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USER'S GUIDE FOR THE BWR LOCA ANALYSIS CAPABILITY OF THE WRAP-EM SYSTEM

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ABSTRACT

The input specifications for the BWR analysis capability of the WRAP-EM system are presented in this document along with the JOSHUA input templates. This document along with the WRAP user's guide provides a step-by-step procedure for setting up a BWR data base for the WRAP-EM system.

Table of Contents

I. Introduction

The WRAP-EM System is an integrated system of computer codes for complete analysis of the loss-of-coolant accident (LOCA) in light water power reactors. The overall system for analysis of boiling water reactors (BWRs) is shown in Figure 1. The modules that comprise the WRAP-BWR-EM system are:

- o WRAPEX - directs the sequence in which the other modules are executed.
- o WRAPIT - reads input records and creates the WRAP intermediate data set (WIDS) through which other modules communicate.
- o WRIN - initializes the thermal-hydraulic state describing the reactor system.
- o TWRAM - calculates the transient response of the system during the blowdown phase of the LOCA.
- o WROP - processes the edit tape and creates microfiche plots of system variables versus time.
- o WRROT - allows the user to restart and continue an earlier calculation from data stored on the restart tape.
- o MWRROT - allows the user to make modifications in system and problem specifications of an earlier calculation and then restart and continue that calculation.
- o GAPCON[1] - calculates the fuel gap conductance and stored energy and provides initial fuel conditions used by MOXY, WRIN, and TWRAM.
- o MOXY [2] - calculates the fuel hot plane temperature using transient response data from TWRAM and NORCOOL.
- o NORCOOL[3] - calculates the transient response of the system during the reflood portion of the accident.

The first seven modules comprise the original WRAP[4,5,6] system developed at the Savannah River Laboratory (SRL) during 1977. WRAP is a reprogrammed version of the RELAP4/MOD5[7] code with an extensively restructured input format, dynamic dimensioning, and additional calculational capabilities such as a self-initialization procedure for pressurized water reactors[6] and an automatic restart capability with provision for renodalization. The new modules (GAPCON, MOXY, and NORCOOL) along with a self-initialization procedure for BWRs[8] which has been developed at SRL provide all the computational tools necessary for a complete LOCA analysis of a BWR.

In this report, the input specifications for the new WRAP-EM modules and the data interfaces between modules are described. This report[a] along with the WRAP user's guide[5] provides a complete description of the input[b] required for the WRAP-EM system. The user should refer to companion reports[8,9] for a more detailed description of the structure of the WRAP-EM system and the BWR self-initialization procedure.

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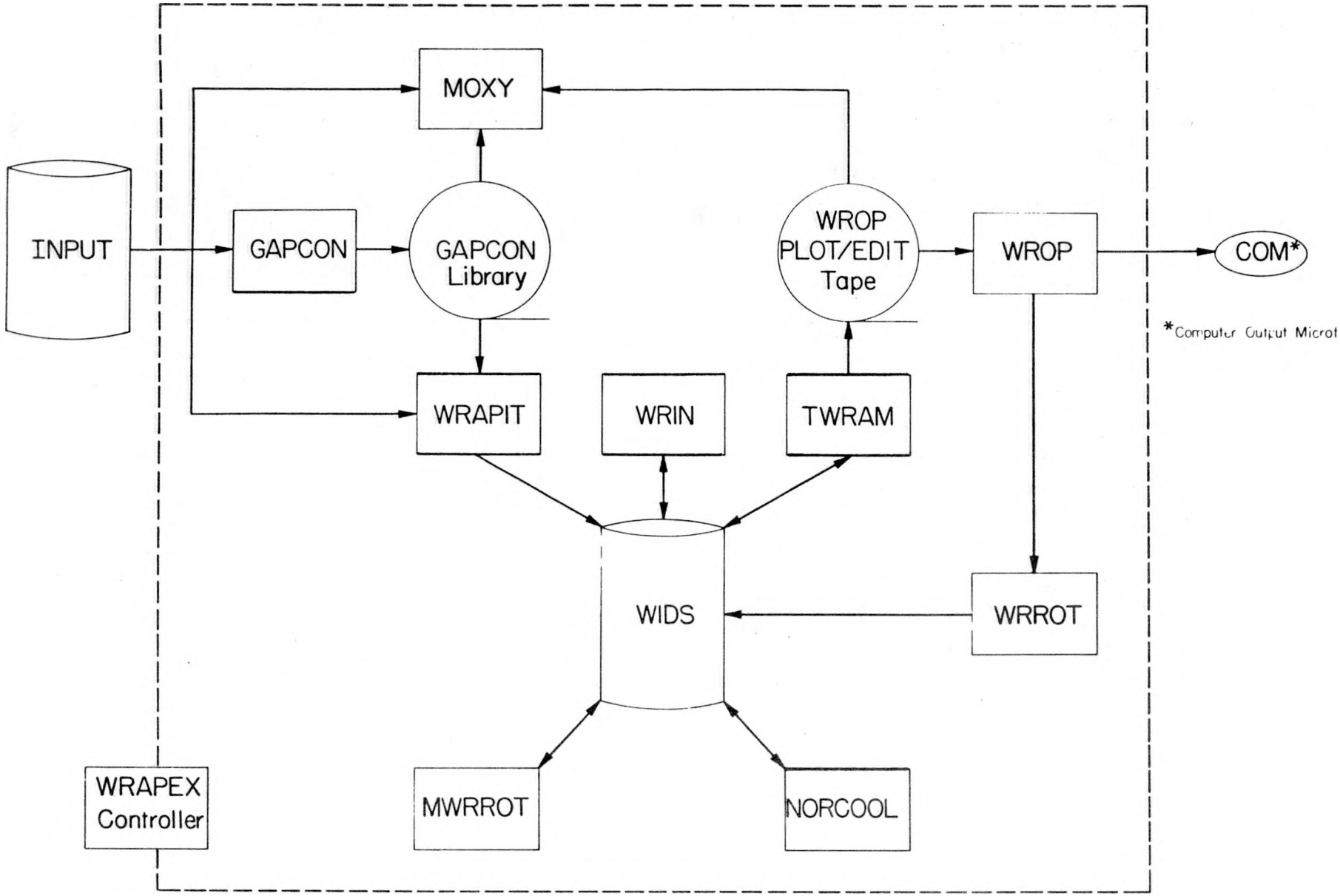
a) In the writing of this report, a familiarity of the reader with the concepts presented in references 4 and 5 was assumed.

b) WRAP records which have been modified during the WRAP-EM development are described in Appendix A.

FIGURE 1



CONCEPTUAL VIEW OF WRAP-EM SYSTEM

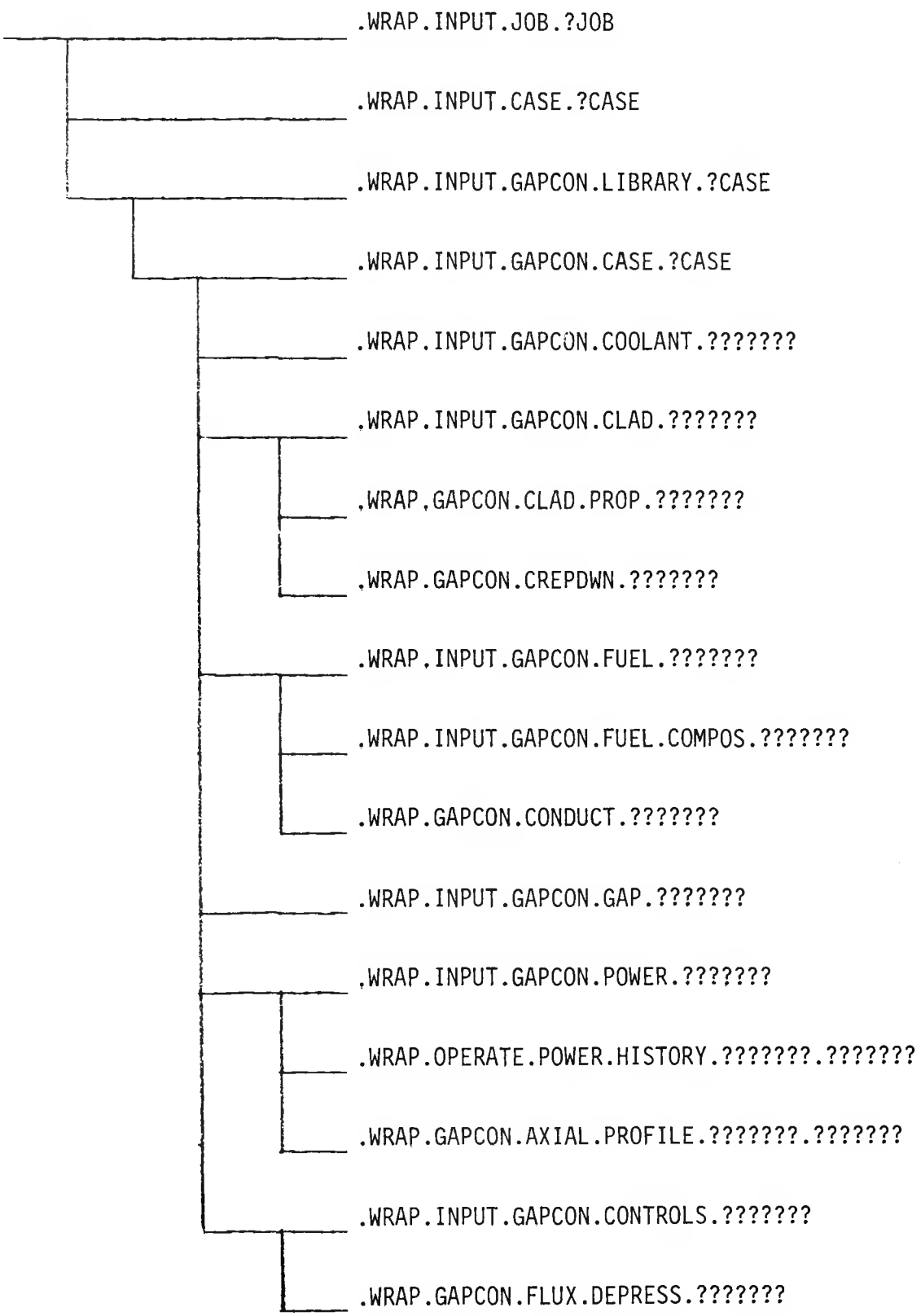
GAPCON, NORCOOL, and MOXY were implemented in the WRAP-EM system by converting the codes to JOSHUA[10] modules, converting the card input formats to templated input JOSHUA records, and defining and programming data interfaces to automate data transfer between the new and existing modules. Each of these modules is designed to run either stand-alone or as part of the WRAP-EM modular path. Sections II, III and IV describe the input records required for execution of GAPCON, MOXY, and NORCOOL respectively. Section V describes the interface specifications between the various modules of the WRAP-EM system. The interfaces are designed to overwrite the appropriate input records for a module with the information calculated in the previous computational step. The last section describes the GAPCON data library in which GAPCON data is stored for retrieval by the GAPCON/WRAP and GAPCON/MOXY interfaces

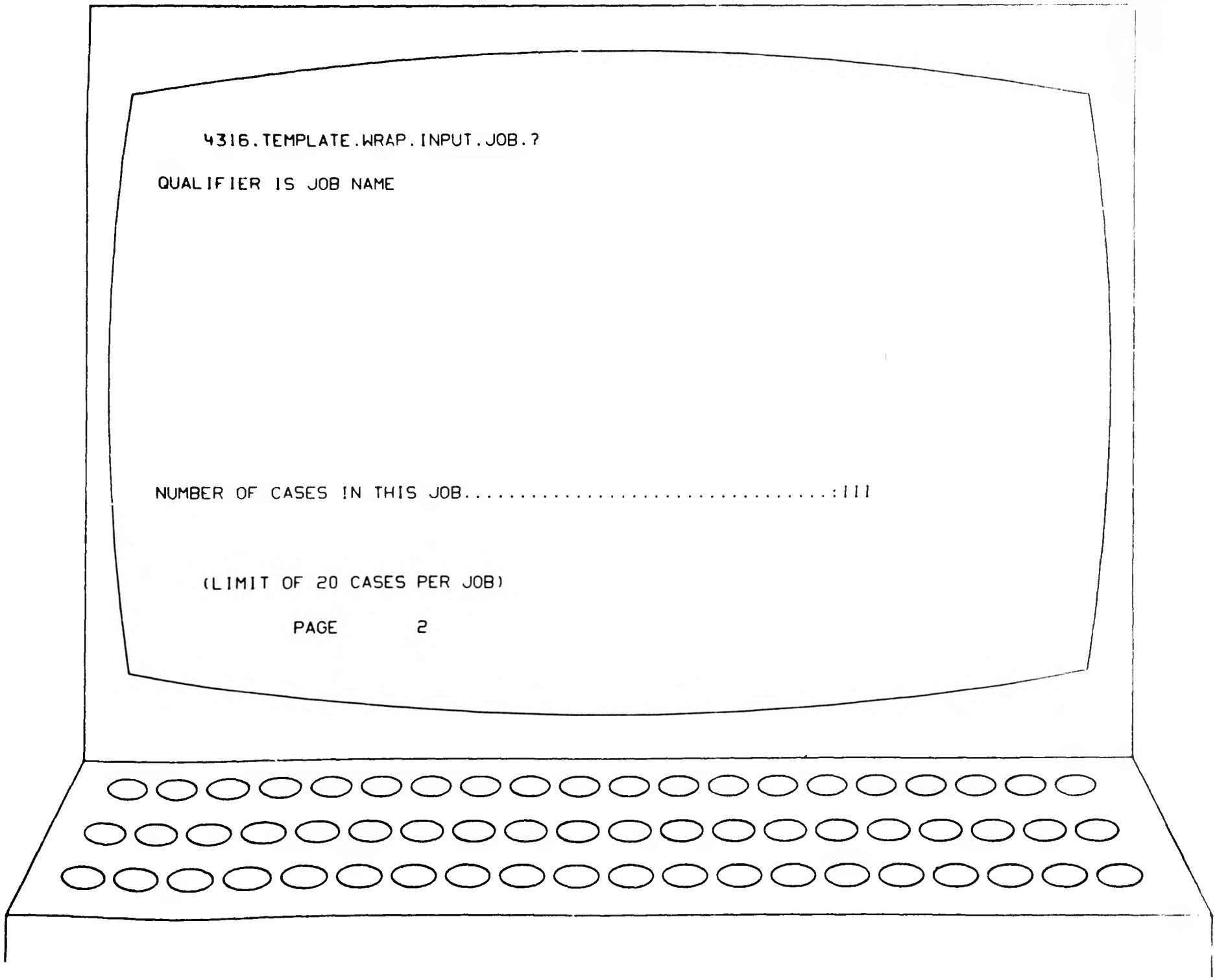
II. GAPCON Input Records

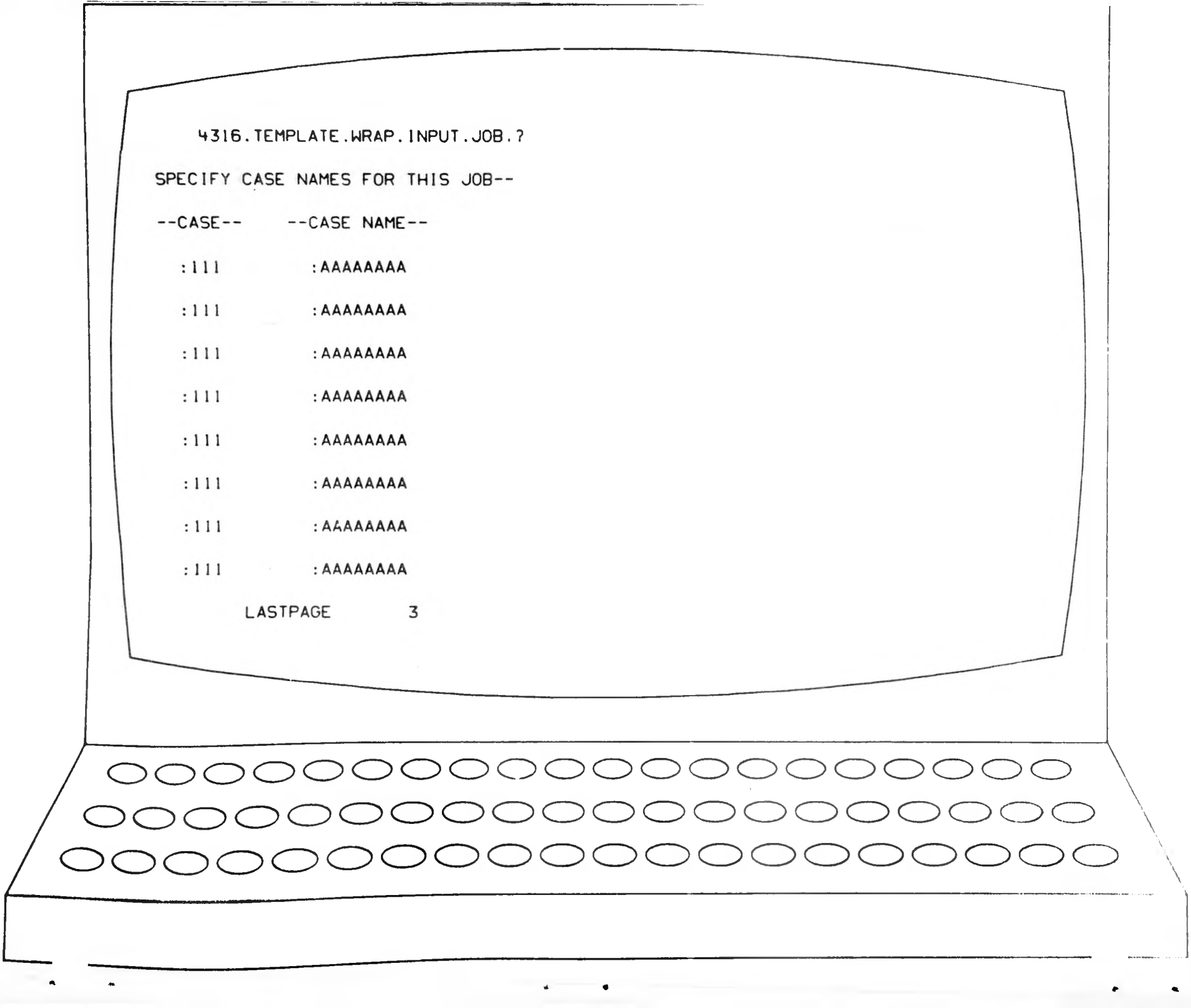
The GAPCON input records are listed in Figure 2. The ?CASE qualifier is the case name specified in the WRAP.INPUT.JOB.?JOB record where ?JOB is the name of the job being executed. The other records require a name qualifier (????????) as specified in the WRAP.INPUT.GAPCON.CASE.?CASE record and thus can be cataloged for use in parametric studies. The input templates for the GAPCON records are presented in pp. 5-46.

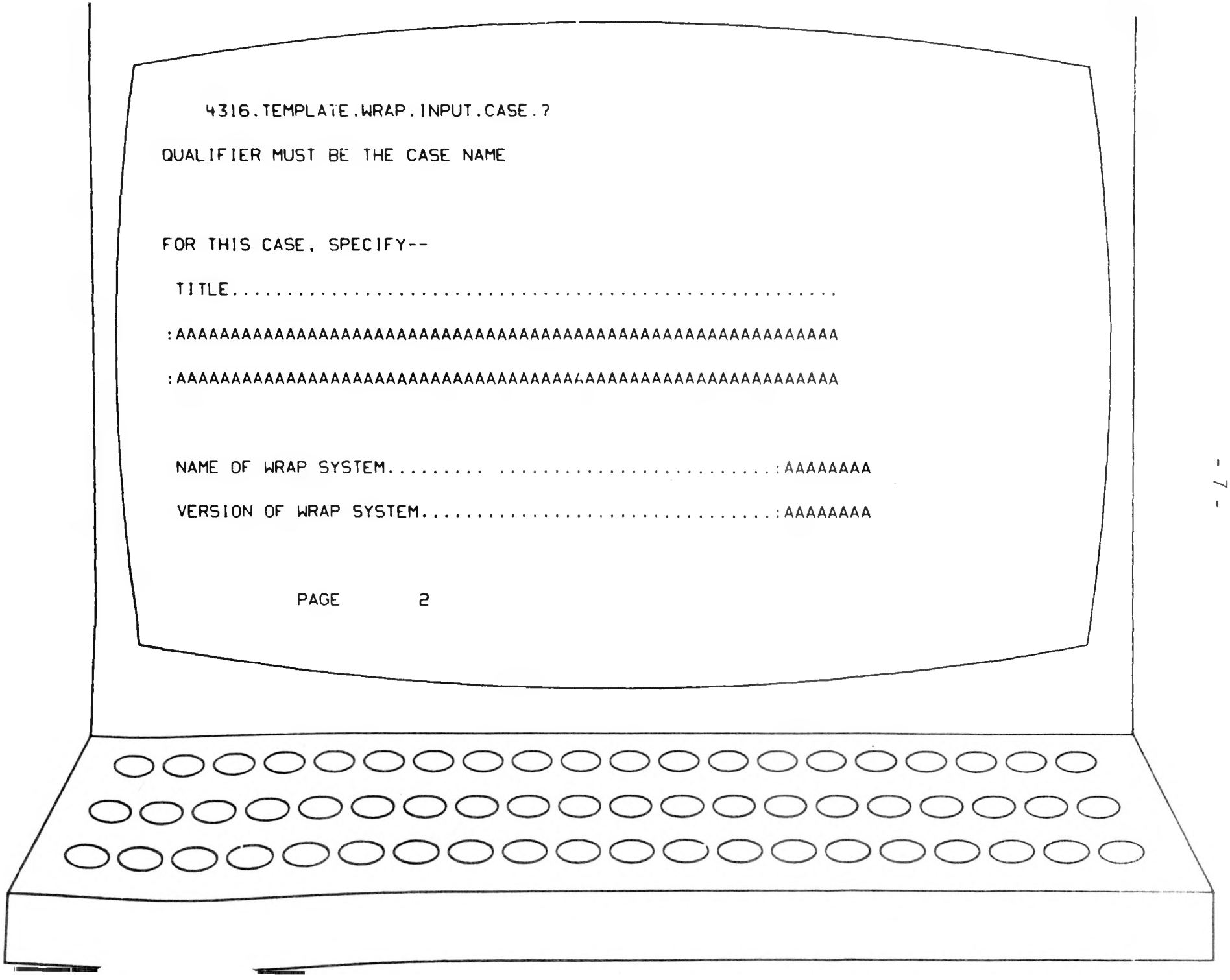
FIGURE 2

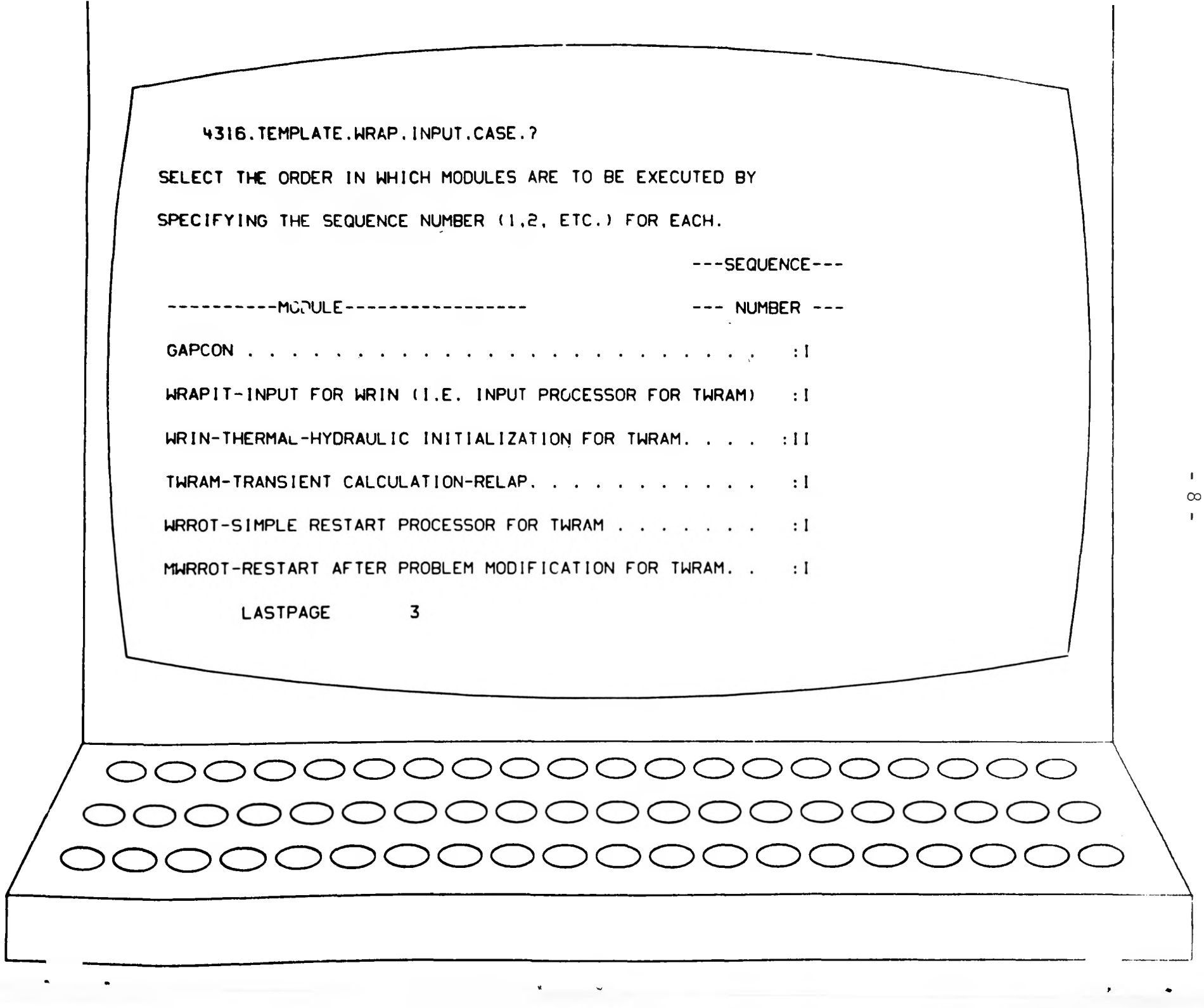
Outline of GAPCON Input Records in WRAP-EM System

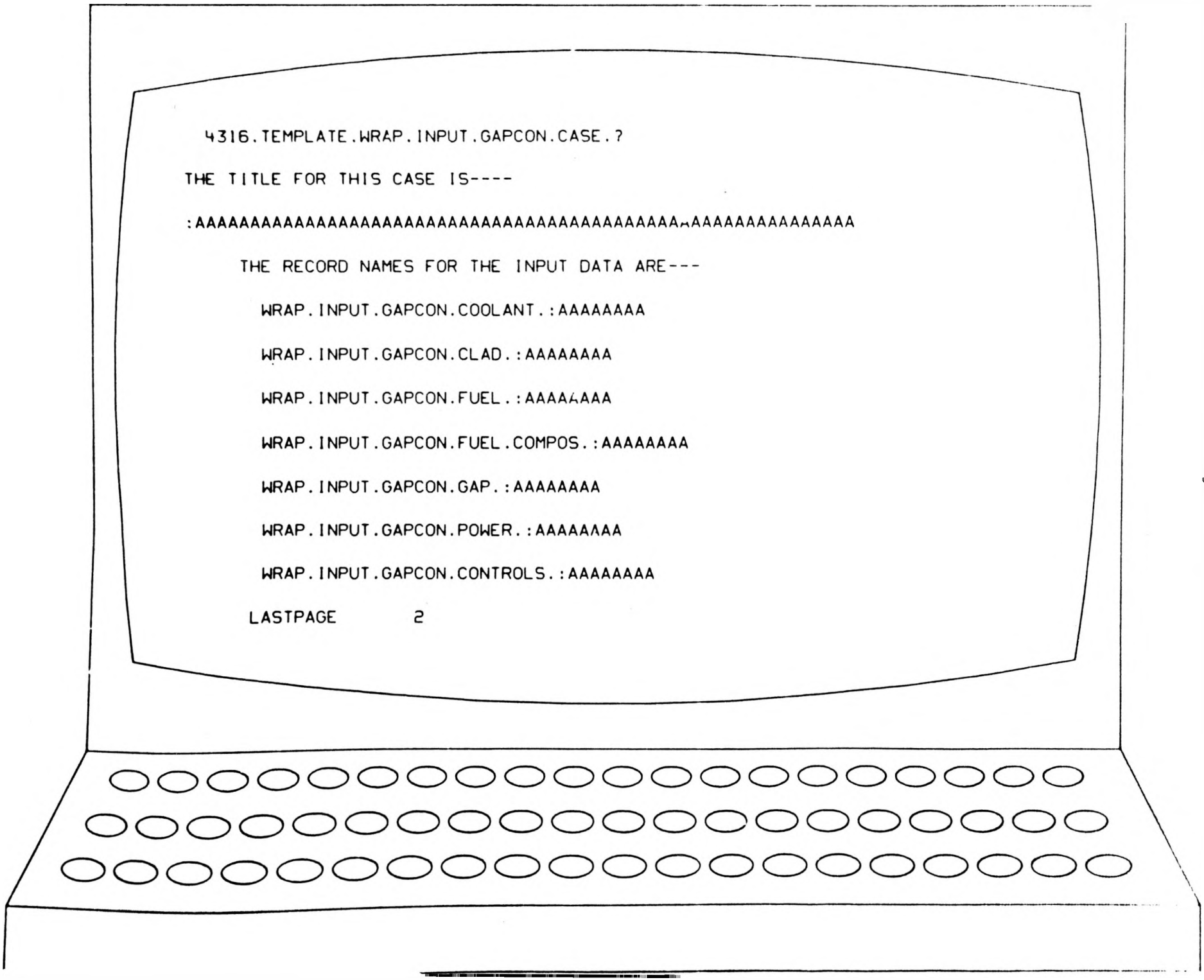


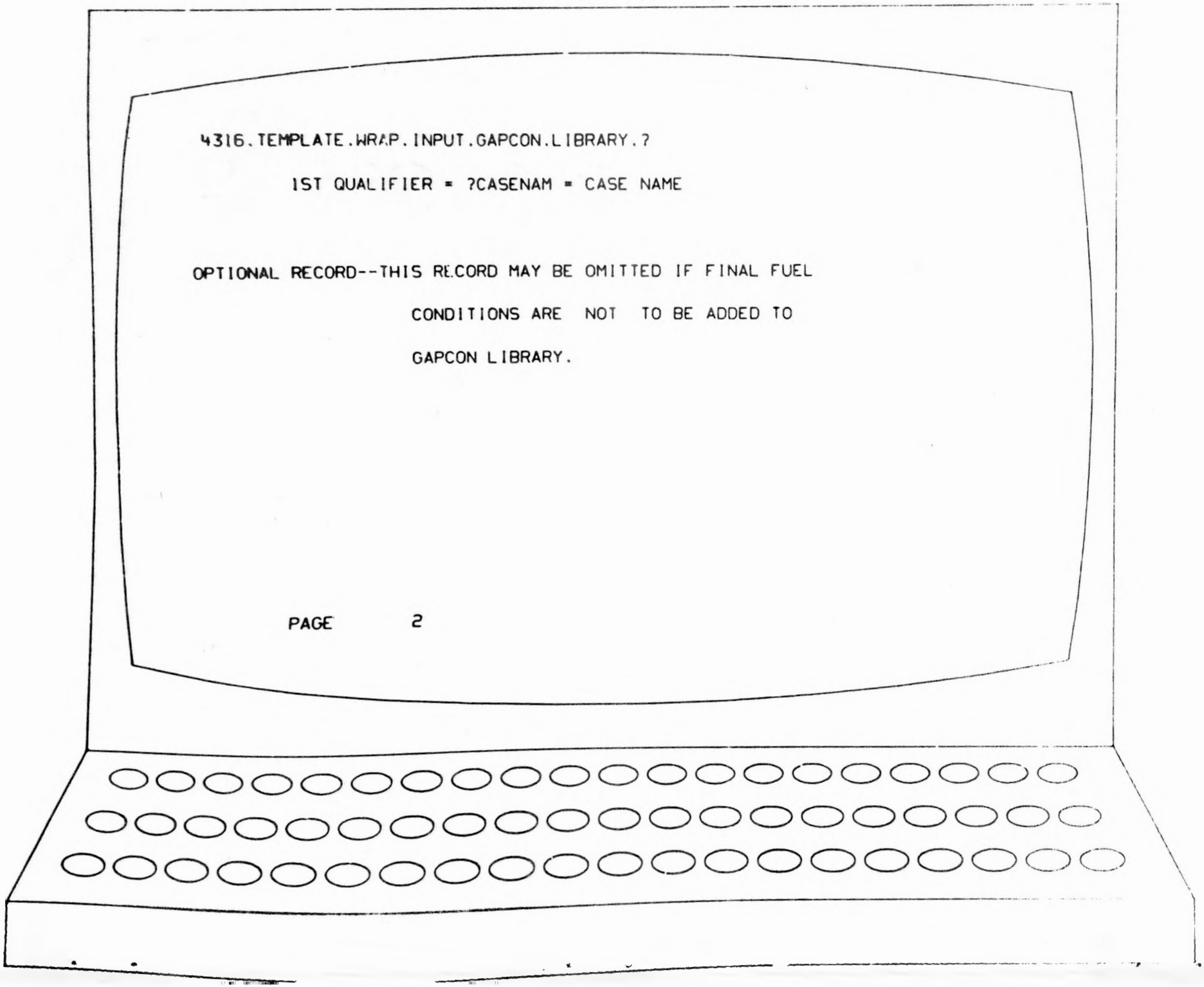

4316.TEMPLATE.WRAP.INPUT.JOB.?
QUALIFIER IS JOB NAME
NUMBER OF CASES IN THIS JOB.....:111
(LIMIT OF 20 CASES PER JOB)
PAGE 2

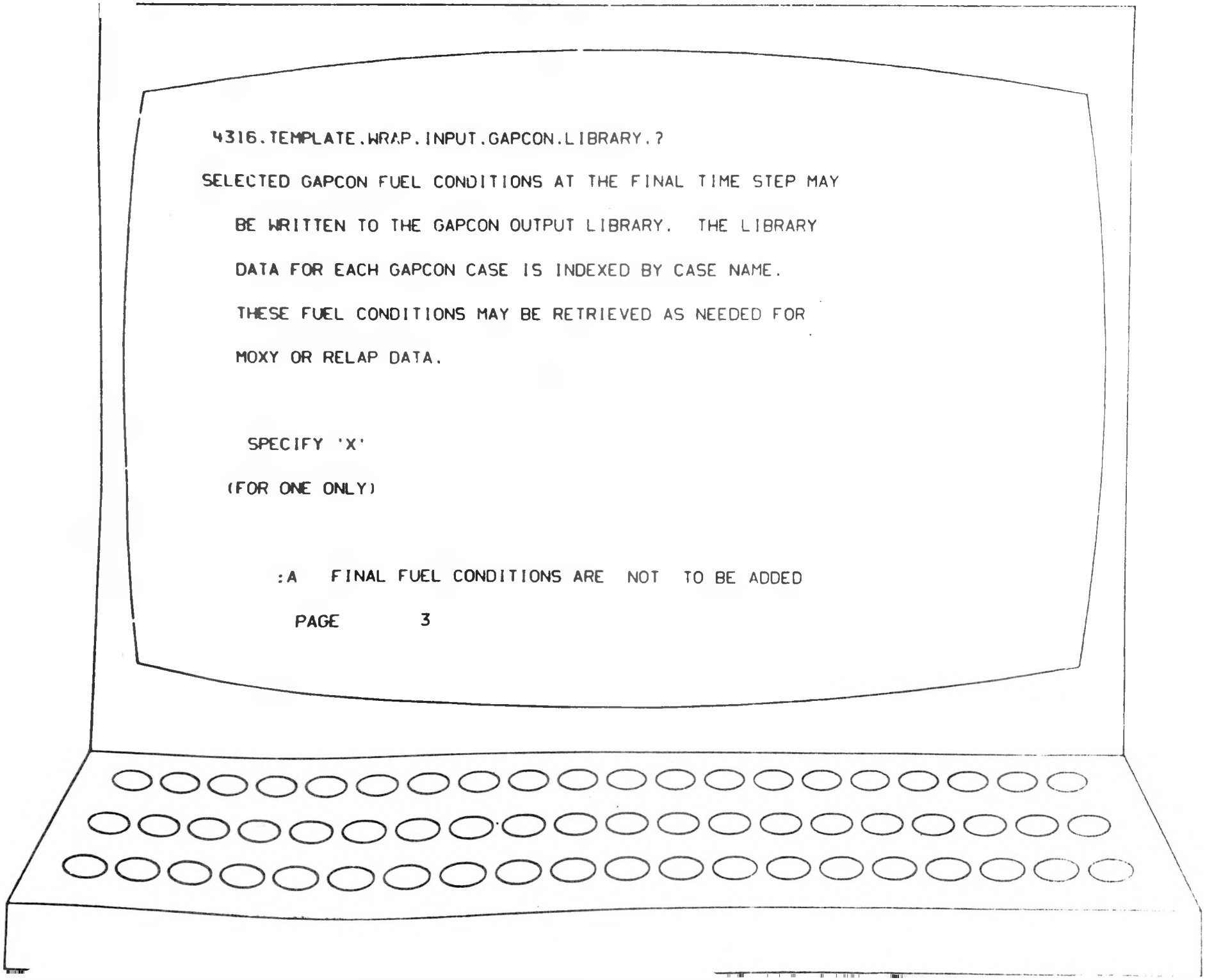

4316.TEMPLATE.WRAP.INPUT.JOB.?
SPECIFY CASE NAMES FOR THIS JOB--
--CASE--
--CASE NAME--
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
:111
:AAAAAAAA
LASTPAGE
3

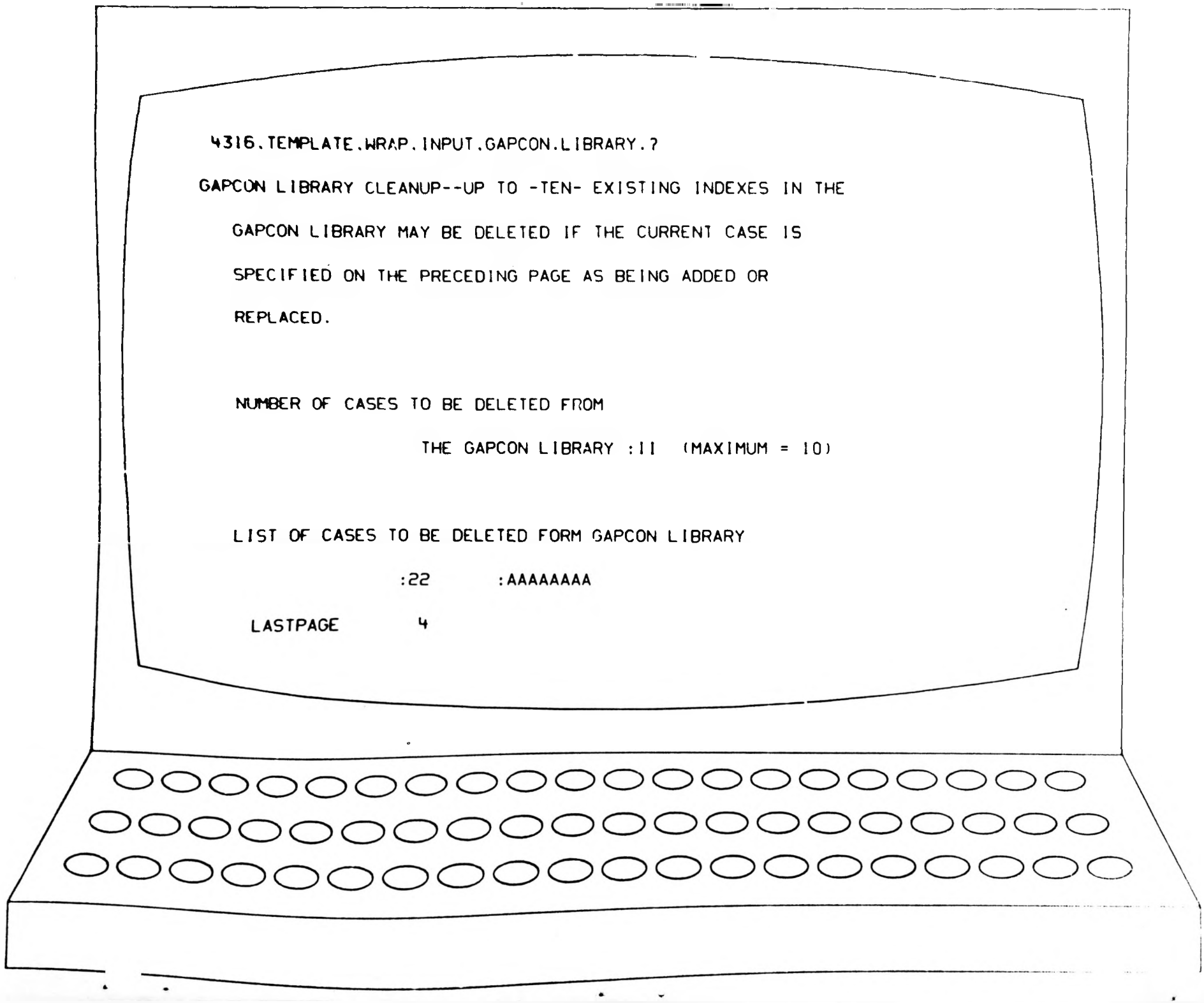

4316.TEMPLATE.WRAP.INPUT.CASE.?
QUALIFIER MUST BE THE CASE NAME
FOR THIS CASE, SPECIFY--
TITLE.....
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
NAME OF WRAP SYSTEM..... .....:AAAAAAAA
VERSION OF WRAP SYSTEM.....:AAAAAAAA
PAGE 2

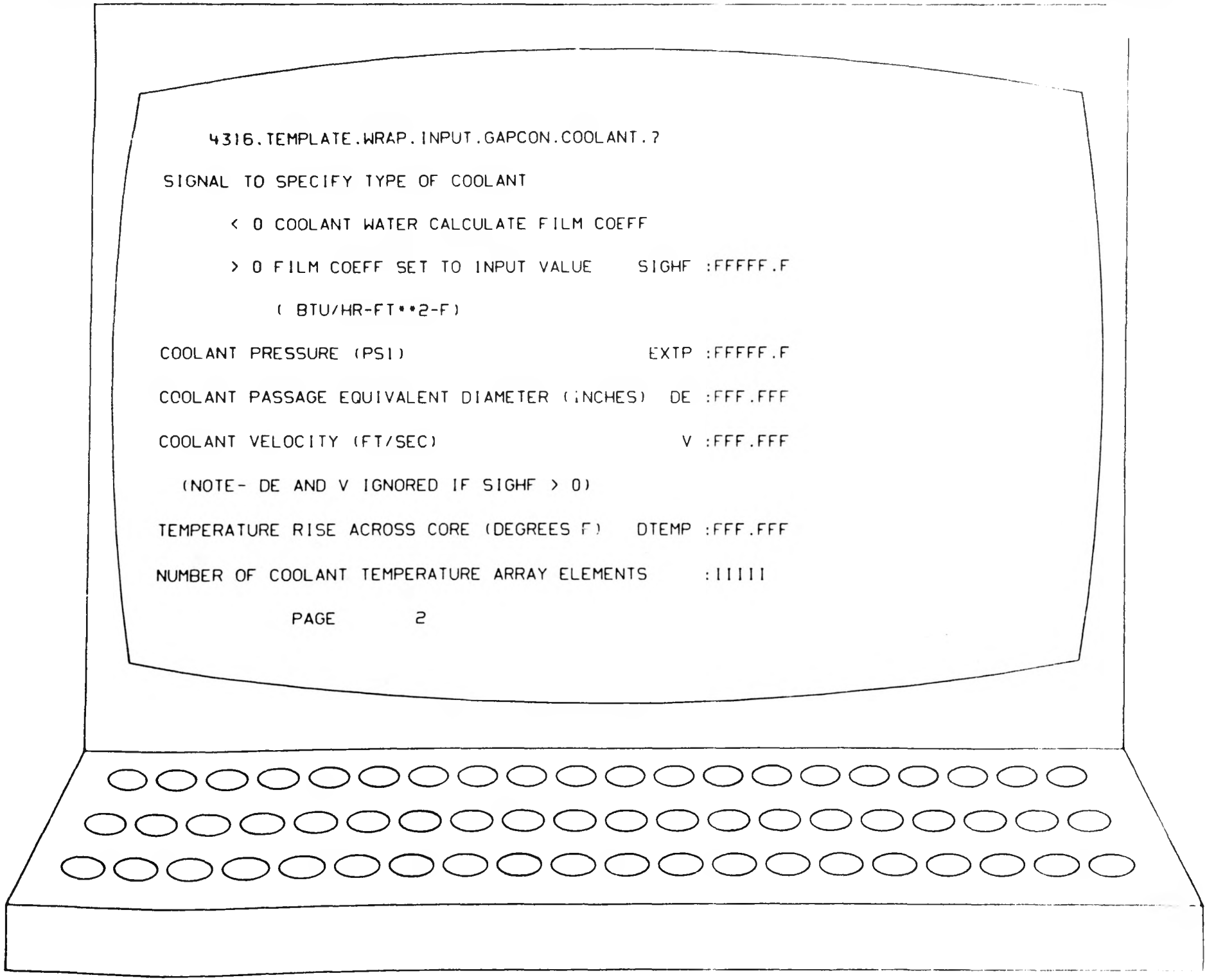

4316.TEMPLATE.WRAP.INPUT.CASE.?
SELECT THE ORDER IN WHICH MODULES ARE TO BE EXECUTED BY
SPECIFYING THE SEQUENCE NUMBER (1,2, ETC.) FOR EACH.
---SEQUENCE---
---------MODULE----------
--- NUMBER ---
GAPCON . . . . . :1
WRAPIT-INPUT FOR WRIN (I.E. INPUT PROCESSOR FOR TWRAM) :1
WRIN-THERMAL-HYDRAULIC INITIALIZATION FOR TWRAM. . . . :11
TWRAM-TRANSIENT CALCULATION-RELAP. . . . . :1
WRROT-SIMPLE RESTART PROCESSOR FOR TWRAM . . . . . :1
MWRROT-RESTART AFTER PROBLEM MODIFICATION FOR TWRAM. . :1
LASTPAGE 3

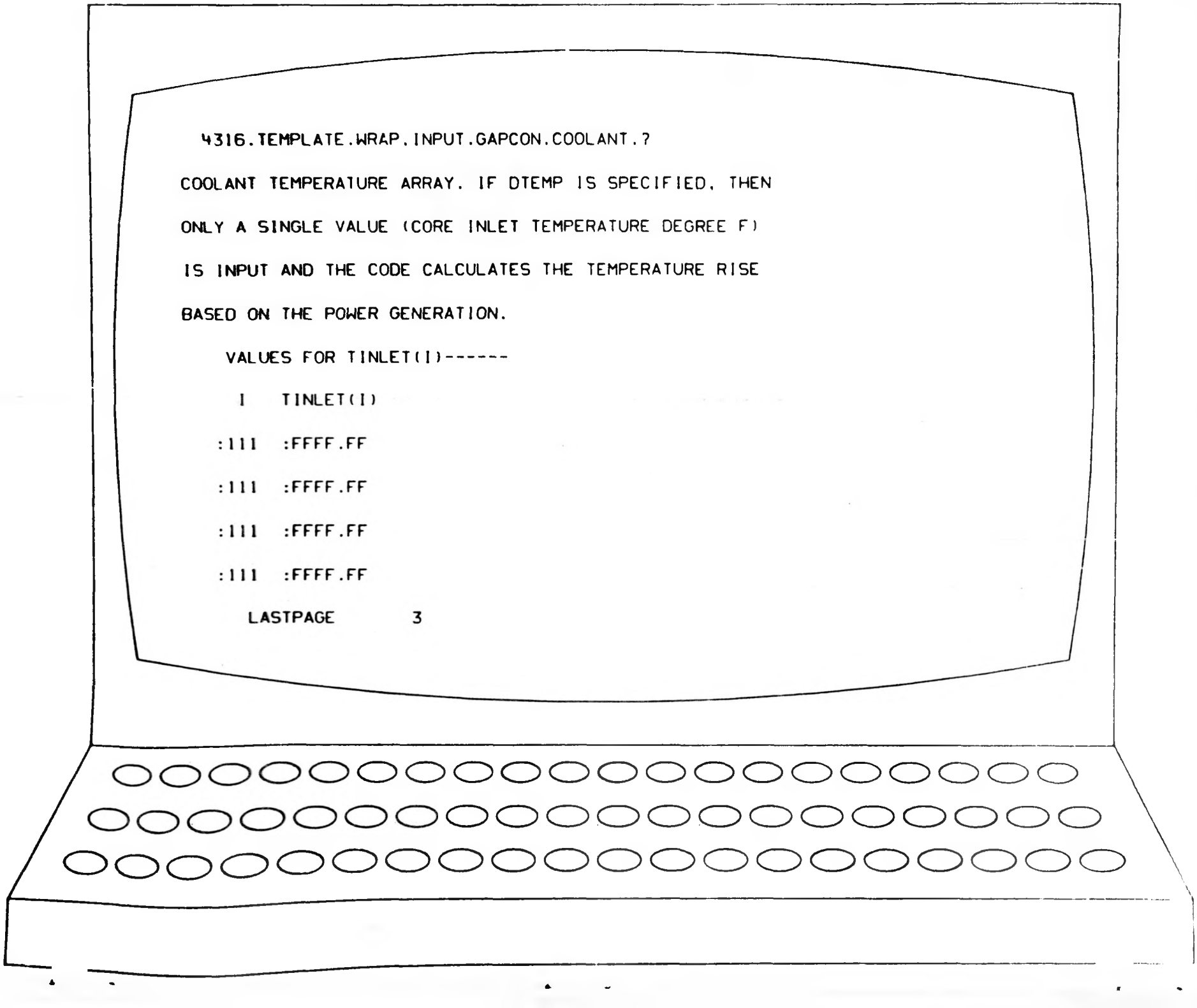

4316.TEMPLATE.WRAP.INPUT.GAPCON.CASE.?
THE TITLE FOR THIS CASE IS----
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
THE RECORD NAMES FOR THE INPUT DATA ARE---
WRAP.INPUT.GAPCON.COOLANT.:AAAAAAAA
WRAP.INPUT.GAPCON.CLAD.:AAAAAAAA
WRAP.INPUT.GAPCON.FUEL.:AAAAAAAA
WRAP.INPUT.GAPCON.FUEL.COMPOS.:AAAAAAAA
WRAP.INPUT.GAPCON.GAP.:AAAAAAAA
WRAP.INPUT.GAPCON.POWER.:AAAAAAAA
WRAP.INPUT.GAPCON.CONTROLS.:AAAAAAAA
LASTPAGE 2

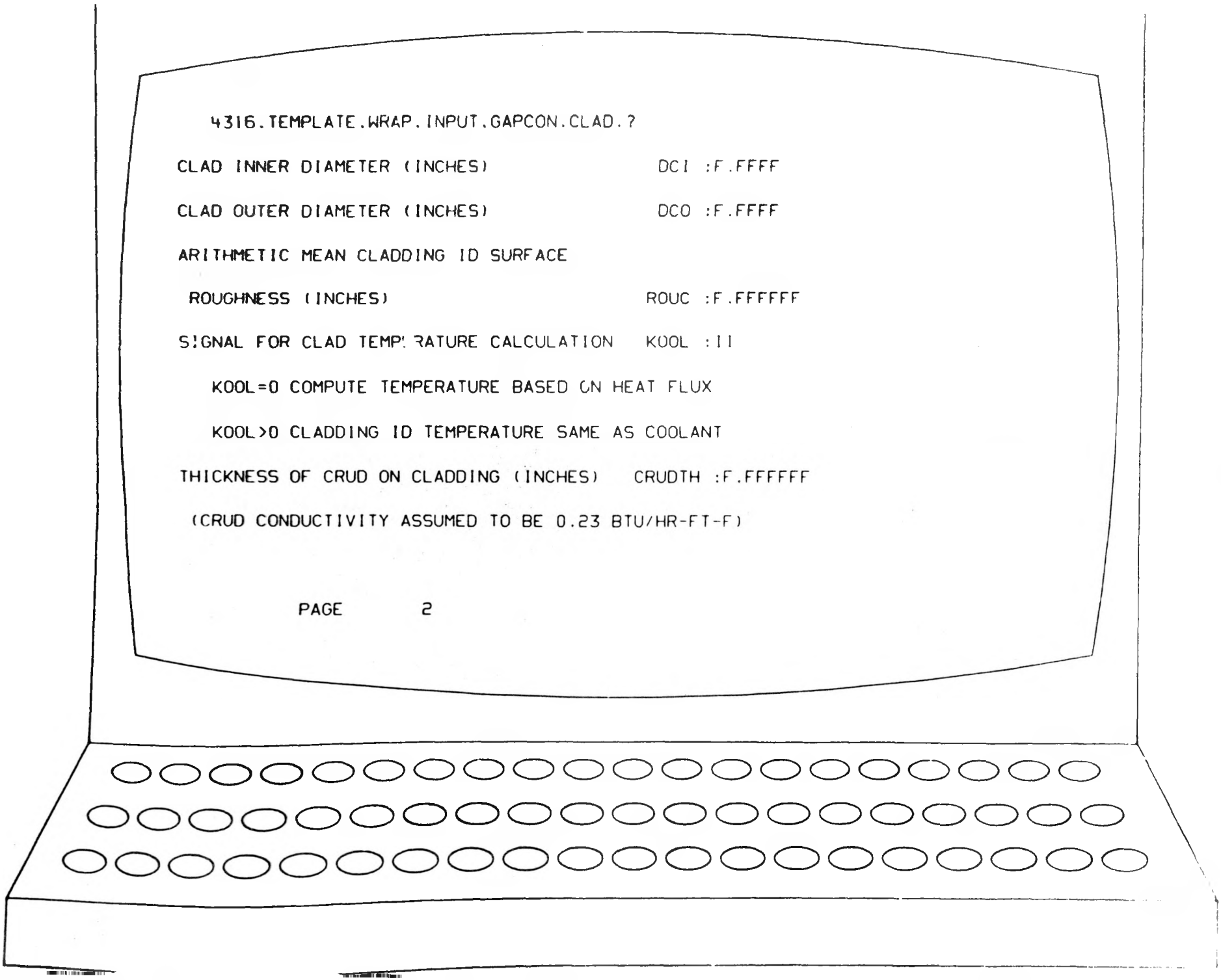

4316.TEMPLATE.WRAP.INPUT.GAPCON.LIBRARY.?
1ST QUALIFIER = ?CASENAM = CASE NAME
OPTIONAL RECORD--THIS RECORD MAY BE OMITTED IF FINAL FUEL
CONDITIONS ARE NOT TO BE ADDED TO
GAPCON LIBRARY.
PAGE 2

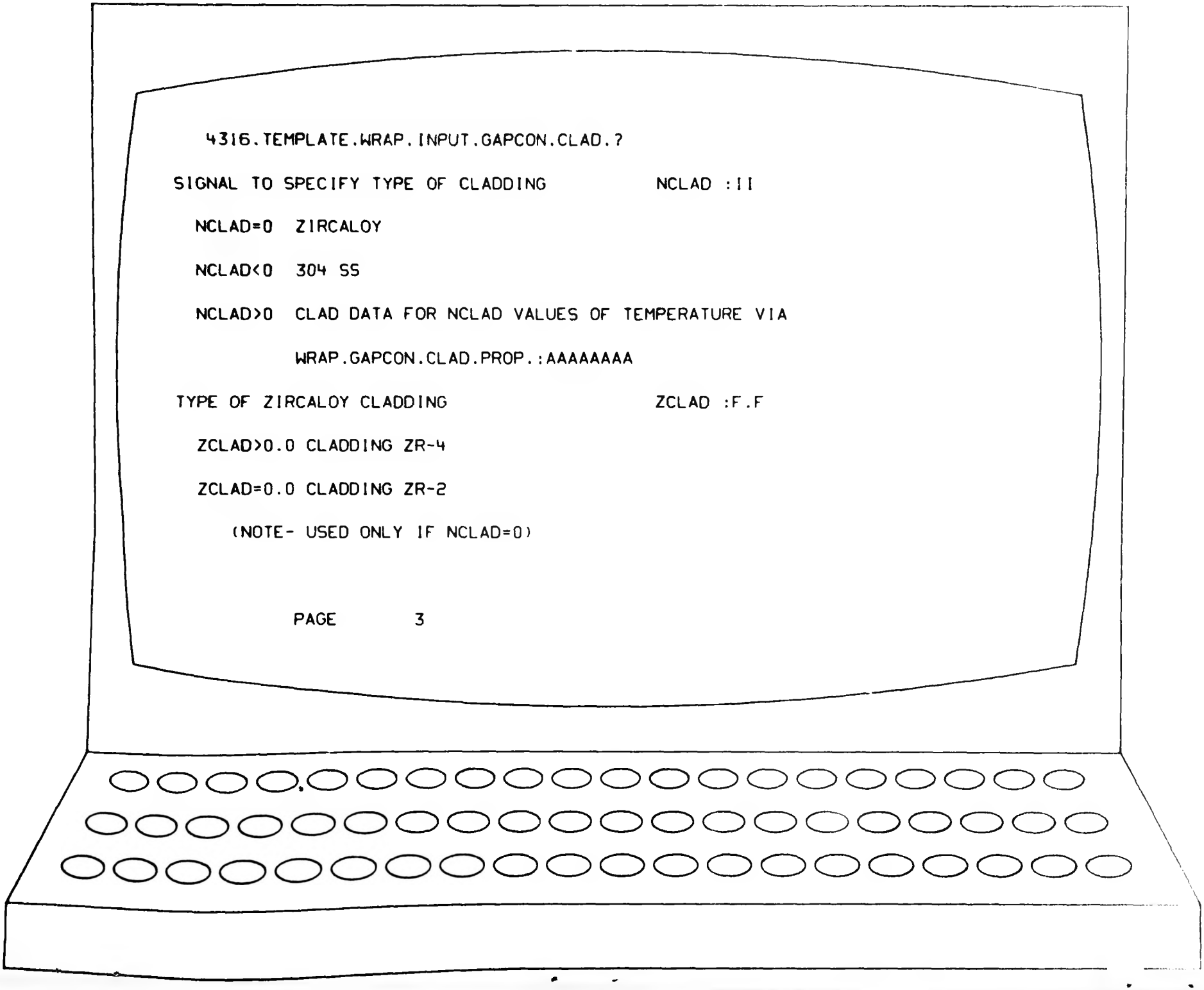

4316.TEMPLATE.WRAP.INPUT.GAPCON.LIBRARY.?
SELECTED GAPCON FUEL CONDITIONS AT THE FINAL TIME STEP MAY
BE WRITTEN TO THE GAPCON OUTPUT LIBRARY. THE LIBRARY
DATA FOR EACH GAPCON CASE IS INDEXED BY CASE NAME.
THESE FUEL CONDITIONS MAY BE RETRIEVED AS NEEDED FOR
MOXY OR RELAP DATA.
SPECIFY 'X'
(FOR ONE ONLY)
:A FINAL FUEL CONDITIONS ARE NOT TO BE ADDED
PAGE 3

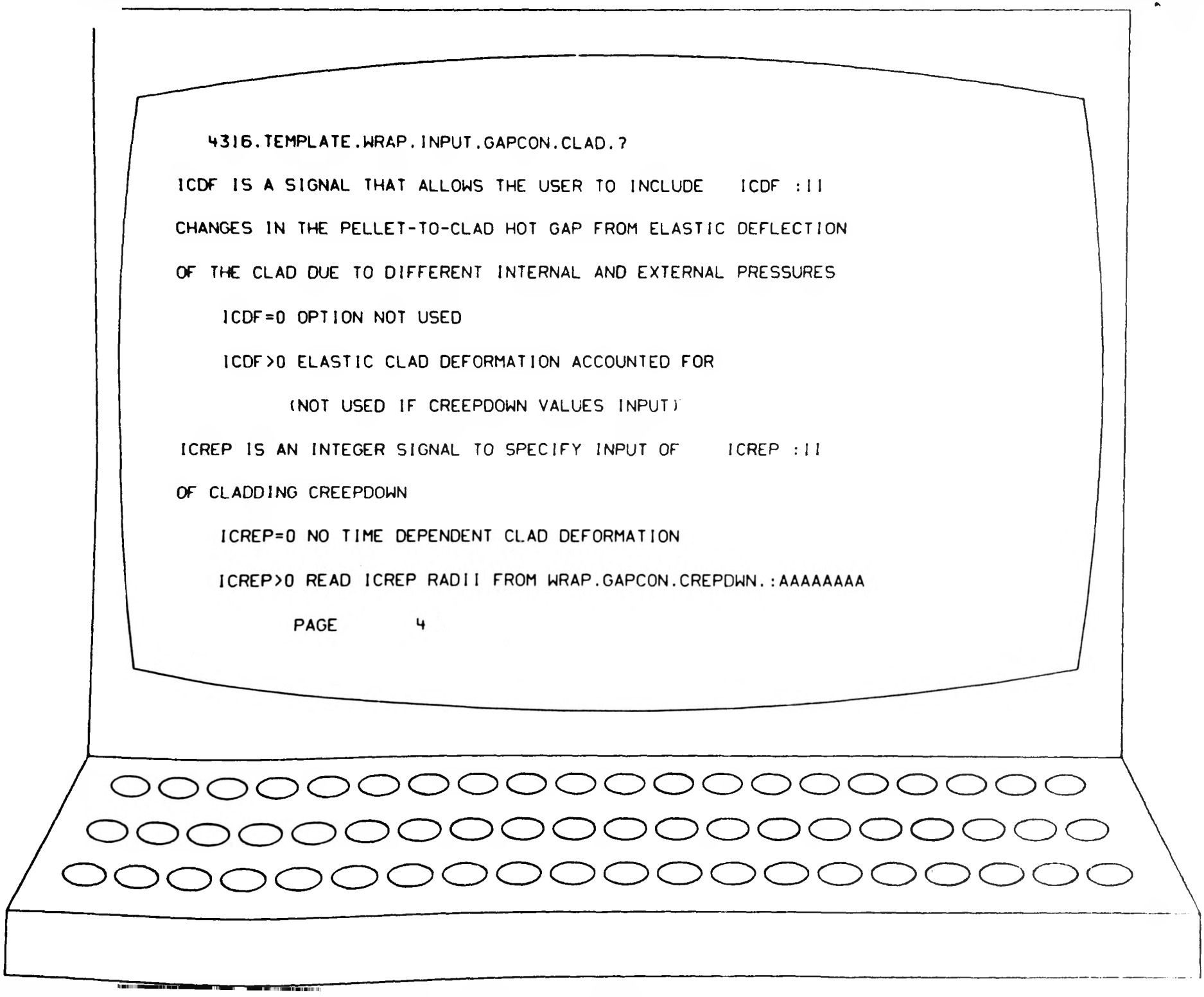

4316.TEMPLATE.WRAP.INPUT.GAPCON.LIBRARY.?
GAPCON LIBRARY CLEANUP--UP TO -TEN- EXISTING INDEXES IN THE
GAPCON LIBRARY MAY BE DELETED IF THE CURRENT CASE IS
SPECIFIED ON THE PRECEDING PAGE AS BEING ADDED OR
REPLACED.
NUMBER OF CASES TO BE DELETED FROM
THE GAPCON LIBRARY :11 (MAXIMUM = 10)
LIST OF CASES TO BE DELETED FORM GAPCON LIBRARY
:22 :AAAAAAAA
LASTPAGE 4

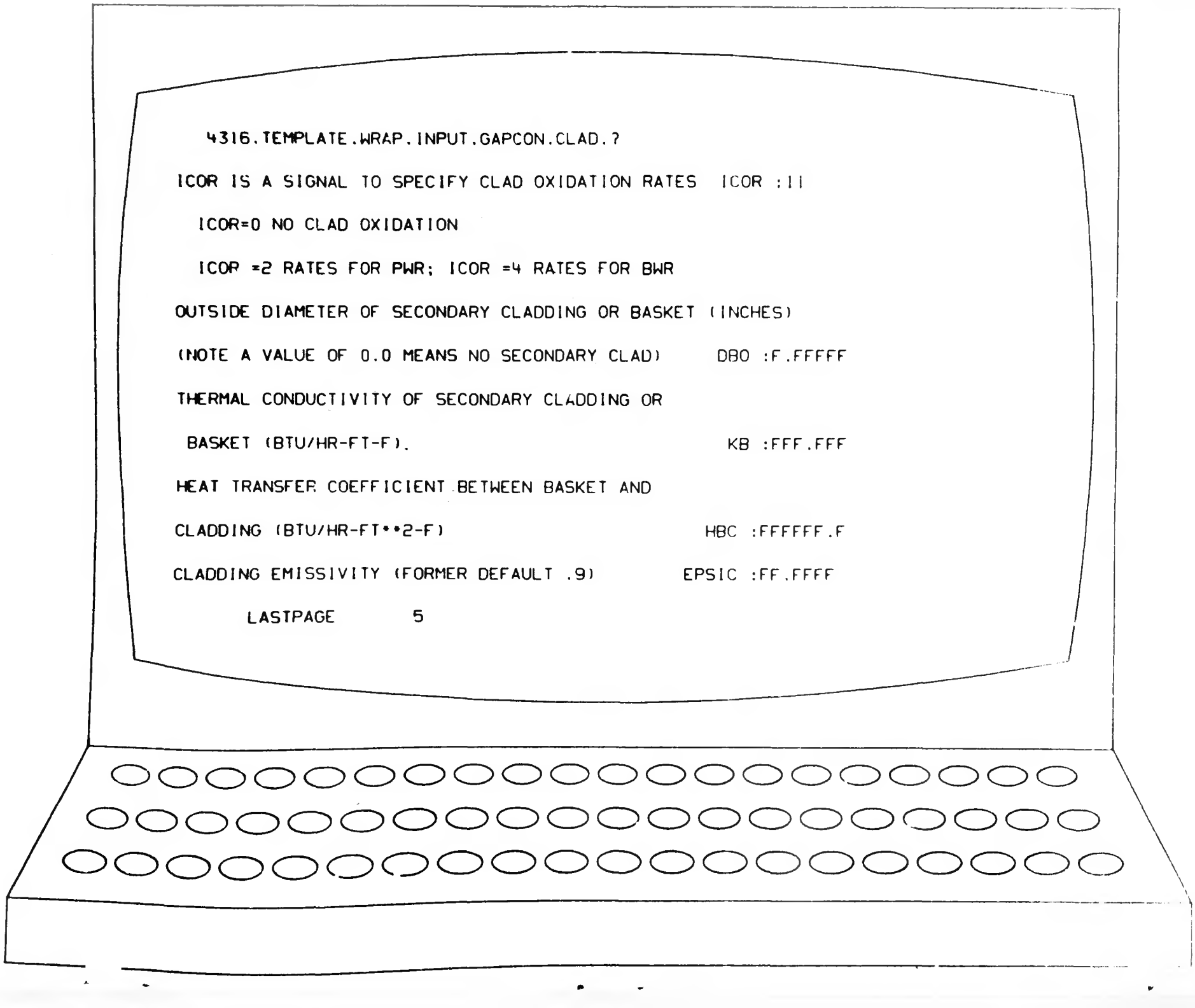

4316.TEMPLATE.WRAP.INPUT.GAPCON.COOLANT.?
SIGNAL TO SPECIFY TYPE OF COOLANT
< 0 COOLANT WATER CALCULATE FILM COEFF
> 0 FILM COEFF SET TO INPUT VALUE SIGHF :FFFFF.F
(BTU/HR-FT**2-F)
COOLANT PRESSURE (PSI) EXTP :FFFFF.F
COOLANT PASSAGE EQUIVALENT DIAMETER (INCHES) DE :FFF.FFF
COOLANT VELOCITY (FT/SEC) V :FFF.FFF
(NOTE- DE AND V IGNORED IF SIGHF > 0)
TEMPERATURE RISE ACROSS CORE (DEGREES F) DTEMP :FFF.FFF
NUMBER OF COOLANT TEMPERATURE ARRAY ELEMENTS :IIIII
PAGE 2

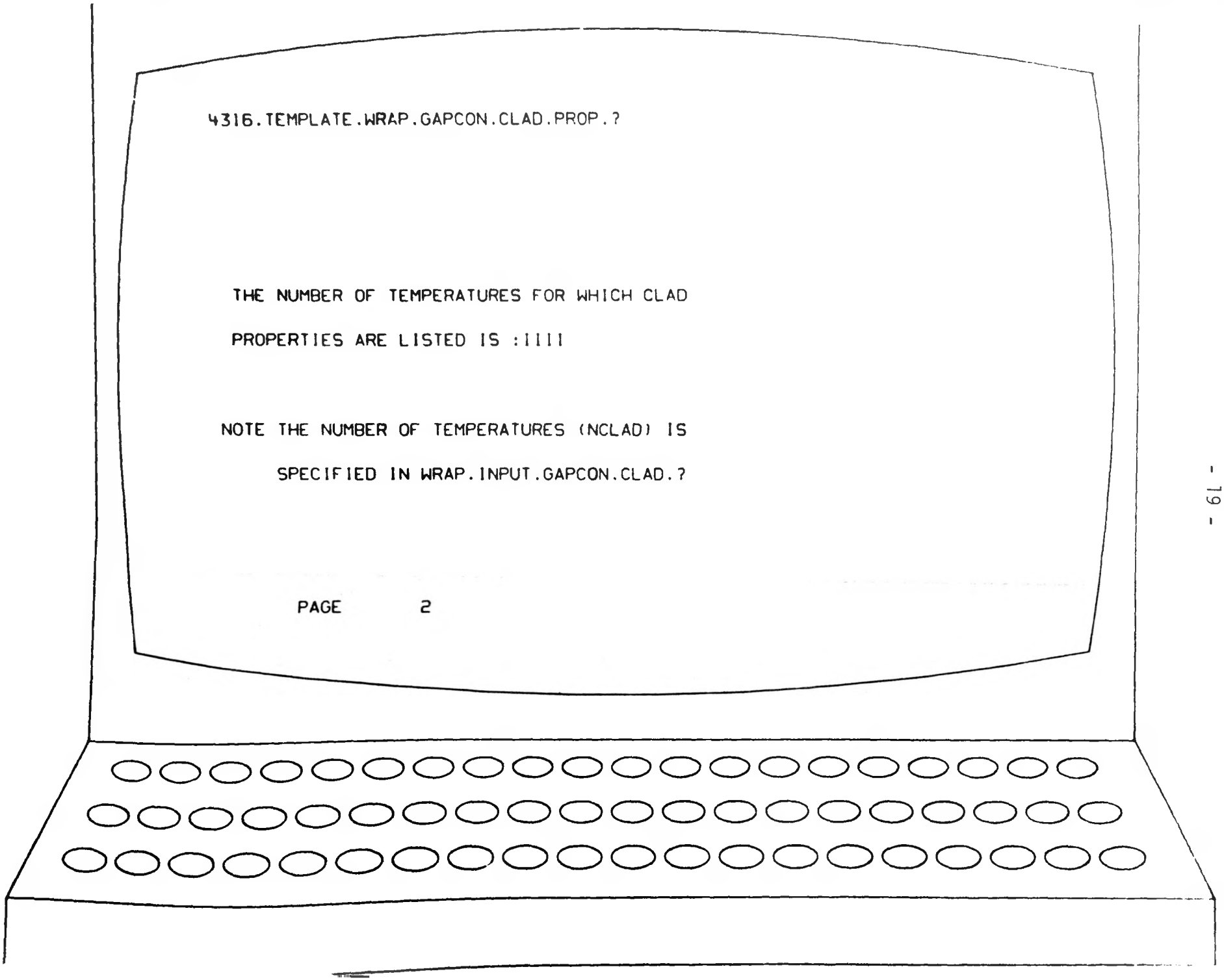

4316.TEMPLATE.WRAP.INPUT.GAPCON.COOLANT.?
COOLANT TEMPERATURE ARRAY. IF DTEMP IS SPECIFIED, THEN
ONLY A SINGLE VALUE (CORE INLET TEMPERATURE DEGREE F)
IS INPUT AND THE CODE CALCULATES THE TEMPERATURE RISE
BASED ON THE POWER GENERATION.
VALUES FOR TINLET(I)------
I TINLET(I)
:111 :FFFF.FF
:111 :FFFF.FF
:111 :FFFF.FF
:111 :FFFF.FF
LASTPAGE 3

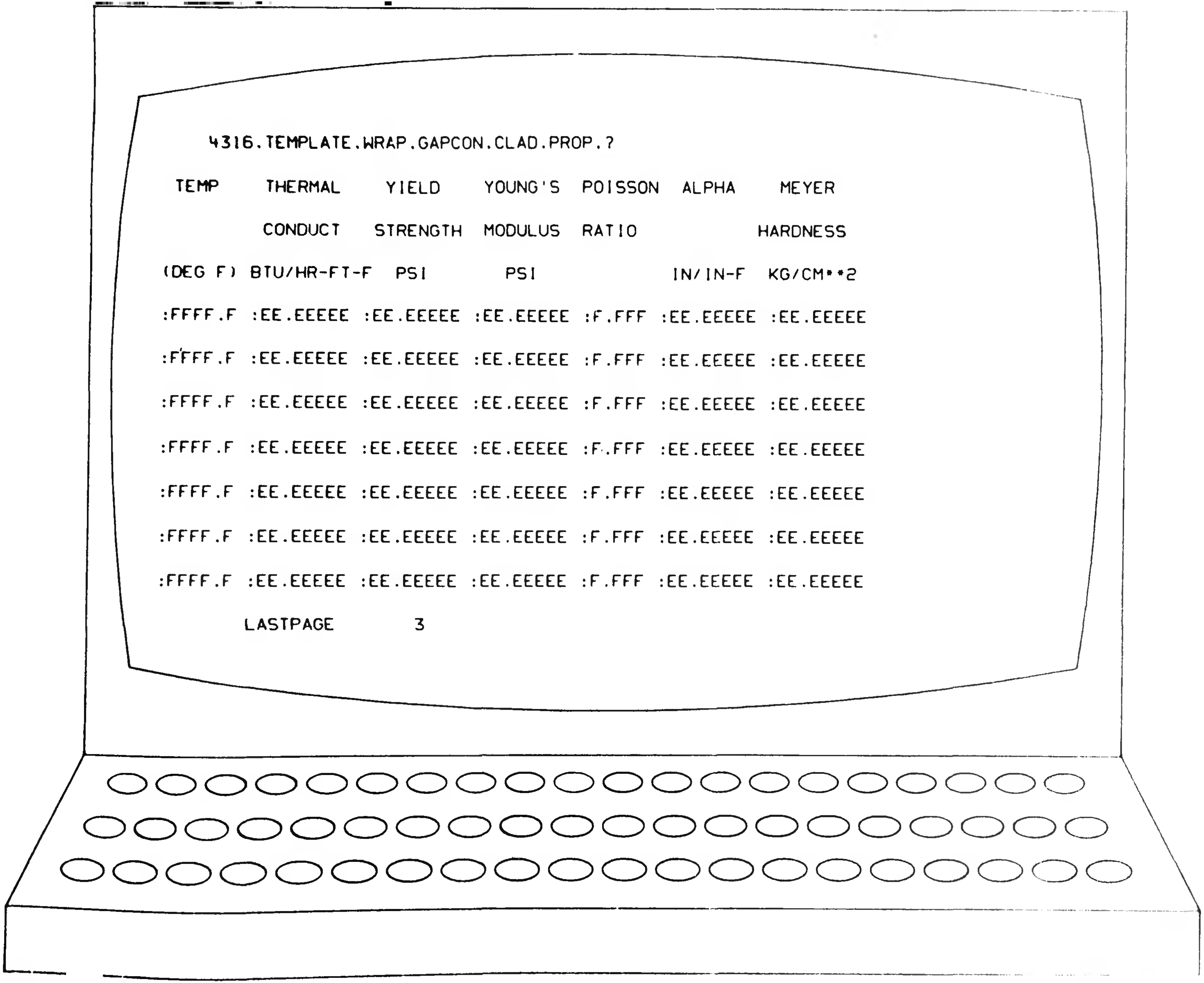

4316.TEMPLATE.WRAP.INPUT.GAPCON.CLAD.?
CLAD INNER DIAMETER (INCHES) DCI :F.FFFF
CLAD OUTER DIAMETER (INCHES) DCO :F.FFFF
ARITHMETIC MEAN CLADDING ID SURFACE
ROUGHNESS (INCHES) ROUC :F.FFFFFF
SIGNAL FOR CLAD TEMPERATURE CALCULATION KOOL :I1
KOOL=0 COMPUTE TEMPERATURE BASED ON HEAT FLUX
KOOL>0 CLADDING ID TEMPERATURE SAME AS COOLANT
THICKNESS OF CRUD ON CLADDING (INCHES) CRUDTH :F.FFFFFF
(CRUD CONDUCTIVITY ASSUMED TO BE 0.23 BTU/HR-FT-F)
PAGE 2

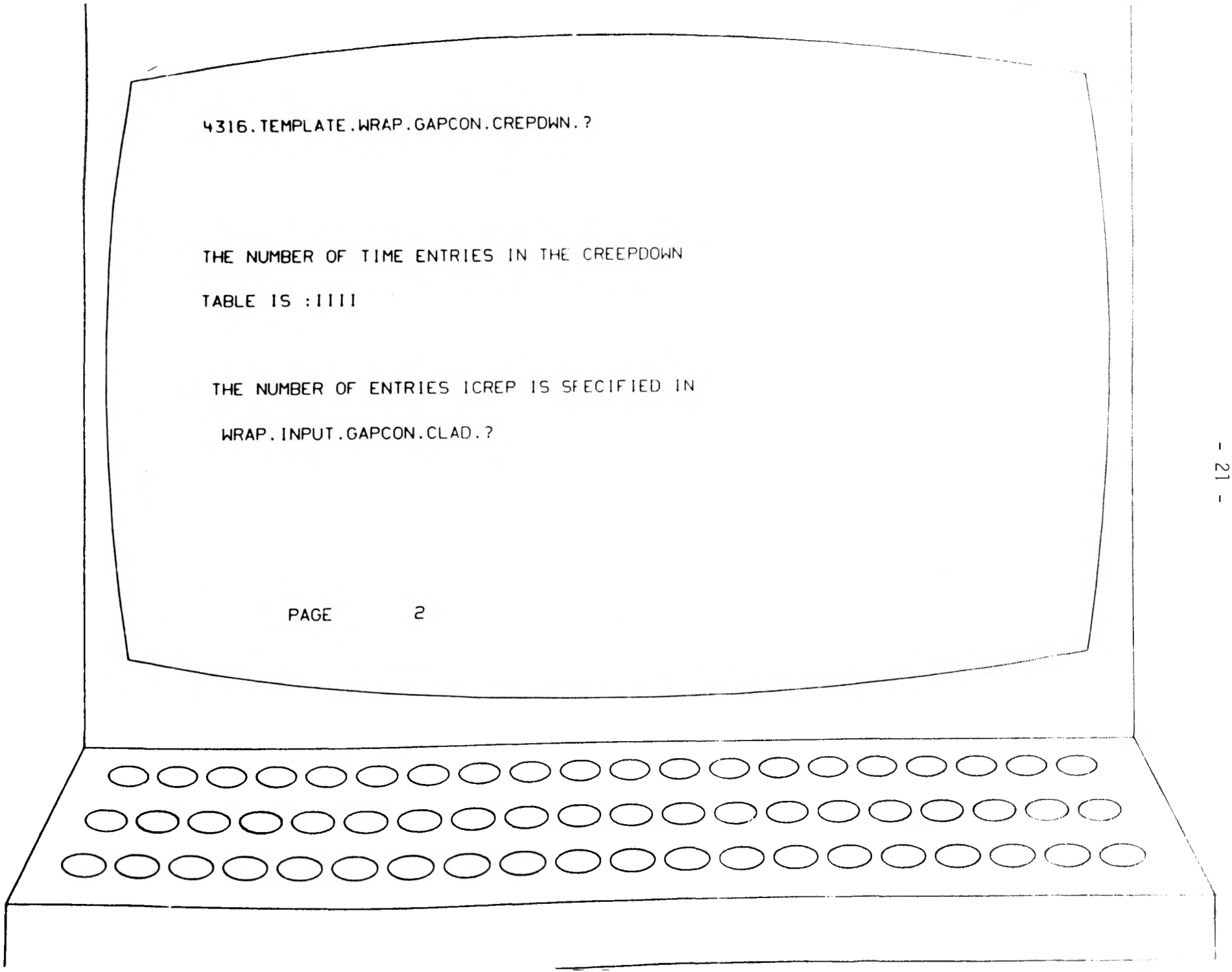

4316.TEMPLATE.WRAP.INPUT.GAPCON.CLAD.?
SIGNAL TO SPECIFY TYPE OF CLADDING NCLAD :I1
NCLAD=0 ZIRCALOY
NCLAD<0 304 SS
NCLAD>0 CLAD DATA FOR NCLAD VALUES OF TEMPERATURE VIA
WRAP.GAPCON.CLAD.PROP.:AAAAAAAA
TYPE OF ZIRCALOY CLADDING ZCLAD :F.F
ZCLAD>0.0 CLADDING ZR-4
ZCLAD=0.0 CLADDING ZR-2
(NOTE- USED ONLY IF NCLAD=0)
PAGE 3

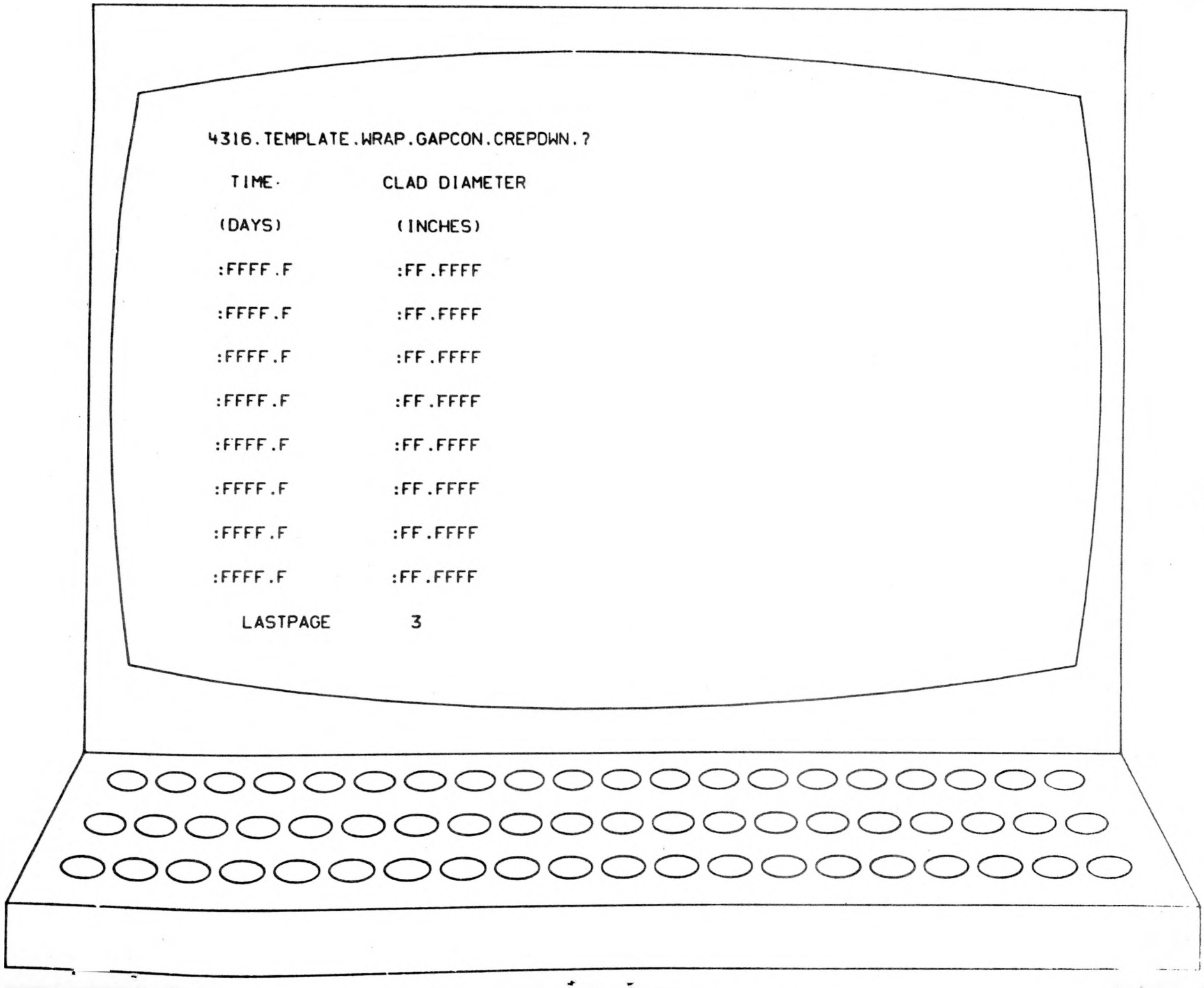

4316.TEMPLATE.WRAP.INPUT.GAPCON.CLAD.?
ICDF IS A SIGNAL THAT ALLOWS THE USER TO INCLUDE ICDF :I
CHANGES IN THE PELLET-TO-CLAD HOT GAP FROM ELASTIC DEFLECTION
OF THE CLAD DUE TO DIFFERENT INTERNAL AND EXTERNAL PRESSURES
ICDF=0 OPTION NOT USED
ICDF>0 ELASTIC CLAD DEFORMATION ACCOUNTED FOR
(NOT USED IF CREEPDOWN VALUES INPUT)
ICREP IS AN INTEGER SIGNAL TO SPECIFY INPUT OF ICREP :I
OF CLADDING CREEPDOWN
ICREP=0 NO TIME DEPENDENT CLAD DEFORMATION
ICREP>0 READ ICREP RADII FROM WRAP.GAPCON.CREPDWN.:AAAAAAAA
PAGE 4

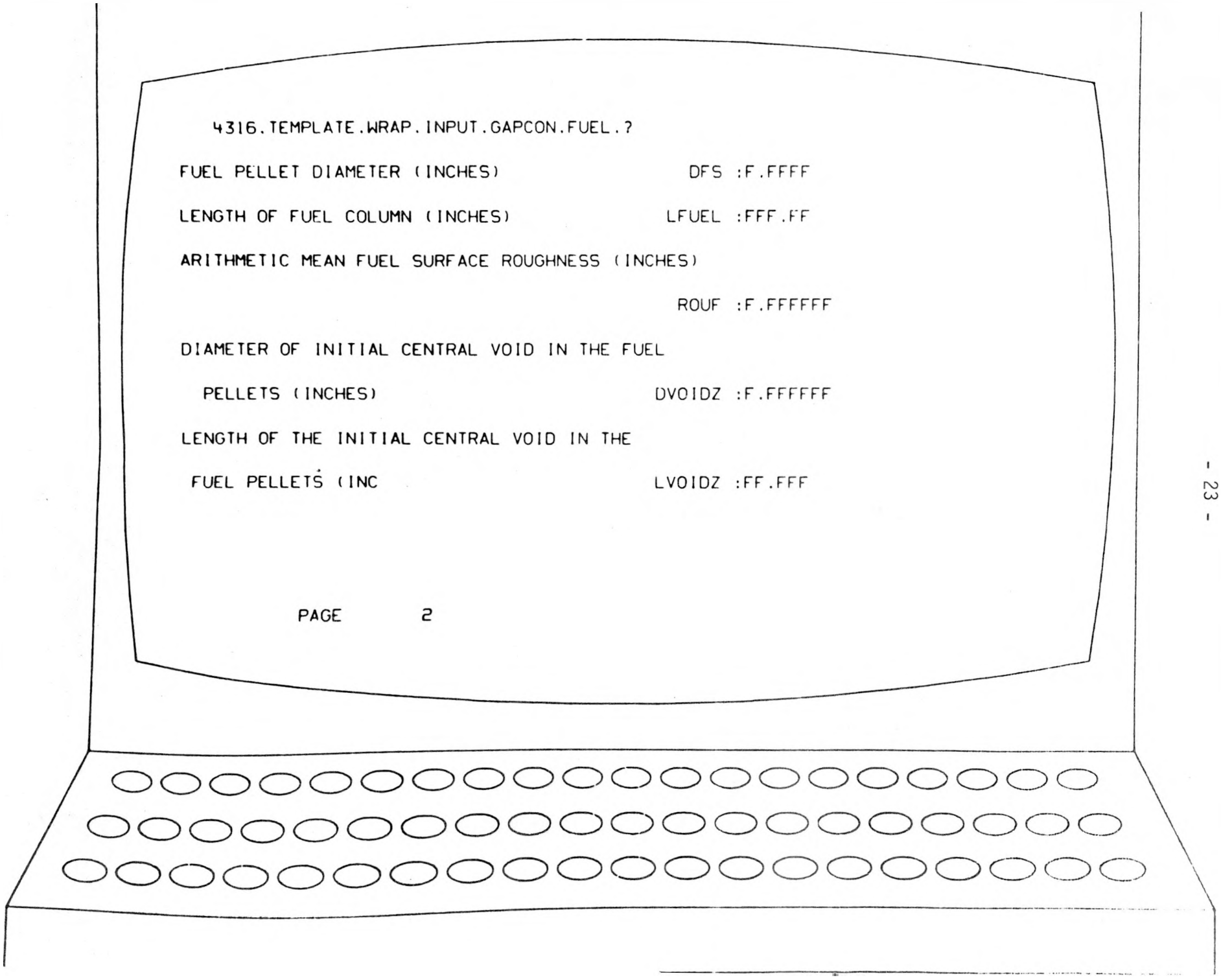

4316.TEMPLATE.WRAP.INPUT.GAPCON.CLAD.?
ICOR IS A SIGNAL TO SPECIFY CLAD OXIDATION RATES ICOR :I1
ICOR=0 NO CLAD OXIDATION
ICOR =2 RATES FOR PWR; ICOR =4 RATES FOR BWR
OUTSIDE DIAMETER OF SECONDARY CLADDING OR BASKET (INCHES)
(NOTE A VALUE OF 0.0 MEANS NO SECONDARY CLAD) DBO :F.FFFFF
THERMAL CONDUCTIVITY OF SECONDARY CLADDING OR
BASKET (BTU/HR-FT-F). KB :FFF.FFF
HEAT TRANSFER COEFFICIENT BETWEEN BASKET AND
CLADDING (BTU/HR-FT**2-F) HBC :FFFFFF.F
CLADDING EMISSIVITY (FORMER DEFAULT .9) EPSIC :FF.FFFF
LASTPAGE 5

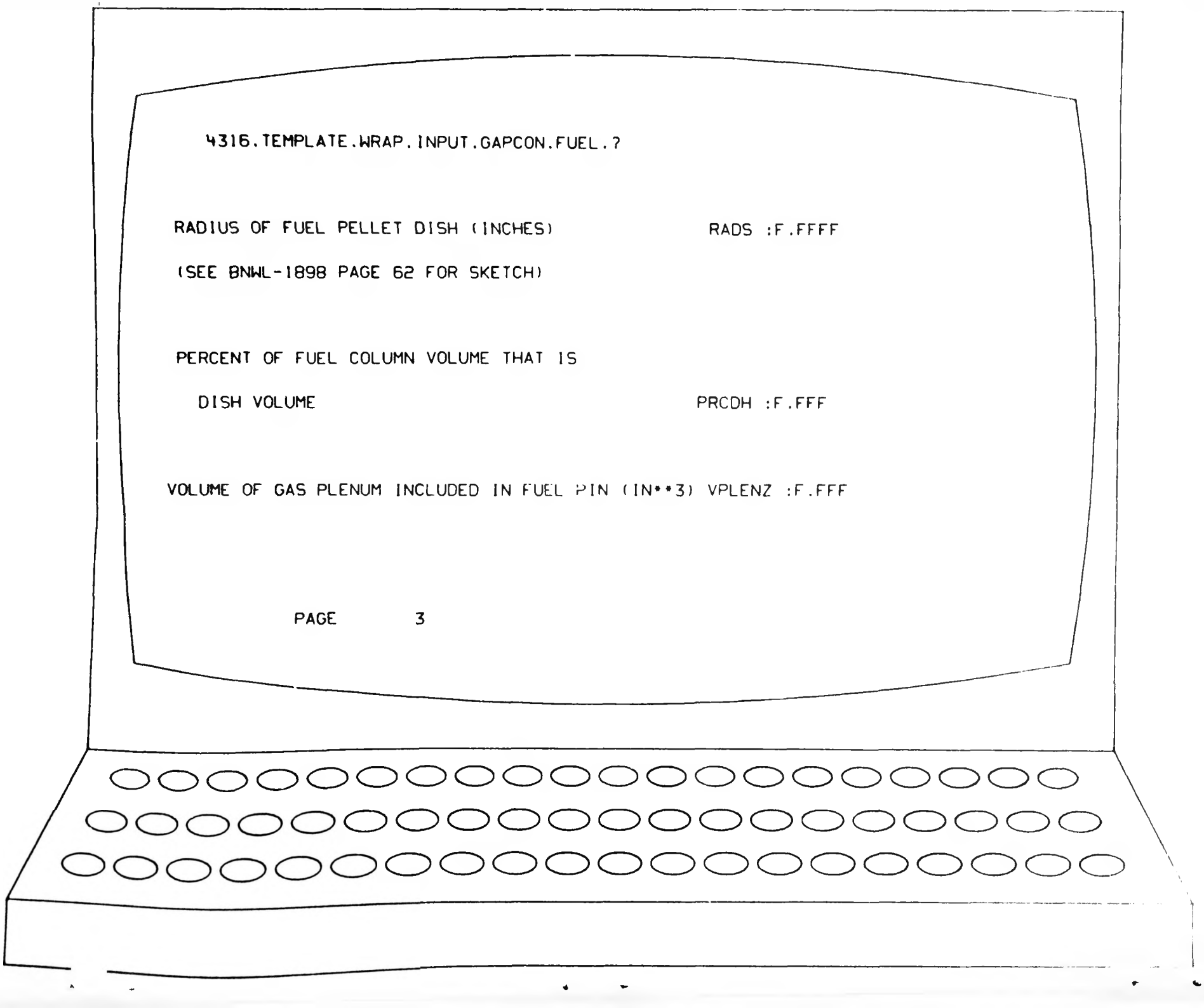

4316.TEMPLATE.WRAP.GAPCON.CLAD.PROP.?
THE NUMBER OF TEMPERATURES FOR WHICH CLAD
PROPERTIES ARE LISTED IS :IIII
NOTE THE NUMBER OF TEMPERATURES (NCLAD) IS
SPECIFIED IN WRAP.INPUT.GAPCON.CLAD.?
PAGE 2

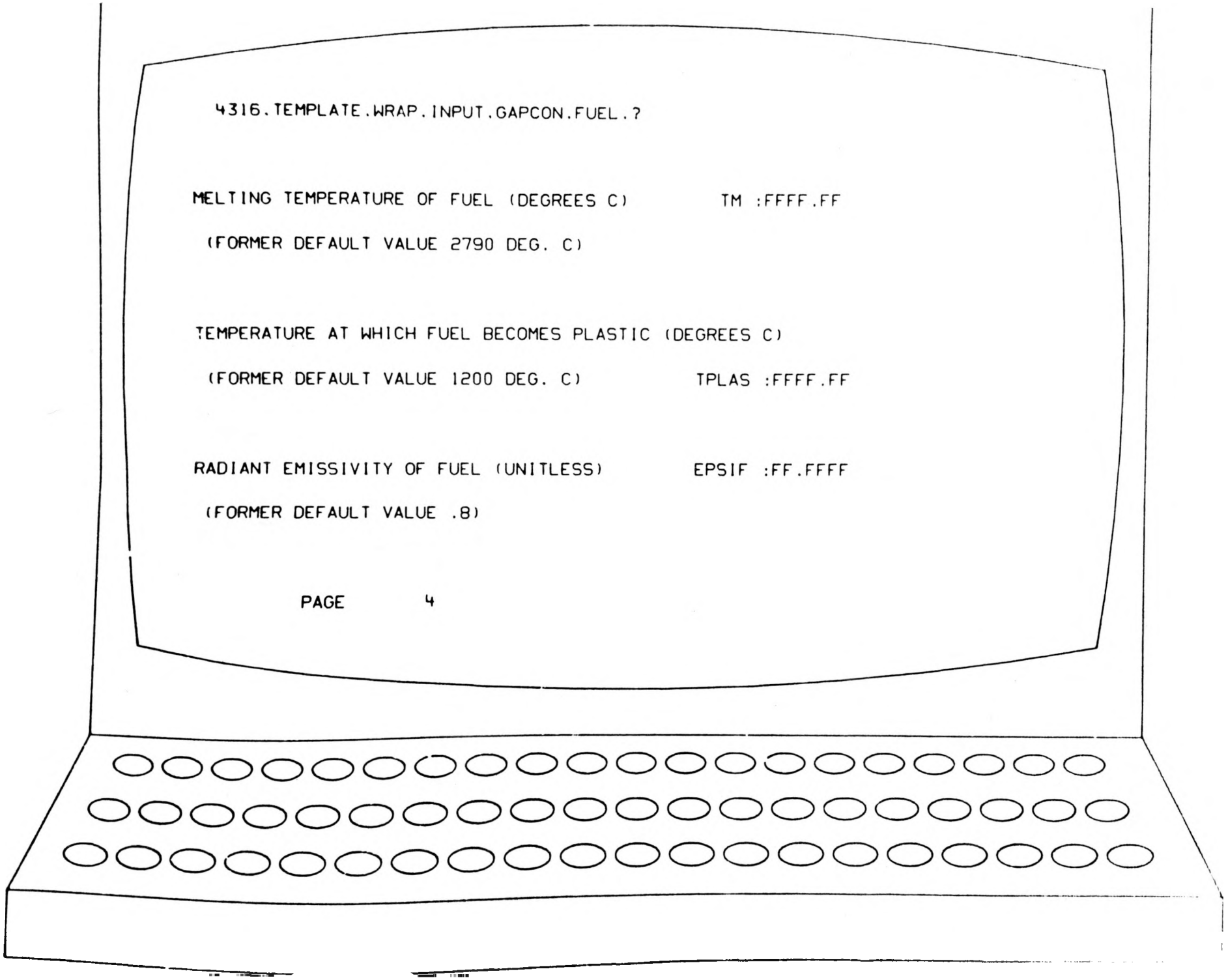

4316.TEMPLATE.WRAP.GAPCON.CLAD.PROP.?
TEMP THERMAL YIELD YOUNG'S POISSON ALPHA MEYER
CONDUCT STRENGTH MODULUS RATIO HARDNESS
(DEG F) BTU/HR-FT-F PSI PSI IN/IN-F KG/CM**2
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
:FFFF.F :EE.EEEEE :EE.EEEEE :EE.EEEEE :F.FFF :EE.EEEEE :EE.EEEEE
LASTPAGE 3

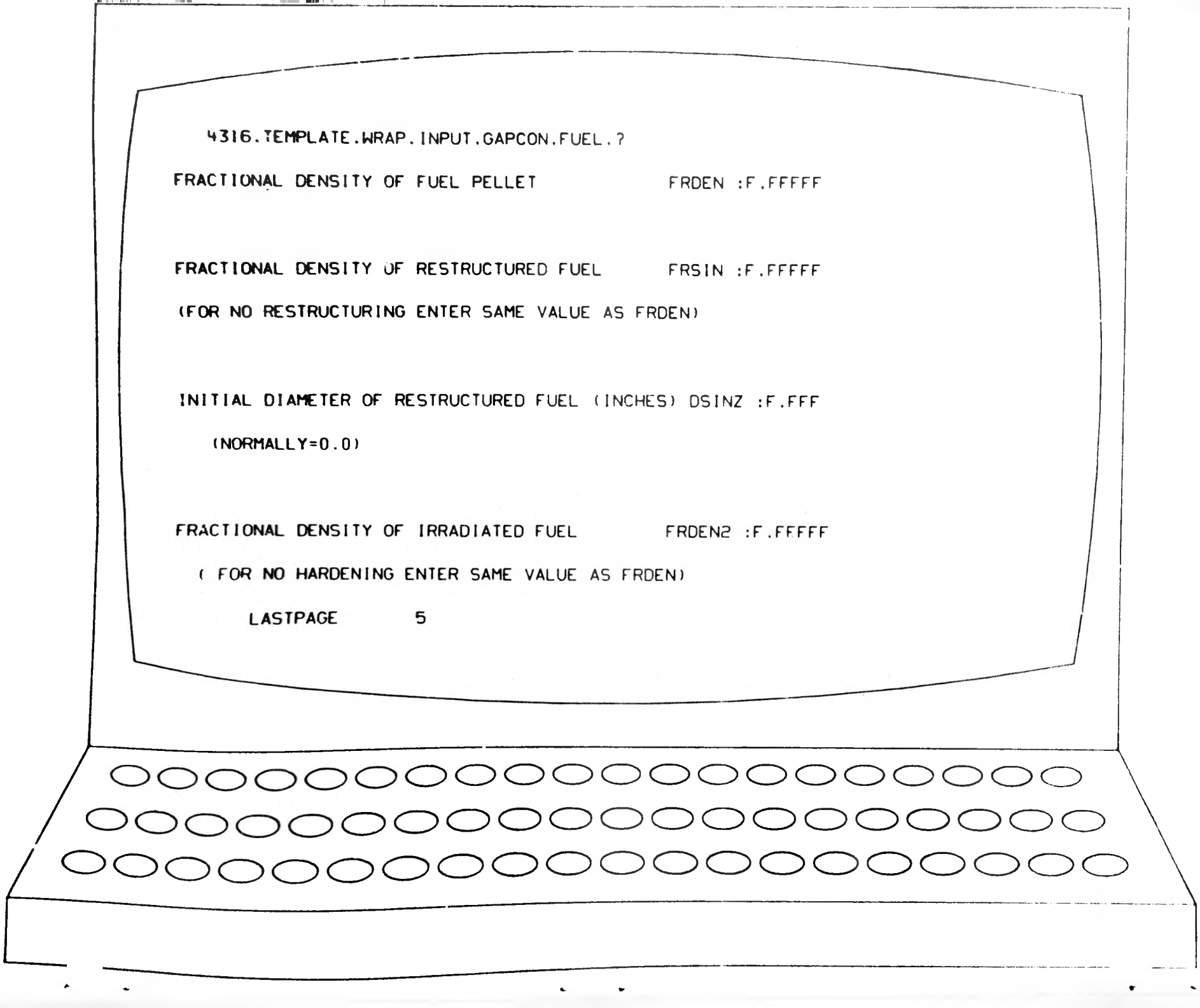

4316.TEMPLATE.WRAP.GAPCON.CREPDWN.?
THE NUMBER OF TIME ENTRIES IN THE CREEPDOWN
TABLE IS :IIII
THE NUMBER OF ENTRIES ICREP IS SPECIFIED IN
WRAP.INPUT.GAPCON.CLAD.?
PAGE 2

