UNCLASSIFIED

AD NUMBER

AD875392

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; Apr 1970. Other requests shall be referred to Air Force Propulsion Lab., Edwards AFB, CA.

AUTHORITY

AFAL ltr, 18 Dec 1989

THIS PAGE IS UNCLASSIFIED

AD875392

AFRPL-TR-70-92

Aerotherm Report No. UM-70-14

USER'S MANUAL
AEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM VERSION 3

Volume II – Fortran Variable Names, Flow Charts, and Listings

April 1970

AD No. ____
DDC FILE COPY

Air Force Rocket Propulsion Laboratory
Director of Laboratories
Edwards, California 93523
Air Force Systems Command
United States Air Force

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of AFRPL (REPORT/STINFO), Edwards, California 93523.

DDC
RECEIVED
OCT 15 1970
C

167

AFRPL-TR-70-92

Aerotherm Report No. UM-70-14

April 1970

USER'S MANUAL

AEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM VERSION 3

Volume II - Fortran Variable Names, Flow Charts, and Listings

Prepared Under
the Sponsorship of

Air Force Rocket Propulsion Laboratory
Director of Laboratories
Edwards, California 93523
Air Force Systems Command
United States Air Force

Project Officer, Robert J. Schoner/RPMCH

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of AFRPL (REPORT/STINFO), Edwards, California 93523.

FOREWORD

This report is one of two computer program user's manuals prepared by Aerotherm Corporation under USAF Contract F04611-70-C-0012. Included herein is Volume II of the manual for Version 3 of the Aerotherm Charring Material Ablation code. This volume presents definitions of Fortran variables, flow charts, and program listings. The report was first published as Aerotherm Report No. UM-70-14. The work was administered under the direction of the Air Force Rocket Propulsion Laboratory, Motor Component Development Branch with Mr. R. J. Schoner as project officer.

Mr. M. R. Wool was program manager and principal investigator. Significant additional assistance was also provided by Dr. C. B. Moyer.

This technical report has been reviewed and is approved.

R. J. Schoner
Project Engineer, AFRPL

ABSTRACT

This two-volume report describes a Fortran IV computer code which computes the transient thermal and ablation response of a charring insulation material structure. The program is for one-dimensional bodies, but can treat a variety of shapes, including planes, cylinders, spheres, and more general thermal "stream tube" bodies. The program can treat complex systems including a main ablating material, several charring back-up materials, and a multiple non-charring material back-up structure.

An unusual feature of the code is the very general heated surface boundary conditions, which can account for

- Simple specified temperature and recession rate
- Specified heat flux with no recession
- General thermochemical erosion model incorporating complete chemical erosion computations, both equilibrium and non-equilibrium, for any material exposed to any environment.

The code has seen extensive use for thermal performance studies of ablating heat shields, rocket nozzles, and spacecraft structures.

Volume I of this report contains descriptions of the problem treated, the equations solved, the input information required of the program user, and the program output information. It also provides a card-by-card user's input guide and a number of sample problem input and output listings. Volume II of the report contains supplemental information on the specific Fortran IV codings. It includes program listings, flow charts, and definitions of Fortran variable names.

ACCESSION for
CFSTI WHITE SECTION ☐
DDC BUFF SECTION ☑
UNANNOUNCED ☐
JUSTIFICATION
BY
DISTRIBUTION/AVAILABILITY CODES
DIST. AVAIL. and/or SPECIAL
2

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

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1-1
2	FORTRAN VARIABLE NAMES	2-1
	COMMON VARIABLES	2-2
	CBM3	2-12
	INPOUT	2-25
	THERMS	2-29
3	FLOW CHARTS	3-1
	MAIN PROGRAM	3-2
	CBM3	3-4
	INPOUT	3-46
	THERMS	3-73
	LCOUNT	3-80
	LOOK	3-81
	OGLE	3-84
	ORDERD	3-86
	ORDERI	3-89
	SEQUA	3-90
	SEQUA5	3-92
	SLOPQ	3-94
4	LISTINGS OF FORTRAN IV SOURCE DECKS	4-1
	MAIN PROGRAM	4-2
	CBM3	4-3
	INPOUT	4-17
	THERMS	4-26
	LCOUNT	4-28
	LOOK	4-28
	OGLE	4-29
	ORDERD	4-30
	ORDERI	4-30
	SEQUA	4-31
	SEQUA5	4-31
	SLOPQ	4-32
	REFERENCES	R-1

SECTION 1

INTRODUCTION

The computer program described in this user's manual is a revised edition of the Aerotherm Charring Material Ablation computer program. The previous code, CMA Version 2, is described in References 1, 2, and 3. The current program, CMA Version 3 (denoted CMA3 or CMA/CBM), solves all problems that earlier versions could solve and provides additional computational capabilities, featuring in particular an added charring back-up material capability.

The purpose of Volume I of this user's manual was to enable an unfamiliar user to utilize effectively Version 3 of the Aerotherm Charring Material Ablation computer program. It contained a general description of the problems that CMA3 solves, an input data deck preparation guide, and sample problem input and output. Volume II of this manual, included herein, contains the following additional program documentation:

- Definitions for important Fortran variables used
- Flow charts of program logic for each Fortran routine
- Listings of Fortran IV source decks

These are given in Sections 2, 3, and 4, respectively. Another document of potential value to a reader desiring a more detailed exposition of the theoretical fundamentals of the CMA program is Reference 4.

SECTION 2

FORTRAN VARIABLE NAMES

The names and definitions of all Fortran variables used in important subroutines in Version 3 of the Aerotherm Charring Material Ablation code are given in this section. Since the CMA3 code is divided into several routines, the majority of all variables are included in COMMON statements. These variables are defined first. Fortran variables which are used only locally in the CBM, INPØUT, and THERMS subroutines are then defined. Variables used locally in minor subroutines are not given.

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
AREA ( )	ORIGINAL (INPUT) CROSS SECTION AREA OF NODE	FT2
ASTER	1H*	
BA	ARRHENIUS PRE-EXPONENTIAL FACTOR IN DECOMPOSITION KINETIC EQUATION FOR COMPONENT A	SEC-1
BB	ARRHENIUS PRE-EXPONENTIAL FACTOR IN DECOMPOSITION KINETIC EQUATION FOR COMPONENT B	SEC-1
BBB(I,J)	ARRENIUS PRE-EXPONENTIAL FACTOR IN DECOMPOSITION KINETIC EQUATION OF J TH COMPONENT OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO BA, BB, BC)	SEC-1
BC	ARRHENIUS PRE-EXPONENTIAL FACTOR IN DECOMPOSITION KINETIC EQUATION FOR COMPONENT C	SEC-1
BLANK	1H	
BREX	INPUT BURNING RATE EXPONENT USED IN MODIFYING INPUT TRANSFER COEFFICIENT	
BRP	BLOWING REDUCTION PARAMETER, LAMBDA	
CHCRI	CHAR INTERFACE CRITERIA: CHAR LINE DEPTH IS DEPTH OF LINE OF DENSITY RHO(2)+CHCRI*(RHO(1)-RHO(2))	
CHH	RATIO OF CH/CH	
DEL ( )	NODE THICKNESS	FT
DELHG	ENTHALPY OF FORMATION OF PYROLYSIS GASES	BTU/LB
DELM	MINIMUM ALLOWED THICKNESS OF LAST (SHRINKING) NODE IN ABLATING MATERIAL	FT
DEN	INTERPOLATION FRACTION FOR FUNCTIONS-OF-TIME TABLES	
DHC(I)	ENTHALPY OF FORMATION OF CHAR OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO DH2)	BTU/LB
DHV(I)	ENTHALPY OF FORMATION OF VIRGIN PLASTIC OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO DH1)	BTU/LB
DH1	ENTHALPY OF FORMATION OF VIRGIN PLASTIC, MAIN MATERIAL	BTU/LB

LIST OF FORTRAN VARIABLES APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
DH2	ENTHALPY OF FORMATION OF CHAR, MAIN MATERIAL	BTU/LB
DTHB	LIMIT VALUE OF TIME INCREMENT	SEC
DTHIN	INITIAL TIME STEP USED AT BEGINNING OF PROBLEM AND AFTER A CHANGE IN OPTION	SEC
DTPRT	FIRST OUTPUT TIME INTERVAL	SEC
DTPR2	SECOND OUTPUT TIME INTERVAL	SEC
DTPR3	THIRD OUTPUT TIME INTERVAL	SEC
EA	ACTIVATION ENERGY FOR COMPONENT A, EA/R	DEG R
EB	ACTIVATION ENERGY FOR COMPONENT B, EB/R	DEG R
EC	ACTIVATION ENERGY FOR COMPONENT C, EC/R	DEG R
EE(I,J)	ACTIVATION ENERGY E(I,J)/R FOR COMPONENT J OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO EA, EB, EC)	DEG R
EMA( )	SLOPE OF AREA VS ABSOLUTE RADIUS (OR DISTANCE) CURVE OBTAINED FROM ORIGINAL INPUT OF NODAL DATA	FT
EPSW	EMISSIVITY OF BACK WALL	
ETA	NOT CURRENTLY USED	
FF(I,J)	PRECALCULATED COLLECTION OF TERMS IN DECOMPOSITION KINETIC EQUATION FOR J TH COMPONENT OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO FA, FB, FC)	(LB/FT3)** (1.-PSI(I,J) /SEC
FJFH	HALF THE STANDARD NUMBER OF NODELETS (SEE JF AND FJFS)	
FJFS	STANDARD NUMBER OF NODELETS PER NODE FOR ALL NODES EXCEPT THE FIRST, WHICH HAS HALF THIS MANY	
F1(I,L)	L TH TABULAR F-FUNCTION FOR VIRGIN CONDUCTIVITY IN COMPUTING CONDUCTIVITY IN PARTIALLY PYROLYZED ZONE	
F2(I,L)	L TH TABULAR F- FUNCTION FOR CHAR CONDUCTIVITY, USED IN COMPUTING CONDUCTIVITY IN PARTIALLY PYROLYZED ZONE	
GA(I)	RESIN VOLUME FRACTION FOR I TH DECOMPOSING BACKUP (ANALOGOUS TO GAMA)	FT3 RESIN/ FT3 MATERIAL

LIST OF FORTRAN VARIABLES APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
GAMA	VOLUME FRACTION OF RESIN (COMPONENTS A AND B) IN UNDECOMPOSED PLASTIC, MAIN MATERIAL	FT3-RESIN/ FT3-MATERIAL
H( )	ENTHALPY AT A NODE	BTU/LB
HCONV	CONVECTIVE HEAT TRANSFER COEFFICIENT AT BACK WALL	BTU/FT2-SEC-DEG F
IDIOT( )	DUMMY EMPTY WORDS IN COMMON	
IEX	NOT USED IN PROGRAM (RETURNED FROM LOOK SUBROUTINE VIA COMMON: SET GREATER THAN UNITY IF EXTRAPOLATION REQUIRED.)	
IHI( )	INDEX OF LAST ENTRY IN A TABLE	
II	OPTION INDEX	
ILO( )	INDEX OF FIRST ENTRY IN A TABLE	
INCH	INPUT TAPE UNIT NUMBER FOR SURFACE EQUILIBRIUM DATA	
INPUT	INPUT TAPE UNIT NUMBER VARIABLE	
IR( )	"REMEMBERED" INDEX IN A GIVEN TABLE ADJACENT TO PREVIOUS VALUE FOR WHICH A LOOK-UP WAS PERFORMED	
ISEN(IPR)	NUMBER OF ENTRIES IN EDGE TABLE FOR INDICATED PRESSURE	
JF	STANDARD NUMBER OF NODELETS PER NODE	
JFH	HALF THE STANDARD NUMBER OF NODELETS PER NODE	
JFHP	JFH + 1	
KHI(I,J)	MARKS LAST ENTRY OF NO-ABLATION (TEMPERATURE INDEPENDENT) PART OF A CHAR RATE TABLE FOR I TH GAS RATE AND J TH PRESSURE (REGARDLESS OF USERS ORIGINAL INTENTION, THIS IS TAKEN AS LAST TEMPERATURE BEFORE TEMPERATURE ENTRIES BEGIN TO DESCEND, IF EVER. THIS EXTENSION SMOOTHS INTERPOLATION.)	
KOUT	OUTPUT TAPE UNIT NUMBER VARIABLE	
LCT	NUMBER OF LINES REMAINING ON CURRENT OUTPUT PAGE	
MATL( )	MATERIAL IDENTIFICATION NUMBER FOR A NODE	

LIST OF FORTRAN VARIABLES APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
NBM	ALWAYS EQUAL TO 1 PLUS THE ORIGINAL NUMBER OF NODES OF ABLATING MATERIAL	
NBM2	EQUAL TO NBM IF THERE ARE NO DECOMPOSING BACK-UPS, OTHERWISE EQUAL TO ONE GREATER THAN THE ORIGINAL NUMBER OF NODES IN THE MAIN ABLATING MATERIAL AND THE DECOMPOSING BACK-UPS	
NBPF	INPUT FLAG INTEGER CALLING FOR READING OF TBPF (, ,) VALUES FROM SURFACE THERMOCHEMISTRY TABLES	
NBUFT(J)	INDEX IDENTIFYING THE NUMBER OF THE F-FUNCTION TABLE (NUMBERED IN ORDER INPUT) ASSIGNED TO J TH CHARRING BACK-UP	
NCON	INPUT FLAG INTEGER CALLING FOR OUTPUT OF NODAL THERMAL CONDUCTIVITY IN PLACE OF NODAL ENTHALPY IN STANDARD OUTPUT BLOCK	
NDBU	NUMBER OF DECOMPOSING BACK-UP MATERIALS	
NFI(I)	NUMBER OF THE FIRST NODE IN THE I TH DECOMPOSING BACK-UP MATERIAL	
NFIS	INPUT FLAG INTEGER CALLING FOR USE OF FISSURE MODEL IN BLOWING REDUCTION OF CONVECTIVE TRANSFER COEFFICIENTS	
NMI(I,J)	MARKS TOP ENTRY IN ABLATION PART OF A CHAR RATE TABLE FOR I TH GAS RATE AND J TH PRESSURE	
NI	NUMBER OF ISOTHERM POINTS CALLED FOR	
NL	NUMBER OF LAST NODE OF ABLATING MATERIAL	
NLA(I)	NUMBER OF THE LAST NODE IN THE I TH DECOMPOSING BACKUP MATERIAL.	
NLO(I,J)	MARKS BOTTOM ENTRY IN ABLATION PART OF A CHAR RATE TABLE FOR I TH GAS RATE AND J TH PRESSURE	
NMG	TOTAL NUMBER OF GAS RATE ENTRIES IN EACH PRESSURE GROUP OF SURFACE EQUILIBRIUM DATA	
NN	FLAG CALLING FOR PUNCH OUTPUT OF THERMOCOUPLE AND ISOTHERM DATA	
NO	NUMBER OF THERMOCOUPLE TEMPERATURES CALLED FOR	

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
NOI	NO + NI	
NPG	CURRENT PAGE NUMBER FOR OUTPUT LISTING, USED IN COMMUNICATION WITH SUBROUTINE LCOUNT	
NPR	NUMBER OF PRESSURES IN SURFACE THERMOCHEMISTRY DATA DECK	
NR	FLAG VARIABLE CALLING FOR BURNING RATE OR RADIUS RATIO CORRECTION TO INPUT CONVECTIVE TRANSFER COEFFICIENTS	
NUMN	ALWAYS EQUAL TO THE ORIGINAL TOTAL NUMBER OF NODES	
OMG	1. - GAMA	FT3-REIN-FORCEMENT/FT3 MATERIAL
OMGA(I)	1. - GA(I)	FT3-REIN-FORCEMENT/FT3 MATERIAL
P(I)	RHOV(I)/(RHOV(I)-RHOC(I)), ANALOGOUS TO PETE	
PET	DENSITY FACTOR, (CHAR DENSITY * PETE)	LB/FT3
PETE	DENSITY TERM, VIRGIN DENSITY/ (VIRGIN DENSITY - CHAR DENSITY)	
PP(I)	RHOC(I)*P(I), ANALOGOUS TO PET	LB/FT3
PSI(I,J)	DECOMPOSITION REACTION ORDER FOR THE J TH COMPONENT OF THE I TH DECOMPOSING BACK-UP MATERIAL (ANALOGOUS TO PSIA, PSIB, PSIC)	
PSIA	DECOMPOSITION REACTION ORDER FOR A COMPONENT	
PSIB	DECOMPOSITION REACTION ORDER FOR B COMPONENT	
PSIC	DECOMPOSITION REACTION ORDER FOR C COMPONENT	
PYCRI	PYROLYSIS INTERFACE CRITERION: PYROLYSIS LINE DEPTH IS DEPTH OF LINE OF DENSITY RHO(2)+PYCRI*(RHO(1)-RHO(2))	
RA( )	CURRENT LOCATION OF NODE, MEASURED FROM ORIGINAL LOCATION OF HEATED SURFACE	IN

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
RAV( )	SAVED ORIGINAL VALUES OF NODAL LOCATIONS RA( )	IN
RC( )	CONTACT RESISTANCE BETWEEN INDICATED NODE AND AND NEXT NODE DOWN	(FT2-SEC-DEG F)/BTU
RECORD( )	ALPHAMERIC TITLING INFORMATION	
RFT	NOT CURRENTLY USED	
RHO( )	DENSITY OF VIRGIN PLASTIC (1), PURE CHAR (2), OR BACK-UP MATERIALS (3-10)	LB/FT3
RHOC(I)	CHAR DENSITY OF I TH DECOMPOSING BACK-UP MATERIAL (ANALOGOUS TO RHO(2))	LB/FT3
RHOO(I,J), J= 1,2	ORIGINAL DENSITY OF J TH COMPONENT OF I TH DECOMPOSING BACK-UP PER UNIT VOLUME OF RESIN (ANALOGOUS TO RHOOA, RHOOB)	LB/FT3
RHOO(I,3)	ORIGINAL DENSITY OF THIRD COMPONENT OF I TH DECOMPOSING BACK-UP FOR UNIT VOLUME OF REINFORCEMENT (ANALOGOUS TO RHOOC)	LB/FT3
RHOOA	ORIGINAL DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN	LB/FT3
RHOOB	ORIGINAL DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN	LB/FT3
RHOOC	ORIGINAL DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT3
RHOR(I,J), J = 1,2	RESIDUAL DENSITY OF J TH COMPONENT OF I TH DECOMPOSING BACK-UP PER UNIT VOLUME OF RESIN (ANALOGOUS TO RHORA, RHORB)	LB/FT3
RHOR(I,3)	RESIDUAL DENSITY OF THIRD COMPONENT OF I TH DECOMPOSING BACK-UP PER UNIT VOLUME OF REINFORCEMENT (ANALOGOUS TO RHORC)	LB/FT3
RHORA	RESIDUAL DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN	LB/FT3
RHORB	RESIDUAL DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN	LB/FT3
RHORC	RESIDUAL DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT3

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
RHOV(I)	VIRGIN DENSITY OF I TH DECOMPOSING BACK-UP MATERIAL (ANALOGOUS TO RHO(I))	LB/FT3
ROA( )	CURRENT DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN, AT A NODELET	LB/FT3
ROB( )	CURRENT DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN, AT A NODELET	LB/FT3
ROC( )	CURRENT DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT3
ROCOM(I,J), J = 1,2	DENSITY OF THE J TH COMPONENT IN THE I TH NODE (BACK-UPS ONLY) PER UNIT VOLUME OF RESIN (ANALOGOUS TO ROA(I), ROB(I))	LB/FT3
ROCOM(I,3)	DENSITY OF THE THIRD COMPONENT IN THE I TH NODE (BACK-UPS ONLY) PER UNIT VOLUME OF RESIN (ANALOGOUS TO ROC(I))	LB/FT3
RSV	ORIGINAL SURFACE RADIUS (NEGATIVE IF EXTERNAL)	IN
SU( )	THERMOCOUPLE DEPTHS AND/OR ISOTHERM TEMPERATURES	IN OR DEG R
SWELL	PROPORTIONALITY FACTOR IN CHAR SWELL CORRECTION OF HEAT TRANSFER COEFFICIENT	
TA( )	NODAL TEMPERATURE	DEG R
TBPF(I,J,K)	TABULAR VALUE OF B PRIME FAIL (THAT IS, MDOT FAIL/RHOE-UE-CM) IN SURFACE THERMOCHEMISTRY TABLE FOR I TH ENTRY, J TH PYROLYSIS GAS RATE, AND K TH PRESSURE	
TBRP(I)	I TH ENTRY IN TIME TABLE VALUES OF BLOWING REDUCTION PARAMETER LAMDA	
TCBU(I,J)	TABULAR VALUE OF SPECIFIC HEAT FOR I TH TEMPERATURE ENTRY AND J TH MATERIAL INDEX NUMBER FOR DECOMPOSING BACK-UPS (ANALOGOUS TO TMZ(I,J))	BTU/LB DEG R
TCHEM (I,J,K)	QUANTITY (CM/CH * CHEM PROD - HW) FOR I TH CHAR RATE, J TH GAS RATE, AND K TH PRESSURE	BTU/LB
TCM( )	TABULAR VALUE OF HEAT TRANSFER COEFFICIENT RHOE-UE-CM IN FUNCTIONS-OF-TIME TABLES	LB/FT2-SEC
TCP(I,J)	TABULAR VALUE OF SPECIFIC HEAT FOR I TH TEMPERATURE ENTRY AND J TH MATERIAL	BTU/LB-DEG R

LIST OF FORTRAN VARIABLES APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
TCPSEN(I,J)	SLOPE OF THSEN VERSUS TW AT I TH TEMPERATURE AND J TH PRESSURE IN EDGE TABLE	BTU/LB-DEG R
TENT(I,J)	TABULAR VALUE OF SPECIFIC HEAT FOR I TH TEMPERATURE ENTRY AND J TH MATERIAL INDEX NUMBER FOR DECOMPOSING BACK-UPS (ANALOGOUS TO THZ(I,J))	BTU/LB
TEP(I,J)	TABULAR VALUE OF EMISSIVITY OF I TH TEMPERATURE ENTRY AND J TH MATERIAL	
THE( )	TABULAR VALUE OF BOUNDARY RECOVERY ENTHALPY IN FUNCTION-OF-TIME TABLES (EQUALS SURFACE TEMPERATURE IN OPTION 2 AND VIEW FACTOR IN OPTION 3)	BTU/LB OR DEG R OR ---
THFIN	TIME AT END OF PROBLEM	SEC
THG( )	TABULAR VALUE OF PYROLYSIS GAS ENTHALPY AS A FUNCTION OF TEMPERATURE	BTU/LB
THSEN(I,J)	VALUE OF HEW AT I TH TEMPERATURE AND J TH PRESSURE IN EDGE TABLES	BTU/LB
THZ(I,J)	TABULAR VALUE OF SENSIBLE ENTHALPY OF I TH TEMPERATURE ENTRY AND J TH MATERIAL	BTU/LB
THZRO	INITIAL PROBLEM TIME	SEC
TKBU(I,J)	TABULAR VALUE OF THERMAL CONDUCTIVITY FOR I TH TEMPERATURE ENTRY AND J TH MATERIAL INDEX NUMBER FOR DECOMPOSING BACK-UPS (ANALOGOUS TO TKP(I,J))	BTU/FT-SEC-DEG F
TKP(I,J)	TABULAR VALUE OF THERMAL CONDUCTIVITY FOR I TH TEMPERATURE ENTRY AND J TH TEMPERATURE	BTU/FT-SEC-DEG F
TLMC(I,J,K)	TABULAR VALUE OF LN(MDOTC/RHOE-UE-CM) IN SURFACE THERMOCHEMISTRY TABLE FOR I TH CHAR RATE, J TH PYROLYSIS GAS RATE, AND K TH PRESSURE	
TMG(I,J)	TABULAR VALUES OF GAS RATES APPEARING IN SURFACE THERMOCHEMISTRY TABLES, I GIVES GAS RATE ENTRY, J GIVES PRESSURE INDEX	
TMWT	NOT CURRENTLY USED	
TPI( )	TABULAR VALUE OF LN OF PRESSURE IN FUNCTIONS-OF-TIME TABLE	
TPR( )	TABULAR VALUE OF LN OF PRESSURE IN SURFACE THERMOCHEMISTRY TABLES	

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
TPR2	TIME OF TRANSITION FROM INITIAL TO SECOND OUTPUT TIME INTERVAL	SEC
TPR3	TIME OF TRANSITION FROM SECOND TO THIRD OUTPUT TIME INTERVAL	SEC
TQR( )	TABULAR VALUE OF RADIANT HEAT FLUX IN FUNCTIONS--OF-TIME TABLE, FOR OPTIONS 1 AND 3 (OPTION 2, SURFACE RECESSION RATE)	BTU/FT2-SEC OR MILS/SEC
TRAC(I,J)	LIMIT TEMPERATURE BELOW WHICH COMPONENT J OF DECOMPOSING BACK-UP I IS NOT ALLOWED TO DECOMPOSE (EFFICIENCY MEASURE) (ANALOGOUS TO TRACA,TRACB, TRACC)	DEG R
TRACA	LIMIT TEMPERATURE BELOW WHICH COMPONENT A IS NOT ALLOWED TO DECOMPOSE (EFFICIENCY MEASURE)	DEG R
TRACB	LIMIT TEMPERATURE BELOW WHICH COMPONENT B IS NOT ALLOWED TO DECOMPOSE (EFFICIENCY MEASURE)	DEG R
TRACC	LIMIT TEMPERATURE BELOW WHICH COMPONENT C IS NOT ALLOWED TO DECOMPOSE (EFFICIENCY MEASURE)	DEG R
TRACM	MINIMUM OF TRACA, TRACB, TRACC	
TREF(I)	REFERENCE TEMPERATURE FOR HEATS OF FORMATION ANALOGOUS TO TZ) FOR I TH DECOMPOSING BACK-UP MATERIAL.	DEG R
TRES	RESERVOIR TEMPERATURE TO WHICH BACK WALL IS EXPOSED	DEG R
TTH( )	TABULAR VALUE OF TIME (INDEPENDENT VARIABLE) IN FUNCTIONS-OF-TIME TABLE	
TTS(I,J,K)	TABULAR VALUE OF TEMPERATURE IN SURFACE THERMO-CHEMISTRY TABLES FOR I TH TEMPERATURE, J TH PYROLYSIS GAS RATE, AND K TH PRESSURE	DEG R
TTSEN(I,J)	TABULAR VALUE OF TEMPERATURE (INDEPENDENT VARI-ABLE) IN EDGE TABLES FOR I TH TEMPERATURE ENTRY IN J TH PRESSURE GROUP	DEG R
TT1( )	TABULAR VALUE OF TEMPERATURE (INDEPENDENT VARIABLE). IN PYROLYSIS GAS ENTHALPY TABLE	DEG R
TT2(I,J)	TABULAR VALUE OF TEMPERATURE (INDEPENDENT VARIABLE) IN MATERIAL PROPERTIES TABLES FOR I TH TEMPERATURE ENTRY IN TABLE FOR J TH MATERIAL	DEG R

LIST OF FORTRAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
TT5(I,J)	TABULAR VALUE OF TEMPERATURE (INDEPENDENT VARIABLE) IN MATERIAL PROPERTIES TABLES FOR I TH TEMPERATURE ENTRY IN TABLE FOR J TH INDEX NUMBER FOR DECOMPOSING BACK-UPS (ANALOGOUS TO TT2)	DEG R
TX(I,J)	TABULAR VALUE OF PLASTIC MASS FRACTION X, INDEPENDENT VARIABLE IN TABLES OF F1(I,J), F2(I,J)	LB VIRGIN/ LB MATERIAL
VFZ	INPUT OPTION 1 VIEW FACTOR	
VR	TABULAR INTERPOLATION RATIO RETURNED BY LOOK SUBROUTINE	
WT	NUMBER OF THE F-FUNCTION TABLE (NUMBERED IN ORDER INPUT) ASSIGNED TO THE MAIN CHARRING MATERIAL	
X( )	MASS FRACTION OF VIRGIN PLASTIC PER UNIT MASS OF MATERIAL	

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS.
A(I)	COEFFICIENT ON NEW TEMPERATURE OF NODE I-1 IN EQUATION OF NODE I IN IMPLICIT MATRIX	BTU/FT3 - DEG F
ASU	CURRENT CROSS SECTION AREA OF SURFACE NODE	FT2
B(I)	COEFFICIENT ON NEW TEMPERATURE OF NODE I IN EQUATION OF NODE I IN IMPLICIT MATRIX	BTU/FT3 - DEG F
BP	AN UNCORRECTED B PRIME, EQUAL TO (MDOTG + MDOTC)/ RHOE-UE-CM, ALSO SEE NEXT ENTRY	
BF	REPLACES BBB(I,J) FOR CONVENIENCE, ALSO SEE ABOVE ENTRY	SEC-1
BPRM	BPRIME = (MDOTG + MDOTC)/RHOE-UE-CM	
BPRMG	BPRIMEG = MDOTG/RHOE-UE-CM	
BK	CH/CHO	
C(I)	COEFFICIENT ON NEW TEMPERATURE OF NODE I+1 IN IN EQUATION OF NODE I IN IMPLICIT MATRIX	BTU/FT3 - DEG F
CH	HEAT TRANSFER COEFFICIENT - RHOE-UE-CH	LB/FT2-SEC
CHZ	HEAT TRANSFER COEFFICIENT NOT CORRECTED FOR BLOWING	LB/FT2-SEC
CMD	CHAR RATE, MDOTC	LB/FT2-SEC
CMDL	LN (MDOTC/RHOE-UE-CM)	
CMFL	VALUE OF THAT PART OF EROSION RATE DUE TO FAILING	LB/FT2 SEC
CMMA	MINIMUM (FROM VARIOUS TABLES) VALUE OF AVERAGES OF NEXT TWO SUCCESSIVE TABULAR VALUES OF TLMC (, ,) ABOVE CURRENT CMDL. USED TO LIMIT CORRECTION SIZE ON CMDL	
CMMI	MAXIMUM VALUE (FROM VARIOUS TABLES) OF AVERAGES OF NEXT TWO SUCCESSIVE TABULAR VALUES OF TLMC (, ,) BELOW CMDL, USED TO LIMIT CORRECTION SIZE ON CMDL	
CNC( )	VALUE OF CHAR THERMAL CONDUCTIVITY AT A NODE	BTU/FT-SEC DEG F

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
CNO(I)	THERMAL CONDUCTIVITY OF NODE I GENERATED FOR OUTPUT PURPOSES IF NCON DIFFERS FROM ZERO	BTU/FT SEC DEG R
CMT	TOTAL AMOUNT OF CHAR ABLATED AWAY, PER UNIT AREA OF ORIGINAL SURFACE	LB/FT2
CN( )	VALUE OF THERMAL CONDUCTIVITY AT A NODE	BTU/FT-SEC-DEG F
COLD	SAVED PREVIOUS VALUE OF CHAR INTERFACE DEPTH	IN
CP( )	SPECIFIC HEAT AT A NODE	BTU/LB-DEG F
CPC(I)	SAVED VALUE OF CHAR SPECIFIC HEAT FOR NODE I	BTU/LB CHAR-DEG R
CPE( )	CHAR OR PYROLYSIS INTERFACE DEPTH	IN
CPGAS	SPECIFIC HEAT OF PYROLYSIS GAS	BTU/LB-DEG F
CPNL	SPECIFIC HEAT AT LAST NODE OF ABLATING MATERIAL	BTU/LB-DEG F
CPV( )	SPECIFIC HEAT OF VIRGIN PLASTIC COMPONENT AT A NODE	BTU/LB-DEG F
CP1	SPECIFIC HEAT OF TOP NODELET IN CURRENT NODE	BTU/LB-DEG F
CZ	RELATIVE THICKNESS PARAMETER USED IN DROPPING LAST NODE	
D(I)	RIGHT HAND TERM IN IMPLICIT MATRIX EQUATION FOR NODE I	BTU/FT3
DCDT	ABSOLUTE VELOCITY OF CHAR INTERFACE	IN/SEC
DECOM	CURRENT ACCUMULATED (NODE BY NODE) AMOUNT OF ENERGY ABSORPTION IN DECOMPOSITION	BTU/FT2-SEC
DECOMT	TIME INTEGRATED VALUE OF DECOM, ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
DEDT	CURRENT ACCUMULATED (NODE BY NODE) RATE OF ENERGY ABSORPTION IN SOLIDS, (BACK-UPS EXCLUDED)	BTU/FT2-SEC
DEDTT	TIME INTEGRATED VALUE OF DEDT, ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
DELCR	MINIMUM OF DEL(1)/FJFH AND DELM/FJFS	FT

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
DELR	THICKNESS RATIO USED IN DROPPING LAST NODE	
DENOLD	SAVED VALUE OF DENSITY OF PREVIOUS NODELET USED IN INTERPOLATING CHAR AND PYROLYSIS INTERFACES	LB/FT3
DEP(I,J)	J TH DEPTH OF THE I TH ISOTHERM IN THE BACKUP MATERIAL	IN
DERR	(1) IN ABLATING SECTION OF SURFACE ENERGY BALANCE	BTU/FT2-SEC
DERR	RATE OF CHANGE OF ERR WITH LN B PRIME CHAR (IN ABLATING SECTION OF SURFACE ENERGY BALANCE CALCULATIONS) OR WITH SURFACE TEMPERATURE (IN NON-ABLATING SECTION)	BTU/FT2-SEC OR BTU/FT2-SEC-DEG F
DIDT	RATE OF SURFACE RECESSION	IN/SEC
DMDG( )	ACCUMULATED AMOUNT OF PYROLYSIS GAS GENERATION IN A NODE PER UNIT AREA AND TIMES NUMBER OF NODELETS PER NODE, FINALLY ADJUSTED TO AMOUNT OF PYROLYSIS GAS GENERATION IN A NODE	LB/SEC-FT2 SURFACE
DMIV	DERIVATIVE OF EMISSIVITY WITH RESPECT TO TEMPERATURE	DEG F-1
DNCP( )	CHAR AND PYROLYSIS LINES CRITERIAL DENSITIES, SEE CHCRI AND PYCRI	LB/FT3
DNS	CURRENT NODELET DENSITY	LB/FT3
DPDT	ABSOLUTE VELOCITY OF PYROLYSIS INTERFACE	IN/SEC
DRL	DENSITY-THICKNESS PRODUCT FOR NODE ABOVE NODE TO BE DROPPED	LB/FT2
DRLC	DENSITY-THICKNESS-SPECIFIC HEAT PRODUCT FOR NODE ABOVE NODE TO BE DROPPED.	BTU/FT2-DEG F
DRLCP	DENSITY-THICKNESS-SPECIFIC HEAT PRODUCT FOR NODE TO BE DROPPED	BTU/FT2 - DEG F
DRLP	DENSITY-THICKNESS PRODUCT FOR NODE TO BE DROPPED	LB/FT2
DROAC	RATE OF CHANGE OF DENSITY OF COMPONENT A AT CONSTANT A DUE TO CONVECTION	LB/FT3 - RESIN-SEC
DROAT	RATE OF CHANGE OF DENSITY OF COMPONENT A AT CONSTANT Y	LB/FT3 - RESIN-SEC

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
DROBC	RATE OF CHANGE OF DENSITY OF COMPONENT B AT CONSTANT X DUE TO CONVECTION	LB/FT3 - RESIN-SEC
DROBT	RATE OF CHANGE OF DENSITY OF COMPONENT B AT CONSTANT Y	LB/FT3 - RESIN-SEC
DROCC	RATE OF CHANGE OF DENSITY OF COMPONENT C AT CONSTANT X DUE TO CONVECTION	LB/FT3 REINFORCE-MENT-SEC
DROCT	RATE OF CHANGE OF DENSITY OF COMPONENT C AT CONSTANT Y	LB/FT3 REINFORCE-MENT-SEC
DRODTD	TOTAL RATE OF CHANGE OF DENSITY AT CONSTANT Y FOR CURRENT NODE, -DMDG(I)/(RR(I)*DEL(I))	LB/FT3-SEC
DROT(J)	LOCAL RATE OF CHANGE IN DENSITY OF COMPONENT J, WHERE J IS THE COMPONENT INDEX (J=1,2,3) IN THE DECOMPOSING BACK-UPS (ANALOGOUS TO DROAT, DROBT, DROCT)	LB/FT3-SEC
DS	SURFACE RECESSION DURING TIME STEP	FT
DSDT	SURFACE RECESSION RATE	FT/SEC
DSDTB	NEW VALUE OF SURFACE RECESSION RATE	FT/SEC
DSI	SURFACE RECESSION DURING TIME STEP	IN
DSS	PARAMETER FJF/DEL(I)*DS/RR(I)	
DTA	TEMPERATURE INCREMENT PER HALF NODELET FOR LINEAR INTERPOLATION IN SPACE	DEG F
DTH	TIME INCREMENT	SEC
DTHC	INPUT MAXIMUM ALLOWABLE TIME STEP	SEC
DTHS	SAVED PREVIOUS VALUE OF DTH	SEC
DTS	CHANGE IN SURFACE TEMPERATURE DURING PREVIOUS COMPUTATION	DEG F
DVB	CONDUCTIVITY PARAMETER	BTU/SEC-DEG F-FT2-SURFACE
DVBS	SAVED VALUE OF DVB FOR DUMP	BTU/SEC DEG F FT2-SURFACE

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
DZ	VALUE USED IN DROPPING LAST NODE	
D1( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DERIVATIVES OF DEPENDENT VARIABLES	VARIOUS
D2( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DERIVATIVES OF DEPENDENT VARIABLES	VARIOUS
D3( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DERIVATIVES OF DEPENDENT VARIABLES	VARIOUS
E	REPLACES EE(I,J) FOR CONVENIENCE	DEG R
EGO	ENERGY LEAVING SURFACE WITH PYROLYSIS GASES, GS*HGAS AT SURFACE TEMPERATURE	BTU/FT2-SEC
EITER( )	VALUE OF ERROR TERM IN SURFACE ENERGY BALANCE, SAVED FOR POSSIBLE DUMP FOR ALL ITERATIONS	BTU/FT2-SEC
EMIV	ABLATING SURFACE EMISSIVITY	
EMO( )	GENERAL VARIABLE NAME FOR CURVE SLOPE	VARIOUS
ERFX	COMBINATION OF TERMS IN SURFACE ENERGY BALANCE EQUATIONS WHICH DO NOT CHANGE DURING ITERATIONS	BTU/FT2-SEC
ERR	ERROR (DEPARTURE FROM ZERO) IN SURFACE ENERGY BALANCE	BTU/FT2-SEC
ERRC	CORRECTION APPLIED TO LN(MDOTC/RHOE-UE-CM) OR TO SURFACE ENERGY BALANCE OPERATION	--- OR DEG R
ERRS	SAVED VALUE OF ERROR, ERR	BTU/FT2-SEC
EZ	FACTOR USED IN DROPPING LAST NODE	
F	REPLACES FF(I,J) FOR CONVENIENCE	(LB/FT3)** (1.-PSI(I,J))
FA	DEFINED AS (1.-PSIA)*BA*(RHOOA**(1.-PSIA))	(LB/FT3)** (1.-PSIA)/SEC
FACT1	FACTOR DTH/(DEL(I)*RH(I))	SEC/FT
FACT2	FACTOR GSM/DEL(I)*RH(I)	LB/FT3-SEC
FB	DEFINED AS (1.-PSIB)*BB*(RHOOB**(1.-PSIB))	(LB/FT3)** (1.-PSIB)/SEC

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
FC	DEFINED AS (1.-PSIC)*BC*(RHOOC**(1.-PSIC))	(LB/FT3)** (1.-PSIC)/SEC
FJF	NUMBER OF NODELETS IN CURRENT NODE	
FK	FACTOR USED IN COMPUTING CONVECTIVE CONTRIBUTIONS TO DENSITY CHANGES IN NODELETS OF LAST NODE OF ABLATING MATERIAL	
FX	VALUE USED IN DROPPING LAST NODE	
FZ	VALUE USED IN DROPPING LAST NODE	
GAM	REPLACES GA(I) FOR CONVENIENCE	FT3 RESIN
GS	TOTAL PYROLYSIS GAS FLOW OUT THE ABLATING SURFACE	LB/FT2 SEC
GSEGR	ENERGY TERM, SUM OF MGAS*DMDG( ) OVER NODES	BTU/SEC-FT2 SURFACE
GSM	ACCUMULATED PYROLYSIS GAS FLOW RATE ENTERING A NODE, ON A UNIT-AREA-OF-SURFACE BASIS	LB/SEC-FT2 SURFACE
GSMS	PYROLYSIS GAS FLOW OUT THE ABLATING SURFACE	LB/SEC-FT2 SURFACE
GSMT	TOTAL (TIME INTEGRATED) PYROLYSIS GAS FLOW OUT THE ABLATING SURFACE ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	LB/FT2
GSM2	ACCUMULATED PYROLYSIS GAS FLOW RATE ENTERING A NODE, ON A UNIT-AREA-OF-SURFACE BASIS, WHICH DERIVES FROM CHARRING BACK-UPS	LB/SEC-FT2 SURFACE
GSM2S	FLOW RATE OF PYROLYSIS GAS ORIGINATING IN DECOMPOSING BACK-UPS OUT THE ABLATING SURFACE	LB/SEC-FT2 SURFACE
GSM2T	TOTAL (TIME INTEGRATED) FLOW OF PYROLYSIS GAS ORIGINATING IN DECOMPOSING BACK-UPS ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	LB/FT2
GZ	FACTOR USED IN DROPPING LAST NODE	
HAPHB	COMBINED ENTHALPY PER UNIT SURFACE AREA OF NODE TO BE DROPPED AND ADJACENT NODE	BTU/FT2
HHAR	TEMPERATURE DEPENDENT REACTION ENTHALPY DEFINED AS (VIRGIN DENSITY * VIRGIN ENTHALPY - CHAR DENSITY * CHAR ENTHALPY)/(VIRGIN DENSITY- CHAR DENSITY)	BTU/LB

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
HBARS	SAVED VALUE OF HBAR FOR DUMP	BTU/LB
HC( )	ENTHALPY OF CHAR AT A NODE	BTU/LB
HE	TOTAL ENTHALPY OF EDGE GASES FOR OPTION 1 (EQUALS SURFACE TEMPERATURE FOR OPTION 2 OR VIEW FACTOR FOR OPTION 3)	BTU/LB, DEG R, OR --
HGAS	ENTHALPY OF PYROLYSIS GAS	BTU/LB
HP( )	ENTHALPY OF PLASTIC AT A NODE	BTU/LB
HRES	TOTAL HEAT TRANSFER COEFFICIENT AT BACK WALL (INCLUDING RADIATION)	BTU/FT2-SEC-DEG F
HW	ENTHALPY OF EDGE GASES AT WALL TEMPERATURE (OPTION 1) OR ENTHALPY OF PYROLYSIS GASES AT WALL TEMPERATURE (OPTION 3)	BTU/LB
H1	ENTHALPY OF TOP NODELET IN A NODE	BTU/LB
I	COUNTING INDEX, USUALLY FOR NODES	
IAB	FLAG USED TO DETECT FIRST PASS THROUGH ABLATING SURFACE ENERGY BALANCE PACKAGE	
IE	COUNTING INDEX	
IMG	INDEX FOR GAS RATES (MDOTG/RHOE-UE-CM)	
IMIN	INTEGER ZERO	
IPR	INDEX FOR PRESSURE ENTRIES	
IRA	SOMETIMES REPLACES IR( ) FOR EFFICIENCY	
IRB	SOMETIMES REPLACES IR( ) FOR EFFICIENCY	
IRC	SOMETIMES REPLACES IR( ) FOR EFFICIENCY	
IRD	SOMETIMES REPLACES IR( ) FOR EFFICIENCY	
IS	NOT CURRENTLY USED	
ISV	SAVED MATERIAL IDENTIFICATION NUMBER FOR FIRST NODE OF BACK-UP MATERIAL	
ITER	NUMBER OF PASSES THROUGH MAIN COMPUTATION LOOP	

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
ITL	LIMIT NUMBERS (ASSUMES 2 VALUES) ON ITS TO CONTROL ITERATION EVENTS IN ABLATING SURFACE ENERGY BALANCE	
ITS	COUNTER FOR NUMBER OF ITERATIONS ON SURFACE ENERGY BALANCE	
I1	REPLACES SUBSCRIPTED INDEX FOR EFFICIENCY	
I2	REPLACES SUBSCRIPTED INDEX FOR EFFICIENCY	
I3	REPLACES SUBSCRIPTED INDEX FOR EFFICIENCY	
I4	REPLACES SUBSCRIPTED INDEX FOR EFFICIENCY	
J	GENERAL INDEX, NODELET COUNTER IN A GIVEN NODE IN DECOMPOSITION BLOCK	
J1	INDICATES NUMBER OF FIRST NODELET IN A NODE, COUNTED NODE BY NODE (EQUALS JFH + 1 FOR FIRST NODE, 1 FOR OTHERS)	
K	GENERAL UTILITY INDEX	
KI	TEMPORARY INDEX IDENTIFYING AN ISOTHERM WITHIN A BACKUP MATERIAL	
KK	COUNTER ON THERMOCOUPLE AND ISOTHERM OUTPUT	
KKSW	RETURNED ARGUMENT IN CALL OF SSWTCH (N,KKN)	
KSCT	SCRATCH TAPE LOGICAL UNIT NUMBER VARIABLE	
KT	INDEX REPLACING SUBSCRIPTED MATERIAL NUMBERS MATL( ) FOR EFFICIENCY	
L	UTILITY INDEX	
LL	UTILITY INDEX, USUALLY LOWER LIMIT OF DO LOOP INDEX	
LU	UTILITY UPPER LIMIT OF DO LOOP INDEX	
M	UTILITY INDEX	
N	GENERAL UTILITY INDEX, USED FOR COUNTING TOTAL NUMBER OF NODELETS IN DECOMPOSITION BLOCK	
NISO(KI)	NUMBER OF DEPTHS AT WHICH THE KI TH ISOTHERM OCCURS AT CURRENT OUTPUT TIME	

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
NDR	NUMBER OF NODES WHICH HAVE BEEN DROPPED	
NLI	NUMBER OF LINES OF NODAL DATA OUTPUT	
NLM	NL-1	
NZ	CURRENT TOTAL NUMBER OF NODELETS	
O	FILLER FOR UNNEEDED VARIABLE NAMES IN LOOK CALL	
OMGAM	REPLACES OMGA(I) FOR CONVENIENCE	FT3 REIN-FORCEMENT/ FT3
OVR	MEASURES APPROACH OF DENSITY TO RESIDUAL DENSITY	LB/FT3
PGPU	EGO - GSEGR	BTU/SEC-FT2-SURFACE
PGPUT	TIME INTEGRATED VALUE OF PGPU, ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
PHI	PARAMETER 2.*BRP*BF	
POLD	SAVED PREVIOUS VALUE OF PYROLYSIS INTERFACE DEPTH	
POW	EXPONENT IN PYROLYSIS DECOMPOSITION RATE CALCULATIONS	
PRES	CURRENT VALUE OF LOG OF PRESSURE	
QCHEM	FROM TABLE LOOK-UP, IS INITIALLY TERM (CM/CH)*(CHEM PROD) - HW), LATER ADJUSTED TO RHOE-UE-CH*(CHEM PROD) =QCHEM	BTU/LB OR BTU/FT2-SEC
QCHEMT	TIME INTEGRATED VALUE OF QCHEM ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
QCOND	QCOND, ENERGY CONDUCTED INTO CHARRING MATERIAL AT HEATED SURFACE	BTU/FT2-SEC
QCONDT	TIME INTEGRATED VALUE OF QCOND ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
QCONV	INITIALLY DUMMY NAME FOR HEW, ADJUSTED TO QCONV = RHOE-UE-CH*(HE-HW)	BTU/LB, BTU/FT2-SEC
QCONVT	TIME INTEGRATED VALUE OF QCONV ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
QLOSS	ENERGY LOSS QLOSS AT REAR FACE OF ABLATING MATERIAL, PER UNIT AREA OF FRONT SURFACE	BTU/SEC-FT2-SURFACE
QLOSST	TIME INTEGRATED VALUE OF QLOSS ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
QQ	DUMMY NAME, INITIAL QCONV FOR INTERPOLATION	BTU/LB
QRA	RADIANT HEAT FLUX TO SURFACE QRAD IN OPTIONS 1 AND 3 (IN OPTION 2, SURFACE RECESSION RATE)	BTU/FT2-SEC OR MILS/SEC
QRP	RADIANT HEAT ABSORBED AT SURFACE, EQUAL TO EMISSIVITY * QRA	BTU/FT2-SEC
QRPT	TIME INTEGRATED VALUE OF QRP, ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
RAD	RATE OF ENERGY RADIATION AWAY FROM SURFACE, SIGMA * EMISSIVITY * VIEW FACTOR * TS**4	BTU/FT2-SEC
RADT	TIME INTEGRATED VALUE OF RAD, ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
RAT( )	CONDUCTION RESISTANCE DEL( )/(CN( )*RR( ))	(FT2 SURF-SEC-DEG F)/BTU
RD	DENSITY DIFFERENCE USED IN PYROLYSIS CALCULATIONS	LB/FT3
REX	BURNING RATE EXPONENT PARAMETER (1.8-.2*BREX)/(1.-BREX)	
RO( )	DENSITY OF A NODE (USUALLY OLD DENSITY)	LB/FT3
RON( )	DENSITY OF A NODE (USUALLY NEW DENSITY)	LB/FT3
ROOZ	DENSITY PARAMETER, EQUAL TO ZERO OR TO FJFH TIMES UNIFORM NODELET DENSITIES IN AREAS WITHOUT DECOMPOSITION REACTIONS (PURE PLASTIC OR PURE CHAR), USED TO EXPEDITE DENSITY CALCULATIONS	LB/FT3
ROT( )	DENSITY OF TOP NODELET IN A GIVEN NODE	LB/FT3
RO1	REPLACES ROT( ) FOR EFFICIENCY	LB/FT3
RK( )	OBTAINED FROM UGLE AS CROSS-SECTION AREA OF A NODE, LATER NORMALIZED ON CROSS-SECTION AREA OF SURFACE NODE	FT2 OR ---

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
RSU	CURRENT SURFACE RADIUS (TOTAL RECESSION FOR PLANE GEOMETRY	IN
SA	CURRENT VALUE OF TOTAL SURFACE RECESSION	IN
SDNET	RATE OF RECESSION AFTER RATE OF CHAR SWELL IS ACCOUNTED FOR	IN/SEC
SIG	STEFAN-BOLTZMANN CONSTANT	BTU/FT2-SEC-DEG R**4
SNET	NEW SURFACE RECESSION AFTER SWELL IS ACCOUNTED FOR	IN
SUEGR	TERM HGAS*DMDG( ), SUMMED OVER ALL NODES	BTU/FT2 - SURFACE-SEC
T	TERM USED IN EVALUATING SOLID CONVECTION ENERGY	BTU/FT3
TABC	INTERPOLATED TEMPERATURE APPROXIMATING BOTTOM OF ABLATION-SECTION OF SURFACE THERMOCHEMISTRY TABLES, COMPARED TO OLD VALUE OF SURFACE TEMPERATURE TO JUDGE IF ABLATION-SECTION SHOULD BE USED	DEG R
TAS	NODELET TEMPERATURE	DEG R
TB	SUMMATION OF TN*DSDT*RR(I) OVER NODES OF ABLATING MATERIAL	BTU/SEC-FT2-SURFACE
TEMP	TEMPORARY NODAL TEMPERATURE	DEG R
TERM1	FACT1 * DVB	BTU/FT-DEC F FT2-SURFACE
TERM2	LUMPING OF TERMS USEFUL IN COMPUTING IMPLICIT TEMPERATURE COEFFICIENTS, SEE STATEMENT 14 + 6	BTU/FT2 - DEG F
TERM3	LUMPING OF TERMS USEFUL IN COMPUTING IMPLICIT TEMPERATURE COEFFICIENTS, SEE STATEMENT 25	BTU/FT3-DEG F-SEC
TH	TIME	SEC
THDS	VALUE OF TIME AT A TIME-TABLE DOUBLE ENTRY (SHIFT OF OPTION)	SEC
THPRT	OUTPUT TIME	SEC
TN	TERM USED IN EVALUATING SOLID CONVECTION ENERGY	BTU/FT3
TU( )	THERMOCOUPLE TEMPERATURE OR ISOTHERM DEPTH	DEG R OR IN

