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THE SYSTEM ASPECTS AND INTERFACE DATA SETS OF THE ARGONNE REACTOR COMPUTATION (ARC) SYSTEM

L. C. Just, H. Henryson, II,
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B. J. Toppel, and P. M. Walker

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Reactor Technology

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The System Aspects and Interface Data Sets of the Argonne Reactor Computation (ARC) System

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PREFACE

The Argonne Reactor Computation (ARC) System was developed on IBM System/360 hardware and makes use of the OS/360 (Operating System/360) software. Because of this, IBM jargon has become an integral part of any discussion of the ARC System. Rather than make this document free of this jargon through extensive definition of terms, we will assume knowledge of it on the part of the reader. The following manuals from the IBM OS/360 library will be useful.

IBM System/360 Principles of Operation	A22-6321
Linkage Editor	C28-6538
Job Control Language	C28-6539
Utilities	C28-6586
Supervisor and Data Management Services	C28-6646
Supervisor and Data Management Macro Instructions	C28-6647
Messages and Completion Codes	C28-6631
Fortran IV Language	C28-6515
Fortran IV Programmer's Guide	C28-6817
Assembler Language	X28-6514
Assembler (F) Programmer's Guide	C26-3756

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ANL-7711 The System Aspects and Interface Data Sets of the Argonne Reactor Computation (ARC) System

ANL-7712 The ARC System Standard Paths

ANL-7713 The ARC System Neutronics Input Processor

Part One. Neutronics Input Processor Module, GNIP (NUI002)

Part Two. Geometry Data Set (GEOM) Copier, CPGEOM (AJC006)

ANL-7714 The ARC System Cross-section Homogenization and Modification Capabilities

Part One. Multigroup Cross-section Homogenization Specification Module, INHOMG (NUI001)

Part Two. Multigroup Cross-section Homogenization Calculation Module, HOMOG (NUC001)

Part Three. Material-to-Composition Cross-section Homogenization Calculation Module, HHOMOG (NUC007)

Part Four. Microscopic Cross-section Group Collapse Module, MICCOL (AJC007)

Part Five. Macroscopic Cross-section Group Collapse Module, MACCOL (AJC008)

Part Six. Run-time Microscopic Cross-section Modification Module, MODXSISO (NUI006)

ANL-7715 The ARC System One-dimensional Diffusion Theory Capability, DARC1D

Part One. One-dimensional, Multigroup Diffusion Theory Module for k-effective and Source Calculations, DIF1D (NUC002)

Part Two. One-dimensional, Multigroup Diffusion Theory Criticality Search Module, D1DSCH (NUC004)

ANL-7716 The ARC System Two-dimensional Diffusion Theory Capability, DARC2D

Part One. Two-dimensional, Multigroup Diffusion Theory Module for k-effective and Source Calculations, DIF2D (NUC005)

Part Two. Two-dimensional, Multigroup Diffusion Theory Criticality Search Module, D2DSCH (NUC006)

ANL-7717 The ARC System One-dimensional Transport Theory Capability, SNARC1D

Part One. One-dimensional, Discrete Ordinate Transport Theory Specification Module, SNIN1D (NUI005)

Part Two. One-dimensional, Discrete Ordinate Transport Theory Calculation Module, SNARC1D (NUC003)

ANL-7718 The ARC System Two-dimensional Transport Theory Capability

Part One. Two-dimensional, Discrete Ordinate Transport Theory Calculation Module, TARGET (NUC008)

Part Two. Two-dimensional, Discrete Ordinate Transport Theory Output Manipulation Module, OUTPUTR (NUE002)

ANL-7719 The ARC System One-dimensional Adjunct Calculations and Edits PARC1D (AJC003)

Part One. One-dimensional Diffusion Theory Perturbation Module, PARC1D (AJC003)

Part Two. One-dimensional Neutron Inventory Module, INVENT1D (AJC001)

Part Three. One-dimensional Neutronics Output Manipulation Module, OUTMAN1D (NUC001)

ANL-7720 The ARC System Two-dimensional Adjunct Calculations

Part One. Two-dimensional Diffusion Theory Perturbation Module, PARC2D (AJC004)

Part Two. Two-dimensional Neutron Inventory Module, INVENT2D (AJC002)

ANL-7721 The ARC System Fuel Cycle Analysis Capability, REBUS

Part One. Fuel Cycle Specification Module, INFUEL (FCI001)

Part Two. Fuel Cycle Analysis Module, FUELCY (FCC001)

ANL-7722 The ARC System Cross-section Generation Capabilities, ARC-MC^2

Part One. Epithermal Cross-section Specification Module, INPUT

Part Two. Resonance Cross-section Calculation Module, REXSEC (CSC001)

Part Three. Nonresonant Cross-section and Fundamental-Mode Spectrum Calculation Module, SCSFM (CSC002)

Part Four. Broad-group Cross-section and Fundamental-Mode Spectrum Calculation Module, BCSFM (CSC003)

Part Five. Cross-section Data Set Editor Module, XSEDIT (CSE001)

Part Six. Delayed Data Preparation Module, DELDATA (CSI007)

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ABSTRACT

This volume describes the overall architecture, the system subprograms and modules, and a listing of all of the interface data sets of the Argonne Reactor Computation (ARC) System. Programming considerations for use of the ARC System are presented for the methods developer user and the manipulation of user input data is described for the production user. A short historical review is presented relating to the development of the ARC System.

CHAPTER 1. MODULAR PROGRAMMING

I. Introduction

A. Modular Systems

Reactor computations may be characterized as a series of large, long-running programs executed in a logical order where each program in the series requires that a portion of its input data be produced by programs executed earlier in the series. A physicist performing a calculation must make logical decisions, based on the output at any given point in the series, concerning what kind of calculation to do next. Because any complete reactor computation system must contain many such series of programs, and since each series can share many of the same programs, the modular system concept is a natural one.

A programming system is modular if the functions to be performed are done by codes having outputs that are directly usable by other codes in the system. A system composed of subprograms is modular in this sense, but can be limited due to restrictions in core size. Subprograms can also be formed into programs that are overlays. This technique increases the scope of a program of given size, but suffers from the fact that the segments of the overlay are not independent entities. A more useful concept for reactor calculations is a system in which the modules are large collections of subprograms, that is, programs or overlays, that can reside on direct access storage devices. Then, if a method can be found to execute modules and to make logical decisions concerning the next module to be executed, a reactor calculation can be totally programmed by the physicist. The Argonne Reactor Computation (ARC) System[1] is an example of the latter type of modular system. In recent years, the reactor community has placed increasing emphasis on the standardization of computational algorithms and the resulting minimization of programming duplication. It is believed that these goals are best attained through the development of modular computation systems, and indeed, such an approach is widely accepted. In addition to the work in the United States (at the Argonne National Laboratory, the Knolls Atomic Power Laboratory, and the Savannah River Laboratory), France, Germany, England, and Japan are developing modular computation systems.

B. Advantages of Modular Systems

The main advantages of a modular system are the standardization of algorithms and of data format. As modules are programmed, a unified library of computational units is built to be used by many calculations. These are the obvious advantages; other advantages exist and are listed here:

1) Human manipulation of interface data is eliminated. The design of any modular system must insure this. If any module requires the reformatting of data (by people) before it can be used, a new module should be written to do that task.

2) The input required to invoke a calculation is standardized. In the ARC System the input is structured into BLOCKs where each BLOCK produces data sets based on ARC system BCD data sets.

3) Numerical experimentation and methods development are facilitated in a modular system because new modules can easily take the place of existing ones. Thus the system can be an environment for developing and testing new algorithms.

4) A modular system facilitates maintenance, improvement, and extension of a computational capability.

5) Unnecessary duplication of algorithms is discouraged and the exchange of algorithms with other groups is encouraged.

C. Disadvantages of a Modular System

While the advantages of the modular approach are great, there are some disadvantages. They include the following:

1) An exchange of code with another installation might involve considerably more than than the equivalent stand alone capability. This could be a concern if the amount of computational code involved is small compared to the system required as an environment. This disadvantage could be overcome by synthesizing a stand alone package for the capability desired.

2) The development of a modular system requires considerable coordination and much preliminary planning. This effort is repaid when the major modules are completed since additional capabilities are easier to add.

3) The unification of the data structure and its management does not automatically insure operational efficiency. This unification, does insure that data management can be improved as can any module in the system.

4) The modular system charges an overhead to each run. It has been found however that for large realistic problems this overhead is a small percentage of the total.

It was concluded at ANL (and at other scientific establishments in the world) that the advantages of modular systems outweigh the disadvantages. Our success with the ARC System has substantiated our original decision to develop such a system.

D. The Objectives of This Report and of the ARC System

This report has as its objective the documentation of the development, implementation, and maintenance of an open-ended modular system that can encompass all aspects of reactor design and analysis.

The ARC System is now established as a computational tool and is used routinely at ANL for reactor calculations and as an environment for methods development activities. The feasibility and utility of a modular computation system has been verified by the development and use of the system at ANL. The current calculational modules which have been analyzed and developed at ANL are based on sound mathematical principles and are representative of the current level of development in production oriented fast reactor calculations.

In the future, it is expected that the ARC System will develop as a useful tool for a long-range plant survey analysis, for detailed design studies, and for standard calculations used in reactor parametric studies and analysis of critical experiments. Theoretical developmental efforts by members of the staff using non-ARC System programming will be gradually shifted into the ARC System both for development and production use. It is expected that one of the major uses of the ARC System will be as a tool to facilitate such numerical development efforts.

Incorporation and testing of additional code capability into the ARC System from other elements of the LMFBR program will be a continuing effort. The utility and capability of the system will accelerate as the algorithm repertoire of the system expands and as future expansion of Argonne's computing facilities permits; the ARC System will continue to grow as Argonne's computational facilities are upgraded.

II. User Experience with the ARC System

User experience with the ARC System has borne out the expectation that a large modular system would provide a practical and efficient environment for reactor physics production and development work.

One of the design criteria established for the ARC System was the need to assure that large problems formerly run using stand alone codes could be run without significant penalty using a modular system. In practice a user need not know that the code he is using is part of a large modular system. The ARC System standard paths have been designed to fulfill this need. Standard paths are used routinely at the Illinois and Idaho Argonne Laboratories to perform one-dimensional neutronics, two-dimensional diffusion theory, burnup and fuel management, and multigroup cross section calculations. The small overhead incurred by the modular system has proved to be worth paying.

The user of a modular system enjoys a number of advantages as compared with the use of equivalent stand alone coding. For example, he need cope with only a single input specification. Thus, the changes in input required in going from a 1-D transport to a 1-D diffusion theory calculation, for example, exclude the information common to both such as geometry, composition, and search specifications. Since in a modular system the same modules perform calculations in a number of paths, the printed output is also standardized. A further benefit to the user of the ARC System has been the ease of saving data from a given run for use in restarting a later run of the same or a different path. This is true for both alphanumeric and binary data.

In methods development work the ARC System has proved itself extremely flexible. It was, for example, a trivial job to provide the choice of a transport, diffusion, or synthesis neutronics calculation in the REBUS[2] burn-up capability. This was done by simply linking to the appropriate neutronics module within the path driver. In developing new capabilities the library of existing modules are available to avoid programming duplication. Thus, the recently completed 2-D transport module[3] is used by a standard path which links to the same input processor, cross section homogenization, and inventory modules as the 2-D diffusion theory path.[4] Similarly, a multigroup space-time reactor disassembly dynamics capability being developed[5] is making

extensive use of the same computational modules used by the neutronics standard paths. The latter effort included the conversion of a stand alone hydrodynamics code, VENUS,[6] to a modular structure. The ease of incorporating stand alone codes into the ARC System was also demonstrated by the minor effort required to link the five ENDF/B processing codes CRECT, CHECKER, DAMMET, ETOE and MERMC2[7] into a single standard path.[4]

The structure of the ARC System libraries also provides the programmer with simple access to a number of code segments which although not modular in structure in that they do not provide interface data for use by other modules, are nevertheless, widely used in program development. Examples of such code segments include BPOINTER* a dynamic storage allocation routine for management of variably dimensioned arrays, and routines to permit overlap of I/O and computation on the IBM 360.[8]

III. Cooperative Code Efforts

Argonne has been actively participating in the work of the *ad hoc* and *de facto* Committees on Computer Code Coordination since March 1969. This activity has as its primary objectives the standardization of computational algorithms, minimization of programming duplication, and facilitation of interchange and implementation of codes among the LMFBR contractor laboratories. These committees have been seeking ways to meet the objectives of this activity through specification of interface data file structures, data management procedures, and considerations related to standardization of coding and code language specifications. The objectives of this effort are motivated by the desire to economize both time and money in the area of computer code development, and to provide a common basis among the contractors for performing calculations and intercomparing results for the physics and engineering design problems involved in the LMFBR program.

Closely related to these activities are efforts to export the ARC System to laboratories outside of ANL. The ARC System is in use at:

1) The Argonne National Laboratory on an IBM/50-75 combination using ASP and OS/360,

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*See Chapter 4.

2) The National Reactor Test Station at Idaho Falls, Idaho on a stand alone IBM/75 using OS/360, and

3) The IBM Scientific Center in Palo Alto, California on an IBM/50 using OS/360.

In addition, the ARC System has been successfully tested on IBM/360 models 65, 67, 85, and 195 in a straightforward manner. The ANL load modules were used with no modifications.

A feasibility study concerning the transportability of the ARC System to CDC 6000 series hardware has been completed.[9] Approximately 25% of the ARC System capability, has been converted, tested, and successfully run under the scope 3.2 operating system using the CELL (CEntral Linking Loader) program and CDC versions of the portions of OS/360 used by the ARC System. The ARC System has been successfully executed on CDC 6400, 6600, and 7600 computers.

CHAPTER 2. THE SOFTWARE ENVIRONMENT OF THE ARC SYSTEM

I. Introduction

The computational components of the ARC System exist in the form of units called modules rather than as independent computer programs. These modules can be specified and written independently of each other, since a module is defined by its input data, its output data, and its internal algorithm. So, for computational purposes, a module is a 'black box' that operates on specific input data to provide specific output data. The capability of the ARC System can be described by the algorithms implemented, by the kinds of data produced, and by the meaningful ways in which algorithms may be combined into complete reactor calculations.

Since a large computer and its operating system must be involved in a system such as the ARC System, other components must be introduced to support the computational components. Modules and subprograms must be written to allow modules to be brought into core, to communicate with the operating system, to produce modules, to direct the computation and to manage data. Since modules exist that are not computational, an auxiliary definition for module may be "a module is a collection of computer codes that can be loaded into core by an appropriate command."

The amount of computer code making up a modular system is vast, and since it may be produced by many people a system for managing its generation and upkeep is required. Routines must therefore be provided for these purposes.

II. The Components of the ARC System

A. Programs

1. Modules

(a) Computational Modules (CM). The CM are the basic units of the ARC System. They are written almost entirely in FORTRAN-IV. In those cases where the code is optimized using assembly language the FORTRAN versions are maintained for purposes of documentation and transportability to other machines. A CM is usually a FORTRAN IV main program. It must be a main

program if the CM uses direct access I/O. This is enforced so that the I/O package can close direct access data sets when the CM returns control. The entry to a CM which uses direct access I/O is always named 'MAIN'

(b) Path Control Modules (PCM). A PCM is the first module executed in an ARC System run. There are two methods for invoking a path; through the use of

EXEC PGM = path name

on a Job Control Language (JCL) execute card, or through the use of the statement

CALL LINK ('path name')

in the code of another PCM or CM where 'path name' is a member of a library designated on a JOBLIB DD card. A PCM can call any module or any other PCM that performs a useful subcomputation. PCMs are FORTRAN IV main programs; the totality of code executed by a PCM is called a path.

(c) System Modules (SM).

(i) Resident System Modules (RSM). These are OS/360 load modules that are brought into core by the OS/360 supervisor call (SVC) LØAD. These modules remain in core during the entire ARC System run; they are marked with the reusable (REUS) attribute so that they are not replaced after each execution. There are only four RSMs in the ARC System.

(α) ARCIBCOM handles all of the I/O activity for an ARC System run. It is brought into core by the system subprogram IBCOM which traps all of the calls to the FORTRAN I/O package. The compiler generates an I/O call before the first executable instruction; IBCOM uses this opportunity to LOAD ARCIBCOM if it is not in core or to locate ARCIBCOM if it is in core. Since IBCOM is part of every module that has I/O activity, one copy of ARCIBCOM serves the entire system. ARCIBCOM consists of the FORTRAN I/O package and an assembler language interface that communicates with the copy of IBCOM that is part of every module that has I/O activity.

(β) INITIAL is loaded and executed by the first PCM to be executed. It loads SNIFF and BCDDS, and executes them. Before returning to the PCM, INITIAL sets a flag that causes a branch to RETURN in order to prevent an attempt at initialization if another PCM is executed.

(γ) SNIFF is loaded and executed by the first call to INITIAL. It too has an initialization phase, during which a table of data set names is transferred from the PCM which has control to an internal array (in SNIFF). This table of data set names is used to provide a correspondence between the internal data set name and the data set reference number that FORTRAN requires to reach an external data set. After initialization, SNIFF sets a flag so that the second and subsequent calls do not reinitialize this table; these calls simply return a number when a data set name is given.

(δ) BCDDS is loaded and first executed by INITIAL and also has an initialization phase. The first time it is executed it uses the OS/360 LINK SVC to load and execute a SM named SCAN; for all subsequent calls, it uses the LINK SVC to load and execute a SM names STUFF. SCAN and STUFF are examples of Transient System Modules (TSM).

(ii) Transient System Modules (TSM). These are OS/360 load modules that have a system function in the ARC System. They are involved in the processing of input data by any module. They remain in core only while they are in use.

(α) SCAN is a TSM called by the RSM BCDDS during its initialization phase. SCAN spools the input BCD data onto data set FT09F001 and builds tables that are stored in the RSM BCDDS. SCAN is only called once in an ARC System run.

(β) STUFF is a TSM brought into core by the second and subsequent calls to the RSM BCDDS. STUFF processes a portion of data set FT09F001 into ARC System data sets for use during a portion of the ARC System run. STUFF is executed whenever a PCM requires more data.

2. System Subprograms

There are several subroutines and subroutine packages in the ARC System that are useful to many of the modules. Each of them is described in detail both in this chapter and in Chapter 4; an understanding of their functions, however, is useful at this point.

(a) LOAD is an assembler language subroutine that allows the FORTRAN programmer to interface with the OS/360 LOAD SVC. The statement

CALL LOAD ('name')

causes a library to be searched for a module called 'name' and for 'name' to be loaded into core. The only modules LOADed in the ARC System are the RSM; these were given the reusable attribute when they were generated, so that one copy of each is in core for the entire ARC System run.

(b) LINK is an assembler language subroutine that allows the FORTRAN programs to execute the statement

CALL LINK ('name', list)

to execute a module that was brought into core by LOAD, or alternatively to load and execute a module called 'name' and to pass a parameter list to it.

(c) SYSTEM is a collection of three subroutines, SNIFF, BCDDS, and SYSTEM, that make the ARC System easier to use. SYSTEM generates appropriate calls to initialize the ARC System, while SNIFF and BCDDS are subroutines that allow the programmer to write

$$\text{CALL } \left\{\begin{matrix}\text{SNIFF}\\ \text{BCDDS}\end{matrix}\right\} \text{ (list)}$$

instead of

$$\text{CALL LINK } \left(\left\{\begin{matrix}\text{'SNIFF'}\\ \text{'BCDDS'}\end{matrix}\right\}, \text{ list}\right) .$$

The statement

CALL SYSTEM (list)

is generally the first exeuctable statement in a PCM.

(d) IBCOM is an assembler language subroutine that traps all of the calls to the FORTRAN I/O package that are generated by the compiler. This subroutine then communicates with the RSM ARCIBCOM, which is simply the FORTRAN I/O package combined with a subroutine that communicates with IBCOM. IBCOM is a part of all modules in the ARC System, with the exception of ARCIBCOM. THIS SUBROUTINE IS NOT THE IBCOM# CONTAINED IN THE FORTRAN I/O PACKAGE.

(e) POINTER is a FORTRAN subprogram package that manages variably dimensioned arrays.

(f) BPOINTER is a FORTRAN and assembly language package which extends the capability of POINTR by allowing the container to be allocated at run time in main core, bulk core or both. This package is also capable of dumping its arrays onto a direct access storage device for restart purposes or to allow the array to be shared with another module.

(g) OPENDS is an assembler language subroutine that returns the data set reference numbers of data sets that are open.

(h) CLOSE is an assembler language subroutine that closes all sequential data sets.

(i) SQUEZE is an assembler language subroutine that left-justifies and removes imbedded blanks from a string of characters.

(j) SHIFT is an assembler language subroutine that shifts an 80-character array one byte to the right and inserts a blank on the left.

3. Utility Programs

These are generally those members of the OS/360 library that are useful to the ARC System. They are all stand alone programs that operate on the libraries of the ARC System or on the data produced.

(a) Utilities used for library maintenance

(i) IEBUPDTE
(ii) IEHLIST
(iii) IEBCOPY
(iv) IEBPTPCH
(v) IEHMOVE

(b) Utilities used for data maintenance

(i) IEHMOVE
(ii) IEBPTPCH
(iii) IEHLIST

NOTE: The above-mentioned utility programs are described in the IBM publication "Utilities," IBM Number C28-6586.

(c) REUS is an assembler language program that marks a member of a library REUSable, so that once loaded into core by OS/360 the module remains there. This is only done for the RSMs.

B. Data Sets

Each group of input or output information associated with an ARC System module is called a data set. In the present operating environment (OS/360) a data set is a collection of data that can be used by the FORTRAN I/O package.

Each data set has an eight-character name that identifies it internally to any module in the ARC System. A data set glossary exists that contains a description of all of the data sets in the system. The description includes the glossary name of the data set, its internal structure (records and files) and the contents and length of each record. Internally, the computation modules refer to data sets by their glossary names whereas the FORTRAN I/O package requires a reference number to be associated with each data set.

The RSM SNIFF sets up the table of correspondence between data set names and reference numbers and will return appropriate numbers for each glossary name that is needed by a module. The data set glossary appears in Chapter 5.

C. Libraries

Since OS/360 can only execute programs out of a particular type of data set (a partitioned data set) called a library, a library is required for the PCMs, CMs, RSMs, and TSMs. In a project as large as the ARC System it is also desirable to store the source statements for all code on a direct access device. Partitioned data sets are also suitable for this purpose. Once these two libraries were incorporated into the ARC System, the need for others became evident and a system for library maintenance was required.

The executable modules of the ARC System are stored in a library called MODLIB. Other libraries (SOURCE, SEGLIB, OVERLAY, PROCLIB and MACLIB) are used to store source cards, compiled code, linkage editor instructions, catalogued procedures and macros. In practice at ANL, all of the libraries have the same four-character prefix 'D28', which indicates that they are located on a 2314 disk pack with the identifier 'DISK28'. Figure 1 shows how the libraries are interrelated and how they may be modified.

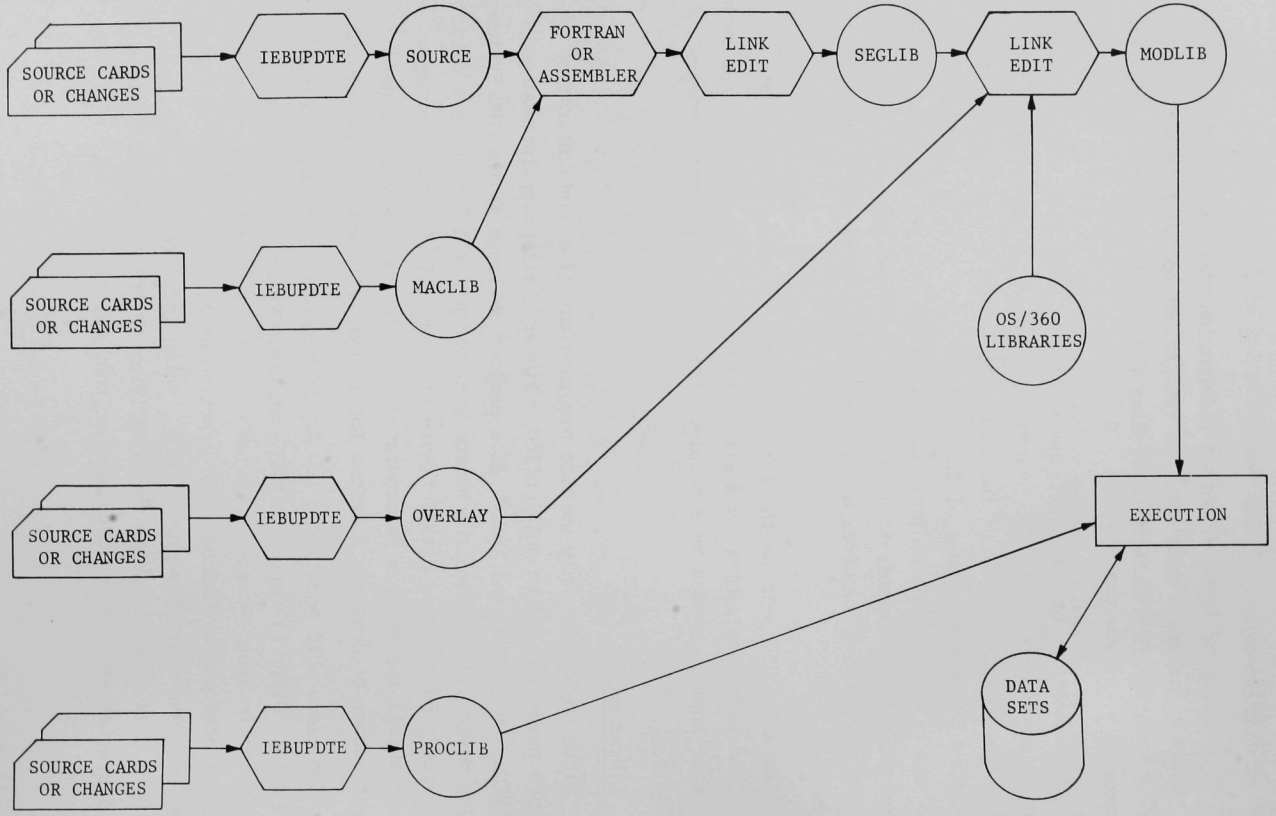


Fig. 1. The Libraries of the ARC System

1. A Description of the Libraries in the ARC System

(a) SOURCE is a library that contains the program source statements. The statements in a member of SOURCE may be a single subprogram or a collection of subprograms. The grouping may be functional (all of the Fortran subprograms of BPOINTER) or for convenience (a group of subprograms that are part of the same module and that can be compiled in a short time).

(b) SEGLIB contains the compiled members of SOURCE. These members have been processed by the LINKAGE EDITOR using the NCAL option so that a listing of external references is available. The members of SOURCE and SEGLIB are in 1:1 correspondence. The important members of SEGLIB discussed in this volume are

BCDDS	OPENDS
BPOINTER	POINTR
CLOSE	REUS
IBCOM	SHIFT
IHCFIOSH	SNIFF
LINK	SQUEZE
LOAD	SYSTEM

(c) MODLIB contains all of the executable modules of the ARC System, including the PCMs. The members are created from the members of SEGLIB by the linkage editor using the instructions in the appropriate member of OVERLAY. The important members of MODLIB discussed in this volume are

ARCIBCOM	SCAN
BCDDS	SNIFF
INITIAL	STUFF
REUS	

(d) OVERLAY contains card images of linkage editor instructions that produce modules (members of MODLIB) from the members of SEGLIB. The members of MODLIB and OVERLAY are in 1:1 correspondence.

(e) MACLIB contains macros that are required by the assembly language members of SEGLIB. An important member of this library is IHCFIOSH, which is a modification of the OS/360 macro that produces IHCFIOS (a component of the FORTRAN I/O package).

(f) PROCLIB contains cataloged procedures that are useful in the creation and maintenance of members of SOURCE, SEGLIB, and MODLIF and in the running of paths.

2. The Use of the ARC System Libraries

Figure 2 shows a system with three load modules (or CM), ONE, TWO, and THREE. Since there are fifteen collections of subprograms A,B,...,N, SOURCE and SEGLIB would each have fifteen members (A,B,...,N); OVERLAY and MODLIB would each have three members (ONE, TWO, and THREE). Each member of OVERLAY contains the instructions for producing the member in MODLIB, having the same name, from the members of SEGLIB. For example, the member of OVERLAY named THREE might contain the following cards:

```
INCLUDE SEGLIB(A,M,B)
ENTRY A
NAME THREE(R).
```

In practice, the maintenance of libraries requires many JCL cards, so cataloged procedures have been written to ease the burden. Two cataloged procedures will be discussed here:

1) ARCUCLP allows the cards in source members to be changed in SOURCE, compiled, and link edited into SEGLIB.

2) ARCLP constructs members of MODLIB from members of SEGLIB using instructions in OVERLAY.

Consider the effect of a change in the member of SOURCE called A. This would affect the three modules ONE, TWO, and THREE. The following JCL deck would accomplish the entire change:

```
// EXEC ARCUCLP,DISKNO=28,MEMBER=A
// UPD.SYSIN DD *
./ CHANGE NAME=A
   SOURCE CARDS
/*
// EXEC ARCLP,DISKNO=28,MEMBER=ONE
// EXEC ARCLP,DISKNO=28,MEMBER=TWO
// EXEC ARCLP,DISKNO=28,MEMBER=THREE
```

These cataloged procedures currently assume that all four libraries (SOURCE, SEGLIB, OVERLAY, and MODLIB) reside on a disk named DISKnn, where DISKNO=nn.

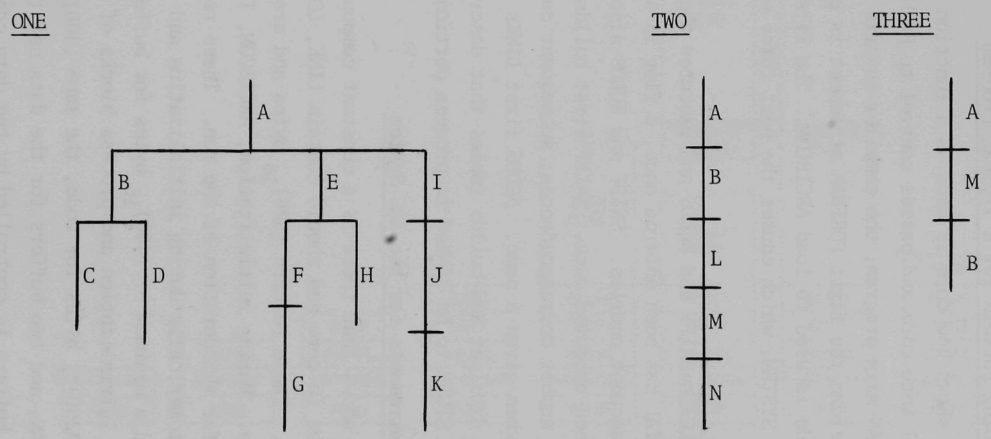


Fig. 2. Example of Module Construction Using Members from the ARC System Libraries

III. Core Utilization During an ARC System Run

It is now possible to show how core is utilized in a typical ARC System run.

A. Core Loading Pattern for a Typical Problem

Figure 3 shows how core is used as a function of time. OS/360 brings a PCM PATH1 into core and passes control to PATH1. Since this module is a FORTRAN main program, the compiler inserts code to initialize the I/O package before the first FORTRAN statement is executed. This initialization code is used to load ARCIBCOM. The first statement of PATH1 may be CALL SYSTEM, which causes the next three modules to be brought into core.

INITIAL LOADs SNIFF and BCDDS and executes them for the first time. After INITIAL has been entered once, a flag is set so that it will do nothing on subsequent entries. SNIFF and BCDDS also change functions after they have been executed once. SNIFF first builds a table of data set name-data set number correspondences; subsequent calls simply return data set numbers when given a name. BCDDS first LINKs to SCAN to spool input data onto a data set and builds tables that describe the input. All other calls cause STUFF to be LINKed to process portions of the input data.

B. Core Requirements for the ARC System

Figure 3 shows that there is a constant component to an ARC System run. A PCM must be in core and should contain LINK, LOAD, SYSTEM, and IBCOM from SEGLIB. These require $(526)_{16}$ bytes and are normally part of any computation module. During initialization, ARCIBCOM, INITIAL, SNIFF, and BCDDS are LOADed for the duration of the run. These require $(79F0)_{16}$ bytes. SCAN is called automatically during initialization and requires $(28288)_{16}$ bytes for code and a minimum of $(400)_{16}$ bytes for buffers. A minimum path would perform the initialization and process blocks of data by LINKing STUFF. STUFF requires $(2A260)_{16}$ bytes for code, the same $(400)_{16}$ bytes used for the buffers in SCAN, and two buffers for the data set that it is producing. The size of these buffers is controlled by the data control block (DCB) parameter in the data definition (DD) card; it would typically be $(C80)_{16}$ bytes (2 buffers of 1600 bytes each).

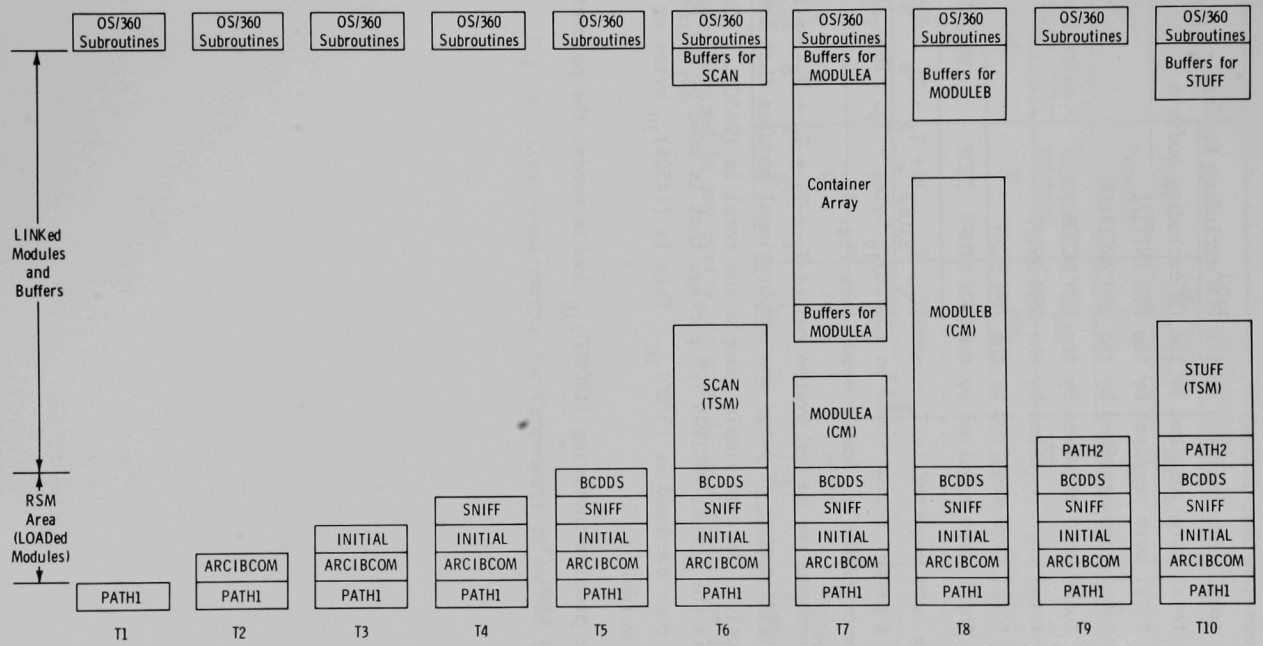


Fig. 3. Core Allocation at Various Times During an ARC System Run

In the discussion that follows

T_P = total core required by the PCM excluding buffers

T_C = total core required by the CM excluding buffers

T_I = total core required by the RSM INITIAL

T_A = total core required by the RSM ARCIBCOM

T_B = total core required by the RSM BCDDS

T_S = total core required by the RSM SNIFF

T_{SCAN} = total core required by the TSM SCAN

T_{STUFF} = total core required by the TSM STUFF

The minimum core required is $T_p + \max(T_C, T_{STUFF}) + T_A + T_B + T_S + T_I$. If $T_C \leq T_{STUFF}$ a proper region would be $(347IC)_{16}$ bytes + T_P. This is $(214812)_{10}$ bytes or $(26852)_{10}$ double words (see Fig. 4).

The core overhead for an ARC System run is $T_I + T_A + T_B + T_S + n(526)_{16}$, where n is the total number of paths and computational modules that are in core simultaneously. For our simple example the total is $(943C)_{16}$. Of this total $(5C5C)_{16}$ is the actual FORTRAN I/O package that is used by any FORTRAN program, so the core overhead is $(37E0)_{16}$. This is $(14304)_{10}$ bytes or $(1788)_{10}$ double words.

For a large problem involving $(100000)_{10}$ double words, the percentage overhead is less than 2%.

Module	Core Requirements (# bytes)$_{16}$			
	Core*	ARC System Routines	Buffers	Total
PATH	Depends on task	526	Path dependent	T_p
Computation MODULE	Depends on task	526	Module dependent	T_c
INITIAL	0	8D0	0	T_I = 8D0
ARCIBCOM	5C5C	204	0	T_A = 5E60
BCDDS	0	DA0	0	T_B = DA0
SNIFF	0	1520	0	T_S = 1520
SCAN	0	28288	400	T_{SCAN} = 28868
STUFF	0	2A260	1080	T_{STUFF} = 282E0

*Code Required in any Fortran program doing a portion of an ARC System run.

Fig. 4. Core Requirements for Components of an ARC System Run

CHAPTER 3. PROGRAMMING CONSIDERATIONS FOR USE OF THE ARC SYSTEM

I. Introduction

The purpose of this chapter is to give the user complete and detailed information concerning the use of the 'system' aspects of the ARC System. The previous chapter described the components of the ARC System and briefly mentioned their utility. Some of the details of Chapter 2 will be reviewed here.

Each group of input or output information associated with any ARC module is called a data set. In the present operating environment, i.e., under the OS/360 software, a data set is equivalent to an OS/360 data set. A description of each ARC System data set is contained in the data set glossary (see Chapter 5). Each description includes the glossary name of the data set, its internal structure in terms of records and files, and the contents and length of each record. Internally, modules refer to the ARC System data sets that they reference by their glossary names.

The modules are so specified that several modules may be employed to form a complete program; a program thus formed is called a path. In relation to paths, certain additional terms may be defined. Associated with each path is one module called the path control module or PCM: this is the module which gets control first when the path is executed.

In terms of the quantities defined above, the ARC System is based on a library of modules, some of which are path control modules. ARC paths may be formed and executed by selecting certain groups of modules from the library. A path execution generally results in the creation of a number of ARC data sets, the structure of each of which is given in the data set glossary. The user may choose to let all such data sets be erased at the end of the execution, or he may choose to save any or all of them for use as input to subsequent path executions.

The library modules, as well as certain data sets, are stored on private disk volumes. Duplicates of the contents of disk volumes are maintained on tapes to provide volume security. In general, those data sets produced as the result of a path execution can be saved for later use.

II. Programming Restrictions for Modules in the ARC System

This section contains a number of restrictions and requirements which modules must obey. They divide mainly into the areas of structure, the reading and writing of data sets, and the reading of data from the main input stream.

A. Restrictions on Computation Modules

1. The entry to a module should be a main program if the module uses direct-access data sets. All I/O is trapped in each module and communicated to a resident I/O module. A FORTRAN main program generates specific I/O calls before the first executable statement and after the return statement. The resident I/O module uses these calls to determine when a module is finished so that direct-access data sets can be closed and when the path is finished. All ARC System computation modules using direct access data sets should be of the following form:

```
CALL SUBR
RETURN
END
SUBROUTINE SUBR  (argument list)
 .
 .
 .
 .
RETURN
END
```

The argument list contains the parameters to be passed to the module. This form may also be used in those cases where direct access data sets are not used.

2. A computational module must refer to each data set that it reads or writes by the glossary name of the data set. The glossary names are only for internal use by the ARC System modules, for when a computational module references a data set during a path execution, it is actually referencing an OS/360 data set and must therefore use the data set reference number (DSRN) of that data set.

To obtain the data set reference number of a data set, a module must interrogate the system via the statement

CALL SNIFF (name, N1,N2)

where "name" is the glossary name of the data set in question, N1 is an output parameter giving the data set reference number, and N2 is an input parameter. For a complete description of this call see paragraph IV.B.2. Note that a particular data set reference number "nn" (where "nn" $\geq$ 11) is associated with one or more DD cards with ddnames "FTnnF001,FTnnF002,..." and with a data set whose glossary name is the "nn-10'-th such name in the array DSNAME as defined in the path control module.

3. The subroutine package SYSTEM and the subroutines LINK, LOAD, and IBCOM are normally included in each computation module (this is done using an

INCLUDE SEGLIB(SYSTEM,LINK,LOAD,IBCOM) card

in the member of the library OVERLAY corresponding to each module). If the module has an overlay structure, SYSTEM,LINK,LOAD, and IBCOM must be located in the root segment of the module.

4. FORTRAN IV has a multiple-return capability $RETURN_i$, using statement numbers of the form &N1, &N2, in the calling sequence. A path control module cannot use &N1, &N2, etc. in the parameter list for a LINK. This coding is acceptable within a load module and the benefits of it can be passed on to the ARC System if the following conventions are followed:

(a) Load module coding (Module name=NAME)

```
      CALL SUB1
      RETURN
      END

      SUBROUTINE SUB1 (N1,N2)
      CALL SUB2 (&100,&200)
      N1=0
      N2=0
      RETURN
  100 N1=100
      N2=0
      RETURN
  200 N2=200
      N1=0
      RETURN
      END
```

```
      SUBROUTINE SUB2 (*,*)
          .
          .
          .
      IF (N) 1,2,3
    1 RETURN
    2 RETURN 1
    3 RETURN 2
      END
```

(b) A path control module may have the benefit of variable returns if parameters are checked in IF statements.

```
      CALL LINK('NAME', N1,N2)
      IF (N1.EQ.100) GO TO 100
      IF (N2 EQ.200) GO TO 200
          .
          .
          .
          .
  200 CONTINUE
          .
          .
          .
          .
  100 CONTINUE
          .
          .
          .
          .
```

B. Restrictions on Path Control Modules

1. A path control module must include the definition of an array DSNAME and a statement that initializes this array.

```
      REAL*8 DSNAME(89)
      DATA DSNAME/'name1','name2',...,'namen','$'/
```

The list "'$name_1$', '$name_2$',..." must be a list of the glossary names of all data sets referenced both by this module (the path control module) and by any other modules of the path. The list must not contain any duplicate names (exception, see II.B.3).

Each '$name_i$' must be a one- through eight-character quantity, where the characters may be alphameric or periods. By convention, the first character of a glossary name must be alphabetic, and the last character must not be a period. An additional convention is imposed: the first two characters of a BCD card-image data set are normally "A.".

The quantities '$name_i$' are the names used as arguments in calls to the SNIFF utility routine (see also IV.B.2).

The dollar sign that terminates the list must appear unless the proceding list of '$name_i$' quantities contains 89 elements. The 89-element restriction is an OS/360 restriction for FORTRAN IV coupled with the convention to reserve data sets numbered 1-10 for system use. This means that only 89 data sets can be used in an ARC System run. If more than 89 data sets are required, the section of the FORTRAN I/Ø package named IHCFIOSH could be modified. This modification would allow 245 data sets to be used.

2. The first executable statement in the MAIN program of a path control module is generally

```
CALL SYSTEM(DSNAME)
```

where DSNAME is the array described in paragraph II.B.1. above.

3. When a path is executed, the OS/360 job deck usually consists of several job steps, one of which is the actual path execution. This path execution job step must include an OS/360 DD card for each file of each of the data sets which are used in the path. These DD cards must have ddnames of the form

```
FTnnF001        for a one-file data set;
FTnnF001,
FTnnF002,       for a two-file data set;
etc.
```

These dd cards are included in the cataloged procedures for executing ARC System paths so that the job deck for an established path is not very large. The quantity "nn" to be used in the ddname of the DD card(s) for the data set with glossary name "$name_i$" has a value that depends on the position of "$name_i$" in the array DSNAME. In general, if "$name_i$" is the i-th name in the list, then "nn" has the value

$$nn = i+10$$

The dsnames to be used on the above DD cards are arbitrary. The dsname used on the DD card for a particular data set is commonly the glossary name of that data set, suffixed by an identifier that insures uniqueness.

Note: If for some reason the user wishes to avoid using certain data set reference numbers on the DD cards, then he may insert "dummy" elements in the appropriate places in DSNAME. (In this case a "dummy" element is any quantity that is never used as an argument in a call to SNIFF.)

Example:

Let the contents of the array DSNAME in the control module of a certain path be as follows:

```
REAL*8 DSNAME(89)
DATA DSNAME/3*'DUMMY','A.NIP','A.BURN','GEOM','DUMMY','XS.C.MIN','$'/
```

where DUMMY is a dummy element, and where XS.C.MIN is a two-file data set and the other data sets consist of one file each. Since DUMMY is never used as an argument in a call to SNIFF, it is used as often as required in the array DSNAME and may be any eight character identifier that is not a glossary name.

The DD cards listed below are those that must be used in the path execution job step of the OS/360 execution job deck. Note that the dummy elements in DSNAME occupy the places in DSNAME corresponding to data set reference numbers 11, 12, 13, and 17.

```
//FT14F001  DD DSNAME=A.NIP,...
//FT15F001  DD DSNAME=A.BURN,...
//FT16F001  DD DSNAME=GEOM.F1,...
//FT18F001  DD DSNAME=XSCMINF1,...
//FT18F002  DD DSNAME=XS.C.MINF2,...
```

Note: Multi-file data sets can be referenced with a separate data set reference number for each file (with a corresponding name for each in the array DSNAME), or as

```
FTnnF001
FTnnF002
. . . .
FTnnF00i
```

with only one name in the array DSNAME. Two or more old data sets can be treated as one multi-file data set even though they were created at different times.

4. Because of the procedures at ANL, certain data set reference numbers are reserved. FT05F001 refers to the card reader and FT06F001 refers to the printer. An additional data set, FT09F001, is always required in ARC System executions; it is used to spool the input data from FT05F001 for later use. This data set is sequential and should use the data control block

```
DCB=(RECFM=VB,LRECL=84,BLKSIZE=1684).
```

III. Structure of a Path Data Deck

A. The input data deck for a path execution must consist of one or more data blocks, one of which may be a data set initialization block. Each data block must begin with a block header card containing "BLOCK=" in columns 1-6 and a one- through eight-character alphameric block name starting in column 7.

Following the block header card, the data set initialization block must consist of zero, one, or more data set name cards described below. The other blocks of a path data deck must each consist of zero, one, or more sub-blocks following their respective block header cards. The structure of a sub-block is also described below.

B. The data set initialization block (DSIB) must be given the block name "OLD". Another block in the path data deck can have this block name, but this is not good practice.

Each data set name card in the DSIB must contain "DATASET=" in columns 1-8 followed by a single ARC System data set glossary name starting in column 9. Each such name must duplicate one of the glossary names in the array DSNAME in the MAIN subprogram of the control module of the first path control module to be executed; else the discrepancy is noted and processing continued.

Note that the DSIB is optional and need not be used in a path data deck. If used, it specifies the glossary names of previously-created data sets that are available to the current path execution.

C. As stated above, each of the non-DSIB data blocks consists of zero, one, or more sub-blocks. A sub-block consists of a sub-block header card followed by zero, one, or more ARC System data cards. A sub-block header card must contain either

(1) "DATASET=" or "SUBLOCK=" in columns 1-8 and a sub-block name (eight-characters) starting in column 9 or,

(2) "MODIFY=" in columns 1-7 and a sub-block name starting in column 8, or

(3) "REMOVE=" in columns 1-7 and a sub-block name starting in column 8, or

(4) "NOSORT=" in columns 1-7 and a sub-block name starting in column 8.

These options will be described below.

During the path execution each sub-block becomes a card-image data set. The name of each such data set is the sub-block name and the contents of the data set are determined by the data cards in the sub-block. See also paragraphs III.D, III.E, and IV.B.1.

Each sub-block name must duplicate one of the glossary names in the appropriate DSNAME array; else the discrepancy is noted and processing continues.

Two or more data blocks having the same block name may be used in a path data deck.

D. The DATASET sub-block is used to create a new card-image data set whose name is the sub-block name. If a data set with this name already exists, it is deleted and replaced with the new data set produced from this sub-block. The contents of the new data set are the data cards of the sub-block, arranged as described in paragraph IV.B.1.d.

Each ARC System data card in a DATASET sub-block is either a <u>standard</u> or a <u>nonstandard</u> data card. A standard card contains a numeric quantity N ($01 \leq N \leq 99$) called the <u>card type</u> in columns 1-2. A nonstandard data card is one containing blanks, zeros or a non-numeric quantity in columns 1-2.

E. The MODIFY sub-block can contain three types of cards: standard data, nonstandard data, and <u>DELETE</u> cards. The standard and nonstandard data cards are described in paragraph D above; a DELETE card contains a numeric card type N in columns 1-2 and the characters "=DELETE" in columns 3-9. If a DELETE card is used in a DATASET sub-block it will be treated as a standard data card. If a card having "=DELETE" in columns 3-9 does not contain a nonzero numeric quantity in columns 1-2, the card <u>is not</u> treated as a DELETE card but is treated instead as a non-standard data card, whether it occurs in a DATASET or in a MODIFY sub-block.

This type of sub-block produces two results depending on the existence or nonexistence of the card-image data set to be modified.

If the data set to be modified <u>does not</u> exist, the cards are treated like a DATASET sub-block, with the exception that DELETE cards do not appear.

If the data set to be modified does exist, it is merged with the cards in the MODIFY sub-block according to the following rules:

(1) Any standard data cards of type N occurring in the MODIFY sub-block replace all existing standard cards of type N in the old data set. If there are no existing cards of type N, those from the MODIFY sub-block are simply added to the cards of the new, merged module.

(2) The presence of a DELETE card for a card type N causes all existing standard data cards of type N to be deleted from the merged data set. If there are no existing cards of type N, any DELETE card for type N is ignored.

(3) Any non-standard data cards occurring in the MODIFY sub-block are appended to any existing non-standard cards in the old data set.

(4) Non-standard cards in an existing card-image data set cannot be deleted as the result of a merge operation produced by the presence of a MODIFY sub-block.

F. The REMOVE sub-block contains no cards. It is used to reset information in one of the internal ARC System tables. Whenever a data set is written, a flag is set so that read requests for that data set will be flagged as being possible. The use of a REMOVE sub-block resets this flag so that SNIFF (IV.B.2) will not treat this data set as existing. Some modules are constructed so that they interrogate a dsname and branch depending on whether or not the data set has been written.

G. The NOSORT sub-block contains cards that are not to be sorted. They are all treated as nonstandard cards.

H. The normal usage of the first two types of sub-blocks for a particular data set is to have at most one DATASET sub-block or one MODIFY sub-block in a single block, the intent being to create a new copy of the data set or to modify an existing version of the data set, respectively. It is, however, possible to have both a DATASET and a MODIFY sub-block for the same data set in the same block, or even to have more than one of each type for the same module and block. Such usage is usually redundant, but will be handled by the system. The rule to follow in determining what the result of multiple sub-block usage will be, is that the sub-blocks in a block are processed strictly sequentially, and that the processing of each sub-block results either in the creation or modification of a data set.

I. A sample path data deck is given below. It consits of six data blocks, including a data set initialization block. The brackets labelled B, SB, and DSIB indicate blocks, sub-blocks, and the data set initialization block, respectively.

Note that the first block named BLKC is empty (i.e., it contains zero sub-blocks) and that in the block BLKD the sub-block A.NAME4 is empty (i.e., it contains zero data cards).

```
      B  { BLOCK=BLKA
           SB { DATASET=A.NAME1
                ........} data cards
           SB { DATASET=GEOM
                ........} data cards
           SB { DATASET=A.NAME3
                ........} data cards
DSIB       { BLOCK=OLD
             ........} data set name cards
      B  { BLOCK=BLKB
           SB { DATASET=A.NAME4
                ........} data cards
      B  { BLOCK=BLKC
      B  { BLOCK=BLKD
           SB { DATASET=VEC.S2X
                ........} data cards
           SB { MODIFY=A.NAME4
           SB { DATASET=RFLUX1
                ........} data cards
           SB { DATASET=RFLUX2
                ........} data cards
      B  { BLOCK=BLKC
           SB { MODIFY=A.NAME4
                ........} data cards
```

J. No module should read the main input stream directly. The entire path data deck is read from the main input stream under control of the utility routines when SYSTEM is called from the path control module (see paragraph II.B.2 and IV.A.4).

The computational modules of the path must access the path data deck via statements of the form

```
CALL BCDDS(name,N)     or
CALL LINK ('BCDDS    ',name,N)
```

where "name" must correspond to a block name in the path data deck and where N is an output parameter. This call causes a data block with the given block name to be processed. For a complete description of the call see paragraph IV.B.1.

The first form of the call is valid if the load module SYSTEM has been LINK EDITED with the module making the call. The second form requires only that SUBROUTINE LINK be a part of the module requiring BCDDS. These observations are valid wherever this document shows two calls of these types.

IV. The Use of ARC System Subprograms and System Modules

A. Utility Subprograms

1. LINK

This is an assembly-language subprogram callable from a FORTRAN subprogram within a module via the statement

```
CALL LINK(name, additional parameters)
```

where "name" is either an eight-character alphameric quantity or a "REAL*8" variable containing such a quantity. The quantity must be the name of a load module which is a member of an OS/360 library available to the JOB or STEP. If 'name' expects parameters, all parameters must be given in the parameter list. The subprogram LINK causes the OS/360 "LINK" macro-instruction to be invoked and results in control being transferred to the entry point of the module "name". If "name" is not currently in core, the "LINK" macro loads "name" into unoccupied core before giving it control. Any additional parameters in the above call to LINK are passed to "name". When control exits from "name", it returns to the calling subprogram at the statement immediately following the call to LINK.

LINK may be used to pass control from one-module to another in exactly the same fashion as the FORTRAN "CALL" statement is used to pass control from one subroutine to another within the same module.

LINK is a member of SEGLIB.

2. LOAD

This is an assembly-language subprogram callable from a FORTRAN subprogram within a module via the statement

CALL LOAD(name),

where the single parameter is either an eight-character alphameric quantity or a "REAL*8" variable containing such a quantity. The quantity must be the name of a load module which is a member of an OS/360 library available to the JOB or STEP.

The subprogram LOAD causes the OS/360 "load" macro-instruction to be invoked and results in the loading of the module "name" into unoccupied core. If the module "name" is already resident in core, then either no action is taken (if the module was declared reusable) or another copy of "name" is loaded (if the module is not reusable).

When the load operation is completed, control returns to the calling subprogram at the statement immediately following the call to LOAD.

LOAD is a member of SEGLIB.

3. POINTER and BPOINTER

(a) POINTER is a member of SEGLIB. It is a collection of subroutines which allows a FORTRAN program to manage a large array in a dynamic manner. The size of the array is fixed and entry points allow the FORTRAN program to store program data arrays in the container, to pack the container (move the arrays to make space available) to purge arrays from the container, to redefine the size of arrays in the container, and to locate the position of a given program array in the container.

(b) BPOINTER is a member of SEGLIB. It does all that POINTER does and also allows the run-time specification of the container array. The container array is obtained dynamically and can be as large as the longest contiguous space in the problem region. On machines with Large Core

Storage (LCS or bulk storage), arrays can be placed into main or bulk at the program's option. A data set named POINTR has been defined so that the arrays managed by BPOINTER can be shared by computational modules. Data set POINTR is described in the data set glossary.

4. SYSTEM

SYSTEM is a subprogram package containing the following subroutines:

SYSTEM
BCDDS
SNIFF

Subroutines BCDDS and SNIFF expand into

CALL LINK ('BCDDS ', parameter list)

or

CALL LINK ('SNIFF ', parameter list), respectively.

SYSTEM is usually included in each load module. In particular, only a module which references the glossary names via the call CALL SNIFF ('name', N1,N2) rather than CALL LINK('SNIFF','name',N1,N2) should include SYSTEM to resolve the external reference SNIFF. Subprogram SYSTEM must be invoked from each path control module via the statement

CALL SYSTEM(DSNAME),

where DSNAME is the array described in paragraph II.B.1.

During a path execution the first module to invoke SYSTEM is the control module of the path. At that time the following actions are taken:

(a) A resident system module SNIFF with which the subroutine SNIFF will communicate is loaded into unoccupied core. The contents of the array DSNAME in the calling subprogram, initialized as indicated in paragraph II.B.1, are stored in the array NAMES in the system utility module (see also paragraph IV.C).

(b) A second resident system module BCDDS with which the subroutine BCDDS will communicate is loaded into unoccupied core. Under control of this module the complete path data deck is read from the main input stream, and all data blocks except the data set initialization block (DSIB) are written unchanged onto auxiliary storage for later processing.

The data set initialization block is processed as follows: each glossary name in the DSIB is compared with the contents of the array NAMES. If one of the glossary names is the same as, say, NAMES(J), then the element DSRN(J) of the array is set to the non-zero integer value J+10 to indicate that the data set corresponding to NAMES(J) exists for the current path execution. If a glossary name in the DSIB does not correspond to any element of NAMES, the discrepancy is noted and processing continues.

(c) When SYSTEM is invoked for the first time, a flag is set to indicate that the actions (a) and (b) described above have been performed. Thereafter, if SYSTEM is invoked from other modules of the path, the flag setting causes an immediate exit. The effect of this procedure is to permit one and only initialization per path; multiple reads of the main input stream are precluded, and all calls to SNIFF from all modules of a path are made with reference to the same list of data set names placed in the array NAMES.

SYSTEM is a member of SEGLIB.

5. IBCOM

IBCOM is an assembler language subprogram that traps all of the calls that the FORTRAN compiler generates for I/O activity. It must be part of every module in MODLIB which has I/O activity with the exception of the I/O module, ARCIBCOM and the stand alone program REUS.

IBCOM is a member of SEGLIB.

6. OPENDS

OPENDS is invoked by the FORTRAN statement

CALL OPENDS (I,IA)

where I is an integer variable and IA an integer array. Prior to calling OPENDS, I should be initialized to the maximum dimension of the array IA. On return from OPENDS:

(i) If the number of open data sets is less than or equal to the dimension of IA, then I is set equal to the number of open data sets and IA contains the data set reference numbers of these data sets.

(ii) If the number of open data sets is greater than the dimension of IA, then I is set equal to the negative of this dimension and the array IA contains the data set reference numbers of -I open data sets. After closing the I open data sets, OPENDS can be called again to obtain the data set reference numbers of the remaining open data sets.

OPENDS is a member of SEGLIB.

7. SQUEZE

SQUEZE is an assembly-language subroutine which left-justifies alphameric quantities and removes imbedded blanks. SQUEZE can be called from FORTRAN as follows: For a double-word variable A the statement

CALL SQUEZE (A)

will call the subroutine, and A will be returned with the first non-blank characters left-justified and the remainder of the word blank-filled.

For a double-word array A, where all members of the array need to have blanks removed, the call is

CALL SQUEZE (A,I)

where I is the length of the array.

SQUEZE is a member of SEGLIB.

8. SHIFT

SHIFT is an assembler language subprogram that is used by the module SCAN. It moves all characters in an 80 byte string one byte to the right and places a blank in byte 1. For an 80 character string, the call is,

CALL SHIFT(A).

9. IHCFIOSH

IHCFIOSH is a modification of the IBM OS/360 subprogram with the same name (see Chapter 4, II.D).

10. CLOSE

CLOSE allows the Fortran programmer to close all data sets that are open in order that their buffers may be released. The alternative to CLOSE is to rewind all units that are open. Each module should close the data sets that have been used so that a maximum of space is available for the next module. The calling statement is CALL CLOSE.

B. Utility Modules

1. BCDDS

(a) This module is a member of MODLIB and is invoked by the statement

```
CALL BCDDS(name,N)      or
CALL LINK ('BCDDS   ',name,N)
```

where "name" is an input parameter and N is an output parameter.

"name" must be either an eight-character alphameric quantity or a floating-point doubleword variable containing such a quantity. This quantity must be the same as one of the block names in the data deck for the current path execution. N must be an integer fullword. Both parameters must be used in all calls to BCDDS.

(b) If the call to BCDDS is the i-th such call for the block "name", it is assumed that the current path data deck contains at least "i" blocks having "name" as a block name. The i-th block with "name" as a block name is read from auxiliary storage and processed as follows:

Each of the sub-blocks of this block is formed into a card image data set. The name of each sub-block must correspond to one of the elements of the array DSNAME as defined and initialized in the entry subprogram MAIN in the root segment of the path control module of the path being executed. If a sub-block name does not duplicate any element of DSNAME, the discrepancy is noted and processing continues.

If a previous version of some data set exists and if the i-th call to BCDDS results in a new version of this data set being formed, then the old version is destroyed and is replaced with the new version.

(c) Seven possible values for N may be returned to the calling subprogram by BCDDS.

N = 1: "name" duplicates a block name in the path data deck, and at least "i" blocks with this block name appear in the data deck. The i-th such block was processed.

N = -2: Same as for N = 1, but the names of one or more sub-blocks in the i-th block that was processed did not correspond to any of the elements of the array DSNAME in the path control module. The block was processed up to the point at which the incorrect sub-block was encountered.

N = -3: "name" does not correspond to the block name of any block in the path data deck. No block was processed.

N = -4: System error. "name" corresponds to a block name in the path data deck, but the block cannot be located in data set reference number 9. No block was processed.

N = -5: "name" duplicates a block name in the path data deck, but less than "i" blocks with this block name appear in the data deck. No block was processed.

N = -6: The number of existing data set cards plus the modification cards exceeds 2000. Proceed at your own risk.

N = -7: The data set created has more than 2000 cards. Proceed at your own risk.

(d) Structure of a (card image) data set produced by BCDDS from a sub-block of the data deck.

The contents of a card-image data set produced from each sub-block of a data block consists of the data cards making up the sub-block and several additional cards. The additional cards precede the data cards and have the following formats:

(i) One card, containing in columns 1-8 the contents of columns 9-16 from the sub-block header card (this is the sub-block name) and containing right-adjusted in columns 9-13 and 14-18 two integers J and K. This card has the format (A8,2I5).

J contains the number of highest card-type appearing on any of the standard cards in this sub-block. In general, J may take on the range of values $0 \leq J \leq 99$. If J is 0, then the sub-block contains no standard ARC System data cards.

K contains the number of non-standard data cards in the sub-block. In general, K may be 0 or positive. If K is 0, then the sub-block contains no non-standard ARC System data cards.

(ii) One through seven cards, containing exactly J integers N_1, N_2,...,N_J, where J is obtained from the first card described in (i) above. Each of these cards contains up to 16 integers according to the format (16I5). The first card contains N_1,...,N_{16}; the second card contains N_{17},...,N_{32}; and so on until the J integers are exhausted.

The value of N_1 is the number of standard cards in this data set (i.e., this sub-block) of card type 01; N_2 gives the number of standard cards of type 02; and so on through N_J.

(iii) The cards described in (i) and (ii) above may be read by the following FORTRAN statements:

```
      CALL SNIFF(name, M,0)
      READ(M,99)ANAME,J,K,(N(I),I=1,J)
   99 FORMAT(A8,2I5/(16I5))
```

The ARC System data cards of the sub-block appear following the prelinimary cards described above. First come any standard cards and DELETE cards in the sub-block, where DELETE cards are in this instance treated as standard data cards: cards of the same type are grouped together in the same order in which they appear in the sub-block, and such groups are re-ordered to appear by increasing card type. Following any standard cards come any non-standard cards in the sub-block, in the same order in which they appear in the sub-block.

(e) The following is an illustration of the effect of BCDDS on the data cards of a DATASET sub-block.

Before: the data cards of sub-block A.NAME1 as they appear in data deck. The numbers 1 through 14 in columns 9-10 on the data cards are not significant. They are inserted merely to illustrate the re-ordering of these cards by BCDDS. Note that the cards numbered 7, 8, and 12 are non-standard.

```
DATASET=A.NAME1
02        1
03        2
03        3
05        4
22        5
03        6
          7
          8
02        9
03       10
05       11
         12
05       13
22       14
```

After: the card image data set A.NAME1 as produced by BCDDS. This is an OS/360 sequential data set with a dsname of A.NAME1.

```
A.NAME1     22    3
    0    2    4    0    3    0    0 .... 0
    0    0    0    0    0    2
02        1
02        9
03        2
03        3
03        6
03       10
05        4
05       11
05       13
22        5
22       14
          7
          8
         12
```

(f) The following is an illustration of a MODIFY sub-block.

```
MODIFY=A.NAME1
24          201
01          202
06          203
05          204
01          205
06          206
            207
03=DELETE   208
            209
05          210
```

(g) The card-image data module shown below is that which would result from a merge of the DATASET sub-block of paragraph (e) and the MODIFY sub-block of paragraph (f), and serves to illustrate the modification operations that may be performed by use of the MODIFY sub-block.

```
A.NAME1     24    5
   2    2    0    0    2    2    0    0 ..... 0
   0    0    0    0    0    2    0    1
01         202
01         205
02       1
02       9
05         204
05         210
06         203
06         206
22       5
22      14
24         201
         7
         8
        12
           207
           209
  -2    0    0    0   -2   -2    0    0 ..... 0
   0    0    0    0    0    0    0   -1 ..... 0
   0    0    0    0    0    0    0    0 ..... 0
   0    0    0    0    0    0    0    0 ..... 0
   0    0    0    0    0    0    0    0 ..... 0
   0    0    0    0    0    0    0    0 ..... 0
   0    0    0    0    0    0    0    0 ..... 0
```

After the modified data set is written, a 100-word array is written, (in 16I5 format) indicating by negative entries which card types and how many of each have been replaced. Note that the nonstandard cards accumulate.

The following modifications have been performed in producing the merged data set given above:

(i) The type 01 cards from the MODIFY sub-block have been added;

(ii) The type 03 cards in the DATASET sub-block have been deleted;

(iii) The type 05 cards from the MODIFY sub-block have replaced those from the DATASET sub-block;

(iv) The type 06 cards from the MODIFY sub-block have been added;

(v) The type 24 card from the MODIFY sub-block has been added;

(vi) The two nonstandard cards from the MODIFY sub-block have been added after the three nonstandard cards from the DATASET sub-block.

2. SNIFF

This module is a member of MODLIB and is invoked via the statement

CALL SNIFF(name,N1,N2)

where "name" and N2 are input parameters, and N1 is an output parameter.

"name" must be either an eight-character alphameric quantity or a REAL*8 variable containing such a quantity that is one of the glossary names in the array DSNAME as initialized in the path control module of the path being executed.

N1 must be an integer fullword variable.

N2 must either be an integer fullword variable having a value of 0, 1, 2, or 3, or one of the integer constants 0, 1, 2, or 3.

All three parameters must be used in all calls to SNIFF.

The main function of SNIFF is to return to the calling program in N1 a data set reference number corresponding to the data set "name".

If N2=1, an existence flag is set that will be interpreted to mean that "name" has been written. If N2=0, N1 will contain one of the values listed below. If N2=2 during a call to SNIFF, the existence flag is reset in the tables of SNIFF. N1 is not set following this call. If N2=3 during a call to SNIFF, the name of the data set that corresponds to N1 will be returned in "name". If "name" = 'CHANGE', the dsname associated with N1 in the DSNAME array will be interchanged with the dsname associated with N2.

Three possible values of N1 may be returned to the calling subprogram by SNIFF:

N1 > 0: The call to SNIFF is valid. N1 contains the data set reference number. (A call to SNIFF is valid if "name" duplicates one of the elements of DSNAME and the existence flag has been set.

N1 = 0: The call to SNIFF is invalid. "Name" corresponds to an element of the array DSNAME, but the existence flag has not been set.

N1 = -1: The call to SNIFF is invalid. "Name" does not correspond to any element of the array DSNAME.

3. ARCIBCOM

This module is a member of MODLIB and is responsible for all I/O activity generated by the FORTRAN IV I/O statements. It consists of an interface that communicates with IBCOM plus the entire FORTRAN I/O package. It is LOADed by the first execution of IBCOM (before the first executable statement of the first path in core). IBCOM and ARCIBCOM are completely transparent to the user. The present system does not allow for the use of the Extended Error Handling Facility.

4. INITIAL

The user need never concern himself with this module. It is LOADed from MODLIB by the first call to the subroutine SYSTEM and stays in core during the entire run. This module LOADs SNIFF and BCDDS and executes each for the first time, thereby initializing the system. After it is finished with these tasks, it sets an indicator so that future executions of this module simply return. This is required because a PCM can LINK a PCM in the ARC System, and the second PCM called will also attempt to initialize the system.

5. SCAN and STUFF

SCAN and STUFF are TSMs that need not be discussed here; they are never called directly by a path or computation module. SCAN is called by BCDDS during its first execution; STUFF is called by BCDDS during its second and subsequent executions.

C. Important ARC System Tables

1. NAMES(89)

Declared "REAL*8". Used by the system utility subprograms and modules in conjunction with the array DSRN.

This array is initialized with the data set glossary names from the array DSNAME in the entry subprogram MAIN of the path control module when SYSTEM is called from that module.

2. DSRN(89)

Declared "INTEGER*4". This array is declared and used by the system utility subprograms and modules in conjunction with the array NAMES. The array DSRN contains the existence flags for the data sets contained in the array NAMES.

The initial value of each element of DSRN is 0. An element of DSRN is made nonzero under any of the following three conditions:

(a) If a glossary name on a data set name card in the data set initialization block of the path deck is equal to NAMES(J), then DSRN(J) is set to J+10 via the call to SYSTEM from the path control module.

(b) If a call to BCDDS results in the processing of a certain data block of the path data deck, and if the name of some sub-block within the data block is equal to NAMES(J), then DSRN(J) is set to J+10.

(c) If the "name" parameter in a call to SNIFF is equal to the element NAMES(J) of the array NAMES, and if the input parameter N2 in the call is 1 then DSRN(J) is set to J+10 via the call to SNIFF.

3. BLKNME(100)

This array in the module BCDDS holds the names of the blocks of data as they are encountered from the input stream. It is declared "REAL*8".

4. BLKDTA(3,100)

This array in the module BCDDS stores information about the blocks of data that were input on FT05F001. It is declared "INTEGER*2".

D. REUS - A Standalone Program in the ARC System

REUS is a program that marks a load module in MODLIB reusable. That is, if the module is brought into core by the LOAD SVC, it will stay in core until the ARC System run is over. Four modules in the ARC System must be reusable; they are:

```
ARCIBCOM
INITIAL
SNIFF
BCDDS.
```

A cataloged procedure ARCREUS is available so that REUS can be easily used.

The following Job Control Language will mark SNIFF for example, reusable.

```
// EXEC ARCREUS
//SYSIN DD *
SNIFF   0
/*
```

E. Summary of ARC System Modules and Subroutines

Figure 5 shows the characteristics of some of the named entities in the ARC System.

NAME	MODULE?	SUBR?	LANGUAGE†	INCLUDED IN	HOW NAME GETS EXECUTED	MODULES LOADED	MODULES LINKED	LINKed BY	REUSABLE (REUS)
ARCIBCOM	X		A		CALL FROM IBCOM				X
BCDDS		X	F	ALL MODULES	CALL		BCDDS		
BCDDS	X		F		LINK		SCAN, STUFF	PATHS	X
BPOINTER		X	F	SOME MODULES	CALL				
CLOSE		X	A	SOME MODULES	CALL				
IBCOM		X	A	ALL MODULES	CALL	ARCIBCOM			
INITIAL	X		F		LINK	BCDDS, SNIFF	BCDDS, SNIFF	SYSTEM	X
LINK		X	A	ALL MODULES	CALL				
LOAD		X	A	ALL MODULES	CALL				
OPENDS		X	A	SOME MODULES	CALL				
POINTR		X	A	SOME MODULES	CALL				
SCAN	X		F		LINK			BCDDS	
SNIFF		X	F	ALL MODULES	CALL		SNIFF		
SNIFF	X		F		LINK			ALL MODULES	X
SQUEZE		X	A	SOME MODULES	CALL				
STUFF	X		F		LINK			BCDDS	
SYSTEM		X	F	ALL MODULES	CALL	INITIAL	INITIAL		

†A = assembly language
F = Fortran

Fig. 5. Characteristics of System Modules and Subroutines of the ARC System

CHAPTER 4. THE SYSTEM MODULES AND SUBPROGRAMS OF THE ARC SYSTEM

I. Introduction

The purpose of this chapter is to provide complete documentation for the system codes of the ARC System. The final authority, however, is the code itself. In those cases where the listing is needed, the actual code will be presented.

II. Detailed Descriptions of the System Subroutines

A. LOAD and LINK

OS/360 has many useful macros that may be invoked only through the assembler. Thus, many useful system functions are denied the FORTRAN programmer.

Two of these macros, LOAD and LINK, allow a programmer to load and execute programs that are in OS/360 libraries. Use of LOAD and LINK eliminates the need for link-editing of all the code necessary to do a job. Code can be brought into core as needed and either be kept there permanently or overlaid when that part of the computation is finished.

Two assembly language subroutines will be presented here; they are named LINK and LOAD, and each invokes the macro of the same name. These subroutines can be called by FORTRAN programs; they are members of SOURCE and SEGLIB.

1. Subroutine LOAD

The FORTRAN statement

CALL LOAD (NAME)

gives access to the LOAD macro. NAME must be REAL*8 padded with blanks on the right, if necessary, and must be the name of a load module which is a member of an OS/360 library that is available to the JOB or STEP. The action of this macro depends on the following conditions:

a) The REUSability attribute of the NAME module,

b) The availability of a copy of NAME in core,

c) Whether or not the copy in core has been used.

Figure 6 gives the complete details for CALL LOAD (NAME).

ACTION \ STATUS OF NAME	REUS	NON-REUS	NAME NOT IN CORE	'NAME' IN CORE	
				UNUSED	USED
Load New Copy	X		X		
No Action	X			X	
No Action	X				X
Load New Copy		X	X		
No Action		X		X	
Load New Copy		X			X

Fig. 6. Attributes of Subroutine LOAD

2. Subroutine LINK

If Subroutine LINK is part of a load module, the FORTRAN statement

CALL LINK (NAME, list)

gives access to the LINK macro. NAME is REAL*8 padded on the right with blanks if necessary and list is a parameter list. This subroutine makes list available to the load-module NAME. The action of this macro depends on

a) The REUSable attribute of NAME

b) Whether or not NAME is already in core due to LOAD

c) Whether or not NAME has been executed.

Figure 7 gives the complete details for CALL LINK (NAME, parameter list).

ACTION \ STATUS OF NAME	REUS	NON-REUS	NAME LOADed	NAME NOT IN CORE	'NAME' IN CORE	
					UNUSED	USED
Load and Execute New Copy	X			X		
Execute	X		X		X	
Execute	X		X			X
Execute		X	X		X	
Load and Execute New Copy		X	X			X

Fig. 7. Attributes of Subroutine LINK

3. Use of LINK and LOAD

As stated in the introduction, the use of LINK and LOAD will allow the FORTRAN programmer to take advantage of dynamic loading. These subroutines are used extensively in the ARC System and have resulted in a flexible, easy-to-use environment.

Specifically, LOAD is used to place programs that are REUSable permanently into core. Such programs can be those that maintain tables. If DATA is a load-module that is useful to many programs that will be using core, and if DATA is REUSable,

```
CALL LOAD('DATA    ')
```

will place DATA permanently into high core. Any program in core that wants to interrogate or update tables in DATA can do so by

```
CALL LINK('DATA    ', parameter list) .
```

The use of these subroutines will allow a FORTRAN programmer to call in any load-module; a programmer can therefore call in a compiler or the linkage-editor. FORTRAN programs can be written to produce a FORTRAN program in source language, compile it, link-edit and execute it.

Only four modules are LOADed in the ARC System; they are ARCIBCOM, INITIAL, SNIFF and BCDDS.

4. Source Language for LOAD

The source listing is given in Figure 8.

5. Source Language for LINK

The source listing is given in Figure 9.

6. Restrictions on LOAD and LINK Under MFT and PCP

Under the OS/360 operating environments MFT and PCP, the LINK macro can load and execute any load-module that the linkage-editor will produce. If the load-module is larger than 512K bytes, trouble will occur because the LINK macro deletes at most 512K bytes after execution of the load-module. The next program to be LINKed may not have enough contiguous space to be loaded (System Completion Code 80A).

This problem does not exist under MVT.

7. The LINKAGE EDITOR and the Program REUS

The LINKAGE EDITOR will not mark a module REUSable, if a component of the module does not have the REUSable attribute. In order to ensure that a single copy of those modules which are LOADed (INITIAL, SNIFF, BCDDS and ARCIBCOM) is brought into core and remains throughout the run to be used by all succeeding modules, it is essential that LOADed modules be marked REUSable. As the LOADed modules do not have all of the attributes required by the linkage editor for REUSable load modules, it is not possible to use simple linkage editor control statements to make the modules REUSable. The program REUS is used instead to mark LOADed modules REUSable. No check is made by REUS to ensure that the modules satisfy any of the requirements of a REUSable load module.

B. SYSTEM, BCDDS and SNIFF

These subroutines are contained in the member SYSTEM of the libraries SOURCE and SEGLIB. They are strictly for the programmer's convenience as their functions are easily programmed in line. The actual code for each will be reproduced below.

```
MEMBER NAME  LOAD                                                    00000100
LOAD     CSECT                                                       00000200
*                                                                    00000300
*     LOAD ALLOWS A FORTRAN PROGRAM TO USE THE LOAD MACRO.           00000400
*     FULL DETAILS IN AMD T. M. #162                                 00000500
*                                                                    00000600
         PRINT GEN                                                   00000700
         SAVE  (14,12)                                               00000800
         BALR  2,0                                                   00000900
         USING *,2                                                   00001000
         ST    13,SAVEBLK+4                                          00001100
         LR    12,13                                                 00001200
         LA    13,SAVEBLK                                            00001300
         ST    13,8(12)                                              00001400
         L     3,0(1)                                                00001500
         MVC   LOADED+8(8),0(3)                                      00001600
LOADED   LOAD  EP=MODULE                                             00001700
RETURN   L     13,4(13)                                              00001800
         RETURN (14,12)                                              00001900
SAVEBLK  DC    18F'0'                                                00002000
         END   LOAD                                                  00002100
```

Fig. 8. Source Listing for Subroutine LOAD

```
MEMBER NAME  LINK                                                    00000100
LINK     CSECT                                                       00000200
         PRINT GEN                                                   00000300
         SAVE  (14,12)                                               00000400
         BALR  2,0                                                   00000500
         USING *,2                                                   00000600
         ST    13,SAVEBLK+4                                          00000700
         LR    12,13                                                 00000800
         LA    13,SAVEBLK                                            00000900
         ST    13,8(12)                                              00001000
         L     3,0(1)                                                00001100
         MVC   LNKMC+14(8),0(3)                                      00001200
         A     1,=F'4'                                               00001300
LNKMC    LINK  EP=MODULE                                             00001400
         S     1,=F'4'                                               00001500
RETURN   L     13,4(13)                                              00001600
         RETURN (14,12)                                              00001700
SAVEBLK  DC    18F'0'                                                00001800
         END   LINK                                                  00001900
```

Fig. 9. Source Listing for Subroutine LINK

1. SYSTEM

```
SUBROUTINE SYSTEM(DS)
REAL*8 DS(1)
CALL LOAD('INITIAL ')
CALL LINK('INITIAL ',DS)
RETURN
END
```

2. BCDDS

```
SUBROUTINE BCDDS(NAME,N)
REAL*8 NAME
CALL LINK('BCDDS   ',NAME,N)
RETURN
END
```

3. SNIFF

```
SUBROUTINE SNIFF(DSNAME,N,IRW)
REAL*8 DSNAME(1)
CALL LINK('SNIFF   ',DSNAME,N,IRW)
RETURN
END
```

4. Special Features

Path control modules require the functions provided by these subroutines. Note that the first executable statement of a PCM is normally

```
CALL SYSTEM(DSNAME)
```

where DSNAME is a REAL*8 array of dimension 89 containing the data set names to be used by the path.

5. Error Messages

These subprograms produce no error messages but the LINK and LOAD invoked by their execution might.

C. Subroutine SQUEZE(WORD,N)

1. Parameters

WORD	REAL*8	DIMENSION N
N	INTEGER*4	

If N is missing, it is assumed to be 1.

2. Description

SQUEZE is an assembler language routine that squeezes blanks out of a string of word(s). The string is left-adjusted with blank fill. It can be included from SEGLIB.

3. Source Language for SQUEZE

The source listing is given in Fig. 10.

D. Subroutine IHCFIOSH

A detailed description of IHCFIOSH is beyond the scope of this volume and unncessary. It is the only OS/360 manufacturer-supplied code that is modified for use in the ARC System. IHCFIOSH had to be modified because it performs the OS/360 macro GETMAIN for core in which to place data control blocks (DCB). When buffers were already in core, this caused core fragmentation because the DCB's could remain in core after the buffers were released. Thus the RSM ARCIBCOM performs the OS/360 macro GETMAIN for 8192 bytes (four 2048 byte blocks) in sub-pool 3 and then makes available 2032 bytes out of each 2048 byte block. This leaves 8128 bytes free and permanently in core at a high address. IHCFIOSH has been changed so that it does its GETMAINs from sub-pool 3. This change only involved 2 cards (in release 17 of OS/360). The specific changes are that card 7320 and card 13230 of the IHCFIOSH macro become respectively

```
NEWGETMN GETMAIN R,LV=164,SP=3                    00007320
```

and

```
NEWFREMN FREEMAIN R,LV=164,SP=3                   00013230
```

The new IHCFIOSH is assembled with the new IHCFIOSH macro called by the following code

```
         GBLA   &ERR
&ERR     SETA
         IHCFIOSM
         END
```

E. Subroutine IBCOM

1. Description

(a) Purpose

The FORTRAN compiler generates calls to entry points in the FORTRAN I/O package. Any module written in FORTRAN, that is to be executed must have resolved these entry points. One method for doing this is to

```
MEMBER NAME  SQUEZE                                                    00000100
SQUEZE START C                                                         00000200
       ENTRY SQUEZE                                                    00000300
        USING *,15                                                     00000400
       BC      15,12(15)                                               00000500
       DC      XL1'7'                                                  00000600
       DC      CL7'SQUEZE '                                            00000700
       STM     14,8,12(13)                                             00000800
       L       4,CNE                                                   00000900
       L       2,0(1)                                                  00001000
       LTR     2,2                                                     00001100
       BC      4,CNLY                                                  00001200
       L       3,4(1)                                                  00001300
       L       3,0(3)                                                  00001400
SIX    MVC     B,0(2)                                                  00001500
       LA      6,C-1                                                   00001600
       L       7,ATE                                                   00001700
       MVC     C,B+8                                                   00001800
       LA      5,B                                                     00001900
AGAN   TM      0(5),X'BF'                                              00002000
       BC      5,STEST                                                 00002100
       TM      0(5),X'40'                                              00002200
       BC      8,STEST                                                 00002300
TOAD   AR      5,4                                                     00002400
       BCT     7,AGAN                                                  00002500
       MVC     0(8,2),C                                                00002600
       A       2,ATE                                                   00002700
       BCT     3,SIX                                                   00002800
       LM      2,8,28(13)                                              00002900
       MVI     12(13),X'FF'                                            00003000
       BCR     15,14                                                   00003100
STEST  AR      6,4                                                     00003200
       MVC     0(1,6),0(5)                                             00003300
       BC      15,TOAD                                                 00003400
CNLY   LR      3,4                                                     00003500
       BC      15,SIX                                                  00003600
ATE    DC       F'8'                                                   00003700
CNE    DC      F'1'                                                    00003800
B      DS      CL8                                                     00003900
       DC      CL8'        '                                           00004000
C      DS      CL8                                                     00004100
       END                                                             00004200
```

Fig. 10. Source Listing for Subroutine SQUEZE

link-edit the FORTRAN I/O routines into every load module in the system. This is wasteful of core (the I/O package is about 16,000 bytes long) since several ARC modules can be in core at once and this may lead to problems of core fragmentation.

An alternative approach is to have a resident I/O module (ARCIBCOM) that is LOADed at the beginning of the run and a small subroutine (IBCOM), containing all of the entry points generated by the compiler, included in each module. IBCOM must be part of any module in the ARC System which has I/O activity except for ARCIBCOM.

IBCOM has several functions:

(i) to LOAD ARCIBCOM into core if ARCIBCOM is not already loaded;

(ii) to find ARCIBCOM if ARCIBCOM is already in core;

(iii) to trap I/O requests and substitute the proper addresses into I/O instructions.

2. FORTRAN I/O

Some knowledge of the FORTRAN I/O philosophy is necessary to understand IBCOM and ARCIBCOM. The following discussion concerns IBCOM# in the FORTRAN I/O package, NOT IBCOM in the ARC System.

The FORTRAN compiler generates I/O initialization and I/O termination coding at the beginning and end of main programs. These instructions are placed before the first executable FORTRAN statement and with the RETURN coding; they are used by ARCIBCOM to decide when modules are terminating and when the path has terminated.

Since most I/O is sequential and since IBCOM# is the entry point for sequential I/O, most calls to the I/O package are of the form,

L	15,=A(IBCOM#)	load register 15 with the address of IBCOM#
BAL	14,D(15)	store the address of the next instruction in register 14 (for return of parameter purposes) and branch to a location D bytes past IBCOM#

The location IBCOM# is the first location in a transfer vector that transfers the request to the appropriate portions of the I/O package. IBCOM# starts as follows:

```
IBCOM#   BC    15,FRDWF      Main entry formatted read
         BC    15,FWRWF      Main entry formatted write
         BC    15,FIOLF      Secondary entry, I/O list item
         BC    15,FIOAF      Secondary entry, I/O list array
         BC    15,FENDF      Final entry, end of I/O list
         BC    15,FRDNF      Main entry, non-formatted read
         BC    15,FWRNF      Main entry, non-formatted write
         BC    15,FIOLN      Secondary entry, I/O list item
         BC    15,FIOAN      Secondary entry, I/O list array
         BC    15,FENDN      Final entry, end of I/O list
         BC    15,RBKSP      Backspace tape
         BC    15,FRWND      Rewind tape
         BC    15,FEORN      Write tape mark
         BC    15,FSTOP      Stop subroutine
         BC    15,FPAUS      Pause subroutine
         BC    15,IBFERR     Execution error monitor
         BC    15,IBFINT     Interruption processor
         BC    15,IBEXIT     Job termination
```

Since these instructions are all 4 bytes long,

```
L       15,=A(IBCOM#)
BAL     14,24(15)
```

causes control to transfer to the 7th instruction in IBCOM#. This instruction is an unconditional branch to FWRNF, where code is stored to initiate an unformatted write. Two entries are of interest here: D=64 and D=68. If D=64 we see that the initialization section is entered and if D=68, the termination phase is entered.

The subroutine IBCOM simply traps the I/O requests and passes them to the module ARCIBCOM. ARCIBCOM must contain code to allow only one 68 and one 64 displacement to enter the I/O package.

3. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 11.