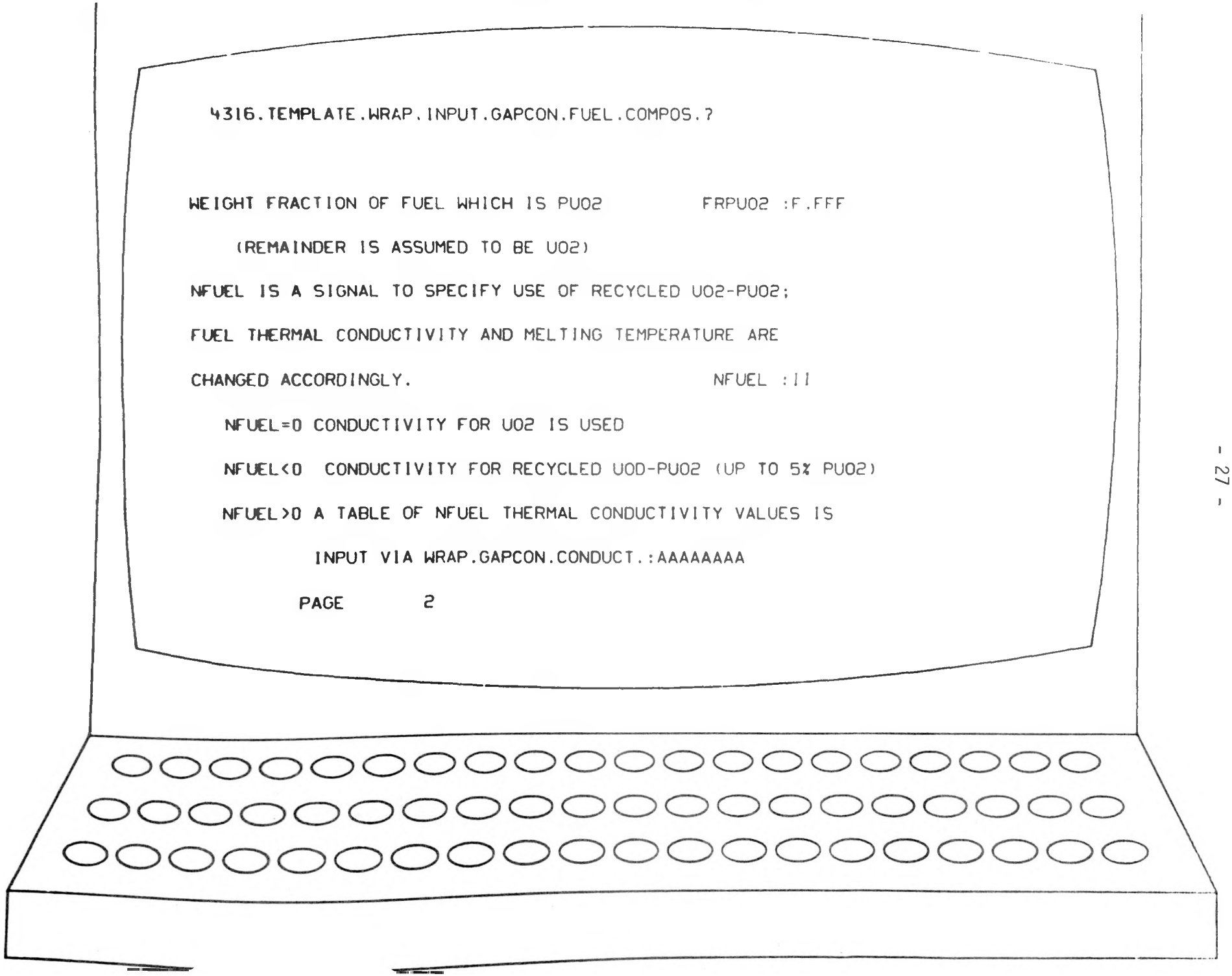

4316.TEMPLATE.WRAP.GAPCON.CREPDWN.?
TIME·
(DAYS)
CLAD DIAMETER
(INCHES)
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
:FFFF.F
:FF.FFFF
LASTPAGE
3

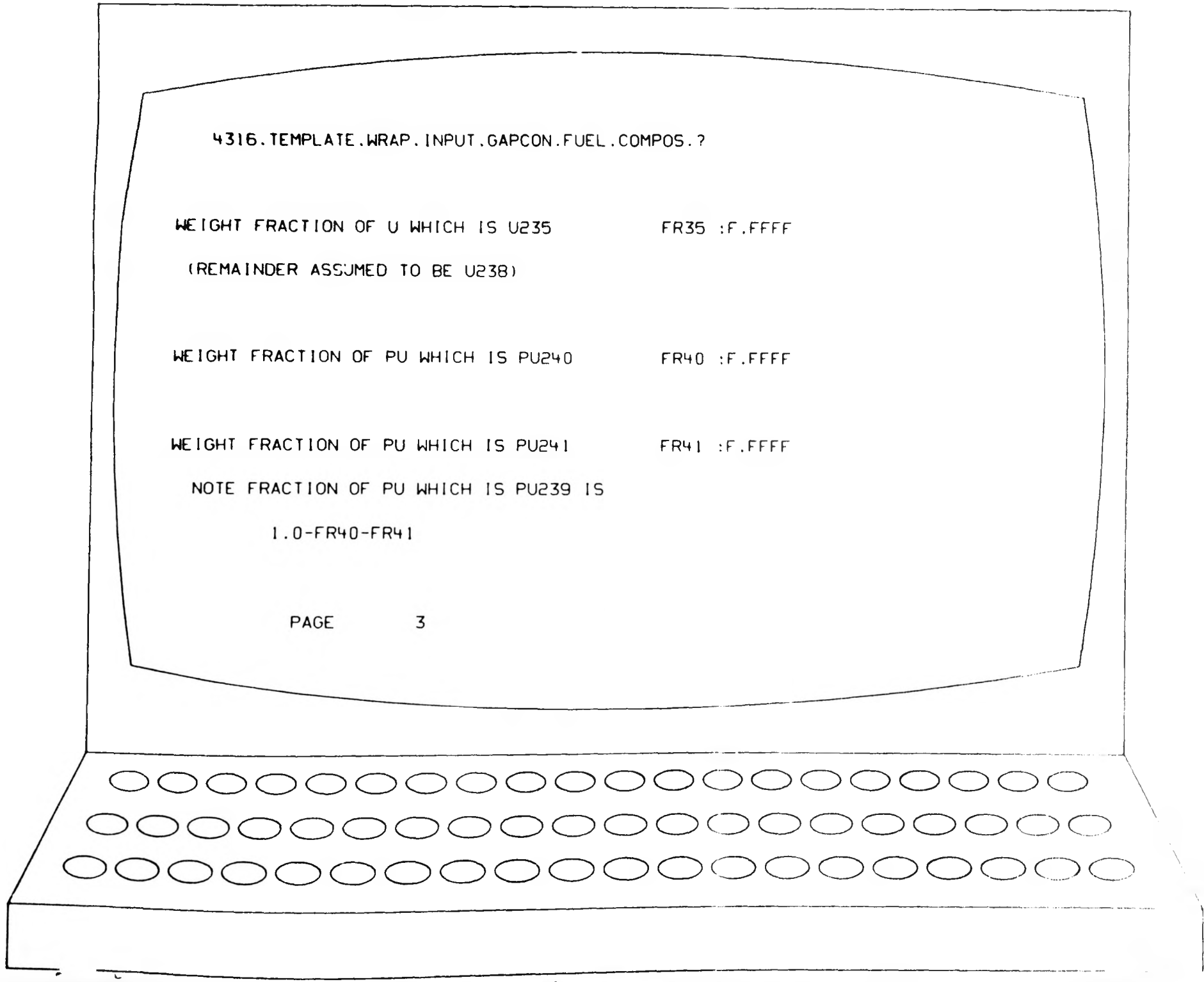

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.?
FUEL PELLET DIAMETER (INCHES) DFS :F.FFFF
LENGTH OF FUEL COLUMN (INCHES) LFUEL :FFF.FF
ARITHMETIC MEAN FUEL SURFACE ROUGHNESS (INCHES)
ROUF :F.FFFFFF
DIAMETER OF INITIAL CENTRAL VOID IN THE FUEL
PELLETS (INCHES) DVOIDZ :F.FFFFFF
LENGTH OF THE INITIAL CENTRAL VOID IN THE
FUEL PELLETS (INC LVOIDZ :FF.FFF
PAGE 2

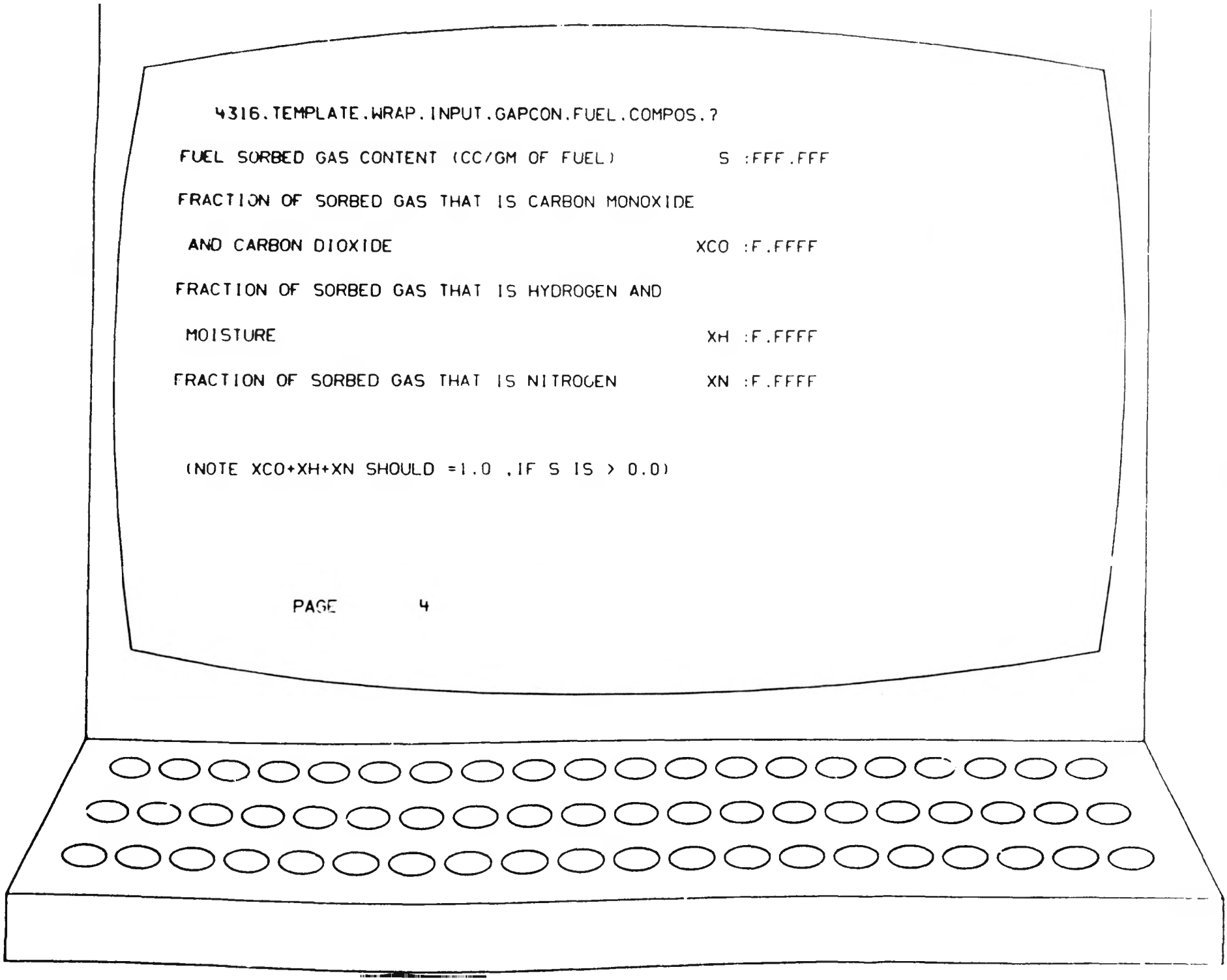

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.?
RADIUS OF FUEL PELLET DISH (INCHES) RADS :F.FFFF
(SEE BNWL-1898 PAGE 62 FOR SKETCH)
PERCENT OF FUEL COLUMN VOLUME THAT IS
DISH VOLUME PRCDH :F.FFF
VOLUME OF GAS PLENUM INCLUDED IN FUEL PIN (IN**3) VPLENZ :F.FFF
PAGE 3

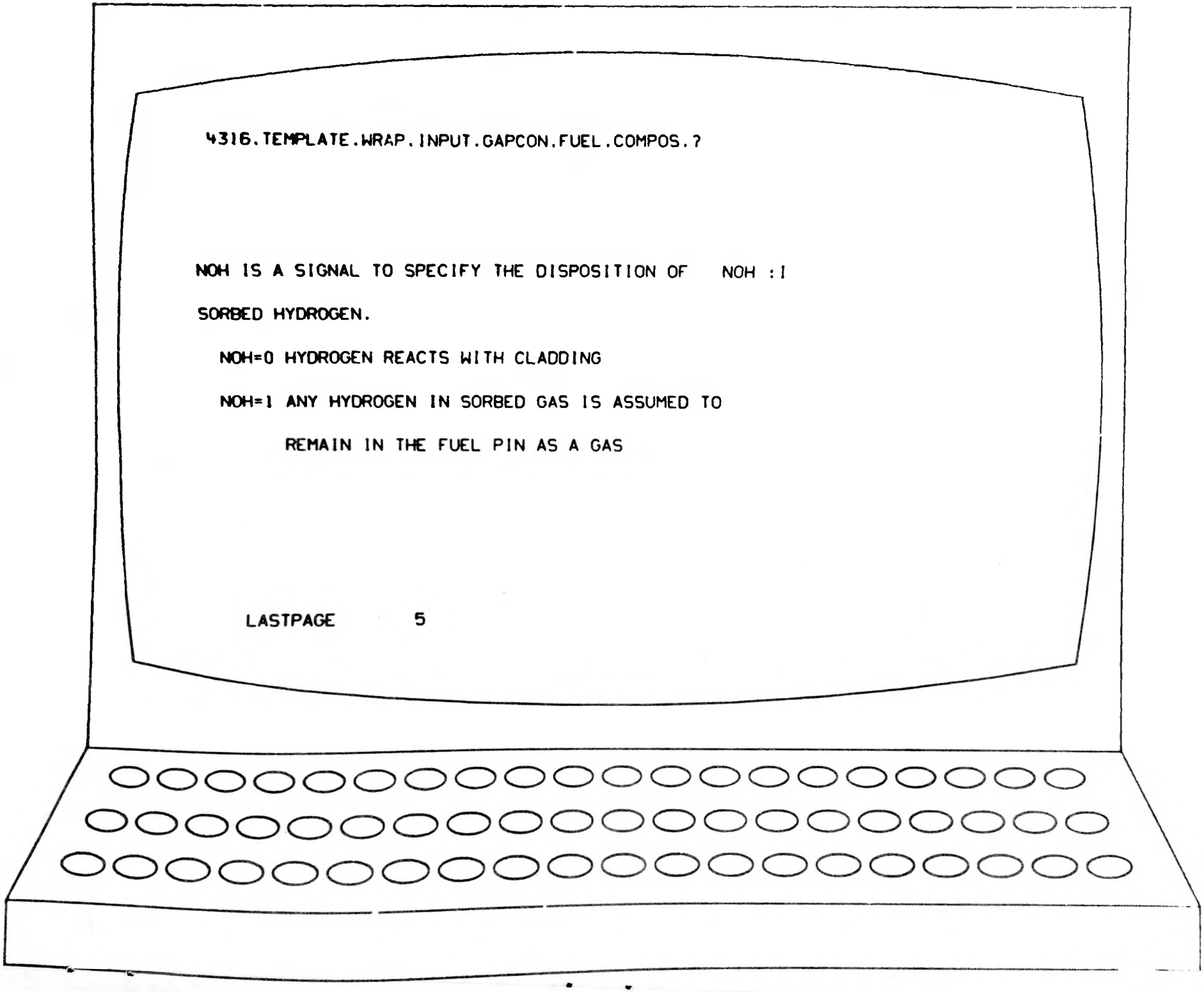

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.?
MELTING TEMPERATURE OF FUEL (DEGREES C) TM :FFFF.FF
(FORMER DEFAULT VALUE 2790 DEG. C)
TEMPERATURE AT WHICH FUEL BECOMES PLASTIC (DEGREES C)
(FORMER DEFAULT VALUE 1200 DEG. C) TPLAS :FFFF.FF
RADIANT EMISSIVITY OF FUEL (UNITLESS) EPSIF :FF.FFFF
(FORMER DEFAULT VALUE .8)
PAGE 4

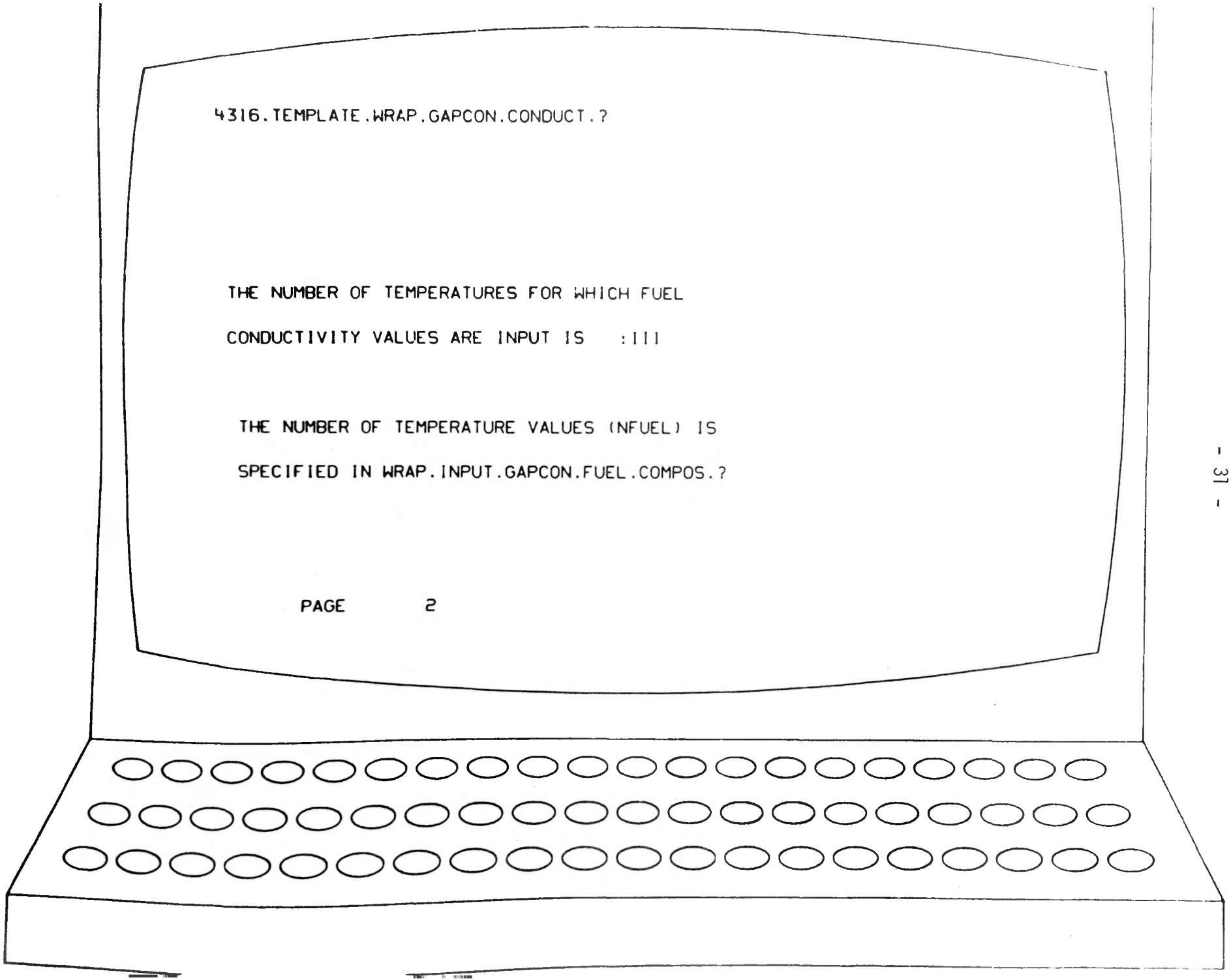

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.?
FRACTIONAL DENSITY OF FUEL PELLET FRDEN :F.FFFFF
FRACTIONAL DENSITY OF RESTRUCTURED FUEL FRSIN :F.FFFFF
(FOR NO RESTRUCTURING ENTER SAME VALUE AS FRDEN)
INITIAL DIAMETER OF RESTRUCTURED FUEL (INCHES) DSINZ :F.FFF
(NORMALLY=0.0)
FRACTIONAL DENSITY OF IRRADIATED FUEL FRDEN2 :F.FFFFF
(FOR NO HARDENING ENTER SAME VALUE AS FRDEN)
LASTPAGE 5

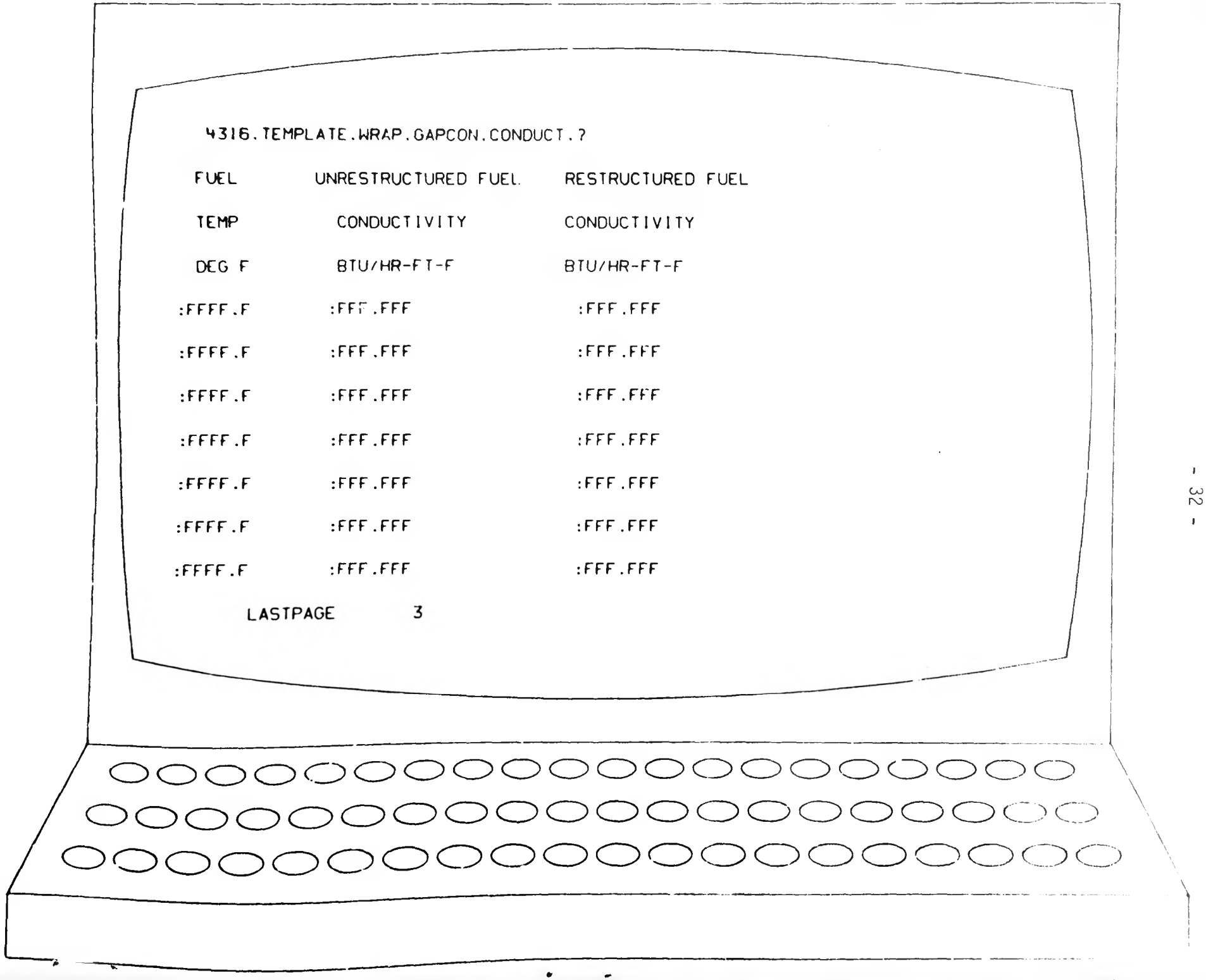

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.COMPOS.?
WEIGHT FRACTION OF FUEL WHICH IS PUO2 FRPUO2 :F.FFF
(REMAINDER IS ASSUMED TO BE UO2)
NFUEL IS A SIGNAL TO SPECIFY USE OF RECYCLED UO2-PUO2;
FUEL THERMAL CONDUCTIVITY AND MELTING TEMPERATURE ARE
CHANGED ACCORDINGLY. NFUEL :I
NFUEL=0 CONDUCTIVITY FOR UO2 IS USED
NFUEL<0 CONDUCTIVITY FOR RECYCLED UOD-PUO2 (UP TO 5% PUO2)
NFUEL>0 A TABLE OF NFUEL THERMAL CONDUCTIVITY VALUES IS
INPUT VIA WRAP.GAPCON.CONDUCT.:AAAAAAAA
PAGE 2

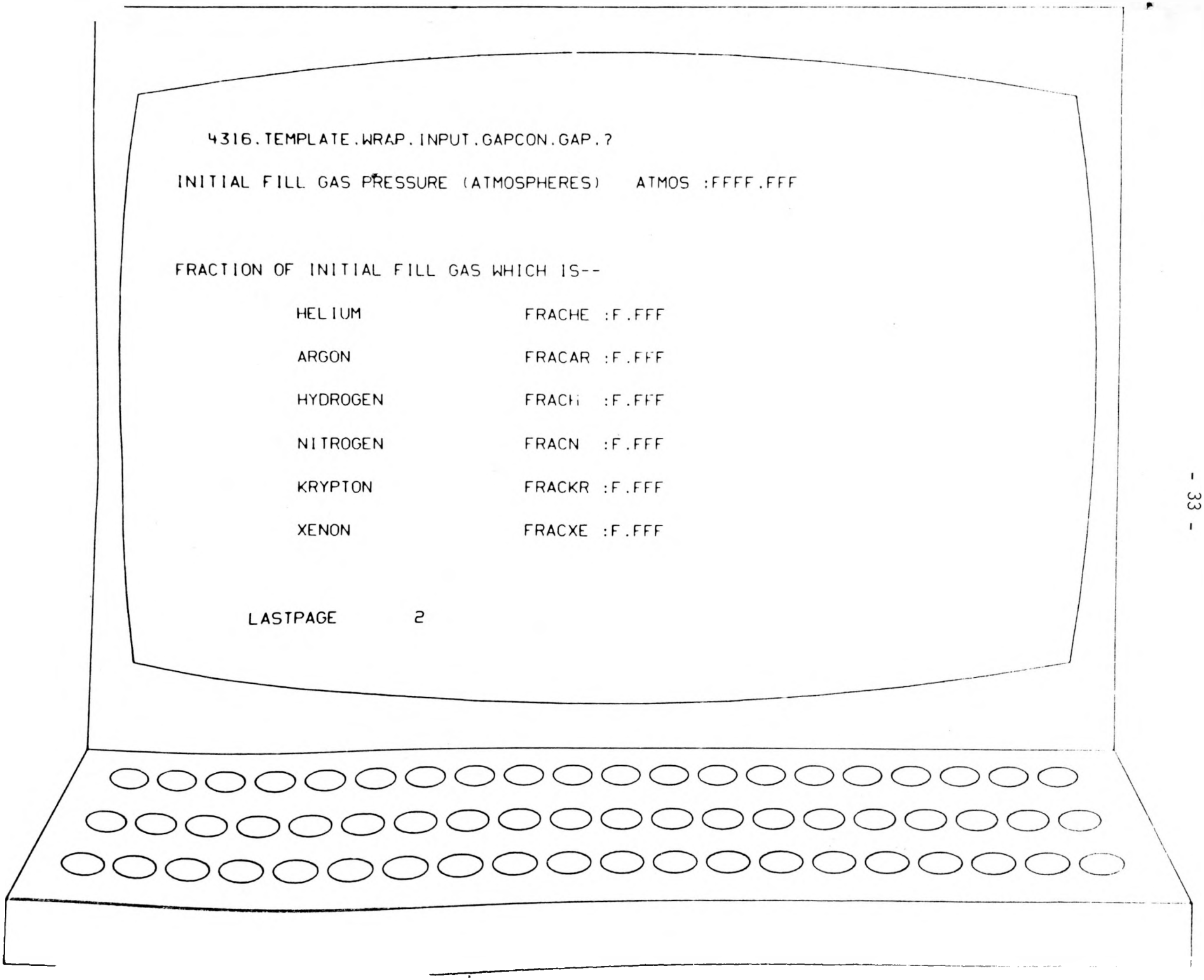

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.COMPOS.?
WEIGHT FRACTION OF U WHICH IS U235 FR35 :F.FFFF
(REMAINDER ASSUMED TO BE U238)
WEIGHT FRACTION OF PU WHICH IS PU240 FR40 :F.FFFF
WEIGHT FRACTION OF PU WHICH IS PU241 FR41 :F.FFFF
NOTE FRACTION OF PU WHICH IS PU239 IS
1.0-FR40-FR41
PAGE 3

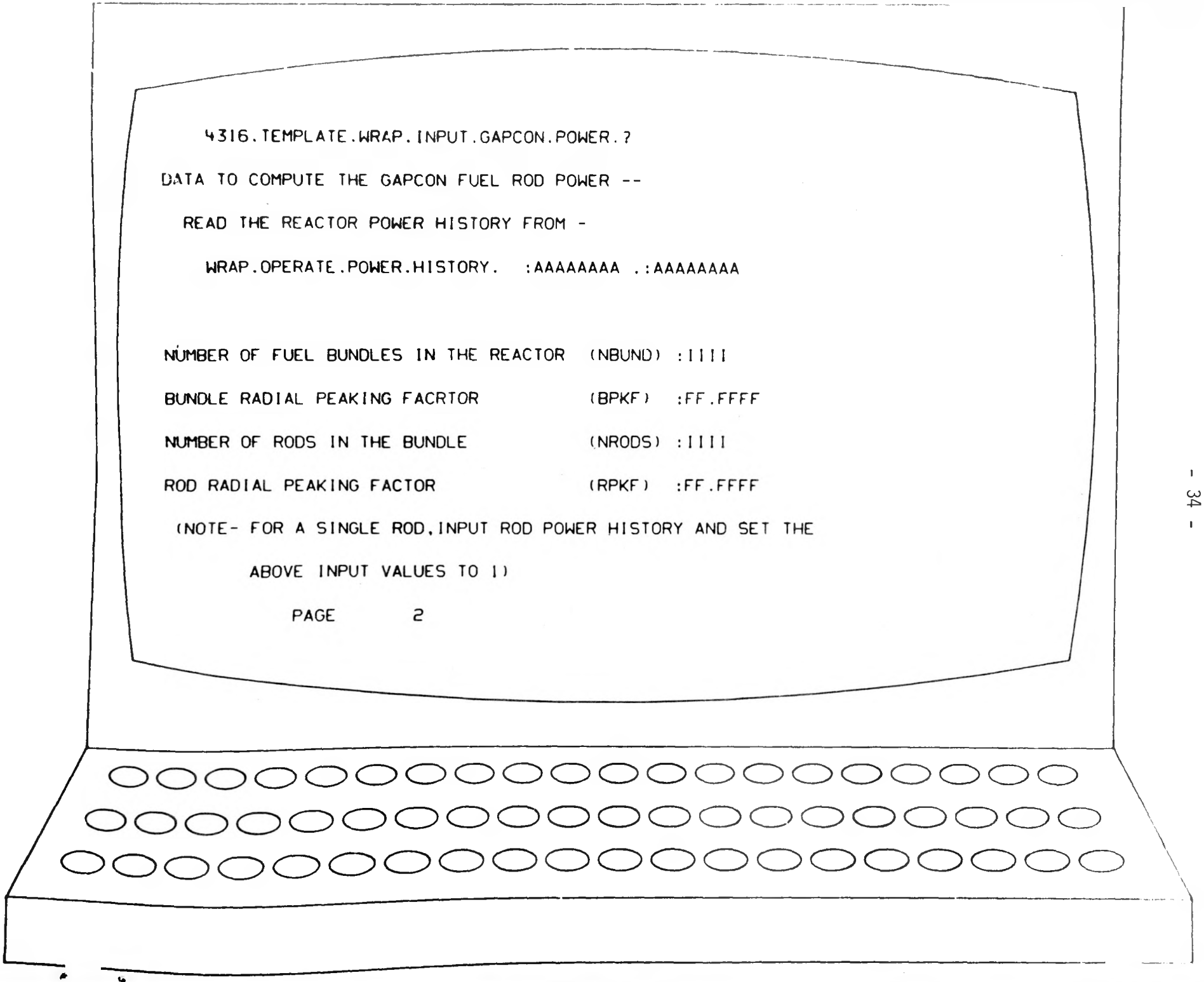

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.COMPOS.?
FUEL SORBED GAS CONTENT (CC/GM OF FUEL) S :FFF.FFF
FRACTION OF SORBED GAS THAT IS CARBON MONOXIDE
AND CARBON DIOXIDE XCO :F.FFFF
FRACTION OF SORBED GAS THAT IS HYDROGEN AND
MOISTURE XH :F.FFFF
FRACTION OF SORBED GAS THAT IS NITROGEN XN :F.FFFF
(NOTE XCO+XH+XN SHOULD =1.0 ,IF S IS > 0.0)
PAGE 4

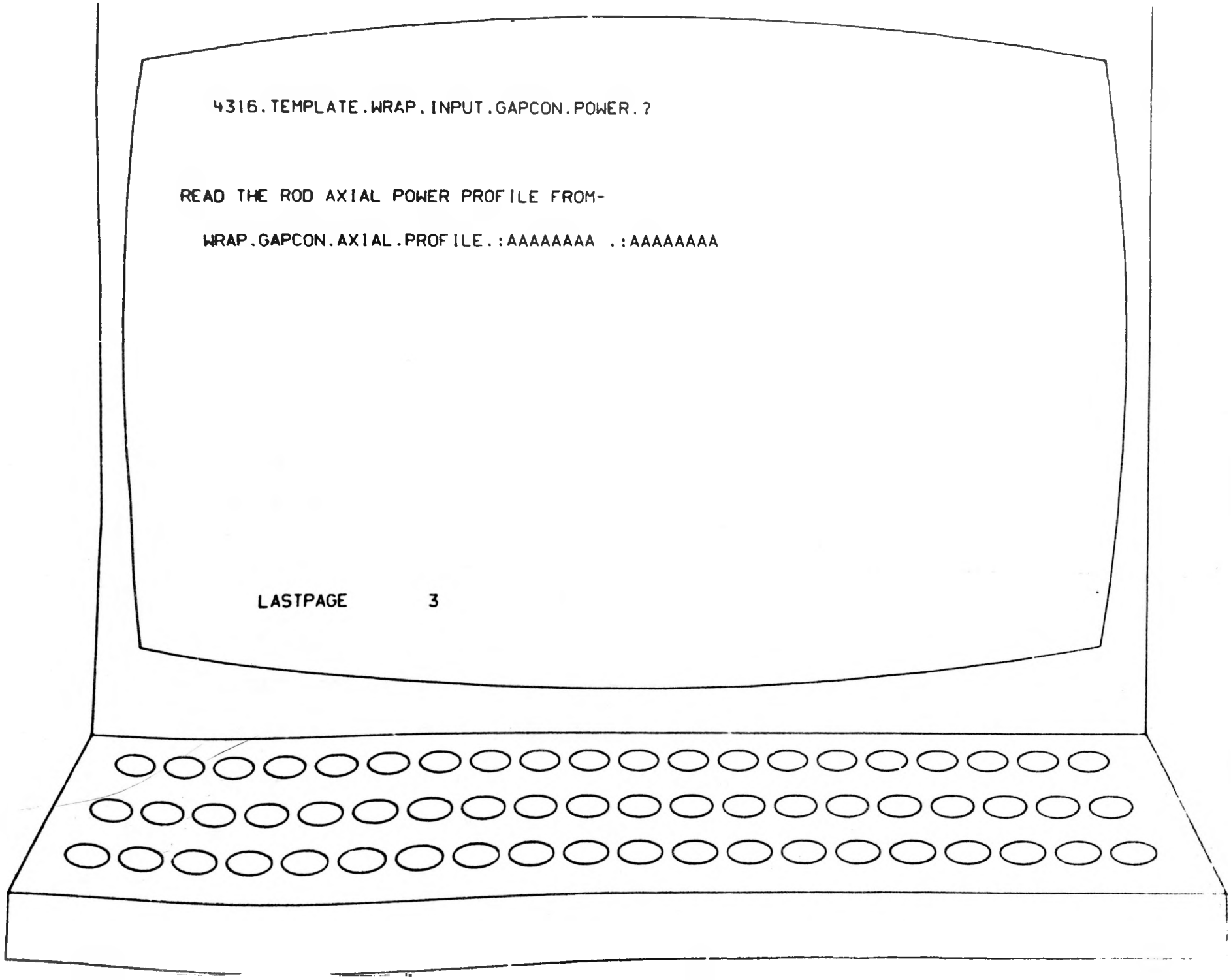

4316.TEMPLATE.WRAP.INPUT.GAPCON.FUEL.COMPOS.?
NOH IS A SIGNAL TO SPECIFY THE DISPOSITION OF NOH :1
SORBED HYDROGEN.
NOH=0 HYDROGEN REACTS WITH CLADDING
NOH=1 ANY HYDROGEN IN SORBED GAS IS ASSUMED TO
REMAIN IN THE FUEL PIN AS A GAS
LASTPAGE 5

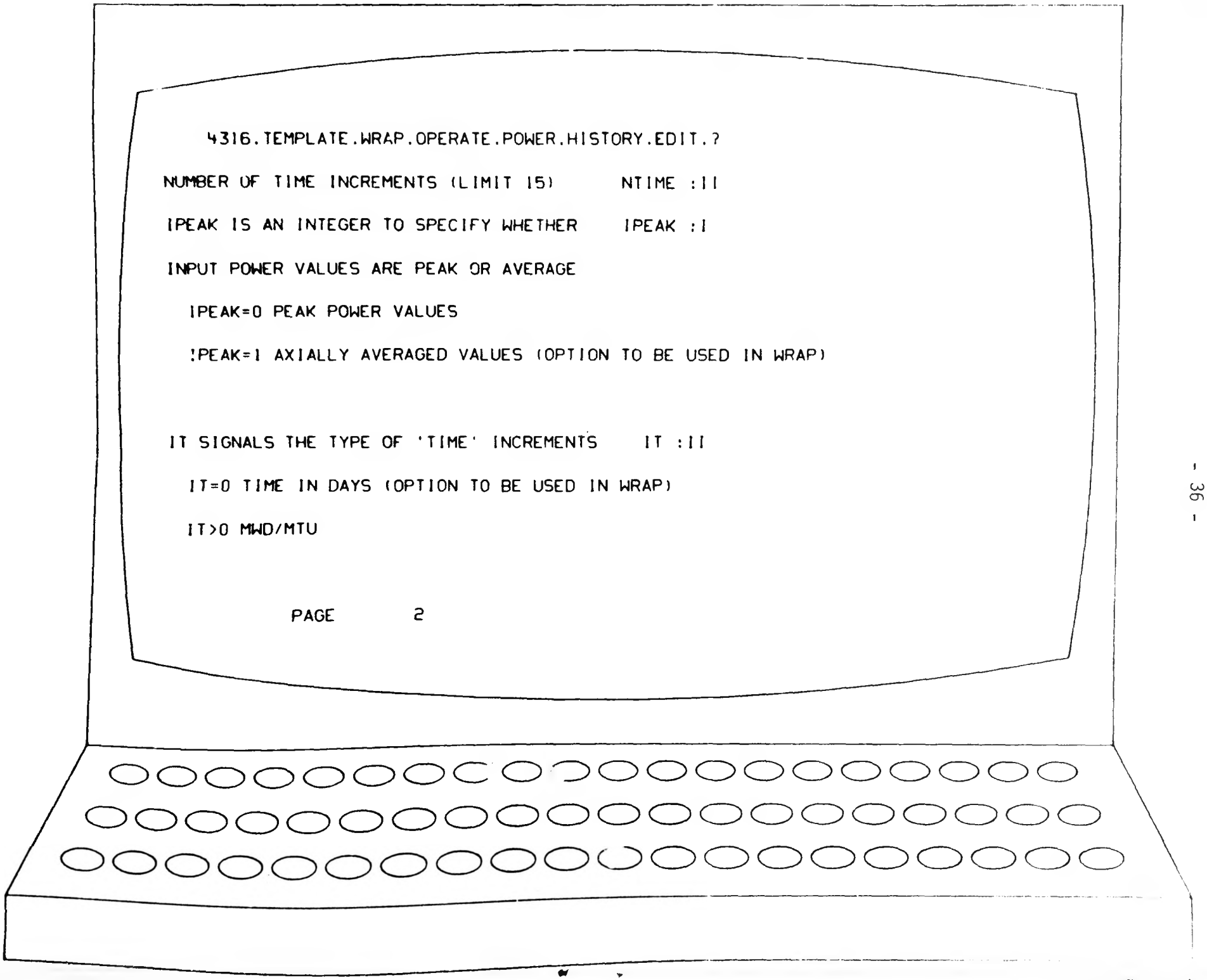

4316.TEMPLATE.WRAP.GAPCON.CONDUCT.?
THE NUMBER OF TEMPERATURES FOR WHICH FUEL
CONDUCTIVITY VALUES ARE INPUT IS :III
THE NUMBER OF TEMPERATURE VALUES (NFUEL) IS
SPECIFIED IN WRAP.INPUT.GAPCON.FUEL.COMPOS.?
PAGE 2

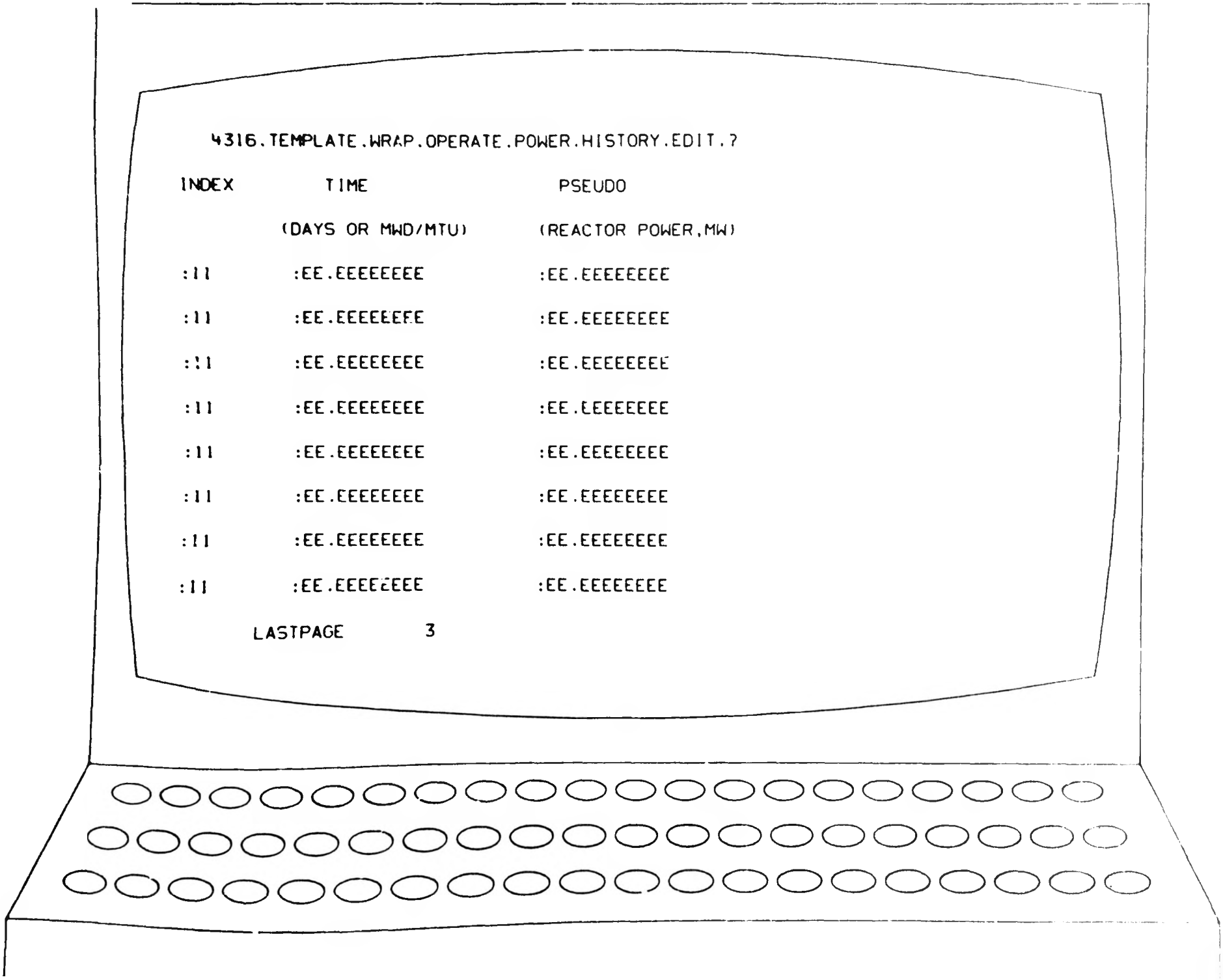

4316.TEMPLATE.WRAP.GAPCON.CONDUCT.?
FUEL TEMP DEG F
UNRESTRUCTURED FUEL CONDUCTIVITY BTU/HR-FT-F
RESTRUCTURED FUEL CONDUCTIVITY BTU/HR-FT-F
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
:FFFF.F :FFF.FFF :FFF.FFF
LASTPAGE 3

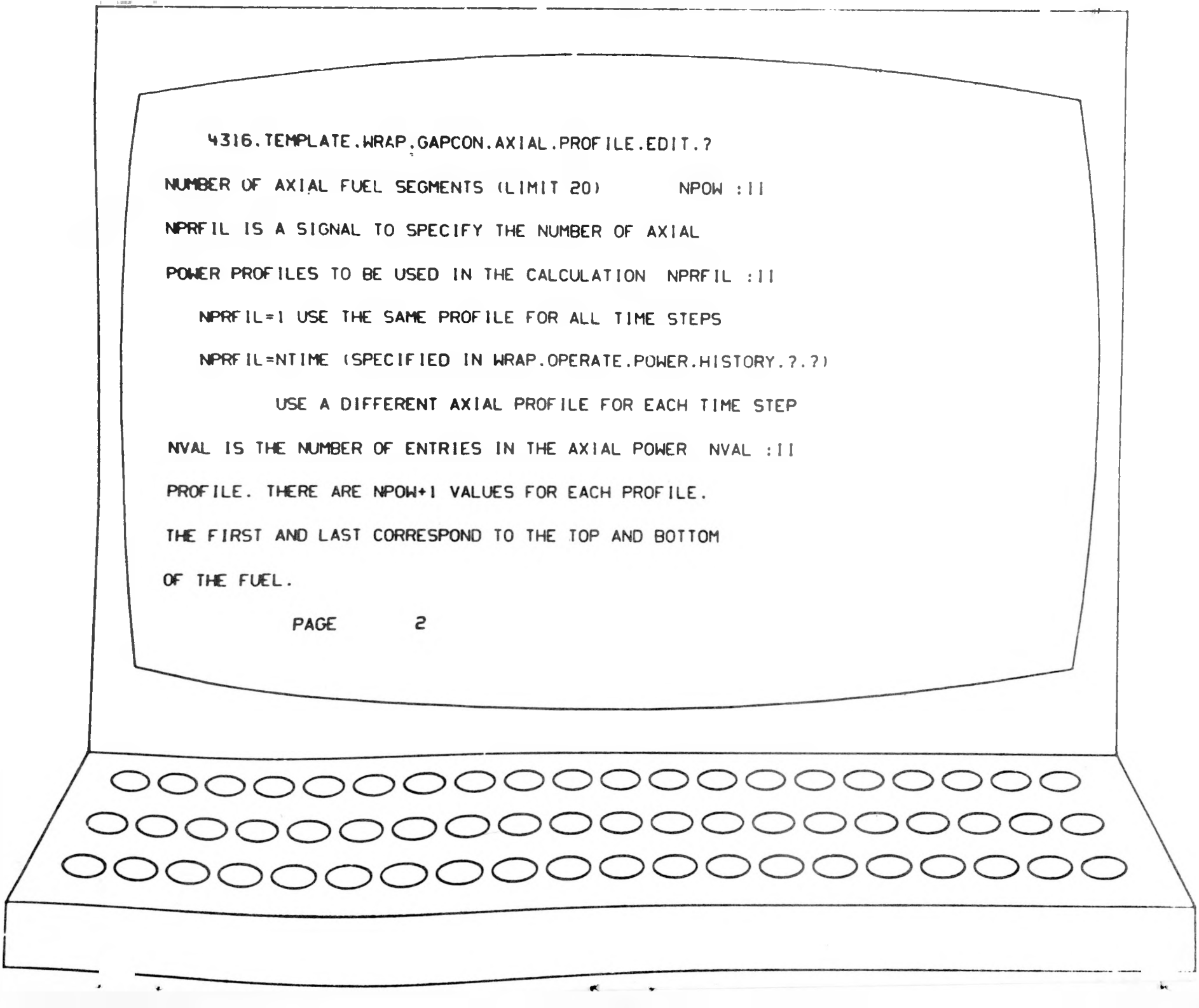

4316.TEMPLATE.WRAP.INPUT.GAPCON.GAP.?
INITIAL FILL GAS PRESSURE (ATMOSPHERES) ATMOS :FFFF.FFF
FRACTION OF INITIAL FILL GAS WHICH IS--
HELIUM FRACHE :F.FFF
ARGON FRACAR :F.FFF
HYDROGEN FRACH :F.FFF
NITROGEN FRACN :F.FFF
KRYPTON FRACKR :F.FFF
XENON FRACXE :F.FFF
LASTPAGE 2

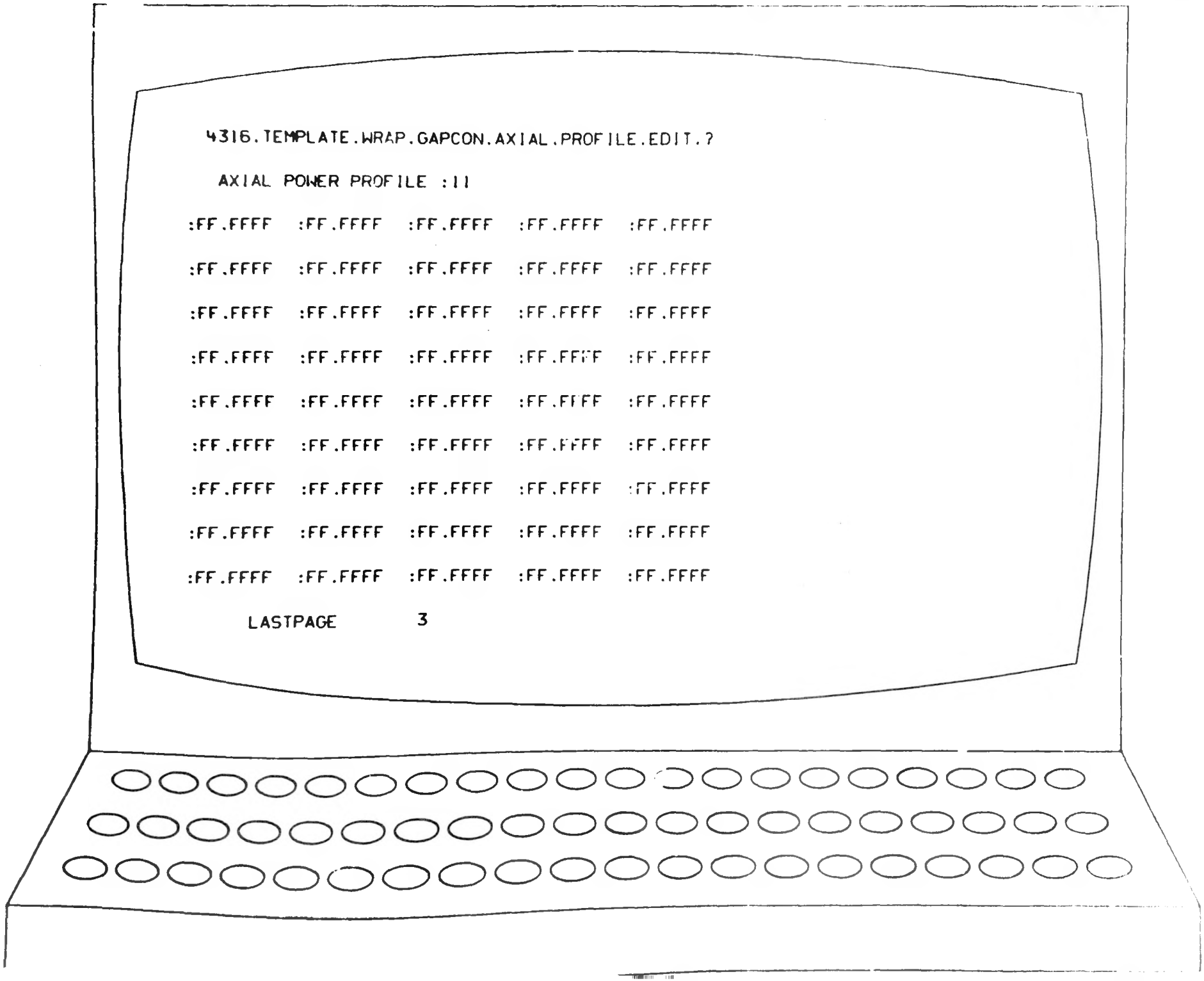

4316.TEMPLATE.WRAP.INPUT.GAPCON.POWER.?
DATA TO COMPUTE THE GAPCON FUEL ROD POWER --
READ THE REACTOR POWER HISTORY FROM -
WRAP.OPERATE.POWER.HISTORY. :AAAAAAAA .:AAAAAAAA
NUMBER OF FUEL BUNDLES IN THE REACTOR (NBUND) :IIII
BUNDLE RADIAL PEAKING FACRTOR (BPKF) :FF.FFFF
NUMBER OF RODS IN THE BUNDLE (NRODS) :IIII
ROD RADIAL PEAKING FACTOR (RPKF) :FF.FFFF
(NOTE- FOR A SINGLE ROD,INPUT ROD POWER HISTORY AND SET THE
ABOVE INPUT VALUES TO 1)
PAGE 2

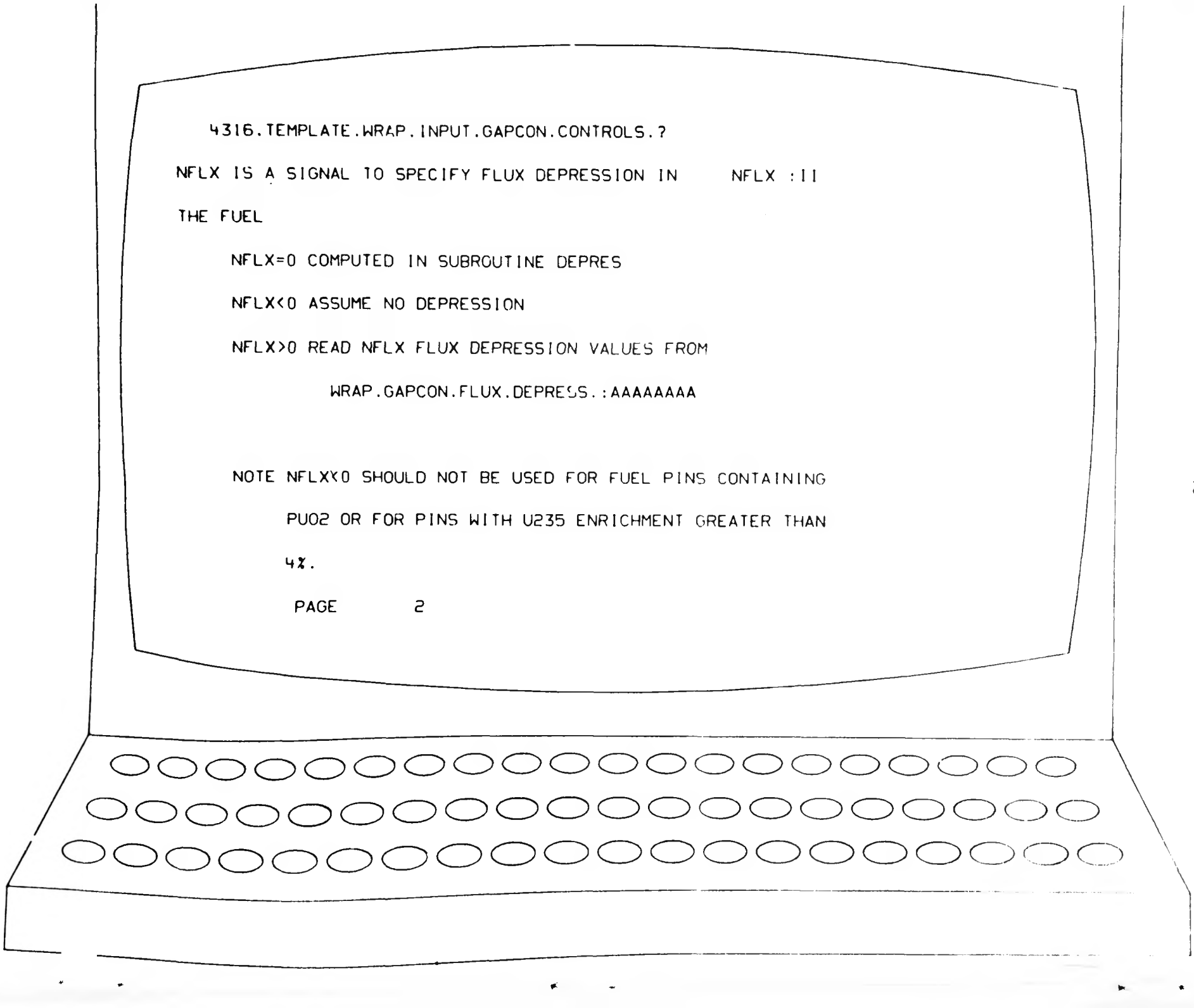

4316.TEMPLATE.WRAP.INPUT.GAPCON.POWER.?
READ THE ROD AXIAL POWER PROFILE FROM-
WRAP.GAPCON.AXIAL.PROFILE.:AAAAAAAA .:AAAAAAAA
LASTPAGE 3

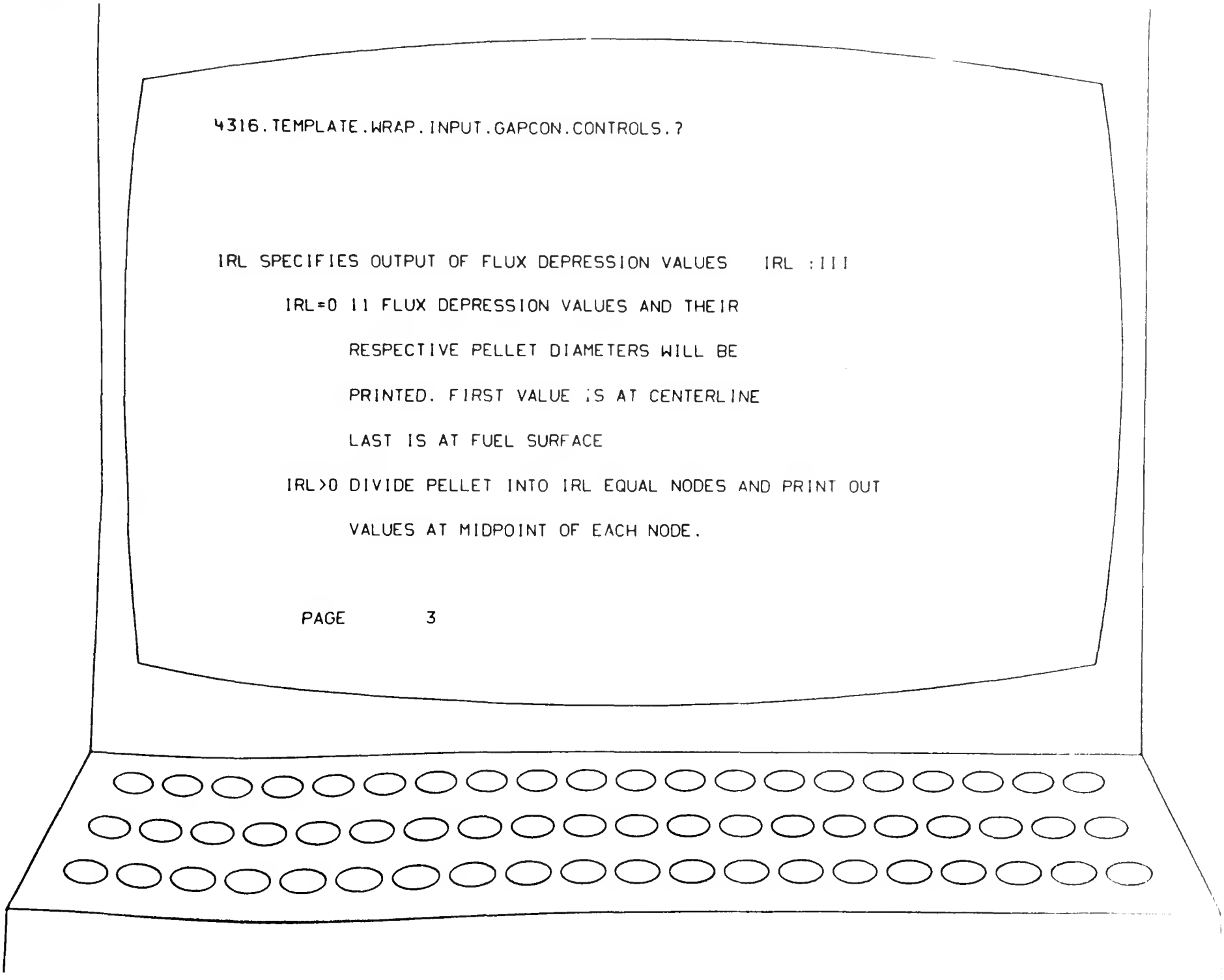

4316.TEMPLATE.WRAP.OPERATE.POWER.HISTORY.EDIT.?
NUMBER OF TIME INCREMENTS (LIMIT 15) NTIME :11
IPEAK IS AN INTEGER TO SPECIFY WHETHER IPEAK :1
INPUT POWER VALUES ARE PEAK OR AVERAGE
IPEAK=0 PEAK POWER VALUES
!PEAK=1 AXIALLY AVERAGED VALUES (OPTION TO BE USED IN WRAP)
IT SIGNALS THE TYPE OF 'TIME' INCREMENTS IT :11
IT=0 TIME IN DAYS (OPTION TO BE USED IN WRAP)
IT>0 MWD/MTU
PAGE 2

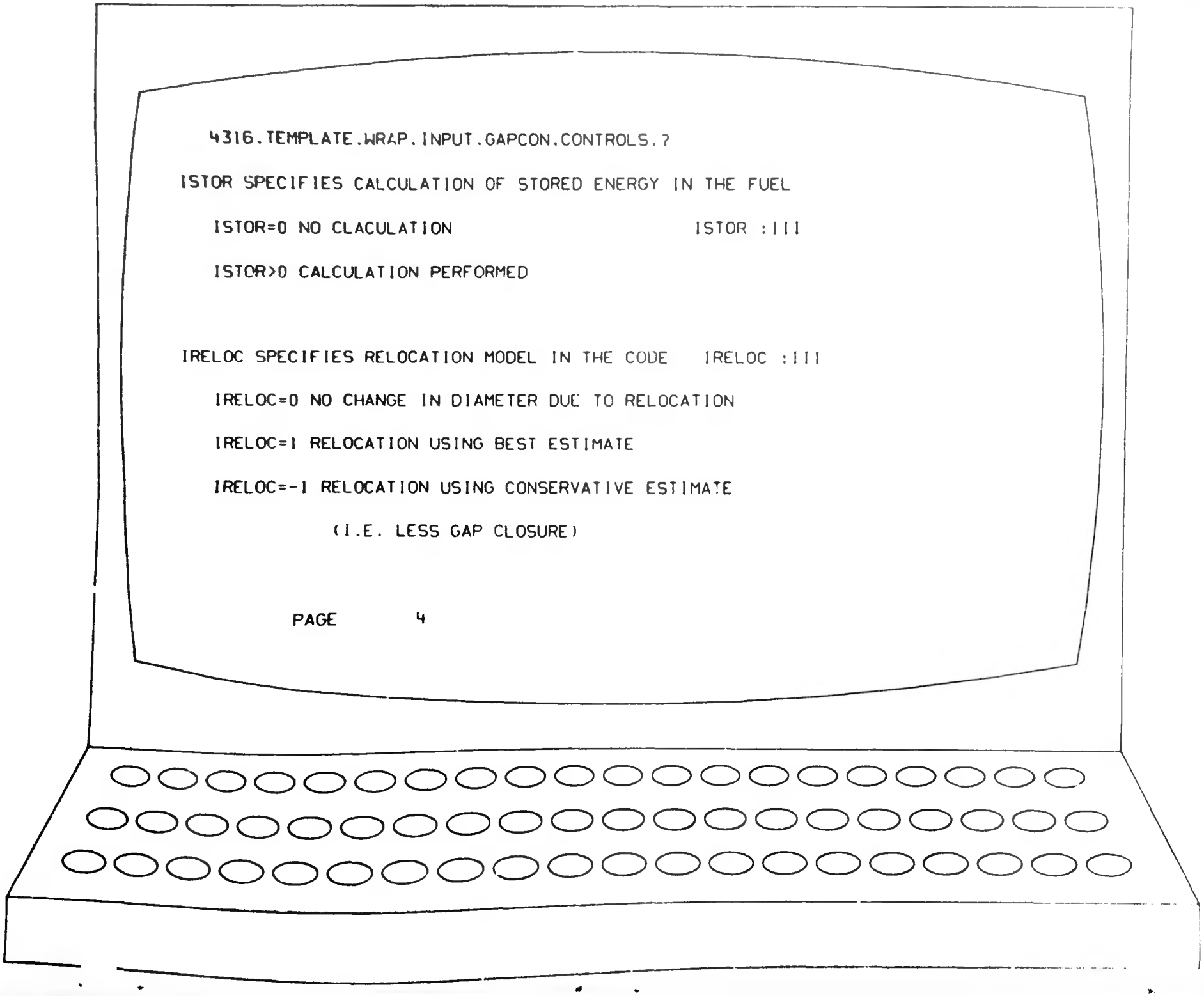

4316.TEMPLATE.WRAP.OPERATE.POWER.HISTORY.EDIT.?
INDEX
TIME
(DAYS OR MWD/MTU)
PSEUDO
(REACTOR POWER,MW)
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
:II :EE.EEEEEEEE :EE.EEEEEEEE
LASTPAGE 3

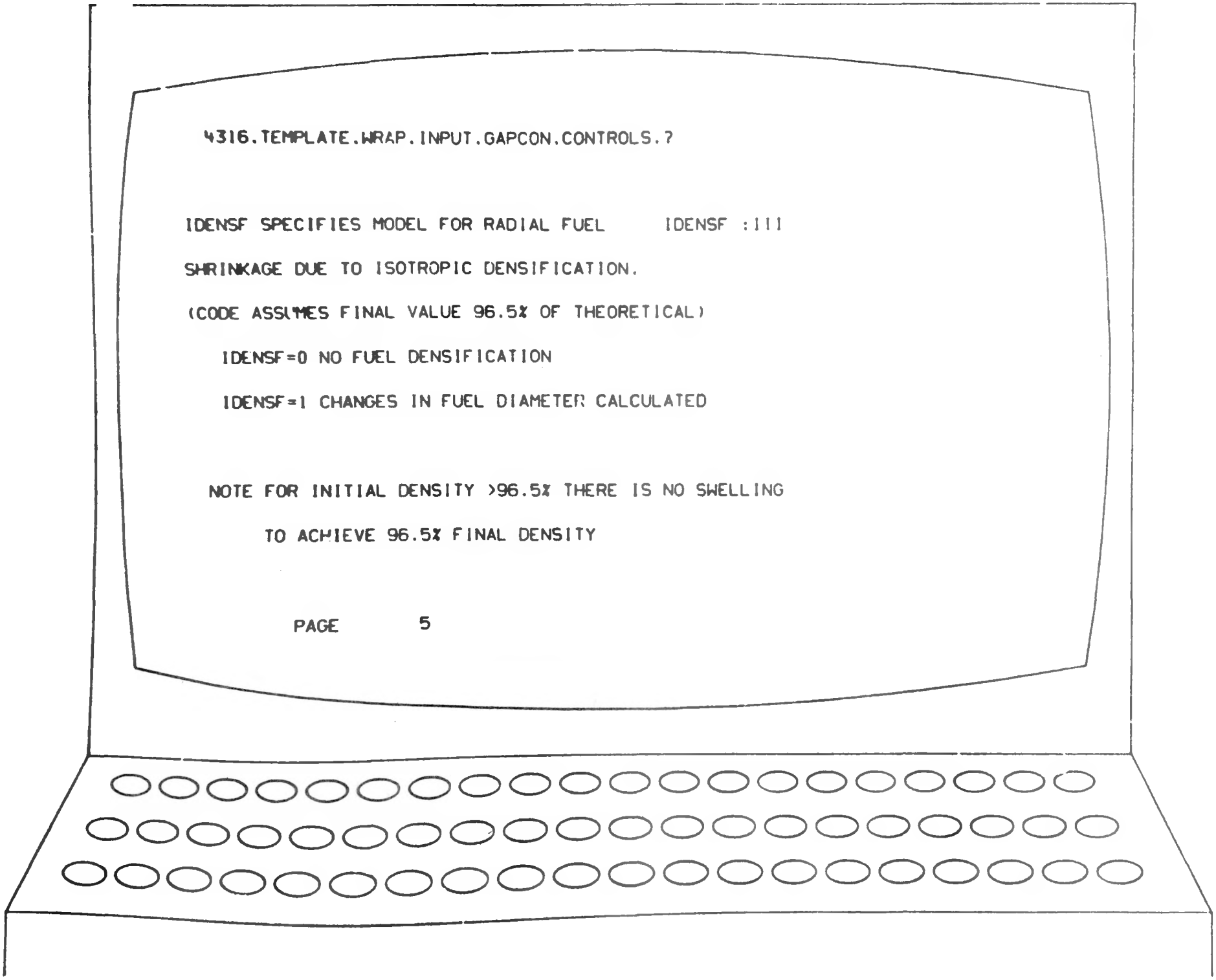

4316.TEMPLATE.WRAP,GAPCON.AXIAL.PROFILE.EDIT.?
NUMBER OF AXIAL FUEL SEGMENTS (LIMIT 20) NPOW :11
NPRFIL IS A SIGNAL TO SPECIFY THE NUMBER OF AXIAL
POWER PROFILES TO BE USED IN THE CALCULATION NPRFIL :11
NPRFIL=1 USE THE SAME PROFILE FOR ALL TIME STEPS
NPRFIL=NTIME (SPECIFIED IN WRAP.OPERATE.POWER.HISTORY.?.?)
USE A DIFFERENT AXIAL PROFILE FOR EACH TIME STEP
NVAL IS THE NUMBER OF ENTRIES IN THE AXIAL POWER NVAL :11
PROFILE. THERE ARE NPOW+1 VALUES FOR EACH PROFILE.
THE FIRST AND LAST CORRESPOND TO THE TOP AND BOTTOM
OF THE FUEL.
PAGE 2

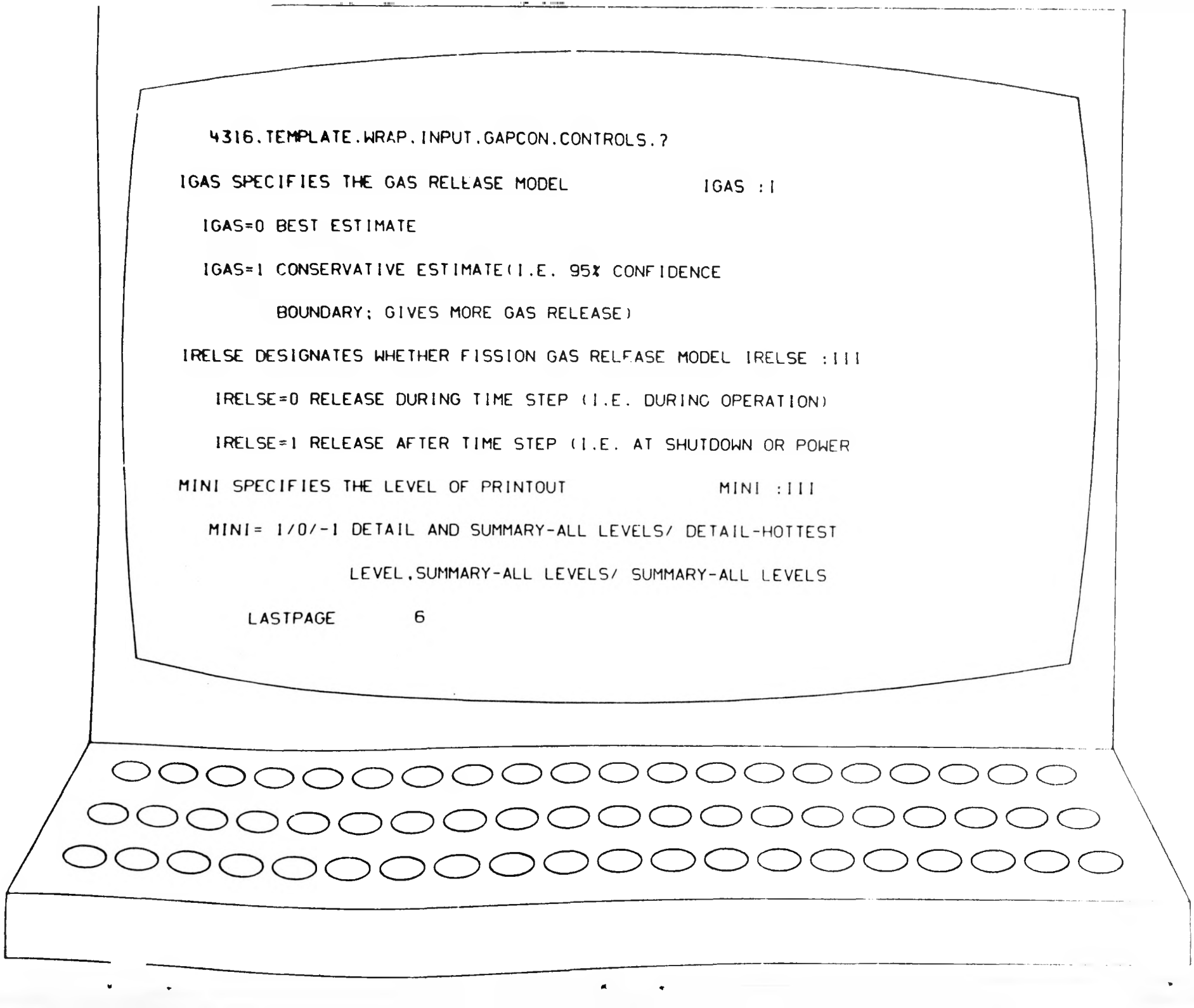

4316.TEMPLATE.WRAP.GAPCON.AXIAL.PROFILE.EDIT.?
AXIAL POWER PROFILE :11
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
:FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF :FF.FFFF
LASTPAGE 3

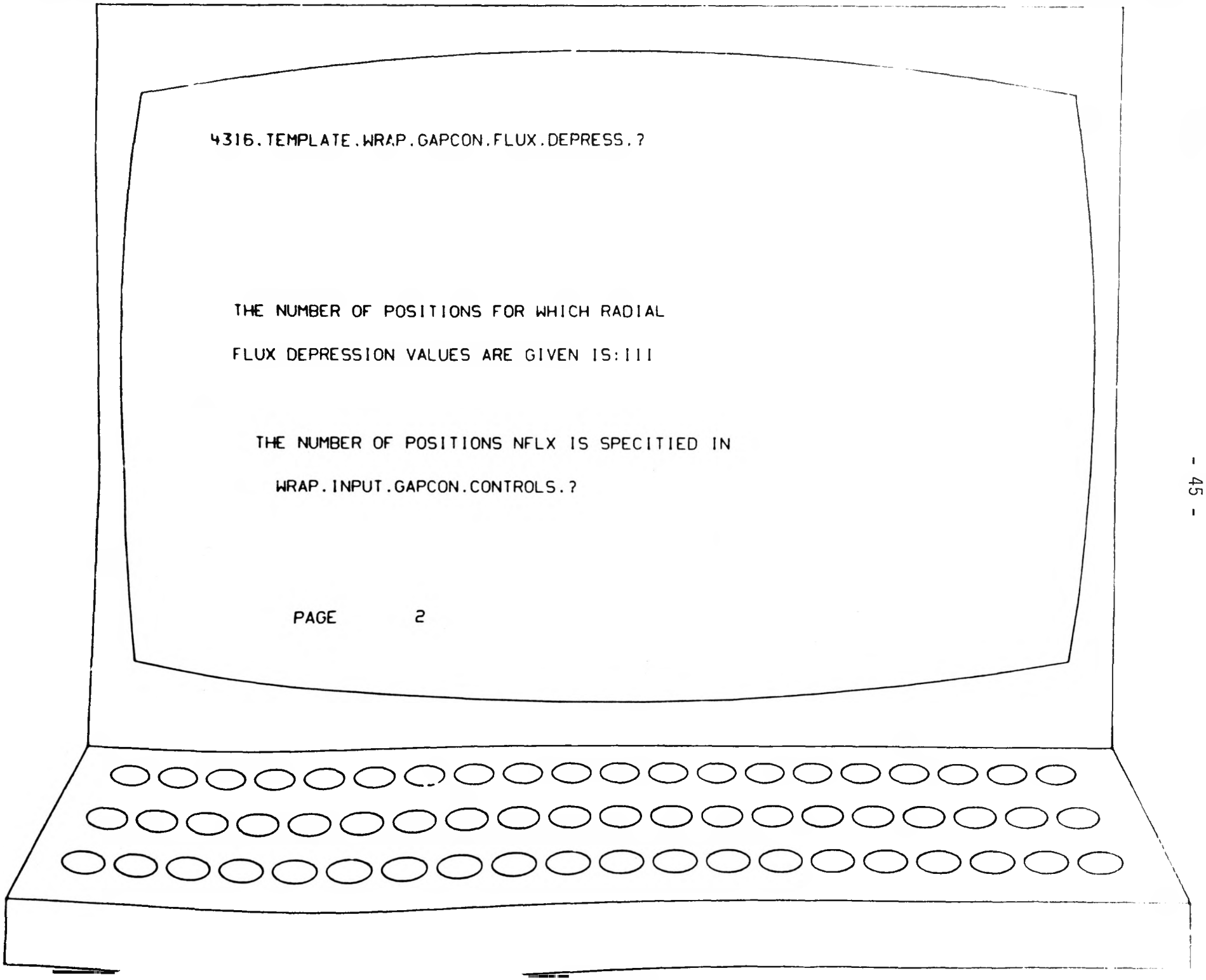

4316.TEMPLATE.WRAP.INPUT.GAPCON.CONTROLS.?
NFLX IS A SIGNAL TO SPECIFY FLUX DEPRESSION IN NFLX :11
THE FUEL
NFLX=0 COMPUTED IN SUBROUTINE DEPRES
NFLX<0 ASSUME NO DEPRESSION
NFLX>0 READ NFLX FLUX DEPRESSION VALUES FROM
WRAP.GAPCON.FLUX.DEPRESS.:AAAAAAAA
NOTE NFLX<0 SHOULD NOT BE USED FOR FUEL PINS CONTAINING
PUO2 OR FOR PINS WITH U235 ENRICHMENT GREATER THAN
4%.
PAGE 2

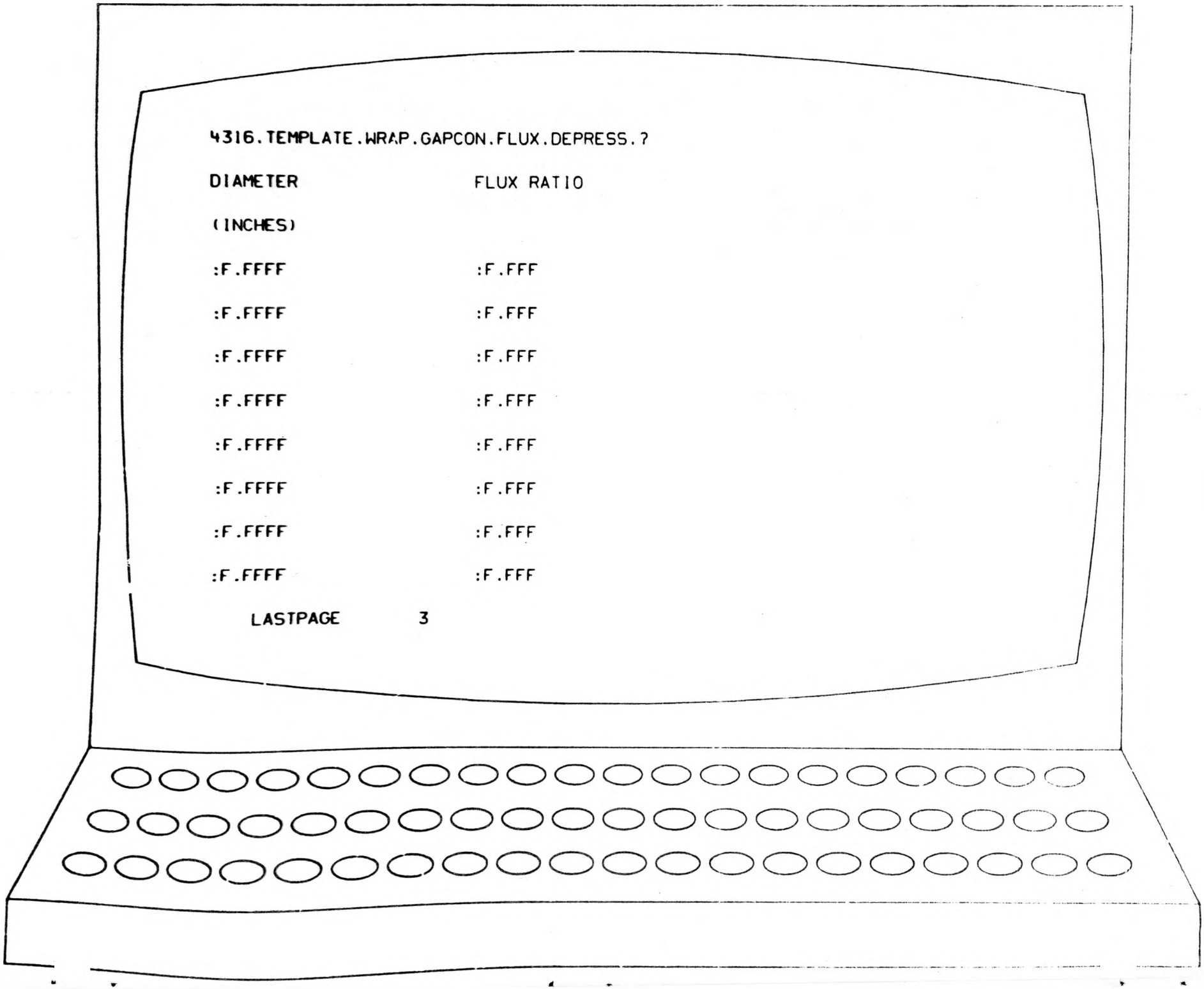

4316.TEMPLATE.WRAP.INPUT.GAPCON.CONTROLS.?
IRL SPECIFIES OUTPUT OF FLUX DEPRESSION VALUES IRL :III
IRL=0 II FLUX DEPRESSION VALUES AND THEIR
RESPECTIVE PELLET DIAMETERS WILL BE
PRINTED. FIRST VALUE IS AT CENTERLINE
LAST IS AT FUEL SURFACE
IRL>0 DIVIDE PELLET INTO IRL EQUAL NODES AND PRINT OUT
VALUES AT MIDPOINT OF EACH NODE.
PAGE 3


4316.TEMPLATE.WRAP.INPUT.GAPCON.CONTROLS.?
ISTOR SPECIFIES CALCULATION OF STORED ENERGY IN THE FUEL
ISTOR=0 NO CLACULATION
ISTOR :III
ISTOR>0 CALCULATION PERFORMED
IRELOC SPECIFIES RELOCATION MODEL IN THE CODE
IRELOC :III
IRELOC=0 NO CHANGE IN DIAMETER DUE TO RELOCATION
IRELOC=1 RELOCATION USING BEST ESTIMATE
IRELOC=-1 RELOCATION USING CONSERVATIVE ESTIMATE
(I.E. LESS GAP CLOSURE)
PAGE 4


4316.TEMPLATE.WRAP.INPUT.GAPCON.CONTROLS.?
IDENSF SPECIFIES MODEL FOR RADIAL FUEL IDENSF :111
SHRINKAGE DUE TO ISOTROPIC DENSIFICATION.
(CODE ASSUMES FINAL VALUE 96.5% OF THEORETICAL)
IDENSF=0 NO FUEL DENSIFICATION
IDENSF=1 CHANGES IN FUEL DIAMETER CALCULATED
NOTE FOR INITIAL DENSITY >96.5% THERE IS NO SWELLING
TO ACHIEVE 96.5% FINAL DENSITY
PAGE 5


4316.TEMPLATE.WRAP.INPUT.GAPCON.CONTROLS.?
IGAS SPECIFIES THE GAS RELEASE MODEL IGAS :1
IGAS=0 BEST ESTIMATE
IGAS=1 CONSERVATIVE ESTIMATE(I.E. 95% CONFIDENCE
BOUNDARY; GIVES MORE GAS RELEASE)
IRELSE DESIGNATES WHETHER FISSION GAS RELEASE MODEL IRELSE :111
IRELSE=0 RELEASE DURING TIME STEP (I.E. DURING OPERATION)
IRELSE=1 RELEASE AFTER TIME STEP (I.E. AT SHUTDOWN OR POWER
MINI SPECIFIES THE LEVEL OF PRINTOUT MINI :111
MINI= 1/0/-1 DETAIL AND SUMMARY-ALL LEVELS/ DETAIL-HOTTEST
LEVEL,SUMMARY-ALL LEVELS/ SUMMARY-ALL LEVELS
LASTPAGE 6


4316.TEMPLATE.WRAP.GAPCON.FLUX.DEPRESS.?
THE NUMBER OF POSITIONS FOR WHICH RADIAL
FLUX DEPRESSION VALUES ARE GIVEN IS:III
THE NUMBER OF POSITIONS NFLX IS SPECITIED IN
WRAP.INPUT.GAPCON.CONTROLS.?
PAGE 2


4316.TEMPLATE.WRAP.GAPCON.FLUX.DEPRESS.?
DIAMETER
(INCHES)
FLUX RATIO
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
:F.FFFF
:F.FFF
LASTPAGE
3

III. MOXY Input Records

The MOXY input records are listed in Table I. The BWR rod bundle layout and length are described in the WRAP.INPUT.MOXY.RODTYPES.?ARRAY record where ?ARRAY is the array name given to a particular fuel bundle. All the other records pertain to the particular case (?CASE) that is to be executed. The input template for the MOXY records are presented in pp. 49-110.

Not all of the MOXY input records listed are needed for execution of a MOXY problem. Records designated '**' in the list are needed only if their data are specified as part of the problem in the PARAM and IPARAM records. Also, the absence of the records designated by '+' will cause MOXY to default to specific calculations and built-in values or tables of values. The records indicated by '++' are optional, but are required for EM calculations. Each record template lists the problem requirements and defaults applicable for that record. Reference to the card identification of the original MOXY input (see MOXY manual, reference 2) has been maintained in each MOXY input record template.

Table I. List of MOXY Input Records

WRAP.INPUT.MOXY.OPTIONS.?JOB*

WRAP.INPUT.MOXY.RODTYPES.?ARRAY

WRAP.INPUT.MOXY.?CASE.PARAM

WRAP.INPUT.MOXY.?CASE.IPARAM

WRAP.INPUT.MOXY.?CASE.GEOMETRY

WRAP.INPUT.MOXY.?CASE.TIMEPRNT

WRAP.INPUT.MOXY.?CASE.SPRAYTIM

WRAP.INPUT.MOXY.?CASE.SURFTEMP**

WRAP.INPUT.MOXY.?CASE.NORMPOWR**

WRAP.INPUT.MOXY.?CASE.HTCOEF.?RODGRP**

WRAP.INPUT.MOXY.?CASE.FLTEMP**

WRAP.INPUT.MOXY.?CASE.HEATPEAK

WRAP.INPUT.MOXY.?CASE.RUPTURE

WRAP.INPUT.MOXY.?CASE.EMISS

WRAP.INPUT.MOXY.?CASE.OXIDE

WRAP.INPUT.MOXY.?CASE.DENSITY

WRAP.INPUT.MOXY.?CASE.GAPPARAM++

WRAP.INPUT.MOXY.?CASE.MOLEFRAC++

WRAP.INPUT.MOXY.?CASE.PRECOEF+

WRAP.INPUT.MOXY.?CASE.POSTCOEF**

WRAP.INPUT.MOXY.?CASE.VIEWFACT

WRAP.INPUT.MOXY.?CASE.PRESTIME**

WRAP.INPUT.MOXY.?CASE.GSVOLUME**

WRAP.INPUT.MOXY.?CASE.AXLDPOC+

WRAP.INPUT.MOXY.?CASE.TOPTEMP**

WRAP.INPUT.MOXY.?CASE.RUPTEMP**

WRAP.INPUT.MOXY.?CASE.SLBLNGTH+

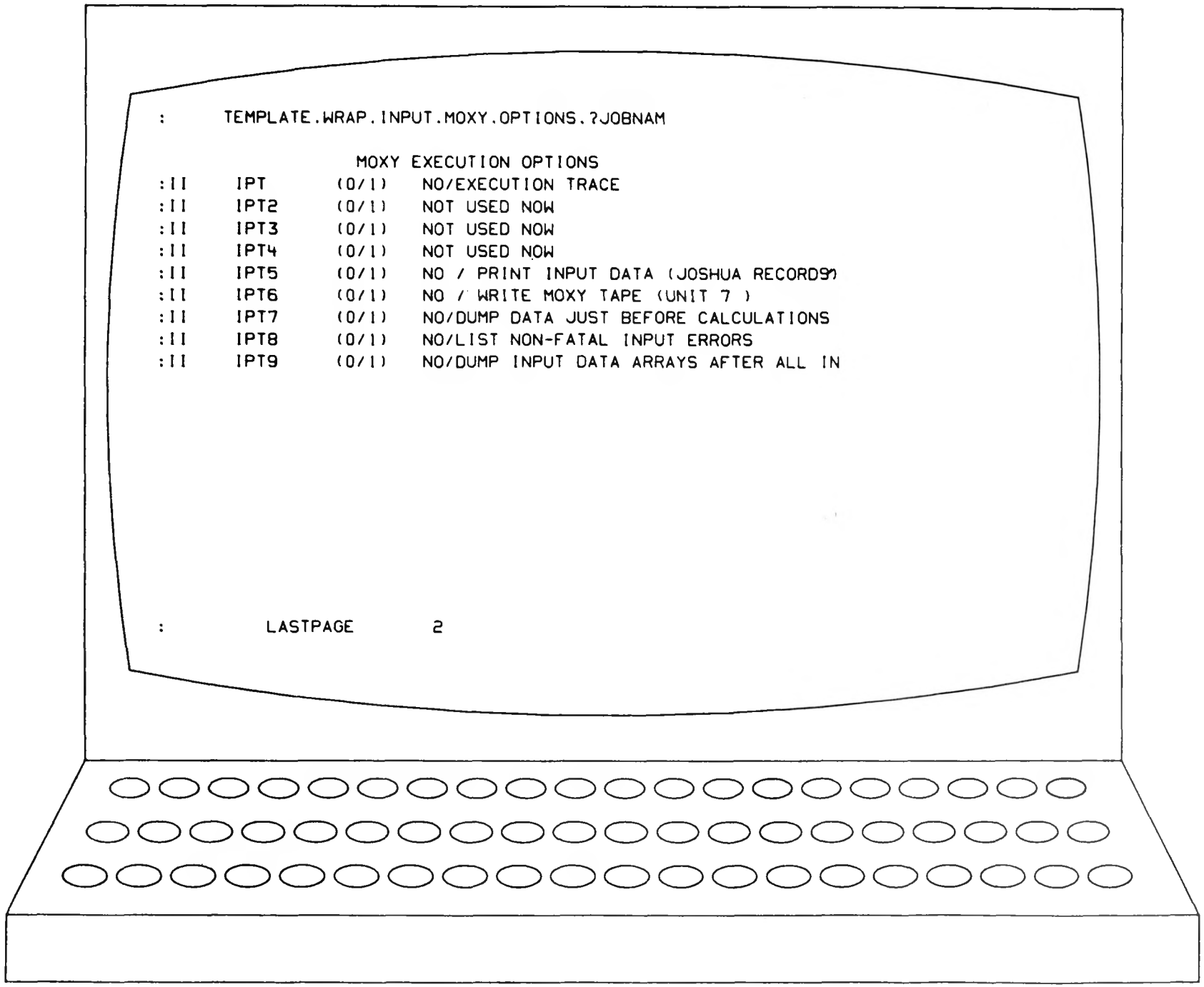
WRAP.INPUT.MOXY.?CASE.PLSTRAIN**

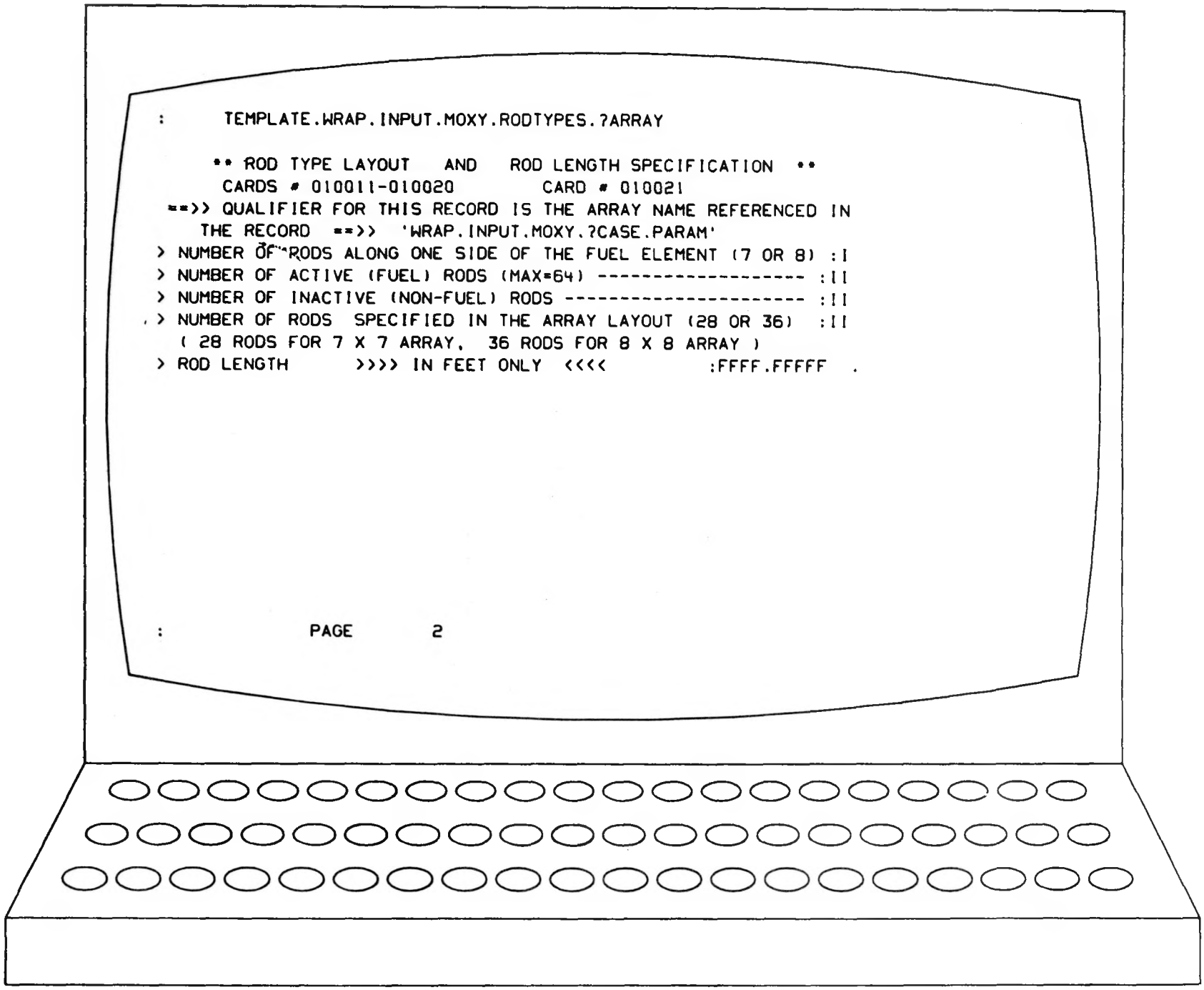
*The options record is normally used only to trace down input or programming errors.

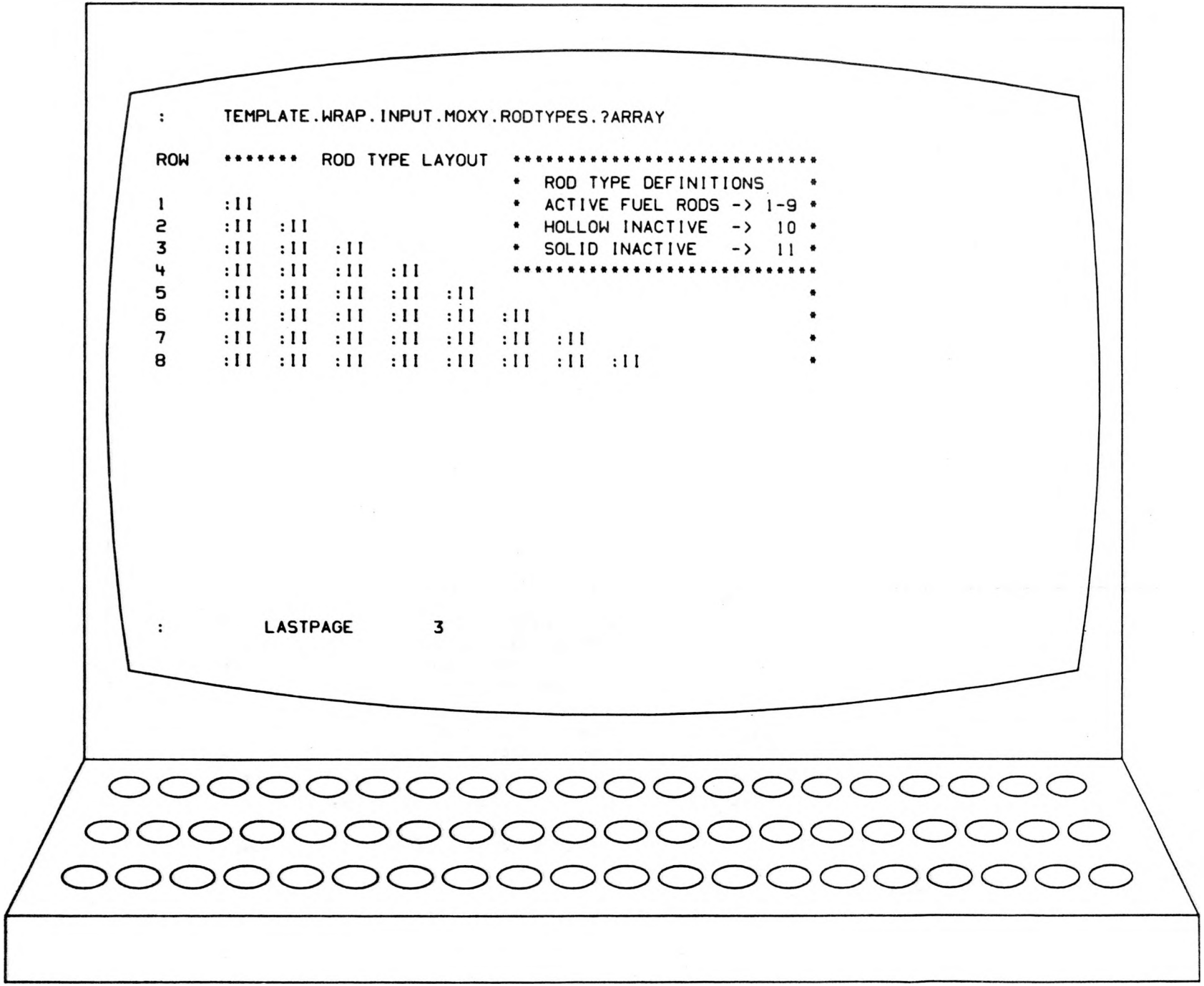
**Optional records.

