2)/WTG*VA                                    150
000153                DUM2=WTL/WTG*DUM1                                       151
000154                IF (KR(4)) 255,255,260                                  152
000155          255   DUM1=0.                                                 153
000156                VA=(RV+1.)*VA                                           154
000157                GO TO 265                                               155
000158          260   DUM1=DUM1*(1.-FFF/FF(I-2))                              156
000159                VA=(RV+FFF/FF(I-2))*VA                                  157
000160          265   DO 270 K=1,IS                                           158
000161          270   A(K+2,I)=DUM1*BLAM(K)+DUM2*PNUS(K)                      159
000162                A(I,I)=A(I,I)+VA                                        160
000163          275   ER(I-2)=ABS(VA)                                         161
000164                IB(I-2)=I-2                                             162
000165                E(I-2)=E(I-2)-VA                                        163
000166          280   IF (MODE-2) 320,300,285                                 164
000167          285   IF (IBC(I-2)) 325,295,290
000168          290   MOS=SB(I-2)                                             166
000169                GO TO 305                                               167
000170          295   MOS=SB(I-2)-1.0E-6*Y(I-2)-1.0E-                         168
000171                GO TO 310                                               169
000172          300   MOS=M(I-2)                                              170
000173                IF (IBC(I-2)) 325,310,305                               171
000174          305   A(1,I)=MOS                                              172
000175                GO TO 315                                               173
000176          310   A(1,I)=MOS*VN(I-2)                                      174
000177          315   E(1,2)=E(1,2)-MOS*VN(I-2)                               175
000178          320   CPF=CPF+CM(I-2,MVN(I-2)                                 176
```

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000179          325   CONTINUE                                                  177
000180                DO 330 I=1,IS                                             178
000181                BE(I)=E(I)                                                179
000182          330   BY(I)=Y(I)                                                180
000183                IER=0                                                      30
000184                IRE=0                                                      31
000185                SER=0.                                                     32
000186          C     - - - MAIN NON-BASE SPECIES LOOP                           33
000187          350   LIM=N+KR(8)                                                34
000188                IF (LIM-ISP) 730,355,355                                   35
000189          355   J=ISP                                                      36
000190                DO 725 IK=ISP,LIM                                          37
000191                IF (IK-N) 365,365,360                                      38
000192          360   E(J)=1.E-10                                                39
000193                IF (IFC(J)) 410,725,445                                    40
000194          365   IF (IFC(J)+1) 725,370,370                                  41
000195          370   IF (ITS) 390,375,390                                       42
000196          375   VN(J)=VN(J)/SUMN                                           43
000197                IF (IFC(J)) 390,385,380                                    44
000198          380   VN(J)=VN(J)/SUMC                                           45
000199                GO TO 390                                                  46
000200          385   Y(J)=Y(J)-SUML                                             47
000201          390   E(J)=VLNK(J)-Y(J)                                          48
000202                DO 405 I=1,IS                                              49
000203                IF (IBC(I)) 400,400,395                                    50
000204          395   FNU(I)=0.                                                  51
000205                GO TO 405                                                  52
000206          400   FNU(I)=VNU(J,I)                                            53
000207                E(J)=E(J)+FNU(I)*BY(I)                                     54
000208          405   CONTINUE                                                   55
000209                IF(KR(8)) 409,409,406
000210            406 IF(ITS) 408,407,408
000211            407 ECD(J)=(1.-EABE)*E(J)
000212            408 E(J)=E(J)-ECD(J)
000213            409 EAB=ABS(E(J))
000214                IF (IFC(J)) 410,390,445                                    56
000215          C     CONDENSED SPECIES                                          57
000216          410   EAB=E(J)
000217                IF (KR(8)) 425,415,415
000218          415   IF (T-TF(J)+.001) 420,420,425
000219          420   E=B=0.
000220                IF (KR(8)) 535,535,545
000221          425   IF (E(J)-EER) 535,535,430
000222          430   EER=E(J)
000223                IF (IER) 435,435,440
000224          435   IRE=ISPG+1
000225                IA=ISPG
000226          440   IE=IER
000227                IRE=IK
000228                GO TO 450
000229          445   ISPG=ISPG+1
000230                IE=ISPG
000231          450   YMR=0.
000232                IF (KR(8)) 460,455,455
000233          455   TMIN=AMAX1(TF(J),TMIN)
000234                DTR=T-TF(J)/NTC
000235          460   DO 465 I=1,ISPG
000236                A(I,IE)=0.
000237          465   A(IE,I)=0.
                      480 K=1,IS
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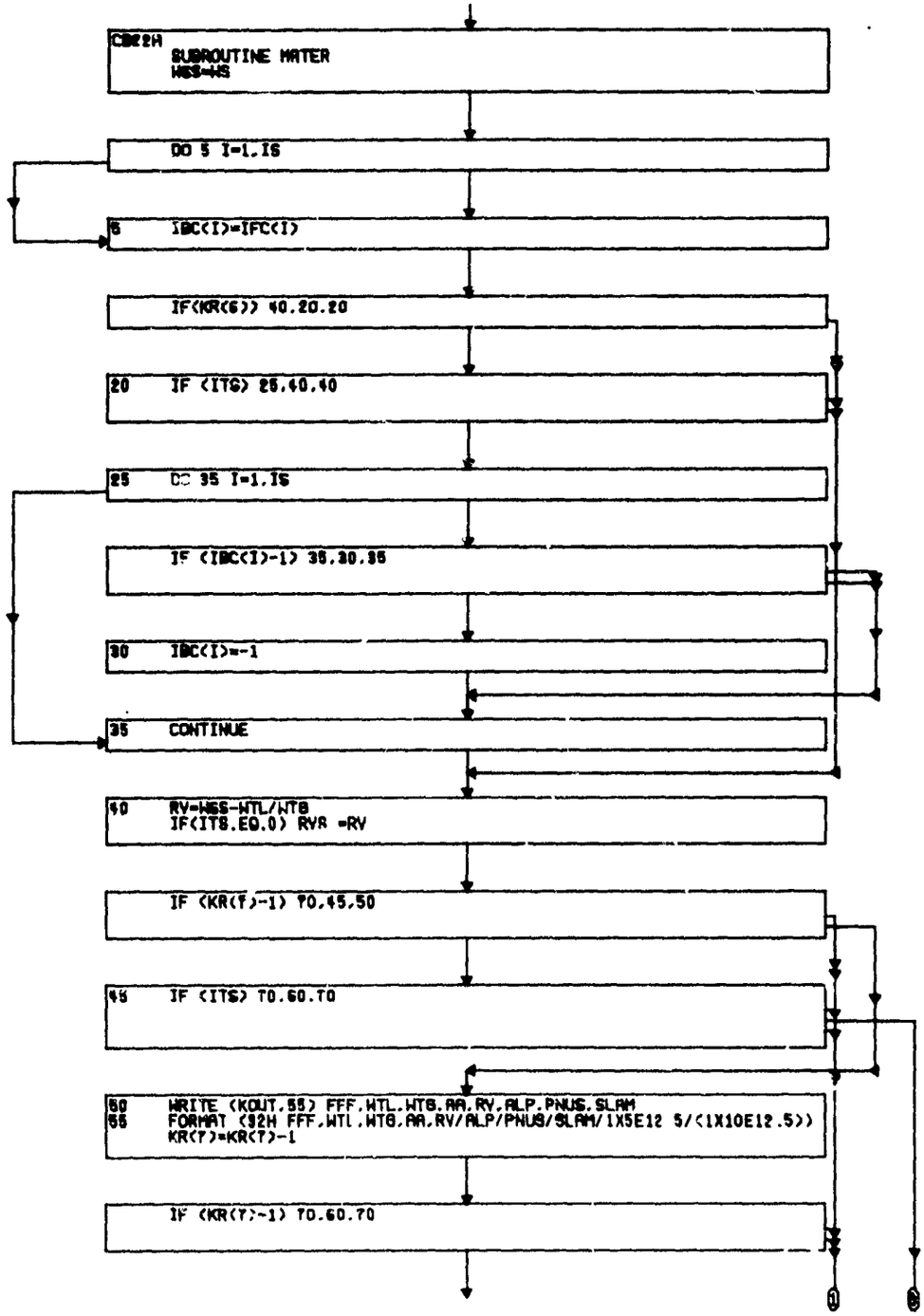
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000239                DUM1=VNU(J,K)                                          84
000240                IF (IBC(K)-1) 470,470,480                              85
000241          470   VA=DUM1*VN(J)                                          86
000242                A(K+2,IE)=DUM1-WTR*(PNUS(K)*GAMF(K)*WTG)               87
000243                BE(K)=BE(K)-VA                                         88
000244                IF (ABS(VA)-EB(K)) 480,480,475                         89
000245          475   EB(K)=ABS(VA)                                          90
000246                IB(K)=IK                                               91
000247          480   CONTINUE                                               92
000248                K=IE-ISP2                                              93
000249                IF (IK-N) 505,505,485                                  94
000250          485   JJ(K)=JC                                               95
000251                B(IE)=Y(JC)                                            96
000252                IF (JC-IS) 495,495,490                                 97
000253          490   A(IE,1)=TC(JC)                                         98
000254                B(IE)=E(JC)                                            99
000255          495   EAB=-B(IE)                                            100
000256                IF (IFCJC) 715,715,500                                101
000257          500   EAB=ABS(EAB)                                          102
000258                GO TO 715                                             103
000259          505   JJ(K)=J                                               104
000260                A(IE,1)=TC(J)                                         106 **-1
000261                B(IE)=E(J)                                            107
000262                IF (T+.001-TF(J)) 515,510,510                         108
000263          510   IF (KR(8)) 530,530,540                                109
000264          515   IF (MODE-1) 520,525,520                               110
000265          520   IF (KR(6)) 530,525,525                                111
000266          525   A(IE,IE)=1.E+10                                       112
000267                B(IE)=-VN(J)*1.001E+10                                113
000268                MODE=0                                                114
000269          530   IF (MODE-2) 535,575,580                               115
000270          535   IF (MODE-1) 715,540,715                               116
000271          540   IF (T-TF(J)-.001) 545,545,560                         117
000272          545   IF (JC) 555,555,550                                   118
000273          550   IF (E(J)-BJC) 725,725,555                             119
000274          555   BJC=E(J)                                              120
000275                JC=IK                                                 121
000276                IFCJC=IFC(JC)                                         122
000277                TMAX=TF(J)                                            123
000278                IF (KR(8)) 565,565,560                                124
000279          560   IF (MODE-2) 725,575,580                               125
000280          565   B(1)=BJC                                              126
000281                DO 570 K=1,IS                                         127
000282          570   A(1,K+2)=-PNU(K)                                      128
000283                A(1,1)=TC(J)                                          129
000284                GO TO 725                                             130
000285          575   HOS=H(J)                                              131
000286                GO TO 585                                             132
000287          580   HOS=EB(J)                                             133
000288          585   A(1,IE)=HOS                                           134
000289                A(1,2)=A(1,2)-VN(J)*HOS                               135
000290                CPF=CPF+CP(J)*VN(J)                                   136
000291                GO TO 715                                             137
000292          C     GAS PHASE SPECIES                                     138
000293          590   IP(J)=0                                               139
000294                IF (VN(J)) 595,715,595                                140
000295          595   IQ=0                                                  141
000296                CPG=CPG+VN(J)*CP(J)                                   142
000297                IF (KR(6)) 625,600,605                                143
000298          600   FFJ=FFF/FF(J)                                         144
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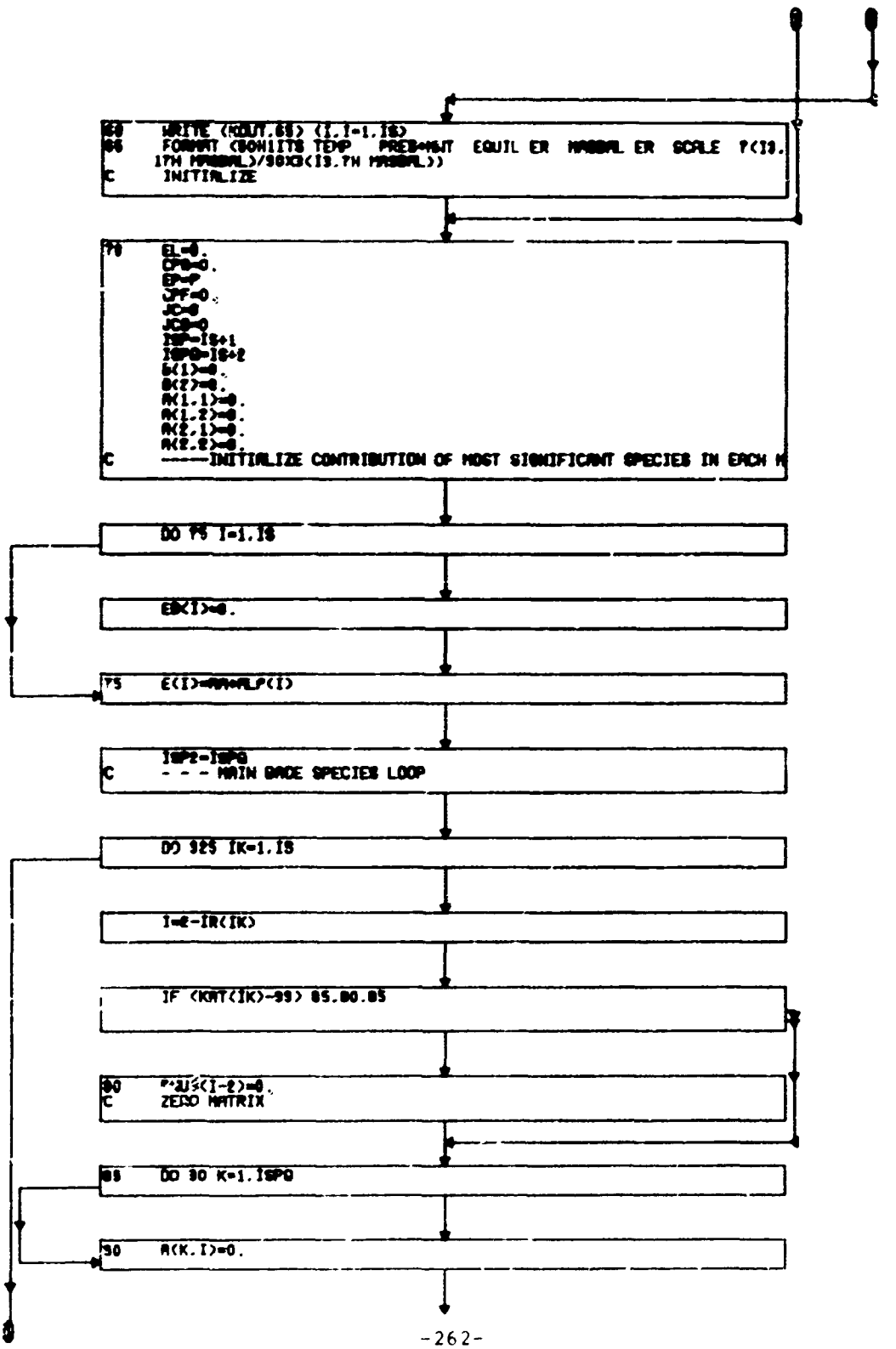
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000299          605   DUM1=WTM(J)/WTG*VN(J)                                  145
000300                DUM2=DUM1/WTG*WTL                                      146
000301                IF (KR(6)) 610,610,625                                 147
000302          610   IF (KR(4)) 615,615,620                                 148
000303          615   DUM1=0.                                                149
000304                FFJ=1.0                                                150
000305                GO TO 625                                              151
000306          620   DUM1=DUM1*(1.-FFJ)                                     152
000307          625   DO 680 KI=1,IS                                         153
000308                I=2-IR(KI)                                             154
000309                VA=VNU(J,I-2)*VN(J)                                    155
000310                IF (KAT(KI)-99) 630,645,630                            156
000311          630   IF (KR(6)) 645,640,635                                 157
000312          635   VA=VA*RV*VN(J)*(VLAM(J,I-2)*GAMM(I-2)*M(J))            158
000313                BE(I-2)=BE(I-2)-VA                                     159
000314                ABSVA=ABS(VA)                                          160
000315                VA=VA*PNUS(I-2)*DUM2                                   161
000316                GO TO 650                                              162
000317          640   VB=VA*FFJ                                              163
000318                VA=RV*VA+VB                                            164
000319                BE(I-2)=BE(I-2)-VA                                     165
000320                ABSVA=ABS(VA)                                          166
000321                VA=VA+SLAM(I-2)*DUM1+DUM2*PNUS(I-2)                    167
000322                GO TO 650                                              168
000323          645   BE(I-2)=BE(I-2)-VA                                     169
000324                ABSVA=ABS(VA)                                          170
000325          650   IF (ABSVA-EBL(I-2)) 660,660,655                        171
000326          655   IQ=1                                                   172
000327                IF (ABSVA-EB(I-2)) 670,670,665                         173
000328          660   IF (ABS(VA)-EBL(I-2)) 680,680,670                      174
000329          665   EB(I-2)=ABSVA                                          175
000330                IR(I-2)=IK                                             176
000331          670   DO 675 K=3,ISP2                                        177
000332          675   A(I,K)=A(I,K)+VA*FNU(K-2)                              178
000333                B(I)=B(I)-VA*E(J)                                      179
000334                A(I,1)=A(I,1)-VA*TC(J)                                 180
000335                A(2,I)=A(2,I)+VN(J)*PNU(I-2)                           181
000336          680   CONTINUE                                               182
000337                IF (IQ) 715,715,685                                    183
000338          685   EP=EP-VN(J)                                            184
000339                IP(J)=-1                                               185
000340                B(2)=B(2)-VN(J)*E(J)                                   186
000341                A(2,1)=A(2,1)-VN(J)*TC(J)                              187
000342                IF (MODE-2) 710,690,695                                188
000343          690   HOS=M(J)*VN(J)                                         189
000344                GO TO 700                                              190
000345          695   HOS=VN(J)*(BB(J)-1.9869*Y(J)-1.9869)                   191
000346          700   DO 705 I=3,ISP2                                        192
000347          705   A(1,I)=HOS*PNU(I-2)+A(1,I)                             193
000348                A(1,2)=A(1,2)-HOS                                      194
000349                A(1,1)=A(1,1)-HOS*TC(J)                                195
000350                B(1)=B(1)-HOS*E(J)                                     196
000351          710   CPF=CPF+VN(J)*CP(J)                                    197
000352          715   IF (EL-EAB) 720,725,725                                198
000353          720   EL=EAB                                                 199
000354          725   J=J+1                                                  200
000355          730   CONTINUE                                               201
000356                ISP3=IS+3                                               29
000357                IF (MODE-2) 785,735,740                                 30
000358          735   CPA=CPF+T                                               31
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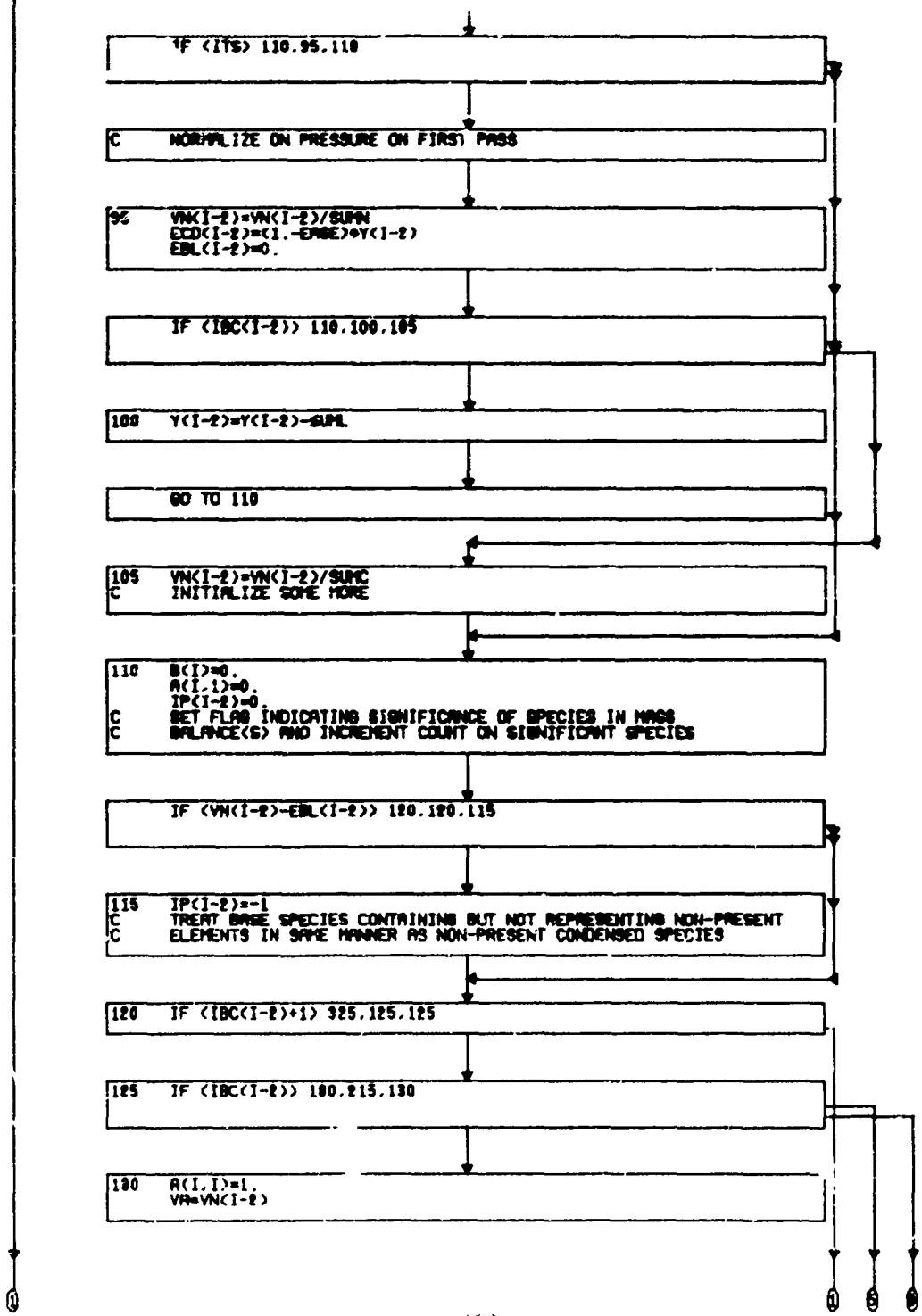
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000359                SHMLT=HMELT*VN(MELT)                                    32
000360                EHS=AA*HIP+A(1,2)                                       33
000361                IF (KKJ+1) 750,740,750                                  34
000362          740   DUM1=SVA/AA*T*T                                         35
000363                EHS=AA*SVC-DUM1+A(1,2)                                  36
000364                HIP=-A(1,2)/AA                                          37
000365                A(1,2)=-AA*SVC-DUM1                                     38
000366                CPA=(CPF+2.*DUM1/T)*T                                   39
000367                DUM2=SVB/AA*T                                           40
000368                P=P-EP                                                  41
000369                EP=0.                                                   42
000370                IF (ABS(EHS/AA)-10.) 745,745,750                        43
000371          745   EP=-P+SVD-DUM2                                          44
000372                A(2,1)=A(2,1)+DUM2                                      45
000373                A(2,2)=-DUM2                                            46
000374          750   IF (KR(2)-MODE) 765,755,765                             47
000375          755   A(1,2)=-AA*HIP                                          48
000376                GO TO 765                                               49
000377          760   CPA=CPF                                                 50
000378                SHMLT=SMELT*VN(MELT)                                    51
000379                EHS=AA*SIP+A(1,2)+1.9869*(P-EP)                         52
000380                A(1,2)=-AA*SIP                                          53
000381          765   B(1)=B(1)+EHS                                           54
000382                A(1,1)=A(1,1)+CPA                                       55
000383                IF (SHMLT) 785,785,770                                  56
000384          770   IF (EHS) 785,785,775                                    57
000385          775   EHS=EHS-SHMLT                                           58
000386                B(1)=B(1)-SHMLT                                         59
000387                IF (EHS) 780,785,785                                    60
000388          780   FLIQ=1.+EHS/SHMLT                                       61
000389                MODE=0                                                  62
000390                A(1,1)=1.E+10                                           63
000391                TMIN=500.                                               64
000392                TMAX=5000.                                              65
000393          785   ENL=ABS(EP)/P*100.                                      66
000394                DO 810 I=3,ISP2                                         67
000395                E(I-2)=BE(I-2)                                          69
000396                EBL(I-2)=EB(I-2)*1.E-7                                  70
000397                A(I,2)=-AA*ALP(I-2)                                     71
000398                IF (IFC(I-2)-1) 795,795,790                             72
000399          790   NFM=NFM+1                                               73
000400                GO TO 810                                               74
000401          795   IF (KR(6)) 805,805,800                                  75
000402          800   A(1,1)=A(1,1)+GAMM(I-2)*T*CPG                           76
000403                E(I-2)=E(I-2)+WTL*GAMF(I-2)                             77
000404          805   ER=E(I-2)                                               78
000405                ABER=ABS(ER)/(EB(I-2)+1.E-20)                           79
000406                ENL=AMAX1(ABER,ENL)                                     80
000407                B(I)=B(I)+ER                                            81
000408          810   CONTINUE                                                82
000409                IF (ISP2-ISPG) 815,880,880                              83
000410          815   IV=0                                                    84
000411                JZ=0                                                    85
000412          C     ADD CONDENSED NONBASE SPECIES TO ARRAY                  86
000413                DO 840 IE=ISP3,ISPG                                     87
000414                J=IE-ISP2                                               88
000415                J=JJ(J)                                                 89
000416                IF (J-IS) 820,820,830                                   90
000417          820   DO 825 K=1,IS                                           91
000418          825   A(IE,K+2)=0.                                            92
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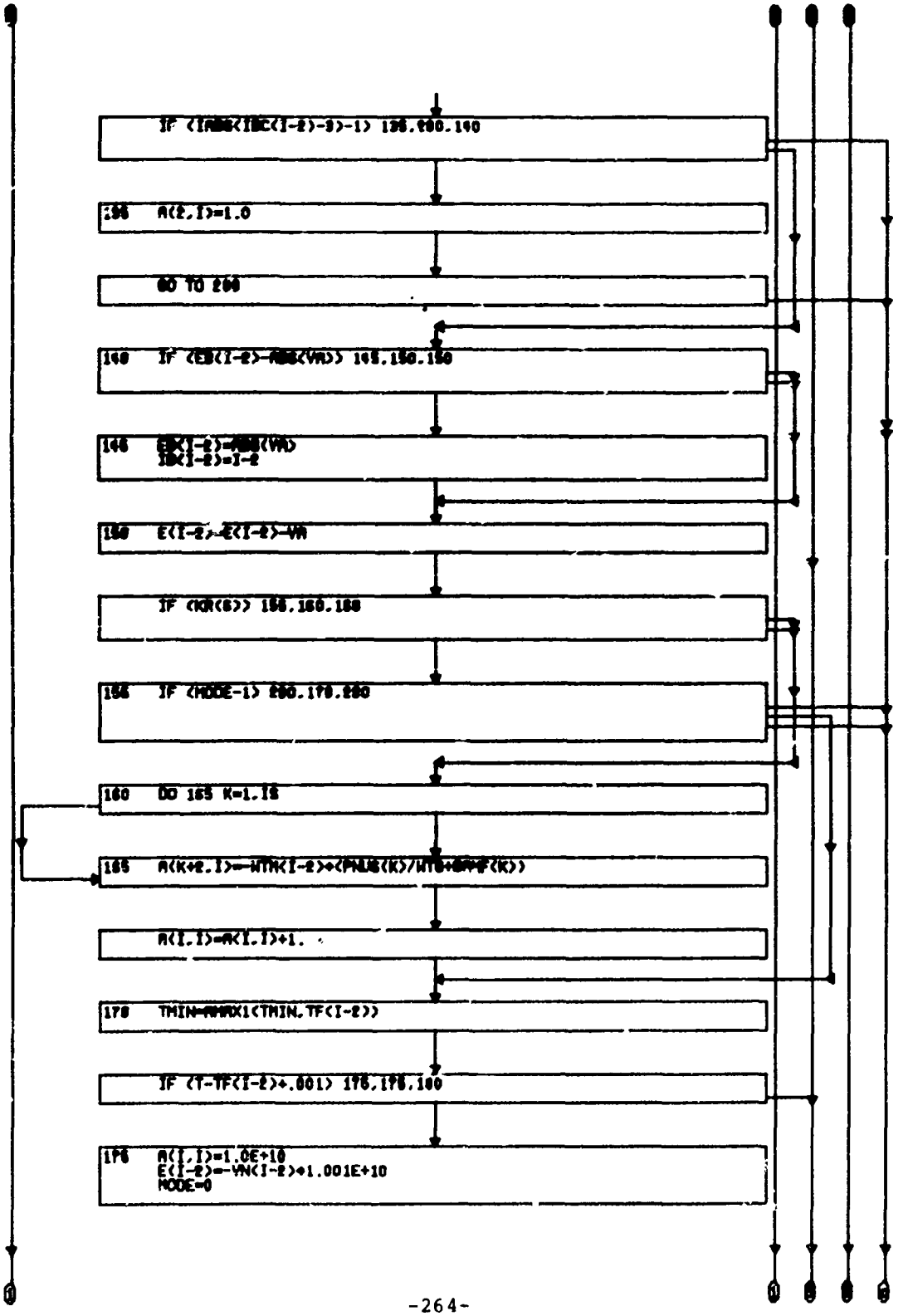
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000419                A(IE,J+2)=-1.0                                          93
000420                GO TO 840                                               94
000421          830   DO 835 K=1,IS                                           95
000422          835   A(IE,K+2)=-VNU(J,K)                                     96
000423          840   CONTINUE                                                97
000424          C     ELIMINATE TERMS CORRESPONDING TO PRESENT BASE CONDENSED  98
000425                DO 855 K=1,IS                                           99
000426                IF (IFC(K)) 855,855,845                                 100
000427          845   DO 850 IE=ISP3,ISPQ                                     101
000428          850   A(IE,K+2)=0.                                            102
000429          855   CONTINUE                                                103
000430          880   B(2)=EP+B(2)                                            111
000431                IF(KR(6)) 5979,5979,5976
000432           5976 ENL=ABS(EP)/P*100.
000433                IF(MT) 5973,5973,5974
000434           5974 CALL KINET
000435           5973 CONTINUE
000436                DO 5975 I=1,IS
000437                IF(EB(I)) 5986,5986,5985
000438           5985 ER(I)=AMAX1(EB(I),ABS(E(I)))
000439                IF(ITS) 5978,5977,5978
000440           5977 EESE(I)=E(I)*(1.-EASE)
000441           5978 E(I)=E(I)-EESE(I)
000442                B(I+2)=B(I+2)-EESE(I)
000443           5986 ER(I)=ABS(EB(I))
000444                IF(IFC(I)-1) 5971,5971,5975
000445           5971 ENL=AMAX1(ENL,ABS(E(I)/(EB(I)+1.E-20)))
000446           5975 CONTINUE
000447           5979 CONTINUE
000448                IF (MODE-1) 910,890,885                                 1
000449          885   IF (ABS(EMB/A(1,1))-.0001) 910,910,920
000450          890   IF (IFCJC) 895,900,905                                  1
000451          895   IF (JC-IRE) 900,905,900                                 1
000452          905   MODE=0                                                  117
000453                TMIN=TTMIN                                              118
000454                TMAX=TTMAX                                              119
000455          900   IF (ABS(B(1))-1.E-4) 910,910,920                        116
000456          910   IF (EL-1.E-4) 915,915,920                               121
000457          915   IF (ENL-1.E-5) 935,935,920                              122
000458          920   IN=ISPQ                                                 123
000459                IL=1                                                    124
000460                IF (MODE) 925,925,930                                   125
000461          925   IN=ISPQ-1                                               126
000462                IL=2                                                    127
000463                X(1)=0.                                                 128
000464          930   RETURN                                                  129
000465          935   IT=ITS+1                                                130
000466                ITS=-1
000467                GO TO 930                                               132
000468                END                                                     133
000469
```

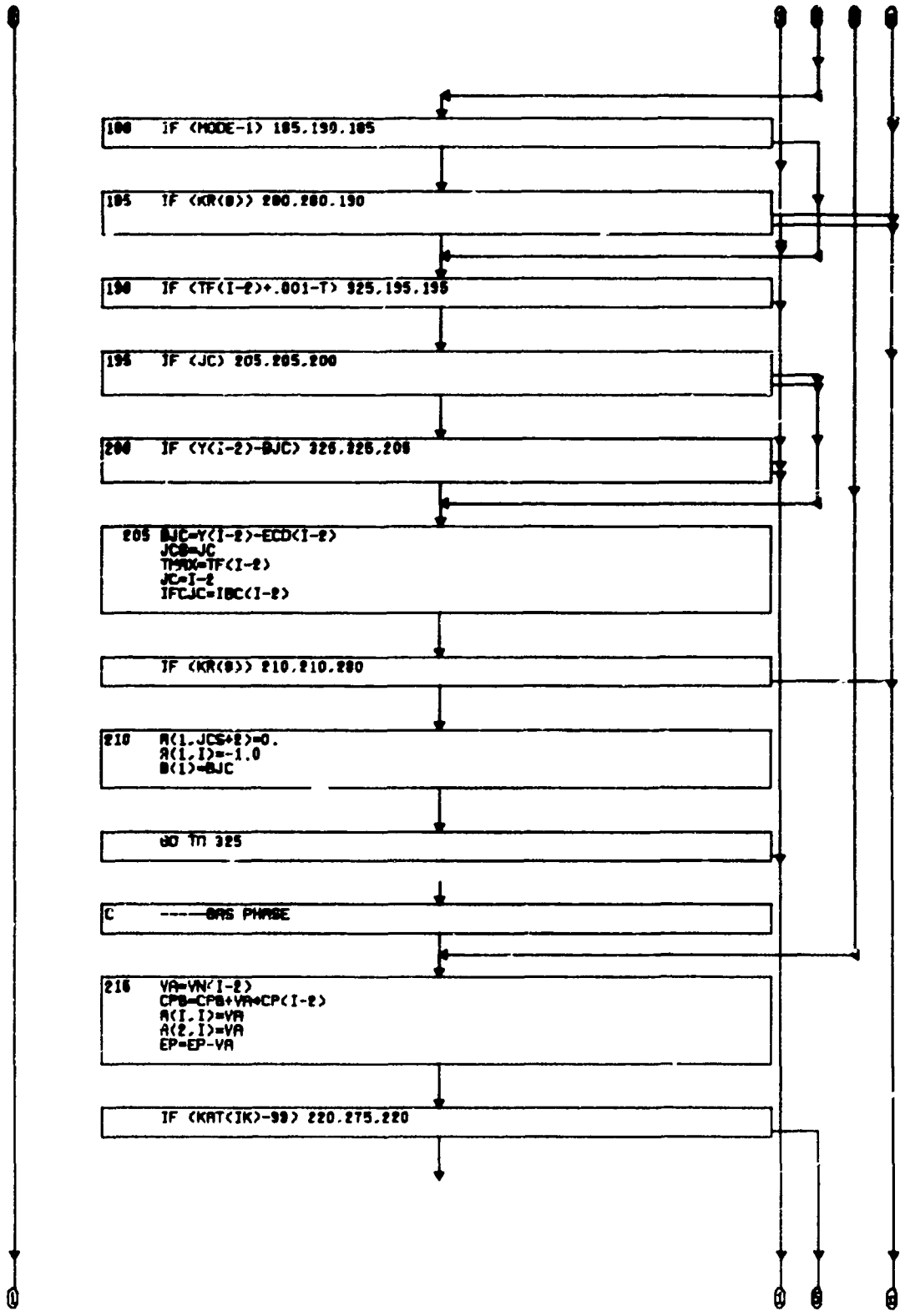
c. Flow Chart

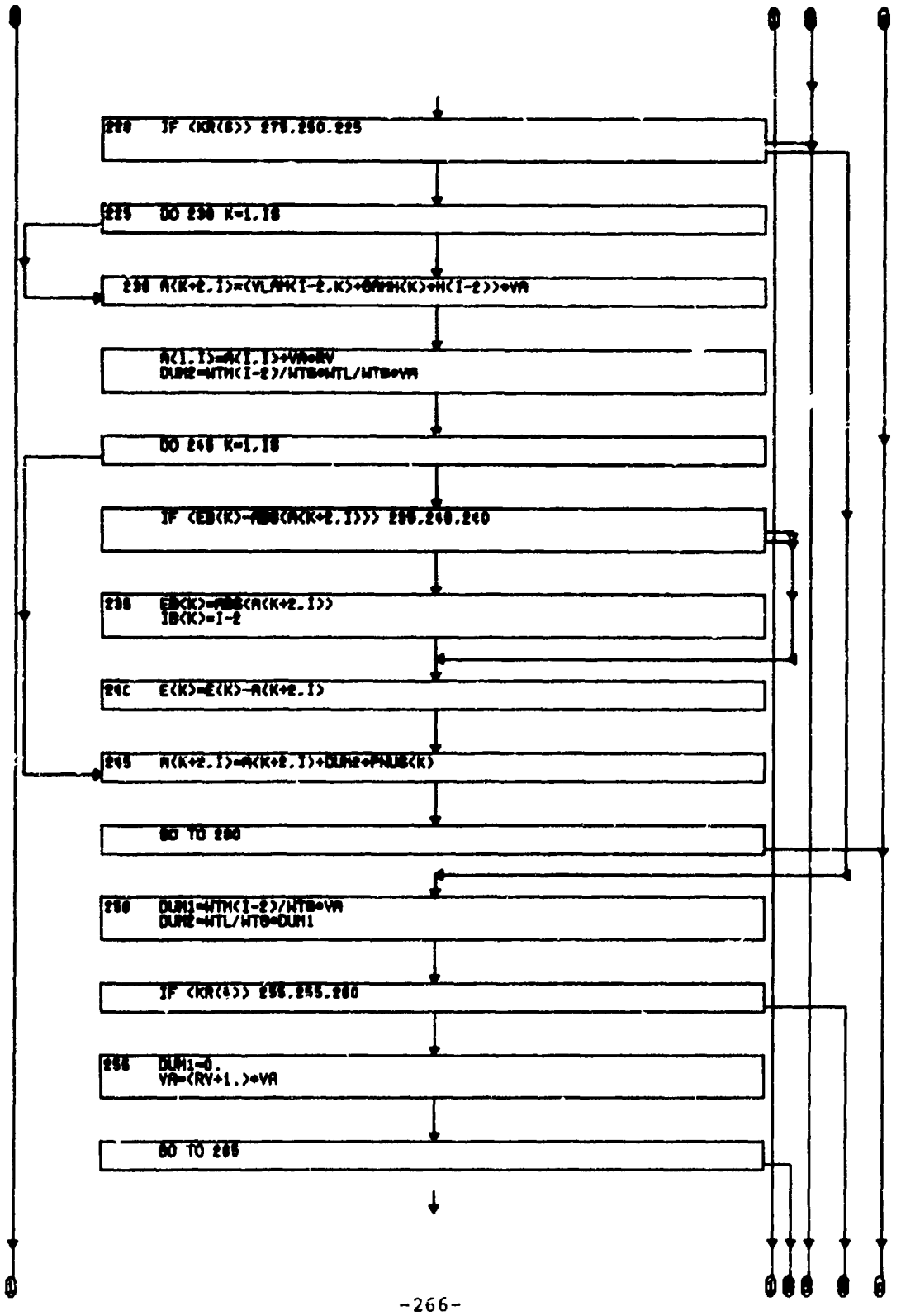

CBR2H
SUBROUTINE MATER
WSS=WS
DO 5 I=1,IS
5 IBC(I)=IFC(I)
IF(KR(6)) 40,20,20
20 IF (ITS) 25,40,40
25 DO 35 I=1,IS
IF (IBC(I)-1) 35,30,35
30 IBC(I)=-1
35 CONTINUE
40 RV=WSS-WTL/WTB
IF(ITS.EQ.0) RVR =RV
IF (KR(7)-1) 70,45,50
45 IF (ITS) 70,60,70
50 WRITE (KOUT,55) FFF,WTL,WTB,AA,RV,ALP,PNUS,SLAM
55 FORMAT (32H FFF,WTL,WTB,AA,RV/ALP/PNUS/SLAM/1X5E12 5/(1X10E12.5))
KR(7)=KR(7)-1
IF (KR(7)-1) 70,60,70

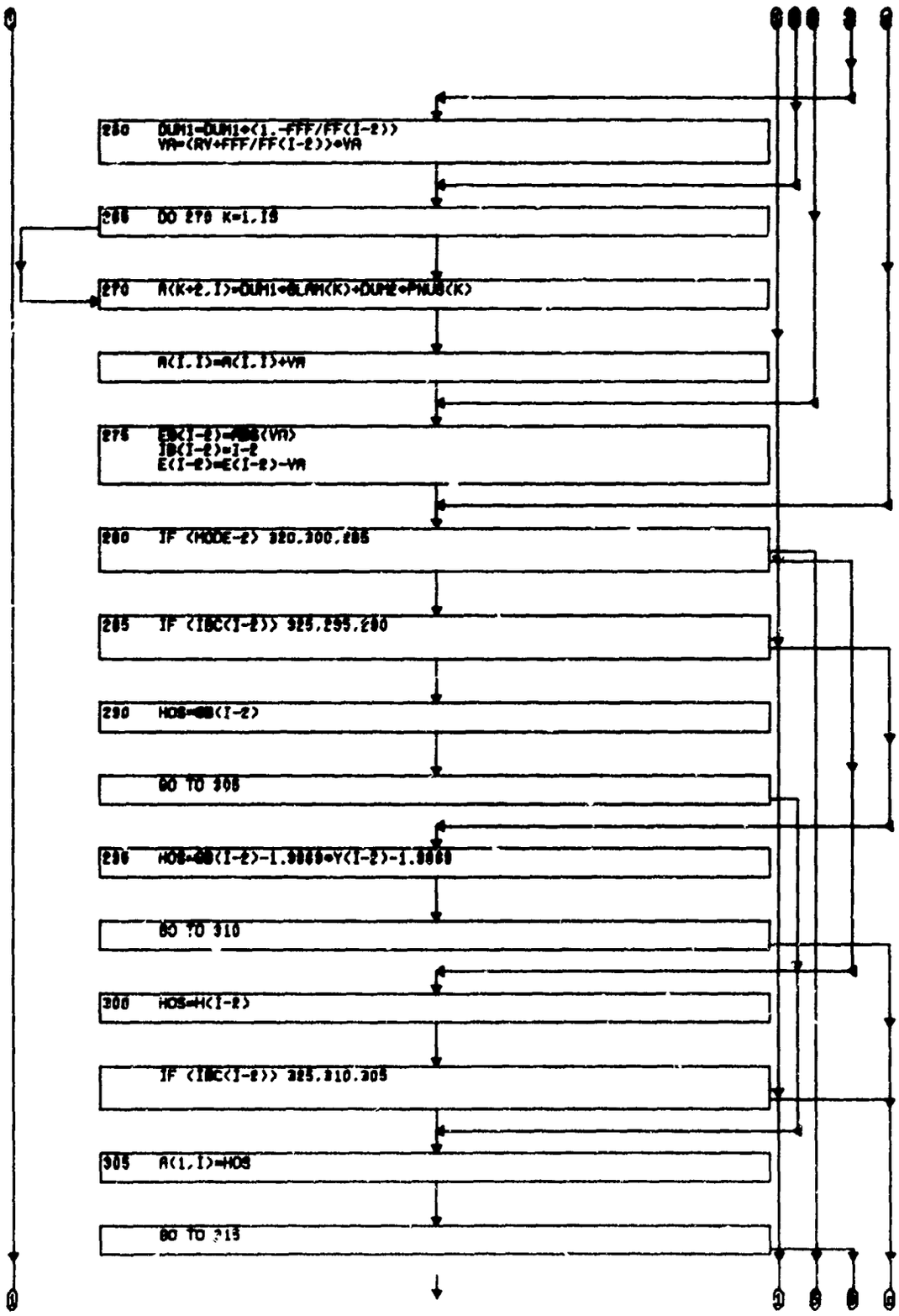

WRITE (KOUT,86) (I,I=1,IS)
FORMAT (80H1ITS TEMP PRES+H2T EQUIL ER MASBAL ER SCALE F(I3.
17H MASBAL)/90X3(I3,7H MASBAL))
C INITIALIZE
EL=0.
CPS=0.
EP=P
JPF=0
JC=0
JCR=0
ISP=IS+1
ISPG=IS+2
B(1)=0.
B(2)=0.
A(1,1)=0.
A(1,2)=0.
A(2,1)=0.
A(2,2)=0.
C -----INITIALIZE CONTRIBUTION OF MOST SIGNIFICANT SPECIES IN EACH M
DO 75 I=1,IS
EBK(I)=0.
75 E(I)=AA*ELP(I)
ISP2=ISPG
C - - - MAIN BASE SPECIES LOOP
DO 925 IK=1,IS
I=E-IR(IK)
IF (KAT(IK)-99) 85,80,85
80 A(I-2)=0.
C ZERO MATRIX
85 DO 90 K=1,ISPG
90 A(K,I)=0.

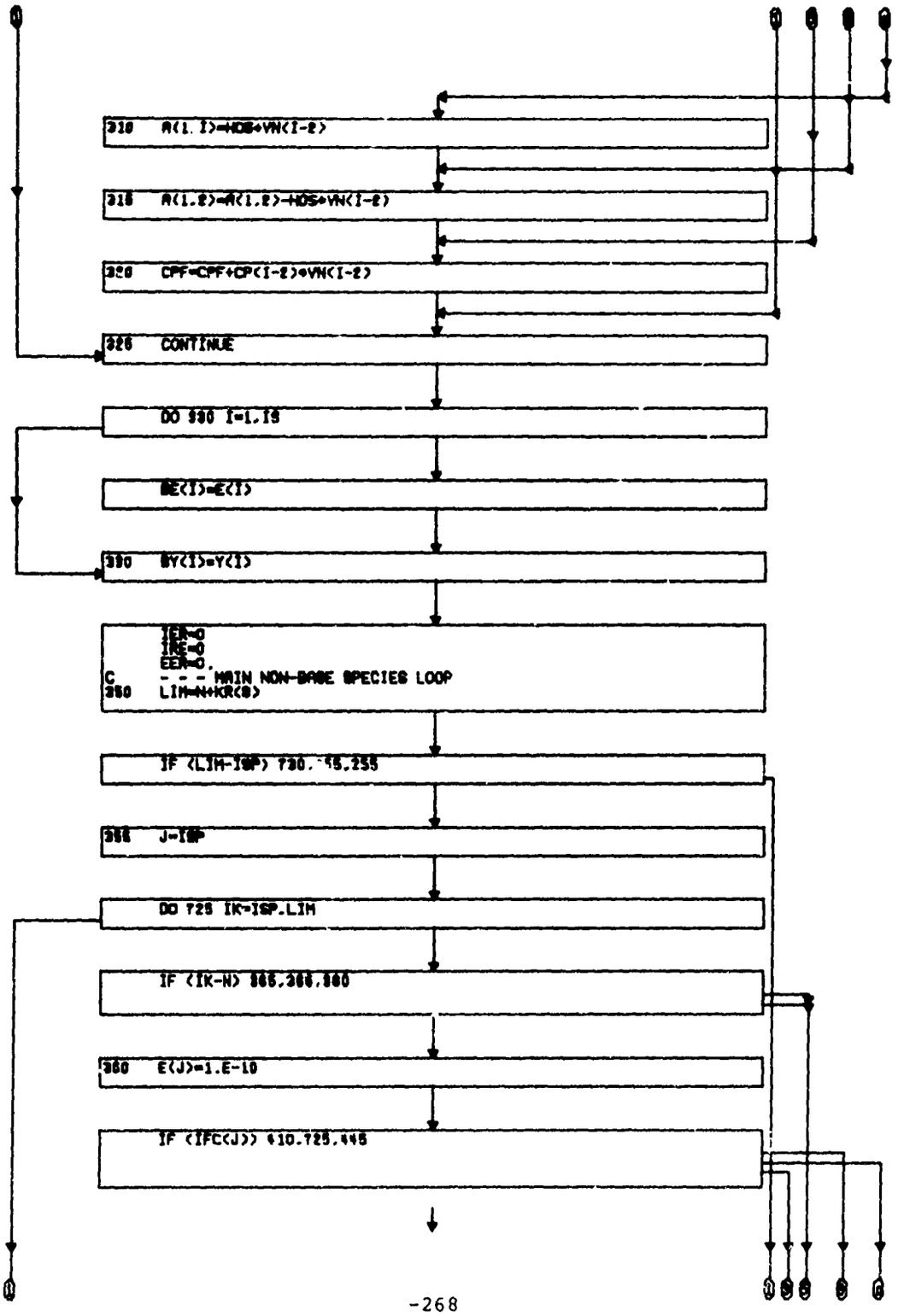

IF (ITS) 110,95,110
C NORMALIZE ON PRESSURE ON FIRST PASS
95 VN(I-2)=VN(I-2)/SUMN
ECD(I-2)=(1.-ERGE)*Y(I-2)
EBL(I-2)=0.
IF (IBC(I-2)) 110,100,105
100 Y(I-2)=Y(I-2)-SUML
GO TO 110
105 VN(I-2)=VN(I-2)/SUMC
C INITIALIZE SOME MORE
110 B(I)=0.
A(I,1)=0.
IP(I-2)=0
C SET FLAG INDICATING SIGNIFICANCE OF SPECIES IN MASS
C BALANCE(G) 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) 125,125,125
125 IF (IBC(I-2)) 130,215,130
130 A(I,I)=1.
VA=VN(I-2)

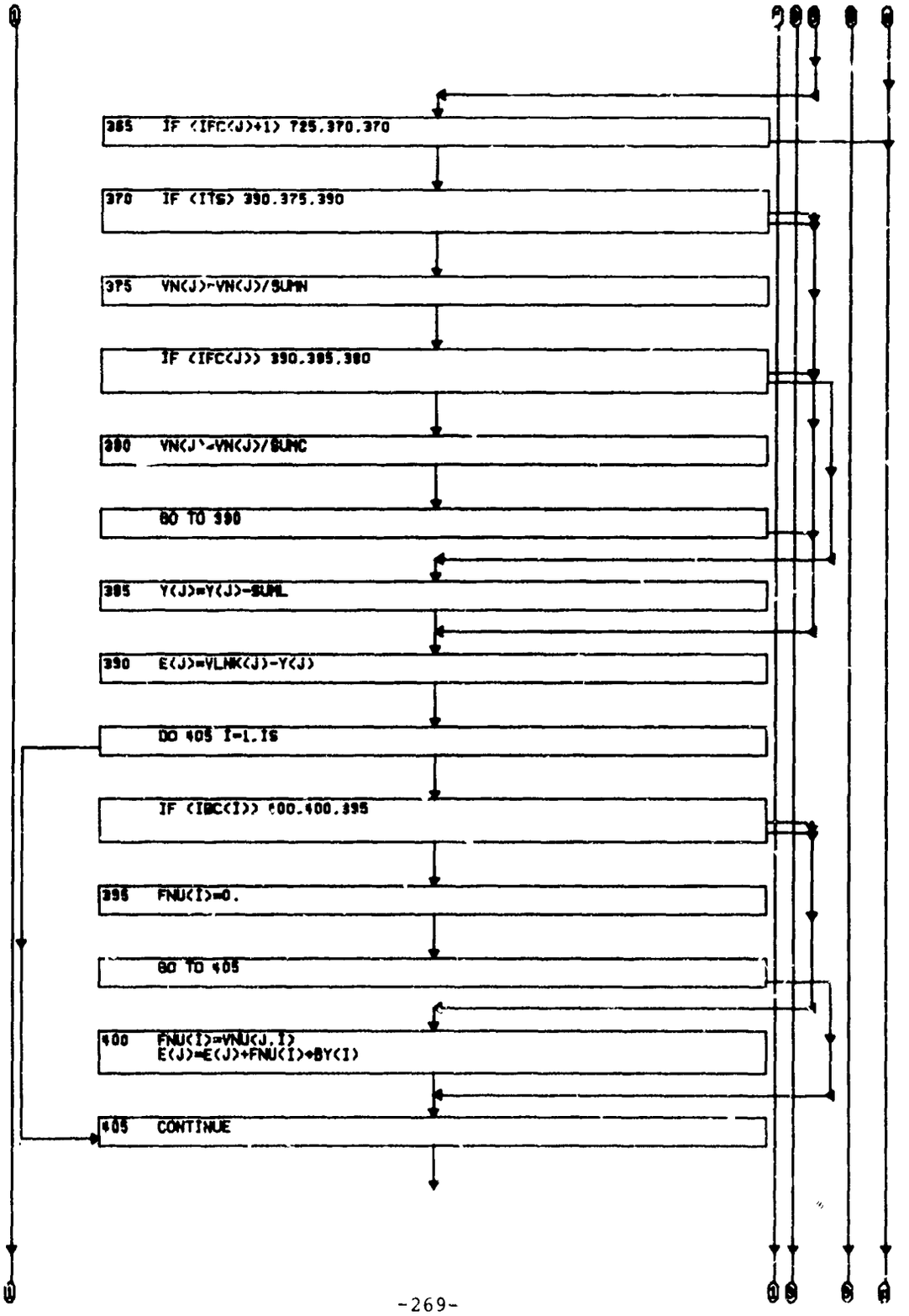

IF (IABS(IBC(I-2)-3)-1) 130,200,140
130 A(2,I)=1.0
GO TO 200
140 IF (E3(I-2)-ABS(VN)) 145,150,150
145 E3(I-2)=ABS(VN)
IB(I-2)=I-2
150 E(I-2)=E(I-2)-VN
IF (KK(6)) 155,160,160
155 IF (MODE-1) 200,170,200
160 DO 165 K=1,18
165 A(K+2,I)=-WTN(I-2)*(PHLS(K)/WTS+BIAS(K))
A(I,I)=A(I,I)+1.
170 TMIN=AMAX1(TMIN,TF(I-2))
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

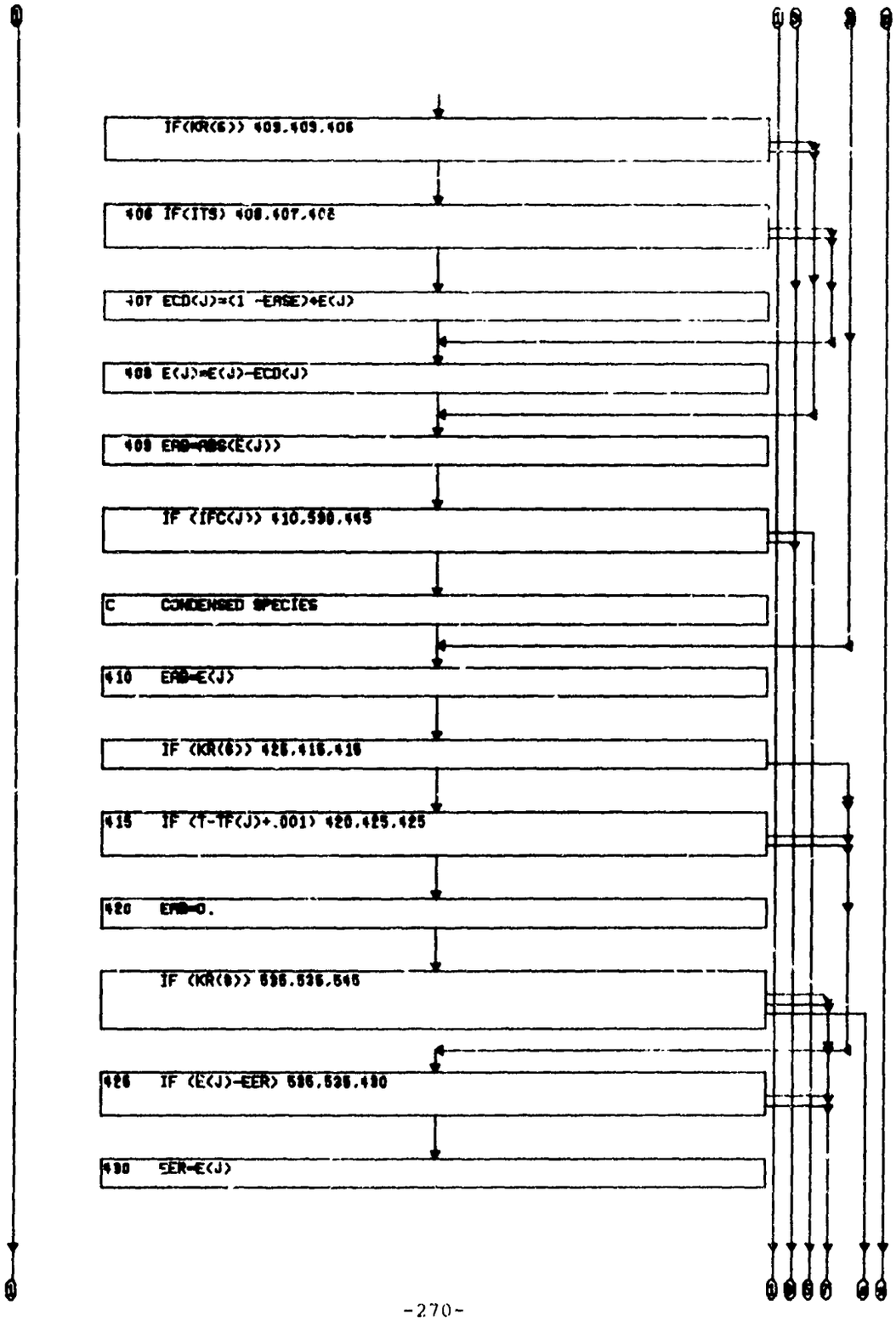

180 IF (MODE-1) 185,190,185
185 IF (KR(8)) 200,200,190
190 IF (TF(I-2)+.001-T) 325,195,195
195 IF (JC) 205,205,200
200 IF (Y(I-2)-BJC) 225,225,205
205 BJC=Y(I-2)-ECD(I-2)
JCB=JC
TMAX=TF(I-2)
JC=I-2
IFCJC=IBC(I-2)
IF (KR(8)) 210,210,200
210 A(1,JCS+2)=0.
A(1,I)=-1.0
B(I)=BJC
GO TO 325
C -----GAS PHASE
215 VA=VN(I-2)
CPB=CPB+VA*CP(I-2)
A(I,I)=VA
A(2,I)=VA
EP=EP-VA
IF (KAT(IK)-99) 220,275,220

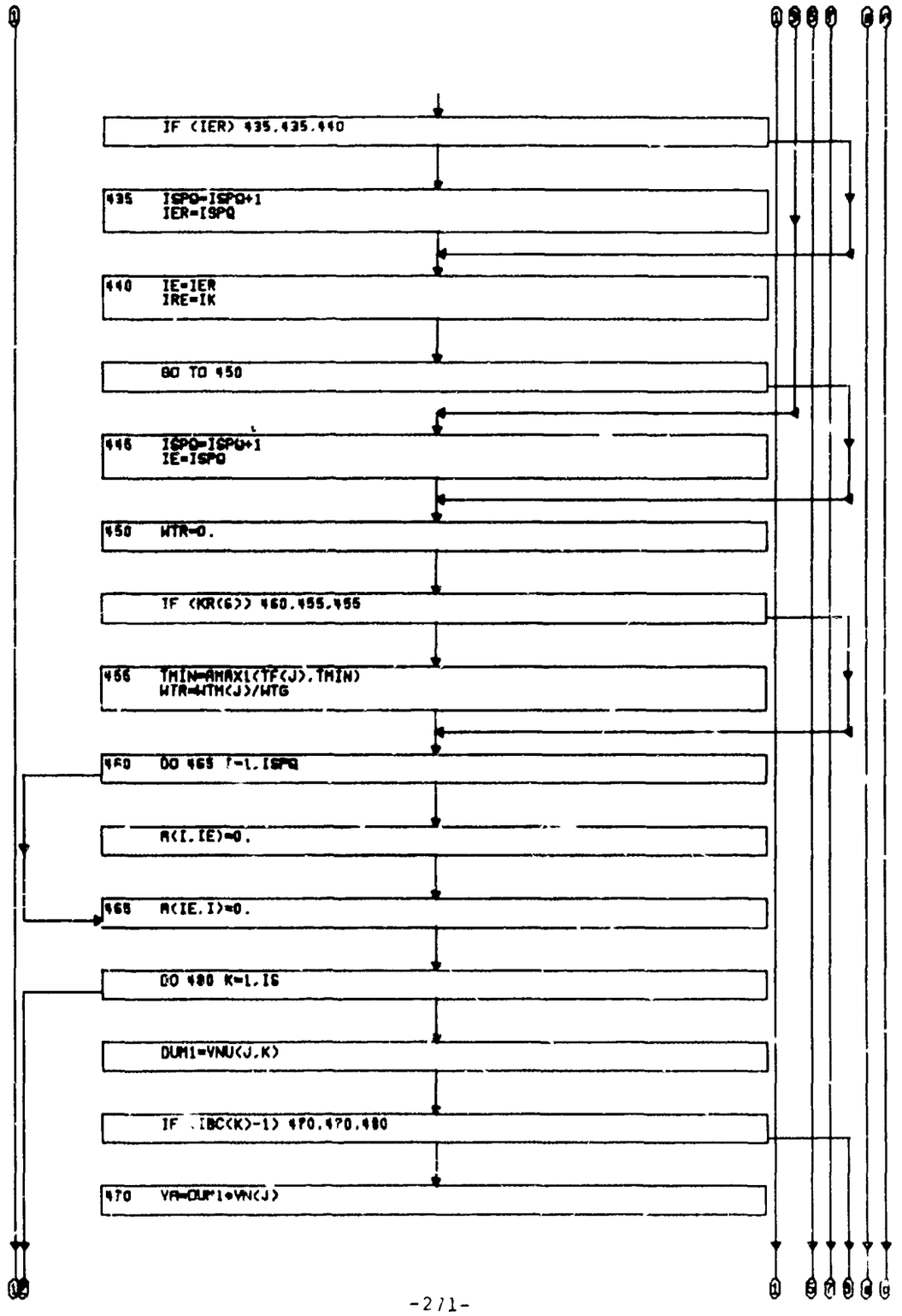

220 IF (KR(6)) 270,250,225
225 DO 230 K=1,18
230 A(K+2,I)=(VL*A(I-2,K)+GAMA(K)*H(I-2))*VA
A(1,I)=A(1,I)+VA*RV
DUM2=WTH(I-2)/WTB*WTL/WTB*VA
DO 240 K=1,18
IF (EB(K)-ABS(A(K+2,I))) 235,240,240
235 EB(K)=ABS(A(K+2,I))
IB(K)=I-2
240 E(K)=E(K)-A(K+2,I)
245 A(K+2,I)=A(K+2,I)+DUM2*PAUB(K)
GO TO 280
250 DUM1=WTH(I-2)/WTB*VA
DUM2=WTL/WTB*DUM1
IF (KR(4)) 255,255,260
255 DUM1=0.
VA=(RV+1.)*VA
GO TO 265

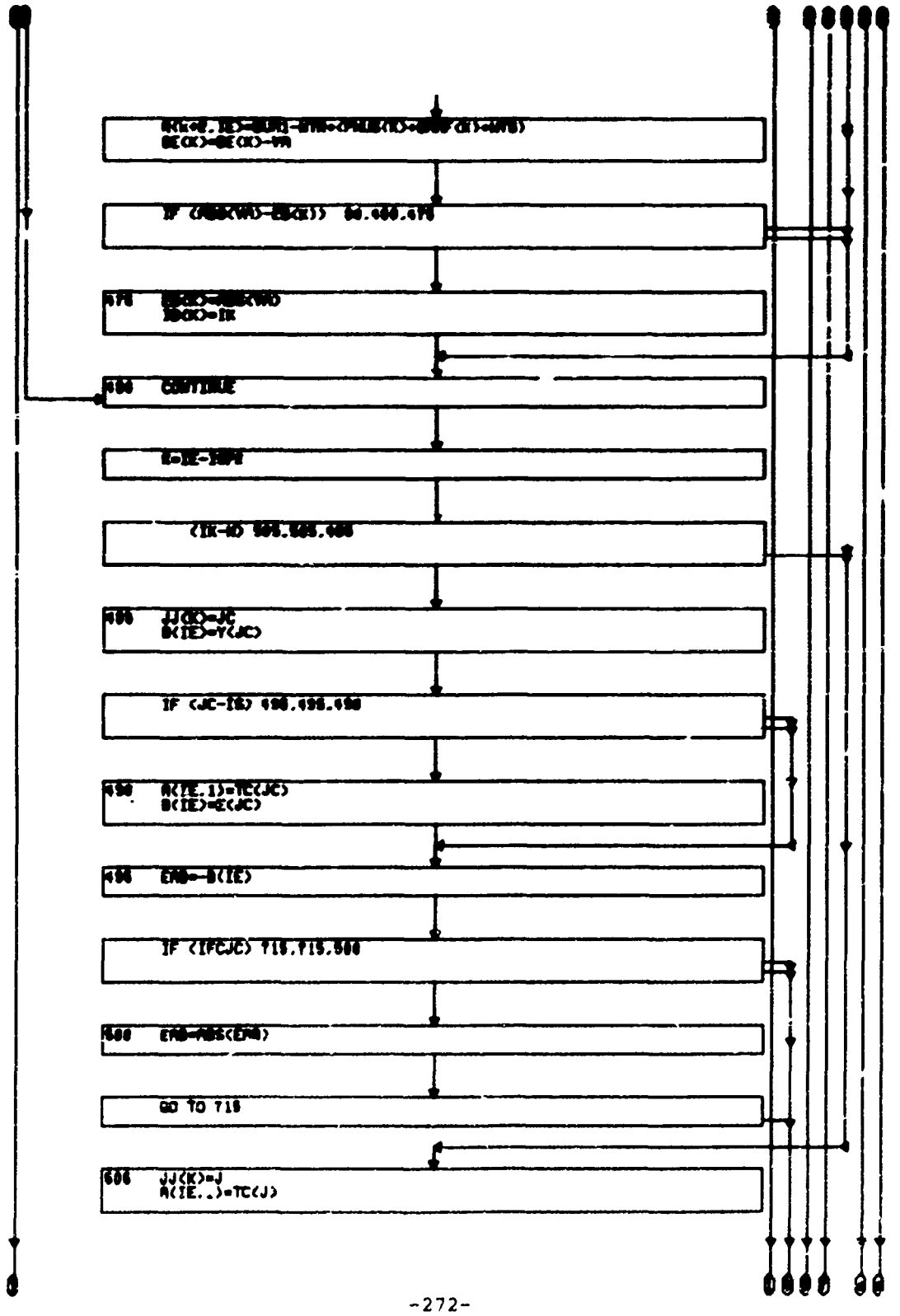

260 DUM1=DUM1+(1.-FFF/FF(I-2))
VA=(RV+FFF/FF(I-2))*VA
265 DO 270 K=1,15
270 A(K+2,I)=DUM1*ALAM(K)+DUM2*PHUB(K)
A(I,I)=A(I,I)+VA
275 E(I-2)=ABS(VA)
IB(I-2)=I-2
E(I-2)=E(I-2)-VA
280 IF (MODE-2) 320,300,285
285 IF (IBC(I-2)) 325,295,290
290 HOS=HB(I-2)
GO TO 305
296 HOS=HB(I-2)-1.9999*V(I-2)-1.9999
GO TO 310
300 HOS=H(I-2)
IF (IBC(I-2)) 325,310,305
305 A(1,I)=HOS
GO TO 315

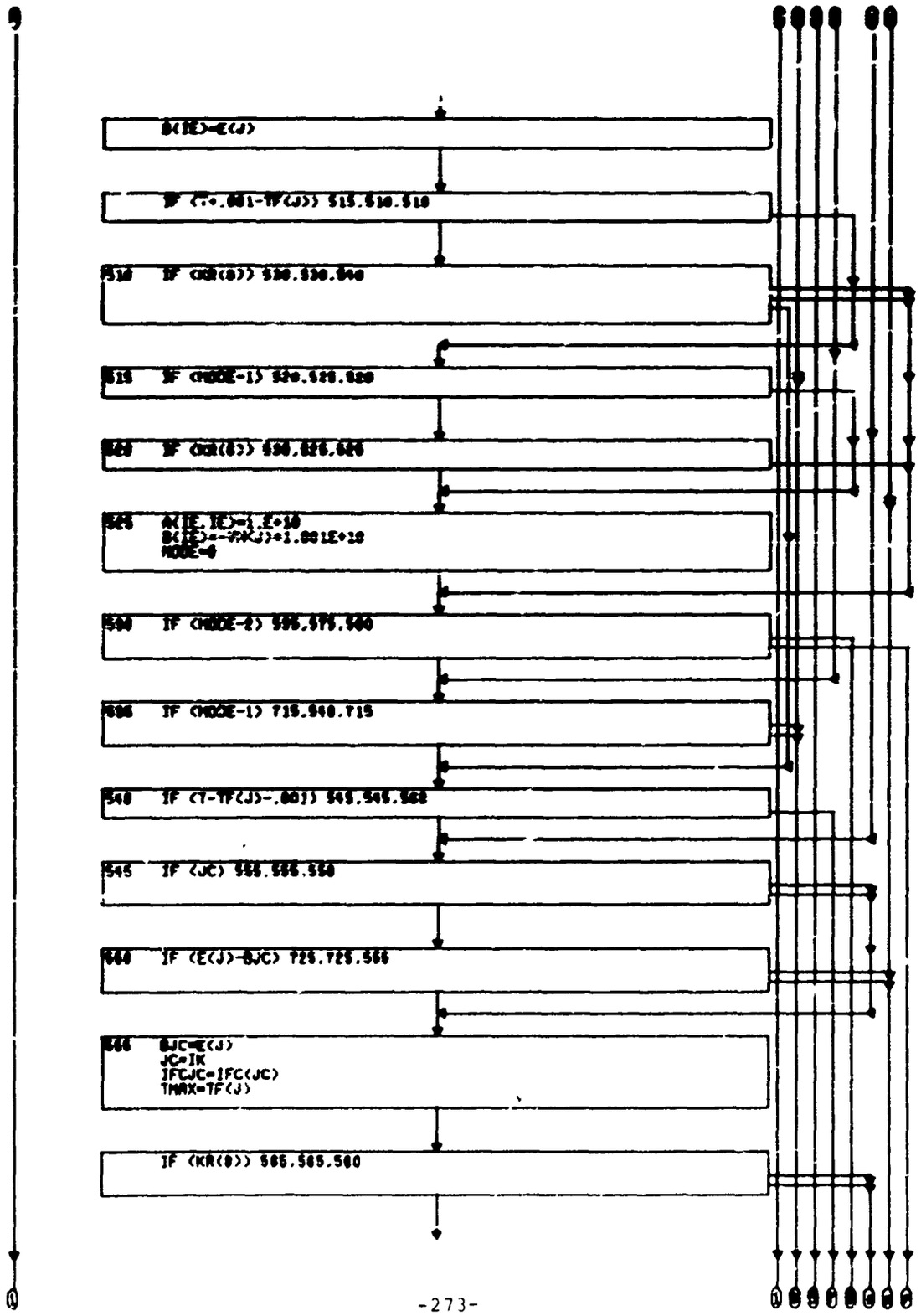

310 A(1,I)=HDS*VN(I-2)
315 A(1,2)=A(1,2)-HDS*VN(I-2)
320 CPF=CPF+CP(I-2)*VN(I-2)
325 CONTINUE
DO 330 I=1,IS
BE(I)=E(I)
330 BY(I)=Y(I)
IEN=0
IRE=0
EEN=0.
C - - - MAIN NON-BASE SPECIES LOOP
350 LIM=N+KR(8)
IF (LIM-ISP) 730, 45,355
355 J=ISP
DO 725 IK=ISP,LIM
IF (IK-N) 365,360,360
360 E(J)=1.E-10
IF (IFC(J)) 410,725,445

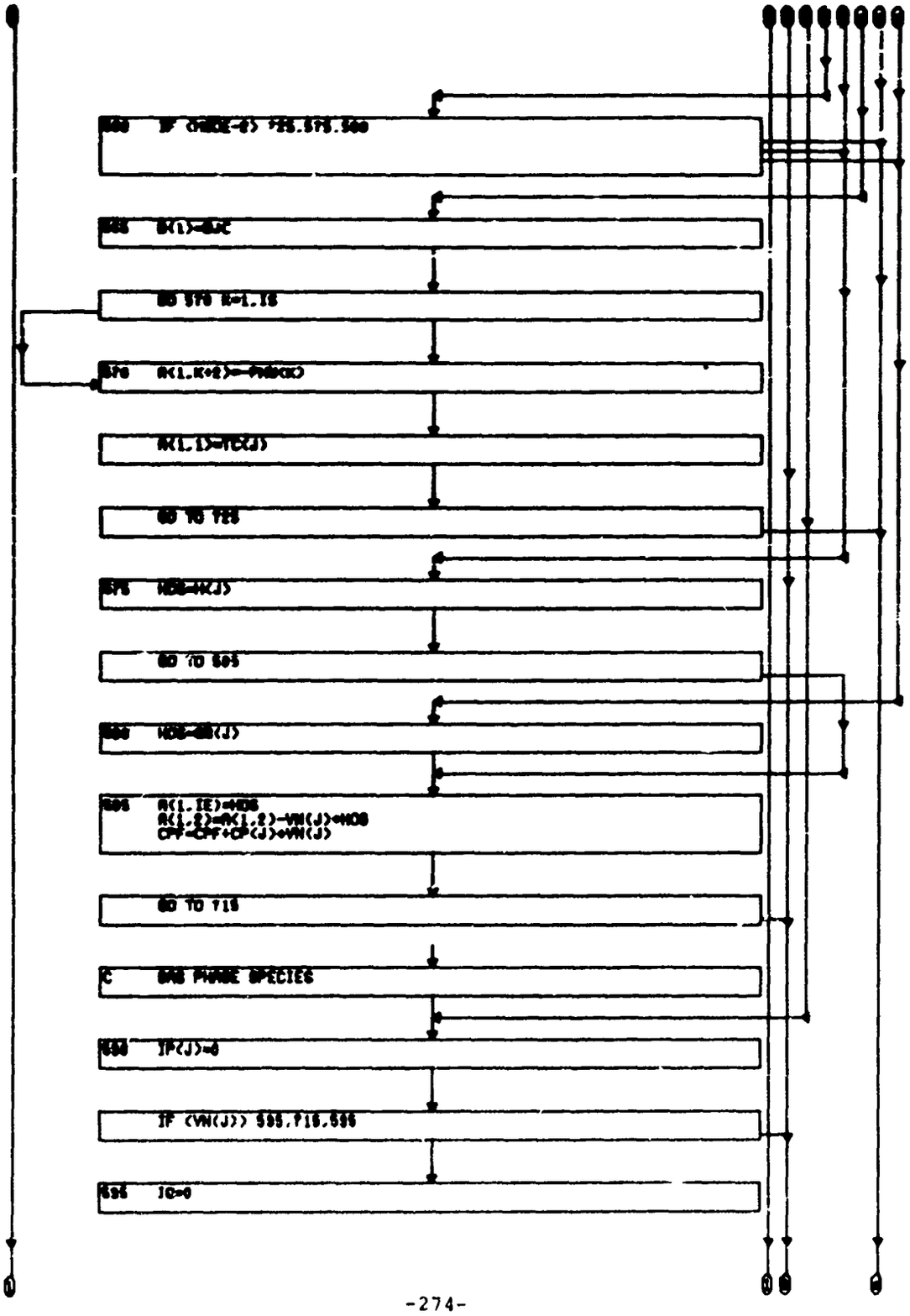

365 IF (IFC(J)+1) 725,370,370
370 IF (ITS) 390,375,390
375 VN(J)=VN(J)/SUMN
IF (IFC(J)) 390,385,380
380 VN(J)=VN(J)/SUMC
GO TO 390
385 Y(J)=Y(J)-SUML
390 E(J)=VLNK(J)-Y(J)
DO 405 I=1,IS
IF (IBC(I)) 400,400,395
395 FNU(I)=0.
GO TO 405
400 FNU(I)=VNU(J,I)
E(J)=E(J)+FNU(I)*BY(I)
405 CONTINUE

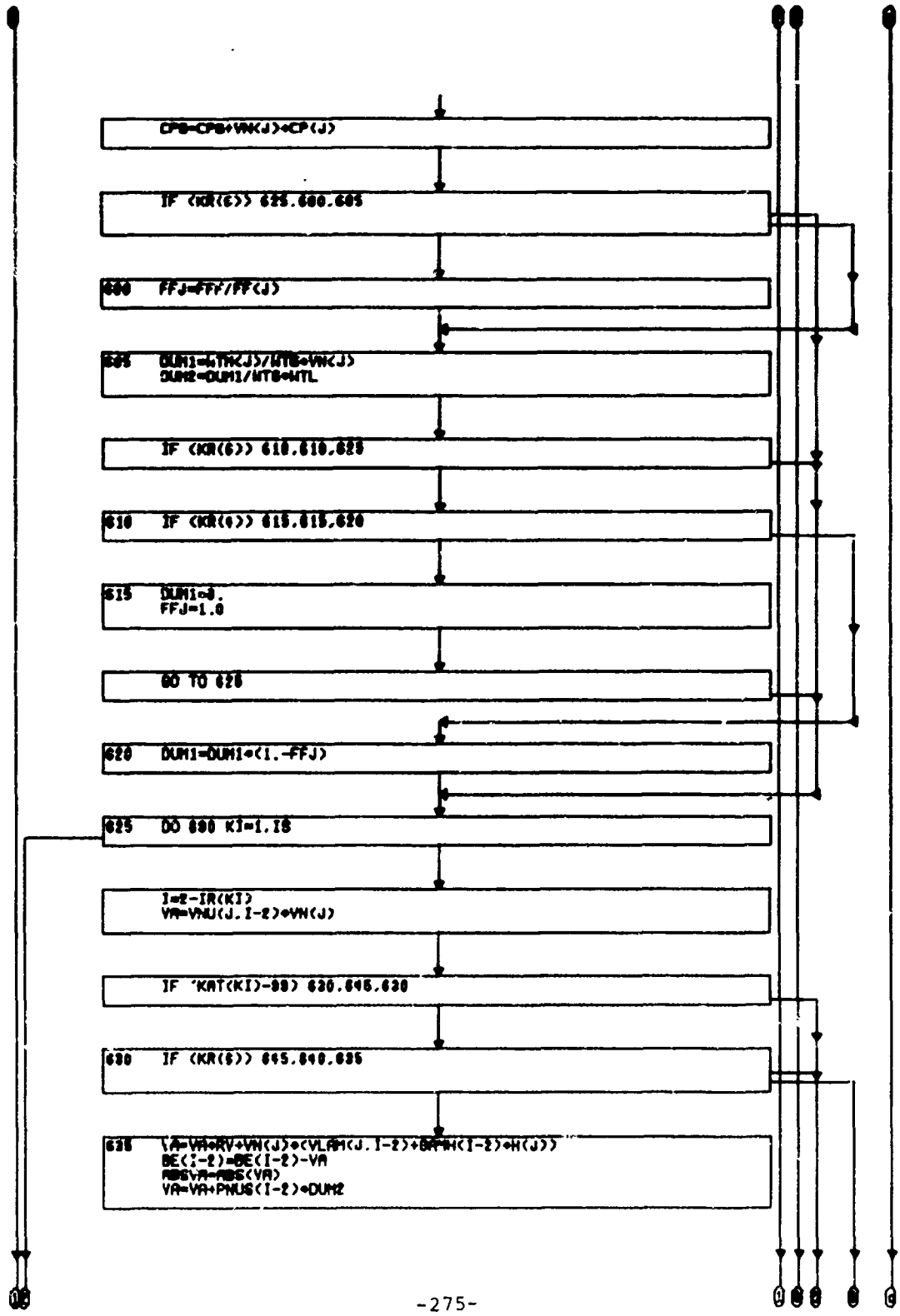

IF(KR(6)) 405,405,406
406 IF(ITS) 408,407,408
407 ECD(J)=(1.-EASE)*E(J)
408 E(J)=E(J)-ECD(J)
409 EAD=ABS(E(J))
IF (IFC(J)) 410,590,445
C CONDENSED SPECIES
410 EAD=E(J)
IF (KR(6)) 425,415,415
415 IF (1.-TF(J)+.001) 420,425,425
420 EAD=0.
IF (KR(8)) 595,595,545
425 IF (E(J)-EER) 595,595,430
430 EER=E(J)

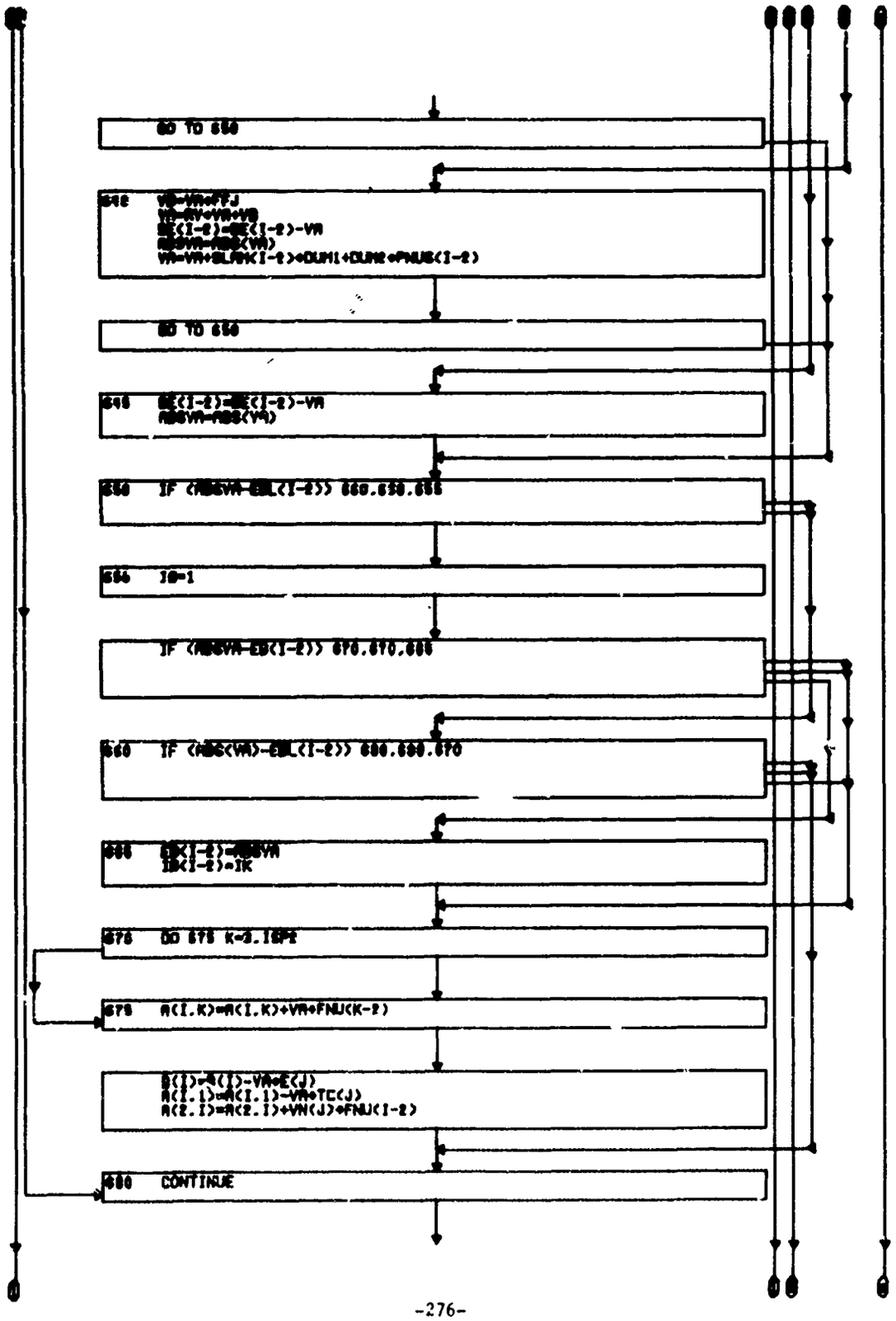

IF (IER) 435,435,440
435 ISPO=ISPO+1
IER=ISPO
440 IE=IER
IRE=IK
GO TO 450
445 ISPO=ISPO+1
IE=ISPO
450 WTR=0.
IF (KR(6)) 460,455,455
456 TMIN=AMAX1(TF(J),TMIN)
WTR=WTM(J)/WTG
460 DO 465 I=1,ISPO
A(I,IE)=0.
465 A(IE,I)=0.
DO 480 K=1,IS
DUM1=VNU(J,K)
IF (IBC(K)-1) 470,470,480
470 VN=DUM1*VN(J)

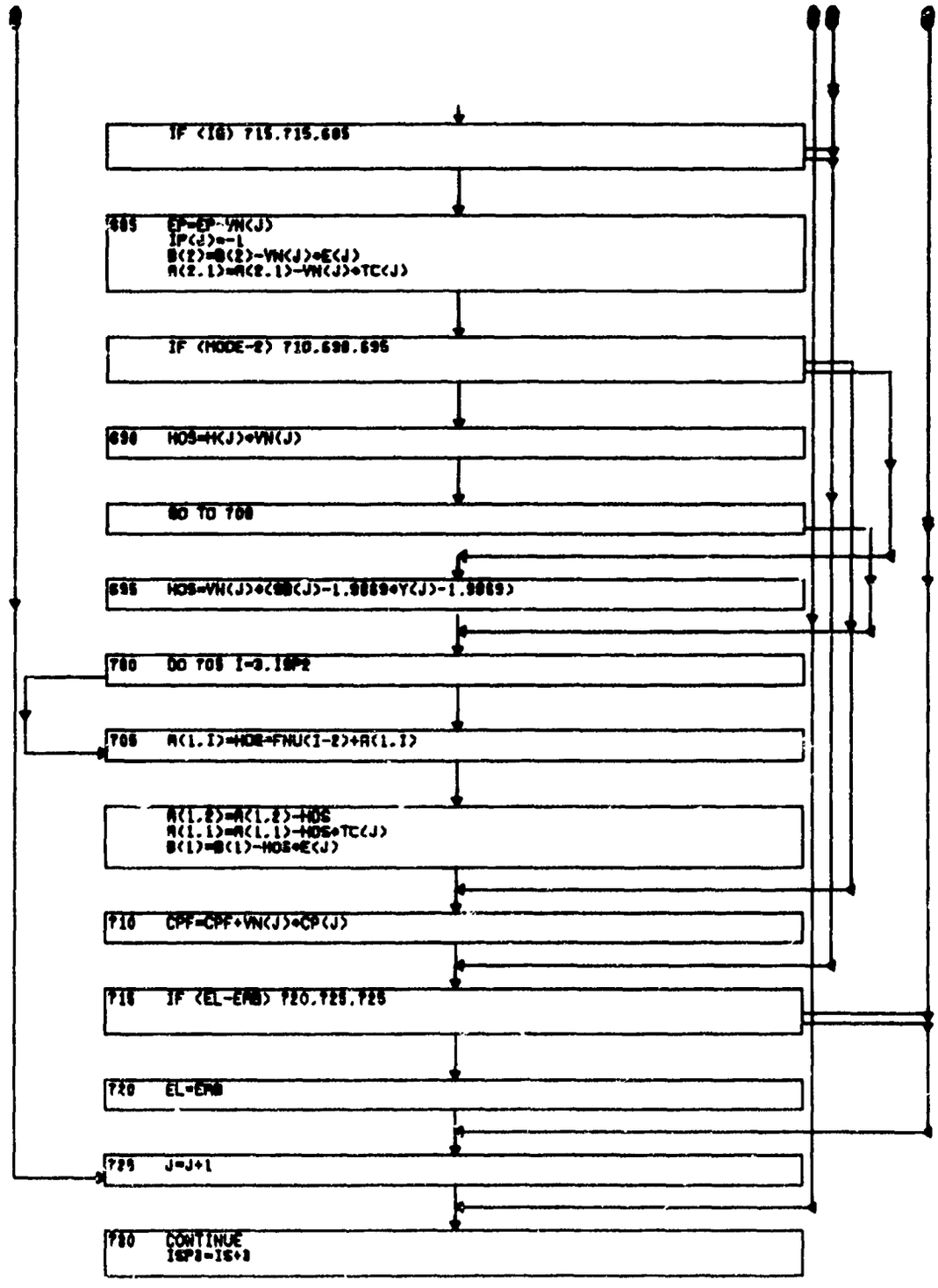

IF (
GO TO 718
CONTINUE
IF (IFCJC) 718,718,500

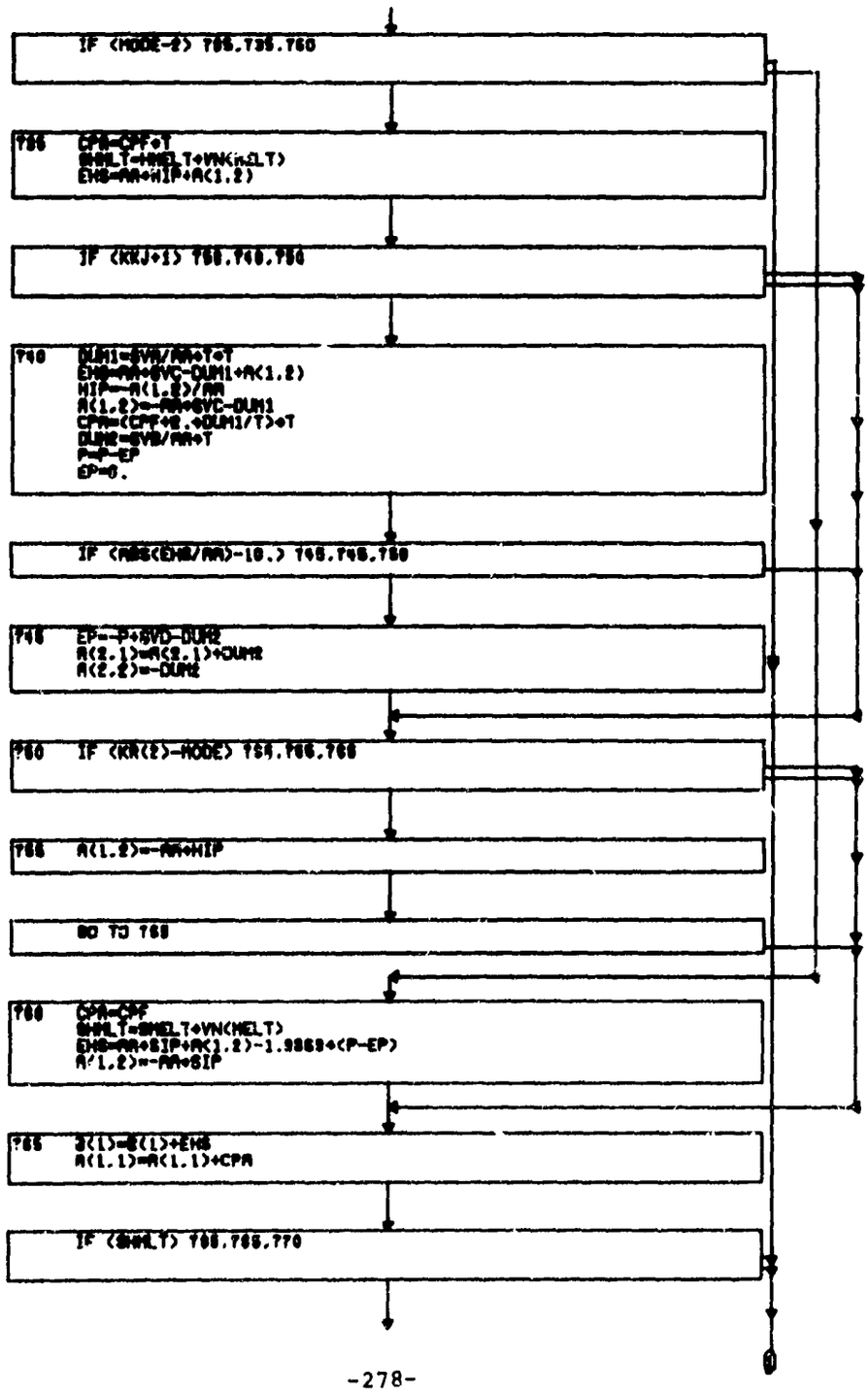

B(IE)=E(J)
IF (.001-TF(J)) 515,510,510
510 IF (KR(0)) 530,530,540
515 IF (MODE-1) 540,525,520
520 IF (KR(0)) 530,525,525
525 A(IE,IE)=1.E+10
B(IE)=-VMAX(J)+1.001E+10
MODE=0
530 IF (MODE-2) 535,575,560
535 IF (MODE-1) 715,540,715
540 IF (T-TF(J)-.001) 545,545,560
545 IF (JC) 555,555,550
550 IF (E(J)-BJC) 725,725,555
555 BJC=E(J)
JC=IK
IFCJC=IFC(JC)
TMAX=TF(J)
IF (KR(0)) 565,565,560

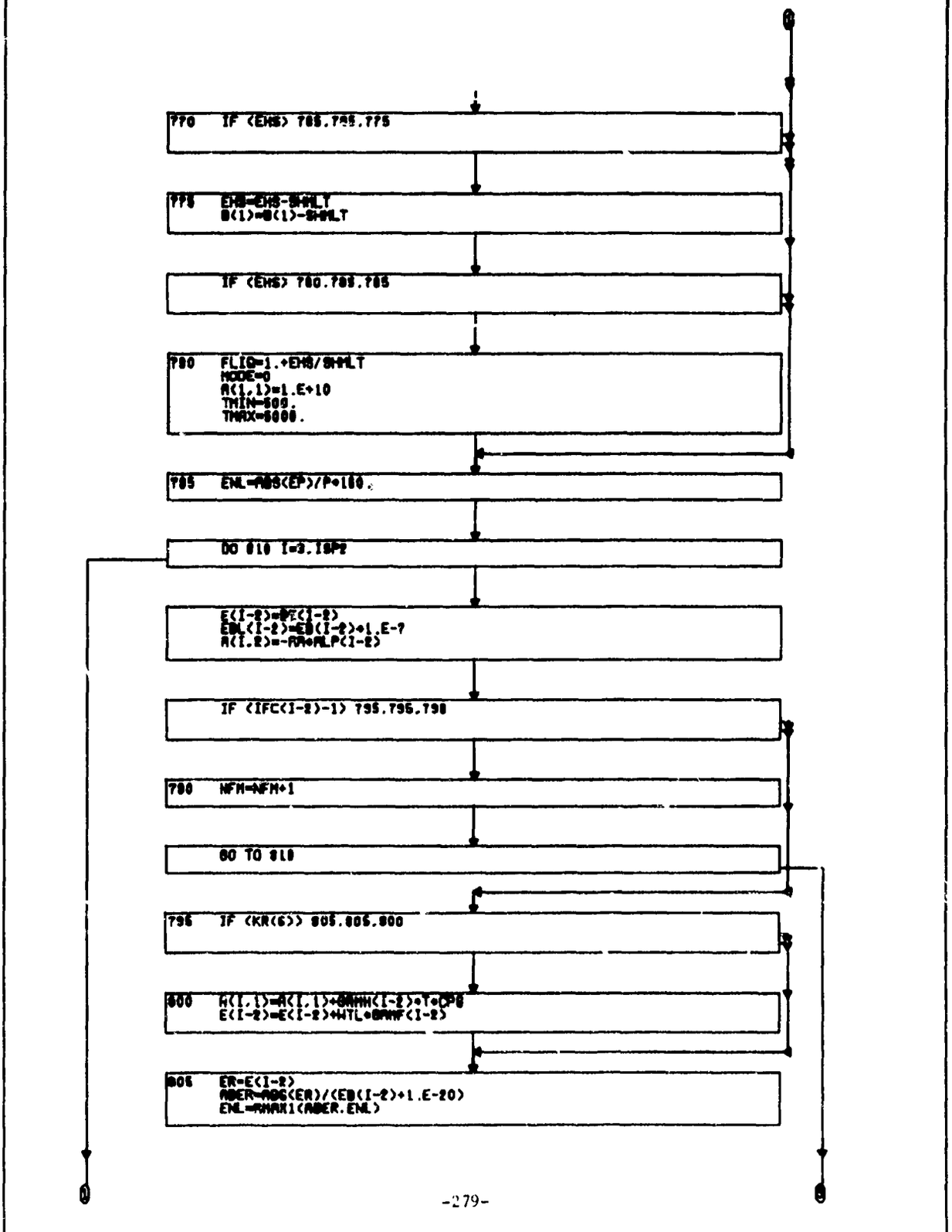

IF (
B(1)=
DO 570 K=1,IS
A(1,K+2)=
A(1,1)=HC(J)
GO TO 725
A(J)
GO TO 595
A(J)
A(1,IE)=HOB
A(1,2)=A(1,2)-VN(J)*HOB
CPF=CPF+CP(J)*VN(J)
GO TO 715
C SAS PURGE SPECIES
IF(J)=0
IF (VN(J)) 595,715,595
IC=0

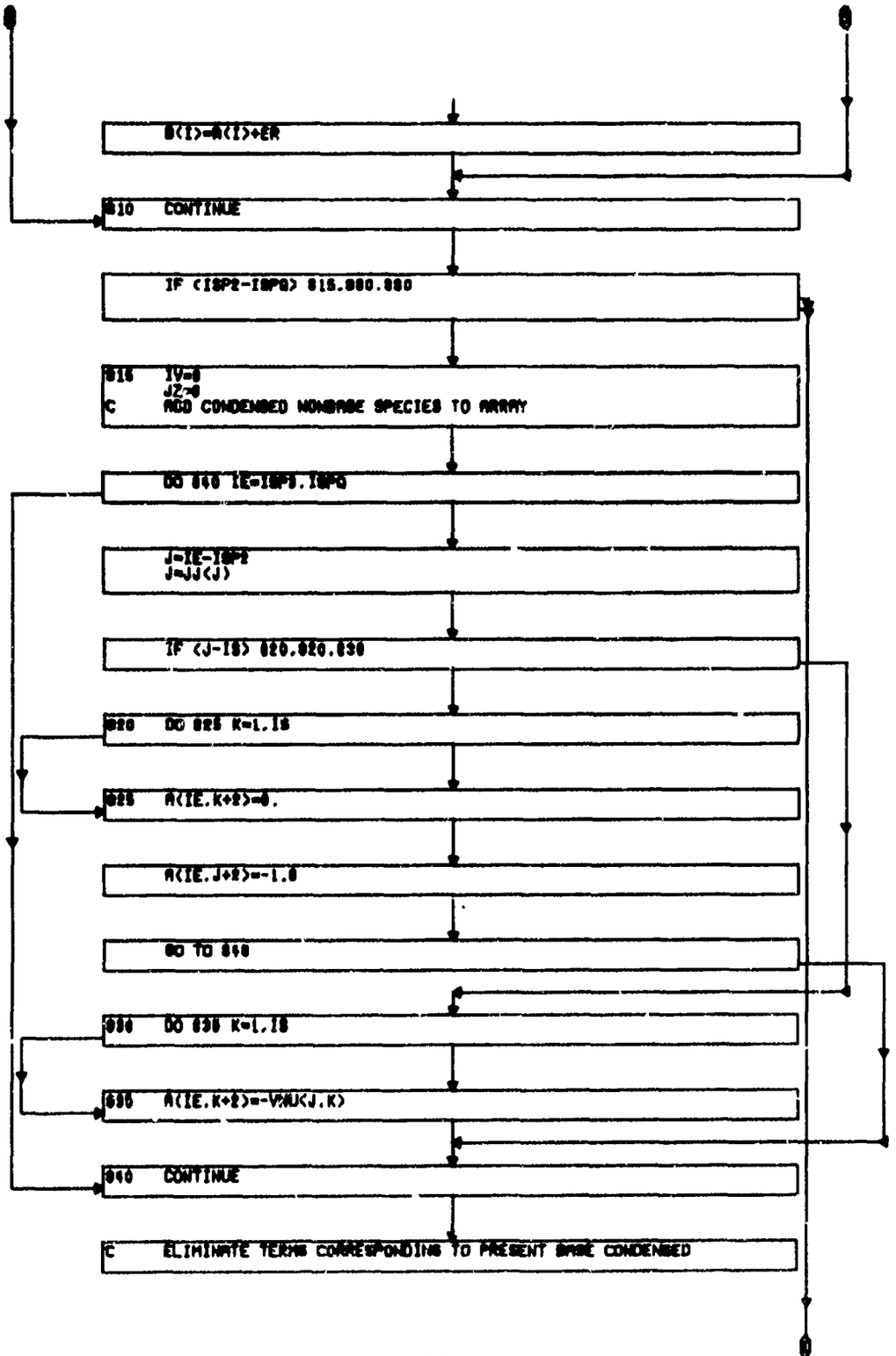

CPB=CPB+VN(J)*CP(J)
IF (KR(6)) 625,600,605
600 FFJ=FFF/FF(J)
605 DUM1=WTN(J)/WTB*VN(J)
DUM2=DUM1/WTB*WTL
IF (KR(6)) 610,610,625
610 IF (KR(6)) 615,615,620
615 DUM1=0.
FFJ=1.0
GO TO 625
620 DUM1=DUM1*(1.-FFJ)
625 DO 630 KI=1,IS
I=2-IR(KI)
VA=VNU(J,I-2)*VN(J)
IF (KAT(KI)-99) 630,645,630
630 IF (KR(6)) 645,640,635
635 VA=VA+RV+VN(J)*(VLRH(J,I-2)+BA*H(I-2)+H(J))
BE(I-2)=BE(I-2)-VA
ABSVA=ABS(VA)
VA=VA+PNUS(I-2)*DUM2

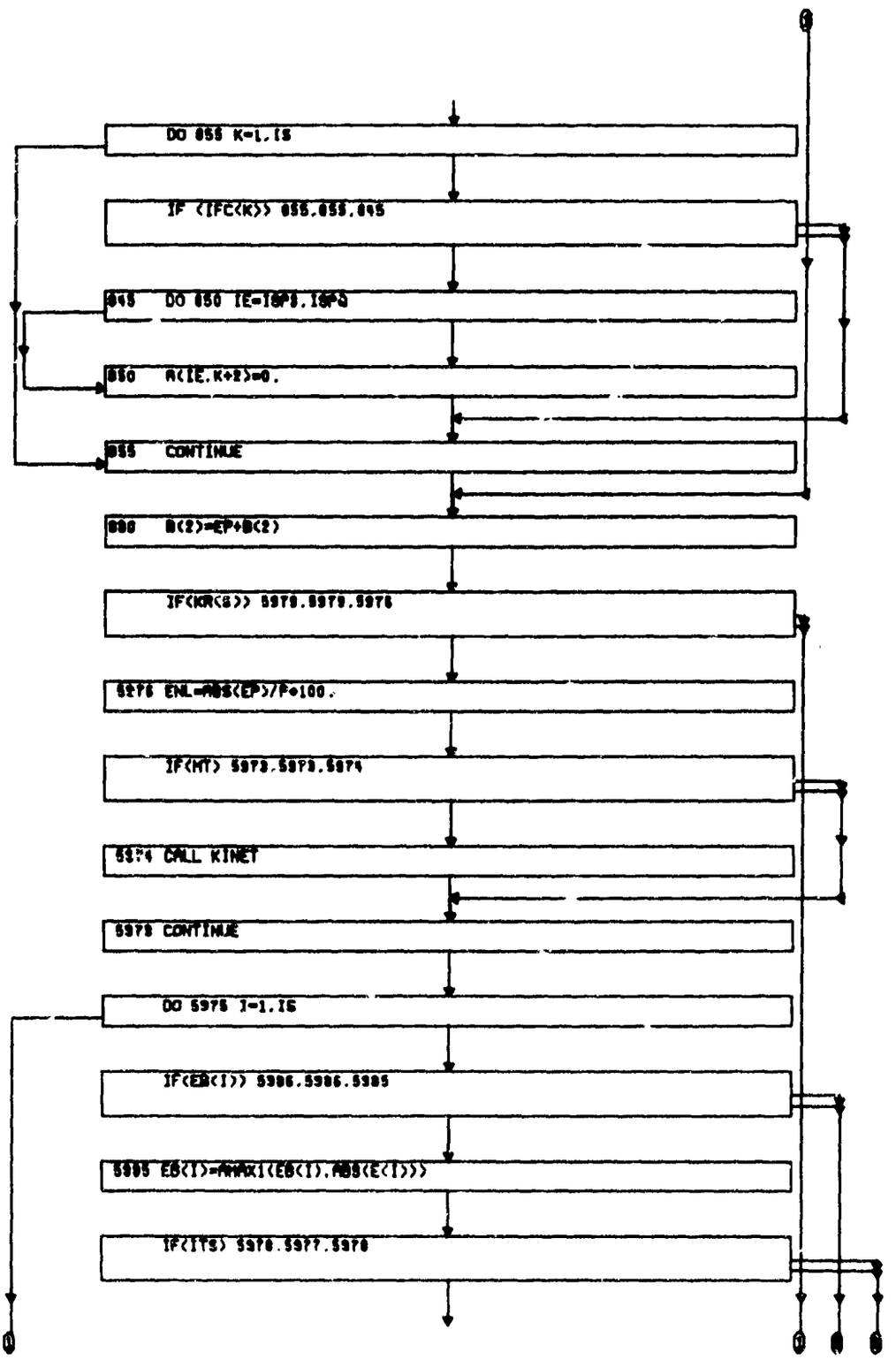

GO TO 650
646 VR=VR+FFJ
VB=RV+VR+VB
BE(I-2)=BE(I-2)-VR
ABSVR=ABS(VR)
VR=VR+SLP(K(I-2)+OLM1+CLM2+FNUB(I-2)
GO TO 650
648 BE(I-2)=BE(I-2)-VR
ABSVR=ABS(VR)
650 IF (ABSVR-EBL(I-2)) 660,660,655
654 IG=1
IF (ABSVR-EB(I-2)) 670,670,665
660 IF (ABS(VR)-EBL(I-2)) 680,680,670
665 EB(I-2)=ABSVR
IB(I-2)=IK
670 DO 675 K=3,IEPT
675 A(I,K)=A(I,K)+VR+FNU(K-2)
B(I)=A(I)-VR+E(J)
A(I,1)=A(I,1)-VR+TC(J)
A(2,I)=A(2,I)+VR(J)+FNU(I-2)
680 CONTINUE

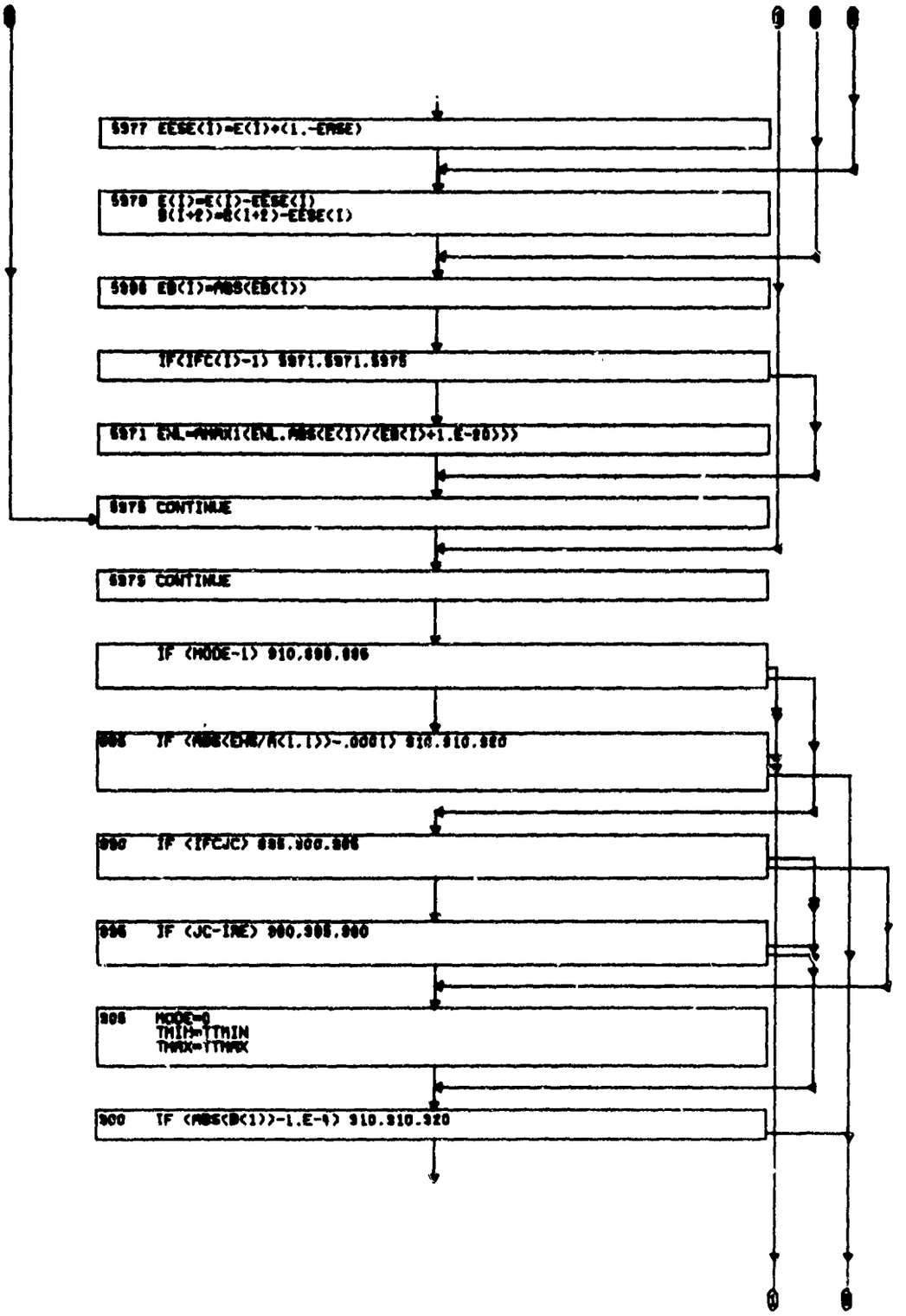

IF (IG) 715,715,695
695 EP=EP-VN(J)
IP(J)=-1
B(2)=B(2)-VN(J)*E(J)
A(2,1)=A(2,1)-VN(J)*TC(J)
IF (MODE-2) 710,698,696
698 HOS=H(J)*VN(J)
GO TO 700
696 HOS=VN(J)*(BB(J)-1.9869*Y(J)-1.9869)
700 DO 705 I=3,ISP2
705 A(1,I)=HOS*FNU(I-2)+A(1,I)
A(1,2)=A(1,2)-HOS
A(1,1)=A(1,1)-HOS*TC(J)
B(1)=B(1)-HOS*E(J)
710 CPF=CPF+VN(J)*CP(J)
715 IF (EL-EMB) 720,725,725
720 EL=EMB
725 J=J+1
730 CONTINUE
ISP2=IS+3

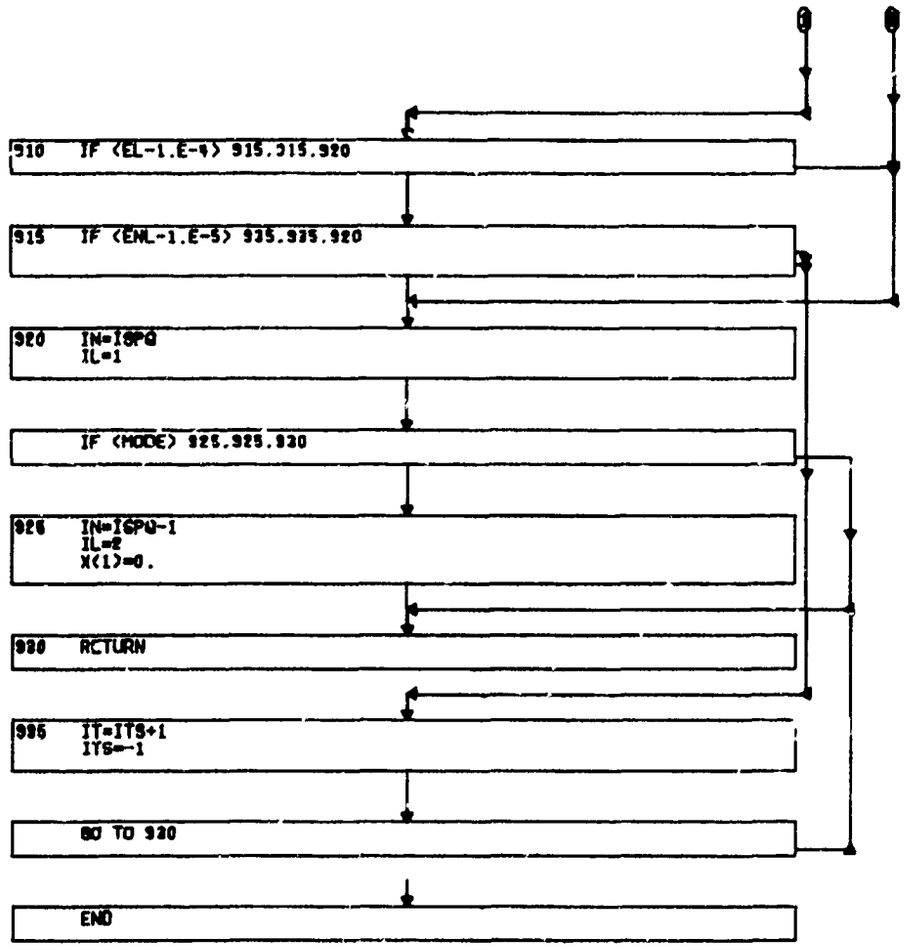

IF (MODE-2) 765,735,760
765 CPR=CPF*T
SMELT=SMELT+VN(MELT)
EMB=AA*SIP+A(1,2)
IF (KKJ+1) 755,740,755
740 DUM1=SVD/AA*T*T
EMB=AA*SVC-DUM1+A(1,2)
SIP=-A(1,2)/AA
A(1,2)=-AA*SVC-DUM1
CPR=(CPF+2.*DUM1/T)*T
DUM2=SVD/AA*T
P=P-EP
EP=0.
IF (ABS(EMB/AA)-10.) 745,745,750
745 EP=-P+SVD-DUM2
A(2,1)=A(2,1)+DUM2
A(2,2)=-DUM2
750 IF (KK(2)-MODE) 754,755,760
755 A(1,2)=-AA*SIP
GO TO 765
760 CPR=CPF
SMELT=SMELT+VN(MELT)
EMB=AA*SIP+A(1,2)-1.9869*(P-EP)
A(1,2)=-AA*SIP
765 A(1)=A(1)+EMB
A(1,1)=A(1,1)+CPR
IF (SMELT) 765,765,770


770 IF (EHS) 785,795,775
775 EHS=EHS-SHMLT
B(1)=B(1)-SHMLT
IF (EHS) 780,780,785
780 FLIQ=1.+EHS/SHMLT
MODE=0
A(1,1)=1.E+10
TMIN=500.
TMAX=5000.
785 ENL=ABS(EP)/P*100.
DO 810 I=3,ISP2
E(I-2)=EP(I-2)
EBL(I-2)=EB(I-2)+1.E-7
A(I,2)=-RRA*RLP(I-2)
IF (IFC(I-2)-1) 795,795,790
790 NFM=NFM+1
GO TO 810
795 IF (KR(6)) 805,805,800
800 A(I,1)=A(I,1)+BRHH(I-2)*T*DTB
E(I-2)=E(I-2)+WTL*BRHF(I-2)
805 ER=E(I-2)
ABER=ABS(ER)/(EB(I-2)+1.E-20)
ENL=AMAX1(ABER,ENL)


B(I)=B(I)+ER
810 CONTINUE
IF (ISP2-ISP8) 815,880,880
815 IV=0
JZ=0
C ADD CONDENSED MONOBASE SPECIES TO ARRAY
DO 840 IE=ISP1,ISP8
J=IE-ISP2
J=JJ(J)
IF (J-IS) 820,820,830
820 DO 825 K=1,IS
825 A(IE,K+2)=0.
A(IE,J+2)=-1.0
GO TO 840
830 DO 835 K=1,IS
835 A(IE,K+2)=-VNU(J,K)
840 CONTINUE
C ELIMINATE TERMS CORRESPONDING TO PRESENT BASE CONDENSED


DO 855 K=1,IS
IF (IFC(K)) 855,855,845
845 DO 850 IE=ISP1,ISP2
850 A(IE,K+2)=0.
855 CONTINUE
880 B(2)=EP+B(2)
IF(KR(8)) 5978,5978,5976
5976 ENL=ABS(EP)/P*100.
IF(MT) 5978,5978,5974
5974 CALL KINET
5978 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.-ERSE)
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) 5971,5971,5978
5971 ENL=AMAX1(ENL,ABS(E(I)/(EB(I)+1.E-30)))
5978 CONTINUE
5979 CONTINUE
IF (MODE-1) 910,890,886
886 IF (ABS(ENL/A(I,I))-.0001) 910,910,920
890 IF (IFCJC) 896,900,896
896 IF (JC-IRE) 900,905,900
906 MODE=0
TMIN=TTMIN
TMAX=TTMAX
900 IF (ABS(B(I))-1.E-9) 910,910,920


910 IF (EL-1.E-4) 915.915.920
915 IF (ENL-1.E-5) 925.925.920
920 IN=IGPQ
IL=1
IF (MODE) 926.925.930
926 IN=IGPU-1
IL=2
X(1)=0.
930 RCTURN
935 IT=ITS+1
ITS=-1
GO TO 920
END

24. SUBROUTINE CRECT (MOE) - B23A

a. Function

Corrects state variables and composition, principal logic being involved with limiting corrections such that instabilities in the iterations will not occur. Called by EQUIL.

