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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

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

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Volume II - Fortran Variable Names,
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Prepared Under
the Sponsorship of

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

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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.

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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/CEM), 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, INPUT, 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
AMEA ()	ORIGINAL (INPUT) CROSS SECTION AREA OF NODE	FT ²
ASTER	IM*	
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
HBB(I,J)	ARRHENIUS 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	IM	
BMEK	INPUT BURNING RATE EXPONENT USED IN MODIFYING INPUT TRANSFER COEFFICIENT	
BMP	BLOWING REDUCTION PARAMETER, LAMBDA	
CHCRI	CHAR INTERFACE CRITERIA: CHAR LINE DEPTH IS DEPTH OF LINE OF DENSITY $WMO(2) = CHCRI * (RMO(1) - WMO(2))$	
CMH	RATIO OF CM/CH	
DEL ()	NODE THICKNESS	FT
DELMG	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	
DMC(I)	ENTHALPY OF FORMATION OF CHAR OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO DM2)	BTU/LB
DMV(I)	ENTHALPY OF FORMATION OF VIRGIN PLASTIC OF I TH DECOMPOSING BACK-UP (ANALOGOUS TO DM1)	BTU/LB
DM1	ENTHALPY OF FORMATION OF VIRGIN PLASTIC, MAIN MATERIAL	BTU/LB

LIST OF FORTHAN VARIABLES
APPEARING IN COMMON STATEMENTS

VARIABLE NAME	DESCRIPTION	UNITS
DM2	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 DECOMP- OSITION 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
IUIOT()	DUMMY EMPTY WORDS IN COMMON	
IEX	NOT USED IN PROGRAM (RETURNED FROM LOOK SUBROUTINE VIA COMMON; SET GREATER THAN UNITY IF EXTRAPOLATION REQUIRED.)	
IMI()	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	
IN()	'REMEMBERED' INDEX IN A GIVEN TABLE ADJACENT TO PREVIOUS VALUE FOR WHICH A LOOK-UP WAS PERFORMED	
ISEN(IPK)	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	
KMI(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 USER'S 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
NNN	ALWAYS EQUAL TO 1 PLUS THE ORIGINAL NUMBER OF NODES OF ABLATING MATERIAL	
NNM2	EQUAL TO NNN 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 TBP (. .) VALUES FROM SURFACE THERMOCHEMISTRY TABLES	
NUFT(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)	$\text{RHOV}(I)/(\text{RHOV}(I)-\text{RHOC}(I))$, ANALOGOUS TO PETE	
PET	DENSITY FACTOR, (CHAR DENSITY * PETE)	LB/FT3
PETE	DENSITY TERM, VIRGIN DENSITY/ (VIRGIN DENSITY - CHAR DENSITY)	
PP(I)	$\text{RHOC}(I)*P(I)$, ANALOGOUS TO PET	LB/FT3
PSI(I,J)	DECOMPOSITION REACTION ORDER FOR THE J TH COMPON- ENT 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 $\text{RHO}(2)+\text{PYCRI}*(\text{RHO}(1)-\text{RHO}(2))$	
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	(FT ² -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/FT ³
RHOC(I)	CHAR DENSITY OF I TH DECOMPOSING BACK-UP MATERIAL (ANALOGOUS TO RHO(2))	LB/FT ³
RHOO(I,J), J = 1,2	ORIGINAL DENSITY OF J TH COMPONENT OF I TH DECOM- POSING BACK-UP PER UNIT VOLUME OF RESIN (ANALOGOUS TO RHOOA, RHOOB)	LB/FT ³
RHOO(I,3)	ORIGINAL DENSITY OF THIRD COMPONENT OF I TH DECOM- POSING BACK-UP FOR UNIT VOLUME OF REINFORCEMENT (ANALOGOUS TO RHOOA)	LB/FT ³
RHOOA	ORIGINAL DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN	LB/FT ³
RHOOB	ORIGINAL DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN	LB/FT ³
RHOOA	ORIGINAL DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT ³
RHOR(I,J), J = 1,2	RESIDUAL DENSITY OF J TH COMPONENT OF I TH DECOM- POSING BACK-UP PER UNIT VOLUME OF RESIN (ANALOGOUS TO RHORA, RHORB)	LB/FT ³
RHOR(I,3)	RESIDUAL DENSITY OF THIRD COMPONENT OF I TH DECOM- POSING BACK-UP PER UNIT VOLUME OF REINFORCEMENT (ANALOGOUS TO RHORC)	LB/FT ³
RHORA	RESIDUAL DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN	LB/FT ³
RHORB	RESIDUAL DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN	LB/FT ³
RHORC	RESIDUAL DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT ³

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(1))	LB/FT ³
RUA()	CURRENT DENSITY OF COMPONENT A PER UNIT VOLUME OF RESIN, AT A NODELET	LB/FT ³
ROB()	CURRENT DENSITY OF COMPONENT B PER UNIT VOLUME OF RESIN, AT A NODELET	LB/FT ³
ROC()	CURRENT DENSITY OF COMPONENT C PER UNIT VOLUME OF REINFORCEMENT	LB/FT ³
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/FT ³
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/FT ³
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 THZ(I,J))	BTU/LB DEG R
TCHEM (I,J,K)	QUANTITY (CM/CM * CHEM PHOD - MW) FOR I TH CHAR RATE, J TH GAS RATE, AND K TH PRESSURE	BTU/LB
TCH()	TABULAR VALUE OF HEAT TRANSFER COEFFICIENT RHOE-UE-CM IN FUNCTIONS-OF-TIME TABLES	LB/FT ² -SEC
TCPI(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 DECOMP- OSING 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 TEMP- ERATURE 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-CN) 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 THERMO- CHEMISTRY 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 RESSION RATE)	BTU/FT2-SEC OR MILS/SEC
THAC(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
TRACH	MINIMUM OF TRACA, TRACB, TRACC	
TREF(I)	REFERENCE TEMPERATURE FOR HEATS OF FORMATION ANALOGOUS TO T2) 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 THERMOCHEMISTRY TABLES FOR I TH TEMPERATURE, J TH PYROLYSIS GAS RATE, AND K TH PRESSURE	DEG R
TTSEN(I,J)	TABULAR VALUE OF TEMPERATURE (INDEPENDENT VARIABLE) 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
TA(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	
VH	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
B+	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-CM	LB/FT2-SEC
CHZ	HEAT TRANSFER COEFFICIENT NOT CORRECTED FOR BLOWING	LB/FT2-SEC
CHD	CHAR RATE, MDOTC	LB/FT2-SEC
CMOL	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 TLNC (. .) ABOVE CURRENT CMOL. USED TO LIMIT CORRECTION SIZE ON CMOL	
CMMI	MAXIMUM VALUE (FROM VARIOUS TABLES) OF AVERAGES OF NEXT TWO SUCCESSIVE TABULAR VALUES OF TLNC (. .) BELOW CMOL, USED TO LIMIT CORRECTION SIZE ON CMOL	
CNC()	VALUE OF CHAR THERMAL CONDUCTIVITY AT A NODE	BTU/FT-SEC DEG F

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CHM

VARIABLE NAME	DESCRIPTION	UNITS
CNO(I)	THERMAL CONDUCTIVITY OF NODE I GENERATED FOR OUTPUT PURPOSES IF NCUN 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
DLDT	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
DELCH	MINIMUM OF DEL(I)/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 CALCU- LATIONS) OR WITH SURFACE TEMPERATURE (IN NON- ABLATING SECTION)	BTU/FT2-SEC OR BTU/FT2-SEC- DEG F
DIDT	RATE OF SURFACE RECESSION	IN/SEC
DMOG()	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
DNLC	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
DNLP	DENSITY-THICKNESS PRODUCT FOR NODE TO BE DROPPED	LB/FT2
DHOAC	RATE OF CHANGE OF DENSITY OF COMPONENT A AT CONSTANT A DUE TO CONVECTION	LB/FT3 - RESIN-SEC
DHCAT	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
DMOBC	RATE OF CHANGE OF DENSITY OF COMPONENT B AT CONSTANT X DUE TO CONVECTION	LB/FT3 - RESIN-SEC
DMOBT	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
DMODTD	TOTAL RATE OF CHANGE OF DENSITY AT CONSTANT Y FOR CURRENT NODE, $-DMOG(1)/(RR(1)*DEL(1))$	LB/FT3-SEC
DMOT(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 DMUAT, DMORT, DMOCT)	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 $FJF/DEL(1)*DS/HR(1)$	
DIA	TEMPERATURE INCREMENT PER HALF NODELET FOR LINEAR INTERPOLATION IN SPACE	DEG F
DTH	TIME INCREMENT	SEC
DTMC	INPUT MAXIMUM ALLOWABLE TIME STEP	SEC
DTMS	SAVED PREVIOUS VALUE OF DTH	SEC
DIS	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 COM

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
ETER()	VALUE OF ERROR TERM IN SURFACE ENERGY BALANCE, SAVED FOR POSSIBLE JUMP 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
ENRC	CORRECTION APPLIED TO LN(MDOTC/RHDE-UE-CH) OR TO SURFACE ENERGY BALANCE OPERATION	--- OR DEG R
EHRS	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*(RH00A**(1.-PSIA))	(LB/FT3)** (1.-PSIA)/SEC
FACT1	FACTOR DTH/(DEL(I)*RM(I))	SEC/FT
FACT2	FACTOR GSM/DEL(I)*RM(I)	LB/FT3-SEC
FB	DEFINED AS (1.-PSIB)*BB*(RH00B**(1.-PSIB))	(LB/FT3)** (1.-PSIB)/SEC

LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE CBM

VARIABLE NAME	DESCRIPTION	UNITS
FC	DEFINED AS $(1.-PSIC)*BC*(RHOOC**((1.-PSIC)))$	$(LB/FT^3)**$ $(1.-PSIC)/SEC$
FJF	NUMBER OF NODELETS IN CURRENT NODE	
FR	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 $H_{GAS}*DMG(I)$ 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
GSM5	PYROLYSIS GAS FLOW OUT THE ABLATING SURFACE	LB/SEC-FT2 SURFACE
GSM7	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
GSM25	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
HMAR	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
MBARS	SAVED VALUE OF MBAR FOR DUMP	BTU/LB
MC()	ENTHALPY OF CHAR AT A NODE	BTU/LB
ME	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 --
MGAS	ENTHALPY OF PYROLYSIS GAS	BTU/LB
MP()	ENTHALPY OF PLASTIC AT A NODE	BTU/LB
MRES	TOTAL HEAT TRANSFER COEFFICIENT AT BACK WALL (INCLUDING RADIATION)	BTU/FT ² -SEC- DEG F
MW	ENTHALPY OF EDGE GASES AT WALL TEMPERATURE (OPTION 1) OR ENTHALPY OF PYROLYSIS GASES AT WALL TEMPERATURE (OPTION 3)	BTU/LB
M1	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	
INA	SOMETIMES REPLACES IR() FOR EFFICIENCY	
INB	SOMETIMES REPLACES IR() FOR EFFICIENCY	
INC	SOMETIMES REPLACES IR() FOR EFFICIENCY	
IND	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
NUR	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	
OMGAN	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 $2.0 \cdot BRP \cdot BF$	
POLD	SAVED PREVIOUS VALUE OF PYROLYSIS INTERFACE DEPTH	
POW	EXPONENT IN PYROLYSIS DECOMPOSITION RATE CALCULATIONS	
PRES	CURRENT VALUE OF LOG OF PRESSURE	
QCMEM	FROM TABLE LOOK-UP, IS INITIALLY TERM $(CH/CH) \cdot (CHEM PROD) - HW$, LATER ADJUSTED TO $RHUE - UE - CH \cdot (CHEM PROD) = QCMEM$	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
QCOND1	TIME INTEGRATED VALUE OF QCOND ADJUSTED TO UNIT AREA OF ORIGINAL SURFACE	BTU/FT2
QCONV	INITIALLY DUMMY NAME FOR HEW. ADJUSTED TO $QCONV = RHOE - UE - CH \cdot (HE - HW)$	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
QU	DUMMY NAME, INITIAL QCONV FOR INTERPOLATION	BTU/LB
QRA	RADIANT HEAT FLUX TO SURFACE QRA 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, $\text{SIGMA} * \text{EMISSIVITY} * \text{VIEW FACTOR} * \text{TS}^4$	BTU/FT2-SEC
RAOT	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
RU	DENSITY DIFFERENCE USED IN PYROLYSIS CALCULATIONS	LB/FT3
REX	BURNING RATE EXPONENT PARAMETER $(1.8-.2*BREX)/(1.-BREX)$	
RU()	DENSITY OF A NODE (USUALLY OLD DENSITY)	LB/FT3
RON()	DENSITY OF A NODE (USUALLY NEW DENSITY)	LB/FT3
RUOZ	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
RUT()	DENSITY OF TOP NODELET IN A GIVEN NODE	LB/FT3
RUI	REPLACES ROT() FOR EFFICIENCY	LB/FT3
RH()	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 CUM

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/FT ² -SEC-DEG R ^{**4}
SNET	NEW SURFACE RECESSION AFTER SWELL IS ACCOUNTED FOR	IN
SUEGR	TERM HGAS*DMDG(), SUMMED OVER ALL NODES	BTU/FT ² - SURFACE-SEC
T	TERM USED IN EVALUATING SOLID CONVECTION ENERGY	BTU/FT ³
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 $TN \cdot DSDT \cdot RR(I)$ OVER NODES OF ABLATING MATERIAL	BTU/SEC-FT ² -SURFACE
TEMP	TEMPORARY NODAL TEMPERATURE	DEG R
TERM1	FACT1 * OVB	BTU/FT-DEC F FT ² -SURFACE
TERM2	LUMPING OF TERMS USEFUL IN COMPUTING IMPLICIT TEMPERATURE COEFFICIENTS, SEE STATEMENT 14 + 6	BTU/FT ² - DEG F
TERM3	LUMPING OF TERMS USEFUL IN COMPUTING IMPLICIT TEMPERATURE COEFFICIENTS, SEE STATEMENT 25	BTU/FT ³ -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/FT ³
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
TUP2	COMBINED THERMAL CAPACITY OF NODE TO BE DROPPED AND ADJACENT NODE	BTU/FT2 - DEG R
TUP3	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/RH0E-UE-CM) OR SURFACE TEMP- ERATURE (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 PYRULYSIS GAS RATE INTERPOLATION	
VRP	REPLACES VR FOR PRESSURE INTERPOLATION	
XP1	REPLACES A(1) FOR EFFICIENCY	
X1	X() FOR TOP NODELET IN A NODE	
YI()	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 INPUT

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	$B \text{ PRIME} = (MDOTC + MDOTG) / \rho_{HOF} - UE - CM$	
BPG	$BPRIMEG = MDOTG / \rho_{HOE} - UE - CM$	
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, $MDOTG / \rho_{HOE} - UE - CM$	
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 T2	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 INPUT

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 SSUTCH (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 INPUT

VARIABLE NAME	DESCRIPTION	UNITS
KNST	CHECK INTEGER TO FLAG FIRST SURFACE TABLE INPUT	
KSV(J)	SAVED NON-ZERO VALUE OF KMT _i (1)	
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 MDOCT 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/FT ³
RSVN	POSITIVE VALUE FOR RSV	INCHES

**LIST OF FORTRAN VARIABLES
APPEARING IN SUBROUTINE INPUT**

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 VAL. 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
VKH	FLOATING KH	
WLO	UNEQUAL DIFFUSION EXPONENT	
WLS	SAVED TEST VALUE OF WLO	

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	
QI	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 CBN)	
T	TEMPERATURE OF CURRENT ISOTHERM	DEG R
TI	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
TATHM(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

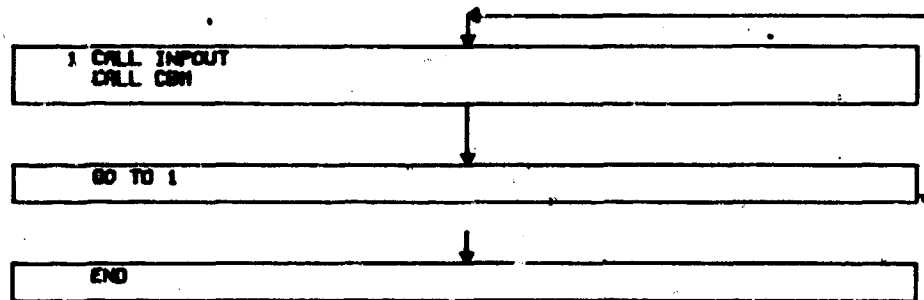
SECTION 3

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

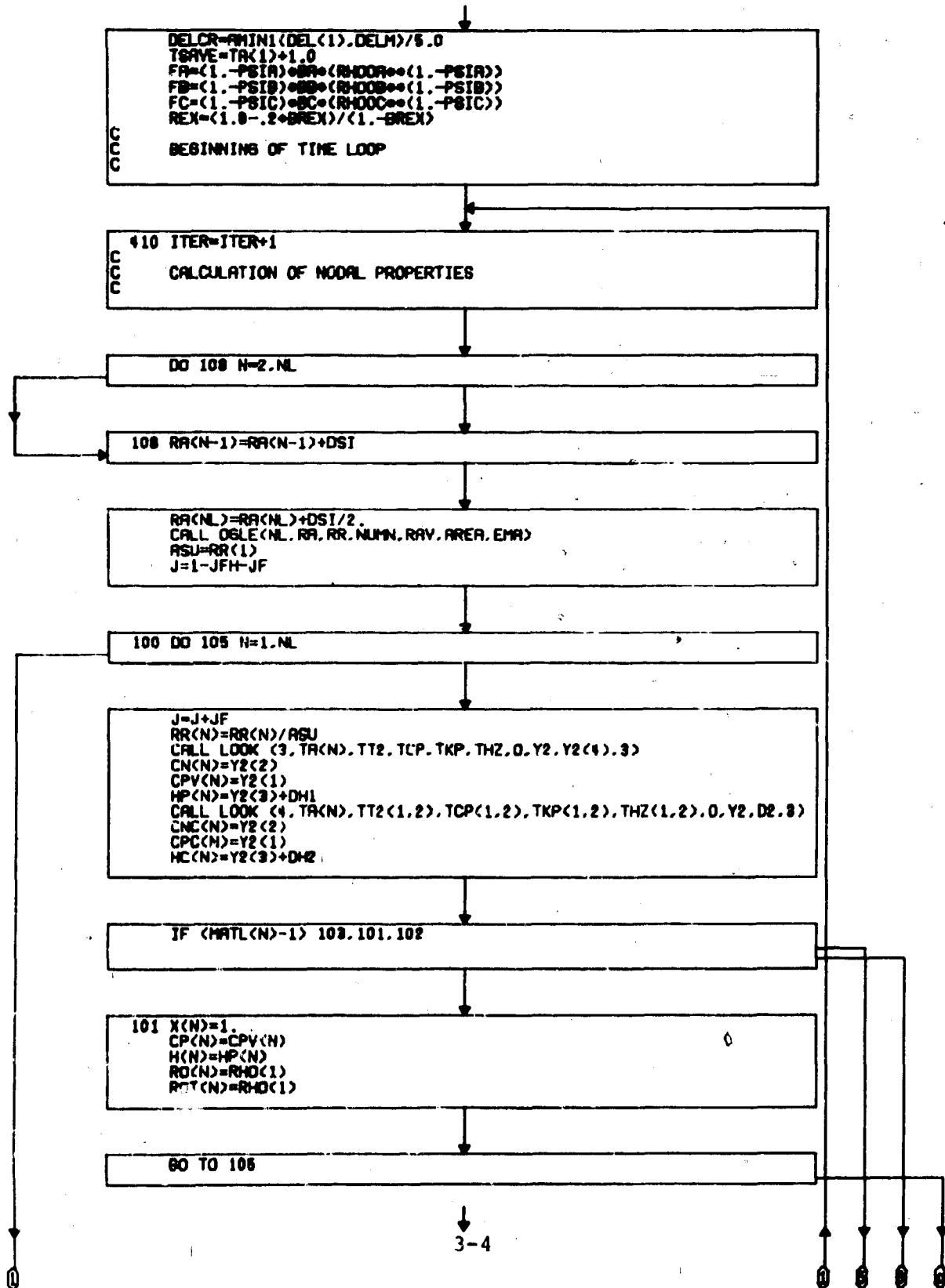


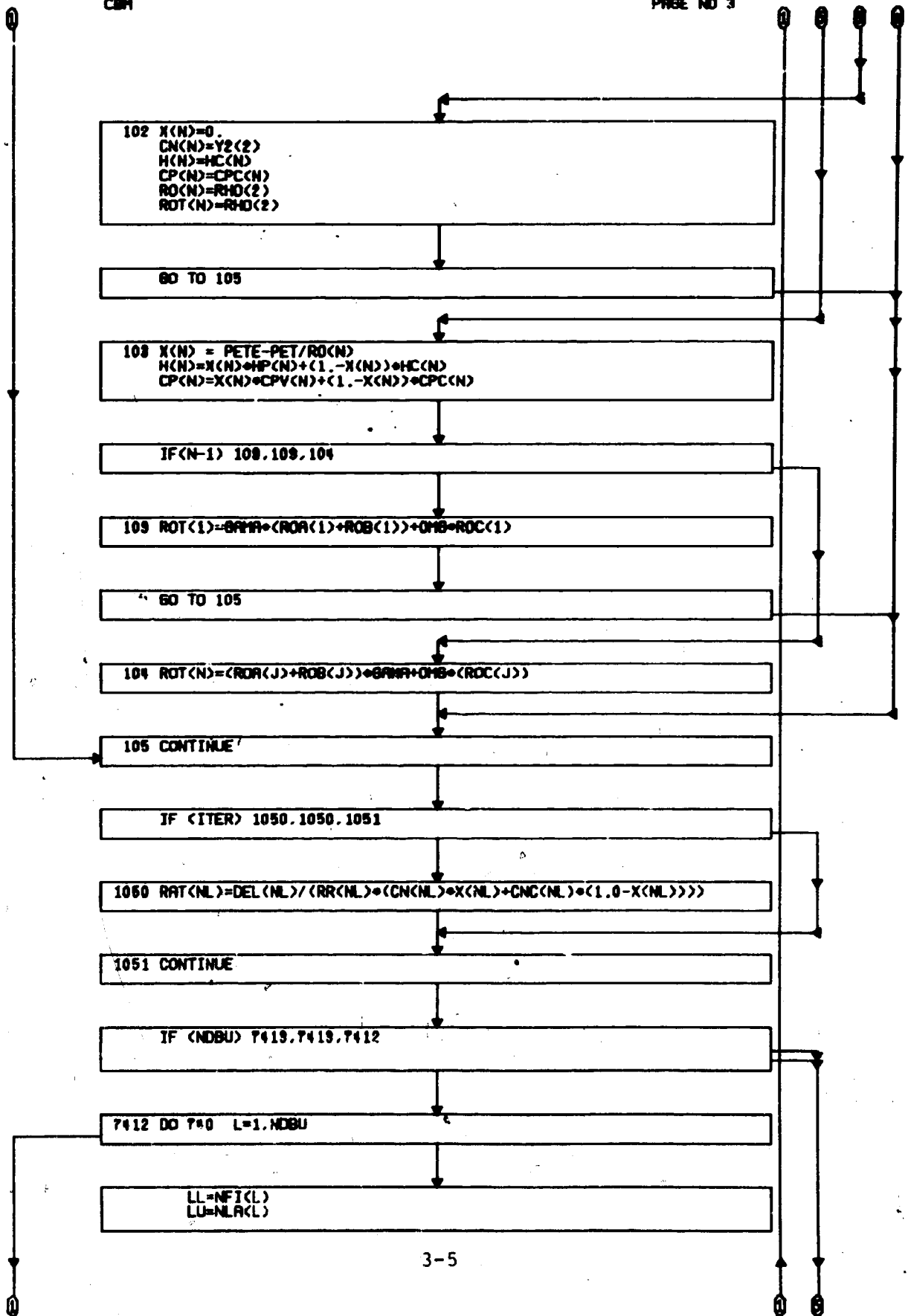
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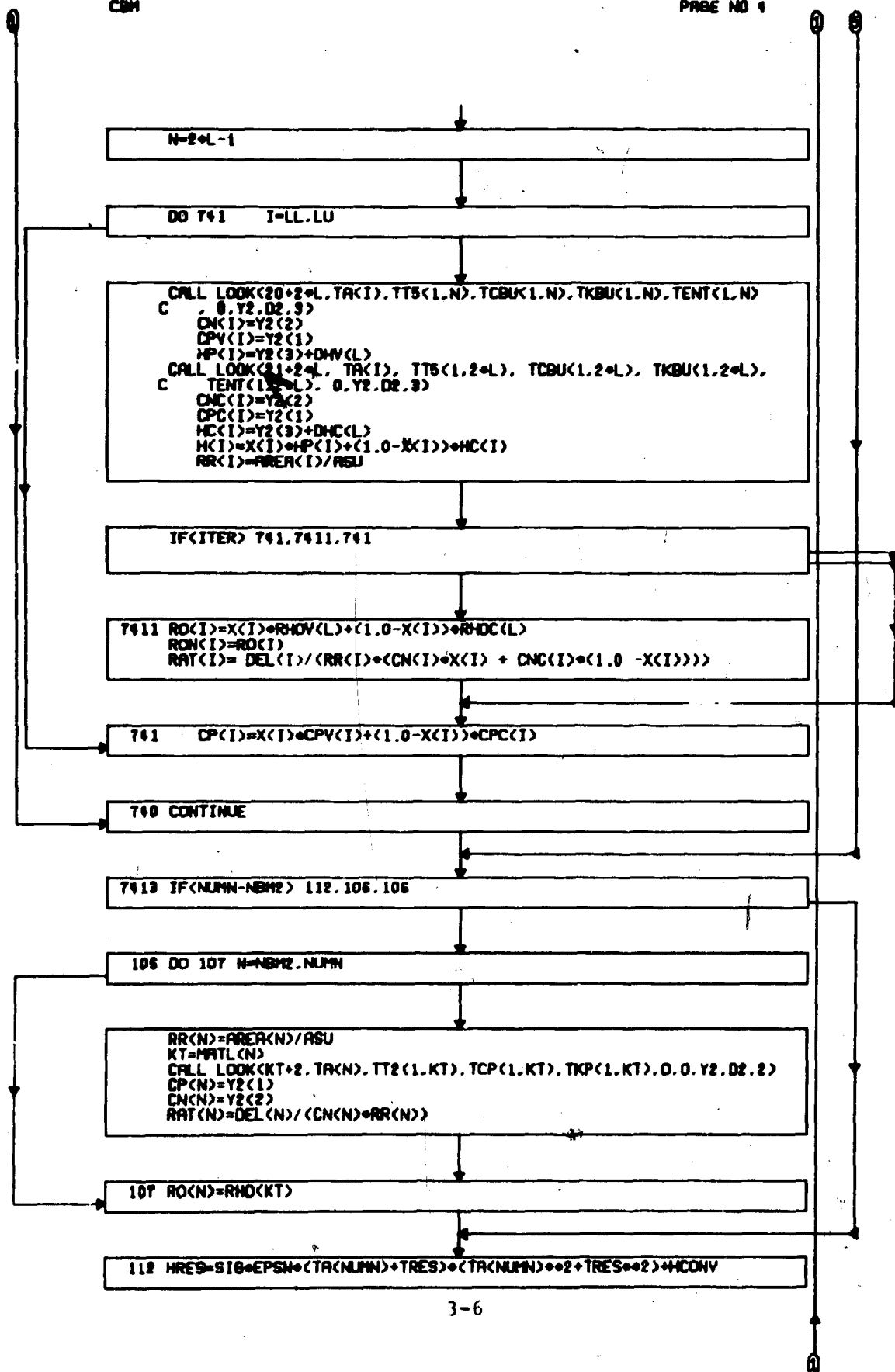
SUBROUTINE CBM
CHARING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM ALLOWING
FOR UP TO FIVE DECOMPOSING BACK-UP MATERIALS
***** SEE CBM LISTING FOR COMMON STATEMENTS *****
***** DIMENSION STATEMENTS *****
***** EQUIVALENCE STATEMENTS *****
***** FORMAT STATEMENTS *****