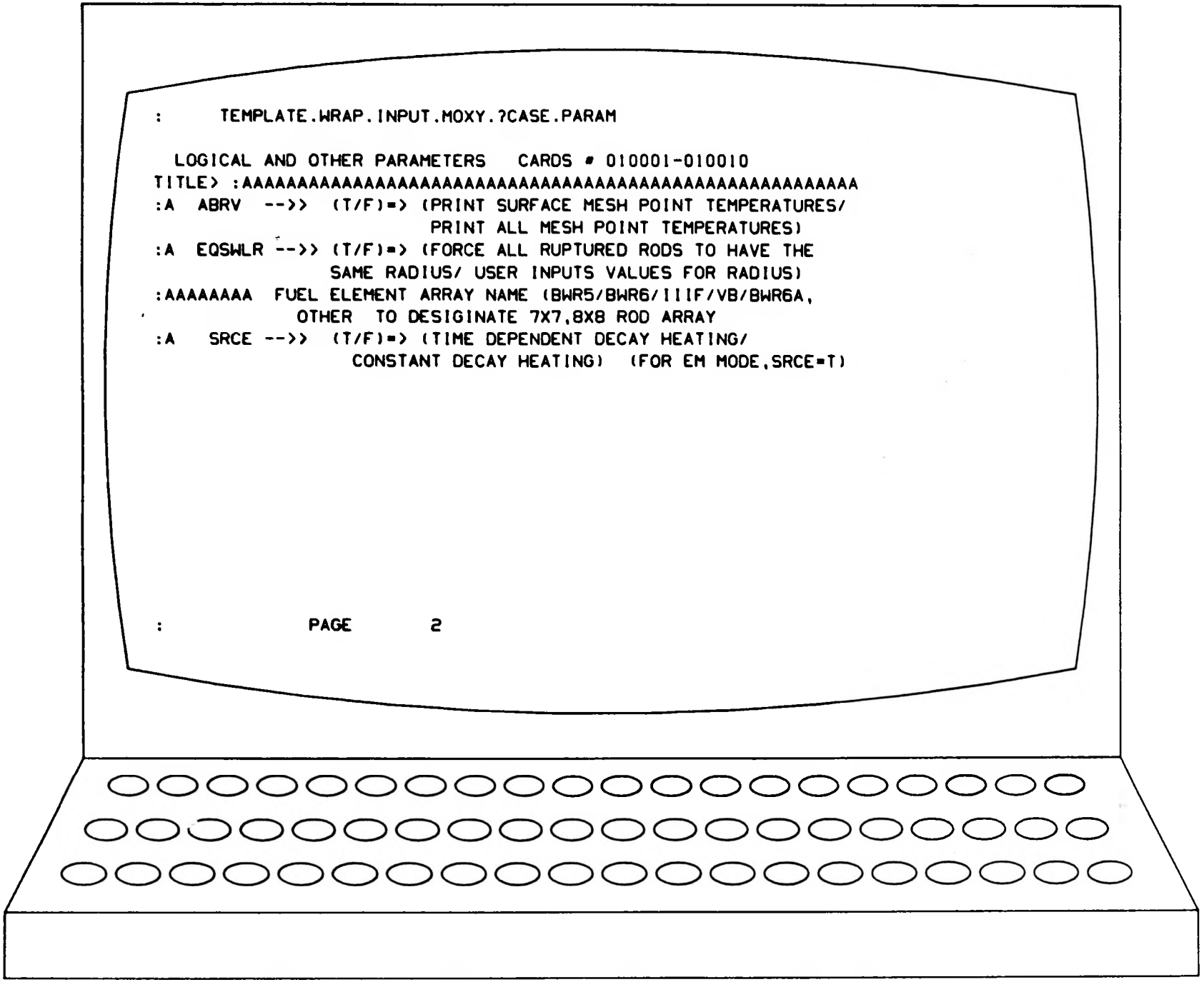
+Optional records with defaults if absent.

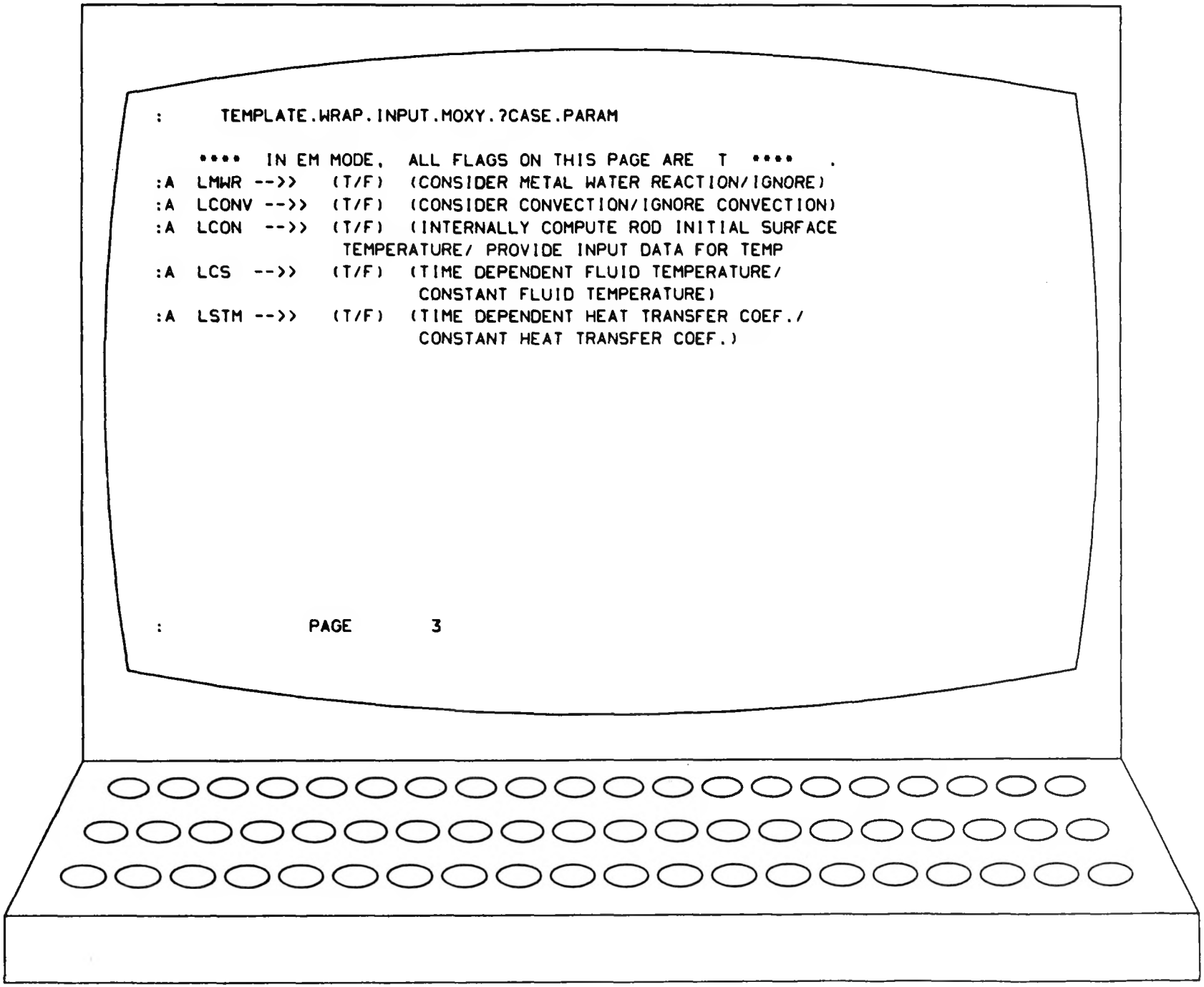
++Optional records required for EM calculations.

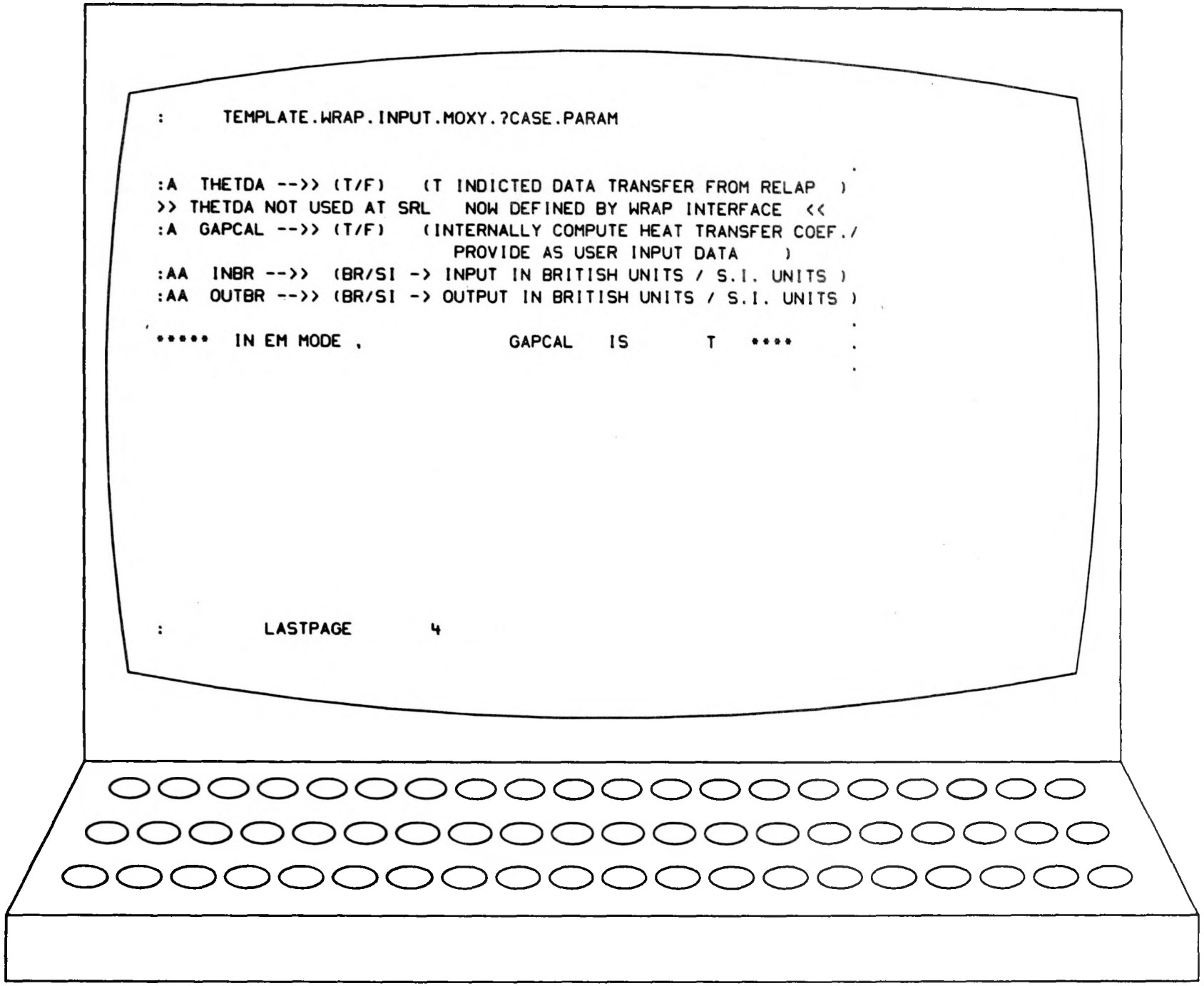

: TEMPLATE.WRAP.INPUT.MOXY.OPTIONS.?JOBNAM
MOXY EXECUTION OPTIONS
:II IPT (0/1) NO/EXECUTION TRACE
:II IPT2 (0/1) NOT USED NOW
:II IPT3 (0/1) NOT USED NOW
:II IPT4 (0/1) NOT USED NOW
:II IPT5 (0/1) NO / PRINT INPUT DATA (JOSHUA RECORDS)
:II IPT6 (0/1) NO / WRITE MOXY TAPE (UNIT 7)
:II IPT7 (0/1) NO/DUMP DATA JUST BEFORE CALCULATIONS
:II IPT8 (0/1) NO/LIST NON-FATAL INPUT ERRORS
:II IPT9 (0/1) NO/DUMP INPUT DATA ARRAYS AFTER ALL IN
: LASTPAGE 2

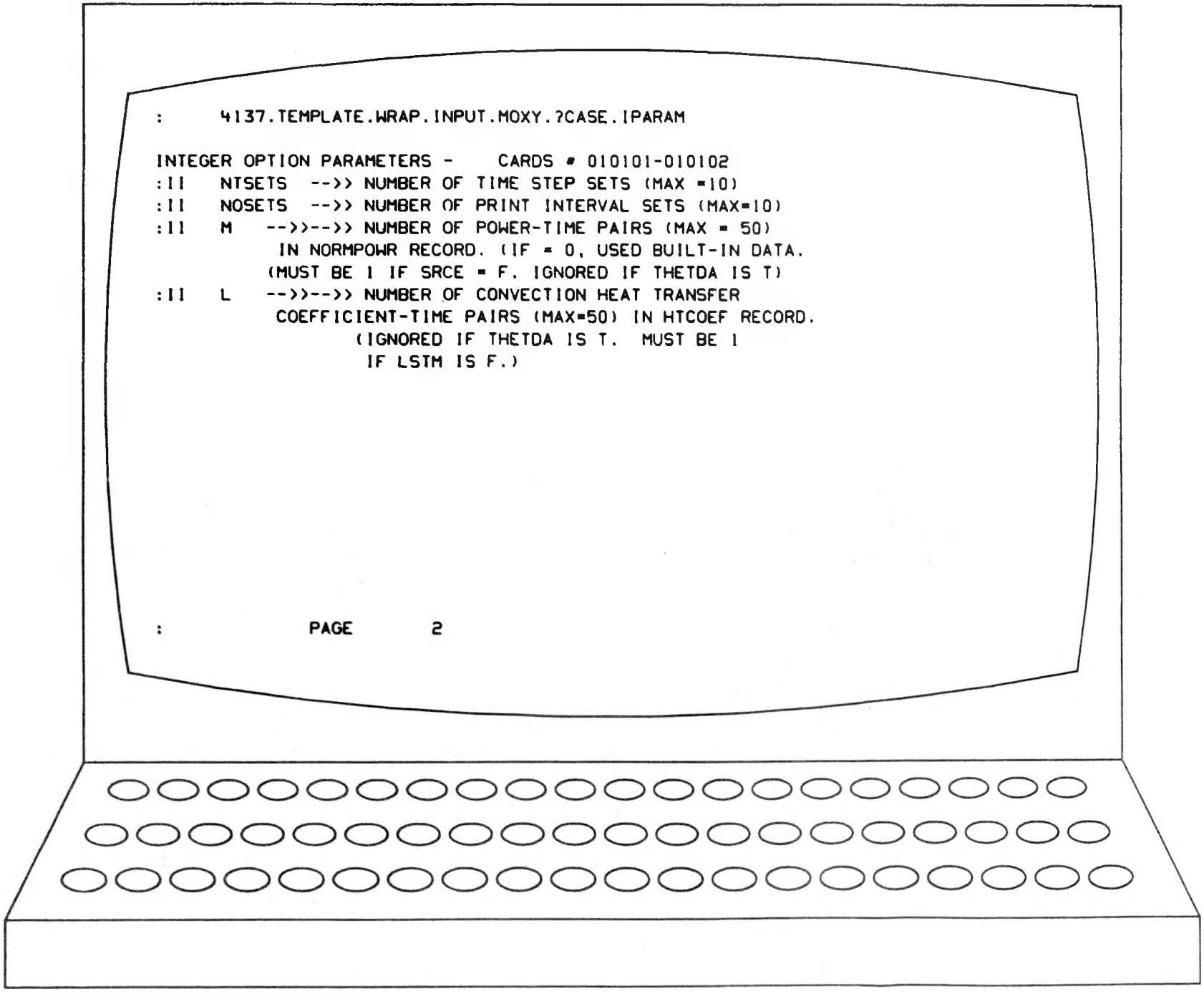

: TEMPLATE.WRAP.INPUT.MOXY.RODTYPES.?ARRAY
** ROD TYPE LAYOUT AND ROD LENGTH SPECIFICATION **
CARDS # 010011-010020 CARD # 010021
==>> QUALIFIER FOR THIS RECORD IS THE ARRAY NAME REFERENCED IN
THE RECORD ==>> 'WRAP.INPUT.MOXY.?CASE.PARAM'
> NUMBER OF RODS ALONG ONE SIDE OF THE FUEL ELEMENT (7 OR 8) :I
> NUMBER OF ACTIVE (FUEL) RODS (MAX=64) ---------- :II
> NUMBER OF INACTIVE (NON-FUEL) RODS ---------- :II
> NUMBER OF RODS SPECIFIED IN THE ARRAY LAYOUT (28 OR 36) :II
(28 RODS FOR 7 X 7 ARRAY, 36 RODS FOR 8 X 8 ARRAY)
> ROD LENGTH >>>> IN FEET ONLY <<<< :FFFF.FFFFF .
: PAGE 2

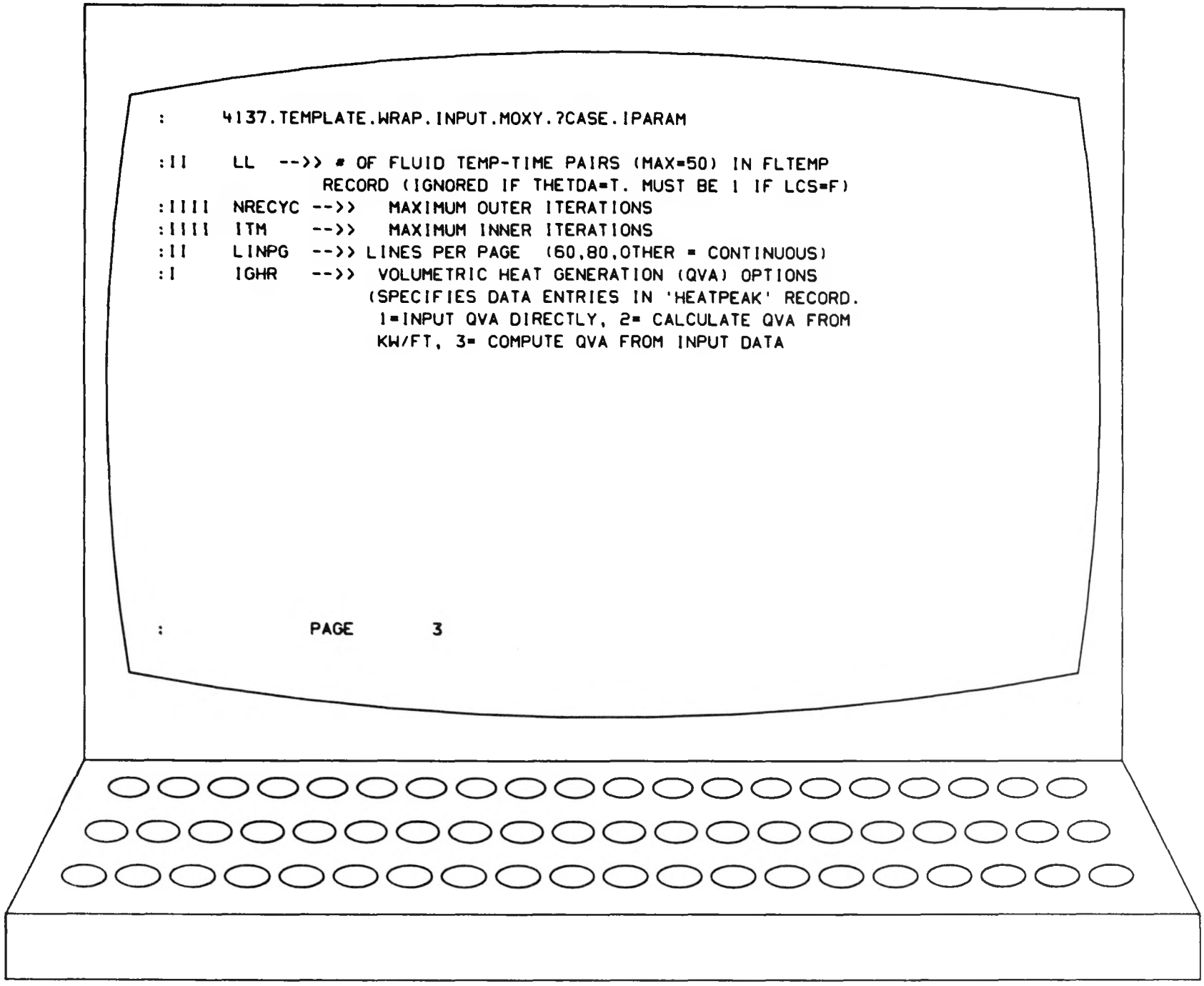

: TEMPLATE.WRAP.INPUT.MOXY.RODTYPES.?ARRAY
ROW ******* ROD TYPE LAYOUT *******
* ROD TYPE DEFINITIONS *
1 :II * ACTIVE FUEL RODS -> 1-9 *
2 :II :II * HOLLOW INACTIVE -> 10 *
3 :II :II :II * SOLID INACTIVE -> 11 *
4 :II :II :II :II *****
5 :II :II :II :II :II *
6 :II :II :II :II :II :II *
7 :II :II :II :II :II :II :II *
8 :II :II :II :II :II :II :II :II *
: LASTPAGE 3

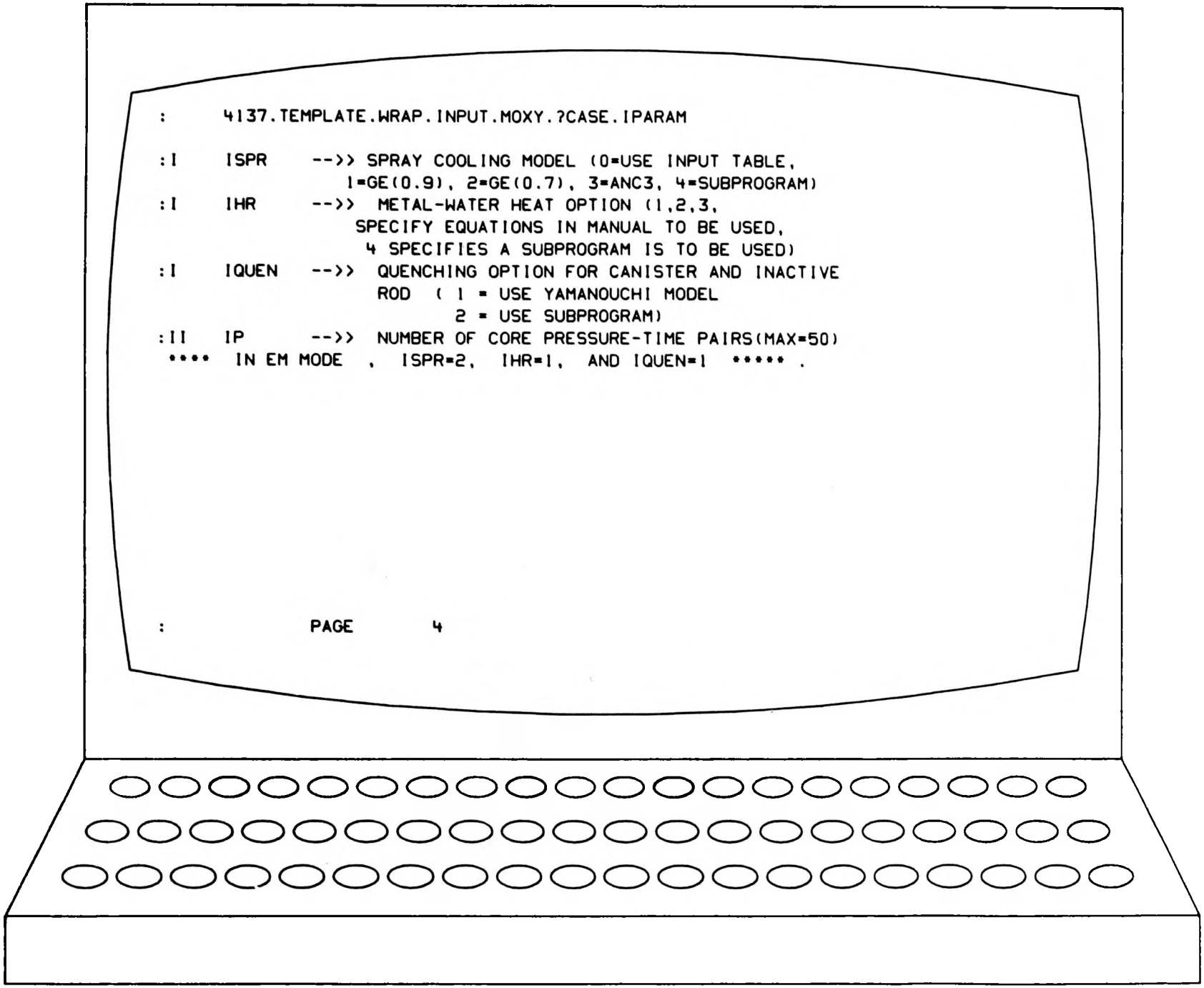

: TEMPLATE.WRAP.INPUT.MOXY.?CASE.PARAM
LOGICAL AND OTHER PARAMETERS CARDS # 010001-010010
TITLE> :AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:A ABRV -->> (T/F)=> (PRINT SURFACE MESH POINT TEMPERATURES/
PRINT ALL MESH POINT TEMPERATURES)
:A EQSWLR -->> (T/F)=> (FORCE ALL RUPTURED RODS TO HAVE THE
SAME RADIUS/ USER INPUTS VALUES FOR RADIUS)
:AAAAAAAA FUEL ELEMENT ARRAY NAME (BWR5/BWR6/IIIF/VB/BWR6A,
OTHER TO DESIGINATE 7X7,8X8 ROD ARRAY
:A SRCE -->> (T/F)=> (TIME DEPENDENT DECAY HEATING/
CONSTANT DECAY HEATING) (FOR EM MODE,SRCE=T)
: PAGE 2

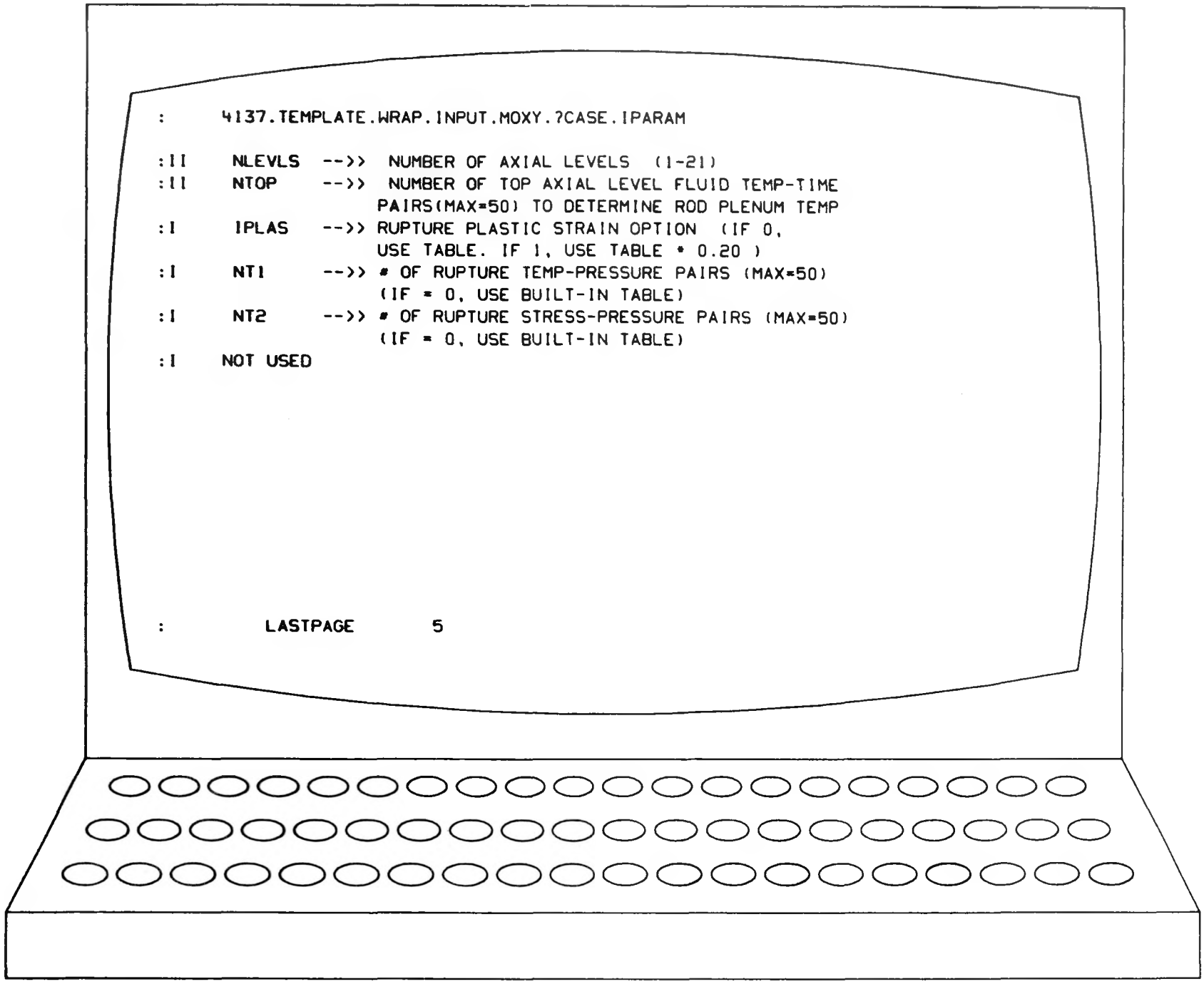

: TEMPLATE.WRAP.INPUT.MOXY.?CASE.PARAM
**** IN EM MODE, ALL FLAGS ON THIS PAGE ARE T **** .
:A LMWR -->> (T/F) (CONSIDER METAL WATER REACTION/IGNORE)
:A LCONV -->> (T/F) (CONSIDER CONVECTION/IGNORE CONVECTION)
:A LCON -->> (T/F) (INTERNALLY COMPUTE ROD INITIAL SURFACE
TEMPERATURE/ PROVIDE INPUT DATA FOR TEMP
:A LCS -->> (T/F) (TIME DEPENDENT FLUID TEMPERATURE/
CONSTANT FLUID TEMPERATURE)
:A LSTM -->> (T/F) (TIME DEPENDENT HEAT TRANSFER COEF./
CONSTANT HEAT TRANSFER COEF.)
: PAGE 3

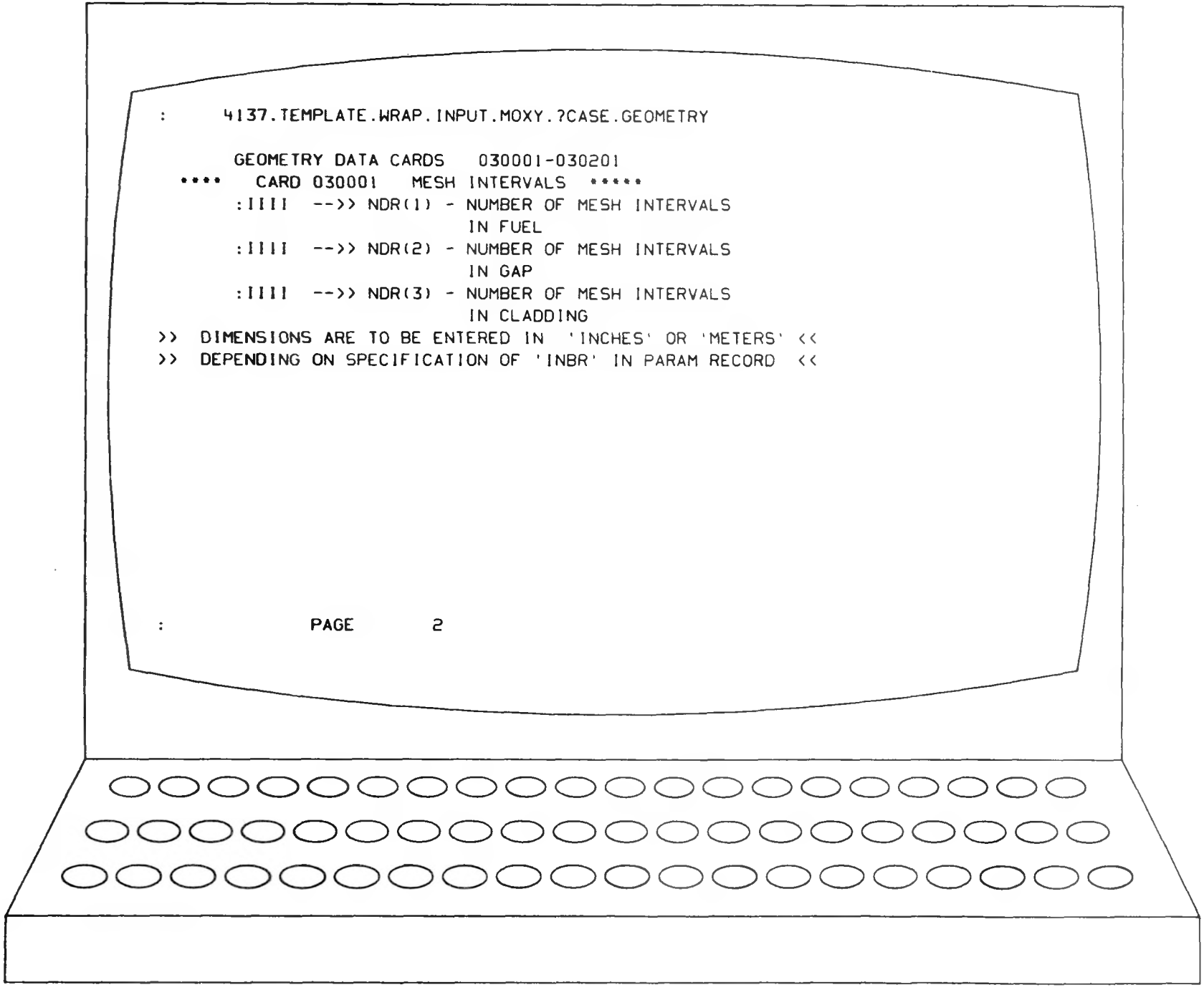

: TEMPLATE.WRAP.INPUT.MOXY.?CASE.PARAM
:A THETDA -->> (T/F) (T INDICTED DATA TRANSFER FROM RELAP)
>> THETDA NOT USED AT SRL NOW DEFINED BY WRAP INTERFACE <<
:A GAPCAL -->> (T/F) (INTERNALLY COMPUTE HEAT TRANSFER COEF./
PROVIDE AS USER INPUT DATA)
:AA INBR -->> (BR/SI -> INPUT IN BRITISH UNITS / S.I. UNITS)
:AA OUTBR -->> (BR/SI -> OUTPUT IN BRITISH UNITS / S.I. UNITS)
***** IN EM MODE , GAPCAL IS T ****
: LASTPAGE 4


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.IPARAM
INTEGER OPTION PARAMETERS - CARDS # 010101-010102
:II NTSETS -->> NUMBER OF TIME STEP SETS (MAX =10)
:II NOSETS -->> NUMBER OF PRINT INTERVAL SETS (MAX=10)
:II M -->>--->> NUMBER OF POWER-TIME PAIRS (MAX = 50)
IN NORMPOWR RECORD. (IF = 0, USED BUILT-IN DATA.
(MUST BE 1 IF SRCE = F. IGNORED IF THETDA IS T)
:II L -->>--->> NUMBER OF CONVECTION HEAT TRANSFER
COEFFICIENT-TIME PAIRS (MAX=50) IN HTCOEF RECORD.
(IGNORED IF THETDA IS T. MUST BE 1
IF LSTM IS F.)
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.IPARAM
:II LL -->> # OF FLUID TEMP-TIME PAIRS (MAX=50) IN FLTEMP
RECORD (IGNORED IF THETDA=T. MUST BE 1 IF LCS=F)
:IIII NRECYC -->> MAXIMUM OUTER ITERATIONS
:IIII ITM -->> MAXIMUM INNER ITERATIONS
:II LINPG -->> LINES PER PAGE (60,80,OTHER = CONTINUOUS)
:I IGHR -->> VOLUMETRIC HEAT GENERATION (QVA) OPTIONS
(SPECIFIES DATA ENTRIES IN 'HEATPEAK' RECORD.
1=INPUT QVA DIRECTLY, 2= CALCULATE QVA FROM
KW/FT, 3= COMPUTE QVA FROM INPUT DATA
: PAGE 3


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.IPARAM
:I ISPR -->> SPRAY COOLING MODEL (0=USE INPUT TABLE,
1=GE(0.9), 2=GE(0.7), 3=ANC3, 4=SUBPROGRAM)
:I IHR -->> METAL-WATER HEAT OPTION (1,2,3,
SPECIFY EQUATIONS IN MANUAL TO BE USED,
4 SPECIFIES A SUBPROGRAM IS TO BE USED)
:I IQUEN -->> QUENCHING OPTION FOR CANISTER AND INACTIVE
ROD (1 = USE YAMANOUCHI MODEL
2 = USE SUBPROGRAM)
:II IP -->> NUMBER OF CORE PRESSURE-TIME PAIRS(MAX=50)
**** IN EM MODE , ISPR=2, IHR=1, AND IQUEN=1 ***** .
: PAGE 4

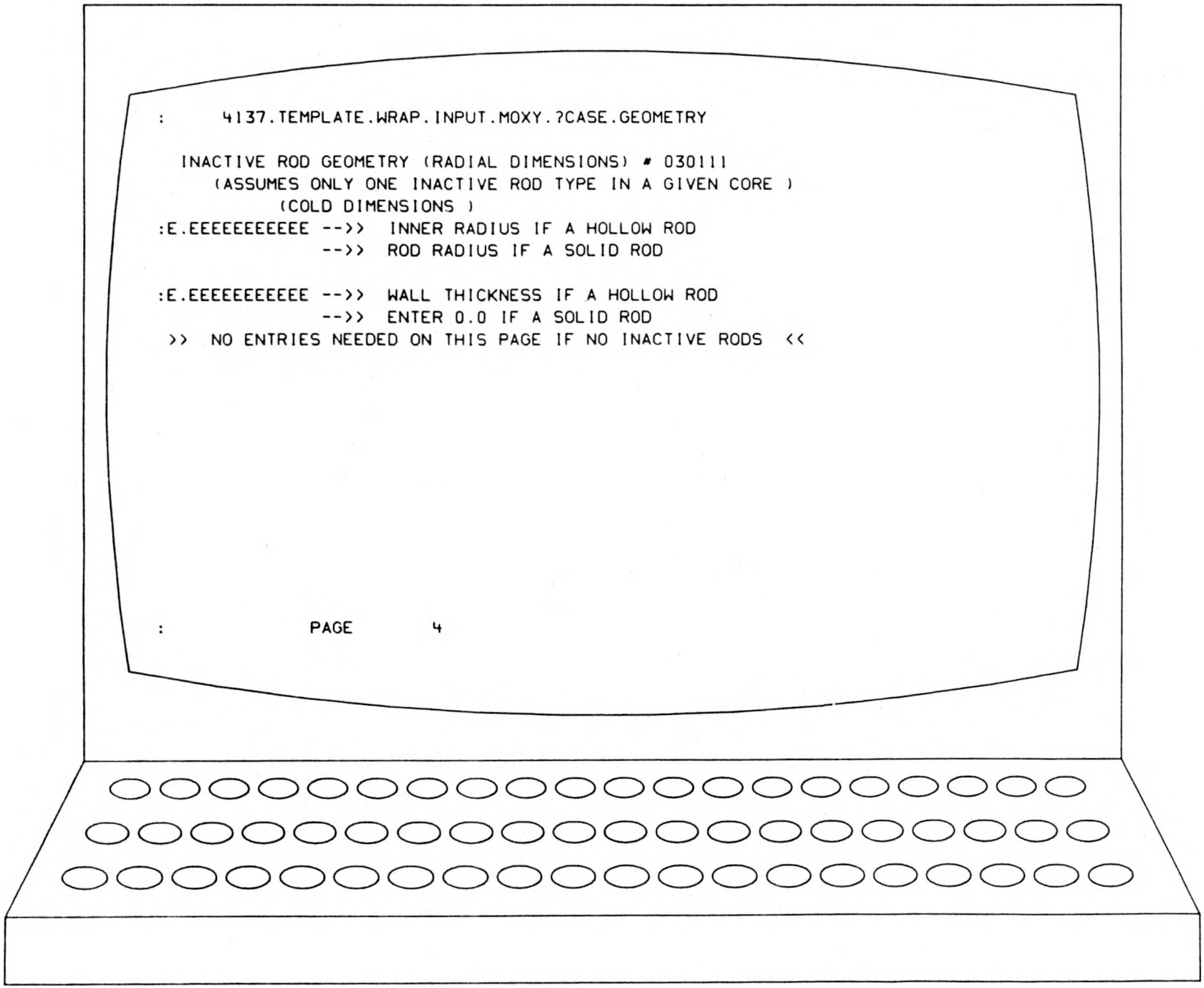

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.IPARAM
:II NLEVLS -->> NUMBER OF AXIAL LEVELS (1-21)
:II NTOP -->> NUMBER OF TOP AXIAL LEVEL FLUID TEMP-TIME
PAIRS(MAX=50) TO DETERMINE ROD PLENUM TEMP
:I IPLAS -->> RUPTURE PLASTIC STRAIN OPTION (IF 0,
USE TABLE. IF 1, USE TABLE * 0.20)
:I NT1 -->> # OF RUPTURE TEMP-PRESSURE PAIRS (MAX=50)
(IF = 0, USE BUILT-IN TABLE)
:I NT2 -->> # OF RUPTURE STRESS-PRESSURE PAIRS (MAX=50)
(IF = 0, USE BUILT-IN TABLE)
:I NOT USED
: LASTPAGE 5

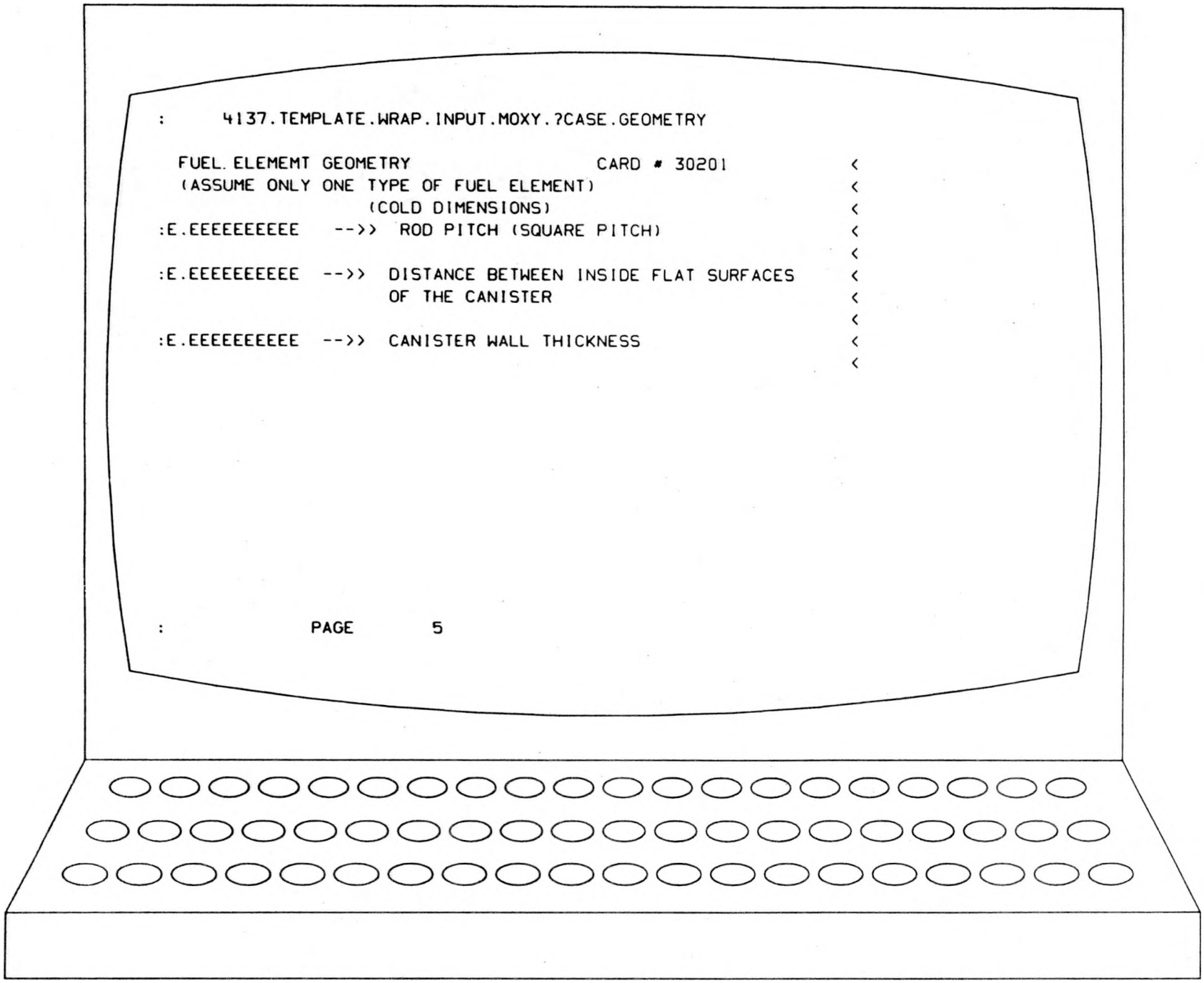

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GEOMETRY
GEOMETRY DATA CARDS 030001-030201
**** CARD 030001 MESH INTERVALS *****
:IIII -->> NDR(1) - NUMBER OF MESH INTERVALS
IN FUEL
:IIII -->> NDR(2) - NUMBER OF MESH INTERVALS
IN GAP
:IIII -->> NDR(3) - NUMBER OF MESH INTERVALS
IN CLADDING
>> DIMENSIONS ARE TO BE ENTERED IN 'INCHES' OR 'METERS' <<
>> DEPENDING ON SPECIFICATION OF 'INBR' IN PARAM RECORD <<
: PAGE 2

```
:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GEOMETRY

FUEL ROD GEOMETRY (COLD RADIAL DIMENSIONS ) # 30101-30109
:II  NUMBER OF ROD TYPES (MUST AGREE WITH 'RODTYPES' RECORD)    :
TYPE   PELLET RADIUS    GAP THICKNESS     CLAD THICKNESS
====   ==============   ==============    ==============
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE
:22    :E.EEEEEEEEEEE   :E.EEEEEEEEEEE    :E.EEEEEEEEEEE

:              PAGE        3
```


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GEOMETRY
INACTIVE ROD GEOMETRY (RADIAL DIMENSIONS) # 030111
(ASSUMES ONLY ONE INACTIVE ROD TYPE IN A GIVEN CORE)
(COLD DIMENSIONS)
:E.EEEEEEEEEEE -->> INNER RADIUS IF A HOLLOW ROD
-->> ROD RADIUS IF A SOLID ROD
:E.EEEEEEEEEEE -->> WALL THICKNESS IF A HOLLOW ROD
-->> ENTER 0.0 IF A SOLID ROD
>> NO ENTRIES NEEDED ON THIS PAGE IF NO INACTIVE RODS <<
: PAGE 4


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GEOMETRY
FUEL. ELEMEMT GEOMETRY CARD # 30201
(ASSUME ONLY ONE TYPE OF FUEL ELEMENT)
(COLD DIMENSIONS)
:E.EEEEEEEEEE --›› ROD PITCH (SQUARE PITCH)
:E.EEEEEEEEEE --›› DISTANCE BETWEEN INSIDE FLAT SURFACES
OF THE CANISTER
:E.EEEEEEEEEE --›› CANISTER WALL THICKNESS
: PAGE 5

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:     4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GEOMETRY

  RUPTURED ROD RADII    CARDS  030301-030309
:II # OF RODS (1,28,36)<IF 1  ALL RODS ARE SAME > (:I NOT USED)
(IF ROD # = 1 AND RADIUS = 0, CODE DEFAULTS TO 1/2 * PITCH )
ROD      RADIUS        ROD   RADIUS        ROD  RADIUS
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE
:22   :E.EEEEEEEEE     :22 :E.EEEEEEEEE    :22 :E.EEEEEEEEE

:          LASTPAGE        6
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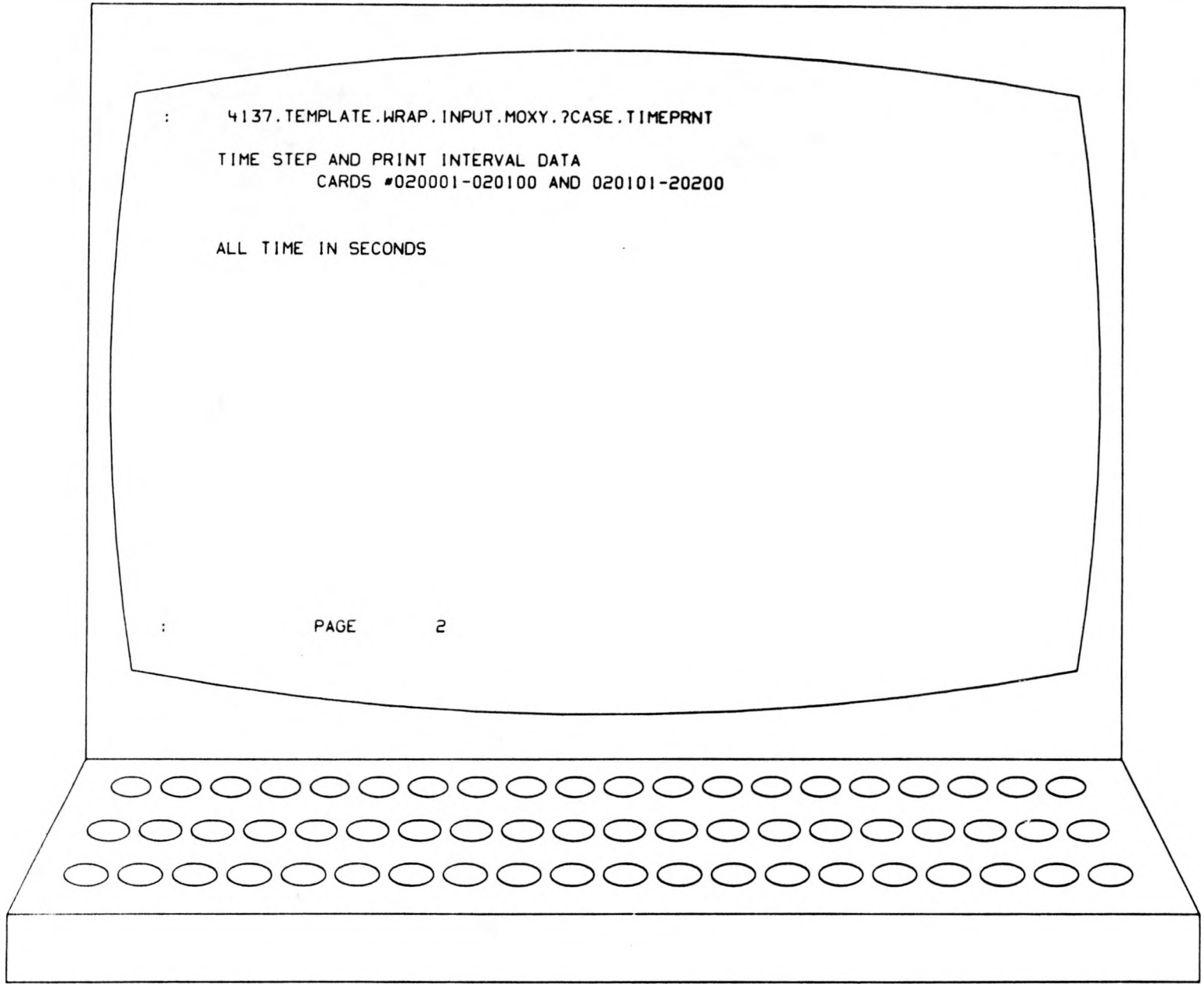
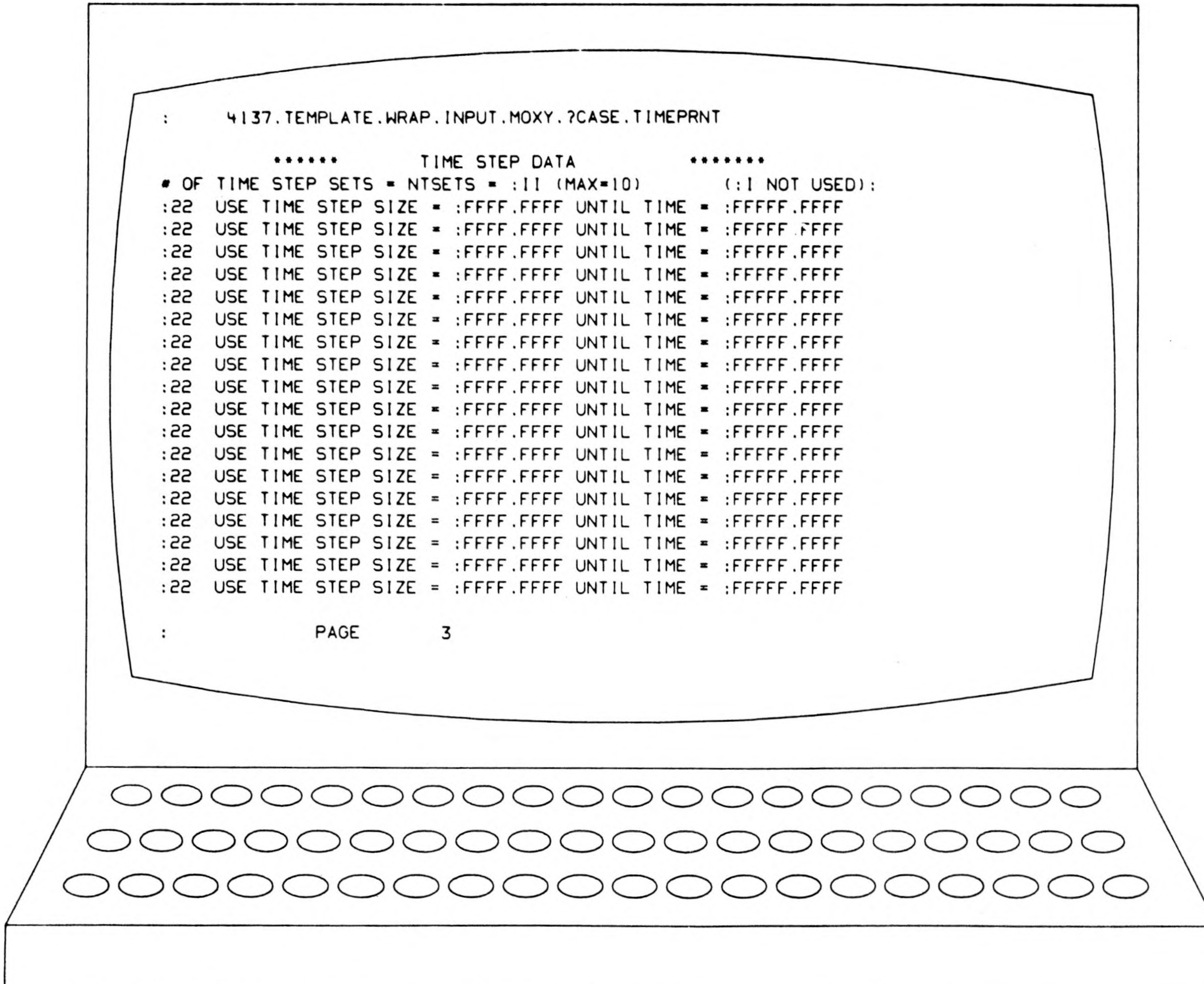

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.TIMEPRNT
TIME STEP AND PRINT INTERVAL DATA
CARDS #020001-020100 AND 020101-20200
ALL TIME IN SECONDS
: PAGE 2



```
:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.TIMEPRNT

          ******        TIME STEP DATA          *******
# OF TIME STEP SETS = NTSETS = :II (MAX=10)        (:I NOT USED):
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF
:22  USE TIME STEP SIZE = :FFFF.FFFF UNTIL TIME = :FFFFF.FFFF

:             PAGE       3
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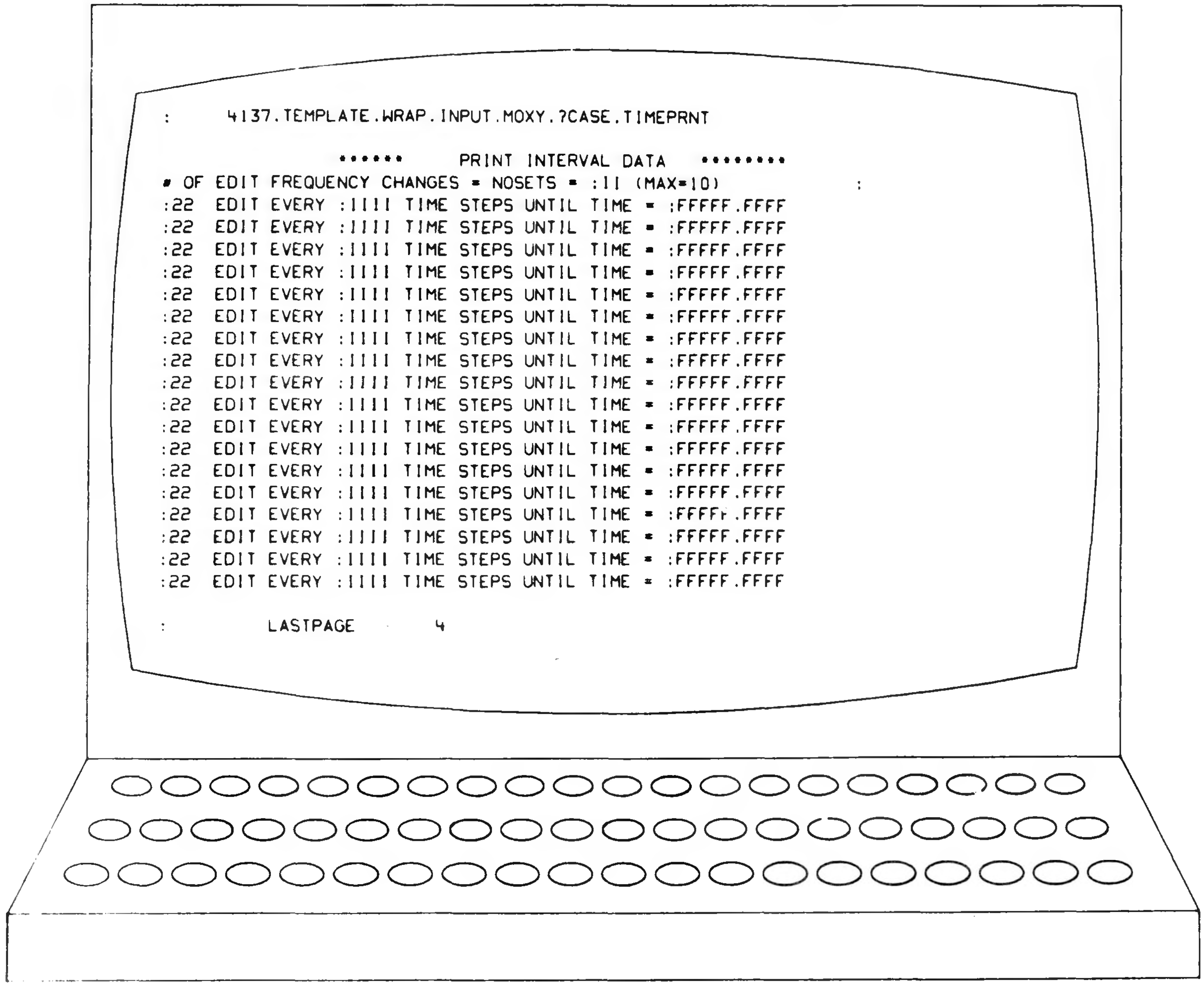

```
:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.TIMEPRNT

                 ******     PRINT INTERVAL DATA    ********
# OF EDIT FREQUENCY CHANGES = NOSETS = :II (MAX=10)          :
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF
:22  EDIT EVERY :IIII TIME STEPS UNTIL TIME = :FFFFF.FFFF

:         LASTPAGE        4
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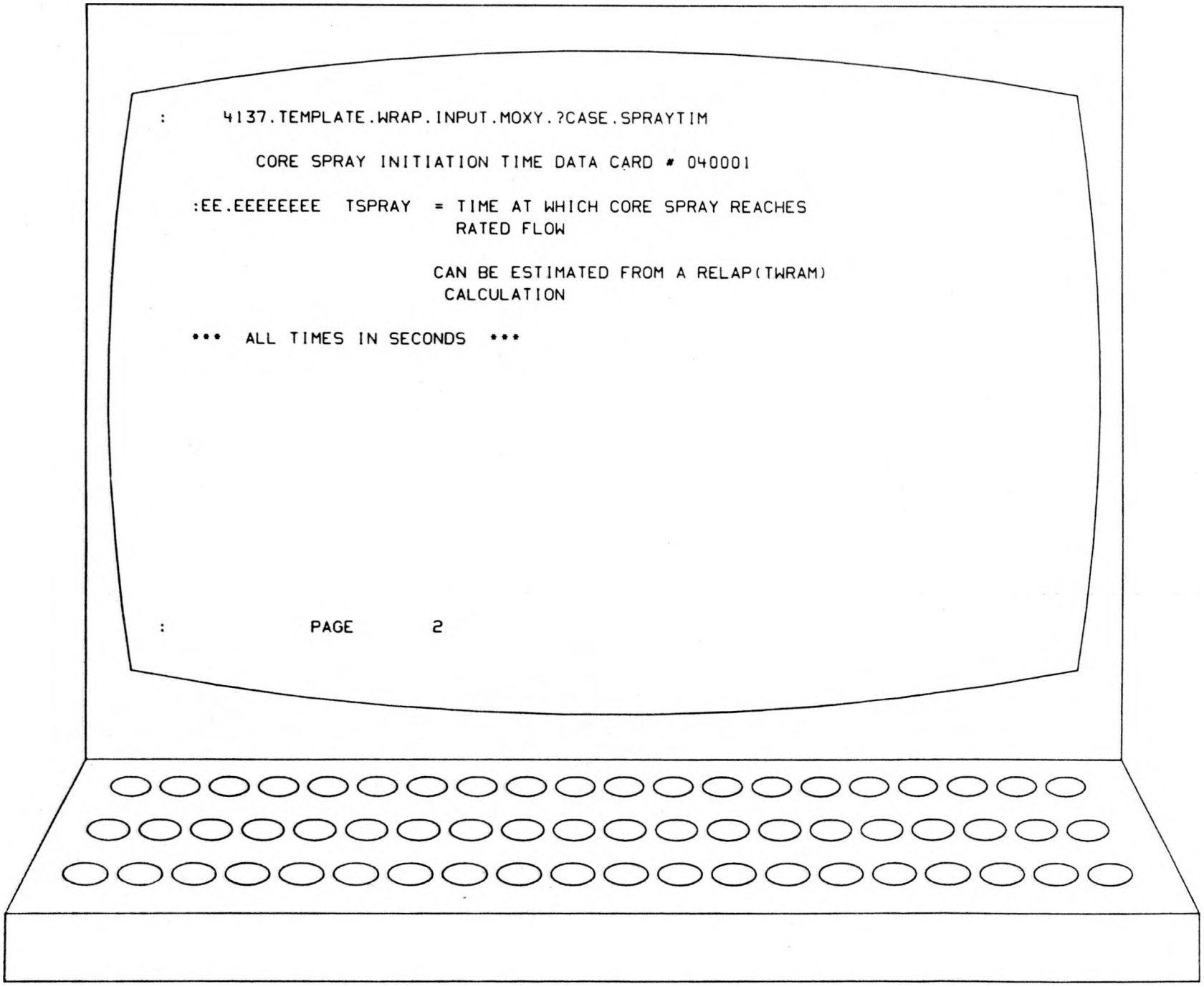
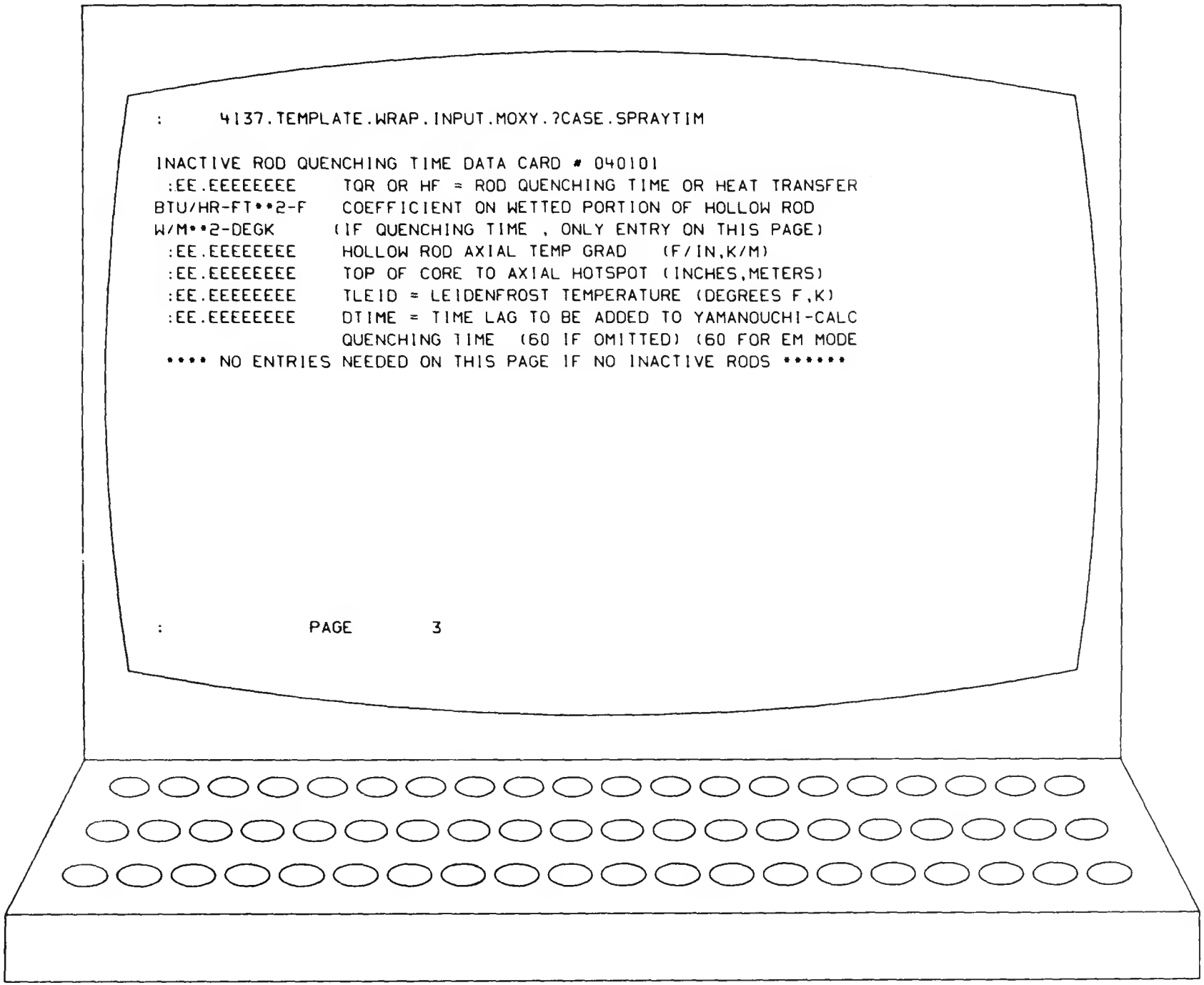
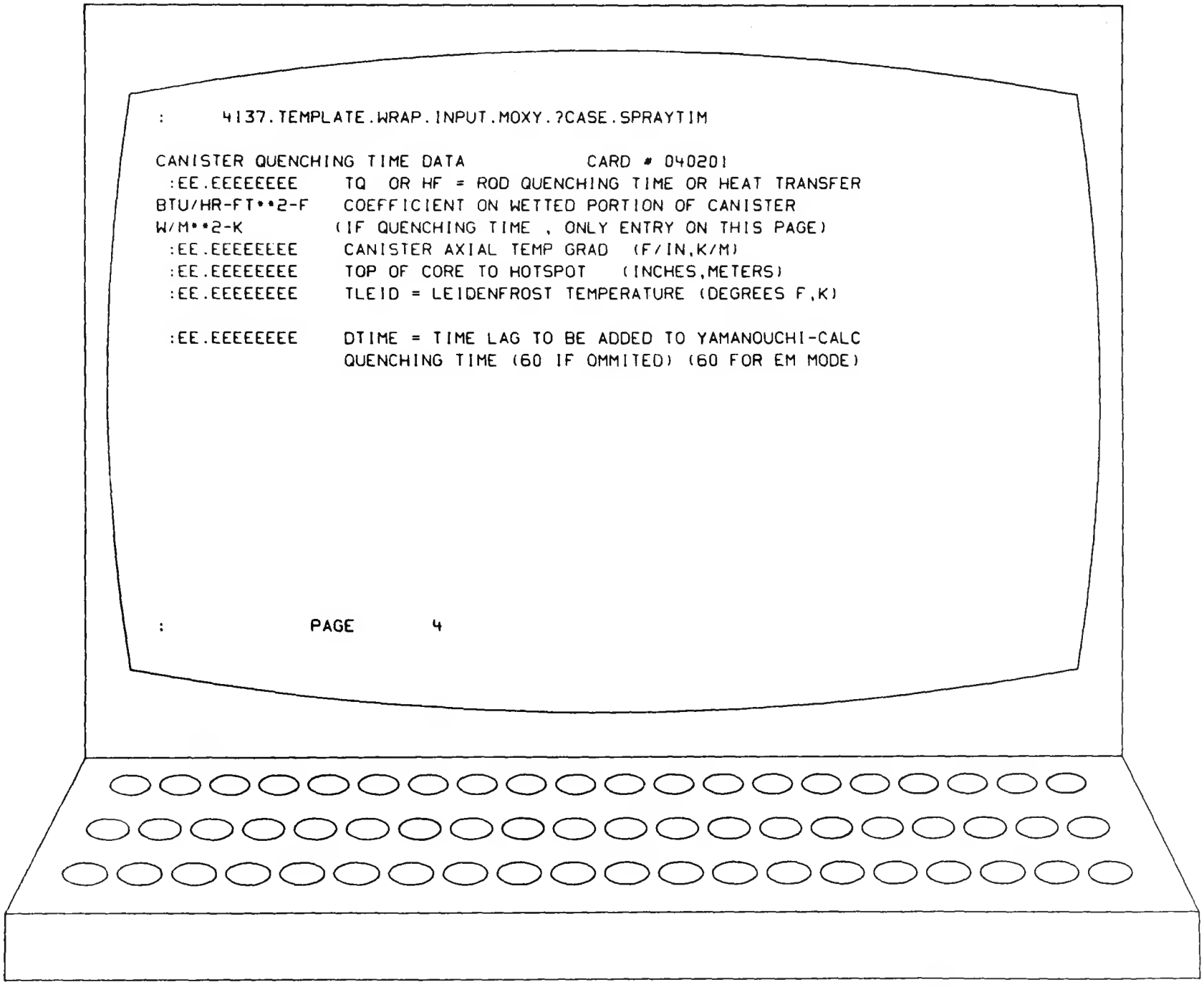
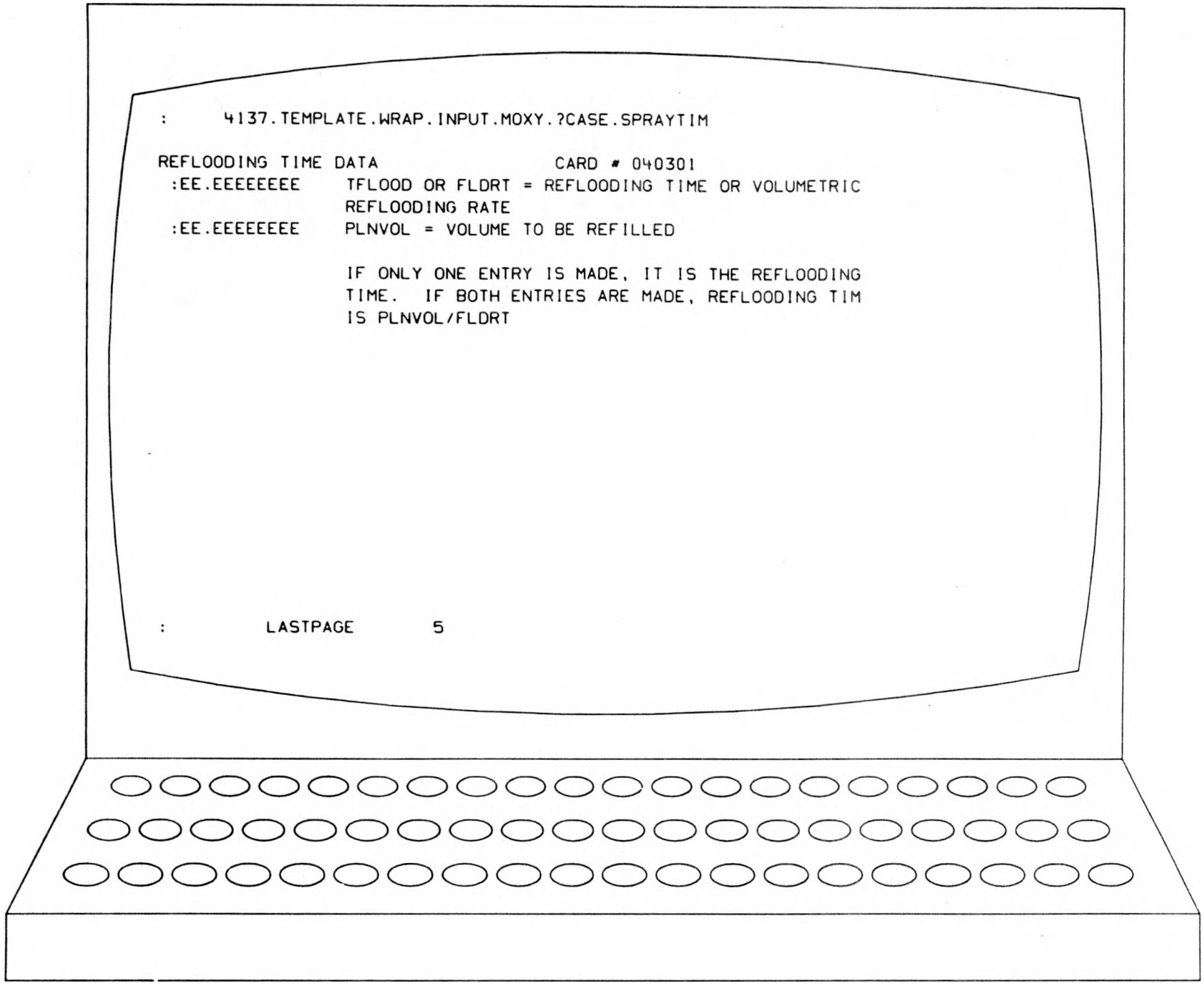
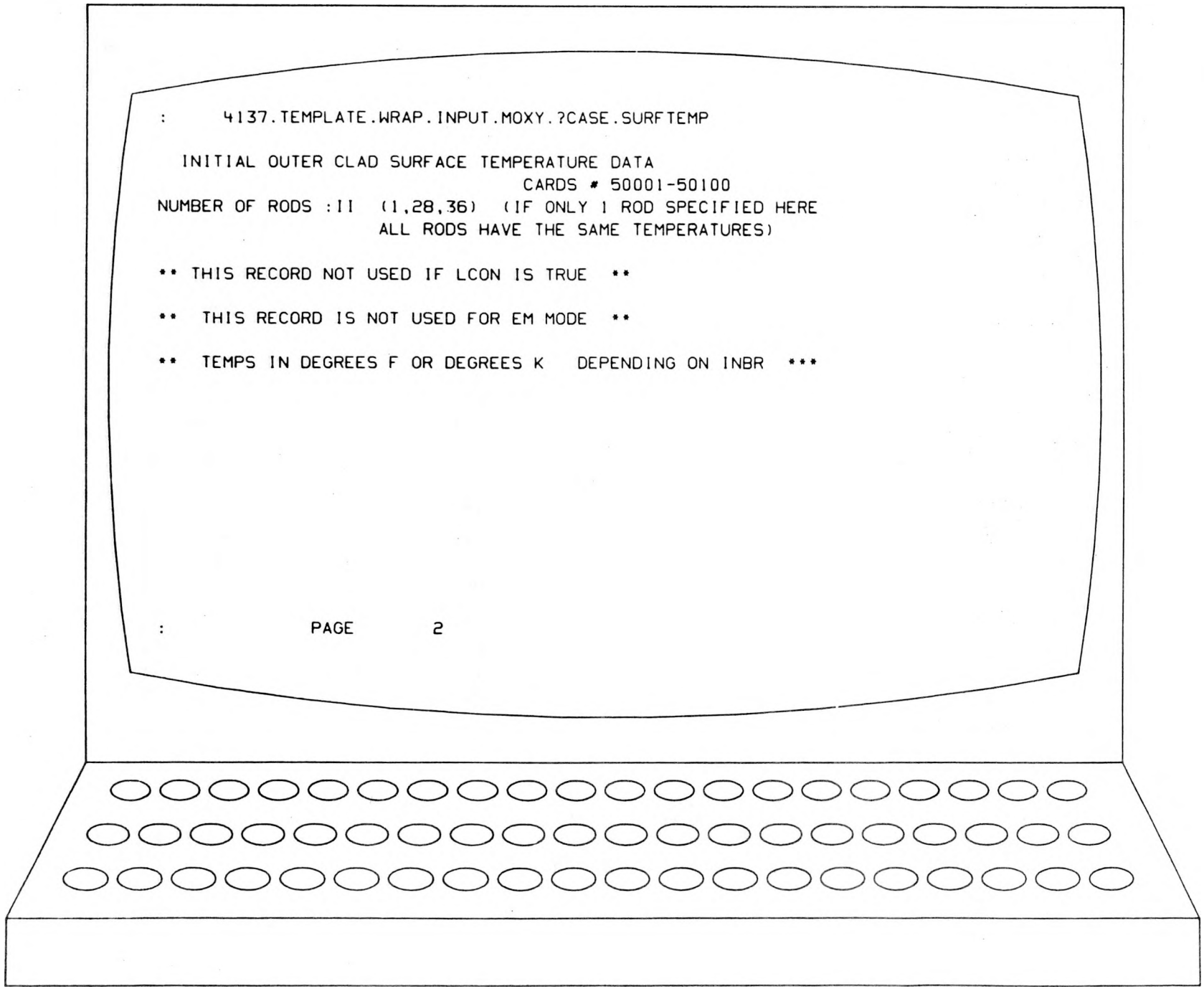
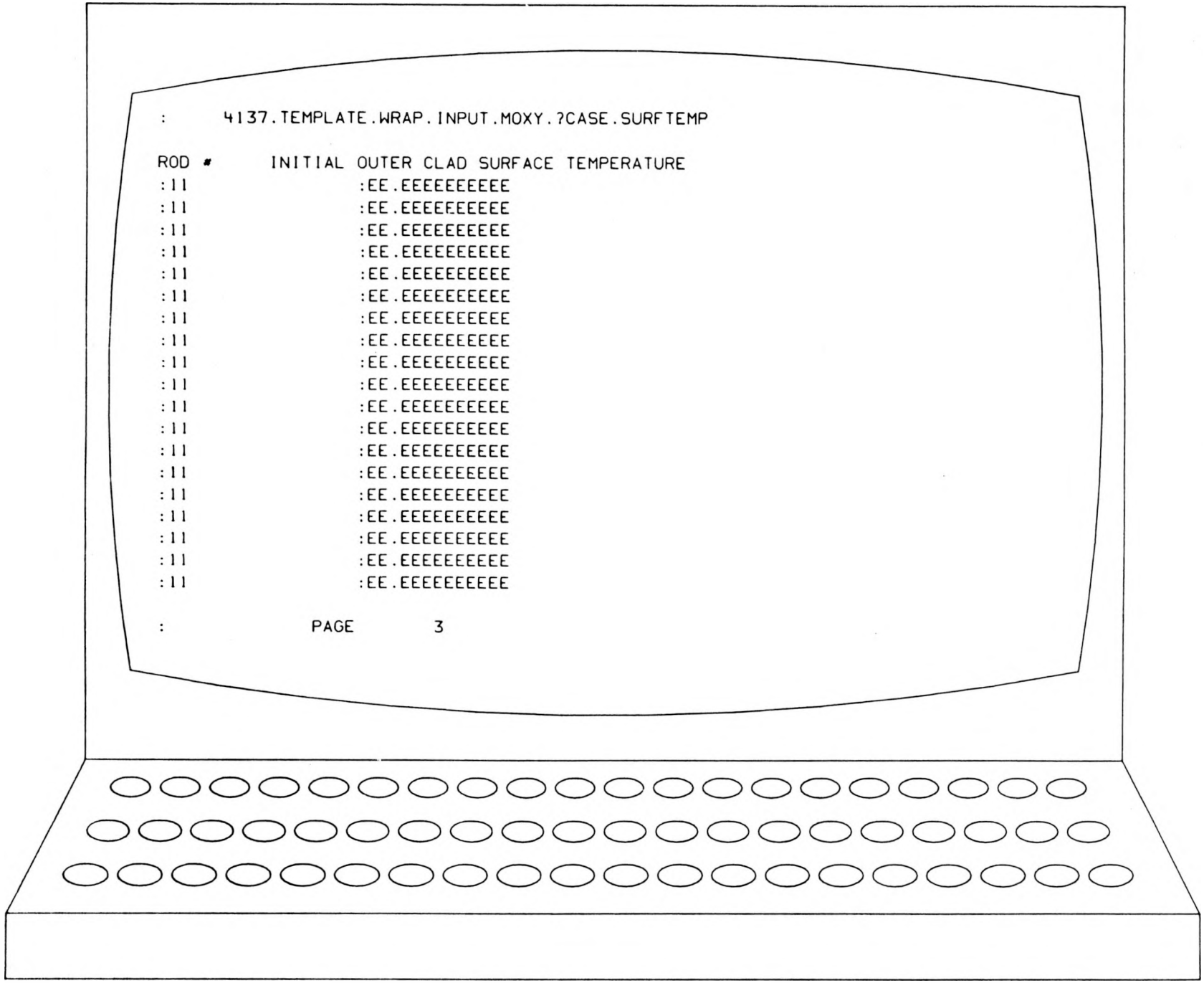

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SPRAYTIM
CORE SPRAY INITIATION TIME DATA CARD # 040001
:EE.EEEEEEEE TSPRAY = TIME AT WHICH CORE SPRAY REACHES
RATED FLOW
CAN BE ESTIMATED FROM A RELAP(TWRAM)
CALCULATION
*** ALL TIMES IN SECONDS ***
: PAGE 2

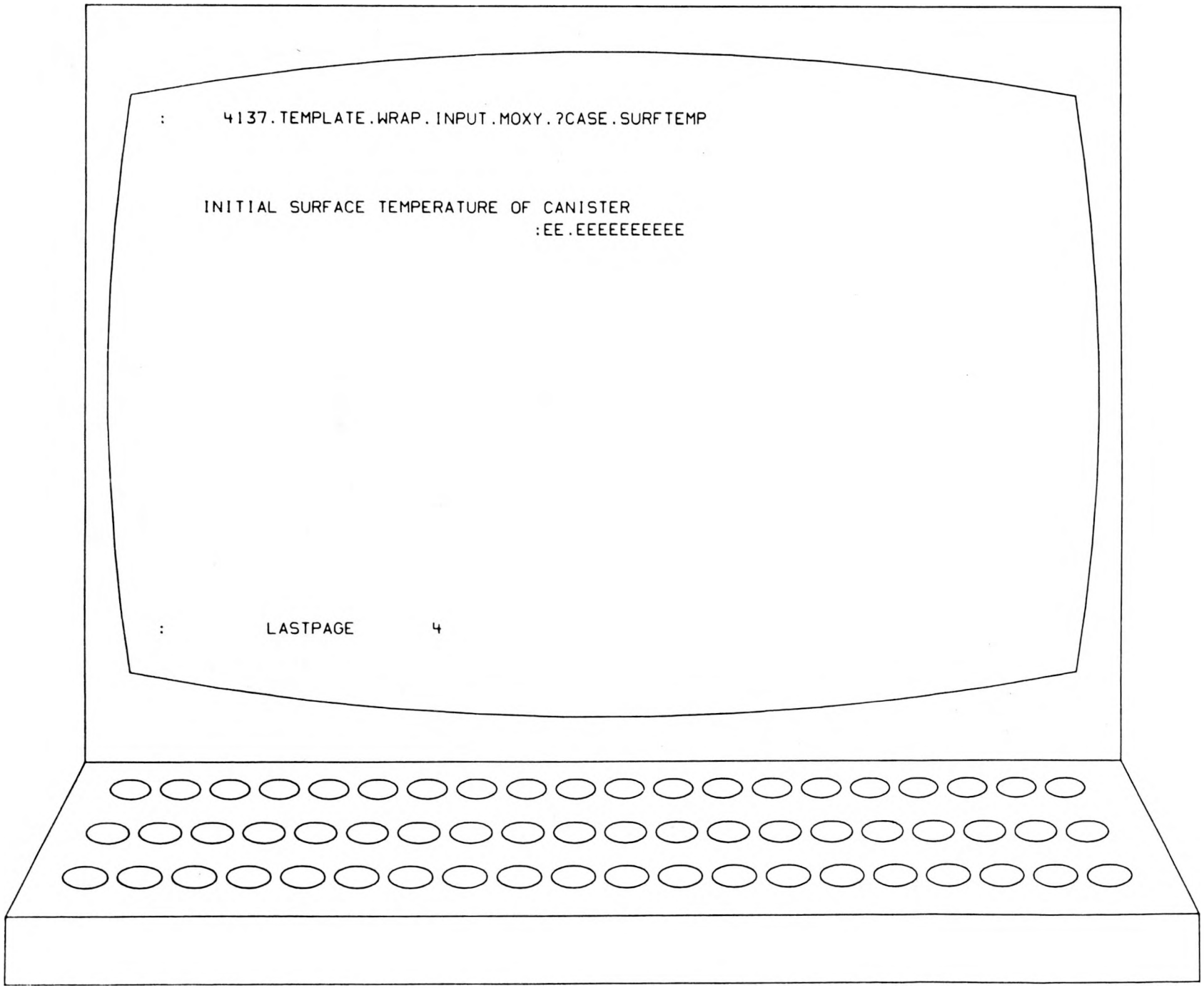

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SPRAYTIM
INACTIVE ROD QUENCHING TIME DATA CARD # 040101
:EE.EEEEEEEE TQR OR HF = ROD QUENCHING TIME OR HEAT TRANSFER
BTU/HR-FT**2-F COEFFICIENT ON WETTED PORTION OF HOLLOW ROD
W/M**2-DEGK (IF QUENCHING TIME , ONLY ENTRY ON THIS PAGE)
:EE.EEEEEEEE HOLLOW ROD AXIAL TEMP GRAD (F/IN,K/M)
:EE.EEEEEEEE TOP OF CORE TO AXIAL HOTSPOT (INCHES,METERS)
:EE.EEEEEEEE TLEID = LEIDENFROST TEMPERATURE (DEGREES F,K)
:EE.EEEEEEEE DTIME = TIME LAG TO BE ADDED TO YAMANOUCHI-CALC
QUENCHING TIME (60 IF OMITTED) (60 FOR EM MODE
**** NO ENTRIES NEEDED ON THIS PAGE IF NO INACTIVE RODS ******
: PAGE 3

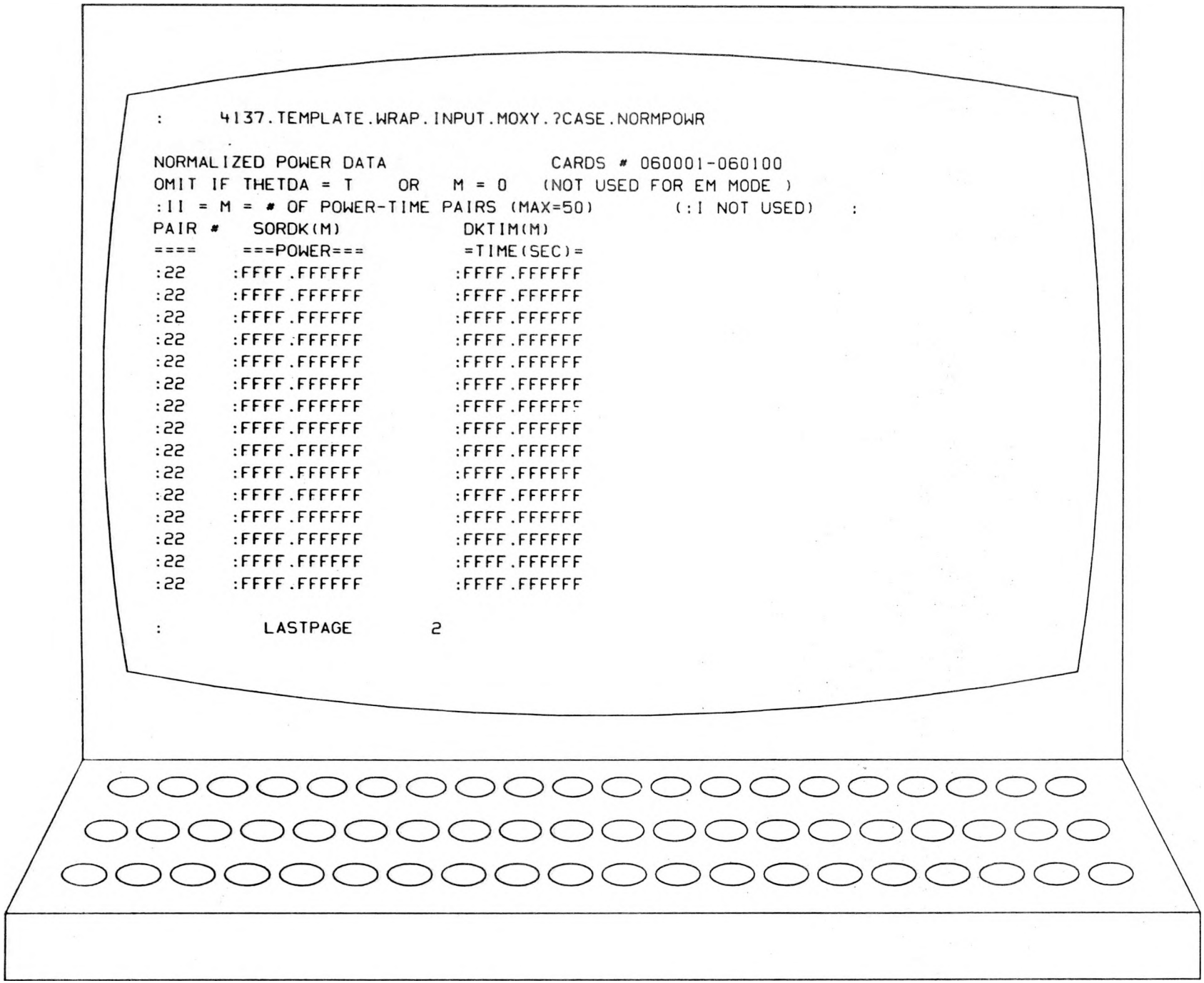

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SPRAYTIM
CANISTER QUENCHING TIME DATA CARD # 040201
:EE.EEEEEEEE TQ OR HF = ROD QUENCHING TIME OR HEAT TRANSFER
BTU/HR-FT**2-F COEFFICIENT ON WETTED PORTION OF CANISTER
W/M**2-K (IF QUENCHING TIME , ONLY ENTRY ON THIS PAGE)
:EE.EEEEEEEE CANISTER AXIAL TEMP GRAD (F/IN,K/M)
:EE.EEEEEEEE TOP OF CORE TO HOTSPOT (INCHES,METERS)
:EE.EEEEEEEE TLEID = LEIDENFROST TEMPERATURE (DEGREES F,K)
:EE.EEEEEEEE DTIME = TIME LAG TO BE ADDED TO YAMANOUCHI-CALC
QUENCHING TIME (60 IF OMMITED) (60 FOR EM MODE)
: PAGE 4

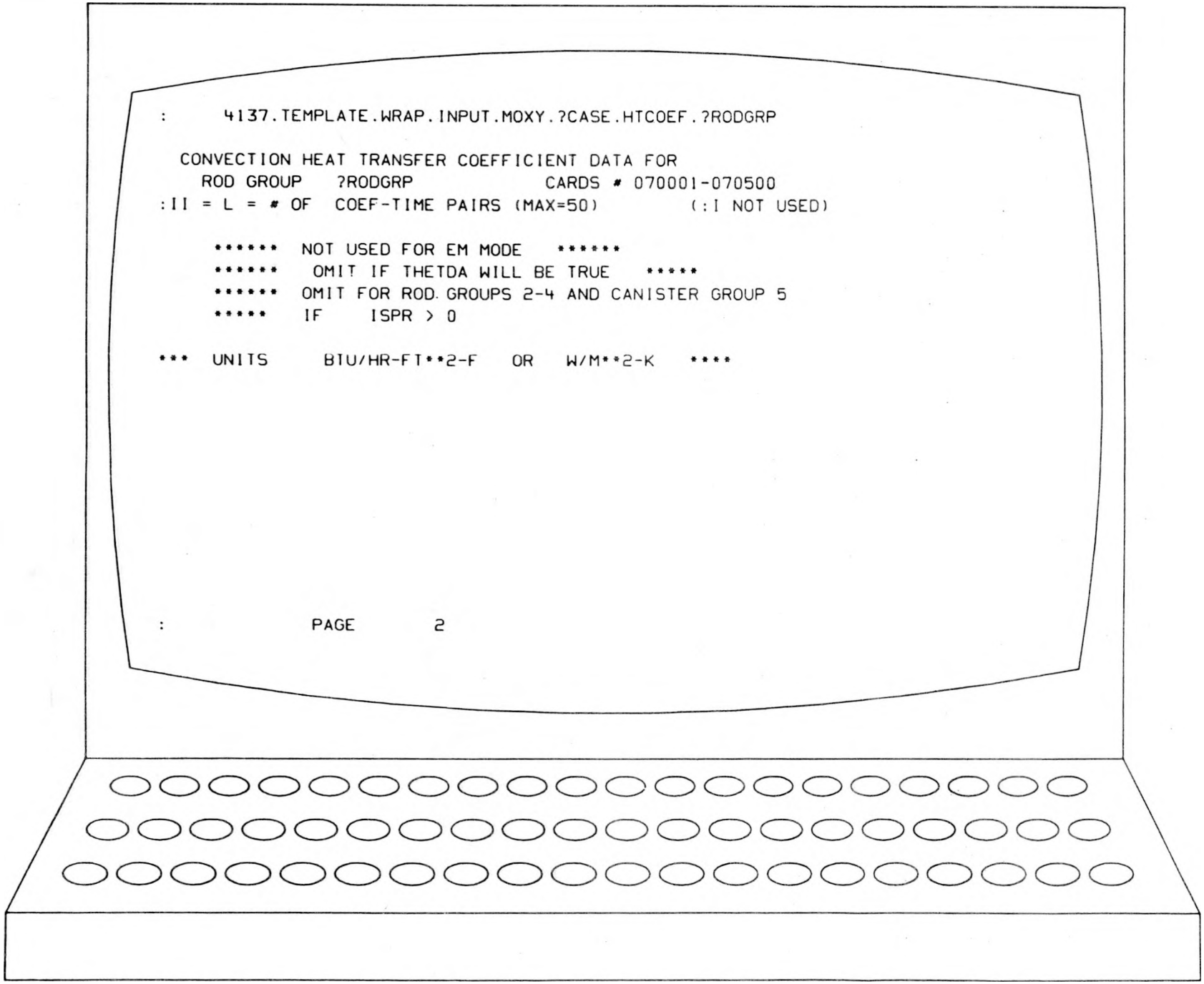

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SPRAYTIM
REFLOODING TIME DATA CARD # 040301
:EE.EEEEEEEE TFLOOD OR FLDRT = REFLOODING TIME OR VOLUMETRIC REFLOODING RATE
:EE.EEEEEEEE PLNVOL = VOLUME TO BE REFILLED
IF ONLY ONE ENTRY IS MADE, IT IS THE REFLOODING TIME. IF BOTH ENTRIES ARE MADE, REFLOODING TIM IS PLNVOL/FLDRT
: LASTPAGE 5

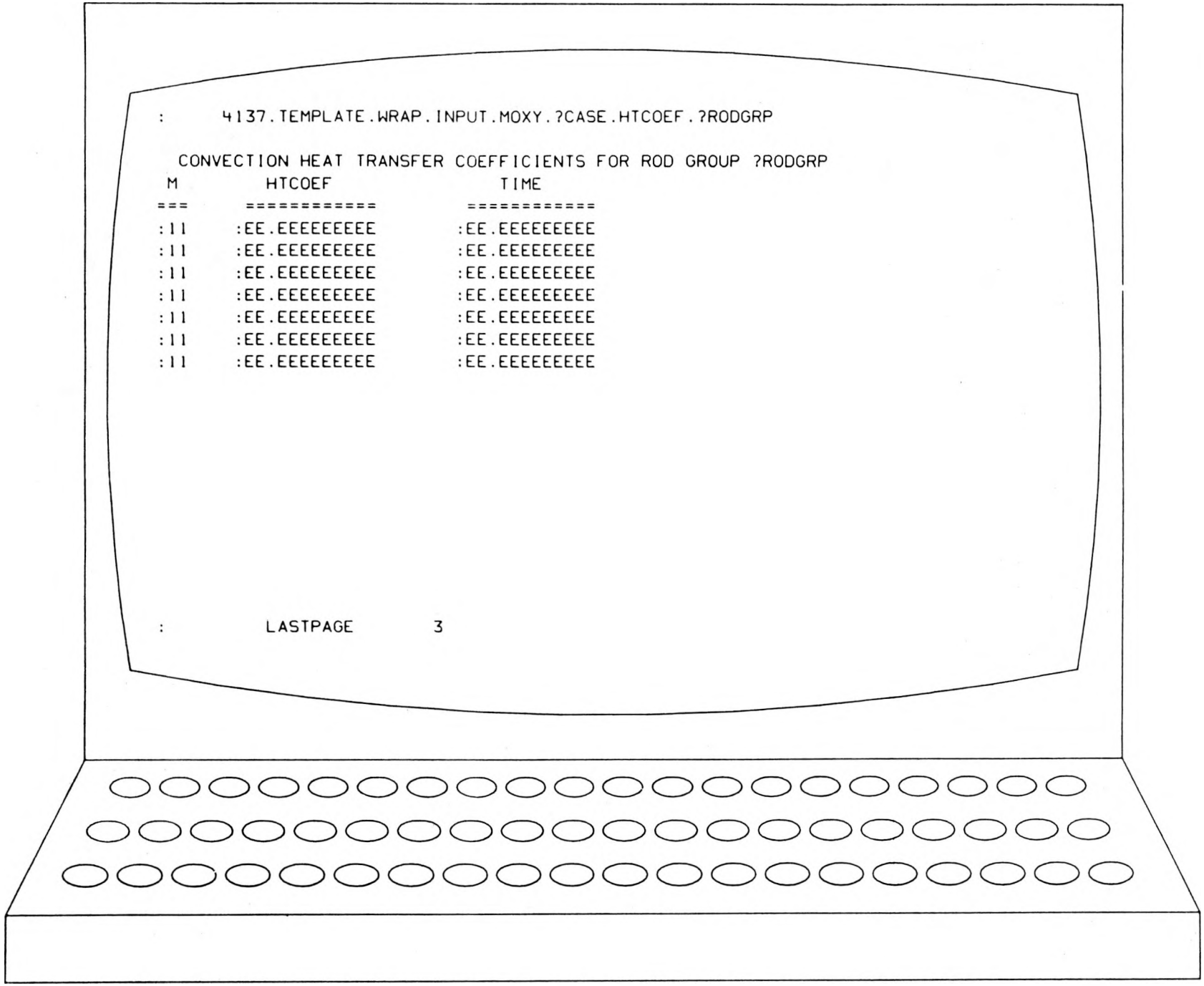

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SURFTEMP
INITIAL OUTER CLAD SURFACE TEMPERATURE DATA
CARDS # 50001-50100
NUMBER OF RODS :I1 (1,28,36) (IF ONLY 1 ROD SPECIFIED HERE
ALL RODS HAVE THE SAME TEMPERATURES)
** THIS RECORD NOT USED IF LCON IS TRUE **
** THIS RECORD IS NOT USED FOR EM MODE **
** TEMPS IN DEGREES F OR DEGREES K DEPENDING ON INBR ***
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SURFTEMP
ROD # INITIAL OUTER CLAD SURFACE TEMPERATURE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
:II :EE.EEEEEEEEE
: PAGE 3