MOE = 0 or 1 if linearlization done predominantly on equilibrium or mass balance relations, respectively.

b. Listing

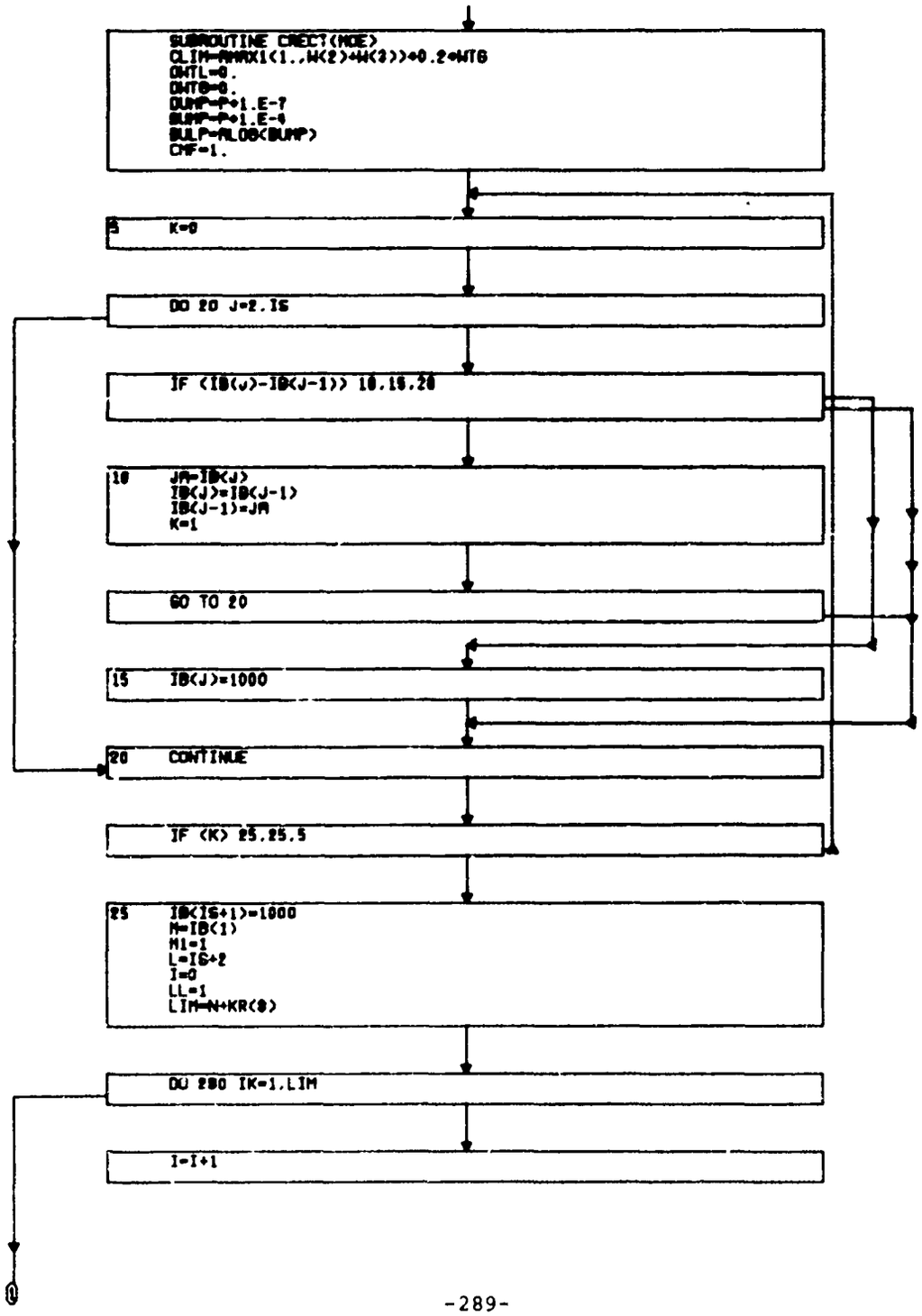
```
000001          C0234                                                                   0234 001
000002                SUBROUTINE CRECT(MODE)                                            0234 002
000003                INTEGER FAMOA,FAMOB                                               0234 003
000004                COMMON/INTCOM/KKR(20),KIN,KOUT
000005                DIMENSION CIJ( 71,1),TF(1)                                        0234 004*MEM
000006                EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                                 0234 005*MEM
000007                DIMENSION X(14)                                                   0234 006*MEM
000008                DIMENSION CREF( 71)                                               0234 007*MEM
000009                COMMON /MLBCOM/FAMOA( 71),FAMOB( 71),X     ,FR( 71,19),W(3),LEF(10)0234   8*MEM
000010               1,LFS(10),PLEASE,LEFB(10)                                          0234   9*MEM
000011                COMMON /EQPCOM/ RA( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),0234  10*MEM
000012               1 TU( 71,2),PF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  0234  11*MEM
000013               2 WAT(10),IR(10),IS,KR(10),LAM( 71),S,T,TK(10, 7),VN( 71),         0234  12*MEM
000014               3 VNU( 71,10),ITFF,KR2,MCH,NCV,NM,WTT( 71,,V( 71),VW( 71),GG( 71)  0234  13*MEM
000015               4 ,T3(10, 7),EPOVRK,SIGMA,BASMOL                                   0234  14*MEM
000016                COMMON /EQTCOM/SIP,NIP,EL,EML,SLIP,CPF,IRE,IER,AA,ITS,IN,IL,IT,    0234  15*MEM
000017               1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMM,BUML,VS,VSS,B1,IBP2,IBP8,   0234  16*MEM
000018               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MG,  0234  17*MEM
000019               3 CPG,TTMIN,TTMAX,LZ,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      0234  18*MEM
000020               4 IP( 71),ALP(10),FMU(10),GAMM( 71),CMM(10),SLAM(10),DV( 71),RVG,  0234  19*MEM
000021               5 CP( 71),M( 71),BB( 71),TC( 71.,VLMM( 71),E( 71),PLUG(10),       0234  20*MEM
000022               6 AC(10),BLMM(10),BV(10),IBC(10),BE(10),JJ( 6)                     0234  21*MEM
000023                EQUIVALENCE(DV1,DV)                                                     0-18
000024                DIMENSION DVA(1,1)
000025                EQUIVALENCE(B,X)                                                  0234  918
000026                CLIM=AMAX1(1.,W(2)+W(3))+0.2+TG                                         31
000027                DVTL=0.                                                                 32
000028                DVTG=0.                                                                 33
000029                DUMP=P=1.E-7                                                            34
000030                BUMP=P=1.E-4                                                            35
000031                BMLP=ALOG(BUMP)                                                         36
000032                CMF=1.                                                                  37
000033          5     K=0                                                                     38
000034                DO 20 J=2,IS                                                            39
000035                IF (IB(J)-IB(J-1)) 10,15,20                                             40
000036          10    JA=IB(J)                                                                41
000037                IB(J)=IB(J-1)                                                           42
000038                IB(J-1)=JA                                                              43
000039                K=1                                                                     44
000040                GO TO 20                                                                45
000041          15    IB(J)=1000                                                              46
000042          20    CONTINUE                                                                47
000043                IF (K) 25,25,5                                                          48
000044          25    IB(IS+1)=1000                                                           49
000045                M=IB(1)                                                                 50
000046                M1=1                                                                    51
000047                L=IS+2                                                                  52
000048                I=0                                                                     53
000049                LL=1                                                                    54
000050                LIM=V+KR(8)                                                             55
000051                DO 240 IK=1,LIM                                                         56
000052                I=I+1                                                                   57
000053                IF (IK-IS) 30,30,45                                                     58
000054          30    SLAM(I)=0.                                                              59
000055                IFC(I)=IFC(I)                                                           60
000056                PAUS(I)=0.                                                              61
000057                IF (IFC(I)-1) 35,35,75                                                  62
000058          35    DV1=X(I+2)                                                              63
```

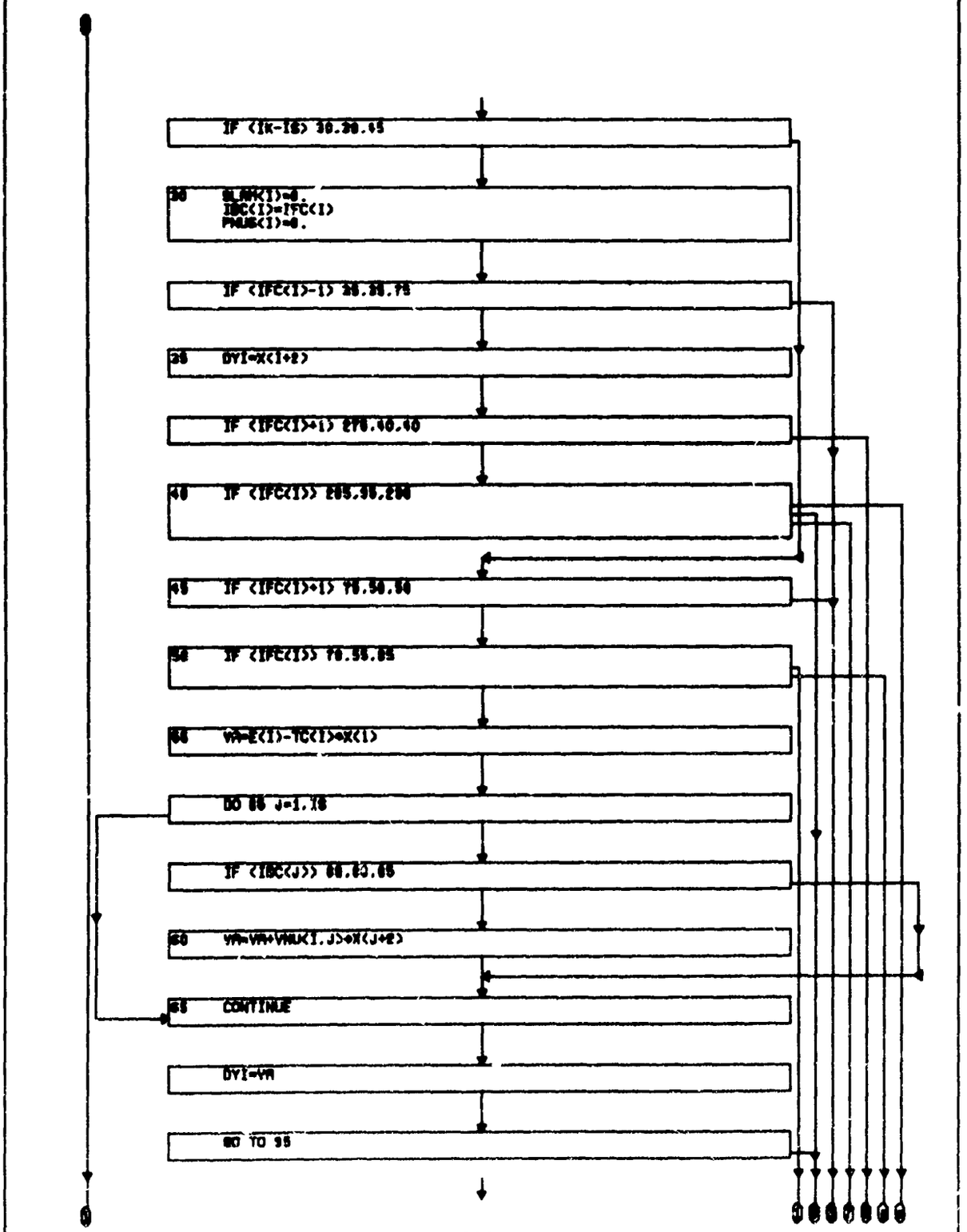
```
000059                IF (IFC(I)+1) 275,40,40                                  64
000060          40    IF (IFC(I)) 209,65,230                                   65
000061          45    IF (IFC(I)+1) 75,50,50                                   66
000062          50    IF (IFC(I)) 70,55,85                                     67
000063          55    VA=E(I)-YC(I)*X(1)                                       68
000064                DO 65 J=1,IS                                             69
000065                IF (IBC(J)) 60,60,65                                     70
000066          60    VA=VA+VM(I,J)*X(J+2)                                     71
000067          65    CONTINUE                                                 72
000068                DYI=VA                                                   73
000069                GO TO 95                                                 74
000070          70    IF (IK-IRE) 75,80,75                                     75
000071          75    DYI=0.                                                   76
000072                GO TO 275                                                77
000073          80    IFC(I)=1                                                 78
000074                DYI=X(IER)                                               79
000075                GO TO 230                                                80
000076          85    L=L+1                                                    81
000077                IF (L-IER) 90,85,90                                      82
000078          90    DYI=X(L)                                                 83
000079                GO TO 230                                                84
000080          95    DWTG=DWTG+VM(I)*DYI*WTM(I)                               85
000081                IF (IP(I)) 100,195,100                                   86
000082          100   IF (IK-M) 105,145,105                                    87
000083          105   IF (VM(I)-BUMP) 110,140,140                              88
000084          110   IF (MOE) 195,195,115                                     89
000085          115   IF (DYI) 120,275,125                                     90
000086          120   IF (VM(I)/BUMP-.9999999-CMF*DYI) 275,275,130             91
000087          125   IF (BUMP/VM(I)-1.-CMF*DYI) 135,275,275                   92
000088          130   CMF=(VM(I)/BUMP-.9999999)/DYI                            93
000089                GO TO 275                                                94
000090          135   CMF=(BUMP/VM(I)-1.)/DYI                                  95
000091                GO TO 275                                                96
000092          140   IF (MOE) 175,175,150                                     97
000093          145   M1=M1+1                                                  98
000094                MEIB(M1)                                                 99
000095          150   IF (DYI) 155,275,160                                     100
000096          155   IF (DYI-CMF+.999) 165,275,275                            101
000097          160   IF (DYI-CMF-9.) 275,275,170                              102
000098          165   CMF=-.999/DYI                                            103
000099                GO TO 275                                                104
000100          170   CMF=9./DYI                                               105
000101                GO TO 275                                                106
000102          175   IF (DYI-CMF-2.303) 180,180,180                           107
000103          180   IF (DYI-CMF+6.909) 185,275,275                           108
000104          185   CMF=-6.909/DYI                                           109
000105                GO TO 275                                                110
000106          190   CMF=2.303/DYI                                            111
000107                GO TO 275                                                112
000108          195   IF (Y(I)-BULP+ABS(DYI)*CMF) 275,200,200                  113
000109          200   CMF=-(Y(I)-BULP)/ABS(DYI)                                114
000110                GO TO 275                                                115
000111          C     NON-PRESENT BASE                                         116
000112          209   IF (KR(6)) 215,210,210                                   117
000113          210   IF (T-TF(I)+.001) 275,215,215                            118
000114          215   IF (Y(I)+CMF*DYI-0.1) 275,220,220                        119
000115          220   DUM1=(.1-Y(I))/DYI                                       120
000116                IF (DUM1-.001) 275,275,225                               121
000117          225   CMF=DUM1                                                 122
000118                GO TO 275                                                123
```

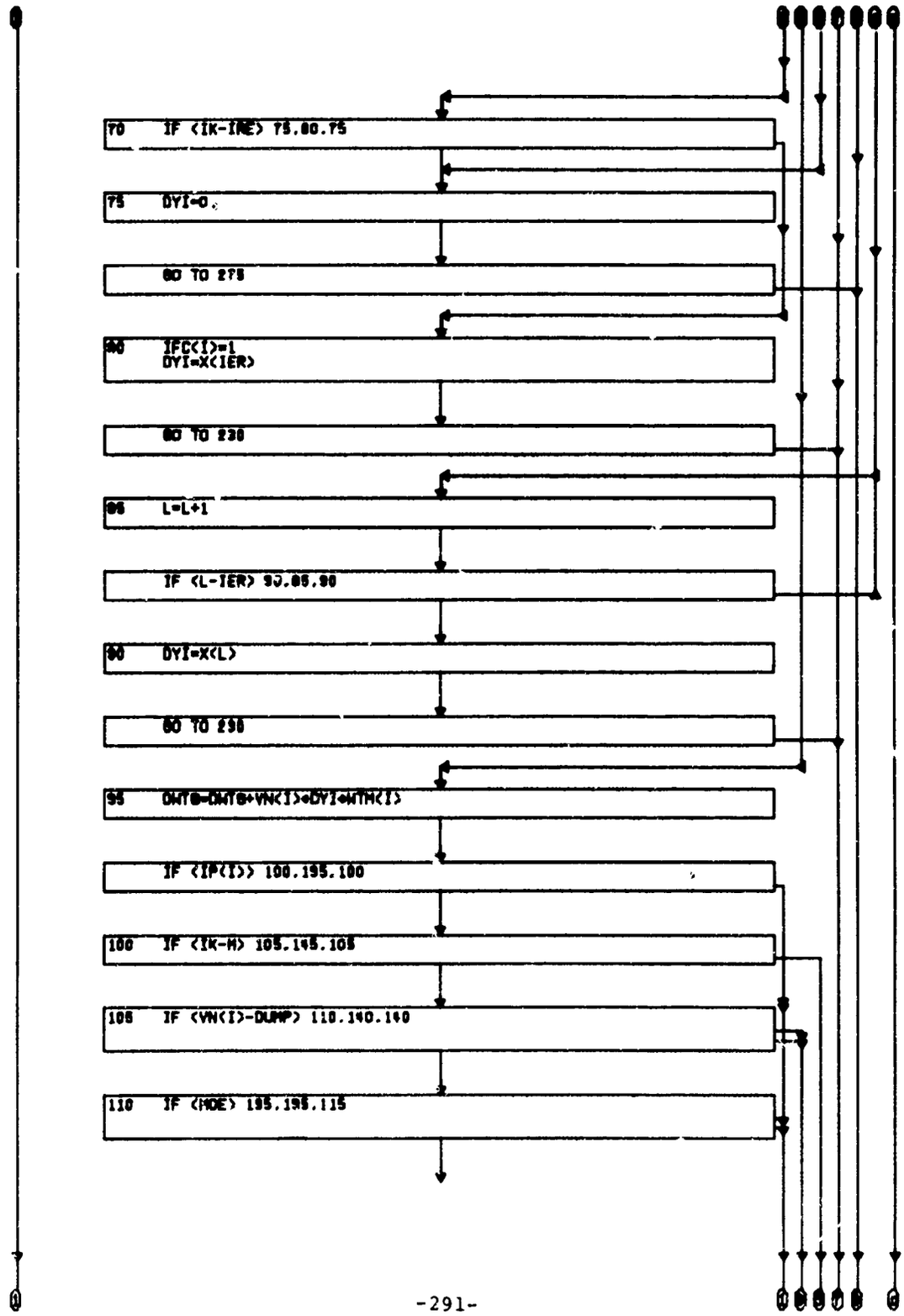
```
000119          230   DWTL=DWTL+DYI*TP(I)                                                124
000120                IF (DYI) 235,275,230                                               125
000121          235   IF (VN(I)) 250,290,240                                             126
000122          240   IF (VN(I)+DYI*CMF) 245,250,250                                     127
000123          245   CMF=-VN(I)/DYI*1.00001                                             128
000124          250   IF (KR(6)) 265,255,255                                             129
000125          255   CLIP=ABS(CLIM/WTM(I))                                              130
000126                IF (ABS(CMF*DYI)-CLIP) 275,275,260                                 131
000127          260   CMF=CLIP/ABS(DYI)                                                  132
000128                GO TO 275                                                          133
000129          265   IF (ABS(CMF*DYI)-P) 275,275,270                                    134
000130          270   CMF=P/ABS(DYI)                                                     135
000131          275   CMFF(I)=CMF                                                        136
000132          280   DY(IK)=DYI                                                         137
000133                IF (KR(6)) 290,285,285                                             138
000134          285   RVL=AMAX1(.1,RV/2.)                                                139
000135                CMF=AMIN1(CMF,WTG/(ABS(DWTL-DWTG/WTG*WTL)/RVL-DWTG))               140
000136          290   IF (KR(7)-1) 315,3   300                                           141
000137          295   FORMAT (1X2(8X2HVN 6HY8X2HDY7X5HSCALE7X1HE4X6HIFC IP)/(1XA4,5E10.  142
000138               13,I3,I2,1X,A4,5E10.  ,I3,I2))                                      143
000139          300   \00=I                                                              144
000140                WRITE (KOUT,295) (FAMOA(J),VN(J),Y(J),DYA(J,LL),CMFF(J),E(J),IFC(J 145
000141               1),IP(J),J=1,NB)                                                    146
000142                WRITE (KOUT,310) (EB(I),I=1,IB)                                    147
000143                WRITE (KOUT,310) (X(I),I=1,ISPB)                                   148
000144                WRITE (KOUT,305) (IB(I),I=1,IB)                                    149
000145          305   FORMAT (10I5)                                                      150
000146          310   FORMAT (8E12.4)                                                    151
000147          315   CONTINUE                                                           152
000148                IF (X(1)) 320,360,320                                              153
000149          320   X1=X(1)*CMF                                                        154
000150                ABX=ABS(X(1))                                                      155
000151                IF (ABS(X1)-.5) 330,330,325                                        156
000152          325   CMF=.5/ABX                                                         157
000153                X1=CMF*X(1)                                                        158
000154          330   IF (X1) 340,360,335                                                159
000155          335   TM=TMAX                                                            160
000156                X1=AMIN1(.2,X1)                                                    161
000157                GO TO 345                                                          162
000158          340   TM=TMIN                                                            163
000159                X1=AMAX1(-0.2,X1)                                                  164
000160          345   DTM=(TM-T)/(TM*X1)                                                 165
000161                IF (DTM-1.) 350,355,355                                            166
000162          350   CMF=DTM*CMF                                                        167
000163                T=TM                                                               168
000164                GO TO 360                                                          169
000165          355   T=T/(1.-X1)                                                        170
000166          360   AA=AA*EXP(CMF*X(2))                                                171
000167                M1=1                                                               30
000168                M=IB(1)                                                            31
000169                WTL=0.                                                             32
000170                WTG=0.                                                             33
000171                DUM2=0.                                                            34
000172                I=1                                                                35
000173                LIM=KR(8)+N                                                        36
000174                DO 495 IK=1,LIM                                                    37
000175                DYI=CMF*DY(IK)                                                     38
000176                IF (DYI) 395,390,395                                               39
000177          390   IF (IFC(I)) 495,435,485                                            40
000178          395   IF (IFC(I)) 455,400,480                                            41
```

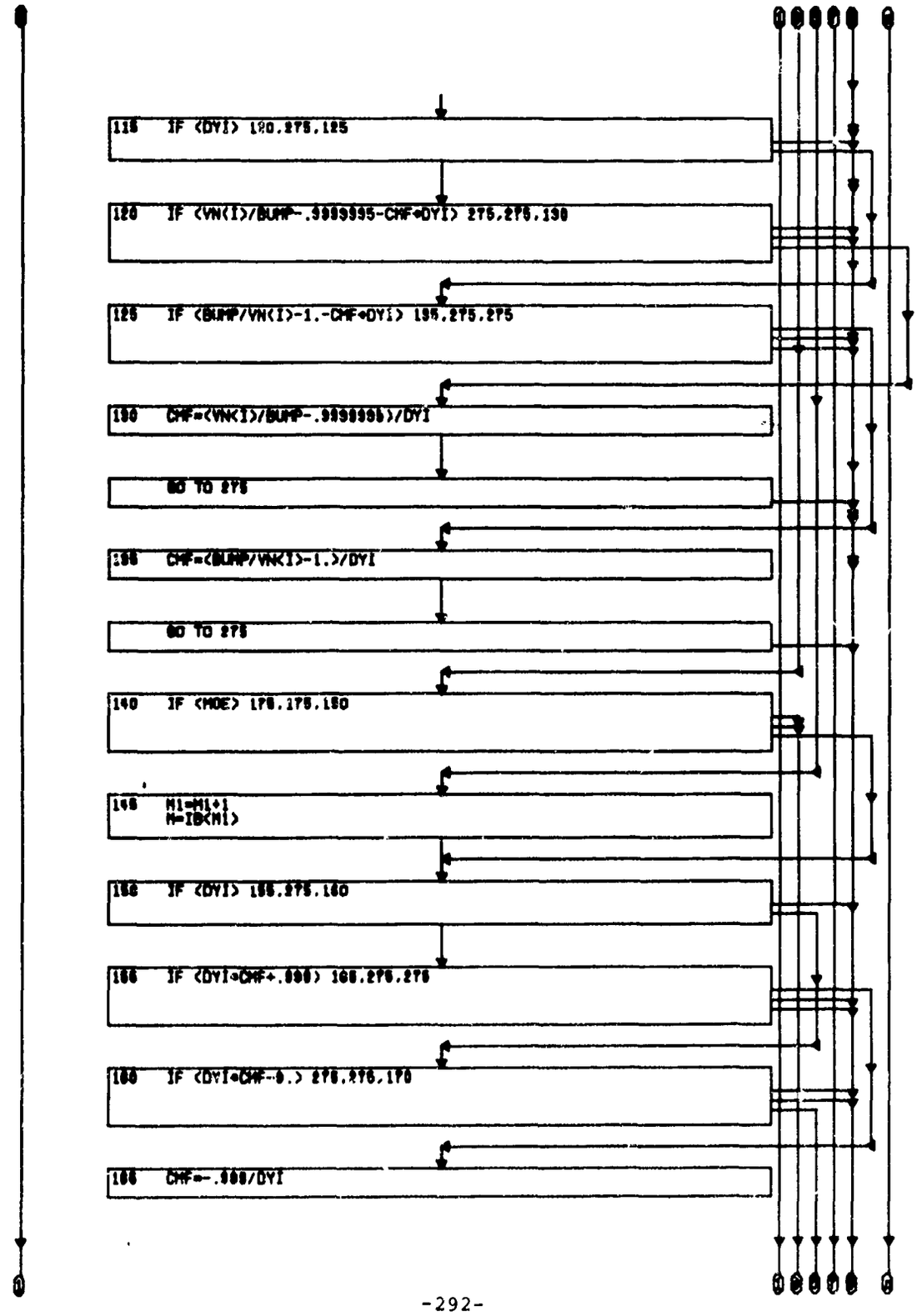
```
000179          400   IF (IP(I)) 405,430,405                                  42
000180          405   IF (M-IK) 410,415,410                                   43
000181          410   IF (MOE) 430,430,420                                    44
000182          415   M1=M1+1                                                 45
000183                M=IB(M1)                                                46
000184          420   VN(I)=VN(I)*(1.+DYI)                                    47
000185                IF (VN(I)) 430,430,425                                  48
000186          425   Y(I)=ALOG(VN(I))                                        49
000187                GO TO 435                                               50
000188          430   Y(I)=Y(I)+DYI                                           51
000189                VN(I)=EXP(Y(I))                                         52
000190          435   VA=WTM(I)*VN(I)                                         53
000191                WTG=WTG+VA                                              54
000192                DUM2=DUM2+VA/FF(I)                                      55
000193                IF (IK-IB) 440,440,445                                  56
000194          440   PNUB(I)=VN(I)                                           57
000195                SLAM(I)=VN(I)/FF(I)                                     58
000196                GO TO 499                                               59
000197          445   DO 450 K=1,IB                                           60
000198                VA=VNU(I,K)*VN(I)                                       61
000199                PNUB(K)=PNUB(K)+VA                                      62
000200          450   SLAM(K)=SLAM(K)+VA/FF(I)                                63
000201                GO TO 499                                               64
000202          C     NON-PRESENT BASE CORRECTIONS AND TESTS                  65
000203          455   Y(I)=Y(I)+DYI                                           66
000204                IF (Y(I)) 499,460,460                                   67
000205          460   IF (IFC(I)+1) 499,465,465                               68
000206          465   IF (KR(6)) 475,470,470                                  69
000207          470   IF (T-TP(I)+.001) 499,475,475                           70
000208          475   Y(I)=0.                                                 71
000209                IFC(I)=1                                                72
000210                GO TO 499                                               73
000211          480   VN(I)=VN(I)+DYI                                         74
000212                IF (VN(I)) 490,490,485                                  75
000213          485   WTL=WTL+VN(I)*WTM(I)                                    76
000214                GO TO 495                                               77
000215          490   VN(I)=0.                                                78
000216                IFC(I)=-1                                               79
000217          495   I=I+1                                                   80
000218                FFF=WTG/DUM2                                            81
000219                DO 500 I=1,IB                                           82
000220          500   SLAM(I)=SLAM(I)*FFF                                     83
000221                RETURN                                                  84
000222                END                                                     85
```

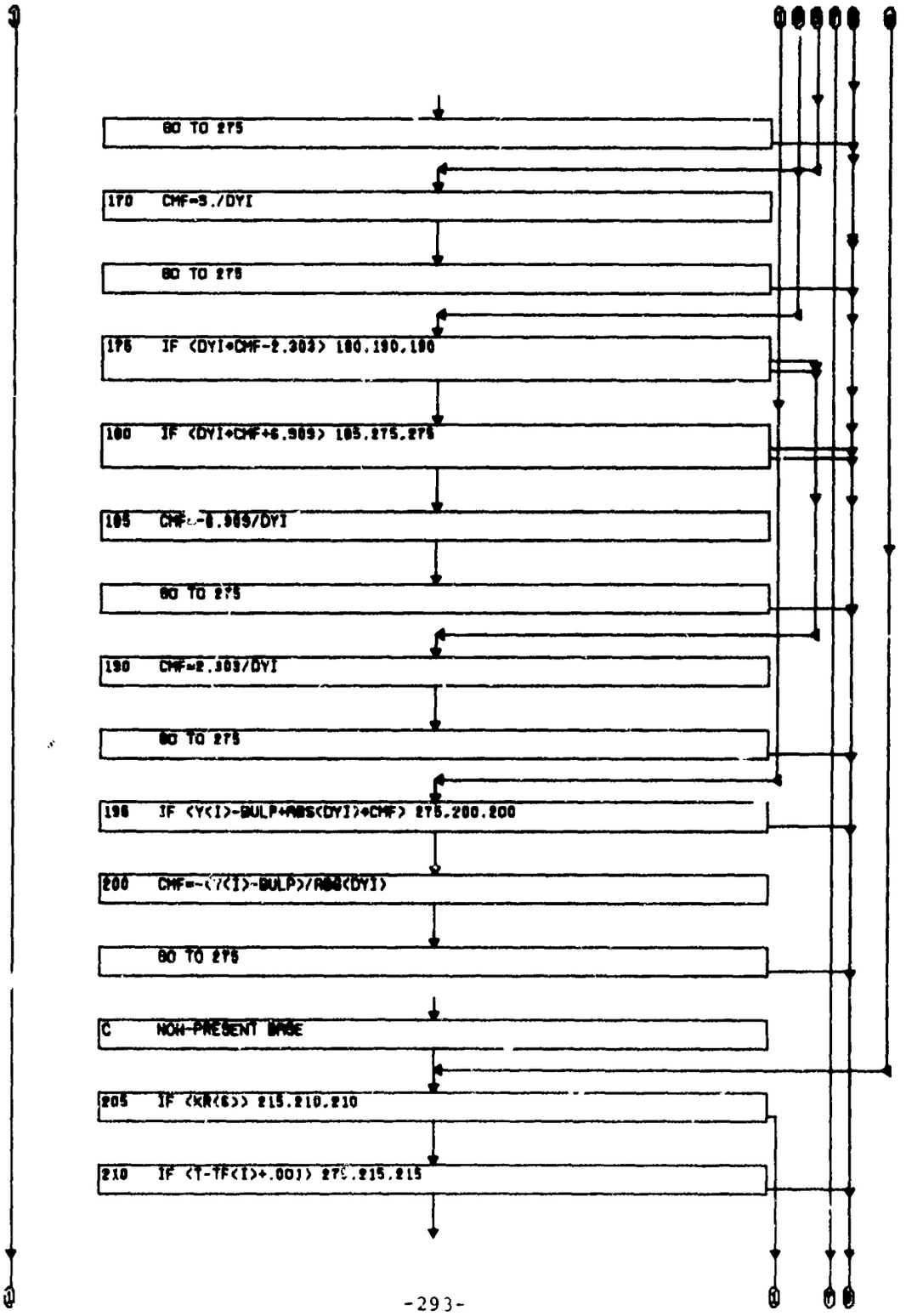
c. Flow Chart

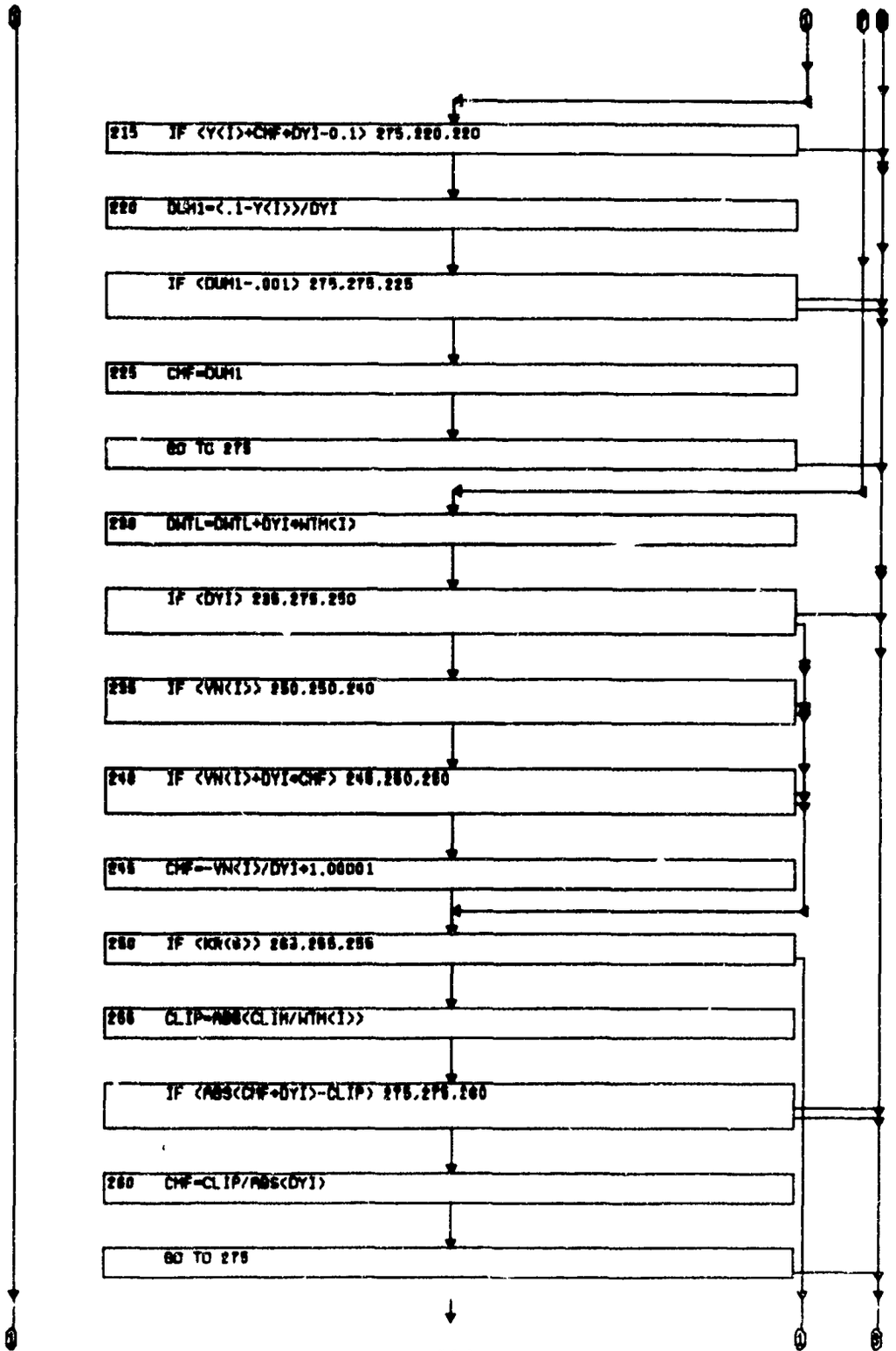

SUBROUTINE CHECT(MODE)
CLIM=AMAX1(1.,W(2)+W(3))+0.2*WTG
CWTL=0.
CWTG=0.
DUMP=P*1.E-7
BUMP=P*1.E-6
BULP=ALOG(BUMP)
CHF=1.
K=0
DO 20 J=2,IS
IF (IB(J)-IB(J-1)) 10,15,20
10 JA=IB(J)
IB(J)=IB(J-1)
IB(J-1)=JA
K=1
GO TO 20
15 IB(J)=1000
20 CONTINUE
IF (K) 25,25,5
25 IB(IS+1)=1000
M=IB(1)
M1=1
L=IS+2
I=0
LL=1
LIM=N+KR(8)
DO 280 IK=1,LIM
I=I+1

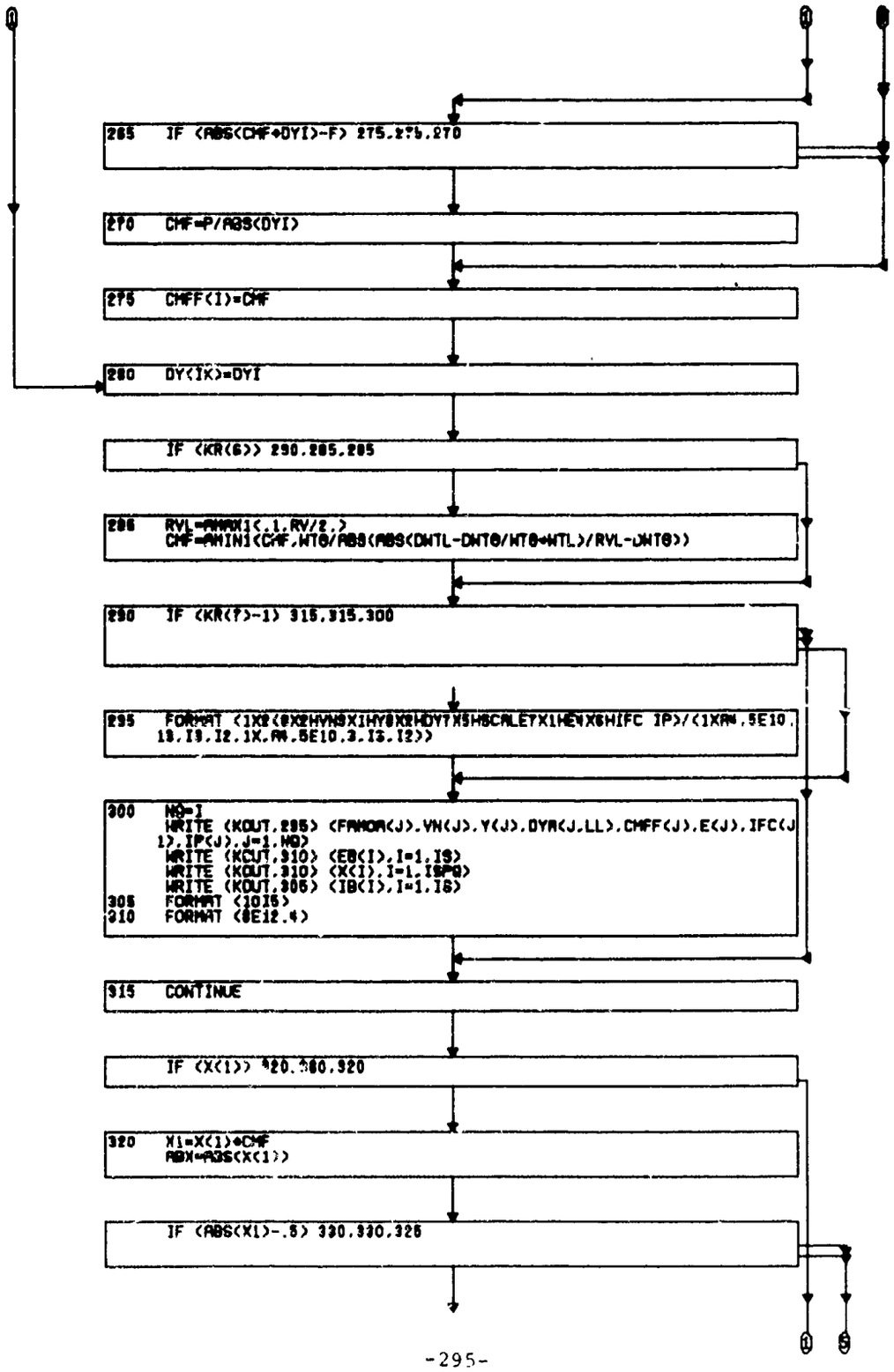

IF (IK-IS) 30,30,45
30 BLANK(I)=0.
IBC(I)=IFC(I)
PMUL(I)=0.
IF (IFC(I)-1) 35,35,75
35 DYI=X(I+2)
IF (IFC(I)+1) 270,40,40
40 IF (IFC(I)) 285,55,290
45 IF (IFC(I)+1) 75,50,50
50 IF (IFC(I)) 75,55,55
55 VA=E(I)-TC(I)*X(I)
DO 65 J=1,IS
IF (IBC(J)) 60,65,65
60 VA=VA+VAL(I,J)*X(J+2)
65 CONTINUE
DYI=VA
GO TO 95

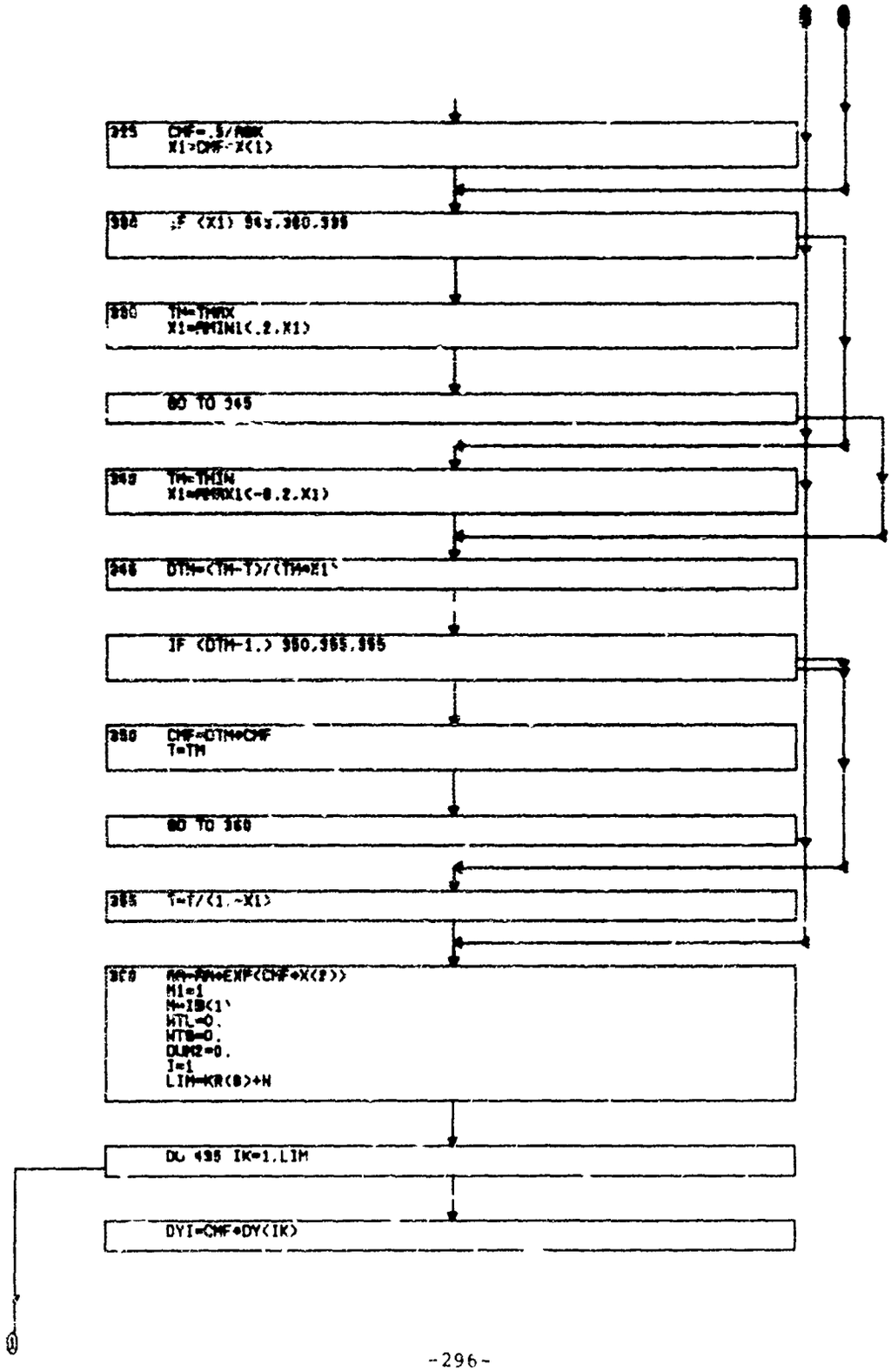

70 IF (IK-IRE) 75.80.75
75 DYI=0.
GO TO 275
80 IFC(I)=1
DYI=X(IER)
GO TO 230
85 L=L+1
IF (L-IER) 90.85.90
90 DYI=X(L)
GO TO 295
95 DWTB=DWTB+VN(I)*DYI*WTH(I)
IF (IP(I)) 100.195.100
100 IF (IK-M) 105.145.105
105 IF (VN(I)-DUMP) 110.140.140
110 IF (MOE) 195.195.115

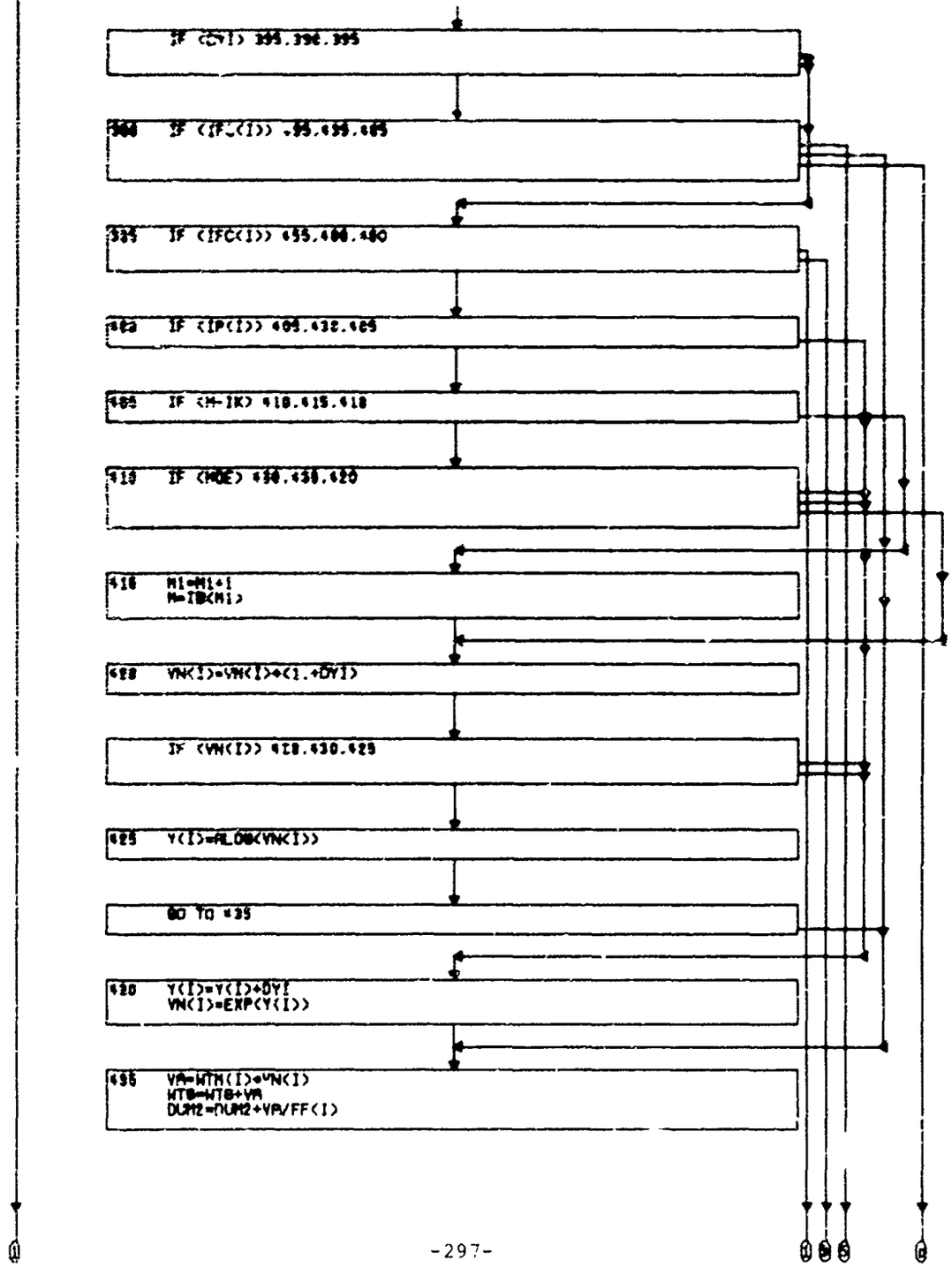

115 IF (DYI) 120,275,125
120 IF (VN(I)/BUMP-.9999995-CHF*DYI) 275,275,130
125 IF (BUMP/VN(I)-1.-CHF*DYI) 135,275,275
130 CHF=(VN(I)/BUMP-.9999995)/DYI
GO TO 275
135 CHF=(BUMP/VN(I)-1.)/DYI
GO TO 275
140 IF (MODE) 145,175,150
145 M1=M1+1
M=IB(M1)
150 IF (DYI) 155,275,160
155 IF (DYI*CHF+.000) 160,275,275
160 IF (DYI*CHF-0.) 275,275,170
165 CHF=-.000/DYI

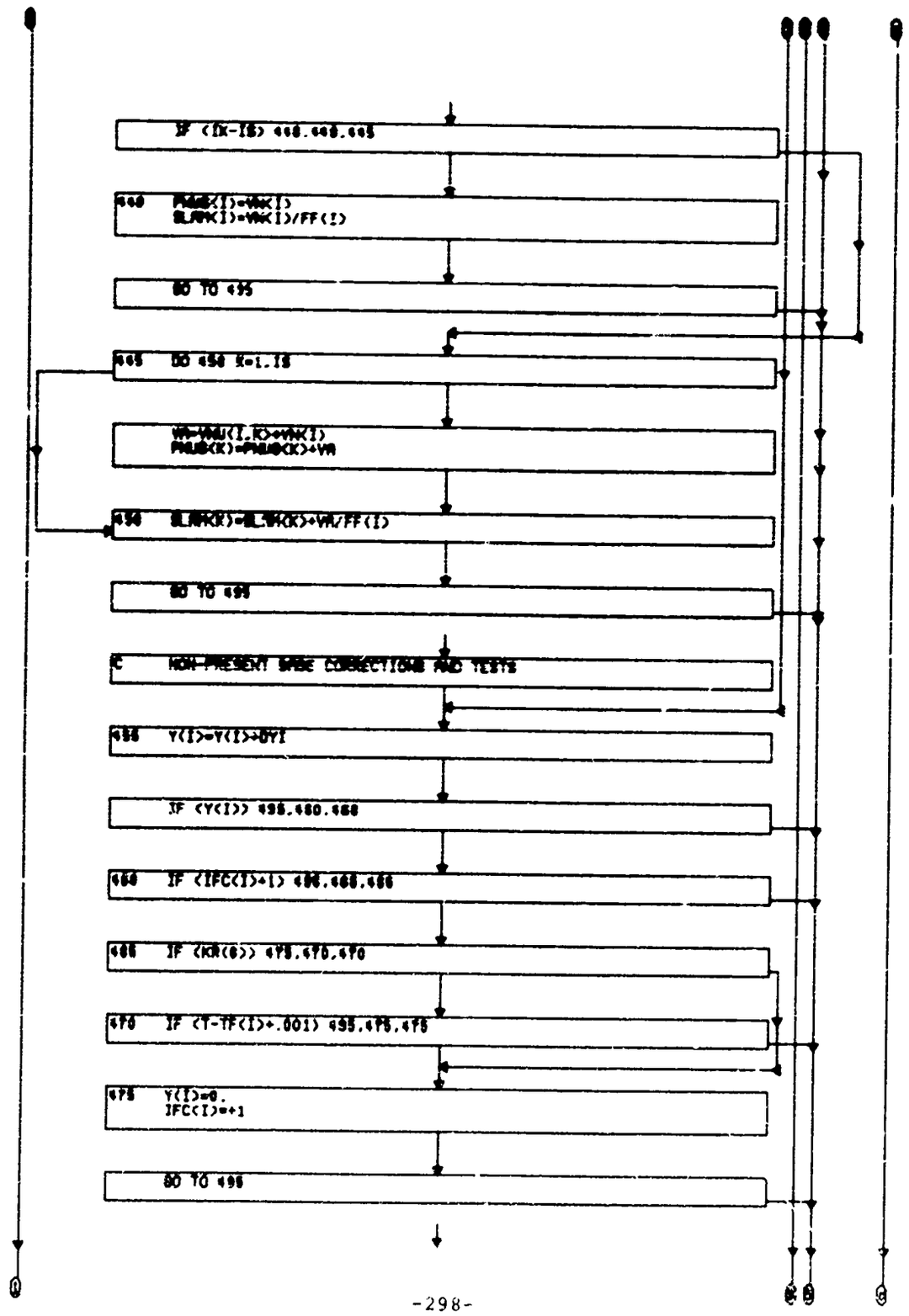

GO TO 275
170 CMF=3./DYI
GO TO 275
175 IF (DYI+CMF-2.303) 180,190,190
180 IF (DYI+CMF+6.909) 185,275,275
185 CMF=-6.909/DYI
GO TO 275
190 CMF=2.303/DYI
GO TO 275
195 IF (Y(I)-BULP+ABS(DYI)+CMF) 275,200,200
200 CMF=-(Y(I)-BULP)/ABS(DYI)
GO TO 275
C NOW-PRESENT BASE
205 IF (KR(6)) 215,210,210
210 IF (T-TF(I)+.001) 275,215,215

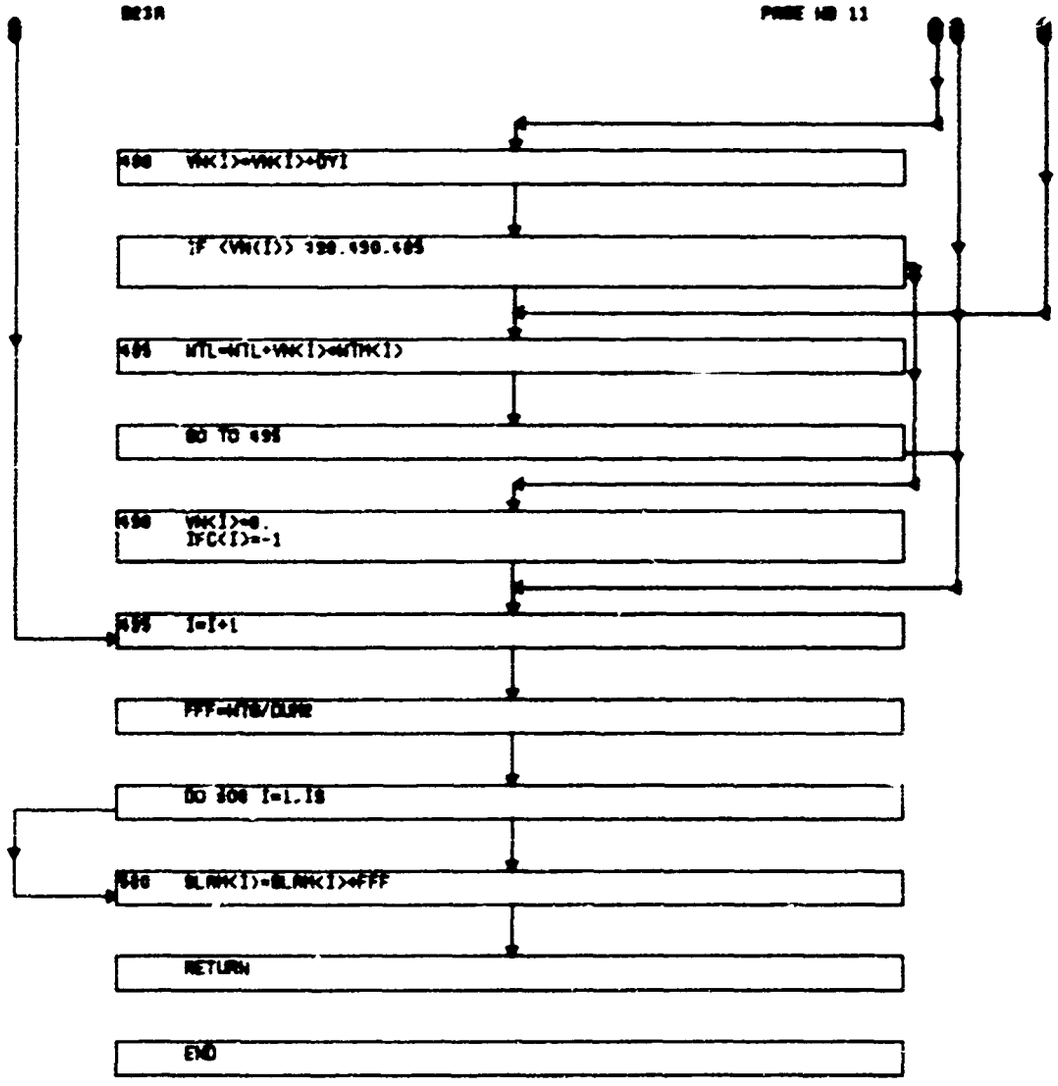

215 IF (Y(I)+CMF*DYI-0.1) 275,220,220
220 DUM1=(.1-Y(I))/DYI
IF (DUM1-.001) 275,275,225
225 CMF=DUM1
GO TO 275
230 DWTL=DWTL+DYI*WTM(I)
IF (DYI) 235,275,250
235 IF (VN(I)) 250,250,240
240 IF (VN(I)+DYI*CMF) 245,250,250
245 CMF=-VN(I)/DYI+1.00001
250 IF (KR(8)) 263,255,255
255 CLIP=ABS(CLIM/WTM(I))
IF (ABS(CMF*DYI)-CLIP) 275,275,260
260 CMF=CLIP/ABS(DYI)
GO TO 275


265 IF (ABS(CMF*DYI)-F) 275,275,270
270 CMF=F/ABS(DYI)
275 CMFF(I)=CMF
280 DY(IK)=DYI
IF (KR(6)) 290,285,285
285 RVL=AMAX1(.1,RV/2.)
CMF=AMIN1(CMF,WT0/ABS(ABS(DWTL-DWT0/WT0*WTL)/RVL-DWT0))
290 IF (KR(7)-1) 315,315,300
295 FORMAT (1X8(8X6HVN8X1HY8X6HDYTX5HSCALETX1HE/1X8HIFC IP)/(1XA4,5E10.
18,I3,I2,1X,A4,5E10.3,I3,I2))
300 MQ=I
WRITE (KOUT,295) (FAMOR(J),VN(J),Y(J),DYA(J,LL),CMFF(J),E(J),IFC(J
1),IP(J),J=1,MQ)
WRITE (KOUT,310) (EB(I),I=1,I9)
WRITE (KOUT,310) (X(I),I=1,I8P9)
WRITE (KOUT,305) (IB(I),I=1,I6)
305 FORMAT (10I5)
310 FORMAT (8E12.4)
315 CONTINUE
IF (X(1)) 320,330,320
320 X1=X(1)*CMF
ABX=ABS(X(1))
IF (ABS(X1)-.5) 330,330,325


CHF=.5/RBX
X1=CHF-X(1)
IF (X1) 945,360,355
TM=THMX
X1=AMIN1(.2,X1)
GO TO 365
TM=THIN
X1=AMAX1(-0.2,X1)
DTM=(TM-T)/(TM+X1)
IF (DTM-1.) 350,365,365
CHF=DTM+CHF
T=TM
GO TO 360
T=T/(1.-X1)
AA=AA+EXP(CHF+X(I))
M1=1
M=IB(1)
WTL=0.
WTB=0.
DUM2=0.
I=1
LIM=KR(8)+N
DO 495 IK=1,LIM
DYI=CHF+DY(IK)


IF (DYI) 395,390,395
IF (IFC(I)) 395,485,485
IF (IFC(I)) 455,400,480
IF (IP(I)) 405,430,405
IF (M-IK) 410,415,410
IF (MOE) 450,450,420
M1=M1+1
M=IB(M1)
VN(I)=VN(I)*(1.+DYI)
IF (VN(I)) 410,430,425
Y(I)=ALOG(VN(I))
GO TO 435
Y(I)=Y(I)+DYI
VN(I)=EXP(Y(I))
VA=WTN(I)*VN(I)
WTB=WTB+VA
DUM2=DUM2+VA/FF(I)


IF (IX-IS) 460,460,465
460 PAGE(I)=VAX(I)
BLANK(I)=VAX(I)/FF(I)
GO TO 495
465 DO 450 K=1,IS
VA=VAU(I,K)+VAX(I)
PAGE(K)=PAGE(K)+VA
450 BLANK(K)=BLANK(K)+VA/FF(I)
GO TO 495
C NON-PRESENT BASE CORRECTIONS AND TESTS
455 Y(I)=Y(I)+DYI
IF (Y(I)) 495,480,460
460 IF (IFC(I)+1) 495,465,465
465 IF (KR(6)) 495,470,470
470 IF (Y-TF(I)+.001) 495,475,475
475 Y(I)=0.
IFC(I)=+1
GO TO 495


BEGIN
PAGE NO 11
490 VVK(I)=VVK(I)+DVI
IF (VVK(I)) 490,490,495
495 WTL=WTL+VVK(I)*WTHK(I)
GO TO 498
498 VVK(I)=0.
IFC(I)=-1
I=I+1
FFF=WTB/DLNG
DO 506 I=1,IS
506 BLNK(I)=BLNK(I)*FFF
RETURN
END

25. SUBROUTINE INPUT - B24A

a. Function

Reads in basic elemental composition data and species property data, selects base species, and sets up stoichiometric coefficients for species formation reactions. Called by REPCON.

b. Listing

```
000001          OB24A                                                          B24A 001
000002                SUBROUTINE INPUT(PP)
000003                INTEGER FAMOA,FAMOB,CHAR,BLANK
000004                INTEGER AMOA,AMOB,ATA,ATB,ATC                            B24A 005
000005                COMMON/INTCOM/KKR(20),KIN,KOUT
000006                DIMENSION CIJ( 71,1),TF(1)                               B24A 006*NEW
000007                DIMENSION UM(10,10)                                      B24A 007*NEW
000008                EQUIVALENCE(TU( 72),TF),(VNU,CIJ)                        B24A 008*NEW
000009                DIMENSION C(10),KPMA(2),RA(2), IM(10),JAT(8),ALPT(8),TAU(10,10)  B24A 009*NEW
000010                DIMENSION IC( 10),LIM(10,10)                             B24A 010*NEW
000011                DIMENSION FFIN( 71),NFIA( 71),NFIB( 71)                  B24A 011*NEW
000012                DIMENSION IFMET( 71),IGMET( 71),ZIGEPS(2),SORCE(8)       B24A 012*NEW
000013                COMMON /BLOCOM/FAMOA( 71),FAMOB( 71),N     ,FR( 71,15),W(3),LEF(10)B24A  13*NEW
000014               1,LEFS(10),FIEASE,LEFW(10)                                B24A  14*NEW
000015                COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B24A  15*NEW
000016               1 TU( 71,2),FF( 71),FFA,FFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B24A  16*NEW
000017               2 KAT(10),IR(10),IS,KR(10),LAM( 71),P,T,TK(10, 7),VN( 71),         B24A  17*NEW
000018               3 VNU( 71,10),ITFF,KR2,NCM,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B24A  18*NEW
000019               4 ,TG(10, 7),EPOVRK,SIGMA,BASMOL                           B24A  19*NEW
000020                COMMON /EQTCOM/SIP,MIP,EL,ENL,FLIB,CPF,IRE,IER,AA,ITB,IN,IL,IT,    B24A  20*NEW
000021               1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WBS,B1,ISP2,ISPB,   B24A  21*NEW
000022               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,MG,  B24A  22*NEW
000023               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      B24A  23*NEW
000024               4 IP( 71),ALP(10),FNU(10),GAMH(10),GAMF(10),BLAM(10),DY( 71),RVS,  B24A  24*NEW
000025               5 CP( 71),H( 71),BB( 71),TC( 71),VLNK( 71),E( 71),PNUB(10),       B24A  25*NEW
000026               6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                    B24A  26*NEW
000027                COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),   B24A  27*NEW
000028               1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),MA(10),LL(10),PMR(10), B24A  28*NEW
000029               2 PRMU(10,10),EESE(10)                                    B24A  29*NEW
000030           301   FORMAT (I3,F7.0,7F10.4)                                        *-24
000031            302 FORMAT(6E9.6,2F6.0,I1)
000032           3020 FORMAT(1X6E12.5,F10.4,F11.4,I2/1X6E12.5,F10.4,F11.4,I2)
000033           3021 FORMAT(2A4,E12.4,2A4,E12.4,2A4,E12.4,2A4,E12.4)             B24A 029
000034            303 FORMAT(1H /1H )                                             B24A 030
000035            304 FORMAT(I3,3A4,E9.3,7E8.3)
000036            305 FORMAT(94HORELATIVE ELEMENTAL COMPOSITIONS, ATOMIC WTS/UNIT MASS  B24A 032
000037               1/6X6HAT.NO.3X7HELEMENT4X9HATOMIC WTS8HEDGE GAS4X10HPYRO.GAS 15X
000038               2 6HCHAR 15X10HPYRO.GAS 25X6HCHAR 25X10HPYRO.GAS 35X6HCHAR 3/
000039               3 (7X13,3X3A4,F10.5,7F13.7))
000040            306 FORMAT(7(F3.0,I3), A2,9A4)
000041                DATA CHAR,BLANK/4HCHAR,4H    /
000042                P=PP
000043                KR(3)=2
000044                KR(2)=KKR(12)+1
000045                IF(KR(2).EQ.3.OR.KR(2).EQ.8) KR(3)=6
000046                IF(KR(2).EQ.7) GO TO 3751
000047           3062 MT=0
000048                FFA=0.489
000049                FITMOL=26.7
000050                FITGMW=24.3
000051                GGA = 0.454
000052                BASMOL=32.0
000053                SIGMA=3.467
000054                EPOVRK=106.7
000055                NFF=0                                                     B24A 042
000056                VINT=P*1.E-6                                              B24A 043
000057                YINT=ALOG(VINT)                                           B24A 044
000058                RMMG=1.                                                   B24A 045
```

```
000059                IF (KR(2)) 334,334,321                                    B24A 046
000060           321 READ(KIN,301) IS,FFAR,DUB2,DUB3,DUB4,DUB5,DUB6,DUB7,DUB8
000061                IF (DUB2.GT.0.) FITMOL=DUB2
000062                IF (DUB3.GT.0.) BASMOL=DUB3
000063                IF (DUB4.GT.0.) SIGMA=DUB4
000064                IF (DUB5.GT.0.) EPOVRK=DUB5
000065                IF (DUB6.GT.0.) GGA =DUB6
000066                IF (DUB7.GT.0.) FITGMW=DUB7
000067                IF(FFAR) 3213,3212,3211                                   B24A 048
000068           3213 FFA=0.                                                    B24A 049
000069                GO TO 3212                                                B24A 050
000070           3211 FFA=FFAR                                                  B24A 051
000071           3212 CONTINUE                                                  B24A 052
000072                JAT(8)=0                                                  B24A 053
000073                IY=3                                                      B24A 054
000074                IF (IS-10) 311,311,399                                    B24A 055
000075            311 READ(KIN,304) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J,I),
000076               1  I=1,7),J=1,IS)
000077                DO 327 K=1,7
000078                VA=0.                                                     B24A 059
000079                DO 322 J=1,IS                                             B24A 060
000080                IF(KAT(J)-99) 3111,325,3111                               B24A 061
000081           3111 IF(TK(J,K)) 324,322,325                                   B24A 062
000082            324 VA=VA-TK(J,K)                                             B24A 063
000083                TK(J,K)=-TK(J,K)/WAT(J)                                   B24A 064
000084                GO TO 322                                                 B24A 065
000085            325 VA=VA+TK(J,K)*WAT(J)                                      B24A 066
000086            322 CONTINUE                                                  B24A 067
000087                IF(VA) 326,327,326
000088            326 DO 323 J=1,IS
000089            323 TK(J,K)=TK(J,K)/VA                                        B24A 069
000090            327 CONTINUE
000091                WRITE(KOUT,305) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J,I),
000092               1  I=1,7),J=1,IS)
000093                WRITE (KOUT,308)
000094           308  FORMAT(//3X61HTHERMODYNAMIC PROPERTY CURVE-FIT DATA (SEE MANUAL FO
000095               1R FORMAT)//)
000096                ISP=IS+1                                                  B24A 072
000097                IF(KR(3)) 399,399,334                                     B24A 073
000098            334 TEMAX=0.                                                  B24A 074
000099                AAA=0.                                                    B24A 075
000100                N=0                                                       B24A 076
000101                II=ISP                                                    B24A 077
000102                J=1                                                       B24A 078
000103            342 READ(KIN,306)(ALPT(I),JAT(K),K=1,7),SORCE,AMOA,AMOB
000104                IF(ALPT(1)) 3421,399,3420
000105           3420 IF(JAT(1)) 344,3421,344
000106           3421 NFF=ABS(ALPT(1))
000107                READ(KIN,3021)(NFIA(I),NFIB(I),FFIN(I),I=1,NFF)           B24A 082
000108                GO TO 342                                                 B24A 083
000109            344 DO 345 K=1,IS
000110            345 C(K)=0.
000111                DO 349 I=1,7
000112                IF(JAT(I)) 346,349,346
000113            346 DO 347 K=1,IS
000114                IF(JAT(I)-KAT(K)) 347,348,347
000115            347 CONTINUE
000116                READ(KIN,303)
000117                GO TO 342
000118            348 C(K)=ALPT(I)
```

```
000119          349 CONTINUE
000120              WT=0.
000121              L=1
000122              LAMKK=0
000123              DO 388 I=1,IS
000124              IF(C(I)) 387,388,387
000125          387 LAMKK=LAMKK+L
000126              WT=WT+C(I) * WAT(I)
000127          388 L=L+L
000128              IF(J-IS) 360,360,369
000129          360 JM=J-1                                                  B24A 099
000130              DO 3601 L=1,IS                                          B24A 100
000131         3601 CIJ(L,J)=C(L)                                           B24A 101
000132              LAMI(J) = LAMKK
000133              IF (JM) 320,320,313
000134          313 DO 314 L=1,JM                                           B24A 104
000135              IML=IM(L)                                               B24A 105
000136              UGH=C(IML)                                              B24A 106
000137              UM(L,J)=0.                                              B24A 107
000138              IF(UGH) 353,314,353                                     B24A 108
000139          353 DO 393 I=1,L                                            B24A 109
000140          393 UM(I,J)=UM(I,J)-UM(I,L)*UGH                             B24A 110
000141              DO 394 I=IML,IS                                         B24A 111
000142          394 C(I)=C(I)-TAU(I,L)*UGH                                  B24A 112
000143          314 UM(J,L)=0.                                              B24A 113
000144          320 DO 316 I=1,IS                                           B24A 114
000145              IF(ABS (C(I))-.001)316,316,317                          B24A 115
000146          316 TAU(I,J)=0.                                             B24A 116
000147              DO 396 I=1,JM                                           B24A 117
000148          396 VNU(II,I)=-UM(I,J)                                      B24A 118
000149              DO 397 I=J,IS                                           B24A 120
000150          397 VNU(II,I)=0.                                            B24A 121
000151              LAMI(II)=LAMKK                                          B24A 123
000152              GO TO 370
000153          317 IM(J)=I                                                 B24A 124
000154              UM(J,J)=1.                                              B24A 125
000155              DO 398 L=1,J                                            B24A 126
000156          398 UM(L,J)=UM(L,J)/C(I)                                    B24A 127
000157              DO 328 L=I,IS                                           B24A 128
000158          328 TAU(L,J)=C(L)/C(I)                                      B24A 129
000159              YC=YINT                                                 B24A 130
000160              KK=J                                                    B24A 131
000161              J=J+1                                                   B24A 132
000162              IF(J-IS) 372,372,329                                    B24A 133
000163          329 DO 330 L=2,IS                                           B24A 134
000164              JM=ISP-L                                                B24A 135
000165              IMJ=IM(JM+1)                                            B24A 136
000166              DO 330 K=1,JM                                           B24A 137
000167              UGH=TAU(IMJ,K)                                          B24A 138
000168              DO 330 I=1,IS                                           B24A 139
000169          330 UM(I,K)=UM(I,K)-UGH*UM(I,JM+1)                          B24A 140
000170              DO 333 I=1,IS                                           B24A 141
000171          337 IMI=IM(I)                                               B24A 142
000172              IF(IMI-I) 336,333,336                                   B24A 143
000173          336 DO 338 K=1,IS                                           B24A 144
000174              V=UM(K,IMI)                                             B24A 145
000175              UM(K,IMI)=UM(K,I)                                       B24A 146
000176          338 UM(K,I)=V                                               B24A 147
000177              IM(I)=IM(IMI)                                           B24A 148
000178              IM(IMI)=IMI                                             B24A 149
                                                                            B24A 150
```

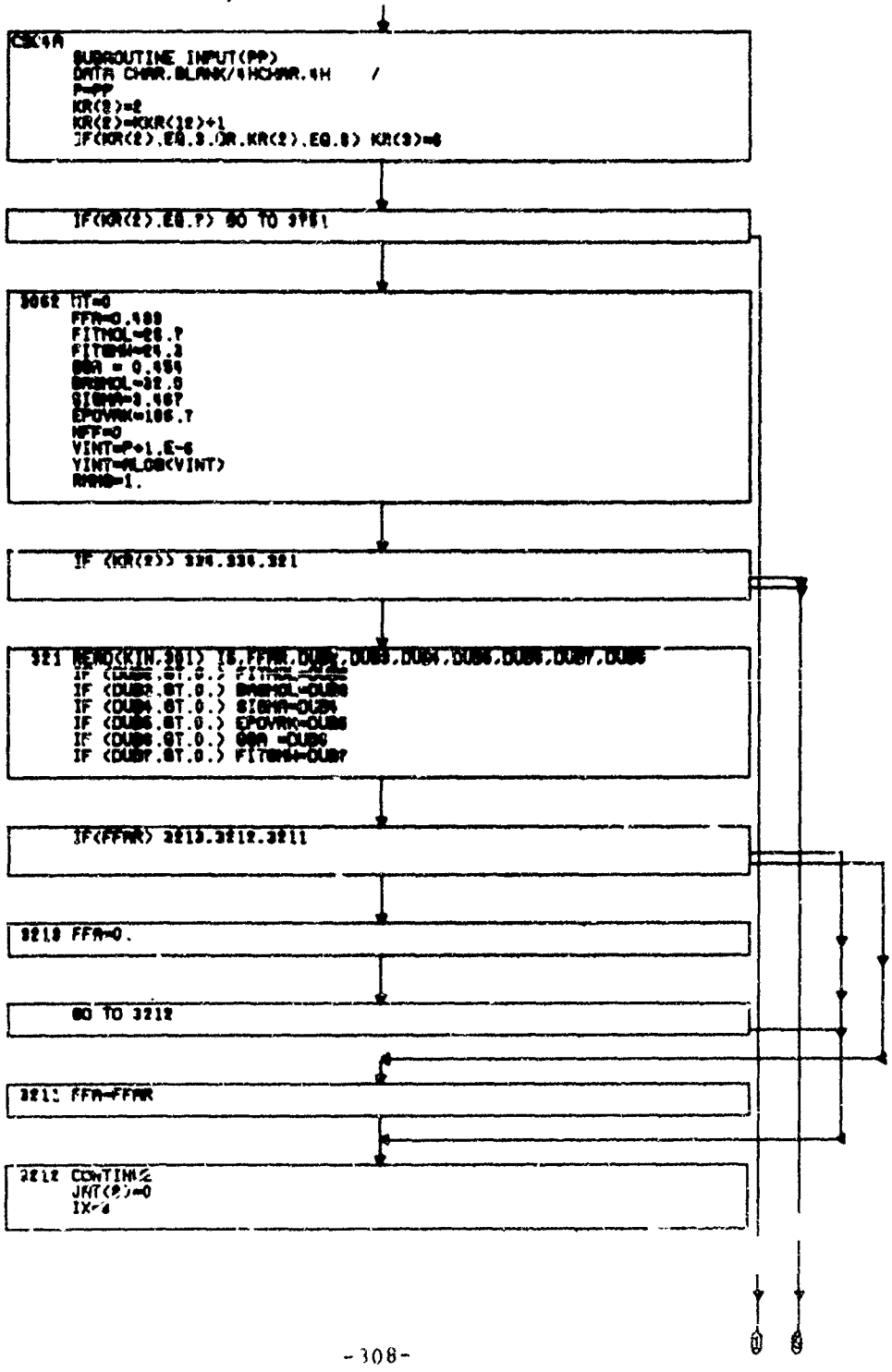
```
000179                  GO TO 337                                                  B24A 151
000180              333 CONTINUE                                                   B24A 152
000181            C-----ELEMENT -- BASE GAS CORRESPONDENCE                        B24A 153
000182            C     INITIALIZE ROW AND COLUMN SUMS                            B24A 154
000183                  IG=IS                                                     B24A 155
000184                  DO 401 I=1,IS                                             B24A 156
000185                  IR(I)=-1                                                  B24A 157
000186              401 IC(I)=-1                                                  B24A 158
000187            C     EVALUATE INITIAL SUMS                                     B24A 159
000188                  LAMD=1
000189                  DO 402 I=1,IS
000190                  DO 403 J=1,IS
000191                  LIM(I,J)=MOD(LAMI(J)/LAMD,2)
000192                  IC(J) = IC(J) + LIM(I,J)
000193              403 IR(I)= IR(I) + LIM(I,J)
000194              402 LAMD=LAMD+LAMD
000195            C     CHECK FOR ZEROS                                           B24A 167
000196              426 IZ=0                                                      B24A 168
000197              404 DO 412 I=1,IS                                             B24A 169
000198                  IF(IC(I)-IZ) 408,405,408                                  B24A 170
000199              405 DO 406 J=1,IS                                             B24A 171
000200                  IF(LIM(J,I)) 407,406,407                                  B24A 172
000201              406 CONTINUE                                                  B24A 173
000202              407 IC(I)=-J                                                  B24A 174
000203                  IR(J)=-I                                                  B24A 175
000204                  DO 428 K=1,IS                                             B24A 176
000205                  LIM(J,K)=0                                                B24A 177
000206                  IF(LIM(J,K)) 425,427,425                                  B24A 178
000207              425 IC(K)=IC(K)-1                                             B24A 179
000208                  LIM(J,K)=0                                                B24A 180
000209              427 IF(LIM(K,I)) 422,428,422                                  B24A 181
000210              422 LIM(K,I)=0                                                B24A 182
000211                  IR(K)=IR(K)-1                                             B24A 183
000212              428 CONTINUE                                                  B24A 184
000213                  GO TO 413                                                 B24A 185
000214              408 IF(IR(I)-IZ)  412,409,412                                 B24A 186
000215              409 DO 410 J=1,IS                                             B24A 187
000216                  IF(LIM(I,J)) 411,410,411                                  B24A 188
000217              411 IC(J)=-I                                                  B24A 189
000218                  IR(I)=-J                                                  B24A 190
000219                  LIM(I,J)=0                                                B24A 191
000220                  GO TO 4101                                                B24A 192
000221              410 CONTINUE                                                  B24A 193
000222             4101 DO 430 K=1,IS                                             B24A 194
000223                  IF(LIM(K,J))424,429,424                                   B24A 195
000224              424 IR(K)=IR(K)-1                                             B24A 196
000225                  LIM(K,J)=0                                                B24A 197
000226              429 IF(LIM(I,K)) 423,430,423                                  B24A 198
000227              423 LIM(I,K)=0                                                B24A 199
000228                  IC(K)=IC(K)-1                                             B24A 200
000229              430 CONTINUE                                                  B24A 201
000230                  GO TO 413                                                 B24A 202
000231              412 CONTINUE                                                  B24A 203
000232                  IZ=IZ+1                                                   B24A 204
000233                  GO TO 404                                                 B24A 205
000234              413 IG=IG-1                                                   B24A 206
000235                  J=IS+1                                                    B24A 207
000236                  IF(IG) 414,414,426                                        B24A 208
000237              414 IF(KR(3)-3) 372,372,415                                   B24A 209
000238              415 FAMOA(IS)=AMOA                                            B24A 210
```

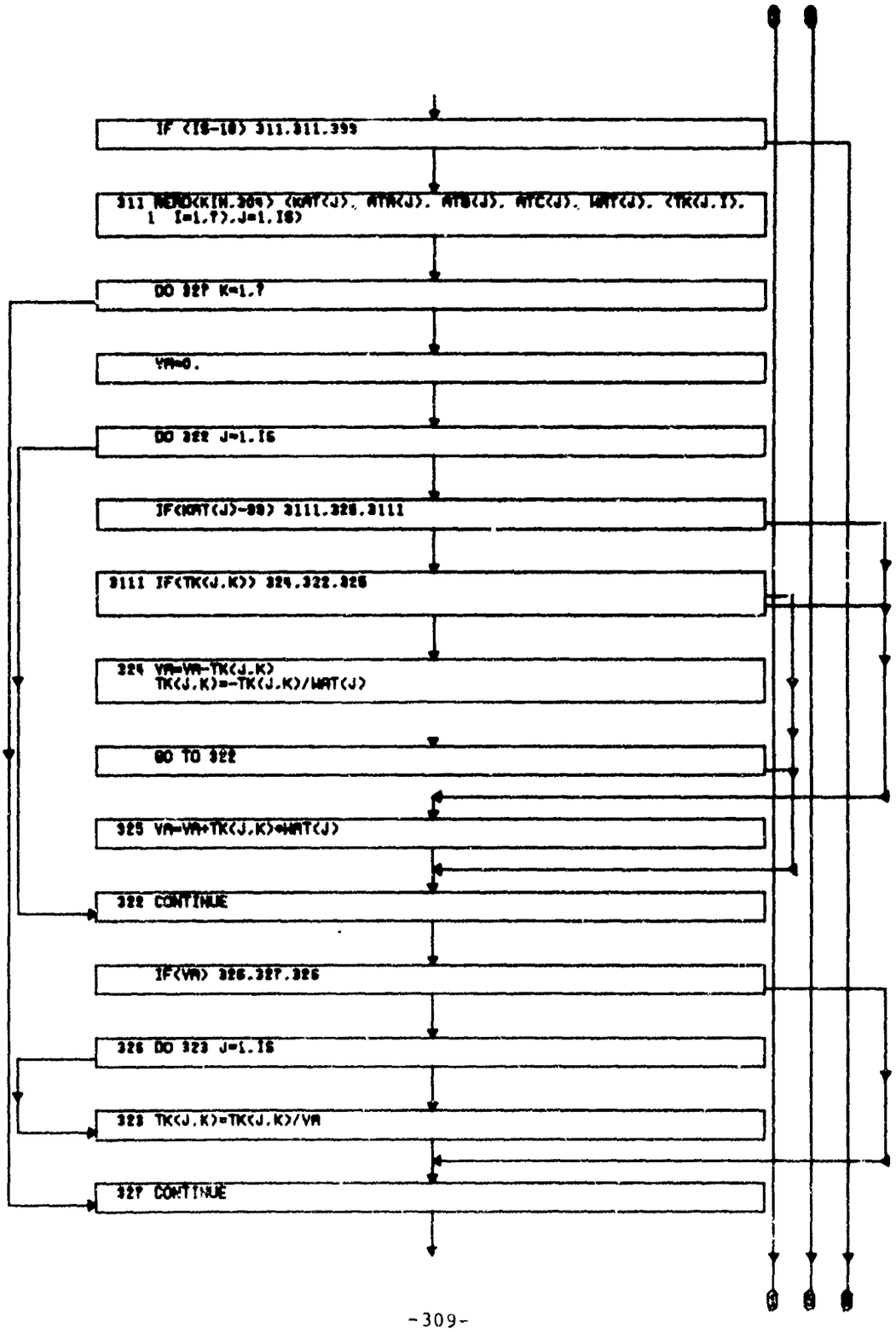
```
000239                FAMOB(IS)=AMOP                                                  B24A 211
000240                DO 416 I=1,IS                                                   B24A 212
000241                K=-IR(I)                                                        B24A 213
000242                IC(I)=FAMOA(K)                                                  B24A 214
000243           416  IM(I)=FAMOB(K)                                                  B24A 215
000244           417  FORMAT(///5X9HELEMENT  ,18A4)
000245           418  FORMAT( 5X9HBASE SP   6(4X2A4))                                 B24A 219
000246                GO TO 372                                                       B24A 220
000247           369  DO 361 L=1,IB                                                   B24A 221
000248                VNU(II,L)=0.                                                    B24A 223
000249                DO 361 I=1,IB                                                   B24A 224
000250           361  VNU(II,L)=VNU(II,L)+C(I)*UM(L,I)                                B24A 225
000251                LAMI(II)=LAMKK
000252           370  KK=II                                                           B24A 226
000253                II=II+1                                                         B24A 227
000254                YC= 0.                                                          B24A 228
000255           372  READ(KIN,302) (RA(K),RB(KK,K), RC(KK,K), RD(KK,K), RE(KK,K),
000256               1RF(KK,K), ZIGEPS(K), TU(KK,K),KPHA(K),K=1,2)
000257                IF(KPHA(1)-KPHA(2)) 3733,3736,3734
000258           3733 IF(KPHA(1)+KPHA(2)-3) 3734,3737,3734
000259           3734 WRITE(KOUT,3735) AMOA,AMOB
000260           3735 FORMAT(////25H BAD PHASE NUMBERING FOR 2A4)
000261                STOP
000262           3736 IF(KPHA(1)-1) 3734,3727,3728
000263           3737 TU(KK,1)=-TU(KK,1)
000264           3728 FF(KK) = 1.E+10
000265                GG(KK) = 1.E+10
000266                GO TO 3729
000267           3727 FF(KK)=(WT/FITMOL) **FFA
000268                IFMET(KK)=2
000269                GG(KK) = -1.
000270           3729 IF(NFF) 3726,3449,3730
000271           3730 DO 3723 I=1,NFF                                                 B24A 233
000272                IF(NFIA(I)-AMOA) 3723,3724,3723                                 B24A 234
000273           3724 IF(NFIB(I)-AMOB) 3723,3720,3723
000274           3720 IF(FFIN(I)-100.) 3725,3731,3731
000275           3725 IF (FFIN(I)) 3480,3480,3481
000276           3480 GG(KK) = -FFIN(I)
000277                 GMET(KK)=1
000278                GO TO 3723
000279           3481 FF(KK) = FFIN(I)
000280                IFMET(KK)=1
000281                GO TO 3723
000282           3731 TF(KK)=FFIN(I)
000283           3723 CONTINUE
000284                IF (GG(KK)) 3449,3449,3455
000285           3449 IF (ZIGEPS(1)-100.) 3453,3452,3452
000286           3453 IF  (ZIGEPS(1)) 3452,3452,3441
000287           3441 IF (ZIGEPS(2)) 3452,3452,3443
000288           3443 GG(KK) = ZIGEPS(1)/SIGMA  *  (ZIGEPS(2)/EPOVRK)**.0795   *
000289               1  (WT/BASMOL)**.25
000290                IGMET(KK)=3
000291                GO TO 3455
000292           3452 IF (KPHA(1)-1)3456,3457,3456
000293           3456 GG(KK) = 1.E+10
000294                GO TO 3455
000295           3457 GG(KK) = (WT/FITGMW)**GGA
000296                IGMET(KK)=2
000297           3455 CONTINUE
000298           3726 IF(KR(3)-6) 3722,3721,3722                                      B24A 243
```

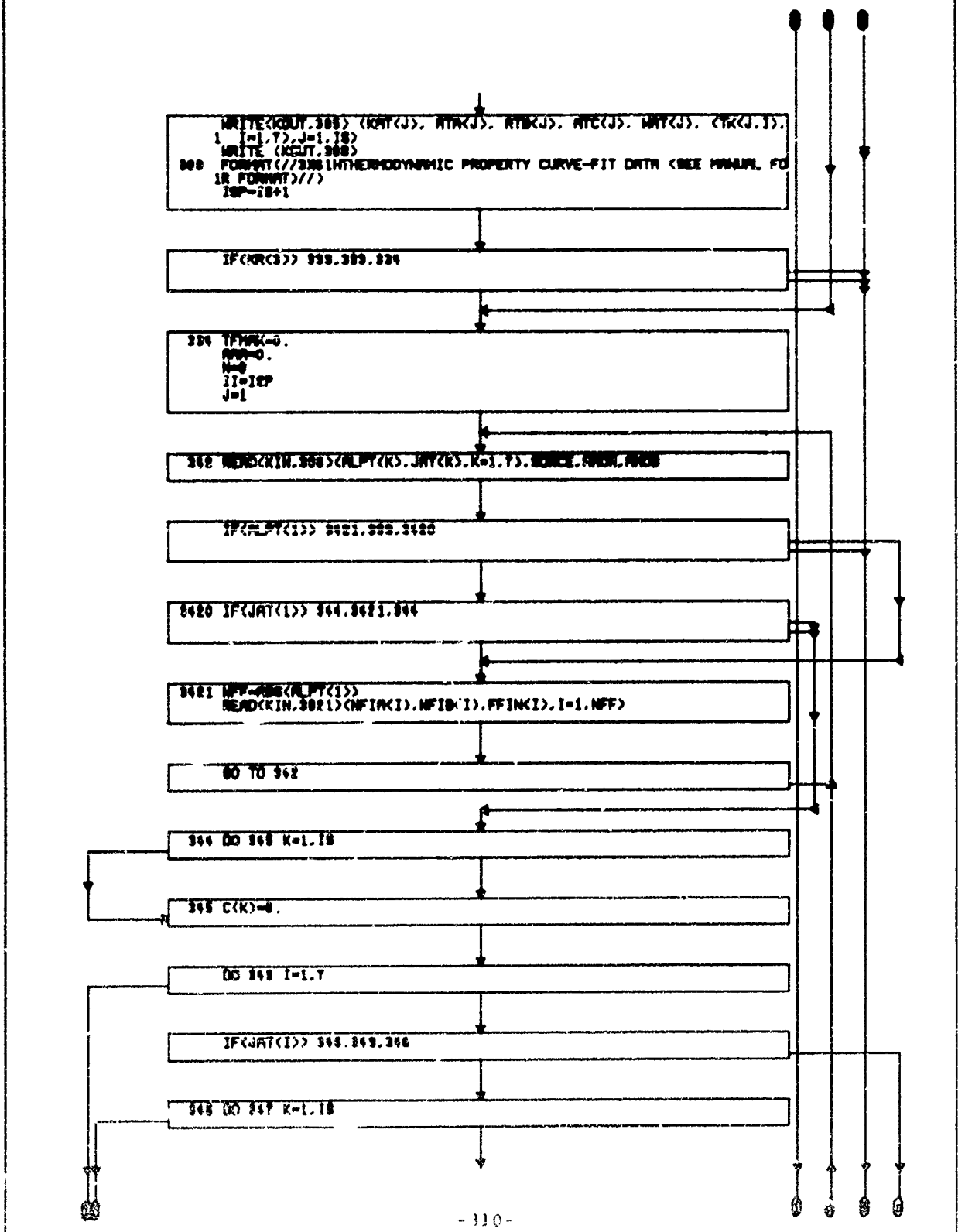
```
000299          3721 WRITE(KOUT,306)(ALPT(K),JAT(K), K=1,7), SORCE,AMOA,AMOB
000300               WRITE(KOUT,3020)(RA(K), RB(KK,K), RC(KK,K), RD(KK,K), RE(KK,K),
000301              1RF(KK,K),ZIGEPS(K),TU(KK,K),KPHA(K),K=1,2)
000302          3722 FAMOA(KK)=AMOA                                                  B24A 247
000303               FAMOB(KK)=AMOB                                                  B24A 248
000304               WTM(KK)=WT                                                      B24A 251
000305               RR(KK,1)= RB(KK,1) + RA(1)
000306               RR(KK,2) = RB(KK,2) + RA(2)
000307               N=N+1                                                           B24A 254
000308               IF(KPHA(1)-1)3734,362,364
000309           364 IFC(KK)=-1                                                      B24A 267
000310               VN(KK)=0.                                                       B24A 268
000311               Y(KK)=YC                                                        B24A 269
000312               IF(TF(KK)-TFMAX) 342,342,371                                    B24A 270
000313           371 TFMAX=TF(KK)                                                    B24A 271
000314               GO TO 342                                                       B24A 272
000315           362 IFC(KK)=0                                                       B24A 273
000316               VN(KK)=VINT                                                     B24A 274
000317               Y(KK)=YINT                                                      B24A 275
000318               GO TO 342                                                       B24A 276
000319          399  WRITE (KOUT,417) (ATA(I),ATB(I),ATC(I),I=1,18)
000320               WRITE (KOUT,418) (IC(I),IM(I),I=1,18)
000321          500  WRITE(KOUT,110) SIGMA,EPOVRK,BARMOL
000322          110  FORMAT(///3X30HMOLECULAR TRANSPORT PROPERTIES/5X79HVISCOSITY .....
000323              1 BUDDENBERG - WILKE MIXTURE FORMULA WITH MU(I) CALCULATED ON/21X34
000324              2HTHE BASIS OF D(I,I) = DBAR/G(I)**2//5X80HTHERMAL CONDUCTIVITY ...
000325              3.. MASON - SAXENA MIXTURE FORMULA WITH EUCKEN CORRECTION//5X73HDIF
000326              4FUSION COEFFICIENTS ..... D(I,J) = DBAR/(F(I)*F(J)) WITH DBAR BASE
000327              5D ON/21X8HSIGMA = ,F8.4,11H, EPOVRK = ,F9.4,13H, AND MREF = ,F8.4)
000328               WRITE (KOUT,111) FITMOL,FFA,FITGMW,GGA
000329          111  FORMAT(///7X16HMETHODS EMPLOYED//8X63HG CONDENSED PHASE, VALUES FOR
000330              1 F(I) AND G(I) SET EQUAL TO 1.E+10//8X42HG VALUES FOR F(I) (OR G(I
000331              2)) INPUT DIRECTLY//8X71HG VALUES FOR F(I) (OR G(I)) CALCULATED BY
000332              3 F(I) =(M(I)/FITMOL)**FFA AND/10X63HG(I) = (M(I)/FITGMW)**GGA WHER
000333              4E M(I) IS SPECIES MOLECULAR WEIGHT,/10X,9HFITMOL = ,F8.4,12H, AND
000334              5FFA = ,F6.4,11H, FITGMW = F8.4,12H, AND GGA = ,F6.4)
000335               WRITE (KOUT,112)
000336          112  FORMAT(/8X79HG VALUES FOR G(I) CALCULATED BY G(I) = SQRT(DBAR/D(I,
000337              1I)) * (SIGMA(I)/SIGMA)    /10X73H* (EPS(I)/EPOVRK) **0.0795 * (M(I
000338              2)/MREF) **0.25 WHERE SIGMA(I) AND EPS(I)/10X33HARE GIVEN WITH THER
000339              3MODYNAMIC DATA//7X73HSPECIES   F(I) METHOD G(I) METHOD       SPECI
000340              4ES   F(I) METHOD G(I) METHOD)
000341               WRITE (KOUT,113 '(FAMOA(KK),FAMOB(KK),FF(KK),IFMET(KK),GG(KK),IGME
000342              1T(KK)),KK=1,N)
000343          113  FORMAT(7X,2A4,1X,F5.3,3X,I1,3X,F9.3,3X,I1,10X,2A4,1X,F5.3,3X,I1,3X
000344              1,F5.3,3X,I1)
000345               WRITE (KOUT,419)
000346          419  FORMAT (//3X61HEQUATION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE
000347              1 EXPANSION/)
000348               DO 375 L=1,7
000349               DO 375 I=1,18                                                   B24A 278
000350               TQ(I,L)=0.                                                      B24A 279
000351               DO 375 K=1,18                                                   B24A 280
000352           375 TQ(I,L)=TQ(I,L)+UM(I,K)*TK(K,L)                                 B24A 281
000353               IF(KR(2)-5) 3752,3752,3751
000354          3751 CONTINUE
000355           240 FORMAT(8F10.6)                                                  THER1330
000356           245 FORMAT (2I3)                                                    THER1340
000357           250 FORMAT(3E10.4)                                                  THER1350
000358           255 READ(KIN,245)NT                                                 THER1370
```

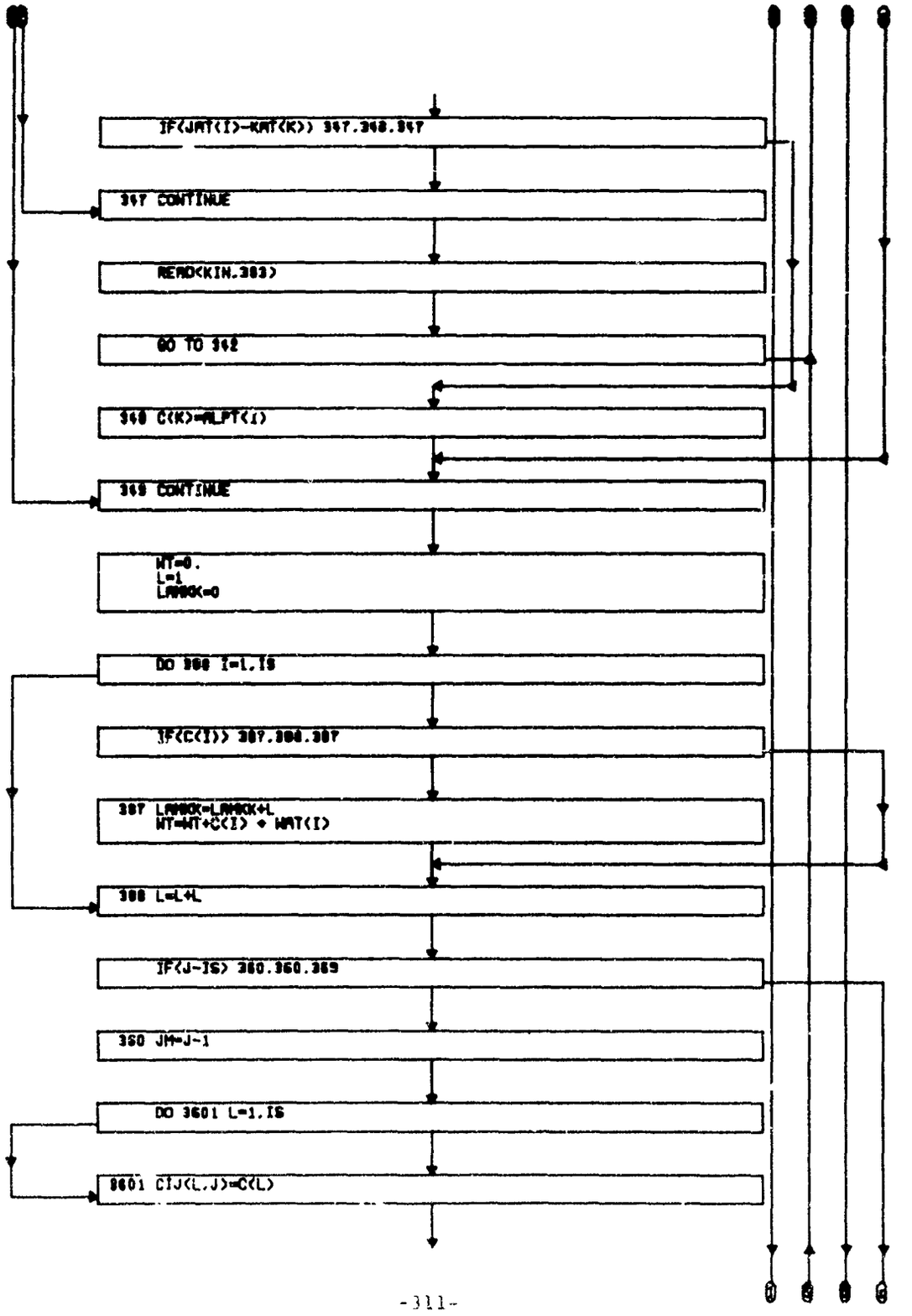
```
000359                IF(MT) 3752,3752,256
000360           256  DO 260 M=1,MT                                          THER1380
000361                READ(KIN,230)FKF(M),EAK(M),EXK(M)                      THER1390
000362                READ(KIN,240)(RMU(I,M),I=1,I8)                         THER1400
000363           260  READ(KIN,240)(PMU(I,M),I=1,I8)                         THER1410
000364           265  FORMAT (//3X,7HKINETIC)
000365           270  FORMAT (3X,11HREACTION---,I7,9I10)
000366           275  FORMAT (/3X,8HREACTANT)
000367           280  FORMAT (5X,12HCOEFFICIENTS/)
000368           285  FORMAT (8X,2A4,F8.2,9F10.2)                            THER1540
000369           290  FORMAT (/3X,7HPRODUCT)
000370           295  FORMAT (/3X,12HPRE-EXPONENT)
000371           200  FORMAT (5X,6HFACTOR,4X,10E10.3)
000372           205  FORMAT (/3X,10HACTIVATION)
000373           210  FORMAT (5X,6HENERGY,4X,10E10.3)
000374           215  FORMAT (/3X,8HREACTION)
000375           220  FORMAT (5X,5HORDER,5X,10E10.3)
000376                WRITE(KOUT,265)
000377                WRITE(KOUT,270)(M,M=1,MT)                              THER1
000378                WRITE(KOUT,275)
000379                WRITE(KOUT,280)
000380                DO 225 I=1,I8
000381           225  WRITE(KOUT,285)FAMOA(I),FAMOB(I),(RMU(I,M),M=1,MT)
000382                WRITE(KOUT,290)
000383                WRITE(KOUT,280)
000384                DO 230 I=1,I8
000385           230  WRITE(KOUT,285)FAMOA(I),FAMOB(I),(PMU(I,M),M=1,MT)
000386                WRITE(KOUT,295)
000387                WRITE(KOUT,200)(FKF(M),M=1,MT)
000388                WRITE(KOUT,205)
000389                WRITE(KOUT,210)(EAK(M),M=1,MT)
000390                WRITE(KOUT,215)
000391                WRITE(KOUT,220)(EXK(M),M=1,MT)
000392           3752 VV(N+1)=0.
000393                IFC(N+1)=-1
000394                WTM(N+1)=-1.
000395                FAMOA(N+1)=CHAR
000396                FAMOB(N+1)=BLANK
000397                TF(N+1)=50000.
000398                IF(DUB8.GT.0.) TF(N+1) = BLANK
000399                RETURN
000400                END                                                    8244 283
```

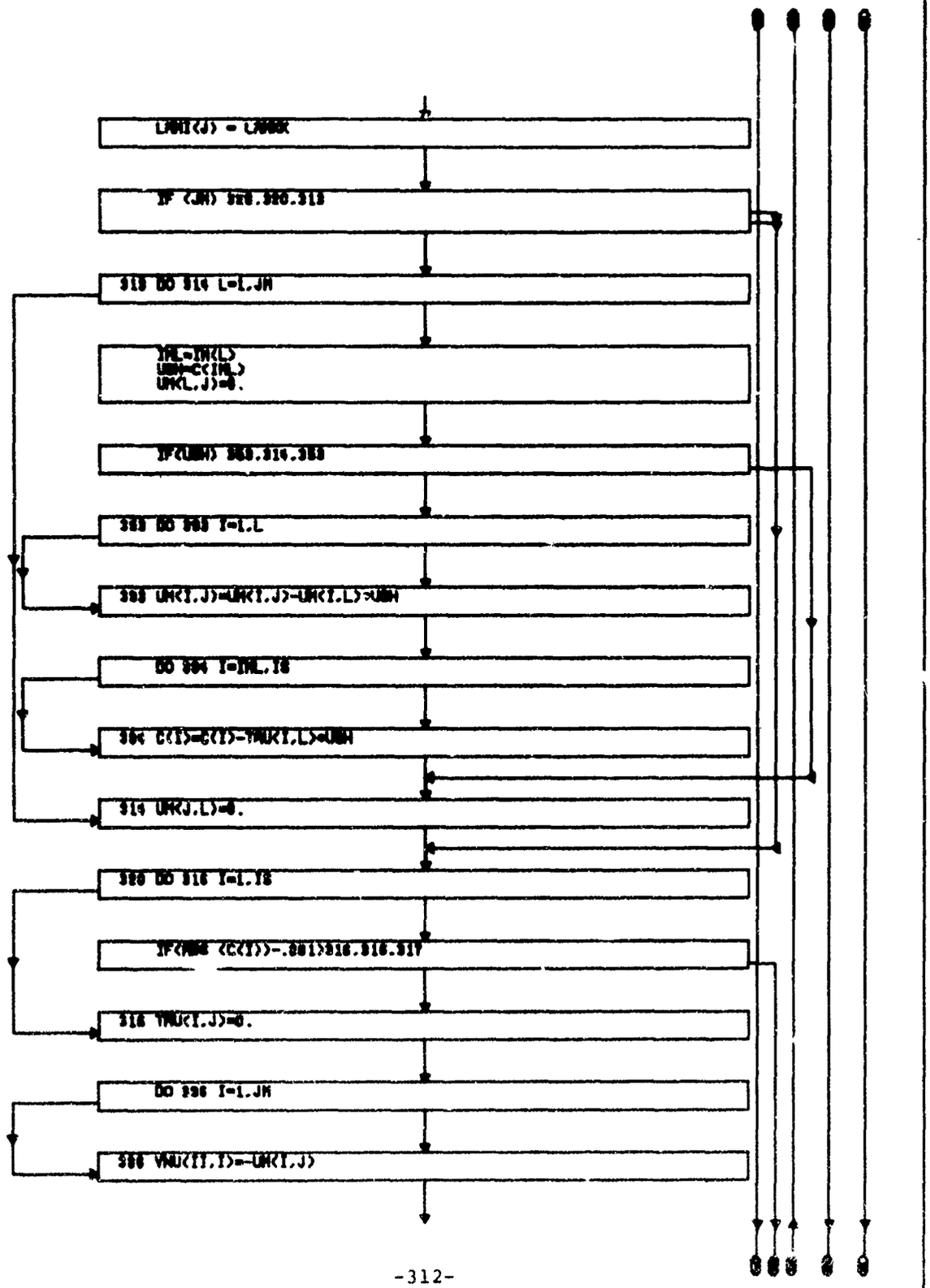
c. Flow Chart

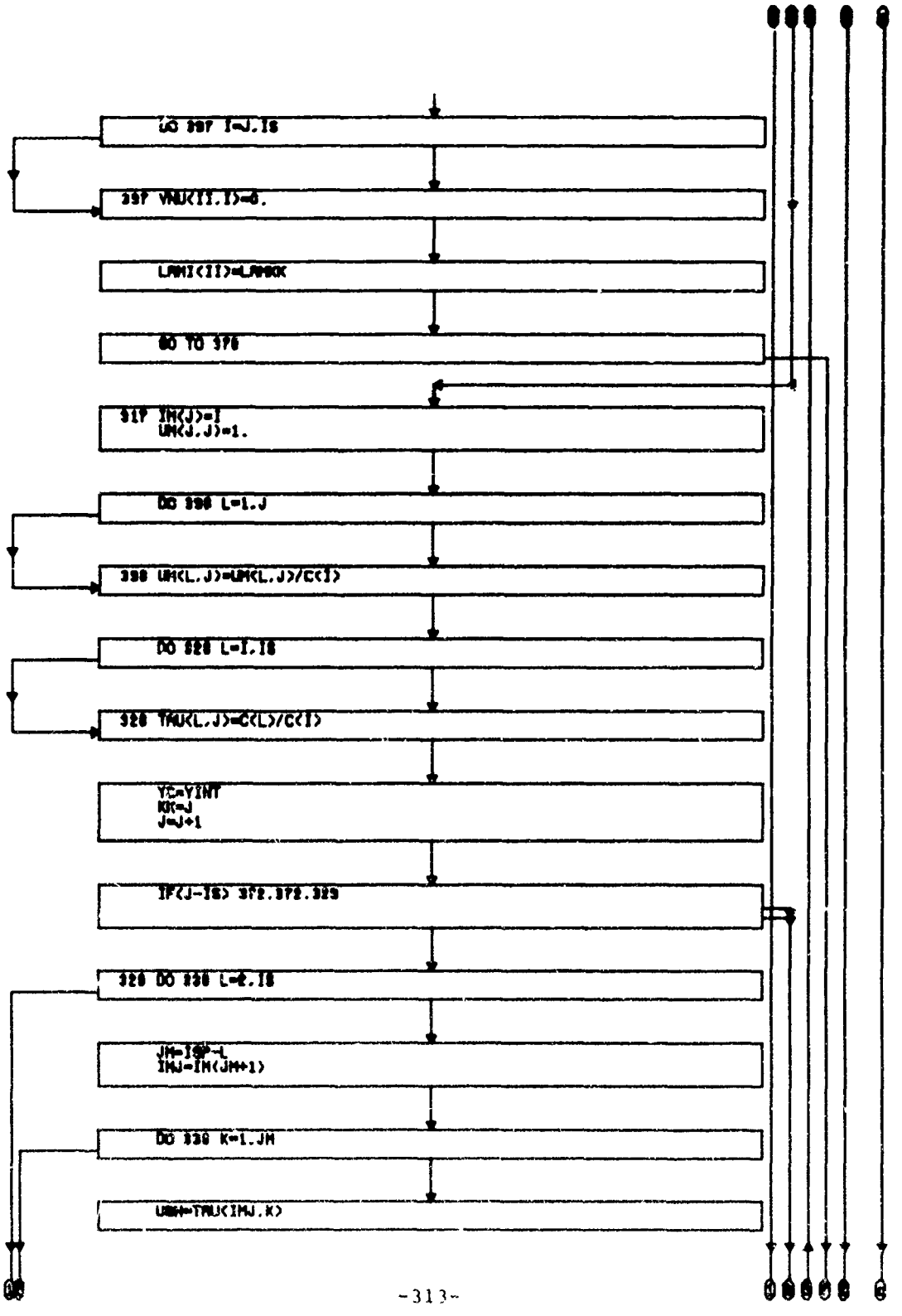

CSC4A
SUBROUTINE INPUT(PP)
DATA CHAR,BLANK/4HCHAR,4H /
P=PP
KR(2)=2
KR(2)=KKR(12)+1
IF(KR(2).EQ.9.OR.KR(2).EQ.8) KR(3)=0
IF(KR(2).EQ.P) GO TO 3981
3062 NT=0
FFR=0.189
FITHOL=26.7
FITBHA=24.3
BBR = 0.454
BRBHOL=32.0
SIGMA=0.467
EPOVRK=186.7
NFF=0
VINT=P+1.E-6
YINT=ALOG(VINT)
RHHO=1.
IF (KR(2)) 334.336.321
321 READ(KIN,301) IB,FFRR,DUB3,DUB4,DUB5,DUB6,DUB7,DUB8
IF (DUB3.GT.0.) FITHOL=DUB3
IF (DUB4.GT.0.) BRBHOL=DUB4
IF (DUB5.GT.0.) SIGMA=DUB5
IF (DUB6.GT.0.) EPOVRK=DUB6
IF (DUB8.GT.0.) BBR =DUB8
IF (DUB7.GT.0.) FITBHA=DUB7
IF(FFRR) 3213.3212.3211
3213 FFR=0.
GO TO 3212
3211 FFR=FFRR
3212 CONTINUE
JNT(2)=0
IX=4

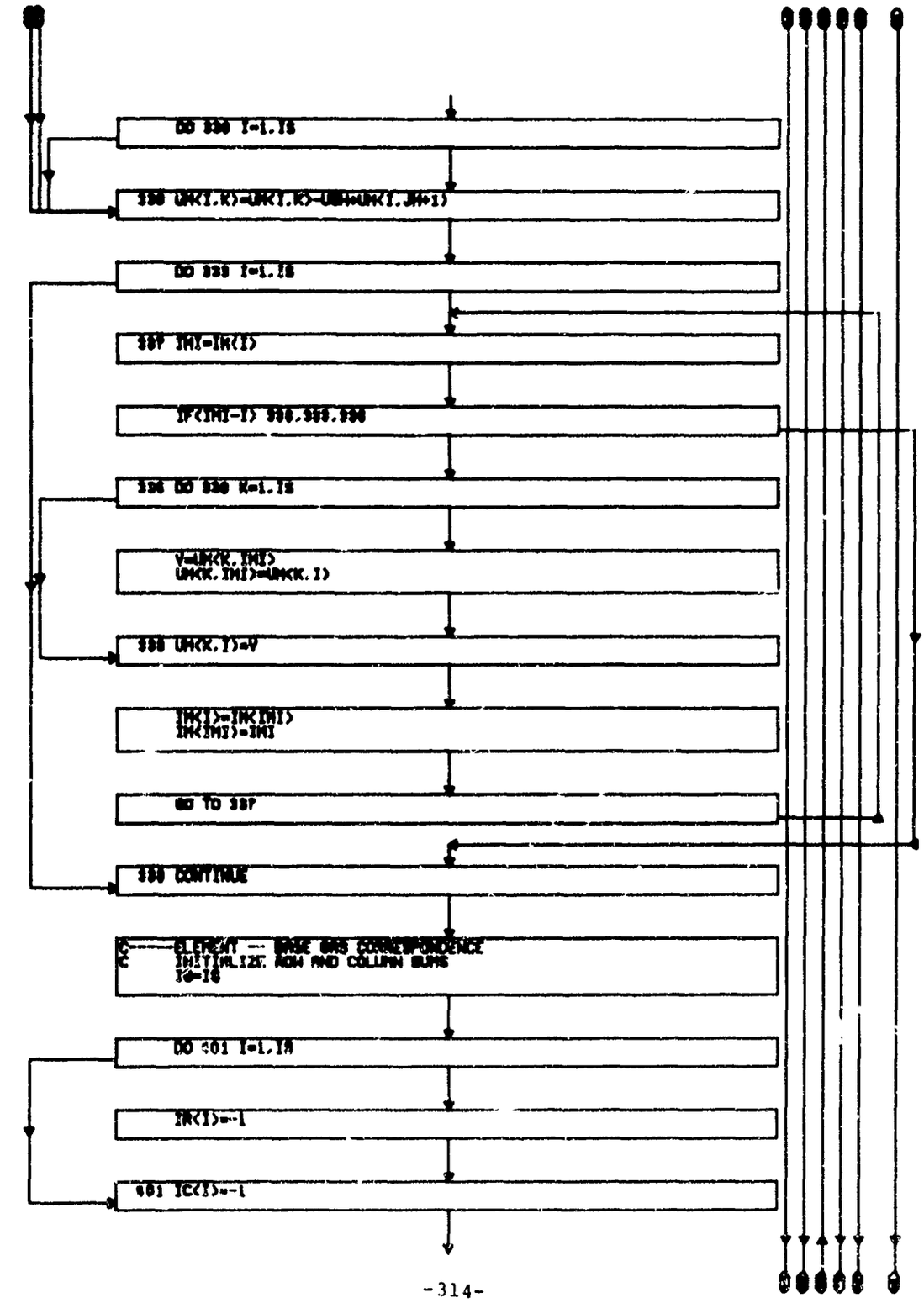

IF (IS-IB) 311.311.399
311 READ(KIN.304) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J.I),
I=1.7),J=1.IB)
DO 327 K=1.7
VA=0.
DO 322 J=1.IB
IF(KAT(J)-99) 3111.326.3111
3111 IF(TK(J.K)) 324.322.326
324 VA=VA-TK(J.K)
TK(J.K)=-TK(J.K)/WAT(J)
GO TO 322
325 VA=VA+TK(J.K)*WAT(J)
322 CONTINUE
IF(VA) 326.327.326
326 DO 323 J=1.IB
323 TK(J.K)=TK(J.K)/VA
327 CONTINUE

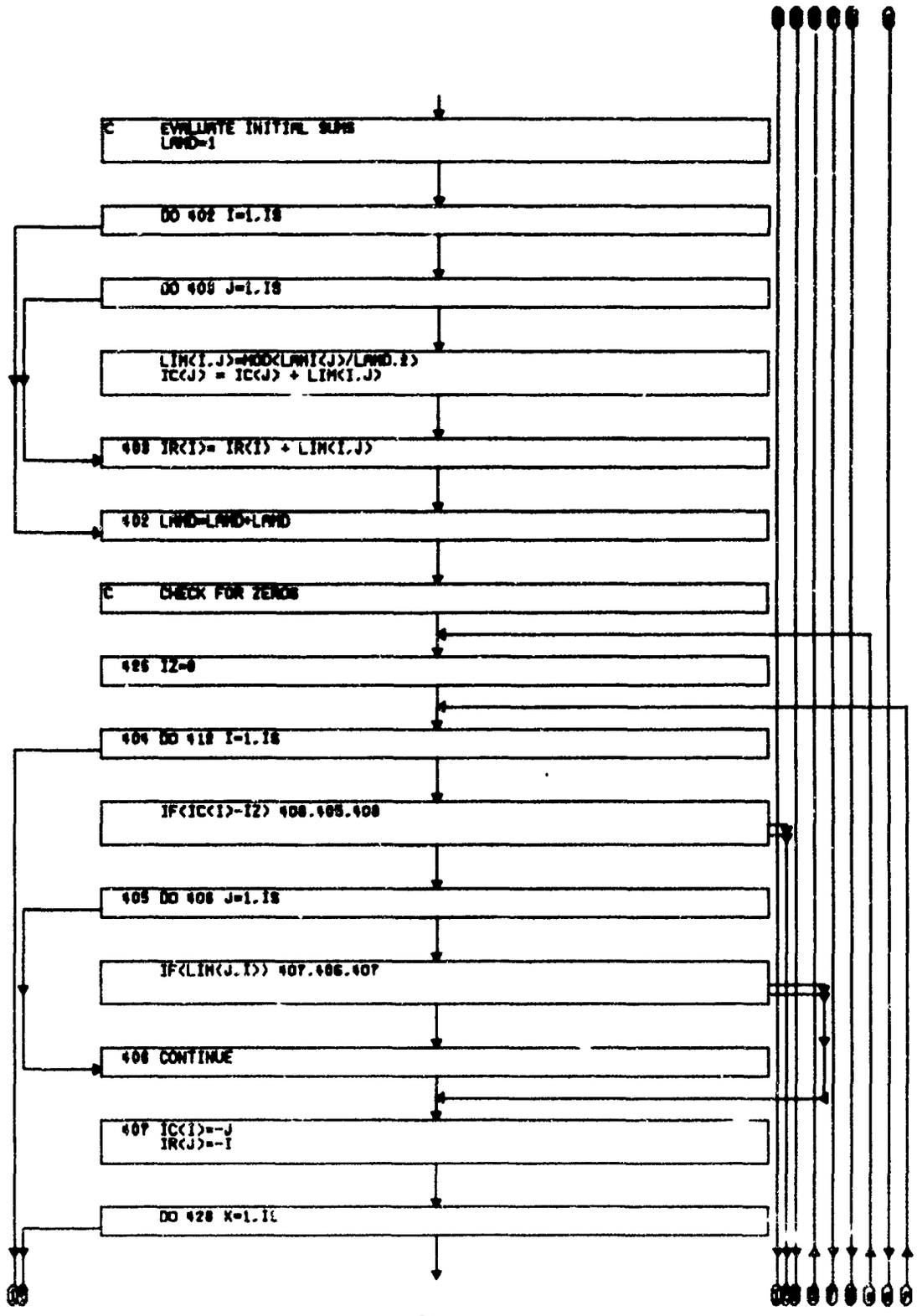

WRITE(KOUT,388) (KAT(J), ATA(J), ATB(J), ATC(J), WAT(J), (TK(J,I),
1 I=1,7),J=1,18)
WRITE (KOUT,900)
900 FORMAT(//39X'THERMODYNAMIC PROPERTY CURVE-FIT DATA (SEE MANUAL FO
1R FORMAT)//)
IGP=IG+1
IF(KR(3)) 999,389,324
324 TPMAX=0.
AAA=0.
N=0
II=IGP
J=1
362 READ(KIN,366)(ALPT(K),JAT(K),K=1,7),SOURCE,AAAA,AAAB
IF(ALPT(1)) 3621,369,3620
3620 IF(JAT(1)) 364,3621,364
3621 NFF=ABS(ALPT(1))
READ(KIN,3621)(NFIX(I),NFIB(I),FFIX(I),I=1,NFF)
GO TO 362
364 DO 368 K=1,18
365 C(K)=0.
DO 368 I=1,7
IF(JAT(I)) 368,368,366
368 DO 367 K=1,18

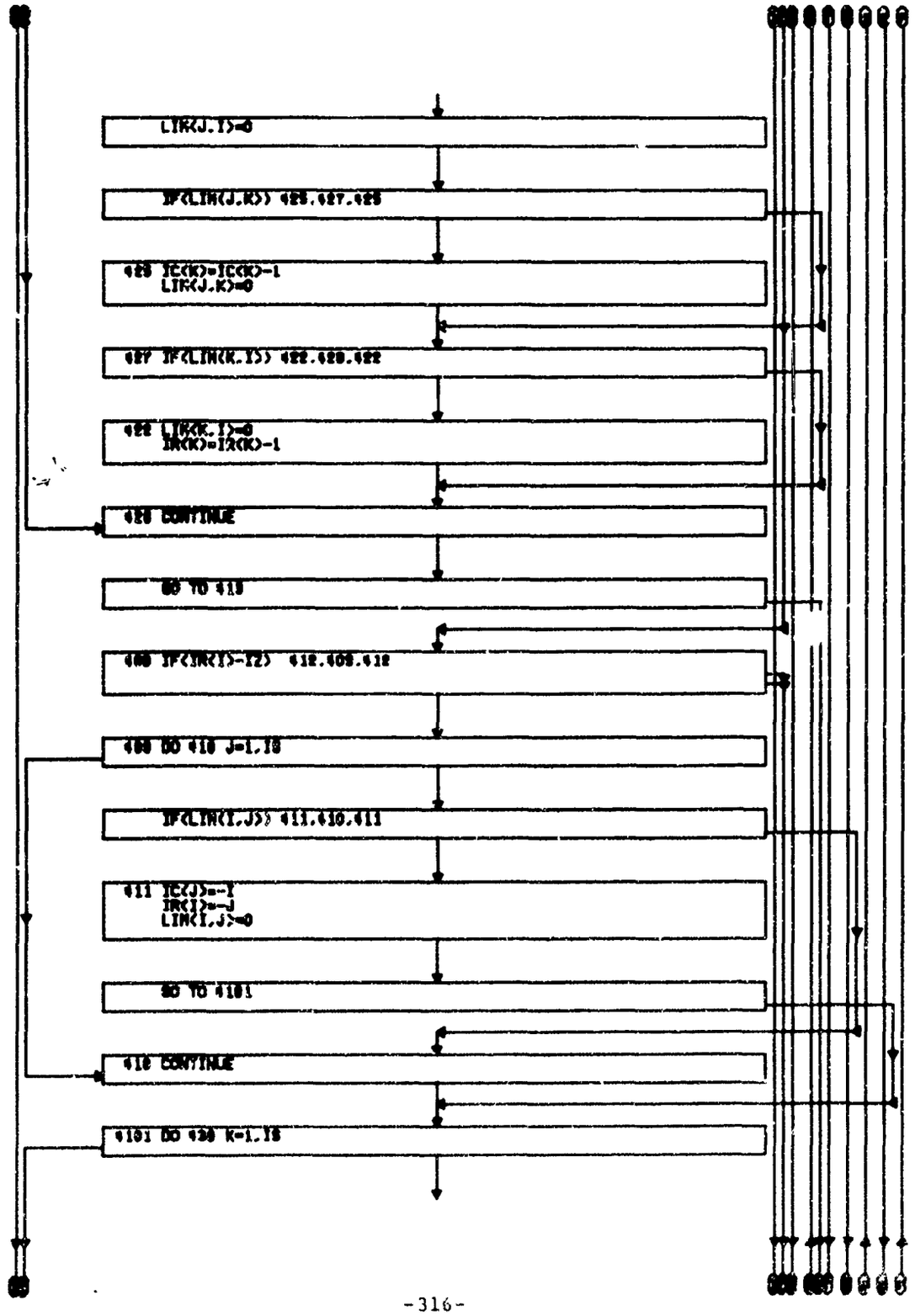

IF(JMT(I)-KMT(K)) 367.368.367
367 CONTINUE
READ(KIN.303)
GO TO 362
368 C(K)=RLPT(I)
369 CONTINUE
WT=0.
L=1
LAMBK=0
DO 388 I=1.IS
IF(C(I)) 387.388.387
387 LAMBK=LAMBK+L
WT=WT+C(I) * WMT(I)
388 L=L+L
IF(J-IS) 350.350.389
350 JM=J-1
DO 3601 L=1.IS
3601 CIJ(L.J)=C(L)

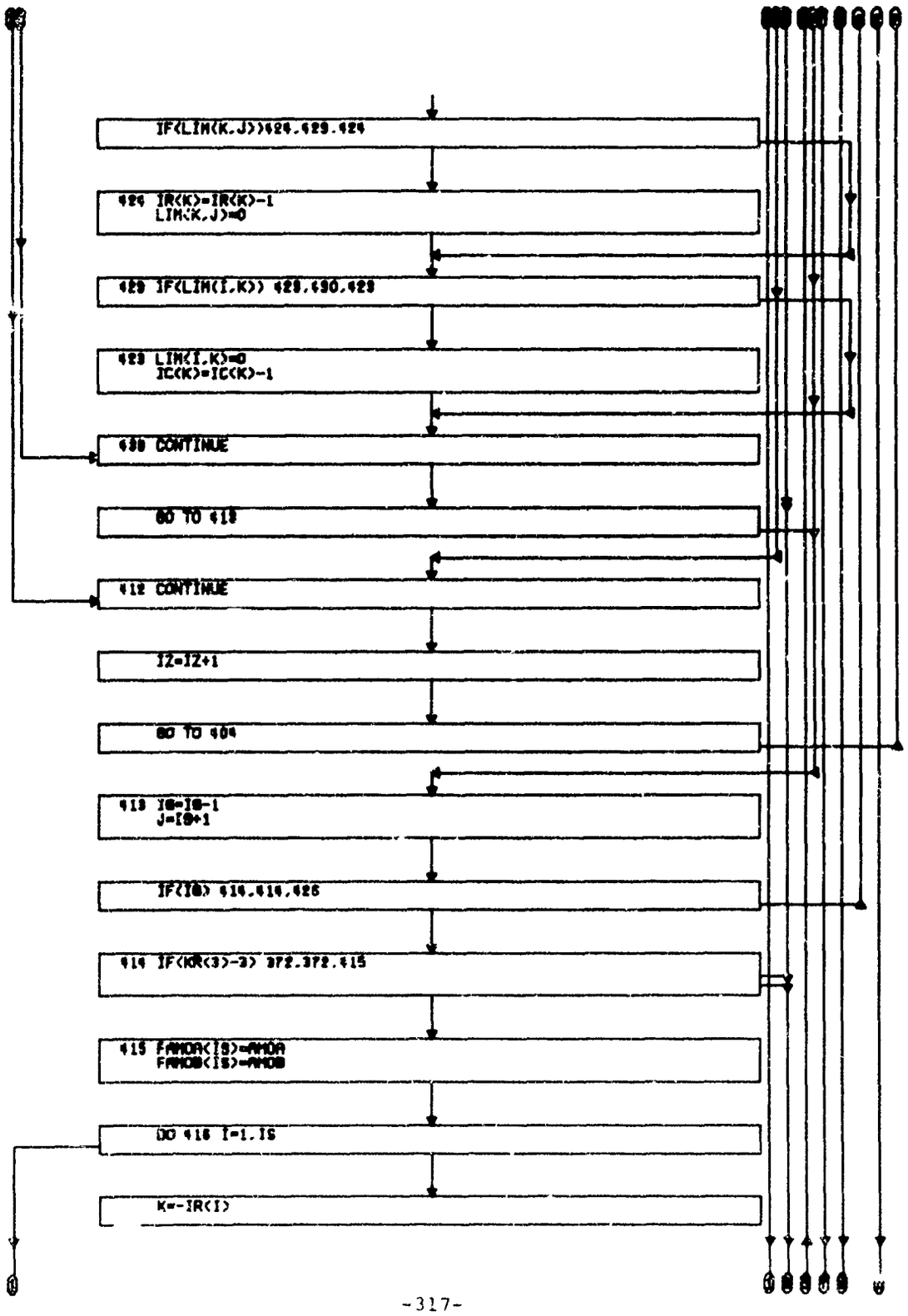

LMAT(J) = LMAX
IF (JM) 888.880.818
818 DO 814 L=1.JM
IML=IM(L)
UMM=C(IML)
UM(L.J)=0.
IF(UMM) 868.814.868
868 DO 868 I=1.L
868 UM(I.J)=UM(I.J)-UM(I.L)*UMM
DO 884 I=IML.IS
884 C(I)=C(I)-VMU(I.L)*UMM
814 UM(J.L)=0.
888 DO 816 I=1.IS
IF(AMAX (C(I))-.881)816.816.817
816 VMU(I.J)=0.
DO 886 I=1.JM
886 VMU(II.I)=-UM(I.J)

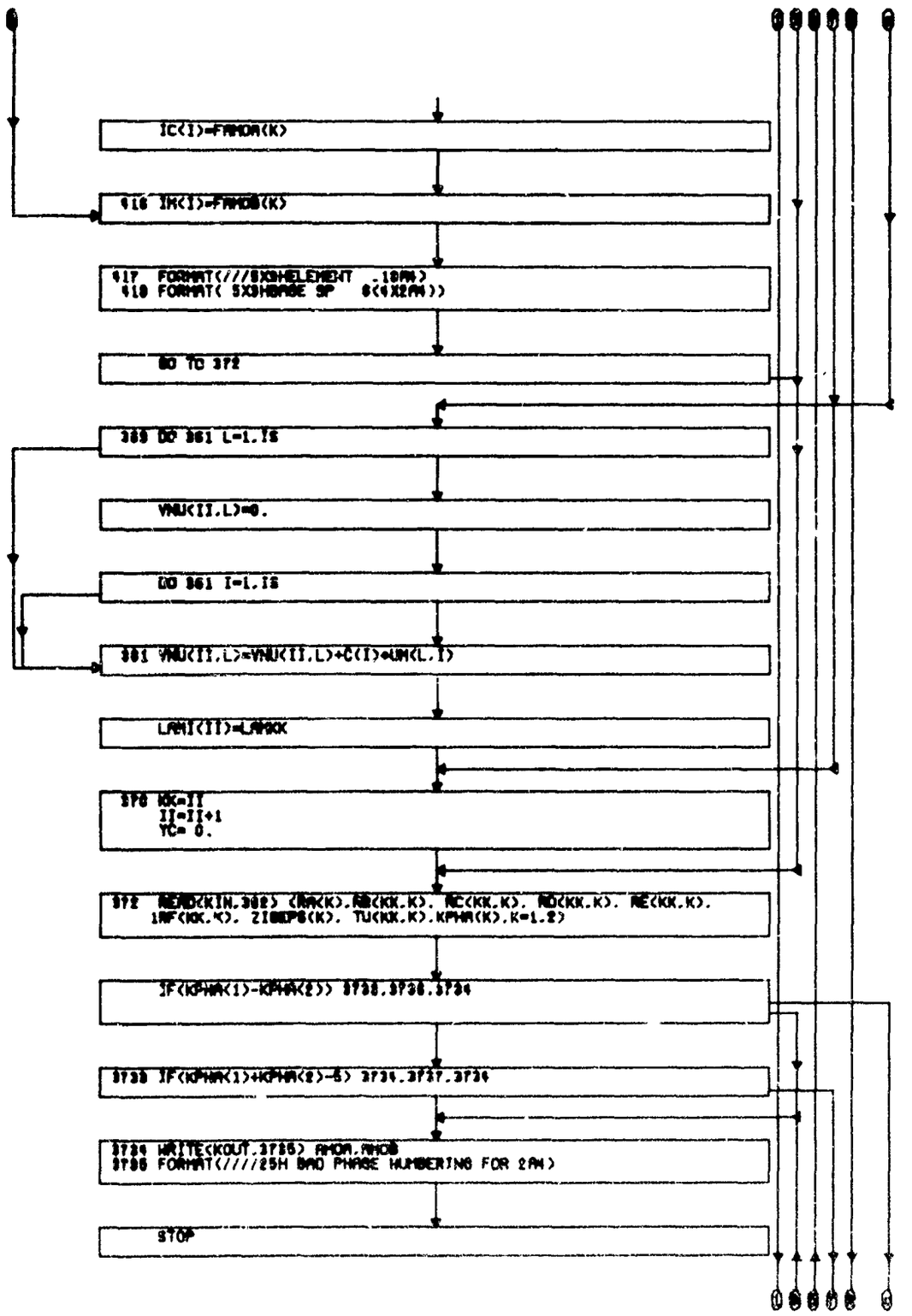

DO 397 I=J,IS
397 VAU(II,I)=0.
LAMI(II)=LAMBK
GO TO 376
317 IM(J)=I
UM(J,J)=1.
DO 398 L=1,J
398 UM(L,J)=UM(L,J)/C(I)
DO 328 L=I,IS
328 TAU(L,J)=C(L)/C(I)
YC=YINT
KK=J
J=J+1
IF(J-IS) 372,372,329
329 DO 330 L=2,IS
JM=ISP-L
IMJ=IM(JM+1)
DO 330 K=1,JM
UMM=TAU(IMJ,K)