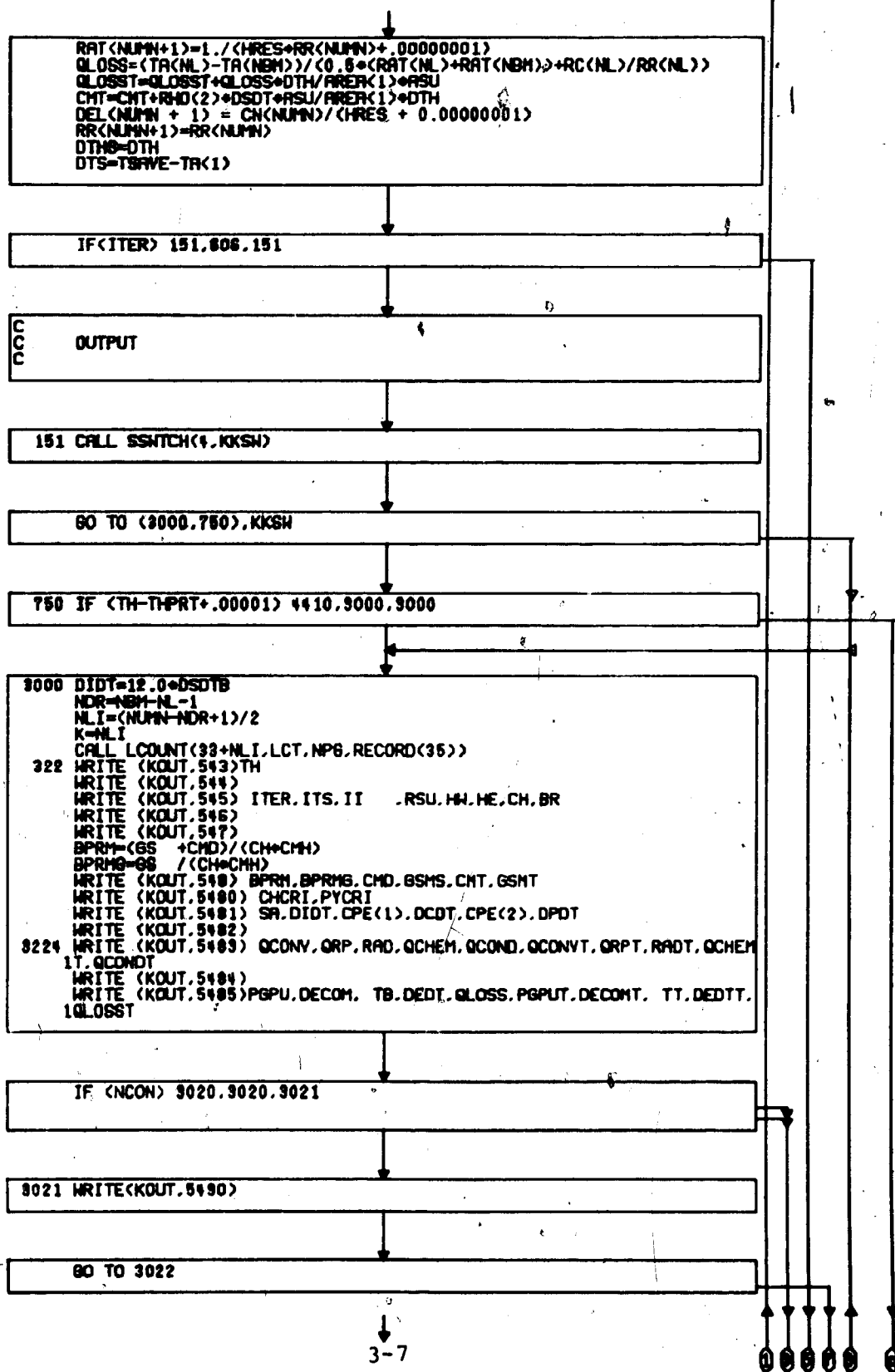
DNCP(3)=99999.
KSCT=17
SIB=101E-12
C CHAR AND PYROLYSIS ZONE CRITERIAL DENSITIES
DNCP(1)=RHO(2)+CHCRI*(RHO(1)-RHO(2))
DNCP(2)=RHO(2)+PYCRI*(RHO(1)-RHO(2))
C
C
C INITIAL VALUES FOR TIME LOOP
1390 ITER=-1
DTHC=DTHB
IAB=0
ITS=0
SA=0.0
SNET=0.
GSMT=0.0
GSMET=0.
GSMIS=0.
CHD=0.0
RSU=ABS(RSV)
GS=0.0
CMFL=0.0
CHT=0.
DSOTB=0.0
DSOT=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.
GRP=0.
QCONVT=0.
GRPT=0.
RADT=0.
QCHEMT=0.
QCONDOT=0.
PSPUT=0.
DECOMT=0.
DEDTT=0.
QLOSST=0.
TT=0.
TB=0.
SGEGR=0.
GSEGR=0.
PSPU=0.
DECOM=0.
EGO=0.
HW=0.
BR=0.
KK=0
TH=THZRO
DTR=0.0
THDS=THZRO-DTHIN
THPRT=TH
REWIND KSCT
CALL LCOUNT (-2,LCT,NP0,RECORD(95))
WRITE (KOUT,542)
IS=0
DTH=DTHIN

```





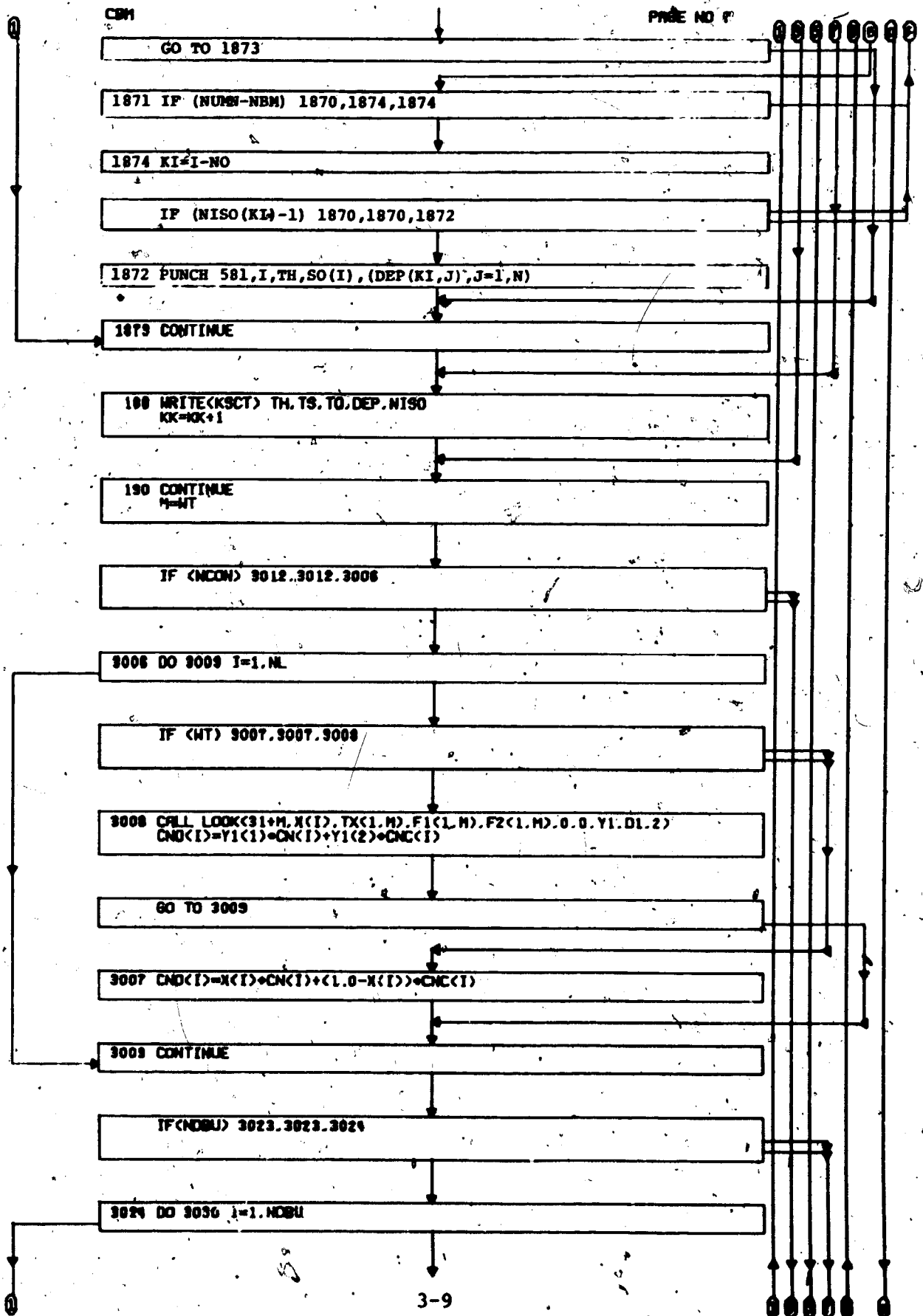


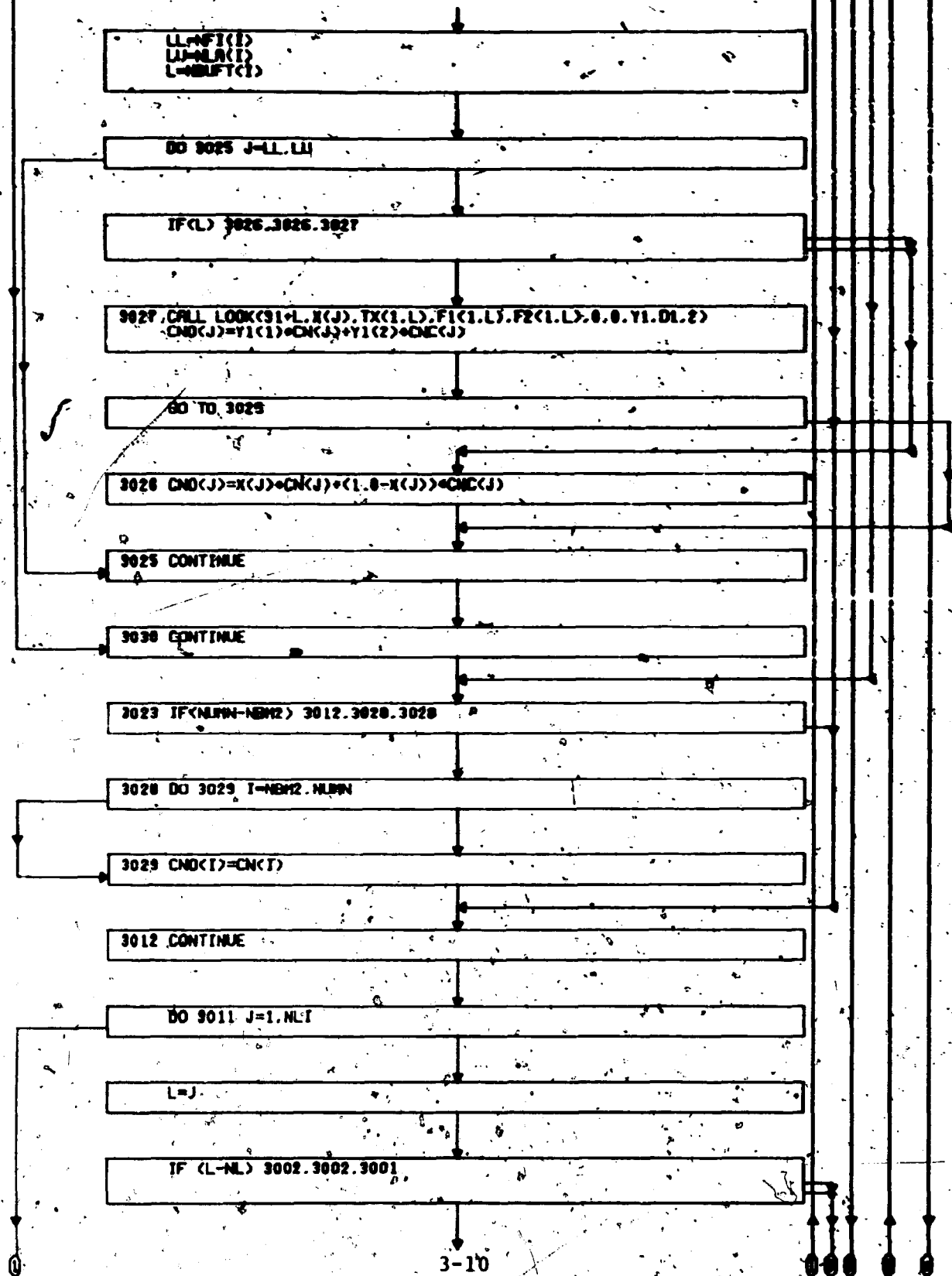




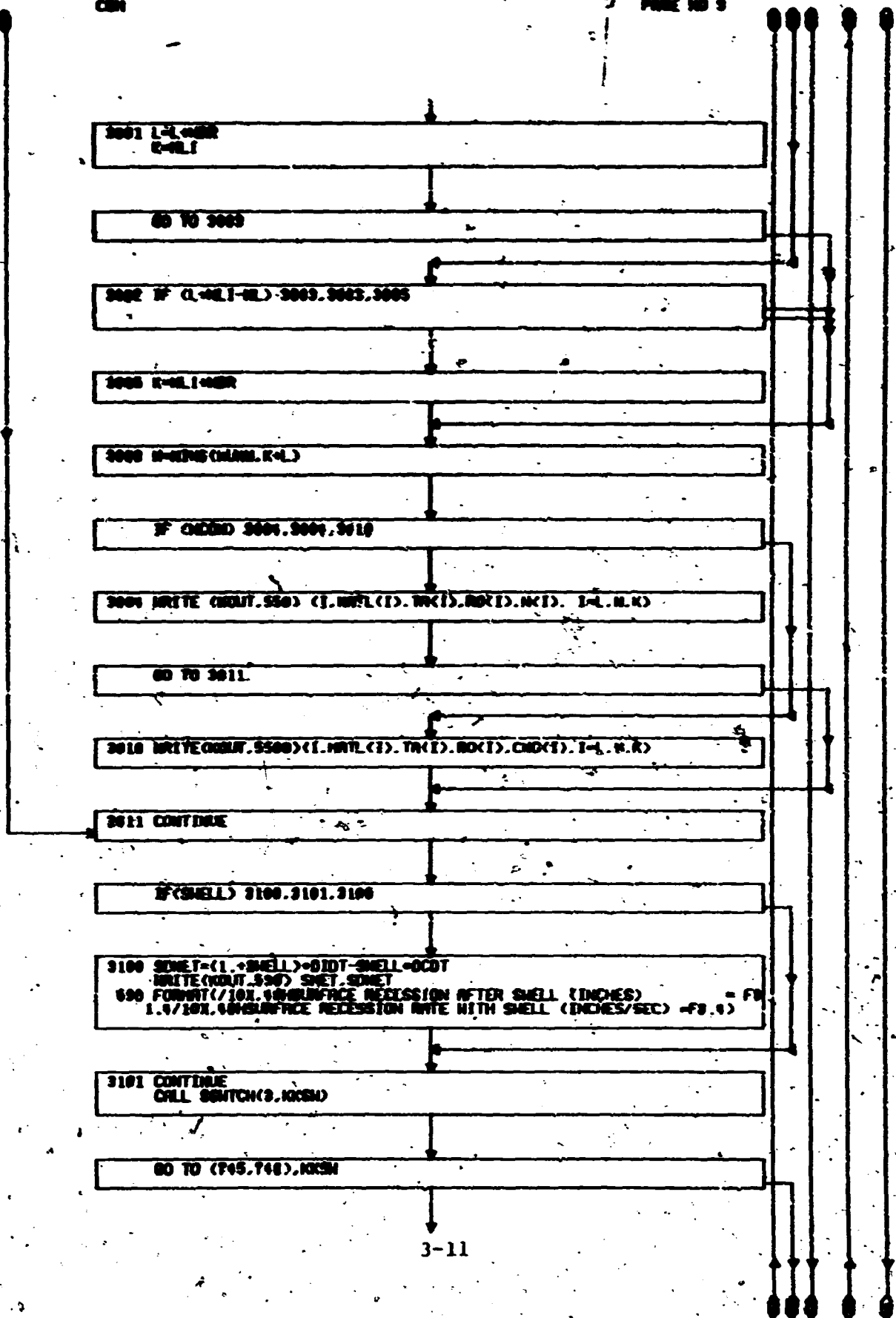
CBM

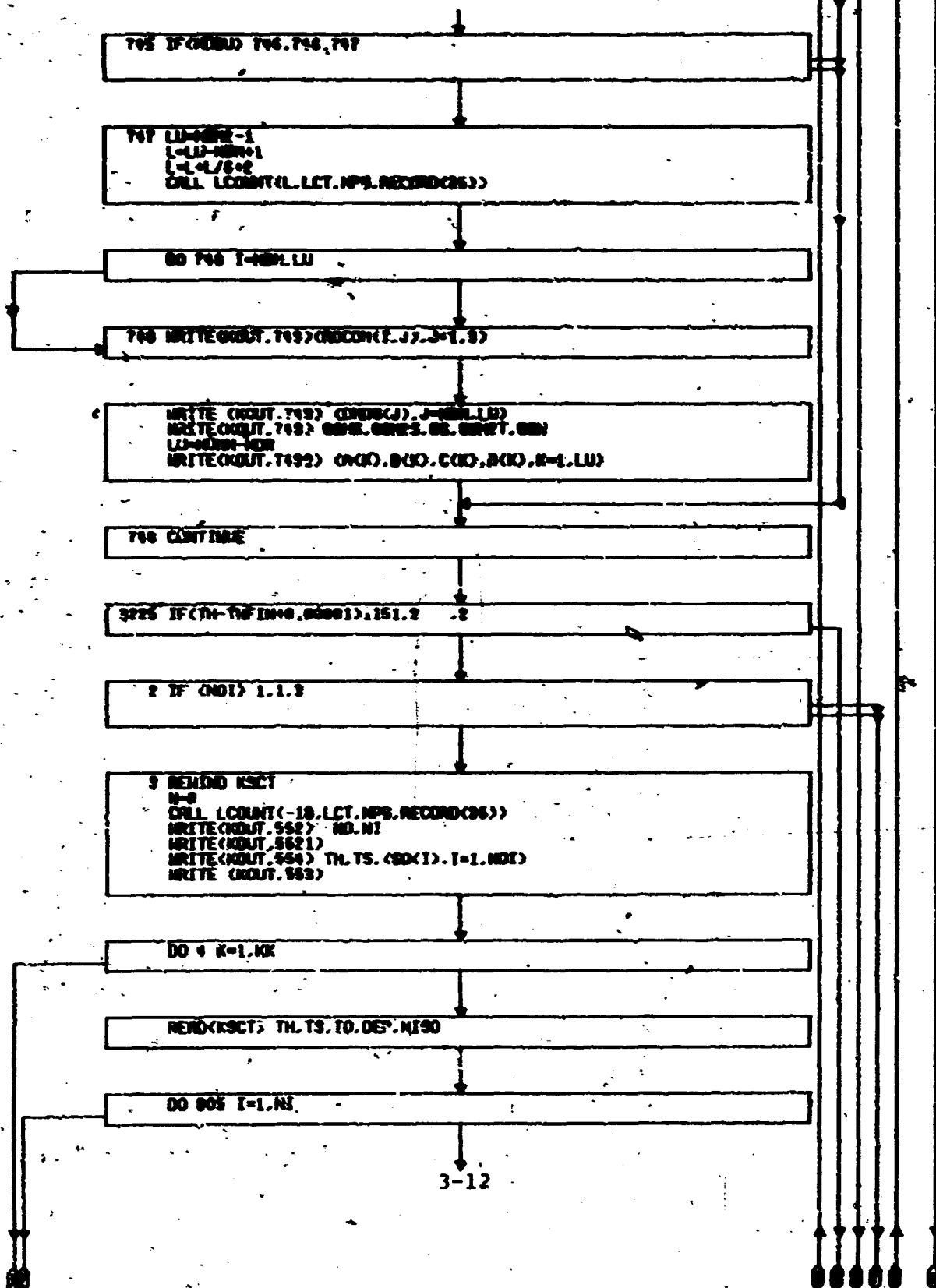
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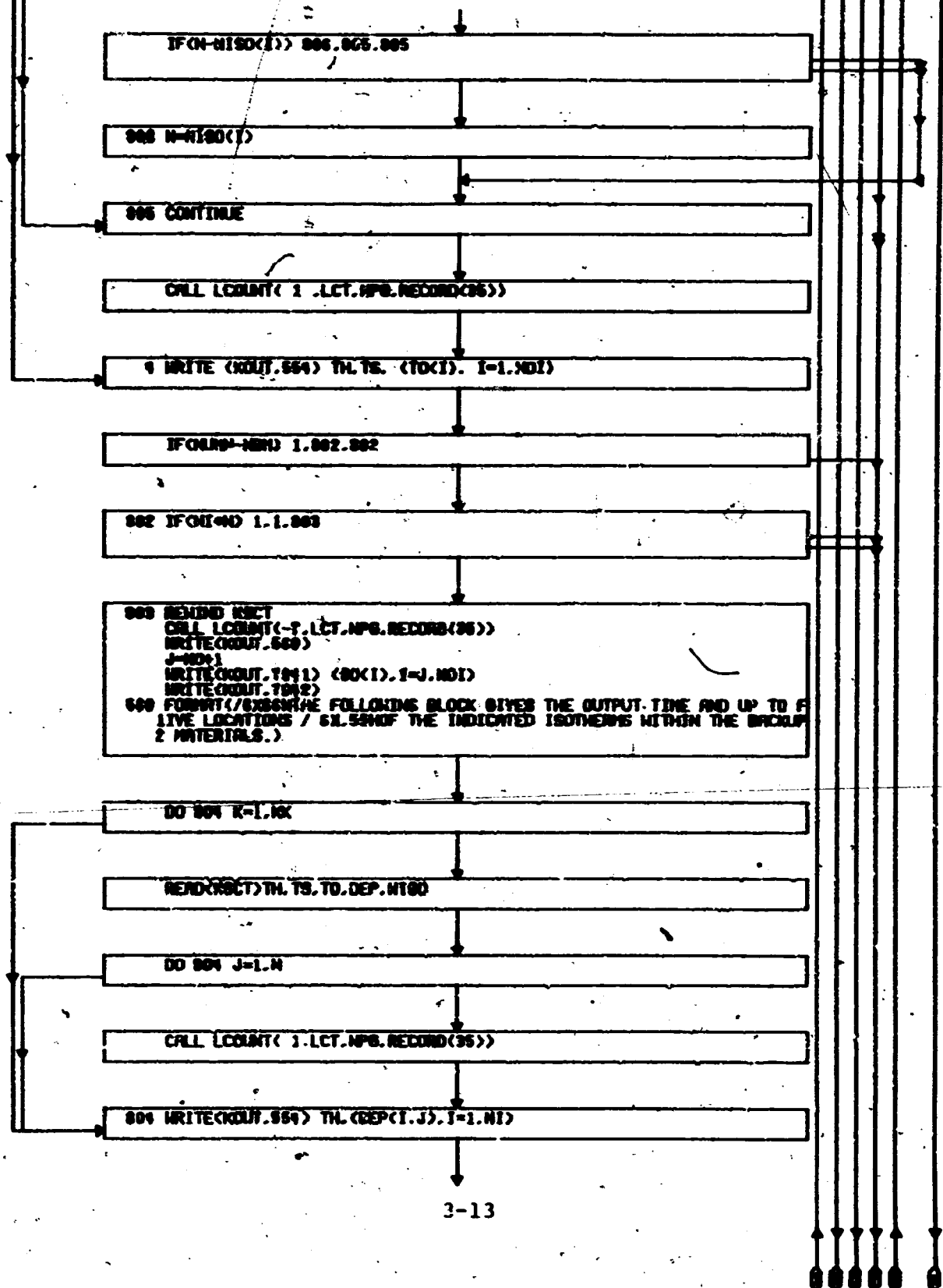




POWER 500

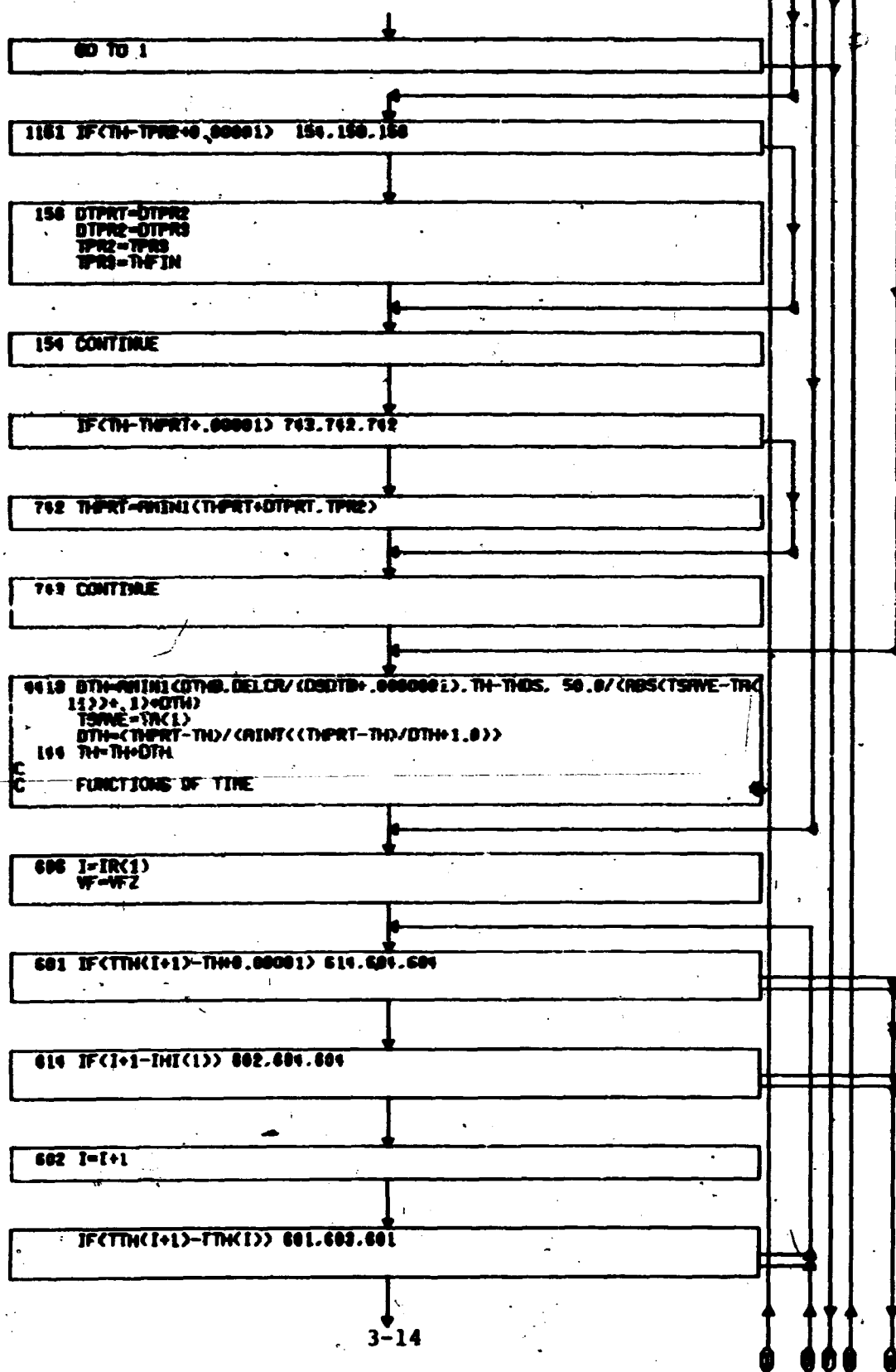


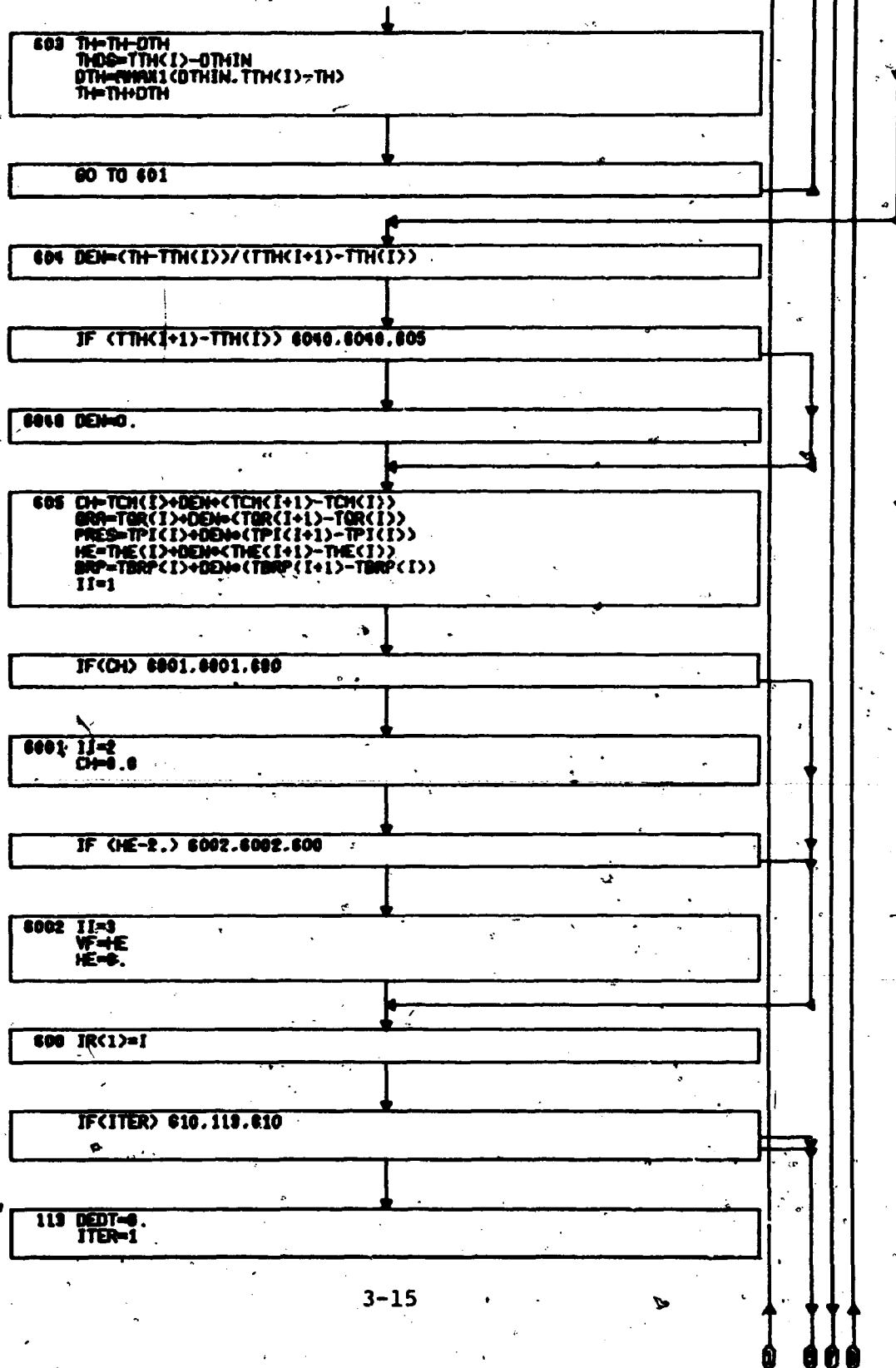




CON

PAGE NO 12





80 TO 3000

610 IF(DTH-.000001) 162,162,600

162 WRITE (KOUT,502) TH,DTH,DTHB,DTHB,THDS,DYS,DELCR,DSDTB
TH=THFIN

80 TO 3000

C C INTERNAL DECOMPOSITION -- DENSITY CALCULATION

600 N=-JFH

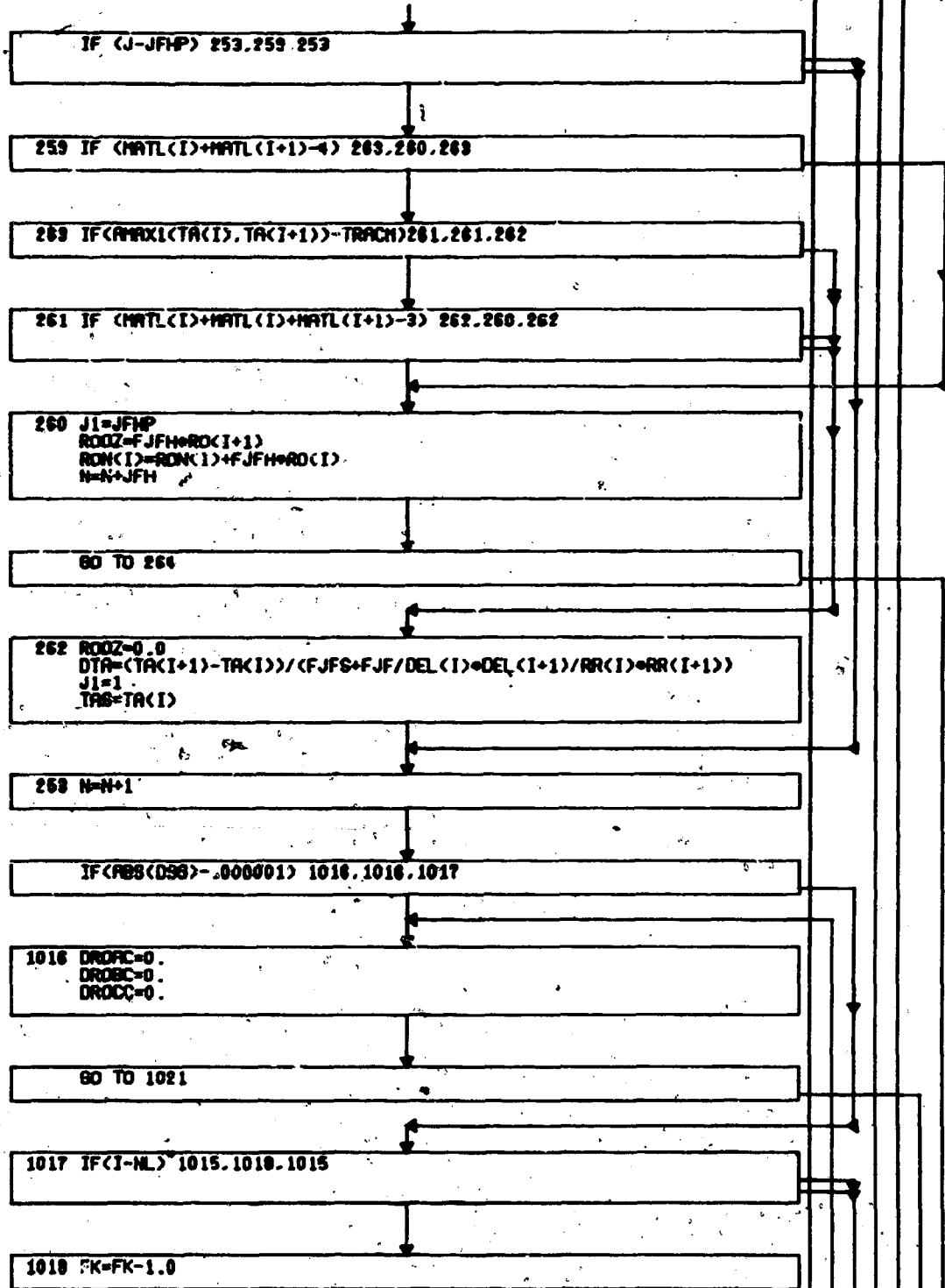
C C SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL
 DSDT=DSDTB
 DS=DSDT*DTH
 DSI=12.0*DS
 SA=SA+DSI
 RSU=ABS(RSV+SA)
 DTHB=DTHC
 DEL(NL)=DEL(NL)-DS
 FK=0.0
 FJF=FJFH
 J1=JFHP
 DENOLD=DND(2)
 COLD=CPE(1)
 FOLD=CPE(2)
 CPE(1)=RR(NL)+6.*DEL(NL)
 CPE(2)=CPE(1)
 IE=1
 ROOZ=0.0
 ISV=MATL(NL+1)
 MATL(NL+1)=MATL(NL)
 TR(NL+1)=TR(NBM)
 DEL(NL+1)=DEL(NBM)
 RR(NL+1)=RR(NBM)

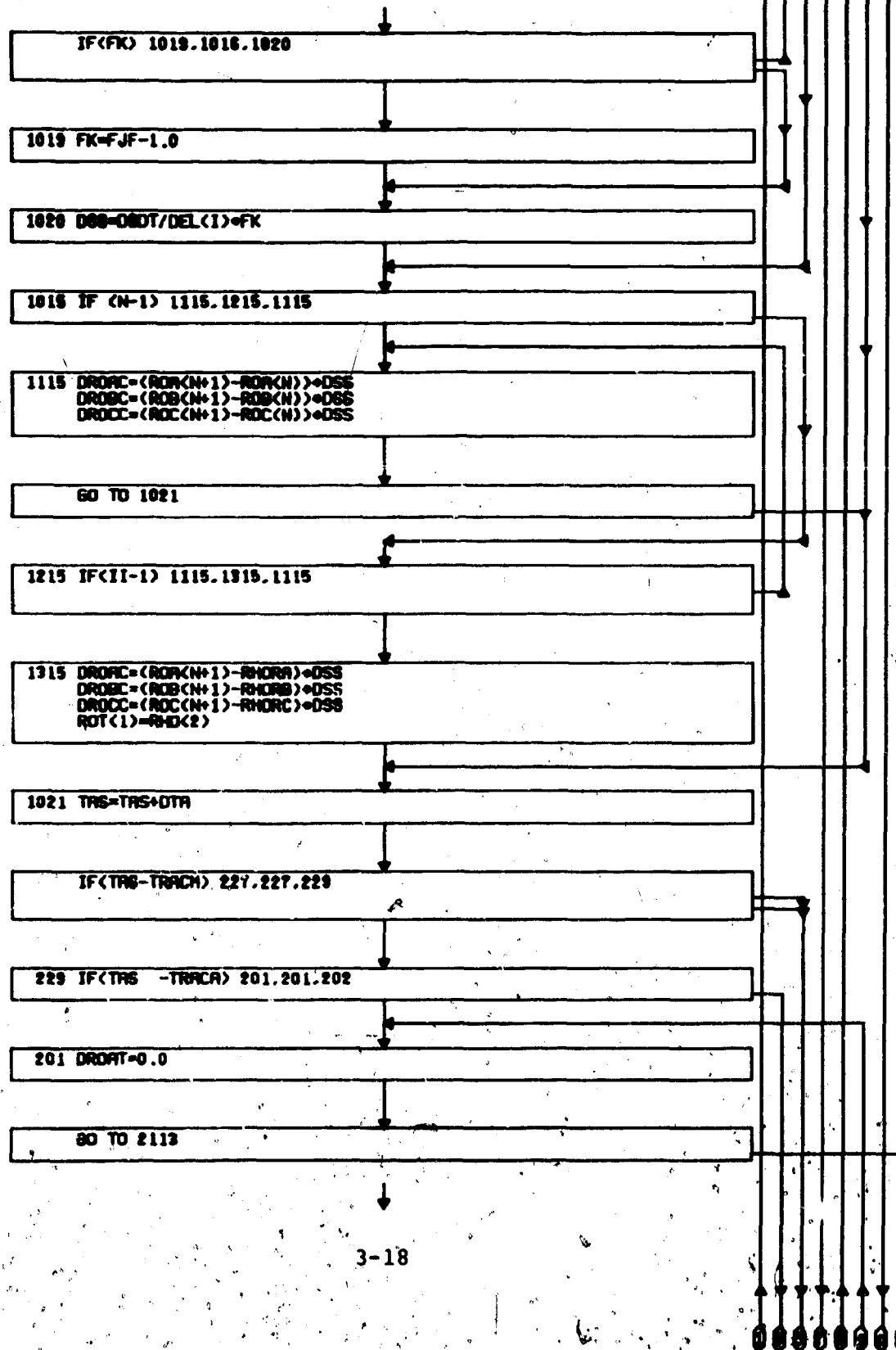
DO 252 I=1,NL

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

163 DO 255 J=J1,JF

N=N+J1-1





202 IF<RHORA-ROR(N)> 211.201.201

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

IF<POW>2111.2112.2111

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

GO TO 2113

2112 DROAT=RD+(EXP(-BR*DTH*EXP(-ER/TAS))-1.)/DTH

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

IF<ROR(N)-RHORA> 2114.221.221

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

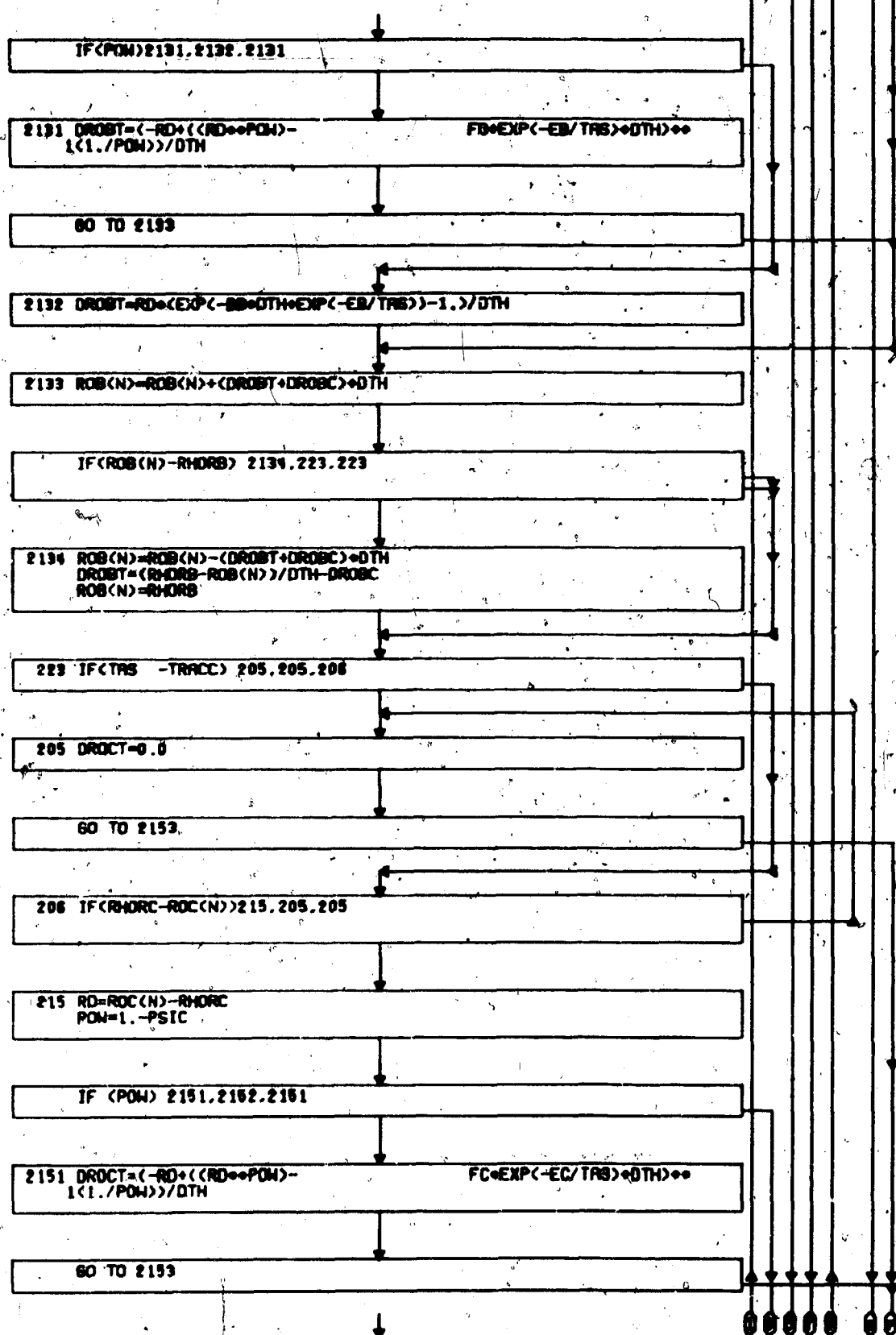
221 IF<TAS -TRACB>203.203.204

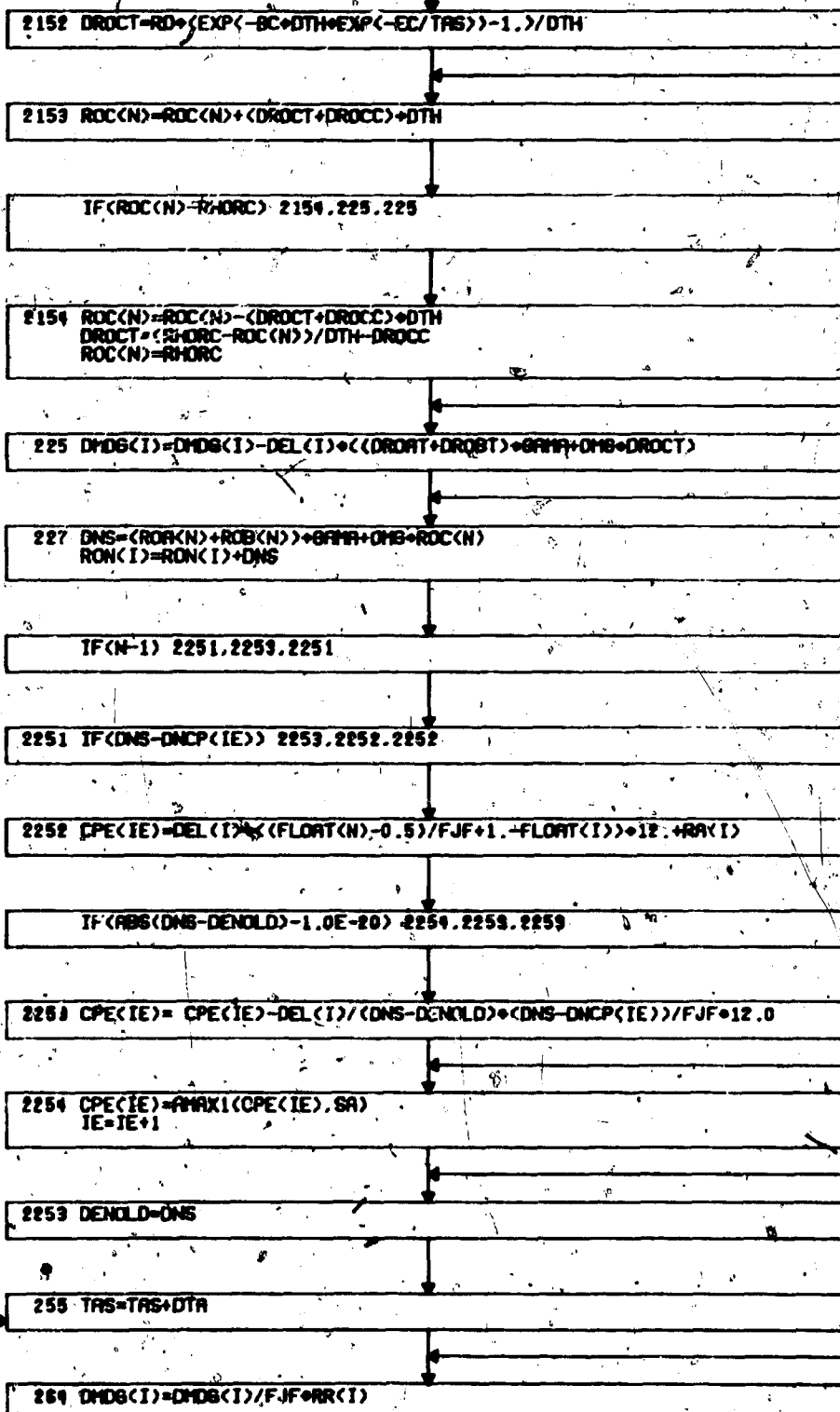
203 DROBT=0.0

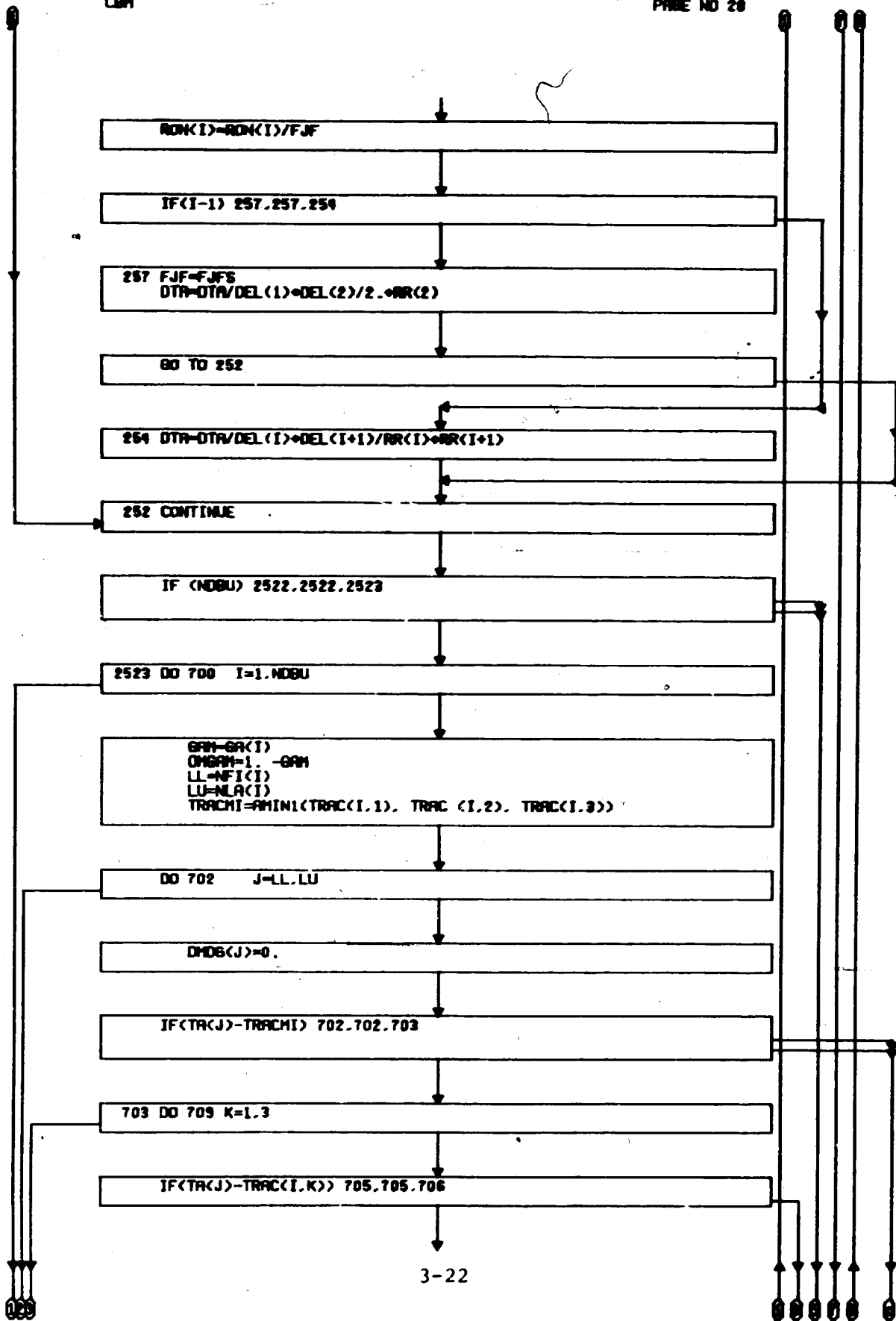
GO TO 2193

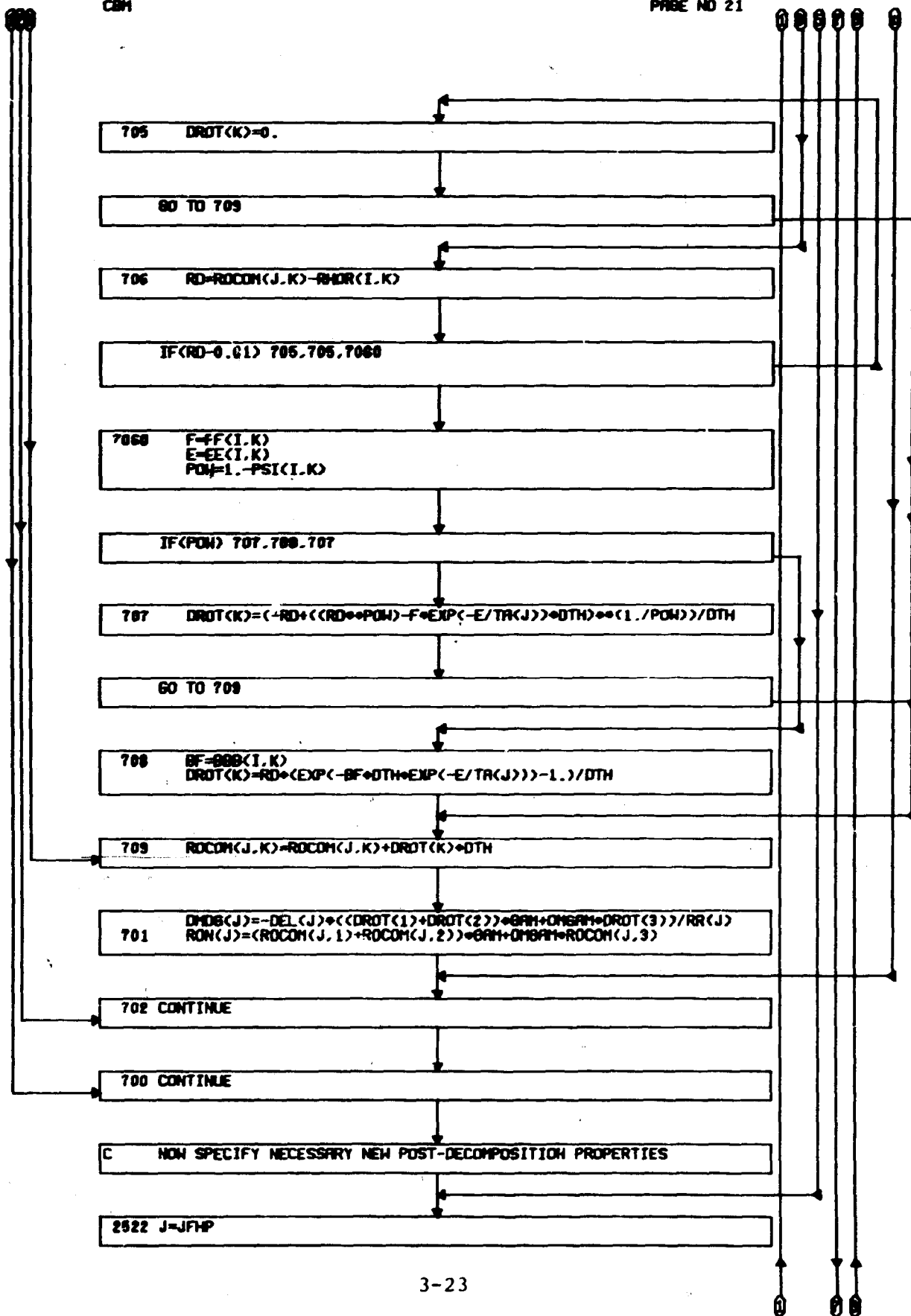
204 IF<RHORB-ROB(N)>218.203.203

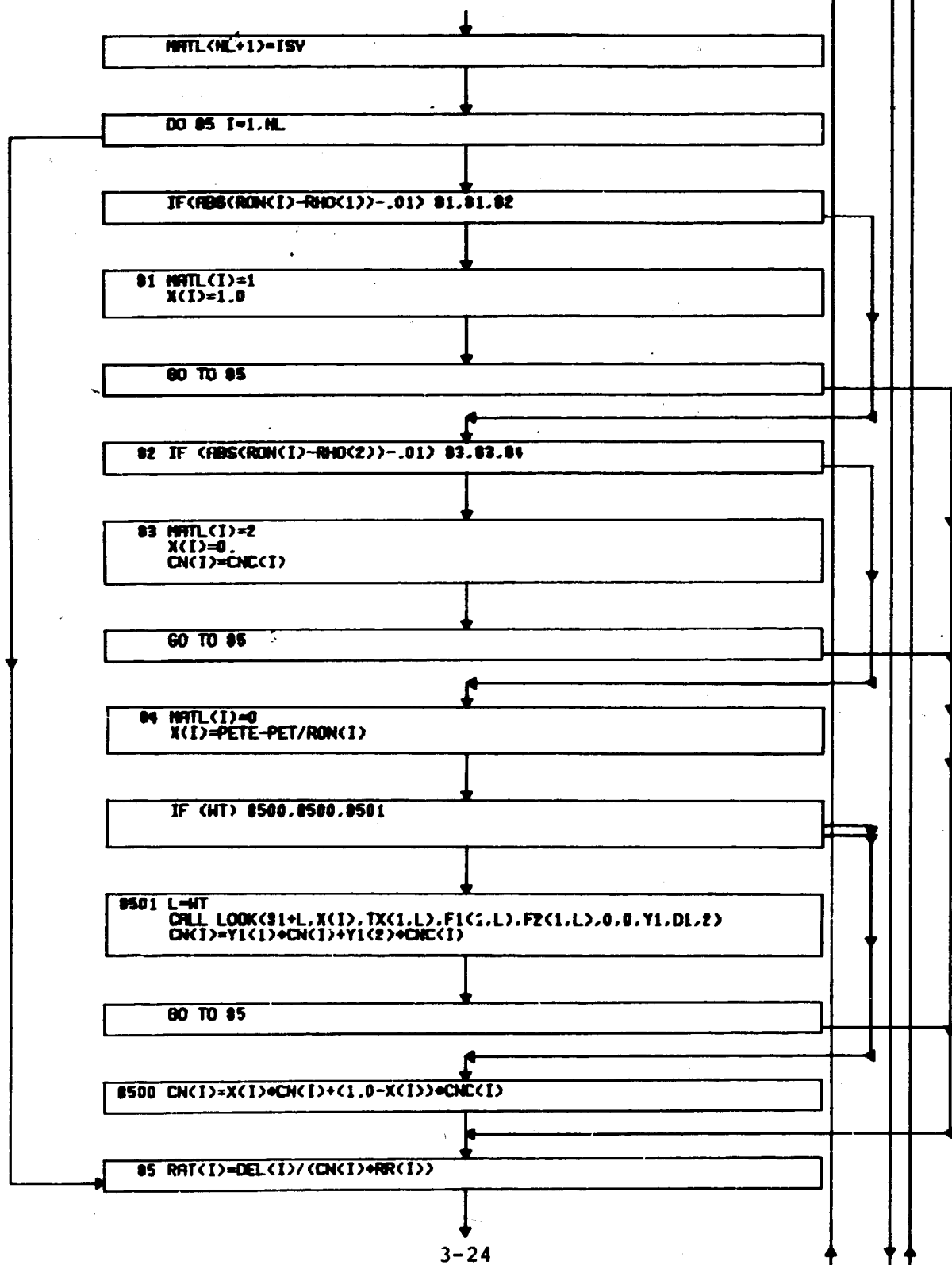
218 RD=ROB(N)-RHORB
POW=1.-PSIB

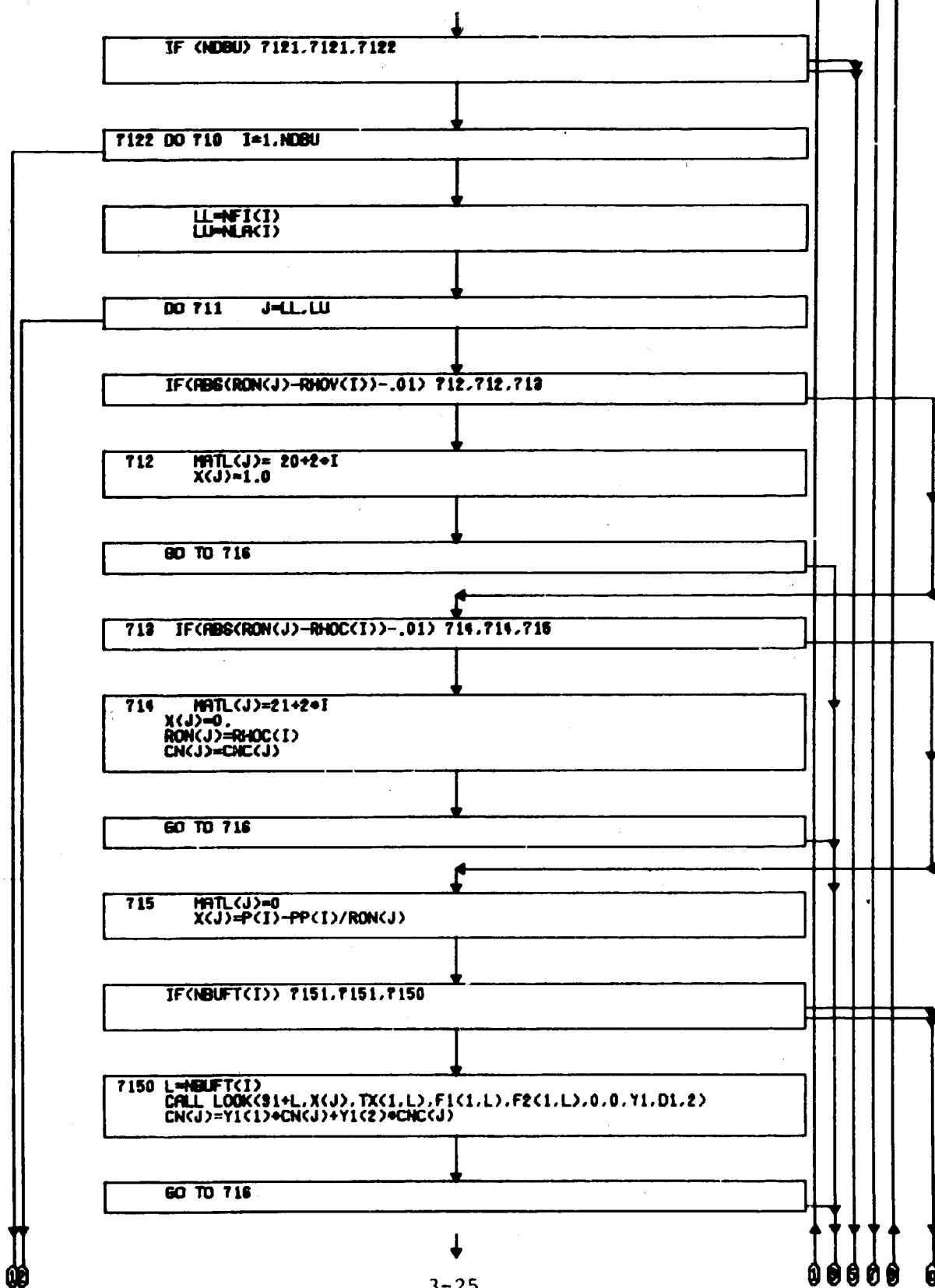


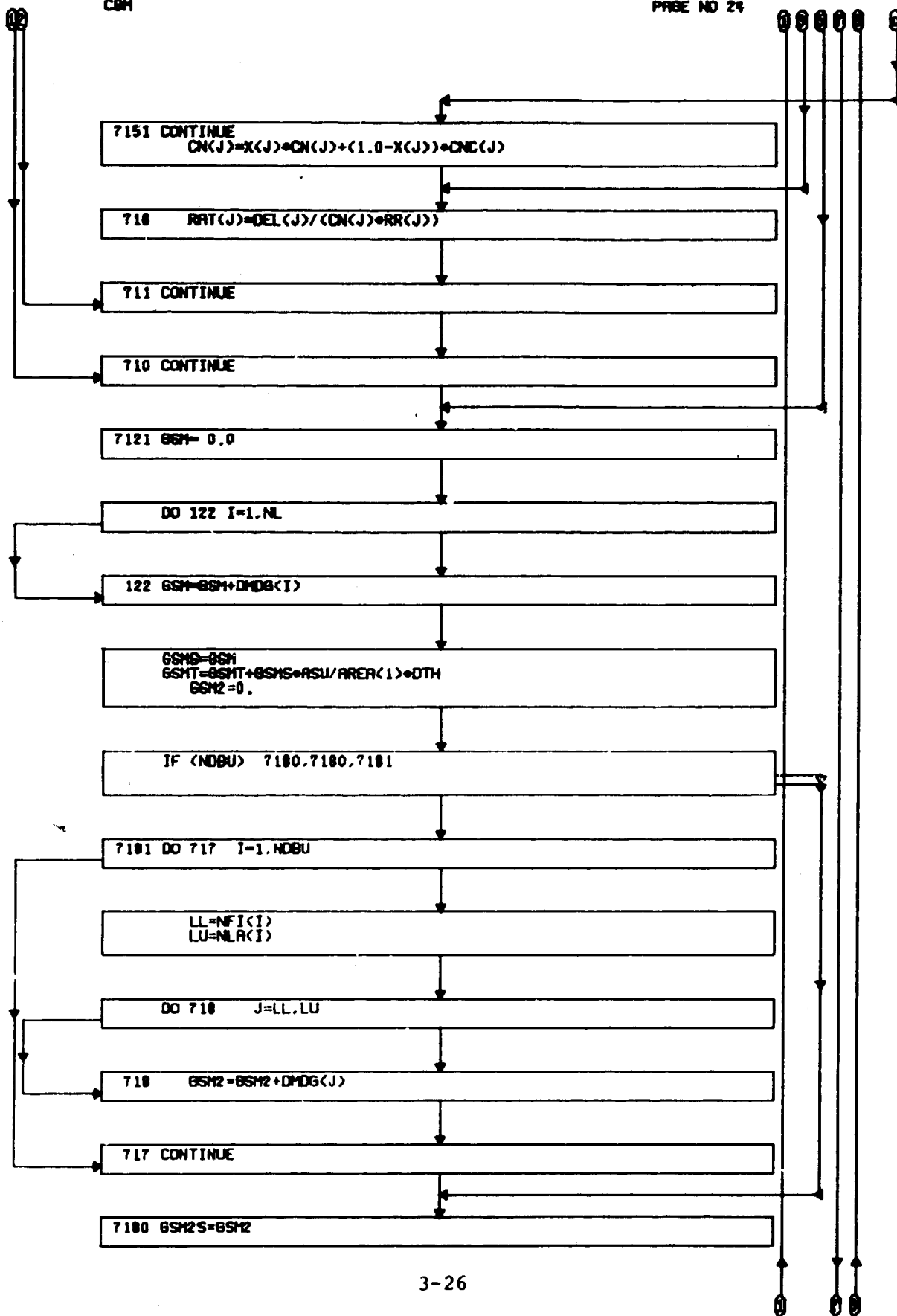












בטח

IF (I) 15, 15, 14

IF (I) 15, 15, 14

1

20

EGO=BSMS+HBAS
HW=HBAS

60 TO 30

```

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

```

```

30 CONTINUE

```

```

C
A(I) = DTH / DEL(I)
TT = TT + TB + DTH / RR(I) + ASU
NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT
DROOTO = -DMDB(NL) / (RR(NL) * DEL(NL))
FACT1 = DTH / (DEL(NL) * RR(NL))
A(NL) = -FACT1 * DVB
DVB = 1.0 / (0.5 * (RAT(NL) + RAT(NBH)) + RC(NL) / RR(NL))
C(NL) = -FACT1 * DVB
TERM2 = RON(NL) * CP(NL) - (CPBAS + DROOTO + (DSDT / DEL(NL)) *
1 (RO(NL) * CP(NL) - RO1 * CP1)) * DTH
B(NL) = TERM2 - C(NL) - A(NL)
D(NL) = TA(NL) * TERM2 + DTH * (HBAS + DROOTO - HBAR * (RON(NL) -
1 RO(NL)) / DTH + DSDT * (RO(NL) + H(NL) - RO1 + H1) / DEL(NL))
K = NL
GSM = GSM - DMDB(NL)

```

```

IF(NDBU) 7170,7171,7170

```

```

7170 FACT2 = GSM / (DEL(NL) * RR(NL))
TERM2 = FACT2 * CPBAS * DTH
B(NL) = B(NL) + TERM2
D(NL) = D(NL) + TA(NL) * TERM2 - FACT2 * HBAS * DTH
CALL LOOK(2, TA(NBH), TT1, TH6, 0.0, 0.0, HBAS, CPBAS, 1)
HBAS = HBAS + DELH6
C(NL) = C(NL) - FACT2 * CPBAS * DTH
D(NL) = D(NL) - TA(NBH) * FACT2 * CPBAS * DTH + FACT2 * HBAS * DTH

```

```

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

```

```

IF (NDBU) 7250,7250,7251

```

```

7251 DO 720 L=1,NDBU

```

```

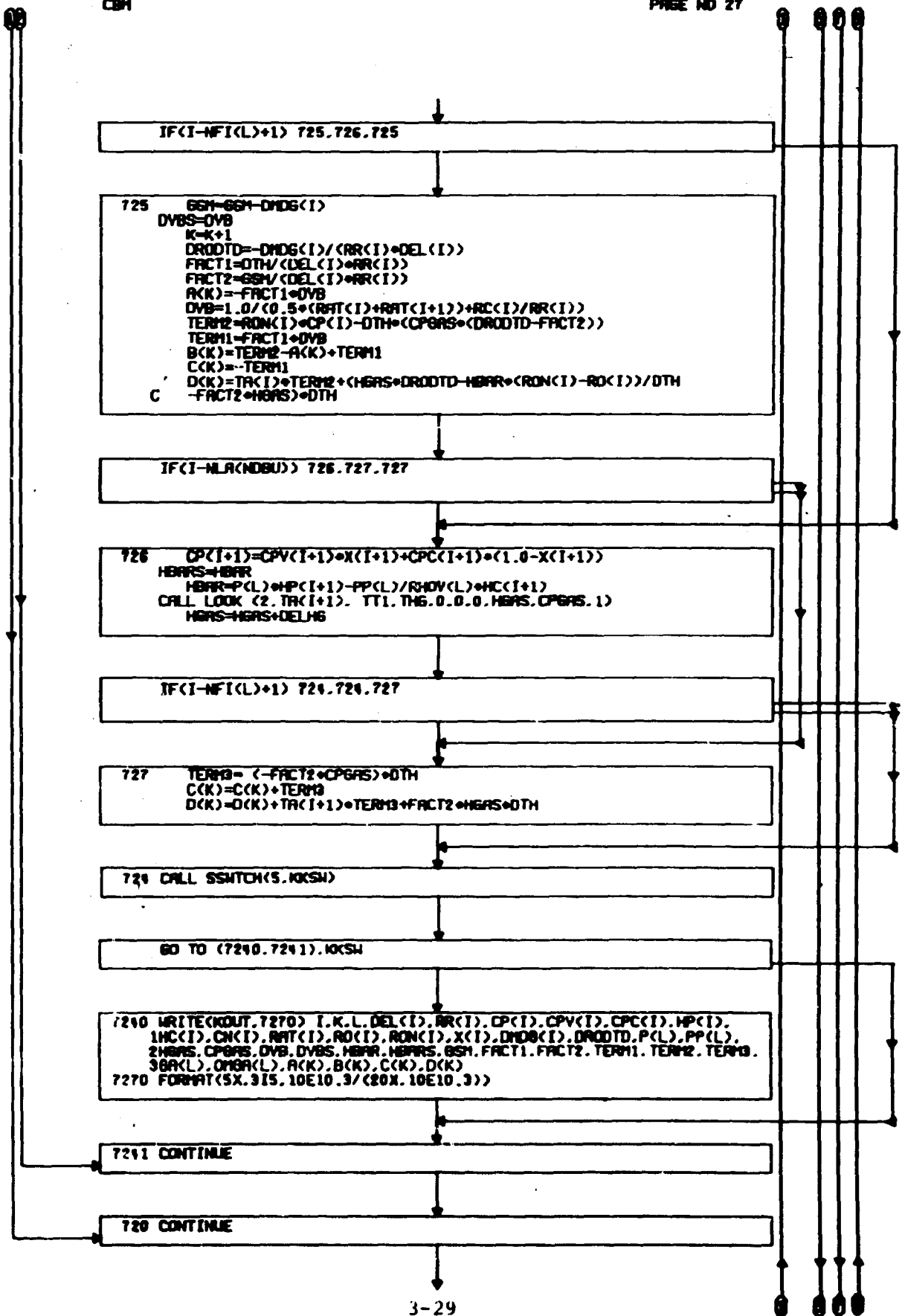
LL=NFI(L)-1
LU=NLA(L)

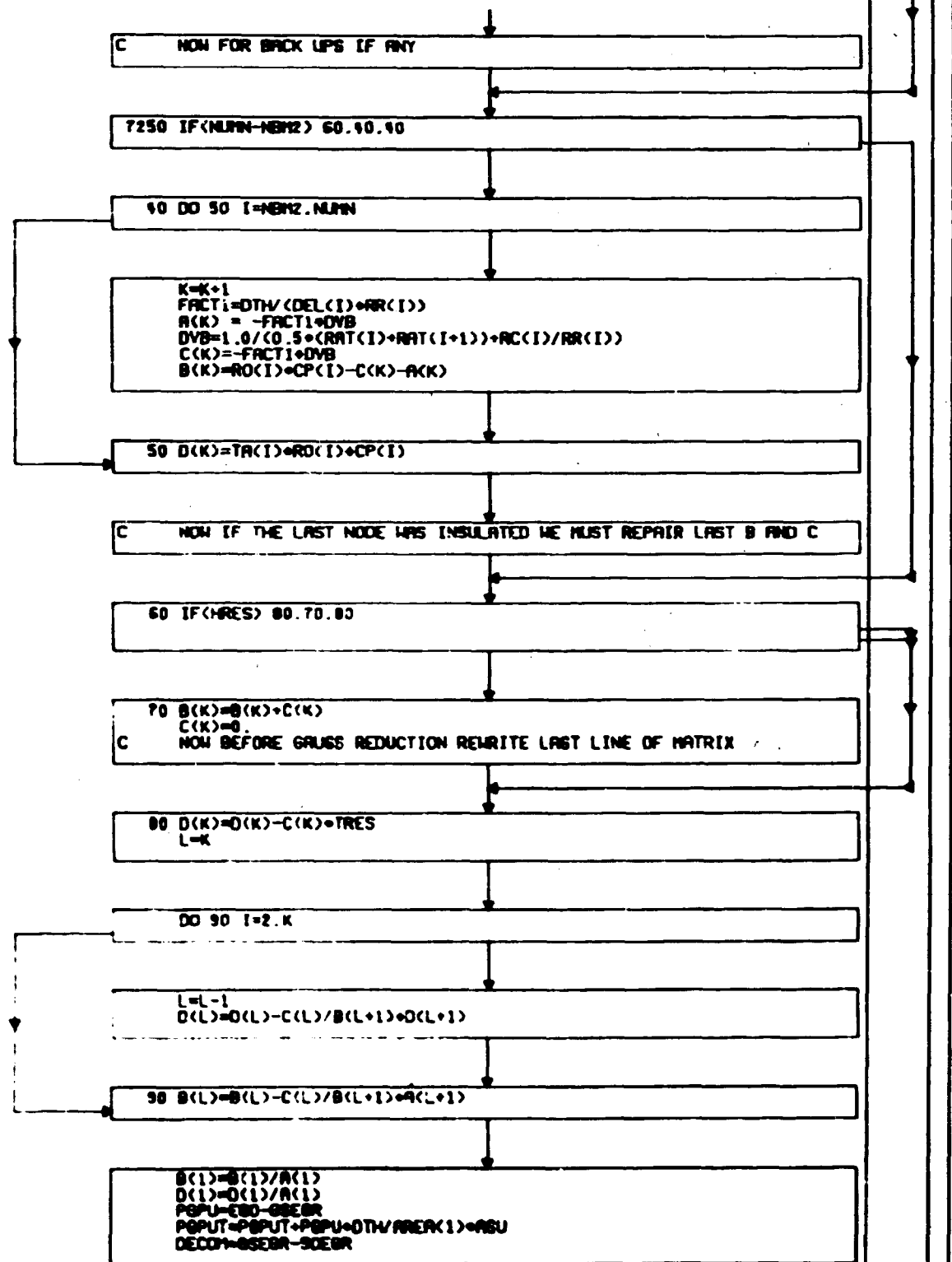
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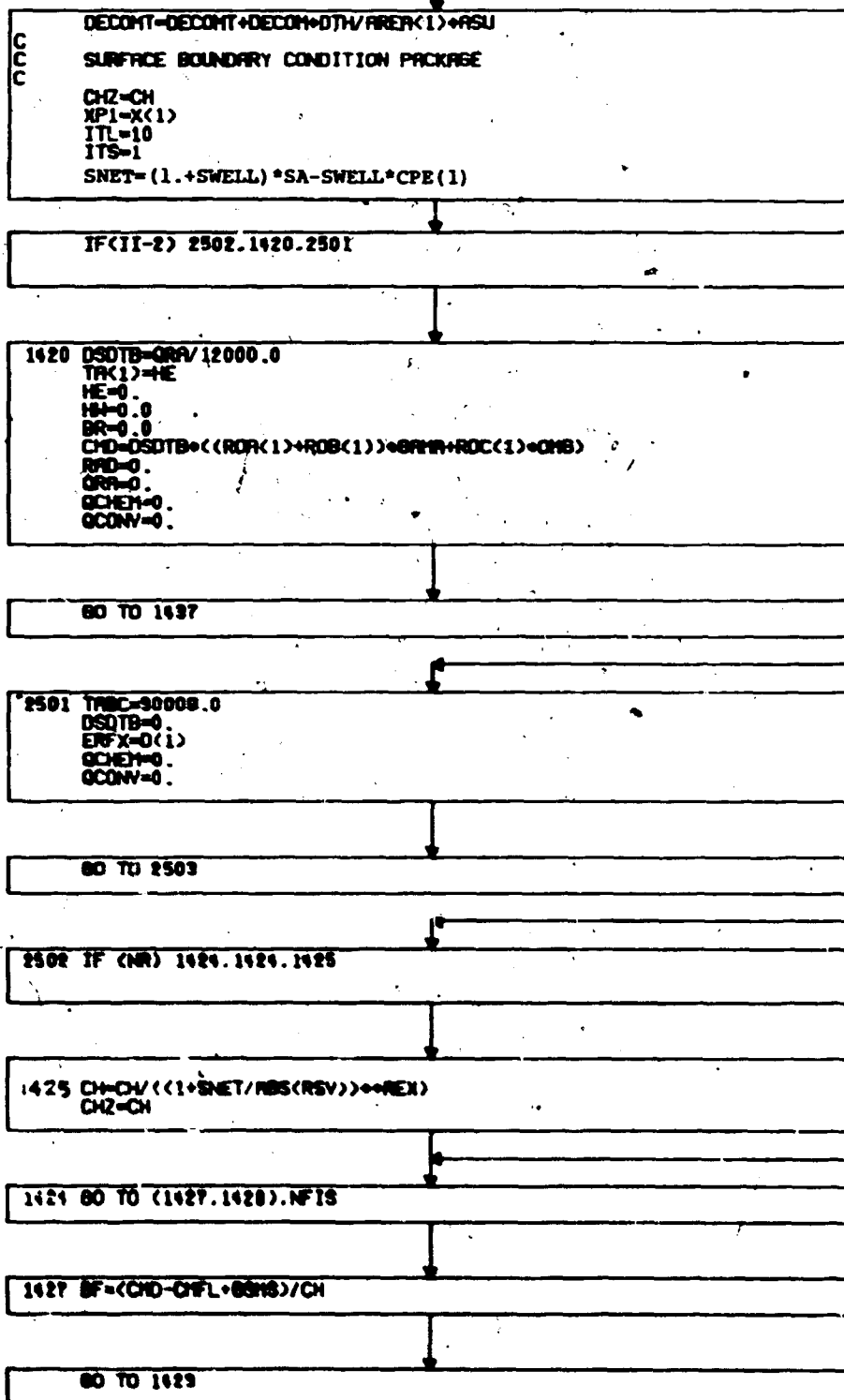
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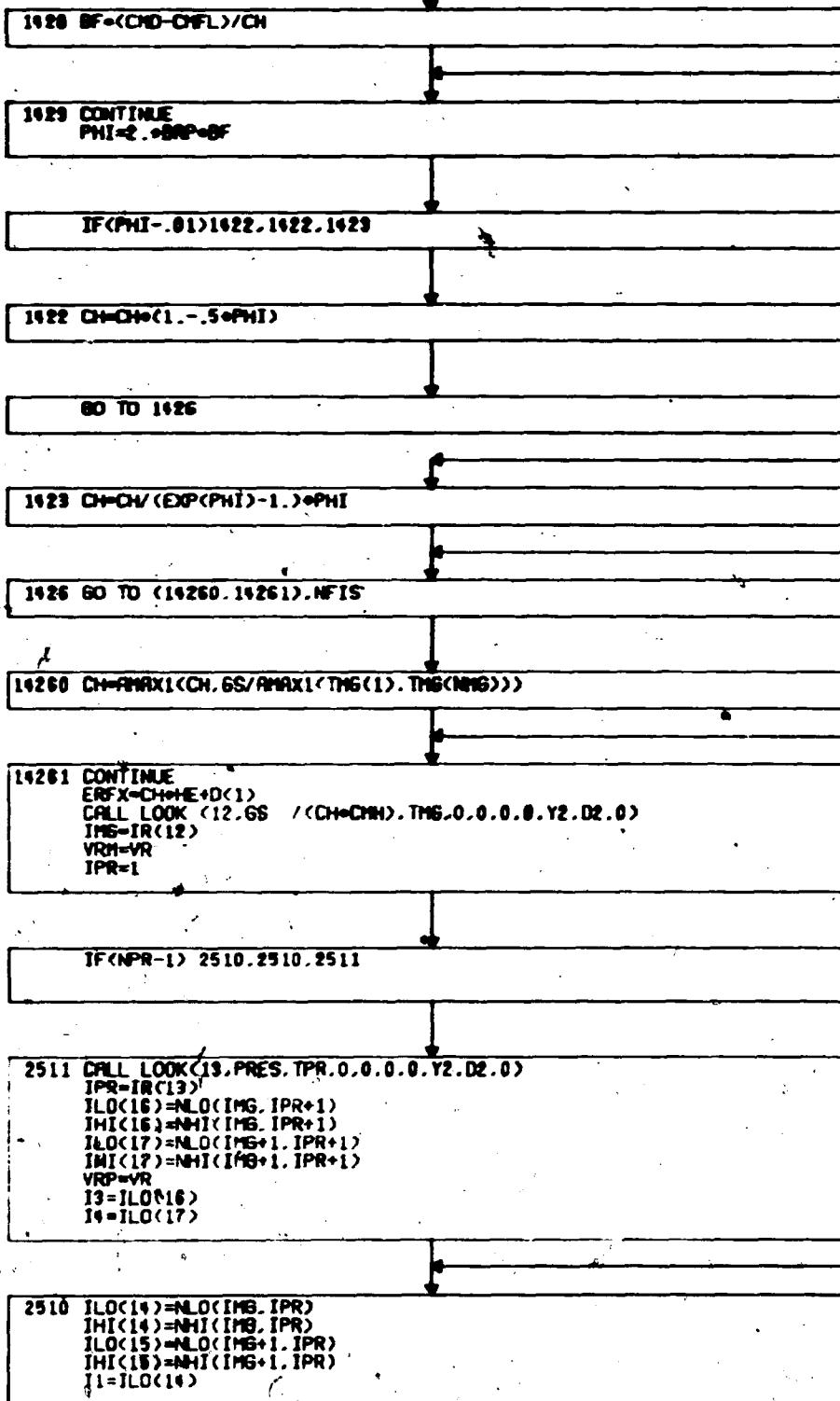
DO 7241 I=LL,LU