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SURFTEMP
INITIAL SURFACE TEMPERATURE OF CANISTER
:EE.EEEEEEEEEE
: LASTPAGE 4


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.NORMPOWR
NORMALIZED POWER DATA CARDS # 060001-060100
OMIT IF THETDA = T OR M = 0 (NOT USED FOR EM MODE)
:II = M = # OF POWER-TIME PAIRS (MAX=50) (:I NOT USED) :
PAIR # SORDK(M) DKTIM(M)
==== ===POWER=== =TIME(SEC)=
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
:22 :FFFF.FFFFFF :FFFF.FFFFFF
: LASTPAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.HTCOEF.?RODGRP
CONVECTION HEAT TRANSFER COEFFICIENT DATA FOR
ROD GROUP ?RODGRP CARDS # 070001-070500
:II = L = # OF COEF-TIME PAIRS (MAX=50) (:I NOT USED)
****** NOT USED FOR EM MODE ******
****** OMIT IF THETDA WILL BE TRUE *****
****** OMIT FOR ROD GROUPS 2-4 AND CANISTER GROUP 5
***** IF ISPR > 0
*** UNITS BTU/HR-FT**2-F OR W/M**2-K ****
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.HTCOEF.?RODGRP
CONVECTION HEAT TRANSFER COEFFICIENTS FOR ROD GROUP ?RODGRP
M HTCOEF TIME
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
:II :EE.EEEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 3

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:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.FLTEMP

FLUID TEMPERATURES AT HOT AXIAL LEVEL -- CARDS # 080001-080100
** OMIT IF THETDA = T  **     ***  OMIT FOR EM MODE  ***
:II = LL = # OF FLUID TEMP-TIME PAIRS (MAX=50)   (:I NOT USED) :
PAIR #   TSINK(I)              TME(M)           DEGREES F OR K
====    =FLUID TEMP=         ===TIME====
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE
:22     :EE.EEEEEEEEE        :EE.EEEEEEEEE

:          LASTPAGE        2
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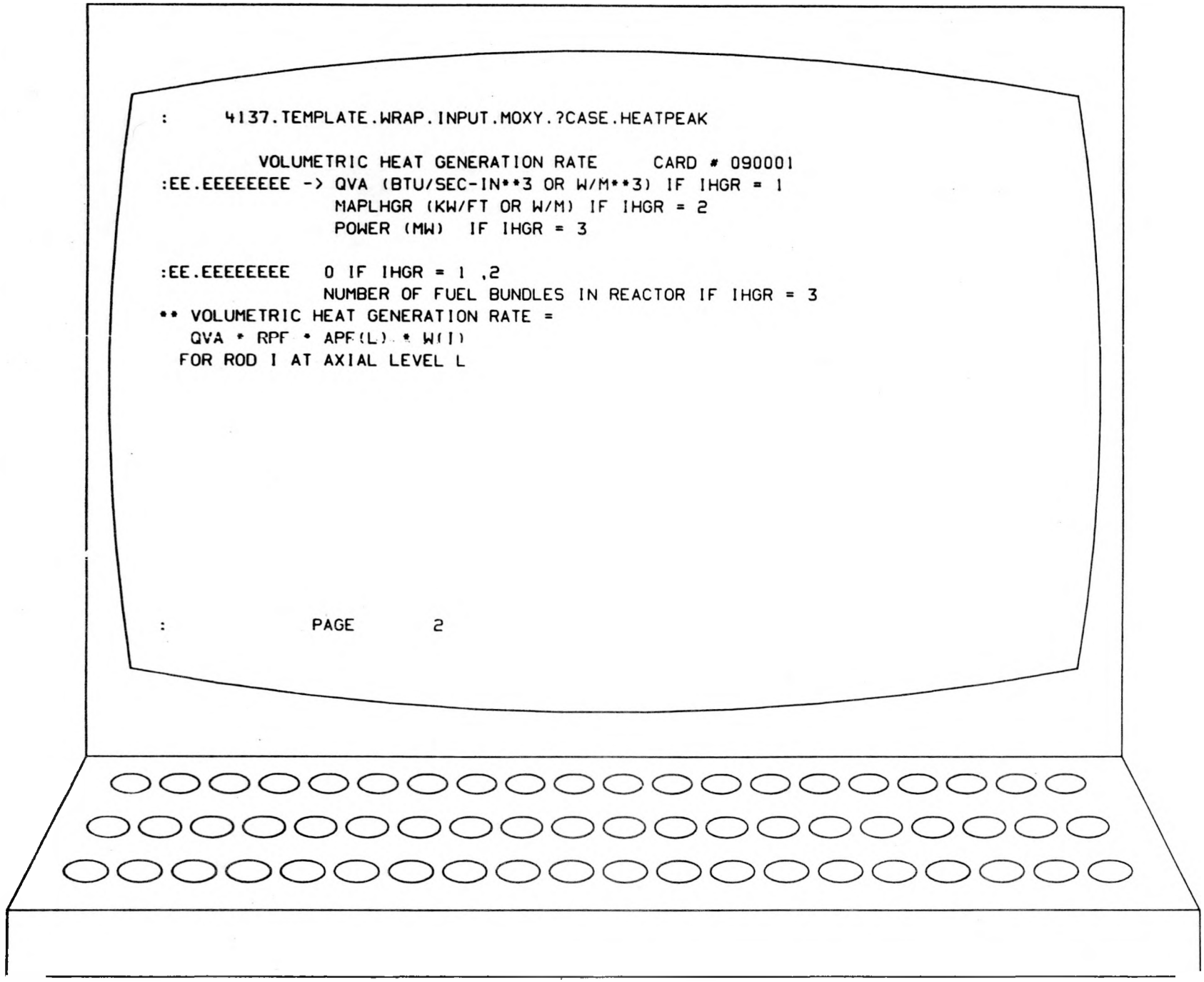
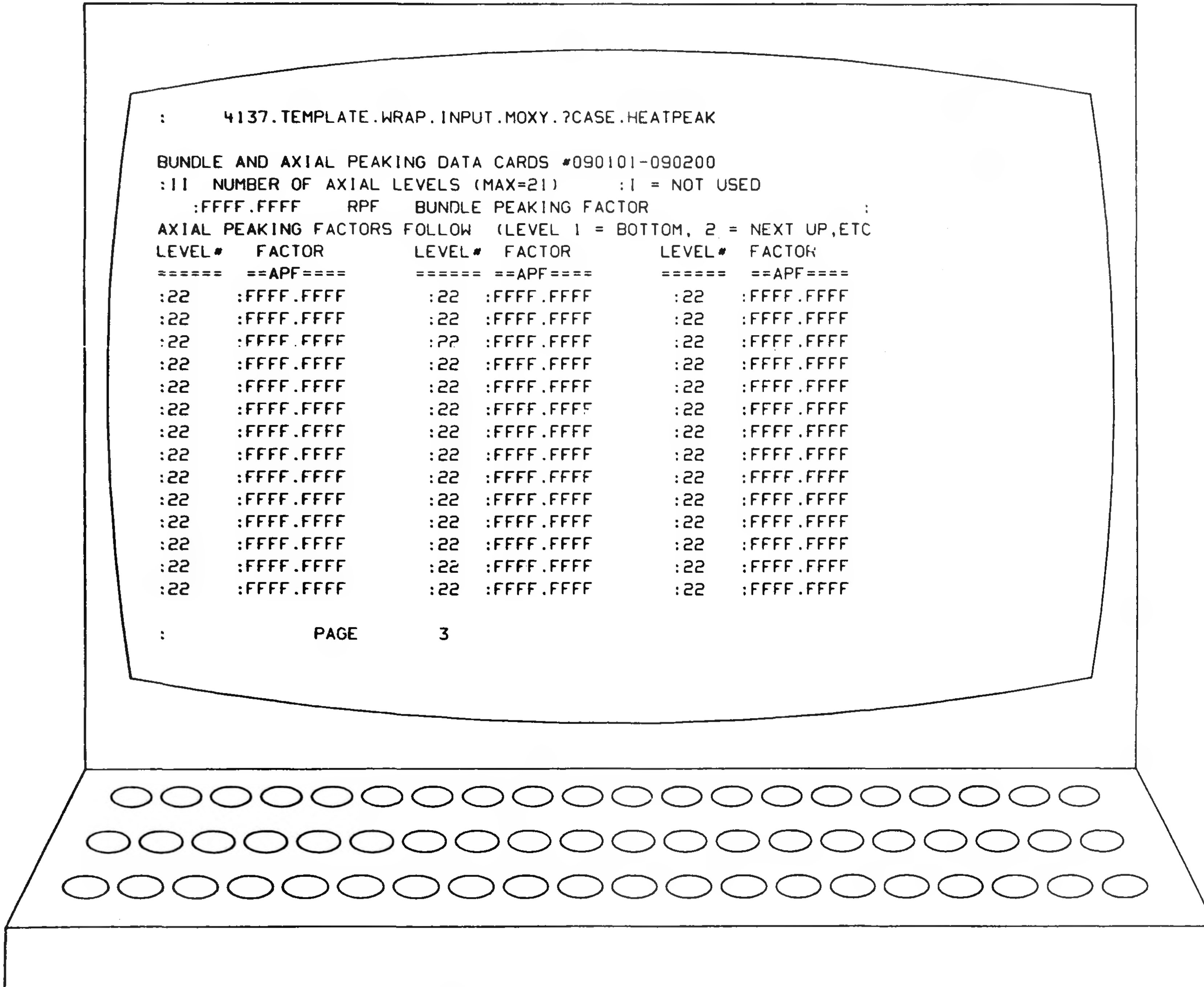

