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**OXREPT
ORINC and Experimental Data to
Relap Plot Tape Interface**

Steven B. Cliff

Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
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COMPUTER SCIENCES DIVISION

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RELAP PLOT TAPE INTERFACE

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ABSTRACT

A computer program which transforms THTF experimental data and ORINC output data into the RELAP4/MOD5 plot/restart tape format is described. Input requirements and program characteristics are discussed.

INTRODUCTION

The computer program OXREPT takes cards, experimental data, and data from the Oak Ridge Inverse Heat Transfer Code and produces a pseudo-RELAP tape suitable for plotting or establishing time-dependent boundary conditions for a follow-up RELAP run. The card input is described later in this document; the experimental data is taken from the Engineering Units tape [1], and the Oak Ridge Inverse Heat Transfer Code. ORINC [2], produces a special file for OXREPT. The RELAP version may be the standard RELAP4/MOD5 from Idaho National Engineering Laboratory [3] or one of the local versions such as RLPSFLUX [4] or RLPORINC [5]. This document contains a description of the card input data and the printed output (including diagnostics).

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CARD INPUT

The card input to OXREPT is in three parts: volume specifications, plot tape specifications, and control information.

Volume Specifications

Volume specifications are read on unit 2 (DDNAME = FT02F001) with standard FORTRAN formatted input. The first card is read under an (I5,F10.5) format. The first item is the number of Boundary Conditioned Volumes (BCVOL); the second item is the end trip time. BCVOL must be between 1 and 10, inclusive. The end time value is used without change only if it is positive; if zero (omitted) or negative, it is set to 30.0 seconds. OXREPT terminates on one of two conditions: 1) end of experimental data, or 2) the time on an experimental data record is greater than the end time specified.

The next four groups of data may occupy more than one card depending on the value of BCVOL and will be described as Groups 2 through 5 (Group 1 has already been described and is always one card). Group 2 is the calculated pressure flags and values and is read with an (8(I2,F8.4)) format. There are BCVOL pairs of values (thus for $BCVOL \leq 8$ one card is required; $BCVOL = 9$ or 10 , two cards are required). The first item is the referenced volume index (REFVOL); the second is the hydrostatic pressure term (HYDROP). Pressures in a given volume are determined by this algorithm:

1. If REVOL(I) is zero, Pressure (I) is the pressure indicated by the experimental data (P(I)), and HYDROP is ignored.
2. If REFFVOL(I) is greater than zero, Pressure (I) is $P(REFVOL(I)) + P(I) + HYDROP(I)$.

3. If REFVOL(I) is less than zero, Pressure (I) is

$$P(\text{ABS}(\text{REFVOL}(I)) - P(I) + \text{HYDROP}(I)).$$

NOTES: a. HYDROP(I) may be positive, negative, or zero.

b. Forward referencing is not allowed; i.e., Volume N may reference only Volumes 1,2,3,...N-1. Thus the absolute value of REFVOL(I) must be less than I, requiring REFVOL(1) to always be zero.

This algorithm allows pressure to be determined either by an absolute pressure transducer or an absolute pressure transducer plus (minus) a differential pressure transducer plus (minus) a hydrostatic term as determined by the input.

Groups 3, 4, and 5 are each read under (15I5) formats and are channel numbers of actual experimental devices on the THTF experimental data acquisition system. The channel number for a given device is its A/D converter channel on the experiment and must be obtained from the experimenters. OXREPT converts these channel numbers to entry numbers as required to read the experimental data tape. (See documentation [1] on the Engineering Units Tape for details of the significance of this information.) Each group consists of triplets of channel numbers for each BCVOL. (Thus, for $\text{BCVOL} \leq 5$, one card is required in each group; for $\text{BCVOL} = 6, 7, 8, 9$, or 10, two cards are required in each group.) Each triplet of channel numbers specifies a first, second, and third choice of experimental devices to be used for a given BCVOL and a given type of data. The data is obtained for the first choice and its validity checked (see below for limits on valid data). If it is invalid, the second choice is used; if it too is invalid, the third choice is used. If the third choice

is invalid, an evaluation error occurs and no RELAP plot tape output is produced for the time step. The groups are checked in order, then the volumes are checked in order; only the first evaluation error is detected.

Channel numbers outside the range from 0 to the maximum number of experimental devices allowed (currently 1000) constitute a fatal error and the run is terminated with a code of 11 (see Appendix A). A value of zero indicates no experimental device is available for that choice.

Group 3 specifies the channels of the appropriate thermocouples for the BCVOL volumes. BCVOL triplets of channel numbers appear here on one or two cards, as needed. Valid temperature data is between 32°F and 2000°F.

Group 4 relates the channels for pressure transducers, either absolute or differential, depending on the REFVOL value. Valid pressures are between -100 psig and 3500 psig.

Group 5 provides the densitometer channel numbers with valid densities between 0 and 75 (lb/ft³).

The last group of card input for this part gives the mixing heights of the volumes. BCVOL values are read under an (10F8.5) format, requiring exactly one card for this group. These values are simply passed to RELAP as the mixing height (feet) of the volume (see RELAP manuals for a definition).

Plot Tape Specifications

The plot tape specifications comprise Part 2 of the data and are read with FORTRAN-formatted input on unit 2 (DDNAME - FT02F002). Two cards are required and are passed unchanged to the plot tape and are read with a (20A4) format. The first is the header and has no restrictions. The

second card is the title, the first twelve characters of which must agree with the RELAP title so that RELAP will accept the plot tape.

Control Information

The control information is Part 3 of OXREPT's card input and is read on unit 5 (DDNAME - FT05F001). Exactly one card, containing three values (call them ℓ , n_1 , and n_2) in an (L5,2I5) format is required. Each of the three controls some aspect of the printed output. More information is printed when the logical variable ℓ is true than when it is false. If $n_1 > 0$, one record is printed for every n_1 input (experimental data) records. If $n_1 \leq 0$, one record is printed for every 1000 input records. An input record is always printed if an error is detected. Similarly, if $n_2 > 0$, one record is printed for every n_2 output (RELAP Plot) records. If $n_2 \leq 0$, one record is printed every 1000 output records.

OTHER INPUT

Two additional inputs are required. The interface tape written by ORINC is required on unit 13 (DDNAME - FT13F001), and the engineering units tape with the appropriate experimental data is required on unit 4 (DDNAME - FT04F001). The data on these two tapes must be from the same experiment to ensure that timing incompatibilities do not occur. OXREPT depends on the engineering units tape for data times and assumes that the ORINC data is simultaneous.

PRINTED OUTPUT

The printed output from OXREPT appears on five units: 6, 20, 21, 22, and 23 (DDNAMES - FT06F001, FT20F001, FT21F001, FT22F001, and FT23F001,

respectively). The general output on unit 6 begins with some identification of OXREPT and the echo of the control input. Then the volume specification data is printed echoing all the input information. The experimental data tape is identified and some statistics on the tape follow.

The channels are converted to entries and the resulting values printed. The steady-state part of the experimental data is skipped and the first transient record read with appropriate printout. As each transient record is read, some information is written, the required calculations are performed, and, if no error occurs, the plot record is written. When the first plot record is written, several lines of identification are printed. As the loop continues, the input and output records are dumped as requested; and simultaneously, the rest of the printed information is produced.

Any errors during the reading of the ORINC interface tape will occur before the first output on unit 6 and will be noted only by system-supplied messages. After successful storing of the ORINC data, OXREPT identifies itself and begins subsequent processing.

During the initialization phase (before the plot tape header printout), several fatal error conditions can occur. Most are indicated by an explanatory message followed by a userabend with specific error code. Appendix A is a directory of such errors. Once the plot tape has been initialized, the only fatal errors detected by OXREPT are those that occur while producing the RELAP tape which is written by the BUFIO package from RELAP.

End of execution is initiated as directed by the input data, and several end-of-program messages are produced with appropriate statistics.

The printed output on unit 20 includes a listing of the volume information-temperature, pressure, quality and mixing height. The time and two volumes are printed per line with as many lines as needed produced.

Units 21, 22, and 23 all have slab information from ORINC written with ten slabs per line. The values are for surface heat flux, surface temperature, and centerline temperature from ORINC. They are labeled as stored on the RELAP tape: surface flux right side, surface temperature right, and average slab temperature.

PROGRAMMING CONSIDERATIONS

OXREPT consists of 16 routines and three common blocks occupying approximately 460K bytes of memory on the IBM 360/195 computer. The 16 routines are divided into experimental data input, physical property evaluation, plot tape output, and general groups which will be discussed separately. Additionally, the special library routines will be discussed. Figure 1 is the overall flow chart of OXREPT, and Figure 2 shows the sub-routine groupings of OXREPT, including calling hierarchies. Appendix B is the source listing of OXREPT.