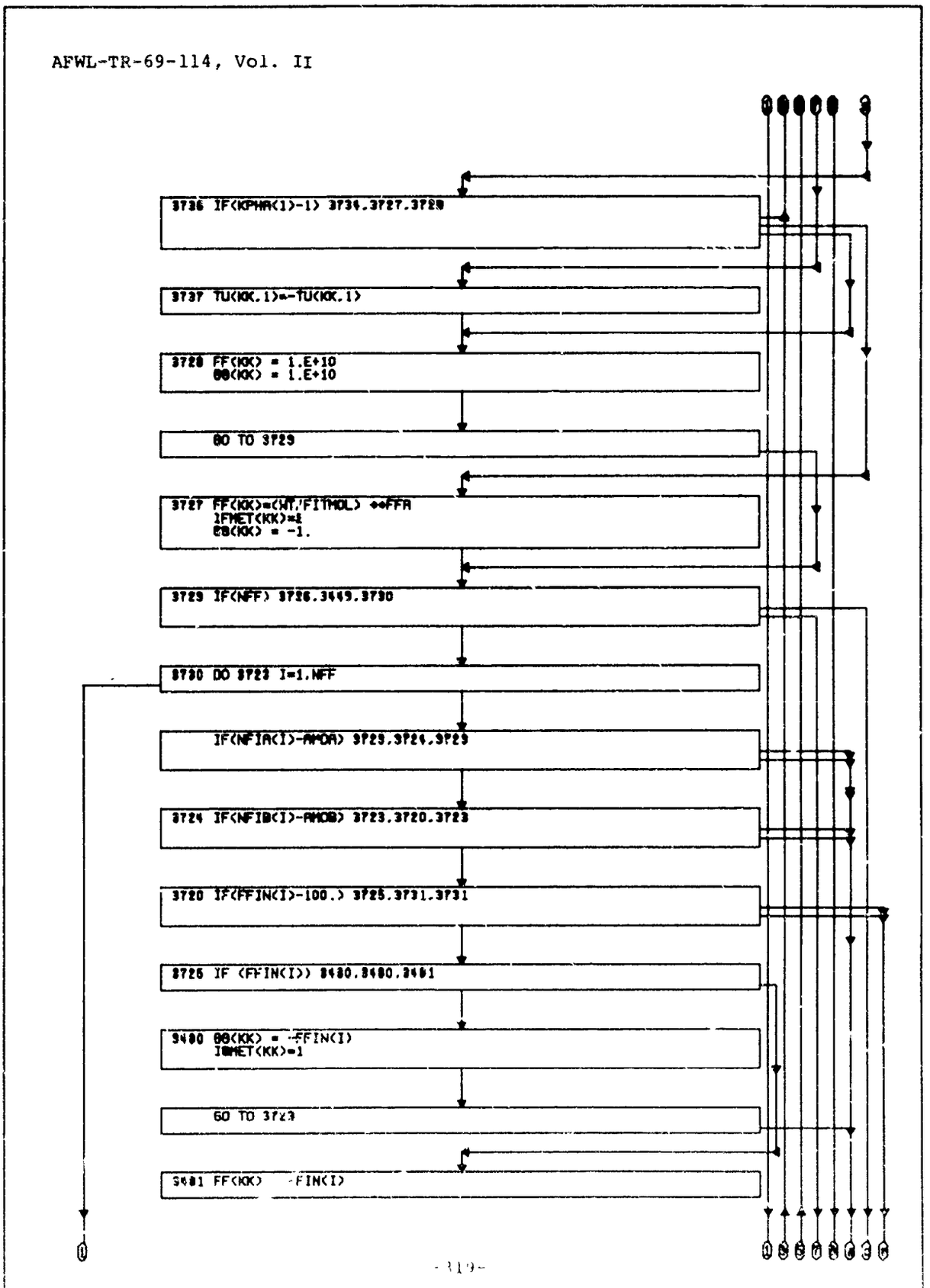

DO 550 I=1,IS
550 UM(I,K)=UM(I,K)-UBK*UM(I,JK+1)
DO 555 I=1,IS
557 IMI=IM(I)
IF(IMI-I) 556,555,556
556 DO 558 K=1,IS
V=UM(K,IMI)
UM(K,IMI)=UM(K,I)
558 UM(K,I)=V
IM(I)=IM(IMI)
IM(IMI)=IMI
GO TO 557
555 CONTINUE
C ELEMENT -- BASE BUS CORRESPONDENCE
C INITIALIZE ROW AND COLUMN BUSS
IS=IS
DO 401 I=1,IN
IR(I)=-1
401 IC(I)=-1

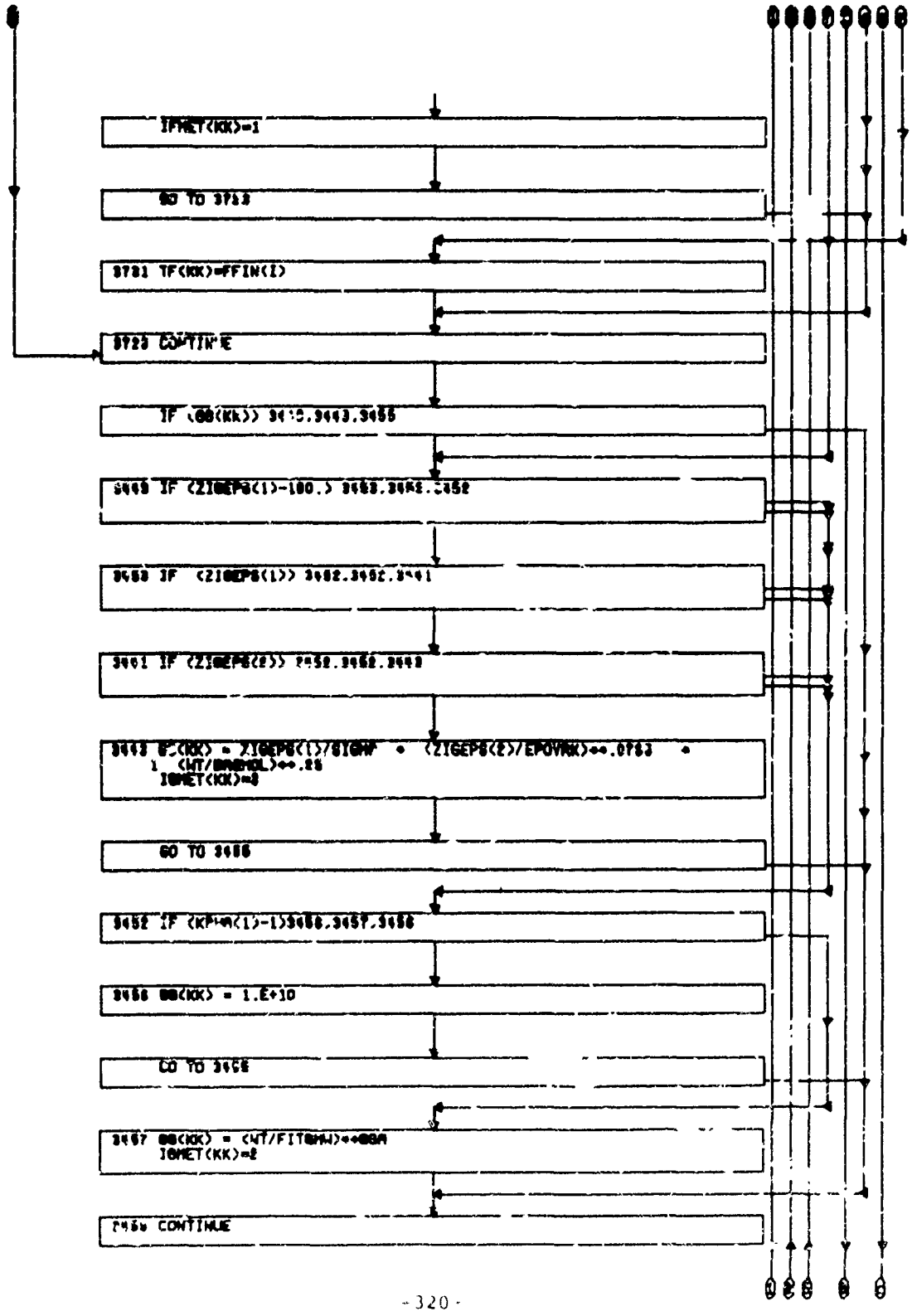

C EVALUATE INITIAL SUMS
LAND=1
DO 402 I=1,IS
DO 403 J=1,IS
LIM(I,J)=MOD(LAM(J)/LAND,2)
IC(J) = IC(J) + LIM(I,J)
403 IR(I)= IR(I) + LIM(I,J)
402 LAND=LAND+LAND
C CHECK FOR ZEROS
426 IZ=0
404 DO 418 I=1,IS
IF(IC(I)-IZ) 408,405,408
405 DO 406 J=1,IS
IF(LIM(J,I)) 407,406,407
406 CONTINUE
407 IC(I)=-J
IR(J)=-I
DO 428 K=1,IL

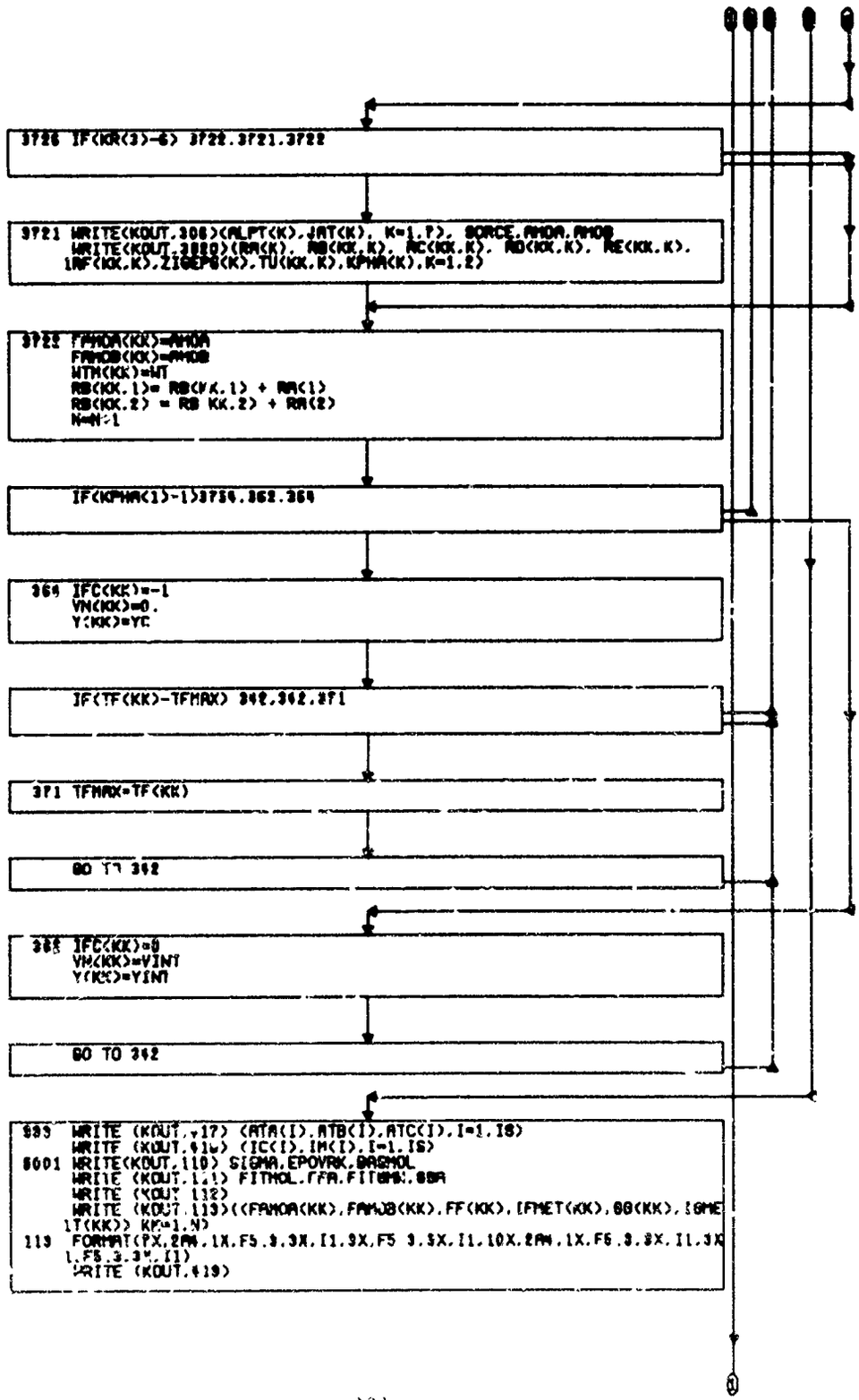

LIN(J,I)=0
IF(LIN(J,K)) 425,427,425
425 IC(K)=IC(K)-1
LIN(J,K)=0
427 IF(LIN(K,I)) 422,420,422
422 LIN(K,I)=0
IN(K)=I2(K)-1
420 CONTINUE
GO TO 419
400 IF(IN(I)-I2) 412,409,412
408 DO 410 J=1,15
IF(LIN(I,J)) 411,410,411
411 IC(J)=-1
IN(I)=-J
LIN(I,J)=0
GO TO 4101
410 CONTINUE
4101 DO 430 K=1,15

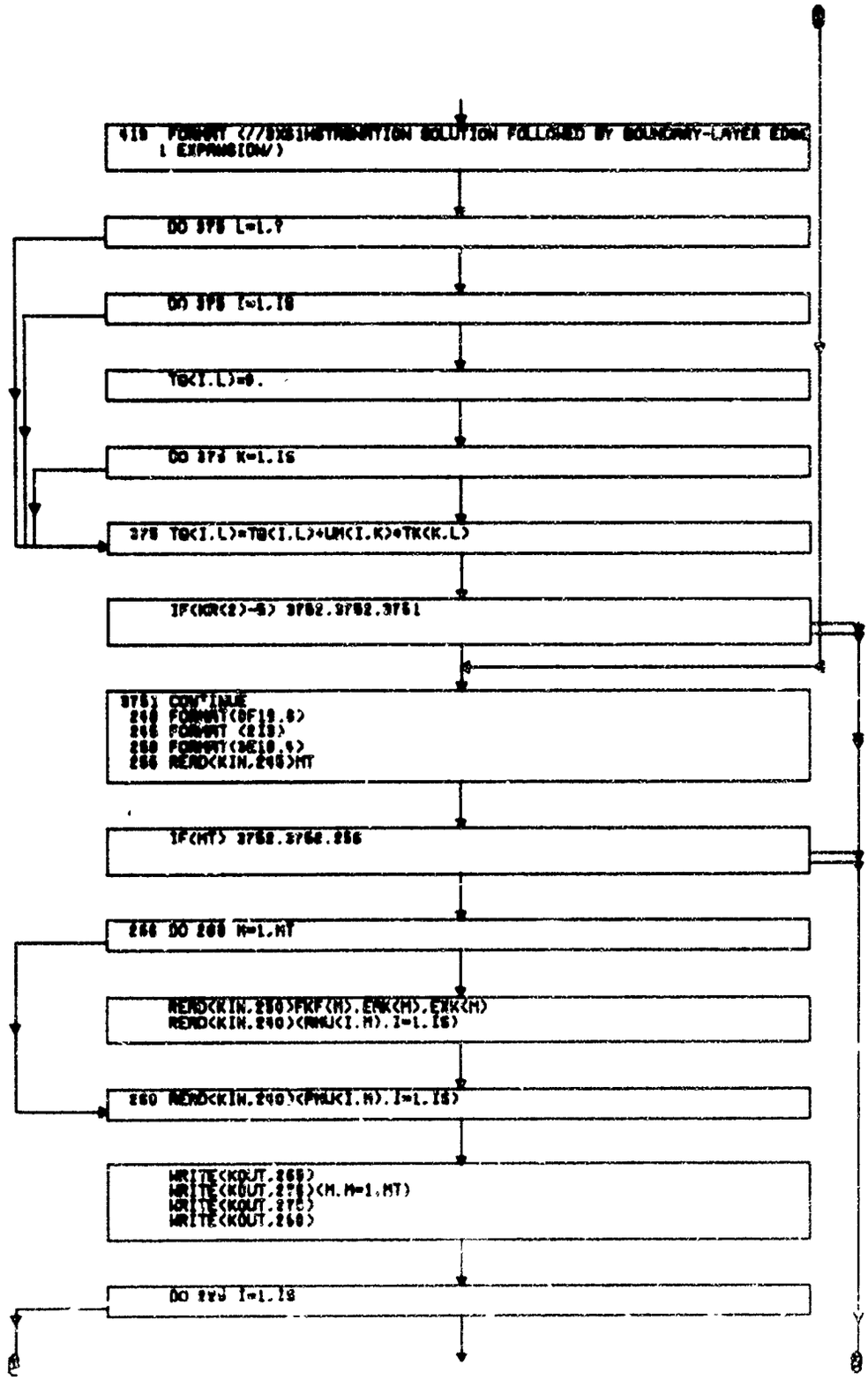

IF(LIM(K,J))424,429,424
424 IR(K)=IR(K)-1
LIM(K,J)=0
429 IF(LIM(I,K)) 428,430,428
428 LIM(I,K)=0
IC(K)=IC(K)-1
430 CONTINUE
GO TO 418
412 CONTINUE
IZ=IZ+1
GO TO 404
418 IS=IS-1
J=IS+1
IF(IS) 414,414,426
414 IF(KR(3)-3) 372,372,415
415 FAMOR(IS)=AMOA
FAMOB(IS)=AMOB
DO 416 I=1,IS
K=-IR(I)

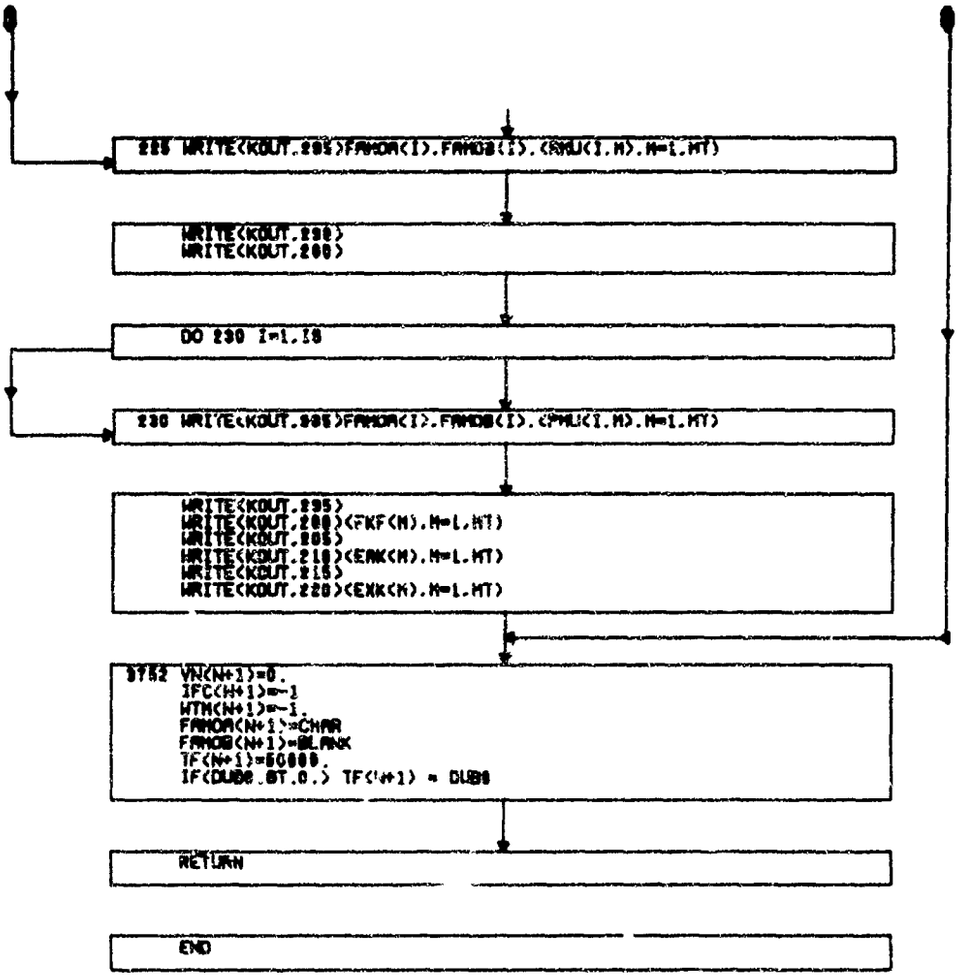

IC(I)=FMOA(K)
416 IM(I)=FMOB(K)
417 FORMAT(///5X3HELEMENT .18A4)
418 FORMAT(5X3HBASE SP 8(4X2A4))
GO TO 372
389 DO 361 L=1.IS
VNU(II.L)=0.
DO 361 I=1.IS
361 VNU(II.L)=VNU(II.L)+C(I)*LM(L.I)
LAM(II)=LAMKK
370 KK=II
II=II+1
YC= 0.
372 READ(KIN.382) (RA(K).RB(KK.K). RC(KK.K). RD(KK.K). RE(KK.K).
1RF(KK.K). ZIBEPS(K). TU(KK.K).KPHA(K).K=1.2)
IF(KPHA(1)-KPHA(2)) 3738.3738.3734
3738 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(I)-1) 3734.3727.3728
3737 TU(KK.1)=-TU(KK.1)
3728 FF(KK) = 1.E+10
BB(KK) = 1.E+10
GO TO 3729
3727 FF(KK)=(WT/FITMOL) **FFA
IFMET(KK)=1
BB(KK) = -1.
3729 IF(NFF) 3726.3449.3730
3730 DO 3723 I=1.NFF
IF(NFIA(I)-AMOA) 3723.3724.3723
3724 IF(NFIB(I)-AMOB) 3723.3720.3723
3720 IF(FFIN(I)-100.) 3725.3731.3731
3725 IF (FFIN(I)) 3480.3480.3481
3480 BB(KK) = -FFIN(I)
IBMET(KK)=1
GO TO 3723
3481 FF(KK) = FIN(I)


IFMET(KK)=1
GO TO 3733
3731 TF(KK)=FFIN(I)
3733 CONTINUE
IF (BB(KK)) 3[illegible]
3449 IF (ZIGEPS(I)-100.) 3[illegible]
3450 IF (ZIGEPS(I)) 3[illegible]
3451 IF (ZIGEPS(I)) 3[illegible]
IOMET(KK)=0
GO TO 3456
3452 IF (KP
3456 BB(KK) = 1.E+10
GO TO 3456
3457 BB(KK) = (WT/FITBMW)
IOMET(KK)=2
3456 CONTINUE


3726 IF(KK(3)-6) 3722,3721,3722
3721 WRITE(KOUT,306)(ALPT(K),JAT(K), K=1,P), SORCE,AMDA,AMDB
WRITE(KOUT,3220)(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 FAMDA(KK)=AMDA
FAMDB(KK)=AMDB
WTH(KK)=WT
RB(KK,1)= RB(KK,1) + RA(1)
RB(KK,2) = RB KK,2) + RA(2)
N=N+1
IF(KPHA(1)-1)3726,362,364
364 IFC(KK)=-1
VN(KK)=0.
Y(KK)=YC
IF(TF(KK)-TFMAX) 362,362,371
371 TFMAX=TF(KK)
GO TO 362
368 IFC(KK)=0
VN(KK)=VINT
Y(KK)=YINT
GO TO 362
335 WRITE (KOUT,117) (ATA(I),ATB(I),ATC(I),I=1,IS)
WRITF (KOUT,416) (IC(I),IM(I),I=1,IS)
6001 WRITE(KOUT,110) SIGMA,EPOVRK,BRGMOL
WRITE (KOUT,111) FITMOL,FFR,FITGMW,BSA
WRITE (KOUT,112)
WRITE (KOUT,113)((FAMDA(KK),FAMDB(KK),FF(KK),(FMET(KK),BB(KK),(GME
1T(KK)) KK=1,N)
113 FORMAT(PX,2A4,1X,F5.3,3X,I1,3X,F5 3,3X,I1,10X,2A4,1X,F6.3,3X,I1,3X
1,F5.3,3X,I1)
WRITE (KOUT,419)


418 FORMAT (///5X31HSTRAUHYTION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE
1 EXPANSION/)
DO 375 L=1,7
DO 375 I=1,18
TG(I,L)=0.
DO 375 K=1,16
375 TG(I,L)=TG(I,L)+UM(I,K)*TK(K,L)
IF(KOR(2)-6) 3752,3752,3751
3751 CONTINUE
240 FORMAT(8F10.6)
245 FORMAT (2I3)
250 FORMAT(3E10.4)
256 READ(KIN,245)MT
IF(MT) 3752,3752,256
256 DO 260 M=1,MT
READ(KIN,250)PRF(M),ENK(M),ENK(M)
READ(KIN,240)(PHUK(I,M),I=1,18)
260 READ(KIN,240)(PHUK(I,M),I=1,18)
WRITE(KOUT,268)
WRITE(KOUT,270)(M,M=1,MT)
WRITE(KOUT,275)
WRITE(KOUT,260)
DO 290 I=1,18
A
B
Y
B


285 WRITE(KOUT,285)FAMOA(I),FAMOB(I),(PMU(I,M),M=1,MT)
WRITE(KOUT,290)
WRITE(KOUT,200)
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)(EMK(M),M=1,MT)
WRITE(KOUT,215)
WRITE(KOUT,220)(EXK(K),K=1,MT)
9752 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(DUB0.GT.0.) TF(N+1) = DUB0
RETURN
END

26. SUBROUTINE PROPS - B25A

a. Function

Computes all properties and property derivatives required by boundary layer calculations. Called by EQUIL.

b. Listing

```
000001          CB25A                                                          B25A 001
000002                SUBROUTINE PROPS                                         B25A 002
000003                INTEGER FAMOA,FAMOB                                      B25A 004
000004                DIMENSION VK(10),PA(12,12),PV(11,12)                     B25A 005*NEW
000005                COMMON /BLOCOM/FAMOA( 71),FAMOB( 71),N    ,PR( 71,15),W(3),LEF(10)B25A   6*NEW
000006               1,LEF(10),PIEASE,LEFW(10)                                 B25A   6*NEW
000007                COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B25A   7*NEW
000008               1UE(40),RUDE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,WE,C90  B25A   8*NEW
000009               2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                           B25A   9*NEW
000010                COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B25A  10*NEW
000011               1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),  B25A  11*NEW
000012               2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),        B25A  12*NEW
000013               3 VNU( 71,10),ITFF,KR2,HCM,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71)  B25A  13*NEW
000014               4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                          B25A  14*NEW
000015                COMMON /EQTCOM/SIP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,IYS,IN,IL,IT,  B25A  15*NEW
000016               1 MODE,HMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ICP2,ISPQ,  B25A  16*NEW
000017               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,WG,  B25A  17*NEW
000018               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),      B25A  18*NEW
000019               4 IP( 71),ALP(10),PNU(10),GAMW(10),GAMF(10),BLAM(10),DY( 71),RVS,  B25A  19*NEW
000020               5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUB(10),        B25A  20*NEW
000021               6 BC(10),BLNK(10),RY(10),IBC(10),BE(10),JJ( 4)            B25A  21*NEW
000022                COMMON /INTCOM/KKR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,II,  B25A  22*NEW
000023               1ISS,MS,ITT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL,MITS,KAPPA,CBAR,  B25A  23*NEW
000024               2CASE(15),BB(8),  MWE,NON,KD(10),ITEM,NITEM,KR17,NRT,NRT2,IDENT,  B25A  24*NEW
000025               3 KR9(40),KAUXO,JTIME,JSPEC,MD(3)                         B25A  25*NEW
000026                COMMON /PRPCOM/PR(15),TT(15),RHO(15),BC(15),CAPC(15),GR(15),HW(15)B25A  26*NEW
000027               1,CPRAR(15),VMW(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKW( 8),  B25A  27*NEW
000028               2MU3K( 8),DMU4K( 8),DTK( 8),DPWIKW( 8),DPRK( 8),DBCK( 8),DCAPCK( 8)B25A  28*NEW
000029               3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   B25A  29*NEW
000030               4,DPWIKK( 8, 8),      DMU4W,DMU3W,DHTILW,VMU12,CT,CTR,CPTIL,WTIL   B25A  30*NEW
000031               5,VMU3,DTH,DCAPCH,DPRH,DBCH,DQRH,DCPBH,DCPTH,DMU12W,VMU(15),  RHOP B25A  31*NEW
000032               6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(19)   B25A  32*NEW
000033                COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),BPW( 8,40, 1)         B25A  33*NEW
000034               1,RHOVW(40, 1),FLUXJ( 3,40, 1),IWW,ITW,IPW,IBPW,IRHOVW,IFLUXJ      B25A  34*NEW
000035                DIMENSION PRP(1)                                                       0-31
000036                EQUIVALENCE (PRP(1),PV(1))
000037                IF(II-1) 310,300,310                                       B25A  032
000038           300  IF(KKR(14)-10) 310,302,302                               B25A  033
000039           302  KKR(14)=KKR(14)-10                                        B25A  034
000040           310  IF(T-300.001) 312,312,320                                 B25A  035
000041           312  KKR(14)=KKR(14)+10                                        B25A  036
000042           320  WM=AA/P
000043                ISV=IS                                                     B25A  038
000044                IS=NSP                                                     B25A  039
000045                ISVP=ISV+1                                                 B25A  040
000046           343  ISV2=ISV+2
000047                CT=0.5                                                     B25A  041
000048                ISM=IS-1                                                   B25A  042
000049                ISP=IS+1                                                   B25A  043
000050                ISP2=IS+2                                                  B25A  044
000051                TT(II)=T+1.A                                               B25A  046
000052                RHO(II)=AA/(1.3146+7)
000053                CTR=CT+1.9876                                              B25A  049
000054           C    FORM NECESSARY SUMMATIONS                                  B25A  051
000055                PMU2=0.                                                    B25A  052
000056                CPTIL=0.                                                   B25A  053
000057                WTG=0.
000058                WG=0.
```

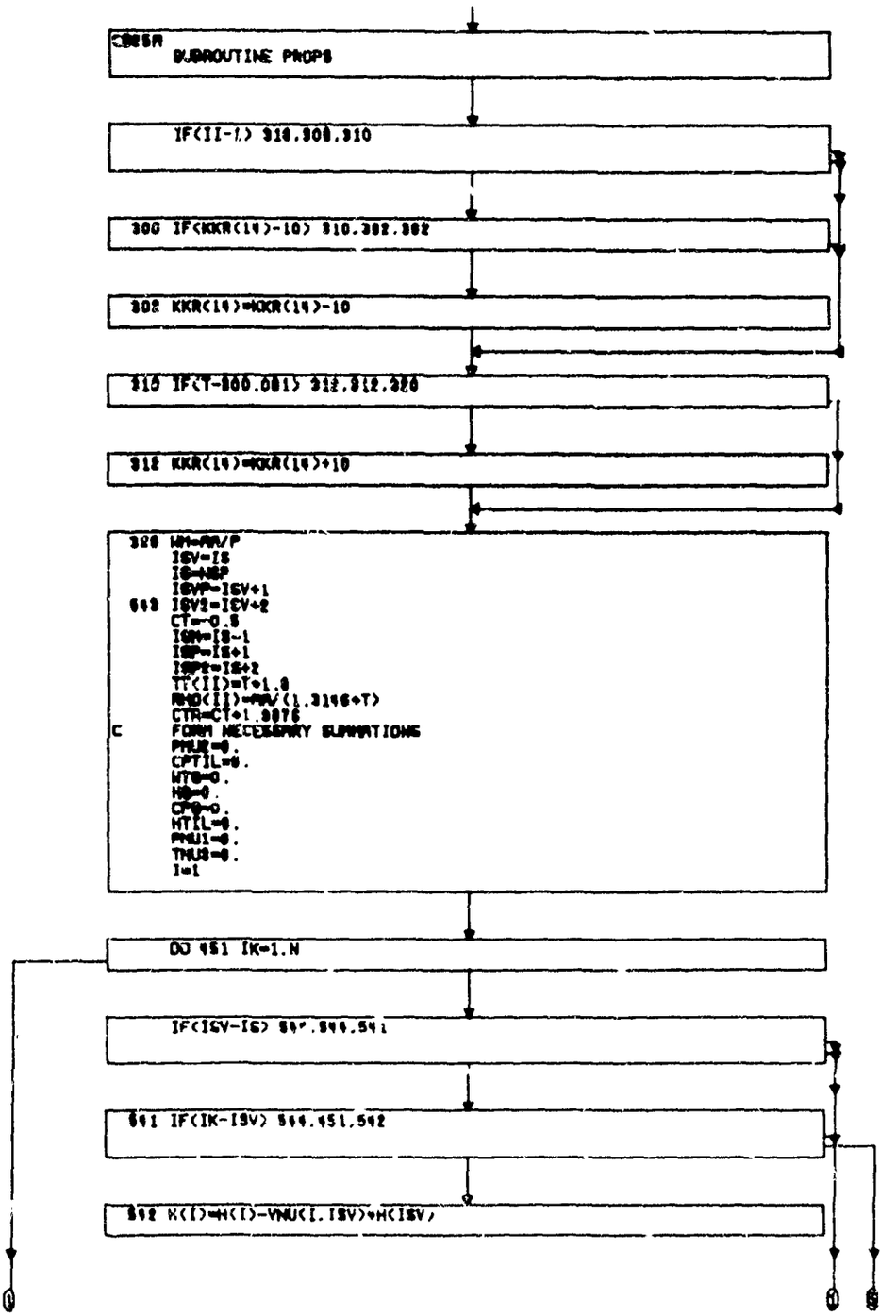
```
000059                CPG=0.                                                    825A 054
000060                HTIL=0.                                                   825A 055
000061                PMU1=0.                                                   825A 056
000062                TMU3=0.
000063                I=1
000064                DO 451 IK=1,N
000065                IF(IBV-IS) 544,544,541
000066           541  IF(IK-IBV) 544,451,542
000067           542  H(I)=H(I)-VNU(I,IBV)*H(IBV)
000068                WTM(I)=WTM(I)-VNU(I,IBV)*WTM(IBV)
000069                CP(I)=CP(I)-VNU(I,IBV)*CP(IBV)
000070           544  IF(IFC(I)) 451,4550,451
000071          4550  PMU1=PMU1+VN(I)*FF(I)                                     825A 060
000072           451  I=I+1
000073                VMU1=PMU1/P                                               825A 062
000074                AMU3=0.                                                   825A 063
000075                PMU6=0.                                                   825A 064
000076                WDZ=1,385                                                 825A 065
000077                WD4 = 0,284*WDZ
000078                I = 1
000079                DO 454 IK = 1,N
000080                ASTAR = 1.13 * SS(I)/FF(I) + SS(I)/FF(I)
000081                WD2=1,2*ASTAR/PMU1
000082                WD7=WD2/PMU1-WD2
000083                WD5=,32*ASTAR/PMU1
000084                WD8=WD4/PMU1-WD5
000085                VA=VN(I)/FF(I)                                            825A 074
000086                VB=VA*WTM(I)                                              825A 075
000087                VC=VN(I)*FF(I)                                            825A 076
000088                IF(IK-IS) 4510,4510,4560
000089          4510  VK(I)=0.                                                  825A 078
000090                ZK(I)=0.                                                  825A 079
000091                IF(IFC(I)) 454,4511,454                                   825A 080
000092          4511  VK(I)=VN(I)                                              825A 081
000093           452  ZK(I)=VA                                                  825A 082
000094                GO TO 457                                                 825A 083
000095          4560  IF(IK-IBV) 454,4562,456
000096          4562  WTM(I)=0.
000097                CP(I)=0.
000098                H(I)=0.
000099                GO TO 454
000100           456  IF(IFC(I)) 454,4561,454                                   825A 085
000101          4561  DO 453 K=1,ISM                                            825A 086
000102                VK(K)=VK(K)+VN(I)*VNU(I,K)                                825A 087
000103           453  ZK(K)=ZK(K)+VA*VNU(I,K)                                   825A 088
000104           457  PMU2=PMU2+VB                                              825A 089
000105                TMU3=TMU3+VA                                              825A 090
000106                CPTIL=VA*CP(I)+CPTIL                                      825A 091
000107                HTIL=HTIL+VA*H(I)                                         825A 092
000108                WTG=WTG+VN(I)*WTM(I)
000109                HG=HG+VN(I)*H(I)
000110                CPG=CPG+VN(I)*CP(I)
000111                AMU3=AMU3+VB/(WDZ-VC*WD7)
000112                PMU6=PMU6+VA/(WD4-VC*WD8)
000113           454  I=I+1
000114                VMU3=AMU3/WTG
000115                VMU6=(PMU6  +CPTIL/1,9869-2,3*TMU3)/P                     2?8A 097
000116                VMU2=PMU2/P                                               825A 098
000117                VMU3=TMU3/PMU2                                            825A 099
000118                CPTIL = CPTIL / PMU2                                      PROP1110
```

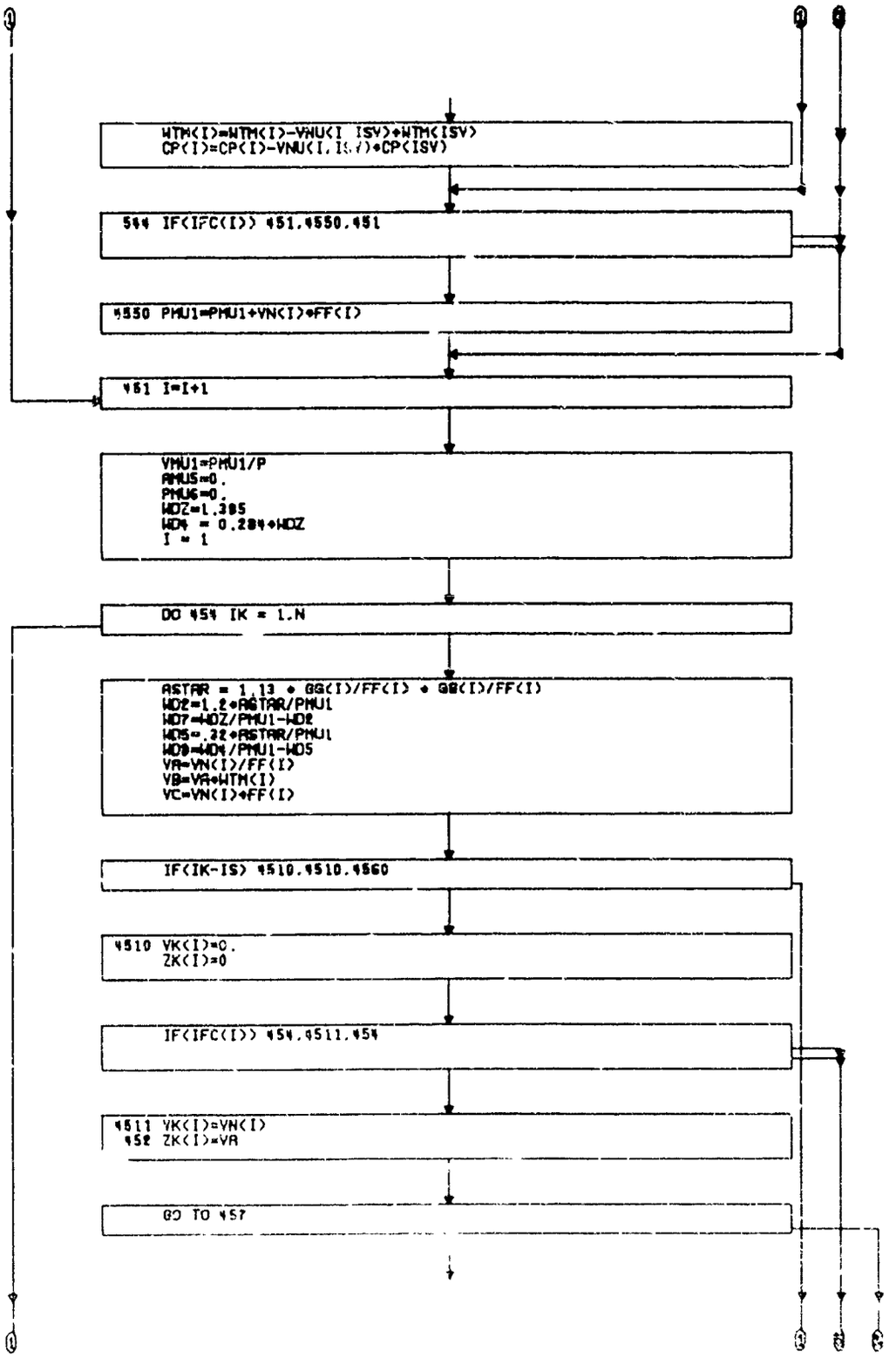
```
000119                WTIL = WTIL / PMU2 + 1.A                                    PROP1120
000120                WG=WG/WTG
000121                CPG=CPG/WTG
000122                WM=WTG/P
000123                ZKS = 1.0                                                   PROP1020
000124                VKS=1.0
000125                DO 95 K=1,ISM                                               PROP1030
000126                VK(K)=VK(K)/WTG*WTM(K)
000127             95 ZK(K) = ZK(K) / PMU2 * WTM(K)                               PROP1050
000128                OMEGA=1.07/(T/EPOVRK) **0.159
000129                DBAR = 2.82861E-6/(SIGMA * SIGMA) *T/P*SQRT(T/BASMOL)/OMEGA
000130                VMU(II)=RHO(II)*DBAR *VMU5/VMU1                             B25A 107
000131                IF(KR(5)) 461,461,460                                       B25A 108
000132             460 RHOE(ISS)=RHO(II)                                          B25A 109
000133                 VMUE(ISS)=VMU (II)                                         B25A 110
000134                 VMWE=WM                                                    B25A 111
000135                 IS=ISV                                                     B25A 112
000136                 RETURN                                                     B25A 113
000137             461 CONTINUE                                                   B25A 114
000138                 CAPC(II)=RHO(II)/RHOE(ISS)*VMU(II)/VMUE(ISS)               B25A 115
000139                 VMW(II)=WM                                                 B25A 116
000140                 VLAM=RHO(II)*DBAR/WM*VMU6/VMU1*1.0869                      B25A 117
000141                 SC(II)=VMU5/VMU2*WM                                        B25A 118
000142                 IF (KKR(14)-1) 4613,4612,4611                              B25A 122
000143             4611 FFK2=WM/VMU2                                              B25A 123
000144                 VMU1=FFK2                                                  B25A 124
000145                 VMU3=1./WM                                                 B25A 125
000146                 CPTIL=CPG
000147                 WTIL=WG+1.8
000148                 DO 4614 K=1,ISM                                            B25A 128
000149             4614 ZK(K)=VK(K)                                               B25A 129
000150             4612 CT=0.                                                     B25A 130
000151                  CTR=0.                                                    B25A 131
000152             4613 VMU12=VMU1*VMU2                                           B25A 132
000153                  IF(KKR(20)) 9004,9005,9004                                B25A 133
000154             9004 WRITE(KOUT,9006)OMEGA,DBAR,    VLAM,SC(II),PR(II),VMU1,VMU2,VMU3,TB25A 134
000155                 1T(II),VMU5,VMU6,FF(1),FF(2),FF(3),CPTIL,WTIL,(VK (I),WTM(I),ZK(I),B25A 135
000156                 2I=1,ISM),VMU(II)                                          B25A 136
000157             9005 CONTINUE                                                  B25A 137
000158                  IF(KR(6)) 5000,5340,5340                                  B25A 139
000159             5000 CPBAR(II)=CPG
000160                  PR(II)=CPG/VMU6*VMU5/1.0869*WM
000161                  NPR=ISP2
000162                  DO 501 I=1,NPR
000163                  DO 501 J=1,ISV2
000164              501 PA(I,J)=0.                                                B25A 142
000165                  PA(3,1)=PMU2*CPTIL*T                                      B25A 143
000166                  DO 502 K=3,ISP2
000167                  IF (KKR(14)-1) 5016,5016,5017                             B25A 145
000168             5016 FFK2=FF(K-2)                                              B25A 146
000169             5017 IF(IFC(K-2)) 502,5011,5012                                B25A 147
000170             5011 PA(1,K)=VK(K-2)/FFK2                                      B25A 148
000171                  GO TO 5013                                                B25A 149
000172             5012 IF(IFC(K-2)-3) 5015,5014,5015
000173             5014 PA(1,K)=1./FFK2
000174                  GO TO 5013
000175             5015 PA(1,K)=0.
000176             5013 PA(2,K)=PA(1,K)*WTM(K-2)                                  B25A 154
000177                  PA(3,K)=PA(1,K)*WM(K-2)                                   B25A 155
000178                  IF(K-ISP)5018,5018,5019
```

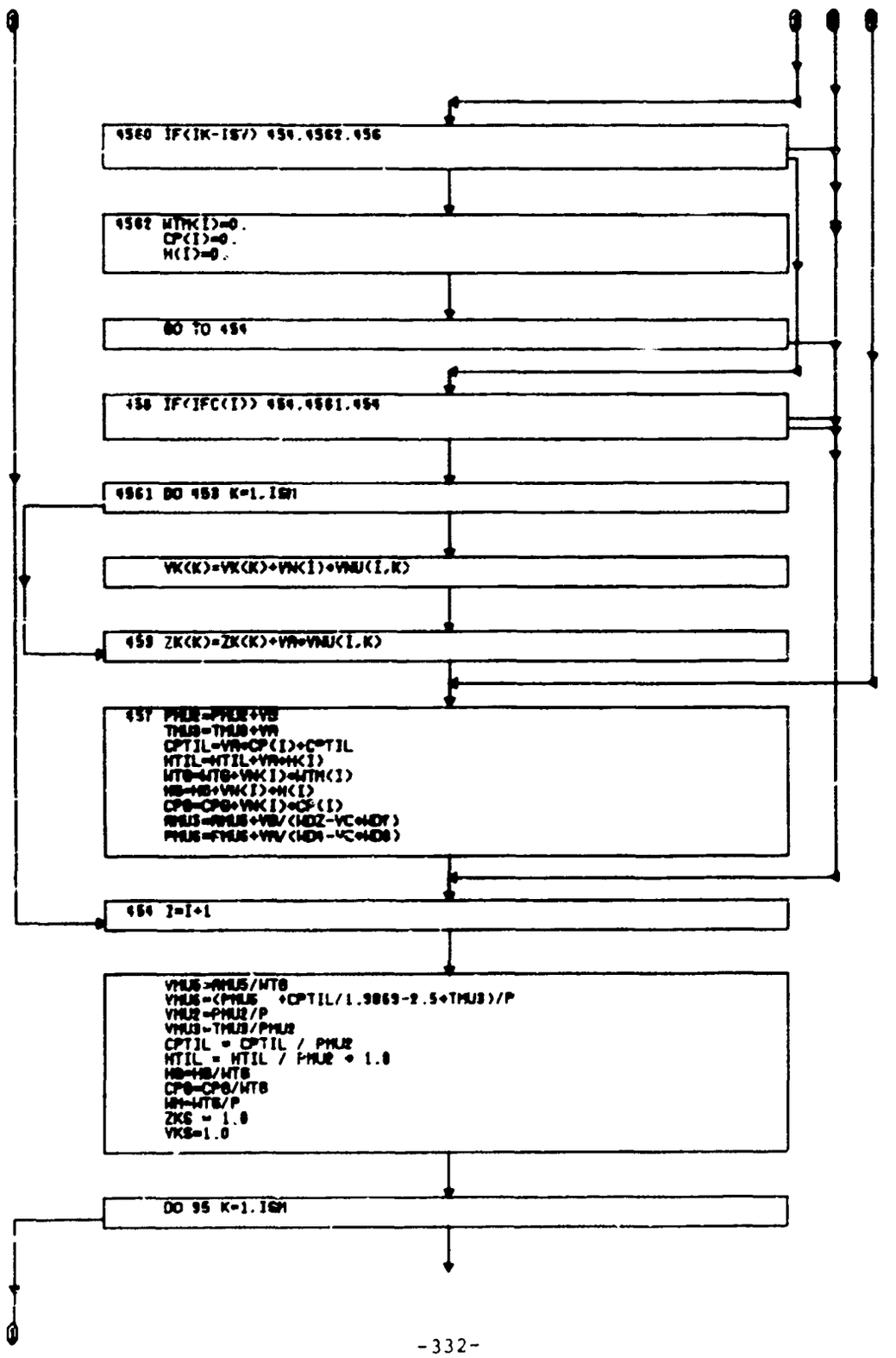
```
000179          5018 PA(K+1,K)=PA(1,K)
000180          5019 CONTINUE
000181           502 CONTINUE                                                  825A 197
000182               J=ISVP
000183               IF(ISVP.GT.N) GO TO 5070
000184               DO 507 IJ=ISVP,N
000185               IF(IFC(J)) 507,5021,507                                   825A 199
000186          5021 PRP(1)=VN(J)/FFK2
000187               IF (KKR(14)-1) 5022,5022,5023                             825A 161
000188          5022 PRP(1)=VN(J)/FF(J)
000189          5023 PRP(2)=PRP(1)*WTM(J)
000190               PRP(3)=PRP(1)*H(J)
000191               DO 5024 I=4,ISP2
000192          5024 PRP(I)=PRP(1)*VNU(J,I-3)
000193               DO 505 I=1,NPR
000194               PA(I,1)=PA(I,1)-TC(J)*PRP(I)
000195               DO 505 K=1,ISV
000196               IF(IFC(K)) 506,506,505
000197           506 PA(I,K+2)=PA(I,K+2)+PRP(I)*VNU(J,K)
000198           505 CONTINUE
000199           507 J=J+1
000200          5070 VA=AA/WTM(IS)
000201               DO 511 I=1,ISV2
000202               A(I,1)=A(I,1)*AA/1.8                                      825A 182
000203           511 A(I,ISP2)=A(I,ISP2)*VA                                    825A 183
000204               DO 512 J=3,ISP                                            825A 184
000205               VA=AA/WTM(J-2)                                            825A 185
000206               DO 512 I=1,ISV2
000207           512 A(I,J)=A(I,J)*VA=A(I,ISP2)                                825A 187
000208             C FORM PA,A PRODUCT AND TRANSPOSE (TO ESTABLISH EQUI  LENCE  825A 188
000209               DO 521 I=1,NPR
000210               DO 521 J=1,ISP                                            825A 190
000211               PV(J,I)=PA(I,1)*A(1,J)                                    825A 191
000212               DO 521 L=3,ISV2
000213           521 PV(J,I)=PV(J,I)+PA(I,L)*A(L,J)                            825A 193
000214               DO 533 K=1,ISP                                            825A 194
000215               PV(K,1)=(PV(K,1)-VMU3*PV(K,2))/PMU2                       825A 195
000216               PV(K,3)=(PV(K,3)+1.8-HTIL*PV(K,2))/PMU2                   825A 196
000217               DO 531 J=1,ISM                                            825A 197
000218           531 PV(K,J+3)=(PV(K,J+3)-WTM(J)*ZK(J)*PV(K,2))/PMU2           825A 198
000219           533 PV(K,2)=CT*A(1,K)+PV(K,2)/PMU2                            825A 199
000220               PV(2,2)=PV(2,2)-1./P                                      825A 200
000221             C POOR MAN-S EQUIVALENCE                                    825A 201
000222               QR(II)=0.                                                 825A 202
000223               DCAPCH=CAPC(II)*(2.*A(2,1)+0.341*A(1,1))                  825A 203
000224               DPRH=0.                                                   825A 204
000225               DQCH=0.                                                   825A 205
000226               DQRH=0.                                                   825A 206
000227               DCPBH=0.                                                  825A 207
000228               DCPTH=0.                                                  825A 208
000229               DMU12H=0.                                                 825A 209
000230               DRHOH=RHO(II)*(A(2,1)-A(1,1))                             825A 210
000231               DTH=T*A(1,1)+1.8                                          825A 211
000232               DMU3H=PV(1,1)                                             825A 212
000233               DMU4H=PV(1,2)                                             825A 213
000234               DHTILH=PV(1,3)                                            825A 214
000235               IF (NSPM1)5340,5340,5320
000236          5320 DO 534 K=1,ISM
000237               PHIK(II,K)=0.                                             825A 216
000238               DPHIKH(K)=0.                                              825A 217
```

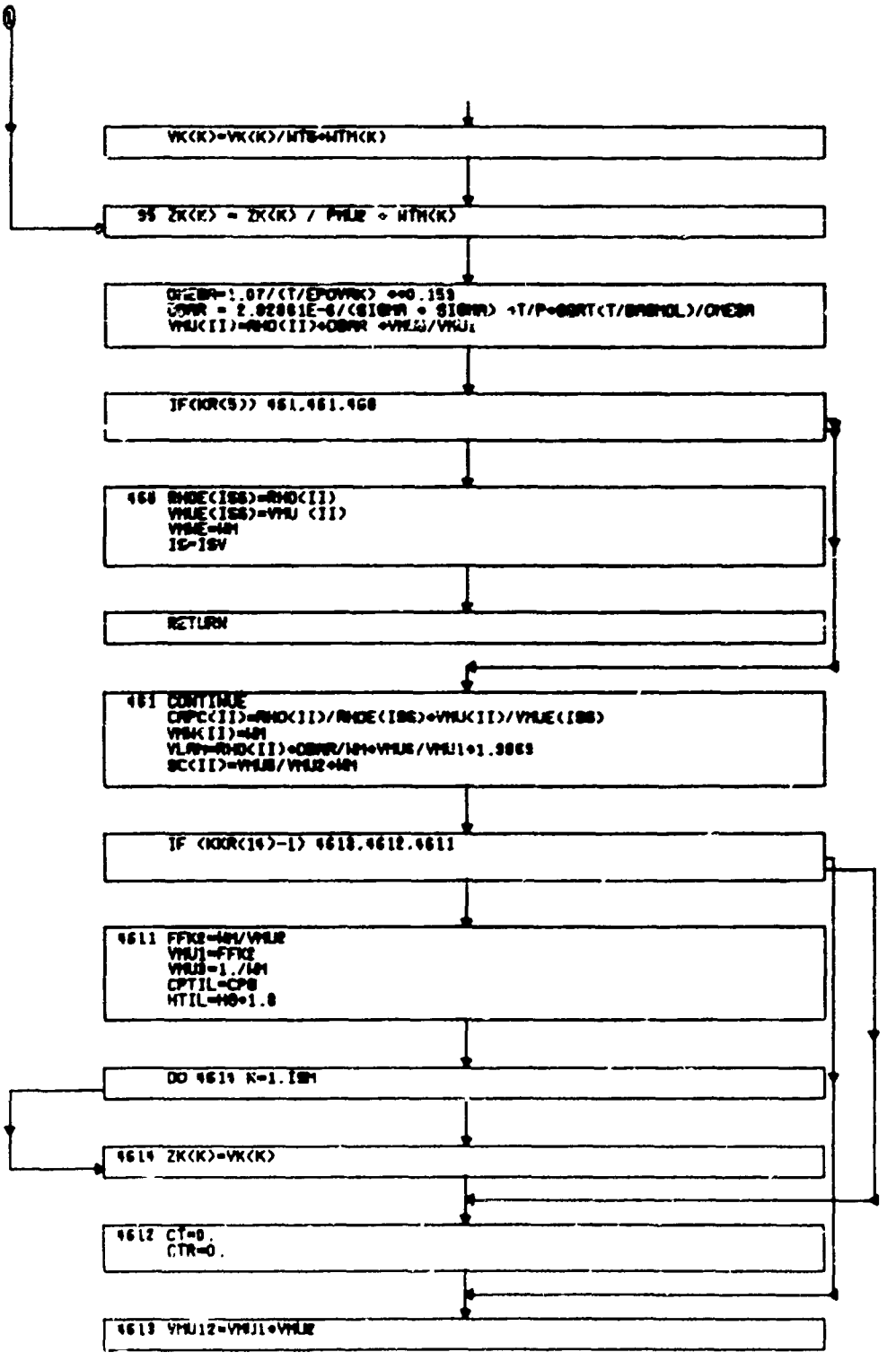
```
                DRHOK(K)=RHO(II)*(A(2,K+2)-A(1,K+2))                                B25A 218
                DPRK(K)=0.                                                          B25A 219
                DECK(K)=0.                                                          B25A 220
                ETK(K)=T*A(1,K+2)*1.8                                               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)                                                  B25A 227
                DMU4K(K)=PV(K+2,2)                                                  B25A 228
                DHTILK(K)=PV(K+2,3)                                                 B25A 229
                DZKK(K)=PV(1,K+3)                                                   B25A 230
                DO 532 I=1,ISM                                                      B25A 231
                DPHIKK(I,K)=0.                                                      B25A 232
            532 DZKK(I,K)=PV(K+2,I+3)                                               B25A 233
            534 CONTINUE                                                            B25A 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                                                    B25A 237
                IF(VN(I)) 5341,5341,535                                             B25A 238
           5341 IF(IFC(I)) 535,5342,535                                             B25A 239
           5342 FR(I,II)=1.E-30                                                     B25A 240
            535 CONTINUE
                IF(KR(6)) 538,538,5350
           5350 IF (KR(1)-1) 536,5361,5360
           5361 Y(JC)=0.
            536 HW(ISS,ITT)=HG*1.8
           5360 DO 537 K=2,IS                                                       B25A 244
            537 SPW(K-1,ISS,ITT)=VK(K-1)
                RHOVW(ISS,ITT)=-RV
                IF(KR(8).GT.0) W(3)=W(3)-VN(N+1)/WTG
                WS=W(1)-W(2)-W(3)+1.E-30
            538 CONTINUE                                                            B25A 246
                IF(KK(20)) 9001,9002,9001                                           B25A 247
           9001 WRITE(KOUT,9006)DMU3H,DMU3K,DMU4H,DMU4K,DHTILH,DHTILK,DTH,DYK,DRHOB25A 248
               1H,DRHOK,DZKH,DZKK,HG,VK
                                                                                    B25A 250
           9002 CONTINUE                                                            B25A 251
                IS=ISV
           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                                                              B25A 253
                END
```

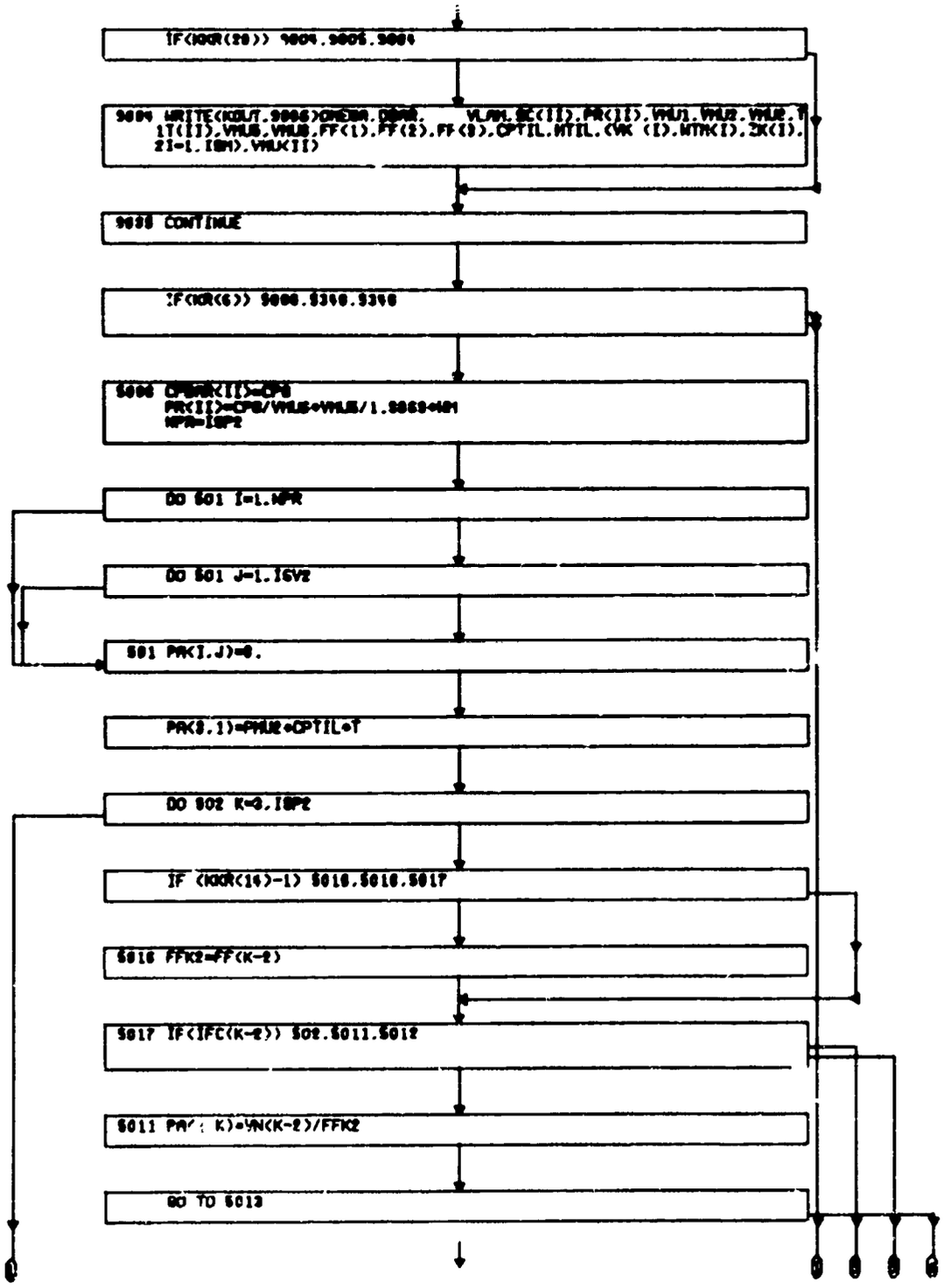
c. Flow Chart

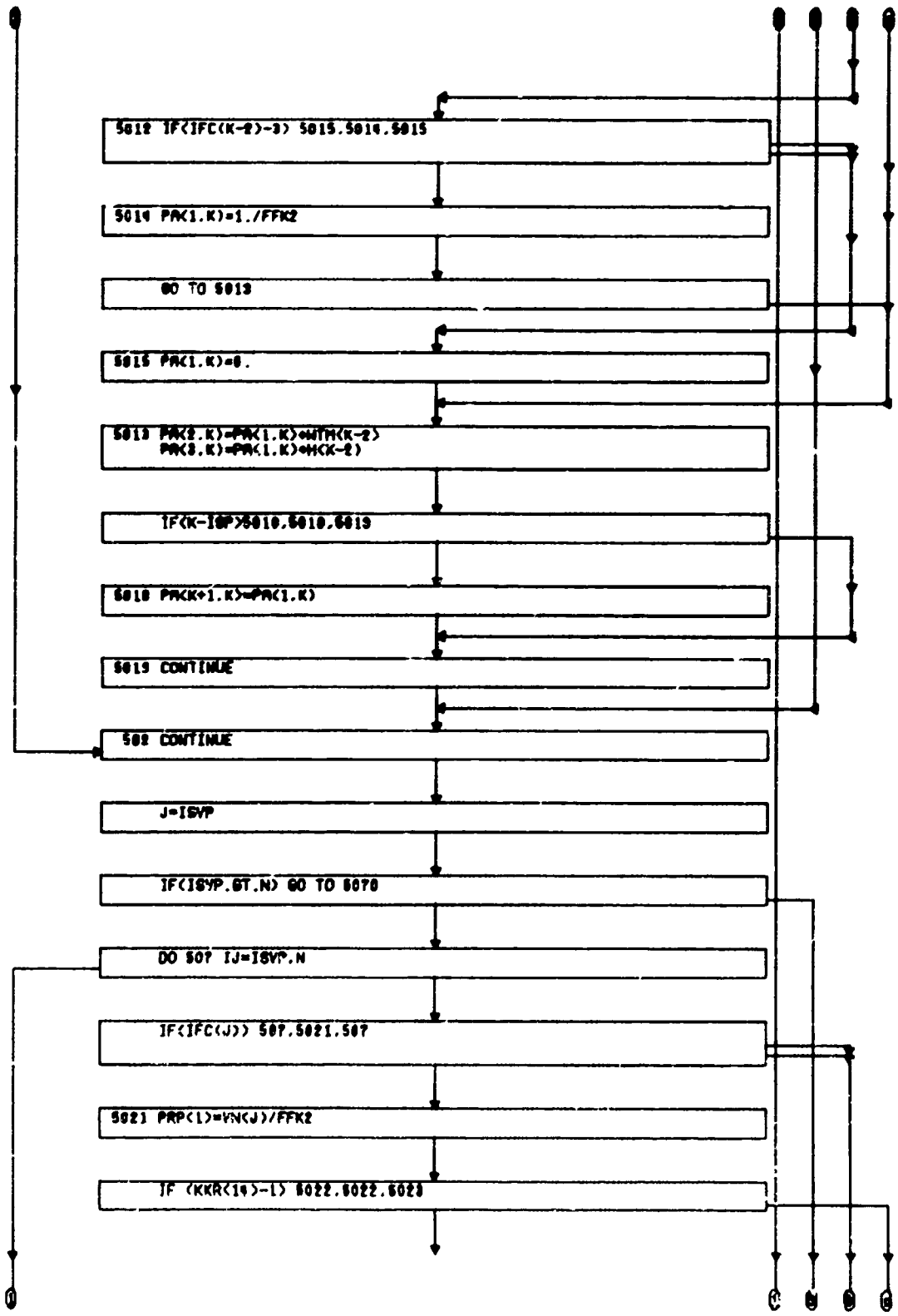

SUBROUTINE PROPS
IF(II-1) 910,900,910
300 IF(KKR(14)-10) 310,302,302
302 KKR(14)=KKR(14)-10
310 IF(T-500.001) 312,312,320
312 KKR(14)=KKR(14)+10
320 WM=RM/P
ISV=IS
IG=NSP
ISVP=ISV+1
ISV2=ISV+2
CT=-0.5
IGM=IG-1
IGP=IG+1
IGP1=IG+2
TT(II)=T+1.8
RHO(II)=RM/(1.3146+T)
CTR=CT+1.8876
C FORM NECESSARY SUMMATIONS
PMUR=0.
CPTIL=0.
WTB=0.
HB=0.
CPB=0.
HTIL=0.
PMUI=0.
THUB=0.
I=1
DO 451 IK=1,N
IF(ISV-IG) 541,541,541
441 IF(IK-ISV) 444,451,442
442 H(I)=H(I)-VNU(I,ISV)*H(ISV)

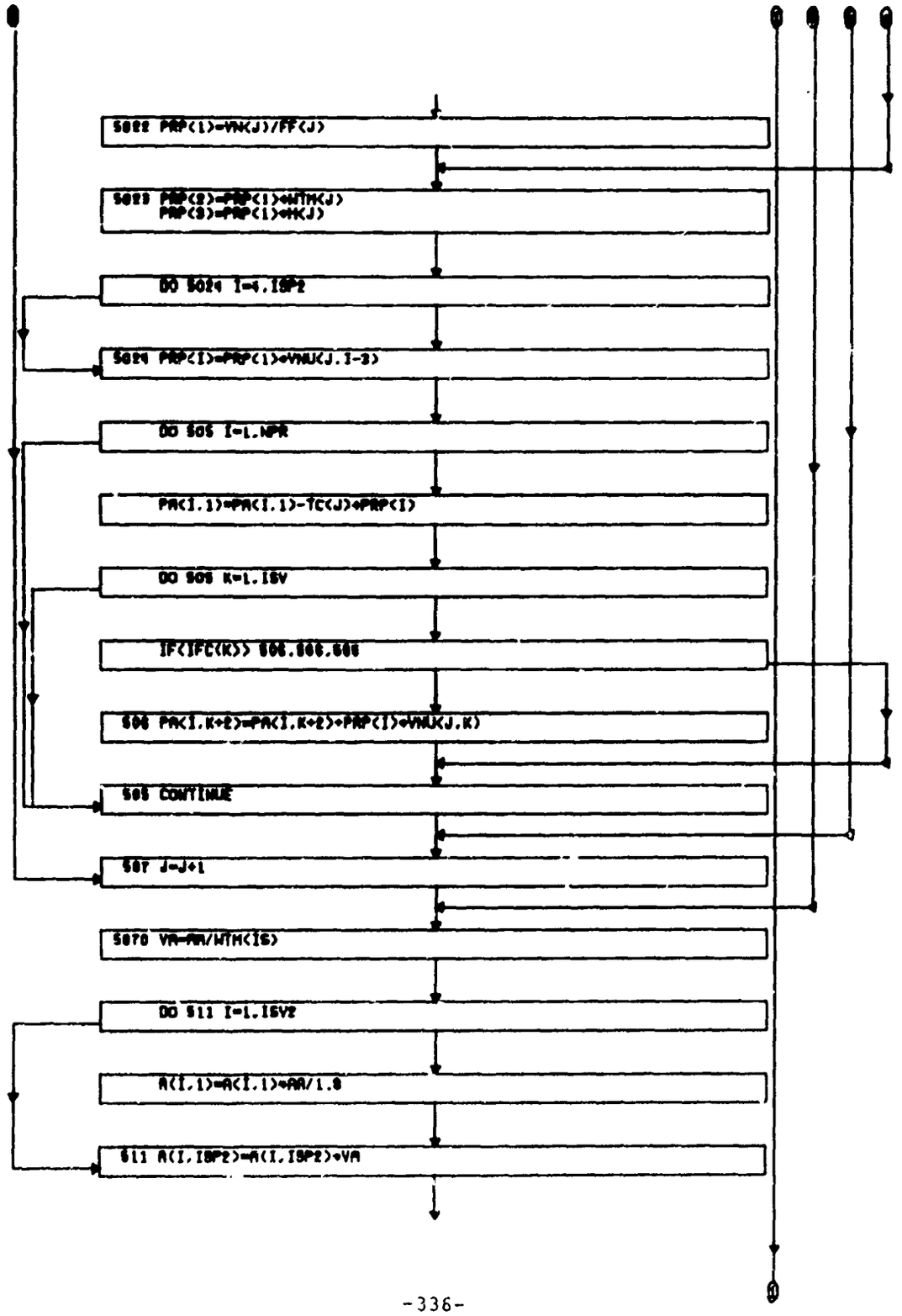

WTM(I)=WTM(I)-VNU(I ISV)*WTM(ISV)
CP(I)=CP(I)-VNU(I,ISV)*CP(ISV)
544 IF(IFC(I)) 451,4550,451
4550 PMU1=PMU1+VN(I)*FF(I)
451 I=I+1
VMU1=PMU1/P
PMU5=0.
PMU6=0.
WDZ=1.385
WD4 = 0.284*WDZ
I = 1
DO 454 IK = 1,N
ASTAR = 1.13 * GG(I)/FF(I) * GG(I)/FF(I)
WD2=1.2*ASTAR/PMU1
WD7=WDZ/PMU1-WD2
WD5=.32*ASTAR/PMU1
WD9=WD4/PMU1-WD5
VA=VN(I)/FF(I)
VB=VA*WTM(I)
VC=VN(I)*FF(I)
IF(IK-IS) 4510,4510,4560
4510 VK(I)=0.
ZK(I)=0
IF(IFC(I)) 454,4511,454
4511 VK(I)=VN(I)
452 ZK(I)=VA
GO TO 457

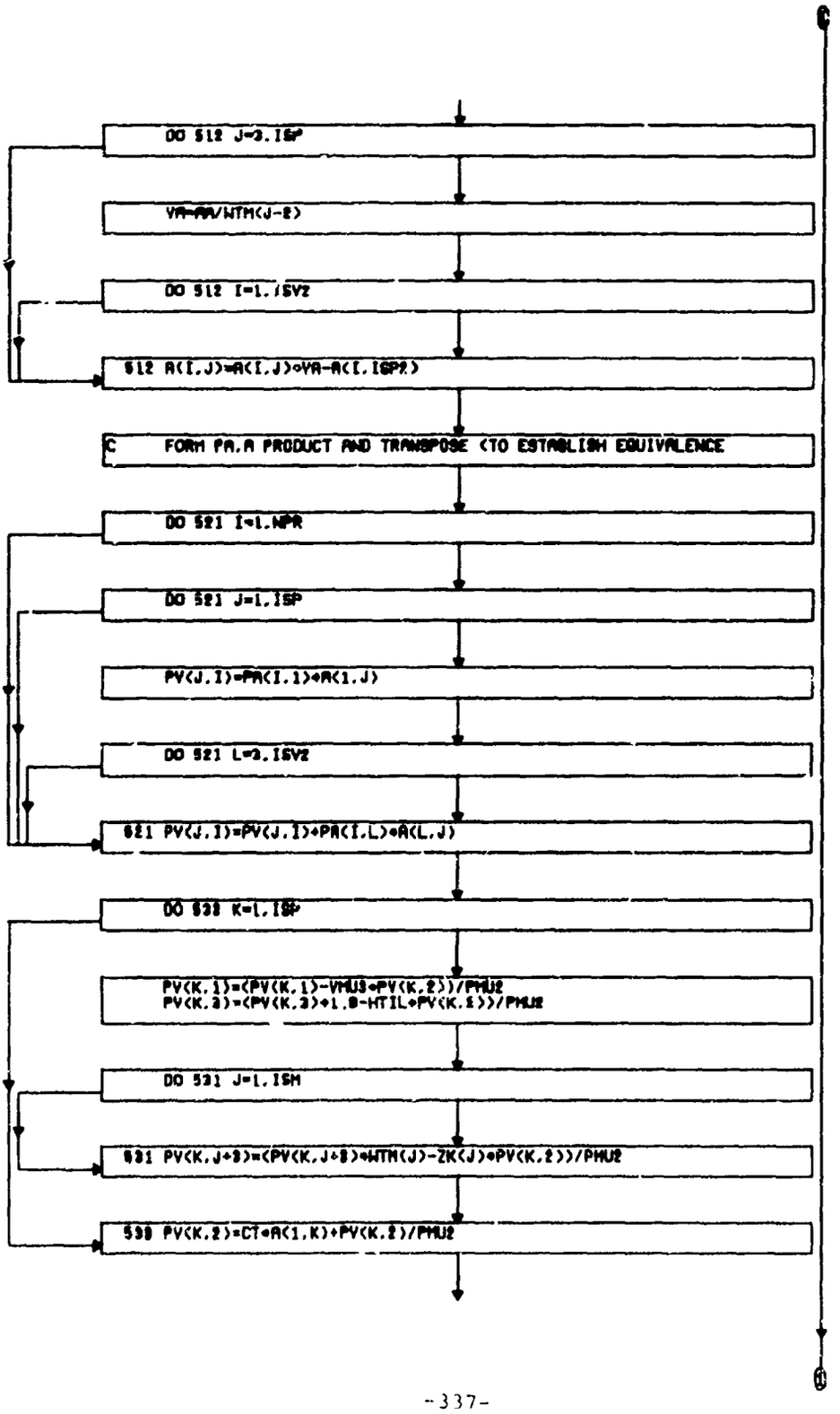

4560 IF(IK-IS7) 454,4562,456
4562 WTH(I)=0.
CP(I)=0.
H(I)=0.
GO TO 454
456 IF(IFC(I)) 454,4561,454
4561 DO 453 K=1,ISM
VK(K)=VK(K)+VNK(I)*VNU(I,K)
453 ZK(K)=ZK(K)+VN*VNU(I,K)
457 PMU5=PMU5+VB
TMU3=TMU3+VN
CPTIL=VN*CP(I)+CPTIL
HTIL=HTIL+VN*H(I)
WTB=WTB+VNK(I)*WTH(I)
HB=HB+VNK(I)*H(I)
CPB=CPB+VNK(I)*CF(I)
RMU3=RMU3+VB/(HDZ-VC*HDY)
PMU5=PMU5+VN/(HDN-VC*HDB)
454 I=I+1
VMU5=RMU5/WTB
VMU5=(PMU5 +CPTIL/1.9869-2.5*TMU3)/P
VMU2=PMU2/P
VMU3=TMU3/PMU2
CPTIL = CPTIL / PMU2
HTIL = HTIL / PMU2 + 1.0
HB=HB/WTB
CPB=CPB/WTB
HM=WTB/P
ZKS = 1.0
VKS=1.0
DO 95 K=1,ISM

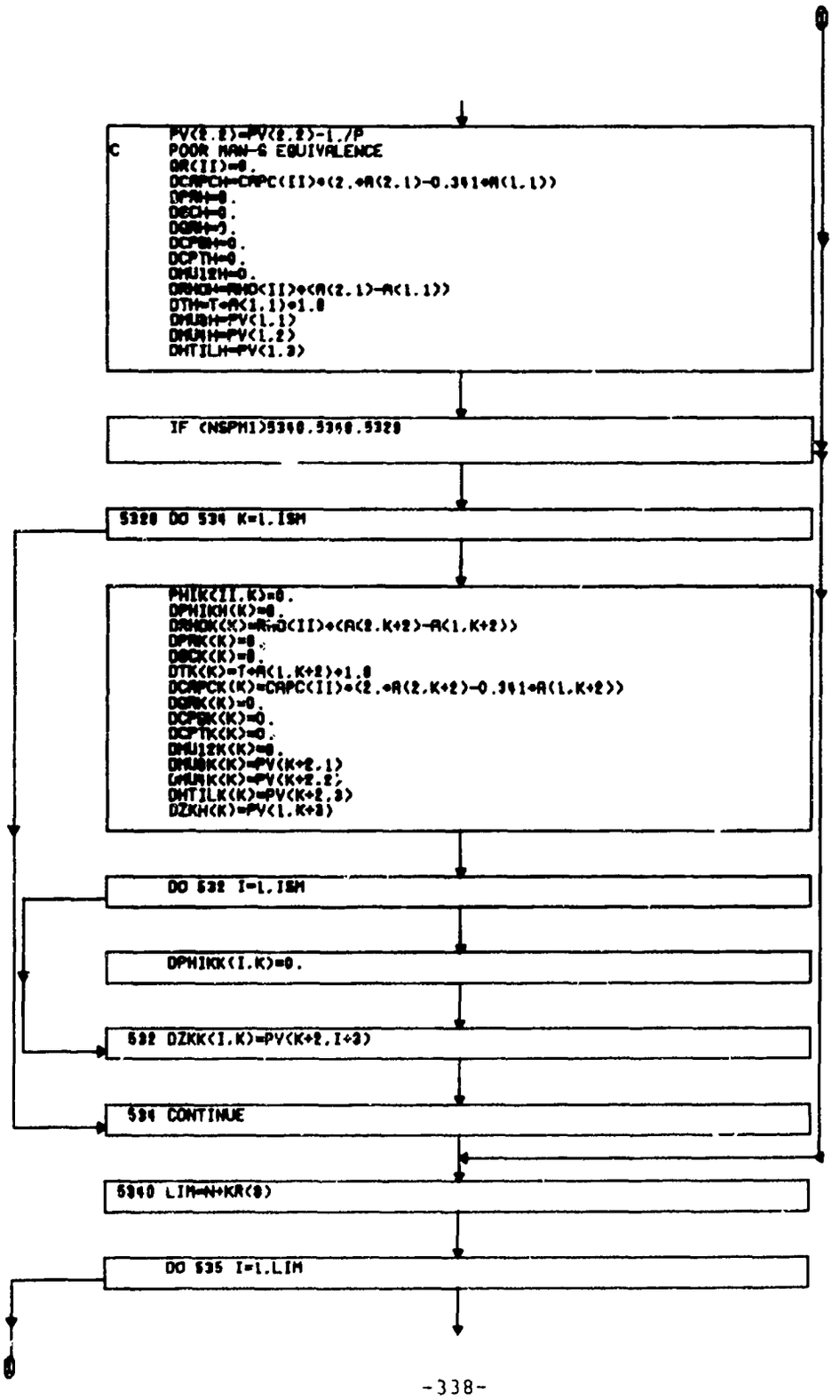

VK(K)=VK(K)/WTS*WTH(K)
95 ZK(K) = ZK(K) / PHLR * WTH(K)
IF(KKR(5)) 461,461,468
468 RHOE(ISS)=RHO(II)
VMUE(ISS)=VMU (II)
RETURN
461 CONTINUE
IF (KKR(14)-1) 4618,4612,4611
4611 FFK2=AM/VMLR
VMU1=FFK2
CPTIL=CPS
HTIL=HS+1.8
DO 4614 K=1.ISM
4614 ZK(K)=VK(K)
4612 CT=0.
CTR=0.
4613 VMU12=VMU1+VMLR

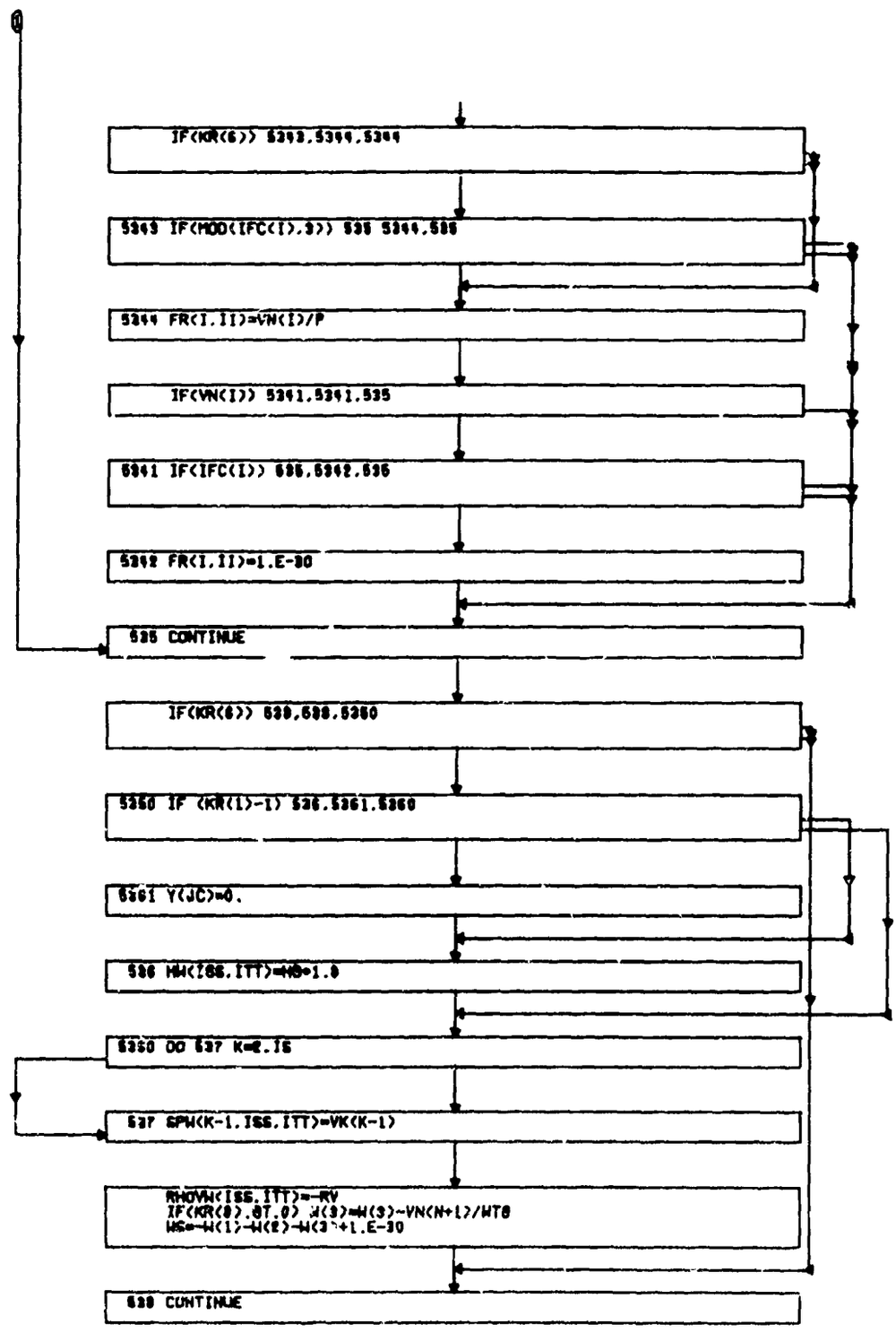

IF(KKR(20)) 9004,9005,9004
9004 WRITE(KOUT,9006)CHEMA,DBAR, VLAM,EC(II),PR(II),VMU1,VMU2,VMU3,T
1T(II),VMU6,VMU8,FF(1),FF(2),FF(3),CPTIL,MTIL,(VK (I),MTHK(I),ZK(I),
2I=1,IBM),VMUK(II)
9005 CONTINUE
IF(KKR(6)) 9006,9366,9366
9006 CHEMR(II)=CPS
PR(II)=CPS/VMU6+VMU8/1.9869+101
NPR=IBP2
DO 501 I=1,NPR
DO 501 J=1,16V2
501 PR(I,J)=0.
PR(8,1)=PMU2+CPTIL+T
DO 902 K=3,IBP2
IF (KKR(14)-1) 5016,5016,5017
5016 FFK2=FF(K-2)
5017 IF(IFC(K-2)) 502,5011,5012
5011 PR(K)=VN(K-2)/FFK2
GO TO 5013

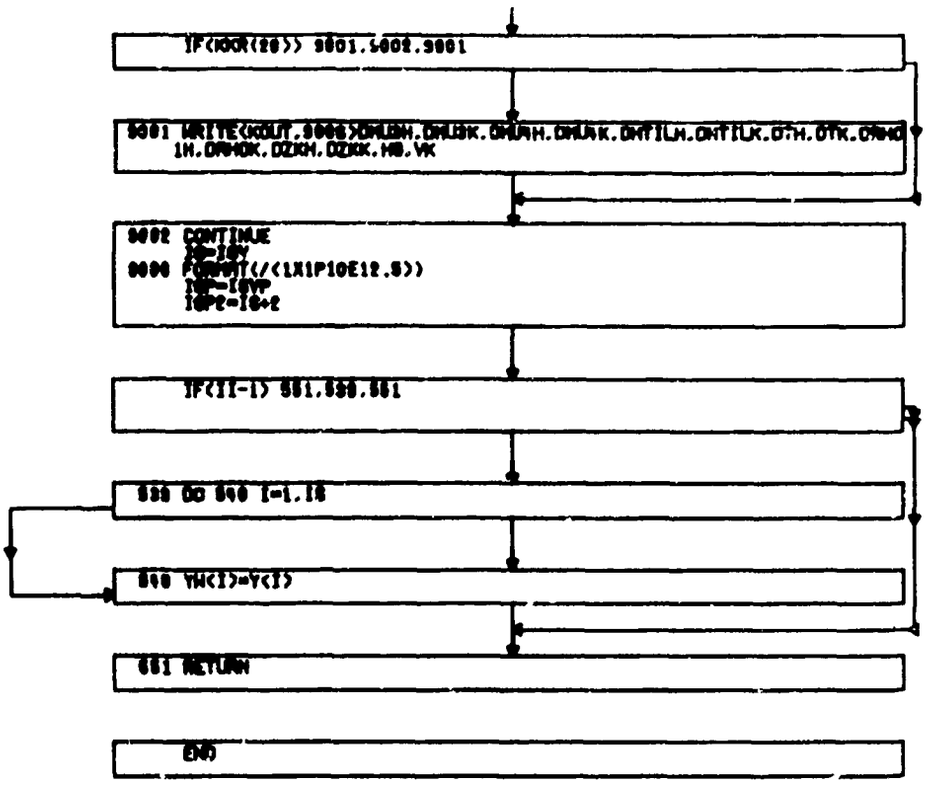

5012 IF(IFC(K-2)-3) 5015,5014,5015
5014 PR(1,K)=1./FFK2
GO TO 5013
5015 PR(1,K)=0.
5013 PR(2,K)=PR(1,K)*WITH(K-2)
PR(3,K)=PR(1,K)*H(K-2)
IF(K-IGP)5010,5010,5019
5010 PR(K+1,K)=PR(1,K)
5019 CONTINUE
502 CONTINUE
J=ISVP
IF(ISVP.GT.N) GO TO 5070
DO 507 IJ=ISVP,N
IF(IFC(J)) 507,5021,507
5021 PRP(1)=VN(J)/FFK2
IF (KKR(19)-1) 5022,5022,5023


5022 PRP(1)=VNKJ)/FF(J)
5023 PRP(2)=PRP(1)*WTM(J)
PRP(3)=PRP(1)*HK(J)
DO 5024 I=4,ISP2
5024 PRP(I)=PRP(1)*VNUK(J,I-2)
DO 505 I=1,NPR
PR(I,1)=PR(I,1)-TC(J)*PRP(I)
DO 506 K=1,ISV
IF(IFC(K)) 506,506,506
506 PR(I,K+2)=PR(I,K+2)+PRP(I)*VNUK(J,K)
505 CONTINUE
507 J=J+1
5070 VR=RR/WTM(IS)
DO 511 I=1,ISV2
R(I,1)=R(I,1)+RR/1.0
511 R(I,ISP2)=R(I,ISP2)+VR


DO 512 J=3,ISP
VA=AA/WTM(J-2)
DO 512 I=1,ISV2
512 A(I,J)=A(I,J)*VA-A(I,ISP2)
C FORM PA,A PRODUCT AND TRANSPOSE (TO ESTABLISH EQUIVALENCE
DO 521 I=1,NPR
DO 521 J=1,ISP
PV(J,I)=PA(I,1)*A(1,J)
DO 521 L=2,ISV2
521 PV(J,I)=PV(J,I)+PA(I,L)*A(L,J)
DO 530 K=1,ISP
PV(K,1)=(PV(K,1)-VMU3*PV(K,2))/PMU2
PV(K,2)=(PV(K,2)+1.0-HTIL*PV(K,1))/PMU2
DO 531 J=1,ISM
531 PV(K,J+3)=(PV(K,J+3)+WTM(J)-ZK(J)*PV(K,2))/PMU2
530 PV(K,2)=CT*A(1,K)+PV(K,2)/PMU2


PV(2,2)=PV(2,2)-1./P
C POOR MAN-G EQUIVALENCE
GR(II)=0.
DCAPCH=CAPC(II)*(2.*A(2,1)-0.3*A(1,1))
DPR=0.
DGCH=0.
DGRH=0.
DCPGH=0.
DCPTH=0.
DMU12H=0.
DRHOH=RHO(II)*(A(2,1)-A(1,1))
DTH=T+A(1,1)*1.8
DMU2H=PV(1,1)
DMUMH=PV(1,2)
DHTILH=PV(1,3)
IF (NSPM1)5340,5340,5320
5320 DO 534 K=1,ISM
PHIK(II,K)=0.
DPHIKH(K)=0.
DRHOK(K)=RHO(II)*(A(2,K+2)-A(1,K+2))
DPRK(K)=0.
DGCK(K)=0.
DTK(K)=T+A(1,K+2)*1.8
DCAPCK(K)=CAPC(II)*(2.*A(2,K+2)-0.3*A(1,K+2))
DGRK(K)=0.
DCPGK(K)=0.
DCPTK(K)=0.
DMU12K(K)=0.
DMU2K(K)=PV(K+2,1)
DMUMK(K)=PV(K+2,2)
DHTILK(K)=PV(K+2,3)
DZKH(K)=PV(1,K+3)
DO 532 I=1,ISM
DPHIKK(I,K)=0.
532 DZKK(I,K)=PV(K+2,I+3)
534 CONTINUE
5340 LIM=N+KR(3)
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
5341 IF(IFC(I)) 535,5342,535
5342 FR(I,II)=1.E-30
535 CONTINUE
IF(KR(6)) 539,538,5350
5350 IF (KR(1)-1) 536,5351,5350
5351 Y(JC)=0.
536 HH(ISS,ITT)=HB=1.0
5350 DO 537 K=2,15
537 SPW(K-1,ISS,ITT)=VK(K-1)
RHOVH(ISS,ITT)=-RV
IF(KR(8).GT.0) W(3)=W(3)-VN(N+1)/WT8
WS=-W(1)-W(2)-W(3)+1.E-30
539 CONTINUE


IF(KOR(28)) 9801,9802,9801
9801 WRITE(KOUT,9806)DHLBH,DHLBK,DHUAH,DHUAK,DHTILH,DHTILK,DTH,DTK,DHMO
1H,DHMOK,DZKH,DZKK,MB,VK
9802 CONTINUE
9806 FORMAT(//(1X1P10E12.5))
IGP=IGVP
IGP2=IG+2
IF(II-1) 851,850,851
850 DO 860 I=1,IS
860 YW(I)=Y(I)
851 RETURN
END

27. SUBROUTINE TAYLOR (D,FM,F,P) - B26A

a. Function

Calculates coefficients in Taylor series expansions of integrals which appear in the integral form of the boundary layer equations. Called by HISTXI, IMONE.

D = Distance between neighboring nodes I and I-1

FM = Value of function and its derivatives at I-1

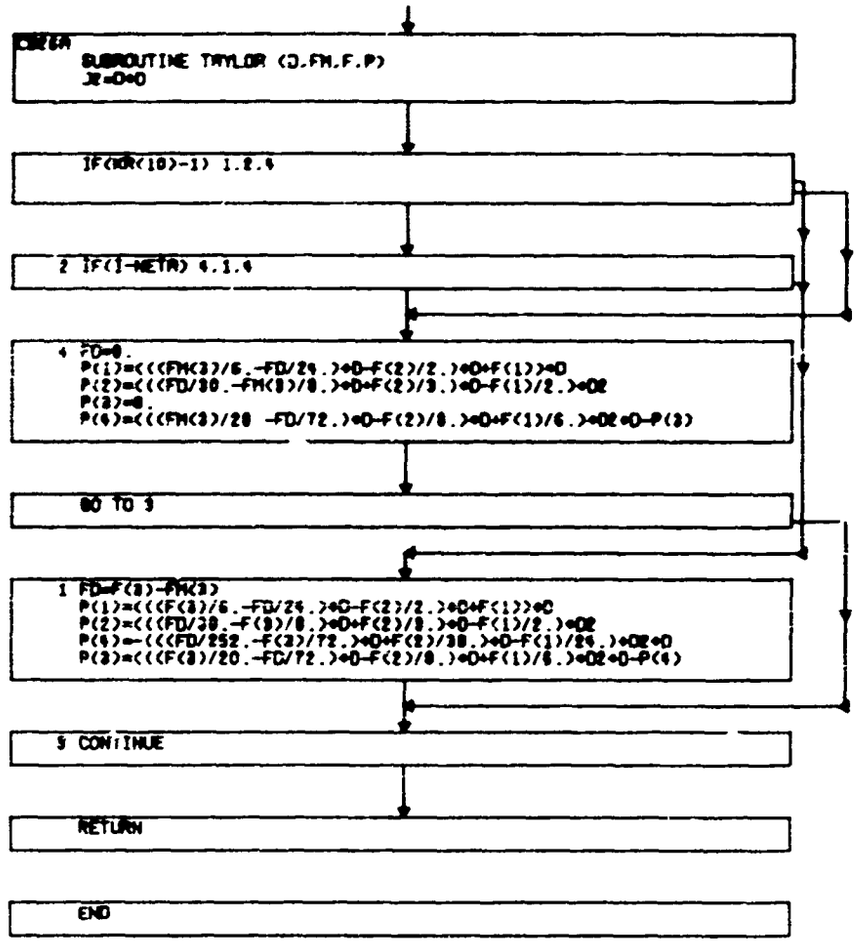
F = Value of function and its derivatives at I

P = Terms in Taylor series expansions

b. Listing

```
000001          C8264                                                          8264 001
000002                SUBROUTINE TAYLOR (D,FM,F,P)                             8264 002
000003                DIMENSION FM(1),F(1),P(1)                                8264 003
000004                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1O,MAT2O,NETA,.  8264 004
000005                D2=D*D                                                   8264 005
000006                IF(KR(10)-1) 1,2,4
000007              2 IF(I-NETA) 4,1,4
000008              4 FD=0.
000009                P(1)=(((FM(3)/6.-FD/24.)*D-F(2)/2.)*D+F(1))*D            8264 009
000010                P(2)=(((FD/30.-FM(3)/8.)*D+F(2)/3.)*D-F(1)/2.)*D2        8264 010
000011                P(3)=0.                                                  8264 011
000012                P(4)=(((FM(3)/20.-FD/72.)*D-F(2)/8.)*D+F(1)/6.)*D2*D-P(3)  8264 012
000013                GO TO 3                                                  8264 013
000014              1 FD=F(3)-FM(3)                                            8264 014
000015                P(1)=(((F(3)/6.-FD/24.)*D+F(2)/2.)*D+F(1))*D             8264 015
000016                P(2)=(((FD/30.-F(3)/8.)*D+F(2)/3.)*D-F(1)/2.)*D2         8264 016
000017                P(4)=(((FD/252.-F(3)/72.)*D+F(2)/30.)*D-F(1)/24.)*D2*D   8264 017
000018                P(3)=(((F(3)/20.-FD/72.)*D+F(2)/8.)*D+F(1)/6.)*D2*D-P(4)  8264 018
000019              3 CONTINUE                                                 8264 019
000020                RETURN                                                   8264 020
000021                END                                                      8264 021
```

c. Flow Chart


SUBROUTINE TAYLOR (D,FM,F,P)
IF(NOR(10)-1) 1,2,4
2 IF(1-METH) 4,1,4
4 FD=0.
P(1)=(((FM(3)/6.-FD/24.)*D-F(2)/2.)*D+F(1))*D
P(2)=(((FD/30.-FM(3)/8.)*D+F(2)/3.)*D-F(1)/2.)*D2
P(3)=0.
P(4)=(((FM(3)/20 -FD/72.)*D-F(2)/8.)*D+F(1)/6.)*D2*D-P(3)
GO TO 5
1 FD=F(3)-FM(3)
P(1)=(((F(3)/6.-FD/24.)*D-F(2)/2.)*D+F(1))*D
P(2)=(((FD/30.-F(3)/8.)*D+F(2)/8.)*D-F(1)/2.)*D2
P(4)=-(((FD/252.-F(3)/72.)*D+F(2)/30.)*D-F(1)/24.)*D2*D
P(3)=(((F(3)/20.-FD/72.)*D-F(2)/8.)*D+F(1)/6.)*D2*D-P(4)
5 CONTINUE
RETURN
END

28. SUBROUTINE LINMAT

a. Function

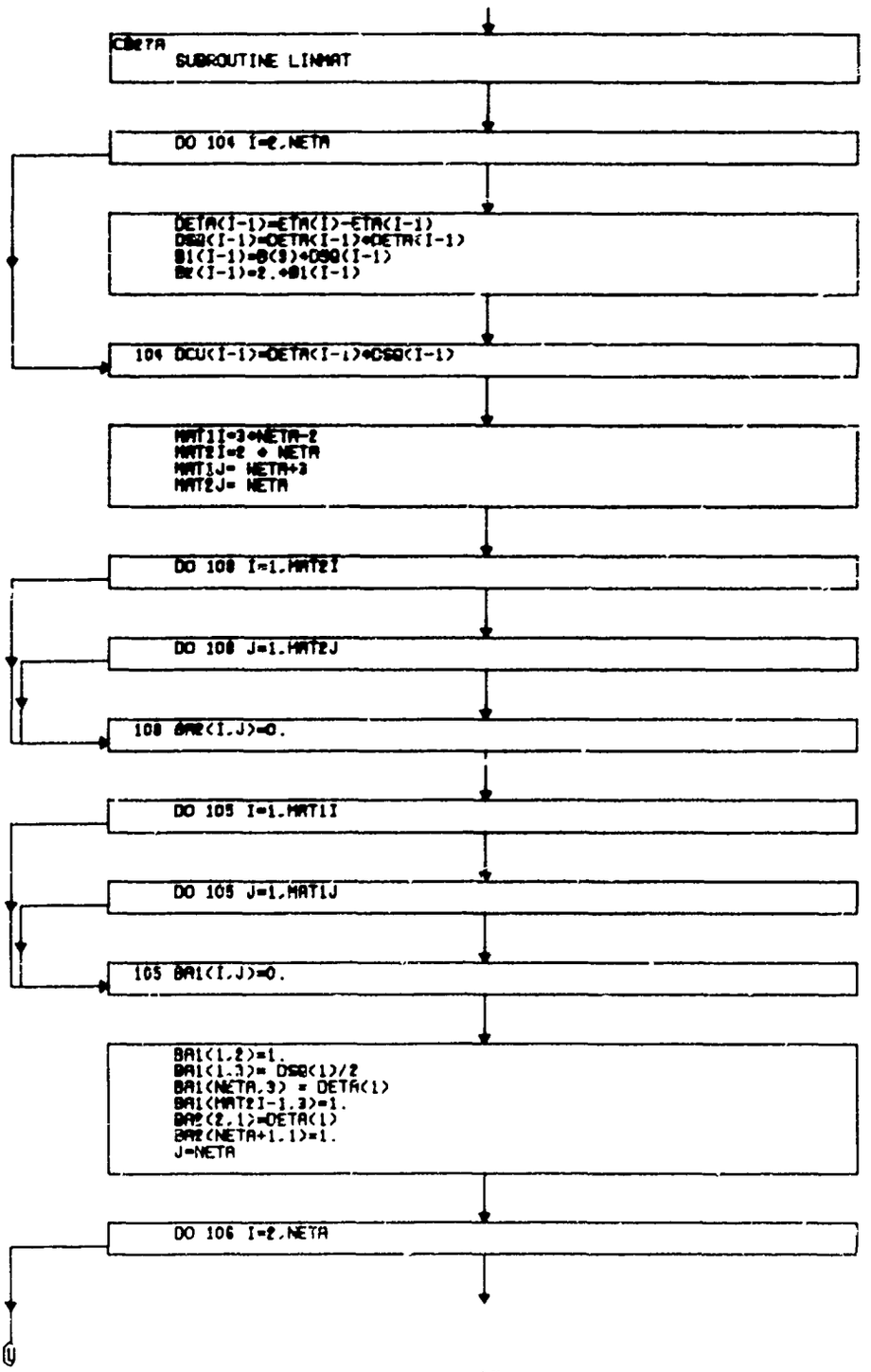
Sets up matrices for Taylor series expansions and linear boundary conditions from eta spacing, and solves to express linear corrections in terms of nonlinear corrections. Called by SETUP. Calls MATS1, MATS2.

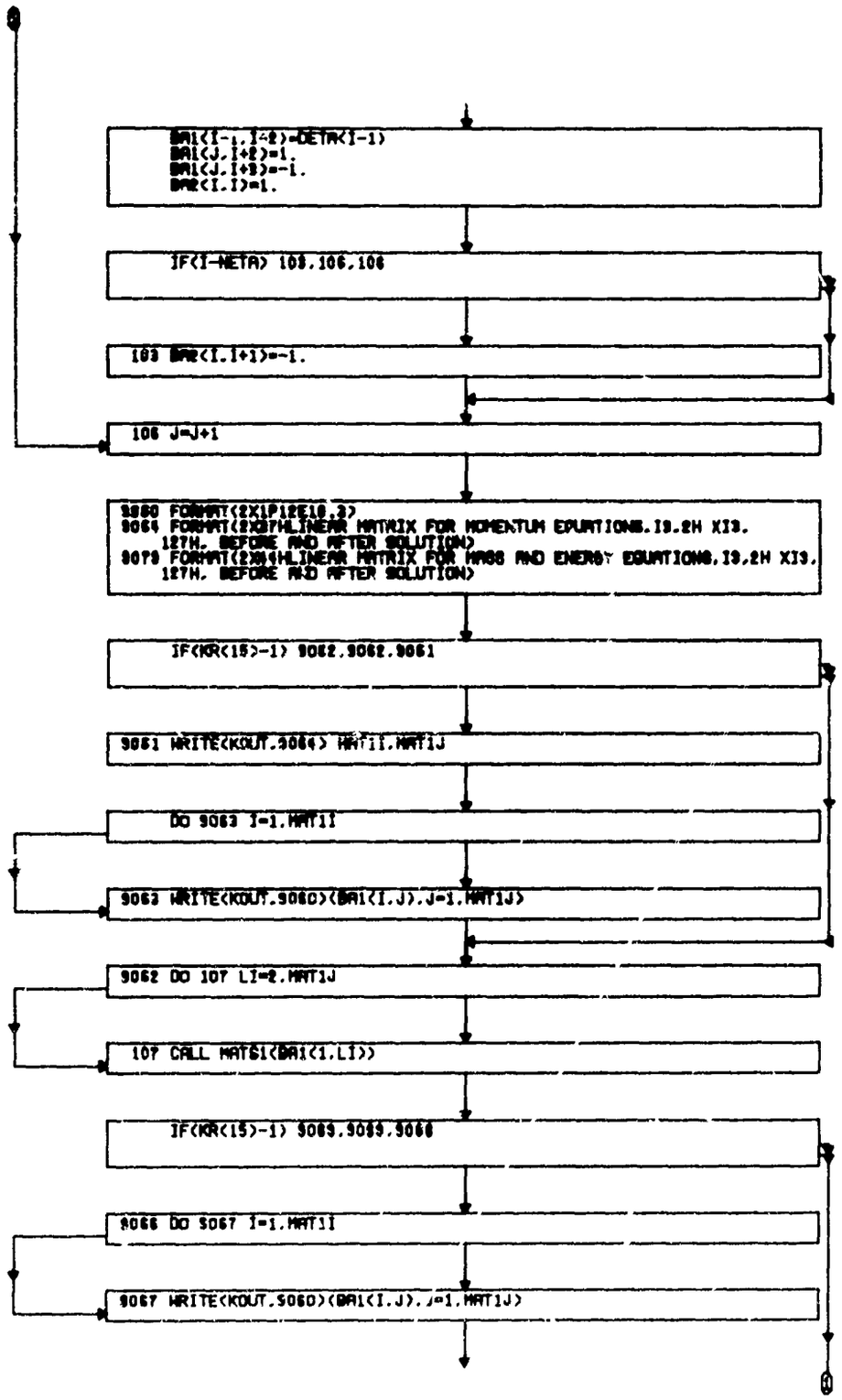
b. Listing

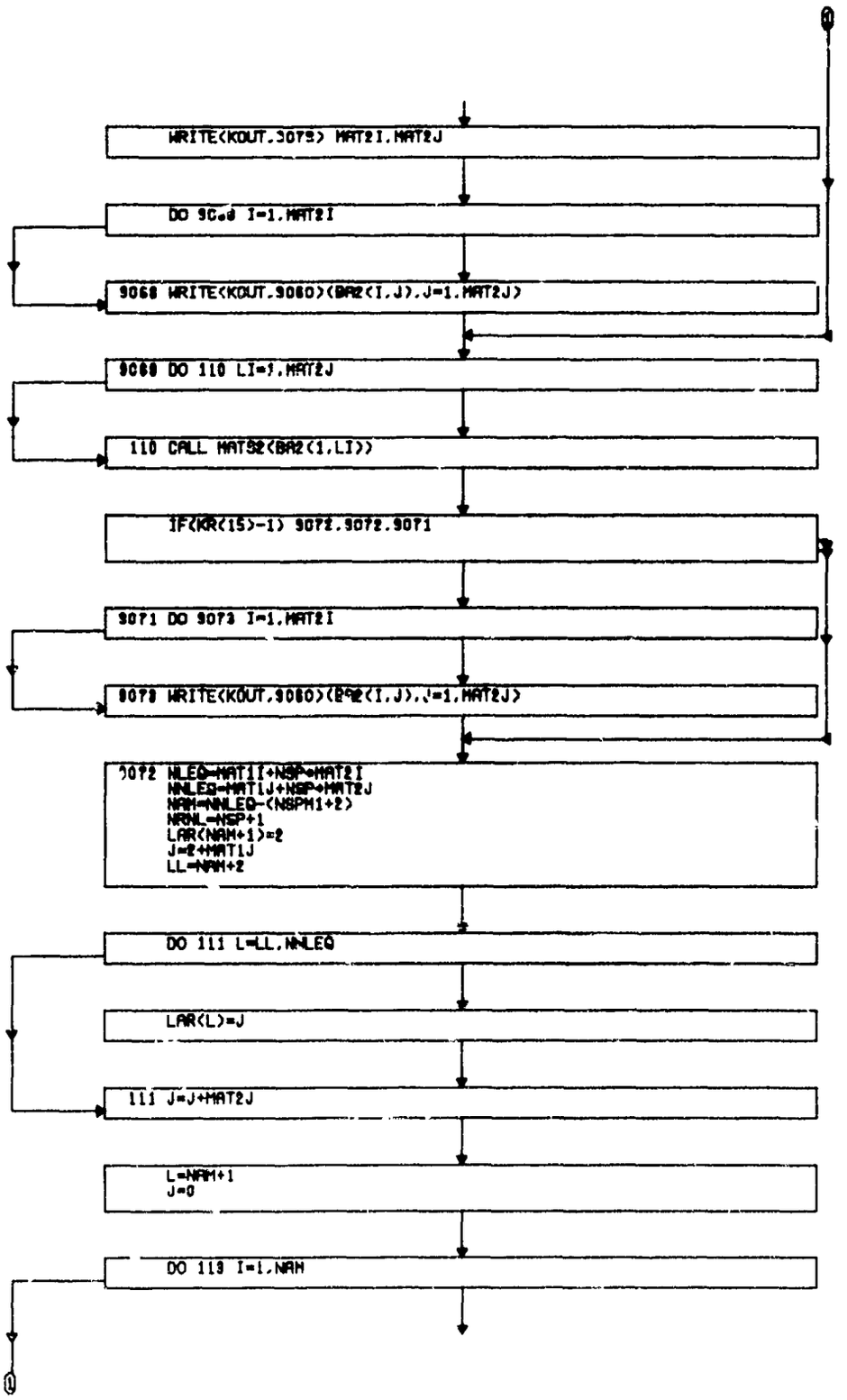
```
      G=27A                                                              B27A 001
            $ PROGRAM LISTING                                            B27A 002
            COMMON/ETA/COMMON/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)   B27A   3*NE*
           1,RA2(1936),RA1(43,18),RA2(30,15)                             B27A   4*NE*
            COMMON/I TCOM/ KR(20),KIT,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,B27A   5*NE*
           1S,IF,NITER,NSP,NSPM1,IAP,NLEG,NNLEG,NNNL, ITS,KAPPA,CBAR,CASE(15) B27A   6*NE*
           2,R( ),      ME.TCN,K(10),ITEM,' ITEM,KR17,NBT,NBT2,IDENT,KR9(40) B27A   7*NE*
           3,KA,X),.TIME,JSPEC,MD(3)                                     B27A   8*NE*
            DO 104 I=2,NETA                                              B27A 008**-6
            DETA(I-1)=ETA(I)-ETA(I-1)                                    B27A 009
            DSQ(I-1)=.5*ETA(I-1)**2*ETA(I-1)                             B27A 010
            B1(I-1)=.5*DSQ(I-1)                                          B27A 011
            B2(I-1)=2.*B1(I-1)                                           B27A 012
        104 DCU(I-1)=.5*ETA(I-1)*DSQ(I-1)                                B27A 013
            MAT1I=3*NETA-2                                               B27A 014
            MAT2I=2 * NETA
            MAT1J= NETA*3
            MAT2J= NETA
            DO 105 I=1,MAT2I
            DO 105 J=1,MAT2J
        105 RA2(I,J)=0.
            DO 105 I=1,MAT1I                                             B27A 017
            DO 105 J=1,MAT1J                                             B27A 018
        105 RA1(I,J)=0.                                                  B27A 019
            RA1(1,2)=1.                                                  B27A 020
            RA1(1,3)= DSQ(1)/2.
            RA1(NETA,3) = DETA(1)
            RA1(MAT2I-1,3)=1.
            RA2(2,1)=DETA(1)
            RA2(NETA+1,1)=1.
            J=NETA
            DO 106 I=2,NETA                                              B27A 022
            RA1(I-1,I+2)=DETA(I-1)
            RA1(J,I+2)=1.
            RA1(J,I+3)=-1.
            RA2(I,I)=1.
            IF(I-NETA) 103,104 106
        103 RA2(I,I+1)=-1.
        106 J=J+1
       9060 FORMAT(2X1P12E10.3)                                          B27A 031
       9064 FORMAT(2X37HLINEAR MATRIX FOR MOMENTUM EQUATIONS,I3,2H X I3, B27A 032
           12H, BEFORE AND AFTER SOLUTION)                               B27A 033
       9079 FORMAT(2X44HLINEAR MATRIX FOR MASS AND ENERGY EQUATIONS,I3,2H X I3,B27A 034
           12H, 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)(RA1(I,J),J=1,MAT1J)                         B27A 039
       9062 DO 107 LI=2,MAT1J
        107 CALL MATS1(RA1(1,LI))
            IF(KR(15)-1) 9069,9068,9066                                  B27A 055
       9066 DO 9067 I=1,MAT1I                                            B27A 056
       9067 WRITE(KOUT,9060)(RA1(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)(RA2(I,J),J=1,MAT2J)                         B27A 060
       9069 DO 110 LI=1,MAT2J
        110 CALL MATS2(RA2(1,LI))
```

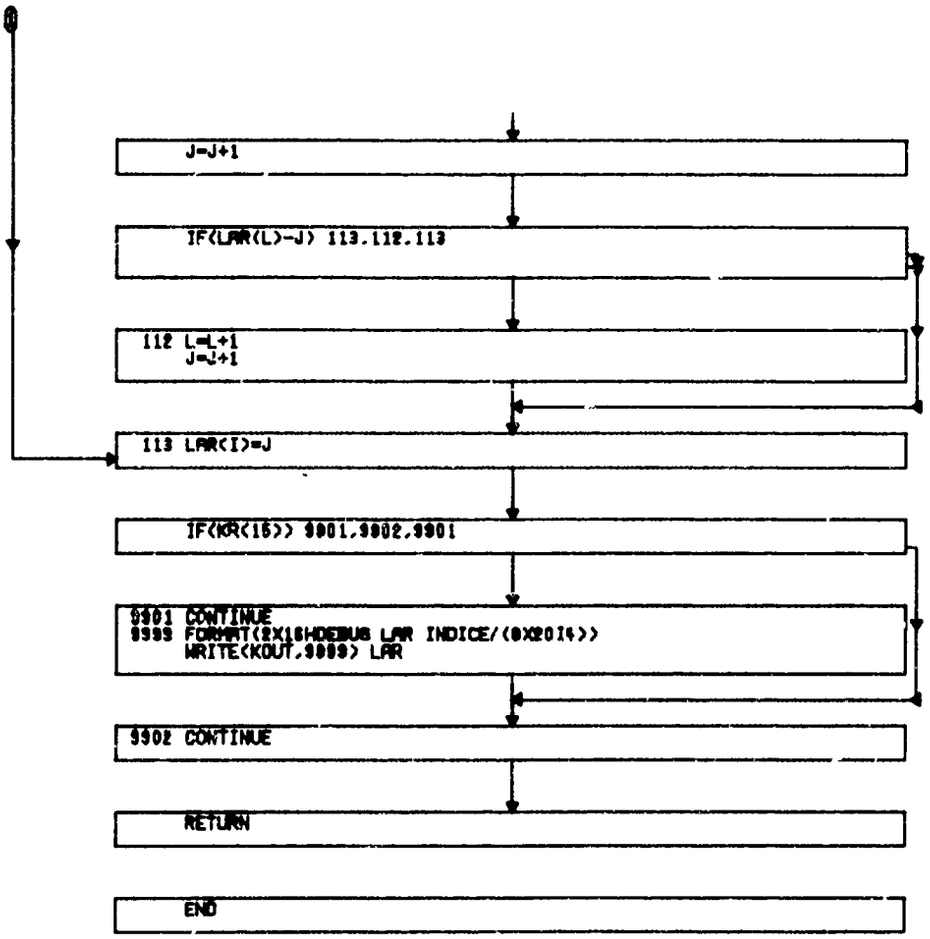
```
000059                IF(KR(15)-1) 9072,9072,9071                          8274 063
000060          9071  DO 9073 I=1,MAT2I                                    8274 064
000061          9073  WRITE(KOUT,9060)(BI2(I,J),J=1,MAT2J)                 8274 065
000062          9072  NLEQ=MAT1I+NSP*MAT2I                                 8274 066
000063                NNLEQ=MAT1J+NSP*MAT2J                                8274 067
000064                NAM=NNLEQ-(NSP*1+2)                                  8274 068
000065                NNL=NSP+1                                            8274 069
000066                LAR(NAM+1)=2
000067                J=2+MAT1J
000068                LL=NAM+2
000069                DO 111 L=LL,NNLEQ
000070                LAR(L)=J
000071           111  J=J+MAT2J
000072                L=NAM+1
000073                J=0
000074                DO 113 I=1,NAM
000075                J=J+1
000076                IF(LAR(L)-J) 113,112,113
000077           112  L=L+1
000078                J=J+1
000079           113  LAR(I)=J
000080                IF(KR(15)) 9901,9902,9901                            8274 085
000081          9901  CONTINUE                                             8274 086
000082          9999  FORMAT(2X16HDEBUG LAR INDICE/(8X2014))               8274 087
000083                WRITE(KOUT,9999) LAR                                 8274 088
000084          9902  CONTINUE                                             8274 089
000085                RETURN                                               8274 090
000086                END                                                  8274 091
```

c. Flow Chart


SUBROUTINE LINMAT
DO 104 I=2,NETA
DETA(I-1)=ETA(I)-ETA(I-1)
DSQ(I-1)=DETA(I-1)*DETA(I-1)
B1(I-1)=B(3)*DSQ(I-1)
B2(I-1)=2.*B1(I-1)
104 DCU(I-1)=DETA(I-1)*DSQ(I-1)
MAT1I=3*NETA-2
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
DO 105 J=1,MAT1J
105 BA1(I,J)=0.
BA1(1,2)=1.
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


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(2X1P12E10.2)
9064 FORMAT(2X37HLINEAR MATRIX FOR MOMENTUM EQUATIONS,I9,2H XI9,
12TH, BEFORE AND AFTER SOLUTION)
9079 FORMAT(2X34HLINEAR MATRIX FOR MASS AND ENERGY EQUATIONS,I9,2H XI9,
12TH, BEFORE AND AFTER SOLUTION)
IF(KR(15)-1) 9062,9062,9061
9061 WRITE(KOUT,9064) MAT1I,MAT1J
DO 9063 I=1,MAT1I
9063 WRITE(KOUT,9060)(BA1(I,J),J=1,MAT1J)
9062 DO 107 LI=2,MAT1J
107 CALL MATSI(BA1(1,LI))
IF(KR(15)-1) 9069,9069,9066
9066 DO 9067 I=1,MAT1I
9067 WRITE(KOUT,9060)(BA1(I,J),J=1,MAT1J)


WRITE(KOUT,3075) MAT2I,MAT2J
DO 9068 I=1,MAT2I
9068 WRITE(KOUT,9080)(BA2(I,J),J=1,MAT2J)
9060 DO 110 LI=1,MAT2J
110 CALL MAT52(BA2(1,LI))
IF(KR(15)-1) 9072,9072,9071
9071 DO 9073 I=1,MAT2I
9073 WRITE(KOUT,9080)(BA2(I,J),J=1,MAT2J)
9072 NLEQ=MAT1I+NSP+MAT2I
NNLEQ=MAT1J+NSP+MAT2J
NAM=NNLEQ-(NSPM1+2)
NANL=NSP+1
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
9901 CONTINUE
9999 FORMAT(2X16HDEBUG LAR INDICE/(8X20I4))
WRITE(KOUT,9999) LAR
9902 CONTINUE
RETURN
END

29. SUBROUTINE KINET - B28A

a. Function

Determines rates for kinetically-controlled reactions, ascertains the controlling reactions on the basis of which it forms transformation matrix, prepares the reduced correction coefficients for the kinetic terms, and combines them with the previously determined coefficients. Called by MATER.