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.HEATPEAK
VOLUMETRIC HEAT GENERATION RATE CARD # 090001
:EE.EEEEEEEE -> QVA (BTU/SEC-IN**3 OR W/M**3) IF IHGR = 1
MAPLHGR (KW/FT OR W/M) IF IHGR = 2
POWER (MW) IF IHGR = 3
:EE.EEEEEEEE 0 IF IHGR = 1 ,2
NUMBER OF FUEL BUNDLES IN REACTOR IF IHGR = 3
** VOLUMETRIC HEAT GENERATION RATE =
QVA * RPF * APF(L) * W(I)
FOR ROD I AT AXIAL LEVEL L
: PAGE 2



```
:     4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.HEATPEAK

BUNDLE AND AXIAL PEAKING DATA CARDS #090101-090200
:11  NUMBER OF AXIAL LEVELS (MAX=21)      :1 = NOT USED
    :FFFF.FFFF    RPF   BUNDLE PEAKING FACTOR                    :
AXIAL PEAKING FACTORS FOLLOW  (LEVEL 1 = BOTTOM, 2 = NEXT UP,ETC
LEVEL#   FACTOR          LEVEL#  FACTOR         LEVEL#  FACTOR
======  ==APF====        ====== ==APF====       ======  ==APF====
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF
:22    :FFFF.FFFF         :22   :FFFF.FFFF       :22    :FFFF.FFFF

:               PAGE        3
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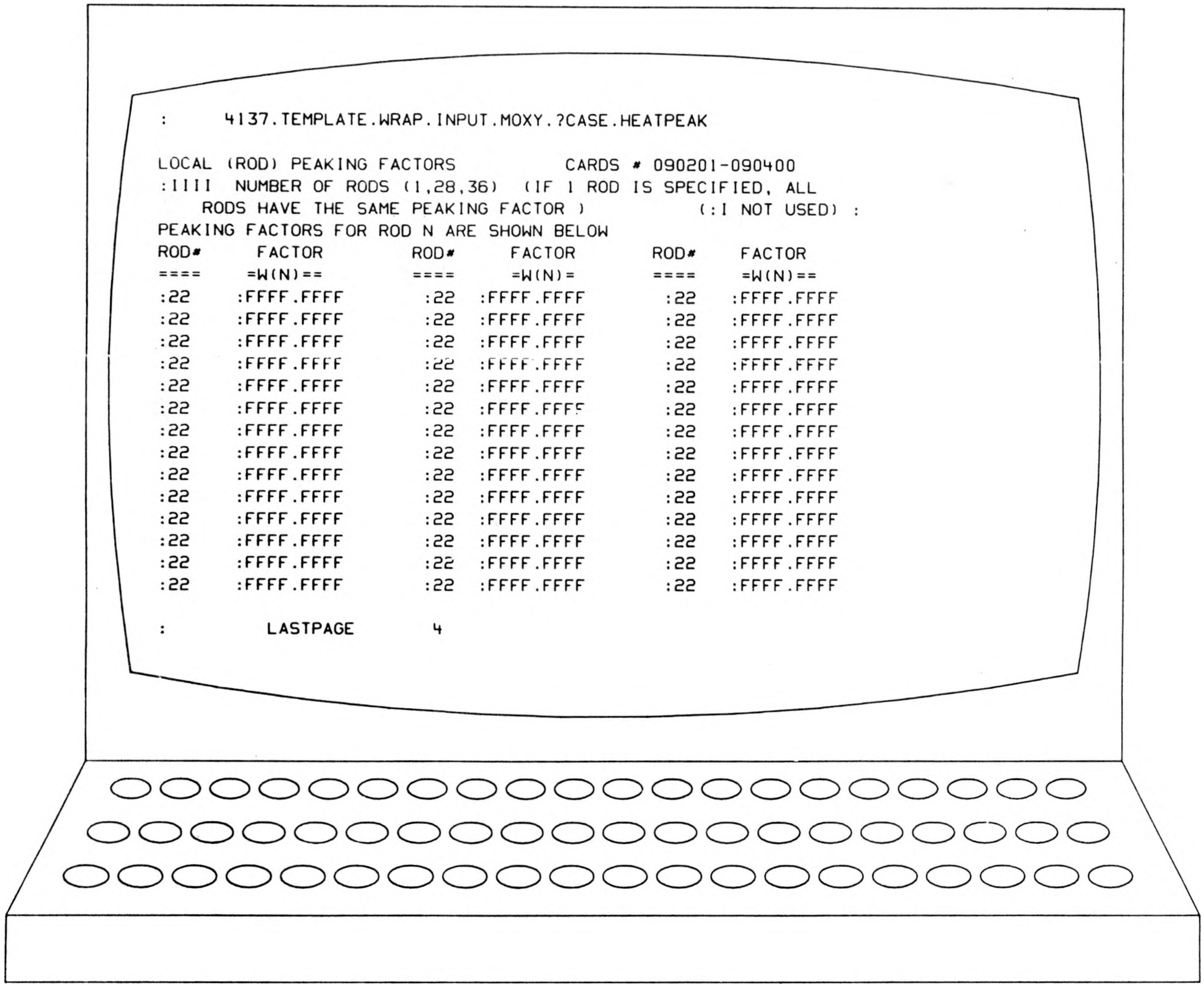

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:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.HEATPEAK

LOCAL (ROD) PEAKING FACTORS            CARDS # 090201-090400
:IIII  NUMBER OF RODS (1,28,36)  (IF 1 ROD IS SPECIFIED, ALL
    RODS HAVE THE SAME PEAKING FACTOR )          (:I NOT USED) :
PEAKING FACTORS FOR ROD N ARE SHOWN BELOW
ROD#       FACTOR          ROD#      FACTOR        ROD#     FACTOR
====      =W(N)==          ====      =W(N)=        ====     =W(N)==
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF
:22     :FFFF.FFFF         :22  :FFFF.FFFF         :22   :FFFF.FFFF

:          LASTPAGE        4
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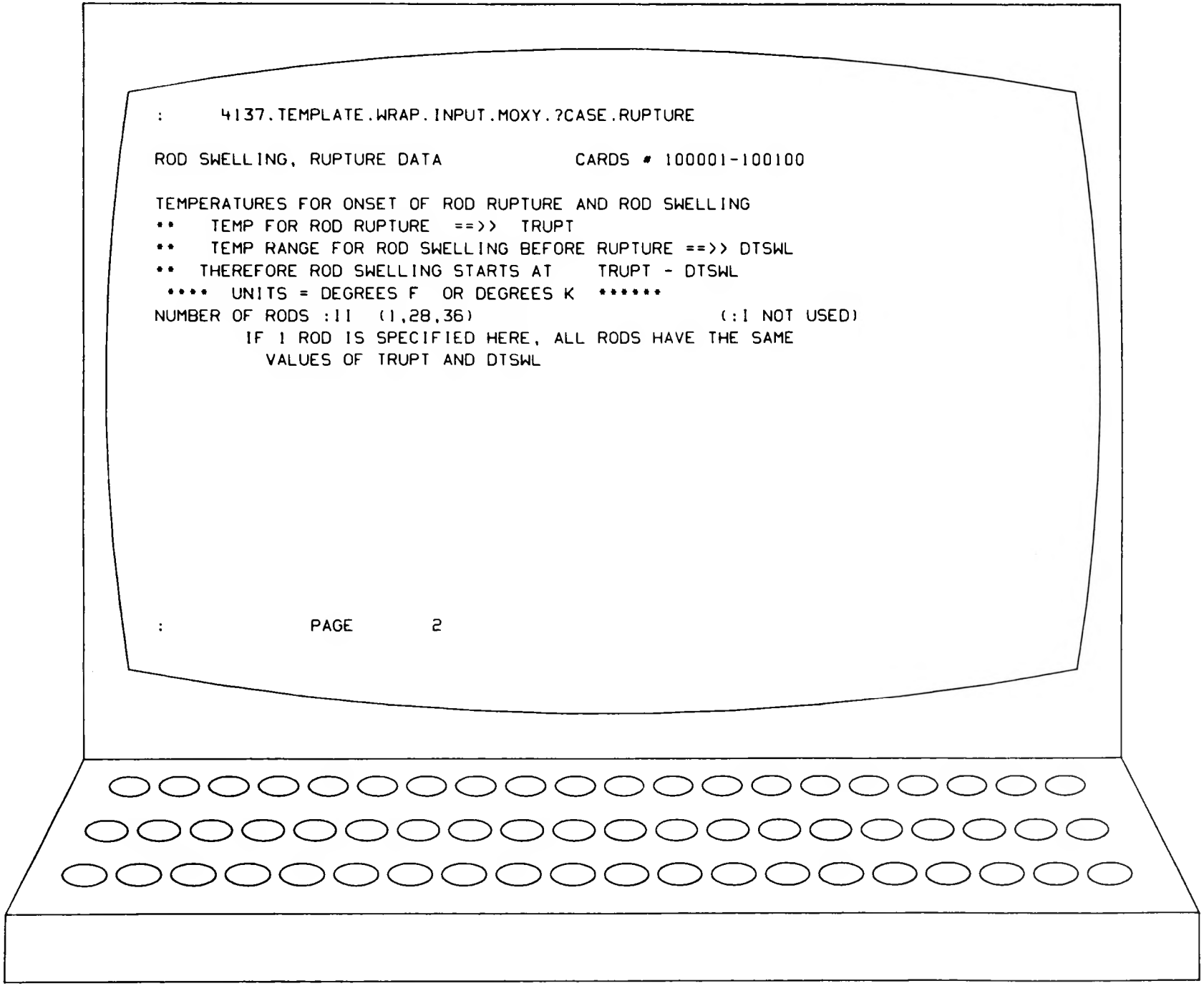
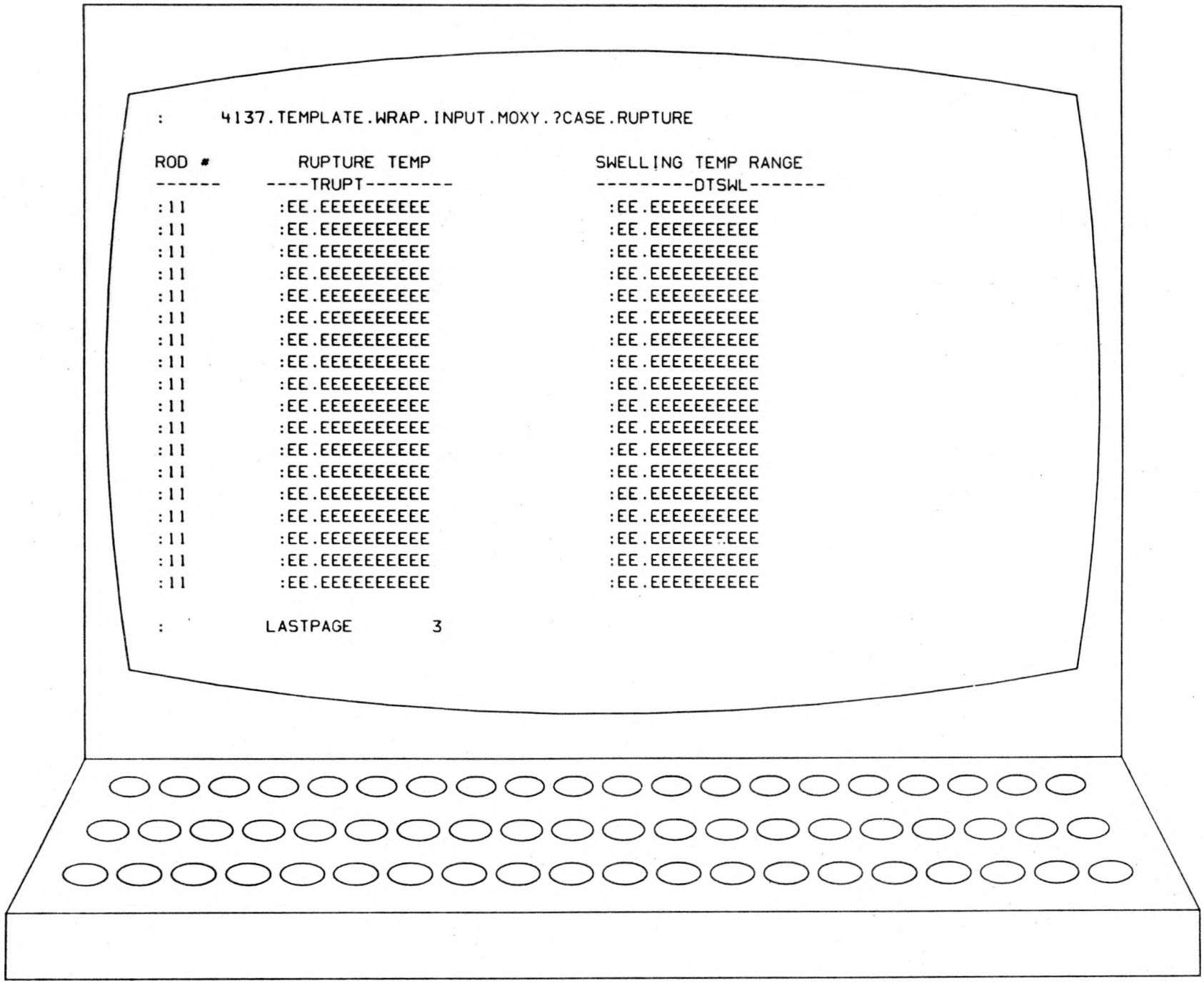
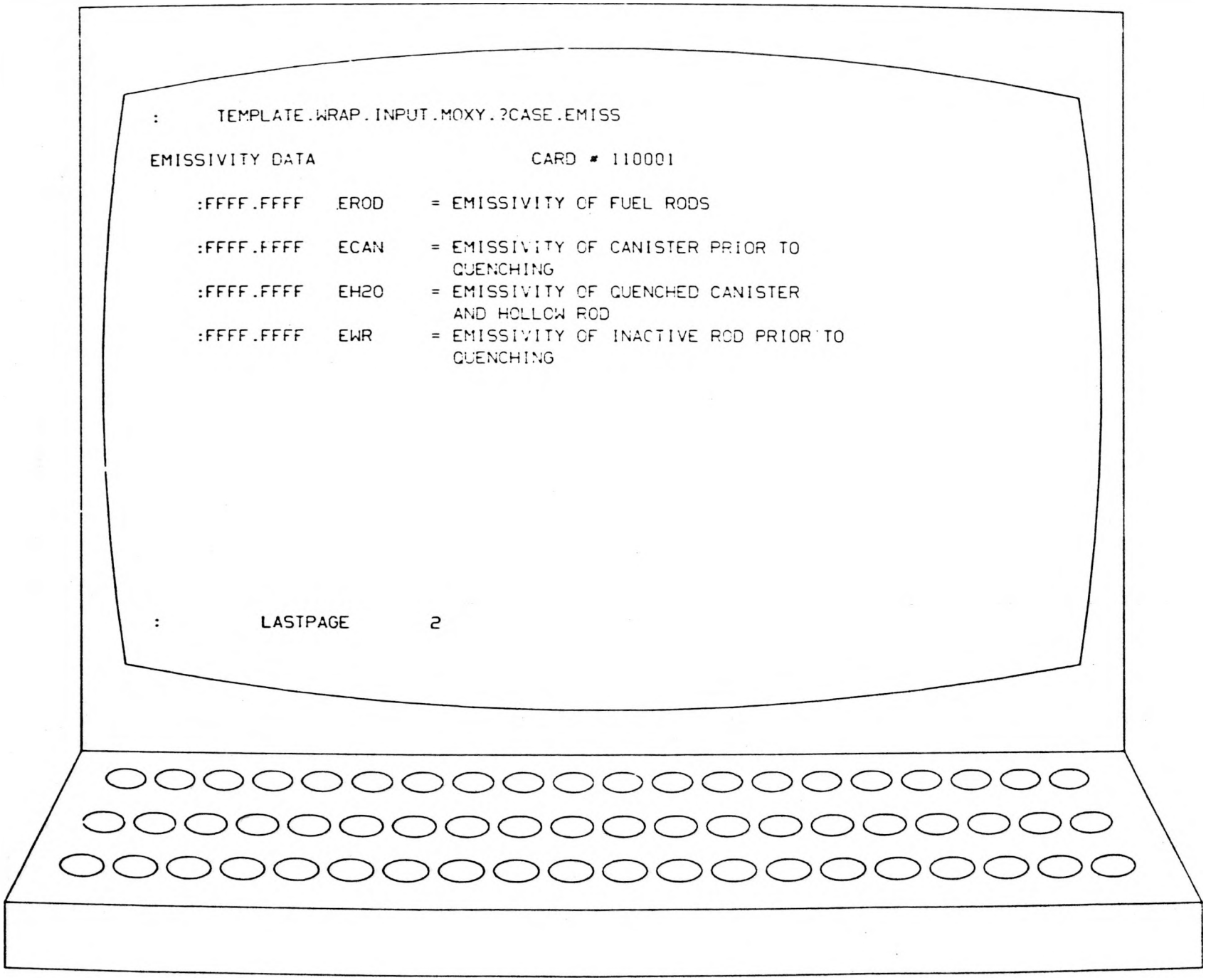
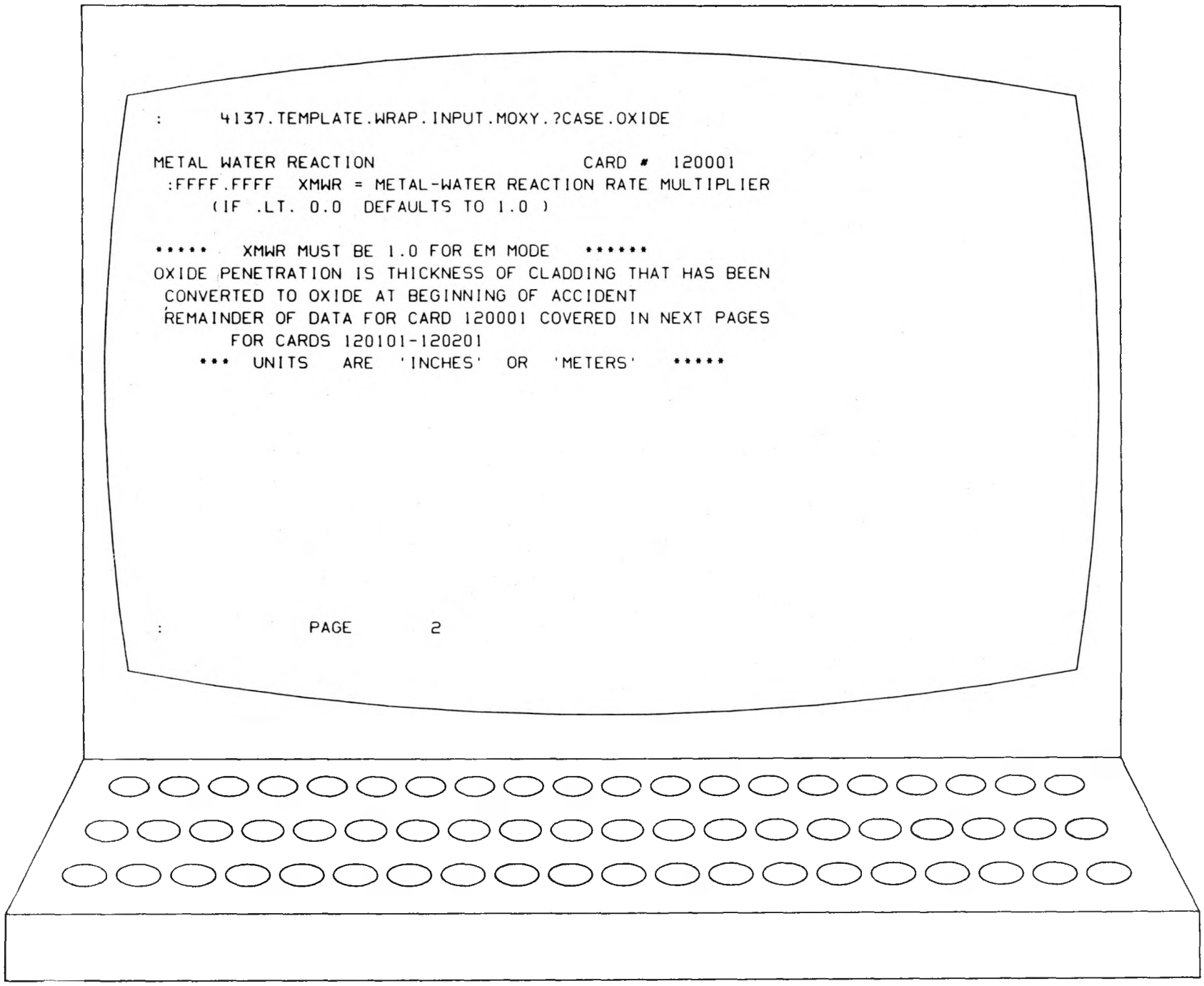
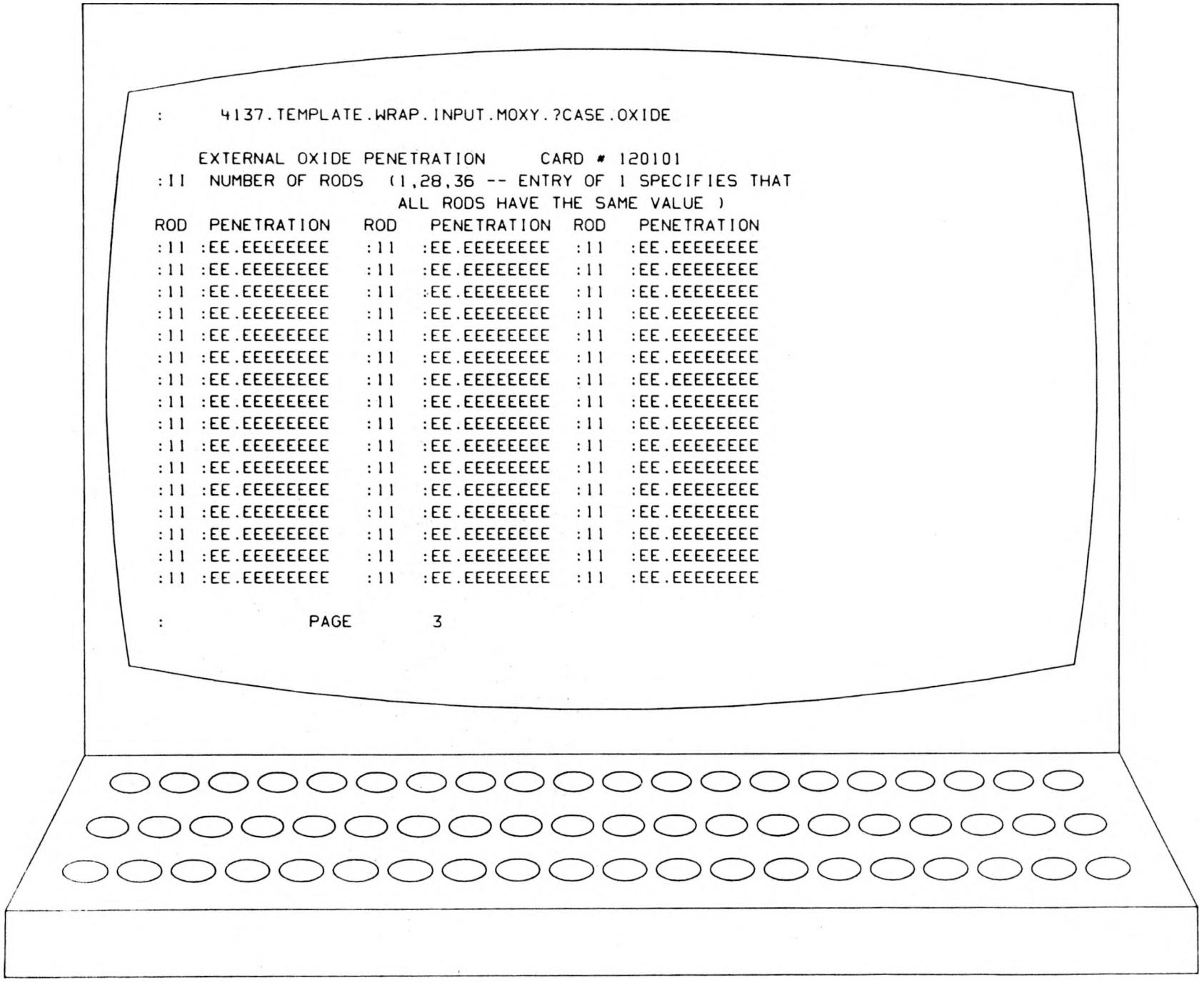
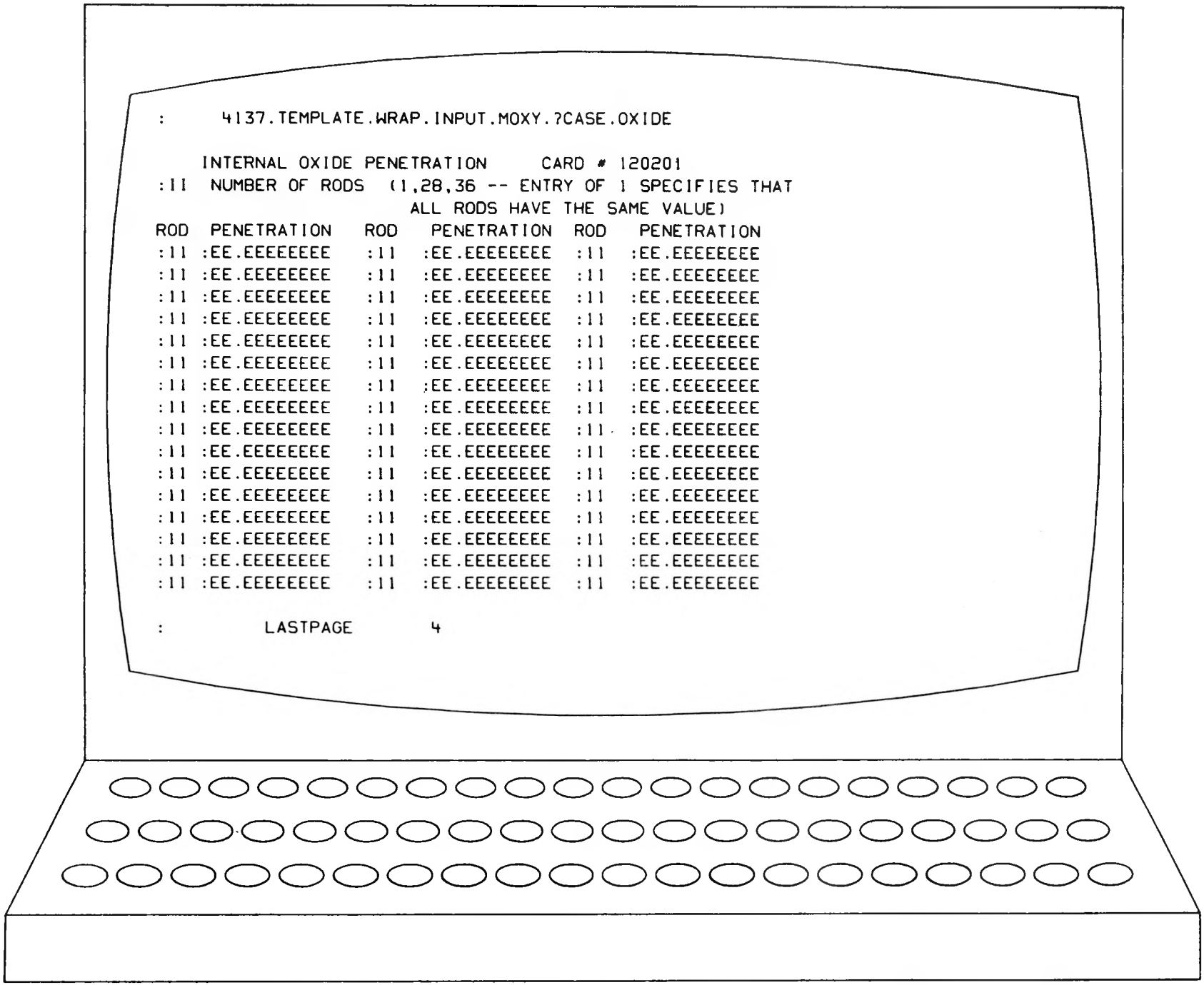

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.RUPTURE
ROD SWELLING, RUPTURE DATA CARDS # 100001-100100
TEMPERATURES FOR ONSET OF ROD RUPTURE AND ROD SWELLING
** TEMP FOR ROD RUPTURE ==>> TRUPT
** TEMP RANGE FOR ROD SWELLING BEFORE RUPTURE ==>> DTSWL
** THEREFORE ROD SWELLING STARTS AT TRUPT - DTSWL
**** UNITS = DEGREES F OR DEGREES K ******
NUMBER OF RODS :11 (1,28,36) (:1 NOT USED)
IF 1 ROD IS SPECIFIED HERE, ALL RODS HAVE THE SAME
VALUES OF TRUPT AND DTSWL
: PAGE 2

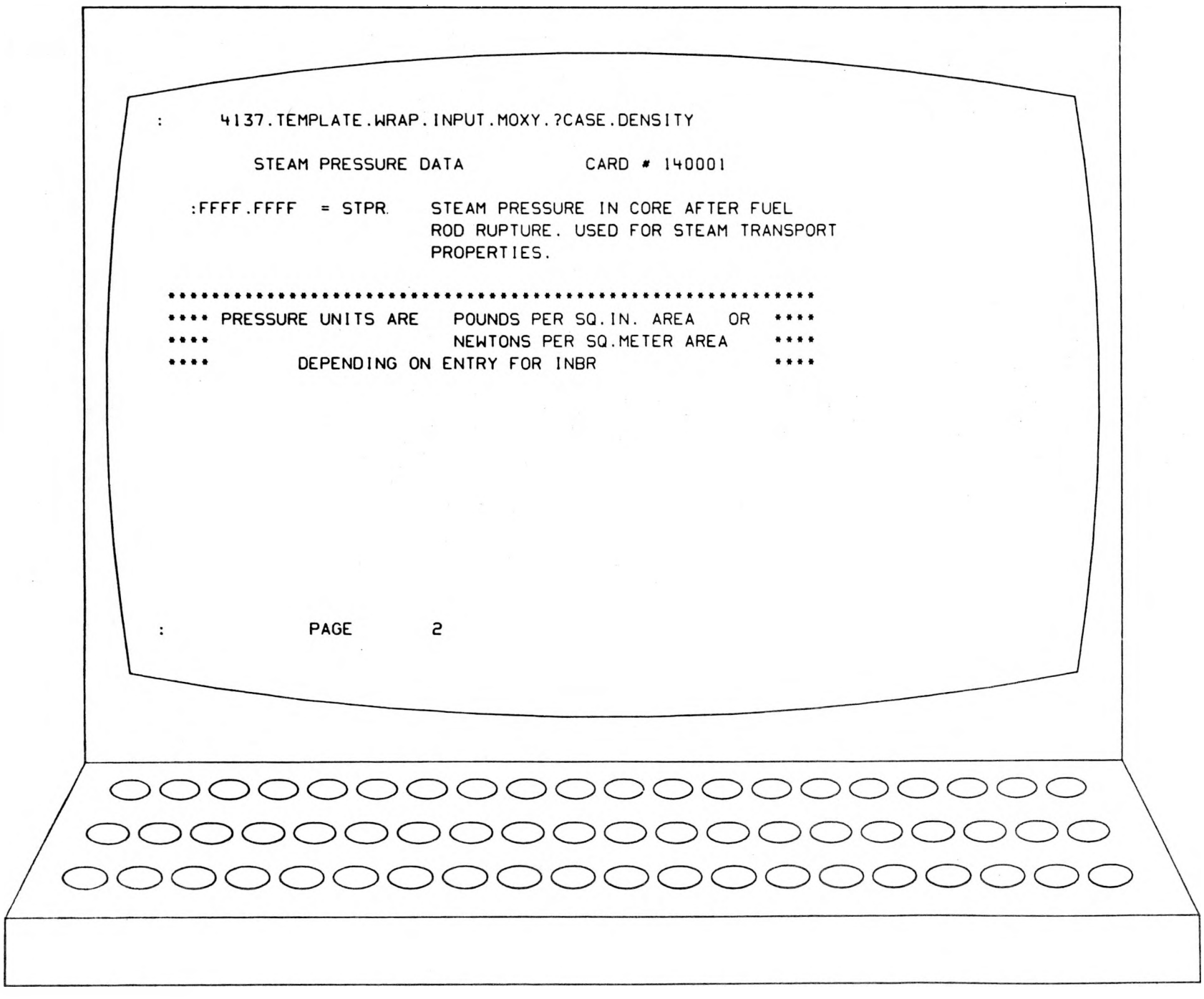

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.RUPTURE
ROD # RUPTURE TEMP SWELLING TEMP RANGE
---TRUPT--- ---DTSWL---
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EE.EEEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 3


: TEMPLATE.WRAP.INPUT.MOXY.?CASE.EMISS
EMISSIVITY DATA CARD # 110001
:FFFF.FFFF EROD = EMISSIVITY OF FUEL RODS
:FFFF.FFFF ECAN = EMISSIVITY OF CANISTER PRIOR TO QUENCHING
:FFFF.FFFF EH2O = EMISSIVITY OF QUENCHED CANISTER AND HOLLOW ROD
:FFFF.FFFF EWR = EMISSIVITY OF INACTIVE ROD PRIOR TO QUENCHING
: LASTPAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.OXIDE
METAL WATER REACTION CARD # 120001
:FFFF.FFFF XMWR = METAL-WATER REACTION RATE MULTIPLIER
(IF .LT. 0.0 DEFAULTS TO 1.0)
***** XMWR MUST BE 1.0 FOR EM MODE ******
OXIDE PENETRATION IS THICKNESS OF CLADDING THAT HAS BEEN
CONVERTED TO OXIDE AT BEGINNING OF ACCIDENT
REMAINDER OF DATA FOR CARD 120001 COVERED IN NEXT PAGES
FOR CARDS 120101-120201
*** UNITS ARE 'INCHES' OR 'METERS' *****
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.OXIDE
EXTERNAL OXIDE PENETRATION CARD # 120101
:I1 NUMBER OF RODS (1,28,36 -- ENTRY OF 1 SPECIFIES THAT
ALL RODS HAVE THE SAME VALUE)
ROD PENETRATION ROD PENETRATION ROD PENETRATION
:I1 :EE.EEEEEEEE :I1 :EE.EEEEEEEE :I1 :EE.EEEEEEEE
: PAGE 3


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.OXIDE
INTERNAL OXIDE PENETRATION CARD # 120201
:11 NUMBER OF RODS (1,28,36 -- ENTRY OF 1 SPECIFIES THAT
ALL RODS HAVE THE SAME VALUE)
ROD PENETRATION ROD PENETRATION ROD PENETRATION
:11 :EE.EEEEEEEE :11 :EE.EEEEEEEE :11 :EE.EEEEEEEE
: LASTPAGE 4


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.DENSITY
STEAM PRESSURE DATA CARD # 140001
:FFFF.FFFF = STPR. STEAM PRESSURE IN CORE AFTER FUEL
ROD RUPTURE. USED FOR STEAM TRANSPORT
PROPERTIES.
**** PRESSURE UNITS ARE POUNDS PER SQ.IN. AREA OR ****
**** NEWTONS PER SQ.METER AREA ****
**** DEPENDING ON ENTRY FOR INBR ****
: PAGE 2

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:      4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.DENSITY

FUEL FRACTIONAL DENSITY DATA               CARDS # 130001-130010
:II  NUMBER OF RODS (1,28,36  IF=1, ALL RODS HAVE SAME VALUE)
FRACTION OF THEORETICAL URANIUM DIOXIDE DENSITY OF FUEL PELLETS
IN ROD (N).
ROD      DENSITY          ROD   DENSITY          ROD     DENSITY   :
===      =========        ===   =========        ===     =========
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF
:22     :FFFF.FFFF        :22  :FFFF.FFFF        :22    :FFFF.FFFF

:          LASTPAGE       3
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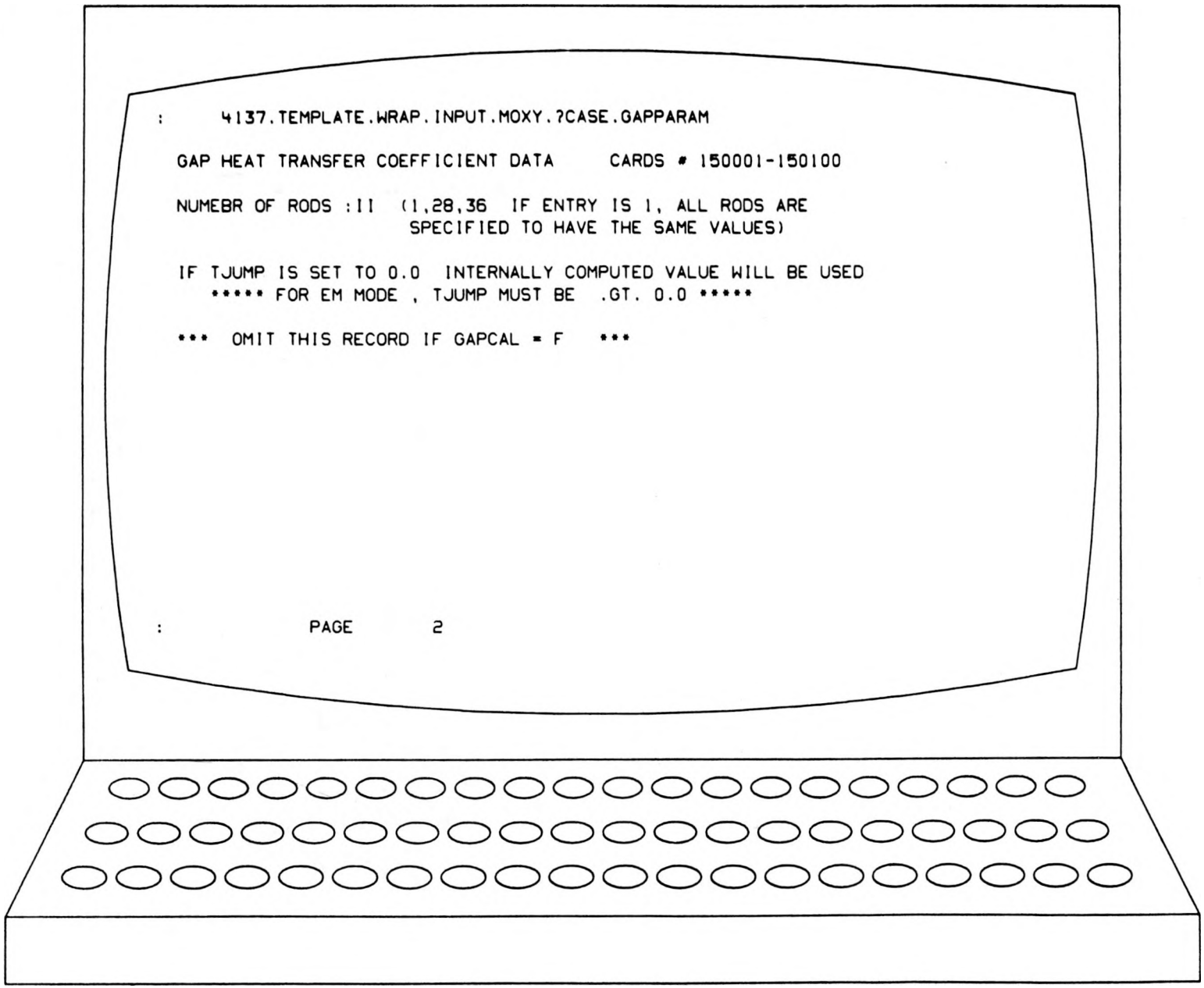
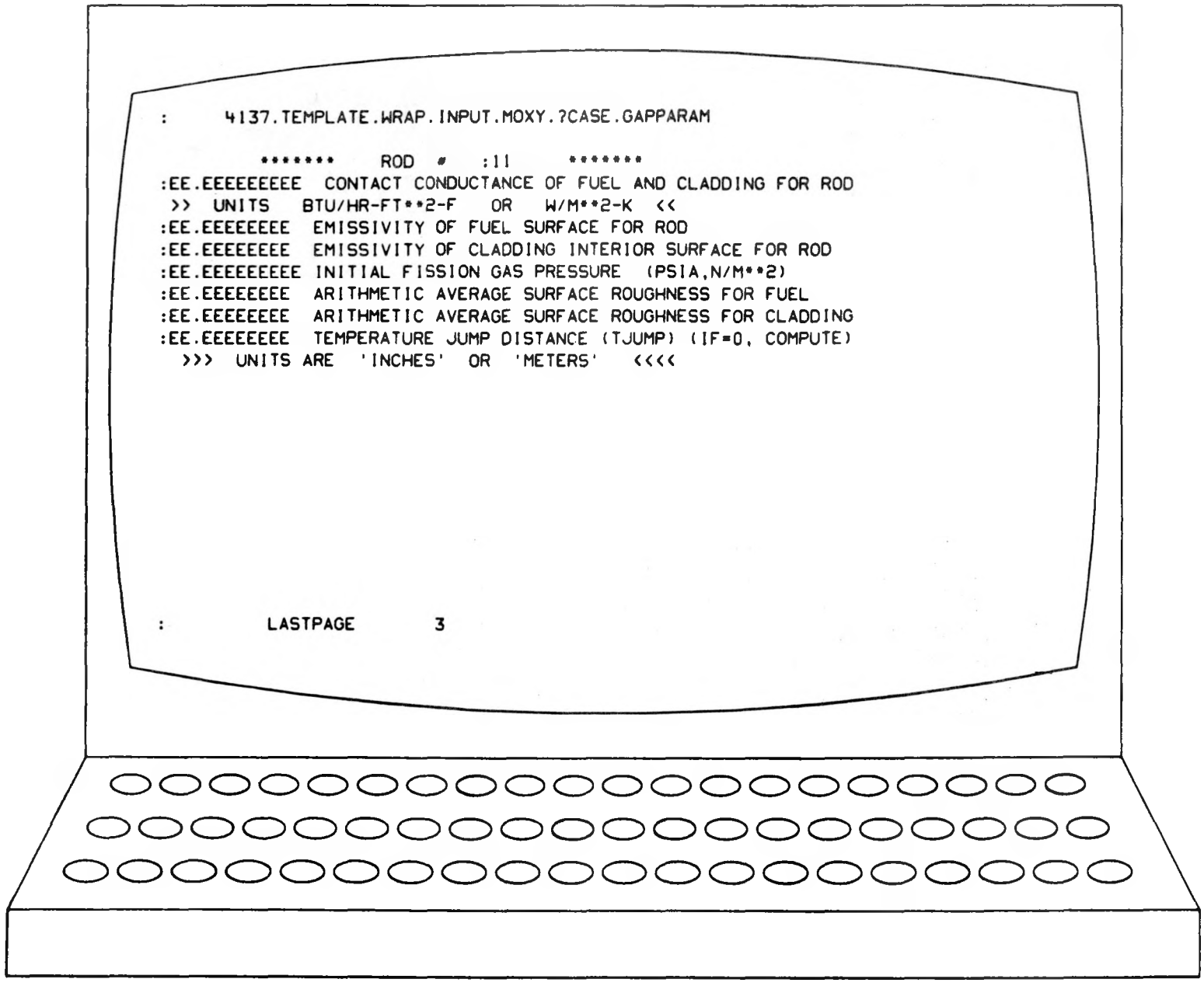
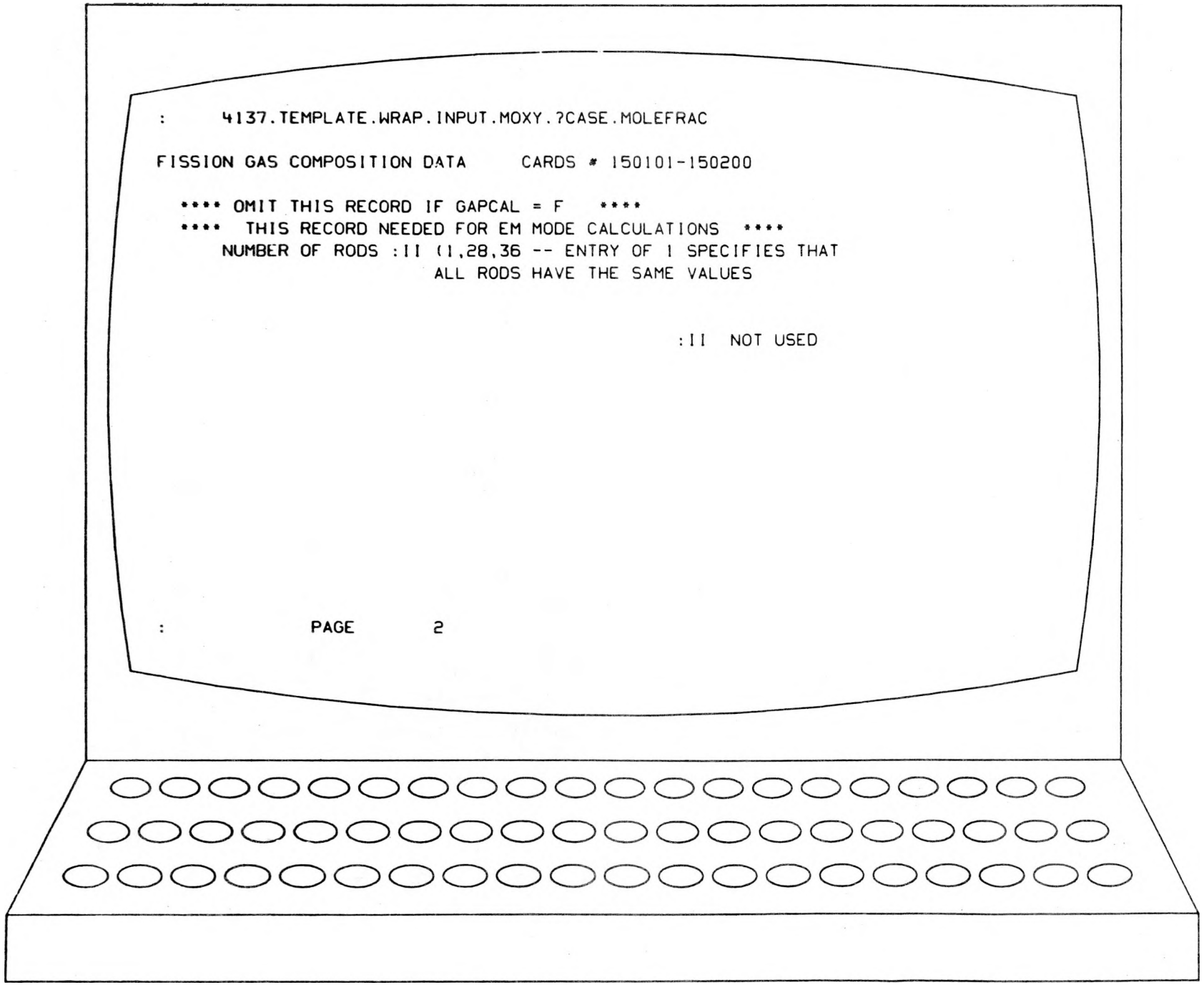
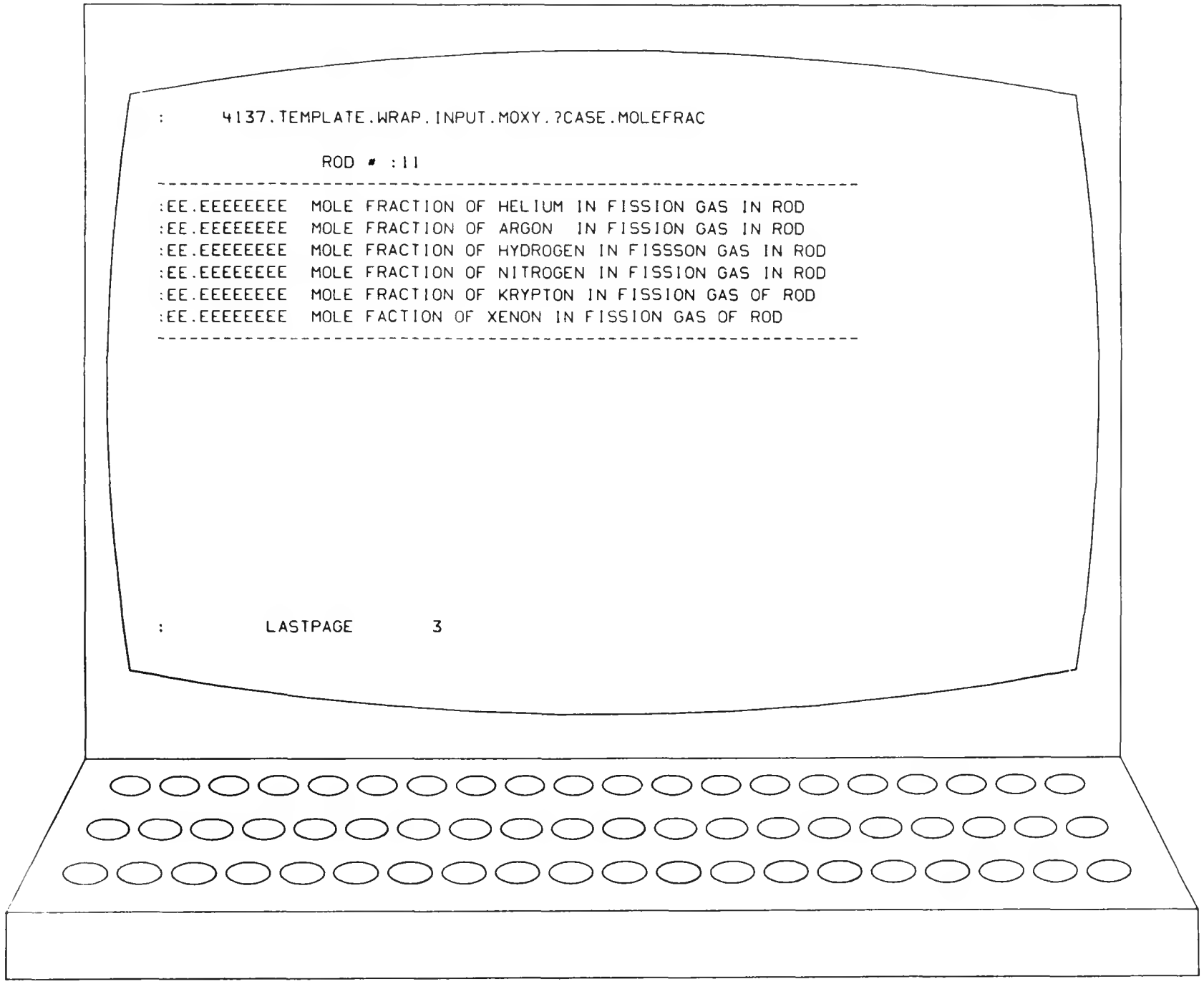
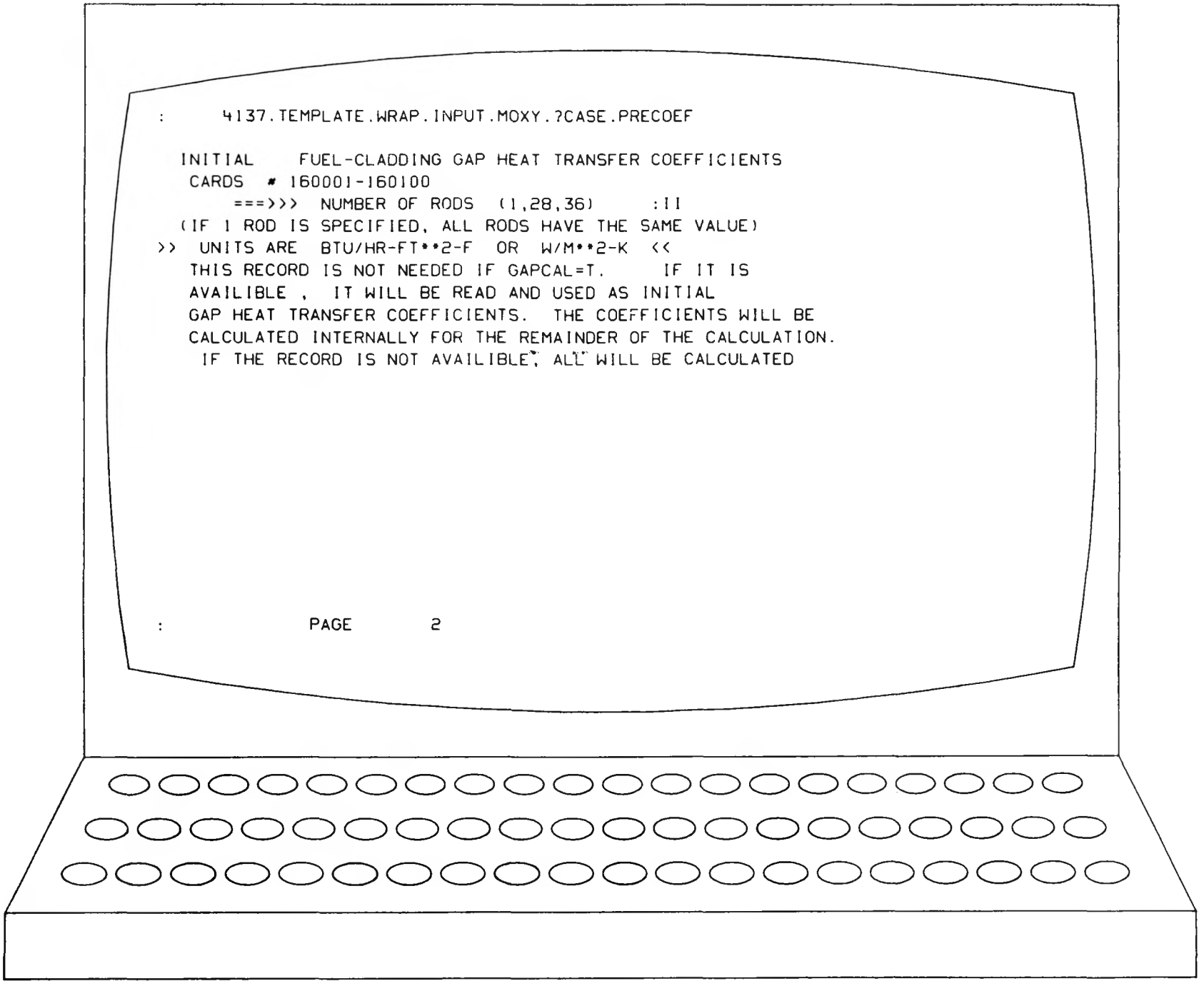
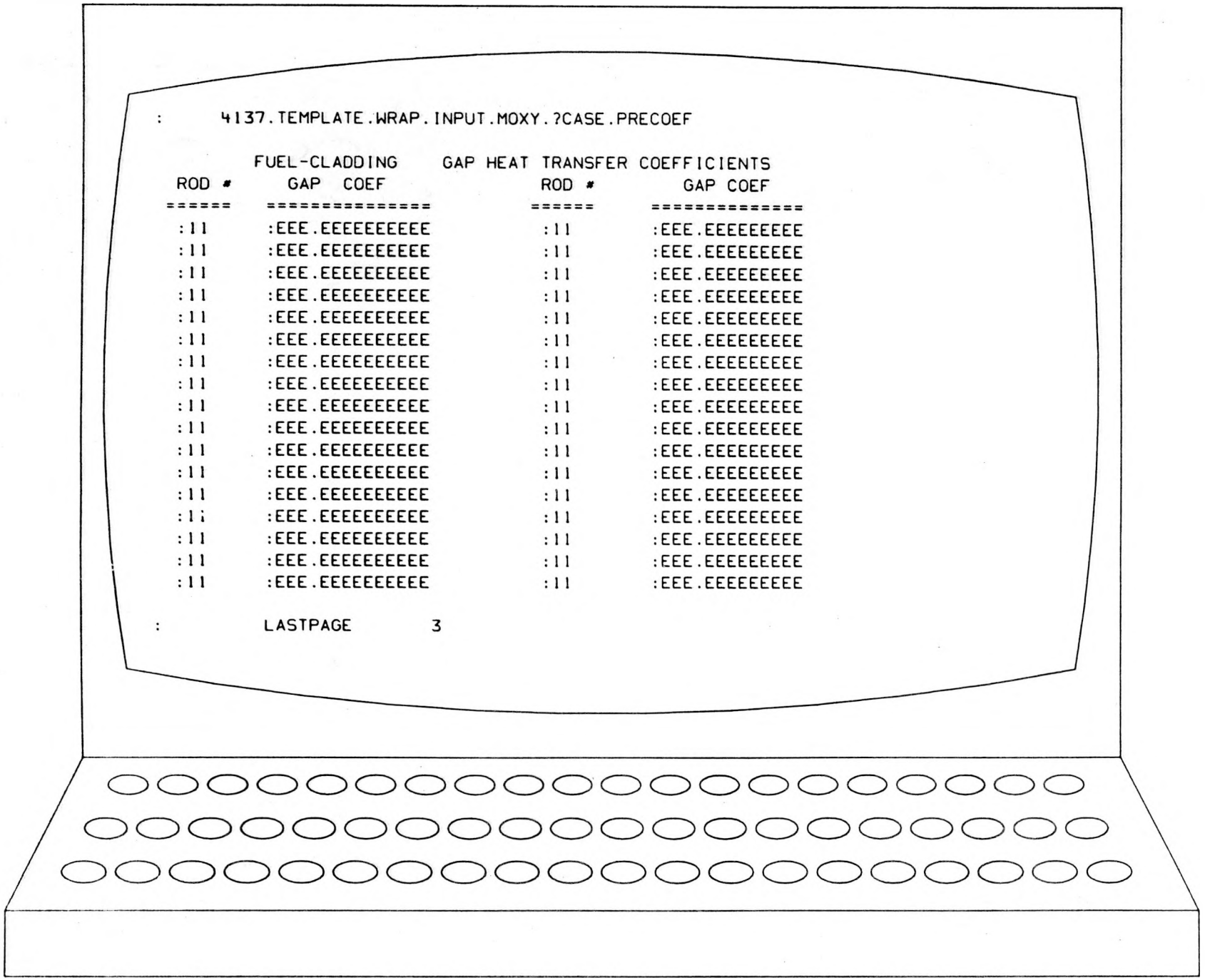

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GAPPARAM
GAP HEAT TRANSFER COEFFICIENT DATA CARDS # 150001-150100
NUMEBR OF RODS :II (1,28,36 IF ENTRY IS 1, ALL RODS ARE
SPECIFIED TO HAVE THE SAME VALUES)
IF TJUMP IS SET TO 0.0 INTERNALLY COMPUTED VALUE WILL BE USED
***** FOR EM MODE , TJUMP MUST BE .GT. 0.0 *****
*** OMIT THIS RECORD IF GAPCAL = F ***
: PAGE 2

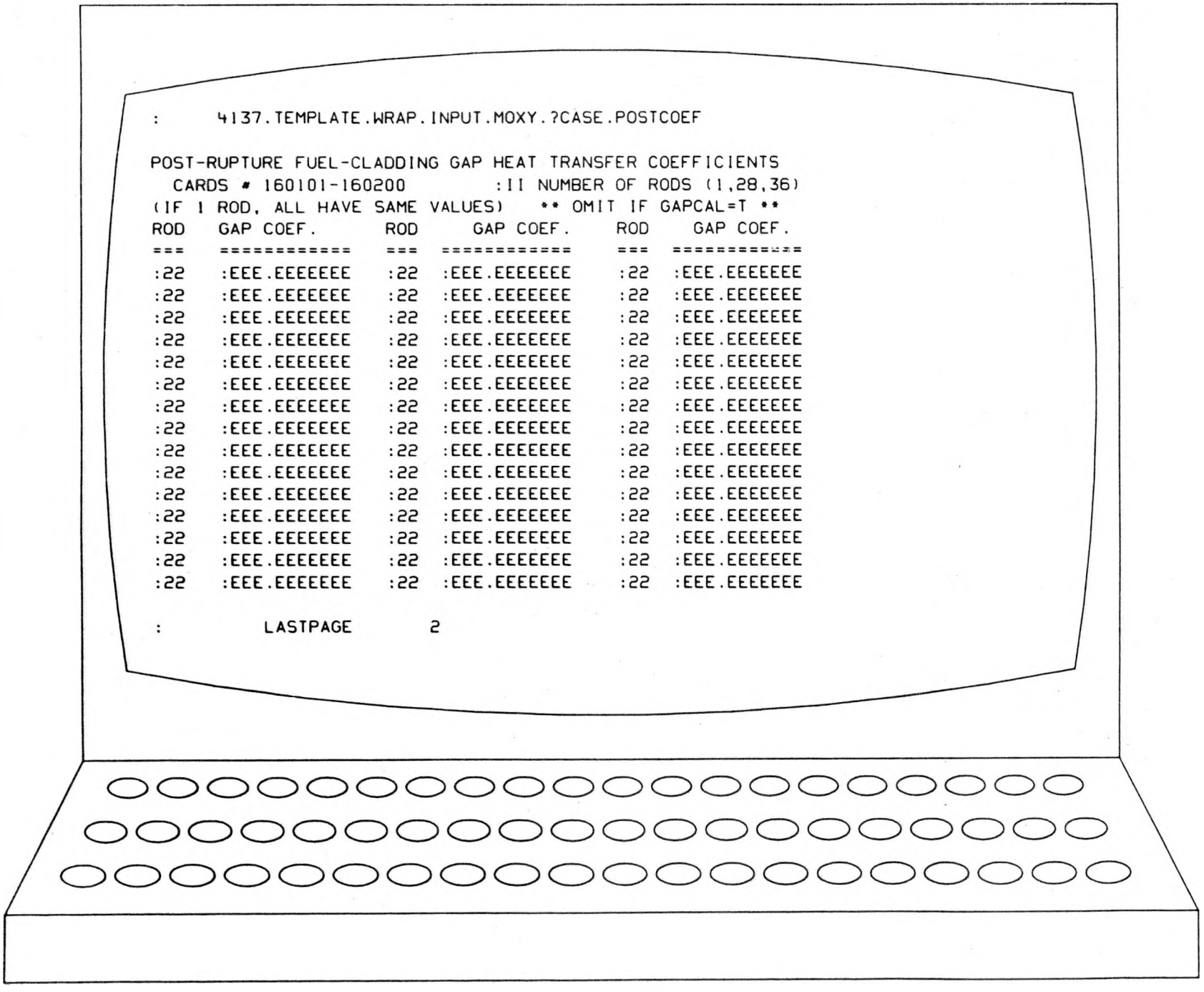

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GAPPARAM
******* ROD # :11 *******
:EE.EEEEEEEEE CONTACT CONDUCTANCE OF FUEL AND CLADDING FOR ROD
>> UNITS BTU/HR-FT**2-F OR W/M**2-K <<
:EE.EEEEEEEE EMISSIVITY OF FUEL SURFACE FOR ROD
:EE.EEEEEEEE EMISSIVITY OF CLADDING INTERIOR SURFACE FOR ROD
:EE.EEEEEEEEE INITIAL FISSION GAS PRESSURE (PSIA,N/M**2)
:EE.EEEEEEEE ARITHMETIC AVERAGE SURFACE ROUGHNESS FOR FUEL
:EE.EEEEEEEE ARITHMETIC AVERAGE SURFACE ROUGHNESS FOR CLADDING
:EE.EEEEEEEE TEMPERATURE JUMP DISTANCE (TJUMP) (IF=0, COMPUTE)
>>> UNITS ARE 'INCHES' OR 'METERS' <<<<
: LASTPAGE 3

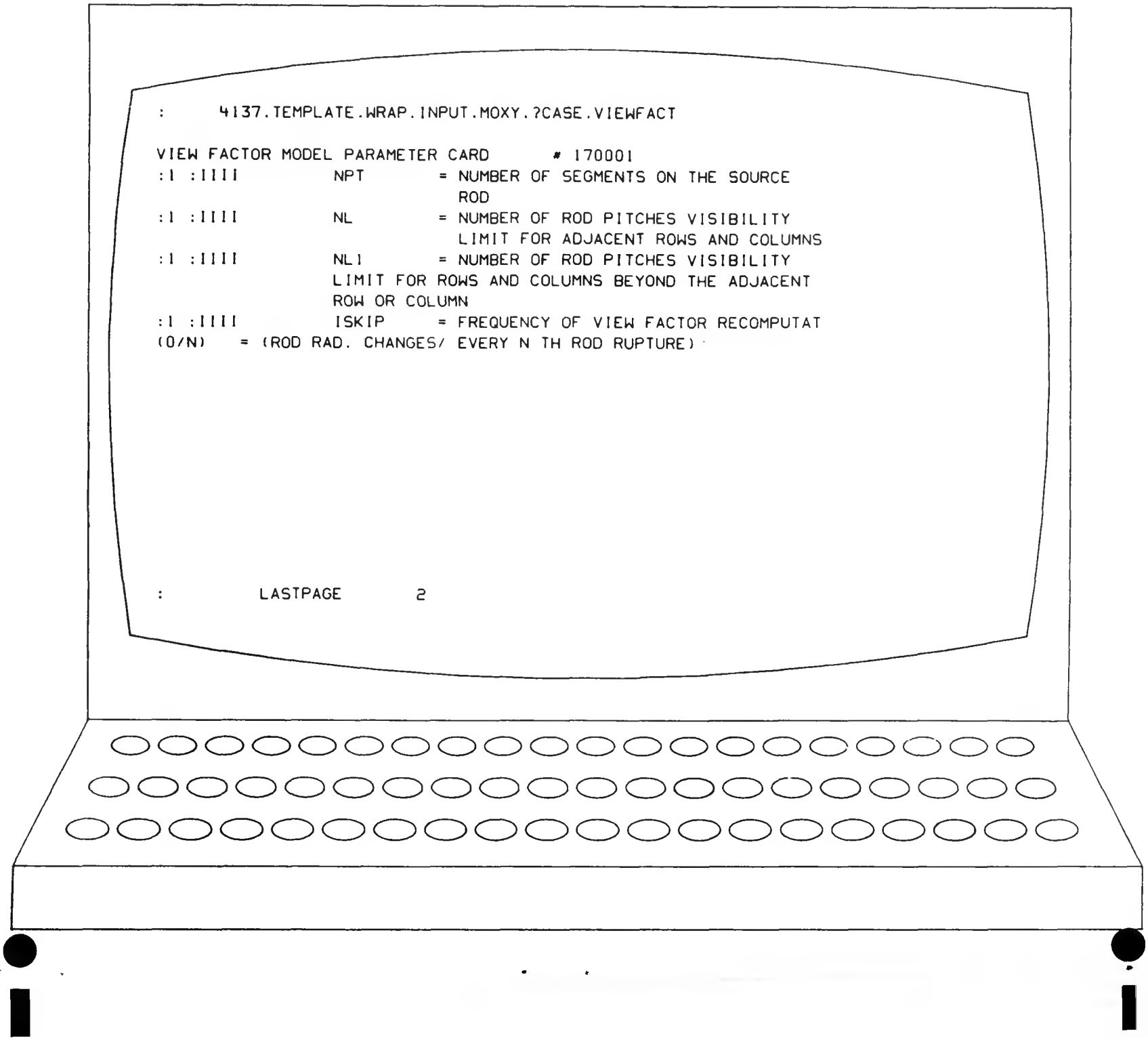

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.MOLEFRAC
FISSION GAS COMPOSITION DATA CARDS # 150101-150200
**** OMIT THIS RECORD IF GAPCAL = F ****
**** THIS RECORD NEEDED FOR EM MODE CALCULATIONS ****
NUMBER OF RODS :I1 (1,28,36 -- ENTRY OF 1 SPECIFIES THAT
ALL RODS HAVE THE SAME VALUES
:I1 NOT USED
: PAGE 2

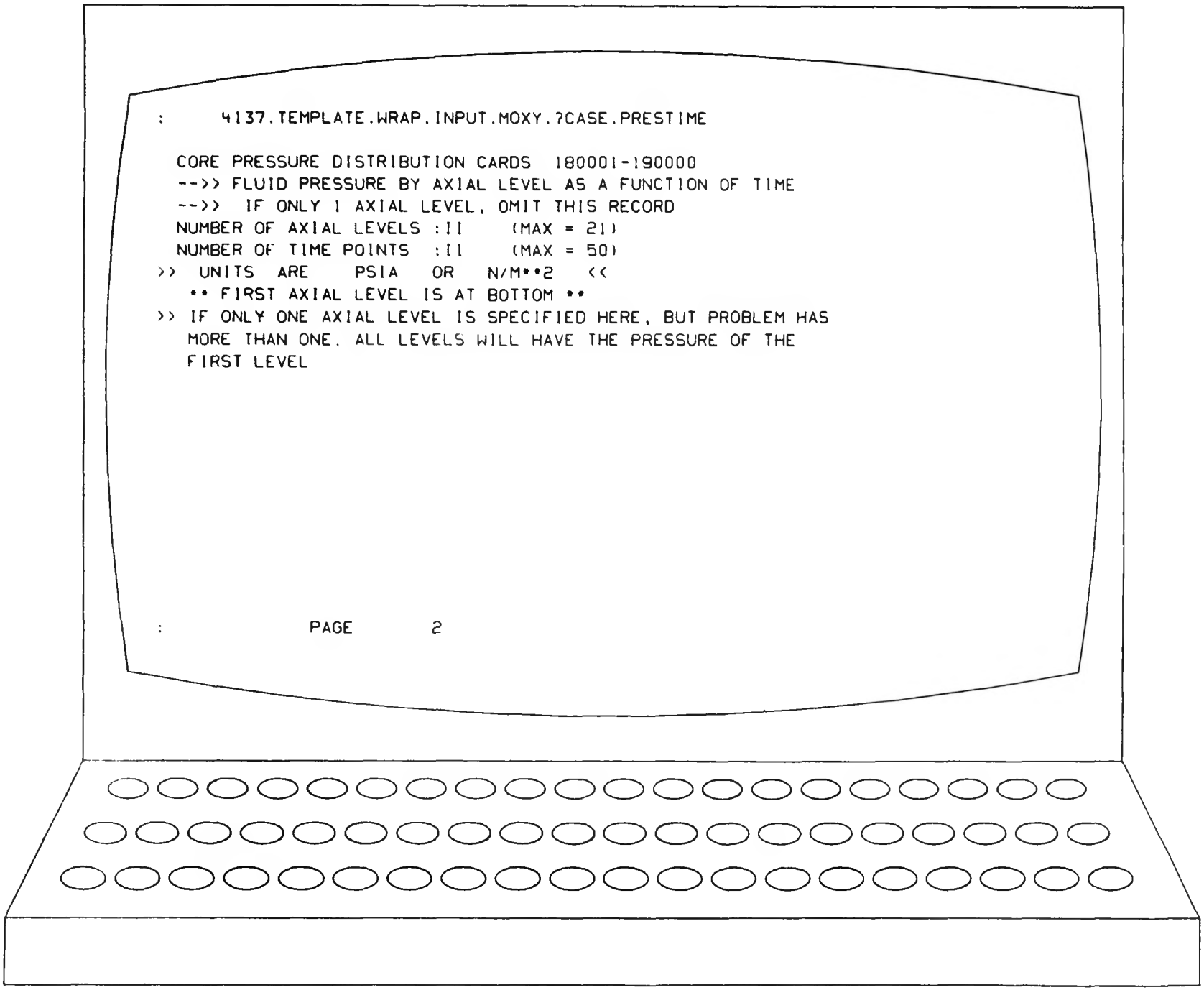

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.MOLEFRAC
ROD # :11
:EE.EEEEEEEE MOLE FRACTION OF HELIUM IN FISSION GAS IN ROD
:EE.EEEEEEEE MOLE FRACTION OF ARGON IN FISSION GAS IN ROD
:EE.EEEEEEEE MOLE FRACTION OF HYDROGEN IN FISSSON GAS IN ROD
:EE.EEEEEEEE MOLE FRACTION OF NITROGEN IN FISSION GAS IN ROD
:EE.EEEEEEEE MOLE FRACTION OF KRYPTON IN FISSION GAS OF ROD
:EE.EEEEEEEE MOLE FACTION OF XENON IN FISSION GAS OF ROD
: LASTPAGE 3

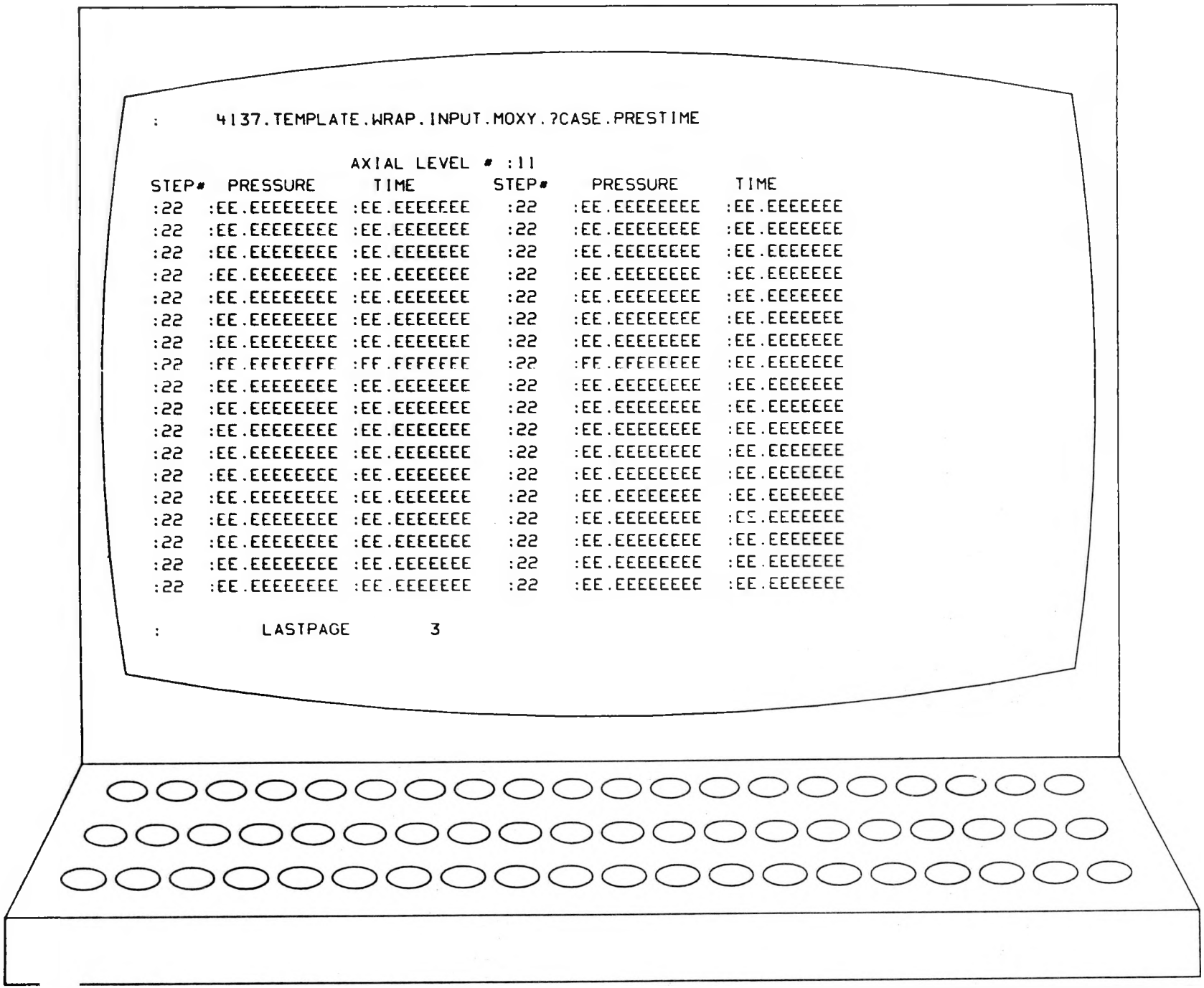

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PRECOEF
INITIAL FUEL-CLADDING GAP HEAT TRANSFER COEFFICIENTS
CARDS # 160001-160100
===>>> NUMBER OF RODS (1,28,36) :II
(IF 1 ROD IS SPECIFIED, ALL RODS HAVE THE SAME VALUE)
>> UNITS ARE BTU/HR-FT**2-F OR W/M**2-K <<
THIS RECORD IS NOT NEEDED IF GAPCAL=T. IF IT IS
AVAILIBLE , IT WILL BE READ AND USED AS INITIAL
GAP HEAT TRANSFER COEFFICIENTS. THE COEFFICIENTS WILL BE
CALCULATED INTERNALLY FOR THE REMAINDER OF THE CALCULATION.
IF THE RECORD IS NOT AVAILIBLE, ALL WILL BE CALCULATED
: PAGE 2

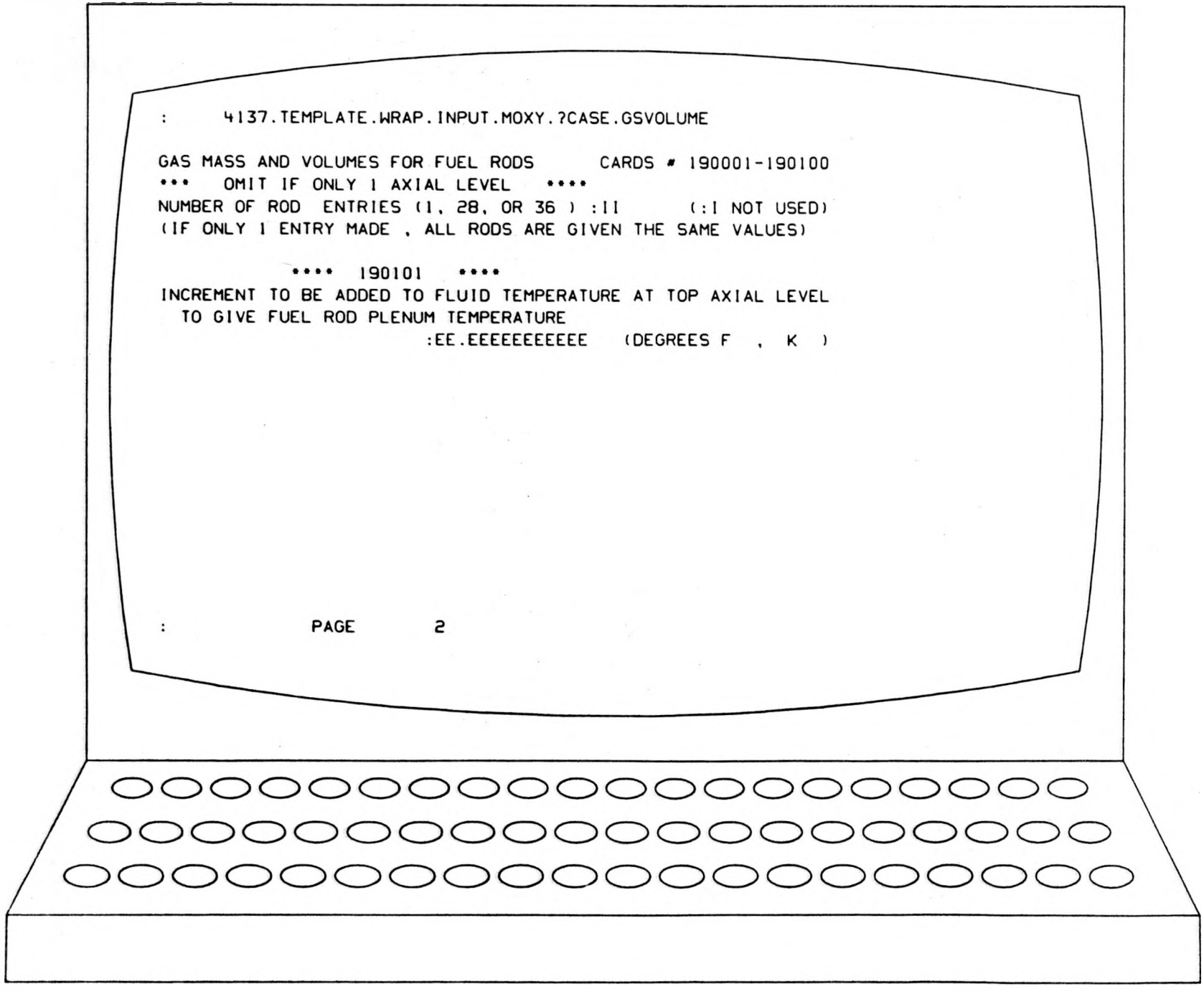

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PRECOEF
FUEL-CLADDING GAP HEAT TRANSFER COEFFICIENTS
ROD # GAP COEF ROD # GAP COEF
:11 :EEE.EEEEEEEEE :11 :EEE.EEEEEEEEE
: LASTPAGE 3

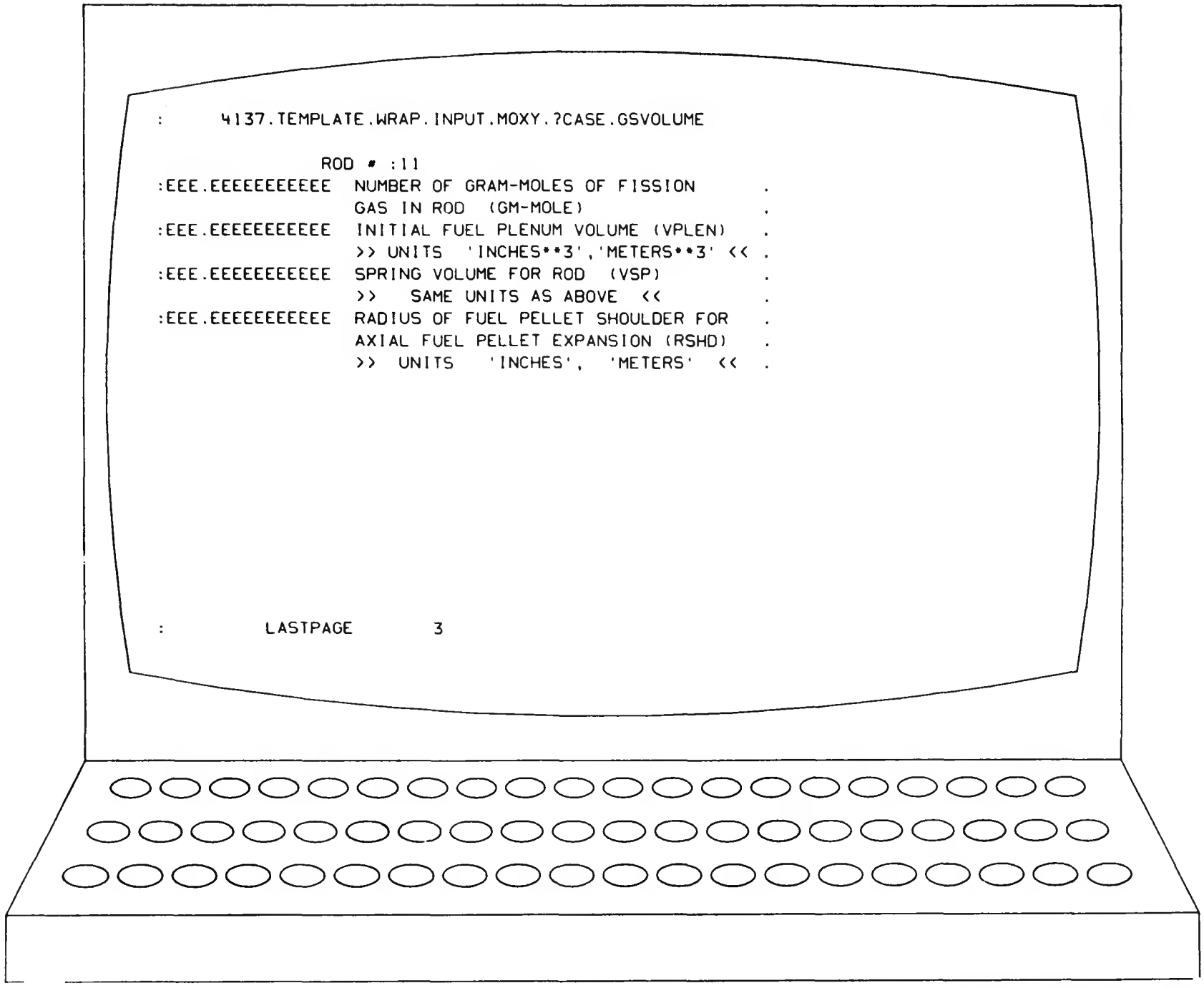

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.POSTCOEF
POST-RUPTURE FUEL-CLADDING GAP HEAT TRANSFER COEFFICIENTS
CARDS # 160101-160200 :II NUMBER OF RODS (1,28,36)
(IF 1 ROD, ALL HAVE SAME VALUES) ** OMIT IF GAPCAL=T **
ROD GAP COEF. ROD GAP COEF. ROD GAP COEF.
:22 :EEE.EEEEEEE :22 :EEE.EEEEEEE :22 :EEE.EEEEEEE
: LASTPAGE 2

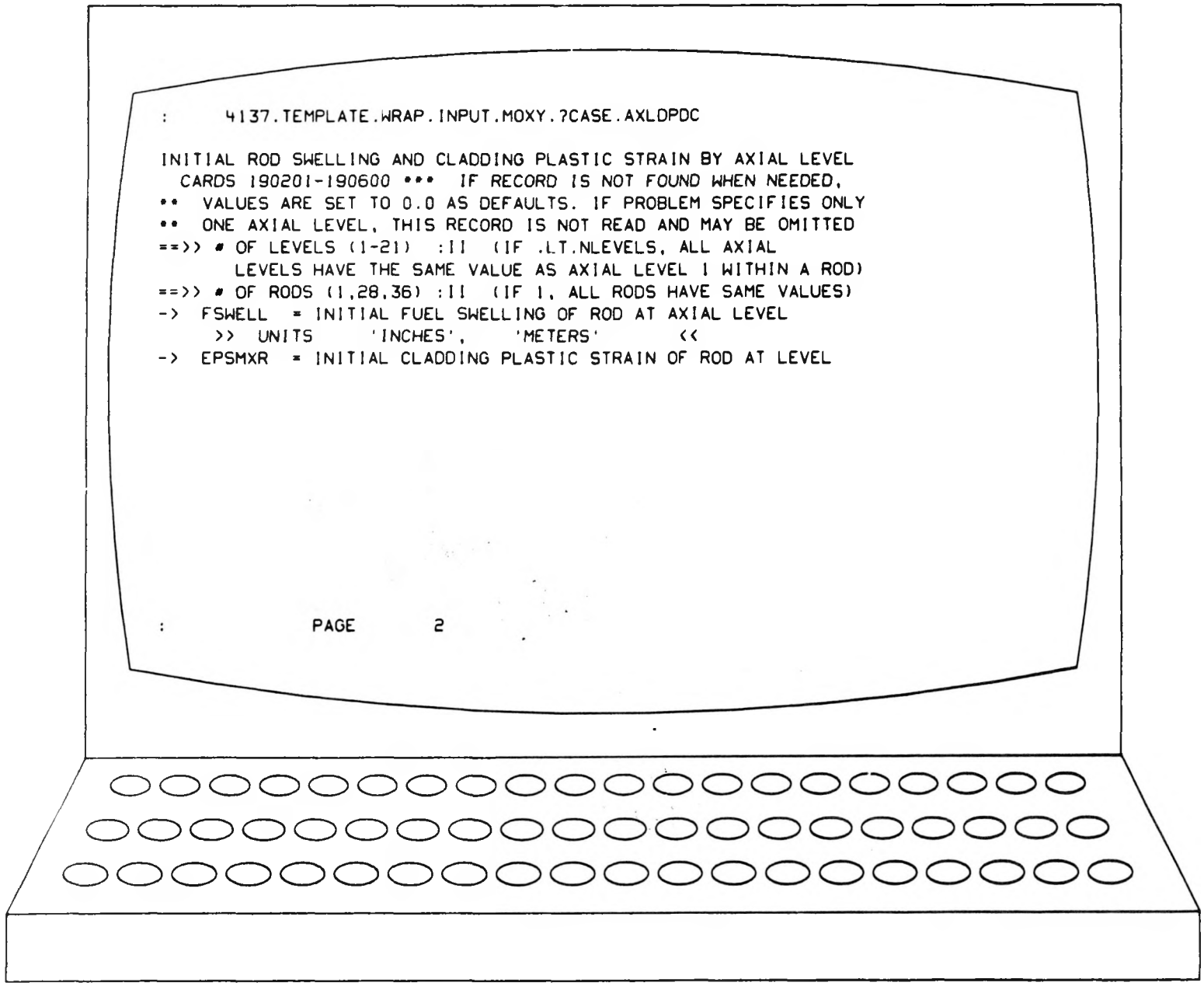

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.VIEWFACT
VIEW FACTOR MODEL PARAMETER CARD # 170001
:I :IIII NPT = NUMBER OF SEGMENTS ON THE SOURCE ROD
:I :IIII NL = NUMBER OF ROD PITCHES VISIBILITY LIMIT FOR ADJACENT ROWS AND COLUMNS
:I :IIII NL1 = NUMBER OF ROD PITCHES VISIBILITY LIMIT FOR ROWS AND COLUMNS BEYOND THE ADJACENT ROW OR COLUMN
:I :IIII ISKIP = FREQUENCY OF VIEW FACTOR RECOMPUTAT
(O/N) = (ROD RAD. CHANGES/ EVERY N TH ROD RUPTURE)
: LASTPAGE 2

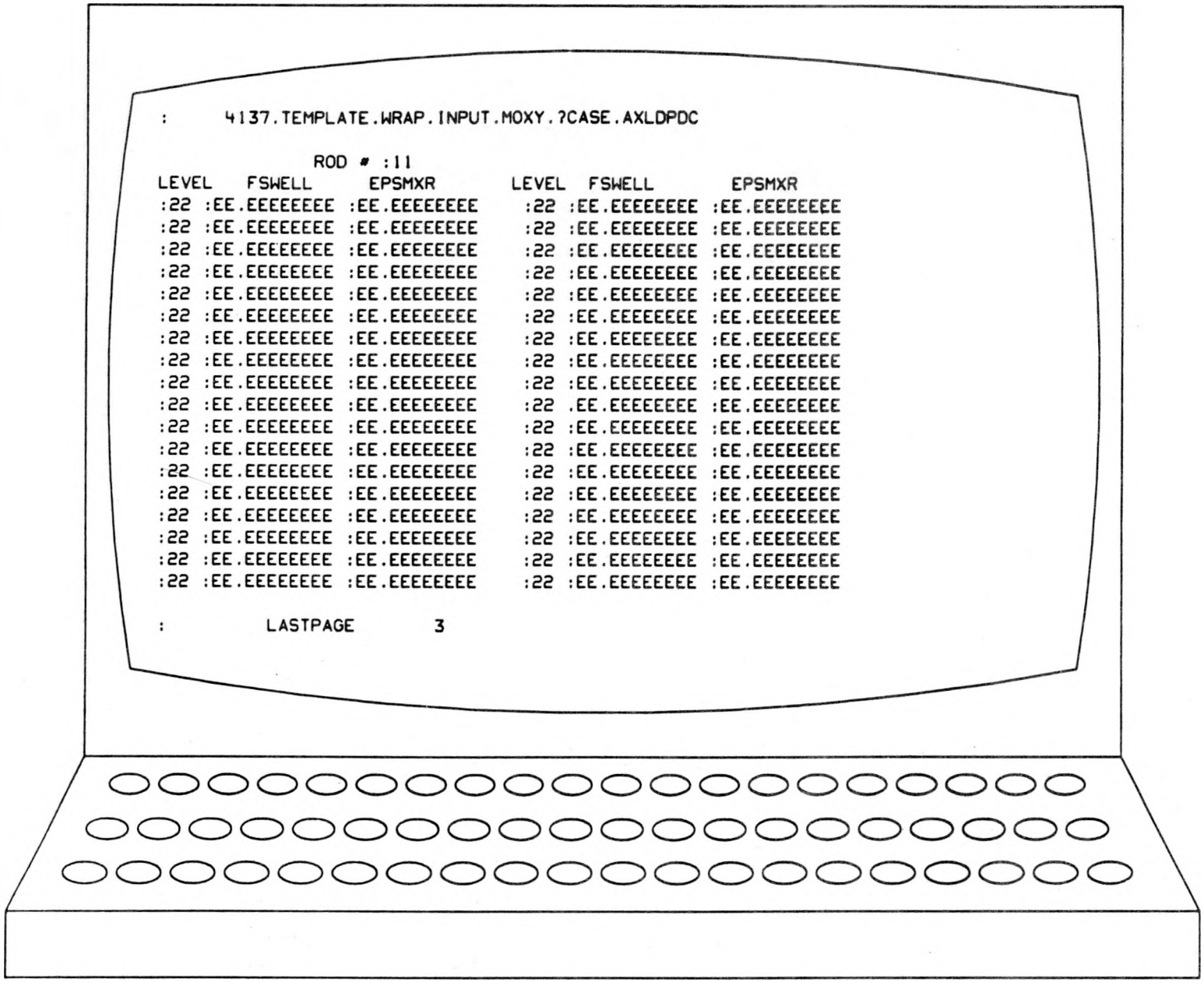

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PRESTIME
CORE PRESSURE DISTRIBUTION CARDS 180001-190000
-->> FLUID PRESSURE BY AXIAL LEVEL AS A FUNCTION OF TIME
-->> IF ONLY 1 AXIAL LEVEL, OMIT THIS RECORD
NUMBER OF AXIAL LEVELS :I1 (MAX = 21)
NUMBER OF TIME POINTS :I1 (MAX = 50)
>> UNITS ARE PSIA OR N/M**2 <<
** FIRST AXIAL LEVEL IS AT BOTTOM **
>> IF ONLY ONE AXIAL LEVEL IS SPECIFIED HERE, BUT PROBLEM HAS
MORE THAN ONE, ALL LEVELS WILL HAVE THE PRESSURE OF THE
FIRST LEVEL
: PAGE 2

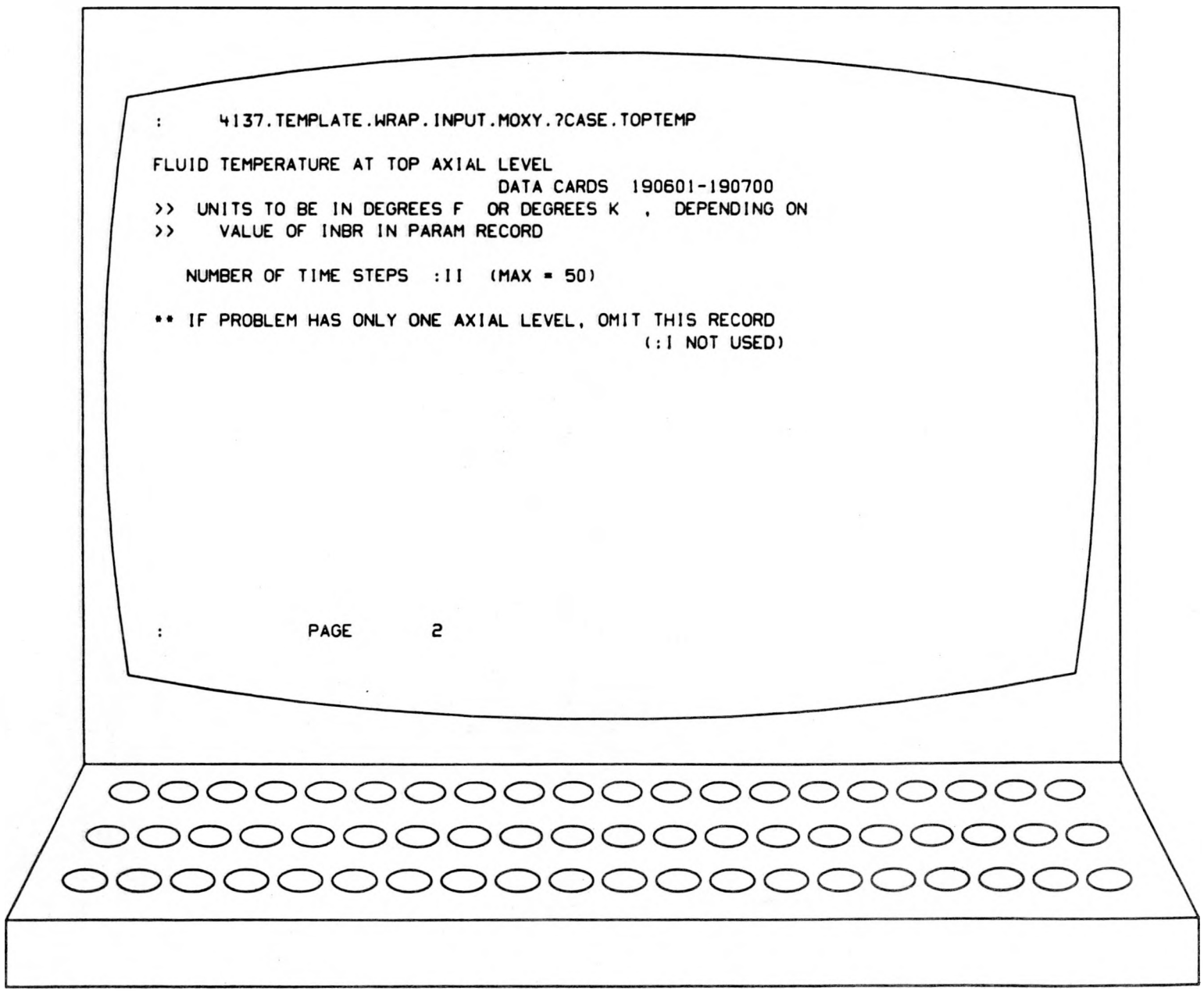

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PRESTIME
AXIAL LEVEL # :11
STEP# PRESSURE TIME STEP# PRESSURE TIME
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :FF.FFFFFFFF :FF.FFFFFFF :22 :FF.FFFFFFFF :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEE
: LASTPAGE 3

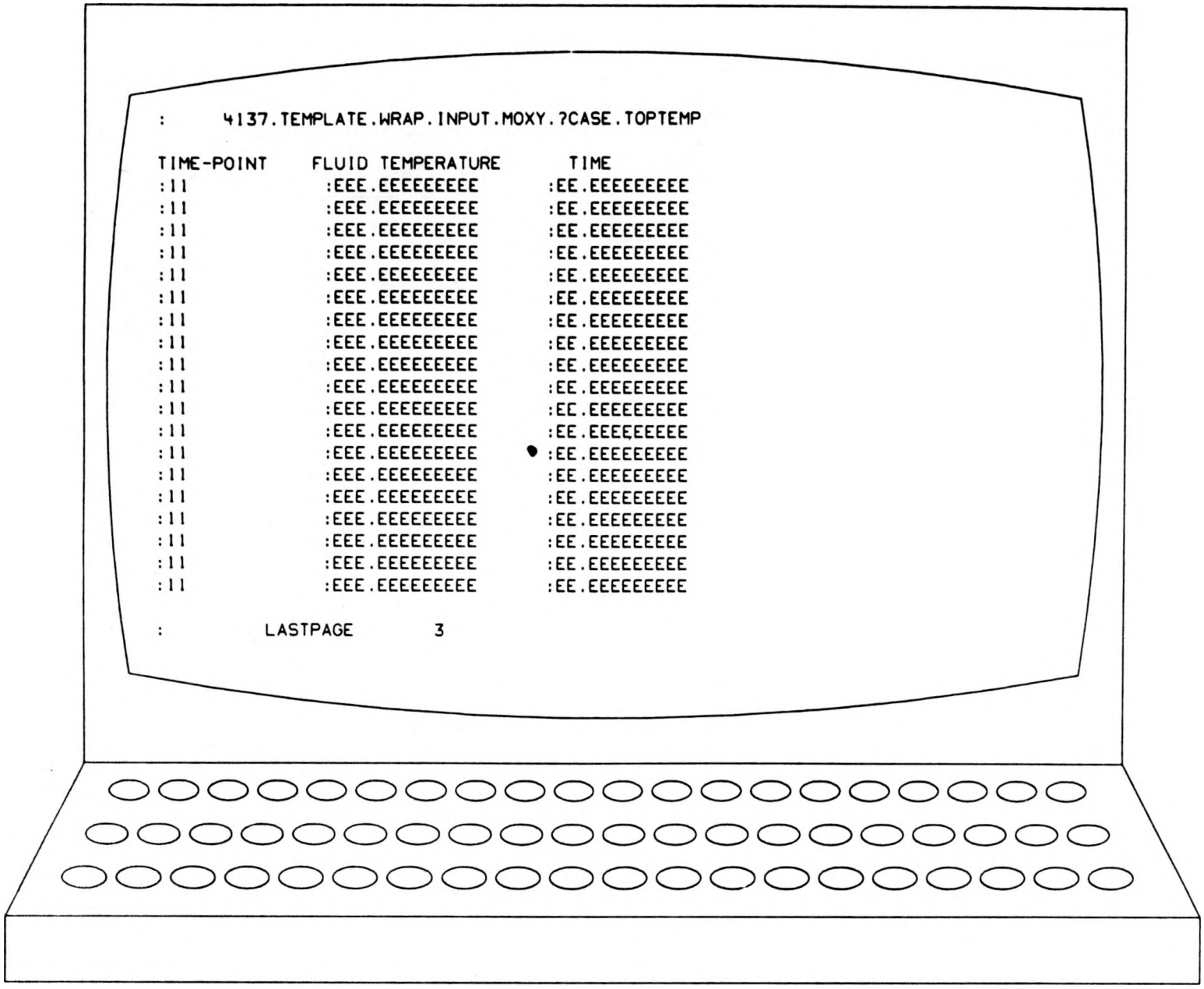

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GSVOLUME
GAS MASS AND VOLUMES FOR FUEL RODS CARDS # 190001-190100
*** OMIT IF ONLY 1 AXIAL LEVEL ****
NUMBER OF ROD ENTRIES (1, 28, OR 36) :II (:I NOT USED)
(IF ONLY 1 ENTRY MADE , ALL RODS ARE GIVEN THE SAME VALUES)
**** 190101 ****
INCREMENT TO BE ADDED TO FLUID TEMPERATURE AT TOP AXIAL LEVEL
TO GIVE FUEL ROD PLENUM TEMPERATURE
:EE.EEEEEEEEEEE (DEGREES F , K)
: PAGE 2

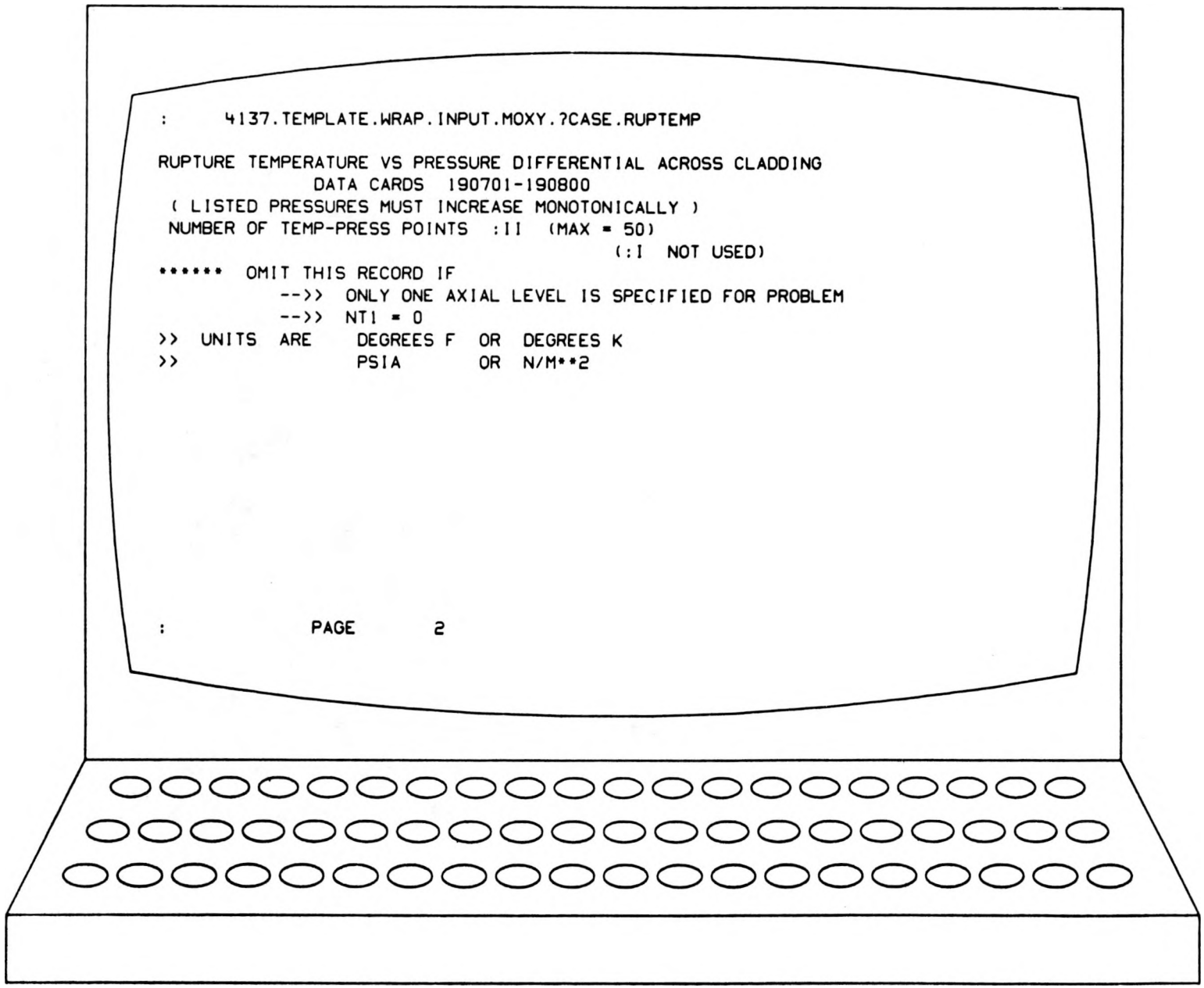

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.GSVOLUME
ROD # :11
:EEE.EEEEEEEEEE NUMBER OF GRAM-MOLES OF FISSION .
GAS IN ROD (GM-MOLE) .
:EEE.EEEEEEEEEE INITIAL FUEL PLENUM VOLUME (VPLEN) .
>> UNITS 'INCHES**3','METERS**3' << .
:EEE.EEEEEEEEEE SPRING VOLUME FOR ROD (VSP) .
>> SAME UNITS AS ABOVE << .
:EEE.EEEEEEEEEE RADIUS OF FUEL PELLET SHOULDER FOR .
AXIAL FUEL PELLET EXPANSION (RSHD) .
>> UNITS 'INCHES', 'METERS' << .
: LASTPAGE 3

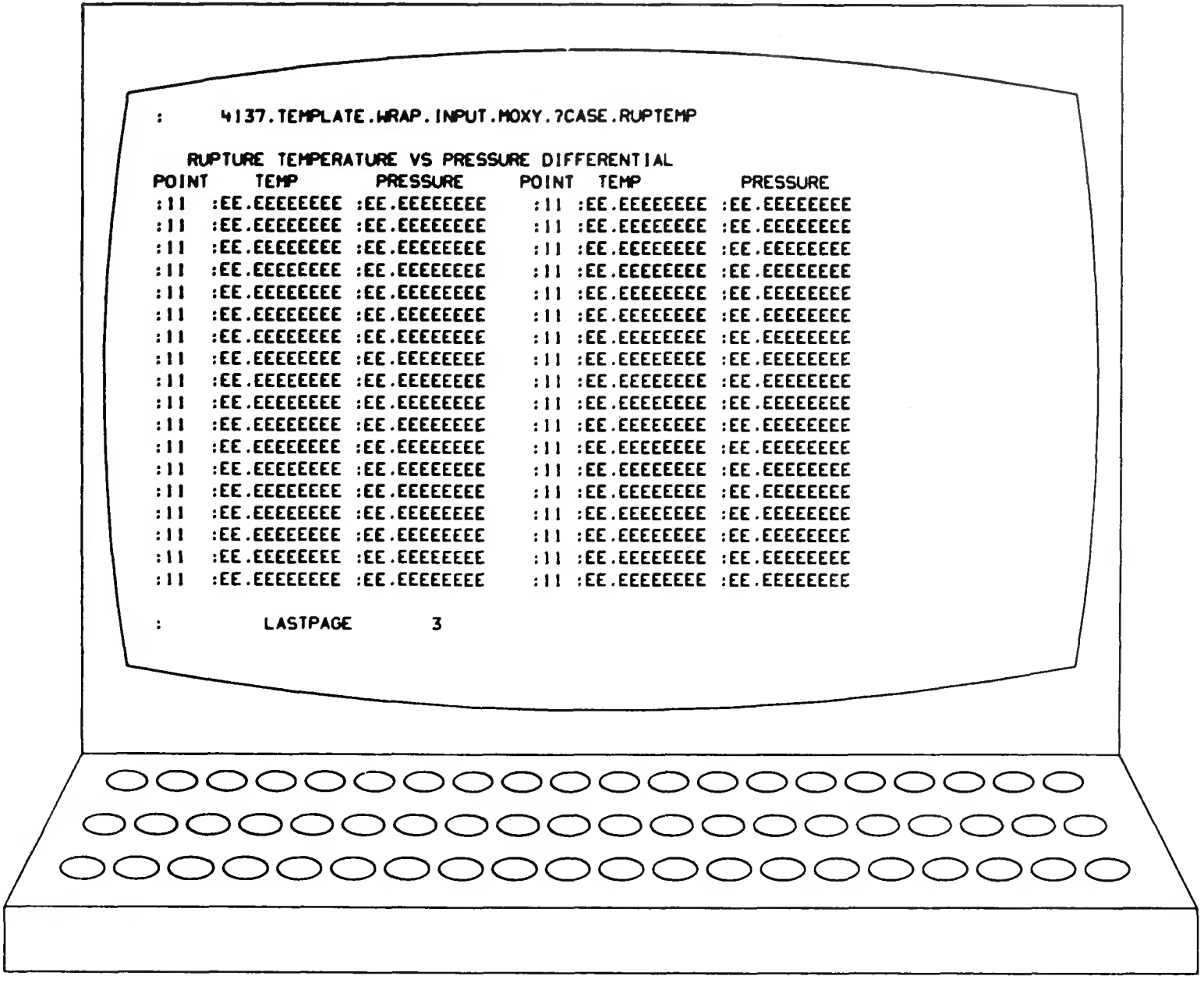

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.AXLDPDC
INITIAL ROD SWELLING AND CLADDING PLASTIC STRAIN BY AXIAL LEVEL
CARDS 190201-190600 *** IF RECORD IS NOT FOUND WHEN NEEDED,
** VALUES ARE SET TO 0.0 AS DEFAULTS. IF PROBLEM SPECIFIES ONLY
** ONE AXIAL LEVEL, THIS RECORD IS NOT READ AND MAY BE OMITTED
==>> # OF LEVELS (1-21) :I (IF .LT.NLEVELS, ALL AXIAL
LEVELS HAVE THE SAME VALUE AS AXIAL LEVEL 1 WITHIN A ROD)
==>> # OF RODS (1,28,36) :I (IF 1, ALL RODS HAVE SAME VALUES)
-> FSWELL = INITIAL FUEL SWELLING OF ROD AT AXIAL LEVEL
>> UNITS 'INCHES', 'METERS' <<
-> EPSMXR = INITIAL CLADDING PLASTIC STRAIN OF ROD AT LEVEL
: PAGE 2

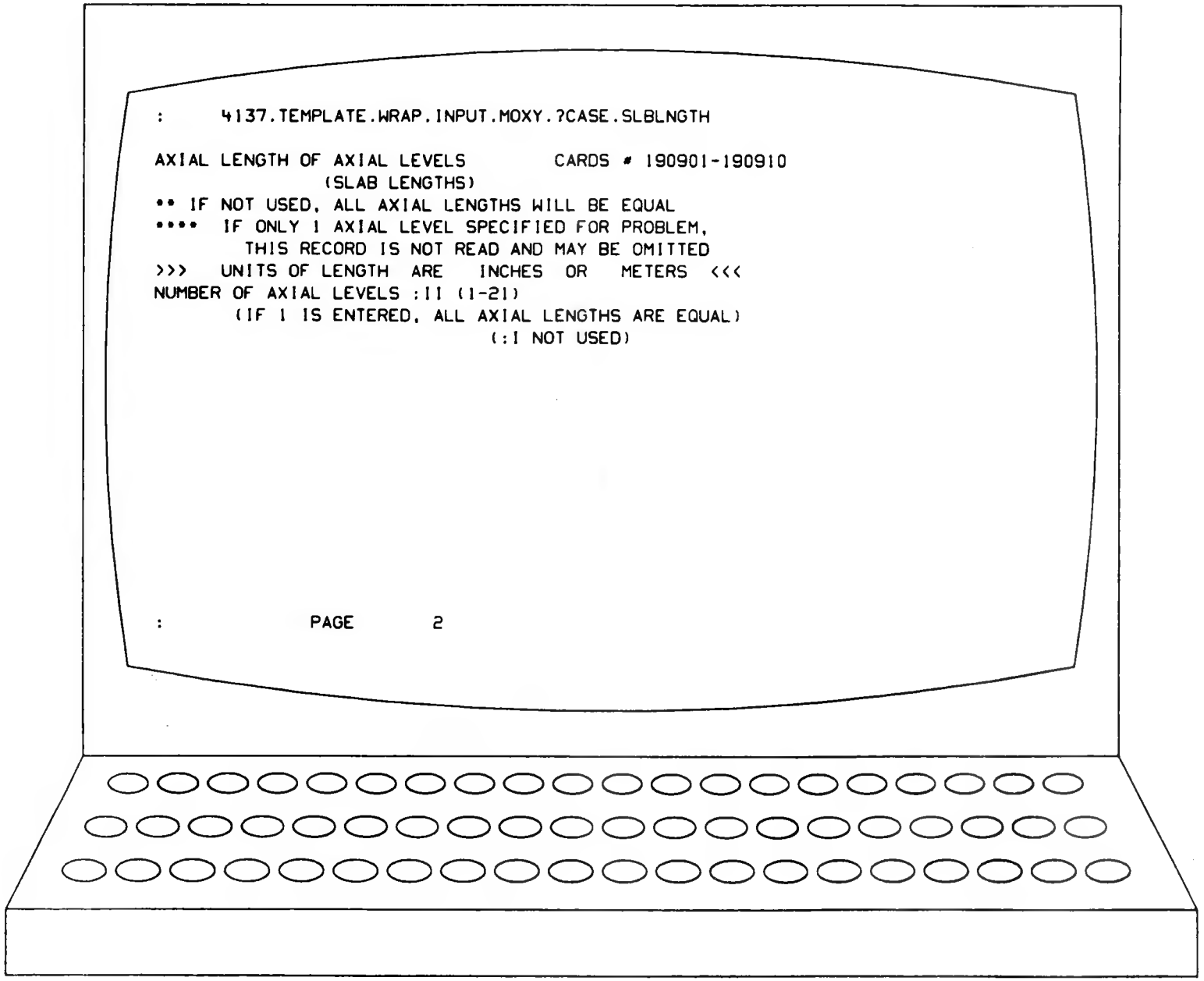

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.AXLDPDC
ROD # :11
LEVEL FSWELL EPSMXR LEVEL FSWELL EPSMXR
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
:22 :EE.EEEEEEEE :EE.EEEEEEEE :22 :EE.EEEEEEEE :EE.EEEEEEEE
: LASTPAGE 3

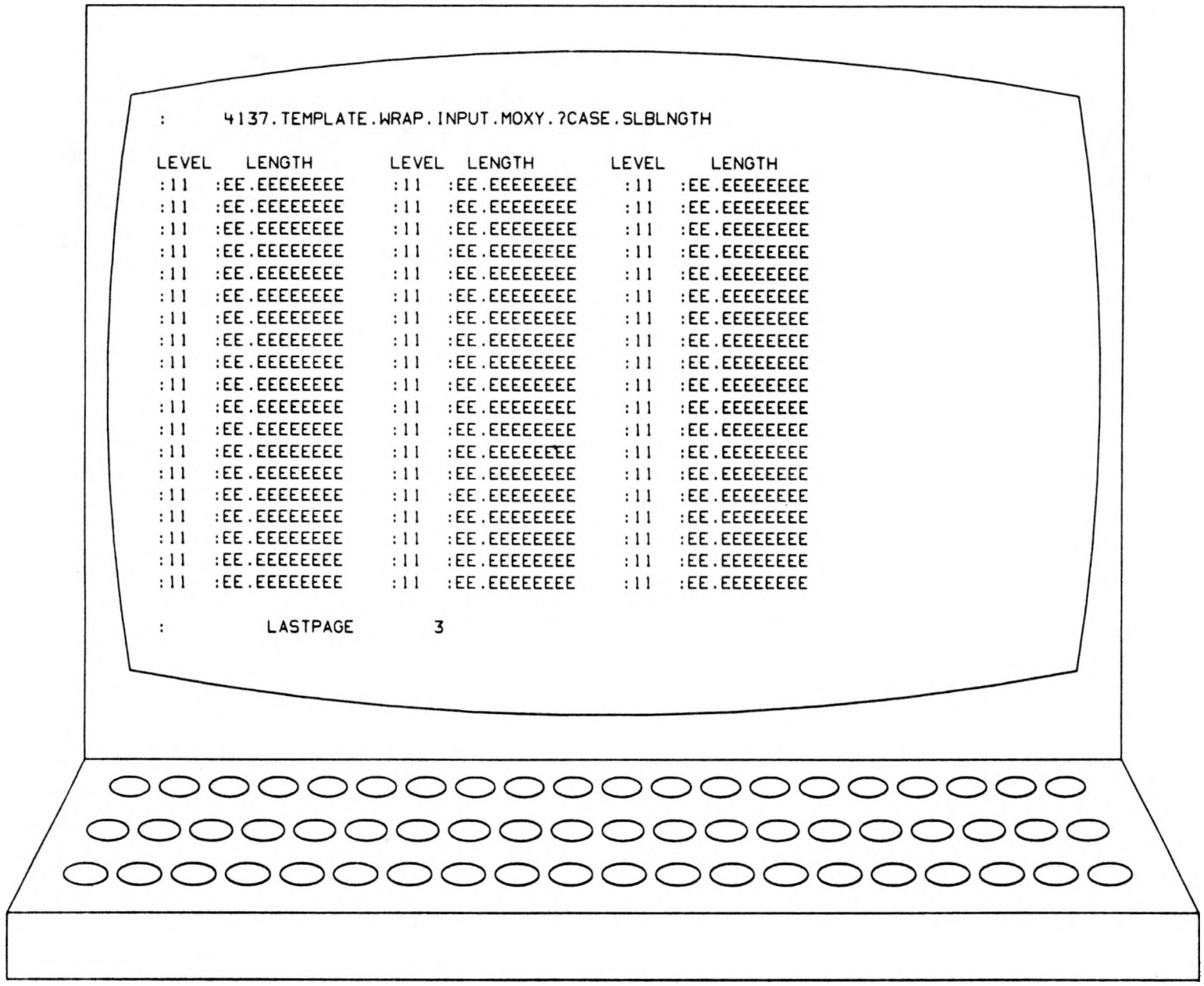

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.TOPTEMP
FLUID TEMPERATURE AT TOP AXIAL LEVEL
DATA CARDS 190601-190700
>> UNITS TO BE IN DEGREES F OR DEGREES K , DEPENDING ON
>> VALUE OF INBR IN PARAM RECORD
NUMBER OF TIME STEPS :II (MAX = 50)
** IF PROBLEM HAS ONLY ONE AXIAL LEVEL, OMIT THIS RECORD
(:I NOT USED)
: PAGE 2

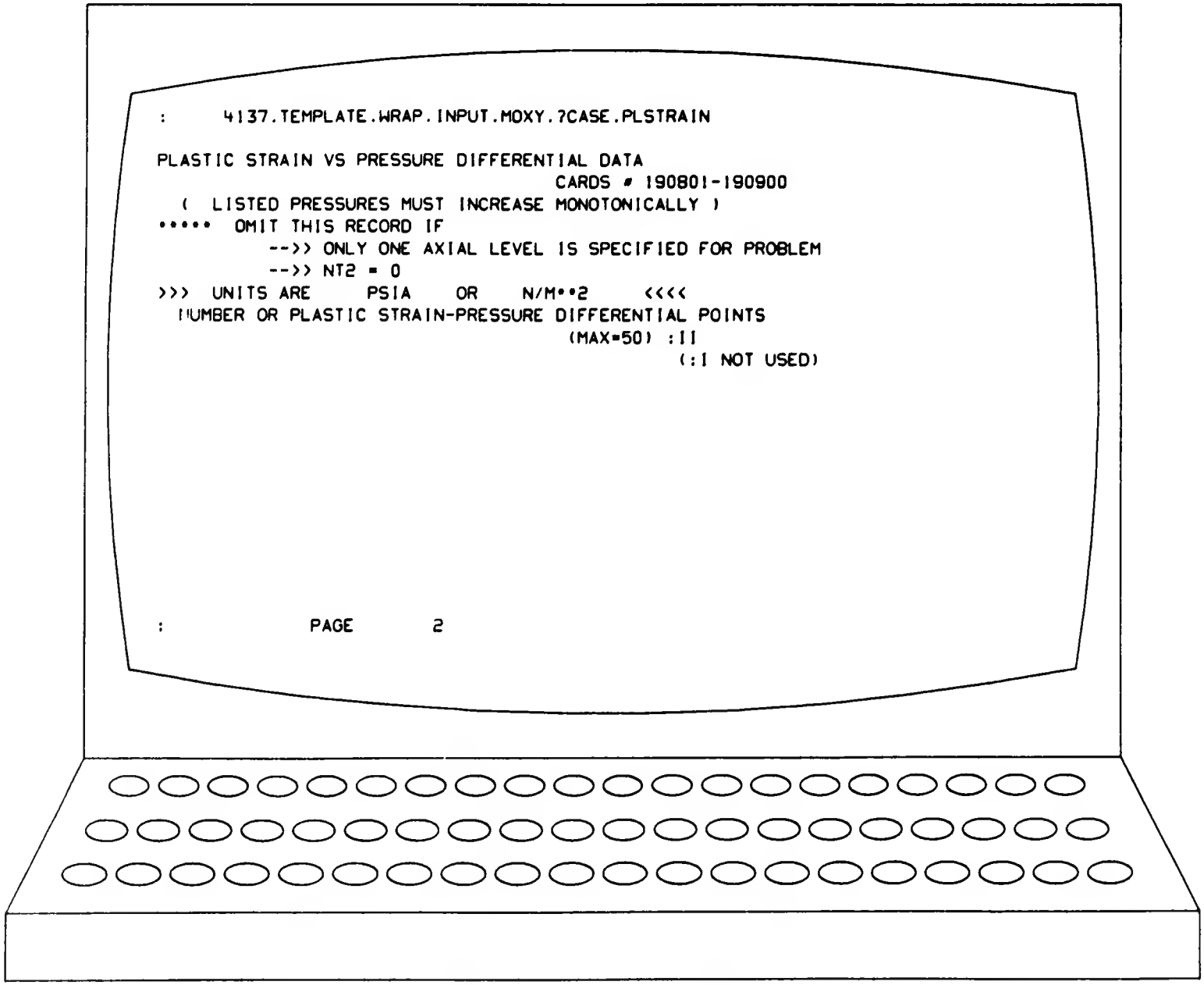

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.TOPTEMP
TIME-POINT FLUID TEMPERATURE TIME
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
:11 :EEE.EEEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 3

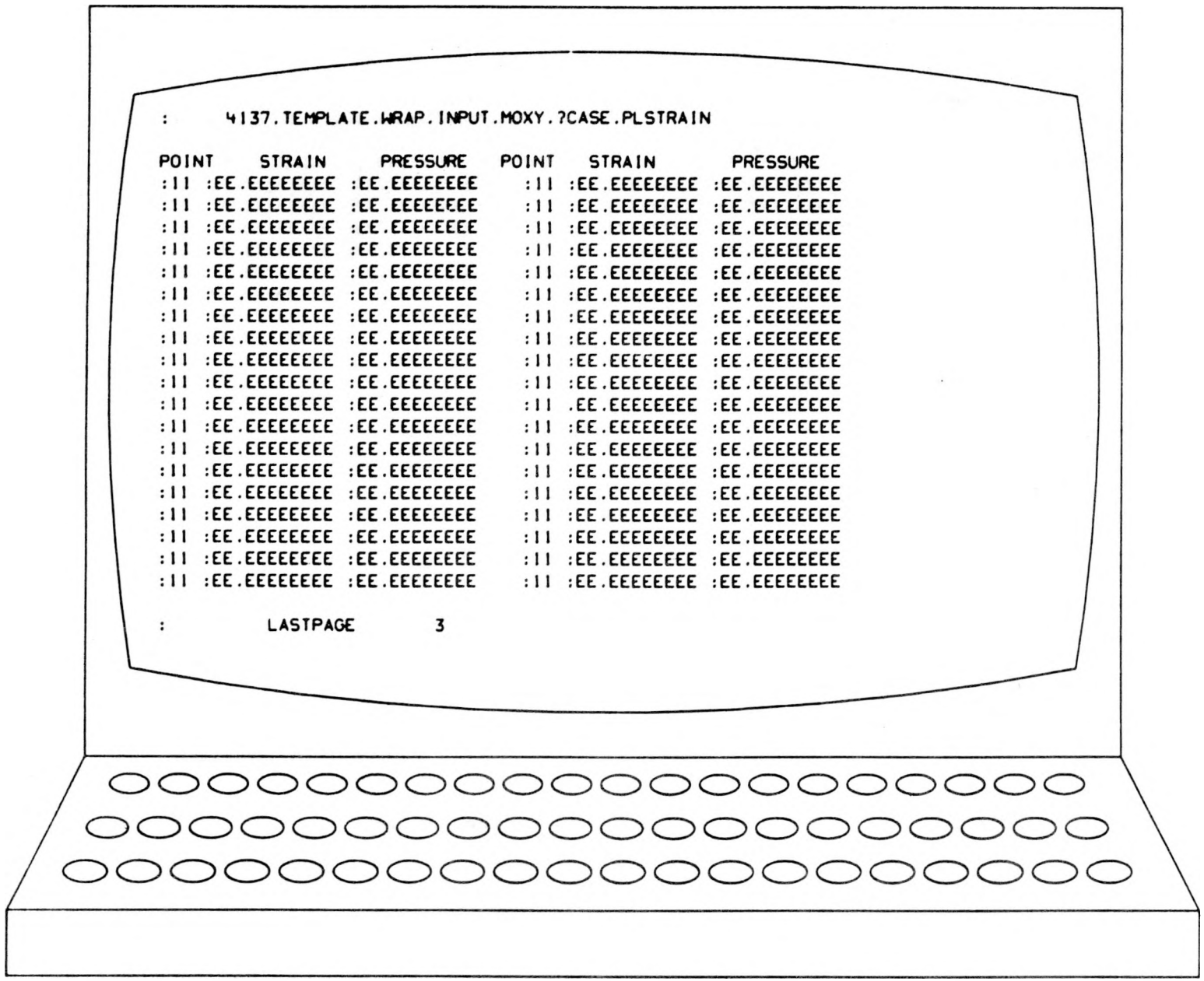

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.RUPTEMP
RUPTURE TEMPERATURE VS PRESSURE DIFFERENTIAL ACROSS CLADDING
DATA CARDS 190701-190800
(LISTED PRESSURES MUST INCREASE MONOTONICALLY)
NUMBER OF TEMP-PRESS POINTS :II (MAX = 50)
(:I NOT USED)
****** OMIT THIS RECORD IF
-->> ONLY ONE AXIAL LEVEL IS SPECIFIED FOR PROBLEM
-->> NT1 = 0
>> UNITS ARE DEGREES F OR DEGREES K
>> PSIA OR N/M**2
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.RUPTEMP
RUPTURE TEMPERATURE VS PRESSURE DIFFERENTIAL
POINT TEMP PRESSURE POINT TEMP PRESSURE
:11 :EE.EEEEEEEE :EE.EEEEEEEE :11 :EE.EEEEEEEE :EE.EEEEEEEE
: LASTPAGE 3


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SLBLNGTH
AXIAL LENGTH OF AXIAL LEVELS CARDS # 190901-190910
(SLAB LENGTHS)
** IF NOT USED, ALL AXIAL LENGTHS WILL BE EQUAL
**** IF ONLY 1 AXIAL LEVEL SPECIFIED FOR PROBLEM,
THIS RECORD IS NOT READ AND MAY BE OMITTED
>>> UNITS OF LENGTH ARE INCHES OR METERS <<<
NUMBER OF AXIAL LEVELS :11 (1-21)
(IF 1 IS ENTERED, ALL AXIAL LENGTHS ARE EQUAL)
(:1 NOT USED)
: PAGE 2


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.SLBLNGTH
LEVEL LENGTH LEVEL LENGTH LEVEL LENGTH
:11 :EE.EEEEEEEE :11 :EE.EEEEEEEE :11 :EE.EEEEEEEE
: LASTPAGE 3


: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PLSTRAIN
PLASTIC STRAIN VS PRESSURE DIFFERENTIAL DATA
CARDS # 190801-190900
(LISTED PRESSURES MUST INCREASE MONOTONICALLY)
***** OMIT THIS RECORD IF
--›› ONLY ONE AXIAL LEVEL IS SPECIFIED FOR PROBLEM
--›› NT2 = 0
››› UNITS ARE PSIA OR N/M**2 ‹‹‹‹
NUMBER OR PLASTIC STRAIN-PRESSURE DIFFERENTIAL POINTS
(MAX=50) :11
(:1 NOT USED)
: PAGE 2

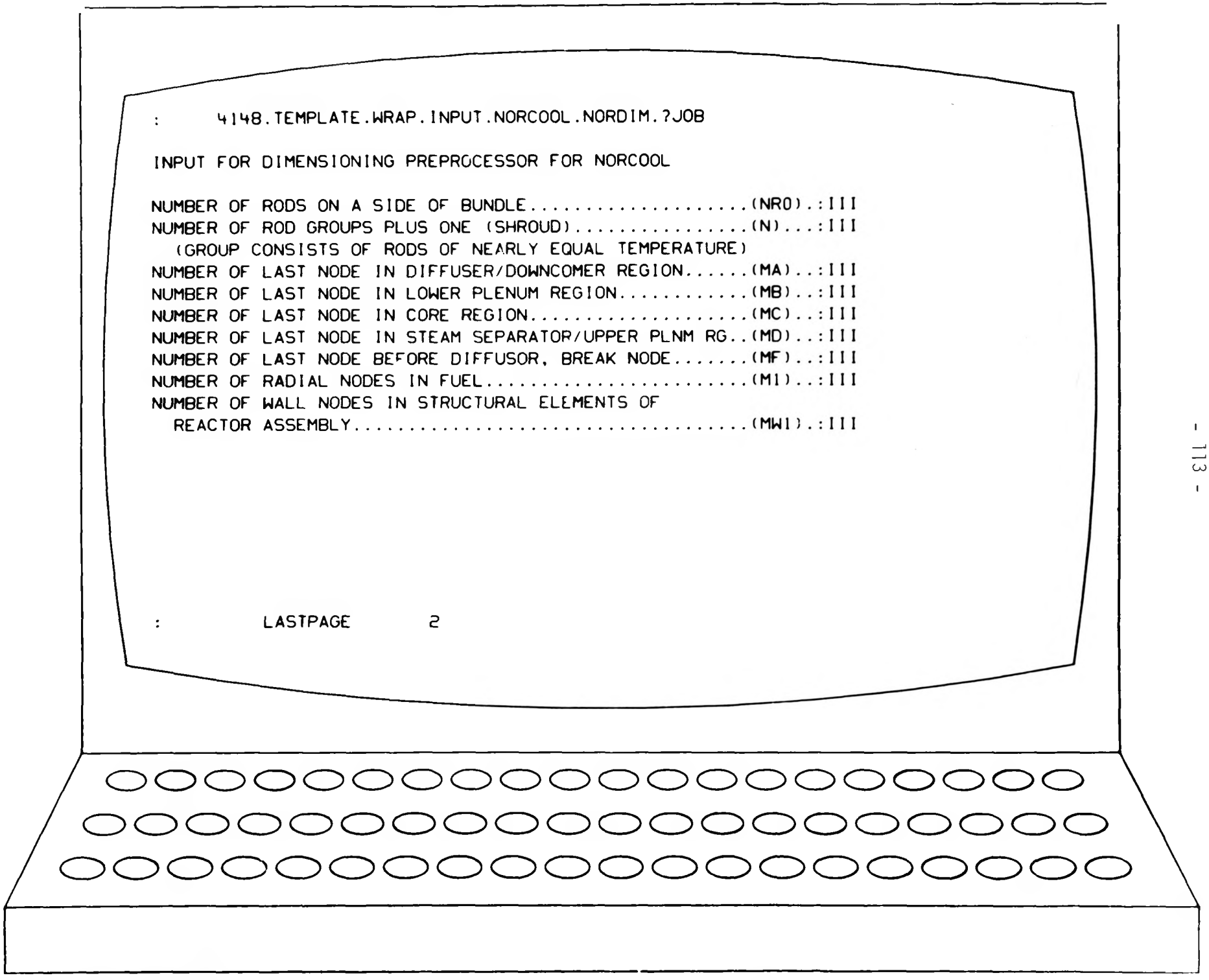

: 4137.TEMPLATE.WRAP.INPUT.MOXY.?CASE.PLSTRAIN
POINT STRAIN PRESSURE POINT STRAIN PRESSURE
:II :EE.EEEEEEEE :EE.EEEEEEEE :II :EE.EEEEEEEE :EE.EEEEEEEE
: LASTPAGE 3

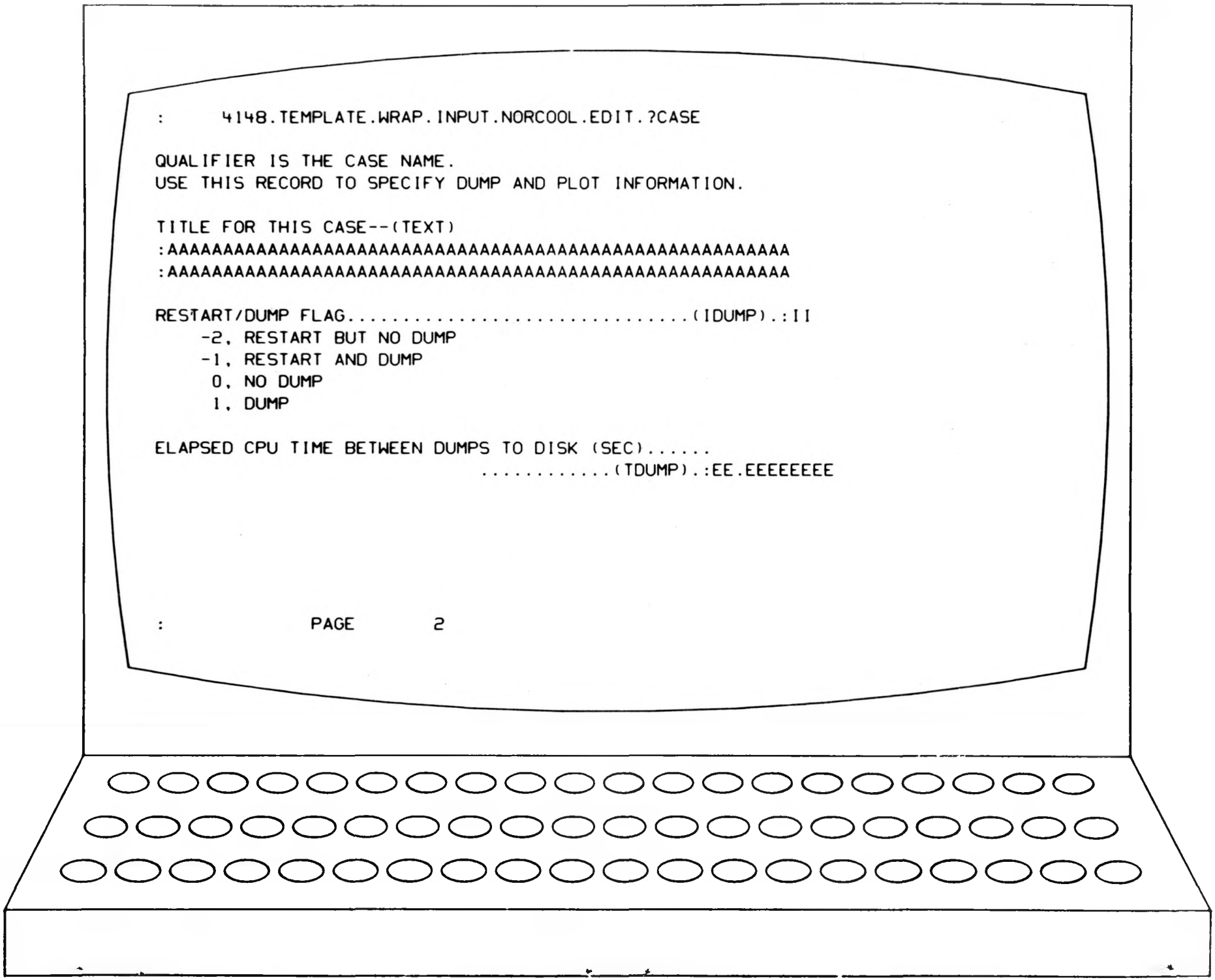
IV. NORCOOL Input Records

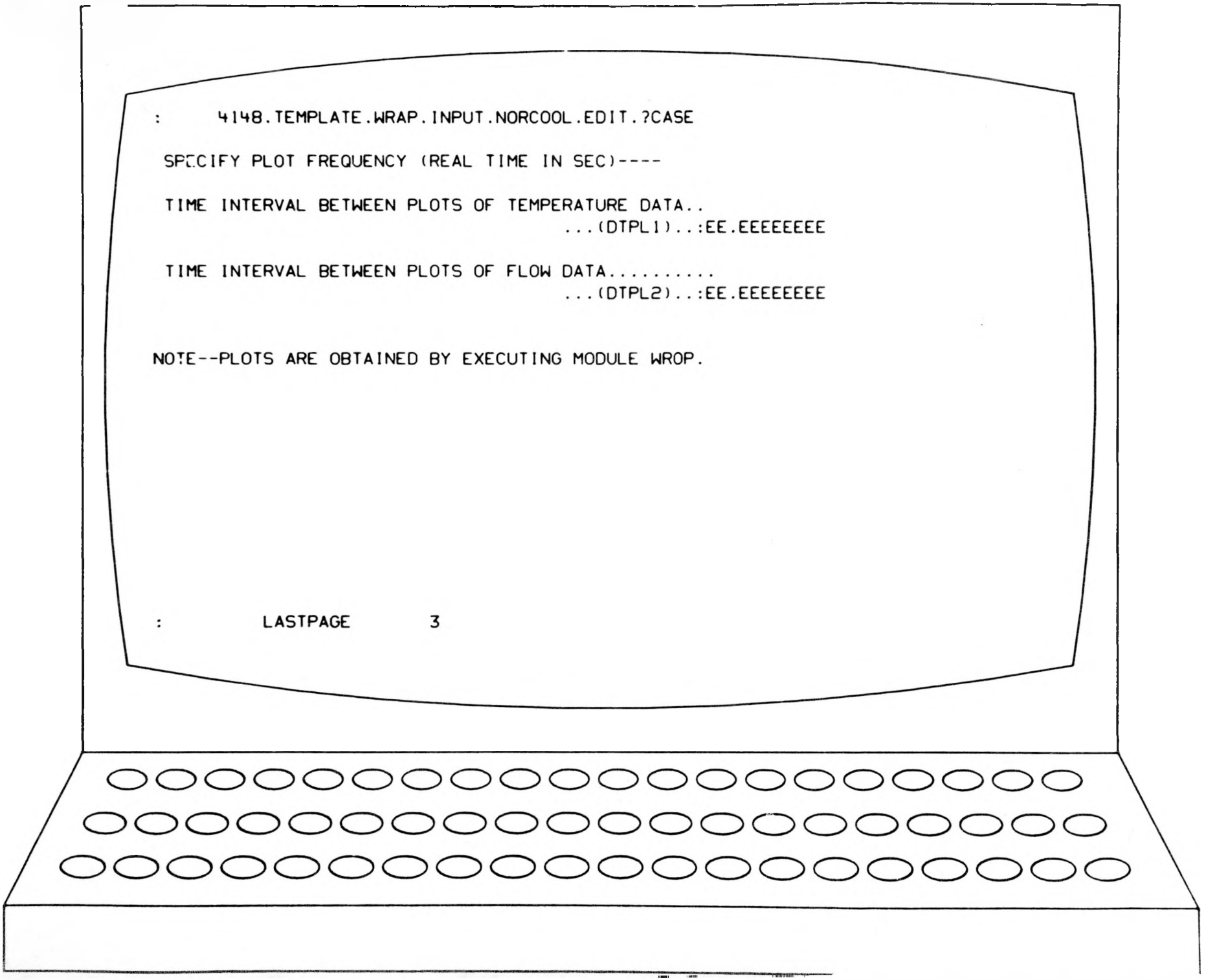
The input records required by the NORCOOL module are listed in Table II. The first record in the list is read by the NORDIM module which sets the array sizes for NORCOOL. Data for the remaining records must be supplied by the user for stand-alone execution of NORCOOL; however, when NORCOOL is executed in the WRAP-EM modular path, most of the data for these records is created from WIDS by the INTNOR module (see Section V.d.). Templates for the NORCOOL records are presented in pp. 113-157.

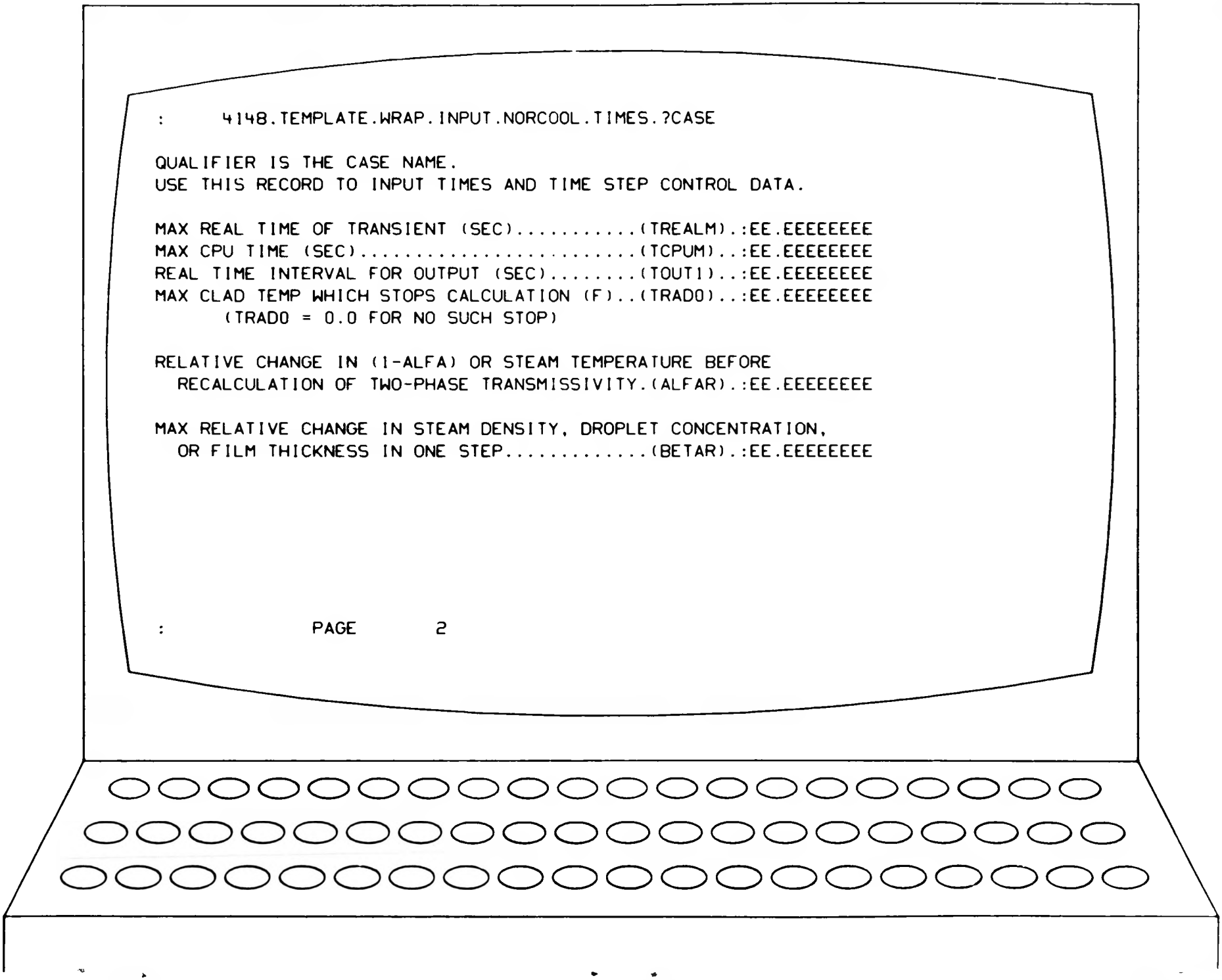
Table II. List of NORCOOL Input Records

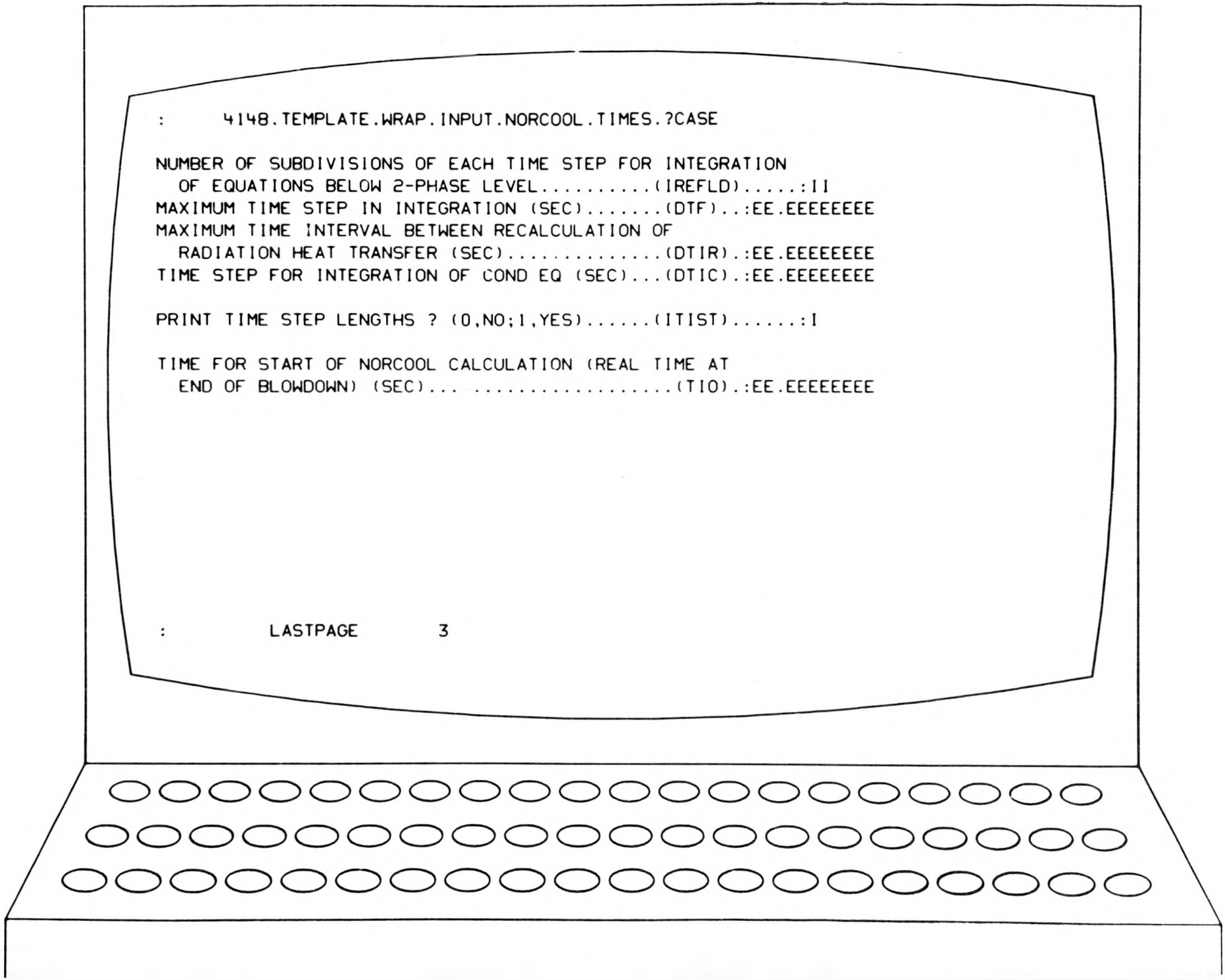
```
WRAP.INPUT.NORCOOL.NORDIM.?JOB
WRAP.INPUT.NORCOOL.EDIT    .?CASE
WRAP.INPUT.NORCOOL.TIMES   .?CASE
WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
WRAP.INPUT.NORCOOL.NODEDATA.?CASE
WRAP.INPUT.NORCOOL.PERIMETR.?CASE
WRAP.INPUT.NORCOOL.FLOWDATA.?CASE
WRAP.INPUT.NORCOOL.REGDATA .?CASE
WRAP.INPUT.NORCOOL.DRYPRESS.?CASE
WRAP.INPUT.NORCOOL.PARAM   .?CASE
WRAP.INPUT.NORCOOL.RODDATA .?CASE
WRAP.INPUT.NORCOOL.TCLAD   .?CASE
WRAP.INPUT.NORCOOL.POWER   .?CASE
WRAP.INPUT.NORCOOL.SPRAY   .?CASE
```

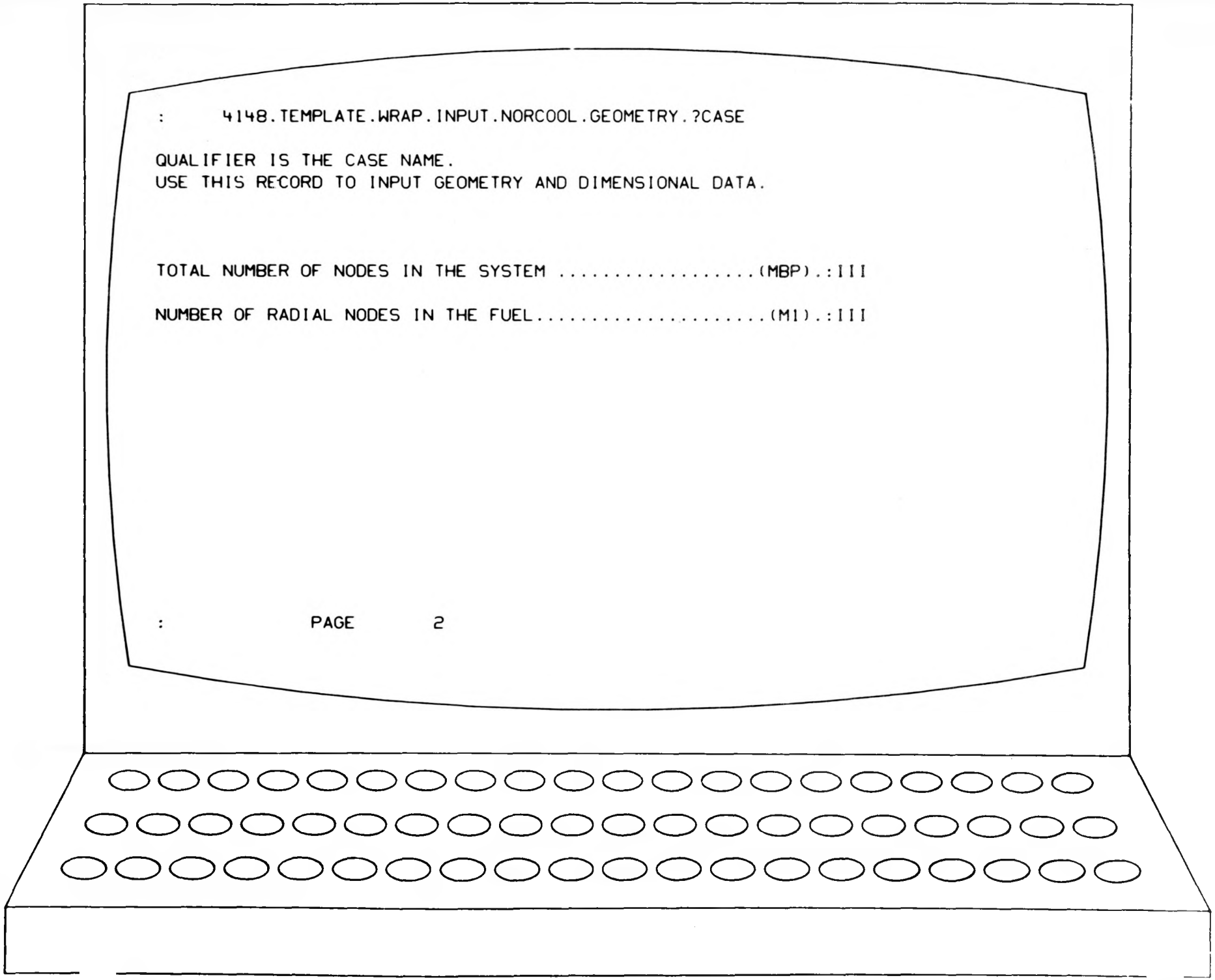

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.NORDIM.?JOB
INPUT FOR DIMENSIONING PREPROCESSOR FOR NORCOOL
NUMBER OF RODS ON A SIDE OF BUNDLE.....(NRO).:III
NUMBER OF ROD GROUPS PLUS ONE (SHROUD).....(N)...:III
(GROUP CONSISTS OF RODS OF NEARLY EQUAL TEMPERATURE)
NUMBER OF LAST NODE IN DIFFUSER/DOWNCOMER REGION.....(MA)..:III
NUMBER OF LAST NODE IN LOWER PLENUM REGION.....(MB)..:III
NUMBER OF LAST NODE IN CORE REGION.....(MC)..:III
NUMBER OF LAST NODE IN STEAM SEPARATOR/UPPER PLNM RG..(MD)..:III
NUMBER OF LAST NODE BEFORE DIFFUSOR, BREAK NODE.....(MF)..:III
NUMBER OF RADIAL NODES IN FUEL.....(M1)..:III
NUMBER OF WALL NODES IN STRUCTURAL ELEMENTS OF
REACTOR ASSEMBLY.....(MW1).:III
: LASTPAGE 2

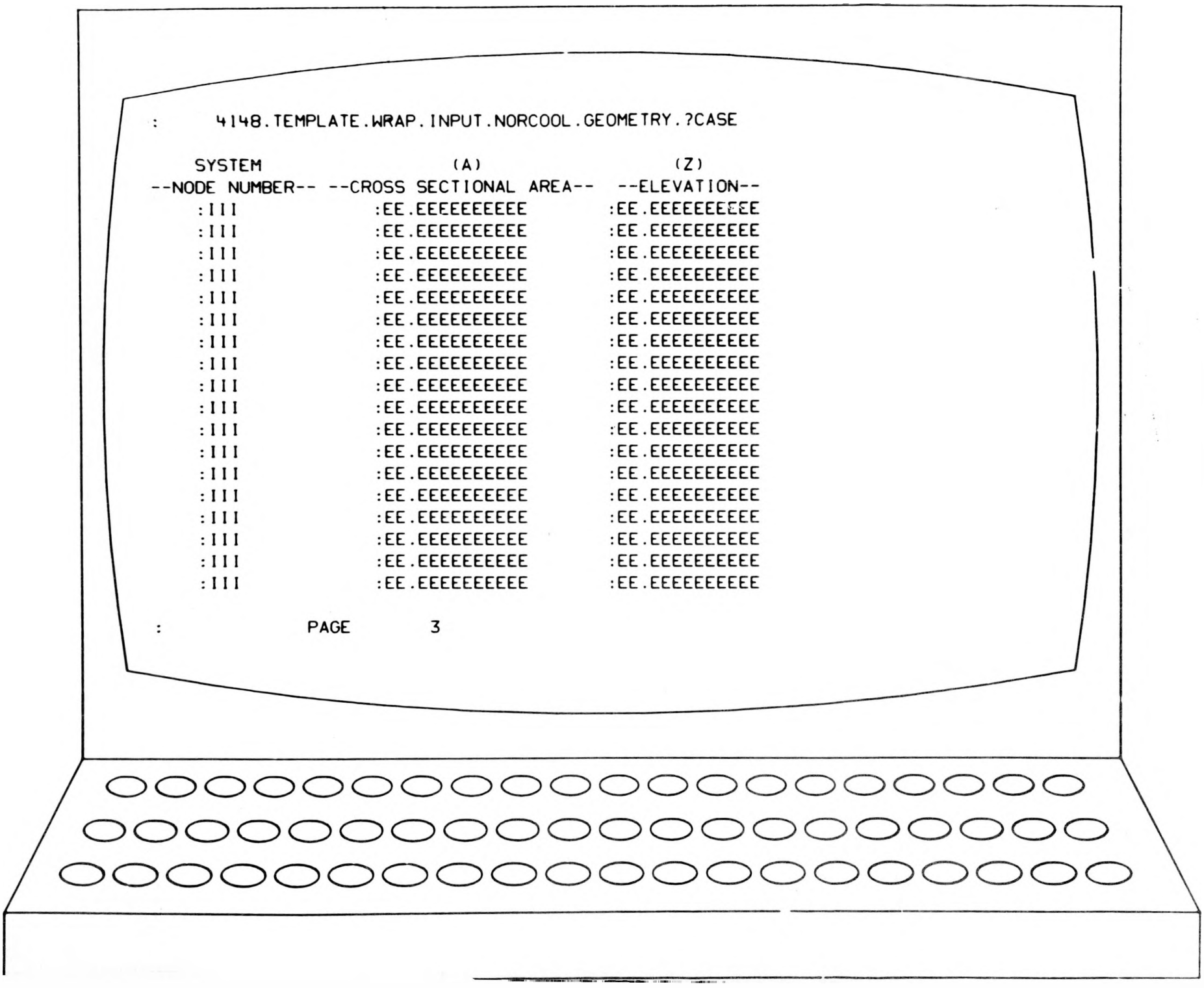

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.EDIT.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO SPECIFY DUMP AND PLOT INFORMATION.
TITLE FOR THIS CASE--(TEXT)
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
RESTART/DUMP FLAG.....(IDUMP).:II
-2, RESTART BUT NO DUMP
-1, RESTART AND DUMP
0, NO DUMP
1, DUMP
ELAPSED CPU TIME BETWEEN DUMPS TO DISK (SEC).....
.....(TDUMP).:EE.EEEEEEEE
: PAGE 2

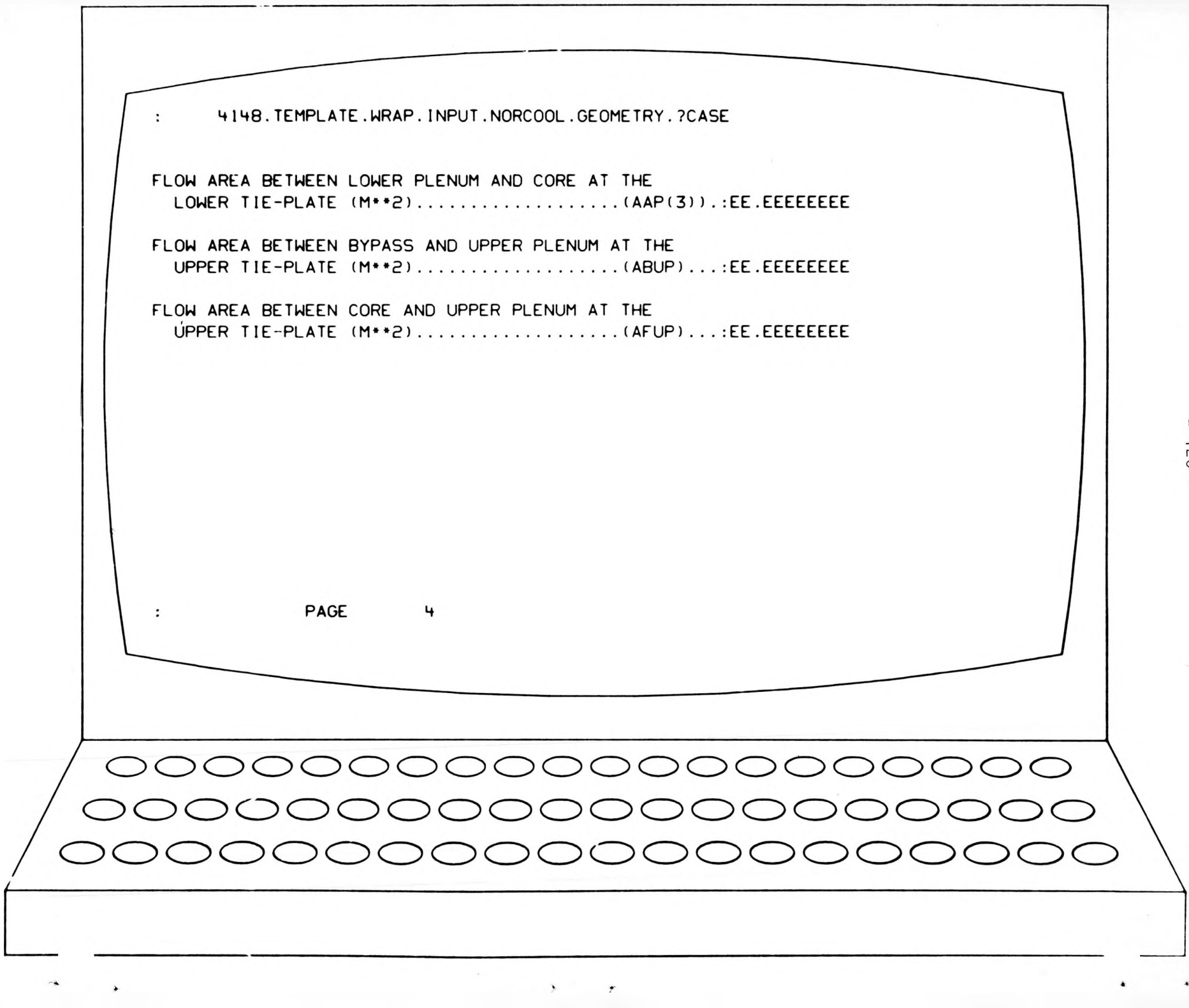

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.EDIT.?CASE
SPECIFY PLOT FREQUENCY (REAL TIME IN SEC)----
TIME INTERVAL BETWEEN PLOTS OF TEMPERATURE DATA..
...(DTPL1)..:EE.EEEEEEEE
TIME INTERVAL BETWEEN PLOTS OF FLOW DATA.....
...(DTPL2)..:EE.EEEEEEEE
NOTE--PLOTS ARE OBTAINED BY EXECUTING MODULE WROP.
: LASTPAGE 3

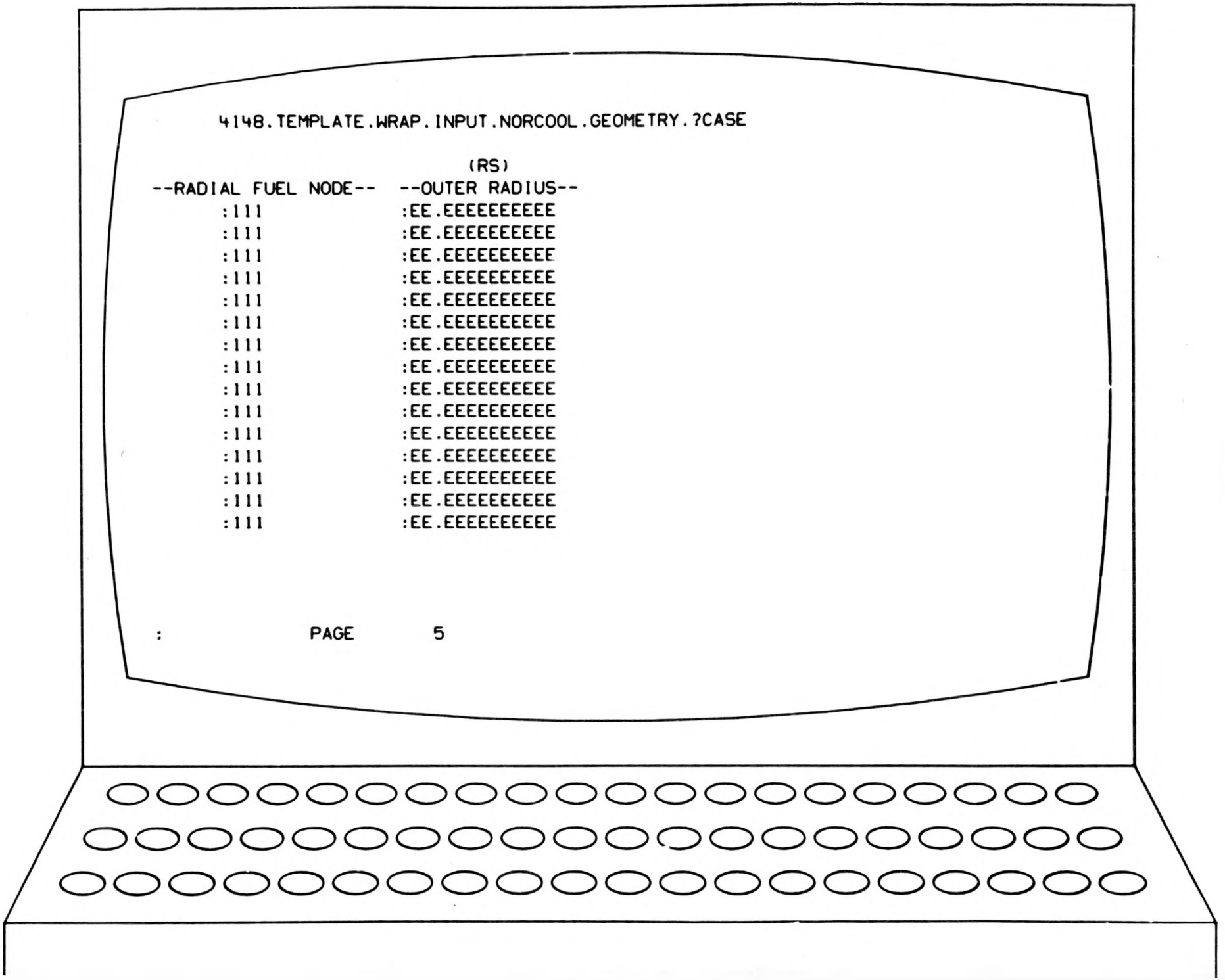

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.TIMES.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT TIMES AND TIME STEP CONTROL DATA.
MAX REAL TIME OF TRANSIENT (SEC).....(TREALM).:EE.EEEEEEEE
MAX CPU TIME (SEC).....(TCPUM)..:EE.EEEEEEEE
REAL TIME INTERVAL FOR OUTPUT (SEC).....(TOUT1)..:EE.EEEEEEEE
MAX CLAD TEMP WHICH STOPS CALCULATION (F)..(TRAD0)..:EE.EEEEEEEE
(TRAD0 = 0.0 FOR NO SUCH STOP)
RELATIVE CHANGE IN (1-ALFA) OR STEAM TEMPERATURE BEFORE
RECALCULATION OF TWO-PHASE TRANSMISSIVITY.(ALFAR).:EE.EEEEEEEE
MAX RELATIVE CHANGE IN STEAM DENSITY, DROPLET CONCENTRATION,
OR FILM THICKNESS IN ONE STEP.....(BETAR).:EE.EEEEEEEE
: PAGE 2

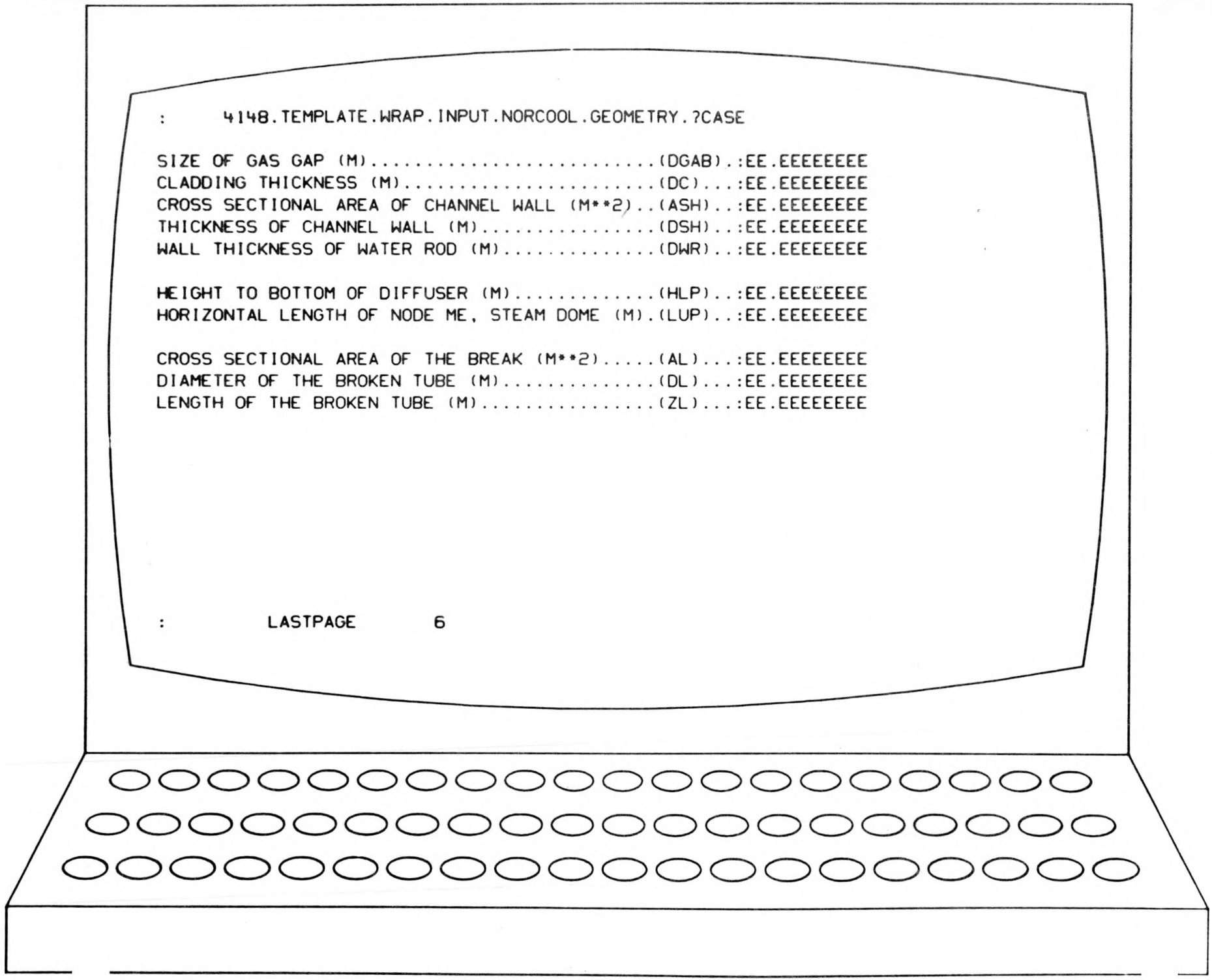

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.TIMES.?CASE
NUMBER OF SUBDIVISIONS OF EACH TIME STEP FOR INTEGRATION
OF EQUATIONS BELOW 2-PHASE LEVEL.....(IREFLD).....:II
MAXIMUM TIME STEP IN INTEGRATION (SEC).....(DTF)..:EE.EEEEEEEE
MAXIMUM TIME INTERVAL BETWEEN RECALCULATION OF
RADIATION HEAT TRANSFER (SEC).....(DTIR).:EE.EEEEEEEE
TIME STEP FOR INTEGRATION OF COND EQ (SEC)...(DTIC).:EE.EEEEEEEE
PRINT TIME STEP LENGTHS ? (0,NO;1,YES).....(ITIST).....:I
TIME FOR START OF NORCOOL CALCULATION (REAL TIME AT
END OF BLOWDOWN) (SEC)... .....(TIO).:EE.EEEEEEEE
: LASTPAGE 3

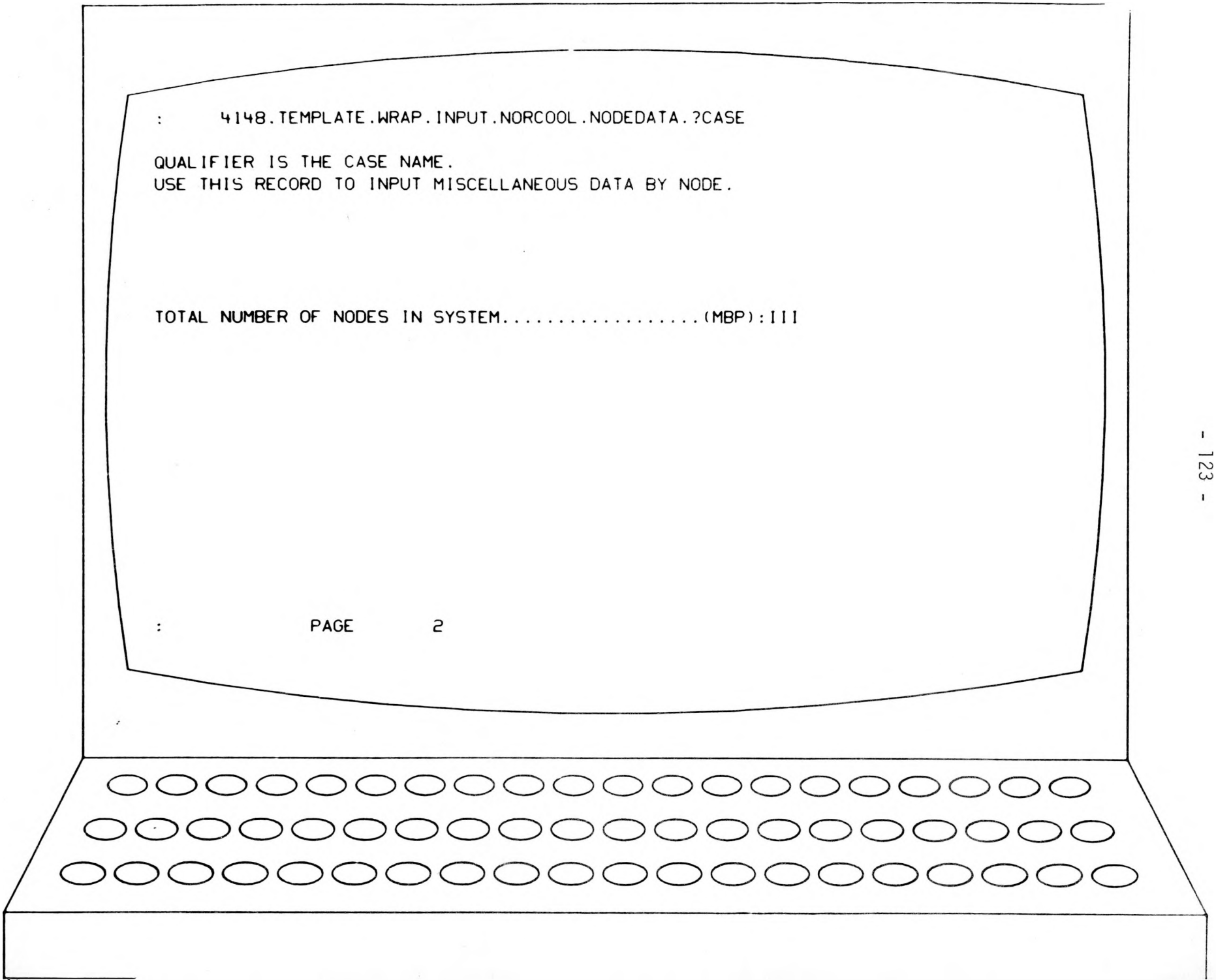

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT GEOMETRY AND DIMENSIONAL DATA.
TOTAL NUMBER OF NODES IN THE SYSTEM .....(MBP).:III
NUMBER OF RADIAL NODES IN THE FUEL.....(M1).:III
: PAGE 2

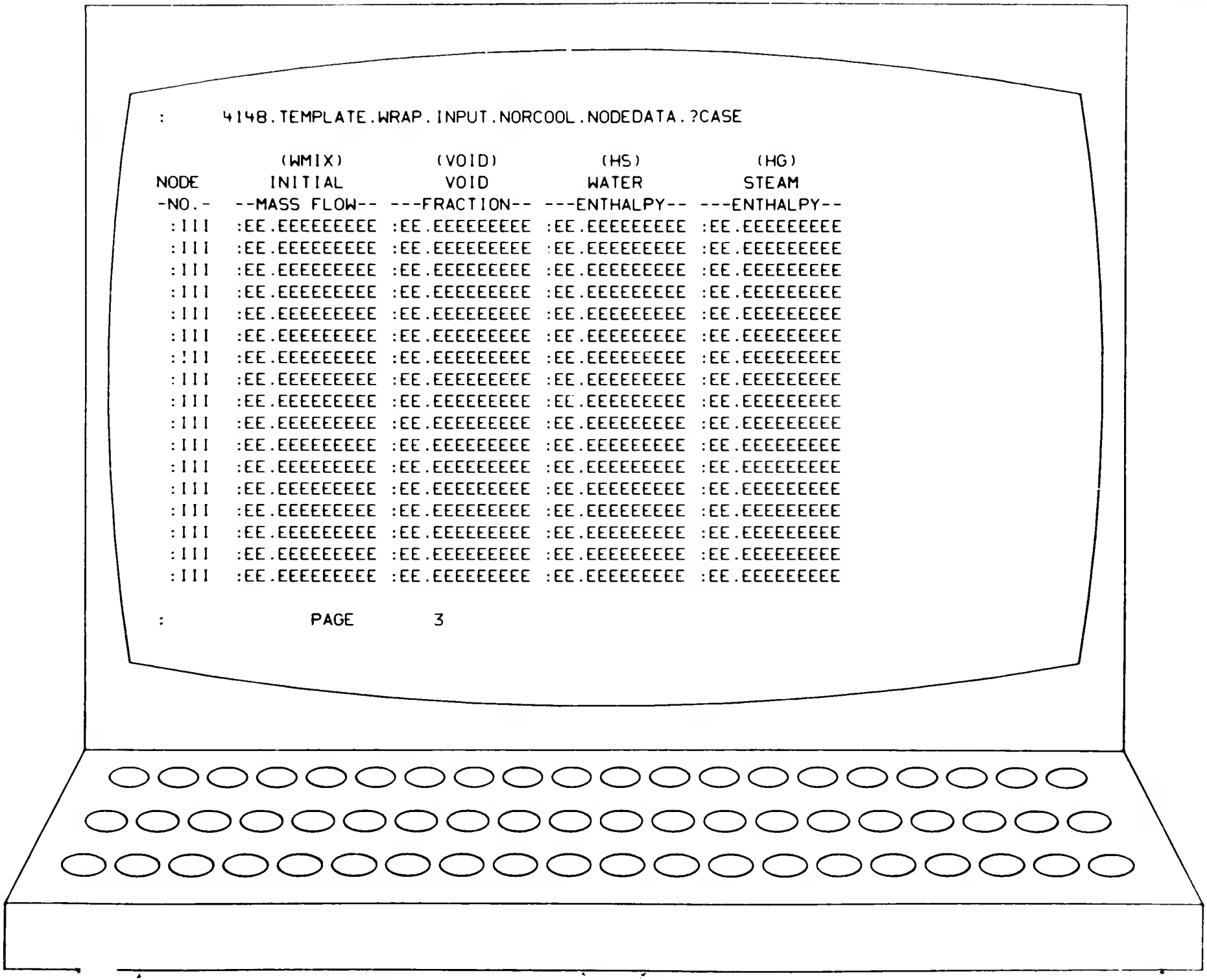

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
SYSTEM (A) (Z)
--NODE NUMBER-- --CROSS SECTIONAL AREA-- --ELEVATION--
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
:III :EE.EEEEEEEEE :EE.EEEEEEEEE
: PAGE 3

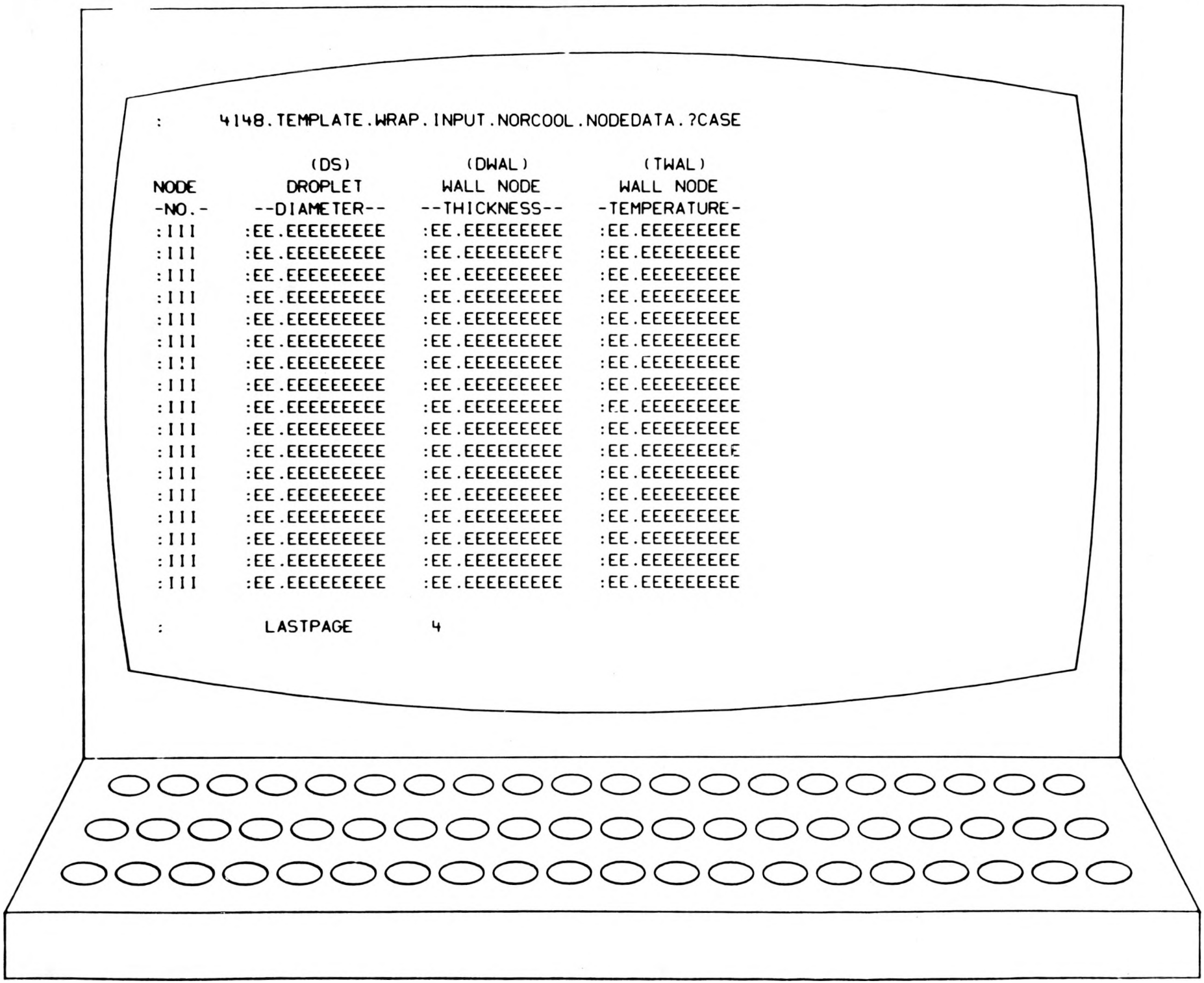

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
FLOW AREA BETWEEN LOWER PLENUM AND CORE AT THE
LOWER TIE-PLATE (M**2).....(AAP(3)).:EE.EEEEEEEE
FLOW AREA BETWEEN BYPASS AND UPPER PLENUM AT THE
UPPER TIE-PLATE (M**2).....(ABUP)...:EE.EEEEEEEE
FLOW AREA BETWEEN CORE AND UPPER PLENUM AT THE
UPPER TIE-PLATE (M**2).....(AFUP)...:EE.EEEEEEEE
: PAGE 4

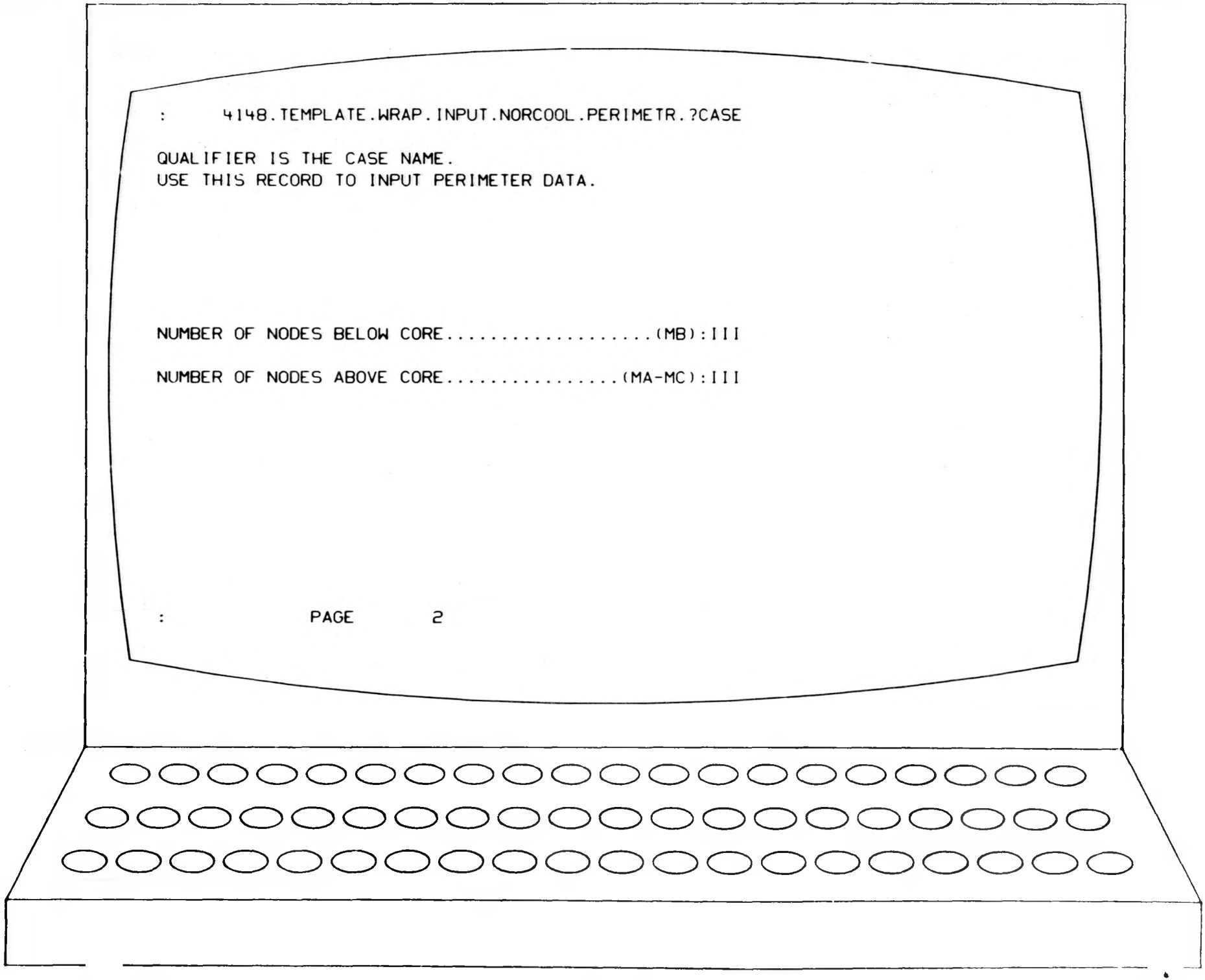

4148.TEMPLATE.WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
(RS)
--RADIAL FUEL NODE-- --OUTER RADIUS--
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:
PAGE 5

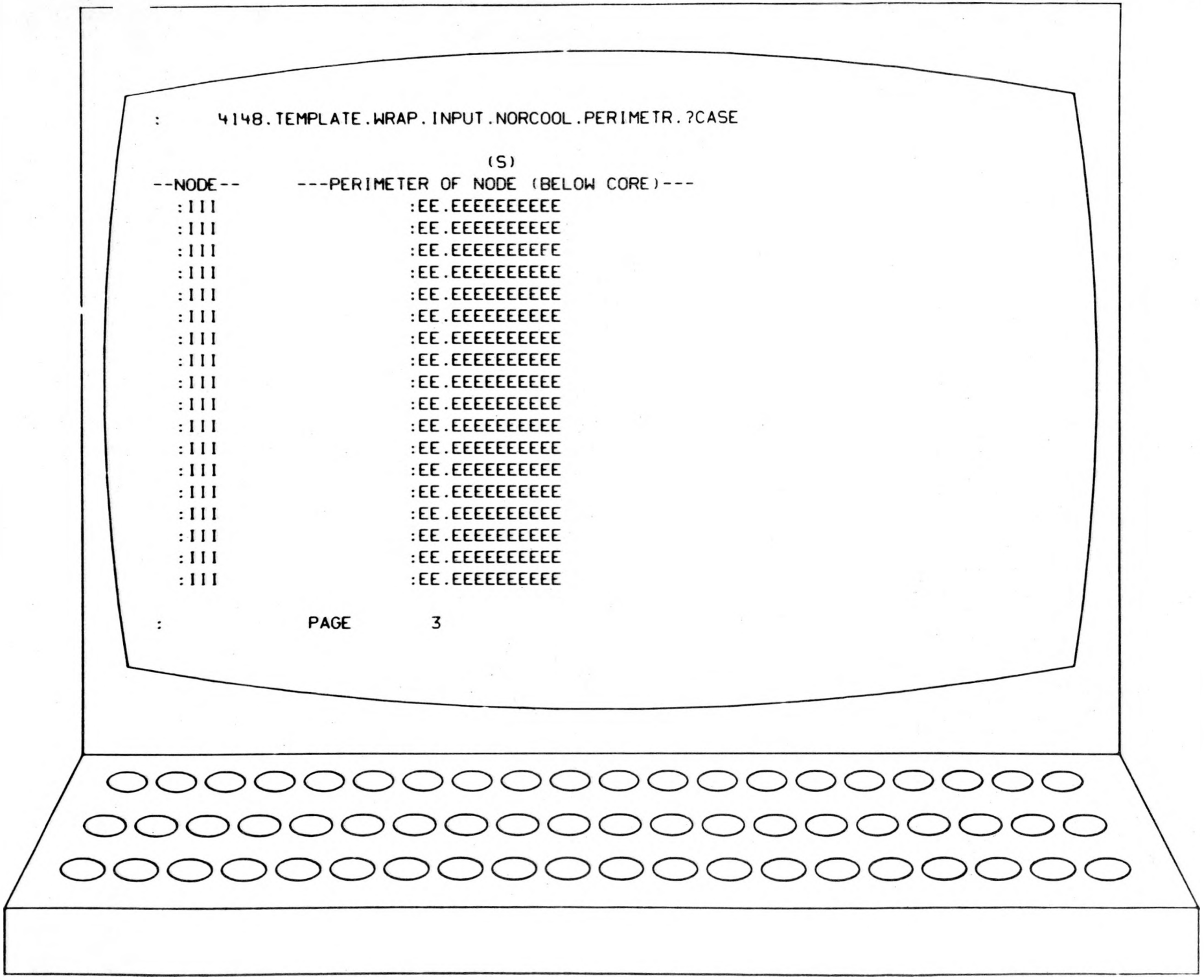

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.GEOMETRY.?CASE
SIZE OF GAS GAP (M).....(DGAB).:EE.EEEEEEEE
CLADDING THICKNESS (M).....(DC)...:EE.EEEEEEEE
CROSS SECTIONAL AREA OF CHANNEL WALL (M**2)..(ASH)..:EE.EEEEEEEE
THICKNESS OF CHANNEL WALL (M).....(DSH)..:EE.EEEEEEEE
WALL THICKNESS OF WATER ROD (M).....(DWR)..:EE.EEEEEEEE
HEIGHT TO BOTTOM OF DIFFUSER (M).....(HLP)..:EE.EEEEEEEE
HORIZONTAL LENGTH OF NODE ME, STEAM DOME (M).(LUP)..:EE.EEEEEEEE
CROSS SECTIONAL AREA OF THE BREAK (M**2).....(AL)...:EE.EEEEEEEE
DIAMETER OF THE BROKEN TUBE (M).....(DL)...:EE.EEEEEEEE
LENGTH OF THE BROKEN TUBE (M).....(ZL)...:EE.EEEEEEEE
: LASTPAGE 6

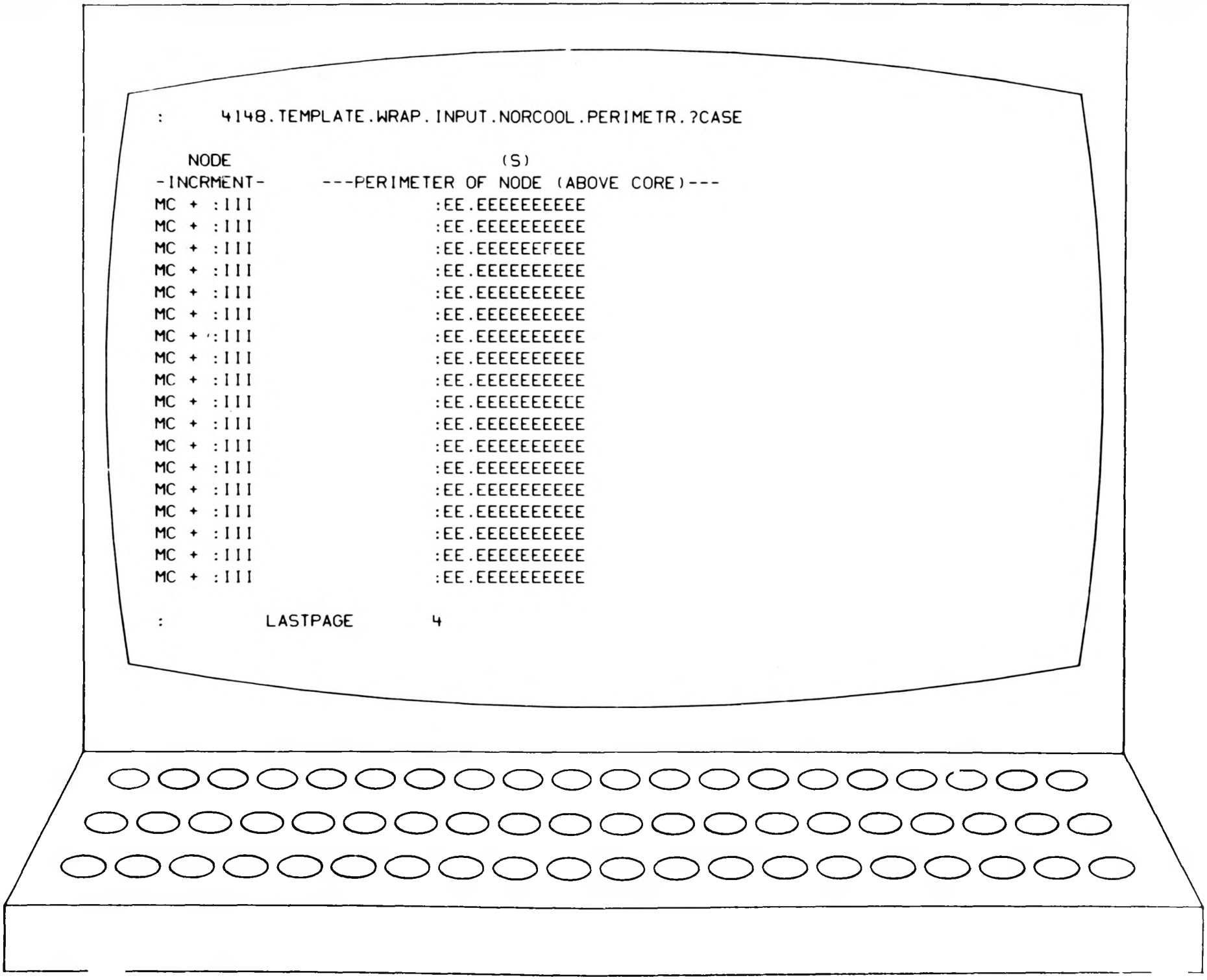

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.NODEDATA.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT MISCELLANEOUS DATA BY NODE.
TOTAL NUMBER OF NODES IN SYSTEM.....(MBP):III
: PAGE 2

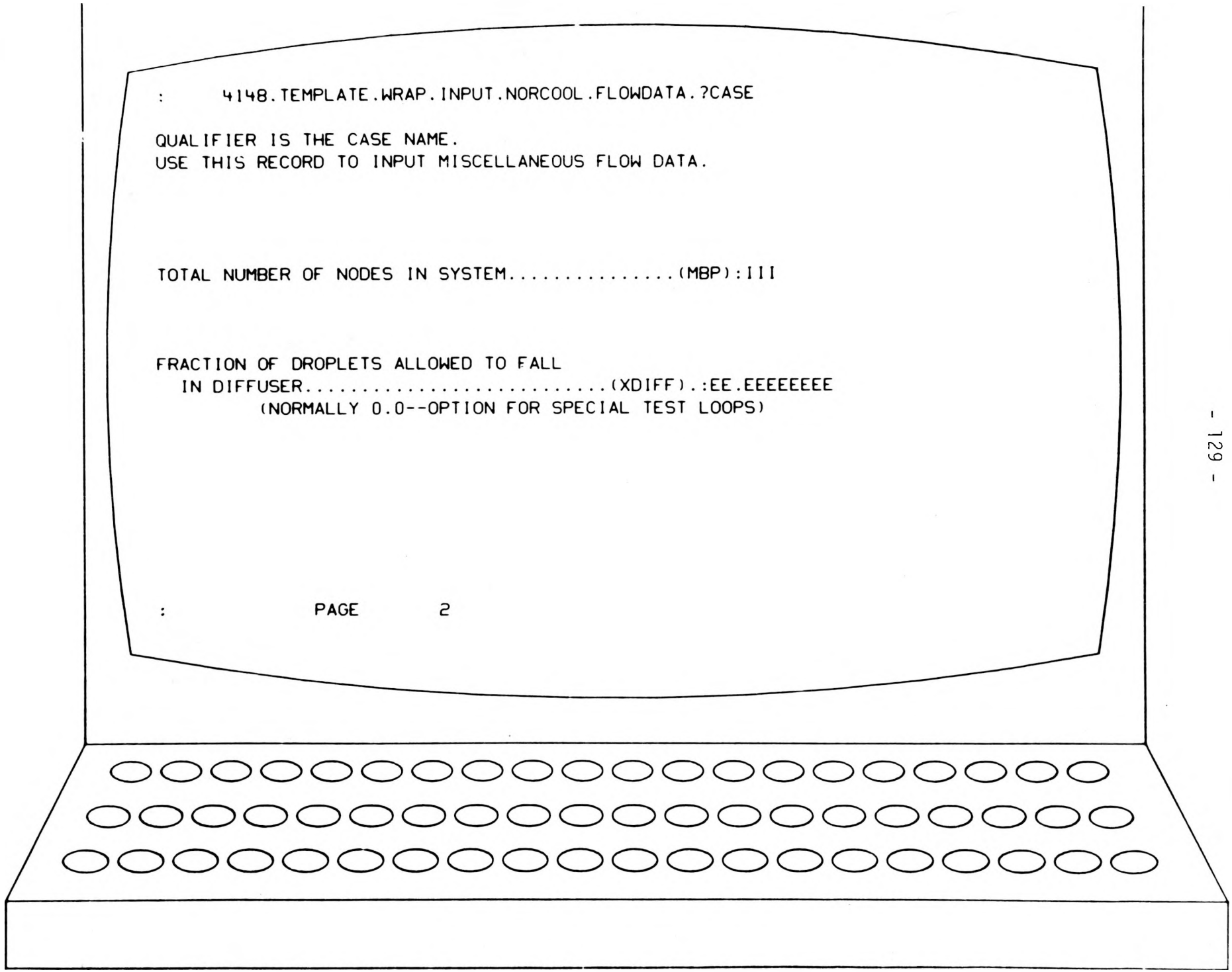

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.NODEDATA.?CASE
(WMIX) (VOID) (HS) (HG)
NODE INITIAL VOID WATER STEAM
-NO.- --MASS FLOW-- ---FRACTION-- ---ENTHALPY-- ---ENTHALPY--
:III :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
: PAGE 3

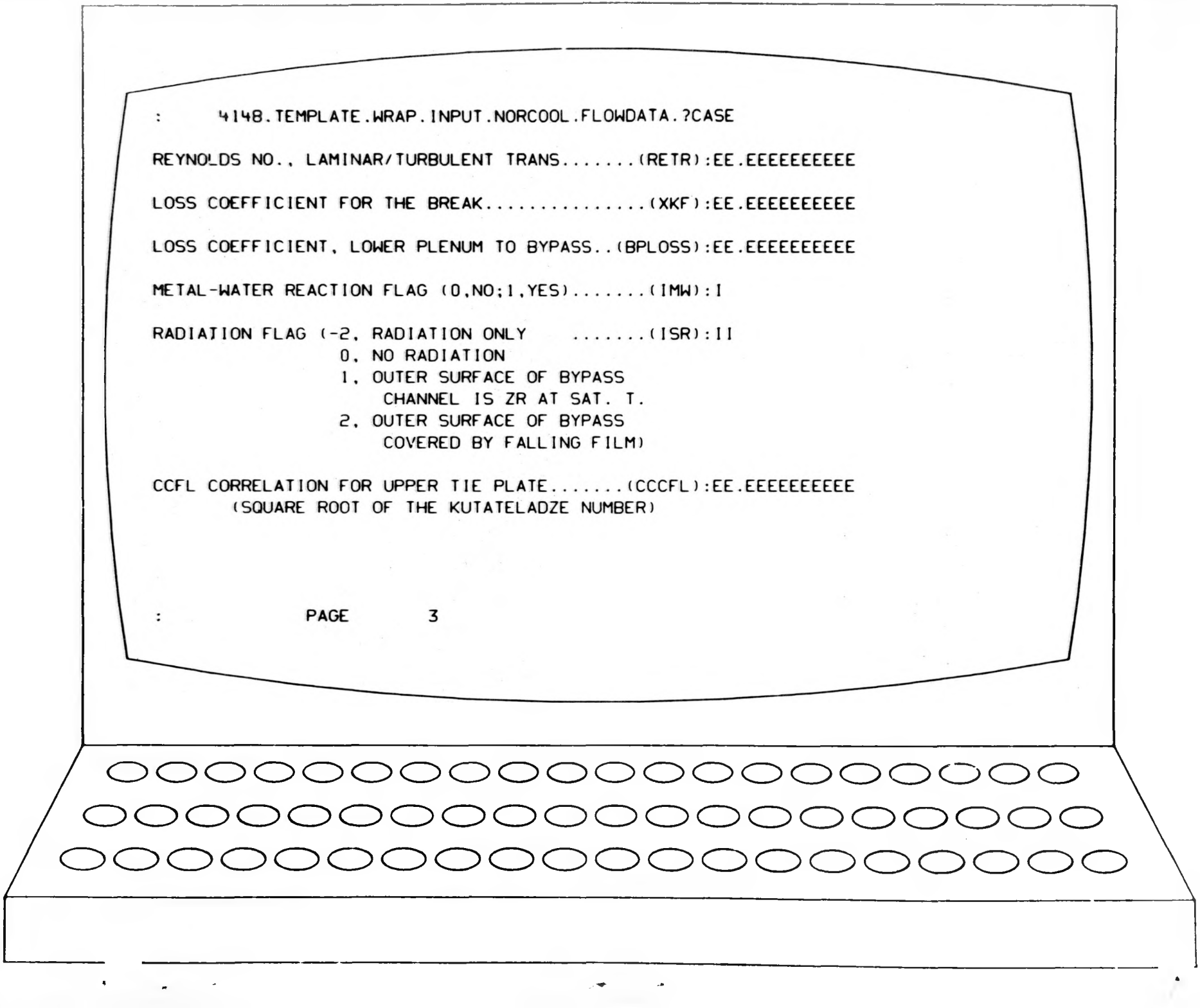

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.NODEDATA.?CASE
(DS) (DWAL) (TWAL)
NODE DROPLET WALL NODE WALL NODE
-NO.- --DIAMETER-- --THICKNESS-- -TEMPERATURE-
:III :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 4

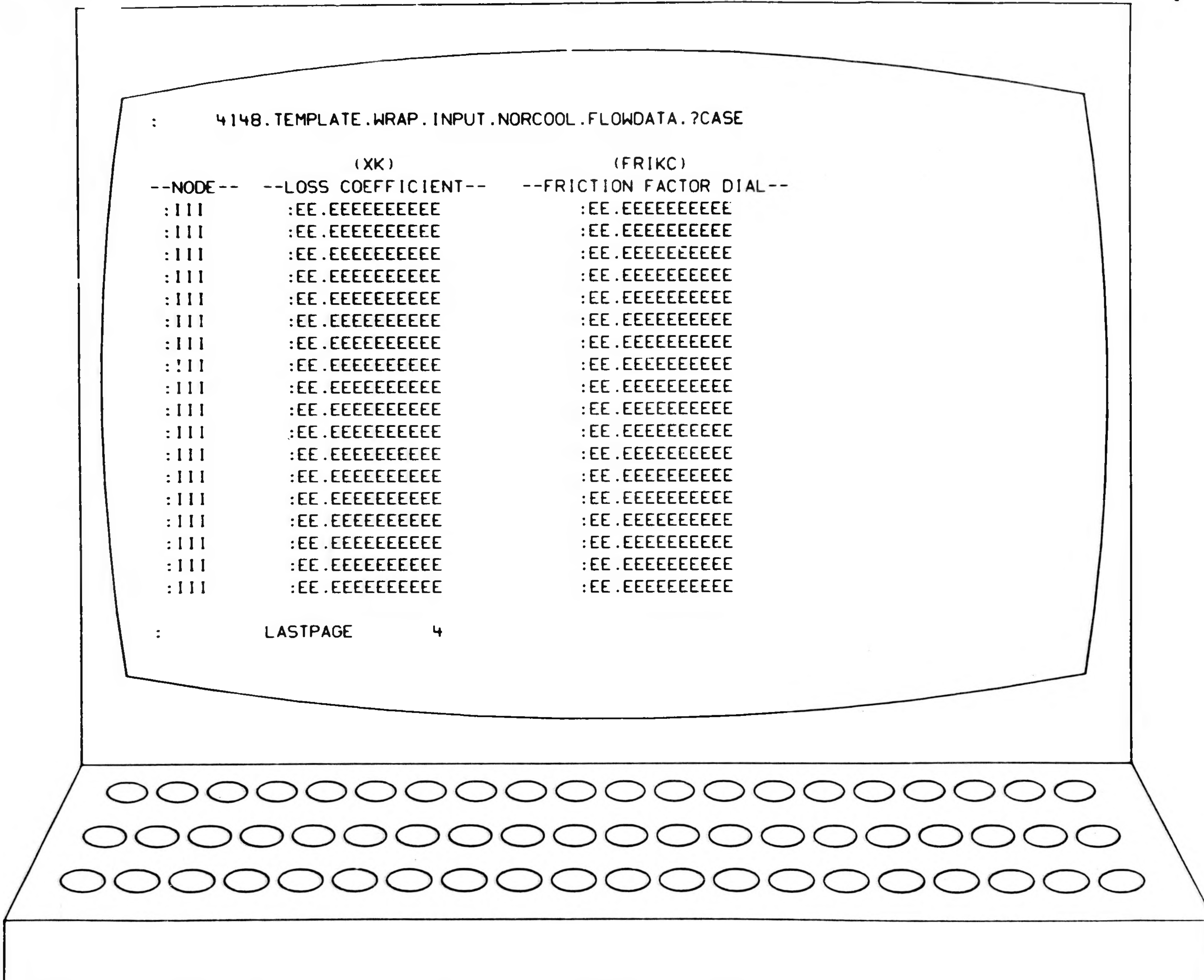

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PERIMETR.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT PERIMETER DATA.
NUMBER OF NODES BELOW CORE.....(MB):III
NUMBER OF NODES ABOVE CORE.....(MA-MC):III
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PERIMETR.?CASE
(S)
--NODE-- ---PERIMETER OF NODE (BELOW CORE)---
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEFE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
:III :EE.EEEEEEEEEE
: PAGE 3


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PERIMETR.?CASE
NODE (S)
-INCRMENT- ---PERIMETER OF NODE (ABOVE CORE)---
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEFEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
MC + :III :EE.EEEEEEEEEE
: LASTPAGE 4


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.FLOWDATA.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT MISCELLANEOUS FLOW DATA.
TOTAL NUMBER OF NODES IN SYSTEM.....(MBP):III
FRACTION OF DROPLETS ALLOWED TO FALL
IN DIFFUSER.....(XDIFF).:EE.EEEEEEEE
(NORMALLY 0.0--OPTION FOR SPECIAL TEST LOOPS)
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.FLOWDATA.?CASE
REYNOLDS NO., LAMINAR/TURBULENT TRANS.....(RETR):EE.EEEEEEEEEE
LOSS COEFFICIENT FOR THE BREAK.....(XKF):EE.EEEEEEEEEE
LOSS COEFFICIENT, LOWER PLENUM TO BYPASS..(BPLOSS):EE.EEEEEEEEEE
METAL-WATER REACTION FLAG (0,NO;1,YES).....(IMW):I
RADIATION FLAG (-2, RADIATION ONLY .....(ISR):II
0, NO RADIATION
1, OUTER SURFACE OF BYPASS
CHANNEL IS ZR AT SAT. T.
2, OUTER SURFACE OF BYPASS
COVERED BY FALLING FILM)
CCFL CORRELATION FOR UPPER TIE PLATE.....(CCCFL):EE.EEEEEEEEEE
(SQUARE ROOT OF THE KUTATELADZE NUMBER)
: PAGE 3



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:      4148.TEMPLATE.WRAP.INPUT.NORCOOL.FLOWDATA.?CASE

                    (XK)                          (FRIKC)
--NODE--   --LOSS COEFFICIENT--   --FRICTION FACTOR DIAL--
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE
  :III        :EE.EEEEEEEEEE             :EE.EEEEEEEEEE

:           LASTPAGE        4
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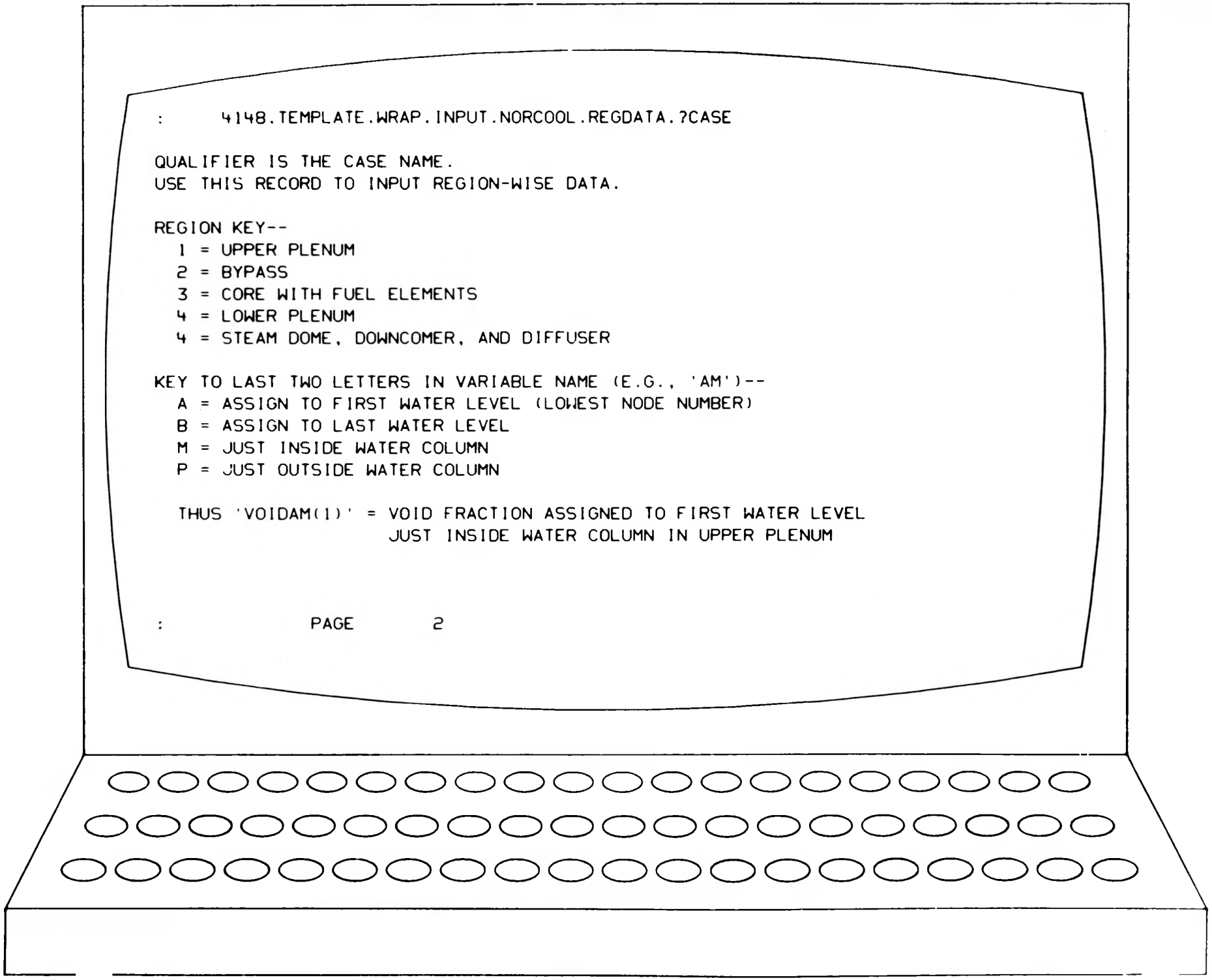
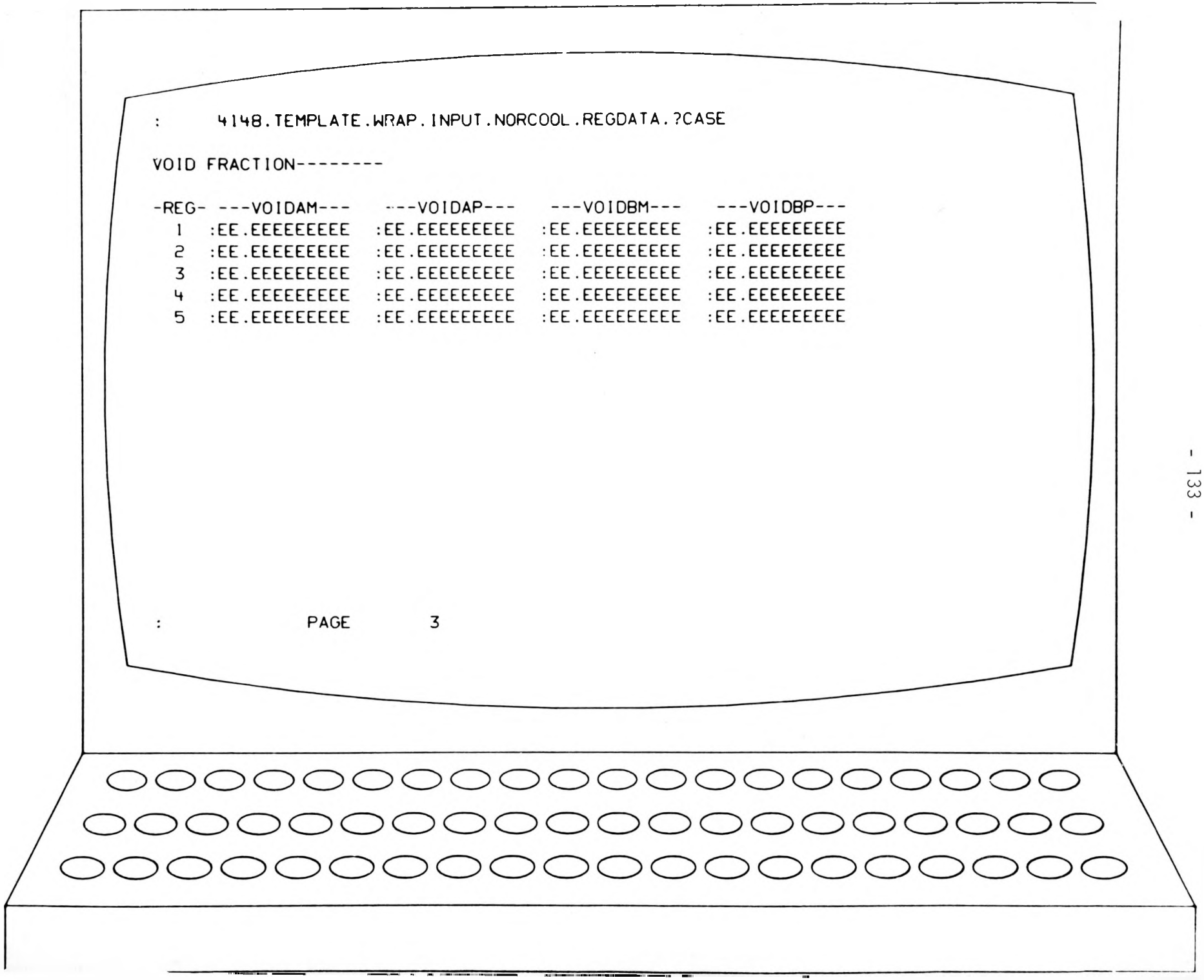
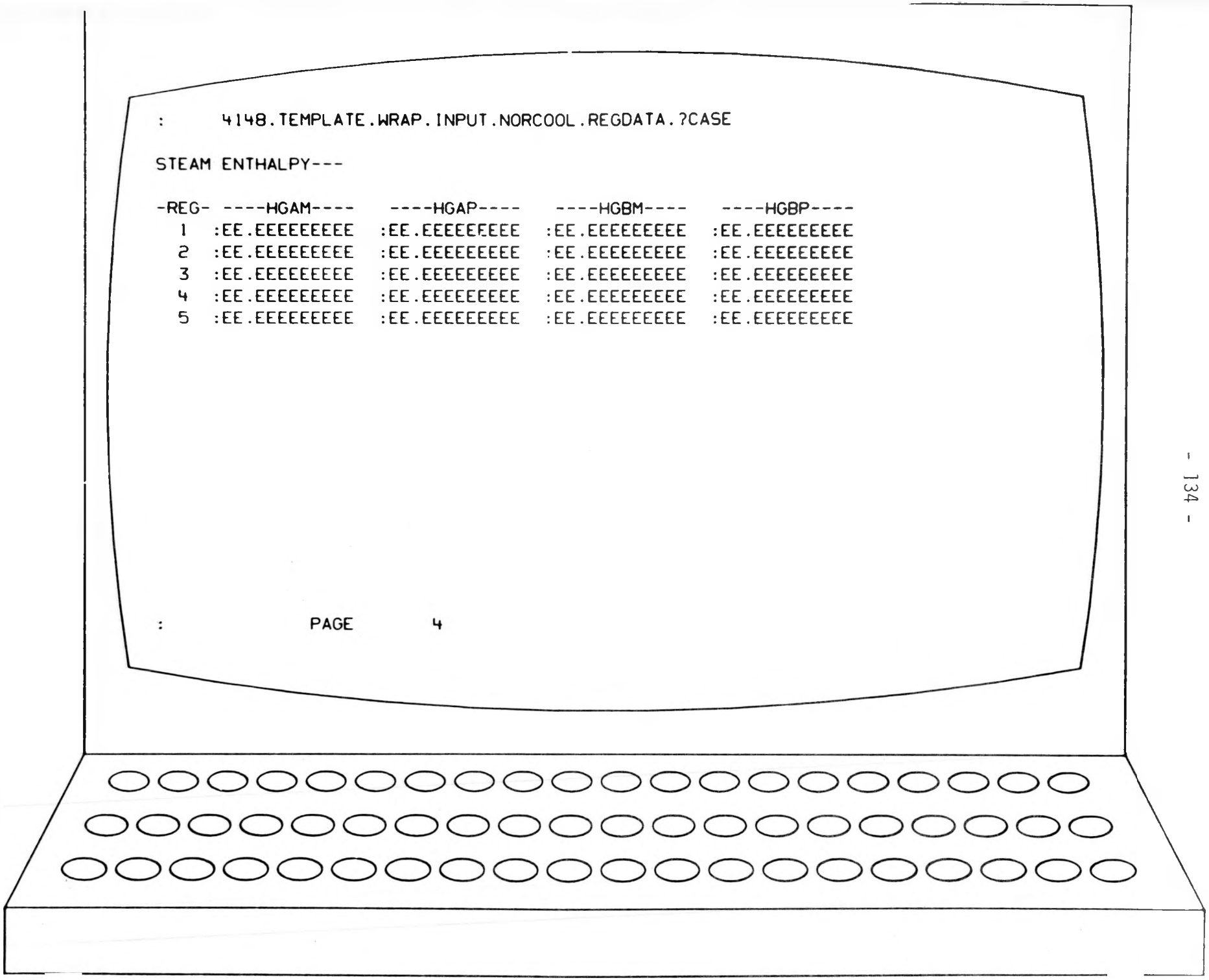
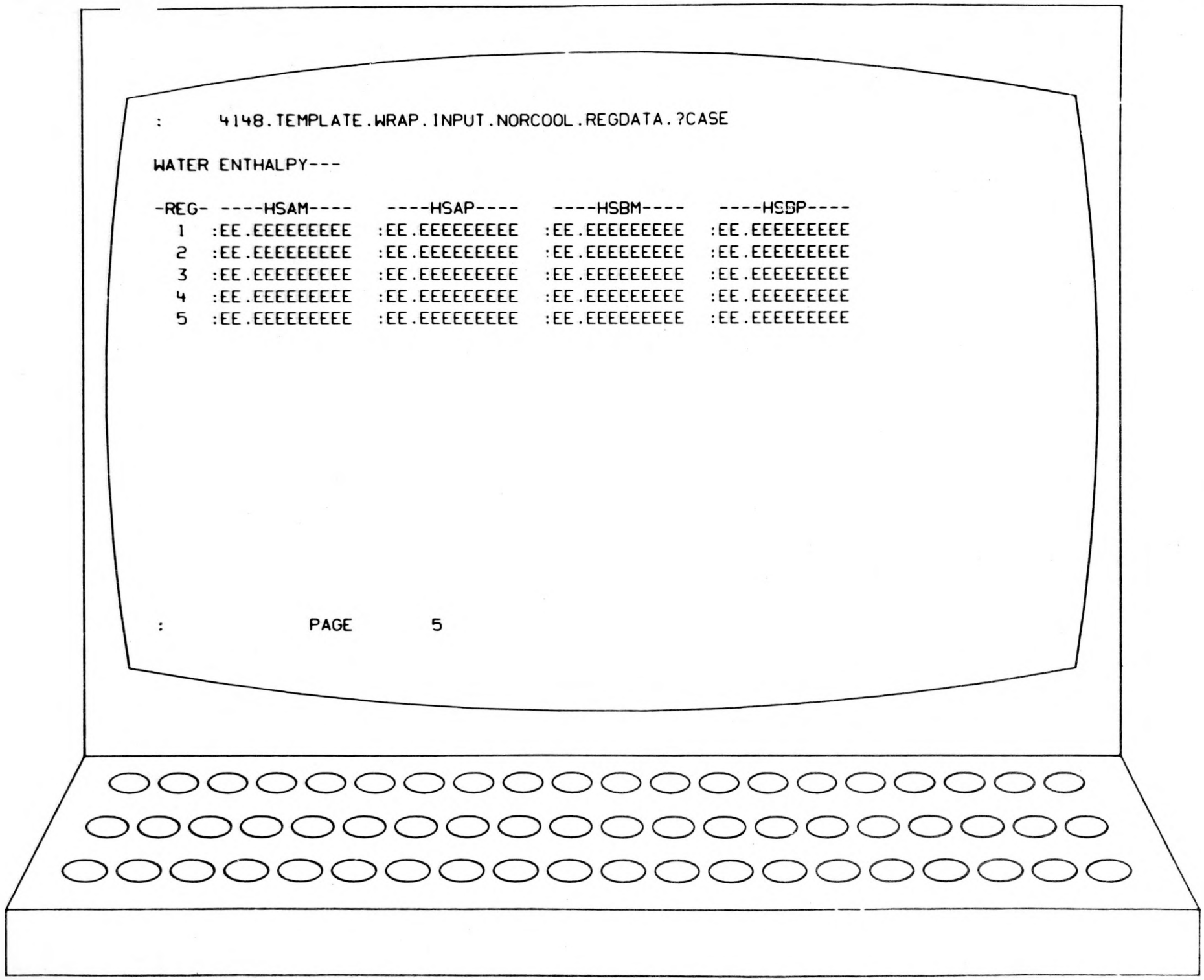
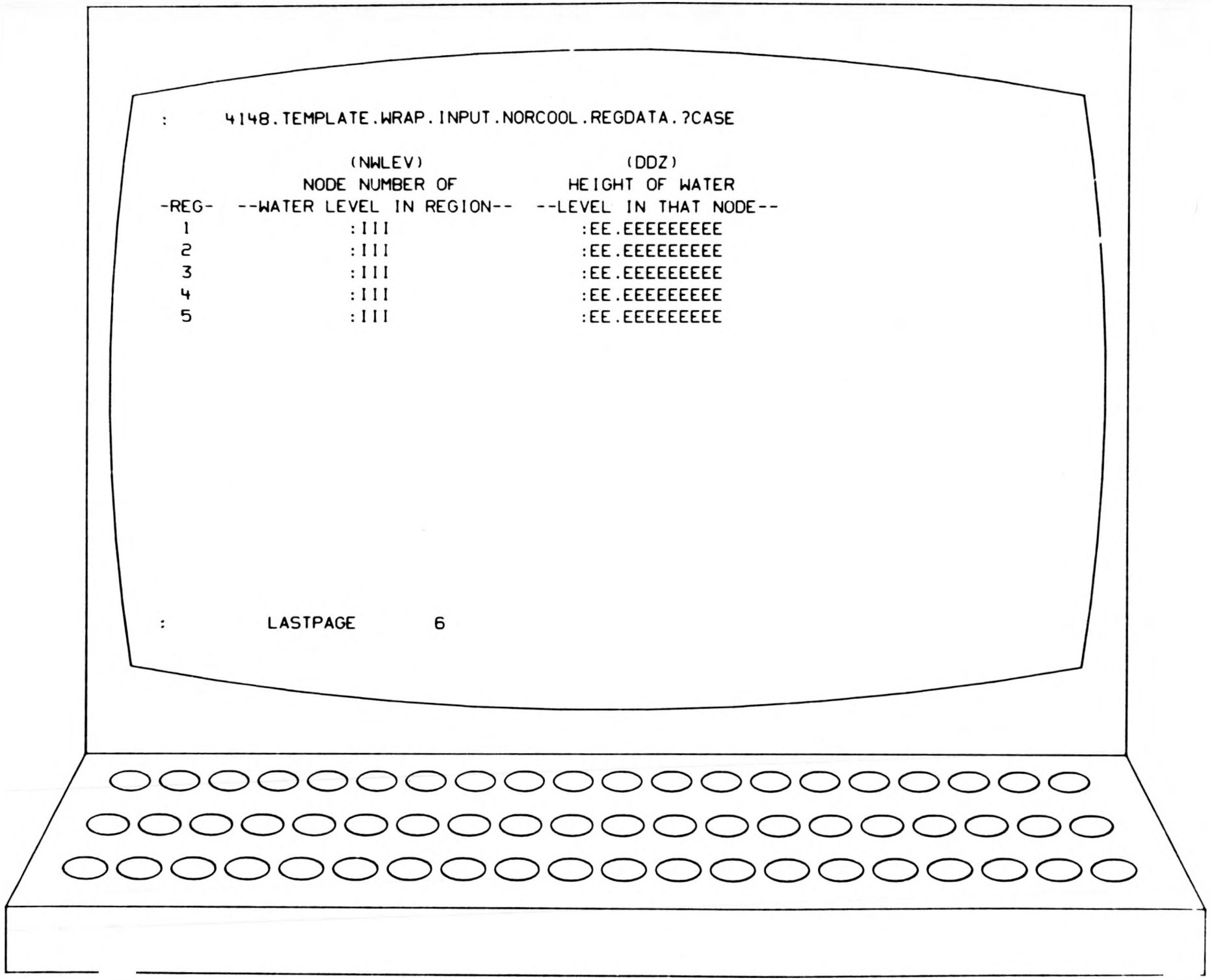
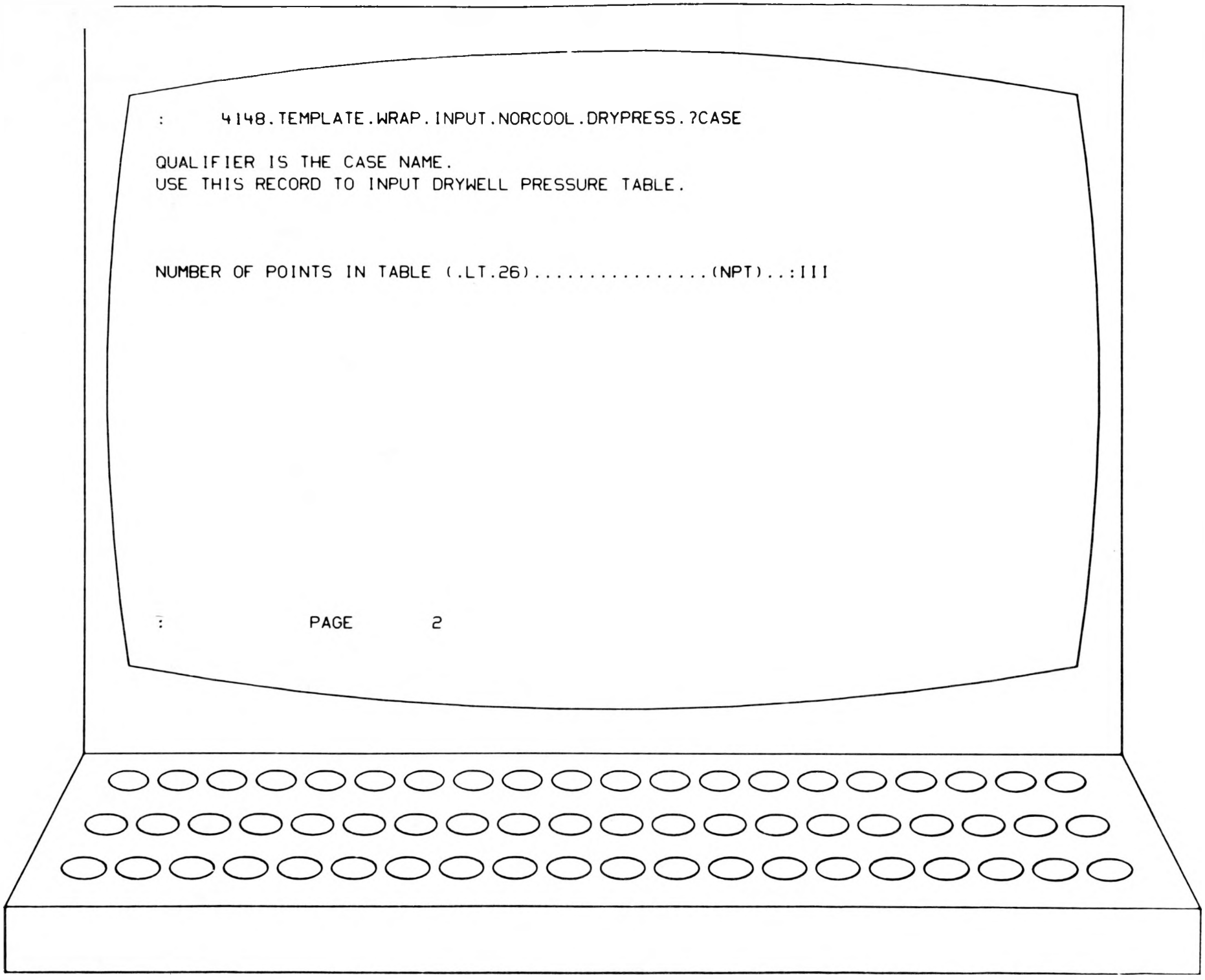

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.REGDATA.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT REGION-WISE DATA.
REGION KEY--
1 = UPPER PLENUM
2 = BYPASS
3 = CORE WITH FUEL ELEMENTS
4 = LOWER PLENUM
4 = STEAM DOME, DOWNCOMER, AND DIFFUSER
KEY TO LAST TWO LETTERS IN VARIABLE NAME (E.G., 'AM')--
A = ASSIGN TO FIRST WATER LEVEL (LOWEST NODE NUMBER)
B = ASSIGN TO LAST WATER LEVEL
M = JUST INSIDE WATER COLUMN
P = JUST OUTSIDE WATER COLUMN
THUS 'VOIDAM(1)' = VOID FRACTION ASSIGNED TO FIRST WATER LEVEL
JUST INSIDE WATER COLUMN IN UPPER PLENUM
: PAGE 2

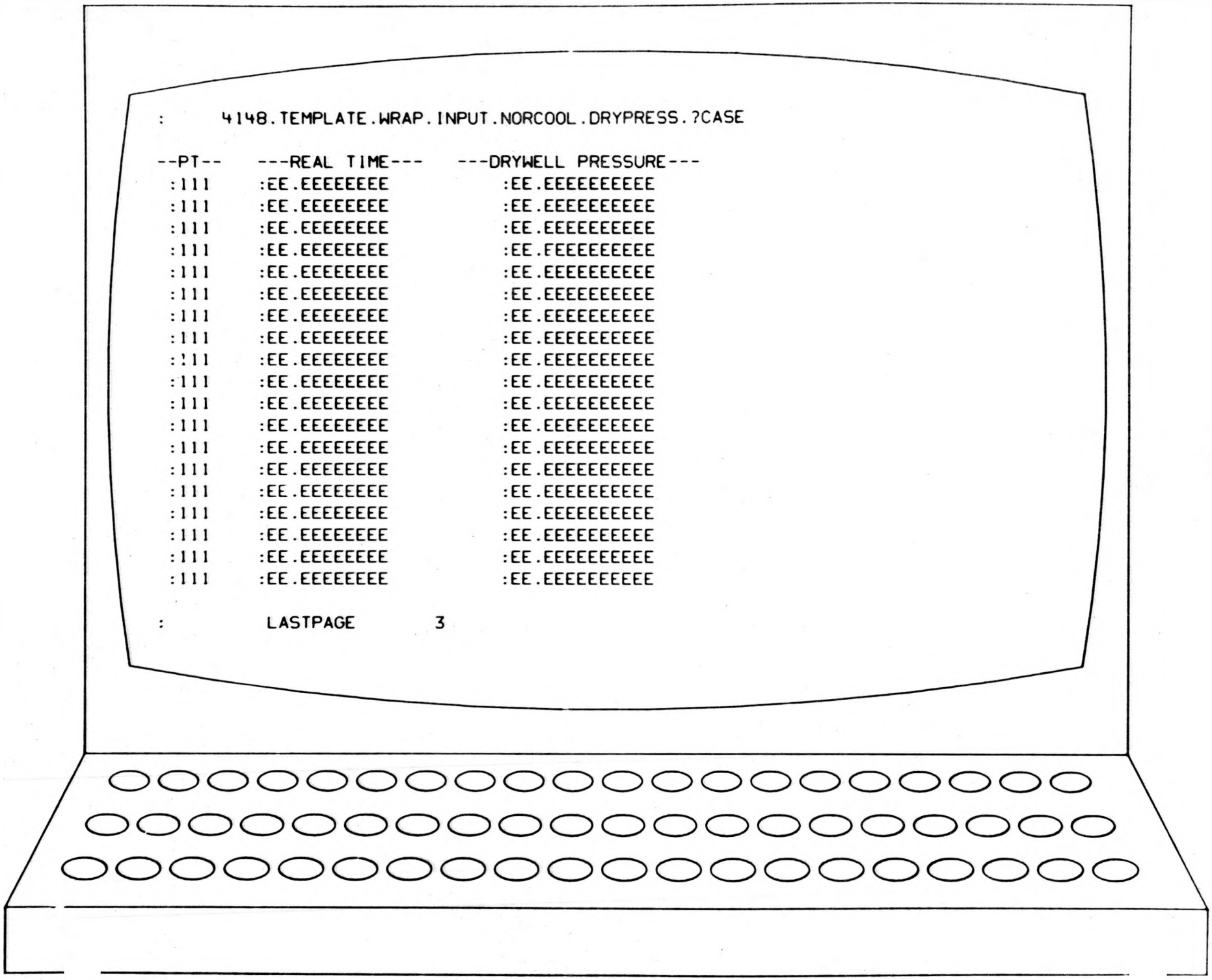

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.REGDATA.?CASE
VOID FRACTION--------
-REG- ---VOIDAM--- ---VOIDAP--- ---VOIDBM--- ---VOIDBP---
1 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
2 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
3 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
4 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
5 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
: PAGE 3

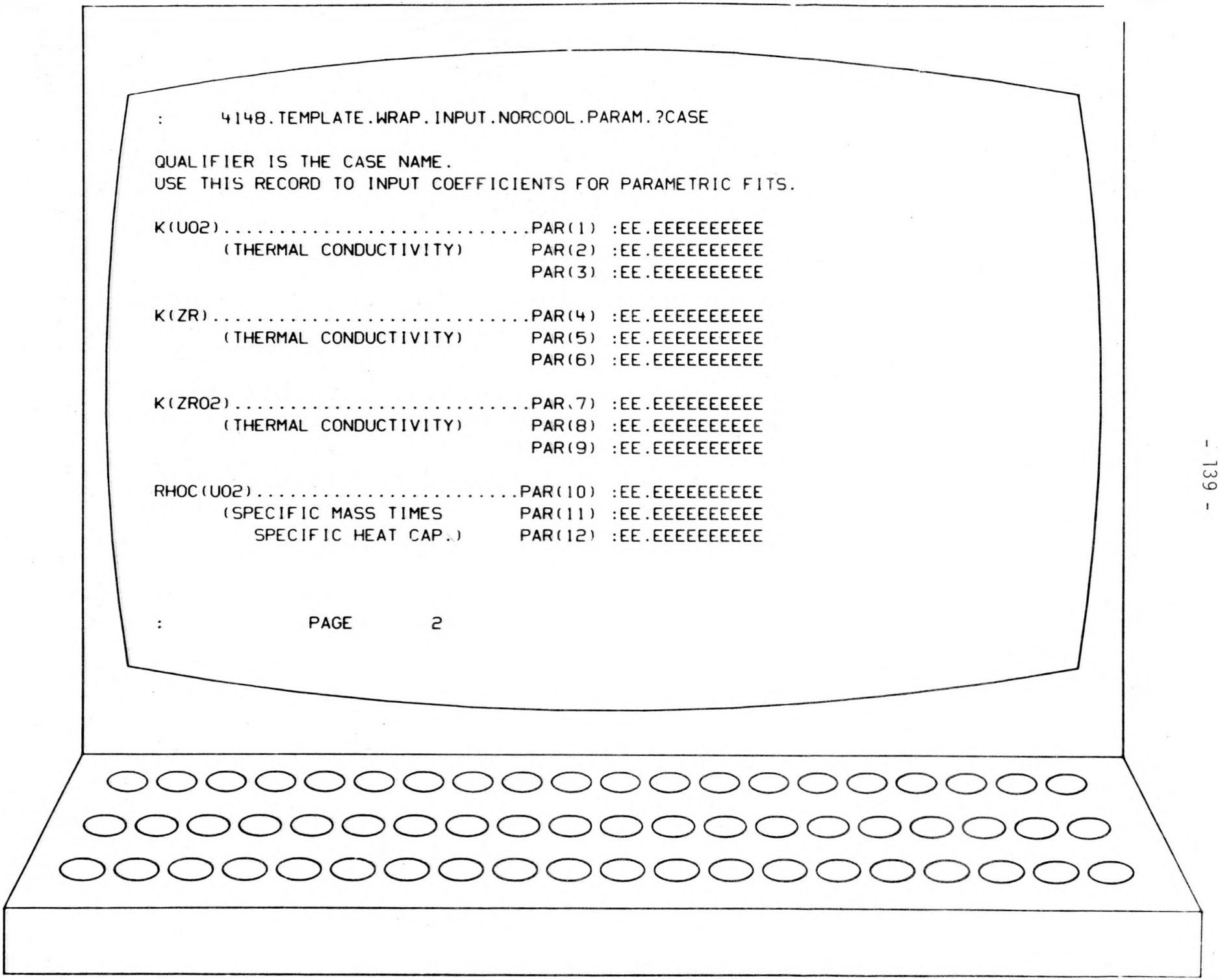

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.REGDATA.?CASE
STEAM ENTHALPY---
-REG- ----HGAM---- ----HGAP---- ----HGBM---- ----HGBP----
1 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
2 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
3 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
4 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
5 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
: PAGE 4