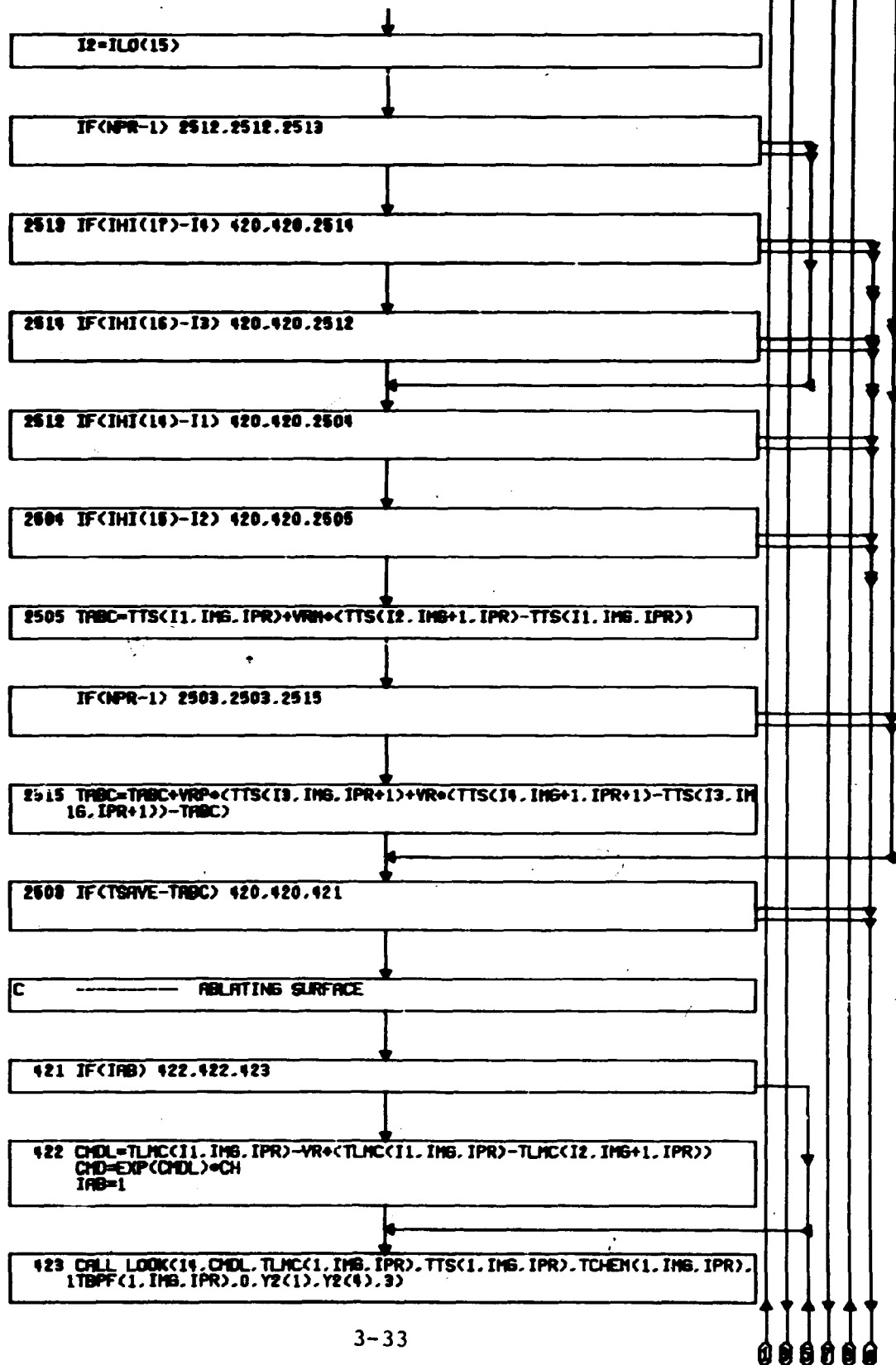
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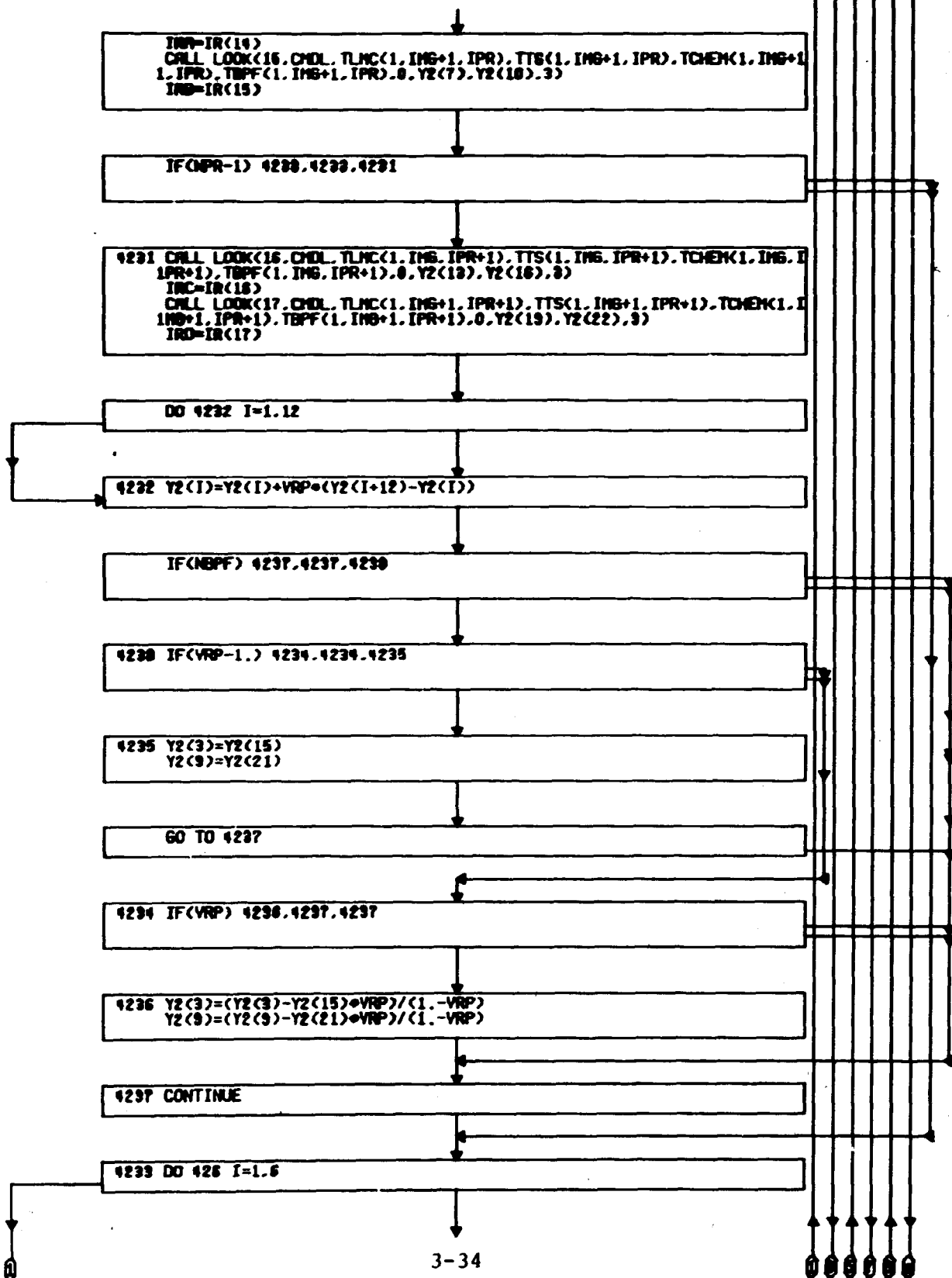


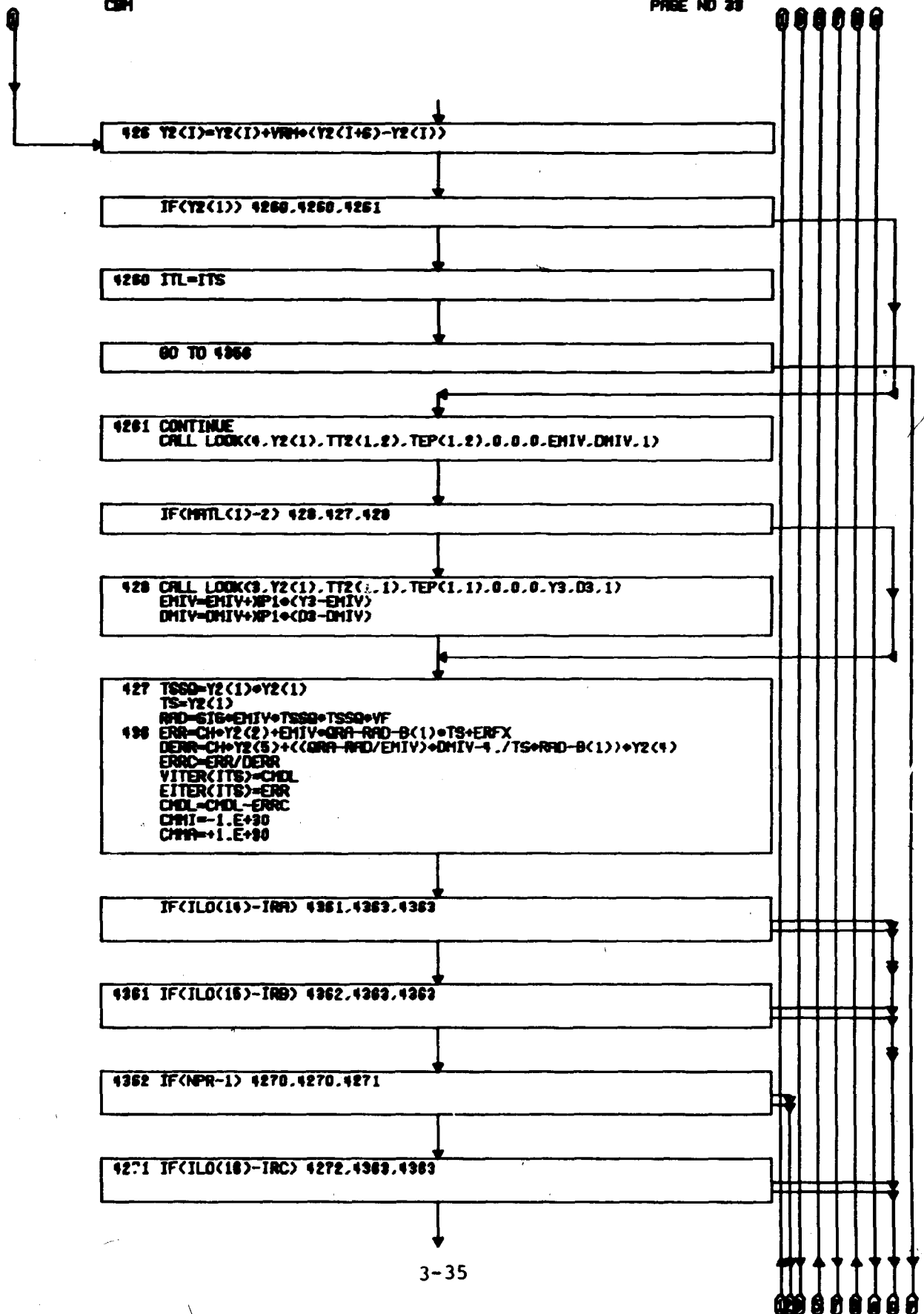


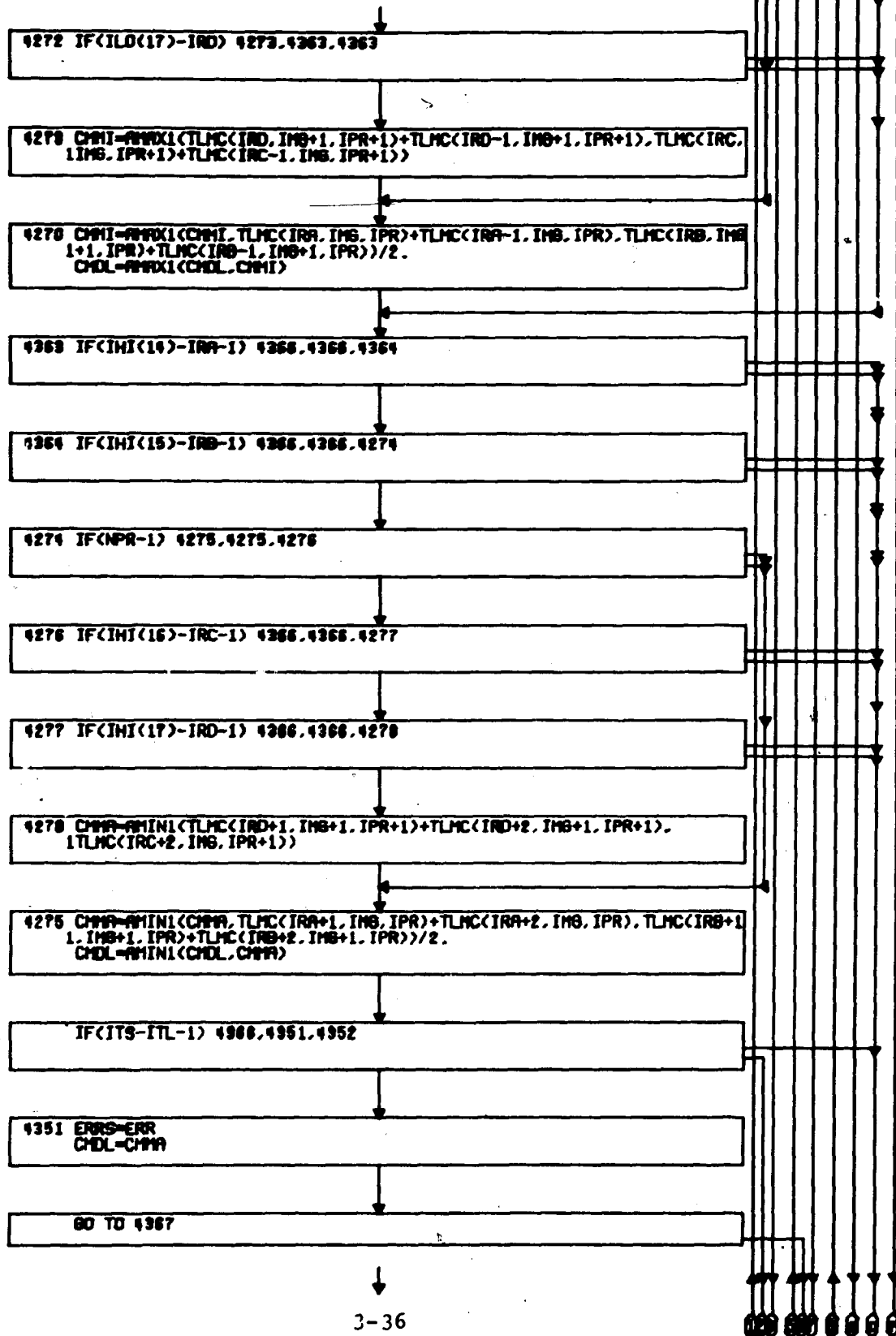


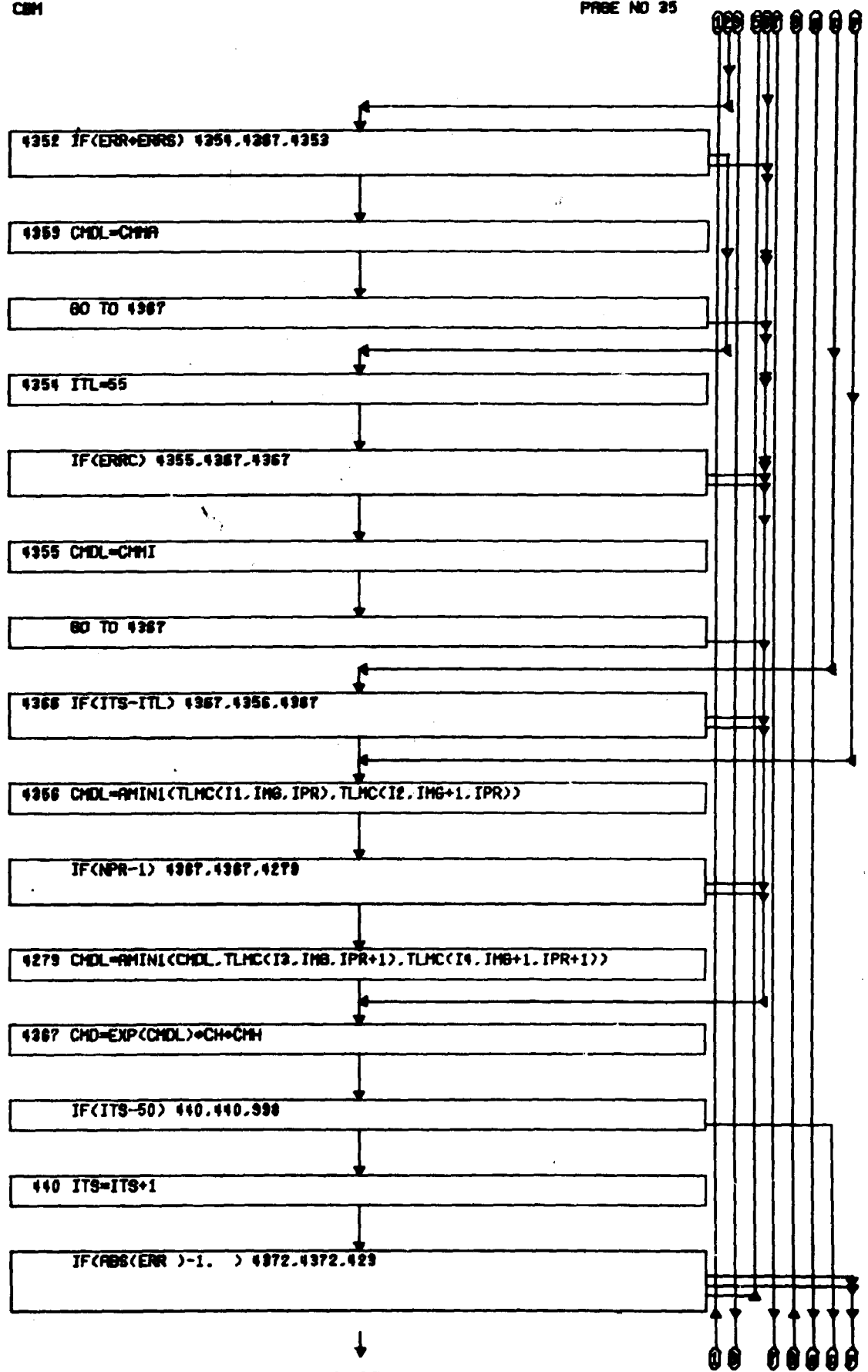


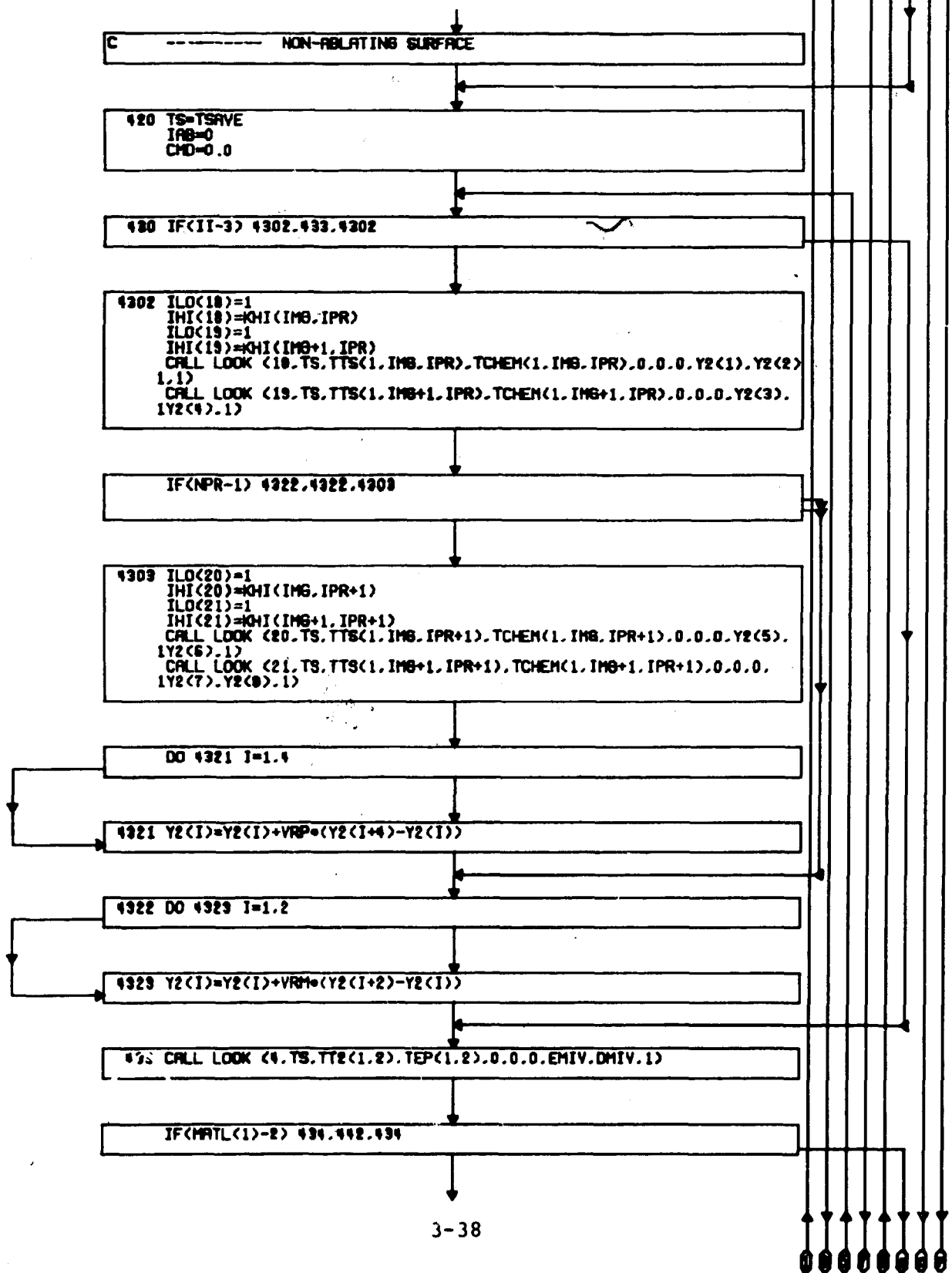


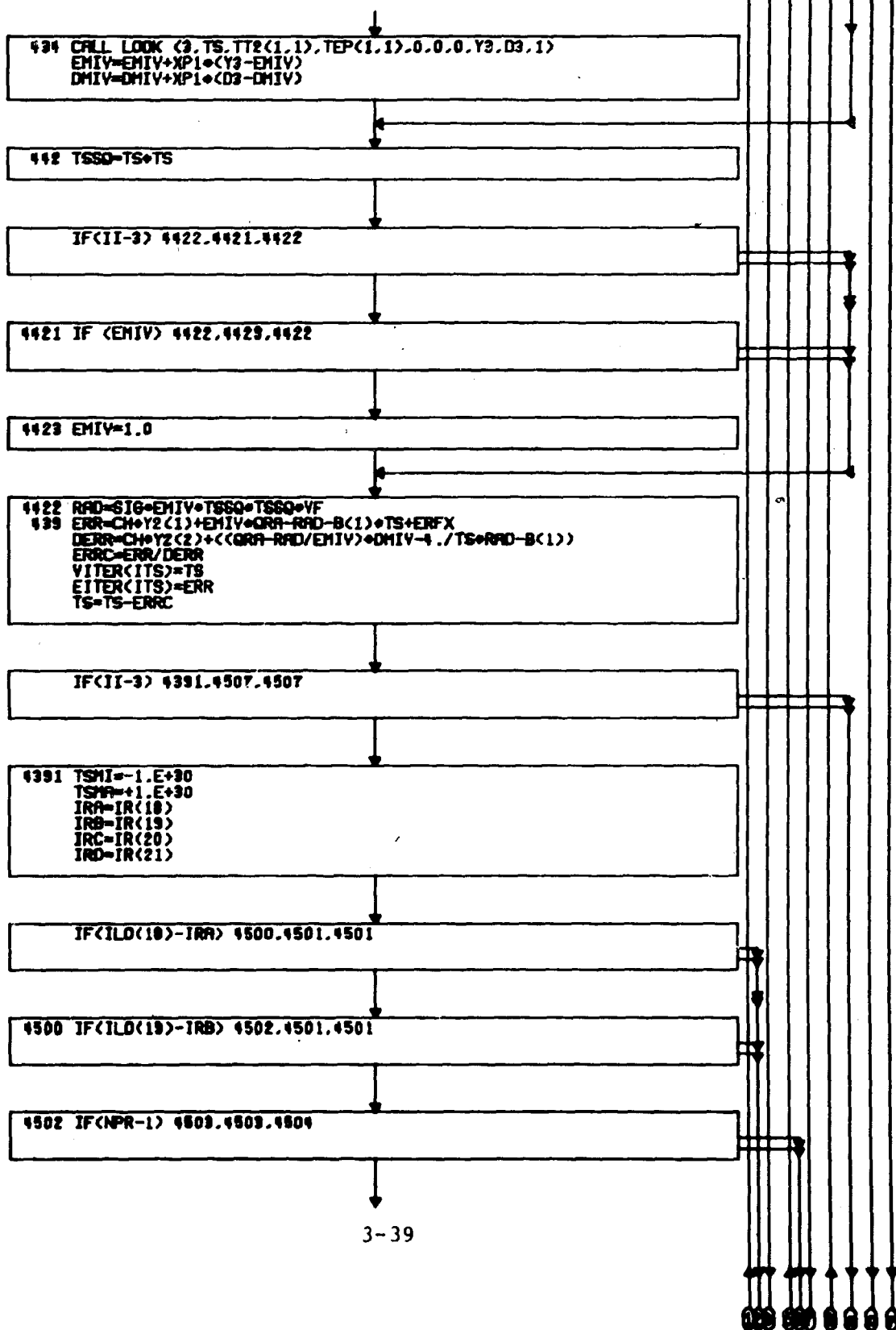


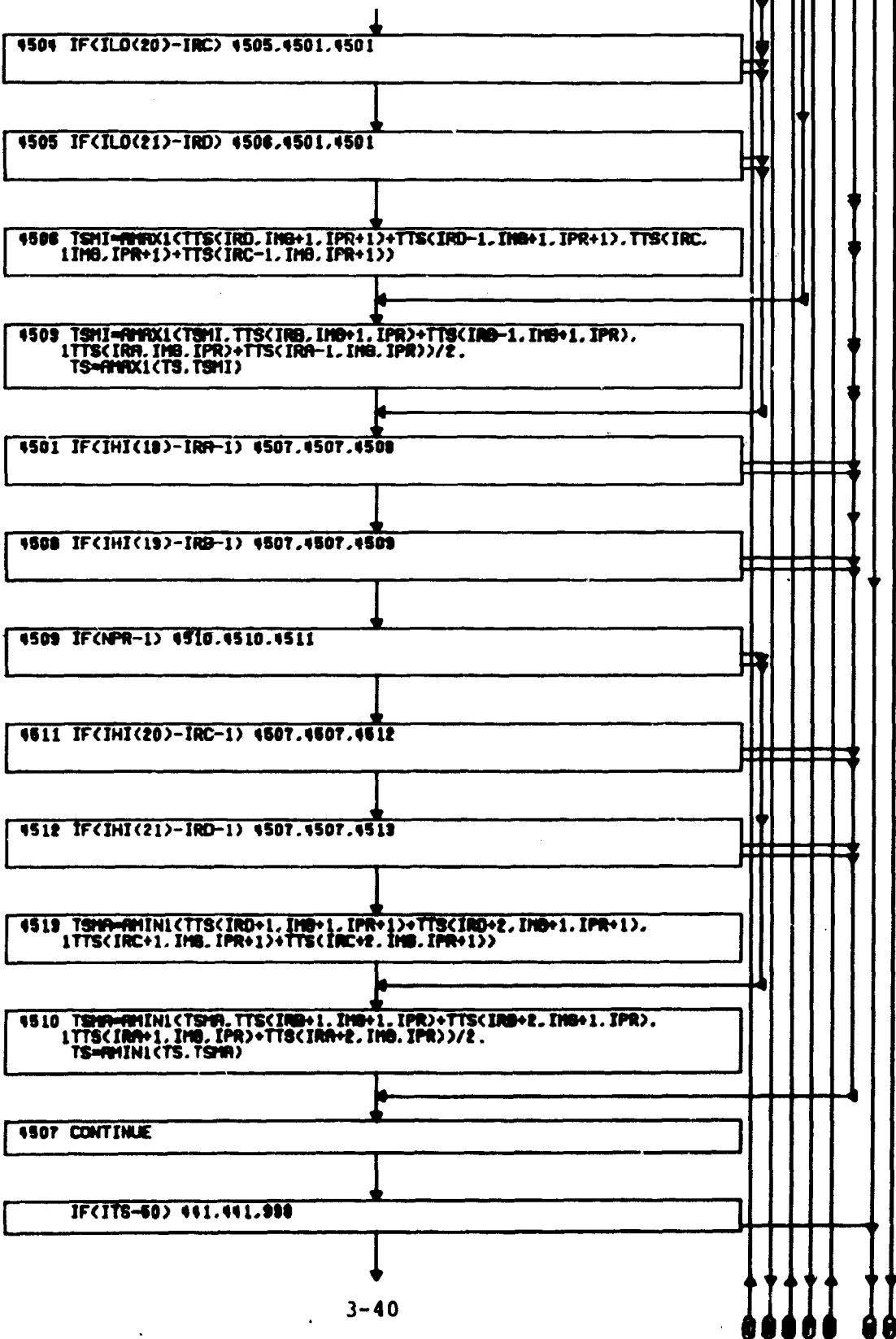


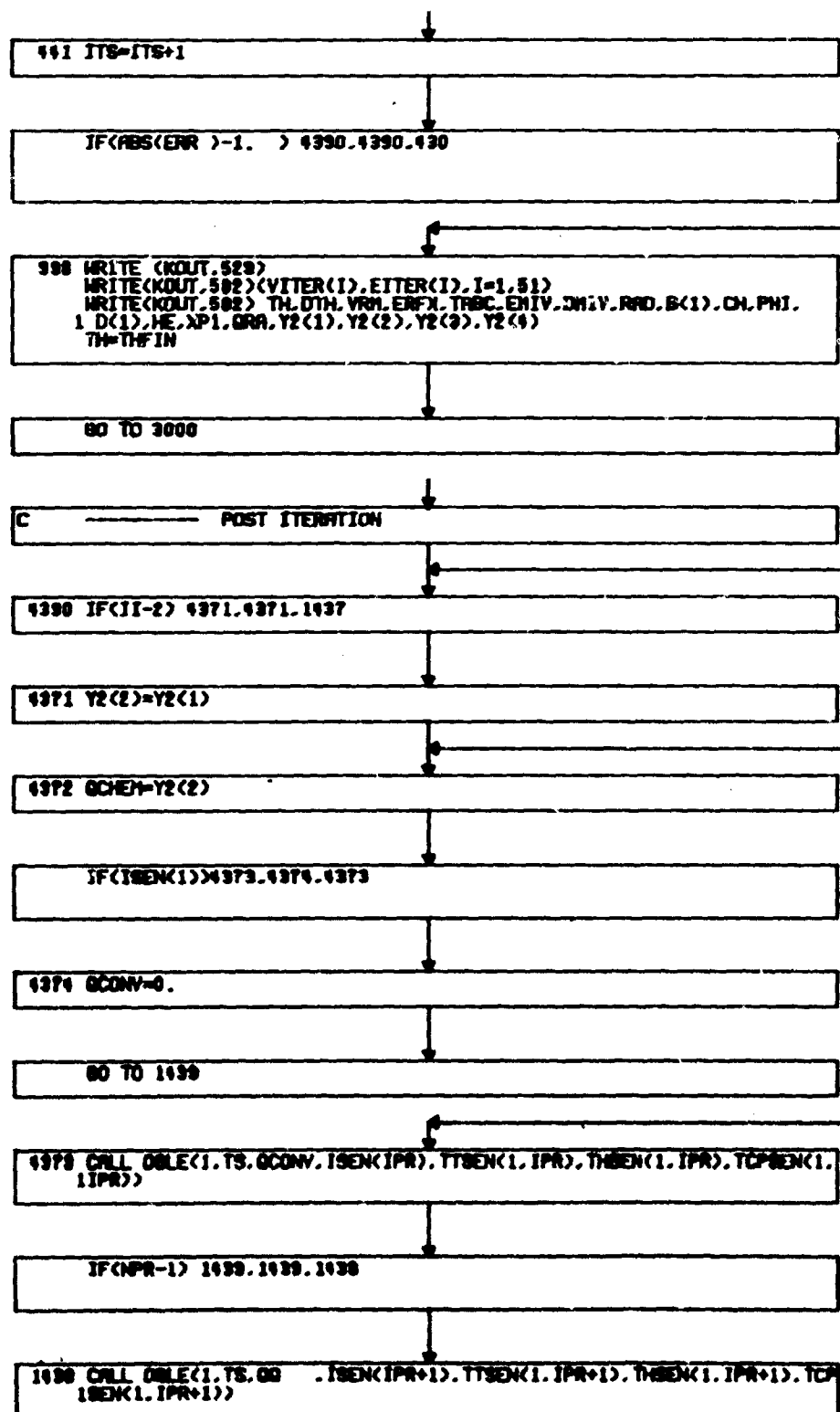


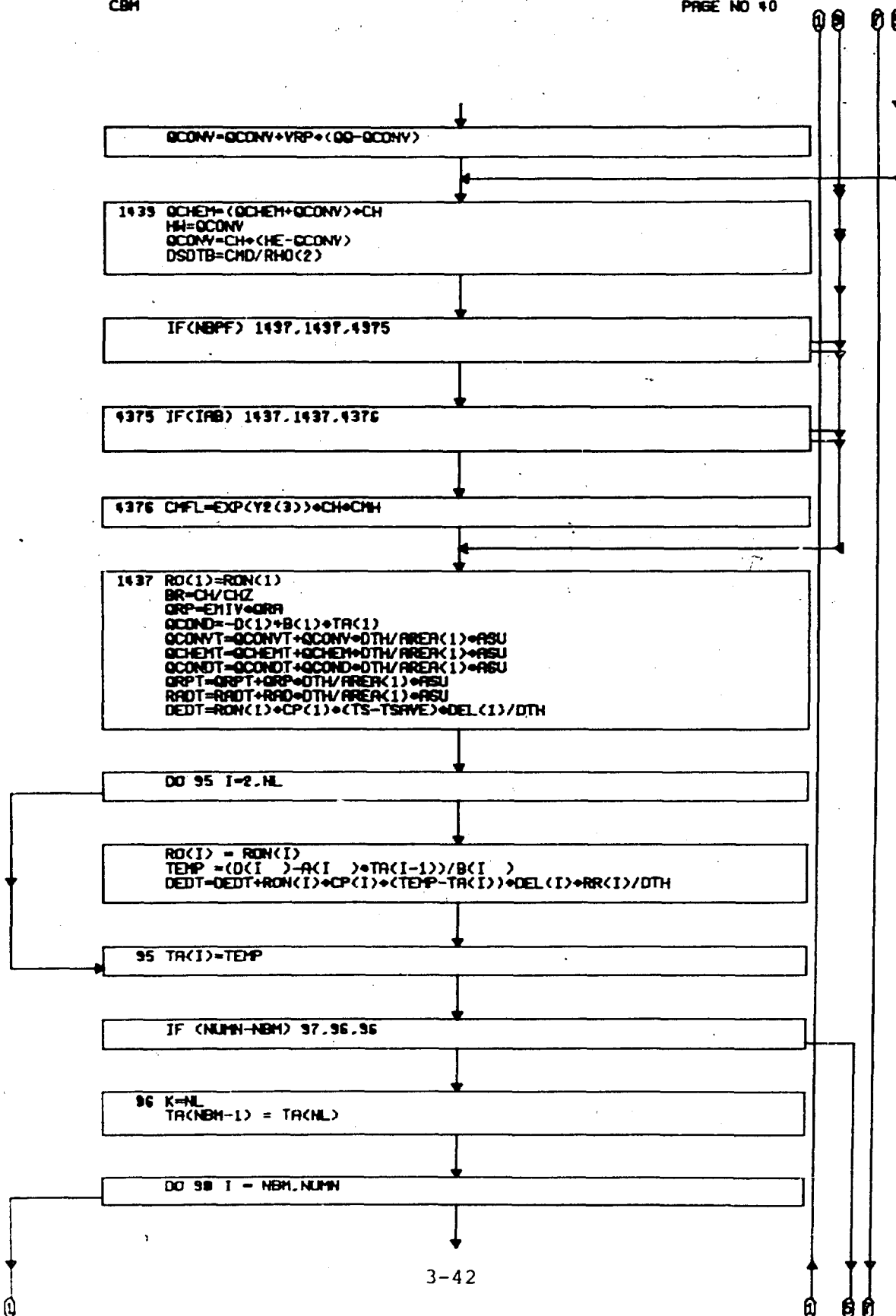


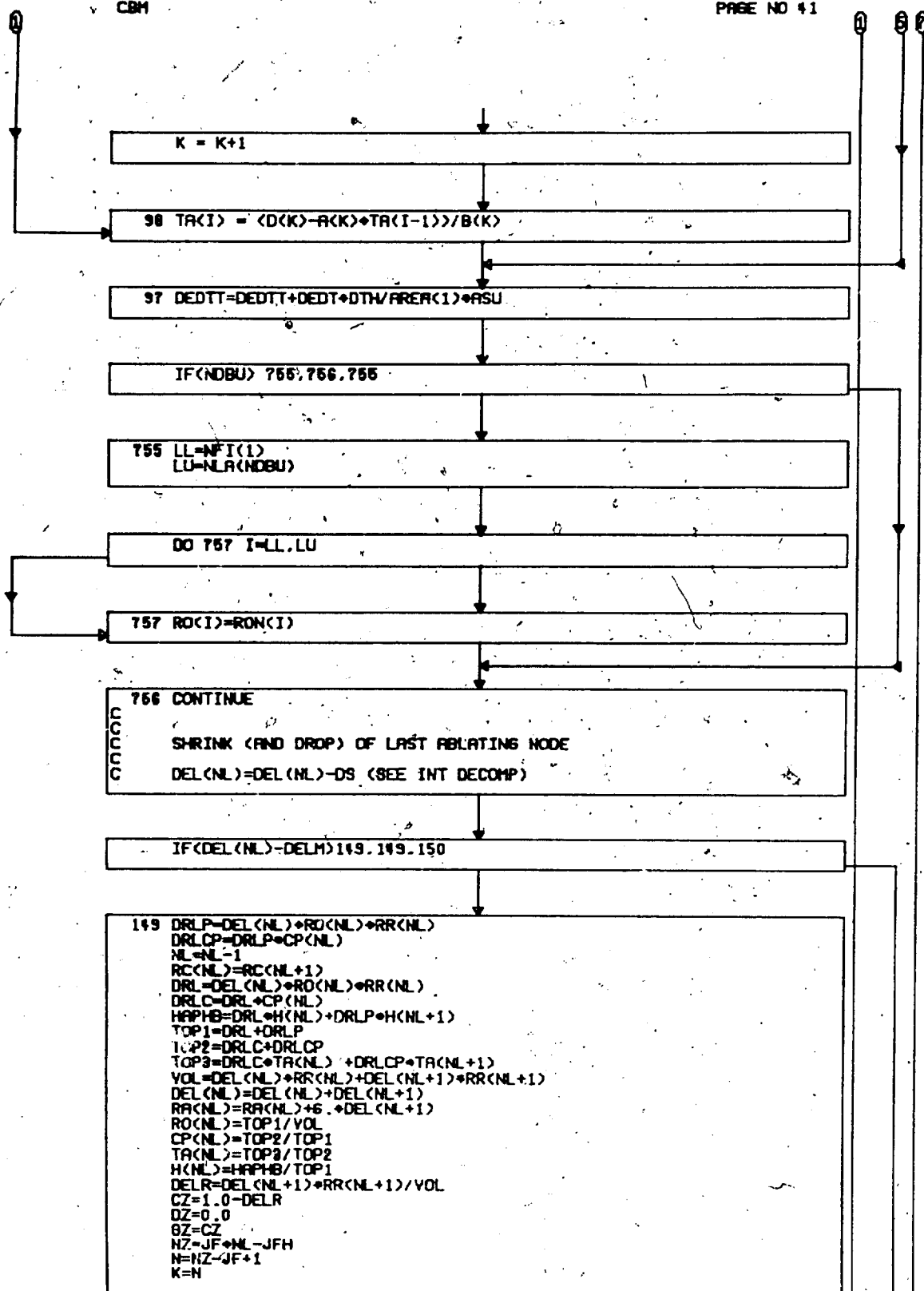






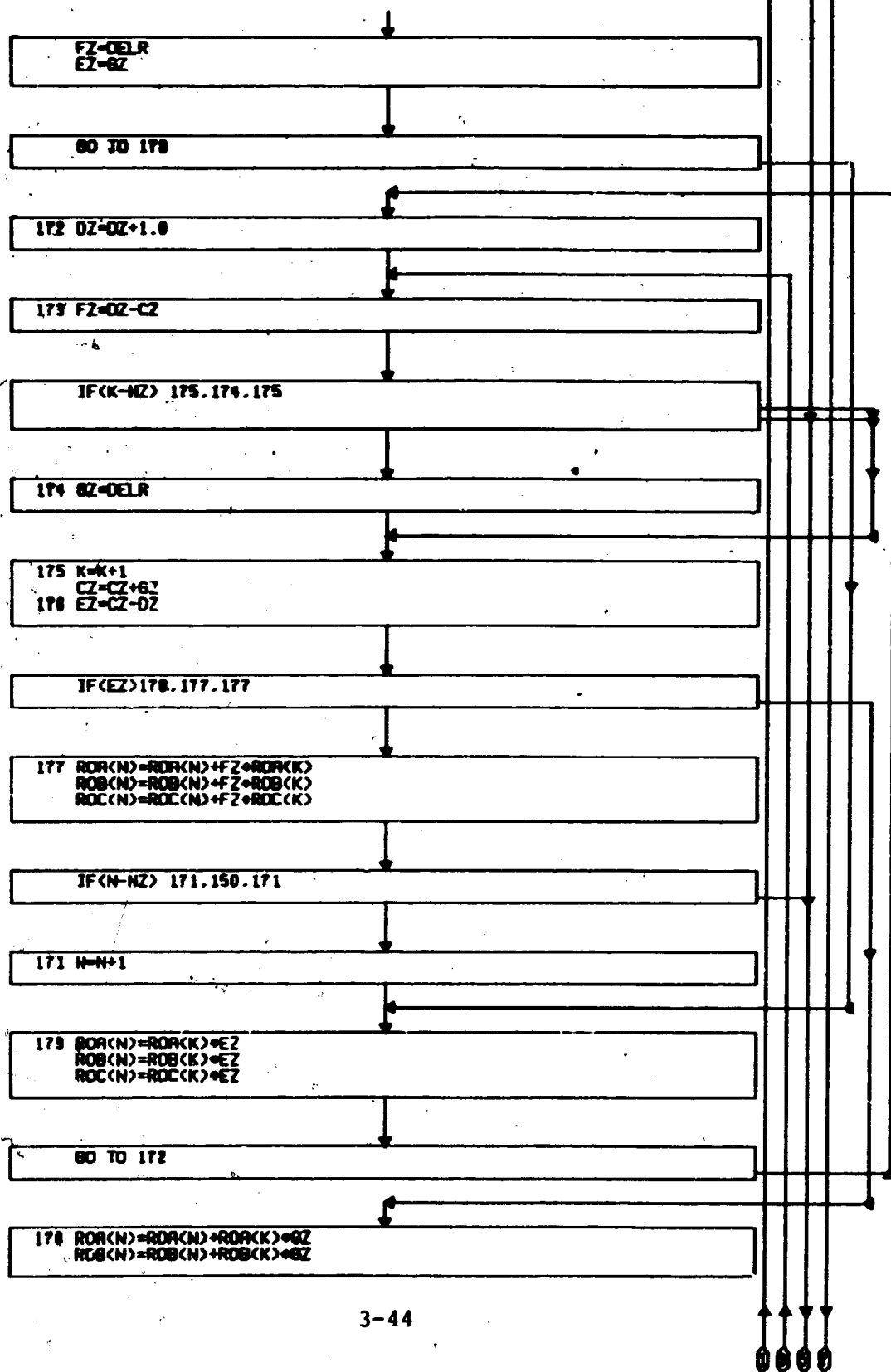






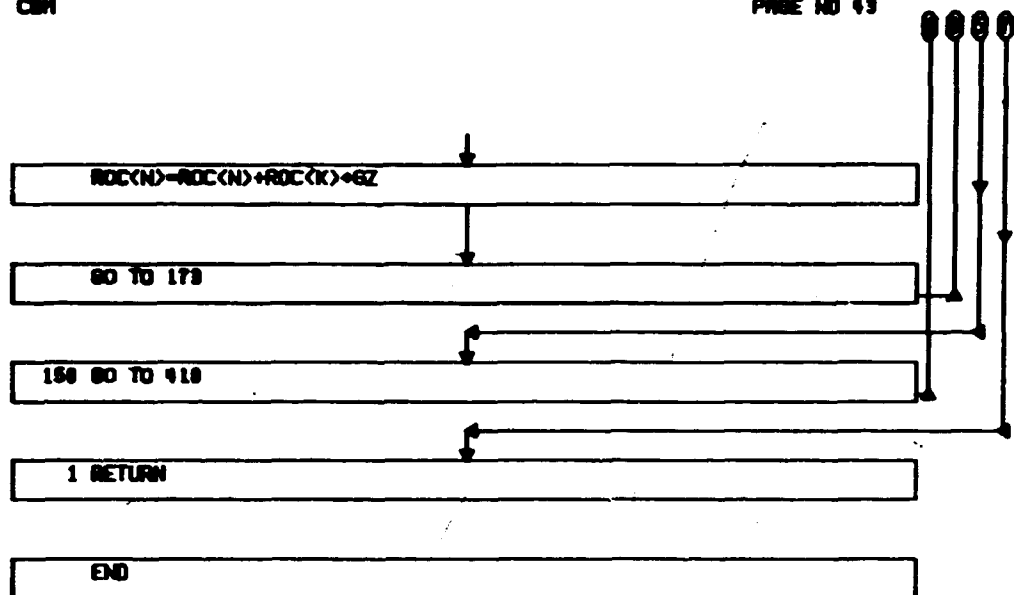
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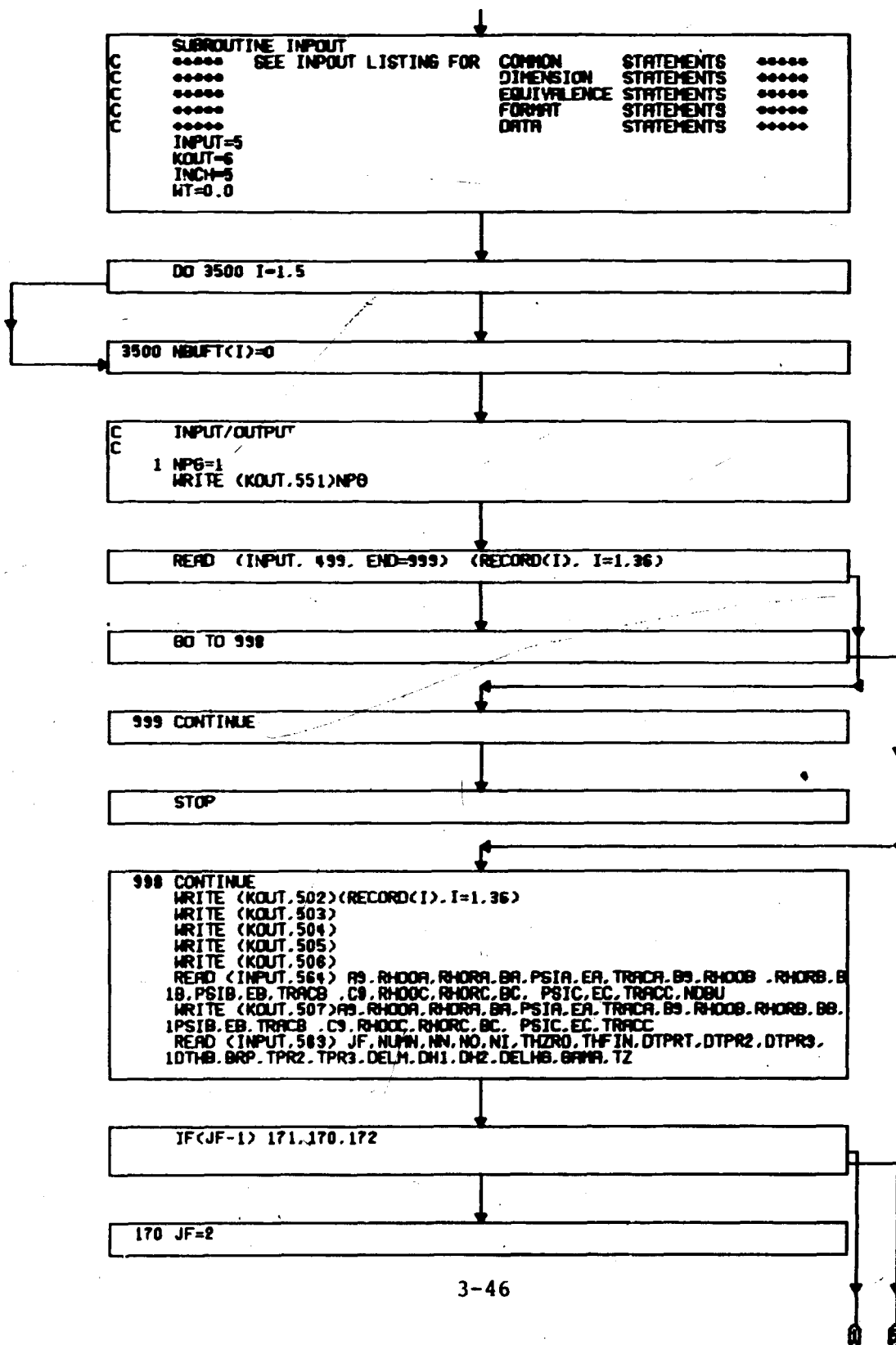
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CBM