General Group

The General Group consists of four routines, MAIN, RPMAIN, CHANIN, and FLXFIX. MAIN receives control from the operating system and is responsible for inputting all the data from the ORINC interface tape and passing it to RPMAIN. RPMAIN is the central controlling routine of OXREPT. It is responsible for sequencing through the initialization stages and then directs the primary loop in OXREPT, recognizing and handling error and end-of-file messages from the other routines

Figure 1

Overall Flowchart of OXREPT

NOTES

1. MEMBERS OF THE GENERAL GROUP.
2. MEMBERS OF THE EXPERIMENTAL DATA INPUT GROUP.
3. MEMBERS OF THE PHYSICAL PROPERTIES GROUP.
4. MEMBERS OF THE PLOT TAPE OUTPUT GROUP.

Figure 2

Subroutine Grouping for OXREPT

as well as producing the beginning and ending statistical messages. It returns to MAIN when end of file or the time trip is reached. Subroutine CHANIN reads all the first file of card data and is responsible for initializing the PCALC and CHANEL common blocks. All card input is checked by CHANIN, and CHANIN does not return to RPMAIN upon input error. Upon exit from CHANIN, common block CHANEL will be filled with the channel numbers from the input. Subroutine FLXFIX is responsible for translating the ORINC data read and stored by MAIN into the format needed for subsequent output.

Experimental Data Group

The Experimental Data Group is charged with the inputting of the experimental data from the engineering units tape. On each call to the controlling routine, EUIN, one record is read and stored for later use. Two special cases exist: the first and last calls. The last call is signaled by the end of experimental data and EUIN informs its caller, RPMAIN, of the condition. On the first call, EUIN calls EUPOS to position the experimental data to the blowdown and to absorb initialization information from the experiment. The first record of the engineering units tape has a table which relates the channel numbers given by card input to offsets into the actual data arrays. Routine LOOKST is invoked by EUPOS to translate these channel numbers to offsets for later use. EUPOS then positions the engineering units tape to the blowdown record leaving the blowdown record in memory. Thus the Experimental Data Group handles all accesses to the engineering units tape and its initialization.

Physical Properties Evaluation Group

The Physical Properties Evaluation Group is required to define the temperature, pressure, and quality of all the time-dependent volumes given experimental data and the translated channel numbers. Subroutine TPX is the controlling routine and it first uses logical function SELECT to determine the pressure, temperature, and density of each time-dependent volume. If SELECT is unable to select valid data as directed by the input, it informs TPX which passes the error condition back to RPMAIN for action. TPX is also responsible for performing the calculations required for pressure references. After all three experimental quantities are known, TPX invokes subroutine QUAL which uses internal tables supplied by R. A. Hedrick [6] to determine the quality from the input. Subroutine INDEX is used to establish the indexes into the tables and the double-precision function INTRP performs the linear interpolation in the tables. If all goes well, the Physical Property Evaluation Group exits with the temperature, pressure, and quality of each time-dependent volume known.

Plot Tape Output Group

The Plot Tape Output Group is responsible for handling the production of a properly formatted RELAP PLOT/RESTART tape. It is entered by RPMAIN at two of its four subroutines. The primary routine is PLTOUT which writes one plot record per call from the data gathered from ORINC (by FLXFIX), from experimental data (by EUIN and TPX) and from card input (the mixing height by CHANIN). On the first call, PLTOUT invokes PLTBEG to write the header and introductory records on the plot tape using information from common block TFLAG and the file 2 card input.

RLPMAIN also enters this group into subroutine PLTEND which writes all necessary closing records on the RELAP plot tape before returning.

The fourth subroutine of this group is PLTERR. It receives control from all three other Plot Tape Output routines upon plot tape error and handles the situation by abnormally terminating. Thus the Plot Tape Output routines handle all interaction with the RELAP PLOT/RESTART tape.

Special Library Routines

OXREPT makes use of several special library routines not supplied by the standard FORTRAN library. These routines have two sources as noted here.

Subroutine ABEND (which abnormally terminates OXREPT upon severe errors) and SETZER (which zeroes storage areas) are documented in Ref. 7. Subroutine DATE (which returns the current calendar date) and MOVEI (which moves storage areas) are part of RELAP's environmental package documented in Ref. 3 as is the entire BUFIO package (with routines BUFIN, BUFOUT, and BUFDLY) which is used to write the PLOT/RESTART tape. These special routines must be supplied to OXREPT for its use.

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APPENDICES

APPENDIX A
ABEND Codes

APPENDIX A

ABEND CODES

<u>Code</u>	<u>Routine</u>	<u>Cause</u>
10	CHANIN	Invalid number of boundary condition volumes. Must be at least 1, but not more than 10.
11	CHANIN	Invalid channel number. Must be between 0 and 1000.
12	CHANIN	No input on FT02F001--immediate end of file.
13	CHANIN	End-of-file reading temperature channels.
14	CHANIN	End-of-file reading pressure channels.
15	CHANIN	End-of-file reading density channels.
16	CHANIN	End-of-file reading volume heights.
17	CHANIN	End-of-file reading calculated pressure parameters.
NOTE:		Errors 11 through 17 indicate invalid or insufficient data available after FT02F001 DD *.
20	EUPOS	First record of experimental data has bad sequence field.
21	EUPOS	Too many experimental devices were specified.
22	EUPOS	No input on FT04F001--immediate end of file.
23	EUPOS	End-of-file while searching for blowdown.
24	LOOKST	Bad scan table or channel number.
NOTE:		Errors 20, 21, and 22 are catastrophic--no additional error message is produced.
		Errors 20, 21, 23, and 24 may indicate bad experimental data.
		Errors 12 and 22 probably indicate JCL errors.
30	PLTERR	Data record output or record setup.
31	PLTERR	Record 1 of setup.

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<u>Code</u>	<u>Routine</u>	<u>Cause</u>
32	PLTERR	Record 2 of setup.
33	PLTERR	Last data record.
34	PLTERR	First end-of-file record.
35	PLTERR	Second end-of-file record.
NOTE:		Errors 30 through 35 are all at the request of the BUFIO package and are preceded by additional messages.

Any error message prior to the identification printout messages probably occurred during the reading of the ORINC tape.

APPENDIX B
OXREPT SOURCE LISTING

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C HANDLE THE FAILURE TO EVALUATE CONDITION HERE
1000 CONTINUE
    WRITE (6,1001) INCNT,TIME
1001 FORMAT (' INPUT RECORD ',I7,' WITH TIME ',G14.7,
1      ' WAS UNSUCCESSFUL IN TPX EVALUATION: NO OUTPUT PRODUCED')
    WRITE (6,2002) DATA
C BEGIN THE LOOP TO READ A EU RECORD, CONVERT IT AND OUTPUT IT
2000 CONTINUE
C GET THE NEXT INPUT RECORD
    CALL FUIN (DATA,LEND,TIME)
    IF(LEND) GO TO 9000
C CHECK TIME VALUE AND TRIP IF NEEDED
    IF (TIME .GT. ENDTIM) GO TO 4000
    INCNT = INCNT+1
    LEDIT = (MOD(INCNT,INPRT) .EQ. 0)
    IF(LEDIT .OR. LPRINT) WRITE (6,2001) INCNT,TIME
2001 FORMAT (' INPUT RECORD NUMBER ',I6,' IS TIME ',G14.5)
    IF(LEDIT) WRITE (6,2002) DATA
2002 FORMAT ((10(1X,G12.6)))
C GET TEMP,PRESS,AND QUALITY FOR THE TDV
3000 CALL TPX (DATA,LERR,PV,TV,XV)
    IF(.NOT. LERR) INCNT = INCNT +1
    LEDIT = MOD(INCNT,INPRT) .EQ. 0
    IF(LERR) GO TO 1000
    CALL FLXFIX (NSLR,INCNT,SFLUX,FS,TS,TSO,TC,TCO)
C OUTPUT A PLOT RECORD
    CALL PLTOUT (PV,TV,XV,HV,FS,TSO,TCO,TIME,LEDIT)
    GO TO 2000
C NOTE THAT END WAS ON TIME, NO EU ENDFILE
4000 CONTINUE
    WRITE (6,4001) ENDTIM
4001 FORMAT('O END ON TIME TRIP = ',G14.7)
9000 CONTINUE
    CALL PLTEND
    WRITE (6,9001) INCNT,IOCNT,TIME
9001 FORMAT('O EXECUTION TERMINATING WITH ',I7,' EU RECORDS ',
1      ' READ AND ',I7,' OUTPUT RECORDS WRITTEN. FINAL OUTPUT TIME',
2      ' WAS: ',G14.7)
    RETURN
END
SUBROUTINE FLXFIX (NSLR,ITIM,SFLUX,FS,TS,TSO,TC,TCO)
C
C OXREP--VERSION 1.0-- APRIL 1,1977
    DIMENSION SFLUX(50,601),FS(50),TS(50,601),TC(50,601),
1      TCO(50),TSO(50)
C MUST COPY SURFACE FLUXES FROM SFLUX(ORINC) TO FS(RELAP)
C WHERE FS(N) IS SURFACE FLUX ON RIGHT SLAB OF SLAB N
C NOTE ASSUMPTION: EACH TIME STEP IN THE ORINC TAPE IS THE
C SAME AS THE TIME STEP IN THE EU TAPE
    CALL SETZER (50,TSO)
    CALL SETZER (50,TCO)
    CALL SETZER (50,FS)
    DO 100 I=1,NSLR
        TSO(I) = TS(I,ITIM)
        TCO(I) = TC(I,ITIM)
        FS(I) = SFLUX(I,ITIM)