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
TOP1	COMBINED MASS OF NODE TO BE DROPPED AND ADJACENT NODE	LB/FT2
TOP2	COMBINED THERMAL CAPACITY OF NODE TO BE DROPPED AND ADJACENT NODE	BTU/FT2 - DEG R
TOP3	COMBINED ENTHALPY OF NODE TO BE DROPPED AND ADJACENT NODE	BTU/FT2
TRACMI	MINIMUM VALUE OF A SET OF TRAC(I,J), J= 1,3	DEG R
TS	SURFACE TEMPERATURE, EQUIVALENCED TO TA(1)	DEG R
TSAVE	SAVED VALUE OF SURFACE TEMPERATURE FROM PREVIOUS TIME STEP	DEG R
TSMA	MINIMUM (FROM VARIOUS TABLES) VALUE OF AVERAGES OF NEXT TWO TABULAR VALUES OF TTS(, ,)ABOVE CURRENT TS, USED TO LIMIT CORRECTION SIZE ON TS	DEG R
TSMI	MAXIMUM (FROM VARIOUS TABLES) VALUE OF AVERAGES OF NEXT TWO TABULAR VALUES OF TTS (, ,) BELOW CURRENT TS, USED TO LIMIT CORRECTION SIZE ON TS	DEG R
TSSQ	SQUARE OF SURFACE TEMPERATURE	DEG R**2
TT	TIME INTEGRATED VALUE OF TB ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
VF	VIEW FACTOR	
VITER( )	VALUE OF LN(MDOTC/RHOE-UE-CM) OR SURFACE TEMPERATURE (FOR A NON-ABLATING CASE) SAVED FOR EACH ITERATION OF SURFACE ENERGY BALANCE, FOR POSSIBLE DUMP	--- OR DEG R
VOL	VOLUME OF NEW AMALGAMATED LAST NODE IN MAIN MATERIAL	FT3/FT2-SURFACE
VRM	REPLACES VR FOR PYROLYSIS GAS RATE INTERPOLATION	
VRP	REPLACES VR FOR PRESSURE INTERPOLATION	
XP1	REPLACES X(1) FOR EFFICIENCY	
X1	X( ) FOR TOP NODELET IN A NODE	
Y1( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DEPENDENT VARIABLES	VARIOUS

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
Y2( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DEPENDENT VARIABLES	VARIOUS
Y3( )	DUMMY VARIABLE NAME USED IN LOOK CALLS FOR DEPENDENT VARIABLES	VARIOUS

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE INPOUT

VARIABLE NAME	DESCRIPTION	UNITS
AE	EXPONENT ON RADIUS GIVING NODAL CROSS-SECTIONAL AREA VARIATION WITH RADIUS	
A9	ALPHAMERIC IDENTIFICATION VARIABLE FOR COMPONENT A	
B	REPLACES BLANK	
BP	B PRIME = (MDOTC+MDOTG)/RHOE-UE-CM	
BPG	BPRIMEG = MDOTG/RHOE-UE-CM	
B9	ALPHAMERIC IDENTIFICATION VARIABLE FOR COMPONENT B	
CMHS	INPUT VALUE OF CMH	
CT1	UNUSED PLACE HOLDING VARIABLE IN LOOK CALL	
CT2	UNUSED PLACE HOLDING VARIABLE IN LOOK CALL	
C9	ALPHAMERIC IDENTIFICATION VARIABLE FOR COMPONENT C	
DMS	TEST VALUE OF PYROLYSIS GAS RATE, MDOTG/RHOE-UE-CM	
DUM	UNUSED PLACE HOLDING VARIABLE IN LOOK CALL	
GAMAM	MASS FRACTION OF RESIN (COMPONENTS A AND B) IN UNDECOMPOSED PLASTIC	LB RESIN/ LB VIRGIN
HCH	ENTHALPY OF CHAR	BTU/LB
HE	TOTAL ENTHALPY OF EDGE GASES AT A GIVEN TEMPERATURE	BTU/LB
HGA	ENTHALPY OF PYROLYSIS GAS	BTU/LB
HSH	DATUM ENTHALPY AT REFERENCE TEMPERATURE TZ	BTU/LB
HZ	Z ENTHALPY TERM FOR EDGE GAS AT A GIVEN TEMPERATURE	BTU/3B
I	UTILITY INDEX	
IFN	INDEX USED IN OUTPUTTING PYROLYSIS GAS ENTHALPY TABLE	

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE INPOUT

VARIABLE NAME	DESCRIPTION	UNITS
IG	FLAG USED TO MARK A MAXIMUM TEMPERATURE ENTRY IN A CHAR RATE TABLE	
IN	UTILITY INDEX	
IOPT(I)	HEATING OPTION (1,2, OR 3) FOR TIME TABLE TABULAR ENTRY I	
IP	INDEX ON PRESSURE IN SURFACE THERMOCHEMISTRY TABLE INPUT	
IPN	INDEX ON PRESSURE IN SURFACE THERMOCHEMISTRY TABLE INPUT	
IS	SAVED VALUE OF II	
IT	UTILITY INDEX	
IX	FLAG ON TYPE OF ERROR STOP IN SURFACE THERMO-CHEMISTRY INPUT	
IZ( )	OUTPUT INDEX ARRAY FROM SUBROUTINE ORDERD	
J	UTILITY INDEX	
JBU	COUNTER FOR NUMBER OF CHARRING BACK-UPS ASSIGNED TO AN F-FUNCTION TABLE	
JNG	FLAG TO IDENTIFY TYPE OF SURFACE THERMOCHEMISTRY TABLE, -1 FOR EDGE TABLE, 0 FOR ZERO CHAR RATE TABLE (INDEPENDENT SURFACE TEMPERATURE), GREATER THAN 0 FOR SURFACE EQUILIBRIUM (SURFACE TEMPER-ATURE DEPENDENT)	
J1	INDEX LIMIT EQUAL TO NUMBER OF NODELETS IN CURRENT NODE	
K	UTILITY INDEX	
KH	ORDINAL RANK OF DECOMPOSING BACK-UP MATERIAL, COUNTING FROM BACK WALL OF MAIN ABLATING MATERIAL	
KHS	SAVED VALUE OF KH	
KKSW	RETURNED ARGUMENT IN CALL OF SSWTCH (N,KKSW)	
KMTL(I)	INPUT ARRAY OF MATERIAL SEQUENCE NUMBERS (ZERO FOR MAIN MATERIAL, 1 TO 5 FOR CHARRING BACK-UPS) ASSIGNED TO CURRENT F-FUNCTION TABLES	

LIST OF FORTRAN VARIABLES APPEARING IN SUBROUTINE INPOUT

VARIABLE NAME	DESCRIPTION	UNITS
KNST	CHECK INTEGER TO FLAG FIRST SURFACE TABLE INPUT	
KSV(J)	SAVED NON-ZERO VALUE OF KMT1 (I)	
KT	INDEX REPLACING SUBSCRIPTED MATERIAL NUMBERS MATL( ) FOR EFFICIENCY	
L	UTILITY INDEX	
LL	UTILITY INDEX	
LLL	NUMBER OF LINES OF OUTPUT OF A GIVEN CHAR RATE TABLE	
LU	UTILITY UPPER LIMIT ON DO LOOPS	
N	INDEX FOR NODELETS	
NC	FLAG MARKING PYROLYSIS GAS ENTHALPY CARD PAIRS AND END OF FUNCTIONS-OF-TIME TABLES	
NDBUCH	CHECK VALUE FOR NDBU SUMMED DURING NODAL DATA INPUT	
NMC	NUMBER OF ENTRIES IN CURRENT MDOTC TABLE	
NOP	EQUAL TO NO + 1	
NOPT	ACCUMULATED NUMBER OF OPTIONS APPEARING IN A TIME-TABLE	
NSEN	NUMBER OF ENTRIES IN CURRENT EDGE TABLE	
NST	INPUT FLAG, NON-ZERO VALUE CALLING FOR RE-USE OF PREVIOUSLY INPUT SURFACE THERMOCHEMISTRY TABLES	
NTH	NUMBER OF TIME POINTS IN FUNCTIONS-OF-TIME TABLES (ACCUMULATED)	
NTI	INDEX USED TO COUNT ENTRIES IN PYROLYSIS GAS ENTHALPY TABLE	
PSV	SAVED TEST VALUE OF PRESSURE DURING INPUT OF SURFACE THERMOCHEMISTRY TABLES	ATM
RHR	TEMPORARILY REPLACES RHOC(K) OR RHOV(K) FOR CONVENIENCE	LB/FT3
RSVN	POSITIVE VALUE FOR RSV	INCHES

LIST OF FORTRAN VARIABLES APPEARING IN SUBROUTINE INPOUT

VARIABLE NAME	DESCRIPTION	UNITS
TCZSEN(I,J)	DERIVATIVE OF FROZEN EDGE GAS Z-ENTHALPY WITH RESPECT TO TEMPERATURE AT I TH EDGE TABLE POINT IN TABLE FOR J TH PRESSURE	BTU/ LB-DEG R
TSEN(I)	READ IN AS ENTHALPY IN FROZEN EDGE TABLES AND VALUE ENTHALPY IN SURFACE THERMOCHEMISTRY TABLES BUT LATER CONVERTED TO FROZEN EDGE ENTHALPY	BTU/LB
TSURF(I)	NAME OF SURFACE SPECIES FOR I TH TABLE ENTRY	
TZ	REFERENCE TEMPERATURE FOR HEAT OF FORMATION	DEG R
TZSEN(I,J)	Z-ENTHALPY TERM AT I TH ENTRY IN FROZEN EDGE TABLE FOR J TH PRESSURE	BTU/LB DEG R
VKM	FLOATING KM	
WLQ	UNEQUAL DIFFUSION EXPONENT	
WLS	SAVED TEST VALUE OF WLQ	

LIST OF FORTRAN VARIABLES APPEARING IN SUBROUTINE THERM

VARIABLE NAME	DESCRIPTION	UNITS
CN(I)	VALUE OF THERMAL CONDUCTIVITY OF THE I TH NODE	BTU/FT SEC DEG F
DEP(I,J)	J TH DEPTH OF THE I TH ISOTHERM IN THE BACKUP MATERIAL	IN
DIS	DISTANCE BETWEEN A THERMOCOUPLE LOCATION AND AN ADJACENT NODAL LOCATION FOR INTERPOLATION PURPOSES	FT
DIS2	INTERPOLATION QUANTITY WHICH ACCOUNTS FOR CONTACT RESISTANCE IN THE EVALUATION OF THE TEMPERATURE OF A THERMOCOUPLE AT AN INTERFACE	FT
I	LOOP INDEX	
IMNS	INTEGER USED IN SEARCHING FOR ISOTHERM LOCATION	
IPLS	INTEGER USED IN SEARCHING FOR ISOTHERM LOCATION	
ISO	NUMBER OF BACKUP NODE OR NUMBER OF BACKUP NODES + 1	
ISOT	CURRENT INDEX IDENTIFYING THE ISOTHERM TEMPERATURE	
J,K,L,M	TEMPORARY NODE IDENTIFIER OR LOOP INDEX	
N	NUMBER OF DEPTHS OF CURRENT ISOTHERM	
NISO(KI)	NUMBER OF DEPTHS OF THE KI TH ISOTHERM	
Q1	HEAT FLUX BETWEEN ADJACENT NODES OF DISSIMILAR MATERIALS. USED FOR INTERPOLATION IN ISOTHERM LOCATING LOGIC	BTU/FT2-SEC
RAISO(I)	DEPTH OF THE I TH NODE BELOW THE CURRENT SURFACE, I=1 IS THE LAST NODE OF MAIN MATERIAL	IN
RAT(I)	CONDUCTION RESISTANCE BETWEEN THE I TH NODE AND I+1 NODE	FT2-SEC-DEG-F/BTU
RH(I)	RELATIVE AREA OF THE I TH NODE (AS DEFINED IN CBM)	
T	TEMPERATURE OF CURRENT ISOTHERM	DEG R
T1	TEMPERATURE OF NODE ABOVE OR BELOW CURRENT ISOTHERM	DEG R

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE THERM

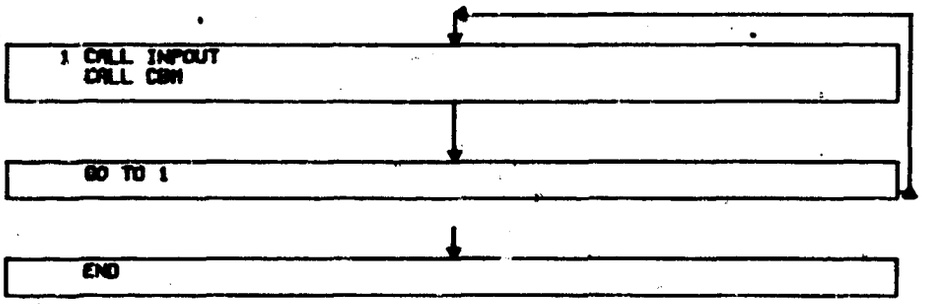
VARIABLE NAME	DESCRIPTION	UNITS
T2	TEMPERATURE OF NODE BELOW OR ABOVE CURRENT ISOTHERM	DEG R
TATMN(I)	TEMPERATURE OF THE I TH NODE, I=1 IS THE LAST NODE OF MAIN MATERIAL	DEG R
TIL	THE LOWER TEMPERATURE AT AN INTERFACE HAVING CONTACT RESISTANCE	DEG R
TIU	THE UPPER TEMPERATURE AT AN INTERFACE HAVING CONTACT RESISTANCE	DEG R
TU(I)	TEMPERATURE OF THE I TH THERMOCOUPLE OR DEPTH OF ISOTHERM IF ONLY ONE LOCATION OCCURS	DEG R OR IN

SECTION 3

FLOW CHARTS

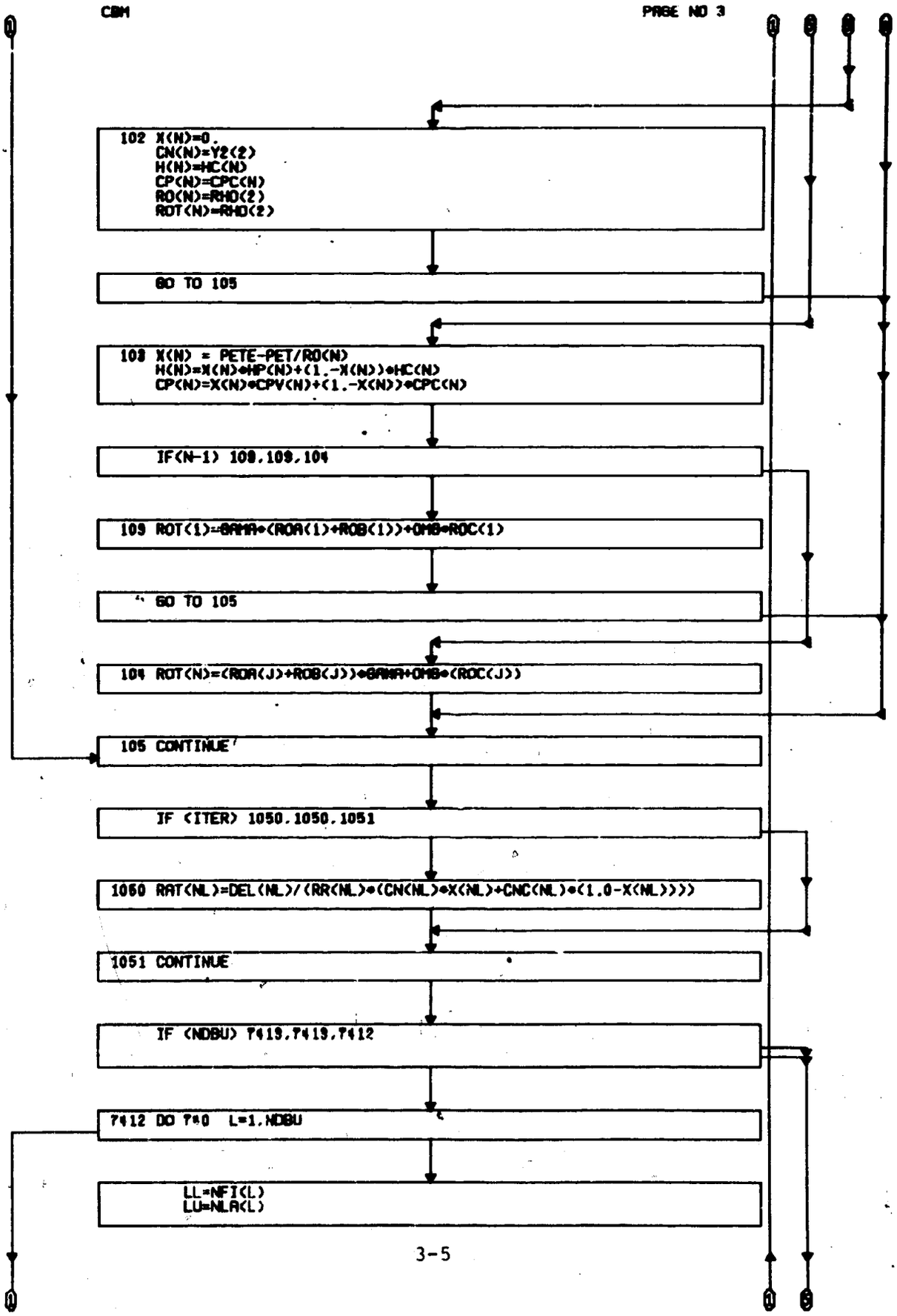
Computer generated flow charts were produced and are given in this section. The flow charts show transfers as lines on the right edge of the figures and DO-loop blocks as lines on the left edge of the figures. The order of presentation corresponds to that used in Section 2 for Fortran variables name definitions.

MAINLINE PAGE NO 1



```
      SUBROUTINE CBM
C     CHARRING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM ALLOWING
C     FOR UP TO FIVE DECOMPOSING BACK-UP MATERIALS
C     *****   SEE  CBM   LISTING FOR  COMMON       STATEMENTS   *****
C     *****                           DIMENSION    STATEMENTS   *****
C     *****                           EQUIVALENCE  STATEMENTS   *****
C     *****                           FORMAT       STATEMENTS   *****
C
C
      DNCP(3)=99999.
      KSCT=17
      SIG=.401E-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
      IAB=0
      ITS=0
      SA=0.0
      SNET=0.
      GSMT=0.0
      GSM2T=0.
      GSMS=0.
      CMD=0.0
      RSU=ABS(RSV)
      GS=0.0
      CMFL=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.
      PGPUT=0.
      DECOMT=0.
      DEDTT=0.
      QLOSST=0.
      TT=0.
      TB=0.
      SOEGR=0.
      GSEGR=0.
      PGPU=0.
      DECOM=0.
      EGO=0.
      HW=0.
      BR=0.
      KK=0
      TH=THZRO
      DTA=0.0
      THDS=THZRO-DTHIN
      THPRT=TH
      REWIND KSCT
      CALL LCOUNT (-2,LCT,NPG,RECORD(95))
      WRITE (KOUT,542)
      IS=0
      DTH=DTHIN
```

```
      DELCR=AMIN1(DEL(1),DELM)/5.0
      TSAVE=TA(1)+1.0
      FA=(1.-PSIA)*BA*(RHOOA**(1.-PSIA))
      FB=(1.-PSIB)*BB*(RHOOB**(1.-PSIB))
      FC=(1.-PSIC)*BC*(RHOOC**(1.-PSIC))
      REX=(1.0-.2*BREX)/(1.-BREX)
C
C     BEGINNING OF TIME LOOP
C
  410 ITER=ITER+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)
      ASU=RR(1)
      J=1-JFH-JF
  100 DO 105 N=1,NL
      J=J+JF
      RR(N)=RR(N)/ASU
      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) 103,101,102
  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 (ITER) 1050,1050,1051
1050 RAT(NL)=DEL(NL)/(RR(NL)*(CN(NL)*X(NL)+CNC(NL)*(1.0-X(NL))))
1051 CONTINUE
IF (NDBU) 7419,7419,7412
7412 DO 740 L=1,NDBU
LL=NFI(L)
LU=NLA(L)

```
      N=2*L-1

      DO 741    I=LL,LU

      CALL LOOK(20+2*L,TA(I),TT5(1,N),TCBU(1,N),TKBU(1,N),TENT(1,N)
C     , 0,Y2,D2,9)
      CN(I)=Y2(2)
      CPV(I)=Y2(1)
      HP(I)=Y2(3)+DHV(L)
      CALL LOOK(21+2*L, TA(I), TT5(1,2*L), TCBU(1,2*L), TKBU(1,2*L),
C     TENT(1,2*L), 0,Y2,D2,3)
      CNC(I)=Y2(2)
      CPC(I)=Y2(1)
      HC(I)=Y2(3)+DHC(L)
      H(I)=X(I)*HP(I)+(1.0-X(I))*HC(I)
      RR(I)=AREA(I)/ASU

      IF(ITER) 741,7411,741

7411  RO(I)=X(I)*RHOV(L)+(1.0-X(I))*RHOC(L)
      RON(I)=RO(I)
      RAT(I)= DEL(I)/(RR(I)*(CN(I)*X(I) + CNC(I)*(1.0 -X(I))))

741   CP(I)=X(I)*CPV(I)+(1.0-X(I))*CPC(I)

740   CONTINUE

7413  IF(NUMN-NBM2) 112,106,106

106   DO 107 N=NBM2,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=SIG*EPSW*(TA(NUMN)+TRES)*(TA(NUMN)**2+TRES**2)+HCONV
```

```
      RAT(NUMN+1)=1./(HRES+RR(NUMN)+.00000001)
      QLOSS=(TA(NL)-TA(NBM))/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL))
      QLOSST=QLOSST+QLOSS*DTH/AREA(1)*ASU
      CMT=CMT+RHO(2)*DSDT*ASU/AREA(1)*DTH
      DEL(NUMN + 1) = CN(NUMN)/(HRES + 0.00000001)
      RR(NUMN+1)=RR(NUMN)
      DTHO=DTH
      DTS=TSAVE-TA(1)
```

```
      IF(ITER) 151,606,151
```

```
C
C     OUTPUT
C
```

```
  151 CALL SSWTCH(4,KKSW)
```

```
      GO TO (3000,750),KKSW
```

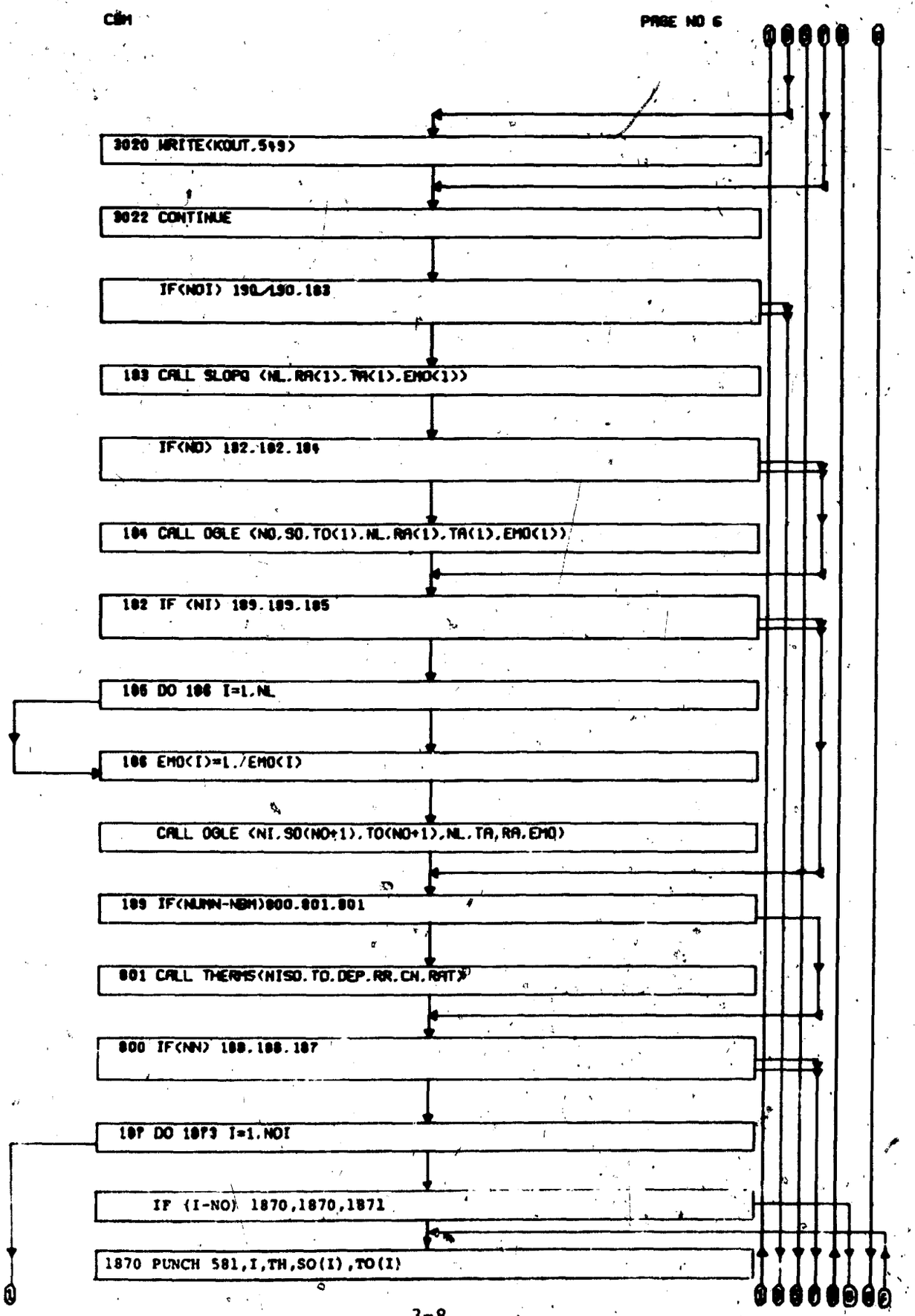
```
  750 IF (TH-THPRT+.00001) 4410,3000,3000
```

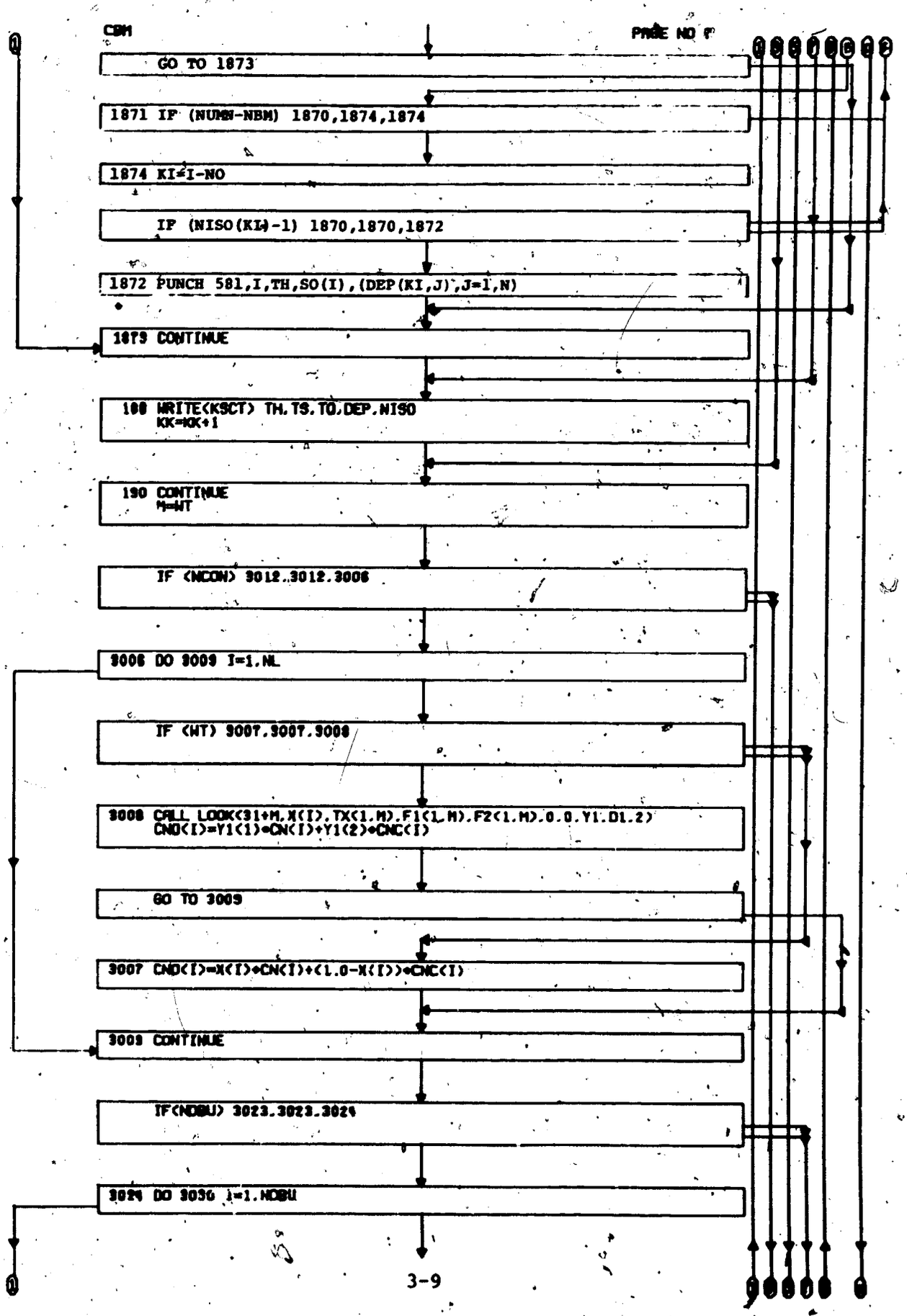
```
 3000 DIDT=12.0*DSDTB
      NDR=NBM-NL-1
      NLI=(NUMN-NDR+1)/2
      K=NLI
      CALL LCOUNT(33+NLI,LCT,NPG,RECORD(35))
  322 WRITE (KOUT,543)TH
      WRITE (KOUT,544)
      WRITE (KOUT,545) ITER,ITS,II    ,RSU,HW,HE,CH,BR
      WRITE (KOUT,546)
      WRITE (KOUT,547)
      BPRM=(GS  +CMD)/(CH+CMH)
      BPRMG=GS  /(CH+CMH)
      WRITE (KOUT,548) BPRM,BPRMG,CMD,GSMS,CMT,GSMT
      WRITE (KOUT,5480) CHCRI,PYCRI
      WRITE (KOUT,5481) SA,DIDT,CPE(1),DCDT,CPE(2),DPDT
      WRITE (KOUT,5482)
 3224 WRITE (KOUT,5483) QCONV,QRP,RAD,QCHEM,QCOND,QCONVT,QRPT,RADT,QCHEM
     1T,QCONDT
      WRITE (KOUT,5484)
      WRITE (KOUT,5485)PGPU,DECOM, TB,DEDT,QLOSS,PGPUT,DECOMT, TT,DEDTT,
     1QLOSST
```

```
      IF (NCON) 3020,3020,3021
```

```
 3021 WRITE(KOUT,5490)
```

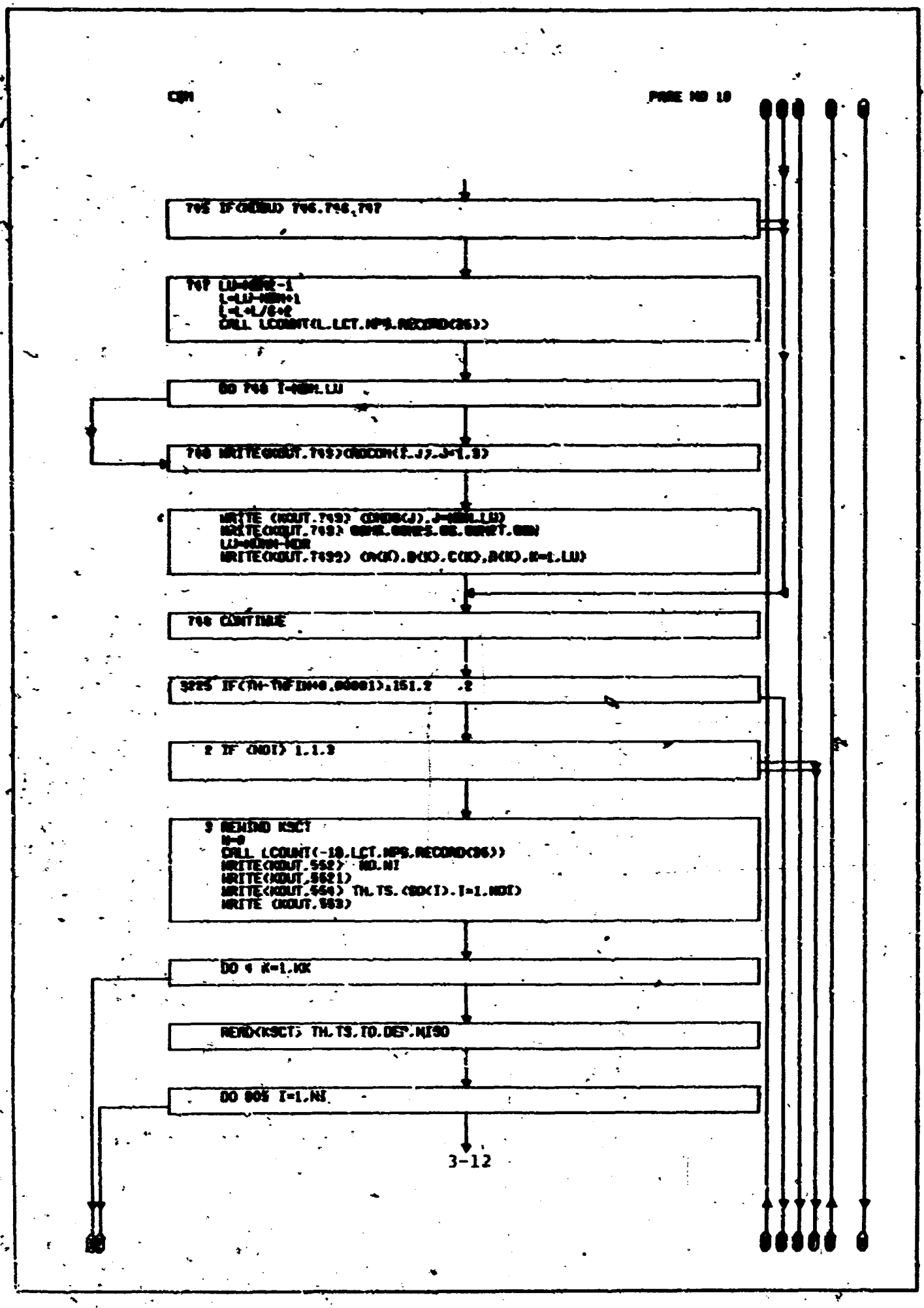
```
      GO TO 3022
```


3020 WRITE(KOUT,549)
3022 CONTINUE
IF(NOI) 190,190,183
183 CALL SLOPQ (NL,RA(1),TA(1),EMO(1))
IF(NO) 182,182,184
184 CALL OGLE (NO,SO,TO(1),NL,RA(1),TA(1),EMO(1))
182 IF (NI) 189,189,185
186 DO 186 I=1,NL
186 EMO(I)=1./EMO(I)
CALL OGLE (NI,SO(NO+1),TO(NO+1),NL,TA,RA,EMO)
189 IF(NUMN-NBM)800,801,801
801 CALL THERMS(NISO,TO,DEP,RR,CN,RAT)
800 IF(NN) 188,188,187
187 DO 1873 I=1,NOI
IF (I-NO) 1870,1870,1871
1870 PUNCH 581,I,TH,SO(I),TO(I)


CBM
PAGE NO 8
GO TO 1873
1871 IF (NUMB-NBM) 1870,1874,1874
1874 KI=I-NO
IF (NISO(KI)-1) 1870,1870,1872
1872 PUNCH 581,I,TH,SO(I),(DEP(KI,J),J=1,N)
1873 CONTINUE
100 WRITE(KSCT) TH,TS,TO,DEP,NISO
KK=KK+1
190 CONTINUE
M=WT
IF (NCON) 3012,3012,3006
3006 DO 3009 I=1,NL
IF (WT) 3007,3007,3008
3008 CALL LOOK(31+M,X(I),TX(1,M),F1(1,M),F2(1,M),0.0,Y1,D1,2)
CND(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)
GO TO 3009
3007 CND(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)
3009 CONTINUE
IF(NDBU) 3023,3023,3024
3024 DO 3030 I=1,NDBU

```
      LL=NFI(I)
      LU=NLA(I)
      L=NBUFT(I)

      DO 3025 J=LL,LU

      IF(L) 3026,3026,3027

3027  CALL LOOK(S1+L,X(J),TX(1,L),F1(1,L),F2(1,L),0.0,Y1,D1,2)
      CND(J)=Y1(1)*CN(J)+Y1(2)*CNC(J)

      GO TO 3025

3026  CND(J)=X(J)*CN(J)+(1.0-X(J))*CNC(J)

3025  CONTINUE

3030  CONTINUE

3023  IF(NUMN-NBM2) 3012,3020,3020

3020  DO 3029 I=NBM2,NUMN

3029  CND(I)=CN(I)

3012  CONTINUE

      DO 9011 J=1,NLI

      L=J

      IF (L-NL) 3002,3002,3001
```

```
3001 L=L+NBR
     K=NLI

     GO TO 3003

3002 IF (L+NLI-NL) 3003,3003,3005

3005 K=NLI+NBR

3008 N=MINS(NUMN,K+L)

     IF (NCOND) 3004,3004,3010

3004 WRITE (NOUT,550) (I,MATL(I),TA(I),RO(I),N(I), I=L,N,K)

     GO TO 3011

3010 WRITE(NOUT,5500)(I,MATL(I),TA(I),RO(I),CND(I),I=L,N,K)

3011 CONTINUE

     IF(SWELL) 3100,3101,3100

3100 SDNET=(1.+SWELL)*DIDT-SWELL*DCDT
     WRITE(NOUT,590) SNET,SDNET
 590 FORMAT(/10X,48HSURFACE RECESSION AFTER SWELL (INCHES)          = F8
    1.4/10X,48HSURFACE RECESSION RATE WITH SWELL (INCHES/SEC) =F8.4)

3101 CONTINUE
     CALL SWTCH(3,KKSW)

     GO TO (745,748),KKSW
```


CBM
PAGE NO 10
745 IF(NOBU) 746,746,747
747 LU=NOBU-1
L=LU-NOBU+1
L=L+L/6+2
CALL LCOUNT(L,LCT,NPS,RECORD(36))
DO 748 I=NOBU,LU
748 WRITE(KOUT,743)(ROCOM(I,J),J=1,3)
WRITE (KOUT,743) (CMDS(J),J=NOBU,LU)
WRITE(KOUT,743) GBMS,GBMPS,GS,GBMPT,GBN
LU=NOBU-NOR
WRITE(KOUT,7432) (A(K),B(K),C(K),D(K),K=1,LU)
748 CONTINUE
3225 IF(TH-THFIN+0.00001),151,2 ,2
2 IF (NOI) 1,1,3
3 REWIND KSCT
N=0
CALL LCOUNT(-18,LCT,NPS,RECORD(36))
WRITE(KOUT,552) NO,NI
WRITE(KOUT,5521)
WRITE(KOUT,554) TH,TS,(SD(I),I=1,NOI)
WRITE (KOUT,553)
DO 4 K=1,KK
READ(KSCT) TH,TS,TO,DEP,NISO
DO 805 I=1,NI

```
      IF(N-NISO(I)) 906,905,905

  908 N=NISO(I)

  906 CONTINUE

      CALL LCOUNT( 1 ,LCT,NPB,RECORD(36))

    9 WRITE (KOUT,554) TH,TS, (TO(I), I=1,NDI)

      IF(NUM-NEN) 1,902,902

  902 IF(NI-N) 1,1,903

  903 REWIND KSCT
      CALL LCOUNT(-1,LCT,NPB,RECORD(36))
      WRITE(KOUT,560)
      J=NDI+1
      WRITE(KOUT,1041) (BO(I),I=J,NDI)
      WRITE(KOUT,1042)
  560 FORMAT(/6X36HTHE FOLLOWING BLOCK GIVES THE OUTPUT TIME AND UP TO F
     1IVE LOCATIONS / 6X,5HOF THE INDICATED ISOTHERMS WITHIN THE BACKUP
     2 MATERIALS.)

      DO 804 K=1,NX

      READ(KSCT)TH,TS,TO,DEP,NISO

      DO 804 J=1,N

      CALL LCOUNT( 1,LCT,NPB,RECORD(36))

  804 WRITE(KOUT,554) TH,(DEP(I,J),I=1,NI)
```

```
      GO TO 1

1161 IF(TH-TPR2+0.00001)  154.150.150

 150 DTPRT=DTPR2
     DTPR2=DTPR3
     TPR2=TPR3
     TPR3=THFIN

 154 CONTINUE

     IF(TH-THPRT+.00001) 763.762.762

 762 THPRT=AMIN1(THPRT+DTPRT.TPR2)

 763 CONTINUE

4610 DTH=AMIN1(DTHB.DELCR/(DSDTD+.000000i).TH-THDS. 50.0/(ABS(TSAVE-TA(
     1i))+.1)*DTH)
     TSAVE=TA(1)
     DTH=(THPRT-TH)/(AINT((THPRT-TH)/DTH+1.0))
 144 TH=TH+DTH
C
C    FUNCTIONS OF TIME

 606 I=IR(1)
     VF=VFZ

 601 IF(TTH(I+1)-TH+0.00001) 614.604.604

 614 IF(I+1-IHI(1)) 602.604.604

 602 I=I+1

     IF(TTH(I+1)-TTH(I)) 601.603.601
```

```
603 TH=TH-DTH
    THDS=TTH(I)-DTHIN
    DTH=AMAX1(DTHIN,TTH(I)-TH)
    TH=TH+DTH

    GO TO 601

604 DEN=(TH-TTH(I))/(TTH(I+1)-TTH(I))

    IF (TTH(I+1)-TTH(I)) 6040,6040,605

6040 DEN=0.

605 CH=TCH(I)+DEN*(TCH(I+1)-TCH(I))
    BRA=TBR(I)+DEN*(TBR(I+1)-TBR(I))
    PRES=TPI(I)+DEN*(TPI(I+1)-TPI(I))
    HE=THE(I)+DEN*(THE(I+1)-THE(I))
    BRP=TBRP(I)+DEN*(TBRP(I+1)-TBRP(I))
    II=1

    IF(CH) 6001,6001,600

6001 II=2
     CH=0.0

     IF (HE-2.) 6002,6002,600

6002 II=3
     VF=HE
     HE=0.

600 IR(1)=I

    IF(ITER) 610,119,610

119 DEDT=0.
    ITER=1
```

```
      GO TO 3000

  610 IF(DTH-.000001) 162,162,608

  162 WRITE (KOUT,582) TH,DTH,DTHS,DTHB,THDS,DTS,DELCR,DSDTB
      TH=THFIN

      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)=RA(NL)+6.*DEL(NL)
      CPE(2)=CPE(1)
      IE=1
      ROOZ=0.0
      ISV=MATL(NL+1)
      MATL(NL+1)=MATL(NL)
      TA(NL+1)=TA(NBM)
      DEL(NL+1)=DEL(NBM)
      RR(NL+1)=RR(NBM)

      DO 252 I=1,NL

      DMDB(I)=0.0
      RON(I)=ROOZ
      DSS=FJF/DEL(I)*DSDT

  463 DO 255 J=J1,JF

      N=N+J1-1
```

```
      IF (J-JFHP) 253,259,253

259 IF (MATL(I)+MATL(I+1)-4) 263,260,263

263 IF(AMAX1(TA(I),TA(I+1))-TRACH)261,261,262

261 IF (MATL(I)+MATL(I)+MATL(I+1)-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
    DTA=(TA(I+1)-TA(I))/(FJFS+FJF/DEL(I)*DEL(I+1)/RR(I)*RR(I+1))
    J1=1
    TAS=TA(I)

264 N=N+1

    IF(ABS(DSB)-.000001) 1016,1016,1017

1016 DROAC=0.
     DROBC=0.
     DROCC=0.

     GO TO 1021

1017 IF(I-NL) 1015,1018,1015

1018 FK=FK-1.0
```

```
      IF(FK) 1019.1016.1020

1019 FK=FJF-1.0

1020 DSS=DSDT/DEL(I)*FK

1016 IF (N-1) 1115.1215.1115

1115 DRDAC=(ROA(N+1)-ROA(N))*DSS
     DRDBC=(ROB(N+1)-ROB(N))*DSS
     DRDCC=(ROC(N+1)-ROC(N))*DSS

     GO TO 1021

1215 IF(II-1) 1115.1315.1115

1315 DRDAC=(ROA(N+1)-RHORA)*DSS
     DRDBC=(ROB(N+1)-RHORB)*DSS
     DRDCC=(ROC(N+1)-RHORC)*DSS
     ROT(1)=RHO(2)

1021 TAS=TAS+DTA

     IF(TAS-TRACM) 227.227.229

229 IF(TAS  -TRACA) 201.201.202

201 DRDAT=0.0

     GO TO 2113
```

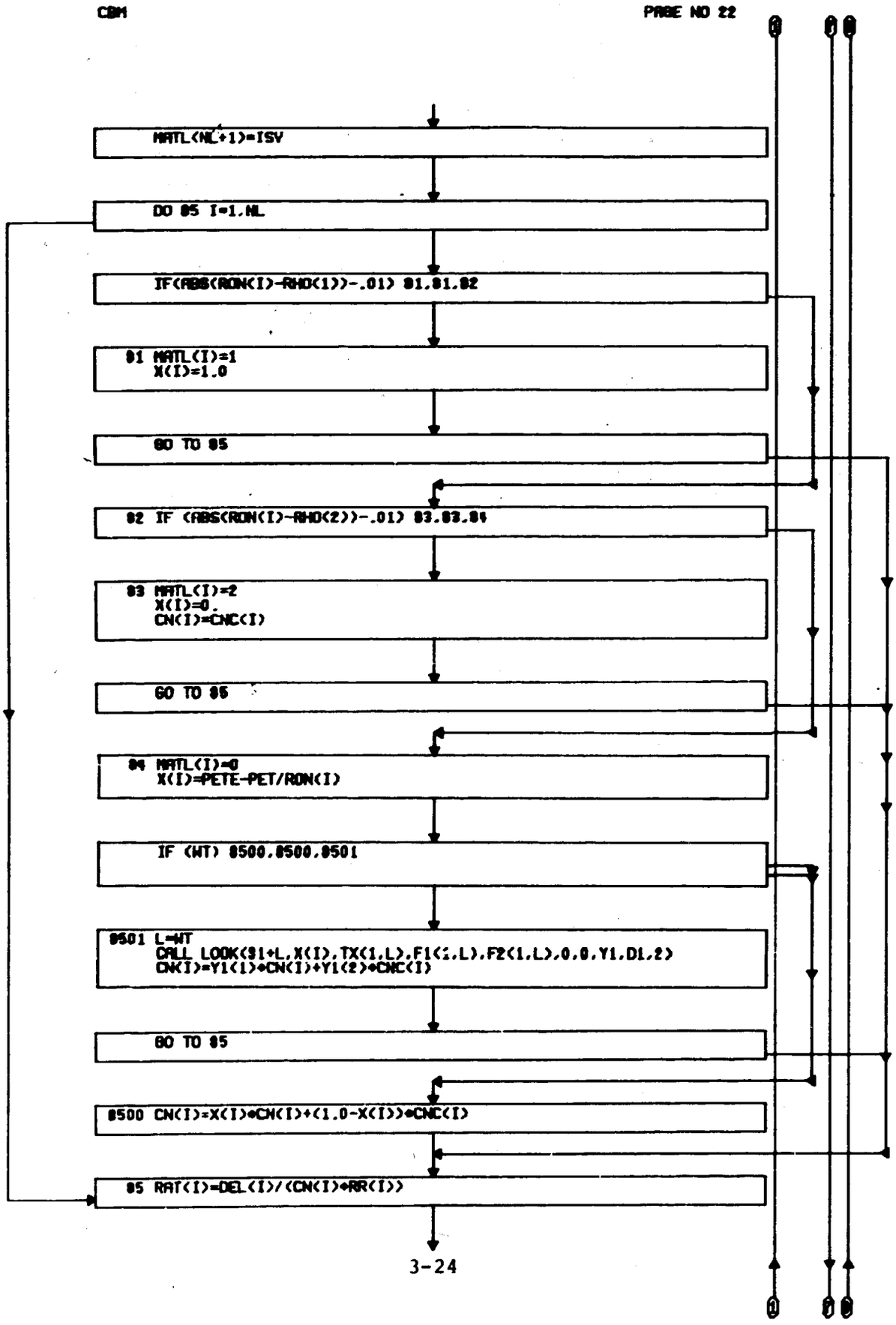
```
202 IF(RHORA-ROA(N)) 211,201,201

211 RD=ROA(N)-RHORA
    POW=1.-PSIA

    IF(POW)2111,2112,2111

2111 DROAT=(-RD+((RD**POW)-                    FA*EXP(-EA/TAS)*DTH)**
     1(1./POW))/DTH

    GO TO 2113

2112 DROAT=RD*(EXP(-BA*DTH*EXP(-EA/TAS))-1.)/DTH

2113 ROA(N)=ROA(N)+(DROAT+DROAC)*DTH

    IF(ROA(N)-RHORA) 2114,221,221

2114 ROA(N)=ROA(N)-(DROAT+DROAC)*DTH
     DROAT=(RHORA-ROA(N))/DTH-DROAC
     ROA(N)=RHORA

221 IF(TAS  -TRACB)203,203,204

203 DROBT=0.0

    GO TO 2133

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=RD*(EXP(-BB*DTH*EXP(-EB/TAS))-1.)/DTH

2133  ROB(N)=ROB(N)+(DROBT+DROBC)*DTH

      IF(ROB(N)-RHORB) 2134,223,223

2134  ROB(N)=ROB(N)-(DROBT+DROBC)*DTH
      DROBT=(RHORB-ROB(N))/DTH-DROBC
      ROB(N)=RHORB

223   IF(TAS  -TRACC) 205,205,206

205   DROCT=0.0

      GO TO 2153

206   IF(RHORC-ROC(N))215,205,205

215   RD=ROC(N)-RHORC
      POW=1.-PSIC

      IF (POW) 2151,2152,2151

2151  DROCT=(-RD+((RD**POW)-                    FC*EXP(-EC/TAS)*DTH)**
      1(1./POW))/DTH

      GO TO 2153
```

```
2152 DROCT=RD*(EXP(-BC*DTH*EXP(-EC/TAS))-1.)/DTH

2153 ROC(N)=ROC(N)+(DROCT+DROCC)*DTH

     IF(ROC(N)-RHORC) 2154,225,225

2154 ROC(N)=ROC(N)-(DROCT+DROCC)*DTH
     DROCT=(RHORC-ROC(N))/DTH-DROCC
     ROC(N)=RHORC

 225 DMDG(I)=DMDG(I)-DEL(I)*((DROAT+DROBT)*GAMA+OMG*DROCT)

 227 DNS=(ROA(N)+ROB(N))*GAMA+OMG*ROC(N)
     RON(I)=RON(I)+DNS

     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))*12.+RA(I)

     IF(ABS(DNS-DENOLD)-1.0E-20) 2254,2253,2253

2253 CPE(IE)= CPE(IE)-DEL(I)/(DNS-DENOLD)*(DNS-DNCP(IE))/FJF*12.0

2254 CPE(IE)=AMAX1(CPE(IE),SA)
     IE=IE+1

2253 DENOLD=DNS

 255 TAS=TAS+DTA

 264 DMDG(I)=DMDG(I)/FJF*RR(I)
```

```
      RDN(I)=RDN(I)/FJF

      IF(I-1) 257,257,254

257   FJF=FJFS
      DTA=DTA/DEL(1)+DEL(2)/2.+RR(2)

      GO TO 252

254   DTA=DTA/DEL(I)+DEL(I+1)/RR(I)+RR(I+1)

252   CONTINUE

      IF (NDBU) 2522,2522,2523

2523  DO 700  I=1,NDBU

        GAM=GA(I)
        OMGAM=1. -GAM
        LL=NFI(I)
        LU=NLA(I)
        TRACMI=AMIN1(TRAC(I,1), TRAC (I,2), TRAC(I,3))

      DO 702    J=LL,LU

        DMDG(J)=0.