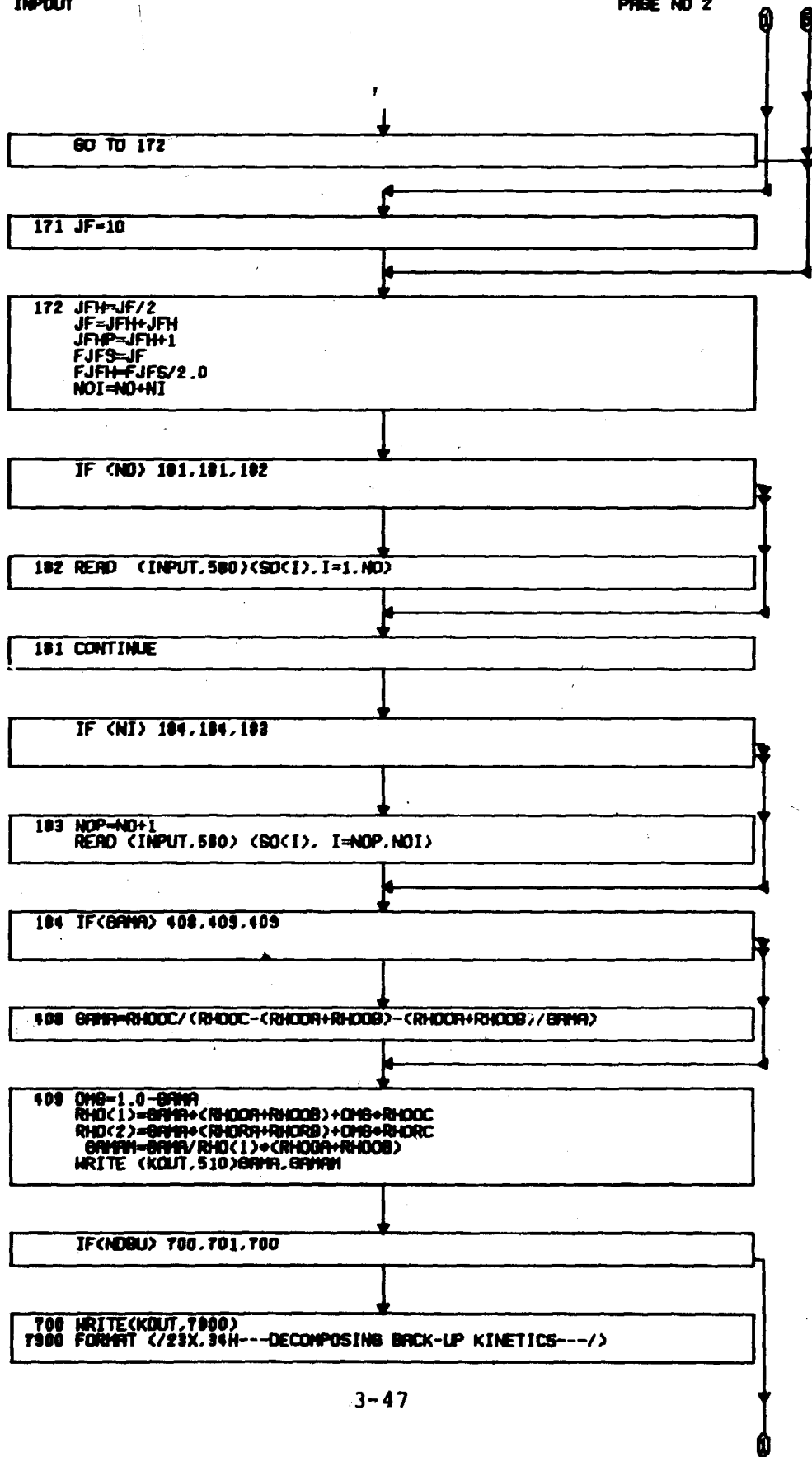
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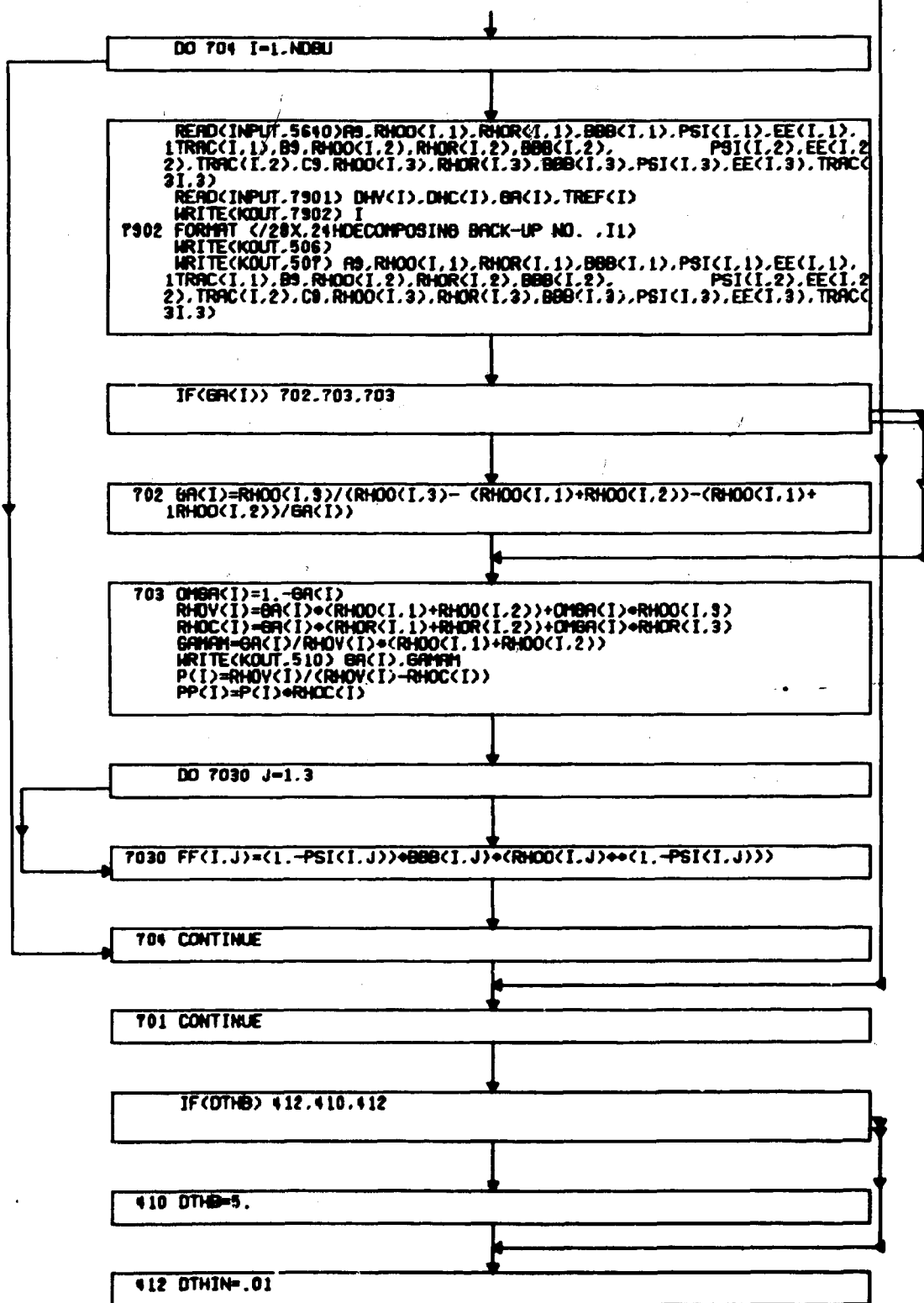


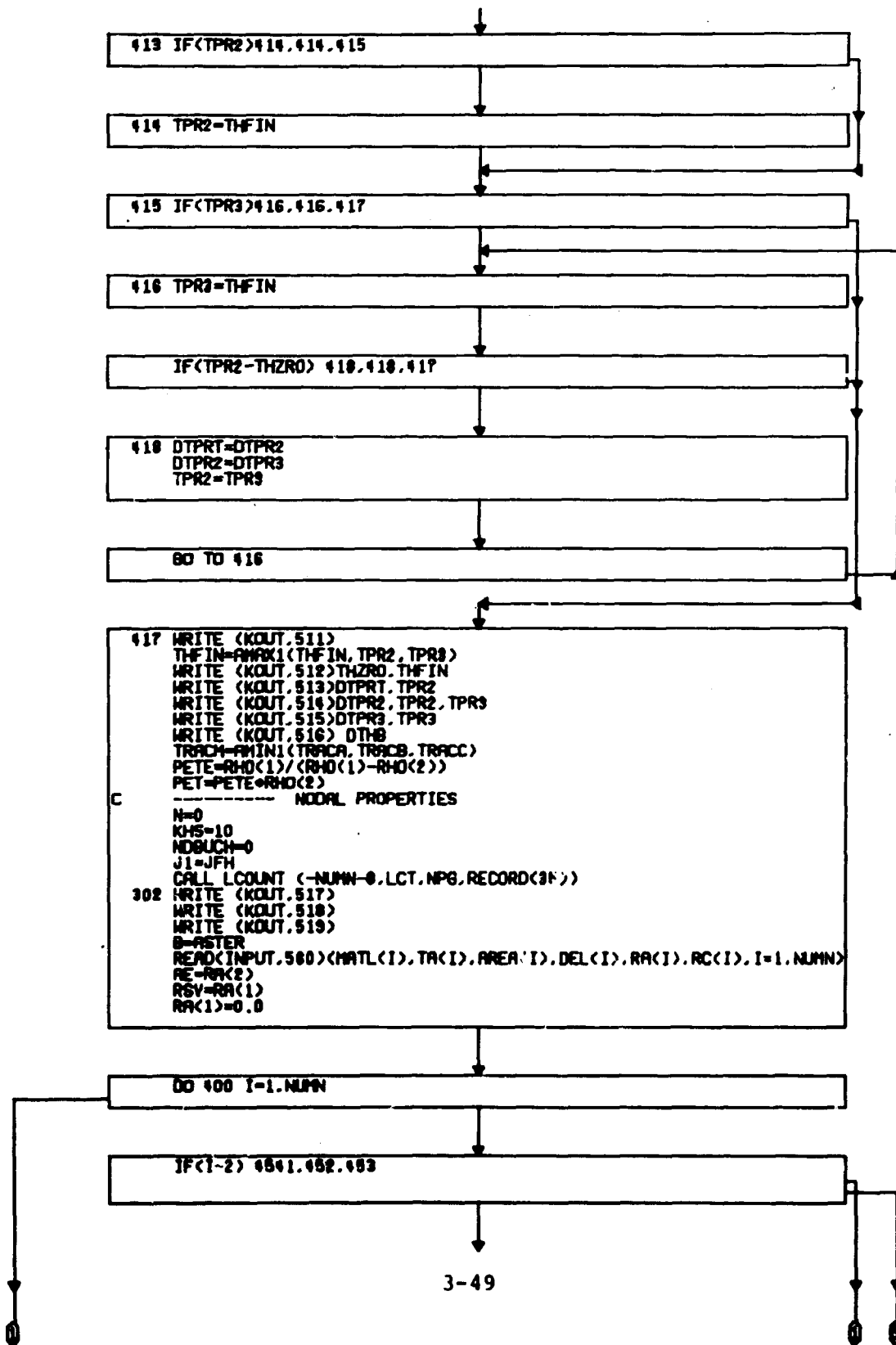


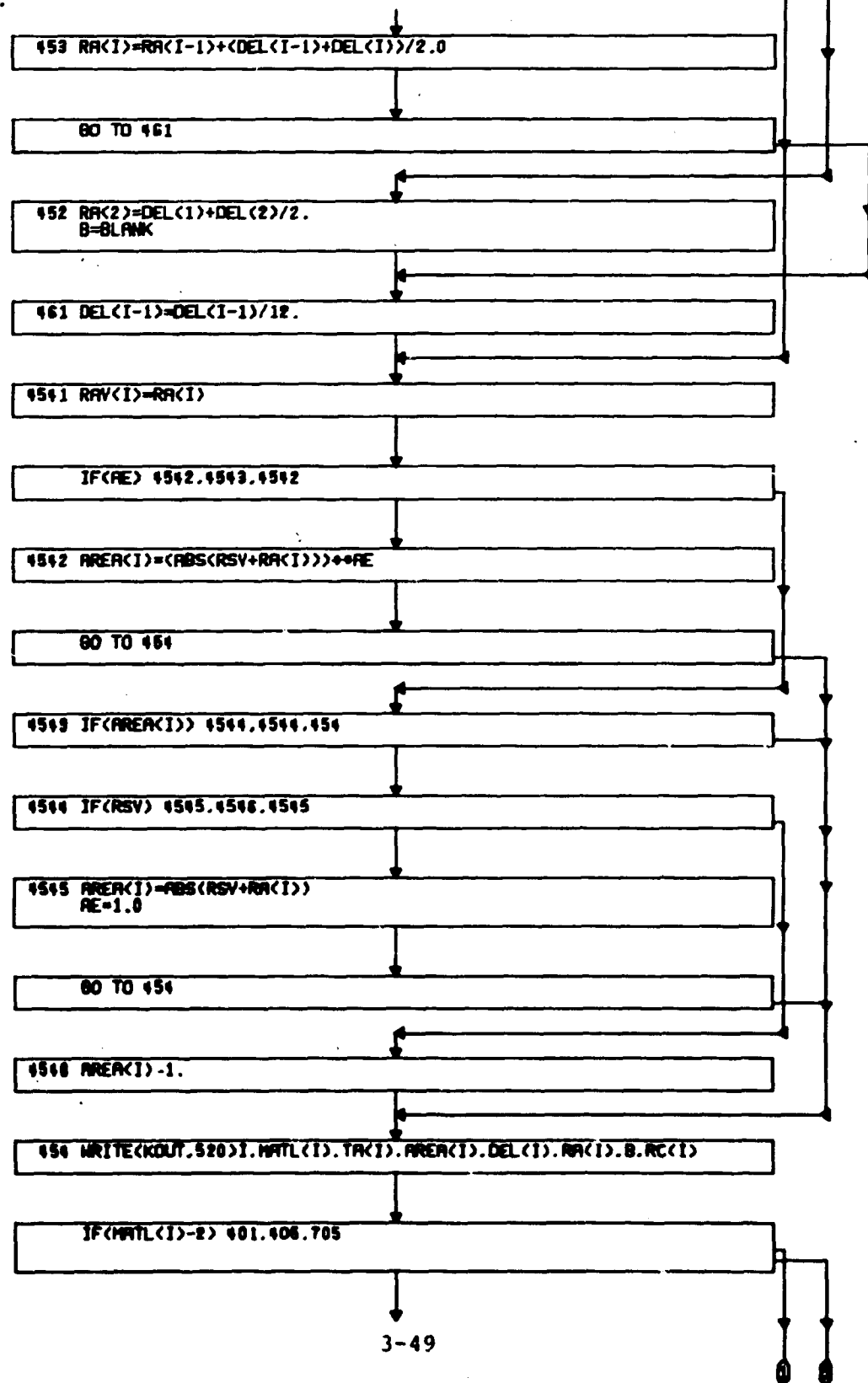
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PAGE NO 2



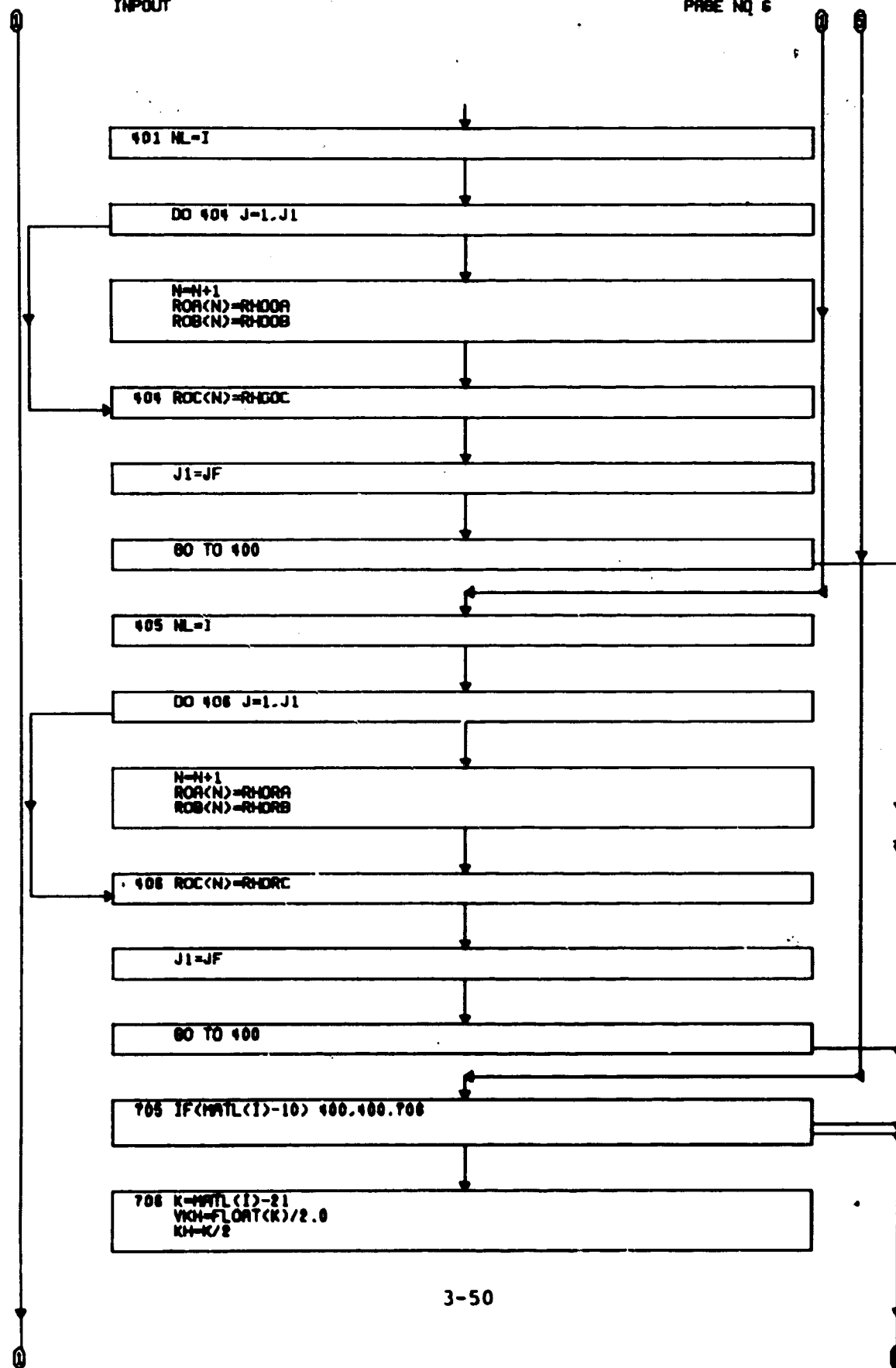






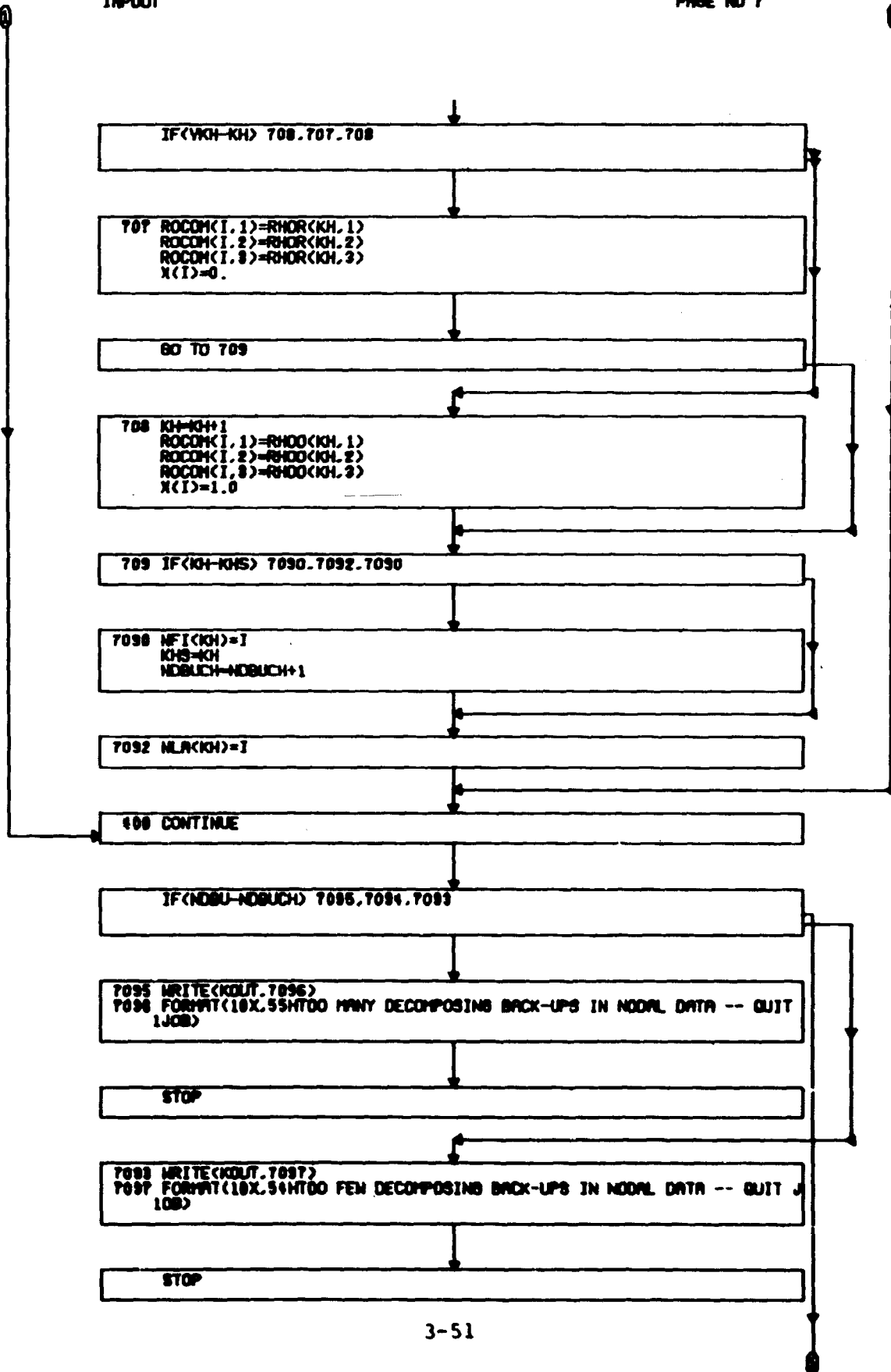
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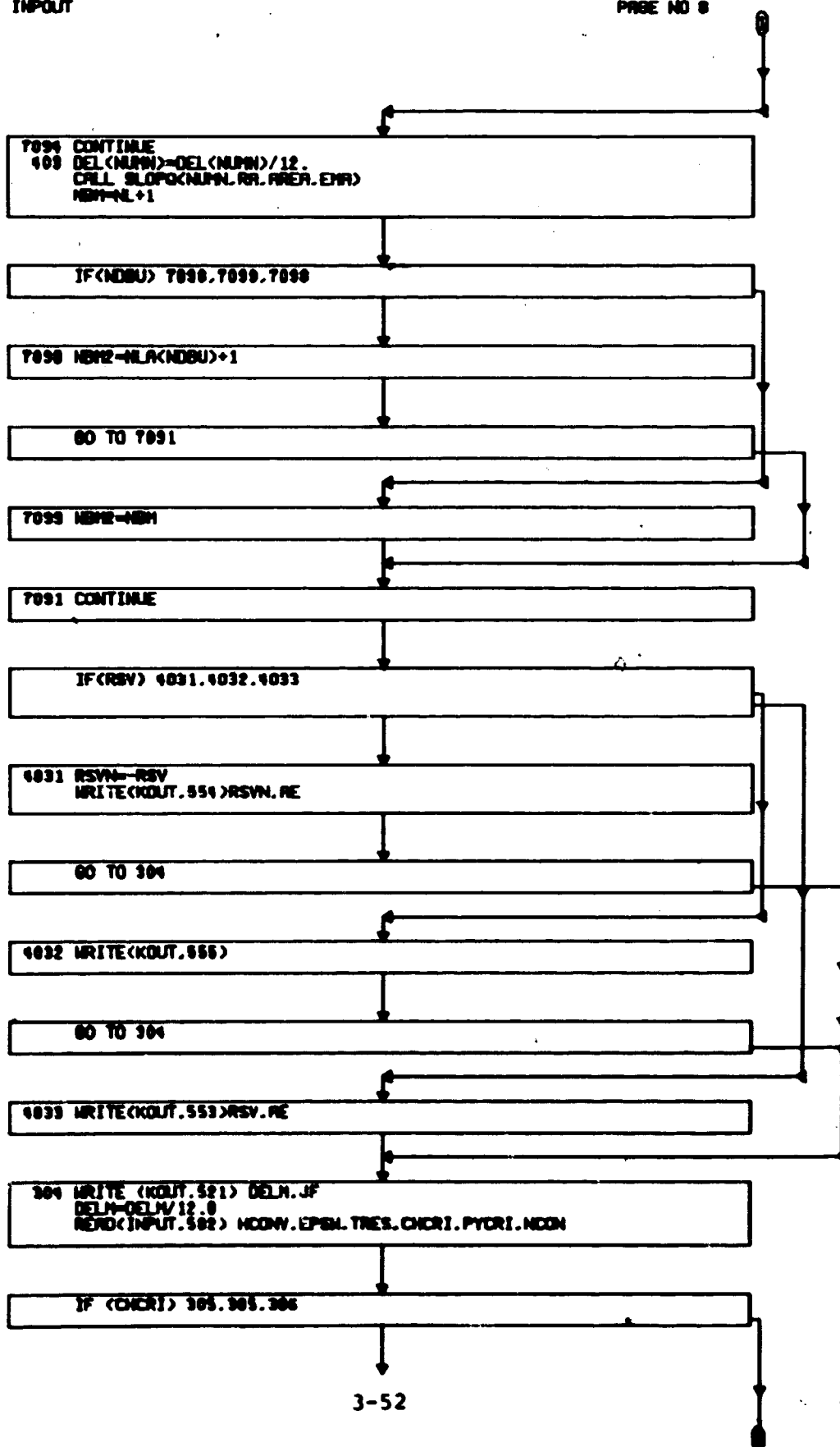
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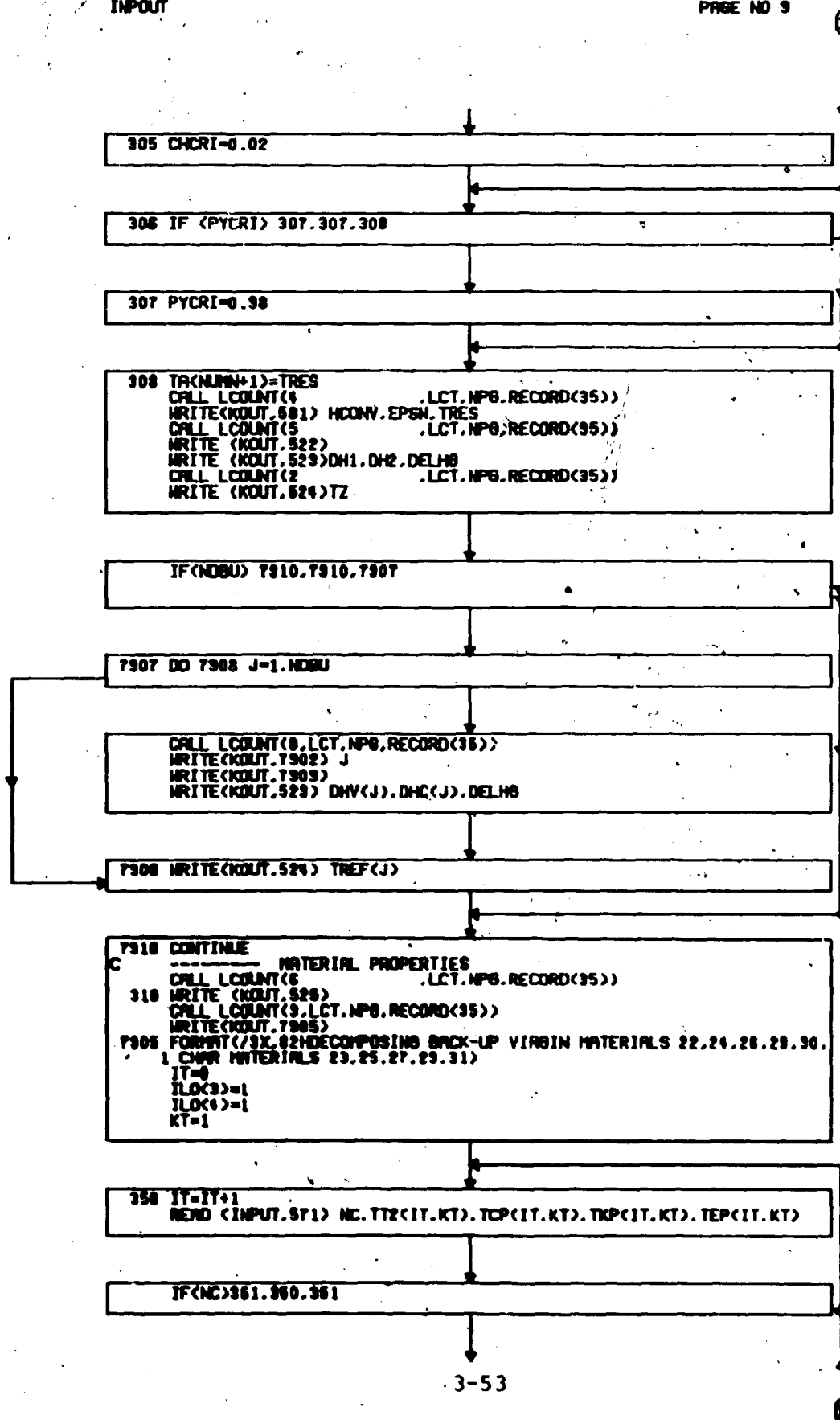
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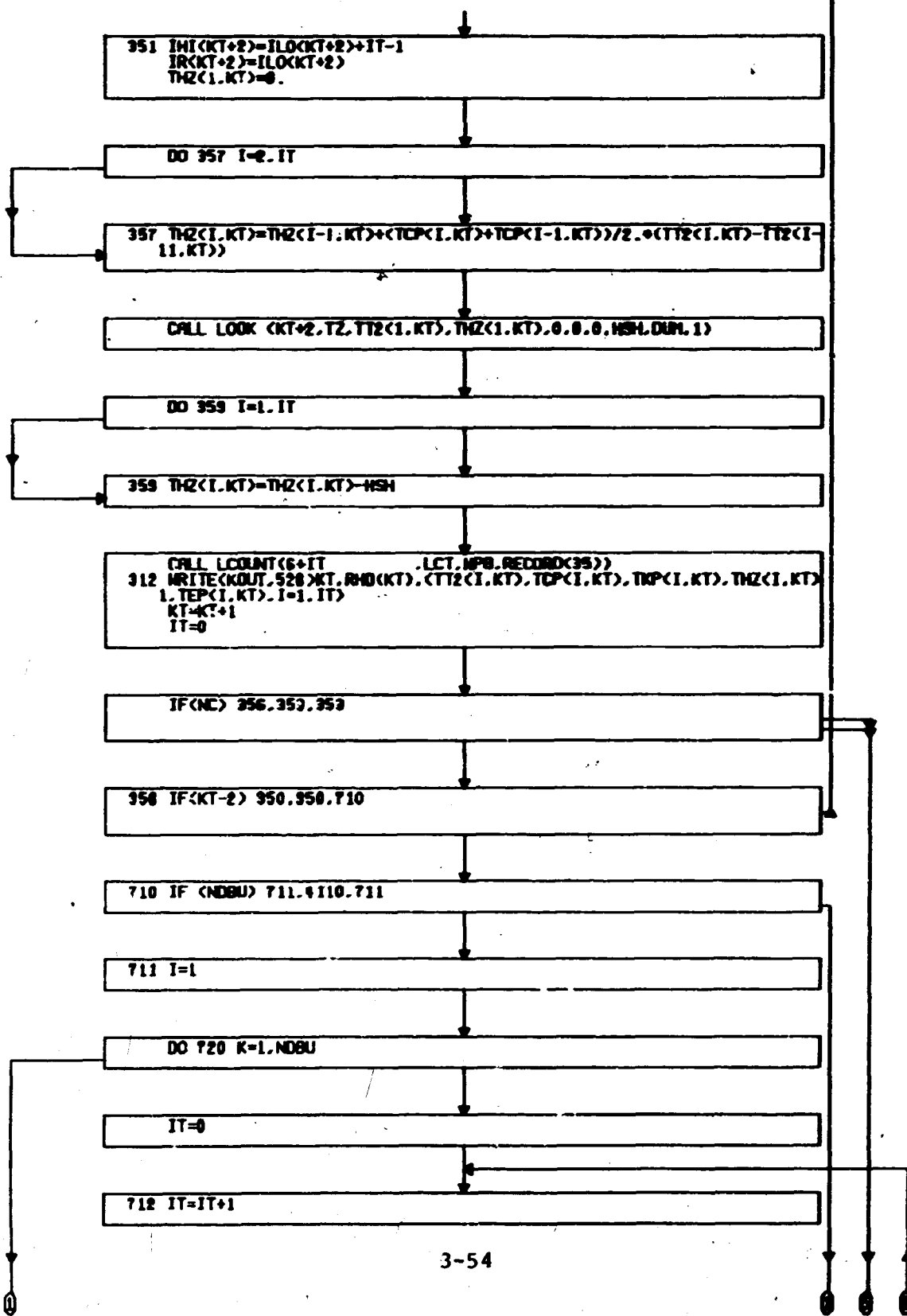


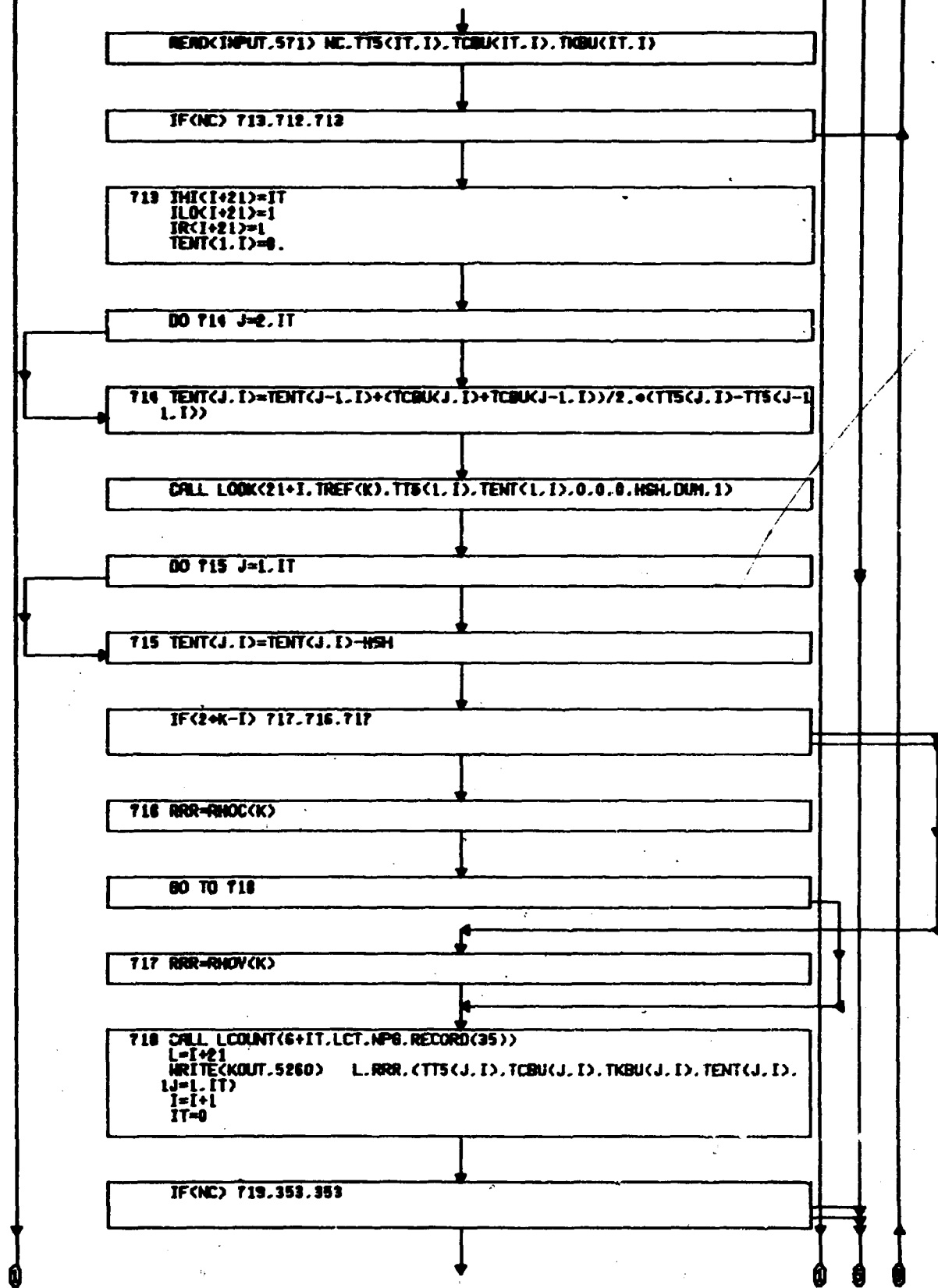
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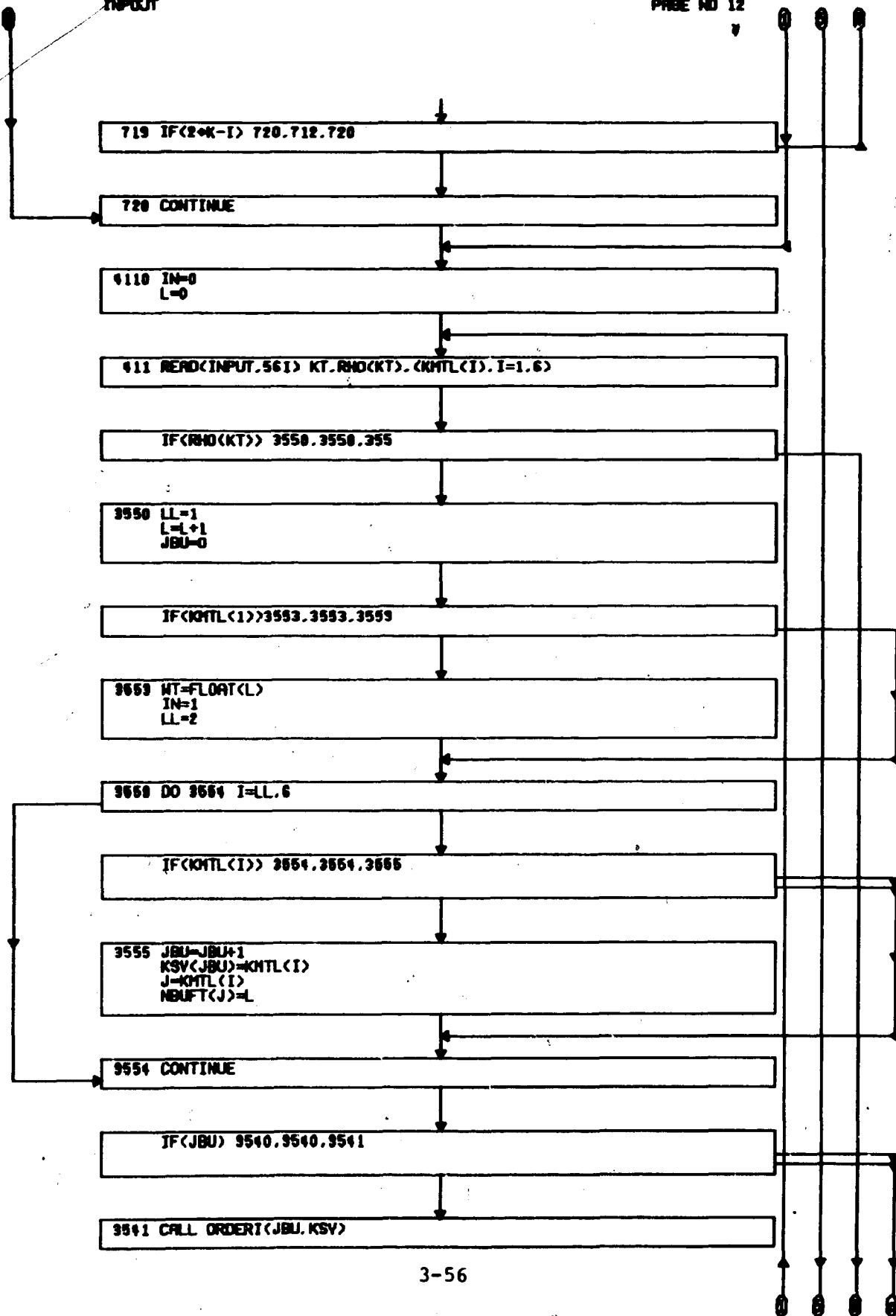


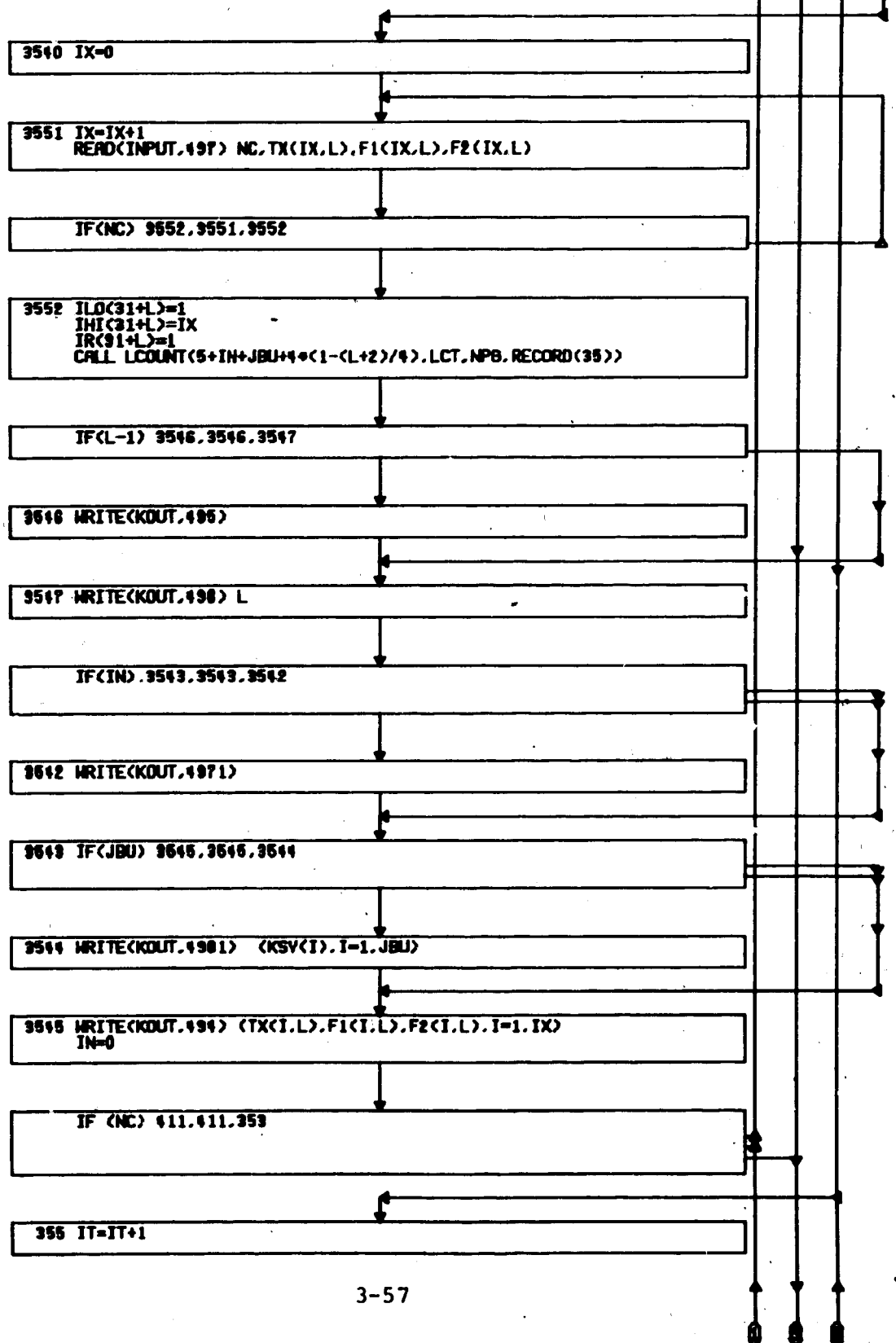


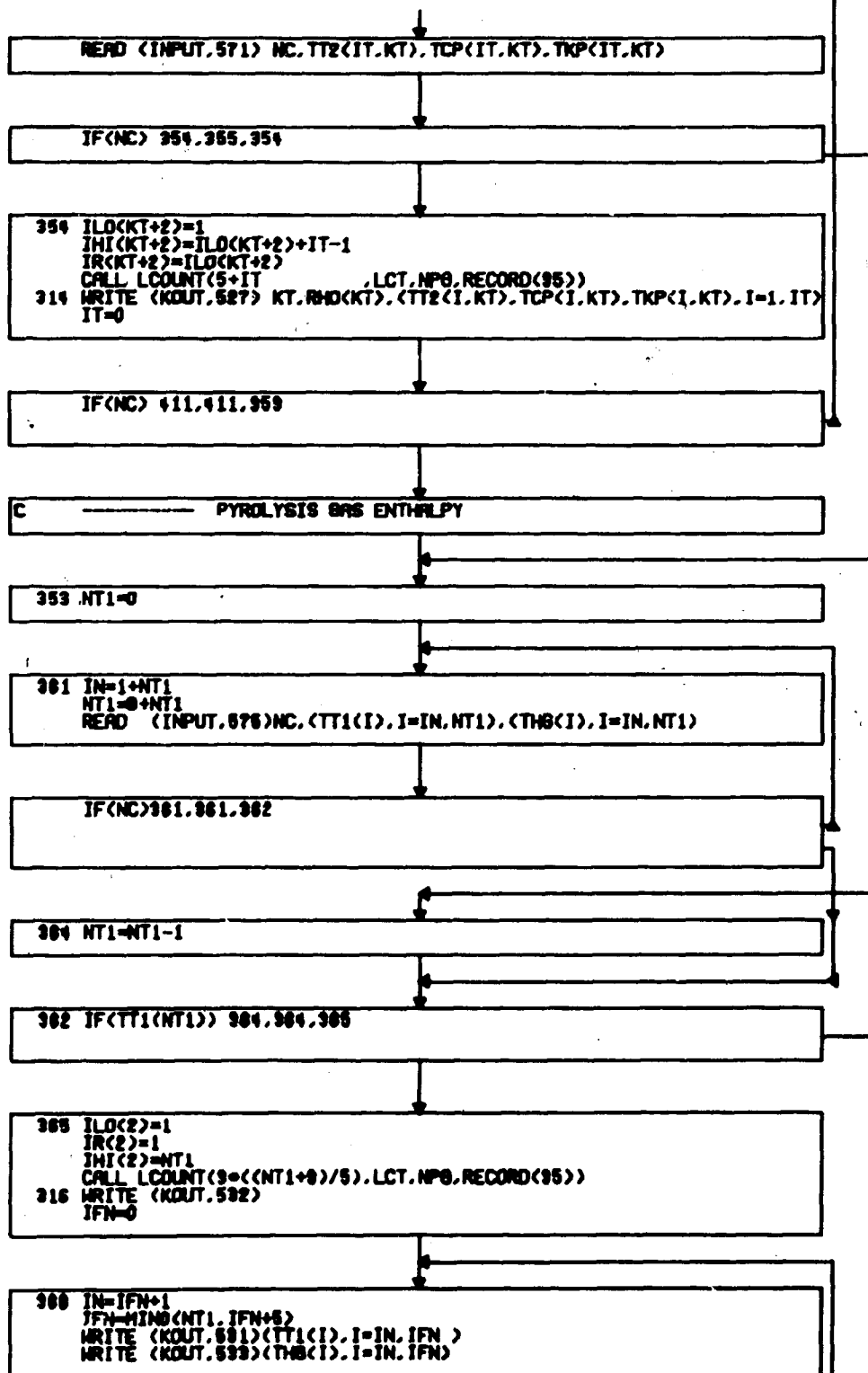


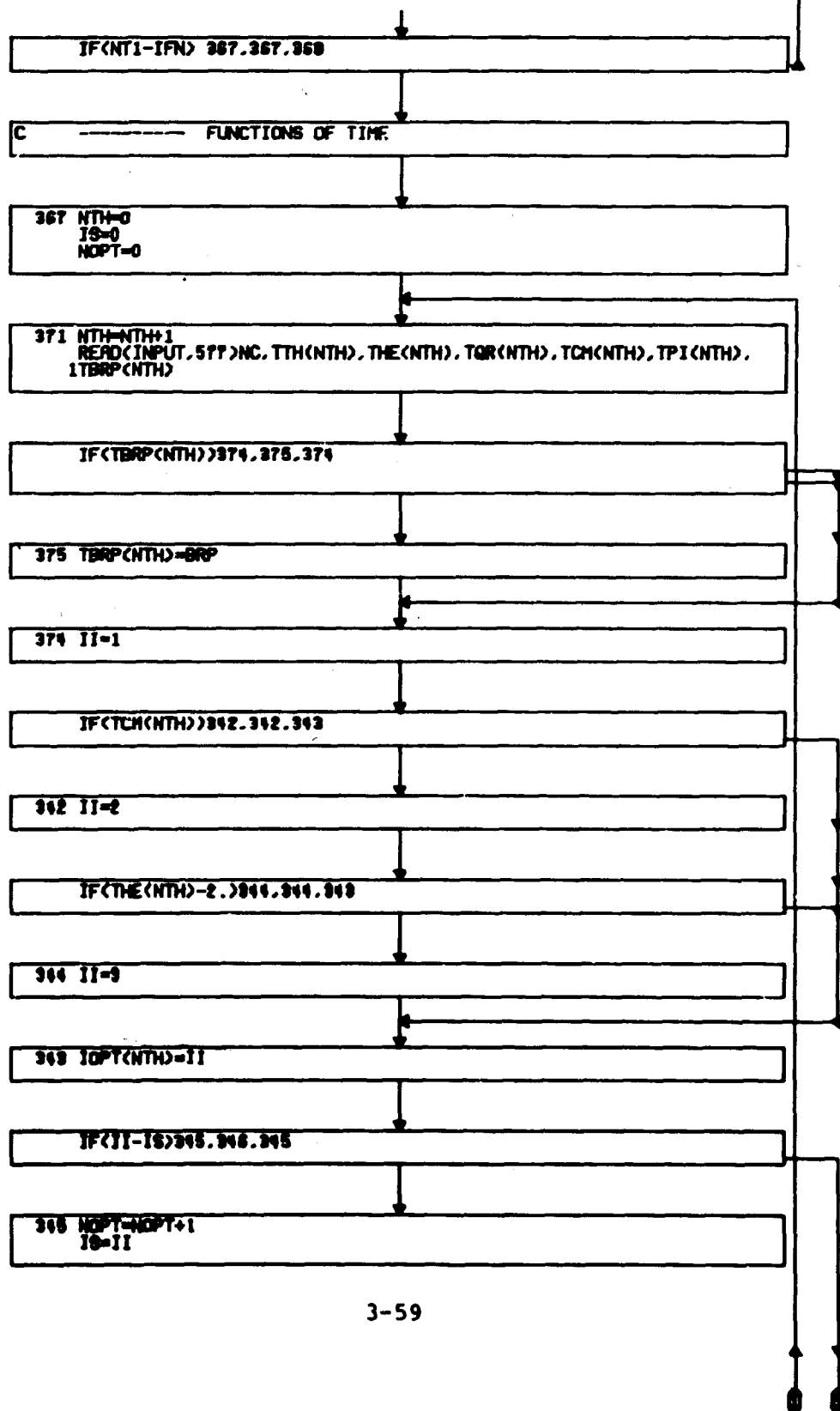
INPUT

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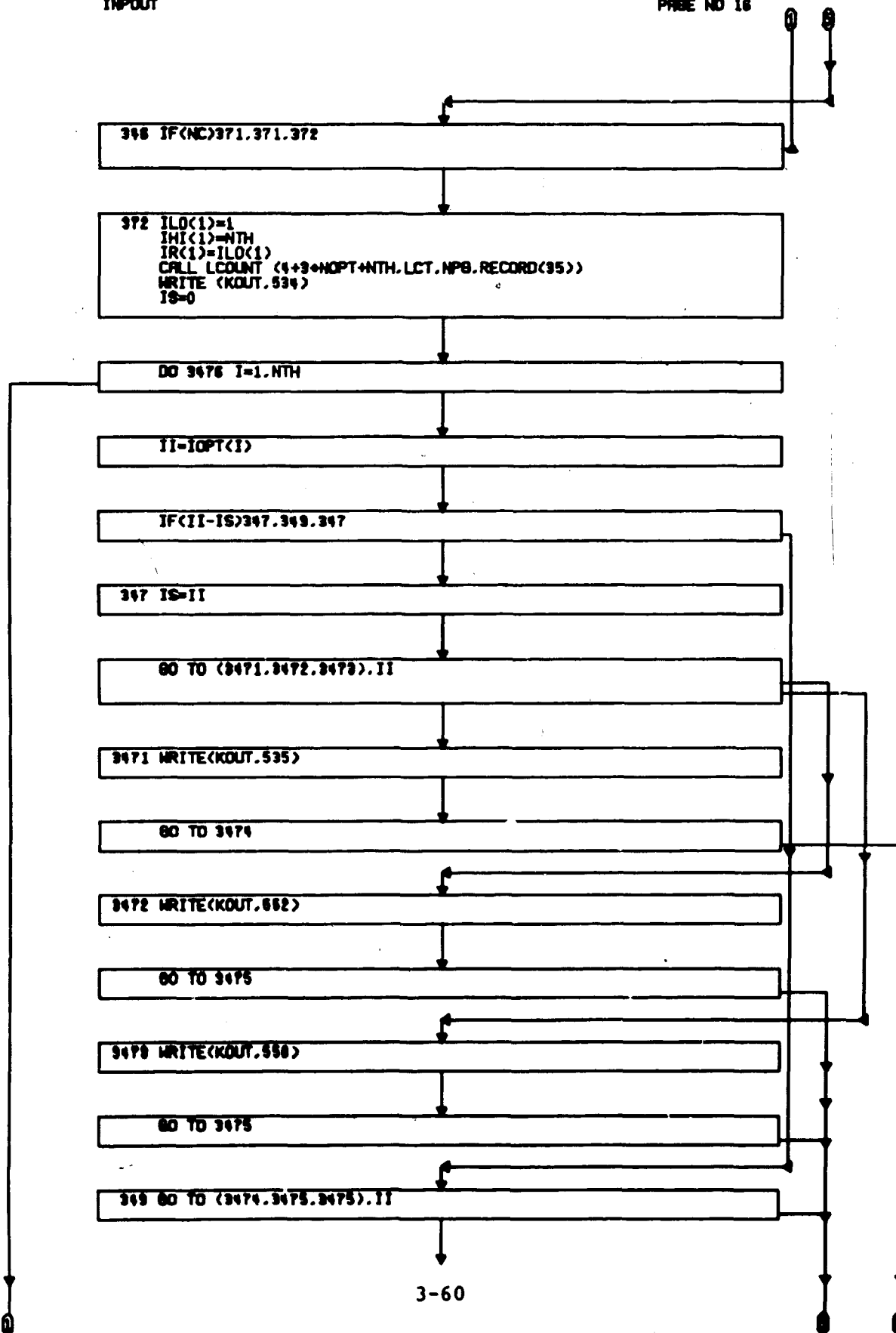