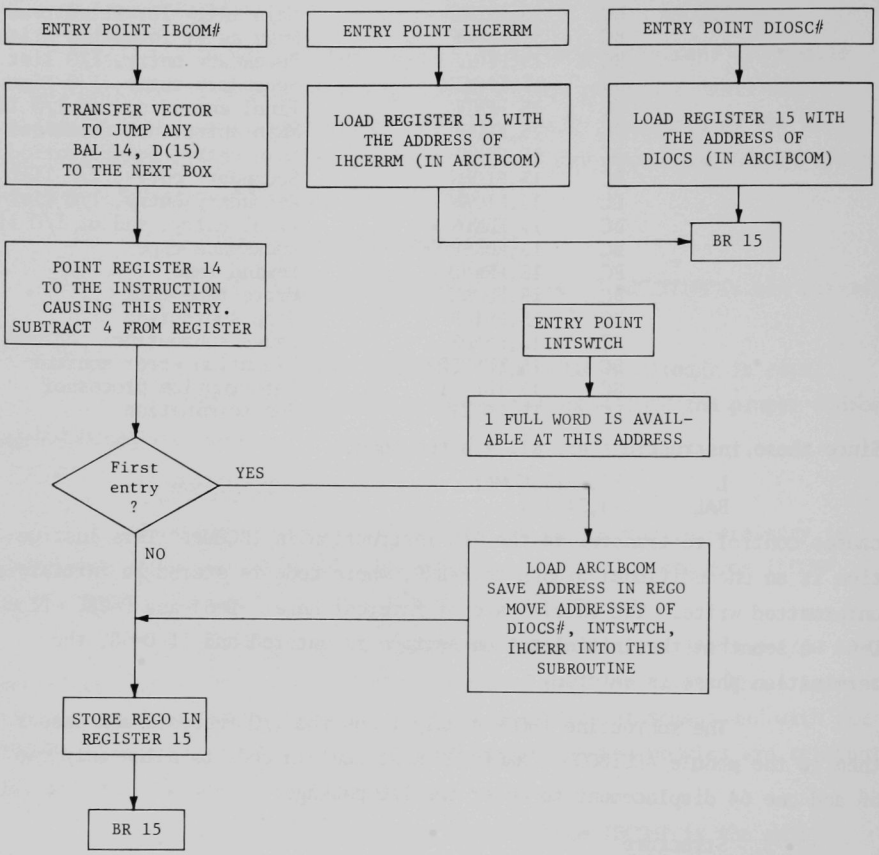


Fig. 11. Flowchart for Subroutine IBCOM

(b) Description of Flowchart

The entry point to IBCOM is IBCOM# (because the compiler generates this symbol). Actual entry is to IBCOM#+4N where N = 0,1...,17. Each of these locations contains the same instruction

```
B        IBCOM#+74                BRANCH TO BYTE 74
```

A test is made to see if this is the first time that this module has been entered. If this is the first entry, the RSM ARCIBCOM is LOADed. If ARCIBCOM is already in core, the address of its entry point is returned in register 0 and stored in location REG0. If ARCIBCOM is not in core, the library specified in the JOBLIB data definition statement is searched for ARCIBCOM which is then brought into core. As in the previous case register 0 contains the entry point.

In any event, this module traps all I/O calls and ensures that ARCIBCOM is in core. Control then passes to ARCIBCOM.

The remainder of the external symbols that are generated by the FORTRAN compiler are handled more simply. When ARCIBCOM is executed for the first time, a table of entry point addresses is filled in. The subroutine IBCOM can reference this table and transfer to the addresses in it.

4. Error Messages

There are no error messages generated by this subroutine.

5. Listing of IBCOM

The listing for IBCOM is shown in Fig. 12.

6. Restriction

The IBCOM/ARCIBCOM combination in use does not currently allow the Extended Error Handling Facilities to be used.

F. Subroutine SHIFT(WORD)

1. Parameters

WORD is an 80 character string or a one-dimensional array totaling 80 characters.

```
MEMBER NAME  IBCOM                                                      00000100
IBCOM#   CSECT                                                          00000200
         ENTRY IHCERRM                                                  00000300
         ENTRY DIOCS#                                                   00000400
         ENTRY INTSWTCH                                                 00000500
         USING *,15                                                     00000600
         B     PROLOGUE                                                 00000700
         B     PROLOGUE                                                 00000800
         B     PROLOGUE                                                 00000900
         B     PROLOGUE                                                 00001000
         B     PROLOGUE                                                 00001100
         B     PROLOGUE                                                 00001200
         B     PROLOGUE                                                 00001300
         B     PROLOGUE                                                 00001400
         B     PROLOGUE                                                 00001500
         B     PROLOGUE                                                 00001600
         B     PROLOGUE                                                 00001700
         B     PROLOGUE                                                 00001800
         B     PROLOGUE                                                 00001900
         B     PROLOGUE                                                 00002000
         B     PROLOGUE                                                 00002100
         B     PROLOGUE                                                 00002200
         B     PROLOGUE                                                 00002300
         B     PROLOGUE                                                 00002400
         DC    X'00'                OVERFLOW/UNDERFLOW INDICATOR        00002500
         DC    X'00'                DIVIDE CHECK INDICATOR              00002600
PROLOGUE STM   0,2,SA                SAVE REGISTERS                      00002700
         DROP  15                                                       00002800
         BALR  2,0                  SET UP BASE REGISTER                00002900
         USING *,2                                                      00003000
         LA    14,0(14)             CLEAR INSTRUCTION LENGTH BITS       00003100
         S     14,=F'4'             POINT TO BALR INSTRUCTION           00003200
         CLI   FLAG1,1              FIRST TIME THROUGH ?                00003300
         BE    NOLOAD               BRANCH IF NOT                       00003400
LOAD     LOAD  EP=ARCIBCOM          LOAD FORTRAN I/O PACKAGE            00003500
         ST    0,REGO                                                   00003600
         LR    1,0                                                      00003700
         S     1,=F'8'              POINT TO ERRMON & DIOCS ADDRESSES   00003800
         LM    0,1,0(1)             LOAD ADDRESSES                      00003900
         STM   0,1,ERRMONAD         STORE LOCALLY                       00004000
         MVI   FLAG1,1              TURN FLAG ON                        00004100
NOLOAD   LM    15,2,REGO                                                00004200
         BR    15                                                       00004300
         DROP  2                                                        00004400
```

Fig. 12. Source Listing for Subroutine IBCOM

```
         USING *,15                                          00004500
IHCERRM  L     15,ERRMONAD                                   00004600
         BR    15                                            00004700
         USING *,15                                          00004800
DIOCS#   L     15,DIOCSAD                                    00004900
         BR    15                                            00005000
REGO     DS    F                                             00005100
SA       DS    3F                                            00005200
INTSWTCH DC    F'0'                                          00005300
FLAG1    DS    0X                                            00005400
ERRMONAD DC    2A(0)                                         00005500
DIOCSAD  EQU   ERRMONAD+4                                    00005600
         END                                                 00005700
```

Fig. 12 (Contd.)

2. Description

WORD is shifted one character to the right and a blank is inserted into byte 1. The subroutine is used to aid in decoding the input control cards and only appears in the module SCAN.

3. Listing

The listing for this subroutine is shown in Fig. 13.

G. Subroutine CLOSE

1. Description

CLOSE makes a call to FIOCS# for the purpose of closing all sequential data sets. The address of FIOCS# is stored in the RSM ARCIBCOM and is known when the address of the entry point to ARCIBCOM is known.

2. Listing

The listing for this subroutine is shown in Fig. 14.

H. Subroutine OPENDS(I,IA)

1. Parameters

```
I        INTEGER*4
IA       INTEGER*4          DIMENSION I
```

2. Description

OPENDS is invoked by the Fortran statement

CALL OPENDS (I,IA)

where I is an integer variable and IA an integer array. Prior to calling OPENDS, I should be initialized to the maximum dimension of the array IA. On return from OPENDS:

(i) If the number of open data sets is less than or equal to the dimension of IA, then I is set equal to the number of open data sets and IA contains the data set reference numbers of these data sets.

(ii) If the number of open data sets is greater than the dimension of IA, then I is set equal to the negative of this dimension and the array IA contains the data set reference numbers of -I open data sets. After closing the I open data sets, OPENDS can be called again to obtain the data set reference numbers of the remaining open data sets. OPENDS is a member of SEGLIB.

```
MEMBER NAME  SHIFT                                                    00000100
SHIFT    CSECT                                                        00000200
         SAVE  (14,12)                                                00000300
         BALR  2,0                                                    00000400
         USING *,2                                                    00000500
         ST    13,SAVE+4                                              00000600
         LR    12,13                                                  00000700
         LA    13,SAVE                                                00000800
         ST    13,8(12)                                               00000900
         L     3,0(1)                                                 00001000
         MVC   BUFF(80),0(3)                                          00001100
         MVC   1(79,3),BUFF                                           00001200
         MVI   0(3),C' '                                              00001300
         L     13,4(13)                                               00001400
         RETURN (14,12)                                               00001500
SAVE     DC    18F'0'                                                 00001600
BUFF     DS    80C                                                    00001700
         END   SHIFT                                                  00001800
```

Fig. 13. Source Listing for Subroutine SHIFT

```
MEMBER NAME  CLOSE                                                      00000100
CLOSE    INOUT                                                          00000200
         LOAD   EP=ARCIBCOM                                             00000300
         LR     R1,R0                                                   00000400
         S      R1,=F'12'                                               00000500
         L      R1,0(R1)                                                00000600
TRYAGN   BALR   R0,R1                                                   00000700
         DC     AL1(4)                                                  00000800
         DC     AL1(0)                                                  00000900
         B      TRYAGN                                                  00001000
         B      RETURN                                                  00001100
         END                                                             00001200
```

Fig. 14. Source Listing for Subroutine CLOSE

3. Flowchart

The flowchart for this subroutine is shown in Fig. 15.

4. Error Messages

There are no error messages given by OPENDS.

I. BPOINTER, A Dynamic Storage Allocation Program

1. Description of Subroutine Package

BPOINTER is a FORTRAN subroutine package which was developed to alleviate bookkeeping chores associated with the use of dynamic storage allocation techniques.

The potential user should be aware that the use of dynamic storage in FORTRAN requires structuring programs in subroutine form. A small control routine is used to define a large block of storage (called the container array*), and make the appropriate calls to BPOINTER to control the allocation of storage within this block. Calls to calculational subroutines transmit pointers corresponding to appropriate array locations through the calling sequences.

The BPOINTER package has been written from a pseudo-language point of view. That is, all BPOINTER capabilities are accessed through an appropriate call to an entry point, subroutine, or function subprogram in BPOINTER. The following capabilities are available in the BPOINTER system:

(a) Storage of data in and retrieval of data from the container array, via user defined variable arrays.

(b) Purge of variable arrays stored in the container array.

(c) Automatic "cleanup" of the container array when more storage is required.

(d) Re-definition of array SIZES without loss of data already stored in the array.

---

*BPOINTER has the capability of extending the container to LCS as well as controlling the fast memory.

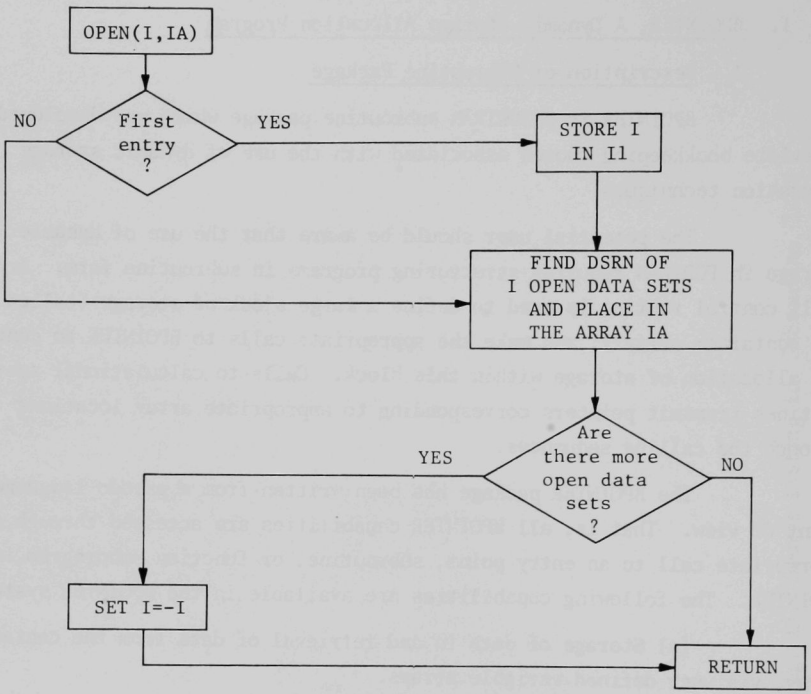


Fig. 15. Flowchart for Subroutine OPENDS

(e) Array dump of selected integer, floating point or BCD arrays in a prescribed format.

(f) Trace dumps of BPOINTER activities.

(g) Status reports of the BPOINTER tables.

The BPOINTER subroutine package currently requires a core storage of 2539_{10} REAL*8 words. This does not include the assembly language routines LOCF, FREE1, FREE2, ALLOC1 and ALLOC2 which require an additional 89_{10} REAL*8 words.

2. BPOINTER Usage

A detailed description of the functions and tasks of the BPOINTER package is presented in the description of each of the subprograms of the package given in section 4 below and by means of the flowchart in section 3. The subroutine POINTR described in 4.8, in particular, contains a discussion of most of the important entries for the package.

The trivial example listed in Fig. 16 is intended to provide the user with an orientation as to the structuring of programming when using the BPOINTER package.

Table I lists the important entry points in the BPOINTER package. These are all described in greater detail in the various subprogram descriptions in section 4 below.

3. Description of Structure

(a) Subroutine Flowchart

The flowchart for the BPOINTER subprograms is shown in Fig. 17.

(b) Description of Flowchart

Routines on the first level of flow are all subroutine entry points to BPOINTER called from the user control routine.

POINTR is the initialization routine which calls ALLOC1 and ALLOC2 to set up bulk and fast memory, respectively. This entry clears the container array and passes its address to the subroutines PURGE and REDEF via the entry points PRGSET and REDSET.

```
C     TRIVIAL EXAMPLE OF THE USE OF THE BPOINTER PACKAGE
C
      REAL*8 BLK(1),FLUX,POWER
C
C     DEFINE UNIQUE NAMES FOR ARRAYS FLUX AND POWER
C
      DATA FLUX/6HFLUX  /,POWER/6HPOWER /
C
C     DEFINE SIZE OF BULK AND MAIN CORE CONAINERS
C
      BLKCOR=125000
      FSTCOR=60000
C
C     INITIALIZE BULK CORE AND BPOINTER TABLES
C
      CALL BULK(BLKCOR)
      CALL POINTR(BLK,FSTCOR,0)
C
      NINT=100
      NGROUP=30
      NWDS=NINT*NGROUP
C
C     RESERVE SPACE FOR ARRAYS FLUX AND POWER IN CONTAINER AND ASSIGN
C     ASSOCIATED UNIQUE POINTERS IFLUX AND IPOWER
C
      CALL PUTM(FLUX,NWDS,8,IFLUX)
      CALL PUTM(POWER,NINT,8,IPOWER)
C
C     CHECK FOR ERROR IN BPOINTER
C
      IF (IPTERR(DUMMY).GT.0) CALL ERROR
C
C     CALL SUBROUTINE SETUP TO INITIALIZE ARRAYS FLUX AND POWER
C
      CALL SETUP(BLK(IFLUX),BLK(IPOWER),NINT,NGROUP)
      .
      .
C
C     FREE SPACE IN MAIN AND BULK CORE
C
      CALL FREE
C
      RETURN
      END
```

Fig. 16. Example of the Use of the BPOINTER Package

```
C
C     IN SUBROUTINE SETUP, ARRAYS FLUX AND POWER HAVE THE LOCAL NAMES
C     FRD1 AND PNTPWR
C
      SUBROUTINE SETUP(FRD1,PNTPWR,NINT,NGROUP)
      REAL*8 FRD1,PNTPWR
      DIMENSION FRD1(NINT,1),PNTPWR(1)
      DO 10 K=1,NGROUP
      DO 10 J=1,NINT
      FRD1(J,K)=1.0
   10 CONTINUE
      DO 20 J=1,NINT
      PNTPWR(J)=100.
   20 CONTINUE
      RETURN
      END


      SUBROUTINE ERROR
      PRINT 1000
 1000 FORMAT(1H1,16H ERROR IN POINTR)
      STOP
      RETURN
      END
```

Fig. 16 (Contd.)

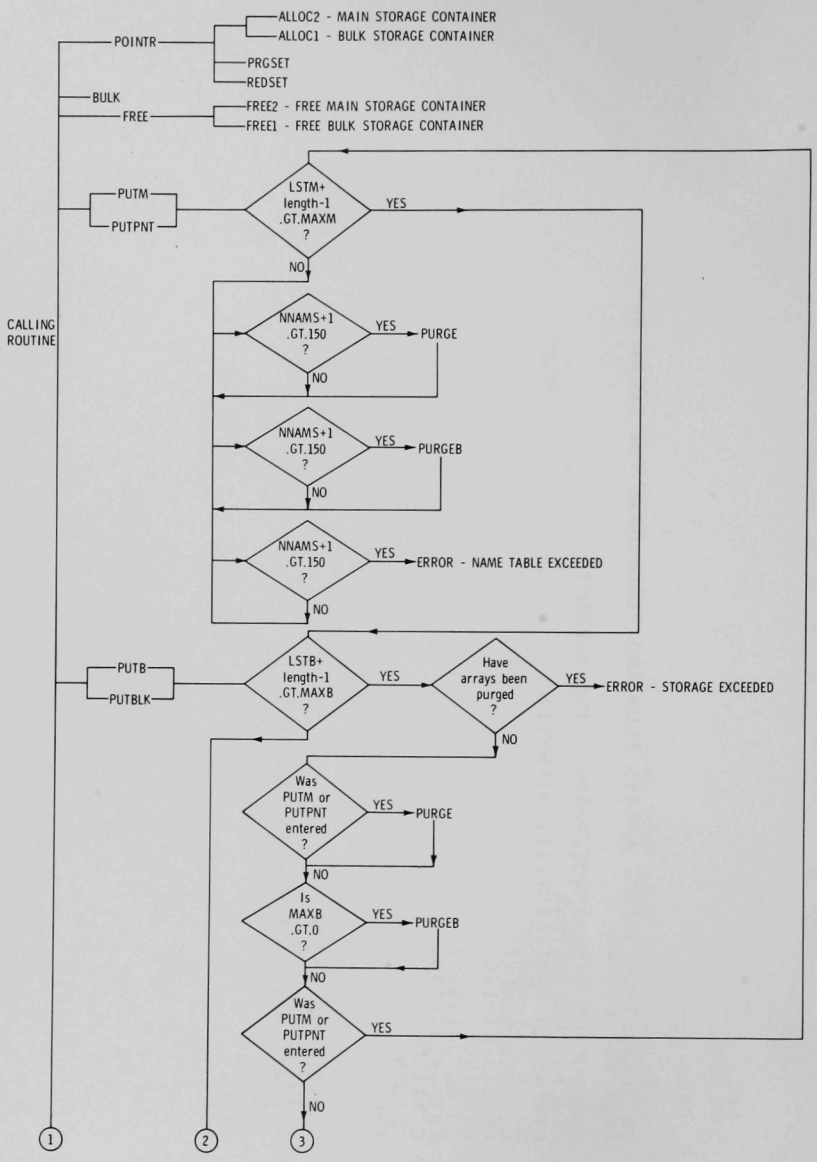


Fig. 17. Flowchart of BPOINTER Package

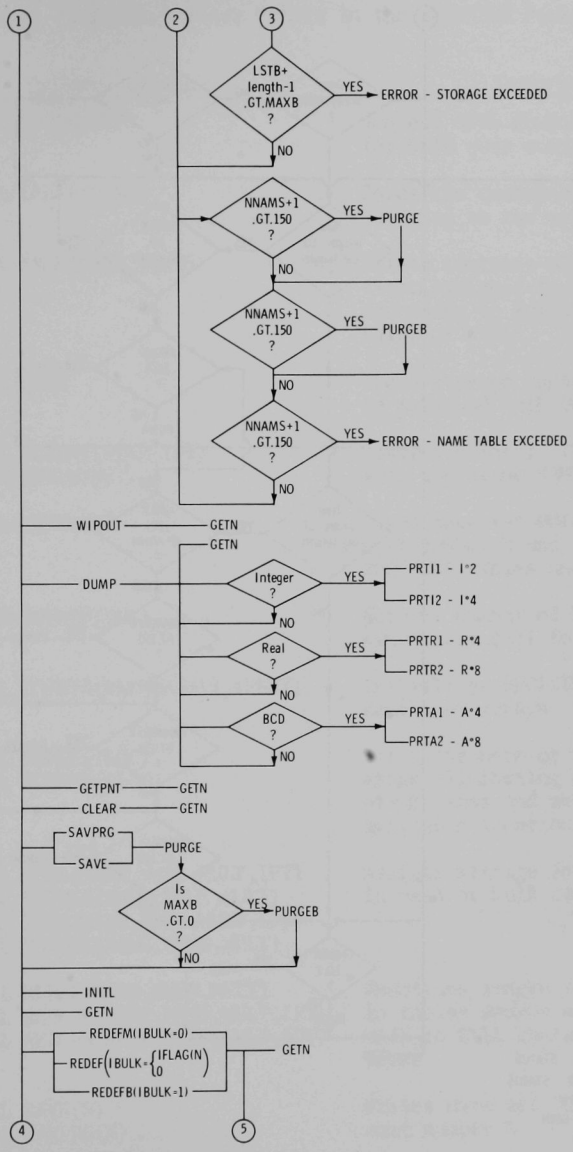


Fig. 17. Flowchart of BPOINTER Package (Contd.)

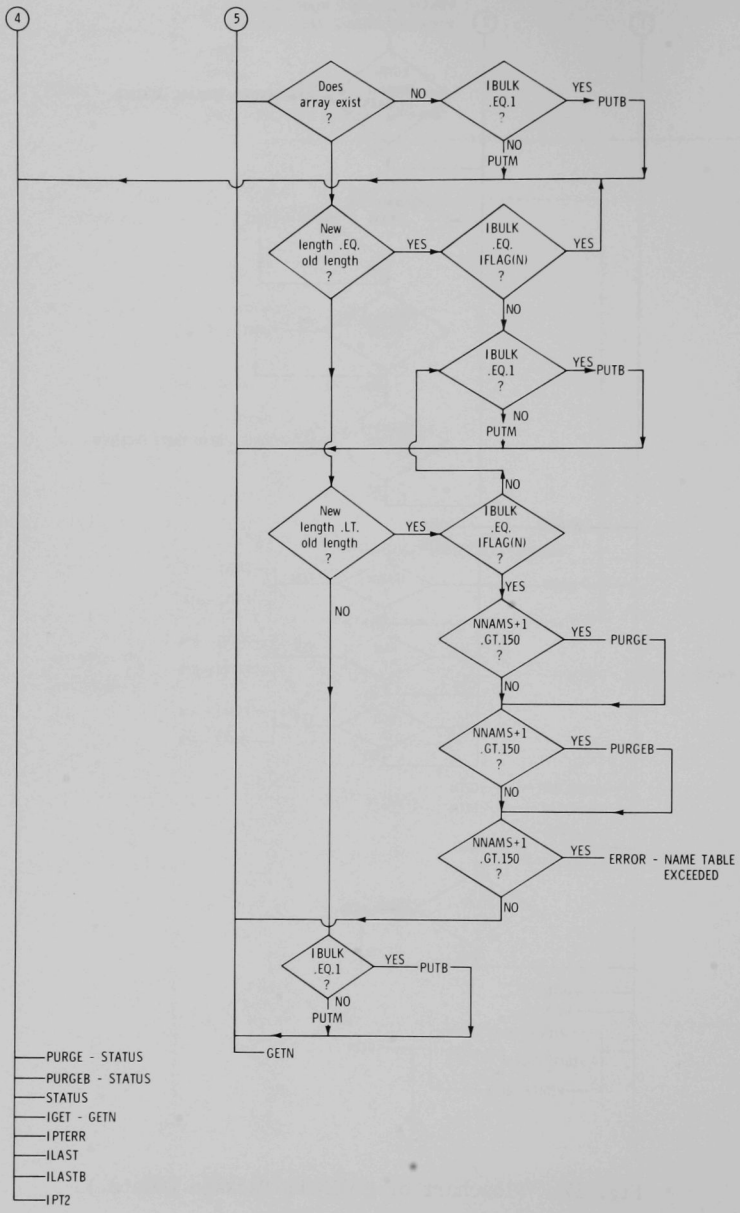


Fig. 17. Flowchart of BPOINTER Package (Contd.)

Table I. Important Entry Points in the BPOINTER Package

Entry Point	Calling Sequence	Description
BULK	CALL BULK(NWDS)	Request NWDS double precision words for bulk core container
CLEAR	CALL CLEAR(NAME)	Zeros the container locations assigned to the array NAME.
DUMP	CALL DUMP(NAME,KIND)	Prints contents of container locations assigned to the array NAME according to format dependent on value of KIND
FREE	CALL FREE	Frees storage locations allocated to main and bulk container arrays
GETPNT IGET	CALL GETPNT(NAME,IPT) IPT=IGET(NAME)	Returns pointer, IPT, associated with the array NAME
INITL	CALL INITL(N)	Reads data set POINTR from logical unit number N and initializes BPOINTER tables and arrays
IPTERR	IERR=IPTERR(DUM)	Returns number of BPOINTER errors since last call to IPTERR
POINTR	CALL POINTR(BLK,MAXSIZ,IPRNT)	Initializes BPOINTER tables and container arrays
PURGE PURGEB	CALL PURGE(ILOC) CALL PURGEB(ILOC)	Sifts the main or bulk container array eliminating storage of blank names and returns first available location in container
PUTB PUTBLK PUTM PUTPNT	CALL PUTB(NAME,NWDS,MULT,IPT) CALL PUTBLK(NAME,NWDS,MULT) CALL PUTM(NAME,NWDS,MULT,IPT) CALL PUTPNT(NAME,NWDS,MULT)	Assigns storage for array NAME in main or bulk container array
REDEF REDEFM REDEFB	CALL REDEF(NAME,NWDS,MULT) CALL REDEFM(NAME,NWDS,MULT,IPT) CALL REDEFB(NAME,NWDS,MULT,IPT)	Redefines length of array NAME in tables and/or moves array from MAIN to BULK container or vice versa
SAVE SAVPRG	CALL SAVE(N) CALL SAVPRG(N)	Writes data set POINTR on logical unit number N
WIPOUT	CALL WIPOUT(NAME)	Replaces array NAME in BPOINTER name tables by blanks
IPT2	IPT=IPT2(IA,N4,N8)	Returns pointer IPT associated with a subarray N4 four byte words and N8 eight byte words into the array which has pointer IA.

BULK is an entry to reset the size of the BULK container array. BPOINTER assumes a BULK container size of 100000 double precision (REAL*8) words unless changed via this call. Logically, a call to BULK must precede the call to POINTR in the user's program.

The entry FREE releases the fast and bulk container arrays when the user's program is complete. A call to FREE is essential if a path is being executed and other modules are to follow so that the core space is available for the new modules and their containers.

PUTPNT and PUTM record variable names in the BPOINTER tables and allocate space in the container array provided that sufficient space is available. PUTPNT and PUTM will first attempt to allocate space in fast memory. If sufficient space is not available an attempt is made to allocate the array in bulk memory. If sufficient space is not available in bulk memory either, a call to PURGE and PURGEB is executed to eliminate arrays which have been "wiped out" previously via a call to WIPOUT. An attempt is then made to allocate the array in fast memory and if sufficient space is not available, in bulk memory. A call to PUTBLK or PUTB differs from the above only in that no attempt is made to allocate the array in fast memory. If sufficient space is not available in bulk memory after calling PURGEB, an error condition is indicated. PUTM and PUTB differ from PUTPNT and PUTBLK respectively, only in that the array pointer is returned via the entry arguments in the former and not in the latter.

WIPOUT extracts the array name number in the BPOINTER tables (via a call to GETN) and sets the name in the table to blanks. This blank name is then a signal to PURGE (or PURGEB) to eliminate storage reserved for this name in the container when more storage is required.

DUMP extracts the desired array pointer from the BPOINTER tables and calls the appropriate print routine.

GETPNT and IGET extract the desired array pointer from the BPOINTER tables and return it to the calling program.

CLEAR sets all variables allocated to the desired array to zero.

REDEF, REDEFM and REDEFB change the storage allocation for the desired array. If the array is not present in the BPOINTER tables, this call is equivalent to a call to PUTPNT, PUTM or PUTB respectively. If the name exists, then these routines may be used to change the size of the array and/or move the array from main to bulk core or vice versa. A call to REDEFM will attempt to allocate the new array in main core and if space is not available will attempt to allocate the new array in bulk core. A call to REDEFB will attempt to allocate the new array only in bulk core. A call to REDEF will attempt to allocate the new array in the same portion of core (main or bulk) as the old array. However, if the length of the new array is greater than the old, and the old array is in main core, then REDEF will try to allocate the new array in bulk core if not enough space is available in main core.

PURGE and PURGEB eliminate storage assigned to "blank" array names in fast and bulk memory, respectively.

STATUS prints the status of the BPOINTER tables on the standard output device.

IPTERR returns a non-zero flag if an error has occurred in any of the BPOINTER activities.

ILAST and ILASTB returns the pointer of the first available location in the container arrays in fast and bulk memory, respectively.

IPT2 returns the pointer associated with a subarray within a named array for which storage has previously been assigned. The pointer returned from IPT2 is with reference to a REAL*4 array which must be equivalenced in the user's program with the REAL*8 container array. This is necessary to avoid boundary allignment errors.

4. BPOINTER Subprogram Descriptions

This section contains descriptions of all subprograms which are part of the BPOINTER package.

Each subprogram description begins with a listing of the calling sequence of the subprogram and its entry points. Subsection (a) is a list of the arguments of the subprogram and its entry points, in order of appearance, with the type of each argument, its dimensions in the subprogram if it

is an array, and its definition or use. The four types of variables used are I*2, denoting an integer halfword (16 bits); I*4, denoting an integer fullword (32 bits); R*4, denoting a floating-point fullword; and R*8, denoting a floating-point doubleword (64 bits).

Subsection (b) contains the names of all common blocks used by the subprogram. Each is followed by a list of the variables used from the common block within the subprogram together with their types and definitions. The dimension, if any, follows the variable name in parentheses.

Subsection (c) contains a listing of important variables which are local to the subprogram, in a format like that of subsection (b).

Subsection (d) describes the functions performed by the subprogram.

Subsection (e) lists all subprograms called by the subprogram or any of its entry points, and subsection (f) lists the subprograms that call the subprogram or any of its entry points.

4.1 ALLOC$ (R,N)

Entry Points: ALLOC1(IR,N)
ALLOC2(IR,N)
FREE1(ILOC,M)
FREE2(ILOC,M)

(a) Arguments

Name	Type	Dimension	Definition
IR	I*4	--	A return code: IR = 1 Bulk core allocated IR = 2 MAIN core allocated IR < 0 No core allocated
N	I*4	--	Number of four byte words to be allocated
ILOC	I*4	--	The starting address of previously allocated
M	I*4	--	The number of four byte words in the block
ALLOC$	I*4	--	The address of allocated memory in either MAIN or BULK core
ALLOC1	I*4	--	The address of allocated memory in BULK core
ALLOC2	I*4	--	The address of allocated memory in MAIN core

(b) Common Blocks

None

(c) Local Variables

See listing

(d) Functions and tasks performed by subprogram

ALLOC$ and its associated entry points is an assembly language subprogram which may be used to allocate and free both main and bulk core by use of Fortran or PL/I calling sequences. A complete description of the subprogram is given in Reference 10. In this section only the use of the subprogram made by BPOINTER will be described.

i) Allocating MAIN and BULK Core

The location of the main and bulk core container arrays is obtained dynamically at run time via calls to ALLOC1 and ALLOC. The calling sequence

```
ILOCM = ALLOC2(IERR,2*MAXM)
ILOCB = ALLOC1(IERR,2*MAXB)
```

allocates MAXM double precision (R*8) words in main core (subpool 2), and MAXB double precision words in bulk core (subpool 1). The respective addresses in core are ILOCM and ILOCB and ALLOC1, ALLOC2 must be declared integer in the calling routine. If core cannot be allocated ILOCM and/or ILOCB are zero on return to the calling program.

ii) Freeing Container Arrays

The storage allocated in subpools 1 (BULK) and 2 (MAIN) are deallocated by use of the calling sequence

```
CALL FREE2(ILOCM,2*MAXM)
CALL FREE1(ILOCB,2*MAXB)
```

A module must always free the storage reserved for its container arrays prior to returning control to the calling module so that the core space is available for the container arrays of modules called into core at a later point in the calculation.

(e) Subprograms called by this subprogram

See listing.

(f) Subprograms calling this subprogram

POINTR
FREE

(g) Assembler language listing of ALLOC$

The listing is given in Fig. 18.

4.2 GETN (NAM1,N)

(a) Arguments

Name	Type	Dimension	Definition
NAM1	R*4	(2)	The eight character name of the array to be extracted from the BPOINTER tables
N	I*4	--	The index in the BPOINTER tables of the array corresponding to NAM1

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
IPRINT	I*4	--	Print flag: 0 - no print 1 - dumps only 2 - trace only 3 - dumps and trace

/TABLES/

Name	Type	Dimension	Definition
NAMLST	R*8	150	The list of array names stored in the container
NNAMS	I*4	--	The number of names stored in the BPOINTER tables

```
Z071      TITLE 'AN Z071S  FORTRAN CORE ALLOCATOR  ** VERSION 1.0 **'     00000100
********                    *********                          ********  00000200
********                                                                 00000300
********          THIS ROUTINE ALLOWS A FORTRAN PROGRAM TO DYNAMICLY     00000400
********      ALLOCATE AND FREE BOTH MAIN (HIGH-SPEED) AND BULK (LOW-    00000500
********      SPEED) MEMORY DURING PROGRAM EXECUTION.                    00000600
********                                                                 00000700
********       TO ALLOCATE CORE:                                         00000800
********                                                                 00000900
********                ALLOC$              EITHER BULK OR MAIN          00001000
********          ILOC = ALLOC1 (R,N)       BULK ONLY                    00001100
********                ALLOC2              MAIN ONLY                    00001200
********                                                                 00001300
********          THE ADDRESS OF ALLOCATED MEMORY IS THE VALUE RETURN    00001400
********          ED BY THE FUNCTICN; ZERO IS RETURNED IF NO MEMORY      00001500
********          IS ALLOCATED.                                          00001600
********                                                                 00001700
********          THE PARAMETERS ARE:                                    00001800
********               R -  THE RETURN CODE IS PLACED IN R               00001900
********                    VALUES ARE 1 (BULK)  2 (MAIN)                00002000
********                    R IS NEGATIVE IF NO ALLOCATION WAS MADE      00002100
********               N -  THE NUMBER OF 4-BYTE WORDS TO BE             00002200
********                    ALLOCATED.                                   00002300
********                                                                 00002400
********       TO FREE CORE:                                             00002500
********                                                                 00002600
********               FREE1                BULK                         00002700
********          CALL FREE2 (ILOC,N)       MAIN                         00002800
********                                                                 00002900
********          THE PARAMETERS ARE:                                    00003000
********               ILOC -  THE STARTING ADDRESS OF PREVIOUSLY        00003100
********                       ALLOCATED MEMORY                          00003200
********               N    -  THE NUMBER OF 4-BYTE WORDS IN THE         00003300
********                       BLOCK                                     00003400
********                                                                 00003500
********          *NOTE*       PARAMETERS TO FREE MAY BE GROUPED,E.G.,   00003600
********                  CALL FREE1 (ILOC(1),N(1),ILOC(2),N(2))         00003700
********          *NOTE*       RESTRICTIONS:                             00003800
********                  1. THE TYPE OF CORE FREED MUST BE THE TYPE     00003900
********                     OF CORE ALLOCATED,I.E., TYPE 1 CORE (BULK   00004000
********                     ) CANNOT BE FREED BY A TYPE 2 CALL.         00004100
********                  2. INVALID CONDITIONS IN A FREE CALL WILL BE   00004200
********                     DETECTED BY THE OPERATING SYSTEM.           00004300
```

Fig. 18. Source Listing for Subroutine ALLOC$

```
********                    3. ALLOCATION IS DONE VIA SINGLE ELEMENT,     00004400
********                       CONDITIONAL REQUESTS.                      00004500
********                    4. ALLOCATION OF TYPE1 (BULK) CORE IS ALWAYS  00004600
********                       IN A MULTIPLE OF 2048 BYTES (512 WORDS).   00004700
********                    5. ALLOCATION OF TYPE2 (MAIN) CORE IS ALWAYS  00004800
********                       IN A MULTIPLE OF 8 BYTES (2 WORDS).        00004900
********                                                                  00005000
********                       **********                        ********  00005100
         SPACE 2                                                          00005200
********      PROGRAMMER            JOHN A. OHDE                          00005300
********      DATE                  MAY 1, 1968                           00005400
         GBLC  &BULK                                                      00005500
&BULK    SETC  'YES'                                                      00005600
********                       **********                        ********  00005700
         EJECT                                                            00005800
ALLOC$   CSECT                                                            00005900
         AIF   ('&BULK' NE 'YES').GOA                                     00006000
         ENTRY ALLOC1,FREE1                                               00006100
.GOA     ANOP                                                             00006200
         ENTRY ALLOC2,FREE2,ALLOCP                                        00006300
R0       EQU   0          REGISTER DEFINITIONS                            00006400
R1       EQU   1                                                          00006500
R2       EQU   2                                                          00006600
R3       EQU   3                                                          00006700
R4       EQU   4                                                          00006800
R5       EQU   5                                                          00006900
R6       EQU   6                                                          00007000
R7       EQU   7                                                          00007100
R8       EQU   8                                                          00007200
R9       EQU   9                                                          00007300
RA       EQU   10                                                         00007400
RB       EQU   11                                                         00007500
RC       EQU   12                                                         00007600
RD       EQU   13                                                         00007700
RE       EQU   14                                                         00007800
RF       EQU   15                                                         00007900
         SPACE 3                                                          00008000
         SAVE  (14,12),,ALLOC$      SAVE REGISTERS                        00008100
ALLOC$A  BALR  RA,0                 SET BASE                              00008200
         USING *,RA                                                       00008300
         BAL   R9,LINKSVS           SET NEW SAVE AREA                     00008400
         BAL   R9,FETCHAD           GET PARMS                             00008500
         AIF   ('&BULK' NE 'YES').GO1                                     00008600
         MVI   ALLOC$SW+1,X'F0'     SET TWO-TRY SWITCH ON                 00008700
```

Fig. 18 (Contd.)

```
         B      ALLOC1A                START WITH BULK                    00008800
         AGO    .GO2                                                      00008900
.GO1     ANOP                                                             00009000
         B      ALLOC2A              GO TO ALLOCATE MAIN CORE             00009100
.GO2     ANOP                                                             00009200
         AIF    ('&BULK' NE 'YES').GO3                                    00009300
         EJECT                                                            00009400
ALLOC1   EQU    *                ALLOCATE BULK CORE ROUTINE              00009500
         SAVE   (14,12),,ALLOC1      SAVE REGISTERS                       00009600
ALLOC$B  BALR   RA,0                                                      00009700
         LA     R9,ALLOC$B-ALLOC$A                                        00009800
         SLR    RA,R9                KEEP SAME BASE                       00009900
         BAL    R9,LINKSVS           SET NEW SAVE AREA                    00010000
         BAL    R9,FETCHAD           GET PARMS                            00010100
         MVI    ALLOC$SW+1,X'00'     TURN TWO-TRY SWITCH OFF              00010200
ALLOC1A  EQU    *                                                         00010300
         ST     R4,BULKSIZE          SAVE REQUEST SIZE (BYTES)            00010400
         LA     R1,BULKLIST                                               00010500
         GETBULK     MF=(E,(1))      ALLOCATE                             00010600
         SPACE 2                                                          00010700
         LA     R5,1                 SET RETURN CODE                      00010800
         LTR    RF,RF                TEST RETURN CODE                     00010900
         BNZ    NOALLOC1              NO ALLOCATION                       00011000
         L      R0,BULKOUT           SET ADDRESS                          00011100
.GO3     ANOP                                                             00011200
         SPACE 6                                                          00011300
EXIT     EQU    *                                                         00011400
         ST     R5,0(R2)             STORE IT                             00011500
EXIT1    L      RB,4(RD)                                                  00011600
EXIT2    LR     RD,RB                RESET SAVE AREA POINTER              00011700
         LM     14,15,12(13)         RESTORE ALL REGISTERS                00011800
         LM     1,12,24(13)            EXCEPT 0 (RETURN VALUE)            00011900
         MVI    12(13),X'FF'         SIGNAL RETURN                        00012000
         SR     RF,RF                                                     00012100
         BR     14                   RETURN                               00012200
         AIF    ('&BULK' NE 'YES').GO4                                    00012300
         SPACE 3                                                          00012400
NOALLOC1 LNR    R5,R5                SET NO ALLOCATION                    00012500
         SR     R0,R0                                                     00012600
ALLOC$SW NOP    ALLOC2A              TWO-TRY SWITCH: NOP|BRANCH           00012700
         B      EXIT                                                      00012800
.GO4     ANOP                                                             00012900
         EJECT                                                            00013000
ALLOC2   EQU    *                ALLOCATE MAIN CORE ROUTINE              00013100
```

Fig. 18 (Contd.)

```
         SAVE   (14,12),,ALLOC2       SAVE REGISTERS                    00013200
ALLOC$C  BALR   RA,0                                                    00013300
         LA     R9,ALLOC$C-ALLOC$A                                      00013400
         SLR    RA,R9                 KEEP SAME BASE                    00013500
         BAL    R9,LINKSVS            SET NEW SAVE AREA                 00013600
         BAL    R9,FETCHAD            GET PARMS                         00013700
ALLOC2A  EQU    *                                                       00013800
         ST     R4,MAINSIZE           SAVE REQUEST SIZE (BYTES)         00013900
         LA     R1,MAINLIST                                             00014000
         GETMAIN     MF=(E,(1))       ALLOCATE                          00014100
         SPACE 2                                                        00014200
         LA     R5,2                  SET RETURN CODE                   00014300
         LTR    RF,RF                 TEST RETURN CODE                  00014400
         BNZ    NOALLOC2               NO ALLOCATION                    00014500
         L      R0,MAINOUT            ADDRESS                           00014600
         B      EXIT                                                    00014700
         SPACE 3                                                        00014800
NOALLOC2 LNR    R5,R5                 SET NO ALLOCATION                 00014900
         SR     R0,R0                                                   00015000
         B      EXIT                                                    00015100
         EJECT                                                          00015200
         AIF    ('&BULK' NE 'YES').GO5                                  00015300
FREE1    EQU    *                FREE BULK CORE ROUTINE                 00015400
         SAVE   (14,12),,FREE1        SAVE REGISTERS                    00015500
ALLOC$D  BALR   RA,0                                                    00015600
         LA     R9,ALLOC$D-ALLOC$A                                      00015700
         SLR    RA,R9                 KEEP SAME BASE                    00015800
         BAL    R9,LINKSVS            SET NEW SAVE AREA                 00015900
FREE1A   EQU    *                                                       00016000
         BAL    R9,FETCHAD            GET PARMS                         00016100
         MVC    BULKIN(4),0(R2)       ADDRESS OF CORE                   00016200
         ST     R4,BULKCT             SIZE OF BLOCK (BYTES)             00016300
         LA     R1,BULKFREE                                             00016400
         FREEBULK    MF=(E,(1))       FREE IT                           00016500
         SPACE 2                                                        00016600
         LTR    R3,R3                                                   00016700
         BM     EXIT1                 LAST OF PARMS - EXIT              00016800
         LA     R6,8(R6)                                                00016900
         LR     R1,R6                                                   00017000
         B      FREE1A                GET NEXT SEQUENCE                 00017100
         EJECT                                                          00017200
.GO5     ANOP                                                           00017300
FREE2    EQU    *                FREE MAIN CORE ROUTINE                 00017400
         SAVE   (14,12),,FREE2        SAVE REGISTERS                    00017500
```

Fig. 18 (Contd.)

```
ALLOC$E  BALR  RA,0                                                  00017600
         LA    R9,ALLOC$E-ALLOC$A                                    00017700
         SLR   RA,R9                 KEEP SAME BASE                 00017800
         BAL   R9,LINKSVS            SET NEW SAVE AREA              00017900
FREE2A   EQU   *                                                    00018000
         BAL   R9,FETCHAD            GET PARMS                      00018100
         MVC   MAININ(4),0(R2)       ADDRESS OF CORE                00018200
         ST    R4,MAINCT             SIZE OF BLOCK (BYTES)          00018300
         LA    R1,MAINFREE                                          00018400
         FREEMAIN     MF=(E,(1))     FREE IT                        00018500
         SPACE 2                                                    00018600
         LTR   R3,R3                                                00018700
         BM    EXIT1                 LAST OF PARMS - EXIT           00018800
         LA    R6,8(R6)                                             00018900
         LR    R1,R6                                                00019000
         B     FREE2A                GET NEXT PARMS                 00019100
         EJECT                                                      00019200
ALLOCP   EQU   *                                                    00019300
         SAVE  (14,12),,ALLOCP       SAVE REGISTERS                 00019400
ALLOC$F  BALR  RA,0                                                 00019500
         LA    R9,ALLOC$F-ALLOC$A                                   00019600
         SLR   RA,R9                                                00019700
*                                                                   00019800
         LR    R2,R1                                                00019900
         GETMAIN R,LV=72                                            00020000
         LR    RB,RD                 GET AND                        00020100
         LR    RD,R1                         CHAIN                  00020200
         ST    RD,8(RB)                            SAVE             00020300
         ST    RB,4(RD)                                  AREAS      00020400
         ST    R1,TEMP1              SAVE AREA ADDRESS              00020500
*                                                                   00020600
         LR    R3,R2                                                00020700
GETLAST  LA    R3,4(R3)                                             00020800
         TM    0(R3),X'80'           TEST FOR LAST PARM             00020900
         BNO   GETLAST                NO                            00021000
         LR    R4,R3                  YES                          00021100
         SR    R4,R2                                                00021200
         LA    R0,C(R4)                                             00021300
         ST    R0,TEMP2              SAVE AREA SIZE                 00021400
         GETMAIN R,LV=(0)            GET NEW P-LIST AREA            00021500
*                                                                   00021600
         ST    R1,TEMP3              SAVE AREA ADDRESS              00021700
         L     RF,0(R2)                                             00021800
         L     RF,0(RF)              GET BRANCH ADDRESS (1ST PARM)  00021900
```

Fig. 18 (Contd.)

```
         LA     R2,4(R2)              RESET LIST POINTER                    00022000
         LR     R7,R1                                                       00022100
         LA     R4,8                  SET UP FOR BXLE BELOW                 00022200
         LR     R5,R3                                                       00022300
MOVELIST L      R6,0(R2)              MOVE THE CONTENTS                     00022400
         L      R6,0(R6)                 TO THE NEW P-LIST                  00022500
         ST     R6,0(R7)                                                    00022600
         MVC    4(4,R7),4(R2)         ADCON FOR WORD COUNT                  00022700
         LA     R7,8(R7)              BUMP TARGET ADDRESS                   00022800
         BXLE   R2,R4,MOVELIST                                              00022900
         MVI    C(R3),X'80'           SET LAST                              00023000
*                                                                           00023100
         BALR   RE,RF                 BRANCH                                00023200
*                                                                           00023300
         L      R0,TEMP2                                                    00023400
         L      R1,TEMP3                                                    00023500
         FREEMAIN  R,LV=(0),A=(1)     FREE THE PARM LIST AREA               00023600
*                                                                           00023700
         L      RD,4(RD)                                                    00023800
         L      R1,TEMP1                                                    00023900
         FREEMAIN  R,LV=72,A=(1)       FREE THE SAVE AREA USED              00024000
*                                                                           00024100
         B      EXIT2                                                       00024200
         EJECT                                                              00024300
********     SUBROUTINES                                          ******** 00024400
         SPACE 2                                                            00024500
LINKSVS  EQU    *                  CHAIN SAVE AREAS                        00024600
         LR     RB,RD                                                       00024700
         LA     RD,SAVEAREA                                                 00024800
         ST     RD,8(RB)                                                    00024900
         ST     RB,4(RD)                                                    00025000
         BR     R9                                                          00025100
         SPACE 6                                                            00025200
FETCHAD  EQU    *                  GET PARAMETER ADDRESSES                 00025300
         LM     R2,R3,0(R1)           TWO PER CALL                          00025400
         L      R4,0(R3)               SIZE IN WORDS                        00025500
         SLA    R4,2                   MULTIPLY BY FOUR                     00025600
         LR     R6,R1                 SAVE LIST POINTER                     00025700
         BR     R9                                                          00025800
         EJECT                                                              00025900
********     CONSTANTS                                            ******** 00026000
         SPACE 2                                                            00026100
SAVEAREA DC     18F'0'                                                      00026200
TEMP1    DC     F'0'                                                        00026300
```

Fig. 18 (Contd.)

```
TEMP2    DC     F'0'                                                  00026400
TEMP3    DC     F'0'                                                  00026500
*                                                                     00026600
MAINLIST GETMAIN EC,LV=2048,A=MAINOUT,MF=L,SP=2                       00026700
*                                                                     00026800
         AIF    ('&BULK' NE 'YES').GO6                                00026900
BULKLIST GETBULK EC,LV=2048,A=BULKOUT,MF=L,SP=1                       00027000
*                                                                     00027100
.GO6     ANOP                                                         00027200
MAINFREE FREEMAIN     LV=2048,A=MAININ,MF=L,SP=2                      00027300
*                                                                     00027400
         AIF    ('&BULK' NE 'YES').GO7                                00027500
BULKFREE FREEBULK     LV=2048,A=BULKIN,MF=L,SP=1                      00027600
*                                                                     00027700
.GO7     ANOP                                                         00027800
MAINOUT  DC     F'0'                                                  00027900
MAININ   DC     F'0'                                                  00028000
MAINSIZE EQU    MAINLIST                                              00028100
MAINCT   EQU    MAINFREE                                              00028200
         AIF    ('&BULK' NE 'YES').GO8                                00028300
BULKOUT  DC     F'0'                                                  00028400
BULKIN   DC     F'0'                                                  00028500
BULKCT   EQU    BULKFREE                                              00028600
BULKSIZE EQU    BULKLIST                                              00028700
.GO8     ANOP                                                         00028800
         SPACE 5                                                      00028900
         END                                                          00029000
```

Fig. 18 (Contd.)

/NAMBLK/

Variables used from this common block

Name	Type	Dimension	Definition
NAME	R*8	--	The eight character name of the array currently being operated on

(c) Local Variables

Name	Type	Definition
NAM2(2)	R*4	Variable equivalenced with NAME

(d) Functions and tasks performed by this subroutine

A locator subprogram. Given NAM1(REAL*4 dimension 2) returns N, the index in the BPOINTER tables that correspond to NAM1. If the array NAM1 cannot be found, N is set to zero and the message: ARRAY NAM1 CANNOT BE FOUND IN THE NAME TABLE is printed.

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine

CLEAR
GETPNT
DUMP
WIPOUT
REDEF
REDEFM
REDEFB
IGET

4.3 IGET (NAM1)

(a) Arguments

Name	Type	Dimension	Definition
NAM1	R*4	(2)	The eight character name of the array whose pointer is to be returned in IGET

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
INDXM	I*4	--	The address (index) "offset" of the fast container in 8 byte words
INDXB	I*4	--	The address (index) "offset" of the bulk container in 8 byte words
IPRINT	I*4	--	Print flag: 0 - no print 1 - dumps only 2 - trace only 3 - dumps and trace

/TABLES/

Variables used from this common block

Name	Type	Dimension	Definition
IPTLST	I*4	150	The pointers (indices) of each array

/BFLAGS/

Variables used from this common block

Name	Type	Dimension	Definition
IFLAG	I*4	150	Memory flag for each array IFLAG(N)=0 - fast memory IFLAG(N)=1 - bulk memory

/NAMBLK/

Variables used from this common block

Name	Type	Dimension	Definition
NAME	R*8	--	The eight character name of the array currently being operated on

(c) Local Variables - None

(d) Functions and tasks performed by this subprogram

There are two methods of requesting pointers. Each method searches the name table for the entry corresponding to array NAME. The associated pointer is then returned to the calling program. If the name cannot be found in the table, a return is made with a zero pointer.

Method 1

```
CALL SUB (ARRAY(IGET(NAME))
```

Method 2

```
CALL GETPNT(NAME,IPOINT)    or IPOINT = IGET(NAME)
CALL SUB (ARRAY(IPOINT))
```

where SUB is a routine where NAME will be used. For example,

```
SUBROUTINE SUB (NAME)
DIMENSION NAME (1)
        :
        :
```

A request for a pointer of an array in bulk memory is identical to that for an array in fast memory.

(e) Subprograms called by this subprogram

GETN

(f) Subprograms calling this subprogram

User programs.

4.4 ILAST (DUMMY), ILASTB (DUMMY)

(a) Arguments

Name	Type	Dimension	Definition
DUMMY	R*4	--	A dummy argument to satisfy FORTRAN requirements that a function routine have at least one argument

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
LSTM	I*4	--	The index of the first available location in the fast container
LSTB	I*4	--	The index of the first available location in the bulk container
MAXB	I*4	--	The maximum length of the bulk container in 8 byte words
INDXM	I*4	--	The address (index) "offset" of the fast container in 8 byte words
INDXB	I*4	--	The address (index) "offset" of the bulk container in 8 byte words

/PTERR/

Variables used from this common block

Name	Type	Dimension	Definition
NPTERR	I*4	--	The number of errors in BPOINTER activities since the last call to IPTERR.

(c) Local Variables - None

(d) Functions and tasks performed by this subprogram

LAST=ILAST (DUMMY)

LAST contains the pointer in the container array of the first unused storage location, i.e., MAXSIZ-LAST is the amount of available storage left in the main container array.

LASTB=ILASTB (DUMMY)

This entry is identical to ILAST and is used for bulk memory. No check is made to see if LAST or LASTB are in the container. Thus, the location may be "unusable".

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subprogram

User programs.

4.5 IPT2(IPT,N4,N8)

(a) Arguments

Name	Type	Dimension	Definition
IPT2	I*4	--	Pointer to a subarray in REAL*4 container
IPT	I*4	--	Pointer to a named array in the BPOINTER tables for which storage has been assigned
N4	I*4	--	Number of four byte words (R*4 or I*4) preceding the subarray of interest
N8	I*4	--	Number of R*8 words preceding the subarray of interest

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this function

The function subprogram IPT2 is intended to provide the user with access (pointers) to subarrays within a named array in the BPOINTER tables. Such access is important if the problem program must ensure that arrays are stored contiguously in core as would be the case, for example, if block data transfer were used in the problem program. Note that in assigning storage for named arrays, BPOINTER always assigns the array on a double word boundary in order to avoid boundary allignment errors. Consequently, there is no guarantee in general that named arrays are stored contiguously. The pointer returned by IPT2 is the pointer with reference to a REAL*4 array, the first element of which must be equivalenced to the first element of the container array in the problem program. A simple example will serve to illustrate

the use of the function IPT2. Consider the list:

(NUP(I),I=1,NGROUP),(NDN(I),I=1,NGROUP)

In order to read this list and make use of block data transfer, the problem program might be:

```
REAL*8 BLK(1)
DIMENSION BLK4(1)
EQUIVALENCE (BLK(1),BLK4(1))
CALL POINTER (BLK,10000,0)
CALL PUTM ('LRGELIST',2*NGROUP,4,ITEMP)
INUP=IPT2(ITEMP,0,0)
INDN=IPT2(ITEMP,NGROUP,0)
CALL READIT(BLK(ITEMP),NGROUP,LUN)
CALL USEIT(BLK4(INUP),BLK4(INDN),NGROUP)
   :
SUBROUTINE READIT(N,NDIM,LUN)
DIMENSION N(NDIM)
READ(LUN)N
RETURN
END
SUBROUTINE USEIT(NUP,NDN,NGROUP)
DIMENSION NUP(1),NDN(1)
   :
```

(e) Subprograms called by this subprogram - None

(f) Subprograms calling this subprogram

User programs.

4.6 IPTERR (DUMMY)

(a) Arguments

Name	Type	Dimension	Definition
DUMMY	R*8	--	A dummy argument to satisfy FORTRAN requirements that a function routine have at least one argument

(b) Common Blocks

/PTERR/

Variables used from this common block

Name	Type	Dimension	Definition
NPTERR	I*4	--	The number of errors in BPOINTER activities since the last call to IPTERR

(c) Local Variables - None

(d) Functions and tasks performed by this function

An error counter (NPTERR, initially zero) is stepped up by 1 and a normal return is made to the calling program. It is the responsibility of the calling program to check for the occurrence of an error in BPOINTER prior to the use of pointers. This is done as follows:

```
IF(IPTERR(DUMMY).GT.0) ——— ERROR EXIT
NO ERRORS ENCOUNTERED--CONTINUE
```

IPTERR is a function subroutine which returns the value of NPTERR to the calling program. If NPTERR=0, no errors have been encountered in BPOINTER. If NPTERR > 0, NPTERR errors have been encountered. If an error occurs in BPOINTER it must be assumed that the program will continue to the next case or terminate. Results may be meaningless if normal execution is continued.

(e) Subprograms called by this function - None

(f) Subprograms calling this function

User programs.

4.7 LOCF(BLK)

Entry Points - None

(a) Arguments

Name	Type	Dimension	Definition
BLK	Any	--	The variable for which a core address is desired
LOCF	I*4	--	The address of the variable BLK in core

(b) Common Blocks

None

(c) Local Variables

See listing.

(d) Functions and tasks performed by subprogram

LOCF is an assembler language routine which may be called by a Fortran program to obtain the absolute address of a variable in core. A complete description of LOCF is provided in reference 11. The calling statement

```
ILOC = LOCF(BLK)
```

returns the absolute core address of BLK in the variable ILOC.

(e) Subprograms called by this subprogram

See listing.

(f) Subprograms calling this subprogram

POINTR

(g) Assembler language listing of LOCF

The listing is given in Fig. 19.

4.8 POINTR (BLK,MAXSIZ,JPRINT)

Entry Points - BULK (MAXSIZ)
FREE
PUTM (NAM1, LENDUM, MULT, IPT)
PUTPNT (NAM1, LENDUM, MULT, IPT)
PUTBLK (NAM1, LENDUM, MULT)
WIPOUT (NAM1)
DUMP (NAM1, IUMP)
GETPNT (NAM1, IPT)
CLEAR (NAM1)
SAVPRG (N)
SAVE (N)
INITL (N)

(a) Arguments

Name	Type	Dimension	Definition
BLK	R*8	1	The address of BLK, the container array
MAXSIZ (POINTR, BULK)	I*4	--	The maximum size of the container array in fast memory or bulk memory
JPRINT	I*4	--	Print flag =0 - no print =1 - dump requests only =2 - trace print only =3 - both trace and dumps
NAM1 (PUTPNT, PUTM, PUTB PUTBLK	R*4	(2)	The eight character array name of the array to be stored in the fast (bulk) container array

```
Z057     TITLE 'AN Z057S   LOCF  ** FORTRAN LOCATION FUNCTION '      00000100
*                                                                    00000200
*              RETURN LOCATION OF A VARIABLE AS 32 BIT INTEGER       00000300
*                                                                    00000400
*              I = LOCF (X)                                          00000500
*                                                                    00000600
*              JOHN A. OHDE                                          00000700
*              JUNE 25, 1968                                         00000800
*                                                                    00000900
*                                                                    00001000
LOCF     CSECT                                                       00001100
         SAVE  (14,12),,LOCF                                         00001200
         L     0,0(1)                LOAD THE ADDRESS                00001300
         SLL   0,1                   REMOVE THE SIGN BIT             00001400
         SRL   0,1                                                   00001500
         MVI   12(13),X'FF'          SIGNAL RETURN                   00001600
         SR    15,15                 RETURN CODE                     00001700
         BR    14                    RETURN                          00001800
         END                                                         00001900
```

Fig. 19. Source Listing for Subroutine LOCF

Name	Type	Dimension	Definition
LENDUM (PUTPNT, PUTM, PUTBLK, PUTB)	I*4	--	The length of the array to be stored in the fast (bulk) container array
MULT (PUTPNT, PUTM, PUTBLK, PUTB)	I*4	--	The variable type of array to be stored MULT=2 - I*2 MULT=4 - { I*4 / R*4 MULT=8 - R*8
NAM1 (WIPOUT)	R*4	(2)	The eight character array name to be set to blank for elimination from storage
NAM1 (DUMP)	R*4	(2)	The eight character array name to be dumped
IUMP (DUMP)	I*4	(2)	Type of printout IUMP = 1 - integer IUMP = 2 - real IUMP = 3 - BCD
NAM1 (GETPNT)	R*4	(2)	The eight character name of the array whose pointer is to be extracted from the BPOINTER tables
IPT (GETPNT, PUTM, PUTB)	I*4	--	The pointer corresponding to array NAM1
NAM1 (CLEAR)	R*4	(2)	The eight character name of the array to be set to zero
N (SAVPRG, SAVE, INITL)	I*4	--	The data set reference number onto which or from which data set POINTR is to be written or read

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
LSTM	I*4	--	The index of the first available location in the fast container
MAXM	I*4	--	The length of the fast container in 8 byte words
LSTB	I*4	--	The index of the first available location in the bulk container
MAXB	I*4	--	The length of the bulk container in 8 byte words
INDXM	I*4	--	The address (index) "offset" of the fast container in 8 byte words
INDXB	I*4	--	The address (index) "offset" of the bulk container in 8 byte words
IPRINT	I*4	--	Print flag 0 - no print 1 - dumps only 2 - trace only 3 - dumps and trace

/TABLES/

Variables used from this common block

Name	Type	Dimension	Definition
NAMLST	R*8	(150)	The list of array names stored in the container
LENLST	I*4	(150)	The length of each array in double words
IPTLIST	I*4	(150)	The pointers (indices) of each array
LEN	I*4	(150)	The original length of each array

Name	Type	Dimension	Definition
MLT	I*4	(150)	The variable type of each array MLT(M) = 2 - I*2 MLT(M) = 4 - I*4 or R*4 MLT(M) = 8 - R*8
NNAMS	I*4	--	The number of names stored in the BPOINTER tables

/BFLAGS/

Variables used from this common block

Name	Type	Dimension	Definition
IFLAG	I*4	(150)	Memory flag for each array IFLAG(N) = 0 = > fast memory IFLAG(N) = 1 = > bulk memory

/NAMBLK/

Variables used from this common block

Name	Type	Dimension	Definition
NAME	R*8	--	The eight character name of the array currently in use

/PTERR/

Variables used from this common block

Name	Type	Dimension	Definition
NPTERR	I*4	--	The number of errors in BPOINTER activities since the last call to IPTERR

(c) Local Variables

Name	Type	Definition
ILOC	I*4	Temporary starting address of fast and bulk containers
ILOCM	I*4	Starting address of fast container

Name	Type	Definition
ILOCB	I*4	Starting address of bulk container
JLOC	I*4	Starting address of user defined container (BLK)
INDX	I*4	Temporary address "offset" fast and bulk containers in 8 byte words
MAXFM	I*4	The maximum length of the container in 8 byte words before extension by address "offset"
MAXFB	I*4	The maximum length of the bulk container in 8 byte words before extension by address "offset"
JUMP	I*4	A flag indicating whether or not the entry BULK has been called JUMP = 1 - BULK container assumed to be 100000 8 byte words JUMP = 0 - use size transmitted through BULK call
LENGTH	I*4	The length in 8 byte words of the array to be operated on
IDUM	I*4	The pointer of the desired array relative to the original address of the container
BLANK	R*8	Eight characters of blanks to be stored in BPOINTER tables when WIPOUT is called
MAXBLK	I*4	Default R*8 length of bulk container array (100000)
LINEUP	R*8	Temporary variable which has ILOCM in first four bytes and ILOCB in last four bytes
BLKLOC(2)	R*4	Temporary variable used in equivalence statement to ensure that ILOCM and ILOCB are in contiguous storage
IERR	I*4	Error flag in call to ALLOC1 and ALLOC2

Name	Type	Definition
NFLAG	I*4	Flag set equal to 0 if PUTM or PUTPNT has been called, 1 if PUTB or PUTBLK has been called
NPURG	I*4	Flag which is zero before purging of arrays and one after purging
N	I*4	Pointer for array NAM1 as returned from GETN

(d) Functions and tasks performed by subprogram

(i) Initialization

SUBROUTINE POINTR (BLK, MAXSIZ, IPRINT)

This entry defines the starting address of the container array (BLK) to POINTR. All variable dimensioned arrays to be referenced through POINTR are packed into the container array. BLK(1) is returned with the starting address of the main container in its first four bytes, and the starting address of the bulk container in the last four bytes.

Storage is allocated in main and bulk memory via a call to ALLOC2 and ALLOC1 respectively. These routines are system programs which issue GETMAIN and GETBULK assembly language macros and return with an address, ILOC. Given these addresses, POINTR uses the routine LOCF to determine the address of BLK.

ILOC = LOCF(BLK)

An index "offset" measured in 8 byte words is then computed as

INDX = (ILOC-JLOC)/8

INDXM and INDXB are the offsets for main and bulk memory, respectively. Using these offsets, POINTR routines may now return indexes for any desired array as described below.

Having determined the index offsets, the POINTR entry now initializes the BPOINTER tables, clears the fast and bulk container arrays, and returns. Note that the user does not need to use the name BLK as his container. For example, the following user code will initialize POINTR

```
REAL*8    ARRAY(1)
          .
          .
          .
CALL      POINTR(ARRAY, 100000, 3)
          .
          .
          .
```

(ii) Allocation of Bulk Storage

Bulk memory of 100000 8 byte words is automatically assumed unless the entry point,

ENTRY BULK(MAXSIZ)

is called before the POINTR entry. Calling this entry will replace the assumption of 100000 8 byte words by MAXSIZ words.

(iii) Freeing Storage

Upon completion, the user program should call the entry,

ENTRY FREE

This entry frees main and bulk memory previously allocated by calling the system routines FREE2 and FREE1 which in turn issue FREEMAIN and FREEBULK macros, respectively.

(iv) Requesting Main Storage

CALL PUTPNT(NAME,LENDUM,MULT)
CALL PUTM(NAME,LENDUM,MULT,IPT)

This entry places the array name (NAME)* in the name table, along with its associated length (LENGTH) and a pointer (IPT).

LENDUM is the length of array NAME in the calling program and LENGTH is the number of double precision (R*8) words to be reserved in the container storage area. LENGTH is computed as

LENGTH = [(LENDUM-1)*MULT+8]/8

---

* NAME = { 'NAME' or / 8H NAME or / VNAME

where VNAME is a double precision FORTRAN variable which contains the Hollerith representation of NAME

Before entering the array NAME in the name table, a test is made to see if the addition will cause storage overflow. If so, an attempt is made to allocate the array in bulk core. If enough storage is available in main core a check is made to see if the addition of NAME exceeds the total number of arrays permitted (150). If so, arrays with blank names (see Section vii) in main core are purged. The storage area is repacked and the new pointers are printed on the standard output medium. Another attempt is made to insert NAME in the name table. If the number of arrays still exceeds 150, the bulk container is purged. If there are no blank names in the bulk container, an error condition results. (See section xiv for error procedures.)

The following calling sequence may be used to change the length of an array previously defined an/or move it from main to bulk core or vice versa

```
CALL REDEF(NAME,LENDUM,MULT)
CALL REDEFM(NAME,LENDUM,MULT,IPT)
CALL REDEFB(NAME,LENDUM,MULT,IPT)
```

These entries are described in section 4.16

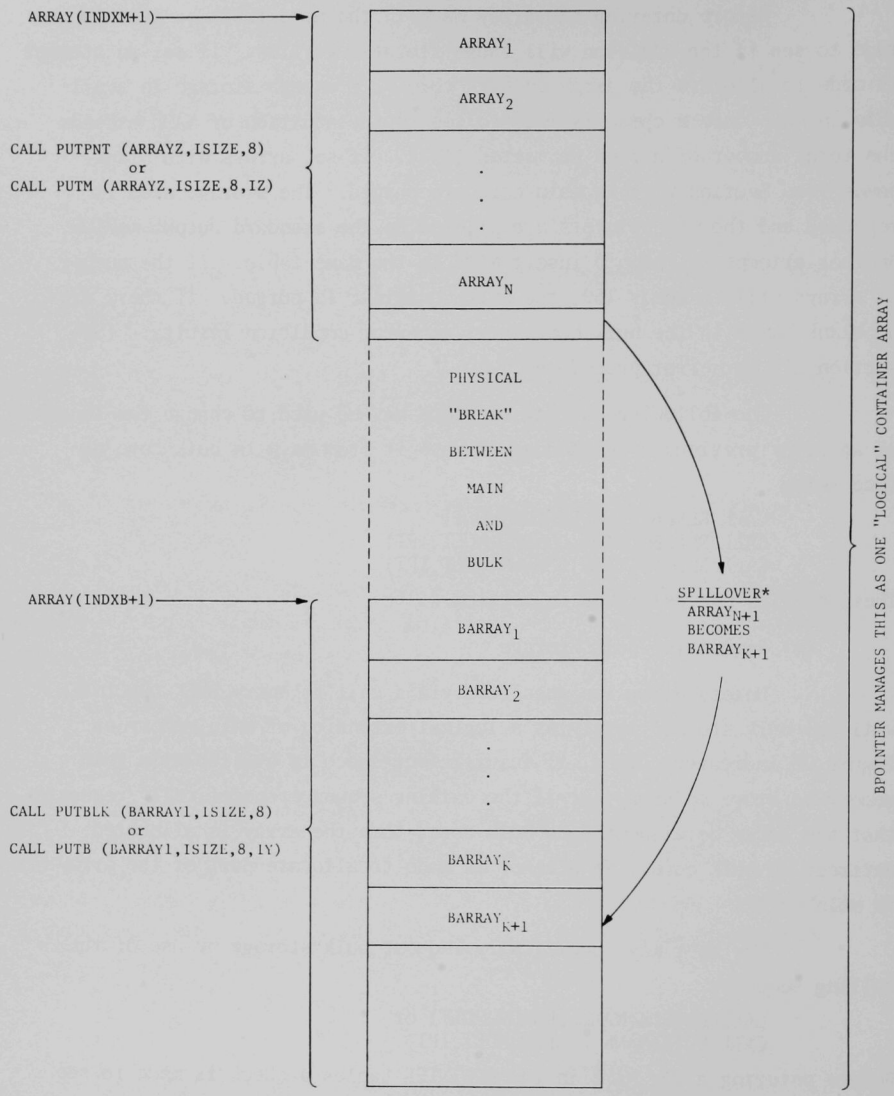
(v) Requesting Bulk Storage

Unless otherwise specified via a call to entry BULK, BPOINTER will use bulk storage merely as a logical extension of main memory as Figure 20 indicates. Thus, if insufficient space is available in main memory to store an array, or if the calling sequence specifically requests that the array be allocated to bulk core, then the array is allocated entirely in bulk core. No attempt is made to allocate part of the array in main core.

The user may specifically request bulk storage by use of the calling sequence

```
CALL PUTBLK(NAME,LENDUM,MULT) or
CALL PUTB(NAME,LENDUM,MULT,IPT)
```

Before entering array NAME in the BPOINTER tables a check is made to see if enough storage is available. If not, the bulk container is purged. If the user had entered this routine from PUTM or PUTPNT, then the main container is also purged and control is returned to PUTPNT or PUTM. In all other respects this entry acts just as PUTM and PUTPNT as described in (iv) above.



*Note: Individual arrays are never split between main and bulk storage.

Fig. 20. Schematic Drawing of Bulk Memory Management

(viii) Status of POINTR tables

The status of the POINTR tables may be printed on the standard output device at any point in the user program. A call to the entry STATUS gives the printout.

(ix) Obtaining Available Storage

LAST=ILAST (DUMMY)

LAST contains the pointer in the container array of the first unused storage location, ie., MAXSIZ-LAST is the amount of available storage left in the main container array.

LASTB=ILASTB (DUMMY)

This entry is identical to ILAST and is used for bulk memory.

(x) Array Clearing

CALL CLEAR (NAME)

This entry zeros the locations in the container array associated with array NAME.

(xi) Dynamic Dumps

CALL DUMP (NAME,ITYPE)

This entry causes the contents of the locations in the container array associated with array NAME to be printed on the standard output medium in a format designated by ITYPE. If ITYPE=1, an integer array is printed using the FORMAT(12I10). If ITYPE=2, a real array is printed using the FORMAT(8E15.7). If ITYPE=3, a BCD array is printed using the FORMAT(25A4) or FORMAT(12A8) depending on the array type. Each array dump is preceded by the heading:

DUMP OF ARRAY NAME POINTER=LENGTH=

(xii) Saving BPOINTER Information

Two entries are available to save the information in the BPOINTER tables. These entries may be used for later use by the entry INITL in reinitializing the BPOINTER tables for restart purposes or to convey information to another module.

(vi) There are two methods of requesting pointers. Each method searches the name table for the entry corresponding to array NAME. The associated pointer is then returned to the calling program. If the name cannot be found in the table, a return is made with a zero pointer.

Method 1

```
CALL SUB(ARRAY(IGET(NAME)))
```

Method 2

```
CALL GETPNT(NAME,IPOINT) or IPOINT=IGET(NAME)
CALL SUB(ARRAY(IPOINT))
```

where SUB is a subroutine where NAME will be used. For example,

```
SUBROUTINE SUB (NAME)
DIMENSION NAME (1)
      .
      .
      .
```

A request for a pointer of an array in bulk memory is identical to that for an array in fast memory.

(vii) Array Purging

```
CALL WIPOUT(NAME)
```

This entry replaces NAME in the name table with a blank name. A blank name signals that this array is no longer needed and may be purged. No sifting of the container array takes place at this time. Only if some future request for storage (via entry PUTPNT) causes overflow will the container array be repacked. The deferred sifting of storage of course greatly reduces the overhead and frequency of this operation.

```
CALL PURGE (LAST)
```

This entry forces the main container array to be sifted and arrays with blank names to be eliminated. Since this operation is time consuming, this option should be used sparingly (i.e., not in tight loops). LAST contains the pointer in the container array of the first unused storage location.

```
CALL PURGEB (LASTB)
```

This entry is identical to PURGE except that it operates on bulk memory.

The calling sequence

```
CALL SAVE(N) or
CALL SAVPRG(N)
```

writes the data set POINTR (c.f. Chapter 5) using the information in the BPOINTER tables and containers. SAVPRG differs from SAVE in that the main and bulk containers are purged prior to writing data set POINTR on the auxiliary device defined by data set reference number N.

(xiii) Initializing BPOINTER Tables from Data Set POINTR

The calling sequence

```
CALL BULK(MAXB)
CALL POINTR(ARRAY,MAXSIZ,IPRINT)
CALL INITIAL(N)
```

reads data set POINTR (c.f. Chapter 5) from the auxiliary device defined by data set reference number N and initializes the BPOINTER tables and containers with the information read.

A simple example of the use of SAVE and INITL is given below:

```
C     MODULE I
      REAL*8 A(1)
      CALL POINTR(A,10000,0)
      CALL PUTM('EXAMPLE',5000,8,IPT1)
      CALL PUTB('EXAMPLEB',1000,8,IPT2)
      CALL SUB(A(IPT1),A(IPT2))
      CALL SAVE(10)
      CALL FREE
      STOP
      END

C     MODULE II
      REAL*8 B(1)
      CALL POINTR(B,7000,3)
      CALL INITL(10)
      CALL SUB2(B(IGET('EXAMPLE')),B(IGET('EXAMPLEB')))
      CALL FREE
      STOP
      END
```

(xiv) Error Procedure

If an error occurs in requesting storage, one of the following messages is written on the standard output device.

```
STORAGE EXCEEDED DURING REQUEST FOR STORAGE OF ARRAY NAME
LENGTH=              LAST AVAILABLE LOCATION=

MAIN STORAGE CANNOT BE ALLOCATED

BULK STORAGE CANNOT BE ALLOCATED

BULK STORAGE HAS NOT BEEN ALLOCATED PUTB
AND PUTBLK CANNOT BE INVOKED

OLD MAIN ARRAY SIZE EXCEEDS MAXIMUM MAIN ARRAY SIZE

BULK ARRAY EXCEEDS MAXIMUM BULK ARRAY SIZE
```

An error counter (NPTERR, initially zero) is stepped up by 1 and a normal return is made to the calling program. It is the responsibility of the calling program to check for the occurrence of an error in POINTR <u>prior</u> to the use of pointers. This is done as follows:

```
IF(IPTERR(DUMMY).GT.0) → ERROR EXIT
          ↓
NO ERRORS ENCOUNTERED--CONTINUE
```

IPTERR is a function subprogram which returns the value of NPTERR to the calling program. If NPTERR=0, no errors have been encountered in BPOINTER. If NPTERR>0, NPTERR errors have been encountered. If an error occurs in POINTR it must be assumed that the program will continue to the next case or terminate. Results will be unpredictable if normal execution is continued.

Error checking using Method 1 for requesting pointers:

```
      .
      .
      .
      CALL SUB(ARRAY(IGET(NAME)), 10)
      NORMAL RETURN--(Continue problem)
      .
      .
      .
   10 CONTINUE
      ERROR RETURN--(GO to next problem to STOP)
      END
```

```
      SUBROUTINE SUB(NAME,*)
      DIMENSION NAME(1)
          :
      IF(IPTERR(DUMMY).GT.0) RETURN 1(First executable statement in SUB)
          :
      RETURN
          :
      END
```

Error checking using method 2 for requesting pointers:

```
          :
      CALL GETPNT(NAME,IPT)
      IF(IPTERR(DUMMY).GT.0) GO TO 10
      CALL SUB(ARRAY(IPT))
          :
   10 CONTINUE
      ERROR RETURN (GO to next problem or STOP)
      END
```

Note that requesting an array pointer prior to assigning storage for that array (via a PUTPNT or PUTBLK) is <u>not</u> considered a terminal error by BPOINTER. A zero pointer is returned, but NPTERR is <u>not</u> incremented. It is assumed that the user is aware of the possibilities in this instance and may have occassion to use this logic. If this is intentional, POINTR assumes the user will test for the return of a zero pointer before proceeding to use the array.

Informational messages printed out by this routine which do not increment NPTERR are

ARRAY NAME WAS PREVIOUSLY ASSIGNED TO BULK CORE BUT NO BULK IS PRESENTLY ASSIGNED - ERROR WILL OCCUR IF ARRAY IS REFERENCED

MAIN CORE ARRAY HAS BEEN SIFTED

BULK CORE ARRAY HAS BEEN SIFTED

(e) Subprograms called by this subroutine:

GETN	PRTR2
PURGE	PRTA1
PURGEB	PRTA2
PRTI1	PRGSET
PRTI2	REDSET
PRTR1	

(f) Subprograms calling this subroutine:

User Programs
REDEF
REDEFM
REDEFB

4.9 PRGSET (BLK)

Entry Points - PURGE (LSTLOC)
PURGEB (LSTLOC)
STATUS

(a) Arguments

Name	Type	Dimension	Definition
BLK	R*8	(1)	The address in core of BLK, the container array
LSTLOC	I*4	---	The first available location in the container after the array has been purged

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
LSTM	I*4	--	The index of the first available location in the fast container
MAXM	I*4	--	The maximum length of the fast container in 8 byte words
LSTB	I*4	--	The index of the first available location in the bulk container

Name	Type	Dimension	Definition
MAXB	I*4	--	The maximum length of the bulk container in 8 byte words
INDXM	I*4	--	The address (index) "offset" of the fast container in 8 byte words
INDXB	I*4	--	The address (index) "offset" of the bulk container in 8 byte words
IPRINT	I*4	--	Print flag: 0 - no print 1 - dumps only 2 - trace only 3 - dumps and trace

/TABLES/

Variables used from this common block

Name	Type	Dimension	Definition
NAMLST	R*8	150	The list of array names stored in the container
LENLST	I*4	150	The length of each array in double words
IPTLST	I*4	150	The pointers (indices) of each array
LEN	I*4	150	The original length of each array
MLT	I*4	150	The variable type of each array MLT(M) = 2 - I*2 MLT(M) = 4 - { I*4 / R*4 MLT(M) = 8 - R*8
NNAMS	I*4	--	The number of names stored in the BPOINTER tables

/BFLAGS/

Varibles used from this common block

Name	Type	Dimension	Definition
IFLAG	I*4	150	Memory flag for eacy array IFLAG(N) = 0 - fast memory IFLAG(N) = 1 - bulk memory

(c) Local Variables

Name	Type	Definition
ISTART	I*4	The starting address (index) of the fast or bulk container depending on whether PURGE or PURGEB has been called
KEY	I*4	KEY = -1 if PURGE has been called KEY = 0 if PURGEB has been called
MAXBLK		The maximum length of the fast or bulk container depending on whether PURGE or PURGEB has been called
IMOV	I*4	An index which keeps track of the first available location as the purging of arrays proceeds
INAM	I*4	The new number of names in the name table as the purging of arrays proceeds
IMAIN	I*4	The index of the first location in the main core container
IBULK	I*4	The index of the first location in the bulk core container
BLANK	R*8	The eight character name /bbbbbbbb/
IMINUS	I*4	The address (index) "offset" of the main or bulk container in R*8 words depending upon whether PURGE or PURGEB was called
MAXBLK	I*4	The maximum length of main or bulk container depending upon whether PURGE or PURGEB was called
IMOV	I*4	A running index giving present location in main or bulk container array
INAM	I*4	A running index giving number of array names processed by routine
ISUB1	I*4	Location of I'th word in new array being processed
ISUB2	I*4	Location of I'th word in old array being processed
IMAX	I*4	Length in R*8 words of array being processed

(d) Functions and tasks performed by this subroutine

A request to purge an array is identical for arrays stored in fast or bulk memory.

CALL PURGE (LAST)

This entry forces the main container array to be sifted and arrays with blank names to be eliminated. Since this operation is time-consuming, this option should be used sparingly. LAST contains the pointer in the container array of the first unused storage location. There is no check made to determine whether LAST is part of the container array. Consequently the location may not be "usable."

CALL PURGEB (LASTB)

This entry is identical to PURGE except that it operates on bulk memory.

This status of the BPOINTER tables may be printed on the standard output device at any point in the user program. A call to the entry STATUS invokes the printout.

An error in this subroutine which increments the error flag NPTERR generates the error message:

BULK STORAGE HAS NOT BEEN ALLOCATED
PURGEB CANNOT BE INVOKED

This subroutine also prints out the informational messages:

MAIN CORE CONTAINER ARRAY HAS BEEN SIFTED

BULK CORE CONTAINER ARRAY HAS BEEN SIFTED

as appropriate.

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

POINTR	PUTPNT
REDEF	PUTB
REDEFM	PUTBLK
REDEFB	SAVPRG
PUTM	User Programs

4.10 PRTA1 (A,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
A	R*4	(1)	The starting address (index) in the container of the BCD array which is to be dumped
LENGTH	I*4	--	The length of the array A

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTA1 dumps arrays (R*4) in BCD representation. The first argument gives the starting address of an array and the second gives the length. Array A is printed on the standard output according to the format (1H ,25A4).

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

DUMP

4.11 PRTA2 (A,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
A	R*8	(1)	The starting address (index) in the container of the BCD array which is to be dumped
LENGTH	I*4	--	The length of the array A

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTA2 dumps arrays (R*8) in BCD representation. The first argument gives the starting address of an array and the second gives the length. The array A is printed on the standard output according to the format (1H ,12A8)

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

DUMP

4.12 PRTR1 (A,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
A	R*4	(1)	The starting address (index) in the container of the real array which is to be dumped
LENGTH	I*4	--	The length of the array A

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTR1 dumps arrays (R*4) in Real representation. The first argument gives the starting address of an array and the second gives the length. The array A is printed on the standard output according to the format (8E15.7).

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

DUMP

4.13 PRTR2 (A,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
A	R*8	(1)	The starting address (index) in the container of the real array which is to be dumped
LENGTH	I*4	--	The length of the array A

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTR2 dumps arrays (R*8) in Real representation. The first argument gives the starting address of an array and the second gives the length. The array A is printed on the standard output according to the format (8E15.7).

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

DUMP

4.14 PRTI1 (J,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
J	I*2	(1)	The starting address (index) in the container of the integer array which is to be dumped
LENGTH	I*4	--	The length of the array J

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTI1 dumps arrays (I*2) in Integer representation. The first argument gives the starting address of an array and the second gives the length. The array J is printed on the standard output according to the format (24I5)

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine:

DUMP

4.15 PRTI2 (J,LENGTH)

(a) Arguments

Name	Type	Dimension	Definition
J	I*4	(1)	The starting address (index) in the container of the integer array which is to be dumped
LENGTH	I*4	--	The length of the array J

(b) Common Blocks - None

(c) Local Variables - None

(d) Functions and tasks performed by this subroutine

PRTI2 dumps arrays (I*4) in Integer representation. The first argument gives the starting address of an array and the second gives the length. The array J is printed on the output medium according to the foramt (12I10).

(e) Subprograms called by this subroutine - None

(f) Subprograms calling this subroutine

DUMP

4.16 REDSET (BLK)

Entry Points - REDEF(NAM1,LENDUM,MULT)
REDEFM(NAM1,LENDUM,MULT,IPT)
REDEFB(NAM1,LENDUM,MULT,IPT)

(a) Arguments

Name	Type	Dimension	Definition
BLK	R*8	(1)	The address of BLK, the container array in core
NAM1	R*4	(2)	The eight character name of the array whose length is to be changed (redefined)
LENDUM	I*4	--	The new length of the array corresponding to NAM1
MULT	I*4	--	The variable type of the array MULT = 2 = - I*4 MULT = 4 = - { I*4, R*4 } MULT = 8 = - R*8
IPT	I*4	--	The pointer corresponding to array NAM1

(b) Common Blocks

/LOCATE/

Variables used from this common block

Name	Type	Dimension	Definition
MAXB	I*4	--	The maximum length of the bulk container in 8 byte words
INDXM	I*4	--	The address (index) "offset" of the fast container in 8 byte words
INDXB	I*4	--	The address (index) "offset" of the bulk container in 8 byte words
IPRINT	I*4	--	Print flag: 0 - no print 1 - dumps only 2 - trace only 3 - dumps and trace

/TABLES/

Variables used from this common block

Name	Type	Dimension	Definition
NAMLST	R*8	150	The list of array names stored in the container
LENLST	I*4	150	The length of each array in double words
IPTLST	I*4	150	The pointers (indexes) of each array
LEN	I*4	150	The original length of each array
MLT	I*4	150	The variable type of each array MLT(M) = 2 - I*4 MLT(M) = 4 - { I*4 / R*4 MLT(M) = 8 - R*8
NNAMS	I*4	--	The number of names stored in the BPOINTER tables

/BFLAGS/

Variables used from this common block

Name	Type	Dimension	Definition
IFLAG	I*4	150	Memory flag for each array IFLAG(N) = 0 - fast memory IFLAG(N) = 1 - bulk memory

/NAMBLK/

Variables used from this common block

Name	Type	Dimension	Definition
NAME	R*8	--	The eight character name of the array currently being operated on

/PTERR/

Variables used from this common block

Name	Type	Dimension	Definition
NPTERR	I*4	--	The number of errors in BPOINTER activities since the last call to IPTERR

(c) Local Variables

Name	Type	Definition
LENNEW	I*4	The new length in 8 byte words of the array to be redefined
LENOLD	I*4	The old length in 8 byte words of the array to be redefined
DUMNAM	R*8	The 8 character name /DUMNAM··/ which is stored temporarily in the BPOINTER tables while extending the length of the array
BLANK	R*8	The eight character name /bbbbbbbb/ which indicates a free storage area for purging in the BPOINTER tables
NAM2(2)	R*4	Variable equivalenced with NAME in common block NAMBLK

Name	Type	Definition
IBULK	I*4	Variable initialized on entry to IBULK = 0 REDEFM = 1 REDEFB = 2 and later IFLAG(N) REDEF
N	I*4	The index in BPOINTER tables corresponding to NAM1. Argument to GETN
LSUB1	I*4	Pointer to the L'th element in old array
LSUB2	I*4	Pointer to the L'th element in new array

(d) Functions and tasks performed by this subroutine

The entries REDEF, REDEFM and REDEFB are used to change the length of an array previously defined and/or to move an array from main to bulk core or vice versa. On entry, the name table is searched for the entry corresponding to array NAME. If NAME is not in the name table, this call is exactly analogous to PUTPNT, PUTM or PUTB. If NAME is in the name table the subsequent action of the code depends upon the call and the new length of the array. If REDEF is called and the old array is in main core, then the code will attempt to allocate the new array in main core, but will place it in bulk core if overflow would result in main. If the old array is in bulk core an attempt will be made to put the new array in bulk core only. If REDEFM is called, the code will attempt to allocate the array in main core whether the old array is in main or bulk core. If the new array will not fit in main core an attempt is made to allocate in bulk. If REDEFB is called, an attempt is made to allocate the new array in bulk core. If overflow were to result an error condition results. If an array is moved from main to bulk or bulk to main, the old array is given a blank name and if more storage is required, the gap will be eliminated. The data are transferred from the old array to the new after storage has been successfully allocated.

If the new LENGTH is less than the old and the array is not to be moved from main to bulk core or vice versa, then the new length is inserted in the table; also a new entry (with a blank name) corresponding to a storage gap is inserted in the table. If the new LENGTH is greater than the old, a new array is defined and data are transferred from the old array to the new.