      IF(TA(J)-TRACMI) 702,702,703

703   DO 709 K=1,3

      IF(TA(J)-TRAC(I,K)) 705,705,706
```

```
705     DROT(K)=0.

        GO TO 709

706     RD=ROCOM(J,K)-RHOR(I,K)

        IF(RD-0.01) 705,705,7060

7060    F=FF(I,K)
        E=EE(I,K)
        POW=1.-PSI(I,K)

        IF(POW) 707,708,707

707     DROT(K)=(-RD+((RD**POW)-F*EXP(-E/TR(J))*DTH)**(1./POW))/DTH

        GO TO 709

708     BF=BBB(I,K)
        DROT(K)=RD*(EXP(-BF*DTH*EXP(-E/TR(J)))-1.)/DTH

709     ROCOM(J,K)=ROCOM(J,K)+DROT(K)*DTH

        DMDG(J)=-DEL(J)*((DROT(1)+DROT(2))*GAM+OMGAM*DROT(3))/RR(J)
701     RON(J)=(ROCOM(J,1)+ROCOM(J,2))*GAM+OMGAM*ROCOM(J,3)

702 CONTINUE

700 CONTINUE

C       NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES

2522 J=JFHP
```


MATL(NL+1)=ISV
DO 85 I=1,NL
IF(ABS(RON(I)-RHO(1))-.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 L=WT
CALL LOOK(81+L,X(I),TX(1,L),F1(1,L),F2(1,L),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))

```
      IF (NDBU) 7121,7121,7122

7122 DO 710  I=1,NDBU

        LL=NFI(I)
        LU=NLA(I)

      DO 711    J=LL,LU

      IF(ABS(RON(J)-RHOV(I))-.01) 712,712,713

 712    MATL(J)= 20+2*I
        X(J)=1.0

      GO TO 716

 713  IF(ABS(RON(J)-RHOC(I))-.01) 714,714,715

 714    MATL(J)=21+2*I
      X(J)=0.
      RON(J)=RHOC(I)
      CN(J)=CNC(J)

      GO TO 716

 715    MATL(J)=0
        X(J)=P(I)-PP(I)/RON(J)

      IF(NBUFT(I)) 7151,7151,7150

7150 L=NBUFT(I)
      CALL LOOK(91+L,X(J),TX(1,L),F1(1,L),F2(1,L),0,0,Y1,D1,2)
      CN(J)=Y1(1)*CN(J)+Y1(2)*CNC(J)

      GO TO 716
```

```
7151 CONTINUE
        CN(J)=X(J)*CN(J)+(1.0-X(J))*CNC(J)

718     RAT(J)=DEL(J)/(CN(J)*RR(J))

711 CONTINUE

710 CONTINUE

7121 GSM= 0.0

     DO 122 I=1,NL

122 GSM=GSM+DMDG(I)

     GSMG=GSM
     GSMT=GSMT+GSMS*RSU/AREA(1)*DTH
        GSM2=0.

     IF (NDBU)  7180,7180,7181

7181 DO 717  I=1,NDBU

        LL=NFI(I)
        LU=NLA(I)

     DO 718     J=LL,LU

718     GSM2=GSM2+DMDG(J)

717 CONTINUE

7180 GSM2S=GSM2
```

```
      GSM2T=GSM2T+GSM2S*ABU/AREA(1)*DTH
      GS=GSM1+GSM2S
      GSM=GS
   DCDT=(CPE(1)-COLD)/DTH
   DPDT=(CPE(2)-POLD)/DTH
C
C     CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS
C     AND INTERNAL ENERGY RATE TERMS
C  MAIN BLOCK
   DVB=0.
   SOEGR=0.
   GSEGR=0.
   TB=0.
   RAT(1)=2.*RAT(1)
   CPNL=CP(NL)
   NLM=NL-1
   IMIN=0
```

```
   DO 30 I=IMIN,NLM
```

```
   IF (I) 15,15,14
```

```
14 GSM=GSM-DMDG(I)
   DRODTD=-DMDG(I)/(RR(I)*DEL(I))
   FACT1=DTH/(DEL(I)*RR(I))
   FACT2=GSM/(DEL(I)*RR(I))
   A(I)=-FACT1*DVB
   DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))
   TERM2=RON(I)*CP(I)-DTH*(CPGAS*(DRODTD-FACT2)
  1          -DSDT*RO1*CP1/DEL(I))
   TERM1=FACT1*DVB
   B(I)=TERM2-A(I)+TERM1
   C(I)=-TERM1
   D(I)=TA(I)*TERM2+(HGAS*DRODTD-HBAR*(RON(I)
  1       -RO(I))/DTH-FACT2*HGAS-DSDT*RO1*H1/DEL(I))*DTH
```

```
15 RO1=ROT(I+1)
   X1=PETE-PET/RO1
   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=-RO1*HBAR+RO1*H1+T
   HBAR=PETE*HP(I+1)-PET/RHO(1)*HC(I+1)
   T=-RO1*H1+RO1*HBAR
20 CALL LOOK (2,TA(I+1),TT1,THG,0.0,0.0,HGAS,CPGAS,1)
   HGAS=HGAS+DELHG
   GSEGR=GSEGR+HGAS*DMDG(I+1)
   SOEGR=SOEGR+HBAR*DMDG(I+1)
```

```
   IF (I) 24,24,25
```

```
24 EGO=GSMS*HGAS
   HW=HGAS
```

```
   GO TO 30
```

```
   25 TERM3=(-FACT2*CPGAS-DSDT*RO1*CP1/DEL(I))*DTH
      C(I)=C(I)+TERM3
      D(I)=D(I)+TA(I+1)*TERM3+(FACT2*HGAS+DSDT*RO1*H1/DEL(I))*DTH
      TB=TB-TN*DSDT*RR(I)

   30 CONTINUE

      A(1)=DTH/DEL(1)
      TT=TT+TB*DTH/AREA(1)*ASU
C     NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT
      DROOTD=-DMDG(NL)/(RR(NL)*DEL(NL))
      FACT1=DTH/(DEL(NL)*RR(NL))
      A(NL)=-FACT1*DVB
      DVB=1.0/(0.5*(RAT(NL)+RAT(NBM))+RC(NL)/RR(NL))
      C(NL)=-FACT1*DVB
      TERM2=RON(NL)*CP(NL)-(CPGAS*DROOTD+(DSDT/DEL(NL))*
     1        (RO (NL)*CPNL  -RO1*CP1))*DTH
      B(NL)=TERM2-C(NL)-A(NL)
      D(NL)=TA(NL)*TERM2+DTH*(HGAS*DROOTD-HBAR*(RON(NL)-
     1        RO(NL))/DTH+DSDT*(RO (NL)*H(NL)-RO1*H1)/DEL(NL))
      K = NL
      GSM=GSM-DMDG(NL)

      IF(NDBU) 7170,7171,7170

 7170 FACT2=GSM/(DEL(NL)*RR(NL))
      TERM2=FACT2*CPGAS*DTH
      B(NL)=B(NL)+TERM2
      D(NL)=D(NL)+TA(NL)*TERM2-FACT2*HGAS*DTH
      CALL LOOK(2,TA(NBM),TT1,THG,0,0,0,HGAS,CPGAS,1)
      HGAS=HGAS+DELHG
      C(NL)=C(NL) -FACT2*CPGAS*DTH
      D(NL)=D(NL)-TA(NBM)*FACT2*CPGAS*DTH+FACT2*HGAS*DTH

 7171 CONTINUE
C-----NOW FOR DECOMPOSING BACK-UPS IF ANY

      IF (NDBU) 7250,7250,7251

 7251 DO 720  L=1,NDBU

      LL=NFI(L)-1
      LU=NLA(L)

      DO 7241  I=LL,LU
```

```
      IF(I-NFI(L)+1) 725,726,725

725   GSM=GSM-DMDG(I)
    DVBS=DVB
      K=K+1
      DRODTD=-DMDG(I)/(RR(I)*DEL(I))
      FACT1=DTH/(DEL(I)*RR(I))
      FACT2=GSM/(DEL(I)*RR(I))
      A(K)=-FACT1*DVB
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))
      TERM2=RON(I)*CP(I)-DTH*(CPGAS*(DRODTD-FACT2))
      TERM1=FACT1*DVB
      B(K)=TERM2-A(K)+TERM1
      C(K)=-TERM1
      D(K)=TA(I)*TERM2+(HGAS*DRODTD-HBAR*(RON(I)-RO(I))/DTH
C     -FACT2*HGAS)*DTH

      IF(I-NLA(NDBU)) 726,727,727

726   CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))
    HBARS=HBAR
      HBAR=P(L)*HP(I+1)-PP(L)/RHOV(L)*HC(I+1)
    CALL LOOK (2,TA(I+1), TT1,THG,0,0,0,HGAS,CPGAS,1)
      HGAS=HGAS+DELHG

      IF(I-NFI(L)+1) 724,724,727

727   TERM3= (-FACT2*CPGAS)*DTH
      C(K)=C(K)+TERM3
      D(K)=D(K)+TA(I+1)*TERM3+FACT2*HGAS*DTH

724 CALL SSWTCH(5,KKSW)

      GO TO (7240,7241),KKSW

7240 WRITE(KOUT,7270) I,K,L,DEL(I),RR(I),CP(I),CPV(I),CPC(I),HP(I),
    1HC(I),CN(I),RAT(I),RO(I),RON(I),X(I),DMDG(I),DRODTD,P(L),PP(L),
    2HGAS,CPGAS,DVB,DVBS,HBAR,HBARS,GSM,FACT1,FACT2,TERM1,TERM2,TERM3,
    3GA(L),OMGA(L),A(K),B(K),C(K),D(K)
7270 FORMAT(5X,3I5,10E10.3/(20X,10E10.3))

7241 CONTINUE

720 CONTINUE
```

```
C     NOW FOR BACK UPS IF ANY

7250 IF(NUMN-NBM2) 60.40.40

   40 DO 50 I=NBM2.NUMN

      K=K+1
      FACT1=DTH/(DEL(I)*RR(I))
      A(K) = -FACT1*DVB
      DVB=1.0/(0.5*(RAT(I)+RAT(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)*RD(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)*A(L+1)

      B(1)=B(1)/A(1)
      D(1)=D(1)/A(1)
      PGPU=E80-GBEGR
      PGPUT=PGPUT+PGPU*DTH/AREA(1)*ASU
      DECOM=GSEGR-SOEGR
```

```
      DECOMT=DECOMT+DECOM*DTH/AREA(1)+ASU
C
C     SURFACE BOUNDARY CONDITION PACKAGE
C
      CHZ=CH
      XP1=X(1)
      ITL=10
      ITS=1
      SNET=(1.+SWELL)*SA-SWELL*CPE(1)
```

```
      IF(II-2) 2502.1420.2501
```

```
 1420 DSDTB=QRA/12000.0
      TR(1)=HE
      HE=0.
      HH=0.0
      BR=0.0
      CHD=DSDTB*((ROA(1)+ROB(1))*GAMA+ROC(1)*OMB)
      RAD=0.
      QRA=0.
      QCHEM=0.
      QCONV=0.
```

```
      GO TO 1437
```

```
 2501 TABC=90008.0
      DSDTB=0.
      ERFX=O(1)
      QCHEM=0.
      QCONV=0.
```

```
      GO TO 2503
```

```
 2502 IF (NR) 1424.1424.1425
```

```
 1425 CH=CH/((1+SNET/ABS(RSV))**REX)
      CHZ=CH
```

```
 1424 GO TO (1427.1428).NFIS
```

```
 1427 BF=(CHD-CHFL+BSMS)/CH
```

```
      GO TO 1429
```

```
1420 BF=(CMD-CMFL)/CH

1429 CONTINUE
     PHI=2.*BMP*BF

     IF(PHI-.01)1422,1422,1423

1422 CH=CH*(1.-.5*PHI)

     GO TO 1426

1423 CH=CH/(EXP(PHI)-1.)*PHI

1426 GO TO (14260,14261),NFIS

14260 CH=AMAX1(CH,GS/AMAX1(TMG(1),TMG(NMG)))

14261 CONTINUE
      ERFX=CH*HE*D(1)
      CALL LOOK (12,GS  /(CH*CMH),TMG,0,0,0,0,Y2,D2,0)
      IMG=IR(12)
      VRM=VR
      IPR=1

      IF(NPR-1) 2510,2510,2511

 2511 CALL LOOK(13,PRES,TPR,0,0,0,0,Y2,D2,0)
      IPR=IR(13)
      ILO(16)=NLO(IMG,IPR+1)
      IHI(16)=NHI(IMG,IPR+1)
      ILO(17)=NLO(IMG+1,IPR+1)
      IHI(17)=NHI(IMG+1,IPR+1)
      VRP=VR
      I3=ILO(16)
      I4=ILO(17)

 2510 ILO(14)=NLO(IMG,IPR)
      IHI(14)=NHI(IMG,IPR)
      ILO(15)=NLO(IMG+1,IPR)
      IHI(15)=NHI(IMG+1,IPR)
      I1=ILO(14)
```

```
      I2=ILO(15)

      IF(NPR-1) 2512,2512,2513

2513  IF(IHI(17)-I4) 420,420,2514

2514  IF(IHI(16)-I3) 420,420,2512

2512  IF(IHI(14)-I1) 420,420,2504

2504  IF(IHI(15)-I2) 420,420,2505

2505  TABC=TTS(I1,IMG,IPR)+VRM*(TTS(I2,IMG+1,IPR)-TTS(I1,IMG,IPR))

      IF(NPR-1) 2503,2503,2515

2515  TABC=TABC+VRP*(TTS(I3,IMG,IPR+1)+VR*(TTS(I4,IMG+1,IPR+1)-TTS(I3,IM
     1G,IPR+1))-TABC)

2503  IF(TSAVE-TABC) 420,420,421

C     ---------- ABLATING SURFACE

 421  IF(IAB) 422,422,423

 422  CMDL=TLMC(I1,IMG,IPR)-VR*(TLMC(I1,IMG,IPR)-TLMC(I2,IMG+1,IPR))
      CMD=EXP(CMDL)*CH
      IAB=1

 423  CALL LOOK(14,CMDL,TLMC(1,IMG,IPR),TTS(1,IMG,IPR),TCHEM(1,IMG,IPR),
     1TBPF(1,IMG,IPR),0,Y2(1),Y2(4),3)
```

```
      IMP=IR(14)
      CALL LOOK(16,CMOL,TLMC(1,IMG+1,IPR),TTS(1,IMG+1,IPR),TCHEM(1,IMG+1
     1,IPR),TBPF(1,IMG+1,IPR),0,Y2(7),Y2(10),3)
      IMD=IR(15)

      IF(NPR-1) 4230,4230,4231

4231  CALL LOOK(16,CMOL,TLMC(1,IMG,IPR+1),TTS(1,IMG,IPR+1),TCHEM(1,IMG,I
     1PR+1),TBPF(1,IMG,IPR+1),0,Y2(13),Y2(16),3)
      IMC=IR(16)
      CALL LOOK(17,CMOL,TLMC(1,IMG+1,IPR+1),TTS(1,IMG+1,IPR+1),TCHEM(1,I
     1MG+1,IPR+1),TBPF(1,IMG+1,IPR+1),0,Y2(19),Y2(22),3)
      IMD=IR(17)

      DO 4232 I=1,12

4232  Y2(I)=Y2(I)+VRP*(Y2(I+12)-Y2(I))

      IF(NBPF) 4237,4237,4230

4230  IF(VRP-1.) 4234,4234,4235

4235  Y2(3)=Y2(15)
      Y2(9)=Y2(21)

      GO TO 4237

4234  IF(VRP) 4236,4237,4237

4236  Y2(3)=(Y2(3)-Y2(15)*VRP)/(1.-VRP)
      Y2(9)=(Y2(9)-Y2(21)*VRP)/(1.-VRP)

4237  CONTINUE

4233  DO 426 I=1,6
```

```
426 Y2(I)=Y2(I)+VRM*(Y2(I+6)-Y2(I))

    IF(Y2(1)) 4260,4260,4261

4260 ITL=ITS

    GO TO 4366

4261 CONTINUE
    CALL LOOK(9,Y2(1),TT2(1,2),TEP(1,2),0.0,0.EMIV,DMIV,1)

    IF(MATL(1)-2) 428,427,428

428 CALL LOOK(9,Y2(1),TT2(1,1),TEP(1,1),0.0,0.Y3,D3,1)
    EMIV=EMIV+XP1*(Y3-EMIV)
    DMIV=DMIV+XP1*(D3-DMIV)

427 TSSQ=Y2(1)*Y2(1)
    TS=Y2(1)
    RAD=SIG*EMIV*TSSQ*TSSQ*VF
436 ERR=CH*Y2(2)+EMIV*QRA-RAD-B(1)*TS+ERFX
    DERR=CH*Y2(5)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))*Y2(4)
    ERRC=ERR/DERR
    VITER(ITS)=CHDL
    EITER(ITS)=ERR
    CHDL=CHDL-ERRC
    CHMI=-1.E+30
    CHMA=+1.E+30

    IF(ILO(16)-IRA) 4361,4363,4363

4361 IF(ILO(16)-IRB) 4362,4363,4363

4362 IF(NPR-1) 4270,4270,4271

4271 IF(ILO(16)-IRC) 4272,4363,4363
```

```
4272 IF(ILD(17)-IRD) 4273,4363,4363

4273 CMMI=AMAX1(TLMC(IRD,IMB+1,IPR+1)+TLMC(IRD-1,IMB+1,IPR+1),TLMC(IRC,
     1IMB,IPR+1)+TLMC(IRC-1,IMB,IPR+1))

4270 CMMI=AMAX1(CMMI,TLMC(IRA,IMB,IPR)+TLMC(IRA-1,IMB,IPR),TLMC(IRB,IMB
     1+1,IPR)+TLMC(IRB-1,IMB+1,IPR))/2.
      CMDL=AMAX1(CMDL,CMMI)

4363 IF(IHI(14)-IRA-1) 4366,4366,4364

4364 IF(IHI(15)-IRB-1) 4366,4366,4274

4274 IF(NPR-1) 4275,4275,4276

4276 IF(IHI(16)-IRC-1) 4366,4366,4277

4277 IF(IHI(17)-IRD-1) 4366,4366,4278

4278 CMMA=AMIN1(TLMC(IRD+1,IMB+1,IPR+1)+TLMC(IRD+2,IMB+1,IPR+1),
     1TLMC(IRC+2,IMB,IPR+1))

4275 CMMA=AMIN1(CMMA,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,CMMA)

      IF(ITS-ITL-1) 4366,4351,4352

4351 ERRS=ERR
      CMDL=CMMA

      GO TO 4367
```

```
4352 IF(ERR+ERRS) 4354,4367,4353

4353 CMDL=CMMA

     GO TO 4367

4354 ITL=55

     IF(ERRC) 4355,4367,4367

4355 CMDL=CMMI

     GO TO 4367

4356 IF(ITS-ITL) 4367,4356,4367

4366 CMDL=AMIN1(TLMC(I1,IMG,IPR),TLMC(I2,IMG+1,IPR))

     IF(NPR-1) 4367,4367,4279

4279 CMDL=AMIN1(CMDL,TLMC(I3,IMG,IPR+1),TLMC(I4,IMG+1,IPR+1))

4367 CMD=EXP(CMDL)*CH*CMH

     IF(ITS-50) 440,440,998

 440 ITS=ITS+1

     IF(ABS(ERR )-1.  ) 4372,4372,429
```

```
C     ---------- NON-ABLATING SURFACE

 420 TS=TSAVE
     IAB=0
     CMD=0.0

 430 IF(II-3) 4302,433,4302

4302 ILO(18)=1
     IHI(18)=KHI(IMG,IPR)
     ILO(19)=1
     IHI(19)=KHI(IMG+1,IPR)
     CALL LOOK (18,TS,TTS(1,IMG,IPR),TCHEM(1,IMG,IPR),0,0,0,Y2(1),Y2(2)
    1,1)
     CALL LOOK (19,TS,TTS(1,IMG+1,IPR),TCHEM(1,IMG+1,IPR),0,0,0,Y2(3),
    1Y2(4),1)

     IF(NPR-1) 4322,4322,4303

4303 ILO(20)=1
     IHI(20)=KHI(IMG,IPR+1)
     ILO(21)=1
     IHI(21)=KHI(IMG+1,IPR+1)
     CALL LOOK (20,TS,TTS(1,IMG,IPR+1),TCHEM(1,IMG,IPR+1),0,0,0,Y2(5),
    1Y2(6),1)
     CALL LOOK (21,TS,TTS(1,IMG+1,IPR+1),TCHEM(1,IMG+1,IPR+1),0,0,0,
    1Y2(7),Y2(8),1)

     DO 4321 I=1,4

4321 Y2(I)=Y2(I)+VRP*(Y2(I+4)-Y2(I))

4322 DO 4323 I=1,2

4323 Y2(I)=Y2(I)+VRM*(Y2(I+2)-Y2(I))

 435 CALL LOOK (4,TS,TT2(1,2),TEP(1,2),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,Y3,D3,1)
    EMIV=EMIV+XP1*(Y3-EMIV)
    DMIV=DMIV+XP1*(D3-DMIV)

442 TSSQ=TS*TS

    IF(II-3) 4422,4421,4422

4421 IF (EMIV) 4422,4423,4422

4423 EMIV=1.0

4422 RAD=SIG*EMIV*TSSQ*TSSQ*VF
439 ERR=CH*Y2(1)+EMIV*QRA-RAD-B(1)*TS+ERFX
    DERR=CH*Y2(2)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))
    ERRC=ERR/DERR
    VITER(ITS)=TS
    EITER(ITS)=ERR
    TS=TS-ERRC

    IF(II-3) 4391,4507,4507

4391 TSMI=-1.E+30
    TSMA=+1.E+30
    IRA=IR(18)
    IRB=IR(19)
    IRC=IR(20)
    IRD=IR(21)

    IF(ILO(18)-IRA) 4500,4501,4501

4500 IF(ILO(19)-IRB) 4502,4501,4501

4502 IF(NPR-1) 4503,4503,4504
```

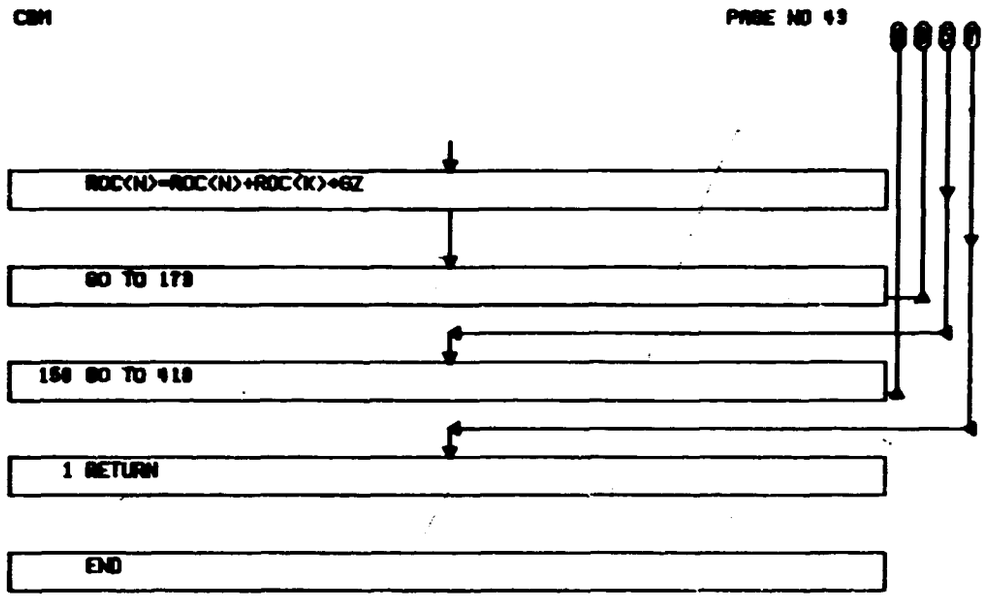
```
4504 IF(ILO(20)-IRC) 4505,4501,4501

4505 IF(ILO(21)-IRD) 4506,4501,4501

4506 TSMI=AMAX1(TTS(IRD,IMB+1,IPR+1)+TTS(IRD-1,IMB+1,IPR+1),TTS(IRC,
    1IMB,IPR+1)+TTS(IRC-1,IMB,IPR+1))

4509 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) 4507,4507,4508

4508 IF(IHI(19)-IRB-1) 4507,4507,4509

4509 IF(NPR-1) 4510,4510,4511

4511 IF(IHI(20)-IRC-1) 4507,4507,4512

4512 IF(IHI(21)-IRD-1) 4507,4507,4513

4513 TSMA=AMIN1(TTS(IRD+1,IMB+1,IPR+1)+TTS(IRD+2,IMB+1,IPR+1),
    1TTS(IRC+1,IMB,IPR+1)+TTS(IRC+2,IMB,IPR+1))

4510 TSMA=AMIN1(TSMA,TTS(IRB+1,IMB+1,IPR)+TTS(IRB+2,IMB+1,IPR),
    1TTS(IRA+1,IMB,IPR)+TTS(IRA+2,IMB,IPR))/2,
     TS=AMIN1(TS,TSMA)

4507 CONTINUE

     IF(ITS-60) 441,441,900
```

```
441 ITS=ITS+1

    IF(ABS(ERR )-1.  ) 4390,4390,430

998 WRITE (KOUT,529)
    WRITE(KOUT,502)(VITER(I),EITER(I),I=1,51)
    WRITE(KOUT,502) TH,DTH,VRM,ERFX,TABC,ENIV,DNIV,RAD,B(1),CH,PHI,
   1 D(1),HE,XP1,GRA,Y2(1),Y2(2),Y2(3),Y2(4)
    TH=THFIN

    GO TO 3000

C       ---------- POST ITERATION

4390 IF(II-2) 4371,4371,1437

4371 Y2(2)=Y2(1)

4372 GCHEM=Y2(2)

    IF(ISEN(1))4373,4374,4373

4374 GCONV=0.

    GO TO 1439

4373 CALL OBLE(1,TS,GCONV,ISEN(IPR),TTSEN(1,IPR),THSEN(1,IPR),TCPSEN(1,
   1IPR))

    IF(NPR-1) 1439,1439,1438

1438 CALL OBLE(1,TS,GC   ,ISEN(IPR+1),TTSEN(1,IPR+1),THSEN(1,IPR+1),TCP
   1SEN(1,IPR+1))
```

```
      QCONV=QCONV+VRP*(QQ-QCONV)

1439  QCHEM=(QCHEM+QCONV)*CH
      HW=QCONV
      QCONV=CH*(HE-QCONV)
      DSDTB=CMD/RHO(2)

      IF(NBPF) 1437,1437,4375

4375  IF(IAB) 1437,1437,4376

4376  CMFL=EXP(Y2(3))*CH*CMH

1437  RO(1)=RON(1)
      BR=CH/CHZ
      QRP=EMIV*QRA
      QCOND=-D(1)+B(1)*TA(1)
      QCONVT=QCONVT+QCONV*DTH/AREA(1)*ASU
      QCHEMT=QCHEMT+QCHEM*DTH/AREA(1)*ASU
      QCONDT=QCONDT+QCOND*DTH/AREA(1)*ASU
      QRPT=QRPT+QRP*DTH/AREA(1)*ASU
      RADT=RADT+RAD*DTH/AREA(1)*ASU
      DEDT=RON(I)*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) 97,96,96

   96 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

      IF(NDBU) 755,756,755

  755 LL=NFI(1)
      LU=NLA(NDBU)

      DO 757 I=LL,LU

  757 RO(I)=RON(I)

  756 CONTINUE
C
C     SHRINK (AND DROP) OF LAST ABLATING NODE
C
C     DEL(NL)=DEL(NL)-DS (SEE INT DECOMP)

      IF(DEL(NL)-DELM)149,149,150

  149 DRLP=DEL(NL)*RO(NL)*RR(NL)
      DRLCP=DRLP*CP(NL)
      NL=NL-1
      RC(NL)=RC(NL+1)
      DRL=DEL(NL)*RO(NL)*RR(NL)
      DRLC=DRL*CP(NL)
      HAPHB=DRL*H(NL)+DRLP*H(NL+1)
      TOP1=DRL+DRLP
      TOP2=DRLC+DRLCP
      TOP3=DRLC*TA(NL) +DRLCP*TA(NL+1)
      VOL=DEL(NL)*RR(NL)+DEL(NL+1)*RR(NL+1)
      DEL(NL)=DEL(NL)+DEL(NL+1)
      RA(NL)=RA(NL)+6.*DEL(NL+1)
      RO(NL)=TOP1/VOL
      CP(NL)=TOP2/TOP1
      TA(NL)=TOP3/TOP2
      H(NL)=HAPHB/TOP1
      DELR=DEL(NL+1)*RR(NL+1)/VOL
      CZ=1.0-DELR
      DZ=0.0
      BZ=CZ
      NZ=JF*NL-JFH
      N=NZ-JF+1
      K=N
```

```
      FZ=DELR
      EZ=BZ

      GO TO 170

172   DZ=DZ+1.0

173   FZ=DZ-CZ

      IF(K-NZ) 175,174,175

174   BZ=DELR

175   K=K+1
      CZ=CZ+BZ
176   EZ=CZ-DZ

      IF(EZ)178,177,177

177   RDA(N)=RDA(N)+FZ*RDA(K)
      RDB(N)=RDB(N)+FZ*RDB(K)
      RDC(N)=RDC(N)+FZ*RDC(K)

      IF(N-NZ) 171,150,171

171   N=N+1

179   RDA(N)=RDA(K)*EZ
      RDB(N)=RDB(K)*EZ
      RDC(N)=RDC(K)*EZ

      GO TO 172

178   RDA(N)=RDA(N)+RDA(K)*BZ
      RDB(N)=RDB(N)+RDB(K)*BZ
```


ROC(N)=ROC(N)+ROC(K)+GZ
GO TO 170
150 GO TO 410
1 RETURN
END

```
      SUBROUTINE INPOUT
C     *****   SEE INPOUT LISTING FOR  COMMON      STATEMENTS  *****
C     *****                           DIMENSION   STATEMENTS  *****
C     *****                           EQUIVALENCE STATEMENTS  *****
C     *****                           FORMAT      STATEMENTS  *****
C     *****                           DATA        STATEMENTS  *****
      INPUT=5
      KOUT=6
      INCH=5
      WT=0.0
```

```
      DO 3500 I=1.5
```

```
 3500 NBUFT(I)=0
```

```
C     INPUT/OUTPUT
C
    1 NPG=1
      WRITE (KOUT.551)NPG
```

```
      READ  (INPUT. 499. END=999)  (RECORD(I). I=1.36)
```

```
      GO TO 998
```

```
  999 CONTINUE
```

```
      STOP
```

```
  998 CONTINUE
      WRITE (KOUT.502)(RECORD(I).I=1.36)
      WRITE (KOUT.503)
      WRITE (KOUT.504)
      WRITE (KOUT.505)
      WRITE (KOUT.506)
      READ (INPUT.564) A9.RHOOA.RHORA.BA.PSIA.EA.TRACA.B9.RHOOB .RHORB.B
     1B.PSIB.EB.TRACB .C9.RHOOC.RHORC.BC.  PSIC.EC.TRACC.NDBU
      WRITE (KOUT.507)A9.RHOOA.RHORA.BA.PSIA.EA.TRACA.B9.RHOOB.RHORB.BB.
     1PSIB.EB.TRACB .C9.RHOOC.RHORC.BC.  PSIC.EC.TRACC
      READ (INPUT.503) JF.NUMN.NN.NO.NI.THZRO.THFIN.DTPRT.DTPR2.DTPR3.
     1DTHB.BRP.TPR2.TPR3.DELM.DH1.DH2.DELHB.GAMA.TZ
```

```
      IF(JF-1) 171.170.172
```

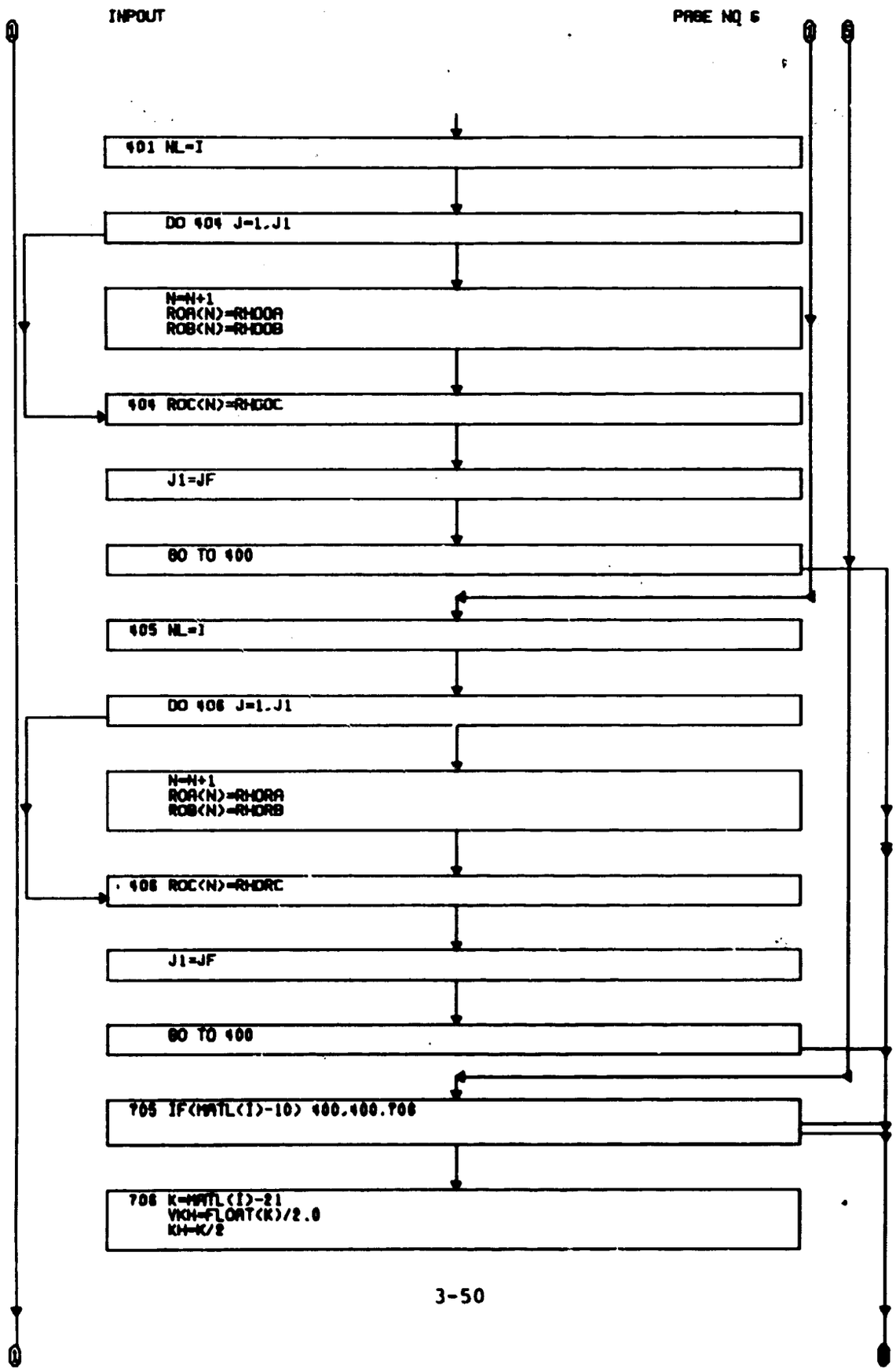
```
  170 JF=2
```

```
      GO TO 172

  171 JF=10

  172 JFH=JF/2
      JF=JFH+JFH
      JFHP=JFH+1
      FJFS=JF
      FJFH=FJFS/2.0
      NOI=NO+NI

      IF (NO) 181,181,182

  182 READ  (INPUT,580)(SO(I),I=1,NO)

  181 CONTINUE

      IF (NI) 184,184,183

  183 NOP=NO+1
      READ (INPUT,580) (SO(I), I=NOP,NOI)

  184 IF(GAMA) 408,409,409

  408 GAMA=RHOOC/(RHOOC-(RHOOA+RHOOB)-(RHOOA+RHOOB)/GAMA)

  409 OMG=1.0-GAMA
      RHO(1)=GAMA*(RHOOA+RHOOB)+OMG*RHOOC
      RHO(2)=GAMA*(RHORA+RHORB)+OMG*RHORC
       GAMAM=GAMA/RHO(1)*(RHOOA+RHOOB)
      WRITE (KOUT,510)GAMA,GAMAM

      IF(NOBU) 700,701,700

  700 WRITE(KOUT,7900)
 7900 FORMAT (/29X,34H---DECOMPOSING BACK-UP KINETICS---/)
```

```
      DO 704 I=1,NDBU

      READ(INPUT,5640)A9,RHOO(I,1),RHOR(I,1),BBB(I,1),PSI(I,1),EE(I,1),
     1TRAC(I,1),B9,RHOO(I,2),RHOR(I,2),BBB(I,2),          PSI(I,2),EE(I,2
     2),TRAC(I,2),C9,RHOO(I,3),RHOR(I,3),BBB(I,3),PSI(I,3),EE(I,3),TRAC(
     3I,3)
      READ(INPUT,7901) DHV(I),DHC(I),GA(I),TREF(I)
      WRITE(KOUT,7902) I
 7902 FORMAT (//20X,24HDECOMPOSING BACK-UP NO. ,I1)
      WRITE(KOUT,506)
      WRITE(KOUT,507) A9,RHOO(I,1),RHOR(I,1),BBB(I,1),PSI(I,1),EE(I,1),
     1TRAC(I,1),B9,RHOO(I,2),RHOR(I,2),BBB(I,2),          PSI(I,2),EE(I,2
     2),TRAC(I,2),C9,RHOO(I,3),RHOR(I,3),BBB(I,3),PSI(I,3),EE(I,3),TRAC(
     3I,3)

      IF(GA(I)) 702,703,703

  702 GA(I)=RHOO(I,9)/(RHOO(I,3)- (RHOO(I,1)+RHOO(I,2))-(RHOO(I,1)+
     1RHOO(I,2))/GA(I))

  703 OMGA(I)=1.-GA(I)
      RHOV(I)=GA(I)*(RHOO(I,1)+RHOO(I,2))+OMGA(I)*RHOO(I,9)
      RHOC(I)=GA(I)*(RHOR(I,1)+RHOR(I,2))+OMGA(I)*RHOR(I,9)
      GAMAM=GA(I)/RHOV(I)*(RHOO(I,1)+RHOO(I,2))
      WRITE(KOUT,510) GA(I),GAMAM
      P(I)=RHOV(I)/(RHOV(I)-RHOC(I))
      PP(I)=P(I)*RHOC(I)

      DO 7030 J=1,3

 7030 FF(I,J)=(1.-PSI(I,J))*BBB(I,J)*(RHOO(I,J)**(1.-PSI(I,J)))

  704 CONTINUE

  701 CONTINUE

      IF(DTHB) 412,410,412

  410 DTHB=5.

  412 DTHIN=.01
```

```
413 IF(TPR2)414,414,415

414 TPR2=THFIN

415 IF(TPR3)416,416,417

416 TPR3=THFIN

    IF(TPR2-THZRO) 418,418,417

418 DTPRT=DTPR2
    DTPR2=DTPR3
    TPR2=TPR3

    GO TO 416

417 WRITE (KOUT,511)
    THFIN=AMAX1(THFIN,TPR2,TPR3)
    WRITE (KOUT,512)THZRO,THFIN
    WRITE (KOUT,513)DTPRT,TPR2
    WRITE (KOUT,514)DTPR2,TPR2,TPR3
    WRITE (KOUT,515)DTPR3,TPR3
    WRITE (KOUT,516) DTHB
    TRACM=AMIN1(TRACA,TRACB,TRACC)
    PETE=RHO(1)/(RHO(1)-RHO(2))
    PET=PETE*RHO(2)
C   ---------- NODAL PROPERTIES
    N=0
    KHS=10
    NDBUCH=0
    J1=JFH
    CALL LCOUNT (-NUMN-8,LCT,NPG,RECORD(3K))
302 WRITE (KOUT,517)
    WRITE (KOUT,518)
    WRITE (KOUT,519)
    B=ASTER
    READ(INPUT,560)(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 461

452 RA(2)=DEL(1)+DEL(2)/2.
    B=BLANK

461 DEL(I-1)=DEL(I-1)/12.

4541 RAV(I)=RA(I)

    IF(AE) 4542,4543,4542

4542 AREA(I)=(ABS(RSV+RA(I)))**AE

    GO TO 464

4543 IF(AREA(I)) 4544,4546,464

4544 IF(RSV) 4545,4546,4545

4545 AREA(I)=ABS(RSV+RA(I))
     AE=1.0

     GO TO 464

4546 AREA(I)-1.

464 WRITE(KOUT,520)I,MATL(I),TA(I),AREA(I),DEL(I),RA(I),B,RC(I)

    IF(MATL(I)-2) 401,406,705
```


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
ROA(N)=RHORA
ROB(N)=RHORB
406 ROC(N)=RHORC
J1=JF
GO TO 400
705 IF(MATL(I)-10) 400,400,706
706 K=MATL(I)-21
VKH=FLOAT(K)/2.0
KH=K/2

```
      IF(VKH-KH) 708,707,708

  707 ROCOM(I,1)=RHOR(KH,1)
      ROCOM(I,2)=RHOR(KH,2)
      ROCOM(I,3)=RHOR(KH,3)
      X(I)=0.

      GO TO 709

  708 KH=KH+1
      ROCOM(I,1)=RHOO(KH,1)
      ROCOM(I,2)=RHOO(KH,2)
      ROCOM(I,3)=RHOO(KH,3)
      X(I)=1.0

  709 IF(KH-KHS) 7090,7092,7090

 7090 NFI(KH)=I
      KHS=KH
      NDBUCH=NDBUCH+1

 7092 NLA(KH)=I

  400 CONTINUE

      IF(NDBU-NDBUCH) 7095,7094,7093

 7095 WRITE(KOUT,7096)
 7096 FORMAT(10X,55HTOO MANY DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT
     1JOB)

      STOP

 7093 WRITE(KOUT,7097)
 7097 FORMAT(10X,54HTOO FEW DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT J
     1OB)

      STOP
```

```
7094 CONTINUE
 409 DEL(NUMN)=DEL(NUMN)/12.
     CALL SLOPQ(NUMN.RA.AREA.EMA)
     NBM=NL+1

     IF(NDBU) 7090.7099.7090

7090 NBM2=NLA(NDBU)+1

     GO TO 7091

7099 NBM2=NBM

7091 CONTINUE

     IF(RSV) 4031.4032.4033

4031 RSVN=-RSV
     WRITE(KOUT.554)RSVN.AE

     GO TO 304

4032 WRITE(KOUT.555)

     GO TO 304

4033 WRITE(KOUT.553)RSV.AE

 304 WRITE (KOUT.521) DELM.JF
     DELM=DELM/12.0
     READ(INPUT.502) NCONV.EPSM.TRES.CNORI.PYORI.NCON

     IF (CNORI) 305.305.306
```

```
305 CHCRI=0.02

306 IF (PYCRI) 307.307.308

307 PYCRI=0.98

308 TR(NUMN+1)=TRES
    CALL LCOUNT(4              .LCT.NPG.RECORD(35))
    WRITE(KOUT.681) HCONV.EPSW.TRES
    CALL LCOUNT(5              .LCT.NPG.RECORD(95))
    WRITE (KOUT.522)
    WRITE (KOUT.529)DH1.DH2.DELHG
    CALL LCOUNT(2              .LCT.NPG.RECORD(35))
    WRITE (KOUT.524)TZ

    IF(NDBU) 7910.7910.7907

7907 DO 7908 J=1.NDBU

    CALL LCOUNT(8.LCT.NPG.RECORD(35))
    WRITE(KOUT.7902) J
    WRITE(KOUT.7903)
    WRITE(KOUT.529) DHV(J).DHC(J).DELHG

7908 WRITE(KOUT.524) TREF(J)

7910 CONTINUE
C    --------- MATERIAL PROPERTIES
    CALL LCOUNT(6              .LCT.NPG.RECORD(35))
 310 WRITE (KOUT.526)
    CALL LCOUNT(9.LCT.NPG.RECORD(35))
    WRITE(KOUT.7905)
7905 FORMAT(//9X.82HDECOMPOSING BACK-UP VIRGIN MATERIALS 22.24.26.28.30.
   1 CHAR MATERIALS 23.25.27.29.31)
    IT=0
    ILO(3)=1
    ILO(4)=1
    KT=1

 350 IT=IT+1
    READ (INPUT.571) NC.TT2(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.

    DO 357 I=2,IT

357 THZ(I,KT)=THZ(I-1,KT)+(TCP(I,KT)+TCP(I-1,KT))/2.*(TT2(I,KT)-TT2(I-
   11,KT))

    CALL LOOK (KT+2,TZ,TT2(1,KT),THZ(1,KT),0.0,0.0,HSH,DUM,1)

    DO 359 I=1,IT

359 THZ(I,KT)=THZ(I,KT)-HSH

    CALL LCOUNT(6+IT          ,LCT,NPB,RECORD(35))
312 WRITE(KOUT,528)KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),THZ(I,KT)
   1,TEP(I,KT),I=1,IT)
    KT=KT+1
    IT=0

    IF(NC) 356,350,350

350 IF(KT-2) 950,950,710

710 IF (NDBU) 711,4110,711

711 I=1

    DO 720 K=1,NDBU

    IT=0

712 IT=IT+1
```

```
      READ(INPUT,571) NC,TTS(IT,I),TCBU(IT,I),TKBU(IT,I)

      IF(NC) 713,712,712

  713 IHI(I+21)=IT
      ILO(I+21)=1
      IR(I+21)=1
      TENT(1,I)=0.

      DO 714 J=2,IT

  714 TENT(J,I)=TENT(J-1,I)+(TCBU(J,I)+TCBU(J-1,I))/2.*(TTS(J,I)-TTS(J-1
     1,I))

      CALL LOOK(21+I,TREF(K),TTS(1,I),TENT(1,I),0,0,0,HSH,DUM,1)

      DO 715 J=1,IT

  715 TENT(J,I)=TENT(J,I)-HSH

      IF(2+K-I) 717,716,717

  716 RRR=RHOC(K)

      GO TO 718

  717 RRR=RHOV(K)

  718 CALL LCOUNT(6+IT,LCT,NPG,RECORD(35))
      L=I+21
      WRITE(KOUT,5260)   L,RRR,(TTS(J,I),TCBU(J,I),TKBU(J,I),TENT(J,I),
     1J=1,IT)
      I=I+1
      IT=0

      IF(NC) 719,353,353
```

```
719 IF(2+K-I) 720,712,720

720 CONTINUE

4110 IN=0
     L=0

411 READ(INPUT,561) KT,RHO(KT),(KMTL(I),I=1,6)

     IF(RHO(KT)) 3550,3550,355

3550 LL=1
     L=L+1
     JBU=0

     IF(KMTL(1))3553,3553,3559

3559 WT=FLOAT(L)
     IN=1
     LL=2

3560 DO 3554 I=LL,6

     IF(KMTL(I)) 3554,3554,3555

3555 JBU=JBU+1
     KSV(JBU)=KMTL(I)
     J=KMTL(I)
     NBUFT(J)=L

3554 CONTINUE

     IF(JBU) 3540,3540,3541

3541 CALL ORDERI(JBU,KSV)
```

```
3540 IX=0

3551 IX=IX+1
     READ(INPUT,497) NC,TX(IX,L),F1(IX,L),F2(IX,L)

     IF(NC) 3552,3551,3552

3552 ILO(31+L)=1
     IHI(31+L)=IX
     IR(91+L)=1
     CALL LCOUNT(5+IN+JBU+4*(1-(L+2)/4),LCT,NPB,RECORD(35))

     IF(L-1) 3546,3546,3547

3546 WRITE(KOUT,496)

3547 WRITE(KOUT,498) L

     IF(IN) 3543,3543,3542

3542 WRITE(KOUT,4971)

3543 IF(JBU) 3545,3545,3544

3544 WRITE(KOUT,4981)  (KSV(I),I=1,JBU)

3545 WRITE(KOUT,494) (TX(I,L),F1(I,L),F2(I,L),I=1,IX)
     IN=0

     IF (NC) 411,411,353

 355 IT=IT+1
```

```
      READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT)

      IF(NC) 354,355,354

  354 ILO(KT+2)=1
      IHI(KT+2)=ILO(KT+2)+IT-1
      IR(KT+2)=ILO(KT+2)
      CALL LCOUNT(5+IT          ,LCT,NPB,RECORD(95))
  314 WRITE (KOUT,527) KT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),I=1,IT)
      IT=0

      IF(NC) 411,411,359

C     ------------ PYROLYSIS GAS ENTHALPY

  353 NT1=0

  361 IN=1+NT1
      NT1=8+NT1
      READ  (INPUT,576)NC,(TT1(I),I=IN,NT1),(THG(I),I=IN,NT1)

      IF(NC)361,361,362

  364 NT1=NT1-1

  362 IF(TT1(NT1)) 364,364,365

  365 ILO(2)=1
      IR(2)=1
      IHI(2)=NT1
      CALL LCOUNT(9+((NT1+8)/5),LCT,NPB,RECORD(95))
  316 WRITE (KOUT,532)
      IFN=0

  368 IN=IFN+1
      IFN=MIND(NT1,IFN+5)
      WRITE (KOUT,531)(TT1(I),I=IN,IFN )
      WRITE (KOUT,533)(THG(I),I=IN,IFN)
```

```
      IF(NT1-IFN) 367,367,368

C     ---------- FUNCTIONS OF TIME

  367 NTH=0
      IS=0
      NOPT=0

  371 NTH=NTH+1
      READ(INPUT,577)NC,TTH(NTH),THE(NTH),TQR(NTH),TCM(NTH),TPI(NTH),
     1TBRP(NTH)

      IF(TBRP(NTH))374,375,374

  375 TBRP(NTH)=BRP

  374 II=1

      IF(TCM(NTH))342,342,343

  342 II=2

      IF(THE(NTH)-2.)344,344,343

  344 II=3

  343 IOPT(NTH)=II

      IF(II-IS)345,346,345

  346 NOPT=NOPT+1
      IS=II
```

```
346 IF(NC)371,371,372

372 ILO(1)=1
    IHI(1)=NTH
    IR(1)=ILO(1)
    CALL LCOUNT (4+3+NOPT+NTH,LCT,NPB,RECORD(35))
    WRITE (KOUT,534)
    IS=0

    DO 3476 I=1,NTH

    II=IOPT(I)

    IF(II-IS)347,349,347

347 IS=II

    GO TO (3471,3472,3473),II

3471 WRITE(KOUT,535)

    GO TO 3474

3472 WRITE(KOUT,552)

    GO TO 3475

3473 WRITE(KOUT,558)

    GO TO 3475

349 GO TO (3474,3475,3475),II
```

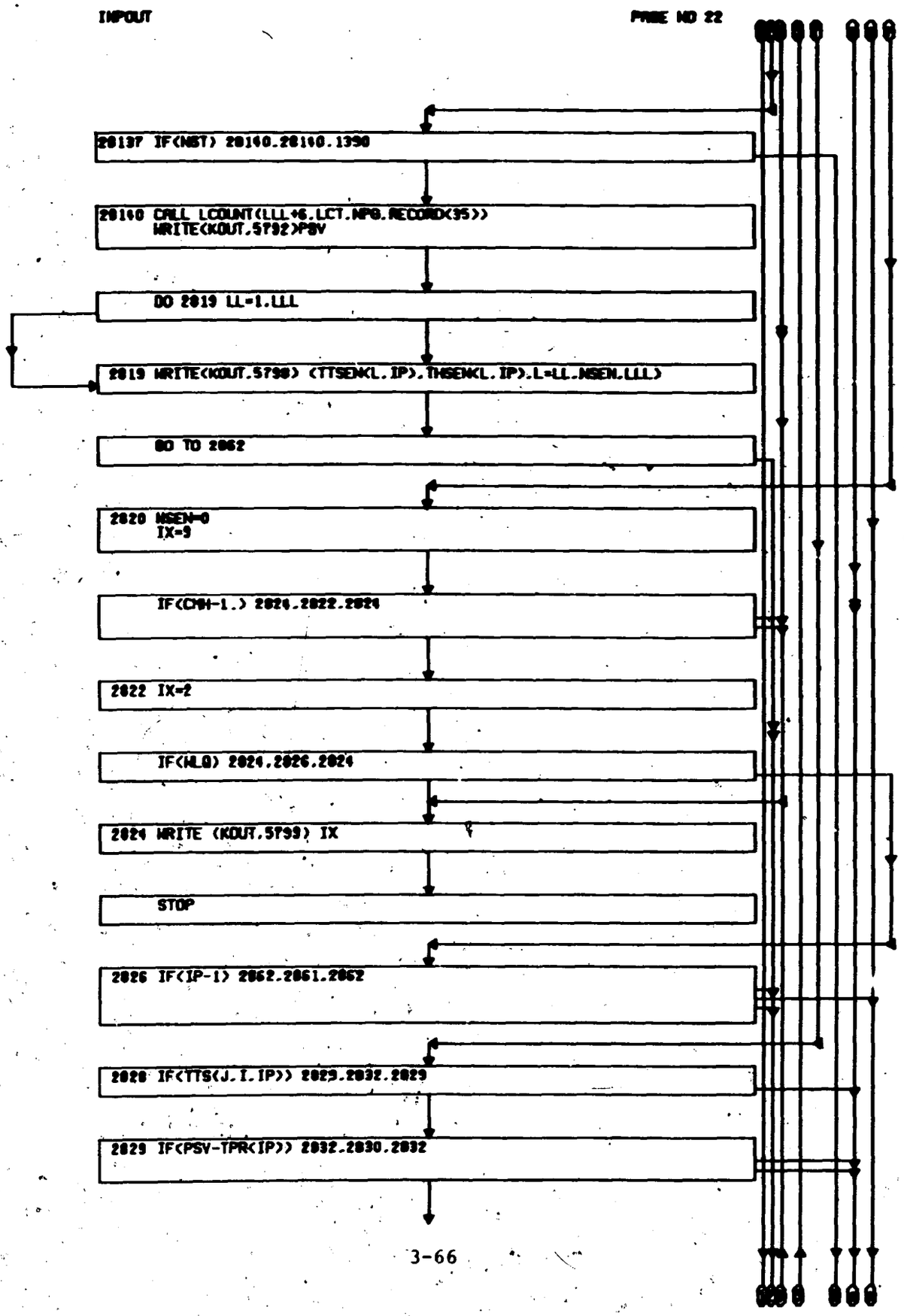
```
3474 WRITE(KOUT,536) TTH(I),II,THE(I),TGR(I),TCM(I),TPI(I),TBRP(I)

     GO TO 3476

3475 WRITE(KOUT,536) TTH(I),II,THE(I),TGR(I)

3476 CONTINUE

     IF(NC-1) 373,373,743

 373 DO 3731 I=1,NTH

3731 TPI(I)=ALOG(AMAX1(TPI(I),.000001))

     CALL LCOUNT(2              ,LCT,NPB,RECORD(35))
 328 WRITE (KOUT,537)
C    ---------SURFTICE EQUILIBRIUM TABLE
     READ(INPUT,6796) CHHS,VFZ,BREX,NR,NST,NBPF,NFIS,SHELL
     NFIS=NFIS+1

     IF(NST) 2900,2900,2901

2900 CHH=CHHS

     GO TO 2902

2901 IF(KNST-777) 2903,2903,2903

2903 IF(CHH-CHHS) 2907,2905,2907

2905 WRITE(KOUT,2906)
     CALL LCOUNT(3,LCT,NPB,RECORD(35))
2906 FORMAT(//10X50HSURFACE TABLES ARE THE SAME AS IN PREVIOUS PROBLEM)
```

```
      GO TO 2912

2907 WRITE(KOUT,2908)
2908 FORMAT(///10X,72HPREVIOUS SURFACE TABLES CALLED FOR BUT CM/CH RATIO
     1 HAS CHANGED. QUIT JOB//)

      STOP

2909 WRITE(KOUT,2910)
2910 FORMAT(///10X,70HPREVIOUS SURFACE TABLES CALLED FOR BUT THIS IS FIR
     1ST PROBLEM. QUIT JOB//)

      STOP

2902 KNBT=777

2912 IF(NR) 9200,9200,9203

9201 IF(RSV) 2024,2024,9204

9200 IF(BREX) 9204,9204,9203

9203 NR=1

      GO TO 9201

9204 IF(NBT) 9205,9205,9206

9206 IF(NBEN) 2013,2061,2013
```

```
3285 CONTINUE
     WLS=-1
     NSEN=-1
     IP=1
     IPN=1
     I=1
     IN=1
     J=0

2800 J=J+1

     IF(NBPF) 28001.28000.28001

28000 READ(INCH.5791) PSV.DMS.TLMC(J.I.IP).TTS(J.I.IP).WLQ.TCHEM(J.I.IP)
     1.TSEN(J).JNS.TSURF(J)
      TBPF(J.I.IP)=0.