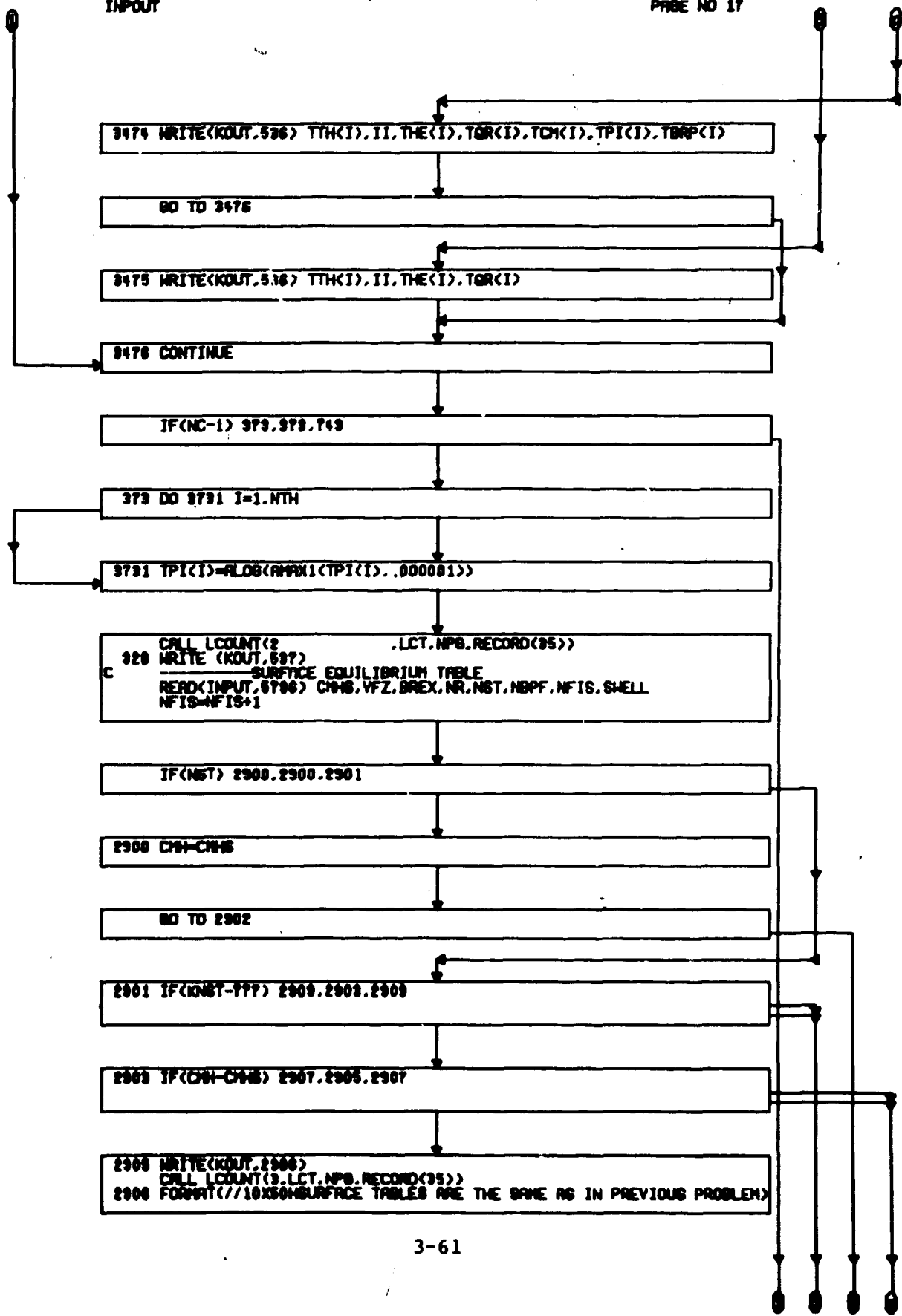


PAGE NO 16



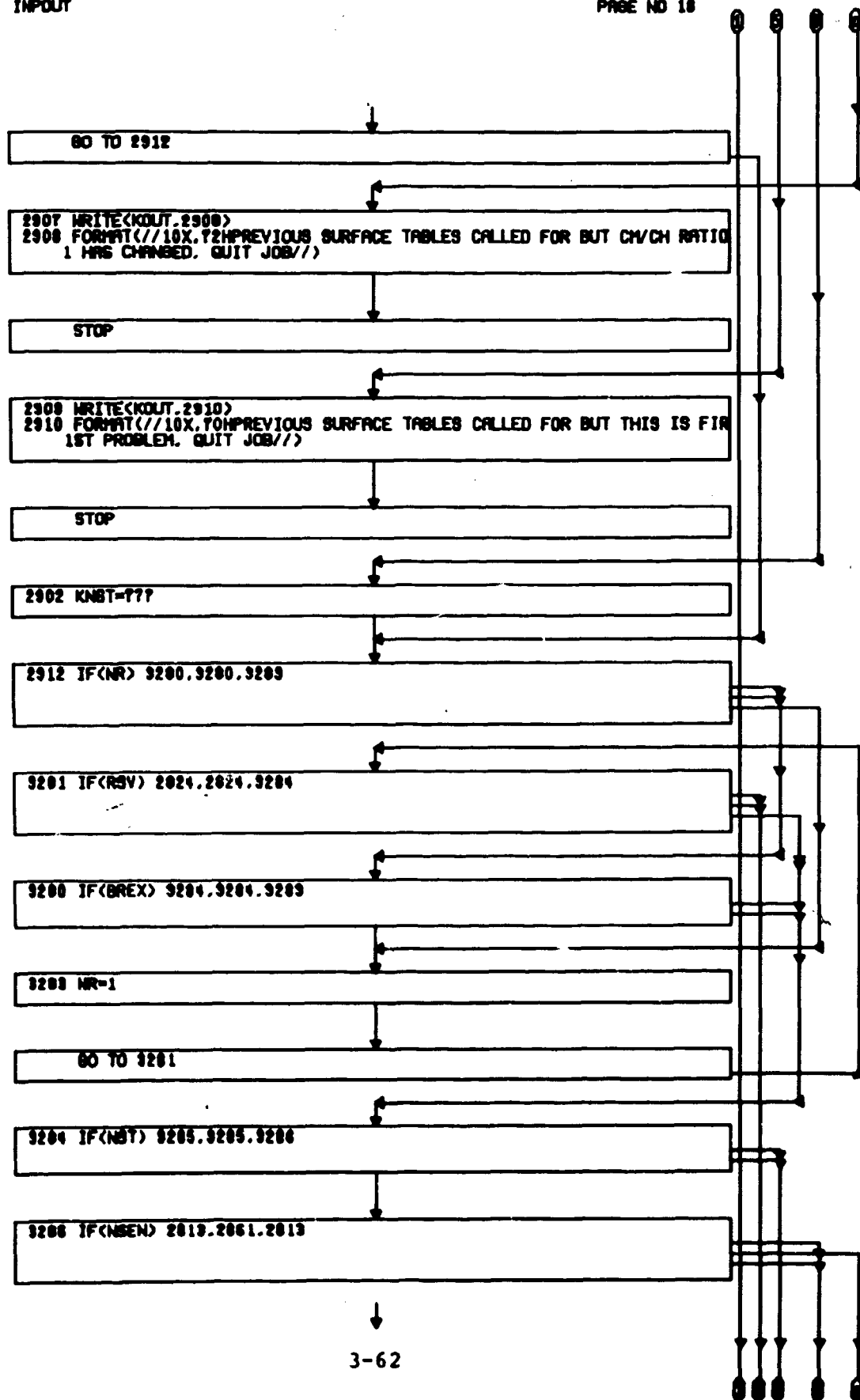
INPUT

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INPUT

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3285 CONTINUE
MLB=-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,TLHC(J,I,IP),TTS(J,I,IP),MLB,TCHEM(J,I,IP)
1,TSBK(J),JMS,TSURF(J)
TBPF(J,I,IP)=0.

GO TO 28002

28001 READ(INCH.5788)PSV,DMS,TLHC(J,I,IP),TTS(J,I,IP),MLB,TCHEM(J,I,IP)
1,TSBK(J),JMS,TSURF(J),TBPF(J,I,IP)

28002 CONTINUE

IF(JMS) 2817.2817.2821

2817 TSURF(J)=BLANK

2821 CONTINUE

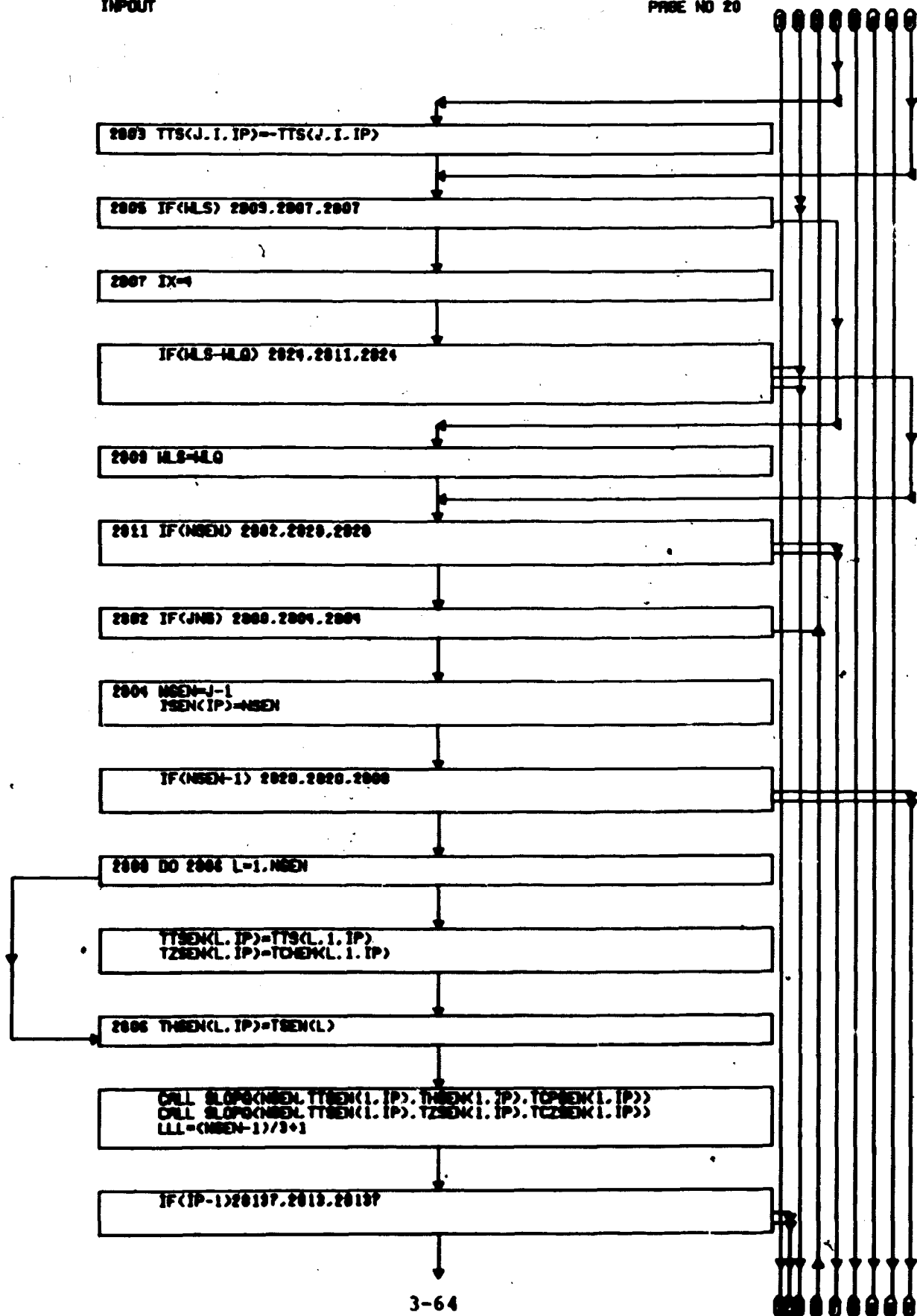
IF(TTS(J,I,IP)) 2803.2832.2801

2801 TTS(J,I,IP)=TTS(J,I,IP)*1.8
TCHEM(J,I,IP)=TCHEM(J,I,IP)*1.8
TSBK(J)=TSBK(J)*1.8

GO TO 2805

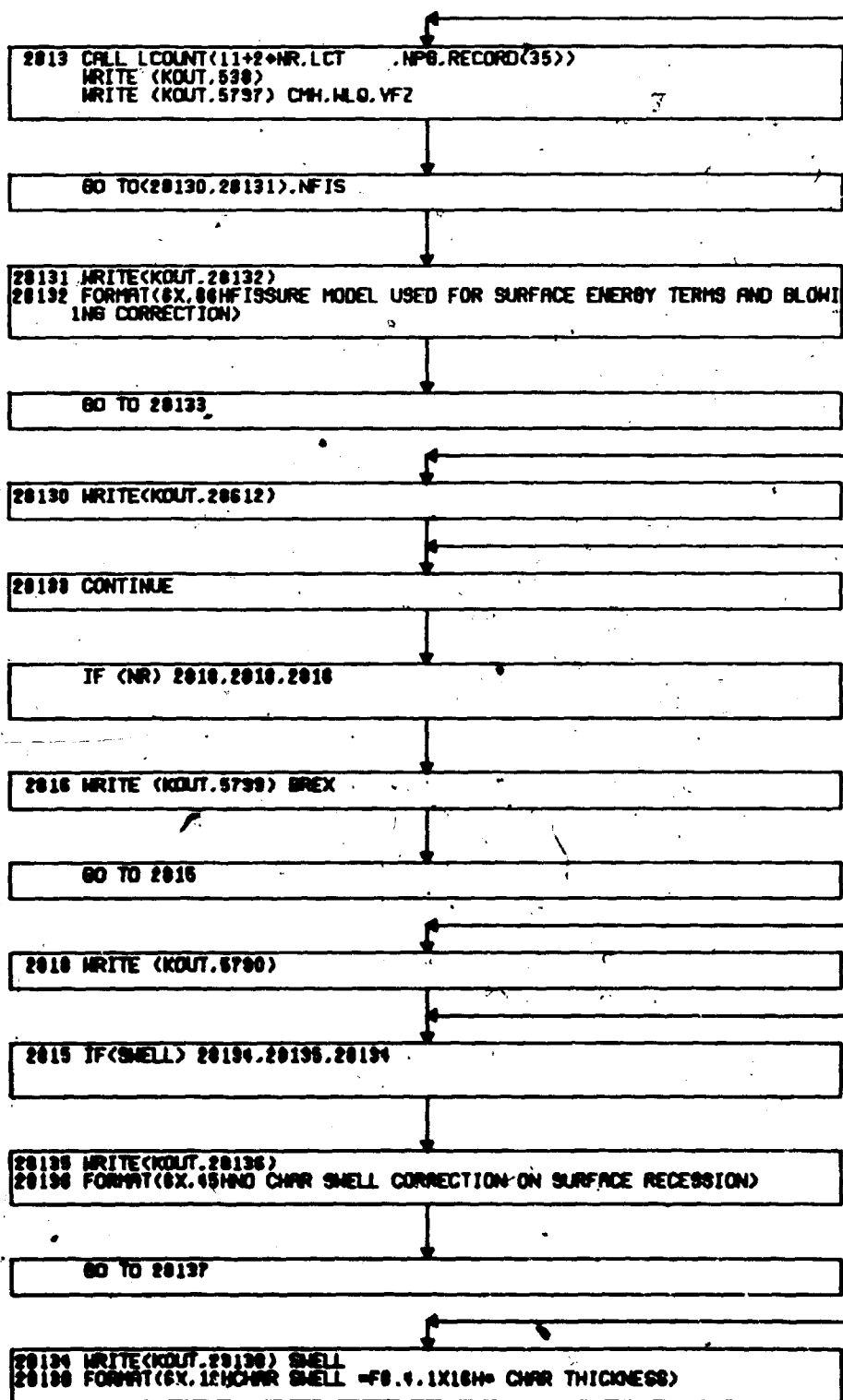
INPUT

PAGE NO 20



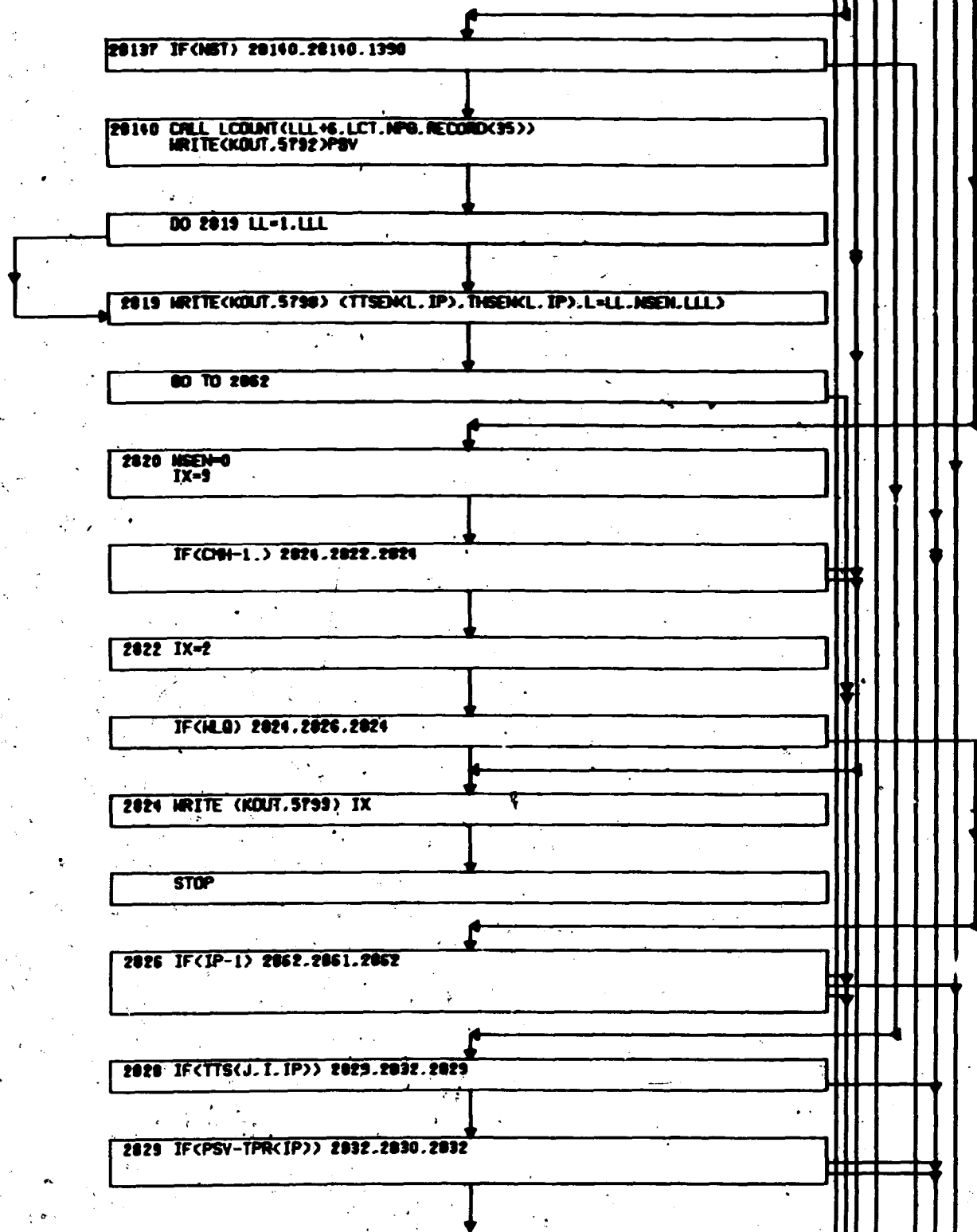
INPUT

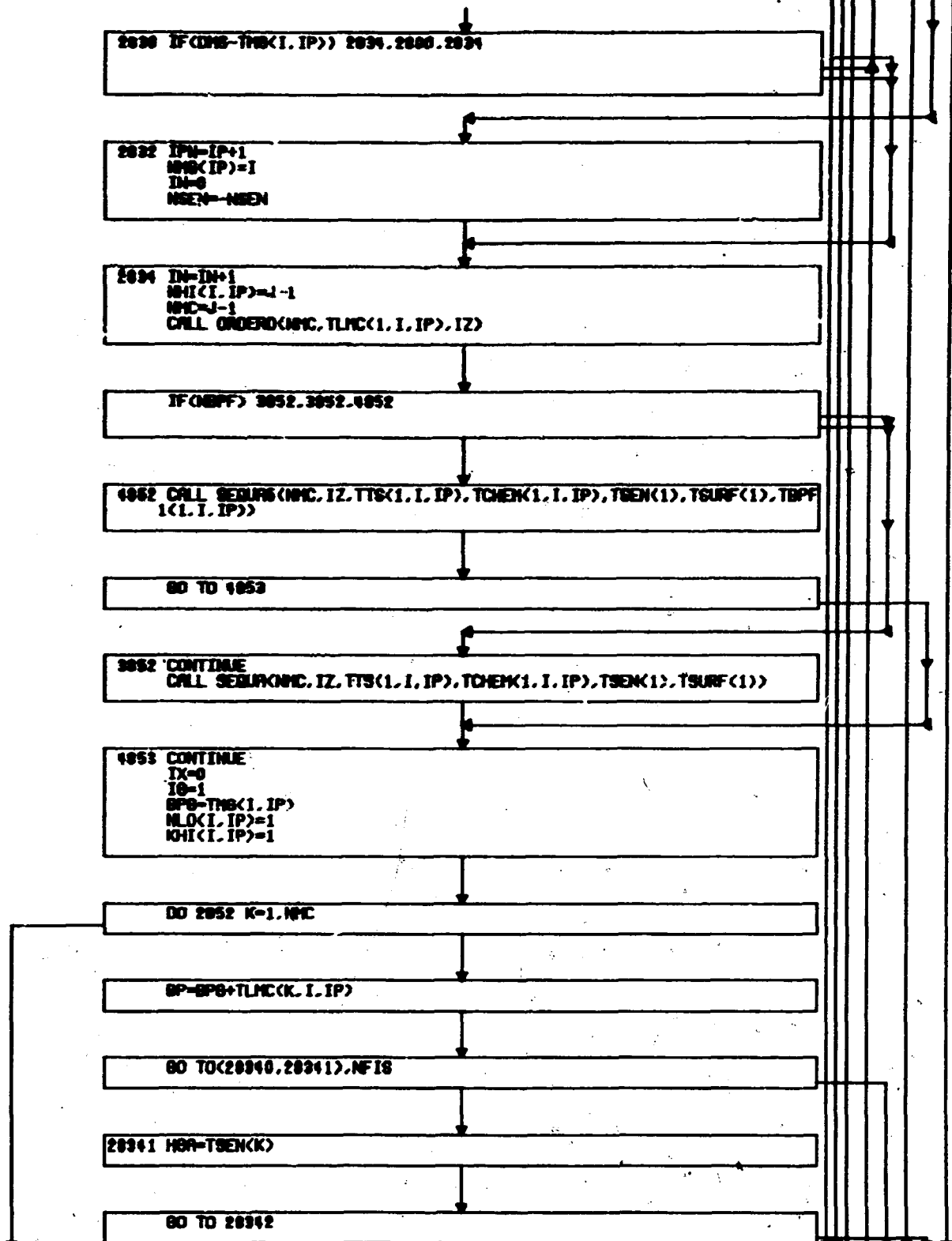
PAGE NO 21



INPUT

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20340 CONTINUE
CALL LOOK(2, TTS(K, I, IP), TT1, THS, 0, 0, 0, HGR, CT1, 1)
HGR = HGR + DELH8

20362 CONTINUE
CALL LOOK(4, TTS(K, I, IP), TT2(1, 2), THZ(1, 2), 0, 0, 0, HCH, CT2, 1)
HCH = HCH + DHZ

IF(NSEN) 2038, 2036, 2030

2038 HE = TCHN(K, I, IP)
TCHN(K, I, IP) = BP8 + HGR + TLHC(K, I, IP) + HCH - BP + TSEN(K)

GO TO 2040

2038 CALL OBLE(1, TTS(K, I, IP), HZ, ISEN(IP), TTSN(1, IP), TZSN(1, IP), TOZSN
1(1, IP))
CALL OBLE(1, TTS(K, I, IP), HE, ISEN(IP), TTSN(1, IP), THSN(1, IP), TSPSN
1(1, IP))
TCHN(K, I, IP) = BP8 + HGR + TLHC(K, I, IP) + HCH - BP + TSEN(K) + HZ - TCHN(K, I, IP)