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OXRPO570
OXRPO580
OXRPO590
OXRPO600
OXRPO610
OXRPO620
OXRPO630
OXRPO640
OXRPO650
OXRPO660
OXRPO670
OXRPO680
OXRPO690
OXRPO700
OXRPO710
OXRPO720
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OXRPO950
OXRPO960
OXRPO970
OXRPO980
OXRPO990
OXRPI000
OXRPI010
OXRPI020
OXRPI030
OXRPI040
OXRPI050
OXRPI060
OXRPI070
OXRPI080
OXRPI090
OXRPI100
OXRPI110
OXRPI120

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100  CONTINUE                                OXRP1130
      RETURN                                OXRP1140
      END                                  OXRP1150
      SUBROUTINE CHANIN (ENDTIM)            OXRP1160
C                                          OXRP1170
C OXRP1--VERSION 1.0-- APRIL 1,1977       OXRP1180
C THIS SUBROUTINE READS THE CHANNEL NUMBERS IN OXRP1190
C LPRINT IS TRUE TO PRINT A LIST OF THE INPUT OXRP1200
      IMPLICIT INTEGER (C)                 OXRP1210
      INTEGER REFVOL                       OXRP1220
      LOGICAL LPRINT                       OXRP1230
      DATA MAXCH /1000/                  OXRP1240
C MAXCH IS THE MAXIMUM ALLOWABLE CHANEEL NUMBER OXRP1250
      DATA CHAR1,CHAR2,CHAR3,CHAR4,CHAR5,CHAR6 OXRP1260
      1 /'TEMP','PRES','DENS','FRST','HIGH','PCAL' / OXRP1270
C CHAR. ARE NEEDED CHARACTER STRINGS      OXRP1280
C                                          OXRP1290
      COMMON /PCALC/ REFVOL(10),HYDROP(10) OXRP1300
C                                          OXRP1310
C REFVOL IS THE VOLUME WHOSE PRESSURE IS THE BASE OXRP1320
C AND THE PRESSURE OF THIS VOLUME WILL BE OXRP1330
C ADDED TO IT IF REFVOL>0 OR WILL BE OXRP1340
C SUBTR FROM IT REFVOL<0 OR NO CHANGE OXRP1350
C IF REFVOL=0 OXRP1360
C IF REFVOL <>0 THEN HYDROP WILL BEADDED TO PRESSURE OXRP1370
C OF THIS VOLUME OXRP1380
C                                          OXRP1390
      COMMON /TFLAG/ NST,NTDV,TITLE(18),HV(10),LPRINT OXRP1400
C 4 IS THE UNIT NUMBER OF THE EU TAPE OXRP1410
      COMMON /CHANNEL/ OXRP1420
      1 CHT1 (3), CHT2 (3), CHT3 (3), CHT4 (3), CHT5 (3), OXRP1430
      2 CHT6 (3), CHT7 (3), CHT8 (3), CHT9 (3), CHT10(3), OXRP1440
      3 CHP1 (3), CHP2 (3), CHP3 (3), CHP4 (3), CHP5 (3), OXRP1450
      4 CHP6 (3), CHP7 (3), CHP8 (3), CHP9 (3), CHP10(3), OXRP1460
      5 CHD1 (3), CHD2 (3), CHD3 (3), CHD4 (3), CHD5 (3), OXRP1470
      6 CHD6 (3), CHD7 (3), CHD8 (3), CHD9 (3), CHD10(3) OXRP1480
C THE CH.. ARE ARRAYS OF THE CHANNEL NUMBERS OF THE DEVICES THAT ARE OXRP1490
C TO BE USED TO DETERMINE THE TIME DEPENDANT VOLUME PROPERTIES OXRP1500
C CH..(1) IS THE PROFFERED PHYSICAL DEVICE (ZERO IF NO DEVICE) OXRP1510
C CH..(2) IS THE SECONDARY CHANNEL NUMBER (OPTIONAL:ZERO IF NONE) OXRP1520
C CH..(3) IS THE TERTIARY CHANNEL NUMBER (OPTIONAL:ZERO IF NONE) OXRP1530
C CHT1,CHT2,CHT3...CHT10 ARE THE UPTO TEN VOLUMNS THAT ARE TIME OXRP1540
C DEPENDANT OXRP1550
C CHP.....ARE THE ASSOCIATED PRESSURE ARRAYS OXRP1560
C CHD.... ARE THE ASSOCIATED DENSITY ARRAYS OXRP1570
C HV ARE THE HEIGHTS OF THE VOL IN THE RELAP MODEL OXRP1580
      DIMENSION CHCLR(90),CHT(30),CHP(30),CHD(30) OXRP1590
      EQUIVALENCE (CHT(1),CHT1(1),CHCLR(1)), OXRP1600
      1 (CHP(1),CHP1(1)),(CHD(1),CHD1(1)) OXRP1610
      WRITE (6,1) OXRP1620
      1 FORMAT ('O READING CHANNEL TABLES') OXRP1630
C FIRST READ THE NUMBER OF TIME DEPENDANT VOLUMNS AND OXRP1640
      IN=2 OXRP1650
      READ (IN,2,END=9000) NTDV,ENDTIM OXRP1660
      2 FORMAT (15,F10.5) OXRP1670
C CHECK NTDV FOR VALIDITY OXRP1680

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      IF (NTDV .LE. 0) .OR. (NTDV .GT. 10) GO TO 4000
      IF (LPRINT) WRITE (6,4) NTDV
      4   FORMAT (' THERE ARE ',I3,' BOUNDARY CONDITION VOLUMES ')
C CHECK THE VALIDITY OF THE CHANNEL NUMBERS
C CHECK THE ENDTIME VALUE, IF NEGATIVE OR ZERO MAKE IT 30.0 SEC-FULL
      IF (ENDTIM .LE. 0.0) ENDTIM=30.0
      WRITE (6,7) ENDTIM
      7   FORMAT (' ENDTIME WILL TRIP AT=',G14.7)
C READ IN THE REFVOL FOR PCALC EFFORTS
      READ (IN,5,END=9500) (REFVOL(I),HYDRUP(I),I=1,NTDV)
      5   FORMAT ((8I12,F8.4))
      WRITE (6,6) (I,REFVOL(I),HYDRUP(I),I=1,NTDV)
      6   FORMAT (//30X,'CALCULATED PRESSURE PARMS',/
      8   5(2X,'VOL',2X,'REFVOL',2X,'HYDRUP'),/
      6   5(12X,I3,3X,I4,3X,F8.4)))
      1000 CONTINUE
C ZERO THE CHANNEL NUMBERS
      CALL SETZER (90,CHCLR)
      CALL SETZER (10,HV)
      NTDV3 = NTDV*3
C READ THE TEMPERATURE CHANNEL
      READ (IN,1001,END=9100) (CHT(I),I=1,NTDV3)
      1001 FORMAT (15I5)
C READ THE PRESSURE CHANNEL
      READ (IN,1001,END=9200) (CHP(I),I=1,NTDV3)
C READ THE DENSITY CHANNEL
      READ (IN,1001,END=9300) (CHD(I),I=1,NTDV3)
C READ THE MIXING HEIGHTS OF THE VOLUMNS
      READ (IN,1002,END=9400) (HV(I),I=1,NTDV)
      1002 FORMAT (10F8.5)
C VALIDITY CHECK ALL OF THE CHANNEL NUMBERS
      DO 2000 I=1,90
      IF ((CHCLR(I) .GT. MAXCH) .OR. (CHCLR(I) .LT. 0)) GO TO 4100
      2000 CONTINUE
C SUCCESSFUL LOAD
C
C      BUMP FTINFO01 TO FTINFO02 FOR PLOTIN
      2500 READ (IN,2501,END=2700) I
      2501 FORMAT (////A1)
      GO TO 2500
      2700 CONTINUE
      WRITE (6,2001)
      2001 FORMAT (//,30X,'TEMPERATURE CHANNELS')
      WRITE (6,2002) (CHT(I),I=1,NTDV3)
      2002 FORMAT (5(5X,'PRIM SEC0 THIR'),/,3X
      1 5(2X,3(I4,3X)),/,3X,5(2X,3(I4,3X)))
      WRITE (6,2003)
      2003 FORMAT (//,30X,'PRESSURE CHANNELS')
      WRITE (6,2002) (CHP(I),I=1,NTDV3)
      WRITE (6,2004)
      2004 FORMAT (//,30X,'DENSITY CHANNELS')
      WRITE (6,2002) (CHD(I),I=1,NTDV3)
      WRITE (6,2005)
      2005 FORMAT (//,30X,'VOLUME HEIGHTS')
      WRITE (6,2006) (I,HV(I),I=1,NTDV)
      2006 FORMAT (1X,10('VOL HEIGHT '),/,1X,10(I3,1X,G9.3))