     GO TO 28002

28001 READ(INCH.5790)PSV.DMS.TLMC(J.I.IP).TTS(J.I.IP).WLQ.TCHEM(J.I.IP)
     1.TSEN(J).JNS.TSURF(J).TBPF(J.I.IP)

28002 CONTINUE

     IF(JNS) 2817.2817.2821

2817 TSURF(J)=BLANK

2821 CONTINUE

     IF(TTS(J.I.IP)) 2803.2832.2801

2801 TTS(J.I.IP)=TTS(J.I.IP)*1.8
     TCHEM(J.I.IP)=TCHEM(J.I.IP)*1.8
     TSEN(J)=TSEN(J)*1.8

     GO TO 2806
```

```
2803 TTS(J.I.IP)=-TTS(J.I.IP)

2805 IF(WLS) 2809.2807.2807

2807 IX=4

     IF(WLS-WLQ) 2824.2811.2824

2809 WLS=WLQ

2811 IF(NSEN) 2802.2820.2820

2802 IF(JNS) 2800.2804.2804

2804 NSEN=J-1
     ISEN(IP)=NSEN

     IF(NSEN-1) 2820.2820.2800

2800 DO 2806 L=1.NSEN

     TTSEN(L.IP)=TTS(L.1.IP)
     TZSEN(L.IP)=TCHEN(L.1.IP)

2806 THSEN(L.IP)=TSEN(L)

     CALL SLOPE(NSEN.TTSEN(1.IP).THSEN(1.IP).TCPSEN(1.IP))
     CALL SLOPE(NSEN.TTSEN(1.IP).TZSEN(1.IP).TCZSEN(1.IP))
     LLL=(NSEN-1)/3+1

     IF(IP-1)28197.2813.28197
```

```
2813 CALL LCOUNT(11+2*NR,LCT     ,NPB,RECORD(35))
     WRITE (KOUT,530)
     WRITE (KOUT,5797) CMH,WLQ,VFZ

     GO TO(28130,28131),NFIS

28131 WRITE(KOUT,28132)
28132 FORMAT(6X,86HFISSURE MODEL USED FOR SURFACE ENERGY TERMS AND BLOWI
     1NG CORRECTION)

     GO TO 28133

28130 WRITE(KOUT,28612)

28133 CONTINUE

     IF (NR) 2816,2816,2816

2816 WRITE (KOUT,5799) BREX

     GO TO 2815

2818 WRITE (KOUT,5790)

2815 IF(SWELL) 28134,28135,28134

28135 WRITE(KOUT,28136)
28136 FORMAT(6X,45HNO CHAR SWELL CORRECTION ON SURFACE RECESSION)

     GO TO 28137

28134 WRITE(KOUT,28138) SWELL
28138 FORMAT(6X,12HCHAR SWELL =F8.4,1X16H= CHAR THICKNESS)
```


20137 IF(NST) 20140.20140.1350
20140 CALL LCOUNT(LLL+6.LCT.NPG.RECORD(35))
WRITE(KOUT.5792)PSV
DO 2019 LL=1.LLL
2019 WRITE(KOUT.5798) (TTSEN(L.IP).THSEN(L.IP).L=LL.NSEN.LLL)
GO TO 2062
2020 NSEN=0
IX=9
IF(CMH-1.) 2024.2022.2024
2022 IX=2
IF(HLG) 2024.2026.2024
2024 WRITE (KOUT.5799) IX
STOP
2026 IF(IP-1) 2062.2061.2062
2028 IF(TTS(J.I.IP)) 2029.2032.2029
2029 IF(PSV-TPR(IP)) 2032.2030.2032

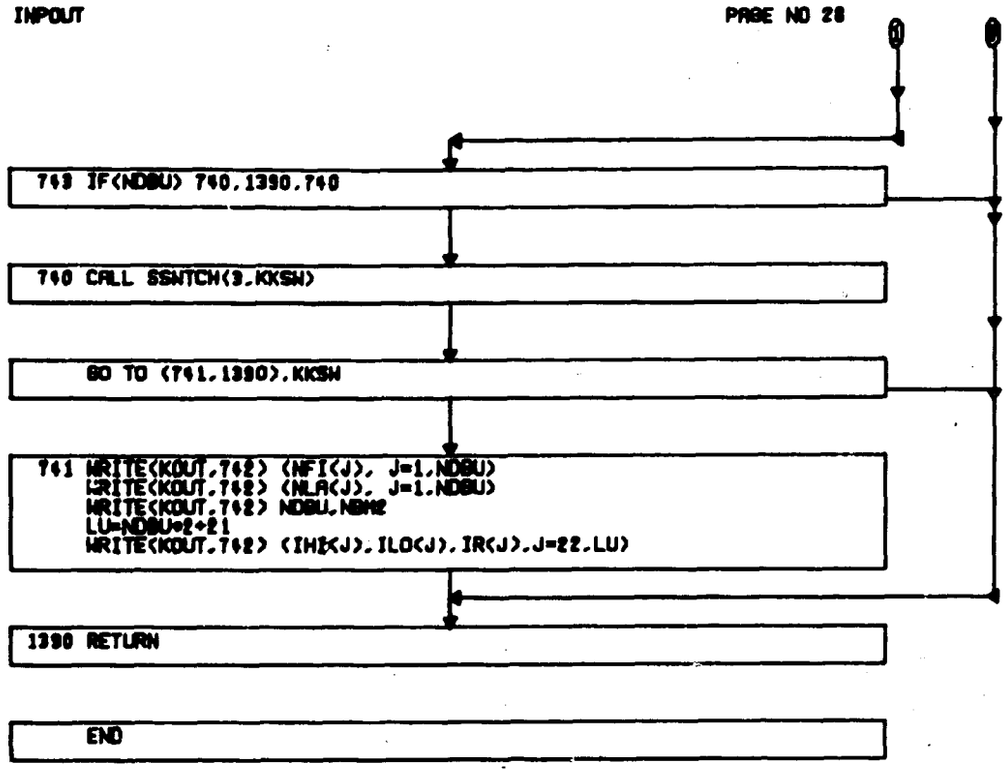
```
2030 IF(DMB-TMB(I,IP)) 2034,2080,2034

2032 IPN=IP+1
     NMB(IP)=I
     IN=0
     NSEN=-NSEN

2034 IN=IN+1
     NHI(I,IP)=J-1
     NMC=J-1
     CALL ORDERD(NMC,TLMC(1,I,IP),IZ)

     IF(NBPF) 3052,3052,4052

4052 CALL SEGURS(NMC,IZ,TTS(1,I,IP),TCHEM(1,I,IP),TSEN(1),TSURF(1),TBPF
    1(1,I,IP))

     GO TO 4053

3052 CONTINUE
     CALL SEGURA(NMC,IZ,TTS(1,I,IP),TCHEM(1,I,IP),TSEN(1),TSURF(1))

4053 CONTINUE
     IX=0
     I0=1
     BP0=TMB(I,IP)
     NLO(I,IP)=1
     KHI(I,IP)=1

     DO 2052 K=1,NMC

     BP=BP0+TLMC(K,I,IP)

     GO TO(20340,20341),NFIS

20341 HGA=TSEN(K)

     GO TO 20342
```

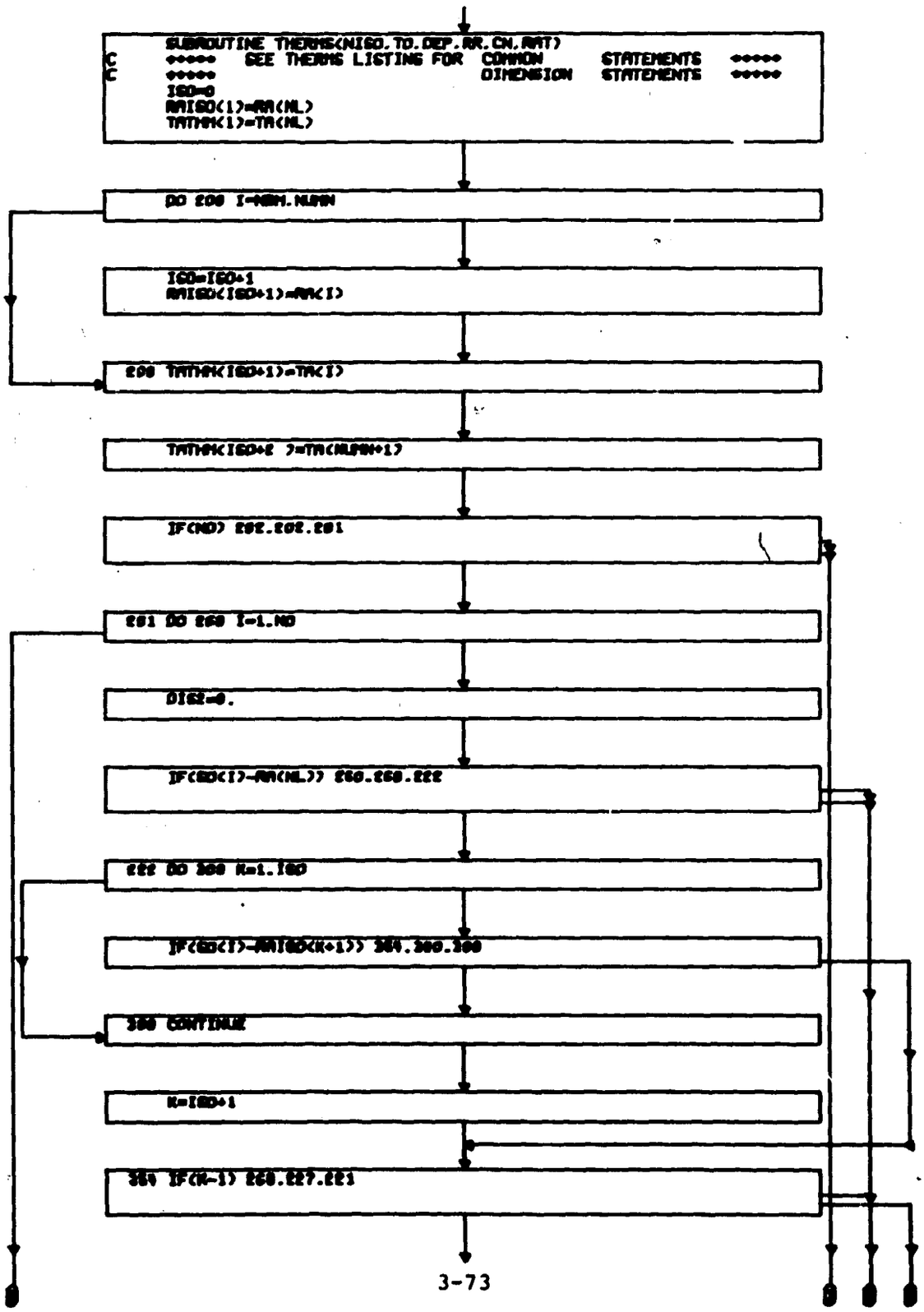
```
20340 CONTINUE
      CALL LOOK(2,TTS(K,I,IP),TT1,THG,0,0,0,HGA,CT1,1)
      HGA=HGA+DELHG

20342 CONTINUE
      CALL LOOK(4,TTS(K,I,IP),TT2(1,2),THZ(1,2),0,0,0,HCH,CT2,1)
      HCH=HCH+DH2

      IF(NSEN) 2030,2036,2030

2036 HE=TCHEM(K,I,IP)
      TCHEM(K,I,IP)=BPG+HGA+TLMC(K,I,IP)+HCH-BP+TSEN(K)

      GO TO 2040

2030 CALL OBLE(1,TTS(K,I,IP),HZ,ISEN(IP),TTSEN(1,IP),TZSEN(1,IP),TGZSEN
     1(1,IP))
      CALL OBLE(1,TTS(K,I,IP),HE,ISEN(IP),TTSEN(1,IP),THSEN(1,IP),TCPSEN
     1(1,IP))
      TCHEM(K,I,IP)=BPG+HGA+TLMC(K,I,IP)+HCH-BP+TSEN(K)+HZ-TCHEM(K,I,IP)

2040 TSEN(K)=HE

      IF(TSURF(K)-BLANK) 2044,2042,2044

2042 HLO(I,IP)=K+1

      IF(IG+IX-1) 2046,2046,2024

2044 IX=1

2046 IF(K-IG) 2052,2052,2048
```

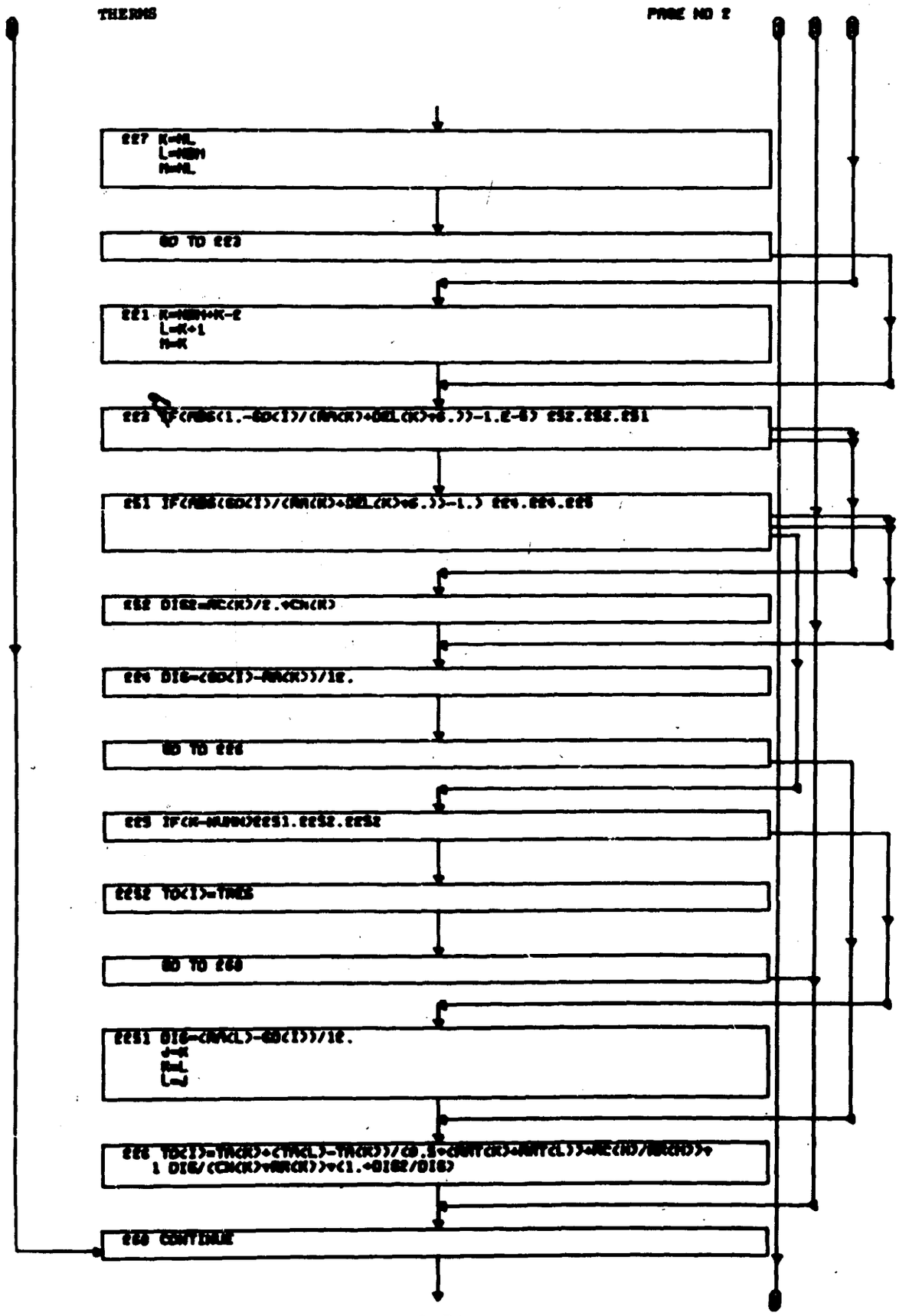
```
2040 IF(TTS(K,I,IP)-TTS(K-1,I,IP)) 2050,2050,2051

2050 IG=NMC

     GO TO 2052

2051 KHI(I,IP)=K

2052 CONTINUE

     LLL=(NMC-1)/2+1
     CALL LCOUNT(LLL+6          ,LCT,NPG,RECORD(35))
     WRITE(KOUT,5795)TMB(I,IP),TPR(IP),((TTS(L,I,IP),TLMC(L,I,IP),TCHEM
    1(L,I,IP),TSURF(L),L=LL,NMC,LLL),LL=1,LLL)

     DO 2056 K=1,NMC

     TCHEM(K,I,IP)=CMH+TCHEM(K,I,IP)-TSEN(K)

     IF(K-NLO(I,IP)) 2056,2054,2054

2054 TLMC(K,I,IP)=ALOG(AMAX1(TLMC(K,I,IP),.00001))

     IF(NBPF) 2056,2056,3056

3056 TBPF(K,I,IP)=ALOG(AMAX1(TBPF(K,I,IP),1.E-12))

2056 CONTINUE

     CALL SSWTCH(1,KKSW)

     GO TO (730,731),KKSW
```

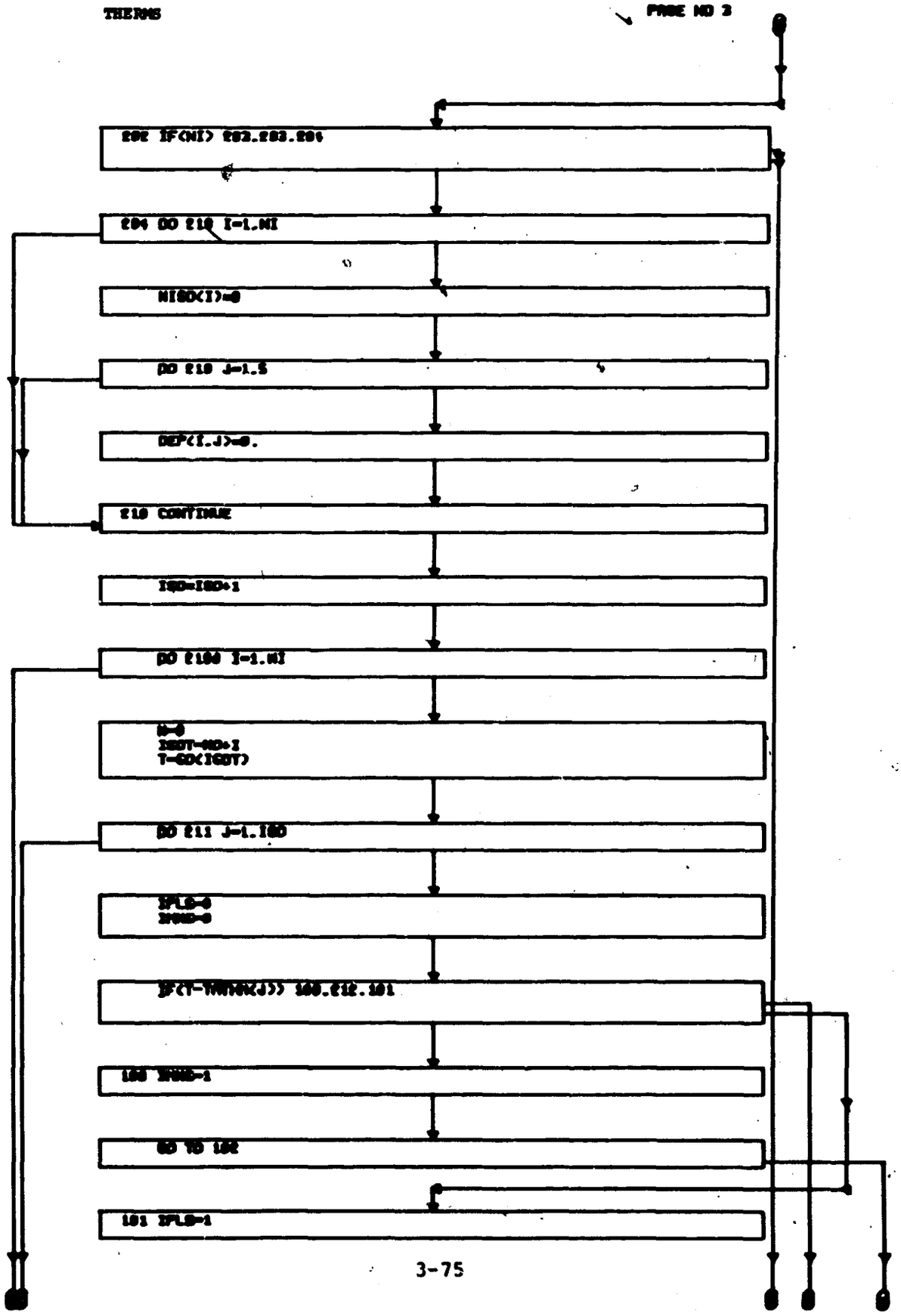
```
730 CALL LCOUNT(LLL+6,LCT,NPB,RECORD(35))
    WRITE(KOUT,5705)THB(I,IP),TPR(IP),((TTS(L,I,IP),TLMC(L,I,IP),TCHEM
   1(L,I,IP),TSEN(L) ,L=LL,NMC,LLL),LL=1,LLL)

    IF(NBPF) 731,731,6016

6016 CALL LCOUNT(9+NMC,LCT,NPB,RECORD(35))
     WRITE(KOUT,6017) (TBPF(L,I,IP),L=1,NMC)

731 CONTINUE

    IF(TTS(J,I,IP)) 2862,2870,2862

2861 CALL LCOUNT(10+2+NR,LCT,NPB,RECORD(35))
     WRITE (KOUT,530)
     WRITE (KOUT,5794) VFZ

     GO TO (20610,20611),NFIS

20611 WRITE(KOUT,20132)

     GO TO 20613

20610 WRITE(KOUT,20612)
20612 FORMAT(6X,36HFISSURE MODEL NOT USED FOR GAS TERMS)

20613 CONTINUE

     IF (NR) 2863,2863,2864

2864 WRITE(KOUT,5799) BREX

     GO TO 2715
```

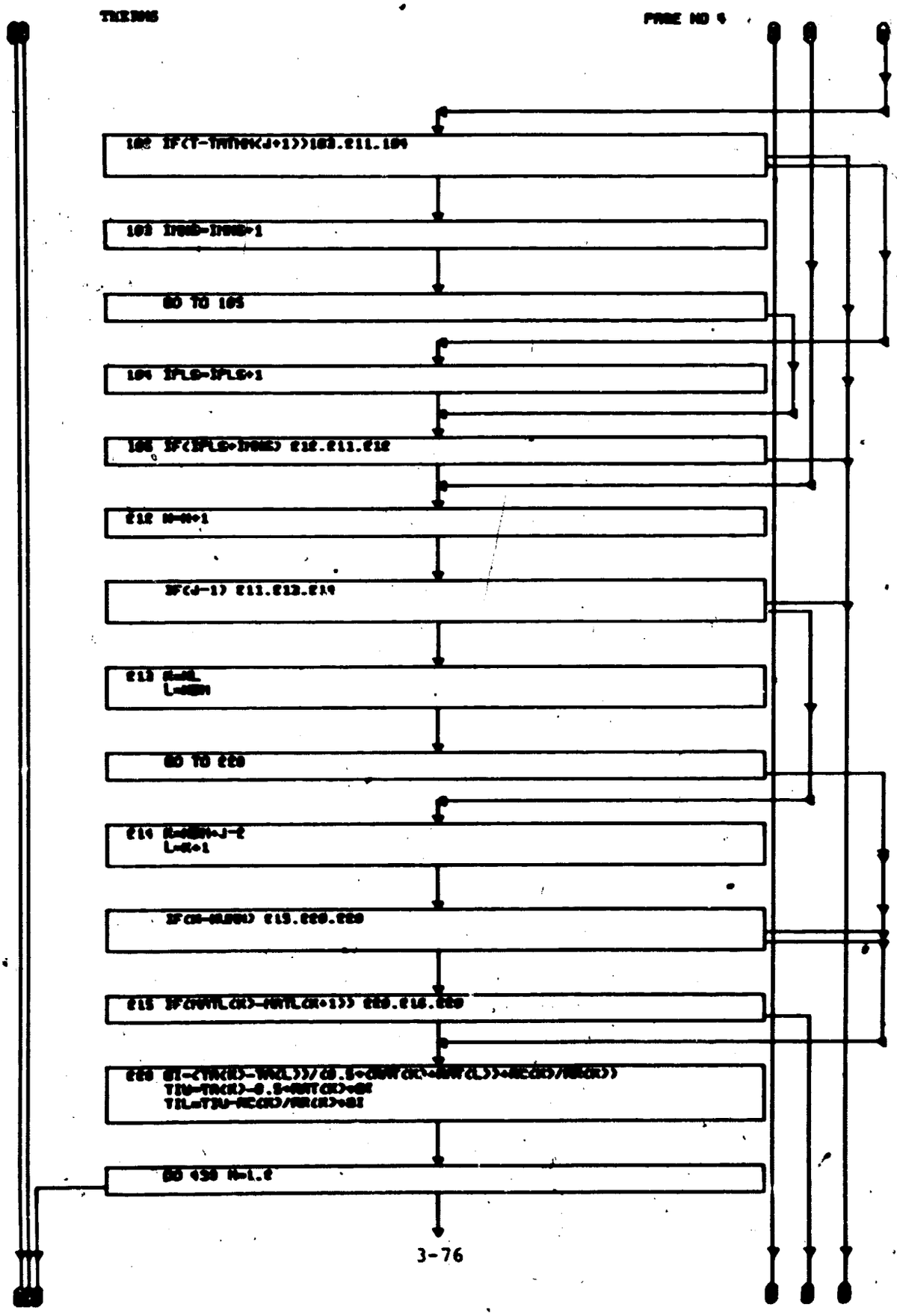
```
2863 WRITE (KOUT,5790)

2715 IF(SHELL) 2734,2735,2734

2735 WRITE(KOUT,20130)

     GO TO 2737

2734 WRITE(KOUT,20130) SHELL

2737 IF(NST) 2862,2862,1390

2862 TPR(IPN)=PSV
     THB(IN,IPN)=OMB
     TLMC(1,IN,IPN)=TLMC(J,I,IP)
     TBPF(1,IN,IPN)=TBPF(J,I,IP)
     TTS (1,IN,IPN)=TTS (J,I,IP)
     TCHEM(1,IN,IPN)=TCHEM(J,I,IP)
     TSURF(1)=TSURF(J)
     TSEN(1)=TSEN(J)
     J=1
     I=IN
     IP=IPN

     GO TO 2800

2870 NPR=IP
     IR(12)=1
     ILO(12)=1
     IHI(12)=I

     DO 2872 I=1,IP

2872 TPR(I)=ALOG(TPR(I))

     IR(13)=1
     IHI(13)=NPR
     ILO(13)=1
```

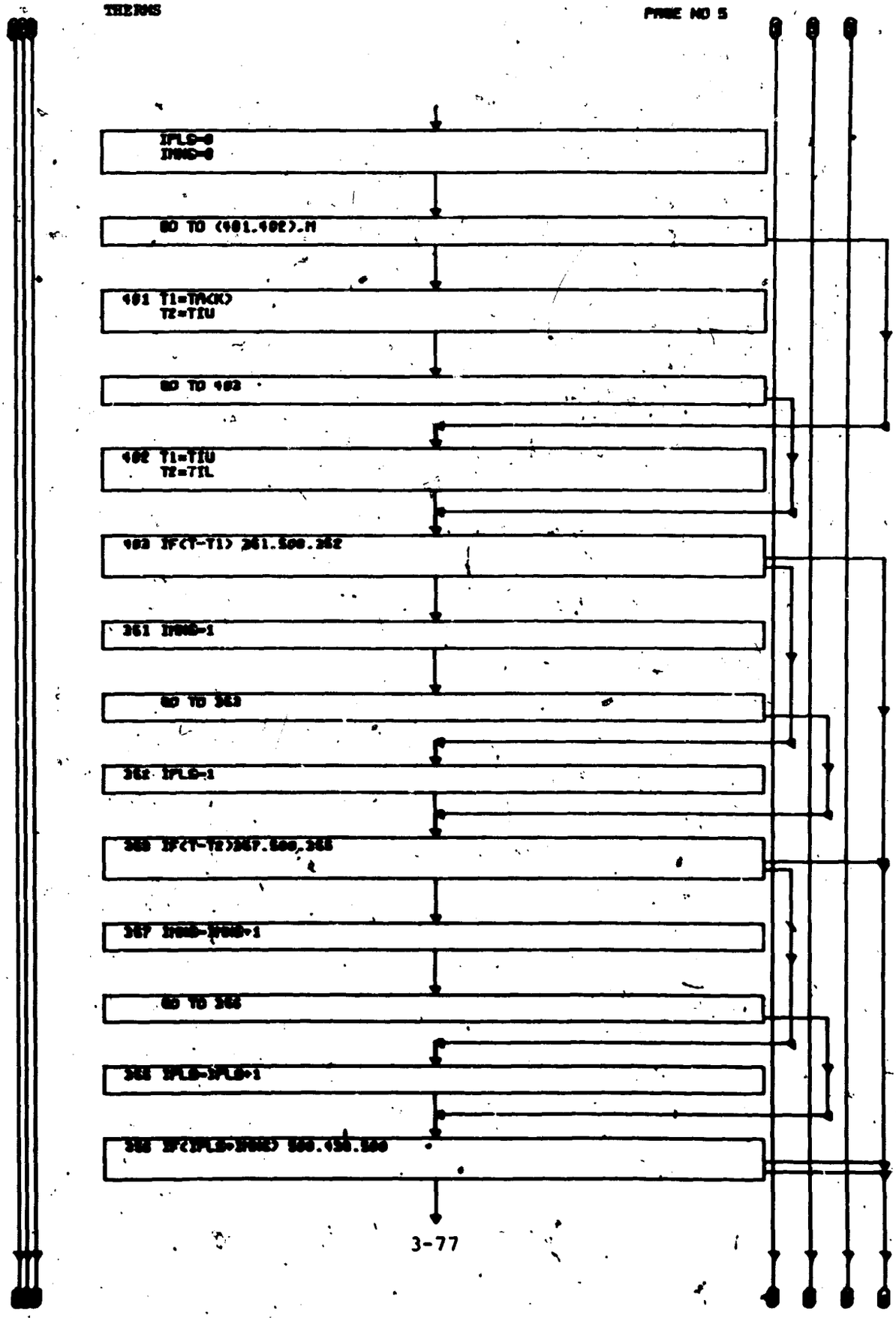

743 IF(NDBU) 740,1390,740
740 CALL SSWTCH(3,KKSW)
GO TO (741,1390),KKSW
741 WRITE(KOUT,742) (NFI(J), J=1,NDBU)
WRITE(KOUT,742) (NLA(J), J=1,NDBU)
WRITE(KOUT,742) NDBU,NBM2
LU=NDBU+2+21
WRITE(KOUT,742) (IHI(J),ILO(J),IR(J),J=22,LU)
1390 RETURN
END

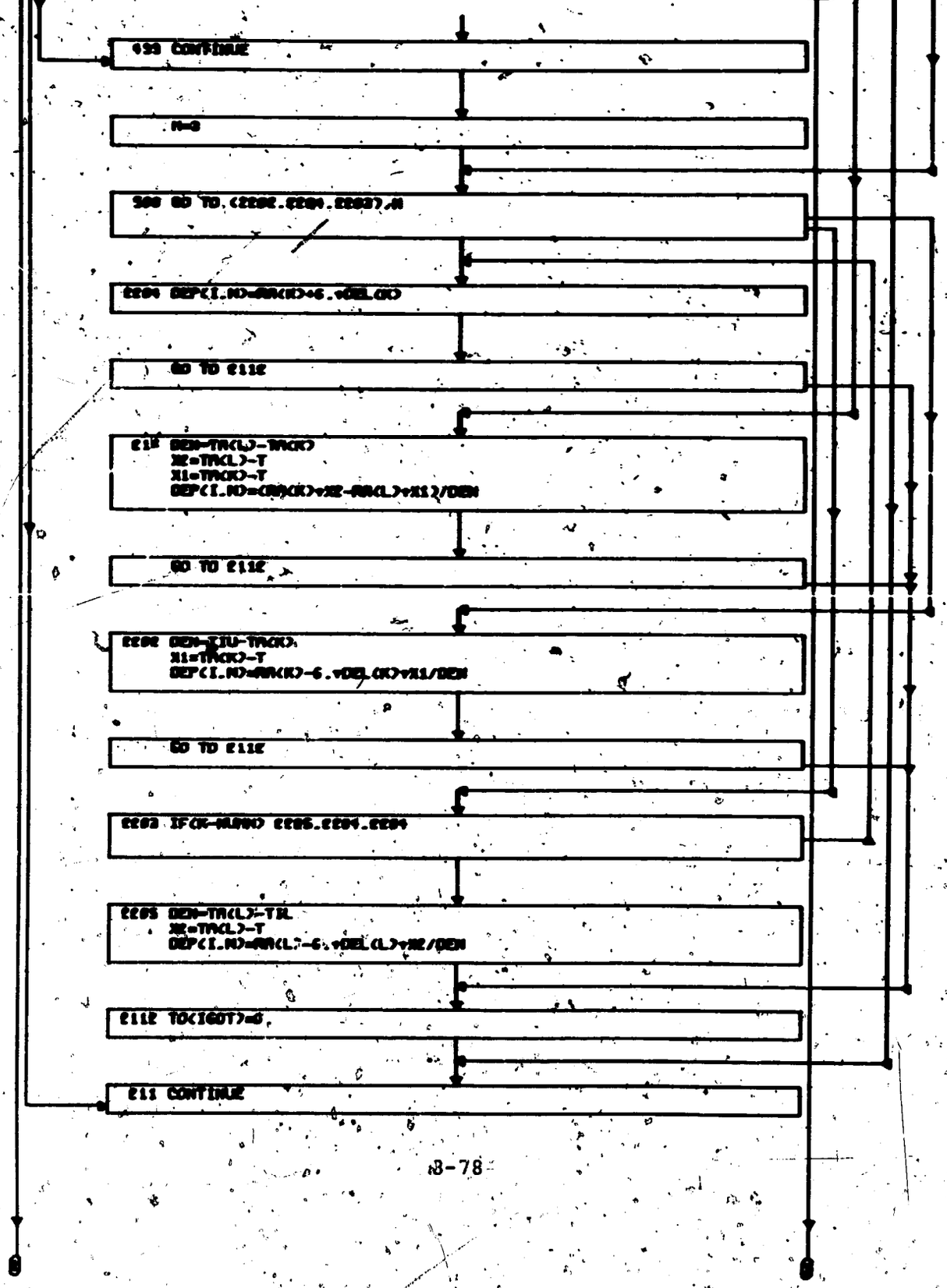

SUBROUTINE THERMS(NISO,TD,DEP,RR,CN,RAT)
C ***** SEE THERMS LISTING FOR COMMON STATEMENTS *****
C ***** DIMENSION STATEMENTS *****
ISO=0
RAISO(1)=RA(NL)
TATMK(1)=TA(NL)
DO 200 I=NBM,NLMN
ISO=ISO+1
RAISO(ISO+1)=RA(I)
200 TATMK(ISO+1)=TA(I)
TATMK(ISO+2)=TA(NLMN+1)
IF(ND) 202,202,201
201 DO 260 I=1,ND
DISZ=0.
IF(SD(I)-RA(NL)) 260,260,222
222 DO 300 K=1,ISO
IF(SD(I)-RAISO(K+1)) 364,300,300
300 CONTINUE
K=ISO+1
364 IF(K-1) 260,227,221

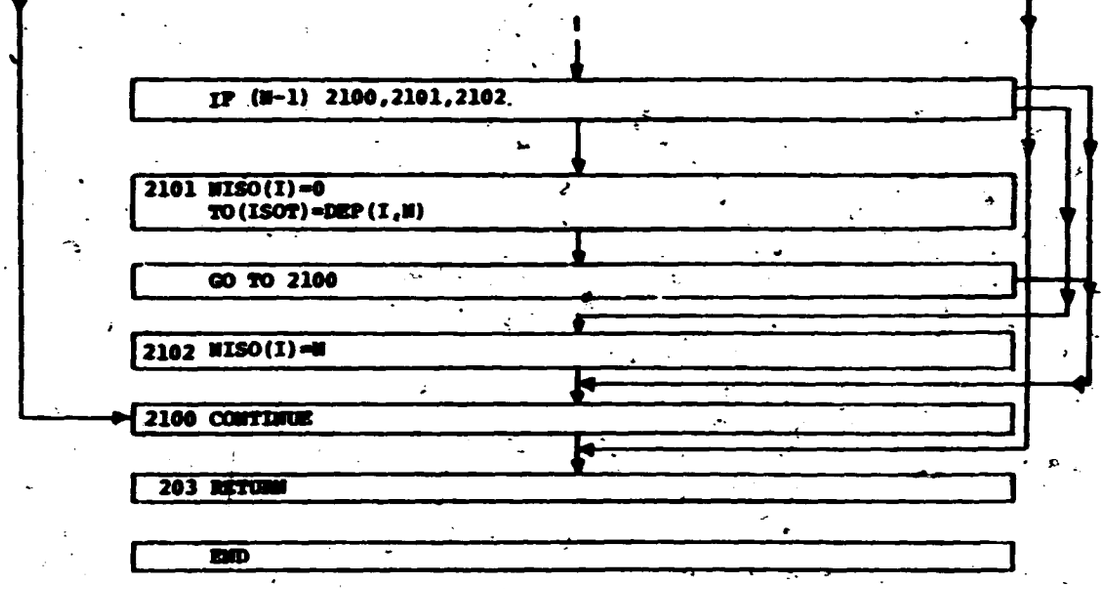

227 K=NL
L=NBM
M=NL
GO TO 223
221 K=NBM+K-2
L=K+1
M=K
223 IF(ABS(1.-GD(I)/(RA(K)+DEL(K)*6.))-1.E-5) 252.252.251
251 IF(ABS(GD(I)/(RA(K)+DEL(K)*6.))-1.) 224.224.225
252 DIS2=AC(K)/2.*CN(K)
224 DIS=(GD(I)-RA(K))/12.
GO TO 226
225 IF(K-NUMN)2251.2252.2252
2252 TO(I)=TRES
GO TO 260
2251 DIS=(RA(L)-GD(I))/12.
J=K
K=L
L=J
226 TO(I)=TA(K)+(TA(L)-TA(K))/(0.5*(RAT(K)+RAT(L))+AC(M)/RA(M))*
1 DIS/(CN(K)*RA(K))*(1.+DIS2/DIS)
260 CONTINUE


IF(NI) 203.203.204
DO 210 I=1.NI
NISO(I)=0
DO 210 J=1.5
DEP(I.J)=0.
210 CONTINUE
ISO=ISO+1
DO 2100 I=1.NI
DO 211 J=1.ISO
GO TO 102
101 IFLS=1


102 IF(T-TMTHR(J+1))102,211,104
103 IPHS=IPHS+1
GO TO 105
104 IPLS=IPLS+1
105 IF(IPLS-IPHS) 212,211,212
212 N=N+1
IF(J-1) 211,212,214
213 M=ML
L=MSM
GO TO 220
214 M=MSM+J-2
L=M+1
IF(M-MLMX) 215,220,220
215 IF(QVTL(M)-QVTL(M+1)) 220,216,220
220 BI=(TM(M)-TM(L))/(0.5*(DBW(M)+DBW(L))+RE(M)/RM(M))
TIU=TM(M)-0.5*DBT(M)+BI
TIL=TIU-RE(M)/RM(M)+BI
GO 450 N=1,2

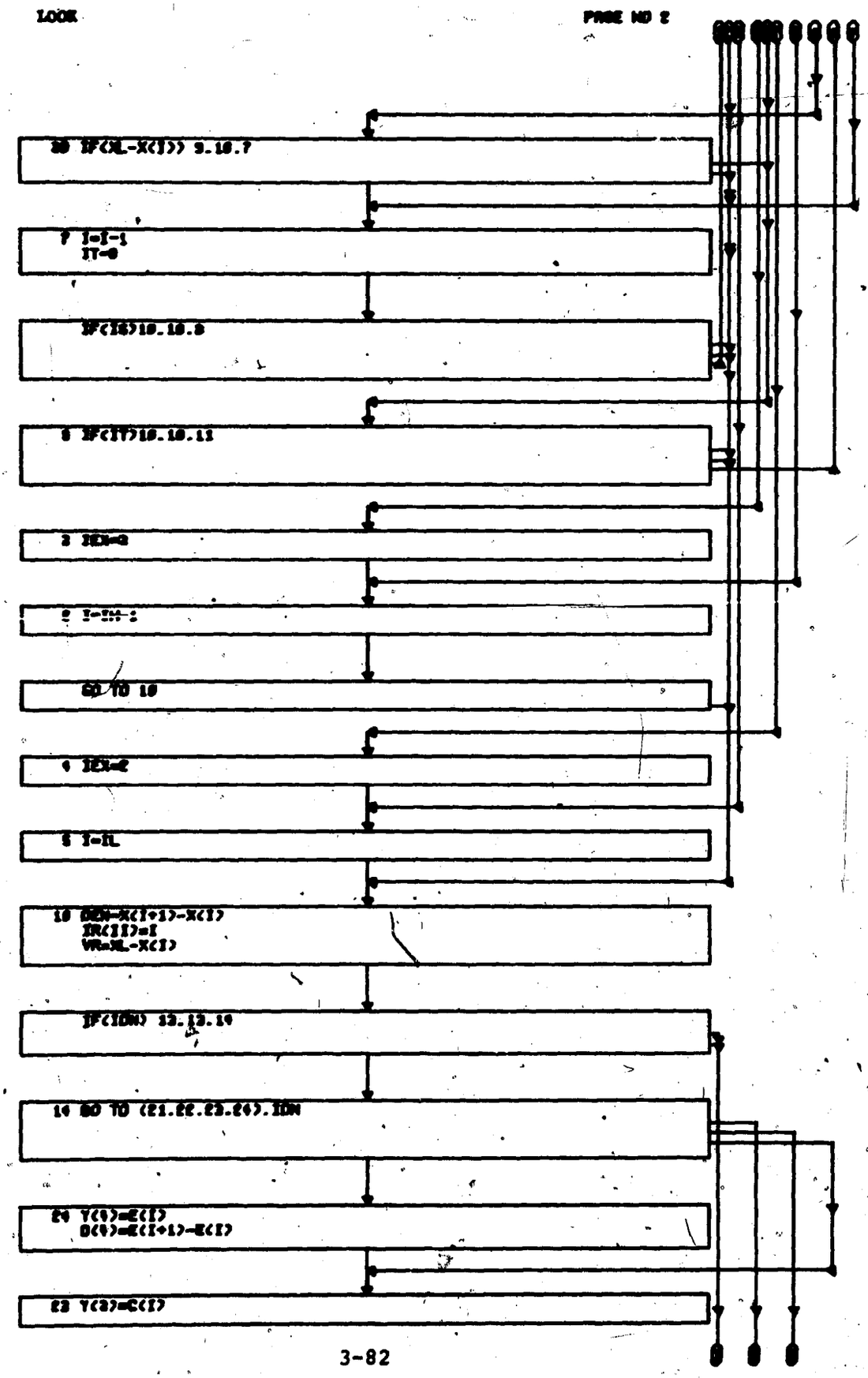

IPLS=0
IMNS=0
GO TO (401,402),M
401 T1=TA(K)
T2=TIU
GO TO 403
402 T1=TIU
T2=TIL
403 IF(T-T1) 361,500,362
361 IMNS=1
GO TO 363
362 IPLS=1
363 IF(T-T2)367,500,365
367 IMNS=IMNS+1
GO TO 366
365 IPLS=IPLS+1
366 IF(IPLS+IMNS) 500,430,500

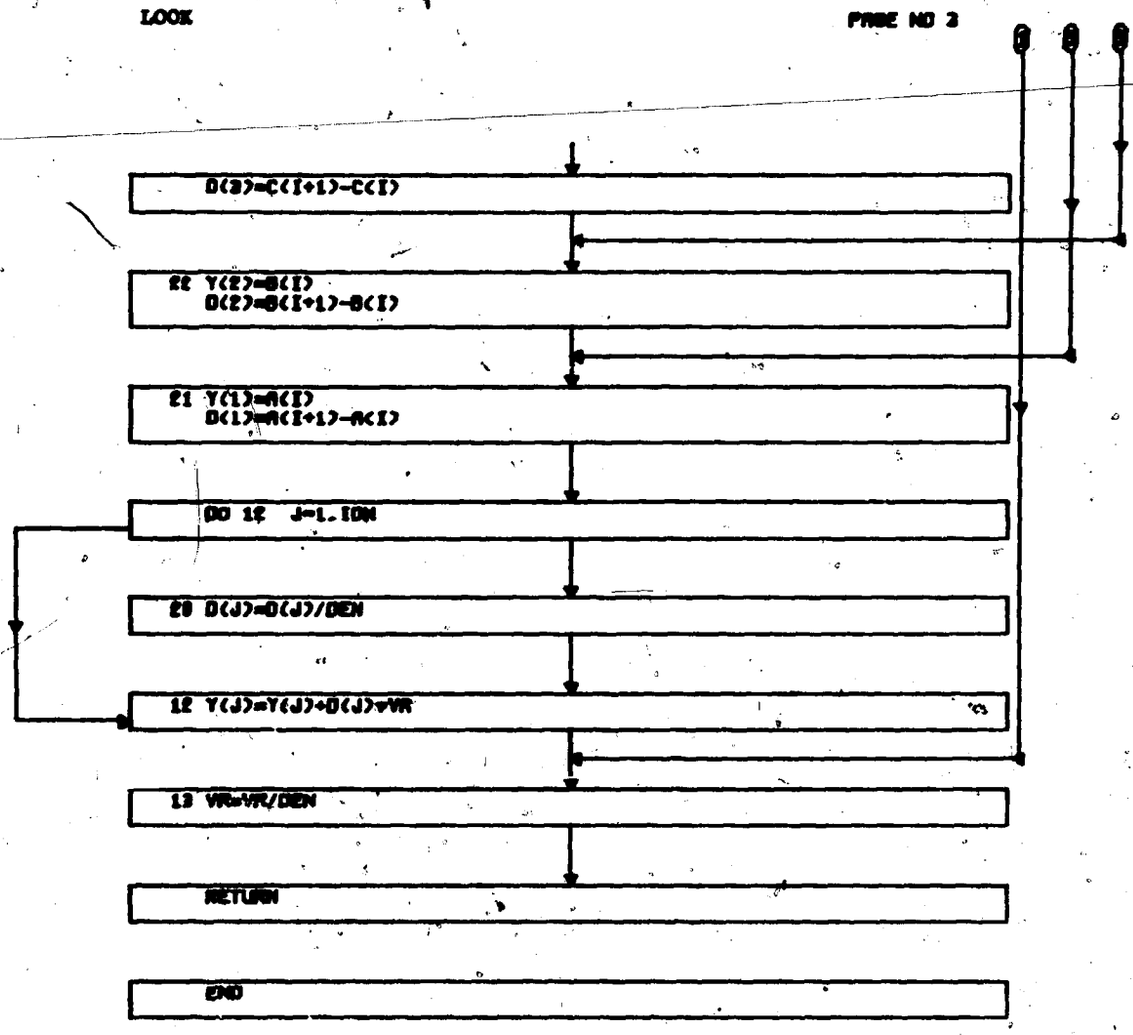

433 CONTINUE
M=0
500 GO TO (2202,2204,2203),M
2204 DEP(I,M)=RA(K)+6.*DEL(K)
GO TO 2112
212 DEN=TA(L)-TA(K)
X2=TA(L)-T
X1=TA(K)-T
DEP(I,M)=(RA(K)*X2-RA(L)*X1)/DEN
GO TO 2112
2202 DEN=TIU-TA(K)
X1=TA(K)-T
DEP(I,M)=RA(K)-6.*DEL(K)*X1/DEN
GO TO 2112
2203 IF(K-NUMN) 2205,2204,2204
2205 DEN=TA(L)-TIL
X2=TA(L)-T
DEP(I,M)=RA(L)-6.*DEL(L)*X2/DEN
2112 TO(IGOT)=0
211 CONTINUE


IF (N-1) 2100,2101,2102.
2101 NISO(I)=0
TO(ISOT)=DEP(I,N)
GO TO 2100
2102 NISO(I)=N
2100 CONTINUE
203 RETURN
END

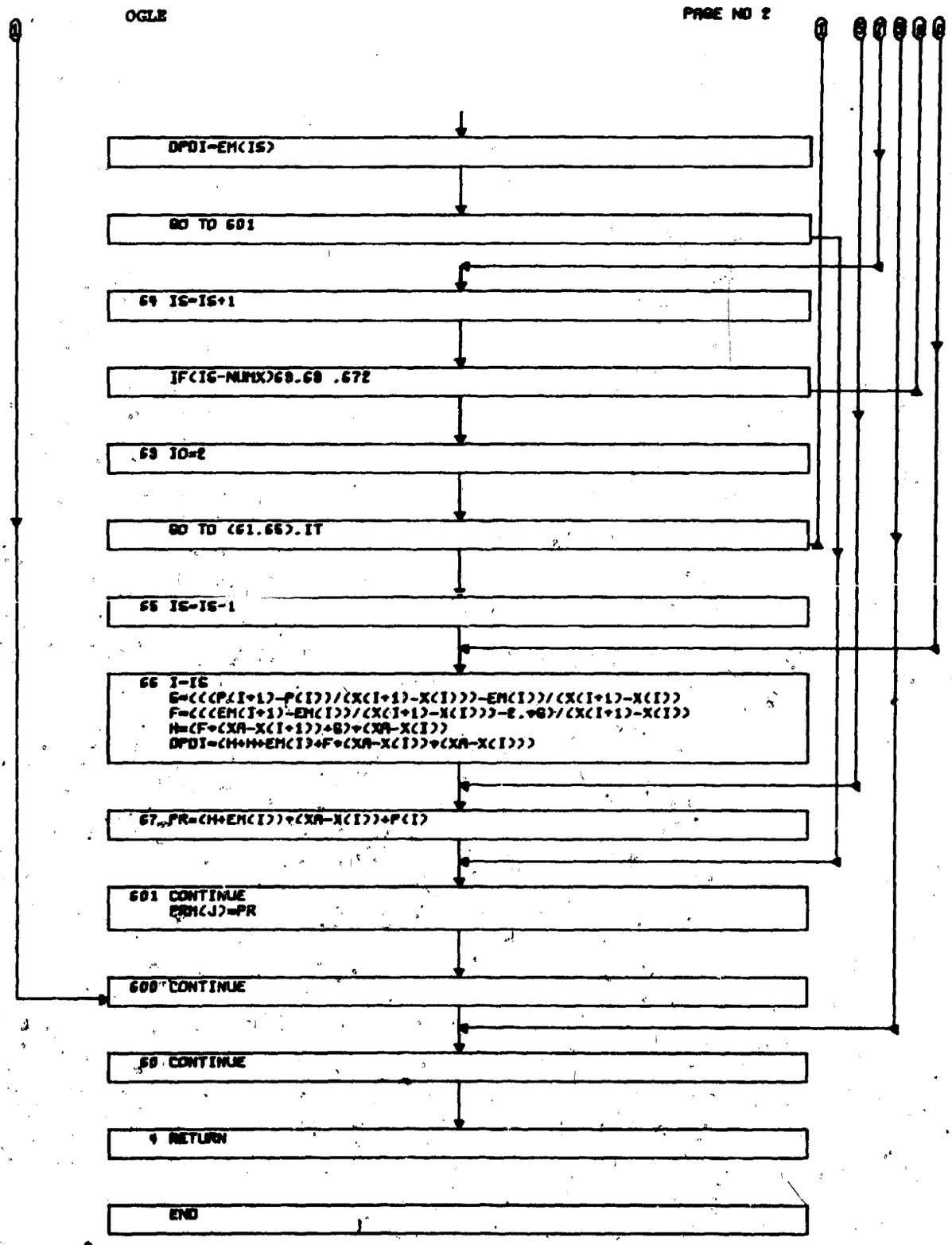
```
      SUBROUTINE LCOUNT (J,LCT,NPG,R)
      COMMON KOUT
      DIMENSION R(2)
 551  FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND A
     1BLATION PROGRAM/73X4HPAGEI3/1H 67X2A6)
      I=J
      IF(I) 2,2,3
    2 I=-I
      GO TO 4
    3 LCT=LCT-I
      IF (LCT) 4,5,5
    4 NPG=NPG+1
      LCT=60-I
      WRITE (KOUT,551) NPG,R
    5 RETURN
      END
```