Error messages printed by this subroutine for which the error flag NPTERR is incremented are:

BULK STORAGE HAS NOT BEEN ALLOCATED. REDEFB CANNOT BE INVOKED
MAXIMUM NUMBER OF ENTRIES IN NAME TABLE EXCEEDED

(e) Subprograms called by this subroutine:

GETN
PUTM
PUTB
PURGE
PURGEB

(f) Subprograms calling this subroutine:

POINTR, User programs

J. POINTER, A Dynamic Storage Allocation Program

1. Description of Subprogram Package

The POINTER subprogram package is an early release of the BPOINTER routines which were described in section I of this chapter. POINTER may be considered a subset of the BPOINTER package in that all of the routines present in the former are also included in the latter and their functions are essentially identical. For that reason, a detailed subprogram description will not be given in this section; rather the reader is referred to section I of this chapter. In Table I (see section I) a list is provided of all subprograms and entry points of the BPOINTER package along with an indication of whether the routine is present in the POINTER package.

Although POINTER provides a large proportion of the data management chores of BPOINTER, some of the most important differences are listed below. It is, of course, obvious that routines and entry points not present in POINTER, as shown in Table II, may not be referenced by the calling program which uses POINTER.

Table II. Status of BPOINTER Subprograms in POINTR

Subprogram or Entry Point of BPOINTER	Status in POINTER Present ≡ Yes Not Present ≡ No
POINTR	Yes
BULK	No
FREE	No
PUTM	No
PUTPNT	Yes
PUTB	No
PUTBLK	No
WIPOUT	Yes
DUMP	Yes
GETPNT	Yes
CLEAR	Yes
SAVPRG	No
SAVE	No
INITL	No
GETN	Yes
REDSET	Yes
REDEFM	No
REDEFB	No
REDEF	Yes
PRGSET	Yes
PURGE	Yes
PURGEB	No
IGET	Yes
PRTI1	Yes
PRTI2	Yes
PRTR1	Yes
PRTR2	Yes
PRTA1	Yes
PRTA2	Yes
IPTERR	Yes
ILAST	Yes
ILASTB	No
ALLOC1	No
ALLOC2	No
FREE1	No
FREE2	No
LOCF	No
IPT2	No

2. Significant Differences Between POINTER and BPOINTER

i) Only one container array is used by POINTER as opposed to the two arrays, located in main and bulk, of BPOINTER. The container array of POINTER may be placed in either MAIN or BULK core by suitable use of the HIARCHY linkage editor control statement and the maximum size of the container array is set by the dimension of the container in the calling program. Thus, the maximum size of the container array may not be set dynamically at run time. Note that load modules which use POINTER will be significantly larger than those which use BPOINTER since the entire container array must be contained within the former whereas only a single word starting location is required by the latter.

ii) The subroutine POINTR has a different argument list in the POINTER package. The statement

```
CALL POINTR(ARRAY,LSTLOC,MAXSIZ,IPRINT)
```

initializes the POINTER package, where

ARRAY ≡ the local container array, a R*8 variable dimensioned to the maximum size of the container array.

LSTLOC ≡ the first available location in the container array, generally 1.

MAXSIZ ≡ the container array length in R*8 words.

IPRINT ≡ printout flag as in BPOINTER.

iii) The POINTER tables are limited to 100 array names rather than the 150 of BPOINTER.

iv) POINTER is written entirely in Fortran and requires no assembler language routines.

III. Detailed Description of the System Modules

A. Module INITIAL (DSNAME)

1. Description

INITIAL is REUSable and is the first module that is LOADed and LINKed (by the subprogram SYSTEM) in an ARC System run. It is executed by

```
CALL LINK ('INITIAL ',DSNAME)
```

where DSNAME is a REAL*8 array in the PCM. INITIAL stays in core for the entire ARC System run and ensures that initialization only occurs once. This RSM LOADs the RSM's SNIFF and BCDDS. It then

(a) LINKs SNIFF to store the array DSNAME,

(b) LINKs BCDDS to spool the input data onto FT09F001 and to build tables describing the input.

2. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 21.

(b) Comments

A call to INITIAL after the first execution simply returns control to the calling routine.

3. Error Messages

This module can only produce error messages if the LOAD or LINK malfunctions.

4. Listing

The listing for this module is shown in Fig. 22.

B. Module SNIFF (DSNAME,N,IRW)

1. Description

SNIFF is a REUSable module that is LOADed and first executed by INITIAL. During the first execution, a table of data set names is transferred from the PCM and stored in the array NAMES of SNIFF. This table of names is passed from the first PCM to be executed, through SUBROUTINE SYSTEM and the RSM INITIAL. The order of the data set names (DSNAME, a REAL*8 array with dimension (89) passed from the PCM must agree with the ddname fields on the OS/360 DD cards for the path execution in the following way:

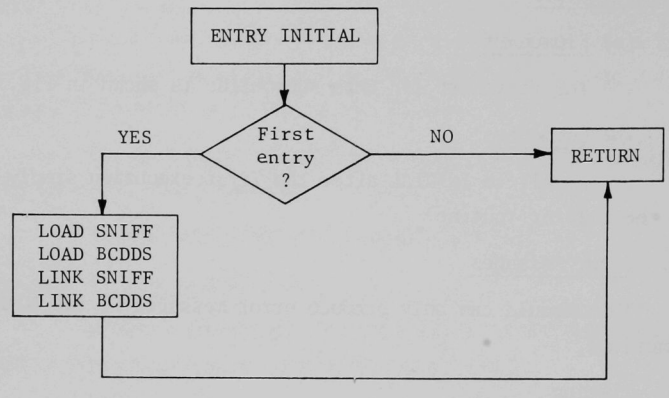


Fig. 21. Flowchart for Module INITIAL

```
MEMBER NAME  INITIAL                                                    00000100
C                                                                       00000200
C      INITIAL IS LOADED AND IS REUSABLE.                               00000300
C                                                                       00000400
C***********************************************************************00000500
C                                                                       00000600
      SUBROUTINE INITIA(DSNAME)                                         00000700
      REAL*8 DSNAME(1)                                                  00000800
      DATA IFLAG/0/                                                     00000900
      REAL*8 SNIFF,BCDDS                                                00001000
      DATA SNIFF/'SNIFF   '/                                            00001100
      DATA BCDDS/'BCDDS   '/                                            00001200
C                                                                       00001300
C     WHEN IFLAG=1, THE DYNAMIC PART OF THIS ROUTINE IS BYPASSED.       00001400
C     NO OTHER CALL TO INITIAL WILL BE EFFECTIVE                        00001500
C                                                                       00001600
      IF(IFLAG.EQ.0)GO TO 1                                             00001700
      RETURN                                                            00001800
C                                                                       00001900
    1 CONTINUE                                                          00002000
      N=1                                                               00002100
      IRW=1                                                             00002200
      IFLAG=1                                                           00002300
      CALL LOAD(SNIFF)                                                  00002400
      CALL LOAD(BCDDS)                                                  00002500
C                                                                       00002600
C                                                                       00002700
C     FIRST CALL TO SNIFF INITIALIZES TABLES.                           00002800
C                                                                       00002900
      CALL LINK(SNIFF,DSNAME,N,IRW)                                     00003000
C                                                                       00003100
C     FIRST CALL TO BCDDS PROCESSES INPUT DATA, PRODUCES DATA SET       00003200
C     FT09F001 AND BUILDS TABLES FOR UP TO 100 DATA BLOCKS.             00003300
C                                                                       00003400
      CALL LINK(BCDDS,DSNAME,N)                                         00003500
      RETURN                                                            00003600
      END                                                               00003700
```

Fig. 22. Source Listing for Module INITIAL

```
DSNAME(1) :FT11F001
DSNAME(2) :FT12F001
 .
 .
DSNAME(22):FT32F00n     where n is a file number that exists.
 .
 .
DSNAME(30):FT40F001,FT40F002 etc.
```

The last correspondence shows that one DSNAME may suffice for several files of data set.

SNIFF moves the DSNAME array into its own array, NAMES. When SNIFF is called, a search is made for the name given in the first parameter. If the name is found, its ordinal in the array NAMES is noted, 10 is added to it and returned in the INTEGER*4 variable N. The third variable IRW (INTEGER*4) is under the control of the programmer. If the intention is to write, IRW is set equal to 1. An existence flag is then set that will be interpreted to mean that DSNAME has been written. This is, of course, not true; the data set isn't written until the proper WRITE statement is executed. If IRW=0, the request is normally for a read, and the existence of this data set is indicated by the fact that a value of N greater than zero is returned. If N=0, the existence flag has not yet been set. If DSNAME does not exist N=-1 is returned. If IRW=2, the existence flag for DSNAME is turned off.

The function of SNIFF is to allow one set of OS/360 DD cards to serve an entire ARC System run, where modules only know the glossary names of the data sets to be used. Moreover, a PCM can call another PCM; the DSNAME array from the first call to SNIFF is retained in the array NAMES. The first PCM executed has filled NAMES and set the DSNAME:DDNAME: DATA SET REFERENCE NUMBER correspondence for the entire run.

A call to SNIFF with DSNAME='CHANGE' interchanges the name associated with N and IRW in the array NAMES.

2. Example

```
      REAL*8  ANIP/'A.NIP'/
      CALL SNIFF(ANIP, N, 1)
      IF(N.GT.0)GO TO 1
      IF(N.LT.0)GO TO 2
      WRITE(6,1000)
 1000 FORMAT('1 SNIFF RETURNED N = 0 FOR IRW = 1')
      CALL ABEND
    2 WRITE(6,1001)ANIP
 1001 FORMAT(1, A8, IS NOT IN DSNAME ARRAY')
      CALL ABEND
    1 WRITE(N) list
```

3. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 23.

(b) Description of Flowchart

IFLAG=0 at the start of the run. The first LINK of this module initializes this routine and sets IFLAG=1 so that any subsequent calls to SNIFF will bypass the initialization section. This first link is a direct result of the statement,

CALL SYSTEM(DSNAME) in the first PCM.

After this first LINK, all modules are able to communicate with the data definition cards as specified by the path.

Subsequent LINKs to SNIFF produce

N = 0 if IRW=1 and the data set does not exist,

N = -1 if the data set name is not in the initialized list,

N > 0 if all conditions are met.

4. Error Messages

(a) SNIFF**********dsname IS NOT A DATA SET IN THIS PATH

(b) SNIFF**********dsname HAS NOT BEEN WRITTEN YET AND YOU HAVE REQUESTED TO READ IT

5. Listing

The listing for this subroutine is shown in Fig. 24.

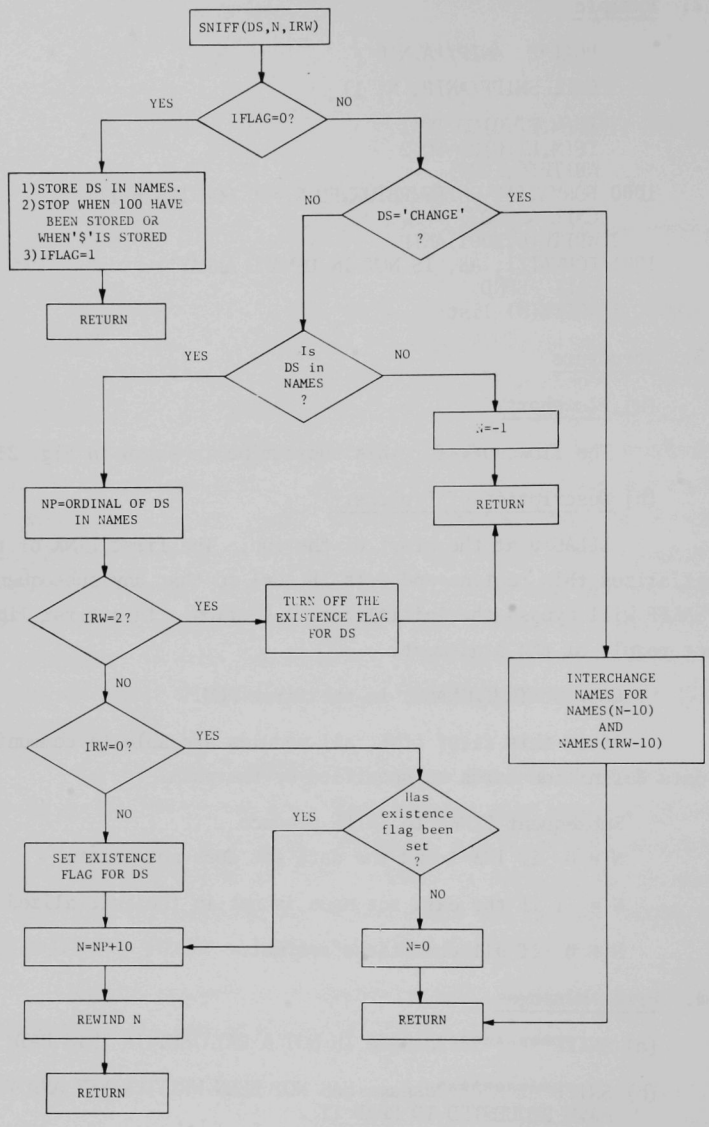


Fig. 23. Flowchart for Subroutine SNIFF

```
MEMBER NAME  SNIFF                                                      00000100
C                                                                       00000200
C***********************************************************************00000300
      SUBRCUTINE SNIFF(DS,N,IRW)                                        00000400
C                                                                       00000500
C     SNIFF IS LOADED AND IS REUSABLE                                   00000600
C     IF DS IS REQUESTED AND IRW=1, THE ORDINAL J OF DS IS FOUND IN     00000700
C     NAMES AND INAME(J) IS SET TO J+10                                 00000800
C     IF DS IS REQUESTED AND IRW=0, THEN INAME(J) WHERE J IS THE        00000900
C     ORDINAL OF DS IN NAMES MUST BE J+10. IF NOT, YOU ARE TRYING TO    00001000
C     READ A NON-EXISTENT DATA SET.                                     00001100
      REAL*8 TEMP,CHANGE                                                00001200
      DATA CHANGE/'CHANGE  '/                                           00001300
      REAL*8 NAMES (89),DS(1)                                           00001400
      DATA NAMES/89*'      '/                                           00001500
      INTEGER*2 INAME(89)/89*0/                                         00001600
      REAL*8 DOLLAR/'$       '/                                         00001700
      DATA IFLAG/0/                                                     00001800
      IF(DS.EQ.CHANGE)GO TO 2                                           00001900
      IF(IFLAG.NE.0)GO TO 3                                             00002000
C                                                                       00002100
C     THIS SECTION BUILDS PERMANENT TABLES OF DATA SET NAMES.           00002200
C     INITIALIZATION IS FROM THE REAL*8 ARRAY DSNAMES IN THE PATH       00002300
C     CONTROL MODULE. ONLY THE FIRST PATH CONTROL MODULE HAS ACCESS TO  00002400
C     THIS SECTION. BY THIS METHOD DATA SET REFERENCE NUMBERS ARE       00002500
C     CONSTANT THROUGHOUT A RUN AND THEY ARE CONTROLLED ONLY BY THE     00002600
C     FIRST PATH CONTROL MODULE. AFTER THIS SECTION IS EXECUTED, THE ARR00002700
C     NAMES CONTAINS THE INITIALIZED ARRAY DSNAMES.                     00002800
C     IRW=2 CAUSES DS TO BE CONSIDERED AS A   NEW DATA SET.             00002900
C     IRW=3 RETURNS THE NAME OF THE DATA SET ASSOCIATED WITH N IN DS.   00003000
C                                                                       00003100
      DO 4 I=1,89                                                       00003200
      NAMES(I)=DS(I)                                                    00003300
      IF(NAMES(I).EQ.DOLLAR)GO TO 5                                     00003400
    4 CONTINUE                                                          00003500
    5 CONTINUE                                                          00003600
      IFLAG=IFLAG+1                                                     00003700
      RETURN                                                            00003800
C                                                                       00003900
    3 CONTINUE                                                          00004000
      IF(IRW.EQ.3) GO TO 300                                            00004100
      DO 100  I=1,89                                                    00004200
      IF(NAMES(I).EQ.DOLLAR)GO TO 101                                   00004300
      IF(DS.NE.NAMES(I))GO TO 100                                       00004400
```

Fig. 24. Source Listing for Subroutine SNIFF

```
      NP=I                                                              00004500
      GO TO 200                                                         00004600
  100 CONTINUE                                                          00004700
  101 CONTINUE                                                          00004800
      N=-1                                                              00004900
      WRITE(6,1000)DS                                                   00005000
 1000 FORMAT(' SNIFF**********',A8,' IS NOT A DATA SET IN THIS PATH.')  00005100
      GO TO 2000                                                        00005200
  200 CONTINUE                                                          00005300
      IF(IRW.EQ.2)GO TO 6                                               00005400
      IF(IRW.NE.0)GO TO 1                                               00005500
      IF(INAME(NP).NE.0)GO TO 1                                         00005600
      N=0                                                               00005700
      WRITE(6,1001)DS                                                   00005800
 1001 FORMAT(' SNIFF**********',A8,' HAS NOT BEEN WRITTEN YET AND YOU HA00005900
     1VE REQUESTED TO READ IT.')                                        00006000
      GO TO 2000                                                        00006100
    1 CONTINUE                                                          00006200
      INAME(NP)=NP+10                                                   00006300
      N=INAME(NP)                                                       00006400
      REWIND N                                                          00006500
 2000 CONTINUE                                                          00006600
      RETURN                                                            00006700
    6 INAME(NP)=0                                                       00006800
      RETURN                                                            00006900
    2 TEMP=NAMES(N-10)                                                  00007000
      NAMES(N-10)=NAMES(IRW-10)                                         00007100
      NAMES(IRW-10)=TEMP                                                00007200
      RETURN                                                            00007300
  300 IF (N.LT.11.OR.N.GT.99) GO TO 310                                 00007400
      DS=NAMES(N-10)                                                    00007500
      RETURN                                                            00007600
  310 WRITE (6,1002)N                                                   00007700
 1002 FORMAT(' SNIFF**********',I4,' IS NOT A LEGAL DATASET REFERENCE NU00007800
     1MBER AND YOU HAVE REQUESTED THE DATASET NAME CORRESPONDING TO IT')00007900
      RETURN                                                            00008000
      END                                                               00008100
```

Fig. 24 (Contd.)

C. Module BCDDS(NAME,N)

1. Description

BCDDS is a REUSable module that is LOADed by INITIAL. This module has two functions,

(a) To spool all of the input data onto FT09F001 and to construct tables describing that input.

(b) To retrieve portions of the input data and to construct or modify the appropriate data sets from that input.

These tasks are done by LINKing the non-resident modules SCAN and STUFF.

SCAN is only LINKed once during an ARC run. During this execution SCAN builds the following table that is stored in BCDDS.

BLKNME	BLKDTA		
100 REAL*8 entries that are names of data blocks in the input stream	=0 until this block is processed =I after block is processed	=0 if no more blocks by this name appear in BLKNME =N (N>I) if another block by this name appears	= count of cards in the block

There are 100 entries in the table allowing for 100 blocks of data to be described. The block names are stored in the 100 REAL*8 word array BLKNME. The 3 × 100 INTEGER*2 array BLKDTA stores 3 pieces of information concerning each block:

1. Has this block been processed?
2. Is there another block by this name? If so, where is it in this array?
3. How big is this block?

2. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 25.

(b) Description of Flowchart

The first LINK to BCDDS causes a LINK to SCAN. This LINK can only come from the first call to INITIAL. Subsequent LINKs to BCDDS, LINK STUFF to process a particular block of data. The detailed discussion of the structure of a path data deck is given in Chapter 3. Only the mechanism for locating blocks will be given here.

The input to an ARC System run is arranged in blocks that are each begun by a card having BLOCK= in cols. 1-6. Columns 7-14 contain the name of the block. When a path needs data, the statement,

```
CALL LINK('BCDDS   ', name, N)  or,
CALL BCDDS(name, N)
```

will cause the block called 'name' to be processed; the results of that LINK are given in N.

When BCDDS LINKs STUFF to find and process the block, STUFF searches the array BLKNME for name. If BLKNME(I) = name and BLKDTA(1,I) = 0, then BLKNME(I) exists and has not been processed. Since BLKDTA(3,I) contains the number of cards in this block (and BLKDTA(3,N) contains the card count in the Nth block) the cards for BLKNME(I) can be found on FT09F001. SCAN then produces data sets according to control cards in the Ith block.

If BLKNME(I) = name and BLKDTA(1,I) = I, this block has already been processed. BLKDTA(2,I) contains the ordinal of the next entry in BLKDTA called name. If BLKDTA(2,I) = 0, there are no more blocks with this name and no data sets are formed.

3. Error Messages

BCDDS produces no error messages, but after calling SCAN or STUFF, error messages may appear. All of the possible conditions are reflected in the value of N returned.

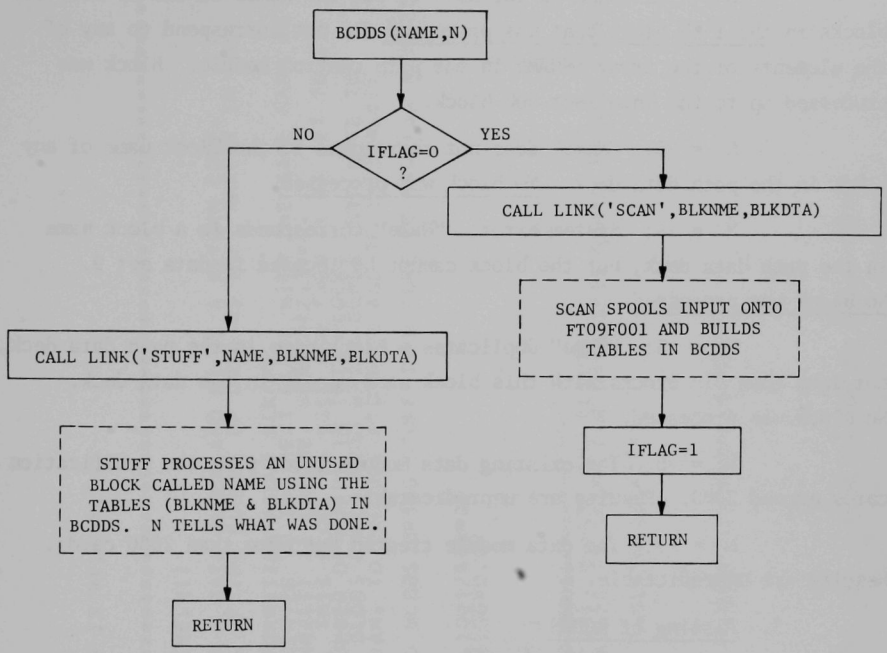


Fig. 25. Flowchart for Module BCDDS

4. Meaning of Values of N as a Returned Value

N = 1: "Name" duplicates a block name in the path data deck, and at least "i" blocks with this block name appear in the data deck. The i-th such block was processed.

N = -2: Same as for N1 = 1, but the names of one or more sub-blocks in the i-th block that was processed did not correspond to any of the elements of the array DSNAME in the path control module. Block was processed up to the incorrect sub-block.

N = -3: "Name" does not correspond to the block name of any block in the path data deck. No block was processed.

N = -4: System error. "Name" corresponds to a block name in the path data deck, but the block cannot be located in data set 9. No block was processed.

N = -5: "Name" duplicates a block name in the path data deck, but less than "i" blocks with this block name appear in the data deck. No block was processed.

N = -6: The existing data module cards plus the modification cards exceed 2000. Results are unpredicatable.

N = -7: The data module created has more than 2000 cards. Results are unpredictable.

5. Listing of BCDDS

The listing for this subroutine is shown in Fig. 26.

D. Module ARCIBCOM

1. Description

This module is REUSable and is the resident I/O package for the ARC System. It is LOADed by the copy of IBCOM in the first PCM executed during an ARC System run. The module consists of an assembler language interface (also called ARCIBCOM) that is link-edited with the entire FORTRAN I/O package. The purpose is to allow modules to use the FORTRAN IV I/O statements with no restrictions and complete transparancy, and to allow all modules to communicate with one copy of the FORTRAN I/O package.

```
MEMBER NAME  BCDDS                                                      00000100
C                                                                       00000200
C      BCDDS IS LOADED AND IS REUSABLE.                                 00000300
C                                                                       00000400
C                                                                       00000500
C*********************************************************************00000600
C                                                                       00000700
      SUBROUTINE BCDDS(NAME,N1)                                         00000800
C                                                                       00000900
C     NAME IS THE NAME OF A DATA BLOCK AND N1 IS A RETURN CODE.         00001000
C     BLKNME IS THE NAMES OF THE BLOCKS OF DATA AS THEY APPEAR IN THE   00001100
C     INPUT STREAM.                                                     00001200
C     BLKDTA CONTAINS INFORMATION ABOUT BLKNME.                         00001300
C     BLKDTA(1,I) IS A POINTER TO THE NEXT BLOCK WITH THE SAME NAME AS  00001400
C     BLKNME(I). IF  BLKNME(I) IS UNIQUE, BLKDTA(2,I)=0.                00001500
C     BLKDTA(1,I)=0 UNTIL THIS BLOCK IS USED AND THEN IT IS SET TO I.   00001600
C     BLKDTA(3,I)= THE NUMBER OF CARDS IN THIS BLOCK.                   00001700
C     THE FIRST ENTRY OF BLDDS CALLS SCAN WHICH COMES INTO CORE TO      00001800
C     READ THE INPUT STREAM, TO PRODUCE FT09F001 AND TO INITIALIZE      00001900
C     BLKNME AND BLKDTA.                                                00002000
C     SUBSEQUENT CALLS TO BCDDS BRING STUFF INTO CORE TO PROCESS A BLOCK00002100
C     OF DATA                                                           00002200
C                                                                       00002300
      INTEGER*2 BLKDTA(3,100)/300*0/                                    00002400
      REAL*8 BLKNME(100)/100*0.0/                                       00002500
      REAL*8 NAME,NAMREC                                                00002600
      DATA IFLAG/0/                                                     00002700
      IF(IFLAG.NE.0)GO TO 1                                             00002800
C                                                                       00002900
C     SCAN IS ONLY CALLED ONCE.                                         00003000
C     SCAN PRODUCES FT09F001, BLKNME AND BLKDTA.                        00003100
C     SCAN UPDATES THE TABLES IN SNIFF FOR DATA SETS NAMED IN BLOCK=OLD.00003200
C                                                                       00003300
      CALL LINK('SCAN    ',BLKNME,BLKDTA)                               00003400
      IFLAG=1                                                           00003500
      RETURN                                                            00003600
C                                                                       00003700
    1 CONTINUE                                                          00003800
      CALL LINK('STUFF   ',NAME,N1,BLKNME,BLKDTA)                       00003900
      RETURN                                                            00004000
      END                                                               00004100
```

Fig. 26. Source Listing for Module BCDDS

There is only one change made to the FORTRAN I/O package supplied by IBM; IHCFIOSH had one character changed on each of two statements (see II.D. of this Chapter).

The I/O mechanism for the ARC System is that all I/O calls are trapped by the system subroutine IBCOM and transmitted to the FORTRAN I/O package through the subroutine ARCIBCOM.

2. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 27.

(b) Description

The use count starts at -1 and its return to negative signifies that the exit call was made by the module that caused ARCIBCOM to be LOADed in the first place. The initiation of every I/O operation is made slower by the addition of several instructions, but once the FORTRAN I/O routines are entered, there is no further overhead.

This module is structured so that only a change in the name and/or functions of entry points of the FORTRAN I/O package can cause trouble.

3. Error Messages

The interface and the subroutine IBCOM (link-edited with the calling module) are constructed to be transparent to the user. No error messages are issued.

4. Listing of ARCIBCOM

The listing of this subroutine is shown in Fig. 28.

E. Module SCAN(BLKNME,BLKDTA)

1. Description

SCAN is used once in the course of an ARC System run. It is LINKed by BCDDS during the initialization phase. The functions of SCAN are very simple:

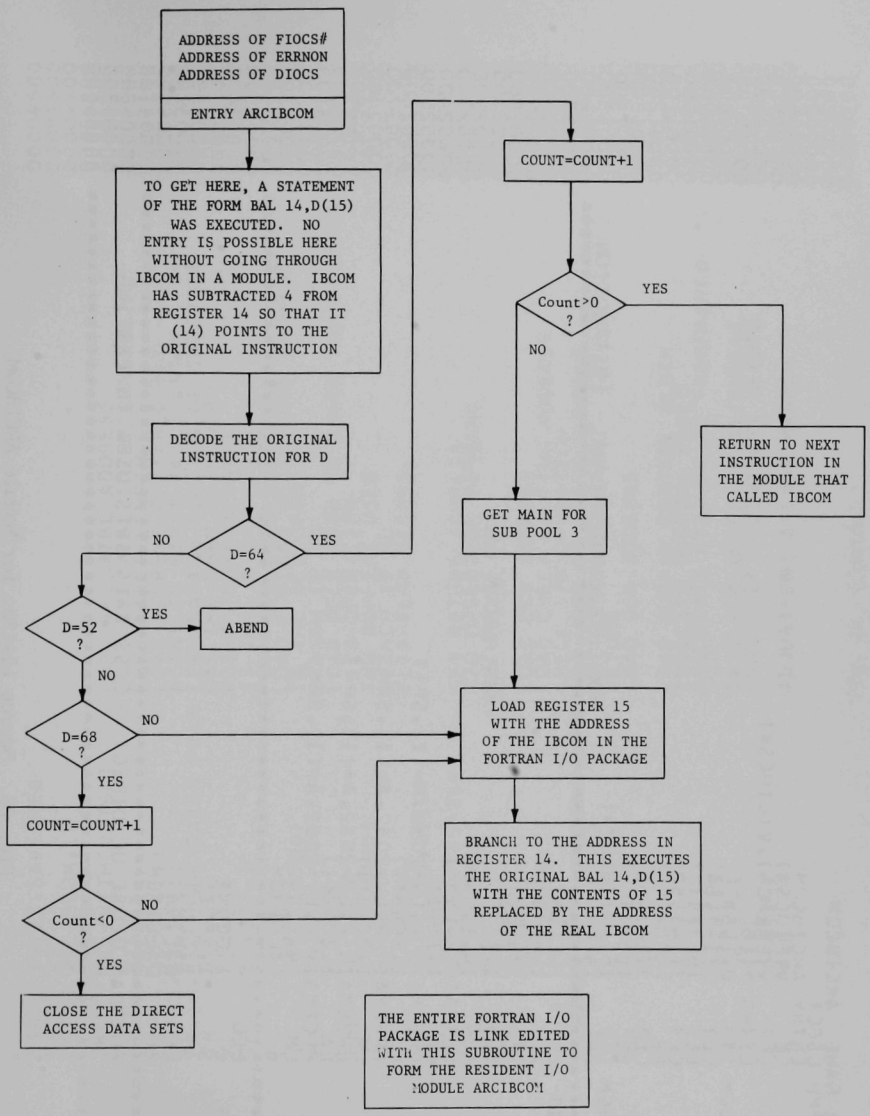


Fig. 27. Flowchart for Module ARCIBCOM

```
MEMBER NAME  ARCIBCOM                                                   00000100
ARCIBCOM CSECT                                                          00000200
         ENTRY ARCIBCOM                                                 00000300
         DC    V(FIOCS#)                                                00000400
         DC    V(ERRMCN),V(DIOCS#)                                      00000500
         USING *,15                                                     00000600
ARCIBCOM STM   0,1,SA                                                   00000700
         CLI   3(14),64                                                 00000800
         BE    IBFINIT                                                  00000900
         CLI   3(14),52                                                 00001000
         BE    FSTOP                                                    00001100
         CLI   3(14),68                                                 00001200
         BE    IBEXIT                                                   00001300
CALLIBCM L     15,=V(IBCOM#)                                            00001400
         BR    14                     EXECUTE ORIGINAL BAL  INSTRUCTION 00001500
******************************************************************* 00001600
IBFINIT  L     1,CCUNT                                                  00001700
         A     1,=F'1'                                                  00001800
         ST    1,COUNT                                                  00001900
         LM    0,1,SA                                                   00002000
         BNZ   4(14)                  NOP IBCOM CALL                   00002100
         STM   14,1,SAVE                                                00002200
         GETMAIN R,LV=8192,SP=3                                         00002300
         LA    1,16(1)                                                  00002400
         FREEMAIN R,LV=2032,A=(1),SP=3                                  00002500
         LA    1,2048(1)                                                00002600
         FREEMAIN R,LV=2032,A=(1),SP=3                                  00002700
         LA    1,2048(1)                                                00002800
         FREEMAIN R,LV=2032,A=(1),SP=3                                  00002900
         LA    1,2048(1)                                                00003000
         FREEMAIN R,LV=2032,A=(1),SP=3                                  00003100
         LM    14,1,SAVE                                                00003200
         B     CALLIBCM                                                 00003300
******************************************************************* 00003400
FSTOP    EQU   *                                                        00003500
IBEXIT   L     1,CCUNT                                                  00003600
         S     1,=F'1'                                                  00003700
         ST    1,CCUNT                                                  00003800
         LM    0,1,SA                                                   00003900
         BM    CALLIBCM                                                 00004000
******************************************************************* 00004100
*        FORTRAN CLOSE OF DIRECT ACCESS DATA SETS USED IN EXITING       00004200
*         MODULE                                                        00004300
******************************************************************* 00004400
```

Fig. 28. Source Listing for Module ARCIBCOM

```
         STM   14,13,SAVEAREA                                          00004500
         DROP  15                                                      00004600
         USING ARCIBCOM,12                                             00004700
         LR    12,15                                                   00004800
         L     11,=V(IHCUATBL)      LOAD IHCUATBL ADDRESS              00004900
         LA    6,16                 LOAD IHCUATBL ENTRY LENGTH         00005000
         LH    7,2(11)              LOAD TABLE LENGTH                  00005100
         LA    7,0(7,11)            LOAD ADDRESS OF TABLE END - 8      00005200
         LA    11,8(11)             POINT TO FIRST TABLE ENTRY         00005300
*        FOLLOWING CODE TAKEN FROM TERMINATION SECTION OF IHCDIOSE     00005400
NEXTENT  TM    3(11),1              HAS THE DSRN BEEN USED             00005500
         BC    SETNEXT              POINT TO NEXT ENTRY                00005600
         TM    15(11),1             IS THIS A DA DATA SET              00005700
         BC    SETNEXT              POINT TO NEXT ENTRY                00005800
         L     10,C(11)             LOAD FORTRAN UNIT BLOCK ADDRESS    00005900
         TM    1(10),X'90'          IS THE DCB OPEN                    00006000
         BZ    FREEUB               BRANCH IF NO                       00006100
         L     5,8(10)              LOAD DECB ADDR TO CHECK FOR PENDING 00006200
         BAL   4,CHECK               I/O OPERATION                     00006300
         TM    1(10),X'A0'          TWO BUFFERS USED                   00006400
         BZ    TERMB                BRANCH IF NO                       00006500
         L     5,16(10)             FLIP FLOP DECB'S                   00006600
         MVC   16(4,10),8(10)                                          00006700
         ST    5,8(10)                                                 00006800
         LA    4,TERMB              SET RETURN ADDRESS                 00006900
CHECK    TM    8(10),X'20'          I/O OPERATION PENDING              00007000
         BCR   1,4                  RETURN IF NO                       00007100
         LA    1,0(5)                                                  00007200
         L     14,8(1)              LOAD DCB ADDRESS                   00007300
         L     15,52(14)            LOAD CHECK ROUTINE ADDRESS         00007400
         BALR  14,15                CHECK I/O OPERATION                00007500
*        FORTRAN MAIN PROGRAM SAVEAREA USED BY CHECK ROUTINE           00007600
         OI    8(10),X'20'          SET COMPLETE FLAG                  00007700
         BR    4                    RETURN                             00007800
TERMB    LA    9,80(10)             LOAD DCB ADDRESS                   00007900
         LR    1,9                                                     00008000
         L     15,20(1)             LOAD BUFFER CONTROL BLOCK          00008100
         OI    23(1),1              INDICATE BUFFERS FREED             00008200
         LH    14,4(15)             CALCULATE SIZE TO BE FREEMAINED    00008300
         MH    14,6(15)                                                00008400
         TM    32(1),1              TEST FOR BOUNDARY ALIGNMENT        00008500
         BO    *+12                 BRANCH IF ADJUSTMENT NEEDED        00008600
         LA    0,8(14)                                                 00008700
         B     *+8                  ADJUSTMENT BYPASS BRANCH           00008800
```

Fig. 28 (Contd.)

```
         LA    0,16(14)          BOUNDARY ALIGNMENT ADJUSTMENT        00008900
         LA    1,0(15)                                                00009000
         SVC   10                FREEMAIN BUFFERS                     00009100
         BAL   1,*+8             SET UP CLOSE PARAMETERS              00009200
         DC    A(0)              DCB ADDRESS                          00009300
         ST    9,0(1)            STORE DCB ADDRESS IN LIST            00009400
         MVI   0(1),128          SET CLOSE OPTION                     00009500
         SVC   20                CLOSE DCB                            00009600
         NI    1(10),X'6F'       INIICATE DCB CLOSED                  00009700
FREEUB   LA    0,184             LOAD UNIT BLOCK LENGTH               00009800
         LR    1,10              LOAD UNIT BLOCK ADDRESS FOR FREEMAIN 00009900
         SVC   10                FREEMAIN                             00010000
         OI    3(11),1           TURN OFF USE INDICATOR               00010100
         OI    15(11),1          TURN OFF DA DATA SET INDICATOR       00010200
SETNEXT  BXLE  11,6,NEXTENT      BRANCH TO NEXT ENTRY OTHERWISE EXIT  00010300
         L     13,4(13)                                               00010400
         L     14,12(13)                                              00010500
         SR    15,15                                                  00010600
         LM    0,12,20(13)                                            00010700
         BR    14                                                     00010800
SAVE     DS    4F                                                     00010900
SAVEAREA DS    16F                                                    00011000
SA       EQU   SAVEAREA+8                                             00011100
COUNT    DC    F'-1'                                                  00011200
         END                                                          00011300
```

Fig. 28 (Contd.)

(a) It spools the input data onto FT09F001 and builds the tables BLKNME and BLKDTA that describe the data. BLKNME and BLKDTA are located in the module BCDDS.

(b) For a BLOCK named 'OLD', SCAN executes the statement

CALL LINK('SNIFF',name,1)

for every DATASET=name that it encounters until the next BLOCK card or the end of data is sensed. This is done so that when a module wants to read an existing data set, SNIFF has been informed of its existence and returns the proper data set reference number.

2. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 29.

(b) Description of the Flowchart

The flowchart shows how SCAN uses the keywords BLOCK, OLD, DATASET, MODIFY, NOSORT, REMOVE and the occurrence of the end of data (EOD) to write the input stream onto unit 9 and to build the tables BLKNME and BLKDTA.

SCAN also performs two functions to make the spooled data (on unit 9) easier to process in STUFF

(i) It SHIFTs all data set names on input cards so that they are aligned on a double-word boundary.

(ii) It places an identifiable END card after each data set and after each block.

3. Error Messages

(a) SCAN**********MORE THAN 100 BLOCKS
OF DATA ARE IN THE INPUT STREAM

(b) MORE THAN 2000 BCD CARDS ARE
IN THE INPUT STREAM

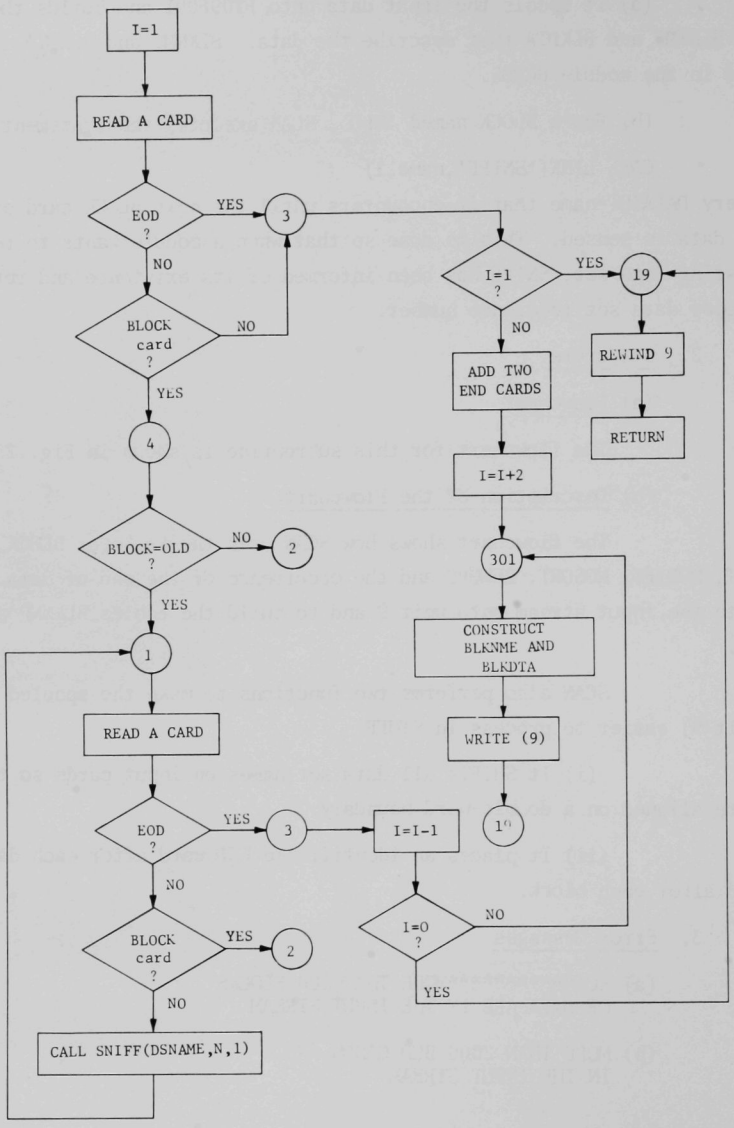


Fig. 29. Flowchart for Module SCAN

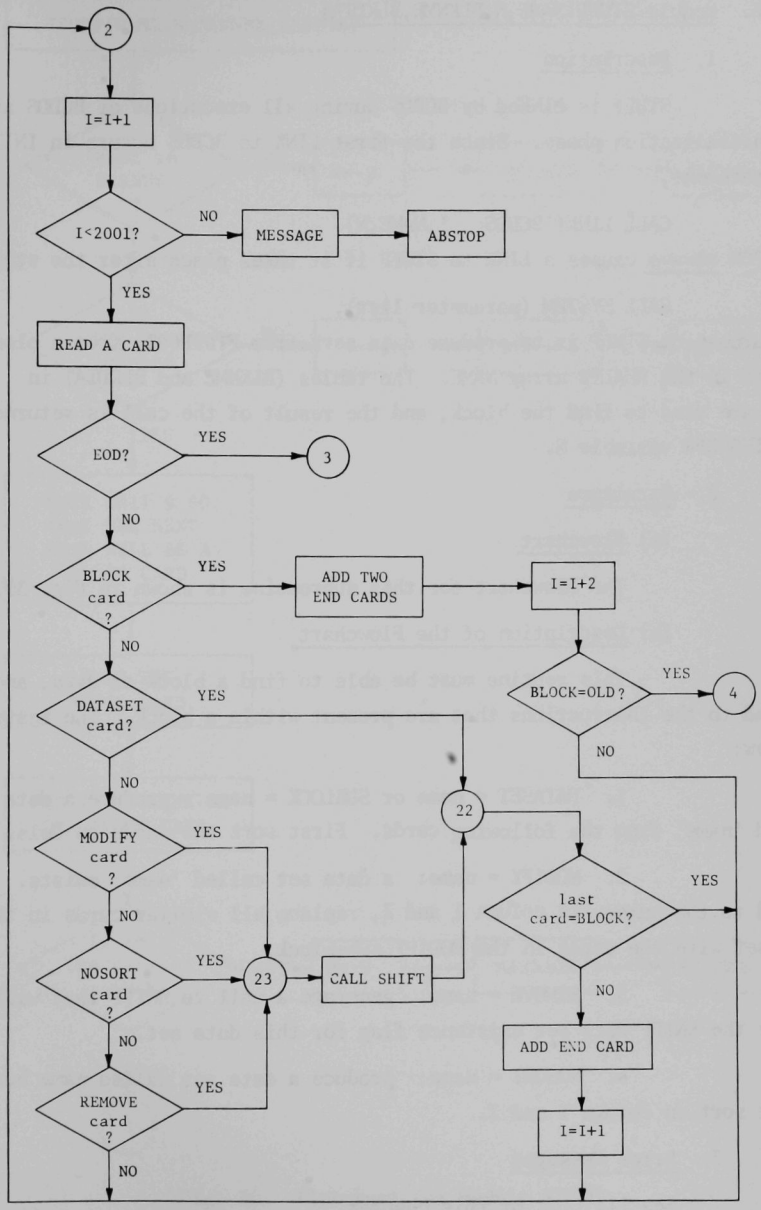


Fig. 29. Flowchart for Module SCAN (Contd.)

F. Module STUFF(NAME,N,BLKNME,BLKDTA)

1. Description

STUFF is LINKed by BCDDS during all executions of BCDDS after the initialization phase. Since the first LINK to BCDDS occurs in INITIAL, the statement,

```
CALL LINK('BCDDS   ',NAME,N)
```

in a PCM always causes a LINK to STUFF if it takes place after the statement

```
CALL SYSTEM (parameter list).
```

The purpose of STUFF is to produce data sets from FT09F001, from a block of data in the REAL*8 array NAME. The tables (BLKNME and BLKDTA) in BCDDS are used to find the block, and the result of the call is returned in INTEGER*4 variable N.

2. Structure

(a) Flowchart

The flowchart for this subroutine is shown in Fig. 30.

(b) Description of the Flowchart

This routine must be able to find a block of data, and respond to the instructions that are present within a block. The instructions are few:

1. DATASET = name or SUBLOCK = name: produce a data set called 'name' from the following cards. First sort the cards on Cols. 1-2.

2. MODIFY = name: a data set called 'name' exists. With regard to the number in column 1 and 2, replace all similar cards in the existing data set with the cards in the MODIFY sub-block.

3. REMOVE = name: generate a call to SNIFF that will modify the SNIFF data set existence flag for this data set.

4. NOSORT = name: produce a data set called name but do not sort on column 1 and 2.

3. Error Messages

See III.C.3. of this chapter.

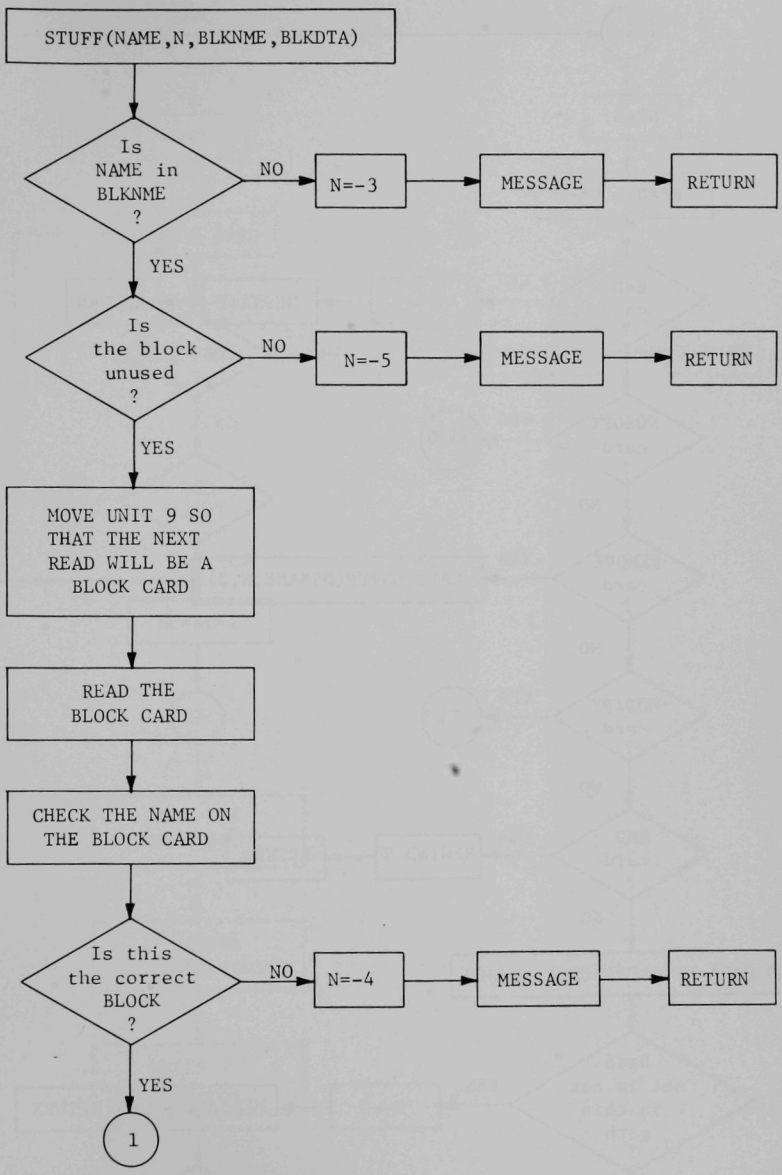


Fig. 30. Flowchart for Module STUFF

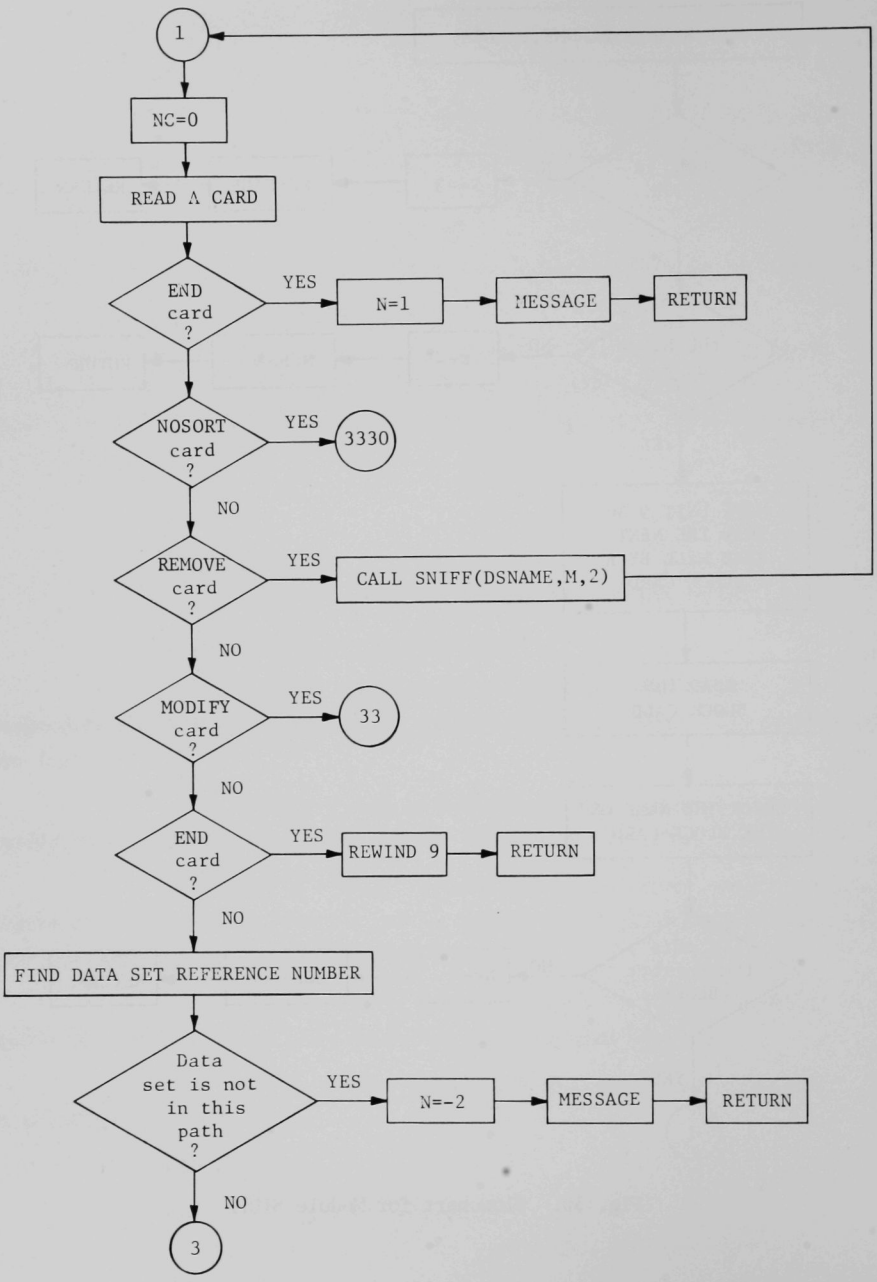


Fig. 30. Flowchart for Module STUFF (Contd.)

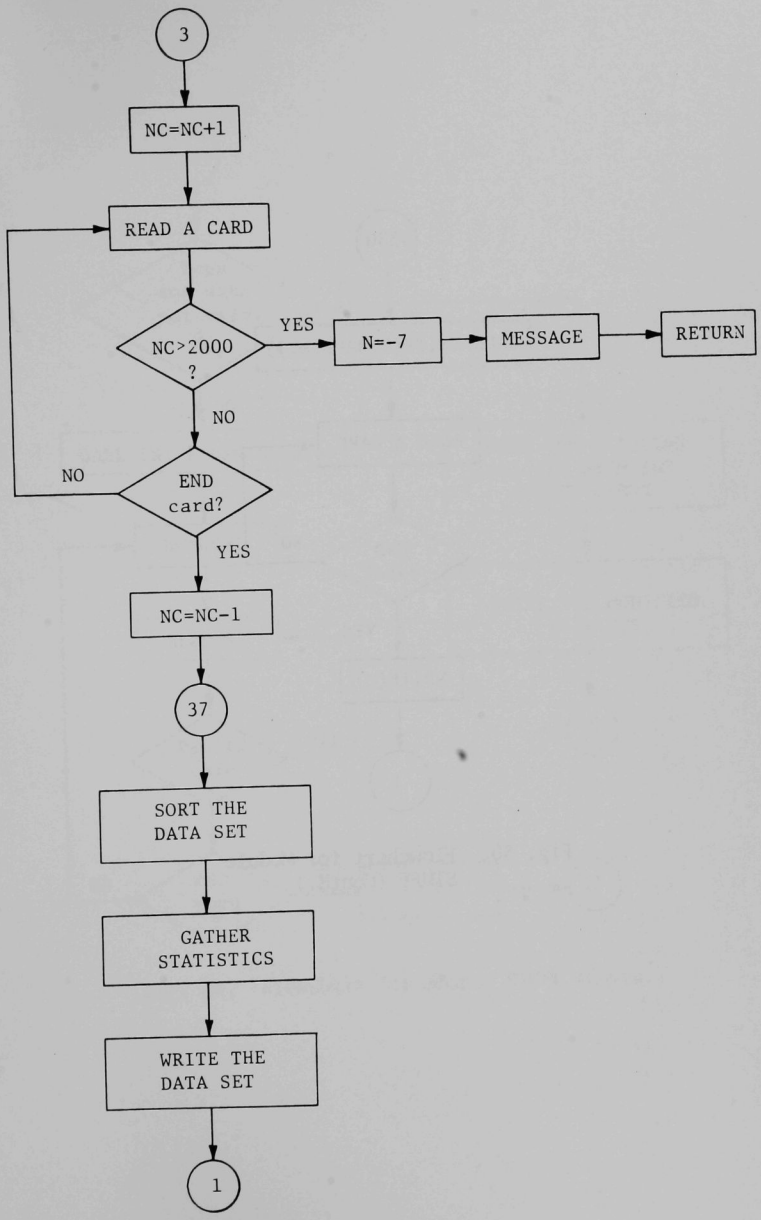


Fig. 30. Flowchart for Module STUFF (Contd.)

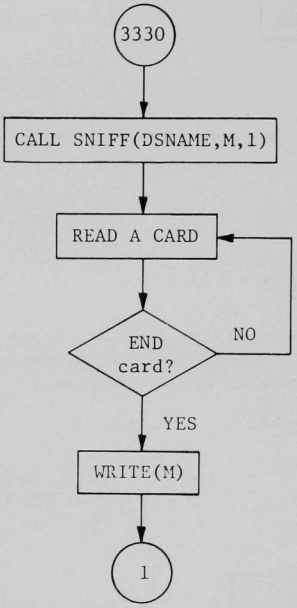


Fig. 30. Flowchart for Module STUFF (Contd.)

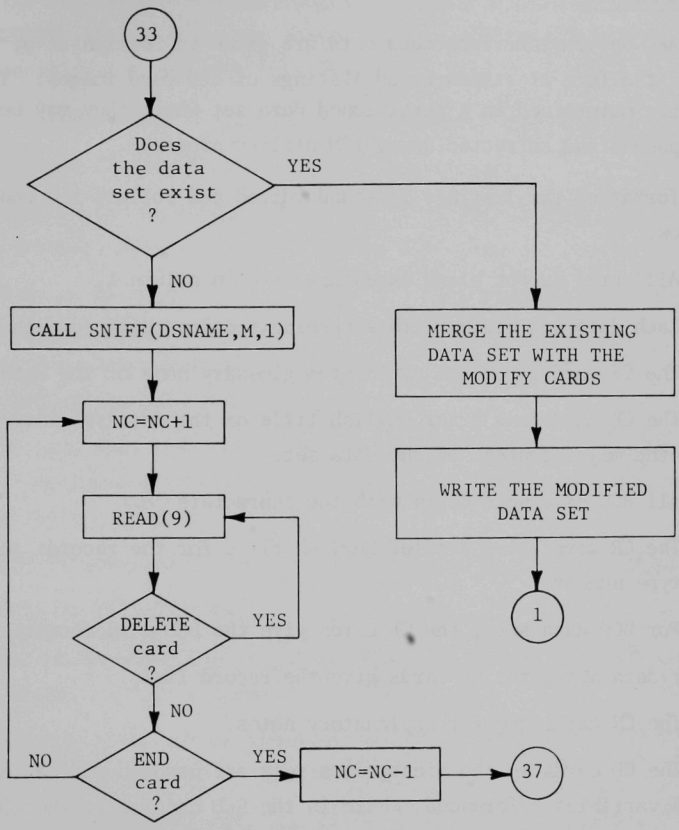


Fig. 30. Flowchart for Module STUFF (Contd.)

CHAPTER 5. DATA SET GLOSSARY

I. Introduction

The ARC System interface data sets are given in Section II of this chapter in the form of standardized listings of BCD card images. These listings are maintained in a partitioned data set where they may be easily expanded and corrected using IBM utility programs.

The format of the listings is standardized and follows the conventions given below.

1. All cards except blank cards have a C in column 1.

2. Each data set begins with a heading section outlined with asterisks.

3. The CF card gives the ARC System glossary name of the data set.

4. The CE card is a brief English title of the data set intended to convey the major content of the data set.

5. All BCD data sets begin with the characters 'A.'

6. The CR cards give a brief English title for the records and a record type number.

7. For BCD data sets, the CL cards give the BCD card formats, while for binary data sets, the CL cards give the record lists.

8. The CN cards are for explanatory notes.

9. The CD cards in the binary data sets are used to define the meaning of variables referenced, while in the BCD data sets, the CD cards give a description of the various fields within each card format.

10. Each record is outlined in minus signs.

11. Records are separated by two blank cards and the end of file is noted by a CEOF card separated by one blank card from the last record of the file.

12. File structure is defined, if necessary, by means of CS cards in a file structure section which follows the heading section.

13. In the binary data sets, variables which are used in more than one record are defined on CD cards located between the file structure section and the first record. These CD cards do not have a minus sign in column 72.

14. The repetition of a particular record is flagged by including 'NOTE STRUCTURE BELOW' after the record list on the CL card and the details of the repetition are described via Fortran Do loop notation.

15. CC cards define conditions under which records appear.

16. Data on CF and CE cards begin in column 13.

17. Data on CN cards begin in column 25 in the heading section and in binary records, and in column 17 in BCD data sets.

18. Data on CD cards begin in column 7. For BCD records, these data references card column numbers with the contents described beginning in column 17. For binary records, the variable being defined begins in column 7 and its definition begins in column 25.

19. CL card data begin on column 7. For BCD records, the data consist of 'FORMAT' followed by the BCD card format. For binary records, the data consist of the record list.

20. The CS cards vary according to the individual file structure.

21. Data on CR and CC cards begin in column 13.

22. All cards other than CD cards appearing before the first record, and blank cards, contain a minus sign in column 72.

23. Columns 73-80 are reserved for numbering sequences with numbering by 100 occurring in columns 76-80, or 75-80 in the case of long data sets.

Section II lists each data set which is written by one module of the ARC System and read by another module. Other data sets which are written by a module for its own use are considered to be non-interface data sets and these are described in the individual module documentations.

II. Listing of the ARC System Interface Data Sets

The ARC System interface data sets are listed on the following pages.

```
C*********************************************************************
C                          PREPARED 1/26/71 AT ANL
C
CE          A.BURN
CE          GENERAL INPUT FOR FUEL CYCLE MODULES.
C
CN                         THIS IS A USER-SUPPLIED BCD DATA SET.
CN                         THE BCD FORMAT OF THE DATA CARD. COLUMNS 1-2
CN                         NORMALLY CONTAIN THE CARD TYPE NUMBER.
C
C*********************************************************************
C---------------------------------------------------------------------
CR          PROBLEM TITLE (TYPE 01)
C
CL     FORMAT-----(I2,4X,11A6)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======      ==================================================
CD     1-2          01
CD
CD     13-72        ANY ALPHANUMERIC CHARACTERS.
C
CN                  AS MANY TYPE 01 CARDS MAY BE USED AS ARE NECESSARY.
C
C---------------------------------------------------------------------
C---------------------------------------------------------------------
CR          STORAGE, DUMP AND CONVERGENCE CRITERIA
CR          SPECIFICATIONS (TYPE 02)
C
CL     FORMAT-----(I2,4X,3I6,3E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======      ==================================================
CD     1-2          02
CD
CD     7-12         POINTR DEBUGGING EDIT.
CD                  0...NO DEBUGGING PRINTOUT (DEFAULT).
CD                  1...DEBUGGING DUMP PRINTOUT.
CD                  2...DEBUGGING TRACE PRINTOUT.
CD                  3...FULL DEBUGGING PRINTOUT.
CD
CD     13-18        POINTR CONTAINER ARRAY SIZE IN REAL*8 WORDS.
CD
CD     19-24        POINTR CONTAINER ARRAY SIZE IN LCS IN REAL*8 WORDS.
CD
CD     25-36        CONVERGENCE CRITERION: MAXIMUM ALLOWABLE ERROR IN
CD                  REGION-ISOTOPE DENSITY (EPSN).
CD
CD     37-48        CONVERGENCE CRITERION: MAXIMUM ALLOWABLE ERROR IN
CD                  ANY ISOTOPE DISCHARGE DENSITY, FOR CONVERGENCE
CD                  OF CYCLIC MODE (EPSC).
CD
CD     49-60        CONVERGENCE CRITERION: MAXIMUM ALLOWABLE ERROR IN
CD                  ANY ISOTOPE CHARGE DENSITY, FOR CONVERGENCE OF
CD                  UNCONSTRAINED EQUILIBRIUM MODE (EPSE).
C
C---------------------------------------------------------------------
C---------------------------------------------------------------------
CR          PROBLEM DEFINITION DATA (TYPE 03)
C
CL     FORMAT-----(I2,10X,2I6,3F12.5,2I6)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======      ==================================================
CD     1-2          03
CD
CD     13-18        TYPE OF PROBLEM.
CD                  0...EQUILIBRIUM
CD                  1...NONEQUILIBRIUM
CD
CD     19-24        SEARCH PROCEDURE.
CD                  0...GIVEN BURNUP LIMIT AND UNPOISONED KEFF AT A
CD                      SPECIFIED FRACTION OF THE BURN TIME, FIND THE
CD                      BURN TIME THAT SATISFIES THE BURNUP LIMIT AS WELL
CD                      AS THE REACTOR CHARGE ENRICHMENT FOR WHICH THE
CD                      SPECIFIED KEFF IS MET.
CD
CD                  1...GIVEN BURN TIME AND UNPOISONED KEFF AT A SPECIFIED
CD                      FRACTION OF THE BURN TIME, FIND THE FUEL CHARGE
CD                      ENRICHMENT FOR WHICH THE SPECIFIED KEFF IS MET.
CD
CD                  2...GIVEN UNPOISONED KEFF AT THE START AND END OF THE
CD                      BURN TIME, FIND THE FUEL CHARGE ENRICHMENT FOR
CD                      WHICH THE INITIAL KEFF IS MET AND THE BURN TIME
CD                      AT WHICH THE FINAL KEFF IS REACHED.
CD
CD     25-36        BURN-TIME GUESS (DAYS) IF THE SEARCH PROCEDURE
CD                  (COLS. 13-18) IS 0 OR 2. SPECIFIED BURN TIME IF
CD                  SEARCH PROCEDURE IS 1.
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CD                                                                      -  009700
CD      37-48       CONVERGENCE CRITERION: RELATIVE ERROR ALLOWABLE IN  -  009800
CD                  BURNUP (SEE CARD TYPE 08).                          -  009900
CD                                                                      -  010000
CD      49-60       TOTAL REACTOR POWER (WATTS).                        -  010100
CD                                                                      -  010200
CD      61-66       NUMBER OF SUBINTERVALS INTO WHICH THE BURN TIME IS  -  010300
CD                  TO BE DIVIDED.                                      -  010400
CD                                                                      -  010500
CD      67-72       NUMBER OF FUEL MANAGEMENT OPERATIONS (BURN STEPS-1) -  010600
CD                  TO BE COMPLETED WITH THE PROBLEM AS DEFINED         -  010700
CD                  (NONEQUILIBRIUM CASE ONLY). PROBLEM WILL BE EDITED  -  010800
CD                  AND DUMPED BEFORE TERMINATION. ENTER 0 FOR EQUILIBRIUM -  010900
CD                  PROBLEMS.                                           -  011000
C                                                                       -  011100
CN                  AN EQUILIBRIUM PROBLEM IS DEFINED AS ONE IN WHICH THE  -  011200
CN                  USER WISHES TO FIND THE OPERATING CONDITIONS OF THE -  011300
CN                  SYSTEM AFTER AN INFINITE NUMBER OF BURN/DISCHARGE/  -  011400
CN                  FUEL STEPS WITH THE FIXED REACTOR CONDITIONS AS     -  011500
CN                  DEFINED. A NONEQUILIBRIUM PROBLEM IS ONE IN WHICH   -  011600
CN                  THE BURN/REFUEL STEPS ARE COMPUTED SUCCESSIVELY WITH -  011700
CN                  THE GIVEN PARAMETERS AND CONSTRAINTS. IT MAY REPRESENT -  011800
CN                  AN APPROACH TO EQUILIBRIUM WITH THE CONDITIONS FIXED -  011900
CN                  AS SPECIFIED.                                       -  012000
CN                                                                      -  012100
CN                  THE TOTAL BURN TIME OF A SINGLE STEP IS DIVIDED INTO -  012200
CN                  A NUMBER OF SUBINTERVALS, AS GIVEN IN COLS. 61-66 OF -  012300
CN                  THIS CARD. CORE FLUX DISTRIBUTIONS WILL BE COMPUTED -  012400
CN                  AT THE END OF EACH INTERVAL, AND IF CONTROL ROD MOCKUP -  012500
CN                  MATERIALS ARE PRESENT, THE APPROPRIATE CONTROL SEARCHES-  012600
CN                  WILL BE CARRIED OUT TO MAINTAIN KEFF=1.0 AT THESE END -  012700
CN                  POINTS. BURNUP MATRIX ELEMENTS WILL BE COMPUTED FROM -  012800
CN                  LINEAR AVERAGES OF THE START AND END VALUES OVER EACH -  012900
CN                  SUBINTERVAL. THESE AVERAGES WILL BE USED IN COMPUTING -  013000
CN                  THE ISOTOPIC CHANGES OVER THE SUBINTERVAL.          -  013100
C                                                                       -  013200
C-----------------------------------------------------------------------  013300
                                                                        013400
                                                                        013500
C-----------------------------------------------------------------------  013600
CR          CHARGE ENRICHMENT/CRITICALITY DATA (TYPE 04)                -  013700
C                                                                       -  013800
CL      FORMAT-----(I2,10X,5E12.5)                                      -  013900
C                                                                       -  014000
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY             -  014100
CD      =======             ===========================================-  014200
CD      1-2         04                                                  -  014300
CD                                                                      -  014400
CD      13-24       DESIRED UNPOISONED KEFF(0).                         -  014500
CD                                                                      -  014600
CD      25-36       ALLOWABLE RELATIVE ERROR IN KEFF(0), EPSILON(K),    -  014700
CD                  DURING CHARGE-ENRICHMENT SEARCHES.                  -  014800
CD                                                                      -  014900
CD      37-48       FRACTION OF BURN TIME AT WHICH KEFF(0) IS TO BE     -  015000
CD                  REACHED. THIS MUST BE ONE OF THE END POINTS OF A    -  015100
CD                  SUBINTERVAL OF THE BURN STEP.                       -  015200
CD                                                                      -  015300
CD      49-60       INITIAL VALUE FOR THE REACTOR CHARGE-ENRICHMENT SEARCH -  015400
CD                  PARAMETER X.                                        -  015500
CD                                                                      -  015600
CD      61-72       SECOND VALUE FOR THE REACTOR CHARGE-ENRICHMENT      -  015700
CD                  SEARCH PARAMETER X.                                 -  015800
C                                                                       -  015900
CN                  THE ENRICHMENT OF A BATCH OF FRESH FUEL IDENTIFIED  -  016000
CN                  AS CHARGE TYPE M IS ADJUSTED ACCORDING TO THE FORMULA -  016100
CN                  E(M)=E(M)(0)(1+X*DELTA(M)),                         -  016200
CN                  WHERE X IS THE CHARGE-ENRICHMENT SEARCH PARAMETER   -  016300
CN                  WHOSE INITIAL VALUE IS GIVEN IN COLS. 49-60.        -  016400
CN                  THE E(M)(0) AND DELTA(M) FOR EACH CHARGE TYPE ARE   -  016500
CN                  SPECIFIED ON CARD TYPE 12.                          -  016600
CN                                                                      -  016700
CN                  IN THE FOLLOWING CARDS, A "LABEL" WILL BE IDENTIFIED -  016800
CN                  FROM THE CARD TYPE (E.G., CARD TYPE 21 INDICATES THAT -  016900
CN                  EXTERNAL FEED DATA ARE TO FOLLOW). A LABEL IS DEFINED -  017000
CN                  AS A SIX-CHARACTER IDENTIFIER THAT REFERENCES THE   -  017100
CN                  SPECIFIC OPERATIONS OR DATA THAT FOLLOW. FOR EXAMPLE, -  017200
CN                  A "PATH" LABEL DEFINES THE SPATIAL POSITIONS AND    -  017300
CN                  MOTIONS OF A "CHARGE" IN THE REACTOR AS LISTED ON   -  017400
CN                  THE CARD.                                           -  017500
CN                                                                      -  017600
CN                  THE ISOTOPE LABELING SYSTEM ALLOWS DIFFERENT LIBRARY -  017700
CN                  LABELS (I.E., DIFFERENT MICROSCOPIC CROSS SECTIONS) TO -  017800
CN                  BE USED IN DIFFERENT FUEL BATCHES. THE INTERNAL, OR -  017900
CN                  RUN-TIME, LABELS FOR "ACTIVE" ISOTOPES (THOSE THAT ARE -  018000
CN                  INCLUDED IN THE TRANSMUTATION MATRIX) ARE DEFINED   -  018100
CN                  IN THE SPECIFICATION OF THE ISOTOPIC CHAIN (CARD TYPE -  018200
CN                  09). THESE RUN-TIME LABELS MAY COINCIDE WITH THE    -  018300
CN                  LIBRARY LABELS FOR ALL MATERIALS, IN WHICH CASE NO  -  018400
CN                  FUTHER INPUT IS REQUIRED. THE USER MAY, HOWEVER,    -  018500
CN                  SPECIFY (SEE CARD TYPE 10) THAT A LIBRARY ISOTOPE   -  018600
CN                  LABEL (WHICH DEFINES APPROPRIATE CROSS SECTIONS FOR -  018700
CN                  SOME FUEL BATCH) IS EQUIVALENT TO ONE OF THOSE      -  018800
CN                  SPECIFIED ON CARD TYPE 09. ALL LIBRARY ISOTOPES THAT -  018900
CN                  ARE EQUIVALENCED TO ONE OF THESE RUN-TIME LABELS ARE -  019000
CN                  CONSIDERED IDENTICAL IN THE EXTERNAL CYCLE.         -  019100
CN                  APPROPRIATE MICROSCOPIC CROSS SECTIONS FOR THE FRESH -  019200
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CN              CHARGE BATCHES ARE SELECTED THROUGH THE CHEMICAL        -  019300
CN              COMPOSITION DATA ON CARD TYPE 13. ACTIVE ISOTOPE        -  019400
CN              LABELS APPEARING ON CARD TYPES OTHER THAN 10 OR 13      -  019500
CN              MUST BE THOSE THAT APPEAR IN COLS. 7-12 OF THE TYPE     -  019600
CN              09 CARDS.                                               -  019700
C                                                                       -  019800
C-----------------------------------------------------------------------   019900
                                                                          020000
                                                                          020100
C-----------------------------------------------------------------------   020200
CR          BURNUP TEST SPECIFICATIONS (TYPE 05)                        -  020300
C                                                                       -  020400
CL     FORMAT-----(I2,4X,11A6)                                          -  020500
C                                                                       -  020600
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  020700
CD     =======     ==================================================-   020800
CD     1-2         05                                                  -  020900
CD                                                                     -  021000
CD     7-12        LABEL OF BURNUP TEST GROUP (REPEATED ON ADDITIONAL  -  021100
CD                 CARDS).                                             -  021200
CD                                                                     -  021300
CD     13-18       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  021400
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  021500
CD                                                                     -  021600
CD     19-24       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  021700
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  021800
CD                                                                     -  021900
CD     25-30       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  022000
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  022100
CD                                                                     -  022200
CD     31-36       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  022300
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  022400
CD                                                                     -  022500
CD     37-42       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  022600
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  022700
CD                                                                     -  022800
CD     43-48       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  022900
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  023000
CD                                                                     -  023100
CD     49-54       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  023200
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  023300
CD                                                                     -  023400
CD     55-60       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  023500
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  023600
CD                                                                     -  023700
CD     61-66       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  023800
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  023900
CD                                                                     -  024000
CD     67-72       PATH LABEL (SEE CARD TYPE 11) TO BE INCLUDED IN TEST -  024100
CD                 GROUP. SEE NOTE FOLLOWING CARD TYPE 08.             -  024200
C                                                                      -  024300
C-----------------------------------------------------------------------   024400
                                                                          024500
                                                                          024600
C-----------------------------------------------------------------------   024700
CR          BURNUP LIMITS (TYPE 06)                                     -  024800
C                                                                       -  024900
CL     FORMAT-----(I2,10X,3(A6,E12.5))                                  -  025000
C                                                                       -  025100
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  025200
CD     =======     ==================================================-   025300
CD     1-2         06                                                  -  025400
CD                                                                     -  025500
CD     13-18       TEST GROUP OR PATH LABEL.                           -  025600
CD                                                                     -  025700
CD     19-30       BURNUP LIMIT: RATIO OF TOTAL ATOMS DESTROYED IN     -  025800
CD                 FISSION TO TOTAL ACCOUNTABLE ATOMS PRESENT INITIALLY. -  025900
CD                 UNLESS SPECIFIED OTHERWISE (SEE CARD TYPES 07 AND 08), -  026000
CD                 THE NUMERATOR INCLUDES ALL FISSION EVENTS, AND THE  -  026100
CD                 DENOMINATOR INCLUDES ALL FISSIONABLE ATOMS PRESENT AT -  026200
CD                 THE START OF THE BURN.                              -  026300
CD                                                                     -  026400
CD     31-36       TEST GROUP OR PATH LABEL.                           -  026500
CD                                                                     -  026600
CD     37-48       BURNUP LIMIT.                                       -  026700
CD                                                                     -  026800
CD     49-54       TEST GROUP OR PATH LABEL.                           -  026900
CD                                                                     -  027000
CD     55-66       BURNUP LIMIT.                                       -  027100
C                                                                      -  027200
C-----------------------------------------------------------------------   027300
                                                                          027400
                                                                          027500
C-----------------------------------------------------------------------   027600
CR          BURNUP NUMERATOR DEFINITION (TYPE 07)                       -  027700
C                                                                       -  027800
CL     FORMAT-----(I2,4X,11A6)                                          -  027900
C                                                                       -  028000
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  028100
CD     =======     ==================================================-   028200
CD     1-2         07                                                  -  028300
CD                                                                     -  028400
CD     7-12        TEST GROUP OR PATH LABEL (REPEATED ON ADDITIONAL    -  028500
CD                 CARDS).                                             -  028600
CD                                                                     -  028700
CD     13-18       LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN      -  028800
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CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      19-24     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      25-30     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      31-36     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      37-42     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      43-48     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      49-54     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      55-60     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      61-66     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
CD
CD      67-72     LABEL OF FISSIONABLE ISOTOPE TO BE INCLUDED IN
CD                NUMERATOR OF BURNUP EXPRESSION FOR THE SPECIFIED
CD                TEST GROUP OR PATH. (NOTE: THIS IS A LABEL FROM
CD                COLS. 7-12 OF THE ACTIVE CHAIN SPECIFIED ON CARD
CD                TYPE 09.)
C
CN                IF THIS CARD IS PRESENT, ONLY FISSION REACTIONS OF
CN                ISOTOPES APPEARING IN THIS LIST CONTRIBUTE TOWARD
CN                "BURNUP" OF THE TEST GROUP OR PATH.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          BURNUP DENOMINATOR DEFINITION (TYPE 08)
C
CL     FORMAT-----(I2,4X,11A6)
C
CD     COLUMNS              CONTENTS...IMPLICATIONS, IF ANY
CD     =======     ==========================================
CD     1-2         08
CD
CD     7-12        TEST GROUP OR PATH LABEL (REPEATED ON ADDITIONAL
CD                 CARDS).
CD
CD     13-18       LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR
CD                 OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR
CD                 PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE
CD                 ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD
CD     19-24       LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR
CD                 OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR
CD                 PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE
CD                 ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD
CD     25-30       LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR
CD                 OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR
CD                 PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE
CD                 ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)
CD
CD     31-36       LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR
CD                 OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR
CD                 PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE
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CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  038500
CD                                                                          -  038600
CD      37-42     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  038700
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  038800
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  038900
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  039000
CD                                                                          -  039100
CD      43-48     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  039200
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  039300
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  039400
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  039500
CD                                                                          -  039600
CD      49-54     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  039700
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  039800
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  039900
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  040000
CD                                                                          -  040100
CD      55-60     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  040200
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  040300
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  040400
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  040500
CD                                                                          -  040600
CD      61-66     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  040700
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  040800
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  040900
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  041000
CD                                                                          -  041100
CD      67-72     LABEL OF ACTIVE ISOTOPE TO BE INCLUDED IN DENOMINATOR     -  041200
CD                OF BURNUP EXPRESSION FOR THE SPECIFIED TEST GROUP OR      -  041300
CD                PATH. (NOTE: THIS IS A LABEL FROM COLS. 7-12 OF THE       -  041400
CD                ACTIVE CHAIN SPECIFIED ON CARD TYPE 09.)                  -  041500
C                                                                           -  041600
CN                FOR ANY ATOM VECTOR AT TIME T, THE BURNUP IS DEFINED      -  041700
CN                AS THE QUOTIENT OF THE SUM OVER SPECIFIED ISOTOPES        -  041800
CN                OF THE TOTAL FISSION REACTIONS IN EACH ISOTOPE FROM       -  041900
CN                TIME ZERO TO TIME T, DIVIDED BY THE SUM OVER SPECIFIED    -  042000
CN                ISOTOPES OF THE TOTAL ATOMS PRESENT AT TIME ZERO.         -  042100
CN                (TIME ZERO IN THIS CONTEXT IS THE TIME AT WHICH THE       -  042200
CN                FUEL CHARGE WAS LOADED INTO THE CORE.) UNLESS CARD        -  042300
CN                TYPES 07 AND/OR 08 ARE PRESENT, THESE SUMS ARE TAKEN      -  042400
CN                OVER ALL ISOTOPES UNDERGOING FISSION.                     -  042500
CN                                                                          -  042600
CN                ATOM VECTORS OF SEVERAL PATHS CAN BE COLLECTED INTO       -  042700
CN                A SINGLE TEST GROUP (CARD TYPE 05) FOR WHICH AN           -  042800
CN                AVERAGE BURNUP IS COMPUTED. A BURNUP LIMIT MAY BE         -  042900
CN                GIVEN ON CARD TYPE 06 FOR TEST GROUPS SPECIFIED ON        -  043000
CN                CARD TYPE 05. IF NO BURNUP LIMIT IS GIVEN, NO BURNUP      -  043100
CN                TEST IS MADE FOR THAT PATH OR TEST GROUP.                 -  043200
CN                                                                          -  043300
CN                WE DEFINE THE RELATIVE BURNUP ERROR AS THE VALUE OF       -  043400
CN                THE DIFFERENCE BETWEEN ALLOWABLE AND ACHIEVED BURNUP      -  043500
CN                RELATIVE TO THE ALLOWABLE BURNUP FOR EACH PATH OR         -  043600
CN                TEST GROUP. THEN BURN TIME WILL BE ADJUSTED UNTIL THE     -  043700
CN                SMALLEST VALUE OF THIS DIFFERENCE BECOMES ZERO            -  043800
CN                WITHIN THE CONVERGENCE LIMIT ON CARD TYPE 03, COLS.       -  043900
CN                37-48.                                                    -  044000
CN                                                                          -  044100
CN                THAT IS, ((BURNUP ALLOWED - BURNUP ACHIEVED)/             -  044200
CN                BURNUP ALLOWED) MIN OVER TEST GROUP = 0 PLUS OR           -  044300
CN                MINUS EPSILON.                                            -  044400
CN                                                                          -  044500
CN                THIS WILL BE THE SMALLEST TIME AT WHICH SOME PATH OR      -  044600
CN                TEST GROUP HAS A BURNUP ERROR OF PLUS OR MINUS EPSILON.-  044700
C                                                                           -  044800
C-----------------------------------------------------------------------------  044900
                                                                               045000
                                                                               045100
C-----------------------------------------------------------------------------  045200
CP          ISOTOPIC CHAIN DATA (TYPE 09)                                   -  045300
C                                                                           -  045400
CL      FORMAT-----(I2,4X,A6,I6,3(A6,E12.5))                                -  045500
C                                                                           -  045600
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                  -  045700
CD      =======   ==========================================================-  045800
CD      1-2       09                                                        -  045900
CD                                                                          -  046000
CD      7-12      LABEL OF ISOTOPE UNDERGOING REACTION (REPEATED ON ALL     -  046100
CD                CARDS THAT SPECIFY OTHER REACTIONS FOR THIS ISOTOPE).     -  046200
CD                                                                          -  046300
CD      13-18     REACTION TYPE (REPEATED ON ADDITIONAL CARDS).             -  046400
CD                 0...NO REACTION.                                         -  046500
CD                 1...(N,GAMMA) REACTION.                                  -  046600
CD                 2...(N,F) REACTION.                                      -  046700
CD                 3...(N,P) REACTION.                                      -  046800
CD                 4...(N,ALPHA) REACTION.                                  -  046900
CD                 5...(N,2N) REACTION.                                     -  047000
CD                 6...BETA-MINUS DECAY.                                    -  047100
CD                 7...BETA-PLUS DECAY.                                     -  047200
CD                 8...ALPHA DECAY.                                         -  047300
CD                                                                          -  047400
CD      19-24     LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED      -  047500
CD                IN COLS. 13-18.                                           -  047600
CD                                                                          -  047700
CD      25-36     YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION       -  047800
CD                TO THE ISOTOPE SPECIFIED IN COLS. 19-24.                  -  047900
CD                                                                          -  048000
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CD     37-42      LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED   -  048100
CD                IN COLS. 13-18.                                        -  048200
CD                                                                       -  048300
CD     43-54      YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION    -  048400
CD                TO THE ISOTOPE SPECIFIED IN COLS. 37-42.               -  048500
CD                                                                       -  048600
CD     55-60      LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED   -  048700
CD                IN COLS. 13-18.                                        -  048800
CD                                                                       -  048900
CD     61-72      YIELD FRACTION OR ISOMERIC STATE BRANCHING FRACTION    -  049000
CD                TO THE ISOTOPE SPECIFIED IN COLS. 37-42.               -  049100
C                                                                        -  049200
CN                ALL ISOTOPE LABELS APPEARING IN COLS. 7-12 OF ONE OR   -  049300
CN                MORE TYPE 09 CARDS ARE DEFINED AS "ACTIVE"; THAT IS,   -  049400
CN                THEY ARE CONSIDERED IN BURNUP/DECAY CALCULATIONS. ALL  -  049500
CN                OTHER ISOTOPES ARE "INACTIVE"; THAT IS, THEY ARE       -  049600
CN                ASSUMED TO UNDERGO NO TRANSMUTATIONS DURING THE        -  049700
CN                PROBLEM.                                               -  049800
CN                                                                       -  049900
CN                IF NO TYPE 10 CARDS ARE GIVEN, THE ISOTOPE LABELS ON   -  050000
CN                THE TYPE 09 CARDS IN COLS. 7-12 MUST BE DEFINED IN THE -  050100
CN                CROSS-SECTION LIBRARY. IF ANY TYPE 10 CARDS ARE GIVEN, -  050200
CN                THE LABELS ON THE 09 CARDS MAY BE LOCAL; THE TYPE 10   -  050300
CN                CARDS WILL RELATE THE LOCAL LABELS TO SPECIFIC CROSS-  -  050400
CN                SECTION LIBRARY LABELS. IF THE FIRST PRODUCT-ISOTOPE   -  050500
CN                LABEL (COLS. 19-24) IS BLANK, IT IMPLIES A YIELD OR    -  050600
CN                BRANCHING FRACTION OF 1.0. THIS FURTHER IMPLIES THAT   -  050700
CN                THE PRODUCT ISOTOPE IS TO BE IDENTIFIED FROM THE PROTON-  050800
CN                AND MASS NUMBERS (Z,A) OF THE PARENT ISOTOPE (AS GIVEN -  050900
CN                IN THE CROSS-SECTION LIBRARY), MODIFIED BY THE         -  051000
CN                SPECIFIED REACTION. FOR FISSION REACTIONS (N,F), AT    -  051100
CN                LEAST ONE PRODUCT-ISOTOPE LABEL MUST BE GIVEN (NO      -  051200
CN                LINKAGE THROUGH A AND Z IS POSSIBLE). IF ONLY ONE      -  051300
CN                PRODUCT ISOTOPE IS NAMED IN COLS. 19-24 FOR ANY        -  051400
CN                REACTION, NO YIELD FRACTION NEED BE ENTERED (1.0 IS    -  051500
CN                ASSUMED). IF MORE THAN ONE PRODUCT ISOTOPE IS LISTED,  -  051600
CN                THE YIELD FRACTIONS MUST BE GIVEN FOR EACH.            -  051700
CN                                                                       -  051800
CN                IF THE PRODUCT-ISOTOPE LABEL FIELDS ARE NONBLANK,      -  051900
CN                EACH LABEL MUST BE ENTERED IN COLS. 7-12 OF ONE TYPE   -  052000
CN                09 CARD.                                               -  052100
CN                                                                       -  052200
CN                ALL ISOTOPES UNDERGOING THE (N,F) REACTION ARE         -  052300
CN                INCLUDED IN THE CALCULATION OF BURNUP UNLESS TYPE      -  052400
CN                07 OR 08 CARDS ARE GIVEN. IN THAT CASE, ONLY THE       -  052500
CN                ISOTOPES LISTED ON 07 OR 08 CARDS WILL BE COUNTED IN   -  052600
CN                THE BURNUP CALCULATION.                                -  052700
C                                                                        -  052800
C-----------------------------------------------------------------------  052900
                                                                            053000
                                                                            053100
C-----------------------------------------------------------------------  053200
CR          ACTIVE ISOTOPE-LABEL EQUIVALENCE LIST (TYPE 10)              -  053300
C                                                                        -  053400
CL     FORMAT-----(I2,4X,11A6)                                           -  053500
C                                                                        -  053600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  053700
CD     =======    ==========================================================  053800
CD     1-2        10                                                    -  053900
CD                                                                       -  054000
CD     7-12       LOCAL ISOTOPE LABEL FROM COLS. 7-12 OF TYPE 09 CARDS  -  054100
CD                (REPEATED, IF NECESSARY, ON ADDITIONAL CARDS).        -  054200
CD                                                                       -  054300
CD     13-18      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  054400
CD                LABEL IN COLS. 7-12.                                  -  054500
CD                                                                       -  054600
CD     19-24      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  054700
CD                LABEL IN COLS. 7-12.                                  -  054800
CD                                                                       -  054900
CD     25-30      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  055000
CD                LABEL IN COLS. 7-12.                                  -  055100
CD                                                                       -  055200
CD     31-36      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  055300
CD                LABEL IN COLS. 7-12.                                  -  055400
CD                                                                       -  055500
CD     37-42      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  055600
CD                LABEL IN COLS. 7-12.                                  -  055700
CD                                                                       -  055800
CD     43-48      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  055900
CD                LABEL IN COLS. 7-12.                                  -  056000
CD                                                                       -  056100
CD     49-54      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  056200
CD                LABEL IN COLS. 7-12.                                  -  056300
CD                                                                       -  056400
CD     55-60      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  056500
CD                LABEL IN COLS. 7-12.                                  -  056600
CD                                                                       -  056700
CD     61-66      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  056800
CD                LABEL IN COLS. 7-12.                                  -  056900
CD                                                                       -  057000
CD     67-72      LIBRARY ISOTOPE LABEL TO BE EQUIVALENCED TO THE LOCAL -  057100
CD                LABEL IN COLS. 7-12.                                  -  057200
C                                                                        -  057300
CN                CARD TYPE 10 IS REQUIRED ONLY IF DIFFERENT LIBRARY    -  057400
CN                ISOTOPE LABELS (I.E., DIFFERENT MICROSCOPIC CROSS-    -  057500
CN                SECTIONS) ARE REQUIRED FOR THE SAME ISOTOPE IN        -  057600
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CN                DIFFERENT MATERIALS.                                  -  057700
C                                                                       -  057800
C-----------------------------------------------------------------------  057900
                                                                         058000
                                                                         058100
C-----------------------------------------------------------------------  058200
CR          REACTOR FUEL MANAGEMENT PATH (TYPE 11)                      -  058300
C                                                                       -  058400
CL    FORMAT-----(I2,4X,A6,2(2I6,2A6))                                  -  058500
C                                                                       -  058600
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  058700
CD    =======   ==========================================================-  058800
CD    1-2       11                                                      -  058900
CD                                                                      -  059000
CD              (TYPE 11 CARD NOT REQUIRED WHEN COLS. 67-72 ON TYPE     -  059100
CD              03 CARD IS EQUAL TO 1.)                                 -  059200
CD                                                                      -  059300
CD    7-12      PATH LABEL (REPEATED ON ADDITIONAL CARDS).              -  059400
CD                                                                      -  059500
CD    13-18     STAGE NUMBER.                                           -  059600
CD                                                                      -  059700
CD    19-24     ANGULAR ROTATION.                                       -  059800
CD                                                                      -  059900
CD    25-30     SECONDARY COMPOSITION LABEL.                            -  060000
CD                                                                      -  060100
CD    31-36     PRIMARY COMPOSITION LABEL OR REGION LABEL.              -  060200
CD                                                                      -  060300
CD    37-42     STAGE NUMBER.                                           -  060400
CD                                                                      -  060500
CD    43-48     ANGULAR ROTATION                                        -  060600
CD                                                                      -  060700
CD    49-54     SECONDARY COMPOSITION LABEL.                            -  060800
CD                                                                      -  060900
CD    55-60     PRIMARY COMPOSITION LABEL OR REGION LABEL.              -  061000
C                                                                       -  061100
CN              THE ANGULAR ROTATION IN DEGREES (ZERO FOR A SHUFFLING   -  061200
CN              PATTERN) IS INCLUDED SO THAT THE CASE OF ROTATION       -  061300
CN              OF ASSEMBLIES CAN BE EASILY SPECIFIED.                  -  061400
CN                                                                      -  061500
CN              THE FUEL-SHUFFLING PATH IS DEFINED BY                   -  061600
CN              STAGE NUMBERS IN ASCENDING NUMERICAL ORDER (1,2,3,      -  061700
CN              4,...,  NOT NECESSARILY ORDERED ON THE CARDS); THE      -  061800
CN              FUEL TO BE MOVED IS IDENTIFIED BY THE PAIR OF LABELS    -  061900
CN              FOR SECONDARY COMPOSITION AND PRIMARY COMPOSITION OR    -  062000
CN              REGION. IN EQUILIBRIUM PROBLEMS THE VOLUMES OF ALL      -  062100
CN              SECONDARY COMPOSITIONS IN A GIVEN PATH MUST BE EQUAL.   -  062200
CN              IF THE PATH HAS K STAGES, THE DISCHARGE LABEL (SEE      -  062300
CN              CARD TYPES 14 AND 15) FOR THIS PATH IS ENTERED IN THE   -  062400
CN              (K+1) STAGE NUMBER OF THE PATH. NO REGION LABEL SHOULD  -  062500
CN              BE ENTERED FOR THIS STAGE.                              -  062600
C                                                                       -  062700
C-----------------------------------------------------------------------  062800
                                                                         062900
                                                                         063000
C-----------------------------------------------------------------------  063100
CR          REACTOR-CHARGE SPECIFICATION (TYPE 12)                      -  063200
C                                                                       -  063300
CL    FORMAT-----(I2,4X,A6,I6,A6,4E12.5)                                -  063400
C                                                                       -  063500
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  063600
CD    =======   ==========================================================-  063700
CD    1-2       12                                                      -  063800
CD                                                                      -  063900
CD    7-12      PATH LABEL.                                             -  064000
CD                                                                      -  064100
CD    13-18     REPETITION FACTOR (MUST BE 1 FOR EQUILIBRIUM PROBLEMS).-  064200
CD                                                                      -  064300
CD    19-24     CHEMICAL COMPOSITION LABEL (SEE CARD TYPE 13).          -  064400
CD                                                                      -  064500
CD    25-36     REFABRICATION TIME (DAYS).                              -  064600
CD                                                                      -  064700
CD    37-48     PRELOADING STORAGE TIME (DAYS).                         -  064800
CD                                                                      -  064900
CD    49-60     INITIAL ENRICHMENT (SEE CARD TYPE 04).                  -  065000
CD                                                                      -  065100
CD    61-72     ENRICHMENT MODIFICATION FACTOR (SEE CARD TYPE 04).      -  065200
CD              (DEFAULT=1.0).                                          -  065300
C                                                                       -  065400
C-----------------------------------------------------------------------  065500
                                                                         065600
                                                                         065700
C-----------------------------------------------------------------------  065800
CR          CHEMICAL COMPOSITION DATA (TYPE 13)                         -  065900
C                                                                       -  066000
CL    FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))                              -  066100
C                                                                       -  066200
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  066300
CD    =======   ==========================================================-  066400
CD    1-2       13                                                      -  066500
CD                                                                      -  066600
CD    7-12      CHEMICAL-COMPOSITION LABEL.                             -  066700
CD                                                                      -  066800
CD    19-24     ACTIVE-ISOTOPE LABEL.                                   -  066900
CD                                                                      -  067000
CD    25-36     FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).                -  067100
CD                                                                      -  067200
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CD     37-42      ACTIVE-ISOTOPE LABEL.                                  -  067300
CD                                                                      -  067400
CD     43-54      FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).               -  067500
CD                                                                      -  067600
CD     55-60      ACTIVE-ISOTOPE LABEL.                                  -  067700
CD                                                                      -  067800
CD     61-72      FULL ATOMIC DENSITY (ATOMS/CC * 1.E-24).               -  067900
C                                                                       -  068000
CN                ACTIVE ISOTOPES SPECIFIED HERE MUST APPEAR IN THE     -  068100
CN                LIBRARY; THEY MAY OR MAY NOT BE NAMED ON A TYPE 09    -  068200
CN                CARD. FULL ATOMIC DENSITY MEANS THE NUMBER OF ATOMS   -  068300
CN                OF THE PURE ISOTOPE PER UNIT VOLUME IN THE GIVEN      -  068400
CN                CHEMICAL COMBINATION AND STATE (E.G., OXIDE AT SOME   -  068500
CN                PERCENTAGE OF THEORETICAL DENSITY).                   -  068600
C                                                                       -  068700
C-----------------------------------------------------------------------   068800
                                                                          068900
                                                                          069000
C-----------------------------------------------------------------------   069100
CR          REACTOR-DISCHARGE COOLING TIMES (TYPE 14)                   -  069200
C                                                                       -  069300
CL    FORMAT-----(I2,4X,3(A6,E12.5))                                    -  069400
C                                                                       -  069500
CD    COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                  -  069600
CD    =======   ========================================================-  069700
CD    1-2       14                                                      -  069800
CD                                                                      -  069900
CD    7-12      REACTOR-DISCHARGE LABEL.                                -  070000
CD                                                                      -  070100
CD    13-24     COOLING TIME (DAYS).                                    -  070200
CD                                                                      -  070300
CD    25-30     REACTOR-DISCHARGE LABEL.                                -  070400
CD                                                                      -  070500
CD    31-42     COOLING TIME (DAYS).                                    -  070600
CD                                                                      -  070700
CD    43-48     REACTOR-DISCHARGE LABEL.                                -  070800
CD                                                                      -  070900
CD    49-60     COOLING TIME (DAYS).                                    -  071000
C                                                                       -  071100
C-----------------------------------------------------------------------   071200
                                                                          071300
                                                                          071400
C-----------------------------------------------------------------------   071500
CR          REACTOR-DISCHARGE DESTINATION DATA (TYPE 15)                -  071600
C                                                                       -  071700
CL    FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))                              -  071800
C                                                                       -  071900
CD    COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                  -  072000
CD    =======   ========================================================-  072100
CD    1-2       15                                                      -  072200
CD                                                                      -  072300
CD    7-12      REACTOR-DISCHARGE LABEL (REPEATED ON ADDITIONAL CARDS).-  072400
CD                                                                      -  072500
CD    19-24     REPROCESSING-PLANT LABEL.                               -  072600
CD                                                                      -  072700
CD    25-36     FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING   -  072800
CD              PLANT.                                                  -  072900
CD                                                                      -  073000
CD    37-42     REPROCESSING-PLANT LABEL.                               -  073100
CD                                                                      -  073200
CD    43-54     FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING   -  073300
CD              PLANT.                                                  -  073400
CD                                                                      -  073500
CD    55-60     REPROCESSING-PLANT LABEL.                               -  073600
CD                                                                      -  073700
CD    61-72     FRACTION OF DISCHARGE TO BE DELIVERED TO REPROCESSING   -  073800
CD              PLANT.                                                  -  073900
C                                                                       -  074000
CN                ALL REACTOR DISCHARGE NOT DELIVERED TO SOME           -  074100
CN                REPROCESSING PLANT WILL BE SOLD.                      -  074200
C                                                                       -  074300
C-----------------------------------------------------------------------   074400
                                                                          074500
                                                                          074600
C-----------------------------------------------------------------------   074700
CR          REPROCESSING-PLANT SPECIFICATIONS (TYPE 16)                 -  074800
C                                                                       -  074900
CL    FORMAT-----(I2,4X,3A6,2E12.5)                                     -  075000
C                                                                       -  075100
CD    COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                  -  075200
CD    =======   ========================================================-  075300
CD    1-2       16                                                      -  075400
CD                                                                      -  075500
CD    7-12      REPROCESSING-PLANT LABEL.                               -  075600
CD                                                                      -  075700
CD    13-18     RECOVERY-FACTOR SPECIFICATION LABEL.                    -  075800
CD                                                                      -  075900
CD    19-24     CLASS-SEPARATION SPECIFICATION LABEL.                   -  076000
CD                                                                      -  076100
CD    25-36     REPROCESSING TIME (DAYS).                               -  076200
CD                                                                      -  076300
CD    37-48     VOLUME OF REPROCESSING PLANT OUTPUT (CM**3).            -  076400
C                                                                       -  076500
CN                (COLS. 37-48 ARE PERTINENT ONLY IF CARD TYPE 23 IS    -  076600
CN                PROVIDED.)                                            -  076700
C                                                                       -  076800
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C-----------------------------------------------------------------------
CR          RECOVERY-FACTOR DATA (TYPE 17)                            -
C                                                                     -
CL    FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))                            -
C                                                                     -
CD    COLUMNS          CONTENTS...IMPLICATION, IF ANY                 -
CD    =======   ==========================================================-
CD    1-2       17                                                    -
CD                                                                    -
CD    7-12      RECOVERY-FACTOR SPECIFICATION LABEL (REPEATED ON      -
CD              ADDITIONAL CARDS).                                    -
CD                                                                    -
CD    19-24     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    25-36     RECOVERY FRACTION.                                    -
CD                                                                    -
CD    37-42     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    43-54     RECOVERY FRACTION.                                    -
CD                                                                    -
CD    55-60     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    61-72     RECOVERY FRACTION.                                    -
C                                                                     -
CN              ALL ISOTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.  -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          CLASS-SEPARATION DATA (TYPE 18)                           -
C                                                                     -
CL    FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))                            -
C                                                                     -
CD    COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                -
CD    =======   ==========================================================-
CD    1-2       18                                                    -
CD                                                                    -
CD    7-12      CLASS-SEPARATION SPECIFICATION LABEL (REPEATED ON     -
CD              ADDITIONAL CARDS).                                    -
CD                                                                    -
CD    19-24     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    25-36     FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.         -
CD                                                                    -
CD    37-42     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    43-54     FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.         -
CD                                                                    -
CD    55-60     ACTIVE-ISOTOPE LABEL.                                 -
CD                                                                    -
CD    61-72     FRACTION OF ISOTOPE ASSIGNED TO CLASS 1 FUEL.         -
C                                                                     -
CN              ALL ISOTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.  -
CN                                                                    -
CN              CLASS 1 FUEL IS NORMALLY CONSIDERED TO BE FUEL THAT   -
CN              ADDS GREATER REACTIVITY TO THE REACTOR THAN DOES CLASS -
CN              2 FUEL. THE COMPLEMENTS OF THE FRACTIONS GIVEN IN COLS.-
CN              25-36, 43-54, AND 61-72 ARE THE FRACTIONS ASSIGNED TO -
CN              CLASS 2 FUEL.                                         -
CN                                                                    -
CN              ANY ACTIVE ISOTOPE SPECIFIED ON CARD TYPE 09 THAT IS  -
CN              NOT GIVEN ON CARD TYPE 18 WILL HAVE A FRACTION 0      -
CN              ASSIGNED TO CLASS 1 FUEL.                             -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          CLASS 1 FABRICATION SPECIFICATIONS (TYPE 19)              -
C                                                                     -
CL    FORMAT-----(I2,4X,A6,6X,2(A6,I6,E12.5))                         -
C                                                                     -
CD    COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                -
CD    =======   ==========================================================-
CD    1-2       19                                                    -
CD                                                                    -
CD    7-12      PATH LABEL OR SALE LABEL (REPEATED ON                 -
CD              ADDITIONAL CARDS).                                    -
CD                                                                    -
CD    19-24     REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.      -
CD                                                                    -
CD    25-30     PRIORITY LEVEL.                                       -
CD                                                                    -
CD    31-42     DISTRIBUTION FRACTION (DEFAULT=1.0).                  -
CD                                                                    -
CD    43-48     REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.      -
CD                                                                    -
CD    49-54     PRIORITY LEVEL.                                       -
CD                                                                    -
CD    55-66     DISTRIBUTION FRACTION (DEFAULT=1.0).                  -
C                                                                     -
CN              THE PRIORITY LEVEL ESTABLISHES THE ORDER OF PREFERENCE -
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CN                FOR USE OF REPROCESSING-PLANT OUTPUT OR EXTERNAL-FEED  -  086500
CN                ATOMS IN FABRICATION OF THE VARIOUS BATCHES OF THE     -  086600
CN                REACTOR CHARGE. THE MOST STRAIGHTFORWARD SYSTEM IS ONE -  086700
CN                IN WHICH ONLY ONE BATCH (SPECIFIED BY THE CHARGE       -  086800
CN                LABEL) REQUIRES ATOMS FROM A GIVEN PLANT OR FEED AT    -  086900
CN                EACH PRIORITY LEVEL. IN THIS CASE ALL ATOMS REQUIRED   -  087000
CN                FOR THE BATCH WITH PRIORITY 1 WILL BE TAKEN FIRST,     -  087100
CN                THEN THOSE REQUIRED FOR PRIORITY 2 (IF ANY REMAIN),    -  087200
CN                AND SO ON.                                             -  087300
CN                                                                       -  087400
CN                IF TWO OR MORE CHARGES SPECIFY THE SAME PLANT OUTPUT   -  087500
CN                OR FEED AT THE SAME PRIORITY LEVEL, THE AVAILABLE      -  087600
CN                ATOMS WILL FIRST BE DISTRIBUTED IN PROPORTION TO THE   -  087700
CN                DISTRIBUTION FRACTION OF EACH CHARGE. IF THE           -  087800
CN                REQUIREMENTS OF SOME OF THESE BATCHES ARE SATISFIED    -  087900
CN                WHILE OTHERS ARE NOT, FURTHER PROPORTIONAL             -  088000
CN                DISTRIBUTIONS ARE MADE TO THE REMAINING BATCHES UNTIL  -  088100
CN                EITHER ALL REQUIREMENTS ARE SATISFIED OR ALL AVAILABLE -  088200
CN                ATOMS ARE USED.                                        -  088300
C                                                                        -  088400
C-----------------------------------------------------------------------   088500
                                                                          088600
                                                                          088700
C-----------------------------------------------------------------------   088800
CR          CLASS 2 FABRICATION SPECIFICATIONS (TYPE 20)                 -  088900
C                                                                        -  089000
CL     FORMAT-----(I2,4X,A6,6X,2(A6,I6,E12.5))                           -  089100
C                                                                        -  089200
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  089300
CD     =======   ==========================================================-  089400
CD     1-2       20                                                      -  089500
CD                                                                       -  089600
CD     7-12      PATH LABEL OR SALE LABEL (REPEATED ON                   -  089700
CD               ADDITIONAL CARDS).                                      -  089800
CD                                                                       -  089900
CD     19-24     REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.        -  090000
CD                                                                       -  090100
CD     25-30     PRIORITY LEVEL.                                         -  090200
CD                                                                       -  090300
CD     31-42     DISTRIBUTION FRACTION (DEFAULT=1.0).                    -  090400
CD                                                                       -  090500
CD     43-48     REPROCESSING-PLANT LABEL OR EXTERNAL-FEED LABEL.        -  090600
CD                                                                       -  090700
CD     49-54     PRIORITY LEVEL.                                         -  090800
CD                                                                       -  090900
CD     55-66     DISTRIBUTION FRACTION (DEFAULT=1.0).                    -  091000
C                                                                        -  091100
CN               THE PRIORITY SYSTEM IS IDENTICAL TO THAT DESCRIBED      -  091200
CN               FOR CLASS 1 MAKEUP ON CARD TYPE 19.                     -  091300
C                                                                        -  091400
C-----------------------------------------------------------------------   091500
                                                                          091600
                                                                          091700
C-----------------------------------------------------------------------   091800
CR          EXTERNAL-FEED SPECIFICATIONS (TYPE 21)                       -  091900
C                                                                        -  092000
CL     FORMAT-----(I2,4X,2A6,E12.5)                                      -  092100
C                                                                        -  092200
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  092300
CD     =======   ==========================================================-  092400
CD     1-2       21                                                      -  092500
CD                                                                       -  092600
CD     7-12      EXTERNAL-FEED LABEL.                                    -  092700
CD                                                                       -  092800
CD     13-18     CLASS-SEPARATION SPECIFICATION LABEL.                   -  092900
CD                                                                       -  093000
CD     19-30     VOLUME OF FEED (CM**3).                                 -  093100
C                                                                        -  093200
CN               THE VOLUME OF ONE OF THE EXTERNAL FEEDS MUST BE LARGE   -  093300
CN               TO ENSURE THAT THERE WILL ALWAYS BE ENOUGH FUEL TO      -  093400
CN               FABRICATE ALL CHARGES. AN INFINITE VOLUME WILL BE       -  093500
CN               ASSIGNED TO THE FEED IF COLS. 19-30 ARE BLANK.          -  093600
C                                                                        -  093700
C-----------------------------------------------------------------------   093800
                                                                          093900
                                                                          094000
C-----------------------------------------------------------------------   094100
CR          EXTERNAL-FEED COMPOSITION (TYPE 22)                          -  094200
C                                                                        -  094300
CL     FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))                              -  094400
C                                                                        -  094500
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  094600
CD     =======   ==========================================================-  094700
CD     1-2       22                                                      -  094800
CD                                                                       -  094900
CD     7-12      EXTERNAL-FEED LABEL (REPEATED ON ADDITIONAL CARDS).     -  095000
CD                                                                       -  095100
CD     19-24     ISOTOPE LABEL.                                          -  095200
CD                                                                       -  095300
CD     25-36     ATOMIC DENSITY (ATOMS/CC * 1.E-24).                     -  095400
CD                                                                       -  095500
CD     37-42     ISOTOPE LABEL.                                          -  095600
CD                                                                       -  095700
CD     43-54     ATOMIC DENSITY (ATOMS/CC * 1.E-24).                     -  095800
CD                                                                       -  095900
CD     55-60     ISOTOPE LABEL.                                          -  096000
```