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OXRP1690
 OXRP1700
 OXRP1710
 OXRP1720
 OXRP1730
 OXRP1740
 OXRP1750
 OXRP1760
 OXRP1770
 OXRP1780
 OXRP1790
 OXRP1800
 OXRP1810
 OXRP1820
 OXRP1830
 OXRP1840
 OXRP1850
 OXRP1860
 OXRP1870
 OXRP1880
 OXRP1890
 OXRP1900
 OXRP1910
 OXRP1920
 OXRP1930
 OXRP1940
 OXRP1950
 OXRP1960
 OXRP1970
 OXRP1980
 OXRP1990
 OXRP2000
 OXRP2010
 OXRP2020
 OXRP2030
 OXRP2040
 OXRP2050
 OXRP2060
 OXRP2070
 OXRP2080
 OXRP2090
 OXRP2100
 OXRP2110
 OXRP2120
 OXRP2130
 OXRP2140
 OXRP2150
 OXRP2160
 OXRP2170
 OXRP2180
 OXRP2190
 OXRP2200
 OXRP2210
 OXRP2220
 OXRP2230
 OXRP2240

RETURN	0XRP2250
C INVALID NUMBER OF TIME DIVISIONS	0XRP2260
8000 CONTINUE	0XRP2270
WRITE (A,8001) NTOV	0XRP2280
8001 FORMAT ('O INVALID NUMBER OF TIME DEPENDANT VOLUMES',I7)	0XRP2290
CALL AEND (10)	0XRP2300
8100 CONTINUE	0XRP2310
IK = CHAR1	0XRP2320
IF (I .GT. 30) IK=CHAR2	0XRP2330
IF (I .GT. 60) IK=CHAR3	0XRP2340
IM = MOD(I-1,30)+1	0XRP2350
WRITE(A,8101) IK,IK,IM,C CLR(1)	0XRP2360
8101 FORMAT ('O INVALID ',A4,' CHANNEL NUMBER FOR ',A4,	0XRP2370
1 ' NUMBER ',I4,' VALUE IS ',I7)	0XRP2380
CALL AEND (11)	0XRP2390
C END OF FILE ON FIRST RECORD	0XRP2400
9000 CONTINUE	0XRP2410
IK = CHAR4	0XRP2420
I=12	0XRP2430
9010 WRITE (A,9011) IK	0XRP2440
9011 FORMAT ('END OF FILE ON ',A4,' RECORD')	0XRP2450
CALL AEND (1)	0XRP2460
C END OF FILE ON TEMP RECORD	0XRP2470
9100 IK=CHAR1	0XRP2480
I=13	0XRP2490
GO TO 9010	0XRP2500
C END OF PRESS	0XRP2510
9200 IK = CHAR2	0XRP2520
I=14	0XRP2530
GO TO 9010	0XRP2540
C END OF DENSITY	0XRP2550
9300 IK = CHAR3	0XRP2560
I=15	0XRP2570
GO TO 9010	0XRP2580
C END OF VOLUME HEIGHTS	0XRP2590
9400 IK=CHAR5	0XRP2600
I=16	0XRP2610
GO TO 9010	0XRP2620
C END OF FILE ON PCALC	0XRP2630
9500 CONTINUE	0XRP2640
IK=CHAR6	0XRP2650
I=17	0XRP2660
GO TO 9010	0XRP2670
END	0XRP2680
SUBROUTINE EFIN (REC,LEND,TIME)	0XRP2690
C	0XRP2700
C OXPERT--VERSION 1.0-- APRIL 1,1977	0XRP2710
C THIS SUBROUTINE RETURNS THE NEXT RECORD FROM THE ENGINEERING	0XRP2720
C UNITS TAPE	0XRP2730
C LEND IS TRUE IF END OF FILE ENCOUNTERED	0XRP2740
C REC IS THE RETURNED NEXT RECORD	0XRP2750
C TIME IS THE TIME OF THE RECORD	0XRP2760
LOGICAL LEND,LPRINT,LFIRC	0XRP2770
C LFIRC AS TRUE IF THIS IS THE FIRST CALL TO EFIN--BECAUSE OF THIS	0XRP2780
C FLAG, THIS SUBROUTINE IS NOT OVERLAYABLE	0XRP2790
DIMENSION REC(1:17),CH(30),CMP(30),CHD(30)	0XRP2800

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C   EVEN THOUGH ONLY THE FIRST 500 WORDS ARE THE DESIRED NEXT DATA RECORD
      DATA LFIRC /.TRUE./                                OXRP2810
      COMMON /TFLAG/ NST,NTDV,TITLE(18),HV(10),LPRINT    OXRP2820
C   NST IS THE NUMBER OF EXPERIMENTAL DEVICES              OXRP2830
C   C   ASSUME NO END OF FILE WILL BE FOUND              OXRP2840
      LFND = .FALSE.                                       OXRP2850
C   IF THIS IS THE FIRST CALL TO EUPNS, CALL EUPNS TO POSITION THE TAPE
      TO THE FIRST RECORD OF THE BLINDOWN I.E. TO TZERO AND TO SET
C   THE NECESSARY DATA AREAS
      IF (LFIRC) GO TO 9000                                OXRP2860
C   READ NEXT RECORD                                         OXRP2870
      READ (4,END=9000) TSFO,TIME,REC                     OXRP2880
C   CALL PDIMP (REC(1),REC(Inst),5)                         OXRP2890
      RETURN                                                OXRP2900
C   HANDLE SPECIAL CASE OF FIRST CALL:
      9000 CONTINUE                                         OXRP2910
      CALL EUPNS(REC,TIME)                                   OXRP2920
C   TURN OFF FIRST CALL FLAG                                OXRP2930
      LFIRC = .FALSE.                                       OXRP2940
C   CALL PDIMP (REC(1),REC(Inst),5)                         OXRP2950
      RETURN                                                OXRP2960
C   END OF FILE :
      9001 CONTINUE                                         OXRP2970
      LFND = .TRUE.                                          OXRP2980
      WRITE(6,9001)                                          OXRP2990
      9001 FORMAT (' END OF FILE IN EU TAPE')              OXRP3000
      RETURN                                                OXRP3010
      END                                                    OXRP3020
      SUMTIME EUPNS (REC,TIME)                              OXRP3030
C   OXREP1--VERSION 1.0-- APRIL 1,1977                    OXRP3040
C   THIS SUBROUTINE POSITIONS THE ENGINEERING UNITS TAPE TO THE FIRST
C   RECORD, CALCULATES THE TIME OF BLINDOWN AND THE TIME BETWEEN THE
      IMPLICIT INTEGER (C)                                  OXRP3050
      REAL*8 MTIME                                           OXRP3060
      LOGICAL LPRINT                                          OXRP3070
      DIMENSION REC (1000),CHT(30),CHD(30),CHP(30),INDT(7),
      1      TTT(20)                                          OXRP3080
      DATA MAXEXP /1000/                                     OXRP3090
C   MAXEXP IS THE MAXIMUM ALLOWABLE NUMBER OF S.T. ENTRIES OXRP3100
C   REC IS THE PHYSICAL RECORD FROM THE TAPE              OXRP3110
      COMMON /TFLAG/ NST,NTDV,TITLE(18),HV(10),LPRINT    OXRP3120
C   4 IS THE UNIT NUMBER OF THE EU TAPE                   OXRP3130
      COMMON /CHANNEL/
      1 CHT1 (3), CHT2 (3), CHT3 (3), CHT4 (3), CHT5 (3),
      2 CHT6 (3), CHT7 (3), CHT8 (3), CHT9 (3), CHT10(3),
      3 CHP1 (3), CHP2 (3), CHP3 (3), CHP4 (3), CHP5 (3),
      4 CHP6 (3), CHP7 (3), CHP8 (3), CHP9 (3), CHP10(3),
      5 CHD1 (3), CHD2 (3), CHD3 (3), CHD4 (3), CHD5 (3),
      6 CHD6 (3), CHD7 (3), CHD8 (3), CHD9 (3), CHD10(3)
C   THE CH.. ARE ARRAYS OF THE CHANNEL NUMBERS OF THE DEVICES THAT ARE
C   TO BE USED TO DETERMINE THE TIME DEPENDANT VOLUME PROPERTIES
C   CH..(1) IS THE PREFERRED PHYSICAL DEVICE (ZERO IF NO DEVICE)
C   CH..(2) IS THE SECONDARY CHANNEL NUMBER (OPTIONAL:ZERO IF NONE)
C   CH..(3) IS THE TERTIARY CHANNEL NUMBER (OPTIONAL:ZERO IF NONE)