```
      SUBROUTINE LOOK(II,XL,X,A,B,C,E,Y,D,IDN)
      COMMON KOUT,IEX,DEN,VR
      COMMON IHI(20),ILO(20),IR(20)
      DIMENSION  X(1),Y(1),D(1)
      DIMENSION A(1),B(1),C(1),E(1)
      IH=IHI(II)
      IL=ILO(II)
      IEX=0

      IF(X(IH)-X(IL)) 30,20,29

   20 IEX=1

      IF (XL-X(IH)) 3,2,31

   31 IF (XL-X(IL)) 6,5,4

   29 IF(XL-X(IH))1,2,3

    1 IF(XL-X(IL))4,5,6

    6 I=IR(II)
      I=MIN0(I,IH)
      I=MAX0(I,IL)
      IG=1
      IT=1

      GO TO 9

   11 I=I+1
      IG=0

    8 IF(IEX) 29,29,38

   28 IF(XL-X(I)) 7,10,9
```

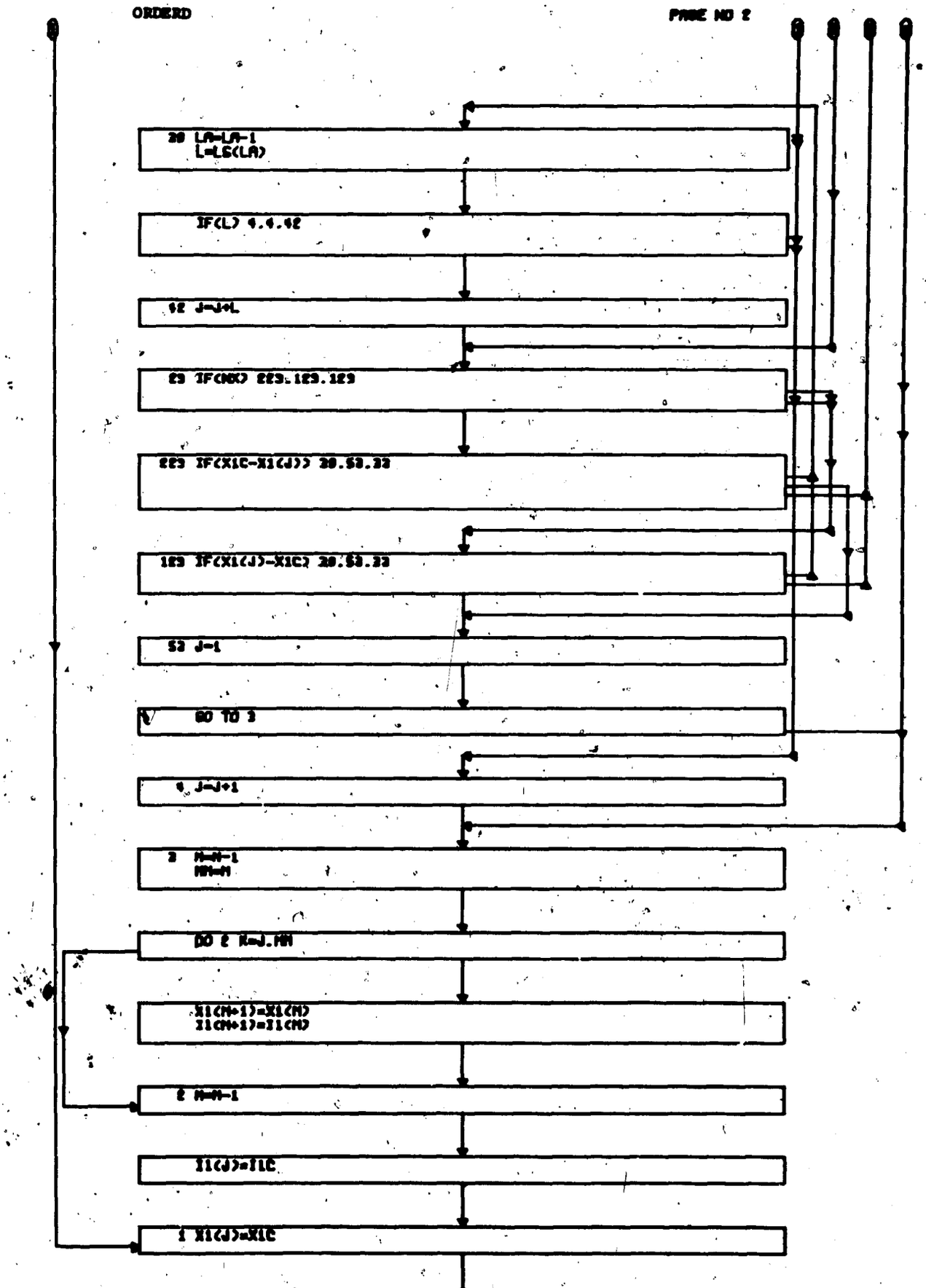

IF(XL-X(I)) 9.10.7
7 I=I-1
IT=0
IF(IE)10.10.8
8 IF(IT)10.10.11
3 IEX=2
GO TO 10
4 IEX=2
5 I=IL
10 DEN=X(I+1)-X(I)
IR(II)=I
VR=XL-X(I)
IF(IDN) 13.13.14
14 GO TO (21.22.23.24).IDN
24 Y(4)=E(I)
D(4)=E(I+1)-E(I)
23 Y(3)=C(I)


D(3)=C(I+1)-C(I)
22 Y(2)=B(I)
D(2)=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
13 VR=VR/DEN
RETURN
END

```
      SUBROUTINE OGLE(N,XAM,PRM,NUMX,X,P,EM)
      DIMENSION XAM(1),X(1),P(1),EM(1),PRM(1),DPDIM(1)
      XDIF=X(NUMX)-X(1)
      IG=1

    2 DO 600 J=1,N

      XA=XAM(J)
   69 IO=1
      IT=1

   61 IF(XDIF) 72,60,71

   71 IF(XA-X(IG)) 62,63,69

   72 IF(X(IG)-XA) 62,63,69

   62 IF(IG-1)671,671,68

   68 IG=IG-1
      IT=2

      GO TO (61,66),IO

  672 IG=NUMX

  671 I=IG
      W=0.
      DPDI=EM(I)

      GO TO 67

   63 PRM=P(IG)
```

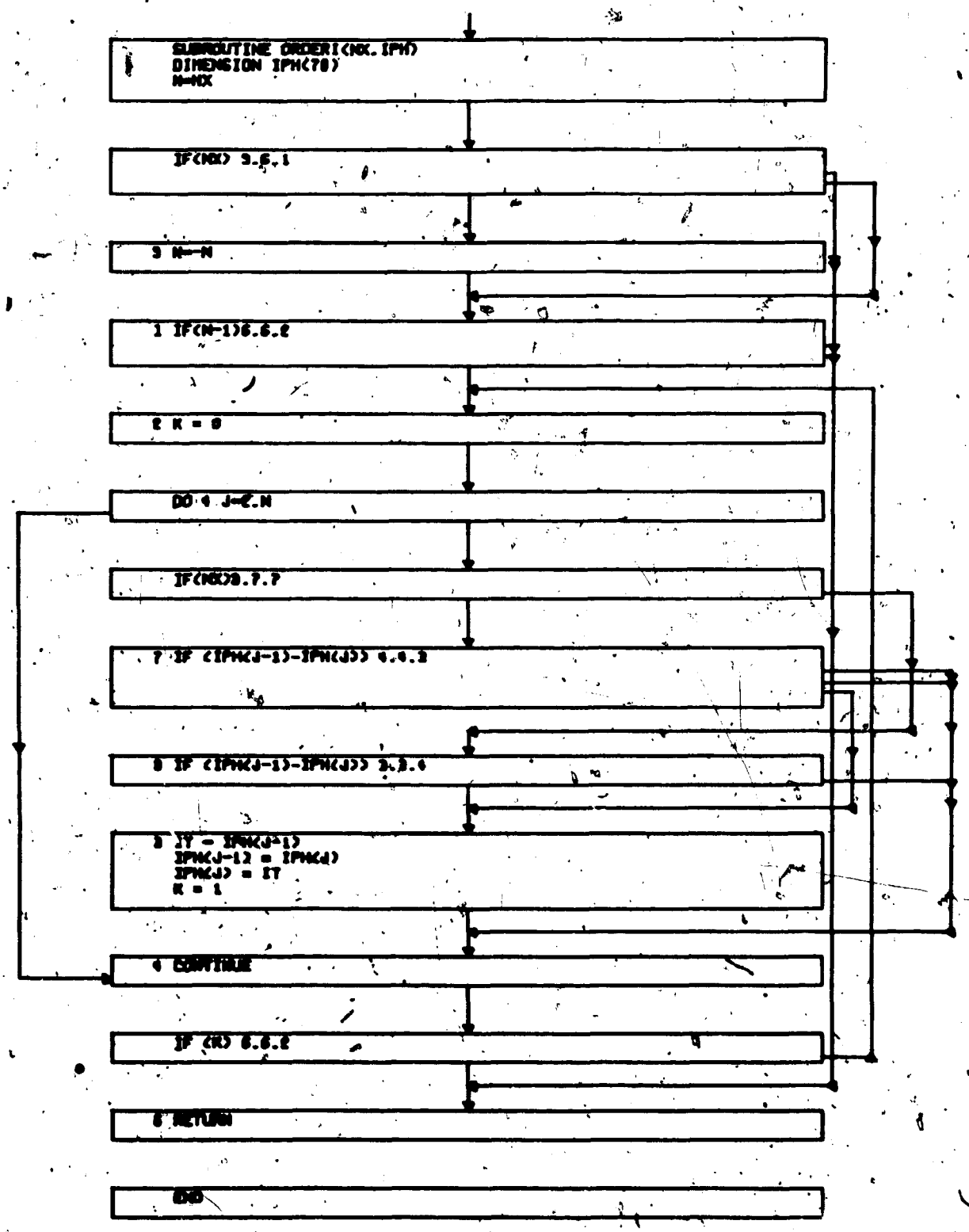

DPDI=EM(IS)
GO TO 601
69 IS=IS+1
IF(IS-NUMX)69,68 ,672
63 IO=2
GO TO (61,66),IT
65 IS=IS-1
66 I=IS
G=(((P(I+1)-P(I))/(X(I+1)-X(I)))-EM(I))/(X(I+1)-X(I))
F=(((EM(I+1)-EM(I))/(X(I+1)-X(I)))-2.*G)/(X(I+1)-X(I))
H=(F*(XA-X(I+1))+G)*(XA-X(I))
DPDI=(H+H+EM(I)+F*(XA-X(I))*(XA-X(I)))
67 PR=(H+EM(I))*(XA-X(I))+P(I)
601 CONTINUE
PRM(J)=PR
600 CONTINUE
60 CONTINUE
4 RETURN
END

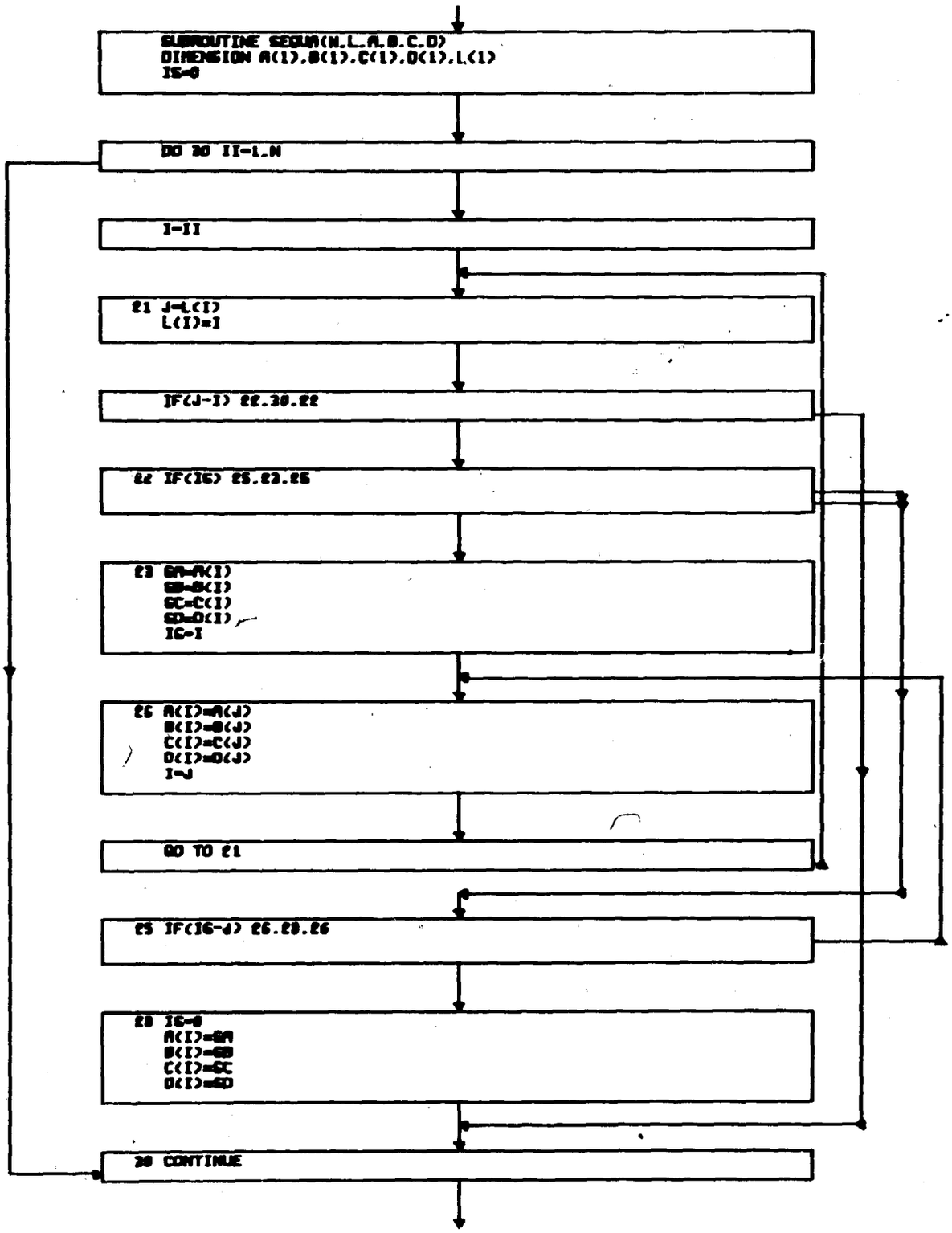
```
      SUBROUTINE ORDERD (NX,X1,I1)
      DIMENSION X1(1),I1(1)
      DIMENSION LS(20)
      NN=IABS(NX)
      LS(1)=0
      LS(2)=1
      LS(3)=2
      LI=3
      I1(1)=1
      DO 1 N=2,NN
      I1(N)=N
      L=LS(LI)
      LA=LI
      J=N
      X1C=X1(J)
      I1C=I1(J)
      J=J-L
      IF(J) 31,31,29
   29 LI=LI+1
      LS(LI)=L+L
      GO TO 29
   33 LA=LA-1
      L=LS(LA)
      IF(L) 3,3,41
   41 J=J-L
   32 IF(J) 31,31,29
   31 LA=LA-1
      L=LS(LA)
      J=J+L
      IF(L) 4,4,32
```

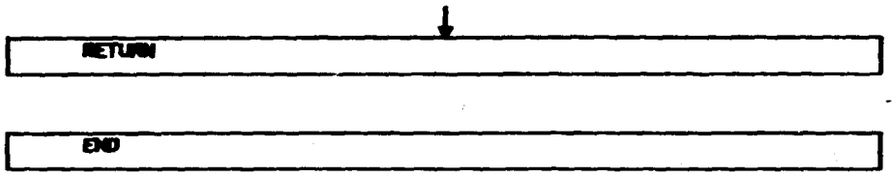

20 LA=LA-1
L=LS(LA)
IF(L) 4,4,42
42 J=J+L
29 IF(NX) 223,129,129
223 IF(X1C-X1(J)) 20,53,33
129 IF(X1(J)-X1C) 20,53,33
53 J=1
GO TO 3
4 J=J+1
3 M=M-1
MM=M
DO 2 M=J,MM
X1(M+1)=X1(M)
I1(M+1)=I1(M)
2 M=M-1
I1(J)=I1C
1 X1(J)=X1C

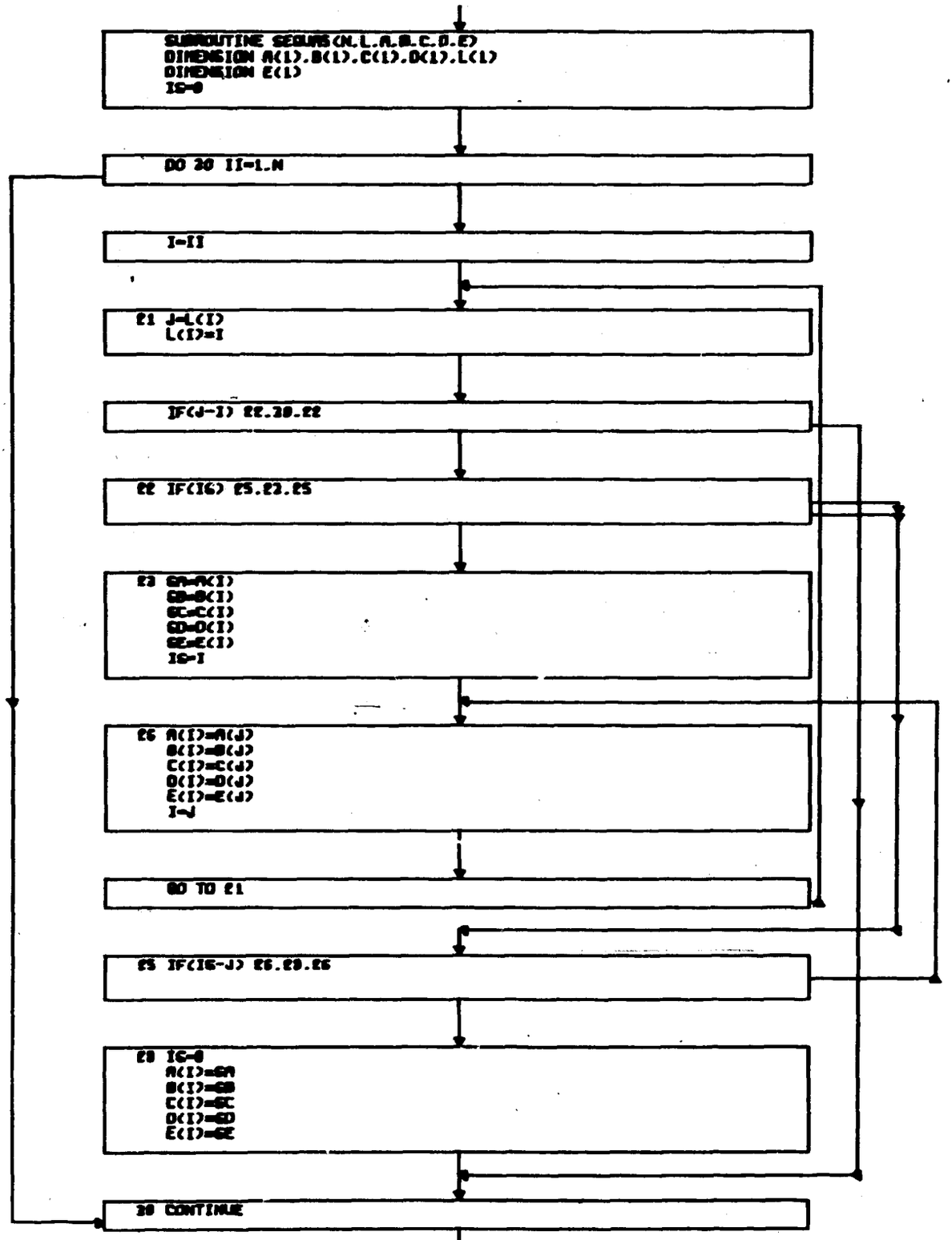
RETURN

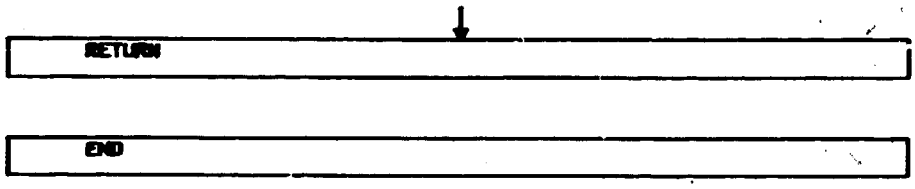
END


SUBROUTINE ORDERI(NX,IPH)
DIMENSION IPH(70)
N=NX
IF(NX) 9,6,1
9 N=-N
1 IF(N-1)6,6,2
2 K = 0
DO 4 J=2,N
IF(NX)8,7,7
7 IF (IPH(J-1)-IPH(J)) 4,4,3
8 IF (IPH(J-1)-IPH(J)) 3,3,4
3 IT = IPH(J-1)
IPH(J-1) = IPH(J)
IPH(J) = IT
K = 1
4 CONTINUE
IF (K) 6,6,2
6 RETURN
END

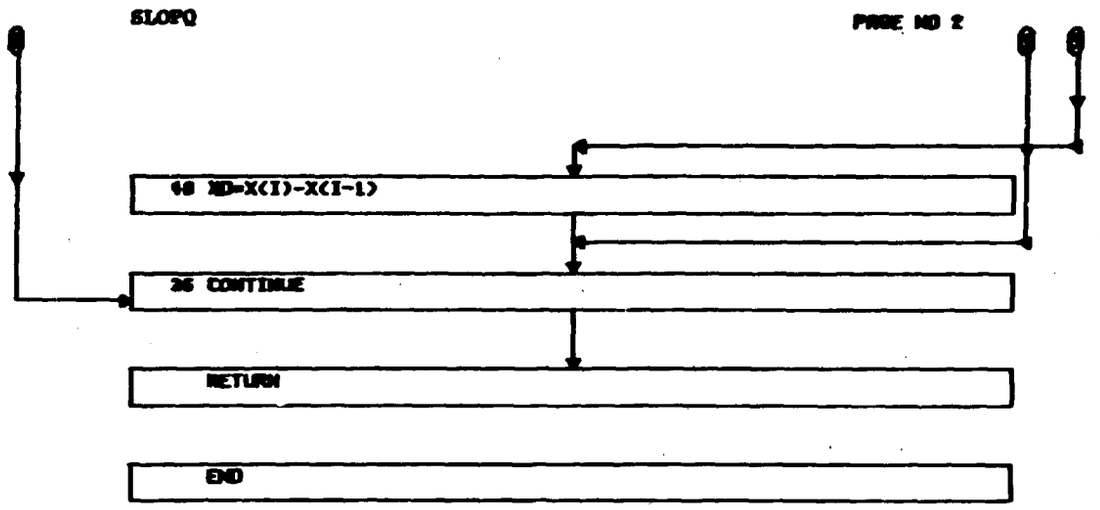

SUBROUTINE SEQUA(N,L,A,B,C,D)
DIMENSION A(1),B(1),C(1),D(1),L(1)
IG=0
DO 30 II=1,N
I=II
21 J=L(I)
L(I)=I
IF(J-I) 22,30,22
22 IF(IG) 25,23,25
23 GA=A(I)
GB=B(I)
GC=C(I)
GD=D(I)
IG=I
26 A(I)=A(J)
B(I)=B(J)
C(I)=C(J)
D(I)=D(J)
I=J
GO TO 21
25 IF(IG-J) 26,28,26
28 IG=0
A(I)=GA
B(I)=GB
C(I)=GC
D(I)=GD
30 CONTINUE


RETURN
END


SUBROUTINE SEQUA5(N,L,A,B,C,D,E)
DIMENSION A(1),B(1),C(1),D(1),L(1)
DIMENSION E(1)
IG=0
DO 20 II=1,N
I=II
21 J=L(I)
L(I)=I
IF(J-I) 22,20,22
22 IF(IG) 25,23,25
23 GA=A(I)
GB=B(I)
GC=C(I)
GD=D(I)
GE=E(I)
IG=I
26 A(I)=A(J)
B(I)=B(J)
C(I)=C(J)
D(I)=D(J)
E(I)=E(J)
I=J
GO TO 21
25 IF(IG-J) 26,28,26
28 IG=0
A(I)=GA
B(I)=GB
C(I)=GC
D(I)=GD
E(I)=GE
20 CONTINUE


RETURN
END

```
      SUBROUTINE SLOPQ(NMAX,X,P,EM)
C     SLOPE EVALUATION ROUTINE
C
      DIMENSION X(1), P(1), EM(1), Z(1)
   20 EM(2) = ( P(2) - P(1) ) / ( X(2) - X(1) )
      EM(1) = EM(2)
      Z(1)=0.0
      BC = EM(1)

      DO 26 I = 1 , NMAX

      IPO = I + 1
      IPT = I + 2
      IT = IPO - NMAX

      IF (IT) 23 , 21 , 22

   21 BB=BC

      GO TO 41

   22 GO TO 40

   23 XOT = X(I) - X(IPO)
      XTT = X(IPO) - X(IPT)
      XTO = X(IPT) - X(I)
      AA = P(I) / ( XOT + XTO )
      XOTT=XOT+XTT
   27 AB=P(I+1)/XOTT
      AC = P(IPT) / ( XTT + XTO )
      AAA = AA + XTT
      ABB = AB + XTO
      ACC = AC + XOT
      BA = BC
      BB = EM(I)
      BC = EM (IPO)
      EM(IPO) = AB + (XOT - XTT) + ACC - AAA
      EM(IPT) = AC + (XTT - XTO) + AAA - ABB
      EM(I)=   AA + (XTO - XOT) + ABB - ACC
   24 BE = EM(I)

      IF(I-2) 26,41,28

   26 EM(I) = ( BE + BA ) /2.

   41 EM(I) = (EM(I) + BB ) /2.
```


40 XD=X(I)-X(I-1)
26 CONTINUE
RETURN
END

SECTION 4

LISTINGS OF FORTRAN IV SOURCE DECKS

Listings of Fortran IV source code decks are presented in this section. A driver routine which allows all computations to be performed by subroutines is presented first. Then the three routines unique to this program CBM, INPØUT, and THERMS are given. Lastly, utility subroutines used by the three main subroutines are listed in alphabetic order.

```
C MAINLINE DUMMY ROUTINE WHICH DRIVES CBM AND INPOUT SUBROUTINES        MAIN   1
    1 CALL INPOUT                                                       MAIN   2
      CALL CBM                                                          MAIN   3
      GO TO 1                                                           MAIN   4
      END                                                               MAIN   5
```

```
      SUBROUTINE CBM                                                    CBM    1
C     CHARRING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM ALLOWING  CBM    2
C     FOR UP TO FIVE DECOMPOSING BACK-UP MATERIALS                      CBM    3
C       AEROTHERM COMPUTATION     RM KENDALL  C MOYER                   CBM    4
      COMMON RGUT,IEX,UEN,VR                                            CBM    5
      COMMON IHI(35),ILU(30),IK(30),TT2(30,10),TCP(30,10),TKP(30,10),THZCBM    6
     1(30,10),TEP(30,10),TIM(30),TME(30),TQR(30),TCN(30),TI1(30),THG(30)CBM    7
     2,DH12(2),RECOND(30),SO(20)                                        CBM    8
      COMMON RHO(10)                                                    CBM    9
      COMMON MATL( 50),DEL( 51),TA( 51),M(50),RC(50),RA( 50),           CBM   10
     1APEA( 50),EMA( 50),RAV( 50)                                       CBM   11
      COMMON ROA( 500),ROB( 500),ROC( 500)                              CBM   12
      COMMON TPM(3),XMG,IDIOT(2),THG(15,3),NLO(15,3),NHI(15,3),         CBM   13
     1KHI(15,3),TTSEN(25,3),THSEN(25,3),TCPSEN(25,3),TLMC(25,15,3),     CBM   14
     2ISEN(3),TPI(30),TTS(25,15,3),TCHEM(25,15,3),VFZ,CMM               CBM   15
      COMMON TBPF(25,15,3)                                              CBM   16
      COMMON NPP                                                        CBM   17
      COMMON LCT,NPG,II,NBM,NUMN,NL,DELMG,DELM,RFT,RHORA,RHORB,RHORC,TRACBM   18
     1CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,CBM   19
     2TRACM,PET,PETE,KSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WF,CBM   20
     3TMWT,GAMA,OMG,NG,FJFM,FJFS,JF,JFMP,JFM,INPUT,      DTMIN,BRP,MCONV,CBM   21
     4EPSW,TRES                                                         CBM   22
      COMMON INCM,DTMB                                                  CBM   23
      COMMON NN,NI,NOI                                                  CBM   24
      COMMON CMCRI,PYCRI                                                CBM   25
      COMMON TBRP(30)                                                   CBM   26
      COMMON NR                                                         CBM   27
      COMMON TX(30,6),F1(30,6),F2(30,6)                                 CBM   28
      COMMON NCON                                                       CBM   29
      COMMON NBPF,MF1S                                                  CBM   30
      COMMON BREX,SWELL                                                 CBM   31
      COMMON BBB(5,3),EE(5,3),FF(5,3),PSI(5,3),RHOO(5,3),RHOR(5,3),     CBM   32
     1ROCOM(50,3),DMC(5),DMN(5),RHOC(5),RHOV(5),P(5),PP(5),TREF(5),GA(5)CBM   33
     2,OMGA(5),WFI(5),NLA(5),TTS(30,10),TEMT(30,10),TKBU(30,10),TCBU(30,CBM   34
     310),X(50),NDBU,RBM2                                               CBM   35
      COMMON TRAC(5,3)                                                  CBM   36
      COMMON NBUFT(5)                                                   CBM   37
      COMMON/DATA/ASTEN,BLANK                                           CBM   38
      DIMENSION UROT(3)                                                 CBM   39
      DIMENSION CNO(50)                                                 CBM   40
      DIMENSION DMCP(3),CPE(3)                                          CBM   41
      DIMENSION TO(20)                                                  CBM   42
      DIMENSION DEP(10,5), NISO(10)                                     CBM   43
      DIMENSION WITER(51),EITER(51)                                     CBM   44
      DIMENSION Y2(24),D2(24),Y3(8),D3(8),YI(2),DI(2)                   CBM   45
      DIMENSION CPC( 50),CPV( 50),CP( 50),HP ( 50),HC( 50),CN( 50),     CBM   46
     1RAT(51),ROT(50),RO(50),RON(50),DMDG(50),RR(50),                   CBM   47
     2CNC( 50),A( 50),B( 50),C( 50),D( 50),EMO( 50)                     CBM   48
      EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                   CBM   49
  529 FORMAT(17H  ITERATION-STOP  )                                     CBM   50
  542 FORMAT(/33X14H----OUTPUT----)                                     CBM   51
  543 FORMAT(//6A28H- - - - - - - - - - - - - - - F9.4,37H SECONDS  - - - CBM   52
     1- - - - - - - - - - - - )                                         CBM   53
  544 FORMAT(6X,4HTIME,2X,4HSURF,2X,4HPROB,2X,7HSURFACE,5X,6HH WALL,    CBM   54
     14X,6HH EDGE,6X,10HHEAT COEFF,6X,6HCH/CHO/6X,4HSTEP,2X,4HITER,2X,4HCBM   55
     2OPTN,2X,8HRAD (IN),3X,8H(BTU/LB),2X,8H(BTU/LB),3X,14H(LB/SQ FT-SECCBM   56
     3))                                                                CBM   57
  545 FORMAT(6X,I4,2I6,F10.4,F11.2,F10.2,F12.4,7X,F8.5/1H )             CBM   58
  546 FORMAT(33X,20H---ABLATION RATES---)                               CBM   59
  547 FORMAT(6X,7HB PRIME,3X,9HB PRIME G,3X,10HH DOT CHAR,3X,9HH DOT GASCBM   60
     16X,6HH CHAR,7X,5HH GAS/34X,14H(LB/SQ FT-SEC),11X,15H(LB/ORIG SQ FTCBM   61
     2))                                                                CBM   62
  548 FORMAT(8X,F8.5,2X,F8.5,4(3X,F10.6)/1H )                           CBM   63
 5480 FORMAT(27X,32H---RECESSIONS/RECESSION RATES---/                   CBM   64
     133X,19H(IN)    /   (IN/SEC)/                                      CBM   65
     2  16X,7HSURFACE,16X,6HCHAR (,F4.2,1H),11X,11HPYROLYSIS (,F4.2,1H)CBM   66
 5481 FORMAT(5X,3(4X,F10.7,1H/,F9.7)/1H )                               CBM   67
 5482 FORMAT(27X,31H---SURFACE ENERGY FLUX TERMS---/25X,37HCURRENT RATESCBM   68
     1 (BTU/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SOCBM   69
     2 FT)/                                                             CBM   70
     3    13X,10HCONVECTED ,4X,10H RADIATED ,4X,10H RADIATED ,4X,10H CHECBM   71
     4ICAL ,4X,10HCONDUCTION/17X,2HIN,12X,2HIN,11X,3HOUT,8X,10HGENERATICBM   72
     5ON,7X,4HAWAY)                                                     CBM   73
 5483 FORMAT (6X,4HRATE,3X,5(E16.3,4X)/6X,5HTOTAL,2X,5(E18.3,4X)/1H )   CBM   74
 5484 FORMAT(30X,27H---INTERIOR ENERGY TERMS---/25X,37HCURRENT RATES (BTCBM   75
     1U/SQ FT SURFACE-SEC)/24X,38HAND INTEGRATED VALUES (BTU/ORIG SQ FT)CBM   76
     2/                                                                 CBM   77
     3        13X,9HPYROL GAS,7X,6HDECOMP,6X,10HCONVECTION,6X,7HSTORAGE, CBM   78
     47X,7HLOSS AT/14X,7HPICK UP,6X,10HABSORPTION,3X,11HWITH SOLIDS,5X, CBM   79
     58HIN SOLID,6X,9HREAR FACE)                                        CBM   80
 5485 FORMAT (6X,4HRATE,3X,5(E10.3,4X)/6X,5HTOTAL,2X,5(E10.3,4X)/1H )   CBM   81
  549 FORMAT (6X,8HNODE MAT3X4HTEMP3X7HDENSITY3X8HENTHALPY2X8HNODE MAT3X4CBM   82
     1HTEMP,3X7HDENSITY3X8HENTHALPY/15X7H(DEG R)11H (LB/CU FT)9H (BTU/LB)CBM   83
     211X7H(DEG R)11H (LB/CU FT)9H (BTU/LB))                            CBM   84
 5490 FORMAT(6X,8HNODE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU/,2X,8HNOCBM   85
     1DE MAT,3X,4HTEMP,3X,7HDENSITY,2X,9HCOND(BTU//15X,7H(DEG R),11H (LBCBM   86
     2/CU FT),9H FT SC F),11X,7H(DEG R),11H (LB/CU FT),9H FT SC F))     CBM   87
  550 FORMAT (5X,2I4,F9.2,F10.3,2XF8.2,1X2I4,F9.2,F10.3,F10.2)          CBM   88
 5500 FORMAT(5X,2I4,F9.2,F10.3,2X,F8.6,1X,2I4,F9.2,F10.3,F10.6)         CBM   89
  551 FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND ACBM   90
```

```
     1RLATION PROGRAM/T34,4HPAGE13/1H 67X2A6)                           CBH   91
 552 FORMAT(19X,67HOPTIONAL OUTPUT OF THERMOCOUPLE TEMPERATURES AND/OR ICBH   92
    .1SOTHERM DEPTHS/24X,37HDEPTHS MEASURED FROM ORIGINAL SURFACE/24X,  CBH   93
    231HTEMPERATURES IN DEGREES RANKINE//6X,77HEACH OUTPUT BLOCK SHOWS CBH   94
    3THE TIME IN SECONDS, THE CURRENT SURFACE TEMPERATURE,/6X,20HTHE TECBH   95
    4MPERATURES OF ,I2,4H THERMOCOUPLES, AND THE DEPTHS IN INCHES OF ,CBH   96
    5I2,10H ISOTHERMS/6X,34H11HIN THE MAIN ABLATING MATERIAL,/)         CBH   97
5521 FORMAT(6X,              7HTHE FIRST BLOCK SHOWS A SAMPLE TIME AND SUCBH   98
    6RFACE TEMPERATURE, THE SPECIFIED/6X,73HDEPTHS OF THE THERMOCOUPLESCBH   99
    7 (IF ANY) AND THE ISOTHERM TEMPERATURES.  THE/6X,76HARRANGEMENT OCBH  100
    8F THIS BLOCK CORRESPONDS TO THE ARRANGEMENT OF THE OUTPUT DATA,/) CBH  101
 553 FORMAT (//6X,11HOUTPUT DATA//)                                     CBH  102
 554 FORMAT(1X,8F10.4/(20X,8F10.4))                                     CBH  103
 581 FORMAT(4F5.7F10.4/(10X7F10.4))                                     CBH  104
 582 FORMAT(12E10.3)                                                    CBH  105
C                                                                       CBH  106
C                                                                       CBH  107
      UNCP(3)=99999.                                                    CBH  108
      KSCT=17                                                           CBH  109
      SIG=.481E-12                                                      CBH  110
C     CHAR AND PYROLYSIS ZONE CRITERIAL DENSITIES                       CBH  111
      DNCP(1)=RHO(2)*UNCRI*(RHO(1)-RHO(2))                              CBH  112
      DNCP(2)=RHO(2)*PYCRI*(RHO(1)-RHO(2))                              CBH  113
C                                                                       CBH  114
C     INITIAL VALUES FOR TIME LOOP                                      CBH  115
C                                                                       CBH  116
 1390 ITER=-1                                                           CBH  117
      DTHC=DTHM                                                         CBH  118
      IAB=0                                                             CBH  119
      ITS=0                                                             CBH  120
      SA=0.0                                                            CBH  121
      SMET=0.                                                           CBH  122
      GSMT=0.0                                                          CBH  123
      GSM2T=0.                                                          CBH  124
      GSMS=0.                                                           CBH  125
      CMD=0.0                                                           CBH  126
      RSU=ABS(PSV)                                                      CBH  127
      GS=0.0                                                            CBH  128
      CMFM=0.0                                                          CBH  129
      CMT=0.                                                            CBH  130
      DSDTB=0.0                                                         CBH  131
      DSDT=0.                                                           CBH  132
      DSI=0.                                                            CBH  133
      DIDT=0.                                                           CBH  134
      CPE(1)=0.                                                         CBH  135
      CPE(2)=0.                                                         CBH  136
      COLD=0.                                                           CBH  137
      POLD=0.                                                           CBH  138
      DCDT=0.                                                           CBH  139
      DPDT=0.                                                           CBH  140
      QCOND=0.                                                          CBH  141
      QCONV=0.                                                          CBH  142
      QCHEM=0.                                                          CBH  143
      RAD=0.                                                            CBH  144
      QRP=0.                                                            CBH  145
      QCONVT=0.                                                         CBH  146
      QRPT=0.                                                           CBH  147
      QRADT=0.                                                          CBH  148
      QCHEMT=0.                                                         CBH  149
      QCONDT=0.                                                         CBH  150
      PGPUT=0.                                                          CBH  151
      DECOMT=0.                                                         CBH  152
      DEDTT=0.                                                          CBH  153
      QLOSST=0.                                                         CBH  154
      TT=0.                                                             CBH  155
      TB=0.                                                             CBH  156
      SOEGR=0.                                                          CBH  157
      GSEGR=0.                                                          CBH  158
      PGPU=0.                                                           CBH  159
      DECOM=0.                                                          CBH  160
      EGO=0.                                                            CBH  161
      MW=0.                                                             CBH  162
      BR=0.                                                             CBH  163
      KK=0                                                              CBH  164
      TM=TMZRO                                                          CBH  165
      DTA=0.0                                                           CBH  166
      TMOS=TMZRO-DTMIN                                                  CBH  167
      TMPRT=TM                                                          CBH  168
      REWIND KSCT                                                       CBH  169
      CALL LCOUNT (-2,LCT,NPG,RECORD(35))                               CBH  170
      WRITE (KOUT,542)                                                  CBH  171
      IS=0                                                              CBH  172
      DTM=DTMIN                                                         CBH  173
      DELCR=AMIN1(DEL(1),DELM)/5.0                                      CBH  174
      TSAVE=TA(1)+1.0                                                   CBH  175
      FA=(1.-PSIA)*BA*(RHOOA**(1.-PSIA))                                CBH  176
      FB=(1.-PSIB)*BB*(RHOOB**(1.-PSIB))                                CBH  177
      FC=(1.-PSIC)*BC*(RHOOC**(1.-PSIC))                                CBH  178
      REX=(1.0-.2*BREA)/(1.-BREX)                                       CBH  179
C                                                                       CBH  180
```