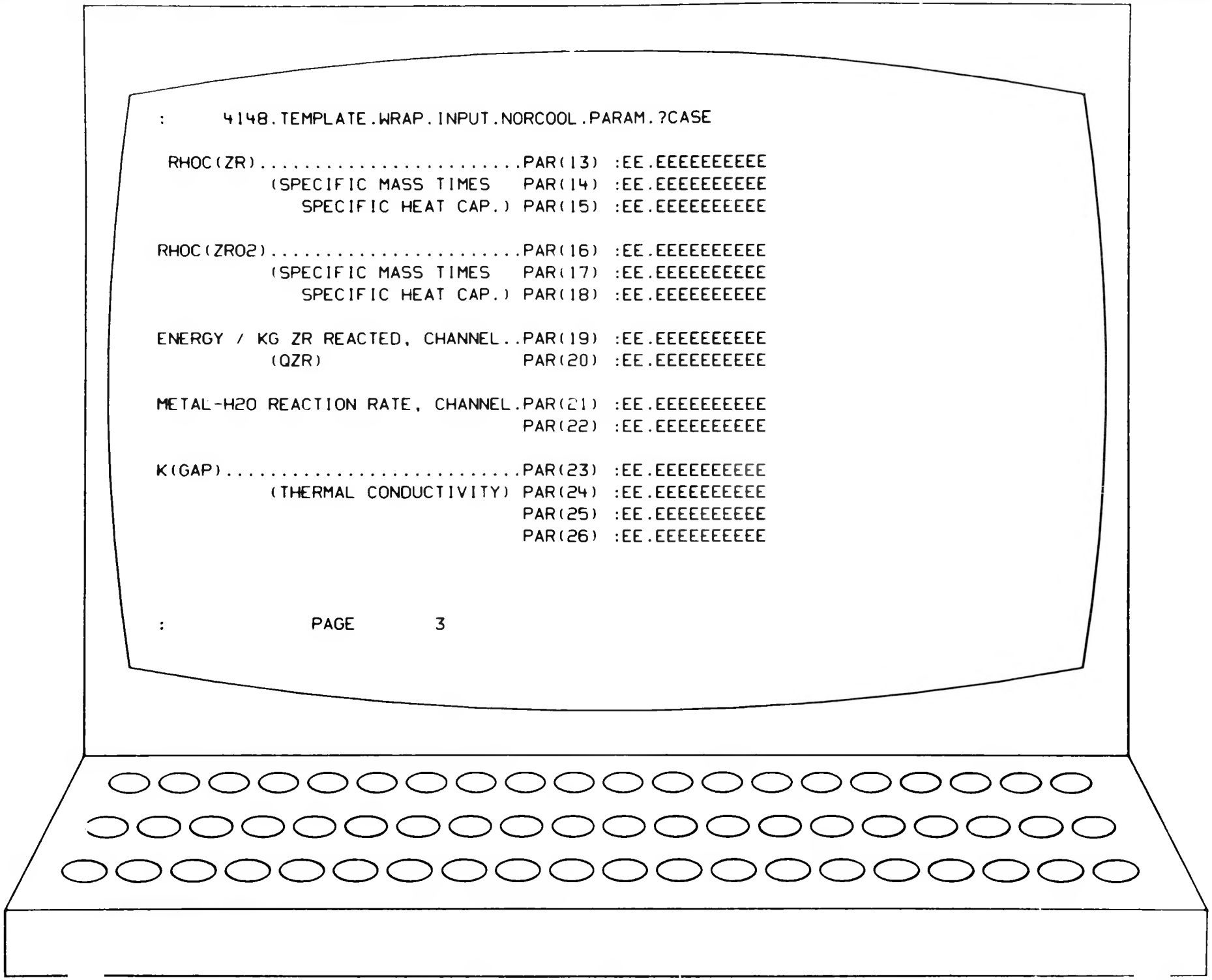

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.REGDATA.?CASE
WATER ENTHALPY---
-REG- ----HSAM---- ----HSAP---- ----HSBM---- ----HSBP----
1 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
2 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
3 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
4 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
5 :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE :EE.EEEEEEEEE
: PAGE 5

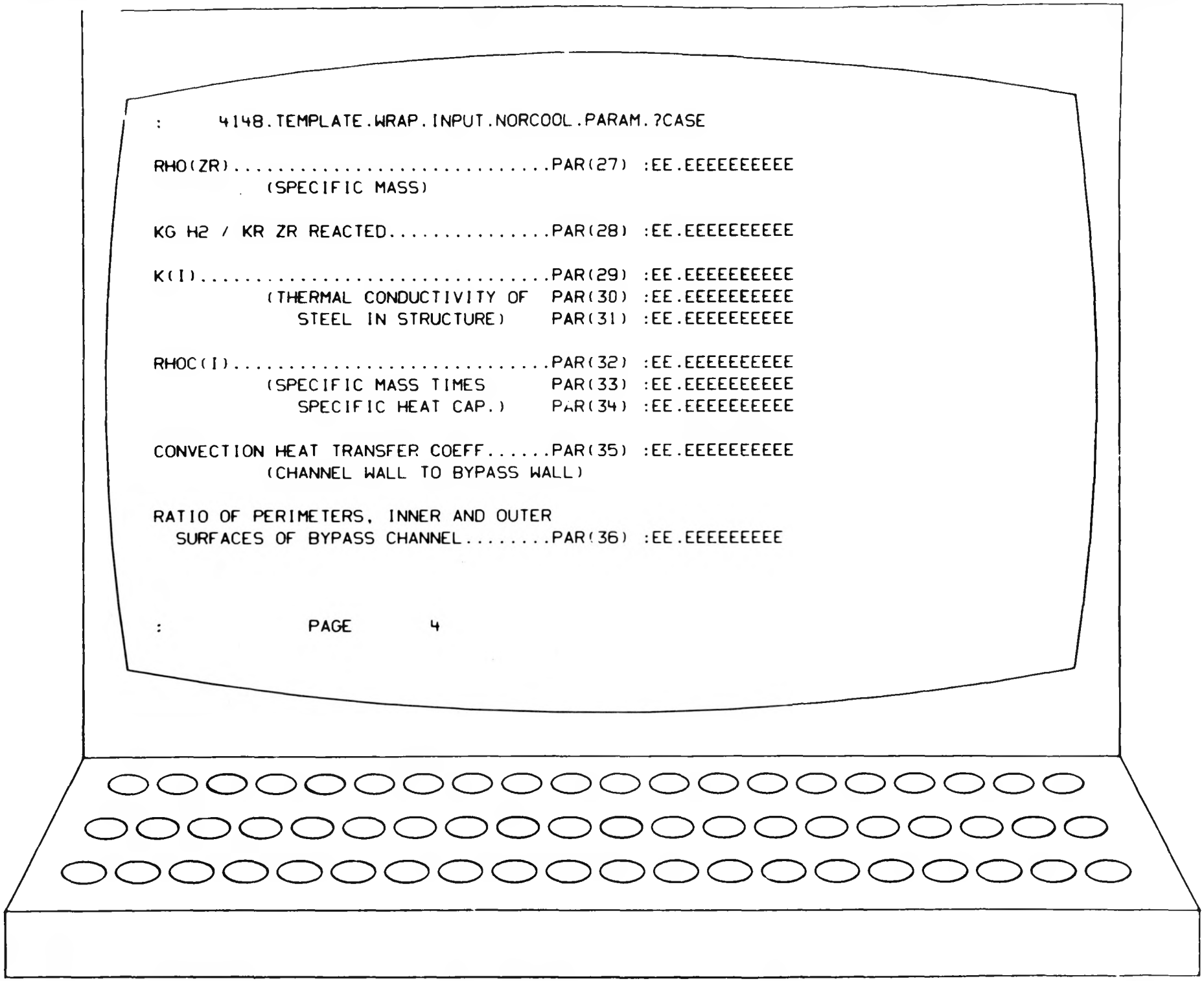

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.REGDATA.?CASE
(NWLEV)
NODE NUMBER OF
-REG- --WATER LEVEL IN REGION--
1 :III
2 :III
3 :III
4 :III
5 :III
(DDZ)
HEIGHT OF WATER
--LEVEL IN THAT NODE--
:EE.EEEEEEEEE
:EE.EEEEEEEEE
:EE.EEEEEEEEE
:EE.EEEEEEEEE
:EE.EEEEEEEEE
: LASTPAGE 6

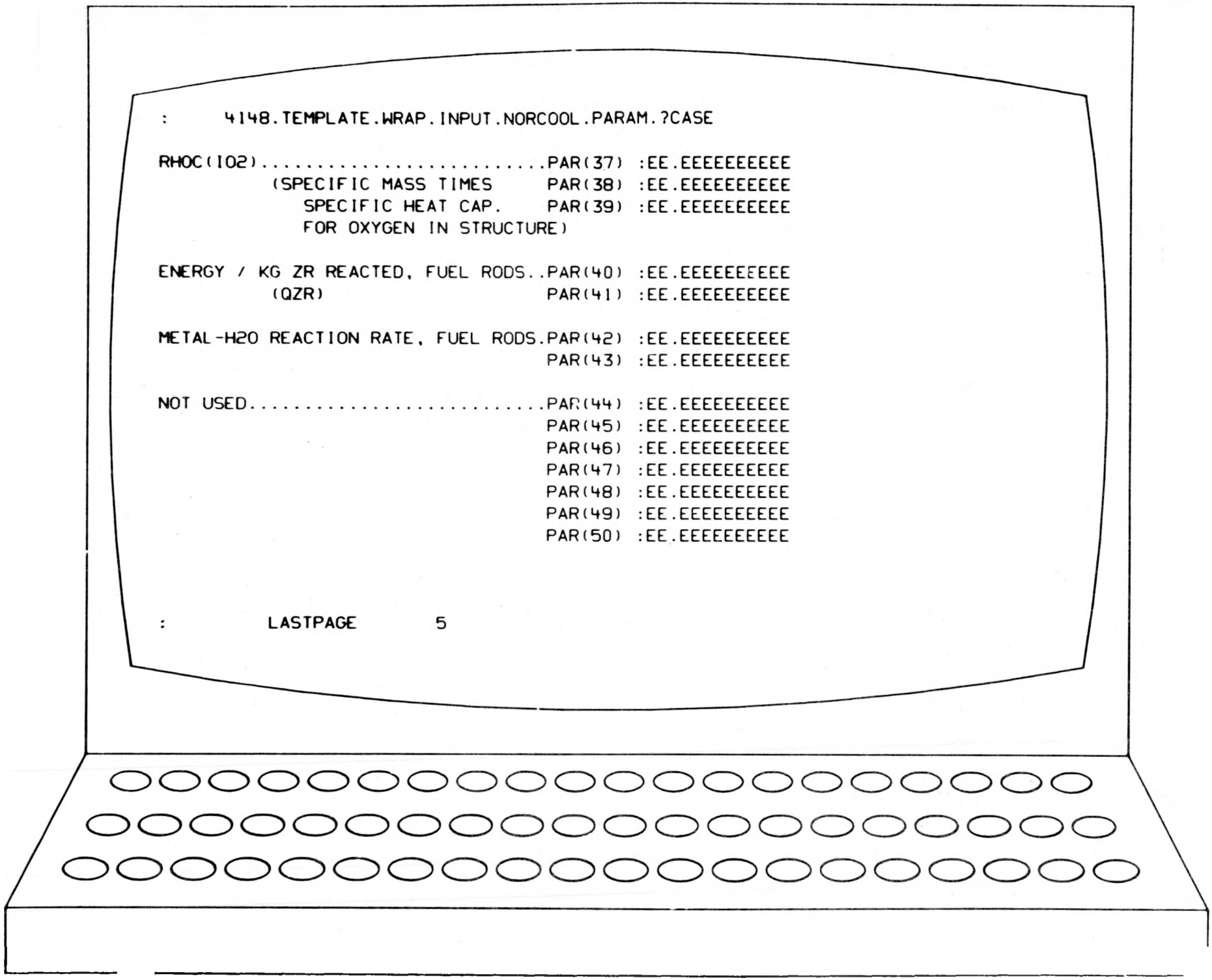

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.DRYPRESS.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT DRYWELL PRESSURE TABLE.
NUMBER OF POINTS IN TABLE (.LT.26).....(NPT)..:III
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.DRYPRESS.?CASE
--PT-- ---REAL TIME--- ---DRYWELL PRESSURE---
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
:111 :EE.EEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 3


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PARAM.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT COEFFICIENTS FOR PARAMETRIC FITS.
K(UO2).....PAR(1) :EE.EEEEEEEEEE
(THERMAL CONDUCTIVITY) PAR(2) :EE.EEEEEEEEEE
PAR(3) :EE.EEEEEEEEEE
K(ZR).....PAR(4) :EE.EEEEEEEEEE
(THERMAL CONDUCTIVITY) PAR(5) :EE.EEEEEEEEEE
PAR(6) :EE.EEEEEEEEEE
K(ZRO2).....PAR(7) :EE.EEEEEEEEEE
(THERMAL CONDUCTIVITY) PAR(8) :EE.EEEEEEEEEE
PAR(9) :EE.EEEEEEEEEE
RHOC(UO2).....PAR(10) :EE.EEEEEEEEEE
(SPECIFIC MASS TIMES PAR(11) :EE.EEEEEEEEEE
SPECIFIC HEAT CAP.) PAR(12) :EE.EEEEEEEEEE
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PARAM.?CASE
RHOC(ZR).....PAR(13) :EE.EEEEEEEEEE
(SPECIFIC MASS TIMES PAR(14) :EE.EEEEEEEEEE
SPECIFIC HEAT CAP.) PAR(15) :EE.EEEEEEEEEE
RHOC(ZRO2).....PAR(16) :EE.EEEEEEEEEE
(SPECIFIC MASS TIMES PAR(17) :EE.EEEEEEEEEE
SPECIFIC HEAT CAP.) PAR(18) :EE.EEEEEEEEEE
ENERGY / KG ZR REACTED, CHANNEL..PAR(19) :EE.EEEEEEEEEE
(QZR) PAR(20) :EE.EEEEEEEEEE
METAL-H2O REACTION RATE, CHANNEL.PAR(21) :EE.EEEEEEEEEE
PAR(22) :EE.EEEEEEEEEE
K(GAP).....PAR(23) :EE.EEEEEEEEEE
(THERMAL CONDUCTIVITY) PAR(24) :EE.EEEEEEEEEE
PAR(25) :EE.EEEEEEEEEE
PAR(26) :EE.EEEEEEEEEE
: PAGE 3


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PARAM.?CASE
RHO(ZR).....PAR(27) :EE.EEEEEEEEEE
(SPECIFIC MASS)
KG H2 / KR ZR REACTED.....PAR(28) :EE.EEEEEEEEEE
K(I).....PAR(29) :EE.EEEEEEEEEE
(THERMAL CONDUCTIVITY OF PAR(30) :EE.EEEEEEEEEE
STEEL IN STRUCTURE) PAR(31) :EE.EEEEEEEEEE
RHOC(I).....PAR(32) :EE.EEEEEEEEEE
(SPECIFIC MASS TIMES PAR(33) :EE.EEEEEEEEEE
SPECIFIC HEAT CAP.) PAR(34) :EE.EEEEEEEEEE
CONVECTION HEAT TRANSFER COEFF.....PAR(35) :EE.EEEEEEEEEE
(CHANNEL WALL TO BYPASS WALL)
RATIO OF PERIMETERS, INNER AND OUTER
SURFACES OF BYPASS CHANNEL.....PAR(36) :EE.EEEEEEEEE
: PAGE 4


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.PARAM.?CASE
RHOC(IO2).....PAR(37) :EE.EEEEEEEEEE
(SPECIFIC MASS TIMES PAR(38) :EE.EEEEEEEEEE
SPECIFIC HEAT CAP. PAR(39) :EE.EEEEEEEEEE
FOR OXYGEN IN STRUCTURE)
ENERGY / KG ZR REACTED, FUEL RODS..PAR(40) :EE.EEEEEEEEEE
(QZR) PAR(41) :EE.EEEEEEEEEE
METAL-H2O REACTION RATE, FUEL RODS.PAR(42) :EE.EEEEEEEEEE
PAR(43) :EE.EEEEEEEEEE
NOT USED.....PAR(44) :EE.EEEEEEEEEE
PAR(45) :EE.EEEEEEEEEE
PAR(46) :EE.EEEEEEEEEE
PAR(47) :EE.EEEEEEEEEE
PAR(48) :EE.EEEEEEEEEE
PAR(49) :EE.EEEEEEEEEE
PAR(50) :EE.EEEEEEEEEE
: LASTPAGE 5

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:     4148.TEMPLATE.WRAP.INPUT.NORCOOL.RODDATA.?CASE

QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT DATA FOR RODS.



NUMBER OF ROD GROUPS.........................(N1):III

NR2 INDEX.....................................(NR2):III
    NR2 = NR0*NR0 + 4*NR0,  WHERE NR0 IS THE NUMBER OF RODS ON
                            A BUNDLE SIDE.
                    X X X X X
                    - - - - -
                X |X X X X X| X
                X |X X X X X| X      EXAMPLE FOR 5 X 5 BUNDLE.
                X |X X X X X| X
                X |X X X X X| X    'CENTRAL' REGION INSIDE BOX.
                X |X X X X X| X    'PERIPHERAL' REGION OUTSIDE.
                    - - - - -
                    X X X X X


:             PAGE       2
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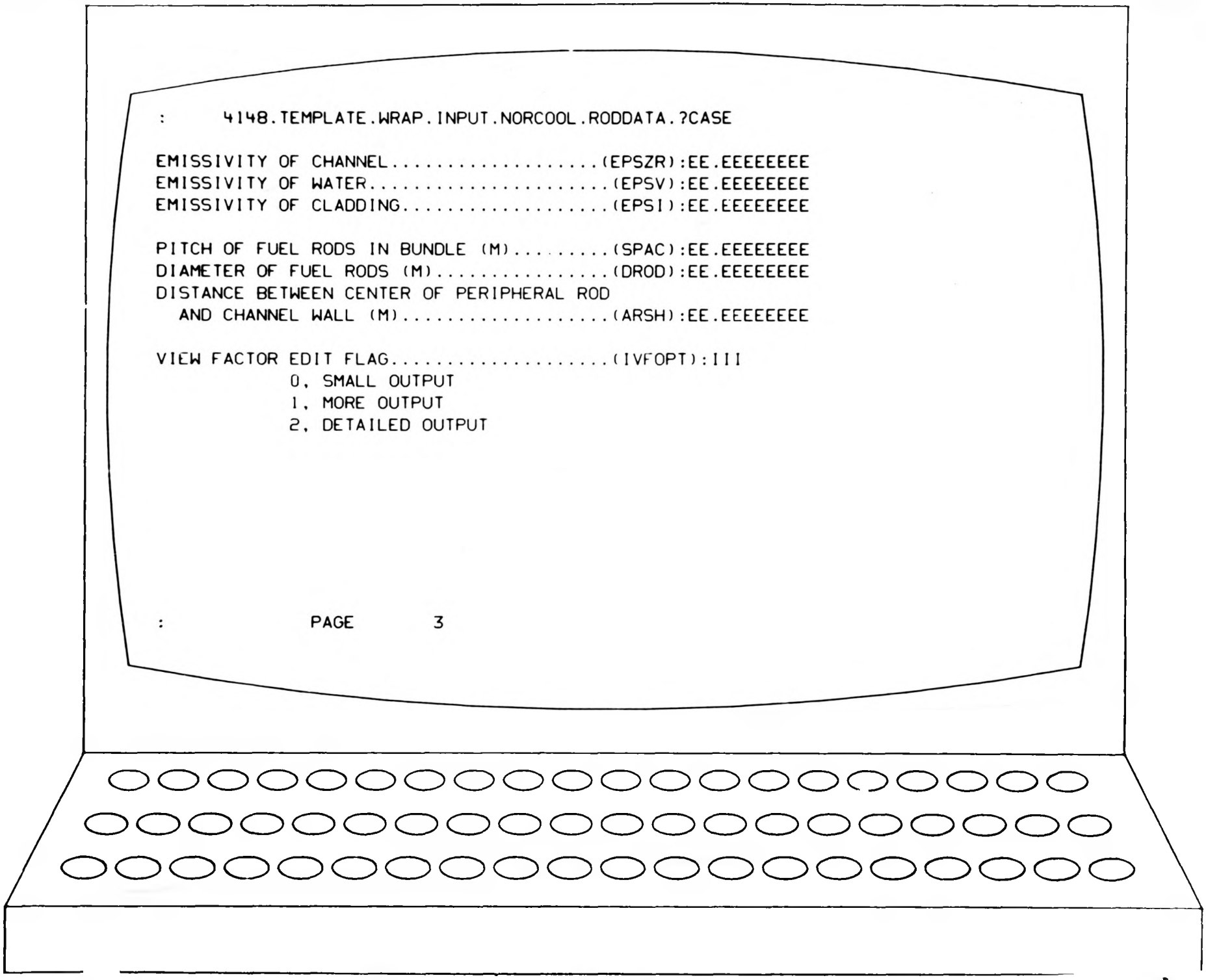
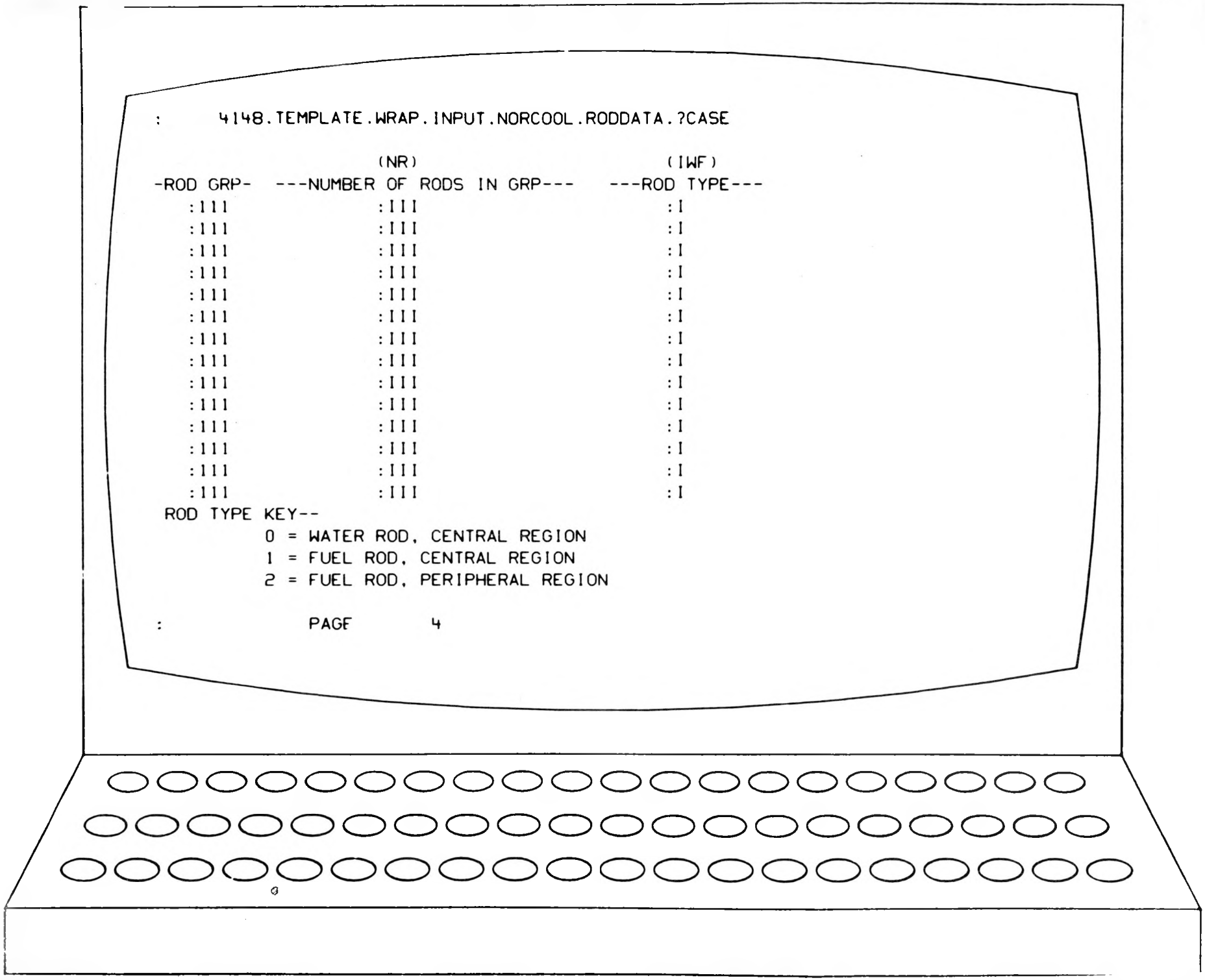
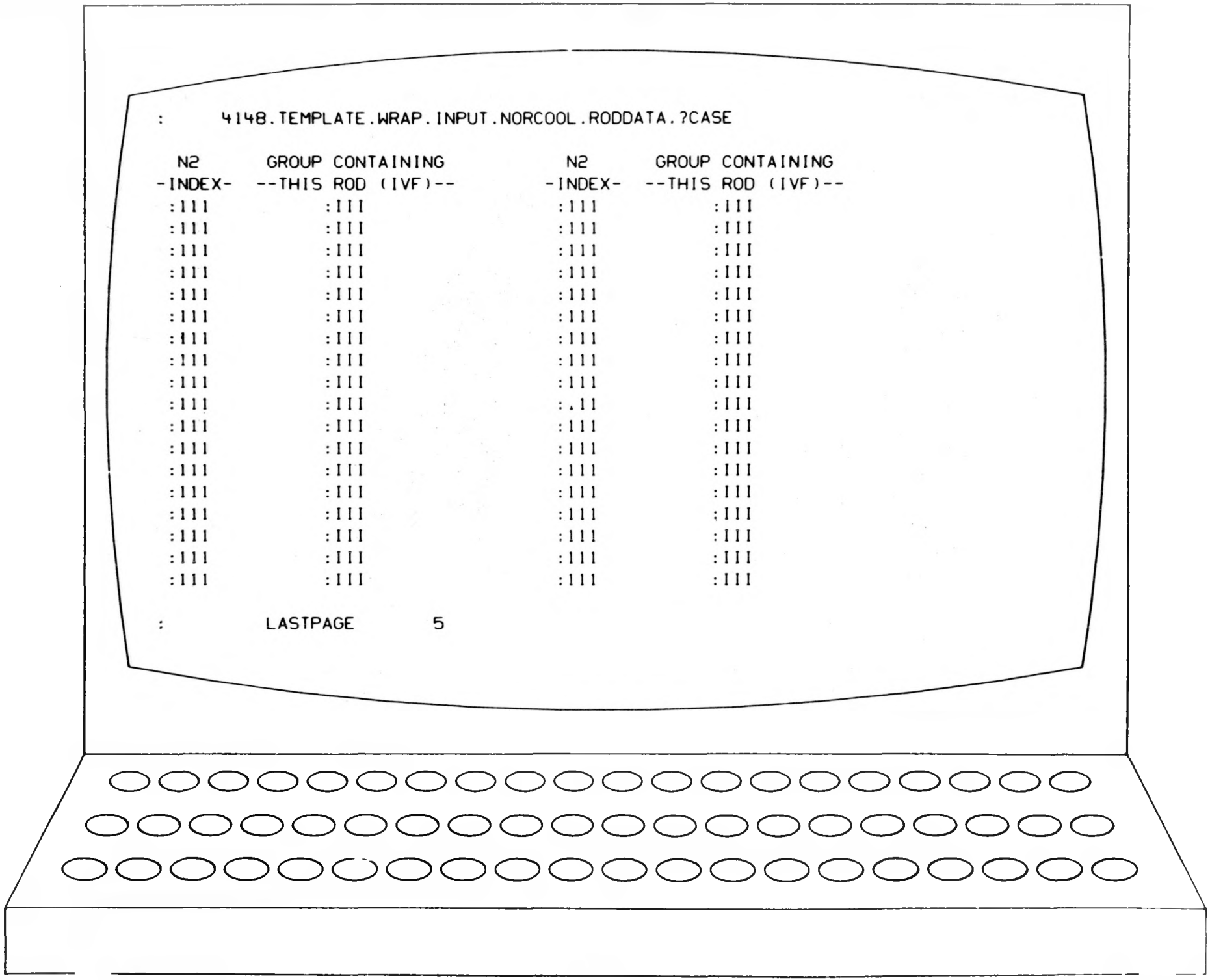
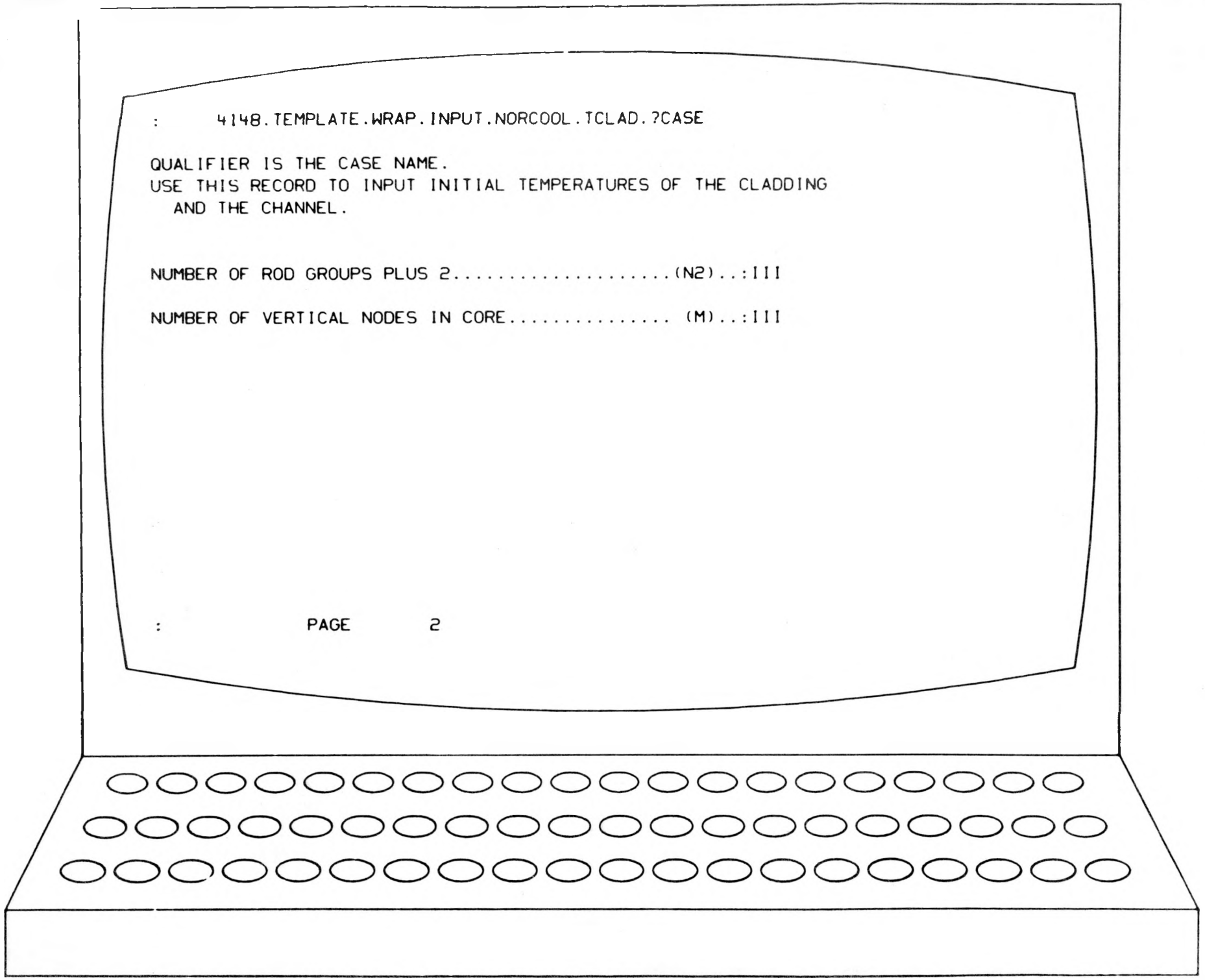
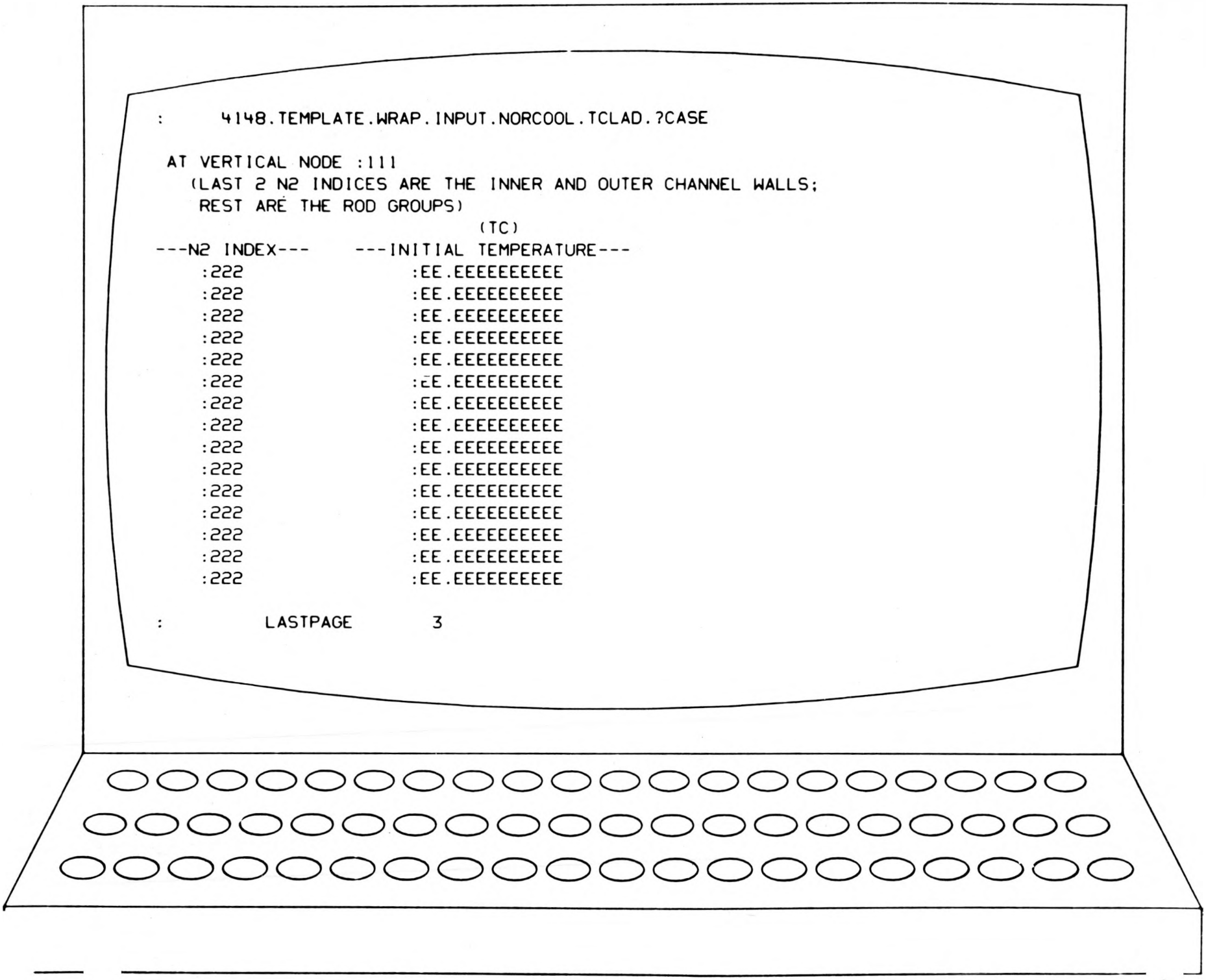
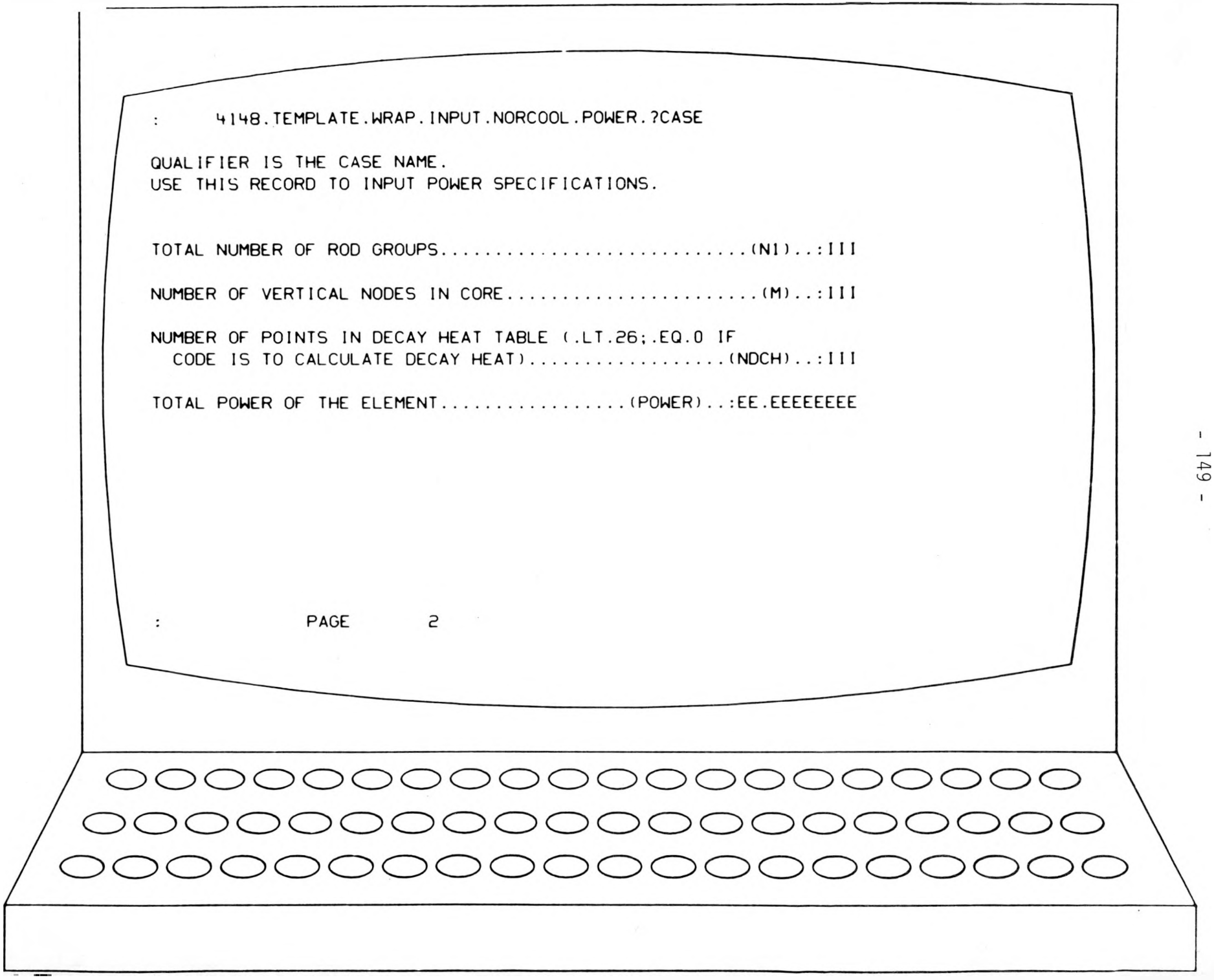

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.RODDATA.?CASE
EMISSIVITY OF CHANNEL.....(EPSZR):EE.EEEEEEEE
EMISSIVITY OF WATER.....(EPSV):EE.EEEEEEEE
EMISSIVITY OF CLADDING.....(EPSI):EE.EEEEEEEE
PITCH OF FUEL RODS IN BUNDLE (M).....(SPAC):EE.EEEEEEEE
DIAMETER OF FUEL RODS (M).....(DROD):EE.EEEEEEEE
DISTANCE BETWEEN CENTER OF PERIPHERAL ROD
AND CHANNEL WALL (M).....(ARSH):EE.EEEEEEEE
VIEW FACTOR EDIT FLAG.....(IVFOPT):III
0, SMALL OUTPUT
1, MORE OUTPUT
2, DETAILED OUTPUT
: PAGE 3

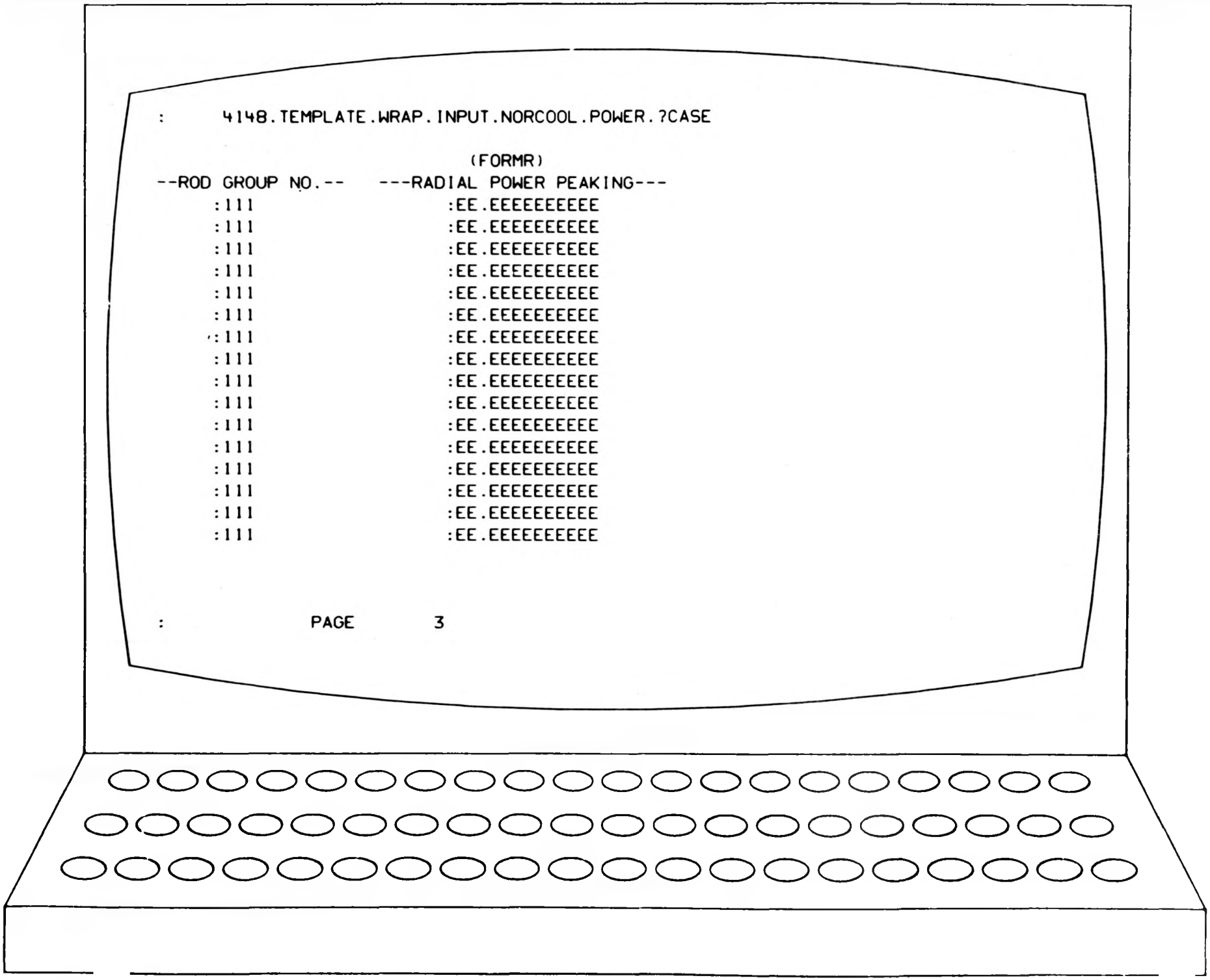

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.RODDATA.?CASE
(NR)
-ROD GRP- ---NUMBER OF RODS IN GRP---
(IWF)
---ROD TYPE---
ROD TYPE KEY--
0 = WATER ROD, CENTRAL REGION
1 = FUEL ROD, CENTRAL REGION
2 = FUEL ROD, PERIPHERAL REGION
: PAGE 4

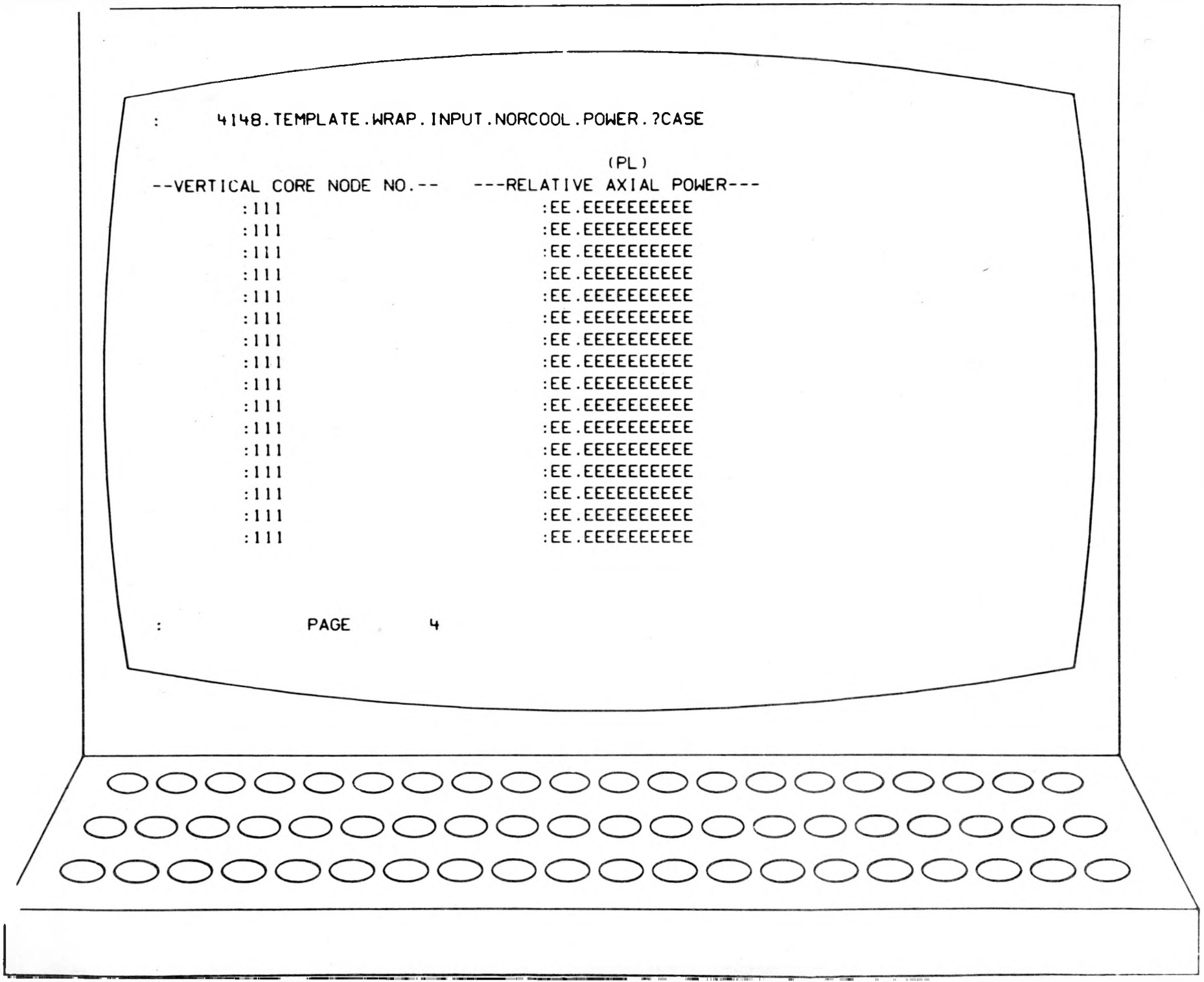

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.RODDATA.?CASE
N2 -INDEX- GROUP CONTAINING --THIS ROD (IVF)--
N2 -INDEX- GROUP CONTAINING --THIS ROD (IVF)--
: LASTPAGE 5

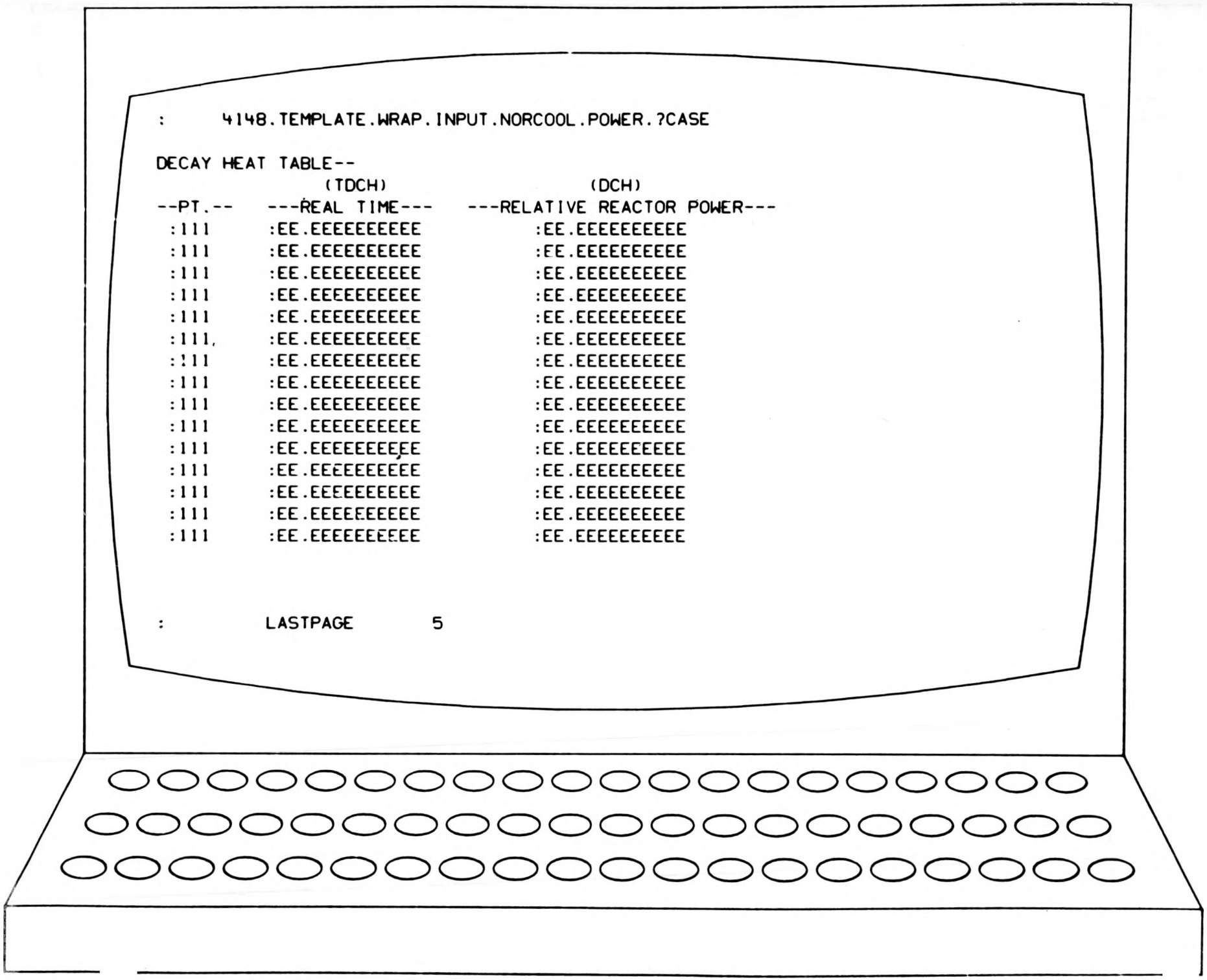

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.TCLAD.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT INITIAL TEMPERATURES OF THE CLADDING
AND THE CHANNEL.
NUMBER OF ROD GROUPS PLUS 2.....(N2)..:III
NUMBER OF VERTICAL NODES IN CORE..... (M)..:III
: PAGE 2

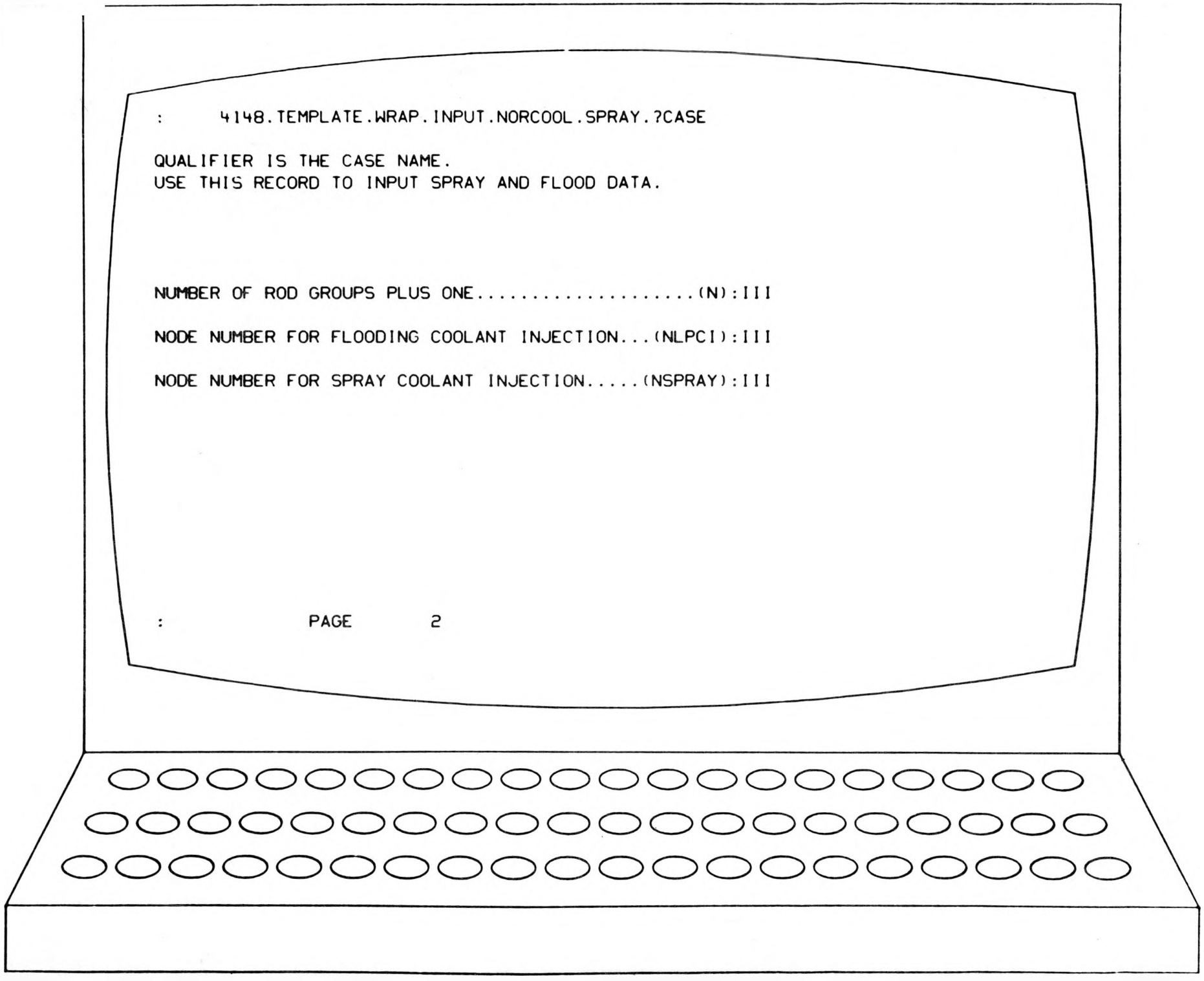

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.TCLAD.?CASE
AT VERTICAL NODE :111
(LAST 2 N2 INDICES ARE THE INNER AND OUTER CHANNEL WALLS;
REST ARE THE ROD GROUPS)
(TC)
---N2 INDEX--- ---INITIAL TEMPERATURE---
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
:222 :EE.EEEEEEEEE
: LASTPAGE 3

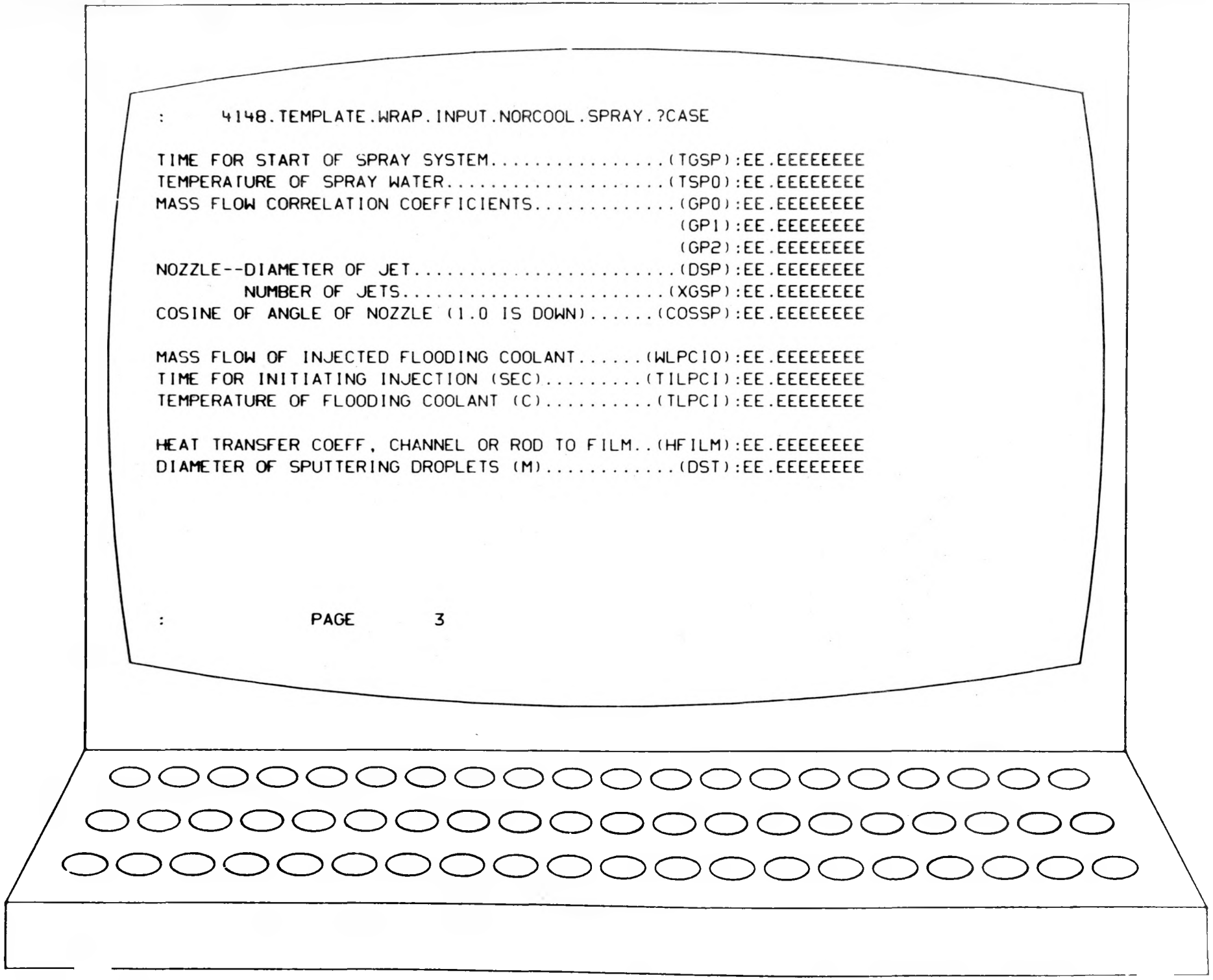

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.POWER.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT POWER SPECIFICATIONS.
TOTAL NUMBER OF ROD GROUPS.....(N1)..:III
NUMBER OF VERTICAL NODES IN CORE.....(M)..:III
NUMBER OF POINTS IN DECAY HEAT TABLE (.LT.26;.EQ.0 IF
CODE IS TO CALCULATE DECAY HEAT).....(NDCH)..:III
TOTAL POWER OF THE ELEMENT.....(POWER)..:EE.EEEEEEEE
: PAGE 2

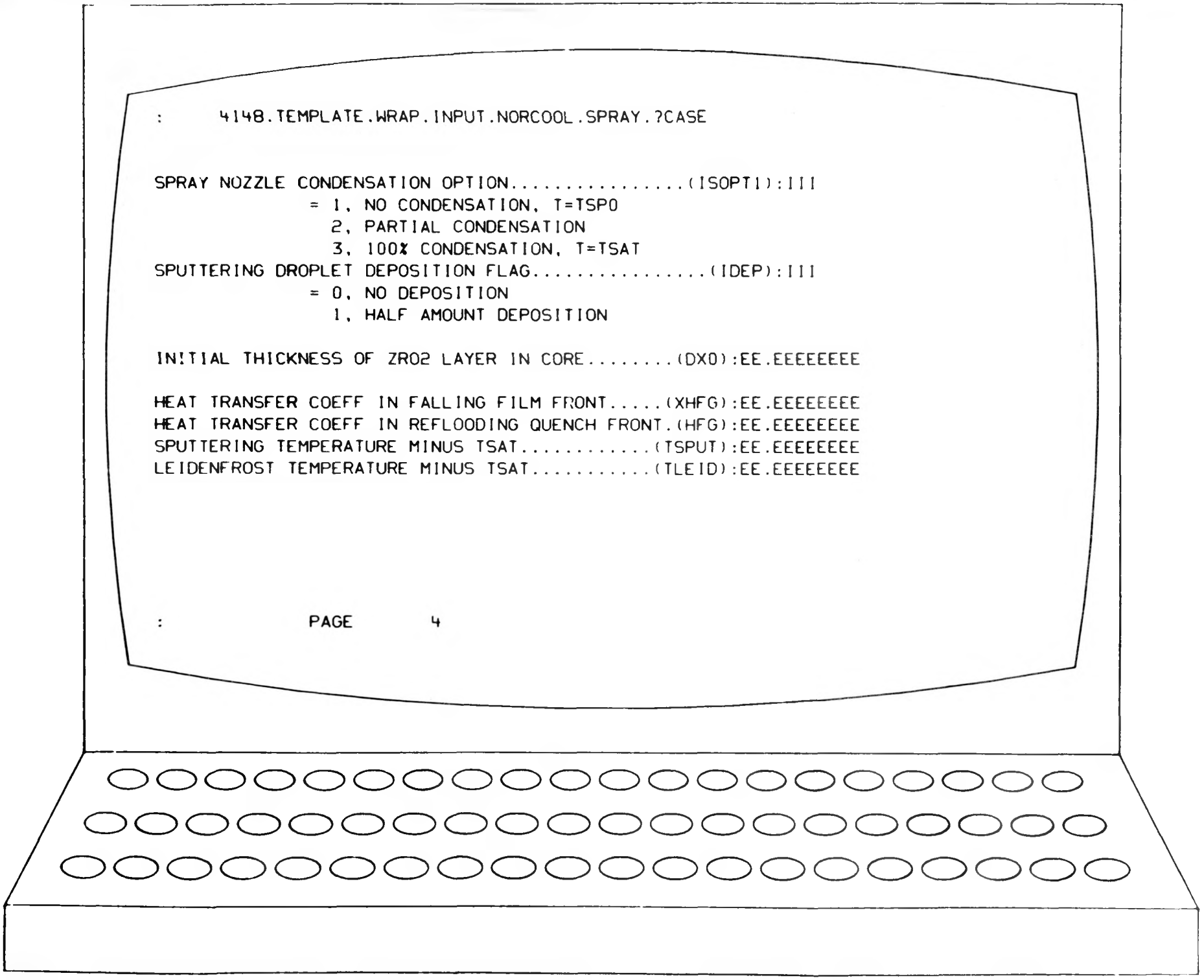

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.POWER.?CASE
(FORMR)
--ROD GROUP NO.-- ---RADIAL POWER PEAKING---
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
:111 :EE.EEEEEEEEE
: PAGE 3

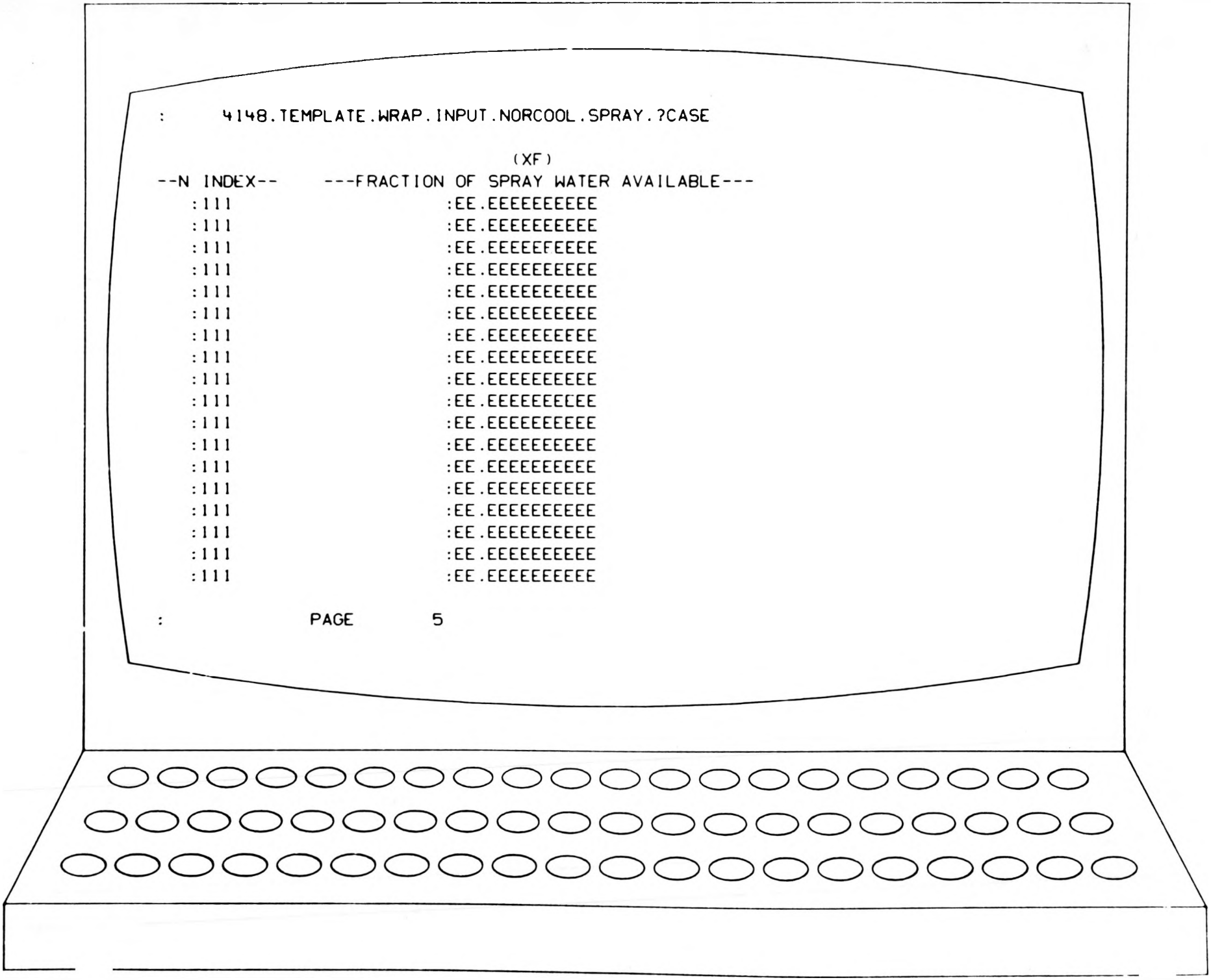

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.POWER.?CASE
(PL)
--VERTICAL CORE NODE NO.-- ---RELATIVE AXIAL POWER---
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
: PAGE 4

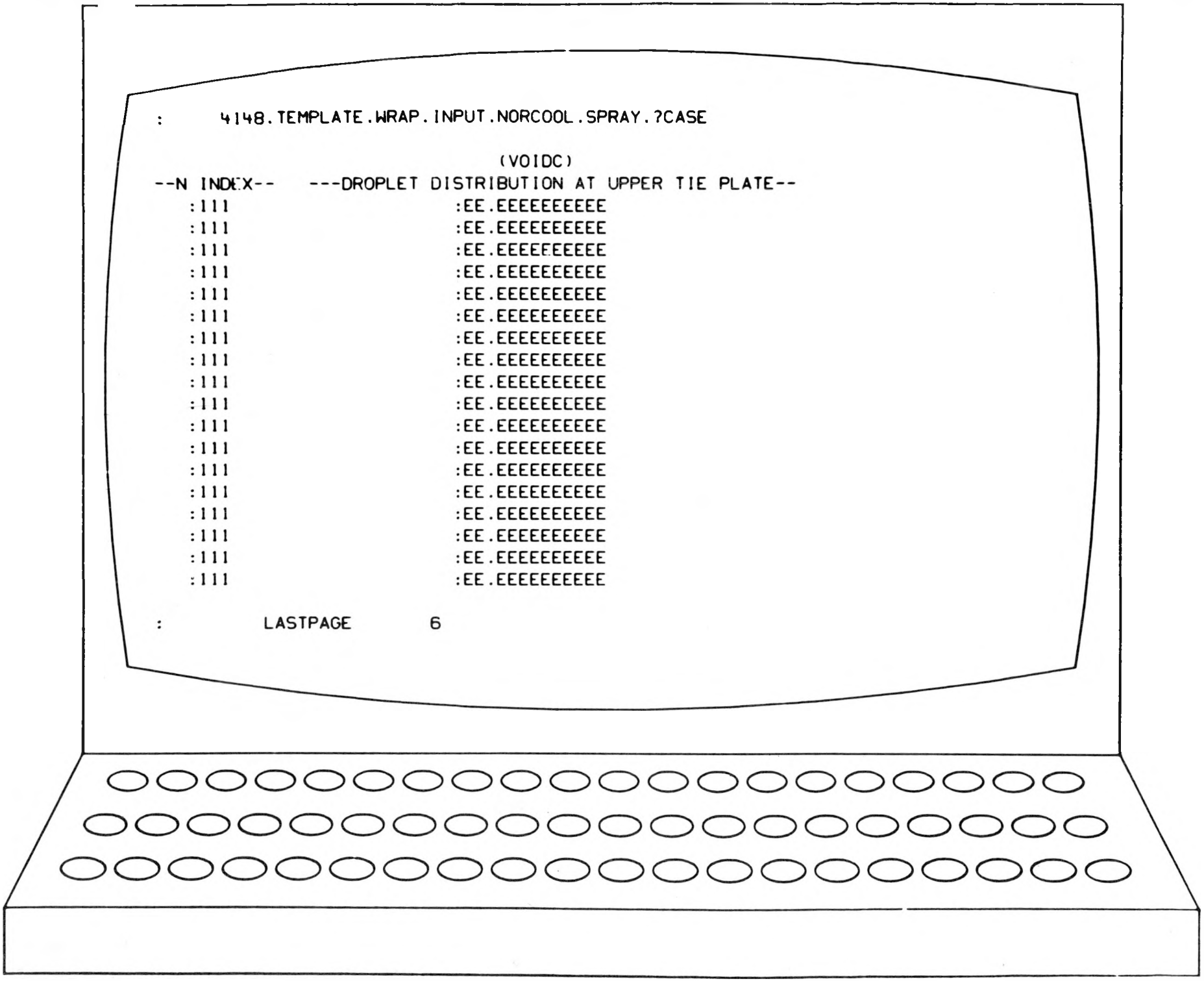

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.POWER.?CASE
DECAY HEAT TABLE--
(TDCH) (DCH)
--PT.-- ---REAL TIME--- ---RELATIVE REACTOR POWER---
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111, :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE :EE.EEEEEEEEEE
: LASTPAGE 5


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.SPRAY.?CASE
QUALIFIER IS THE CASE NAME.
USE THIS RECORD TO INPUT SPRAY AND FLOOD DATA.
NUMBER OF ROD GROUPS PLUS ONE.....(N):III
NODE NUMBER FOR FLOODING COOLANT INJECTION...(NLPCI):III
NODE NUMBER FOR SPRAY COOLANT INJECTION.....(NSPRAY):III
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.SPRAY.?CASE
TIME FOR START OF SPRAY SYSTEM.....(TGSP):EE.EEEEEEEE
TEMPERATURE OF SPRAY WATER.....(TSP0):EE.EEEEEEEE
MASS FLOW CORRELATION COEFFICIENTS.....(GP0):EE.EEEEEEEE
(GP1):EE.EEEEEEEE
(GP2):EE.EEEEEEEE
NOZZLE--DIAMETER OF JET.....(DSP):EE.EEEEEEEE
NUMBER OF JETS.....(XGSP):EE.EEEEEEEE
COSINE OF ANGLE OF NOZZLE (1.0 IS DOWN).....(COSSP):EE.EEEEEEEE
MASS FLOW OF INJECTED FLOODING COOLANT.....(WLPCI0):EE.EEEEEEEE
TIME FOR INITIATING INJECTION (SEC).....(TILPCI):EE.EEEEEEEE
TEMPERATURE OF FLOODING COOLANT (C).....(TLPCI):EE.EEEEEEEE
HEAT TRANSFER COEFF, CHANNEL OR ROD TO FILM..(HFILM):EE.EEEEEEEE
DIAMETER OF SPUTTERING DROPLETS (M).....(DST):EE.EEEEEEEE
: PAGE 3


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.SPRAY.?CASE
SPRAY NOZZLE CONDENSATION OPTION.....(ISOPT1):III
= 1, NO CONDENSATION, T=TSP0
2, PARTIAL CONDENSATION
3, 100% CONDENSATION, T=TSAT
SPUTTERING DROPLET DEPOSITION FLAG.....(IDEP):III
= 0, NO DEPOSITION
1, HALF AMOUNT DEPOSITION
INITIAL THICKNESS OF ZRO2 LAYER IN CORE.....(DX0):EE.EEEEEEEE
HEAT TRANSFER COEFF IN FALLING FILM FRONT.....(XHFG):EE.EEEEEEEE
HEAT TRANSFER COEFF IN REFLOODING QUENCH FRONT.(HFG):EE.EEEEEEEE
SPUTTERING TEMPERATURE MINUS TSAT.....(TSPUT):EE.EEEEEEEE
LEIDENFROST TEMPERATURE MINUS TSAT.....(TLEID):EE.EEEEEEEE
: PAGE 4


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.SPRAY.?CASE
(XF)
--N INDEX-- ---FRACTION OF SPRAY WATER AVAILABLE---
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEFEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
: PAGE 5


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.SPRAY.?CASE
(VOIDC)
--N INDEX-- ---DROPLET DISTRIBUTION AT UPPER TIE PLATE--
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
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:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
:111 :EE.EEEEEEEEEE
: LASTPAGE 6

V. Input Specification for Modular Interfaces

A. GAPCON/WRAP

The user activates the GAPCON/WRAP interface by supplying the input record WRAP.INPUT.GAPCON.RELAP.INTERFAC.?JOB (see pp. 165-166 for template). When the GAPCON/WRAP interface is activated, data from the GAPCON library is automatically linked to the WRIN module via WRAPIT and WIDS.

Within WRAPIT the interface subroutine performs the following steps:

1) Data is retrieved from the GAPCON library,

2) Selected WRAP input records are read,

3) Portions of the input records read are overlaid with GAPCON data, and

4) These updated input records are written to the job data set.

In particular, the updated input records are WRAP.PART.?PART.HEATSLAB.DESC.?SLAB and WRAP.INPUT.SLABGEOM.?GEOM. These records are processed later in the execution of WRAPIT.

B. WRAP/MOXY

The WRAP/MOXY interface is invoked by including the input record WRAP.INPUT.RELAP.MOXY.INTERFAC.?JOB (see pp. 167-170 for template) for the given MOXY calculation. When this record is included in the MOXY input the interface code does the following:

1) A WRAP PLOT/EDIT tape is scanned for the necessary information, and

2) Data from the WRAP PLOT/EDIT tape is placed in a temporary data set.

MOXY then proceeds to execute using the temporary data set created by the interface.

C. GAPCON/MOXY

The GAPCON/MOXY interface is automatically activated when the MOXY input includes the record WRAP.INPUT.GAPCON.MOXY.INTERFAC.?JOB (see pp. 171-173 for template). In much the same manner as the GAPCON/WRAP interface, the GAPCON/MOXY interface acts as a preprocessor. That is, the interface includes the following steps:

1) Data is retrieved from the GAPCON library,

2) Selected MOXY input records are read,

3) Portions of those input records are overlaid with GAPCON data, and

4) The updated input records are written to the job data set.

The MOXY input records updated by the interface and written to the job data set are:

WRAP.INPUT.MOXY.RODTYPES.?JOB

WRAP.INPUT.MOXY.?CASE .GEOMETRY

WRAP.INPUT.MOXY.?CASE .IPARAM

WRAP.INPUT.MOXY.?CASE .SLBLNGTH

WRAP.INPUT.MOXY.?CASE .HEATPEAK

WRAP.INPUT.MOXY.?CASE .DENSITY

WRAP.INPUT.MOXY.?CASE .MOLEFRAC

WRAP.INPUT.MOXY.?CASE .GSVOLUME

WRAP.INPUT.MOXY.?CASE .AXLDPDC

WRAP.INPUT.MOXY.?CASE .GAPPARAM.

D. WRAP/NORCOOL

The transfer of data between WRAP and NORCOOL is effected by the INTNOR module. The module operates in either of two modes. If a specific input record does not exist, module INTNOR will create it. The data which the user has selected for transfer will be written into the record. Data which does not exist in the WRAP data base will be treated in one of two fashions: default parameters (see Table III) built into the module will be assigned to this class of variables; undefined variables (see Table IV) will be assigned obvious values (i.e., HEX-7S). The user would then modify the record, updating the undefined and default variables as needed.

To effect the second mode of operation, the input record is required to already exist. Module INTNOR then writes into the record only those variables the user has selected for transfer. This latter mode would be used in a 'hands-off' coupled calculation. Skeletal input records would be created ahead of time with the non-data base variables already specified. Module INTNOR would then be executed following the completion of WRAP in order to transfer the remaining data base variables characteristic of the end of blowdown.

These following records are read by the interface module INTNOR and control the extraction of NORCOOL input from the database at the conclusion of the blowdown (WRAP) calculation:

WRAP.INPUT.NORCOOL.INTER1.?CASE

WRAP.INPUT.NORCOOL.INTER2.?CASE

WRAP.INPUT.NORCOOL.INTER3.?CASE.

The 'INTER1' record defines most of the interface operations. The template (pp. 174-178) is largely self-explanatory. In a normal situation, the user should fill in all the input called for in the record to assure the maximum transfer of data. Note that the case name and step name must be defined at the start of the record--these must be consistent with the qualifiers in the database which will be processed for NORCOOL input. The single exception occurs when the user wishes to create skeletal records which will be filled in by INTNOR in the 'hands-off' mode. In that case, the database would not have been created yet, thus the two qualifiers should be left blank. The blank names indicate to the module that it should create all the input records with default values filled in, but that no data transfer from the database is desired. After this step is completed, the user is ready to run the transient from initialization through blowdown through reflood, without intervention, provided the case name and step name are now correctly filled in.

The 'INTER2' record (see pp. 179-180 for template) is required only if more than one rod group is required in the NORCOOL calculation. This is not the normal case, thus this record may be ignored in routine calculations. The 'INTER3' record (see pp. 181-183 for template) is used to specify the tables which will be used in generating the coefficients used to describe material properties in NORCOOL. Note that the tables required will typically be in the input dataset for the WRAPIT (input processor) step, thus that dataset must be in the hierarchy for the INTNOR job.

Table III. NORCOOL1 Default Parameters

Variable Description	In NORCOOL	Default Value
Correlation	PAR(19)	6.669D+6
Parameters	PAR(20)	-2.57D-1
	PAR(21)	3.937D-5
	PAR(22)	-1.905D+5
	PAR(27)	6.4D+3
	PAR(28)	4.42D-2
	PAR(35)	2.84D+1
	PAR(36)	1.0D+0
	PAR(40)	6.669D+6
	PAR(41)	-2.57D-1
	PAR(42)	3.937D-5
	PAR(44-50)	0.0
Timestep Subdivision	IREFLD	10
Conduction Timestep	DTIC	0.1
Plot Interval	DTPL1	2.0
Plot Interval	DTPL2	0.2
Transition Reynolds No.	RETR	1000.
Radiation H.T. Flag	ISR	0
Friction Fact Multiplier	FRIKC	1.0
Group No.	IVF	1,Rods 2,Chan.
Channel Emiss.	EPSZR	0.67
Water Emiss.	EPSV	0.96
Time Start of Spray	TGSP	0.0
Nozzle Param.	DSP	0.002
Nozzle Param.	XGSP	60.0
Time Start of Flood	TILPCI	0.0

Table III (contd)

Variable Description	In NORCOOL	Default Value
Diam. of sputtering droplet	DST	0.003
Droplet deposition flag	IDEP	1
Thickness of ZRO2 layer	DXO	1.0D-6
Sput temp - TSAT	TSPUT	65.0
Droplet Distr.	VOIDC	All 1.0
No. pts in drywell table	NPT	2
Wall thickness	DWR	=DC,Clad
Dump Flag	IDUMP	1
Dump Interval	TDUMP	300.
Max time of transient	TREALM	999.
Max cpu time	TCPUM	999.
Time interval for output	TOUT1	10.
TC stop test	TRADO	0.
Convergence test	ALFAR	0.05
Convergence test	BETAR	0.05
Max timestep	DTF	0.1
Max radiation recalculation	DTIR	1.0
Timestep print flag	ITIST	1
Radial power peaking	FORMR	1.0
Metal water flag	IMW	1
CCFL correl.	CCCFL	1.789
Droplet diam.	DS	0.0001
Rod type	IWF	1, One fuel grp
No. of rods in grp.	NR	NR(1)=NRO**2 NR(2)=NRO**2+4*NRO-NR(1)
View factor print flag	IVFOPT	0
Spray flow correlation	GPO	1.11 (GP1=GP2=0.0)
Nozzle angle cosine	COSSP	0.0

Table III (contd)

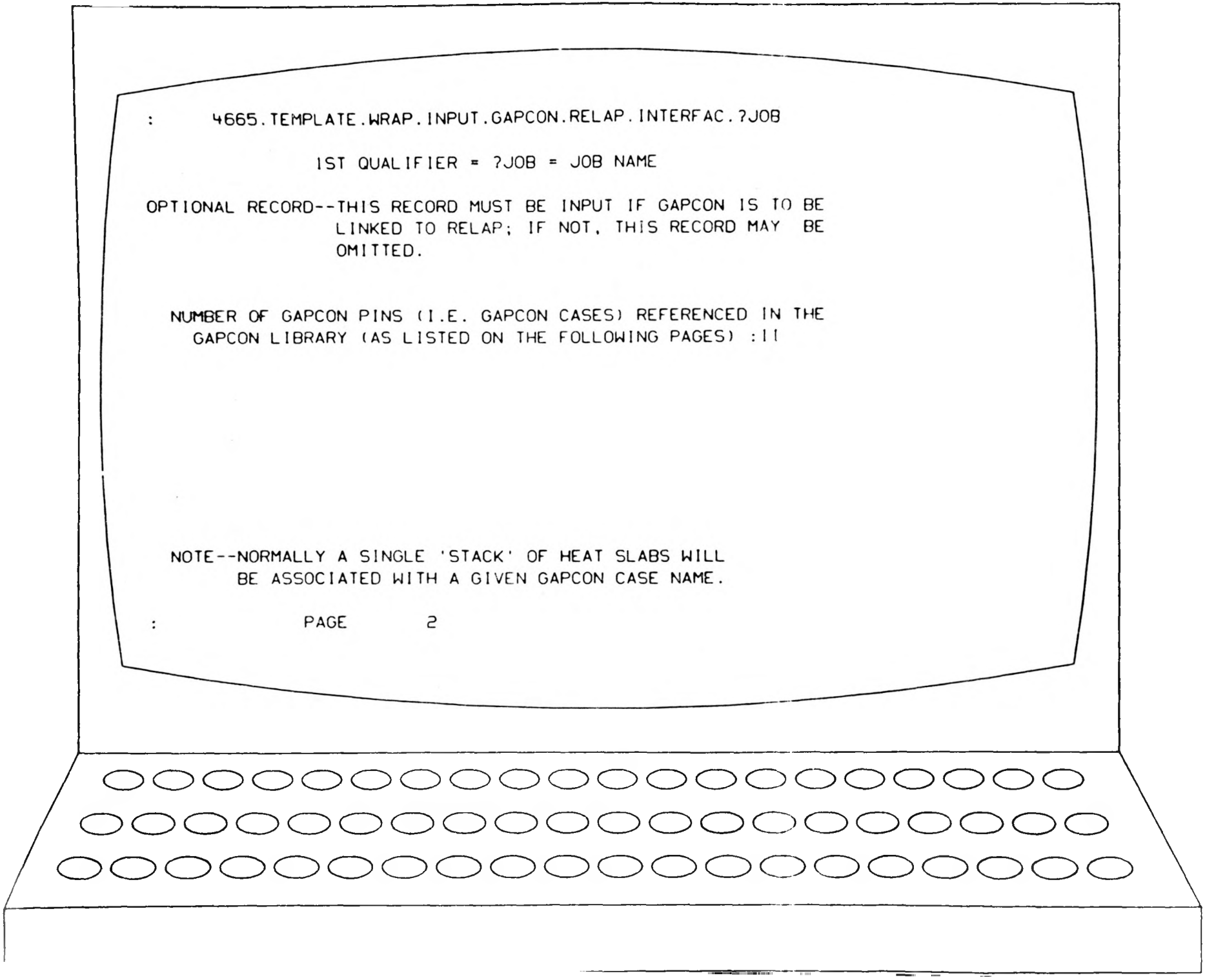
Variable Description	In NORCOOL	Default Value
H.T. coeff.	HFILM	3000.
Spray nozzle flag	ISOPT1	2
Fraction of spray avail.	XF	XF(1)=0.4125 XF(2)=0.40
H.T. Coeff.	XHFG	1.13D+6
H.T. Coeff.	HFG	1.13D+6
Leidenfrost Temp - TSAT	TLEID	65.0
Decay table flag	NDCM	0 (Thus TDCH and DCH not needed)
Times in dry - well table	TPT	0.,1000.Constant PPT

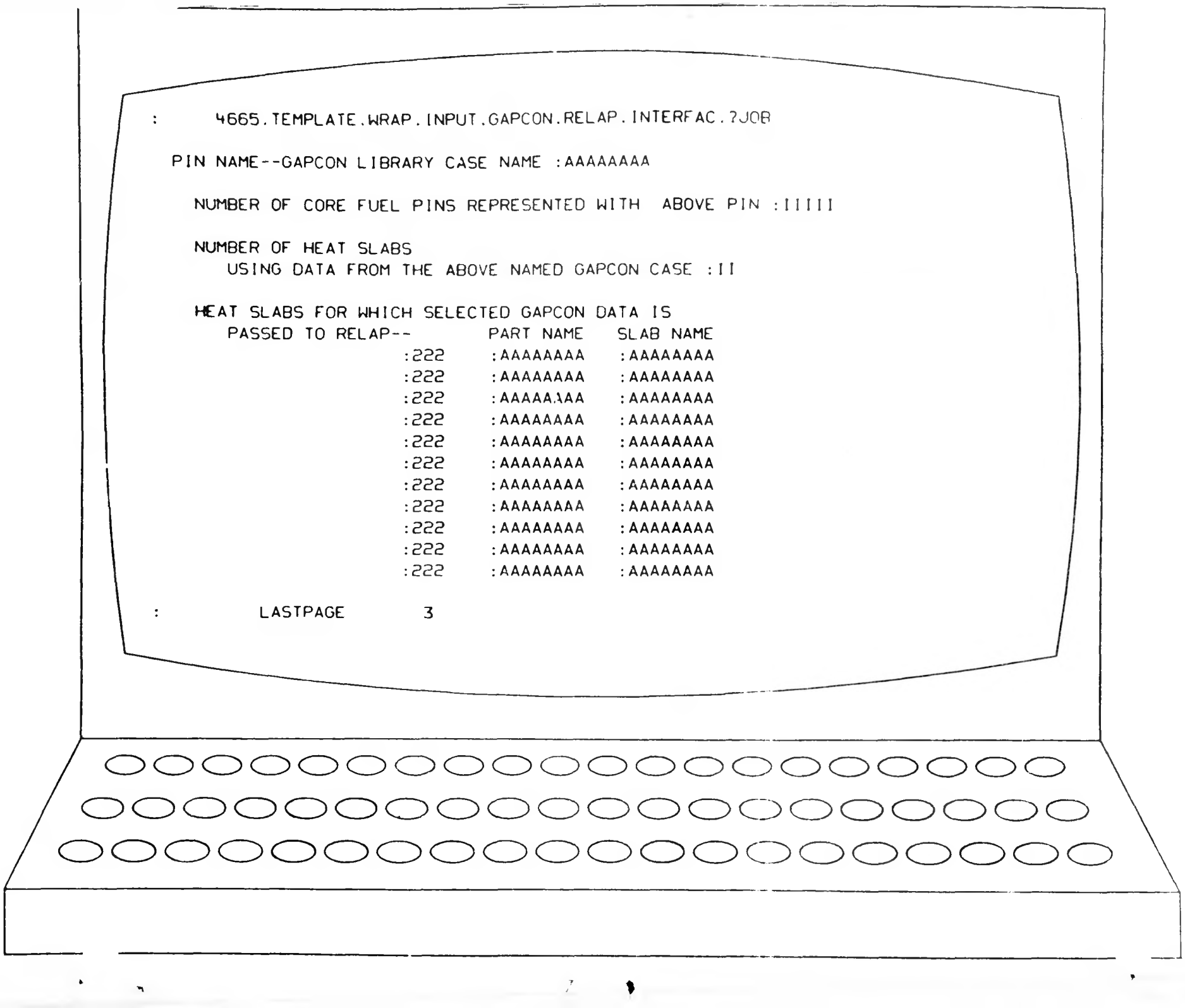
Table IV. NORCOOL1 User-Defined Parameters

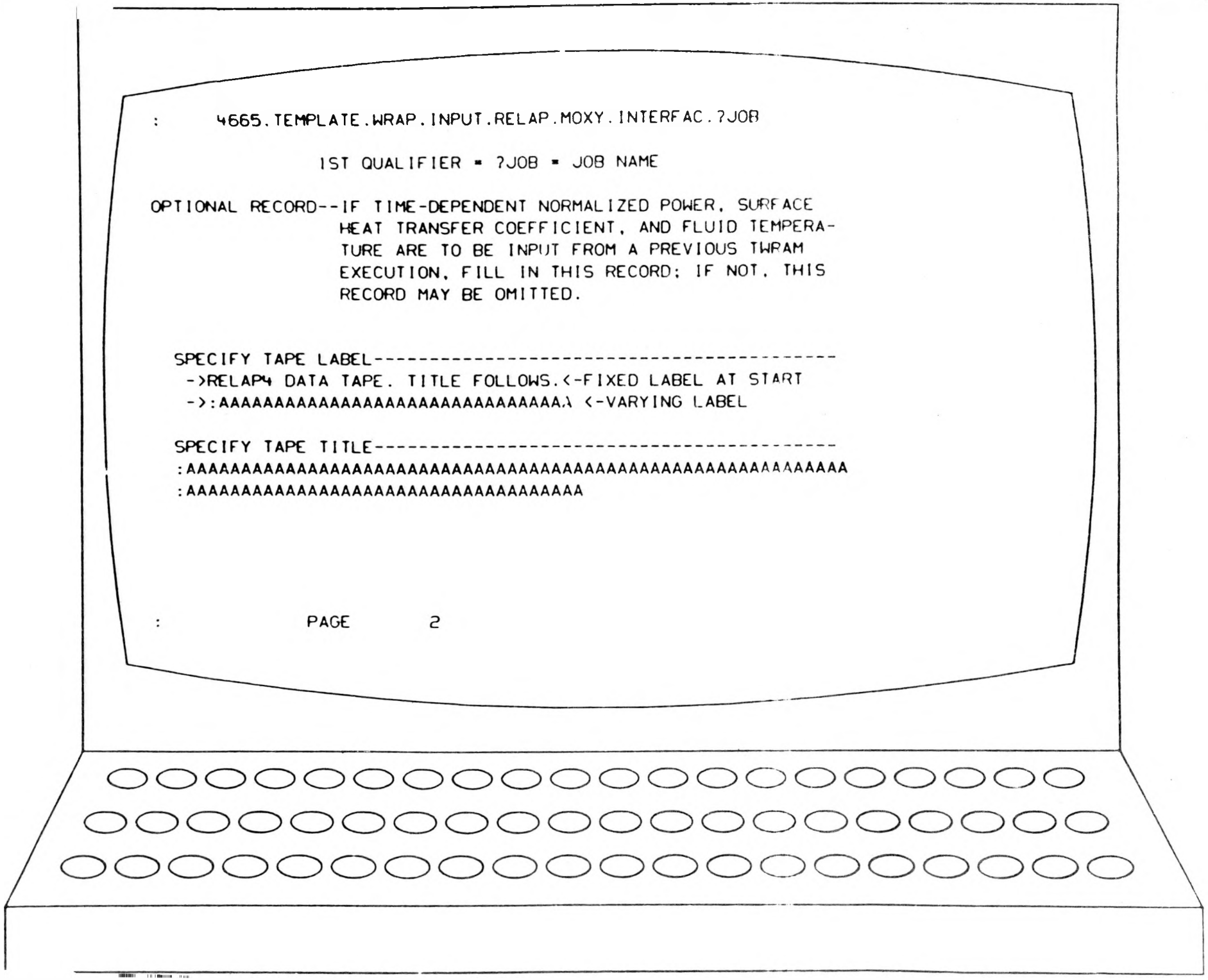
Variable Description	In NORCOOL
Cross-sectional area of channel wall	ASH
Thickness of channel wall	DSH
Horizontal length of steam dome	LUP
Thickness of wall nodes	DWAL
Temperature of spray	TSPO
Mass flow of flooding	WLPCIO
Temperature of flooding	TLPCI
Cross-section of break	AL
Diameter of broken tube	DL
Length of broken tube	ZL
Pitch of rods in bundle	SPAC
Rod/channel distance	ARSH
Loss coeff. for break	XKF
Loss coeff. for lower plenum/bypass choke	BPLOSS
Node no. for spray	NSPRAY
Node no. for flooding	NLPCI

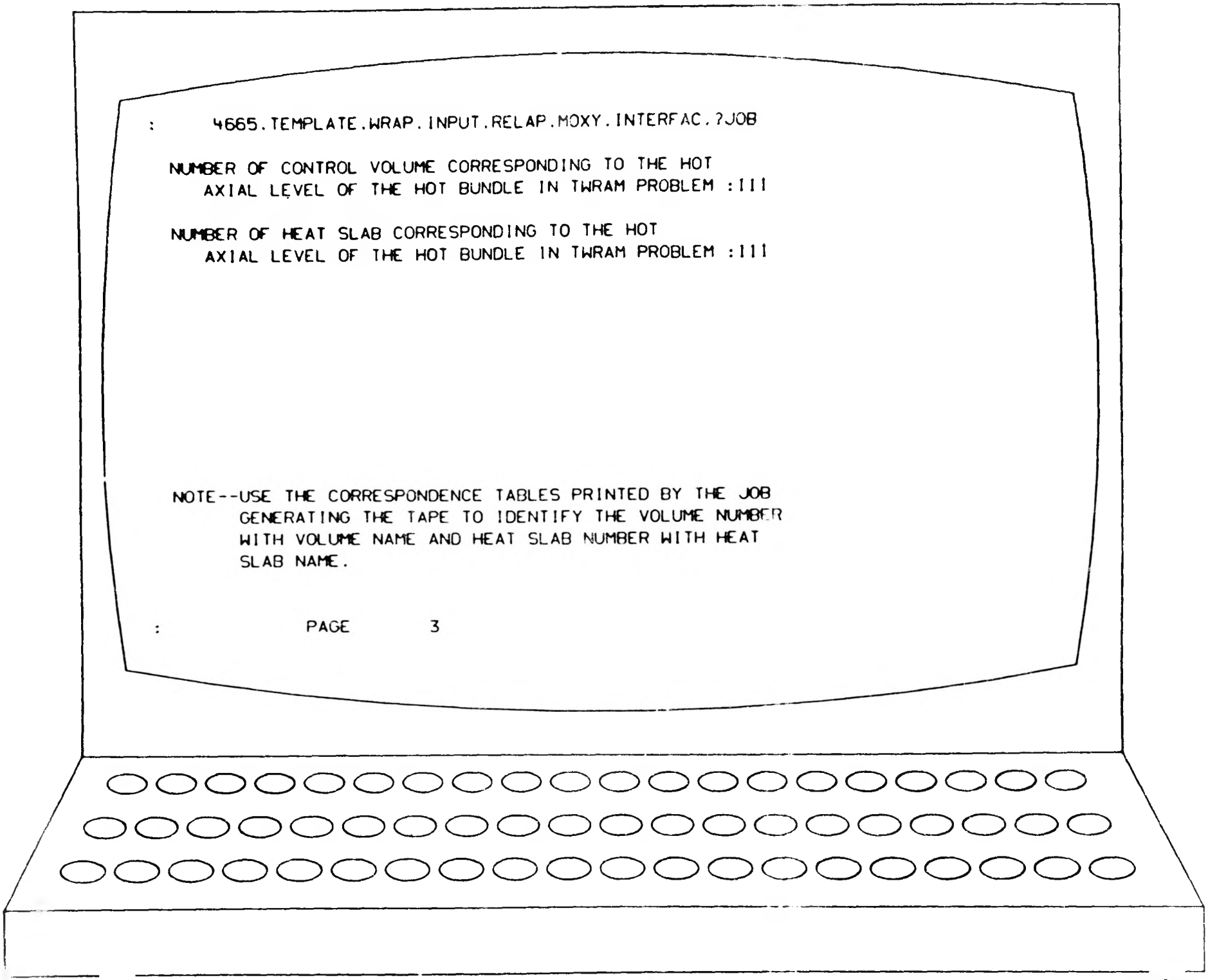
Unit conversion factor built into code --

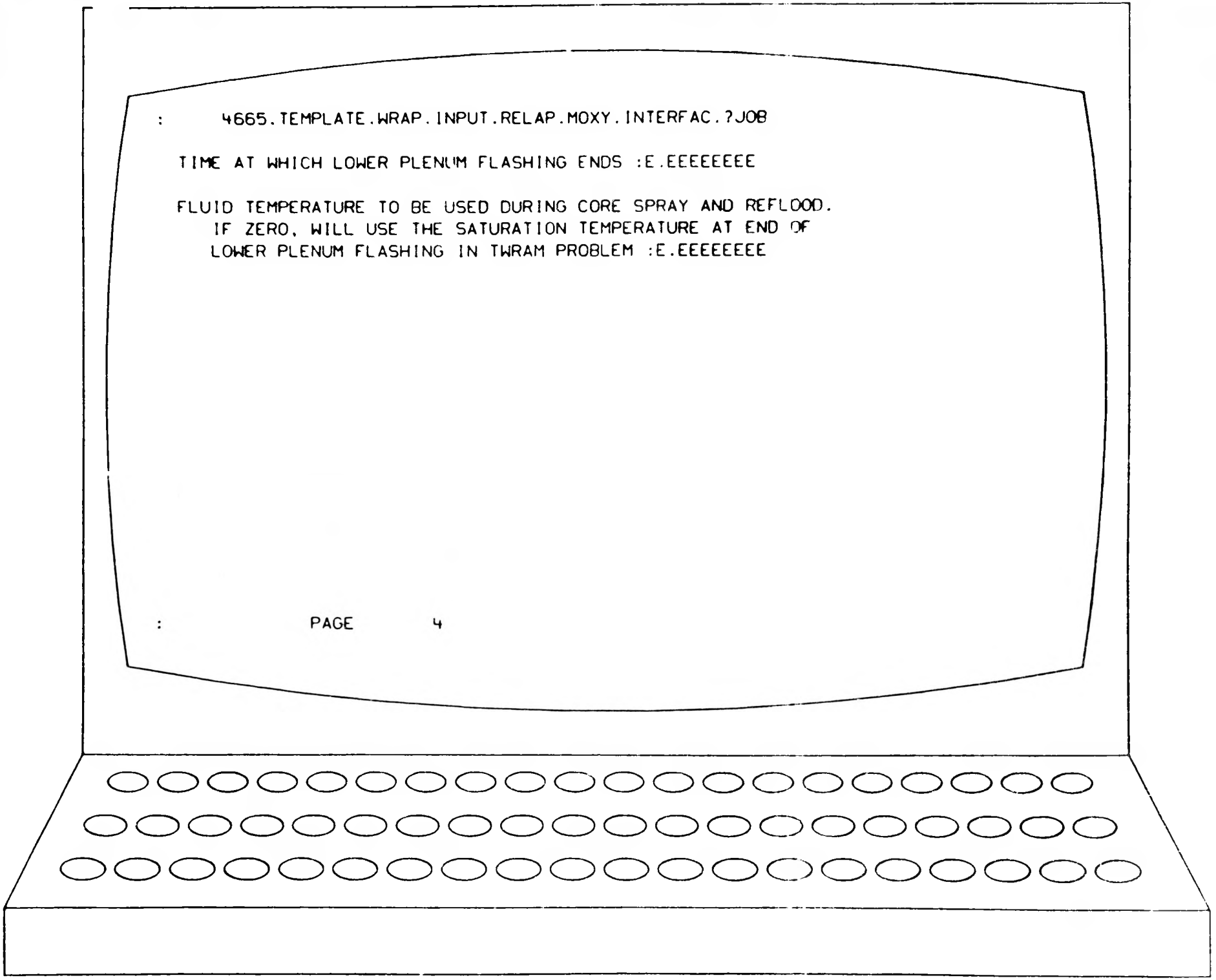
Feet/3.280833 = Meters
BTU/9.478D-4 = Joule
Pound/2.2046223 = Kilogram
PSI*6.895D+3 = NT/M**2

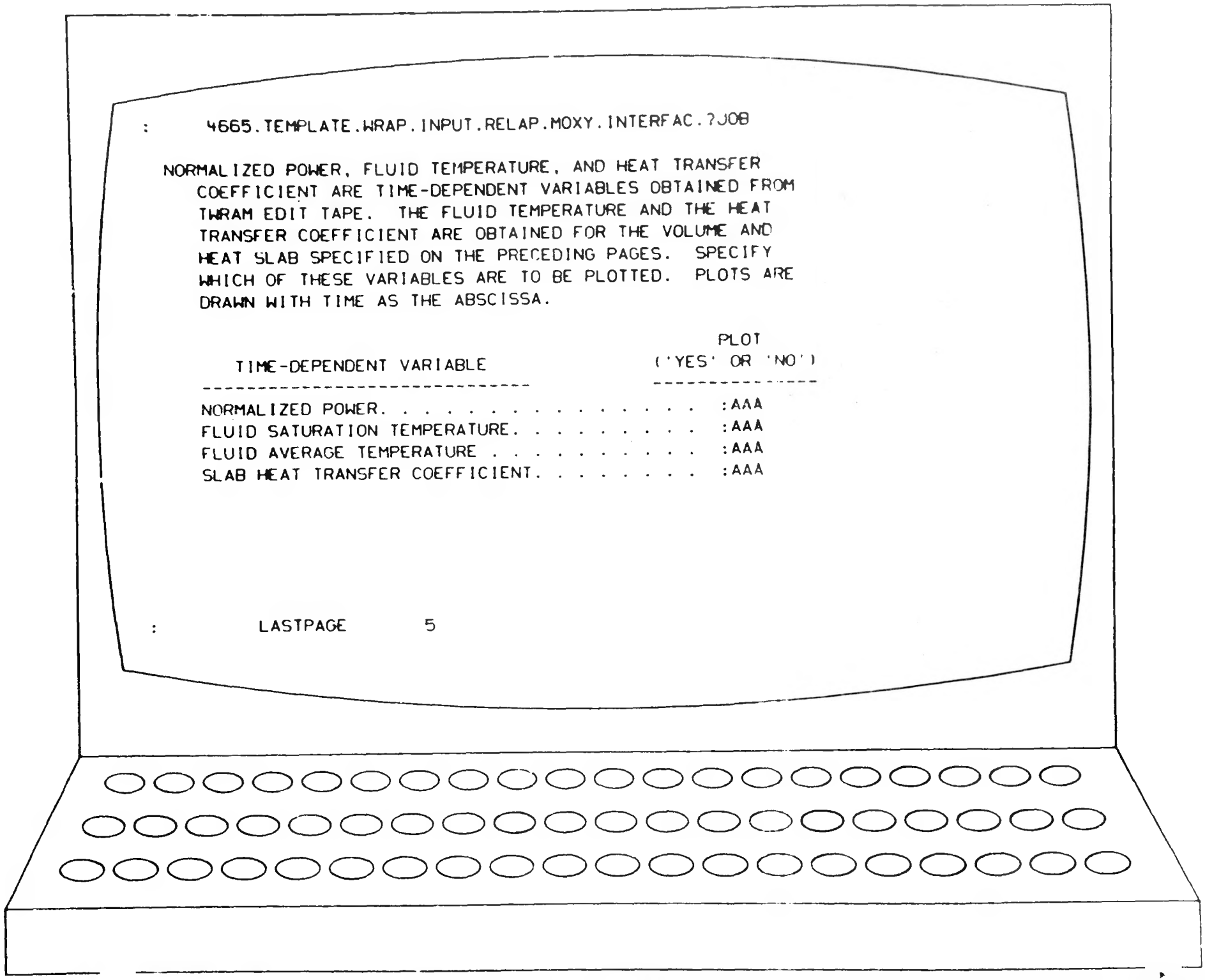

: 4665.TEMPLATE.WRAP.INPUT.GAPCON.RELAP.INTERFAC.?JOB
1ST QUALIFIER = ?JOB = JOB NAME
OPTIONAL RECORD--THIS RECORD MUST BE INPUT IF GAPCON IS TO BE LINKED TO RELAP; IF NOT, THIS RECORD MAY BE OMITTED.
NUMBER OF GAPCON PINS (I.E. GAPCON CASES) REFERENCED IN THE GAPCON LIBRARY (AS LISTED ON THE FOLLOWING PAGES) :11
NOTE--NORMALLY A SINGLE 'STACK' OF HEAT SLABS WILL BE ASSOCIATED WITH A GIVEN GAPCON CASE NAME.
: PAGE 2

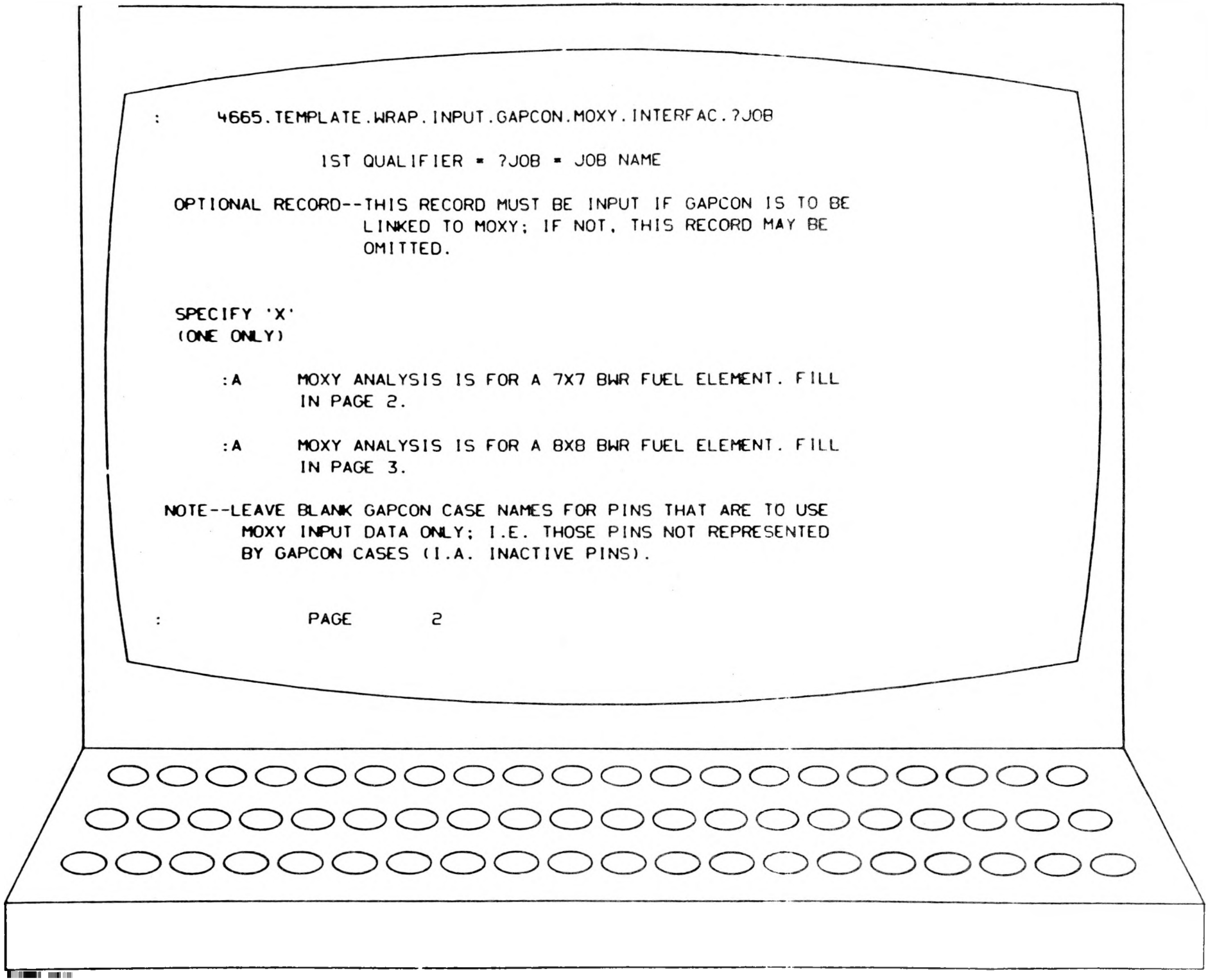

: 4665.TEMPLATE.WRAP.INPUT.GAPCON.RELAP.INTERFAC.?JOB
PIN NAME--GAPCON LIBRARY CASE NAME :AAAAAAAA
NUMBER OF CORE FUEL PINS REPRESENTED WITH ABOVE PIN :IIIII
NUMBER OF HEAT SLABS
USING DATA FROM THE ABOVE NAMED GAPCON CASE :II
HEAT SLABS FOR WHICH SELECTED GAPCON DATA IS
PASSED TO RELAP-- PART NAME SLAB NAME
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
:222 :AAAAAAAA :AAAAAAAA
: LASTPAGE 3

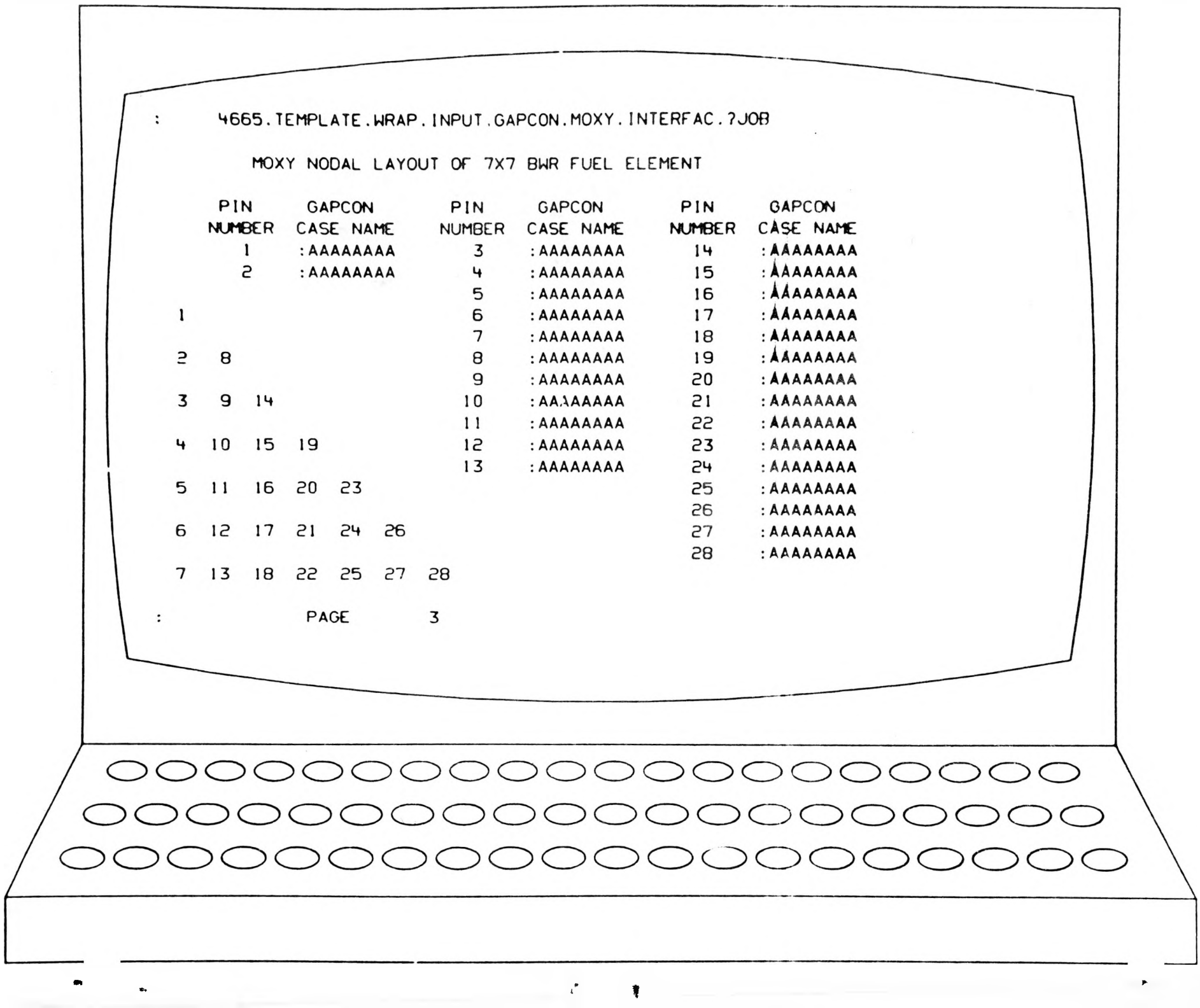

: 4665.TEMPLATE.WRAP.INPUT.RELAP.MOXY.INTERFAC.?JOB
1ST QUALIFIER = ?JOB = JOB NAME
OPTIONAL RECORD--IF TIME-DEPENDENT NORMALIZED POWER, SURFACE HEAT TRANSFER COEFFICIENT, AND FLUID TEMPERATURE ARE TO BE INPUT FROM A PREVIOUS TWRAM EXECUTION, FILL IN THIS RECORD; IF NOT, THIS RECORD MAY BE OMITTED.
SPECIFY TAPE LABEL----------
->RELAP4 DATA TAPE. TITLE FOLLOWS.<-FIXED LABEL AT START
->:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAA\ <-VARYING LABEL
SPECIFY TAPE TITLE----------
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
: PAGE 2

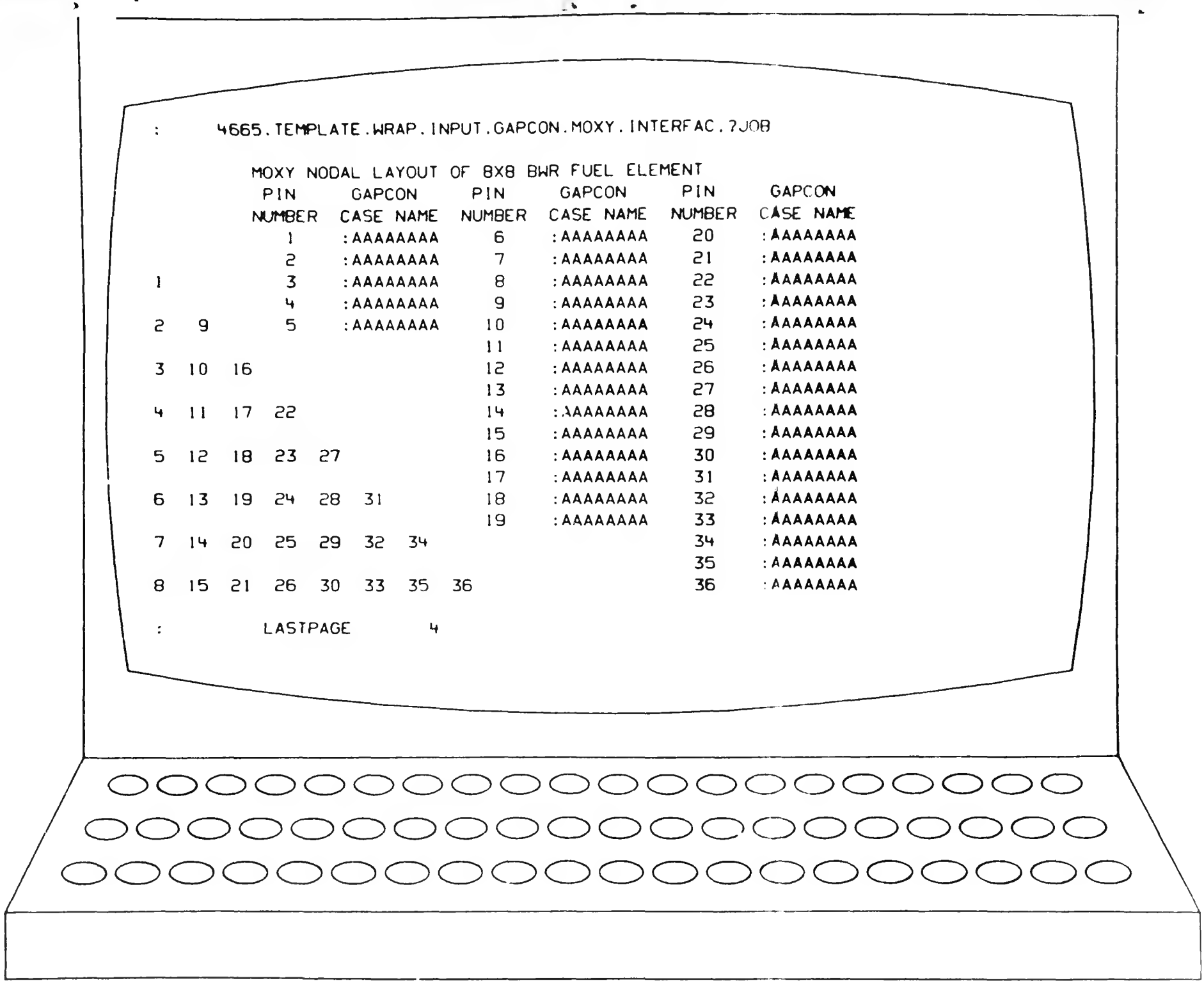

: 4665.TEMPLATE.WRAP.INPUT.RELAP.MOXY.INTERFAC.?JOB
NUMBER OF CONTROL VOLUME CORRESPONDING TO THE HOT
AXIAL LEVEL OF THE HOT BUNDLE IN TWRAM PROBLEM :111
NUMBER OF HEAT SLAB CORRESPONDING TO THE HOT
AXIAL LEVEL OF THE HOT BUNDLE IN TWRAM PROBLEM :111
NOTE--USE THE CORRESPONDENCE TABLES PRINTED BY THE JOB
GENERATING THE TAPE TO IDENTIFY THE VOLUME NUMBER
WITH VOLUME NAME AND HEAT SLAB NUMBER WITH HEAT
SLAB NAME.
: PAGE 3

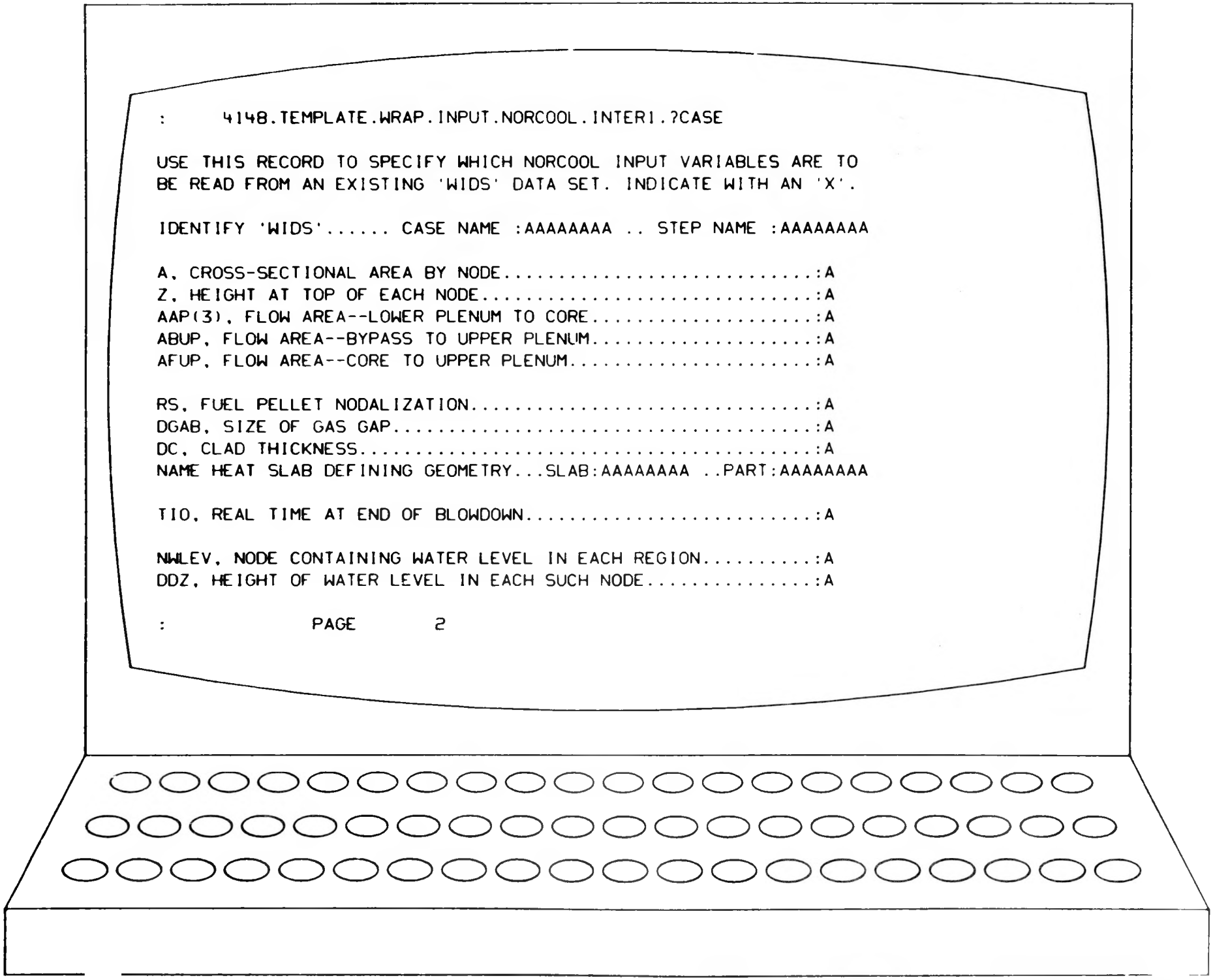

: 4665.TEMPLATE.WRAP.INPUT.RELAP.MOXY.INTERFAC.?JOB
TIME AT WHICH LOWER PLENUM FLASHING ENDS :E.EEEEEEEE
FLUID TEMPERATURE TO BE USED DURING CORE SPRAY AND REFLOOD.
IF ZERO, WILL USE THE SATURATION TEMPERATURE AT END OF
LOWER PLENUM FLASHING IN TWRAM PROBLEM :E.EEEEEEEE
: PAGE 4

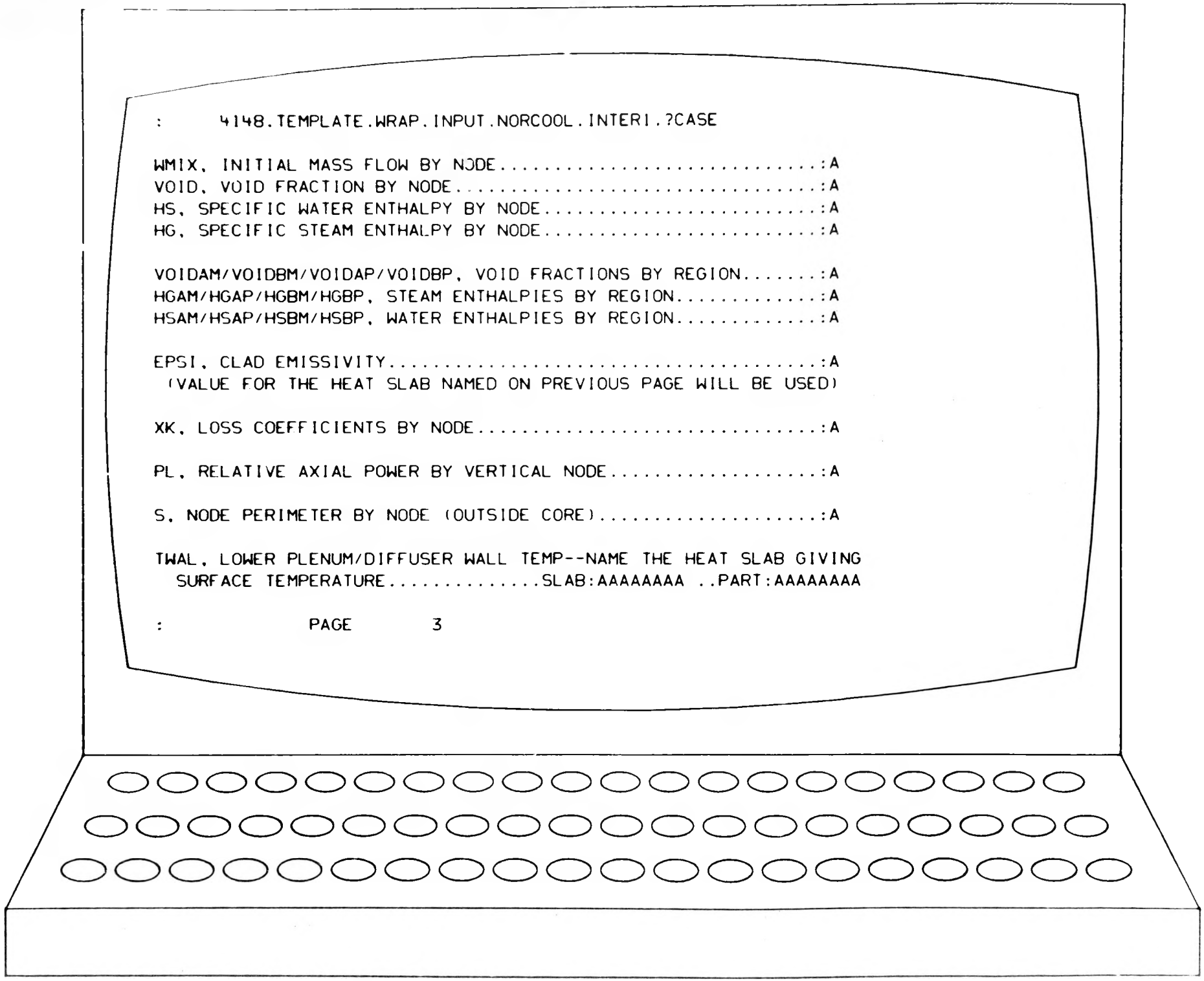

: 4665.TEMPLATE.WRAP.INPUT.RELAP.MOXY.INTERFAC.?J08
NORMALIZED POWER, FLUID TEMPERATURE, AND HEAT TRANSFER
COEFFICIENT ARE TIME-DEPENDENT VARIABLES OBTAINED FROM
TWRAM EDIT TAPE. THE FLUID TEMPERATURE AND THE HEAT
TRANSFER COEFFICIENT ARE OBTAINED FOR THE VOLUME AND
HEAT SLAB SPECIFIED ON THE PRECEDING PAGES. SPECIFY
WHICH OF THESE VARIABLES ARE TO BE PLOTTED. PLOTS ARE
DRAWN WITH TIME AS THE ABSCISSA.
TIME-DEPENDENT VARIABLE
PLOT ('YES' OR 'NO')
NORMALIZED POWER. . . . . :AAA
FLUID SATURATION TEMPERATURE. . . . . :AAA
FLUID AVERAGE TEMPERATURE . . . . . :AAA
SLAB HEAT TRANSFER COEFFICIENT. . . . . :AAA
: LASTPAGE 5

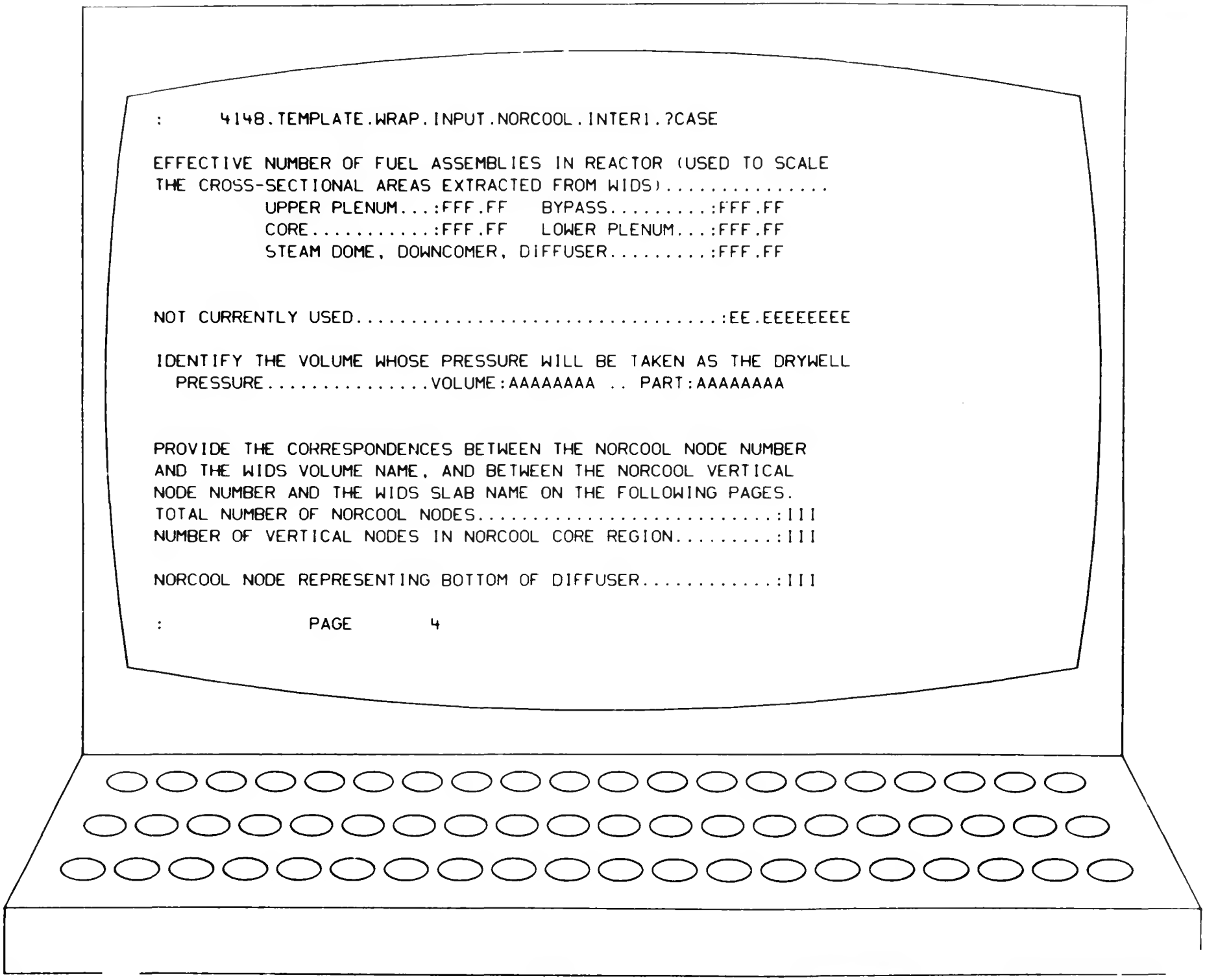

: 4665.TEMPLATE.WRAP.INPUT.GAPCON.MOXY.INTERFAC.?JOB
1ST QUALIFIER = ?JOB = JOB NAME
OPTIONAL RECORD--THIS RECORD MUST BE INPUT IF GAPCON IS TO BE LINKED TO MOXY; IF NOT, THIS RECORD MAY BE OMITTED.
SPECIFY 'X'
(ONE ONLY)
:A MOXY ANALYSIS IS FOR A 7X7 BWR FUEL ELEMENT. FILL IN PAGE 2.
:A MOXY ANALYSIS IS FOR A 8X8 BWR FUEL ELEMENT. FILL IN PAGE 3.
NOTE--LEAVE BLANK GAPCON CASE NAMES FOR PINS THAT ARE TO USE MOXY INPUT DATA ONLY; I.E. THOSE PINS NOT REPRESENTED BY GAPCON CASES (I.A. INACTIVE PINS).
: PAGE 2


: 4665.TEMPLATE.WRAP.INPUT.GAPCON.MOXY.INTERFAC.?JOB
MOXY NODAL LAYOUT OF 7X7 BWR FUEL ELEMENT
PIN NUMBER
GAPCON CASE NAME
1 :AAAAAAAA
2 :AAAAAAAA
1
2 8
3 9 14
4 10 15 19
5 11 16 20 23
6 12 17 21 24 26
7 13 18 22 25 27 28
3 :AAAAAAAA
4 :AAAAAAAA
5 :AAAAAAAA
6 :AAAAAAAA
7 :AAAAAAAA
8 :AAAAAAAA
9 :AAAAAAAA
10 :AAAAAAAA
11 :AAAAAAAA
12 :AAAAAAAA
13 :AAAAAAAA
14 :AAAAAAAA
15 :AAAAAAAA
16 :AAAAAAAA
17 :AAAAAAAA
18 :AAAAAAAA
19 :AAAAAAAA
20 :AAAAAAAA
21 :AAAAAAAA
22 :AAAAAAAA
23 :AAAAAAAA
24 :AAAAAAAA
25 :AAAAAAAA
26 :AAAAAAAA
27 :AAAAAAAA
28 :AAAAAAAA
: PAGE 3


: 4665.TEMPLATE.WRAP.INPUT.GAPCON.MOXY.INTERFAC.?JOB
MOXY NODAL LAYOUT OF 8X8 BWR FUEL ELEMENT
PIN NUMBER
GAPCON CASE NAME
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
:AAAAAAAA
: LASTPAGE 4


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER1.?CASE
USE THIS RECORD TO SPECIFY WHICH NORCOOL INPUT VARIABLES ARE TO
BE READ FROM AN EXISTING 'WIDS' DATA SET. INDICATE WITH AN 'X'.
IDENTIFY 'WIDS'..... CASE NAME :AAAAAAAA .. STEP NAME :AAAAAAAA
A, CROSS-SECTIONAL AREA BY NODE.....:A
Z, HEIGHT AT TOP OF EACH NODE.....:A
AAP(3), FLOW AREA--LOWER PLENUM TO CORE.....:A
ABUP, FLOW AREA--BYPASS TO UPPER PLENUM.....:A
AFUP, FLOW AREA--CORE TO UPPER PLENUM.....:A
RS, FUEL PELLET NODALIZATION.....:A
DGAB, SIZE OF GAS GAP.....:A
DC, CLAD THICKNESS.....:A
NAME HEAT SLAB DEFINING GEOMETRY...SLAB:AAAAAAAA ..PART:AAAAAAAA
TIO, REAL TIME AT END OF BLOWDOWN.....:A
NWLEV, NODE CONTAINING WATER LEVEL IN EACH REGION.....:A
DDZ, HEIGHT OF WATER LEVEL IN EACH SUCH NODE.....:A
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTERI.?CASE
WMIX, INITIAL MASS FLOW BY NODE.....:A
VOID, VOID FRACTION BY NODE.....:A
HS, SPECIFIC WATER ENTHALPY BY NODE.....:A
HG, SPECIFIC STEAM ENTHALPY BY NODE.....:A
VOIDAM/VOIDBM/VOIDAP/VOIDBP, VOID FRACTIONS BY REGION.....:A
HGAM/HGAP/HGBM/HGBP, STEAM ENTHALPIES BY REGION.....:A
HSAM/HSAP/HSBM/HSBP, WATER ENTHALPIES BY REGION.....:A
EPSI, CLAD EMISSIVITY.....:A
(VALUE FOR THE HEAT SLAB NAMED ON PREVIOUS PAGE WILL BE USED)
XK, LOSS COEFFICIENTS BY NODE.....:A
PL, RELATIVE AXIAL POWER BY VERTICAL NODE.....:A
S, NODE PERIMETER BY NODE (OUTSIDE CORE).....:A
TWAL, LOWER PLENUM/DIFFUSER WALL TEMP--NAME THE HEAT SLAB GIVING
SURFACE TEMPERATURE.....SLAB:AAAAAAAA ..PART:AAAAAAAA
: PAGE 3

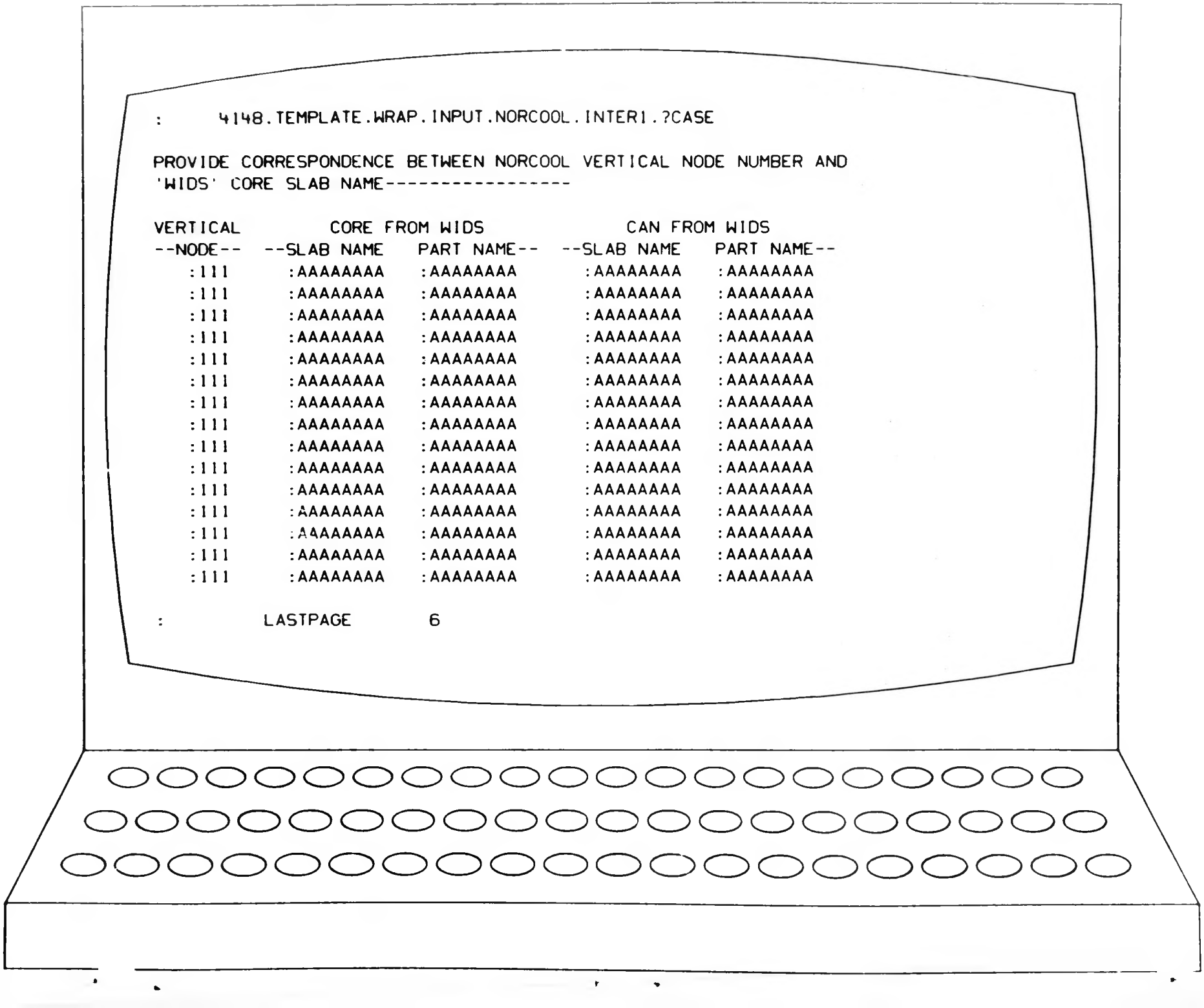

: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER1.?CASE
EFFECTIVE NUMBER OF FUEL ASSEMBLIES IN REACTOR (USED TO SCALE
THE CROSS-SECTIONAL AREAS EXTRACTED FROM WIDS).....
UPPER PLENUM...:FFF.FF BYPASS.....:FFF.FF
CORE.....:FFF.FF LOWER PLENUM...:FFF.FF
STEAM DOME, DOWNCOMER, DIFFUSER.....:FFF.FF
NOT CURRENTLY USED.....:EE.EEEEEEEE
IDENTIFY THE VOLUME WHOSE PRESSURE WILL BE TAKEN AS THE DRYWELL
PRESSURE.....VOLUME:AAAAAAAA .. PART:AAAAAAAA
PROVIDE THE CORRESPONDENCES BETWEEN THE NORCOOL NODE NUMBER
AND THE WIDS VOLUME NAME, AND BETWEEN THE NORCOOL VERTICAL
NODE NUMBER AND THE WIDS SLAB NAME ON THE FOLLOWING PAGES.
TOTAL NUMBER OF NORCOOL NODES.....:III
NUMBER OF VERTICAL NODES IN NORCOOL CORE REGION.....:III
NORCOOL NODE REPRESENTING BOTTOM OF DIFFUSER.....:III
: PAGE 4

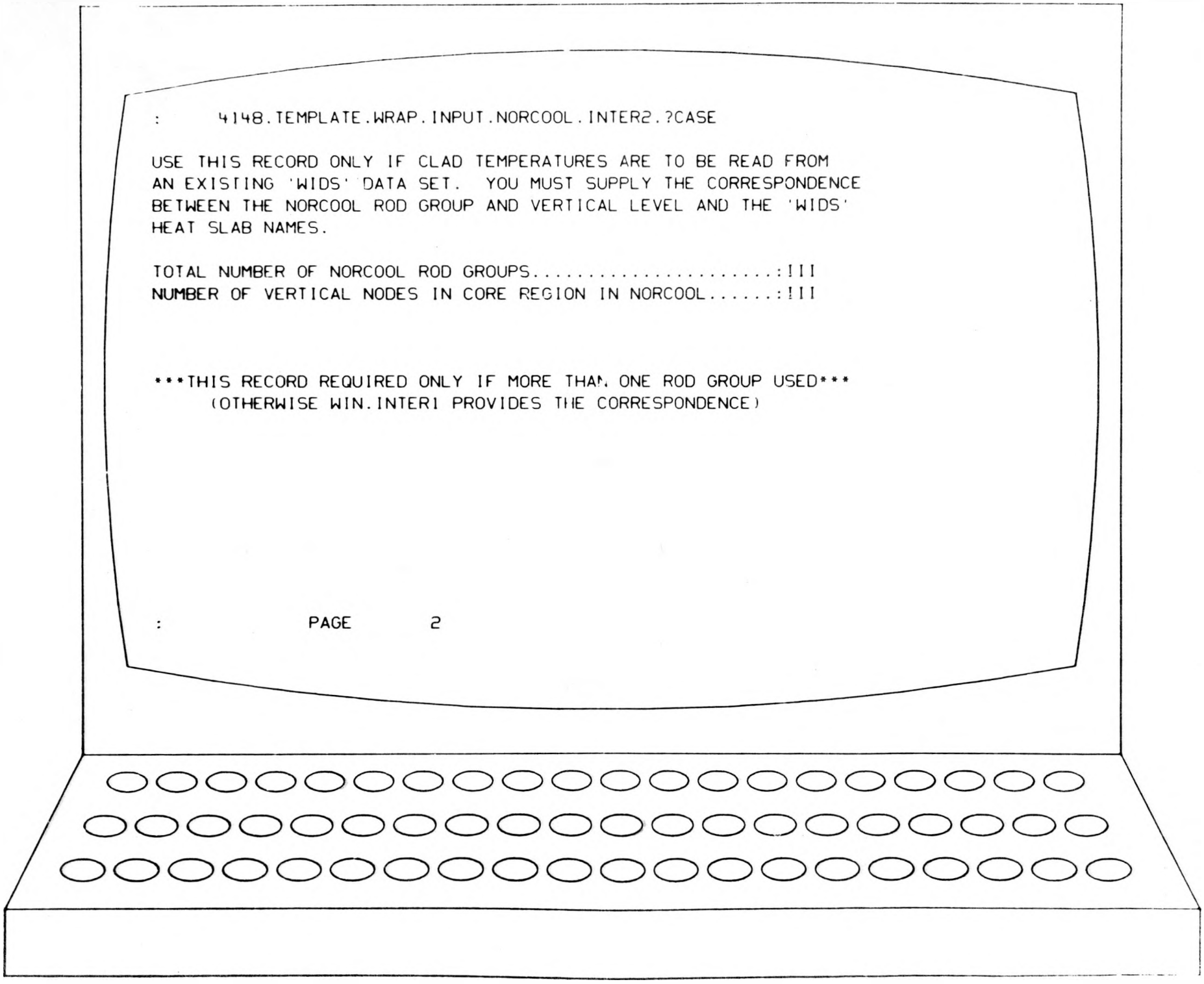
```
:     4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER1.?CASE