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1	FORMAT (//,30X,'TEMPERATURE ENTRIES')	OXR P3930
	WRITE (A,2) (CHT(I),I=1,NTDV3)	OXR P3940
2	FORMAT (5(5X,'PRIM SEC' THIR'),/,3X	OXR P3950
1	5(2X,3(14,3X)),/,3X,5(2X,3(14,3X)))	OXR P3960
	WRITE (A,3)	OXR P3970
3	FORMAT (//,30X,'PRESSURE ENTRIES')	OXR P3980
	WRITE (A,2) (CHP(I),I=1,NTDV3)	OXR P3990
	WRITE (A,4)	OXR P4000
4	FORMAT (//,30X,'DENSITY ENTRIES')	OXR P4010
	WRITE (A,2) (CHD(I),I=1,NTDV3)	OXR P4020
	ICNT=0	OXR P4030
1000	CONTINUE	OXR P4040
	READ (A,END=9100) ISEO,TIME,(REC(I),I=1,NST)	OXR P4050
	ICNT=ICNT+1	OXR P4060
	IF(ISEO .LT. INDR) GO TO 1000	OXR P4070
	IF(ANS(TIME) .GT. 1E-10) GO TO 1000	OXR P4080
C THIS	IS ALOWDOWN RECORD FOR SURE	OXR P4090
	WRITE (A,1001) ISEO,TIME,ICNT	OXR P4100
1001	FORMAT ('OBLOWDOWN FOUND IN DATA RECORD ',I5,	OXR P4110
5	' AT RELATIVE TIME ',F14.7,' WITH ',I4,	OXR P4120
5	' RECORDS SKIPPED')	OXR P4130
	RETURN	OXR P4140
C END	OF FILE BEFORE BREAK ERROR	OXR P4150
9001	FORMAT ('O END OF FILE ENCOUNTERED WHILE SEARCHING FOR',	OXR P4160
1	' ALOWDOWN WITH ',I4,' DATA RECORDS SKIPPED')	OXR P4170
9100	CONTINUE	OXR P4180
	ICNT = -ICNT	OXR P4190
	WRITE (A,9001) ICNT	OXR P4200
	CALL ABEND (23)	OXR P4210
9000	CALL ABEND (22)	OXR P4220
	RETURN	OXR P4230
	END	OXR P4240
	SUBROUTINE LOOKST (CH,ST)	OXR P4250
C		OXR P4260
C OXRPT--VERSION 1.0-- APRIL 1,1977		OXR P4270
	INTEGER ST,CH	OXR P4280
C THIS	SUBROUTINE CONVERTS THE CHANEL NUMBER IN CH TO THE ENTRY	OXR P4290
C	NUMBER OF THE SCAN TABLE IN ST	OXR P4300
	COMMON /TFLAG/ NST,NTDV,TITLE(14),MV(10),LPRINT	OXR P4310
	DIMENSION ST(NST),CH(3)	OXR P4320
	DO 3000 I = 1,3	OXR P4330
C	CHECK FOR END OF CHANELS	OXR P4340
	IF(CH(I)) .EQ. 0) RETURN	OXR P4350
C	LOOK THROUGH THE TABLE FOR THE CHANEL NUMBER	OXR P4360
	DO 2000 ICH = 1,NST	OXR P4370
	IF(CH(I)) .NE. ST(ICH)) GO TO 2000	OXR P4380
C	HAVE FOUND THE CHANEL, NOW TRANSFORM IT	OXR P4390
	CH(I) = ICH	OXR P4400
	GO TO 3000	OXR P4410
2000	CONTINUE	OXR P4420
	WRITE (A,2001) CH(I),I	OXR P4430
2001	FORMAT ('O UNABLE TO FIND CHANEL NUMBER ',I4,	OXR P4440
1	' WHICH IS NUMBER: ',I2)	OXR P4450
	CALL ABEND (24)	OXR P4460
3000	CONTINUE	OXR P4470
	RETURN	OXR P4480

```

      END
      SIMRCHTIME TPIX(ATA,LEHR,PV,TV,XV)
C
C NEXTPT--VERSION 1.0-- APRIL 1,1977
C THIS SIMRCHTIME DETERMINES THE TEMPERATURE,
C THE PRESSURE, AND QUALITY FOR THE TIME DEPENDANT
C VOLUMINS
C DATA IS THE INPUT FROM THE EU TAPE
C LEHR IS TRUE IF CANNOT DETERMINE ALL THE QUANTITIES
C PV,TV, & XV ARE THE PRESS,TEMP,QUAL OF THE TDV VOLS
C
      IMPLICIT INTEGER (I)
      LOGICAL LEHR,SELECT,LTORP,LPRINT
      COMMON /PCALC/ REFVOL(10),HYDROPI(10)
      INTEGER REFVOL
      COMMON /TFLAG/ NST,NTDV,TITLE(18),MV(10),LPRINT
C TZERO IS THE TIME OF THE BLOWDOWN
C STEP IS ONE-HALF THE TIME BETWEEN PHYSICAL RECORDS
C IO IS THE UNIT NUMBER OF THE EU TAPE
      COMMON /CHANNEL/
      1 CHT1 (3), CHT2 (3), CHT3 (3), CHT4 (3), CHT5 (3),
      2 CHT6 (3), CHT7 (3), CHT8 (3), CHT9 (3), CHT10(3),
      3 CHP1 (3), CHP2 (3), CHP3 (3), CHP4 (3), CHP5 (3),
      4 CHP6 (3), CHP7 (3), CHP8 (3), CHP9 (3), CHP10(3),
      5 CHD1 (3), CHD2 (3), CHD3 (3), CHD4 (3), CHD5 (3),
      6 CHD6 (3), CHD7 (3), CHD8 (3), CHD9 (3), CHD10(3)
C THE CH... ARE ARRAYS OF THE CHANEL NUMBERS OF THE DEVICES THAT ARE
C TO BE USED TO DETERMINE THE TIME DEPENDANT VOLUME PROPERTIES
C CH... (1) IS THE PREFERRED PHYSICAL DEVICE (ZERO IF NO DEVICE)
C CH... (2) IS THE SECONDARY CHANEL NUMBER (OPTIONAL:ZERO IF NONE)
C CH... (3) IS THE TERTIARY CHANEL NUMBER (OPTIONAL:ZERO IF NONE)
C CHT1,CHT2,CHT3...CHT10 ARE THE INPUT TEN VOLUMINS THAT ARE TIME
C DEPENDANT
C CHP.....ARE THE ASSOCIATED PRESSURE ARRAYS
C CHD.... ARE THE ASSOCIATED DENSITY ARRAYS
C MV ARE THE HEIGHTS OF THE VOL IN THE RELAP MODEL
      DIMENSION DATA(NST),PV(NTDV),TV(NTDV),CHT(30),
      5 CHD(30),CHP(30),XV(NTDV)
      EQUIVALENCE (CHT(1),CHT1(1)),(CHP(1),CHP1(1)),
      6 (CHD(1),CHD1(1))
C CHECK ALL THE TIME DEPENDANT VOLUMINS
      DO 5000 ITDV=1,NTDV
      ITDV3=(ITDV-1)*3+1
C CHECK FOR PROPER INSTRUMENT READINGS
      IF(SELECT(CHT(ITDV3),CHP(ITDV3),CHD(ITDV3),
      7 PV(ITDV),TV(ITDV),DEN,DATA,NST,LTORP)) GO TO 9000
      IF(REFVOL(ITDV) .EQ. 0) GO TO 2000
      INV=IABS(REFVOL(ITDV))
      PV(ITDV)=PV(INV)+PV(ITDV)*ISIGN(1,REFVOL(ITDV))+HYDROPI(ITDV)
      2000 CONTINUE
      CALL QUAL(PV(ITDV),TV(ITDV),XV(ITDV),DEN,LTORP)
      5000 CONTINUE
      LEHR = .FALSE.
      RETURN
      9000 CONTINUE
      WRITE (A,9001) ITDV

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OXRP4490
 OXRP4500
 OXRP4510
 OXRP4520
 OXRP4530
 OXRP4540
 OXRP4550
 OXRP4560
 OXRP4570
 OXRP4580
 OXRP4590
 OXRP4600
 OXRP4610
 OXRP4620
 OXRP4630
 OXRP4640
 OXRP4650
 OXRP4660
 OXRP4670
 OXRP4680
 OXRP4690
 OXRP4700
 OXRP4710
 OXRP4720
 OXRP4730
 OXRP4740
 OXRP4750
 OXRP4760
 OXRP4770
 OXRP4780
 OXRP4790
 OXRP4800
 OXRP4810
 OXRP4820
 OXRP4830
 OXRP4840
 OXRP4850
 OXRP4860
 OXRP4870
 OXRP4880
 OXRP4890
 OXRP4900
 OXRP4910
 OXRP4920
 OXRP4930
 OXRP4940
 OXRP4950
 OXRP4960
 OXRP4970
 OXRP4980
 OXRP4990
 OXRP5000
 OXRP5010
 OXRP5020
 OXRP5030
 OXRP5040

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0001  FORMAT (14,30X,13)
      LERR = .TRUE.
      RETURN
      END
      LOGICAL FUNCTION SELECT(ICMT,ICMP,ICMD,PV,TV,DV,
      DATA,NST,LTMP)
C
C  OREPT--VERSION 1.0-- APRIL 1,1977
C  THIS FUNCTION SELECTS PRESSURE (PV), TEMPERATURE (TV), AND
C  DENSITY (DV) VALUES FROM THE ARRAY FROM THE E1 TAPE (DATA)
C  WITH SCAN TABLE ENTRIES OF ICMT,ICMP,ICMD
C  IF UNABLE TO DEFINE ALL 3 PROPERTIES, A .TRUE. VALUE
C  IS RETURNED AS A FUNCTIONAL VALUE; ELSE A FALSE
C  LTMP IS TRUE IF TEMPERATURE IS THE PREFERRED
C  QUANTITY FOR USE IN DEFINING QUALITY
      IMPLICIT LOGICAL (L),INTEGER(I)
      DIMENSION ICMT(3),ICMP(3),ICMD(3),DATA(NST)
C  STMT FUNCTION TO TEST FOR VALID TEMP VALUES
      LTMP(XD) = (XD .LT. 2000.) .AND. (XD .GT. 32.)
C  STMT FUNCTION TO TEST FOR VALID PRESSURE VALUES
      LPRES(PD) = (PD .LT. 3500.) .AND. (PD .GT. -100.)
C  STMT FUNCTION TO TEST FOR VALID DENSITY VALUES
      LDEN(DD) = (DD .LT. 75.) .AND. (DD .GT. 0.)
      DATA STMP,SPRES,SDEN/'TEMP','PRES','DEN'/
C