b. Listing

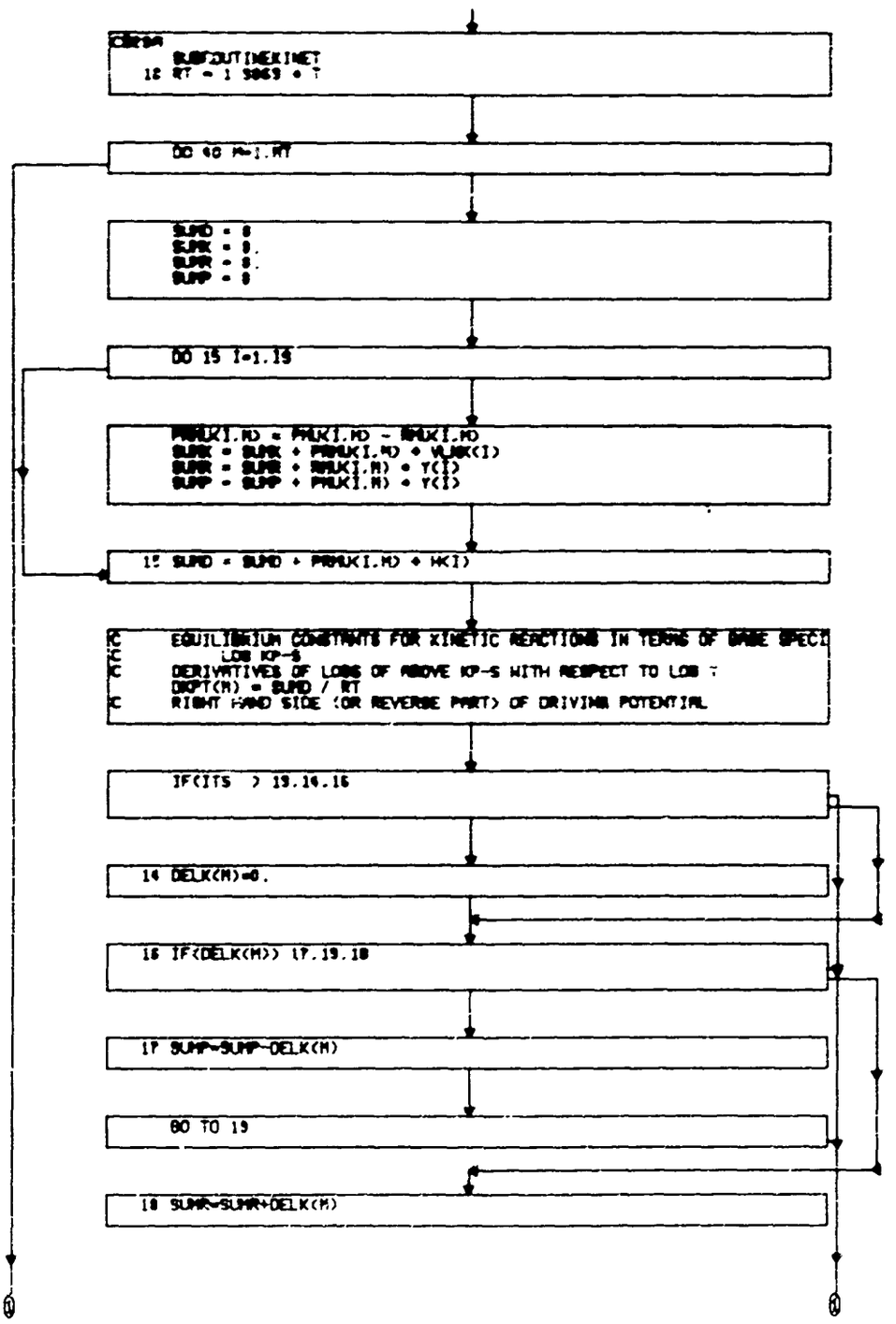
```
000001          C828A
000002                SUBROUTINE KINET                                                KINE0010
000003                COMMON /MISCOM/ C1,C2,C3
000004                COMMON /BUMCOM/ BUMP,CORMA,EASE
000005                COMMON/INTCOM/KKR(20),KIN,KOUT
000006                DIMENSION ELKM(10),DELK(10)                                     828A 004*NEW
000007                COMMON /EQPCOM/ RB( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),828A   5*NEW
000008               1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10), 828A   6*NEW
000009               2 KAT(10),IR(10),IS,KR(10),LAMI( 71),P,T,TK(10, 7),VN( 71),      828A   7*NEW
000010               3 VNU( 71,10),ITFF,KR2,HCH,NCV,WM,WTM( 71),Y( 71),YW( 71),GG( 71) 828A   8*NEW
000011               4 ,TQ(10, 7),EPOVRK,SIGMA,BASMOL                                828A   9*NEW
000012                COMMON /EQTCOM/3IP,HIP,EL,ENL,FLIQ,CPF,IRE,IER,AA,ITS,IN,IL,IT, 828A  10*NEW
000013               1 MODE,MMELT,SMELT,TMAX,TMIN,MELT,SUMN,SUML,WS,WSS,B1,ISP2,ISPQ, 828A  11*NEW
000014               2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,HG, 828A  12*NEW
000015               3 CPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),B(16),     828A  13*NEW
000016               4 IP( 71),ALP(10),FNU(10),GAMM(10),GAMF(10),BLAM(10),DY( 71),RVS, 828A  14*NEW
000017               5 CP( 71),H( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUB(10),      828A  15*NEW
000018               6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JJ( 4)                   828A  16*NEW
000019                COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),  828A  17*NEW
000020               1 DKPT(10),PKP(10),PKR(10),RAT(10),RBIG(10),MA(10),LL(10),PMR(10), 828A  18*NEW
000021               2 PRMU(10,10),EESE(10)                                           828A  19*NEW
000022               5 FORMAT(1313)                                                   KINE0320*--16
000023              10 RT = 1.9869 * T                                                KINE0330
000024                 DO 40 M=1,MT                                                   KINE0340
000025                 SUMD = 0.                                                      KINE0350
000026                 SUMK = 0.                                                      KINE0360
000027                 SUMR = 0.                                                      KINE0370
000028                 SUMP = 0.                                                      KINE0380
000029                 DO 15 I=1,IS                                                   KINE0390
000030                 PRMU(I,M) = PMU(I,M) * RMU(I,M)                                KINE0400
000031                 SUMK = SUMK + PRMU(I,M) * VLNK(I)                              KINE0410
000032                 SUMR = SUMR + RMU(I,M) * Y(I)                                  KINE0420
000033                 SUMP = SUMP + PMU(I,M) * Y(I)                                  KINE0430
000034              15 SUMD = SUMD + PRMU(I,M) * H(I)                                 KINE0440
000035          C      EQUILIBRIUM CONSTANTS FOR KINETIC REACTIONS IN TERMS OF BASE SPECIKINE0450
000036          C           LOG KP-S                                                  KINE0460
000037          C      DERIVATIVES OF LOGS OF ABOVE KP-S WITH RESPECT TO LOG T        KINE0480
000038                 DKPT(M) = SUMD / RT                                            KINE0490
000039          C      RIGHT HAND SIDE (OR REVERSE PART) OF DRIVING POTENTIAL         KINE0500
000040                 IF(ITS  ) 19,14,16
000041              14 DELK(M)=0.
000042              16 IF(DELK(M)) 17,19,18
000043              17 SUMP=SUMP-DELK(M)
000044                 GO TO 19
000045              18 SUMR=SUMR+DELK(M)
000046              19 ELKM(M)=SUMP-SUMK-SUMR
000047                 PKP(M) = EXP(SUMP - SUMK)                                      KINE0510
000048          C      LEFT HAND SIDE (OR FORWARD PART) OF DRIVING POTENTIAL          KINE0520
000049                 PKR(M) = EXP(SUMR)                                             KINE0530
000050                 VK1 = PKR(M) - PKP(M)                                          KINE0540
000051                 IF (VK1) 25,20,25                                              KINE0550
000052              20 VK1 = 1.E - 9 * PKR(M)                                         KINE0560
000053              25 CONTINUE
000054                 VK2 = AA * FKF(M, * (ABS(VK1)) ** (EXK(M) - 1.) * EXP( - EAK(M) /KINE0580
000055                1 RT)*(-C3)
000056                 VK3 = VK2                                                      KINE0600
000057                 IF (EXK(M) - 1.) 35,30,30                                      KINE0610
000058              30 VK3 = VK2 * EXK(M)                                             KINE0620
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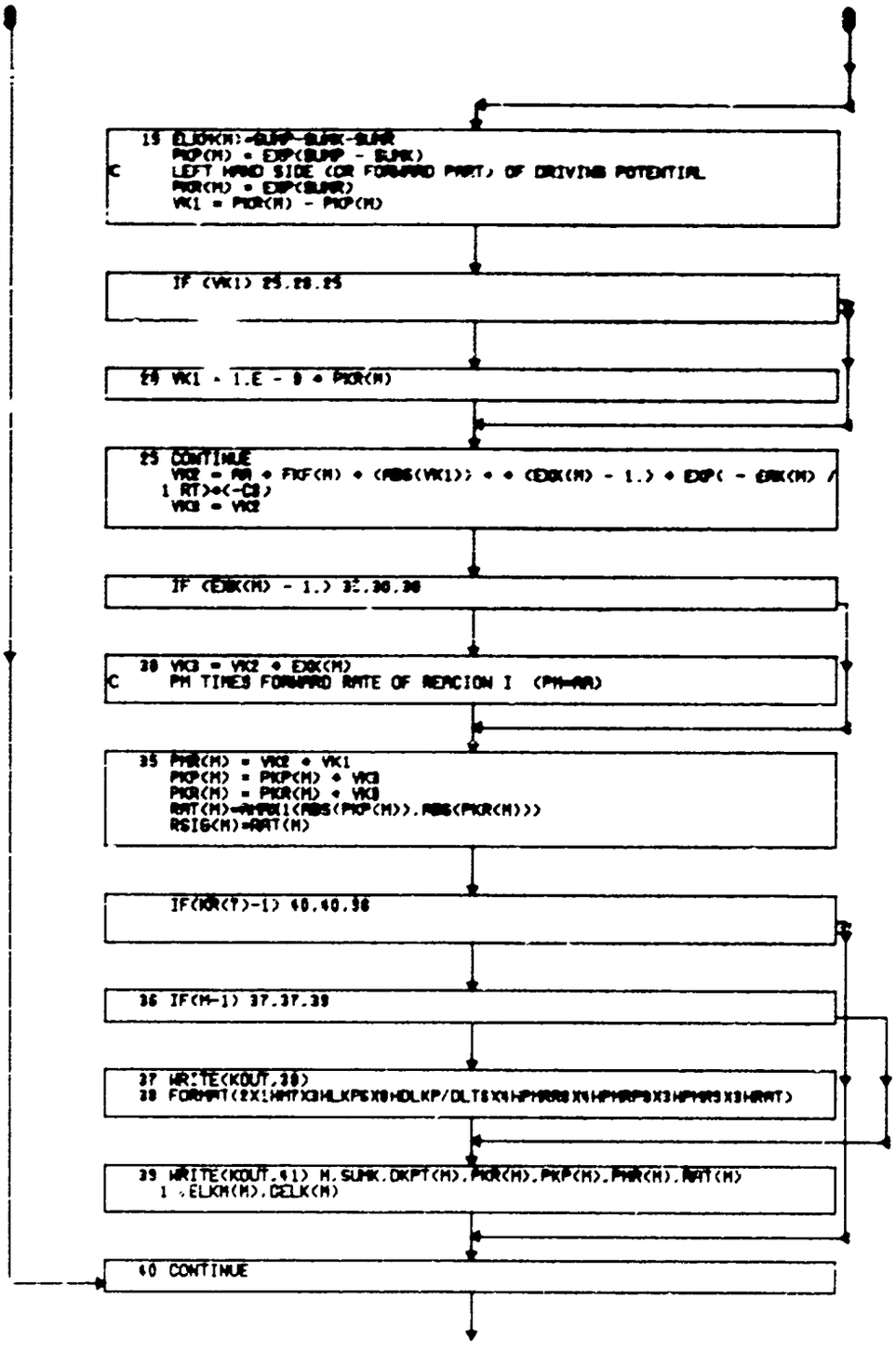
```
000059          C     PR TIMES FORWARD RATE OF REACION .  (PM=AA)                    KINE0630
000060             35 PMR(M) = VK2 * VK1                                             KINE0640
000061                PKP(M) = PKP(M) * VK3                                          KINE0650
000062                PKR(M) = PKR(M) * VK3                                          KINE0660
000063                RAT(M)=AMAX1(ABS(PKP(M)),ABS(PKR(M)))
000064                RSIG(M)=RAT(M)
000065                IF(KR(7)-1) 40,40,36
000066             36 IF(M-1) 37,37,39
000067             37 WRITE(KOUT,38)
000068             38 FORMAT(2X1HM7X3HLKP6XAHDLKP/DLT6X4HPMRR8X4HPMRP9X3HPMR9X3HRAT)
000069             39 WRITE(KOUT,41) M,SUMK,DKPT(M),PKR(M),PKP(M),PMR(M),RAT(M)
000070               1 ,ELKM(M),DELK(M)
000071             40 CONTINUE
000072             41 FORMAT(I3,2X8E12.5)
000073             45 FORMAT(1X28HA(I,J),B(I),I=1,8,J=1,8 IN)                        KINE0690
000074             50 FORMAT(1X12E10.3)                                              KINE0700
000075             55 FORMAT(1X27HA(I,J),B(I),I=1,8,J=1,8 OUT)                       KINE0710
000076                IF (KR(7) - 1) 80,80,65                                        KINE0730
000077             65 CONTINUE
000078                WRITE(KOUT,50)PRMU                                             KINE0810
000079                WRITE(KOUT,215)                                                KINE0820
000080                WRITE(KOUT,50)(EB(I),I=1,IS)                                   KINE0830
000081                WRITE(KOUT,50)(E(I),I=1,IS)
000082             70 WRITE(KOUT,45)                                                 KINE0840
000083                DO 75 I=1,ISP2                                                 KINE0850
000084             75 WRITE(KOUT,50)(A(I,J),J=1,ISPG),B(I)
000085             80 CONTINUE                                                       KINE0870
000086                IF(ITS) 105,85,105
000087          C*****ORDER REACTIONS                                                KINE0880
000088             85 DO 86 M=1,MT
000089             86 MA(M)=M
000090                IF(MT-1) 105,105,90
000091             90 K = 0                                                          KINE0900
000092                DO 100 M=2,MT                                                  KINE0910
000093                IF(RSIG(M)-RSIG(M-1)) 100,100,95
000094             95 K = MA(M)                                                      KINE0930
000095                MA(M) = MA(M - 1)                                              KINE0940
000096                MA(M - 1) = K                                                  KINE0950
000097                DUM1=RSIG(M)
000098                RSIG(M)=RSIG(M-1)
000099                RSIG(M-1)=DUM1
000100            100 CONTINUE                                                       KINE0990
000101                IF (K) 105,105,85                                              KINE1000
000102          C*****START SECOND MAJOR LOOP ON REACTIONS                           KINE1010
000103            105 DO 200 MM=1,MT
000104                RSIG(MM)=0.
000105                M = MA(MM)                                                     KINE1030
000106          C*****IS IT A CONTROLLING REACTION                                   KINE1040
000107                IF(ITS) 106,108,106
000108            106 L=LL(MM)
000109                IF(L) 126,126,107
000110            107 DUM=ABS(PRMU(L,M)*RAT(M))
000111                GO TO 130
000112            108 LL(MM)=0
000113                DO 125 L=1,IS                                                  KINE1060
000114                IF (PRMU(L,M)) 110,125,110                                     KINE1070
000115            110 DO 115 K=1,MM                                                  KINE1080
000116                IF (L - LL(K)) 115,125,115                                     KINE1090
000117            115 CONTINUE                                                       KINE1100
000118                DUM=ABS(PRMU(L,M)*RAT(M))
```

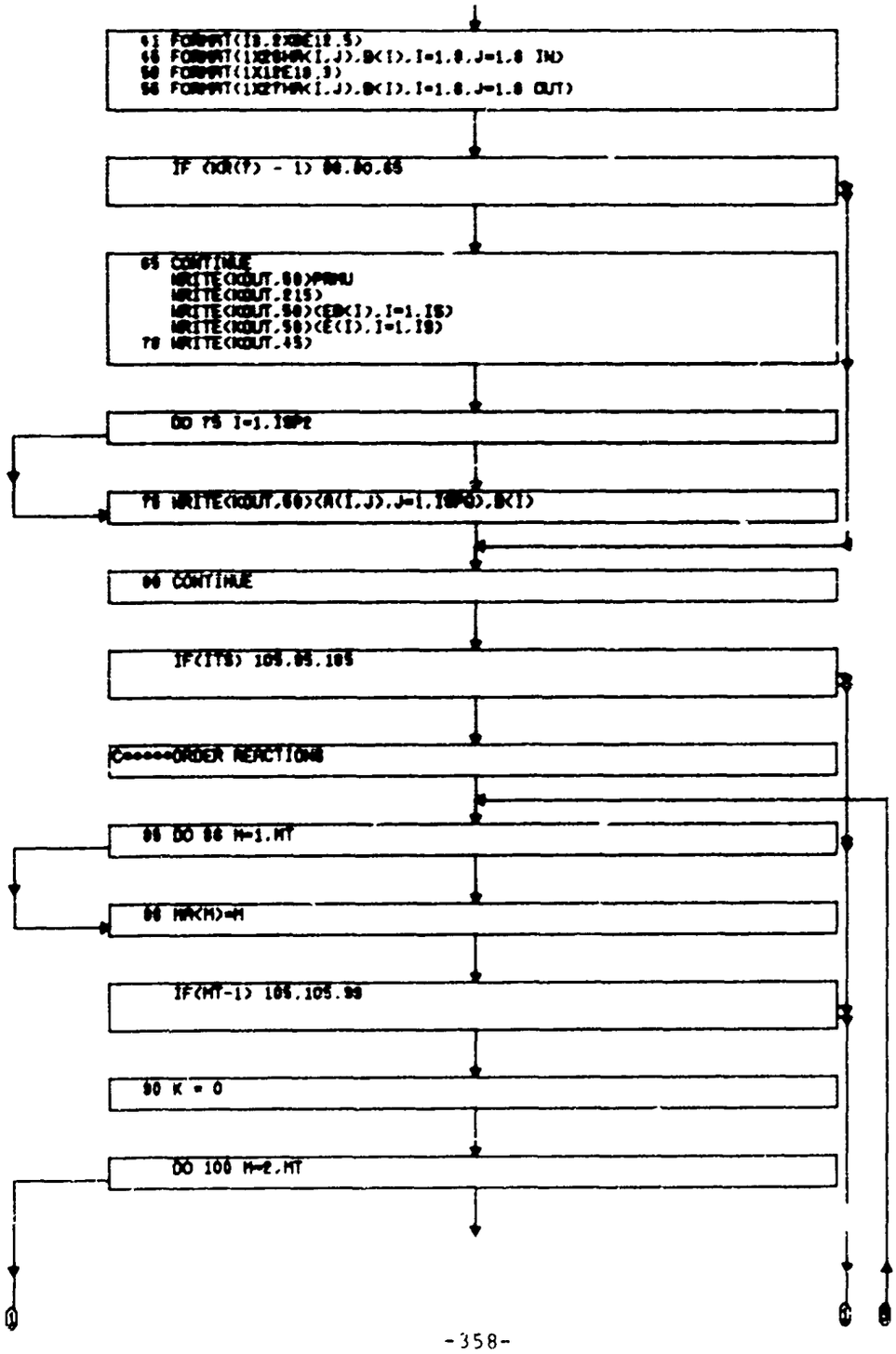
```
000119            IF(ABS(PRMU(L,M))-.001) 125,125,120
000120          C* * * YES,IT IS FOR MASS BALANCE L                          KINE1120
000121            120 LL(MM) = L                                             KINE1130
000122                GOTO 130                                               KINE1140
000123            125 CONTINUE                                               KINE1150
000124          C* * *NO, IT IS NOT, ADD INTO ALL MASS BALANCES               KINE1160
000125            126 I1=1
000126                I2 = IS                                                KINE1180
000127                GOTO 170                                               KINE1190
000128          C*****REARRANGE ACCORDING TO CONTROLLING REACTION             KINE1200
000129            130 RSIG(MM)=DUM/EB(L)*0.1
000130                DUM1=PRMU(L,M)
000131                PRMU(L,M) = 0.                                         KINE1220
000132                DO 155 I=1,IS                                          KINE1230
000133                IF (PRMU(I,M)) 135,165,135                             KINE1240
000134            135 DUM2 = PRMU(I,M) / DUM1                                KINE1250
000135                IP(1)=1
000136                MP = MM + 1                                            KINE1260
000137                IF (MT - MP) 155,140,140                               KINE1270
000138            140 DO 150 K=MP,MT                                         KINE1280
000139                M1 = MA(K)                                             KINE1290
000140                PRMU(I,M1) = PRMU(I,M1) - DUM2 * PRMU(L,M1)            KINE1300
000141                IF (ABS(PRMU(I,M1)) - .001) 145,150,150                KINE1310
000142            145 PRMU(I,M1) = 0.                                        KINE1320
000143            150 CONTINUE                                               KINE1330
000144            155 DO 160 K=1,ISP2                                        KINE1340
000145            160 A(I + 2,K) = A(I + 2,K) - DUM2 * A(L + 2,K)            KINE1350
000146                B(I + 2) = B(I + 2) - DUM2 * B(L + 2)                  KINE1360
000147                E(I)=E(I)-DUM2*E(L)
000148                DUM2 = ABS(DUM2)                                       KINE1378
000149                EB(I) = AMAX1(EB(I) ,DUM2 * EB(L))                     KINE1380
000150            165 CONTINUE                                               KINE1390
000151                PRMU(L,M) = DUM1                                       KINE1400
000152          C*****ADD CONTROLLING REACTION INTO ITS MASS BALANCE          KINE1410
000153                I1 = L                                                 KINE1420
000154                I2 = L                                                 KINE1430
000155                EOL=E(L)+PMR(M)*PRMU(L,M)
000156                IF(ITS) 170,230,170
000157            230 DELK(M)=(1.-EABE)*ELKM(M)*AMINI(1.,ABS(EOL/EB(L)))
000158                ELKM(M)=ELKM(M)-DELK(M)
000159                IF(PKR(M)-PKP(M)) 240,170,235
000160            235 PKP(M)=PKP(M)*EXP(-DELK(M))
000161                GO TO 245
000162            240 PKR(M)=PKR(M)*EXP(DELK(M))
000163            245 PMR(M)=PKR(M)-PKP(M)
000164            170 DO 176 J=1,IS
000165                IF(IFC(J)) 171,171,176
000166            171 SUMD = RMU(J,M) * PKR(M) - PMU(J,M) * PKP(M)           KINE1450
000167                DO 175 I=I1,I2                                         KINE1460
000168            175 A(I + 2,J + 2) = A(I + 2,J + 2) - SUMD * PRMU(I,M)     KINE1470
000169            176 CONTINUE
000170                SUMD = - PXP(M) * DXPT(M) - EAK(M) / RT * PMR(M)       KINE1480
000171                DO 180 I=I1,I2                                         KINE1490
000172                DUM1 = PMR(M) * PRMU(I,M)                              KINE1500
000173                A(I+2,2)=A(I+2,2)-DUM1
000174                A(I + 2,1) = A(I + 2,1) + SUMD * PRMU(I,M)             KINE1510
000175                E(I)=E(I)+DUM1
000176                B(I + 2) = B(I + 2) + DUM1                             KINE1520
000177            180 EB(I) = AMAX1(EB(I) ,ABS(PRMU(I,M) * RAT(M)))
000178                EB(I) =AMAX1(EB(I),ABS(E(I)))
```

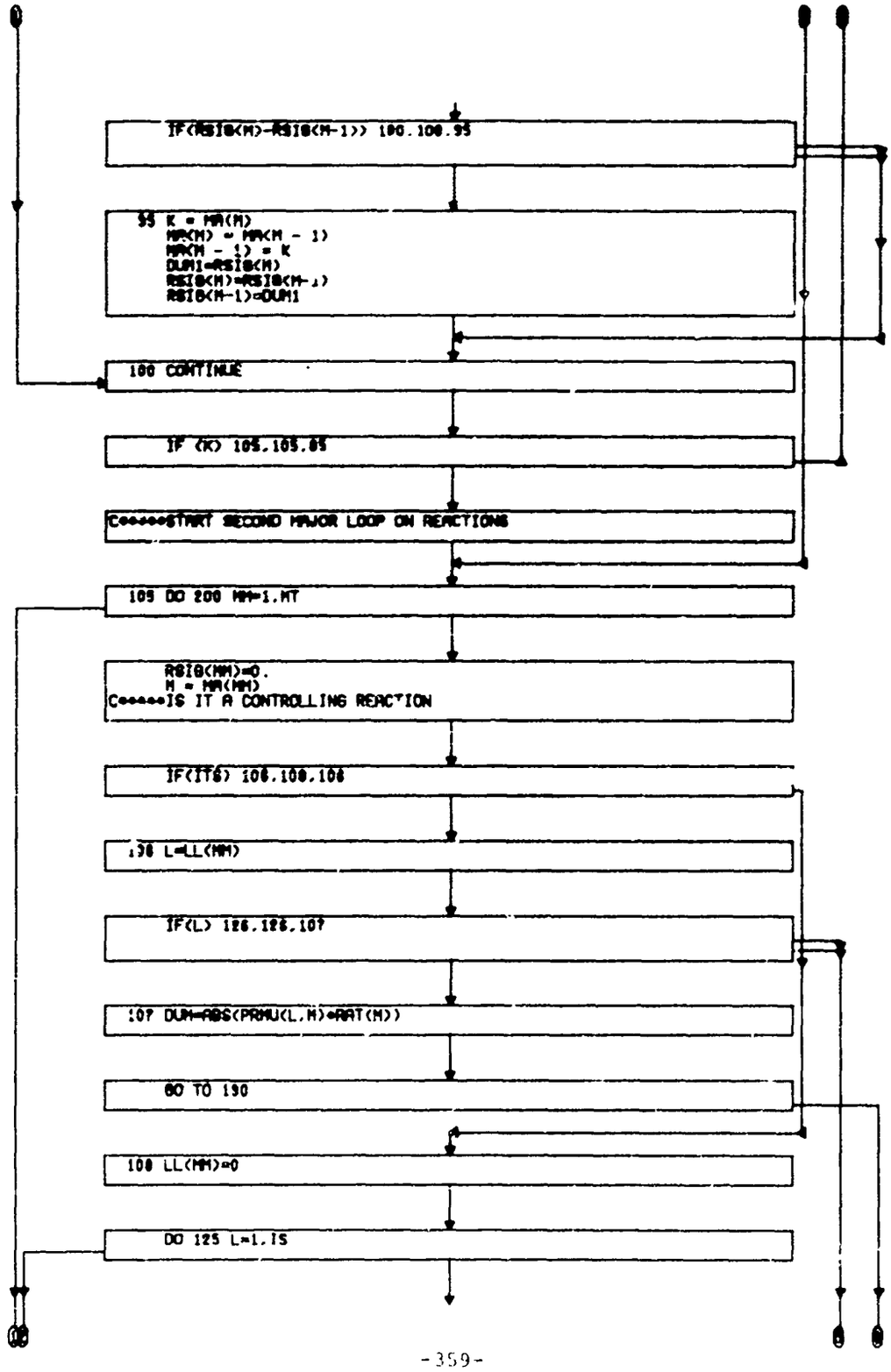
```
000179                IF (KR(7) - 1) 200,200,185                                        KINE1940
000180            185 WRITE(KOUT,215)                                                   KINE1950
000181                WRITE(KOUT,50)(EB(I),I=1,IS)                                      KINE1960
000182                WRITE(KOUT,50)(E(I),I=1,IS)
000183            190 WRITE (KOUT,55)                                                   KINE1970
000184                DO 195 I=1,ISP2                                                   KINE1980
000185                WRITE(KOUT,50)(A(I,J),J=1,ISP2),B(I)
000186            195 CONTINUE                                                          KINE1990
000187                WRITE(KOUT,51)M,(I,I=2,ISP2),MM,MA                                KINE2010
000188                WRITE(KOUT,52)PRES                                                KINE2020
000189            200 CONTINUE                                                          KINE2030
000190      C*****ITERATE ON PRESSURE TO ACHIEVE LINEARITY AS EQUIL IS APPROACHED
000191                DO 204 MM=1,MM
000192                IBAD(MM)
000193                IF(J) 201,204,201
000194            201 MA=MA+MM
000195                D MM=PRES(MM
000196                IF(MM) 240,240,250
000197            240 EESE(M)=E(M)=(1.-EASE)/(1.+DUM2)
000198            250 E(M)=E(M)-EESE(M)
000199                B(M+2)=B(M+2)-EESE(M)
000200                EB(M)=E(M)
000201                AR=1.
000202                EXEL=PRES(M)/PVP(M)
000203                IF(EXEL) 191,192,193
000204            191 EXEL=1.E-35
000205                IF(PVP(M)-PRES(M)) 192,193,193
000206            192 EXEL=1.E+35
000207            193 CONTINUE
000208                EMLOSS=(DUM2/DUM2+1.)
000209                DUM1=(1.+DUM2)/(1.+PRES(MM))
000210                EB(M)=EB(M)+ABS(DUM1)
000211                IF(ABS(EXEL-1.)-.1) 204,204,202
000212            202 DUM1=EXEL/(EL*M(M)*PRMU(M))
000213                ARG=(DUM1+EXP(M))/PRES(M)
000214                ARG=AMAX1(ARG,0.)
000215                ARG=AMIN1(1.,ARG)
000216            204 DO 205 J=1,IS
000217                IF(IFO(J)) 203,203,205
000218            203 A(L+2,J+2)=A(L+2,J+2)+ EOL*(PMU(J,M)*(1.-AR)+ARG*PMU(J,M))
000219            205 CONTINUE
000220                A(L+2,1)=A(L+2,1)+EOL*(DLOG(PVP(M))*(1.-AR)+ELM(M)/RT)
000221                A(L+2,2)=A(L+2,2)+EOL
000222            206 CONTINUE
000223            215 FORMAT(1X12HEB(I),I=1,I8)
000224                IF(KR(7)-1) 225,225,220
000225            220 WRITE(KOUT,55)
000226                DO 221 I=1,ISP2
000227            221 WRITE(KOUT,50)(A(I,J),J=1,ISP8) B(I
000228                WRITE(KOUT,50)(E(I),I=1,IS)
000229            225 RETURN                                                            KINE1710
000230                END                                                               KINE1720
```

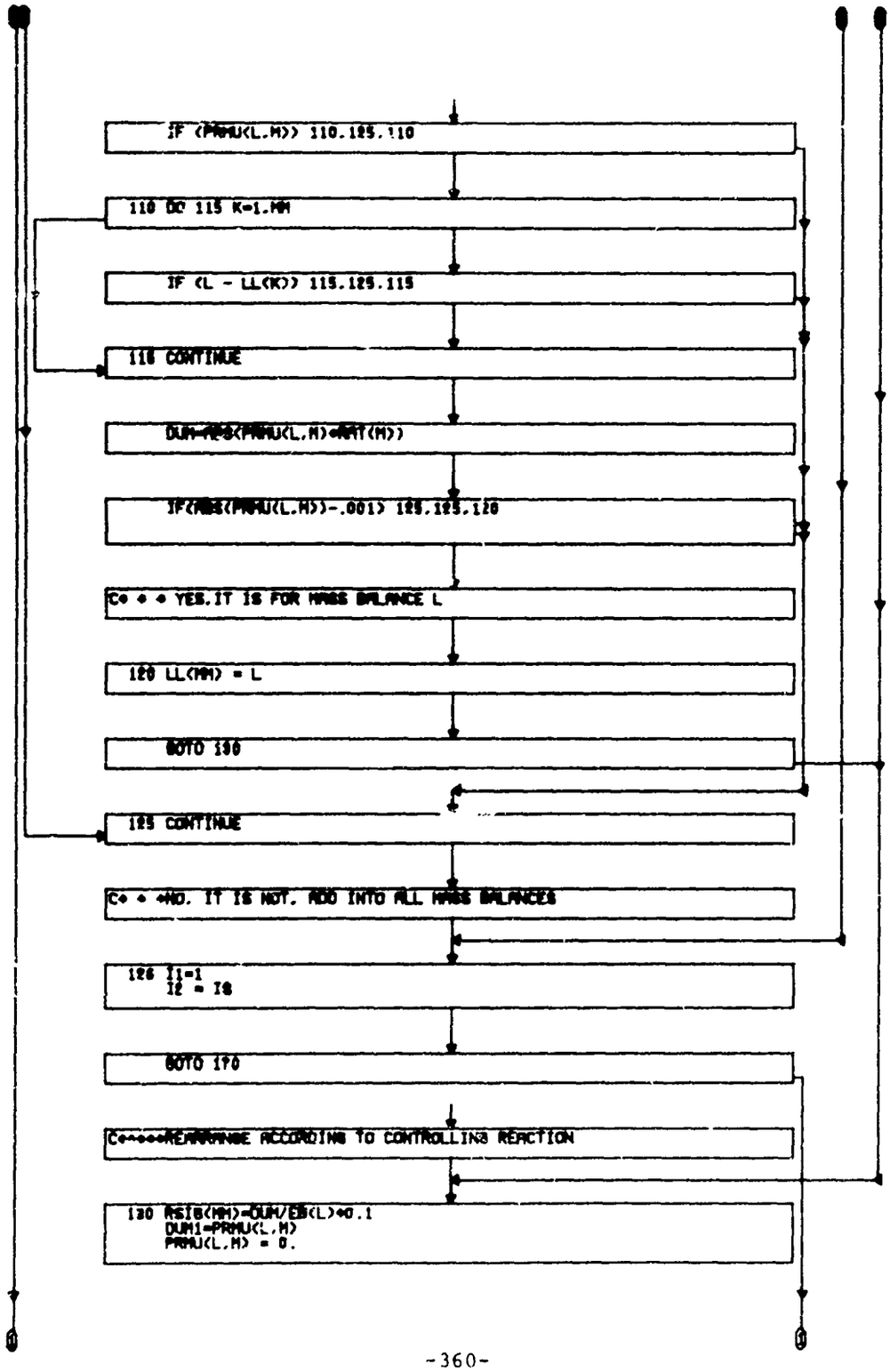
c. Flow Chart

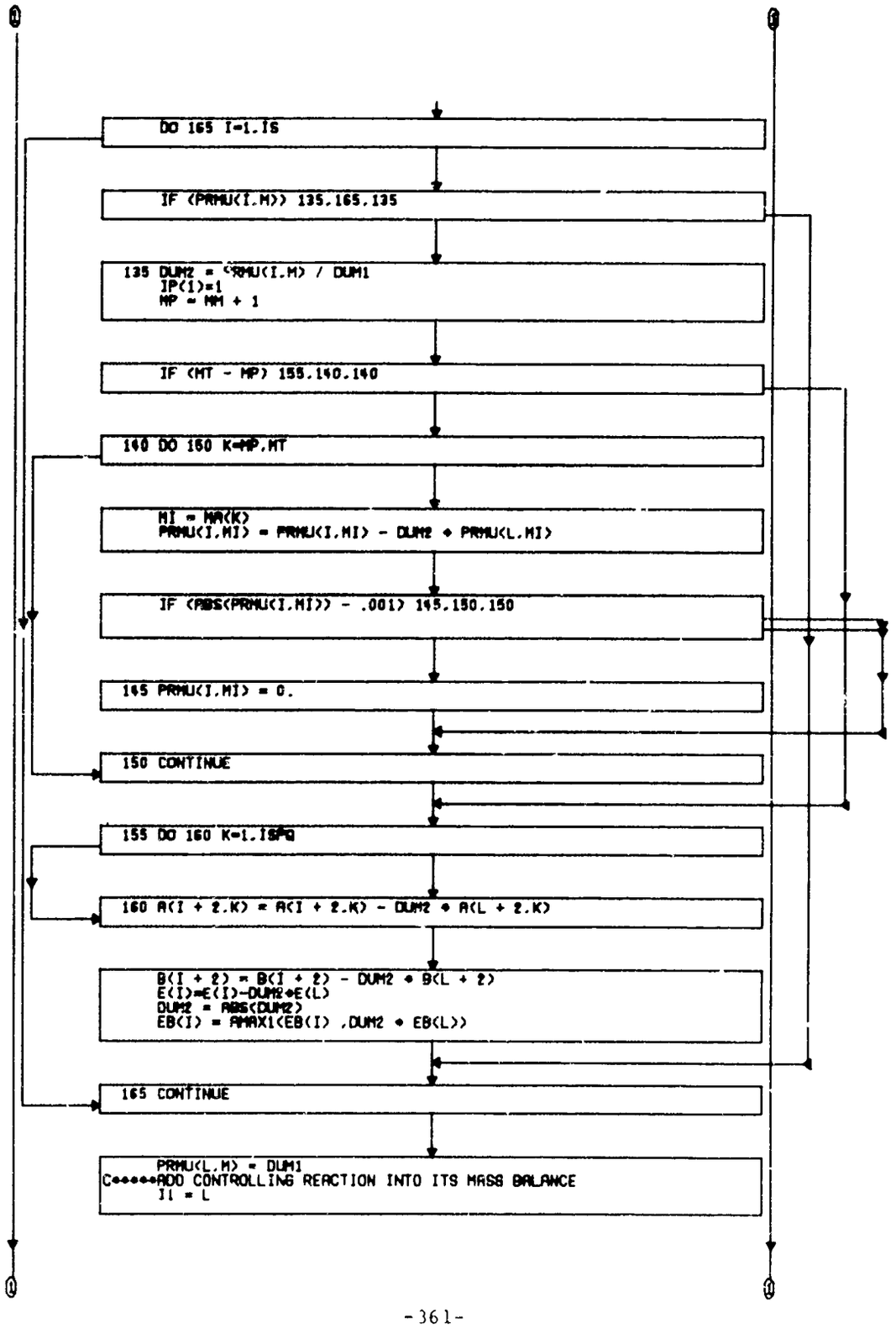

SUBROUTINE KINET
18 RT = 1.9869 * T
DO 40 M=1,MT
SUMD = 0.
SUMK = 0.
SUMR = 0.
SUMP = 0.
DO 15 I=1,IS
PMNUK(I,M) = PMUK(I,M) - RMUK(I,M)
SUMK = SUMK + PMNUK(I,M) * WUNK(I)
SUMR = SUMR + RMUK(I,M) * Y(I)
SUMP = SUMP + PMUK(I,M) * Y(I)
15 SUMD = SUMD + PMNUK(I,M) * WK(I)
C EQUILIBRIUM CONSTANTS FOR KINETIC REACTIONS IN TERMS OF BASE SPECI
C LOG KP-S
C DERIVATIVES OF LOGS OF ABOVE KP-S WITH RESPECT TO LOG T
DKPT(M) = SUMD / RT
C RIGHT HAND SIDE (OR REVERSE PART) OF DRIVING POTENTIAL
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)

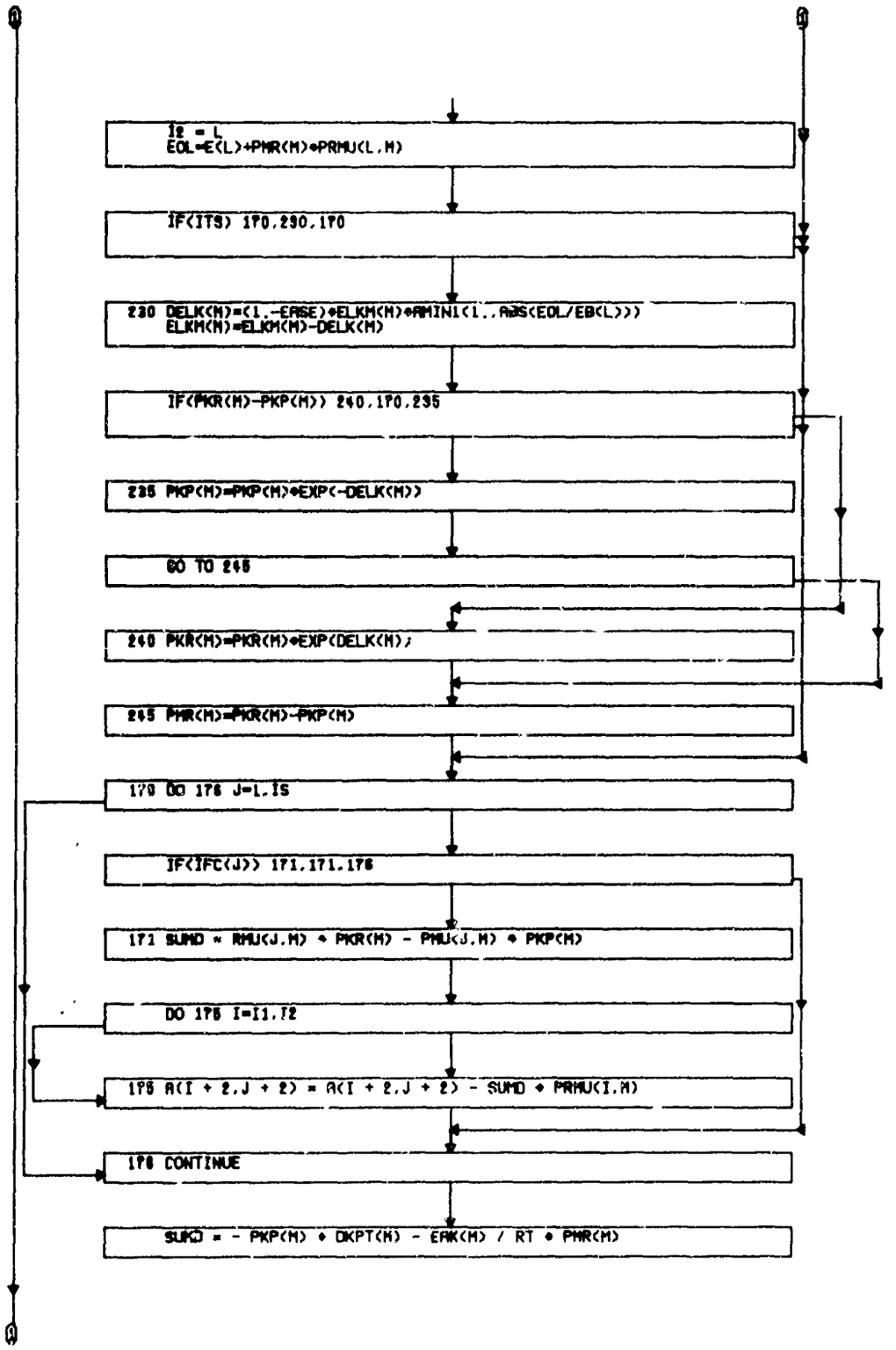

15 ELOK(M)=SUMP-SUMK-SUMR
PKP(M) = EXP(SUMP - SUMK)
C LEFT HAND SIDE (OR FORWARD PART) OF DRIVING POTENTIAL
PKR(M) = EXP(SUMR)
VK1 = PKR(M) - PKP(M)
IF (VK1) 25.20.25
20 VK1 = 1.E - 8 * PKR(M)
25 CONTINUE
VK2 = AA * FKF(M) * (ABS(VK1)) * * (EXK(M) - 1.) * EXP(- EXK(M) /
1 RT)*(-CB)
VK3 = VK2
IF (EXK(M) - 1.) 35.30.30
30 VK3 = VK2 * EXK(M)
C PH TIMES FORWARD RATE OF REACION I (PH=AA)
35 PKR(M) = VK2 * VK1
PKP(M) = PKP(M) * VK3
PKR(M) = PKR(M) * VK3
RAT(M)=AMAX1(ABS(PKP(M)),ABS(PKR(M)))
RSIG(M)=RAT(M)
IF(KR(Y)-1) 40.40.36
36 IF(M-1) 37.37.39
37 WRITE(KOUT,38)
38 FORMAT(2X1HM7X3HLKP5X3HDLKP/DLT8X4HPMRP3X3HPMRP2X3HPMR3X3HRAT)
39 WRITE(KOUT,41) M,SUMK,DKPT(M),PKR(M),PKP(M),PMR(M),RAT(M)
1 ,ELKM(M),CELK(M)
40 CONTINUE

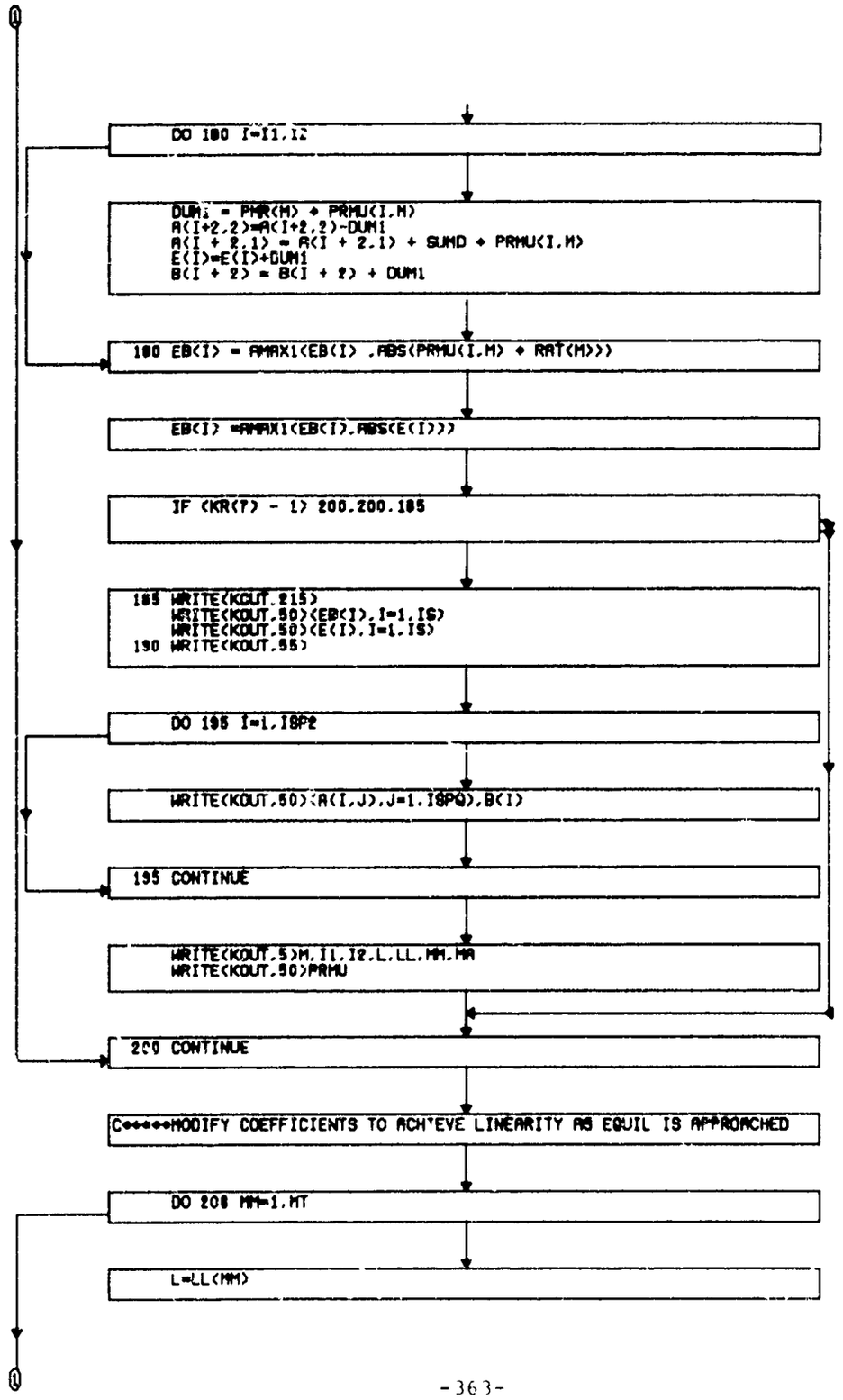

61 FORMAT(I8,8XE12.5)
66 FORMAT(1X20HRK(I,J),BK(I),I=1,8,J=1,8 IN)
69 FORMAT(1X1PE10.3)
96 FORMAT(1X20THRK(I,J),BK(I),I=1,8,J=1,8 OUT)
IF (NCR(Y) - 1) 86,80,65
65 CONTINUE
WRITE(KOUT,80)PHHU
WRITE(KOUT,215)
WRITE(KOUT,50)(EBK(I),I=1,IS)
WRITE(KOUT,50)(E(I),I=1,IS)
70 WRITE(KOUT,45)
DO 75 I=1,ISP2
75 WRITE(KOUT,60)(A(I,J),J=1,ISP2),BK(I)
66 CONTINUE
IF(ITS) 105,85,105
C*****ORDER REACTIONS
85 DO 86 M=1,MT
86 MK(M)=M
IF(MT-1) 105,105,90
90 K = 0
DO 100 M=2,MT

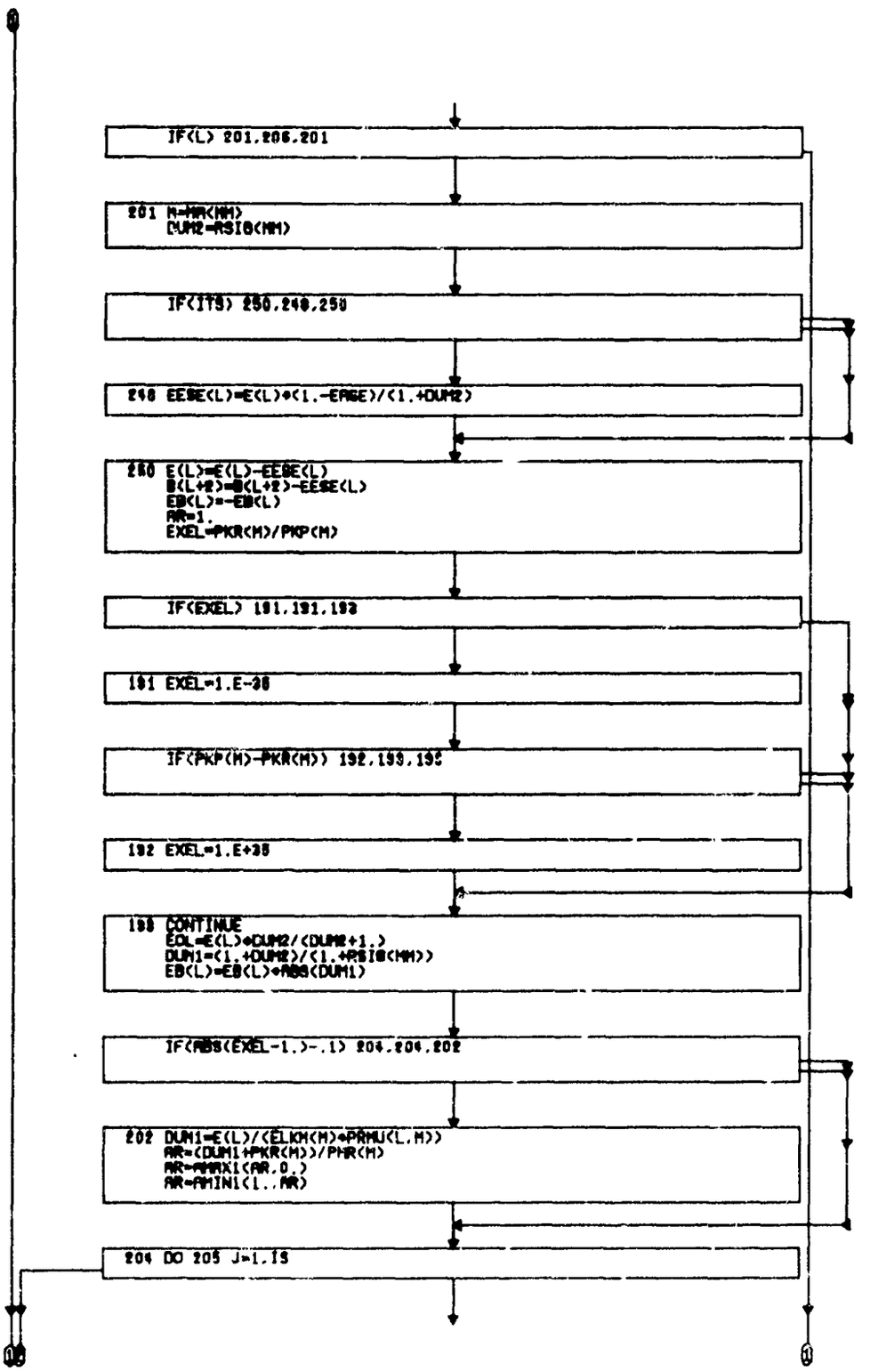

IF(RSIG(M)-RSIG(M-1)) 100,100,95
95 K = MM(M)
MM(M) = MM(M - 1)
MM(M - 1) = K
DUM1=RSIG(M)
RSIG(M)=RSIG(M-1)
RSIG(M-1)=DUM1
100 CONTINUE
IF (K) 105,105,85
C******START SECOND MAJOR LOOP ON REACTIONS
105 DO 200 MM=1,MT
RSIG(MM)=0.
M = MM(MM)
C******IS IT A CONTROLLING REACTION
IF(IT6) 106,106,106
106 L=LL(MM)
IF(L) 126,126,107
107 DUM=ABS(PRNU(L,M)*ART(M))
GO TO 190
108 LL(MM)=0
DO 125 L=1,IS

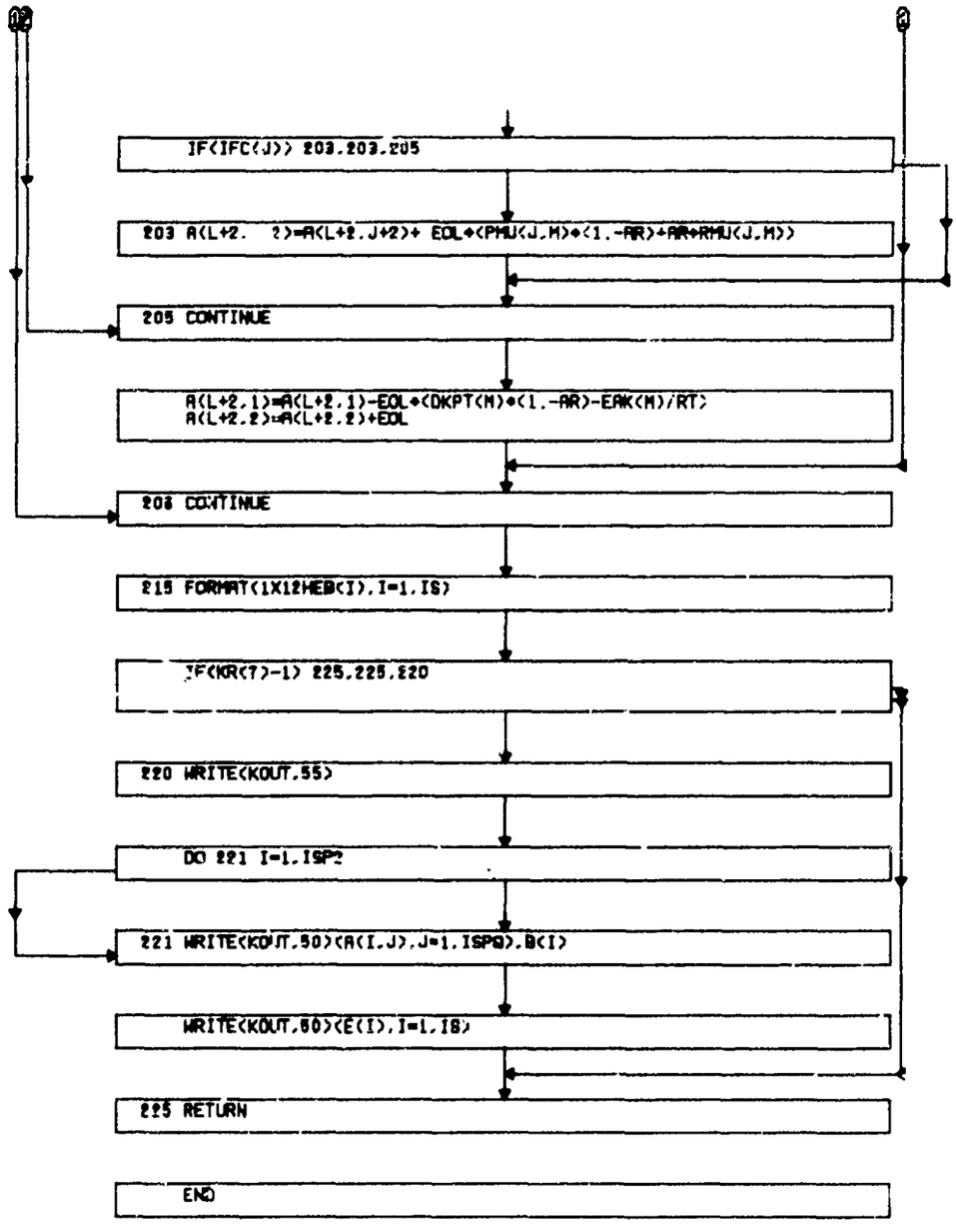

IF (PRMU(L,M)) 110,125,110
110 DO 115 K=1,MM
IF (L - LL(K)) 115,125,115
115 CONTINUE
DUM=ABS(PRMU(L,M)*ART(M))
IF(ABS(PRMU(L,M))-.001) 125,125,120
C* * * YES.IT IS FOR MASS BALANCE L
120 LL(MM) = L
GOTO 130
125 CONTINUE
C* * *NO. IT IS NOT. ADD INTO ALL MASS BALANCES
126 I1=1
I2 = I8
GOTO 170
C*****REARRANGE ACCORDING TO CONTROLLING REACTION
130 RSIB(MM)=DUM/EB(L)*0.1
DUM1=PRMU(L,M)
PRMU(L,M) = 0.


DO 165 I=1,IS
IF (PRMU(I,M)) 135,165,135
135 DUM2 = PRMU(I,M) / DUM1
IP(I)=1
MP = MM + 1
IF (MT - MP) 155,140,140
140 DO 160 K=MP,MT
MI = MA(K)
PRMU(I,MI) = PRMU(I,MI) - DUM2 * PRMU(L,MI)
IF (ABS(PRMU(I,MI)) - .001) 145,150,150
145 PRMU(I,MI) = 0.
150 CONTINUE
155 DO 160 K=1,ISPQ
160 A(I + 2,K) = A(I + 2,K) - DUM2 * A(L + 2,K)
B(I + 2) = B(I + 2) - DUM2 * B(L + 2)
E(I)=E(I)-DUM2*E(L)
DUM2 = ABS(DUM2)
EB(I) = AMAX1(EB(I) ,DUM2 * EB(L))
165 CONTINUE
PRMU(L,M) = DUM1
C*****ADD CONTROLLING REACTION INTO ITS MASS BALANCE
II = L


I2 = L
EOL=E(L)+PMR(M)*PRMU(L,M)
IF(ITS) 170,230,170
230 DELK(M)=(1.-ERSE)*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 175 J=1,IS
IF(IFC(J)) 171,171,175
171 SUMD = RMU(J,M) * PKR(M) - PMU(J,M) * PKP(M)
DO 175 I=I1,I2
175 A(I + 2,J + 2) = A(I + 2,J + 2) - SUMD * PRMU(I,M)
178 CONTINUE
SUMD = - PKP(M) * DKPT(M) - EAK(M) / RT * PMR(M)


DO 180 I=I1,I2
DUM1 = PHR(M) * PRMU(I,M)
A(I+2,2)=A(I+2,2)-DUM1
A(I + 2,1) = A(I + 2,1) + SUMD * PRMU(I,M)
E(I)=E(I)+DUM1
B(I + 2) = B(I + 2) + DUM1
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
185 WRITE(KOUT,215)
WRITE(KOUT,50)(EB(I),I=1,IS)
WRITE(KOUT,50)(E(I),I=1,IS)
190 WRITE(KOUT,55)
DO 195 I=1,ISP2
WRITE(KOUT,50)(A(I,J),J=1,ISPQ),B(I)
195 CONTINUE
WRITE(KOUT,5)M,I1,I2,L,LL,MM,MA
WRITE(KOUT,50)PRMU
200 CONTINUE
C*****MODIFY COEFFICIENTS TO ACHIEVE LINEARITY AS EQUIL IS APPROACHED
DO 208 MM=1,MT
L=LL(MM)


IF(L) 201,206,201
201 M=MM(MM)
DUM2=RSIB(MM)
IF(ITS) 250,240,250
240 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-38
IF(PKP(M)-PKR(M)) 192,193,193
192 EXEL=1.E+38
193 CONTINUE
EDL=E(L)*DUM2/(DUM2+1.)
DUM1=(1.+DUM2)/(1.+RSIB(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=1,15


02
IF(IFC(J)) 203,203,205
203 A(L+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)-EAK(M)/RT)
A(L+2,2)=A(L+2,2)+EOL
208 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
END

30. SUBROUTINE FIRSTG - B29A

a. Function

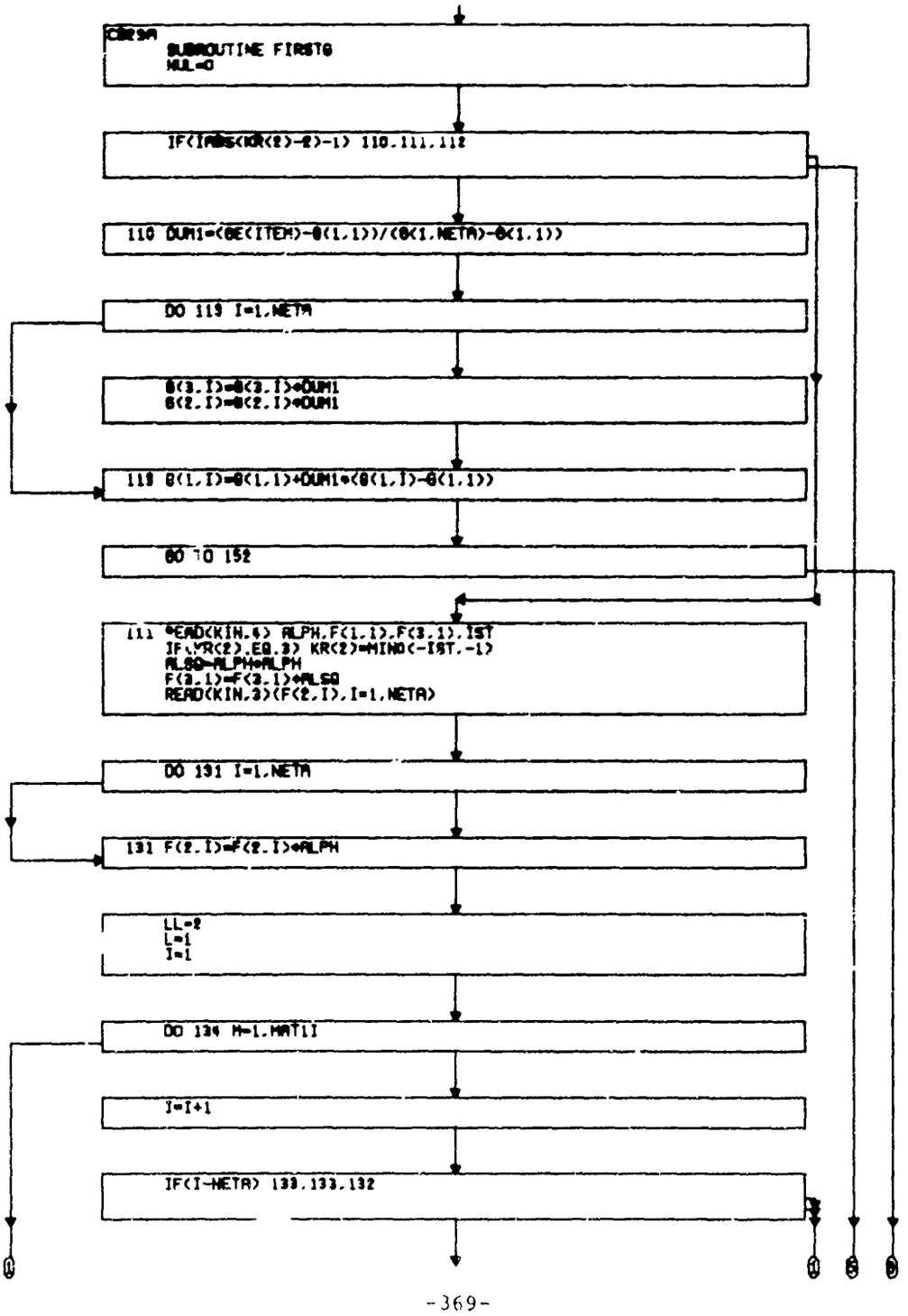
Computes or reads in first guesses for primary variables or instructs program to use values from previous case. Called by SETUP.

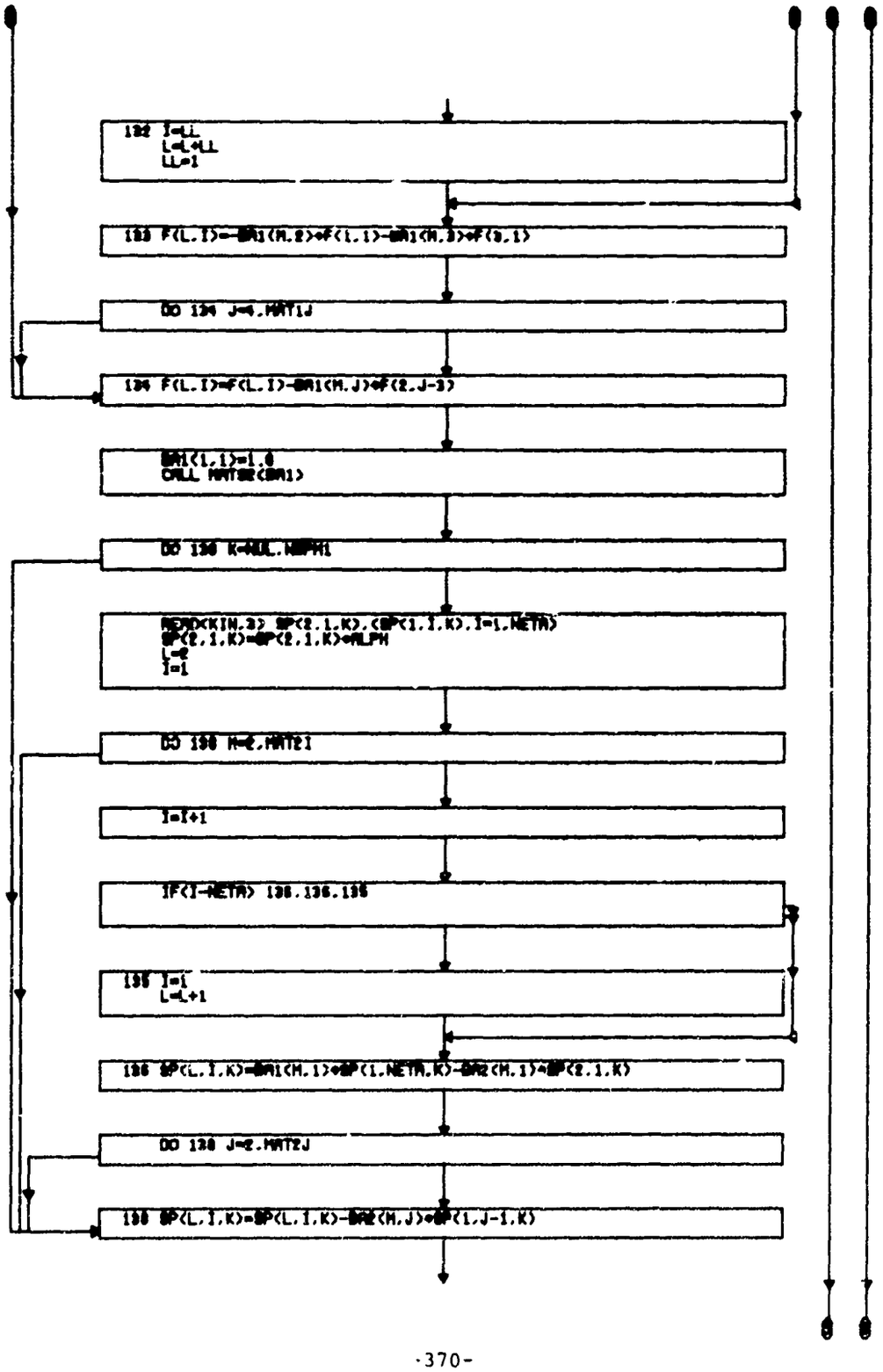
E. Listing

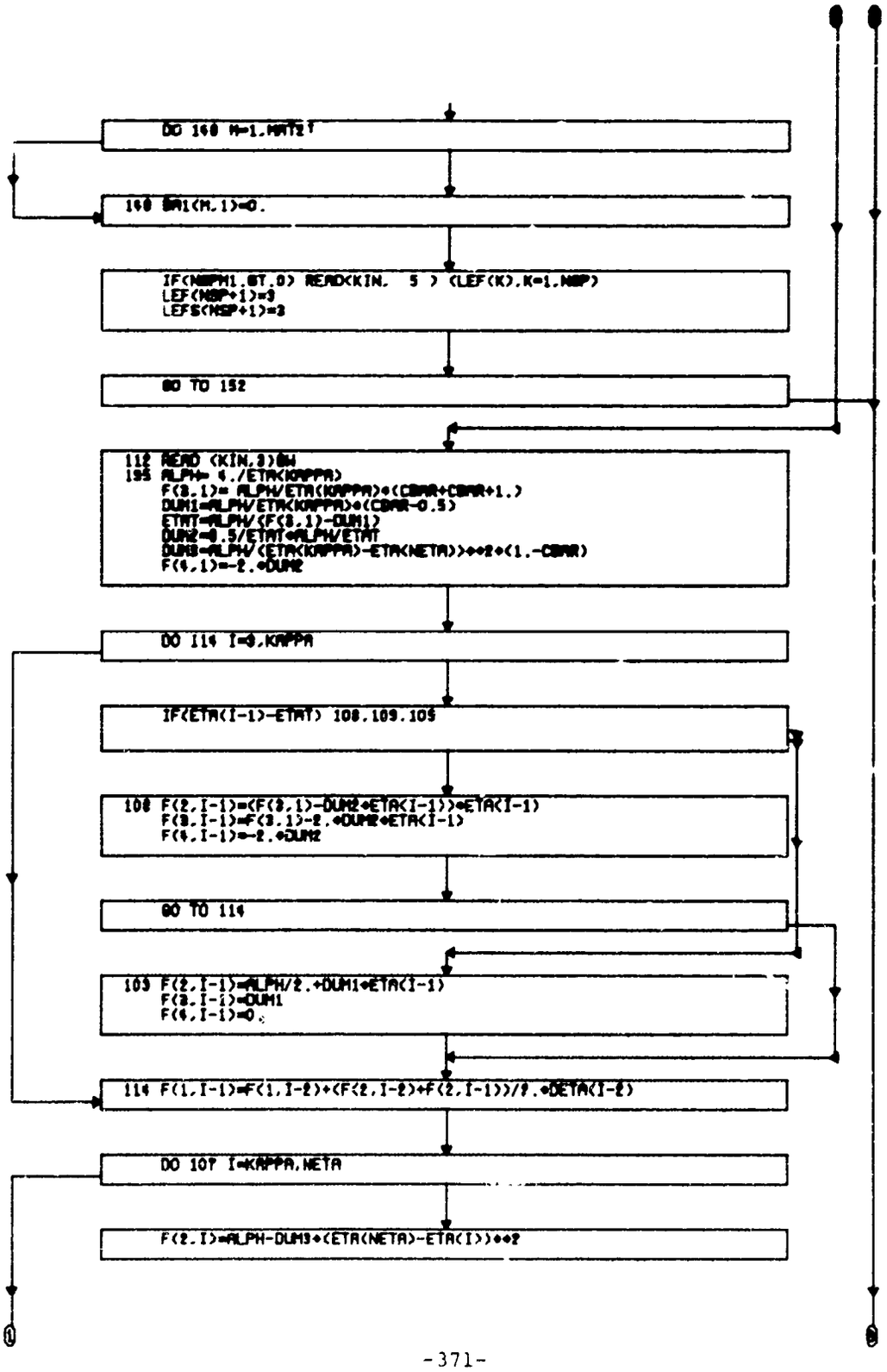
```
000001          C9294                                                          B29A 001
000002                SUBROUTINE FIRSTG                                        B29A 002
000003                COMMON/ALGCOM/ MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) B29A   3*NEW
000004               1,LEFS(10),PLEASE,LEFW(10)                                B29A   4*NEW
000005                COMMON/ETACOM/ETA(15),DETA(15),MSD(14),DCU(14),B1(14),B2(14)  B29A   5*NEW
000006               1,LAR(133),BA1(43,18),BA2(30,15)                          B29A   6*NEW
000007                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IB,M B29A   7*NEW
000008               1B,IT,NTIME,NSP,NSPM1,NAM,NLEB,NNLEB,NONL, ITS,KAPPA,CBAR,CASE(15) B29A   8*NEW
000009               2,R(8),      MWE,NON,KD(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) B29A   9*NEW
000010               3,KEJXO,JTIME,JSPEC,MD(3)                                 B29A  10*NEW
000011                COMMON/PRMCOM/TIME( 50),PRE(40),PTET( 50),GE( 30),S(40),ROKAP(40) B29A  11*NEW
000012               1,RNCSE,VKAP,NDISC,IDISC(40),MBD(10),MSD(10),ITF( 50),IPRE,RADNO, B29A  12*NEW
000013               2CONE,RADFL( 50),RADT(40),RADS(40),IRAD                   B29A  13*NEW
000014                COMMON/VARCOM/F(4,15),G(3,15),BP(3,15, 9),ALPH            B29A  14*NEW
000015              3 FORMAT(8E10.4)                                            B29A 011*-12
000016              4 FORMAT(3E10.4,5X15)
000017              5 FORMAT(40I2)
000018                NUL=0
000019                IF(IABS(KR(2)-2)*1) 110,111,112
000020          110 DUM1=(GE(ITEM)-G(1,1))/(G(1,NETA)-G(1,1))                   B29A 013
000021                DO 113 I=1,NETA                                           B29A 014
000022                G(3,I)=G(3,I)*DUM1                                        B29A 015
000023                G(2,I)=G(2,I)*DUM1                                        B29A 016
000024          113 G(1,I)=G(1,1)+DUM1*(G(1,I)-G(1,1))                          B29A 017
000025                GO TO 192                                                 B29A 018
000026          111 READ(KIN,4) ALPH,F(1,1),F(3,1),IST
000027                IF(KR(2).EQ.3) KR(2)=MINO(-IST,-1)
000028                ALSQ=ALPH*ALPH
000029                F(3,1)=F(3,1)*ALSQ
000030                READ(KIN,3)(F(2,I),I=1,NETA)
000031                DO 131 I=1,NETA
000032          131 F(2,I)=F(2,I)*ALPH
000033                LL=2
000034                L=1
000035                I=1
000036                DO 134 M=1,MAT1I
000037                I=I+1
000038                IF(I-NETA) 133,133,132
000039          132 I=LL
000040                L=L+LL
000041                LL=1
000042          133 F(L,I)=-BA1(M,2)*F(1,1)-BA1(M,3)*F(3,1)
000043                DO 134 J=4,MAT1J
000044          134 F(L,I)=F(L,I)-BA1(M,J)*F(2,J-3)
000045                BA1(1,1)=1.0
000046                CALL MATS2(BA1)
000047                DO 138 K=NUL,NSPM1
000048                READ(KIN,3) BP(2,1,K),(BP(1,I,K),I=1,NETA)
000049                BP(2,1,K)=BP(2,1,K)*ALPH
000050                L=2
000051                I=1
000052                DO 138 M=2,MAT2I
000053                I=I+1
000054                IF(I-NETA) 136,136,135
000055          135 I=1
000056                L=L+1
000057          136 BP(L,I,K)=BA1(M,1)*BP(1,NETA,K)-BA2(M,1)*BP(2,1,K)
000058                DO 138 J=2,MAT2J
```

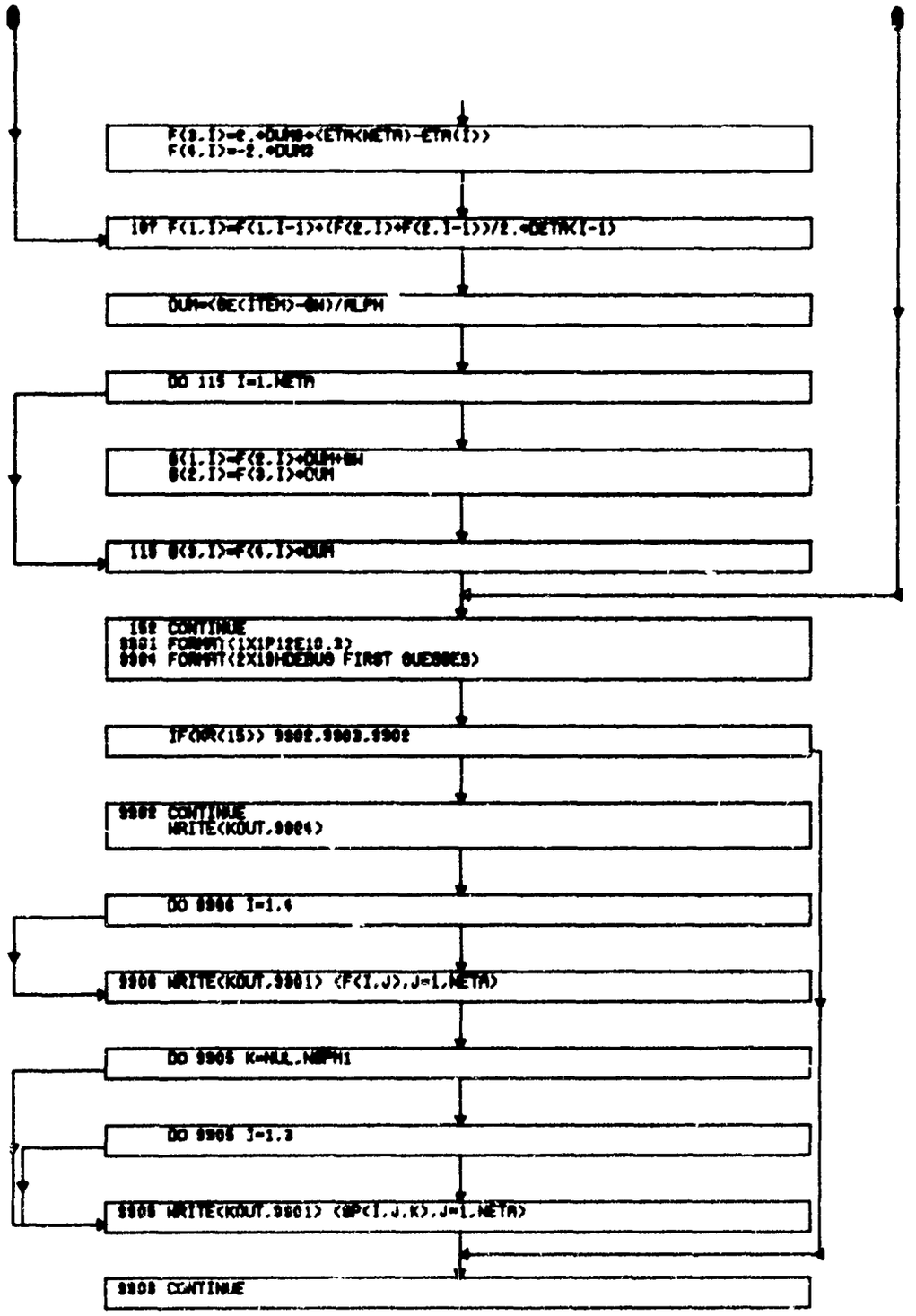
```
000059          138 SP(L,I,K,=SP(L,I,K)+BA2(M,J)*SP(I,J-1,K)
000060              DO 140 M=1,MAT2I
000061          140 BA1(M,1)=0.
000062              IF(NSPM1.GT.0) READ(KIN,  5 ) (LEF(K),K=1,NSP)
000063              LEF(NSP+1)=3
000064              LEFS(NSP+1)=3
000065              GO TO 152                                                   B29A 038
000066          112 READ (KIN,3)GW                                              B29A 039
000067          195 ALPH= 4./ETA(KAPPA)
000068              F(3,1)= ALPH/ETA(KAPPA)*(CBAR*CBAR+1.)
000069              DUM1=ALPH/ETA(KAPPA)*(CBAR+3.5)
000070              ETAT=ALPH/(F(3,1)+DUM1)
000071              DUM2=0.5/ETAT*ALPH/ETAT
000072              DUM3=ALPH/(ETA(KAPPA)+ETA(NETA))**2*(1.+CBAR)
000073              F(4,1)=-2.*DUM2
000074              DO 114 I=3,KAPPA
000075              IF(ETA(I-1)-ETAT) 108,109,109
000076          108 F(2,I-1)=(F(3,1)+DUM2*ETA(I-1))*ETA(I-1)
000077              F(3,I-1)=F(3,1)-2.*DUM2*ETA(I-1)
000078              F(4,I-1)=-2.*DUM2
000079              GO TO 114
000080          109 F(2,I-1)=ALPH/2.*DUM1*ETA(I-1)
000081              F(3,I-1)=DUM1
000082              F(4,I-1)=0.
000083          114 F(1,I-1)=F(1,I-2)+(F(2,I-2)+F(2,I-1))/2.*DETA(I-2)
000084              DO 107 I=KAPPA,NETA
000085              F(2,I)=ALPH-DUM3*(ETA(NETA)-ETA(I))**2
000086              F(3,I)=2.*DUM3*(ETA(NETA)-ETA(I))
000087              F(4,I)=-2.*DUM3
000088          107 F(1,I)=F(1,I-1)+(F(2,I)+F(2,I-1))/2.*DETA(I-1)
000089              DUM=(GE(ITEM)-GW)/ALPH
000090              DO 115 I=1,NETA
000091              G(1,I)=F(2,I)*DUM+GW
000092              G(2,I)=F(3,I)*DUM
000093          115 G(3,I)=F(4,I)*DUM
000094          152 CONTINUE                                                    B29A 059
000095         9901 FORMAT(1X1P12E10.3)
000096         9904 FORMAT(2X19HDEBUG FIRST GUESSEC)                            B29A 061
000097              IF(KR(19)) 9902,9903,9902                                   B29A 062
000098         9902 CONTINUE                                                    B29A 063
000099              WRITE(KOUT,9904)                                            B29A 064
000100              DO 9906 I=1,4
000101         9906 WRITE(KOUT,9901) (F(I,J),J=1,NETA)
000102              DO 9905 K=NUL,NSPM1
000103              DO 9905 I=1,3
000104         9905 WRITE(KOUT,9901) (SP(I,J,K),J=1,NETA)
000105         9903 CONTINUE                                                    B29A 067
000106              RETURN                                                      B29A 068
000107              END                                                         B29A 0
```

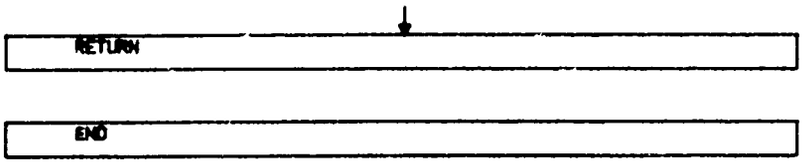
c. Flow Chart


SUBROUTINE FIRSTG
NUL=0
IF(IABS(KR(2)-2)-1) 110,111,112
110 DUM1=(BE(ITEM)-B(1,1))/(B(1,NETA)-B(1,1))
DO 119 I=1,NETA
B(3,I)=B(3,I)+DUM1
B(2,I)=B(2,I)+DUM1
119 B(1,I)=B(1,1)+DUM1*(B(1,I)-B(1,1))
GO TO 152
111 READ(KIN,6) ALPH,F(1,1),F(3,1),IST
IF(KR(2).EQ.3) KR(2)=MIND(-IST,-1)
ALSO=ALPH+ALPH
F(3,1)=F(3,1)+ALSO
READ(KIN,3)(F(2,I),I=1,NETA)
DO 131 I=1,NETA
131 F(2,I)=F(2,I)+ALPH
LL=2
L=1
I=1
DO 134 M=1,MATII
I=I+1
IF(I-NETA) 133,133,132


132 I=LL
L=L+LL
LL=1
133 F(L,I)=BA1(M,2)*F(L,1)-BA1(M,3)*F(3,I)
DO 134 J=4,MAT1J
134 F(L,I)=F(L,I)-BA1(M,J)*F(2,J-3)
BA1(1,1)=1.0
CALL MATBE(BA1)
DO 136 K=KLL,NBPH1
READ(KIN,3) BP(2,1,K),(BP(1,I,K),I=1,NETA)
BP(2,1,K)=BP(2,1,K)*ALPH
L=2
I=1
DO 138 M=2,MAT2I
I=I+1
IF(I-NETA) 138,136,136
135 I=1
L=L+1
136 BP(L,I,K)=BA1(M,1)*BP(1,NETA,K)-BA2(M,1)*BP(2,1,K)
DO 138 J=2,MAT2J
138 BP(L,I,K)=BP(L,I,K)-BA2(M,J)*BP(1,J-1,K)


DO 160 M=1,MMT2
160 BM1(M,1)=0.
IF(NBPM1.GT.0) READ(KIN, 5) (LEF(K),K=1,NBP)
LEF(NBP+1)=9
LEFS(NBP+1)=3
GO TO 152
112 READ (KIN,3)BW
195 ALPH= 1./ETA(KAPPA)
F(3,1)= ALPH/ETA(KAPPA)*(CBAR+CBAR+1.)
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
10? F(1,I)=F(1,I-1)+(F(2,I)+F(2,I-1))/2.*DETA(I-1)
DUM=(BE(ITEM)-BW)/ALPH
DO 115 I=1,NETA
B(1,I)=F(2,I)*DUM+BW
B(2,I)=F(3,I)*DUM
115 B(3,I)=F(4,I)*DUM
152 CONTINUE
9901 FORMAT(1X1P12E10.3)
9904 FORMAT(2X19HDEBUG FIRST GUESSES)
IF(NR(15)) 9902,9903,9902
9902 CONTINUE
WRITE(KOUT,9904)
DO 9906 I=1,4
9906 WRITE(KOUT,9901) (F(I,J),J=1,NETA)
DO 9905 K=NLE,NEPH1
DO 9905 I=1,3
9905 WRITE(KOUT,9901) (BP(I,J,K),J=1,NETA)
9903 CONTINUE


RETURN
END

31. FUNCTION ERP(X) - B30A

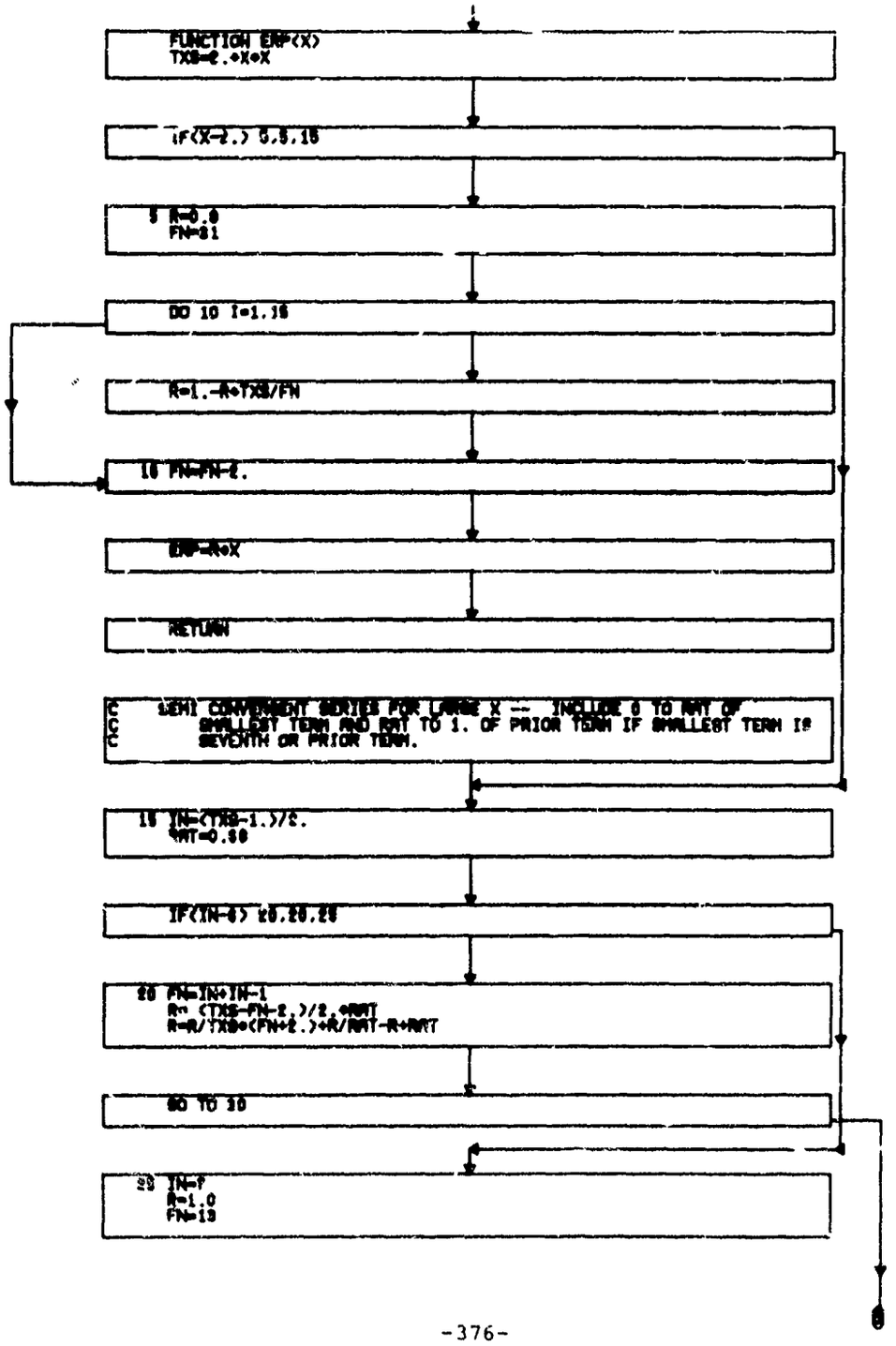
a. Function

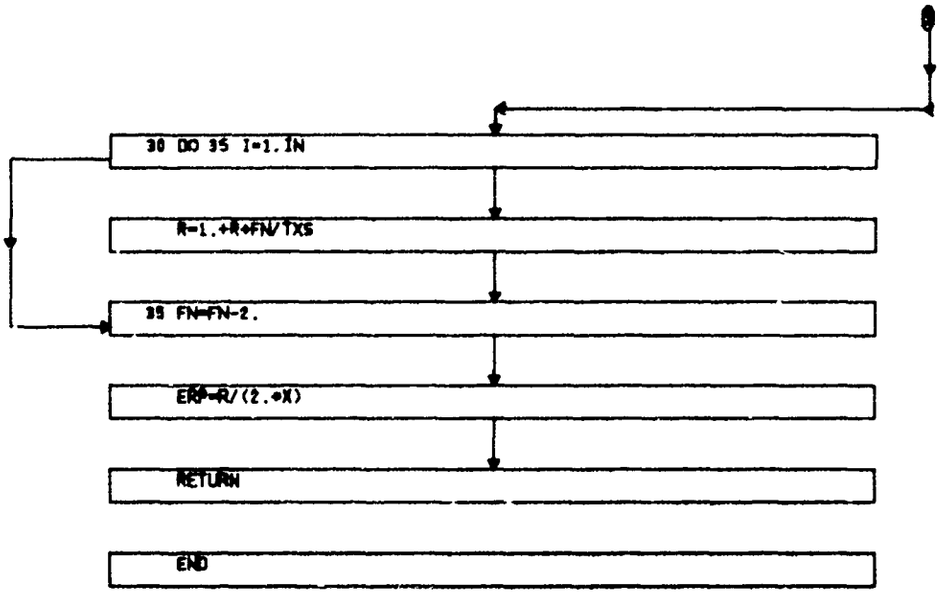
Forms Dawson Integral of X.

b. Listing

```
000001                FUNCTION ERP(X)
000002                TXS=2.*X*X
000003                IF(X-2.) 5,5,15
000004              5 R=0.8
000005                FN=31
000006                DO 10 I=1,15
000007                R=1.-R*TXS/FN
000008             10 FN=FN-2.
000009                ERP=R*X
000010                RETURN
000011           C    SEMI CONVERGENT SERIES FOR LARGE X --  INCLUDE 0 TO RAT OF
000012           C       SMALLEST TERM AND RAT TO 1. OF PRIOR TERM IF SMALLEST TERM IS
000013           C       SEVENTH OR PRIOR TERM.
000014             15 IN=(TXS-1.)/2.
000015                RAT=0.68
000016                IF(IN-6) 20,20,25
000017             20 FN=IN+IN-1
000018                R= (TXS-FN-2.)/2.*RAT
000019                R=R/TXS*(FN+2.)+R/RAT-R*RAT
000020                GO TO 30
000021             25 IN=7
000022                R=1.0
000023                FN=13
000024             30 DO 35 I=1,IN
000025                R=1.+R*FN/TXS
000026             35 FN=FN-2.
000027                ERP=R/(2.*X)
000028                RETURN
000029                END
```

c. Flow Chart

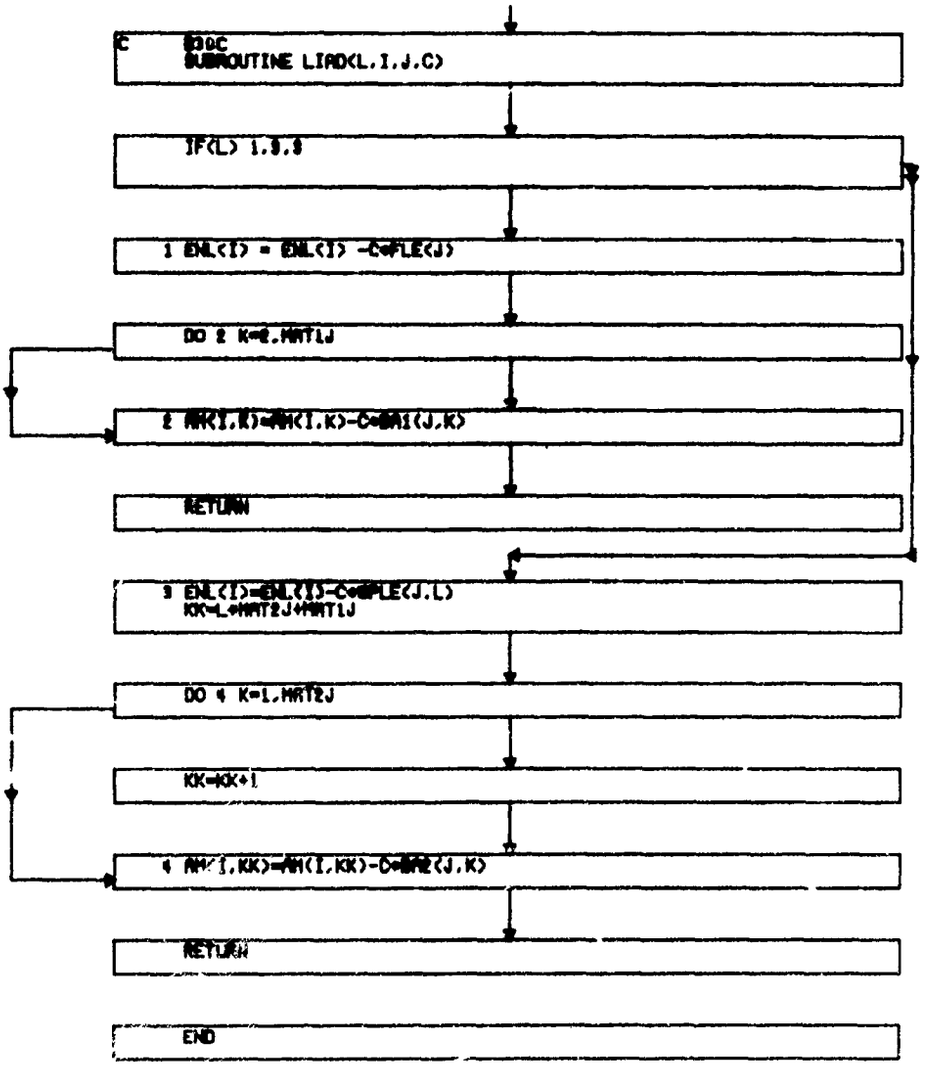

FUNCTION EXP(X)
TXS=2.*X*X
IF(X-2.) 5,5,15
5 R=0.0
FN=31
DO 10 I=1,15
R=1.-R*TXS/FN
10 FN=FN-2.
EXP=R*X
RETURN
C USE CONVERGENT SERIES FOR LARGE X -- INCLUDE 0 TO RMT OF
C SMALLEST TERM AND RMT TO 1. OF PRIOR TERM IF SMALLEST TERM IS
C SEVENTH OR PRIOR TERM.
15 IN=(TXS-1.)/2.
RMT=0.99
IF(IN-6) 20,20,25
20 FN=IN+IN-1
R=(TXS-FN-2.)/2.*RMT
R=R/TXS*(FN+2.)+R/RMT-R+RMT
GO TO 10
25 IN=7
R=1.0
FN=13


30 DO 35 I=1.IN
R=1.+R*FN/TXS
35 FN=FN-2.
ERR=R/(2.*X)
RETURN
END

b. Listing

```
000001          C     B30C
000002                SUBROUTINE LIAD(L,I,J,C)
000003                COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM      B30C   3*NEW
000004               1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)     B30C   4*NEW
000005               2,DGL(30),DSPL(30, 8),FNLE(18),GNLE(15),SPNLE(15, 8),ENL(153)      B30C   5*NEW
000006               3,FNLEM,GNLEM,SPNLEM( 8),          ENLMM,IFNLM,IGNLM,ISPNLM( 8)   B30C   6*NEW
000007               4,NENLM,INLMM,DFNL(18),DGNL(15),DSPNL(15, 8),DRNL(10)              B30C   7*NEW
000008                COMMON/ETACOM/ETA(15),DETA(15),DSG(14),DCU(14),B1(14),B2(14)      B30C   8*NEW
000009               1,LAM(153),BA1(43,18),BA2(30,15)                                   B30C   9*NEW
000010                COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                          B30C  10*NEW
000011               1VLNKW,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)              B30C  11*NEW
000012                COMMON/INTCOM/KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA               **-9
000013                IF(L) 1,3,3
000014              1 ENL(I) = ENL(I) -C*FLE(J)
000015                DO 2 K=2,MAT1J
000016              2 AM(I,K)=AM(I,K)-C*BA1(J,K)
000017                RETURN
000018              3 ENL(I)=ENL(I)-C*SPLE(J,L)
000019                KK=L*MAT2J+MAT1J
000020                DO 4 K=1,MAT2J
000021                KK=KK+1
000022              4 AM(I,KK)=AM(I,KK)-C*BA2(J,K)
000023                RETURN
000024                END                                                                B05A5360
```

c. Flow Chart


C $IBDC
SUBROUTINE LIAD(L,I,J,C)
IF(L) 1,3,3
1 ENL(I) = ENL(I) -C*FLE(J)
DO 2 K=1,MAT1J
2 AA(I,K)=AA(I,K)-C*BA1(J,K)
RETURN
3 ENL(I)=ENL(I)-C*FLE(J,L)
KK=L*MAT2J+MAT1J
DO 4 K=1,MAT2J
KK=KK+1
4 AA(I,KK)=AA(I,KK)-C*BA2(J,K)
RETURN
END

SECTION III

OPERATION OF BLIMP COUPLED TO A CHARRING ABLATION PROGRAM: THE CABLE CODE

1. INPUT INSTRUCTIONS

The input cards for the CABLE program consist of a nearly complete set of CMA input together with a complete set of BLIMP input, plus a few extra cards. Input instructions for the CMA program from reference 3 will be repeated here for completeness. The BLIMP input instructions are contained in Volume I of this report, and will only be discussed here in general terms. The user should be thoroughly familiar with BLIMP before attempting to use the CABLE program.

a. Restart Card

The CABLE input is started with a control card which is used to indicate restarts, or whether restart information should be saved for future use, and the KR array for the BLIMP program. In the case of restart problems, only this data card, CMA decks for subsequent stations, and the last BLIMP data card (. or ,) together with restart information on logical units 12, 13, and 14 are read in.

Column	Format	Data	Units
10	I1	KCM(10) 0 indicates this is a new case 1 indicates this is a new case, save information for restart 2 indicates this is a restart 3 indicates this is a restart, save information for other restarts	

The next four fields are used only if this is a restart case.

11-15	I5	ITEM. This is the time index from which the problem is to be restarted	
16-20	I5	IS. This is the station index from which the problem is to be restarted	
21-30	I5	NITEM. Total number of times to be considered at each station	
61-80	20I1	KR. This is the KR array for the BLIMP program. In the case of restarts elements 3, 4 and 13-20 of this array may be different from the array in the case being restarted. The new values will then be used at all following times and stations.	

b. CMA Program Input

The input to the Charring Material Thermal Response and Ablation program can conveniently be divided into seven parts. All seven portions of the deck must be present for each run. These individual parts will be described in the following subsections.

(1) Title and Heading Information

The first three cards of the data deck are used to transmit title and heading information to the output. The first 72 columns of each of these cards may be used for the title, the alphameric information in columns 61 through 72 of the third card being used as a page heading on all pages after the first.

(2) Internal-Decomposition Kinetic Data

These three cards supply the constants used in equation (2) of reference 2.* They are supplied according to the following format.

Column	Format	Data	Units
1	I1	Alphabetic character A, B, or C referring to the material components. These must be on the first, second and third cards of this set in order.	
11-20	F10.5	Initial density of component i, ρ_{o_i}	lb/ft^3
21-30	F10.5	Residual density of component i, ρ_{r_i}	lb/ft^3
31-40	F10.3	Pre-exponential factor, B_i	sec^{-1}
41-50	F10.5	Density factor exponent, ψ_i	---
51-60	10.3	Activation energy factor ($E_{a_i}/^oR$)	^oR
61-70	F10.5	Minimum temperature of reaction zone	^oR

The last entry in this table, the minimum temperature of the reaction zone, is included only as a means of reducing computational time. Thus, if a nodal temperature is below this value, the program will bypass the fairly complex density-calculation procedure. Also for the case of a nondecomposing reinforcing material, the value of this temperature can be set to a ridiculously high value, thus assuring no decomposition.

*Reference 6 cites relevant data for many materials of interest.

(3) Output Interval Specification and General Program Constants

Two cards are used to provide the program with the values of certain general constants, to establish the time intervals for which output will be obtained, and to specify thermocouple and isotherm output, if desired. (If thermocouples and/or isotherms are called for, additional cards are needed, as described.)

First Card

Column	Format	Data	Units
1-2	I2	Number of nodelets per node (blank implies 10, maximum is 152/total number of nodes)	---
3-5	I3	Total number of nodes (maximum of 38)	---
6	I1	A nonzero punch in this column will cause thermocouple and isotherm output, normally listed with regular output, to also be punched as cards. Punch output on logical unit 7.	---
7-8	I2	Number of thermocouples for which output is desired. (The depths of these thermocouples are specified on additional cards of this group.) Punches here will cause thermocouple temperatures as a function of time to be output at the end of the regular program output. Maximum of this plus subsequent number is 20.	----
9-10	I2	Number of isotherms for which output is desired. (The temperatures of these isotherms are specified on additional cards of this group.) Punches here will cause isotherm depths as a function of time to be output at the end of the regular program listing. Maximum of this plus previous number is 20.	----
11-20	F10.5	Initial value of time	sec
21-30	F10.5	Final value of time	sec
31-40	F10.5	Initial output time interval	sec
41-50	F10.5	Second output time interval	sec
51-60	F10.5	Third output time interval	sec
61-70	F10.5	Maximum time step permitted under any circumstances. If unpunched, this limit will be set equal to 5.0 seconds. Recommended value is 0.001 times total elapsed time.	sec

Second Card

Column	Format	Data	Units
1-10	F10.5	Time of transition from initial to second output time interval	sec
11-20	F10.5	Time of transition from second to third output time interval	sec
21-30	F10.5	Minimum thickness of last ablator node. When, because of surface recession, the last node of the ablation material shrinks below this value, it is combined with the adjacent ablator node. A value equal to the second node's thickness is usually appropriate.	in
31-40 41-50 51-60	F10.5 F10.5 F10.5	Heats of formation of the virgin plastic, the char, and the pyrolysis gas, respectively. These are evaluated at the datum temperature given in columns 71-80.	Btu/lb
61-70	F10.5	Volume fraction or mass fraction of the virgin plastic which is occupied by resin. If mass fraction, it is input as a negative number.	---
71-80	F10.5	Datum temperature for heats of formation given in columns 31-50. This must be the same temperature as used in the BLIMP program thermochemical data cards.	^{o}R

Additional Cards as Required

Column	Format	Data	Units
1-80	8(F10.5)	If thermocouple and/or isotherm output have been called for, these cards specify thermocouple depths in inches below the original surface and isotherm temperatures in degrees Rankine. Isotherm temperatures must begin on a new card. The total number of thermocouples and isotherms may not exceed 20. If no thermocouples or isotherms are called for, these card(s) are omitted.	in and/or ^{o}R

(4) Nodal Data

A set of cards equal in number to the number of nodes is used to provide certain information with regard to the initial state of the nodes, their thickness, and the contact resistances between them. In addition, the first card of this set is used to specify the geometric nature of the exposed surface, that is whether it is a flat plate or an internal external radius. The format for these cards is shown below.

Column	Format	Data	Units
1-2	I2	Material number, 1 for virgin plastic, 2 for char.	---
3-12	E10.0	Initial temperature of the node.	^{o}R
13-22	E10.0	Initial cross-sectional area of the node, in any units or normalized on any convenient reference such as the surface area. This data is required only for "general" geometries; for planar, cylindrical, and spherical geometries, and for shapes for which the area varies as a power of the radius the specification of individual nodal areas is not required and these columns should be left blank.	Arbitrary
23-32	E10.0	Initial thickness of the node.	in
33-42	E10.0	First card only. 0 for planar surface; positive value of internal radius or negative of value of external radius for all nonplanar axisymmetric geometries (including spheres and shapes with $A \sim r^a$).	
		Second card only. Exponent on radius giving nodal cross-sectional area variation for spherical and other "regular" geometries. Sphere requires 2.0. No entry needed for planar and cylindrical geometries. Must be blank if "general" geometry option is used.	
43-52	E10.0	Contact resistance between this node and the next node.	ft^2-sec-^{o}R/Btu

(5) Back Wall Heat Transfer Conditions; Char and Pyrolysis Zone Criteria

Heat transfer at the back wall is characterized by a convective heat transfer coefficient, an emissivity, and the temperature of a "reservoir" to which heat transfer takes place from the back wall. This card allows the specification of these three quantities. Blanks serve to specify an insulated back wall.

Two additional entries define char edge density and pyrolysis zone edge density according to the following definitions:

$$\rho_{\substack{\text{char}\\\text{edge}}} = \rho_c + r_c(\rho_p - \rho_c) \tag{1}$$

$$\rho_{\substack{\text{pyrolysis}\\\text{edge}}} = \rho_c + r_p(\rho_p - \rho_c) \tag{2}$$

The user inputs values for r_c and r_p. Typical values are $r_c = 0.02$ (defining the char edge as occurring where the density is $\rho_c + 0.02(\rho_p - \rho_c)$) and $r_p = 0.98$. If no entries are made for r_c and r_p, 0.02 and 0.98 will be assumed.

Column	Format	Data	Units
1-10	F10.5	Back wall convective coefficient	Btu/sec-ft^2-$^\circ$R
11-20	F10.5	Back wall emissivity	---
21-30	F10.5	Reservoir temperature	$^\circ$R
31-40	F10.5	Char zone criterion r_c	---
41-50	F10.5	Pyrolysis zone criterion r_p	---
60	I1	One punch calls for output of thermal conductivity in place of enthalpy in standard output block	

(6) Material Property Tables

In these tables are presented the requisite thermodynamic data for the virgin plastic (material no. 1), and the char layer (material no. 2). These data are input as functions of temperature according to the following format.

Column	Format	Data	Units
1-2	I2	Flag, nominally zero, +1 marks terminal card of last material property table, -1 marks terminal card of other intermediate material property tables	---
3-12	F10.5	Temperature (independent variable)	$^\circ$R
13-22	F10.5	Specific heat	Btu/lb-$^\circ$R
23-32	F10.8	Thermal conductivity	Btu/ft-sec-$^\circ$R
33-42	F10.5	Emissivity	---

The program always expects to find the first two tables for materials 1 and 2 (plastic and char). For problems without decomposition, a "char" table should still be included. It may, of course, be a duplicate of the "plastic" table except for any flags.

The number of temperature points in each table may not exceed 20 or may not be less than 2. The tables must be ordered on either ascending or descending temperatures.

Note that the virgin plastic properties table must precede the char table. Material properties for partially degraded or charred material are formed from weighted averages of the plastic and char properties for the relevant nodal temperatures. The weighting variable is x, the plastic mass fraction (i.e., the

mass fraction of pure plastic, in a simple mixture of pure plastic and pure char, required to yield the local nodal density):

$$x = \frac{\rho_p}{\rho_p - \rho_c}\left(1 - \frac{\rho_c}{\rho}\right) \tag{3}$$

Thus

$$C_p = xC_{p_p} + (1 - x)C_{p_c} \tag{4}$$

The thermal conductivity k will be weighted in the same manner.

(7) Pyrolysis Gas Enthalpy Table

In this table the variation of pyrolysis gas enthalpy with temperature is specified. These values are added to the heat of formation of the pyrolysis gas as specified on the program constant cards. This table is presented on card pairs, the first of which presents a set of temperatures (up to 8), the second containing the corresponding enthalpy values. The first column of the temperature card is used as a flag, nominally blank but containing an integer to mark the last pair of cards. The format for this card pair is given as (I1, F9.5, 7F10.5/8F10.5), implying a basic field length of ten columns for both temperature and enthalpy, with the exception of the first temperature which is restricted to columns 2 through 10. The temperatures should be given in ascending sequence with 8 entries on each card pair (with the exception of the last card pair which may have from one to eight entries). The total number of temperature points in the table may not exceed 30 and may not be less than 2.

c. Grid Points for Interpolation ($\dot{m}_g^*$, $\dot{m}_c^*$)

As discussed in reference 1, CABLE interpolates a matrix of BLIMP solutions in the ($\dot{m}_g^*$, $\dot{m}_c^*$, θ) or ($\dot{m}_g^*$, T, θ) coordinate array to form the boundary conditions for the CMA program. The matrix of ($\dot{m}_g^*$, $\dot{m}_c^*$) or ($\dot{m}_g^*$, T) values are input in this card set. Up to 10 values of $\dot{m}_g^*$ may be read in, with up to 19 values of $\dot{m}_c^*$ and/or T for each $\dot{m}_g^*$ value. The program assumes that everything less than 99. is a normalized mass flux rate, while everything greater than 99. is a temperature. All assigned temperature points should precede all $\dot{m}_c^*$. Up to 10 cards of the following type will be read.

Column	Format	Data	Units
1-4	F4.0	$\dot{m}_g^*$	---
5-80	19F4.0	$\dot{m}_c^*$ or T	dimensionless or $^{\circ}R$

Last Card of this Set

Column	Format	Data	Units
1-4	F4.0	View factor for reradiation from the surface	----

d. BLIMP Input

An ordinary BLIMP input deck, complete through but not beyond card group 15, is input next. The input KR(9) and KR(11) values are ignored, however the user should leave the KR9( ) array blank (group 3, card 3, field 2 of the BLIMP input).

e. Other Decks and Last Card

A new CMA deck is input for each body station. These may be duplicates of the deck prepared under (b) above, or it may be altered according to changes in material, thicknesses, etc. The last card of the CABLE input deck should contain a period (.) in column 1, as discussed in Volume I, Section III, Last Group.

2. OUTPUT DESCRIPTION

The output from the CABLE code consists of the usual output from the CMA and BLIMP codes. Program output begins with an output of the input title and heading information, internal decomposition kinetic data, output interval specifications and general program constants, nodal data, material property tables, and pyrolysis gas enthalpy table. All this output is fully labeled and is printed exactly as input by the user. The standard BLIMP summary of input conditions is listed next, including the KR array, eta values, enthalpy, pressure, and radiation flux tables, material compositions, and thermodynamic property curve fit data. An edge gas stagnation solution at time zero (or other initial time) followed by edge gas expansions to the pressure at each body station appears next, these solutions being summarized in an edge gas expansion summary table. Output of boundary layer and in-depth solutions then begins.

The solution output begins with a CMA solution at time zero (or other initial time) which shows the material starting condition. The first BLIMP solution appears next, for the first ($\dot{m}_g^*$, $\dot{m}_c^*$, θ) or ($\dot{m}_g^*$, T, θ) combination. In order to proceed to the next mandatory time, another BLIMP stagnation solution and edge expansion is carried out. BLIMP solutions at the remaining combinations of ($\dot{m}_g^*$, $\dot{m}_c^*$, θ) or ($\dot{m}_g^*$, T, θ) are then run to fill in the interpolation matrix which provides boundary conditions for the CMA program. The CMA program then proceeds, printing output at the specified print interval, until one of two events occurs. If the solution exceeds the limits of the current ($\dot{m}_g^*$, $\dot{m}_c^*$, θ) or ($\dot{m}_g^*$, T, θ)

interpolation cube, new BLIMP solutions are run immediately to fill in the corners of a new interpolation cube. If the CMA solution proceeds up to one of the mandatory solution times, the actual values of $\dot{m}_g^*$ and $\dot{m}_c^*$ or $\dot{m}_g^*$ and T are then used to generate a BLIMP solution at that mandatory time. The CABLE program then proceeds by forming BLIMP solutions for interpolation at the next mandatory time, and carrying out CMA solutions using interpolated BLIMP solutions for boundary conditions until the final mandatory time is reached.

3. SAMPLE PROBLEM

As a demonstration of the CABLE program, a coupled transient solution was run for a sphere-cone reentry body with a nose radius of 0.5 inches and a cone half-angle of eight degrees. Two body points at surface running lengths of 10 and 16 inches (based on the original body shape) were analyzed although there is no reason other than computer time limitations why more body stations could not have been specified. Laminar flow was assumed for the boundary layer to hold the required number of nodes to a minimum. The heat shield material was one-inch thick phenolic carbon with properties as described in reference 6 and was insulated at the back face. Total flight time from 300,000 feet was 27 seconds with an impact velocity of 17,000 ft/sec. Pressure ratio P/P_o at the body stations of interest were assumed to be 0.0262 and 0.0195 for the entire 27 seconds. Mandatory BLIMP solution times were 0.0, 7.0, 14.0, 18,0, 21.0, 23.0, 25.0, and 27.0 seconds. Due to the plateau-like behavior of this carbonaceous material, interpolation on surface temperature rather than $\dot{m}_c^*$ was selected for the entire flight. Temperatures from $500^\circ R$ to $9500^\circ R$ at $500^\circ R$ intervals were used.

Based on observation of the results of this sample case, it appears that the maximum allowed time step of 0.5 seconds input for this case was too large, allowing oscillations of the pyrolysis gas mass flux which in turn required an inordinate number of BLIMP solutions for interpolation. The value suggested in Subsection 1.b above of 0.001 times the maximum time (0.027 seconds) would have resulted in a more stable solution.

a. Input for CABLE Sample Problem

```
CMA DECK FOR CABLE ANALYSIS OF PHENOLIC CARBON HEATSHIELD
TWO STATIONS, ONE INCH THICK PH. CARB., PROPERTIES FROM NASA CR 72301
KIRTLAND SAMPLE PROBLEM NO. 5
A          60.75      32.4       4.48     F93.0       3.68     F4600.
B          20.25      0.         1.40     E43.0       1.54     E41000.
C          97.4       97.4       0.         0.        0.         90000.
   15      0.         27.        1.         1.        1.         .02        0.5
1.         2.         .02       -376.5      0.        0.         -.330      536.
 1530.                  .01        -1.788
 1530.                  .01
 1530.                  .02
 1530.                  .02
 1530.                  .03
 1530.                  .03
 1530.                  .03
 1530.                  .05
 1530.                  .05
 1530.                  .05
 1530.                  .10
 1530.                  .10
 1530.                   15
 1530.                  .15
 1530.                  .20
1.0   E-10             530.
    530.       0.210       2.230-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
    800.       0.360       2.540-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   1160.       0.360       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   1500.       0.472       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   2000.       0.484       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   3000.       0.493       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   4000.       0.498       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
   5000.       0.500       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
-1 6000.       0.500       2.940-04    1.000          MX4926 (VIRGIN,60 DEG LAYUP)
    530.       0.210       2.230-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   1000.       0.430       2.980-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   1500.       0.472       3.035-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   2000.       0.484       3.906-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   3000.       0.493       8.490-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   4000.       0.498      14.300-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
   5000.       0.500      20.950-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
+1 6000.       0.500      28.100-04    1.000          MX4926 (CHAR  ,60 DEG LAYUP)
1    900.0     1800.0      2700.0     3600.0     4500.0     5400.0     6300.0
   -1782.0     -930.2       195.6      [illegible]3600.0     4696.0     615[illegible].0
     500100015002000250030003500400045005000550060006500700075008000850090009500
.05  500100015002000250030003500400045005000550060006500700075008000850090009500
 .1  500100015002000250030003500400045005000550060006500700075008000850090009500
.15  500100015002000250030003500400045005000550060006500700075008000850090009500
 .2  500100015002000250030003500400045005000550060006500700075008000850090009500
 .25 500100015002000250030003500400045005000550060006500700075008000850090009500
 .3  500100015002000250030003500400045005000550060006500700075008000850090009500
 .35 500100015002000250030003500400045005000550060006500700075008000850090009500
 .4  500100015002000250030003500400045005000550060006500700075008000850090009500
 .5  500100015002000250030003500400045005000550060006500700075008000850090009500
     (Plan card)
```

```
1010440;224202   1  CABLE SOLUTION FOR PH. CARBON HEATSHIELD

 4
 8
0.          7.          14.         18.         21.         23.         25.         27.
 2
0.8333      1.3333
 7
0.          .2          .6          1.2         2.          3.          5.
 5   .80
0.149       0.2187
.001123      0509       1.033       8.22        40.4        107.3       203.        267.5
10000.      10120.      10230.      10180.      9870.       9160.       7700.       5700.