```
C     BEGINNING OF FIRE LOOP                                            CBM  181
C                                                                       CBM  182
  410 ITER=ITER+1                                                       CBM  183
C                                                                       CBM  184
C     CALCULATION OF NODAL PROPERTIES                                   CBM  185
C                                                                       CBM  186
      DO 106 N=2,NL                                                     CBM  187
  106 RA(N-1)=RA(N-1)+DSI                                               CBM  188
      RA(NL)=RA(NL)+DSI/2.                                              CBM  189
      CALL UGLE(NL,RA,RK,NUMN,NAV,AREA,EMA)                             CBM  190
      ASU=RK(1)                                                         CBM  191
      J=1-JF M-JF                                                       CBM  192
  100 DO 105 N=1,NL                                                     CBM  193
      J=J+JF                                                            CBM  194
      RR(N)=RK(N)/ASU                                                   CBM  195
      CALL LOOK (3,TA(N),TT2,TCP,TKP,THZ,0,Y2,Y2(4),3)                  CBM  196
      CN(N)=Y2(2)                                                       CBM  197
      CPV(N)=Y2(1)                                                      CBM  198
      HP(N)=Y2(3)+DH1                                                   CBM  199
      CALL LOOK (4,TA(N),TT2(1,2),TCP(1,2),TKP(1,2),THZ(1,2),0,Y2,D2,3) CBM  200
      CNC(N)=Y2(2)                                                      CBM  201
      CPC(N)=Y2(1)                                                      CBM  202
      HC(N)=Y2(3)+DH2                                                   CBM  203
      IF (MATL(N)-1) 103,101,102                                        CBM  204
  101 X(N)=1.                                                           CBM  205
      CP(N)=CPV(N)                                                      CBM  206
      H(N)=HP(N)                                                        CBM  207
      RO(N)=RHO(1)                                                      CBM  208
      ROT(N)=RHO(1)                                                     CBM  209
      GO TO 105                                                         CBM  210
  102 X(N)=0.                                                           CBM  211
      CN(N)=Y2(2)                                                       CBM  212
      H(N)=HC(N)                                                        CBM  213
      CP(N)=CPC(N)                                                      CBM  214
      RO(N)=RHO(2)                                                      CBM  215
      ROT(N)=RHO(2)                                                     CBM  216
      GO TO 105                                                         CBM  217
  103 X(N) = PETE-PET/RO(N)                                             CBM  218
      H(N)=X(N)*HP(N)+(1.-X(N))*HC(N)                                   CBM  219
      CP(N)=X(N)*CPV(N)+(1.-X(N))*CPC(N)                                CBM  220
      IF(N-1) 109,109,104                                               CBM  221
  109 ROT(1)=GAMA*(ROA(1)+ROB(1))+OMG*ROC(1)                            CBM  222
      GO TO 105                                                         CBM  223
  104 ROT(N)=(ROA(J)+ROB(J))*GAMA+OMG*(ROC(J))                          CBM  224
  105 CONTINUE                                                          CBM  225
      IF (ITER) 1050,1050,1051 +                                        CBM  226
 1050 RAT(NL)=DEL(NL)/(RR(NL)*(CN(NL)*X(NL)+CNC(NL)*(1.0-X(NL))))       CBM  227
 1051 CONTINUE                                                          CBM  228
      IF (NUBU) 7413,7413,7412                                          CBM  229
 7412 DO 740  L=1,NUBU                                                  CBM  230
        LL=NFI(L)                                                       CBM  231
        LU=NLA(L)                                                       CBM  232
      N=2*L-1                                                           CBM  233
      DO 741    I=LL,LU                                                 CBM  234
      CALL LOOK(20+2*L,TA(I),TTS(1,N),TCBU(1,N),TKBU(1,N),TENT(1,N)     CBM  235
     C   , 0,Y2,D2,3)                                                   CBM  236
        CN(I)=Y2(2)                                                     CBM  237
        CPV(I)=Y2(1)                                                    CBM  238
        HP(I)=Y2(3)+DHV(L)                                              CBM  239
      CALL LOOK(21+2*L, TA(I), TTS(1,2*L), TCBU(1,2*L), TKBU(1,2*L),     CBM  240
     C    TENT(1,2*L), 0,Y2,D2,3)                                       CBM  241
        CNC(I)=Y2(2)                                                    CBM  242
        CPC(I)=Y2(1)                                                    CBM  243
        HC(I)=Y2(3)+DHC(L)                                              CBM  244
        H(I)=X(I)*HP(I)+(1.0-X(I))*HC(I)                                CBM  245
        RK(I)=AREA(I)/ASU                                               CBM  246
      IF(ITER) 741,7411,741                                             CBM  247
 7411 RO(I)=X(I)*RHOV(L)+(1.0-X(I))*RHOC(L)                             CBM  248
      ROT(I)=RO(I)                                                      CBM  249
      RAT(I)= DEL(I)/(RR(I)*(CN(I)*X(I) + CNC(I)*(1.0 -X(I))))          CBM  250
  741    CP(I)=X(I)*CPV(I)+(1.0-X(I))*CPC(I)                            CBM  251
  740 CONTINUE                                                          CBM  252
 7413 IF(NUMN-NBM2) 112,106,106                                         CBM  253
  106 DO 107 N=NBM2,NUMN                                                CBM  254
      RR(N)=AREA(N)/ASU                                                 CBM  255
      KT=MATL(N)                                                        CBM  256
      CALL LOOK(KT+2,TA(N),TT2(1,KT),TCP(1,KT),TKP(1,KT),0,0,Y2,D2,2)   CBM  257
      CP(N)=Y2(1)                                                       CBM  258
      CN(N)=Y2(2)                                                       CBM  259
      RAT(N)=DEL(N)/(CN(N)*RR(N))                                       CBM  260
  107 RO(N)=RHO(KT)                                                     CBM  261
  112 HRES=SIG*EPSW*(TA(NUMN)+TRES)*(TA(NUMN)**2+TRES**2)+HCONV         CBM  262
      RAT(NUMN+1)=1./(HRES*RR(NUMN)+.00000001)                          CBM  263
      QLOSS=(TA(NL)-TA(NUMN))/(0.5*(RAT(NL)+RAT(NUMN))+RC(NL)/RR(NL))   CBM  264
      QLOSST=QLOSST+QLOSS*DTH/AREA(1)*ASU                               CBM  265
      CHT=CHT+RHO(2)*DSDT*ASU/AREA(1)*DTH                               CBM  266
      DEL(NUMN + 1) = CN(NUMN)/(HRES + 0.00000001)                      CBM  267
      RR(NUMN+1)=RR(NUMN)                                               CBM  268
      DTHS=DTH                                                          CBM  269
      DTS=TSAVE-TA(1)                                                   CBM  270
```

```
      IF(ITER) 151,606,151                                              CBM  271
C                                                                       CBM  272
C     OUTPUT                                                            CBM  273
C                                                                       CBM  274
  151 CALL SSWTCH(4,KKSW)                                               CBM  275
      GO TO (3000,750),KKSW                                             CBM  276
  750 IF (TM-THPRT-.00001) 4410,3000,3000                               CBM  277
 3000 DIDT=12.0*USDTB                                                   CBM  278
      NDR=NUMM-NBL-1                                                    CBM  279
      NLI=(NUMM-NDR+1)/2                                                CBM  280
      K=NLI                                                             CBM  281
      CALL LCOUNT(3J+NLI,LCT,NPG,NECORD(35))                            CBM  282
  322 WRITE (KOUT,543)TM                                                CBM  283
      WRITE (KOUT,544)                                                  CBM  284
      WRITE (KOUT,545) ITER,ITS,II    ,RSU,HW,HE,CM,BR                  CBM  285
      WRITE (KOUT,546)                                                  CBM  286
      WRITE (KOUT,547)                                                  CBM  287
      BPRM=(GS  +CND)/(CM*CBM)                                          CBM  288
      BPRMG=GS  /(CM*CBM)                                               CBM  289
      WRITE (KOUT,548) BPRM,BPRMG,CND,GSMS,CMT,GSMT                     CBM  290
      WRITE (KOUT,5480) CMCRI,PYCRI                                     CBM  291
      WRITE (KOUT,5481) SA,DIDT,CPE(1),DCDT,CPE(2),DPDT                 CBM  292
      WRITE (KOUT,5482)                                                 CBM  293
 3224 WRITE (KOUT,5483) QCONV,QRP,RAD,QCHEM,QCOND,QCONVT,QRPT,RADT,QCHEMCBM  294
     1T,QCONDT                                                          CBM  295
      WRITE (KOUT,5484)                                                 CBM  296
      WRITE (KOUT,5485)PGPU,DFCOM, TB,DEDT,QLOSS,PGPUT,DECOMT, TT,DEDTT,CBM  297
     1QLOSST                                                            CBM  298
      IF (NCOM) 3020,3020,3021                                          CBM  299
 3021 WRITE(KOUT,5490)                                                  CBM  300
      GO TO 3022                                                        CBM  301
 3020 WRITE(KOUT,549)                                                   CBM  302
 3022 CONTINUE                                                          CBM  303
      IF(NDI) 190,190,183                                               CBM  304
  183 CALL SLOPE (NL,HA(1),TA(1),EMO(1))                                CBM  305
      IF(NO) 182,182,184                                                CBM  306
  184 CALL OGLE (NO,SW,TO(1),NL,RA(1),TA(1),EMO(1))                     CBM  307
  182 IF (NI) 189,189,185                                               CBM  308
  185 DO 186 I=1,NL                                                     CBM  309
  186 EMO(I)=1./EMO(I)                                                  CBM  310
      CALL OGLE (NI,SO(NO+1),TO(NO+1),NL,TA,RA,EMO)                     CBM  311
  189 IF(NUMM-NBM)800,801,801                                           CBM  312
  801 CALL THERMS(NISO,TO,DEP,AR,CN,RAT)                                CBM  313
  800 IF(NN) 188,188,187                                                CBM  314
  187 DO 1873 I=1,NDI                                                   CBM  315
      IF(I-NO) 1870,1870,1871                                           CBM  316
 1870 PUNCH 581,I, TM, SO(I), TO(I)                                     CBM  317
      GO TO 1873                                                        CBM  318
 1871 IF(NUMM-NBM) 1870,1874,1874                                       CBM  319
 1874 KI=I-NO                                                           CBM  320
      IF(NISO(KI)-1) 1870,1870,1872                                     CBM  321
 1872 PUNCH 581,I,TM,SO(I),(DEP(KI,J),J=1,N)                            CBM  322
 1873 CONTINUE                                                          CBM  323
  188 WRITE(KSCT) TM,TS,TO,DEP,NISO                                     CBM  324
      KK=KK+1                                                           CBM  325
  190 CONTINUE                                                          CBM  326
      M=NT                                                              CBM  327
      IF (NCOM) 3012,3012,3006                                          CBM  328
 3006 DO 3009 I=1,NL                                                    CBM  329
      IF (NI) 3007,3007,3008                                            CBM  330
 3008 CALL LOOK(31+M,AA(I),TX(1,M),F1(1,M),F2(1,M),0,0,Y1,D1,2)         CBM  331
      CNO(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                                   CBM  332
      GO TO 3009                                                        CBM  333
 3007 CNO(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                               CBM  334
 3009 CONTINUE                                                          CBM  335
      IF(NDBU) 3023,3023,3024                                           CBM  336
 3024 DO 3030 I=1,NDBU                                                  CBM  337
      LL=NF1(I)                                                         CBM  338
      LU=NLA(I)                                                         CBM  339
      L=NBUFT(I)                                                        CBM  340
      DO 3025 J=LL,LU                                                   CBM  341
      IF(L) 3026,3026,3027                                              CBM  342
 3027 CALL LOOK(31+L,X(J),TX(1,L),F1(1,L),F2(1,L),0,0,Y1,D1,2)          CBM  343
      CNO(J)=Y1(1)*CN(J)+Y1(2)*CNC(J)                                   CBM  344
      GO TO 3025                                                        CBM  345
 3026 CNO(J)=X(J)*CN(J)+(1.0-X(J))*CNC(J)                               CBM  346
 3025 CONTINUE                                                          CBM  347
 3030 CONTINUE                                                          CBM  348
 3023 IF(NUMM-NBM2) 3012,3028,3028                                      CBM  349
 3028 DO 3029 I=NBM2,NUMM                                               CBM  350
 3029 CNO(I)=CN(I)                                                      CBM  351
 3012 CONTINUE                                                          CBM  352
      DO 3011 J=1,NLI                                                   CBM  353
      L=J                                                               CBM  354
      IF (L-NL) 3002,3002,3001                                          CBM  355
 3001 L=L+NDR                                                           CBM  356
      K=NLI                                                             CBM  357
      GO TO 3003                                                        CBM  358
 3002 IF (L+NLI-NL) 3003,3003,3005                                      CBM  359
 3005 K=NLI+NDR                                                         CBM  360
```

```
 3003 N=MIN0(NUMN,K+L)                                                  CBM  361
      IF (NCON) 3004,3004,3010                                          CBM  362
 3004 WRITE (KOUT,550) (I,MATL(I),TA(I),RO(I),M(I), I=L,N,K)            CBM  363
      GO TO 3011                                                        CBM  364
 3010 WRITE(KOUT,5500)(I,MATL(I),TA(I),RO(I),CNO(I),I=L,N,K)            CBM  365
 3011 CONTINUE                                                          CBM  366
      IF(SWELL) 3100,3101,3100                                          CBM  367
 3100 SDWET=(1.+SWELL)*DIDT-SWELL*DCDT                                  CBM  368
      WRITE(KOUT,590) SWET,SDWET                                        CBM  369
  590 FORMAT(/10X,40HSURFACE RECESSION AFTER SWELL (INCHES)          = FBCBM  370
     1.4/10X,40HSURFACE RECESSION RATE WITH SWELL (INCHES/SEC) =F8.4)   CBM  371
 3101 CONTINUE                                                          CBM  372
      CALL SSWTCH(3,KKSW)                                               CBM  373
      GO TO (745,746),KKSW                                              CBM  374
  745 IF(NDWU) 746,746,747                                              CBM  375
  747 LU=NBM2-1                                                         CBM  376
      L=LU-NBM+1                                                        CBM  377
      L=L+L/6+2                                                         CBM  378
      CALL LCOUNT(L,LCT,NPG,RECORD(35))                                 CBM  379
      DO 748 I=NBM,LU                                                   CBM  380
  748 WRITE(KOUT,749)(ROCOM(I,J),J=1,3)                                 CBM  381
      WRITE (KOUT,749) (DNDG(J),J=NBM,LU)                               CBM  382
      WRITE(KOUT,749) WSMS,GSM2S,GS,GSM2T,BSM                           CBM  383
      LU=NUMN-NDR                                                       CBM  384
      WRITE(KOUT,7490) (A(K),B(K),C(K),D(K),K=1,LU)                     CBM  385
  749 FORMAT (10X,6E10.3)                                               CBM  386
 7490 FORMAT(10X,4E10.3)                                                CBM  387
  746 CONTINUE                                                          CBM  388
 3225 IF(TM-THFIN+0.00001)115,1,2    ,2                                CBM  389
    2 IF (NUI) 1,1,3                                                    CBM  390
    3 REWIND KSCT                                                       CBM  391
      N=0                                                               CBM  392
      CALL LCOUNT(-18,LCT,NPG,RECORD,35))                               CBM  393
      WRITE(KOUT,552)  NO,NI                                            CBM  394
      WRITE(KOUT,5521)                                                  CBM  395
      WRITE(KOUT,554) TM,TS,(SO(I),I=1,NOI)                             CBM  396
      WRITE (KOUT,553)                                                  CBM  397
      DO 4 K=1,KK                                                       CBM  398
      READ(KSCT) TM,TS,TO,DEP,NISO                                      CBM  399
      DO 805 I=1,NI                                                     CBM  400
      IF(N-NISO(I)) 806,805,805                                         CBM  401
  806 N=NISO(I)                                                         CBM  402
  805 CONTINUE                                                          CBM  403
      CALL LCOUNT( 1 ,LCT,NPG,RECORD(35))                               CBM  404
    4 WRITE (KOUT,554) TM,TS, (TO(I), I=1,NOI)                          CBM  405
      IF(NUMN-NBM) 1,802,802                                            CBM  406
  802 IF(NI-N) 1,1,803                                                  CBM  407
  803 REWIND KSCT                                                       CBM  408
      CALL LCOUNT(-7,LCT,NPG,RECORD(35))                                CBM  409
      WRITE(KOUT,560)                                                   CBM  410
      J=NO+1                                                            CBM  411
      WRITE(KOUT,7041) (SO(I),I=J,NOI)                                  CBM  412
      WRITE(KOUT,7042)                                                  CBM  413
  560 FORMAT(/6X66HTHE FOLLOWING BLOCK GIVES THE OUTPUT TIME AND UP TO FCBM  414
     1IVE LOCATIONS / 6X,55HOF THE INDICATED ISOTHERMS WITHIN THE BACKUPCBM  415
     2 MATERIALS.)                                                      CBM  416
 7041 FORMAT(//12X,9(2X,F10.4))                                         CBM  417
 7042 FORMAT(/)                                                         CBM  418
      DO 804 K=1,KK                                                     CBM  419
      READ(KSCT)TM,TS,TO,DEP,NISO                                       CBM  420
      DO 804 J=1,N                                                      CBM  421
      CALL LCOUNT( 1,LCT,NPG,RECORD(35))                                CBM  422
  804 WRITE(KOUT,554) TM,(DEP(I,J),I=1,NI)                              CBM  423
      GO TO 1                                                           CBM  424
 1151 IF(TM-TPR2+0.00001)  154,158,158                                  CBM  425
  158 DTPRT=DTPR2                                                       CBM  426
      DTPR2=DTPR3                                                       CBM  427
      TPR2=TPR3                                                         CBM  428
      TPR3=THFIN                                                        CBM  429
  154 CONTINUE                                                          CBM  430
      IF(TM-THPRT+.00001) 743,742,742                                   CBM  431
  742 THPRT=AMIN1(THPRT+DTPRT,TPR2)                                     CBM  432
  743 CONTINUE                                                          CBM  433
 4410 DTH=AMIN1(DTHB,DELCR/(DSDTB+.0000001),TM-THDS, 50.0/(ABS(TSAVE-TA(CBM  434
     11))+.1)*DTH)                                                      CBM  435
      TSAVE=TA(1)                                                       CBM  436
      DTH=(THPRT-TM)/(AINT((THPRT-TM)/DTH+1.0))                         CBM  437
  144 TM=TM+DTH                                                         CBM  438
C                                                                       CBM  439
C     FUNCTIONS OF TIME                                                 CBM  440
  606 I=IR(1)                                                           CBM  441
      VF=VFZ                                                            CBM  442
  601 IF(TTM(I+1)-TM+0.00001) 614,604,604                               CBM  443
  614 IF(I+1-INT(1)) 602,604,604                                        CBM  444
  602 I=I+1                                                             CBM  445
      IF(TTM(I+1)-TTM(1)) 601,603,601                                   CBM  446
  603 TM=TM-DTH                                                         CBM  447
      THDS=TTM(I)-DTHIN                                                 CBM  448
      DTH=AMAX1(DTHIN,TTM(I)-TM)                                        CBM  449
      TM=TM+DTH                                                         CBM  450
```

```
      GO TO 601                                                         CBM  451
  604 DEN=(TM-TTM(I))/((TM(I+1)-TTM(I))                                 CBM  452
      IF (TTM(I+1)-TTM(I)) 6040,6040,605                                CBM  453
 6040 DEN=0.                                                            CBM  454
  605 CM=TCM(I)+DEN*(TCM(I+1)-TCM(I))                                   CBM  455
      QRA=TQR(I)+DEN*(TQR(I+1)-TQR(I))                                  CBM  456
      PRES=TPI(I)+DEN*(TPI(I+1)-TPI(I))                                 CBM  457
      ME=TME(I)+DEN*(TME(I+1)-TME(I))                                   CBM  458
      BRP=TBRP(I)+DEN*(TBRP(I+1)-TBRP(I))                               CBM  459
      II=1                                                              CBM  460
      IF(CM) 6001,6001,600                                              CBM  461
 6001 II=2                                                              CBM  462
      CM=0.0                                                            CBM  463
      IF (ME-2.) 6002,6002,600                                          CBM  464
 6002 II=3                                                              CBM  465
      VF=ME                                                             CBM  466
      ME=0.                                                             CBM  467
  600 IR(1)=1                                                           CBM  468
      IF(ITER) 610,113,610                                              CBM  469
  113 DEDT=0.                                                           CBM  470
      ITER=1                                                            CBM  471
      GO TO 3000                                                        CBM  472
  610 IF(DTM-.000001) 162,162,608                                       CBM  473
  162 WRITE (KOUT,502) TM,DTM,DTMS,DTMB,TMDS,DTS,DELCR,DSDTB            CBM  474
      TM=TMFIN                                                          CBM  475
      GO TO 3000                                                        CBM  476
C                                                                       CBM  477
C     INTERNAL DECOMPOSITION  --  DENSITY CALCULATION                   CBM  478
  608 N=-JFM                                                            CBM  479
C                                                                       CBM  480
C     SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL                 CBM  481
      DSDT=DSDTB                                                        CBM  482
      DS=DSDT*DTM                                                       CBM  483
      DSI=12.0*DS                                                       CBM  484
      SA=SA+DSI                                                         CBM  485
      RSU=ABS(RSV+SA)                                                   CBM  486
      DTMB=DTMC                                                         CBM  487
      DEL(NL)=DEL(NL)-DS                                                CBM  488
      FR=0.0                                                            CBM  489
      FJF=FJFM                                                          CBM  490
      J1=JFMP                                                           CBM  491
      DENOLD=RHO(2)                                                     CBM  492
      COLD=CPE(1)                                                       CBM  493
      POLD=CPE(2)                                                       CBM  494
      CPE(1)=RA(NL)+6.*DEL(NL)                                          CBM  495
      CPE(2)=CPE(1)                                                     CBM  496
      IE=1                                                              CBM  497
      ROOZ=0.0                                                          CBM  498
      ISV=MATL(NL+1)                                                    CBM  499
      MATL(NL+1)=MATL(NL)                                               CBM  500
      TA(NL+1)=TA(NBM)                                                  CBM  501
      DEL(NL+1)=DEL(NBM)                                                CBM  502
      RR(NL+1)=RR(NBM)                                                  CBM  503
      DO 252 I=1,NL                                                     CBM  504
      DHDG(I)=0.0                                                       CBM  505
      RON(I)=ROOZ                                                       CBM  506
      DSS=FJF/DEL(I)*DSDT                                               CBM  507
  463 DO 255 J=J1,JF                                                    CBM  508
      N=N+J1-1                                                          CBM  509
      IF (J-JFMP) 253,259,253                                           CBM  510
  259 IF (MATL(I)+MATL(I+1)-4) 263,260,263                              CBM  511
  263 IF(AMAX1(TA(I),TA(I+1))-TRACM)261,261,262                         CBM  512
  261 IF (MATL(I)+MATL(I)+MATL(I+1)-3) 262,260,262                      CBM  513
  260 J1=JFMP                                                           CBM  514
      ROOZ=FJFM*RO(I+1)                                                 CBM  515
      RON(I)=RON(I)+FJFM*RO(I)                                          CBM  516
      N=N+JFM                                                           CBM  517
      GO TO 264                                                         CBM  518
  262 ROOZ=0.0                                                          CBM  519
      DTA=(TA(I+1)-TA(I))/(FJFS-FJF/DEL(I)*DEL(I+1)/RR(I)*RR(I+1))      CBM  520
      J1=1                                                              CBM  521
      TAS=TA(I)                                                         CBM  522
  253 N=N+1                                                             CBM  523
      IF(ABS(DSS)-.000001) 1016,1016,1017                               CBM  524
 1016 DROAC=0.                                                          CBM  525
      DROBC=0.                                                          CBM  526
      DROCC=0.                                                          CBM  527
      GO TO 1021                                                        CBM  528
 1017 IF(I-NL) 1015,1018,1015                                           CBM  529
 1018 FK=FK-1.0                                                         CBM  530
      IF(FK) 1019,1016,1020                                             CBM  531
 1019 FK=FJ-1.0                                                         CBM  532
 1020 DSS=DSDT/DEL(I)*FK                                                CBM  533
 1015 IF (N-1) 1115,1215,1115                                           CBM  534
 1115 DROAC=(ROA(N+1)-ROA(N))*DSS                                       CBM  535
      DROBC=(ROB(N+1)-ROB(N))*DSS                                       CBM  536
      DROCC=(ROC(N+1)-ROC(N))*DSS                                       CBM  537
      GO TO 1021                                                        CBM  538
 1215 IF(II-1) 1115,1315,1115                                           CBM  539
 1315 DROAC=(ROA(N+1)-HHORA)*DSS                                        CBM  540
```

```
      DWOBL=(ROB(N+1)-WWOWB)*DSS                                        CBM  561
      DROCL=(ROC(N+1)-WWORC)*DSS                                        CBM  562
      ROT(1)=RWO(2)                                                     CBM  563
 1021 TAS=TAS+DTA                                                       CBM  564
      IF(TAS-TRACM) 227,227,229                                         CBM  565
  229 IF(TAS  -TWACA) 201,201,202                                       CBM  566
  201 DROAT=0.0                                                         CBM  567
      GO TO 2113                                                        CBM  568
  202 IF(RMORA-ROA(N)) 211,201,201                                      CBM  569
  211 RD=ROA(N)-RMORA                                                   CBM  570
      POW=1.-PSIA                                                       CBM  571
      IF(POW)2111,2112,2111                                             CBM  572
 2111 DROAT=(-RD+((RD**POW)-                    FA*EXP(-EA/TAS)*DTH)**  CBM  573
     1(1./POW))/DTH                                                     CBM  574
      GO TO 2113                                                        CBM  575
 2112 DROAT=RD*(EXP(-WA*DTH*EXP(-EA/TAS))-1.)/DTH                       CBM  576
 2113 ROA(N)=ROA(N)+(DROAT+DROAC)*DTH                                   CBM  577
      IF(ROA(N)-RMORA) 2114,221,221                                     CBM  578
 2114 ROA(N)=ROA(N)-(DROAT+DROAC)*DTH                                   CBM  579
      DROAT=(RMORA-ROA(N))/DTH-DROAC                                    CBM  580
      ROA(N)=RMORA                                                      CBM  581
  221 IF(TAS  -TWACB)203,203,204                                        CBM  582
  203 DROBT=0.0                                                         CBM  583
      GO TO 2133                                                        CBM  584
  204 IF(WWORB-ROB(N))213,203,203                                       CBM  585
  213 RD=ROB(N)-RMORB                                                   CBM  586
      POW=1.-PSIB                                                       CBM  587
      IF(POW)2131,2132,2131                                             CBM  588
 2131 DROBT=(-RD+((RD**POW)-                    FB*EXP(-EB/TAS)*DTH)**  CBM  589
     1(1./POW))/DTH                                                     CBM  590
      GO TO 2133                                                        CBM  591
 2132 DROBT=RD*(EXP(-WB*DTH*EXP(-EB/TAS))-1.)/DTH                       CBM  592
 2133 ROB(N)=ROB(N)+(DROBT+DROBC)*DTH                                   CBM  593
      IF(ROB(N)-RMORB) 2134,223,223                                     CBM  594
 2134 ROB(N)=ROB(N)-(DROBT+DROBC)*DTH                                   CBM  595
      DROBT=(RMORB-ROB(N))/DTH-DROBC                                    CBM  596
      ROB(N)=RMORB                                                      CBM  597
  223 IF(TAS  -TRACC) 205,205,206                                       CBM  598
  205 DROCT=0.0                                                         CBM  599
      GO TO 2153                                                        CBM  600
  206 IF(RMORC-ROC(N))215,205,205                                       CBM  601
  215 RD=ROC(N)-RMORC                                                   CBM  602
      POW=1.-PSIC                                                       CBM  603
      IF (POW) 2151,2152,2151                                           CBM  604
 2151 DROCT=(-RD+((RD**POW)-                    FC*EXP(-EC/TAS)*DTH)**  CBM  605
     1(1./POW))/DTH                                                     CBM  606
      GO TO 2153                                                        CBM  607
 2152 DROCT=RD*(EXP(-WC*DTH*EXP(-EC/TAS))-1.)/DTH                       CBM  608
 2153 ROC(N)=ROC(N)+(DROCT+DROCC)*DTH                                   CBM  609
      IF(ROC(N)-RMORC) 2154,225,225                                     CBM  610
 2154 ROC(N)=ROC(N)-(DROCT+DROCC)*DTH                                   CBM  611
      DROCT=(RMORC-ROC(N))/DTH-DROCC                                    CBM  612
      ROC(N)=RMORC                                                      CBM  613
  225 DHDG(I)=DHDG(I)-VEL(I)*((DROAT+DROBT)*GAMA+DMG+DROCT)             CBM  614
  227 DWS=(ROA(N)+ROB(N))*GAMA+DMG+ROC(N)                               CBM  615
      RON(I)=RON(I)+DWS                                                 CBM  616
      IF(N-1) 2251,2253,2251                                            CBM  617
 2251 IF(DWS-DWCP(IE)) 2253,2252,2252                                   CBM  618
 2252 CPE(IE)=DEL(I)*((FLOAT(N)-0.5)/FJF+1.-FLOAT(I))*12.+RA(I)         CBM  619
      IF(ABS(DWS-DENOLD)-1.0E-20) 2254,2259,2259                        CBM  620
 2259 CPE(IE)= CPE(IE)-DEL(I)/(DWS-DENOLD)*(DWS-DWCP(IE))/FJF*12.0      CBM  621
 2254 CPE(IE)=AMAX1(CPE(IE),5A)                                         CBM  622
      IE=IE+1                                                           CBM  623
 2253 DENOLD=DWS                                                        CBM  624
  255 TAS=TAS+DTA                                                       CBM  625
  264 DHDG(I)=DHDG(I)/FJF*RR(I)                                         CBM  626
      RON(I)=RON(I)/FJF                                                 CBM  627
      IF(I-1) 257,257,254                                               CBM  628
  257 FJF=FJFS                                                          CBM  629
      DTA=DTA/DEL(1)*VEL(2)/2.*RR(2)                                    CBM  630
      GO TO 252                                                         CBM  631
  254 DTA=DTA/DEL(I)*VEL(I+1)/RR(I)*RR(I+1)                             CBM  632
  252 CONTINUE                                                          CBM  633
      IF (NUBU) 2522,2522,2523                                          CBM  634
 2523 DO 700  I=1,NUBU                                                  CBM  635
         GAM=GA(I)                                                      CBM  636
         OMGAM=1. -GAM                                                  CBM  637
         LL=NFI(I)                                                      CBM  638
         LU=NLA(I)                                                      CBM  639
         TRACMI=AMIN1(TRAC(I,1), TRAC (I,2), TRAC(I,3))                 CBM  640
      DO 702    J=LL,LU                                                 CBM  641
         DHDG(J)=0.                                                     CBM  642
      IF(TA(J)-TRACMI) 702,702,703                                      CBM  643
  703 DO 709 K=1,3                                                      CBM  644
      IF(TA(J)-TRAC(I,K)) 705,705,706                                   CBM  645
  705    DRUT(K)=0.                                                     CBM  646
      GO TO 709                                                         CBM  647
  706    RD=ROCOM(J,K)-RMOR(I,K)                                        CBM  648
      IF(RD-0.01) 705,705,7060                                          CBM  649
 7060    F=FF(I,K)                                                      CBM  650
```

```
      E=EE(I,K)                                                         CBM  631
      POW=1.-PSI(I,K)                                                   CBM  632
    IF(POW) 707,708,707                                                 CBM  633
707   DROT(K)=(-RD+((RD**PNW)-4*EXP(-E/TA(J))*DTH)**(1./PON))/DTH       CBM  634
    GO TO 709                                                           CBM  635
708   BF=BBB(I,K)                                                       CBM  636
      DROT(K)=RD*(EXP(-BF*DTH*EXP(-E/TA(J)))-1.)/DTH                    CBM  637
709   ROCON(J,K)=ROCON(J,K)+DROT(K)*DTH                                 CBM  638
      DMDG(J)=-DEL(J)*((DROT(1)+DROT(2))*GAM+OMGAM*DROT(3))/RR(J)       CBM  639
701   RON(J)=(ROCON(J,1)+ROCON(J,2))*GAM+OMGAM*ROCON(J,3)               CBM  640
702 CONTINUE                                                            CBM  641
700 CONTINUE                                                            CBM  642
C     NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES           CBM  643
2522 J=JFMP                                                             CBM  644
    MATL(NL+1)=ISV                                                      CBM  645
    DO 85 I=1,NL                                                        CBM  646
    IF(ABS(RON(I)-RHO(1))-.01) 81,81,82                                 CBM  647
 81 MATL(I)=1                                                           CBM  648
    X(I)=1.0                                                            CBM  649
    GO TO 85                                                            CBM  650
 82 IF (ABS(RON(I)-RHO(2))-.01) 83,83,84                                CBM  651
 83 MATL(I)=2                                                           CBM  652
    X(I)=0.                                                             CBM  653
    CN(I)=CNC(I)                                                        CBM  654
    GO TO 85                                                            CBM  655
 84 MATL(I)=0                                                           CBM  656
    X(I)=PETE-PET/RON(I)                                                CBM  657
    IF (WT) 8500,8500,8501                                              CBM  658
8501 L=WT                                                               CBM  659
    CALL LOOK(3,L,X(I),TX(1,L),F1(1,L),F2(1,L),0,0,Y1,D1,2)             CBM  660
    CN(I)=Y1(1)*CN(I)+Y1(2)*CNC(I)                                      CBM  661
    GO TO 85                                                            CBM  662
8500 CN(I)=X(I)*CN(I)+(1.0-X(I))*CNC(I)                                 CBM  663
 85 RAT(I)=DEL(I)/(CN(I)*RR(I))                                         CBM  664
    IF (NUBU) 7121,7121,7122                                            CBM  665
7122 DO 710  I=1,NDBU                                                   CBM  666
      LL=NFI(I)                                                         CBM  667
      LU=NLA(I)                                                         CBM  668
    DO 711    J=LL,LU                                                   CBM  669
    IF(ABS(RON(J)-RHOV(I))-.01) 712,712,713                             CBM  670
 712    MATL(J)= 20+2*I                                                 CBM  671
      X(J)=1.0                                                          CBM  672
    GO TO 716                                                           CBM  673
 713  IF(ABS(RON(J)-RHOC(I))-.01) 714,714,715                           CBM  674
 714    MATL(J)=21+2*I                                                  CBM  675
    X(J)=0.                                                             CBM  676
    RON(J)=RHOC(I)                                                      CBM  677
    CN(J)=CNC(J)                                                        CBM  678
    GO TO 716                                                           CBM  679
 715    MATL(J)=0                                                       CBM  680
      X(J)=P(I)-PP(I)/RON(J)                                            CBM  681
    IF(NBUFT(I)) 7151,7153,7150                                         CBM  682
7150 L=NBUFT(I)                                                         CBM  683
    CALL LOOK(3,L,X(J),TX(1,L),F1(1,L),F2(1,L),0,0,Y1,D1,2)             CBM  684
    CN(J)=Y1(1)*CN(J)+Y1(2)*CNC(J)                                      CBM  685
    GO TO 716                                                           CBM  686
7151 CONTINUE                                                           CBM  687
      CN(J)=X(J)*CN(J)+(1.0-X(J))*CNC(J)                                CBM  688
 716    RAT(J)=DEL(J)/(CN(J)*RR(J))                                     CBM  689
 711 CONTINUE                                                           CBM  690
 710 CONTINUE                                                           CBM  691
7121 GSM= 0.0                                                           CBM  692
    DO 122 I=1,NL                                                       CBM  693
 122 GSM=GSM+DMDG(I)                                                    CBM  694
    GSMS=GSM                                                            CBM  695
    GSMT=GSMT+GSMS*ASW/AREA(1)*DTH                                      CBM  696
      GSM2=0.                                                           CBM  697
    IF (NUBU)  7100,7100,7101                                           CBM  698
7101 DO 717  I=1,NDBU                                                   CBM  699
      LL=NFI(I)                                                         CBM  700
      LU=NLA(I)                                                         CBM  701
    DO 718    J=LL,LU                                                   CBM  702
 718    GSM2=GSM2+DMDG(J)                                               CBM  703
 717 CONTINUE                                                           CBM  704
7100 GSM2S=GSM2                                                         CBM  705
      GSM2T=GSM2T+GSM2S*ASW/AREA(1)*DTH                                 CBM  706
      GS=GSMS+GSM2S                                                     CBM  707
      GSS=GS                                                            CBM  708
    UCDT=(CPE(1)-COLD)/DTH                                              CBM  709
    DPDT=(CPE(2)-POLD)/DTH                                              CBM  710
C                                                                       CBM  711
C       CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS                CBM  712
C       AND INTERNAL ENERGY RATE TERMS                                  CBM  713
C     MAIN BLOCK                                                        CBM  714
    DVB=0.                                                              CBM  715
    SDEGR=0.                                                            CBM  716
    GSEGR=0.                                                            CBM  717
    TB=0.                                                               CBM  718
    RAT(1)=2.*RAT(1)                                                    CBM  719
    CPNL=CP(NL)                                                         CBM  720
```

```
      NLM=NL-1                                                          CBM  721
      IMIN=0                                                            CBM  722
      DO 30 I=IMIN,NLM                                                  CBM  723
      IF (I) 15,15,14                                                   CBM  724
   14 GSM=GSM-DMDG(I)                                                   CBM  725
      DRODTD=-DMDG(I)/(RR(I)*DEL(I))                                    CBM  726
      FACT1=DTM/(DEL(I)*RR(I))                                          CBM  727
      FACT2=GSM/(DEL(I)*RR(I))                                          CBM  728
      A(I)=-FACT1*DVB                                                   CBM  729
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))                       CBM  730
      TERM2=RON(I)*CP(I)-DTM*(CPGAS*(DRODTD-FACT2)                      CBM  731
     1          -DSDT*RO1*CP1/DEL(I))                                   CBM  732
      TERM1=FACT1*DVB                                                   CBM  733
      B(I)=TERM2-A(I)+TERM1                                             CBM  734
      C(I)=-TERM1                                                       CBM  735
      D(I)=TA(I)*TERM1+(HGAS*DRODTD-HBAR*(RON(I)                        CBM  736
     1          -RO(I))/DTM-FACT2*HGAS-DSDT*RO1*H1/DEL(I))*DTM          CBM  737
   15 RO1=ROT(I+1)                                                      CBM  738
      X1=PETE-PET/RO1                                                   CBM  739
      CP1=CPV(I+1)*X1+CPC(I+1)*(1.0-X1)                                 CBM  740
      H1=HP(I+1)*X1+HC(I+1)*(1.0-X1)                                    CBM  741
      CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))                     CBM  742
      TN=-RO1*HBAR+RO1*H1+T                                             CBM  743
      HBAR=PETE*HP(I+1)-PET/RHO(1)*HC(I+1)                              CBM  744
      T=-RO1*H1+RO1*HBAR                                                CBM  745
   20 CALL LOOK (2,TA(I+1),TT1,TMG,0,0,0,HGAS,CPGAS,1)                  CBM  746
      HGAS=HGAS+DELHG                                                   CBM  747
      GSEGR=GSEGR+HGAS*DMDG(I+1)                                        CBM  748
      SOEGR=SOEGR+HBAR*DMDG(I+1)                                        CBM  749
      IF (I) 24,24,25                                                   CBM  750
   24 EGO=GSMS*HGAS                                                     CBM  751
      HW=HGAS                                                           CBM  752
      GO TO 30                                                          CBM  753
   25 TERM3=(-FACT2*CPGAS-DSDT*RO1*CP1/DEL(I))*DTM                      CBM  754
      C(I)=C(I)+TERM3                                                   CBM  755
      D(I)=D(I)+TA(I+1)*TERM3+(FACT2*HGAS+DSDT*RO1*H1/DEL(I))*DTM       CBM  756
      TB=TB-TN*DSDT*RR(I)                                               CBM  757
   30 CONTINUE                                                          CBM  758
      A(1)=DTM/DEL(1)                                                   CBM  759
      TT=TT+TB*DTM/AREA(1)*ASU                                          CBM  760
C     NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT           CBM  761
      DRODTD=-DMDG(NL)/(RR(NL)*DEL(NL))                                 CBM  762
      FACT1=DTM/(DEL(NL)*RR(NL))                                        CBM  763
      A(NL)=-FACT1*DVB                                                  CBM  764
      DVB=1.0/(0.5*(RAT(NL)+RAT(NBN))+RC(NL)/RR(NL))                    CBM  765
      C(NL)=-FACT1*DVB                                                  CBM  766
      TERM2=RON(NL)*CP(NL)-(CPGAS*DRODTD+(DSDT/DEL(NL))*                CBM  767
     1          (RO (NL)*CPNL  -RO1*CP1))*DTM                           CBM  768
      B(NL)=TERM2-C(NL)-A(NL)                                           CBM  769
      D(NL)=TA(NL)*TERM2+DTM*(HGAS*DRODTD-HBAR*(RON(NL)-                CBM  770
     1          RO(NL))/DTM+DSDT*(RO (NL)*H(NL)-RO1*H1)/DEL(NL))        CBM  771
      K = NL                                                            CBM  772
      GSM=GSM-DMDG(NL)                                                  CBM  773
      IF(NDBU) 7170,7171,7170                                           CBM  774
 7170 FACT2=GSM/(DEL(NL)*RR(NL))                                        CBM  775
      TERM2=FACT2*CPGAS*DTM                                             CBM  776
      B(NL)=B(NL)+TERM2                                                 CBM  777
      D(NL)=D(NL)+TA(NL)*TERM2-FACT2*HGAS*DTM                           CBM  778
      CALL LOOK(2,TA(NBN),TT1,TMB,0,0,0,HGAS,CPGAS,1)                   CBM  779
      HGAS=HGAS+DELHG                                                   CBM  780
      C(NL)=C(NL)-FACT2*CPGAS*DTM                                       CBM  781
      D(NL)=D(NL)-TA(NBN)*FACT2*CPGAS*DTM+FACT2*HGAS*DTM                CBM  782
 7171 CONTINUE                                                          CBM  783
C-----NOW FOR DECOMPOSING BACK-UPS IF ANY                               CBM  784
      IF (NDBU) 7250,7250,7251                                          CBM  785
 7251 DO 720  L=1,NDBU                                                  CBM  786
      LL=NFI(L)-1                                                       CBM  787
      LU=NLA(L)                                                         CBM  788
      DO 7241  I=LL,LU                                                  CBM  789
      IF(I-NFI(L)+1) 725,726,725                                        CBM  790
  725    GSM=GSM-DMDG(I)                                                CBM  791
      DVBS=DVB                                                          CBM  792
         K=K+1                                                          CBM  793
         DRODTD=-DMDG(I)/(RR(I)*DEL(I))                                 CBM  794
         FACT1=DTM/(DEL(I)*RR(I))                                       CBM  795
         FACT2=GSM/(DEL(I)*RR(I))                                       CBM  796
         A(K)=-FACT1*DVB                                                CBM  797
         DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))                    CBM  798
         TERM2=RON(I)*CP(I)-DTM*(CPGAS*(DRODTD-FACT2))                  CBM  799
         TERM1=FACT1*DVB                                                CBM  800
         B(K)=TERM2-A(K)+TERM1                                          CBM  801
         C(K)=-TERM1                                                    CBM  802
         D(K)=TA(I)*TERM2+(HGAS*DRODTD-HBAR*(RON(I)-RO(I))/DTM          CBM  803
     C   -FACT2*HGAS)*DTM                                               CBM  804
      IF(I-NLA(NDBU)) 726,727,727                                       CBM  805
  726    CP(I+1)=CPV(I+1)*X(I+1)+CPC(I+1)*(1.0-X(I+1))                  CBM  806
      HBARS=HBAR                                                        CBM  807
         HBAR=P(L)*HP(I+1)-PP(L)/RHOV(L)*HC(I+1)                        CBM  808
      CALL LOOK (2,TA(I+1), TT1,TMB,0,0,0,HGAS,CPGAS,1)                 CBM  809
         HGAS=HGAS+DELHG                                                CBM  810
```

```
      IF(I-NF1(L)+1) 724,724,727                                        CBN  811
  727     TEMM3= (-FACT2*CPGAS)*DTH                                     CBN  812
          C(K)=C(K)+TEMM3                                               CBN  813
          D(K)=D(K)+TA(I+1)*TEMM3+FACT2*MGAS*DTH                        CBN  814
  724 CALL SSWTCH(5,NASW)                                               CBN  815
      GO TO (7240,7241),KKSW                                            CBN  816
 7240 WRITE(KOUT,7270) I,K,L,DEL(I),RR(I),CP(I),CPV(I),CPC(I),HP(I),    CBN  817
     1HC(I),CH(I),RAT(I),RO(I),RON(I),X(I),DMDG(I),DMDDTD,P(L),PP(L),   CBN  818
     2MGAS,CPGAS,DVB,DVBS,MBAR,MBARS,GSM,FACT1,FACT2,TERM1,TERM2,TERM3, CBN  819
     3GA(L),OMGA(L),A(K),B(K),C(K),D(K)                                 CBN  820
 7270 FORMAT(5X,3I5,16E10.3/(20X,10E10.3))                              CBN  821
 7241 CONTINUE                                                          CBN  822
  720 CONTINUE                                                          CBN  823
C     NOW FOR BACK UPS IF ANY                                           CBN  824
 7250 IF(NUMB-NBM2) 60,40,40                                            CBN  825
   40 DO 50 I=NBM2,NUMM                                                 CBN  826
      K=K+1                                                             CBN  827
      FACT1=DTH/(DEL(I)*RR(I))                                          CBN  828
      A(K) = -FACT1*DVB                                                 CBN  829
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+HC(I)/RR(I))                       CBN  830
      C(K)=-FACT1*DVB                                                   CBN  831
      B(K)=RO(I)*CP(I)-C(K)-A(K)                                        CBN  832
   50 D(K)=TA(I)*RO(I)*CP(I)                                            CBN  833
C     NOW IF THE LAST NODE WAS INSULATED WE MUST REPAIR LAST B AND C    CBN  834
   60 IF(MRES) 80,70,60                                                 CBN  835
   70 B(K)=B(K)+C(K)                                                    CBN  836
      C(K)=0.                                                           CBN  837
C     NOW BEFORE GAUSS REDUCTION REWRITE LAST LINE OF MATRIX            CBN  838
   80 D(K)=D(K)-C(K)*TRES                                               CBN  839
      L=K                                                               CBN  840
      DO 90 I=2,K                                                       CBN  841
      L=L-1                                                             CBN  842
      D(L)=D(L)-C(L)/B(L+1)*D(L+1)                                      CBN  843
   90 B(L)=B(L)-C(L)/B(L+1)*A(L+1)                                      CBN  844
      B(1)=B(1)/A(1)                                                    CBN  845
      D(1)=D(1)/A(1)                                                    CBN  846
      PGPU=EGO-GSEGR                                                    CBN  847
      PGPUT=PGPUT+PGPU*DTH/AREA(1)*ASU                                  CBN  848
      DECOM=GSEGR-SOEGR                                                 CBN  849
      DECOMT=DECOMT+DECOM*DTH/AREA(1)*ASU                               CBN  850
C                                                                       CBN  851
C     SURFACE BOUNDARY CONDITION PACKAGE                                CBN  852
C                                                                       CBN  853
      CHZ=CH                                                            CBN  854
      AP1=A(1)                                                          CBN  855
      ITL=10                                                            CBN  856
      ITS=1                                                             CBN  857
      SHET=(1.+SHELL)*SA-SHELL*CPE(1)                                   CBN  858
      IF(II-2) 2502,1420,2501                                           CBN  859
 1420 DSDTD=GRA/12000.0                                                 CBN  860
      TA(1)=HE                                                          CBN  861
      HE=0.                                                             CBN  862
      HW=0.0                                                            CBN  863
      QR=0.0                                                            CBN  864
      CHD=DSDTD*((HOA(1)+HOB(1))*GAMA+ROC(1)*GHB)                       CBN  865
      RAD=0.                                                            CBN  866
      QRA=0.                                                            CBN  867
      QCHEM=0.                                                          CBN  868
      QCONV=0.                                                          CBN  869
      GO TO 1437                                                        CBN  870
 2501 TABC=V0000.0                                                      CBN  871
      DSDTD=0.                                                          CBN  872
      EBFA=U(1)                                                         CBN  873
      QCHEM=0.                                                          CBN  874
      QCONV=0.                                                          CBN  875
      GO TO 2503                                                        CBN  876
 2502 IF (RN) 1424,1424,1425                                            CBN  877
 1425 CHW=CH/((1+SHET/ABS(HSV))**REX)                                   CBN  878
      CHZ=CH                                                            CBN  879
 1424 GO TO (1427,1428),NFIS                                            CBN  880
 1427 BF=(CHD-CHFL+ GB)/CH                                              CBN  881
      GO TO 1429                                                        CBN  882
 1428 BF=(CHD-CHFL)/CH                                                  CBN  883
 1429 CONTINUE                                                          CBN  884
      PHI=2.*BRP*BF                                                     CBN  885
      IF(PHI-.01)1422,1422,1423                                         CBN  886
 1422 CHW=CH*(1.-.5*PHI)                                                CBN  887
      GO TO 1426                                                        CBN  888
 1423 CHW=CH/(EXP(PHI)-1.)*PHI                                          CBN  889
 1426 GO TO (14260,14261),NFIG                                          CBN  890
14260 CHW=AMAX1(CH,GS/AMAX1(TWS(1),TWS(NWB)))                           CBN  891
14261 CONTINUE                                                          CBN  892
      EBFA=CHW*HE+D(1)                                                  CBN  893
      CALL LOOK (12,6b  /(CH*(TW).TWS,0.0,0.0,0.0,V2,02,0)              CBN  894
      INS=IR(12)                                                        CBN  895
      VRW=VH                                                            CBN  896
      IPR=1                                                             CBN  897
      IF(NPR-1) 2510,2510,2511                                          CBN  898
 2511 CALL LOOK(13,PRLS,TPR,0.0,0.0,0.0,V2,02,0)                        CBN  899
      IPR=IR(13)                                                        CBN  900
```

```
      ILO(16)=MLO(IMG,IPR+1)                                            CBM  901
      IMI(16)=MMI(IMG,IPR+1)                                            CBM  902
      ILO(17)=MLO(IMG+1,IPR+1)                                          CBM  903
      IMI(17)=MMI(IMG+1,IPR+1)                                          CBM  904
      VRP=VW                                                            CBM  905
      I3=ILO(16)                                                        CBM  906
      I4=ILO(17)                                                        CBM  907
 2510 ILO(14)=MLO(IMG,IPR)                                              CBM  908
      IMI(14)=MMI(IMG,IPR)                                              CBM  909
      ILO(15)=MLO(IMG+1,IPR)                                            CBM  910
      IMI(15)=MMI(IMG+1,IPR)                                            CBM  911
      I1=ILO(14)                                                        CBM  912
      I2=ILO(15)                                                        CBM  913
      IF(NPW-1) 2512,2512,2513                                          CBM  914
 2513 IF(IMI(17)-I4) 420,420,2514                                       CBM  915
 2514 IF(IMI(16)-I3) 420,420,2512                                       CBM  916
 2512 IF(IMI(14)-I1) 420,420,2504                                       CBM  917
 2504 IF(IMI(15)-I2) 420,420,2505                                       CBM  918
 2505 TABC=TTS(I1,IMG,IPR)+VRW*(TTS(I2,IMG+1,IPR)-TTS(I1,IMG,IPR))      CBM  919
      IF(NPW-1) 2503,2503,2515                                          CBM  920
 2515 TABC=TABC+VRP*(TTS(I3,IMG,IPR+1)+VR*(TTS(I4,IMG+1,IPR+1)-TTS(I3,IMCBM  921
     1G,IPR+1))-TABC)                                                   CBM  922
 2503 IF(TSAVE-TABC) 420,420,421                                        CBM  923
C     ---------- ABLATING SURFACE                                       CBM  924
  421 IF(IAB) 422,422,423                                               CBM  925
  422 CMDL=TLMC(I1,IMG,IPR)-VR*(TLMC(I1,IMG,IPR)-TLMC(I2,IMG+1,IPR))    CBM  926
      CMD=EXP(CMDL)*CM                                                  CBM  927
      IAB=1                                                             CBM  928
  423 CALL LOOK(14,CMDL,TLMC(1,IMG,IPR),TTS(1,IMG,IPR),TCHEM(1,IMG,IPR),CBM  929
     1TBPF(1,IMG,IPR),0,Y2(1),Y2(4),3)                                  CBM  930
      IRA=IW(14)                                                        CBM  931
      CALL LOOK(15,CMDL,TLMC(1,IMG+1,IPR),TTS(1,IMG+1,IPR),TCHEM(1,IMG+1CBM  932
     1,IPR),TBPF(1,IMG+1,IPR),0,Y2(7),Y2(10),3)                         CBM  933
      IRB=IW(15)                                                        CBM  934
      IF(NPW-1) 4233,4233,4231                                          CBM  935
 4231 CALL LOOK(16,CMDL,TLMC(1,IMG,IPR+1),TTS(1,IMG,IPR+1),TCHEM(1,IMG,ICBM  936
     1PR+1),TBPF(1,IMG,IPR+1),0,Y2(13),Y2(16),3)                        CBM  937
      IRC=IR(16)                                                        CBM  938
      CALL LOOK(17,CMDL,TLMC(1,IMG+1,IPR+1),TTS(1,IMG+1,IPR+1),TCHEM(1,ICBM  939
     1MG+1,IPW+1),TBPF(1,IMG+1,IPR+1),0,Y2(19),Y2(22),3)                CBM  940
      IRD=IW(17)                                                        CBM  941
      DO 4232 I=1,12                                                    CBM  942
 4232 Y2(I)=Y2(I)+VRP*(Y2(I+12)-Y2(I))                                  CBM  943
      IF(NBWF) 4237,4237,4238                                           CBM  944
 4238 IF(VRP-1.) 4234,4234,4235                                         CBM  945
 4235 Y2(3)=Y2(15)                                                      CBM  946
      Y2(9)=Y2(21)                                                      CBM  947
      GO TO 4237                                                        CBM  948
 4234 IF(VRP) 4236,4237,4237                                            CBM  949
 4236 Y2(3)=(Y2(3)-Y2(15)*VRP)/(1.-VRP)                                 CBM  950
      Y2(9)=(Y2(9)-Y2(21)*VRP)/(1.-VRP)                                 CBM  951
 4237 CONTINUE                                                          CBM  952
 4233 DO 426 I=1,6                                                      CBM  953
  426 Y2(I)=Y2(I)+VRW*(Y2(I+6)-Y2(I))                                   CBM  954
      IF(Y2(1)) 4260,4260,4261                                          CBM  955
 4260 ITL=115                                                           CBM  956
      GO TO 4356                                                        CBM  957
 4261 CONTINUE                                                          CBM  958
      CALL LOOK(4,Y2(1),TT2(1,2),TEP(1,2),0,0,0,EMIV,DMIV,1)            CBM  959
      IF(MATL(1)-2) 428,427,428                                         CBM  960
  428 CALL LOOK(3,Y2(1),TT2(1,1),TEP(1,1),0,0,0,Y3,D3,1)                CBM  961
      EMIV=EMIV+XP1*(Y3-EMIV)                                           CBM  962
      DMIV=DMIV+XP1*(D3-DMIV)                                           CBM  963
  427 TSSQ=Y2(1)*Y2(1)                                                  CBM  964
      TS=Y2(1)                                                          CBM  965
      RAD=SIG*EMIV*TSSQ*TSSQ*VF                                         CBM  966
  436 ERR=CM*Y2(2)+EMIV*QRA-RAD-B(1)*TS+ERFX                            CBM  967
      DERR=CM*Y2(5)+((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))*Y2(4)          CBM  968
      ERRC=ERR/DERR                                                     CBM  969
      VITER(ITS)=CMDL                                                   CBM  970
      ETER(ITS)=ERR                                                     CBM  971
      CMDL=CMDL-ERRC                                                    CBM  972
      CMMI=-1.E+30                                                      CBM  973
      CMMA=+1.E+30                                                      CBM  974
      IF(ILO(14)-IRA) 4361,4363,4363                                    CBM  975
 4361 IF(ILO(15)-IRB) 4362,4363,4363                                    CBM  976
 4362 IF(NPR-1) 4270,4270,4271                                          CBM  977
 4271 IF(ILO(16)-IRC) 4272,4363,4363                                    CBM  978
 4272 IF(ILO(17)-IRD) 4273,4363,4363                                    CBM  979
 4273 CMMI=AMAX1(TLMC(IRD,IMG,1,IPR+1)+TLMC(IRD-1,IMG+1,IPW+1),TLMC(IRC,CBM  980
     1IMG,IPR+1)+TLMC(IRC-1,IMG,IPR+1))                                 CBM  981
C        GMI,BRI(CMLT,)RPI,GMI,1-ARI(CMLT+)RPI,GMI,ARI(CMLT,IMMC(F1XAM=IMCBM  982
 4270 CMMI=AMAX1(CMMI,TLMC(IRA,IMG,IPR)+TLMC(IRA-1,IMG,IPR),TLMC(IRB,IMGCBM  983
     1+1,IPW)+TLMC(IRB-1,IMG+1,IPR))/2.                                 CBM  984
      CMDL=AMAX1(CMDL,CMMI)                                             CBM  985
 4363 IF(IMI(14)-IRA-1) 4366,4366,4364                                  CBM  986
 4364 IF(IMI(15)-IRB-1) 4366,4366,4274                                  CBM  987
 4274 IF(NPR-1) 4275,4275,4276                                          CBM  988
 4276 IF(IMI(16)-IRC-1) 4366,4366,4277                                  CBM  989
 4277 IF(IMI(17)-IRD-1) 4366,4366,4278                                  CBM  990
```