C  GET TEMPERATURE IF KNOWN
C  CHECK ALL THREE POSSIBLE S.T. ENTRIES
      SWICH = STMP
      DO 1000 INT=1,3
C  GET THIS S.T. ENTRY
      IT= ICMT(INT)
C  TEST FOR AN ENTRY; IF NONE , ERROR
      IF(IT .LE. 0) GO TO 9000
C  ASSUME THE VALUE IS O.K.
      TV = DATA (IT)
C  CHECK THE VALIDITY OF THE DATA
      IF (LTMP(TV)) GO TO 2000
C  INVALID DATA, TRY AGAIN
      1000 CONTINUE
C  CHECKED ALL S.T. ENTRIES, NONE VALID
      GO TO 9000
      2000 CONTINUE
      SWICH = SPRES
C  DO THE SAME FOR PRESSURES
      DO 3000 IMP=1,3
      IP=ICMP(IMP)
      IF(IP .LE. 0) GO TO 9000
      PV=DATA(IP)
      IF (LPRES(PV)) GO TO 4000
      3000 CONTINUE
      GO TO 9000
      4000 CONTINUE
      SWICH = SDEN
C  DO THE SAME FOR DENSITY
      DO 5000 IND = 1,3
      ID = ICMD(IND)

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      IF (ID,LE,0) GO TO 9000
      OV = DATA(1)
      IF (LDEN(OV)) GO TO 4000
5000  CONTINUE
      GO TO 9000
4000  CONTINUE
C HAVE ALL 3 PROPERTIES, NO ERROR
      SELECT = .FALSE.
C SET VALUE CLOSEST TO PRIMARY AS PREFERRED
      LTRIP= (INT .LE. INP)
      RETURN
9000  CONTINUE
C FROM - UNABLE TO DEFINE ALL PROPERTIES
      SELECT = .TRUE.
      PV = -1.
      TV = -1.
      DV = -1.
      WRITE (A,9001) WHICH
9001  FORMAT ('UNABLE TO FIND ',A4,' FOR VOLUME')
      RETURN
      END
      SIMULTANEOUS QIAL (P,T,X,D,LTRIP)
C
C NEXT--VERSION 1.0-- APRIL 1,1977
C THIS SUBROUTINE CALCULATES QUALITY (X) FROM
C TABLES AND FORMULAS SUPPLIED BY R.A.
C MERRICK USING TEMPERATURE (LTRIP=.TRUE.)
C OR PRESSURE (LTRIP=.FALSE.).
C P,T,X,D ARE THE PRESS,TEMP,QUAL,DEN OF THE FLUID
      IMPLICIT REAL*8(A-H,I-Z)
      LOGICAL LTRIP
      REAL*4 P,T,X,D
      REAL*8 INTRP
      DIMENSION PJ(30),VJ(30),VJS(30),ST(30)
C
C---PJ      PRESSURE (PSIA)
C
      DATA PJ/
1      0.0000000000000000 , 1.0000000000000000 , 3.0000000000000000 ,
2      4.0000000000000000 , 5.0000000000000000 , 10.0000000000000000 ,
3      14.6960000000000000 , 30.0000000000000000 , 50.0000000000000000 ,
4      75.0000000000000000 , 100.0000000000000000 , 150.0000000000000000 ,
5      200.0000000000000000 , 250.0000000000000000 , 300.0000000000000000 ,
6      350.0000000000000000 , 400.0000000000000000 , 450.0000000000000000 ,
7      500.0000000000000000 , 550.0000000000000000 , 600.0000000000000000 ,
8      650.0000000000000000 , 700.0000000000000000 , 750.0000000000000000 ,
9      800.0000000000000000 , 900.0000000000000000 , 1000.0000000000000000 ,
10     1200.0000000000000000 , 1400.0000000000000000 , 1600.0000000000000000 ,
11     1800.0000000000000000 , 2000.0000000000000000 , 2100.0000000000000000 ,
12     2200.0000000000000000 , 2300.0000000000000000 , 2500.0000000000000000 ,
13     2700.0000000000000000 , 3200.2000000000000000 /
C
C---VJ      SATURATED LIQUID DENSITY (LBM/FT**3)
C
      DATA VJ/
1      62.41410000000000 , 61.97401051160000 , 61.34411133160000 ,

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OXRPS610
OXRPS620
OXRPS630
OXRPS640
OXRPS650
OXRPS660
OXRPS670
OXRPS680
OXRPS690
OXRPS700
OXRPS710
OXRPS720
OXRPS730
OXRPS740
OXRPS750
OXRPS760
OXRPS770
OXRPS780
OXRPS790
OXRPS800
OXRPS810
OXRPS820
OXRPS830
OXRPS840
OXRPS850
OXRPS860
OXRPS870
OXRPS880
OXRPS890
OXRPS900
OXRPS910
OXRPS920
OXRPS930
OXRPS940
OXRPS950
OXRPS960
OXRPS970
OXRPS980
OXRPS990
OXRPA000
OXRPA010
OXRPA020
OXRPA030
OXRPA040
OXRPA050
OXRPA060
OXRPA070
OXRPA080
OXRPA090
OXRPA100
OXRPA110
OXRPA120
OXRPA130
OXRPA140
OXRPA150
OXRPA160

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2	41.13244492900	40.94777421050	60.24444444400	QXRP6170
3	59.41341440970	54.79364185400	57.49207932620	QXRP6180
4	57.04944495040	54.37115154450	55.27746146420	QXRP6190
5	54.34544411000	53.41494405200	52.92614025500	QXRP6200
6	52.29443440400	51.71275424000	51.14437930830	QXRP6210
7	50.44447154350	50.14917515440	49.47341477130	QXRP6220
8	49.21456244540	48.77014732400	48.33823433180	QXRP6230
9	47.91711442400	47.10192234040	46.31541496790	QXRP6240
10	46.40344174010	45.34143010340	41.90102077680	QXRP6250
1	40.44747414190	34.94427249210	34.23524452140	QXRP6260
2	37.44404007130	34.44454924420	34.97244391100	QXRP6270
3	33.01933911420	19.44070000000	/	QXRP6280
C				QXRP6290
C---VJS	SATURATED STEAM DENSITY (LBM/FT**3)			QXRP6300
C				QXRP6310
	DATA VJS/			QXRP6320
1	0.00030245000	0.00299757320	0.00442259100	QXRP6330
2	0.01103236940	0.01359959760	0.02602795730	QXRP6340
3	0.03731504130	0.07274111940	0.11745416500	QXRP6350
4	0.17194541790	0.22544127320	0.33179382550	QXRP6360
5	0.43719994040	0.54254340350	0.64419798490	QXRP6370
6	0.75440947040	0.86136071490	0.94919393120	QXRP6380
7	1.07403007190	1.18797551540	1.29912771300	QXRP6390
8	1.41157453210	1.52416440300	1.64072794900	QXRP6400
9	1.75759457030	1.94635764100	2.24237714640	QXRP6410
10	2.75900905010	3.31344402440	3.91442524210	QXRP6420
1	4.57429494950	5.31050091770	5.71422504530	QXRP6430
2	6.14577665070	6.60423047740	7.65207236480	QXRP6440
3	8.93359524020	19.44070000000	/	QXRP6450
C				QXRP6460
C				QXRP6470
C---ST	SATURATION TEMPERATURE (F)			QXRP6480
C				QXRP6490
	DATA ST/			QXRP6500
1	32.01400000000	101.73250474930	141.47011477580	QXRP6510
2	152.26443045410	162.24090986450	193.21380901660	QXRP6520
3	212.00158194470	250.33351439940	281.01531454140	QXRP6530
4	307.40478662110	327.42349471660	354.42620211210	QXRP6540
5	381.79477976300	401.00052576750	417.33605462060	QXRP6550
6	431.71741110640	444.60101594120	456.29476932170	QXRP6560
7	467.03338745310	476.96951204520	486.23230744110	QXRP6570
8	494.91915104550	503.10728711790	510.85901145500	QXRP6580
9	514.27528622880	531.96344208290	544.54532617020	QXRP6590
10	567.19635208350	587.09342125940	604.90592783460	QXRP6600
1	621.04778782900	635.81415766970	642.75664326140	QXRP6610
2	649.44305673220	655.49354692350	664.11191334800	QXRP6620
3	679.52454560550	705.46842164740	/	QXRP6630
C				QXRP6640
C	CHANGE PSIG TO PSIA			QXRP6650
	PRES = P + 14.7			QXRP6660
	TEMP = T			QXRP6670
	EUNEN = 0			QXRP6680
C	GET POSITION IN TABLE FOR INTERPOLATION			QXRP6690
	IF(LTORP) CALL INDEXIST,TEMP,IWHER,REL)			QXRP6700
	IF(.NOT. LTORP) CALL INDEX (PJ,PRES,IWHER,REL)			QXRP6710
C	GET FLUID DENSITY			QXRP6720