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CD
CD     61-72      ATOMIC DENSITY (ATOMS/CC * 1.E-24).
C
C-----------------------------------------------------------------------
C
CR          REPROCESSING-PLANT OUTPUT INITIAL COMPOSITION (TYPE 23)
C
CL     FORMAT-----(I2,4X,A6,6X,3(A6,E12.5))
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        23
CD
CD     7-12       REPROCESSING-PLANT LABEL (REPEATED ON ADDITIONAL
CD                CARDS).
CD
CD     19-24      ISOTOPE LABEL.
CD
CD     25-36      ATOMIC DENSITY (ATOMS/CC * 1.E-24).
CD
CD     37-42      ISOTOPE LABEL.
CD
CD     43-54      ATOMIC DENSITY (ATOMS/CC * 1.E-24).
CD
CD     55-60      ISOTOPE LABEL.
CD
CD     61-72      ATOMIC DENSITY (ATOMS/CC * 1.E-24).
C
CN                ALL ISOTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.
CN
CN                CARD TYPE 23 IS PROVIDED ONLY IF IT IS DESIRED TO
CN                SPECIFY THE COMPOSITION OF THE REPROCESSING-PLANT
CN                OUTPUT STORAGE AT THE START OF THE PROBLEM. IF CARD
CN                TYPE 23 IS GIVEN, COLS. 37-48 ON CARD TYPE 16 MUST
CN                SPECIFY THE VOLUME OF THE PROCESSING-PLANT OUTPUT.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ACTIVE ISOTOPE DESCRIPTION (TYPE 24)
C
CL     FORMAT-----(I2,4X,2(A6,I6,I6,E12.5))
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        24
CD
CD     7-12       LOCAL ISOTOPE LABEL.
CD
CD     13-18      FISSILE FLAG.
CD
CD     19-24      ATOMIC NUMBER.
CD
CD     25-36      ATOMIC MASS.
CD
CD     37-42      LOCAL ISOTOPE LABEL.
CD
CD     43-48      FISSILE FLAG.
CD
CD     49-54      ATOMIC NUMBER.
CD
CD     55-66      ATOMIC MASS.
C
CN                ALL ISOTOPE LABELS MUST BE DEFINED ON TYPE 09 CARDS.
CN                THE FISSILE FLAG MUST BE EQUAL TO "1" FOR ALL FISSILE
CN                ISOTOPES AND "0" FOR ALL NON-FISSILE ISOTOPES.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ACTIVE ISOTOPE DECAY CONSTANTS (TYPE 25)
C
CL     FORMAT-----(I2,4X,A6,I6,3(A6,E12.5))
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        25
CD
CD     7-12       LABEL OF ISOTOPE UNDERGOING REACTION (REPEATED ON ALL
CD                CARDS THAT SPECIFY OTHER REACTIONS FOR THIS ISOTOPE).
CD
CD     13-18      REACTION TYPE (REPEATED ON ADDITIONAL CARDS; THE SAME
CD                AS ON CARD TYPE 09).
CD                6...BETA-MINUS DECAY.
CD                7...BETA-PLUS DECAY.
CD                8...ALPHA DECAY.
CD
CD     19-24      LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED
CD                IN COLS. 13-18.
CD
CD     25-36      DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN
CD                COLS. 19-24.
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CD                                                                      -  105700
CD     37-42      LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED   -  105800
CD                IN COLS. 13-18.                                        -  105900
CD                                                                       -  106000
CD     43-54      DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN    -  106100
CD                COLS. 37-42.                                           -  106200
CD                                                                       -  106300
CD     55-60      LABEL OF PRODUCT ISOTOPE FROM THE REACTION SPECIFIED   -  106400
CD                IN COLS. 13-18.                                        -  106500
CD                                                                       -  106600
CD     61-72      DECAY CONSTANT (1/SEC) FOR THE ISOTOPE SPECIFIED IN    -  106700
CD                COLS. 55-60.                                           -  106800
C                                                                        -  106900
C-----------------------------------------------------------------------  107000
                                                                         107100
CEOF                                                                     107200
```

```
C*********************************************************************  000100
C*********************************************************************  000100
C                                                                     -  000200
C                        PREPARED 1/20/71 AT ANL                      -  000300
C                                                                     -  000400
CF          A.COL                                                     -  000500
CE          INPUT FOR COLLAPSING CROSS SECTION DATA                   -  000600
C                                                                     -  000700
CN                       THIS IS A USER SUPPLIED BCD DATA SET.        -  000800
CN                       THE LIST FOR EACH RECORD IS GIVEN IN TERMS   -  000900
CN                       OF THE BCD FORMAT OF THE DATA SET.           -  001000
C                                                                     -  001100
C*********************************************************************  001200
                                                                         001300
                                                                         001400
C-----------------------------------------------------------------------  001500
CR          STORAGE SPECIFICATIONS (TYPE 01)                          -  001600
C                                                                     -  001700
CL     FORMAT-----(I2,10X,3I6)                                        -  001800
C                                                                     -  001900
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY            -  002000
CD     =======    ==========================================------    -  002100
CD     1-2        01                                                 -  002200
CD                                                                    -  002300
CD     13-18      SIZE OF FAST CORE STORAGE ARRAY IN REAL*8 WORDS    -  002400
CD                (DEFAULT=60000).                                   -  002500
CD                                                                    -  002600
CD     19-24      SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS    -  002700
CD                (DEFAULT=100000).  IF LT.0, NO SLOW CORE IS ALLOCATED. -  002800
CD                                                                    -  002900
CD     25-30      POINTR DEBUGGING PRINTOUT.                         -  003000
CD                0...NO DEBUGGING PRINTOUT (DEFAULT).               -  003100
CD                1...DEBUGGING DUMP PRINTOUT.                       -  003200
CD                2...DEBUGGING TRACE PRINTOUT.                      -  003300
CD                3...FULL DEBUGGING PRINTOUT.                       -  003400
C                                                                     -  003500
```

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CN                IF NO TYPE 01 CARD IS SUPPLIED, THE DEFAULT OPTIONS    -  003600
CN                ARE ASSIGNED.                                          -  003700
C                                                                        -  003800
C-----------------------------------------------------------------------   003900
                                                                            004000
                                                                            004100
C-----------------------------------------------------------------------   004200
CR          GROUP STRUCTURE FOR COLLAPSE (TYPE 02)                       -  004300
C                                                                        -  004400
CL    FORMAT-----(I2,10X,I6)                                                004500
C                                                                        -  004600
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  004700
CD    =======   ==========================================================-  004800
CD    1-2       02                                                       -  004900
CD                                                                       -  005000
CD    13-18     NUMBER OF COLLAPSED GROUPS REQUESTED.                    -  005100
C                                                                        -  005200
C-----------------------------------------------------------------------   005300
                                                                            005400
                                                                            005500
C-----------------------------------------------------------------------   005600
CR          POWER-NORMALIZED REAL REGION-AVERAGED GROUP FLUXES           -  005700
CR          TO BE USED FOR COLLAPSING (TYPE 03)                          -  005800
C                                                                        -  005900
CL    FORMAT-----(I2,10X,5E12.5)                                         -  006000
C                                                                        -  006100
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  006200
CD    =======   ==========================================================-  006300
CD    1-2       03                                                       -  006400
CD                                                                       -  006500
CD    13-24     REGION FLUX FOR GROUP J.                                 -  006600
CD                                                                       -  006700
CD    25-36     REGION FLUX FOR GROUP J+1.                               -  006800
CD                                                                       -  006900
CD    37-48     REGION FLUX FOR GROUP J+2.                               -  007000
CD                                                                       -  007100
CD    49-60     REGION FLUX FOR GROUP J+3.                               -  007200
CD                                                                       -  007300
CD    61-72     REGION FLUX FOR GROUP J+4.                               -  007400
C                                                                        -  007500
CN              TYPE 03 CARDS ARE REQUIRED ONLY FOR THE EXECUTION        -  007600
CN              OF THE MODULE AJC007, WHERE ONE REGION ONLY IS           -  007700
CN              ALLOWED.  FOR THE EXECUTION OF THE MODULE AJC008,        -  007800
CN              THE MULTIPLE REGION DATA SUPPLIED FROM THE DATA SET      -  007900
CN              FR.PN IS USED.                                           -  008000
CN                                                                       -  008100
CN              AS MANY TYPE 03 CARDS MAY BE USED AS ARE NECESSARY       -  008200
CN              TO SWEEP THROUGH THE NUMBER OF GROUPS IN THE             -  008300
CN              ORIGINAL UNCOLLAPSED DATA.  THE TYPE 03 CARDS MUST       -  008400
CN              BE IN ORDER AND THE FLUXES ORDERED SEQUENTIALLY          -  008500
CN              STARTING WITH THE HIGHEST ENERGY GROUP.                  -  008600
C                                                                        -  008700
C-----------------------------------------------------------------------   008800
                                                                            008900
                                                                            009000
C-----------------------------------------------------------------------   009100
CR          GROUP CORRESPONDENCE FACTORS (TYPE 04)                       -  009200
C                                                                        -  009300
CL    FORMAT-----(I2,4X,11I6)                                            -  009400
C                                                                        -  009500
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  009600
CD    =======   ==========================================================-  009700
CD    1-2       04                                                       -  009800
CD                                                                       -  009900
CD    7-12      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J.       -  010000
CD                                                                       -  010100
CD    13-18     HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+1.     -  010200
CD                                                                       -  010300
CD    19-24     HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+2.     -  010400
CD                                                                       -  010500
CD    25-30     HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+3.     -  010600
CD                                                                       -  010700
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CD     31-36      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+4.   -  010800
CD                                                                       -  010900
CD     37-42      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+5.   -  011000
CD                                                                       -  011100
CD     43-48      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+6.   -  011200
CD                                                                       -  011300
CD     49-54      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+7.   -  011400
CD                                                                       -  011500
CD     55-60      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+8.   -  011600
CD                                                                       -  011700
CD     61-66      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+9.   -  011800
CD                                                                       -  011900
CD     67-72      HIGHEST ORIGINAL GROUP NUMBER INCLUDED IN GROUP J+10.  -  012000
C                                                                        -  012100
CN                THIS ARRAY OF INDICES SPECIFIES THE CORRESPONDENCE     -  012200
CN                BETWEEN THE COLLAPSED ENERGY BOUNDARIES EC AND THE     -  012300
CN                ORIGINAL ENERGY BOUNDARIES E, I.E., THE ENERGY         -  012400
CN                BOUNDARY EC(I) = E(KE(I)), WHERE KE(I) IS THE ITH      -  012500
CN                ENTRY ON THE TYPE 04 CARD(S).                          -  012600
CN                                                                       -  012700
CN                AS MANY TYPE 04 CARDS MAY BE USED AS ARE NECESSARY     -  012800
CN                TO SWEEP THROUGH THE NUMBER OF COLLAPSED GROUPS + 1.   -  012900
CN                THE TYPE 04 CARDS MUST BE IN ORDER AND THE GROUP       -  013000
CN                CORRESPONDENCE FACTORS ORDERED SEQUENTIALLY STARTING   -  013100
CN                WITH THE HIGHEST ENERGY GROUP.                         -  013200
C                                                                        -  013300
C-----------------------------------------------------------------------   013400
                                                                            013500
CEOF                                                                        013600
```

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C*********************************************************************   000100
C                                                                    -   000200
C                        PREPARED 1/26/71 AT ANL                     -   000300
C                                                                    -   000400
CE          A.DELGRP                                                 -   000500
CE          SPECIFICATIONS FOR DELAYED NEUTRON DATA                  -   000600
C                                                                    -   000700
CN                       THIS IS A USER-SUPPLIED BCD DATA SET.       -   000800
CN                       THE LIST FOR EACH RECORD IS GIVEN IN TERMS  -   000900
CN                       OF THE BCD FORMAT OF THE DATA CARD.         -   001000
CN                       COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE  -   001100
CN                       NUMBER.                                     -   001200
C                                                                    -   001300
C*********************************************************************   001400
                                                                            001500
                                                                            001600
C-----------------------------------------------------------------------   001700
CR          PROBLEM TITLE (TYPE 01)                                  -   001800
C                                                                    -   001900
CL     FORMAT-----(I2,4X,11A6)                                       -   002000
C                                                                    -   002100
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY              -   002200
CD     =======    ==================================================-   002300
CD     1-2        01                                                -   002400
CD                                                                  -   002500
CD     7-72       ANY ALPHANUMERIC CHARACTERS                       -   002600
C                                                                    -   002700
C-----------------------------------------------------------------------   002800
                                                                            002900
                                                                            003000
C-----------------------------------------------------------------------   003100
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 03)                 -   003200
C                                                                    -   003300
CL     FORMAT-----(I2,10X,2I6)                                       -   003400
C                                                                    -   003500
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY              -   003600
CD     =======    ==================================================-   003700
CD     1-2        03                                                -   003800
CD                                                                  -   003900
CD     13-18      OPERATION FLAG.                                   -   004000
CD                0...IDENTIFY DELAYED NEUTRON PRECURSOR FAMILIES WITH  004100
CD                    IDENTICAL DECAY CONSTANTS AND EMISSION SPECTRA -   004200
CD                    AS ONE FAMILY, INDEPENDENT OF THE FISSIONING   -   004300
CD                    ISOTOPE.                                       -   004400
CD                1...IDENTIFY AS SEPARATE PRECURSOR FAMILIES THE    -   004500
CD                    CONTRIBUTIONS FROM FISSION OF EACH ISOTOPE, EVEN   004600
CD                    IF THE DECAY CONSTANTS AND EMISSION SPECTRA ARE -  004700
CD                    IDENTICAL.                                     -   004800
```

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CD                                                                      -  004900
CD      19-24       SPECTRUM AND COLLAPSING FLAG.                       -  005000
CD                  0...READ DATA SETS B.XSSPC, XS.I.RES, XS.C.SMT, AND -  005100
CD                      FR.FM TO OBTAIN GROUP STRUCTURE SPECIFICATIONS, -  005200
CD                      FISSION CROSS SECTIONS, AND COLLAPSING SPECTRUM. -  005300
CD                      IN THIS OPTION THE DEFINITIONS OF AVERAGE DELAYED -  005400
CD                      YIELD PER FISSION WILL CORRESPOND EXACTLY TO    -  005500
CD                      THOSE GIVEN FOR THE TOTAL YIELD IN CSC001, CSC002, -  005600
CD                      AND CSC004.                                     -  005700
CD                  1...ASSUME CONSTANT FISSION CROSS SECTION OVER THE  -  005800
CD                      BROAD GROUP AND A 1/E FLUX SPECTRUM IN ENERGY.  -  005900
CD                  2...AS ABOVE WITH CONSTANT FLUX IN ENERGY.          -  006000
CD                  3...AS ABOVE WITH PHI(E)=E                          -  006100
C                                                                       -  006200
CN                  SINCE THE DELAYED NEUTRON YIELD PER FISSION IS ALMOST -  006300
CN                  INDEPENDENT OF ENERGY UP TO A FEW MEV, THE LATTER   -  006400
CN                  OPTIONS WILL PROBABLY BE ACCEPTABLE, GIVEN THE      -  006500
CN                  UNCERTAINTY IN THE YIELD ITSELF.                    -  006600
C                                                                       -  006700
C-----------------------------------------------------------------------  006800
                                                                         006900
                                                                         007000
C-----------------------------------------------------------------------  007100
CR              ENDF/B MATERIAL NUMBER TO XS.ISO ISOTOPE LABEL          -  007200
CR              CORRESPONDENCE LIST (TYPE 04)                           -  007300
C                                                                       -  007400
CL      FORMAT-----(I2,6X,I4,10A6)                                      -  007500
C                                                                       -  007600
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY             -  007700
CD      =======     ==================================================  -  007800
CD      1-2         04                                                  -  007900
CD                                                                      -  008000
CD      9-12        ENDF/B MATERIAL NUMBER (REPEATED ON ADDITIONAL CARDS). -  008100
CD                                                                      -  008200
CD      13-18       ISOTOPE LABEL.                                      -  008300
CD                                                                      -  008400
CD      19-24       ISOTOPE LABEL.                                      -  008500
CD                                                                      -  008600
CD      25-30       ISOTOPE LABEL.                                      -  008700
CD                                                                      -  008800
CD      31-36       ISOTOPE LABEL.                                      -  008900
CD                                                                      -  009000
CD      37-42       ISOTOPE LABEL.                                      -  009100
CD                                                                      -  009200
CD      43-48       ISOTOPE LABEL.                                      -  009300
CD                                                                      -  009400
CD      49-54       ISOTOPE LABEL.                                      -  009500
CD                                                                      -  009600
CD      55-60       ISOTOPE LABEL.                                      -  009700
CD                                                                      -  009800
CD      61-66       ISOTOPE LABEL.                                      -  009900
CD                                                                      -  010000
CD      67-72       ISOTOPE LABEL.                                      -  010100
C                                                                       -  010200
CN                  THE DELAYED NEUTRON DATA FOR THE ENDF/B MATERIAL    -  010300
CN                  IDENTIFIED BY THE INTEGER IN COLS. 9-12 WILL BE     -  010400
CN                  ASSIGNED TO EACH ISOTOPE LISTED IN THE SUCCEEDING A6 -  010500
CN                  FIELDS. ANY ISOTOPES WHICH ARE NOT PRESENT IN THIS  -  010600
CN                  LIST FOR SOME MATERIAL NUMBER WILL BE CONSIDERED TO -  010700
CN                  PRODUCE NO DELAYED NEUTRONS UPON FISSIONING. EACH   -  010800
CN                  ISOTOPE LABEL MAY BE ENTERED ONLY ONCE.             -  010900
C                                                                       -  011000
C-----------------------------------------------------------------------  011100
                                                                         011200
CEOF                                                                     011300
```

```
C*********************************************************************
C                                                                    -
C                          PREPARED 1/26/71 AT ANL                   -
C                                                                    -
CF          A.DIF1D                                                  -
CE          ONE-DIMENSIONAL DIFFUSION THEORY                         -
CE          MODULE-DEPENDENT BCD INPUT                               -
C                                                                    -
CN                         THIS IS A USER-SUPPLIED BCD DATA SET.     -
CN                         THE LIST FOR EACH RECORD IS GIVEN IN TERMS -
CN                         OF THE BCD FORMAT OF THE DATA CARD.       -
CN                         COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE -
CN                         NUMBER.                                   -
CN                         CARD TYPES 01 THROUGH 04 ARE REQUIRED.    -
CN                         THE TWO TYPE 01 CARDS MUST BE IN THE      -
CN                         ORDER SHOWN.                              -
CN                         BLANK OR ZERO FIELDS PRODUCE DEFAULT VALUES. -
C                                                                    -
C*********************************************************************
C----------------------------------------------------------------------
CR          PROBLEM TITLE (TYPE 01)                                  -
C                                                                    -
CL     FORMAT-----(I2,10X,10A6)                                      -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY            -
CD     =======      ==================================================-
CD     1-2          01                                                -
CD                                                                   -
CD     13-72        ANY ALPHANUMERIC CHARACTERS.                      -
C                                                                    -
C----------------------------------------------------------------------
C----------------------------------------------------------------------
CR          PROBLEM OPTIONS (TYPE 01)                                -
C                                                                    -
CL     FORMAT-----(I2,10X,8I6)                                       -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY            -
CD     =======      ==================================================-
CD     1-2          01                                                -
CD                                                                   -
CD     13-18        KINETICS OPTION.                                  -
CD                  0...KINETICS OPTION NOT DESIRED (DEFAULT).        -
CD                  1...KINETICS OPTION 1 (DELAYED DATA FOR SOURCE    -
CD                      CALCULATION) USED.                            -
CD                  2...KINETICS OPTION 2 (DELAYED DATA FOR ALPHA SEARCH) -
CD                      USED.                                         -
CD                                                                    -
CD     19-24        POINTR DEBUGGING EDIT.                            -
CD                  0...NO DEBUGGING PRINTOUT (DEFAULT).              -
CD                  1...DEBUGGING DUMP PRINTOUT.                      -
CD                  2...DEBUGGING TRACE PRINTOUT.                     -
CD                  3...FULL DEBUGGING PRINTOUT.                      -
CD                                                                    -
CD     25-30        MAXIMUM NUMBER OF UPSCATTER ITERATIONS (DEFAULT=0). -
CD                                                                    -
CD     31-36        DIFFUSION OUTPUT EDIT.                            -
CD                  0...NO OUTPUT EDIT (DEFAULT).                     -
CD                  1...INPUT CROSS SECTION AND GEOMETRY EDIT ONLY.   -
CD                  2...STANDARD OUTPUT EDIT (BALANCE CALCULATIONS AND -
CD                      FLUX EDITS).                                  -
CD                  3...COMPLETE OUTPUT EDIT (ABOVE PLUS POWER        -
CD                      CALCULATIONS).                                -
CD                                                                    -
CD     37-42        N, WHERE N OUTER ITERATIONS ARE PERFORMED BEFORE  -
CD                  INITIALLY WRITING THE FLUX DATA SET FR.D1 (FA.D1) -
CD                  (DEFAULT=THE MAXIMUM NUMBER OF OUTER ITERATIONS AS -
CD                  GIVEN ON CARD TYPE 03 (BELOW) +1).                -
CD                                                                    -
CD     43-48        M, WHERE AFTER INITIALLY WRITING FR.D1 (FA.D1) AS -
CD                  SPECIFIED IN COLUMNS 37-42 ABOVE, FR.D1 (FA.D1) IS -
CD                  REWRITTEN EVERY M ADDITIONAL OUTER ITERATIONS     -
CD                  (DEFAULT=10).                                     -
CD                                                                    -
CD     49-54        FISSION SOURCE DATA SETS.                         -
CD                  0...FISSION SOURCE DATA SET IS NOT WRITTEN (DEFAULT). -
CD                  1...FISSION SOURCE DATA SET FSR.D1 (FSA.D1) IS    -
CD                      WRITTEN.                                      -
CD                                                                    -
CD     55-60        SEARCH OUTPUT DATA SETS.                          -
CD                  0...ALL DATA SETS DEPENDENT ON SEARCH PARAMETER ARE -
CD                      REWRITTEN TO CORRESPOND TO CONVERGED VALUE OF -
CD                      SEARCH PARAMETER (DEFAULT).                   -
CD                  1...DATA SETS ARE NOT REWRITTEN.                  -
C                                                                    -
C----------------------------------------------------------------------
C----------------------------------------------------------------------
CR          UPSCATTER ITERATION AND NORMALIZATION CONTROL (TYPE 02)  -
C                                                                    -
CL     FORMAT-----(I2,10X,2E12.5)                                    -
C                                                                    -
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```
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  009700
CD     =======    ==========================================================-  009800
CD     1-2        02                                                       -  009900
CD                                                                         -  010000
CD     13-24      CONVERGENCE CRITERION FOR UPSCATTER ITERATIONS           -  010100
CD                (DEFAULT=0.00001).                                       -  010200
CD                                                                         -  010300
CD     25-36      POWER IN WATTS TO WHICH PROBLEM IS NORMALIZED FOR        -  010400
CD                BURNUP CALCULATIONS (DEFAULT IS NO NORMALIZATION         -  010500
CD                OF FLUXES FOR BURNUP).                                   -  010600
C                                                                          -  010700
C-------------------------------------------------------------------------  010800
                                                                           010900
                                                                           011000
C-------------------------------------------------------------------------  011100
CR          ITERATION AND ARRAY CONTROL (TYPE 03)                          -  011200
C                                                                          -  011300
CL     FORMAT-----(I2,10X,8I6)                                             -  011400
C                                                                          -  011500
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  011600
CD     =======    ==========================================================-  011700
CD     1-2        03                                                       -  011800
CD                                                                         -  011900
CD     13-18      MAXIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=100).        -  012000
CD                                                                         -  012100
CD     19-24      OUTER ITERATION EXTRAPOLATION.                           -  012200
CD                0...NO EXTRAPOLATION (DEFAULT).                          -  012300
CD                1...CHEBYSHEV EXTRAPOLATION.                             -  012400
CD                2...OVERRELAXATION, FOR SOURCE CALCULATIONS ONLY.        -  012500
CD                                                                         -  012600
CD     25-30      NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BEFORE         -  012700
CD                EXTRAPOLATION (DEFAULT=5).                               -  012800
CD                                                                         -  012900
CD     31-36      NUMBER OF EXTRAPOLATED OUTER ITERATIONS BEFORE           -  013000
CD                TESTING FOR EXTRAPOLATION PAYOFF (DEFAULT=3).            -  013100
CD                                                                         -  013200
CD     37-42      MAXIMUM NUMBER OF EXTRAPOLATED OUTER ITERATIONS IN       -  013300
CD                AN EXTRAPOLATION SEQUENCE (DEFAULT=8).                   -  013400
CD                                                                         -  013500
CD     43-48      MINIMUM NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS        -  013600
CD                BETWEEN EXTRAPOLATION SEQUENCES (DEFAULT=3).             -  013700
CD                                                                         -  013800
CD     49-54      SIZE OF FAST CORE STORAGE ARRAY IN REAL*8 WORDS          -  013900
CD                (DEFAULT=60000).                                         -  014000
CD                                                                         -  014100
CD     55-60      SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS          -  014200
CD                (DEFAULT=120000). IF LT.0, NO BULK CORE IS ALLOCATED.    -  014300
C                                                                          -  014400
C-------------------------------------------------------------------------  014500
                                                                           014600
                                                                           014700
C-------------------------------------------------------------------------  014800
CR          CONVERGENCE CRITERIA (TYPE 04)                                 -  014900
C                                                                          -  015000
CL     FORMAT-----(I2,10X,5E12.5)                                          -  015100
C                                                                          -  015200
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  015300
CD     =======    ==========================================================-  015400
CD     1-2        04                                                       -  015500
CD                                                                         -  015600
CD     13-24      OUTER ITERATION CONVERGENCE CRITERION ON THE SUM         -  015700
CD                OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES                -  015800
CD                (DEFAULT=0.00001).                                       -  015900
CD                                                                         -  016000
CD     25-36      OUTER ITERATION CONVERGENCE CRITERION ON THE             -  016100
CD                DIFFERENCE OF THE FLUX BOUNDS LAMBDA MAX AND             -  016200
CD                LAMBDA MIN (DEFAULT=0.00001).                            -  016300
CD                                                                         -  016400
CD     37-48      OUTER ITERATION CONVERGENCE CRITERION ON THE             -  016500
CD                DIFFERENCE IN KEFF (DEFAULT=0.00001).                    -  016600
CD                                                                         -  016700
CD     49-60      INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV            -  016800
CD                EXTRAPOLATION TO OUTER ITERATIONS (DEFAULT=0.).          -  016900
CD                                                                         -  017000
CD     61-72      LAMBDA MONITOR (DEFAULT=0.). IF THE RATIO OF THE FLUX    -  017100
CD                AT ANY POINT TO THE ROOT MEAN SQUARE FLUX IS LESS THAN   -  017200
CD                THE LAMBDA MONITOR, THEN THE FLUX AT THAT POINT IS       -  017300
CD                ELIMINATED FROM THE CALCULATION OF LAMBDA MAX AND        -  017400
CD                LAMBDA MIN.                                              -  017500
C                                                                          -  017600
C-------------------------------------------------------------------------  017700
                                                                           017800
                                                                           017900
C-------------------------------------------------------------------------  018000
CR          BLACK COMPOSITION CONTROL (TYPE 07)                            -  018100
C                                                                          -  018200
CL     FORMAT-----(I2,10X,A6,2I6)                                          -  018300
C                                                                          -  018400
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  018500
CD     =======    ==========================================================-  018600
CD     1-2        07                                                       -  018700
CD                                                                         -  018800
CD     13-18      NAME OF BLACK COMPOSITION                                -  018900
CD                                                                         -  019000
CD     19-24      INITIAL (HIGHER ENERGY) GROUP NUMBER TREATED AS BLACK.   -  019100
CD                                                                         -  019200
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CD     25-30      FINAL (LOWER ENERGY) GROUP NUMBER TREATED AS BLACK.     -  019300
CD                                                                        -  019400
CD                IF COLUMNS 19-24 ARE BLANK, THE COMPOSITION SPECIFIED   -  019500
CD                IN COLUMNS 13-18 IS TREATED AS BLACK FOR ALL ENERGY     -  019600
CD                GROUPS. IF COLUMNS 25-30 ARE BLANK, THE COMPOSITION     -  019700
CD                IS TREATED AS BLACK FOR THE ENERGY GROUP GIVEN          -  019800
CD                IN COLUMNS 19-24.                                       -  019900
C                                                                         -  020000
C-------------------------------------------------------------------------  020100
                                                                           020200
CEOF                                                                       020300
```

A.DIF2D Requires all but 07 cards

```
C*************************************************************************  000100
C                                                                         -  000200
C                         PREPARED 1/26/71 AT ANL                         -  000300
C                                                                         -  000400
CE          A.DIF2D                                                       -  000500
CE          TWO-DIMENSIONAL DIFFUSION THEORY                              -  000600
CE          MODULE-DEPENDENT BCD INPUT                                    -  000700
C                                                                         -  000800
CN                        THIS IS A USER-SUPPLIED BCD DATA SET.           -  000900
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS      -  001000
CN                        OF THE BCD FORMAT OF THE DATA CARD.             -  001100
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE      -  001200
CN                        NUMBER.                                         -  001300
CN                        CARD TYPES 01 THROUGH 06 ARE REQUIRED.          -  001400
CN                        THE TWO TYPE 01 CARDS MUST BE IN THE            -  001500
CN                        ORDER SHOWN.                                    -  001600
CN                        BLANK FIELDS PRODUCE DEFAULT VALUES.            -  001700
C                                                                         -  001800
C*************************************************************************  001900
                                                                           002000
                                                                           002100
C-------------------------------------------------------------------------  002200
CR          PROBLEM TITLE (TYPE 01)   TITLE                               -  002300
C                                                                         -  002400
CL     FORMAT-----(I2,10X,10A6)                                           -  002500
C                                                                         -  002600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  002700
CD     =======    ==========================================================-  002800
CD     1-2        01                                                      -  002900
CD                                                                        -  003000
CD     13-72      ANY ALPHANUMERIC CHARACTERS.                            -  003100
C                                                                         -  003200
C-------------------------------------------------------------------------  003300
                                                                           003400
                                                                           003500
C-------------------------------------------------------------------------  003600
CR          PROBLEM OPTIONS (TYPE 01)   DATA                              -  003700
C                                                                         -  003800
CL     FORMAT-----(I2,10X,9I6)                                            -  003900
C                                                                         -  004000
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  004100
CD     =======    ==========================================================-  004200
CD     1-2        01                                                      -  004300
CD                                                                        -  004400
CD     13-18      KINETICS OPTION.                                        -  004500
CD                0...KINETICS OPTION NOT DESIRED (DEFAULT).              -  004600
CD                1...KINETICS OPTION 1 (DELAYED DATA FOR SOURCE          -  004700
CD                    CALCULATION) USED.                                  -  004800
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CD                2...KINETICS OPTION 2 (DELAYED DATA FOR ALPHA SEARCH)  -  004900
CD                    USED.                                              -  005000
CD                                                                       -  005100
CD      19-24     POINTR DEBUGGIN EDIT.                                  -  005200
CD                0...NO DEBUGGING PRINTOUT (DEFAULT).                   -  005300
CD                1...DEBUGGING DUMP PRINTOUT.                           -  005400
CD                2...DEBUGGING TRACE PRINTOUT.                          -  005500
CD                3...FULL DEBUGGING PRINTOUT.                           -  005600
CD                                                                       -  005700
CD      25-30     MAXIMUM NUMBER OF UPSCATTER ITERATIONS (DEFAULT=0).    -  005800
CD                                                                       -  005900
CD      31-36     DIFFUSION OUTPUT EDIT.                                 -  006000
CD                0...NO OUTPUT EDIT (DEFAULT).                          -  006100
CD                1...INPUT CROSS SECTION AND GEOMETRY EDIT ONLY.        -  006200
CD                2...STANDARD OUTPUT EDIT (BALANCE AND POWER            -  006300
CD                    CALCULATIONS AND FLUX EDITS).                      -  006400
CD                3...COMPLETE OUTPUT EDIT (ABOVE PLUS NEUTRON CURRENT   -  006500
CD                    CALCULATIONS).                                     -  006600
CD                                                                       -  006700
CD      37-42     SOLUTION TYPE.                                         -  006800
CD                1...GROUP-ORDERED SOLUTION.                            -  006900
CD                2...CHANNEL-ORDERED SOLUTION.                          -  007000
CD                                                                       -  007100
CD      43-48     N, WHERE N OUTER ITERATIONS ARE PERFORMED BEFORE       -  007200
CD                INITIALLY WRITING THE FLUX DATA SET FR.D2 (FA.D2)      -  007300
CD                (DEFAULT=THE MAXIMUM NUMBER OF OUTER ITERATIONS AS     -  007400
CD                GIVEN ON CARD TYPE 03 BELOW + 1).                      -  007500
CD                                                                       -  007600
CD      49-54     M, WHERE AFTER INITIALLY WRITING FR.D2 (FA.D2) AS      -  007700
CD                SPECIFIED IN COLUMNS 43-48 ABOVE, FR.D2 (FA.D2) IS     -  007800
CD                REWRITTEN EVERY M ADDITIONAL OUTER ITERATIONS          -  007900
CD                (DEFAULT=0).                                           -  008000
CD                                                                       -  008100
CD      55-60     MINIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=1).        -  008200
CD                                                                       -  008300
CD      67-72     SEARCH OUTPUT DATA SETS.                               -  008400
CD                0...ALL DATA SETS DEPENDENT ON SEARCH PARAMETER ARE    -  008500
CD                    REWRITTEN TO CORRESPOND TO CONVERGED VALUE OF      -  008600
CD                    SEARCH PARAMETER (DEFAULT).                        -  008700
CD                1...DATA SETS ARE NOT REWRITTEN.                       -  008800
C                                                                        -  008900
C-----------------------------------------------------------------------  009000
                                                                         009100
                                                                         009200
C-----------------------------------------------------------------------  009300
CR          UPSCATTER ITERATION AND NORMALIZATION CONTROL (TYPE 02)      -  009400
C                                                                        -  009500
CL      FORMAT-----(I2,10X,2E12.5)                                       -  009600
C                                                                        -  009700
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  009800
CD      =======   ==========================================================  009900
CD      1-2       02                                                     -  010000
CD                                                                       -  010100
CD      13-24     CONVERGENCE CRITERION FOR UPSCATTER ITERATIONS         -  010200
CD                (DEFAULT=0.00001).                                     -  010300
CD                                                                       -  010400
CD      25-36     POWER IN WATTS TO WHICH PROBLEM IS NORMALIZED FOR      -  010500
CD                BURNUP CALCULATIONS (DEFAULT=1.0).                     -  010600
C                                                                        -  010700
C-----------------------------------------------------------------------  010800
                                                                         010900
                                                                         011000
C-----------------------------------------------------------------------  011100
CR          ITERATION AND ARRAY CONTROL (TYPE 03)                        -  011200
C                                                                        -  011300
CL      FORMAT-----(I2,10X,8I6)                                          -  011400
C                                                                        -  011500
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  011600
CD      =======   ==========================================================  011700
CD      1-2       03                                                     -  011800
CD                                                                       -  011900
CD      13-18     MAXIMUM NUMBER OF OUTER ITERATIONS (DEFAULT=100).      -  012000
CD                                                                       -  012100
CD      19-24     OUTER ITERATION EXTRAPOLATION.                         -  012200
CD                0...NO EXTRAPOLATION (DEFAULT).                        -  012300
CD                1...CHEBYSHEV EXTRAPOLATION.                           -  012400
CD                2...OVERRELAXATION, FOR SOURCE CALCULATIONS ONLY.      -  012500
CD                                                                       -  012600
CD      25-30     NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BEFORE       -  012700
CD                EXTRAPOLATION (DEFAULT=3 IF INPUT VALUE IS .LT.3).     -  012800
CD                                                                       -  012900
CD      31-36     NUMBER OF EXTRAPOLATED OUTER ITERATIONS BEFORE         -  013000
CD                TESTING FOR EXTRAPOLATION PAYOFF (DEFAULT=5).          -  013100
CD                                                                       -  013200
CD      37-42     MAXIMUM NUMBER OF EXTRAPOLATED OUTER ITERATIONS IN     -  013300
CD                AN EXTRAPOLATION SEQUENCE (DEFAULT WILL BE 3 + VALUE   -  013400
CD                IN COLUMNS 31-36 ABOVE IF INPUT VALUE IS LESS          -  013500
CD                THAN THE VALUE INPUT IN COLUMNS 31-36).                -  013600
CD                                                                       -  013700
CD      43-48     NUMBER OF UNEXTRAPOLATED OUTER ITERATIONS BETWEEN      -  013800
CD                EXTRAPOLATION SEQUENCES (DEFAULT=3 IF INPUT VALUE IS   -  013900
CD                .LT.3).                                                -  014000
CD                                                                       -  014100
CD      49-54     SIZE OF FAST CORE STORAGE ARRAY IN REAL*8 WORDS        -  014200
CD                (DEFAULT=60000).                                       -  014300
CD                                                                       -  014400
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Blank OK.

40000

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CD     55-60      SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS          -  014500
CD                (DEFAULT=125000). IF LT.0, NO BULK CORE IS ALLOCATED.   -  014600
C                                                                         -  014700
C-----------------------------------------------------------------------------  014800
                                                                              014900
                                                                              015000
C-----------------------------------------------------------------------------  015100
CR          CONVERGENCE CRITERIA (TYPE 04)                                -  015200
C                                                                         -  015300
CL     FORMAT-----(I2,10X,5E12.5)                                         -  015400
C                                                                         -  015500
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  015600
CD     =======    ==========================================================-  015700
CD     1-2        04                                                      -  015800
CD                                                                        -  015900
CD     13-24      OUTER ITERATION CONVERGENCE CRITERION ON THE SUM        -  016000
CD                OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES               -  016100
CD                (DEFAULT=0.00001).                                      -  016200
CD                                                                        -  016300
CD     25-36      OUTER ITERATION CONVERGENCE CRITERION ON THE            -  016400
CD                DIFFERENCE OF THE FLUX BOUNDS LAMBDA MAX AND            -  016500
CD                LAMBDA MIN (DEFAULT=0.00001).                           -  016600
CD                                                                        -  016700
CD     37-48      OUTER ITERATION CONVERGENCE CRITERION ON THE            -  016800
CD                DIFFERENCE IN KEFF (DEFAULT=0.00001).                   -  016900
CD                                                                        -  017000
CD     49-60      INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV           -  017100
CD                EXTRAPOLATION TO OUTER ITERATIONS (DEFAULT=0.).         -  017200
CD                                                                        -  017300
CD     61-72      LAMBDA MONITOR (DEFAULT=.01). IF THE RATIO OF THE FLUX  -  017400
CD                AT ANY POINT TO THE ROOT MEAN SQUARE FLUX IS LESS THAN  -  017500
CD                THE LAMBDA MONITOR, THEN THE FLUX AT THAT POINT IS      -  017600
CD                ELIMINATED FROM THE CALCULATION OF LAMBDA MAX AND       -  017700
CD                LAMBDA MIN.                                             -  017800
C                                                                         -  017900
C-----------------------------------------------------------------------------  018000
                                                                              018100
                                                                              018200
C-----------------------------------------------------------------------------  018300
CR          INNER ITERATION CONTROL (TYPE 05)                             -  018400
C                                                                         -  018500
CL     FORMAT-----(I2,10X,6I6)                                            -  018600
C                                                                         -  018700
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  018800
CD     =======    ==========================================================-  018900
CD     1-2        05                                                      -  019000
CD                                                                        -  019100
CD     13-18      MAXIMUM NUMBER OF INNER ITERATIONS PER OUTER ITERATION  -  019200
CD                (DEFAULT=200).                                          -  019300
CD                                                                        -  019400
CD     19-24      INNER ITERATION EXTRAPOLATION.                          -  019500
CD                0...NO EXTRAPOLATION (DEFAULT).                         -  019600
CD                1...CHEBYSHEV EXTRAPOLATION.                            -  019700
CD                2...SUCCESSIVE OVERRELAXATION.                          -  019800
CD                                                                        -  019900
CD     25-30      NUMBER OF UNEXTRAPOLATED INNER ITERATIONS BEFORE        -  020000
CD                EXTRAPOLATING (DEFAULT=3 IF INPUT VALUE.LT.3).          -  020100
CD                                                                        -  020200
CD     31-36      NUMBER OF EXTRAPOLATED INNER ITERATIONS BEFORE          -  020300
CD                TESTING FOR EXTRAPOLATION PAYOFF (IF GROUP-ORDERED      -  020400
CD                SOLUTION, DEFAULT=3; IF CHANNEL-ORDERED SOLUTION,       -  020500
CD                DEFAULT=5).                                             -  020600
CD                                                                        -  020700
CD     37-42      MAXIMUM NUMBER OF EXTRAPOLATED INNER ITERATIONS IN      -  020800
CD                AN EXTRAPOLATED SEQUENCE (IF INPUT VALUE IS .LT.        -  020900
CD                COLUMNS 31-36 ABOVE, DEFAULT VALUE IS 3+VALUE IN        -  021000
CD                COLUMNS 31-36 ABOVE).                                   -  021100
CD                                                                        -  021200
CD     43-48      NUMBER OF UNEXTRAPOLATED INNER ITERATIONS BETWEEN       -  021300
CD                EXTRAPOLATION SEQUENCES (DEFAULT=3 IF INPUT             -  021400
CD                VALUE.LT.3).                                            -  021500
C                                                                         -  021600
C-----------------------------------------------------------------------------  021700
                                                                              021800
                                                                              021900
C-----------------------------------------------------------------------------  022000
CR          INNER ITERATION CONVERGENCE CRITERIA (TYPE 06)                -  022100
C                                                                         -  022200
CL     FORMAT-----(I2,10X,3E12.5)                                         -  022300
C                                                                         -  022400
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  022500
CD     =======    ==========================================================-  022600
CD     1-2        06                                                      -  022700
CD                                                                        -  022800
CD     13-24      INNER ITERATION CONVERGENCE CRITERION ON THE SUM        -  022900
CD                OF THE ABSOLUTE VALUE OF FLUX DIFFERENCES               -  023000
CD                (DEFAULT=0.000001).                                     -  023100
CD                                                                        -  023200
CD     25-36      INTERVAL SHIFT FACTOR WHEN APPLYING CHEBYSHEV           -  023300
CD                EXTRAPOLATION TO INNER ITERATIONS (DEFAULT=0.).         -  023400
CD                                                                        -  023500
CD     37-48      INITIAL ESTIMATE OF CONVERGENCE RATE OF INNER           -  023600
CD                ITERATIONS (IF GROUP-ORDERED, DEFAULT=0; IF             -  023700
CD                CHANNEL-ORDERED, DEFAULT=0.9).                          -  023800
C                                                                         -  023900
C-----------------------------------------------------------------------------  024000
```

blank card

Default

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C-----------------------------------------------------------------------
CR          BLACK COMPOSITION CONTROL (TYPE 07)                        -
C                                                                      -
CL    FORMAT-----(I2,10X,A6,2I6)                                       -
C                                                                      -
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -
CD    =======    ==========================================================-
CD    1-2        07                                                    -
CD                                                                     -
CD    13-18      NAME OF BLACK COMPOSITION                             -
CD                                                                     -
CD    19-24      INITIAL (HIGHER ENERGY) GROUP NUMBER TREATED AS BLACK. -
CD                                                                     -
CD    25-30      FINAL (LOWER ENERGY) GROUP NUMBER TREATED AS BLACK.   -
CD                                                                     -
CD               IF COLUMNS 19-24 ARE BLANK, THE COMPOSITION SPECIFIED -
CD               IN COLUMNS 13-18 IS TREATED AS BLACK FOR ALL ENERGY   -
CD               GROUPS. IF COLUMNS 25-30 ARE BLANK, THE COMPOSITION   -
CD               IS TREATED AS BLACK FOR THE ENERGY GROUP GIVEN        -
CD               IN COLUMNS 19-24.                                     -
C                                                                      -
C-----------------------------------------------------------------------

CEOF
```

NOT USED

```
C*********************************************************************-
C                                                                      -
C                    PREPARED 1/26/71 AT ANL                           -
C                                                                      -
CF          A.INPTR1                                                   -
CE          ONE DIMENSIONAL TRANSPORT THEORY                           -
CE          MODULE-DEPENDENT BCD INPUT                                 -
C                                                                      -
CN                   THIS IS USER-SUPPLIED BCD DATA SET.               -
CN                   THE LIST FOR EACH RECORD IS GIVEN IN TERMS OF     -
CN                   THE BCD FORMAT OF THE DATA CARD. COLUMNS 1-2      -
CN                   NORMALLY CONTAIN THE CARD TYPE NUMBER.            -
C                                                                      -
CN                   CARD TYPE 01 IS REQUIRED. BLANK FIELDS YIELD      -
CN                   DEFAULT VALUES.                                   -
C                                                                      -
C*********************************************************************-