```
 4278 CMMA=AMIN1(TLMC(IRD+1,IMG+1,IPR+1)+TLMC(IRD+2,IMG+1,IPR+1),        CBM  991
     1TLMC(IRC+2,IMG,IPR+1))                                             CBM  992
C        1+SMI(CMLT,)RPI,GMI,2+ARI(CMLT,)RPI,GMI,1+ARI(CMLT,AMMC(FINIM=AMCBM  993
 4275 CMMA=AMIN1(CMMA,TLMC(IRA+1,IMG,IPR)+TLMC(IRA+2,IMG,IPR),TLMC(IRB+1CBM  994
     1,IMG+1,IPR)+TLMC(IRB+2,IMG+1,IPR))/2.                              CBM  995
      CMDL=AMIN1(CMDL,CMMA)                                              CBM  996
      IF(ITS-ITL-1) 4366,4351,4352                                       CBM  997
 4351 ERRS=ERR                                                           CBM  998
      CMDL=CMMA                                                          CBM  999
      GO TO 4367                                                         CBM 1000
 4352 IF(ERR*ERRS) 4354,4367,4353                                        CBM 1001
 4353 CMDL=CMMA                                                          CBM 1002
      GO TO 4367                                                         CBM 1003
 4354 ITL=55                                                             CBM 1004
      IF(ERR<) 4355,4367,4367                                            CBM 1005
 4355 CMDL=CMMI                                                          CBM 1006
      GO TO 4367                                                         CBM 1007
 4366 IF(ITS-ITL) 4367,4356,4367                                         CBM 1008
 4356 CMDL=AMIN1(TLMC(I1,IMG,IPR),TLMC(I2,IMG+1,IPR))                    CBM 1009
      IF(NPW-3) 4367,4367,4279                                           CBM 1010
C                  )1+RPI,1+GMI,4I(CMLT,)1+RPI,GMI,3I(CMLT,LDMC(FINIM=LDCBM 1011
 4279 CMDL=AMIN1(CMDL,TLMC(I3,IMG,IPR+1),TLMC(I4,IMG+1,IPR+1))           CBM 1012
 4367 CMD=EXP(CMDL)*CM*CMM                                               CBM 1013
      IF(ITS-50) 440,440,998                                             CBM 1014
  440 ITS=ITS+1                                                          CBM 1015
      IF(ABS(ERR )-1.  ) 4372,4372,423                                   CBM 1016
C     ----------  NON-ABLATING SURFACE                                   CBM 1017
  428 TS=TSAVE                                                           CBM 1018
      IAB=0                                                              CBM 1019
      CMD=0.0                                                            CBM 1020
  430 IF(II-3) 4302,433,4302                                             CBM 1021
 4302 ILO(18)=1                                                          CBM 1022
      IHI(18)=MHI(IMG,IPR)                                               CBM 1023
      ILO(19)=1                                                          CBM 1024
      IHI(19)=MHI(IMG+1,IPR)                                             CBM 1025
      CALL LOOK (18,TS,TTS(1,IMG,IPR),TCMEM(1,IMG,IPR),0.0,0.0,Y2(1),Y2(2)CBM 1026
     1,1)                                                                CBM 1027
      CALL LOOK (19,TS,TTS(1,IMG+1,IPR),TCMEM(1,IMG+1,IPR),0.0,0.0,Y2(3), CBM 1028
     1Y2(4),1)                                                           CBM 1029
      IF(NPW-1) 4322,4322,4303                                           CBM 1030
 4303 ILO(20)=1                                                          CBM 1031
      IHI(20)=MHI(IMG,IPR+1)                                             CBM 1032
      ILO(21)=1                                                          CBM 1033
      IHI(21)=MHI(IMG+1,IPR+1)                                           CBM 1034
      CALL LOOK (20,TS,TTS(1,IMG,IPR+1),TCMEM(1,IMG,(PR+1),0.0,0.0,Y2(5), CBM 1035
     1Y2(6),1)                                                           CBM 1036
      CALL LOOK (21,TS,TTS(1,IMG+1,IPR+1),TCMEM(1,IMG+1,IPR+1),0.0,0.0,   CBM 1037
     1Y2(7),Y2(8),1)                                                     CBM 1038
      DO 4321 I=1,4                                                      CBM 1039
 4321 Y2(I)=Y2(I)+VWP*(Y2(I+4)-Y2(I))                                    CBM 1040
 4322 DO 4323 I=1,2                                                      CBM 1041
 4323 Y2(I)=Y2(I)+VRM*(Y2(I+2)-Y2(I))                                    CBM 1042
  433 CALL LOOK (4,TS,TT2(1,2),TEP(1,2),0.0,0.0,EMIV,DMIV,1)             CBM 1043
      IF(MAIL(1)-2) 434,442,434                                          CBM 1044
  434 CALL LOOK (3,TS,TT2(1,1),TEP(1,1),0.0,0.0,Y3,D3,1)                 CBM 1045
      EMIV=EMIV+AP1*(Y3-EMIV)                                            CBM 1046
      DMIV=DMIV+AP1*(D3-DMIV)                                            CBM 1047
  442 TSSQ=TS*TS                                                         CBM 1048
      IF(II-3) 4422,4421,4422                                            CBM 1049
 4421 IF (EMIV) 4422,4423,4422                                           CBM 1050
 4423 EMIV=1.0                                                           CBM 1051
 4422 RAD=SIG*EMIV*TSSQ*TSSQ*VF                                          CBM 1052
  439 ERR=CM*Y2(1)*EMIV*QRA-RAD-B(1)*TS+ERFX                             CBM 1053
      DERR=CM*Y2(2)*((QRA-RAD/EMIV)*DMIV-4./TS*RAD-B(1))                 CBM 1054
      ERRC=ERR/DERR                                                      CBM 1055
      VITER(ITS)=TS                                                      CBM 1056
      ETTER(ITS)=ERR                                                     CBM 1057
      TS=TS-ERRC                                                         CBM 1058
      IF(II-3) 4391,4507,4507                                            CBM 1059
 4391 TSMI=-1.E+30                                                       CBM 1060
      TSMA=+1.E+30                                                       CBM 1061
      IRA=IH(18)                                                         CBM 1062
      IRB=IH(19)                                                         CBM 1063
      IRC=IH(20)                                                         CBM 1064
      IRD=IH(21)                                                         CBM 1065
      IF(ILO(18)-IRA) 4500,4501,4501                                     CBM 1066
 4500 IF(ILO(19)-IRB) 4502,4501,4501                                     CBM 1067
 4502 IF(NPW-1) 4503,4503,4504                                           CBM 1068
 4504 IF(ILO(20)-IRC) 4505,4501,4501                                     CBM 1069
 4505 IF(ILO(21)-IRD) 4506,4501,4501                                     CBM 1070
 4506 TSMI=AMAX1(TTS(IRD,IMG+1,IPR+1)+TTS(IRD-1,IMG+1,IPR+1),TTS(IRC,    CBM 1071
     1IMG,IPR+1)+TTS(IRC-1,IMG,IPR+1))                                   CBM 1072
 4503 TSMI=AMAX1(TSMI,TTS(IRB,IMG+1,IPR)+TTS(IRB-1,IMG+1,IPR),           CBM 1073
     1TTS(IRA,IMG,IPR)+TTS(IRA-1,IMG,IPR))/2.                            CBM 1074
      TS=AMAX1(TS,TSMI)                                                  CBM 1075
 4501 IF(IHI(18)-IRA-1) 4507,4507,4508                                   CBM 1076
 4508 IF(IHI(19)-IRB-1) 4507,4507,4509                                   CBM 1077
 4509 IF(NPW-1) 4510,4510,4511                                           CBM 1078
 4511 IF(IHI(20)-IRC-1) 4507,4507,4512                                   CBM 1079
 4512 IF(IHI(21)-IRD-1) 4507,4507,4513                                   CBM 1080
```

```
 4513 TSMA=AMIN1(TTS(IRD+1,IMG+1,IPR+1),TTS(IRD+2,IMG+1,IPR+1),
     1TTS(IRC+1,IMG,IPR+1),TTS(IRC+2,IMG,IPR+1))
 4510 TSMA=AMIN1(TSMA,TTS(IRB+1,IMG+1,IPR),TTS(IRB+2,IMG+1,IPR),
     1TTS(IRA+1,IMG+IPR),TTS(IRA+2,IMG+IPR))/2.
      TS=AMIN1(TS,TSMA)
 4507 CONTINUE
      IF(ITS-50) 441,441,998
  441 ITS=ITS+1
      IF(ABS(ERR )-1.  ) 4390,4390,430
  998 WRITE (KOUT,529)
      WRITE(KOUT,582)(XITER(I),EITER(I),I=1,51)
      WRITE(KOUT,582) TH,DTH,VRM,ERFA,TABC,EMIV,DMIV,RAD,B(1),CH,PHI,
     1 D(1),HE,RP1,QRA,Y2(1),Y2(2),Y2(3),Y2(4)
      TH=THFIN
      GO TO 3000
C     ---------  POST ITERATION
 4390 IF(II-2) 4371,4371,1437
 4371 Y2(2)=Y2(1)
 4372 QCHEM=Y2(2)
      IF(ISEN(1))4373,4374,4373
 4374 QCONV=0.
      GO TO 1439
 4373 CALL OGLE(1,TS,QCONV,ISEN(IPR),TTSEN(1,IPR),THSEN(1,IPR),TCPSEN(1,
     1IPR))
      IF(NPR-1) 1439,1439,1438
 1438 CALL OGLE(1,TS,QQ    ,ISEN(IPR+1),TTSEN(1,IPR+1),THSEN(1,IPR+1),TCP
     1SEN(1,IPR+1))
      QCONV=QCONV+VRP*(QQ-QCONV)
 1439 QCHEM=(QCHEM+QCONV)*CH
      HW=QCONV
      QCONV=CH*(HE-QCONV)
      DSDTB=CHD/RHO(2)
      IF(NBPF) 1437,1437,4375
 4375 IF(IAB) 1437,1437,4376
 4376 CHFL=EXP(Y2(3))*CH*CHH
 1437 RO(1)=RON(1)
      BR=CH/CHZ
      QRP=EMIV*QRA
      QCOND=-D(1)+B(1)*TA(1)
      QCONVT=QCONVT+QCONV*DTH/AREA(1)*ASU
      QCHEMT=QCHEMT+QCHEM*DTH/AREA(1)*ASU
      QCONDT=QCONDT+QCOND*DTH/AREA(1)*ASU
      QRPT=QRPT+QRP*DTH/AREA(1)*ASU
      HADT=HADT+HAD*DTH/AREA(1)*ASU
C
      DEDT=HON(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  )
       EDT=DEDT+RON(I)*CP(I)*(TEMP-TA(I))*DEL(I)*RR(I)/DTH
   95 TA(I)=TEMP
      IF (NUMN-NBM) 97,96,96
   96 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
      IF(NOBU) 755,756,755
  755 LL=NF1(1)
      LU=NLA(NOBU)
      DO 757 I=LL,LU
  757 RO(I)=RON(I)
  756 CONTINUE
C
C
C     SHRINK (AND DROP) OF LAST ABLATING NODE
C
C     DEL(NL)=DEL(NL)-US (SEE INT DECOMP)
      IF(DEL(NL)-DELM)149,149,150
  149 DRLP=DEL(NL)*RO(NL)*RR(NL)
      DRLCP=DRLP*CP(NL)
      NL=NL-1
      RC(NL)=RC(NL+1)
      DRL=DEL(NL)*RO(NL)*RR(NL)
      DRLC=DRL*CP(NL)
      HAPHB=DRL*H(NL)+DRLP*H(NL+1)
      TOP1=DRL+DRLP
      TOP2=DRLC-DRLCP
      TOP3=DRLC*TA(NL)  +DRLCP*TA(NL+1)
      VOL=DEL(NL)*RR(NL)+DEL(NL+1)*RR(NL+1)
      DEL(NL)=DEL(NL)+DEL(NL+1)
      RA(NL)=RA(NL)+6.*DEL(NL+1)
      RO(NL)=TOP1/VOL
      CP(NL)=TOP2/TOP1
      TA(NL)=TOP3/TOP2
      H(NL)=HAPHB/TOP1
      DELR=DEL(NL+1)*RR(NL+1)/VOL
      CZ=1.0-DELR
      DZ=0.0
```

```
      GZ=CZ                                                     CBM 1171
      NZ=JF*NL-JFM                                              CBM 1172
      N=NZ-JF+1                                                 CBM 1173
      K=N                                                       CBM 1174
      FZ=DELR                                                   CBM 1175
      EZ=GZ                                                     CBM 1176
      GO TO 179                                                 CBM 1177
  172 DZ=DZ+1.0                                                 CBM 1178
  173 FZ=DZ-CZ                                                  CBM 1179
      IF(K-NZ) 175,174,175                                      CBM 1180
  174 GZ=DELR                                                   CBM 1181
  175 K=K+1                                                     CBM 1182
      CZ=CZ+GZ                                                  CBM 1183
  176 EZ=CZ-DZ                                                  CBM 1184
      IF(EZ)178,177,177                                         CBM 1185
  177 ROA(N)=ROA(N)+FZ*ROA(K)                                   CBM 1186
      ROB(N)=ROB(N)+FZ*ROB(K)                                   CBM 1187
      ROC(N)=ROC(N)+FZ*ROC(K)                                   CBM 1188
      IF(N-NZ) 171,150,171                                      CBM 1189
  171 N=N+1                                                     CBM 1190
  179 ROA(N)=ROA(K)*EZ                                          CBM 1191
      ROB(N)=ROB(K)*EZ                                          CBM 1192
      ROC(N)=ROC(K)*EZ                                          CBM 1193
      GO TO 172                                                 CBM 1194
  178 ROA(N)=ROA(N)+RUA(K)*GZ                                   CBM 1195
      ROB(N)=ROB(N)+RUB(K)*GZ                                   CBM 1196
      ROC(N)=ROC(N)+RUC(K)*GZ                                   CBM 1197
      GO TO 173                                                 CBM 1198
C                                                               CBM 1199
  150 GO TO 410                                                 CBM 1200
    1 RETURN                                                    CBM 1201
      END                                                       CBM 1202
```

```
17:18:00    ▶ FIN
```

```
      SUBROUTINE INPOUT                                                 INPOU  1
      COMMON KOUT,IEX,DEN,VR                                            INPOU  2
      COMMON IHI(38),ILO(38),IR(38),TT2(30,10),TCP(30,10),TKP(30,10),THZINPOU  3
     1(30,10),TEP(30,10),TTH(30),THE(30),TQR(30),TCM(30),TT1(30),THG(30)INPOU  4
     2,DH12(2),RECORD(36),SO(20)                                        INPOU  5
      COMMON RHO(10)                                                    INPOU  6
      COMMON MATL( 50),DEL( 51),TA( 51),H(50),RC(50),RA( 50),           INPOU  7
     1AREA( 50),EMA( 50),RAV( 50)                                       INPOU  8
      COMMON ROA( 500),ROB( 500),ROC( 500)                              INPOU  9
      COMMON TPR(3),NMG(3),TMG(15,3),NLU(15,3),NHI(15,3),               INPOU 10
     1KHI(15,3),TTSEN(25,3),THSEN(25,3),TCPSEN(25,3),TLMC(25,15,3),     INPOU 11
     2ISEN(3),TPI(30),TTS(25,15,3),TCMEM(25,15,3),VFZ,CNH               INPOU 12
      COMMON TBPF(25,15,3)                                              INPOU 13
      COMMON NPR                                                        INPOU 14
      COMMON LCT,NPG,II,NBM,NUMN,NL,DELHG,DELM,RFT,RHORA,RHORB,RHORC,TRAINPOU 15
     1CA,TRACB,TRACC,RHOOA,RHOOB,RHOOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,INPOU 16
     2TRACM,PET,PETE,HSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WT,INPOU 17
     3THWT,GAMA,OMG,NU,FJFH,FJFS,JF,JFHP,JFH,INPUT,     DTHIN,BRP,HCONV,INPOU 18
     4EPSW,TRES                                                         INPOU 19
      COMMON INCM,DTMB                                                  INPOU 20
      COMMON NN,NI,NO1                                                  INPOU 21
      COMMON CMCRI,PYCRI                                                INPOU 22
      COMMON TBRP(30)                                                   INPOU 23
      COMMON NR                                                         INPOU 24
      COMMON TX(30,6),F1(30,6),F2(30,6)                                 INPOU 25
      COMMON NCON                                                       INPOU 26
      COMMON NBPF,NFIS                                                  INPOU 27
      COMMON BREX,SWELL                                                 INPOU 28
      COMMON BBB(5,3),EE(5,3),FF(5,3),PSI(5,3),RHOO(5,3),RHOR(5,3),     INPOU 29
     1ROCOM(50,3),DHC(5),DHV(5),RHOC(5),RHOV(5),P(5),PP(5),TREF(5),GA(5)INPOU 30
     2,OMGA(5),NFI(5),NLA(5),TTS(30,10),TENT(30,10),TKBU(30,10),TCBU(30,INPOU 31
     310),X(50),NDBU,NBM2                                               INPOU 32
      COMMON TRAC(5,3)                                                  INPOU 33
      COMMON NBUFT(5)                                                   INPOU 34
      COMMON/DATA/ASTER,BLANK                                           INPOU 35
      DIMENSION TZSEN(25,3),TCZSEN(25,3),TSURF(25),TSEN(25),IZ(25)      INPOU 36
      DIMENSION IOPT(30)                                                INPOU 37
      DIMENSION KSV(5),KMTL(6)                                          INPOU 38
      EQUIVALENCE (DH1,DH12(1)),(DH2,DH12(2)),(TS,TA)                   INPOU 39
  497 FORMAT(I2,3F10.5)                                                 INPOU 40
  499 FORMAT(12A6)                                                      INPOU 41
  502 FORMAT (6X12A6)                                                   INPOU 42
  503 FORMAT(//24X31H---REACTION KINETIC EQUATION---/1H )               INPOU 43
  504 FORMAT(10X67HDRHO/DTIME = GAMMA ( BA*EXP(-EA/T)RHOOA((RHOA-RHORA)/INPOU 44
     1RHOOA)**PSIA )/   21X56H+ GAMMA ( BB*EXP(-EB/T)RHOOB((RHOB-RHORB)/INPOU 45
     2RHOOB)**PSIB )/ 19X58H+(1-GAMMA)( BC*EXP(-EC/T)RHOOC((RHOC-RHORC)/1INPOU 46
     3RHOOC)**PSIC ))                                                   INPOU 47
  505 FORMAT(/24X32H---REACTION KINETIC CONSTANTS---/1H )               INPOU 48
  506 FORMAT (11X8HREACTION2X4HRHOO5X4HRHOR8X1HB7X3HPSI8X1HE6X6HT REAC/2INPOU 49
     1X10H(LB/CU FT)6X7H(1/SFC)12X7H(DEG R)3X7H(DEG R))                 INPOU 50
  507 FORMAT (14XA1,2X2F9.2,2XE10.4,F7.2,2XE10.4,F8.0)                  INPOU 51
  510 FORMAT(12X31HRESIN VOLUME FRACTION, GAMMA = F5.3,17H(MASS FRACTIONINPOU 52
     1 = F5.3,1H)/1H )                                                  INPOU 53
  511 FORMAT (24X32H---TIME INCREMENT INFORMATION---/1H )               INPOU 54
  512 FORMAT (6X18H1NITIAL TIME (SEC)F7.3,26X16HFINAL TIME (SEC)F7.2)   INPOU 55
  513 FORMAT (1H /6X17HOUTPUT INTERVAL =F6.3,1X27HSEC FROM INITIAL TIME INPOU 56
     1UNTIL F7.3,4H SEC)                                                INPOU 57
  514 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1X8HSEC FROMF7.3,1X9HSEC UNTILFINPOU 58
     17.3,4H SEC)                                                       INPOU 59
  515 FORMAT (6X17HOUTPUT INTERVAL =F6.3,1X8HSEC FROMF7.3,1X20HSEC UNTILINPOU 60
     1 FINAL TIME/1H )                                                  INPOU 61
  516 FORMAT (6X,19HMAXIMUM TIME STEP =,F4.2,8H SECONDS)                INPOU 62
  517 FORMAT(/29X16H---NODAL DATA---/1H )                               INPOU 63
  518 FORMAT(6X74HNODE  MATL  TEMPERATURE  RELATIVE  THICKNESS  NODAL DEINPOU 64
     1PTH  CONT.RESISTANCE)                                             INPOU 65
  519 FORMAT(7X73HNO.   NO. (DEG.RANKINE)   AREA    (INCHES)    (INCHES)INPOU 66
     1   (SQFT-S-DEG/BTU))                                              INPOU 67
  520 FORMAT(3X2I6,F12.2,E13.4,F9.5,F12.6,A1,E15.4)                     INPOU 68
  521 FORMAT (    14X47HMINIMUM THICKNESS OF LAST ABLATOR NODE (INCHES)FINPOU 69
     17.4/14X,10HTHERE ARE ,I2,40H NODELETS ASSIGNED TO EACH ABLATING NOINPOU 70
     2DE)                                                               INPOU 71
  522 FORMAT(/18X48H---HEAT OF FORMATION OF MATERIAL CONSTITUENTS---/37XINPOU 72
     18H(BTU/LB)/21X7HPLASTIC11X4HCHAR17X3HGAS)                         INPOU 73
  523 FORMAT (20XF9.2,7XF9.2,11XF9.2)                                   INPOU 74
  524 FORMAT(/7X26HENTHALPY DATUM TEMPERATURE =F9.3,1X11HDEG RANKINE)   INPOU 75
  525 FORMAT    (//22X36H---MATERIAL THERMAL PROPERTY DATA---//6X14HMATERINPOU 76
     1IAL NO. 110X14HMATERIAL NO. 210X26HMATERIAL NOS. 3 THROUGH 10/6X14INPOU 77
     2HVIRGIN PLASTIC15X4HCHAR23X7HBACK-UP)                             INPOU 78
  526 FORMAT(/6X12HMATERIAL NO.I2,30X9HDENSITY =F8.3,1X8HLB/CU FT/      INPOU 79
     1         7X11HTEMPERATURE5X13HSPECIFIC HEAT5X12HCONDUCTIVITY5X8HSENINPOU 80
     2SIBLE4X10HEMISSIVITY/58X8HENTHALPY/9X7H(DEG R)7X12H(BTU/LB-DEG)4X1INPOU 81
     36H(BTU/FT-SEC-DEG)3X8H(BTU/LB)/                                   INPOU 82
     4        (8XF8.2,8XF7.4,9XF10.7,7XF9.2,4XF7.4))                    INPOU 83
 5260 FORMAT(/6X12HMATERIAL NO.I2,30X9HDENSITY =F8.3,1X8HLB/CU FT/      INPOU 84
     1         7X11HTEMPERATURE5X13HSPECIFIC HEAT5X12HCONDUCTIVITY5X8HSENINPOU 85
     2SIBLE                /58X8HENTHALPY/9X7H(DEG R)7X12H(BTU/LB-DEG)4X1INPOU 86
     36H(BTU/FT-SEC-DEG)3X8H(BTU/LB)/                                   INPOU 87
     4        (8XF8.2,8XF7.4,9XF10.7,7XF9.2       ))                    INPOU 88
  527 FORMAT(/6X12HMATERIAL NO.I2,30X9HDENSITY =F8.3,1X8HLB/CU FT/      INPOU 89
     1         7X11HTEMPERATURE5X13HSPECIFIC HEAT5X12HCONDUCTIVITY/9X7H(DINPOU 90
```

```
     2EG R)/X12H(BTU/LB-DEG)4X14H(BTU/FT-SEC-DEG)/                      INPOU 91
     3        (8XF8.2,8AF7.4,9XF10.7))                                  INPOU 92
 531 FORMAT (1H /6X19HTEMPERATURE (DEG R)5F11.2)                        INPOU 93
 532 FORMAT    (//20X47H---RESIN DECOMPOSITION GAS SENSIBLE ENTHALPY---)INPOU 94
 533 FORMAT      (6X19HENTHALPY   (BTU/LB)5F11.2)                       INPOU 95
 534 FORMAT (1H //23X40H---TIME DEPENDENT BOUNDARY CONDITIONS---/1H )   INPOU 96
 535 FORMAT (9X,4HTIME,8X,4HPROB,3X,8HRECOVERY,3X,9HRADIATION,4X,4HHEATINPOU 97
     15X,8HPRESSURE,3X,7HBLOWING/9X,5H(SEC),7X,4HOPTN,3X,8HENTHALPY,3X, INPOU 98
     29HHEAT RATE,4X,3HCOEFF,14X,9HREDUCTION/20X,8H(BTU/LB),2X,11H(BTU/SINPOU 99
     30 FT-,1X,10H(LB/SQ FT-,3X,5H(ATM),3X,9HPARAMETER /40X,7HSECOND),  INPOU100
     44X,7HSECOND))                                                     INPOU101
 536 FORMAT (6X,F8.2,8X,I2,4X,2(F8.2,3X),F8.4,3X,F8.5,3X,F8.3)          INPOU102
 537 FORMAT (1H /9X,6HCH/CH0 = PHI/(EXP(PHI)-1.) WHERE PHI = 2.*BRP*H INPOU103
     1DOT/CH0. BRP IN TABLE)                                            INPOU104
 538 FORMAT(//27X38H---SURFACE EQUILIBRIUM DATA---)                     INPOU105
 551 FORMAT(1H110X6SHAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND AINPOU106
     1BLATION PROGRAM/73X4HPAGE13/1H 67X2A6)                            INPOU107
 552 FORMAT (9X,4HTIME,8X,4HPROB,3X,7HSURFACE,4X,7HSURFACE/9X,5H(SEC), INPOU108
     17X,4HOPTN,5X,4HTEMP,5X,9HRECESSION/20X,7H(DEG R),6X,4HRATE/38X,   INPOU109
     21H(MILS/SEC))                                                     INPOU110
 553 FORMAT(8X24H*INITIAL INTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP.TO RAINPOU111
     1DIUS**F4.2)                                                       INPOU112
 554 FORMAT(8X24H*INITIAL EXTERNAL RADIUS,1X,F6.3,4X,21HAREA PROP.TO RAINPOU113
     1DIUS**F4.2)                                                       INPOU114
 555 FORMAT(8X15H*PLANAR SURFACE)                                       INPOU115
 556 FORMAT (9X,4HTIME,8X,4HPROB,5X,4HVIEW,5X,9HRADIATION/9X,5H(SEC),   INPOU116
     17X,4HOPTN,4X,6HFACTOR,4X,9HHEAT RATE/38X,11H(BTU/SQ FT-/40X,      INPOU117
     27HSECOND))                                                        INPOU118
 560 FORMAT(I2,5E10.0)                                                  INPOU119
 561 FORMAT(I2,F8.4,6I1)                                                INPOU120
 563 FORMAT (I2,I3,I1,I2,7F10.5/8F10.5)                                 INPOU121
 564 FORMAT(A1,9X,2F10.5,E10.3,F10.5,E10.3,F10.5,A1,9X,2F10.5,E10.3,    INPOU122
     1F10.5, E10.3,F10.5/A1,9X,2F10.5,E10.3,F10.5,E10.3,F10.5,9X,I1)    INPOU123
5640 FORMAT (A1,9X2F10.5,E10.3,F10.5,E10.3,F10.5)                       INPOU124
 571 FORMAT(I2,F10.5,F10.5,F10.0,F10.5)                                 INPOU125
 575 FORMAT(I1,F9.5,7F10.5/8F10.5)                                      INPOU126
 577 FORMAT(I1,F9.5,2F10.5)                                             INPOU127
 579 FORMAT(12X,2E12.5,2E13.6,I1)                                       INPOU128
5790 FORMAT (6X,26HNO RADIUS CORRECTION ON CH)                          INPOU129
5791 FORMAT (3F8.5,F9.4,F5.3,2F9.3,I2,A6)                               INPOU130
5792 FORMAT(//6X,3HP =,F9.4,4H ATM//6X,3(25HTEMPERATURE  EDGE ENTH  +/INPOU131
     16X,3(25H  (DEG K)     AT T-WALL    ))                             INPOU132
5793 FORMAT (//6X,37HNAD SURFACE EQUILIBRIUM TABLE OF TYPE,I2)          INPOU133
5794 FORMAT (//6X,74HEQUAL MASS AND HEAT TRANSFER COEFFICIENTS AND EQUAINPOU134
     1L DIFFUSION COEFFICIENTS/6X,29HNONINAL SURFACE VIEW FACTOR =,     INPOU135
     2F6.3)                                                             INPOU136
5795 FORMAT(//6X,14HN-DOT-GAS/CM =,F7.4,8X,10HPRESSURE =,F9.4,4H ATM// INPOU137
     17X,21HTEMP,5X,26HN-DOT-  CHEM.PROD  SURFACE,3X)/6X,2(36H(DEG R)   INPOU138
     2CHAR/CM    (BTU/LB)   SPECIES,2X)/(5X,F8.2,2X,F7.4,2X,F8.2,4X,A6,1X,INPOU139
     3F8.2,2X,F7.4,2X,F8.2,4X,A6))                                      INPOU140
5796 FORMAT(2F10.0,F9.0,I1,3(9X,I1),F10.0)                              INPOU141
5797 FORMAT(//6X,45HRATIO OF MASS TO HEAT TRANSFER COEFFICIENTS =,F6.3/INPOU142
     1 6X,26HNEQUAL DIFFUSION EXPONENT =,F6.3/6X,29HNONINAL SURFACE VIEINPOU143
     2W FACTOR =,F6.3,11H (OPTION 1))                                   INPOU144
5798 FORMAT                          (6X,F9.2,4X,F9.2,3X,F9.2,4X,F9.INPOU145
     22,3X,F9.2,4X,F9.2)                                                INPOU146
5799 FORMAT (6X,66HHEAT TRANSFER COEFFICIENT MULTIPLIED BY (R INITIAL/RINPOU147
     1 CURRENT)**EX,/6X,63HWHERE EX = (1.0-.2N)/(1.-N) AND N IS THE BURNINPOU148
     2ING RATE EXPONENT;/8X,46HIN THIS PROBLEM N HAS BEEN SET EQUAL TO ,INPOU149
     3F4.5)                                                             INPOU150
 580 FORMAT (8F10.5)                                                    INPOU151
 581 FORMAT(/14X20HBACK WALL CONVECTION10X9HBACK WALL10X9HRESERVOIR/    INPOU152
     113X23HCOEF BTU/FTSQ-SEC-DEG R8X10HEMISSIVITY8X11HTEMPERATURE/     INPOU153
     217XF10.4,10XF6.3,10XF10.2)                                        INPOU154
 582 FORMAT(5F10.5,9X,I1)                                               INPOU155
     DATA BLANK,ASTER/1H ,1H*/                                          INPOU156
     INPUT=5                                                            INPOU157
     KOUT=6                                                             INPOU158
     INCH=5                                                             INPOU159
     WT=0.0                                                             INPOU160
     DO 3500 I=1,5                                                      INPOU161
3500 NBUFT(I)=0                                                         INPOU162
C    INPUT/OUTPUT                                                       INPOU163
C                                                                       INPOU164
   1 NPG=1                                                              INPOU165
     WRITE (KOUT,551)NPG                                                INPOU166
     READ  (INPUT, 499, END=999)  (RECORD(I), I=1,36)                   INPOU167
C    READ  (INPUT, 499)           (RECORD(I), I=1,36)                   INPOU168
     GO TO 998                                                          INPOU169
C    IF (EOF, INPUT)  999, 998                                          INPOU170
 999 CONTINUE                                                           INPOU171
     STOP                                                               INPOU172
 998 CONTINUE                                                           INPOU173
C                                                                 EUNITINPOU174
     WRITE (KOUT,582)(RECORD(I),I=1,36)                                 INPOU175
     WRITE (KOUT,583)                                                   INPOU176
     WRITE (KOUT,584)                                                   INPOU177
     WRITE (KOUT,585)                                                   INPOU178
     WRITE (KOUT,586)                                                   INPOU179
     READ (INPUT,564) A9,RHOQA,HHORA,BA,PSIA,EA,TRACA,B9,RHOQB ,RHOHB,BINPOU180
```

```
     1B,PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC,NDBU                INPOU181
      WRITE (KOUT,567)A9,RHOOA,RHORA,BA,PSIA,EA,TRACA,B9,RHOOB,RHORB,BB,INPOU182
     1PSIB,EB,TRACB ,C9,RHOOC,RHORC,BC, PSIC,EC,TRACC                      INPOU183
      READ (INPUT,563) JF,NUMN,NN,NO,NI,THZRO,THFIN,DTPRT,DTPR2,DTPR3,     INPOU184
     1DTMB,BHY,TPR2,TPR3,DELM,DM1,DM2,DELMG,GAMA,TZ                        INPOU185
      IF(JF-1) 171,170,172                                                 INPOU186
  170 JF=2                                                                 INPOU187
      GO TO 172                                                            INPOU188
  171 JF=10                                                                INPOU189
  172 JFH=JF/2                                                             INPOU190
      JF=JFH+JFH                                                           INPOU191
      JFHP=JFH+1                                                           INPOU192
      FJFS=JF                                                              INPOU193
      FJFH=FJFS/2.0                                                        INPOU194
      NOI=NU+NI                                                            INPOU195
      IF (NO) 181,181,182                                                  INPOU196
  182 READ  (INPUT,580)(SO(I),I=1,NO)                                      INPOU197
  181 CONTINUE                                                             INPOU198
      IF (NI) 184,184,183                                                  INPOU199
  183 NOP=NU+1                                                             INPOU200
      READ (INPUT,580) (SO(I), I=NOP,NOI)                                  INPOU201
  184 IF(GAMA) 408,409,409                                                 INPOU202
  408 GAMA=RHOOC/(RHOOC-(RHOOA+RHOOB)-(RHOOA+RHOOB)/GAMA)                  INPOU203
  409 OMG=1.0-GAMA                                                         INPOU204
      RHO(1)=GAMA*(RHOOA+RHOOB)+OMG*RHOOC                                  INPOU205
      RHO(2)=GAMA*(RHORA+RHORB)+OMG*RHORC                                  INPOU206
       GAMAM=GAMA/RHO(1)*(RHOOA+RHOOB)                                     INPOU207
      WRITE (KOUT,510)GAMA,GAMAM                                           INPOU208
      IF(NDBU) 700,701,700                                                 INPOU209
  700 WRITE(KOUT,7900)                                                     INPOU210
 7900 FORMAT (/23X,34H---DECOMPOSING BACK-UP KINETICS---/)                 INPOU211
      DO 704 I=1,NDBU                                                      INPOU212
      READ(INPUT,5640)A9,RHOO(I,1),RHOR(I,1),BBB(I,1),PSI(I,1),EE(I,1),    INPOU213
     1TRAC(I,1),B9,RHOO(I,2),RHOR(I,2),BBB(I,2),          PSI(I,2),EE(I,2INPOU214
     2),TRAC(I,2),C9,RHOO(I,3),RHOR(I,3),BBB(I,3),PSI(I,3),EE(I,3),TRAC(INPOU215
     3I,3)                                                                 INPOU216
      READ(INPUT,7901) DHV(I),DHC(I),GA(I),TREF(I)                         INPOU217
 7901 FORMAT (30X,2F10.5,10X,2F10.5)                                       INPOU218
      WRITE(KOUT,7902) I                                                   INPOU219
 7902 FORMAT (/28X,24HDECOMPOSING BACK-UP NO. ,I1)                         INPOU220
      WRITE(KOUT,506)                                                      INPOU221
      WRITE(KOUT,507) A9,RHOO(I,1),RHOR(I,1),BBB(I,1),PSI(I,1),EE(I,1),    INPOU222
     1TRAC(I,1),B9,RHOO(I,2),RHOR(I,2),BBB(I,2),          PSI(I,2),EE(I,2INPOU223
     2),TRAC(I,2),C9,RHOO(I,3),RHOR(I,3),BBB(I,3),PSI(I,3),EE(I,3),TRAC(INPOU224
     3I,3)                                                                 INPOU225
      IF(GA(I)) 702,703,703                                                INPOU226
  702 GA(I)=RHOO(I,3)/(RHOO(I,3)- (RHOO(I,1)+RHOO(I,2))-(RHOO(I,1)+        INPOU227
     1RHOO(I,2))/GA(I))                                                    INPOU228
  703 OMGA(I)=1.-GA(I)                                                     INPOU229
      RHOV(I)=GA(I)*(RHOO(I,1)+RHOO(I,2))+OMGA(I)*RHOO(I,3)                INPOU230
      RHOC(I)=GA(I)*(RHOR(I,1)+RHOR(I,2))+OMGA(I)*RHOR(I,3)                INPOU231
      GAMAM=GA(I)/RHOV(I)*(RHOO(I,1)+RHOO(I,2))                            INPOU232
      WRITE(KOUT,510) GA(I),GAMAM                                          INPOU233
      P(I)=RHOV(I)/(RHOV(I)-RHOC(I))                                       INPOU234
      PP(I)=P(I)*RHOC(I)                                                   INPOU235
      DO 7030 J=1,3                                                        INPOU236
 7030 FF(I,J)=(1.-PSI(I,J))*BBB(I,J)*(RHOO(I,J)**(1.-PSI(I,J)))            INPOU237
  704 CONTINUE                                                             INPOU238
  701 CONTINUE                                                             INPOU239
      IF(DTMB) 412,410,412                                                 INPOU240
  410 DTMB=5.                                                              INPOU241
  412 DTMIN=.01                                                            INPOU242
  413 IF(TPR2)414,414,415                                                  INPOU243
  414 TPR2=THFIN                                                           INPOU244
  415 IF(TPR3)416,416,417                                                  INPOU245
  416 TPR3=THFIN                                                           INPOU246
      IF(TPR2-THZRO) 418,418,417                                           INPOU247
  418 DTPRT=DTPR2                                                          INPOU248
      DTPR2=DTPR3                                                          INPOU249
      TPR2=TPR3                                                            INPOU250
      GO TO 416                                                            INPOU251
  417 WRITE (KOUT,511)                                                     INPOU252
      THFIN=AMAX1(THFIN,TPR2,TPR3)                                         INPOU253
      WRITE (KOUT,512)THZRO,THFIN                                          INPOU254
      WRITE (KOUT,513)DTPRT,TPR2                                           INPOU255
      WRITE (KOUT,514)DTPR2,TPR2,TPR3                                      INPOU256
      WRITE (KOUT,515)DTPR3,TPR3                                           INPOU257
      WRITE (KOUT,516) DTMB                                                INPOU258
      TRACM=AMIN1(TRACA,TRACB,TRACC)                                       INPOU259
      PETE=RHO(1)/(RHO(1)-RHO(2))                                          INPOU260
      PFT=PETE*RHO(2)                                                      INPOU261
C     ---------- NODAL PROPERTIES                                          INPOU262
      N=0                                                                  INPOU263
      KMS=10                                                               INPOU264
      NDBUCH=0                                                             INPOU265
      J1=JFH                                                               INPOU266
      CALL LCOUNT (-NUMN-8,LCT,NPG,RECORD(35))                             INPOU267
  302 WRITE (KOUT,517)                                                     INPOU268
      WRITE (KOUT,518)                                                     INPOU269
      WRITE (KOUT,519)                                                     INPOU270
```

```
      B=ASTER                                                           INPOU271
      READ(INPUT,560)(MATL(I),TA(I),AREA(I),DEL(I),RA(I),RC(I),I=1,NUMN)INPOU272
      AE=RA(2)                                                          INPOU273
      RSV=RA(1)                                                         INPOU274
      RA(1)=0.0                                                         INPOU275
      DO 400 I=1,NUMN                                                   INPOU276
      IF(I-2) 4541,452,453                                              INPOU277
  453 RA(I)=RA(I-1)+(DEL(I-1)+DEL(I))/2.0                               INPOU278
      GO TO 461                                                         INPOU279
  452 RA(2)=DEL(1)+DEL(2)/2.                                            INPOU280
      B=BLANK                                                           INPOU281
  461 DEL(I-1)=DEL(I-1)/12.                                             INPOU282
 4541 RAV(I)=RA(I)                                                      INPOU283
      IF(AE) 4542,4543,4542                                             INPOU284
 4542 AREA(I)=(ABS(RSV+RA(I)))**AE                                      INPOU285
      GO TO 454                                                         INPOU286
 4543 IF(AREA(I)) 4544,4544,454                                         INPOU287
 4544 IF(RSV) 4545,4546,4545                                            INPOU288
 4545 AREA(I)=ABS(RSV+RA(I))                                            INPOU289
      AE=1.0                                                            INPOU290
      GO TO 454                                                         INPOU291
 4546 AREA(I)=1.                                                        INPOU292
  454 WRITE(KOUT,520)I,MATL(I),TA(I),AREA(I),DEL(I),RA(I),W,RC(I)       INPOU293
      IF(MATL(I)-2) 401,405,705                                         INPOU294
  401 NL=I                                                              INPOU295
      DO 404 J=1,J1                                                     INPOU296
      N=N+1                                                             INPOU297
      ROA(N)=RHOOA                                                      INPOU298
      ROB(N)=RHOOB                                                      INPOU299
  404 ROC(N)=RHOOC                                                      INPOU300
      J1=JF                                                             INPOU301
      GO TO 400                                                         INPOU302
  405 NL=I                                                              INPOU303
      DO 406 J=1,J1                                                     INPOU304
      N=N+1                                                             INPOU305
      ROA(N)=RHORA                                                      INPOU306
      ROB(N)=RHORB                                                      INPOU307
  406 ROC(N)=RHORC                                                      INPOU308
      J1=JF                                                             INPOU309
      GO TO 400                                                         INPOU310
  705 IF(MATL(I)-10) 400,400,706                                        INPOU311
  706 K=MATL(I)-21                                                      INPOU312
      VKH=FLOAT(K)/2.0                                                  INPOU313
      KH=K/2                                                            INPOU314
      IF(VKH-KH) 708,707,708                                            INPOU315
  707 ROCOM(I,1)=RHOR(KH,1)                                             INPOU316
      ROCOM(I,2)=RHOR(KH,2)                                             INPOU317
      ROCOM(I,3)=RHOR(KH,3)                                             INPOU318
      A(I)=0.                                                           INPOU319
      GO TO 709                                                         INPOU320
  708 KH=KH+1                                                           INPOU321
      ROCOM(I,1)=RHOO(KH,1)                                             INPOU322
      ROCOM(I,2)=RHOO(KH,2)                                             INPOU323
      ROCOM(I,3)=RHOO(KH,3)                                             INPOU324
      A(I)=1.0                                                          INPOU325
  709 IF(KH-KHS) 7090,7092,7090                                         INPOU326
 7090 NFI(KH)=I                                                         INPOU327
      KHS=KH                                                            INPOU328
      NDBUCH=NDBUCH+1                                                   INPOU329
 7092 NLA(KH)=I                                                         INPOU330
  400 CONTINUE                                                          INPOU331
      IF(NDBU-NDBUCH) 7095,7094,7093                                    INPOU332
 7095 WRITE(KOUT,7096)                                                  INPOU333
 7096 FORMAT(10X,55HTOO MANY DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT INPOU334
     1JOB)                                                              INPOU335
      STOP                                                              INPOU336
 7093 WRITE(KOUT,7097)                                                  INPOU337
 7097 FORMAT(10X,54HTOO FEW DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT JINPOU338
     1OB)                                                               INPOU339
      STOP                                                              INPOU340
 7094 CONTINUE                                                          INPOU341
  403 DEL(NUMN)=DEL(NUMN)/12.                                           INPOU342
      CALL SLOPQ(NUMN,RA,AREA,EMA)                                      INPOU343
      NBM=NL+1                                                          INPOU344
      IF(NDBU) 7098,7099,7098                                           INPOU345
 7098 NBM2=NLA(NDBU)+1                                                  INPOU346
      GO TO 7091                                                        INPOU347
 7099 NBM2=NBM                                                          INPOU348
 7091 CONTINUE                                                          INPOU349
      IF(RSV) 4031,4032,4033                                            INPOU350
 4031 RSVN=-RSV                                                         INPOU351
      WRITE(KOUT,554)RSVN,AE                                            INPOU352
      GO TO 304                                                         INPOU353
 4032 WRITE(KOUT,555)                                                   INPOU354
      GO TO 304                                                         INPOU355
 4033 WRITE(KOUT,553)RSV,AE                                             INPOU356
  304 WRITE (KOUT,521) DELN,JF                                          INPOU357
      DELN=DELN/12.0                                                    INPOU358
      READ(INPUT,502) NCONV,EPSW,TMES,CMCRI,PYCRI,NCON                  INPOU359
      IF (CMCRI) 305,305,306                                            INPOU360
```

```
  305 CHCRI=0.02                                                        INPOU361
  306 IF (PYCRI) 307,307,308                                            INPOU362
  307 PYCRI=0.98                                                        INPOU363
  308 TA(NUMN+1)=TRES                                                   INPOU364
      CALL LCOUNT(4              ,LCT,NPG,RECORD(35))                   INPOU365
      WRITE(KOUT,561) MCONV,EPSW,TRES                                   INPOU366
      CALL LCOUNT(5              ,LCT,NPG,RECORD(35))                   INPOU367
      WRITE (KOUT,522)                                                  INPOU368
      WRITE (KOUT,523)DM1,DM2,DELMG                                     INPOU369
      CALL LCOUNT(2              ,LCT,NPG,RECORD(35))                   INPOU370
      WRITE (KOUT,524)TZ                                                INPOU371
      IF(NUBU) 7910,7910,7907                                           INPOU372
 7907 DO 7908 J=1,NUBU                                                  INPOU373
      CALL LCOUNT(6,LCT,NPG,RECORD(35))                                 INPOU374
      WRITE(KOUT,7902) J                                                INPOU375
 7909 FORMAT(/21X7HPLASTIC11X4HCHAR17X3HGAS)                            INPOU376
      WRITE(KOUT,7909)                                                  INPOU377
      WRITE(KOUT,523) UNV(J),DNC(J),DELMG                               INPOU378
 7908 WRITE(KOUT,524) TREF(J)                                           INPOU379
 7910 CONTINUE                                                          INPOU380
C     --------- MATERIAL PROPERTIES                                     INPOU381
      CALL LCOUNT(6              ,LCT,NPG,RECORD(35))                   INPOU382
  310 WRITE (KOUT,525)                                                  INPOU383
      CALL LCOUNT(3,LCT,NPG,RECORD(35))                                 INPOU384
      WRITE(KOUT,7905)                                                  INPOU385
 7905 FORMAT(/3X,82HDECOMPOSING BACK-UP VIRGIN MATERIALS 22,24,26,28,30,INPOU386
     1 CHAR MATERIALS 23,25,27,29,31)                                   INPOU387
      IT=0                                                              INPOU388
      ILO(3)=1                                                          INPOU389
      ILO(4)=1                                                          INPOU390
      KT=1                                                              INPOU391
  350 IT=IT+1                                                           INPOU392
      READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT),TEP(IT,KT)   INPOU393
      IF(NC)351,350,351                                                 INPOU394
  351 IHI(KT+2)=ILO(KT+2)+IT-1                                          INPOU395
      IR(KT+2)=ILO(KT+2)                                                INPOU396
      THZ(1,KT)=0.                                                      INPOU397
      DO 357 I=2,IT                                                     INPOU398
  357 THZ(I,KT)=THZ(I-1,KT)+(TCP(I,KT)+TCP(I-1,KT))/2.*(TT2(I,KT)-TT2(I-INPOU399
     11,KT))                                                            INPOU400
      CALL LOOK (KT+2,IZ,TT2(1,KT),THZ(1,KT),0,0,0,HSM,DUM,1)           INPOU401
      DO 359 I=1,IT                                                     INPOU402
  359 THZ(I,KT)=THZ(I,KT)-HSM                                           INPOU403
      CALL LCOUNT(6+IT           ,LCT,NPG,RECORD(35))                   INPOU404
  312 WRITE(KOUT,526)AT,RHO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),THZ(I,KT)INPOU405
     1,TEP(I,KT),I=1,IT)                                                INPOU406
      KT=KT+1                                                           INPOU407
      IT=0                                                              INPOU408
      IF(NC) 356,353,353                                                INPOU409
  356 IF(KT-2) 350,350,710                                              INPOU410
  710 IF (NUBU) 711,4110,711                                            INPOU411
  711 I=1                                                               INPOU412
      DO 720 K=1,NUBU                                                   INPOU413
      IT=0                                                              INPOU414
  712 IT=IT+1                                                           INPOU415
      READ(INPUT,571) NC,TTS(IT,I),TCBU(IT,I),TKBU(IT,I)                INPOU416
      IF(NC) 713,712,713                                                INPOU417
  713 IHI(I+21)=IT                                                      INPOU418
      ILO(I+21)=1                                                       INPOU419
      IR(I+21)=1                                                        INPOU420
      TENT(1,I)=0.                                                      INPOU421
      DO 714 J=2,IT                                                     INPOU422
  714 TENT(J,I)=TENT(J-1,I)+(TCBU(J,I)+TCBU(J-1,I))/2.*(TTS(J,I)-TTS(J-1INPOU423
     1,I))                                                              INPOU424
      CALL LOOK(21+I,IREF(K),TTS(1,I),TENT(1,I),0,0,0,HSM,DUM,1)        INPOU425
      DO 715 J=1,IT                                                     INPOU426
  715 TENT(J,I)=TENT(J,I)-HSM                                           INPOU427
      IF(2*K-1) 717,716,717                                             INPOU428
  716 RHR=RHOC(K)                                                       INPOU429
      GO TO 718                                                         INPOU430
  717 RHR=RHOV(K)                                                       INPOU431
  718 CALL LCOUNT(6+IT,LCT,NPG,RECORD(35))                              INPOU432
      L=I+21                                                            INPOU433
      WRITE(KOUT,5260)   L,RHR,(TTS(J,I),TCBU(J,I),TKBU(J,I),TENT(J,I),INPOU434
     1J=1,IT)                                                           INPOU435
      I=I+1                                                             INPOU436
      IT=0                                                              INPOU437
      IF(NC) 719,353,353                                                INPOU438
  719 IF(2*K-1) 720,712,720                                             INPOU439
  720 CONTINUE                                                          INPOU440
 4110 IN=0                                                              INPOU441
      L=0                                                               INPOU442
  411 READ(INPUT,561) KT,RHO(KT),(HMTL(I),I=1,6)                        INPOU443
      IF(RHO(KT)) 3550,3500,3550                                        INPOU444
 3550 LL=1                                                              INPOU445
      L=L+1                                                             INPOU446
      JBU=0                                                             INPOU447
      IF(HMTL(1))3553,3553,3554                                         INPOU448
 3553 HT=FLOAT(L)                                                       INPOU449
      IN=1                                                              INPOU450
```