```

      FLDEN = INTRP(VJ,IWHER,REL)
      X=SNGL(((100/ELDEN)-(100/FLDEN))/
      S      ((100/INTRP(VJS,IWHER,REL))-(100/FLDEN)))
C      WRITE (6,1) LTORP,P,T,D,PRES,TEMP,FLDEN,X.
C      1 FLDEN,IWHER,REL
C      1 FORMAT ('??',L2,(10(1X,G11.5)))
      IF(X.GT. 1.0) X=1.0
      IF(X.LT. 0.0) X=0.0
      RETURN
      END
      SUBROUTINE INDEX(TABLE,ENTRY,IWHER,REL)
C
C OXREPT--VERSION 1.0-- APRIL 1,1977
      IMPLICIT REAL*8 (A-H,O-Z)
C THIS SUBROUTINE SEARCHES THROUGH TABLE TO FIND WHERE
C THE ENTRY BELONGS
C IWHER IS THE MEMBER WHICH IMMEDIATELY PRECEEDS THE
C WHERE ENTRY SHOULD BE
C IF ENTRY IS LESS THAN THE FIRST IN TABLE, IWHER=0
C IF ENTRY IS GREATER THAN THE LAST ENTRY IN TABLE,
C IWHER=-1
C BOTH THE OF THE ABOVE TESTS INCLUDE THE EQUAL CONDITION
C TABLE IS ASSUMED TO BE ORDERED WITH THE SMALLEST FIRST
C REL IS THE RELATIVE POSITION (0-1) OF ENTRY BETWEEN
C THE IWHER AND IWHER+1 MEMBERS OF THE TABLE
      DATA LEN,LENM1 /30,37/
C LEN IS THE LENGTH OF THE TABLE, LENM1=LEN-1
      DIMENSION TABLE (30)
      REL = 0.0
      IWHER = 0
      IF(ENTRY.LE. TABLE(1)) RETURN
      DO 1000 IWHER=2,LENM1
      IF(ENTRY.LT. TABLE(IWHER+1)) GO TO 2000
1000 CONTINUE
      IWHER = -1
      RETURN
2000 CONTINUE
      IF(ENTRY.EQ. TABLE(IWHER)) RETURN
      REL = (ENTRY -TABLE(IWHER))/
      S      (TABLE(IWHER+1)-TABLE(IWHER))
      RETURN
      END
      REAL FUNCTION INTRP*8 (TABLE,IWHER,REL)
C
C OXREPT--VERSION 1.0-- APRIL 1,1977
C THIS FUNCTION INTERPOLATES (LINEARLY) IN TABLE
C AT ENTRY IWHER WITH REL (0-1) THE RELATIVE DISTANCE
C BETWEEN THE TWO SUCCESSIVE ENTRIES IN TABLE
C IF IWHER IS ZERO, THE FIRST VALUE IS RETURNED
C IF IWHER IS NEGATIVE, THE LAST IS RETURNED
      IMPLICIT REAL*8 (A-H,O-Z)
      DIMENSION TABLE(30)
      DATA LEN/30/
      IF (IWHER) 1000,2000,3000
1000 CONTINUE
      INTRP=TABLE(LEN)

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OXRP6730
OXRP6740
OXRP6750
OXRP6760
OXRP6770
OXRP6780
OXRP6790
OXRP6800
OXRP6810
OXRP6820
OXRP6830
OXRP6840
OXRP6850
OXRP6860
OXRP6870
OXRP6880
OXRP6890
OXRP6900
OXRP6910
OXRP6920
OXRP6930
OXRP6940
OXRP6950
OXRP6960
OXRP6970
OXRP6980
OXRP6990
OXRP7000
OXRP7010
OXRP7020
OXRP7030
OXRP7040
OXRP7050
OXRP7060
OXRP7070
OXRP7080
OXRP7090
OXRP7100
OXRP7110
OXRP7120
OXRP7130
OXRP7140
OXRP7150
OXRP7160
OXRP7170
OXRP7180
OXRP7190
OXRP7200
OXRP7210
OXRP7220
OXRP7230
OXRP7240
OXRP7250
OXRP7260
OXRP7270
OXRP7280