PROVIDE CORRESPONDENCE BETWEEN NORCOOL NODE AND 'WIDS'
VOLUME NAMES-------------

-NODE-   --VOLUME ; PART---    -NODE-   --VOLUME ; PART---
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 .111    :AAAAAAAA:AAAAAAAA     :111    .AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA
 :111    :AAAAAAAA:AAAAAAAA     :111    :AAAAAAAA:AAAAAAAA

:               PAGE        5
```


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER1.?CASE
PROVIDE CORRESPONDENCE BETWEEN NORCOOL VERTICAL NODE NUMBER AND
'WIDS' CORE SLAB NAME----------
VERTICAL CORE FROM WIDS CAN FROM WIDS
--NODE-- --SLAB NAME PART NAME-- --SLAB NAME PART NAME--
:111 :AAAAAAAA :AAAAAAAA :AAAAAAAA :AAAAAAAA
: LASTPAGE 6


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER2.?CASE
USE THIS RECORD ONLY IF CLAD TEMPERATURES ARE TO BE READ FROM
AN EXISTING 'WIDS' DATA SET. YOU MUST SUPPLY THE CORRESPONDENCE
BETWEEN THE NORCOOL ROD GROUP AND VERTICAL LEVEL AND THE 'WIDS'
HEAT SLAB NAMES.
TOTAL NUMBER OF NORCOOL ROD GROUPS.....:III
NUMBER OF VERTICAL NODES IN CORE REGION IN NORCOOL.....:III
THIS RECORD REQUIRED ONLY IF MORE THAN ONE ROD GROUP USED
(OTHERWISE WIN.INTER1 PROVIDES THE CORRESPONDENCE)
: PAGE 2

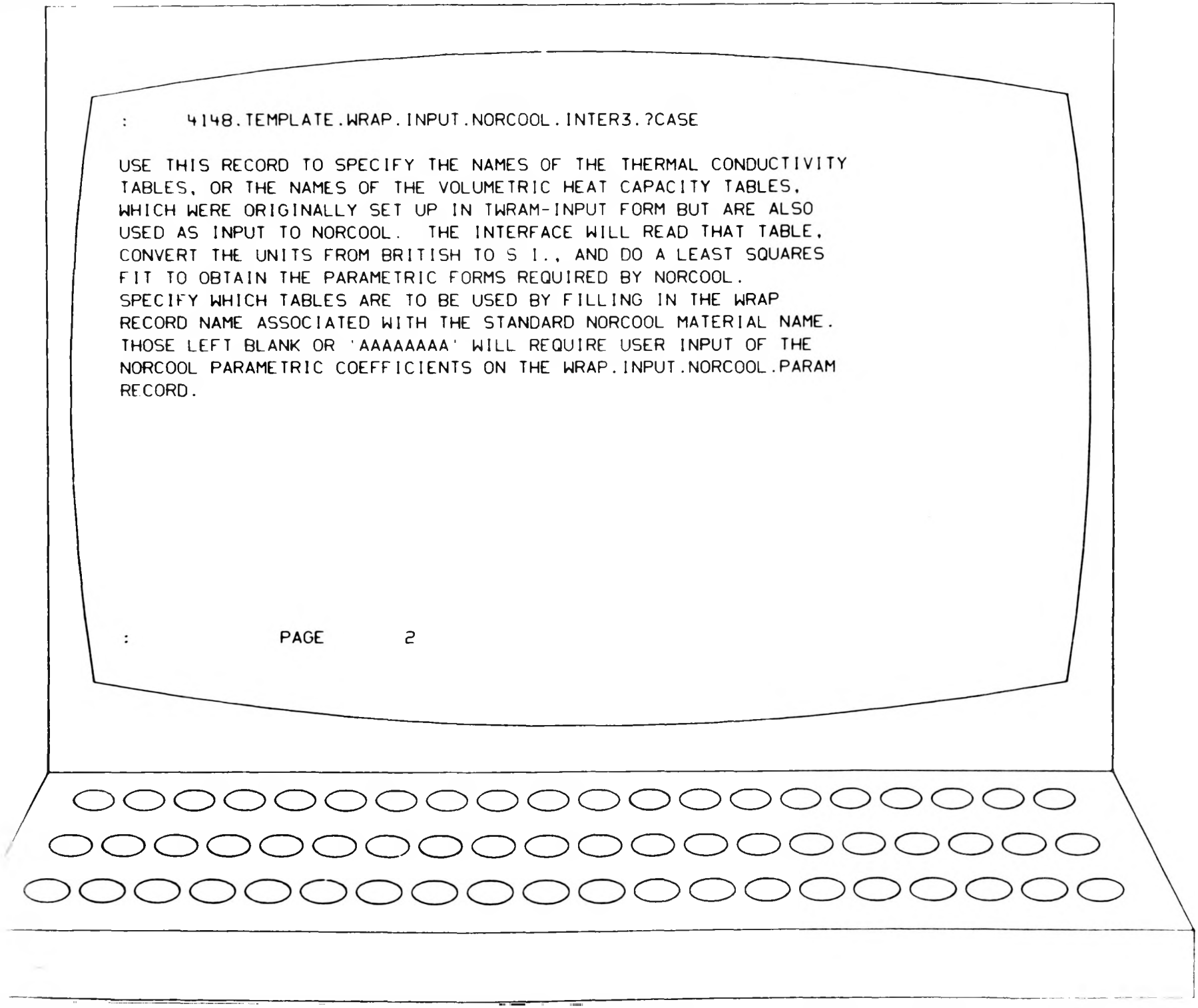
```
:     4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER2.?CASE