100.
  5  .431  23.4         32.         3.467         106.7                            800.
  1HYDROGEN          1.00797           6.
  6CARBON           12.011             6.          1.
  7NITROGEN         14.008   -.765
  8OXYGEN           16.000   -.235     1.
 99ELECTRON          0.00055
  3  6  0  0  0  0  0  0  0  0  0  0  0 0JANAF 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
  1  6  0  0  0  0  0  0  0  0  0  0  0 0JANAF 03/61                                  C*
 000000-0 144120+5 586075+1 953976-4-766621+6 121290+2  500. 3000.2 100.C*
 000000-0 144120+5 485134+1 291605-3 307202+7 121290+2 3000. 5000.2 100.C*
  1  6  1  8  0  0  0  0  0  0  0  0  0 0JANAF 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
  1  1  0  0  0  0  0  0  0  0  0  0  0 0JANAF 12/60                                  H
 521020+3 134230+5 480223+1 555469-4 173095+6 388620+2  500. 3000.1   0.H
 521020+3 134230+5 308752+1 315025-3 929744+7 388620+2 3000. 5000.1   0.H
  2  7  0  0  0  0  0  0  0  0  0  0  0 0JANAF 03/61                                  N2
 000000-0 221650+5 862699+1 116090-3-103715+7 637650+2  500. 3000.1   0.N2
 000000-0 221650+5 984175+1-116232-3-612728+7 637650+2 3000. 5000.1   0.N2
  1  6  0  0  0  0  0  0  0  0  0  0  0 0JANAF 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
  4  1  1  6  0  0  0  0  0  0  0  0  0 0JANAF 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  0  0 0JANAF 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  0  0  0 0JANAF 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 103028+2 633312-3 121615+8 789830+2 3000. 5000.1    0.CHO
  1  6  2  8  0  0  0  0  0  0  0  0  0JANAF 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  6  0  0  0  0  0  0  0  0  0  0  0JANAF 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
  2  1  2  6  0  0  0  0  0  0  0  0  0JANAF 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
  1  1  1  8  0  0  0  0  0  0  0  0  0JANAF 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
  2  1  0  0  0  0  0  0  0  0  0  0  0JANAF 03/61                        H2
 000000-0 212100+5 711963+1 621950-3-712694+6 484650+2  500. 3000.1    0.H2
 000000-0 212100+5 681794+1 589854-3 265106+7 484650+2 3000. 5000.1    0.H2
  2  1  1  8  0  0  0  0  0  0  0  0  0JANAF 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
  1  7  0  0  0  0  0  0  0  0  0  0  0JANAF 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
  1  7  1  8  0  0  0  0  0  0  0  0  0JANAF 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
  1  8  0  0  0  0  0  0  0  0  0  0  0JANAF 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
  2  8  0  0  0  0  0  0  0  0  0  0  0JANAF 03/61                        O2
 000000-0 234460+5 804370+1 510872-3-152718+6 679730+2  500. 3000.1    0.O2
 000000-0 234460+5 103071+2 290991-4-783079+7 679730+2 3000. 5000.1    0.O2
  1 99  0  0  0  0  0  0  0  0  0  0  0CONVAIR ZPH-122 12/61             E-
        +149010+5+498851+1-272800-5-135900+6+164558+22000. 10000.1      E-
        +149010+5+498851+1-272800-5-135900+6+164558+22000. 10000.1      E-
  1  6 -1 99  0  0  0  0  0  0  0  0  0CONVAIR ZPH-122 12/61             C+
+428985+6+150120+5+489657+1+180700-4+340000+5+484232+22000. 10000.1      C+
+428985+6+150120+5+489657+1+180700-4+340000+5+484232+22000. 10000.1      C+
  1  7 -1 99  0  0  0  0  0  0  0  0  0CONVAIR 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  0  0  0  0CONVAIR 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  0CONVAIR ZPH-122 12/61             CO+
+294283+6+243830+5+893619+1+378000-4-150900+7+666595+22000. 10000.1      CO+
+294283+6+243830+5+893619+1+378000-4-150900+7+666595+22000. 10000.1      CO+
  1  7  1  8 -1 99  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  0  0  0CONVAIR 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+484849+22000. 10000.1      O+
```

(blank card)

```
.0262     .0195
          (3 blank cards)

CMA DECK FOR CABLE ANALYSIS OF PHENOLIC CARBON HEATSHIELD
TWO STATIONS. ONE INCH THICK PH. CARB.. PROPERTIES FROM NASA CR 72301
KIRTLAND SAMPLE PROBLEM NO. 5
A          60.75     32.4      4.48     E93.0      3.68     E4600.
B          20.25     0.        1.40     E43.0      1.54     E41000.
C          97.4      97.4      0.         0.       0.         90000.
   15      0.        27.       1.         1.       1.         .02        0.5
1.         2.        .02      -376.5      0.       0.         -.330      536.
 1530.                .01       -1.788
 1530.                .01
 1530.                .02
 1530.                .02
 1530.                .03
 1530.                .03
 1530.                .03
 1530.                .05
 1530.                .05
 1530.                .05
 1530.                .10
 1530.                .10
 1530.                .15
 1530.                .15
 1530.                .20
1.0   F-10          530.
    530.       0.210      2.230-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
    800.       0.360      2.540-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   1160.       0.360      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   1500.       0.472      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   2000.       0.484      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   3000.       0.493      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   4000.       0.498      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
   5000.       0.500      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
-1 6000.       0.500      2.940-04    1.000          MX4926 (VIRGIN.60 DEG LAYUP)
    530.       0.210      2.230-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   1000.       0.430      2.980-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   1500.       0.472      3.035-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   2000.       0.484      3.906-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   3000.       0.493      8.490-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   4000.       0.498     14.300-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
   5000.       0.500     20.950-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
+1 6000.       0.500     28.100-04    1.000          MX4926 (CHAR  .60 DEG LAYUP)
1    900.0    1800.0     2700.0     3600.0     4500.0     5400.0     6300.0
   -1782.0    -930.2      195.6     2289.0     3600.0     4696.0     6152.0
     500100015002000250030003500400045005000550060006500700075008000850090009500
.05  500100015002000250030003500400045005000550060006500700075008000850090009500
 .1  500100015002000250030003500400045005000550060006500700075008000850090009500
.15  500100015002000250030003500400045005000550060006500700075008000850090009500
 .2  500100015002000250030003500400045005000550060006500700075008000850090009500
```

```
.25 5001000150020002500300035004000450050005500600065007000750080008500900095 00
.3  5001000150020002500300035004000450050005500600065007000750080008500900095 00
.35 5001000150020002500300035004000450050005500600065007000750080008500900095 00
.4  5001000150020002500300035004000450050005500600065007000750080008500900095 00
.5  5001000150020002500300035004000450050005500600065007000750080008500900095 00
        (blank card)
```

b. Output from CABLE Sample Problems

Due to the very large quantity of output from the CABLE program, only a small portion is included here in the sample output. That portion consists of the input summary for CMA and BLIMP, the edge expansion at time zero, the first mandatory BLIMP solution at time zero, the BLIMP stagnation solution and edge expansion for the second mandatory time, the eight BLIMP solutions to be used for interpolation, the CMA output for the first seven seconds, and the second mandatory BLIMP solution (at 7.0 seconds).

CMA DECK FOR CABLE ANALYSIS OF PHENOLIC CARBON HEATSHIELD
TWO STATIONS, ONE INCH THICK PH, CARB,, PROPERTIES FROM NASA CR 72301
KIRTLAND SAMPLE PROBLEM NO. 5

---REACTION KINETIC EQUATION---

$$\frac{d\rho/dt}{} = \gamma\left(B_A \exp(-E_A/T)\rho_{0A}\left(\frac{\rho_A-\rho_{RA}}{\rho_{0A}}\right)^{PSI_A}\right) + \gamma\left(B_B \exp(-E_B/T)\rho_{0B}\left(\frac{\rho_B-\rho_{RB}}{\rho_{0B}}\right)^{PSI_B}\right) + (1-\gamma)\left(B_C \exp(-E_C/T)\rho_{0C}\left(\frac{\rho_C-\rho_{RC}}{\rho_{0C}}\right)^{PSI_C}\right)$$

---REACTION KINETIC CONSTANTS---

REACTION	RHO0 (LB/CU FT)	RHOR (LB/CU FT)	B (1/SEC)	PSI	E (DEG R)	T REAC (DEG R)
A	60.75	32.40	.4480+10	3.00	.3680+05	600.
B	20.25	.00	.1400+05	3.00	.1540+05	1000.
C	97.40	97.40	.0000	.00	.0000	90000.

RESIN VOLUME FRACTION, GAMMA = .372(MASS FRACTION = .330)

---TIME INCREMENT INFORMATION---

INITIAL TIME (SEC) .000 FINAL TIME (SEC) 27.00

OUTPUT INTERVAL = 1.000 SEC FROM INITIAL TIME UNTIL 1.000 SEC
OUTPUT INTERVAL = 1.000 SEC FROM 1.000 SEC UNTIL 2.000 SEC
OUTPUT INTERVAL = 1.000 SEC FROM 2.000 SEC UNTIL FINAL TIME

MAXIMUM TIME STEP = .50 SECONDS

---NODAL DATA---

NODE NO.	MATL NO.	TEMPERATURE (DEG.RANKINE)	RELATIVE AREA	THICKNESS (INCHES)	NODAL DEPTH (INCHES)	CONT.RESISTANCE (SQFT-H-DEG/BTU)
1	1	530.00	.1788+01	.01000	.0000000	=.0000
2	1	530.00	.1773+01	.01000	.015000	=.0000
3	1	530.00	.1758+01	.02000	.030000	=.0000
4	1	530.00	.1738+01	.02000	.050000	=.0000
5	1	530.00	.1713+01	.03000	.075000	=.0000
6	1	530.00	.1683+01	.03000	.105000	=.0000
7	1	530.00	.1653+01	.03000	.135000	=.0000
8	1	530.00	.1613+01	.05000	.175000	=.0000
9	1	530.00	.1563+01	.05000	.225000	=.0000
10	1	530.00	.1513+01	.05000	.275000	=.0000
11	1	530.00	.1436+01	.10000	.350000	=.0000
12	1	530.00	.1338+01	.10000	.450000	=.0000
13	1	530.00	.1213+01	.15000	.573000	=.0000
14	1	530.00	.1063+01	.15000	.725000	=.0000
15	1	530.00	.8880-00	.20000	.900000	=.0000

*INITIAL EXTERNAL RADIUS 1.786 AREA PROP.TO RADIUS**1.00
MINIMUM THICKNESS OF LAST ABLATOR NODE (INCHES) .0200
THERE ARE 10 NODELETS ASSIGNED TO EACH ABLATING NODE

BACK WALL CONVECTION COEF BTU/FTSQ-SEC-DEG R	BACK WALL EMISSIVITY	RESERVOIR TEMPERATURE
.0000	=.000	530.00

---HEAT OF FORMATION OF MATERIAL CONSTITUENTS---
(BTU/LB)

PLASTIC	CHAR	GAS
-376.50	.00	.00

ENTHALPY DATUM TEMPERATURE = 536.000 DEG RANKINE

---MATERIAL THERMAL PROPERTY DATA---

MATERIAL NO. 1 VIRGIN PLASTIC — MATERIAL NO. 2 CHAR — MATERIAL NOS. 3 THROUGH 10 BACK-UP

MATERIAL NO. 1 DENSITY = 91.300 LB/CU FT

TEMPERATURE (DEG R)	SPECIFIC HEAT (BTU/LB-DEG)	CONDUCTIVITY (BTU/FT-SEC-DEG)	SENSIBLE ENTHALPY (BTU/LB)	EMISSIVITY
530.00	.2100	.0002250	-1.71	1.0000
800.00	.3600	.0002540	75.24	1.0000
1160.00	.3600	.0002940	204.84	1.0000
1500.00	.4720	.0002940	344.26	1.0000
2000.00	.4840	.0002940	585.26	1.0000
3000.00	.4930	.0002940	1073.78	1.0000
4000.00	.4980	.0002940	1569.28	1.0000
5000.00	.5000	.0002940	2068.28	1.0000
6000.00	.5000	.0002940	2568.28	1.0000

MATERIAL NO. 2 DENSITY = 73.222 LB/CU FT

TEMPERATURE (DEG R)	SPECIFIC HEAT (BTU/LB-DEG)	CONDUCTIVITY (BTU/FT-SEC-DEG)	SENSIBLE ENTHALPY (BTU/LB)	EMISSIVITY
530.00	.2100	.0002230	-1.92	1.0000
1000.00	.4300	.0002980	148.48	1.0000
1500.00	.4720	.0003039	373.98	1.0000
2000.00	.4840	.0003908	612.98	1.0000
3000.00	.4930	.0008490	1101.46	1.0000
4000.00	.4980	.0014300	1596.98	1.0000
5000.00	.5030	.0020950	2093.98	1.0000
6000.00	.5080	.0026100	2595.98	1.0000

---RESIN DECOMPOSITION GAS SENSIBLE ENTHALPY---

TEMPERATURE (DEG R)	900.00	1800.00	2700.00	3600.00	4500.00
ENTHALPY (BTU/LB)	-1782.00	-930.20	195.40	2299.00	3650.00
TEMPERATURE (DEG R)	5400.00	6300.00			
ENTHALPY (BTU/LB)	4696.00	5152.00			

B'UNDARY LAYER 'NTEGRAL MATRIX PROGRAM (BLIMP)

AEROTHERM CORPORATION,PALO ALTO,CALIF (RMK,EPB) 09 OCT 69 13:50:25

CASE CABLE SOLUTION FOR PH, CARBON HEATSHIELD

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

1 0 1 0 4 4 0 1 2 2 4 2 0 2 -0 -0 -0 1 -0 -0

PUNCH CONTROL
IDENT JSPEC
-0

J/UE TO NORM, ETA	NODAL PT, AT WHICH ETA NORM,	ETA VALUES						
8,000-01	5	0,000	2,000-01	6,000-01	1,200+00	2,000+00	3,000+00	5,000+00
HE,SEC		0,00000	7,00000+00	1,40000+01	1,80000+01	2,10000+01	2,30000+01	2,50000+01	2,70000+01
TAL ENTHALPY,BTU/LB		1,00000+04	1,01200+04	1,02500+04	1,01300+04	9,87000+03	9,16000+03	7,70000+03	5,70000+03
PRESSURE,ATM		1,12300-03	5,09000-02	1,03300+00	8,22000+00	4,04000+01	1,07300+02	2,03000+02	2,67500+02
RAD FLUX,B/SF2		-0,00000	-0,00000	-0,00000	-0,00000	-0,00000	-0,00000	-0,00000	-0,00000

TIME ,00000 SECONDS - 09 OCT 69 13150125

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	1.00797	.0000000	.0637526	.0000000	-.0000000	-.0000000	-.0000000	-.0000000
6	CARBON	12.01100	.0000000	.0637526	.0832970	-.0000000	-.0000000	-.0000000	-.0000000
7	NITROGEN	14.00800	.0546117	.0000000	.0000000	-.0000000	-.0000000	-.0000000	-.0000000
8	OXYGEN	16.00000	.0146875	.0106294	.0000000	-.0000000	-.0000000	-.0000000	-.0000000
99	ELECTRON	.00055	.0000000	.0000000	.0000000	-.0000000	-.0000000	-.0000000	-.0000000

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

```
1,  6 0,  3 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 12/60                C3
   ,18947+04  ,36622+05  ,14644+02  ,62254-04 -,16823+07  ,79841+02  500,0000  3000,0000 1
   ,18947+06  ,36622+05  ,14478+02  ,79225-04 -,64688+06  ,79841+02 3000,0000  5000,0000 1
1,  6 0,  2 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                C2
   ,00000     ,14412+05  ,58607+    ,95398-04 -,76662+06  ,12129+02  500,0000  3000,0000 2
   ,00000     ,14412+05  ,48513+    ,29161-03  ,30720+07  ,12129+02 3000,0000  5000,0000 2
1,  6 1,  8 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CO
  -,26417+02  ,22357+05  ,86904+01  ,11702-03 -,89821+06  ,65370+02  500,0000  3000,0000 1
  -,26417+05  ,22357+05  ,11550+02 -,42414-03 -,13156+08  ,65370+02 3000,0000  5000,0000 1
1,  1 0,  2 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 12/60                H
   ,52102+05  ,13423+05  ,48022+01  ,55547-04  ,17310+06  ,38862+02  500,0000  3000,0000 1
   ,52102+05  ,13423+05  ,30875+01  ,31502-03  ,92974+07  ,38862+02 3000,0000  5000,0000 1
1,  7 0,  2 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                N2
   ,00000     ,22165+05  ,86270+01  ,11609-03 -,10372+07  ,63765+02  500,0000  3000,0000 1
   ,00000     ,22165+05  ,98417+01 -,11623-03 -,61273+07  ,63765+02 3000,0000  5000,0000 1
1,  6 0,  1 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                C
   ,17089+04  ,13550+05  ,44443+01  ,22812-03  ,40983+06  ,49287+02  500,0000  3000,0000 1
   ,17089+04  ,13550+05  ,41221+01  ,26191-03  ,26289+07  ,49287+02 3000,0000  5000,0000 1
1,  1 1,  4 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CH4
  -,17895+05  ,53079+05  ,23095+02  ,67790-03 -,75506+07  ,82997+02  500,0000  3000,0000 1
  -,17895+05  ,53079+05  ,23605+02  ,37432-03 -,36823+07  ,82997+02 3000,0000  5000,0000 1
1,  6 1,  7 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 12/62                CN
   ,10900+04  ,23249+05  ,65591+01  ,11533-02  ,47952+06  ,66976+02  500,0000  3000,0000 1
   ,10900+04  ,23249+05  ,98801+01  ,33385-03 -,64945+07  ,66976+02 3000,0000  5000,0000 1
1,  1 1,  6 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CH
   ,14201+04  ,22130+05  ,82608+01  ,30221-03 -,10018+07  ,61612+02  500,0000  3000,0000 1
   ,14201+04  ,22130+05  ,70709+01  ,46328-03  ,55286+07  ,61612+02 3000,0000  5000,0000 1
1,  1 1,  6 1,  7 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CHN
   ,31200+05  ,35593+05  ,13702+02  ,95324-03 -,22896+07  ,75862+02  500,0000  3000,0000 1
   ,31200+05  ,35593+05  ,17889+02 -,[illegible]03-03 -,18367+08  ,75862+02 3000,0000  5000,0000 1
1,  1 1,  6 1,  8 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CHO
  -,29000+04  ,32367+05  ,12893+02  ,30064-03 -,20172+07  ,78983+02  500,0000  3000,0000 1
  -,29000+04  ,32367+05  ,10303+02  ,63331-03  ,12162+08  ,78983+02 3000,0000  5000,0000 1
1,  6 2,  8 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                CC
  -,94054+05  ,36535+05  ,14456+02  ,21039-03 -,18239+07  ,79848+02  500,0000  3000,0000 1
  -,94054+05  ,36535+05  ,19645+02 -,38156-04 -,60277+07  ,79848+02 3000,0000  5000,0000 1
2,  6 0,  2 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 9/61                 C2
   ,19900+04  ,24699+05  ,77661+01  ,69608-03  ,18565+06  ,68552+02  500,0000  3000,0000 1
   ,19900+06  ,24699+05  ,10416+02  ,56684-04 -,64020+07  ,68552+02 3000,0000  5000,0000 1
2,  1 2,  6 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                C2H2
   ,54190+05  ,48257+05  ,18998+02  ,78904-03 -,40904+07  ,84969+02  500,0000  3000,0000 1
   ,54190+05  ,48257+05  ,20395+02  ,38906-03 -,64530+07  ,84969+02 3000,0000  5000,0000 1
1,  1 1,  8 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 12/60                HO
   ,93300+04  ,21404+05  ,77319+01  ,39439-03 -,97396+06  ,61382+02  500,0000  3000,0000 1
   ,93300+04  ,21404+05  ,96514+01 -,44353-04 -,68611+07  ,61382+02 3000,0000  5000,0000 1
2,  1 0,  2 0,  0 0,  0 0,  0 0,  0 0,  OJANAF 03/61                H2
```

```
   ,00000       ,21210+05    ,71196+01    ,62195-03   -,71269+06    ,48469+02  500,0000  3000,0000 1
   ,00000       ,21210+05    ,68179+01    ,58985-03    ,26511+07    ,48469+02 3000,0000  9000,0000 1
2,  1 1,  3 0,   0 0,  0 0,   0 0,  0 0,   0JANAF 03/61                    H2O
  -,57798+05    ,30201+05    ,11225+02    ,81140-03   -,26080+07    ,48421+02  500,0000  3000,0000 1
  -,57768+05    ,30201+05    ,19728+02   -,19159-03   -,17360+08    ,48421+02 3000,0000  9000,0000 1
1,  7 0,  0 0,   0 0,  0 0,   0 0,  0 0,   0JANAF 03/61                    N
   ,11296+06    ,13437+05    ,48694+01    ,38352-04    ,89846+05    ,48098+02  500,0000  3000,0000 1
   ,11296+06    ,13437+05    ,42896+01    ,34084-03   -,41727+06    ,48098+02 3000,0000  9000,0000 1
   7 1,  8 0,   0 0,  0 0,   0 0,  0 0,   0JANAF 06/63                    NO
   ,21380+05    ,22700+05    ,87762+01    ,89903-04   -,78966+06    ,48849+02  500,0000  3000,0000 1
   ,21380+05    ,22700+05    ,91629+01    ,69788-05   -,21292+07    ,48849+02 3000,0000  9000,0000 1
1,  8 0,  0 0,   0 0,  0 0,   0 0,  0 0,   0JANAF 06/62                    O
   ,59559+05    ,13522+05    ,49723+01    ,38077-05    ,15475+05    ,30096+02  500,0000  3000,0600 1
   ,59559+05    ,13522+05    ,65749+01   -,22427-03   -,89178+07    ,30096+02 3000,0000  9000,0000 1
2,  8 0,  0 0,   0 0,  0 0,   0 0,  0 0,   0JANAF 03/61                    O2
   ,00000       ,23446+05    ,80437+01    ,51087-03   -,19272+06    ,67973+02  500,0000  3000,0000 1
   ,00000       ,23446+05    ,10307+02    ,29099-04   -,78308+07    ,67973+02 3000,0000  9000,0000 1
-, 99 0,  0 0,   0 0,  0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           E-
  -,00000       ,14901+05    ,49885+01   -,27280-05   -,13590+06    ,16456+02 2000,0000 10000,0000 1
  -,00000       ,14901+05    ,69885+01   -,27280-05   -,13590+06    ,16456+02 2000,0000 10000,0000 1
-   5-1, 99 0,   0 0,  0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           C+
   ,42899+04    ,15012+05    ,48966+01    ,18070-04    ,34000+05    ,48423+02 2000,0000 10000,0000 1
   ,42899+04    ,15012+05    ,48966+01    ,18070-04    ,34000+05    ,48423+02 2000,0000 10000,0000 1
1,  7-1, 99 0,   0 0,  0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           N+
   ,44664+06    ,15131+05    ,50175+01    ,81710-04   -,18410+07    ,49685+02 2000,0000 10000,0000 1
   ,44664+04    ,15131+05    ,90175+01    ,61710-04   -,18410+07    ,49685+02 2000,0000 10000,0000 1
4,  8 1, 99 0,   0 0,  0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           O2+
  -,20525+05    ,26757+05    ,11148+02   -,65670-04   -,77910+07    ,69919+02 2000,0000 10000,0000 1
  -,20525+05    ,26757+05    ,11143+02   -,65670-04   -,77910+07    ,69919+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+
   ,29628+04    ,24383+05    ,89362+01    ,37800-04   -,15090+07    ,66659+02 2000,0000 10000,0000 1
   ,29628+06    ,24383+05    ,89362+01    ,37800-04   -,15091+07    ,66659+02 2000,0000 10000,0000 1
-,  7 1,  8-1, 99 0,   0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           NO+
       92+06    ,24197+05    ,91022+01    ,27740-04   -,31660+07    ,65438+02 2000,0000 10000,0000 1
   ,  292+06    ,24197+05    ,91022+01    ,27740-04   -,31660+07    ,65438+02 2000,0000 10000,0000 1
-,  8-1, 99 0,   0 0,  0 0,   0 0,  0 0,   0CONVAIR ZPH=122 12/61           O+
   ,37200+06    ,14929+05    ,33627+01    ,30671-05    ,89020+07    ,48485+02 2000,0000 10000,0000 1
   ,37200+06    ,14929+05    ,33627+01    ,30671-05    ,89020+07    ,48485+02 2000,0000 10000,0000 1
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ELEMENT	HYDROGEN	CARBON	NITROGEN	OXYGEN	ELECTRON
BASE SP	H	C3	N2	CO	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 = 23.4000, AND FFA = .4310; FITGMW = 24.3000, AND GGA = .4940

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
C3	1,204	2	1,196	2
H	,258	2	,236	2
E-	,010	2	,008	2
C	,750	2	,726	2
CN	1,047	2	1,032	2
CHN	1,064	2	1,049	2
CO2	1,313	2	1,310	2
C2H2	1,047	2	1,032	2
H2	,348	2	,323	2
N	,802	2	,779	2
O	,849	2	,827	2
C+	,750	2	,726	2
O2+	1,144	2	1,133	2
NO+	1,113	2	1,101	2

SPECIES	F(I)	METHOD	G(I)	METHOD
CO	1,081	2	1,067	2
N2	1,081	2	1,067	2
C+	*****	0	*****	0
CH4	,850	2	,828	2
CH	,777	2	,753	2
CHO	1,097	2	1,084	2
C2	1,011	2	,995	2
HO	,872	2	,850	2
H2O	,895	2	,873	2
NO	1,113	2	1,101	2
O2	1,144	2	1,133	2
N+	,802	2	,779	2
CO+	1,081	2	1,067	2
O+	,849	2	,827	2

STAGNATION SOLUTION FOLLOWED BY BOUNDARY-LAYER EDGE EXPANSION

CP-FROZEN	CP-EQUIL	DLNM/DLNT	DLNM/DLNP	GAMMA
,34796+00	,57994+01	-,20950+01	,89349+01	,11036+01

TEMP = 5011,7894 DEG-K PRES = ,0011 ATM MOL WT = 17,9129670
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 ,00000 ,00000 ,00000
ENTHALPY = ,3555556+04 CAL/GM ENTROPY = ,39689+01 CAL/GM-DEG K
DENSITY = ,305317-05 LB/CUFT
VEL = ,000 FT/SEC MACH = -,000 AREA = ,000 SQFT/LB/SEC

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
C3	,00000	CO	,00000	H	,00000
N2	,24104+00	E-	,18839-03	C+	,00000
C	,00000	CH4	,00000	CN	,00000
CH	,00000	CHN	,00000	CHO	,00000
CO2	,00000	C2	,00000	C2H2	,00000
HO	,00000	H2	,00000	H2O	,00000
N	,49567-00	NO	,31112-03	O	,26260+00
O2	,15519-05	C+	,00000	N+	,14435+04
O2+	,43191-14	CO+	,00000	NO+	,16078+03
O+	,13173+04				

CP-FROZEN	CP-EQUIL	DLNM/DLNT	DLNM/DLNP	GAMMA
,33275+00	,58414+01	-,19670+01	,89389+01	,10883+01

TEMP = 4116,4436 DEG-K PRES = ,0000 ATM MOL WT = 20,1201180
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 ,00000 ,00000 ,00000
ENTHALPY = ,3824303+04 CAL/GM ENTROPY = ,39689+01 CAL/GM-DEG K

DENSITY = .179341-06 LB/CUFT
VEL = .125+05 FT/SEC MACH = .280+01 AREA = .732+03 SQFT/LB/SEC

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
C3	.00000	CO	.00000	H	.00000
N2	.39413-00	E-	.63069-04	C+	.00000
C	.00000	CH4	.00000	CN	.00000
CH	.00000	CHN	.00000	CHO	.00000
CO2	.00000	C2	.00000	C2H2	.00000
HO	.00000	H2	.00000	H2O	.00000
N	.31029-00	NO	.17564-03	O	.29527-00
O2	.75221-06	C+	.00000	N+	.42492-06
O2-	.42940-16	CO+	.00000	NO+	.61527-04
O-	.11144-05				

CP-FROZEN	CP-EQUIL	DLNM/DLNT	DLNM/DLNP	GAMMA
.33177-00	.37422+01	-.19208+01	.66788-01	.10854+01

TEMP = 4058.1013 DEG-K PRES = .0000 ATM MOL WT = 20.2936430
RELATIVE MASSES OF COMPONENTS 1,2 AND 3 .00000 .00000 .00000
ENTHALPY = .3705578+04 CAL/GM ENTROPY = .39689+01 CAL/GM-DEG K
DENSITY = .833025-07 LB/CUFT
VEL = .129+05 FT/SEC MACH = .293+01 AREA = .930+03 SQFT/LB/SEC

SPECIES	MOLE FR.	SPECIES	MOLE FR.	SPECIES	MOLE FR.
C3	.00000	CO	.00000	H	.00000
N2	.40617-00	E-	.57977-04	C+	.00000
C	.00000	CH4	.00000	CN	.00000
CH	.00000	CHN	.00000	CHO	.00000
CO2	.00000	C2	.00000	C2H2	.00000
HO	.00000	H2	.00000	H2O	.00000
N	.29571-00	NO	.16699-03	O	.29784-00
O2	.71238-06	C+	.00000	N+	.31208-06
O2-	.29553-16	CO+	.00000	NO+	.86364-04
O-	.90161-06				

DISTANCE,FT	,83330-00	,13333+01
ROKAP	,14900+00	,21870+00
XI,(LB/SEC)**2	,14479-08	,26131-08
PRESSURE RATIO	,26200-01	,19900-01
STATIC PRESSURE,ATM	,29423-04	,21898-04
EDGE VELOCITY,FT/SEC	,12490+05	,12911+05
BETA	,11240+00	,11664+00
INCIDENT RADIATION FLUX	,00000	,00000
ENTROPY DROP,BTU/LB R	,00000	,00000
*I/FLUX NORM,PARAMETER	*,46146+04	-,54085+04

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330-00FEET - - -, 09 OCT [illegible] 3190128

----OUTPUT----

,0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
1	3	0	1,7880	,00	,00	,0002	,00000

---ABLATION RATES---

B PRIME	B PRIME C	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS	M CHAR (LB/ORIG SQ FT)	M GAS
,00000	,00000	,000000	,000000	,000000	,000000

---RECESSIONS/RECESSION RATES---
(IN) / (IN/SEC)

SURFACE	CHAR (,02)	PYROLYSIS (,98)
,0000000/ ,0000000	,0000000/ ,0000000	,0000000/ ,0000000

---SURFACE ENERGY FLUX TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	,000	,000	,000	,000	,000
TOTAL	,000	,000	,000	,000	,000

---INTERIOR ENERGY TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDE	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	,000	,000	,000	,000	,000
TOTAL	,000	,000	,000	,000	,000

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	530,00	91,300	-378,21	9	1	530,00	91,300	-378,21
2	1	530,00	91,300	-378,21	10	1	530,00	91,300	-378,21
3	1	530,00	91,300	-378,21	11	1	530,00	91,300	-378,21
4	1	530,00	91,300	-378,21	12	1	530,00	91,300	-378,21
5	1	530,00	91,300	-378,21	13	1	530,00	91,300	-378,21
6	1	530,00	91,300	-378,21	14	1	530,00	91,300	-378,21
7	1	530,00	91,300	-378,21	15	1	530,00	91,300	-378,21
8	1	530,00	91,300	-378,21					

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330-00 FEET - - -09 OCT 69 13190127

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX,LIN ERROR		MAX,ERRORS IN CONSERVATION EQS, MOMENTUM		ENERGY		C3		CO		H	
1	4,112	1,934	,6147	,0910	4,+00	5	2,5+00	2	1,9+04	2	-8,2-05	2	5,1-05	4	-9,8-11	0
2	5,607	1,794	,5249	,2141	4,+00	5	2,3+00	2	1,8+04	2	1,1-05	2	-1,3-05	2	-3,1-09	0
3	6,960	1,625	,4012	,3315	3,+00	5	1,8+00	2	1,5+04	2	-4,6-06	2	-1,5-04	2	1,1-09	0
4	8,498	1,407	,2228	,6441	2,+00	5	1,2+00	2	1,0+04	2	1,2-04	2	-1,1-05	2	-4,7-10	0
5	9,940	1,248	,16731,0000		7,-01	10	-3,8-01	2	5,9+03	2	-8,5-05	2	6,8-05	2	8,3-10	0
6	11,396	1,212	,16651,0000		2,-07	6	1,4-02	2	-3,6+03	2	-8,2-05	2	1,4-04	2	-4,9-10	0
7	12,590	1,218	,16651,0000		2,-07	7	7,6-03	4	7,8+01	2	2,9-05	2	6,1-04	3	-2,4-10	0
8	13,640	1,217	,16651,0000		1,-07	6	5,1-04	3	2,5+00	2	2,3-04	2	-3,9-04	4	2,5-10	0
9	14,656	1,217	,16651,0000		6,-08	6	1,4-05	2	-1,3+00	2	-1,9-04	2	2,4-06	3	7,4-10	0
10	15,691	1,217	,16651,0000		4,-08	5	1,0-05	2	2,0-01	2	-4,5-05	2	-4,9-04	3	-1,4-09	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING DIFFUSIONAL PARAMETER		HEAT FLUXES TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
1,217+00	1,448-09	1,490-01	2,942-05	1,249+04	1,124-01	2,187-04	1,371+00	1,371+00	0,000	1,371+00

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
5,241-02	0,000	0,000	0,000	0,000	1,422-14	-9,469-08	1,194-07	-6,068-08

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*CH (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN
1,350-04	1,381-04	0,000	0,000	0,000	-0,000	9,348-01	-4,479-02	-2,357-02

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
1,401-01	1,140-01	1,140-01	1,774-01	2,383+01	-0,000	-9,284+02	8,179-01	6,038-01

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FT2S0)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0,000	0,000	0,000	0,000	1,665+01	5,241-02	7,129+01	1,709+03	1,089+03	7,129+01	5,300+02	9,969+06
3,308-03	2,435-01	6,084-03	9,471-02	2,829+01	5,228-02	5,405+02	2,060+03	1,938+03	9,312+02	2,529+03	4,564+06
4,656-02	7,304-01	6,883-02	2,003-01	3,480+01	5,041-02	1,726+03	2,809+03	1,077+03	1,591+03	3,934+03	3,659+06
1,492-01	1,461+00	3,182-01	4,809-01	3,972+01	4,347-02	4,069+03	3,594+03	-6,937+02	3,346+03	6,020+03	2,958+06
3,589-01	2,435+00	9,526-01	8,000-01	2,590+01	2,418-02	7,297+03	2,989+03	-1,860+03	5,263+03	7,074+03	2,729+06
6,610-01	3,652+00	2,063+00	9,778-01	3,309+02	2,849-03	9,481+03	6,947+02	-3,959+02	6,502+03	7,345+03	2,678+06
1,302+00	6,087+00	4,494+00	1,000+00	-1,489+02	-1,249-03	1,000+04	-2,681+02	-2,969+02	6,889+03	7,413+03	2,666+06

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
0,000	2,194-06	1,069-05	3,743+00	-4,291-02	-4,323-07	1,001+00	7,443-01	2,886+31	0,000	0,000
3,308-03	4,597-07	2,994-05	2,197+00	2,895-01	1,230-05	7,046-01	7,343-01	2,886+01	0,000	2,866-01
4,656-02	2,730-07	3,952-05	1,722+00	3,060-01	1,712-05	7,062-01	7,423-01	2,886+01	0,000	9,192-01
1,492-01	1,582-07	5,151-05	1,301+00	3,174-01	2,319-05	7,094-01	7,431-01	2,869+01	0,000	1,595+00
3,589-01	1,236-07	5,627-05	1,110+00	3,264-01	2,610-05	7,037-01	7,386-01	2,170+01	0,000	2,377+00
6,610-01	1,123-07	5,711-05	1,023+00	3,313-01	2,696-05	7,016-01	7,372-01	2,047+01	0,000	2,774+00
1,302+00	1,093-07	5,731-05	1,000+00	3,328-01	2,721-05	7,008-01	7,371-01	2,012+01	0,000	2,799+00

	DISTANCE FROM WALL,FT						
	0.000	3.308-03	4.656-02	1.492-01	3.589-01	6.610-01	1.302+00
ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA							
C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	1.446-05	-1.099-06	-1.045-06	-1.276-06	-1.050-06	-2.971-07	1.088-07
	-6.389-05	1.109-07	-3.170-07	2.318-07	6.139-07	1.667-07	0.000
CO	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	2.431-05	9.691-07	4.260-07	4.908-07	3.903-07	8.428-08	-3.517-08
	-9.590-05	-1.107-06	3.402-08	-6.211-08	-2.914-07	-4.906-08	0.000
H	0.000	1.471-11	-4.981-11	-1.093-10	-1.988-11	1.059-12	0.000
	6.573-11	5.910-11	-3.301-10	1.572-10	2.649-11	7.809-12	-8.779-12
	-4.369-11	-7.705-10	6.934-10	-1.342-10	-1.926-11	-6.895-12	0.000
N2	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01
	-3.877-03	1.335-07	6.190-07	8.292-07	6.600-07	2.128-07	-7.363-08
	1.598-04	9.971-07	2.824-07	-1.696-07	-3.674-07	-1.176-07	-0.000
MOLE FRACTIONS							
C3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.881-01	7.876-01	7.233-01	6.378-01	5.034-01	4.187-01	3.941-01
E-	0.000	0.000	2.054-09	5.117-06	3.932-05	5.779-05	6.308-05
C-	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	7.390-13	1.627-06	1.498-02	1.778-01	2.806-01	3.104-01
NO	1.300-16	8.139-04	9.142-03	8.174-04	2.712-04	1.928-04	1.756-04
O	1.000-30	8.599-05	1.926-01	3.464-01	3.184-01	3.009-01	2.993-01
O2	2.119-01	2.115-01	1.149-01	3.349-05	1.798-06	8.958-07	7.919-07
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	2.931-24	1.142-11	4.873-08	2.804-07	4.249-07
O2+	0.000	0.000	6.703-15	4.202-16	7.930-17	4.881-17	4.293-17
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	2.054-09	5.115-06	3.900-05	5.646-05	6.154-05
O+	0.000	0.000	6.739-18	1.343-09	2.732-07	8.489-07	1.119-06

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TIME    ,70000+01 SECONDS - - - - - - - - - - - - - - - - - - - - - - - - - -  09 OCT 69 13:50:43

    CP-FROZEN     CP-EQUIL    DLNM/DLNT    DLNM/DLNP      GAMMA
      ,34958-00    ,42177+01  -,17737+01   ,88824-01    ,11234+01

   TEMP = 5915,9953 DEG-K       PRES =    ,0509 ATM       MOL WT = 18,2659570
RELATIVE MASSES OF COMPONENTS 1,2 AND 3      ,00000      -,00000      -,00000
     ENTHALPY =     ,5622222+04 CAL/GM      ENTROPY =    ,35620+01 CAL/GM-DEG K
     DENSITY =     ,119547-03 LB/CUFT
VEL =     ,000     FT/SEC    MACH =  -,000        AREA =    ,000     SQFT LB/SEC

SPECIES    MOLE FR,          SPECIES    MOLE FR,          SPECIES    MOLE FR,
C3           ,00000          CO           ,00000          H            ,00000
N2           ,26469-00       E-           ,35584-03       C+           ,00000
C            ,00000          CH4          ,00000          CN           ,00000
CH           ,00000          CHN          ,00000          CHO          ,00000
CO2          ,00000          C2           ,00000          C2H2         ,00000
HO           ,00000          H2           ,00000          H2O          ,00000
N            ,46664-00       NO           ,11861-02       O            ,26676-00
O2           ,10951-04       O+           ,00000          N+           ,41249-04
O2-          ,13424-11       CO+          ,00000          NO+          ,28494-03
O+           ,29252-04


    CP-FROZEN     CP-EQUIL    DLNM/DLNT    DLNM/DLNP      GAMMA
      ,33251-00    ,39520+01  -,15053+01   ,60074-01    ,11015+01

   TEMP = 4669,4916 DEG K       PRES =    ,0013 ATM       MOL WT = 20,7339790
RELATIVE MASSES OF COMPONENTS 1,2 AND 3      ,00000      -,00000      -,00000
     ENTHALPY =     ,3667643+04 CAL/GM      ENTROPY =    ,35620+01 CAL/GM-DEG K
     DENSITY =     ,480442-05 LB/CUFT
VEL =     ,133+05 FT/SEC    MACH =     ,282+01    AREA =    ,167+02 SQFT/LB/SEC

SPECIES    MOLE FR,          SPECIES    MOLE FR,          SPECIES    MOLE FR,
C3           ,00000          CO           ,00000          H            ,00000
N2           ,43613-00       E-           ,10250-03       C+           ,00000
C            ,00000          CH4          ,00000          CN           ,00000
CH           ,00000          CHN          ,00000          CHO          ,00000
CO2          ,00000          C2           ,00000          C2H2         ,00000
HO           ,00000          H2           ,00000          H2O          ,00000
N            ,25924-00       NO           ,71241-03       O            ,30370-00
O2           ,61065-05       C+           ,00000          N+           ,82988-06
O2-          ,14781-13       CO+          ,00000          NO+          ,99710-04
O+           ,19632-05


    CP-FROZEN     CP-EQUIL    DLNM/DLNT    DLNM/DLNP      GAMMA
      ,33152-00    ,38436+01  -,14488+01   ,56632-01    ,11005+01

   TEMP = 4586,6417 DEG-K       PRES =    ,0010 ATM       MOL WT = 20,9252690
RELATIVE MASSES OF COMPONENTS 1,2 AND 3      ,00000      -,00000      -,00000
     ENTHALPY =     ,3537262+04 CAL/GM      ENTROPY =    ,35620+01 CAL/GM-DEG K
     DENSITY =     ,344457-05 LB/CUFT
VEL =     ,137+05 FT/SEC    MACH =     ,295+01    AREA =    ,212+02 SQFT/LB/SEC

SPECIES    MOLE FR,          SPECIES    MOLE FR,          SPECIES    MOLE FR,
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C3	.00000	CO	.00000	H	.00000
N2	.44942-00	E-	.92191-04	C+	.00000
C	.00000	CH4	.00000	CN	.00000
CH	.00000	CHN	.00000	CHO	.00000
CO2	.00000	C2	.00000	C2H2	.00000
HO	.00000	H2	.00000	H2O	.00000
N	.44316-00	NO	.68173-03	O	.30695-00
O2	.38860-05	C+	.00000	N+	.57888-06
O2-	.10298-13	CO+	.00000	NO+	.90976-04
O+	.15370-03				

DISTANCE,FT	,83330-00	,13333+01
ROKAP	,14900-00	,21870-00
XI,(LB/SEC)**2	,89161-07	,12483-06
PRESSURE RATIO	,26200-01	,19500-01
STATIC PRESSURE,ATM	,13336-02	,99255-03
EDGE VELOCITY,FT/SEC	,13271+05	,13707+05
BETA	,10939-00	,11352+00
INCIDENT RADIATION FLUX	,00000	,00000
ENTROPY DROP,BTU/LB R	,00000	,00000
-1/FLUX NORM,PARAMETER	-,66769+03	-,78186+03

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330+00FEET - - -, 09 OCT 69 13:50:43

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330-00 FEET - - -09 OCT 69 13:50:44

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX.LIN ERROR	MAX.ERRORS IN CONSERVATION EQS. MOMENTUM		ENERGY		C3		CO		H	
1	2.391	1.220	.1632	.4599	1.-07	6 1.3-02	3	1.1+02	2	4.6-05	2	1.2-03	3	1.2-09	0
2	3.408	1.227	.1603	1.0000	1.-07	6 6.6-03	2	8.7+02	2	-4.5-05	2	9.0-05	4	-6.0-10	0
3	4.517	1.229	.1604	1.0000	1.-07	5 -2.1-03	2	4.4+02	2	1.5-04	2	-5.4-04	2	3.9-10	0
4	5.622	1.228	.1604	1.0000	1.-07	6 8.0-04	3	8.7+00	2	-1.1-04	2	3.3-04	2	2.5-11	0
5	6.634	1.228	.1604	1.0000	6.-08	8 1.0-05	2	3.7-01	2	1.1-05	2	-2.7-05	7	-1.7-11	0

ALPHA	XI (LB/SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
1.228+00	6.916-08	1.490-01	1.334-03	1.327+04	1.094-01	1.498-03	9.606+00	9.606+00	0.000	9.605+00

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
3.823-01	0.000	0.000	0.000	0.000	-2.853-14	2.034-09	2.883-08	-3.086-08

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
9.268-04	9.561-04	0.000	0.000	0.000	-0.000	2.873+00	6.717-03	7.186-03

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
2.221-02	1.641-02	1.641-02	2.799-02	9.559+02	-0.000	8.623+01	-3.429-02	-1.993-02

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FT**2)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.000	0.000	0.000	0.000	1.608+01	3.823-01	7.319+01	1.491+03	2.366+03	7.319+01	9.000+02	4.692+08
8.421-04	2.457-01	5.982-03	5.330-02	2.731+01	3.809-01	9.010+02	2.032+03	1.689+03	4.911+02	2.392+03	2.127+08
7.293-03	7.371-01	6.812-02	2.057-01	3.471+01	3.680-01	1.703+03	2.860+03	1.031+03	1.554+03	4.397+03	1.969+08
2.267-02	1.474+00	3.182-01	4.787-01	3.938+01	3.190-01	4.091+03	3.620+03	-6.028+02	3.288+03	6.202+03	1.321+08
5.536-02	2.457+00	9.393-01	8.000-01	2.601+01	1.777-01	7.387+03	3.028+03	-1.924+03	5.106+03	7.931+03	1.168+08
1.035-01	3.689+00	2.079+00	9.790-01	3.132+02	1.978-02	9.629+03	6.647+02	-3.772+02	6.254+03	8.313+03	1.141+08
2.097-01	6.142+00	4.533+00	1.000+00	-1.419+02	-8.766-03	1.012+04	-2.621+02	-2.171+02	6.603+03	8.489+03	1.139+08

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
0.000	1.054-04	1.029-05	3.650+00	-8.500-02	-1.00 -06	8.709-01	7.443-01	2.886+01	0.000	0.000
8.421-04	2.203-05	2.887-05	2.257+00	2.872-01	1.17?-05	7.044-01	7.443-01	2.886+01	0.000	3.042-01
7.293-03	1.133-05	4.267-05	1.716+00	3.079-01	1.859-05	7.069-01	7.424-01	2.728+01	0.000	9.108-01
2.267-02	7.021-06	5.261-05	1.311+00	3.179-01	2.379-05	7.096-01	7.434-01	2.384+01	0.000	1.971+00
5.536-02	5.113-06	6.094-05	1.108+00	3.269-01	2.825-05	7.042-01	7.399-01	2.221+01	0.000	2.393+00
1.035-01	4.627-06	6.225-05	1.022+00	3.311-01	2.934-05	7.023-01	7.377-01	2.106+01	0.000	2.703+00
2.097-01	4.504-06	6.294-05	9.999-01	3.325-01	2.964-05	7.017-01	7.374-01	2.073+01	0.000	2.814+00

DISTANCE FROM WALL,FT

0.000	8.421-04	7.293-03	2.267-02	5.536-02	1.035-01	2.097-01

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

C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	8.220-06	1.137-08	7.406-07	7.868-07	6.883-07	2.281-07	-8.813-08
	-3.341-05	1.484-06	6.264-08	-1.002-09	-3.746-07	-1.275-07	0.000
CO	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	-8.061-05	1.977-06	-2.434-07	-1.133-09	-2.316-07	-1.140-07	4.801-08
	2.531-04	-3.704-06	1.768-07	-1.204-09	9.576-08	6.594-08	0.000
H	0.000	-3.798-12	6.000-12	2.102-11	6.317-12	3.709-12	0.000
	-4.426-12	-2.690-11	6.638-11	-2.346-11	-8.084-12	3.838-12	-6.898-12
	-8.982-11	1.890-10	-1.219-10	1.964-11	9.709-12	-4.383-12	0.000
N2	7.650-01	7.650-01	7.650-01	7.650-01	7.696-01	7.650-01	7.650-01
	9.239-05	-1.308-06	-4.973-07	-6.739-07	-4.868-07	-1.141-07	3.712-08
	-2.197-04	2.220-06	-2.390-07	2.206-07	2.788-07	6.196-08	-0.000

MOLE FRACTIONS

C3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.861-01	7.878-01	7.369-01	6.469-01	5.379-01	4.990-01	4.361-01
E-	0.000	0.000	6.330-09	2.992-06	5.909-05	9.292-05	1.025-04
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	1.098-14	3.999-06	3.720-03	1.399-01	2.316-01	2.893-01
NO	1.588-17	5.229-04	1.702-02	4.613-03	1.101-03	7.702-04	7.183-04
O	1.000-30	3.688-06	1.092-01	3.439-01	3.290-01	3.065-01	3.037-01
O2	2.119-01	2.117-01	1.372-01	8.712-04	1.947-05	7.294-06	6.104-06
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	1.987-22	5.048-13	7.512-08	5.545-07	8.308-07
O2+	0.000	0.000	5.536-13	2.496-13	2.777-14	1.677-14	1.478-14
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	6.331-09	2.991-06	5.868-05	9.091-05	9.973-05
O+	0.000	0.000	9.208-17	2.159-10	4.169-07	1.475-06	1.965-06

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330-00 FEET - - -09 OCT 69 13:50:50

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX.LIN ERROR	MAX.ERRORS IN CONSERVATION EQS. MOMENTUM		ENERGY		C3		CO		H	
1	8.457	1.226	.1622	.4999	1.-07	6 -1.3-02	3	-1.0-02	2	-1.3-05	2	-1.9-04	4	3.1-10	0
2	9.516	1.223	.16361	.0000	1.-07	4 -6.5-03	3	-9.2-01	2	4.0-05	2	-2.2-04	4	4.0-10	0
3	10.561	1.223	.16361	.0000	1.-07	9 -1.3-04	5	1.7-00	2	9.2-06	2	2.3-04	4	-8.3-10	0
4	11.592	1.223	.16361	.0000	1.-07	6 1.7-05	2	4.6-01	2	-1.4-04	2	-4.6-05	4	1.3-09	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
1.223-00	1.448-05	1.490-01	2.942-05	1.249-04	1.124-01	8.167-04	1.379-00	1.379-00	0.000	1.300-00

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
5.295-02	0.000	0.000	0.000	0.000	-6.958-14	-3.376-08	3.995-08	-6.194-09

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*CH (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN
1.354-04	2.390-04	0.000	0.000	0.000	-0.000	-1.431-02	1.888-02	2.937-03

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
1.404-01	1.149-01	1.149-01	1.784-01	2.383-01	-0.000	1.915-03	-4.437-01	-2.230-01

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FTSQ)	TOTAL ENTHALPY,H (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.000	0.000	0.000	0.000	1.636-01	5.255-02	7.319-01	1.482-03	2.363-03	7.319-01	9.000-02	1.026-07
9.836-03	2.446-01	6.031-03	9.397-02	2.777-01	5.253-02	4.989-02	2.030-03	1.289-03	4.898-02	2.388-03	4.697-06
4.819-02	7.337-01	6.838-02	2.066-01	3.462-01	5.049-02	1.681-03	2.809-03	1.084-03	1.948-03	3.913-03	3.649-06
1.501-01	1.467+00	3.177-01	4.791-01	3.968-01	4.398-02	4.031-03	3.600-03	-6.421-02	3.316-03	5.976-03	2.969-06
3.604-01	2.446+00	9.543-01	8.000-01	2.591-01	2.421-02	7.249-03	2.972-03	-1.866-03	5.251-03	7.071-03	2.729-06
6.638-01	3.669+00	2.070+00	9.782-01	3.259-02	2.789-03	9.484-03	6.896-02	-3.914-02	5.303-03	7.349-03	2.678-06
1.308+00	6.114+00	4.512+00	1.000+00	-1.460-02	-1.228-03	1.000-04	-2.676-02	-2.942-02	6.885-03	7.413-03	2.666-06

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	RHOSC*EPS /RHOE*MUE	MACH NUMBER
0.000	2.325-06	1.029-05	3.818+00	-8.930-02	-1.004-06	8.709-01	7.443-01	2.886+01	0.000	0.000
5.838-03	4.869-07	2.883-05	2.240+00	2.871-01	1.179-05	7.043-01	7.443-01	2.886+01	0.000	2.902-01
4.819-02	2.757-07	3.941-05	1.734+00	3.097-01	1.706-05	7.062-01	7.424-01	2.677+01	0.000	9.518-01
1.501-01	1.596-07	5.127-05	1.308+00	3.171-01	2.305-05	7.094-01	7.432-01	2.347+01	0.000	1.992+00
3.604-01	1.237-07	5.626-05	1.110+00	3.264-01	2.609-05	7.037-01	7.386-01	2.171+01	0.000	2.378+00
6.638-01	1.123-07	5.711-05	1.023+00	3.313-01	2.696-05	7.016-01	7.372-01	2.147+01	0.000	2.779+00
1.308+00	1.093-07	5.731-05	1.000+00	3.328-01	2.721-05	7.008-01	7.371-01	2.012+01	0.000	2.799+00

DISTANCE FROM WALL,FT

0.000 5.838-03 4.819-02 1.501-01 3.604-01 6.638-01 1.308+00

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

C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	2.571-05	-1.073-06	-3.630-07	-4.450-07	-3.864-07	-9.784-08	3.929-08
	-1.095-04	1.191-06	-1.117-07	5.983-08	2.360-07	5.442-08	0.000
CO	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	-3.642-05	1.201-06	6.430-08	2.860-08	1.906-07	2.438-08	-6.709-09
	1.538-04	-2.325-06	-4.866-08	1.636-07	-1.359-07	-1.271-08	0.000
H	0.000	-7.338-12	-8.979-11	-1.709-10	-8.797-11	-1.970-11	0.000
	-2.466-11	-3.535-11	-3.018-10	8.062-11	8.894-11	2.929-11	-1.641-11
	-4.373-11	-5.447-10	5.212-10	8.904-12	-4.881-11	-1.867-11	0.000
N2	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01
	1.071-05	-1.285-07	2.990-07	4.163-07	1.997-07	7.343-08	-2.853-08
	-4.433-05	8.740-07	1.598-07	-2.259-07	-1.000-07	-4.169-08	-0.000

MOLE FRACTIONS

C3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.861-01	7.878-01	7.269-01	6.393-01	5.042-01	4.186-01	3.941-01
E-	0.000	0.000	1.786-09	4.608-06	3.914-05	5.780-05	6.308-05
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	6.563-14	1.416-06	1.317-02	1.769-01	2.806-01	3.104-01
NO	1.588-17	5.149-04	9.110-03	8.963-04	2.721-04	1.928-04	1.796-04
O	1.000-30	2.378-05	1.446-01	3.447-01	3.186-01	3.009-01	2.953-01
O2	2.119-01	2.117-01	1.198-01	3.847-05	1.812-06	8.947-07	7.819-07
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	1.653-24	7.537-12	4.775-08	2.806-07	4.249-07
O2+	0.000	0.000	6.295-15	4.513-14	7.972-17	4.880-17	4.293-17
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	1.786-09	4.607-06	3.882-05	5.667-05	6.184-05
O+	0.000	0.000	4.918-18	1.033-09	2.696-07	8.493-07	1.119-06

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330-00 FEET - - -09 OCT 69 13:50:55

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX,LIN ERROR		MAX,ERRORS IN CONSERVATION EQS, MOMENTUM		ENERGY		CO		H	
1	13,290	1,101	,8698	,2210	1,-07	1	-5,0-02	1	-1,0+03	1	5,9-02	1	-7,8-03	1	4,7-03	0
2	16,381	1,135	,7063	,2010	2,-07	5	3,0+00	2	2,7+04	1	4,4-02	1	-6,2-03	1	3,4-03	0
3	18,636	1,170	,5587	,2420	1,-07	5	2,4+00	2	2,3+04	1	3,6-02	2	-6,2-03	1	2,8-03	0
4	20,549	1,205	,4253	,3066	2,-07	5	1,8+00	2	1,8+04	1	2,8-02	2	3,9-03	1	2,2-03	0
5	22,490	1,242	,3042	,4272	2,-07	5	1,3+00	2	1,3+04	1	2,0-02	2	-4,3-03	1	1,6-03	0
6	24,507	1,281	,1956	,7092	2,-07	5	7,9-01	2	9,4+03	1	1,2-02	1	-1,6-03	1	9,1-04	0
7	26,491	1,299	,15101	,0000	1,-07	5	2,2-01	2	2,3+03	1	3,5-03	2	1,4-03	1	2,8-04	0
8	28,224	1,298	,15081	,0000	2,-07	7	-4,5-03	3	5,9+01	3	-2,0-04	2	-1,0-03	3	-1,6-05	0
9	29,774	1,298	,15081	,0000	1,-07	7	-2,7+04	4	-1,7+01	2	3,2-04	2	1,1-03	2	1,6-05	0
10	31,216	1,298	,15081	,0000	6,-08	6	-2,5-05	4	-1,0+00	2	-5,4-04	2	-1,4-04	2	-2,1-05	0

ALPHA	XI (FT)/SEC)+2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
1,298+00	1,448-09	1,490-01	2,942-05	1,249+04	1,124-01	2,167-04	1,488+00	1,498+00	0,000	1,349+00

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
4,982-02	0,000	1,084-05	0,000	1,084-05	-6,501-07	-7,822-06	7,839-06	6,372-07

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
1,283-04	1,363-04	7,950-02	0,000	7,950-02	1,392-04	1,409-04	1,409-04	1,390-04

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
1,665-01	8,754-02	1,008-01	1,881+01	2,383+01	1,923-01	1,922-01	1,923-01	1,908-01

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (BU/HE)	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)
0,000	0,000	-5,000-02	0,000	1,508-01	4,982-02	-9,182+02	1,319+03	3,113+03	-9,184+02	5,000+02	1,026+07
7,329-03	2,595-01	-4,375-02	5,270-02	2,554-01	4,978-02	-4,712+02	2,126+03	1,492+03	-4,801+02	2,343+03	4,742+06
4,918-02	7,785-01	2,089-02	2,019-01	3,197-01	4,858-02	8,333+02	2,901+03	8,402+02	7,060+02	3,660+03	3,794+06
1,386-01	1,557+00	2,804-01	4,719-01	3,738-01	4,314-02	3,346+03	3,555+03	-2,523+02	2,652+03	4,778+03	3,320+06
3,470-01	2,595+00	9,509-01	8,000-01	2,584-01	2,422-02	6,900+03	3,293+03	-2,012+03	4,906+03	6,989+03	2,745+06
6,683-01	3,893+00	2,141+00	9,834-01	2,430-02	2,089-03	9,479+03	6,820+02	-3,708+02	6,466+03	7,340+03	2,679+06
1,393+00	6,486+00	4,734+00	1,000+00	-1,153-02	-9,696-04	1,000+04	-2,802+02	-2,614+02	6,885+03	7,413+03	2,666+06

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
0,000	2,393-06	1,029-07	3,928+00	-2,065-01	-2,810-06	7,557-01	7,413-01	2,970+01	0,000	0,000
7,329-03	5,100-07	2,846-05	2,317+00	3,061-01	1,246-05	7,028-01	7,414-01	2,966+01	0,000	2,940-01
4,918-02	2,999-07	3,774-05	1,806+00	3,214-01	1,820-05	6,666-01	7,402-01	2,724+01	0,000	9,343-01
1,386-01	1,950-07	4,408-05	1,372+00	3,264-01	2,267-05	6,346-01	7,407-01	2,313+01	0,000	1,638+00
3,470-01	1,250-07	5,583-05	1,114+00	3,319-01	2,758-05	6,710-01	7,379-01	2,169+01	0,000	2,389+00
6,683-01	1,122-07	5,707-05	1,022+00	3,324-01	2,729-05	6,951-01	7,370-01	2,044+01	0,000	2,789+00
1,393+00	1,093-07	5,731-05	1,000+00	3,328-01	2,721-05	7,008-01	7,371-01	2,012+01	0,000	2,799+00

	DISTANCE FROM WALL,FT						
	0.000	7.329-03	4.918-02	1.386-01	3.470-01	6.683-01	1.353+00
ELEMENTAL FRACTIONS AND THEIR FIRST AND SECOND DERIVATIVES WITH RESPECT TO ETA							
C3	-1.172-01	-1.197-01	-1.269-01	-1.405-01	-1.593-01	-1.730-01	-1.764-01
	-7.157-03	-1.212-02	-1.557-02	-1.950-02	-1.672-02	-4.331-03	1.704-03
	-1.914-02	-6.647-03	-5.047-03	2.684-03	9.547-03	2.326-03	0.000
CO	4.031-01	4.035-01	4.045-01	4.064-01	4.090-01	4.109-01	4.114-01
	9.630-04	1.692-03	2.276-03	2.729-03	2.339-03	6.090-04	-2.380-04
	2.808-03	9.324-04	7.096-04	-3.794-04	-1.334-03	-3.249-04	0.000
H	4.671-03	4.474-03	3.907-03	2.829-03	1.346-03	2.690-04	0.000
	-5.608-04	-9.965-04	-1.229-03	-1.539-03	-1.319-03	-3.417-04	1.344-04
	-1.525-03	-5.245-04	-3.981-04	2.117-04	7.932-04	1.835-04	0.000
N2	7.094-01	7.117-01	7.185-01	7.313-01	7.490-01	7.618-01	7.650-01
	6.755-03	1.139-02	1.463-02	1.832-02	1.570-02	4.068-03	-1.600-03
	1.786-02	6.239-03	4.739-03	-2.920-03	-8.966-03	-2.184-03	-0.000
MOLE FRACTIONS							
C3	1.000-30	1.000-30	1.000-30	2.857-28	1.659-17	1.678-18	0.000
CO	1.000-30	1.780-05	5.637-02	6.471-02	2.879-02	5.296-03	0.000
H	1.000-30	4.593-07	2.942-02	6.446-02	2.897-02	5.454-03	0.000
N2	7.519-01	7.533-01	6.961-01	6.023-01	5.055-01	4.171-01	3.941-01
E-	0.000	0.000	2.219-10	1.119-07	3.226-05	5.696-05	6.308-05
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	1.000-30	3.409-32	9.628-17	6.601-11	1.774-04	1.630-04	0.000
CH4	1.000-30	1.779-33	1.720-23	1.279-26	2.679-32	1.000-30	0.000
CN	1.000-30	5.317-27	3.199-15	3.866-11	1.990-06	1.126-06	0.000
CH	1.000-30	1.000-30	2.113-19	2.309-15	1.598-11	1.611-12	0.000
CHN	1.000-30	2.088-22	6.482-14	1.159-12	1.124-11	5.304-13	0.000
CHO	1.000-30	1.413-16	3.981-10	1.601-10	4.679-12	1.322-13	0.000
CO2	1.376-01	1.316-01	4.921-02	2.169-04	5.398-08	4.682-09	0.000
C2	1.000-30	1.000-30	2.949-28	3.159-20	3.792-11	1.283-11	0.000
C2H2	1.000-30	1.000-30	1.212-24	2.710-24	1.763-22	4.689-25	0.000
HO	1.592-28	8.496-09	1.312-02	3.953-04	2.679-07	2.620-08	0.000
H2	1.000-30	4.835-06	6.232-03	5.432-05	1.494-08	2.663-10	0.000
H2O	6.868-02	6.577-02	2.529-02	1.178-06	2.356-13	2.010-13	0.000
N	1.000-30	2.778-14	2.209-07	1.596-04	1.486-01	2.773-01	3.104-01
NO	6.880-14	2.066-04	5.022-03	2.869-03	2.615-04	1.892-04	1.796-04
O	1.000-30	7.330-06	4.329-02	2.629-01	2.897-01	2.944-01	2.993-01
O2	4.167-02	4.895-02	7.593-02	2.340-03	1.780-06	8.679-07	7.919-07
C+	0.000	0.000	1.493-28	1.319-18	1.819-07	9.395-08	0.000
N+	0.000	0.000	8.152-27	6.267-16	2.845-08	2.730-07	4.249-07
O2-	0.000	0.000	7.756-16	2.237-15	6.818-17	4.660-17	4.283-17
CO+	0.000	0.000	4.098-20	2.397-14	2.435-08	2.126-08	0.000
NO+	0.000	0.000	2.219-10	1.119-07	3.185-05	5.531-05	6.154-05
O+	0.000	0.000	6.601-20	1.216-13	1.784-07	8.206-07	1.119-06

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330+00 FEET - - -09 OCT 69 13:51:14

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP ERROR	MAX.LIN MOMENTUM	MAX.ERRORS IN CONSERVATION EQS. ENERGY	C3	CO	H
1	33.650	1.300	.1495	1.-07	6 1.3-02	5 -2.6+02	3 -5.9-04	2 -2.1-04	3 -4.7-05 0
2	35.175	1.303	.14821,0000	1.-07	6 7.3-03	5 -1.4+02	3 -3.3-04	2 -5.9-04	3 -2.6-05 0
3	36.680	1.303	.14821,0000	1.-07	7 -1.1-03	4 -9.1+00	2 -3.5-04	2 4.1-04	2 9.7-06 0
4	38.091	1.303	.14821,0000	1.-07	6 -5.7-05	4 -1.7+00	2 2.8-04	2 1.9-04	2 9.1-06 0
5	39.475	1.303	.14821,0000	1.-07	5 -4.9-06	2 -1.4+00	2 -1.4-04	2 -1.3-03	2 -1.0-05 0
6	40.896	1.303	.14821,0000	1.-07	6 -1.8-05	2 1.9+00	2 1.2-04	2 1.9-03	2 -3.9-05 0

ALPHA	XI (LB /SEC)+*2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
1.303+00	6.916-06	1.490-01	1.334-03	1.327+04	1.094-01	1.498-03	1.025+01	1.032+01	0.000	9.321+00

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
3.627-01	0.000	7.489-03	0.000	7.489-03	-4.514-06	-5.201-05	5.071-05	5.811-06

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*CH (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN
8.792-04	9.287-04	8.063-02	0.000	8.063-02	9.637-04	9.316-04	9.092-04	1.228-03

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
2.318-02	1.243-02	1.453-02	2.929-02	9.559+02	3.024-02	3.023-02	3.020-02	3.066-02

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)
0.000	0.000	-5.000-02	0.000	1.482+01	3.629-01	-9.211+02	1.304+03	3.058+03	-9.209+02	5.000+02	4.692+08
1.092-03	2.606-01	-4.381-02	5.198-02	2.507+01	3.629-01	-4.775+02	2.101+03	1.567+03	-4.868+02	2.331+03	2.154+08
7.365-03	7.818-01	2.046-02	2.006-01	3.196+01	3.944-01	8.300+02	2.917+03	1.007+03	6.887+02	4.077+03	1.629+08
2.183-02	1.564+00	2.803-01	4.708-01	3.717+01	3.145-01	3.418+03	3.709+03	-3.899+02	2.639+03	5.202+03	1.442+08
5.351-02	2.606+00	9.527-01	8.000-01	2.599+01	1.777-01	7.068+03	5.298+03	-2.041+03	4.817+03	7.824+03	1.176+08
1.045-01	3.909+00	2.149+00	9.843-01	2.209+02	1.449-02	9.634+03	6.392+02	-3.473+02	6.226+03	8.307+03	1.141+08
2.130-01	6.515+00	4.753+00	1.000+00	-1.095-02	-6.765-03	1.012+04	-2.658+02	-2.620+02	6.603+03	8.405+03	1.135+08

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
0.000	1.085-04	1.029-05	3.961+00	2.068-01	2.815-06	7.596-01	7.413-01	2.970+01	0.000	0.000
1.092-03	2.323-05	2.637-05	2.340+00	3.099-01	1.239-05	7.028-01	7.413-01	2.966+01	0.000	3.086-01
7.365-03	1.245-05	4.062-05	1.799+00	3.241-01	1.933-05	6.812-01	7.402+01	2.779+01	0.000	9.368-01
2.183-02	8.262-06	4.670-05	1.370+00	3.274-01	2.400-05	6.372-01	7.403-01	2.354+01	0.000	1.737+00
5.351-02	5.162-06	6.037-05	1.106+00	3.317-01	2.984-05	6.710-01	7.387-01	2.212+01	0.000	2.401+00
1.045-01	4.621-06	6.220-05	1.020+00	3.322-01	2.969-05	6.958-01	7.375-01	2.103+01	0.000	2.807+00
2.130-01	4.504-06	6.254-05	9.999-01	3.325-01	2.964-05	7.017-01	7.374-01	2.073+01	0.000	2.816+00

DISTANCE FROM WALL,FT

0.000	1.092-03	7.365-03	2.183-02	5.351-02	1.045-01	2.130-01

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

C3	-1.170-01	-1.195-01	-1.267-01	-1.405-01	-1.594-01	-1.731-01	-1.764-01
	-7.123-03	-1.200-02	-1.567-02	-1.991-02	-1.679-02	-4.219-03	1.672-03
	-1.871-02	-7.041-03	-4.919-03	2.616-03	9.646-03	2.208-03	0.000
CO	4.031-01	4.035-01	4.045-01	4.064-01	4.090-01	4.109-01	4.114-01
	9.307-04	1.676-03	2.189-03	2.726-03	2.345-03	5.893-04	-2.339-04
	2.860-03	9.839-04	6.872-04	-3.695-04	-1.348-03	-3.158-04	0.000
H	4.684-03	4.488-03	3.919-03	2.834-03	1.341-03	2.618-04	0.000
	-5.358-04	-9.466-04	-1.256-03	-1.540-03	-1.324-03	-3.326-04	1.319-04
	-1.500-03	-5.556-04	-3.881-04	2.064-04	7.610-04	1.703-04	0.000
N2	7.092-01	7.116-01	7.183-01	7.313-01	7.490-01	7.619-01	7.650-01
	6.748-03	1.127-02	1.472-02	1.833-02	1.577-02	3.962-03	-1.570-03
	1.735-02	6.613-03	4.620-03	-2.497-03	-9.060-03	-2.123-03	-0.000

MOLE FRACTIONS

C3	1.000-30	1.000-30	7.479-34	1.023-26	2.160-16	2.618-17	0.000
CO	1.000-30	2.250-06	5.166-02	6.493-02	2.928-02	5.304-03	0.000
H	1.000-30	2.246-08	1.630-02	6.295-02	2.944-02	5.462-03	0.000
N2	7.518-01	7.533-01	7.083-01	6.094-01	5.343-01	4.969-01	4.961-01
E-	0.000	0.000	7.348-10	1.732-07	4.818-05	9.139-05	1.025-04
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	1.000-30	4.672-34	8.097-15	9.219-11	1.493-04	1.946-04	0.000
CH4	1.000-30	1.290-33	4.500-21	1.162-22	3.388-28	2.592-32	0.000
CN	1.000-30	5.509-28	6.411-14	1.267-10	4.883-06	3.077-06	0.000
CH	1.000-30	4.980-36	1.324-17	3.773-14	1.857-10	1.980-11	0.000
CHN	1.000-30	6.160-23	1.714-12	2.391-11	2.069-10	9.998-12	0.000
CHO	1.000-30	4.426-17	4.122-09	4.314-09	1.398-10	3.773-12	0.000
CO2	1.380-01	1.321-01	9.641-02	1.248-03	4.459-07	3.393-08	0.000
C2	1.000-30	1.000-30	1.569-25	2.967-19	1.603-10	6.439-11	0.000
C2H2	1.000-30	1.000-30	6.694-24	9.939-22	4.954-20	1.267-22	0.000
HO	6.126-29	3.046-05	1.533-02	2.664-03	2.769-06	2.540-07	0.000
H2	1.000-30	6.493-07	5.530-03	4.202-04	1.910-07	2.403-08	0.000
H2O	6.900-02	6.602-02	3.269-02	9.737-09	2.015-11	1.493-13	0.000
N	1.000-30	3.342-19	6.088-07	1.414-04	1.131-01	2.209-01	2.393-01
NO	6.838-18	1.975-04	8.707-03	9.436-03	1.058-03	7.648-04	7.123-04
O	1.000-30	9.684-07	3.003-02	2.361-01	2.926-01	3.023-01	3.037-01
O2	4.117-02	4.843-02	7.506-02	1.289-02	1.519-05	7.072-06	6.104-06
C+	0.000	0.000	1.940-26	1.783-18	1.084-07	3.937-07	0.000
N+	0.000	0.000	9.523-25	1.740-17	4.400-08	5.282-07	8.308-07
O2+	0.000	0.000	5.645-14	5.368-13	2.359-14	1.604-14	1.478-14
CO+	0.000	0.000	1.159-18	6.176-14	4.224-08	4.120-08	0.000
NO+	0.000	0.000	7.360-10	1.732-07	4.771-05	8.900-05	9.973-05
O+	0.000	0.000	1.126-18	2.496-13	2.733-07	1.431-06	1.945-06

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330+00 FEET - - -09 OCT 69 13:51:24

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP ERROR	MAX.LIN MOMENTUM		MAX.ERRORS IN CONSERVATION EQS. ENERGY		C3		CO		H	
1	42.921	1.262	.1624	.4999	1.-07	1 5.0-02	1	9.9+02	1 -8.0-02	1	8.4-03	1	-4.8-03	0
2	47.371	1.203	.2583	.8212	1.-07	8 -4.7-02	2	1.1+03	1 -2.9-02	1	4.0-03	1	-2.3-03	1
3	49.961	1.215	.20641	.0000	2.-07	5 2.1-01	2	1.6+03	2 -8.4-03	2	-1.4-03	2	-5.3-04	0
4	51.045	1.215	.20391	.0000	1.-07	5 7.1-03	2	4.7+01	2 -2.7-04	2	9.7-05	2	-2.6-05	0
5	52.029	1.215	.20391	.0000	1.-07	6 3.8-04	3	3.8+00	2 3.2-05	2	-8.6-06	2	-4.3-09	0
6	53.014	1.215	.20391	.0000	1.-07	8 6.9-06	2	-1.3-01	2 -1.7-05	3	2.8-06	4	5.4-10	0

ALPHA	XI (LB /SEC)*-2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	RERAD	SCOND
1.215+00	6.916-06	1.490-01	1.334-03	1.327+04	1.094-01	1.498-03	9.575+00	9.575+00	0.000	9.575+00

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
3.828-01	0.000	0.000	0.000	0.000	-8.031-14	-2.458-08	2.198-08	2.605-09

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
9.280-04	9.581-04	0.000	0.000	0.000	-0.000	-1.280+01	-1.475-01	1.749-02

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
2.219-02	1.714-02	1.714-02	2.807-02	9.599+02	-0.000	4.505+00	1.329+00	1.264+00

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NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (=U/UE)	FPP	SHEAR (LB/FT**2)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.000	0.000	0.000	0.000	2.039-01	3.828-01	1.269+02	1.455+03	2.581+03	1.269+02	1.000+03	3.290+08
1.559-03	2.431-01	6.767-03	5.875-02	2.795-01	3.802-01	5.563+02	2.082+03	1.638+03	5.442+02	2.574+03	2.050+08
8.151-03	7.292-01	7.109-02	2.118-01	3.490-01	3.670-01	1.762+03	2.878+03	1.022+03	1.609+03	4.432+03	1.562+08
2.397-02	1.458+00	3.221-01	4.823-01	3.938-01	3.176-01	4.132+03	3.623+03	-6.198+02	3.314+03	6.267+03	1.314+08
5.601-02	2.431+00	9.559-01	8.006-01	2.598-01	1.775-01	7.362+03	3.021+03	-1.923+03	5.111+03	7.932+03	1.168+08
1.136-01	3.646+00	2.084+00	9.777-01	3.298-02	2.084-02	9.613+03	6.836+02	-3.908+02	6.249+03	8.312+03	1.141+08
2.047-01	6.076+00	4.498+00	1.000+00	-1.479-02	-9.137-03	1.012+04	-2.661+02	-3.012+02	6.603+03	8.405+03	1.135+08

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

0.000	5.270-05	1.625-05	3.039+00	2.031-01	4.771-06	6.919-01	7.443-01	2.886+01	0.000	0.000
1.559-03	2.047-05	3.029-05	2.201+00	2.901-01	1.247-05	7.047-01	7.443-01	2.886+01	0.000	3.240-05
8.151-03	1.119-05	4.286-05	1.702+00	3.082-01	1.869-05	7.069-01	7.423-01	2.715+01	0.000	9.309-01
2.357-02	6.944-06	5.297-05	1.306+00	3.182-01	2.389-05	7.056-01	7.434-01	2.383+01	0.000	1.578+00
5.601-02	5.111-06	6.094-05	1.106+00	3.269-01	2.829-05	7.042-01	7.394-01	2.220+01	0.000	2.393+00
1.036-01	4.629-06	6.225-05	1.023+00	3.310-01	2.934-05	7.023-01	7.377-01	2.107+01	0.000	2.791+00
2.047-01	4.504-06	6.254-05	9.999-01	3.325-01	2.964-05	7.017-01	7.374-01	2.073+01	0.000	2.816+00

DISTANCE FROM WALL,FT

0.000	1.559-03	8.151-03	2.357-02	5.601-02	1.036-01	2.047-01

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

C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	7.593-07	7.454-08	-2.598-08	-1.563-07	-6.700-08	-1.203-09	1.625-09
	-2.817-06	-2.068-07	-1.784-07	9.187-08	5.419-08	1.184-09	0.000
CO	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	1.331-06	-2.580-07	4.961-08	1.349-07	6.286-08	-2.508-08	1.099-08
	-6.538-06	6.327-07	1.169-07	-7.406-08	-7.236-08	1.484-08	0.000
H	0.000	-1.492-11	-2.677-11	7.151-12	5.108-11	3.896-11	0.000
	-4.532-11	-7.748-11	2.873-11	6.432-11	2.604-11	-4.598-11	1.392-11
	-1.323-10	2.185-10	4.881-11	-3.937-11	-5.926-11	2.464-11	0.000
N2	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01
	-2.090-06	1.835-07	-2.366-08	2.139-08	4.119-09	2.633-08	-1.263-08
	9.356-06	-4.261-07	6.178-08	-1.776-08	1.827-08	-1.603-06	-0.000

MOLE FRACTIONS

C3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.891-01	7.876-01	7.328-01	6.463-01	5.376-01	4.593-01	4.361-01
E-	0.000	0.000	7.667-09	3.496-06	5.923-05	9.277-05	1.025-04
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	2.248-13	4.773-06	4.430-05	1.363-01	2.311-01	2.593-01
NO	5.844-09	9.321-04	1.723-02	4.343-03	1.099-03	7.803-04	7.123-04
O	5.896-20	1.869-05	1.183-01	3.442-01	3.249-01	3.086-01	3.037-01
O2	7.119-01	2.115-01	2.316-01	7.246-04	1.542-05	7.319-06	6.104-06
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	3.507-22	8.881-13	7.584-08	5.304-07	8.308-07
O2-	0.000	0.000	6.124-13	2.277-13	2.770-14	1.681-14	1.478-14
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	7.667-09	3.495-06	5.873-05	9.077-05	9.973-05
O+	0.000	0.000	1.409-16	3.083-10	4.195-07	1.448-06	1.965-06

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330-00 FEET - - -09 OCT 69 13:51:36

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX,LIN ERROR	MAX,ERRORS IN CONSERVATION EQS, MOMENTUM		ENERGY		C3		CO		H	
1	54,822	1,213	,2057	,4999	1,-07	6 -1,3-02	3	-1,1+02	2	-2,5-05	2	2,6-05	3	-1,2-09	0
2	55,832	1,210	,20761	,0000	1,-07	6 -6,5-03	3	-5,9+01	3	1,8-06	2	-2,1-05	3	-5,9-10	0
3	56,841	1,210	,20761	,0000	1,-07	9 -1,2-04	5	1,4+00	2	4,8-06	2	2,8-05	3	1,3-09	0
4	57,829	1,210	,20761	,0000	1,-07	6 1,2-05	5	1,4-01	2	1,3-06	2	-2,2-05	3	-6,0-10	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH	RERAD (BTU/SEC SQ FT)	QCOND
1,210+00	1,448-09	1,400-01	2,942-05	1,249+04	1,124-01	2,167-04	1,375+00	1,375+00	0,000	1,375+00

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
5,263-02	0,000	0,000	0,000	0,000	-1,783-14	-1,722-09	4,029-09	-2,303-09

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
1,356-04	1,393-04	0,000	0,000	0,000	-0,000	-5,294-01	-1,929-02	-1,082-02

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
1,403-01	1,195-01	1,195-01	1,789-01	2,383+01	-0,00	-1,369+01	-7,143+00	-6,740+00

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)
0,000	0,000	0,000	0,000	2,076-01	5,263-02	1,265+02	1,458+03	2,582+03	1,269+02	1,000+03	7,258+06
1,081-02	2,420-01	6,826-03	5,951-02	2,842-01	5,224-02	5,543+02	2,080+03	1,533+03	5,433+02	2,570+03	4,527+06
5,408-02	7,260-01	7,141-02	2,129-01	3,480-01	5,034-02	1,741+03	2,822+03	1,079+03	1,600+03	3,938+03	3,657+06
1,962-01	1,452+00	3,217-01	4,828-01	3,965-01	4,339-02	4,073+03	3,602+03	-6,591+02	3,346+03	6,021+03	2,956+06
3,645-01	2,420+00	9,532-01	8,000-01	2,889-01	2,418-02	7,251+03	2,964+03	-1,865+03	5,257+03	7,073+03	2,729+06
6,647-01	3,630+00	2,056+00	9,772-01	3,401-02	2,929-03	9,472+03	7,074+02	-4,043+02	6,497+03	7,344+03	2,675+06
1,302+00	6,050+00	4,472+00	1,000+00	-1,318-02	-1,277-03	1,000+04	-2,709+02	-3,002+02	6,885+03	7,413+03	2,666+06

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	RHOSO*EPS /RHOE*MUE	MACH NUMBER
0,000	1,163-06	1,625-05	3,014+00	2,031-01	4,771-06	6,915-01	7,443-01	2,886+01	0,000	0,000
1,081-02	4,524-07	3,026-05	2,185+00	2,901-01	1,246-05	7,047-01	7,443-01	2,886+01	0,000	3,095-01
5,408-02	2,724-07	3,955-05	1,719+00	3,060-01	1,714-05	7,062-01	7,423-01	2,663+01	0,000	9,327-01
1,562-01	1,582-07	5,152-05	1,301+00	3,174-01	2,318-05	7,054-01	7,431-01	2,365+01	0,000	1,562+00
3,645-01	1,25?-07	5,626-05	1,110+00	3,264-01	2,610-05	7,037-01	7,386-01	2,170+01	0,000	2,378+00
6,647-01	1,123-07	5,711-05	1,024+00	3,312-01	2,696-05	7,016-01	7,372-01	2,048+01	0,000	2,773+00
1,302+00	1,093-07	5,731-05	1,000+00	3,328-01	2,721-05	7,006-01	7,371-01	2,012+01	0,000	2,799+00

DISTANCE FROM WALL,FT

0,000	1,081-02	5,408-02	1,562-01	3,645-01	6,647-01	1,302+00

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

C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	2.230-06	2.624-07	-1.847-07	-2.131-07	-1.619-07	-3.712-08	1.235-08
	-8.130-06	-9.238-07	-3.914-08	5.295-08	1.031-07	2.044-08	0.000
CO	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	2.105-06	-8.425-08	-4.754-09	5.089-08	8.771-08	3.505-09	1.921-09
	-9.045-06	1.643-07	7.665-08	3.804-08	-6.712-08	-1.894-09	0.000
H	0.000	8.936-12	1.219-12	-2.633-11	-2.095-11	-8.368-13	0.000
	-1.165-11	3.221-11	-8.412-11	-1.177-11	2.290-11	1.035-11	-9.654-12
	-3.900-11	-1.990-10	7.210-11	3.582-11	-1.037-11	-8.264-12	0.000
N2	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01	7.650-01
	-4.334-06	-1.781-07	1.895-07	1.683-07	7.414-08	3.000-08	-1.426-08
	1.717-05	7.597-07	-3.758-08	-9.103-08	-3.598-08	-1.854-08	-0.000

MOLE FRACTIONS

C3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.881-01	7.875-01	7.227-01	6.377-01	5.039-01	4.190-01	3.941-01
E-	0.000	0.000	2.115-09	5.129-06	3.922-05	5.772-05	6.308-05
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CH2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	1.416-12	1.678-06	1.900-02	1.773-01	2.802-01	3.104-01
NO	5.844-09	9.203-04	9.147-03	8.165-04	2.717-04	1.931-04	1.756-04
O	3.969-19	1.214-04	1.544-01	3.464-01	3.185-01	3.005-01	2.953-01
O2	2.119-01	2.114-01	1.138-01	3.338-05	1.805-06	8.971-07	7.519-07
O+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	2.771-24	1.193-11	4.821-08	2.788-07	4.249-07
O2-	0.000	0.000	6.790-15	4.195-16	7.952-17	4.890-17	4.293-17
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	2.115-09	5.127-06	3.890-05	5.659-05	6.154-05
O+	0.000	0.000	7.900-18	1.351-09	2.713-07	8.496-07	1.112-06

TIME .00000 SECONDS - - - STREAMWISE DIMENSION .83330+00 FEET - - -09 OCT 69 13:51:41

ITERATED VALUES				DAMP	MAX,LIN ERROR	MAX,ERRORS IN CONSERVATION EQS. MOMENTUM		ENERGY		C3		CO		H	
1	99,560	1.317	.0582	.2673	1.-07	1	-5.0+02	1	-1.0+03	1	5.9-02	1	-7.0-03	1	4.7-03	0
2	92.786	1.296	.1482	.6668	3.-07	5	-4.8+01	2	-3.9+03	1	4.4-02	1	-6.2-03	1	3.5-03	0
3	64,830	1.282	.19051	.0000	2.-07	5	-1.5+01	2	-1.2+03	1	1.4-02	1	-2.0-03	1	1.1-03	0
4	66,645	1.283	.19111	.0000	6.-08	6	-6.6+03	5	7.9+01	3	3.3-04	2	7.3-09	3	2.7-05	0
5	65,110	1.283	.19111	.0000	1.-07	6	-6.6+04	5	6.2+00	3	3.4-09	3	-1.1-05	3	2.6-06	0
6	69,539	1.283	.19111	.0000	1.-07	7	3.5+09	4	1.5+00	2	-1.7-05	3	-3.7-06	4	-1.8-07	0
7	70,962	1.283	.19111	.0000	1.-07	6	5.0+08	4	1.4+01	2	8.8-08	3	+7.0-09	2	-3.0-07	0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	REWAD	QCOND
1.283+00	1.448-09	1.490-01	2.942-05	1.249+04	1.124-01	2.167-04	1.489+00	1.499+00	0.000	1.349-00

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
4.986+02	0.000	1.084+05	0.000	1.084+05	-6.457-07	-7.698-06	7.698-06	6.448-07

MOM TRNS COEFF, RHO*UE*CF/2	HEAT TRNS COEFF, RHO*UE*CH	BLOWING PARAMETERS (BASED ON CH) FOR PYROL GAS	CHAR	TOTAL GAS	ELEMENTAL MASS TRANSFER COEFFICIENTS, RHOE*UE*CH (LB/SEC SQ FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN
1.284+04	1.364+04	7.946-02	0.000	7.946-02	1.380-04	1.381-04	1.383-04	1.383-04

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
1.484-01	9.193-02	1.051-01	1.884-01	2.383+01	1.921-01	1.921-01	1.921-01	1.919-01

NODAL INFORMATION

DISTANCE FROM WALL (FT)	ETA	F	FP (#U/#E)	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)
0.000	0.000	+5.000+02	0.000	1.911+01	4.986+02	-8.896+02	1.539+03	2.900+03	-8.897+02	1.000+03	7.258+06
1.108-02	2.566-01	+4.294+02	5.809-02	2.613+01	4.970-02	-4.125+02	2.180+03	1.449+03	-4.230+02	2.515+03	4.576+06
5.378-02	7.498-01	2.391+02	2.076-01	3.216+01	4.849-02	8.966+02	2.922+03	8.127+02	7.423+02	3.602+03	3.782+06
1.431-01	1.540+00	2.843+01	4.795-01	3.743+01	4.297-02	3.387+03	3.547+03	-2.497+02	2.682+03	4.842+03	3.298+06
3.509-01	2.566+00	9.491-01	8.000+01	2.579+01	2.418-02	6.896+03	3.291+03	-2.014+03	4.902+03	4.988+03	2.746+06
6.683-01	3.849+00	2.124+00	9.822-01	2.612+02	2.247-03	9.461+03	7.091+02	-3.874+02	6.469+03	7.359+03	2.679+06
1.345+00	6.415+00	4.689+00	1.003+00	-1.227-02	-1.032-03	1.00 +04	-2.870+02	-2.470+02	6.889+03	7.413+03	2.666+06

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
0.000	1.194-06	1.624-05	3.101+00	1.936-01	4.546-04	6.917-01	7.413-01	2.970+01	0.000	0.000
1.108-02	4.750-07	2.983-05	2.241+00	3.099-01	1.319-03	7.030-01	7.413-01	2.969+01	0.000	3.137-01
5.378-02	2.965-07	3.787-05	1.791+00	3.216-01	1.839-03	6.637-01	7.401-01	2.708+01	0.000	9.549-01
1.431-01	1.923-07	4.446-05	1.364+00	3.266-01	2.287-03	6.348-01	7.408-01	2.311+01	0.000	1.629+00
3.509-01	1.251-07	5.582-05	1.114+00	3.315-01	2.758-03	6.709-01	7.379-01	2.170+01	0.000	2.390+00
6.683-01	1.173-07	5.705-05	1.022+00	3.324-01	2.729-03	6.949-01	7.370-01	2.049+01	0.000	2.746+00
1.345+00	1.093-07	5.731-05	1.000+00	3.328-01	2.721-03	7.008-01	7.371-01	2.012+01	0.000	2.799+00

DISTANCE FROM WALL,FT

0.000	1.108-02	5.378-02	1.431-01	3.509-01	6.683-01	1.345+00

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

C3	-1.171-01	-1.199-01	-1.271-01	-1.407-01	-1.593-01	-1.729-01	-1.764-01
	-9.029-03	-1.243-02	-1.570-02	-1.998-02	-1.673-02	-4.461-03	1.728-03
	-1.329-02	-6.388-03	-3.040-03	2.784-03	9.560-03	2.412-03	0.000
CO	4.031-01	4.035-01	4.045-01	4.064-01	4.090-01	4.109-01	4.114-01
	1.268-03	1.734-03	2.194-03	2.736-03	2.337-03	6.232-04	-2.414-04
	1.821-03	8.923-04	7.043-04	-3.890-04	-1.339-03	-3.369-04	0.000
H	4.678-03	4.660-03	3.891-03	2.819-03	1.349-03	2.706-04	0.000
	-7.120-04	-9.803-04	-1.239-03	-1.949-03	-1.320-03	-3.919-04	1.343-04
	-1.045-03	-5.040-04	-3.977-04	2.196-04	7.943-04	1.903-04	0.000
N2	7.093-01	7.119-01	7.187-01	7.314-01	7.489-01	7.617-01	7.650-01
	8.468-03	1.187-02	1.475-02	1.839-02	1.571-02	4.190-03	-1.623-03
	1.248-02	6.000-03	4.734-03	-2.614-03	-8.979-03	-2.269-03	-0.000

MOLE FRACTIONS

C3	1.000-30	1.000-30	1.000-30	8.799-28	1.684-17	1.804-18	0.000
CO	1.115-20	1.003-04	9.848-02	6.449-02	2.886-02	9.449-03	0.000
H	1.472-25	4.145-06	3.210-02	6.429-02	2.904-02	9.613-03	0.000
N2	7.519-01	7.533-01	6.922-01	6.320-01	5.057-01	4.177-01	3.941-01
E-	0.000	0.000	2.662-10	1.415-07	3.220-05	9.680-05	6.308-05
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	1.000-30	3.901-29	1.394-16	1.265-10	1.760-04	1.664-04	0.000
CH3	1.000-30	2.804-31	1.840-23	8.583-27	2.717-38	1.000-30	0.000
CN	1.000-30	1.144-24	2.802-15	5.819-11	1.986-06	1.153-06	0.000
CH	1.000-30	1.579-31	2.892-19	3.949-15	1.999-11	1.697-12	0.000
CHN	1.000-30	1.256-29	7.383-14	1.385-12	1.127-11	9.810-13	0.000
CHO	1.000-30	5.343-15	4.290-10	1.668-10	4.498-12	1.402-13	0.000
CO2	1.378-01	1.511-01	4.608-02	1.270-04	9.404-08	4.807-09	0.000
C2	1.000-30	1.000-30	4.684-28	8.057-26	3.738-11	1.303-11	0.000
C2H2	1.000-30	1.000-30	1.561-28	5.824-24	1.774-22	9.016-25	0.000
NO	1.596-13	2.380-04	1.334-02	2.718-04	2.687-07	2.705-08	0.000
H2	3.180-19	2.335-05	6.293-03	4.098-05	2.[illegible]-08	2.830-10	0.000
H2O	6.890-07	6.946-02	2.327-02	6.374-07	2.379-[illegible]	2.143-13	0.000
N	1.000-30	5.791-15	2.617-07	2.134-04	1.482-05	2.765-01	3.104-01
NO	2.524-09	3.687-04	5.166-03	2.607-03	2.618-04	1.895-04	[illegible]794-04
O	1.755-19	3.679-05	4.741-02	2.642-01	2.874-01	2.943-01	[illegible]993-01
O2	4.143-02	4.936-02	7.367-02	1.738-03	1.784-06	8.710-07	7.519-07
C+	0.000	0.000	2.582-28	3.093-18	1.809-07	9.433-07	0.000
N+	0.000	0.000	1.361-26	1.593-17	2.822-08	2.698-07	4.249-07
O2-	0.000	0.000	8.903-16	1.992-15	6.827-17	[illegible]690-17	4.293-17
CO+	0.000	0.000	5.866-20	4.397-14	2.427-08	2.170-08	0.000
NO+	0.000	0.000	2.662-10	1.415-07	3.179-05	9.516-05	6.194-05
O+	0.000	0.000	9.041-20	2.263-13	1.778-07	8.140-07	1.119-06

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330+00 FEET - - -09 OCT 89 13:51:54

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP ERROR	MAX,LIN MOMENTUM	MAX,ERRORS IN CONSERVATION EQS, ENERGY	C3	CO	H
1	73.381	1.286	.1894 ,4999	1.-07 6	1.3+02 5	-2.8+02 3	-9.9-04 3	8.2-05 3	-4.7-05 0
2	74.825	1.289	.18771,0000	1.-07 6	7.2-03 5	-1.5+02 4	3.3-04 4	-4.6-05 4	2.6-05 0
3	76.263	1.289	.18781,0000	1.-07 7	-1.1+03 4	-1.1+01 4	6.7-05 2	6.1-05 4	5.3-06 0
4	77.635	1.289	.18781,0000	1.-07 6	-6.0-05 4	-1.8+00 2	3.7-06 2	-4.2-05 2	-4.3-07 0
5	78.979	1.289	.18781,0000	1.-07 6	-1.0-05 5	2.0-01 2	-8.1-06 2	3.4-05 4	-4.1-08 0

ALPHA	X1 (LB /SEC)+2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC	RERAD SQ FT)	QCOND
1.289+00	6.916-08	1.490-01	1.334-03	1.327+04	1.094-01	1.498-03	1.023+01	1.030+01	0.000	9.260+00

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
3.628-01	0.000	7.489-05	0.000	7.489-05	-4.461-06	-9.314-09	9.307-09	4.939-06

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
8.795-04	9.258-04	8.062-02	0.000	8.062-02	9.911-04	9.909-04	9.904-04	9.907-04

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
2.315-02	1.293-02	1.905-02	2.928-02	9.559+02	3.022-02	3.022-02	3.022-02	3.026-02

NODAL INFORMATION

DISTANCE, FROM WALL (FT)	ETA	F	FP (*U/UE)	FPP	SHEAR (LB/FT**2)	TOTAL ENTHALPY,G (BTU/LB)	GP (BTU/LB)	GPP (BTU/LB)	STATIC ENTHALPY (BTU/LB)	TEMP (DEG R)	ELECTRON COLL FREQ (1/SEC)
0.000	0.000	-5.000-02	0.000	1.878-01	3.628-01	-8.924+02	1.921+03	2.448+03	-8.924+02	1.000+03	3.290+08
1.590-03	2.578-01	-4.300-02	5.728-02	2.565-01	3.619-01	-4.189+02	2.152+03	1.829+03	-4.305+02	2.903+03	2.079+08
8.041-03	7.734-01	2.352-02	2.063-01	3.215-01	3.535-01	8.934+02	2.938+03	9.874+02	7.437+02	4.109+03	1.623+08
2.248-02	1.547+00	2.843-01	4.744-01	3.718-01	3.132-01	3.461+03	3.702+03	-3.956+02	2.669+03	5.237+03	1.437+08
5.396-02	2.578+00	9.513-01	8.000-01	2.596-01	1.774-01	7.068+03	3.294+03	-2.042+03	4.817+03	7.824+03	1.176+08
1.043-01	3.867+00	2.133+00	9.832-01	2.468-02	1.556-02	9.618+03	6.617+02	-3.622+02	6.218+03	8.309+03	1.141+08
2.117-01	6.445+00	4.710+00	1.000+00	-1.165-02	-7.197-03	1.012+04	-2.721+02	-2.674+02	6.603+03	8.409+03	1.139+08

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
0.000	5.423-03	1.624-05	3.127+00	1.936-01	4.946-06	6.917-01	7.413-01	2.970+01	0.000	0.000
1.590-03	2.163-05	2.974-05	2.283+00	3.097-01	1.310-05	7.030-01	7.413-01	2.966+01	0.000	3.289-01
8.041-03	1.229-05	4.080-05	1.740+00	3.243-01	1.949-05	6.789-01	7.402-01	2.765+01	0.000	9.573-01
2.248-02	8.191-06	4.690-05	1.364+00	3.276-01	2.411-05	6.372-01	7.403-01	2.349+01	0.000	1.738+00
5.396-02	5.162-06	6.037-05	1.106+00	3.317-01	2.988-05	6.710-01	7.387-01	2.212+01	0.000	2.401+00
1.043-01	4.624-06	6.219-05	1.021+00	3.322-01	2.970-05	6.956-01	7.375-01	2.103+01	0.000	2.805+00
2.117-01	4.504-06	6.254-05	9.999-01	3.325-01	2.964-05	7.017-01	7.374-01	2.073+01	0.000	2.816+00

DISTANCE FROM WALL,FT

0.000 1.590-03 8.041-03 2.248-02 5.396-02 1.043-01 2.117-01

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

C3	-1.170-01	-1.197-01	-1.269-01	-1.406-01	-1.594-01	-1.730-01	-1.764-01
	-8.951-03	-1.230-02	-1.580-02	-1.958-02	-1.680-02	-4.338-03	1.695-03
	-1.299-02	-6.790-03	-4.883-03	2.696-03	9.665-03	2.340-03	0.000
CO	4.031-01	4.035-01	4.049-01	4.064-01	4.070-01	4.109-01	4.114-01
	1.246-03	1.720-03	2.207-03	2.739-03	2.346-03	6.060-04	-2.367-04
	1.839-03	9.455-04	6.822-04	-3.787-04	-1.350-03	-3.269-04	0.000
H	4.690-03	4.474-03	3.903-03	2.823-03	1.344-03	2.689-04	0.000
	-7.061-04	-9.703-04	-1.247-03	-1.545-03	-1.325-03	-3.423-04	1.337-04
	-1.025-03	-5.358-04	-3.852-04	2.127-04	7.625-04	1.846-04	0.000
N2	7.092-01	7.117-01	7.185-01	7.314-01	7.490-01	7.618-01	7.650-01
	8.411-03	1.155-02	1.484-02	1.839-02	1.578-02	4.079-03	-1.592-03
	1.218-02	6.380-03	4.586-03	-2.932-03	-9.077-03	-2.198-03	-0.000

MOLE FRACTIONS

C3	1.000-30	1.000-30	1.389-33	1.658-26	2.171-16	2.804-17	0.000
CO	1.671-21	1.343-05	5.424-02	6.471-02	2.933-02	5.449-03	0.000
H	8.462-27	2.073-07	1.830-02	6.258-02	2.948-02	5.610-03	0.000
N2	7.518-01	7.533-01	7.047-01	6.086-01	5.343-01	4.973-01	4.361-01
E-	0.000	0.000	9.116-10	1.945-09	4.817-05	9.114-05	1.025-04
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	1.000-30	5.587-31	3.059-15	1.230-10	1.495-04	1.576-04	0.000
CH4	1.000-30	2.102-31	5.182-21	9.604-23	3.414-28	2.978-32	0.000
CN	1.000-30	1.226-25	5.509-14	1.568-10	4.891-06	3.145-06	0.000
CH	1.000-30	5.900-33	1.904-17	4.596-14	1.863-10	2.06[illegible]-11	0.000
CHN	1.000-30	3.802-21	2.030-12	2.941-11	2.079-10	1.054-11	0.000
CHO	1.000-30	1.070-15	4.596-09	4.144-09	1.402-10	3.989-12	0.000
CO2	1.382-01	1.316-01	5.281-02	1.086-03	4.464-07	3.703-08	0.000
C2	1.000-30	1.000-30	2.688-25	4.457-19	1.609-10	8.722-11	0.000
C2H2	1.000-30	1.000-30	9.303-24	1.112-21	4.986-20	1.407-22	0.000
HO	5.151-14	8.594-05	1.589-02	2.383-03	2.772-06	2.616-07	0.000
H2	4.763-20	3.169-06	3.760-03	3.792-04	1.514-07	2.607-09	0.000
H2O	6.910-02	6.378-02	3.067-02	4.442-05	2.020-11	1.577-13	0.000
N	1.000-30	7.052-14	7.376-07	1.617-04	1.131-01	2.283-01	2.593-01
NO	2.509-09	3.533-04	9.027-03	9.127-03	1.058-03	7.683-04	7.123-04
O	2.592-20	4.911-06	3.349-02	2.394-01	2.925-01	3.022-01	3.037-01
O2	4.096-02	4.886-02	7.519-02	1.149-02	1.518-05	7.093-06	6.104-06
C+	0.000	0.000	3.738-26	2.917-18	1.086-07	3.994-07	0.000
N+	0.000	0.000	1.718-24	2.666-17	4.400-08	5.168-07	8.308-07
O2+	0.000	0.000	6.660-14	5.176-13	2.357-14	1.607-14	1.478-14
CO+	0.000	0.000	1.761-18	8.192-14	4.231-08	4.202-08	0.000
NO+	0.000	0.000	9.116-10	1.945-07	4.771-05	8.976-05	9.973-05
O+	0.000	0.000	1.787-18	3.259-13	2.733-07	1.421-06	1.965-06

1.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
8	3	0	1.7880	-2112.31	.00	.0004	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS (LB/SQ FT-SEC)	M CHAR (LB/ORIG SQ FT)	M GAS (LB/ORIG SQ FT)
.00001	.00000	.000000	.000000	.000000	.000000

---RECESSIONS/RECESSION RATES---
(IN) / (IN/SEC)

SURFACE	CHAR (.02)	PYROLYSIS (.98)
.0000000/ .0000000	.0000000/ .0000000	.0000000/ .0000000

---SURFACE ENERGY FLUX TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.255+01	.000	.000	.000	.255+01
TOTAL	.214+01	.000	.000	.000	.214+01

---INTERIOR ENERGY TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.000	-.000	.231-07	.255+01	-.132-10
TOTAL	-.000	-.000	.192-07	.214+01	-.113-10

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	566.44	91.300	-367.83	9	1	530.04	91.300	-378.20
2	1	555.32	91.300	-371.00	10	1	530.01	91.300	-378.21
3	1	546.44	91.300	-373.52	11	1	530.00	91.300	-378.21
4	1	539.33	91.300	-375.55	12	1	530.00	91.300	-378.21
5	1	534.23	91.300	-377.00	13	1	530.00	91.300	-378.21
6	1	531.68	91.300	-377.73	14	1	530.00	91.300	-378.21
7	1	530.36	91.300	-378.02	15	1	530.00	91.300	-378.21
8	1	530.17	91.300	-378.14					

2.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
11	3	0	1.7880	-2076.79	.00	.0006	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS	M CHAR (LB/ORIG SQ FT)	M GAS
.00001	.00000	.000000	.000000	.000000	.000000

---RECESSIONS/RECESSION RATES---

SURFACE (IN) / (IN/SEC)	CHAR (.02) (IN) / (IN/SEC)	PYROLYSIS (.98) (IN) / (IN/SEC)
.0000000/ .0000000	.0000000/ .0000000	.0000000/ .0000000

---SURFACE ENERGY FLUX TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.371+01	.000	.000	.000	.371+01
TOTAL	.547-01	.000	.000	.000	.547+01

---INTERIOR ENERGY TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.000	-.000	.186-06	.371+01	-.192-10
TOTAL	-.000	-.000	.931-07	.547+01	-.284-10

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	600.08	91.300	-358.24	9	1	530.32	91.300	-378.12
2	1	583.25	91.300	-363.03	10	1	530.09	91.300	-378.19
3	1	568.94	91.300	-367.11	11	1	530.01	91.300	-378.21
4	1	555.71	91.300	-370.88	12	1	530.00	91.300	-378.21
5	1	544.45	91.300	-374.09	13	1	530.00	91.300	-378.21
6	1	537.20	91.300	-376.16	14	1	530.00	91.300	-378.21
7	1	533.51	91.300	-377.21	15	1	530.00	91.300	-378.21
8	1	531.17	91.300	-377.88					

3.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
14	3	0	1.7880	-2043.05	.00	.0008	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS	M CHAR (LB/ORIG SQ FT)	M GAS
.00001	-.00000	.000000	-.000000	.000000	-.000000

---RECESSIONS/RECESSION RATES---

SURFACE (IN) / (IN/SEC)	CHAR (.02) (IN) / (IN/SEC)	PYROLYSIS (.96) (IN) / (IN/SEC)
.0000000/ .0000000	.0030000/ .0000000	.0050000/ .0000000

---SURFACE ENERGY FLUX TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.489+01	.000	.000	.000	.489+01
TOTAL	.996+01	.000	.000	.000	.996+01

---INTERIOR ENERGY TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.341-08	.642-07	.230-06	.489+01	-.291-10
TOTAL	-.114-08	.335-07	.278-06	.996+01	-.916-10

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	636.69	91.300	-347.80	9	1	531.16	91.300	-377.88
2	1	614.43	91.300	-354.15	10	1	530.38	91.300	-378.10
3	1	595.00	91.300	-359.68	11	1	530.05	91.300	-378.19
4	1	575.96	91.300	-365.11	12	1	530.00	91.300	-378.21
5	1	558.64	91.300	-370.05	13	1	530.00	91.300	-378.21
6	1	546.13	91.300	-373.61	14	1	530.00	91.300	-378.21
7	1	538.89	91.300	-375.68	15	1	530.00	91.300	-378.21
8	1	533.57	91.300	-377.19					

- - - - - - - - - - - - - - - - 4.0000 SECONDS - - - - - - - - - - - - - - - -

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
17	3	0	1.7880	-2006.75	.00	.0009	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS (LB/SQ FT-SEC)	M CHAR (LB/ORIG SQ FT)	M GAS (LB/ORIG SQ FT)
.00001	-.00000	.000000	-.000000	.000000	-.000000

---RECESSIONS/RECESSION RATES---
(IN) / (IN/SEC)

SURFACE	CHAR (.02)	PYROLYSIS (.98)
.0000000/ .0000000	.0030000/ .0000000	.0090000/ .0000000

---SURFACE ENERGY FLUX TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.606+01	.000	.000	.000	.606+01
TOTAL	.156+02	.000	.000	.000	.156+02

---INTERIOR ENERGY TERMS---
CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.283-07	.138-06	.406-06	.606+01	-.307-10
TOTAL	-.198-07	.148-06	.622-06	.156+02	-.804-10

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	675.82	91.300	-336.65	9	1	532.86	91.300	-377.39
2	1	648.36	91.300	-344.48	10	1	531.07	91.300	-377.91
3	1	623.97	91.300	-351.43	11	1	530.19	91.300	-378.16
4	1	599.30	91.300	-358.46	12	1	530.02	91.300	-378.20
5	1	575.90	91.300	-365.13	13	1	530.00	91.300	-378.21
6	1	557.89	91.300	-370.26	14	1	530.00	91.300	-378.21
7	1	546.64	91.300	-373.47	15	1	530.00	91.300	-378.21
8	1	537.56	91.300	-376.06					

9.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
20	3	0	1.7880	-1968.41	.00	.0011	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS (LB/SQ FT-SEC)	M CHAR (LB/ORIG SQ FT)	M GAS (LB/ORIG SQ FT)
.00001	-.00000	.000000	-.000000	.000000	-.000000

---RECESSIONS/RECESSION RATES---

(IN) / (IN/SEC)		
SURFACE	CHAR (.02)	PYROLYSIS (.98)
.0000000/ .0000000	.0030000/ .0000000	.0090000/ .0000000

---SURFACE ENERGY FLUX TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.723+01	.000	.000	.000	.723+01
TOTAL	.225+02	.000	.000	.000	.225+02

---INTERIOR ENERGY TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.797-07	.198-06	.638-06	.723+01	-.389-10
TOTAL	-.803-07	.327-06	.118-05	.225+02	-.119-09

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	716.93	91.300	-324.93	9	1	535.54	91.300	-376.63
2	1	684.45	91.300	-334.19	10	1	532.29	91.300	-377.56
3	1	655.26	91.300	-342.51	11	1	530.47	91.300	-378.08
4	1	625.08	91.300	-351.11	12	1	530.07	91.300	-378.19
5	1	595.68	91.300	-359.49	13	1	530.00	91.300	-378.21
6	1	572.05	91.300	-366.23	14	1	530.00	91.300	-378.21
7	1	556.50	91.300	-370.66	15	1	530.00	91.300	-378.21
8	1	543.16	91.300	-374.46					

6.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
23	3	0	1.7880	-1928.51	.00	.0013	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS (LB/SQ FT-SEC)	M CHAR (LB/ORIG SQ FT)	M GAS (LB/ORIG SQ FT)
.00001	-.00000	.000000	-.000000	.000000	-.000000

---RECESSIONS/RECESSION RATES---

SURFACE (IN)	/	CHAR (.02) (IN/SEC)	/	PYROLYSIS (.98) (IN/SEC)
.0000000/ .0000000		********** / **********		.0090000/ .0000000

---SURFACE ENERGY FLUX TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.841+01	.000	.000	.000	.841+01
TOTAL	.309+02	.000	.000	.000	.309+02

---INTERIOR ENERGY TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.150-06	.239-06	.926-06	.841+01	-.408-10
TOTAL	-.203-06	.547-06	.200-05	.309+02	-.154-09

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	759.55	91.300	-312.79	9	1	539.28	91.300	-375.57
2	1	722.25	91.300	-325.92	10	1	534.16	91.300	-377.02
3	1	688.42	91.300	-333.06	11	1	530.94	91.300	-377.93
4	1	652.86	91.300	-343.20	12	1	536.17	91.300	-378.16
5	1	617.54	91.300	-353.26	13	1	530.01	91.300	-378.21
6	1	588.25	91.300	-361.61	14	1	530.00	91.300	-378.21
7	1	566.25	91.300	-367.31	15	1	530.00	91.300	-378.21
8	1	550.32	91.300	-372.42					

7.0000 SECONDS

TIME STEP	SURF ITER	PROB OPTN	SURFACE RAD (IN)	H WALL (BTU/LB)	H EDGE (BTU/LB)	HEAT COEFF (LB/SQ FT-SEC)	CH/CHO
26	3	0	1.7880	-1887.41	.00	.0015	1.00000

---ABLATION RATES---

B PRIME	B PRIME G	M DOT CHAR (LB/SQ FT-SEC)	M DOT GAS	M CHAR (LB/ORIG SQ FT)	M GAS
.00001	-.00000	.000000	-.000000	.000000	-.000000

---RECESSIONS/RECESSION RATES---

(IN) / (IN/SEC)			
SURFACE		CHAR (.02)	PYROLYSIS (.98)
.0000000/ .0000000		**********/*********	.0050000/ .0000000

---SURFACE ENERGY FLUX TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	CONVECTED IN	RADIATED IN	RADIATED OUT	CHEMICAL GENERATION	CONDUCTION AWAY
RATE	.959+01	.000	.000	.000	.959+01
TOTAL	.397+02	.000	.000	.000	.397+02

---INTERIOR ENERGY TERMS---

CURRENT RATES (BTU/SQ FT SURFACE-SEC)
AND INTEGRATED VALUES (BTU/ORIG SQ FT)

	PYROL GAS PICK UP	DECOMP ABSORPTION	CONVECTION WITH SOLIDS	STORAGE IN SOLID	LOSS AT REAR FACE
RATE	-.237-06	.249-06	.127-05	.959+01	-.442-10
TOTAL	-.410-06	.792-06	.316-05	.397+02	-.197-09

NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)	NODE	MAT	TEMP (DEG R)	DENSITY (LB/CU FT)	ENTHALPY (BTU/LB)
1	1	803.33	91.300	-300.06	9	1	544.08	91.300	-374.20
2	1	761.40	91.300	-312.26	10	1	536.74	91.300	-376.29
3	1	723.08	91.300	-323.18	11	1	531.77	91.300	-377.71
4	1	682.28	91.300	-334.81	12	1	530.35	91.300	-378.11
5	1	641.14	91.300	-346.53	13	1	530.04	91.300	-378.20
6	1	606.20	91.300	-356.49	14	1	530.00	91.300	-378.21
7	1	581.66	91.300	-363.49	15	1	530.00	91.300	-378.21
8	1	558.91	91.300	-369.97					

TIME .70000+01 SECONDS - - - STREAMWISE DIMENSION .83330+00 FEET - - -09 OCT 69 13:52:04

ITERATED VALUES ITS	TIME	ALPH	FPPW	DAMP	MAX,LIN ERROR		MAX,ERRORS IN CONSERVATION EQS, MOMENTUM		ENERGY		CJ		CO		H	
1	82,303	1,252	.1919	,4999	1,-07	1	9,0-02	1	1,0+03	1	-1,0-02	1	8,4-03	1	-4,6-03	0
2	86,916	1,220	.19261,0000		4,-07	1	2,0-02	1	4,8+02	1	-3,0-02	1	9,0-03	1	-8,3-03	2
3	88,113	1,225	.18941,0000		2,-07	7	7,9-03	4	1,9+02	2	8,3-04	1	-9,0-04	2	3,9-05	0
4	87,340	1,234	.18921,0000		2,-07	6	1,7-03	3	1,4+01	2	-2,9-05	2	1,0-04	6	1,6-07	0

5 90.91 1.224 .18931,0000 1.-07 5 -2.5-05 3 4.9-01 2 -2.2-05 2 -1.9-06 4 -1.1-09 0

ALPHA	XI (LB /SEC)**2	ROKAP (FT)	PRESSURE (ATM)	EDGE VELOCITY (FT/SEC)	BETA	FLUX NORMALIZING PARAMETER	HEAT FLUXES DIFFUSIONAL	TOT ENTH (BTU/SEC SQ FT)	RERAD	QCOND
1.224+00	6.916-04	1.490-01	1.334-03	1.327+04	1.094-01	1.498-03	9.639+00	9.639+00	0.000	9.639+00

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
3.829-01	0.000	-2.170-09	1.498-08	1.281-08	-9.219-10	-4.766-08	4.432-06	3.343-09

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
9.282-04	9.688-04	-2.289-06	1.999-05	1.353-05	-0.000	3.271-03	3.978-03	9.781-04

MOMENTUM THICKNESS, THETA (FT)	DISPLACE. THICKNESS, DELSTAR (FT)	EFFECTIVE ENTHALPY BODY DISPLACE. THICKNESS, (FT)	LAMBDA (FT)	REYNOLDS NUMBER PER FOOT	MASS THICKNESSES (FT) FOR HYDROGEN	CARBON	NITROGEN	OXYGEN
2.223-02	1.671-02	1.671-02	2.813-02	9.589+02	-0.000	3.042-02	3.944-02	9.340-04

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)
0.000	0.000	-8.351-06	0.000	1.893-01	3.829-01	9.183+01	1.328+03	2.612+03	9.184+01	8.033+02	3.470+08
1.437-03	2.448-01	6.302-03	3.661-02	2.732-01	3.807-01	5.036+02	2.048+03	1.690+03	4.923+02	2.397+03	2.129+08
7.867-03	7.345-01	6.992-02	2.084-01	3.468-01	3.478-01	1.706+03	2.869+03	1.889+03	1.953+03	4.396+03	1.549+08
2.316-02	1.469+00	3.207-01	4.802-01	3.932-01	3.187-01	4.091+03	3.628+03	-6.041+02	3.280+03	6.190+03	1.322+08
5.971-02	2.448+00	9.582-01	8.000-01	2.600-01	1.777-01	7.351+03	3.033+03	-1.928+03	5.100+03	7.928+03	1.168+08
1.036-01	3.673+00	2.079+00	9.786-01	3.184-02	2.011-02	9.620+03	6.728+02	-3.827+02	6.251+03	8.313+03	1.141+08
2.055-01	6.121+00	4.521+00	1.000+00	-1.438-02	-8.885-03	1.012+04	-2.642+02	-2.969+02	6.603+03	8.409+03	1.139+08

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
0.000	6.560-05	1.406-05	3.275+00	1.404-01	3.105-06	6.767-01	7.443-01	2.886+01	0.100	0.000
1.437-03	2.199-05	2.890-05	2.256+00	2.872-01	1.179-05	7.044-01	7.443-01	2.886+01	0.100	3.228-01
7.867-03	1.133-05	4.266-05	1.717+00	5.079-01	1.858-05	7.869-01	7.424-01	2.729+01	0.000	9.230-01
2.316-02	7.039-06	5.254-05	1.312+00	5.178-01	2.367-05	7.050-01	7.434-01	2.389+01	0.000	1.577+00
5.971-02	5.116-06	6.093-05	1.107+00	5.264-01	2.824-05	7.042-01	7.395-01	2.221+01	0.000	2.394+00
1.036-01	4.628-06	6.225-05	1.023+00	5.310-01	2.934-05	7.083-01	7.377-01	2.107+01	0.000	2.793+00
2.055-01	4.304-06	6.254-05	9.999-01	5.325-01	2.964-05	7.017-01	7.374-01	2.075+01	0.000	2.816+00

DISTANCE FROM WALL,FT

0.000 1.437-03 7.867-03 2.316-02 5.971-02 1.036-01 2.055-01

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

C3	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01	-1.764-01
	2.198-06	-3.836-06	-4.989-06	-4.179-06	-5.125-06	-1.443-06	3.246-07
	-2.469-05	-2.354-06	-1.621-06	1.077-06	3.008-06	8.037-07	0.000
CC	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01	4.114-01
	-7.940-07	1.250-06	1.730-06	2.179-06	1.854-06	4.784-07	-1.713-07
	8.347-06	9.811-07	8.093-07	-3.270-07	-1.126-06	-2.641-07	0.000
H	0.000	-2.473-12	1.719-11	1.045-12	-4.579-11	-1.106-11	0.000

	-1.051-11	-9.688-12	9.000-11	-1.340-10	3.871-11	1.844-11	-9.4 6-12
	3.368-12	2.036-10	-3.049-10	1.799-10	-1.624-11	-1.137-11	0.000
N2	7.690-01	7.690-01	7.690-01	7.690-01	7.690-01	7.690-01	7.690-01
	-1.404-06	2.886-06	3.298-06	4.009-06	3.271-06	9.677-07	-3.933-07
	1.630-05	1.372-06	1.016-06	-7.498-07	-1.881-06	-9.399-07	-0.000

MOLE FRACTIONS

C3	1.000-30	0.000	0.000	0.000	0.000	0.000	0.000
CO	5.857-32	0.000	0.000	0.000	0.000	0.000	0.000
H	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N2	7.681-01	7.678-01	7.366-01	6.470-01	5.303-01	4.592-01	4.361-01
E-	0.000	0.000	4.302-09	2.914-06	5.890-05	9.283-05	1.029-04
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C	1.000-30	0.000	0.000	0.000	0.000	0.000	0.000
CH4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CN	1.000-30	0.000	0.000	0.000	0.000	0.000	0.000
CH	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHN	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CHO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2	3.501-05	0.000	0.000	0.000	0.000	0.000	0.000
C2	1.009-30	0.000	0.000	0.000	0.000	0.000	0.000
C2H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
H2C	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	1.000-30	1.145-14	3.942-06	3.804-03	1.394-01	2.313-01	2.393-01
NO	4.771-11	5.308-04	1.702-02	4.663-03	1.103-05	7.798-04	7.123-04
O	9.965-26	3.846-06	1.090-01	3.438-01	3.251-01	3.089-01	3.037-01
O2	2.119-01	2.117-01	1.374-01	9.009-04	1.955-05	7.307-06	6.104-06
C+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N+	0.000	0.000	1.961-22	4.884-13	7.409-08	9.320-07	8.308-07
O2+	0.000	0.000	5.523-13	2.838-13	2.786-14	1.679-14	1.478-14
CO+	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NO+	0.000	0.000	4.303-09	2.914-06	5.841-05	9.282-05	9.973-05
O+	0.000	0.000	9.118-17	2.019-10	4.133-07	1.470-06	1.969-06

4. CABLE LISTINGS AND FLOW CHARTS

a. Program CABLE - C00A

(1) Function

Main Program. Calls DUMCOM, DM2COM, INPOUT, SETUP, CMA. BLIMP, LOOK.

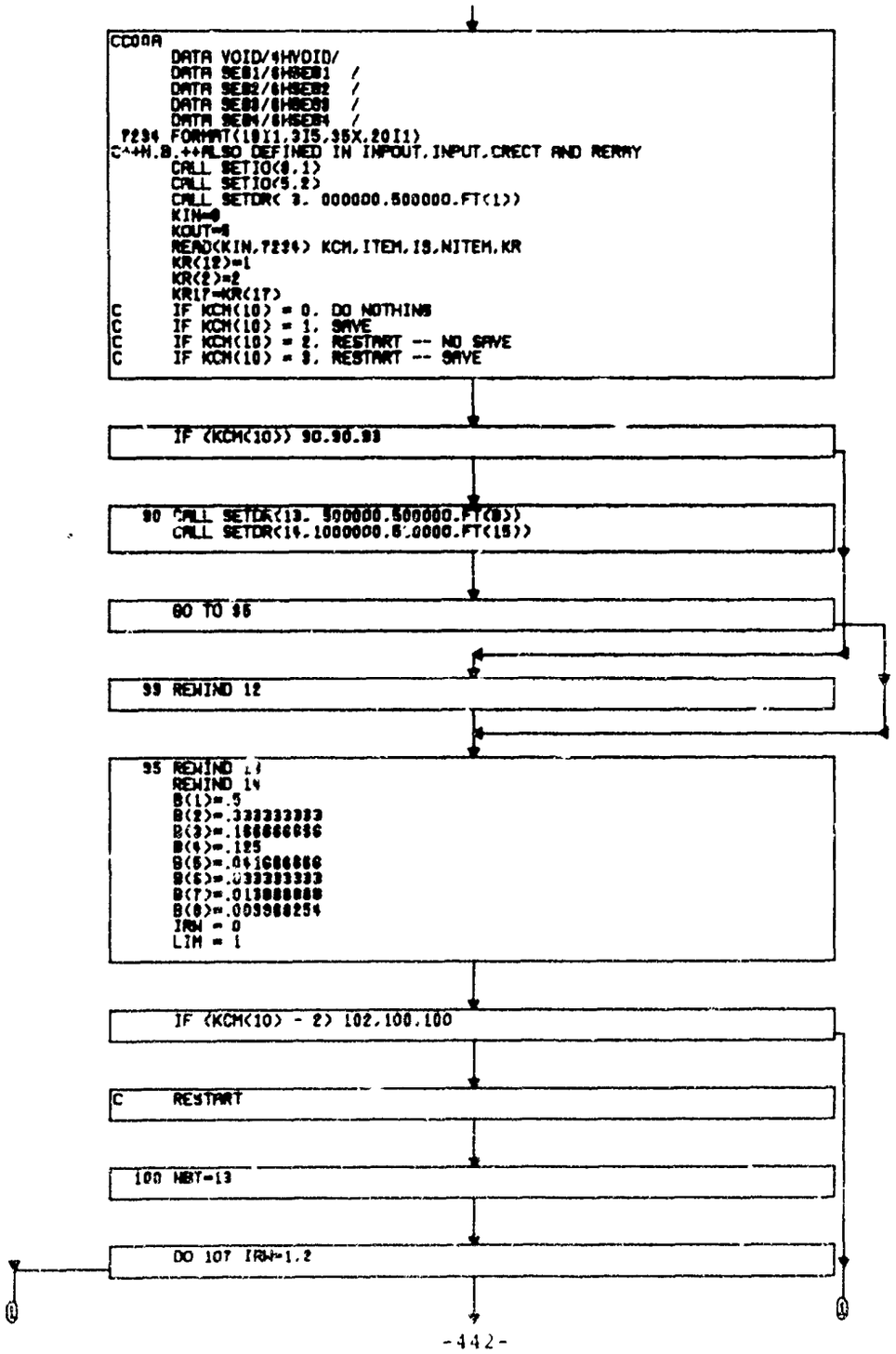
(2) Listing

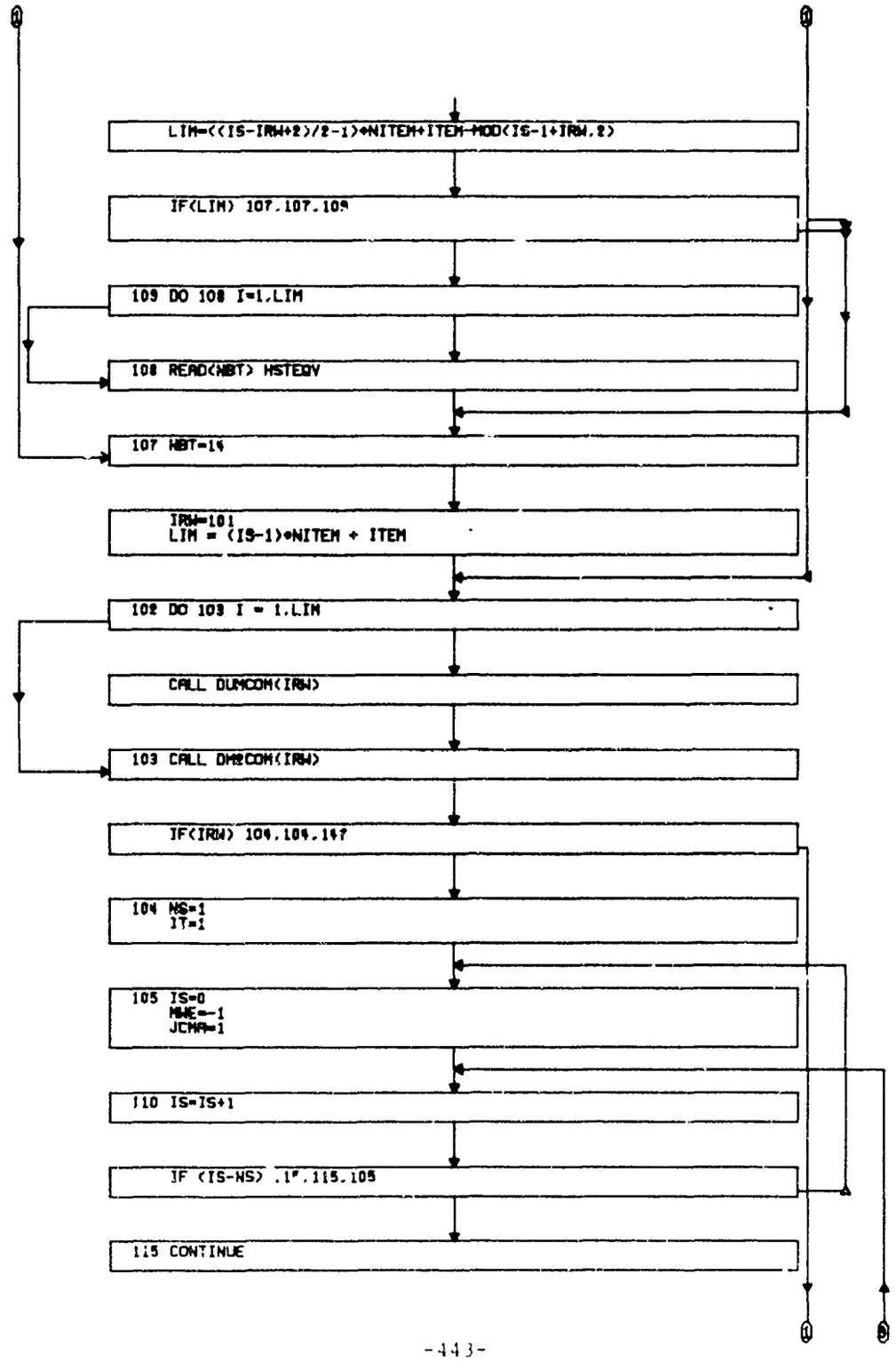
```
      C003A                                                                  C00A 001
            IMPLICIT REAL(A-H,O-Z)                                           C00A 002
            COMMON/CASCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  C00A 003
           1NP(20),  NI(20),KHI(20),JCMA,IMG,IMC,NMG,                        C00A 004
           2TCH(2),TMP(2),TRAD(2),IAH                                        C00A 005
           3,TT2(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(30),DELMG,I1,I2,CHC00A 006
           4,C  D,HPR  ,KCM(10)                                              C00A 007
            COMMON/BLKCOM/  MOA( 71),  MOF( 71),NSPEC,FR( 71,15),W(3),LEF(10) C00A   7
           1,LEFS(10),PLEASE,LEF*(10)                                        C00A   8
            COMMON/FLKCOM/DELJK( 8),DJNL(153),DJNL(153, 8),WALL9             C00A   9
           1,WALLJ( 8),DJKW( 9),TPWALL                                       C00A  10
            COMMON/HISCOM/C1,C2,C3,C4,ALPHO,BETA,ZH(4,14),ZG(4,14),ZSP(4,14, *C00A  11
           1 ),XI(40),HF(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUF,HWUE,HFW,DLX2 C00A  12
           2,F34(40),ETAM(40)                                                C00A  13
            COMMON/INTCOM/ KH(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,*C00A  14
           1S,IT,NTI  ,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) C00A  15
           2,F(4),      NUE,EON,KO(11)),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) C00A  16
           3,*AUXO,JTIME,JSPEC,MD(3)                                         C00A  17
            COMMON/PROCOM/TIME( 50),PPE(40),PTET( 50),GE( 50),S(40),ROKAP(40) C00A  18
           1,PHOSE,VKAP,*DISC,IDISC(40),NSD(10),MSD(10),ITF( 50),IPRE,RADNO, C00A  19
           2COME,HADFL( 50),RADR(40),RADS(40),IRAD                           C00A  20
            COMMON/PRPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),OR(15),H(15)  C00A  21
           1,CPRAR(15),VMW(15),PHIK(15, 8),DRHOH,DRHOK( 8),ZK( 8),DZKH( 8),  *C00A  22
           2DUSK( 8),DMU4K( 8),DTK( 8),DPHIKH( 9),DPRK( 8),DSCK( 8),DCAPCK( 9)C00A  23
           3,CHTILK( 8),DJHK( 8),DCP8K( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)   C00A  24
           4,DPHIKK( 8, 8),      DMU4H,DMU3H,CHTILH,VMU12,CT,CTR,CPTIL,HTIL   C00A  25
           5,VMU3,DTH,DCAPCH,DPRH,DSCH,DCPRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP C00A  26
           6(15),PHIKP(15),HK,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,CHOW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ      C00A  30
            COMMON/FSTCOM/SIP,HIP                                                *NEW
            DATA VOID/4HVOID/                                                C00A 023
            DATA SEG1/6HSEG1  /                                              C00A 024
            DATA SEG2/6HSEG2  /                                              C00A 025
            DATA SEG3/6HSEG3  /                                              C00A 026
            DATA SEG4/6HSEG4  /                                              C00A 027
       7234 FORMAT(10I1,3I5,35X,20I1)
      C***,*,**ALSO DEFINED IN INPOUT,INPUT,CRECT AND RERAY
            CALL SETIO(1,1)
            CALL SETIO(5,2)
            CALL SETDX( 3, 000000,500000,FT(1))
            KIN=5
            KOUT=6
            READ(KIN,7234) KCM,ITEM,IS,NITEM,KR
            KO(12)=1
            KW(2)=2
            KR17=KR(17)
      C     IF KCM(1)) = 0, TO NOTHING
      C     IF KCM(1)) = 1, SAVE
      C     IF KCM(1)) = 2, RESTART -- NO SAVE
      C     IF KCM(1)) = 3, RESTART -- SAVE
            IF (KCM(10)) 90,20,93
         90 CALL SETDX(13, 000000,500000,FT(8))
            CALL SETDX(14,1000000,500000,FT(15))
            GO TO 95
         93 READIN 12
         95 READIN 13
```

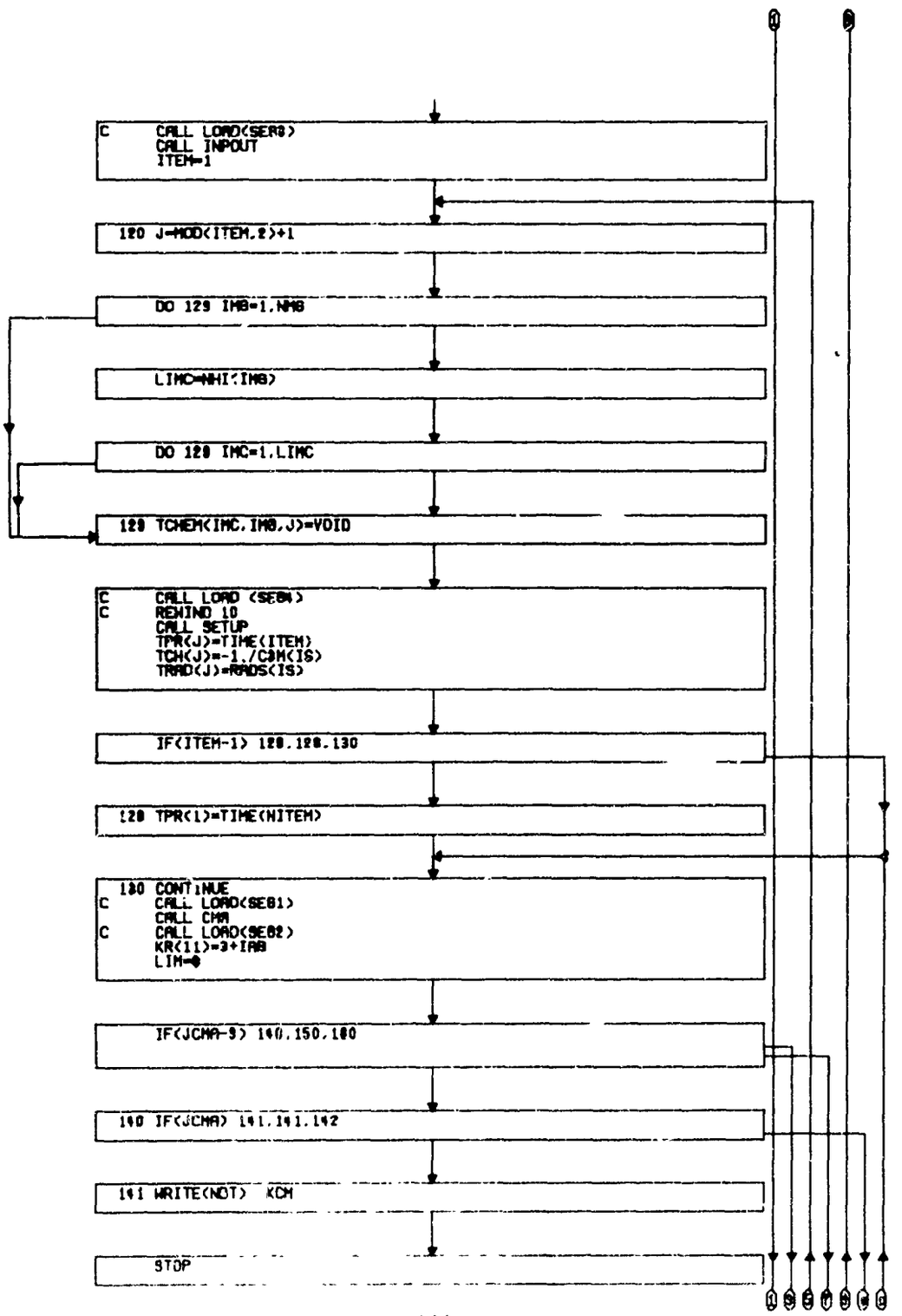
```
000059                 REAL*10 14
000060                 B(1)=.5                                                  C00A 031
000061                 B(2)=.33333333                                           C00A 032
000062                 B(3)=.166666666                                          C00A 033
000063                 B(4)=.125                                                C00A 034
000064                 B(5)=.041666666                                          C00A 035
000065                 B(6)=.033333333                                          C00A 036
000066                 B(7)=.013888888                                          C00A 037
000067                 B(8)=.00396*254                                          C00A 038
000068                 IRW = 0
000069                 LIM = 1
000070                 IF (KCM(1:) - 2) 102,100,100
000071           C     RESTART
000072           100   NRT=13
000073                 DO 107 IW=1,2
000074                 LIM=((IS-(KW+2)/2-1)*NITEM+ITEM-MOD(IS-1+IRW,2)
000075                 IF(LIM) 107,107,109
000076           109   DO 108 I=1,LIM
000077           108   READ(NRT) HSTEJV
000078           107   NRT=14
000079                 IRW=101
000080                 LIM = (IS-1)*NITEM + ITEM
000081           102   DO 103 I = 1,LIM
000082                 CALL DW4COM(IRW)
000083           103   CALL DM2COM(IRW)
000084                 IF(IRW) 104,104,147
000085           104   NS=1
000086                 IT=1                                                     C00A 041
000087           105   IS=0                                                     C00A 042
000088                 MODE=-1                                                  C00A 043
000089                 JCMA=1                                                   C00A 044
000090           110   IS=IS+1                                                  C00A 045
000091                 IF (IS-NS) 115,115,105
000092           115   CONTINUE
000093           C     CALL LOAD(SEG3)                                          C00A 047
000094                 CALL INPOUT                                              C00A 048
000095                 ITEM=1                                                   C00A 049
000096           120   J=MOD(ITEM,2)+1                                          C00A 050
000097                 DO 129 IMG=1,NMG                                         C00A 051
000098                 LIMC=NMI(IMG)                                            C00A 052
000099                 DO 129 IMC=1,LIMC                                        C00A 053
000100           129   TRM(IMC,IMG,J)=VOID                                      C00A 054
000101           C     CALL LOAD (SEG4)                                         C00A 055
000102           C     READ 10                                                  C00A 056
000103                 CALL SETUP                                               C00A 057
000104                 TRM(J)=TIME(ITEM)                                        C00A 058
000105                 TCM(J)=1./C3M(IS)                                        C00A 059
000106                 TRAD(J)=RADS(IS)
000107                 IF(ITEM-1) 126,126,130                                   C00A 061
000108           126   TRM(1)=TIME(NITEM)                                       C00A 062
000109           130   CONTINUE
000110           C     CALL LOAD(SEG1)                                          C00A 063
000111                 CALL CMA                                                 C00A 064
000112           C     CALL LOAD(SEG2)                                          C00A 065
000113                 K(11)=3+IAB                                              C00A 066
000114                 LIM=K                                                    C00A 067
000115                 IF(JCMA-3) 140,150,160                                   C00A 068
000116           140   IF(JCMA) 141,141,142                                     C00A 069
000117           141   WRITE(NRT)  KCM                                          C00A 070
000118                 STOP                                                     C00A 071
```

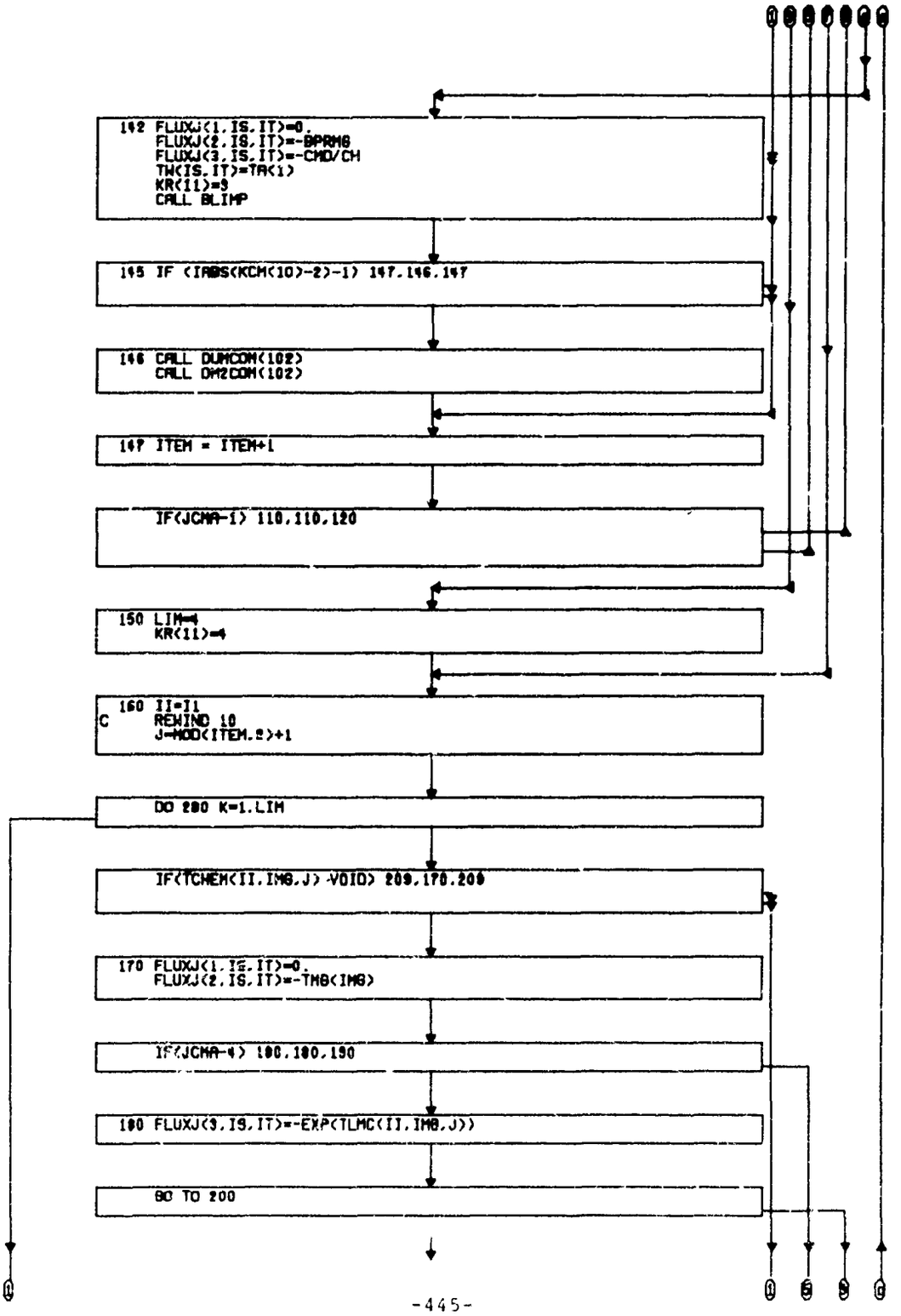
```
000119          142 FLUXJ(1,IS,IT)=0.
000120              FLUXJ(2,IS,IT)=-HPRMG
000121              FLUXJ(3,IS,IT)=-CMD/CM
000122              T(IS,IT)=TA(1)
000123              KP(11)=3                                                  C00A 075
000124              CALL BLIMP
000125          145 IF (IABS(KC(10)-2)-1) 147,146,147                         C00A 076
000126          146 CALL DUMCOM(102)
000127              CALL DM2COM(102)
000128          147 ITEM = ITEM+1
000129              IF(JCMA-1) 110,110,120
000130          150 LIM=4                                                     C00A 078
000131              KP(11)=4                                                  C00A 079
000132          160 II=I1                                                     C00A 080
000133      C       RESIND 10                                                 C00A 081
000134              J=MOD(ITEM,2)+1                                           C00A 082
000135              DO 260 K=1,LIM                                            C00A 083
000136              IF(TCHEM(II,IMG,J)-VOID) 209,170,209                      C00A 084
000137          170 FLUXJ(1,IS,IT)=0.                                         C00A 085
000138              FLUXJ(2,IS,IT)=-TMG(IMG)
000139              IF(JCMA-4) 180,180,190
000140          180 FLUXJ(3,IS,IT)=-EXP(TLMC(II,IMG,J))                       C00A 088
000141              GO TO 200
000142          190 FLUXJ(3,IS,IT)=0.                                         C00A 090
000143              T(IS,1)=TTS(II,IMG,J)
000144          200 CALL BLIMP                                                C00A 092
000145              CALL LOOK(2,T(1),TT1,THG,0,0,0,HGA,CT1,1)                 C00A 093
000146              HGA=HGA+DELHG                                             C00A 094
000147              CALL LOOK(4,T(1),TT2(1,2),THZ(1,2),0,0,0,HCM,CT2,1)       C00A 095
000148              HCM=HCM+DH12(2)                                           C00A 096
000149              IF(JCMA.GT.4) TLMC(II,IMG,J)=ALOG(AMAX1(-W(3),0.00001))   C00A 097
000150              TCHEM(II,IMG,J)=(W(2)+W(3))*HTP*1.8+WALLQ-W(2)*HGA-W(3)*HCM
000151              TTS(II,IMG,J)=T(1)
000152          209 GO TO (210,220,260,250,210,230,260,250),K                 C00A 099
000153          210 ITEM=ITEM-1                                               C00A 100
000154              GO TO 270                                                 C00A 101
000155          220 II=I2                                                     C00A 102
000156              GO TO 240                                                 C00A 103
000157          230 II=I2+1                                                   C00A 104
000158          240 IMG=IMG+1                                                 C00A 105
000159              GO TO 260                                                 C00A 106
000160          250 IMG=IMG-1                                                 C00A 107
000161              II=I1+1                                                   C00A 108
000162              GO TO 240                                                 C00A 109
000163          260 ITEM=ITEM+1                                               C00A 110
000164          270 J=3-J                                                     C00A 111
000165          280 CONTINUE                                                  C00A 112
000166              GO TO 130                                                 C00A 113
000167              END                                                       C00A 114
                                                                              C00A 115
```

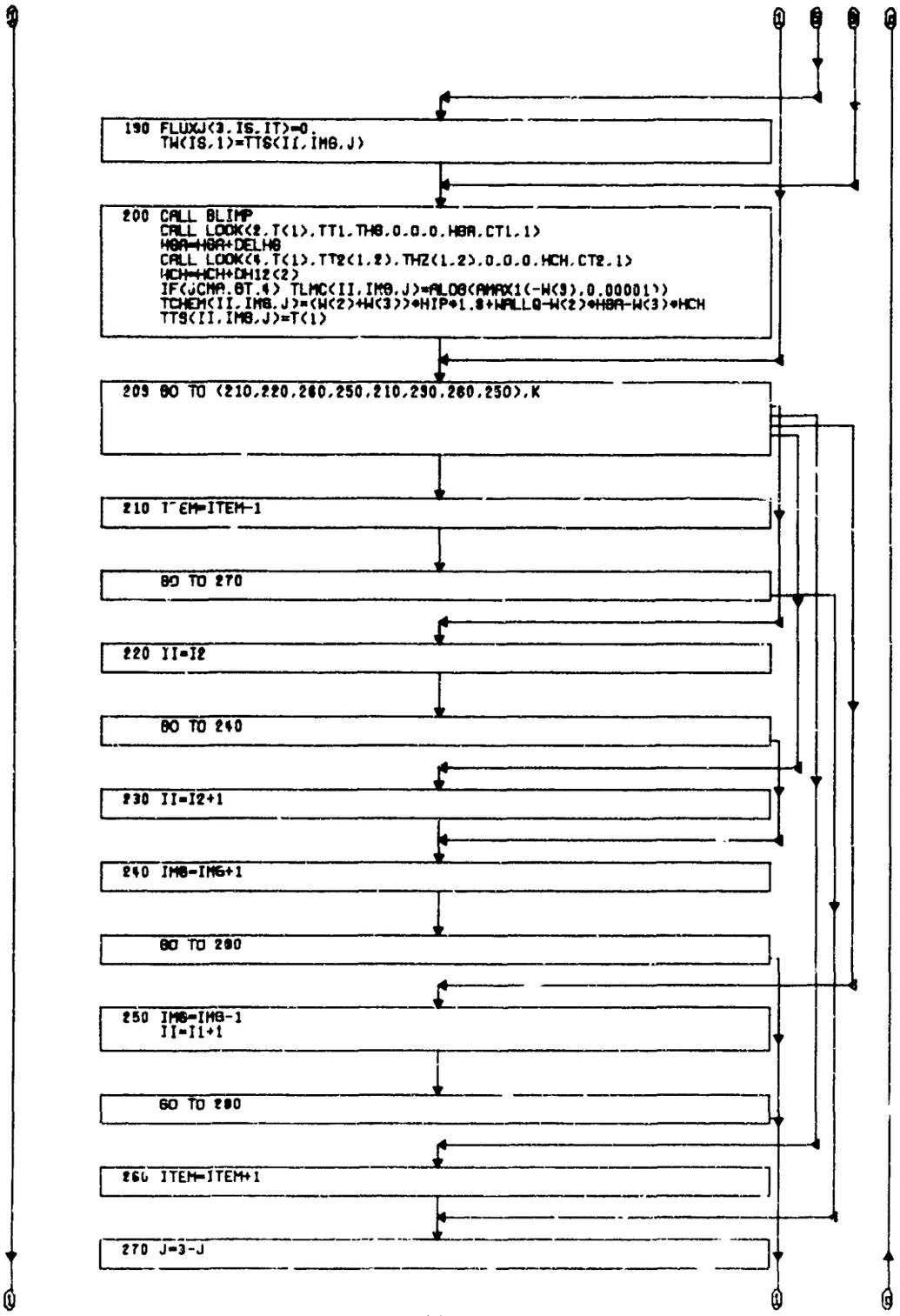
(3) Flow Chart

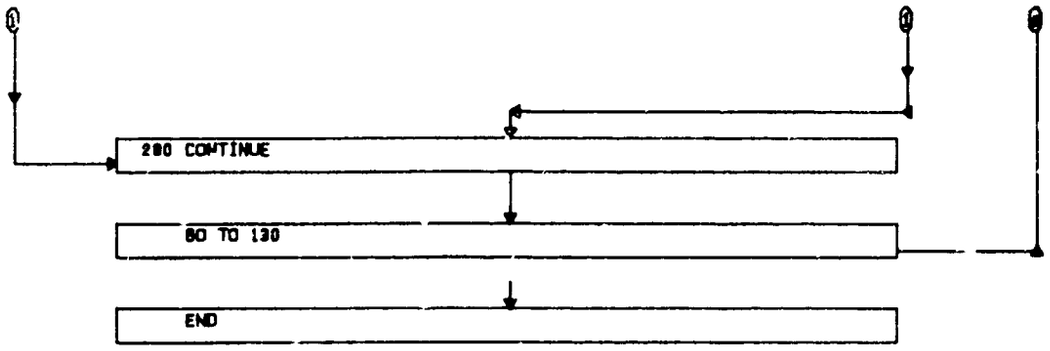

CCOOA
DATA VOID/4HVOID/
DATA SEB1/6HSEB1 /
DATA SEB2/6HSEB2 /
DATA SEB3/6HSEB3 /
DATA SEB4/6HSEB4 /
7234 FORMAT(10I1,3I5,35X,20I1)
C**N.B.++ALSO DEFINED IN INPOUT.INPUT.CRECT AND RERAY
CALL SETIO(0.1)
CALL SETIO(5.2)
CALL SETDR(3. 000000.500000.FT(1))
KIN=0
KOUT=4
READ(KIN,7234) KCM,ITEM,IS,NITEM,KR
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)) 90,90,99
90 CALL SETDR(13. 500000.500000.FT(8))
CALL SETDR(14.1000000.6.0000.FT(15))
GO TO 95
99 REWIND 12
95 REWIND 13
REWIND 14
B(1)=.5
B(2)=.333333333
B(3)=.166666666
B(4)=.125
B(5)=.041666666
B(6)=.033333333
B(7)=.013888888
B(8)=.009988254
IRN = 0
LIM = 1
IF (KCM(10) - 2) 102,100,100
C RESTART
100 NBT=13
DO 107 IRN=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
IRW=101
LIM = (IS-1)*NITEM + ITEM
102 DO 103 I = 1,LIM
CALL DUMCOM(IRW)
103 CALL DMPCOM(IRW)
IF(IRW) 104,104,107
104 NS=1
IT=1
105 IS=0
MME=-1
JCMA=1
110 IS=IS+1
IF (IS-NS) 1?,115,105
115 CONTINUE


C CALL LOAD(SEG3)
CALL INPOUT
ITEM=1
120 J=MOD(ITEM,2)+1
DO 129 IM8=1,NM8
LIMC=NHI(IM8)
DO 128 IMC=1,LIMC
128 TCHEM(IMC,IM8,J)=VOID
C CALL LOAD (SEG4)
C REWIND 10
CALL SETUP
TPR(J)=TIME(ITEM)
TCH(J)=-1./C8M(IS)
TRAD(J)=RADS(IS)
IF(ITEM-1) 120,120,130
120 TPR(1)=TIME(NITEM)
130 CONTINUE
C CALL LOAD(SEG1)
CALL CMA
C CALL LOAD(SEG2)
KR(11)=3+IA8
LIM=0
IF(JCMA-9) 140,150,160
140 IF(JCMA) 141,141,142
141 WRITE(NOT) KCM
STOP


142 FLUXJ(1,IS,IT)=0.
FLUXJ(2,IS,IT)=-BPRMB
FLUXJ(3,IS,IT)=-CMD/CH
TW(IS,IT)=TA(1)
KR(11)=9
CALL BLIMP
145 IF (IABS(KCM(10)-2)-1) 147,146,147
146 CALL DUMCOM(102)
CALL DM2COM(102)
147 ITEM = ITEM+1
IF(JCMA-1) 110,110,120
150 LIM=4
KR(11)=4
160 II=11
C REWIND 10
J=MOD(ITEM,2)+1
DO 200 K=1,LIM
IF(TCHEM(II,IMB,J)-VOID) 200,170,200
170 FLUXJ(1,IS,IT)=0.
FLUXJ(2,IS,IT)=-TMB(IMB)
IF(JCMA-4) 180,180,190
180 FLUXJ(3,IS,IT)=-EXP(TLMC(II,IMB,J))
GO TO 200


190 FLUXJ(3,IS,IT)=0.
TW(IS,1)=TTS(II,IM8,J)
200 CALL BLIMP
CALL LOOK(2,T(1),TT1,TH8,0.0,0.0,H8A,CT1,1)
H8A=H8A+DELH8
CALL LOOK(4,T(1),TT2(1,2),TH2(1,2),0.0,0.0,HCH,CT2,1)
HCH=HCH+DH12(2)
IF(JCMA.GT.4) TLMC(II,IM8,J)=ALOG(AMAX1(-W(3),0.00001))
TCHEM(II,IM8,J)=(W(2)+W(3))*HIP*1.8+WALLQ-W(2)*H8A-W(3)*HCH
TTS(II,IM8,J)=T(1)
209 GO TO (210,220,260,250,210,230,260,250),K
210 ITEM=ITEM-1
GO TO 270
220 II=I2
GO TO 240
230 II=I2+1
240 IM8=IM8+1
GO TO 280
250 IM8=IM8-1
II=I1+1
GO TO 280
260 ITEM=ITEM+1
270 J=3-J


200 CONTINUE
GO TO 130
END

b. Subroutine DUMCOM (ICK) - B01A

(1) Function

Contains all BLIMP commons with their maximum lengths. This routine is to be loaded first on those machines requiring such a feature. Called by CABLE.