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      RETURN
2000  CONTINUE
      INTREP = TABLF(1)
      RETURN
3000  CONTINUE
      INTREP = TABLF(IWHFR) + REL * (TABLF(IWHFR + 1) -
      &          TABLF(IWHFR))
      RETURN
      END
      SIMRINTIME PLTOUT (PV,TV,XV,MV,SF,TS,TC,TIME,LEDT)
C
C OXREP7--VERSION 1.0-- APRIL 1,1977
C THIS SIMRINTIME WRITES THE PSUFDD-PLT RESTART TAPE RECORDS
      INTEGER REC,TIME
      LOGICAL LFIRC,LPRINT,LEDT
      DATA LFIRC/.TRUE./
C PV IS THE PRESSURES IN NTDV VOLUMMS
C TV IS THE TEMPERATURES IN NTDV VOLUMMS
C XV IS THE QUALITY IN NTDV VOLUMMS
C MV IS THE HEIGHT OF THE NTDV VOLUMMS
C TIME IS THE TIME SINCE BLOWDOWN
      COMMON /FLAG/ NST,NTDV,TITLE(10),M(10),LPRINT,NSLH
      DIMENSION PV(NTDV),TV(NTDV),XV(NTDV),MV(NTDV)
      DIMENSION REC(1297),SF(NSLH),TC(NSLH),TS(NSLH)
C MAXPLOT REC LENGTH IS (VOL 2,P223):
C 41+24*(10)+16*(1)+20(50)=1297 WORDS
      DATA REC(1),REC(21)/'PLT',1/
      IF(.NOT. LFIRC) GO TO 1000
      CALL PLTRFG
      LFIRC = .FALSE.
      CALL SFT7FR (1275,REC(22))
      CALL MOVEI(TITLE(1),REC(2),18)
      IPV = 42
      ITV = 42 + 3 * NTDV
      IXV = 42 + 6 * NTDV
      IMV = 42 + 8 * NTDV
C PUT IN INTC'S CENTERLINE TEMPERATURE IN RELAP'S AVERAGE TEMP PLACE
      ITS = 42 + 24 * NTDV + 16 + 1 * NSLH
      ISF = 42 + 24 * NTDV + 16 + 5 * NSLH
      ITC = 42 + 24 * NTDV + 16 + 12 * NSLH
      ITIM = 39
      ILEN=41+24*(INTDV) +16+ 20*(NSLH)
      REC (20) = NTDV
1000  CONTINUE
      CALL RUFOLDY (3,X,Y,IST,IWC)
      IF(IST.NE. 1) CALL PLTERK(0,IST,IWC)
      CALL MOVEI(PV(1),REC(IPV),NTDV)
      CALL MOVEI(TV(1),REC(ITV),NTDV)
      CALL MOVEI(MV(1),REC(IMV),NTDV)
      CALL MOVEI(XV(1),REC(IXV),NTDV)
      CALL MOVEI(SF(1),REC(ISF),NSLH)
      CALL MOVEI(TS(1),REC(ITS),NSLH)
      CALL MOVEI(TC(1),REC(ITC),NSLH)
      REC(ITIM)=TIME
      CALL RUFOUT (3,REC,ILEN,IST,IWC)
      IF(LEDT) CALL PDUMP(REC(1),REC(1297),0)

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OXRP7290
OXRP7300
OXRP7310
OXRP7320
OXRP7330
OXRP7340
OXRP7350
OXRP7360
OXRP7370
OXRP7380
OXRP7390
OXRP7400
OXRP7410
OXRP7420
OXRP7430
OXRP7440
OXRP7450
OXRP7460
OXRP7470
OXRP7480
OXRP7490
OXRP7500
OXRP7510
OXRP7520
OXRP7530
OXRP7540
OXRP7550
OXRP7560
OXRP7570
OXRP7580
OXRP7590
OXRP7600
OXRP7610
OXRP7620
OXRP7630
OXRP7640
OXRP7650
OXRP7660
OXRP7670
OXRP7680
OXRP7690
OXRP7700
OXRP7710
OXRP7720
OXRP7730
OXRP7740
OXRP7750
OXRP7760
OXRP7770
OXRP7780
OXRP7790
OXRP7800
OXRP7810
OXRP7820
OXRP7830
OXRP7840

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WRITE (20,1001) TIME,(PV(1),TV(1),MV(1),I=1,NTDV)
1001 FORMAT (1X,F7.2,(14,4(13,5,2)))
IF(NSLN.LE. 0) RETURN
WRITE (21,1002) TIME,SF
WRITE (22,1002) TIME,TS
WRITE (23,1002) TIME,TC
1002 FORMAT('0',F7.3,(14,10(1X,G11.3)))
RETURN
END
SIMROUTINE PLTMEG
C
C DEXEPT--VERSION 1.0-- APRIL 1,1977
C THIS SIMROUTINE WRITES THE HEADER AND ALL INFORMATION
C THAT IS NEEDED BEFORE THE FIRST PLOT RECORD ON THE
C PSUEDO-PILOT-RESTART TAPE
LOGICAL LPRINT
INTEGER R3
DIMENSION RLPT(4),R1(16),R2(18),TODAY(2),HEADER(5),R3(20)
FOUR(VALFNC (R1(1),RLPT(1)),(R1(10),HEADER(1)),
      (R1(15),TODAY(1)),(R2(1),TITLE(1)))
COMMON /FLAG/ NST,NTDV,TITLE(18),MV(10),LPRINT,NSLN
DATA RLPT/'FLA','P4 D','ATA ','TAP',' ',T1,'TLE ','
      'FOLL','OWS',' ' '/'
C R3 IS THE THIRD RECORD OF THE HEADER THREE AND IT
C INDICATES THAT THIS PROBLEM SAVED THE RESTART TAPE ON UNIT 4
C HAS NTDV VOLUMES AND ONE JUNCTION--ESSENTIALLY ALL OTHER
C QUANTITIES IN THE PROBLEM WERE ZERO
DATA R3/-2,0.2*1,3*0,1,12*0/
C GET TODAYS DATE AS THE DATE FOR THE TAPE
CALL DATE (TODAY)
C GET HEADER FOR THE TAPE
READ(2,1) HEADER
1 FORMAT (20A4)
C WRITE FIRST HEADER RECORD
CALL HUFOUT(3,R1,16,1ST,ICNT)
C GET THE TITLE FOR THIS PROBLEM
READ (2,1) TITLE
C WRITE SECOND HEADER RECORD
CALL HUFOUT (3,R2,18,1ST,ICNT)
IF(1ST.NE. 1) CALL PLTERR(1,1ST,ICNT)
C WRITE THIRD HEADER RECORD
R3(5) = NTDV
R3(13) = NSLN
CALL HUFOUT (3,R3,20,1ST,ICNT)
IF(1ST.NE. 1) CALL PLTERR (1ST,ICNT)
WRITE (6,2) RLPT,HEADER,TODAY,TITLE
2 FORMAT (17//3X,16A4,/,3X,18A4,/,
      3X,'HEADER RECORD WRITTEN'///)
WRITE (20,3) NTDV,(1,1,1,1,I=1,NTDV)
3 FORMAT (' EXPERIMENTAL RELAP PLOTAPE PRODUCED WITH ',I3,
      ' BOUNDARY CONDITION VOLUMES WITH VALUES:',/,
      ' T1,219X,'PRESSURE',7X,'TEMPERATURE',3X,'QUALITY',
      ' 8X,'HEIGHT',13,'TIME',/,(15,8(12X,I3)))
IF(NSLN.LE. 0) RETURN
WRITE (21,5)
WRITE (22,6)
WRITE (23,7)
5 FORMAT(T30,'SURFACE FLUX RIGHT')
6 FORMAT(T30,'SURFACE TEMP RIGHT')

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7  FORMAT(130,'AVERAGE SLAH (FMM)')
   WRITE(21,4) NSLM,(I,I=1,10)
   WRITE(22,4) NSLM,(I,I=1,10)
   WRITE(23,4) NSLM,(I,I=1,10)
4  FORMAT (' EXPERIMENTAL RELAP PLOTAPE PRODUCED WITH %.13,
   & ' BOUNDARY CONDITION SLAHs WITH VALUES:'./,
   = 13,'TIME',10G12.3)
   RETURN
   END
   SIMRNTIME PLTEND
C
C OXREPT--VERSION 1.0-- APRIL 1,1977
C THIS SIMRNTIME WRITES THE END OF FILE MARKERS
C ON THE PLOTAPE IN THE FORMAT RECOGNIZED BY RELAP
   DIMENSION LABL(10)
   DATA LABL/'END ','OF R','ELAP','4 DA','TA. ','
1  'EOF ','FOLL','OWS.','. ',' ' /
   CALL RUFOUT(3,LABL,10,IST,ICNT)
   IF(IST.NE.1) CALL PLTERR(2,IST,ICNT)
   CALL RUFOUT(3,LABL,10,IST,ICNT)
   IF(IST.NE.1) CALL PLTERR(3,IST,ICNT)
   CALL RUFOLY(3,X,Y,IST,ICNT)
   IF(IST.NE.1) CALL PLTERR(4,IST,ICNT)
   WRITE(6,1) LABL
1  FORMAT (/,1X,10A4,/, ' END OF FILE ON RELAP TAPE')
   RETURN
   END
   SIMRNTIME PLTERR (IAH,IST,ICNT)
C
C OXREPT--VERSION 1.0-- APRIL 1,1977
   WRITE(6,1) IST,ICNT
1  FORMAT (////'O ERROR IN WRITING PLOT RECORD PARAMS WERE:',
4  219)
   CALL AREND(30+IAH)
   RETURN
   END

```

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OXRPA440
OXRPA450
OXRPA460
OXRPA470
OXRPA480
OXRPA490
OXRPA500
OXRPA510
OXRPA520
OXRPA530
OXRPA540
OXRPA550
OXRPA560
OXRPA570
OXRPA580
OXRPA590
OXRPA600
OXRPA610
OXRPA620
OXRPA630
OXRPA640
OXRPA650
OXRPA660
OXRPA670
OXRPA680
OXRPA690
OXRPA700
OXRPA710
OXRPA720
OXRPA730
OXRPA740
OXRPA750
OXRPA760
OXRPA770
OXRPA780
OXRPA790

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