2040 TSEN(K) = HE

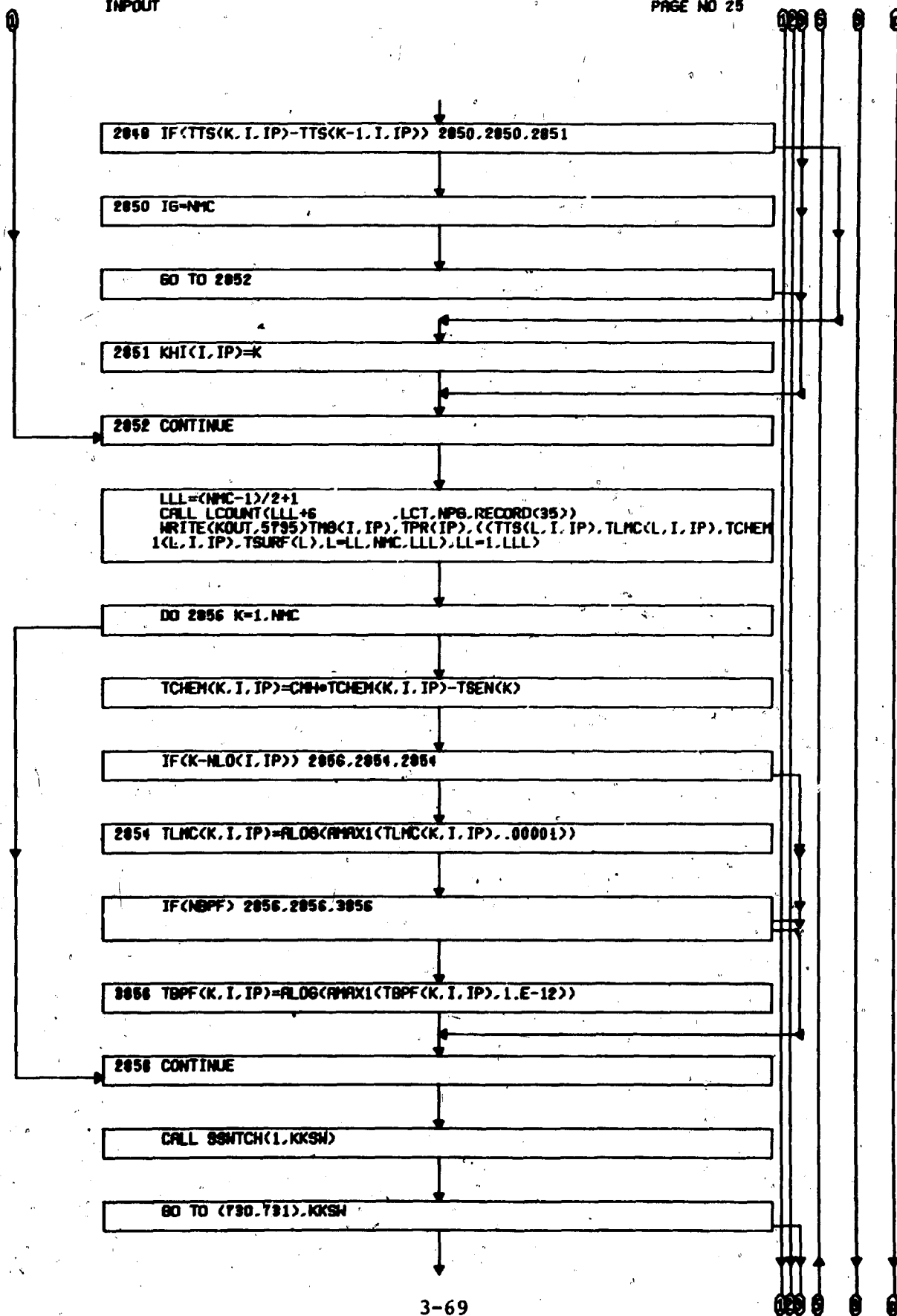
IF(TSURF(K) = BLANK) 2044, 2042, 2044

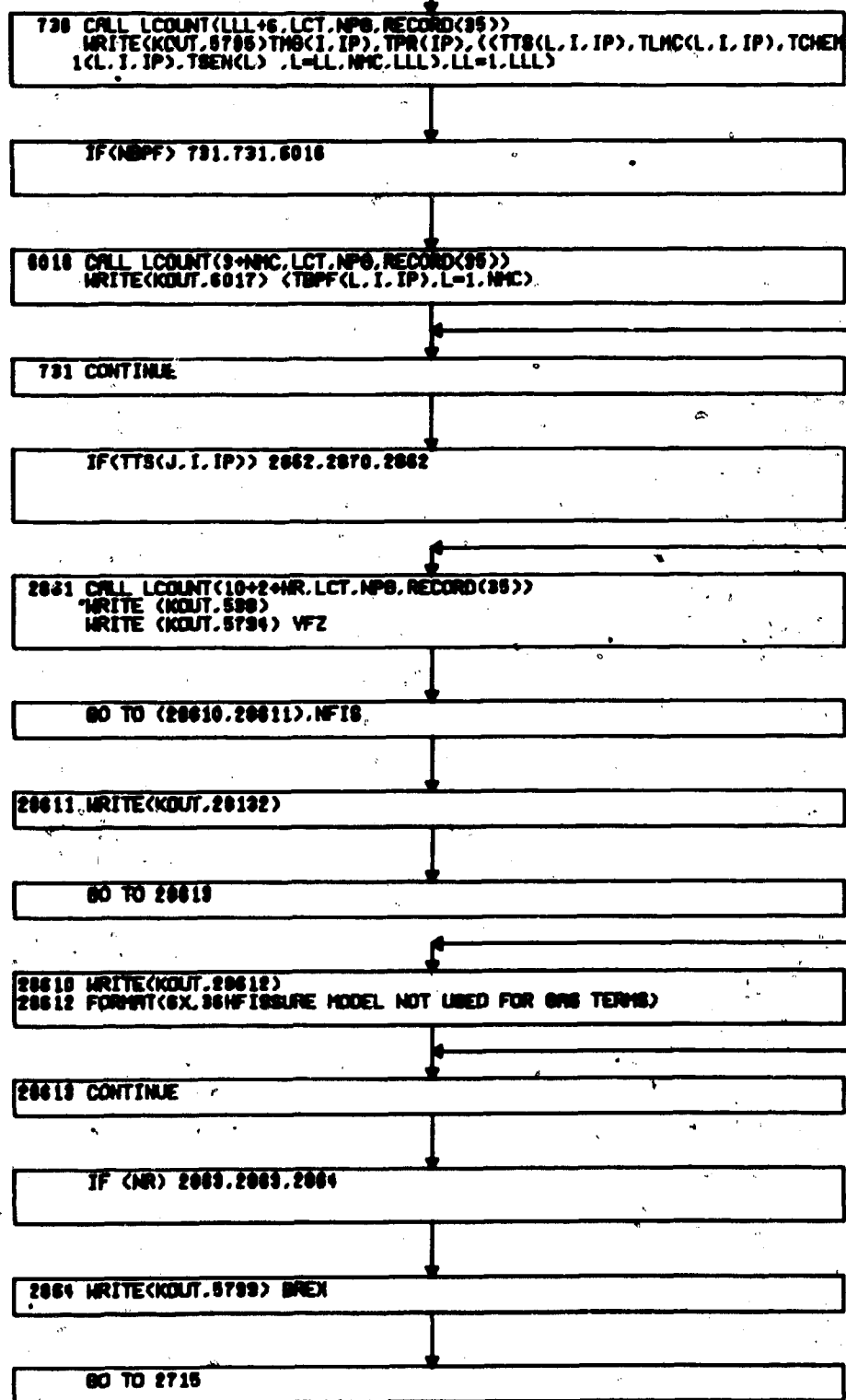
2042 HLOC(I, IP) = K + 1

IF(IG + IX - 1) 2046, 2046, 2044

2044 IX = 1

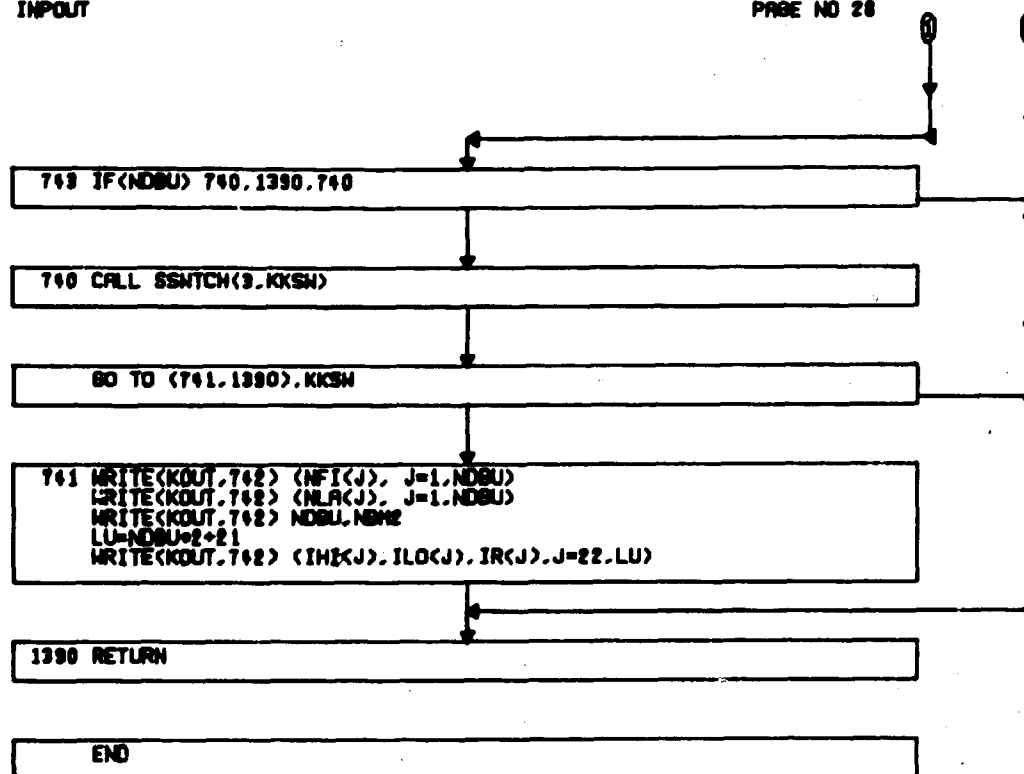
2046 IF(K - IG) 2052, 2052, 2048

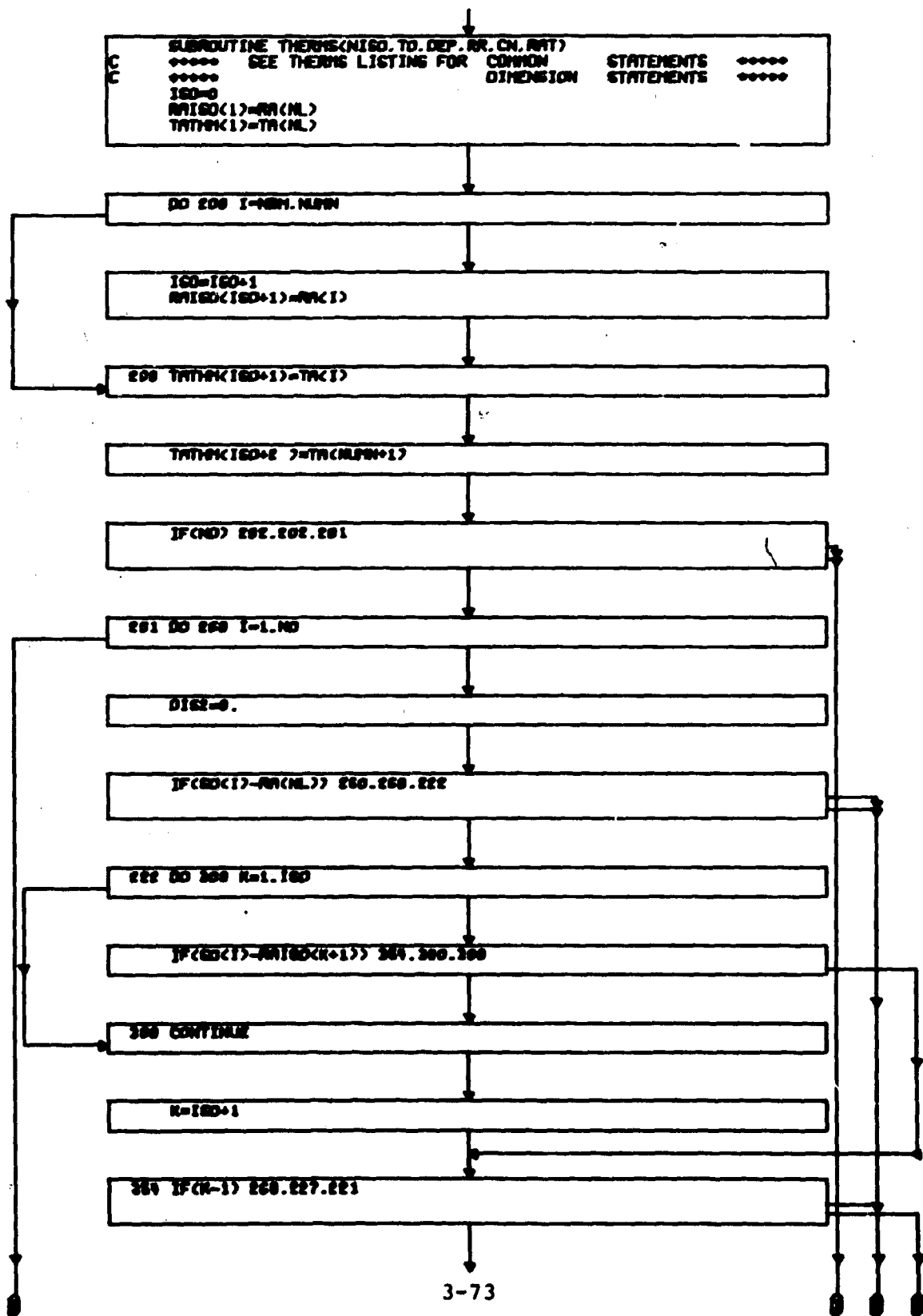


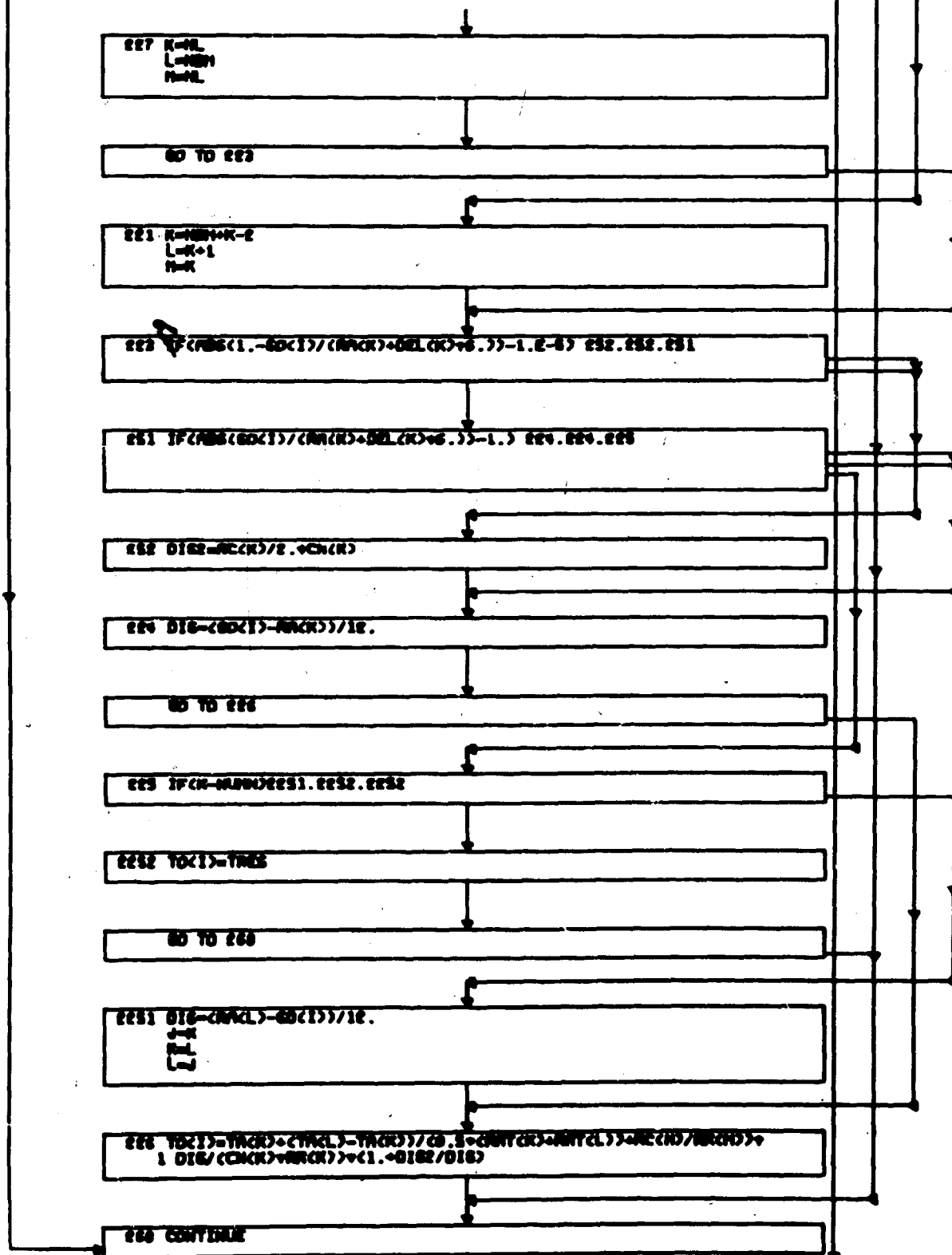


INPUT

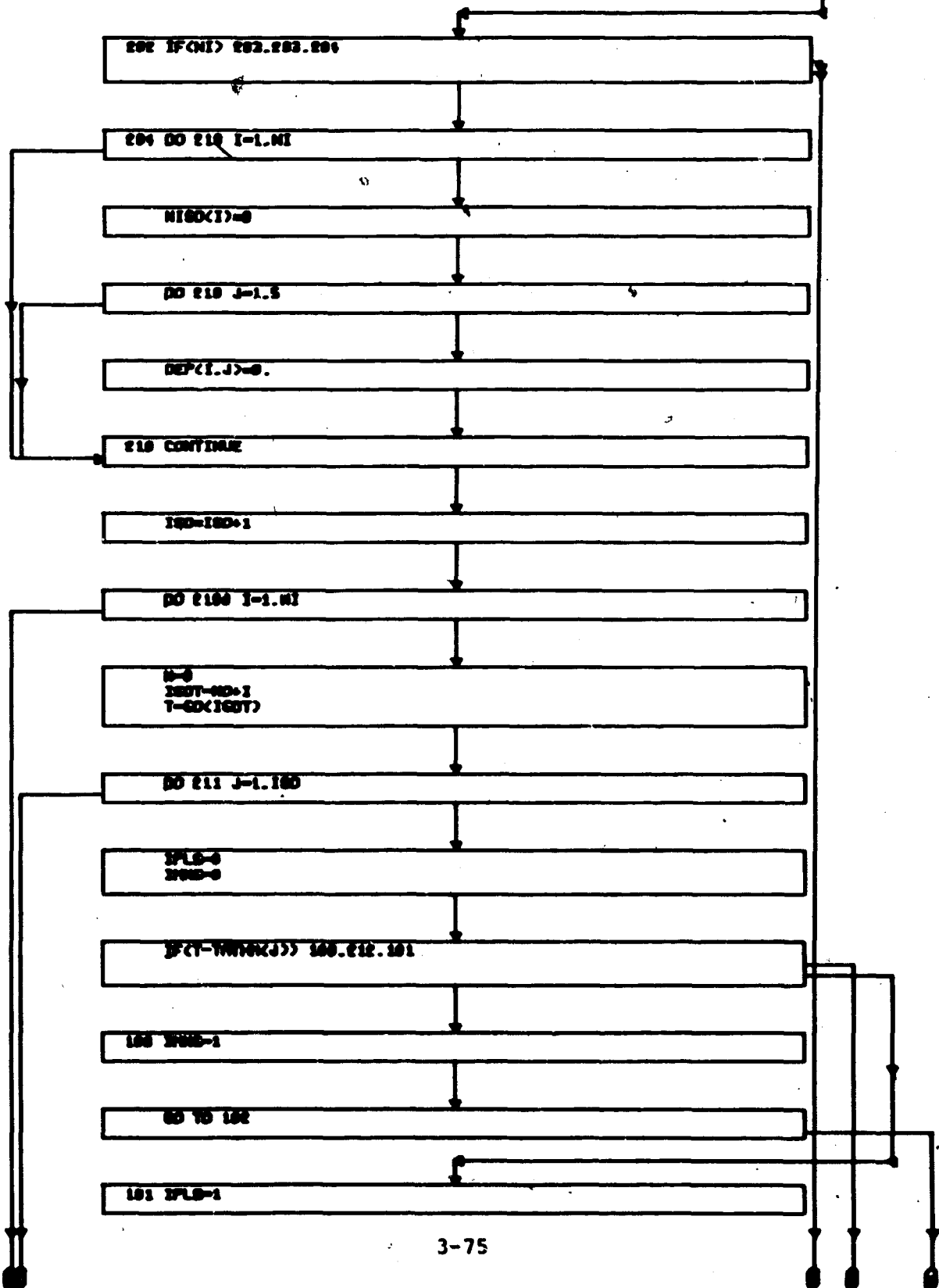
PAGE NO 28

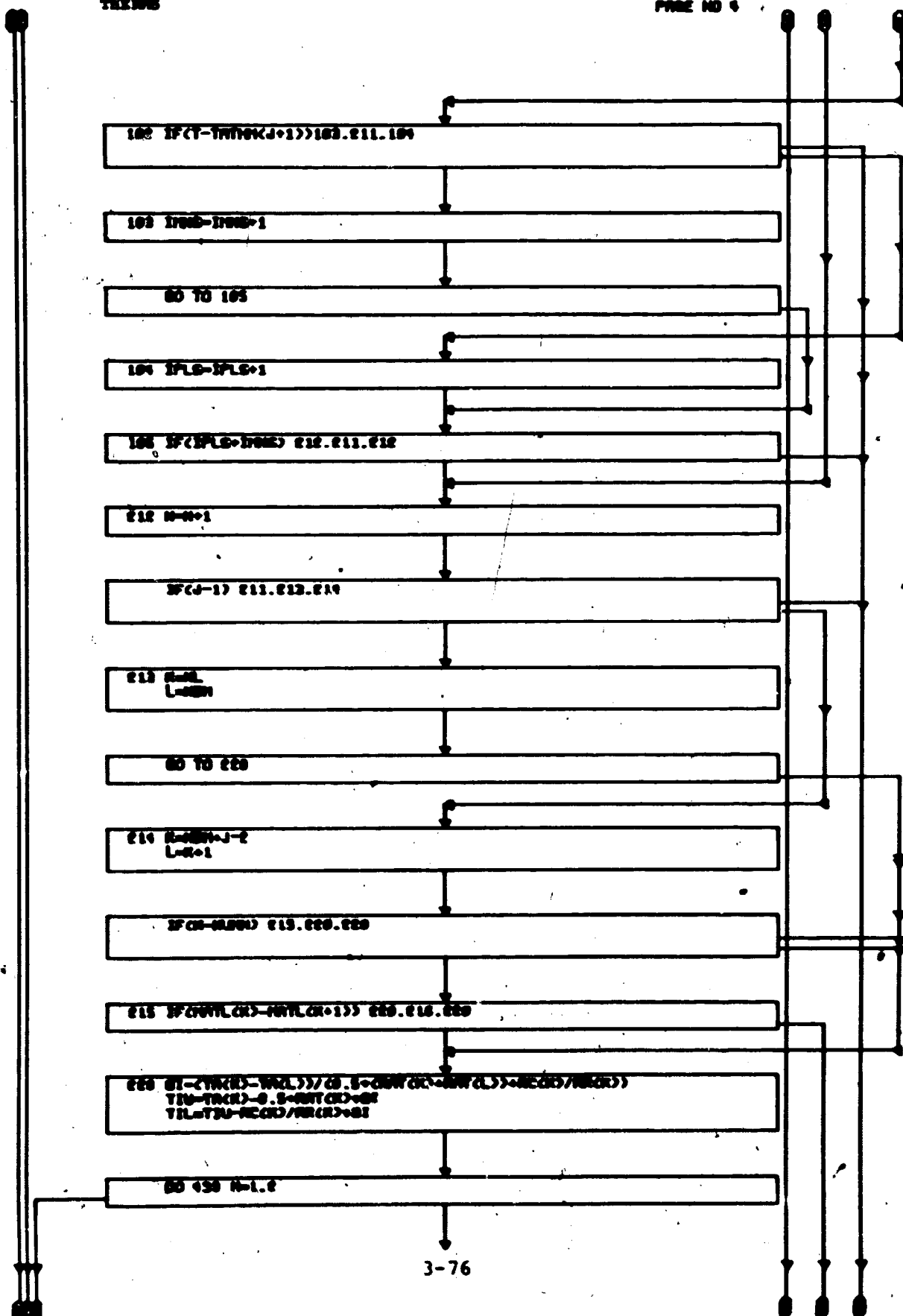






PAGE NO 3





THIRMS

PAGE NO 5

IFLS-0
IPLS-0

GO TO (401.402).H

401 T1=TRCK
T2=TIU

GO TO 402

402 T1=TIU
T2=TIL

403 IF(T-T1) 361.500.362

361 IPRB-1

GO TO 363

362 IFLB-1

363 IF(T-T2) 367.500.368

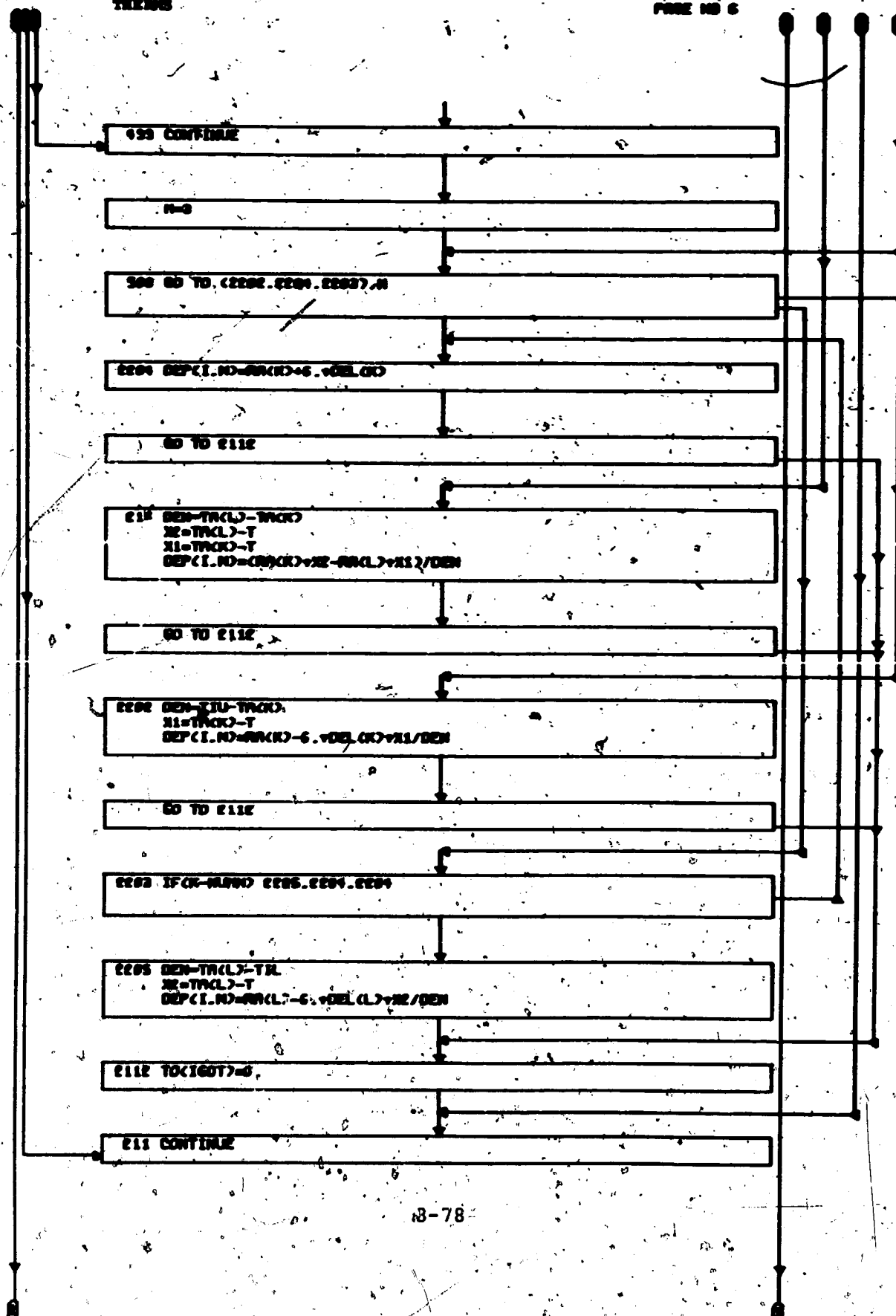
367 IPRB-IPRB-1

GO TO 365

365 IFLB-IFLB-1

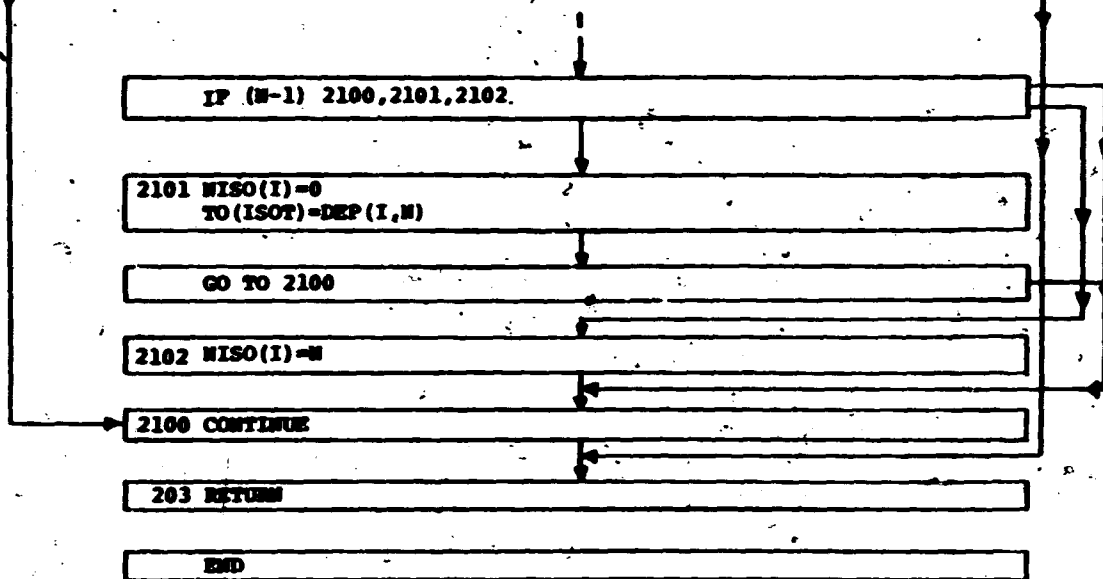
368 IF(IPRB-IPRB) 500.450.500

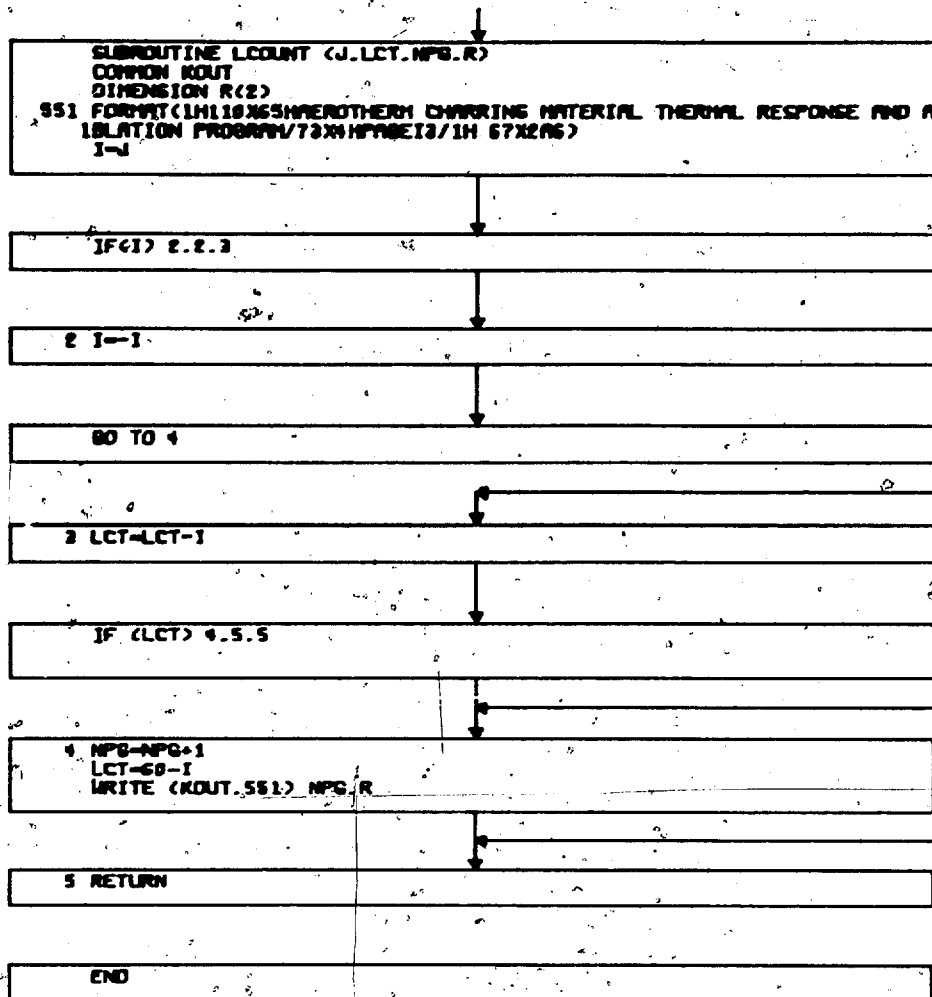
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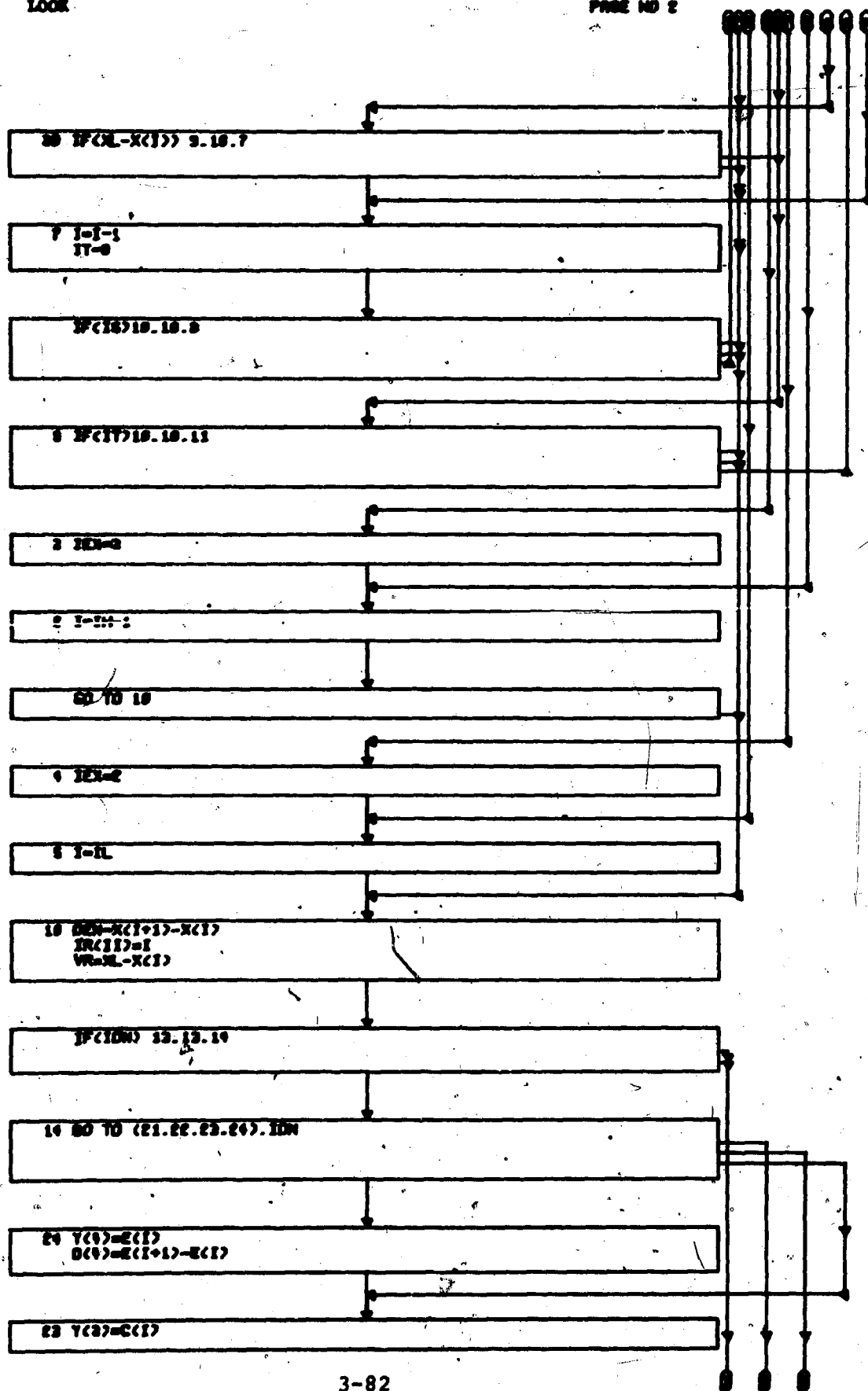
THEOREM

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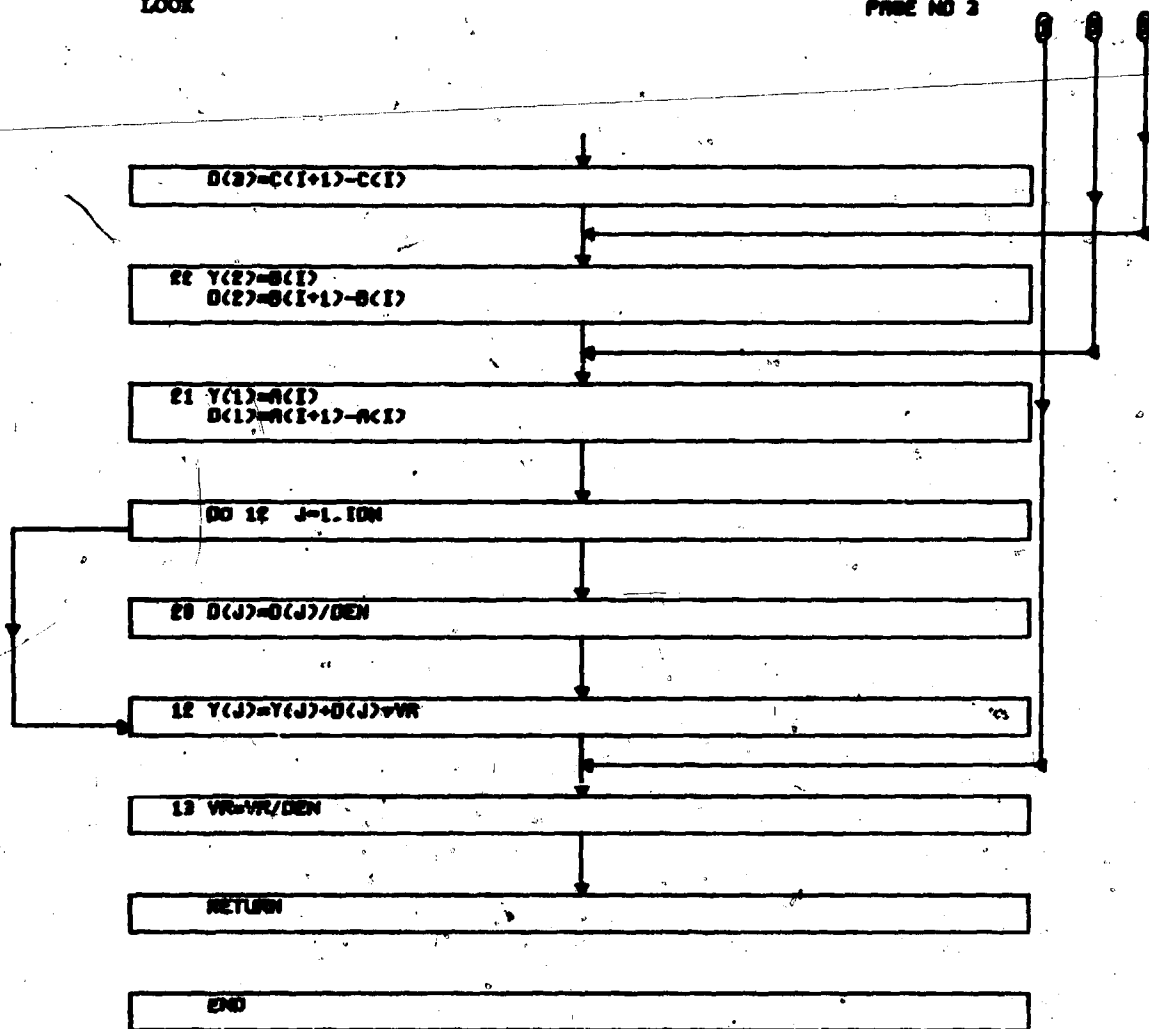


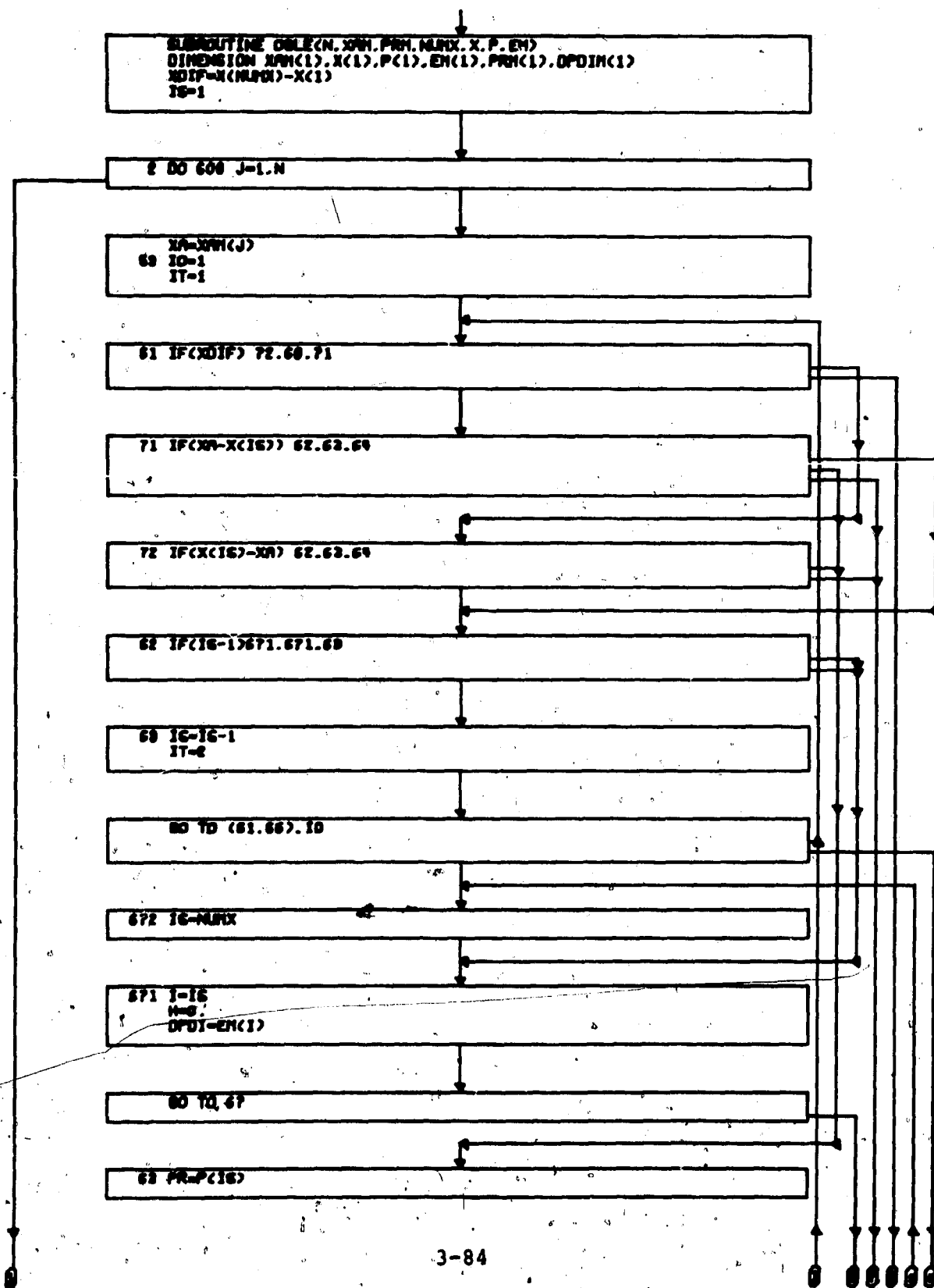


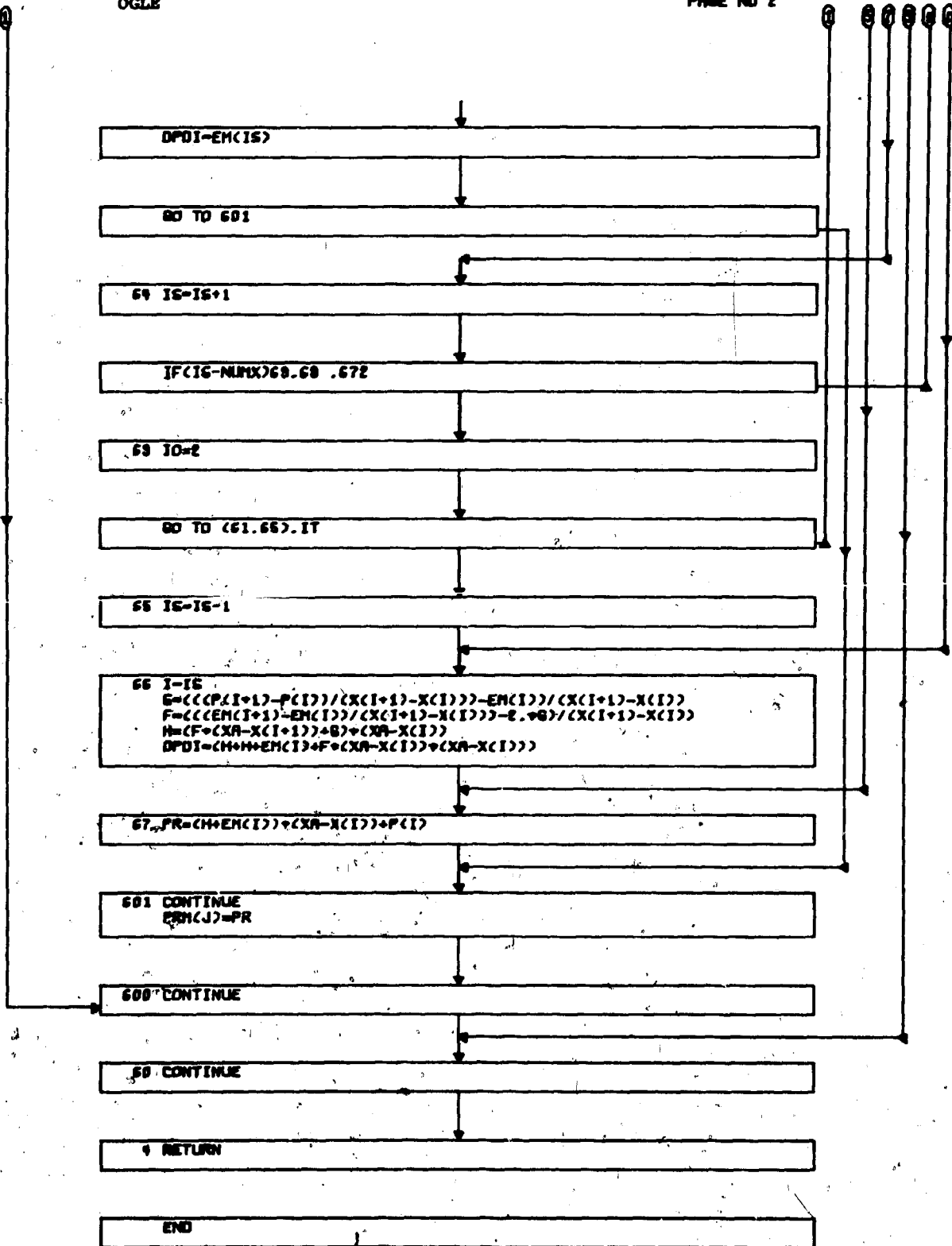


LOOK

PAGE NO 2

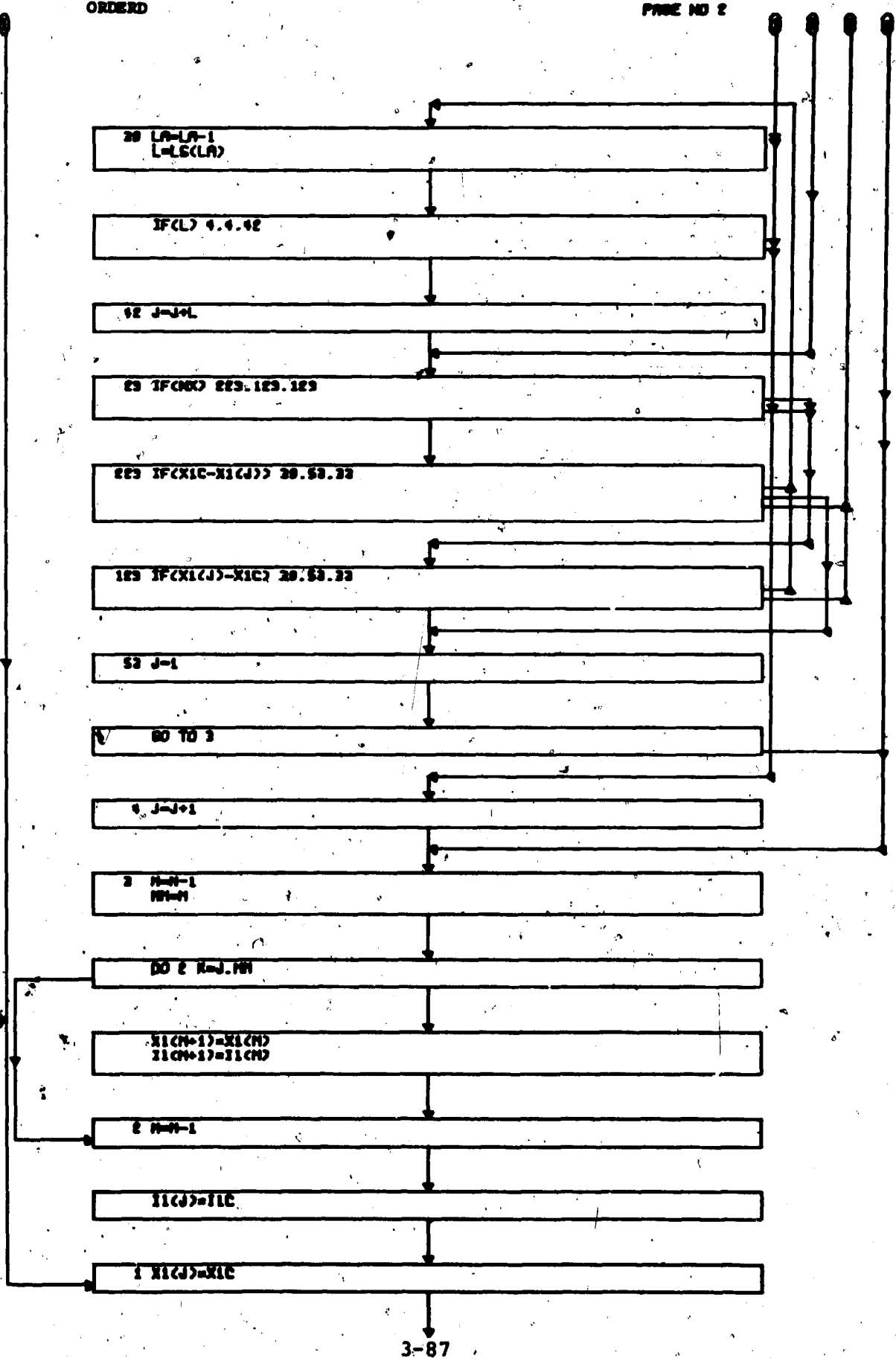






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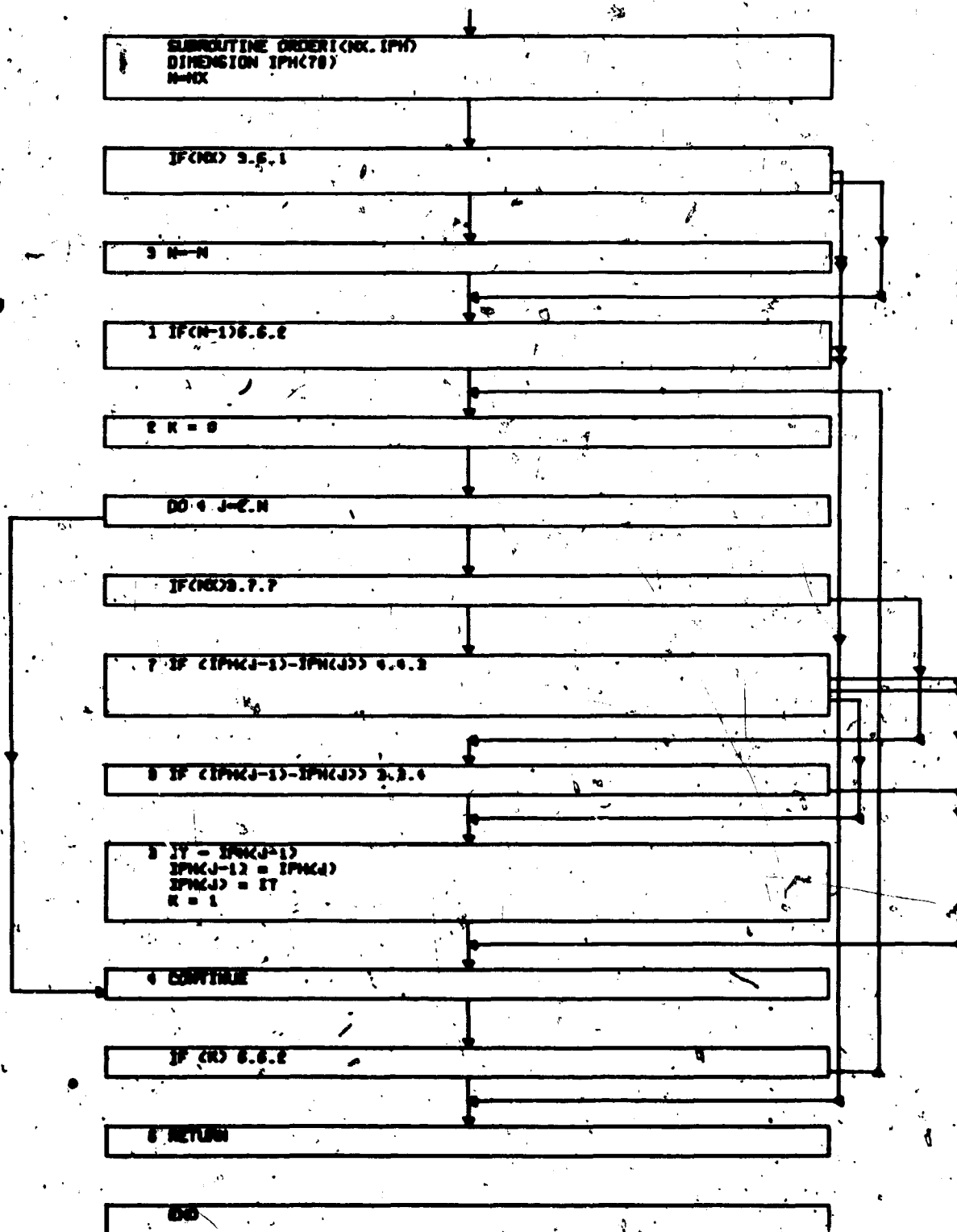
ORDERED

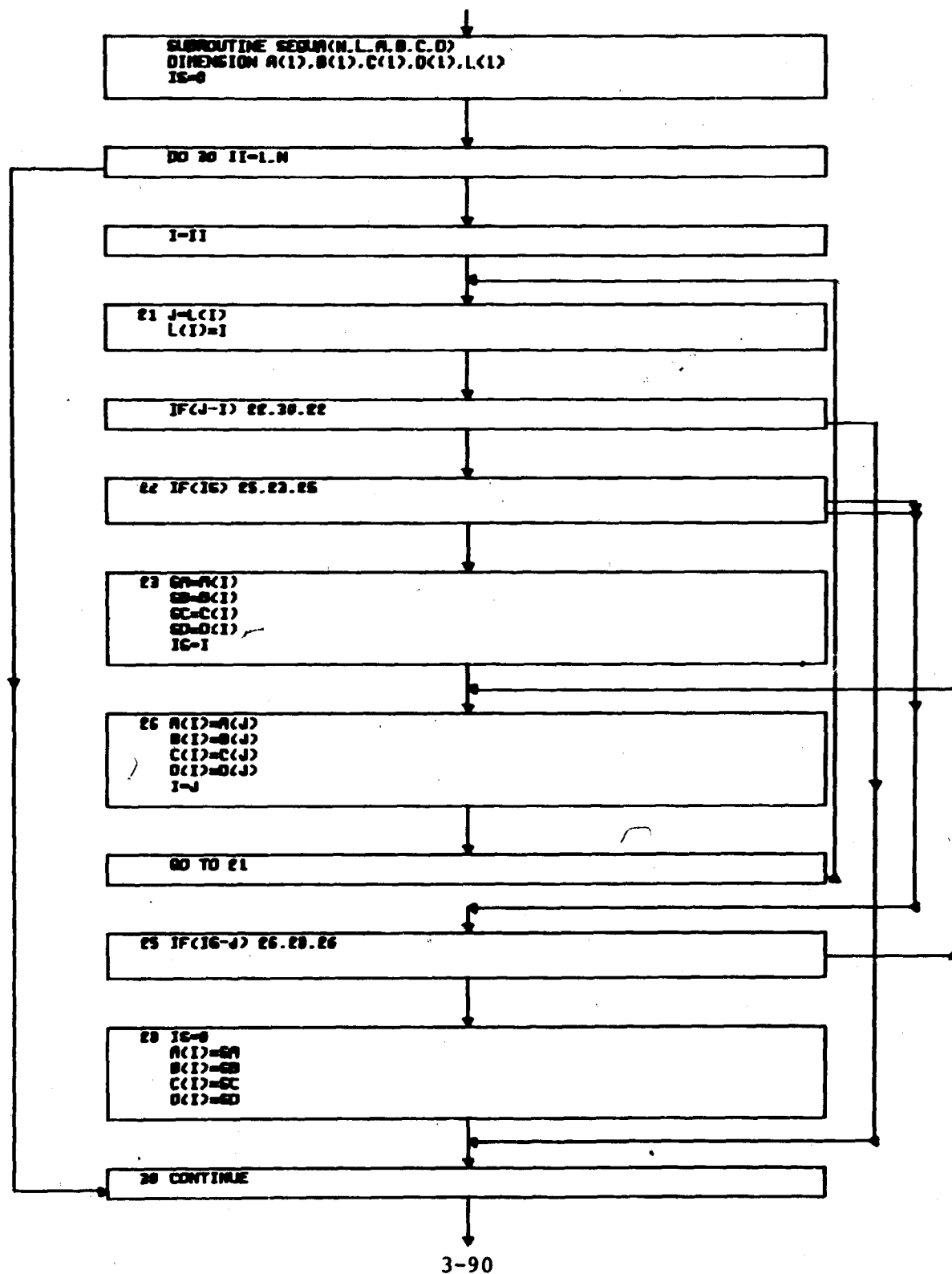
PAGE NO 2

RETURN

NO

3-88



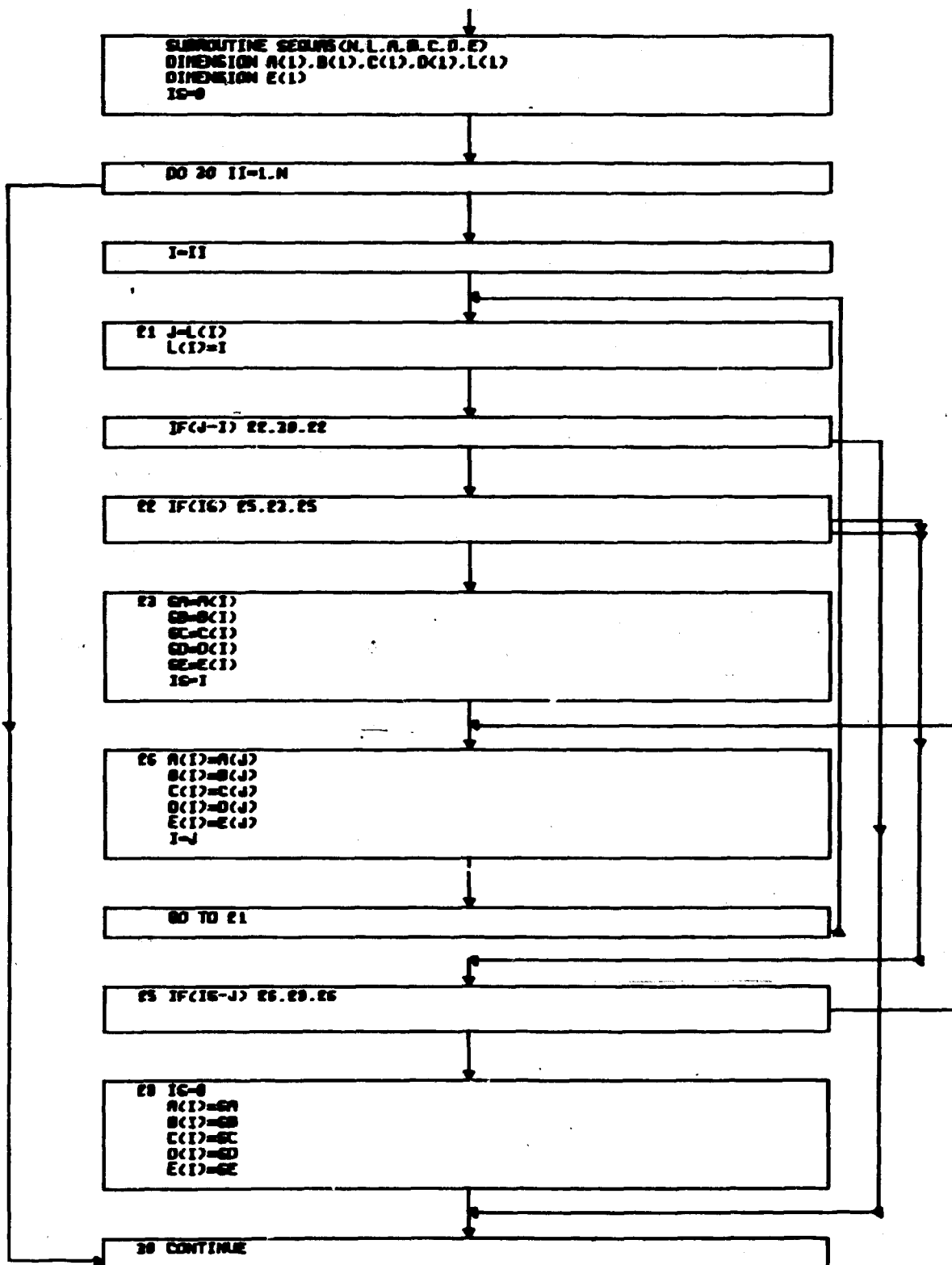


SEQUA

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↓
RETURN

END

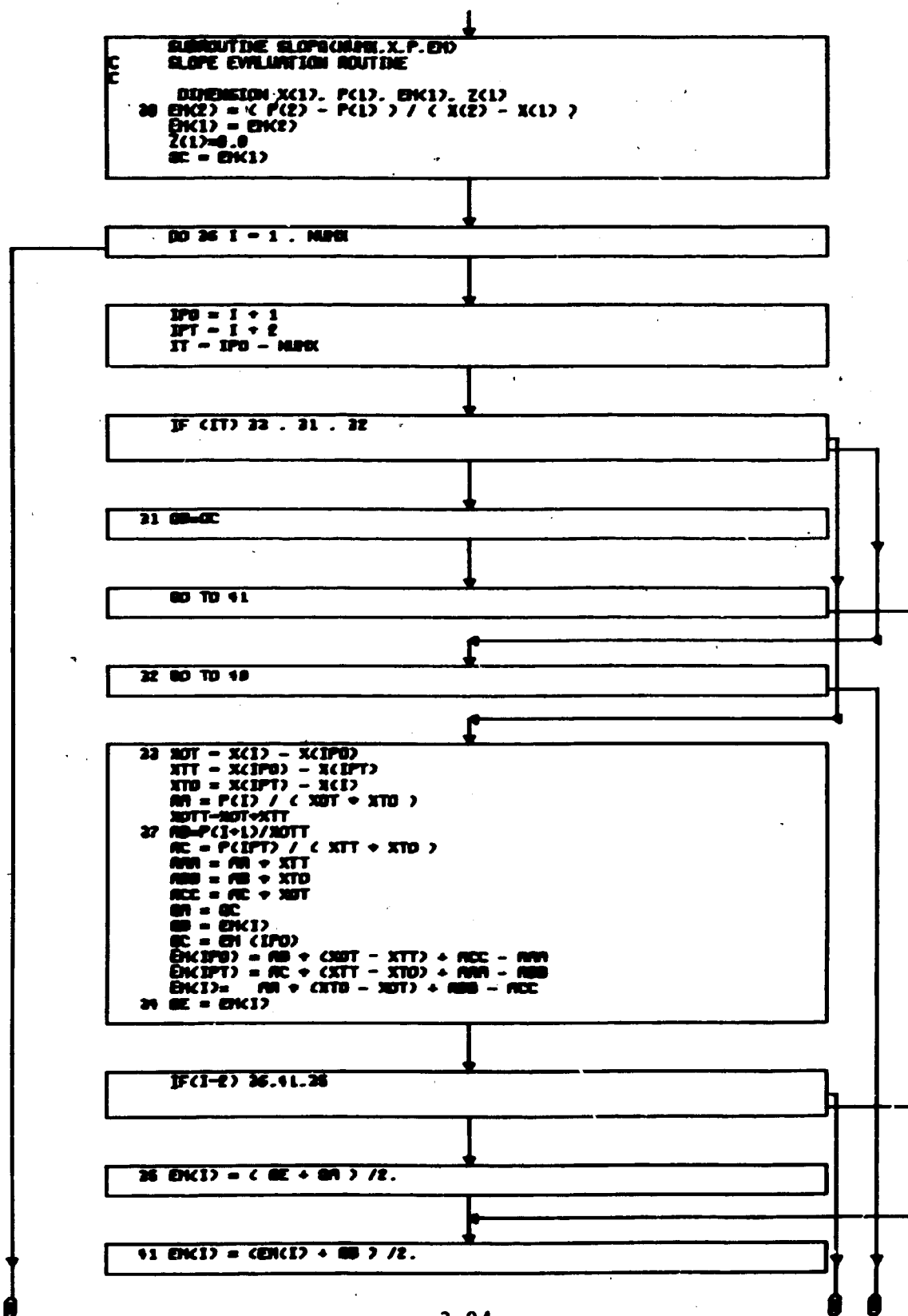


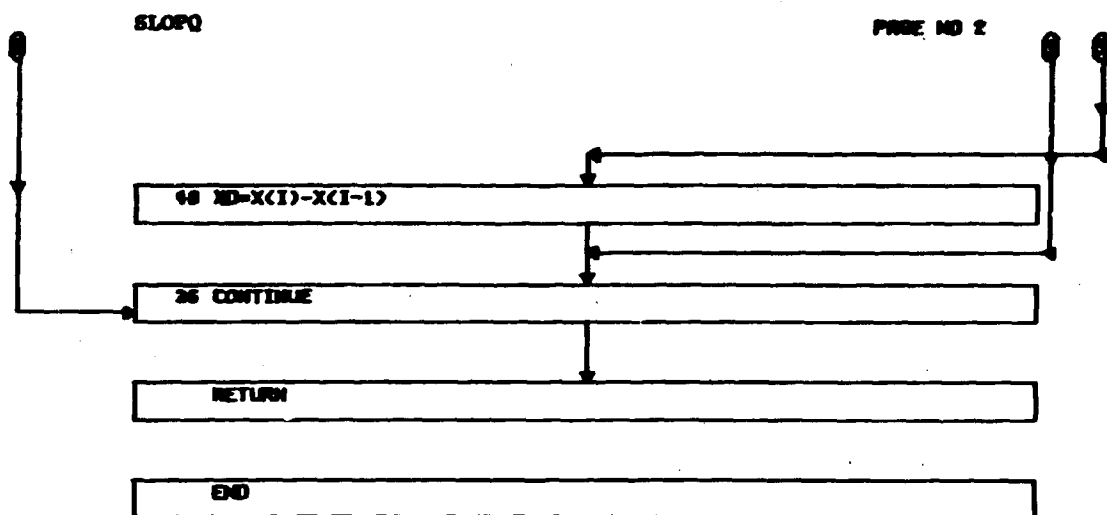
880045

PAGE NO 2

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, INPUT, 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 INPUT SUBROUTINES

1 CALL INPUT

CALL CBM

GO TO 1

END

MAIN 1

MAIN 2

MAIN 3

MAIN 4

MAIN 5

```

SUBROUTINE CBM                                CBM 1
CHARMING MATERIAL THERMAL RESPONSE AND ABLATION PROGRAM ALLOWING CBM 2
FOR UP TO FIVE DECOMPOSING BACK-UP MATERIALS CBM 3
ALHUTHERM COMPARISON WM KENDALL C MOYEN CBM 4
COMMON RGUT,ICX,UBEN,VR CBM 5
COMMON IMI(35),ILU(30),IK(30),ITZ(30,10),TCP(30,10),TKP(30,10),THZCBM 6
1(30,10),TEP(30,10),TIM(30),THE(30),TOR(30),TCN(30),TII(30),THG(30)CBM 7
2,DH12(2),RECOND(50),SO(20) CBM 8
COMMON RND(10) CBM 9
COMMON MATL( 50),DEL( 5),TA( 5),MISO( 5),RC(50),RA( 50), CBM 10
1APEA( 50),EMA( 50),RAV( 50) CBM 11
COMMON ROA( 500),HOB( 500),HOC( 500) CBM 12
COMMON TPH(3),NPH,DIOT(2),THG(15,3),NLO(15,3),NHI(15,3), CBM 13
IKHI(15,3),TTSEN(25,3),THSEN(25,3),TCPSEN(25,3),TLNC(25,15,3), CBM 14
2ISEN(3),TPI(30),TTS(25,15,3),TCHEM(25,15,3),VFZ,CBM 15
COMMON THFF(25,15,3) CBM 16
COMMON NPP CBM 17
COMMON LCT,MFG,11,NBN,NUN,NL,DELHG,DELH,RFT,RHORA,RHORB,RHORB,TRACBM 18
1CA,TRACB,THACC,RHOOA,RHOOB,RHOC,EA,EB,EC,BA,BB,BC,PSIA,PSIB,PSIC,CBM 19
2TRACH,PET,PETE,KSV,ETA,DTPR3,DTPR2,DTPRT,TPR3,TPR2,THZRO,THFIN,WF,CBM 20
3THMT,GAMA,OMG,NG,FJFH,FJFS,FJFHP,JFH,INPUT, DTHIN,BRP,MCONV,CBM 21
4EPSA,TRES CBM 22
COMMON INCH,DTHB CBM 23
COMMON HN,NI,NDI CBM 24
COMMON CMCR1,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 NBRF,NFIS 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
1ROCON(50,3),DMC(5),DM(5),RHOC(5),RHOF(5),P(5),PP(5),TREF(5),GA(5)CBM 33
2,OMGA(5),NF1(5),MLA(5),TTS(30,10),TENT(30,10),TKBU(30,10),TCBU(30,CBM 34
310),X(50),NDBU,NDB2 CBM 35
COMMON TRAC(5,3) CBM 36
COMMON NBUFT(5) CBM 37
COMMON DATA/ASTEN,BLANK CBM 38
DIMENSION DROT(3) CBM 39
DIMENSION CNO(50) CBM 40
DIMENSION DMC(3),CPE(3) CBM 41
DIMENSION TO(20) CBM 42
DIMENSION DEP(10,5),MISO(10) CBM 43
DIMENSION VITER(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),CPI( 50),MP( 50),MC( 50),CN( 50), CBM 46
1RAT(51),ROT(50),RO(50),RON(50),DMOG(50),RR(50), CBM 47
2CNC( 50),AI( 50),BI( 50),CI( 50),DI( 50),EMO( 50) CBM 48
EQUIVALENCE (DH1,DM12(1)),(DM2,DM12(2)),(TS,TA) CBM 49
529 FORMAT(17H ITERATION=STOP ) CBM 50
542 FORMAT(13X14H-----OUTPUT-----) CBM 51
543 FORMAT(1//6A2BH-----F9.4,37H SECONDS - - - CBM 52
1-----) CBM 53
544 FORMAT(6X,4HTIME,2X,4HMSURF,2X,4HPROB,2X,7HSURFACE,5X,6HWALL, CBM 54
14X,6HE EDGE,6X,10HEAT COEFF,6X,6HCH/CMO,6X,4HSTEP,2X,4HITER,2X,4HCBM 55
20PTH,2X,6HRAD (IN),3X,6H(BTU/LB),2X,6H(BTU/LB),3X,14HILB/SQ FT-SECCBM 56
3)) CBM 57
545 FORMAT(6X,14.216,F10.4,F11.2,F10.2,F12.4,7X,F8.5/1H ) CBM 58
546 FORMAT(13X,20H-----ABLATION RATES-----) CBM 59
547 FORMAT(6X,7H PTIME,3X,9H PRIME G,3X,10HM DOT CHAR,3X,9HM DOT GASCBM 60
16X,6HM CHAM,7X,5HM GAS/34X,14HILB/SQ FT-SEC),11X,15HILB/ORIG SQ FTCBM 61
2)) CBM 62
548 FORMAT(6X,F8.5,2X,F8.5,4(3X,F10.6)/1H ) CBM 63
5490 FORMAT(27X,32H-----RECESSIONS/RECESSION RATES-----/ CBM 64
133X,19H1IN) / (IN/SEC)/ CBM 65
2 16X,7HSURFACE,16X,6HCHAM (F4.2,1H),11X,11HPYROLYSIS (F4.2,1H)CBM 66
5491 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/CRIG SOCBM 69
2 FT)/ CBM 70
3 13X,10HCONVCTED ,4X,10H RADIATED ,4X,10H RADIATED ,4X,10H CHECBM 71
MICAL ,4X,10HCONDUCTION/17X,2HIN,12X,2HIN,11X,3HOUT,8X,10HGENERATIONCBM 72
50H,7X,4HAWAY) CBM 73
5483 FORMAT(6X,4HRATE,3X,5(E10.3,4X)/6X,5HSTOTAL,2X,5(E10.3,4X)/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 FTCBM 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
50HIN SOLID,6X,6HREAR FACE) CBM 80
5485 FORMAT(6X,4HRATE,3X,5(E10.3,4X)/6X,5HSTOTAL,2X,5(E10.3,4X)/1H ) CBM 81
549 FORMAT(6X,6HMODE MAT,3X,4HTEMP,3X,7HDEENSITY,3X,8HENTHALPY,2X,6HMODE MAT,3X,4CBM 82
1TEMP,3X,7HDEENSITY,3X,8HENTHALPY/15X,7H(DEG R)11H (ILB/CU FT)9H (BTU/LB)CBM 83
211X,7H(DEG R)11H (ILB/CU FT)9H (BTU/LB)) CBM 84
5490 FORMAT(6X,6HMODE MAT,3X,4HTEMP,3X,7HDEENSITY,2X,9HCOND(BTU//2X,6HMOCBM 85
1DE MAT,3X,4HTEMP,3X,7HDEENSITY,2X,9HCOND(BTU//15X,7H(DEG R)11H (ILB/CB 86
2/CU FT),9H FT SC F),11X,7H(DEG R)11H (ILB/CU FT),9H FT SC F)) CBM 87
550 FORMAT(5X,214,F9.2,F10.3,2X,F8.6,1X,214,F9.2,F10.3,F10.2) CBM 88
5500 FORMAT(5X,214,F9.2,F10.3,2X,F8.6,1X,214,F9.2,F10.3,F10.6) CBM 89
551 FORMAT(1H)10X6SHAENOTHERM CHARRING MATERIAL THERMAL RESPONSE AND ACBH CBM 90

```

CDB	91
CDB	92
CDB	93
CDB	94
CDB	95
CDB	96
CDB	97
CDB	98
CDB	99
CDB	100
CDB	101
CDB	102
CDB	103
CDB	104
CDB	105
CDB	106
CDB	107
CDB	108
CDB	109
CDB	110
CDB	112
CDB	111
CDB	113
CDB	114
CDB	115
CDB	116
CDB	117
CDB	118
CDB	119
CDB	120
CDB	121
CDB	122
CDB	123
CDB	124
CDB	125
CDB	126
CDB	127
CDB	128
CDB	129
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CDB	132
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CDB	162
CDB	163
CDB	164
CDB	165
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CDB	168
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CDB	170
CDB	171
CDB	172
CDB	173
CDB	174
CDB	175
CDB	176
CDB	177
CDB	178
CDB	179
CDB	180

C	BEGINNING OF TIME LOOP	CBN	101
C		CBN	102
C	410 ITER=ITER+1	CBN	103
C		CBN	104
C	CALCULATION OF NUJAL PROPERTIES	CBN	105
C		CBN	106
	DO 100 N=2,NL	CBN	107
100	RA(N-1)=RA(N-1)+US1	CBN	108
	RA(NL)=RA(NL)+DS1/2.	CBN	109
	CALL UGLE(NL,WA,NK,NUMN,NAV,AREA,CMA)	CBN	110
	ASU=RA(1)	CBN	111
	J=1-JF N-JF	CBN	112
100	DO 105 N=1,NL	CBN	113
	J=J+JF	CBN	114
	RR(N)=RR(N)/ASU	CBN	115
	CALL LOOK(3,TA(N),TT2,TCP,TKP,THZ,0,Y2,Y2(4),3)	CBN	116
	CN(N)=Y2(7)	CBN	117
	CPV(N)=Y2(1)	CBN	118
	MP(N)=Y2(3)+DM1	CBN	119
	CALL LOOK(4,TA(N),TT2(1,2),TCP(1,2),TKP(1,2),THZ(1,2),0,Y2,02,3)	CBN	120
	CNC(N)=Y2(2)	CBN	121
	CPC(N)=Y2(1)	CBN	122
	MC(N)=Y2(3)+DM2	CBN	123
	IF (MATL(N)-1) 103,101,102	CBN	124
101	X(N)=1.	CBN	125
	CP(N)=CPV(N)	CBN	126
	H(N)=MP(N)	CBN	127
	MO(N)=RMO(1)	CBN	128
	ROT(N)=RMO(1)	CBN	129
	GO TO 105	CBN	130
102	X(N)=0.	CBN	131
	CN(N)=Y2(2)	CBN	132
	H(N)=MC(N)	CBN	133
	CP(N)=CPC(N)	CBN	134
	MO(N)=RMO(2)	CBN	135
	ROT(N)=RMO(2)	CBN	136
	GO TO 105	CBN	137
103	X(N) = PETE-PET/MO(N)	CBN	138
	H(N)=X(N)*MP(N)+(1.-X(N))*MC(N)	CBN	139
	CP(N)=X(N)*CPV(N)+(1.-X(N))*CPC(N)	CBN	140
	IF (N-1) 109,109,104	CBN	141
109	NOT(N)=GAMA*(ROA(1)+ROB(1))+ONG*ROC(1)	CBN	142
	GO TO 105	CBN	143
104	ROT(N)=(ROA(J)+ROB(J))+GAMA+ONG*(ROC(J))	CBN	144
105	CONTINUE	CBN	145
	IF (ITER) 1050,1050,1051 +	CBN	146
1050	RAT(NL)=DEL(NL)/(RR(NL)*(CN(NL)*X(NL)+CNC(NL)*(1.-X(NL))))	CBN	147
1051	CONTINUE	CBN	148
	IF (NUMU) 7413,7413,7412	CBN	149
7412	DO 740 L=1,NUMU	CBN	150
	LL=MF1(L)	CBN	151
	LU=MLA(L)	CBN	152
	N=2*LL-1	CBN	153
	DO 741 J=LL,LU	CBN	154
	CALL LOOK(20,2*LL,TA(I),TTS(1,N),TCBU(1,N),TKBU(1,N),TENT(1,N)	CBN	155
	+ 0,Y2,02,3)	CBN	156
	CN(I)=Y2(2)	CBN	157
	CPV(I)=Y2(1)	CBN	158
	MP(I)=Y2(3)+DMV(L)	CBN	159
	CALL LOOK(21,2*LL,TA(I),TTS(1,2*LL),TCBU(1,2*LL),TKBU(1,2*LL),	CBN	160
	TENT(1,2*LL)+ 0,Y2,02,3)	CBN	161
	CNC(I)=Y2(2)	CBN	162
	CPC(I)=Y2(1)	CBN	163
	MC(I)=Y2(3)+DMC(L)	CBN	164
	H(I)=X(I)*MP(I)+(1.-X(I))*MC(I)	CBN	165
	RA(I)=AREA(I)/ASU	CBN	166
	IF (ITER) 741,7411,741	CBN	167
7411	RO(I)=X(I)*RMOV(L)+(1.-X(I))*RMO(L)	CBN	168
	RON(I)=RO(I)	CBN	169
	RAT(I)=DEL(I)/(HR(I)*(CN(I)*X(I)+CNC(I)*(1.-X(I))))	CBN	170
741	CP(I)=X(I)*CPV(I)+(1.-X(I))*CPC(I)	CBN	171
740	CONTINUE	CBN	172
7413	IF (NUMN-NBM2) 112,106,106	CBN	173
106	DO 107 N=NUM2,NUMN	CBN	174
	RR(N)=AREA(N)/ASU	CBN	175
	KT=MATL(N)	CBN	176
	CALL LOOK(KT+2,TA(N),TT2(1,KT),TCP(1,KT),TKP(1,KT),0,0,Y2,02,2)	CBN	177
	CP(N)=Y2(1)	CBN	178
	CN(N)=Y2(2)	CBN	179
	RAT(N)=DEL(N)/(CN(N)*RR(N))	CBN	180
107	RO(N)=RMO(KT)	CBN	181
112	HRES=SIG*EPSU*(TA(NUMN)+TRES)*(TA(NUMN)+2*TRES+2)*NCONV	CBN	182
	RAT(NUMN+1)=1./(HRES*RR(NUMN)+.00000001)	CBN	183
	GLOSS=(TA(NL)-TA(NUMN))/(0.5*(RAT(NL)+RAT(NUMN))+RC(NL)/RR(NL))	CBN	184
	GLOSS=GLOSS+GLOSS*OTH/AREA(1)*ASU	CBN	185
	CHT=CHT+RHO(2)*DSOT*ASU/AREA(1)*OTH	CBN	186
	DEL(NUMN+1) = CN(NUMN)/(HRES + 0.00000001)	CBN	187
	RR(NUMN+1)=RR(NUMN)	CBN	188
	DTHS=OTH	CBN	189
	DTS=TSAVE-TA(1)	CBN	190