ICK = 101 when restaring and reading dumped commons

= 102 when dumping commons to tape.

(2) Listing

```
000001          CH01A                                                                   B01A 301
000002           S BRCUTINE SUMCOM(ICK)                                                 B01A 002
000003           COMMON/BLOCOM/  MOA( 71),  MOM( 71),ASPEC,FR( 71,15),W(3),LEF(10)     B01A   3
000004          1,LEFS(10),PIEASE,LEFW(10)                                              B01A   4
000005           COMMON/SUMCOM/     BUMP,CORMA,EASE,ICORM,WDOT,TFZ,1777,DTEMP,KIP,IXB01A   5
000006           COMMON/CDECOM/                C9,C8,C7,C8,C9,C10,C11,C12,C13,C14,C15B01A   6
000007          1,C16,C17,C18,C19,C20,C21,C22,C23,C24,C25,C26,C27,C28,C29,C30,C31,CB01A   7
000008          232,C33,C34,C35,C36,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48B01A   8
000009          3,C49,C50,C51,C52,C53,C54,C55,C56,C57,C58,C59,C60,C61,C62,C63,C64,CB01A   9
000010          465,C66,C67,C68,C69,C70,C71,C72,C73,C74,C75,C76,C77,C78,C79,C80,C81B01A  10
000011          5,C82,C83,C84,C85,C86,C87,C88                                           B01A  11
000012           COMMON/CODECOM/ CK1( 8),CK2( 8),CK3( 8),CK4( 8),CK5( 8),CK6( 8)        B01A  12
000013          1,CK7( 8),CK8( 8),CK9( 8),CK10( 4),CK11( 8),CK12( 4),CK13( 8)          B01A  13
000014          2,CK14( 8),CK15( 6),CK16( 8),CK17( 8),CK18( 8),CK19( 8),CK20( 8)       B01A  14
000015          3,CK21( 8),CK22( 8),CKK1( 8, 8),CKK2( 8, 8),XM(5),XC(5),XSP(5, 9)     B01A  15
000016          4,CKK3( 8, 8)                                                           B01A  16
000017           COMMON/CRECOM/WCARB,EMIS,STEF,ADUM,BDUM,CDUM,WTEF,WMAT,EMISC,EMISTB01A  17
000018          1,WRG,ASU(3),BSU(3),WPYC(3),WCWAR(3),EMIV(3),KS(40),ISU                 B01A  18
000019           COMMON/EDGCOM/              PF(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,B01A  19
000020          1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,ME,C90        B01A  20
000021          2 ,DSIP(40),IDSIP,TTVC,TVCC(40)                                         B01A  21
000022           COMMON/EPSCOM/ELCON,YAP,CLNUM,SCT,PRT,NED,DVS,RHOVS,PI,PIM,CL,         B01A  22
000023          1EPSA(15),EPSI,EL(15),DPI(15,2),DLI(153),DEPS(153),DEPC,TREF,RETR      B01A  23
000024           COMMON/EQPCOM/  R9( 71,2),RC( 71,2),RD( 71,2),RE( 71,2),RF( 71,2),B01A  24
000025          1 TU( 71,2),FF( 71),FFA,IFC( 71),ATA(10),ATB(10),ATC(10),WAT(10),      B01A  25
000026          2 WAT(10),IR(10),IZ,KZ(10),LAM1( 71),P,Z,TK(10, 7),VN( 71),            B01A  26
000027          3 VNU( 71,10),ITEF,KR2,WCW,NCV,KM,WTM( 71),YYY( 71),VW( 71),GG( 71)B01A  27
000028          4 ,TG(10, 7),EPOVRK,SIGMA,RASMOL                                        B01A  28
000029           COMMON/EGTCOM/SIF,WIP,EEL,EENL,FLIQ,CPF,IRE,IER,AA,IITS,IN,IL,IIT,B01A  29
000030          1 MODE,WMELT,SMELT,TMAX,TMIN,MFLT,SUMN,SUML,WS,WBS,BX,ISP2,ISPO,       B01A  30
000031          2 ISP,KKJ,SVA,SVB,SVC,SVD,SUMC,FFF,CMF,EP,RV,IFCJC,WTG,WTL,JC,WMG,    B01A  31
000032          3 CCPG,TTMIN,TTMAX,L2,L3,IB(11),EB(10),EBL(10),A(16,16),BB(16),        B01A  32
000033          4 IP( 71),ALP(10),ENU(10),GAMW(10),GAMF(10),SLAM(10),DY( 71),RVS,      B01A  33
000034          5 CP( 71),WH( 71),SB( 71),TC( 71),VLNK( 71),E( 71),PNUS(10),           B01A  34
000035          6 BC(10),BLNK(10),BY(10),IBC(10),BE(10),JZ( 4)                          B01A  35
000036           COMMON/ERRCOM/FLE( 43),GLE(30),SPLE(30, 8),ELA(313),FLEM,GLEM          B01A  36
000037          1,SPLEM( 8),ELM(14),ELMM,IFLM,IGLM,ISPLM( 8),NELM,ILMM,DFL(43)         B01A  37
000038          2,DGL(30),DSPL(30, 8),ENLE(18),GNLE(15),SPNLE(15, 8),ENL(153)          B01A  38
000039          3,ENLEM,GNLEM,SPNLEM( 8),          ENLMM,IENLM,IGNLM,ISPNLM( 8)        B01A  39
000040          4,DENLM,INLMM,DENL(18),DGNL(15),DSPNL(15, 8),DRNL(10)                  B01A  40
000041           COMMON/ETACOM/ETA(15),DETA(15),DSQ(14),DCU(14),B1(14),B2(14)           B01A  41
000042          1,BAR(153),BA1(43,18),BA2(30,19)                                        B01A  42
000043           COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)       B01A  43
000044          2,THF(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KQT(2)                  B01A  44
000045           COMMON/FLXCOM/DELQW,DELJW( 8),DQNL(153),DJNL(153, 8),WALLQ             B01A  45
000046          1,WALLJ( 8),QW,VJKW( 9),TPWALL                                          B01A  46
000047           COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8)B01A  47
000048          1 ),XI(40),HF(15,5),HG(15,3),HGP(15,3, 8),HALPH,HUE,HHUE,HFW,DLX2      B01A  48
000049          2,C34(40),BETAM(40)                                                     B01A  49
000050           COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NB01A  50
000051          1S,IT,NTIME,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) B01A  51
000052          2,P(8),      MWE,NON,KG(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40)     B01A  52
000053          3,KAUXO,JTIME,JSPEC,MD(3)                                               B01A  53
000054           COMMON/KINCOM/MT,FKF(10),EAK(10),EXK(10),PMU(10,10),RMU(10,10),        B01A  54
000055          1 DKPT(10),PKP(10),PKR(10),RAT(10),RSIG(10),MA(10),LL(10),PMR(10),     B01A  55
000056          2 PRMU(10,10),EESE(10)                                                  B01A  56
000057           COMMON/NONCOM/AM(153,153),DVNL(153),TCW,                               B01A  57
000058          1VLNK4,DLPH( 9),DLPK( 8, 9),DTHW,DTKW( 8),FLUXJB( 9)                    B01A  58
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000056                 COMMON/OUTCOM/V(15),RES,DELST,THENGY,THMOM,CM,BLOW,SHEAR,CF,SHAPE B01A  59
000060                1 ,CM( 9),THELEM( 9)                                              B01A  60
000061                 COMMON/PW COM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) B01A  61
000062                1,RNOSE,VMAP,NDISC,IDISC(40),*SD(10),MSD(10),ITF( 50),IPRE,RADNO, B01A  62
000063                2CMAF,RADEL( 50),RADR(40),RADS(40),IRAD                           B01A  63
000064                 COMMON/PWPCOM/PR(15),T(15),RHO(15),SC(15),CAPC(15),QR(15),H(15)  B01A  64
000065                1,PHRAP(15),VMH(15),PHIK(15, 8),DRHOW,DRHOK( 8),ZK( 8),DZKH( 8),  B01A  65
000066                2H 3K( 8),DMU4K( 8),DTK( 8),DPHIKH( 8),DPRK( 8),DSCK( 8),DCAPCK( 8)B01A  66
000067                3,DHTILK( 8),DQRK( 8),DCPBK( 8),DCPTK( 8),DMU12K( 8),DZKK( 8, 8)  B01A  67
000068                4,PHIKA( 8, 8),      DMU4H,DMU3H,DHTILH,VMU12,CT,CTR,CPTIL,HTIL   B01A  68
000069                5,VMU3,DTH,DCAPCH,DPRH,DSCH,DQRH,DCPBH,DCPTH,DMU12H,VMU(15),  RHOP B01A  69
000070                6(15),PHIKP(15),HP,TP,ZKP( 8),VMU3P,VMU4P,HTILP,CRHO(14),GMR(15)  B01A  70
000071                 COMMON/STTCOM/GAM1,PHOUM,PHA,PRB,PRC,PRD,VMUA,VMUB,VMUC,VMUD,NC,  B01A  71
000072                1 FLD(6,3),VMWD                                                   B01A  72
000073                 COMMON/TEMCOM/SPDUM( 8),DER(40),DUMM1(15),SLOPE(15),REDUM(15)    B01A  73
000074                1,SDUM1(40),SDUM2(40),FWDUM(40),XICON(40),FWCON(40),FWINIT( 1)    B01A  74
000075                2,XIINIT( 1),DUDS( 40)                                            B01A  75
000076                 COMMON/VARCOM/F(4,15),G(3,15),SP(3,15, 9),ALPH                   B01A  76
000077                 COMMON/WALCOM/FW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)        B01A  77
000078                1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IFW,ISPW,IRHOVW,IFLUXJ     B01A  78
000079                 EQUIVALENCE (FLPEQV,TXI),(BLQEQV,MOA),(BUMEQV,BUMP),(COEEQV,CS),
000080                1(CONEQV,CK1),(CRBEQV,HCARB),(EDGEQV,PE),(EQPEQV,RS),(EPSEQV,ELCON)
000081                2,(KINEQV,MT),(EQTEQV,SIP),(ERREQV,FLE),(ETAEQV,ETA),(HISEQV,C1),
000082                3 (INTEQV,KIN),(NONEQV,AM),(PRMEQV,TIME),(PRPEQV,PR),(STTEQV,GAM1),
000083                4 (TEMEQV,SPDUM),(VAREQV,F),(WALEQV,FW),(FLXEQV,DELQW),(OUTEQV,Y)
000084                 DIMENSION BLQEQV( 1242),BUMEQV(   10),COEEQV(   84),CONEQV(  423)
000085                1          ,CRBEQV(   67),EDGEQV(  449),EPSEQV(  381),EQPEQV( 2352)        *NEW
000086                2          ,EQTEQV( 1033),ERREQV( 1468),ETAEQV( 1463),FLPEQV( 1200)        *NEW
000087                3          ,FLXEQV( 1406),HISEQV( 1171),INTEQV(  128),KINEQV(  421)        *NEW
000088                4          ,NONEQV(23663),OUTEQV(   42),PRMEQV(  517),PRPEQV(  608)        *NEW
000089                5          ,STTEQV(   30),TEMEQV(  335),VAREQV(  511),WALEQV(  606)        *NEW
000090                 DATA ATA(1),ATB(1),ATC(1)/4H    ,4H    ,4H    /                 *6-5
000091                 IF (ICK-101) 70,10,40
000092               10 READ( 12 )  FLPEQV,BLQEQV,BUMEQV,COEEQV,CONEQV,CRBEQV,EPSEQV,
000093                1             EDGEQV, EQPEQV, KINEQV, EQTEQV, ERREQV, ETAEQV,
000094                2             FLXEQV, HISEQV, INTEQV, NONEQV, OUTEQV, PRMEQV,
000095                3             PRPEQV, STTEQV, TEMEQV, VAREQV, WALEQV
000096                 GO TO 70
000097               40 WRITE(12 )  FLPEQV,BLQEQV,BUMEQV,COEEQV,CONEQV,CRBEQV,EPSEQV,
000098                1             EDGEQV, EQPEQV, KINEQV, EQTEQV, ERREQV, ETAEQV,
000099                2             FLXEQV, HISEQV, INTEQV, NONEQV, OUTEQV, PRMEQV,
000100                3             PRPEQV, STTEQV, TEMEQV, VAREQV, WALEQV
000101               70 CONTINUE
000102                5 RETURN                                                         C01A 067
000103                 END                                                             C01A 068
```

c. Subroutine DM2COM((ICK) - C01B

(1) Function

Contains all CMA commons with their maximum lengths. Called by CABLE.

ICK = 101 when restarting and reading dumped commons.

= 102 when dumping commons to tape.

(2) Listing

```
      CC01R                                                                    C01R 001
            SUBROUTINE TM2CON(ICK)                                             C01R 002
            COMMON/CACOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),    C01R 003
           1JO(20),JHI(20),KHI(20),JCMA,IMG,IMC,NMG,                           C01R 004
           2TCH(2),TMH(2),TRAD(2),IAB                                          C01R 005
           3,T12(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELHG,I1,I2,CHC01R 006
           4,CAD,BPRM,KCM(10)                                                  C01R 007
            EQUIVALENCE (ICLASS,JCMA)                                          C01R 008
            COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)               C01R 009
            COMMON/C ACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                     C01R 010
           5,DH0(2),ATL(38),DEL(39),SO(20),H(38),RC(38),RA(38),RECORD(36),     C01R 011
           6AREA(36),RHA(36),RAV(38),                                          C01R 012
           7RHA(152),RHR(152),ROC(152),                                        C01R 013
           8    TRI(30),VEZ,CMH,NPR,                                           C01R 014
           9LCT,JPG,II,NBM,NUMN,NL,      DELM,RET,RHORA,RHORB,RHORC,TRA       C01R 015
           ACT,TRACR,TRACC,RHOOA,RHOOB,RHOOC,FA,FB,FC,BA,BB,HC,PSIA,PSIB,PSIC,C01R 016
           BTRAC4,PET,PETE,PSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT  C01R 017
            COMMON/C ACOM/EPSW,TRES,                                           C01R 018
           1TMAT,GAMA,OMG,NO,FJFW,FJFS,JF,JFHP,JFW,INPUT,      DTHIN,BRP,HCONV,C01R 019
           2ITCH,DTHR,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  C01R 020
            COMMON/SRCP/RF,CMMA,CMMI,DERR,DMIV,EMIV,FREX,ERRC,ERR,ERRS,I3,I4,  C01R 021
           1V M,VRP, IPR,IRA,IRB,IRC,IRD,ITL,PHI,QQ,TABC,TEMP,TSMA,TSMI,TSSQ  C01R 022
            COMMON/SRCP/ TNXT,    DNCP(3),CPF(3),TC(20),VITER(51),EITER(51)    C01R 023
            COMMON/SHCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)                 C01R 024
            COMMON/SHCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CV( 50),   C01R 025
           1MAT( 50),ROT( 50),RO( 50),X( 50),RON( 50),DMDG( 50),RR ( 50),      C01R 026
           2CMC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50),CNO( 50)             C01R 027
            COMMON/SHCP/BR,    CHZ,     CMDL,     DEDT,DFDTT,DSDTR,DTH,GSMS,HW,C01R 028
           1HF,     ITS,PRFS,QCHEM,QCHEMT,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP,   C01R 029
           2QRPT,RAD,RADT,RSU,SIG,    TSAVF,XF,XP1,ASL                        C01R 030
            COMMON/MISC/       BPRM,CMT,COLD,CP1,CPGAS,CPNL,CZ,DCDT,DECOM,     C01R 031
           1DECOMT,DELCP,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DROAC, C01R 032
           2DROAT,DRORC,DROBT,DROCC,DROCT,DRONTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHSC01R 033
           3,DTS,DVR,DZ,EGO,EZ,FACT1,FACT2,FA,FR,FC,FJF,FK,FZ,GSEGR,GSM,GSMT, C01R 034
           4G7,H1,HAPHB,HFAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,  C01R 035
           5NPM,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SAC01R 036
           6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TM,THPRT,TN,TOP1,TOP2,TOP3,T,C01R 037
           7TT,VOL,X1                                                          C01R 038
            EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                    C01R 039
            DIMENSION CAMEQV(1478),LOOEQV( 73),CMAEQV(1125),SRCEQV(1237),
           1          MISEQV(101)
            EQUIVALENCE (CAMEQV,TLMC),(LOOEQV,KOUT),(CMAEQV,TEP),
           1            (SRCEQV,RF),(MISEQV,BPRM)
            IF (ICK - 101) 40,10,20
         10 READ ( 12 ) CAMEQV, LOOEQV, CMAEQV, SRCEQV, MISEQV
            GO TO 40
         20 WRITE( 12 ) CAMEQV, LOOEQV, CMAEQV, SRCEQV, MISEQV
         40 RETURN
            END                                                                C01R 041
```

d. Subroutine BLIMP - C02A

(1) Function

Similar to BLIMP main program. Called by CABLE. Calls ITERAT, OUTPUT.

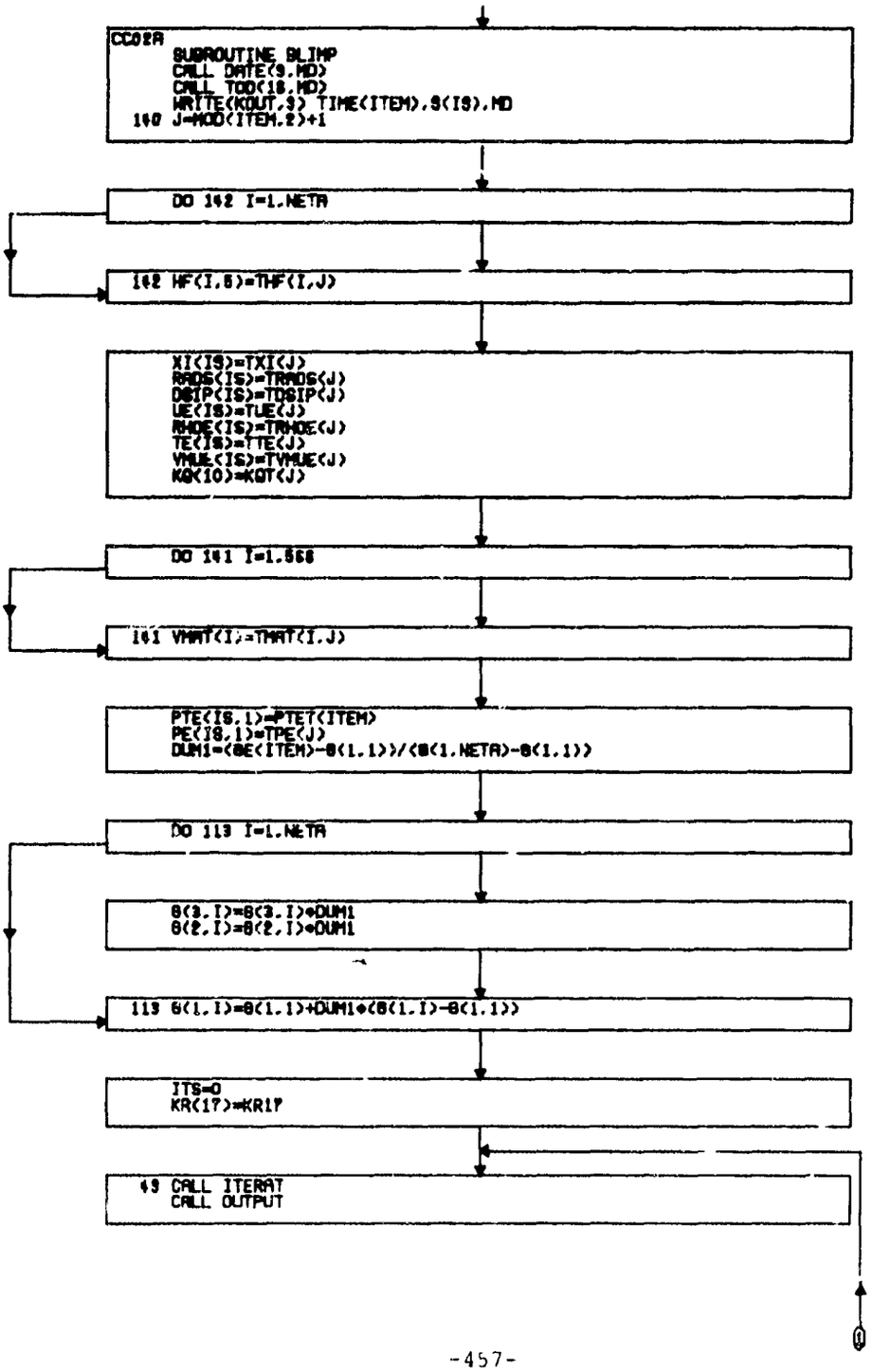
(2) Listing

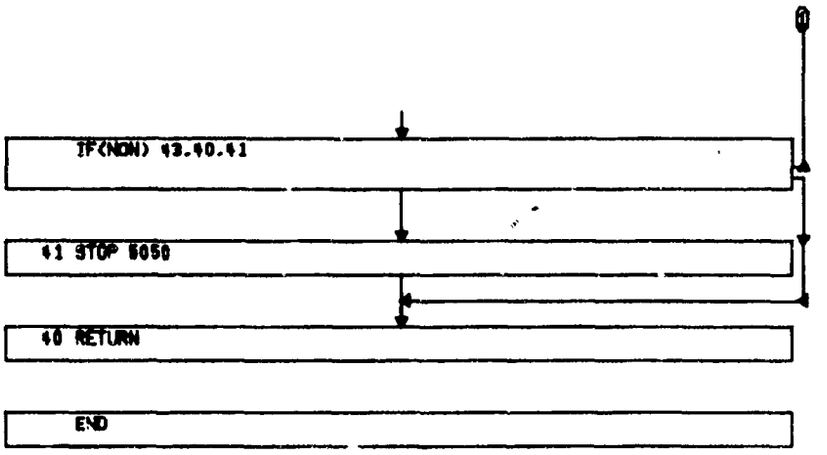
```
000001          C002A                                                                   C02A  001
000002                SUBROUTINE SLIMP                                                  C02A  002
000003                DIMENSION HIST1(605),HIST2(607),HIST3(511),VMAT(566),HIST4(600)   C02A  003*NEW
000004                COMMON/SLSCOM/  MOA( 71),  MOB( 71),NSPEC,FR( 71,15),W(3),LEF(10) C02A    4*NEW
000005               1,IFFS(10),PHASE,LEFW(10)                                          C02A    5*NEW
000006                COMMON/EDGCOM/            PE(40, 1),PTE(40, 1),SPE( 8,40, 1),DUES,C02A    6*NEW
000007               1UE(40),RHOE(40),VMUE(40),TE(40),UEDGE,DUEDGE,D2UEDG,VMWE,HE,C90   C02A    7*NEW
000008               2 ,CSIP(40),IDSIP,TTVC,TVCC(40)                                    C02A    8*NEW
000009                COMMON/FLPCOM/TXI(2),TUE(2),TRHOE(2),TTE(2),TVMUE(2),TMAT(566,2)  C02A    9*NEW
000010               2,THE(15,2),LEFT(10,2),TPE(2),TRADS(2),TDSIP(2),KQT(2)             C02A   10*NEW
000011                COMMON/HISCOM/C1,C2,C3,C4,ALPHD,BETA,ZM(4,14),ZG(4,14),ZSP(4,14, 8C02A   11*NEW
000012               1 ),XI(40),HE(15,5),HG(15,3),HSP(15,3, 8),HALPH,HUE,HHUE,HEW,DLX2  C02A   12*NEW
000013               2,CSI(40),HETAM(40)                                                C02A   13*NEW
000014                COMMON/INTCOM/ KR(20),KIN,KOUT,MAT1I,MAT2I,MAT1J,MAT2J,NETA,I,IS,NC02A   14*NEW
000015               1S,IT,NITE,NSP,NSPM1,NAM,NLEQ,NNLEQ,NRNL, ITS,KAPPA,CBAR,CASE(15) C02A   15*NEW
000016               2,DC(8),      MWE,NON,KQ(10),ITEM,NITEM,KR17,NBT,NBT2,IDENT,KR9(40) C02A   16*NEW
000017               3,VAUXC,JTIME,JSPEC,MD(3)                                          C02A   17*NEW
000018                COMMON/PARCOM/TIME( 50),PRE(40),PTET( 50),GE( 50),S(40),ROKAP(40) C02A   18*NEW
000019               1,RNOSE,VKAP,NDISC,IDISC(40),NSD(10),MSD(10),ITE( 50),IPRE,RADNO,  C02A   19*NEW
000020               2CONF,RADE( 50),RADR(40),RADS(40),IRAD                             C02A   20*NEW
000021                COMMON/VARCOM/E(4,15),G(3,15),SP(3,15, 9),ALPH                    C02A   21*NEW
000022                COMMON/WALCOM/EW(40, 1),TW(40, 1),HW(40, 1),SPW( 8,40, 1)         C02A   22*NEW
000023               1,RHOVW(40, 1),FLUXJ( 3,40, 1),IHW,ITW,IEW,ISPW,IRHOVW,IFLUXJ      C02A   23*NEW
000024                EQUIVALENCE(HIST1,XI),(HIST2, PE),(HIST3,E),(VMAT,C1),(HIST4,EW)  C02A  008**-21
000025              3 FORMAT(/1H17X4HTIMEE12,5,35H SECONDS - - - STREAMWISE DIMENSIONE12C02A  023
000026               1,5,11H FEET - - - 3A6)
000027                CALL DATE(9,MD)
000028                CALL TOD(18,MD)
000029                WRITE(KOUT,3) TIME(ITEM),S(IS),MD
000030            140 J=NOR(ITEM,2)+1                                                   C02A  027
000031                DO 142 I=1,NETA                                                   C02A  028
000032            142 HE(I,5)=THE(I,J)                                                  C02A  029
000033                XI(IS)=TXI(J)                                                     C02A  030
000034                RADS(IS)=TRADS(J)
000035                DSIP(IS)=TDSIP(J)
000036                UE(IS)=TUE(J)                                                     C02A  031
000037                RHOE(IS)=TRHOE(J)                                                 C02A  032
000038                TE(IS)=TTE(J)                                                     C02A  033
000039                VMUE(IS)=TVMUE(J)                                                 C02A  034
000040                KQ(10)=KQT(J)
000041                DO 141 I=1,566                                                    C02A  035*NEW
000042            141 VMAT(I)=TMAT(I,J)                                                 C02A  036**-1
000043                PTE(IS,1)=PTET(ITEM)                                              C02A  037
000044                PE(IS,1)=TPE(J)                                                   C02A  038
000045                DUM1=(GE(ITEM)-G(1,1))/(G(1,NETA)-G(1,1))                         C02A  039
000046                DO 113 I=1,NETA                                                   C02A  040
000047                G(3,I)=G(3,I)*DUM1                                                C02A  041
000048                G(2,I)=G(2,I)*DUM1                                                C02A  042
000049            113 G(1,I)=G(1,1)+DUM1*(G(1,I)-G(1,1))                                C02A  043
000050                ITS=1                                                             C02A  044
000051                KR(17)=KR17                                                       C02A  045
000052             43 CALL ITERAT                                                       C02A  046
000053                CALL OUTPUT                                                       C02A  047
000054                IF(S.LT.1) 43,40,41
000055             41 STOP 5050
000056             40 RETURN                                                          C02A  049
000057                END                                                             C02A  050
```

```
000059          104 KR17=KR(17)                                                 C03A 045
000060          154 IF(IS+ITEM-2) 105,105,1572
000061         1572 IF(KR(3)) 1570,1577,1570
000062         1570 IF(KR(6)-1) 1571,1571,1576
000063         1571 IF(IS-1) 1577,1577,1576
000064         1576 DO 1573 K=1,NSP                                            C03A 048
000065              IF(LEF(K)-1) 1573,1575,1573                                C03A 049
000066         1575 LEF(K)=2                                                   C03A 050
000067         1573 CONTINUE                                                   C03A 051
000068         1577 IF(NITEM-1) 1574,107,1574                                  C03A 052
000069         1574 WRITE(NBT)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KG(10)
000070              IF(ITEM-1) 157,156,157                                     C03A 054
000071          156 IDUM=NBT                                                   C03A 055
000072              NBT=NBT2                                                   C03A 056
000073              NBT2=IDUM                                                  C03A 057
000074              DO 153 I=1,NITEM
000075          153 BACKSPACE NBT2
000076              GO TO 155                                                  C03A 060
000077          157 IF(IS-1) 105,105,155
000078          155 READ(NBT2)HIST1,HIST2,HIST3,HIST4,W,LEF,RADS,KG(10)
000079              GO TO 107                                                  C03A 063
00008C        C     INITIAL GUESSES FOR PRINCIPAL DEPENDENT VARIABLES, CALCULATE(KR(2)C03A 066
000081        C     =0), INPUT(KR(2)=1), OR USE VALUES FROM FROM PREVIOUS CASE(KR(2)  C03A 067
000082        C     =2), NOTE..LATTER REQUIRES SAME ETA VALUES AND SAME SPECIES. ITS  C03A 068
000083        C     UTILITY IS FOR REPEATED SIMILARITY SOLUTIONS. IT OBVIOUSLY  CANNOTC03A 069
000084        C     BE USED FOR FIRST CASE.                                    C03A 070
000085          105 CALL FIRSTG                                                C03A 071
000086              IF(TIME(1)) 1051,1052,1052
000087         1051 ITAB=ABS(TIME(ITEM))
000088              WRITE(KOUT,4) ITAB, MD
000089              GO TO 106
000090         1052 WRITE(KOUT,2) TIME(ITEM),MD
000091          106 IF(KR(7))204,204,203
000092          203 IF(KR(12),NE.1) CALL STATEN
000093              GO TO 202
000094          204 IF(KR(12),NE.1) CALL INPUT(PTET(1))
000095          202 CALL REFCON
000096              IF(KG(9),NE.0) CALL TRANCR(1)                                    *NEW
000097              KR(12)=1                                                   C03A 076***-1
000098              IS=1                                                       C03A 077
000099          107 DO 1262 I=1,NSP
000100              IF(IS,EQ.1.AND.LEF(I),EQ.2) LEF(I)=1
000101         1262 LEFT(I,J)=LEF(I)                                           C03A 080
000102        C-----COMPUTE HISTORIC INFORMATION
000103              CALL HISTXI
000104              IF(TIME(1)) 1053,1054,1054
000105         1053 ITAB=ABS(TIME(ITEM))
000106              WRITE(KOUT,5) ITAB, S(IS), MD
000107              GO TO 126
000108         1054 WRITE(KOUT,3)TIME(ITEM),S(IS),MD
000109          126 DO 1261 I=1,NETA
000110         1261 THF(I,J)=HF(I,3)                                           C03A 085
000111              TXI(J)=XI(IS)                                              C03A 086
000112              TRADS(J)=RADS(IS)
000113              TDSIP(J)=DSIP(IS)
000114              TUE(J)=UE(IS)                                              C03A 087
000115              TRHOE(J)=RHOE(IS)                                          C03A 088
000116              TTE(J)=TE(IS)                                              C03A 089
000117              KGT(J)=KG(10)
000118              TVMUE(J)=VMUE(IS)                                          C03A 090
```

```
000119                  DO 184 I=1,966                                  B03A 091*NEW
000120              184 TMAT(I,J)=VMAT(I)                               C03A 092**-1
000121                  TPE(J)=PE(IS,1)                                 C03A 093
000122                  MVE=0                                           C03A 094
000123            C     START OF ITERATION LOOP                         C03A 095
000124              158 ITS=0                                           C03A 096
000125                  KR(17)=KR17                                     C03A 097
000126              159 RETURN                                          C03A 098
000127                  END                                             C03A 099
```

(3) Flow Chart


CCOZA
SUBROUTINE BLIMP
CALL DATE(9,MD)
CALL TOD(18,MD)
WRITE(KOUT,9) TIME(ITEM),S(IS),MD
140 J=MOD(ITEM,2)+1
DO 142 I=1,NETA
142 HF(I,6)=THF(I,J)
XI(IS)=TXI(J)
RADS(IS)=TRADS(J)
DSIP(IS)=TDSIP(J)
UE(IS)=TUE(J)
RMDE(IS)=TRMDE(J)
TE(IS)=TTE(J)
VMUE(IS)=TVMUE(J)
KQX(10)=KQT(J)
DO 141 I=1,566
141 VMAT(I)=TMAT(I,J)
PTE(IS,1)=PTET(ITEM)
PE(IS,1)=TPE(J)
DUM1=(QE(ITEM)-Q(1,1))/(Q(1,NETA)-Q(1,1))
DO 113 I=1,NETA
Q(3,I)=Q(3,I)+DUM1
Q(2,I)=Q(2,I)+DUM1
113 Q(1,I)=Q(1,1)+DUM1*(Q(1,I)-Q(1,1))
ITS=0
KR(17)=KR17
49 CALL ITERAT
CALL OUTPUT


IF(NON) 43,40,41
41 STOP 5050
40 RETURN
END

e. Subroutine CMA - B31A

(1) Function

This is the charring material ablation program of reference 2. It is the controlling program for CABLE, calling for BLIMP solutions when necessary. Called by CABLE. Calls LCOUNT, LOOK, OGLE, SLOPQ, SBCPKG.

(2) Listing

```
000001      CM314                                                          B31A 001
000002            S SROUTINE CMA                                           B31A 002
000003      C       TWO SOLVING BOUNDARY INTERNAL CONDUCTION PACKAGE       B31A 003
000004      C       AEROTHERM CORPORATION    RM KENDALL  C MOYER         B31A 004
000005            COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCMEM(20,10,2),  B31A 005
000006           1TLO(20),XMI(20),RMI(20),JCMA,IMG,IMC,NMG,                B31A 006
000007           2TCM(2),TPR(2),TRAD(2),IAB                                B31A 007
000008           3,TT2(20,2),THZ(20,2),TTJ(30),THG(30),DM12(2),TA(39),DELMG,I1,I2,CM B31A 008
000009           4,CMD,BPRMG,KCM(10)                                       B31A 009
000010            EQUIVALENCE (NCLASS,JCMA)                                B31A 010
000011            COMMON/LOGCOM/KOUT,IEX,DEW VR,IPI(23),ILO(23),IR(23)     B31A 011
000012            COMMON/T ACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)           B31A 012
000013           3,EPO(2),ATL(39),QCL(39),SO(20),W(38),RC(38),RA(38),RECORD(38),  B31A 013
000014           4AREA(38),SMA(38),RAV(38),                                B31A 014
000015           5RMA(152),RDR(152),ROC(152),                              B31A 015
000016           6     TPI(30),VEZ,CMH,VPR,                                B31A 016
000017           7LPT,NPS,II,NBM,NUMN,NL,      PELM,RFT,RHORA,RHORB,RHORC,TRA  B31A 017
000018           8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,ER,EC,BA,BB,BC,PSIA,PSIB,PSIC,B31A 018
000019           9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT B31A 019
000020            COMMON/CMACOM/EPSI,TRES,                                 B31A 020
000021           ATMWT,GAMA,OMG,NC,FJF,FJFS,JF,JFHP,JFH,INPUT,     DTMIN,ERP,HCONV,B31A 021
000022           2TMCH,DTHR,NN,NI,SOI,GHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  B31A 022
000023            COMMON/SHCP/BF,CMMA,CMMI,DERR,DMIV,EMIV,EREX,ENRC,ERR,FRRS,I3,I4,  B31A 023
000024           1VRM,VRP, IPP,IMA,IRB,IRC,IRD,ITL,PHI,QB,TABC,TEMP,TPMA,TSMI,TSSJ  B31A 024
000025            COMMON/SHCP/ TNXT,   DNCP(3),CPE(3),TO(20),VITER(51),EITER(51)  B31A 025
000026            COMMON/SHCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)       B31A 026
000027            COMMON/SHCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50),  B31A 027
000028           1RN( 50),ROT( 50),RO( 50),X( 50),RON( 50),DMDG( 50),RR ( 50),  B31A 028
000029           2C C( 50) A( 50),B( 50),C( 50),D( 50),EMO( 50),CNO( 50)  B31A 029
000030            COMMON/SHCP/BR,   CMZ,    CMDL,    DEDT,DEDTT,DSDTB,DTH,GSMS,HW,  B31A 030
000031           1HF,     ITS,PRES,QCHEM,QCHEMT,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP,  B31A 031
000032           2WPRT,RAD,RADT,RSU,SIG,    TSAVF,VF,XP1,ASU              B31A 032
000033            COMMON/MISC/      BPRM,CMT,COLD,CP1,CPGAS,CPNL,CZ,DCDT,DECOM,  B31A 033
000034           1DECOMT,DELCP,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DROAC,  B31A 034
000035           2DROAT,DROBC,DROBT,DROCC,DROCT,DROOTO,DSDT,DSI,DS,DSS,DTA,DTHC,DTHS B31A 035
000036           3,DTS,DVH,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSM,GSMT,  B31A 036
000037           4GT,H1,HAPHB,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,  B31A 037
000038           5NBR,NLI,NLM,N,NZ,O,PGPU,PGPUT,PRLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SA B31A 038
000039           6,SUEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,TWPRT,TN,TOP1,TOP2,TOP3,T. B31A 039
000040           7TT,VOL,X1                                                B31A 040
000041            EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)          B31A 041
000042          542 FORMAT(/33X14H----OUTPUT----)                          B31A 042
000043          543 FORMAT(//6X14(2H- )F11.4,9H SECONDS 14(2H -))          B31A 043
000044          544 FORMAT(6X,4HTIME,2X,4HSURF,2X,4HPROR,2X,7HSURFACE,5X,6HW ALL,  B31A 045
000045             14X,6HH EDGE,6X,10HHE    EFF,4X,6HCH/CHO/6X,4HSTEP,2X,4HITER,2X,4HB31A 046
000046             20PTN,2X,6HRAD (IN),3X,    T/(LB) 2X,8H(BTU/LB),3X,14H(LB/SQ FT-SEC)B31A 047
000047             3))                                                     B31A 048
000048          545 FORMAT(6X,I4,2I6,F10.4,F14.2,F10.2,F12.4,7X,F8.3/1H )  B31A 049
000049          546 FORMAT(33X,20H---ABLATION RATES---)                    B31A 050
000050          547 FORMAT(8X,7HR PRIME,3X,9HR PRIME G  ,1  M DOT CHAR,3X,9HM DOT GAS B31A 051
000051             1X,A  M CHAR,7X,5HM GAS/34X,14H(LB/SQ FT-SEC),11X,15H(LB/ORIG SQ FTB31A 052
000052             2))                                                     B31A 053
000053          548 FORMAT(8X,F8.5,2X,F8.5,4(3X,F10.6)/1H )                B31A 054
000054         5446 FORMAT(27X,32H---RECESSIONS/RECESSION RATES---/         B31A 055
000055             133X,19H(IN)    /    (IN/SEC)/                          B31A 056
000056             2  16X,7HSURFACE,16X,6HCHAR (,F4.2,1H),11X,11HPYROLYSIS (,F4.2,1H))B31A 057
000057         5441 FORMAT(5X,3(4X,F10.7,1H/,F9.7)/1H )                    B31A 058
000058         5442 FORMAT(27X,31H---SURFACE ENERGY FLUX TERMS---/25X,37HCURRENT RATESB31A 059
```

```
000059          1 (BTU/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SQ B31A 060
000060          2 FT)/                                                              B31A 061
000061          3    13X,10HCONVECTED ,4X,10H RADIATED ,4X,10H RADIATED ,4X,10H CHEM B31A 062
000062          4ICAL ,4X,10HCONDUCTION/17X,2HIN,12X,2HIN,11X,3HOUT,8X,10HGENERATI B31A 063
000063          5O',7X,6HABLAY)                                                     B31A 064
000064       5483 FORMAT (6X,4HRATE,3X,5(E10.3,4X)/6X,5HTOTAL,2X,5(E10.3,4X)/1H )   B31A 065
000065       5484 FORMAT(3X,27H----INTERIOR ENERGY TERMS---/25X,37HCURRENT RATES (BT B31A 066
000066          1U/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SQ FT) B31A 067
000067          2/                                                                  B31A 068
000068          3       13X,9HPYROL GAS,7X,6HDECOMP,6X,10HCONVECTION,6X,7HSTORAGE,  B31A 069
000069          47X,7HLOSS AT/14X,7HPICK UP,6X,10HABSORPTION,3X,11HWITH SOLIDS,5X,  B31A 070
000070          58HIN SOLID,6X,9HREAR FACE)                                         B31A 071
000071       5485 FORMAT (6X,4HRATE,3X,5(E10.3,4X)/6X,5HTOTAL,2X,5(E10.3,4X)/1H )   B31A 072
000072       5486 FORMAT (6X8HNODE MAT3X4HTEMP3X7HDENSITY3X8HENTHALPY2X8HNODE MAT3X4B31A 073
000073          1HTEMP3X7HDENSITY3X8HENTHALPY/15X7H(DEG R)11H (LB/CU FT)9H (BTU/LB)B31A 074
000074          211X7H(DEG R)11H (LB/CU FT)9H (BTU/LB))                             B31A 075
000075       5490 FORMAT(6X,8HNODE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU/,2X,8HNOB31A 076
000076          1DE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU//15X,7H(DEG R),11H (LBB31A 077
000077          2/CU FT),9H FT SC F),11X,7H(DEG R),11H (LB/CU FT),9H FT SC F))      B31A 078
000078       550 FORMAT (5X2I4,F9.2,F10.3,2XF8.2,1X2I4,F9.2,F10.3,F10.2)            B31A 079
000079       5500 FORMAT(5X,2I4,F9.2,F10.3,2X,F8.2,1X,2I4,F9.2,F10.3,F10.6)         B31A 080
000080       551 FORMAT(1H1110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND B31A 081
000081          1ABLATION PROGRAM/73X4HPAGEI3/1H 67X2A6)                            B31A 082
000082       552 FORMAT(9X,67HOPTIONAL OUTPUT OF THERMOCOUPLE TEMPERATURES AND/OR IB31A 083
000083          1SOTHERM DEPTHS/24X,37HDEPTHS MEASURED FROM ORIGINAL SURF  E/24X,  B31A 084
000084          231HTEMPERATURES IN DEGREES RANKINE//6X,77HEACH OUTPUT BLOCK SHOWS B31A 085
000085          3THE TIME IN SECONDS, THE CURRENT SURFACE TEMPERATURE,/6X,20HTHE TEB31A 086
000086          4MPERATURES OF ,I2,44H THERMOCOUPLES, AND THE DEPTHS IN INCHES OF ,B31A 087
000087          512,1JH ISOTHERMS//6X,74HTHE FIRST BLOCK SHOWS A SAMPLE TIME AND SUB31A 088
000088          6RFACE TEMPERATURE, THE SPECIFIED/6X,73HDEPTHS OF THE THERMOCOUPLESB31A 089
000089          7 (IF ANY) AND THE ISOTHERM TEMPERATURES.   THE/6X,76HARRANGEMENT OB31A 090
000090          8F THIS BLOCK CORRESPONDS TO THE ARRANGEMENT OF THE OUTPUT DATA.// B31A 091
000091          9(10(2X,F10.4)))                                                    B31A 092
000092       553 FORMAT (//6X,11HOUTPUT DATA//)                                     B31A 093
000093       554 FORMAT (10(2X,F10.4))                                              B31A 094
000094       581 FORMAT(8F10.4/(10X7F10.4))                                         B31A 095
000095       582 FORMAT(12E10.3)                                                    B31A 096
000096       C                                                                      B31A 097
000097       C                                                                      B31A 098
000098        7600 GO TO (7601,6081,761,761,761),JCMA                               B31A 099
000099        7601 CONTINUE                                                         B31A 100
000100             DMCP(3)=99999.                                                   B31A 101
000101             SIG=.481E-12                                                     B31A 102
000102       C     CHAR AND PYROLYSIS ZONE CRITERIAL DENSITIES                      B31A 103
000103             DMCP(1)=RHO(2)+CHCRI*(RHO(1)-RHO(2))                             B31A 104
000104             DMCP(2)=RHO(2)+PYCRI*(RHO(1)-RHO(2))                             B31A 105
000105       C                                                                      B31A 106
000106       C     INITIAL VALUES FOR TIME LOOP                                     B31A 107
000107       C                                                                      B31A 108
000108        1300 ITER=-1                                                          B31A 109
000109             DTHC=DTHB                                                        B31A 110
000110             CMH=1.0                                                          B31A 111
000111             THZRO=TPR(2)                                                     B31A 112
000112             TMXT=TPR(2)                                                      B31A 113
000113             TPR2=TPR2+THZRO                                                  B31A 114
000114             TPR3=TPR3+THZRO                                                  B31A 115
000115             THPY=TPR(1)                                                      B31A 116
000116             IHR=0                                                            B31A 117
000117             ITS=0                                                            B31A 118
000118             SA=0.0                                                           B31A 119
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000119                 ...ST=0.0                                                B31A 120
000120                 GSMS=0.                                                  B31A 121
000121                 CMD=0.0                                                  B31A 122
000122                 CMT=0.                                                   B31A 123
000123                 DSDTM=0.0                                                B31A 124
000124                 DSDT=0.                                                  B31A 125
000125                 DSI=0.                                                   B31A 126
000126                 SIDT=0.                                                  B31A 127
000127                 CPE(1)=0.                                                B31A 128
000128                 CPE(2)=0.                                                B31A 129
000129                 CPLD=0.                                                  B31A 130
000130                 PPLD=0.                                                  B31A 131
000131                 ...DT=0.                                                 B31A 132
000132                 ...DT=0.                                                 B31A 133
000133                 QCOND=0.                                                 B31A 134
000134                 QCONV=0.                                                 B31A 135
000135                 QCHEM=0.                                                 B31A 136
000136                 RAD=0.                                                   B31A 137
000137                 GPM=0.                                                   B31A 138
000138                 QCONVT=0.                                                B31A 139
000139                 QRPT=0.                                                  B31A 140
000140                 RADT=0.                                                  B31A 141
000141                 QCHEMT=0.                                                B31A 142
000142                 QCONDT=0.                                                B31A 143
000143                 PGPUT=0.                                                 B31A 144
000144                 QECOMT=0.                                                B31A 145
000145                 QFDTT=0.                                                 B31A 146
000146                 ...LOSST=0.                                              B31A 147
000147                 TT=0.                                                    B31A 148
000148                 TR=0.                                                    B31A 149
000149                 SQEGR=0.                                                 B31A 150
000150                 GSEGR=0.                                                 B31A 151
000151                 PGPU=0.                                                  B31A 152
000152                 QECOM=0.                                                 B31A 153
000153                 EGO=0.                                                   B31A 154
000154                 HS=0.                                                    B31A 155
000155                 BP=0.                                                    B31A 156
000156                 KK=0                                                     B31A 157
000157                 TH=THZRO                                                 B31A 158
000158                 THDS=THZRO-DTHIN                                         B31A 159
000159                 THPRT=TH                                                 B31A 160
000160                 REWIND 3                                                 B31A 161
000161                 CALL LCOUNT (-2,LCT,NPG,RECORD(35))                      B31A 162
000162                 WRITE (KOUT,542)                                         B31A 163
000163                 I=0                                                      B31A 164
000164                 DTH=DTHIN                                                B31A 165
000165                 RSU=ABS(RSV)                                             B31A 166
000166                 DELCR=AMIN1(DEL(1),DELM)/5.0                             B31A 167
000167                 TSAVE=TA(1)+1.0                                          B31A 168
000168                 FA=(1.-PSIA)*BA*(RHOOA**(1.-PSIA))                       B31A 169
000169                 FB=(1.-PSIB)*BB*(RHOOB**(1.-PSIB))                       B31A 170
000170                 FC=(1.-PSIC)*BC*(RHOOC**(1.-PSIC))                       B31A 171
000171           C                                                              B31A 172
000172           C     BEGINNING OF TIME LOOP                                   B31A 173
000173           C                                                              B31A 174
000174             410 ITER=ITER+1                                              B31A 175
000175                 JCMA=1                                                   B31A 176
000176           C                                                              B31A 177
000177           C     CALCULATION OF NODAL PROPERTIES                          B31A 178
000178           C                                                              B31A 179
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000179                  DO 107 N=2,NL                                          B31A 180
000180            108   RA(N-1)=RA(N-1)+DSI                                    B31A 181
000181                  RA(NL)=RA(NL)+DSI/2.                                   B31A 182
000182                  CALL OBLP(NL,RA,RR,NUMN,RAV,AREA,EMA)                  B31A 183
000183                  ASU=RR(1)                                              B31A 184
000184                  J=1-JF+JF                                              B31A 185
000185            109   DO 115 JM1,NL                                          B31A 186
000186                  J=J+JF                                                 B31A 187
000187                  RP(J)=RR(J)/ASU                                        B31A 188
000188                  CALL LOOK (3,TA(J),TT2,TCP,TKP,THZ,0,Y2,Y2(4),3)       B31A 189
000189                  CP(J)=Y2(2)                                            B31A 190
000190                  CPV(J)=Y2(1)                                           B31A 191
000191                  HP(N)=Y2(3)+DH1                                        B31A 192
000192                  CALL LOOK (4,TA(J),TT2(1,2),TCP(1,2),TKP(1,2),THZ(1,2),0,Y2,D2,3) B31A 193
000193                  CPC(J)=Y2(2)                                           B31A 194
000194                  CPC(J)=Y2(1)                                           B31A 195
000195                  HC(J)=Y2(3)+DH2                                        B31A 196
000196                  IF (MATL(J)-1) 103,101,102                             B31A 197
000197            101   X(J)=1.                                                B31A 198
000198                  CP(J)=CPV(J)                                           B31A 199
000199                  H(J)=HP(J)                                             B31A 200
000200                  RO(J)=RHO(1)                                           B31A 201
000201                  ROT(J)=RHO(1.                                          B31A 202
000202                  GO TO 105                                              B31A 203
000203            102   X(J)=0.                                                B31A 204
000204                  CP(J)=Y2(2)                                            B31A 205
000205                  H(J)=HC(J)                                             B31A 206
000206                  CP(J)=CPC(J)                                           B31A 207
000207                  RO(J)=RHO(2)                                           B31A 208
000208                  ROT(J)=RHO(2)                                          B31A 209
000209                  GO TO 105                                              B31A 210
000210            103   X(J) = PETE-PET/RO(J)                                  B31A 211
000211                  H(J)=X(J)*HP(J)+(1.-X(J))*HC(J)                        B31A 212
000212                  CP(J)=X(J)*CPV(J)+(1.-X(J))*CPC(J)                     B31A 213
000213                  IF(N-1) 109,109,104                                    B31A 214
000214            109   ROT(1)=GAMA*(ROA(1)+ROB(1))+OMG*ROC(1)                 B31A 215
000215                  GO TO 105                                              B31A 216
000216            104   ROT(J)=(ROA(J)+ROB(J))*GAMA+OMG*(ROC(J))               B31A 217
000217            105   CONTINUE                                               B31A 218
000218                  IF (NUMN-NBM) 112,106,106                              B31A 219
000219            106   DO 107 N=NBM,NUMN                                      B31A 220
000220                  RR(N)=AREA(N)/ASU                                      B31A 221
000221                  KT=MATL(J)                                             B31A 222
000222                  CALL LOOK(K*2,TA(N),TT2(1,KT),TCP(1,KT),TKP(1,KT),0,0,Y2,D2,2) B31A 223
000223                  CP(N)=Y2(1)                                            B31A 224
000224                  CV(N)=Y2(2)                                            B31A 225
000225                  RAT(N)=DEL(N)/(CV(N)*RR(N))                            B31A 226
000226            107   RO(N)=RHO(KT)                                          B31A 227
000227            112   HRES=SIG*EPSW*(TA(NUMN)+TRES)*(TA(NUMN)**2+TRES**2)*HCONV B31A 228
000228                  RAT(NUMN+1)=1./(HRES*RR(NUMN)+.000000^1                B31A 229
000229                  QLOSS=(TA(NL)-TA(NBM))/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL)) B31A 230
000230                  QLOSST=QLOSST+QLOSS*DTH/AREA(1)*ASU                    B31A 231
000231                  CVT=CVT+RHO(2)*DSDT*ASU/AREA(1)*DTH                    B31A 232
000232                  DEL(NUMN+1)=CV(NUMN)/HRES                              B31A 233
000233                  RR(NUMN+1)=RR(NUMN)                                    B31A 234
000234                  DTHS=DTH                                               B31A 235
000235                  DTS=TSAVE-TA(1)                                        B31A 236
000236                  IF(ITER) 151,113,151                                   B31A 237
000237            113   ITER=0                                                 B31A 238
000238                  ITER=1                                                 B31A 239
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000239                CH=TCH(2)                                                 B31A 240
000240                JCMA=2                                                    B31A 241
000241                GO TO 3000                                                B31A 242
000242          C                                                               B31A 243
000243          C     OUTPUT                                                    B31A 244
000244          C                                                               B31A 245
000245            151 JCMA=2                                                    B31A 246
000246                IF(TH-TNXT+.00001) 700,3000,3000                          B31A 247
000247            700 JCMA=1                                                    B31A 248
000248                IF(TH-THPRT+.00001) 3410,3000,3000                        B31A 249
000249           3410 IPUMP=1                                                   B31A 250
000250                IF(KCM(4)) 4410,4410,3411                                 B31A 251
000251           3000 IPUMP=0                                                   B31A 252
000252           3411 HDT=12.*DSQTR                                             B31A 253
000253                NRR=NM-NL-1                                               B31A 254
000254                NLI=(NCM-NDR+1)/2                                         B31A 255
000255                CALL LOOK T(33+NLI,LCT,NPG,RECORD(35))                    B31A 256
000256            322 WRITE (KOUT,543)TH                                        B31A 257
000257                WRITE (KOUT,544)                                          B31A 258
000258                WRITE (KOUT,545) ITER,ITS,II    ,RSU,HW,HE,CH,BR          B31A 259
000259                WRITE (KOUT,546)                                          B31A 260
000260                WRITE (KOUT,547)                                          B31A 261
000261                HERM=(GSMS+CMD)/CH                                        B31A 262
000262                BPRMG=GSMS/CH                                             B31A 263
000263                WRITE (KOUT,548) BPRM,BPRMG,CMD,GSMS,CMT,GSMT             B31A 264
000264                WRITE (KOUT,5480) CHCRI,PYCRI                             B31A 265
000265                WRITE (KOUT,5481) SA,DIDT,CPE(1),DCDT,CPE(2),DPDT         B31A 266
000266                WRITE (KOUT,5482)                                         B31A 267
000267           3224 WRITE (KOUT,5483) QCONV,QRP,RAD,QCHEM,QCOND,QCONVT,QRPT,RADT,QCHEMB31A 268
000268              1T,QCONDT                                                   B31A 269
000269                WRITE (KOUT,5484)                                         B31A 270
000270                WRITE (KOUT,5485)PGPU,DECOM, TB,DEDT,QLOSS,PGPUT,DECOMT, TT,DEDTT,B31A 271
000271              1QLOSST                                                     B31A 272
000272                IF (NCON) 3020,3020,3021                                  B31A 273
000273           3021 WRITE(KOUT,5490)                                          B31A 274
000274                GO TO 3022                                                B31A 275
000275           3020 WRITE(KOUT,549)                                           B31A 276
000276           3022 CONTINUE                                                  B31A 277
000277                IF(IDUMP) 3023,3023,190                                   B31A 278
000278           3023 IF(NOI) 190,190,183                                       B31A 279
000279            183 CALL SLOPD (NL,RA(1),TA(1),EMO(1),EMO(1))                 B31A 280
000280                IF(NO) 182,182,184                                        B31A 281
000281            184 CALL OGLE (NC,SO,TO(1),NL,RA(1),TA(1),EMO(1))             B31A 282
000282            182 IF (NI) 189,189,185                                       B31A 283
000283            185 DO 186 I=1,NL                                             B31A 284
000284            186 EMO(I)=1./EMO(I)                                          B31A 285
000285                CALL OGLE (NI,SO(NO+1),TO(NO+1),NL,TA,RA,EMO)             B31A 286
000286            189 IF (NN) 188,188,187                                       B31A 287
000287            187 WRITE (7,581) TH,TS,(TO(I), I=1,NOI)                      B31A 288
000288            188 WRITE (3) TH,TS, (TO(I), I=1,NOI)                         B31A 289
000289                KK=KK+1                                                   B31A 290
000290            190 CONTINUE                                                  B31A 291
000291                IF (NCON) 3012,3012,3006                                  B31A 292
000292           3006 DO 3009 I=1,NL                                            B31A 293
000293                IF (X) 3007,3007,3008                                     B31A 294
000294           3008 CALL LOOK(11,X(I),TX,F1,F2,0,0,Y1,D1,2)                   B31A 295
000295                CNC(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                           B31A 296
000296                GO TO 3009                                                B31A 297
000297           3007 CNC(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                       B31A 298
000298           3009 CONTINUE                                                  B31A 299
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000299          3012 CONTINUE                                                          B31A 300
000300               DO 3011 J=1,NLI                                                   B31A 301
000301               K=NLI                                                             B31A 302
000302               L=J                                                               B31A 303
000303               IF (L-NL) 3002,3002,3001                                          B31A 304
000304          3001 L=L+NDR                                                           B31A 305
000305               GO TO 3003                                                        B31A 306
000306          3002 IF (L+NLI-NL) 3003,3003,3005                                      B31A 307
000307          3005 K=NLI+NDR                                                         B31A 308
000308          3003 N=MIND(NUMN,K+L)                                                  B31A 309
000309               IF (ICON) 3004,3004,3010                                          B31A 310
000310          3004 WRITE (KOUT,550) (I,MATL(I),TA(I),RO(I),H(I), I=L,N,K)            B31A 311
000311               GO TO 3011                                                        B31A 312
000312          3010 WRITE(KOUT,5500)(I,MATL(I),TA(I),RO(I),CNO(I),I=L,N,K)            B31A 313
000313          3011 CONTINUE                                                          B31A 314
000314               IF(IDUMP) 3225,3225,4410                                          B31A 315
000315          3225 IF(TH-THFIN+0.00001)1151,2   ,2                                   B31A 316
000316             2 JCMA=JCMA-1                                                       B31A 317
000317               IF (ICO) 1,1,3                                                    B31A 318
000318             3 REWIND 3                                                          B31A 319
000319               CALL LCOUNT (-1,LCT,NPG,RECORD(35))                               B31A 320
000320               WRITE (KOUT,552) NO,NI,TH,TS,(SO(I), I=1,NOI)                     B31A 321
000321               WRITE (KOUT,553)                                                  B31A 322
000322               DO 4 K=1,KK                                                       B31A 323
000323               READ (3) TH,TS, (TO(I), I=1,NOI)                                  B31A 324
000324             4 WRITE (KOUT,554) TH,TS, (TO(I), I=1,NOI)                          B31A 325
000325               GO TO 1                                                           B31A 326
000326          1151 IF(JCMA-2) 606,799,606                                            B31A 327
000327          6061 TNXT=AMAX1(TPR(1),TPR(2))                                         B31A 328
000328           606 IF(TH-TPR2+0.00001)  154,158,158                                  B31A 329
000329           158 DTPRT=DTPR2                                                       B31A 330
000330               DTPR2=DTPR3                                                       B31A 331
000331               TPR2=TPR3                                                         B31A 332
000332               TPR3=THFIN                                                        B31A 333
000333           154 THPRT=AMIN1(THPRT+DTPRT,TPR2,TNXT)                                B31A 334
000334          4410 DTHB=AMIN1(DTHB,DELCR/(DSDTB+.0000001),TH-THDS, 50.0/(ABS(TSAVE-TA(B31A 335
000335              11))+.1)*DTH)                                                      B31A 336
000336               TSAVE=TA(1)                                                       B31A 337
000337               DTHB=(THPRT-TH)/(AINT((THPRT-TH)/DTH+1.0))                        B31A 338
000338           144 TH=TH+DTH                                                         B31A 339
000339           610 IF(DTH-.000001) 142,142,609                                       B31A 340
000340           142 WRITE (KOUT,552) TH,DTH,DTHS,DTHB,THDS,DTS,DELCR,DSDTB            B31A 341
000341               TH=THFIN                                                          B31A 342
000342               JCMA=0                                                            B31A 343
000343               GO TO 3000                                                        B31A 344
000344          C                                                                      B31A 345
000345          C     INTERNAL DECOMPOSITION -- DENSITY CALCULATION                    B31A 346
000346            608 NA=JFH                                                          B31A 347
000347          C                                                                      B31A 348
000348          C     SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL                B31A 349
000349               DSDT=DSDTB                                                        B31A 350
000350               DS=DSDT*DTH                                                       B31A 351
000351               DSI=12.0*DS                                                       B31A 352
000352               SA=SA+DSI                                                         B31A 353
000353               RSU=ARC(RSV+SA)                                                   B31A 354
000354               DTHR=DTHC                                                         B31A 355
000355               DEL(NL)=DEL(NLI-DS                                                B31A 356
000356               FK=0.0                                                            B31A 357
000357               FJFF=FJFH                                                         B31A 358
000358               JI=JFHF                                                           B31A 359
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000356                DENOLD=RHO(2)                                          B31A 360
000360                GOLD=GPE(1)                                            B31A 361
000361                POLD=GPE(2)                                            B31A 362
000362                GPE(1)=SA                                              B31A 363
000363                GPE(2)=SB                                              B31A 364
000364                IE=1                                                   B31A 365
000365                RHOZ=0.0                                               B31A 366
000366                TA(NL+1)=TA(NL)                                        B31A 369
000367                DEL(NL+1)=DEL(NL)                                      B31A 370
000368                RR(NL+1)=RR(NL)                                        B31A 371
000369                DO 252 I=1,NL                                          B31A 372
000370                1SV=MIND(NL,I+1)
000371                RHO(I)=0.0                                             B31A 373
000372                RR(I)=RRZ                                              B31A 374
000373                DSS=FJF/DEL(I)*DSDT                                    B31A 375
000374                J2=J1                                                  B31A 376
000375                DO 255 J=J2,JF                                         B31A 377
000376                N=N+J1-1                                               B31A 378
000377                IF (J-JFHP) 253,259,253                                B31A 379
000378           259  IF(MATL(I)+MATL(ISV)-4) 243,240,243
000379           243  IF(AMAX1(TA(I),TA(I+1))-TRACM)241,241,242              B31A 381
000380           241  IF(MATL(I)+MATL(I)+MATL(ISV)-3) 242,240,242
000381           240  J1=JFHP                                                B31A 383
000382                RHOZ=FJFH*RHO(I+1)                                     B31A 384
000383                RHO(I)=RHO(I)+FJFH*RO(I)                               B31A 385
000384                N=N+JFH                                                B31A 386
000385                GO TO 244                                              B31A 387
000386           242  RHOZ=0.0                                               B31A 388
000387                J1=1                                                   B31A 389
000388                DTA=(TA(I+1)-TA(I))/(FJFS+FJF/DEL(I)*DEL(I+1)/RR(I)*RR(I+1))  B31A 390
000389                TAS=TA(I)                                              B31A 391
000390           253  N=N+1                                                  B31A 392
000391                IF(ABS(DSS)-.0000001) 1016,1016,1017                   B31A 393
000392          1016  DROAC=0.                                               B31A 394
000393                DROBC=0.                                               B31A 395
000394                DROCC=0.                                               B31A 396
000395                GO TO 1021                                             B31A 397
000396          1017  IF(I-NL) 1015,1018,1015                                B31A 398
000397          1018  FK=FK-1.0                                              B31A 399
000398                IF(FK) 1019,1016,1020                                  B31A 400
000399          1019  FK=FJF-1.0                                             B31A 401
000400          1020  DSS=DSDT/DEL(I)*FK                                     B31A 402
000401          1015  IF ( -1) 1115,1215,1115                                B31A 403
000402          1115  DROAC=(ROA(N+1)-ROA(N))*DSS                            B31A 404
000403                DROBC=(ROB(N+1)-ROB(N))*DSS                            B31A 405
000404                DROCC=(ROC(N+1)-ROC(N))*DSS                            B31A 406
000405                GO TO 1021                                             B31A 407
000406          1215  CONTINUE                                               B31A 408
000407          1315  DRHOAC=(ROA(N+1)-RHORA)*DSS                            B31A 409
000408                DRHOBC=(ROB(N+1)-RHORB)*DSS                            B31A 410
000409                DRHOCC=(ROC(N+1)-RHORC)*DSS                            B31A 411
000410                RHO(1)=RHO(2)                                          B31A 412
000411          1321  TAS=TAS+DTA                                            B31A 413
000412                IF(TAS-TRACA) 227,227,229                              B31A 414
000413           229  IF(TAS  -TRACA) 201,200,202                            B31A 415
000414           201  RHOAT=0.0                                              B31A 416
000415                GO TO 2113                                             B31A 417
000416           202  IF(RHORA-ROA(J)) 211,201,201                           B31A 418
000417           211  RO=ROA(N)-RHORA                                        B31A 419
000418                RO=1.-PSIA                                             B31A 420
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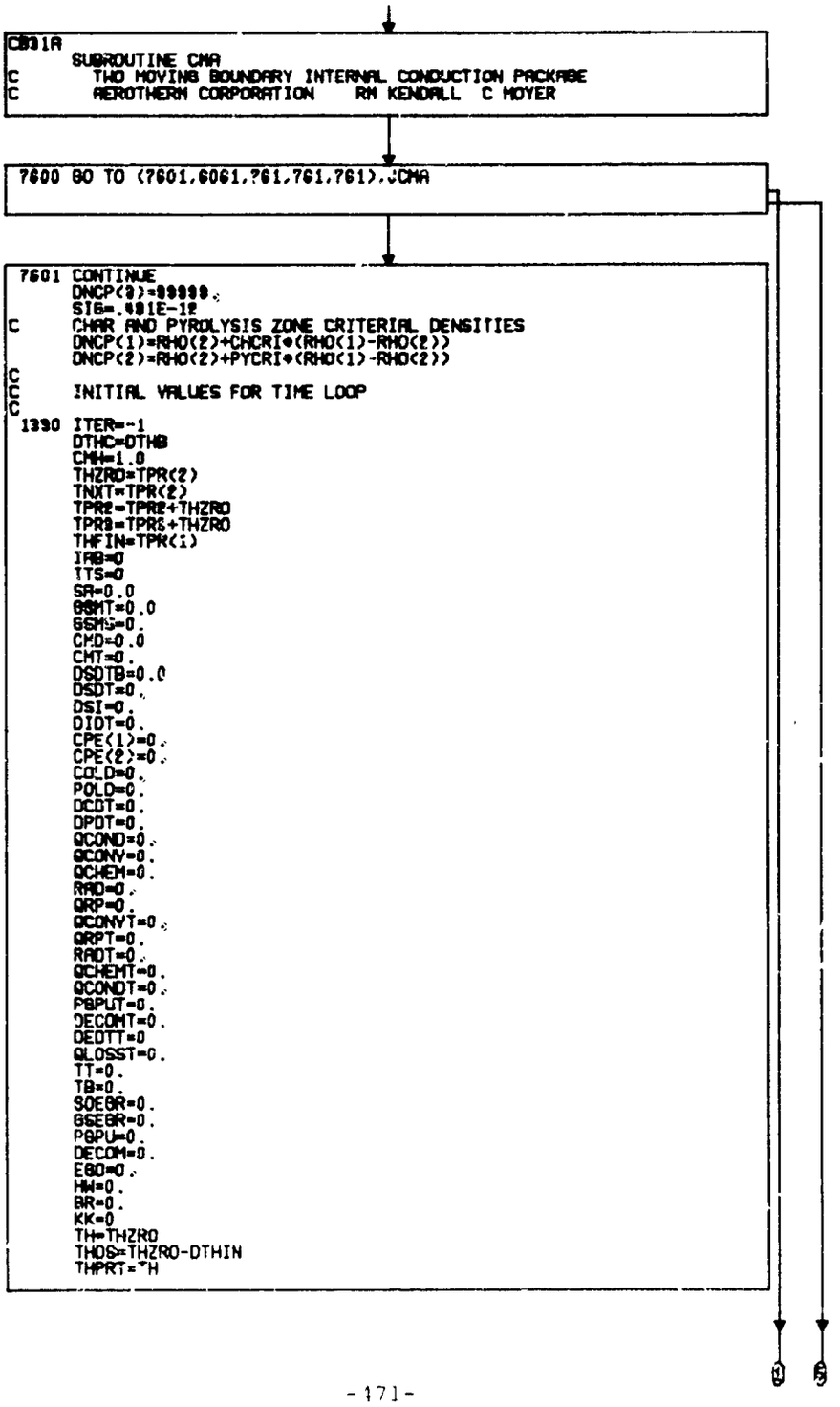
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000419                IF(POW)2111,2112,2111                                          B31A 421
000420           2111 DROAT=(-RO*((RO**POW)-                    FA*EXP(-EA/TAS)*DTH)**  B31A 422
000421               1(1./PO*))/DTH                                                  B31A 423
000422                GO TO 2113                                                     B31A 424
000423           2112 DROAT=RO*(EXP(-FA*DTH*EXP(-EA/TAS))-1.)/DTH                    B31A 425
000424           2113 ROA(N)=ROA(N)+(DROAT+DROAC)*DTH                                B31A 426
000425            221 IF(TAS  -TRACR)203,203,204                                     B31A 427
000426            203 DROAT=0.0                                                      B31A 428
000427                GO TO 2133                                                     B31A 429
000428            204 IF(RHORA-ROA(N))213,203,203                                    B31A 430
000429            213 RO=ROA(N)-RHORA                                                B31A 431
000430                POW=1.-PSIA                                                    B31A 432
000431                IF(POW)2131,2132,2131                                          B31A 433
000432           2131 DROBT=(-RO*((RO**POW)-                    FB*EXP(-EB/TAS)*DTH)**  B31A 434
000433               1(1./PO*))/DTH                                                  B31A 435
000434                GO TO 2133                                                     B31A 436
000435           2132 DROBT=RO*(EXP(-FB*DTH*EXP(-EB/TAS))-1.)/DTH                    B31A 437
000436           2133 ROB(N)=ROB(N)+(DROBT+DROBC)*DTH                                B31A 438
000437            223 IF(TAS  -TRACC) 205,205,206                                    B31A 439
000438            205 DROCT=0.0                                                      B31A 440
000439                GO TO 2153                                                     B31A 441
000440            206 IF(RHORC-ROC(N))215,205,205                                    B31A 442
000441            215 RO=ROC(N)-RHORC                                                B31A 443
000442                POW=1.-PSIC                                                    B31A 444
000443                IF (PO*) 2151,2152,2151                                        B31A 445
000444           2151 DROCT=(-RO*((RO**POW)-                    FC*EXP(-EC/TAS)*DTH)**  B31A 446
000445               1(1./PO*))/DTH                                                  B31A 447
000446                GO TO 2153                                                     B31A 448
000447           2152 DROCT=RO*(EXP(-FC*DTH*EXP(-EC/TAS))-1.)/DTH                    B31A 449
000448           2153 ROC(N)=ROC(N)+(DROCT+DROCC)*DTH                                B31A 450
000449            225 DMDG(I)=DMDG(I)-DEL(I)*((DROAT+DROBT)*GAMA+OMG*DROCT)         B31A 451
000450            227 DNS=(ROA(N)+ROB(N))*GAMA+OMG*ROC(N)                            B31A 452
000451                RON(I)=RON(I)+DNS                                              B31A 453
000452                IF(N-1) 2251,2253,2251                                         B31A 454
000453           2251 IF(DNS-DNCP(IE)) 225),2252,2252                                B31A 455
000454           2252 CPE(IE)=DEL(I)*((FLOAT(N)-0.5)/FJF+1.-FLOAT(I))*12.+RA(I)     B31A 456
000455                CPE(IE)=CPE(IE)-DEL(I)/(DNS-DENOLD)*(DNS-DNCP(IE))/FJF*12.     B31A 457
000456                CPE(IE)=AMAX1(CPE(IE),SA)                                      B31A 458
000457                IE=IE+1                                                        B31A 459
000458           2253 DENOLD=DNS                                                     B31A 460
000459            255 TAS=TAS+DTA                                                    B31A 461
000460            264 DMDG(I)=DMDG(I)/FJF*RR(I)                                      B31A 462
000461                RON(I)=RON(I)/FJF                                              B31A 463
000462                IF(I-1) 257,257,254                                            B31A 464
000463            257 FJF=FJFS                                                       B31A 465
000464                DTA=DTA/DEL(1)*DEL(2)/2.*RR(2)                                 B31A 466
000465                GO TO 252                                                      B31A 467
000466            254 DTA=DTA/DEL(I)*DEL(I+1)/RR(I)*RR(I+1)                          B31A 468
000467            252 CONTINUE                                                       B31A 469
000468              C     NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES     B31A 470
000469                GO=FJFHP                                                       B31A 471
000470                DO 85 I=1,NL                                                   B31A 472
000471                IF(ABS(RON(I)-RHO(1))-.01) 81,81,82                            B31A 473
000472             81 MATL(I)=1                                                      B31A 474
000473                X(I)=1.0                                                       B31A 475
000474                GO TO 85                                                       B31A 476
000475             82 IF (ABS(RON(I)-RHO(2))-.01) 83,83,84                           B31A 477
000476             83  MATL(I)=2                                                    B31A 478
000477                X(I)=0.                                                        B31A 479
000478                G(I)=GNC(I)                                                    B31A 480
```

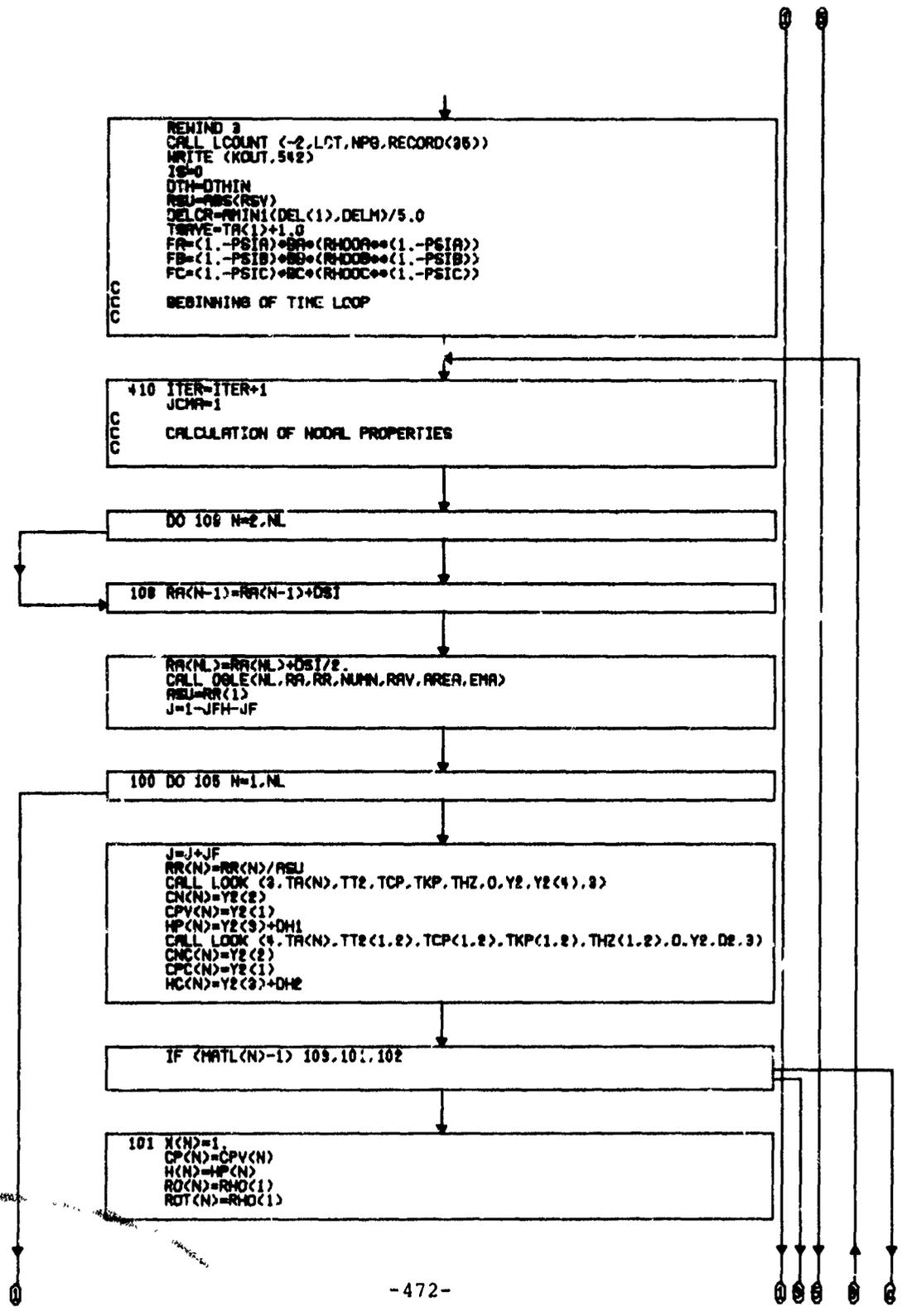
```
000479                GO T  85                                                  B31A 481
000480             84 WETL(I)=1                                                 B31A 482
000481                X(I)=PETE-PET/RON(I)                                      B31A 483
000482                IF (ST) 8500,8500,8501                                    B31A 484
000483           8501 CALL LOOK(11,X(I),TX,F1,F2,0,0,Y1,D1,2)                   B31A 485
000484                CNC(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                           B31A 486
000485                GO T  85                                                  B31A 487
000486           8500 CN(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                        B31A 488
000487             85 RAT(I)=DEL(I)/(CN(I)*RR(I))                              B31A 489
000488                GSM=0.0                                                   B31A 491
000489                DO 122 I=1,NL                                             B31A 492
000490            122 GSM=GSM+DMDG(I)                                           B31A 493
000491                GSMS=GSM                                                  B31A 494
000492                GSMT=GSMT+GSMS*ASU/AREA(1)*DTH                            B31A 495
000493                DCDT=(CPE(1)-COLD)/DTH                                    B31A 496
000494                DPDT=(CPE(2)-POLD)/DTH                                    B31A 497
000495           C                                                              B31A 498
000496           C       CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS       B31A 499
000497           C       AND INTERNAL ENERGY RATE TERMS                         B31A 500
000498           C     MAIN BLOCK                                               B31A 501
000499                DVB=0.                                                    B31A 502
000500                SMEGR=0.                                                  B31A 503
000501                GMEGR=0.                                                  B31A 504
000502                TR=0.                                                     B31A 505
000503                RAT(1)=2.*RAT(1)                                          B31A 506
000504                CPNL=CP(NL)                                               B31A 507
000505                NLM=NL-1                                                  B31A 508
000506                IMIN=0                                                    B31A 509
000507                DO 30 I=IMIN,NLM                                          B31A 510
000508                IF (I) 15,15,14                                           B31A 511
000509             14 GSM=GSM-DMDG(I)                                           B31A 512
000510                DRODTD=-DMDG(I)/(RR(I)*DEL(I))                            B31A 513
000511                FACT1=DTH/(DEL(I)*RR(I))                                  B31A 514
000512                FACT2=GSM/(DEL(I)*RR(I))                                  B31A 515
000513                A(I)=-FACT1*DVB                                           B31A 516
000514                DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))               B31A 517
000515                TERM2=RON(I)*CP(I)-DTH*(CPGAS*(DRODTD-FACT2)              B31A 518
000516               1          -DSDT*RO1*CP1/DEL(I))                          B31A 519
000517                TERM1=FACT1*DVB                                           B31A 520
000518                B(I)=TERM2-A(I)*TERM1                                     B31A 521
000519                C(I)=-TERM1                                               B31A 522
000520                D(I)=TA(I)*TERM2+(HGAS*DRODTD-HRAR*(RON(I))               B31A 523
000521               1       -RO(I))/DTH-FACT2*HGAS-DSDT*RO1*H1/DEL(I))*DTH     B31A 524
000522             15 RO1=RO(I+1)                                               B31A 525
000523                X1=PETE-PET/RO1                                           B31A 526
000524                CP1=CPV(I+1)*X1+CPC(I+1)*(1.0-X1)                         B31A 527
000525                H1=HP(I+1)*X1+HC(I+1)*(1.0-X1)                            B31A 528
000526                CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))             B31A 529
000527                TR=-RO1*HRAR*RO1/H1*                                      B31A 530
000528                HGAS=PETE*HP(I+1)-PET/RH(I+1)*HC(I+1)                     B31A 531
000529                ...=RO1*...1*RO1*...AR                                    B31A 532
000530                CALL LOOK(11,X(I),TH,0.0,0.0,HGAS,CPGAS,1)                B31A 533
000531                HGAS=HGAS...*HG                                           B31A 534
000532                ...                                                       B31A 535
000533                ...                                                       B31A 536
000534                IF (I) 24,24,20                                           B31A 537
000535             24 ...GAS                                                    B31A 538
000536                ...                                                       B31A 539
000537                ...                                                       B31A 540
000538                DO ... ...*DTH                                            B31A 541
```

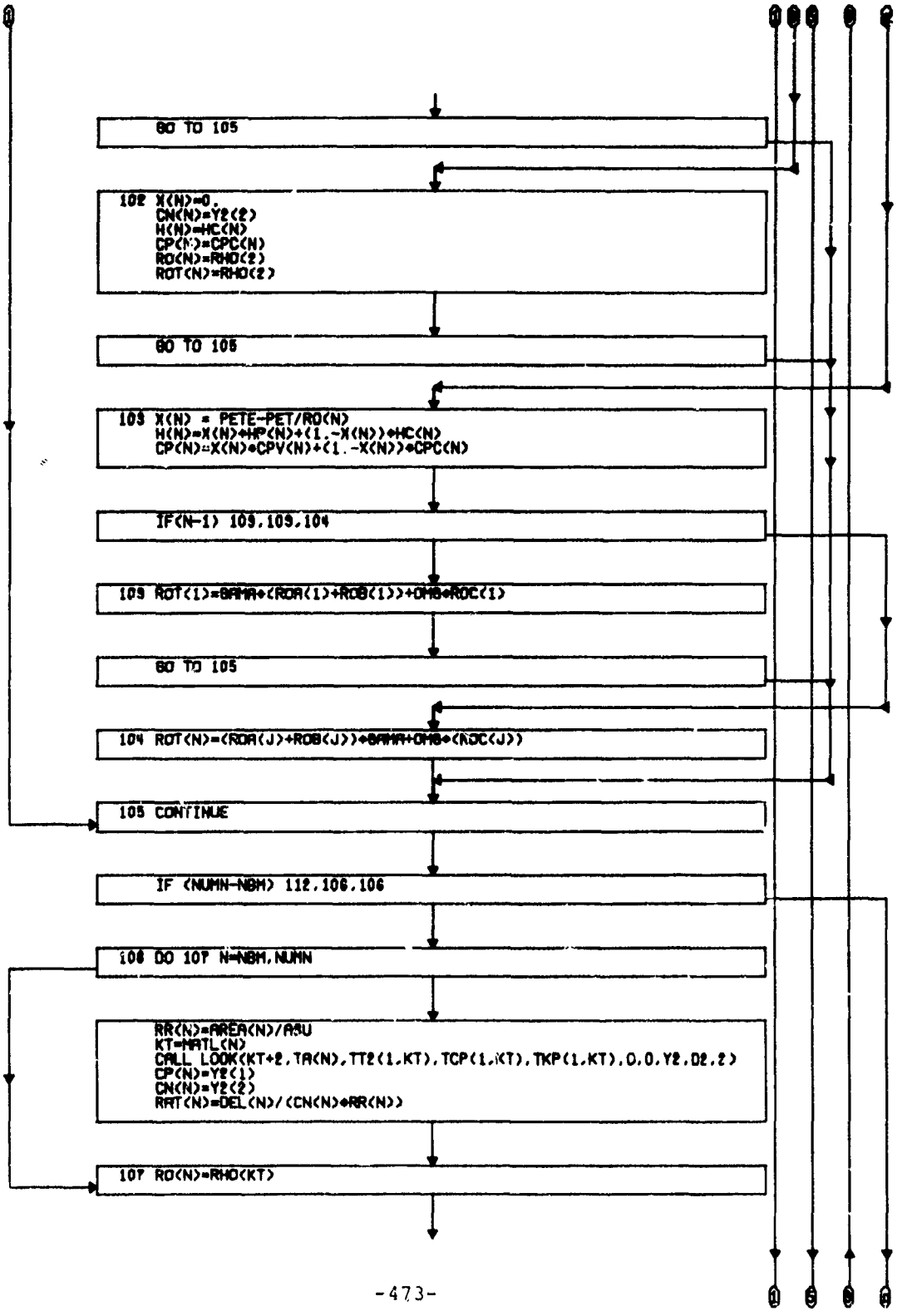
```
000539                C(I)=C(I)+TERM3                                                  B31A 542
000540                D(I)=D(I)+TA(I+1)*TERM3+(FACT2*HGAS*DSDT*RO1*H1/DEL(I))*DTH      B31A 543
000541                TR=TR-TN*DSDT*RR(I)                                              B31A 544
000542             30 CONTINUE                                                         B31A 545
000543                A(1)=DTH/DEL(1)                                                  B31A 546
000544                TT=TT+TR*DTH/AREA(1)*ASU                                         B31A 547
000545          C     NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT          B31A 548
000546                DRODTD=-DMDG(NL)/(RR(NL)*DEL(NL))                                B31A 549
000547                FACT1=DTH/(DEL(NL)*RR(NL))                                       B31A 550
000548                A(NL)=-FACT1*DVB                                                 B31A 551
000549                DVB=1.0/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL))                   B31A 552
000550                C(NL)=-FACT1*DVB                                                 B31A 553
000551                TERM2=RO(NL)*CP(NL)-(CPGAS*DRODTD+(DSDT/DEL(NL)))*               B31A 554
000552               1         (RO(NL)*CPNL  -RO1*CP1))*DTH                          B31A 555
000553                B(NL)=TERM2-C(NL)-A(NL)                                          B31A 556
000554                D(NL)=TA(NL)*TERM2+DTH*(HGAS*DRODTD-HRAR*(RON(NL)-               B31A 557
000555               1         RO(NL))/DTH+DSDT*(RO(NL)*H(NL)-RO1*H1)/DEL(NL))       B31A 558
000556          C     NOW FOR BACK UPS IF ANY                                          B31A 559
000557                K = NL                                                           B31A 560
000558                IF(NUMN-NBM) 60,40,40                                            B31A 561
000559             40 DO 50 I=NBM,NUMN                                                 B31A 562
000560                K=K+1                                                            B31A 563
000561                FACT1=DTH/(DEL(I)*RR(I))                                         B31A 564
000562                A(K) = -FACT1*DVB                                                B31A 565
000563                DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))                      B31A 566
000564                C(K)=-FACT1*DVB                                                  B31A 567
000565                B(K)=RO(I)*CP(I)-C(K)-A(K)                                       B31A 568
000566             50 D(K)=TA(I)*RO(I)*CP(I)                                           B31A 569
000567          C     NOW IF THE LAST NODE WAS INSULATED WE MUST REPAIR LAST B AND C   B31A 570
000568             60 IF(WHES) 80,70,80                                                B31A 571
000569             70 B(K)=B(K)+C(K)                                                   B31A 572
000570                C(K)=0.                                                          B31A 573
000571          C     NOW BEFORE GAUSS REDUCTION REWRITE LAST LINE OF MATRIX           B31A 574
000572             80 D(K)=D(K)-C(K)*TRES                                              B31A 575
000573                L=K                                                              B31A 576
000574                DO 90 I=2,K                                                      B31A 577
000575                L=L-1                                                            B31A 578
000576                D(L)=D(L)-C(L)/B(L+1)*D(L+1)                                     B31A 579
000577             90 B(L)=B(L)-C(L)/B(L+1)*A(L+1)                                     B31A 580
000578                B(1)=B(1)/A(1)                                                   B31A 581
000579                D(1)=D(1)/A(1)                                                   B31A 582
000580                PGPU=EGO-GSEGR                                                   B31A 583
000581                PGPUT=PGPUT+PGPU*DTH/AREA(1)*ASU                                 B31A 584
000582                DECOM=GSEGR-SOEGR                                                B31A 585
000583                DECOMT=DECOMT+DECOM*DTH/AREA(1)*ASU                              B31A 586
000584          C                                                                      B31A 587
000585          C     SURFACE BOUNDARY CONDITION PACKAGE                               B31A 588
000586            761 CALL SBCPKG                                                      B31A 589
000587          C                                                                      B31A 590
000588                IF(JCMA-2) 780,780,799                                           B31A 591
000589            780 IF(JCMA) 148,3000,148                                            B31A 592
000590            148 CONTINUE                                                         B31A 593
000591          C                                                                      B31A 594
000592          C     SHRINK (AND DROP) OF LAST ABLATING NODE                          B31A 595
000593          C                                                                      B31A 596
000594          C     DEL(NL)=DEL(NL)-DS (SEE INT DECOMP)                              B31A 597
000595                IF(DEL(NL)-DELM)149,149,150                                      B31A 598
000596            149 DRLP=DEL(NL)*RO(NL)*RR(NL)                                       B31A 599
000597                DRLCP=DRLP*CP(NL)                                                B31A 600
000598                NL=NL-1                                                          B31A 601
```

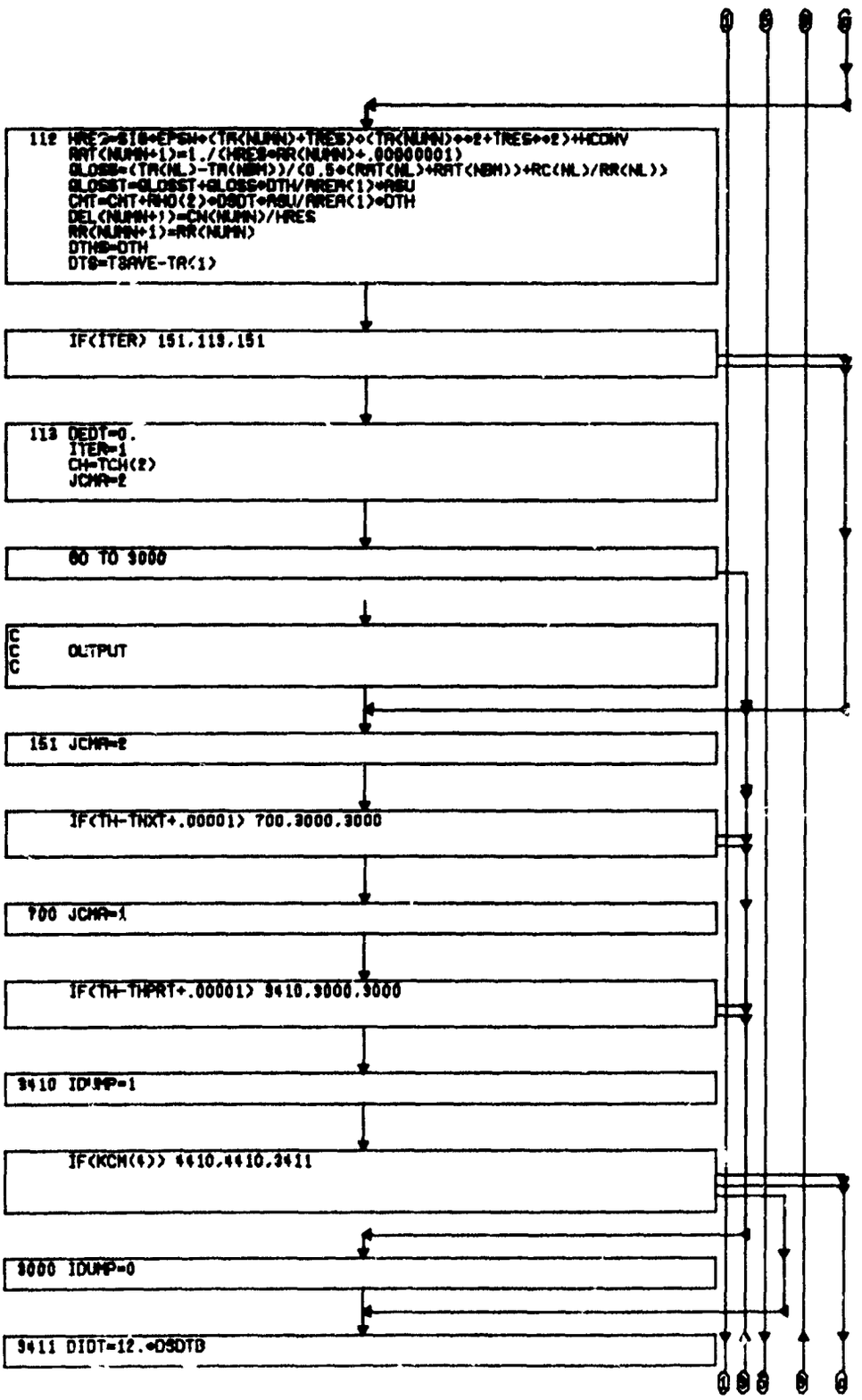
```
000599                 RC(NL)=RC(NL+1)                                          B31A 602
000600                 DPL=DEL(NL)*RO(NL)*RR(NL)                                B31A 603
000601                 DRLC=DRL*CP(NL)                                          B31A 604
000602                 HAPHB=DRL*H(NL)+DRLP*H(NL+1)                             B31A 605
000603                 TOP1=DRL+DRLP                                            B31A 606
000604                 TOP2=DRLC+DRLCP                                          B31A 607
000605                 TOP3=DRLC*TA(NL) +DRLCP*TA(NL+1)                         B31A 608
000606                 VOL=DEL(NL)*RR(NL)+DEL(NL+1)*RR(NL+1)                    B31A 609
000607                 DEL(NL)=DEL(NL)+DEL(NL+1)                                B31A 610
000608                 RO(NL)=TOP1/VOL                                          B31A 611
000609                 CP(NL)=TOP2/TOP1                                         B31A 612
000610                 TA(NL)=TOP3/TOP2                                         B31A 613
000611                 H(NL)=HAPHB/TOP1                                         B31A 614
000612                 DELR=DEL(NL+1)*RR(NL+1)/VOL                              B31A 615
000613                 CZ=1.0-DELR                                              B31A 616
000614                 DZ=0.0                                                   B31A 617
000615                 GZ=CZ                                                    B31A 618
000616                 NZ=JF*NL-JFH                                             B31A 619
000617                 K=N-Z-JF+1                                               B31A 620
000618                 KK=K                                                     B31A 621
000619                 FZ=DELR                                                  B31A 622
000620                 EZ=GZ                                                    B31A 623
000621                 GO TO 179                                                B31A 624
000622             172 DZ=DZ+1.0                                                B31A 625
000623             173 FZ=DZ-CZ                                                 B31A 626
000624                 IF(K-NZ) 175,174,175                                     B31A 627
000625             174 GZ=DELR                                                  B31A 628
000626             175 K=K+1                                                    B31A 629
000627                 CZ=CZ+GZ                                                 B31A 630
000628             176 EZ=CZ-DZ                                                 B31A 631
000629                 IF(EZ)178,177,177                                        B31A 632
000630             177 ROA(N)=ROA(N)+FZ*ROA(K)                                  B31A 633
000631                 ROB(N)=ROB(N)+FZ*ROB(K)                                  B31A 634
000632                 ROC(N)=ROC(N)+FZ*ROC(K)                                  B31A 635
000633                 IF(N-NZ) 171,150,171                                     B31A 636
000634             171 N=N+1                                                    B31A 637
000635             179 ROA(N)=ROA(K)*EZ                                         B31A 638
000636                 ROB(N)=ROB(K)*EZ                                         B31A 639
000637                 ROC(N)=ROC(K)*EZ                                         B31A 640
000638                 GO TO 172                                                B31A 641
000639             178 ROA(N)=ROA(N)+ROA(K)*GZ                                  B31A 642
000640                 ROB(N)=ROB(N)+ROB(K)*GZ                                  B31A 643
000641                 ROC(N)=ROC(N)+ROC(K)*GZ                                  B31A 644
000642                 GO TO 173                                                B31A 645
000643           C                                                              B31A 646
000644             150 GO TO 410                                                B31A 647
000645               1 RETURN                                                   B31A 648
000646             799 CONTINUE                                                 B31A 649
000647                 RETURN                                                   B31A 650
000648                 END                                                      B31A 651
```

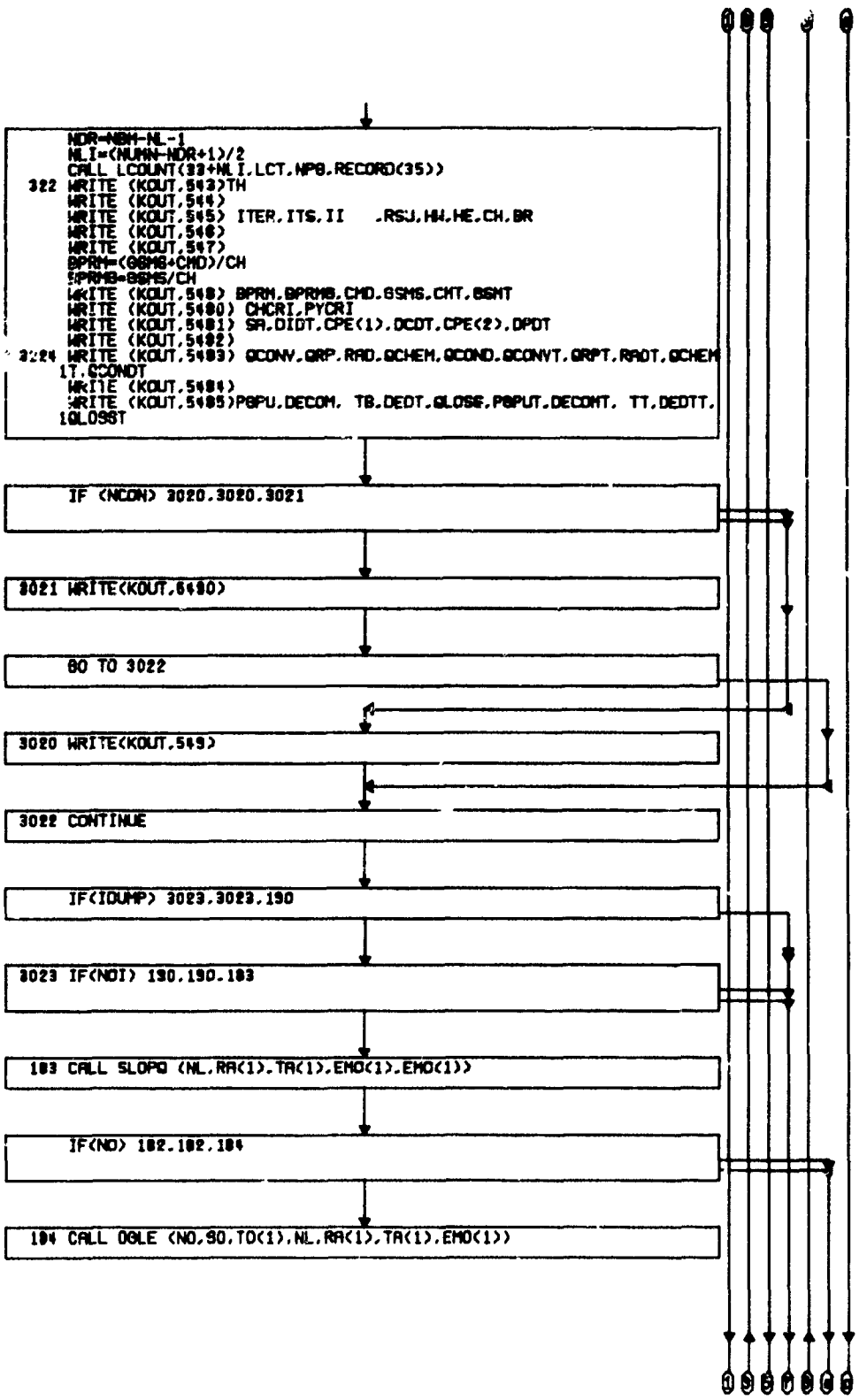
(3) Flow Chart

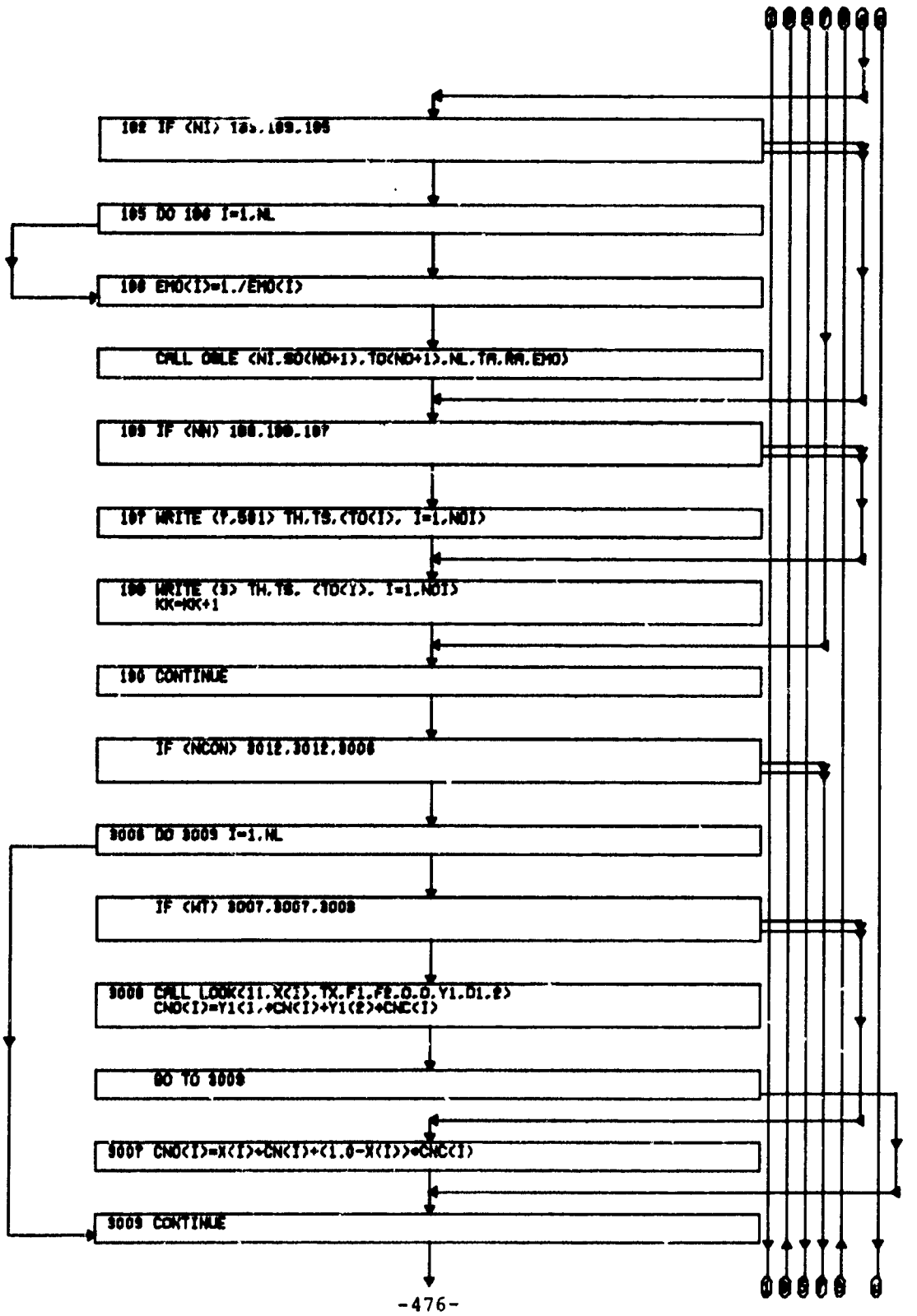

CB31A
SUBROUTINE CMA
C THD MOVING BOUNDARY INTERNAL CONDUCTION PACKABE
C AEROTHERM CORPORATION RM KENDALL C MOYER
7600 BO TO (7601,6061,761,761,761),JCMA
7601 CONTINUE
DNCP(3)=99999.
SIG=.481E-12
C CHAR AND PYROLYSIS ZONE CRITERIAL DENSITIES
DNCP(1)=RHO(2)+CHCRI*(RHO(1)-RHO(2))
DNCP(2)=RHO(2)+PYCRI*(RHO(1)-RHO(2))
C
C INITIAL VALUES FOR TIME LOOP
C
1390 ITER=-1
DTHC=DTHB
CMH=1.0
THZRO=TPR(2)
TNXT=TPR(2)
TPR2=TPR2+THZRO
TPR3=TPR3+THZRO
THFIN=TPR(1)
IAB=0
ITS=0
SR=0.0
BBMT=0.0
BBMS=0.
CMD=0.0
CMT=0.
DSDTB=0.0
DSDT=0.
DSI=0.
DIDT=0.
CPE(1)=0.
CPE(2)=0.
COLD=0.
POLD=0.
DCDT=0.
DPDT=0.
QCOND=0.
QCONV=0.
QCHEM=0.
RAD=0.
QRP=0.
QCONVT=0.
QRPT=0.
RADT=0.
QCHEMT=0.
QCONDT=0.
PBPUT=0.
DECOMT=0.
DEDTT=0
QLOSST=0.
TT=0.
TB=0.
SOEBR=0.
BSEBR=0.
PBPU=0.
DECOM=0.
EBO=0.
HW=0.
BR=0.
KK=0
TH=THZRO
THOS=THZRO-DTHIN
THPRT=TH

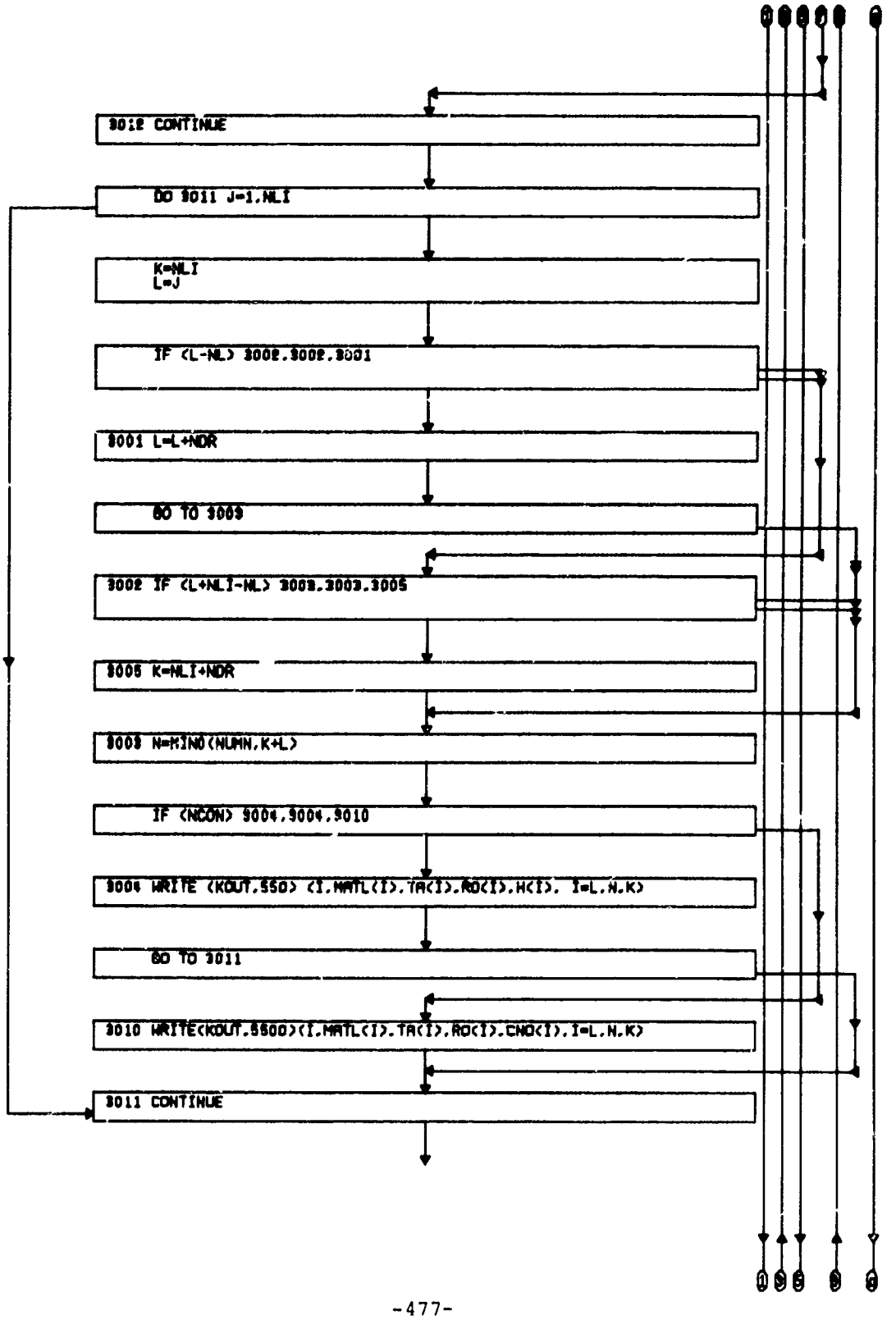

REWIND 3
CALL LCOUNT (-2,LCT,NPG,RECORD(35))
WRITE (KOUT,542)
IS=0
DTH=DTHIN
RSU=ABS(RSV)
DELCR=AMIN1(DEL(1),DELM)/5.0
TSAVE=TA(1)+1.0
FA=(1.-PSIA)*GA*(RHOOA**(1.-PSIA))
FB=(1.-PSIB)*GB*(RHOOB**(1.-PSIB))
FC=(1.-PSIC)*GC*(RHOOC**(1.-PSIC))
C
C BEGINNING OF TIME LOOP
C
410 ITER=ITER+1
JCMA=1
C
C CALCULATION OF NODAL PROPERTIES
C
DO 108 N=2,NL
108 RA(N-1)=RA(N-1)+DSI
RA(NL)=RA(NL)+DSI/2.
CALL OGLE(NL,RA,RR,NUMN,RAV,AREA,EMA)
RSU=RR(1)
J=1-JFH-JF
100 DO 105 N=1,NL
J=J+JF
RR(N)=RR(N)/RSU
CALL LOOK (3,TA(N),TT2,TCP,TKP,THZ,0,Y2,Y2(4),3)
CN(N)=Y2(2)
CPV(N)=Y2(1)
HP(N)=Y2(3)+DH1
CALL LOOK (4,TA(N),TT2(1,2),TCP(1,2),TKP(1,2),THZ(1,2),0,Y2,D2,3)
CNC(N)=Y2(2)
CPC(N)=Y2(1)
HC(N)=Y2(3)+DH2
IF (MATL(N)-1) 109,101,102
101 X(N)=1.
CP(N)=CPV(N)
H(N)=HP(N)
RO(N)=RHO(1)
ROT(N)=RHO(1)

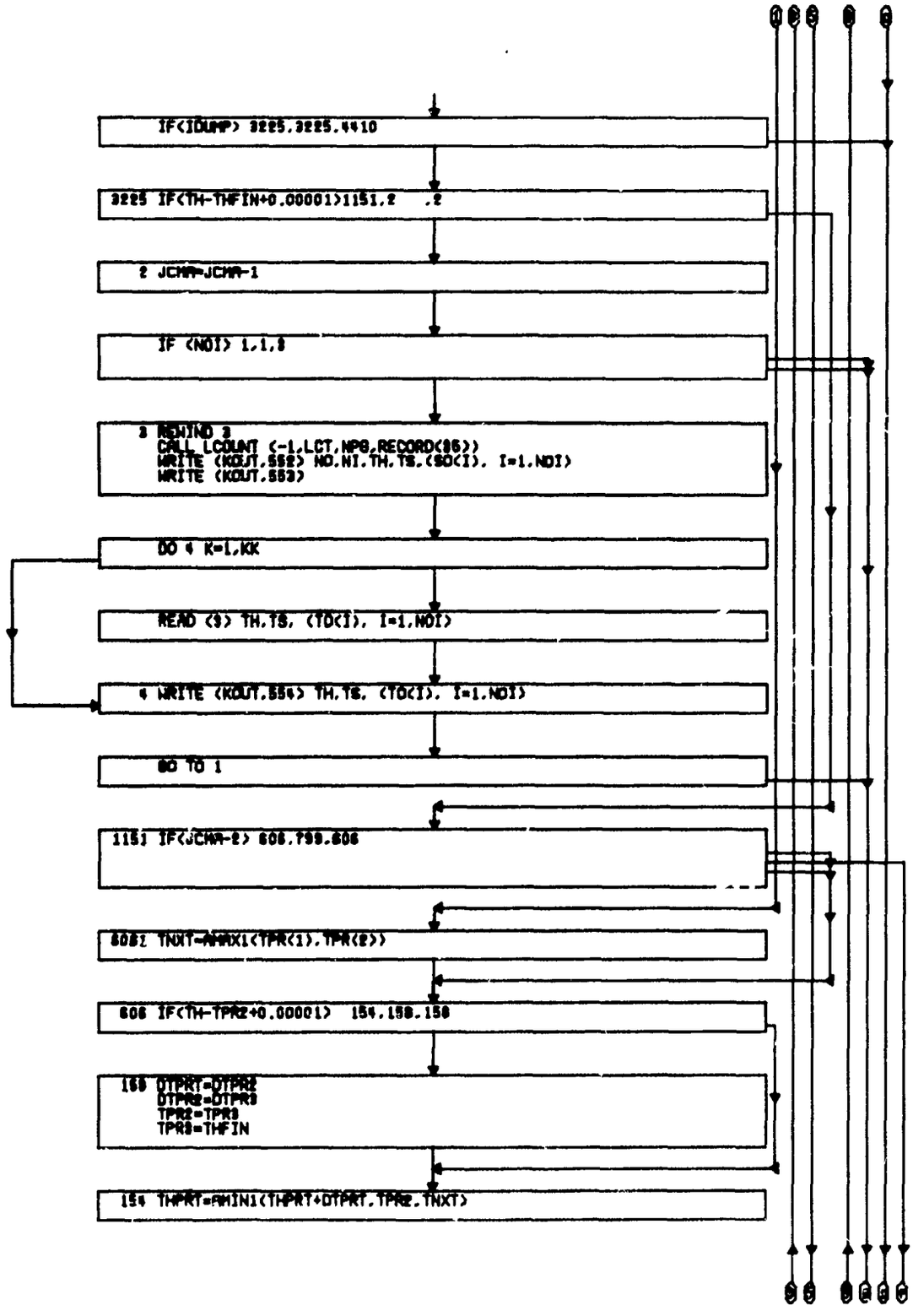

GO TO 105
102 X(N)=0.
CN(N)=Y2(2)
H(N)=HC(N)
CP(N)=CPC(N)
RO(N)=RHO(2)
ROT(N)=RHO(2)
GO TO 105
103 X(N) = PETE-PET/RO(N)
H(N)=X(N)*HP(N)+(1.-X(N))*HC(N)
CP(N)=X(N)*CPV(N)+(1.-X(N))*CPC(N)
IF(N-1) 109,109,104
109 ROT(1)=GAMA*(ROA(1)+ROB(1))+OMG*ROC(1)
GO TO 105
104 ROT(N)=(ROA(J)+ROB(J))*GAMA+OMG*(ROC(J))
105 CONTINUE
IF (NUMN-NBM) 112,106,106
106 DO 107 N=NBM,NUMN
RR(N)=AREA(N)/ASU
KT=MATL(N)
CALL LOOK(KT+2,TA(N),TT2(1,KT),TCP(1,KT),TKP(1,KT),0,0,Y2,D2,2)
CP(N)=Y2(1)
CN(N)=Y2(2)
RAT(N)=DEL(N)/(CN(N)*RR(N))
107 RO(N)=RHO(KT)