```
      LL=2                                                              INPOU451
 3559 DO 3554 I=LL,6                                                    INPOU452
      IF(KNTL(I)) 3554,3554,3555                                        INPOU453
 3555 JBU=JBU+1                                                         INPOU454
      KSV(JBU)=KNTL(I)                                                  INPOU455
      J=KNTL(I)                                                         INPOU456
      NBUFT(J)=L                                                        INPOU457
 3554 CONTINUE                                                          INPOU458
      IF(JBU) 3540,3540,3541                                            INPOU459
 3541 CALL ORDER1(JBU,KSV)                                              INPOU460
 3540 IX=0                                                              INPOU461
 3551 IX=IX+1                                                           INPOU462
      READ(INPUT,497) NC,TX(IX,L),F1(IX,L),F2(IX,L)                     INPOU463
      IF(NC) 3552,3551,3552                                             INPOU464
 3552 ILO(31+L)=1                                                       INPOU465
      INI(31+L)=IX                                                      INPOU466
      IR(31+L)=1                                                        INPOU467
      CALL LCOUNT(5+IN+JBU+4*(1-(L+2)/4),LCT,NPG,RECORD(35))            INPOU468
      IF(L-1) 3546,3546,3547                                            INPOU469
 3546 WRITE(KOUT,495)                                                   INPOU470
 3547 WRITE(KOUT,496) L                                                 INPOU471
      IF(IN) 3543,3543,3542                                             INPOU472
 3542 WRITE(KOUT,4971)                                                  INPOU473
 3543 IF(JBU) 3545,3545,3544                                            INPOU474
 3544 WRITE(KOUT,4981)  (KSV(I),I=1,JBU)                                INPOU475
 3545 WRITE(KOUT,494) (TX(I,L),F1(I,L),F2(I,L),I=1,IX)                  INPOU476
      IN=0                                                              INPOU477
  494 FORMAT(/25X,1H4,12X,5HF1(X),18X,5HF2(X)//(13X,3(5X,F10.4)))       INPOU478
  495 FORMAT(//7X,6HTABLES OF OPTIONAL MASS-FRACTION FUNCTIONS FOR THER INPOU479
     1MAL CONDUCTIVITY/25X,23HK = F1(X)*KP + F2(X)*KC)                  INPOU480
  496 FORMAT(/23X,21HF-FUNCTION TABLE NO. ,I1,12H ASSIGNED TO)          INPOU481
 4971 FORMAT(34X,13HMAIN MATERIAL)                                      INPOU482
 4981 FORMAT(28X,24HDECOMPOSING BACK-UP NO. ,I1)                        INPOU483
      IF (NC) 411,411,353                                               INPOU484
  355 IT=IT+1                                                           INPOU485
      READ (INPUT,571) NC,TT2(IT,KT),TCP(IT,KT),TKP(IT,KT)              INPOU486
      IF(NC) 354,355,354                                                INPOU487
  354 ILO(KT+2)=1                                                       INPOU488
      INI(KT+2)=ILO(KT+2)+IT-1                                          INPOU489
      IR(KT+2)=ILO(KT+2)                                                INPOU490
      CALL LCOUNT(5+IT          ,LCT,NPG,RECORD(35))                    INPOU491
  314 WRITE (KOUT,527) KT,AMO(KT),(TT2(I,KT),TCP(I,KT),TKP(I,KT),I=1,IT)INPOU492
      IT=0                                                              INPOU493
      IF(NC) 411,411,353                                                INPOU494
C     ---------- PYROLYSIS GAS ENTHALPY                                 INPOU495
  353 NT1=0                                                             INPOU496
  361 IN=1+NT1                                                          INPOU497
      NT1=8+NT1                                                         INPOU498
      READ  (INPUT,575)NC,(TT1(I),I=IN,NT1),(THG(I),I=IN,NT1)           INPOU499
      IF(NC)361,361,362                                                 INPOU500
  364 NT1=NT1-1                                                         INPOU501
  362 IF(TT1(NT1)) 364,364,365                                          INPOU502
  365 ILO(2)=1                                                          INPOU503
      IR(2)=1                                                           INPOU504
      INI(2)=NT1                                                        INPOU505
      CALL LCOUNT(3+((NT1+9)/4),LCT,NPG,RECORD(35))                     INPOU506
  316 WRITE (KOUT,532)                                                  INPOU507
      IFN=0                                                             INPOU508
  368 IN=IFN+1                                                          INPOU509
      IFN=MIN0(NT1,IFN+5)                                               INPOU510
      WRITE  (KOUT,531)(TT1(I),I=IN,IFN )                               INPOU511
      WRITE  (KOUT,533)(THG(I),I=IN,IFN)                                INPOU512
      IF(NT1-IFN) 367,367,368                                           INPOU513
C     ---------- FUNCTIONS OF TIME                                      INPOU514
  367 NTH=0                                                             INPOU515
      IS=0                                                              INPOU516
      NOPT=0                                                            INPOU517
  371 NTH=NTH+1                                                         INPOU518
      READ(INPUT,577)NC,TTH(NTH),THE(NTH),TQR(NTH),TCH(NTH),TPI(NTH),   INPOU519
     1TBRP(NTH)                                                         INPOU520
      IF(TBRP(NTH))374,375,374                                          INPOU521
  375 TBRP(NTH)=BRP                                                     INPOU522
  374 II=1                                                              INPOU523
      IF(TCH(NTH))342,342,343                                           INPOU524
  342 II=2                                                              INPOU525
      IF(THE(NTH)-2.)344,344,343                                        INPOU526
  344 II=3                                                              INPOU527
  343 IOPT(NTH)=II                                                      INPOU528
      IF(II-IS)345,346,345                                              INPOU529
  345 NOPT=NOPT+1                                                       INPOU530
      IS=II                                                             INPOU531
  346 IF(NC)371,371,372                                                 INPOU532
  372 ILO(1)=1                                                          INPOU533
      INI(1)=NTH                                                        INPOU534
      IR(1)=ILO(1)                                                      INPOU535
      CALL LCOUNT (4+JBU+NOPT+NTH+LCT,NPG,RECORD(35))                   INPOU536
      WRITE (KOUT,536)                                                  INPOU537
      IS=0                                                              INPOU538
      DO 3476 I=1,NTH                                                   INPOU539
      II=IOPT(I)                                                        INPOU540
```

```
      IF(II-IS)347,349,347                                              INPOU541
  347 IS=II                                                             INPOU542
      GO TO (3471,3472,3473),II                                         INPOU543
 3471 WRITE(KOUT,550)                                                   INPOU544
      GO TO 3474                                                        INPOU545
 3472 WRITE(KOUT,552)                                                   INPOU546
      GO TO 3475                                                        INPOU547
 3473 WRITE(KOUT,556)                                                   INPOU548
      GO TO 3475                                                        INPOU549
  349 GO TO (3474,3475,3475),II                                         INPOU550
 3474 WRITE(KOUT,536) TTH(I),II,THE(I),TGR(I),TCH(I),TPI(I),TBRP(I)     INPOU551
      GO TO 3476                                                        INPOU552
 3475 WRITE(KOUT,536) TTH(I),II,THE(I),TGR(I)                           INPOU553
 3476 CONTINUE                                                          INPOU554
      IF(NC-1) 373,373,743                                              INPOU555
  373 DO 3731 I=1,NTH                                                   INPOU556
 3731 TPI(I)=ALOG(AMAX1(TPI(I),.000001))                                INPOU557
      CALL LCOUNT(2              ,LCT,NPG,RECORD(35))                   INPOU558
  328 WRITE (KOUT,537)                                                  INPOU559
C     ----------SURFACE EQUILIBRIUM TABLE                               INPOU560
      READ(INPUT,5796) CRMS,VFZ,BREX,NR,NST,NBPF,NFIS,SWELL             INPOU561
      NFIS=NFIS+1                                                       INPOU562
      IF(NST) 2900,2900,2901                                            INPOU563
 2900 CRM=CRMS                                                          INPOU564
      GO TO 2902                                                        INPOU565
 2901 IF(KNST-777) 2909,2903,2909                                       INPOU566
 2903 IF(CRM-CRMS) 2907,2905,2907                                       INPOU567
 2905 WRITE(KOUT,2906)                                                  INPOU568
      CALL LCOUNT(3,LCT,NPG,RECORD(35))                                 INPOU569
 2906 FORMAT(//10X50HSURFACE TABLES ARE THE SAME AS IN PREVIOUS PROBLEM)INPOU570
      GO TO 2912                                                        INPOU571
 2907 WRITE(KOUT,2908)                                                  INPOU572
 2908 FORMAT(//10X,72HPREVIOUS SURFACE TABLES CALLED FOR BUT CR/CH RATIOINPOU573
     1 HAS CHANGED. QUIT JOB//)                                         INPOU574
      STOP                                                              INPOU575
 2909 WRITE(KOUT,2910)                                                  INPOU576
 2910 FORMAT(//10X,70HPREVIOUS SURFACE TABLES CALLED FOR BUT THIS IS FIRINPOU577
     1ST PROBLEM. QUIT JOB//)                                           INPOU578
      STOP                                                              INPOU579
 2902 KNST=777                                                          INPOU580
 2912 IF(NR) 3280,3280,3283                                             INPOU581
 3281 IF(RSV) 2824,2824,3284                                            INPOU582
 3280 IF(BREX) 3284,3284,3283                                           INPOU583
 3283 NR=1                                                              INPOU584
      GO TO 3281                                                        INPOU585
 3284 IF(NSI) 3285,3285,3286                                            INPOU586
 3286 IF(NSEN) 2813,2861,2813                                           INPOU587
 3285 CONTINUE                                                          INPOU588
      WLS=-1                                                            INPOU589
      NSEN=-1                                                           INPOU590
      IP=1                                                              INPOU591
      IPM=1                                                             INPOU592
      I=1                                                               INPOU593
      IN=1                                                              INPOU594
      J=0                                                               INPOU595
 2800 J=J+1                                                             INPOU596
      IF(NBPF) 20001,20000,20001                                        INPOU597
20000 READ(INCH,5791) PSV,BMS,TLNC(J,I,IP),TTS(J,I,IP),WLO,TCHEN(J,I,IP)INPOU598
     1,TSEN(J),JNG,TSURF(J)                                             INPOU599
      TBPF(J,I,IP)=0.                                                   INPOU600
      GO TO 20002                                                       INPOU601
20001 READ(INCH,5788)PSV,BMS,TLNC(J,I,IP),TTS(J,I,IP),WLO,TCHEN(J,I,IP) INPOU602
     1,TSEN(J),JNG,TSURF(J),TBPF(J,I,IP)                                INPOU603
20002 CONTINUE                                                          INPOU604
 5788 FORMAT(3F8.5,F9.4,F5.3,F9.3,I2,2X,A4,4X,E10.3)                    INPOU605
      IF(JNG) 2817,2817,2821                                            INPOU606
 2817 TSURF(J)=BLANK                                                    INPOU607
 2821 CONTINUE                                                          INPOU608
      IF(TTS(J,I,IP)) 2803,2832,2801                                    INPOU609
 2801 TTS(J,I,IP)=TTS(J,I,IP)+1.0                                       INPOU610
      TCHEN(J,I,IP)=TCHEN(J,I,IP)+1.0                                   INPOU611
      TSEN(J)=TSEN(J)+1.0                                               INPOU612
      GO TO 2805                                                        INPOU613
 2803 TTS(J,I,IP)=-TTS(J,I,IP)                                          INPOU614
 2805 IF(WLS) 2809,2807,2807                                            INPOU615
 2807 I=4                                                               INPOU616
      IF(WLS-WLO) 2824,2811,2824                                        INPOU617
 2809 WLS=WLO                                                           INPOU618
 2811 IF(NSEN) 2802,2820,2820                                           INPOU619
 2802 IF(JNG) 2800,2804,2804                                            INPOU620
 2804 NSEN=J-1                                                          INPOU621
      ISEN(IP)=NSEN                                                     INPOU622
      IF(NSEN-1) 2820,2820,2868                                         INPOU623
 2868 DO 2866 L=1,NSEN                                                  INPOU624
      TTSEN(L,IP)=TTS(L,I,IP)                                           INPOU625
      TZSEN(L,IP)=TCHEN(L,I,IP)                                         INPOU626
 2866 THSEN(L,IP)=TSEN(L)                                               INPOU627
      CALL SLOPE(NSEN,TTSEN(1,IP),THSEN(1,IP),TCPSEN(1,IP))             INPOU628
      CALL SLOPE(NSEN,TTSEN(1,IP),TZSEN(1,IP),TCZSEN(1,IP))             INPOU629
      LLL=(NSEN-1)/3+1                                                  INPOU630
```

```
      IF(IP-1)20137,2013,20137                                          INPOU631
 2013 CALL LCOUNT(11,2*NN,LCT     ,NPG,RECUND(35))                      INPOU632
      WRITE  (KOUT,536)                                                 INPOU633
      WRITE  (KOUT,5797) CMN,WLG,WFZ                                    INPOU634
      GO TO(20130,20131),NFIS                                           INPOU635
20131 WRITE(KOUT,20132)                                                 INPOU636
20132 FORMAT(6X,66HFIXSURE MODEL USED FOR SURFACE ENERGY TERMS AND BLOWI INPOU637
     1NG CORRECTION)                                                    INPOU638
      GO TO 20133                                                       INPOU639
20130 WRITE(KOUT,20612)                                                 INPOU640
20133 CONTINUE                                                          INPOU641
      IF (NN) 2018,2018,2016                                            INPOU642
 2016 WRITE  (KOUT,5799) BREA                                           INPOU643
      GO TO 2015                                                        INPOU644
 2018 WRITE  (KOUT,5790)                                                INPOU645
 2015 IF(SWLLL) 20134,20135,20134                                       INPOU646
20135 WRITE(KOUT,20136)                                                 INPOU647
20136 FORMAT(6X,45HNO CHAR SWELL CORRECTION ON SURFACE RECESSION)       INPOU648
      GO TO 20137                                                       INPOU649
20134 WRITE(KOUT,20130) SWELL                                           INPOU650
20130 FORMAT(6X,12HCHAR SWELL =F8.4,1X16HP CHAR THICKNESS)              INPOU651
20137 IF(NST) 20140,20140,1390                                          INPOU652
20140 CALL LCOUNT(LLL+6,LCT,NPG,RECORD(35))                             INPOU653
      WRITE(KOUT,5792)PSV                                               INPOU654
      DO 2019 LL=1,LLL                                                  INPOU655
 2019 WRITE(KOUT,5790)  (TTSEN(L,IP),THSEN(L,IP),KLL,NSEN,LLL)          INPOU656
      GO TO 2062                                                        INPOU657
 2020 NSEN=0                                                            INPOU658
      IX=3                                                              INPOU659
      IF(CMN-1.) 2024,2022,2024                                         INPOU660
 2022 IX=2                                                              INPOU661
      IF(WLG) 2024,2026,2024                                            INPOU662
 2024 WRITE  (KOUT,5793) IX                                             INPOU663
      STOP                                                              INPOU664
 2026 IF(IP-1) 2062,2061,2062                                           INPOU665
 2028 IF(TTS(J,I,IP)) 2029,2032,2029                                    INPOU666
 2029 IF(PSV-TPR(IP)) 2032,2030,2032                                    INPOU667
 2030 IF(DMS-TMG(I,IP)) 2034,2000,2034                                  INPOU668
 2032 IPN=IP+1                                                          INPOU669
      NMG(IP)=I                                                         INPOU670
      IN=0                                                              INPOU671
      NSEN=-NSEN                                                        INPOU672
 2034 IN=IN+1                                                           INPOU673
      NMI(I,IP)=J-1                                                     INPOU674
      NMC=J-1                                                           INPOU675
      CALL UNDERU(NMC,TLMC(1,I,IP),IZ)                                  INPOU676
      IF(NSWF) 3052,3052,4052                                           INPOU677
 4052 CALL SEGUAS(NMC,IZ,TTS(1,I,IP),TCHEM(1,I,IP),TSEN(1),TSURF(1),TBPF INPOU678
     1(1,I,IP))                                                         INPOU679
      GO TO 4053                                                        INPOU680
 3052 CONTINUE                                                          INPOU681
      CALL SEGUA(NMC,IZ,TTS(1,I,IP),TCHEM(1,I,IP),TSEN(1),TSURF(1))     INPOU682
 4053 CONTINUE                                                          INPOU683
      IA=0                                                              INPOU684
      IG=1                                                              INPOU685
      NMG=TMG(I,IP)                                                     INPOU686
      NLO(I,IP)=1                                                       INPOU687
      KM(I,IP)=1                                                        INPOU688
      DO 2032 K=1,NMC                                                   INPOU689
      UP=UP+TLMC(K,I,IP)                                                INPOU690
      GO TO(20340,20341),NFIS                                           INPOU691
20341 HGA=TSEN(K)                                                       INPOU692
      GO TO 20342                                                       INPOU693
20340 CONTINUE                                                          INPOU694
      CALL LOOK(2,TTS(K,I,IP),T11,TH0,0,0,0,HGA,CT1,1)                  INPOU695
      HGA=HGA+DELHG                                                     INPOU696
20342 CONTINUE                                                          INPOU697
      CALL LOOK(4,TTS(K,I,IP),T12(1,2),TH2(1,2),0,0,0,HCH,CT2,1)        INPOU698
      HCH=HCH+DH2                                                       INPOU699
      IF(NSAN) 2030,2030,2030                                           INPOU700
 2036 HE=TCHEM(K,I,IP)                                                  INPOU701
      TCHEM(K,I,IP)=BP*HGA+TLMC(K,I,IP)*HCH-BP*TSEN(K)                  INPOU702
      GO TO 2040                                                        INPOU703
 2030 CALL WALE(1,TTS(K,I,IP),HE,ISEN(IP),TTSEN(1,IP),TZSEN(1,IP),TCZSEN INPOU704
     1(1,IP))                                                           INPOU705
      CALL WALE(1,TTS(K,I,IP),HE,ISEN(IP),TTSEN(1,IP),THSEN(1,IP),TCPSEN INPOU706
     1(1,IP))                                                           INPOU707
      TCHEM(K,I,IP)=BP*HGA+TLMC(K,I,IP)*HCH-BP*TSEN(K)+HE-TCHEM(K,I,IP) INPOU708
 2040 TSEN(K)=HE                                                        INPOU709
      IF(TSURF(K)-BLANK) 2044,2042,2044                                 INPOU710
 2042 NLO(I,IP)=K+1                                                     INPOU711
      IF(IG+IA-1) 2046,2046,2044                                        INPOU712
 2044 IA=1                                                              INPOU713
 2046 IF(K-1) 2052,2052,2048                                            INPOU714
 2048 IF(TTS(K,I,IP)-TTS(K-1,I,IP)) 2050,2050,2051                      INPOU715
 2050 IG=NMC                                                            INPOU716
      GO TO 2052                                                        INPOU717
 2051 KM(I,IP)=K                                                        INPOU718
 2052 CONTINUE                                                          INPOU719
      LLL=(NMC-1)/2+1                                                   INPOU720
```

```
      CALL LCOUNT(LLL+6          ,LCT,NPG,RECORD(35))                    INPOUT721
      WRITE(KOUT,5795)TMG(1,IP),TPR(IP),((TTS(L,I,IP),TLMC(L,I,IP),TCHEM INPOUT722
     1(L,I,IP),TSUMF(L),L=LL,NMC,LLL),LL=1,LLL)                         INPOUT723
      DO 2856 K=1,NMC                                                   INPOUT724
      TCHEM(K,I,IP)=CMM*TCHEM(K,I,IP)-TSEN(K)                           INPOUT725
      IF(K-NLO(I,IP)) 2856,2854,2854                                    INPOUT726
 2854 TLMC(K,I,IP)=ALOG(AMAX1(TLMC(K,I,IP),.00001))                     INPOUT727
      IF(NBPF) 2856,2856,3856                                           INPOUT728
 3856 TBPF(K,I,IP)=ALOG(AMAX1(TBPF(K,I,IP),1.E-12))                     INPOUT729
 2856 CONTINUE                                                          INPOUT730
      CALL SSWTCH(1,KKSW)                                               INPOUT731
      GO TO (730,731),KKSW                                              INPOUT732
  730 CALL LCOUNT(LLL+6,LCT,NPG,RECORD(35))                             INPOUT733
      WRITE(KOUT,5795)TMG(1,IP),TPR(IP),((TTS(L,I,IP),TLMC(L,I,IP),TCHEM INPOUT734
     1(L,I,IP),TSEN(L) ,L=LL,NMC,LLL),LL=1,LLL)                         INPOUT735
      IF(NBPF) 731,731,6016                                             INPOUT736
 6016 CALL LCOUNT(3+NMC,LCT,NPG,RECORD(35))                             INPOUT737
      WRITE(KOUT,6017) (TBPF(L,I,IP),L=1,NMC)                           INPOUT738
 6017 FORMAT(/10X,16HLOG B PRIME FAIL//(10X,E12.3))                     INPOUT739
  731 CONTINUE                                                          INPOUT740
      IF(TTS(J,I,IP)) 2862,2870,2862                                    INPOUT741
 2861 CALL LCOUNT(10+2*NR,LCT,NPG,RECORD(35))                           INPOUT742
      WRITE (KOUT,538)                                                  INPOUT743
      WRITE (KOUT,5794) VFZ                                             INPOUT744
      GO TO (28610,28611),NFIS                                          INPOUT745
28611 WRITE(KOUT,28132)                                                 INPOUT746
      GO TO 28613                                                       INPOUT747
28610 WRITE(KOUT,28612)                                                 INPOUT748
28612 FORMAT(6X,36HFISSURE MODEL NOT USED FOR GAS TERMS)                INPOUT749
28613 CONTINUE                                                          INPOUT750
      IF (NH) 2863,2863,2864                                            INPOUT751
 2864 WRITE(KOUT,5799) BREX                                             INPOUT752
      GO TO 2715                                                        INPOUT753
 2863 WRITE (KOUT,5790)                                                 INPOUT754
 2715 IF(SWELL) 2734,2735,2736                                          INPOUT755
 2735 WRITE(KOUT,28136)                                                 INPOUT756
      GO TO 2737                                                        INPOUT757
 2734 WRITE(KOUT,28138) SWELL                                           INPOUT758
 2737 IF(NST) 2862,2862,1390                                            INPOUT759
 2862 TPR(IPN)=PSV                                                      INPOUT760
      TMG(IN,IPN)=DMS                                                   INPOUT761
      TLMC(1,IN,IPN)=TLMC(J,I,IP)                                       INPOUT762
      TBPF(1,IN,IPN)=TBPF(J,I,IP)                                       INPOUT763
      TTS (1,IN,IPN)=TTS (J,I,IP)                                       INPOUT764
      TCHEM(1,IN,IPN)=TCHEM(J,I,IP)                                     INPOUT765
      TSUMF(1)=TSUMF(J)                                                 INPOUT766
      TSEN(1)=TSEN(J)                                                   INPOUT767
      J=1                                                               INPOUT768
      I=IN                                                              INPOUT769
      IP=IPN                                                            INPOUT770
      GO TO 2800                                                        INPOUT771
 2870 NPR=IP                                                            INPOUT772
      IR(12)=1                                                          INPOUT773
      ILO(12)=1                                                         INPOUT774
      IHI(12)=1                                                         INPOUT775
      DO 2872 I=1,IP                                                    INPOUT776
 2872 TPR(I)=ALOG(TPR(I))                                               INPOUT777
      IR(13)=1                                                          INPOUT778
      IHI(13)=NPR                                                       INPOUT779
      ILO(13)=1                                                         INPOUT780
  743 IF(NBDU) 740,1390,740                                             INPOUT781
  740 CALL SSWTCH(3,KKSW)                                               INPOUT782
      GO TO (741,1390),KKSW                                             INPOUT783
  741 WRITE(KOUT,742) (NFI(J), J=1,NBDU)                                INPOUT784
      WRITE(KOUT,742) (NLA(J), J=1,NBDU)                                INPOUT785
      WRITE(KOUT,742) NBDU,NBM2                                         INPOUT786
      LU=NBDU*2+21                                                      INPOUT787
      WRITE(KOUT,742) (IHI(J),ILO(J),IR(J),J=22,LU)                     INPOUT788
  742 FORMAT(6I5)                                                       INPOUT789
 1390 RETURN                                                            INPOUT790
      END                                                               INPOUT791
```

```
      SUBROUTINE THEMWS(NI,SO,TO,DEP,MR,CN,MAT)                         THEMW  1
      COMMON MOUT,TEA,UEM,VR                                            THEMW  2
      COMMON IMI(30),ILO(30),IN(30),TT2(30,10),TCP(30,10),TMP(30,10),TMZTHEMW  3
     1(30,10),TEP(30,10),TTM(30),TME(30),TBR(30),TCM(30),TTI(30),TMG(30)THEMW  4
     2,DM12(2),REC(30),D(30),SO(30)                                     THEMW  5
      COMMON MMO(10)                                                    THEMW  6
      COMMON MATL( 50),DEL( 51),TA( 51),M(50),RC(50),RA( 50),           THEMW  7
     1AREA( 50),EMA( 50),MAV( 50)                                       THEMW  8
      COMMON MDA( 500),MDU( 500),MDC( 500)                              THEMW  9
      COMMON TPB(3),MMB,IOIOT(2),TMG(15,3),MLO(15,3),MMI(15,3),         THEMW 10
     1MMI(15,3),TTSEN(25,3),TMGEN(25,3),TCPSEN(25,3),TLMC(25,15,3),     THEMW 11
     2TSEN(3),TPI(30),TTS(25,15,3),TCMEN(25,15,3),WZ,CMM                THEMW 12
      COMMON TBPF(25,15,3)                                              THEMW 13
      COMMON MPR                                                        THEMW 14
      COMMON LCT,MPG,II,MBM,MLMM,ML,DELMS,DELM,MFT,MMBRA,MMBRD,MMBRC,TMATHEMW 15
     1CA,TRACB,TRACC,MMBDA,MMBDU,MMBDC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,THEMW 16
     2TRACM,PET,PETC,MSV,ETA,MIPR3,DTPR2,DTPRT,TPR3,TPR2,TMZRD,TMFIN,MT,THEMW 17
     3TMST,GAMA,GMS,MU,FJMM,FJS,FJMP,FJM,INPUT,      DTMIN,DMP,MCOMV,THEMW 18
     4EPSU,TRES,IMCM,UTMB                                               THEMW 19
      COMMON MM,MI,MBI                                                  THEMW 20
      DIMENSION MAISO(51),TATMM(51),TO(10),DEP(10,5),MISO(5),MK(1),CM(1)THEMW 21
      DIMENSION MAT(51)                                                 THEMW 22
      ISO=0                                                             THEMW 23
      MAISO(1)=MA(ML)                                                   THEMW 24
      TATMM(1)=TA(ML)                                                   THEMW 25
      DO 200 I=MBM,MLMM                                                 THEMW 26
      ISO=ISO+1                                                         THEMW 27
      MAISO(ISO+1)=MA(I)                                                THEMW 28
  200 TATMM(ISO+1)=TA(I)                                                THEMW 29
      TATMM(ISO+2 )=TA(MLMM+1)                                          THEMW 30
      IF(MD) 202,202,201                                                THEMW 31
  201 DO 200 I=1,MD                                                     THEMW 32
      DIS2=0.                                                           THEMW 33
      IF(SO(I)-MA(ML)) 200,200,222                                      THEMW 34
  222 DO 300 K=1,ISO                                                    THEMW 35
      IF(SO(I)-MAISO(K+1)) 354,300,300                                  THEMW 36
  300 CONTINUE                                                          THEMW 37
      K=ISO+1                                                           THEMW 38
  354 IF(K-1) 200,227,221                                               THEMW 39
  227 K=ML                                                              THEMW 40
      L=MBM                                                             THEMW 41
      MM=ML                                                             THEMW 42
      GO TO 223                                                         THEMW 43
  221 K=MBM+K-2                                                         THEMW 44
      L=K+1                                                             THEMW 45
      MM=K                                                              THEMW 46
  223 IF(ABS(1.-SO(I)/(MA(K)+DEL(K)*0.))-1.E-5) 252,252,251             THEMW 47
  251 IF(ABS(SO(I)/(MA(K)+DEL(K)*0.))-1.) 224,224,225                   THEMW 48
  252 DIS2=DC(K)/2.+CM(K)                                               THEMW 49
  224 DIS=(SO(I)-MA(K))/12.                                             THEMW 50
      GO TO 226                                                         THEMW 51
  225 IF(K-MBM)2251,2252,2252                                           THEMW 52
 2252 TO(I)=TRES                                                        THEMW 53
      GO TO 260                                                         THEMW 54
 2251 DIS=(MA(L)-SO(I))/12.                                             THEMW 55
      JM=L                                                              THEMW 56
      K=ML                                                              THEMW 57
      L=J                                                               THEMW 58
  226 TO(I)=TA(K)+(TA(L)-TA(K))/(0.5*(MAT(K)+MAT(L))+DC(K)/MM(K))*      THEMW 59
     1 DIS/(CM(K)+MM(K))*(1.+DIS2/DIS)                                  THEMW 60
  260 CONTINUE                                                          THEMW 61
  202 IF(MI) 203,203,204                                                THEMW 62
  204 DO 210 I=1,MI                                                     THEMW 63
      MISO(I)=0                                                         THEMW 64
      DO 210 J=1,5                                                      THEMW 65
      DEP(I,J)=0.                                                       THEMW 66
  210 CONTINUE                                                          THEMW 67
      ISO=ISO+1                                                         THEMW 68
      DO 2100 I=1,MI                                                    THEMW 69
      N=0                                                               THEMW 70
      ISOT=MBI+I                                                        THEMW 71
      T=SO(ISOT)                                                        THEMW 72
      DO 211 J=1,ISO                                                    THEMW 73
      IPLS=0                                                            THEMW 74
      IMNS=0                                                            THEMW 75
      IF(T-TATMM(J)) 100,212,101                                        THEMW 76
  100 IMNS=1                                                            THEMW 77
      GO TO 102                                                         THEMW 78
  101 IPLS=1                                                            THEMW 79
  102 IF(T-TATMM(J+1))103,211,104                                       THEMW 80
  103 IMNS=IMNS+1                                                       THEMW 81
      GO TO 105                                                         THEMW 82
  104 IPLS=IPLS+1                                                       THEMW 83
  105 IF(IPLS*IMNS) 212,211,212                                         THEMW 84
  212 N=N+1                                                             THEMW 85
      IF(J-1) 211,213,214                                               THEMW 86
  213 K=ML                                                              THEMW 87
      L=MBM                                                             THEMW 88
      GO TO 220                                                         THEMW 89
  214 K=MBM+J-2                                                         THEMW 90
```

```
      L=K+1                                                             THERM 91
      IF(K-NUMN) 215,220,220                                            THERM 92
  215 IF(MATL(K)-MATL(K+1)) 220,216,220                                 THERM 93
  220 QI=(TA(K)-TA(L))/(0.5*(RAT(K)+RAT(L))+RC(K)/RN(K))                THERM 94
      TIU=TA(K)-0.5*RAT(K)*QI                                           THERM 95
      TIL=TIU-RC(K)/RN(K)*QI                                            THERM 96
      DO 499 M=1,2                                                      THERM 97
      IPLS=0                                                            THERM 98
      INMS=0                                                            THERM 99
      GO TO (401,402),M                                                 THERM 99
  401 T1=TA(K)                                                          THERM100
      T2=TIU                                                            THERM101
      GO TO 403                                                         THERM102
  402 T1=TIU                                                            THERM103
      T2=TIL                                                            THERM104
  403 IF(T-T1) 351,500,352                                              THERM105
  351 INMS=1                                                            THERM106
      GO TO 353                                                         THERM107
  352 IPLS=1                                                            THERM108
  353 IF(T-T2)357,500,355                                               THERM109
  357 INMS=INMS+1                                                       THERM110
      GO TO 356                                                         THERM111
  355 IPLS=IPLS+1                                                       THERM112
  356 IF(IPLS*INMS) 500,499,500                                         THERM113
  499 CONTINUE                                                          THERM114
      M=3                                                               THERM115
  500 GO TO (2202,2204,2203),M                                          THERM116
 2204 DEP(I,M)=RA(K)+0.5*DEL(K)                                         THERM117
      GO TO 2112                                                        THERM118
  216 DEN=TA(L)-TA(K)                                                   THERM119
      X2=TA(L)-T                                                        THERM120
      X1=TA(K)-T                                                        THERM121
      DEP(I,M)=(RA(K)*X2-RA(L)*X1)/DEN                                  THERM122
      GO TO 2112                                                        THERM123
 2202 DEN=TIU-TA(K)                                                     THERM124
      X1=TA(K)-T                                                        THERM125
      DEP(I,M)=RA(K)-0.5*DEL(K)*X1/DEN                                  THERM126
      GO TO 2112                                                        THERM127
 2203 IF(K-NUMN) 2205,2204,2204                                         THERM128
 2205 DEN=TA(L)-TIL                                                     THERM129
      X2=TA(L)-T                                                        THERM130
      DEP(I,M)=RA(L)-0.5*DEL(L)*X2/DEN                                  THERM131
 2112 TO(ISOT)=0.                                                       THERM132
  211 CONTINUE                                                          THERM133
      IF(M-1) 2100,2101,2102                                            THERM134
 2101 MISO(I)=0                                                         THERM135
      TO(ISOT)=DEP(I,M)                                                 THERM136
      GO TO 2100                                                        THERM137
 2102 CONTINUE                                                          THERM138
      MISO(I)=M                                                         THERM139
 2100 CONTINUE                                                          THERM140
  203 RETURN                                                            THERM141
      END                                                               THERM142
                                                                        THERM143
```

```
C UTILITY ROUTINE LCOUNT -- COUNTS,TITLES, AND NUMBERS EACH PAGE
      SUBROUTINE LCOUNT (J,LCT,NPG,R)
      COMMON KOUT
      DIMENSION R(2)
  551 FORMAT(1H110X65HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND A
     1BLATION PROGRAM/73X4HPAGE I3/1H 67X2A6)
      I=J
      IF(I) 2,2,3
    2 I=-I
      GO TO 4
    3 LCT=LCT-I
      IF (LCT) 4,5,5
    4 NPG=NPG+1
      LCT=60-I
      WRITE (KOUT,551) NPG,R
    5 RETURN
      END
```

```
C UTILITY ROUTINE LOOK  -- LOOKS UP AND LINEARLY INTERPOLATES WITHIN
C     TABLES HAVING ONE INDEPENDENT AND UP TO FOUR DEPENDENT VARIABLES
      SUBROUTINE LOOK(II,XL,X,A,B,C,E,Y,D,IDN)
      COMMON KOUT,IEX,DEN,VR
      COMMON IHI(36),ILO(38),IR(38)
      DIMENSION  X(1),Y(1),D(1)
      DIMENSION A(1),B(1),C(1),E(1)
      IH=IHI(II)
      IL=ILO(II)
      IEX=0
      IF(X(IH)-X(IL)) 30,30,29
   30 IEX=1
      IF (XL-X(IH)) 3,2,31
   31 IF (XL-X(IL)) 6,5,4
   29 IF(XL-X(IH))1,2,3
    1 IF(XL-X(IL))4,5,6
    6 I=IR(II)
      I=MIN0(I,IH)
      I=MAX0(I,IL)
      IS=1
      IT=1
      GO TO 8
   11 I=I+1
      IS=0
    8 IF(IEX) 28,28,38
   28 IF(XL-X(I)) 7,10,9
   38 IF(XL-X(I)) 9,10,7
    7 I=I-1
      IT=0
      IF(IS)10,10,8
    9 IF(IT)10,10,11
    3 IEX=3
    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(4)=E(I)
      D(4)=E(I+1)-E(I)
   23 Y(3)=C(I)
      D(3)=C(I+1)-C(I)
   22 Y(2)=B(I)
      D(2)=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
   13 VR=VR/DEN
      RETURN
      END
```

```
C UTILITY ROUTINE OGLE  -- EVALUATES AN ARRAY OF VALUES OF A DEPENDENT  OGLE   1
C     VARIABLE FROM AN ARRAY OF VALUES OF AN INDEPENDENT VARIABLE USING OGLE   2
C     A CUBIC CURVE FIT FOUND FROM TABULAR VALUES AND SLOPES OF         OGLE   3
C     SURROUNDING POINTS                                                OGLE   4
      SUBROUTINE OGLE(N,XAN,PRN,NUMX,X,P,EN)                            OGLE   5
      DIMENSION XAN(1),X(1),P(1),EN(1),PRN(1),DPDIN(1)                  OGLE   6
      XDIF=X(NUMX)-X(1)                                                 OGLE   7
      IS=1                                                              OGLE   8
    2 DO 600 J=1,N                                                      OGLE   9
      XA=XAN(J)                                                         OGLE  10
   59 IO=1                                                              OGLE  11
      IT=1                                                              OGLE  12
   61 IF(XDIF) 72,60,71                                                 OGLE  13
   71 IF(XA-X(IS)) 62,63,64                                             OGLE  14
   72 IF(X(IS)-XA) 62,63,64                                             OGLE  15
   62 IF(IS-1)671,671,68                                                OGLE  16
   68 IS=IS-1                                                           OGLE  17
      IT=2                                                              OGLE  18
      GO TO (61,66),IO                                                  OGLE  19
  672 IS=NUMX                                                           OGLE  20
  671 I=IS                                                              OGLE  21
      H=0.                                                              OGLE  22
      DPDI=EN(I)                                                        OGLE  23
      GO TO 67                                                          OGLE  24
   63 PR=P(IS)                                                          OGLE  25
      DPDI=EN(IS)                                                       OGLE  26
      GO TO 601                                                         OGLE  27
   64 IS=IS+1                                                           OGLE  28
      IF(IS-NUMX)69,69,672                                              OGLE  29
   69 IO=2                                                              OGLE  30
      GO TO (61,65),IT                                                  OGLE  31
   65 IS=IS-1                                                           OGLE  32
   66 I=IS                                                              OGLE  33
      G=(((P(I+1)-P(I))/(X(I+1)-X(I)))-EN(I))/(X(I+1)-X(I))             OGLE  34
      F=(((EN(I+1)-EN(I))/(X(I+1)-X(I)))-2.*G)/(X(I+1)-X(I))            OGLE  35
      H=(F*(XA-X(I+1))+G)*(XA-X(I))                                     OGLE  36
      DPDI=(H+H+EN(I)+F*(XA-X(I)))*(XA-X(I)))                           OGLE  37
   67 PR=(H+EN(I))*(XA-X(I))+P(I)                                       OGLE  38
  601 CONTINUE                                                          OGLE  39
      PRN(J)=PR                                                         OGLE  40
  600 CONTINUE                                                          OGLE  41
   60 CONTINUE                                                          OGLE  42
    4 RETURN                                                            OGLE  43
      END                                                               OGLE  44
```

```
C UTILITY ROUTINE ORDERD -- ROUTINE TO REORDER A FLOATING POINT ARRAY   ORDERD 1
C     WITH SPECIAL FEATURES FOR ORDERING SURFACE THERMOCHEMISTRY TABLES ORDERD 2
      SUBROUTINE ORDERD (NX,X1,I1)                                      ORDERD 3
      DIMENSION X1(1),I1(1)                                             ORDERD 4
      DIMENSION LS(20)                                                  ORDERD 5
      NN=IABS(NX)                                                       ORDERD 6
      LS(1)=0                                                           ORDERD 7
      LS(2)=1                                                           ORDERD 8
      LS(3)=2                                                           ORDERD 9
      LI=3                                                              ORDERD10
      I1(1)=1                                                           ORDERD11
      DO 1 N=2,NN                                                       ORDERD12
      I1(N)=N                                                           ORDERD13
      L=LS(LI)                                                          ORDERD14
      LA=LI                                                             ORDERD15
      J=N                                                               ORDERD16
      X1C=X1(J)                                                         ORDERD17
      I1C=I1(J)                                                         ORDERD18
      J=J-L                                                             ORDERD19
      IF(J) 31,31,34                                                    ORDERD20
   34 LI=LI+1                                                           ORDERD21
      LS(LI)=L+L                                                        ORDERD22
      GO TO 29                                                          ORDERD23
   33 LA=LA-1                                                           ORDERD24
      L=LS(LA)                                                          ORDERD25
      IF(L) 3,3,41                                                      ORDERD26
   41 J=J-L                                                             ORDERD27
   32 IF(J) 31,31,29                                                    ORDERD28
   31 LA=LA-1                                                           ORDERD29
      L=LS(LA)                                                          ORDERD30
      J=J+L                                                             ORDERD31
      IF(L) 4,4,32                                                      ORDERD32
   30 LA=LA-1                                                           ORDERD33
      L=LS(LA)                                                          ORDERD34
      IF(L) 4,4,42                                                      ORDERD35
   42 J=J+L                                                             ORDERD36
   29 IF(NX) 229,129,129                                                ORDERD37
  229 IF(X1C-X1(J)) 30,53,33                                            ORDERD38
  129 IF(X1(J)-X1C) 30,53,33                                            ORDERD39
   53 J=1                                                               ORDERD40
      GO TO 3                                                           ORDERD41
    4 J=J+1                                                             ORDERD42
    3 N=N-1                                                             ORDERD43
      NN=N                                                              ORDERD44
      DO 2 K=J,NN                                                       ORDERD45
      X1(N+1)=X1(N)                                                     ORDERD46
      I1(N+1)=I1(N)                                                     ORDERD47
    2 N=N-1                                                             ORDERD48
      I1(J)=I1C                                                         ORDERD49
    1 X1(J)=X1C                                                         ORDERD50
      RETURN                                                            ORDERD51
      END                                                               ORDERD52
```

```
C UTILITY ROUTINE ORDERI -- ROUTINE TO REORDER INTEGER ARRAYS           ORDERI 1
      SUBROUTINE ORDERI(NX,IPM)                                         ORDERI 2
      DIMENSION IPM(70)                                                 ORDERI 3
      N=NX                                                              ORDERI 4
      IF(NX) 9,6,1                                                      ORDERI 5
    9 N=-N                                                              ORDERI 6
    1 IF(N-1)6,6,2                                                      ORDERI 7
    2 K = 0                                                             ORDERI 8
      DO 4 J=2,N                                                        ORDERI 9
      IF(NX)8,7,7                                                       ORDERI10
    7 IF (IPM(J-1)-IPM(J)) 4,6,3                                        ORDERI11
    8 IF (IPM(J-1)-IPM(J)) 3,3,4                                        ORDERI12
    3 IT = IPM(J-1)                                                     ORDERI13
      IPM(J-1) = IPM(J)                                                 ORDERI14
      IPM(J) = IT                                                       ORDERI15
      K = 1                                                             ORDERI16
    4 CONTINUE                                                          ORDERI17
      IF (K) 6,6,2                                                      ORDERI18
    6 RETURN                                                            ORDERI19
      END                                                               ORDERI20
```

```
C UTILITY ROUTINE SEQUA -- REORDERS UP TO FOUR DEPENDENT VARIABLE
C     ARRAYS BASED ON THE RESULTS OF ORDERD CALL
      SUBROUTINE SEQUA(N,L,A,B,C,D)
      DIMENSION A(1),B(1),C(1),D(1),L(1)
      IS=0
      DO 30 II=1,N
      I=II
   21 J=L(I)
      L(I)=I
      IF(J-I) 22,30,22
   22 IF(IS) 25,23,25
   23 SA=A(I)
      SB=B(I)
      SC=C(I)
      SD=D(I)
      IS=I
   26 A(I)=A(J)
      B(I)=B(J)
      C(I)=C(J)
      D(I)=D(J)
      I=J
      GO TO 21
   25 IF(IS-J) 26,28,26
   28 IS=0
      A(I)=SA
      B(I)=SB
      C(I)=SC
      D(I)=SD
   30 CONTINUE
      RETURN
      END
```

```
C UTILITY ROUTINE SEQUAS -- REORDERS UP TO FIVE DEPENDENT VARIABLE
C     ARRAYS BASED ON THE RESULTS OF ORDERD CALL
      SUBROUTINE SEQUAS(N,L,A,B,C,D,E)
      DIMENSION A(1),B(1),C(1),D(1),L(1)
      DIMENSION E(1)
      IS=0
      DO 30 II=1,N
      I=II
   21 J=L(I)
      L(I)=I
      IF(J-I) 22,30,22
   22 IF(IS) 25,23,25
   23 SA=A(I)
      SB=B(I)
      SC=C(I)
      SD=D(I)
      SE=E(I)
      IS=I
   26 A(I)=A(J)
      B(I)=B(J)
      C(I)=C(J)
      D(I)=D(J)
      E(I)=E(J)
      I=J
      GO TO 21
   25 IF(IS-J) 26,28,26
   28 IS=0
      A(I)=SA
      B(I)=SB
      C(I)=SC
      D(I)=SD
      E(I)=SE
   30 CONTINUE
      RETURN
      END
```

```
C UTILITY ROUTINE SLOPU -- GENERATES SLOPES OF DEPENDENT VARIABLES
C     BASED ON QUADRATIC FITS THROUGH THREE SUCCESSIVE TABLE POINTS
      SUBROUTINE SLOPU(NUMX,X,P,EM)
C     SLOPE EVALUATION ROUTINE
C
       DIMENSION X(1), P(1), EM(1), Z(1)
   30 EM(2) = ( P(2) - P(1) ) / ( X(2) - X(1) )
      EM(1) = EM(2)
      Z(1)=0.0
      QC = EM(1)
      DO 36 I = 1 , NUMX
      IPO = I + 1
      IPT = I + 2
      IT = IPO - NUMX
      IF (IT) 33 , 31 , 32
   31 QB=QC
      GO TO 41
   32 GO TO 40
   33 XOT = X(I) - X(IPO)
      XTT = X(IPO) - X(IPT)
      XTO = X(IPT) - X(I)
      AA = P(I) / ( XOT * XTO )
      XOTT=XOT*XTT
   37 AB=P(I+1)/XOTT
      AC = P(IPT) / ( XTT * XTO )
      AAA = AA * XTT
      ABB = AB * XTO
      ACC = AC * XOT
      QA = QC
      QB = EM(I)
      QC = EM (IPO)
      EM(IPO) = AB * (XOT - XTT) + ACC - AAA
      EM(IPT) = AC * (XTT - XTO) + AAA - ABB
      EM(I)=   AA * (XTO - XOT) + ABB - ACC
   34 QE = EM(I)
      IF(I-2) 36,41,35
   35 EM(I) = ( QE + QA ) /2.
   41 EM(I) = (EM(I) + QB ) /2.
   40 XO=X(I)-X(I-1)
   36 CONTINUE
      RETURN
      END
```

REFERENCES

1. Aerotherm Corporation, Mountain View, California, User's Manual, Aerotherm Charring Material Ablation Program, Version 2, Second Edition, January 1969.

2. Aerotherm Corporation, Mountain View, California, Fortran Variable Names, Aerotherm Charring Material Ablation Program, Version 2, February 1966.

3. Aerotherm Corporation, Mountain View, California, Flow Charts, Aerotherm Charring Material Ablation Program, Version 2, April 1966.

4. Moyer, D. B. and Rindal, R. A., "Finite Difference Solution for the In-Depth Response of Charring Materials Considering Surface Chemical and Energy Balances." Aerotherm Corporation Final Report 66-7, Part II, March 14, 1967 (also NASA CR-1061, June 1968).

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

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

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

3. REPORT TITLE

User's Manual - Aerotherm Charring Material Thermal Response and Ablation Program, Version 3 - Volume II - Fortran Variable Names, Flow Charts, and Listings

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

User's Manual

5. AUTHOR(S) (First name, middle initial, last name)

Dr. Carl B. Moyer
Mitchell R. Wool

6. REPORT DATE April 1970	7a. TOTAL NO. OF PAGES 167	7b. NO. OF REFS 4
8a. CONTRACT OR GRANT NO. F04611-70-C-0012 b. PROJECT NO. c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) UM-70-14 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) AFRPL-TR-70-92	

10. DISTRIBUTION STATEMENT

This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of AFRPL (REPORT/STINFO), Edwards, California 93523.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Air Force Rocket Propulsion Laboratory Edwards Air Force Base, California

13. ABSTRACT

This two-volume report describes a Fortran IV computer code which computes the transient thermal and ablation response of a charring insulation material structure. The program is for one-dimensional bodies, but can treat a variety of shapes, including planes, cylinders, spheres, and more general thermal "stream tube" bodies. The program can treat complex systems including a main ablating material, several charring back-up materials, and a multiple non-charring material back-up structure.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Unclassified

Security Classification

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Ablation						
Boundary layer heat and mass transfer						
Charring Ablators						
Chemical equilibrium						
Chemistry						
Corrosivity						
Equilibrium computer codes						
Fortran computer program						
Heat transfer						
Heterogeneous chemistry						
Resin degradation						
Rocket nozzle analysis						
Solid propellant						
Surface reactions						
Thermal decomposition						
Thermal response						
Thermochemistry						
User's Manual (Computer Code)						

UNCLASSIFIED

Security Classification