IF (ITER) 151,000,151	CBM 271
C OUTPUT	CBM 272
C	CBM 273
C	CBM 274
151 CALL SSHTCH(4,KASD)	CBM 275
GO TO (3000,750),KKSU	CBM 276
750 IF (TH-TMPRT-.00001) 4410,3000,3000	CBM 277
3000 DIDT=12.0*USDTS	CBM 278
NDR=NUM-NL-1	CBM 279
NL1=(NUM-NDR+1)/2	CBM 280
K=NLI	CBM 281
CALL LCOUNT(3J,NL1,LCT,NP%,RECORD(35))	CBM 282
322 WRITE (KOUT,543)TH	CBM 283
WRITE (KOUT,544)	CBM 284
WRITE (KOUT,545) ITER,ITS,II ,RSU,MM,ME,CH,BR	CBM 285
WRITE (KOUT,546)	CBM 286
WRITE (KOUT,547)	CBM 287
UPRM=(65 *CHD)/(CH*CHN)	CBM 288
BPRNG=65 /(CH*CHN)	CBM 289
WRITE (KOUT,548) BPRNG,BPRNG,CHD,GSNS,CHT,GSHT	CBM 290
WRITE (KOUT,548) CHCRI,PYCHI	CBM 291
WRITE (KOUT,548) SA,DIDT,CPE(1),DCOT,CPE(2),DPDT	CBM 292
WRITE (KOUT,548)	CBM 293
3224 WRITE (KOUT,548) OCONV,ORP,RAD,OCHEP,OCND,OCNVT,ORPT,RADT,OCHEP	CBM 294
IT,OCNDT	CBM 295
WRITE (KOUT,548)	CBM 296
WRITE (KOUT,548) PGPU,DFCON, TB,DEDT,BLOSS,PGPUT,DECONT, TT,DEDTT,	CBM 297
LOLOSS	CBM 298
IF (NCON) 3020,3020,3021	CBM 299
3021 WRITE (KOUT,549)	CBM 300
GO TO 3022	CBM 301
3020 WRITE (KOUT,549)	CBM 302
3022 CONTINUE	CBM 303
IF (NO1) 100,100,103	CBM 304
103 CALL SLOPD (NL,NA(1),TA(1),ENO(1))	CBM 305
IF (NO) 102,102,104	CBM 306
104 CALL OGLE (NO,SO,TO(1),NL,RA(1),TA(1),ENO(1))	CBM 307
102 IF (NI) 109,109,105	CBM 308
105 DO 106 1=1,NL	CBM 309
106 ENO(1)=1./ENO(1)	CBM 310
CALL OGLE (NI,SO,(NO+1),TO(NO+1),NL,TA,RA,ENO)	CBM 311
109 IF (NUM-NM) 000,001,001	CBM 312
001 CALL THERMS(NISO,TO,DEP,RR,CH,RAT)	CBM 313
000 IF (NM) 100,100,107	CBM 314
107 DO 1073 1=1,NO1	CBM 315
IF (1=NO) 1070,1070,1071	CBM 316
1070 PUNCH 501,1, TH, 50(1), TO(1)	CBM 317
GO TO 1073	CBM 318
1071 IF (NUM-NM) 1070,1070,1074	CBM 319
1074 KI=1-NO	CBM 320
IF (NISO(KI)-1) 1070,1070,1072	CBM 321
1072 PUNCH 501,1,TH,50(1),(DEP(KI,J),J=1,N)	CBM 322
1073 CONTINUE	CBM 323
100 WRITE (KSCT) TH,TS,TO,DEP,NISO	CBM 324
KK=KK+1	CBM 325
190 CONTINUE	CBM 326
M=MY	CBM 327
IF (NCON) 3012,3012,3006	CBM 328
DO 3009 1=1,NL	CBM 329
IF (W1) 3007,3007,3000	CBM 330
3000 CALL LOOK(31,L,A(J),TX(1,L),F1(1,L),F2(1,L),0.0,Y1,D1,2)	CBM 331
CNO(1)=Y1(1)*CN(1)+Y1(2)*CNC(1)	CBM 332
GO TO 3009	CBM 333
3007 CNO(1)=X(1)*CN(1)+(1.0-X(1))*CNC(1)	CBM 334
3009 CONTINUE	CBM 335
IF (NDNU) 3023,3023,3024	CBM 336
3024 DO 3020 1=1,NDNU	CBM 337
LL=MF1(1)	CBM 338
LUMLA(1)	CBM 339
L=NDUFT(1)	CBM 340
DO 3025 J=LL,LU	CBM 341
IF (L) 3026,3026,3027	CBM 342
3027 CALL LOOK(31,L,A(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 (NUM-NM2) 3012,3020,3020	CBM 349
3020 DO 3029 1=NM2,NUM	CBM 350
3029 CNO(1)=CN(1)	CBM 351
3012 CONTINUE	CBM 352
DO 3011 J=1,NL1	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-NL1-NL) 3003,3003,3005	CBM 359
3005 K=NLI-NDR	CBM 360

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3003 N=MIN(M,N,K,L) CBN 361
IF (NCON) 3004,3004,3010 CBN 362
3004 WRITE (KOUT,550) (I,MATL(I),TA(I),RO(I),N(I), I=L,N,K) CBN 363
GO TO 3011 CBN 364
3010 WRITE (KOUT,5500) (I,MATL(I),TA(I),RO(I),CNO(I), I=L,N,K) CBN 365
3011 CONTINUE CBN 366
IF (SMELL) 3100,3101,3100 CBN 367
3100 SOMET=(1.+SMELL)*DIDY-SWELL*DCDT CBN 368
WRITE (KOUT,590) SOMET CBN 369
590 FORMAT(10X,40'SURFACE RECESSON AFTER SWELL (INCHES) = FBCBN 370
1.4/10X,40'SURFACE RECESSON RATE WITH SWELL (INCHES/SEC) =F0.4) CBN 371
3101 CONTINUE CBN 372
CALL SSUTCH(3,KKSW) CBN 373
GO TO (745,746),KKSW CBN 374
745 IF (NDNU) 746,746,747 CBN 375
747 LU=NDN2-1 CBN 376
L=LU-NDN-1 CBN 377
L=L+L/6+2 CBN 378
CALL LCOUNT(L,LCT,NPG,RECORD(35)) CBN 379
DO 748 I=NDN,LU CBN 380
748 WRITE (KOUT,749) (ROCON(I,J),J=1,3) CBN 381
WRITE (KOUT,749) (DNDG(J),J=NDN,LU) CBN 382
WRITE (KOUT,749) (SMS,GS425,GS,GS427,GSN CBN 383
LU=NDN-NDN CBN 384
WRITE (KOUT,7490) (A(K),B(K),C(K),D(K),K=1,LU) CBN 385
749 FORMAT (10X,4E10.3) CBN 386
7490 FORMAT(10X,4E10.3) CBN 387
740 CONTINUE CBN 388
3225 IF (TH-THFIN+0.00001)1151,2 .2 CBN 389
2 IF (NU1) 1,1,3 CBN 390
3 REWIND KSCT CBN 391
N=0 CBN 392
CALL LCOUNT(-10,LCT,NPG,RECORD(35)) CBN 393
WRITE (KOUT,552) NO,N1 CBN 394
WRITE (KOUT,5521) CBN 395
WRITE (KOUT,554) TH,TS,(SO(I),I=1,NO1) CBN 396
WRITE (KOUT,553) CBN 397
DO 4 K=1,NK CBN 398
READ(KSCT) TH,TS,TO,DEP,NISO CBN 399
DO 805 I=1,N1 CBN 400
IF (N-NISO(I)) 806,805,805 CBN 401
806 N=NISO(I) CBN 402
805 CONTINUE CBN 403
CALL LCOUNT(1,LCT,NPG,RECORD(35)) CBN 404
4 WRITE (KOUT,554) TH,TS,(TO(I), I=1,NO1) CBN 405
IF (N-NDN) 1,802,802 CBN 406
802 IF (N1-N) 1,1,803 CBN 407
803 REWIND KSCT CBN 408
CALL LCOUNT(-7,LCT,NPG,RECORD(35)) CBN 409
WRITE (KOUT,560) CBN 410
J=NO+1 CBN 411
WRITE (KOUT,7041) (SO(I),I=J,NO1) CBN 412
WRITE (KOUT,7042) CBN 413
560 FORMAT(10X,60TH: FOLLOWING BLOCK GIVES THE OUTPUT TIME AND UP TO FCBN 414
1IVE LOCATIONS / 04,SSHOW THE INDICATED ISOTHERMS WITHIN THE BACKUPCBN 415
2 MATERIALS.) CBN 416
7041 FORMAT(10X,9(2X,F10.4)) CBN 417
7042 FORMAT(1) CBN 418
DO 804 K=1,KK CBN 419
READ(KSCT)TH,TS,TO,DEP,NISO CBN 420
DO 804 J=1,N CBN 421
CALL LCOUNT(1,LCT,NPG,RECORD(35)) CBN 422
804 WRITE (KOUT,554) TH,(DEP(I,J),I=1,N1) CBN 423
GO TO 1 CBN 424
1151 IF (TH-TPR2+0.00001) 154,150,150 CBN 425
150 DTPRT=OTPR2 CBN 426
OTPR2=OTPR3 CBN 427
TPR2=TPR3 CBN 428
TPR3=THFIN CBN 429
154 CONTINUE CBN 430
IF (TH-THPRT+0.00001) 743,742,742 CBN 431
742 THPRT=ANIN1(THPRT+OTPR2,TPR2) CBN 432
743 CONTINUE CBN 433
4410 DTH=ANIN1(DTHB,UELCR/(DSDB+0.000001),TH-THDS, 50.0/(ABS(TSAVE-TA(CBN 434
111)+.1)*DTH) CBN 435
TSAVE=TA(1) CBN 436
DTH=(THPRT-TH)/(AINT((THPRT-TH)/DTH+1.0)) CBN 437
144 TH=TH+DTH CBN 438
C CBN 439
C FUNCTIONS OF TIME CBN 440
606 I=IR(1) CBN 441
VF=VF2 CBN 442
601 IF (ITN(I)-TH+0.00001) 614,604,604 CBN 443
614 IF (I-1-INT(1)) 602,604,604 CBN 444
602 I=I-1 CBN 445
IF (ITN(I)-TTN(1)) 601,603,601 CBN 446
603 TH=TH-DTH CBN 447
THDS=ITN(1)-DTHIN CBN 448
DTH=AMAX1(DTHIN,TTN(1)-TH) CBN 449
TH=TH+DTH CBN 450

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GO TO 601
604 DEN=(TH-TM(I))/(TM(I)-TM(I))
IF (TM(I)-TM(I)) 6040,6040,605
6040 DEN=0.
605 CM=TCM(I)+DEN*(TCM(I)-TCM(I))
ORA=TJM(I)+DEN*(TJM(I)-TJM(I))
PRES=TPI(I)+DEN*(TPI(I)-TPI(I))
ME=TME(I)+DEN*(TME(I)-TME(I))
BOP=TORP(I)+DEN*(TORP(I)-TORP(I))
II=1
IF (CM) 6001,6001,600
6001 II=2
CM=0.0
IF (ME-2.) 6002,6002,600
6002 II=3
IF ME
ME=0.
600 IR(I)=1
IF (ITER) 610,113,610
113 OEDT=0.
ITER=1
GO TO 3000
610 IF (DTM-.000001) 162,162,600
162 WRITE (KOUT,50) TM,DTM,DTMS,DTMB,TMDS,OTS,DELCR,DSOTB
TM=TM*IN
GO TO 3000
C
C INTERNAL DECOMPOSITION -- DENSITY CALCULATION
600 N=-JFH
C
C SPECIFY SURFACE CHANGES DURING THIS TIME INTERVAL
DSOT=USOTB
DS=OSOT*DTM
DSI=12.0*DS
SA=SA+DSI
NSU=ABS(RSV+SA)
DTMB=DTMC
DEL(NL)=DEL(NL)-JS
FY=0.0
FJ=FJFH
J1=JFNP
DENOLD=DMO(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(NHM)
DEL(NL+1)=DEL(NHM)
RR(NL+1)=RR(NHM)
DO 252 I=1,NL
DMDG(I)=0.0
RON(I)=ROOZ
DSS=FJ/DEL(I)*USOT
463 DO 255 J=1,JF
N=N+J1-1
IF (J-JFNP) 253,259,253
259 IF (MATL(I)+MATL(I+1)-4) 263,260,263
263 IF (AMAX)(TA(I),TA(I+1))-TRACH) 261,261,262
261 IF (MATL(I)+MATL(I)+MATL(I+1)-3) 262,260,262
260 J1=JFNP
ROOZ=FJH*RO(I+1)
RON(I)=RON(I)+FJH*RO(I)
N=N+JFH
GO TO 264
262 ROOZ=0.0
OTA=(TA(I+1)-TA(I))/(FJFS-FJF/DEL(I)*DEL(I+1)/RR(I+1)+RR(I+1))
J1=1
TAS=TA(I)
253 N=N+1
IF (ABS(DSS)-.000001) 1016,1016,1017
1016 DPOAC=0.
DROUC=0.
DROCC=0.
GO TO 1021
1017 IF (I-NL) 1015,1016,1015
1018 FK=FK-1.0
IF (FK) 1019,1016,1020
1019 FK=FJ-1.0
1020 DSS=OSOT/DEL(I)*FK
1015 IF (N-1) 1115,1215,1115
1115 DROAC=(ROA(N+1)-ROA(N))*DSS
DROUC=(ROB(N+1)-ROB(N))*DSS
DROCC=(ROC(N+1)-ROC(N))*DSS
GO TO 1021
1215 IF (I-1) 1115,1315,1115
1315 DPOAC=(ROA(N+1)-ROA(N))*DSS

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UNOBL=(ROB(N)-ROB(N-1))*NS5	CBM	541
OROC=(HOC(N)-HOC(N-1))*NS5	CBM	542
ROT(1)=HNO(2)	CBM	543
1021 TAS=TAS+DTA	CBM	544
IF (TAS-TRACH) 221,227,229	CBM	545
229 IF (TAS-TRACH) 201,201,202	CBM	546
201 DROAT=0.0	CBM	547
GO TO 2113	CBM	548
202 IF (RMURA-ROA(N)) 211,201,201	CBM	549
211 RO=ROA(N)-RMURA	CBM	550
POW=1.-PSIA	CBM	551
IF (POW) 2111,2112,2111	CBM	552
2111 DROAT=(-RO*((RO**POW)-	CBM	553
1(1./POW))/DTH	CBM	554
GO TO 2113	CBM	555
2112 DROAT=RO*(EXP(-RO**DTH*EXP(-EA/TAS))-1.)/DTH	CBM	556
2113 ROA(N)=ROA(N)+(UNOAT+DROAC)*DTH	CBM	557
IF (ROA(N)-RMONA) 2114,221,221	CBM	558
2114 ROA(N)=ROA(N)-(DROAT+DROAC)*DTH	CBM	559
DROAT=(RMORA-ROA(N))/DTH+DROAC	CBM	560
ROA(N)=RMORA	CBM	561
221 IF (TAS-TRACH) 203,203,204	CBM	562
203 DROBT=0.0	CBM	563
GO TO 2133	CBM	564
204 IF (RMURB-ROB(N)) 213,203,203	CBM	565
213 RO=ROB(N)-RMURB	CBM	566
POW=1.-PSIB	CBM	567
IF (POW) 2131,2132,2131	CBM	568
2131 DROBT=(-RO*((RO**POW)-	CBM	569
1(1./POW))/DTH	CBM	570
GO TO 2133	CBM	571
2132 DROBT=RO*(EXP(-RO**DTH*EXP(-EB/TAS))-1.)/DTH	CBM	572
2133 ROB(N)=ROB(N)+(DROBT+DROBC)*DTH	CBM	573
IF (ROB(N)-RMORB) 2134,223,223	CBM	574
2134 ROB(N)=ROB(N)-(DROBT+DROBC)*DTH	CBM	575
DROBT=(RMORB-ROB(N))/DTH+DROBC	CBM	576
ROB(N)=RMORB	CBM	577
223 IF (TAS-TRACC) 205,205,206	CBM	578
205 DROCT=0.0	CBM	579
GO TO 2153	CBM	580
206 IF (RMURC-ROC(N)) 215,205,205	CBM	581
215 RO=ROC(N)-RMURC	CBM	582
POW=1.-PSIC	CBM	583
IF (POW) 2151,2152,2151	CBM	584
2151 DROCT=(-RO*((RO**POW)-	CBM	585
1(1./POW))/DTH	CBM	586
GO TO 2153	CBM	587
2152 DROCT=RO*(EXP(-RO**DTH*EXP(-EC/TAS))-1.)/DTH	CBM	588
2153 ROC(N)=ROC(N)+(UNOCT+DROCC)*DTH	CBM	589
IF (ROC(N)-RMURC) 2154,225,225	CBM	590
2154 ROC(N)=ROC(N)-(DROCT+DROCC)*DTH	CBM	591
DROCT=(RMURC-ROC(N))/DTH+DROCC	CBM	592
ROC(N)=RMURC	CBM	593
225 DNDG(1)=DNDG(1)-VEL(1)*((DROAT+DROBT)*GAMA+ONG+DROCT)	CBM	594
227 DNS=(ROA(N)+ROB(N))*GAMA+ONG+ROC(N)	CBM	595
RON(1)=RON(1)+ONS	CBM	596
IF (N-1) 2251,2252,2251	CBM	597
2251 IF (DNS-UNCP(1E)) 2253,2252,2252	CBM	598
2252 CPE(1E)=DEL(1)*((FLOAT(1)-0.5)/F.F+1.-FLOAT(1))*12.*RA(1)	CBM	599
IF (ABS(DNS-DENDLU)-1.0E-20) 2254,2259,2259	CBM	600
2259 CPE(1E)=CPE(1E)-DEL(1)/(ONS-DENDLU)*(ONS-UNCP(1E))/F.F+12.0	CBM	601
2254 CPE(1E)=AMAX(1,CPE(1E),5A)	CBM	602
IE=IE+1	CBM	603
2253 DENOLD=ONS	CBM	604
225 TAS=TAS+DTA	CBM	605
264 DNDG(1)=DNDG(1)/F.F+RR(1)	CBM	606
RON(1)=RON(1)/F.F	CBM	607
IF (1-1) 257,257,254	CBM	608
257 F.F=F.F	CBM	609
DTA=DTA/DEL(1)*VEL(2)/Z.*RR(2)	CBM	610
GO TO 252	CBM	611
254 DTA=DTA/DEL(1)*VEL(1)/RR(1)*RR(1)	CBM	612
252 CONTINUE	CBM	613
IF (NDBU) 2522,2522,2521	CBM	614
2523 DO 700 1=1,NDBU	CBM	615
GAM=GA(1)	CBM	616
ONGAM=1.-GAM	CBM	617
LL=MF(1)	CBM	618
LU=MLA(1)	CBM	619
TRACH(1)=AMIN(1,TRACH(1), TRACH(1,2), TRACH(1,3))	CBM	620
DO 702 J=LL,LU	CBM	621
DNDG(J)=0.	CBM	622
IF (TA(J)-TRACH(1)) 702,702,703	CBM	623
703 DO 700 K=1,3	CBM	624
IF (TA(J)-TRACH(1,K)) 705,705,706	CBM	625
705 DROT(K)=0.	CBM	626
GO TO 700	CBM	627
706 RD=ROCON(J,K)-RMOR(I,K)	CBM	628
IF (RD=0.0) 705,705,706	CBM	629
7060 F=FF(1,K)	CBM	630

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      E=EE(I,K)
      POW=1.-PSI(I,K)
      IF (POW) 707,708,707
      DROT(K)=(-RD+((RD+POW)-EXP(-E/TA(I)))*DTH)/(1./POW)/DTH
      GO TO 709
      SF=SM(I,K)
      DROT(K)=RD*(EXP(-SF*DTH*EXP(-E/TA(I)))-1.)/DTH
      ROCON(J,K)=ROCON(J,K)+DROT(K)*DTH
      DMG(J)=DEL(J)*(DROT(1)+DROT(2)+SAM+OSAM*DROT(3))/TR(J)
      RON(J)=(ROCON(J,1)+ROCON(J,2)+SAM+OSAM*ROCON(J,3))
      702 CONTINUE
      700 CONTINUE
C      NOW SPECIFY NECESSARY NEW POST-DECOMPOSITION PROPERTIES
      2522 J=JMP
      MATL(NL)=15V
      DO 85 I=1,NL
      IF (ABS(RON(I)-RHO(I))-0.1) 81,81,82
      81 MATL(I)=1
      A(I)=1.0
      GO TO 85
      82 IF (ABS(RON(I)-RHO(2))-0.1) 83,83,84
      83 MATL(I)=2
      X(I)=0.
      CN(I)=CNC(I)
      GO TO 85
      84 MATL(I)=8
      A(I)=PETE-PEI/RON(I)
      IF (N) 8500,8500,8501
      8501 L=NT
      CALL LOOK(31+L,A(I),TX(1+L),F(1+L),FZ(1+L),0.0,V1,D1,2)
      CN(I)=Y1(I)*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)*RHO(I))
      IF (NBU) 7121,7121,7122
      7122 DO 710 I=1,NBU
      LL=MF(I)
      LU=MLA(I)
      DO 711 J=LL,LU
      IF (ABS(RON(J)-RHOV(I))-0.1) 712,712,713
      712 MATL(J)=20+2*I
      X(J)=1.0
      GO TO 716
      713 IF (ABS(RON(J)-RHO(I))-0.1) 714,714,715
      714 MATL(J)=21+2*I
      X(J)=0.
      RON(J)=RHO(I)
      CN(J)=CNC(J)
      GO TO 716
      715 MATL(J)=8
      A(J)=P(I)-PP(I)/RON(J)
      IF (NBUFT(I)) 7151,7151,7150
      7150 L=NBUFT(I)
      CALL LOOK(31+L,A(J),TX(1+L),F(1+L),FZ(1+L),0.0,V1,D1,2)
      CN(J)=Y1(I)*CN(J)+Y1(2)*CNC(J)
      GO TO 716
      7151 CONTINUE
      CN(J)=X(J)*CN(J)+(1.0-X(J))*CNC(J)
      716 RAT(J)=DEL(J)/(CN(J)*RHO(J))
      711 CONTINUE
      710 CONTINUE
      7121 GSM=0.0
      DO 122 I=1,NL
      GSM=GSM+DMG(I)
      GSNT=GSNT+GSM*ASU/AREA(I)*DTH
      GSM2=0.
      IF (NBU) 7100,7100,7101
      7101 DO 717 I=1,NBU
      LL=MF(I)
      LU=MLA(I)
      DO 718 J=LL,LU
      GSM2=GSM2+DMG(J)
      718 CONTINUE
      717 GSM2=GSNT
      7100 GSM2=GSNT+GSM2*ASU/AREA(I)*DTH
      GS=GSNT+GSM2
      GS=GS
      UCDT=(CPE(1)-COLD)/DTH
      DMDT=(CPE(2)-COLD)/DTH
C
C      CALCULATION OF IMPLICIT TEMPERATURE COEFFICIENTS
C      AND INTERNAL ENERGY RATE TERMS
C      MAIN BLOCK
      DVB=0.
      SOEG=0.
      GSEGA=0.
      TB=0.
      RAT(I)=2.*RAT(I)
      CPML=CP(NL)

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 CBN 718
 CBN 719
 CBN 720

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      NLN=NL-1
      IMIN=0
      DO 30 I=IMIN,NLN
      IF (I) 15,15,14
14  GSN=GSN-ONDG(I)
      DROOTD=-ONDG(I)/(RR(I)*DEL(I))
      FACT1=OTH/(DEL(I)*RR(I))
      FACT2=GSN/(DEL(I)*RR(I))
      A(I)=-FACT1*OVB
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))
      TERM2=RON(I)*CP(I)-OTH*(CPBAS*(DROOTD-FACT2)
      -OSDT*RO1*CP1/DEL(I))
      TERM1=FACT1*OVB
      B(I)=TERM2-A(I)-TERM1
      C(I)=-TERM1
      D(I)=TA(I)+TERM2*(NGAS*DROOTD+MBAR*(RON(I)
      -RO(I))/DTH-FACT2*NGAS-OSDT*RO1*MI/DEL(I))*OTH
15  RO1=RO1(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)*X1+H1*(1.0-X1)
      T1=RO1*MBAR+RO1*MI*T
      MBAR=PETE*HP(I+1)-PET/RND(I)*HC(I+1)
      T1=RO1*MI+RO1*MBAR
20  CALL LOOK (2,TA(I+1),T1,TMG,0.0,0.0,NGAS,CPBAS,1)
      NGAS=NGAS+DELNG
      GSEGR=GSEGR+NGAS*ONDG(I+1)
      SOEGR=SOEGR+MBAR*ONDG(I+1)
      IF (I) 24,24,25
24  EGO=GSN*NGAS
      MW=NGAS
      GO TO 30
25  TERM3=(-FACT2*CPBAS-OSDT*RO1*CP1/DEL(I))*OTH
      C(I)=C(I)+TERM3
      D(I)=D(I)+TA(I+1)+TERM3*(FACT2*NGAS+OSDT*RO1*MI/DEL(I))*OTH
      TB=TB+TN*OSDT*RR(I)
30  CONTINUE
      A(I)=OTH/DEL(I)
      TI=TI+TB*OTH/ANLA(I)*ASU
C  NOW THE LAST ABLATING NODE REQUIRES DIFFERENT TREATMENT
      DROOTD=-ONDG(NLN)/(RR(NLN)*DEL(NLN))
      FACT1=OTH/(DEL(NLN)*RR(NLN))
      A(NLN)=-FACT1*OVB
      DVB=1.0/(0.5*(RAT(NLN)+RAT(NLN+1))+RC(NLN)/RR(NLN))
      C(NLN)=-FACT1*OVB
      TERM2=RON(NLN)*CP(NLN)-(CPBAS*DROOTD-OSDT/DEL(NLN))*
      (RO(NLN)*CPNL-RO1*CP1)*OTH
      B(NLN)=TERM2-C(NLN)-A(NLN)
      D(NLN)=TA(NLN)+TERM2*OTH*(NGAS*DROOTD+MBAR*(RON(NLN)-
      RO(NLN))/DTH-OSDT*(RO(NLN)*MI/DEL(NLN)-RO1*MI)/DEL(NLN))
      K = NLN
      GSN=GSN-ONDG(NLN)
      IF (NDGU) 7170,7171,7170
7170  FACT2=GSN/(DEL(NLN)*RR(NLN))
      TERM2=FACT2*CPBAS*OTH
      B(NLN)=B(NLN)+TERM2
      D(NLN)=D(NLN)+TA(NLN)+TERM2*FACT2*NGAS*OTH
      CALL LOOK (2,TA(NLN),T1,TMG,0.0,0.0,NGAS,CPBAS,1)
      NGAS=NGAS+DELNG
      C(NLN)=C(NLN)-FACT2*CPBAS*OTH
      D(NLN)=D(NLN)-TA(NLN)+FACT2*CPBAS*OTH+FACT2*NGAS*OTH
7171  CONTINUE
C  NOW FOR DECOMPOSING BACK-UPS IF ANY
      IF (NDGU) 7250,7250,7251
7251  DO 720 L=1,NDGU
      LL=MF1(L)-1
      LU=MLA(L)
      DO 724 I=LL,LU
      IF (I-MF1(L)) 725,726,725
725  GSN=GSN-ONDG(I)
      UOVS=OVB
      K=NL-1
      DROOTD=-ONDG(I)/(RR(I)*DEL(I))
      FACT1=OTH/(DEL(I)*RR(I))
      FACT2=GSN/(DEL(I)*RR(I))
      A(I)=-FACT1*OVB
      DVB=1.0/(0.5*(RAT(I)+RAT(I+1))+RC(I)/RR(I))
      TERM2=RON(I)*CP(I)-OTH*(CPBAS*(DROOTD-FACT2)
      -OSDT*RO1*CP1/DEL(I))
      TERM1=FACT1*OVB
      B(I)=TERM2-A(I)-TERM1
      C(I)=-TERM1
      D(I)=TA(I)+TERM2*(NGAS*DROOTD+MBAR*(RON(I)-RO(I))/DTH
      -FACT2*NGAS)*OTH
C  IF (I=MLA(NDGU)) 726,727,727
726  CP(I+1)=CPV(I+1)*X1+H1*(1.0-X1)
      MBAR=MBAR
      MBAR=MBAR*HP(I+1)-HP(L)/RND(L)*HC(I+1)
      CALL LOOK (2,TA(I+1),T1,TMG,0.0,0.0,NGAS,CPBAS,1)
      NGAS=NGAS+DELNG

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F(1)=F(1L)+1 724,724,727
727 TERM3=(-FACT2*CPGAS)*OTH
      C(K)=C(K)+TERM3
      O(K)=O(K)+TA(1+J)*TERM3+FACT2*MGAS*OTH
724 CALL SSETCH(5,KASU)
      GO TO (7240,7241),KKSU
7240 WRITE(KOUT,7270) 1,K,L,DEL(1),RR(1),CP(1),CPV(1),CPC(1),MP(1),
      INC(1),CM(1),RAT(1),RO(1),RDN(1),X(1),DMS(1),DMODT,P(L),PP(L),
      ZNGAS,CPGAS,DVB,DVBS,MBAR,MBARS,GSM,FACT1,FACT2,TERM1,TERM2,TERM3,
      36A(IL),OMGA(IL),A(K),B(K),C(K),D(K)
7270 FORMAT(5X,3I5,16E10,3/(20X,10E10,3))
7241 CONTINUE
720 CONTINUE
C NOW FOR BACK UPS IF ANY
7250 IF (NUNH-NH2) 00,0,0,0
      DO 50 1=NH2,NUNH
      A=K+1
      FACT1=OTH/(DEL(1)+RR(1))
      A(K)=-FACT1*DVB
      DVB=1.0/(10.5*(RAT(1)+RAT(1+J)+RC(1)/RR(1)))
      C(K)=-FACT1*DVB
      D(K)=D(1)+CP(1)-C(K)-A(K)
      DO 50 D(K)=TA(1)+RO(1)+CP(1)
C NOW IF THE LAST NODE WAS INSULATED WE MUST REPAIR LAST B AND C
      DO 60 I=RES,80,70,00
      B(K)=B(K)+C(K)
      C(K)=0.
C NOW BEFORE GAUSS REDUCTION REWRITE LAST LINE OF MATRIX
      DO 80 D(K)=B(K)-C(K)*TRES
      L=K
      DO 90 I=2,K
      L=L-1
      D(L)=B(L)-C(L)/B(L+1)*D(L+1)
      B(L)=B(L)-C(L)/B(L+1)*A(L+1)
      B(1)=B(1)/A(1)
      D(1)=B(1)/A(1)
      PGPUT=GG-GSEGR
      PGPUT=PGPUT+PGP*OTH/AREA(1)*ASU
      DECOM=GSEGR-SOEGR
      DECOM=DECOM-DECOM*OTH/AREA(1)*ASU
C
C SURFACE BOUNDARY CONDITION PACKAGE
C
      CMZ=CM
      AP1=A(1)
      ITL=10
      IT5=1
      SMT=(1.+SMELL)*SA-SMELL*CPE(1)
      IF (IT1-2) 2502,1420,2501
1420 USD7B=BRA/12000.0
      TA(1)=ME
      ME=0.
      MD=0.0
      BD=0.0
      CD=D*OTH*(1+ROA(1)+ROB(1)+GAMA+ROC(1)+BND)
      RAD=0.
      JMA=0.
      OCME=0.
      OCONV=0.
      GO TO 1437
2501 TABC=V0000.0
      DSD7B=0.
      ENFA=U(1)
      OCME=0.
      OCONV=0.
      GO TO 2503
2502 IF (NH) 1424,1420,1425
1425 CM=CM/(1.+SMT/ABS(NSV))+REAL
      CMZ=CM
      GO TO (1427,1420),NF15
1427 BV=(CM-CMFL+OB)/CB
      GO TO 1429
1420 BV=(CM-CMFL)/CB
1429 CONTINUE
      PH1=2.*BND*BF
      IF (PH1-.01)1422,1422,1423
1422 CM=CM*(1.-.5*PH1)
      GO TO 1426
1423 CM=CM/(EAP(PH1)-1)+PH1
1420 GO TO (14200,14201),NF14
14200 CM=AMAX1(CM,GS/AMAX1(TNB(1),TNB(NHB)))
14201 CONTINUE
      ENFA=CM*ME+O(1)
      CALL LOOK(12,00 / (CM*CM),TNB,0.0,0.0,0.0,V2,02,0)
      INB=IR(12)
      VPM=VH
      IPR=1
      IF (IPR-1) 2510,2510,2511
2511 CALL LOOK(13,PM,5,IPR,0.0,0.0,0.0,V2,02,0)
      IPR=1+1(1)

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I(0(16))=ALU(I(NG,IPR+1))	CBM 901
I(1(16))=MI(I(NG,IPR+1))	CBM 902
I(0(17))=ALU(I(NG+1,IPR+1))	CBM 903
I(1(17))=MI(I(NG+1,IPR+1))	CBM 904
VRP=VH	CBM 905
I3=ILU(16)	CBM 906
I4=ILU(17)	CBM 907
2510 I(0(14))=ALU(I(NG,IPR))	CBM 908
I(1(14))=MI(I(NG,IPR))	CBM 909
I(0(15))=ALU(I(NG+1,IPR))	CBM 910
I(1(15))=MI(I(NG+1,IPR))	CBM 911
I1=ILU(14)	CBM 912
I2=ILU(15)	CBM 913
IF (NPR-1) 2512,2512,2513	CBM 914
2513 IF (I(1(17))-I4) 420,420,2514	CBM 915
2514 IF (I(1(16))-I3) 420,420,2512	CBM 916
2512 IF (I(1(14))-I1) 420,420,2504	CBM 917
2504 IF (I(1(15))-I2) 420,420,2505	CBM 918
2505 TABC=TTS(I1,ING,IPR)+VRP*(TTS(I2,ING+1,IPR)-TTS(I1,ING,IPR))	CBM 919
IF (NPR-1) 2503,2503,2515	CBM 920
2515 TABC=TABC+VRP*(TTS(I3,ING,IPR+1)+VRP*(TTS(I4,ING+1,IPR+1)-TTS(I3,ING,IPR+1)))-TABC	CBM 921
2503 IF (TSAVE-TABC) 420,420,421	CBM 922
----- ABLATING SURFACE	CBM 923
421 IF (I40) 422,422,423	CBM 924
422 CHOL=TLNC(I1,ING,IPR)-VRP*(TLNC(I1,ING,IPR)-TLNC(I2,ING+1,IPR))	CBM 925
CHD=EAP(CHOL)*CH	CBM 926
IAB=1	CBM 927
423 CALL LOOK(I4,CHOL,TLNC(I1,ING,IPR),TTS(I1,ING,IPR),TOHEN(I1,ING,IPR),	CBM 928
1,IPR),TBP(I1,ING+1,IPR),0,Y2(1),Y2(4),3)	CBM 929
IRA=I(14)	CBM 930
CALL LOOK(I5,CHOL,TLNC(I1,ING+1,IPR),TTS(I1,ING+1,IPR),TOHEN(I1,ING+1,IPR),	CBM 931
1,IPR),TBP(I1,ING+1,IPR),0,Y2(7),Y2(10),3)	CBM 932
IRB=I(15)	CBM 933
IF (NPR-1) 4231,4233,4231	CBM 934
4231 CALL LOOK(I6,CHOL,TLNC(I1,ING,IPR+1),TTS(I1,ING,IPR+1),TOHEN(I1,ING,IPR+1),	CBM 935
1,IPR+1),TBP(I1,ING,IPR+1),0,Y2(13),Y2(16),3)	CBM 936
IRC=I(16)	CBM 937
CALL LOOK(I7,CHOL,TLNC(I1,ING+1,IPR+1),TTS(I1,ING+1,IPR+1),TOHEN(I1,ING+1,IPR+1),	CBM 938
1,IPR+1),TBP(I1,ING+1,IPR+1),0,Y2(19),Y2(22),3)	CBM 939
IRD=I(17)	CBM 940
DO 4232 I=1,12	CBM 941
4232 Y2(I)=Y2(I)+VRP*(Y2(I+12)-Y2(I))	CBM 942
IF (NPR-1) 4237,4237,4238	CBM 943
4238 IF (VRP-1.) 4234,4234,4235	CBM 944
4235 Y2(3)=Y2(15)	CBM 945
Y2(9)=Y2(21)	CBM 946
GO TO 4237	CBM 947
4234 IF (VRP) 4236,4237,4237	CBM 948
4236 Y2(3)=(Y2(3)-Y2(15)*VRP)/(1.-VRP)	CBM 949
Y2(9)=(Y2(9)-Y2(21)*VRP)/(1.-VRP)	CBM 950
4237 CONTINUE	CBM 951
4233 DO 426 I=1,6	CBM 952
426 Y2(I)=Y2(I)+VRP*(Y2(I+6)-Y2(I))	CBM 953
IF (Y2(1)) 4260,4260,4261	CBM 954
4260 I1L=115	CBM 955
GO TO 4256	CBM 956
4261 CONTINUE	CBM 957
CALL LOOK(4,Y2(1),TTZ(1,2),TEP(1,2),0,0,0,EMIV,OMIV,1)	CBM 958
IF (MATL(1)-2) 428,427,428	CBM 959
428 CALL LOOK(3,Y2(1),TTZ(1,1),TEP(1,1),0,0,0,Y3,D3,1)	CBM 960
EMIV=EMIV*AP1*(Y3-EMIV)	CBM 961
OMIV=OMIV*AP1*(D3-OMIV)	CBM 962
427 TSSO=Y2(1)*Y2(1)	CBM 963
TS=Y2(1)	CBM 964
RAD=SIG*EMIV*TSSO*TSSO*VF	CBM 965
426 ERR=CH*Y2(2)+EMIV*ORA-RAD-B(1)*TS*ERFX	CBM 966
UERR=CH*Y2(5)+((ORA-RAD/EMIV)*OMIV-4./TS+RAD-B(1))*Y2(4)	CBM 967
ERRC=ERR/DERR	CBM 968
VITER(I1S)=CHOL	CBM 969
EITER(I1S)=ERR	CBM 970
CHOL=CHOL-ERRC	CBM 971
CMNI=-1.E+30	CBM 972
CMNA=-1.E+30	CBM 973
IF (ILU(14)-IRA) 4361,4363,4363	CBM 974
4361 IF (ILU(15)-IRB) 4362,4363,4363	CBM 975
4362 IF (NPR-1) 4270,4270,4271	CBM 976
4271 IF (ILU(16)-IRC) 4272,4363,4363	CBM 977
4272 IF (ILU(17)-IRD) 4273,4363,4363	CBM 978
4273 CMNI=AMAX1(TLNC(IRD,ING+1,IPR+1),TLNC(IRD-1,ING+1,IPR+1),TLNC(IRC,ING,IPR+1),	CBM 979
TLNC(IPR+1),TLNC(IRC-1,ING,IPR+1))	CBM 980
CMNI=AMAX1(CMNI,TLNC(IRA,ING,IPR),TLNC(IRA-1,ING,IPR),TLNC(IRB,ING,IPR+1),	CBM 981
TLNC(IPR+1),TLNC(IRD-1,ING+1,IPR+1))/2.	CBM 982
CMNA=AMAX1(CMNA,CMNI)	CBM 983
4363 IF (I(1(14))-IRA-1) 4366,4366,4364	CBM 984
4364 IF (I(1(15))-IRB-1) 4366,4366,4274	CBM 985
4274 IF (NPR-1) 4275,4275,4276	CBM 986
4276 IF (I(1(16))-IRC-1) 4366,4366,4277	CBM 987
4277 IF (I(1(17))-IRD-1) 4366,4366,4278	CBM 988

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4278 CMA=AMIN(TLNC(IRD+1,IMG+1,IPR+1)+TLNC(IRD+2,IMG+1,IPR+1), CBN 991
      TLNC(IRC+2,IMG+1,IPR+1)) CBN 992
C      I=I+1 CMLT,IRP,GM1,2,ARI(CMLT,IRP,GM1,1,ARI(CMLT,AMNC(FIN)=AMC CBN 993
4275 CMA=AMIN(CMA,TLNC(IRA+1,IMG+1,IPR+1)+TLNC(IRA+2,IMG+1,IPR+1)+TLNC(IRB+1,IMG+1,IPR+1)+TLNC(IRB+2,IMG+1,IPR+1))/2, CBN 994
      CBN 995
      CML=AMIN(CML,CMA) CBN 996
      IF(ITS-ITL-1) 4366,4351,4352 CBN 997
4351 ERRS=ERR CBN 998
      CML=CMA CBN 999
      GO TO 4367 CBN 1000
4352 IF(ERN=ERRS) 4354,4367,4353 CBN 1001
4353 CML=CMA CBN 1002
      GO TO 4367 CBN 1003
4354 ITL=55 CBN 1004
      IF(ERN=C) 4355,4367,4367 CBN 1005
4355 CML=CML CBN 1006
      GO TO 4367 CBN 1007
4366 IF(ITS-ITL) 4367,4356,4367 CBN 1008
4356 CML=AMIN(TLNC(1,IMG+1,IPR+1)+TLNC(2,IMG+1,IPR+1) CBN 1009
      IF(NPW-1) 4367,4367,4279 CBN 1010
C      I=I+1 CMLT,IRP,GM1,3,ARI(CMLT,IRP,GM1,1,ARI(CMLT,LDMC(FIN)=LDC CBN 1011
4279 CML=AMIN(CML,TLNC(1,IMG+1,IPR+1)+TLNC(2,IMG+1,IPR+1) CBN 1012
4367 CML=AP(CML)+CML CBN 1013
      IF(ITS-50) 440,440,998 CBN 1014
440 ITS=ITS+1 CBN 1015
      IF(ABS(ERR)-1. ) 4372,4372,423 CBN 1016
C      ----- NON-ABLATING SURFACE CBN 1017
420 TS=TSAVE CBN 1018
      IAB=0 CBN 1019
      CML=0.0 CBN 1020
430 IF(1-1) 4302,433,4302 CBN 1021
4302 ILO(18)=1 CBN 1022
      IM(18)=MIN(IMG,IPR) CBN 1023
      ILO(19)=1 CBN 1024
      IM(19)=MIN(IMG+1,IPR) CBN 1025
      CALL LOOK (18,TS,ITS(1,IMG+1,IPR+1),TCHEM(1,IMG+1,IPR+1),0.0,0.0,Y2(1),Y2(2) CBN 1026
      I=1 CBN 1027
      CALL LOOK (19,TS,ITS(1,IMG+1,IPR+1),TCHEM(1,IMG+1,IPR+1),0.0,0.0,Y2(3), CBN 1028
      Y2(4),1) CBN 1029
      IF(NPW-1) 4322,4322,4303 CBN 1030
4303 ILO(20)=1 CBN 1031
      IM(20)=MIN(IMG,IPR+1) CBN 1032
      ILO(21)=1 CBN 1033
      IM(21)=MIN(IMG+1,IPR+1) CBN 1034
      CALL LOOK (20,TS,ITS(1,IMG+1,IPR+1),TCHEM(1,IMG+1,IPR+1),0.0,0.0,Y2(5), CBN 1035
      Y2(6),1) CBN 1036
      CALL LOOK (21,TS,ITS(1,IMG+1,IPR+1),TCHEM(1,IMG+1,IPR+1),0.0,0.0, CBN 1037
      Y2(7),Y2(8),1) CBN 1038
      GO 4321 I=1,4 CBN 1039
4321 Y2(1)=Y2(1)+VMP*(Y2(1,4)-Y2(1)) CBN 1040
4322 GO 4323 I=1,2 CBN 1041
4323 Y2(1)=Y2(1)+VMP*(Y2(1,2)-Y2(1)) CBN 1042
433 CALL LOOK (4,TS,ITS(1,2),TEP(1,2),0.0,0.0,ENIV,OMIV,1) CBN 1043
      IF(MATL(1)-2) 434,442,434 CBN 1044
434 CALL LOOK (3,TS,ITS(1,1),TEP(1,1),0.0,0.0,Y3,03,1) CBN 1045
      ENIV=ENIV+AP1*(Y3-ENIV) CBN 1046
      OMIV=OMIV+AP1*(03-OMIV) CBN 1047
442 TSSQ=TS+TS CBN 1048
      IF(1-1) 4422,4422,4422 CBN 1049
4421 IF(ENIV) 4422,4423,4422 CBN 1050
4423 ENIV=1.0 CBN 1051
4422 RAD=510*ENIV+TSSQ+TSSQ*VF CBN 1052
439 ERRC=CML*Y2(1)+ENIV*ORA-RAD-0(1)*TS+ERRX CBN 1053
      DEPR=CML*Y2(2)+((URA-RAD/ENIV)+OMIV-4./TS+RAD-0(1)) CBN 1054
      ERRC=ERR/DEPR CBN 1055
      VITER(ITS)=TS CBN 1056
      EITER(ITS)=ERR CBN 1057
      TS=TS-ERRC CBN 1058
      IF(1-1) 4391,4507,4507 CBN 1059
4391 TSMI=-1.E+30 CBN 1060
      TSMA=-1.E+30 CBN 1061
      IRA=I(18) CBN 1062
      IRB=I(19) CBN 1063
      IRC=I(20) CBN 1064
      IRD=I(21) CBN 1065
      IF(ILO(18)-IRA) 4508,4501,4501 CBN 1066
4500 IF(ILO(19)-IRB) 4502,4501,4501 CBN 1067
4502 IF(NPW-1) 4503,4503,4504 CBN 1068
4504 IF(ILO(20)-IRC) 4505,4501,4501 CBN 1069
4505 IF(ILO(21)-IRD) 4506,4501,4501 CBN 1070
4506 TSMI=AMAX(TTS(IRD,IMG+1,IPR+1)+TTS(IRD-1,IMG+1,IPR+1),TTS(IRC, CBN 1071
      IMG+1,IPR+1)+TTS(IRC-1,IMG+1,IPR+1)) CBN 1072
4503 TSMI=AMAX(TSMI,TTS(1,IRB,IMG+1,IPR+1)+TTS(1,IRB-1,IMG+1,IPR+1), CBN 1073
      TTS(1,IRA,IMG+1,IPR+1)+TTS(1,IRA-1,IMG+1,IPR+1))/2, CBN 1074
      TS=AMAX(TS,TSMI) CBN 1075
4501 IF(IM(18)-IRA-1) 4507,4507,4508 CBN 1076
4508 IF(IM(19)-IRB-1) 4507,4507,4509 CBN 1077
4509 IF(NPW-1) 4510,4510,4511 CBN 1078
4511 IF(IM(20)-IRC-1) 4507,4507,4512 CBN 1079
4512 IF(IM(21)-IRD-1) 4507,4507,4513 CBN 1080

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4513 TSMA=AMIN(TTS(INK=1,IMG=1,IPR=1)+TTS(INK=2,IMG=1,IPR=1),
      TTS(INK=1,IMG=1,IPR=1)+TTS(INK=2,IMG=1,IPR=1))
4510 TSMA=AMIN(TSMA,TTS(INK=1,IMG=1,IPR=1)+TTS(INK=2,IMG=1,IPR=1),
      TTS(INK=1,IMG=1,IPR=1)+TTS(INK=2,IMG=1,IPR=1)/2,
      TS=AMIN(TS,TSMA))
4507 CONTINUE
      IF(ITS=50) 441,441,998
441 ITS=ITS+1
      IF(ABS(ERR)-1. 1 4390,4390,430
498 WRITE(KOUT,529)
      WRITE(KOUT,582)(VITER(I),ETER(I),I=1,51)
      WRITE(KOUT,582) TH,DTM,VHM,ERFA,TABC,EMIV,DMIV,RAD,B(1),CH,PHI,
      1 D(1),ME,XP1,QRA,Y2(1),Y2(2),Y2(3),Y2(4)
      TH=TMFIN
      GO TO 3000
C ----- POST ITERATION
4390 IF(II=2) 4371,4371,1437
4371 Y2(2)=Y2(1)
4372 QCHEN=Y2(2)
      IF(ISEN(1))4373,4374,4373
4374 QCONV=0.
      GO TO 1439
4373 CALL UGLE(1,TS,QCONV,ISEN(IPR),TTSEN(1,IPR),THSEN(1,IPR),TCPSEN(1,IPR))
      IF(NPR=1) 1439,1439,1438
1438 CALL UGLE(1,TS,QO,ISEN(IPR=1),TTSEN(1,IPR=1),THSEN(1,IPR=1),TCPSEN(1,IPR=1))
      ISEN(1,IPR=1)
      QCONV=QCONV+VHP*(QO-QCONV)
1439 QCHEN=(QCHEN+QCONV)*CH
      MV=QCONV
      QCONV=CH*(HE-QCONV)
      OSDTB=CMD/RHO(2)
      IF(NBPF) 1437,1437,4375
4375 IF(IAH) 1437,1437,4376
4376 CHFL=EXP(Y2(3))*CH*QCH
1437 RO(1)=RON(1)
      BR=CH/CHZ
      QRP=EMIV*QRA
      QCOND=D(1)+B(1)*TA(1)
      QCONVT=QCONVT+QCONV*DTM/AREA(1)*ASU
      QCHMT=QCHMT+QCHEN*DTM/AREA(1)*ASU
      QCOND1=QCOND+QCONV*DTM/AREA(1)*ASU
      QPPT=QRP+QRP*DTM/AREA(1)*ASU
      MADT=MADT+MAD*DTM/AREA(1)*ASU
C
      DEDT=RON(1)*CP(1)*(TS-TSAVE)*DEL(1)/DTM
      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)/DTM
9. TA(I)=TEMP
      IF(NUMM-NBM) 97,96,96
96 K=NL
      TA(NBM)=TA(NL)
      DO 96 I=NBM,NUMM
      K=K+1
98 TA(I)=(D(K)-A(K)*TA(I-1))/B(K)
97 UEDTT=DEDT+EDT*DTM/AREA(1)*ASU
      IF(NDBU) 755,756,755
755 LL=NF1(1)
      LU=MLA(NBU)
      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(M)-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)
      MAPNB=DRL*M(NL)+DRLP*M(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
      M(NL)=MAPNB/TOP1
      DELR=DEL(NL+1)*M(NL+1)/VOL
      CZ=1.0-DELR
      DZ=0.0

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CBM 1081
 CBM 1082
 CBM 1083
 CBM 1084
 CBM 1085
 CBM 1086
 CBM 1087
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 CBM 1100
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 CBM 1150
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 CBM 1159
 CBM 1160
 CBM 1161
 CBM 1162
 CBM 1163
 CBM 1164
 CBM 1165
 CBM 1166
 CBM 1167
 CBM 1168
 CBM 1169
 CBM 1170

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GZ=CZ
NZ=JF*NL-JFH
NZ=JF-1
K=N
FZ=DELH
EZ=GZ
GO TO 174
172 DZ=DZ+1.0
173 FZ=DZ-CZ
IF (R-NZ) 175,174,175
174 GZ=DELH
175 R=N+1
CZ=CZ-GZ
176 EZ=CZ-DZ
IF (EZ) 178,177,177
177 ROA(N)=ROA(N)+FZ*ROA(K)
ROB(N)=ROB(N)+FZ*ROB(K)
ROC(N)=ROC(N)+FZ*ROC(K)
IF (N-NZ) 171,150,171
171 N=N+1
179 ROA(N)=ROA(K)*EZ
ROB(N)=ROB(K)*EZ
ROC(N)=ROC(K)*EZ
GO TO 172
178 ROA(N)=ROA(N)+RUA(K)*GZ
ROB(N)=ROB(N)+RUB(K)*GZ
ROC(N)=ROC(N)+RUC(K)*GZ
GO TO 173
150 GO TO 410
1 RETURN
END

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CBN 1171
CBN 1172
CBN 1173
CBN 1174
CBN 1175
CBN 1176
CBN 1177
CBN 1178
CBN 1179
CBN 1180
CBN 1181
CBN 1182
CBN 1183
CBN 1184
CBN 1185
CBN 1186
CBN 1187
CBN 1188
CBN 1189
CBN 1190
CBN 1191
CBN 1192
CBN 1193
CBN 1194
CBN 1195
CBN 1196
CBN 1197
CBN 1198
CBN 1199
CBN 1200
CBN 1201
CBN 1202