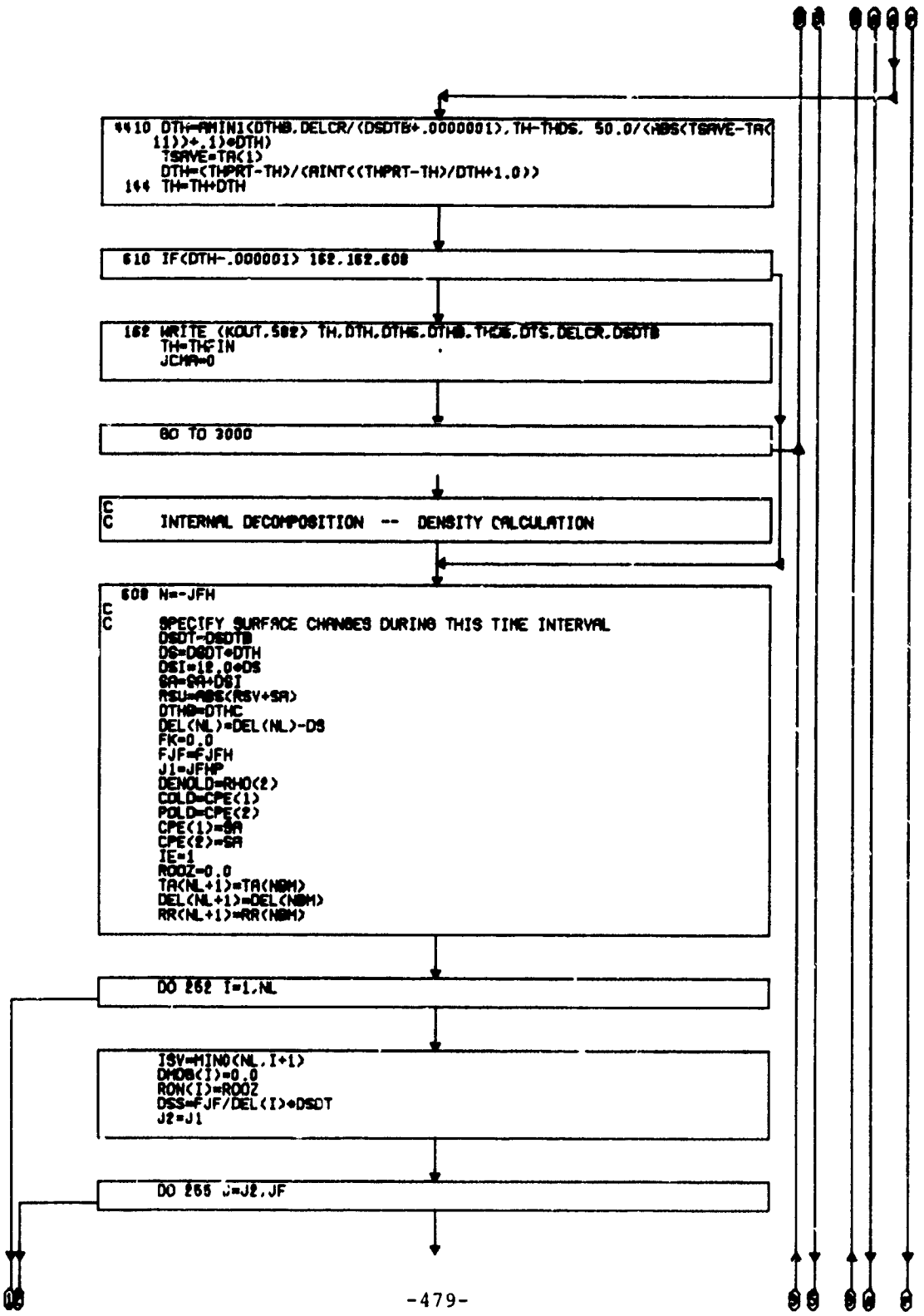

112 HRES=BIG*EPSH*(TR(NUMN)+TRES)*(TR(NUMN)**2+TRES**2)+HCONV
RAT(NUMN+1)=1./(HRES*RR(NUMN)+.00000001)
GLOSS=(TR(NL)-TR(NBM))/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL))
GLOSST=GLOSST+GLOSS*DTH/AREA(1)*ASU
CHT=CHT+RHO(2)*DSDT*ASU/AREA(1)*DTH
DEL(NUMN+1)=CH(NUMN)/HRES
RR(NUMN+1)=RR(NUMN)
DTHS=DTH
DTS=TSAVE-TR(1)
IF(ITER) 151,113,151
113 DEDT=0.
ITER=1
CH=TCH(2)
JCHA=2
GO TO 9000
C
C
C
OUTPUT
151 JCHA=2
IF(TH-THXT+.00001) 700,9000,9000
700 JCHA=1
IF(TH-THPRT+.00001) 9410,9000,9000
9410 IDUMP=1
IF(KCH(4)) 4410,4410,9411
9000 IDUMP=0
9411 DIDT=12.*DSDTB

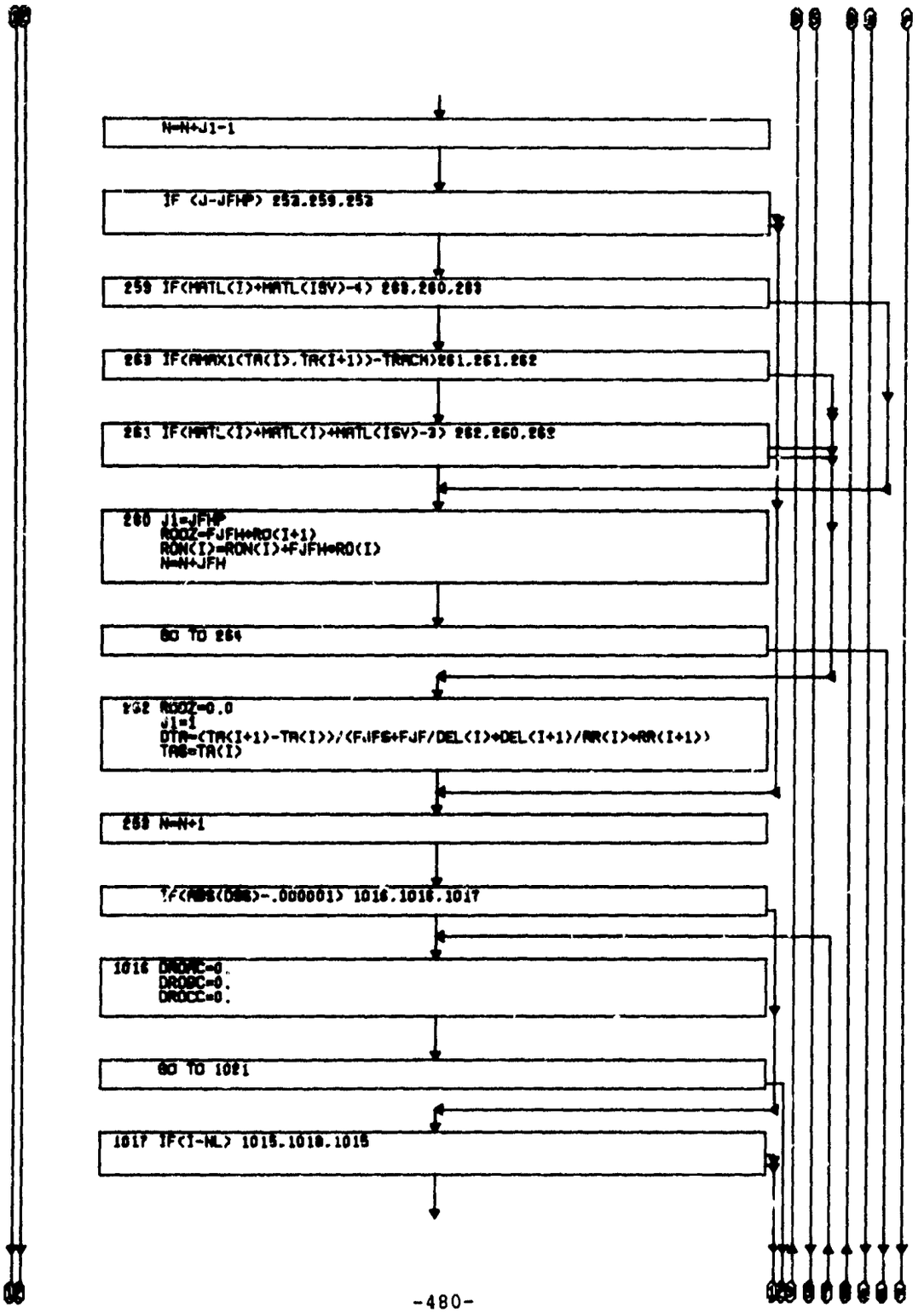

NDR=NBH-NL-1
NLI=(NUMN-NDR+1)/2
CALL LCOUNT(33+NLI,LCT,NPB,RECORD(35))
322 WRITE (KOUT,543)TH
WRITE (KOUT,544)
WRITE (KOUT,545) ITER,ITS,II .RSU,HW,HE,CH,BR
WRITE (KOUT,546)
WRITE (KOUT,547)
BPRM=(BSMB+CMD)/CH
BPRMB=BSMS/CH
WRITE (KOUT,548) BPRM,BPRMB,CMD,BSMS,CHT,BSNT
WRITE (KOUT,5480) CHCRI,PYCRI
WRITE (KOUT,5481) SA,DIDT,CPE(1),DCDT,CPE(2),DPDT
WRITE (KOUT,5482)
3224 WRITE (KOUT,5483) BCONV,GRP,RAD,BCHEM,BCOND,BCONVT,BRPT,RADT,BCHEM
1T,BCONDT
WRITE (KOUT,5484)
WRITE (KOUT,5485)PBPU,DECOM, TB,DEDT,BLOSE,PBPUT,DECONT, TT,DEDTT,
1BLOSST
IF (NCON) 3020,3020,3021
3021 WRITE(KOUT,6480)
GO TO 3022
3020 WRITE(KOUT,549)
3022 CONTINUE
IF(IDUMP) 3023,3023,190
3023 IF(NDI) 190,190,183
183 CALL SLOPD (NL,RA(1),TA(1),EMO(1),EMO(1))
IF(ND) 182,182,184
184 CALL OBLE (ND,BO,TO(1),NL,RA(1),TA(1),EMO(1))

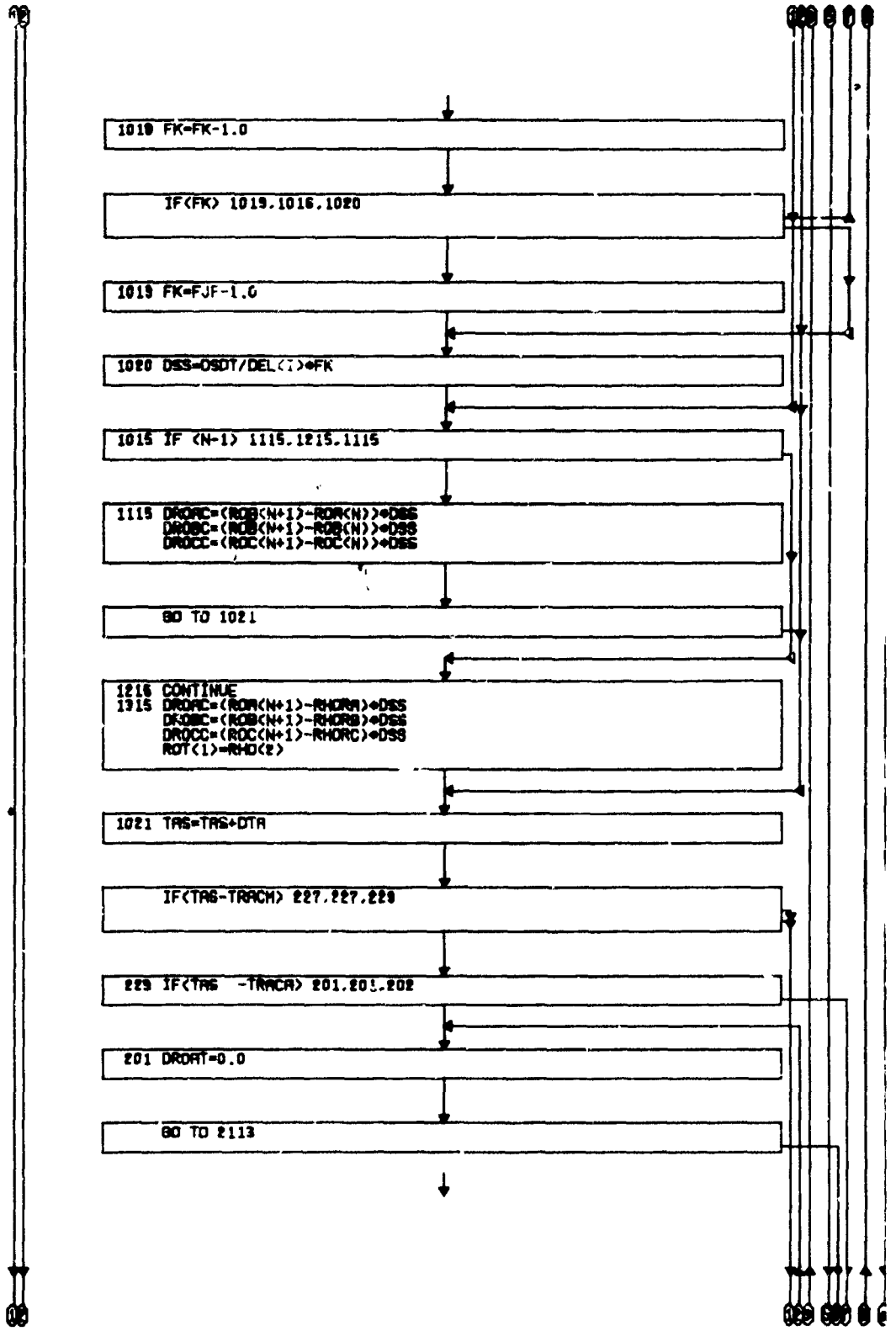

102 IF (NI) 103,103,105
105 DO 106 I=1,NL
106 EMO(I)=1./EMO(I)
CALL OBLE (NI,SO(NO+1),TO(NO+1),NL,TA,MM,EMO)
107 IF (NN) 108,108,107
107 WRITE (7,501) TH,TS,(TO(I), I=1,NOI)
108 WRITE (5) TH,TS, (TO(I), I=1,NOI)
KK=KK+1
110 CONTINUE
IF (NCON) 9012,9012,9008
9008 DO 9009 I=1,NL
IF (WT) 9007,9007,9008
9008 CALL LOOK(11,X(I),TX,F1,FE,0,0,Y1,D1,2)
CNO(I)=Y1(1,)*CN(I)+Y1(2)*CNC(I)
GO TO 9009
9007 CNO(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)
9009 CONTINUE

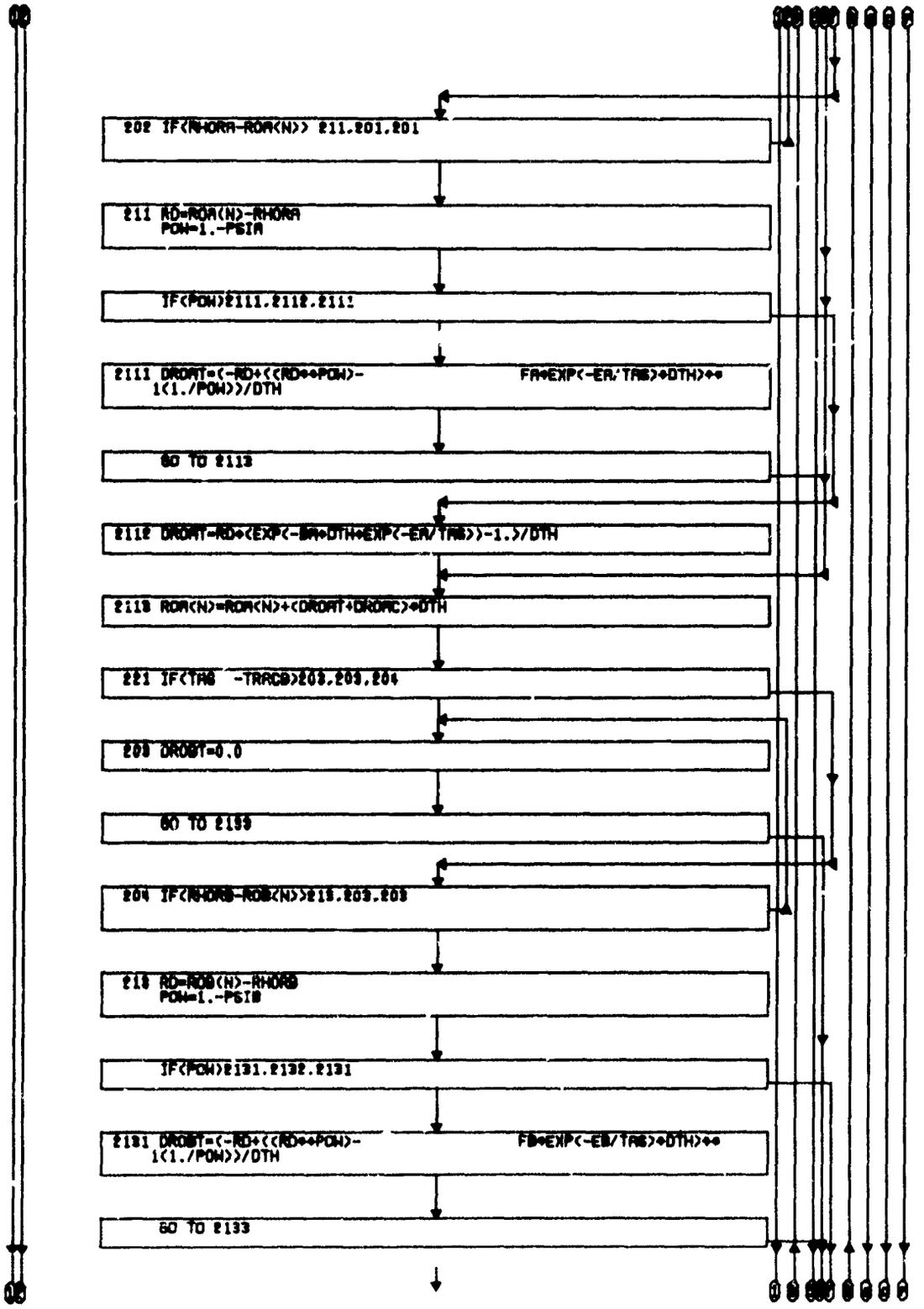

3012 CONTINUE
DO 3011 J=1,NLI
K=NLI
L=J
IF (L-NL) 3002,3002,3001
3001 L=L+NDR
GO TO 3003
3002 IF (L+NLI-NL) 3003,3003,3005
3005 K=NLI+NDR
3003 N=MIN0(NUMN,K+L)
IF (NCON) 3004,3004,3010
3004 WRITE (KOUT,550) (I,MATL(I),TA(I),RO(I),H(I), I=L,N,K)
GO TO 3011
3010 WRITE(KOUT,5500)(I,MATL(I),TA(I),RO(I),CNO(I),I=L,N,K)
3011 CONTINUE

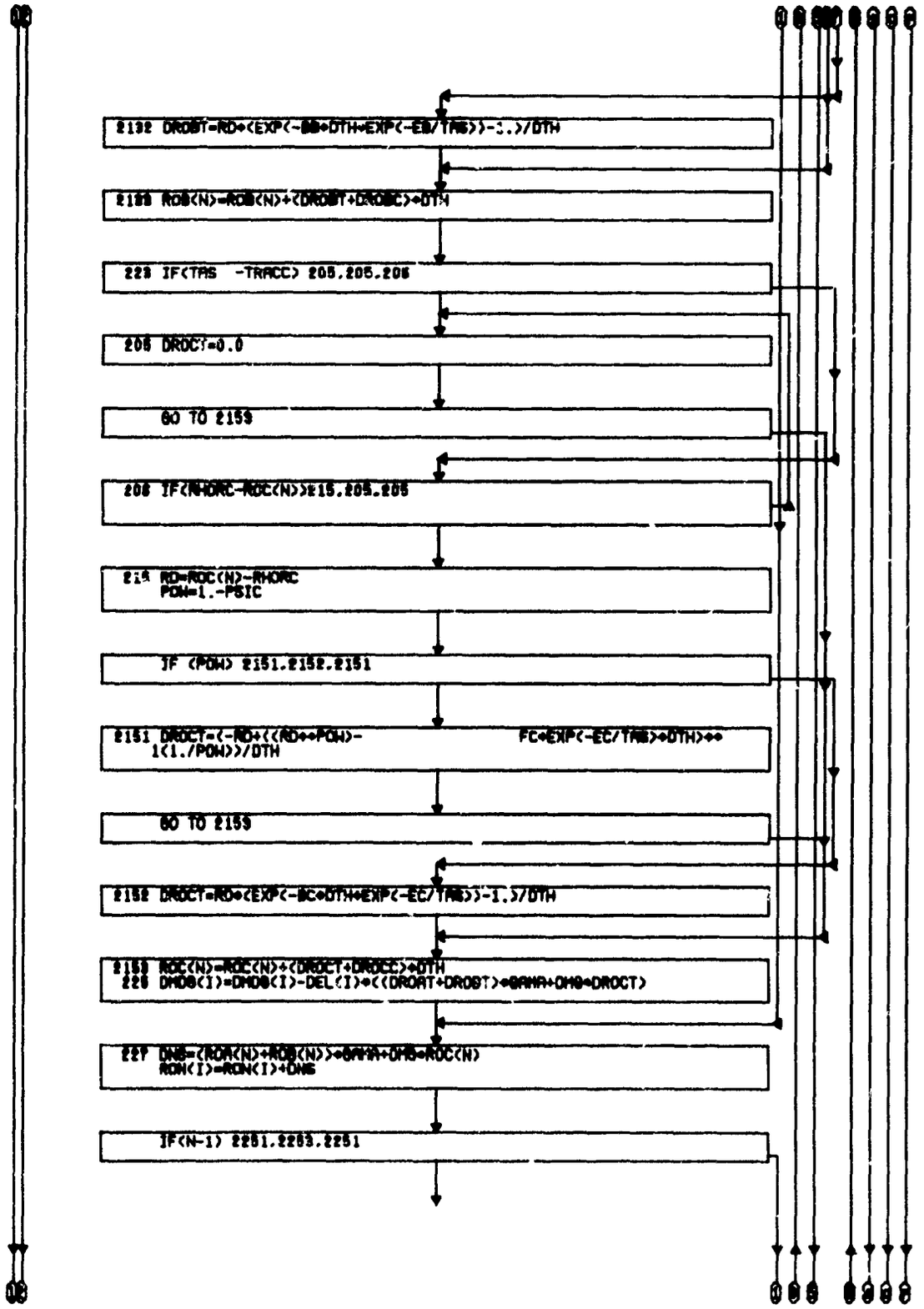

IF(IDUMP) 3225,3225,4410
3225 IF(TH-THFIN+0.00001)1151,2 ,2
2 JCHA=JCHA-1
IF (NOI) 1,1,3
3 REWIND 3
CALL LCOUNT (-1,LCT,NPG,RECORD(86))
WRITE (KOUT,552) NO,NI,TH,TS,(SO(I), I=1,NOI)
WRITE (KOUT,553)
DO 4 K=1,KK
READ (3) TH,TS, (TO(I), I=1,NOI)
4 WRITE (KOUT,554) TH,TS, (TO(I), I=1,NOI)
GO TO 1
1151 IF(JCHA-2) 606,799,606
8081 TNXT=AMAX1(TPR(1),TPR(2))
606 IF(TH-TPR2+0.00001) 154,158,158
158 DTPRT=DTPR2
DTPR2=DTPR3
TPR2=TPR3
TPR3=THFIN
154 THPRT=AMIN1(THPRT+DTPRT,TPR2,TNXT)

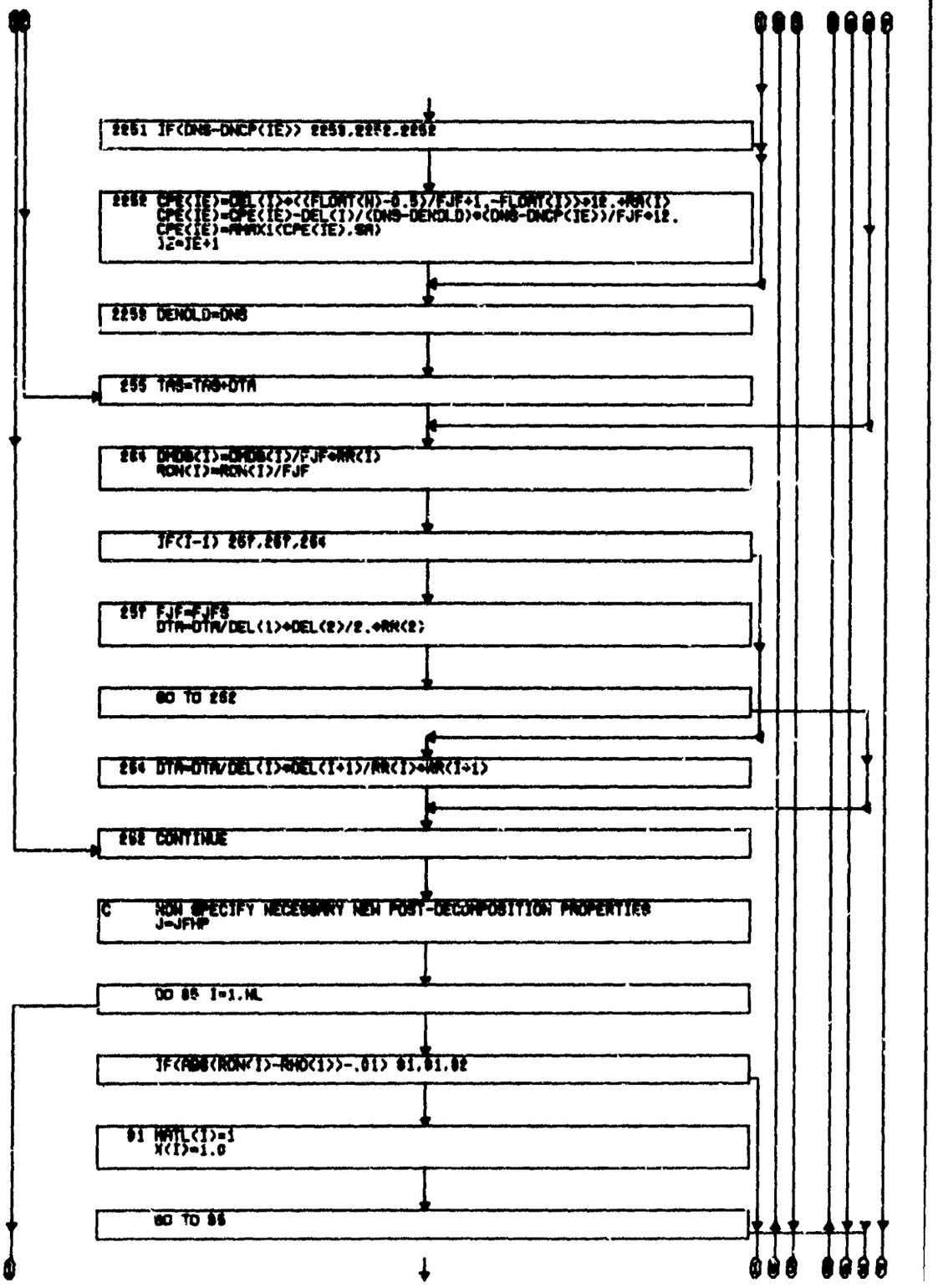

$$10 DTH=AMIN1(DTHB,DELCR/(DSDTB+.0000001),TH-THDS, 50.0/(ABS(TSAVE-TA(
1))+.1)*DTH)
TSAVE=TA(1)
DTH=(THPRT-TH)/(AINT((THPRT-TH)/DTH+1.0))
164 TH=TH+DTH
610 IF(DTH-.000001) 162,162,608
162 WRITE (KOUT,502) TH,DTH,DTHS,DTHB,THDS,DTS,DELCR,DSDTB
TH=THPIN
JCMA=0
GO TO 3000
C
C INTERNAL DECOMPOSITION -- DENSITY CALCULATION
608 N=-JFH
C
C SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL
DSDT=DSDTB
DS=DSDT*DTH
DSI=12.0*DS
SA=SA+DSI
RSU=ABS(RSV+SA)
DTHB=DTHC
DEL(NL)=DEL(NL)-DS
FK=0.0
FJF=FJFH
J1=JFHP
DENOLD=RHO(2)
COLD=CPE(1)
POLD=CPE(2)
CPE(1)=SA
CPE(2)=SA
IE=1
ROOZ=0.0
TA(NL+1)=TA(NBM)
DEL(NL+1)=DEL(NBM)
RR(NL+1)=RR(NBM)
DO 252 I=1,NL
ISV=MIN0(NL,I+1)
DMOB(I)=0.0
RON(I)=ROOZ
DSS=FJF/DEL(I)*DSDT
J2=J1
DO 255 J=J2,JF

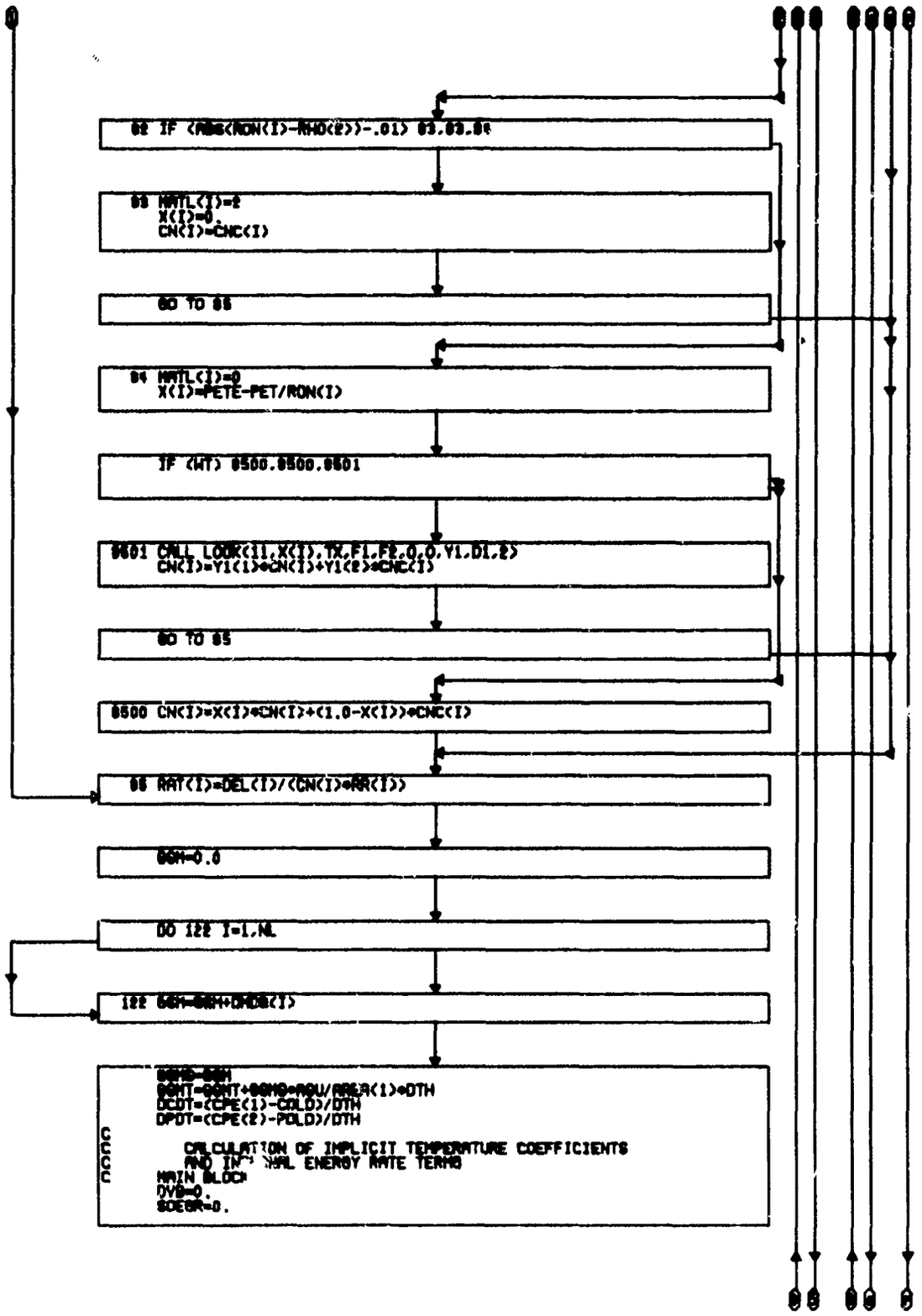

N=N+J1-1
IF (J-JFHP) 252,259,252
259 IF(MATL(I)+MATL(ISV)-4) 268,260,268
260 IF(AMAX1(TA(I),TA(I+1))-TRACH)261,261,262
261 IF(MATL(I)+MATL(I)+MATL(ISV)-3) 262,260,262
260 J1=JFHP
ROOZ=FJFH*RO(I+1)
RON(I)=RON(I)+FJFH*RO(I)
N=N+JFH
GO TO 264
262 ROOZ=0.0
J1=1
DTA=(TA(I+1)-TA(I))/(F.IFS+FJF/DEL(I)+DEL(I+1)/RR(I)+RR(I+1))
TAS=TA(I)
268 N=N+1
IF(ABS(DBB)-.000001) 1016,1016,1017
1016 DROAC=0.
DROBC=0.
DROCC=0.
GO TO 1021
1017 IF(I-NL) 1015,1018,1015

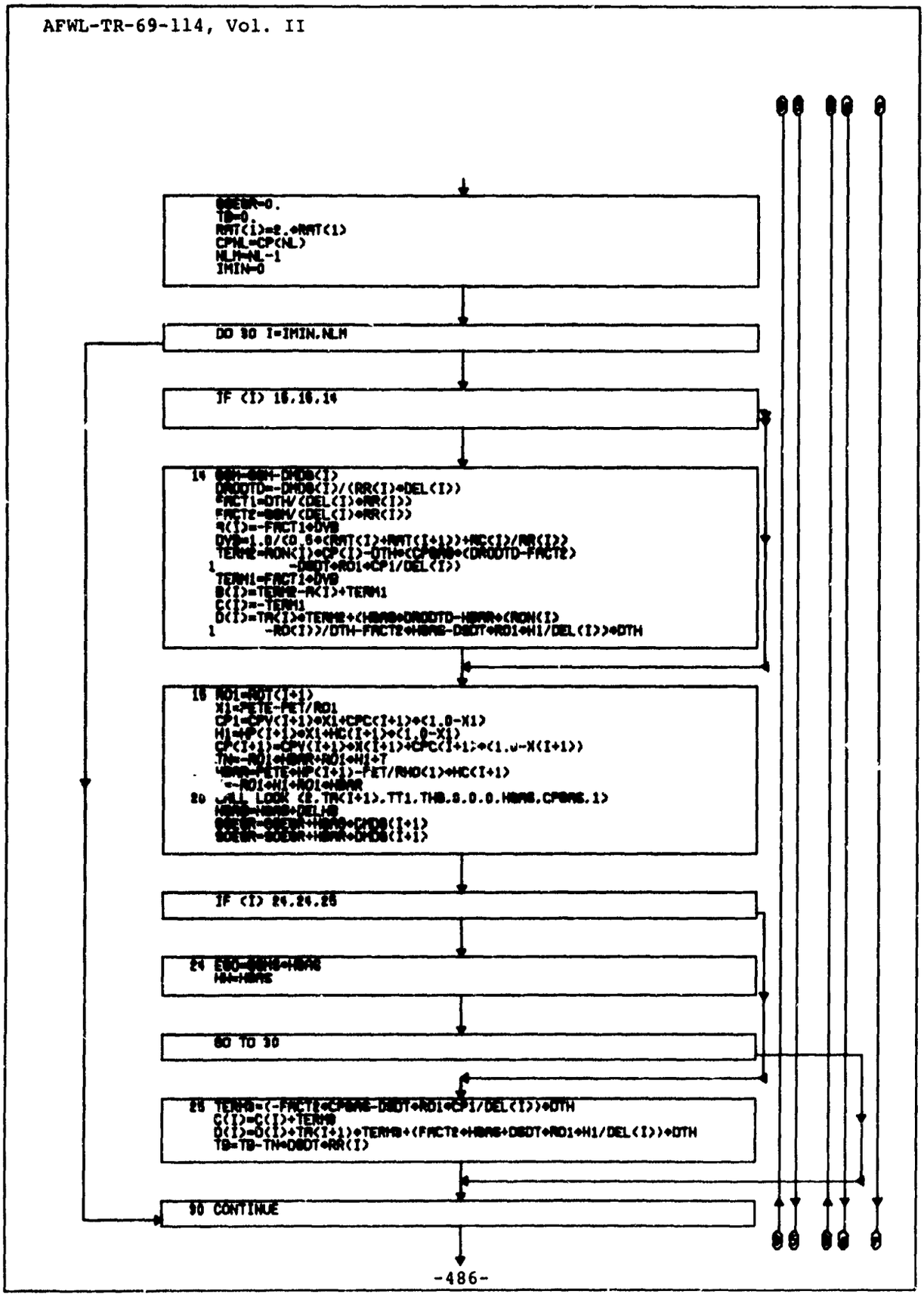

1019 FK=FK-1.0
IF(FK) 1019.1016.1020
1019 FK=FJF-1.0
1020 DSS=OSDT/DEL(I)*FK
1015 IF (N-1) 1115.1215.1115
1115 DRORC=(ROR(N+1)-ROR(N))*DSS
DROBC=(ROB(N+1)-ROB(N))*DSS
DROCC=(ROC(N+1)-ROC(N))*DSS
GO TO 1021
1216 CONTINUE
1215 DRORC=(ROR(N+1)-RHORR)*DSS
DROBC=(ROB(N+1)-RHORB)*DSS
DROCC=(ROC(N+1)-RHORC)*DSS
ROT(1)=RHO(2)
1021 TAS=TAS+DTA
IF(TAS-TRACH) 227.227.229
229 IF(TAS -TRACA) 201.201.202
201 DRORT=0.0
GO TO 2113

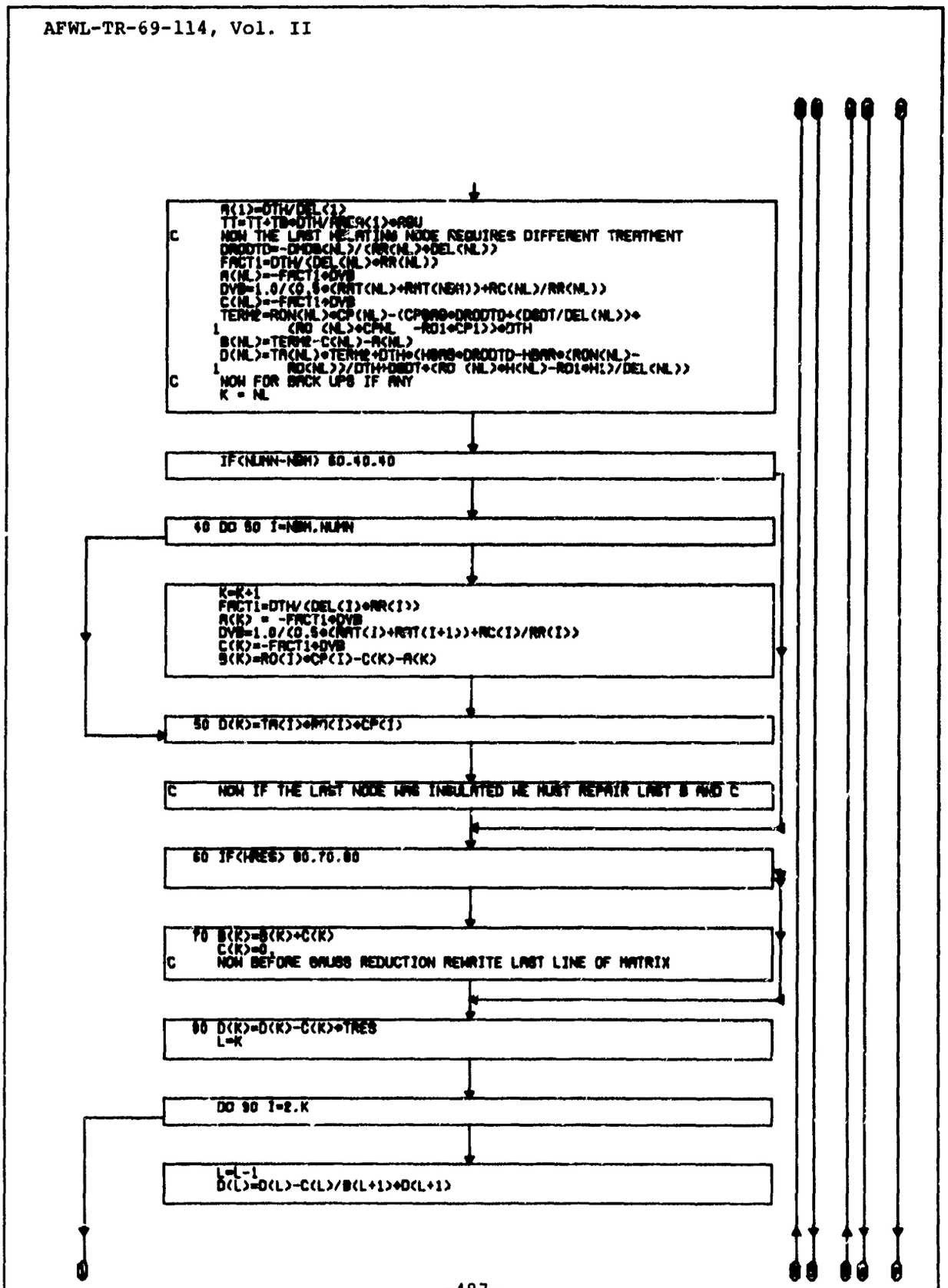

202 IF(RHORA-RORA(N)) 211,201,201
211 RD=RORA(N)-RHORA
POW=1.-PSIA
IF(POW)2111,2112,2111
2111 DROAT=(-RD+((RD**POW)- FA*EXP(-ER/TAS)*DTH)**
1(1./POW))/DTH
GO TO 2113
2112 DROAT=RD*(EXP(-BA*DTH*EXP(-ER/TAS))-1.)/DTH
2113 RORA(N)=RORA(N)+(DROAT+DRORC)*DTH
221 IF(TAS -TRRCB)203,203,204
203 DROBT=0.0
GO TO 2135
204 IF(RHORB-ROB(N))213,203,203
213 RD=ROB(N)-RHORB
POW=1.-PSIB
IF(POW)2131,2132,2131
2131 DROBT=(-RD+((RD**POW)- FB*EXP(-EB/TAS)*DTH)**
1(1./POW))/DTH
GO TO 2133

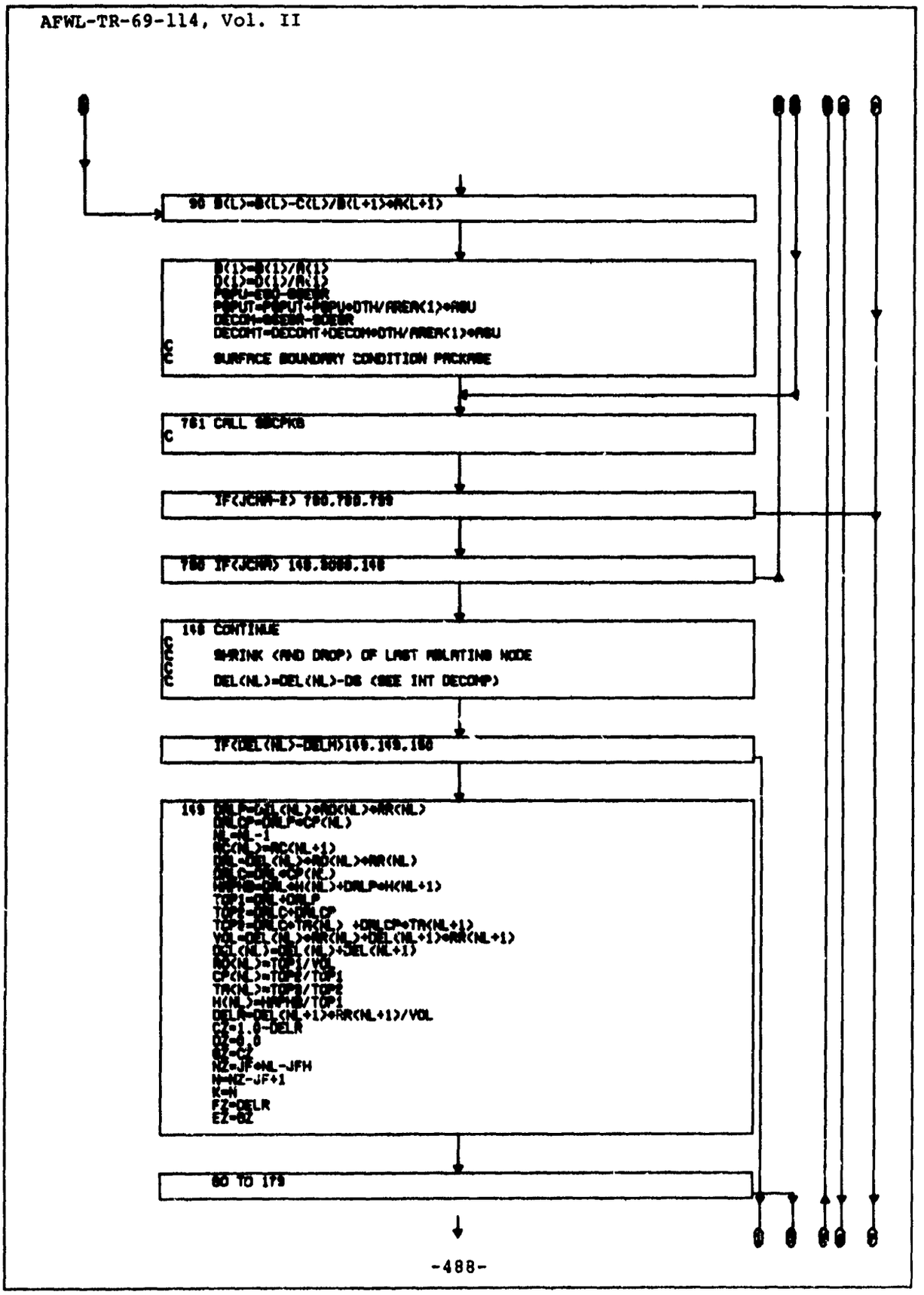

2132 DROBT=RO*(EXP(-BB*DTH*EXP(-EB/TAS))-1.)/DTH
2133 ROB(N)=ROB(N)+(DROBT+DROBC)*DTH
223 IF(TAS -TRACC) 205,205,206
206 DROCT=0.0
GO TO 2159
208 IF(RHORC-ROC(N))215,205,205
215 RO=ROC(N)-RHORC
POW=1.-PSIC
IF (POW) 2151,2152,2151
2151 DROCT=(-RO+((RO**POW)-
1(1./POW))/DTH
FC*EXP(-EC/TAS)*DTH)**
GO TO 2159
2152 DROCT=RO*(EXP(-BC*DTH*EXP(-EC/TAS))-1.)/DTH
2159 ROC(N)=ROC(N)+(DROCT+DROCC)*DTH
220 DMDB(I)=DMDB(I)-DEL(I)*((DROAT+DROBT)*GAMA+DMB*DROCT)
227 DNB=(ROA(N)+ROB(N))*GAMA+DMB*ROC(N)
RON(I)=RON(I)+DNB
IF(N-1) 2251,2253,2251

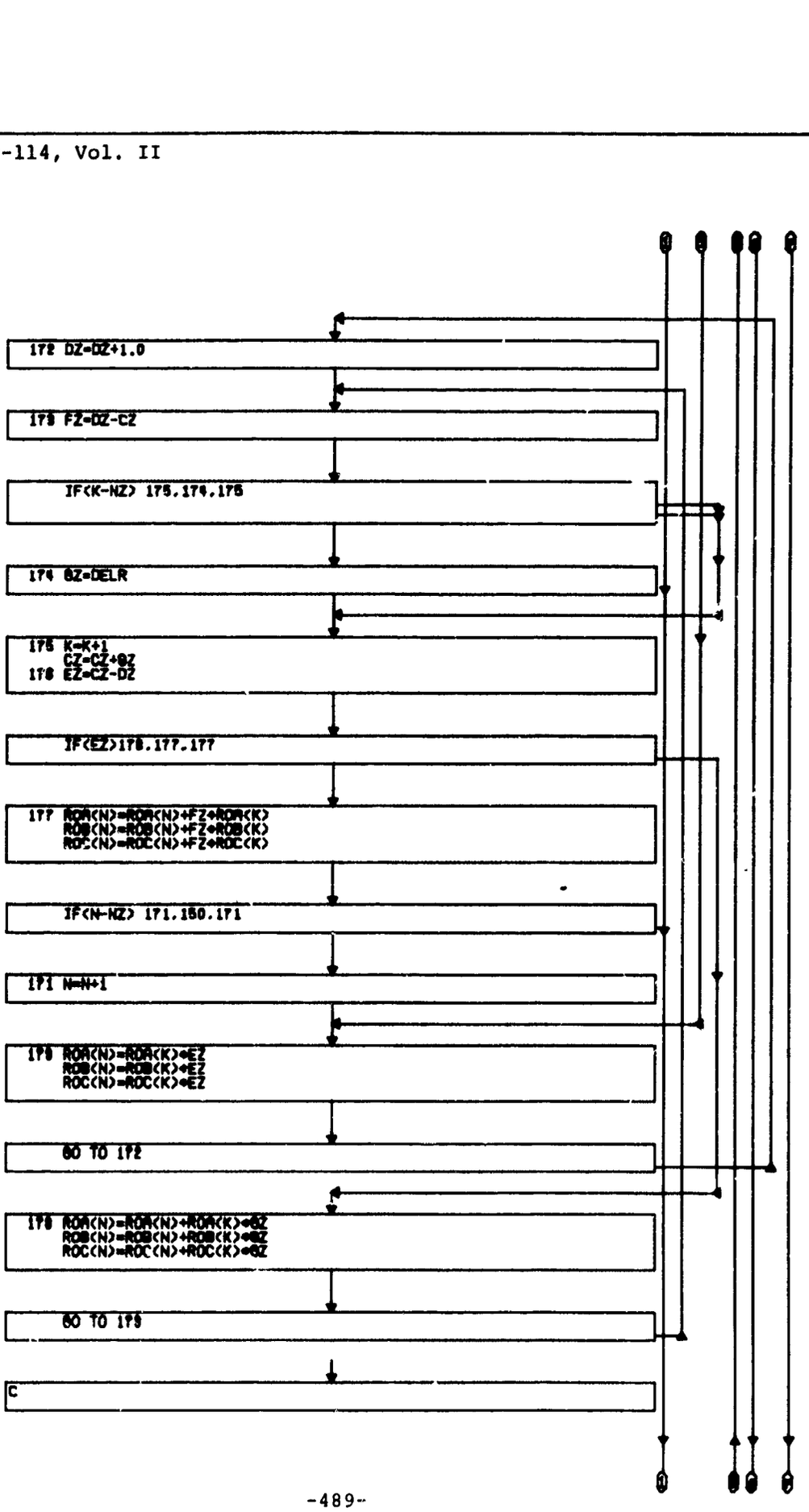

2251 IF(DNS-DNCP(IE)) 2253,2252,2252
2252 CPE(IE)=DEL(I)+((FLOAT(N)-0.5)/FJF+1.-FLOAT(I))+10.+RR(I)
CPE(IE)=CPE(IE)-DEL(I)/(DNS-DENOLD)+(DNS-DNCP(IE))/FJF+10.
CPE(IE)=AMAX1(CPE(IE),SM)
IE=IE+1
2253 DENOLD=DNS
255 TAS=TAS+DTA
264 DMEB(I)=DMEB(I)/FJF+RR(I)
RON(I)=RON(I)/FJF
IF(I-1) 259,259,264
259 FJF=FJFS
DTA=DTA/DEL(1)+DEL(2)/2.+RR(2)
GO TO 262
264 DTA=DTA/DEL(I)+DEL(I+1)/RR(I)+RR(I+1)
262 CONTINUE
C NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES
J=JFMP
DO 85 I=1,ML
IF(ABS(RON(I)-RHO(I))-.01) 81,81,82
81 MATL(I)=1
X(I)=1.0
GO TO 85

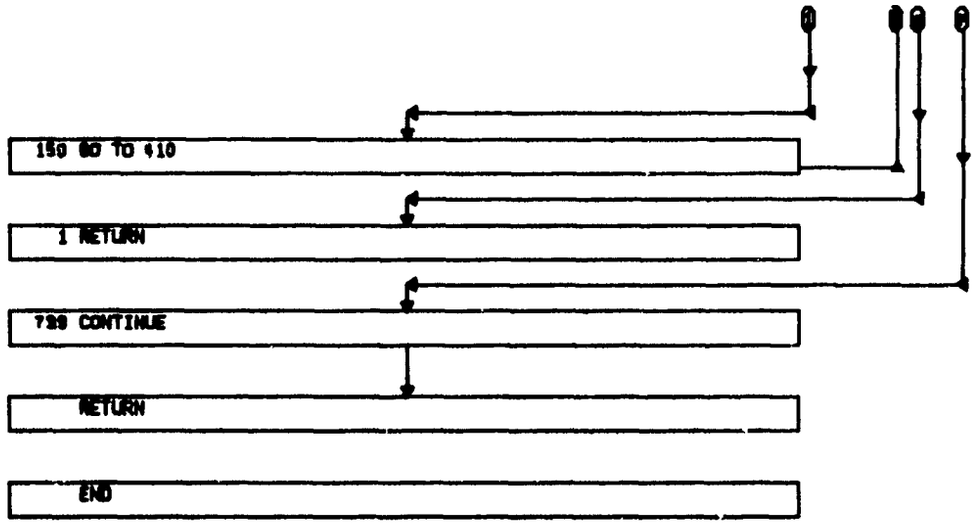

82 IF (ABS(RON(I)-RHO(2))-.01) 83,83,84
83 MATL(I)=2
X(I)=0.
CN(I)=CNC(I)
GO TO 85
84 MATL(I)=0
X(I)=PETE-PET/RON(I)
IF (WT) 8500,8500,8501
8501 CALL LOOK(11,X(I),TX,F1,F2,0,0,Y1,D1,2)
CN(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)
GO TO 85
8500 CN(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)
85 RAT(I)=DEL(I)/(CN(I)*RR(I))
SGN=0.0
DO 122 I=1,NL
122 SGN=SGN+CHGS(I)
GAMG=SGN
GAMT=GAMT+GAMG*RGU/RREA(1)*DTH
DCDT=(CPE(1)-COLD)/DTH
DPDT=(CPE(2)-POLD)/DTH
C CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS
C AND IN[illegible]NAL ENERGY RATE TERMS
MAIN BLOCK
DVB=0.
SOEGR=0.


SDEBR=0.
TB=0.
RMT(I)=2.*RMT(1)
CPNL=CP(NL)
NLM=NL-1
IMIN=0
DO 90 I=IMIN,NLM
IF (I) 16,16,14
14 SBM=SBM-DMDB(I)
DRDDTD=-DMDB(I)/(RR(I)*DEL(I))
FACT1=DTH/(DEL(I)*RR(I))
FACT2=SBM/(DEL(I)*RR(I))
B(I)=-FACT1*DVB
DVB=1.0/(0.5*(RMT(I)+RMT(I+1))+RC(I)/RR(I))
TERM2=RON(I)*CP(I)-DTH*(CPBAR*(DRDDTD-FACT2)
1 -DBDT*RD1*CP1/DEL(I))
TERM1=FACT1*DVB
B(I)=TERM2-R(I)+TERM1
C(I)=-TERM1
D(I)=TR(I)+TERM2*(HBAR*DRDDTD-HBAR*(RON(I)
1 -RD(I))/DTH-FACT2*HBAR-DBDT*RD1*H1/DEL(I))*DTH
16 RD1=RDT(I+1)
X1=PETE-PET/RD1
CP1=CPV(I+1)*X1+CPC(I+1)*(1.0-X1)
H1=HP(I+1)*X1+HC(I+1)*(1.0-X1)
CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))
TN=-RD1*HBAR+RD1*H1+T
HBAR=PETE*HP(I+1)-PET/RHO(1)*HC(I+1)
-RD1*H1+RD1*HBAR
20 CALL LOOK (2,TR(I+1),TT1,THB,0,0,0,HBAR,CPBAR,1)
HBAR=HBAR*DELHB
SDEBR=SDEBR+HBAR*DMDB(I+1)
SDEBR=SDEBR+HBAR*DMDB(I+1)
IF (I) 24,24,25
24 EBD=SBM+HBAR
HA=HBAR
GO TO 30
25 TERM3=(-FACT2*CPBAR-DBDT*RD1*CP1/DEL(I))*DTH
C(I)=C(I)+TERM3
D(I)=D(I)+TR(I+1)*TERM3+(FACT2*HBAR+DBDT*RD1*H1/DEL(I))*DTH
TB=TB-TN*DBDT*RR(I)
90 CONTINUE


A(1)=DTH/DEL(1)
TT=TT+TB*DTH/RRC*(1)*ABU
C NOW THE LAST HEATING NODE REQUIRES DIFFERENT TREATMENT
DRODTD=-DHDB(NL)/(RR(NL)*DEL(NL))
FACT1=DTH/(DEL(NL)*RR(NL))
A(NL)=-FACT1*DVB
DVB=1.0/(0.5*(RRT(NL)+RHT(NBH))+RC(NL)/RR(NL))
C(NL)=-FACT1*DVB
TERM2=RON(NL)*CP(NL)-(CPBAR*DRODTD+(DBDT/DEL(NL))*
1 (RO (NL)*CPNL -RO1*CP1))*DTH
B(NL)=TERM2-C(NL)-A(NL)
D(NL)=TA(NL)*TERM2+DTH*(HBAR*DRODTD+HBAR*(RON(NL)-
1 RO(NL))/DTH+DBDT*(RO (NL)*H(NL)-RO1*H1)/DEL(NL))
C NOW FOR BACK UPS IF ANY
K = NL
IF(NUMN-NBH) 80,40,40
40 DO 50 I=NBH,NUMN
K=K+1
FACT1=DTH/(DEL(I)*RR(I))
A(K) = -FACT1*DVB
DVB=1.0/(0.5*(RRT(I)+RHT(I+1))+RC(I)/RR(I))
C(K)=-FACT1*DVB
B(K)=RO(I)*CP(I)-C(K)-A(K)
50 D(K)=TA(I)*RM(I)*CP(I)
C NOW IF THE LAST NODE WAS INSULATED WE MUST REPAIR LAST B AND C
60 IF(HRES) 80,70,80
70 B(K)=B(K)+C(K)
C(K)=0
C NOW BEFORE GAUSS REDUCTION REWRITE LAST LINE OF MATRIX
80 D(K)=D(K)-C(K)*TRES
L=K
DO 90 I=2,K
L=L-1
D(L)=D(L)-C(L)/B(L+1)*D(L+1)


90 B(L)=B(L)-C(L)/B(L+1)*AA(L+1)
B(1)=B(1)/AA(1)
D(1)=D(1)/AA(1)
PSPU=END-BREAK
PSPUT=PSPUT+PSPU*DTH/AREA(1)*ABU
DECOM=BEGIN-BREAK
DECOMT=DECOMT+DECOM*DTH/AREA(1)*ABU
C
C SURFACE BOUNDARY CONDITION PACKAGE
781 CALL SBCPKG
C
IF(JCHA-2) 780,780,799
780 IF(JCHA) 148,8888,148
148 CONTINUE
C SHRINK (AND DROP) OF LAST ABLATING NODE
C
DEL(NL)=DEL(NL)-DB (SEE INT DECOMP)
IF(DEL(NL)-DELH)149,149,150
149 DELR=DEL(NL)*RD(NL)*AA(NL)
DRLCP=DRLP*CP(NL)
NL=NL-1
RC(NL)=RC(NL+1)
DEL=DEL(NL)*RD(NL)*AA(NL)
DRLC=DRL*CP(NL)
HMPHB=DRL*H(NL)+DRLP*H(NL+1)
TOP1=DRL+DRLP
TOP2=DRLC+DRLCP
TOP3=DRLC*TA(NL) +DRLCP*TA(NL+1)
VOL=DEL(NL)*AA(NL)+DEL(NL+1)*AA(NL+1)
DEL(NL)=DEL(NL)+DEL(NL+1)
AA(NL)=TOP1/VOL
CP(NL)=TOP2/TOP1
TA(NL)=TOP3/TOP2
H(NL)=HMPHB/TOP1
DELR=DEL(NL+1)*AA(NL+1)/VOL
CZ=1.0-DELR
DZ=0.0
EZ=CZ
NZ=JF*NL-JFH
N=NZ-JF+1
K=N
FZ=DELR
EZ=BZ
150 GO TO 175


172 DZ=DZ+1.0
173 FZ=DZ-CZ
IF(K-NZ) 175,174,175
174 DZ=DELR
175 K=K+1
CZ=CZ+DZ
176 EZ=CZ-DZ
IF(EZ)176,177,177
177 ROA(N)=ROA(N)+FZ*ROA(K)
ROB(N)=ROB(N)+FZ*ROB(K)
ROC(N)=ROC(N)+FZ*ROC(K)
IF(N-NZ) 171,150,171
171 N=N+1
178 ROA(N)=ROA(K)*EZ
ROB(N)=ROB(K)*EZ
ROC(N)=ROC(K)*EZ
GO TO 172
179 ROA(N)=ROA(N)+ROA(K)*DZ
ROB(N)=ROB(N)+ROB(K)*DZ
ROC(N)=ROC(N)+ROC(K)*DZ
GO TO 179
C


150 GO TO 410
1 RETURN
700 CONTINUE
RETURN
END

f. Subroutine INPOUT - B32A

(1) Function

Input/output routine for CMA. Called by CMA. Calls LCOUNT, SLOPQ, LOOK.

(2) Listing

```
000001          C8324                                                                   8324 001
000002                SUBROUTINE INPUT                                                  8324 002
000003                COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),  8324 003
000004               1NLO(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                         8324 004
000005               2TCM(2),TPR(2),TRAD(2),IAB                                         8324 005
000006               3,TT2(20,2),TMZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELMG,I1,I2,CM8324 006
000007               4,CMC,RPRMG,KCM(10)                                                8324 007
000008                EQUIVALENCE (NCLASS,JCMA)                                         8324 008
000009                COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)              8324 009
000010                COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                    8324 010
000011               3,RHO(2),MATL(38),DEL(39),SO(20),H(38),RC(38),RA(38),RECORD(36),   8324 011
000012               4APEA(38),EMA(38),RAV(38),                                         8324 012
000013               5RHOA(152),ROB(152),ROC(152),                                      8324 013
000014               6     TPI(30),VFZ,CHH,NPR,                                         8324 014
000015               7LCT, PG,II,NBM,NUMN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA      8324 015
000016               8CA,THACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,8324 016
000017               9TPACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT 8324 017
000018                COMMON/CMACOM/EPSW,TRES,                                          8324 018
000019               1TMWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFHP,JFH,INPUT,      DTHIN,BRP,HCONV,8324 019
000020               2IMCH,DTHB,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  8324 020
000021                COMMON/MISC/       BPRM,CMT,COLD,CP1,CPGAS,CPNL,CZ,DCDT,DECOM,     8324 021
000022               1DFCOMT,DELCR,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DROAC, 8324 022
000023               2DROAT,DROBC,DROBT,DROCC,DROCT,DRODTO,DSDT,DSI,DS,DSS,DTA,DTHC,DTHC8324 023
000024               3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GSEGR,GSM,GSMT, 8324 024
000025               4G2,H1,HAPHB,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,  8324 025
000026               5NAR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLN,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SA8324 026
000027               6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,THPRT,TN,TOP1,TOP2,TOP3,T,8324 027
000028               7TT,VOL,X1                                                        8324 028
000029                EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                  8324 029
000030                DIMENSION TNRY(20)                                               8324 030
000031              497 FORMAT(I2,3F10.5)                                              8324 033
000032              498 FORMAT(///7X,66HTABLE OF OPTIONAL MASS-FRACTION FUNCTIONS FOR THER8324 034
000033                 1AL CONDUCTIVITY/25X,23HK = F1(X)*KP + F2(X)*KC//29X,1HX,12X,   8324 035
000034                 25HF1(X),10X,5HF2(X)//(13X,3(5X,F10.4)))                        8324 036
000035              499 FORMAT(12A6)                                                   8324 037
000036              502 FORMAT (6X12A6)                                                8324 038
000037              503 FORMAT(//24X31H---REACTION KINETIC EQUATION---/1H )            8324 039
000038              504 FORMAT(10X67HDRHO/DTIME = GAMMA ( BA*EXP(-EA/T)RHOOA((RHOA-RHORA)/8324 040
000039                 1RHOOA)**PSIA )/   21X56H+ GAMMA ( BB*EXP(-EB/T)RHOOB((RHOB-RHORB)/8324 041
000040                 2RHOOB)**PSIB )/ 19X58H+(1-GAMMA)( BC*EXP(-EC/T)RHOOC((RHOC-RHORC)/8324 042
000041                 3RHOOC)**PSIC ))                                                8324 043
000042              505 FORMAT (24X32H---REACTION KINETIC CONSTANTS---/1H )            8324 044
000043              506 FORMAT (11XAHREACTION2X4HRHOO5X4HARHORAX1HB7X3HPSIAX1HE6X6HT REAC/8324 045
000044                 13X10H(LB/CU FT)6X7H(1/SEC)12X7H(DEG R  X7H(DEG R))             8324 046
000045              507 FORMAT (14XA1,2X2F9.2,2XE10.4,F7.2,2XE10.4,F8.0)               8324 047
000046              510 FORMAT(12X31HRESIN VOLUME FRACTION, GAMMA = F5.3,17H(MASS FRACTION8324 048
000047                 1 = F5.3,1H)/1H )                                               8324 049
000048              511 FORMAT (24X32H---TIME INCREMENT INFORMATION---/1H )            8324 050
000049              512 FORMAT (6X18HINITIAL TIME (SEC)F7.3,26X16HFINAL TIME (SEC)F7.2) 8324 051
000050              513 FORMAT (1H /6X17HOUTPUT INTERVAL =F6.3,1X27HSEC FROM INITIAL TIME 8324 052
000051                 1UNTIL F7.3,4H SEC)                                             8324 053
000052              514 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1XAHSEC FROMF7.3,1X9HSEC UNTILF8324 054
000053                 17.3,4H SEC)                                                    8324 055
000054              515 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1XAHSEC FROMF7.3,1X20HSEC UNTIL8324 056
000055                 1 FINAL TIME/1H )                                               8324 057
000056              516 FORMAT (6X,19HMAXIMUM TIME STEP =,F4.2,8H SECONDS)             8324 058
000057              517 FORMAT('29X16H---NODAL DATA---/1H )                            8324 059
000058              518 FORMAT(6X74HNODE  MATL  TEMPERATURE  RELATIVE  THICKNESS  NODAL DE8324 060
```

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000056                1FTH  CONT.RESISTANCE)                                                  B     061
00006C              519 FORMAT(7X73HNO.   NO. (DEG.RANKINE)   AREA    (INCHES)    (INCHES)B     062
000061                1   (SQFT-S-DEG/BTU))                                                 B     063
000062              520 FORMAT(5X2I6,F12.2,E13.4,F9.5,F12.6,A1,E15.4)                       B     064
000063              521 FORMAT (    14X47HMINIMUM THICKNESS OF LAST ABLATOR NODE (INCHES)FB     065
000064                17.4/14X,19HTHERE ARE ,I2,40H NODELETS ASSIGNED TO EACH ABLATING NOB     066
000065                2DE)                                                              B     067
000066              522 FORMAT(/15X48H---HEAT OF FORMATION OF MATERIAL CONSTITUENTS---/37XB     068
000067                1A4(BTU/LB)/21X7HPLASTIC11X4HCHAR17X3HGAS)                        B     069
000068              523 FORMAT (20XF9.2,7XF9.2,11XF9.2)                                 B     070
000069              524 FORMAT(/7X28HENTHALPY DATUM TEMPERATURE =F9.3,1X11HDEG RANKINE)  B     071
00007C              525 FORMAT   (///22X36H---MATERIAL THERMAL PROPERTY DATA---//6X14HMATERB     072
000071                1I/L NO. 110X14HMATERIAL NO. 210X26HMATERIAL NOS. 3 THROUGH 10/6X14B     073
000072                2HVIRGIN PLASTIC15X4HCHAR23X7HBACK-UP)                            B     074
000073              526 FORMAT(/6X12HMATERIAL NO.,I2,30X9HDENSITY =F8.3,1X8HLB/CU FT/     B     075
000074                1         7X11HTEMPERATURE5X13HSPECIFIC HEAT5X12HCONDUCTIVITY5X8HSENB     076
000075                2SIBLE4X10HEMISSIVITY/56X8HENTHALPY/9X7H(DEG R)7X12H(BTU/LB-DEG)4X1B     077
000076                36H(BTU/FT-SEC-DEG)3XAH(BTU/LB)/                                  B     078
000077                4       (6XF8.2,8XF7.4,9XF10.7,7XF9.2,4XF7.4))                    B     079
000078              527 FORMAT(/6X12HMATERIAL NO.,I2,30X9HDENSITY =F8.3,1X8HLB/CU FT/     B     080
000079                1         7X11HTEMPERATURE5X13HSPECIFIC HEAT5X12HCONDUCTIVITY/9X7H(DB     081
00007F                2EG R)7X12H(BTU/LB-DEG)4X16H(BTU/FT-SEC-DEG)/                     B     082
000081                3       (6XF8.2,8XF7.4,9XF10.7))                                  B     083
000082              528 FORMAT(39H  BAD SURFACE STATE TABLE  --  QUIT JOB  )             B     084
000083              531 FORMAT (1H /6X19HTEMPERATURE (DEG R)5F11.2)                     B     085
000084              532 FORMAT    (///20X47H---RESIN DECOMPOSITION GAS SENSIBLE ENTHALPY---)B     086
000085              533 FORMAT      (6X19HENTHALPY   (BTU/LB)5F11.2)                    B     087
000086              534 FORMAT (1H ///23X40H---TIME DEPENDENT BOUNDARY CONDITIONS---/1H )  B     088
000087              535 FORMAT (9X,4HTIME,8X,4HPROB,3X,8HRECOVERY,3X,9HRADIATION,4X,4HHEATB     089
000088                15Y,8HPRESSURE,3X,7HBLOWING/9X,5H(SEC),7X,4HOPTN,3X,8HENTHALPY,3X,  B     090
000089                29HHEAT RATE,4X,5HCOEFF,14X,9HREDUCTION/28X,8H(BTU/LB),2X,11H(BTU/SB     091
00009C                3Q FT-,1X,10H(LB/SQ FT-,3X,5H(ATM),3X,9HPARAMETER /40X,7HSECOND),  B     092
000091                44Y,7HSECOND))                                                    B     093
000092              536 FORMAT (6X,F8.2,8X,I2,4X,2(F8.2,3X),F8.4,3X,F8.5,3X,F9.3)       B     094
000093              537 FORMAT (1H /9X,49HCH/CHO = PHI/(EXP(PHI)-1.) WHERE PHI = 2.*BRP*M B     095
000094                1DOT/CHO. BRP IN TABLE)                                           B     096
000095              538 FORMAT(//27X30H---SURFACE EQUILIBRIUM DATA---)                   B     097
000096              539 FORMAT (1H /6X12HM DOT G/CM **2,4/1H )                          B     098
000097              540 FORMAT(2(7X4HTEMPRX3HLOG7X9H(H WALL),3X)/2(6X7H(DEG R)3X10HM-DOT-CB     099
000098                1/CM2X11H(1+B PRIME)2X)/2(29X8H(BTU/LB)4X))                       B     100
000099              541 FORMAT (5XF8.2,4XF7.4,5XF9.2,8XF8.2,4XF7.4,5XF9.2)              B     101
0000AC              551 FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND AB     102
0000A1                1BLATION PROGRAM/73X4HPAGEI3/1H 67X246)                           B     103
0000A2              552 FORMAT (9X,4HTIME,8X,4HPROB,3X,7HSURFACE,4X,7HSURFACE/9X,5H(SEC),B     104
0000A3                17X,4HOPTN,5X,4HTEMP,5X,9HRECESSION/28X,7H(DEG R),6X,4HRATE/38X,    B     105
0000A4                21OH(MILS/SEC))                                                   B     106
0000A5              553 FORMAT(8X24H*INITIAL INTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP,TO RAB     107
0000A6                1DIUS**F4.2)                                                      B     108
0000A7              554 FORMAT(8X24H*INITIAL EXTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP,TO RAB     109
0000A8                1DIUS**F4.2)                                                      B     110
0000A9              555 FORMAT(8X15H*PLANAR SURFACE)                                    B     111
0000AC              556 FORMAT (9X,4HTIME,8X,4HPROB,5X,4HVIEW,5X,9HRADIATION/9X,5H(SEC),B     112
0000AB                17X,4HOPTN,4X,6HFACTOR,4X,9HHEAT RATE/38X,11H(BTU/SQ FT-/40X,     B     113
0000AC                27HSECOND))                                                       B     114
0000AD              560 FORMAT(I2,5E10.0)                                               B     115
0000AE              561 FORMAT (I2,F8.4)                                                B     116
0000AF              562 FORMAT (I2,I3,I1,I2,I2,7F10.5/8F10.5)                           B     117
0000B0              564 FORMAT (A1,9X2F10.5,E10.3,F10.5,E10.3,F10.5)                    B     118
0000B1              571 FORMAT(I2,F10.5,F10.5,F10.8,F10.5)                              B     119
0000B2              575 FORMAT(I1,F9.5,7F10.5/8F10.5)                                   B     120
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000119          577 FORMAT(I1,F9.5,5F10.5)                                                  B32A 121
000120          579 FORMAT(12X2E12.5,2E13.6,I1)                                             B32A 122
000121         5790 FORMAT (6X,26HNO RADIUS CORRECTION ON CH)                               B32A 123
000122         5791 FORMAT (3F8.5,F9.4,F5.3,2F9.3,I2,46)                                    B32A 124
000123         5792 FORMAT(//6X,3HP =,F9.4,4H ATM//6X,3(25HTEMPERATURE  EDGE ENTH   )/B32A 125
000124             16X,3(25H  (DEG R)    AT T-WALL    ))                                   B32A 126
000125         5793 FORMAT (//6X,37HBAD SURFACE EQUILIBRIUM TABLE OF TYPE,I2)              B32A 127
000126         5794 FORMAT (//6X,74HEQUAL MASS AND HEAT TRANSFER COEFFICIENTS AND EQUAB32A 128
000127             1L DIFFUSION COEFFICIENTS/6X,29HNOMINAL SURFACE VIEW FACTOR =,       B32A 129
000128             2F4.3)                                                                  B32A 130
000129         5795 FORMAT(//6X,14HM-DOT-GAS/CM =,F7.4,8X,10HPRESSURE =,F9.4,4H ATM//  B32A 131
000130             17X,2(4HTEMP,5X,26HM-DOT-  CHEM.PROD  SURFACE,3X)/6X,2(36H(DEG R)   B32A 132
000131             2CHAR/CM   (BTU/LB)  SPECIES,2X))                                       B32A 133
000132         5796 FORMAT(5X,F8.2,2X,F7.4,2X,F8.2,4X,A6,1X,F8.2,2X,F7.4,2X,F8.2,4X,A6B32A 134
000133             1)                                                                      B32A 135
000134         5796 FORMAT (2F10.0,9X,I1)                                                  B32A 136
000135         5797 FORMAT(//6X,45HRATIO OF MASS TO HEAT TRANSFER COEFFICIENTS =,F6.3/B32A 137
000136             1 4X,28HUNEQUAL DIFFUSION EXPONENT =,F6.3/6X,29HNOMINAL SURFACE VIEB32A 138
000137             2W FACTOR =,F6.3,11H (OPTION 1))                                        B32A 139
000138         5798 FORMAT                          (6X,F9.2,4X,F9.2,3X,F9.2,4X,F9.B32A 140
000139             22,3X,F9.2,4X,F9.2)                                                     B32A 141
000140         5799 FORMAT (6X,66HHEAT TRANSFER COEFFICIENT MULTIPLIED BY (R INITIAL/RB32A 142
000141             1 CURRENT)**1.8)                                                        B32A 143
000142          580 FORMAT (8F10.5)                                                        B32A 144
000143          581 FORMAT(/14X20HBACK WALL CONVECTION10X9HBACK WALL10X9HRESERVOIR/    B32A 145
000144             113X23HCOEF BTU/FT**8-SEC-DEG RAX10HEMISSIVITY8X11HTEMPERATURE/      B32A 146
000145             217XF10.4,10XF8.3,10XF10.2)                                             B32A 147
000146          582 FORMAT(5F10.5,9X,I1)                                                   B32A 148
000147              DATA  BLANK,ASTER/ 1H ,1H*/                                            B32A 149
000148              KOUT=5                                                                 B32A 150
000149              INPUT=8                                                                B32A 151
000150              NPG=0                                                                  B32A 152
000151              INCH=8                                                                 B32A 153
000152              WT=0.0                                                                 B32A 154
000153         C    INPUT/OUTPUT                                                           B32A 155
000154         C                                                                           B32A 156
000155             1 NPG=1                                                                 B32A 157
000156              WRITE (KOUT,551)NPG                                                    B32A 158
000157              READ  (INPUT,499)(RECORD(I),I=1,36)                                    B32A 159
000158         C                                                                 EUNITNB32A 160
000159         C                                                                   PAB32A 161
000160         C                                                  8999,9999 )TUPNI,FOE(B32A 162
000161              WRITE (KOUT,502)(RECORD(I),I=1,36)                                     B32A 163
000162              WRITE (KOUT,503)                                                       B32A 164
000163              WRITE (KOUT,504)                                                       B32A 165
000164              WRITE (KOUT,505)                                                       B32A 166
000165              WRITE (KOUT,506)                                                       B32A 167
000166              READ  (INPUT,564)A9,RHOOA,RHORA,BA,PSIA,EA,TRACA,A9,RHOOB ,RHORB,BB32A 168
000167             1B,PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC                      B32A 169
000168              WRITE (KOUT,507)A9,RHOOA,RHORA,BA,PSIA,EA,TRACA,A9,RHOOB,RHORB,BB,B32A 170
000169             1PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC                        B32A 171
000170              READ (INPUT,563) JF,NUMN,NN,NO,NI,THZRO,THFIN,DTPRT,DTPR2,DTPR3,    B32A 172
000171             1DTHP,BRP,TPR2,TPR3,DELM,DW1,DW2,DELHG,GAMA,TZ                          B32A 173
000172              IF(JF-1) 171,170,172                                                   B32A 174
000173          170 JF=2                                                                   B32A 175
000174              GO TO 172                                                              B32A 176
000175          171 JF=10                                                                  B32A 177
000176          172 JFH=JF/2                                                               B32A 178
000177              JF=JFH+JFH                                                             B32A 179
000178              JFHP=JFH+1                                                             B32A 180
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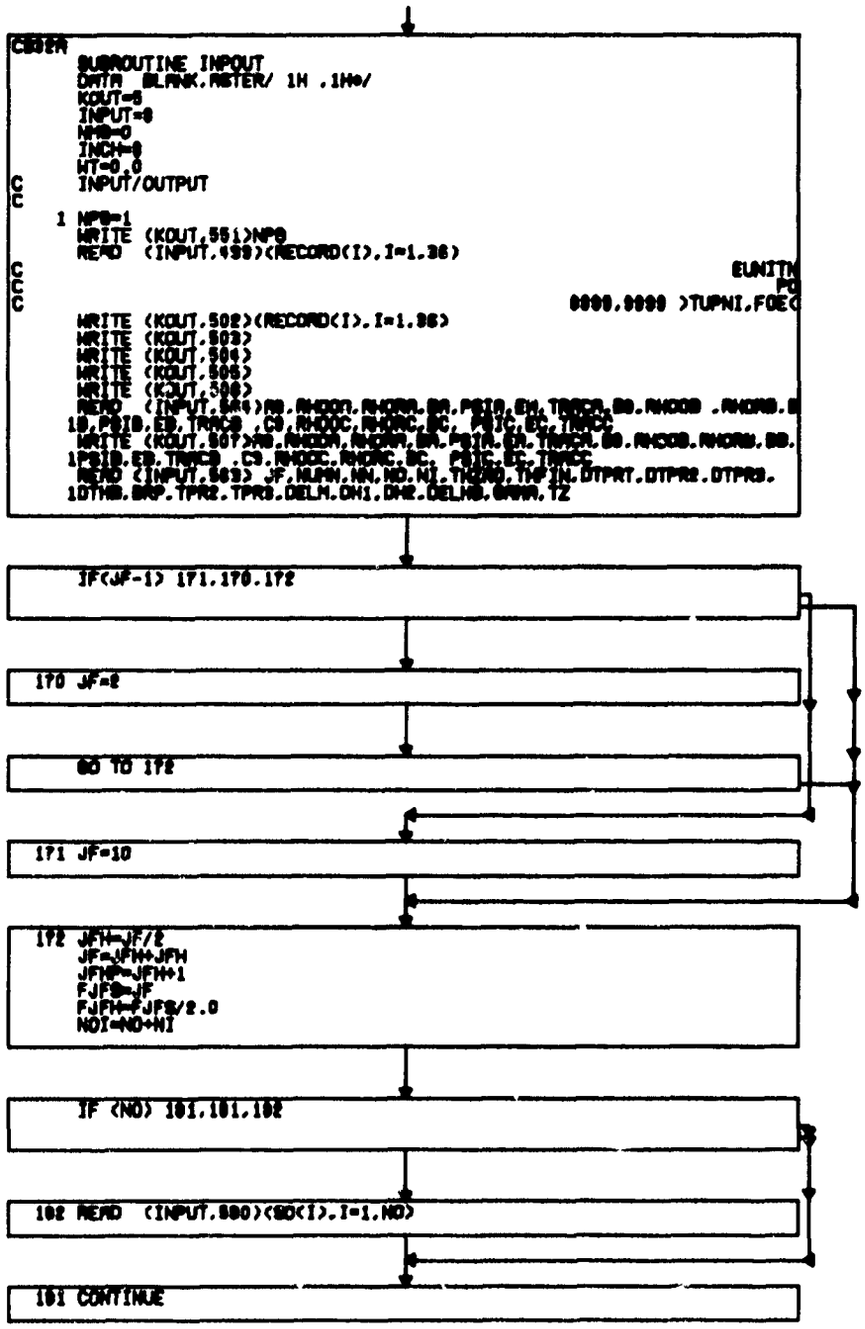
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000179                FJFS=JF                                                        B32A 191
000180                FJFH=FJFS/2.0                                                  B32A 192
000181                NO=NO+NI                                                       B32A 193
000182                IF (NO) 181,181,182                                            B32A 194
000183           182  READ  (INPUT,580)(SO(I),I=1,NO)                               B32A 195
000184           181  CONTINUE                                                       B32A 196
000185                IF (NI) 184,184,183                                            B32A 197
000186           183  NOP=NO+1                                                       B32A 198
000187                READ (INPUT,580) (SO(I), I=NOP,NOI)                            B32A 199
000188           184  IF(GAMA) 408,409,409                                           B32A 200
000189           408  GAMA=RHOOC/(RHOOC-(RHOOA+RHOOB)-(RHOOA+RHOOB)/GAMA)           B32A 201
000190           409  OMG=1.0-GAMA                                                   B32A 202
000191                RHO(1)=GAMA*(RHOOA+RHOOB)+OMG*RHOOC                            B32A 203
000192                RHO(2)=GAMA*(RHORA+RHORB)+OMG*RHORC                            B32A 204
000193                 GAMAM=GAMA/RHO(1)*(RHOOA+RHOOB)                               B32A 205
000194                WRITE (KOUT,510)GAMA,GAMAM                                     B32A 206
000195                IF(DTHB) 412,410,412                                           B32A 207
000196           410  DTHB=5.                                                        B32A 208
000197           412  DTHIN=.01                                                      B32A 209
000198           413  IF(TPR2)414,414,415                                            B32A 210
000199           414  TPR2=THFIN                                                     B32A 211
000200           415  IF(TPR3)416,416,417                                            B32A 212
000201           416  TPR3=THFIN                                                     B32A 213
000202                IF(TPR2-THZRO) 418,418,417                                     B32A 214
000203           418  DTPRT=DTPR2                                                    B32A 215
000204                DTPR2=DTPR3                                                    B32A 216
000205                TPR2=TPR3                                                      B32A 217
000206                GO TO 416                                                      B32A 218
000207           417  WRITE (KOUT,511)                                               B32A 219
000208                THFIN=AMAX1(THFIN,TPR2,TPR3)                                   B32A 220
000209                WRITE (KOUT,512)THZRO,THFIN                                    B32A 221
000210                WRITE (KOUT,513)DTPRT,TPR2                                     B32A 222
000211                WRITE (KOUT,514)DTPR2,TPR2,TPR3                                B32A 223
000212                WRITE (KOUT,515)DTPR3,TPR3                                     B32A 224
000213                WRITE (KOUT,516) DTHB                                          B32A 225
000214           C461                                    )CCART,RCART,ACART(FINIM=MC4B32A 226
000215                TRACM=AMIN1(TRACA,TRACB,TRAC )                                 B32A 227
000216                PETE=RHO(1)/(RHO(1)-RHO(2))                                    B32A 228
000217                PET=PETE*RHO(2)                                                B32A 229
000218           C    ----------  NODAL PROPERTIES                                   B32A 230
000219                J=0                                                            B32A 231
000220                J1=JFH                                                         B32A 232
000221                CALL LCOUNT (-NUMN-8,LCT,NPG,RECORD(38))                       B32A 233
000222           302  WRITE (KOUT,517)                                               B32A 234
000223                WRITE (KOUT,518)                                               B32A 235
000224                WRITE (KOUT,519)                                               B32A 236
000225                BASTER                                                         B32A 237
000226                READ(INPUT,560)(MATL(I),TA(I),AREA(I),DEL(I),RA(I),RC(I),I=1,NUMN)B32A 238
000227                AF=RA(2)                                                       B32A 239
000228                RSV=RA(1)                                                      B32A 240
000229                RA(1)=0.0                                                      B32A 241
000230                DO 400 I=1,NUMN                                                B32A 242
000231                IF(I-2) 4541,452,453                                           B32A 243
000232           453  RA(I)=RA(I-1)+(DEL(I-1)+DEL(I))/2.0                            B32A 244
000233                GO TO 461                                                      B32A 245
000234           452  RA(2)=DEL(1)+DEL(2)/2.                                         B32A 246
000235                BBLANK                                                         B32A 247
000236           461  DEL(I-1)=DEL(I-1)/12.                                          B32A 248
000237          4541  RAV(I)=RA(I)                                                   B32A 249
000238                IF(AB) 4542,4543,4542                                          B32A 250
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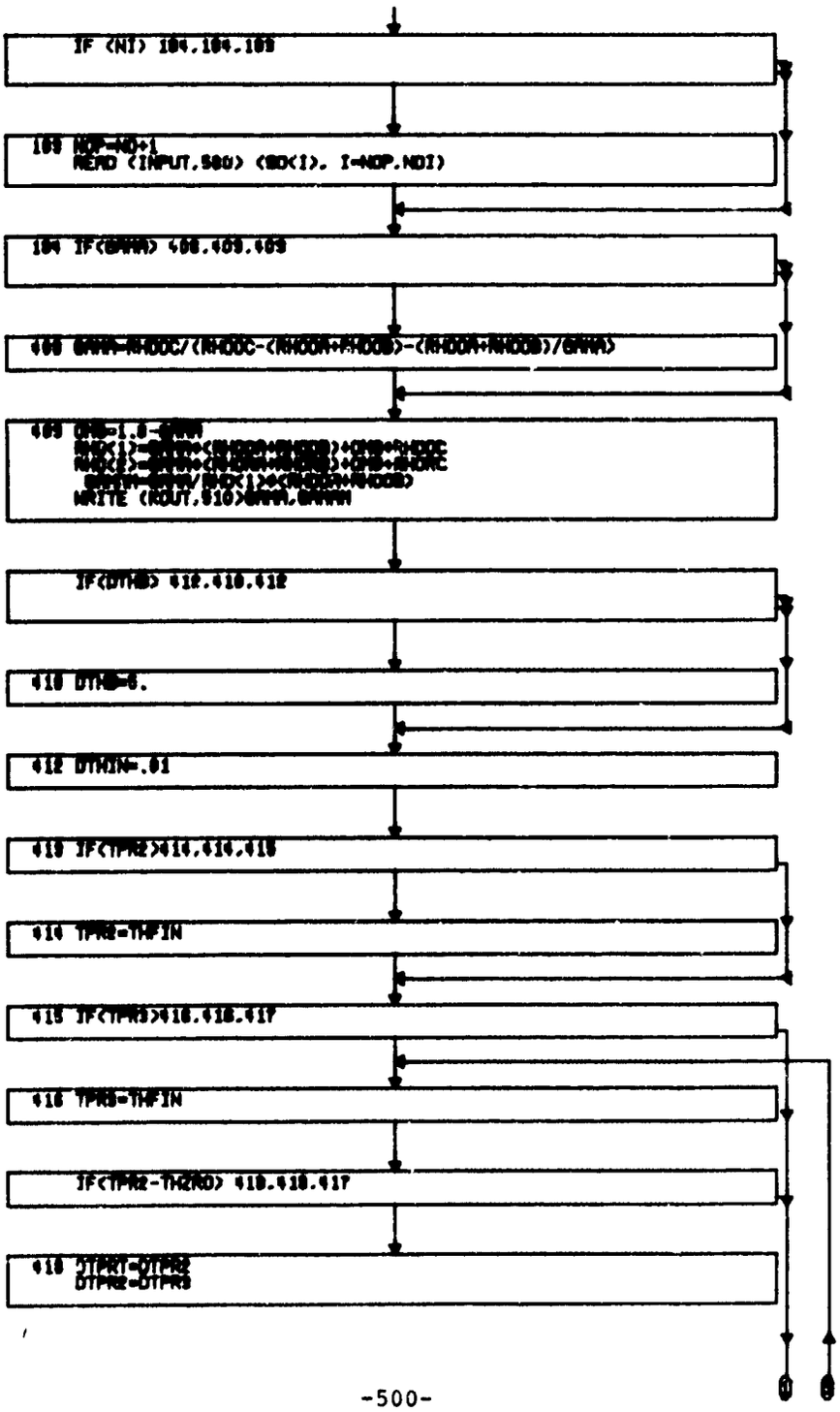
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000239          4542 AREA(I)=(ABS(RSV+RA(I)))**AE                                  B32A 241
000240               GO TO 454                                                     B32A 242
000241          4543 IF(AREA(I)) 4544,4544,454                                     B32A 243
000242          4544 IF(RSV) 4545,4546,4545                                        B32A 244
000243          4545 AREA(I)=ABS(RSV+RA(I))                                        B32A 245
000244               AE=1.0                                                        B32A 246
000245               GO TO 454                                                     B32A 247
000246          4546 AREA(I)=1.                                                    B32A 248
000247           454 WRITE(KOUT,520)I,MATL(I),TA(I),AREA(I),DEL(I),RA(I),B,RC(I)   B32A 249
000248               IF(MATL(I)-2) 401,405,400                                     B32A 250
000249           401 NL=I                                                          B32A 251
000250               DO 404 J=1,J1                                                 B32A 252
000251               N=N+1                                                         B32A 253
000252               ROA(N)=RHOOA                                                  B32A 254
000253               ROB(N)=RHOOB                                                  B32A 255
000254           404 ROC(N)=RHOOC                                                  B32A 256
000255               J1=JF                                                         B32A 257
000256               GO TO 400                                                     B32A 258
000257           405 NL=I                                                          B32A 259
000258               DO 406 J=1,J1                                                 B32A 260
000259               N=N+1                                                         B32A 261
000260               ROA(N)=RHORA                                                  B32A 262
000261               ROB(N)=RHORB                                                  B32A 263
000262           406 ROC(N)=RHORC                                                  B32A 264
000263               J1=JF                                                         B32A 265
000264           400 CONTINUE                                                      B32A 266
000265           403 DEL(NUMN)=DEL(NUMN)/12.                                       B32A 267
000266               CALL SLOPG(NUMN,RA,AREA,EMA,EPA)                              B32A 268
000267               NRM=NL+1                                                      B32A 269
000268               IF(RSV) 4031,4032,4033                                        B32A 270
000269          4031 RSVN=-RSV                                                     B32A 271
000270               WRITE(KOUT,554)RSVN,AE                                        B32A 272
000271               GO TO 304                                                     B32A 273
000272          4032 WRITE(KOUT,555)                                               B32A 274
000273               GO TO 304                                                     B32A 275
000274          4033 WRITE(KOUT,553)RSV,AE                                         B32A 276
000275           304 WRITE (KOUT,521) DELM,JF                                      B32A 277
000276               DELM=DELM/12.0                                                B32A 278
000277               READ(INPUT,582) HCONV,EPSW,TRES,CHCRI,PYCRI,NCON              B32A 279
000278               IF (CHCRI) 305,305,306                                        B32A 280
000279           305 CHCRI=0.02                                                    B32A 281
000280           306 IF (PYCRI) 307,307,308                                        B32A 282
000281           307 PYCRI=0.9R                                                    B32A 283
000282           308 TA(NUMN+1)=TRES                                               B32A 284
000283               CALL LCOUNT(4             ,LCT,NPG,RECORD(35))                B32A 285
000284               WRITE(KOUT,581) HCONV,EPSW,TRES                               B32A 286
000285               CALL LCOUNT(5             ,LCT,NPG,RECORD(35))                B32A 287
000286               WRITE (KOUT,522)                                              B32A 288
000287               WRITE (KOUT,523)DH1,DH2,DELHG                                 B32A 289
000288               CALL LCOUNT(2             ,LCT,NPG,RECORD(35))                B32A 290
000289               WRITE (KOUT,524)TZ                                            B32A 291
000290          C    --------- MATERIAL PROPERTIES                                 B32A 292
000291               CALL LCOUNT(6             ,LCT,NPG,RECORD(35))                B32A 293
000292           310 WRITE (KOUT,525)                                              B32A 294
000293               IT=0                                                          B32A 295
000294               ILO(3)=1                                                      B32A 296
000295               ILO(4)=1                                                      B32A 297
000296               KT=1                                                          B32A 298
000297           350 IT=IT+1                                                       B32A 299
000298               READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT),TEP(IT,KT)  B32A 300
```

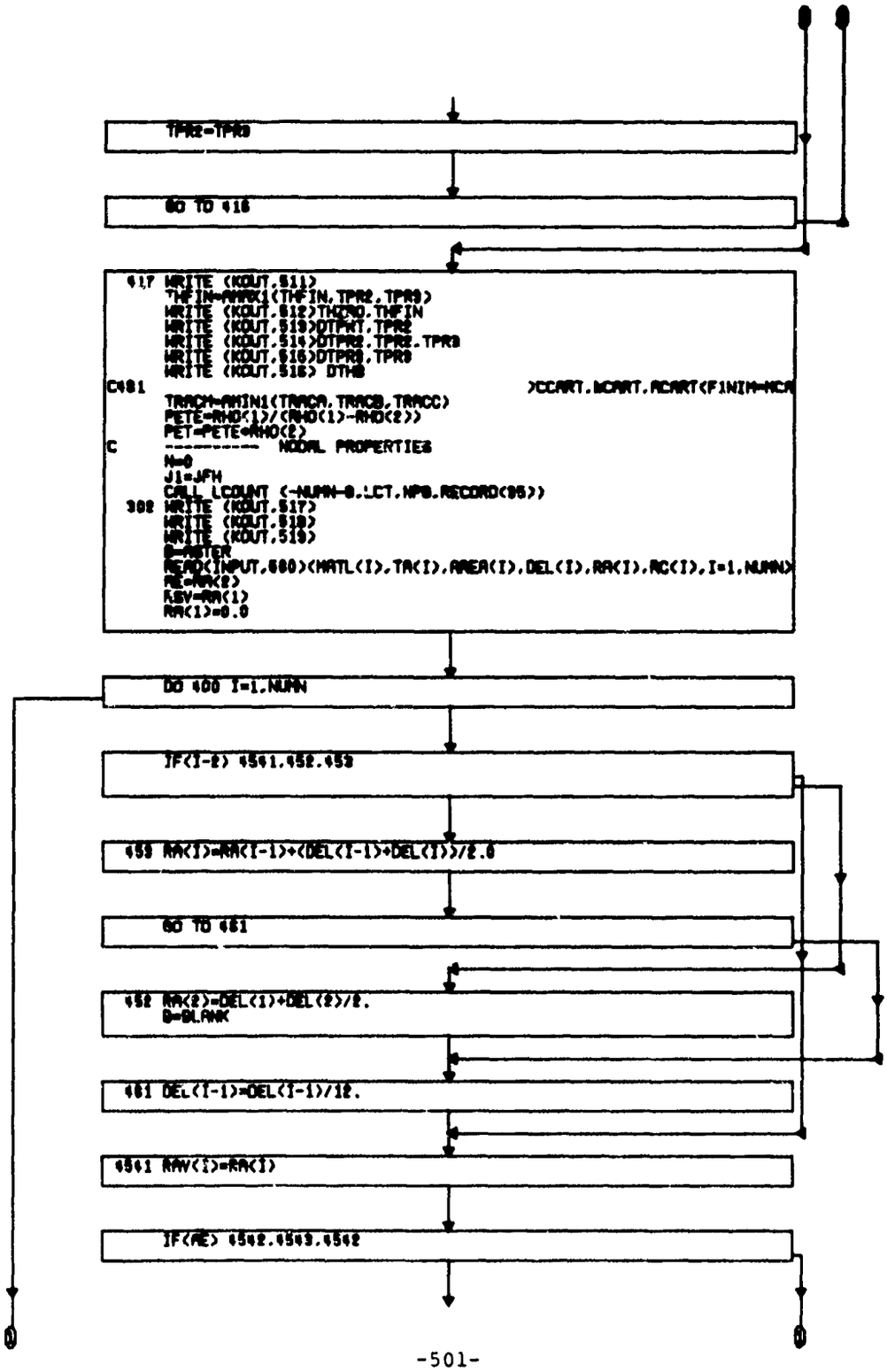
```
000299                IF(NC)351,350,351                                                  832A 301
000300           351  IHI(KT+2)=ILO(KT+2)+IT-1                                           832A 302
000301                IR(KT+2)=ILO(KT+2)                                                 832A 303
000302                THZ(1,KT)=0.                                                       832A 304
000303                IF (IT-2) 2357,1357,1357                                           832A 305
000304           1357 DO 357 I=2,IT                                                      832A 306
000305            357 THZ(I,KT)=THZ(I-1,KT)+(TCP(I,KT)+TCP(I-1,KT))/2.*(TT2(I,KT)-TT2(I-832A 307
000306               11,KT))                                                          832A 308
000307           2357 CONTINUE                                                         832A 309
000308                CALL LOOK (KT+2,TZ,TT2(1,KT),THZ(1,KT),0,0,0,HSH,NUM,1)          832A 310
000309                DO 359 I=1,IT                                                   832A 311
000310            359 THZ(I,KT)=THZ(I,KT)-HSH                                         832A 312
000311                CALL LCOUNT(6+IT          ,LCT,NPG,RECORD(35))                  832A 313
000312            312 IF (IT-1) 2312,1312,1312                                        832A 314
000313           1312 WRITE(KOUT,526)KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),THZ(I,KT)832A 315
000314              1,TEP(I,KT),I=1,IT)                                               832A 316
000315           2312 CONTINUE                                                        832A 317
000316                KT=KT+1                                                         832A 318
000317                IT=0                                                            832A 319
000318                IF(NC) 356,353,353                                              832A 320
000319            356 IF(KT-2) 350,350,411                                            832A 321
000320            411 READ (INPUT,561) KT,RHO(KT)                                     832A 322
000321                IF (RHO(KT)) 3550,3550,355                                      832A 323
000322           3550 KT=1,0                                                          832A 324
000323                IX=0                                                            832A 325
000324           3551 IX=IX+1                                                         832A 326
000325                READ (INPUT,497) NC,TX(IX), F1(IX),F2(IX)                       832A 327
000326                IF (NC) 3552,3551,3552                                          832A 328
000327           3552 ILO(11)=1                                                       832A 329
000328                IHI(11)=IX                                                      832A 330
000329                IR(11)=1                                                        832A 331
000330                CALL LCOUNT(8+IX,LCT,NPG,RECORD(35))                            832A 332
000331                IF (IX-1) 6001,6000,6000                                        832A 333
000332           6000 WRITE(KOUT,498) (TX(I),F1(I),F2(I),I=1,IX)                      832A 334
000333           6001 CONTINUE                                                        832A 335
000334                IF (NC) 411,411,353                                             832A 336
000335            355 IT=IT+1                                                         832A 337
000336                READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT)           832A 338
000337                IF(NC) 354,355,354                                              832A 339
000338            354 ILO(KT+2)=1                                                     832A 340
000339                IHI(KT+2)=ILO(KT+2)+IT-1                                        832A 341
000340                IR(KT+2)=ILO(KT+2)                                              832A 342
000341                CALL LCOUNT(5+IT          ,LCT,NPG,RECORD(35))                  832A 343
000342            314 IF (IT-1) 2314,1314,1314                                        832A 344
000343           1314 WRITE (KOUT,527) KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),I=1,IT)832A 345
000344           2314 CONTINUE                                                        832A 346
000345                IT=0                                                            832A 347
000346                IF(NC) 411,411,353                                              832A 348
000347           C    ----------  PYROLYSIS GAS ENTHALPY                             832A 349
000348            353 NT1=0                                                           832A 350
000349            341 IN=1+NT1                                                        832A 351
000350                NT1=N+NT1                                                       832A 352
000351                IF (NT1-IN) 6003,6002,6002                                      832A 353
000352           6002 READ  (INPUT,575)NC,(TT1(I),I=IN,NT1),(THG(I),I=IN,NT1)        832A 354
000353           6003 CONTINUE                                                        832A 355
000354                IF(NC)361,361,362                                               832A 356
000355            364 NT1=NT1-1                                                       832A 357
000356            362 IF(TT1(NT1)) 364,364,365                                        832A 358
000357            365 ILO(2)=1                                                        832A 359
000358                IR(2)=1                                                         832A 360
```

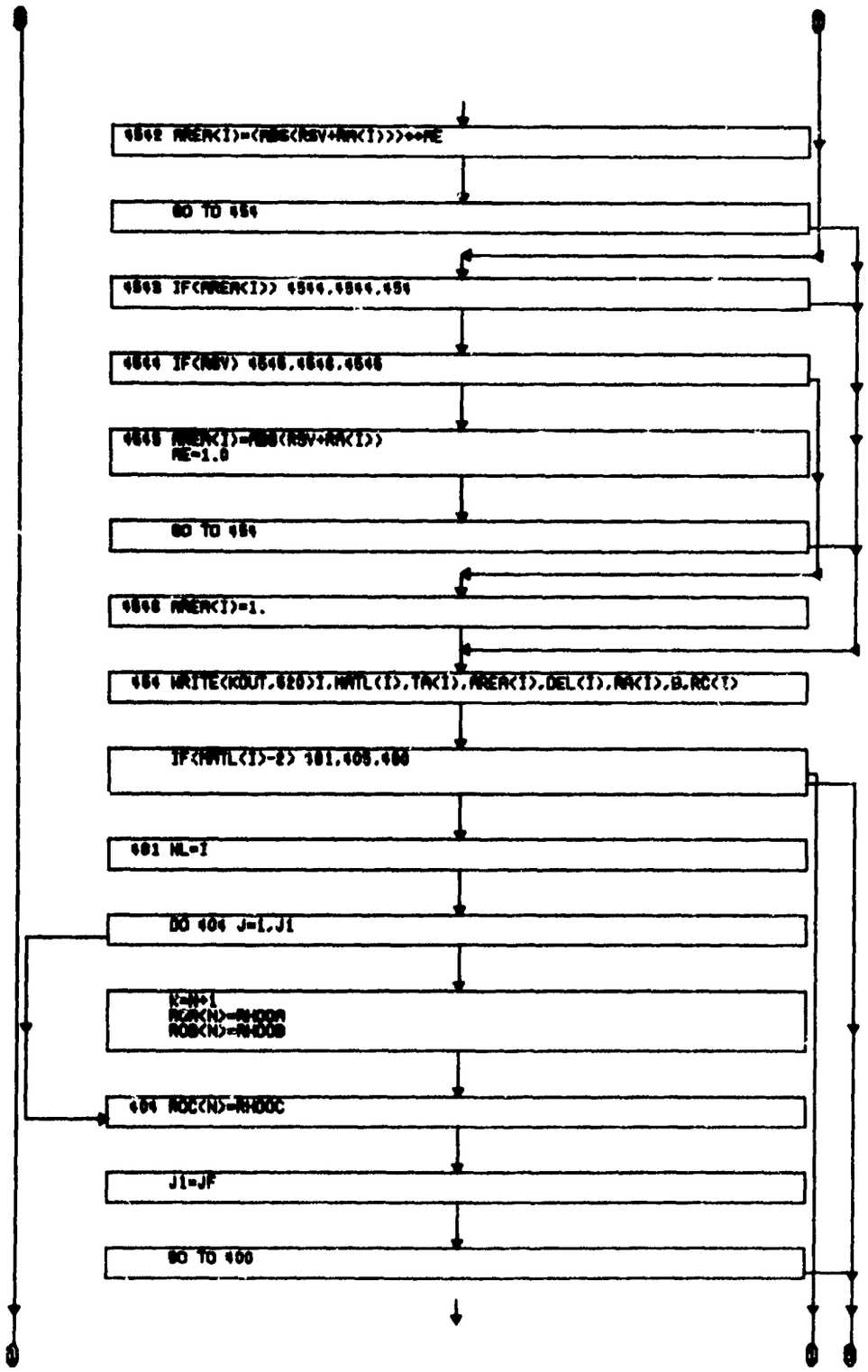
```
000359                  I(I(2)=NT1                                                  B32A 361
000360                  CALL LGOUT(3*((NT1+9)/5),LOT,NPG,RECORD(35))                B32A 362
000361           318    WRITE (KOUT,532)                                            B32A 363
000362                  IEN=0                                                       B32A 364
000363           347    I=IEN+1                                                     B32A 365
000364                  IEN=MIN0(NT1,IEN+5)                                         B32A 366
000365                  IF (IEN-I) 6005,6004,6004                                   B32A 367
000366           6004   WRITE (KOUT,531)(TT1(I),I=I,IEN)                            B32A 368
000367                  WRITE (KOUT,533)(TWG(I),I=I,IEN)                            B32A 369
000368           6005   CONTINUE                                                    B32A 370
000369                  IF(NT1-IEN) 347,347,348                                     B32A 371
000370           348    K=1                                                         B32A 372
000371           2803   READ(INPUT,583) BPG,(TNRY(I),I=1,19)                        B32A 373
000372                  IF(TNRY(1)) 2804,2804,2805                                  B32A 374
000373           2805   TWG(K)=BPG                                                  B32A 375
000374                  DO 2802 I=1,19                                              B32A 376
000375                  IF(TNRY(I)-29.) 2800,2800,2801                              B32A 377
000376           2801   TTS(I,K,1)=TNRY(I)                                          B32A 378
000377                  KHI(K)=I                                                    B32A 379
000378                  NHI(K)=I
000379                  GO TO 2802                                                  B32A 380
000380           2800   IF(TNRY(I)) 2811,2811,2810                                  B32A 381
000381           2810   TLMC(I,K,1) = TNRY(I)                                       B32A 382
000382                  NHI(K)=I                                                    B32A 383
000383           2802   CONTINUE                                                    B32A 384
000384           2811   K=K+1                                                       B32A 385
000385                  GO TO 2803                                                  B32A 386
000386           2804   NMG=K-1                                                     B32A 387
000387                  IHI(12)=NMG                                                 B32A 388
000388                  ILO(12)=1                                                   B32A 389
000389                  I=(12)=1                                                    B32A 390
000390                  DO 2818 K=1,NMG
000391                  NLO(K)=KHI(K)+1                                             B32A 392
000392                  KHIK=KHI(K)                                                 B32A 393
000393                  NLOK=NLO(K)                                                 B32A 394
000394                  NHIK=NHI(K)                                                 B32A 395
000395                  DO 2807 I=1,KHIK                                            B32A 396
000396           2807   TTS(I,K,2)=TTS(I,K,1)                                       B32A 397
000397                  IF(NHIK-NLOK) 2818,2809,2809
000398           2809   DO 2808 I=NLOK,NHIK
000399                  TLMC(I,K,1)=ALOG(AMAX1(TLMC(I,K,1),.00001))                 B32A 399
000400           2808   TLMC(I,K,2)=TLMC(I,K,1)                                     B32A 400
000401           2818   CONTINUE
000402            583   FORMAT(2LF4.0)                                              B32A 401
000403                  VEZ=1.0
000404                  IF(BPG.GT.0.) VEZ=BPG
000405                  RETURN
000406                  END
```

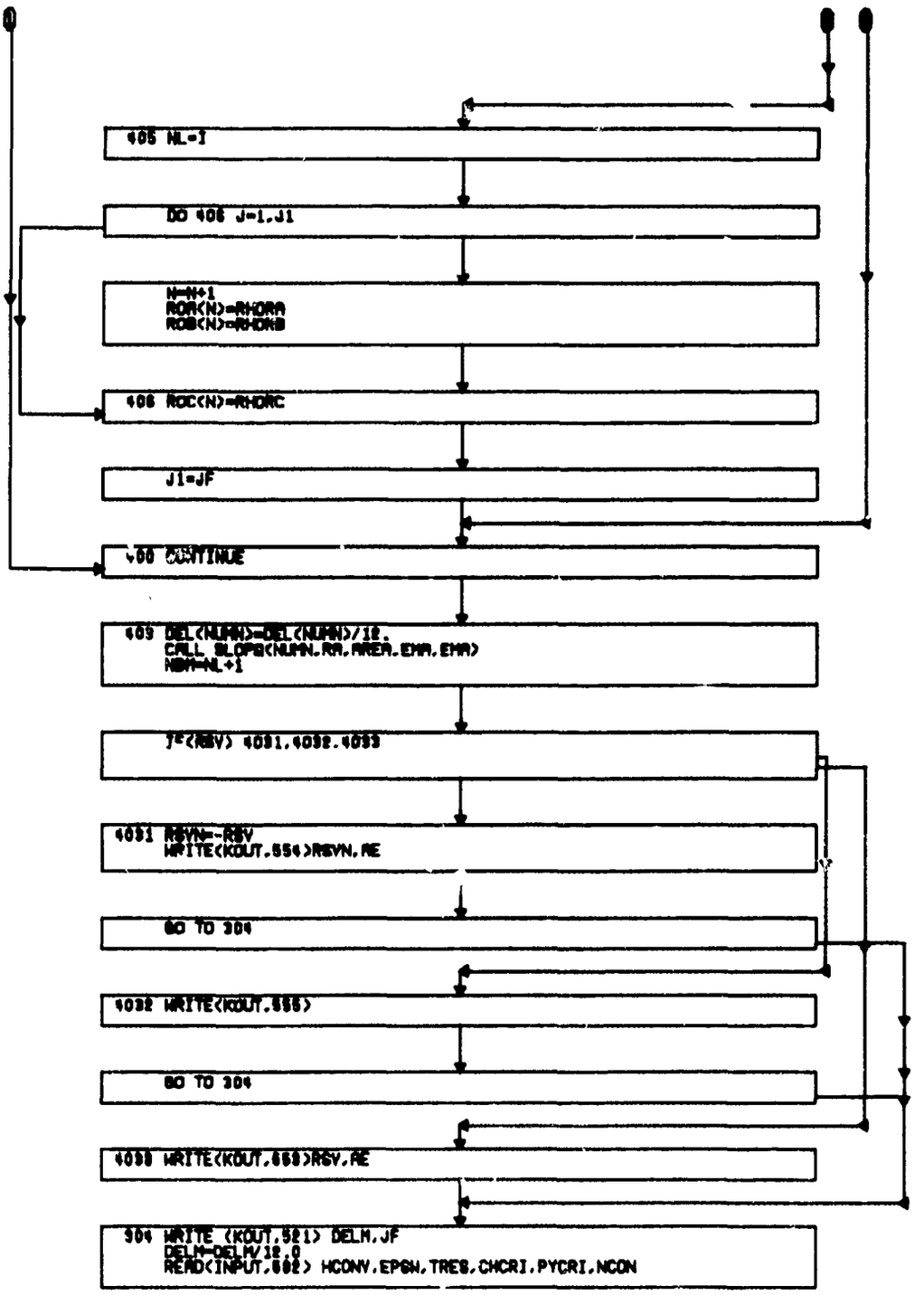
(3) Flow Chart

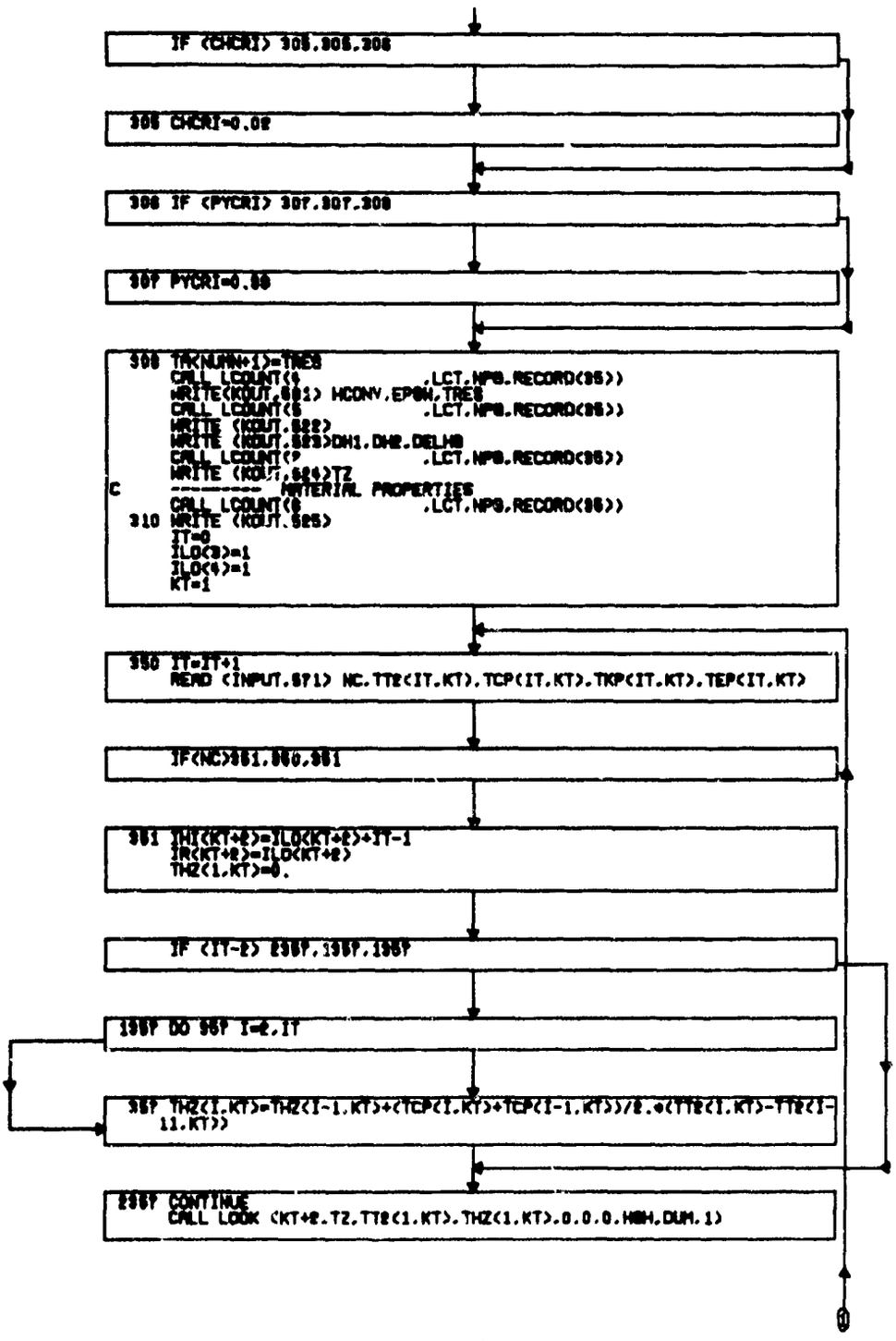

CDDER
SUBROUTINE INPUT
DATA BLANK,MSTER/ 1H ,1H*/
KOUT=6
INPUT=8
MPB=0
INCH=0
WT=0.0
C INPUT/OUTPUT
C
1 MPB=1
WRITE (KOUT,551)MPB
READ (INPUT,499)(RECORD(I),I=1,36)
C
C
WRITE (KOUT,502)(RECORD(I),I=1,36)
WRITE (KOUT,503)
WRITE (KOUT,504)
WRITE (KOUT,505)
WRITE (KOUT,506)
IF(JF-1) 171,170,172
170 JF=2
GO TO 172
171 JF=10
172 JFH=JF/2
JF=JFH+JFH
JFH=JFH+1
FJFS=JF
FJFH=FJFS/2.0
NOI=ND+NI
IF (ND) 181,181,182
182 READ (INPUT,580)(SD(I),I=1,ND)
181 CONTINUE

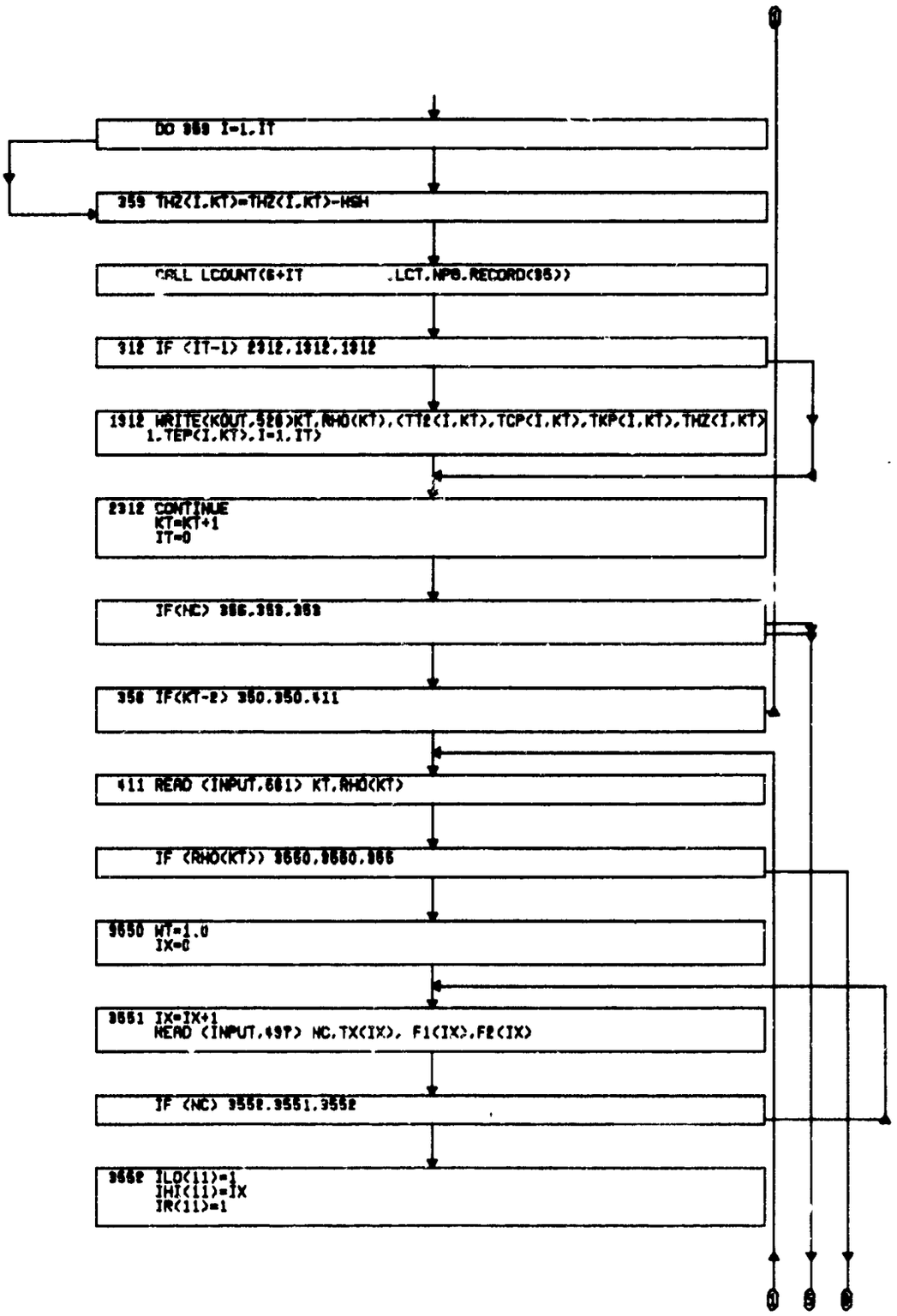

IF (NI) 104,104,103
103 NDP=ND+1
READ (INPUT,500) (BD(I), I=NDP,NDI)
104 IF(GAMA) 406,405,405
406 GAMA=AMOOC/(AMOOC-(AMOOA+AMOOB)-(AMOOA+AMOOB))/GAMA)
405 DTHB=1.0-GAMA
WRITE (IOUT,510)GAMA,GAMMA
IF(DTHB) 410,410,412
410 DTHB=0.
412 DTHIN=.01
413 IF(TPR2)414,414,415
414 TPR2=THFIN
415 IF(TPR3)416,416,417
416 TPR3=THFIN
IF(TPR2-THZRO) 410,410,417
418 DTPR1=DTPR2
DTPR2=DTPR3

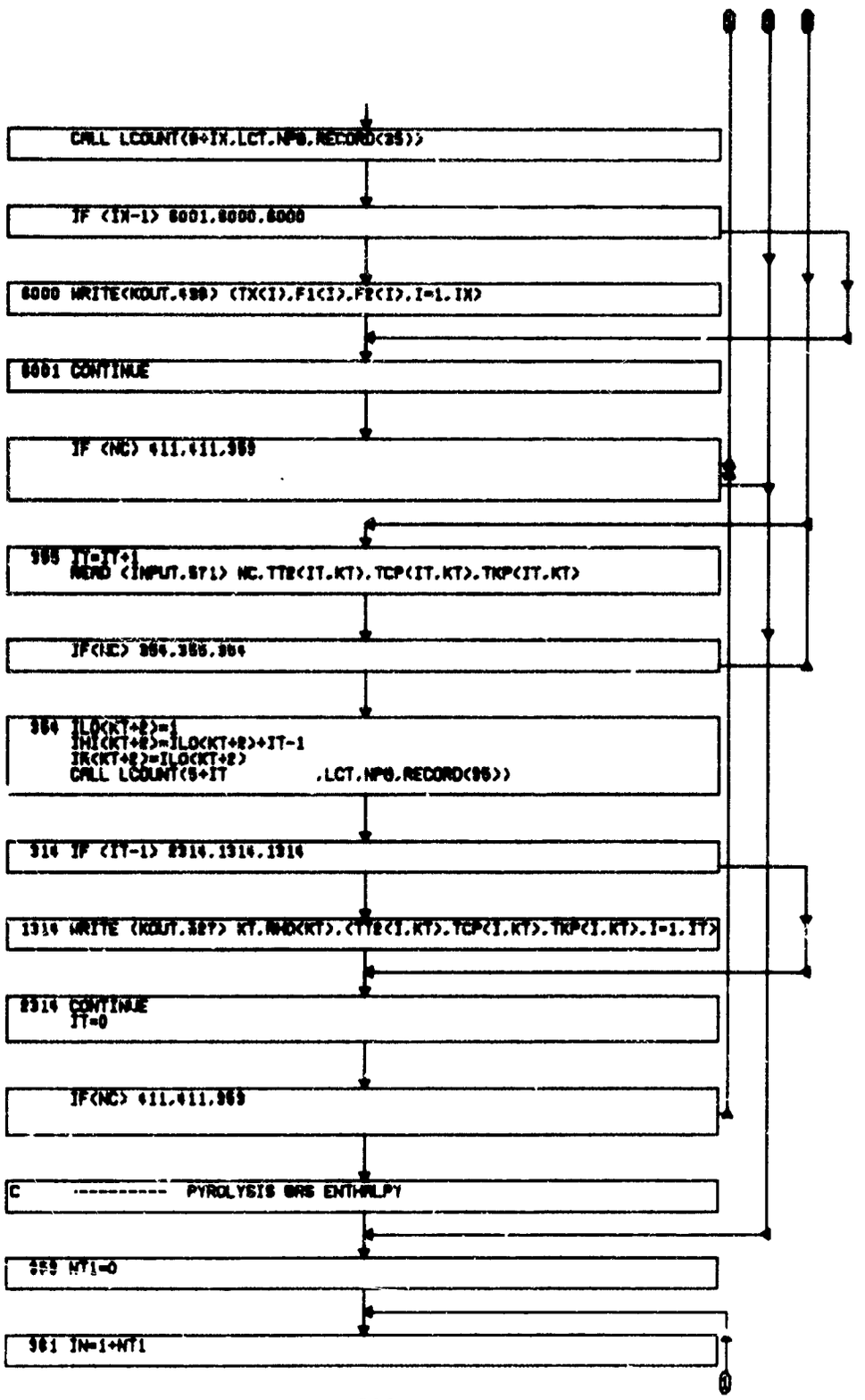

TPR2=TPR3
GO TO 416
417 WRITE (KOUT,511)
THFIN=AMAX1(THFIN,TPR2,TPR3)
WRITE (KOUT,512)THCRD,THFIN
WRITE (KOUT,513)DTPRT,TPR2
WRITE (KOUT,514)DTPR2,TPR2,TPR3
WRITE (KOUT,515)DTPR3,TPR3
WRITE (KOUT,516) DTHB
C481)CCART,WCART,RCART(FINIM=NCR
TRACM=AMIN1(TRACA,TRACB,TRACC)
PETE=RHO(1)/(RHO(1)-RHO(2))
PET=PETE*RHO(2)
C ---------- NODAL PROPERTIES
N=0
J1=JFH
CALL LCOUNT (-NUMN-8,LCT,NP8,RECORD(95))
302 WRITE (KOUT,517)
WRITE (KOUT,518)
WRITE (KOUT,519)
8=MSTER
READ(INPUT,600)(MATL(I),TA(I),AREA(I),DEL(I),RA(I),RC(I),I=1,NUMN)
RE=RA(2)
RSV=RA(1)
RA(1)=0.0
DO 400 I=1,NUMN
IF(I-2) 4541,452,453
453 RA(I)=RA(I-1)+(DEL(I-1)+DEL(I))/2.0
GO TO 451
452 RA(2)=DEL(1)+DEL(2)/2.
8=BLANK
451 DEL(I-1)=DEL(I-1)/12.
4541 RAV(I)=RA(I)
IF(RE) 4542,4543,4542

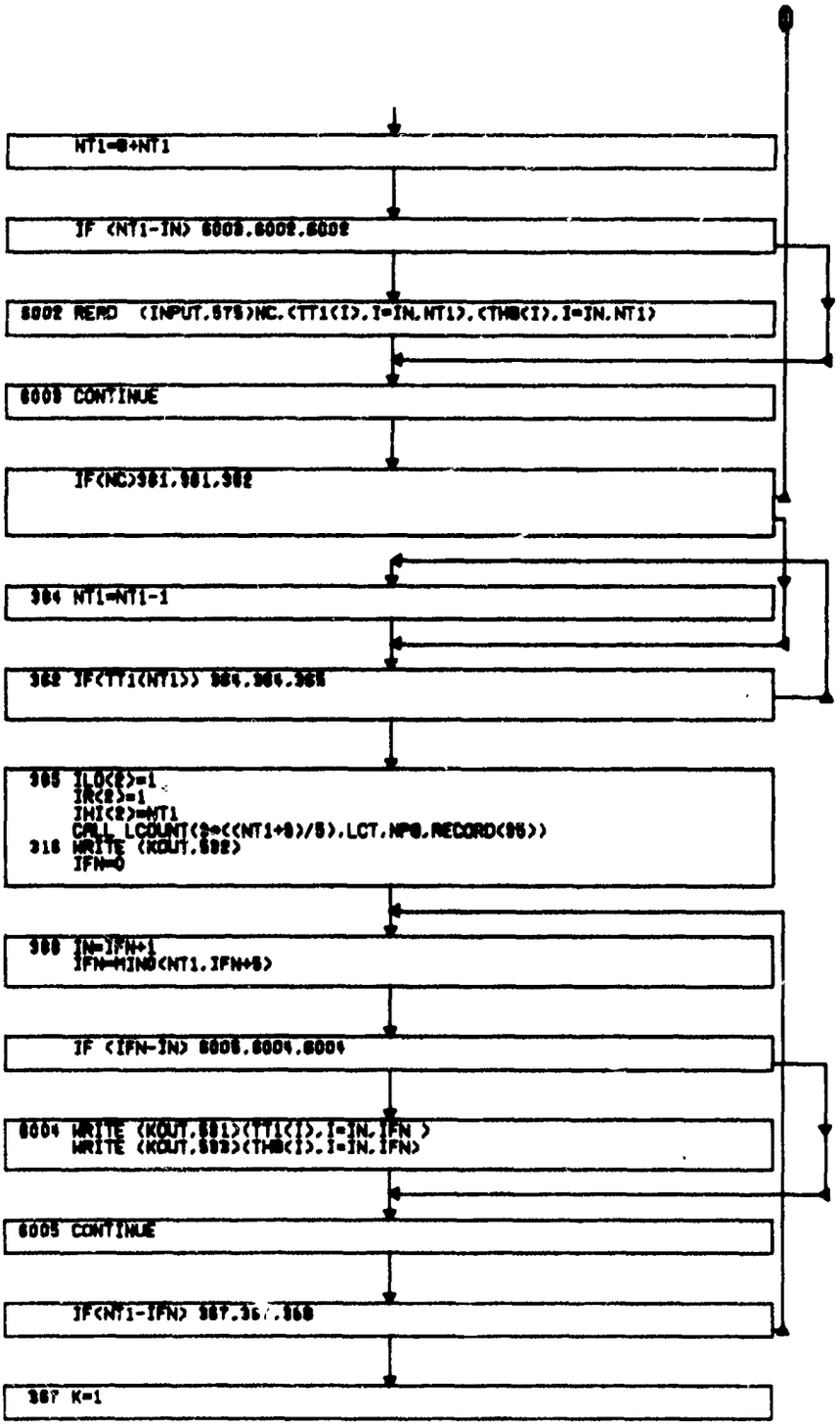

4642 AREA(I)=(ABS(RSV+RA(I)))*RE
GO TO 454
4643 IF(AREA(I)) 4644,4644,454
4644 IF(RSV) 4645,4645,4646
4645 AREA(I)=ABS(RSV+RA(I))
RE=1.0
GO TO 454
4646 AREA(I)=1.
454 WRITE(KOUT,620)I,HWTL(I),TA(I),AREA(I),DEL(I),RA(I),B,RC(I)
IF(HWTL(I)-2) 401,405,406
401 NL=I
DO 404 J=1,J1
N=N+1
ROA(N)=RHOOA
ROB(N)=RHOOB
404 ROC(N)=RHOOC
J1=JF
GO TO 400

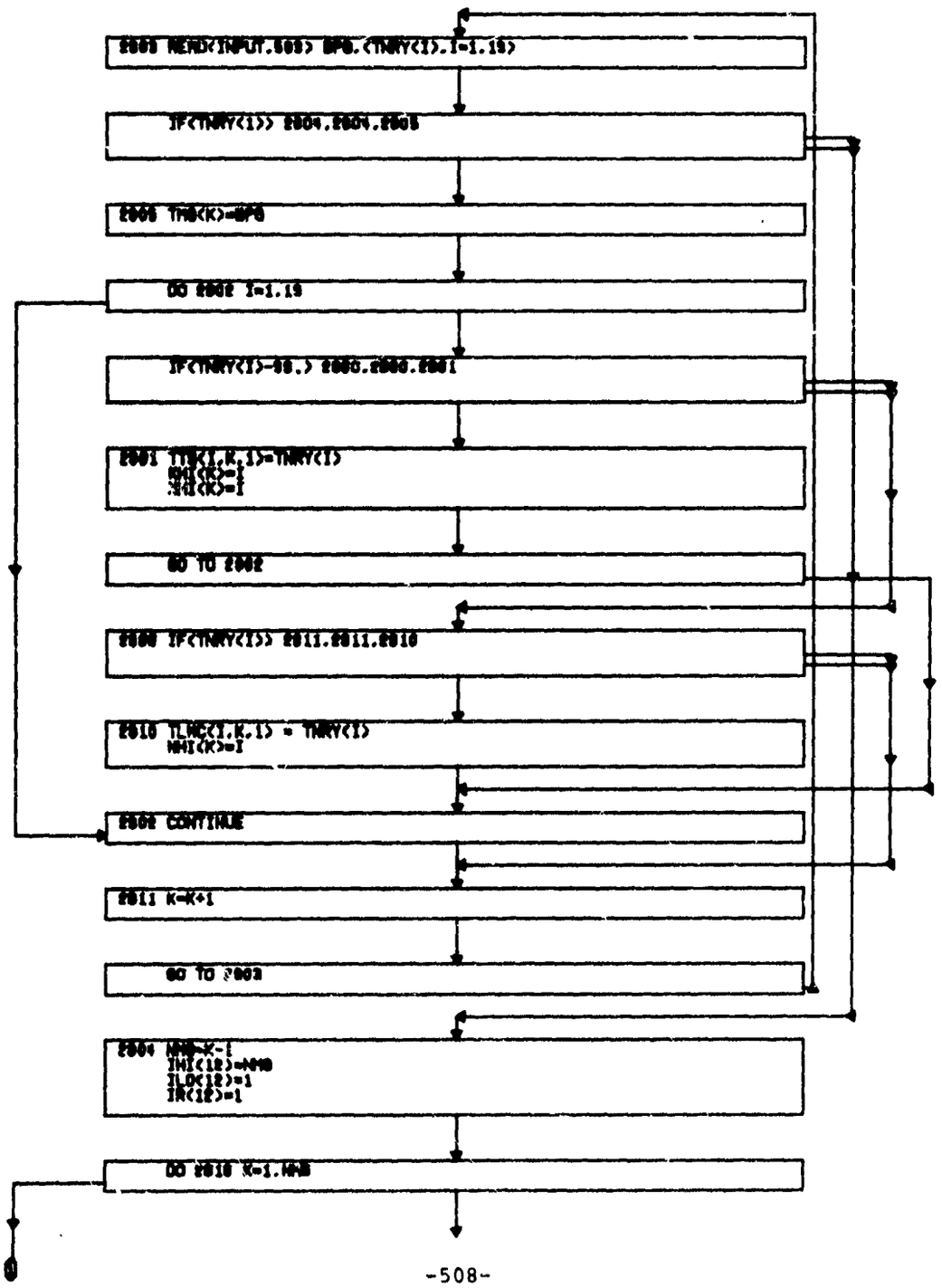

405 NL=I
DO 406 J=1,J1
N=N+1
ROR(N)=RHORA
ROB(N)=RHORB
406 ROC(N)=RHORC
J1=JF
400 CONTINUE
409 DEL(NUMN)=DEL(NUMN)/12.
CALL SLOPS(NUMN,RA,AREA,EMA,EMA)
NBM=NL+1
J=(RSV) 4051,4052,4053
4051 RSVN=-RSV
WRITE(KOUT,554)RSVN,AE
GO TO 304
4052 WRITE(KOUT,555)
GO TO 304
4053 WRITE(KOUT,553)RSV,AE
304 WRITE (KOUT,521) DELH,JF
DELH=DELH/12.0
READ(INPUT,502) HCONV,EPGW,TRES,CHCRI,PYCRI,NCON

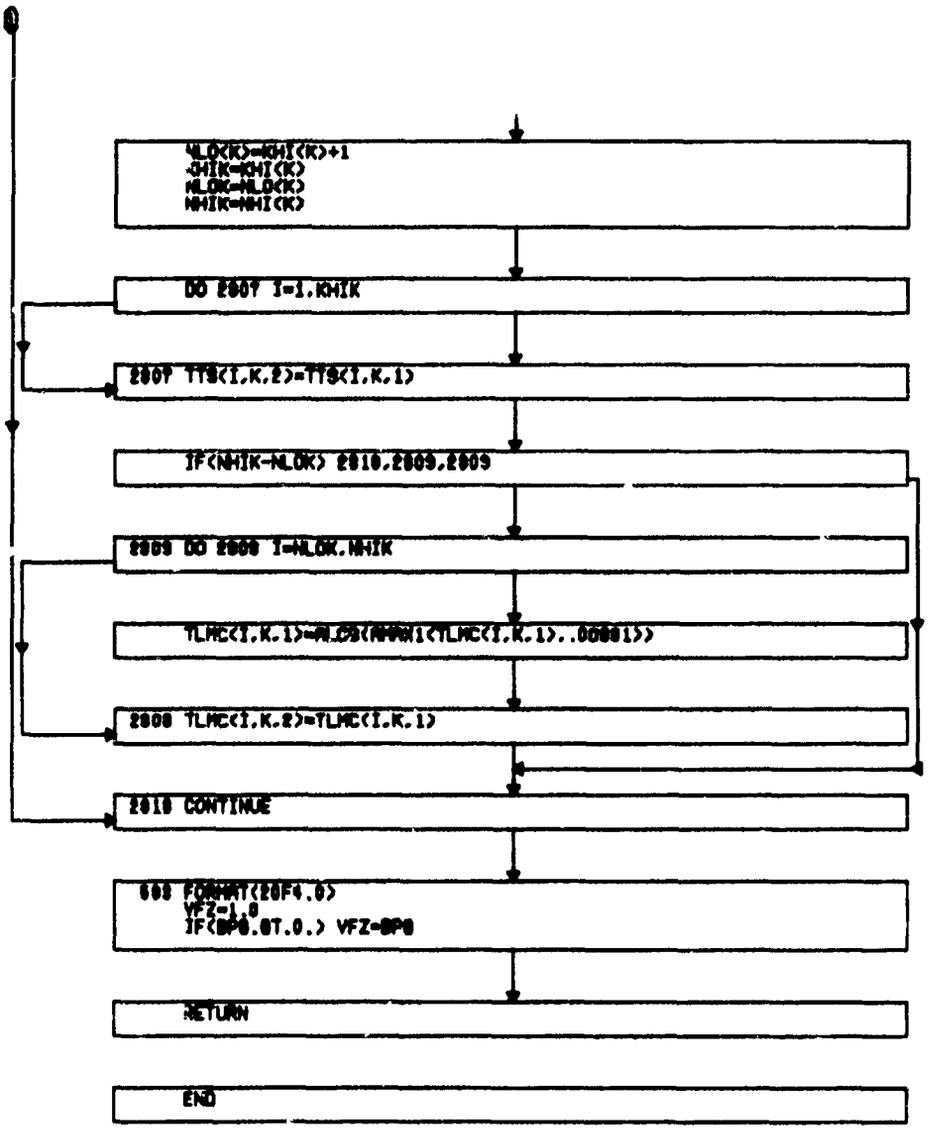

IF (CHCRI) 305,305,306
305 CHCRI=0.02
306 IF (PYCRI) 307,307,308
307 PYCRI=0.80
308 TA(NUMN+1)=TRES
CALL LCOUNT(6 .LCT.NPB.RECORD(95))
WRITE(KOUT,601) HCONV,EPSW,TRES
CALL LCOUNT(6 .LCT.NPB.RECORD(95))
WRITE (KOUT,822)
WRITE (KOUT,823)DH1,DH2,DELHB
CALL LCOUNT(7 .LCT.NPB.RECORD(95))
WRITE (KOUT,824)TZ
C --------- MATERIAL PROPERTIES
CALL LCOUNT(6 .LCT.NPB.RECORD(95))
310 WRITE (KOUT,825)
IT=0
ILO(3)=1
ILO(4)=1
KT=1
350 IT=IT+1
READ (INPUT,871) NC,TTZ(IT,KT),TCP(IT,KT),TKP(IT,KT),TEP(IT,KT)
IF(NC)351,360,351
351 IHI(KT+2)=ILO(KT+2)+IT-1
IR(KT+2)=ILO(KT+2)
THZ(1,KT)=0.
IF (IT-2) 2350,1350,1350
1350 DO 350 I=2,IT
350 THZ(I,KT)=THZ(I-1,KT)+(TCP(I,KT)+TCP(I-1,KT))/2.*(TTZ(I,KT)-TTZ(I-1,KT))
2350 CONTINUE
CALL LOOK (KT+2,TZ,TTZ(1,KT),THZ(1,KT),0,0,0,HBH,DUM,1)


DO 359 I=1,IT
359 THZ(I,KT)=THZ(I,KT)-HSH
CALL LCOUNT(6+IT .LCT,NP6,RECORD(95))
312 IF (IT-1) 2312,1312,1312
1312 WRITE(KOUT,526)KT,RHO(KT),(TTZ(I,KT),TCP(I,KT),TKP(I,KT),THZ(I,KT)
1,TEP(I,KT),I=1,IT)
2312 CONTINUE
KT=KT+1
IT=0
IF(NC) 356,359,359
356 IF(KT-2) 350,350,411
411 READ (INPUT,681) KT,RHO(KT)
IF (RHO(KT)) 9650,9650,356
9650 WT=1.0
IX=0
9651 IX=IX+1
READ (INPUT,497) NC,TX(IX), F1(IX),F2(IX)
IF (NC) 9552,9651,9552
9552 ILO(11)=1
IHI(11)=IX
IR(11)=1


CALL LCOUNT(6+IX,LCT,NP6,RECORD(35))
IF (IX-1) 6001,6000,6000
6000 WRITE(KOUT,490) (TX(I),F1(I),F2(I),I=1,IX)
6001 CONTINUE
IF (NC) 411,411,969
IT=IT+1
READ (INPUT,871) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT)
IF(NC) 964,965,964
ILO(KT+2)=1
IHI(KT+2)=ILO(KT+2)+IT-1
IR(KT+2)=ILO(KT+2)
CALL LCOUNT(6+IT ,LCT,NP6,RECORD(96))
314 IF (IT-1) 8314,1314,1314
1314 WRITE (KOUT,887) KT,NHD(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),I=1,IT)
8314 CONTINUE
IT=0
IF(NC) 411,411,969
C ---------- PYROLYSIS GAS ENTHALPY
MT1=0
961 IN=1+MT1


NT1=0+NT1
IF (NT1-IN) 6005,6002,6002
6002 READ (INPUT,575)NC,(TT1(I),I=IN,NT1),(THB(I),I=IN,NT1)
6003 CONTINUE
IF(NC)981,981,982
984 NT1=NT1-1
982 IF(TT1(NT1)) 984,984,985
985 ILO(2)=1
IR(2)=1
IHI(2)=NT1
CALL LCOUNT(2,((NT1+8)/5),LCT,NP8,RECORD(96))
918 WRITE (KOUT,592)
IFN=0
988 IN=IFN+1
IFN=MIND(NT1,IFN+5)
IF (IFN-IN) 6005,6004,6004
6004 WRITE (KOUT,591)(TT1(I),I=IN,IFN)
WRITE (KOUT,593)(THB(I),I=IN,IFN)
6005 CONTINUE
IF(NT1-IFN) 987,36,988
987 K=1


2003 READ(INPUT,603) BPB,(THRV(I),I=1,18)
IF(THRV(1)) 2004,2004,2005
2005 THB(K)=BPB
DO 2002 I=1,18
IF(THRV(I)-88.) 2000,2000,2001
2001 TTB(I,K,1)=THRV(I)
NH1(K)=I
NH(K)=I
GO TO 2002
2000 IF(THRV(I)) 2011,2011,2010
2010 TLHC(I,K,1) = THRV(I)
NHI(K)=I
2002 CONTINUE
2011 K=K+1
GO TO 2003
2004 NHB=K-1
NHI(18)=NHB
TLOC(18)=1
IR(18)=1
DO 2010 K=1,NHB


NLOK(K)=NHI(K)+1
NHIK=NHI(K)
NLOK=NLOK(K)
NHIK=NHI(K)
DO 2007 I=1,NHIK
2007 TTS(I,K,2)=TTS(I,K,1)
IF(NHIK-NLOK) 2010,2009,2009
2009 DO 2008 I=NLOK,NHIK
TLMC(I,K,1)=ALOG(AMAX1(TLMC(I,K,1),.00001))
2008 TLMC(I,K,2)=TLMC(I,K,1)
2010 CONTINUE
888 FORMAT(20F4.0)
VFZ=1.0
IF(BP0.GT.0.) VFZ=BP0
RETURN
END

g. Subroutine LOOK (II,XL,X,A,B,C,E,Y,D,IDN) - B33A

(1) Function

Table look-up and linear interpolation routine for CMA.

II = table identification number

XL = value of independent variable for which dependent variables are to be evaluated

X = name of independent variable

A, B, C, E = names of dependent variables (if less than four, unneeded places must be filled with dummy place holders

Y( ) = names of output values of dependent variables (arrayed in order of call from left to right) at XL

D( ) = names of output values of derivatives of dependent variables Y( )

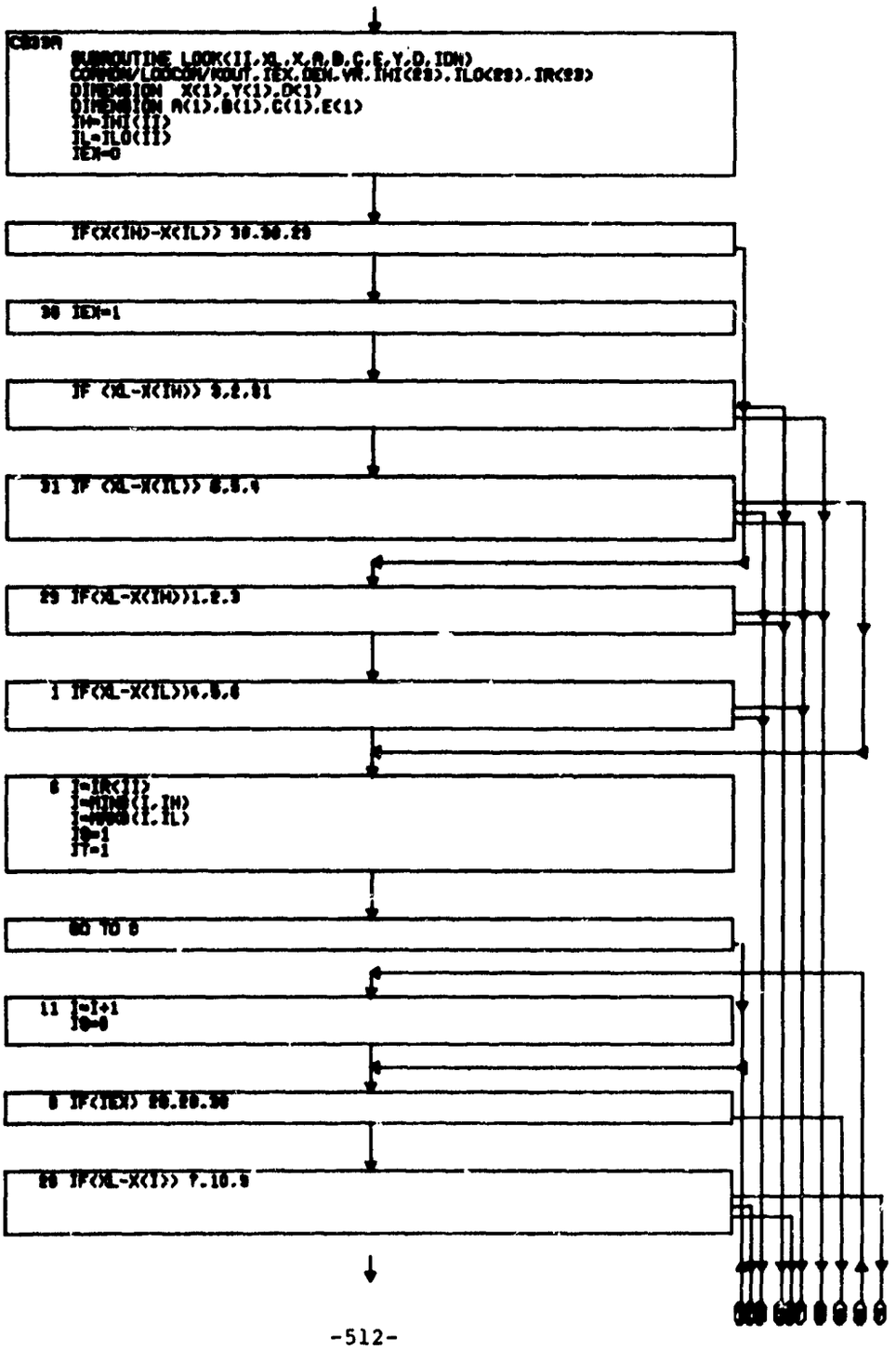
IDN = number of dependent variables in list

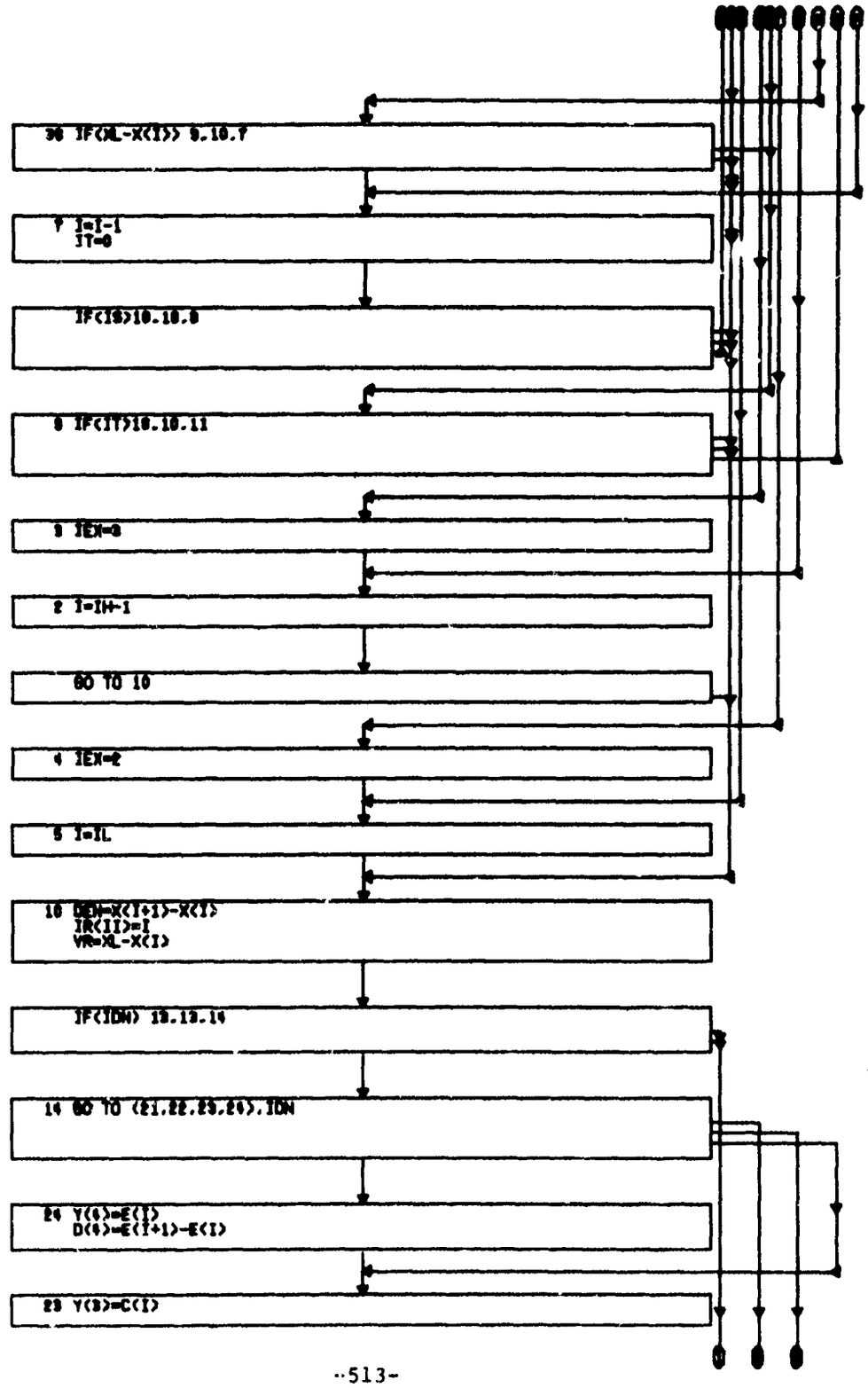
Called by CABLE, CMA, SBCPKG.

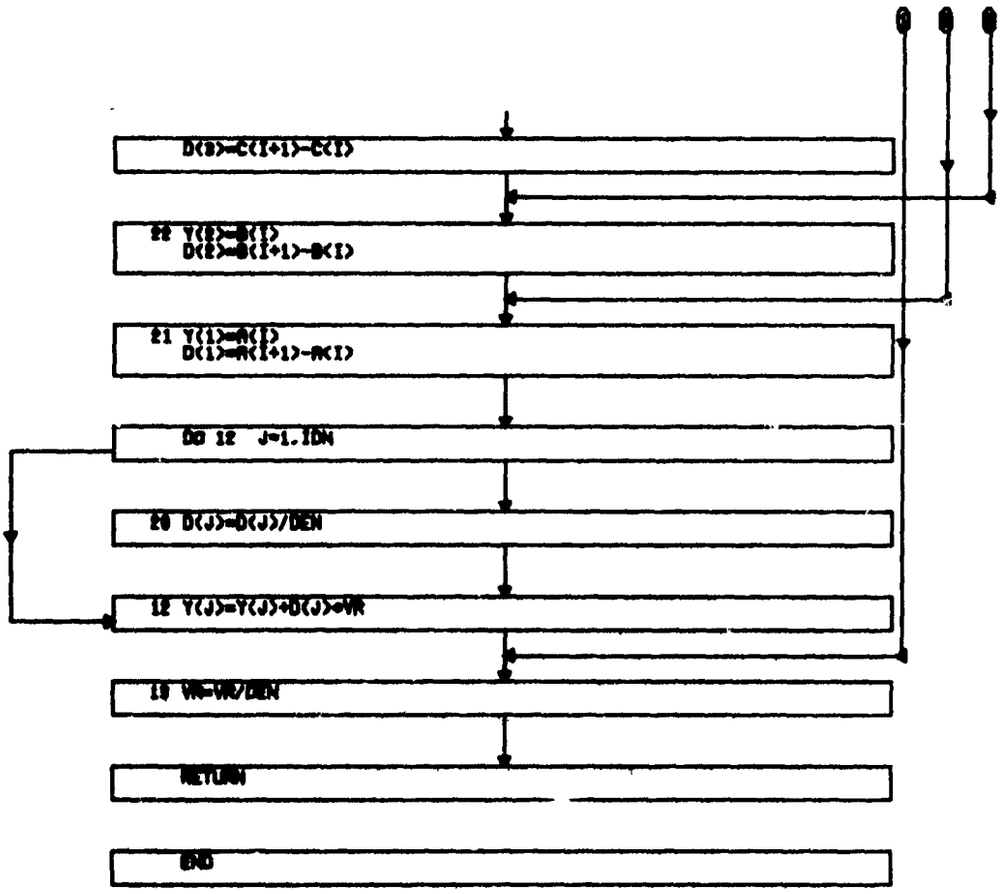
(2) Listing