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 01)                                   -
C                                                                      -
CL    FORMAT-----(I2,10X,4I6,3D12.11)                                  -
C                                                                      -
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -
CD    ======     ==========================================================-
CD    1-2        01                                                    -
CD                                                                     -
CD    13-18      ISN, THE S(N) ORDER DESIRED. (ISN .LT. 0 IF S(N)      -
CD               CONSTANTS ARE TO BE TAKEN FROM STORED DATA RATHER     -
CD               THAN FROM TYPE 03 CARDS. IN THIS CASE, THE ORDER IS   -
CD               |ISN|).                                               -
CD                                                                     -
CD    19-24      MAXII, THE MAXIMUM NUMBER OF INNER ITERATIONS FOR ALL -
CD               GROUPS (DEFAULT=25).                                  -
CD                                                                     -
CD    25-30      MAXOI, THE MAXIMUM NUMBER OF OUTER ITERATIONS FOR THE -
CD               PROBLEM (DEFAULT=50).                                 -
CD                                                                     -
CD    31-36      MKRFLX                                                -
CD               0...NO ANGULAR FLUX PRINTOUT (DEFAULT).               -
CD               1...PRINT ANGULAR FLUXES.                             -
CD                                                                     -
CD    37-48      EPS, CONVERGENCE CRITERION CONSTANT FOR INHOMOGENEOUS -
CD               SOLUTIONS OR KEFF CALCULATIONS; LEAVE BLANK FOR       -
CD               CRITICALITY SEARCHES.                                 -
CD                                                                     -
CD    49-60      PAROD, THE PARAMETER OSCILLATION DAMPER FOR CRITICALITY-
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CD                SEARCHES ONLY (DEFAULT=1.0 FOR A GEOMETRY SEARCH,
CD                0.75 FOR A TIME ABSORPTION CALCULATION, OR 0.50 FOR
CD                A CONCENTRATION SEARCH).
CD
CD     61-72      CONNF, THE NORMALIZATION FACTOR (0.0 MEANS NO
CD                NORMALIZATION; DEFAULT=1.0).
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          OUTPUT SPECIFICATIONS (TYPE 02)
C
CL     FORMAT-----(I2,10X,I6,18X,D12.11)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        02
CD
CD     13-18      POINTR DEBUGGING EDIT.
CD                0...NO DEBUGGING PRINTOUT (DEFAULT).
CD                1...DEBUGGING DUMP PRINTOUT.
CD                2...DEBUGGING TRACE PRINTOUT.
CD                3...FULL DEBUGGING PRINTOUT.
CD
CD     37-48      TIFAC. PROBLEM IS ASSUMED CONVERGED IF TIFAC*TIME OF
CD                LAST ITERATION .GT.TIME REMAINING ON PROBLEM AS
CD                SPECIFIED ON JOB CARD (DEFAULT=1.0).
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          DISCRETE ORDINATE SPECIFICATIONS (TYPE 03)
C
CL     FORMAT-----(I2,10X,2D12.11)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        03
CD
CD     13-24      DIRWGT, WEIGHT USED FOR INTEGRATION.
CD
CD     25-36      DIRMU, DIRECTION COSINE.
C
CN                IF ISN.LT.0 (TYPE 01 CARD), THE TYPE 03 CARDS ARE
CN                IRRELEVANT. IF ISN.GT.0, NUMDIR TYPE 03 CARDS ARE
CN                REQUIRED, WHERE NUMDIR=ISN+1 FOR PLANE OR SPHERE AND
CN                NUMDIR=ISN*(ISN+4)/4 FOR CYLINDER.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ANISOTROPY SPECIFICATIONS (TYPE 05)
C
CL     FORMAT-----(I2,4X,A6,I6)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        05
CD
CD     7-12       NAMANS, COMPOSITION LABEL FOR WHICH L NUMBER IS TO BE
CD                SPECIFIED.
CD
CD     13-18      LNOANS, L NUMBER TO BE DEFINED FOR THIS COMPOSITION.
CD                0...FOR ISOTROPIC ONLY.
CD                1...FOR LINEAR ANISOTROPIC SCATTERING.
CD                .GT.1...FOR HIGHER ORDER SCATTERING.
C
CN                THE ABSENCE OF THIS INFORMATION FOR A COMPOSITION
CN                INDICATES THAT ALL SCATTERING INFORMATION AVAILABLE
CN                WILL BE USED FOR THAT COMPOSITION.
C
CN                IF AN L NUMBER IS SPECIFIED FOR ONE COMPOSITION AN L
CN                NUMBER MUST BE SPECIFIED FOR ALL COMPOSITIONS.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          DENSITY FACTOR SPECIFICATIONS (TYPE 06)
C
CL     FORMAT-----(I2,4X,A6,5D12.11)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     ======     ==========================================================
CD     1-2        06
CD
CD                FOR DENSITY FACTOR SPECIFIED BY REGION:
CD
CD     7-12       REGLBL,  REGION LABEL. (1.0 IS ASSUMED FOR DENSFC FOR
CD                THOSE REGIONS NOT SPECIFIED.)
CD
CD     13-24      DENSFC, DENSITY FACTOR FOR THIS REGION.
CD
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CD                FOR DENSITY FACTOR SPECIFIED BY INTERVAL (COLS.        -  014500
CD                7-12 BLANK):                                           -  014600
CD                                                                       -  014700
CD     13-24      CSCFAC(I), DENSITY FACTOR BY INTERVAL. FIRST BLANK     -  014800
CD                FIELD SPECIFIES END OF STRING. ALL ELEMENTS NOT        -  014900.
CD                SPECIFIED ARE SET TO 1.0.                              -  015000
CD                                                                       -  015100
CD     25-36      CSCFAC(I), DENSITY FACTOR BY INTERVAL. FIRST BLANK     -  015200
CD                FIELD SPECIFIES END OF STRING. ALL ELEMENTS NOT        -  015300
CD                SPECIFIED ARE SET TO 1.0.                              -  015400
CD                                                                       -  015500
CD     37-48      CSCFAC(I), DENSITY FACTOR BY INTERVAL. FIRST BLANK     -  015600
CD                FIELD SPECIFIES END OF STRING. ALL ELEMENTS NOT        -  015700
CD                SPECIFIED ARE SET TO 1.0.                              -  015800
CD                                                                       -  015900
CD     49-60      CSCFAC(I), DENSITY FACTOR BY INTERVAL. FIRST BLANK     -  016000
CD                FIELD SPECIFIES END OF STRING. ALL ELEMENTS NOT        -  016100
CD                SPECIFIED ARE SET TO 1.0.                              -  016200
CD                                                                       -  016300
CD     61-72      CSCFAC(I), DENSITY FACTOR BY INTERVAL. FIRST BLANK     -  016400
CD                FIELD SPECIFIES END OF STRING. ALL ELEMENTS NOT        -  016500
CD                SPECIFIED ARE SET TO 1.0.                              -  016600
C                                                                        -  016700
C-----------------------------------------------------------------------   016800
                                                                            016900
                                                                            017000
C-----------------------------------------------------------------------   017100
CR          DIFFUSION-THEORY OPTION SPECIFICATIONS (TYPE 07)             -  017200
C                                                                        -  017300
CL     FORMAT-----(I2,10X,10I6)                                          -  017400
C                                                                        -  017500
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  017600
CD     ======    ==========================================================-  017700
CD     1-2       07                                                      -  017800
CD                                                                       -  017900
CD     13-18     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  018000
CD               BE USED.                                                -  018100
CD                                                                       -  018200
CD     19-24     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  018300
CD               BE USED.                                                -  018400
CD                                                                       -  018500
CD     25-30     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  018600
CD               BE USED.                                                -  018700
CD                                                                       -  018800
CD     31-36     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  018900
CD               BE USED.                                                -  019000
CD                                                                       -  019100
CD     37-42     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  019200
CD               BE USED.                                                -  019300
CD                                                                       -  019400
CD     43-43     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  019500
CD               BE USED.                                                -  019600
CD                                                                       -  019700
CD     49-54     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  019800
CD               BE USED.                                                -  019900
CD                                                                       -  020000
CD     55-60     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  020100
CD               BE USED.                                                -  020200
CD                                                                       -  020300
CD     61-66     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  020400
CD               BE USED.                                                -  020500
CD                                                                       -  020600
CD     67-72     GROUP FOR WHICH DIFFUSION-THEORY APPROXIMATION WILL     -  020700
CD               BE USED.                                                -  020800
C                                                                        -  020900
C-----------------------------------------------------------------------   021000
                                                                            021100
                                                                            021200
C-----------------------------------------------------------------------   021300
CR          GROUP-SKIPPING OPTION SPECIFICATIONS (TYPE 08)               -  021400
C                                                                        -  021500
CL     FORMAT-----(I2,10X,10I6)                                          -  021600
C                                                                        -  021700
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  021800
CD     ======    ==========================================================-  021900
CD     1-2       08                                                      -  022000
CD                                                                       -  022100
CD     13-18     GROUP TO BE SKIPPED.                                    -  022200
CD                                                                       -  022300
CD     19-24     GROUP TO BE SKIPPED.                                    -  022400
CD                                                                       -  022500
CD     25-30     GROUP TO BE SKIPPED.                                    -  022600
CD                                                                       -  022700
CD     31-36     GROUP TO BE SKIPPED.                                    -  022800
CD                                                                       -  022900
CD     37-42     GROUP TO BE SKIPPED.                                    -  023000
CD                                                                       -  023100
CD     43-48     GROUP TO BE SKIPPED.                                    -  023200
CD                                                                       -  023300
CD     49-54     GROUP TO BE SKIPPED.                                    -  023400
CD                                                                       -  023500
CD     55-60     GROUP TO BE SKIPPED.                                    -  023600
CD                                                                       -  023700
CD     61-66     GROUP TO BE SKIPPED.                                    -  023800
CD                                                                       -  023900
CD     67-72     GROUP TO BE SKIPPED.                                    -  024000
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C                                                                       -  024100
CN              NO CARD TYPE 08 IS PERMITTED IF THERE ARE ANY CARDS     -  024200
CN              OF TYPE 07.                                             -  024300
C                                                                       -  024400
C-----------------------------------------------------------------------   024500
                                                                          024600
CEOF                                                                      024700
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C***********************************************************************  000100
C                                                                       -  000200
C                        PREPARED 1/26/71 AT ANL                        -  000300
C                                                                       -  000400
CE          A.INPTR2                                                    -  000500
CE          TWO-DIMENSIONAL TRANSPORT THEORY MODULE-DEPENDENT BCD DATA  -  000600
C                                                                       -  000700
CN                       THIS IS A USER-SUPPLIED BCD DATA SET.          -  000800
CN                       THE LIST FOR EACH RECORD IS GIVEN IN TERMS     -  000900
CN                       OF THE BCD FORMAT OF THAT DATA CARD.           -  001000
CN                       COLUMNS 1-2 CONTAIN THE CARD TYPE NUMBER.      -  001100
CN                       BLANK FIELDS PRODUCE THE DEFAULT OPTIONS       -  001200
CN                       INDICATED.  BLANKS ARE NOT MEANINGFUL IN       -  001300
CN                       A6 LABEL FIELDS.                               -  001400
C                                                                       -  001500
C***********************************************************************  001600
                                                                          001700
                                                                          001800
C-----------------------------------------------------------------------   001900
CR          GENERAL SPECIFICATIONS (TYPE 01)                            -  002000
C                                                                       -  002100
CL     FORMAT-----(I2,10X,5I6,D12.5)                                    -  002200
C                                                                       -  002300
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  002400
CD     =======    ==================================================-  002500
CD     1-2        01                                                   -  002600
CD                                                                     -  002700
CD     13-18      SN ORDER. WEIGHTS AND COSINES ARE OBTAINED FROM STORED -  002800
CD                DATA. IF COLS. 13-18 ARE ZERO, WEIGHTS AND COSINES   -  002900
CD                MUST BE SUPPLIED ON CARD TYPE 07 DATA. ALLOWABLE     -  003000
CD                VALUES FOR THE SN ORDER IN COLS. 13-18 ARE 2,4,6,8,12, -  003100
CD                OR 16. ANY OTHER ORDER REQUIRES USE OF CARD TYPE 07  -  003200
CD                DATA.                                                -  003300
CD                                                                     -  003400
CD     19-24      MAIN CORE STORAGE FOR CONTAINER ARRAY IN REAL*8      -  003500
CD                WORDS (DEFAULT=60000).                               -  003600
CD                                                                     -  003700
CD     25-30      BULK CORE STORAGE FOR CONTAINER ARRAY IN REAL*8      -  003800
CD                WORDS (DEFAULT=100000).                              -  003900
CD                                                                     -  004000
CD     31-36      PARTIAL CURRENT OPTION.                              -  004100
CD                0...PARTIAL CURRENTS AT MESH INTERVAL EDGES NOT      -  004200
CD                    WRITTEN INTO DATA SET JPR.D2 (DEFAULT).          -  004300
CD                1...PARTIAL CURRENTS WRITTEN INTO DATA SET JPR.D2.   -  004400
CD                                                                     -  004500
CD     37-42      MAXIMUM NUMBER OF OUTER ITERATIONS BETWEEN CORE      -  004600
CD                DUMPS TO BE USED FOR RESTART (DEFAULT=5).            -  004700
CD                                                                     -  004800
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CD     43-54      POWER IN WATTS TO WHICH REGIONAL AVERAGED FLUX IS      -  004900
CD                TO BE NORMALIZED. IF COLS. 43-54 ARE ZERO OR BLANK,    -  005000
CD                DATA SET FR.PN IS NOT WRITTEN.                         -  005100
C                                                                        -  005200
C-----------------------------------------------------------------------  005300
                                                                         005400
                                                                         005500
C-----------------------------------------------------------------------  005600
CR          ITERATION SPECIFICATIONS (TYPE 02)                           -  005700
C                                                                        -  005800
CL     FORMAT-----(I2,10X,6I6)                                           -  005900
C                                                                        -  006000
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  006100
CD     =======   ==========================================================-  006200
CD     1-2       02                                                     -  006300
CD                                                                      -  006400
CD     13-18     MAXIMUM NUMBER OF OUTER ITERATIONS PER SEARCH          -  006500
CD               PASS (DEFAULT=20).                                     -  006600
CD                                                                      -  006700
CD     19-24     MINIMUM NUMBER OF OUTER ITERATIONS PER SEARCH PASS     -  006800
CD               (DEFAULT=2).                                           -  006900
CD                                                                      -  007000
CD     25-30     MAXIMUM NUMBER OF SELF-SCATTERING (INNER) ITERATIONS   -  007100
CD               PER GROUP PER OUTER ITERATION (DEFAULT=20).            -  007200
CD                                                                      -  007300
CD     31-36     MAXIMUM NUMBER OF UPSCATTERING ITERATIONS PER OUTER    -  007400
CD               ITERATION (DEFAULT=1). PERTINENT ONLY FOR PROBLEMS     -  007500
CD               WITH UPSCATTERING.                                     -  007600
CD                                                                      -  007700
CD     37-42     MAXIMUM NUMBER OF ITERATIONS PER INNER ITERATION FOR   -  007800
CD               THE EXTERNAL BOUNDARY ANGULAR FLUXES IN THE CASE OF    -  007900
CD               REFLECTIVE, PERIODIC, OR WHITE BOUNDARY CONDITIONS     -  008000
CD               (DEFAULT=1).                                           -  008100
CD                                                                      -  008200
CD     43-48     NUMBER OF INNER ITERATIONS BETWEEN COARSE MESH         -  008300
CD               REBALANCING (DEFAULT=5). IF COLS. 43-48 ARE LESS       -  008400
CD               THAN 0, NO REBALANCING IS PERFORMED.                   -  008500
C                                                                       -  008600
CN               IF CARD TYPE 02 IS NOT SUPPLIED, ALL DEFAULT OPTIONS   -  008700
CN               ARE SELECTED.                                          -  008800
CN               IF ZERO INCOMING FLUX IS SPECIFIED AT BOTH THE         -  008900
CN               UPPER "X" AND UPPER "Y" BOUNDARIES OF THE PROBLEM      -  009000
CN               (SEE CARD TYPE 04 OF A.NIP), COLS. 37-42 ARE ASSUMED   -  009100
CN               TO BE 0.                                               -  009200
C                                                                       -  009300
C-----------------------------------------------------------------------  009400
                                                                         009500
C-----------------------------------------------------------------------  009700
CR          CONVERGENCE CRITERIA (TYPE 03)                               -  009800
C                                                                        -  009900
CL     FORMAT-----(I2,10X,4D12.5)                                        -  010000
C                                                                        -  010100
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  010200
CD     =======   ==========================================================-  010300
CD     1-2       03                                                     -  010400
CD                                                                      -  010500
CD     13-24     CONVERGENCE CRITERION FOR OUTER ITERATIONS             -  010600
CD               (DEFAULT=1.E-3).                                       -  010700
CD                                                                      -  010800
CD     25-36     CONVERGENCE CRITERION FOR UPSCATTERING ITERATIONS      -  010900
CD               (DEFAULT=1.E-3).                                       -  011000
CD                                                                      -  011100
CD     37-48     CONVERGENCE CRITERION FOR ITERATIONS ON EXTERNAL       -  011200
CD               BOUNDARY ANGULAR FLUXES (DEFAULT=1.E-3).               -  011300
CD                                                                      -  011400
CD     49-60     CONVERGENCE CRITERION FOR REBALANCING ITERATIONS       -  011500
CD               (DEFAULT=1.E-5).                                       -  011600
C                                                                       -  011700
CN               IF CARD TYPE 03 IS NOT SUPPLIED, ALL DEFAULT OPTIONS   -  011800
CN               ARE UTILIZED.                                          -  011900
C                                                                       -  012000
C-----------------------------------------------------------------------  012100
                                                                         012200
                                                                         012300
C-----------------------------------------------------------------------  012400
CR          INNER ITERATION CONVERGENCE CRITERIA (TYPE 04)               -  012500
C                                                                        -  012600
CL     FORMAT-----(I2,10X,2(D12.5,2I6))                                  -  012700
C                                                                        -  012800
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  012900
CD     =======   ==========================================================-  013000
CD     1-2       04                                                     -  013100
CD                                                                      -  013200
CD     13-24     CONVERGENCE CRITERION FOR INNER ITERATIONS.            -  013300
CD                                                                      -  013400
CD     25-30     HIGHER-ENERGY GROUP NUMBER TO WHICH CONVERGENCE        -  013500
CD               CRITERION APPLIES.                                     -  013600
CD                                                                      -  013700
CD     31-36     LOWER-ENERGY GROUP NUMBER TO WHICH CONVERGENCE         -  013800
CD               CRITERION APPLIES.                                     -  013900
CD                                                                      -  014000
CD     37-48     CONVERGENCE CRITERION FOR INNER ITERATIONS.            -  014100
CD                                                                      -  014200
CD     49-54     HIGHER-ENERGY GROUP NUMBER TO WHICH CONVERGENCE        -  014300
CD               CRITERION APPLIES.                                     -  014400
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CD                                                                      -  014500
CD      55-60       LOWER-ENERGY GROUP NUMBER TO WHICH CONVERGENCE      -  014600
CD                  CRITERION APPLIES.                                  -  014700
C                                                                       -  014800
CN                  IF NO CARD TYPE 04 IS SUPPLIED, 1.E-3 IS ASSIGNED TO -  014900
CN                  ALL GROUPS FOR THE INNER ITERATION CRITERION. IF COLS. -  015000
CN                  25-30 ARE BLANK, THE VALUE IN COLS. 13-24 IS USED FOR -  015100
CN                  ALL GROUPS AND THE REST OF THE TYPE 04 DATA IS      -  015200
CN                  IGNORED. IF COLS. 31-36 AND/OR 55-60 ARE BLANK, THE -  015300
CN                  CRITERION IN COLS. 13-24 AND/OR 37-48 ARE ASSIGNED TO -  015400
CN                  THE GROUP INDICATED IN COLS. 25-30 AND/OR 49-54. ALL -  015500
CN                  GROUPS NOT COVERED BY TYPE 04 DATA ARE ASSIGNED THE -  015600
CN                  DEFAULT CRITERION 1.E-3. AS MANY TYPE 04 CARDS AS   -  015700
CN                  NECESSARY ARE USED TO SPECIFY THE INNER ITERATION   -  015800
CN                  CONVERGENCE CRITERIA.                               -  015900
C                                                                       -  016000
C-----------------------------------------------------------------------  016100
                                                                         016200
                                                                         016300
C-----------------------------------------------------------------------  016400
CR          ISOTROPIC SCATTERING SPECIFICATIONS. (TYPE 05)              -  016500
C                                                                       -  016600
CL      FORMAT-----(I2,4X,11A6)                                         -  016700
C                                                                       -  016800
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY             -  016900
CD      =======   ==========================================================  017000
CD      1-2         05                                                  -  017100
CD                                                                      -  017200
CD      7-12        COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  017300
CD                  TREATED ISOTROPICALLY.                              -  017400
CD                                                                      -  017500
CD      13-18       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  017600
CD                  TREATED ISOTROPICALLY.                              -  017700
CD                                                                      -  017800
CD      19-24       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  017900
CD                  TREATED ISOTROPICALLY.                              -  018000
CD                                                                      -  018100
CD      25-30       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  018200
CD                  TREATED ISOTROPICALLY.                              -  018300
CD                                                                      -  018400
CD      31-36       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  018500
CD                  TREATED ISOTROPICALLY.                              -  018600
CD                                                                      -  018700
CD      37-42       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  018800
CD                  TREATED ISOTROPICALLY.                              -  018900
CD                                                                      -  019000
CD      43-48       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  019100
CD                  TREATED ISOTROPICALLY.                              -  019200
CD                                                                      -  019300
CD      49-54       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  019400
CD                  TREATED ISOTROPICALLY.                              -  019500
CD                                                                      -  019600
CD      55-60       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  019700
CD                  TREATED ISOTROPICALLY.                              -  019800
CD                                                                      -  019900
CD      61-66       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  020000
CD                  TREATED ISOTROPICALLY.                              -  020100
CD                                                                      -  020200
CD      67-72       COMPOSITION LABEL OF COMPOSITION WHICH IS TO BE     -  020300
CD                  TREATED ISOTROPICALLY.                              -  020400
C                                                                       -  020500
CN                  CARD TYPE 5 IS PERTINENT ONLY IF SOME OR ALL        -  020600
CN                  OF THE PROBLEM COMPOSITIONS HAVE ANISOTROPIC        -  020700
CN                  SCATTERING. IF COLS. 7-12 ARE BLANK, ALL COMPOSITIONS -  020800
CN                  WILL BE TREATED ISOTROPICALLY AND THE REST OF THE   -  020900
CN                  TYPE 05 CARD DATA IS IGNORED.                       -  021000
C                                                                       -  021100
C-----------------------------------------------------------------------  021200
                                                                         021300
                                                                         021400
C-----------------------------------------------------------------------  021500
CR          DENSITY FACTOR SPECIFICATIONS (TYPE 06)                     -  021600
C                                                                       -  021700
CL      FORMAT-----(I2,10X,3(A6,D12.5))                                 -  021800
C                                                                       -  021900
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY             -  022000
CD      =======   ==========================================================  022100
CD      1-2         06                                                  -  022200
CD                                                                      -  022300
CD      13-18       REGION LABEL.                                       -  022400
CD                                                                      -  022500
CD      19-30       DENSITY FACTOR.                                     -  022600
CD                                                                      -  022700
CD      31-36       REGION LABEL.                                       -  022800
CD                                                                      -  022900
CD      37-48       DENSITY FACTOR.                                     -  023000
CD                                                                      -  023100
CD      49-54       REGION LABEL.                                       -  023200
CD                                                                      -  023300
CD      55-66       DENSITY FACTOR.                                     -  023400
C                                                                       -  023500
CN                  ALL CROSS SECTIONS IN THE REGION SPECIFIED ARE      -  023600
CN                  MULTIPLIED BY THE CORRESPONDING SPECIFIED DENSITY   -  023700
CN                  FACTOR.                                             -  023800
CN                  IF NO CARD TYPE 06 IS SUPPLIED, ALL REGIONS ARE     -  023900
CN                  ASSIGNED A DENSITY FACTOR OF 1.0. AS MANY TYPE 07   -  024000
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CN              CARDS AS NECESSARY ARE USED TO SPECIFY THE DENSITY      -  024100
CN              FACTORS. ANY REGION NOT COVERED BY TYPE 07 DATA         -  024200
CN              IS ASSIGNED A DENSITY FACTOR OF 1.0.                    -  024300
C                                                                       -  024400
C-----------------------------------------------------------------------   024500
                                                                          024600
                                                                          024700
C-----------------------------------------------------------------------   024800
CR          ANGULAR DISCRETE ORDINATE SPECIFICATIONS (TYPE 07)          -  024900
C                                                                       -  025000
CL    FORMAT-----(I2,10X,3D12.5)                                        -  025100
C                                                                       -  025200
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  025300
CD    =======  ==========================================================-  025400
CD    1-2      07                                                       -  025500
CD                                                                      -  025600
CD    13-24    COSINE OF POLAR ANGLE.                                   -  025700
CD                                                                      -  025800
CD    25-36    COSINE OF AZIMUTHAL ANGLE.                               -  025900
CD                                                                      -  026000
CD    37-48    QUADRATURE WEIGHT FOR DIRECTION SPECIFIED.               -  026100
C                                                                       -  026200
CN              TYPE 07 CARDS MUST BE SUPPLIED IF COLS. 13-18 ON CARD   -  026300
CN              TYPE 01 ARE 0. AS MANY TYPE 07 CARDS AS NECESSARY       -  026400
CN              ARE USED TO SPECIFY THE DISCRETE ANGLES AND WEIGHTS.    -  026500
CN              DATA SHOULD BE SUPPLIED FOR EACH POINT IN ONE OCTANT    -  026600
CN              OF THE UNIT SPHERE. THE NUMBER OF AZIMUTHAL ANGLES      -  026700
CN              AND WEIGHTS SPECIFIED MAY VARY WITH POLAR ANGLE.        -  026800
CN                                                                      -  026900
CN              FOR R-Z GEOMETRY, FOR EACH POLAR ANGLE ONE OF THE       -  027000
CN              AZIMUTHAL ANGLES MUST BE SPECIFIED SUCH THAT THE        -  027100
CN              (COSINE AZIMUTHAL ANGLE)**2 + (COSINE POLAR             -  027200
CN              ANGLE)**2 = 1 AND FOR THAT AZIMUTHAL ANGLE THE          -  027300
CN              QUADRATURE WEIGHT MUST BE 0.                            -  027400
C                                                                       -  027500
C-----------------------------------------------------------------------   027600
                                                                          027700
                                                                          027800
C-----------------------------------------------------------------------   027900
CR          GROUP SKIPPING SPECIFICATIONS (TYPE 08)                     -  028000
C                                                                       -  028100
CL    FORMAT-----(I2,10X,10I6)                                          -  028200
C                                                                       -  028300
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  028400
CD    =======  ==========================================================-  028500
CD    1-2      08                                                       -  028600
CD                                                                      -  028700
CD    13-18    GROUP TO BE SKIPPED.                                     -  028800
CD                                                                      -  028900
CD    19-24    GROUP TO BE SKIPPED.                                     -  029000
CD                                                                      -  029100
CD    25-30    GROUP TO BE SKIPPED.                                     -  029200
CD                                                                      -  029300
CD    31-36    GROUP TO BE SKIPPED.                                     -  029400
CD                                                                      -  029500
CD    37-42    GROUP TO BE SKIPPED.                                     -  029600
CD                                                                      -  029700
CD    43-48    GROUP TO BE SKIPPED.                                     -  029800
CD                                                                      -  029900
CD    49-54    GROUP TO BE SKIPPED.                                     -  030000
CD                                                                      -  030100
CD    55-60    GROUP TO BE SKIPPED.                                     -  030200
CD                                                                      -  030300
CD    61-66    GROUP TO BE SKIPPED.                                     -  030400
CD                                                                      -  030500
CD    67-72    GROUP TO BE SKIPPED.                                     -  030600
CD                                                                      -  030700
C                                                                       -  030800
CN              AS MANY TYPE 08 CARDS AS NECESSARY ARE USED TO SPECIFY  -  030900
CN              GROUPS TO BE SKIPPED. ANY GROUP NOT SPECIFIED ON        -  031000
CN              THE TYPE 08 CARD WILL BE INCLUDED IN THE CALCULATION.   -  031100
C                                                                       -  031200
C-----------------------------------------------------------------------   031300
                                                                          031400
                                                                          031500
C-----------------------------------------------------------------------   031600
CR          EDIT SPECIFICATIONS (TYPE 09)                               -  031700
C                                                                       -  031800
CL    FORMAT-----(I2,10X,2I6)                                           -  031900
C                                                                       -  032000
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  032100
CD    =======  ==========================================================-  032200
CD    1-2      09                                                       -  032300
CD                                                                      -  032400
CD    13-18    POWER OPTION.                                            -  032500
CD             0...REGION AND INTERVAL POWERS NOT EDITED (DEFAULT).     -  032600
CD             1...REGION AND INTERVAL POWERS EDITED.                   -  032700
CD                                                                      -  032800
CD    19-24    FISSION SOURCE OPTION.                                   -  032900
CD             0...FISSION SOURCE BY INTERVAL NOT EDITED (DEFAULT).     -  033000
CD             1...FISSION SOURCE BY INTERVAL EDITED.                   -  033100
C                                                                       -  033200
C-----------------------------------------------------------------------   033300
                                                                          033400
                                                                          033500
C-----------------------------------------------------------------------   033600
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CR          REBALANCING SPECIFICATIONS (TYPE 10)                          -  033700
C                                                                         -  033800
CL    FORMAT-----(I2,9X,A1,5(2I6))                                        -  033900
C                                                                         -  034000
CD    CONTENTS          CONTENTS...IMPLICATIONS, IF ANY                   -  034100
CD    =======   ==========================================================-  034200
CD    1-2       10                                                        -  034300
CD                                                                        -  034400
CD    12        COORDINATE DIRECTION.                                     -  034500
CD              X..."X" COORDINATE DIRECTION.                             -  034600
CD              Y..."Y" COORDINATE DIRECTION.                             -  034700
CD                                                                        -  034800
CD    13-18     NUMBER OF MESH INTERVALS BETWEEN COARSE REBALANCING       -  034900
CD              MESH LINES.                                               -  035000
CD                                                                        -  035100
CD    19-24     NUMBER OF COARSE REBALANCING MESH LINES WITH SPACING      -  035200
CD              AS SPECIFIED IN COLS. 13-18.                              -  035300
CD                                                                        -  035400
CD    25-30     NUMBER OF MESH INTERVALS BETWEEN COARSE REBALANCING       -  035500
CD              MESH LINES.                                               -  035600
CD                                                                        -  035700
CD    31-36     NUMBER OF COARSE REBALANCING MESH LINES WITH SPACING      -  035800
CD              AS SPECIFIED IN COLS. 25-30.                              -  035900
CD                                                                        -  036000
CD    37-42     NUMBER OF MESH INTERVALS BETWEEN COARSE REBALANCING       -  036100
CD              MESH LINES.                                               -  036200
CD                                                                        -  036300
CD    43-48     NUMBER OF COARSE REBALANCING MESH LINES WITH SPACING      -  036400
CD              AS SPECIFIED IN COLS. 37-42.                              -  036500
CD                                                                        -  036600
CD    49-54     NUMBER OF MESH INTERVALS BETWEEN COARSE REBALANCING       -  036700
CD              MESH LINES.                                               -  036800
CD                                                                        -  036900
CD    55-60     NUMBER OF COARSE REBALANCING MESH LINES WITH SPACING      -  037000
CD              AS SPECIFIED IN COLS. 49-54.                              -  037100
CD                                                                        -  037200
CD    61-66     NUMBER OF MESH INTERVALS BETWEEN COARSE REBALANCING       -  037300
CD              MESH LINES.                                               -  037400
CD                                                                        -  037500
CD    67-72     NUMBER OF COARSE REBALANCING MESH LINES WITH SPACING      -  037600
CD              AS SPECIFIED IN COLS. 61-66.                              -  037700
C                                                                         -  037800
CN              THE NUMBER PAIRS IN COLS. 13-18 AND 19-24, 25-30 AND      -  037900
CN              31-36, ETC. MUST BE GIVEN IN ORDER OF INCREASING MESH.    -  038000
CN              AS MANY TYPE 10 CARDS AS NECESSARY ARE SUPPLIED.          -  038100
CN              EACH ADDITIONAL CARD SHOULD REPEAT X OR Y AS              -  038200
CN              APPROPRIATE IN COL. 12. IF NO TYPE 10 CARD IS             -  038300
CN              SUPPLIED AND COLS. 43-48 ON CARD TYPE 02 ARE .GE.0,       -  038400
CN              REBALANCING WILL BE PERFORMED WITH A DEFAULT MESH         -  038500
CN              SPACING. ANY PART OF THE MESH NOT SPECIFIED ON TYPE       -  038600
CN              10 CARDS WILL BE REBALANCED USING THE DEFAULT MESH        -  038700
CN              SPACING. IF COLS. 19-24, 31-36, 43-48, 55-60, OR          -  038800
CN              67-72 RESPECTIVELY ARE BLANK, THE SUCCEEDING DATA ON      -  038900
CN              THE TYPE 10 CARDS FOR THE DIRECTION INVOLVED ARE          -  039000
CN              IGNORED AND THE SPACING GIVEN IN THE CORRESPONDING        -  039100
CN              COLS. 13-18, 25-30, 37-42, 49-54, OR 61-66 RESPECTIVELY-  039200
CN              WILL BE USED TO FILL OUT THE REMAINDER OF THE "X"         -  039300
CN              OR "Y" DIRECTION.                                         -  039400
C                                                                         -  039500
C-------------------------------------------------------------------------   039600
                                                                            039700
                                                                            039800
C-------------------------------------------------------------------------   039900
CR          STREAMING CORRECTION REGIONS (TYPE 11)                        -  040000
C                                                                         -  040100
CL    FORMAT-----(I2,4X,11A6)                                             -  040200
C                                                                         -  040300
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY                   -  040400
CD    =======   ==========================================================-  040500
CD    1-2       11                                                        -  040600
CD                                                                        -  040700
CD    7-12      LABEL OF REGION USING STREAMING CORRECTION.               -  040800
CD                                                                        -  040900
CD    13-18     LABEL OF REGION USING STREAMING CORRECTION.               -  041000
CD                                                                        -  041100
CD    19-24     LABEL OF REGION USING STREAMING CORRECTION.               -  041200
CD                                                                        -  041300
CD    25-30     LABEL OF REGION USING STREAMING CORRECTION.               -  041400
CD                                                                        -  041500
CD    31-36     LABEL OF REGION USING STREAMING CORRECTION.               -  041600
CD                                                                        -  041700
CD    37-42     LABEL OF REGION USING STREAMING CORRECTION.               -  041800
CD                                                                        -  041900
CD    43-48     LABEL OF REGION USING STREAMING CORRECTION.               -  042000
CD                                                                        -  042100
CD    49-54     LABEL OF REGION USING STREAMING CORRECTION.               -  042200
CD                                                                        -  042300
CD    55-60     LABEL OF REGION USING STREAMING CORRECTION.               -  042400
CD                                                                        -  042500
CD    61-66     LABEL OF REGION USING STREAMING CORRECTION.               -  042600
C                                                                         -  042700
CD    67-72     LABEL OF REGION USING STREAMING CORRECTION.               -  042800
C                                                                         -  042900
CN              TYPE 11 CARDS ARE PERTINENT ONLY FOR FINITE X-Y           -  043000
CN              GEOMETRY PROBLEMS. IN REGIONS NAMED IN COLS. 7-12,        -  043100
CN              13-18, 19-24, ETC., DURING THE SOLUTION OF THE            -  043200
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CN              SN EQUATIONS, THE TOTAL CROSS SECTION IS INCREASED     -  043300
CN              BY THE TERM  XI/H, WHERE XI IS THE ABSOLUTE VALUE      -  043400
CN              OF THE COSINE OF THE POLAR ANGLE FOR THE DIRECTION     -  043500
CN              BEING CONSIDERED AND H IS THE ACTUAL HALF-HEIGHT       -  043600
CN              OF THE SPECIFIED REGION. REGIONS NOT SPECIFIED ON      -  043700
CN              TYPE 11 CARDS WILL HAVE THE TOTAL CROSS SECTIONS       -  043800
CN              INCREASED BY B**2/(3*SIGMA TRANSPORT), WHERE B**2      -  043900
CN              IS THE TRANSVERSE GEOMETRIC BUCKLING AND SIGMA         -  044000
CN              TRANSPORT IS THE TRANSPORT CROSS SECTION.              -  044100
C                                                                      -  044200
C-----------------------------------------------------------------------  044300
                                                                         044400
CEOF                                                                     044500
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C***********************************************************************  000100
C                                                                      -  000200
C                         PREPARED 1/26/71 AT ANL                      -  000300
C                                                                      -  000400
CF          A.INVENT                                                   -  000500
CF          GENERAL INPUT FOR NEUTRON INVENTORY                        -  000600
C                                                                      -  000700
CN                        THIS IS A USER-SUPPLIED BCD DATA SET.        -  000800
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS   -  000900
CN                        OF THE BCD FORMAT OF THE DATA CARD.          -  001000
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE   -  001100
CN                        NUMBER.                                      -  001200
C                                                                      -  001300
C***********************************************************************  001400
                                                                         001500
                                                                         001600
C-----------------------------------------------------------------------  001700
CR          PROBLEM TITLE (TYPE 01)                                    -  001800
C                                                                      -  001900
CL    FORMAT-----(I2,4X,11A6)                                          -  002000
C                                                                      -  002100
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY                -  002200
CD    =======   ==================================================     -  002300
CD    1-2       01                                                     -  002400
CD                                                                     -  002500
CD    7-72      ANY ALPHANUMERIC CHARACTERS.                           -  002600
C                                                                      -  002700
CN              AS MANY TYPE 01 CARDS AS NECESSARY MAY BE USED.        -  002800
C                                                                      -  002900
C-----------------------------------------------------------------------  003000
                                                                         003100
                                                                         003200
C-----------------------------------------------------------------------  003300
CR          NORMALIZATION SPECIFICATIONS (TYPE 03)                     -  003400
C                                                                      -  003500
CL    FORMAT-----(I2,10X,2E12.5,4I6,E12.5)                             -  003600
C                                                                      -  003700
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY                -  003800
CD    =======   ==================================================     -  003900
CD    1-2       03                                                     -  004000
CD                                                                     -  004100
CD    13-24     TOTAL REACTOR POWER IN MW (DEFAULT=1.E-6).             -  004200
CD                                                                     -  004300
CD    25-36     FISSION POWER CONVERSION FACTOR (DEFAULT=3.1E+10       -  004400
CD              FISSIONS/SECOND/WATT).                                 -  004500
CD                                                                     -  004600
CD    37-42     POWER CALCULATION FLAG.                                -  004700
CD              0...MAXIMUM-TO-AVERAGE POWER NOT CALCULATED (DEFAULT). -  004800
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CD                1...MAXIMUM-TO-AVERAGE POWER CALCULATED.                  -  004900
CD                                                                          -  005000
CD      43-48     DELTA VOLUME FACTOR FLAG.                                 -  005100
CD                0...DELTA VOLUME FACTOR NOT USED FOR FOIL INVENTORIES     -  005200
CD                     (DEFAULT).                                           -  005300
CD                1...DELTA VOLUME FACTOR USED FOR FOIL INVENTORIES.        -  005400
CD                                                                          -  005500
CD      49-54     "X" DIRECTION MESH INTERVAL NUMBER AT WHICH               -  005600
CD                FOIL INVENTORIES ARE NORMALIZED.                          -  005700
CD                                                                          -  005800
CD      55-60     "Y" DIRECTION MESH INTERVAL NUMBER AT WHICH               -  005900
CD                FOIL INVENTORIES ARE NORMALIZED.                          -  006000
CD                                                                          -  006100
CD      61-72     NORMALIZATION VALUE FOR FOIL INVENTORIES                  -  006200
CD                (DEFAULT=1.0).                                            -  006300
C                                                                           -  006400
CN                IF COLS. 49-54 ARE BLANK OR ZERO, THE FOIL INVENTORIES    -  006500
CN                ARE NOT SEPARATELY NORMALIZED. COLS. 55-60 ARE IGNORED    -  006600
CN                FOR 1-D GEOMETRIES.                                       -  006700
C                                                                           -  006800
C-----------------------------------------------------------------------------  006900
                                                                               007000
                                                                               007100
C-----------------------------------------------------------------------------  007200
CR            FERTILE ISOTOPE SPECIFICATIONS (TYPE 04)                      -  007300
C                                                                           -  007400
CL      FORMAT-----(I2,4X,11A6)                                             -  007500
C                                                                           -  007600
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                  -  007700
CD      =======   ==========================================================-  007800
CD      1-2       04                                                        -  007900
CD                                                                          -  008000
CD      7-12      REGION LABEL (REPEATED ON ADDITIONAL CARDS).              -  008100
CD                                                                          -  008200
CD      13-18     FERTILE ISOTOPE LABEL.                                    -  008300
CD                                                                          -  008400
CD      19-24     FERTILE ISOTOPE LABEL.                                    -  008500
CD                                                                          -  008600
CD      25-30     FERTILE ISOTOPE LABEL.                                    -  008700
CD                                                                          -  008800
CD      31-36     FERTILE ISOTOPE LABEL.                                    -  008900
CD                                                                          -  009000
CD      37-42     FERTILE ISOTOPE LABEL.                                    -  009100
CD                                                                          -  009200
CD      43-48     FERTILE ISOTOPE LABEL.                                    -  009300
CD                                                                          -  009400
CD      49-54     FERTILE ISOTOPE LABEL.                                    -  009500
CD                                                                          -  009600
CD      55-60     FERTILE ISOTOPE LABEL.                                    -  009700
CD                                                                          -  009800
CD      61-66     FERTILE ISOTOPE LABEL.                                    -  009900
CD                                                                          -  010000
CD      67-72     FERTILE ISOTOPE LABEL.                                    -  010100
C                                                                           -  010200
CN                IF COLS. 7-12 ARE BLANK, ISOTOPES SPECIFIED IN COLS.      -  010300
CN                13-18, 19-24,...,67-72 WILL BE ASSUMED FERTILE IN ALL     -  010400
CN                REACTOR REGIONS IN WHICH THEY OCCUR.                      -  010500
C                                                                           -  010600
C-----------------------------------------------------------------------------  010700
                                                                               010800
                                                                               010900
C-----------------------------------------------------------------------------  011000
CR            FISSILE ISOTOPE SPECIFICATIONS (TYPE 05)                      -  011100
C                                                                           -  011200
CL      FORMAT-----(I2,4X,11A6)                                             -  011300
C                                                                           -  011400
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                  -  011500
CD      =======   ==========================================================-  011600
CD      1-2       05                                                        -  011700
CD                                                                          -  011800
CD      7-12      REGION LABEL (REPEATED ON ADDITIONAL CARDS).              -  011900
CD                                                                          -  012000
CD      13-18     FISSILE ISOTOPE LABEL.                                    -  012100
CD                                                                          -  012200
CD      19-24     FISSILE ISOTOPE LABEL.                                    -  012300
CD                                                                          -  012400
CD      25-30     FISSILE ISOTOPE LABEL.                                    -  012500
CD                                                                          -  012600
CD      31-36     FISSILE ISOTOPE LABEL.                                    -  012700
CD                                                                          -  012800
CD      37-42     FISSILE ISOTOPE LABEL.                                    -  012900
CD                                                                          -  013000
CD      43-48     FISSILE ISOTOPE LABEL.                                    -  013100
CD                                                                          -  013200
CD      49-54     FISSILE ISOTOPE LABEL.                                    -  013300
CD                                                                          -  013400
CD      55-60     FISSILE ISOTOPE LABEL.                                    -  013500
CD                                                                          -  013600
CD      61-66     FISSILE ISOTOPE LABEL.                                    -  013700
CD                                                                          -  013800
CD      67-72     FISSILE ISOTOPE LABEL.                                    -  013900
C                                                                           -  014000
CN                IF COLS. 7-12 ARE BLANK, ISOTOPES SPECIFIED IN COLS.      -  014100
CN                13-18, 19-24,..., 67-72 WILL BE ASSUMED FISSILE IN ALL    -  014200
CN                REACTOR REGIONS IN WHICH THEY OCCUR. IF EITHER CARD       -  014300
CN                TYPE 04 OR CARD TYPE 05 IS NOT PROVIDED, NO BREEDING      -  014400
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CN                RATIO CALCULATION WILL BE PERFORMED.                  -  014500
C                                                                       -  014600
C-----------------------------------------------------------------------  014700
                                                                         014800
                                                                         014900
C-----------------------------------------------------------------------  015000
CR            CONVERSION RATIO REGIONS (TYPE 06)                        -  015100
C                                                                       -  015200
CL     FORMAT-----(I2,4X,11A6)                                          -  015300
C                                                                       -  015400
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  015500
CD     =======   ==========================================================-  015600
CD     1-2       06                                                    -  015700
CD                                                                     -  015800
CD     7-12      REGION LABEL.                                         -  015900
CD                                                                     -  016000
CD     13-18     REGION LABEL.                                         -  016100
CD                                                                     -  016200
CD     19-24     REGION LABEL.                                         -  016300
CD                                                                     -  016400
CD     25-30     REGION LABEL.                                         -  016500
CD                                                                     -  016600
CD     31-36     REGION LABEL.                                         -  016700
CD                                                                     -  016800
CD     37-42     REGION LABEL.                                         -  016900
CD                                                                     -  017000
CD     43-48     REGION LABEL.                                         -  017100
CD                                                                     -  017200
CD     49-54     REGION LABEL.                                         -  017300
CD                                                                     -  017400
CD     55-60     REGION LABEL.                                         -  017500
CD                                                                     -  017600
CD     61-66     REGION LABEL.                                         -  017700
CD                                                                     -  017800
CD     67-72     REGION LABEL.                                         -  017900
C                                                                      -  018000
CN               A REGION CONVERSION RATIO WILL BE TABULATED FOR EACH  -  018100
CN               OF THE REGIONS INDICATED USING THE FERTILE AND FISSILE -  018200
CN               ISOTOPES SPECIFIED ON CARD TYPES 04 AND 05            -  018300
CN               RESPECTIVELY. IF EITHER CARD TYPE 04 OR 05 IS NOT     -  018400
CN               PROVIDED, CARD TYPE 06 WILL BE IGNORED. IF COLS. 7-12 -  018500
CN               ARE BLANK, A CONVERSION RATIO WILL BE TABULATED FOR ALL-  018600
CN               REGIONS.                                              -  018700
C                                                                      -  018800
C-----------------------------------------------------------------------  018900
                                                                         019000
                                                                         019100
C-----------------------------------------------------------------------  019200
CR            MATERIAL DESIGNATIONS (TYPE 07)                           -  019300
C                                                                       -  019400
CL     FORMAT-----(I2,4X,1146)                                          -  019500
C                                                                       -  019600
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  019700
CD     =======   ==========================================================-  019800
CD                                                                     -  019900
CD     1-2       07                                                    -  020000
CD                                                                     -  020100
CD     7-12      MATERIAL LABEL.                                       -  020200
CD                                                                     -  020300
CD     13-18     MATERIAL LABEL.                                       -  020400
CD                                                                     -  020500
CD     19-24     MATERIAL LABEL.                                       -  020600
CD                                                                     -  020700
CD     25-30     MATERIAL LABEL.                                       -  020800
CD                                                                     -  020900
CD     31-36     MATERIAL LABEL.                                       -  021000
CD                                                                     -  021100
CD     37-42     MATERIAL LABEL.                                       -  021200
CD                                                                     -  021300
CD     43-48     MATERIAL LABEL.                                       -  021400
CD                                                                     -  021500
CD     49-54     MATERIAL LABEL.                                       -  021600
CD                                                                     -  021700
CD     55-60     MATERIAL LABEL.                                       -  021800
CD                                                                     -  021900
CD     61-66     MATERIAL LABEL.                                       -  022000
CD                                                                     -  022100
CD     67-72     MATERIAL LABEL.                                       -  022200
C                                                                      -  022300
CN               CARD TYPES 07 AND HIGHER SELECT ADDITIONAL DETAILS    -  022400
CN               BEYOND THOSE PROVIDED IN THE STANDARD MINIMUM         -  022500
CN               INVENTORY.                                            -  022600
CN                                                                     -  022700
CN               A REGIONAL NEUTRON INVENTORY FOR ALL REACTION TYPES,  -  022800
CN               INTEGRATED OVER ALL ENERGIES, WILL BE PROVIDED FOR    -  022900
CN               EACH MATERIAL NAMED ON CARD TYPE 07.                  -  023000
C                                                                      -  023100
C-----------------------------------------------------------------------  023200
                                                                         023300
                                                                         023400
C-----------------------------------------------------------------------  023500
CR            COMPOSITION DESIGNATION (TYPE 08)                         -  023600
C                                                                      -  023700
CL     FORMAT-----(I2,4X,11A6)                                          -  023800
C                                                                      -  023900
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY                 -  024000
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CD     =======   ==========================================================-  024100
CD     1-2       08                                                        -  024200
CD                                                                         -  024300
CD     7-12      COMPOSITION LABEL.                                        -  024400
CD                                                                         -  024500
CD     13-18     COMPOSITION LABEL.                                        -  024600
CD                                                                         -  024700
CD     19-24     COMPOSITION LABEL.                                        -  024800
CD                                                                         -  024900
CD     25-30     COMPOSITION LABEL.                                        -  025000
CD                                                                         -  025100
CD     31-36     COMPOSITION LABEL.                                        -  025200
CD                                                                         -  025300
CD     37-42     COMPOSITION LABEL.                                        -  025400
CD                                                                         -  025500
CD     43-48     COMPOSITION LABEL.                                        -  025600
CD                                                                         -  025700
CD     49-54     COMPOSITION LABEL.                                        -  025800
CD                                                                         -  025900
CD     55-60     COMPOSITION LABEL.                                        -  026000
CD                                                                         -  026100
CD     61-66     COMPOSITION LABEL.                                        -  026200
CD                                                                         -  026300
CD     67-72     COMPOSITION LABEL.                                        -  026400
C                                                                          -  026500
CN               A REGIONAL NEUTRON INVENTORY FOR ALL REACTION TYPES,      -  026600
CN               INTEGRATED OVER ALL ENERGIES WILL BE PROVIDED FOR EACH    -  026700
CN               COMPOSITION NAMED ON CARD TYPE 08.                        -  026800
C                                                                          -  026900
C-------------------------------------------------------------------------   027000
                                                                              027100
                                                                              027200
C-------------------------------------------------------------------------   027300
CR          REGIONAL MESH DESIGNATION (TYPE 09)                            -  027400
C                                                                          -  027500
CL     FORMAT-----(I2,4X,11A6)                                             -  027600
C                                                                          -  027700
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  027800
CD     =======   ==========================================================-  027900
CD     1-2       09                                                        -  028000
CD                                                                         -  028100
CD     7-12      REGION LABEL.                                             -  028200
CD                                                                         -  028300
CD     13-18     REGION LABEL.                                             -  028400
CD                                                                         -  028500
CD     19-24     REGION LABEL.                                             -  028600
CD                                                                         -  028700
CD     25-30     REGION LABEL.                                             -  028800
CD                                                                         -  028900
CD     31-36     REGION LABEL.                                             -  029000
CD                                                                         -  029100
CD     37-42     REGION LABEL.                                             -  029200
CD                                                                         -  029300
CD     43-48     REGION LABEL.                                             -  029400
CD                                                                         -  029500
CD     49-54     REGION LABEL.                                             -  029600
CD                                                                         -  029700
CD     55-60     REGION LABEL.                                             -  029800
CD                                                                         -  029900
CD     61-66     REGION LABEL.                                             -  030000
CD                                                                         -  030100
CD     67-72     REGION LABEL.                                             -  030200
C                                                                          -  030300
CN               A NEUTRON INVENTORY WILL BE PROVIDED AT EACH MESH         -  030400
CN               POINT OF EACH REGION SPECIFIED ON CARD TYPE 09 FOR        -  030500
CN               ALL REACTION TYPES AND ALL CONSTITUENT ISOTOPES           -  030600
CN               INTEGRATED OVER ALL ENERGIES. IF COLS. 7-12 ARE BLANK,    -  030700
CN               AN INVENTORY WILL BE CALCULATED AT ALL MESH POINTS        -  030800
CN               IN THE PROBLEM.                                           -  030900
C                                                                          -  031000
C-------------------------------------------------------------------------   031100
                                                                              031200
                                                                              031300
C-------------------------------------------------------------------------   031400
CR          AREA DESIGNATION (TYPE 10)                                     -  031500
C                                                                          -  031600
CL     FORMAT-----(I2,4X,11A6)                                             -  031700
C                                                                          -  031800
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  031900
CD     =======   ==========================================================-  032000
CD     1-2       10                                                        -  032100
CD                                                                         -  032200
CD     7-12      AREA LABEL.                                               -  032300
CD                                                                         -  032400
CD     13-18     AREA LABEL.                                               -  032500
CD                                                                         -  032600
CD     19-24     AREA LABEL.                                               -  032700
CD                                                                         -  032800
CD     25-30     AREA LABEL.                                               -  032900
CD                                                                         -  033000
CD     31-36     AREA LABEL.                                               -  033100
CD                                                                         -  033200
CD     37-42     AREA LABEL.                                               -  033300
CD                                                                         -  033400
CD     43-48     AREA LABEL.                                               -  033500
CD                                                                         -  033600
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CD     49-54      AREA LABEL.                                          -  033700
CD                                                                     -  033800
CD     55-60      AREA LABEL.                                          -  033900
CD                                                                     -  034000
CD     61-66      AREA LABEL.                                          -  034100
CD                                                                     -  034200
CD     67-72      AREA LABEL.                                          -  034300
C                                                                      -  034400
CN                AA NEUTRON INVENTORY WILL BE PROVIDED FOR EACH AREA  -  034500
CN                SPECIFIED ON CARD TYPE 10 FOR ALL REACTION TYPES AND -  034600
CN                ALL CONSTITUENT ISOTOPES INTEGRATED OVER ALL ENERGIES. -  034700
CN                IF COLS. 7-12 ARE BLANK, AN INVENTORY WILL BE        -  034800
CN                CALCULATED FOR ALL AREAS OF THE PROBLEM.             -  034900
C                                                                      -  035000
C-----------------------------------------------------------------------  035100
                                                                         035200
                                                                         035300
C-----------------------------------------------------------------------  035400
CR          ZONE DESIGNATION (TYPE 11)                                 -  035500
C                                                                      -  035600
CL     FORMAT-----(I2,4X,11A6)                                         -  035700
C                                                                      -  035800
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY               -  035900
CD     =======   ========================================================-  036000
CD     1-2       11                                                    -  036100
CD                                                                     -  036200
CD     7-12      ZONE LABEL.                                           -  036300
CD                                                                     -  036400
CD     13-18     ZONE LABEL.                                           -  036500
CD                                                                     -  036600
CD     19-24     ZONE LABEL.                                           -  036700
CD                                                                     -  036800
CD     25-30     ZONE LABEL.                                           -  036900
CD                                                                     -  037000
CD     31-36     ZONE LABEL.                                           -  037100
CD                                                                     -  037200
CD     37-42     ZONE LABEL.                                           -  037300
CD                                                                     -  037400
CD     43-48     ZONE LABEL.                                           -  037500
CD                                                                     -  037600
CD     49-54     ZONF LABEL.                                           -  037700
CD                                                                     -  037800
CD     55-60     ZONE LABEL.                                           -  037900
CD                                                                     -  038000
CD     61-66     ZONE LABEL.                                           -  038100
CD                                                                     -  038200
CD     67-72     ZONE LABEL.                                           -  038300
C                                                                      -  038400
CN                AA NEUTRON INVENTORY WILL BE PROVIDED FOR EACH ZONE  -  038500
CN                SPECIFIED ON CARD TYPE 11 FOR ALL REACTION TYPES AND -  038600
CN                ALL CONSTITUENT ISOTOPES INTEGRATED OVER ALL ENERGIES. -  038700
CN                IF COLS. 7-12 ARE BLANK, AN INVENTORY WILL BE        -  038800
CN                CALCULATED FOR ALL ZONES OF THE PROBLEM.             -  038900
C                                                                      -  039000
C-----------------------------------------------------------------------  039100
                                                                         039200
                                                                         039300
C-----------------------------------------------------------------------  039400
CR          ENERGY GROUP DESIGNATION (TYPE 12)                         -  039500
C                                                                      -  039600
CL     FORMAT-----(I2,10X,10I6)                                        -  039700
C                                                                      -  039800
CD     COLUMNS          CONTENTS...IMPLICATIONS, IF ANY               -  039900
CD     =======   ========================================================-  040000
CD     1-2       12                                                    -  040100
CD                                                                     -  040200
CD     13-18     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL   -  040300
CD               BE PERFORMED.                                         -  040400
CD                                                                     -  040500
CD     19-24     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL    -  040600
CD               BE PERFORMED.                                         -  040700
CD                                                                     -  040800
CD     25-30     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL   -  040900
CD               BE PERFORMED.                                         -  041000
CD                                                                     -  041100
CD     31-36     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL    -  041200
CD               BE PERFORMED.                                         -  041300
CD                                                                     -  041400
CD     37-42     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL   -  041500
CD               BE PERFORMED.                                         -  041600
CD                                                                     -  041700
CD     43-48     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL    -  041800
CD               BE PERFORMED.                                         -  041900
CD                                                                     -  042000
CD     49-54     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL   -  042100
CD               BE PERFORMED.                                         -  042200
CD                                                                     -  042300
CD     55-60     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL    -  042400
CD               BE PERFORMED.                                         -  042500
CD                                                                     -  042600
CD     61-66     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL   -  042700
CD               BE PERFORMED.                                         -  042800
CD                                                                     -  042900
CD     67-72     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL    -  043000
CD               BE PERFORMED.                                         -  043100
C                                                                      -  043200
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CN                A REGIONAL NEUTRON INVENTORY WILL BE PROVIDED FOR      -  043300
CN                ALL REACTION TYPES AND FOR ALL OF THE CONSTITUENT      -  043400
CN                ISOTOPES FOR THE ENERGY RANGES SPECIFIED ON THE TYPE   -  043500
CN                12 CARDS. IF COLS. 19-24, 31-36, 43-48, 55-60, OR      -  043600
CN                67-72 ARE BLANK, THE INVENTORY WILL BE PROVIDED FOR    -  043700
CN                THE ENERGY GROUPS SPECIFIED IN COLS. 13-18, 25-30,     -  043800
CN                37-42, 49-54, OR 61-66, RESPECTIVELY. IF COLS. 13-18   -  043900
CN                ARE BLANK, THE INVENTORY WILL BE PERFORMED FOR ALL     -  044000
CN                ENERGY GROUPS.                                         -  044100
C                                                                        -  044200
C-----------------------------------------------------------------------   044300
                                                                          044400
                                                                          044500
C-----------------------------------------------------------------------   044600
CR          FOIL SPECIFICATIONS (TYPE 13)                                -  044700
C                                                                        -  044800
CL    FORMAT-----(I2,4X,A6,I6,9A6)                                       -  044900
C                                                                        -  045000
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  045100
CD    =======   ==========================================================-  045200
CD    1-2       13                                                       -  045300
CD                                                                       -  045400
CD    7-12      FOIL ISOTOPE LABEL (REPEATED ON ADDITIONAL CARDS).       -  045500
CD                                                                       -  045600
CD    13-18     REACTION TYPE (REPEATED ON ADDITIONAL CARDS).            -  045700
CD              1...(N,GAMMA).                                           -  045800
CD              2...(N,F).                                               -  045900
CD              3...(N,ALPHA).                                           -  046000
CD              4...(N,P).                                               -  046100
CD                                                                       -  046200
CD    19-24     REGION LABEL.                                            -  046300
CD                                                                       -  046400
CD    25-30     REGION LABEL.                                            -  046500
CD                                                                       -  046600
CD    31-36     REGION LABEL.                                            -  046700
CD                                                                       -  046800
CD    37-42     REGION LABEL.                                            -  046900
CD                                                                       -  047000
CD    43-48     REGION LABEL.                                            -  047100
CD                                                                       -  047200
CD    49-54     REGION LABEL.                                            -  047300
CD                                                                       -  047400
CD    55-60     REGION LABEL.                                            -  047500
CD                                                                       -  047600
CD    61-66     REGION LABEL.                                            -  047700
CD                                                                       -  047800
CD    67-72     REGION LABEL.                                            -  047900
C                                                                        -  048000
CN              A NEUTRON INVENTORY INTEGRATED OVER ALL ENERGIES IS      -  048100
CN              PROVIDED FOR THE REACTION TYPES SELECTED IN COLS.        -  048200
CN              13-18 FOR EACH MESH POINT IN EACH OF THE REGIONS         -  048300
CN              DESIGNATED IN COLS. 19-24, 25-30,..., 67-72. IF COLS.    -  048400
CN              19-24 ARE BLANK, THE SELECTED INVENTORY IS PROVIDED      -  048500
CN              AT ALL POINTS IN THE REACTOR.                            -  048600
C                                                                        -  048700
C-----------------------------------------------------------------------   048800
                                                                          048900
                                                                          049000
C-----------------------------------------------------------------------   049100
CR          FOIL ENERGY GROUP DESIGNATION (TYPE 14)                      -  049200
C                                                                        -  049300
CL    FORMAT-----(I2,4X,A6,I6,A6,8I6)                                    -  049400
C                                                                        -  049500
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  049600
CD    =======   ==========================================================-  049700
CD    1-2       14                                                       -  049800
CD                                                                       -  049900
CD    7-12      FOIL ISOTOPE LABEL (REPEATED ON ADDITIONAL CARDS).       -  050000
CD                                                                       -  050100
CD    13-18     REACTION TYPE (REPEATED ON ADDITIONAL CARDS).            -  050200
CD              1...(N,GAMMA).                                           -  050300
CD              2...(N,F).                                               -  050400
CD              3...(N,ALPHA).                                           -  050500
CD              4...(N,P).                                               -  050600
CD                                                                       -  050700
CD    19-24     REGION LABEL (REPEATED ON ADDITIONAL CARDS).             -  050800
CD                                                                       -  050900
CD    25-30     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL      -  051000
CD              BE PERFORMED.                                            -  051100
CD                                                                       -  051200
CD    31-36     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL       -  051300
CD              BE PERFORMED.                                            -  051400
CD                                                                       -  051500
CD    37-42     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL      -  051600
CD              BE PERFORMED.                                            -  051700
CD                                                                       -  051800
CD    43-48     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL       -  051900
CD              BE PERFORMED.                                            -  052000
CD                                                                       -  052100
CD    49-54     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL      -  052200
CD              BE PERFORMED.                                            -  052300
CD                                                                       -  052400
CD    55-60     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL       -  052500
CD              BE PERFORMED.                                            -  052600
CD                                                                       -  052700
CD    61-66     HIGHER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL      -  052800
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CD                BE PERFORMED.                                          -  052900
CD                                                                       -  053000
CD      67-72     LOWER-ENERGY GROUP NUMBER FOR WHICH INVENTORY WILL     -  053100
CD                BE PERFORMED.                                          -  053200
C                                                                        -  053300
CN                A NEUTRON INVENTORY FOR THE REACTION TYPE SELECTED     -  053400
CN                AND FOR THE ENERGY RANGES SPECIFIED ON THE TYPE 14     -  053500
CN                CARDS IS PROVIDED FOR ALL POINTS IN THE SPECIFIED      -  053600
CN                REGION. IF COLS. 31-36, 43-48, 55-60, OR 67-72 ARE     -  053700
CN                BLANK, THE INVENTORY WILL BE PROVIDED FOR THE ENERGY   -  053800
CN                GROUPS SPECIFIED IN COLS. 25-30, 37-42, 49-54, OR      -  053900
CN                61-66, RESPECTIVELY. IF COLS. 25-30 ARE BLANK, THE     -  054000
CN                INVENTORY WILL BE PERFORMED FOR ALL ENERGY GROUPS. IF  -  054100
CN                COLS. 19-24 ARE BLANK, THE SPECIFIED INVENTORY IS      -  054200
CN                PERFORMED FOR ALL POINTS IN THE REACTOR.               -  054300
C                                                                        -  054400
C-----------------------------------------------------------------------   054500
                                                                          054600
                                                                          054700
C-----------------------------------------------------------------------   054800
CR          FOIL RATIO DESIGNATIONS (TYPE 15)                            -  054900
C                                                                        -  055000
CL      FORMAT-----(I2,4X,2(A6,I6))                                      -  055100
C                                                                        -  055200
CD      COLUMNS           CONTENTS...IMPLICATIONS, IF ANY                -  055300
CD      =======   ==========================================================  055400
CD      1-2       15                                                     -  055500
CD                                                                       -  055600
CD      7-12      FOIL ISOTOPE LABEL.                                    -  055700
CD                                                                       -  055800
CD      13-18     REACTION TYPE.                                         -  055900
CD                1...(N,GAMMA).                                         -  056000
CD                2...(N,F).                                             -  056100
CD                3...(N,ALPHA).                                         -  056200
CD                4...(N,P).                                             -  056300
CD                                                                       -  056400
CD      19-24     FOIL ISOTOPE LABEL.                                    -  056500
CD                                                                       -  056600
CD      25-30     REACTION TYPE.                                         -  056700
CD                1...(N,GAMMA).                                         -  056800
CD                2...(N,F).                                             -  056900
CD                3...(N,ALPHA).                                         -  057000
CD                4...(N,P).                                             -  057100
C                                                                        -  057200
CN                THE RATIO OF THE INVENTORY INTEGRATED OVER ALL         -  057300
CN                ENERGIES FOR THE FOIL SPECIFIED IN COLS. 7-12 AND      -  057400
CN                REACTION TYPE SPECIFIED IN COLS. 13-18, TO THAT OF     -  057500
CN                THE FOIL IN COLS. 19-24 AND REACTION TYPE GIVEN IN     -  057600
CN                COLS. 25-30, IS TABULATED FOR EACH SPATIAL POINT AT    -  057700
CN                WHICH BOTH EXIST. CARD TYPE 15 IS IGNORED IF NO CARDS  -  057800
CN                TYPE 13 ARE PROVIDED FOR THE FOILS AND REACTIONS       -  057900
CN                INVOLVED.                                              -  058000
C                                                                        -  058100
C-----------------------------------------------------------------------   058200
                                                                          058300
CEOF                                                                      058400
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only cards you want

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C*********************************************************************
C                                                                    -
C                         PREPARED 1/26/71 AT ANL                    -
C                                                                    -
CF          A.NIP                                                    -
CE          GENERAL INPUT FOR NEUTRONICS CALCULATIONS                -
C                                                                    -
CN                        THIS IS A USER-SUPPLIED BCD DATA SET.      -
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS OF -
CN                        THE BCD FORMAT OF THE DATA CARD.           -
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE -
CN                        NUMBER.                                    -
CN                                                                   -
CN                        BLANKS ARE NOT MEANINGFUL IN A6 LABEL FIELDS. -
C                                                                    -
C*********************************************************************

C---------------------------------------------------------------------
CR          PROBLEM TITLE (TYPE 01)                                  -
C                                                                    -
CL    FORMAT-----(I2,4X,11A6)                                        -
C                                                                    -
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY              -
CD    =======   ========================================================-
CD    1-2       01                                                   -
CD                                                                   -
CD    7-72      ANY ALPHANUMERIC CHARACTERS.                         -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          INPUT PROCESSING SPECIFICATION (TYPE 02)                 -
C                                                                    -
CL    FORMAT-----(I2,10X,2I6)                                        -
C                                                                    -
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY              -
CD    =======   ========================================================-
CD    1-2       02                                                   -
CD                                                                   -
CD    13-18     POINTR DEBUGGING EDIT.                               -
CD              0...NO DEBUGGING PRINTOUT (DEFAULT).                 -
CD              1...DEBUGGING DUMP PRINTOUT.                         -
CD              2...DEBUGGING TRACE PRINTOUT.                        -
CD              3...FULL DEBUGGING PRINTOUT.                         -
CD                                                                   -
CD    19-24     NUI002 EDIT.                                         -
CD              0...NO NUI002 EDIT (DEFAULT).                        -
CD              1...NUI002 EDIT.                                     -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          BASIC PROBLEM IDENTIFICATION (TYPE 03)                   -
C                                                                    -
CL    FORMAT-----(I2,10X,3I6,18X,2E12.5)                             -
C                                                                    -
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY.             -
CD    =======   ========================================================-
CD    1-2       03                                                   -
CD                                                                   -
CD    13-18     GEOMETRY TYPE.                                       -
CD              10...SLAB, INFINITE.                                 -
CD              11...SLAB, CYLINDRICAL.                              -
CD              12...SLAB, FINITE IN ONE TRANSVERSE DIRECTION.       -
CD              13...SLAB, FINITE IN BOTH TRANSVERSE DIRECTIONS.     -
CD              20...CYLINDER, INFINITE.                             -
CD              21...CYLINDER, FINITE.                               -
CD              30...SPHERE.                                         -
CD              40...X-Y, INFINITE.                                  -
CD              41...X-Y, FINITE.                                    -
CD              42...X-Y, 45 DEGREE SYMMETRY, INFINITE.              -
CD              43...X-Y, 45 SYMMETRY, INFINITE.                     -
CD              50...R-Z.                                            -
CD              51...Z-R.                                            -
CD              60...R-THETA, INFINITE.                              -
CD              61...R-THETA, FINITE.                                -
CD                                                                   -
CD    19-24     PROBLEM TYPE.                                        -
CD              0...REAL (DEFAULT).                                  -
CD              1...ADJOINT.                                         -
CD              2...BOTH REAL AND ADJOINT (MAY BE SELECTED ONLY IF   -
CD                  COLS. 25-30 BELOW ARE ZERO OR BLANK).            -
CD              3...SYNTHESIS.                                       -
CD                                                                   -
CD    25-30     CALCULATION TYPE                                     -
CD              0...HOMOGENEOUS (DEFAULT).                           -
CD              1...INHOMOGENEOUS.                                   -
CD                                                                   -
CD    49-60     FIXED KEFF FOR THE PROBLEM.                          -
CD                                                                   -
CD    61-72     INITIAL ALPHA, FOR AN ALPHA CRITICALITY SEARCH       -
CD              PROBLEM, OR FIXED ALPHA FOR THE PROBLEM.             -
C                                                                    -
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X = X, R Z
Y = Y, Z

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C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          EXTERNAL BOUNDARY CONDITIONS (TYPE 04)                    -
C                                                                     -
CL     FORMAT-----(I2,10X,4I6)                                        -
C                                                                     -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY             -
CD     =======   ==========================================================-
CD     1-2       04                                                    -
CD                                                                    -
CD     13-18     BOUNDARY CONDITION AT LOWER "X" BOUNDARY OF REACTOR.  -
CD                                                                    -
CD     19-24     BOUNDARY CONDITION AT UPPER "X" BOUNDARY OF REACTOR.  -
CD                                                                    -
CD     25-30     BOUNDARY CONDITION AT LOWER "Y" BOUNDARY OF REACTOR.  -
CD                                                                    -
CD     31-36     BOUNDARY CONDITION AT UPPER "Y" BOUNDARY OF REACTOR.  -
CD                                                                    -
CD               1...PHI=A.                                           -
CD               2...PHI=0.                                           -
CD               3...PHI PRIME=0.   inner B.C                         -
CD               4...PHI PRIME + A/D * PHI=0.  outer B.C              -
CD               5...PHI PRIME + A * PHI=0.                           -
CD               6...PERIODIC (R-THETA).                              -
CD               7...A * PHI PRIME + B * PHI=1.                       -
CD               8...A * PHI PRIME + B/D * PHI=1.                     -
CD               9...INCOMING ANGULAR FLUX ZERO.                      -
CD               10...REFLECTIVE.                                     -
CD               11...PERIODIC.                                       -
CD               12...WHITE.                                          -
CD                                                                    -
CN               PHI PRIME IS THE DERIVATIVE OF THE FLUX IN THE       -
CN               DIRECTION OF THE REACTOR OUTWARD NORMAL. D IS THE    -
CN               DIFFUSION COEFFICIENT IN THE MESH INTERVAL           -
CN               IMMEDIATELY INSIDE THE REACTOR BOUNDARY.             -
CN                                                                    -
CN               CONDITIONS 1-8 APPLY TO DIFFUSION THEORY PROBLEMS,   -
CN               AND 9-12 APPLY TO TRANSPORT THEORY PROBLEMS.         -
C                                                                     -
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          EXTERNAL BOUNDARY CONDITION CONSTANTS (TYPE 05)           -
C                                                                     -
CL     FORMAT-----(I2,8X,A2,2E12.5,2I6,2E12.5)                        -
C                                                                     -
CD     COLUMNS      CONTENTS...IMPLICATIONS, IF ANY                   -
CD     =======   ==========================================================-
CD     1-2       05                                                    -
CD                                                                    -
CD     11-12     BOUNDARY DESIGNATOR.                                  -
CD               XL..."X" LOWER.                                      -
CD               XU..."X" UPPER.                                      -
CD               YL..."Y" LOWER.                                      -
CD               YU..."Y" UPPER.                                      -
CD                                                                    -
CD     13-24     VALUE OF CONSTANT A REFERRED TO ON CARD TYPE 04.      -
CD                                                                    -
CD     25-36     VALUE OF CONSTANT B REFERRED TO ON CARD TYPE 04.      -
CD                                                                    -
CD     37-42     HIGHER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY. -
CD                                                                    -
CD     43-48     LOWER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.  -
CD                                                                    -
CD     49-60     LOWER COORDINATE ON BOUNDARY FOR WHICH CONSTANTS      -
CD               APPLY.                                               -
CD                                                                    -
CD     61-72     UPPER COORDINATE ON BOUNDARY FOR WHICH CONSTANTS      -
CD               APPLY.                                               -
CD                                                                    -
CN               IF COLS. 37-42 ARE BLANK, CONSTANTS GIVEN APPLY TO   -
CN               ALL ENERGY GROUPS. IF COLS. 43-48 ARE BLANK,         -
CN               CONSTANTS GIVEN APPLY TO GROUP SPECIFIED IN COLS.    -
CN               37-42. IF COLS. 49-72 ARE BLANK, CONSTANTS GIVEN     -
CN               APPLY TO THE ENTIRE EXTERNAL BOUNDARY CONCERNED.     -
CN               LOWER AND UPPER COORDINATES MUST COINCIDE WITH MESH  -
CN               LINES, WHICH BOUND MESH INTERVALS.                   -
C                                                                     -
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          REGION BOUNDARY COORDINATES AND CONSTANT MESH STRUCTURE   -
CR          (TYPE 06)                                                 -
C                                                                     -
CL     FORMAT-----(I2,4X,A6,2E12.5,2I6,2E12.5)                        -
C                                                                     -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY             -
CD     =======   ==========================================================-
CD     1-2       06                                                    -
CD                                                                    -
CD     7-12      REGION LABEL (REPEATED ON ADDITIONAL TYPE 06 CARDS).  -
CD
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CD     13-24      "X"-DIRECTION LOWER-BOUNDARY COORDINATE.                  -  019300
CD                                                                          -  019400
CD     25-36      "X"-DIRECTION UPPER-BOUNDARY COORDINATE.                  -  019500
CD                                                                          -  019600
CD     37-42      NUMBER OF INTERVALS IN "X" DIRECTION.                     -  019700
CD                                                                          -  019800
CD     43-48      NUMBER OF INTERVALS IN "Y" DIRECTION.                     -  019900
CD                                                                          -  020000
CD     49-60      "Y"-DIRECTION LOWER-BOUNDARY COORDINATE.                  -  020100
CD                                                                          -  020200
CD     61-72      "Y"-DIRECTION UPPER-BOUNDARY COORDINATE.                  -  020300
CD                                                                          -  020400
CN                "X" REPRESENTS X, R, OR, IN THE CASE OF Z-R               -  020500
CN                GEOMETRY, Z. "Y" REPRESENTS Y, X, THETA, OR,              -  020600
CN                IN THE CASE OF Z-R GEOMETRY, R.                           -  020700
CN                                                                          -  020800
CN                REGIONS MAY BE DEFINED USING THE OVERLAY PRECEDURE,       -  020900
CN                WITH THE LATEST REGION ASSIGNMENT OVERLAYING THE          -  021000
CN                PREVIOUS CONFIGURATION, OR USING THE USUSAL PRECEDURE,    -  021100
CN                WITH EACH REGION'S BOUNDARIES GIVEN EXPLICITLY.           -  021200
CN                REGION LABELS MUST BE NON-BLANK.                          -  021300
CN                THE MESH FOR A DIRECTION MUST BE COMPLETELY               -  021400
CN                SPECIFIED EITHER ON THE TYPE 06 OR 09 CARDS. IF MESH      -  021500
CN                DATA ARE SUPPLIED ON BOTH TYPE 06 AND 09 CARDS, THE       -  021600
CN                TYPE 09 DATA WILL BE USED. FOR ONE-DIMENSIONAL            -  021700
CN                PROBLEMS, ONLY THE "X"-DIRECTION UPPER BOUNDARIES NEED    -  021800
CN                BE GIVEN FOR REGIONS AFTER THE FIRST.                     -  021900
C                                                                           -  022000
C-----------------------------------------------------------------------------  022100
                                                                                022200
                                                                                022300
C-----------------------------------------------------------------------------  022400
CR          AREA SPECIFICATIONS (TYPE 07)                                   -  022500
C                                                                           -  022600
CL    FORMAT-----(I2,4X,11A6)                                               -  022700
C                                                                           -  022800
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                    -  022900
CD    =======   ==========================================================-  023000
CD    1-2       07                                                          -  023100
CD                                                                          -  023200
CD    7-12      AREA LABEL (REPEATED ON ADDITIONAL TYPE 07 CARDS).          -  023300
CD                                                                          -  023400
CD    13-18     LABEL OF REGION COMPRISING AREA.                            -  023500
CD                                                                          -  023600
CD    19-24     LABEL OF REGION COMPRISING AREA.                            -  023700
CD                                                                          -  023800
CD    25-30     LABEL OF REGION COMPRISING AREA.                            -  023900
CD                                                                          -  024000
CD    31-36     LABEL OF REGION COMPRISING AREA.                            -  024100
CD                                                                          -  024200
CD    37-42     LABEL OF REGION COMPRISING AREA.                            -  024300
CD                                                                          -  024400
CD    43-48     LABEL OF REGION COMPRISING AREA.                            -  024500
CD                                                                          -  024600
CD    49-54     LABEL OF REGION COMPRISING AREA.                            -  024700
CD                                                                          -  024800
CD    55-60     LABEL OF REGION COMPRISING AREA.                            -  024900
CD                                                                          -  025000
CD    61-66     LABEL OF REGION COMPRISING AREA.                            -  025100
CD                                                                          -  025200
CD    67-72     LABEL OF REGION COMPRISING AREA.                            -  025300
CD                                                                          -  025400
CN              AREA LABELS MUST BE NON-BLANK.                              -  025500
C                                                                           -  025600
C-----------------------------------------------------------------------------  025700
                                                                                025800
                                                                                025900
C-----------------------------------------------------------------------------  026000
CR          ZONE SPECIFICATIONS (TYPE 08)                                   -  026100
C                                                                           -  026200
CL    FORMAT-----(I2,4X,A6,4E12.5)                                          -  026300
C                                                                           -  026400
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                    -  026500
CD    =======   ==========================================================-  026600
CD    1-2       08                                                          -  026700
CD                                                                          -  026800
CD    7-12      ZONE LABEL (REPEATED ON ADDITIONAL TYPE 07 CARDS).          -  026900
CD                                                                          -  027000
CD    13-24     LOWER "X" BOUNDARY OF SECTION.                              -  027100
CD                                                                          -  027200
CD    25-36     UPPER "X" BOUNDARY OF SECTION.                              -  027300
CD                                                                          -  027400
CD    37-48     LOWER "Y" BOUNDARY OF SECTION.                              -  027500
CD                                                                          -  027600
CD    49-60     UPPER "Y" BOUNDARY OF SECTION.                              -  027700
CD                                                                          -  027800
CN              AS MANY SECTIONS MAY BE SPECIFIED AS NECESSARY TO           -  027900
CN              DEFINE THE ZONE. EACH ZONE BOUNDARY MUST COINCIDE WITH      -  028000
CN              SOME MESH LINE. ZONE LABELS MUST BE NON-BLANK.              -  028100
C                                                                           -  028200
C-----------------------------------------------------------------------------  028300
                                                                                028400
                                                                                028500
C-----------------------------------------------------------------------------  028600
CR          VARIABLE-MESH STRUCTURE (TYPE 09)                               -  028700
C                                                                           -  028800
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CL    FORMAT-----(I2,9X,A1,3(I6,E12.5))                                  -  028900
C                                                                        -  029000
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  029100
CD    =======    ==========================================================-  029200
CD    1-2        09                                                      -  029300
CD                                                                       -  029400
CD    12         COORDINATE DIRECTION.                                   -  029500
CD               X..."X" COORDINATE DIRECTION.                           -  029600
CD               Y..."Y" COORDINATE DIRECTION.                           -  029700
CD                                                                       -  029800
CD    13-18      NUMBER OF INTERVALS.                                    -  029900
CD                                                                       -  030000
CD    19-30      UPPER COORDINATE.                                       -  030100
CD                                                                       -  030200
CD    31-36      NUMBER OF INTERVALS.                                    -  030300
CD                                                                       -  030400
CD    37-48      UPPER COORDINATE.                                       -  030500
CD                                                                       -  030600
CD    49-54      NUMBER OF INTERVALS.                                    -  030700
CD                                                                       -  030800
CD    55-66      UPPER COORDINATE.                                       -  030900
CD                                                                       -  031000
CN               "X" REPRESENTS X, R, OR, IN THE CASE OF Z-R             -  031100
CN               GEOMETRY, Z; "Y" REPRESENTS Y, X, THETA, OR,            -  031200
CN               IN THE CASE OF Z-R GEOMETRY, R. EACH                    -  031300
CN               NUMBER PAIR IS OF THE FORM (N(I), X(I)). THERE ARE      -  031400
CN               N(I) INTERVALS BETWEEN X(I-1) AND X(I), WHERE X(0) IS   -  031500
CN               THE LOWER REACTOR BOUNDARY IN THIS DIRECTION. NUMBER    -  031600
CN               PAIRS MUST BE GIVEN IN ORDER OF INCREASING MESH         -  031700
CN               COORDINATES. ALL REGION BOUNDARIES MUST COINCIDE WITH   -  031800
CN               THE MESH LINES THAT BOUND MESH INTERVALS.               -  031900
C                                                                        -  032000
C-------------------------------------------------------------------------  032100
                                                                           032200
                                                                           032300
C-------------------------------------------------------------------------  032400
CR          INTERNAL BOUNDARY OR INTERFACE CONDITIONS (TYPE 10)          -  032500
C                                                                        -  032600
CL    FORMAT-----(I2,4X,A6,5X,A1,I6,3E12.5)                              -  032700
C                                                                        -  032800
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  032900
CD    =======    ==========================================================-  033000
CD    1-2        10                                                      -  033100
CD                                                                       -  033200
CD    7-12       INTERNAL INTERFACE LABEL.                               -  033300
CD                                                                       -  033400
CD    18         COORDINATE DIRECTION OF INTERNAL BOUNDARY OR            -  033500
CD               INTERFACE.                                              -  033600
CD               X..."X" COORDINATE DIRECTION.                           -  033700
CD               Y..."Y" COORDINATE DIRECTION.                           -  033800
CD                                                                       -  033900
CD    19-24      INTERNAL CONDITION                                      -  034000
CD               0...PHI PRIME+(A/D)*PHI=B.                              -  034100
CD               1...PHI PRIME+A*PHI=B.                                  -  034200
CD               2...PHI(I+1)=A*PHI(I)+B*PHI PRIME(I),                   -  034300
CD                   PHI PRIME(I+1)=C*PHI(I)+D*PHI PRIME(I).             -  034400
CD               3...A*PHI PRIME+B*PHI=0.                                -  034500
CD               4...A*PHI PRIME+B/D*PHI=0                               -  034600
CD               5...A*PHI PRIME+PHI=B.                                  -  034700
CD               6...A*PHI PRIME+1/D*PHI=B.                              -  034800
CD                                                                       -  034900
CD    25-36      "Y" COORDINATE ALONG WHICH "X"-DIRECTION INTERFACE      -  035000
CD               LIES, OR "X" COORDINATE ALONG WHICH "Y"-DIRECTION       -  035100
CD               INTERFACE LIES.                                         -  035200
CD                                                                       -  035300
CD    37-48      COORDINATE OF LOWER END OF INTERFACE.                   -  035400
CD                                                                       -  035500
CD    49-60      COORDINATE OF UPPER END OF INTERFACE.                   -  035600
CD                                                                       -  035700
CN               EACH TYPE 10 CARD ABOVE MUST BE FOLLOWED BY ONE OR      -  035800
CN               MORE TYPE 11 CARDS WHICH CONTAIN THE NECESSARY          -  035900
CN               CONSTANTS FOR THE SPATIAL INTERVAL DEFINED ABOVE. THE   -  036000
CN               INTERNAL INTERFACE LABEL IS USED ON THE TYPE 11 CARDS   -  036100
CN               TO DESIGNATE THE INTERFACE DEFINED ON THE TYPE 10 CARD  -  036200
CN               WITH THE SAME LABEL.                                    -  036300
C                                                                        -  036400
C-------------------------------------------------------------------------  036500
                                                                           036600
                                                                           036700
C-------------------------------------------------------------------------  036800
CR          INTERNAL-BOUNDARY OR INTERFACE-CONDITION CONSTANTS           -  036900
CR          (TYPE 11)                                                    -  037000
C                                                                        -  037100
CL    FORMAT-----(I2,4X,A6,4E12.5,2I6)                                   -  037200
C                                                                        -  037300
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  037400
CD    =======    ==========================================================-  037500
CD    1-2        11                                                      -  037600
CD                                                                       -  037700
CD    7-12       INTERNAL-INTERFACE LABEL.                               -  037800
CD                                                                       -  037900
CD    13-24      CONSTANTS DEFINED BELOW.                                -  038000
CD                                                                       -  038100
CD    25-36      CONSTANTS DEFINED BELOW.                                -  038200
CD                                                                       -  038300
CD    37-48      CONSTANTS DEFINED BELOW.                                -  038400
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mesh structure

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CD                                                                      -  038500
CD      49-60      CONSTANTS DEFINED BELOW.                              -  038600
CD                                                                      -  038700
CD      61-66      HIGHER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY. -  038800
CD                                                                      -  038900
CD      67-72      LOWER-ENERGY GROUP NUMBER FOR WHICH CONSTANTS APPLY.  -  039000
CD                                                                      -  039100
CN                 IF COLS. 61-66 ARE BLANK, CONSTANTS APPLY TO ALL      -  039200
CN                 ENERGY GROUPS.                                       -  039300
CN                 IF COLS. 67-72 ARE BLANK, CONSTANTS APPLY TO GROUP    -  039400
CN                 SPECIFIED IN COLS. 61-66.                            -  039500
CN                                                                      -  039600
CN                 FOR THE LOGARITHMIC BOUNDARY CONDITIONS, OPTIONS 0, 1, -  039700
CN                 3-6: PHI PRIME + (A/D) * PHI=B, PHI PRIME + A * PHI=B, -  039800
CN                 ETC., ONE PAIR OF CONSTANTS, A AND B, IS GIVEN FOR    -  039900
CN                 EACH SIDE OF THE BOUNDARY. THE CONSTANTS A AND B GIVEN -  040000
CN                 IN COLS. 13-24 AND 25-36, RESPECTIVELY, WILL BE       -  040100
CN                 APPLIED AT THE SIDE OF THE BOUNDARY ENCOUNTERED FIRST -  040200
CN                 AS THE MESH IS SWEPT, AND THE CONSTANTS A AND B IN    -  040300
CN                 COLS. 37-48 AND 49-60 WILL BE APPLIED AT THE OTHER    -  040400
CN                 SIDE OF THE BOUNDARY LINE. THE MESH IS SWEPT IN THE   -  040500
CN                 DIRECTION OF INCREASING DIMENSION. D IS THE DIFFUSION -  040600
CN                 COEFFICIENT IN THE CORRESPONDING REGION; PHI PRIME IS -  040700
CN                 THE DERIVATIVE OF THE FLUX IN THE DIRECTION OF THE    -  040800
CN                 OUTWARD NORMAL TO THE BOUNDARY. FOR THE GENERAL       -  040900
CN                 INTERFACE CONDITION, OPTION 2,                        -  041000
CN                                                                      -  041100
CN                 PHI(I+1)=A*PHI(I)+B*PHI PRIME(I),                    -  041200
CN                 PHI PRIME(I+1)=C*PHI(I)+D*PHI PRIME(I),              -  041300
CN                                                                      -  041400
CN                 THE CONSTANTS A,B,C, AND D ARE GIVEN IN COLS. 13-24, -  041500
CN                 25-36, 37-48, AND 49-60, RESPECTIVELY. THE INDICES I  -  041600
CN                 AND I+I REFER TO MESH INTERVALS ON EITHER SIDE OF     -  041700
CN                 THE INTERFACE, I BEING ENCOUNTERED BEFORE I+I AS THE  -  041800
CN                 MESH IS SWEPT; PHI PRIME IS THE DERIVATIVE OF THE FLUX -  041900
CN                 IN THE DIRECTION OF THE MESH SWEEP.                   -  042000
C                                                                       -  042100
C-----------------------------------------------------------------------  042200
                                                                        042300
                                                                        042400
C-----------------------------------------------------------------------  042500
CR            FINITE-GEOMETRY TRANVERSE DISTANCES (TYPE 12)             -  042600
C                                                                       -  042700
CL      FORMAT-----(I2,4X,A6,4E12.5)                                    -  042800
C                                                                       -  042900
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  043000
CD      =======   ==================================================-  043100
CD      1-2       12                                                    -  043200
CD                                                                      -  043300
CD      7-12      REGION LABEL.                                         -  043400
CD                                                                      -  043500
CD      13-24     ACTUAL TRANSVERSE HALF-HEIGHT OR RADIUS.              -  043600
CD                                                                      -  043700
CD      25-36     TRANSVERSE EXTRAPOLATION DISTANCE.                    -  043800
CD                                                                      -  043900
CD      37-48     ACTUAL TRANSVERSE HALF-HEIGHT IN THE SECOND DIRECTION -  044000
CD                FOR A FINITE ONE-DIMENSIONAL RECTANGULAR SLAB.        -  044100
CD                                                                      -  044200
CD      49-60     TRANSVERSE EXTRAPOLATION DISTANCE IN THE SECOND       -  044300
CD                DIRECTION FOR A FINITE ONE-DIMENSIONAL RECTANGULAR    -  044400
CD                SLAB.                                                 -  044500
CD                                                                      -  044600
CN                IF COLS. 7-12 ARE BLANK, THE DATA IN COLS 13-60 APPLY -  044700
CN                TO ALL REGIONS OF THE REACTOR.                        -  044800
CN                                                                      -  044900
CN                IF COLS. 13-24 AND/OR 37-48 ARE BLANK, THE REACTOR IS -  045000
CN                ASSUMED TO BE INFINITE IN THE CORRESPONDING TRANSVERSE -  045100
CN                DIRECTION.                                            -  045200
C                                                                       -  045300
C-----------------------------------------------------------------------  045400
                                                                        045500
                                                                        045600
C-----------------------------------------------------------------------  045700
CR            MATERIAL SPECIFICATIONS (TYPE 13)                         -  045800
C                                                                       -  045900
CL      FORMAT-----(I2,10X,A6,3(A6,E12.5))                              -  046000
C                                                                       -  046100
CD      COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  046200
CD      =======   ==================================================-  046300
CD      1-2       13                                                    -  046400
CD                                                                      -  046500
CD      13-18     MATERIAL LABEL (REPEATED ON ADDITIONAL TYPE 13 CARDS). -  046600
CD                                                                      -  046700
CD      19-24     ISOTOPE LABEL.                                        -  046800
CD                                                                      -  046900
CD      25-36     ISOTOPE ATOM DENSITY (ATOMS/CC * 1.E-24).             -  047000
CD                                                                      -  047100
CD      37-42     ISOTOPE LABEL.                                        -  047200
CD                                                                      -  047300
CD      43-54     ISOTOPE ATOM DENSITY (ATOMS/CC * 1.E-24).             -  047400
CD                                                                      -  047500
CD      55-60     ISOTOPE LABEL.                                        -  047600
CD                                                                      -  047700
CD      61-72     ISOTOPE ATOM DENSITY (ATOMS/CC * 1.E-24).             -  047800
CD                                                                      -  047900
CN                MATERIAL LABELS MUST BE NON-BLANK.                    -  048000
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Transverse in R-Z

mate X-Y only

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C                                                                       -  048100
C-----------------------------------------------------------------------  048200
                                                                         048300
                                                                         048400
C-----------------------------------------------------------------------  048500
CR          COMPOSITION SPECIFICATIONS (TYPE 14)                        -  048600
C                                                                       -  048700
CL     FORMAT-----(I2,10X,A6,3(A6,E12.5))                               -  048800
C                                                                       -  048900
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  049000
CD     =======   ==========================================================049100
CD     1-2       14                                                     -  049200
CD                                                                      -  049300
CD     13-18     COMPOSITION LABEL (REPEATED ON ADDITIONAL TYPE 14      -  049400
CD               CARDS).                                                -  049500
CD                                                                      -  049600
CD     19-24     MATERIAL LABEL.                                        -  049700
CD                                                                      -  049800
CD     25-36     MATERIAL VOLUME FRACTION.                              -  049900
CD                                                                      -  050000
CD     37-42     MATERIAL LABEL.                                        -  050100
CD                                                                      -  050200
CD     43-54     MATERIAL VOLUME FRACTION.                              -  050300
CD                                                                      -  050400
CD     55-60     MATERIAL LABEL.                                        -  050500
CD                                                                      -  050600
CD     61-72     MATERIAL VOLUME FRACTION.                              -  050700
CD                                                                      -  050800
CN               COMPOSITION LABELS MUST BE NON-BLANK.                  -  050900
CN               IF CARD TYPE 13 IS NOT GIVEN, "MATERIAL" ON CARD TYPE  -  051000
CN               14 CORRESPONDS TO ISOTOPE, AND "VOLUME FRACTION"       -  051100
CN               CORRESPONDS TO ATOM DENSITY.                           -  051200
C                                                                       -  051300
C-----------------------------------------------------------------------  051400
                                                                         051500
                                                                         051600
C-----------------------------------------------------------------------  051700
CR          COMPOSITION AND REGION ASSIGNMENTS (TYPE 15)                -  051800
C                                                                       -  051900
CL     FORMAT-----(I2,4X,11A6)                                          -  052000
C                                                                       -  052100
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  052200
CD     =======   ==========================================================052300
CD     1-2       15                                                     -  052400
CD                                                                      -  052500
CD     7-12      COMPOSITION LABEL (REPEATED ON ADDITIONAL TYPE 15      -  052600
CD               CARDS).                                                -  052700
CD                                                                      -  052800
CD     13-18     REGION LABEL OF REGION CONTAINING SPECIFIED            -  052900
CD               COMPOSITION.                                           -  053000
CD                                                                      -  053100
CD     19-24     REGION LABEL OF REGION CONTAINING SPECIFIED            -  053200
CD               COMPOSITION.                                           -  053300
CD                                                                      -  053400
CD     25-30     REGION LABEL OF REGION CONTAINING SPECIFIED            -  053500
CD               COMPOSITION.                                           -  053600
CD                                                                      -  053700
CD     31-36     REGION LABEL OF REGION CONTAINING SPECIFIED            -  053800
CD               COMPOSITION.                                           -  053900
CD                                                                      -  054000
CD     37-42     REGION LABEL OF REGION CONTAINING SPECIFIED            -  054100
CD               COMPOSITION.                                           -  054200
CD                                                                      -  054300
CD     43-48     REGION LABEL OF REGION CONTAINING SPECIFIED            -  054400
CD               COMPOSITION.                                           -  054500
CD                                                                      -  054600
CD     49-54     REGION LABEL OF REGION CONTAINING SPECIFIED            -  054700
CD               COMPOSITION.                                           -  054800
CD                                                                      -  054900
CD     55-60     REGION LABEL OF REGION CONTAINING SPECIFIED            -  055000
CD               COMPOSITION.                                           -  055100
CD                                                                      -  055200
CD     61-66     REGION LABEL OF REGION CONTAINING SPECIFIED            -  055300
CD               COMPOSITION.                                           -  055400
CD                                                                      -  055500
CD     67-72     REGION LABEL OF REGION CONTAINING SPECIFIED            -  055600
CD               COMPOSITION.                                           -  055700
C                                                                       -  055800
C-----------------------------------------------------------------------  055900
                                                                         056000
                                                                         056100
C-----------------------------------------------------------------------  056200
CR          INITIAL FISSION SOURCE OR FLUX SPECIFICATIONS (TYPE 16)     -  056300
C                                                                       -  056400
CL     FORMAT-----(I2,10X,2I6,E12.5,2I6,E12.5)                          -  056500
C                                                                       -  056600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  056700
CD     =======   ==========================================================056800
CD     1-2       16                                                     -  056900
CD                                                                      -  057000
CD     13-18     TYPE OF QUANTITY BEING SPECIFIED FOR REAL PROBLEM.     -  057100
CD               0...FISSION SOURCE.                                    -  057200
CD               1...FLUX.                                              -  057300
CD                                                                      -  057400
CD     19-24     SPECTRUM DISTRIBUTION FOR REAL PROBLEM.                -  057500
CD               0...USE SPECIFIED QUANTITIES AS GIVEN.                 -  057600
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CD                1...DISTRIBUTE SPECIFIED QUANTITIES INTO THE ENERGY    -  057700
CD                    GROUPS USING FISSION-SPECTRUM WEIGHTING AT EACH    -  057800
CD                    MESH INTERVAL.                                     -  057900
CD                                                                       -  058000
CD     25-36      BASE VALUE FOR REAL PROBLEM.                           -  058100
CD                                                                       -  058200
CD     37-42      TYPE OF QUANTITY BEING SPECIFIED FOR ADJOINT PROBLEM.  -  058300
CD                0...FISSION SOURCE.                                    -  058400
CD                1...FLUX.                                              -  058500
CD                                                                       -  058600
CD     43-48      SPECTRUM DISTRIBUTION FOR ADJOINT PROBLEM.             -  058700
CD                0...USE SPECIFIED QUANTITIES AS GIVEN.                 -  058800
CD                1...DISTRIBUTE SPECIFIED QUANTITIES INTO ENERGY GROUPS -  058900
CD                    J USING (NU SIGMA FISSION) SUB J / SUMMATION OVER  -  059000
CD                    J OF (NU SIGMA FISSION) SUB J FOR WEIGHTING AT     -  059100
CD                    EACH MESH INTERVAL.                                -  059200
CD                                                                       -  059300
CD     49-60      BASE VALUE FOR ADJOINT PROBLEM.                        -  059400
CD                                                                       -  059500
CN                IF NO CARD TYPE 16 IS GIVEN, INITIAL REAL AND/OR       -  059600
CN                ADJOINT FLUX VALUES OF 1.0 WILL BE ASSUMED FOR ALL     -  059700
CN                ENERGY GROUPS AND FOR ALL MESH INTERVALS ACCORDING TO  -  059800
CN                THE PROBLEM TYPE GIVEN IN COLS. 19-24 ON CARD TYPE 03. -  059900
CN                                                                       -  060000
CN                CARD TYPE 16 MUST BE USED IF CARD TYPES 17 AND/OR 18   -  060100
CN                ARE USED. THE BASE VALUES GIVEN IN COLS. 25-36 AND     -  060200
CN                49-60 WILL BE MODIFIED ACCORDING TO COLS. 19-24 AND    -  060300
CN                43-48 AND ASSIGNED TO EACH MESH INTERVAL IN THE        -  060400
CN                PROBLEM. QUANTITIES GIVEN ON CARD TYPES 17 AND/OR 18   -  060500
CN                WILL OVERRIDE THIS ORIGINAL ARRAY. COLUMNS 19-24 AND   -  060600
CN                43-48 ALSO INFLUENCE THE DATA FROM CARD TYPES 17 AND   -  060700
CN                18 EXCEPT FOR THE DATA ON CARD TYPES 17 OR 18 THAT ARE -  060800
CN                GIVEN SPECIFICALLY AS A FUNCTION OF ENERGY GROUPS.     -  060900
C                                                                        -  061000
C-----------------------------------------------------------------------   061100
                                                                          061200
                                                                          061300
C-----------------------------------------------------------------------   061400
CR          DISTRIBUTED INITIAL FISSION SOURCE OR FLUX DATA (TYPE 17)    -  061500
C                                                                        -  061600
CL    FORMAT-----(I2,4X,I6,A6,I6,E12.5,2I6,E12.5,2I6)                    -  061700
C                                                                        -  061800
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  061900
CD    =======   ==========================================================  062000
CD    1-2       17                                                       -  062100
CD                                                                       -  062200
CD    7-12      PORTION OF REACTOR FOR WHICH DATA ARE GIVEN.             -  062300
CD              0...COLS. 13-18 CONTAIN A REGION LABEL.                  -  062400
CD              1...COLS. 13-18 CONTAIN AN AREA LABEL.                   -  062500
CD              2...COLS. 13-18 CONTAIN A ZONE LABEL.                    -  062600
CD                                                                       -  062700
CD    13-18     LABEL OF REGION, AREA, OR ZONE (REPEATED ON ADDITIONAL   -  062800
CD              TYPE 17 CARDS AS NECESSARY).                             -  062900
CD                                                                       -  063000
CD    19-24     TYPE OF PROBLEM FOR WHICH DATA ARE GIVEN.                -  063100
CD              0...QUANTITIES SPECIFIED APPLY TO BOTH REAL AND          -  063200
CD                  ADJOINT PROBLEMS.                                    -  063300
CD              1...QUANTITIES SPECIFIED APPLY TO REAL PROBLEMS ONLY.    -  063400
CD              2...QUANTITIES SPECIFIED TO ADJOINT PROBLEMS ONLY.       -  063500
CD                                                                       -  063600
CD    25-36     QUANTITY BEING SPECIFIED.                                -  063700
CD                                                                       -  063800
CD    37-42     HIGHER-ENERGY GROUP NUMBER TO WHICH QUANTITY SPECIFIED   -  063900
CD              IN COLS. 25-36 APPLIES.                                  -  064000
CD                                                                       -  064100
CD    43-48     LOWER-ENERGY GROUP NUMBER TO WHICH QUANTITY SPECIFIED    -  064200
CD              IN COLS. 25-36 APPLIES.                                  -  064300
CD                                                                       -  064400
CD    49-60     QUANTITY BEING SPECIFIED.                                -  064500
CD                                                                       -  064600
CD    61-66     HIGHER-ENERGY GROUP NUMBER TO WHICH QUANTITY SPECIFIED   -  064700
CD              IN COLS. 49-60 APPLIES.                                  -  064800
CD                                                                       -  064900
CD    67-72     LOWER-ENERGY GROUP NUMBER TO WHICH QUANTITY SPECIFIED    -  065000
CD              IN COLS. 49-60 APPLIES.                                  -  065100
CD                                                                       -  065200
CN              COLUMNS 19-24 ARE IGNORED UNLESS COLS. 19-24 OF CARDS    -  065300
CN              TYPE 03 SPECIFY BOTH REAL AND ADJOINT PROBLEMS.          -  065400
CN                                                                       -  065500
CN              THE QUANTITY SPECIFIED IS ASSIGNED TO EACH MESH          -  065600
CN              INTERVAL OF THE REGION, AREA, OR ZONE INDICATED. IF      -  065700
CN              COLS. 13-18 ARE BLANK, THE DATA ON THIS CARD ARE         -  065800
CN              APPLIED TO THE ENTIRE REACTOR. IF COLS. 37-42 ARE        -  065900
CN              BLANK, THE QUANTITY IN COLS. 25-36 IS MODIFIED           -  066000
CN              ACCORDING TO COLS. 19-24 OR COLS. 43-48 ON CARD TYPE     -  066100
CN              16, AND THE REMAINDER OF THE CARD IS IGNORED.            -  066200
CN                                                                       -  066300
CN              IF COLS. 43-48 AND/OR 67-72 ARE BLANK, THE QUANTITY      -  066400
CN              SPECIFIED IN COLS. 25-36 AND/OR 49-60 APPLIES TO THE     -  066500
CN              ENERGY GROUP IN COLS. 37-42 AND/OR 61-66.                -  066600
C                                                                        -  066700
C-----------------------------------------------------------------------   066800
                                                                          066900
                                                                          067000
C-----------------------------------------------------------------------   067100
CR          MESH-DISTRIBUTED INITIAL FISSION SOURCE OR FLUX DATA         -  067200
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CR          (TYPE 18)                                                   -  067300
C                                                                       -  067400
CL     FORMAT-----(I2,4X,3I6,4E12.5)                                    -  067500
C                                                                       -  067600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  067700
CD     =======   ==========================================================-  067800
CD     1-2       18                                                    -  067900
CD                                                                     -  068000
CD     7-12      TYPE OF PROBLEM FOR WHICH DATA ARE GIVEN.             -  068100
CD               0...QUANTITIES SPECIFIED APPLY TO BOTH REAL AND       -  068200
CD                     ADJOINT PROBLEMS.                               -  068300
CD               1...QUANTITIES SPECIFIED APPLY TO REAL PROBLEMS ONLY. -  068400
CD               2...QUANTITIES SPECIFIED APPLY TO ADJOINT PROBLEMS    -  068500
CD                     ONLY.                                           -  068600
CD                                                                     -  068700
CD     13-18     ENERGY GROUP NUMBER TO WHICH QUANTITIES SPECIFIED     -  068800
CD               APPLY (REPEATED ON ADDITIONAL TYPE 18 CARDS).         -  068900
CD                                                                     -  069000
CD     19-24     CARD NUMBER.                                          -  069100
CD                                                                     -  069200
CD     25-36     INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS, -  069300
CD               IN ORDER OF INCREASING "X" DIRECTION.                 -  069400
CD                                                                     -  069500
CD     37-48     INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS, -  069600
CD               IN ORDER OF INCREASING "X" DIRECTION.                 -  069700
CD                                                                     -  069800
CD     49-60     INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS, -  069900
CD               IN ORDER OF INCREASING "X" DIRECTION.                 -  070000
CD                                                                     -  070100
CD     61-72     INITIAL FISSION SOURCE OR FLUX DATA BY MESH INTERVALS, -  070200
CD               IN ORDER OF INCREASING "X" DIRECTION.                 -  070300
CD                                                                     -  070400
CN               COLUMNS 7-12 ARE IGNORED UNLESS COLS. 19-24 OF CARD   -  070500
CN               TYPE 03 SPECIFY BOTH REAL AND ADJOINT PROBLEMS.       -  070600
CN                                                                     -  070700
CN               IF COLS. 13-18 ARE BLANK, THE DATA ARE ASSIGNED TO ALL -  070800
CN               ENERGY GROUPS, AS MODIFIED BY COLS. 19-24 OR 43-48 ON -  070900
CN               CARD TYPE 16.                                         -  071000
CN                                                                     -  071100
CN               THE DATA ON CARD TYPE 18 OVERRIDE INITIAL DATA ON CARD -  071200
CN               TYPES 16 AND/OR 17. FOR EACH ENERGY GROUP OF DATA     -  071300
CN               BEING GIVEN ON CARD TYPE 18, THE ENTIRE SPACE MESH    -  071400
CN               MUST BE COVERED. THE SPACE MESH IS COVERED BY A SWEEP -  071500
CN               IN THE DIRECTION OF INCREASING "X" VALUES. COLUMNS    -  071600
CN               19-24 OF THE FIRST CARD FOR EACH ENERGY GROUP MUST BE -  071700
CN               1 TO INDICATE THE BEGINNING OF THE SWEEP. FOR         -  071800
CN               TWO-DIMENSIONAL GEOMETRIES, THE SWEEP PROCEEDS ACROSS -  071900
CN               THE FIRST ROW, THEN BEGINS ON A NEW CARD, PROCEEDING  -  072000
CN               IN THE DIRECTION OF INCREASING "X" VALUES AGAIN, FOR  -  072100
CN               EACH NEW ROW. CARD NUMBERS, IN COLS. 19-24, INCREASE  -  072200
CN               CONSECUTIVELY UNTIL THE MESH SWEEP IS COMPLETED.      -  072300
C                                                                      -  072400
C-----------------------------------------------------------------------  072500
                                                                          072600
                                                                          072700
C-----------------------------------------------------------------------  072800
CR          DISTRIBUTED ISOTROPIC INHOMOGENEOUS SOURCE DATA (TYPE 19)  -  072900
C                                                                      -  073000
CL     FORMAT-----(I2,4X,I6,A6,3I6,3E12.5)                              -  073100
C                                                                      -  073200
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  073300
CD     =======   ==========================================================-  073400
CD     1-2       19                                                    -  073500
CD                                                                     -  073600
CD     7-12      PORTION OF REACTOR FOR WHICH SOURCE IS GIVEN.         -  073700
CD               0...COLS 13-18 CONTAIN A REGION LABEL.                -  073800
CD               1...COLS 13-18 CONTAIN AN AREA LABEL.                 -  073900
CD               2...COLS 13-18 CONTAIN A ZONE LABEL.                  -  074000
CD                                                                     -  074100
CD     13-18     LABEL OF REGION, AREA OR ZONE (BLANK IF DATA ARE GIVEN -  074200
CD               BY MESH INTERVALS).                                   -  074300
CD                                                                     -  074400
CD     19-24     SPECTRUM DISTRIBUTION FOR DATA NOT GIVEN BY SPECIFIC  -  074500
CD               GROUP NUMBERS.                                        -  074600
CD               0...USE SPECIFIED SOURCE AS GIVEN.                    -  074700
CD               1...DISTRIBUTE SPECIFIED SOURCE INTO THE ENERGY GROUPS -  074800
CD                   USING FISSION SPECTRUM WEIGHTING AT EACH MESH     -  074900
CD                   POINT FOR A REAL PROBLEM, OR (NU SIGMA FISSION)   -  075000
CD                   SUB J SUMMATION OF J (NU SIGMA FISSION) SUB J     -  075100
CD                   WEIGHTING FOR GROUP J IN AN ADJOINT PROBLEM.      -  075200
CD                                                                     -  075300
CD     25-30     HIGHER-ENERGY GROUP NUMBER.                           -  075400
CD                                                                     -  075500
CD     31-36     LOWER-ENERGY GROUP NUMBER.                            -  075600
CD                                                                     -  075700
CD     37-48     ISOTROPIC SOURCE VALUE IN THE SPECIFIED MESH INTERVAL -  075800
CD               FOR THIS ENERGY RANGE.                                -  075900
CD                                                                     -  076000
CD     49-60     LOWER "X" DIRECTION COORDINATE OF MESH INTERVAL       -  076100
CD               CONTAINING THIS SOURCE.                               -  076200
CD                                                                     -  076300
CD     61-72     LOWER "Y" DIRECTION COORDINATE OF MESH INTERVAL       -  076400
CD               CONTAINING THIS SOURCE.                               -  076500
CD                                                                     -  076600
CN               IF COLS. 13-18 ARE BLANK, THE DATA IN COLS. 37-48 ARE -  076700
CN               PLACED IN THE ONE MESH INTERVAL REFERENCED BY COLS.   -  076800
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CN                49-60 AND 61-72. IF COLS. 13-18 ARE NONBLANK, COLS.     -  076900
CN                49-72 ARE IGNORED AND THE VALUE GIVEN IN COLS. 37-48    -  077000
CN                IS USED EVERYWHERE IN THE REGION, AREA, OR ZONE NAMED   -  077100
CN                IN COLS. 13-18.                                         -  077200
CN                                                                        -  077300
CN                IF COLS. 25-30 ARE BLANK, THE SOURCE VALUE APPLIES TO   -  077400
CN                ALL ENERGY GROUPS. IF COLS. 31-36 ARE BLANK, THE        -  077500
CN                SOURCE VALUE APPLIES TO THE GROUP SPECIFIED IN COLS.    -  077600
CN                25-30.                                                  -  077700
C                                                                         -  077800
C-------------------------------------------------------------------------  077900
                                                                           078000
                                                                           078100
C-------------------------------------------------------------------------  078200
CR          RUN-TIME CROSS SECTION MODIFIERS (TYPE 20)                    -  078300
C                                                                         -  078400
CL     FORMAT-----(I2,4X,A6,3I6,6X,2E12.5,2I6)                            -  078500
C                                                                         -  078600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                -  078700
CD     =======   ==========================================================-  078800
CD     1-2       20                                                      -  078900
CD                                                                        -  079000
CD     7-12      ISOTOPE LABEL.                                          -  079100
CD                                                                        -  079200
CD     13-18     CROSS SECTION TYPE BEING MODIFIED.                      -  079300
CD               1...TRANSPORT CROSS SECTION.                            -  079400
CD               2...RADIATIVE CAPTURE CROSS SECTION.                    -  079500
CD               3...(N,ALPHA) CROSS SECTION.                            -  079600
CD               4...(N,P) CROSS SECTION.                                -  079700
CD               5...FISSION CROSS SECTION.                              -  079800
CD               6...NUMBER OF FISSION NEUTRONS PER FISSION TIMES        -  079900
CD                   FISSION CROSS SECTION.                              -  080000
CD               7...ISOTROPIC ELASTIC SELF-SCATTERING CONSISTENT WITH   -  080100
CD                   ANISOTROPIC TOTAL CROSS SECTION.                    -  080200
CD               10...FISSION SPECTRUM FRACTION (CHI).                   -  080300
CD               70...INELASTIC SCATTERING CROSS SECTION FOR ALL         -  080400
CD                   LEGENDRE ORDERS.                                    -  080500
CD               71...INELASTIC SCATTERING CROSS SECTION FOR             -  080600
CD                   ISOTROPIC SCATTERING.                               -  080700
CD               72...INELASTIC SCATTERING CROSS SECTION FOR             -  080800
CD                   LINEAR ANISOTROPIC SCATTERING.                      -  080900
CD               80...ELASTIC SCATTERING CROSS SECTION FOR ALL           -  081000
CD                   LEGENDRE ORDERS.                                    -  081100
CD               81...ELASTIC SCATTERING CROSS SECTION FOR ISOTROPIC     -  081200
CD                   SCATTERING.                                         -  081300
CD               82...ELASTIC SCATTERING CROSS SECTION FOR LINEAR        -  081400
CD                   ANISOTROPIC SCATTERING.                             -  081500
CD               90...(N,2N) CROSS SECTION FOR ALL LEGENDRE ORDERS.      -  081600
CD               91...(N,2N) CROSS SECTION FOR ISOTROPIC SCATTERING.     -  081700
CD               92...(N,2N) CROSS SECTION FOR LINEAR ANISOTROPIC        -  081800
CD                   SCATTERING.                                         -  081900
CD                                                                        -  082000
CD     19-24     GROUP NUMBER IF1.                                       -  082100
CD                                                                        -  082200
CD     25-30     GROUP NUMBER IF2 (IF2.GE.IF1).                          -  082300
CD                                                                        -  082400
CD     37-48     CROSS SECTION MODIFIER CONSTANT A.                      -  082500
CD                                                                        -  082600
CD     49-60     CROSS SECTION MODIFIER CONSTANT B.                      -  082700
CD                                                                        -  082800
CD     61-66     GROUP NUMBER II1.                                       -  082900
CD                                                                        -  083000
CD     67-72     GROUP NUMBER II2 (II2.GE.II1).                          -  083100
CN                                                                        -  083200
CN               IF THE CROSS SECTION TYPE NUMBER IN COLS. 13-18 IS      -  083300
CN               .LE.10, THEN COLS. 61-72 (II1, II2) ARE NEGLECTED AND   -  083400
CN               THE CROSS SECTION TYPE SIGMA INDICATED IN COLS. 13-18   -  083500
CN               WILL BE MODIFIED TO THE VALUE NEW SIGMA ACCORDING TO    -  083600
CN               THE FORMULA                                             -  083700
CN                                                                        -  083800
CN               NEW SIGMA(G) = B + A*SIGMA(G),                          -  083900
CN               WHERE G IS THE GROUP INDEX.                             -  084000
CN                                                                        -  084100
CN               COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER FOR  -  084200
CN               WHICH CONSTANTS APPLY.                                  -  084300
CN                                                                        -  084400
CN               COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER FOR   -  084500
CN               WHICH CONSTANTS APPLY,                                  -  084600
CN                                                                        -  084700
CN               E.G., IF IF1 = 6, IF2 = 8,                              -  084800
CN                                                                        -  084900
CN               THEN,                                                   -  085000
CN                                                                        -  085100
CN               SIGMA FOR GROUPS 6,7,8 ARE MODIFIED USING THE           -  085200
CN               CONSTANTS A AND B.                                      -  085300
CN                                                                        -  085400
CN               IF COLS. 19-24 ARE BLANK, THE CONSTANTS GIVEN IN        -  085500
CN               COLS. 37-60 WILL BE APPLIED TO ALL ENERGY GROUPS.       -  085600
CN               IF COLS. 25-30 ARE BLANK, THE CONSTANTS WILL BE         -  085700
CN               APPLIED TO THE GROUP GIVEN IN COLS. 19-24.              -  085800
CN                                                                        -  085900
CN               IF THE CROSS SECTION TYPE NUMBER IN COLS. 13-18 IS      -  086000
CN               .GT.10, THEN THE SCATTERING MATRIX IS MODIFIED          -  086100
CN               ACCORDING TO THE SAME ALGORITHM,                        -  086200
CN                                                                        -  086300
CN               NEW SIGMA(G TO G PRIME) = B + A*SIGMA(G TO G PRIME).    -  086400
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Leakage DB2 accounts for scattering