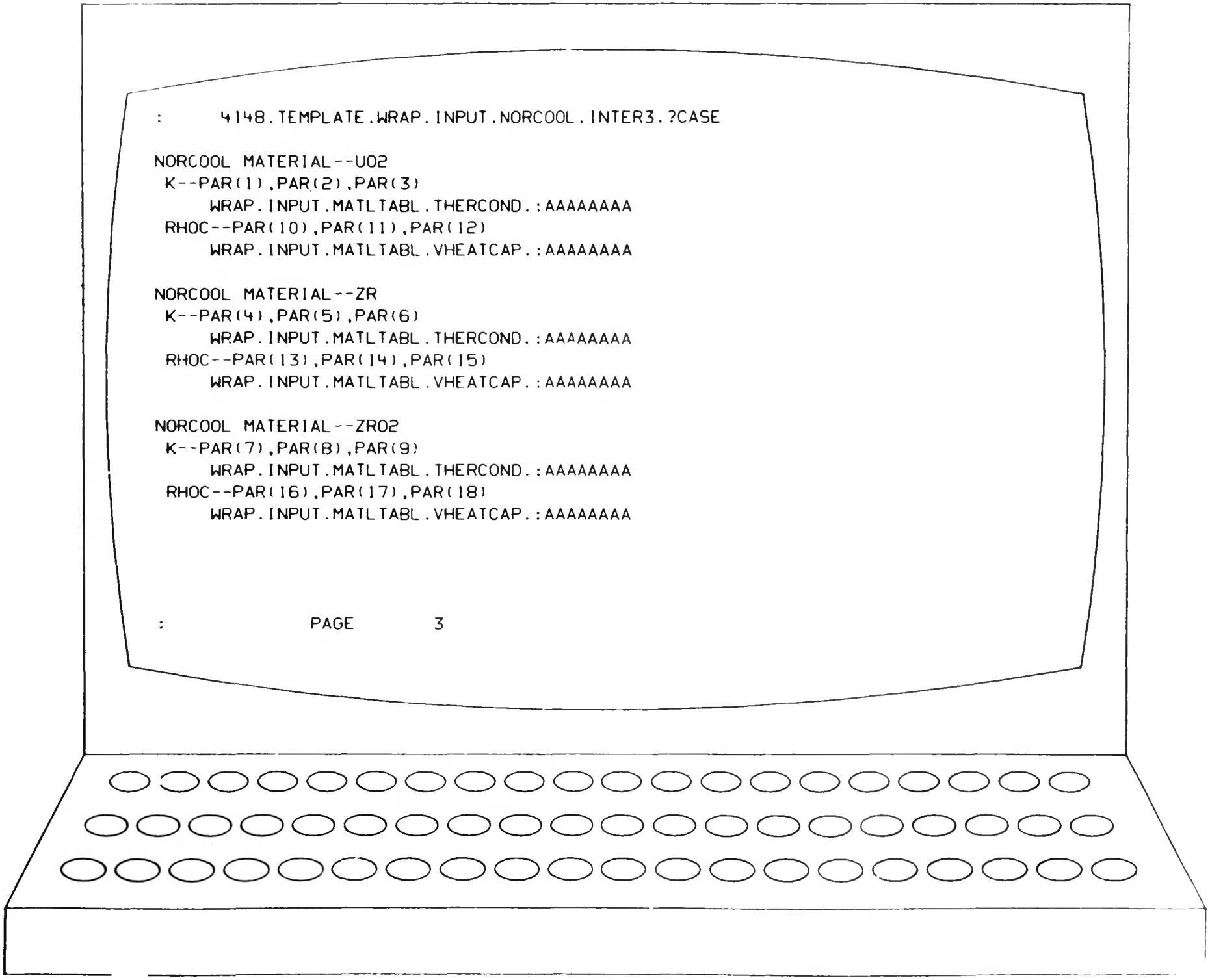
PROVIDE CORRESPONDENCE BETWEEN NORCOOL ROD GROUP AND VERTICAL
NODE NUMBER AND THE 'WIDS' HEAT SLAB NAMES------

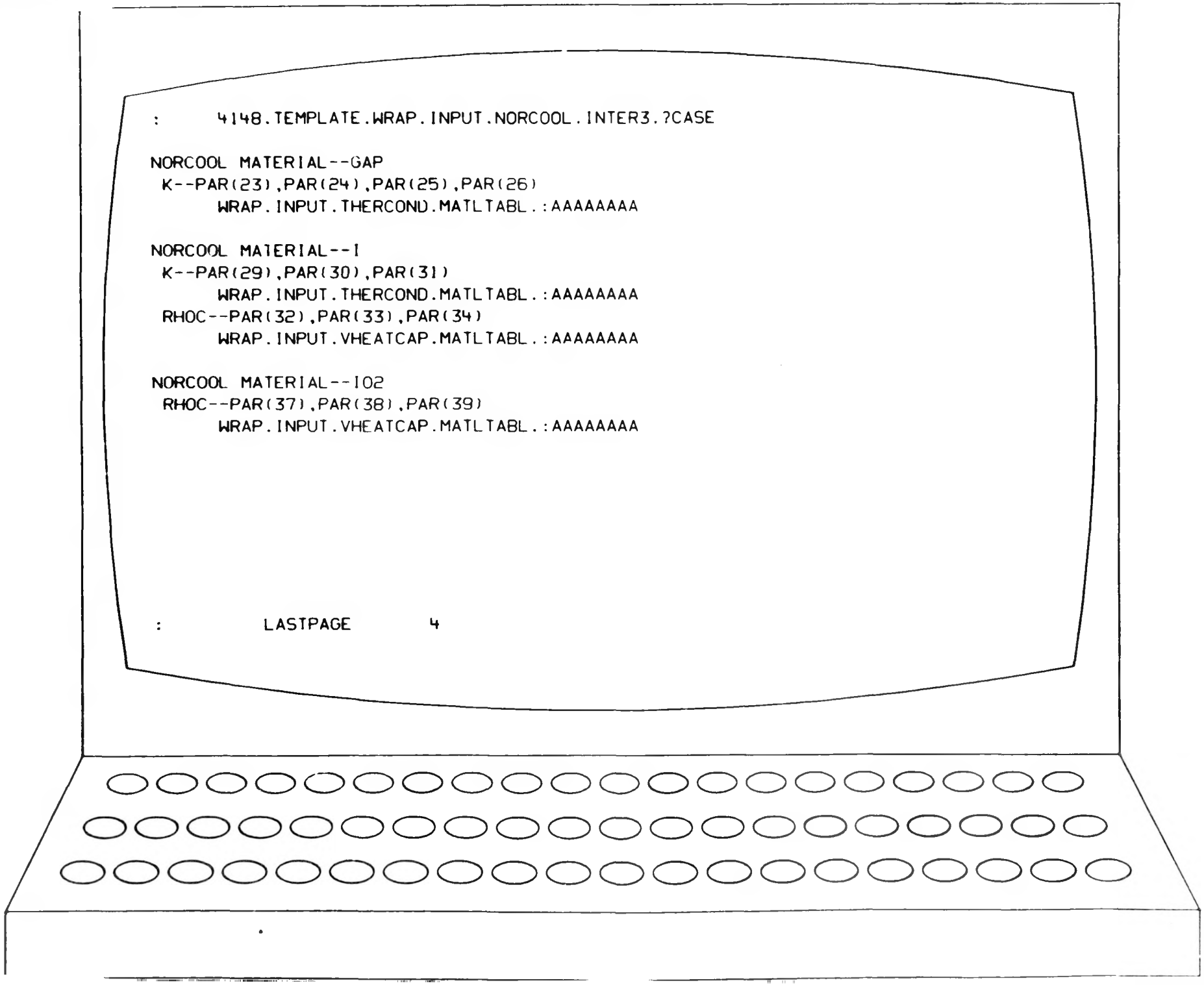
FOR THE NORCOOL ROD GROUP    :111

 VERT                           VERT
-NODE-  --SLAB  ;  PART--     -NODE-  --SLAB  ;  PART--
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222,  :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA
 :222   :AAAAAAAA:AAAAAAAA     :222   :AAAAAAAA:AAAAAAAA

:          LASTPAGE        3
```


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER3.?CASE
USE THIS RECORD TO SPECIFY THE NAMES OF THE THERMAL CONDUCTIVITY
TABLES, OR THE NAMES OF THE VOLUMETRIC HEAT CAPACITY TABLES,
WHICH WERE ORIGINALLY SET UP IN TWRAM-INPUT FORM BUT ARE ALSO
USED AS INPUT TO NORCOOL. THE INTERFACE WILL READ THAT TABLE,
CONVERT THE UNITS FROM BRITISH TO S I., AND DO A LEAST SQUARES
FIT TO OBTAIN THE PARAMETRIC FORMS REQUIRED BY NORCOOL.
SPECIFY WHICH TABLES ARE TO BE USED BY FILLING IN THE WRAP
RECORD NAME ASSOCIATED WITH THE STANDARD NORCOOL MATERIAL NAME.
THOSE LEFT BLANK OR 'AAAAAAAA' WILL REQUIRE USER INPUT OF THE
NORCOOL PARAMETRIC COEFFICIENTS ON THE WRAP.INPUT.NORCOOL.PARAM
RECORD.
: PAGE 2


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER3.?CASE
NORCOOL MATERIAL--UO2
K--PAR(1),PAR(2),PAR(3)
WRAP.INPUT.MATLTABL.THERCOND.:AAAAAAAA
RHOC--PAR(10),PAR(11),PAR(12)
WRAP.INPUT.MATLTABL.VHEATCAP.:AAAAAAAA
NORCOOL MATERIAL--ZR
K--PAR(4),PAR(5),PAR(6)
WRAP.INPUT.MATLTABL.THERCOND.:AAAAAAAA
RHOC--PAR(13),PAR(14),PAR(15)
WRAP.INPUT.MATLTABL.VHEATCAP.:AAAAAAAA
NORCOOL MATERIAL--ZRO2
K--PAR(7),PAR(8),PAR(9)
WRAP.INPUT.MATLTABL.THERCOND.:AAAAAAAA
RHOC--PAR(16),PAR(17),PAR(18)
WRAP.INPUT.MATLTABL.VHEATCAP.:AAAAAAAA
: PAGE 3


: 4148.TEMPLATE.WRAP.INPUT.NORCOOL.INTER3.?CASE
NORCOOL MATERIAL--GAP
K--PAR(23),PAR(24),PAR(25),PAR(26)
WRAP.INPUT.THERCOND.MATLTABL.:AAAAAAAA
NORCOOL MATERIAL--I
K--PAR(29),PAR(30),PAR(31)
WRAP.INPUT.THERCOND.MATLTABL.:AAAAAAAA
RHOC--PAR(32),PAR(33),PAR(34)
WRAP.INPUT.VHEATCAP.MATLTABL.:AAAAAAAA
NORCOOL MATERIAL--I02
RHOC--PAR(37),PAR(38),PAR(39)
WRAP.INPUT.VHEATCAP.MATLTABL.:AAAAAAAA
: LASTPAGE 4

VI. GAPCON Data Library

A necessary part of the linking together of GAPCON, WRAP, and MOXY in the WRAP-EM system is a data library in which GAPCON fuel conditions may be stored and from which WRAP and MOXY may retrieve data. This section gives a detailed description of that library. Explanations of the data elements are given from the perspective of each of the three codes.

1. Fuel Rod Geometry

GAPCON - cold* diameter of the fuel pellet

- cold cladding inside diameter
- cold cladding outside diameter
- pin plenum volume, V_{plen} -- both MOXY and WRAP allow for a hold-down spring in the upper pin plenum volume. GAPCON does not. Thus, in MOXY and WRAP a portion of their pin plenum volume is occupied by the spring volume. In MOXY the spring volume is entered directly. In WRAP the spring volume is calculated from input values of length of coiled spring, number of coil, outside coil diameter of spring, and spring wire diameter.
- radius of fuel pellet shoulder for axial expansion (radius of fuel pellet dish)
- GAPCON allows in addition the option of a central void, secondary cladding, and crud on the cladding surface. These additional details are not part of the MOXY model. While WRAP can handle these concepts by specification of an inner slab radius and additional materials in the heat slab description, their inclusion (i.e. increasing heat slab detail) can significantly lengthen WRAP execution time. Thus, while these quantities may be of interest in a GAPCON stand-alone calculation (and indeed they may be used in a stand-alone execution), they are not permitted in cases written to the GAPCON library.

MOXY - cold diameter of the fuel pellet -- same

- cold cladding inside diameter -- same
- cold cladding outside diameter -- same
- pin plenum volume -- $V_{plen} + V_{spring}$
- radius of fuel pellet shoulder for axial expansion -- same

---

* 'Cold' as used here and throughout this section means the initial values as input to GAPCON.

WRAP - cold diameter of the fuel pellet -- same

- cold cladding inside diameter -- same

- cold cladding outside diameter -- same

- pin plenum volume -- $V_{plen} + V_{spring}$

- radius of fuel pellet shoulder for axial expansion -- same

- WRAP considers the heat slabs in any stack to represent the sum of all the pins. Thus, the pin plenum volume must be multiplied by the number of pins represented by a given stack.

2. Power

GAPCON - Each GAPCON calculation is performed at a specific power level and axial power profile for the pin. GAPCON input includes reactor power history, radial peaking factor, local peaking factor, axial peaking factors, number of bundles, number of rods per bundle, and rod length. The reactor power history and axial peaking factor are input to GAPCON as named records. The power history record name, final reactor power, radial peaking factor, local peaking factor, axial peaking factor record name, axial peaking factors, number of bundles, number of rods per bundle, and rod length are placed in the GAPCON library.

MOXY - same -- All rods for a given MOXY calculation are required to have the same radial peaking factor, axial peaking factors, power history, and rod length. In addition, the number of bundles and number of rods per bundle are checked for consistency.

WRAP - Only reactor power, number of bundles, and number of rods per bundle are retrieved from the GAPCON library for use in WRAP.

3. Fuel Density

GAPCON - as manufactured fuel fractional density

MOXY - same

WRAP - same

4. Gap Heat Transfer Factors

GAPCON - emissivity of fuel

- emissivity of cladding interior surface

- average surface roughness of fuel

- average surface roughness of cladding

- final* fission gas pressure

- temperature jump distance

MOXY - emissivity of fuel -- same

- emissivity of cladding surface -- same

- average surface roughness of fuel -- same

- average surface roughness of cladding - same

- final fission gas pressure - GAPCON fission gas pressure is used as the initial fission gas pressure in MOXY

- temperature jump distance -- the GAPCON temperature jump distances are multiplied by 1.845 to account for model differences between GAPCON and MOXY

WRAP - emissivity of fuel -- same

- emissivity of cladding interior surface -- same

- average surface roughness of fuel -- not used

- average surface roughness of cladding -- not used

- final fission gas pressure -- not used

5. Fission Gas Composition

GAPCON - final mole fraction of helium

- final mole fraction of argon

- final mole fraction of krypton

- final mole fraction of xenon

- final mole fraction of hydrogen

- final mole fraction of nitrogen

- GAPCON can also consider the sorbed gas content of the oxide fuel; however, WRAP and MOXY do not have this capability. Thus, while sorbed gas can be included in GAPCON stand-alone calculations, it is not permitted in cases written to the GAPCON library.

---

* 'Final' as used here and throughout this section means the value at the end time in GAPCON.

MOXY - same

WRAP - same -- WRAP also allows the initial specification of steam properties. No steam may initially be present if the codes are linked.

6. GM-Moles of Fission Gas

GAPCON - Final number of gm-moles of fission gas in gap as a function of axial position, M_{gap_i}

- final number of gm-moles of fission gas in pin plenum, M_{plen}

MOXY - gm-moles in rod -- MOXY input requires the number of gm-moles of fission gas in the rod. This represents the sum

$$\sum_{length} M_{gap_i} + M_{plen}.$$

Recall that no central void is permitted (see item 1). GAPCON also allows for dish volumes and MOXY does not. Thus the gas contained in the dish volumes is not included in the above sum.

WRAP - gm-moles of gas in pin gap and plenum --
In WRAP the data for gm-moles of gas in the pin gap may be interpolated from GAPCON. In addition, for the top heat slab in the stack the gm-moles of fission gas in the pin plenum must be added to the gm-moles in the gap of the top section. WRAP considers the heat slabs in any stack to represent the sum of all the pins. Thus the pin volume must be multiplied by the number of pins in a given stack.

7. Changes in Fuel and Cladding Radii (Values placed in library will be a function of axial position)

GAPCON - final change in fuel radius due to relocation

- final change in fuel radius due to desification

- final change in fuel radius due to swelling

- final change in clad radius due to creep (not present if using pressure differences to calculate elastic deflection)

MOXY - initial fuel swelling -- sum of changes in fuel radius due to relocation, desification, and swelling

- initial cladding plastic strain -- same as final change in clad radius due to creep

WRAP - same as for MOXY

REFERENCES

1. C. E. Beyer, et al., *GAPCON-THERMAL-2: A Computer Program for Calculating the Thermal Behavior of an Oxide Fuel Rod.* BNWL-1897 and BNWL-1898, Battelle Pacific Northwest Laboratories, Richland, Washington (November, 1975).

2. D. R. Evans, *The MOXY Digital Computer Program for Boiling Water Reactor Core Thermal Analysis.* RE-A-77-081, Idaho National Engineering Laboratory, September 7, 1977.

3. J. G. M. Anderson, et al., *NORCOOL-1, A Model for Analysis of a BWR Under LOCA Conditions, A Revised Report.* Report No. NORHAV-D-47, RISO National Laboratory (Denmark) (August, 1977).

4. M. M. Anderson, *WRAP - A Water Reactor Analysis Package.* Report DPST-NUREG-77-1, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (June, 1977).

5. M. V. Gregory, *User's Guide to Input for WRAP - A Water Reactor Analysis Package.* Report DPST-NUREG-77-2, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (June, 1977).

6. D. A. Sharp, *The PWR Steady-State Capability of WRAP - A Water Reactor Analysis Package.* Report DPST-NUREG-77-3, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (April, 1975).

7. *RELAP4/MOD5 - A Computer Program for Transient Thermal-Hydraulic Analysis of Nuclear Reactors and Related Systems - User's Manual.* ANCR-NUREG-1335, Idaho National Engineering Laboratory, Aerojet Nuclear Company, Idaho Falls, ID (1976).

8. D. A. Sharp, *The BWR Steady-State Capability of the WRAP-EM System,* Report DPST-NUREG-78-1, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (December, 1978).

9. M. R. Buckner, et al., *The BWR Loss-of-Coolant Accident Capability of the WRAP-EM System,* Report DPST-NUREG-78-2, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (December, 1978).

10. H. C. Honeck, *The JOSHUA System,* ERDA Report DP-1380, Savannah River Laboratory, E. I. du Pont de Nemours and Company, Aiken, SC (1975).

Appendix: Updated WRAP Input Records

Several of the input records given in the original WRAP User's Guide (Ref. 5) have changed form. The records are listed below and are presented in pp. 190-204:

WRAP.INPUT.CASE.?CASE

WRAP.INPUT.SOURCE.?CASE

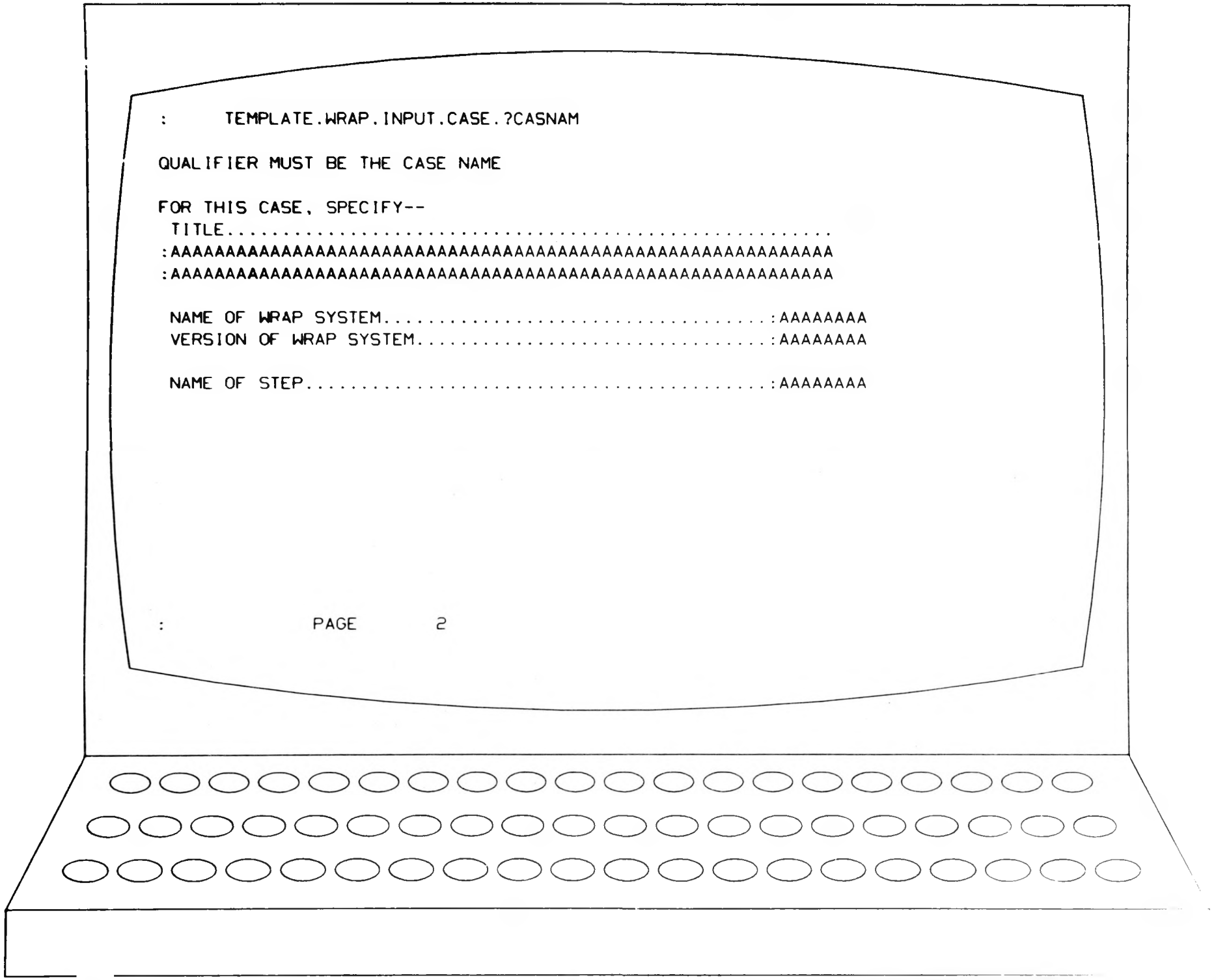
WRAP.INPUT.MISC.OPTIONS.?CASE

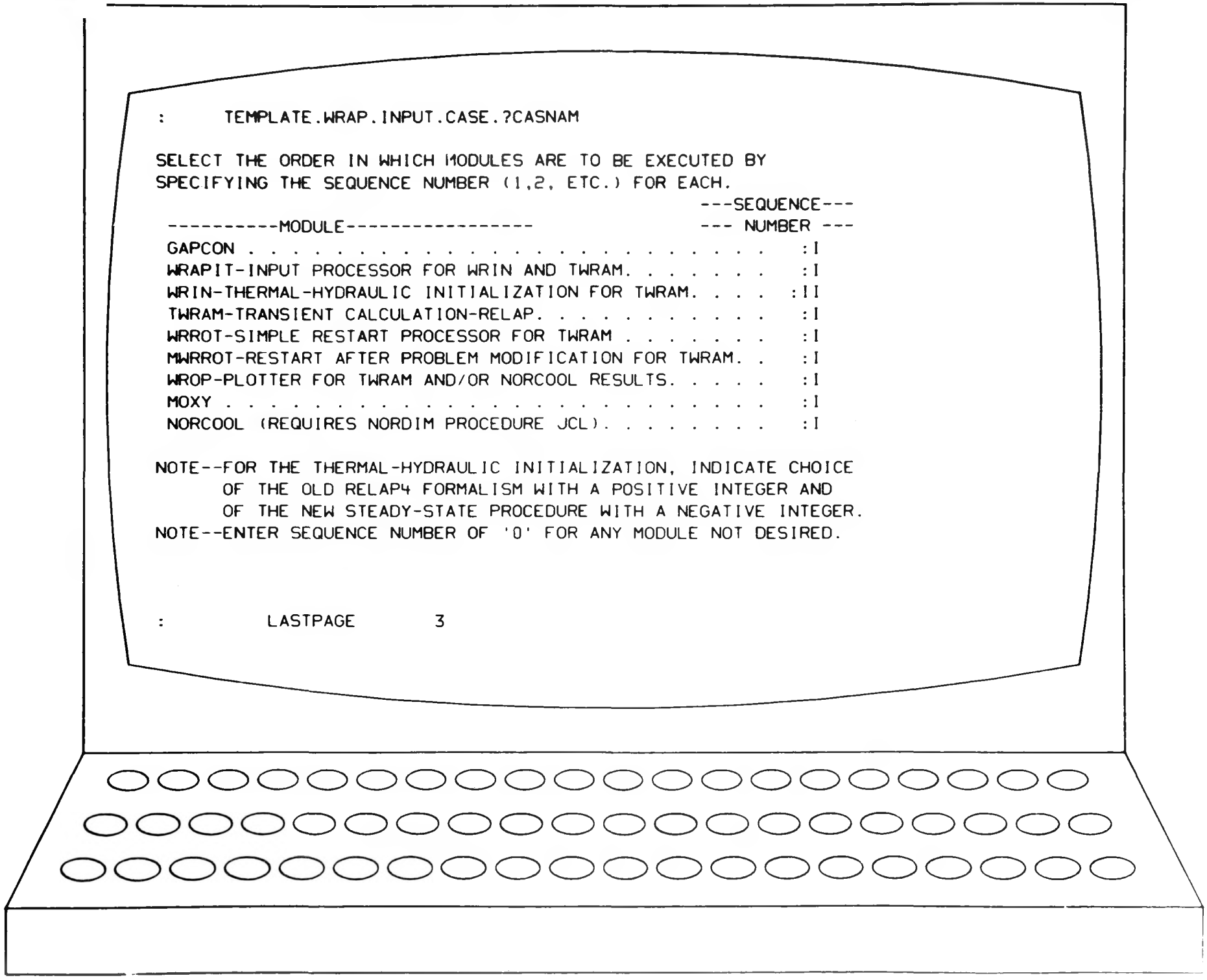
WRAP.INPUT.EDITOR.?JOB.

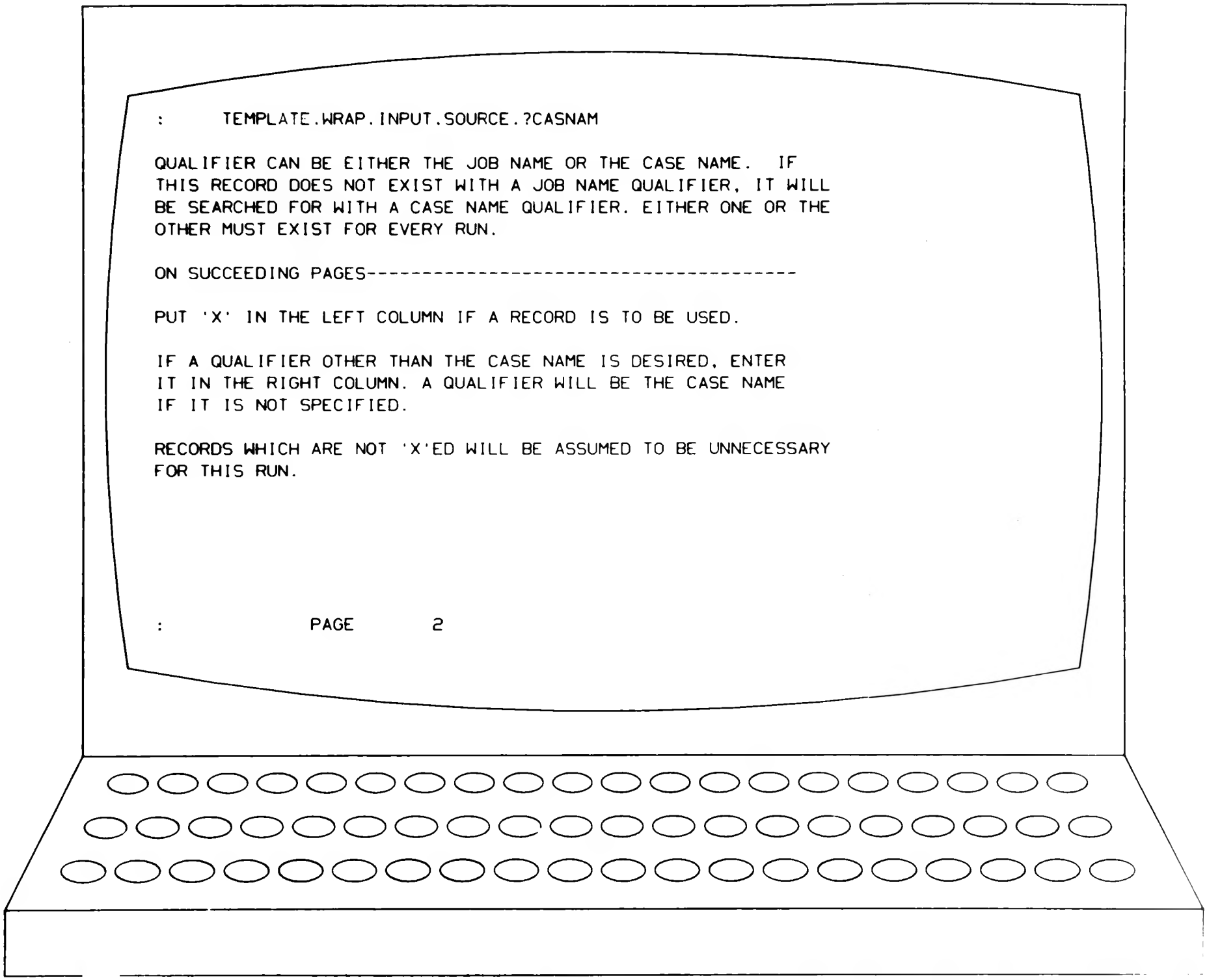
One additional record is required for the BWR initialization procedure[8]:

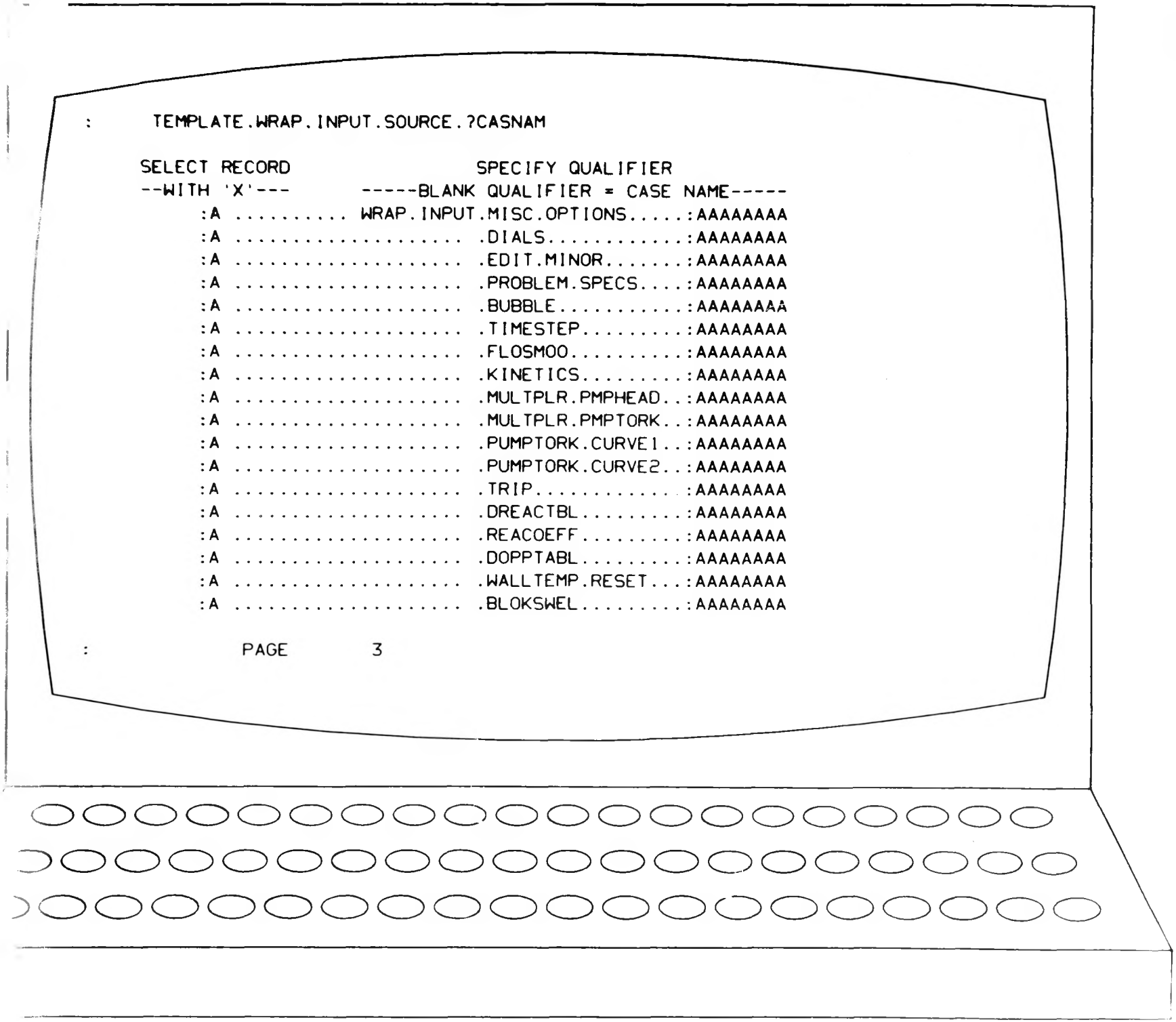
WRAP.INPUT.BWRSS.?JOB.

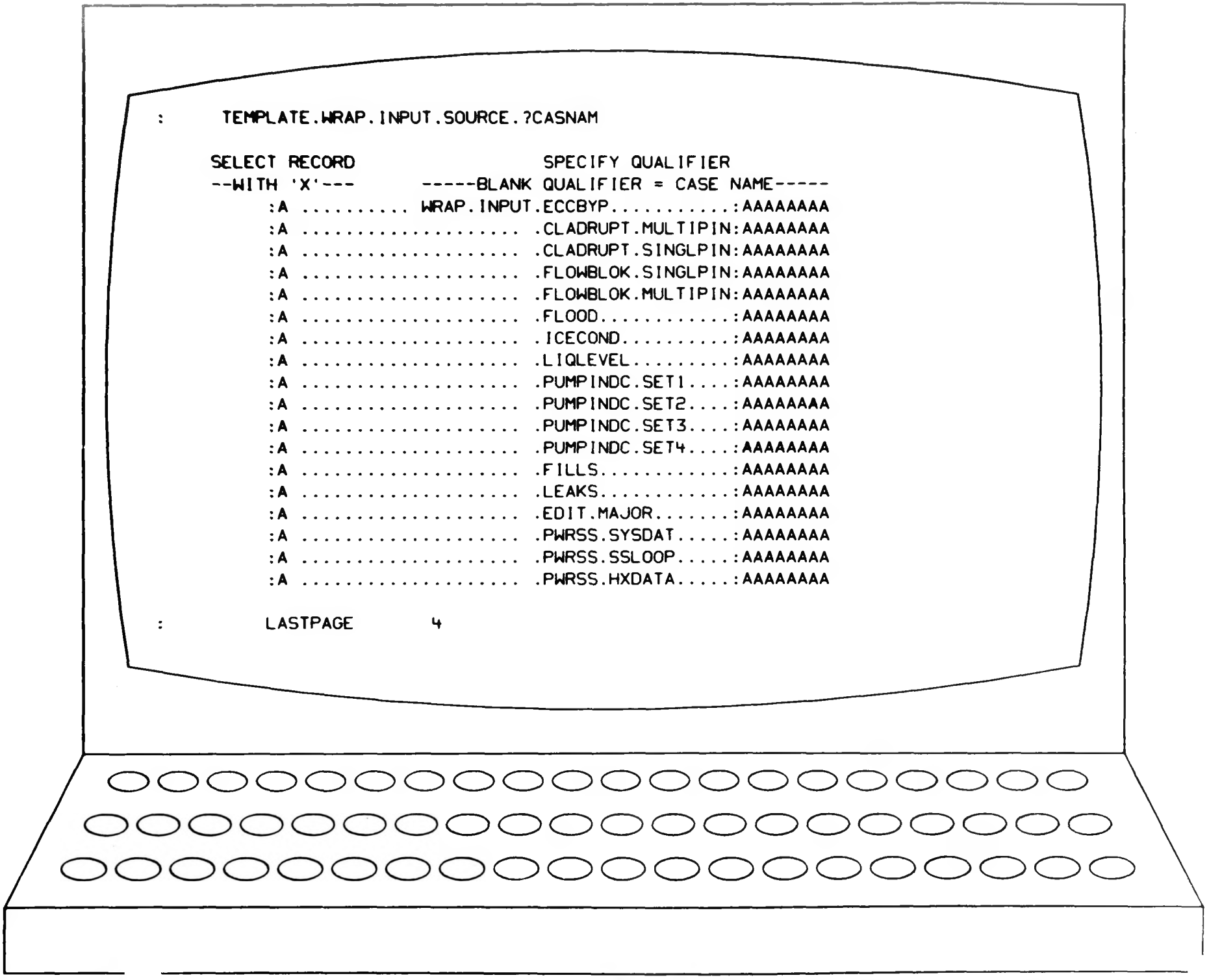
The template for this record is also presented (pp. 205-208).

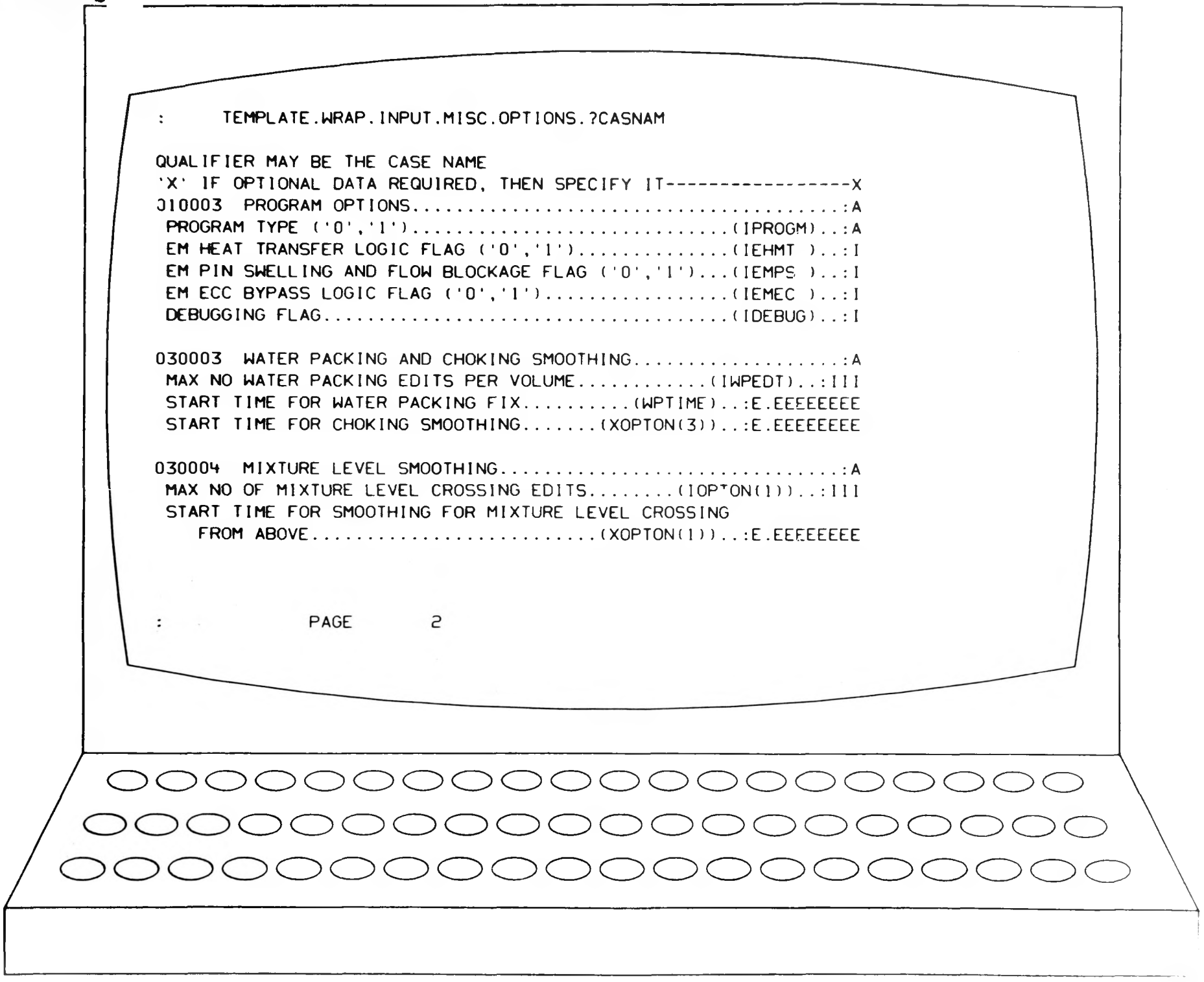

: TEMPLATE.WRAP.INPUT.CASE.?CASNAM
QUALIFIER MUST BE THE CASE NAME
FOR THIS CASE, SPECIFY--
TITLE.....
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
NAME OF WRAP SYSTEM.....:AAAAAAAA
VERSION OF WRAP SYSTEM.....:AAAAAAAA
NAME OF STEP.....:AAAAAAAA
: PAGE 2

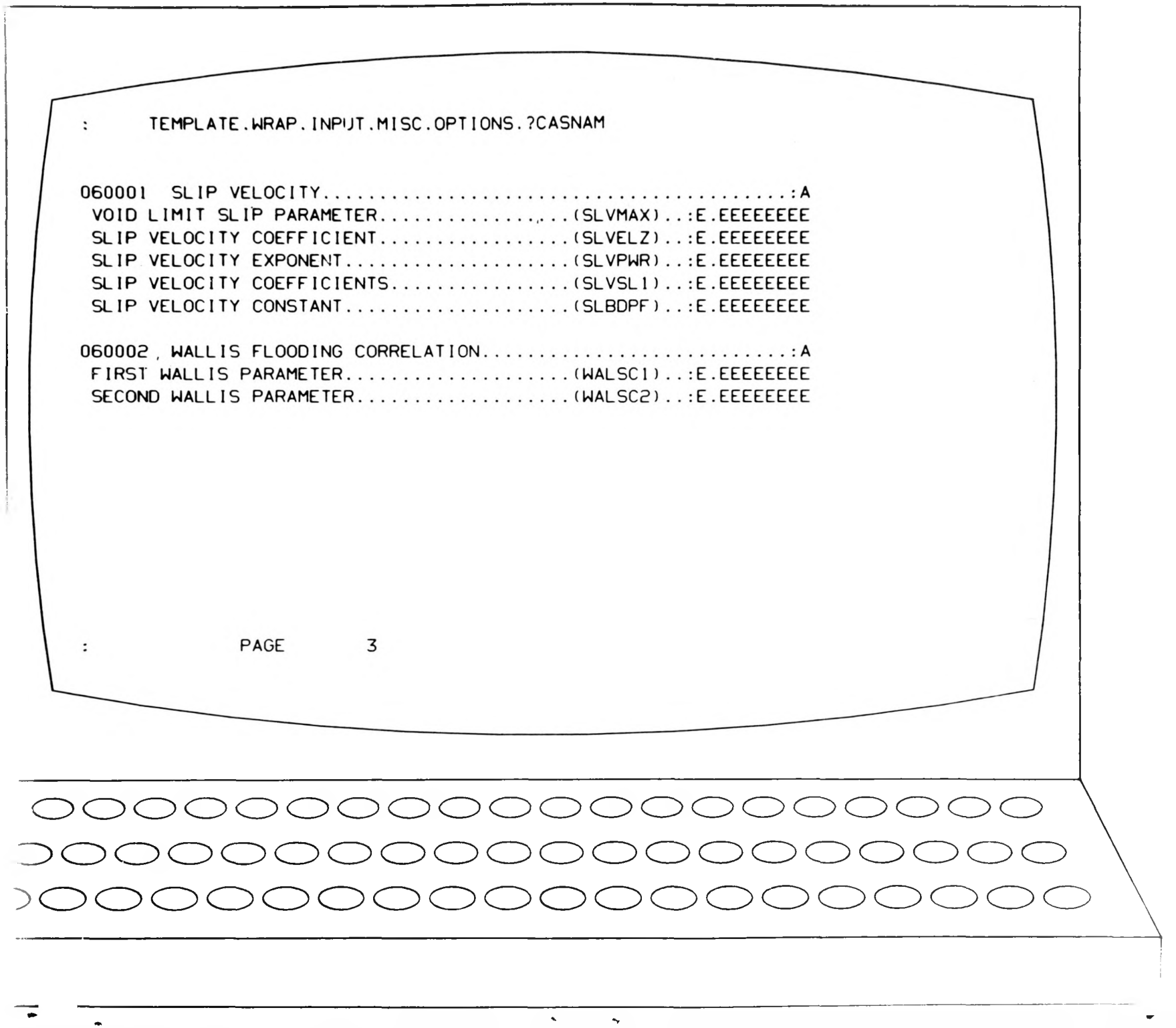

: TEMPLATE.WRAP.INPUT.CASE.?CASNAM
SELECT THE ORDER IN WHICH MODULES ARE TO BE EXECUTED BY
SPECIFYING THE SEQUENCE NUMBER (1,2, ETC.) FOR EACH.
---SEQUENCE---
----------MODULE---------- --- NUMBER ---
GAPCON . . . . . :I
WRAPIT-INPUT PROCESSOR FOR WRIN AND TWRAM. . . . . :I
WRIN-THERMAL-HYDRAULIC INITIALIZATION FOR TWRAM. . . . :II
TWRAM-TRANSIENT CALCULATION-RELAP. . . . . :I
WRROT-SIMPLE RESTART PROCESSOR FOR TWRAM . . . . . :I
MWRROT-RESTART AFTER PROBLEM MODIFICATION FOR TWRAM. . :I
WROP-PLOTTER FOR TWRAM AND/OR NORCOOL RESULTS. . . . . :I
MOXY . . . . . :I
NORCOOL (REQUIRES NORDIM PROCEDURE JCL). . . . . :I
NOTE--FOR THE THERMAL-HYDRAULIC INITIALIZATION, INDICATE CHOICE
OF THE OLD RELAP4 FORMALISM WITH A POSITIVE INTEGER AND
OF THE NEW STEADY-STATE PROCEDURE WITH A NEGATIVE INTEGER.
NOTE--ENTER SEQUENCE NUMBER OF '0' FOR ANY MODULE NOT DESIRED.
: LASTPAGE 3

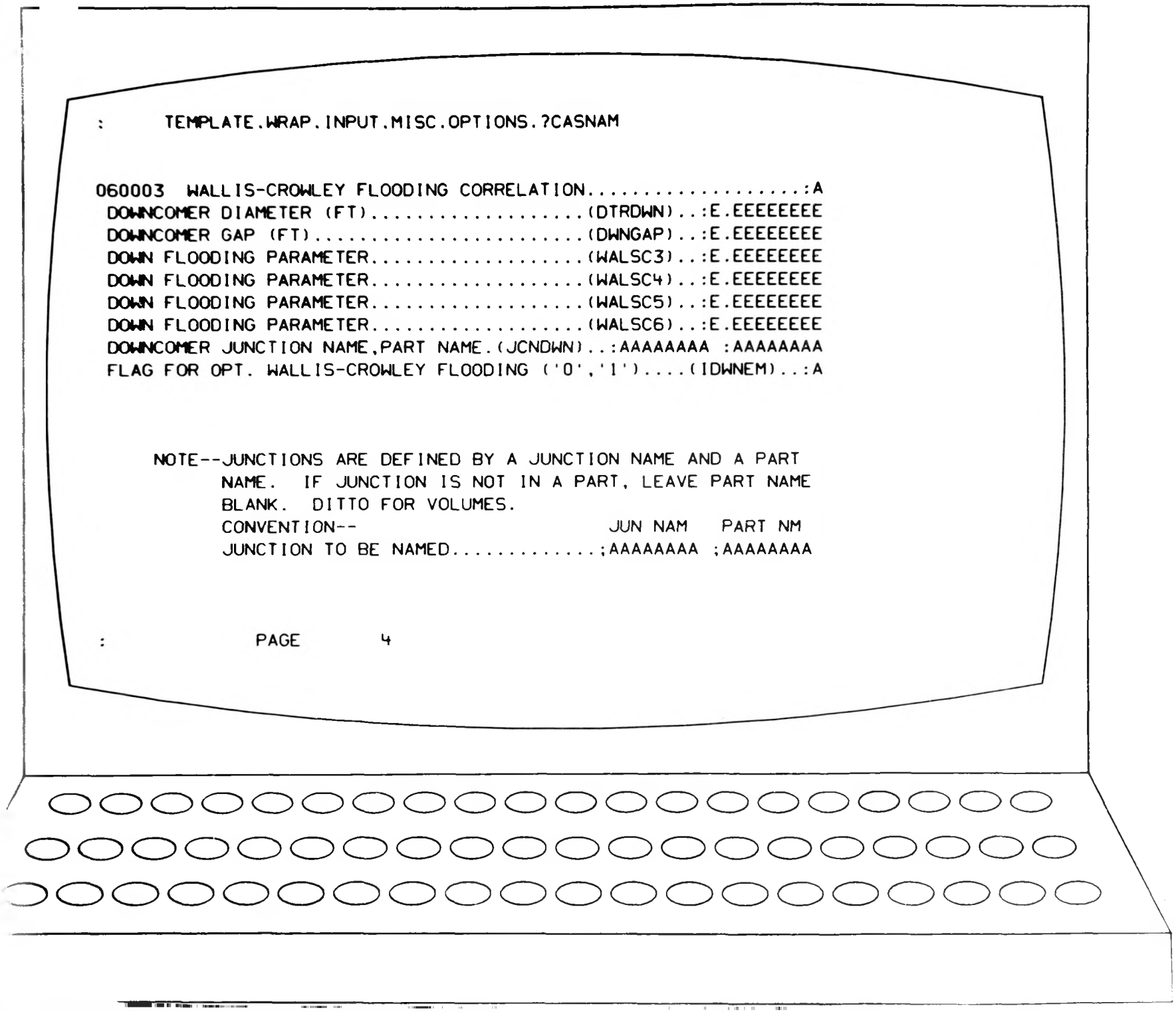

: TEMPLATE.WRAP.INPUT.SOURCE.?CASNAM
QUALIFIER CAN BE EITHER THE JOB NAME OR THE CASE NAME. IF THIS RECORD DOES NOT EXIST WITH A JOB NAME QUALIFIER, IT WILL BE SEARCHED FOR WITH A CASE NAME QUALIFIER. EITHER ONE OR THE OTHER MUST EXIST FOR EVERY RUN.
ON SUCCEEDING PAGES----------
PUT 'X' IN THE LEFT COLUMN IF A RECORD IS TO BE USED.
IF A QUALIFIER OTHER THAN THE CASE NAME IS DESIRED, ENTER IT IN THE RIGHT COLUMN. A QUALIFIER WILL BE THE CASE NAME IF IT IS NOT SPECIFIED.
RECORDS WHICH ARE NOT 'X'ED WILL BE ASSUMED TO BE UNNECESSARY FOR THIS RUN.
: PAGE 2

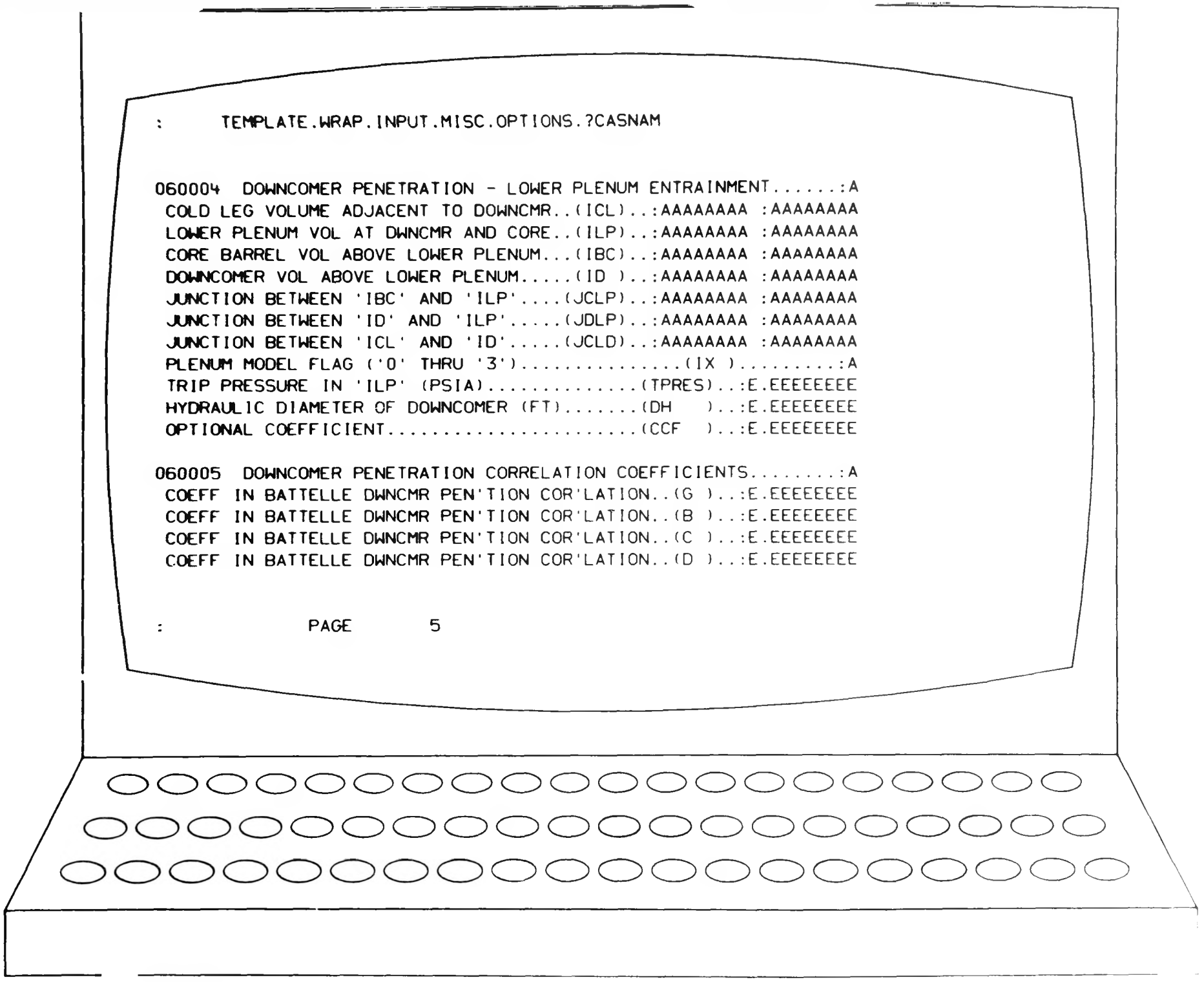

: TEMPLATE.WRAP.INPUT.SOURCE.?CASNAM
SELECT RECORD
--WITH 'X'---
SPECIFY QUALIFIER
-----BLANK QUALIFIER = CASE NAME-----
:A ..... WRAP.INPUT.MISC.OPTIONS.....:AAAAAAAA
:A ..... .DIALS.....:AAAAAAAA
:A ..... .EDIT.MINOR.....:AAAAAAAA
:A ..... .PROBLEM.SPECS....:AAAAAAAA
:A ..... .BUBBLE.....:AAAAAAAA
:A ..... .TIMESTEP.....:AAAAAAAA
:A ..... .FLOSMOO.....:AAAAAAAA
:A ..... .KINETICS.....:AAAAAAAA
:A ..... .MULTPLR.PMPHEAD..:AAAAAAAA
:A ..... .MULTPLR.PMPTORK..:AAAAAAAA
:A ..... .PUMPTORK.CURVE1..:AAAAAAAA
:A ..... .PUMPTORK.CURVE2..:AAAAAAAA
:A ..... .TRIP.....:AAAAAAAA
:A ..... .DREACTBL.....:AAAAAAAA
:A ..... .REACOEFF.....:AAAAAAAA
:A ..... .DOPPTABL.....:AAAAAAAA
:A ..... .WALLTEMP.RESET...:AAAAAAAA
:A ..... .BLOKSWEL.....:AAAAAAAA
: PAGE 3

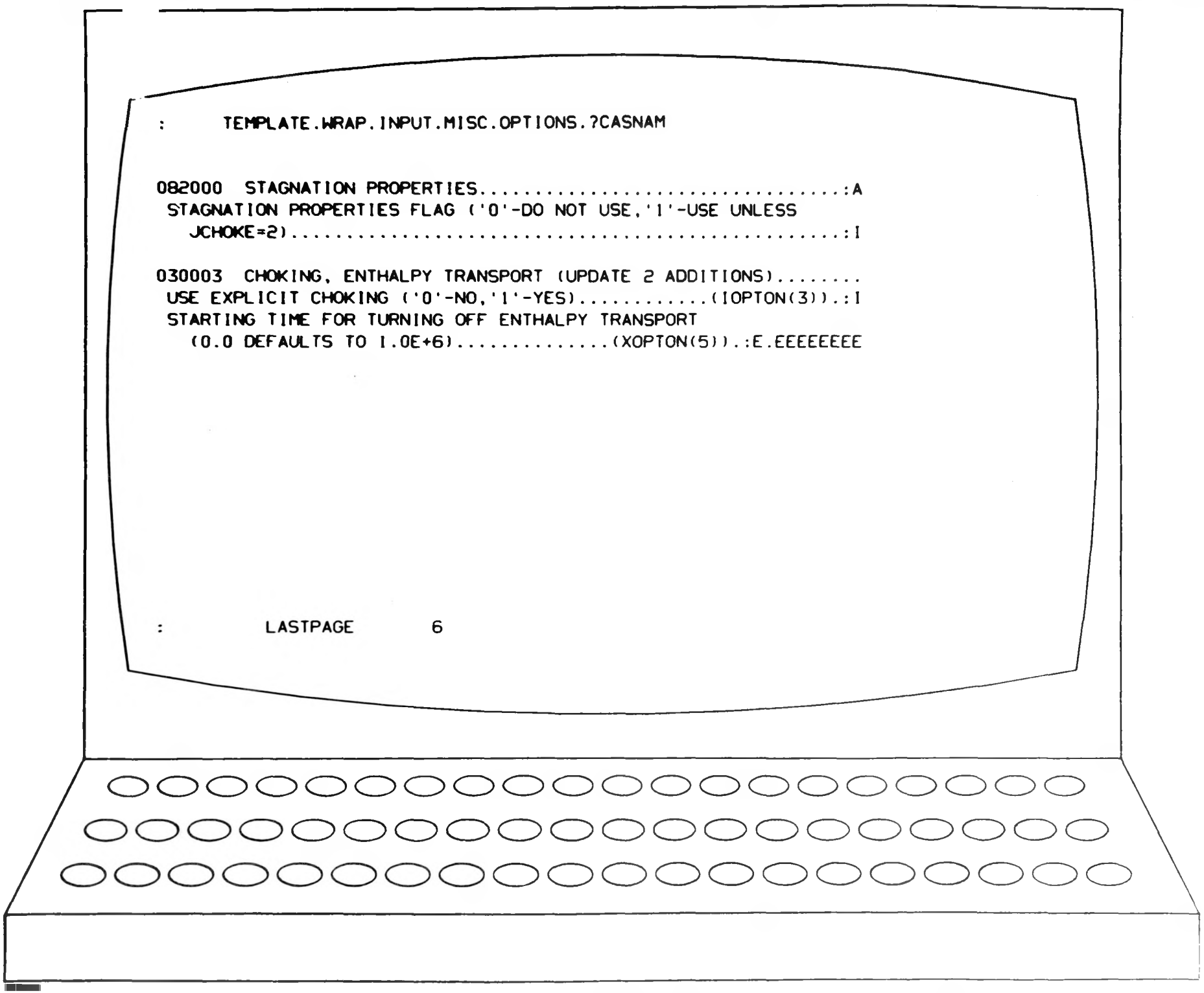

: TEMPLATE.WRAP.INPUT.SOURCE.?CASNAM
SELECT RECORD
--WITH 'X'---
SPECIFY QUALIFIER
-----BLANK QUALIFIER = CASE NAME-----
:A ..... WRAP.INPUT.ECCBYP.....:AAAAAAAA
:A ..... .CLADRUPT.MULTIPIN:AAAAAAAA
:A ..... .CLADRUPT.SINGLPIN:AAAAAAAA
:A ..... .FLOWBLOK.SINGLPIN:AAAAAAAA
:A ..... .FLOWBLOK.MULTIPIN:AAAAAAAA
:A ..... .FLOOD.....:AAAAAAAA
:A ..... .ICECOND.....:AAAAAAAA
:A ..... .LIQLEVEL.....:AAAAAAAA
:A ..... .PUMPINDC.SET1....:AAAAAAAA
:A ..... .PUMPINDC.SET2....:AAAAAAAA
:A ..... .PUMPINDC.SET3....:AAAAAAAA
:A ..... .PUMPINDC.SET4....:AAAAAAAA
:A ..... .FILLS.....:AAAAAAAA
:A ..... .LEAKS.....:AAAAAAAA
:A ..... .EDIT.MAJOR.....:AAAAAAAA
:A ..... .PWRSS.SYSDAT.....:AAAAAAAA
:A ..... .PWRSS.SSLOOP.....:AAAAAAAA
:A ..... .PWRSS.HXDATA.....:AAAAAAAA
: LASTPAGE 4


: TEMPLATE.WRAP.INPUT.MISC.OPTIONS.?CASNAM
QUALIFIER MAY BE THE CASE NAME
'X' IF OPTIONAL DATA REQUIRED, THEN SPECIFY IT----------X
010003 PROGRAM OPTIONS.....:A
PROGRAM TYPE ('0','1').....(IPROGM)..:A
EM HEAT TRANSFER LOGIC FLAG ('0','1').....(IEHMT)..:I
EM PIN SWELLING AND FLOW BLOCKAGE FLAG ('0','1')...(IEMPS)..:I
EM ECC BYPASS LOGIC FLAG ('0','1').....(IEMEC)..:I
DEBUGGING FLAG.....(IDEBUG)..:I
030003 WATER PACKING AND CHOKING SMOOTHING.....:A
MAX NO WATER PACKING EDITS PER VOLUME.....(IWPEDT)..:III
START TIME FOR WATER PACKING FIX.....(WPTIME)..:E.EEEEEEEE
START TIME FOR CHOKING SMOOTHING.....(XOPTON(3))..:E.EEEEEEEE
030004 MIXTURE LEVEL SMOOTHING.....:A
MAX NO OF MIXTURE LEVEL CROSSING EDITS.....(IOPTON(1))..:III
START TIME FOR SMOOTHING FOR MIXTURE LEVEL CROSSING
FROM ABOVE.....(XOPTON(1))..:E.EEEEEEEE
: PAGE 2

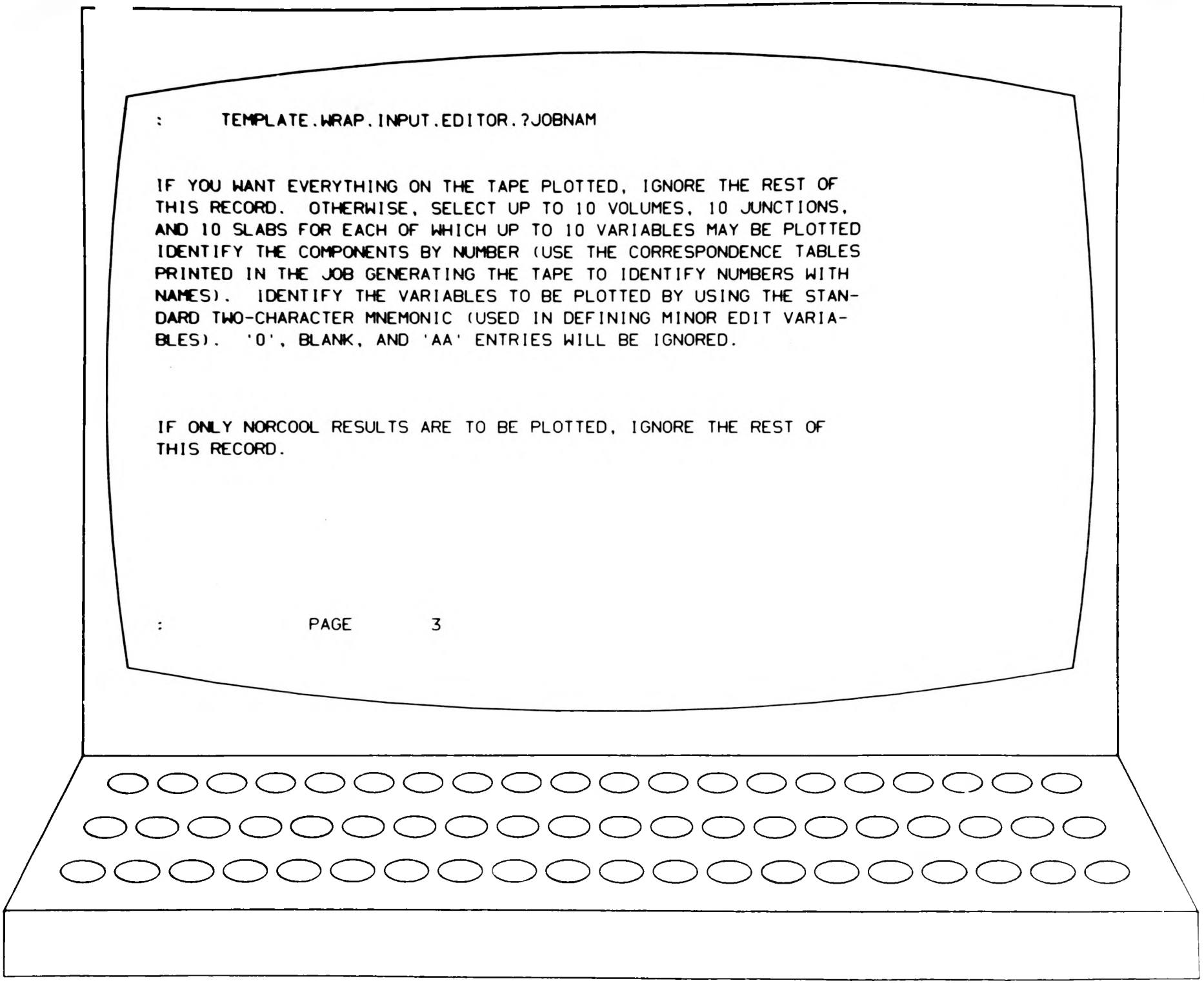

: TEMPLATE.WRAP.INPUT.MISC.OPTIONS.?CASNAM
060001 SLIP VELOCITY.....:A
VOID LIMIT SLIP PARAMETER.....(SLVMAX)..:E.EEEEEEEE
SLIP VELOCITY COEFFICIENT.....(SLVELZ)..:E.EEEEEEEE
SLIP VELOCITY EXPONENT.....(SLVPWR)..:E.EEEEEEEE
SLIP VELOCITY COEFFICIENTS.....(SLVSL1)..:E.EEEEEEEE
SLIP VELOCITY CONSTANT.....(SLBDPF)..:E.EEEEEEEE
060002 WALLIS FLOODING CORRELATION.....:A
FIRST WALLIS PARAMETER.....(WALSC1)..:E.EEEEEEEE
SECOND WALLIS PARAMETER.....(WALSC2)..:E.EEEEEEEE
: PAGE 3

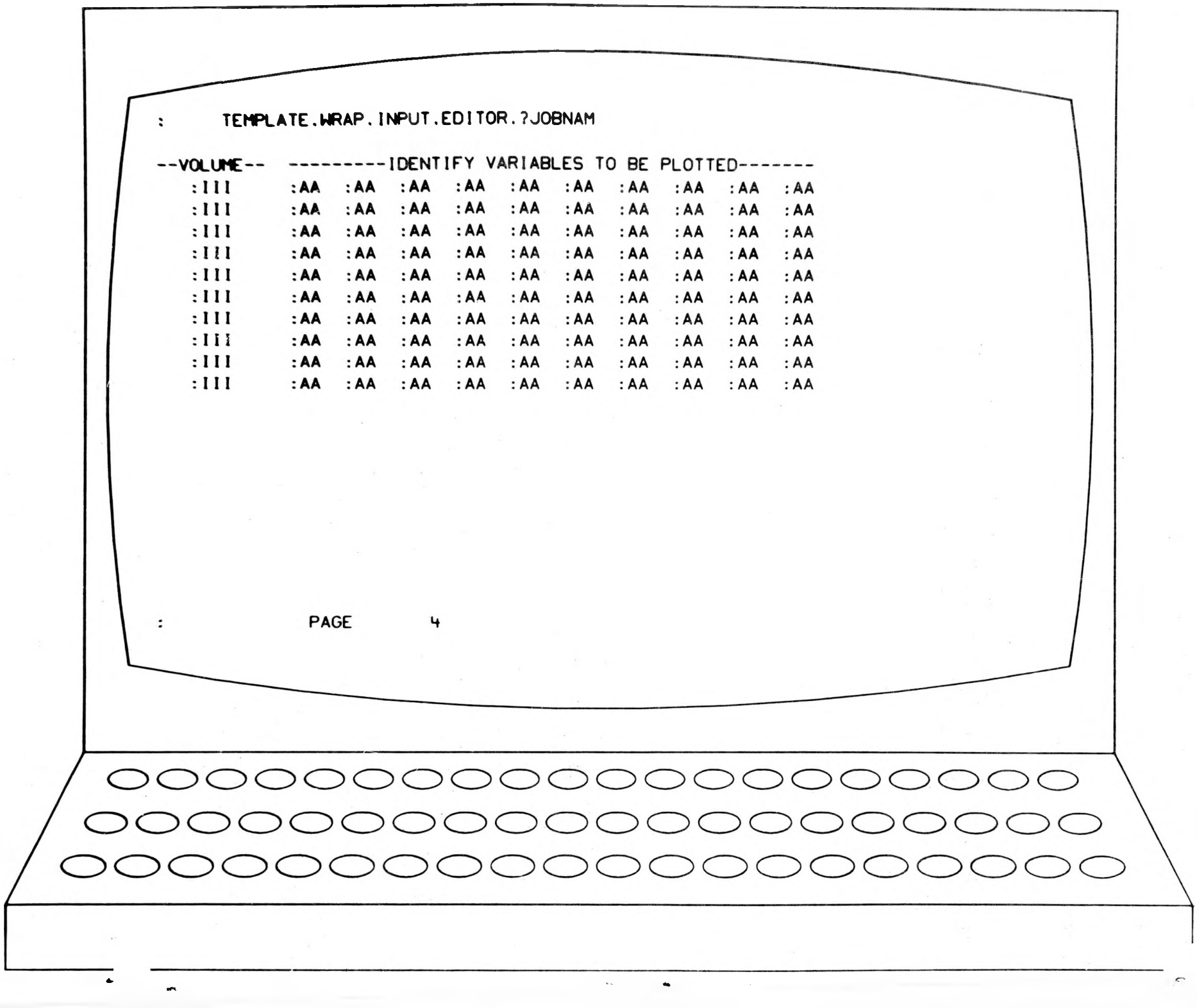

: TEMPLATE.WRAP.INPUT.MISC.OPTIONS.?CASNAM
060003 WALLIS-CROWLEY FLOODING CORRELATION.....:A
DOWNCOMER DIAMETER (FT).....(DTRDWN)..:E.EEEEEEEE
DOWNCOMER GAP (FT).....(DWNGAP)..:E.EEEEEEEE
DOWN FLOODING PARAMETER.....(WALSC3)..:E.EEEEEEEE
DOWN FLOODING PARAMETER.....(WALSC4)..:E.EEEEEEEE
DOWN FLOODING PARAMETER.....(WALSC5)..:E.EEEEEEEE
DOWN FLOODING PARAMETER.....(WALSC6)..:E.EEEEEEEE
DOWNCOMER JUNCTION NAME,PART NAME.(JCNDWN)..:AAAAAAAA :AAAAAAAA
FLAG FOR OPT. WALLIS-CROWLEY FLOODING ('0','1')....(IDWNEM)..:A
NOTE--JUNCTIONS ARE DEFINED BY A JUNCTION NAME AND A PART
NAME. IF JUNCTION IS NOT IN A PART, LEAVE PART NAME
BLANK. DITTO FOR VOLUMES.
CONVENTION-- JUN NAM PART NM
JUNCTION TO BE NAMED.....;AAAAAAAA ;AAAAAAAA
: PAGE 4

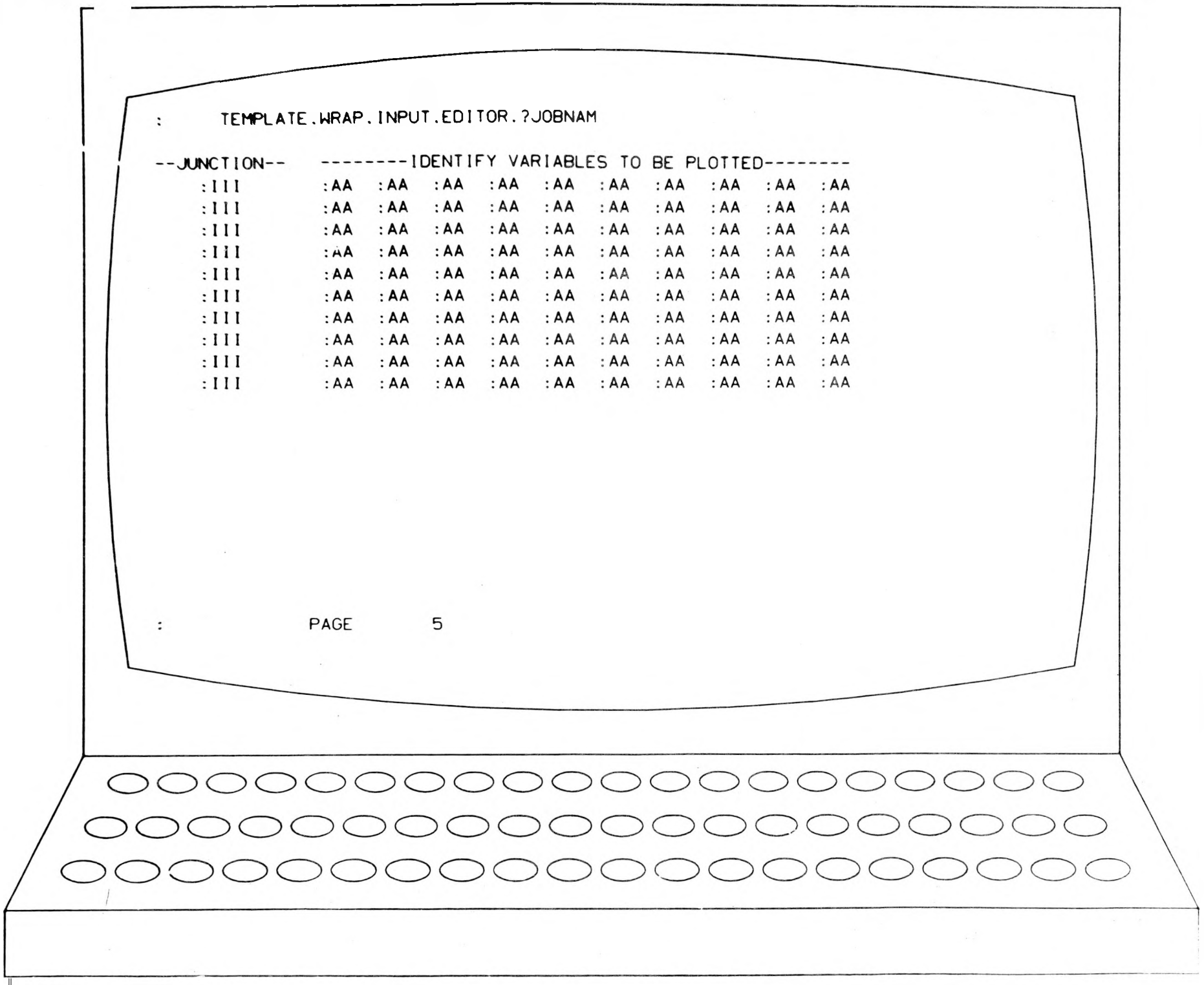

: TEMPLATE.WRAP.INPUT.MISC.OPTIONS.?CASNAM
060004 DOWNCOMER PENETRATION - LOWER PLENUM ENTRAINMENT.....:A
COLD LEG VOLUME ADJACENT TO DOWNCMR..(ICL)..:AAAAAAAA :AAAAAAAA
LOWER PLENUM VOL AT DWNCMR AND CORE..(ILP)..:AAAAAAAA :AAAAAAAA
CORE BARREL VOL ABOVE LOWER PLENUM...(IBC)..:AAAAAAAA :AAAAAAAA
DOWNCOMER VOL ABOVE LOWER PLENUM.....(ID)..:AAAAAAAA :AAAAAAAA
JUNCTION BETWEEN 'IBC' AND 'ILP'....(JCLP)..:AAAAAAAA :AAAAAAAA
JUNCTION BETWEEN 'ID' AND 'ILP'.....(JDLP)..:AAAAAAAA :AAAAAAAA
JUNCTION BETWEEN 'ICL' AND 'ID'.....(JCLD)..:AAAAAAAA :AAAAAAAA
PLENUM MODEL FLAG ('0' THRU '3').....(IX).....:A
TRIP PRESSURE IN 'ILP' (PSIA).....(TPRES)..:E.EEEEEEEE
HYDRAULIC DIAMETER OF DOWNCOMER (FT).....(DH)..:E.EEEEEEEE
OPTIONAL COEFFICIENT.....(CCF)..:E.EEEEEEEE
060005 DOWNCOMER PENETRATION CORRELATION COEFFICIENTS.....:A
COEFF IN BATTELLE DWNCMR PEN'TION COR'LATION..(G)..:E.EEEEEEEE
COEFF IN BATTELLE DWNCMR PEN'TION COR'LATION..(B)..:E.EEEEEEEE
COEFF IN BATTELLE DWNCMR PEN'TION COR'LATION..(C)..:E.EEEEEEEE
COEFF IN BATTELLE DWNCMR PEN'TION COR'LATION..(D)..:E.EEEEEEEE
: PAGE 5

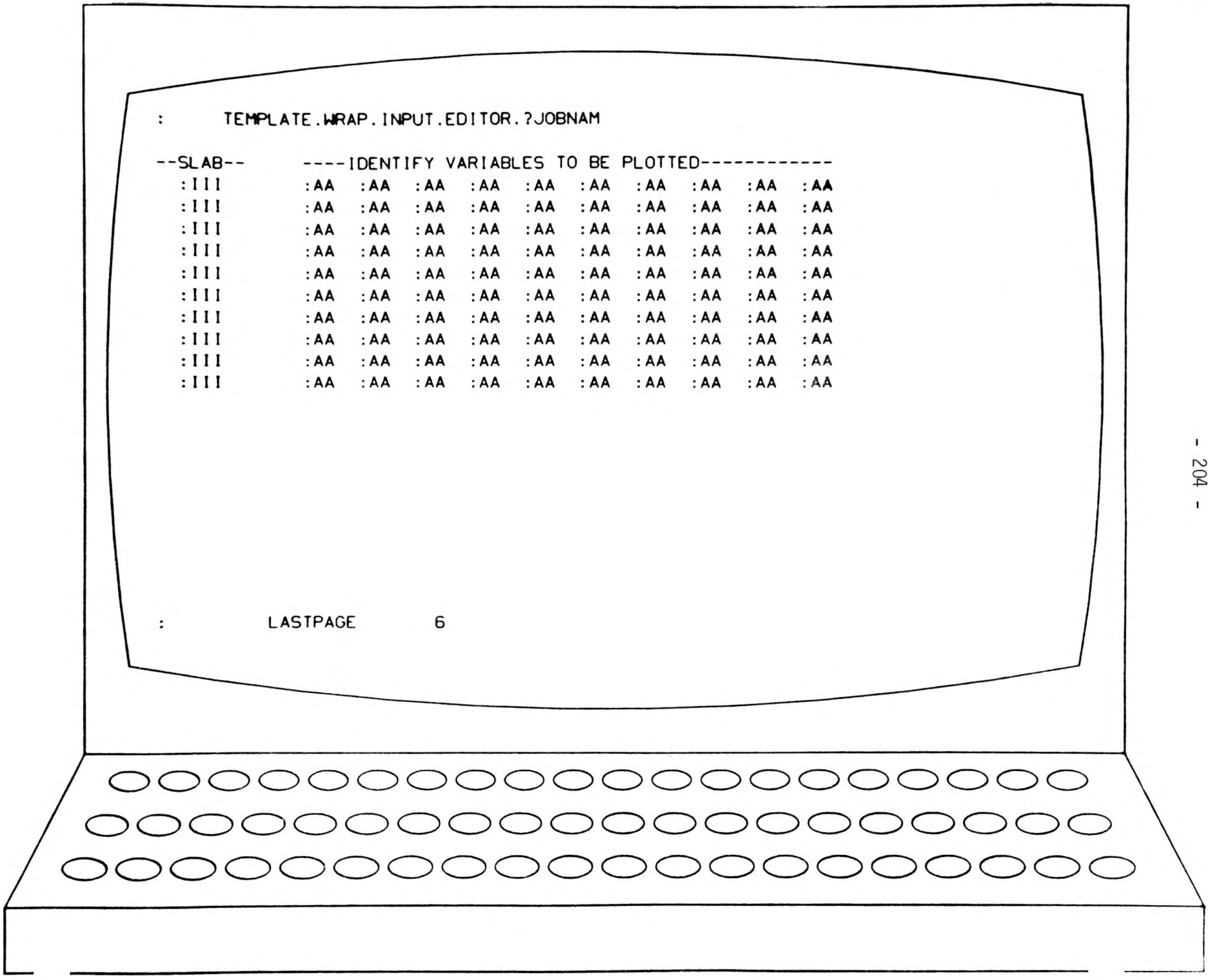

: TEMPLATE.WRAP.INPUT.MISC.OPTIONS.?CASNAM
082000 STAGNATION PROPERTIES.....:A
STAGNATION PROPERTIES FLAG ('0'-DO NOT USE,'1'-USE UNLESS
JCHOKE=2).....:I
030003 CHOKING, ENTHALPY TRANSPORT (UPDATE 2 ADDITIONS).....
USE EXPLICIT CHOKING ('0'-NO,'1'-YES).....(IOPTON(3)).:I
STARTING TIME FOR TURNING OFF ENTHALPY TRANSPORT
(0.0 DEFAULTS TO 1.0E+6).....(XOPTON(5)).:E.EEEEEEEE
: LASTPAGE 6

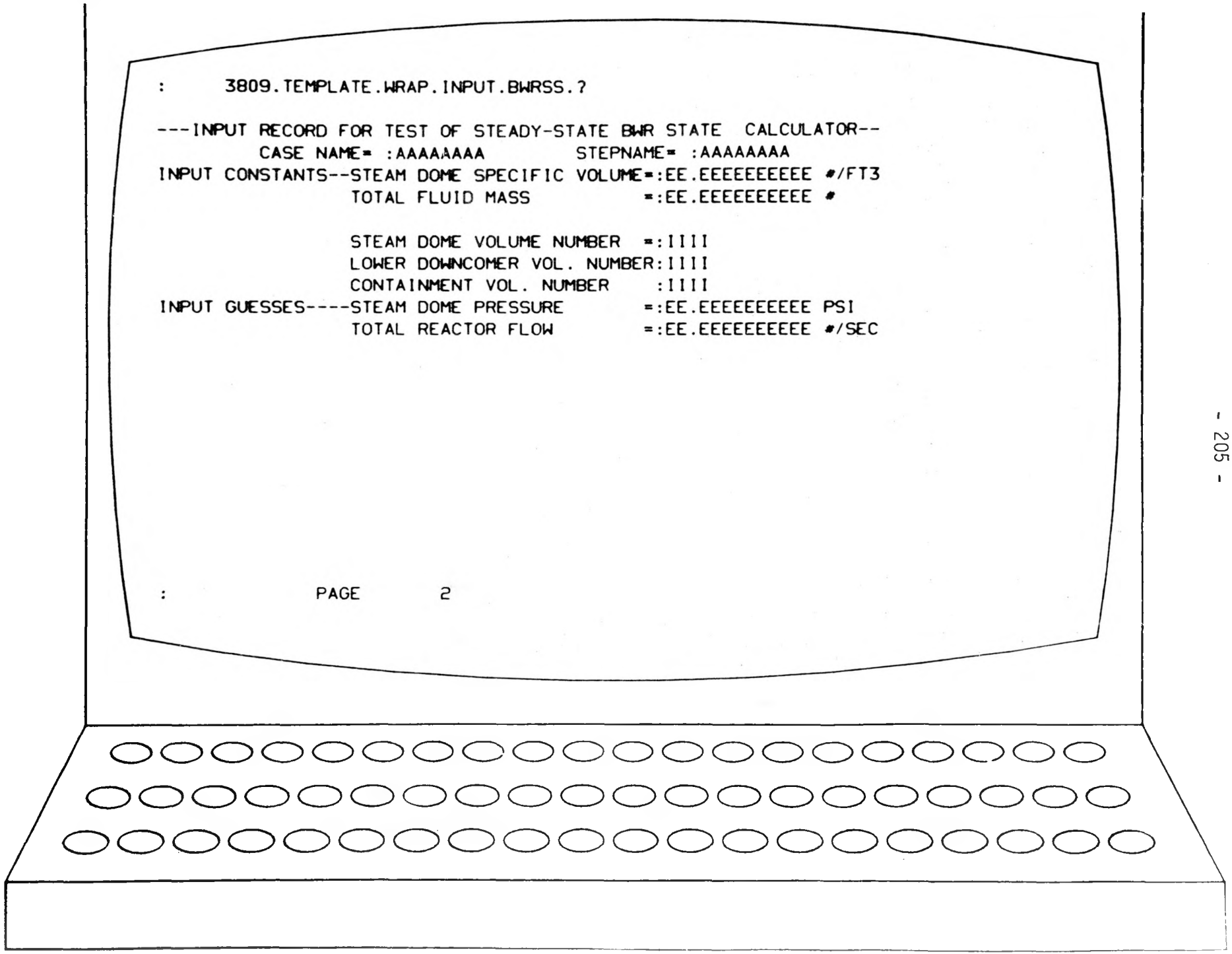

: TEMPLATE.WRAP.INPUT.EDITOR.?JOBNAM
QUALIFIER IS NAME OF JOB
++
ONLY FOR PLOTTING OF TWRAM RESULTS==
SPECIFY TAPE LABEL----------
->RELAP4 DATA TAPE. TITLE FOLLOWS.<-FIXED LABEL AT START
->:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA <-VARYING LABEL
SPECIFY TAPE TITLE----------
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
:AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
++
DO YOU WISH ONLY NORCOOL RESULTS TO BE PLOTTED ? .....:I
(0 = ONLY TWRAM PLOT, OR TWRAM AND NORCOOL PLOTS)
(1 = ONLY NORCOOL PLOT)
IF ONLY NORCOOL PLOT DESIRED, IGNORE EVERYTHING ELSE ON
THIS RECORD EXCEPT THE ABOVE FLAG.
: PAGE 2

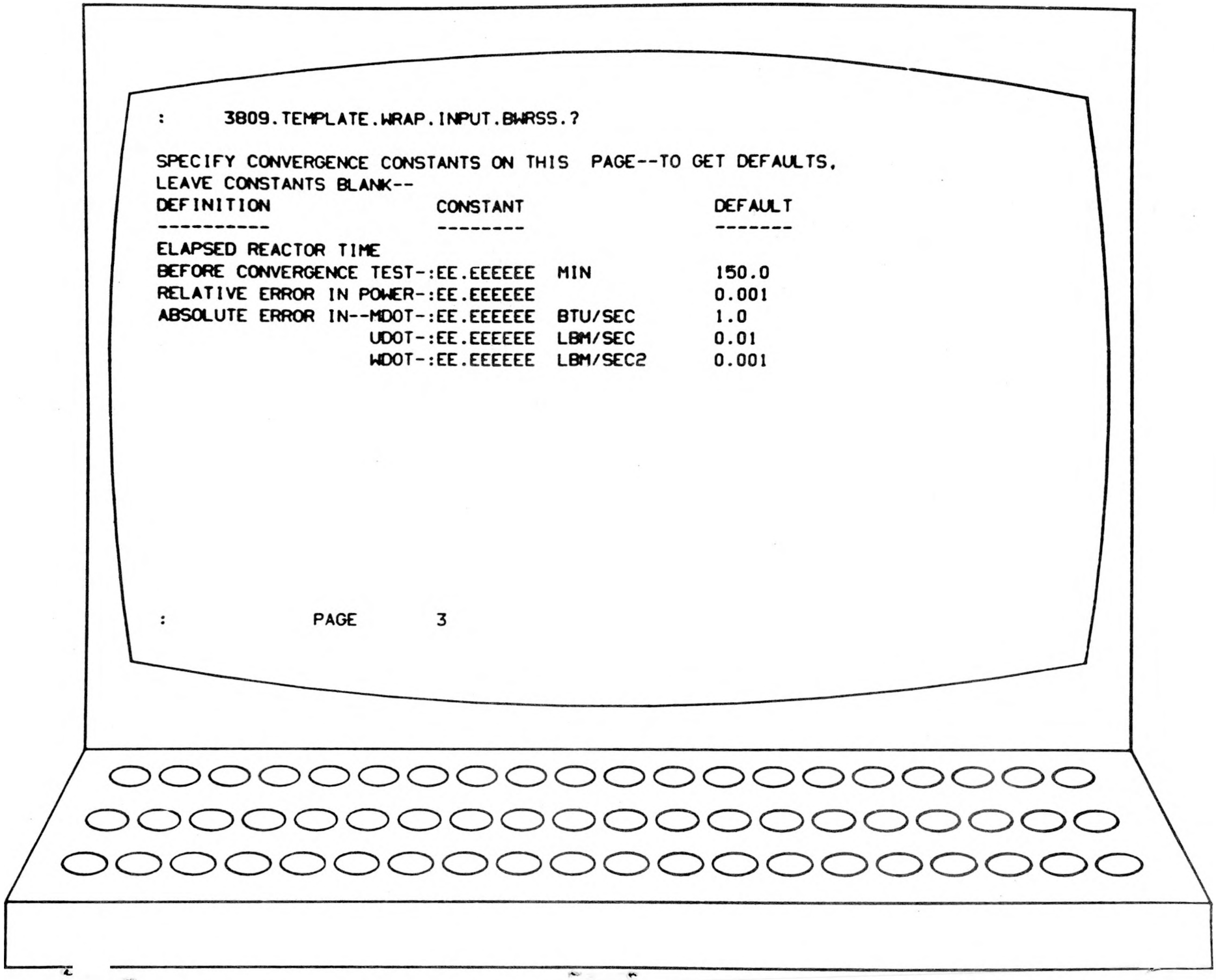

: TEMPLATE.WRAP.INPUT.EDITOR.?JOBNAM
IF YOU WANT EVERYTHING ON THE TAPE PLOTTED, IGNORE THE REST OF THIS RECORD. OTHERWISE, SELECT UP TO 10 VOLUMES, 10 JUNCTIONS, AND 10 SLABS FOR EACH OF WHICH UP TO 10 VARIABLES MAY BE PLOTTED IDENTIFY THE COMPONENTS BY NUMBER (USE THE CORRESPONDENCE TABLES PRINTED IN THE JOB GENERATING THE TAPE TO IDENTIFY NUMBERS WITH NAMES). IDENTIFY THE VARIABLES TO BE PLOTTED BY USING THE STANDARD TWO-CHARACTER MNEMONIC (USED IN DEFINING MINOR EDIT VARIABLES). '0', BLANK, AND 'AA' ENTRIES WILL BE IGNORED.
IF ONLY NORCOOL RESULTS ARE TO BE PLOTTED, IGNORE THE REST OF THIS RECORD.
: PAGE 3

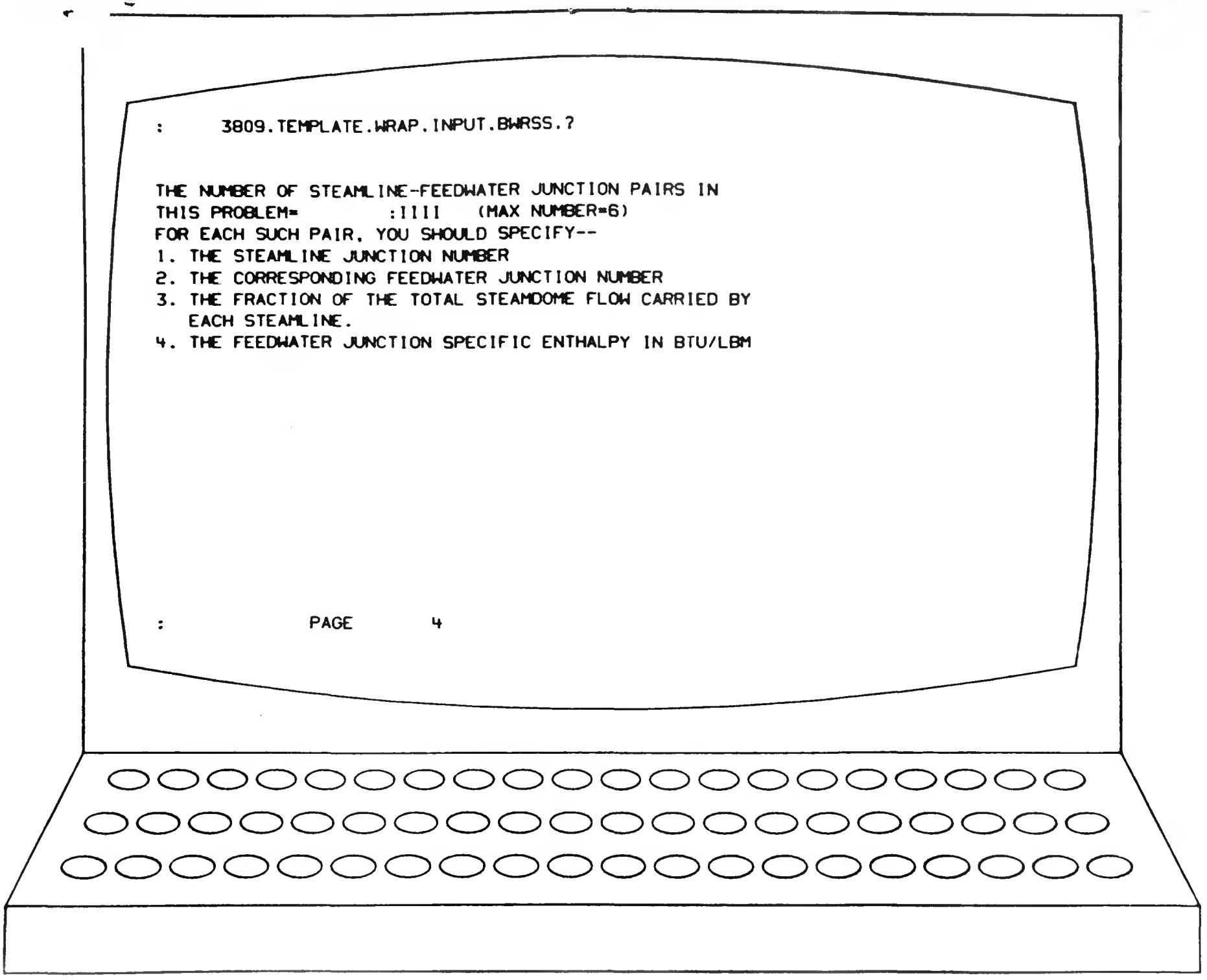

: TEMPLATE.WRAP.INPUT.EDITOR.?JOBNAM
--VOLUME-- ---------IDENTIFY VARIABLES TO BE PLOTTED-------
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
: PAGE 4

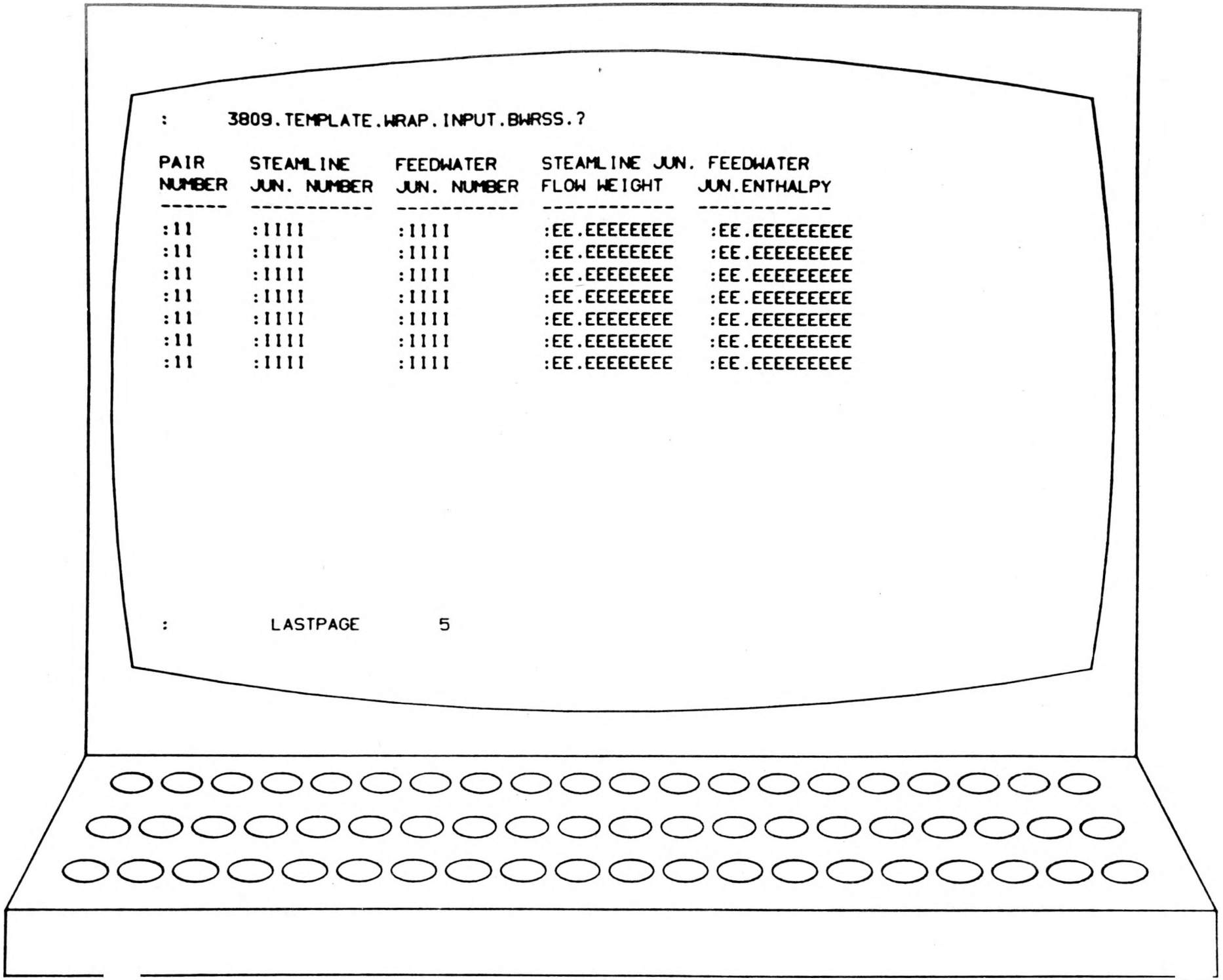

: TEMPLATE.WRAP.INPUT.EDITOR.?JOBNAM
--JUNCTION-- --------IDENTIFY VARIABLES TO BE PLOTTED--------
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
: PAGE 5


: TEMPLATE.WRAP.INPUT.EDITOR.?JOBNAM
--SLAB-- ----IDENTIFY VARIABLES TO BE PLOTTED----------
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
:III :AA :AA :AA :AA :AA :AA :AA :AA :AA :AA
: LASTPAGE 6


: 3809.TEMPLATE.WRAP.INPUT.BWRSS.?
---INPUT RECORD FOR TEST OF STEADY-STATE BWR STATE CALCULATOR--
CASE NAME= :AAAAAAAA STEPNAME= :AAAAAAAA
INPUT CONSTANTS--STEAM DOME SPECIFIC VOLUME=:EE.EEEEEEEEEE #/FT3
TOTAL FLUID MASS =:EE.EEEEEEEEEE #
STEAM DOME VOLUME NUMBER =:IIII
LOWER DOWNCOMER VOL. NUMBER:IIII
CONTAINMENT VOL. NUMBER :IIII
INPUT GUESSES----STEAM DOME PRESSURE =:EE.EEEEEEEEEE PSI
TOTAL REACTOR FLOW =:EE.EEEEEEEEEE #/SEC
: PAGE 2


: 3809.TEMPLATE.WRAP.INPUT.BWRSS.?
SPECIFY CONVERGENCE CONSTANTS ON THIS PAGE--TO GET DEFAULTS,
LEAVE CONSTANTS BLANK--
DEFINITION CONSTANT DEFAULT
ELAPSED REACTOR TIME
BEFORE CONVERGENCE TEST-:EE.EEEEEE MIN 150.0
RELATIVE ERROR IN POWER-:EE.EEEEEE 0.001
ABSOLUTE ERROR IN--MDOT-:EE.EEEEEE BTU/SEC 1.0
UDOT-:EE.EEEEEE LBM/SEC 0.01
WDOT-:EE.EEEEEE LBM/SEC2 0.001
: PAGE 3


: 3809.TEMPLATE.WRAP.INPUT.BWRSS.?
THE NUMBER OF STEAMLINE-FEEDWATER JUNCTION PAIRS IN
THIS PROBLEM= :1111 (MAX NUMBER=6)
FOR EACH SUCH PAIR, YOU SHOULD SPECIFY--
1. THE STEAMLINE JUNCTION NUMBER
2. THE CORRESPONDING FEEDWATER JUNCTION NUMBER
3. THE FRACTION OF THE TOTAL STEAMDOME FLOW CARRIED BY
EACH STEAMLINE.
4. THE FEEDWATER JUNCTION SPECIFIC ENTHALPY IN BTU/LBM
: PAGE 4


: 3809.TEMPLATE.WRAP.INPUT.BWRSS.?
PAIR NUMBER
STEAMLINE JUN. NUMBER
FEEDWATER JUN. NUMBER
STEAMLINE JUN. FLOW WEIGHT
FEEDWATER JUN.ENTHALPY
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
:11 :IIII :IIII :EE.EEEEEEEE :EE.EEEEEEEEE
: LASTPAGE 5

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