```
000001          CH33A                                                   B33A 001
000002                SUBROUTINE LOOK(II,XL,X,A,B,C,E,Y,D,IDN)          B33A 002
000003                COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)  B33A 003
000004                DIMENSION  X(1),Y(1),D(1)                         B33A 004
000005                DIMENSION A(1),B(1),C(1),E(1)                     B33A 005
000006                IH=IHI(II)                                        B33A 006
000007                IL=ILO(II)                                        B33A 007
000008                IEX=0                                             B33A 008
000009                IF(X(IH)-X(IL)) 30,30,29                          B33A 009
000010             30 IEX=1                                             B33A 010
000011                IF (XL-X(IH)) 3,2,31                              B33A 011
000012             31 IF (XL-X(IL)) 6,5,4                               B33A 012
000013             29 IF(XL-X(IH))1,2,3                                 B33A 013
000014              1 IF(XL-X(IL))4,5,6                                 B33A 014
000015              6 I=IR(II)                                          B33A 015
000016                I=MIN0(I,IH)                                      B33A 016
000017                I=MAX0(I,IL)                                      B33A 017
000018                IS=1                                              B33A 018
000019                IT=1                                              B33A 019
000020                GO TO 8                                           B33A 020
000021             11 I=I+1                                             B33A 021
000022                IS=0                                              B33A 022
000023              8 IF(IEX) 24,28,38                                  B33A 023
000024             28 IF(XL-X(I)) 7,10,9                                B33A 024
000025             38 IF(XL-X(I)) 9,10,7                                B33A 025
000026              7 I=I-1                                             B33A 026
000027                IT=0                                              B33A 027
000028                IF(IS)10,10,8                                     B33A 028
000029              9 IF(IT)10,10,11                                    B33A 029
000030              3 IEX=3                                             B33A 030
000031              2 I=IH-1                                            B33A 031
000032                GO TO 10                                          B33A 032
000033              4 IEX=2                                             B33A 033
000034              5 I=IL                                              B33A 034
000035             10 DEN=X(I+1)-X(I)                                   B33A 035
000036                IR(II)=I                                          B33A 036
000037                VR=XL-X(I)                                        B33A 037
000038                IF(IDN) 13,13,14                                  B33A 038
000039             14 GO TO (21,22,23,24),IDN                           B33A 039
000040             24 Y(4)=E(I)                                         B33A 040
000041                D(4)=E(I+1)-E(I)                                  B33A 041
000042             23 Y(3)=C(I)                                         B33A 042
000043                D(3)=C(I+1)-C(I)                                  B33A 043
000044             22 Y(2)=B(I)                                         B33A 044
000045                D(2)=B(I+1)-B(I)                                  B33A 045
000046             21 Y(1)=A(I)                                         B33A 046
000047                D(1)=A(I+1)-A(I)                                  B33A 047
000048                DO 12  J=1,IDN                                    B33A 048
000049             20 D(J)=D(J)/DEN                                     B33A 049
000050             12 Y(J)=Y(J)+D(J)*VR                                 B33A 050
000051             13 VR=VR/DEN                                         B33A 051
000052                RETURN                                            B33A 052
000053                END                                               B33A 053
```

(3) Flow Chart


CDC6R
SUBROUTINE LOOK(II,XL,X,N,D,C,E,Y,D,IDN)
COMMON/LOOCOM/KOUT,IEX,DEN,VR,IMI(20),ILO(20),IR(20)
DIMENSION X(1),Y(1),D(1)
DIMENSION A(1),B(1),C(1),E(1)
IM=IMI(II)
IL=ILO(II)
IEX=0
IF(X(IM)-X(IL)) 30,30,29
30 IEX=1
IF (XL-X(IM)) 5,2,31
31 IF (XL-X(IL)) 6,6,4
29 IF(XL-X(IM))1,2,3
1 IF(XL-X(IL))4,6,6
6 I=IR(II)
I=MIMI(I,IM)
I=MAXO(I,IL)
IO=1
IT=1
GO TO 8
11 I=I+1
IO=0
8 IF(IEX) 20,20,30
20 IF(XL-X(I)) 7,10,9


30 IF(XL-X(I)) 9,10,7
7 I=I-1
IT=0
IF(I8)10,10,8
8 IF(IT)10,10,11
9 IEX=0
2 I=IH-1
GO TO 10
4 IEX=2
5 I=IL
10 DEN=X(I+1)-X(I)
IR(II)=I
VR=XL-X(I)
IF(IDN) 13,13,14
14 GO TO (21,22,23,24),IDN
24 Y(6)=E(I)
D(6)=E(I+1)-E(I)
23 Y(3)=C(I)


D(8)=C(I+1)-C(I)
22 Y(8)=B(I)
D(8)=B(I+1)-B(I)
21 Y(1)=A(I)
D(1)=A(I+1)-A(I)
DO 12 J=1,IDN
20 D(J)=D(J)/DEN
12 Y(J)=Y(J)+D(J)*VR
10 VR=VR/DEN
RETURN
END

h. Subroutine COMP (X,Y,VOID, IFLAG)

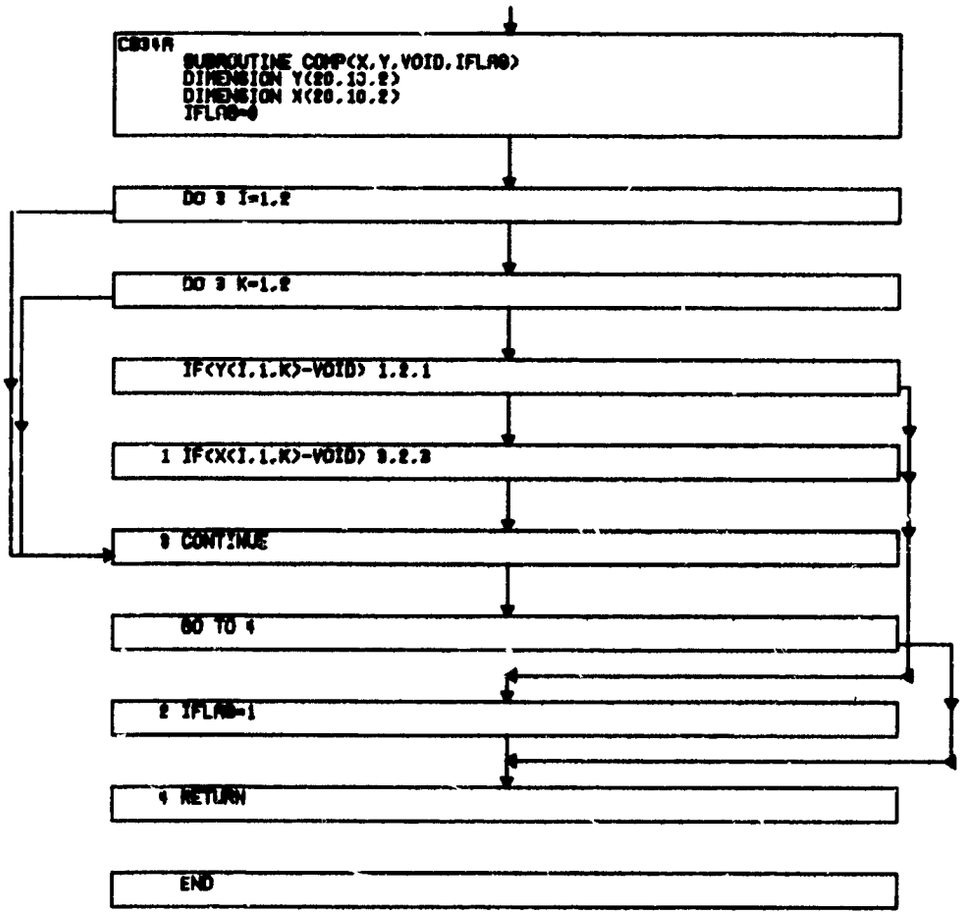
(1) Function

Determines whether the word "VOID" exists at any of the eight corners of the interpolation matrix of BLIMP solutions. Called by SBCPKG.

(2) Listing

```
000001          CB34A                                                   B34A 001
000002                SUBROUTINE COMP(X,Y,VOID,IFLAG)
000003                DIMENSION Y(20,10,2)                              B34A 003
000004                DIMENSION X(20,10,2)                              B34A 004
000005                IFLAG=0                                           B34A 005
000006                DO 3 I=1,2                                        B34A 007
000007                DO 3 K=1,2
000008                IF(Y(I,1,K)-VOID) 1,2,1
000009              1 IF(X(I,1,K)-VOID) 3,2,3                           B34A 009
000010              3 CONTINUE                                          B34A 010
000011                GO TO 4                                           B34A 011
000012              2 IFLAG=1                                           B34A 012
000013              4 RETURN                                            B34A 013
000014                END
```

(3) Flow Chart


C$$$$R
SUBROUTINE COMP(X,Y,VOID,IFLAG)
DIMENSION Y(20,10,2)
DIMENSION X(20,10,2)
IFLAG=0
DO 3 I=1,2
DO 3 K=1,2
IF(Y(I,1,K)-VOID) 1,2,1
1 IF(X(I,1,K)-VOID) 3,2,3
3 CONTINUE
GO TO 4
2 IFLAG=1
4 RETURN
END

i. Subroutine OGLE (N,XAM,PRM,NUMX,X,P,EM) - B36A

(1) Function

Subroutine OGLE looks up an array of values of a single dependent variable corresponding to an array of values of a single independent variable, using a cubic curve fit between any two points of the table. The curve fit employs the values and slopes of the independent variable at the tabular points surrounding the look-up value of the independent variable to determine the four constants of the cubic interpolation function. The necessary slopes are conveniently provided by subroutine SLOPQ. Points off the ends of the table are evaluated with a linear extension of the tabulated values, using the input slopes at the first and last tabular entries. Called by CMA.

N = number of points to be considered

XAM = name of value of independent variable for which look-up is to be performed (if an array, looking starts at XL(1) and proceeds to XL(N))

PRM = name of output interpolated values returned by OGLE

NUMX = number of tabular entries in the table

X = name of tabular independent variable

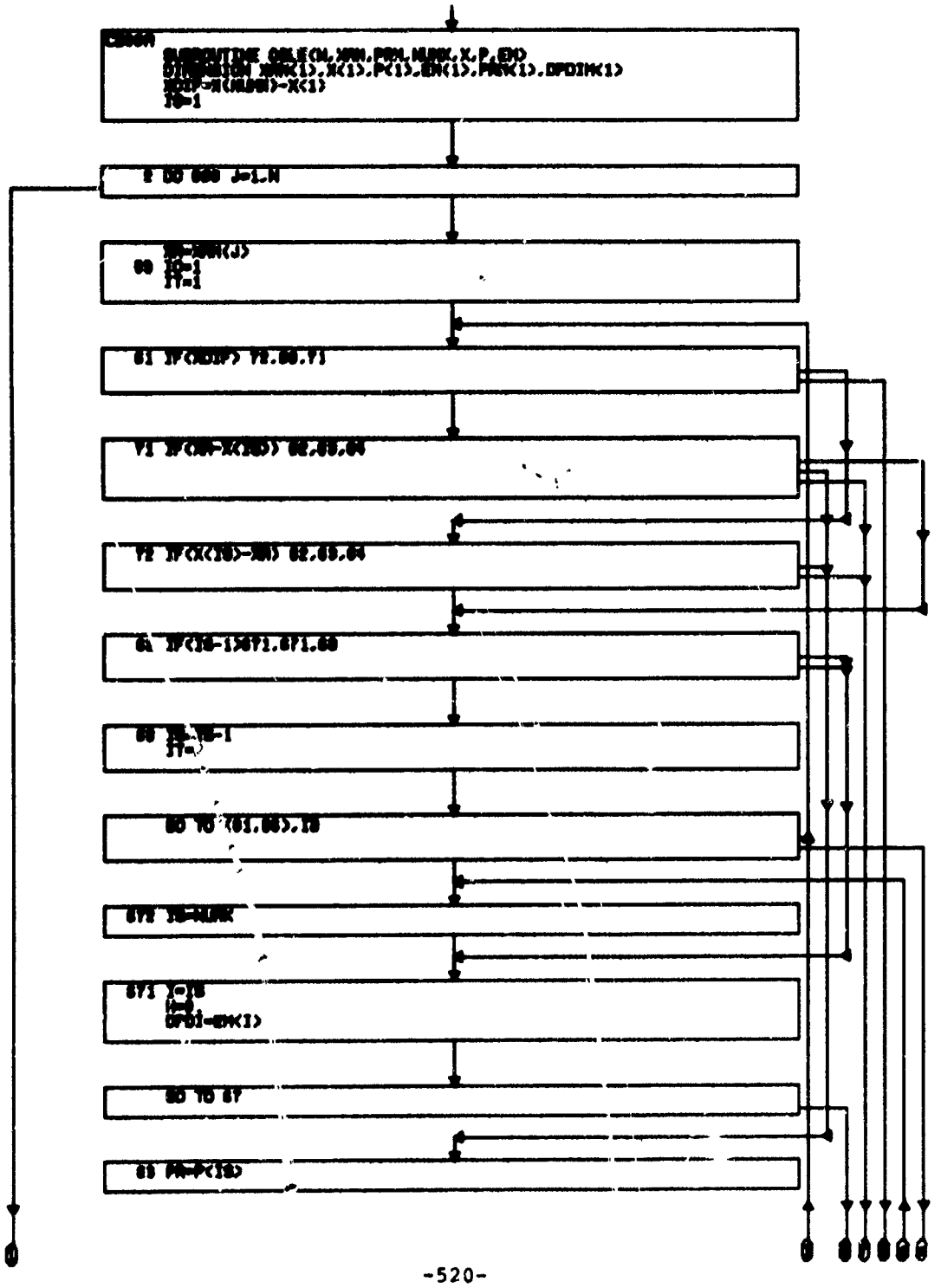
P = name of tabular dependent variable

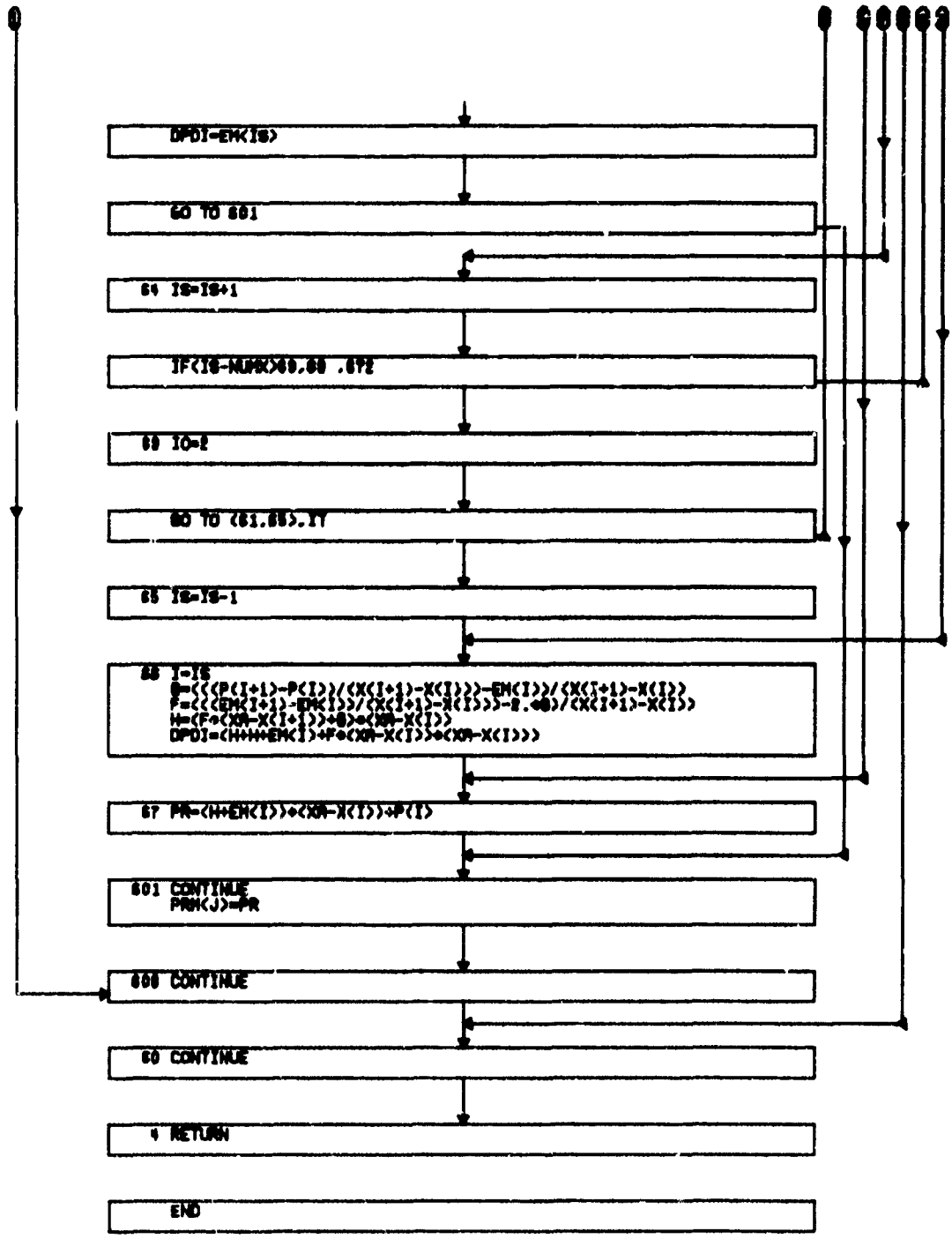
EM = name of slopes to be used.

(2) Listing

```
000001          CB36A                                                          B36A 001
000002                SUBROUTINE OGLE(N,XAM,PRM,NUMX,X,P,EM)                   B36A 002
000003                DIMENSION XAM(1),X(1),P(1),EM(1),PRM(1),DPDIM(1)         B36A 003
000004                XDIF=X(NUMX)-X(1)                                        B36A 004
000005                IS=1                                                     B36A 005
000006              2 DO 600 J=1,N                                             B36A 006
000007                XA=XAM(J)                                                B36A 007
000008             59 I0=1                                                     B36A 008
000009                IT=1                                                     B36A 009
000010             61 IF(XDIF) 72,60,71                                        B36A 010
000011             71 IF(XA-X(IS)) 62,63,64                                    B36A 011
000012             72 IF(X(IS)-XA) 62,63,64                                    B36A 012
000013             62 IF(IS-1)671,671,68                                       B36A 013
000014             68 IS=IS-1                                                  B36A 014
000015                IT=2                                                     B36A 015
000016                GO TO (61,66),I0                                         B36A 016
000017            672 IS=NUMX                                                  B36A 017
000018            671 I=IS                                                     B36A 018
000019                H=0.                                                     B36A 019
000020                DPDI=EM(I)                                               B36A 020
000021                GO TO 67                                                 B36A 021
000022             63 PR=P(IS)                                                 B36A 022
000023                DPDI=EM(IS)                                              B36A 023
000024                GO TO 601                                                B36A 024
000025             64 IS=IS+1                                                  B36A 025
000026                IF(IS-NUMX)69,69 ,672                                    B36A 026
000027             69 I0=2                                                     B36A 027
000028                GO TO (61,65),IT                                         B36A 028
000029             65 IS=IS-1                                                  B36A 029
000030             66 I=IS                                                     B36A 030
000031                G=(((P(I+1)-P(I))/(X(I+1)-X(I)))-EM(I))/(X(I+1)-X(I))    B36A 031
000032                F=(((EM(I+1)-EM(I))/(X(I+1)-X(I)))-2.*G)/(X(I+1)-X(I))   B36A 032
000033                H=(F*(XA-X(I+1))+G)*(XA-X(I))                            B36A 033
000034                DPDI=(H+H+EM(I)+F*(XA-X(I))*(XA-X(I)))                   B36A 034
000035             67 PR=(H+EM(I))*(XA-X(I))+P(I)                              B36A 035
000036            601 CONTINUE                                                 B36A 036
000037                PRM(J)=PR                                                B36A 037
000038            600 CONTINUE                                                 B36A 038
000039             60 CONTINUE                                                 B36A 039
000040              4 RETURN                                                   B36A 040
000041                END                                                      B36A 041
```

(3) Flow Chart




DPDI=EM(IS)
GO TO 601
64 IS=IS+1
IF(IS-NUMX)60,66 ,672
69 IO=2
GO TO (61,65),IY
65 IS=IS-1
66 I=IS
B=(((P(I+1)-P(I))/(X(I+1)-X(I)))-EM(I))/(X(I+1)-X(I))
F=(((EM(I+1)-EM(I))/(X(I+1)-X(I)))-2.*B)/(X(I+1)-X(I))
H=(F*(XR-X(I+1))+B)*(XR-X(I))
DPDI=(H+H+EM(I))+F*(XR-X(I))*(XR-X(I))
67 PR=(H+EM(I))*(XR-X(I))+P(I)
601 CONTINUE
PRM(J)=PR
600 CONTINUE
60 CONTINUE
4 RETURN
END

j. Subroutine LCOUNT (J,LCT,NPG,R) - B37A

(1) Function

Line counting and page numbering routine for output. Called by CMA, INPOUT.

J = number of lines to be output (if written negative, the subroutine will automatically being a new page, otherwise the subroutine begins a new page only if I would lap over onto the next page)

LCT = number of lines left on page (the subroutine keeps track of this quantity if a variable name is entered in the call list)

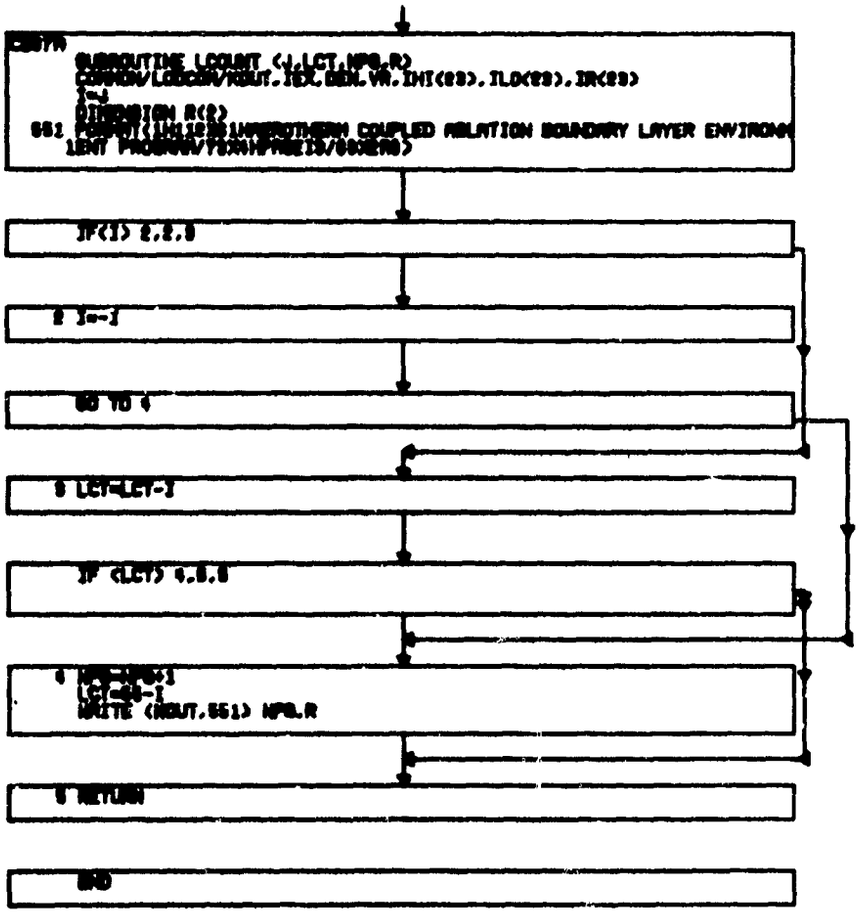
NPG = page number (the subroutine keeps track of this quantity if a variable name is entered in the call list; the quantity NPG must be initialized outside the subroutine)

R( ) = a title in format 2A6 which will be printed on each new page.

(2) Listing

```
000001          C837A                                                   837A 001
000002                SUBROUTINE LCOUNT (J,LCT,NPG,R)                   837A 002
000003                COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)  837A 003
000004                I=J                                               837A 004
000005                DIMENSION R(2)                                    837A 005
000006              551 FORMAT(1H1,12X,61HAEROTHERM COUPLED ABLATION BOUNDARY LAYER ENVIRONM
000007             1ENT PROGRAM/73X4HPAGE,I3/68X2A6)
000008                IF(I) 2,2,3                                       837A 008
000009              2 I=-I                                              837A 009
000010                GO TO 4                                           837A 010
000011              3 LCT=LCT-I                                         837A 011
000012                IF (LCT) 4,5,5                                    837A 012
000013              4 NPG=NPG+1                                         837A 013
000014                LCT=55-I                                          837A 014
000015                WRITE (KOUT,551) NPG,R                            837A 015
000016              5 RETURN                                            837A 016
000017                END                                               837A 017
```

(3) Flow Chart


SUBROUTINE LCOUNT (J,LCT,NPB,R)
IF(I) 2,2,3
2 I=-I
GO TO 4
3 LCT=LCT-I
IF (LCT) 4,5,5
4 NPB=NPB+1
LCT=0
DELETE (INOUT,551) NPB,R
5 RETURN
END

k. Subroutine SBCPKG - B38A

(1) Function

This routine performs the surface energy balance and implements the surface boundary conditions. Called by CMA. Calls LOOK, COMP.

(2) Listing

```
000001          CB38A                                                                   B38A 001
000002               SUBROUTINE SBCPKG                                                  B38A 002
000003               COMMON/CAMCOM/TLMC(20,10,2),TMG(20),TTS(20,10,2),TCHEM(20,10,2),   B38A 003
000004              1NLO(20),NHI(20),KHI(20),JCMA,IMG,IMC,NMG,                          B38A 004
000005              2TCH(2),TPR(2),TRAD(2),IAB                                          B38A 005
000006              3,TT2(20,2),THZ(20,2),TT1(30),THG(30),DH12(2),TA(39),DELHG,I1,I2,CHB38A 006
000007              4,CMD,APRMG,KCM(10)                                                 B38A 007
000008               EQUIVALENCE (NCLASS,JCMA)                                          B38A 008
000009               COMMON/LOOCOM/KOUT,IEX,DEN,VR,IHI(23),ILO(23),IR(23)               B38A 009
000010               COMMON/CMACOM/TEP(20,2), TCP(20, 2),TKP(20, 2)                     B38A 010
000011              3,RHO(2),MATL(38),DEL(39),SO(20),M(38),RC(38),RA(38),RECORD(36),    B38A 011
000012              4APEA(38),EMA(38),RAV(38),                                          B38A 012
000013              5RCA(152),RCB(152),RCC(152),                                        B38A 013
000014              6     TPI(30),VFZ,CMM,NPR,                                          B38A 014
000015              7LCT,NPG,II,NBM,NUMN,NL,       DELM,RFT,RHORA,RHORB,RHORC,TRA       B38A 015
000016              8CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,B38A 016
000017              9TRACM,PET,PETE,RSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT B38A 017
000018               COMMON/CMACOM/EPSW,TRES,                                           B38A 018
000019              1TMWT,GAMA,OMG,NO,FJFH,FJFS,JF,JFHP,JFH,INPUT,      DTHIN,BRP,HCONV,B38A 019
000020              2INCH,DTHB,NN,NI,NOI,CHCRI,PYCRI,NCON,     NR,TX(30),F1(30),F2(30)  B38A 020
000021               COMMON/SBCP/BF,CMMA,CMMI,DERR,DMIV,EMIV,ERFX,ERRC,ERR,ERRS,I3,I4,  B38A 021
000022              1VRM,VRP, IPR,IRA,IRB,IRC,IRD,ITL,PHI,QB,TABC,TEMP,TSMA,TSMI,TSSQ   B38A 022
000023               COMMON/SBCP/ TNXT,   DNCP(3),CPE(3),TO(20),VITER(51),EITER(51)     B38A 023
000024               COMMON/SBCP/ Y2(16),D2(16),Y3(8),D3(8),Y1(2),D1(2)                 B38A 024
000025               COMMON/SBCP/ CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50),   B38A 025
000026              1RAT( 50),ROT( 50),RO( 50),X( 50),RON( 50),DMDG( 50),RR ( 50),      B38A 026
000027              2CNC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50),CNO( 50)             B38A 027
000028               COMMON/SBCP/BR,    CHZ,     CMDL,     DEDT,DEDTT,DSDTB,DTH,GSMS,HW,  B38A 028
000029              1ME,     ITS,PRES,QCHEM,QCHEMT ,QCOND,QCONDT,QCONV,QCONVT,QRA,QRP,   B38A 029
000030              2QRPT,RAD,RADT,RSU,SIG,    TSAVE,VF,XP1,ASU                        B38A 030
000031               COMMON/MISC/       BPRM,CMT,COLD,CP1,CPGAS,CPNL,CZ,DCDT,DECOM,     B38A 031
000032              1DECOMT,DELCR,DELR,DENOLD,DIDT,DNS,DPDT,DRLCP,DRLC,DRLP,DRL,DROAC,  B38A 032
000033              2DROAT,DROBC,DROBT,DROCC,DROCT,DRODTD,DSDT,DSI,DS,DSS,DTA,DTHC,DTHSB38A 033
000034              3,DTS,DVB,DZ,EGO,EZ,FACT1,FACT2,FA,FB,FC,FJF,FK,FZ,GBEGR,GSM,GSMT,  B38A 034
000035              4GZ,H1,HAPHS,HBAR,HGAS,HRES,IE,IMIN,I,IS,ISV,ITER,J1,J,KK,K,KT,L,   B38A 035
000036              5NDR,NLI,NLM,N,NZ,O,PGPU,PGPUT,POLD,POW,QLOSS,QLOSST,RD,RO1,ROOZ,SABB38A 036
000037              6,SOEGR,TAS,TB,TERM1,TERM2,TERM3,THDS,TH,THPRT,TN,TOP1,TOP2,TOP3,T, B38A 037
000038              7TT,VOL,X1                                                          B38A 038
000039               EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                    B38A 039
000040               DATA VOID/4HVOID/                                                  B38A 040
000041          529 FORMAT(17H  ITERATION STOP  )                                       B38A 041
000042          582 FORMAT(1P12E10.3)                                                   B38A 042
000043               IF(JCMA-2) 771,771,770                                             B38A 043
000044          770 IF(JCMA-4) 2513,744,753                                             B38A 044
000045          771 CONTINUE                                                            B38A 045
000046               XP1=X(1)                                                           B38A 046
000047               VF=VFZ                                                             B38A 047
000048               ITL=10                                                             B38A 048
000049               ITS=1                                                              B38A 049
000050               VRP=(TH-TPR(1))/(TPR(2)-TPR(1))                                    B38A 050
000051               TNXT=AMAX1(TPR(2),TPR(1))                                          B38A 051
000052               CH = TCH(1)+VRP*(TCH(2)-TCH(1))                                    B38A 052
000053               QRA=TRAD(1)+VRP*(TRAD(2)-TRAD(1))                                  B38A 053
000054               CHZ=CH                                                             B38A 054
000055               IPR=1                                                              B38A 055
000056               ERFX=D(1)                                                          B38A 056
000057               CALL LOOK(12,GSMS/CH,TMG,0,0,0,0,Y2,D2,0)                          B38A 057
000058               IMG=IR(12)
```

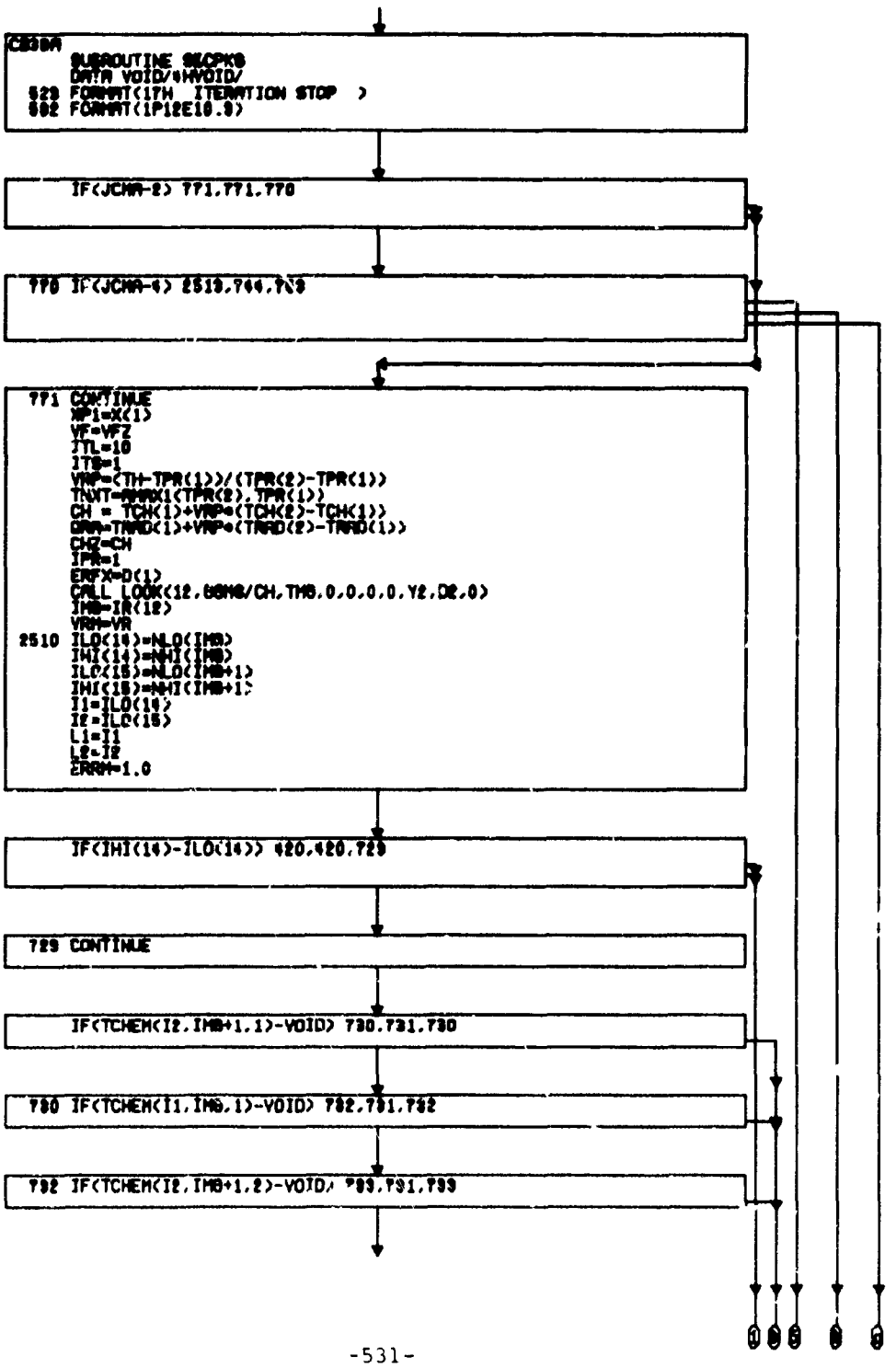
```
000059                VRM=VR                                                    B30A 058
000060           2510 ILO(14)=NLO(IMG)                                          B30A 059
000061                INI(14)=NHI(IMG)                                          B30A 060
000062                ILO(15)=NLO(IMG+1)                                        B30A 061
000063                IHI(15)=NHI(IMG+1)                                        B30A 062
000064                I1=ILO(14)                                                B30A 063
000065                I2=ILO(15)                                                B30A 064
000066                L1=I1
000067                L2=I2
000068                ERRM=1.0
000069                IF(IHI(14)-ILO(14)) 420,420,729
000070            729 CONTINUE
000071                IF(TCHEM(I2,IMG+1,1)-VOID) 730,732,730                    B30A 065
000072            730 IF(TCHEM(I1,IMG,1)-VOID) 732,731,732                      B30A 066
000073            732 IF(TCHEM(I2,IMG+1,2)-VOID) 733,731,733                    B30A 067
000074            733 IF(TCHEM(I1,IMG,2)-VOID) 2513,731,2513                    B30A 068
000075            731 JCMA=3                                                    B30A 069
000076                RETURN                                                    B30A 070
000077           2513 TABC=TTS(I1,IMG,1)+VRM*(TTS(I2,IMG+1,1)-TTS(I1,IMG,1))    B30A 071
000078           2515 TABC=TABC+VRP*(TTS(I1,IMG,2)+VRM*(TTS(I2,IMG+1,2)-TTS(I1,IMG+1,2))B30A 072
000079              1-TABC)                                                     B30A 073
000080           2503 IF(TSAVE-TABC+.0001) 420,420,421
000081              C     ----------  ABLATING SURFACE                          B30A 075
000082            421 IF(IAB) 422,422,423                                       B30A 076
000083            422 CMDL=TLMC(I1,IMG,1)-VRM*(TLMC(I1,IMG,1)-TLMC(I2,IMG+1,1)) B30A 077
000084                CMD=EXP(CMDL)*CM                                          B30A 078
000085                IAB=1                                                     B30A 079
000086            423 CALL LOOK(14,CMDL,TLMC(1,IMG,1),0,0,0,0,0,0,0)            B30A 080
000087                IRA=IR(14)                                                B30A 081
000088                I1=IRA                                                    B30A 082
000089                CALL LOOK(15,CMDL,TLMC(1,IMG+1,1),0,0,0,0,0,0,0)          B30A 083
000090                IRB=IR(15)                                                B30A 084
000091                I2=IRB                                                    B30A 085
000092                CALL COMP (TCHEM(I1,IMG,1),TCHEM(I2,IMG+1,1),VOID,IFLAG)
000093                IF(IFLAG-1) 740,741,740                                   B30A 087
000094            741 JCMA=4                                                    B30A 088
000095                RETURN                                                    B30A 089
000096            740 CONTINUE                                                  B30A 090
000097            744 CALL LOOK(14,CMDL,TLMC(1,IMG,1),TTS(1,IMG,1),TCHEM(1,IMG,1),0,0, B30A 091
000098               1Y2(1),Y2(3),2)                                            B30A 092
000099                CALL LOOK(15,CMDL,TLMC(1,IMG+1,1),TTS(1,IMG+1,1),TCHEM(1,IMG+1,1),B30A 093
000100               10,0,Y2(5),Y2(7),2)                                        B30A 094
000101                CALL LOOK(14,CMDL,TLMC(1,IMG,2),TTS(1,IMG,2),TCHEM(1,IMG,2),0,0, B30A 095
000102               1Y2(9),Y2(11),2)                                           B30A 096
000103                CALL LOOK(15,CMDL,TLMC(1,IMG+1,2),TTS(1,IMG+1,2),TCHEM(1,IMG+1,2),B30A 097
000104               10,0,Y2(13),Y2(15),2)                                      B30A 098
000105                IIX=IEX-2
000106                DO 4232 I=1,8                                             B30A 099
000107           4232 Y2(I)=Y2(I)+VRP*(Y2(I+8)-Y2(I))                           B30A 100
000108           4233 DO 426 I=1,4                                              B30A 101
000109            426 Y2(I)=Y2(I)+ (Y2(I+4)-Y2(I))*VRM                          B30A 102
000110                IF(Y2(1)) 4260,4260,4261                                  B30A 103
000111           4260 ITL=ITS                                                   B30A 104
000112                GO TO 4356                                                B30A 105
000113           4261 CONTINUE                                                  B30A 106
000114                CALL LOOK(4,Y2(1),TT2(1,2),TEP(1,2),0,0,0,EMIV,DMIV,1)    B30A 107
000115                IF(MATL(1)-2) 428,427,428                                 B30A 108
000116            428 CALL LOOK(3,Y2(1),TT2(1,1),TEP(1,1),0,0,0,Y3,D3,1)        B30A 109
000117                EMIV=EMIV+XP1*(Y3(1)-EMIV)
000118                DMIV=DMIV+XP1*(D3(1)-DMIV)
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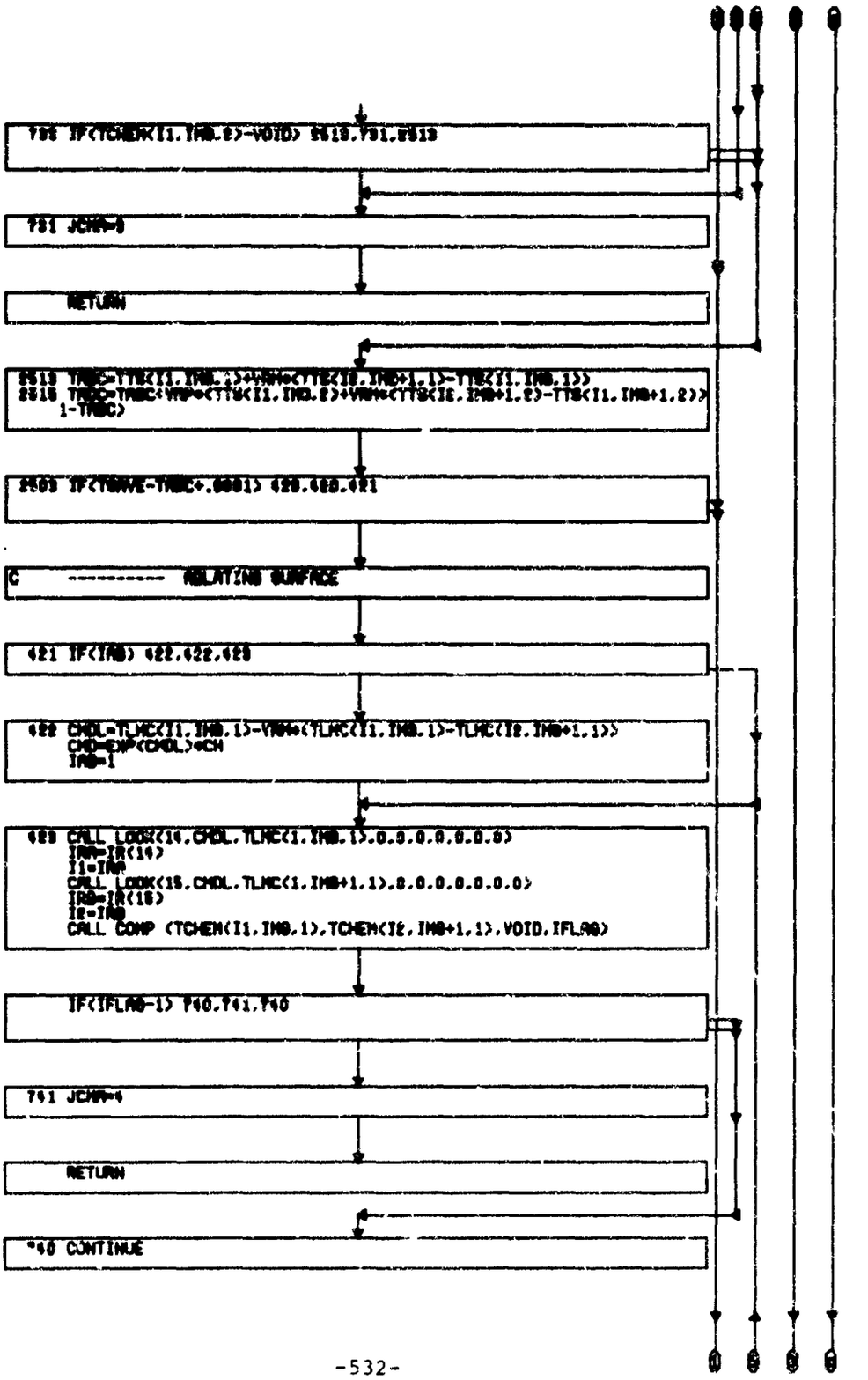
```
000119          427 TSSQ=Y2(1)*Y2(1)                                                B38A 112
000120              TS=Y2(1)                                                        B38A 113
000121              RAD=SIG*EMIV*TSSQ*TSSQ*VF                                       B38A 114
000122          436 ERR=CH*Y2(2)+EMIV*QRA-RAD-B(1)*TS+ERFX                          B38A 115
000123              ERRM=AMAX1(ABS(CH*Y2(2)),ABS(EMIV*QRA),ABS(RAD),ABS(B(1)*TS),
000124             1  ABS(ERFX))
000125              DERR=CH*Y2(4)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))*Y2(3)        B38A 116
000126              IF(DERR) 4365,4365,4362
000127         4362 IF(IIX) 4365,4368,4365
000128         4368 ITL=ITS
000129              GO TO 4356
000130         4365 CONTINUE
000131              ERRC=ERR/DERR                                                   B38A 117
000132              VITER(ITS)=CMDL                                                 B38A 118
000133              EITER(ITS)=ERR                                                  B38A 119
000134              CMDL=CMDL-ERRC                                                  B38A 120
000135              CMMI=-1.E+30                                                    B38A 121
000136              CMMA=+1.E+30                                                    B38A 122
000137              IF(ILO(14)-IRA) 4361,4363,4363                                  B38A 123
000138         4361 IF(ILO(15)-IRB) 4270,4363,4363                                  B38A 124
000139         4270 CMMI=AMAX1(CMMI,TLMC(IRA,IMG,IPR)+TLMC(IRA-1,IMG,IPR),TLMC(IRB,IMGB38A 125
000140             1+1,IPR)+TLMC(IRB-1,IMG+1,IPR))/2.                              B38A 126
000141              CMDL=AMAX1(CMDL,CMMI)                                           B38A 127
000142         4363 IF(IHI(14)-IRA-1) 4369,4369,4364
000143         4364 IF(IHI(15)-IRB-1) 4369,4369,4275
000144         4369 IF(ITS-ITL) 4366,4356,4360
000145         4360 IF(ERRS) 420,4367,4367
000146         4275 CMMA=AMIN1(CMMA,TLMC(IRA+1,IMG,IPR)+TLMC(IRA+2,IMG,IPR),TLMC(IRB+1B38A 130
000147             1,IMG+1,IPR)+TLMC(IRB+2,IMG+1,IPR))/2.                          B38A 131
000148              CMDL=AMIN1(CMDL,CMMA)                                           B38A 132
000149              IF(ITS-ITL-1) 4366,4351,4352                                    B38A 133
000150         4351 ERRS=ERR                                                        B38A 134
000151              CMDL=CMMA                                                       B38A 135
000152              GO TO 4278
000153         4352 IF(ERR*ERRS) 4354,4367,4353                                     B38A 137
000154         4353 CMDL=CMMA                                                       B38A 138
000155              GO TO 4278
000156         4354 ITL=55                                                          B38A 140
000157              IF(ERRC) 4355,4367,4367                                         B38A 141
000158         4355 CMDL=CMMI                                                       B38A 142
000159              GO TO 4278
000160         4366 IF(ITS-ITL) 4367,4356,4367                                      B38A 144
000161         4356 CMDL=AMIN1(TLMC(L1,IMG,IPR),TLMC(L2,IMG+1,IPR))
000162         4279 CMDL=AMIN1(CMDL,TLMC(L1,IMG,IPR+1),TLMC(L2,IMG+1,IPR+1))
000163         4278 ERR=1.E+20
000164         4367 CMD=EXP(CMDL)*CH                                                B38A 147
000165              IF(ITS-50) 440,440,998                                          B38A 148
000166          440 ITS=ITS+1                                                       B38A 149
000167              IF(ABS(ERR/ERRM)-.01) 4372,4372,423
000168          C   ----------  NON-ABLATING SURFACE                                B38A 151
000169          420 TS=TSAVE                                                        B38A 152
000170              IAB=0                                                           B38A 153
000171              CMD=0.0                                                         B38A 154
000172         4302 ILO(18)=1                                                       B38A 155
000173              IHI(18)=KHI(IMG)                                                B38A 156
000174              ILO(19)=1                                                       B38A 157
000175              IHI(19)=KHI(IMG+1)                                              B38A 158
000176          430 CONTINUE                                                        B38A 159
000177              CALL LOOK(18,TS,TTS(1,IMG,1),0,0,0,0,0,0,0)                     B38A 160
000178              CALL LOOK(19,TS,TTS(1,IMG+1,1),0,0,0,0,0,0,0)                   B38A 161
```

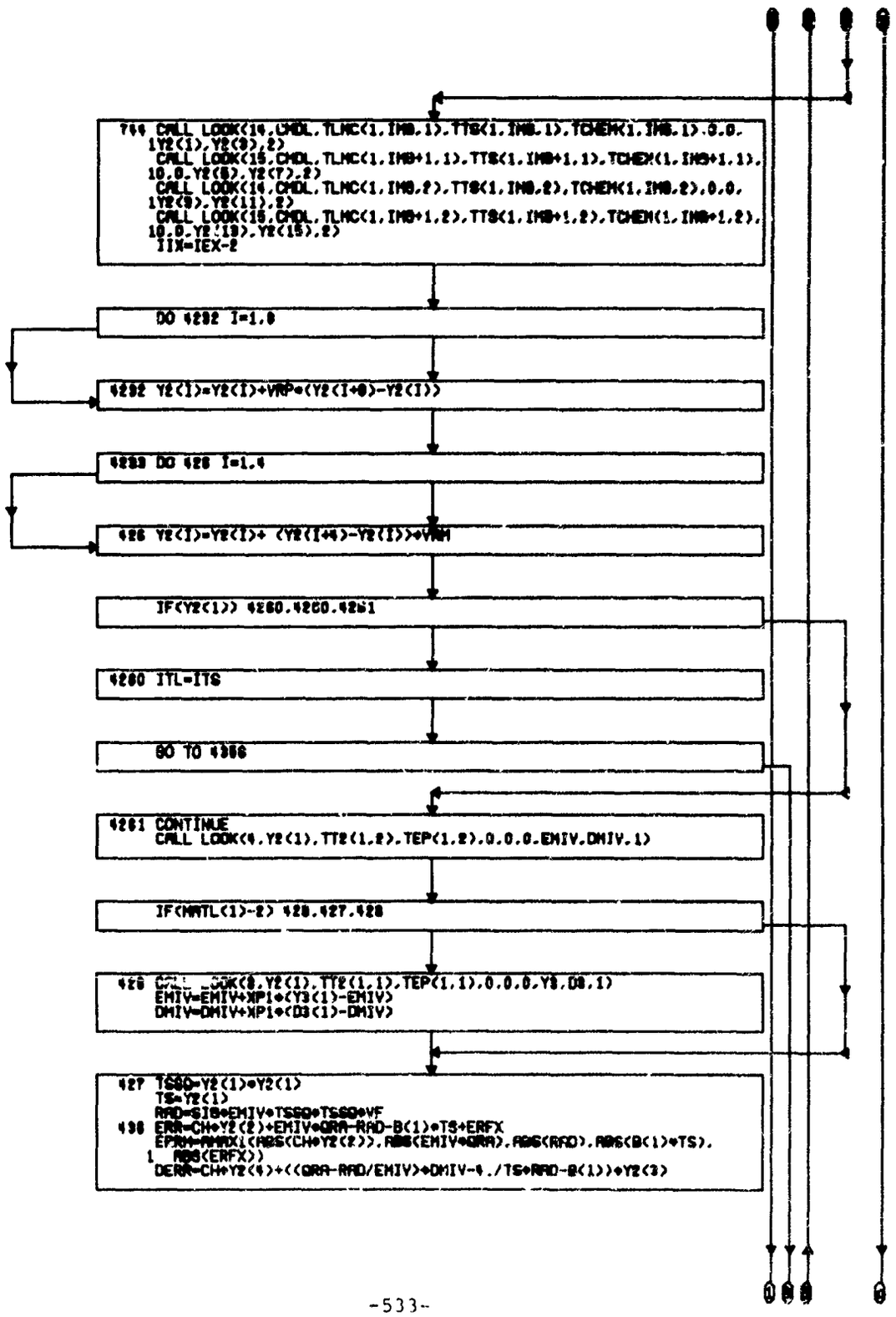
```
000179                IRA=IR(18)                                                    B38A 162
000180                I1=IRA                                                        B38A 163
000181                IRB=IR(19)                                                    B38A 164
000182                I2=IRB                                                        B38A 165
000183                CALL COMP (TCHEM(I1,IMG,1),TCHEM(I2,IMG+1,1),VOID,IFLAG)
000184                IF(IFLAG-1) 742,743,742                                       B38A 167
000185           743  JCMA=5                                                       B38A 168
000186                RETURN                                                        B38A 169
000187           742  CONTINUE                                                     B38A 170
000188           753  CALL LOOK(18,TS,TTS(1,IMG  ,1),TCHEM(1,IMG  ,1),TLMC(1,IMG  ,1),
000189               1 0,0,Y2(1),Y2(3),2)
000190                CALL LOOK(18,TS,TTS(1,IMG+1,1),TCHEM(1,IMG+1,1),TLMC(1,IMG+1,1),
000191               1 0,0,Y2(5),Y2(7),2)
000192                CALL LOOK(18,TS,TTS(1,IMG  ,2),TCHEM(1,IMG  ,2),TLMC(1,IMG  ,2),
000193               1 0,0,Y2(9),Y2(11),2)
000194                CALL LOOK(18,TS,TTS(1,IMG+1,2),TCHEM(1,IMG+1,2),TLMC(1,IMG+1,2),
000195               1 0,0,Y2(13),Y2(15),2)
000196                DO 4321 I=1,8
000197           4321 Y2(I)=Y2(I)+VRP*(Y2(I+8)-Y2(I))
000198           4322 DO 4323 I=1,4
000199           4323 Y2(I)=Y2(I)+VRM*(Y2(I+4)-Y2(I))
000200            433 CALL LOOK (4,TS,TT2(1,2),TEP(1,2),0,0,0,EMIV,DMIV,1)          B38A 181
000201                IF(MATL(1)-2) 434,442,434                                     B38A 182
000202            434 CALL LOOK (3,TS,TT2(1,1),TEP(1,1),0,0,0,Y3,D3,1)              B38A 183
000203                EMIV=EMIV+XP1*(Y3(1)-EMIV)
000204                DMIV=DMIV+XP1*(D3(1)-DMIV)
000205            442 TSSQ=TS*TS                                                    B38A 186
000206           4422 RAD=SIG*EMIV*TSSQ*TSSQ*VF                                     B38A 187
000207            439 ERR=CH*Y2(1)+EMIV*GRA-RAD-B(1)*TS+ERFX                        B38A 188
000208                ERRM=AMAX1(ABS(CH*Y2(1)),ABS(EMIV*GRA),ABS(RAD),ABS(B(1)*TS),
000209               1  ABS(ERFX))
000210                DERR=CH*Y2(3)+((GRA-RAD/EMIV)*DMIV-4,/TS*RAD-B(1))
000211                ERRC=ERR/DERR                                                 B38A 190
000212                VITER(ITS)=TS                                                 B38A 191
000213                EITER(ITS)=ERR                                                B38A 192
000214                TS=TS-ERRC                                                    B38A 193
000215           4391 TSMI=-1.E+30                                                  B38A 194
000216                TSMA=+1.E+30                                                  B38A 195
000217                IF(ILO(18)-IRA) 4500,4501,4501                                B38A 196
000218           4500 IF(ILO(19)-IRB) 4503,4501,4501                                B38A 197
000219           4503 TSMI=AMAX1(TSMI,TTS(IRB,IMG+1,IPR)+TTS(IRB-1,IMG+1,IPR),     B38A 198
000220              1TTS(IRA,IMG,IPR)+TTS(IRA-1,IMG,IPR))/2.                        B38A 199
000221                TS=AMAX1(TS,TSMI)                                             B38A 200
000222           4501 IF(IHI(18)-IRA-1) 4507,4507,4508                              B38A 201
000223           4508 IF(IHI(19)-IRB-1) 4507,4507,4510                              B38A 202
000224           4510 TSMA=AMIN1(TSMA,TTS(IRB+1,IMG+1,IPR)+TTS(IRB+2,IMG+1,IPR),   B38A 203
000225              1TTS(IRA+1,IMG,IPR)+TTS(IRA+2,IMG,IPR))/2,                      B38A 204
000226                TS=AMIN1(TS,TSMA)                                             B38A 205
000227           4507 CONTINUE                                                      B38A 206
000228                IF(ITS-50) 441,441,998                                        B38A 207
000229            441 ITS=ITS+1                                                     B38A 208
000230                IF(ABS(ERR/ERRM)-.01) 4390,4390,430
000231            998 WRITE (KOUT,529)                                              B38A 210
000232                WRITE(KOUT,582)(VITER(I),EITER(I),I=1,51)                     B38A 211
000233                WRITE(KOUT,582) TH,DTH,VRM,ERFX,TABC,EMIV,DMIV,RAD,B(1),CH,PHI,  B38A 212
000234               1 D(1),HE,XP1,GRA,Y2(1),Y2(2),Y2(3),Y2(4)                      B38A 213
000235                TH=THFIN                                                      B38A 214
000236                JCMA=0                                                        B38A 215
000237                RETURN                                                        B38A 216
00023A           C    ----------  POST ITERATION                                   B38A 217
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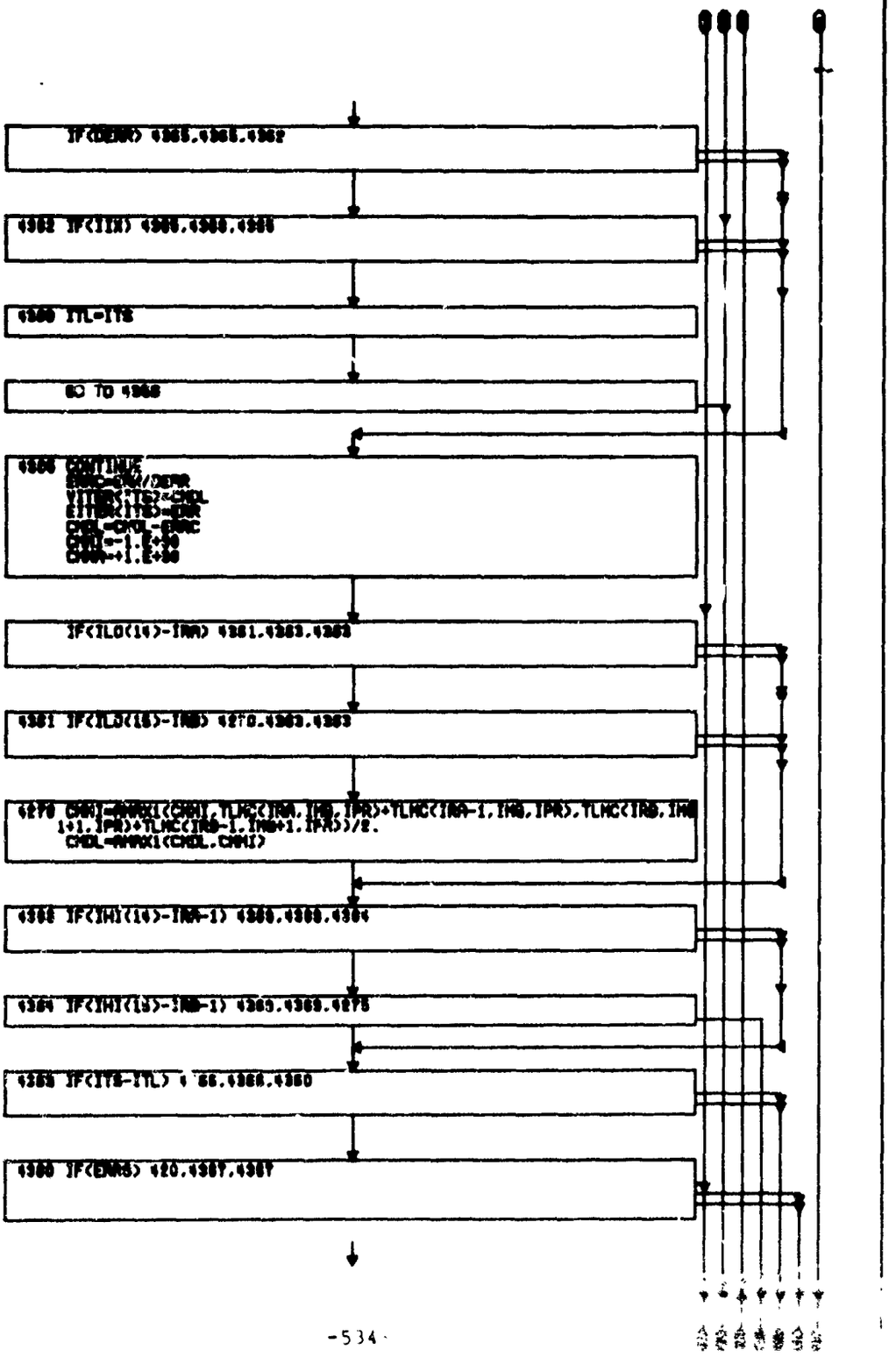
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000239          4390 CONTINUE                                                  B38A 218
000240               IF(IAB) 4371,4371,4372                                    B38A 219
000241          4371 CMD=EXP(Y2(2))*CH
000242               Y2(2)=Y2(1)
000243          4372 QCONV=CH*Y2(2)                                            B38A 221
000244               IF(KCM(4)) 4376,4375,4376
000245          4376 WRITE(KOUT,582) (VITER(I),EITER(I),I=1,ITS)
000246               WRITE(KOUT,582) TH,DTH,VRM,ERRX,QC,EMIV,DMIV,RAD,B(1),CH,PHI,
000247              1 D(1),HE,XP1,QRA,Y2,DERR,VRP
000248          4375 CONTINUE
000249               QCHEM=0.                                                  B38A 222
000250               DSDTB=CMD/RHO(2)                                          B38A 223
000251          1437 RO(1)=RON(1)                                              B38A 224
000252               BR=CH/CHZ                                                 B38A 225
000253               QRP=EMIV*QRA                                              B38A 226
000254               QCOND=-D(1)+B(1)*TA(1)                                    B38A 227
000255               QCONVT=QCONVT+QCONV*DTH/AREA(1)*ASU                       B38A 228
000256               QCHEMT=QCHEMT+QCHEM*DTH/AREA(1)*ASU                       B38A 229
000257               QCONDT=QCONDT+QCOND*DTH/AREA(1)*ASU                       B38A 230
000258               QRPT=QRPT+QRP*DTH/AREA(1)*ASU                             B38A 231
000259               RADT=RADT+RAD*DTH/AREA(1)*ASU                             B38A 232
000260          C                                                              B38A 233
000261               DEDT=RON(1)*CP(1)*(TS-TSAVE)*DEL(1)/DTH                   B38A 234
000262               DO 95 I=2,NL                                              B38A 235
000263               RO(I) = RON(I)                                            B38A 236
000264               TEMP =(D(I  )-A(I  )*TA(I-1))/B(I  )                      B38A 237
000265               DEDT=DEDT+RON(I)*CP(I)*(TEMP-TA(I))*DEL(I)*RR(I)/DTH      B38A 238
000266            95 TA(I)=TEMP                                                B38A 239
000267               IF (NUMN-NBM) 97,96,96                                    B38A 240
000268            96 K=NL                                                      B38A 241
000269               TA(NBM-1) = TA(NL)                                        B38A 242
000270               DO 98 I = NBM,NUMN                                        B38A 243
000271               K = K+1                                                   B38A 244
000272            98 TA(I) = (D(K)-A(K)*TA(I-1))/B(K)                          B38A 245
000273            97 DEDTT=DEDTT+DEDT*DTH/AREA(1)*ASU                          B38A 246
000274               JCMA=1                                                    B38A 247
000275               RETURN                                                    B38A 248
000276               END                                                       B38A 249
```

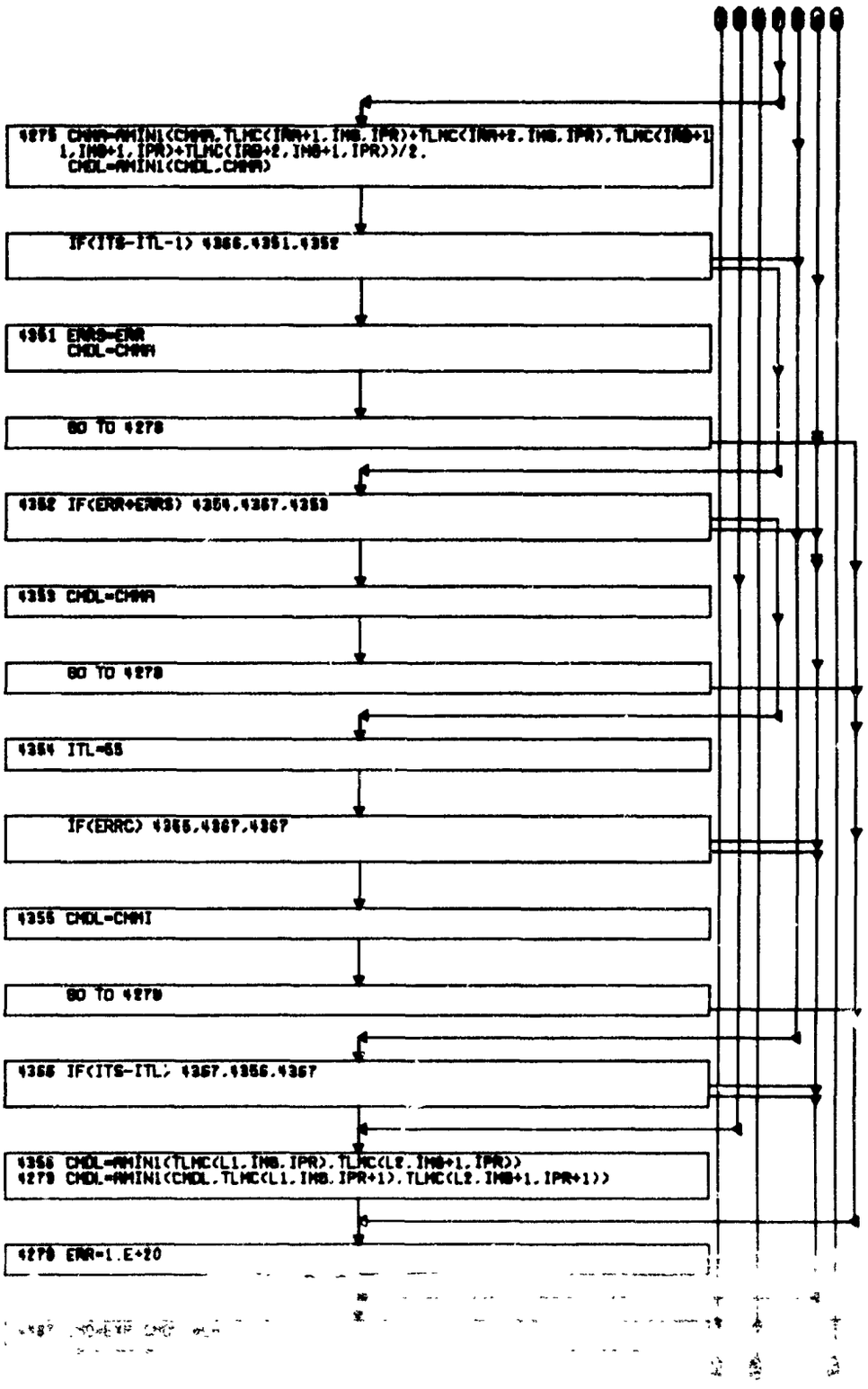
(3) Flow Chart

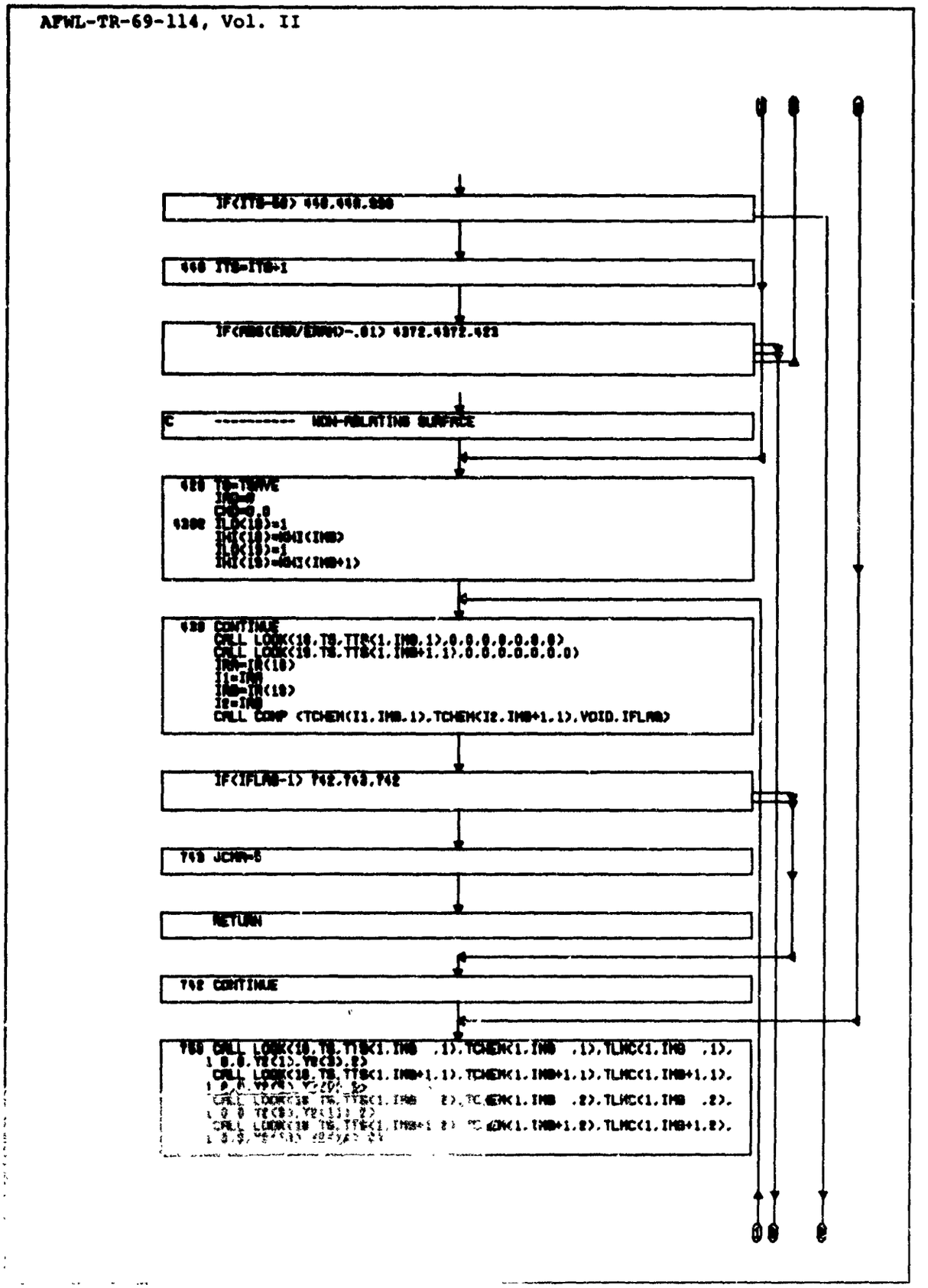

C$SUBA
SUBROUTINE SECPKB
DATA VOID/*HVOID/
529 FORMAT(17H ITERATION STOP)
502 FORMAT(1P12E10.3)
IF(JCHA-2) 771,771,770
770 IF(JCHA-4) 2510,744,749
771 CONTINUE
XP1=X(1)
VF=VFZ
ITL=10
ITB=1
VRP=(TH-TPR(1))/(TPR(2)-TPR(1))
TNXT=AMAX1(TPR(2),TPR(1))
CH = TCH(1)+VRP*(TCH(2)-TCH(1))
CHA=TRAD(1)+VRP*(TRAD(2)-TRAD(1))
CHZ=CH
IPR=1
ERFX=D(1)
CALL LOOK(12,SGMB/CH,TMB,0.0,0.0,0.0,Y2,D2,0)
IMB=IR(12)
VRH=VR
2510 ILO(14)=NLO(IMB)
IHI(14)=NHI(IMB)
ILO(15)=NLO(IMB+1)
IHI(15)=NHI(IMB+1)
I1=ILO(14)
I2=ILO(15)
L1=I1
L2=I2
ERRM=1.0
IF(IHI(14)-ILO(14)) 420,420,729
729 CONTINUE
IF(TCHEM(I2,IMB+1,1)-VOID) 730,731,730
730 IF(TCHEM(I1,IMB,1)-VOID) 732,731,732
732 IF(TCHEM(I2,IMB+1,2)-VOID) 733,731,733

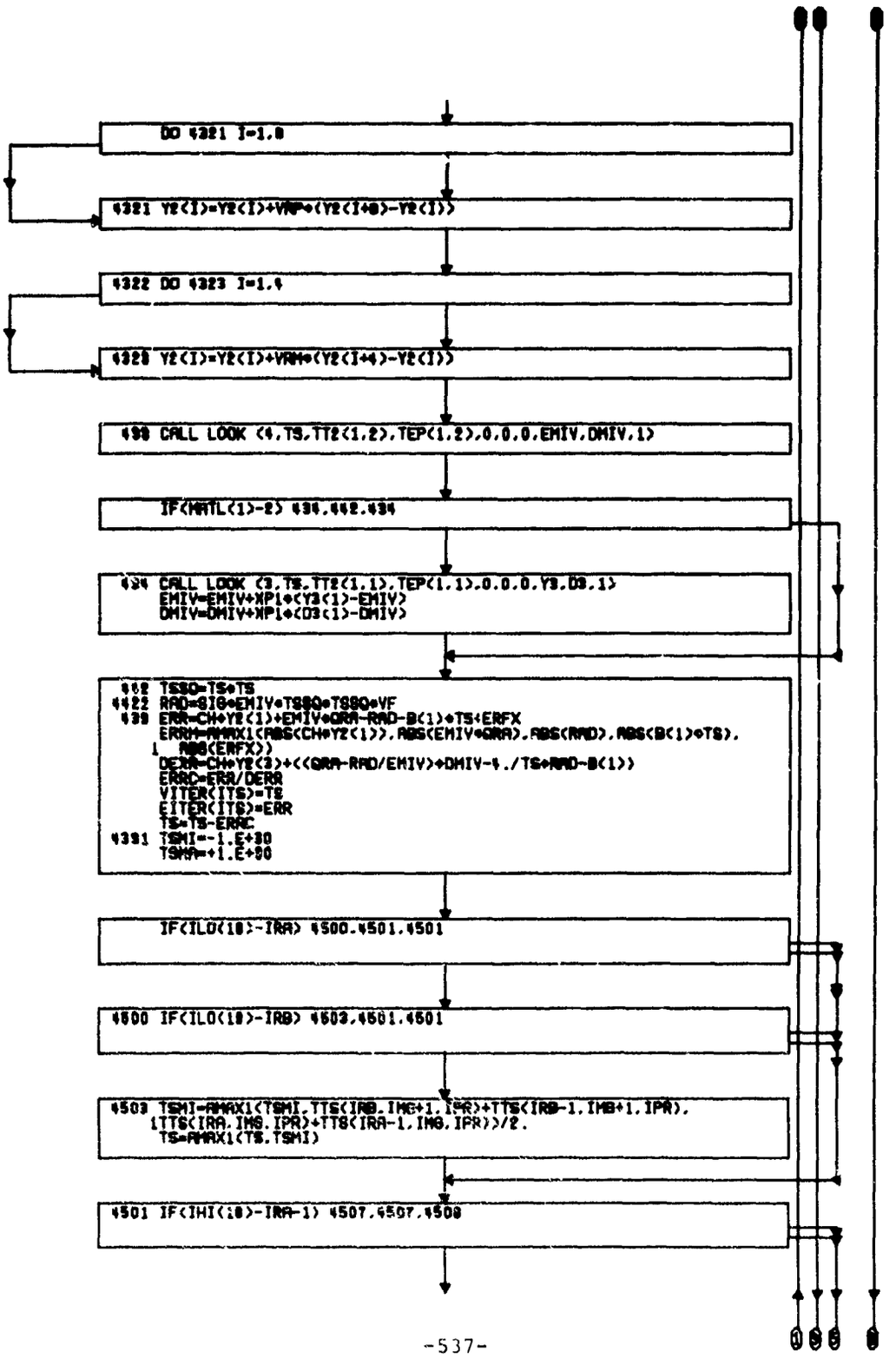

700 IF(TCHEM(I1,IM8,8)-VOID) 8618,791,8618
791 JCHM=0
RETURN
8618 TMBC=TTB(I1,IM8,1)+VBM*(TTB(I8,IM8+1,1)-TTB(I1,IM8,1))
8618 TMBC=TMBC+VBM*(TTB(I1,IM8,8)+VBM*(TTB(I8,IM8+1,8)-TTB(I1,IM8+1,8))
1-TMBC)
8609 IF(TSAVE-TMBC+.0001) 420,488,421
C ---------- ABLATING SURFACE
421 IF(IAB) 422,422,428
422 CHOL=TLMC(I1,IM8,1)-VBM*(TLMC(I1,IM8,1)-TLMC(I8,IM8+1,1))
CHO=EXP(CHOL)*CH
IAB=1
428 CALL LOOK(14,CHOL,TLMC(1,IM8,1),0,0,0,0,0,0,0)
IAA=IA(14)
I1=IAA
CALL LOOK(15,CHOL,TLMC(1,IM8+1,1),0,0,0,0,0,0,0)
IAB=IA(15)
I8=IAB
CALL COMP (TCHEM(I1,IM8,1),TCHEM(I8,IM8+1,1),VOID,IFLAG)
IF(IFLAG-1) 740,741,740
741 JCHM=0
RETURN
740 CONTINUE

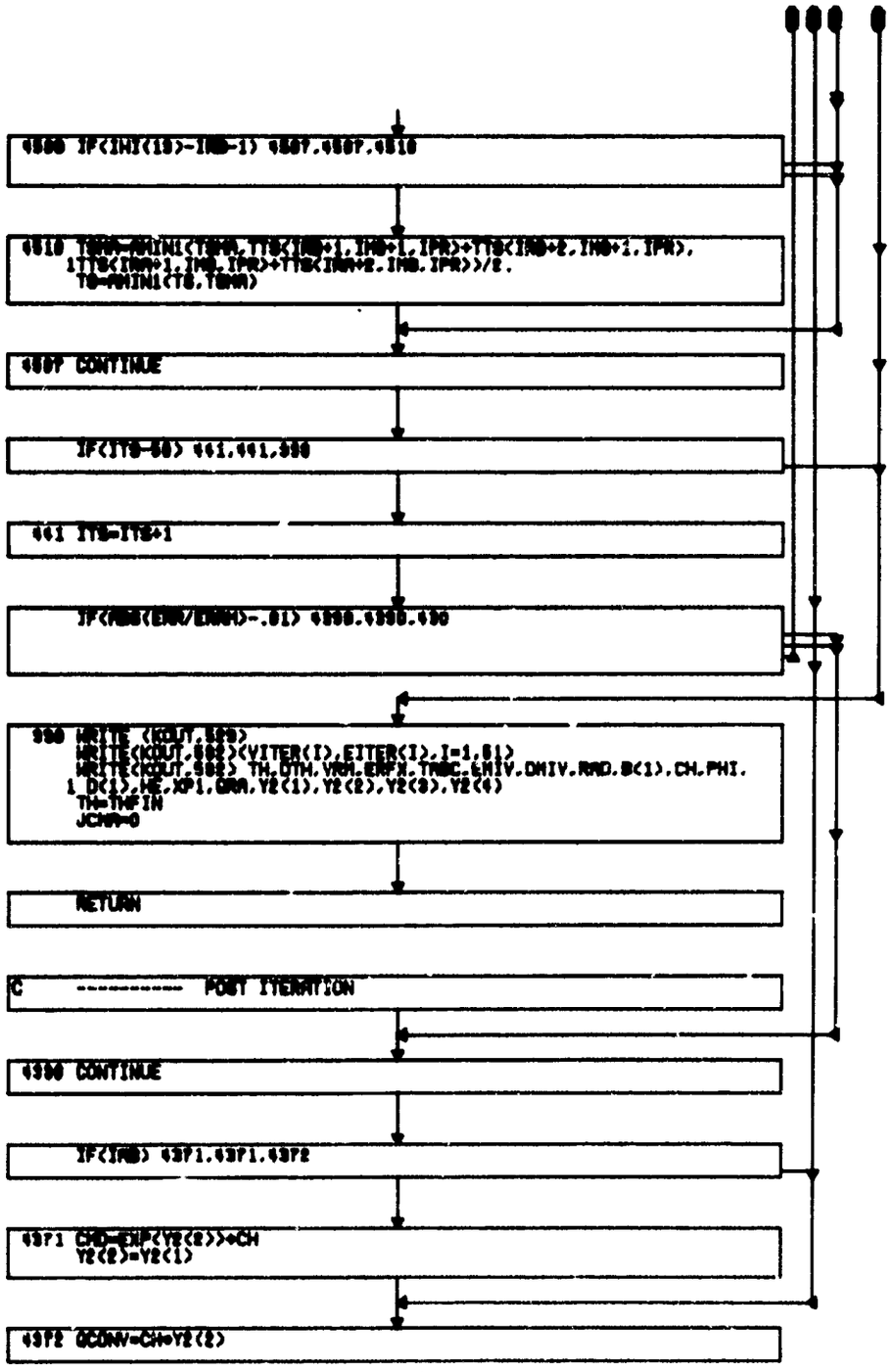

744 CALL LOOK(14,CHDL,TLHC(1,IHB,1),TTS(1,IHB,1),TCHEM(1,IHB,1),0.0,
1Y2(1),Y2(9),2)
CALL LOOK(15,CHDL,TLHC(1,IHB+1,1),TTS(1,IHB+1,1),TCHEM(1,IHB+1,1),
10.0,Y2(5),Y2(7),2)
CALL LOOK(14,CHDL,TLHC(1,IHB,2),TTS(1,IHB,2),TCHEM(1,IHB,2),0.0,
1Y2(9),Y2(11),2)
CALL LOOK(15,CHDL,TLHC(1,IHB+1,2),TTS(1,IHB+1,2),TCHEM(1,IHB+1,2),
10.0,Y2(13),Y2(15),2)
IIX=IEX-2
DO 4282 I=1,8
4282 Y2(I)=Y2(I)+VRP*(Y2(I+8)-Y2(I))
4283 DO 426 I=1,6
426 Y2(I)=Y2(I)+ (Y2(I+6)-Y2(I))*VRH
IF(Y2(1)) 4260,4260,4261
4260 ITL=ITS
GO TO 4366
4261 CONTINUE
CALL LOOK(4,Y2(1),TT2(1,2),TEP(1,2),0.0,0.0,EMIV,DMIV,1)
IF(MRTL(1)-2) 428,427,428
428 CALL LOOK(8,Y2(1),TT2(1,1),TEP(1,1),0.0,0.0,YS,DS,1)
EMIV=EMIV+XP1*(Y3(1)-EMIV)
DMIV=DMIV+XP1*(D3(1)-DMIV)
427 TSSQ=Y2(1)*Y2(1)
TS=Y2(1)
RAD=SIG*EMIV*TSSQ*TSSQ*VF
ERR=CH*Y2(2)+EMIV*QRA-RAD-B(1)*TS+ERFX
EPRM=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)

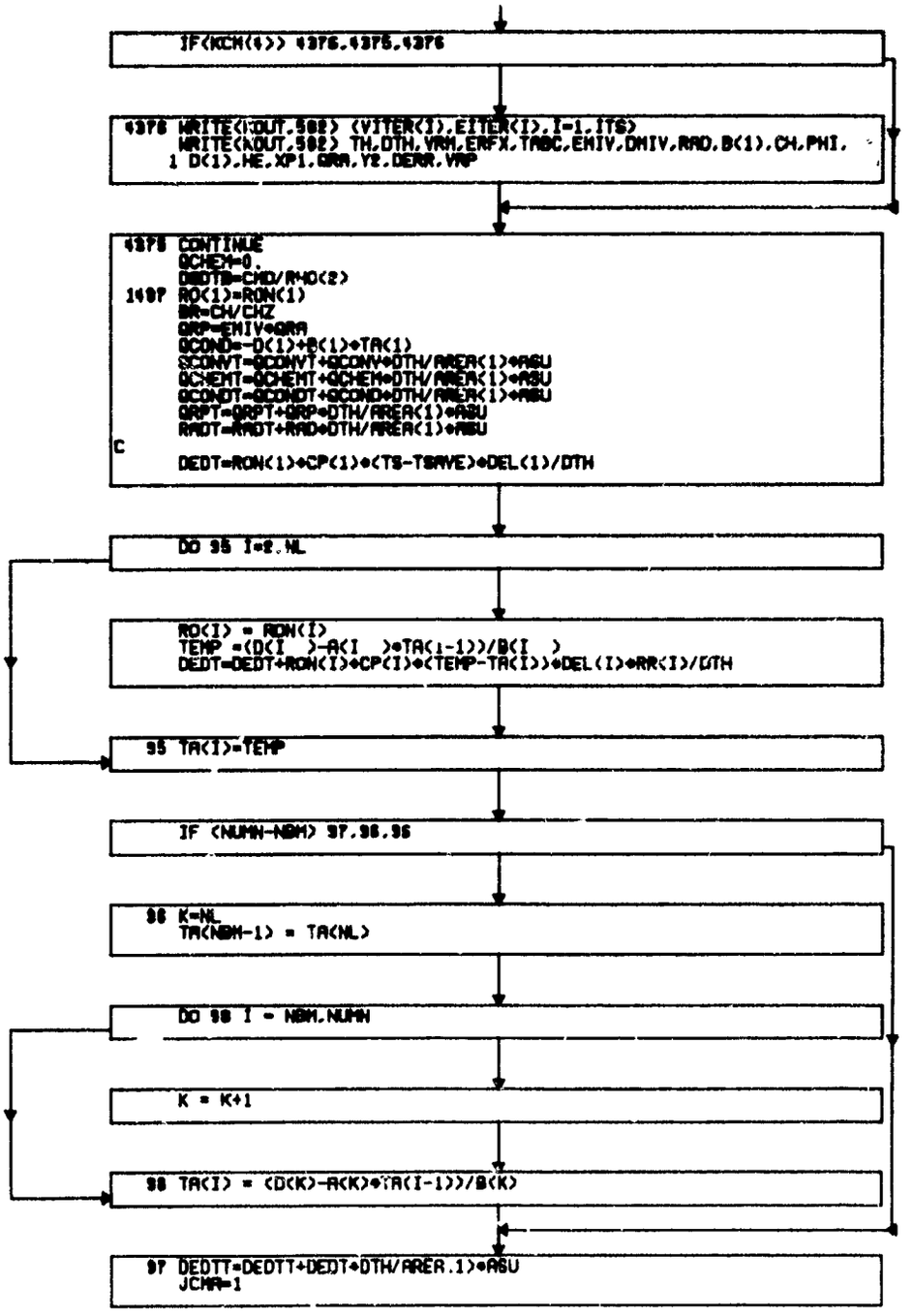

IF(IEND) 4365,4365,4362
4362 IF(IIH) 4365,4365,4365
4365 ITL=ITS
GO TO 4368
4368 CONTINUE
IF(ILO(14)-IMA) 4381,4383,4383
4381 IF(ILO(15)-IMB) 4270,4383,4383
4270 CMAI=AMAX1(CMAI,TLMC(IMA,IMB,IPR)+TLMC(IMA-1,IMB,IPR),TLMC(IMA,IMB
1+1,IPR)+TLMC(IMA-1,IMB+1,IPR))/2.
CMDL=AMAX1(CMDL,CMAI)
4368 IF(IHI(14)-IMA-1) 4365,4365,4364
4364 IF(IHI(15)-IMB-1) 4365,4365,4275
4365 IF(ITS-ITL) 4 66,4366,4360
4360 IF(ENDS) 420,4367,4367

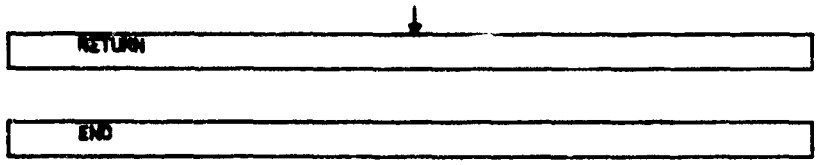

4278 CMAA=AMIN1(CMAA,TLMC(IRA+1,IMB,IPR)+TLMC(IRA+2,IMB,IPR),TLMC(IRB+1
1,IMB+1,IPR)+TLMC(IRB+2,IMB+1,IPR))/2.
CMDL=AMIN1(CMDL,CMAA)
IF(ITS-ITL-1) 4366,4351,4352
4351 ERRS=ERR
CMDL=CMAA
GO TO 4278
4352 IF(ERR+ERRS) 4354,4367,4353
4353 CMDL=CMAA
GO TO 4278
4354 ITL=65
IF(ERRC) 4355,4367,4367
4355 CMDL=CMAI
GO TO 4278
4366 IF(ITS-ITL) 4367,4356,4367
4356 CMDL=AMIN1(TLMC(L1,IMB,IPR),TLMC(L2,IMB+1,IPR))
4278 CMDL=AMIN1(CMDL,TLMC(L1,IMB,IPR+1),TLMC(L2,IMB+1,IPR+1))
4279 ERR=1.E+20


IF(ITS-50) 440,440,550
440 ITS=ITS+1
IF(ABS(ENO/ENOM)-.01) 4372,4372,423
C ---------- NON-RELATING SURFACE
420 TS=TSAVE
IND=0
CHK=0.0
4200 ILO(10)=1
IHI(10)=NHI(IMB)
ILO(11)=1
IHI(11)=NHI(IMB+1)
430 CONTINUE
CALL LOOK(10,TS,TTS(1,IMB,1),0,0,0,0,0,0,0)
CALL LOOK(10,TS,TTS(1,IMB+1,1),0,0,0,0,0,0,0)
IMA=IA(10)
I1=IMA
IMB=IA(10)
I2=IMB
CALL COMP (TCHEM(I1,IMB,1),TCHEM(I2,IMB+1,1),VOID,IFLAG)
IF(IFLAG-1) 742,743,742
743 JCHK=5
RETURN
742 CONTINUE
750 CALL LOOK(10,TS,TTS(1,IMB ,1),TCHEM(1,IMB ,1),TLMC(1,IMB ,1),
1 0,0,YI(1),YB(1),2)
CALL LOOK(10,TS,TTS(1,IMB+1,1),TCHEM(1,IMB+1,1),TLMC(1,IMB+1,1),
CALL LOOK(10,TS,TTS(1,IMB ,2),TCHEM(1,IMB ,2),TLMC(1,IMB ,2),
CALL LOOK(10,TS,TTS(1,IMB+1,2),TCHEM(1,IMB+1,2),TLMC(1,IMB+1,2),


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))
498 CALL LOOK (4,TS,TT2(1,2),TEP(1,2),0.0,0.0,EMIV,DMIV,1)
IF(MATL(1)-2) 434,442,434
434 CALL LOOK (3,TS,TT2(1,1),TEP(1,1),0.0,0.0,Y3,D3,1)
EMIV=EMIV+XPI*(Y3(1)-EMIV)
DMIV=DMIV+XPI*(D3(1)-DMIV)
442 TSSQ=TS*TS
4422 RAD=SIG*EMIV*TSSQ*TSSQ*VF
439 ERR=CH*Y2(1)+EMIV*QRA-RAD-B(1)*TS+ERFX
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
VITER(ITS)=TS
EITER(ITS)=ERR
TS=TS-ERRC
4391 TSMI=-1.E+30
TSMA=+1.E+30
IF(ILO(18)-IRA) 4500,4501,4501
4500 IF(ILO(18)-IRB) 4503,4501,4501
4503 TSMI=AMAX1(TSMI,TTS(IRB,IMB+1,IPR)+TTS(IRB-1,IMB+1,IPR),
1TTS(IRA,IMB,IPR)+TTS(IRA-1,IMB,IPR))/2.
TS=AMAX1(TS,TSMI)
4501 IF(IHI(18)-IRA-1) 4507,4507,4509
1
2
3
4


4500 IF(IHI(IS)-IMB-1) 4507,4507,4510
4510 TMAX=AMIN1(TMAX,TTB(IMB+1,IMB+1,IPR)+TTB(IMB+2,IMB+1,IPR),
1TTB(IMB+1,IMB,IPR)+TTB(IMB+2,IMB,IPR))/2.
TB=AMIN1(TB,TMAX)
4507 CONTINUE
IF(ITS-50) 441,441,550
441 ITS=ITS+1
IF(ABS(ERR/ERRM)-.01) 4550,4550,430
550 WRITE (KOUT,599)
WRITE(KOUT,502)(XITER(I),EITER(I),I=1,81)
WRITE(KOUT,503) TH,DTH,VRM,ERFN,TMAC,ENIV,DNIV,RMD,B(1),CH,PHI,
1 D(1),HE,XP1,GMA,Y2(1),Y2(2),Y2(3),Y2(4)
TH=THFIN
JCNV=0
RETURN
C ---------- POST ITERATION
4550 CONTINUE
IF(IMB) 4571,4571,4572
4571 CHD=EXP(Y2(2))+CH
Y2(2)=Y2(1)
4572 QCONV=CH+Y2(2)


IF(KCH(4)) 4376,4375,4376
4376 WRITE(KOUT,502) (VITER(I),EITER(I),I=1,ITS)
WRITE(KOUT,502) TH,DTH,VRM,ERFX,TABC,EMIV,DMIV,RAD,B(1),CH,PHI,
1 D(1),HE,XP1,GRA,YE,DERR,VRP
4375 CONTINUE
QCHEM=0.
DEDTB=CHD/RHO(2)
1497 RO(1)=RON(1)
BR=CH/CHZ
GRP=EMIV*GRA
QCOND=-D(1)+B(1)*TA(1)
SCONVT=QCONVT+QCONV*DTH/AREA(1)*ASU
QCHEMT=QCHEMT+QCHEM*DTH/AREA(1)*ASU
QCONDT=QCONDT+QCOND*DTH/AREA(1)*ASU
GRPT=GRPT+GRP*DTH/AREA(1)*ASU
RADT=RADT+RAD*DTH/AREA(1)*ASU
C
DEDT=RON(1)*CP(1)*(TS-TSAVE)*DEL(1)/DTH
DO 95 I=2,NL
RO(I) = RON(I)
TEMP =(D(I)-A(I)*TA(I-1))/B(I)
DEDT=DEDT+RON(I)*CP(I)*(TEMP-TA(I))*DEL(I)*RR(I)/DTH
95 TA(I)=TEMP
IF (NUMN-NBM) 97,98,98
98 K=NL
TA(NBM-1) = TA(NL)
DO 98 I = NBM,NUMN
K = K+1
98 TA(I) = (D(K)-A(K)*TA(I-1))/B(K)
97 DEDTT=DEDTT+DEDT*DTH/AREA(1)*ASU
JCHA=1


RETURN
END

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13. ABSTRACT

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Listings and flow charts for the Boundary Layer Integral Matrix Procedure (BLIMP) computer program are given, along with comments on the function of each program or subroutine. In addition, input instructions, output description, a sample problem, flow charts and listings are given for the CABLE program, which couples BLIMP to an in-depth charring ablation analysis program.

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Viscous flow						
Plasma sheath						
Missile reentry						
Computer program						
Nonsimilar boundary layer						