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CN                                                                      -  086500
CN              IN THIS CASE,                                           -  086600
CN              COLS. 19-24: IF1 IS THE HIGHER-ENERGY FINAL GROUP       -  086700
CN              NUMBER OF THE SCATTERED PARTICLES FOR WHICH CONSTANTS   -  086800
CN              APPLY.                                                  -  086900
CN                                                                      -  087000
CN              COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER OF    -  087100
CN              THE SCATTERED PARTICLES FOR WHICH CONSTANTS APPLY.      -  087200
CN                                                                      -  087300
CN              COLS. 61-66: II1 IS THE HIGHER-ENERGY INITIAL GROUP     -  087400
CN              NUMBER OF THE INCIDENT PARTICLES FOR WHICH CONSTANTS    -  087500
CN              APPLY.                                                  -  087600
CN                                                                      -  087700
CN              COLS. 67-72: II2 IS THE LOWER-ENERGY INITIAL GROUP      -  087800
CN              NUMBER OF THE INCIDENT PARTICLES FOR WHICH CONSTANTS    -  087900
CN              APPLY,                                                  -  088000
CN                                                                      -  088100
CN              E.G., IF IF1 = 3, IF2 = 5, II1 = 4, II2 = 5,            -  088200
CN                                                                      -  088300
CN              THEN,                                                   -  088400
CN                                                                      -  088500
CN              SIGMA(4 TO 3), SIGMA(4 TO 4), SIGMA(4 TO 5),            -  088600
CN              SIGMA(5 TO 3), SIGMA(5 TO 4), SIGMA(5 TO 5)             -  088700
CN              ARE MODIFIED.                                           -  088800
CN                                                                      -  088900
CN              IF COLS. 61-66 ARE BLANK, THE CONSTANTS GIVEN IN COLS.  -  089000
CN              37-60 WILL BE APPLIED TO ALL GROUPS OF INCIDENT         -  089100
CN              PARTICLES. IF COLS. 67-72 ARE BLANK, THE CONSTANTS      -  089200
CN              WILL BE APPLIED TO THE GROUP GIVEN IN COLS. 61-66. IF   -  089300
CN              COLS. 19-24 ARE BLANK, THE CONSTANTS WILL BE APPLIED    -  089400
CN              FOR A SINGLE GROUP DOWNSCATTER FOR THE GROUPS AS        -  089500
CN              SPECIFIED IN COLS. 61-72,                               -  089600
CN                                                                      -  089700
CN              SIGMA(II1 TO II1+1), SIGMA(II1+1 TO II1+2),..., SIGMA   -  089800
CN              (II2 TO II2+1).                                         -  089900
CN                                                                      -  090000
CN              IF COLS. 25-30 ARE BLANK THE CONSTANTS WILL BE APPLIED  -  090100
CN              TO THE GROUP OF SCATTERED PARTICLES GIVEN IN COLS.      -  090200
CN              19-24.                                                  -  090300
CN                                                                      -  090400
CN              IF THE FISSION SPECTRUM FRACTION CHI IS BEING           -  090500
CN              MODIFIED, X=10, THEN THE ALGORITHM USED WILL DEPEND     -  090600
CN              UPON WHETHER CHI IS A VECTOR OR MATRIX QUANTITY.        -  090700
CN              THE CHI VECTOR IS MODIFIED ACCORDING TO THE ALGORITHM   -  090800
CN                                                                      -  090900
CN              NEW CHI(G) = B + A*CHI(G),                              -  091000
CN                                                                      -  091100
CN              WHERE G IS THE GROUP INDEX, B AND A ARE GIVEN BY COLS.  -  091200
CN              49-60 AND 37-48 RESPECTIVELY AND                        -  091300
CN                                                                      -  091400
CN              COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER FOR  -  091500
CN              WHICH CONSTANTS APPLY.                                  -  091600
CN                                                                      -  091700
CN              COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP FOR WHICH    -  091800
CN              CONSTANTS APPLY.                                        -  091900
CN                                                                      -  092000
CN              IF COLS. 19-24 ARE BLANK, THE CONSTANTS GIVEN IN COLS.  -  092100
CN              37-60 WILL BE APPLIED TO ALL ENERGY GROUPS. IF COLS.    -  092200
CN              25-30 ARE BLANK, THE CONSTANTS WILL BE APPLIED TO THE   -  092300
CN              GROUP GIVEN IN COLS. 19-24.                             -  092400
CN                                                                      -  092500
CN              THE CHI MATRIX IS MODIFIED ACCORDING TO THE ALGORITHM   -  092600
CN                                                                      -  092700
CN              NEW CHI(G PRIME TO G) = B + A*CHI(G PRIME TO G).        -  092800
CN                                                                      -  092900
CN              IN THIS CASE,                                           -  093000
CD                                                                      -  093100
CN              COLS. 19-24: IF1 IS THE HIGHER-ENERGY GROUP NUMBER OF   -  093200
CN              SOURCE NEUTRONS FOR WHICH CONSTANTS APPLY.              -  093300
CN                                                                      -  093400
CN              COLS. 25-30: IF2 IS THE LOWER-ENERGY GROUP NUMBER OF    -  093500
CN              SOURCE NEUTRONS FOR WHICH CONSTANTS APPLY.              -  093600
CN                                                                      -  093700
CN              COLS. 61-66: II1 IS THE HIGHER-ENERGY GROUP NUMBER OF   -  093800
CN              ABSORBED NEUTRONS FOR WHICH CONSTANTS APPLY.            -  093900
CN                                                                      -  094000
CN              COLS. 67-72: II2 IS THE LOWER-ENERGY GROUP NUMBER OF    -  094100
CN              ABSORBED NEUTRONS FOR WHICH CONSTANTS APPLY.            -  094200
CN                                                                      -  094300
CN              E.G., IF IF1 = 3, IF2 = 5, II1 = 4, II2 = 5,            -  094400
CN                                                                      -  094500
CN              THEN,                                                   -  094600
CN                                                                      -  094700
CN              CHI(4 TO 3), CHI(4 TO 4), CHI(4 TO 5), CHI(5 TO 3),     -  094800
CN              CHI(5 TO 4), CHI(5 TO 5)  ARE MODIFIED.                 -  094900
CN                                                                      -  095000
CN              IF COLS 61-66 ARE BLANK, THE CONSTANTS GIVEN IN COLS.   -  095100
CN              37-60 WILL BE APPLIED TO ALL GROUPS OF ABSORBED         -  095200
CN              PARTICLES. IF COLS. 67-72 ARE BLANK, THE CONSTANTS      -  095300
CN              WILL BE APPLIED TO THE GROUP GIVEN IN COLS. 61-66. IF   -  095400
CN              COLS. 19-24 ARE BLANK, THE CONSTANTS WILL BE APPLIED    -  095500
CN              TO ALL GROUPS OF SOURCE NEUTRONS. IF COLS. 25-30 ARE    -  095600
CN              BLANK, THE CONSTANTS WILL BE APPLIED TO THE GROUP       -  095700
CN              GIVEN IN COLS. 19-24.                                   -  095800
CN                                                                      -  095900
CN              IN ORDER TO MODIFY THE CHI FISSION SPECTRUM FRACTION    -  096000
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CN                OF THE CROSS SECTION SET, THE ISOTOPE LABEL GIVEN IN   -  096100
CN                COLS. 7-12 MUST READ SETCHI. THE SAME RULES AS GIVEN   -  096200
CN                ABOVE APPLY DEPENDING UPON WHETHER THE SET CHI IS A    -  096300
CN                VECTOR OR MATRIX.                                      -  096400
CN                                                                       -  096500
CN                IT IS NOT POSSIBLE TO MODIFY A NON-FISSIONABLE ISOTOPE -  096600
CN                WITH MODIFIER TYPES 5, 6 OR 10.                        -  096700
CN                                                                       -  096800
CN                THE SCATTERING BAND WIDTH AT ANY ENERGY CANNOT BE      -  096900
CN                MODIFIED.                                              -  097000
CN                                                                       -  097100
CN                THE TYPE 20 CARDS ARE PROCESSED SEQUENTIALLY AND       -  097200
CN                MODIFICATIONS SPECIFIED ARE CUMULATIVE.                -  097300
CN                                                                       -  097400
CN                THE FISSION SPECTRUM STRUCTURE OF THE DATA SET MAY NOT -  097500
CN                BE MODIFIED. THUS IF A PARTICULAR ISOTOPE USES THE     -  097600
CN                SET CHI, AN ISOTOPE CHI MAY NOT BE SPECIFIED FOR THIS  -  097700
CN                ISOTOPE. SIMILARLY, A VECTOR MAY NOT BE EXPANDED INTO  -  097800
CN                A MATRIX AND VICE VERSA.                               -  097900
C                                                                        -  098000
C-----------------------------------------------------------------------   098100
                                                                            098200
                                                                            098300
C-----------------------------------------------------------------------   098400
C                                                                        -  098500
CR          SEARCH MODIFIERS (TYPE 21)                                   -  098600
C                                                                        -  098700
CL     FORMAT-----(I2,10X,2I6,2E12.5)                                    -  098800
C                                                                        -  098900
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  099000
CD     =======   ==================================================     -  099100
CD     1-2       21                                                     -  099200
C                                                                        -  099300
CD     13-18     TYPE OF PRESCRIBED VARIABLE.                           -  099400
CD               0...SEARCH TO OBTAIN A PRESCRIBED KEFF.                -  099500
CD               1...SEARCH TO OBTAIN A PRESCRIBED ALPHA.               -  099600
CD                                                                      -  099700
CD     19-24     MAXIMUM NUMBER OF SEARCH PASSES.                       -  099800
CD                                                                      -  099900
CD     25-36     PRESCRIBED KEFF, KEFF(0) OR ALPHA, ALPHA(0).           -  100000
CD                                                                      -  100100
CD     37-48     CONVERGENCE CRITERION, EPSILON, FOR CURRENT VALUE OF   -  100200
CD               KEFF OR ALPHA:                                         -  100300
CD                                                                      -  100400
CD               ABSOLUTE VALUE OF ((KEFF-KEFF(0)) / KEFF(0)).LE.       -  100500
CD               EPSILON OR THE ABSOLUTE VALUE OF (ALPHA-ALPHA(0) /     -  100600
CD               ALPHA(0)).LE.EPSILON.                                  -  100700
CD                                                                      -  100800
CN               IF COLS. 13-18 ARE 0, A BLANK IN COLS. 25-36 IMPLIES   -  100900
CN               1.0 FOR THE PRESCRIBED KEFF.                           -  101000
C                                                                       -  101100
C-----------------------------------------------------------------------   101200
                                                                            101300
                                                                            101400
C-----------------------------------------------------------------------   101500
CR          SEARCH PARAMETERS (TYPE 22)                                  -  101600
C                                                                        -  101700
CL     FORMAT-----(I2,10X,4E12.5)                                        -  101800
C                                                                        -  101900
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  102000
CD     =======   ==================================================     -  102100
CD     1-2       22                                                     -  102200
CD                                                                      -  102300
CD     13-24     INITIAL VALUE OF X.                                    -  102400
CD                                                                      -  102500
CD     25-36     SECOND VALUE OF X (IGNORED IF COLS. 61-72 ARE          -  102600
CD               NON-ZERO).                                             -  102700
CD                                                                      -  102800
CD     37-48     LOWER BOUND FOR X.                                     -  102900
CD                                                                      -  103000
CD     49-60     UPPER BOUND FOR X.                                     -  103100
CD                                                                      -  103200
CD     61-72     DERIVATIVE OF KEFF WITH RESPECT TO X (OR ALPHA WITH    -  103300
CD               RESPECT TO X).                                         -  103400
CD                                                                      -  103500
CN               GENERAL SEARCH EXPRESSION:                             -  103600
CN               P(X) = P(0) + X * M,                                   -  103700
CN               WHERE P IS THE QUANTITY BEING VARIED, X IS THE SEARCH  -  103800
CN               PARAMETER, AND M IS THE QUANTITY MODIFIER OBTAINED     -  103900
CN               FROM INFORMATION CONTAINED ON CARD TYPE 23, 24, 25 OR  -  104000
CN               26.                                                    -  104100
C                                                                       -  104200
C-----------------------------------------------------------------------   104300
                                                                            104400
                                                                            104500
C-----------------------------------------------------------------------   104600
CR          COMPOSITION MODIFIERS FOR CRITICALITY SEARCH (TYPE 23)       -  104700
C                                                                        -  104800
CL     FORMAT-----(I2,4X,11A6)                                           -  104900
C                                                                        -  105000
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY               -  105100
CD     =======   ==================================================     -  105200
CD     1-2       23                                                     -  105300
CD                                                                      -  105400
CD     7-12      COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  105500
CD               TO BE USED AS THE MODIFIER M IN THE SEARCH FORMULA.    -  105600
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CD                                                                      -  105700
CD      13-18       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  105800
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  105900
CD                                                                         -  106000
CD      19-24       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  106100
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  106200
CD                                                                         -  106300
CD      25-30       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  106400
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  106500
CD                                                                         -  106600
CD      31-36       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  106700
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  106800
CD                                                                         -  106900
CD      37-42       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  107000
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  107100
CD                                                                         -  107200
CD      43-48       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  107300
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  107400
CD                                                                         -  107500
CD      49-54       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  107600
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  107700
CD                                                                         -  107800
CD      55-60       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  107900
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  108000
CD                                                                         -  108100
CD      61-66       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  108200
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  108300
CD                                                                         -  108400
CD      67-72       COMPOSITION LABEL OF COMPOSITION (FROM CARD TYPE 14)   -  108500
CD                  WITH WHICH MODIFIER COMPOSITION IS TO BE USED.         -  108600
CD                                                                         -  108700
CN                  IN THE SEARCH FORMULA P(X) = P(0) + X * M, P(X), P(0), -  108800
CN                  AND M ARE MACROSCOPIC CROSS SECTIONS. P(0) AND M ARE   -  108900
CN                  OBTAINED FROM THE DATA ON CARD TYPE 14, WITH CARD TYPE -  109000
CN                  23 SELECTING THOSE COMPOSITIONS ON CARD TYPE 14 TO BE  -  109100
CN                  USED IN PRODUCING THE M.                               -  109200
C                                                                          -  109300
C-------------------------------------------------------------------------   109400
                                                                            109500
                                                                            109600
C-------------------------------------------------------------------------   109700
CR            MESH MODIFIERS FOR CRITICALITY SEARCH (TYPE 24)              -  109800
C                                                                          -  109900
CL      FORMAT-----(I2,9X,A1,3E12.5)                                       -  110000
C                                                                          -  110100
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY                -  110200
CD      =======   ==========================================================-  110300
CD      1-2       24                                                       -  110400
CD                                                                         -  110500
CD      12        COORDINATE DIRECTION.                                    -  110600
CD                X..."X" COORDINATE DIRECTION.                            -  110700
CD                Y..."Y" COORDINATE DIRECTION.                            -  110800
CD                                                                         -  110900
CD      13-24     LOWER COORDINATE.                                        -  111000
CD                                                                         -  111100
CD      25-36     UPPER COORDINATE.                                        -  111200
CD                                                                         -  111300
CD      37-48     MESH MODIFIER, M, FOR EACH MESH INTERVAL BETWEEN         -  111400
CD                THE ABOVE COORDINATES.                                   -  111500
CD                                                                         -  111600
CN                IN THE SEARCH FORMULA, P(X) IS THE RESULTING MESH        -  111700
CN                INTERVAL, P(0) IS THE INITIAL MESH INTERVAL, AND         -  111800
CN                M IS THE MESH INTERVAL MODIFIER.                         -  111900
C                                                                          -  112000
C-------------------------------------------------------------------------   112100
                                                                            112200
                                                                            112300
C-------------------------------------------------------------------------   112400
CR            BUCKLING MODIFIERS FOR CRITICALITY SEARCH (TYPE 25)          -  112500
C                                                                          -  112600
CL      FORMAT-----(I2,4X,A6,2F12.5)                                       -  112700
C                                                                          -  112800
CD      COLUMNS             CONTENTS...IMPLICATIONS, IF ANY                -  112900
CD      =======   ==========================================================-  113000
CD      1-2       25                                                       -  113100
CD                                                                         -  113200
CD      7-12      REGION LABEL.                                            -  113300
CD                                                                         -  113400
CD      13-24     BUCKLING MODIFIER, M, IN FIRST TRANVERSE DIRECTION.      -  113500
CD                                                                         -  113600
CD      25-36     BUCKLING MODIFIER, M, IN SECOND TRANVERSE DIRECTION.     -  113700
CD                                                                         -  113800
CN                IN THE SEARCH FORMULA, P(X) IS THE RESULTING BUCKLING, -  113900
CN                P(0) IS THE INITIAL BUCKLING, AND M IS THE               -  114000
CN                BUCKLING MODIFIER. P(0) WILL BE EVALUATED FROM           -  114100
CN                THE TRANSVERSE HEIGHTS GIVEN ON CARD TYPE 12.            -  114200
CN                                                                         -  114300
CN                IF COLS. 7-12 ARE BLANK, THE DATA IN COLS. 13-36 APPLY -  114400
CN                TO ALL REGIONS OF THE REACTOR.                           -  114500
C                                                                          -  114600
C-------------------------------------------------------------------------   114700
                                                                            114800
                                                                            114900
C-------------------------------------------------------------------------   115000
CR            ALPHA MODIFIER FOR CRITICALITY SEARCH (TYPE 26)              -  115100
C                                                                          -  115200
```

```
CL     FORMAT-----(I2,10X,E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        26
CD
CD     13-24      ALPHA MODIFIER, M.
CD
CN                IN THE SEARCH FORMULA, P(X) IS THE RESULTING ALPHA,
CN                P(0) IS THE INITITAL ALPHA, AND M IS THE ALPHA
CN                MODIFIER. P(0) IS OBTAINED FROM COLS.
CN                60-72 OF CARD TYPE 03.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          INHOMOGENEOUS SURFACE SOURCE SPECTRUM SPECIFICATION
CR          (TYPE 27)
C
CL     FORMAT-----(I2,4X,A6,6X,2I6,3E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        27
CD
CD     7-12       SURFACE SOURCE LABEL.
CD
CD     19-24      HIGHER ENERGY GROUP NUMBER.
CD
CD     25-30      LOWER ENERGY GROUP NUMBER.
CD
CD     37-48      ISOTROPIC COMPONENT OF SURFACE SOURCE.
CD
CD     49-60      ANISOTROPIC "X" DIRECTION COMPONENT OF SURFACE SOURCE.
CD
CD     61-72      ANISOTROPIC "Y" DIRECTION COMPONENT OF SURFACE SOURCE.
CD
CN                CARD TYPE 27 IS PERTINENT ONLY FOR TRANSPORT
CN                THEORY CALCULATIONS.
CN
CN                THE SURFACE SOURCE IS ASSUMED TO BE REPRESENTABLE BY
CN                A LEGENDRE EXPANSION FOR SPERICAL AND SLAB
CN                GEOMETRY AND BY A SURFACE HARMONIC EXPANSION FOR
CN                ALL OTHER GEOMETRIES. IN EACH CASE, THE
CN                EXPANSION IS TRUNCATED AFTER THE FIRST ORDER TERMS.
CN                FOR SPHERICAL AND SLAB GEOMETRY THE SURFACE SOURCE IS
CN                TAKEN TO BE S0+3*MU*S1 AND FOR ALL OTHER CASES
CN                S0+3*MU*S1+3*ETA*S2, WHERE S0, S1, AND S2 ARE GIVEN
CN                RESPECTIVELY IN COLS. 37-48, 49-60, AND 61-72. MU AND
CN                ETA ARE RESPECTIVELY THE DIRECTION COSINES IN THE
CN                "X" AND "Y" DIRECTIONS OF THE DISCRETE ANGLE BEING
CN                CONSIDERED.
CN
CN                IF COLS. 7-12 ARE BLANK, THE DATA ON THIS CARD WILL BE
CN                APPLIED TO ALL SOURCES SPECIFIED ON TYPE 28 CARDS.
CN
CN                IF COLS. 19-24 ARE BLANK, THE SURFACE SOURCE VALUES
CN                APPLY TO ALL ENERGY GROUPS. IF COLS. 25-30 ARE BLANK,
CN                THE SURFACE SOURCE VALUES APPLY TO THE GROUP SPECIFIED
CN                IN COLS. 19-24.
CN
CN                COLS. 61-72 ARE PERTINENT FOR TWO-DIMENSIONAL PROBLEMS
CN                AND FOR ONE-DIMENSIONAL CYLINDRICAL PROBLEMS.
CN
CN                AS MANY TYPE 27 CARDS AS NECESSARY ARE USED.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          INHOMOGENEOUS SURFACE SOURCE GEOMETRY DATA (TYPE 28)
C
CL     FORMAT-----(I2,4X,A6,5X,A1,6X,3E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======    ==========================================================
CD     1-2        28
CD
CD     7-12       SURFACE SOURCE LABEL.
CD
CD     18         COORDINATE DIRECTION.
CD                X..."X" COORDINATE DIRECTION.
CD                Y..."Y" COORDINATE DIRECTION.
CD
CD     25-36      LOWER COORDINATE OF SPECIFIED COORDINATE DIRECTION.
CD
CD     37-48      UPPER COORDINATE OF SPECIFIED COORDINATE DIRECTION.
CD
CD     49-60      "Y" COORDINATE ALONG WHICH THE "X" COORDINATE
CD                DIRECTION LIES.
CD                "X" COORDINATE ALONG WHICH THE "Y" COORDINATE
CD                DIRECTION LIES.
CD                FOR ONE DIMENSIONAL PROBLEMS, "X" COORDINATE OF
CD                THE SURFACE SOURCE.
CD
```

Not needed

Not needed

```
CN                CARD TYPE 28 IS PERTINENT ONLY FOR TRANSPORT          -  124900
CN                THEORY CALCULATIONS.                                  -  125000
CN                                                                      -  125100
CN                THE SURFACE SOURCE SPECIFIED BY THE CORRESPONDING     -  125200
CN                SURFACE SOURCE LABEL IN COLS. 7-12 OF CARD TYPE 27    -  125300
CN                WILL BE PLACED ON THE MESH LINE SPECIFIED.            -  125400
CN                FOR ONE-DIMENSIONAL PROBLEMS, COLS. 19-48 ARE         -  125500
CN                IRRELEVANT. IN THIS CASE COLS. 49-60 SPECIFY THE "X"  -  125600
CN                COORDINATE OF THE ONE-DIMENSIONAL SURFACE SOURCE AND  -  125700
CN                COL. 18 SHOULD CONTAIN Y. FOR TWO-DIMENSIONAL         -  125800
CN                PROBLEMS ALL COLUMNS ARE RELEVANT. THE COORDINATE     -  125900
CN                SPECIFIED MUST COINCIDE WITH A MESH LINE THAT BOUNDS  -  126000
CN                A MESH INTERVAL.                                      -  126100
CN                                                                      -  126200
CN                FOR TWO-DIMENSIONAL PROBLEMS, IF COLS. 25-36 ARE      -  126300
CN                BLANK, THE SPECIFIED SURFACE SOURCE IS PLACED ALONG   -  126400
CN                THE ENTIRE MESH LINE AS SPECIFIED IN COLS. 49-60. IF  -  126500
CN                COLS. 37-48 ARE BLANK, THE SURFACE SOURCE IS PLACED   -  126600
CN                ALONG THE SINGLE MESH INTERVAL LENGTH FOR WHICH COLS. -  126700
CN                25-36 SPECIFY THE LOWER DIMENSION.                    -  126800
CN                                                                      -  126900
CN                IF COLS. 49-60 ARE BLANK, THE SURFACE SOURCE IS PLACED -  127000
CN                ALONG THE HIGHEST "X" OR "Y" COORDINATE OF THE SYSTEM -  127100
CN                FOR TWO-DIMENSIONAL PROBLEMS OR AT THE HIGHEST        -  127200
CN                COORDINATE FOR ONE-DIMENSIONAL PROBLEMS.              -  127300
CN                                                                      -  127400
CN                AS MANY TYPE 28 CARDS AS NECESSARY ARE USED.          -  127500
C                                                                       -  127600
C-----------------------------------------------------------------------   127700
                                                                          127800
CEOF                                                                      127900
```

```
C*********************************************************************   000100
C                                                                     -  000200
C                       PREPARED 3/16/71 AT ANL                       -  000300
C                                                                     -  000400
CF          A.NIP.P                                                   -  000500
CE          GENERAL INPUT FOR PERTURBATION MODULES FOR PERTURBATION   -  000600
CE          WITHIN MODULE.                                            -  000700
C                                                                     -  000800
CN                      THIS DATA SET IS A SUBSET OF DATA SET A.NIP   -  000900
CN                      USED TO SPECIFY PERTURBATIONS IN FINITE       -  001000
CN                      GEOMETRY TRANSVERSE DISTANCES OR IN           -  001100
CN                      COMPOSITION AND REGION ASSIGNMENTS.           -  001200
CN                                                                    -  001300
CN                      THE FORMATS OF THE REQUIRED CARDS FOR THIS    -  001400
CN                      DATA SET ARE IDENTICAL TO THOSE OF THE        -  001500
CN                      CORRESPONDING CARDS OF DATA SET A.NIP.        -  001600
CN                                                                    -  001700
CN                      ONE CARD CONTAINING THE PROBLEM TITLE (TYPE 01)-  001800
CN                      IS ALLOWED; ANY NUMBER OF FINITE-GEOMETRY     -  001900
CN                      TRANSVERSE DISTANCES (TYPE 12) CARDS AND/OR   -  002000
CN                      COMPOSITION AND REGION ASSIGNMENTS (TYPE 15)  -  002100
CN                      CARDS MAY BE SPECIFIED. NO OTHER CARDS SHOULD -  002200
CN                      BE PRESENT.                                   -  002300
C                                                                     -  002400
C*********************************************************************   002500
                                                                          002600
CEOF                                                                      002700
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 1/20/71 AT ANL                     -
C                                                                    -
CF          A.OUTMAN                                                 -
CE          OUTPUT MANIPULATION MODULE-DEPENDENT INPUT               -
C                                                                    -
CN                        THIS IS A USER SUPPLIED BCD DATA SET.      -
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS -
CN                        OF THE BCD FORMAT OF THE DATA SET.         -
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD      -
CN                        TYPE NUMBER.                               -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 01)                                 -
C                                                                    -
CL     FORMAT-----(I2,4X,6I6)                                        -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY           -
CD     =======      ==================================================-
CD     1-2          01                                               -
CD                                                                   -
CD     7-12         NORMALIZATION REQUEST.                           -
CD                  0...NO FLUX NORMALIZATION (DEFAULT).             -
CD                  1...POWER NORMALIZATION.                         -
CD                  2...UNIT FISSION NORMALIZATION.                  -
CD                                                                   -
CD     13-18        TERMINATION AND OUTPUT FLAG.                     -
CD                  .LT.0...DATA SET FR.PN NOT TO BE WRITTEN.        -
CD                  0...WRITE DATA SET FR.PN AND CHECK PARAMETERS IN -
CD                      COLS. 19-24 FOR TERMINATION INSTRUCTIONS (DEFAULT).-
CD                  1...WRITE DATA SET FR.PN, THEN TERMINATE MODULE  -
CD                      EXECUTION.                                   -
CD                                                                   -
CD     19-24        OUTPUT EDIT FLAG.                                -
CD                  0...NO OUTPUT EDITS.                             -
CD                  1...COMPLETE OUTPUT EDITS (DEFAULT).             -
CD                                                                   -
CD     25-30        POINTR DEBUGGING EDIT.                           -
CD                  0...NO DEBUGGING PRINTOUT (DEFAULT).             -
CD                  1...DEBUGGING DUMP PRINTOUT.                     -
CD                  2...DEBUGGING TRACE PRINTOUT.                    -
CD                  3...FULL DEBUGGING PRINTOUT.                     -
CD                                                                   -
CD     31-36        SIZE OF MAIN CORE STORAGE ARRAY IN REAL*8 WORDS  -
CD                  (DEFAULT=60000).                                 -
CD                                                                   -
CD     37-42        SIZE OF BULK CORE STORAGE ARRAY IN REAL*8 WORDS  -
CD                  (DEFAULT=120000).                                -
CD                                                                   -
CD                  IF COLS. 7-12 ARE SPECIFIED AS 1, TYPE 02 CARD IS -
CD                  REQUIRED INPUT.                                  -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          NORMALIZATION SPECIFICATIONS (TYPE 02)                   -
C                                                                    -
CL     FORMAT-----(I2,4X,2E12.6)                                     -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY           -
CD     =======      ==================================================-
CD     1-2          02                                               -
CD                                                                   -
CD     7-18         POWER TO WHICH FLUXES ARE TO BE NORMALIZED (WATTS).-
CD                                                                   -
CD     19-30        POWER NORMALIZATION FACTOR (DEFAULT=3.1E+10).    -
CD                                                                   -
CD                  IF COLS. 7-12 OF THE TYPE 01 CARD ARE SPECIFIED AS 1, -
CD                  FLUXES ARE NORMALIZED TO THE POWER SPECIFIED IN  -
CD                  COLS. 7-18 OF THIS CARD.                         -
C                                                                    -
C--------------------------------------------------------------------

CEOF
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```
C*********************************************************************  000100
C                                                                     -  000200
C                          PREPARED 1/26/71 AT ANL                    -  000300
C                                                                     -  000400
CF          A.PDIF1D                                                  -  000500
CE          ONE-DIMENSIONAL DIFFUSION THEORY STANDARD PATH BCD INPUT  -  000600
C                                                                     -  000700
CN                         THIS IS A USER-SUPPLIED BCD DATA SET.      -  000800
CN                         THE LIST FOR EACH RECORD IS GIVEN IN TERMS -  000900
CN                         OF THE BCD FORMAT OF THE DATA CARD.        -  001000
CN                         COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE -  001100
CN                         NUMBER.                                    -  001200
C                                                                     -  001300
C*********************************************************************  001400
                                                                          001500
                                                                          001600
C---------------------------------------------------------------------  001700
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                  -  001800
C                                                                     -  001900
CL     FORMAT-----(I2,4X,4I6)                                         -  002000
C                                                                     -  002100
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY            -  002200
CD     =======   ==========================================          -  002300
CD     1-2       01                                                   -  002400
CD                                                                    -  002500
CD     7-12      1...EDIT ALL DATA SETS USED BY MODULE NUC001.        -  002600
CD               4...NO EDIT OF DATA SETS.                            -  002700
CD                                                                    -  002800
CD     13-18     0...NO INVENTORY CALCULATION (DEFAULT).              -  002900
CD               1...DO INVENTORY CALCULATION.                        -  003000
CD                                                                    -  003100
CD     19-24     0...NO OUTPUT MANIPULATION CALCULATION (DEFAULT).    -  003200
CD               1...DO OUTPUT MANIPULATION CALCULATION.              -  003300
CD                                                                    -  003400
CD     25-30     0...DIFFUSION THEORY CALCULATION REQUIRED (DEFAULT). -  003500
CD               1...NO DIFFUSION THEORY CALCULATION REQUIRED.        -  003600
C                                                                     -  003700
C---------------------------------------------------------------------  003800
                                                                          003900
CEOF                                                                      004000
```

```
C*********************************************************************  000100
C                                                                     -  000200
C                          PREPARED 1/26/71 AT ANL                    -  000300
C                                                                     -  000400
CF          A.PDIF2D                                                  -  000500
CE          TWO-DIMENSIONAL DIFFUSION THEORY STANDARD PATH BCD INPUT  -  000600
C                                                                     -  000700
CN                         THIS IS A USER-SUPPLIED BCD DATA SET.      -  000800
CN                         THE LIST FOR EACH RECORD IS GIVEN IN TERMS -  000900
CN                         OF THE BCD FORMAT OF THE DATA CARD.        -  001000
CN                         COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE -  001100
CN                         NUMBER.                                    -  001200
C                                                                     -  001300
C*********************************************************************  001400
                                                                          001500
                                                                          001600
C---------------------------------------------------------------------  001700
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                  -  001800
C                                                                     -  001900
CL     FORMAT-----(I2,4X,2I6,6X,I6)                                   -  002000
C                                                                     -  002100
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY            -  002200
CD     =======   ==========================================          -  002300
CD     1-2       01                                                   -  002400
CD                                                                    -  002500
CD     7-12      1...EDIT ALL DATA SETS USED BY MODULE NUC001.        -  002600
CD               4...NO EDIT OF DATA SETS.                            -  002700
CD                                                                    -  002800
CD     13-18     0...NO INVENTORY CALCULATION (DEFAULT).              -  002900
CD               1...DO INVENTORY CALCULATION.                        -  003000
CD                                                                    -  003100
CD     25-30     0...DIFFUSION THEORY CALCULATION REQUIRED (DEFAULT). -  003200
CD               1...NO DIFFUSION THEORY CALCULATION REQUIRED.        -  003300
C                                                                     -  003400
C---------------------------------------------------------------------  003500
                                                                          003600
CEOF                                                                      003700
```

```
C*********************************************************************-  000100
C                                                                     -  000200
C                          PREPARED 1/26/71 AT ANL                    -  000300
C                                                                     -  000400
CF          A.PERT                                                    -  000500
CE          ONE- AND TWO-DIMENSIONAL DIFFUSION PERTURBATION           -  000600
CE          MODULE-DEPENDENT BCD INPUT                                -  000700
C                                                                     -  000800
CN                         THIS IS A USER-SUPPLIED BCD DATA SET.      -  000900
CN                         THE LIST FOR EACH RECORD IS GIVEN IN TERMS -  001000
CN                         OF THE BCD FORMAT OF THE DATA CARD. COLUMNS -  001100
CN                         1-2 NORMALLY CONTAIN THE CARD TYPE NUMBER. -  001200
CN                                                                    -  001300
CN                         CARD TYPES 01 AND 02 ARE REQUIRED. BLANK   -  001400
CN                         OR ZERO FIELDS PRODUCE DEFAULT VALUES.     -  001500
C                                                                     -  001600
C*********************************************************************-  001700
                                                                         001800
                                                                         001900
C-------------------------------------------------------------------------  002000
CR          PROBLEM TITLE (TYPE 01)                                   -  002100
C                                                                     -  002200
CL    FORMAT-----(I2,10X,10A6)                                        -  002300
C                                                                     -  002400
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  002500
CD    =======    ==========================================================-  002600
CD    1-2        01                                                    -  002700
CD                                                                    -  002800
CD    13-72      ANY ALPHANUMERIC CHARACTERS.                          -  002900
C                                                                     -  003000
C-------------------------------------------------------------------------  003100
                                                                         003200
                                                                         003300
C-------------------------------------------------------------------------  003400
CR          PROBLEM OPTIONS (TYPE 02)                                 -  003500
C                                                                     -  003600
CL    FORMAT-----(I2,10X,6I6)                                         -  003700
C                                                                     -  003800
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  003900
CD    =======    ==========================================================-  004000
CD    1-2        02                                                    -  004100
CD                                                                    -  004200
CD    13-18      POINTR DEBUGGING EDIT.                                -  004300
CD               0...NO DEBUGGING PRINTOUT (DEFAULT).                  -  004400
CD               1...DEBUGGING DUMP PRINTOUT.                          -  004500
CD               2...DEBUGGING TRACE PRINTOUT.                         -  004600
CD               3...FULL DEBUGGING PRINTOUT.                          -  004700
CD                                                                    -  004800
CD    19-24      PERTURBATION OUTPUT EDIT.                             -  004900
CD               0...BASIC PERTURBATION OUTPUT EDIT (DEFAULT).         -  005000
CD               1...FULL REGION-AND-GROUP OUTPUT EDIT.                -  005100
CD                                                                    -  005200
CD    25-30      LEAKAGE MULTIPLICATION FACTOR.                        -  005300
CD               0...LEAKAGE TERM IN USUAL FORM (DEFAULT).             -  005400
CD               1...LEAKAGE TERM MULTIPLIED BY D/(D PRIME).           -  005500
CD                                                                    -  005600
CD    31-36      SIZE OF FAST CORE STORAGE ARRAY IN REAL*8 WORDS       -  005700
CD               (DEFAULT=30000).                                      -  005800
CD                                                                    -  005900
CD    37-42      SIZE OF SLOW CORE STORAGE ARRAY IN REAL*8 WORDS       -  006000
CD               (DEFAULT=12500). IF LE.0, NO BULK CORE IS ALLOCATED.  -  006100
CD                                                                    -  006200
CD    49-54      DELAYED NEUTRON DATA FLAG.                            -  006300
CD               0...BETA-EFFECTIVE AND REACTIVITY CALCULATIONS        -  006400
CD                   DESIRED (DEFAULT).                                -  006500
CD               1...BETA-EFFECTIVE AND REACTIVITY CALCULATIONS        -  006600
CD                   NOT DESIRED.                                      -  006700
CD                                                                    -  006800
CD    55-60      POINTWISE DELTA K/(K**2) FLAG.                        -  006900
CD               0...NO PRINTOUT OF DELTA K/(K**2) BY MESH POINT       -  007000
CD                   (DEFAULT).                                        -  007010
CD               1...PRINTOUT OF DELTA K/(K**2) BY MESH POINT, DIVIDED -  007020
CD                   BY PHYSICAL VOLUME OF CELL.                       -  007030
CD               2...PRINTOUT OF DELTA K/(K**2) BY MESH POINT,         -  007040
CD                   INCLUDING CELL VOLUME FACTOR.                     -  007100
C                                                                     -  007200
C-------------------------------------------------------------------------  007300
                                                                         007400
                                                                         007500
C-------------------------------------------------------------------------  007600
CR          REACTOR PERIOD DEFINITIONS (TYPE 03)                      -  007700
C                                                                     -  007800
CL    FORMAT-----(I2,10X,5E12.5)                                      -  007900
C                                                                     -  008000
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  008100
CD    =======    ==========================================================-  008200
CD    1-2        03                                                    -  008300
CD                                                                    -  008400
CD    13-24      REACTOR PERIOD T FOR REACTIVITY TABLE.                -  008500
CD                                                                    -  008600
CD    25-36      REACTOR PERIOD T FOR REACTIVITY TABLE.                -  008700
CD                                                                    -  008800
CD    37-48      REACTOR PERIOD T FOR REACTIVITY TABLE.                -  008900
CD                                                                    -  009000
CD    49-60      REACTOR PERIOD T FOR REACTIVITY TABLE.                -  009100
CD                                                                    -  009200
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CD     61-72      REACTOR PERIOD T FOR REACTIVITY TABLE.                  -  009300
C                                                                         -  009400
CN                A REACTIVITY TABLE WILL BE COMPUTED USING THE          -  009500
CN                VALUES OF REACTOR PERIOD TABULATED IN COLS. 13-24,     -  009600
CN                25-36,...,61-72 WITH INTERMEDIATE VALUES OF REACTOR    -  009700
CN                PERIOD GENERATED USING THE DELTA T INCREMENTS          -  009800
CN                GIVEN ON CARD TYPE 04. BOTH REACTOR PERIODS AND        -  009900
CN                INCREMENTS ARE PACKED SO THAT ONLY NON-ZERO OR         -  010000
CN                NON-BLANK VALUES ARE USED. THE REACTOR PERIODS MUST    -  010100
CN                BE MONOTONICALLY INCREASING. THE REACTIVITY TABLE      -  010200
CN                WILL BE COMPUTED USING THE VALUES T(I)+N*DELTA T(I),   -  010300
CN                N=0, 1, 2, ...,NMAX, WHERE NMAX IS THE VALUE OF N      -  010400
CN                SUCH THAT (T(I)+NMAX*DELTA T(I)) .LT. T(I+1) .LE.      -  010500
CN                (T(I)+(NMAX+1)*DELTA T(I)). THE REACTOR PERIOD         -  010600
CN                INCREMENTS DELTA T(I) ARE READ FROM THE TYPE 04        -  010700
CN                CARDS, IF ANY ARE PRESENT.                             -  010800
CN                IF NO TYPE 04 CARDS ARE GIVEN, ONLY THE REACTOR        -  010900
CN                PERIODS GIVEN ON CARD TYPE 03 WILL BE USED.            -  011000
C                                                                         -  011100
C-----------------------------------------------------------------------  011200
                                                                          011300
                                                                          011400
C-----------------------------------------------------------------------  011500
CR          REACTOR PERIOD INCREMENT DEFINITIONS (TYPE 04)                -  011600
C                                                                         -  011700
CL     FORMAT-----(I2,10X,5E12.5)                                         -  011800
C                                                                         -  011900
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  012000
CD     =======   ==========================================================-  012100
CD     1-2       04                                                      -  012200
CD                                                                       -  012300
CD     13-24     REACTOR PERIOD INCREMENT DELTA T.                       -  012400
CD                                                                       -  012500
CD     25-36     REACTOR PERIOD INCREMENT DELTA T.                       -  012600
CD                                                                       -  012700
CD     37-48     REACTOR PERIOD INCREMENT DELTA T.                       -  012800
CD                                                                       -  012900
CD     49-60     REACTOR PERIOD INCREMENT DELTA T.                       -  013000
CD                                                                       -  013100
CD     61-72     REACTOR PERIOD INCREMENT DELTA T.                       -  013200
C                                                                         -  013300
CN               IF TYPE 04 CARDS ARE PRESENT, THE NUMBER OF NON-ZERO    -  013400
CN               REACTOR PERIOD INCREMENTS DEFINED MUST BE EXACTLY ONE   -  013500
CN               LESS THAN THE NUMBER OF NON-ZERO REACTOR PERIODS        -  013600
CN               DEFINED ON TYPE 03 CARDS.                               -  013700
C                                                                         -  013800
C-----------------------------------------------------------------------  013900
                                                                          014000
                                                                          014100
C-----------------------------------------------------------------------  014200
CR          INTEGRATION LIMIT SPECIFICATIONS (TYPE 05)                    -  014300
C                                                                         -  014400
CL     FORMAT-----(I2,4X,A6,2E12.5)                                       -  014500
C                                                                         -  014600
CD     COLUMNS            CONTENTS...IMPLICATIONS,IF ANY                  -  014700
CD     =======   ==========================================================-  014800
CD     1-2       05                                                      -  014900
CD                                                                       -  015000
CD     7-12      REGION LABEL.                                           -  015100
CD                                                                       -  015200
CD     13-24     INTEGRATION LIMIT IN FIRST TRANSVERSE DIRECTION.        -  015300
CD                                                                       -  015400
CD     25-36     INTEGRATION LIMIT IN SECOND TRANSVERSE DIRECTION FOR    -  015500
CD               A ONE-DIMENSIONAL FINITE RECTANGULAR SLAB.              -  015600
C                                                                         -  015700
CN               IF COLS. 7-12 ARE BLANK, THE DATA IN COLS. 13-36        -  015800
CN               APPLY TO ALL REGIONS OF THE REACTOR.                    -  015900
CN                                                                       -  016000
CN               IF AN INTEGRATION LIMIT IS SPECIFIED, IT WILL BE        -  016100
CN               USED IN THE NUMERATOR OF THE PERTURBATION EQUATION.     -  016200
CN               IF NO INTEGRATION LIMIT IS SPECIFIED, THE EXTRAPOLATED  -  016300
CN               HALF-HEIGHT OF THE REACTOR WILL BE USED AS THE          -  016400
CN               INTEGRATION LIMIT.                                      -  016500
CN                                                                       -  016600
CN               THE EXTRAPOLATED HALF-HEIGHT IS ALWAYS USED AS THE      -  016700
CN               INTEGRATION LIMIT IN THE DENOMINATOR OF THE             -  016800
CN               PERTURBATION EQUATION AND IN THE DELAYED NEUTRON        -  016900
CN               FRACTION AND REACTIVITY TABLE CALCULATIONS, IF ANY.     -  017000
CN                                                                       -  017100
CN               IF NO TYPE 05 CARDS ARE PROVIDED, THE DEFAULT WILL      -  017200
CN               BE USED FOR ALL REGIONS.                                -  017300
CN                                                                       -  017400
CN               FOR ANY REGION NOT SPECIFIED ON A TYPE 05 CARD THE      -  017500
CN               EXTRAPOLATED HALF-HEIGHT WILL BE USED AS THE            -  017600
CN               INTEGRATION LIMIT.                                      -  017700
C                                                                         -  017800
C-----------------------------------------------------------------------  017900
                                                                          018000
                                                                          018100
C-----------------------------------------------------------------------  018200
CR          BLACK COMPOSITION CONTROL (TYPE 07)                           -  018300
C                                                                         -  018400
CL     FORMAT-----(I2,10X,A6,2I6)                                         -  018500
C                                                                         -  018600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                 -  018700
CD     =======   ==========================================================-  018800
```

```
CD     1-2        07                                                    -  018900
CD                                                                      -  019000
CD     13-18      NAME OF BLACK COMPOSITION.                            -  019100
CD                                                                      -  019200
CD     19-24      INITIAL (HIGHER ENERGY) GROUP NUMBER TREATED AS BLACK. -  019300
CD                                                                      -  019400
CD     25-30      FINAL (LOWER ENERGY) GROUP NUMBER TREATED AS BLACK.   -  019500
C                                                                       -  019600
CN                IF COLUMNS 19-24 ARE BLANK, THE COMPOSITION SPECIFIED -  019700
CN                IN COLUMNS 13-18 IS TREATED AS BLACK FOR ALL ENERGY   -  019800
CN                GROUPS. IF COLUMNS 25-30 ARE BLANK, THE COMPOSITION   -  019900
CN                IS TREATED AS BLACK FOR THE ENERGY GROUP GIVEN IN     -  020000
CN                COLUMNS 19-24.                                        -  020100
C                                                                       -  020200
C-----------------------------------------------------------------------   020300
                                                                          020400
CEOF                                                                      020500
```

```
C***********************************************************************  000100
C                                                                       -  000200
C                         PREPARED 1/26/71 AT ANL                       -  000300
C                                                                       -  000400
CF          A.PRT1D                                                     -  000500
CF          ONE-DIMENSIONAL TRANSPORT THEORY STANDARD PATH BCD INPUT    -  000600
C                                                                       -  000700
CN                        THIS IS A USER-SUPPLIED BCD DATA SET.         -  000800
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS    -  000900
CN                        OF THE BCD FORMAT OF THE DATA CARD.           -  001000
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE    -  001100
CN                        NUMBER.                                       -  001200
C                                                                       -  001300
C***********************************************************************  001400
                                                                          001500
                                                                          001600
C-----------------------------------------------------------------------   001700
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                    -  001800
C                                                                       -  001900
CL    FORMAT-----(I2,4X,4I6)                                            -  002000
C                                                                       -  002100
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY                 -  002200
CD    =======   ==========================================================  002300
CD    1-2       01                                                      -  002400
CD                                                                      -  002500
CD    7-12      1...EDIT ALL DATA SETS USED BY MODULE NUC001.           -  002600
CD              4...NO EDIT OF DATA SETS.                               -  002700
CD                                                                      -  002800
CD    13-18     0...NO INVENTORY CALCULATION (DEFAULT).                 -  002900
CD              1...DO INVENTORY CALCULATION.                           -  003000
CD                                                                      -  003100
CD    19-24     0...NO OUTPUT MANIPULATION CALCULATION (DEFAULT).       -  003200
CD              1...DO OUTPUT MANIPULATION CALCULATION.                 -  003300
CD                                                                      -  003400
CD    25-30     0...TRANSPORT THEORY CALCULATION REQUIRED (DEFAULT).    -  003500
CD              1...NO TRANSPORT THEORY CALCULATION REQUIRED.           -  003600
C                                                                       -  003700
C-----------------------------------------------------------------------   003800
                                                                          003900
CEOF                                                                      004000
```

```
C*********************************************************************-  000100
C                                                                     -  000200
C                        PREPARED 1/26/71 AT ANL                      -  000300
C                                                                     -  000400
CF          A.STP006                                                  -  000500
CE          ONE-DIMENSIONAL DIFFUSION THEORY PERTURBATION             -  000600
CE          STANDARD PATH BCD INPUT                                   -  000700
C                                                                     -  000800
CN                       THIS IS A USER-SUPPLIED BCD DATA SET. THE    -  000900
CN                       LIST FOR EACH RECORD IS GIVEN IN TERMS OF    -  001000
CN                       THE BCD FORMAT OF THE DATA CARD. COLUMNS     -  001100
CN                       1-2 NORMALLY CONTAIN THE CARD TYPE NUMBER.   -  001200
C                                                                     -  001300
C*********************************************************************-  001400
                                                                        001500
                                                                        001600
C-------------------------------------------------------------------------  001700
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                  -  001800
C                                                                     -  001900
CL    FORMAT-----(I2,4X,4I6)                                          -  002000
C                                                                     -  002100
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  002200
CD    =======    ==================================================-  002300
CD    1-2        01                                                   -  002400
CD                                                                    -  002500
CD    7-12       1...EDIT ALL DATA SETS USED BY MODULE NUC001.        -  002600
CD               4...NO EDIT OF DATA SETS.                            -  002700
CD                                                                    -  002800
CD    13-18      0...NO INVENTORY CALCULATION (DEFAULT).              -  002900
CD               1...DO INVENTORY CALCULATION.                        -  003000
CD                                                                    -  003100
CD    19-24      0...NO OUTPUT MANIPULATION CALCULATION (DEFAULT).    -  003200
CD               1...DO OUTPUT MANIPULATION CALCULATION.              -  003300
CD                                                                    -  003400
CD    25-30      0...DIFFUSION THEORY CALCULATION REQUIRED (DEFAULT). -  003500
CD               1...NO DIFFUSION THEORY CALCULATION REQUIRED.        -  003600
C                                                                     -  003700
C-------------------------------------------------------------------------  003800
                                                                        003900
CEOF                                                                    004000
```

```
C*********************************************************************-  000100
C                                                                     -  000200
C                        PREPARED 1/26/71 AT ANL                      -  000300
C                                                                     -  000400
CF          A.STP007                                                  -  000500
CE          TWO-DIMENSIONAL DIFFUSION THEORY PERTURBATION             -  000600
CF          STANDARD PATH BCD INPUT                                   -  000700
C                                                                     -  000800
CN                       THIS IS A USER-SUPPLIED BCD DATA SET. THE    -  000900
CN                       LIST FOR EACH RECORD IS GIVEN IN TERMS OF    -  001000
CN                       THE BCD FORMAT OF THE DATA CARD. COLUMNS     -  001100
CN                       1-2 NORMALLY CONTAIN THE CARD TYPE NUMBER.   -  001200
C                                                                     -  001300
C*********************************************************************-  001400
                                                                        001500
                                                                        001600
C-------------------------------------------------------------------------  001700
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                  -  001800
C                                                                     -  001900
CL    FORMAT-----(I2,4X,2I6,6X,I6)                                    -  002000
C                                                                     -  002100
CD    COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -  002200
CD    =======    ==================================================-  002300
CD    1-2        01                                                   -  002400
CD                                                                    -  002500
CD    7-12       1...EDIT ALL DATA SETS USED BY MODULE NUC001.        -  002600
CD               4...NO EDIT OF DATA SETS.                            -  002700
CD                                                                    -  002800
CD    13-18      0...NO INVENTORY CALCULATION (DEFAULT).              -  002900
CD               1...DO INVENTORY CALCULATION.                        -  003000
CD                                                                    -  003100
CD    25-30      0...DIFFUSION THEORY CALCULATION REQUIRED (DEFAULT). -  003200
CD               1...NO DIFFUSION THEORY CALCULATION REQUIRED.        -  003300
C                                                                     -  003400
C-------------------------------------------------------------------------  003500
                                                                        003600
CEOF                                                                    003700
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 12/19/70 AT ANL                    -
C                                                                    -
CF          A.STP010                                                 -
CE          ENDF/B DATA MANAGEMENT STANDARD PATH DATA                -
C                                                                    -
CN                       THIS IS A USER-SUPPLIED BCD DATA SET.       -
CN                       THE LIST FOR EACH RECORD IS GIVEN IN TERMS  -
CN                       OF THE BCD FORMAT OF THE DATA CARD.         -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 01)                 -
C                                                                    -
CL     FORMAT-----(I2,4X,5I6)                                        -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY           -
CD     =======   ==================================================-
CD     1-2       01                                                  -
CD                                                                   -
CD     7-12      1...EXECUTE MODULE CSI002 (CHECKER)                 -
CD               0...DO NOT EXECUTE MODULE CSI002                    -
CD                                                                   -
CD     13-18     1...EXECUTE MODULE CSI003 (CRECT)                   -
CD               0...DO NOT EXECUTE MODULE CSI003                    -
CD                                                                   -
CD     19-24     1...EXECUTE MODULE CSI004 (DAMMET)                  -
CD               0...DO NOT EXECUTE MODULE CSI004                    -
CD                                                                   -
CD     25-30     1...EXECUTE MODULE CSI005 (ETOE)                    -
CD               0...DO NOT EXECUTE MODULE CSI005                    -
CD                                                                   -
CD     31-36     1...EXECUTE MODULE CSI006 (MERMC2)                  -
CD               0...DO NOT EXECUTE MODULE CSI006                    -
CD                                                                   -
C                                                                    -
C--------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 1/26/71 AT ANL                     -
C                                                                    -
CF          A.STP011                                                 -
CE          TWO-DIMENSIONAL TRANSPORT THEORY STANDARD PATH BCD INPUT -
C                                                                    -
CN                       THIS IS A USER-SUPPLIED BCD DATA SET.       -
CN                       THE LIST FOR EACH RECORD IS GIVEN IN TERMS  -
CN                       OF THE BCD FORMAT OF THE DATA CARD.         -
CN                       COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE  -
CN                       NUMBER.                                     -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CR          GENERAL PROBLEM SPECIFICATIONS                           -
C                                                                    -
CL     FORMAT-----(I2,4X,5I6)                                        -
C                                                                    -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY           -
CD     =======   ==================================================-
CD     1-2       01                                                  -
CD                                                                   -
CD     7-12      1...EDIT ALL DATA SETS USED BY MODULE NUC001.       -
CD               4...NO EDIT OF DATA SETS.                           -
CD                                                                   -
CD     13-18     0...NO INVENTORY CALCULATION (DEFAULT).             -
CD               1...DO INVENTORY CALCULATION.                       -
CD                                                                   -
CD     19-24     0...DO OUTPUT MANIPULATION CALCULATION (DEFAULT).   -
CD               1...NO OUTPUT MANIPULATION CALCULATION.             -
CD                                                                   -
CD     25-30     0...TRANSPORT THEORY CALCULATION REQUIRED (DEFAULT). -
CD               1...NO TRANSPORT THEORY CALCULATION REQUIRED.       -
CD                                                                   -
CD     31-36     RESTART DISPOSITION.                                -
CD               0...CONTINUE ITERATION PROCESS FROM RESTART DATA.   -
CD               .LT.0...EDIT LATEST RESTART DATA AND TERMINATE THE  -
CD                   TRANSPORT COMPUTATION.                          -
CD               N...(N.GT.0). IF THE PROBLEM IS A KEFF OR A SOURCE  -
CD                   COMPUTATION, RESTART AND DO 'N' ADDITIONAL OUTER -
CD                   ITERATIONS.  IF THE PROBLEM IS A SEARCH, RESTART -
CD                   AND DO 'N' ADDITIONAL SEARCH PASSES.            -
C                                                                    -
CN               THE NUMBER GIVEN IN COLS. 31-36 IS NOT USED IF THE  -
CN               PROBLEM IS NOT A RESTART.                           -
C                                                                    -
C--------------------------------------------------------------------

CEOF
```

```
C*********************************************************************-  000100
C                                                                     -  000200
C                         PREPARED 1/26/71 AT ANL                     -  000300
C                                                                     -  000400
CF          A.XSSPC                                                   -  000500
CE          GENERAL BCD INPUT FOR EPITHERMAL CROSS SECTION            -  000600
CE          CALCULATIONS (CSI001)                                     -  000700
C                                                                     -  000800
CN                        THIS IS A USER-SUPPLIED BCD DATA SET.       -  000900
CN                        THE LIST FOR EACH RECORD IS GIVEN IN TERMS  -  001000
CN                        OF THE BCD FORMAT OF THIS DATA CARD.        -  001100
CN                        COLUMNS 1-2 NORMALLY CONTAIN THE CARD TYPE  -  001200
CN                        NUMBER.                                     -  001300
CN                        BLANK FIELDS PRODUCE THE DEFAULT OPTIONS NOTED.-  001400
C                                                                     -  001500
C*********************************************************************-  001600
                                                                         001700
                                                                         001800
C----------------------------------------------------------------------  001900
CR          PROBLEM TITLE (TYPE 01)                                   -  002000
C                                                                     -  002100
CL    FORMAT-----(I2,4X,11A6)                                         -  002200
C                                                                     -  002300
CD    COLUMNS           CONTENTS...IMPLICATIONS,IF ANY                -  002400
CD    =======     ==================================================-  002500
CD    1-2         01                                                  -  002600
CD                                                                    -  002700
CD    7-72        ANY ALPHANUMERIC CHARACTERS.                        -  002800
C                                                                     -  002900
C----------------------------------------------------------------------  003000
                                                                         003100
                                                                         003200
C----------------------------------------------------------------------  003300
CR          COMPUTER CONTAINER ARRAY (TYPE 02)                        -  003400
C                                                                     -  003500
CL    FORMAT-----(I2,4X,3I6)                                          -  003600
C                                                                     -  003700
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY               -  003800
CD    =======     ==================================================-  003900
CD    1-2         02                                                  -  004000
CD                                                                    -  004100
CD    7-12        SIZE OF MAIN CORE STORAGE ARRAY IN REAL*8 WORDS,    -  004200
CD                TYPICALLY 60000 (DEFAULT=60000).                    -  004300
CD                                                                    -  004400
CD    13-18       SIZE OF BULK CORE STORAGE ARRAY IN REAL*8 WORDS,    -  004500
CD                TYPICALLY 100000 (DEFAULT=100000). A REQUEST FOR    -  004600
CD                STORAGE FROM BETWEEN 128000 TO 256000 WORDS MAY BE  -  004700
CD                OBTAINED WITH SPECIAL ARRANGEMENT.                  -  004800
CD                                                                    -  004900
CD    19-24       POINTR DEBUGGING EDIT, TYPICALLY 0.                 -  005000
CD                0...NO DEBUGGING PRINTOUT (DEFAULT).                -  005100
CD                1...DEBUGGING DUMP PRINTOUT.                        -  005200
CD                2...DEBUGGING TRACE PRINTOUT.                       -  005300
CD                3...FULL DEBUGGING PRINTOUT.                        -  005400
C                                                                     -  005500
CN                NO TYPE 02 CARD WILL GIVE THE FOLLOWING DEFAULT VALUES.-  005600
CN                MAIN CORE ARRAY=60000-(NUMBER OF MATERIALS WITH     -  005700
CN                                LEGENDRE TREATMENT)*900.            -  005800
CN                BULK CORE ARRAY=100000.                             -  005900
CN                PRINT OPTION FLAG=0.                                -  006000
CN                FOR THE DEFAULT VALUES ON THE 02 TYPE CARD THE REGION  -  006100
CN                PARAMETER ON THE JOB CARD SHOULD BE                 -  006200
CN                REGION=(780K,1000K)                                 -  006300
C                                                                     -  006400
C----------------------------------------------------------------------  006500
                                                                         006600
                                                                         006700
C----------------------------------------------------------------------  006800
CR          GENERAL PROBLEM SPECIFICATIONS (TYPE 03)                  -  006900
C                                                                     -  007000
CL    FORMAT-----(I2,10X,6I6,E12.5,I6)                                -  007100
C                                                                     -  007200
CD    COLUMNS           CONTENTS...IMPLICATIONS, IF ANY               -  007300
CD    =======     ==================================================-  007400
CD    1-2         03                                                  -  007500
CD                                                                    -  007600
CD    13-18       FUNDAMENTAL MODE TYPE.                              -  007700
CD                1...P1.                                             -  007800
CD                2...CONSISTENT B1 FOR ISOTROPIC NEUTRONICS.         -  007900
CD                3...CONSISTENT P1 FOR ISOTROPIC NEUTRONICS.         -  008000
CD                4...CONSISTENT B1 FOR ANISOTROPIC NEUTRONICS.       -  008100
CD                5...CONSISTENT P1 FOR ANISOTROPIC NEUTRONICS.       -  008200
CD                                                                    -  008300
CD    19-24       FUEL PIN GEOMETRY.                                  -  008400
CD                1...SLAB.                                           -  008500
CD                2...CYLINDER.                                       -  008600
CD                                                                    -  008700
CD    25-30       LIBRARY IDENTIFICATION NUMBER FOR FISSION SOURCE.   -  008800
CD                IDENTIFICATION NUMBER MUST BE RIGHT-JUSTIFIED IN    -  008900
CD                FORMAT FIELD (SEE TABLE I BELOW).                   -  009000
CD                                                                    -  009100
CD    31-36       BROAD GROUP CROSS SECTION CALCULATION SPECIFICATION.-  009200
CD                0...CALCULATE BROAD GROUP CROSS SECTIONS.           -  009300
CD                1...BROAD GROUP CROSS SECTIONS NOT CALCULATED.      -  009400
CD                                                                    -  009500
CD    37-42       FINE GROUP DETAIL.                                  -  009600
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CD                0...ALL FINE GROUP PROBLEM.                                  -  009700
CD                1...ULTRA FINE GROUP PROBLEM.                                -  009800
CD                                                                             -  009900
CD     43-48      FINE GROUP WEIGHTING SPECTRUM.                               -  010000
CD                1...1/E WEIGHTING SPECTRUM.                                  -  010100
CD                2...CONSTANT WEIGHTING SPECTRUM.                             -  010200
CD                3...E WEIGHTING SPECTRUM.                                    -  010300
CD                                                                             -  010400
CD     49-60      FINE GROUP LETHARGY WIDTH, TYPICALLY 0.25.                   -  010500
CD                                                                             -  010600
CD                NUMBER OF ULTRAFINE GROUPS       FINE GROUP                  -  010700
CD                PER FINE GROUP DESIRED           LETHARGY WIDTH              -  010800
CD                                                                             -  010900
CD                ----------------------------     ---------------             -  011000
CD                          1                       .83334E-2                  -  011100
CD                          2                       .16667E-2                  -  011200
CD                          3                       .25000E-1                  -  011300
CD                          4                       .33334E-1                  -  011400
CD                          5                       .41667E-1                  -  011500
CD                          6                       .50000E-1                  -  011600
CD                                                                             -  011700
CD                         10                       .83334E-1                  -  011800
CD                         12                       .10000                     -  011900
CD                         15                       .12500                     -  012000
CD                                                                             -  012100
CD                         20                       .16667                     -  012200
CD                         30                       .25000                     -  012300
CD                         60                       .50000                     -  012400
CD     61-66      STANDARD PATH CAPABILITY.                                    -  012500
CD                1...COMPLETE MC**2 PROBLEM.                                  -  012600
CD                2...CALCULATE RESOLVED AND UNRESOLVED RESONANCE              -  012700
CD                    CROSS SECTIONS ONLY.                                     -  012800
CD                3...GENERATE SMOOTH CROSS SECTIONS AND A FUNDMENTAL          -  012900
CD                    MODE SPECTRUM AND COLLAPSE TO A BROAD GROUP SET          -  013000
CD                    USING PREVIOUSLY GENERATED RESONANCE CROSS SECTIONS-     013100
CD                4...GENERATE BROAD GROUP SET USING PREVIOUSLY GENERATED-     013200
CD                    DATA AND SPECTRUM.                                       -  013300
CD                5...COMPLETE MC**2 PROBLEM FOLLOWED BY REPEATED              -  013400
CD                    INVOCATIONS TO SPECTRUM AVERAGE AND GROUP COLLAPS-       -  013500
CD                    ING. THIS USES ONE SET OF RESONANCE DATA FOR             -  013600
CD                    SEVERAL SPECTRUM AND BROAD GROUP GENERATIONS.            -  013700
C                                                                              -  013800
C-----------------------------------------------------------------------------   013900
                                                                                   014000
                                                                                   014100
C-----------------------------------------------------------------------------   014200
CR          BROAD GROUP SPECIFICATIONS (TYPE 04)                               -  014300
C                                                                              -  014400
CL     FORMAT-----(I2,10X,3(I6,E12.5))                                         -  014500
C                                                                              -  014600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                     -  014700
CD     =======            ===============================================     -  014800
CD     1-2        04                                                           -  014900
CD                                                                             -  015000
CD     13-18      BROAD GROUP NUMBER.                                          -  015100
CD                                                                             -  015200
CD     19-30      UPPER ENERGY OF GROUP (EV).                                  -  015300
CD                                                                             -  015400
CD     31-36      BROAD GROUP NUMBER.                                          -  015500
CD                                                                             -  015600
CD     37-48      UPPER ENERGY OF GROUP (EV).                                  -  015700
CD                                                                             -  015800
CD     49-54      BROAD GROUP NUMBER.                                          -  015900
CD                                                                             -  016000
CD     55-66      UPPER ENERGY OF GROUP (EV).                                  -  016100
C                                                                              -  016200
CN                GROUP 1 IS THE GROUP OF HIGHEST ENERGY. THE THERMAL          -  016300
CN                GROUP HAVING THE LARGEST GROUP NUMBER HAS AS UPPER           -  016400
CN                ENERGY THE INTERFACE BETWEEN THE THERMAL AND EPI-            -  016500
CN                THERMAL GROUPS. AS MANY TYPE 04 CARDS ARE USED AS            -  016600
CN                ARE NECESSARY TO SPECIFY THE ENERGIES.                       -  016700
C                                                                              -  016800
C-----------------------------------------------------------------------------   016900
                                                                                   017000
                                                                                   017100
C-----------------------------------------------------------------------------   017200
CR          FUEL PIN SPECIFICATIONS (TYPE 05)                                  -  017300
C                                                                              -  017400
CL     FORMAT-----(I2,10X,2E12.5)                                              -  017500
C                                                                              -  017600
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY                     -  017700
CD     =======            ===============================================     -  017800
CD     1-2        05                                                           -  017900
CD                                                                             -  018000
CD     13-24      RADIUS OF FUEL PIN IF COLS. 19-24 ON CARD TYPE 03 EQUAL-     018100
CD                2, HALF THICKNESS OF FUEL SLAB SLAB IF COLS. 19-24 ON        -  018200
CD                CARD TYPE 03 EQUAL 1.                                        -  018300
CD                                                                             -  018400
CD     25-36      RADIUS OF OUTER CLAD-COOLANT REGION IF COLS. 19-24 ON        -  018500
CD                CARD TYPE 03 EQUAL 2, OUTER BOUND OF CLAD COOLANT            -  018600
CD                REGION RELATIVE TO CENTER OF FUEL SLAB IF COLS. 19-24        -  018700
CD                ON CARD TYPE 03 EQUAL 1.                                     -  018800
C                                                                              -  018900
CN                CARD TYPE 05 IS PERTINENT ONLY FOR A HETEROGENEOUS           -  019000
CN                PROBLEM.                                                     -  019100
C                                                                              -  019200
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C-----------------------------------------------------------------------
CR          PROBLEM COMPOSITION SPECIFICATIONS (TYPE 06)
C
CL     FORMAT-----(I2,4X,2A6,I6,4E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======   ==========================================================
CD     1-2       06
CD
CD     7-12      NUCLIDE IDENTIFICATION LABEL ON LIBRARY. IDENTIFICATION
CD               LABEL MUST BE LEFT-JUSTIFIED IN FORMAT FIELD WITH
CD               IMBEDDED BLANKS PRESERVED. (SEE TABLE I BELOW)
CD
CD     13-18     ISOTOPE NAME. THIS NAME CAN BE ANY ALIAS NAME USER
CD               WISHES. AN ISOTOPE NAME IN THIS FIELD WILL ADD THE
CD               ISOTOPE TO THE DATA MODULE XS.ISO.  IF THE ISOTOPE
CD               IS NOT TO BE ADDED TO XS.ISO THEN COLS. 13-18
CD               SHOULD BE BLANK.
CD
CD     19-24     LEGENDRE TREATMENT SPECIFICATIONS.
CD               0...NON-LEGENDRE TREATMENT OF ELASTIC SCATTERING.
CD               1...ELASTIC SCATTERING FOR NUCLIDE USES THE
CD                   LEGENDRE TREATMENT.
CD
CD     25-36     NUCLIDE ATOMIC CONCENTRATION USED TO COMPUTE HOMOGEN-
CD               IZED MACROSCOPIC CROSS SECTIONS FOR USE IN THE FUND-
CD               AMENTAL MODE CALCULATION (ATOMS/CC * 1.E-24).
CD
CD     37-48     NUCLIDE TEMPERATURE (DEGREES K).
CD
CD     49-60     NUCLIDE CONCENTRATIONS IN THE FUEL PIN
CD               (ATOMS/CC * 1.E-24). IF BLANK, THE VALUES GIVEN
CD               IN COLS. 25-36 WILL BE USED PROVIDED ALL 06 CARDS
CD               USED ARE BLANK IN COLS. 49-60.
CD
CD     61-72     NUCLIDE CONCENTRATIONS IN THE FUEL-COOLANT OUTER
CD               REGION (ATOMS/CC * 1.E-24). IGNORED IF CARD TYPE 05
CD               IS NOT SUPPLIED.
C
CN               AS MANY TYPE 06 CARDS ARE USED AS ARE NECESSARY
CN               TO SPECIFY THE COMPOSITION.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          FUNDAMENTAL MODE ITERATION SPECIFICATIONS (TYPE 07)
C
CL     FORMAT-----(I2,10X,3E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======   ==========================================================
CD     1-2       07
CD
CD     13-24     FIRST GUESS FOR BUCKLING.
CD
CD     25-36     SECOND GUESS FOR BUCKLING.
CD
CD     37-48     CONVERGENCE CRITERION, EPSILON, FOR KEFF,
CD               ABSOLUTE VALUE (KEFF - 1).LE.EPSILON.
C
CN               IF EPSILON=0, FIRST BUCKLING GUESS IS USED AND NO
CN               ITERATION IS PERFORMED.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          THERMAL CROSS SECTION DATA (TYPE 08)
C
CL     FORMAT-----(I2,10X,A6,6X,4E12.5)
C
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY
CD     =======   ==========================================================
CD     1-2       08
CD
CD     13-18     NUCLIDE IDENTIFICATION LABEL.
CD
CD     25-36     MICROSCOPIC THERMAL GROUP CAPTURE CROSS SECTION
CD               (BARNS).
CD
CD     37-48     MICROSCOPIC THERMAL GROUP FISSION CROSS SECTION
CD               (BARNS).
CD
CD     49-60     NUMBER OF NEUTRONS EMITTED PER FISSION IN THE THERMAL
CD               GROUP.
CD
CD     61-72     MICROSCOPIC THERMAL GROUP TRANSPORT CROSS SECTION
CD               (BARNS).
C
CN               AS MANY TYPE 08 CARDS ARE USED AS ARE NECESSARY
CN               TO SPECIFY THE THERMAL CROSS SECTIONS.
C
```

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C-----------------------------------------------------------------------
CR          THERMAL CROSS SECTION DATA (TYPE 09)                       -
C                                                                      -
CL     FORMAT-----(I2,10X,A6,6X,3E12.5)                                -
C                                                                      -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -
CD     =======    ========================================================
CD     1-2        09                                                   -
CD                                                                     -
CD     13-18      NUCLIDE IDENTIFICATION LABEL.                        -
CD                                                                     -
CD     25-36      MICROSCOPIC THERMAL (N,ALPHA) CROSS SECTION (BARNS).  -
CD                                                                     -
CD     37-48      MICROSCOPIC THERMAL (N,P) CROSS SECTION (BARNS).     -
CD                                                                     -
CD     49-60      THERMAL GROUP AVERAGE RECIPROCAL VELOCITY (SEC/CM)   -
C                                                                      -
CN                IF COLS. 49-60 ARE BLANK OR IF THERE IS NO TYPE 09   -
CN                CARD, A THERMAL GROUP VELOCITY OF 2.2E+05 CM/SEC     -
CN                IS ASSUMED                                           -
C                                                                      -
CN                AS MANY TYPE 09 CARDS ARE USED AS ARE NECESSARY      -
CN                TO SPECIFY THE THERMAL CROSS SECTIONS.               -
C                                                                      -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          WEIGHTING SPECTRUM DATA (TYPE 10)                          -
C                                                                      -
CL     FORMAT-----(I2,10X,3(I6,E12.5))                                 -
C                                                                      -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -
CD     ======     ========================================================
CD     1-2        10                                                   -
CD                                                                     -
CD     13-18      FINE GROUP NUMBER.                                   -
CD                                                                     -
CD     19-30      FINE GROUP WEIGHTING SPECTRUM.                       -
CD                                                                     -
CD     31-36      FINE GROUP NUMBER.                                   -
CD                                                                     -
CD     37-48      FINE WEIGHTING SPECTRUM.                             -
CD                                                                     -
CD     49-54      FINE GROUP NUMBER.                                   -
CD                                                                     -
CD     55-66      FINE GROUP WEIGHTING SPECTRUM.                       -
C                                                                      -
CN                AS MANY TYPE 10 CARDS ARE USED AS ARE NECESSARY      -
CN                TO SPECIFY THE WEIGHTING SPECTRUM.                   -
C                                                                      -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          PRINT SELECTION OPTIONS (TYPE 11)                          -
C                                                                      -
CL     FORMAT-----(I2,4X,6I6)                                          -
C                                                                      -
CD     COLUMNS            CONTENTS...IMPLICATIONS, IF ANY              -
CD     ======     ========================================================
CD     1-2        11                                                   -
CD                                                                     -
CD     7-12       IF NON-ZERO, EDIT AVERAGE MICROSCOPIC GROUP CROSS    -
CD                SECTIONS SUMMED OVER ALL CONTRIBUTING RESONANCES     -
CD                IN THE RESOLVED RESONANCE REGION. ALSO EDIT POINT    -
CD                VALUES OF MICROSCOPIC CROSS SECTIONS AVERAGED OVER   -
CD                PORTER-THOMAS DISTRIBUTIONS IN THE UNRESOLVED REGION. -
CD                                                                     -
CD     13-18      IF NON-ZERO, EDIT AVERAGE MICROSCOPIC GROUP CROSS    -
CD                SECTIONS FOR EACH RESONANCE IN THE RESOLVED RESONANCE -
CD                REGION.                                              -
CD                                                                     -
CD     19-24      IF NON-ZERO, EDIT MICROSCOPIC AVERAGE FINE GROUP CROSS -
CD                SECTIONS COMPUTED FROM LINEAR-SEGMENT DATA.          -
CD                                                                     -
CD     25-30      IF NON-ZERO, EDIT HOMOGENIZED MACROSCOPIC FINE GROUP -
CD                AND ULTRA FINE GROUP CROSS SECTIONS. ALSO EDIT FISSION -
CD                SPECTRUM.                                            -
CD                                                                     -
CD     31-36      IF NON-ZERO, EDIT FINE AND ULTRA FINE GROUP FLUXES FOR -
CD                EACH BUCKLING ITERATION.                             -
CD                                                                     -
CD     37-42      IF NON-ZERO, EDIT ULTRA FINE GROUP MATERIAL MACROSCOPIC-
CD                ELASTIC REMOVAL CROSS SECTIONS, ELASTIC TRANSPORT    -
CD                CROSS SECTIONS, AND ELASTIC TRANSFER CROSS SECTIONS. -
C                                                                      -
CN                PRINTED OUTPUT INCLUDES A COMPLETE EDIT OF ALL CROSS -
CN                SECTIONS AND WEIGHTING SPECTRA.                      -
C                                                                      -
C-----------------------------------------------------------------------
```

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C-----------------------------------------------------------------------  038500
CN          TABLE I. ENDF/B DATA AVAILABLE IN THE ARC SYSTEM AS OF      -  038600
CN                   3/20/70.                                           -  038700
CN                                                                      -  038800
CN          LIB.   NUCLIDE LEGEN- RE-      LIB    NUCLIDE LEGEN- RE-    -  038900
CN          IDENT. IDENT.  DRE    SOLVED   IDENT. IDENT.  DRE    SOLVED -  039000
CN          NUMBER LABEL   DATA   RES.     NUMBER LABEL   DATA   RES.   -  039100
CN          ------ ------ ------ ------   ------ ------ ------ ------  -  039200
CN          1003   D      NO     0                                     -  039300
CN          1005   LI  6  NO     0        1037   AU197  NO     63      -  039400
CN          1006   LI  7  NO     0        1044   U 235  NO     89      -  039500
CN          1009   B  10  YES    0        1048   NP237  NO     33      -  039600
CN          1010   C  12  YES    0        1050   PU238  NO     14      -  039700
CN          1012   N  14  YES    0        1055   PU242  NO     21      -  039800
CN          1014   MG     YES    0        1058   CM244  NO     15      -  039900
CN          1016   TI     YES    0        1007   BE  9  YES    0       -  040000
CN          1017   V      YES    0        1015   AL 27  YES    0       -  040100
CN          1019   MN     NO     27       1038   TH232  NO     229     -  040200
CN          1025   MO     YES    32       1041   U 233  NO     0       -  040300
CN          1030   GD     NO     29       1044   U 2351 NO     89      -  040400
CN          1035   TA181  NO     78       1013   O  16  YES    0       -  040500
CN          1053   PU240  NO     41       1020   FE     YES    0       -  040600
CN          1059   NA 23  YES    3        1026   XE135  NO     0       -  040700
CN          1060   W 182  NO     6        1027   SM149  NO     30      -  040800
CN          1061   W 183  NO     16       1043   U 234  NO     21      -  040900
CN          1062   W 184  NO     17       1046   U 236  NO     15      -  041000
CN          1063   W 186  NO     5        1047   U 238  NO     209     -  041100
CN          1042   U3FP1  NO     0        1051   PU239  NO     89      -  041200
CN          1045   U5FP1  NO     0        1056   AM241  NO     19      -  041300
CN          1052   P9FP1  NO     0        1057   AM243  NO     12      -  041400
CN          1066   U3FP2  NO     0        1018   CR     YES    0       -  041500
CN          1067   U3FP3  NO     0        1021   NI     YES    0       -  041600
CN          1068   U5FP2  NO     0        1054   PU241  NO     0       -  041700
CN          1069   U5FP3  NO     0        1044   U 2352 NO     89      -  041800
CN          1070   P9FP2  NO     0        1044   U 2353 NO     89      -  041900
CN          1071   P9FP3  NO     0        1087   CU     YES    48      -  042000
CN          1024   NB     NO     218      1083   RE185  NO     30      -  042100
CN          1028   EU151  NO     28       1084   RE187  NO     25      -  042200
CN          1029   EU153  NO     21       1085   CU 63  YES    28      -  042300
CN          1031   DY164  NO     2        1086   CU 65  YES    20      -  042400
CN          1032   LU175  NO     17       1088   HE     NO     0       -  042500
CN          1033   LU176  NO     21       1022   ZR     YES    83      -  042600
CN                                                                      -  042700
C-----------------------------------------------------------------------  042800
                                                                         042900
CEOF                                                                     043000

C***********************************************************************  000100
C                                                                       -  000200
C                         PREPARED 2/5/71 AT ANL                        -  000300
C                                                                       -  000400
CF                        BC                                            -  000500
CE                        BOUNDARY CONDITION SPECIFICATIONS             -  000600
C                                                                       -  000700
C***********************************************************************  000800
                                                                         000900
CD    NVB                 NUMBER OF VERTICAL BOUNDARY CONDITIONS RECORDS  001000
CD                        GIVEN FOR VERTICAL BOUNDARIES OR INTERFACES.    001100
CD    NHB                 NUMBER OF HORIZONTAL BOUNDARY CONDITIONS        001200
CD                        RECORDS GIVEN FOR HORIZONTAL BOUNDARIES OR      001300
CD                        INTERFACES.                                     001400
CD    MFACE               MESH LINE NUMBER AND SIDE INDICATOR FOR WHICH   001500
CD                        THIS RECORD APPLIES. SIGN OF MFACE INDICATES    001600
CD                        SIDE OF INTERFACE. THUS, FOR THE LEFT REACTOR   001700
CD                        BOUNDARY, MFACE=+1. THE ABSOLUTE VALUE OF       001800
CD                        MFACE LIES BETWEEN 1 AND THE NUMBER OF FIRST    001900
CD                        DIMENSION MESH LINES FOR VERTICAL FACES         002000
CD                        AND BETWEEN 1 AND THE NUMBER OF SECOND          002100
CD                        DIMENSION MESH LINES FOR HORIZONTAL             002200
CD                        FACES.                                          002300
CD    M1                  MESH LINE NUMBER DEFINING BEGINNING OF THE      002400
CD                        INTERVAL ALONG THIS FACE FOR WHICH INTERFACE    002500
CD                        CONDITIONS APPLY.                               002600
CD    M2                  MESH LINE NUMBER DEFINING END OF THE            002700
CD                        INTERVAL ALONG THIS FACE FOR WHICH INTERFACE    002800
CD                        CONDITIONS APPLY.                               002900
CD    NBIT                BOUNDARY OR INTERFACE CONDITION TYPE NUMBER     003000
CD                        (SEE SPECIFICATIONS RECORD DEFINITIONS).        003100
CD    JI                  INITIAL (HIGHER-ENERGY) GROUP NUMBER TO WHICH   003200
CD                        CONSTANTS C1-C4 APPLY.                          003300
CD    JF                  FINAL (LOWER-ENERGY) GROUP NUMBER TO WHICH      003400
CD                        CONSTANTS APPLY.                                003500
CD    C1                  CONSTANT USED IN INTERFACE CONDITION TYPES 1-3. 003600
CD    C2                  CONSTANT USED IN INTERFACE CONDITION TYPES 1-3. 003700
CD    C3                  CONSTANT USED IN INTERFACE CONDITION TYPES 1-3. 003800
CD    C4                  CONSTANT USED IN INTERFACE CONDITION TYPES 1-3. 003900
                                                                         004000
                                                                         004100
C-----------------------------------------------------------------------  004200
CR          SPECIFICATIONS (TYPE 1)                                     -  004300
CC          FOR ONE-DIMENSIONAL GEOMETRIES, WORDS 4-6 OF THIS           -  004400
CC          RECORD ARE 0.                                               -  004500
C                                                                       -  004600
CL    NBCL,NBCR,NVB,NBCB,NBCT,NHB                                       -  004700
C                                                                       -  004800
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CD     NBCL                BOUNDARY CONDITION TYPE NUMBER FOR LEFT        -
CD                         BOUNDARY OF THE REACTOR (SEE BELOW)            -
CD     NBCR                BOUNDARY CONDITION TYPE NUMBER FOR RIGHT       -
CD                         BOUNDARY OF THE REACTOR (SEE BELOW)            -
CD     NBCB                BOUNDARY CONDITION TYPE NUMBER FOR BOTTOM      -
CD                         BOUNDARY OF THE REACTOR (SEE BELOW)            -
CD     NBCT                BOUNDARY CONDITION TYPE NUMBER FOR TOP         -
CD                         BOUNDARY OF THE REACTOR (SEE BELOW)            -
CD                                                                        -
CD                         TYPE              DESCRIPTION                  -
CD                         ----  ---------------------------------------  -
CD                           1     C1*PHI PRIME+C2*PHI=C3, WHERE PHI IS   -
CD                                 THE GROUP FLUX AND PHI PRIME IS ITS    -
CD                                 DERIVATIVE.                            -
CD                           2     C1*D*PHI PRIME+C2*PHI=C3, WHERE D IS   -
CD                                 THE GROUP DIFFUSION CONSTANT.          -
CD                           3     PHI(I+1)=C1*PHI(I)+C2*PHI(I) PRIME     -
CD                                 PHI(I+1) PRIME=C3*PHI(I)+C4*PHI(I) PRIME-
CD                           7     INCOMING ANGULAR FLUX=0.               -
CD                           8     REFLECTIVE.                            -
CD                           9     PERIODIC.                              -
CD                          10     WHITE.                                 -
CD                         TYPES 1-3 AND 9 ARE USED FOR DIFFUSION THEORY  -
CD                         AND TYPES 7-10 ARE USED FOR TRANSPORT THEORY.  -
C                                                                         -
C-------------------------------------------------------------------------
                                                                          -
C-------------------------------------------------------------------------
CR          VERTICAL BOUNDARY CONDITIONS (TYPE 2)                         -
C                                                                         -
CL     MFACE,M1,M2,NBIT,JI,JF,C1,C2,C3,C4-----NOTE STRUCTURE BELOW----- -
C                                                                         -
C      DO 1 L=1,NVB                                                       -
C    1 READ(N) *LIST AS ABOVE*                                            -
C                                                                         -
CN                         THE CONSTANTS C1-C4 ARE GIVEN WITH RESPECT     -
CN                         TO THE SIDE OF THE FACE BEING REFERENCED. IF   -
CN                         C1 IS POSITIVE ON THE LEFT SIDE OF A FACE,     -
CN                         WHERE MFACE.LT.0 AND NBIT=1 OR 2, THEN C1 IS   -
CN                         NEGATIVE ON THE RIGHT SIDE, WHERE MFACE.GT.0   -
CN                         AND NBIT IS THE SAME AS ON THE LEFT SIDE.      -
CN                         FOR NBIT=3, THE ADJOINT OF THE MATRIX          -
CN                                     C1  C2                             -
CN                                     C3  C4                             -
CN                         IS GIVEN ON THE SECOND SIDE OF THE FACE.       -
CN                         FOR NBIT=2, D IS APPROPRIATE TO THE            -
CN                         COMPOSITION ON THE SIDE OF THE INTERFACE BEING -
CN                         REFERENCED.                                    -
C                                                                         -
C-------------------------------------------------------------------------
                                                                          -
C-------------------------------------------------------------------------
CR          HORIZONTAL BOUNDARY CONDITIONS (TYPE 3)                       -
C                                                                         -
CL     MFACE,M1,M2,NBIT,JI,JF,C1,C2,C3,C4-----NOTE STRUCTURE BELOW----- -
C                                                                         -
C      DO 1 L=1,NHB                                                       -
C    1 READ(N) *LIST AS ABOVE*                                            -
C                                                                         -
CN                         THE CONSTANTS C1-C4 ARE GIVEN WITH RESPECT     -
CN                         TO THE SIDE OF THE FACE BEING REFERENCED. IF   -
CN                         C1 IS POSITIVE ON THE BOTTOM SIDE OF A FACE,   -
CN                         WHERE MFACE.LT.0 AND NBIT=1 OR 2, THEN C1 IS   -
CN                         NEGATIVE ON THE TOP SIDE, WHERE MFACE.GT.0 AND -
CN                         NBIT IS THE SAME AS ON THE LEFT SIDE.          -
CN                         FOR NBIT=3, THE ADJOINT OF THE MATRIX          -
CN                                     C1  C2                             -
CN                                     C3  C4                             -
CN                         IS GIVEN ON THE SECOND SIDE OF THE FACE.       -
CN                         FOR NBIT=2, D IS APPROPRIATE TO THE            -
CN                         COMPOSITION ON THE SIDE OF THE INTERFACE BEING -
CN                         REFERENCED.                                    -
C                                                                         -
C-------------------------------------------------------------------------
                                                                          -
CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 3/16/71 AT ANL                     -
C                                                                    -
CF          BC.P                                                     -
CE          PROBLEM-DEPENDENT BOUNDARY CONDITION SPECIFICATIONS      -
C                                                                    -
CN                       THIS DATA SET IS USED BY ANY MODULE FOR WHICH -
CN                       TWO BOUNDARY CONDITION SPECIFICATION DATA SETS -
CN                       ARE NEEDED.                                 -
CN                                                                   -
CN                       THE FORMAT OF THIS DATA SET IS IDENTICAL TO -
CN                       THAT OF DATA SET BC.                        -
C                                                                    -
C*********************************************************************
CEOF
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          B.HOMOG                                                  -
CE          BINARY VERSION OF HOMOGENIZATION INPUT                   -
C                                                                    -
C*********************************************************************

CD     MSLTH             LENGTH OF MATERIAL MIX TABLE.
CD     NMAT              NUMBER OF MATERIALS.
CD     NISO2             NUMBER OF ISOTOPES.
CD     MCSLTH            LENGTH OF COMPOSITION MIX TABLE.
CD     NCMP              NUMBER OF COMPOSITIONS.