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17510100 D FIN

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SUBROUTINE INPOUT
COMMON ROUT, IEA, DEN, VR
COMMON IMI(38), ILO(38), TR(38), TT2(30,10), TCP(30,10), TKP(30,10), THZINPOU 1
COMMON IMI(38), ILO(38), TR(38), TT2(30,10), TCP(30,10), TKP(30,10), THZINPOU 2
1(30,10), TEP(30,10), TTH(30), THE(30), TUR(30), TCM(30), TTI(30), TMG(30) INPOU 3
2, DM12(2), RECORD(36), SO(20) INPOU 4
COMMON RHO(10) INPOU 5
COMMON MATL( 50), DEL( 5), TA( 5), H(50), RC(50), RA( 50), INPOU 6
1AREA( 50), LMA( 50), NAV( 50) INPOU 7
COMMON ROA( 500), ROB( 500), ROC( 500) INPOU 8
COMMON TPR(3), NMG(3), TMG(15,3), NLU(15,3), NHI(15,3), INPOU 9
1KHI(15,3), TTSEN(25,3), TSEN(25,3), TCPSEN(25,3), TLMC(25,15,3), INPOU 10
2ISEN(3), TPI(30), TTS(25,15,3), TCHEM(25,15,3), VFZ, CMH INPOU 11
COMMON TBP(25,15,3) INPOU 12
COMMON NPR INPOU 13
COMMON LCT, NPG, II, NBM, NUMN, NL, DELHG, DELM, RFT, RHORA, RHORB, RHORC, TRAINPOU 14
1CA, TRACB, TRACC, RHOOA, RHOOB, RHOOOC, EA, EB, EC, BA, BB, BC, PSIA, PSIB, PSIC, INPOU 15
2TRACH, PET, PETE, NSV, ETA, DTPR3, DTPR2, DTPR1, TPR3, TPR2, THZRO, THFIN, WT, INPOU 16
3THWT, UAMA, UMG, NU, FJFH, FJFS, JF, JFHP, JFH, INPUT, DTHIN, BRP, MCONV, INPOU 17
4EPSW, TRES INPOU 18
COMMON INCH, DTH INPOU 19
COMMON NN, NI, NOI INPOU 20
COMMON CMCHI, PYCHI INPOU 21
COMMON TBRP(30) INPOU 22
COMMON NR INPOU 23
COMMON TX(30,6), F1(30,6), F2(30,6) INPOU 24
COMMON NCON INPOU 25
COMMON NBPF, NFIS INPOU 26
COMMON BREX, SWELL INPOU 27
COMMON BBB(5,3), EE(5,3), FF(5,3), PSI(5,3), RHOO(5,3), RHOR(5,3), INPOU 28
1ROCOM(50,3), DHC(5), DMV(5), RHOC(5), RHOV(5), P(5), PP(5), TREF(5), GA(5) INPOU 29
2OMGA(5), NFI(5), NLA(5), TTS(30,10), TENT(30,10), TKBU(30,10), TCBU(30,10) INPOU 30
3IG), X(50), NDBU, NBM2 INPOU 31
COMMON TRAC(5,3) INPOU 32
COMMON NBUFT(5) INPOU 33
COMMON/DATA/ASTER, BLANK INPOU 34
DIMENSION TSEN(25,3), TCZSEN(25,3), TSURF(25), TSEN(25), IZ(25) INPOU 35
DIMENSION IOPT(30) INPOU 36
DIMENSION KSV(5), KMTL(6) INPOU 37
EQUIVALENCE (DH1, DM12(1)), (DM2, DM12(2)), (TS, TA) INPOU 38
497 FORMAT(12,3F10.5) INPOU 39
499 FORMAT(12A6) INPOU 40
502 FORMAT(4X12A6) INPOU 41
503 FORMAT(/24X3)H---REACTION KINETIC EQUATION---/H) INPOU 42
504 FORMAT(10X67)HMO/DTIME = GAMMA ( BA*EXP(-EA/T)RHOOA((RHOA-RHORA)/ INPOU 43
1RHOOA)**PSIA // 21X56H+ GAMMA ( BB*EXP(-EB/T)RHOOB((RHOB-RHORB)/ INPOU 44
2RHOOB)**PSIB // 19X58H+ (1-GAMMA) ( BC*EXP(-EC/T)RHOOOC((RHOC-RHORC)/ INPOU 45
3RHOOOC)**PSIC // INPOU 46
505 FORMAT(/24X32H---REACTION KINETIC CONSTANTS---/H) INPOU 47
506 FORMAT(11X8HREACTION2X4HMOOSX4HMOB8X1H87X3HPS18X1HE6X6HT REAC/2 INPOU 48
1X10H(LB/CU FT)6X7H(1/SEC)12X7H(DEG R)3X7H(DEG R)) INPOU 49
507 FORMAT(14XA1, 2X2F9.2, 2XE10.4, F7.2, 2XE10.4, F8.0) INPOU 50
510 FORMAT(12X3)HMESIN VOLUME FRACTION, GAMMA = F5.3, 17HMASS FRACTION INPOU 51
1 = FS.3, 1H/1H) INPOU 52
511 FORMAT(24X32H---TIME INCREMENT INFORMATION---/H) INPOU 53
512 FORMAT(6X18HINITIAL TIME (SEC)F7.3, 26X16HFINAL TIME (SEC)F7.2) INPOU 54
513 FORMAT(1H /6X17HOUTPUT INTERVAL =F6.3, 1X27HSEC FROM INITIAL TIME INPOU 55
UNTIL F7.3, 4H SEC) INPOU 56
514 FORMAT(6X17HOUTPUT INTERVAL =F6.3, 1X8HSEC FROM F7.3, 1X9HSEC UNTIL F INPOU 57
17.3, 4H SEC) INPOU 58
515 FORMAT(6X17HOUTPUT INTERVAL =F6.3, 1X8HSEC FROM F7.3, 1X20HSEC UNTIL INPOU 59
1 FINAL TIME/1H) INPOU 60
516 FORMAT(6X19HMAXIMUM TIME STEP =F4.2, 8H SECONDS) INPOU 61
517 FORMAT(/29X16H---NODAL DATA---/H) INPOU 62
518 FORMAT(6X74HNODE MATL TEMPERATURE RELATIVE THICKNESS NODAL DE INPOU 63
1PTH CONT, RESISTANCE) INPOU 64
519 FORMAT(7X73HNO. NO. (DEG. RANKINE) AREA (INCHES) (INCHES) INPOU 65
1 (SUFT-S-DEG/BTU)) INPOU 66
520 FORMAT(3X216, F12.2, E13.4, F9.5, F12.6, A1, E15.4) INPOU 67
521 FORMAT( 14X47HMINIMUM THICKNESS OF LAST ABLATOR NODE (INCHES)F INPOU 68
17.4/14X, 10H THERE ARE 12, 40H NODELETS ASSIGNED TO EACH ABLATING NO INPOU 69
2UE) INPOU 70
522 FORMAT(/18X48H---HEAT OF FORMATION OF MATERIAL CONSTITUENTS---/37X INPOU 71
18H(BTU/LB)/21X7HPLASTIC114HCHAR17X3HMBAS) INPOU 72
523 FORMAT(20XF9.2, 7XF9.2, 11XF9.2) INPOU 73
524 FORMAT(/7X26HENTHALPY DATUM TEMPERATURE #F9.3, 1X11HDEG RANKINE) INPOU 74
525 FORMAT( //22X36H---MATERIAL THERMAL PROPERTY DATA---//6X14HMA INPOU 75
1IAL NO. 110X14H MATERIAL NO. 210X26H MATERIAL NOS. 3 THROUGH 10/6X14 INPOU 76
2HVI6IN PLASTIC15X4HCHAR23X7HBACK-UP) INPOU 77
526 FORMAT(/6X12H MATERIAL NO. 12, 30X9H DENSITY =F8.3, 1X8H LB/CU FT/ INPOU 78
1 7X11H TEMPERATURES 13H SPECIFIC HEATS 12H CONDUCTIVITY 5X8H SEN INPOU 79
251BLE 4X10H EMISSIVITY/58X8H ENTHALPY/9X7H (DEG R) 7X12H (BTU/LB-DEG) 4X1 INPOU 80
36H (BTU/FT-SEC-DEG) 3X8H (BTU/LB) INPOU 81
4 (8XF8.2, 8XF7.4, 9XF10.7, 7XF9.2, 4XF7.4)) INPOU 82
5260 FORMAT(/6X12H MATERIAL NO. 12, 30X9H DENSITY =F8.3, 1X8H LB/CU FT/ INPOU 83
1 7X11H TEMPERATURES 13H SPECIFIC HEATS 12H CONDUCTIVITY 5X8H SEN INPOU 84
251BLE /58X8H ENTHALPY/9X7H (DEG R) 7X12H (BTU/LB-DEG) 4X1 INPOU 85
36H (BTU/FT-SEC-DEG) 3X8H (BTU/LB) INPOU 86
4 (8XF8.2, 8XF7.4, 9XF10.7, 7XF9.2) INPOU 87
527 FORMAT(/6X12H MATERIAL NO. 12, 30X9H DENSITY =F8.3, 1X8H LB/CU FT/ INPOU 88
1 7X11H TEMPERATURES 13H SPECIFIC HEATS 12H CONDUCTIVITY/9X7H (D INPOU 89
2INPOU 90

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[illegible]

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18,PS1B,CB,TRACB,C9,RH00C,RH00C,BC,PS1C,EC,TRACC,N0MU      INPOU181
WRITE (KOUT,567)A9,RH00A,RH00A,BA,PS1A,EA,TRACA,B9,RH00B,RH00B,BB INPOU182
1PS1B,CB,TRACB,C9,RH00C,RH00C,BC,PS1C,EC,TRACC              INPOU183
HEAD (INPUT,563) JF,MUMN,MN,N0,N1,THZRO,THFIN,OTPR2,OTPR3,    INPOU184
10THM,WHY,TPR2,TPR3,DELN,DH1,DH2,DELHG,GAMA,TZ              INPOU185
IF(JF-1) 171,170,172                                          INPOU186
170 JF=2                                                         INPOU187
GO TO 172                                                       INPOU188
171 JF=10                                                        INPOU189
172 JF=JF/2                                                      INPOU190
JF=JF+JF                                                         INPOU191
JFNP=JF+1                                                        INPOU192
FJFS=JF                                                           INPOU193
FJFH=FJFS/2.0                                                    INPOU194
N01=MU+NI                                                        INPOU195
IF (N0) 181,181,182                                             INPOU196
182 READ (INPUT,580) (S0(I),I=1,N0)                            INPOU197
181 CONTINUE                                                     INPOU198
IF (N1) 184,184,183                                             INPOU199
183 N0P=MU+1                                                     INPOU200
HEAD (INPUT,580) (S0(I),I=N0P,N01)                             INPOU201
184 IF (GAMA) 488,489,489                                       INPOU202
488 GAMA=RH00C/(RH00C-(RH00A-RH00B)-(RH00A-RH00B)/GAMA)      INPOU203
489 ONG=1.0-GAMA                                                 INPOU204
RH0(1)=GAMA*(RH00A-RH00A)+ONG*RH00C                           INPOU205
RH0(2)=GAMA*(RH00A-RH00B)+ONG*RH00C                           INPOU206
GAMAH=GAMA/RH0(1)*(RH00A-RH00B)                               INPOU207
WRITE (KOUT,510)GAMA,GAMAH                                      INPOU208
IF (N0MU) 788,781,788                                          INPOU209
780 WRITE(KOUT,7988)                                             INPOU210
7988 FORMAT (1/23X,34H---DECOMPOSING BACK-UP KINETICS---/)  INPOU211
DO 784 I=1,N0MU                                                 INPOU212
READ (INPUT,5648)A9,RH00(I,1),RH0R(I,1),BBB(I,1),PS1(I,1),EE(I,1), INPOU213
1TRAC(I,1),B9,RH00(I,2),RH0R(I,2),BBB(I,2),PS1(I,2),EE(I,2) INPOU214
2),TRAC(I,2),C9,RH00(I,3),RH0R(I,3),BBB(I,3),PS1(I,3),EE(I,3),TRAC(INPOU215
3I,3)                                                           INPOU216
READ (INPUT,7981) DHV(I),DHC(I),GA(I),TREF(I)                 INPOU217
7981 FORMAT (30X,2F10.5,10X,2F10.5)                           INPOU218
WRITE (KOUT,7982) I                                             INPOU219
7982 FORMAT (1/28X,24HDECOMPOSING BACK-UP NO. ,I)            INPOU220
WRITE (KOUT,587) A9,RH00(I,1),RH0R(I,1),BBB(I,1),PS1(I,1),EE(I,1), INPOU221
1TRAC(I,1),B9,RH00(I,2),RH0R(I,2),BBB(I,2),PS1(I,2),EE(I,2) INPOU222
2),TRAC(I,2),C9,RH00(I,3),RH0R(I,3),BBB(I,3),PS1(I,3),EE(I,3),TRAC(INPOU223
3I,3)                                                           INPOU224
IF (GA(I)) 782,783,783                                         INPOU225
782 GA(I)=RH00(I,3)/(RH00(I,3)-(RH00(I,1)+RH00(I,2)-(RH00(I,1)+ INPOU226
1RH00(I,2))/GA(I))                                              INPOU227
783 ONGA(I)=1.-GA(I)                                           INPOU228
RH0V(I)=GA(I)*(RH00(I,1)+RH00(I,2))+ONGA(I)*RH00(I,3)         INPOU229
RH0C(I)=GA(I)*(RH0R(I,1)+RH0R(I,2))+ONGA(I)*RH0R(I,3)         INPOU230
GAMAH=GA(I)/RH0V(I)*(RH00(I,1)+RH00(I,2))                     INPOU231
WRITE (KOUT,510) GA(I),GAMAH                                    INPOU232
P(I)=RH0V(I)/(RH0V(I)+RH0C(I))                                  INPOU233
PP(I)=P(I)*RH0C(I)                                              INPOU234
DO 7838 J=1,3                                                    INPOU235
7838 FF(I,J)=1.-PS1(I,J)+BBB(I,J)*(RH00(I,J)+1.-PS1(I,J))    INPOU236
784 CONTINUE                                                     INPOU237
781 CONTINUE                                                     INPOU238
IF (DTHB) 412,410,412                                          INPOU239
410 DTHB=.5.                                                    INPOU240
412 DTHIN=.01                                                    INPOU241
413 IF (TPR2) 414,414,415                                       INPOU242
414 TPR2=THFIN                                                    INPOU243
415 IF (TPR3) 416,416,417                                       INPOU244
416 TPR3=THFIN                                                    INPOU245
IF (TPR2-THZHU) 418,418,417                                    INPOU246
418 OTPR2=OTPR2                                                  INPOU247
OTPR2=OTPR3                                                      INPOU248
TPR2=TPR3                                                        INPOU249
GO TO 416                                                         INPOU250
417 WRITE (KOUT,511)                                             INPOU251
THFIN=AMAX1(THFIN,TPR2,TPR3)                                    INPOU252
WRITE (KOUT,512)THZRO,THFIN                                     INPOU253
WRITE (KOUT,513)OTPR2,TPR2                                       INPOU254
WRITE (KOUT,514)OTPR2,TPR2,TPR3                                  INPOU255
WRITE (KOUT,515)OTPR3,TPR3                                       INPOU256
WRITE (KOUT,516) DTHB                                           INPOU257
TRACH=AMIN1(TRACA,TRACB,TRACC)                                  INPOU258
PETE=RH0(1)/(RH0(1)+RH0(2))                                     INPOU259
PFT=PETE+RH0(2)                                                 INPOU260
C ----- MODAL PROPERTIES                                     INPOU261
N=8                                                             INPOU262
KNS=10                                                           INPOU263
N0BUCH=0                                                         INPOU264
J)=JFH                                                           INPOU265
CALL LCOUNT (-MUMN-B,LCT,NPG,RECORD(36))                     INPOU266
302 WRITE (KOUT,517)                                             INPOU267
WRITE (KOUT,518)                                                 INPOU268
WRITE (KOUT,519)                                                 INPOU269

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B=ASTEX
HEAD (INPUT,500) (MATL(I),TA(I),AREA(I),DEL(I),RA(I),RC(I),I=1,NUMN) INPOU271
AE=RA(2) INPOU272
RSV=RA(1) INPOU273
RA(1)=0.0 INPOU274
DO 400 I=1,NUMN INPOU275
IF (I-2) 454,454,453 INPOU276
453 RA(1)=RA(I-1)+DEL(I-1)*DEL(I)/2.0 INPOU277
GO TO 461 INPOU278
452 RA(2)=DEL(I)+DEL(I)/2. INPOU279
b=BLANK INPOU280
461 DEL(I-1)=DEL(I-1)/12. INPOU281
4541 RAV(I)=RA(I) INPOU282
IF (AE) 4542,4543,4542 INPOU283
4542 AREA(I)=(ABS(RSV+RA(I)))**AE INPOU284
GO TO 454 INPOU285
4543 IF (AREA(I)) 4544,4544,454 INPOU286
4544 IF (RSV) 4545,4545,4545 INPOU287
4545 AREA(I)=ABS(RSV+RA(I)) INPOU288
AE=1.0 INPOU289
GO TO 454 INPOU290
4546 AREA(I)=1. INPOU291
454 WRITE (KOUT,520) I,MATL(I),TA(I),AREA(I),DEL(I),RA(I),b,RC(I) INPOU292
IF (MATL(I)-2) 401,405,705 INPOU293
401 NL=I INPOU294
DO 404 J=1,J1 INPOU295
N=N+1 INPOU296
ROA(N)=RHOOA INPOU297
ROB(N)=RHOOB INPOU298
404 ROC(N)=RHODUC INPOU299
J1=JF INPOU300
GO TO 400 INPOU301
405 NL=I INPOU302
DO 406 J=1,J1 INPOU303
N=N+1 INPOU304
ROA(N)=RHOOA INPOU305
ROB(N)=RHOOB INPOU306
406 ROC(N)=RHODUC INPOU307
J1=JF INPOU308
GO TO 400 INPOU309
705 IF (MATL(I)-10) 400,400,700 INPOU310
706 K=MATL(I)-21 INPOU311
VKH=FLOAT(K)/2.0 INPOU312
KH=K/2 INPOU313
IF (VKH-KH) 708,707,708 INPOU314
707 NOCOM(I,1)=RHODR(KH,1) INPOU315
NOCOM(I,2)=RHODR(KH,2) INPOU316
NOCOM(I,3)=RHODR(KH,3) INPOU317
A(I)=0. INPOU318
GO TO 709 INPOU319
708 KH=KH+1 INPOU320
NOCOM(I,1)=RHODR(KH,1) INPOU321
NOCOM(I,2)=RHODR(KH,2) INPOU322
NOCOM(I,3)=RHODR(KH,3) INPOU323
A(I)=1.0 INPOU324
709 IF (KH-KH5) 7090,7092,7090 INPOU325
7090 NF1(KH)=1 INPOU326
KHS=KH INPOU327
NDUCH=NDUCH+1 INPOU328
7092 NLA(KH)=1 INPOU329
400 CONTINUE INPOU330
IF (NDU-NDUCH) 7095,7094,7093 INPOU331
7095 WRITE (KOUT,7096) INPOU332
7096 FORMAT (10X,55#TOU MANY DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT INPOU333
JON) INPOU334
STOP INPOU335
7093 WRITE (KOUT,7097) INPOU336
7097 FORMAT (10X,55#TOU FEW DECOMPOSING BACK-UPS IN NODAL DATA -- QUIT J INPOU337
JON) INPOU338
STOP INPOU339
7094 CONTINUE INPOU340
403 DEL (NUMN)=DEL (NUMN)/12. INPOU341
CALL SLOP (NUMN,RA,AREA,ENA) INPOU342
NUMN=1 INPOU343
IF (NDU) 7098,7099,7098 INPOU344
7098 NUM2=NLA (NDU)=1 INPOU345
GO TO 7091 INPOU346
7099 NUM2=NDN INPOU347
7091 CONTINUE INPOU348
IF (RSV) 4031,4032,4033 INPOU349
4031 RSV=RSV INPOU350
WRITE (KOUT,554) RSV,AE INPOU351
GO TO 304 INPOU352
4032 WRITE (KOUT,555) INPOU353
GO TO 304 INPOU354
4033 WRITE (KOUT,553) RSV,AE INPOU355
304 WRITE (KOUT,521) DELN,JF INPOU356
DELN=DELN/12.0 INPOU357
HEAD (INPUT,502) NCONV,EPSt,TRES,CHCRI,PYCRI,NCON INPOU358
IF (CHCRI) 305,305,306 INPOU359

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305 CMCH1=0.02                                INPOU361
306 IF (PYCH1) 307,307,308                    INPOU362
307 PYCH1=0.98                                INPOU363
308 TA(MUMN+1)=THES                             INPOU364
      CALL LCOUNT(4,                          ,LCT,NPG,RECORD(35)) INPOU365
      WRITE(KOUT,501) HCONV,EDSN,TRES          INPOU366
      CALL LCOUNT(5,                          ,LCT,NPG,RECORD(35)) INPOU367
      WRITE(KOUT,522)                          INPOU368
      WRITE(KOUT,523) DM1,DM2,DELNG           INPOU369
      CALL LCOUNT(12,                         ,LCT,NPG,RECORD(35)) INPOU370
      WRITE(KOUT,524) T2                      INPOU371
      IF (NUBU) 710,710,710,710              INPOU372
7907 DO 7908 J=1,NUBU                          INPOU373
      CALL LCOUNT(6,LCT,NPG,RECORD(35))      INPOU374
      WRITE(KOUT,7902) J                      INPOU375
7909 FORMAT(/21A7,PLASTIC)A,NCCHAR(17A3MGAS) INPOU376
      WRITE(KOUT,7909)                        INPOU377
      WRITE(KOUT,523) DMV(J),DMC(J),DELNG     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(/31A8,DECOMPOSING BACK-UP VIRGIN MATERIALS 22,24,26,28,30, INPOU386
      1 CHAR MATERIALS 23,25,27,29,31)        INPOU387
      IT=0                                    INPOU388
      IL0(3)=1                               INPOU389
      IL0(4)=1                               INPOU390
      KT=1                                    INPOU391
350 IT=IT+1                                  INPOU392
      READ (INPUT,571) NC,TT2(1,KT),TCP(1,KT),TNP(1,KT),TEP(1,KT) INPOU393
      IF (NC) 351,350,351                    INPOU394
351 IN(1,KT)=IL0(KT+2)+IT-1                 INPOU395
      IN(1,KT)=IL0(KT+2)                     INPOU396
      THZ(1,KT)=0.                            INPOU397
      DO 357 I=2,IT                           INPOU398
357 THZ(1,KT)=THZ(1,KT-1)+(TCP(1,KT)+TCP(1,KT-1))/2.+(TT2(1,KT)-TT2(1, INPOU399
      1,KT-1))                                INPOU400
      CALL LOOK (KT+2,TT2(1,KT),THZ(1,KT),0.0,0.0,MSH,DUM,1) INPOU401
      DO 359 I=1,IT                           INPOU402
359 THZ(1,KT)=INZ(1,KT)+MSH                  INPOU403
      CALL LCOUNT(6,                          ,LCT,NPG,RECORD(35)) INPOU404
312 WRITE(KOUT,526) IN,THO(KT),TT2(1,KT),TCP(1,KT),TNP(1,KT),THZ(1,KT) INPOU405
      1,TEP(1,KT),1,1,1)                     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,TT5(1,I),TCBU(1,I),TDBU(1,I) INPOU416
      IF (NC) 713,712,713                     INPOU417
713 I=I(1-21)+1                             INPOU418
      IL0(1-21)=1                             INPOU419
      IN(1-21)=1                             INPOU420
      TINT(1,1)=0.                            INPOU421
      DO 715 J=2,IT                           INPOU422
714 TENT(J,1)=TENT(J-1,1)+(TCBU(J,1)+TCBU(J-1,1))/2.+(TT5(J,1)-TT5(J-1, INPOU423
      1,1))                                    INPOU424
      CALL LOOK (21+1,INZ(1,1),TENT(1,1),0.0,0.0,MSH,DUM,1) INPOU425
      DO 715 J=1,IT                           INPOU426
715 TENT(J,1)=TINT(J,1)+MSH                  INPOU427
      IF (2nd-1) 717,710,717                     INPOU428
716 RUM=HCONV(K)                             INPOU429
      GO TO 716                                INPOU430
717 RUM=HCONV(K)                             INPOU431
718 CALL LCOUNT(6,IT,LCT,NPG,RECORD(35))    INPOU432
      L=1+21                                  INPOU433
      WRITE(KOUT,5260) L,RPM,(TT5(J,1),TCBU(J,1),TDBU(J,1),TENT(J,1), INPOU434
      1,J=1,1))                               INPOU435
      I=1+1                                    INPOU436
      IT=0                                    INPOU437
      IF (NC) 719,353,353                     INPOU438
719 IF (2nd-1) 720,712,720                     INPOU439
720 CONTINUE                                INPOU440
4110 I=0                                       INPOU441
      L=0                                       INPOU442
411 READ (INPUT,561) KT,RHO(KT),INTEL(1,1=1,6) INPOU443
      IF (RHO(KT)) 3550,3550,3550             INPOU444
3550 LL=1                                     INPOU445
      L=1+1                                    INPOU446
      J=0                                       INPOU447
      IF (INTEL(1)) 3553,3553,3554            INPOU448
3553 OT=LOAD(L)                              INPOU449
      I=1                                       INPOU450

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      LL=2
3559 DO 3554 I=LL,6
      IF (KNTL(I)) 3554,3554,3555
3555 JBU=JBU+1
      KSV(JBU)=KNTL(I)
      J=KNTL(I)
      NOUT(J)=L
3556 CONTINUE
      IF (JBU) 3540,3540,3541
3541 CALL ORDER1(JBU,KSU)
3540 IX=0
3551 IX=IX+1
      READ (INPUT,497) NC,TA(IX,L),F1(IX,L),F2(IX,L)
      IF (NC) 3552,3551,3552
3552 ILO(31+L)=1
      IHI(31+L)=IX
      IRI(31+L)=1
      CALL LCOUNT(5+IN-JBU+4*(1-(L+2)/4),LCT,NPG,RECORD(35))
      IF (L-1) 3540,3540,3547
3546 WRITE (KOUT,495) L
3547 WRITE (KOUT,496) 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) (TA(I,L),F1(I,L),F2(I,L),I=1,IX)
      I=0
494 FORMAT(/25A,1NA,12A,5NF1(4),10A,5NF2(4)//(13A,3(5X,F10.4)))
495 FORMAT(/7A,67HTABLES OF OPTIONAL MASS-FRACTION FUNCTIONS FOR THER
496 CONDUCTIVITY/25A,23NF = F1(A)*UP + F2(A)*NC)
4971 FORMAT(/23A,21NF-FUNCTION TABLE NO. ,11,12N ASSIGNED TO)
4981 FORMAT(20A,24NDECOMPOSING BACK-UP NO. ,11)
      IF (NC) 411,411,353
355 IT=IT+1
      READ (INPUT,571) NC,VT2(IT,KT),TCP(IT,KT),TAP(IT,KT)
      IF (NC) 354,355,354
354 ILO(KT+2)=1
      IHI(KT+2)=ILO(KT+2)+IT-1
      IRI(KT+2)=ILO(KT+2)
      CALL LCOUNT(5+IT,NC,LCT,NPG,RECORD(35))
3514 WRITE (KOUT,527) KT,AND(KT),VT2(IT,KT),TCP(IT,KT),TAP(IT,KT),I=1,IT)
      I=0
      IF (NC) 411,411,353
C ----- PYRULYSIS GAS ENTHALPY
353 NT=0
361 I=1+NT1
      NT1=0+NT1
      READ (INPUT,575) NC,TT1(I),I=IN,NT1),TNG(I),I=IN,NT1)
      IF (NC) 361,361,362
364 NT1=NT1+1
362 IF (TT1(NT1)) 364,364,365
365 ILO(2)=1
      IHI(2)=1
      IRI(2)=NT1
      CALL LCOUNT(3+(NT1+9)/4),LCT,NPG,RECORD(35))
3516 WRITE (KOUT,532)
      IF=0
368 I=I+401
      IF=MIN0(NT1,IFN+5)
      WRITE (KOUT,531) (TT1(I),I=IN,IFN)
      WRITE (KOUT,533) (TNG(I),I=IN,IFN)
      IF (NT1-IFN) 367,367,368
C ----- FUNCTIONS OF TIME
367 NTN=0
      IS=0
      NOPT=0
371 NTN=NTN+1
      READ (INPUT,577) NC,TTN(NTN),TNG(NTN),TGR(NTN),TCN(NTN),TPI(NTN),
      TBP(NTN)
      IF (TBP(NTN)) 374,375,374
375 TBP(NTN)=BPP
374 I=1
      IF (TCN(NTN)) 362,362,363
362 I=2
      IF (TNG(NTN)-2.) 364,364,363
364 I=3
363 IOPT(NTN)=1
      IF (I-15) 365,364,365
365 NOPT=NOPT+1
      IS=11
366 IF (NC) 371,371,372
372 ILO(1)=1
      IHI(1)=NTN
      IRI(1)=ILO(1)
      CALL LCOUNT(4+J*NOPT+NTN,LCT,NPG,RECORD(35))
      WRITE (KOUT,536)
      IS=0
      DO 3676 I=1,NTN
      I=IOPT(I)

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IF (I1-I5) 347,349,347
347 IS=I1
GO TO (3471,3472,3473),I1
3471 WRITE(KOUT,535)
GO TO 3474
3472 WRITE(KOUT,552)
GO TO 3475
3473 WRITE(KOUT,556)
GO TO 3475
349 GO TO (3474,3475,3475),I1
3474 WRITE(KOUT,536) TTH(I),I,THE(I),TOR(I),TCH(I),TPI(I),TDRP(I)
GO TO 3476
3475 WRITE(KOUT,536) TTH(I),I,THE(I),TOR(I)
3476 CONTINUE
IF (NC-I) 373,373,743
373 DO 3731 I=1,NTH
3731 TPI(I)=ALOG(AMAX1(TPI(I),.000001))
CALL LCOUNT(2 ,LCT,NPG,RECORD(35))
328 WRITE (KOUT,537)
C -----SURFACE EQUILIBRIUM TABLE
READ(INPUT,5796) CHMS,VF2,BREX,NR,NST,NBPF,NFIS,SMELL
NFIS=NFIS+1
IF (NST) 2900,2900,2901
2900 CH=CHMS
GO TO 2902
2901 IF (KNST-777) 2909,2903,2909
2903 IF (CH=CHMS) 2907,2905,2907
2905 WRITE(KOUT,2906)
CALL LCOUNT(3,LCT,NPG,RECORD(35))
2906 FORMAT(//10A50H SURFACE TABLES ARE THE SAME AS IN PREVIOUS PROBLEM)
GO TO 2912
2907 WRITE(KOUT,2908)
2908 FORMAT(//10A72H PREVIOUS SURFACE TABLES CALLED FOR BUT CH/CH RATIO
1 HAS CHANGED. QUIT JOB//)
STOP
2909 WRITE(KOUT,2910)
2910 FORMAT(//10A70H PREVIOUS SURFACE TABLES CALLED FOR BUT THIS IS FIRST
1ST PROBLEM. QUIT JOB//)
STOP
2902 KNST=777
2912 IF (NR) 3200,3200,3203
3201 IF (RSV) 3204,3204,3204
3200 IF (UREA) 3204,3204,3203
3203 NR=1
GO TO 3201
3204 IF (NST) 3205,3205,3206
3206 IF (NSEN) 2013,2001,2013
3205 CONTINUE
NLS=1
NSEN=1
IP=1
IP4=1
I=1
IN=1
J=0
2000 J=J+1
IF (NBPF) 2001,2000,2001
2000 READ(1,CH=5791) P5V,BMS,TLNC(J,I,IP),TTS(J,I,IP),ULO,TCHN(J,I,IP)
1-TSEN(J),JMS,TSUM(J)
TDP(J,I,IP)=0.
GO TO 2002
2001 READ(1,CH=5780) P5V,BMS,TLNC(J,I,IP),TTS(J,I,IP),ULO,TCHN(J,I,IP)
1-TSEN(J),JMS,TSUM(J),TDP(J,I,IP)
2002 CONTINUE
5700 FORMAT(//8.5//9.4//3.3//9.3,12,21,44,44,210.3)
IF (JMS) 2017,2017,2021
2017 TSUM(J)=BLANK
2021 CONTINUE
IF (TTS(J,I,IP)) 2003,2032,2001
2001 TTS(J,I,IP)=TTS(J,I,IP)+1.0
TCHN(J,I,IP)=TCHN(J,I,IP)+1.0
TSEN(J)=TSEN(J)+1.0
GO TO 2005
2003 TTS(J,I,IP)=TTS(J,I,IP)
2005 IF (NLS) 2009,2007,2007
2007 IN=0
IF (NLS-ULO) 2024,2011,2024
2009 NLS=ULO
2011 IF (NSEN) 2002,2020,2020
2002 IF (JMS) 2000,2004,2004
2004 NLEN=J-1
ISEN(IP)=NSEN
IF (NSEN=1) 2020,2020,2000
2000 DO 2006 L=1,NLEN
TSEN(L,IP)=TTS(L,I,IP)
TSEN(L,IP)=TCHN(L,I,IP)
2006 TSEN(L,IP)=TSEN(L)
CALL SLOP(NSEN,TSEN(1,IP),TSEN(1,IP),TCPSN(1,IP))
CALL SLOP(NSEN,TSEN(1,IP),TSEN(1,IP),TCSEN(1,IP))
LL=(NSEN-1)/3+1

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CALL LCOUNT(LLL*6, LCT,NPG,RECORD(35)) INP0UT21
WRITE (KOUT,5745) TNG(1,IP),TPR(IP),((TTS(L,1,IP),TLNC(L,1,IP),TCHEM INP0UT22
1(L,1,IP),TSUMF(L),L*LL*HNC,LLL),LL=1,LLL) INP0UT23
DO 2056 K=1,HNC INP0UT24
TCHEM(K,1,IP)=CAN*TCHEM(K,1,IP)-TSEN(K) INP0UT25
IF (K=HNC) INP0UT26
2054 TLNC(K,1,IP)=ALOG(AMAX(TLNC(K,1,IP),.00001)) INP0UT27
IF (HNC) 2056,2056,3056 INP0UT28
3056 T2TF(K,1,IP)=ALOG(AMAX(T2TF(K,1,IP),1.E-12)) INP0UT29
2056 CONTINUE INP0UT30
CALL SSWTCH(1,KASH) INP0UT31
GO TO (730,731),KASH INP0UT32
730 CALL LCOUNT(LLL*6,LCT,NPG,RECORD(35)) INP0UT33
WRITE (KOUT,5745) TNG(1,IP),TPR(IP),((TTS(L,1,IP),TLNC(L,1,IP),TCHEM INP0UT34
1(L,1,IP),TSEN(L),L*LL*HNC,LLL),LL=1,LLL) INP0UT35
IF (HNC) 731,731,.0010 INP0UT36
6016 CALL LCOUNT(3*HNC,LCT,NPG,RECORD(35)) INP0UT37
WRITE (KOUT,6017) (T2TF(L,1,IP),L=1,HNC) INP0UT38
6017 FORMAT(/10X,10ALOG 0 PRIME FAIL/(10X,E12.3)) INP0UT39
731 CONTINUE INP0UT40
IF (TTS(J,1,IP)) 2062,2070,2062 INP0UT41
2061 CALL LCOUNT(10*2*HNC,LCT,NPG,RECORD(35)) INP0UT42
WRITE (KOUT,530) INP0UT43
WRITE (KOUT,5794) WZ INP0UT44
GO TO (20610,20611),WZ INP0UT45
20611 WRITE (KOUT,20134) INP0UT46
GO TO 20613 INP0UT47
20610 WRITE (KOUT,20612) INP0UT48
20612 FORMAT(6X,36F15.6) MODEL NOT USED FOR GAS TERMS INP0UT49
20613 CONTINUE INP0UT50
IF (HNC) 2063,2063,2064 INP0UT51
2064 WRITE (KOUT,5794) SHEL INP0UT52
GO TO 2715 INP0UT53
2063 WRITE (KOUT,5794) INP0UT54
2715 IF (SHELL) 2734,2735,2734 INP0UT55
2735 WRITE (KOUT,20136) INP0UT56
GO TO 2737 INP0UT57
2734 WRITE (KOUT,20136) SHEL INP0UT58
2737 IF (HNC) 2062,2062,1390 INP0UT59
2062 TPR(1,IP)=PSU INP0UT60
TNG(1,IP)=ONS INP0UT61
TLNC(1,IP)=TLNC(J,1,IP) INP0UT62
T2TF(1,IP)=T2TF(J,1,IP) INP0UT63
TTS(1,IP)=TTS(J,1,IP) INP0UT64
TCHEM(1,IP)=TCHEM(J,1,IP) INP0UT65
TSUMF(1)=TSUMF(J) INP0UT66
TSEN(1)=TSEN(J) INP0UT67
J=1 INP0UT68
I=IN INP0UT69
IP=IPN INP0UT70
GO TO 2060 INP0UT71
2070 HNC=IP INP0UT72
IN(12)=1 INP0UT73
ILO(12)=1 INP0UT74
INI(12)=1 INP0UT75
ON 2072 1=1,IP INP0UT76
2072 IPN(1)=ALOG(TPR(1)) INP0UT77
IN(13)=1 INP0UT78
INI(13)=HNC INP0UT79
ILO(13)=1 INP0UT80
743 IF (HNC) 740,1390,740 INP0UT81
740 CALL SSWTCH(1,HASH) INP0UT82
GO TO (741,1390),HNC INP0UT83
741 WRITE (KOUT,742) (H(1,J),J=1,HNC) INP0UT84
WRITE (KOUT,742) (H(1,J),J=1,HNC) INP0UT85
WRITE (KOUT,742) HNC,HNC INP0UT86
LUNHNC=2*21 INP0UT87
WRITE (KOUT,742) (INI(1),ILO(1),10(1),J=22,LL) INP0UT88
742 FORMAT(1015) INP0UT89
1390 RETURN INP0UT90
END INP0UT91

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4-26

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L=K+1
IF (K-MAXN) 215, 220, 220
215 IF (MATL(K)-MATL(K-1)) 220, 216, 220
220 U=(TA(K)-TA(L))/10.5*(RAT(K)+RAT(L))+RC(K)/RW(K)
TJU=TA(K)-0.5*RAT(K)*U
TIL=TJU-RC(K)/RW(K)*U
DO 499 N=1,2
IPLS=0
INMS=0
GO TO (401, 402), N
401 T1=TA(K)
T2=TJU
GO TO 403
402 T1=TJU
T2=TIL
403 IF (T-T1) 351, 500, 352
351 INMS=1
GO TO 353
352 IPLS=1
353 IF (T-T2) 357, 500, 355
357 INMS=INMS+1
GO TO 356
355 IPLS=IPLS+1
356 IF (IPLS*INMS) 500, 499, 500
499 CONTINUE
N=3
500 GO TO (220, 220, 220), N
2204 DEP(1,N)=RA(K)+0.*DEL(K)
GO TO 2112
216 DEN=TA(L)-TA(K)
A2=TA(L)-T
A1=TA(K)-T
DEP(1,N)=(RA(K)*A2-RA(L)*A1)/DEN
GO TO 2112
2202 DEN=TJU-TA(K)
A1=TA(K)-T
DEP(1,N)=RA(K)+0.*DEL(K)*A1/DEN
GO TO 2112
2203 IF (K-MAXN) 2205, 2204, 2204
2205 DEN=TA(L)-TIL
A2=TA(L)-T
A1=TA(K)-T
DEP(1,N)=(RA(L)+0.*DEL(L)*A2)/DEN
2112 TOTISSU=0.
211 CONTINUE
IF (N-1) 2100, 2101, 2102
2101 NISSOT=0
TOTISSU=DEP(1,N)
GO TO 2100
2102 CONTINUE
NISSOT=N
2100 CONTINUE
203 RETURN
END

```

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THERM 01
THERM 02
THERM 03
THERM 04
THERM 05
THERM 06
THERM 07
THERM 08
THERM 09
THERM 100
THERM 101
THERM 102
THERM 103
THERM 104
THERM 105
THERM 106
THERM 107
THERM 108
THERM 109
THERM 110
THERM 111
THERM 112
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THERM 133
THERM 134
THERM 135
THERM 136
THERM 137
THERM 138
THERM 139
THERM 140
THERM 141
THERM 142
THERM 143

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C UTILITY ROUTINE LCOUNT -- COUNTS, TITLES, AND NUMBERS EACH PAGE	LCOUNT 1
SUBROUTINE LCOUNT (J,LCT,NPG,R)	LCOUNT 2
COMMON KOUT	LCOUNT 3
DIMENSION N(2)	LCOUNT 4
551 FORMAT(11H10005HAEROTHERM CHARRING MATERIAL THERMAL RESPONSE AND	LCOUNT 5
ISOLATION PROGRAM/7340NPG13/1H 67A2.6)	LCOUNT 6
I=J	LCOUNT 7
IF(I) 4,2,3	LCOUNT 8
2 I=1	LCOUNT 9
GO TO 4	LCOUNT 10
3 LCT=LCT-I	LCOUNT 11
IF (LCT) 4,5,5	LCOUNT 12
4 NPG=NPG-I	LCOUNT 13
LCT=0	LCOUNT 14
WRITE (KOUT,551) NPG,R	LCOUNT 15
5 RETURN	LCOUNT 16
END	LCOUNT 17

C UTILITY ROUTINE LOOK -- LOOKS UP AND LINEARLY INTERPOLATES WITHIN	LOOK 1
C TABLES HAVING ONE INDEPENDENT AND UP TO FOUR DEPENDENT VARIABLES	LOOK 2
SUBROUTINE LOOK(I1,AL,X,A,B,C,E,Y,D,ION)	LOOK 3
COMMON KOUT,IEA,UBEN,VR	LOOK 4
COMMON IM(36),ILO(36),IR(36)	LOOK 5
DIMENSION A(1),Y(1),D(1)	LOOK 6
DIMENSION A(1),B(1),C(1),E(1)	LOOK 7
IM=IM(11)	LOOK 8
IL=ILO(11)	LOOK 9
IEA=0	LOOK 10
IF(A(IM)-X(IL)) 30,30,20	LOOK 11
30 IEA=1	LOOK 12
IF (AL-X(IM)) 3,2,31	LOOK 13
31 IF (AL-X(IL)) 0,5,4	LOOK 14
29 IF(AL-X(IM)) 1,2,3	LOOK 15
1 IF(AL-X(IL)) 4,5,6	LOOK 16
6 I=1(11)	LOOK 17
I=MIN(I,IM)	LOOK 18
I=MAX(I,IL)	LOOK 19
IS=1	LOOK 20
IT=1	LOOK 21
GO TO 8	LOOK 22
11 I=1-1	LOOK 23
IS=0	LOOK 24
8 IF(IEA) 20,20,30	LOOK 25
20 IF(AL-X(I)) 7,10,9	LOOK 26
30 IF(AL-X(I)) 9,10,7	LOOK 27
7 I=1-1	LOOK 28
IT=0	LOOK 29
IF(IS) 10,10,8	LOOK 30
9 IF(IT) 10,10,11	LOOK 31
3 I=X-3	LOOK 32
2 I=IM-1	LOOK 33
GO TO 10	LOOK 34
4 IEA=2	LOOK 35
5 IL=1	LOOK 36
10 DEN=X(I-1)-X(I)	LOOK 37
IR(I)=1	LOOK 38
VR=X(I)-X(I)	LOOK 39
IF(ION) 13,13,14	LOOK 40
14 GO TO (21,22,23,24),ION	LOOK 41
24 Y(4)=E(I)	LOOK 42
D(4)=E(I+1)-E(I)	LOOK 43
23 Y(3)=C(I)	LOOK 44
D(3)=C(I+1)-C(I)	LOOK 45
22 Y(2)=B(I)	LOOK 46
D(2)=B(I+1)-B(I)	LOOK 47
21 Y(1)=A(I)	LOOK 48
D(1)=A(I+1)-A(I)	LOOK 49
DO 12 J=1,ION	LOOK 50
20 D(J)=D(J)/DEN	LOOK 51
12 Y(J)=Y(J)+D(J)*VR	LOOK 52
13 VR=VR/DEN	LOOK 53
RETURN	LOOK 54
END	LOOK 55

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,XAM,PRM,NMUM,X,P,EM)	OGLE	5
DIMENSION XAM(1),X(1),P(1),EM(1),PRM(1),DPDIN(1)	OGLE	6
ADIF=X(NMUM)-X(1)	OGLE	7
IS=1	OGLE	8
2 ON 600 J=1,N	OGLE	9
XA=XAM(J)	OGLE	10
59 IO=1	OGLE	11
IT=1	OGLE	12
61 IF (ADIF) 72,60,71	OGLE	13
71 IF (XA-X(15)) 62,63,64	OGLE	14
72 IF (X(15)-XA) 62,63,64	OGLE	15
62 IF (15-1) 671,671,60	OGLE	16
60 IS=15-1	OGLE	17
IT=2	OGLE	18
GO TO (61,60),10	OGLE	19
672 IG=NMUM	OGLE	20
671 I=IS	OGLE	21
MO=0	OGLE	22
DPDI=EM(I)	OGLE	23
50 TO 67	OGLE	24
63 PR=P(15)	OGLE	25
DPDI=EM(15)	OGLE	26
GO TO 601	OGLE	27
64 IS=IS+1	OGLE	28
IF (15-NMUM) 69,69,672	OGLE	29
69 IO=2	OGLE	30
GO TO (61,65),17	OGLE	31
65 IS=15-1	OGLE	32
66 I=IS	OGLE	33
G=((P(I)-P(1))/(X(I)-X(1)))-EM(I)/(X(I)-X(1))	OGLE	34
F=((EM(I)-EM(1))/(X(I)-X(1)))-2.*G/(X(I)-X(1))	OGLE	35
M=(F*(XA-X(1))+G*(XA-X(1)))	OGLE	36
DPDI=(M+M+EM(I)+F*(XA-X(1))+(XA-X(1)))	OGLE	37
67 PR=(M+EM(I))*(XA-X(1))+P(1)	OGLE	38
601 CONTINUE	OGLE	39
PRM(J)=PR	OGLE	40
600 CONTINUE	OGLE	41
60 CONTINUE	OGLE	42
4 RETURN	OGLE	43
END	OGLE	44

C UTILITY ROUTINE ORDER0 -- ROUTINE TO REORDER A FLOATING POINT ARRAY	ORDER0 1
C WITH SPECIAL FEATURES FOR ORDERING SURFACE THERMOCHEMISTRY TABLES	ORDER0 2
SUBROUTINE ORDER0 (NA,X1,I1)	ORDER0 3
DIMENSION A1(I1),I1(I1)	ORDER0 4
DIMENSION LS(20)	ORDER0 5
NN=IAMS(NH)	ORDER0 6
LS(1)=0	ORDER0 7
LS(2)=1	ORDER0 8
LS(3)=2	ORDER0 9
LI=3	ORDER010
I1(I1)=1	ORDER011
DO 1 N=2,NN	ORDER012
I1(N)=N	ORDER013
L=LS(LI)	ORDER014
LA=L	ORDER015
J=N	ORDER016
A1C=A1(J)	ORDER017
I1C=I1(J)	ORDER018
J=J-L	ORDER019
IF (J) 31,31,34	ORDER020
34 L=L-1	ORDER021
LS(LI)=L-L	ORDER022
GO TO 29	ORDER023
33 LA=LA-1	ORDER024
L=LS(LA)	ORDER025
IF (L) 3,3,41	ORDER026
41 J=J-L	ORDER027
32 IF (J) 31,31,29	ORDER028
31 LA=LA-1	ORDER029
L=LS(LA)	ORDER030
J=J-L	ORDER031
IF (L) 4,4,32	ORDER032
30 LA=LA-1	ORDER033
L=LS(LA)	ORDER034
IF (L) 4,4,42	ORDER035
42 J=J-L	ORDER036
29 IF (NA) 229,129,129	ORDER037
229 IF (A1C-A1(J)) 34,53,33	ORDER038
129 IF (A1(J)-A1C) 34,53,33	ORDER039
53 J=1	ORDER040
GO TO 3	ORDER041
4 J=J-1	ORDER042
3 N=N-1	ORDER043
NN=N	ORDER044
DO 2 K=J,NN	ORDER045
A1(N+1)=A1(K)	ORDER046
I1(N+1)=I1(K)	ORDER047
2 N=N-1	ORDER048
I1(J)=I1C	ORDER049
A1(J)=A1C	ORDER050
RETURN	ORDER051
END	ORDER052

C UTILITY ROUTINE ORDER1 -- ROUTINE TO REORDER INTEGER ARRAYS	ORDER1 1
SUBROUTINE ORDER1(NA,IPH)	ORDER1 2
DIMENSION IPH(70)	ORDER1 3
N=NA	ORDER1 4
IF (NA) 9,6,1	ORDER1 5
9 N=N	ORDER1 6
1 IF (N-1) 6,6,2	ORDER1 7
2 K = 0	ORDER1 8
DO 4 J=2,N	ORDER1 9
IF (NA) 6,7,7	ORDER110
7 IF (IPH(J-1)-IPH(J)) 4,6,3	ORDER111
6 IF (IPH(J-1)-IPH(J)) 3,3,6	ORDER112
3 IT = IPH(J-1)	ORDER113
IPH(J-1) = IPH(J)	ORDER114
IPH(J) = IT	ORDER115
K = 1	ORDER116
4 CONTINUE	ORDER117
IF (K) 6,6,2	ORDER118
6 RETURN	ORDER119
END	ORDER120

```

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 I1=1,N
  I=I1
  21 J=L(I1)
  L(I1)=I
  IF(J=1) 22,30,22
  22 IF(I5) 25,23,25
  23 SA=A(I1)
  SB=B(I1)
  SC=C(I1)
  SD=D(I1)
  IS=I
  26 A(I1)=A(J)
  B(I1)=B(J)
  C(I1)=C(J)
  D(I1)=D(J)
  I=J
  GO TO 21
  25 IF(I5=J) 26,28,26
  28 IS=0
  A(I1)=SA
  B(I1)=SB
  C(I1)=SC
  D(I1)=SD
  30 CONTINUE
  RETURN
  END

```

```

SEQUA 1
SEQUA 2
SEQUA 3
SEQUA 4
SEQUA 5
SEQUA 6
SEQUA 7
SEQUA 8
SEQUA 9
SEQUA 10
SEQUA 11
SEQUA 12
SEQUA 13
SEQUA 14
SEQUA 15
SEQUA 16
SEQUA 17
SEQUA 18
SEQUA 19
SEQUA 20
SEQUA 21
SEQUA 22
SEQUA 23
SEQUA 24
SEQUA 25
SEQUA 26
SEQUA 27
SEQUA 28
SEQUA 29
SEQUA 30
SEQUA 31

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```

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 I1=1,N
  I=I1
  21 J=L(I1)
  L(I1)=I
  IF(J=1) 22,30,22
  22 IF(I5) 25,23,25
  23 SA=A(I1)
  SB=B(I1)
  SC=C(I1)
  SD=D(I1)
  SE=E(I1)
  IS=I
  26 A(I1)=A(J)
  B(I1)=B(J)
  C(I1)=C(J)
  D(I1)=D(J)
  E(I1)=E(J)
  I=J
  GO TO 21
  25 IF(I5=J) 26,28,26
  28 IS=0
  A(I1)=SA
  B(I1)=SB
  C(I1)=SC
  D(I1)=SD
  E(I1)=SE
  30 CONTINUE
  RETURN
  END

```

```

SEQUAS 1
SEQUAS 2
SEQUAS 3
SEQUAS 4
SEQUAS 5
SEQUAS 6
SEQUAS 7
SEQUAS 8
SEQUAS 9
SEQUAS 10
SEQUAS 11
SEQUAS 12
SEQUAS 13
SEQUAS 14
SEQUAS 15
SEQUAS 16
SEQUAS 17
SEQUAS 18
SEQUAS 19
SEQUAS 20
SEQUAS 21
SEQUAS 22
SEQUAS 23
SEQUAS 24
SEQUAS 25
SEQUAS 26
SEQUAS 27
SEQUAS 28
SEQUAS 29
SEQUAS 30
SEQUAS 31
SEQUAS 32
SEQUAS 33
SEQUAS 34
SEQUAS 35

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C UTILITY ROUTINE SLOPU -- GENERATES SLOPES OF DEPENDENT VARIABLES	SLOPE 1
C BASED ON QUADRATIC FITS THROUGH THREE SUCCESSIVE TABLE POINTS	SLOPE 2
C SUBROUTINE SLOPU(NUMA,X,P,EN)	SLOPE 3
C SLOPE EVALUATION ROUTINE	SLOPE 4
C	SLOPE 5
DIMENSION X(1), P(1), FM(1), Z(1)	SLOPE 6
30 EN(2) = (P(2) - P(1)) / (X(2) - X(1))	SLOPE 7
EN(1) = EN(2)	SLOPE 8
Z(1)=0.0	SLOPE 9
QC = EN(1)	SLOPE 10
DO 36 I = 1, NUMX	SLOPE 11
IPO = I - 1	SLOPE 12
IPT = I - 2	SLOPE 13
IT = IPO - NUMX	SLOPE 14
IF (IT) 33, J1, 32	SLOPE 15
31 OB=QC	SLOPE 16
GO TO 41	SLOPE 17
32 GO TO 40	SLOPE 18
33 XOT = X(I) - X(IPO)	SLOPE 19
XTT = X(IPO) - X(IPT)	SLOPE 20
ATO = X(IPT) - X(I)	SLOPE 21
AA = P(I) / (XOT * ATO)	SLOPE 22
XOTT=XOT*XTT	SLOPE 23
37 AB=P(1+1)/XOTT	SLOPE 24
AC = P(IPT) / (XTT * ATO)	SLOPE 25
AAA = AA * XTT	SLOPE 26
ABB = AB * ATO	SLOPE 27
ACC = AC * XOT	SLOPE 28
QA = QC	SLOPE 29
QH = EN(1)	SLOPE 30
QC = EN (IPO)	SLOPE 31
EN(IPO) = AB * (XOT - XTT) * ACC - AAA	SLOPE 32
EN(IPT) = AC * (ATT - XTO) * AAA - ABB	SLOPE 33
EN(I) = AA * (ATO - XOT) * ABB - ACC	SLOPE 34
34 QE = EN(1)	SLOPE 35
IF (I-2) 36,41,35	SLOPE 36
35 EN(1) = (QE * QA) / 2.	SLOPE 37
41 EN(1) = (EN(1) * QB) / 2.	SLOPE 38
40 XD=X(I)-X(I-1)	SLOPE 39
36 CONTINUE	SLOPE 40
RETURN	SLOPE 41
END	SLOPE 42

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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.			

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