C---------------------------------------------------------------------
CR          MATERIAL MIXTURE CONTROL DATA (TYPE 1)                   -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     MSLTH,NMAT,NISO2                                              -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          MATERIAL MIXTURE DATA (TYPE 2)                           -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     (DIMIX(I),I=1,MSLTH),(ATMDEN(I),I=1,MSLTH),(MSPEC(J),J=1,NMAT), -
CL    1(DITBL(K),K=1,NISO2),(DMTBL(J),J=1,NMAT)                      -
C                                                                    -
CD     DIMIX             MIX TABLE.                                  -
CD     ATMDEN            ATOMIC DENSITY TABLE.                       -
CD     MSPEC             NUMBER OF ISOTOPES MAKING UP EACH MATERIAL. -
CD     DITBL             LIST OF ALL ISOTOPES USED, WITH EACH ISOTOPE -
CD                       LABEL APPEARING ONCE.                       -
CD     DMTBL             LABELS OF MATERIALS.                        -
C                                                                    -
CD                       THE MATERIAL LABELED DMTBL(J) IS MADE UP    -
CD                       FROM MSPEC(J) ISOTOPES WHICH ARE NAMED IN   -
CD                       ORDER IN DIMIX AND USED WITH CORRESPONDING  -
CD                       ATOMIC DENSITIES IN ATMDEN. THE INDEX OF THE -
CD                       FIRST ELEMENT IN DIMIX AND ATMDEN FOR MATERIAL -
CD                       J IS L(J), WHERE L(J)=1+SUM OVER M OF       -
```

```
CD                      MSPEC(M), M=1,J-1.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          COMPOSITION MIXTURE CONTROL DATA (TYPE 3)
C
CC          ALWAYS PRESENT
C
CL    MCSLTH,NCMP,NMAT
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          COMPOSITION MIXTURE DATA (TYPE 4)
C
CC          ALWAYS PRESENT
C
CL    (DMMIX(I),I=1,MCSLTH),(VOLFRC(I),I=1,MCSLTH),
CL   1(MCSPEC(J),J=1,NCMP),(DMTBL1(K),K=1,NMAT),
CL   2(DCTBL(J),J=1,NCMP)
C
CD    DMMIX                 MIX TABLE.
CD    VOLFRC                VOLUME FRACTION TABLE.
CD    MCSPEC                NUMBER OF MATERIALS MAKING UP EACH
CD                          COMPOSITION.
CD    DMTBL1                LIST OF ALL MATERIALS USED, WITH EACH
CD                          MATERIAL LABEL APPEARING ONCE.
CD    DCTBL                 LABELS OF COMPOSITIONS.
C
CD                          COMPOSITION TABLES DMMIX AND VOLFRC ARE USED
CD                          WITH MCSPEC TO DEFINE COMPOSITION DCTBL(J)
CD                          IN THE SAME MANNER AS THAT DESCRIBED IN THE
CD                          MATERIAL MIXTURE DATA RECORD TO DEFINE
CD                          MATERIAL DMTBL(J).
C
C-----------------------------------------------------------------------

CEOF
```

```
C***********************************************************************
C
C                           PREPARED 2/5/71 AT ANL
C
CE          ES.D1D
CE          ONE-DIMENSIONAL DISTRIBUTED EXTERNAL SOURCE
C
C***********************************************************************

CD    NGROUP                NUMBER OF ENERGY GROUPS.
CD    NINTI                 NUMBER OF MESH INTERVALS.

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)
C
CL    NINTI,NGROUP,(IFLAG(I),I=1,NINTI)
C
CD    IFLAG                 IF IFLAG(I).NE.0, THE SOURCE AT INTERVAL I
CD                          SHOULD BE FISSION SPECTRUM WEIGHTED BY THE
CD                          MODULE READING THE DATA SET.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          ONE-DIMENSIONAL DISTRIBUTED EXTERNAL SOURCE (TYPE 2)
C
CL    ((FSEXT(I,J),I=1,NINTI),J=1,NGROUP)
C
CD    FSEXT                 FIXED SOURCE AT INTERVAL I AND ENERGY GROUP J.
C
C-----------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CE          ES.D1SH                                                  -
CE          ONE-DIMENSIONAL SURFACE SOURCE                           -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NPTI                NUMBER OF "X" DIRECTION MESH INTERVAL LINES.
CD    NVEDGE              NUMBER OF ONE-DIMENSIONAL SURFACE SOURCES
CD                        SPECIFIED.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NANISO,NGROUP,NPTI,NVEDGE                                      -
C                                                                    -
CD    NANISO              ANISOTROPIC FLAG. IF 0, SURFACE SOURCE IS -
CD                        ISOTROPIC. IF 1, SURFACE SOURCE IS ANISOTROPIC -
CD                        FOR SPHERICAL AND SLAB GEOMETRIES. IF 2,  -
CD                        SURFACE SOURCE IS ANISOTROPIC FOR CYLINDRICAL -
CD                        GEOMETRY.                                 -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          SOURCE POINTERS (TYPE 2)                                 -
C                                                                    -
CL    (IVERT(I), I=1,NPTI)                                           -
C                                                                    -
CD    IVERT               IVERT(I)=0 IF NO SURFACE SOURCE IS PRESENT -
CD                        AT THE MESH INTERVAL LINE I. IVERT(I)=K IF -
CD                        THE K-TH SURFACE SOURCE, AS SPECIFIED IN THE -
CD                        SOURCE DATA RECORD BY THE VSUR1, VSUR2, AND -
CD                        VSUR3 ARRAYS, IS PRESENT AT MESH INTERVAL -
CD                        LINE I.                                   -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          SOURCE DATA (TYPE 3)                                     -
C                                                                    -
CL    ((VSUR1(K,N), K=1,NVEDGE), N=1,NGROUP),                        -
CL   1((VSUR2(K,N), K=1,NVEDGE), N=1,NGROUP),                        -
CL   2((VSUR3(K,N), K=1,NVEDGE), N=1,NGROUP)                         -
C                                                                    -
CD    VSUR1               ISOTROPIC COMPONENT OF THE K-TH SURFACE  -
CD                        SOURCE FOR EACH GROUP.                    -
CD                                                                  -
CD    VSUR2               ANISOTROPIC COMPONENT OF THE K-TH SURFACE -
CD                        SOURCE FOR EACH GROUP. VSUR2 IS PRESENT   -
CD                        ONLY IF NANISO.GT.0.                      -
CD                                                                  -
CD    VSUR3               ANISOTROPIC COMPONENT OF THE K-TH SURFACE -
CD                        SOURCE FOR EACH GROUP. VSUR3 IS PRESENT ONLY -
CD                        IF NANISO=2.                              -
C                                                                    -
CN                        THE SURFACE SOURCE IS ASSUMED TO BE       -
CN                        REPRESENTABLE BY A LEGENDRE EXPANSION FOR -
CN                        SPHERES OR SLABS AND BY A SURFACE HARMONIC -
CN                        EXPANSION FOR CYLINDERS.  IN EACH CASE, THE -
CN                        EXPANSION IS TRUNCATED AT THE FIRST ORDER -
CN                        TERMS.  THE SURFACE SOURCE IS THEREFORE TAKEN -
CN                        TO BE VSUR1+3*MU*VSUR2 FOR SPHERICAL OR SLAB -
CN                        GEOMETRY AND VSUR1+3*MU*VSUR2+3*ETA*VSUR3 FOR -
CN                        CYLINDRICAL GEOMETRY, WHERE MU AND ETA ARE -
CN                        THE DIRECTION COSINES IN THE "X" AND "Y"  -
CN                        DIRECTIONS RESPECTIVELY OF THE DISCRETE   -
CN                        ANGLE BEING CONSIDERED.  FOR SPHERES OR   -
CN                        CYLINDERS "X"=R, FOR SLABS "X"=X, AND FOR -
CN                        CYLINDERS "Y"=Z.                          -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          ES.D2D                                                   -
CE          TWO-DIMENSIONAL DISTRIBUTED EXTERNAL SOURCE              -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS.

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NINTJ,NGROUP,(((IFLAG(I,J),I=1,NINTI),J=1,NINTJ)         -
C                                                                    -
CD    IFLAG               IF IFLAG(I,J).NE.0, THE SOURCE AT INTERVAL I,J -
CD                        SHOULD BE FISSION SPECTRUM WEIGHTED BY THE -
CD                        MODULE READING THE DATA SET.               -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          TWO-DIMENSIONAL DISTRIBUTED EXTERNAL SOURCE (TYPE 2)     -
C                                                                    -
CL    ((FSEXT(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW----- -
C                                                                    -
C     DO 1 K=1,NGROUP                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FSEXT               FIXED SOURCE AT INTERVAL I,J FOR ENERGY    -
CD                        GROUP K.                                   -
C                                                                    -
C--------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          ES.D2SH                                                  -
CE          TWO-DIMENSIONAL SURFACE SOURCE                           -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF "X" DIRECTION MESH INTERVALS.
CD    NINTJ               NUMBER OF "Y" DIRECTION MESH INTERVALS.
CD    NPTI                NUMBER OF "X" DIRECTION MESH LINES.
CD    NPTJ                NUMBER OF "Y" DIRECTION MESH LINES.
CD    NVEDGE              NUMBER OF "Y" DIRECTION SURFACE SOURCES
CD                        SPECIFIED.
CD    NHEDGE              NUMBER OF "X" DIRECTION SURFACE SOURCES
CD                        SPECIFIED.

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NANISO,NGROUP,NINTI,NINTJ,NPTI,NPTJ,NVEDGE,NHEDGE              -
C                                                                    -
CD    NANISO              ANISOTROPIC FLAG. IF 0, "X" AND "Y" DIRECTION -
CD                        SURFACE SOURCES ARE ISOTROPIC. IF 1, "X" AND -
CD                        "Y" DIRECTION SURFACE SOURCES ARE ANISOTROPIC. -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          SOURCE POINTERS (TYPE 2)                                 -
C                                                                    -
CL    ((IVERT(I,J),I=1,NPTI),J=1,NINTJ),((IHORZ(I,J),I=1,NPTJ),      -
CL   1J=1,NINTI)                                                     -
C                                                                    -
CD    IVERT               IVERT(I,J) DENOTES THE MESH INTERVAL EDGE -
CD                        ALIGNED IN THE "Y" DIRECTION AND LOCATED   -
CD                        ON THE I-TH MESH LINE IN                   -
CD                        THE "X" DIRECTION AND EXTENDING FROM THE   -
CD                        J-TH TO THE J+1 ST MESH LINES IN           -
CD                        THE "Y" DIRECTION. IVERT(I,J)=0 IF NO SURFACE -
CD                        SOURCE IS PRESENT AT THE SPECIFIED MESH    -
CD                        INTERVAL EDGE. IVERT(I,J)=K IF THE K-TH SURFACE-.
CD                        SOURCE, AS SPECIFIED IN THE SOURCE DATA    -
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CD                          RECORD BY THE ARRAYS VSUR1, VSUR2, AND VSUR3,  -
CD                          IS PRESENT AT THE SPECIFIED MESH INTERVAL EDGE.-
CD                                                                         -
CD     IHORZ                IHORZ(I,J) DENOTES THE MESH INTERVAL EDGE      -
CD                          ALIGNED IN THE "X" DIRECTION AND LOCATED ON    -
CD                          THE I-TH "Y" DIRECTION MESH LINE               -
CD                          AND EXTENDING FROM THE J-TH TO THE             -
CD                          J+1 ST "X" DIRECTION MESH LINES.               -
CD                          IHORZ(I,J)=0 IF NO SURFACE SOURCE IS PRESENT AT-
CD                          THE SPECIFIED MESH INTERVAL EDGE. IHORZ(I,J)=K -
CD                          IF THE K-TH SURFACE SOURCE, AS SPECIFIED IN THE-
CD                          SOURCE DATA RECORD BY THE ARRAYS HSUR1, HSUR2, -
CD                          AND HSUR3, IS PRESENT AT THE SPECIFIED MESH    -
CD                          INTERVAL EDGE.                                 -
C                                                                          -
C-------------------------------------------------------------------------
C-------------------------------------------------------------------------
CR          SOURCE DATA (TYPE 3)                                           -
C                                                                          -
CL     ((VSUR1(K,N),K=1,NVEDGE),N=1,NGROUP),((VSUR2(K,N),K=1,NVEDGE),      -
CL    1N=1,NGROUP),((VSUR3(K,N),K=1,NVEDGE),N=1,NGROUP),((HSUR1(K,N),      -
CL    2K=1,NHEDGE),N=1,NGROUP),((HSUR2(K,N),K=1,NHEDGE),N=1,NGROUP),       -
CL    3((HSUR3(K,N),K=1,NHEDGE),N=1,NGROUP)                                -
C                                                                          -
CD     VSUR1                ISOTROPIC COMPONENT OF THE K-TH SURFACE SOURCE -
CD                          ALIGNED IN THE "Y" DIRECTION FOR EACH GROUP.   -
CD                                                                         -
CD     VSUR2                "X" DIRECTION ANISOTROPIC COMPONENT OF THE     -
CD                          K-TH SURFACE SOURCE WHOSE ISOTROPIC COMPONENT  -
CD                          IS VSUR1, FOR EACH GROUP.                      -
CD                                                                         -
CD     VSUR3                "Y" DIRECTION ANISOTROPIC COMPONENT OF THE     -
CD                          K-TH SURFACE SOURCE WHOSE ISOTROPIC COMPONENT  -
CD                          IS VSUR1, FOR EACH GROUP.                      -
CD                                                                         -
CD     HSUR1                ISOTROPIC COMPONENT OF THE K-TH SURFACE SOURCE -
CD                          ALIGNED IN THE "X" DIRECTION FOR EACH GROUP.   -
CD                                                                         -
CD     HSUR2                "X" DIRECTION ANISOTROPIC COMPONENT OF THE     -
CD                          K-TH SURFACE SOURCE WHOSE ISOTROPIC COMPONENT  -
CD                          IS HSUR1, FOR EACH GROUP.                      -
CD                                                                         -
CD     HSUR3                "Y" DIRECTION ANISOTROPIC COMPONENT OF THE     -
CD                          K-TH SURFACE SOURCE WHOSE ISOTROPIC COMPONENT  -
CD                          IS HSUR1, FOR EACH GROUP.                      -
C                                                                          -
CN                          THE SURFACE SOURCE IS ASSUMED TO BE            -
CN                          REPRESENTABLE BY A SURFACE HARMONIC EXPANSION  -
CN                          WHICH IS TRUNCATED AT THE FIRST ORDER TERMS.   -
CN                          THUS, FOR EXAMPLE, THE SURFACE SOURCE ALIGNED  -
CN                          IN THE "Y" DIRECTION IS TAKEN TO BE            -
CN                          VSUR1+3*MU*VSUR2+3*ETA*VSUR3, WHERE MU AND     -
CN                          ETA ARE THE DIRECTION COSINES IN THE "X"       -
CN                          AND "Y" DIRECTIONS RESPECTIVELY OF THE         -
CN                          DISCRETE ANGLE BEING CONSIDERED.               -
CN                                                                         -
CN                          VSUR2,VSUR3,HSUR2,AND HSUR3 ARE PRESENT        -
CN                          ONLY IF NANISO=1. IN ADDITION, VSUR1, VSUR2,   -
CN                          AND VSUR3 ARE PRESENT ONLY IF NVEDGE.GT.0      -
CN                          AND HSUR1,HSUR2,AND HSUR3 ARE PRESENT          -
CN                          ONLY IF NHEDGE.GT.0.                           -
C                                                                          -
C-------------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FA.D1                                                    -
CE          ONE-DIMENSIONAL ADJOINT SCALAR GROUP FLUXES              -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF MESH INTERVALS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NGROUP,EVALUE,KIND,ITER                                  -
C                                                                    -
CD    EVALUE              EIGENVALUE.                                -
CD    KIND                KIND OF INITIAL FLUX.  KIND=-1 IF WRITTEN BY -
CD                        INPUT PROCESSOR OR FROM A NON-CONVERGED    -
CD                        PROBLEM.  KIND=+1 IF WRITTEN BY REAL FLUX  -
CD                        DIFFUSION THEORY PROBLEM.  KIND=+2 IF WRITTEN -
CD                        BY REAL FLUX TRANSPORT THEORY PROBLEM.     -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION THEORY -
CD                        PROBLEM.  KIND=+4 IF WRITTEN BY ADJOINT    -
CD                        TRANSPORT THEORY PROBLEM.                  -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN, MEANINGFUL ONLY IF KIND=-1.       -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL ADJOINT SCALAR FLUX (TYPE 2)             -
C                                                                    -
CL    ((FAN1(I,J),I=1,NINTI),J=1,NGROUP)                             -
C                                                                    -
CD    FAN1                ONE-DIMENSIONAL ADJOINT SCALAR FLUX BY     -
CD                        INTERVAL AND GROUP.                        -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FA.D1A                                                   -
CE          ONE-DIMENSIONAL ADJOINT ANGULAR GROUP FLUXES             -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NPTI                NUMBER OF MESH INTERVAL LINES.
CD    NUMDIR              NUMBER OF ANGULAR DIRECTIONS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NPTI,NUMDIR,NGROUP,KIND,ITER                                   -
C                                                                    -
CD    KIND                KIND OF INPUT GUESS. KIND=-1 FOR USER INPUT -
CD                        GUESS. KIND=+2 IF WRITTEN BY REAL          -
CD                        TRANSPORT THEORY PROBLEM. KIND=+4 IF WRITTEN -
CD                        BY ADJOINT TRANSPORT THEORY PROBLEM.       -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN. ITER=0 IF KIND.LT.0.              -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL ADJOINT ANGULAR FLUX (TYPE 2)            -
C                                                                    -
CL    ((FAN1A(I,J),I=1,NPTI),J=1,NUMDIR)-----NOTE STRUCTURE BELOW----- -
C                                                                    -
C     DO 1 L=1,NGROUP                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FAN1A               ONE-DIMENSIONAL ADJOINT ANGULAR FLUX FOR   -
CD                        MESH POINT I, DIRECTION J, AND ENERGY GROUP L. -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FA.D2                                                    -
CE          TWO-DIMENSIONAL ADJOINT SCALAR GROUP FLUXES              -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NINTJ,NGROUP,EVALUE,KIND,ITER                            -
C                                                                    -
CD    EVALUE              EIGENVALUE.                                -
CD    KIND                KIND OF INITIAL FLUX.  KIND=-1 IF WRITTEN BY -
CD                        INPUT PROCESSOR OR FROM A NON-CONVERGED    -
CD                        PROBLEM.  KIND=+1 IF WRITTEN BY REAL FLUX  -
CD                        DIFFUSION THEORY PROBLEM.  KIND=+2 IF WRITTEN -
CD                        BY REAL FLUX TRANSPORT THEORY PROBLEM.     -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION THEORY -
CD                        PROBLEM.  KIND=+4 IF WRITTEN BY ADJOINT    -
CD                        TRANSPORT THEORY PROBLEM.                  -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN, MEANINGFUL ONLY IF KIND=-1.       -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          TWO-DIMENSIONAL ADJOINT SCALAR FLUX (TYPE 2)             -
C                                                                    -
CL    ((FAN2(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW------
C                                                                    -
C     DO 1 K=1,NGROUP                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FAN2                TWO-DIMENSIONAL ADJOINT SCALAR FLUX BY   -
CD                        INTERVAL AND GROUP.                        -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FR.D1                                                    -
CF          ONE-DIMENSIONAL REAL SCALAR GROUP FLUXES                 -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF MESH INTERVALS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NGROUP,EVALUE,KIND,ITER                                  -
C                                                                    -
CD    EVALUE              EIGENVALUE.                                -
CD    KIND                KIND OF INITIAL FLUX.  KIND=-1 IF WRITTEN BY -
CD                        INPUT PROCESSOR OR FROM A NON-CONVERGED    -
CD                        PROBLEM.  KIND=+1 IF WRITTEN BY REAL FLUX  -
CD                        DIFFUSION THEORY PROBLEM.  KIND=+2 IF WRITTEN -
CD                        BY REAL FLUX TRANSPORT THEORY PROBLEM.     -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION THEORY -
CD                        PROBLEM.  KIND=+4 IF WRITTEN BY ADJOINT    -
CD                        TRANSPORT THEORY PROBLEM.                  -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN, MEANINGFUL ONLY IF KIND=-1.       -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL REAL SCALAR FLUX (TYPE 2)                -
C                                                                    -
CL    ((FRN1(I,J),I=1,NINTI),J=1,NGROUP)                             -
C                                                                    -
CD    FRN1                ONE-DIMENSIONAL REAL SCALAR FLUX BY INTERVAL -
CD                        AND GROUP.                                 -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FR.D1A                                                   -
CE          ONE-DIMENSIONAL REAL ANGULAR GROUP FLUXES                -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NPTI                NUMBER OF MESH INTERVAL LINES.
CD    NUMDIR              NUMBER OF ANGULAR DIRECTIONS.

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NPTI,NUMDIR,NGROUP,KIND,ITER                                   -
C                                                                    -
CD    KIND                KIND OF INPUT GUESS. KIND=-1 FOR USER INPUT -
CD                        GUESS. KIND=+2 IF WRITTEN BY REAL          -
CD                        TRANSPORT THEORY PROBLEM. KIND=+4 IF WRITTEN -
CD                        BY ADJOINT TRANSPORT THEORY PROBLEM.       -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN. ITER=0 IF KIND.LT.0.              -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          ONE-DIMENSIONAL REAL ANGULAR FLUX (TYPE 2)               -
C                                                                    -
CL    ((FRN1A(I,J),I=1,NPTI),J=1,NUMDIR)-----NOTE STRUCTURE BELOW----- -
C                                                                    -
C     DO 1 L=1,NGROUP                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FRN1A               ONE-DIMENSIONAL REAL ANGULAR FLUX FOR      -
CD                        MESH POINT I, DIRECTION J, AND ENERGY GROUP L. -
C                                                                    -
C--------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FR.D2                                                    -
CE          TWO-DIMENSIONAL REAL SCALAR GROUP FLUXES                 -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS.

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NINTJ,NGROUP,EVALUE,KIND,ITER                            -
C                                                                    -
CD    EVALUE              EIGENVALUE.                                -
CD    KIND                KIND OF INITIAL FLUX.  KIND=-1 IF WRITTEN BY -
CD                        INPUT PROCESSOR OR FROM A NON-CONVERGED    -
CD                        PROBLEM.  KIND=+1 IF WRITTEN BY REAL FLUX  -
CD                        DIFFUSION THEORY PROBLEM.  KIND=+2 IF WRITTEN -
CD                        BY REAL FLUX TRANSPORT THEORY PROBLEM.     -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION THEORY -
CD                        PROBLEM.  KIND=+4 IF WRITTEN BY ADJOINT    -
CD                        TRANSPORT THEORY PROBLEM.                  -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN, MEANINGFUL ONLY IF KIND=1.        -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          TWO-DIMENSIONAL REAL SCALAR FLUX (TYPE 2)                -
C                                                                    -
CL    ((FRN2(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW-----  -
C                                                                    -
C     DO 1 L=1,NGRCUP                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FRN2                TWO-DIMENSIONAL REAL SCALAR FLUX BY INTERVAL -
CD                        AND GROUP.                                 -
C                                                                    -
C--------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FR.PN                                                    -
CE          POWER-NORMALIZED REAL REGION-AVERAGED GROUP FLUXES       -
C                                                                    -
C*********************************************************************

CD    NGROUP              NUMBER OF ENERGY GROUPS.
CD    NREG                NUMBER OF REGIONS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL      NREG,NGROUP,EVALUE,KIND,ITER,POWER                           -
C                                                                    -
CD    EVALUE              EIGENVALUE.                                -
CD    KIND                KIND OF INITIAL FLUX.  KIND=-1 IF WRITTEN BY -
CD                        INPUT PROCESSOR OR FROM A NON-CONVERGED    -
CD                        PROBLEM.  KIND=+1 IF WRITTEN BY REAL FLUX  -
CD                        DIFFUSION THEORY PROBLEM.  KIND=+2 IF WRITTEN -
CD                        BY REAL FLUX TRANSPORT THEORY PROBLEM.     -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION THEORY -
CD                        PROBLEM.  KIND=+4 IF WRITTEN BY ADJOINT    -
CD                        TRANSPORT THEORY PROBLEM.                  -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FLUX WAS   -
CD                        WRITTEN, MEANINGFUL ONLY IF KIND=-1.       -
CD    POWER               TOTAL REACTOR POWER IN WATTS.              -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          POWER-NORMALIZED REGION-AVERAGED GROUP FLUX (TYPE 2)     -
C                                                                    -
CL    ((FP(I,J),I=1,NGROUP),J=1,NREG)                                -
C                                                                    -
CD    FP                  POWER-NORMALIZED REGION-AVERAGED GROUP FLUX -
CD                        FOR ENERGY GROUP I AND REGION J.           -
C                                                                    -
C---------------------------------------------------------------------
CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FSA.D1                                                   -
CE          ONE-DIMENSIONAL ADJOINT FISSION SOURCE                   -
C                                                                    -
C*********************************************************************

CD    NINTI               NUMBER OF MESH INTERVALS.
CD    NORONE              NORONE=NGROUP IF FISSION SOURCE IS GROUP-
CD                        DEPENDENT, WHERE NGROUP IS THE NUMBER OF
CD                        ENERGY GROUPS. OTHERWISE, NORONE=1.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NORONE,KIND,ITER                                         -
C                                                                    -
CD    KIND                KIND OF INITIAL FISSION SOURCE. KIND=-1 IF -
CD                        WRITTEN BY INPUT PROCESSOR OR FROM A       -
CD                        NON-CONVERGED PROBLEM. KIND=+1 IF WRITTEN BY -
CD                        REAL DIFFUSION THEORY PROBLEM. KIND=+2 IF  -
CD                        WRITTEN BY REAL TRANSPORT THEORY PROBLEM.  -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION    -
CD                        THEORY PROBLEM. KIND=+4 IF WRITTEN BY      -
CD                        ADJOINT TRANSPORT THEORY PROBLEM.          -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FISSION    -
CD                        SOURCE WAS WRITTEN, MEANINGFUL ONLY IF     -
CD                        KIND=-1.                                   -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL ADJOINT FISSION SOURCE (TYPE 2)          -
C                                                                    -
CL    ((FSAN1(I,J), I=1,NINTI), J=1,NORONE)                          -
C                                                                    -
CD    FSAN1               ONE-DIMENSIONAL ADJOINT FISSION SOURCE     -
CD                        BY INTERVAL AND GROUP.                     -
C                                                                    -
C---------------------------------------------------------------------
CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FSA.D2                                                   -
CE          TWO-DIMENSIONAL ADJOINT FISSION SOURCE                   -
C                                                                    -
C*********************************************************************

CD    NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS.
CD    NORONE              NORONE=NGROUP IF FISSION SOURCE IS GROUP-
CD                        DEPENDENT, WHERE NGROUP IS THE NUMBER OF
CD                        ENERGY GROUPS. OTHERWISE, NORONE=1.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NINTJ,NORONE,KIND,ITER                                   -
C                                                                    -
CD    KIND                KIND OF INITIAL FISSION SOURCE. KIND=-1 IF -
CD                        WRITTEN BY INPUT PROCESSOR OR FROM A       -
CD                        NON-CONVERGED PROBLEM. KIND=+1 IF WRITTEN BY -
CD                        REAL DIFFUSION THEORY PROBLEM. KIND=+2 IF  -
CD                        WRITTEN BY REAL TRANSPORT THEORY PROBLEM.  -
CD                        KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION    -
CD                        THEORY PROBLEM. KIND=+4 IF WRITTEN BY      -
CD                        ADJOINT TRANSPORT THEORY PROBLEM.          -
CD    ITER                OUTER ITERATION NUMBER AT WHICH FISSION    -
CD                        SOURCE WAS WRITTEN, MEANINGFUL ONLY IF     -
CD                        KIND=-1.                                   -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          TWO-DIMENSIONAL ADJOINT FISSION SOURCE (TYPE 2)          -
C                                                                    -
CL    ((FSAN2(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW----- -
C                                                                    -
C     DO 1 M=1,NORONE                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FSAN2               TWO-DIMENSIONAL ADJOINT FISSICN SOURCE     -
CD                        BY INTERVAL AND GROUP.                     -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FSR.D1                                                   -
CF          ONE-DIMENSIONAL REAL FISSION SOURCE                      -
C                                                                    -
C*********************************************************************

CD    NINTI                 NUMBER OF MESH INTERVALS.
CD    NORONE                NORONE=NGROUP IF FISSION SOURCE IS GROUP-
CD                          DEPENDENT, WHERE NGROUP IS THE NUMBER OF
CD                          ENERGY GROUPS. OTHERWISE, NORONE=1.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NORONE,KIND,ITER                                         -
C                                                                    -
CD    KIND                  KIND OF INITIAL FISSION SOURCE. KIND=-1 IF -
CD                          WRITTEN BY INPUT PROCESSOR OR FROM A     -
CD                          NON-CONVERGED PROBLEM. KIND=+1 IF WRITTEN BY -
CD                          REAL DIFFUSION THEORY PROBLEM. KIND=+2 IF -
CD                          WRITTEN BY REAL TRANSPORT THEORY PROBLEM. -
CD                          KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION  -
CD                          THEORY PROBLEM. KIND=+4 IF WRITTEN BY    -
CD                          ADJOINT TRANSPORT THEORY PROBLEM.        -
CD    ITER                  OUTER ITERATION NUMBER AT WHICH FISSION  -
CD                          SOURCE WAS WRITTEN, MEANINGFUL ONLY IF   -
CD                          KIND=-1.                                 -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL REAL FISSION SOURCE (TYPE 2)             -
C                                                                    -
CL    ((FSRN1(I,J), I=1,NINTI), J=1,NORONE)                          -
C                                                                    -
CD    FSRN1                 ONE-DIMENSIONAL REAL FISSION SOURCE BY   -
CD                          INTERVAL AND GROUP.                      -
C                                                                    -
C---------------------------------------------------------------------

CEOF

C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          FSR.D2                                                   -
CF          TWO-DIMENSIONAL REAL FISSION SOURCE                      -
C                                                                    -
C*********************************************************************

CD    NINTI                 NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ                 NUMBER OF SECOND-DIMENSION MESH INTERVALS.
CD    NORONE                NORONE=NGROUP IF FISSION SOURCE IS GROUP-
CD                          DEPENDENT, WHERE NGROUP IS THE NUMBER OF
CD                          ENERGY GROUPS. OTHERWISE, NORONE=1.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NINTI,NINTJ,NORONE,KIND,ITER                                   -
C                                                                    -
CD    KIND                  KIND OF INITIAL FISSION SOURCE. KIND=-1 IF -
CD                          WRITTEN BY INPUT PROCESSOR OR FROM A     -
CD                          NON-CONVERGED PROBLEM. KIND=+1 IF WRITTEN BY -
CD                          REAL DIFFUSION THEORY PROBLEM. KIND=+2 IF -
CD                          WRITTEN BY REAL TRANSPORT THEORY PROBLEM. -
CD                          KIND=+3 IF WRITTEN BY ADJOINT DIFFUSION  -
CD                          THEORY PROBLEM. KIND=+4 IF WRITTEN BY    -
CD                          ADJOINT TRANSPORT THEORY PROBLEM.        -
CD    ITER                  OUTER ITERATION NUMBER AT WHICH FISSION  -
CD                          SOURCE WAS WRITTEN, MEANINGFUL ONLY IF   -
CD                          KIND=-1.                                 -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          TWO-DIMENSIONAL REAL FISSION SOURCE (TYPE 2)             -
C                                                                    -
CL    ((FSRN2(I,J),I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW----- -
C                                                                    -
C     DO 1 M=1,NORONE                                                -
C   1 READ(N) *LIST AS ABOVE*                                        -
C                                                                    -
CD    FSRN2                 TWO-DIMENSIONAL REAL FISSION SOURCE      -
CD                          BY INTERVAL AND GROUP.                   -
C                                                                    -
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C-----------------------------------------------------------------------
CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          GEOM                                                     -
CF          GEOMETRY DATA                                            -
C                                                                    -
C*********************************************************************
                                                  .
CD     NPTI              NUMBER OF FIRST-DIMENSION MESH INTERVAL
CD                       LINES.
CD     NPTJ              NUMBER OF SECOND-DIMENSION MESH INTERVAL
CD                       LINES.
CD     NINTI             NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD     NINTJ             NUMBER OF SECOND-DIMENSION MESH INTERVALS.
CD     NREG              NUMBER OF REGIONS.
CD     NCMP              NUMBER OF COMPOSITIONS.
CD     NAREA             NUMBER OF AREAS.
CD     LAREA             LENGTH OF AREA DEFINITION RECORD.
CD     NZONE             NUMBER OF ZONES.
CD     LZONE             LENGTH OF ZONE DEFINITION RECORD.
CD     NIL               NUMBER OF FINITE DIRECTIONS.

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     NDIM,NGEOM,NPTI,NPTJ,NINTI,NINTJ,NREG,NCMP,NAREA,LAREA,NZONE, -
CL    1LZONE,NFIN,NIL                                                -
C                                                                    -
CD     NDIM              NUMBER OF DIMENSIONS.                      -
CD     NGEOM             GEOMETRY.                                  -
CD                       NGEOM=1, ONE-DIMENSIONAL SLAB.             -
CD                            =2, ONE-DIMENSIONAL CYLINDER.         -
CD                            =3, ONE-DIMENSIONAL SPHERE.           -
CD                            =4, TWO-DIMENSIONAL X-Y.              -
CD                            =5, TWO-DIMENSIONAL R-Z.              -
CD                            =6, TWO-DIMENSIONAL R-THETA.          -
CD                            =7, TWO-DIMENSIONAL X-Y WITH 45-DEGREE -
CD                                SYMMETRY.                          -
CD                            =8, TWO-DIMENSIONAL Z-R.               -
CD     NFIN              NUMBER OF FINITE GEOMETRY TYPE             -
CD                                                                   -
CD          NFIN         NGEOM        NIL       GEOMETRY TYPE       -
CD           0            ANY          0         INFINITE           -
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CD          1           1           1        CYLINDRICAL SLAB          -  004900
CD          2           1           1        SLAB FINITE IN Y DIR.     -  005000
CD          3           1           2        SLAB FINITE IN Y&Z DIR.   -  005100
CD          4           2           1        FINITE CYLINDER           -  005200
CD          5           4,7         1        X-Y FINITE IN Z DIR.      -  005300
CD          6           6           1        R-THETA FINITE IN Z DIR.  -  005400
C                                                                      -  005500
C-----------------------------------------------------------------------   005600
                                                                          005700
                                                                          005800
C-----------------------------------------------------------------------   005900
CR          MESH INTERVAL BOUNDARIES (TYPE 2)                          -  006000
C                                                                      -  006100
CC          ALWAYS PRESENT                                             -  006200
C                                                                      -  006300
CL    (XMESH(I),I=1,NPTI),(YMESH(J),J=1,NPTJ)                          -  006400
C                                                                      -  006500
CD    XMESH                 FIRST-DIMENSION BOUNDARIES.                -  006600
CD    YMESH                 SECOND-DIMENSION BOUNDARIES.               -  006700
C                                                                      -  006800
C-----------------------------------------------------------------------   006900
                                                                          007000
                                                                          007100
C-----------------------------------------------------------------------   007200
CR          REGION-INTERVAL CORRESPONDENCE (TYPE 3)                    -  007300
C                                                                      -  007400
CC          ALWAYS PRESENT                                             -  007500
C                                                                      -  007600
CL    ((MR(I,J),I=1,NINTI),J=1,NINTJ)                                  -  007700
C                                                                      -  007800
CD    MR                    REGION INDEX. IF MR(I,J)=N, THEN REG(N) IS -  007900
CD                          THE REGION LABEL IN INTERVAL (I,J)         -  008000
CD                          (SEE LABELS RECORD BELOW).                 -  008100
C                                                                      -  008200
C-----------------------------------------------------------------------   008300
                                                                          008400
                                                                          008500
C-----------------------------------------------------------------------   008600
CR          COMPOSITION-INTERVAL CORRESPONDENCE (TYPE 4)               -  008700
C                                                                      -  008800
CC          ALWAYS PRESENT                                             -  008900
C                                                                      -  009000
CL    ((MC(I,J),I=1,NINTI),J=1,NINTJ)                                  -  009100
C                                                                      -  009200
CD    MC                    COMPOSITION INDEX. IF MC(I,J)=N, THEN CNAME(N) -  009300
CD                          IS THE COMPOSITION LABEL IN INTERVAL (I,J) -  009400
CD                          (SEE LABELS RECORD BELOW).                 -  009500
C                                                                      -  009600
C-----------------------------------------------------------------------   009700
                                                                          009800
                                                                          009900
C-----------------------------------------------------------------------   010000
CR          COMPOSITION-REGION CORRESPONDENCE (TYPE 5)                 -  010100
C                                                                      -  010200
CC          ALWAYS PRESENT                                             -  010300
C                                                                      -  010400
CL    (NC(I),I=1,NREG)                                                 -  010500
C                                                                      -  010600
CD    NC                    COMPOSITION INDEX. IF NC(I)=N, THEN CNAME(N)   -  010700
CD                          IS THE COMPOSITION LABEL IN REGION I       -  010800
CD                          (SEE LABELS RECORD BELOW).                 -  010900
C                                                                      -  011000
C-----------------------------------------------------------------------   011100
                                                                          011200
                                                                          011300
C-----------------------------------------------------------------------   011400
CR          AREA DEFINITIONS (TYPE 6)                                  -  011500
C                                                                      -  011600
CC          PRESENT IF LAREA.GT.0                                      -  011700
C                                                                      -  011800
CL    (NREGA(I),I=1,NAREA),LREGA,(NRA(I),I=1,LREGA)                    -  011900
C                                                                      -  012000
CD    NREGA                 NUMBER OF REGIONS IN EACH AREA I.          -  012100
CD    LREGA                 LENGTH OF VECTOR NRA                       -  012200
CD                          (LREGA=SUM OF NREGA(I),I=1,NAREA).         -  012300
CD    NRA                   REGION INDICES. IF NRA(I)=N, THEN REG(N) IS    -  012400
CD                          THE REGION LABEL FOR THIS PORTION OF AN AREA I -  012500
CD                          (SEE LABELS RECORD BELOW).                 -  012600
C                                                                      -  012700
C-----------------------------------------------------------------------   012800
                                                                          012900
                                                                          013000
C-----------------------------------------------------------------------   013100
CR          ZONE DEFINITIONS (TYPE 7)                                  -  013200
C                                                                      -  013300
CC          PRESENT IF LZONE.GT.0                                      -  013400
C                                                                      -  013500
CL    (NSECTZ(I),I=1,NZONE),LSECT,(NSB(I),I=1,LSECT)                   -  013600
C                                                                      -  013700
CD    NSECTZ                NUMBER OF SECTIONS IN EACH ZONE I.         -  013800
CD    LSECT                 LENGTH OF VECTOR NSB                       -  013900
CD                          (LSECT=2*NDIM*SUM OF NSECTZ(I),I=1,NZONE). -  014000
CD    NSB                   SECTION BOUNDARIES FOR EACH OF THE NSECTZ  -  014100
CD                          SECTIONS OF EACH OF THE NZONE ZONES.       -  014200
CD                          EACH SECTION IS DEFINED BY THE FIRST AND   -  014300
CD                          SECOND FIRST-DIMENSION MESH INTERVAL LINE  -  014400
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CD                          NUMBERS, FOLLOWED BY THE FIRST AND SECOND      -  014500
CD                          SECOND-DIMENSION MESH INTERVAL LINE NUMBERS    -  014600
CD                          FOR TWO-DIMENSIONAL PROBLEMS.                  -  014700
C                                                                          -  014800
C-----------------------------------------------------------------------------  014900
                                                                               015000
                                                                               015100
C-----------------------------------------------------------------------------  015200
CR          FINITE GEOMETRY DATA (TYPE 8)                                  -  015300
C                                                                          -  015400
CC          PRESENT IF NIL.GT.0                                            -  015500
C                                                                          -  015600
CL     ((BSQ(I,J),I=1,NREG),J=1,NIL),((H(I,J),I=1,NREG),J=1,NIL),          -  015700
CL    1((X(I,J),I=1,NREG),J=1,NIL)                                         -  015800
C                                                                          -  015900
CD     BSQ                  BUCKLING BY REGION FOR EACH FINITE DIRECTION.  -  016000
CD     H                    ACTUAL HALF-HEIGHT FOR EACH REGION IN EACH     -  016100
CD                          FINITE DIRECTION.                              -  016200
CD     X                    EXTRAPOLATED HALF-HEIGHT FOR EACH REGION IN    -  016300
CD                          EACH FINITE DIRECTION. X=H+EXTRAPOLATION       -  016400
CD                          DISTANCE.                                      -  016500
C                                                                          -  016600
C-----------------------------------------------------------------------------  016700
                                                                               016800
                                                                               016900
C-----------------------------------------------------------------------------  017000
CR          LABELS (TYPE 9)                                                -  017100
C                                                                          -  017200
CC          ALWAYS PRESENT                                                 -  017300
C                                                                          -  017400
CL     (REG(I),I=1,NREG),(CNAME(I),I=1,NCMP),(AREA(I),I=1,NAREA),          -  017500
CL    1(ZONE(I),I=1,NZONE)                                                 -  017600
C                                                                          -  017700
CD     REG                  REGION LABELS.                                 -  017800
CD     CNAME                COMPOSITION LABELS.                            -  017900
CD     AREA                 AREA LABELS (DEFAULT=BLANK).                   -  018000
CD     ZONE                 ZONE LABELS (DEFAULT=BLANK).                   -  018100
C                                                                          -  018200
C-----------------------------------------------------------------------------  018300
                                                                               018400
                                                                               018500
C-----------------------------------------------------------------------------  018600
CR          REGION VOLUMES (TYPE 10)                                       -  018700
C                                                                          -  018800
CC          ALWAYS PRESENT                                                 -  018900
C                                                                          -  019000
CL     (VOL(I),I=1,NREG)                                                   -  019100
C                                                                          -  019200
CD     VOL                  VOLUME OF REGION REG(I) (SEE LABELS RECORD     -  019300
CD                          ABOVE). FOR Z-R AND R-Z GEOMETRIES, VOL IS THE -  019400
CD                          VOLUME OF JUST THAT PORTION OF THE REACTOR     -  019500
CD                          WHICH IS BEING CALCULATED. FOR OTHER FINITE    -  019600
CD                          GEOMETRIES, VOL INCLUDES A FACTOR EQUAL TO     -  019700
CD                          THE ACTUAL HEIGHT FOR THE REGION IN EACH       -  019800
CD                          FINITE DIRECTION, EXCEPT THAT FOR ONE-         -  019900
CD                          DIMENSIONAL CYLINDRICAL SLAB GEOMETRY THE      -  020000
CD                          FACTOR IS EQUAL TO PI*RADIUS SQUARED (SEE      -  020100
CD                          FINITE GEOMETRY DATA RECORD ABOVE). FOR        -  020200
CD                          INFINITE GEOMETRY, VOL EQUALS THE VOLUME PER   -  020300
CD                          UNIT HEIGHT IN THE TRANSVERSE DIRECTION.       -  020400
C                                                                          -  020500
C-----------------------------------------------------------------------------  020600
                                                                               020700
CEOF                                                                           020800
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 3/16/71 AT ANL                     -
C                                                                    -
CF          GEOM.P                                                   -
CE          PROBLEM-DEPENDENT GEOMETRY DATA                          -
C                                                                    -
CN                       THIS DATA SET IS USED BY ANY MODULE FOR     -
CN                       WHICH TWO GEOMETRY DATA SETS ARE NEEDED.    -
CN                                                                   -
CN                       THE FORMAT OF THIS DATA SET IS IDENTICAL    -
CN                       TO THAT OF DATA SET GEOM.                   -
C                                                                    -
C*********************************************************************
CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          ISO1                                                     -
CE          MICROSCOPIC ELASTIC TRANSFER CROSS SECTIONS FOR A        -
CE          LEGENDRE TREATMENT OF ELASTIC SCATTERING                 -
C                                                                    -
CN                       THE FILE STRUCTURE AND THE FORMAT FOR THE DATA -
CN                       SETS ISO2 THRU ISO20 CONTAINING ELASTIC     -
CN                       TRANSFER CROSS SECTIONS FOR MATERIALS 2-20  -
CN                       ARE THE SAME AS FOR DATA SET ISO1.          -
C                                                                    -
C*********************************************************************
C----------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                          PRESENT IF          -
CS          ================================     ====================-
CS    ******** (REPEAT FOR ALL ULTRAFINE GROUPS)                     -
CS    *     ELASTIC SCATTERING FOR LEGENDRE      MATERIAL HAS        -
CS    *     MATERIAL 1                           LEGENDRE TREATMENT  -
CS    ********                                                       -
C                                                                    -
C----------------------------------------------------------------------
C----------------------------------------------------------------------
CR          ELASTIC SCATTERING FOR LEGENDRE MATERIAL 1 (TYPE 1)      -
C                                                                    -
CC          PRESENT IF MATERIAL HAS LEGENDRE TREATMENT               -
C                                                                    -
CL    (SIGET(K),K=1,KEIGHT)                                          -
C                                                                    -
CS    SIGET                PO ELASTIC SCATTERING CROSS SECTIONS    -
CD                         FROM K=1 TO K=N. (N=1+THE NUMBER OF ULTRAFINE -
CD                         GROUPS DOWNSCATTERED BY MATERIAL 1 TRUNCATED -
CD                         TO AN INTEGER).                         -
CD                         ELASTIC REMOVAL CROSS SECTION FOR K=N+1. -
CD                         TRANSPORT CROSS SECTION FOR K=N+2.      -
CD                         3*ELASTIC REMOVAL CROSS SECTION FOR K=N+3. -
CD                         P1 ELASTIC SCATTERING CROSS SECTIONS    -
CD                         FROM K=N+4 TO K=2N+3.                   -
CD    KEIGHT               EQUAL TO N+3 FOR P1 FUNDAMENTAL MODE OPTION. -
CD                         EQUAL TO 2N+3 FOR CONSISTENT B1 AND     -
CD                         CONSISTENT P1 FUNDAMENTAL MODE OPTIONS. -
```

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C                                                                       -  004900
C-----------------------------------------------------------------------   005000
                                                                          005100
CEOF                                                                      005200
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C*********************************************************************   000100
C                                                                       -  000200
C                          PREPARED 2/5/71 AT ANL                       -  000300
C                                                                       -  000400
CF          JA.D1                                                       -  000500
CE          ONE-DIMENSIONAL ADJOINT NET CURRENT                         -  000600
C                                                                       -  000700
C*********************************************************************   000800
                                                                          000900
                                                                          001000
CD    NPTI                NUMBER OF MESH INTERVAL LINES.                  001100
CD    NGROUP              NUMBER OF ENERGY GROUPS.                        001200
                                                                          001300
                                                                          001400
C-----------------------------------------------------------------------   001500
CR          SPECIFICATIONS (TYPE 1)                                     -  001600
C                                                                       -  001700
CL    NPTI,NGROUP                                                       -  001800
C                                                                       -  001900
C-----------------------------------------------------------------------   002000
                                                                          002100
                                                                          002200
C-----------------------------------------------------------------------   002300
CR          ONE-DIMENSIONAL ADJOINT NET CURRENT (TYPE 2)                -  002400
C                                                                       -  002500
CL    ((JAN1(I,J),I=1,NPTI),J=1,NGROUP)                                 -  002600
C                                                                       -  002700
CD    JAN1                ONE-DIMENSIONAL ADJOINT NET CURRENT ACROSS    -  002800
CD                        MESH INTERVAL LINE I FOR ENERGY GROUP J.      -  002900
C                                                                       -  003000
C-----------------------------------------------------------------------   003100
                                                                          003200
CEOF                                                                      003300
```

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C***********************************************************************
C                                                                      -
C                        PREPARED 2/5/71 AT ANL                        -
C                                                                      -
CF          JPA.D2                                                     -
CE          TWO-DIMENSIONAL ADJOINT PARTIAL CURRENTS                   -
C                                                                      -
C***********************************************************************

CD    NINTI                 NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ                 NUMBER OF SECOND-DIMENSION MESH INTERVALS.
CD    NGROUP                NUMBER OF ENERGY GROUPS.
CD    IFLAG                 +4 IF PARTIAL CURRENTS RECORDS CONTAIN ONLY
CD                          THE OUTWARD CURRENT FOR EACH MESH INTERVAL.
CD                          +8 IF PARTIAL CURRENTS RECORDS CONTAIN BOTH
CD                          OUTWARD AND INWARD DIRECTED PARTIAL CURRENTS
CD                          FOR EACH MESH INTERVAL.

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                    -
C                                                                      -
CL    NINTI,NINTJ,NGROUP,IFLAG                                         -
C                                                                      -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          PARTIAL CURRENTS (TYPE 2)                                  -
C                                                                      -
CL    (((JPAN2(L,I,J),L=1,IFLAG),                                      -
CL   1I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW-----               -
C                                                                      -
C     DO 1 K=1,NGROUP                                                  -
C   1 READ(N) *LIST AS ABOVE*                                          -
C                                                                      -
CD    JPAN2                 CURRENT POINTING OUTWARD FROM THE MESH     -
CD                          INTERVAL AT LEFT, TOP, RIGHT, AND BOTTOM   -
CD                          MESH INTERVAL EDGES, FOLLOWED (WHEN IFLAG=8) -
CD                          BY CURRENT POINTING INTO THE MESH INTERVAL AT -
CD                          LEFT, TOP, RIGHT, AND BOTTOM MESH INTERVAL -
CD                          EDGES. THE SIGN OF THE PARTIAL CURRENTS ARE -
CD                          ORIENTED WITH RESPECT TO INCREASING "X" AND -
CD                          "Y" COORDINATE DIRECTIONS.                 -
C                                                                      -
C-----------------------------------------------------------------------

CEOF
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C***********************************************************************
C                                                                      -
C                        PREPARED 2/5/71 AT ANL                        -
C                                                                      -
CF          JPR.D2                                                     -
CE          TWO-DIMENSIONAL REAL PARTIAL CURRENTS                      -
C                                                                      -
C***********************************************************************

CD    NINTI                 NUMBER OF FIRST-DIMENSION MESH INTERVALS.
CD    NINTJ                 NUMBER OF SECOND-DIMENSION MESH INTERVALS.
CD    NGROUP                NUMBER OF ENERGY GROUPS.
CD    IFLAG                 +4 IF PARTIAL CURRENTS RECORDS CONTAIN ONLY
CD                          THE OUTWARD CURRENT FOR EACH MESH INTERVAL.
CD                          +8 IF PARTIAL CURRENTS RECORDS CONTAIN BOTH
CD                          OUTWARD AND INWARD DIRECTED PARTIAL CURRENTS
CD                          FOR EACH MESH INTERVAL.

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                    -
C                                                                      -
CL    NINTI,NINTJ,NGROUP,IFLAG                                         -
C                                                                      -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          PARTIAL CURRENTS (TYPE 2)                                  -
C                                                                      -
CL    (((JPRN2(L,I,J),L=1,IFLAG),                                      -
CL   1I=1,NINTI),J=1,NINTJ)-----NOTE STRUCTURE BELOW-----               -
C                                                                      -
C     DO 1 K=1,NGROUP                                                  -
C   1 READ(N) *LIST AS ABOVE*                                          -
C                                                                      -
CD    JPRN2                 CURRENT POINTING OUTWARD FROM THE MESH     -
CD                          INTERVAL AT LEFT, TOP, RIGHT, AND BOTTOM   -
CD                          MESH INTERVAL EDGES, FOLLOWED (WHEN IFLAG=8) -
CD                          BY CURRENT POINTING INTO THE MESH INTERVAL AT -
CD                          LEFT, TOP, RIGHT, AND BOTTOM MESH INTERVAL -
CD                          EDGES. THE SIGN OF THE PARTIAL CURRENTS ARE -
CD                          ORIENTED WITH RESPECT TO INCREASING "X" AND -
CD                          "Y" COORDINATE DIRECTIONS.                 -
C                                                                      -
C-----------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          JR.D1                                                    -
CE          ONE-DIMENSIONAL REAL NET CURRENT                         -
C                                                                    -
C*********************************************************************
CD    NPTI                NUMBER OF MESH INTERVAL LINES.
CD    NGROUP              NUMBER OF ENERGY GROUPS.
C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL    NPTI,NGROUP                                                    -
C                                                                    -
C---------------------------------------------------------------------
C---------------------------------------------------------------------
CR          ONE-DIMENSIONAL REAL NET CURRENT (TYPE 2)                -
C                                                                    -
CL    ((JRN1(I,J),I=1,NPTI),J=1,NGROUP)                              -
C                                                                    -
CD    JRN1                ONE-DIMENSIONAL REAL NET CURRENT ACROSS    -
CD                        MESH INTERVAL LINE I FOR ENERGY GROUP J.   -
C                                                                    -
C---------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/5/71 AT ANL                      -
C                                                                    -
CF          POINTR                                                   -
CE          TABLES AND ARRAY VALUES FOR INITIALIZATION OF POINTR     -
C                                                                    -
C*********************************************************************

CD    INDXB               STORAGE OFFSET BETWEEN THE LOCATION OF ARRAY(1)
CD                        AND THE POINTER IN THE BULK CORE ARRAY.
CD    INDXM               STORAGE OFFSET BETWEEN THE LOCATION OF ARRAY(1)
CD                        AND THE POINTER IN THE MAIN CORE ARRAY.
CD    LSTB                POINTER IN THE CONTAINER ARRAY OF THE
CD                        FIRST UNUSED STORAGE LOCATION IN BULK CORE.
CD    LSTM                POINTER IN THE CONTAINER ARRAY OF THE
CD                        FIRST UNUSED STORAGE LOCATION IN MAIN CORE.
CD    NNAMS               TOTAL NUMBER OF VARIABLE NAMES IN
CD                        CONTAINER ARRAY.
C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    NNAMS,LSTM,MAXSIZ,LSTB,MAXB,INDXM,INDXB                        -
C                                                                    -
CD    MAXSIZ              MAIN CORE ARRAY LENGTH IN REAL*8 WORDS.    -
CD    MAXB                BULK CORE ARRAY LENGTH IN REAL*8 WORDS.    -
C                                                                    -
C---------------------------------------------------------------------
C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 2)                                  -
C                                                                    -
CC          PRESENT ONLY IF NNAMS.GT.0                               -
C                                                                    -
CL    (NAMLST(I),I=1,NNAMS),(LENLST(I),I=1,NNAMS),                   -
CL   1(IPTLST(I),I=1,NNAMS),(LEN(I),I=1,NNAMS),                      -
CL   2(MLT(I),I=1,NNAMS),(IFLAG(I),I=1,NNAMS)                        -
C                                                                    -
CD    NAMLST              REAL*8 NAMES OF THE VARIABLE-DIMENSIONED   -
CD                        ARRAYS IN THE CONTAINER ARRAY.             -
CD    LENLST              LENGTH IN REAL*8 WORDS OF THE ARRAY NAMLST(I). -
CD    IPTLST              THE POINTER ASSOCIATED WITH THE ARRAY      -
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CD                          NAMLST(I).                                  -  004900
CD      LEN                 THE LENGTH OF ARRAY NAMLST(I) AS DEFINED    -  005000
CD                          IN THE CALLING PROGRAM.                     -  005100
CD      MLT                 THE MULTIPLICITY OF ARRAY NAMLST(I) AS      -  005200
CD                          DEFINED IN THE CALLING PROGRAM, WHERE       -  005300
CD                          2=HALFWORD INTEGER VARIABLES                -  005400
CD                          4=FULLWORD REAL OR INTEGER VARIABLES        -  005500
CD                          8=DOUBLEWORD REAL VARIABLES.                -  005600
CD      IFLAG               POINTER INDICATING WHETHER ARRAY NAMLST(I)  -  005700
CD                          IS IN MAIN CORE OR BULK CORE WHERE          -  005800
CD                          0=MAIN CORE AND 1=BULK CORE.                -  005900
C                                                                       -  006000
C-----------------------------------------------------------------------   006100
                                                                          006200
                                                                          006300
C-----------------------------------------------------------------------   006400
CR            MAIN CORE ARRAY (TYPE 3)                                  -  006500
C                                                                       -  006600
CC            PRESENT ONLY IF NNAMS.GT.0                                -  006700
C                                                                       -  006800
CL      (ARRAYM(I), I=I1,I2)                                            -  006900
C                                                                       -  007000
CD      ARRAYM              ARRAY OF VARIABLES IN MAIN CORE             -  007100
CD                          CONTAINER ARRAY.                            -  007200
CD      I1                  I1=INDXM+1.                                 -  007300
CD      I2                  I2=LSTM-1.                                  -  007400
C                                                                       -  007500
C-----------------------------------------------------------------------   007600
                                                                          007700
                                                                          007800
C-----------------------------------------------------------------------   007900
CR            BULK CORE ARRAY (TYPE 4)                                  -  008000
C                                                                       -  008100
CC            PRESENT ONLY IF LSTB.GT.INDXB+1                           -  008200
C                                                                       -  008300
CL      (ARRAYB(I), I=I1,I2)                                            -  008400
C                                                                       -  008500
CD      ARRAYB              ARRAY OF VARIABLES IN BULK CORE             -  008600
CD                          CONTAINER ARRAY.                            -  008700
CD      I1                  I1=INDXB+1.                                 -  008800
CD      I2                  I2=LSTB-1.                                  -  008900
C                                                                       -  009000
C-----------------------------------------------------------------------   009100
                                                                          009200
CEOF                                                                      009300


C***********************************************************************   000100
C                                                                       -  000200
C                           PREPARED 2/15/71 AT ANL                     -  000300
C                                                                       -  000400
CF            SP.CICN                                                   -  000500
CD            MODULE-INDEPENDENT DATA                                   -  000600
C                                                                       -  000700
C***********************************************************************   000800
                                                                          000900
                                                                          001000
C-----------------------------------------------------------------------   001100
CR            SPECIFICATIONS (TYPE 1)                                   -  001200
C                                                                       -  001300
CL      MKRTHY,NGEOM,NDIM,NINTI,NINTJ,NGROUP,IPROB,CONVCR,(X(I),I=1,2), -  001400
CL     1ALPHA,FIXEDK                                                    -  001500
C                                                                       -  001600
CD      MKRTHY              SOLUTION TYPE.                              -  001700
CD                          0 FOR REAL SOLUTION.                        -  001800
CD                          1 FOR ADJOINT SOLUTION.                     -  001900
CD                          2 FOR BOTH REAL AND ADJOINT SOLUTIONS.      -  002000
CD      NGEOM               GEOMETRY TYPE NUMBER (SEE DATA SET GEOM).   -  002100
CD      NDIM                NUMBER OF DIMENSIONS.                       -  002200
CD      NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS.   -  002300
CD      NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS.  -  002400
CD      NGROUP              NUMBER OF ENERGY GROUPS.                    -  002500
CD      IPROB               CALCULATION TYPE.                           -  002600
CD                          1 FOR INHOMOGENEOUS (SOURCE) CALCULATION.   -  002700
CD                          2 FOR KEFF CALCULATION.                     -  002800
CD                          3 FOR CONCENTRATION SEARCH CALCULATION.     -  002900
CD                          4 FOR BUCKLING SEARCH CALCULATION.          -  003000
CD                          5 FOR ALPHA SEARCH CALCULATION.             -  003100
CD                          6 FOR DIMENSION SEARCH CALCULATION.         -  003200
CD      CONVCR              CONVERGENCE CRITERION FOR SEARCH CALCULATION -  003300
CD                          (SEE DATA SETS A.NIP AND SP.CRIT).          -  003400
CD      X(1),X(2)           FIRST AND SECOND VALUES OF SEARCH PARAMETER -  003500
CD                          (SEE DATA SETS A.NIP AND SP.CRIT).          -  003600
CD      ALPHA               INITIAL ALPHA FOR ALPHA SEARCH CALCULATION  -  003700
CD                          OR FIXED ALPHA FOR THE CALCULATION (SEE DATA -  003800
CD                          SET A.NIP).                                 -  003900
CD      FIXEDK              FIXED KEFF FOR SOURCE CALCULATION OR 1.0    -  004000
CD                          (SEE DATA SET A.NIP).                       -  004100
C                                                                       -  004200
C-----------------------------------------------------------------------   004300
                                                                          004400
CEOF                                                                      004500
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          SP.CRIT                                                  -
CE          CITICALITY SEARCH SPECIFICATIONS                         -
C                                                                    -
C*********************************************************************

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     KSRCH,ICONV,LORP,NPMAX,NPASS,LSPR,CONVCR,XL,XU,DSKEFF,        -
CL    1(X(I),I=1,3),DKDX,DMOD,KFLAG                                  -
C                                                                    -
CD     KSRCH              SEARCH TYPE.                              -
CD                        1 FOR CONCENTRATION SEARCH                -
CD                        2 FOR FIRST DIMENSION SEARCH              -
CD                        3 FOR SECOND DIMENSION SEARCH             -
CD                        4 FOR BUCKLING SEARCH                     -
CD                        5 FOR ALPHA SEARCH                        -
CD                        6 FOR BOTH FIRST AND SECOND DIMENSION SEARCH -
CD     ICONV              CONVERGENCE FLAG.                         -
CD                        0 WHEN CONVERGENCE IS NOT YET ATTAINED    -
CD                        .NE.0 WHEN THE SEARCH IS CONVERGED        -
CD     LORP               INTERPOLATION TYPE.                       -
CD                        1 FOR LINEAR INTERPOLATION ON SEARCH      -
CD                        PARAMETER X                               -
CD                        .NE.1 FOR PARABOLIC INTERPOLATION ON SEARCH -
CD                        PARAMETER X                               -
CD     NPMAX              MAXIMUM NUMBER OF SEARCH PASSES.          -
CD     NPASS              SEARCH PASS NUMBER, INITIALLY 0.          -
CD     LSPR               LENGTH OF MODIFIER ARRAYS IN RECORD TYPE  -
CD                        2, 3, OR 4.                               -
CD     CONVCR             SEARCH CONVERGENCE CRITERION.             -
CD     XL                 LOWER LIMIT FOR THE SEARCH PARAMETER X.   -
CD     XU                 UPPER LIMIT FOR THE SEARCH PARAMETER X.   -
CD     DSKEFF             VALUE OF KEFF OR ALPHA BEING SEARCHED FOR. -
CD     X                  THREE MOST RECENT VALUES OF THE SEARCH    -
CD                        PARAMETER.                                -
CD     DKDX               DERIVATIVE OF KEFF WITH RESPECT TO THE SEARCH -
CD                        PARAMETER X, USED TO INITIALLY CALCULATE X(2) -
CD                        FROM X(1). NOT RELEVANT IF DKDX=0.        -
CD     DMOD               MODIFIER FOR ALPHA SEARCHES.              -
CD     KFLAG              PRESCRIBED PARAMETER.                     -
CD                        0 IF SEARCHING FOR A FIXED KEFF           -
CD                        1 IF SEARCHING FOR A FIXED ALPHA          -
C                                                                    -
CN                        THE GENERAL SEARCH EXPRESSION IS          -
CN                        P(X)=P(0)+X*DMOD, WHERE P IS THE QUANTITY -
CN                        BEING VARIED, X IS THE SEARCH PARAMETER,  -
CN                        AND DMOD IS THE MODIFIER. X IS TO         -
CN                        BE VARIED UNTIL P(X) RESULTS IN THE       -
CN                        DESIRED EIGENVALUE.                       -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          CONCENTRATION SEARCH MODIFIERS (TYPE 2)                  -
C                                                                    -
CC          PRESENT IF KSRCH=1                                       -
C                                                                    -
CL     (MC(I),I=1,NCMP)                                              -
C                                                                    -
CD     MC                 THE NUMBER OF THE COMPOSITION WHICH IS TO ACT -
CD                        AS MODIFIER FOR COMPOSITION NUMBER I.     -
CD                        MC(I)=0 IF COMPOSITION I IS NOT ONE OF THE -
CD                        COMPOSITIONS PRESENT IN THE REACTOR OR IF IT -
CD                        IS NOT TO BE MODIFIED IN THE SEARCH.      -
CD     NCMP               THE NUMBER OF COMPOSITIONS NCMP IS LSPR   -
CD                        IN RECORD 1.                              -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          DIMENSION SEARCH MODIFIERS (TYPE 3)                      -
C                                                                    -
CC          PRESENT IF KSRCH=2,3,6                                   -
C                                                                    -
CL     NINTI,NINTJ,(DIMOD(I),I=1,NINTI),(DJMOD(I),I=1,NINTJ)         -
C                                                                    -
CD     NINTI              NUMBER OF FIRST-DIMENSION MESH INTERVALS. -
CD     NINTJ              NUMBER OF SECOND-DIMENSION MESH INTERVALS. -
CD                        ON RECORD 1, LSPR=NINTI+NINTJ.            -
CD     DIMOD              MODIFIERS FOR FIRST-DIMENSION INTERVALS.  -
CD                        DIMOD=0 FOR KSRCH=3.                      -
CD     DJMOD              MODIFIERS FOR SECOND-DIMENSION INTERVALS. -
CD                        DJMOD=0 FOR KSRCH=2. FOR ONE DIMENSIONAL  -
CD                        PROBLEMS AND KSRCH=2, NINTJ=1 AND DJMOD(1)=0. -
C                                                                    -
CN                        IF DIMOD(I) OR DJMOD(I)=0 FOR ANY INTERVAL I, -
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CN                      THE LENGTH OF THAT INTERVAL IS NOT TO BE        -  009700
CN                      VARIED DURING THE SEARCH.                       -  009800
C                                                                       -  009900
C-----------------------------------------------------------------------  010000
                                                                         010100
                                                                         010200
C-----------------------------------------------------------------------  010300
CR          BUCKLING SEARCH MODIFIERS (TYPE 4)                          -  010400
C                                                                       -  010500
CC          PRESENT IF KSRCH=4                                          -  010600
C                                                                       -  010700
CL    NREG,NIL,((DMOD(I,J),I=1,NREG),J=1,NIL)                           -  010800
C                                                                       -  010900
CD    NREG              NUMBER OF REGIONS.                              -  011000
CD    NIL               NUMBER OF FINITE DIRECTIONS. ON RECORD 1,       -  011100
CD                      LSPR=NREG*NIL.                                  -  011200
CD    DMOD              MODIFIERS FOR BUCKLING VALUES.                  -  011300
C                                                                       -  011400
C-----------------------------------------------------------------------  011500
                                                                         011600
CEOF                                                                     011700
```

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C***********************************************************************  000100
C                                                                       -  000200
C                       PREPARED 2/15/71 AT ANL                         -  000300
C                                                                       -  000400
CF          SP.T1NEW    (FILE 1)                                        -  000500
CE          BINARY VERSION OF PART OF ONE-DIMENSIONAL TRANSPORT         -  000600
CF          THEORY MODULE-DEPENDENT INPUT, FILE 1                       -  000700
C                                                                       -  000800
CN                      THIS IS FILE 1 OF A TWO-FILE DATA SET           -  000900
CN                      CONTAINING MODULE-DEPENDENT INPUT.              -  001000
C                                                                       -  001100
C***********************************************************************  001200
                                                                         001300
                                                                         001400
C-----------------------------------------------------------------------  001500
CR          SPECIFICATIONS (TYPE 1)                                     -  001600
C                                                                       -  001700
CC          ALWAYS PRESENT                                              -  001800
C                                                                       -  001900
CL    MKRDF,MKRDTH,MKRSKI,MKRANS,MAXII,MAXOI,NUMDIR,ISN,EPS,PAROD,CONNF-  002000
C                                                                       -  002100
CD    MKRDF             DENSITY FACTOR FLAG.                            -  002200
CD                      MKRDF=0, NO DENSITY FACTORS GIVEN.              -  002300
CD                      MKRDF=NINTI, DENSITY FACTORS GIVEN, WHERE       -  002400
CD                      NINTI IS THE NUMBER OF MESH INTERVALS AS        -  002500
CD                      DEFINED IN DATA SET GEOM.                       -  002600
CD    MKRDTH            DIFFUSION THEORY OPTION FLAG.                   -  002700
CD                      MKRDTH=0, NO DIFFUSION THEORY OPTION            -  002800
CD                      REQUESTED.                                      -  002900
CD                      MKRDTH.GT.0, NUMBER OF GROUPS FOR WHICH         -  003000
CD                      DIFFUSION THEORY OPTION IS REQUESTED.           -  003100
CD    MKRSKI            GROUP SKIPPING FLAG.                            -  003200
CD                      MKRSKI=0, NO GROUP-SKIPPING REQUESTED.          -  003300
CD                      MKRSKI.GT.0, NUMBER OF GROUPS TO BE SKIPPED.    -  003400
CD    MKRANS            ANISOTROPIC COMPOSITION FLAG.                   -  003500
CD                      MKRANS=0, NO SCATTERING ORDER L SPECIFIED.      -  003600
CD                      MKRANS.GT.0, NUMBER OF COMPOSITIONS FOR WHICH   -  003700
CD                      SCATTERING ORDERS L ARE GIVEN EXPLICITLY.       -  003800
CD    MAXII             MAXIMUM NUMBER OF INNER ITERATIONS FOR          -  003900
CD                      EACH GROUP.                                     -  004000
CD    MAXOI             MAXIMUM NUMBER OF OUTER ITERATIONS FOR          -  004100
CD                      PROBLEM.                                        -  004200
CD    NUMDIR            NUMBER OF DIRECTIONS IN THE ANGULAR             -  004300
CD                      INTEGRATION SCHEME.                             -  004400
CD    ISN               THE SN ORDER.                                   -  004500
CD    EPS               THE KEFF CALCULATION CONVERGENCE CRITERION.     -  004600
CD    PAROD             PARAMETER OSCILLATION DAMPER, FOR CRITICALITY   -  004700
CD                      SEARCHES ONLY.                                  -  004800
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CD     CONNF              NORMALIZATION FACTOR.  IF 0.0, NO                 -  004900
CD                        NORMALIZATION IS TO BE PERFORMED.                 -  005000
C                                                                           -  005100
C-----------------------------------------------------------------------------  005200
                                                                               005300
CEOF                                                                           005400
```

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C*****************************************************************************  000100
C                                                                           -  000200
C                         PREPARED 2/15/71 AT ANL                           -  000300
C                                                                           -  000400
CF          SP.T1NEW      (FILE 2)                                          -  000500
CE          BINARY VERSION OF PART OF ONE-DIMENSIONAL TRANSPORT             -  000600
CE          THEORY MODULE-DEPENDENT INPUT, FILE 2                           -  000700
C                                                                           -  000800
CN                        THIS IS FILE 2 OF A TWO-FILE DATA SET             -  000900
CN                        CONTAINING MODULE-DEPENDENT INPUT.                -  001000
C                                                                           -  001100
C*****************************************************************************  001200
                                                                               001300
                                                                               001400
CD     MKRDT              GROUP NUMBER OF THE GROUP USING DIFFUSION         -  001500
CD                        THEORY OPTION OR GROUP-SKIPPING OPTION.           -  001600
                                                                               001700
                                                                               001800
C-----------------------------------------------------------------------------  001900
CR          DISCRETE ORDINATE SPECIFICATIONS (TYPE 1)                       -  002000
C                                                                           -  002100
CC          ALWAYS PRESENT                                                  -  002200
C                                                                           -  002300
CL     (DIRWGT(I),I=1,NUMDIR),(DIRMU(I),I=1,NUMDIR)                         -  002400
C                                                                           -  002500
CD     DIRWGT             DIRECTION WEIGHT FOR EACH DIRECTION.              -  002600
CD     DIRMU              DIRECTION COSINE FOR EACH DIRECTION.              -  002700
CD     NUMDIR             NUMBER OF DIRECTIONS IN THE ANGULAR               -  002800
CD                        INTEGRATION SCHEME                                -  002900
CD                        (SEE FILE 1 OF DATA SET SP.T1NEW).                -  003000
C                                                                           -  003100
C-----------------------------------------------------------------------------  003200
                                                                               003300
                                                                               003400
C-----------------------------------------------------------------------------  003500
CR          ANISOTROPY SPECIFICATIONS (TYPE 2)                              -  003600
C                                                                           -  003700
CC          PRESENT ONLY IF MKRANS.GT.0                                     -  003800
CC          (SEE FILE 1 OF DATA SET SP.T1NEW)                               -  003900
C                                                                           -  004000
CL     (NAMANS(I),LNOANS(I),I=1,MKRANS)                                     -  004100
C                                                                           -  004200
CD     NAMANS             COMPOSITION NUMBER FOR WHICH A SCATTERING         -  004300
CD                        ORDER IS GIVEN EXPLICITLY.                        -  004400
CD     LNOANS             SCATTERING ORDER L TO BE USED IN THE              -  004500
CD                        CORRESPONDING COMPOSITION.                        -  004600
CD     MKRANS             NUMBER OF COMPOSITIONS FOR WHICH SCATTERING       -  004700
CD                        ORDERS L ARE GIVEN EXPLICITLY.                    -  004800
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C                                                                       -  004900
C-----------------------------------------------------------------------   005000
                                                                          005100
                                                                          005200
C-----------------------------------------------------------------------   005300
CR          DENSITY FACTOR SPECIFICATIONS (TYPE 3)                      -  005400
C                                                                       -  005500
CC          PRESENT ONLY IF MKRDF.GT.0                                  -  005600
CC          (SEE FILE 1 OF DATA SET SP.T1NEW)                           -  005700
C                                                                       -  005800
CL    (CSCFAC(I),I=1,MKRDF)                                             -  005900
C                                                                       -  006000
CD    CSCFAC              DENSITY FACTOR FOR EACH MESH INTERVAL.      -  006100
CD    MKRDF               NUMBER OF MESH INTERVALS.                   -  006200
C                                                                       -  006300
C-----------------------------------------------------------------------   006400
                                                                          006500
                                                                          006600
C-----------------------------------------------------------------------   006700
CR          DIFFUSION THEORY OPTION SPECIFICATIONS (TYPE 4)             -  006800
C                                                                       -  006900
CC          PRESENT ONLY IF MKRDTH.GT.0                                 -  007000
CC          (SEE FILE 1 OF DATA SET SP.T1NEW)                           -  007100
C                                                                       -  007200
CL    (MKRDT(K),K=1,MKRDTH)                                             -  007300
C                                                                       -  007400
CD    MKRDTH              NUMBER OF GROUPS FOR WHICH DIFFUSION THEORY -  007500
CD                        OPTION IS REQUESTED.                        -  007600
C                                                                       -  007700
CN                        IF MKRDTH.GT.0, MKRSKI MUST BE 0, SINCE ONLY -  007800
CN                        THE DIFFUSION THEORY OPTION OR THE GROUP    -  007900
CN                        SKIPPING OPTION CAN BE USED IN A GIVEN PROBLEM.-  008000
C                                                                       -  008100
C-----------------------------------------------------------------------   008200
                                                                          008300
                                                                          008400
C-----------------------------------------------------------------------   008500
CR          GROUP-SKIPPING OPTION SPECIFICATIONS (TYPE 5)               -  008600
C                                                                       -  008700
CC          PRESENT ONLY IF MKRSKI.GT.0                                 -  008800
CC          (SEE FILE 1 OF DATA SET SP.T1NEW)                           -  008900
C                                                                       -  009000
CL    (MKRDT(K),K=1,MKRSKI)                                             -  009100
C                                                                       -  009200
CD    MKRSKI              NUMBER OF GROUPS TO BE SKIPPED.             -  009300
C                                                                       -  009400
CN                        IF MKRSKI.GT.0, MKRDTH MUST BE 0 SINCE ONLY -  009500
CN                        THE DIFFUSION THEORY OPTION OR THE GROUP    -  009600
CN                        SKIPPING OPTION CAN BE USED IN A GIVEN PROBLEM.-  009700
C                                                                       -  009800
C-----------------------------------------------------------------------   009900
                                                                          010000
CEOF                                                                      010100
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C*********************************************************************
C                                                                    -
C                          PREPARED 3/16/71 AT ANL                   -
C                                                                    -
CE          SP.T2NEW                                                 -
CE          BINARY VERSION OF TWO-DIMENSIONAL TRANSPORT              -
CE          THEORY MODULE-DEPENDENT INPUT                            -
C                                                                    -
C*********************************************************************

CD     IBALMX              NUMBER OF INNER ITERATIONS PERFORMED BETWEEN
CD                         COARSE MESH REBALANCING.
CD     IVOID               NUMBER OF REGIONS FOR WHICH STREAMING
CD                         CORRECTION IS SPECIFIED.
CD     MKRANS              NUMBER OF COMPOSITIONS SPECIFIED
CD                         TO BE TREATED AS ISOTROPIC.
CD     MKRSKI              GROUP SKIPPING FLAG.
CD                         MKRSKI=0, NO GROUP SKIPPING TO BE DONE.
CD                         MKRSKI.GT.0, NUMBER OF GROUPS TO BE SKIPPED.
CD     NANGLL              NUMBER OF DIFFERENT AZMUTHAL ANGLES FOR
CD                         EACH POLAR ANGLE.
CD     NCX                 NUMBER OF COARSE MESH INTERVALS IN THE
CD                         FIRST-DIMENSION.
CD     NCY                 NUMBER OF COARSE MESH INTERVALS IN THE
CD                         SECOND-DIMENSION.
CD     NGROUP              NUMBER OF ENERGY GROUPS.
CD     NLEVEL              NUMBER OF DIFFERENT POLAR ANGLES IN
CD                         QUADRATURE SET.
CD     NREG                NUMBER OF REGIONS.

C--------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                          PRESENT IF          -
CS          ==================================   ===================-
CS          SPECIFICATIONS                       ALWAYS              -
CS          INNER ITERATION CONVERGENCE          ALWAYS              -
CS          SPECIFICATIONS                                           -
CS     ********* (REPEAT NLEVEL TIMES)                              -
CS     *    DISCRETE ORDINATE SPECIFICATIONS     ALWAYS              -
CS     *********                                                    -
CS          ANISOTROPY SPECIFICATIONS            MKRANS.GT.0         -
CS          DENSITY FACTOR SPECIFICATIONS        MKRDF.GT.0          -
CS          GROUP-SKIPPING SPECIFICATIONS        MKRSKI.GT.0         -
CD          REBALANCING SPECIFICATIONS           IBALMX.GT.0         -
CS          STREAMING CORRECTION SPECIFICATIONS  IVOID.GT.0          -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     MAXSZM,MAXSZB,NGROUP,NINTI,NINTJ,NREG,MKRDF,MKRSKI,MKRANS,    -
CL    1MKRCUR,IVOID,MAXBC,MAXAI,MAXIUP,MAXOI,MINOI,IDMPMX,EPSBC,EPSIUP, -
CL    2EPSOUT,ISN,NLEVEL,POWER,MKRPWR,MKRFIS,IBALMX,NCX,NCY,EPSREB   -
C                                                                    -
CD     MAXSZM              SIZE OF MAIN CORE CONTAINER ARRAY.        -
CD     MAXSZB              SIZE OF BULK CORE CONTAINER ARRAY.        -
CD     NINTI               NUMBER OF FIRST-DIMENSION MESH INTERVALS. -
CD     NINTJ               NUMBER OF SECOND-DIMENSION MESH INTERVALS. -
CD     MKRDF               DENSITY FACTOR FLAG.                      -
CD                         MKRDF=0, NO DENSITY FACTORS GIVEN.        -
CD                         MKRDF=1, DENSITY FACTORS GIVEN.           -
CD     MKRCUR              PARTIAL CURRENTS FLAG.                    -
CD                         MKRCUR=0, PARTIAL CURRENTS NOT WRITTEN INTO -
CD                                   DATA SET JPR.D2 (JPA.D2) (DEFAULT). -
CD                                =1, PARTIAL CURRENTS WRITTEN INTO DATA -
CD                                   SET JPR.D2 (JPA.D2).            -
CD     MAXBC               MAXIMUM NUMBER OF ITERATIONS PER INNER    -
CD                         ITERATION TO SATISFY IMPLICIT BOUNDARY    -
CD                         CONDITIONS.                               -
CD     MAXAI               MAXIMUM NUMBER OF INNER ITERATIONS PER OUTER -
CD                         ITERATION.                                -
CD     MAXIUP              MAXIMUM NUMBER OF UPSCATTERING ITERATIONS -
CD                         PER OUTER ITERATION.                      -
CD     MAXOI               MAXIMUM NUMBER OF OUTER ITERATIONS PER    -
CD                         SEARCH PASS.                              -
CD     MINOI               MINIMUM NUMBER OF OUTER ITERATIONS PER    -
CD                         SEARCH PASS.                              -
CD     IDMPMX              NUMBER OF OUTER ITERATIONS PERFORMED BETWEEN -
CD                         CORE DUMPS FOR RESTART.                   -
CD     EPSBC               CONVERGENCE CRITERION FOR ITERATIONS ON   -
CD                         EXTERNAL BOUNDARY ANGULAR FLUXES.         -
CD     EPSIUP              CONVERGENCE CRITERION FOR UPSCATTERING    -
CD                         ITERATIONS.                               -
CD     EPSOUT              CONVERGENCE CRITERION FOR OUTER ITERATIONS. -
CD     ISN                 THE SN QUADRATURE. IF ISN=0, QUADRATURE IS -
CD                         SUPPLIED BY THE USER.                     -
CD     POWER               TOTAL POWER (WATTS).                      -
CD     MKRPWR              POWER NORMALIZATION FLAG. IF NON-ZERO,    -
CD                         DATA SET FR.PN IS WRITTEN.                -
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CD     MKRFIS              FISSION SOURCE FLAG. IF NON-ZERO, DATA        -  009700
CD                         SET FSR.D2 (FSA.D2) IS EDITED BY MESH INTERVAL.-  009800
CD     EPSREB              CONVERGENCE CRITERION FOR COARSE MESH         -  009900
CD                         REBALANCING ITERATIONS.                       -  010000
C                                                                        -  010100
C-----------------------------------------------------------------------   010200
                                                                            010300
                                                                            010400
C-----------------------------------------------------------------------   010500
CR          INNER ITERATION CONVERGENCE SPECIFICATIONS (TYPE 2)          -  010600
C                                                                        -  010700
CC          ALWAYS PRESENT                                               -  010800
C                                                                        -  010900
CL     (EPSANG(J),J=1,NGROUP),(NANGLL(I),I=1,NLEVEL)                     -  011000
C                                                                        -  011100
CD     EPSANG              CONVERGENCE CRITERION FOR INNER ITERATIONS.   -  011200
C                                                                        -  011300
C-----------------------------------------------------------------------   011400
                                                                            011500
                                                                            011600
C-----------------------------------------------------------------------   011700
CR          DISCRETE ORDINATE SPECIFICATIONS (TYPE 3)                    -  011800
C                                                                        -  011900
CC          ALWAYS PRESENT                                               -  012000
C                                                                        -  012100
CL     (DIRMU(I),DIRETA(I),DIRZEE(I),DIRWGT(I),I=1,NANGLL(L))            -  012200
C                                                                        -  012300
CD     DIRMU               DIRECTION COSINE WITH RESPECT TO THE X-AXIS   -  012400
CD                         FOR EACH DIRECTION.                           -  012500
CD     DIRETA              DIRECTION COSINE WITH RESPECT TO THE Y-AXIS   -  012600
CD                         FOR EACH DIRECTION.                           -  012700
CD     DIRZEE              DIRECTION COSINE WITH RESPECT TO THE Z-AXIS   -  012800
CD                         FOR EACH DIRECTION.                           -  012900
CD     DIRWGT              DIRECTION WEIGHT FOR EACH DIRECTION.          -  013000
C                                                                        -  013100
C-----------------------------------------------------------------------   013200
                                                                            013300
                                                                            013400
C-----------------------------------------------------------------------   013500
CR          ANISOTROPY SPECIFICATIONS (TYPE 4)                           -  013600
C                                                                        -  013700
CC          PRESENT ONLY IF MKRANS.GT.0                                  -  013800
C                                                                        -  013900
CL     (NAMANS(I),LNOANS(I),I=1,MKRANS)                                  -  014000
C                                                                        -  014100
CD     NAMANS              COMPOSITION NUMBER FOR WHICH A SCATTERING     -  014200
CD                         ORDER IS GIVEN EXPLICITLY.                    -  014300
CD     LNOANS              SCATTERING ORDER L TO BE USED IN THE          -  014400
CD                         CORRESPONDING COMPOSITION.                    -  014500
C                                                                        -  014600
C-----------------------------------------------------------------------   014700
                                                                            014800
                                                                            014900
C-----------------------------------------------------------------------   015000
CD          DENSITY FACTOR SPECIFICATIONS (TYPE 5)                       -  015100
C                                                                        -  015200
CC          PRESENT ONLY IF MKRDF.GT.0                                   -  015300
C                                                                        -  015400
CL     (CSCFAC(K),K=1,NRFG)                                              -  015500
C                                                                        -  015600
CD     CSCFAC              DENSITY FACTOR FOR EACH REGION.               -  015700
C                                                                        -  015800
C-----------------------------------------------------------------------   015900
                                                                            016000
                                                                            016100
C-----------------------------------------------------------------------   016200
CR          GROUP-SKIPPING OPTION SPECIFICATIONS (TYPE 6)                -  016300
C                                                                        -  016400
CC          PRESENT ONLY IF MKRSKI.GT.0                                  -  016500
C                                                                        -  016600
CL     (MKRDT(K),K=1,MKRSKI)                                             -  016700
C                                                                        -  016800
CD     MKRDT               GROUP NUMBER OF THE GROUP USING THE           -  016900
CD                         GROUP-SKIPPING OPTION.                        -  017000
C                                                                        -  017100
C-----------------------------------------------------------------------   017200
                                                                            017300
                                                                            017400
C-----------------------------------------------------------------------   017500
CR          REBALANCING SPECIFICATIONS (TYPE 7)                          -  017600
C                                                                        -  017700
CC          PRESENT ONLY IF IBALMX.GT.0                                  -  017800
C                                                                        -  017900
CL     (ICA(K),K=1,NCX),(KCA(K),K=1,NCY)                                 -  018000
C                                                                        -  018100
CD     ICA                 NUMBER OF THE FINE MESH LINES THAT ARE THE    -  018200
CD                         RIGHT BOUNDARIES OF THE COARSE MESH INTERVALS. -  018300
CD     KCA                 NUMBER OF THE FINE MESH LINES THAT ARE THE    -  018400
CD                         UPPER BOUNDARIES OF THE COARSE MESH INTERVALS. -  018500
C                                                                        -  018600
C-----------------------------------------------------------------------   018700
                                                                            018800
                                                                            018900
C-----------------------------------------------------------------------   019000
CR          STREAMING CORRECTION SPECIFICATIONS (TYPE 8)                 -  019100
C                                                                        -  019200
```

```
CC          PRESENT ONLY IF IVOID.GT.0                                  -  019300
C                                                                       -  019400
CL    (IVREG(I),I=1,IVOID)                                              -  019500
C                                                                       -  019600
CD    IVREG                 REGION NUMBERS OF REGIONS FOR WHICH STREAMING  -  019700
CD                          CORRECTION IS SPECIFIED.                  -  019800
C                                                                       -  019900
C-----------------------------------------------------------------------   020000
                                                                          020100
CEOF                                                                      020200
```

```
C***********************************************************************  000100
C                                                                       -  000200
C                         PREPARED 2/15/71 AT ANL                       -  000300
C                                                                       -  000400
CE          XS.C.ANI      (FILE 1)                                      -  000500
CE          ANISOTROPIC MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 1 -  000600
C                                                                       -  000700
CN                        THIS IS FILE 1 OF A TWO-FILE DATA SET RELATED -  000800
CN                        TO MACROSCOPIC COMPOSITION CROSS SECTIONS.    -  000900
C                                                                       -  001000
C***********************************************************************  001100
                                                                          001200
                                                                          001300
C-----------------------------------------------------------------------   001400
CR          SPECIFICATIONS (TYPE 1)                                     -  001500
C                                                                       -  001600
CL    NCMP,NUMANI,NGROUP,MAXLNO,MAXUPS,MAXDNS,(CNAME(I),I=1,NCMP)       -  001700
C                                                                       -  001800
CD    NCMP                NUMBER OF COMPOSITIONS.                     -  001900
CD    NUMANI              NUMBER OF COMPOSITIONS WITH ANISOTROPIC     -  002000
CD                        COMPONENTS.                                 -  002100
CD    NGROUP              NUMBER OF ENERGY GROUPS.                    -  002200
CD    MAXLNO              MAXIMUM SCATTERING ORDER IN THE SET.        -  002300
CD                        MAXLNO=0, NO SCATTERING.                    -  002400
CD                              =1, ISOTROPIC SCATTERING.             -  002500
CD                              =2, LINEAR ANISOTROPIC SCATTERING.    -  002600
CD    MAXUPS              MAXIMUM NUMBER OF GROUPS OF UPSCATTERING.   -  002700
CD    MAXDNS              MAXIMUM NUMBER OF GROUPS OF DOWNSCATTERING. -  002800
CD    CNAME               COMPOSITION LABELS, INDEXED AS COMPOSITION  -  002900
CD                        BLOCKS IN FILE 2 OF DATA SET XS.C.ANI.      -  003000
C                                                                       -  003100
C-----------------------------------------------------------------------   003200
                                                                          003300
CEOF                                                                      003400
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.C.ANI     (FILE 2)                                    -
CE          ANISOTROPIC MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 2 -
C                                                                    -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET RELATED -
CN                       TO MACROSCOPIC COMPOSITION CROSS SECTIONS.  -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ==================================       ================-
CS                                                                   -
CS     ******** (REPEAT FOR ALL COMPOSITIONS)                        -
CS     *      COMPOSITION DESCRIPTION               ALWAYS           -
CS     *  ****** (REPEAT FOR EACH SCATTERING                         -
CS     *  *         ORDER L, L=1,LNO-1)                             -
CS     *  *  ANISOTROPIC SCATTERING                 LNO.GT.1         -
CS     *********                                                     -
C                                                                    -
C--------------------------------------------------------------------

CD     LASCAT              LENGTH OF SCATTERING LIST, LASCAT=MAXUP+1+
CD                         NUMBER OF GROUPS OF DOWN-SCATTERING.

C--------------------------------------------------------------------
CR          COMPOSITION DESCRIPTION (TYPE 1)                         -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     LNO,MAXUP,LASCAT                                              -
C                                                                    -
CD     LNO                 SCATTERING ORDER FOR THIS COMPOSITION.   -
CD                         LNO=0, NO SCATTERING.                    -
CD                            =1, ISOTROPIC SCATTERING.             -
CD                            =2, LINEAR ANISOTROPIC SCATTERING.    -
CD     MAXUP               NUMBER OF GROUPS OF UPSCATTERING FOR THIS -
CD                         COMPOSITION.                             -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          ANISITROPIC SCATTERING (TYPE 2)                          -
C                                                                    -
CC          PRESENT IF LNO.GT.1                                      -
C                                                                    -
CL     ((SCAT(K,J),K=1,LASCAT),J=1,NGROUP)                           -
C                                                                    -
CD     SCAT                TOTAL MACROSCOPIC COMPOSITION ANISOTROPIC -
CD                         CROSS SECTION FOR SCATTERING ORDER L INTO -
CD                         GROUP J FROM GROUP INDEXED BY K.         -
CD                         K REFERENCES J+MAXUP,J+MAXUP-1,...,J,J-1,...,-
CD                         J-NUMBER OF GROUPS OF DOWNSCATTERING.    -
CD     NGROUP              NUMBER OF ENERGY GROUPS.                 -
C                                                                    -
C--------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.C.AUX     (FILE 1)                                    -
CE          AUXILIARY MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 1 -
C                                                                    -
CN                       THIS IS FILE 1 OF A TWO-FILE DATA SET RELATED -
CN                       TO MACROSCOPIC COMPOSITION CROSS SECTION DATA. -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL     NCMP,NGROUP,MAXLNO,(CNAME(I),I=1,NCMP)                        -
C                                                                    -
CD     NCMP                NUMBER OF COMPOSITIONS.                   -
CD     NGROUP              NUMBER OF ENERGY GROUPS.                  -
CD     MAXLNO              MAXIMUM SCATTERING ORDER IN THE SET.      -
CD                         MAXLNO=0, NO SCATTERING.                  -
CD                               =1, ISOTROPIC SCATTERING.           -
CD                               =2, LINEAR ANISOTROPIC SCATTERING.  -
CD     CNAME               COMPOSITION LABELS, INDEXED AS COMPOSITION -
CD                         BLOCKS IN FILE 2 OF DATA SET XS.C.AUX.    -
C                                                                    -
C--------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.C.AUX     (FILE 2)                                    -
CE          AUXILIARY MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 2 -
C                                                                    -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET RELATED -
CN                       TO MACROSCOPIC COMPOSITION CROSS SECTION DATA. -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ==================================       ================-
CS                                                                   -
CS     ********* (REPEAT FOR ALL COMPOSITIONS)                       -
CS     *     COMPOSITION DESCRIPTION                 ALWAYS          -
CS     *  ****** (REPEAT FOR EACH SCATTERING                         -
CS     *  *        ORDER L=1,LNO IF LNO.GT.0)                        -
CS     *  *  SCATTERING DESCRIPTION                  ALWAYS          -
CS     *  *  INELASTIC SCATTERING                    LIN.GE.L        -
CS     *  *  (N,2N) SCATTERING                       LN2N.GE.L       -
CS     *  *  N2N SCATTERING                          LN2N.GE.L       -
CS     *  *  TOTAL INELASTIC                         LIN.GE.L        -
CS     *  *  TOTAL ELASTIC                           LN2N.GE.L       -
CS     *  *  TOTAL (N,2N)                            LN2N.GE.L       -
CS     *********                                                     -
C                                                                    -
C--------------------------------------------------------------------

CD     LSCAT               LENGTH OF SCATTERING LIST FOR THE GIVEN   -
CD                         COMPOSITION AND SCATTERING ORDER.         -
CD     NGROUP              NUMBER OF ENERGY GROUPS.                  -

C--------------------------------------------------------------------
CR          COMPOSITION DESCRIPTION (TYPE 1)                         -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    LNO,LIN,LEL,LN2N,(SCAP(I),I=1,NGROUP),(SNALF(I),I=1,NGROUP),   -
CL   1(SNP(I),I=1,NGROUP)                                            -
C                                                                    -
```

```
CD     LNO                 MAXIMUM SCATTERING ORDER OF THIS COMPOSITION.  -  004900
CD                         LND IS THE LARGEST OF LIN, LEL, AND LN2N.      -  005000
CD     LIN                 INELASTIC SCATTERING ORDER OF THIS COMPOSITION.-  005100
CD                         LIN=0, NO SCATTERING.                          -  005200
CD                            =1, ISOTROPIC SCATTERING.                   -  005300
CD                            =2, LINEAR ANISOTROPIC SCATTERING.          -  005400
CD     LEL                 ELASTIC SCATTERING ORDER OF THIS CCMPOSITION.  -  005500
CD                         LEL=0, NO SCATTERING.                          -  005600
CD                            =1, ISOTROPIC SCATTERING.                   -  005700
CD                            =2, LINEAR ANISOTROPIC SCATTERING.          -  005800
CD     LN2N                (N,2N) SCATTERING ORDER OF THIS COMPOSITION.   -  005900
CD                         LN2N=0, NO SCATTERING.                         -  006000
CD                             =1, ISOTROPIC SCATTERING.                  -  006100
CD                             =2, LINEAR ANISOTROPIC SCATTERING.         -  006200
CD     SCAP                MACROSCOPIC COMPOSITION (N,GAMMA) CROSS        -  006300
CD                         SECTION.                                       -  006400
CD     SNALF               MACROSCOPIC COMPOSITION (N,ALPHA) CROSS        -  006500
CD                         SECTION.                                       -  006600
CD     SNP                 MACROSCOPIC COMPOSITION (N,P) CROSS SECTION.   -  006700
C                                                                         -  006800
C-----------------------------------------------------------------------------  006900
                                                                              007000
                                                                              007100
C-----------------------------------------------------------------------------  007200
CR           SCATTERING DESCRIPTION (TYPE 2)                              -  007300
C                                                                         -  007400
CC           PRESENT IF LND.GT.0                                          -  007500
C                                                                         -  007600
CL     NUP,LSCAT                                                          -  007700
C                                                                         -  007800
CD     NUP                 NUMBER OF GROUPS OF UPSCATTERING FOR THIS      -  007900
CD                         COMPOSITION AND ORDER OF SCATTERING.           -  008000
C                                                                         -  008100
C-----------------------------------------------------------------------------  008200
                                                                              008300
                                                                              008400
C-----------------------------------------------------------------------------  008500
CR           INELASTIC SCATTERING (TYPE 3)                                -  008600
C                                                                         -  008700
CC           PRESENT IF LIN.GE.CURRENT SCATTERING ORDER                   -  008800
C                                                                         -  008900
CL     ((XINEL(K,J),K=1,LSCAT),J=1,NGROUP)                                -  009000
C                                                                         -  009100
CD     XINEL               MACROSCOPIC COMPOSITION INELASTIC SCATTERING   -  009200
CD                         CROSS SECTION INTO GROUP J FROM THE GROUP      -  009300
CD                         INDEXED BY K FOR THIS SCATTERING ORDER.        -  009400
CD                         K REFERENCES J+NUP,J+NUP-1,...,J,J-1,...,      -  009500
CD                         J-NUMBER OF GROUPS OF DOWNSCATTERING.          -  009600
C                                                                         -  009700
C-----------------------------------------------------------------------------  009800
                                                                              009900
                                                                              010000
C-----------------------------------------------------------------------------  010100
CR           ELASTIC SCATTERING (TYPE 4)                                  -  010200
C                                                                         -  010300
CC           PRESENT IF LEL.GE.CURRENT SCATTERING ORDER                   -  010400
C                                                                         -  010500
CL     ((XEL(K,J),K=1,LSCAT),J=1,NGROUP)                                  -  010600
C                                                                         -  010700
CD     XEL                 MACROSCOPIC COMPOSITION ELASTIC SCATTERING     -  010800
CD                         CROSS SECTION, INDEXED AS INELASTIC SCATTERING.-  010900
C                                                                         -  011000
C-----------------------------------------------------------------------------  011100
                                                                              011200
                                                                              011300
C-----------------------------------------------------------------------------  011400
CR           (N,2N) SCATTERING (TYPE 5)                                   -  011500
C                                                                         -  011600
CC           PRESENT IF LN2N.GE.CURRENT SCATTERING ORDER                  -  011700
C                                                                         -  011800
CL     ((XN2N(K,J),K=1,LSCAT),J=1,NGROUP)                                 -  011900
C                                                                         -  012000
CD     XN2N                MACROSCOPIC COMPOSITION (N,2N) CROSS SECTION,  -  012100
CD                         INDEXED AS INELASTIC SCATTERING.               -  012200
C                                                                         -  012300
C-----------------------------------------------------------------------------  012400
                                                                              012500
                                                                              012600
C-----------------------------------------------------------------------------  012700
CR           TOTAL INELASTIC SCATTERING (TYPE 6)                          -  012800
C                                                                         -  012900
CC           PRESENT IF LIN.GE.CURRENT SCATTERING ORDER                   -  013000
C                                                                         -  013100
CL     (XTIR(J),J=1,NGROUP)                                               -  013200
C                                                                         -  013300
CD     XTIR                TOTAL MACROSCOPIC COMPOSITION INELASTIC        -  013400
CD                         SCATTERING CROSS SECTION.                      -  013500
C                                                                         -  013600
C-----------------------------------------------------------------------------  013700
                                                                              013800
                                                                              013900
C-----------------------------------------------------------------------------  014000
CR           TOTAL ELASTIC SCATTERING (TYPE 7)                            -  014100
C                                                                         -  014200
CC           PRESENT IF LEL.GE.CURRENT SCATTERING ORDER                   -  014300
C                                                                         -  014400
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CL     (XTER(J),J=1,NGROUP)                                              -  014500
C                                                                        -  014600
CD     XTER                TOTAL MACROSCOPIC COMPOSITION ELASTIC         -  014700
CD                         SCATTERING CROSS SECTION.                     -  014800
C                                                                        -  014900
C-----------------------------------------------------------------------  015000
                                                                            015100
                                                                            015200
C-----------------------------------------------------------------------  015300
CR           TOTAL (N,2N) CROSS SECTION (TYPE 8)                         -  015400
C                                                                        -  015500
CC           PRESENT IF LN2N.GE.CURRENT SCATTERING ORDER                 -  015600
C                                                                        -  015700
CL     (XTN2NR(J),J=1,NGROUP)                                            -  015800
C                                                                        -  015900
CD     XTN2NR              TOTAL MACROSCOPIC COMPOSITION (N,2N)          -  016000
CD                         CROSS SECTION.                                -  016100
C                                                                        -  016200
C-----------------------------------------------------------------------  016300
                                                                            016400
CEOF                                                                        016500
```

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C***********************************************************************  000100
C                                                                        -  000200
C                          PREPARED 2/15/71 AT ANL                       -  000300
C                                                                        -  000400
CF           XS.C.MIN      (FILE 1)                                      -  000500
CE           MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 1              -  000600
C                                                                        -  000700
CN                         THIS IS FILE 1 OF A TWO-FILE DATA SET RELATED -  000800
CN                         TO MACROSCOPIC COMPOSITION CROSS SECTION DATA. -  000900
C                                                                        -  001000
C***********************************************************************  001100
                                                                            001200
                                                                            001300
C-----------------------------------------------------------------------  001400
CR           SPECIFICATIONS (TYPE 1)                                     -  001500
C                                                                        -  001600
CL     NCMP,NGROUP,ISCHI,NFCMP,NFAM,MAXUP,MAXDN,(CNAME(I),I=1,NCMP),     -  001700
CL    1ISCHID                                                            -  001800
C                                                                        -  001900
CD     NCMP                NUMBER OF COMPOSITIONS.                       -  002000
CD     NGROUP              NUMBER OF ENERGY GROUPS.                      -  002100
CD     ISCHI               PROMPT FISSION SPECTRUM FLAG. ISCHI=0 IF      -  002200
CD                         THERE IS NO SET-WIDE PROMPT CHI. ISCHI=1 IF   -  002300
CD                         THERE IS A SET-WIDE PROMPT CHI VECTOR.        -  002400
CD                         ISCHI=NGROUP IF THERE IS A SET-WIDE PROMPT CHI -  002500
CD                         MATRIX.                                       -  002600
CD     NFCMP               NUMBER OF FISSIONABLE COMPOSITIONS.           -  002700
CD     NFAM                TOTAL NUMBER OF FAMILIES OF DELAYED NEUTRON   -  002800
CD                         PRECURSORS IN THE SET.                        -  002900
CD     MAXUP               MAXIMUM NUMBER OF GROUPS OF UPSCATTERING FOR  -  003000
CD                         THE SET.                                      -  003100
CD     MAXDN               MAXIMUM NUMBER OF GROUPS OF DOWNSCATTERING    -  003200
CD                         FOR THE SET.                                  -  003300
CD     CNAME               COMPOSITION LABELS.                           -  003400
CD     ISCHID              DELAYED FISSION SPECTRUM FLAG. ISCHID=0 IF    -  003500
CD                         THERE IS NO SET-WIDE DELAYED CHI. ISCHID=1    -  003600
CD                         IF THERE IS A SET-WIDE DELAYED CHI VECTOR.    -  003700
CD                         ISCHID=NGROUP IF THERE IS A SET-WIDE DELAYED  -  003800
CD                         CHI MATRIX.                                   -  003900
C                                                                        -  004000
C-----------------------------------------------------------------------  004100
                                                                            004200
CEOF                                                                        004300
```

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C*********************************************************************
C                                                                    -
C                         PREPARED 2/15/71 AT ANL                    -
C                                                                    -
CF          XS.C.MIN     (FILE 2)                                    -
CF          MACROSCOPIC COMPOSITION CROSS SECTIONS, FILE 2           -
C                                                                    -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET RELATED -
CN                       TO MACROSCOPIC COMPOSITION CROSS SECTION DATA. -
C                                                                    -
C*********************************************************************

C---------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ==================================       ================-
CS          SET CHI                                  ISCHI.GT.0 (SEE -
CS                                                   FILE 1 OF XS.C.MIN) -
CS     ********* (REPEAT FOR ALL COMPOSITIONS)                      -
CS     *    COMPOSITION SPECIFICATIONS               ALWAYS          -
CS     *  ****** (REPEAT FOR ALL ENERGY GROUPS)                      -
CS     *  *  COMPOSITION MACROSCOPIC GROUP           ALWAYS          -
CS     *  *  CROSS SECTIONS                                          -
CS     *********                                                    -
CS                                                                   -
CS          SET DELAYED CHI                          ISCHID.GT.0 (SEE -
CS                                                   FILE 1 OF XS.C.MIN) -
C                                                                    -
C---------------------------------------------------------------------

CD     NGROUP            NUMBER OF ENERGY GROUPS.
CD     ICHI              PROMPT FISSION SPECTRUM FLAG FOR THIS
CD                       COMPOSITION. ICHI=-1 IF COMPOSITION USES THE
CD                       SET-WIDE PROMPT CHI GIVEN IN SET CHI RECORD
CD                       (BELOW). ICHI=0 IF COMPOSITION IS NOT
CD                       FISSIONABLE. ICHI=1 FOR COMPOSITION PROMPT CHI
CD                       VECTOR. ICHI=NGROUP FOR COMPOSITION PROMPT CHI
CD                       MATRIX.
CD     NUP               NUMBER OF GROUPS OF UPSCATTERING FOR THIS
CD                       COMPOSITION.
CD     NDN               NUMBER OF GROUPS OF DOWNSCATTERING FOR THIS
CD                       COMPOSITION.
CD     ICHID             DELAYED FISSION SPECTRUM FLAG FOR THIS
CD                       COMPOSITION. ICHID=-1 IF COMPOSITION USES
CD                       SET-WIDE DELAYED CHI GIVEN IN SET DELAYED CHI
CD                       RECORD BELOW. ICHID=0 IF COMPOSITION IS NOT
CD                       FISSIONABLE. ICHID=1 FOR COMPOSITION DELAYED
CD                       CHI VECTOR. ICHID=NGROUP FOR COMPOSITION
CD                       DELAYED CHI MATRIX.

C---------------------------------------------------------------------
CR          SET CHI (TYPE 2)                                         -
C                                                                    -
CC          PRESENT IF ISCHI.GT.0                                    -
C           (SEE FILE 1 OF XS.C.MIN)                                 -
C                                                                    -
CL     ((CHI(I,J),I=1,ISCHI),J=1,NGROUP)                             -
C                                                                    -
CD     CHI               PROMPT FISSION FRACTION INTO GROUP J FROM -
CD                       GROUP I. IF ISCHI=1, THE LIST REDUCES TO  -
CD                       (CHI(J),J=1,NGROUP), WHERE CHI(J) IS THE  -
CD                       FISSION FRACTION INTO GROUP J.            -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          COMPOSITION SPECIFICATIONS (TYPE 3)                      -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     ICHI,(NUP(I),I=1,NGROUP),(NDN(I),I=1,NGROUP),ICHID            -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          COMPOSITION MACROSCOPIC GROUP CROSS SECTIONS (TYPE 4)    -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     J,XA,XTOT,XREM,XTR,XF,XNF,(CHI(I),I=1,ICHI),                  -
CL    1(XSCATU(I),I=1,NUP(J)),XSCATJ,(XSCATD(I),I=1,NDN(J)),         -
CL    2(DNXNF(L),L=1,NFAM),((DNCHI(I,L),I=1,ICHID),L=1,NFAM)         -
C                                                                    -
CD     J                 GROUP NUMBER (GROUP 1 IS HIGHEST IN ENERGY). -
CD     XA                ABSORPTION CROSS SECTION.                 -
CD     XTOT              TOTAL CROSS SECTION.                      -
CD     XREM              REMOVAL CROSS SECTION, TOTAL CROSS SECTION -
CD                       FOR REMOVING A NEUTRON FROM GROUP J DUE TO ALL -
CD                       PROCESSES.                                -
CD     XTR               TRANSPORT CROSS SECTION.                  -
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CD     XF                  FISSION CROSS SECTION, PRESENT ONLY IF          -  009700
CD                         ICHI.NE.0.                                      -  009800
CD     XNF                 TOTAL NUMBER OF NEUTRONS EMITTED PER FISSION    -  009900
CD                         TIMES XF, PRESENT ONLY IF ICHI.NE.0.            -  010000
CD     CHI                 PROMPT FISSION FRACTION INTO GROUP J FROM       -  010100
CD                         GROUP I, PRESENT ONLY IF ICHI.GT.0. IF ICHI=1,  -  010200
CD                         THE LIST REDUCES TO THE SINGLE NUMBER CHI,      -  010300
CD                         WHICH IS THE PROMPT FISSION FRACTION INTO       -  010400
CD                         GROUP J.                                        -  010500
CD     XSCATU              TOTAL SCATTERING CROSS SECTION INTO GROUP J     -  010600
CD                         FROM GROUPS J+NUP(J),J+NUP(J)-1,...,J+2,J+1,    -  010700
CD                         PRESENT ONLY IF NUP(J).GT.0.                    -  010800
CD     XSCATJ              TOTAL SELF-SCATTERING CROSS SECTION FROM        -  010900
CD                         GROUP J TO GROUP J.                             -  011000
CD     XSCATD              TOTAL SCATTERING CROSS SECTION INTO GROUP J     -  011100
CD                         FROM GROUPS J-1,J-2,...,J-NDN(J), PRESENT       -  011200
CD                         ONLY IF NDN(J).GT.0.                            -  011300
CD     DNXNF               NUMBER OF DELAYED NEUTRONS EMITTED PER FISSION -  011400
CD                         TIMES XF FOR PRECURSOR FAMILY L, PRESENT        -  011500
CD                         ONLY IF NFAM.GT.0 AND ICHID.NE.0.               -  011600
CD     DNCHI               DELAYED NEUTRON FISSION FRACTION INTO GROUP J   -  011700
CD                         FROM GROUP I FOR PRECURSOR FAMILY L,            -  011800
CD                         PRESENT ONLY IF NFAM.GT.0 AND ICHID.GT.0.       -  011900
CD                         IF ICHID=1, THE LIST REDUCES TO                 -  012000
CD                         (DNCHI(L),L=1,NFAM), WHERE DNCHI(L) IS THE      -  012100
CD                         DELAYED FISSION FRACTION INTO GROUP J FOR       -  012200
CD                         FAMILY L.                                       -  012300
                                                                              012400
C-----------------------------------------------------------------------------  012500
                                                                              012600
                                                                              012700
C-----------------------------------------------------------------------------  012800
CR           SET DELAYED CHI (TYPE 5)                                       -  012900
C                                                                           -  013000
CC           PRESENT IF ISCHID.GT.0                                         -  013100
C            (SEE FILE 1 OF XS.C.MIN)                                       -  013200
C                                                                           -  013300
CL     ((CHID(I,J),I=1,ISCHID),J=1,NGROUP)----NOTE STRUCTURE BELOW-----     -  013400
C                                                                           -  013500
C      DO 1 L=1,NFAM                                                        -  013600
C    1 READ(N) *LIST AS ABOVE*                                              -  013700
C                                                                           -  013800
CD     CHID                DELAYED FISSION FRACTION INTO GROUP J FROM      -  013900
CD                         GROUP I FOR PRECURSOR FAMILY L. IF ISCHID=1,    -  014000
CD                         THE LIST REDUCES TO (CHID(J),J=1,IGM), WHERE    -  014100
CD                         CHID(J) IS THE DELAYED FISSION FRACTION INTO    -  014200
CD                         GROUP J FOR PRECURSOR FAMILY L.                 -  014300
C                                                                           -  014400
C-----------------------------------------------------------------------------  014500
                                                                              014600
CEOF                                                                          014700
```

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C*********************************************************************  000100
C                                                                    -  000200
C                         PREPARED 3/16/71 AT ANL                    -  000300
C                                                                    -  000400
CF          XS.C.MI1     (FILE 1)                                    -  000500
CE          PROBLEM-DEPENDENT MACROSCOPIC COMPOSITION CROSS          -  000600
CF          SECTIONS, FILE 1                                         -  000700
C                                                                    -  000800
CN                       THIS IS FILE 1 OF A TWO-FILE DATA SET WHOSE -  000900
CN                       FORMAT IS IDENTICAL TO THAT OF DATA SET     -  001000
CN                       XS.C.MIN (FILE 1).                          -  001100
CN                                                                   -  001200
CN                       IT IS USED BY ANY MODULE FOR WHICH TWO      -  001300
CN                       MACROSCOPIC COMPOSITION CROSS SECTION       -  001400
CN                       DATA SETS ARE NEEDED.                       -  001500
C                                                                    -  001600
C*********************************************************************  001700
                                                                        001800
CEOF                                                                    001900
```

```
C*********************************************************************  000100
C                                                                    -  000200
C                         PREPARED 3/16/71 AT ANL                    -  000300
C                                                                    -  000400
CF          XS.C.MI1     (FILE 2)                                    -  000500
CE          PROBLEM-DEPENDENT MACROSCOPIC COMPOSITION CROSS          -  000600
CE          SECTIONS, FILE 2                                         -  000700
C                                                                    -  000800
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET WHOSE -  000900
CN                       FORMAT IS IDENTICAL TO THAT OF DATA SET     -  001000
CN                       XS.C.MIN (FILE 2).                          -  001100
CN                                                                   -  001200
CN                       IT IS USED BY ANY MODULE FOR WHICH TWO      -  001300
CN                       MACROSCOPIC COMPOSITION CROSS SECTION       -  001400
CN                       DATA SETS ARE NEEDED.                       -  001500
C                                                                    -  001600
C*********************************************************************  001700
                                                                        001800
CEOF                                                                    001900
```

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C*********************************************************************
C                                                                   -
C                        PREPARED 2/15/71 AT ANL                    -
C                                                                   -
CF          XS.C.RES    (FILE 1)                                    -
CE          PARAMETERS RELATED TO THE HOMOGENIZED MACROSCOPIC       -
CE          RESOLVED RESONANCE CROSS SECTIONS                       -
C                                                                   -
CN                       THIS IS FILE 1 OF A TWO-FILE DATA SET      -
C                                                                   -
C*********************************************************************
C-------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                 -
C                                                                   -
CC          ALWAYS PRESENT                                          -
C                                                                   -
CL    NINT1R                                                        -
C                                                                   -
CD    NINT1R             NUMBER OF RESOLVED RESONANCE GROUPS.       -
C                                                                   -
C-------------------------------------------------------------------
CEOF
```

```
C*********************************************************************
C                                                                   -
C                        PREPARED 2/15/71 AT ANL                    -
C                                                                   -
CF          XS.C.RES    (FILE 2)                                    -
CE          HOMOGENIZED MACROSCOPIC RESOLVED RESONANCE CROSS SECTIONS -
C                                                                   -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET      -
C                                                                   -
C*********************************************************************
C-------------------------------------------------------------------
CR          HOMOGENIZED CROSS SECTIONS (TYPE 1)                     -
C                                                                   -
CC          PRESENT IF NINT1R.GT.0                                  -
C                                                                   -
CL    (HOMCAP(I),HOMBRG(I),HOMFIS(I),I=1,NINT1R)                    -
C                                                                   -
CD    HOMCAP             HOMOGENIZED MACROSCOPIC RESONANCE CAPTURE  -
CD                       CROSS SECTION.                             -
CD    HOMBRG             HOMOGENIZED MACROSCOPIC FISSION CROSS SECTION. -
CD    HOMFIS             HOMOGENIZED MACROSCOPIC NU TIMES FISSION   -
CD                       CROSS SECTION.                             -
CD    NINT1R             NUMBER OF RESOLVED RESONANCE GROUPS.       -
C                                                                   -
CN                       THE CROSS SECTIONS ARE ORDERED FROM LOW    -
CN                       ENERGY GROUPS TO HIGH ENERGY GROUPS.       -
C                                                                   -
C-------------------------------------------------------------------
CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.C.SMT                                                 -
CE          FINE GROUP MICROSCOPIC CROSS SECTIONS                    -
C                                                                    -
C*********************************************************************

CD    NINTC              NUMBER OF FINE ENERGY GROUPS.
CD    NOI                NUMBER OF MATERIALS.

C---------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ================================         ================-
CS          SPECIFICATIONS                           ALWAYS          -
CS          UNRESOLVED FINE GROUP CROSS SECTIONS     NUNRES.GT.0     -
CS    ********* (REPEAT FOR ALL MATERIALS)                           -
CS    *         FINE GROUP CROSS SECTIONS            ALWAYS          -
CS    *********                                                      -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    NUNRES,NINTC,NOI                                               -
C                                                                    -
CD    NUNRES             NUMBER OF MATERIALS WITH UNRESOLVED CAPTURE -
CD                       OR FISSION PARAMETERS.                      -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          UNRESOLVED FINE GROUP CROSS SECTIONS (TYPE 2)            -
C                                                                    -
CC          PRESENT IF NUNRES.GT.0                                   -
C                                                                    -
CL    ((CSUM(L,J),FSUM(L,J),L=1,NOI),J=1,NINTC)                      -
C                                                                    -
CD    CSUM               UNRESOLVED FINE GROUP CAPTURE CROSS SECTION. -
CD    FSUM               UNRESOLVED FINE GROUP FISSION CROSS SECTION. -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          FINE GROUP CROSS SECTIONS (TYPE 3)                       -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    ((SAV(K,J),J=1,NINTC),K=1,11)                                  -
C                                                                    -
CD    SAV                CROSS SECTION ASSOCIATED WITH FINE GROUP J  -
CD                       FOR REACTION TYPE K.                        -
C                                                                    -
CN                       THE CROSS SECTIONS FOR THE DIFFERENT REACTION -
CN                       TYPES WILL BE GIVEN IN THE FOLLOWING ORDER: -
CN                                                                   -
CN                         K                    SAV                  -
CN                       ----- ----------------------------------    -
CN                         1   ELASTIC TRANSPORT FOR NON-LEGENDRE    -
CN                             MATERIALS                             -
CN                         2   ELASTIC REMOVAL FOR NON-LEGENDRE      -
CN                             MATERIALS                             -
CN                         3   TOTAL INELASTIC                       -
CN                         4   FISSION (SMOOTH TABULATED + UNRESOLVED -
CN                             RESONANCE)                            -
CN                         5   CAPTURE (SMOOTH TABULATED + UNRESOLVED -
CN                             RESONANCE)                            -
CN                         6   NU                                    -
CN                         7   ELASTIC TRANSPORT FOR LEGENDRE MATERIALS -
CN                         8   ELASTIC REMOVAL FOR LEGENDRE MATERIALS -
CN                         9   (N,2N)                                -
CN                        10   (N,P)                                 -
CN                        11   (N,ALPHA)                             -
C                                                                    -
C---------------------------------------------------------------------

CEOF
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.C.UFG                                                 -
CE          ULTRAFINE GROUP CROSS SECTIONS                           -
C                                                                    -
C*********************************************************************
C---------------------------------------------------------------------
CR          ULTRAFINE GROUP MACROSCOPIC CROSS SECTIONS (TYPE 1)      -
C                                                                    -
CC          PRESENT ONLY FOR AN ULTRAFINE GROUP PROBLEM              -
C                                                                    -
CL    NINT,(HAM3(I),I=1,NINT),(HAM9(I),I=1,NINT)                     -
C                                                                    -
CD    NINT                NUMBER OF ULTRAFINE ENERGY GROUPS.         -
CD    HAM3                ULTRAFINE GROUP HOMOGENIZED MACROSCOPIC    -
CD                        INELASTIC CROSS SECTION.                   -
CD    HAM9                ULTRAFINE GROUP HOMOGENIZED MACROSCOPIC    -
CD                        (N,2N) CROSS SECTION.                      -
C                                                                    -
C---------------------------------------------------------------------
CEOF
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.ENDF     (FILE 1)                                     -
CE          REAL AND IMAGINARY PART OF W FUNCTION                    -
CC          THIS IS FILE 1 OF MC**2 LIBRARY TAPE                     -
C                                                                    -
CN                      THIS IS FILE 1 OF A TWO-FILE DATA SET        -
C                                                                    -
C*********************************************************************
C---------------------------------------------------------------------
CR          REAL W (TYPE 1)                                          -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    (RWTBL(I),I=1,3844)                                            -
C                                                                    -
CD    RWTBL               REAL PART OF W(X,Y) TABULATED              -
CD                        -.1.LE.X.LE.6, -.1.LE.Y.LE.6               -
C                                                                    -
C---------------------------------------------------------------------
C---------------------------------------------------------------------
CR          IMAGINARY W (TYPE 2)                                     -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL    (WTBL(I),I=1,3844)                                             -
C                                                                    -
CD    WTBL                IMAGINARY PART OF W(X,Y) TABULATED         -
CD                        -.1.LE.X.LE.6, -.1.LE.Y.LE.6               -
C                                                                    -
C---------------------------------------------------------------------
CEOF
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.ENDF     (FILE 2)                                     -
CE          RESOLVED AND UNRESOLVED RESONANCE DATA                   -
CC          THIS IS FILE 2 OF MC**2 LIBRARY TAPE                     -
C                                                                    -
CN                      THIS IS FILE 2 OF A TWO-FILE DATA SET        -
C                                                                    -
C*********************************************************************
CD     NOMAT            NUMBER OF MATERIALS ON THE LIBRARY.
CD     IWR              RESOLVED RESONANCE PARAMETER INDEX.
CD                      IWR=0, MATERIAL HAS NO RESOLVED RESONANCE
CD                             PARAMETERS; ATOMIC NUMBER IS NOT GIVEN.
CD                      IWR=1, MATERIAL HAS RESOLVED RESONANCE
CD                             PARAMETERS; ATOMIC NUMBER IS NOT GIVEN.
CD                      IWR=2, MATERIAL HAS NO RESOLVED RESONANCE
CD                             PARAMETERS; ATOMIC NUMBER IS GIVEN.
CD                      IWR=3, MATERIAL HAS RESOLVED RESONANCE
CD                             PARAMETERS; ATOMIC NUMBER IS GIVEN.
CD     NUN              UNRESOLVED RESONANCE PARAMETER INDEX.
CD                      NUN=1, MATERIAL HAS UNRESOLVED RESONANCE
CD                             PARAMETERS.
CD                      NUN=0, MATERIAL HAS NO UNRESOLVED RESONANCE
CD                             PARAMETERS.
CD     IS               NUMBER OF ISOTOPES IN MATERIAL.
CD     LST              NUMBER OF ANGULAR MOMENTUM STATES CONSIDERED
CD                      IN UNRESOLVED CALCULATION.
CD     JST              NUMBER OF CHANNEL SPIN STATES ASSOCIATED WITH
CD                      A PARTICULAR ANGULAR MOMENTUM STATE.
CD     NPT              NUMBER OF ENERGIES AT WHICH UNRESOLVED
CD                      CALCULATION IS DONE.
CD     SIGPM            CONSTANT BACKGROUND SCATTERING CROSS SECTION.
CD     XI               ISOTOPIC MASS (ATOMIC WEIGHT/NEUTRON).
CD     NRGYS            NUMBER OF RESOLVED RESONANCES FOR AN ISOTOPE.
CD     IZ               ATOMIC NUMBER.
CD     A0,A1,A2,A3      COEFFICIENTS IN POLYNOMIAL FIT TO DATA FOR
CD                      NUMBER OF NEUTRONS EMITTED PER FISSION.

C-------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                RECORD TYPE                          PRESENT IF    -
CS                ==================================   ==============-
CS                TABLE OF CONTENTS                    ALWAYS        -
CS     ************** (REPEAT FOR ALL MATERIALS)
CS     *          MATERIAL HEADING                     ALWAYS        -
CS     *          MATERIAL CONTROL                     ALWAYS        -
CS     *  ************ (REPEAT FOR ALL ISOTOPES IN                   -
CS     *  *            UNRESOLVED CALCULATION)                       -
CS     *  *          UNRESOLVED CONTROL DATA            NUN.GT.0      -
CS     *  *  ********* (REPEAT FOR ALL ANGULAR MOMENTUM              -
CS     *  *  *          STATES CONSIDERED IN UNRESOLVED               -
CS     *  *  *          CALCULATION)                                  -
CS     *  *  *        UNRESOLVED ENERGY DATA               NUN.GT.0  -
CS     *  *  *  ***** (REPEAT FOR ALL CHANNEL SPIN                   -
CS     *  *  *  *      STATES ASSOCIATED WITH EACH                   -
CS     *  *  *  *      ANGULAR MOMENTUM STATE)                       -
CS     *  *  *  *  STATISTICAL INFORMATION                 NUN.GT.0  -
CS     *  *  *  *  NEUTRON AND FISSION WIDTH DATA          NUN.GT.0  -
CS     *  ************                                                -
CS     *          MINIMUM RESOLVED DATA A                  IWR.EQ.0  -
CS     *          MINIMUM RESOLVED DATA B                  IWR.EQ.2  -
CS     *          RESONANCE DATA A                         IWR.EQ.1  -
CS     *          RESONANCE DATA B                         IWR.EQ.3  -
CS     *          RESOLVED RESONANCE PARAMETERS            IWR.EQ.1.OR.-
CS     *                                                   IWR.EQ.3  -
CS     **************                                                -
C                                                                    -
C-------------------------------------------------------------------

C-------------------------------------------------------------------
CR          TABLE OF CONTENTS (TYPE 1)                               -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     NOMAT,(ILIST(I),I=1,NOMAT)                                    -
C                                                                    -
CD     ILIST            IDENTIFICATION OF LIBRARY MATERIALS.         -
C                                                                    -
C-------------------------------------------------------------------

C-------------------------------------------------------------------
CR          MATERIAL HEADING (TYPE 2)                                -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     ID,IWR,ISK                                                    -
C                                                                    -
CD     ID               MATERIAL IDENTIFICATION.                     -
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CD     ISK                 NUMBER OF LOGICAL RECORDS OF RESONANCE DATA.   -  009700
CD                         ISK=IWR+2+SUM OVER IS*(1+SUM OVER LST*(1+SUM   -  009800
CD                         OVER JST(2)))                                  -  009900
C                                                                         -  010000
C-------------------------------------------------------------------------   010100
                                                                             010200
                                                                             010300
C-------------------------------------------------------------------------   010400
CR          MATERIAL CONTROL (TYPE 3)                                     -  010500
C                                                                         -  010600
CC          ALWAYS PRESENT                                                -  010700
C                                                                         -  010800
CL     NUN,IFI,IS,(ABUN(I),I=1,IS)                                        -  010900
C                                                                         -  011000
CD     IFI                 FISSILE ISOTOPE INDEX.                        -  011100
CD                         IFI=1, FISSILE ISOTOPES.                      -  011200
CD                         IFI=0, NON-FISSILE ISOTOPES.                  -  011300
CD     ABUN                ABUNDANCE OF EACH ISOTOPE IN UNRESOLVED       -  011400
CD                         CALCULATION.                                  -  011500
C                                                                         -  011600
C-------------------------------------------------------------------------   011700
                                                                             011800
                                                                             011900
C-------------------------------------------------------------------------   012000
CR          UNRESOLVED CONTROL DATA (TYPE 4)                              -  012100
C                                                                         -  012200
CC          PRESENT IF NUN.GT.0                                           -  012300
C                                                                         -  012400
CL     LST,AAA,(JST(I),NPT(I),I=1,LST)                                    -  012500
C                                                                         -  012600
CD     AAA                 AAA=KA/DSQRT(E), K= WAVE NUMBER,              -  012700
CD                         A=NUCLEAR RADIUS,E=ENERGY. FOR USE IN         -  012800
CD                         OBTAINING P WAVE PENETRATION FACTOR.          -  012900
C                                                                         -  013000
C-------------------------------------------------------------------------   013100
                                                                             013200
                                                                             013300
C-------------------------------------------------------------------------   013400
CR          UNRESOLVED ENERGY DATA (TYPE 5)                               -  013500
C                                                                         -  013600
CC          PRESENT IF NUN.GT.0                                           -  013700
C                                                                         -  013800
CL     (ES(I),I=1,NPT)                                                    -  013900
C                                                                         -  014000
CD     ES                  ENERGIES AT WHICH UNRESOLVED CALCULATION      -  014100
CD                         IS TO BE DONE (EV), IN ORDER OF INCREASING    -  014200
CD                         ENERGY.                                       -  014300
C                                                                         -  014400
C-------------------------------------------------------------------------   014500
                                                                             014600
                                                                             014700
C-------------------------------------------------------------------------   014800
CR          STATISTICAL INFORMATION (TYPE 6)                              -  014900
C                                                                         -  015000
CC          PRESENT IF NUN.GT.0                                           -  015100
C                                                                         -  015200
CL     (GA(I),I=1,N),NU,G,(D(I),I=1,N),AMU                                -  015300
C                                                                         -  015400
CD     N                   N=1   IF NUN=1.                               -  015500
CD                         N=NPT IF NUN=2.                               -  015600
CD     GA                  AVERAGE RADIATION WIDTH (EV).                 -  015700
CD     NU                  NUMBER OF DEGREES OF FREEDOM IN FISSION WIDTH -  015800
CD                         DISTRIBUTION (1,2,3 OR 4).                    -  015900
CD     G                   STATISTICAL FACTOR.                           -  016000
CD     D                   AVERAGE SPACING (EV).                         -  016100
CD     AMU                 NUMBER OF DEGREES OF FREEDOM IN NEUTRON WIDTH -  016200
CD                         DISTRIBUTION (1 OR 2). NUMBER OF ENTRANCE     -  016300
CD                         CHANNELS FOR NEUTRONS IN AN L,J SEQUENCE.     -  016400
C                                                                         -  016500
C-------------------------------------------------------------------------   016600
                                                                             016700
                                                                             016800
C-------------------------------------------------------------------------   016900
CR          NEUTRON AND FISSION WIDTH INFORMATION (TYPE 7)                -  017000
C                                                                         -  017100
CC          PRESENT IF NUN.GT.0                                           -  017200
C                                                                         -  017300
CL     (GF(I),GNO(I),I=1,NPT)                                             -  017400
C                                                                         -  017500
CD     GF                  AVERAGE FISSION WIDTH (EV)                    -  017600
CD                         FOR EACH ENERGY ES.                           -  017700
CD     GNO                 AVERAGE REDUCED NEUTRON WIDTH (EV)            -  017800
CD                         FOR EACH ENERGY ES.                           -  017900
C                                                                         -  018000
C-------------------------------------------------------------------------   018100
                                                                             018200
                                                                             018300
C-------------------------------------------------------------------------   018400
CR          MINIMUM RESOLVED DATA A (TYPE 8)                              -  018500
C                                                                         -  018600
CC          PRESENT IF IWR.EQ.0                                           -  018700
C                                                                         -  018800
CL     SIGPM,XI                                                           -  018900
C                                                                         -  019000
C-------------------------------------------------------------------------   019100
                                                                             019200
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C-----------------------------------------------------------------------
CR          MINIMUM RESOLVED DATA B (TYPE 9)                          -
C                                                                     -
CC          PRESENT IF IWR.EQ.2                                       -
C                                                                     -
CL    SIGPM,XI,IZ                                                     -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          RESOLVED DATA A (TYPE 10)                                 -
C                                                                     -
CC          PRESENT IF IWR.EQ.1                                       -
C                                                                     -
CL    NRGYS,SIGPM,XI,AO,A1,A2,A3                                      -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          RESOLVED DATA B (TYPE 11)                                 -
C                                                                     -
CC          PRESENT IF IWR.EQ.3                                       -
C                                                                     -
CL    NRGYS,SIGPM,XI,AO,A1,A2,A3,IZ                                   -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          RESOLVED RESONANCE PARAMETERS (TYPE 12)                   -
C                                                                     -
CC          PRESENT IF IWR.EQ.1.OR.IWR.EQ.3                           -
C                                                                     -
CL    (EN(J),LL,SIGO(J),ZETAP(J),ABUNDI(J),AFAC(J),GAMT(J),GAMGAM(J), -
CL   1GAF(J),J=1,NRGYS)                                               -
C                                                                     -
CD    EN                RESONANCE ENERGY.                             -
CD    LL                IDENTIFICATION NUMBER (OBSOLETE).             -
CD    SIGO              CROSS SECTION AT RESONANCE.                   -
CD    ZETAP             RATIO OF NATURAL WIDTH TO DOPPLER WIDTH *     -
CD                      SQRT(TEMPERATURE).                            -
CD    ABUNDI            ISOTOPIC ABUNDANCE FOR NATURAL ISOTOPE.       -
CD    AFAC              FACTOR TO MULTIPLY CHI TO OBTAIN INTERFERENCE -
CD                      SCATTERING.                                   -
CD    GAMT              RESOLVED RESONANCE TOTAL LINE WIDTH.          -
CD    GAMGAM            RESOLVED RESONANCE RADIATION LINE WIDTH.      -
CD    GAF               RESOLVED RESONANCE FISSION LINE WIDTH.        -
C                                                                     -
C-----------------------------------------------------------------------

CEOF
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C*********************************************************************
C                                                                    -
C                         PREPARED 2/15/71 AT ANL                    -
C                                                                    -
CF          XS.ENDF3     (FILE 1)                                    -
CF          SMOOTH (TABULATED) NON-RESONANT DATA                     -
CC          THIS IS FILE 3 OF MC**2 LIBRARY TAPE                     -
C                                                                    -
CN                       THIS IS FILE 1 OF A FOUR-FILE DATA SET      -
C                                                                    -
C*********************************************************************

CD     INT                NUMBER OF INTERPOLATION REGIONS ASSOCIATED
CD                        WITH EACH REACTION TYPE.
CD     NS                 NUMBER OF COORDINATE PAIRS ASSOCIATED WITH
CD                        EACH REACTION TYPE AND INTERPOLATION RANGE.
CD     N                  N=NS(1)+NS(2)+...+NS(INT).

C---------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ================================ ========================-
CS     ******** (REPEAT FOR ALL MATERIALS)                           -
CS     *    SPECIFICATIONS                          ALWAYS           -
CS     *  ***** (REPEAT EIGHT TIMES)                                 -
CS     *  *  CONTROL                                 ALWAYS           -
CS     *  *  ENERGY-CROSS SECTION PAIRS              N.GT.0           -
CS     ********                                                      -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     MT,(INT(K),K=1,8),EMUO,A0,A1,A2,A3,XI1                        -
C                                                                    -
CD     MT                 MATERIAL IDENTIFICATION.                  -
CD     EMUO               AVERAGE COSINE OF SCATTERING ANGLE IN     -
CD                        LAB SYSTEM FOR ISOTROPIC SCATTERING IN    -
CD                        CENTER OF MASS SYSTEM (2/(3*MASS)).       -
CD     A0,A1,A2,A3        COEFFICIENTS FOR CALCULATION OF NU(E).    -
CD     XI1                AVERAGE LOGARITHMIC ENERGY LOSS PER COLLISION. -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          CONTROL (TYPE 2)                                         -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     (NS(I),KT(I),I=1,MAX(1,INT))                                  -
C                                                                    -
CD     KT                 FLAG INDICATING TYPE OF INTERPOLATION TO BE -
CD                        USED FOR THE GIVEN REACTION TYPE IN THE GIVEN -
CD                        INTERPOLATION RANGE.                      -
CD                        KT=1, LN(E) VS. LN(SIGMA).                -
CD                        KT=2, LN(E) VS. SIGMA.                    -
CD                        KT=3, E VS. SIGMA.                        -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          ENERGY-CROSS SECTION PAIRS (TYPE 3)                      -
C                                                                    -
CC          PRESENT IF N.GT.0                                        -
C                                                                    -
CL     (EN(J),SIG(J),J=1,N)                                          -
C                                                                    -
CD     EN                 ENERGY COORDINATE ASSOCIATED WITH A PARTICULAR -
CD                        ENERGY POINT FOR A GIVEN REACTION.        -
CD     SIG                CROSS SECTION COORDINATE ASSOCIATED WITH A -
CD                        PARTICULAR ENERGY POINT FOR A GIVEN REACTION. -
C                                                                    -
C---------------------------------------------------------------------

CFOF
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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.ENDF3     (FILE 2)                                    -
CF          SECONDARY DISTRIBUTIONS                                  -
CC          THIS IS FILE 4 OF MC**2 LIBRARY TAPE                     -
C                                                                    -
CN                       THIS IS FILE 2 OF A FOUR-FILE DATA SET      -
C                                                                    -
C*********************************************************************

CD     NLEVLS            NUMBER OF RESOLVED LEVELS FOR INELASTIC
CD                       SCATTERING IN A PARTICULAR MATERIAL.
CD     NSTAT             IF NSTAT.GT.0 THE DATA FOR A STATISTICAL
CD                       CALCULATION OF INELASTIC SCATTERING ARE
CD                       INCLUDED.
CD     N2N               IF N2N.GT.0 THE DATA FOR (N,2N) SCATTERING
CD                       ARE INCLUDED.
CD     KT                TYPE OF INTERPOLATION RULE TO BE USED FOR A
CD                       GIVEN INTERPOLATION REGION AND REACTION TYPE.
CD                       KT=1, LN(E) VS. LN(SIGMA).
CD                       KT=2, LN(E) VS. SIGMA.
CD                       KT=3, E VS. SIGMA.

C--------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                          PRESENT IF          -
CS          ================================  ======================-
CS     ******** (REPEAT FOR ALL MATERIALS)                           -
CS     *    SPECIFICATIONS                       ALWAYS              -
CS     *  ***** (REPEAT FOR ALL DISCRETE LEVELS)                     -
CS     *  *  DISCRETE INELASTIC INTERPOLATION    NLEVLS.GT.0         -
CD     *  *  DATA                                                    -
CS     *  *  DISCRETE ENERGY-CROSS SECTION       NLEVLS.GT.C         -
CS     *  *  PAIRS                                                   -
CS     *  *****                                                     -
CS     *    ENERGY-TEMPERATURE INTERPOLATION     NSTAT.GT.0          -
CS     *    DATA                                                    -
CS     *    ENERGY-TEMPERATURE PAIRS             NSTAT.GT.0          -
CS     *    ENERGY-CROSS SECTION                 NSTAT.GT.0          -
CS     *    INTERPOLATION DATA                                      -
CS     *    ENERGY-INELASTIC CROSS               NSTAT.GT.0          -
CS     *    SECTION DATA                                            -
CS     *    ENERGY-(N,2N) INTERPOLATION DATA     N2N.GT.0            -
CS     *    ENERGY-(N,2N) CROSS SECTION DATA     N2N.GT.0            -
CS     ********                                                      -
CS                                                                   -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CC          ALWAYS PRESENT                                           -
C                                                                    -
CL     ID,NLEVLS,NSTAT,AMASS,ESTAT,N2N,THRESH                        -
C                                                                    -
CD     ID                MATERIAL IDENTIFICATION.                   -
CD     AMASS             MASS.                                      -
CD     ESTAT             ENERGY (EV) AT WHICH A STATISTICAL         -
CD                       CALCULATION BEGINS.                        -
CD     THRESH            ENERGY (EV) AT WHICH A STATISTICAL         -
CD                       CALCULATION FOR (N,2N) SCATTERING BEGINS.  -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          DISCRETE INELASTIC INTERPOLATION DATA (TYPE 2)           -
C                                                                    -
CC          PRESENT IF NLEVLS.GT.0                                   -
C                                                                    -
CL     IR,EGAM,(NS(I),KT(I),I=1,IR)                                  -
C                                                                    -
CD     IR                NUMBER OF INTERPOLATION REGIONS FOR RESOLVED -
CD                       INELASTIC SCATTERING.                      -
CD     EGAM              ENERGY OF GAMMA RAY (EV) WHICH IS EMITTED  -
CD                       WHEN A PARTICULAR RESOLVED LEVEL IS EXCITED. -
CD     NS                NUMBER OF COORDINATE PAIRS ASSOCIATED WITH -
CD                       THE DATA FOR A PARTICULAR RESOLVED LEVEL   -
CD                       FOR INELASTIC SCATTERING IN A GIVEN MATERIAL -
CD                       FOR A GIVEN INTERPOLATION RANGE.           -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          DISCRETE ENERGY-CROSS SECTION PAIRS (TYPE 3)             -
C                                                                    -
CC          PRESENT IF NLEVLS.GT.0                                   -
C                                                                    -
CL     (EIN(K),SIGIN(K),K=1,NS1)                                     -
```

```
C                                                                       -  009700
CD    NS1                 NS1=NS(1)+NS(2)+...+NS(IR).                   -  009800
CD    EIN                 ENERGY COORDINATE ASSOCIATED WITH A PARTICULAR -  009900
CD                        RESOLVED INELASTIC LEVEL.                     -  010000
CD    SIGIN               CROSS SECTION COORDINATE ASSOCIATED WITH A    -  010100
CD                        PARTICULAR RESOLVED INELASTIC LEVEL (BARNS).  -  010200
C                                                                       -  010300
C-----------------------------------------------------------------------   010400
                                                                          010500
                                                                          010600
C-----------------------------------------------------------------------   010700
CR          ENERGY-NUCLEAR TEMPERATURE INTERPOLATION DATA (TYPE 4)      -  010800
C                                                                       -  010900
CC          PRESENT IF NSTAT.GT.0                                       -  011000
C                                                                       -  011100
CL    IR, (NS(I),KT(I),I=1,IR)                                          -  011200
C                                                                       -  011300
CD    IR                  NUMBER OF INTERPOLATION REGIONS FOR UNRESOLVED -  011400
CD                        INELASTIC SCATTERING NUCLEAR TEMPERATURES.    -  011500
CD    NS                  NUMBER OF ENERGY POINTS ASSOCIATED WITH THE   -  011600
CD                        DATA FOR NUCLEAR TEMPERATURE FOR UNRESOLVED   -  011700
CD                        INELASTIC SCATTERING FOR A GIVEN INTERPOLATION -  011800
CD                        REGION.                                       -  011900
C                                                                       -  012000
C-----------------------------------------------------------------------   012100
                                                                          012200
                                                                          012300
C-----------------------------------------------------------------------   012400
CR          ENERGY-NUCLEAR TEMPERATURE COORDINATE PAIRS (TYPE 5)        -  012500
C                                                                       -  012600
CC          PRESENT IF NSTAT.GT.0                                       -  012700
C                                                                       -  012800
CL    (EIN(K),SIGIN(K),K=1,NST)                                         -  012900
C                                                                       -  013000
CD    NST                 NST=NS(1)+NS(2)+...+NS(IR).                   -  013100
CD    EIN                 ENERGY COORDINATE ASSOCIATED WITH DATA FOR    -  013200
CD                        NUCLEAR TEMPERATURE IN INELASTIC SCATTERING.  -  013300
CD    SIGIN               TEMPERATURE COORDINATE ASSOCIATED WITH DATA   -  013400
CD                        FOR A STATISTICAL CALCULATION OF INELASTIC    -  013500
CD                        SCATTERING.                                   -  013600
C                                                                       -  013700
C-----------------------------------------------------------------------   013800
                                                                          013900
                                                                          014000
C-----------------------------------------------------------------------   014100
CR          ENERGY-CROSS SECTION INTERPOLATION DATA (TYPE 6)            -  014200
C                                                                       -  014300
CC          PRESENT IF NSTAT.GT.0                                       -  014400
C                                                                       -  014500
CL    IR,(NS(I),KT(I),I=1,IR)                                           -  014600
C                                                                       -  014700
CD    IR                  NUMBER OF INTERPOLATION REGIONS FOR INELASTIC -  014800
CD                        SCATTERING DATA FOR UNRESOLVED CALCULATION.   -  014900
CD    NS                  NUMBER OF POINTS ASSOCIATED WITH THE DATA     -  015000
CD                        DESCRIBING THE GRAPH OF THE DIFFERENCE BETWEEN -  015100
CD                        TOTAL INELASTIC CROSS SECTION AND THE SUM     -  015200
CD                        OF CONTRIBUTIONS DUE TO THE RESOLVED LEVELS   -  015300
CD                        FOR A PARTICULAR INTERPOLATION REGION.        -  015400
C                                                                       -  015500
C-----------------------------------------------------------------------   015600
                                                                          015700
                                                                          015800
C-----------------------------------------------------------------------   015900
CR          ENERGY-INELASTIC CROSS SECTION DATA (TYPE 7)                -  016000
C                                                                       -  016100
CC          PRESENT IF NSTAT.GT.0                                       -  016200
C                                                                       -  016300
CL    (EIN(K),SIGIN(K),K=1,NST)                                         -  016400
C                                                                       -  016500
CD    NST                 NST=NS(1)+NS(2)+...+NS(IR).                   -  016600
CD    EIN                 ENERGY COORDINATE ASSOCIATED WITH DATA        -  016700
CD                        DESCRIBING THE DIFFERENCE BETWEEN TOTAL       -  016800
CD                        INELASTIC CROSS SECTION AND THE SUM OF RESOLVED-  016900
CD                        LEVELS.                                       -  017000
CD    SIGIN               CROSS SECTION COORDINATE ASSOCIATED WITH      -  017100
CD                        DATA DESCRIBING THE DIFFERENCE BETWEEN        -  017200
CD                        TOTAL INELASTIC CROSS SECTION AND THE SUM     -  017300
CD                        OF RESOLVED LEVELS.                           -  017400
C                                                                       -  017500
C-----------------------------------------------------------------------   017600
                                                                          017700
                                                                          017800
C-----------------------------------------------------------------------   017900
CR          ENERGY-(N,2N) INTERPOLATION DATA (TYPE 8)                   -  018000
C                                                                       -  018100
CC          PRESENT IF N2N.GT.0                                         -  018200
C                                                                       -  018300
CL    IR,(NS(I),KT(I),I=1,IR)                                           -  018400
C                                                                       -  018500
CD    IR                  NUMBER OF INTERPOLATION REGIONS FOR (N,2N)    -  018600
CD                        NUCLEAR TEMPERATURES.                         -  018700
CD    NS                  NUMBER OF POINTS ASSOCIATED WITH THE NUCLEAR  -  018800
CD                        TEMPERATURE DATA FOR (N,2N) REACTION FOR A    -  018900
CD                        PARTICULAR INTERPOLATION REGION.              -  019000
C                                                                       -  019100
C-----------------------------------------------------------------------   019200
```

```
C-----------------------------------------------------------------------
CR          ENERGY-(N,2N) NUCLEAR TEMPERATURE DATA (TYPE 9)
C
CC          PRESENT IF N2N.GT.0
C
CL    (EIN(K),SIGIN(K),K=1,NST)
C
CD    NST                 NST=NS(1)+NS(2)+...+NS(IR).
CD    EIN                 ENERGY COORDINATE ASSOCIATED WITH DATA FOR
CD                        A STATISTICAL CALCULATION OF THE (N,2N)
CD                        REACTION.
CD    SIGIN               TEMPERATURE COORDINATE ASSOCIATED WITH DATA
CD                        FOR A STATISTICAL CALCULATION OF THE (N,2N)
CD                        REACTION (MEV).
C
C-----------------------------------------------------------------------

CEOF
```

```
C***********************************************************************
C
C                         PREPARED 2/15/71 AT ANL
C
CF          XS.ENDF3     (FILE 3)
CE          FISSION SPECTRA DATA
CC          THIS IS FILE 5 OF MC**2 LIBRARY TAPE
C
CD                        THIS IS FILE 3 OF A FOUR-FILE DATA SET
C
C***********************************************************************

CD    MSORS               NUMBER OF FISSION SPECTRA IN LIBRARY.

C-----------------------------------------------------------------------
CS          FILE STRUCTURE
CS
CS          RECORD TYPE                          PRESENT IF
CS          ================================  ========================
CS          SPECIFICATIONS                       ALWAYS
CS    ******** (REPEAT MSORS TIMES)
CS    *     FISSION SPECTRA                      ALWAYS
CS    ********
CS
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)
C
CC          ALWAYS PRESENT
C
CL    MSORS
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          FISSION SPECTRA (TYPE 2)
C
CC          ALWAYS PRESENT
C
CL    ISORS,BETA,ALPHA,TAU
C
CD    ISORS               THE SOURCE TYPE NUMBER (FISSION SPECTRA NUMBER)
CD                        FOR WHICH THESE DATA ARE APPROPRIATE.
```

```
CD    BETA,ALPHA,TAU    PARAMETERS IN GENERALIZED FISSION SPECTRUM.    -  004900
C                                                                      -  005000
C-----------------------------------------------------------------------  005100
                                                                         005200
CEOF                                                                     005300
```

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C***********************************************************************  000100
C                                                                      -  000200
C                          PREPARED 2/15/71 AT ANL                     -  000300
C                                                                      -  000400
CF          XS.ENDF3     (FILE 4)                                      -  000500
CE          LEGENDRE DATA                                              -  000600
CC          THIS IS FILE 6 OF MC**2 LIBRARY TAPE                       -  000700
C                                                                      -  000800
CN                       THIS IS FILE 4 OF A FOUR-FILE DATA SET        -  000900
C                                                                      -  001000
C***********************************************************************  001100
                                                                         001200
                                                                         001300
CD    MATLS              NUMBER OF MATERIALS IN THE LIBRARY.            001400
CD    NPASS              NUMBER OF PASSES INTO WHICH THE DATA ARE       001500
CD                       GROUPED.                                       001600
CD    MANY1              THE NUMBER OF ENERGY POINTS OF INFORMATION IN  001700
CD                       EACH OF THE NPASS BLOCKS OF DATA.              001800
                                                                         001900
                                                                         002000
C-----------------------------------------------------------------------  002100
CS          FILE STRUCTURE                                             -  002200
CS                                                                     -  002300
CS          RECORD TYPE                          PRESENT IF            -  002400
CS          ================================  ========================-  002500
CS          TABLE OF CONTENTS                    ALWAYS                -  002600
CD    ******** (REPEAT NPASS TIMES)                                    -  002700
CS    ******** (REPEAT FOR ALL MATERIALS)                              -  002800
CS    *     MATERIAL IDENTIFICATION              ALWAYS                -  002900
CS    *     TRANSFORMATION VECTOR                I.EQ.1                -  003000
CS    *     LEGENDRE COEFFICIENTS                ALWAYS                -  003100
CS    ********                                                         -  003200
CS                                                                     -  003300
C-----------------------------------------------------------------------  003400
                                                                         003500
                                                                         003600
C-----------------------------------------------------------------------  003700
CR          TABLE OF CONTENTS (TYPE 1)                                 -  003800
C                                                                      -  003900
CC          ALWAYS PRESENT                                             -  004000
C                                                                      -  004100
CL    MATLS,LEVLS,ESTART,NPASS,(MANY1(NP),NP=1,NPASS)                  -  004200
C                                                                      -  004300
CD    ESTART             ENERGY AT TOP OF LEGENDRE LIBRARY.             -  004400
CD    LEVLS              NUMBER OF ENERGY LEVELS AT WHICH LEGENDRE      -  004500
CD                       DATA ARE GIVEN.                                -  004600
C                                                                      -  004700
C-----------------------------------------------------------------------  004800
```

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C-----------------------------------------------------------------------
CR          MATERIAL IDENTIFICATION (TYPE 2)                          -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    MATID                                                           -
C                                                                     -
CD    MATID                 MATERIAL IDENTIFICATION.                  -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR    TRANSFORMATION VECTOR (TYPE 3)                                  -
C                                                                     -
CC          PRESENT ONLY IN FIRST OF NPASS BLOCKS OF DATA             -
C                                                                     -
CL    (U(J),J=1,19),A                                                 -
C                                                                     -
CD    U                     ELEMENTS OF TRANSFORMATION MATRIX THAT    -
CD                          TRANSFORMS LEGENDRE DATA FROM CENTER OF MASS -
CD                          SYSTEM TO THE LABORATORY SYSTEM.          -
CD    A                     MATERIAL MASS.                            -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          LEGENDRE COEFFICIENTS (TYPE 4)                            -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    (B0(J),B1(J),...,B19(J),J=1,MANY1)                              -
C                                                                     -
CD    B0,B1,...,B19         FIRST,SECOND,...,TWENTIETH ORDER EXPANSION -
CD                          COEFFICIENT AT THE ENERGY LEVEL SPECIFIED BY -
CD                          THE INDEX J. FOR EXAMPLE, ON THE THIRD PASS, -
CD                          THE THIRD BLOCK OF DATA, B0(1) WOULD BE THE -
CD                          FIRST ORDER COEFFICIENT FOR ENERGY LEVEL  -
CD                          MANY1(1)+MANY1(2)-1.                      -
C                                                                     -
C-----------------------------------------------------------------------

CEOF

C*********************************************************************
C                                                                     -
C                           PREPARED 2/15/71 AT ANL                   -
C                                                                     -
CF          XS.FLUX                                                   -
CE          FINE AND ULTRAFINE GROUP REAL FLUXES AND CURRENTS         -
C                                                                     -
C*********************************************************************

CD    NOI                   NUMBER OF MATERIALS.

C-----------------------------------------------------------------------
CR          FINE GROUP REAL FLUXES AND CURRENTS (TYPE 1)              -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    NINTC,KMINS,(PHIC(I),CRNTC(I),SHAPEC(I),(S(J,I),J=1,11),        -
CL   1I=1,NINTC),PHIC(KMINS),CRNTC(KMINS),NOI,(N2N(I),I=1,NOI)        -
C                                                                     -
CD    NINTC                 NUMBER OF FINE ENERGY GROUPS.             -
CD    KMINS                 NINTC+1.                                  -
CD    PHIC                  FINE GROUP FLUX.                          -
CD    CRNTC                 FINE GROUP CURRENT.                       -
CD    SHAPEC                SOURCE CONTRIBUTION INTO FINE GROUP.      -
CD    S                     FINE GROUP CROSS SECTIONS FOR DIFFERENT   -
CD                          REACTION TYPES, WHICH ARE GIVEN IN THE    -
CD                          FOLLOWING ORDER:                          -
CD                          ELASTIC TRANSPORT FOR NON-LEGENDRE MATERIALS, -
CD                          ELASTIC REMOVAL FOR NON-LEGENDRE MATERIALS, -
CD                          TOTAL INELASTIC, FISSION (SMOOTH TABULATED -
CD                          PLUS UNRESOLVED RESONANCE), CAPTURE (SMOOTH -
CD                          TABULATED PLUS UNRESOLVED RESONANCE), NU, -
CD                          ELASTIC TRANSPORT FOR LEGENDRE MATERIALS, -
CD                          ELASTIC REMOVAL FOR LEGENDRE MATERIALS,   -
CD                          (N,2N), (N,P), AND (N,ALPHA).             -
CD    N2N                   FLAG INDICATING PRESENCE OF (N,2N)        -
CD                          REACTION DATA.                            -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ULTRAFINE GROUP REAL FLUXES AND CURRENTS (TYPE 2)         -
C                                                                     -
CC          PRESENT ONLY FOR AN ULTRAFINE GROUP PROBLEM               -
C
```

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CL    JEND1,NOI,MTOT,NPASS,(NELMO(I),LMO(I),I=1,NOI),                   -  004900
CL   1(PHIS(I),CURENT(I),SHAPES(I),GAMMA(I),I=1,JEND1)                  -  005000
C                                                                       -  005100
CD    JEND1                NUMBER OF ULTRAFINE ENERGY GROUPS.          -  005200
CD    MTOT                 NUMBER OF LEGENDRE MATERIALS.               -  005300
CD    NPASS                NUMBER OF PASSES INTO WHICH LEGENDRE        -  005400
CD                         DATA IS GROUPED.                            -  005500
CD    NELMO                INDICATES WHETHER MATERIAL HAS LEGENDRE     -  005600
CD                         TREATMENT FOR ELASTIC SCATTERING.           -  005700
CD                         NELMO=0, NO LEGENDRE TREATMENT.             -  005800
CD                                =1, HAS LEGENDRE TREATMENT.          -  005900
CD    LMO                  FLAG FOR IDENTIFICATION AND INDEXING        -  006000
CD                         LEGENDRE TREATMENT FOR A MATERIAL.          -  006100
CD                         LMO=0, MATERIAL DOES NOT HAVE LEGENDRE      -  006200
CD                                TREATMENT OF ELASTIC SCATTERING.     -  006300
CD                         LMO.GT.0, MATERIAL HAS LEGENDRE TREATMENT   -  006400
CD                                   OF ELASTIC SCATTERING. THE FLAG   -  006500
CD                                   INDICATES THE NUMBER OF MATERIALS -  006600
CD                                   THAT HAVE LEGENDRE TREATMENT UP TO -  006700
CD                                   AND INCLUDING THIS PRESENT MATERIAL. -  006800
CD    PHIS                 ULTRAFINE GROUP FLUX.                       -  006900
CD    CURENT               ULTRAFINE GROUP CURRENT.                    -  007000
CD    SHAPES               SOURCE CONTRIBUTION INTO ULTRAFINE GROUP.   -  007100
CD    GAMMA                P1 AND CONSISTENT P1 FUNDAMENTAL MODE OPTION -  007200
CD                         USE GAMMA=1. FOR CONSISTENT B1 FUNDAMENTAL  -  007300
CD                         MODE OPTION, GAMMA IS DEFINED BY            -  007400
CD                         EQ. 91, PAGE 41 OF ANL 7318.                -  007500
C                                                                       -  007600
C-----------------------------------------------------------------------  007700
                                                                         007800
CEOF                                                                     007900
```

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C***********************************************************************  000100
C                                                                       -  000200
C                         PREPARED 2/15/71 AT ANL                       -  000300
C                                                                       -  000400
CF          XS.I.INP                                                    -  000500
CE          BINARY REPRESENTATION OF EBCDIC INPUT DATA                  -  000600
CE          FROM MODULE CSI001                                          -  000700
C                                                                       -  000800
C***********************************************************************  000900
                                                                         001000
                                                                         001100
C-----------------------------------------------------------------------  001200
CR          SPECIFICATIONS (TYPE 1)                                     -  001300
C                                                                       -  001400
CC          ALWAYS PRESENT                                              -  001500
C                                                                       -  001600
CL    NOI,NOBG,NOBGB,(IDENT(I),I=1,12),DELU,DELUN,EMAX,EMIN,EPSABS,     -  001700
CL   1EPSINT,EPSTOT,FACA,IA,IOPT,IYOS,KT1,KT2,KT3,KT4,KT5,KT6,KT7,      -  001800
CL   2KTFLUX,MTOT,NDELU,NGEOM,NINT,NINTC,NJINT,NMIC,NSORS,NTHRM,RADC,   -  001900
CL   3RADP,IN12,MAXSIZ,MAXB,IPNTR,IPRINT,NPATH,TVEL                     -  002000
C                                                                       -  002100
CD    NOI                  NUMBER OF MATERIALS IN PROBLEM.             -  002200
CD    NOBG                 NUMBER OF BROAD ENERGY GROUPS.              -  002300
CD    NOBGB                NOBG+1.                                     -  002400
CD    IDENT                PROBLEM IDENTIFICATION.                     -  002500
CD    DELU                 ULTRAFINE GROUP LETHARGY WIDTH.             -  002600
CD    DELUN                FINE GROUP LETHARGY WIDTH.                  -  002700
CD    EMAX                 UPPER ENERGY LIMIT OF HIGHEST ENERGY GROUP(EV).-  002800
CD    EMIN                 ENERGY INTERFACE BETWEEN THERMAL AND        -  002900
CD                         EPITHERMAL GROUP.                           -  003000
CD    EPSABS               RESOLVED RESONANCES THAT PRODUCE A SIGMA.LT.  -  003100
CD                         EPSABS AT THE ENERGY LIMITS OF AN ULTRAFINE   -  003200
CD                         GROUP AND DO NOT LIE WITHIN THE GROUP ARE NOT -  003300
CD                         INCLUDED IN THE EFFECTIVE ULTRAFINE GROUP     -  003400
CD                         CROSS SECTIONS FOR THAT GROUP. EPSABS IS      -  003500
CD                         SET TO 0.001 BARNS BY CODE IN MODULE CSI001.  -  003600
CD    EPSINT               RELATIVE CONVERGENCE CRITERION FOR INTEGRATION -  003700
CD                         TO GENERATE ULTRAFINE GROUP CROSS SECTIONS IN -  003800
CD                         THE RESOLVED RESONANT REGION. EPSINT IS       -  003900
CD                         SET TO 0.0005 BY CODE IN MODULE CSI001.       -  004000
CD    EPSTOT               RESOLVED RESONANCES THAT PRODUCE AN AVERAGE   -  004100
CD                         SIGMA TOTAL.LT.EPSTOT AT THE ENERGY LIMITS OF -  004200
CD                         AN ULTRAFINE GROUP AND DO NOT LIE WITHIN THE  -  004300
CD                         GROUP ARE TREATED AS HAVING A CONSTANT AVERAGE -  004400
CD                         VALUE OVER THE GROUP.                         -  004500
CD    FACA                 THE CONSTANT A, USED TO IMPROVE THE RATIONAL  -  004600
CD                         APPROXIMATION TO THE ESCAPE PROBILITY.        -  004700
CD                         FACA IS SET TO 1.35 BY CODE IN MODULE CSI001. -  004800
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CD      IA              ULTRAFINE EDIT FLAG.                                    - 004900
CD                      .GT.0, EDIT ULTRAFINE GROUP MATERIAL MACRO-             - 005000
CD                          SCOPIC ELASTIC REMOVAL CROSS SECTIONS,              - 005100
CD                          ELASTIC TRANSPORT CROSS SECTIONS, AND               - 005200
CD                          ELASTIC TRANSFER MATERIALS.                         - 005300
CD                      = 0, NO EDIT OF ULTRAFINE GROUP ELASTIC CROSS           - 005400
CD                          SECTIONS.                                           - 005500
CD      IOPT            FUNDAMENTAL MODE FLAG.                                  - 005600
CD                      = 1, P1 FUNDAMENTAL MODE CALCULATION.                   - 005700
CD                      = 2, CONSISTENT B1 FUNDAMENTAL MODE                     - 005800
CD                          CALCULATIONS FOR ISOTROPIC NEUTRONICS.              - 005900
CD                      = 3, CONSISTENT P1 FUNDAMENTAL MODE                     - 006000
CD                          CALCULATION FOR ISOTROPIC NEUTRONICS.               - 006100
CD                      = 4, CONSISTENT B1 FUNDAMENTAL MODE                     - 006200
CD                          CALCULATION FOR ANISOTROPIC NEUTRONICS.             - 006300
CD                      = 5, CONSISTENT P1 FUNDAMENTAL MODE                     - 006400
CD                          CALCULATION FOR ANISOTROPIC NEUTRONICS.             - 006500
CD      IYOS            IYOS.GT.0, INPUT WEIGHTING SPECTRUM APPEARS             - 006600
CD                      WITH PROBLEM DATA, AND FUNDAMENTAL MODE                 - 006700
CD                      SPECTRUM IS NOT GENERATED.                              - 006800
CD      KT1             KT1.GT.0, EDIT ULTRAFINE GROUP AVERAGE MICRO-           - 006900
CD                      SCOPIC CROSS SECTIONS SUMMED OVER ALL                   - 007000
CD                      CONTRIBUTING RESONANCES IN THE RESOLVED                 - 007100
CD                      RESONANCE REGION. ALSO EDIT POINT VALUES OF             - 007200
CD                      MICROSCOPIC CROSS SECTIONS AVERAGED OVER                - 007300
CD                      PORTER-THOMAS DISTRIBUTIONS IN THE UNRESOLVED           - 007400
CD                      RESONANCE REGION.                                       - 007500
CD      KT2             KT2.GT.0, EDIT ULTRAFINE GROUP AVERAGE MICRO-           - 007600
CD                      SCOPIC CROSS SECTIONS FOR EACH RESONANCE IN             - 007700
CD                      THE RESOLVED RESONANCE REGION.                          - 007800
CD      KT3             KT3.GT.0, EDIT MICROSCOPIC FINE GROUP AVERAGE           - 007900
CD                      CROSS SECTIONS COMPUTED FROM NONRESONANT                - 008000
CD                      LINEAR SEGMENT DATA.                                    - 008100
CD      KT4             KT4.GT.0, EDIT HOMOGENIZED MACROSCOPIC FINE             - 008200
CD                      GROUP AND ULTRAFINE GROUP AVERAGE CROSS                 - 008300
CD                      SECTIONS. ALSO EDIT FISSION SPECTRUM FOR                - 008400
CD                      FINE GROUPS.                                            - 008500
CD      KT5             KT5.GT.0, EDIT FOR DEBUGGING PURPOSES                   - 008600
CD                      (DEFAULT=0).                                            - 008700
CD      KT6             KT6.GT.0, EDIT FINE AND ULTRAFINE GROUP FLUXES          - 008800
CD                      FOR EACH BUCKLING ITERATION.                            - 008900
CD      KT7             HYDROGEN FLAG. SET BY CODE IN MODULE CSI001.            - 009000
CD                      = 0, HYDROGEN NOT USED IN THE PROBLEM.                  - 009100
CD                      = 1, HYDROGEN USED IN THE PROBLEM.                      - 009200
CD      KTFLUX          WEIGHTING SPECTRUM FLAG.                                - 009300
CD                      = 1, 1/E WEIGHTING SPECTRUM USED FOR FINE               - 009400
CD                          GROUP CROSS SECTIONS.                               - 009500
CD                      = 2, CONSTANT WEIGHTING SPECTRUM USED FOR               - 009600
CD                          FINE GROUP CROSS SECTIONS.                          - 009700
CD                      = 3, E WEIGHTING SPECTRUM USED FOR FINE GROUP           - 009800
CD                          CROSS SECTIONS.                                     - 009900
CD      MTOT            NUMBER OF MATERIALS THAT HAVE A LEGENDRE                - 010000
CD                      TREATMENT OF ELASTIC SCATTERING.                        - 010100
CD      NDELU           GROUP TYPE FLAG.                                        - 010200
CD                      = 1, ALL FINE GROUP PROBLEM.                            - 010300
CD                      = 2, ULTRAFINE GROUP PROBLEM.                           - 010400
CD      NGEOM           FUEL PIN GEOMETRY, 1 = SLAB, 2 = CYLINDER.              - 010500
CD      NINT            NUMBER OF ULTRAFINE GROUPS IN PROBLEM.                  - 010600
CD      NINTC           NUMBER OF FINE GROUPS IN PROBLEM.                       - 010700
CD      NJINT           NJINT.GT.0, FLUX CORRECTION FACTOR IN                   - 010800
CD                      UNRESOLVED RESONANCE CALCULATION SET TO UNITY.          - 010900
CD      NMIC            BROAD GROUP CROSS SECTION FLAG.                         - 011000
CD                      = 0, CALCULATE MICROSCOPIC AND MACROSCOPIC              - 011100
CD                          BROAD GROUP CROSS SECTIONS.                         - 011200
CD                      .GT.0, BROAD GROUP CROSS SECTIONS NOT                   - 011300
CD                          CALCULATED.                                         - 011400
CD      NSORS           LIBRARY IDENTIFICATION NUMBER FOR FISSION               - 011500
CD                      SOURCE.                                                 - 011600
CD      NTHRM           THERMAL GROUP FLAG.                                     - 011700
CD                      .GT.0, READ IN THERMAL GROUP CROSS SECTIONS             - 011800
CD                          WITH PROBLEM DATA.                                  - 011900
CD                      = 0, THERMAL FLUXES AND CROSS SECTIONS ARE              - 012000
CD                          ARE SET TO 0 BY CODE IN MODULE CSI001.              - 012100
CD      RADC            RADIUS OF OUTER CLADDING COOLANT REGION I IF            - 012200
CD                      NGEOM = 2; OUTER BOUND OF CLADDING COOLANT              - 012300
CD                      REGION RELATIVE TO CENTER OF FUEL SLAB IF               - 012400
CD                      NGEOM = 1; IN CM.                                       - 012500
CD      RADP            RADIUS OF FUEL PIN IF NGEOM = 2; HALF-THICKNESS-        - 012600
CD                      OF FUEL SLAB IF NGEOM = 1; IN CM.                       - 012700
CD      IN12            IN12.GT.0, THEN XS.ISO DATA SET EXISTS.                 - 012800
CD      MAXSIZ          SIZE OF MAIN CORE CONTAINER ARRAY IN REAL*8             - 012900
CD                      WORDS (DEFAULT=60000).                                  - 013000
CD      MAXB            SIZE OF BULK CORE CONTAINER ARRAY IN REAL*8             - 013100
CD                      WORDS (DEFAULT=100000).                                 - 013200
CD      IPNTR           CONTAINER ARRAY FLAG.                                   - 013300
CD                      = 0, NO USER SPECIFICATION FOR MAIN OR BULK             - 013400
CD                          CORE CONTAINER ARRAY.USE DEFAULT FOR BOTH.-         - 013500
CD                      = 1, USER HAS BLANK FIELD FOR BULK CONTAINER            - 013600
CD                          ARRAY. USE DEFAULT FOR BULK CONTAINER               - 013700
CD                          ARRAY.                                              - 013800
CD                      = 2, USER SPECIFIES A 0 SIZE FOR BULK                   - 013900
CD                          CONTAINER ARRAY.                                    - 014000
CD      IPRINT          PRINT OPTION FLAG FOR CONTAINER ARRAY.                  - 014100
CD                      DEFAULT = 0.                                            - 014200
CD      NPATH           FLAG FOR STANDARD PATH CAPABILITY.                      - 014300
CD                      = 1, COMPLETE MC2 PROBLEM.                              - 014400
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CD                          = 2, CALCULATE RESOLVED AND UNRESOLVED          -  014500
CD                               RESONANCE CROSS SECTIONS ONLY.             -  014600
CD                          = 3, GENERATE SMOOTH CROSS SECTIONS AND A       -  014700
CD                               FUNDAMENTAL MODE SPECTRUM, AND COLLAPSE    -  014800
CD                               TO A  BROAD GROUP SET. USES PREVIOUSLY     -  014900
CD                               GENERATED RESONANCE CROSS SECTIONS.        -  015000
CD                          = 4, GENERATE BROAD GROUP SET USING PREVIOUSLY  -  015100
CD                               GENERATED DATA AND SPECTRUM.               -  015200
CD     TVEL                 THERMAL GROUP AVERAGE RECIPROCAL VELOCITY       -  015300
CD                          (SEC/CM). DEFAULT = 1./2.2E+5.                  -  015400
C                                                                           -  015500
C-----------------------------------------------------------------------------  015600
                                                                               015700
                                                                               015800
C-----------------------------------------------------------------------------  015900
CR          ITERATION SPECIFICATIONS (TYPE 2)                               -  016000
C                                                                           -  016100
CC          PRESENT IF IYOS=0                                               -  016200
C                                                                           -  016300
CL     IBSQ,BSQ,BSQ2,EPS                                                    -  016400
C                                                                           -  016500
CD     IBSQ                 IBSQ.GT.0, ITERATE ON BUCKLING TO CRITICAL.     -  016600
CD     BSQ                  FIRST GUESS FOR BUCKLING.                       -  016700
CD     BSQ2                 SECOND GUESS FOR BUCKLING.                      -  016800
CD     EPS                  CONVERGENCE CRITERION ON ABS(KEFF-1).           -  016900
C                                                                           -  017000
C-----------------------------------------------------------------------------  017100
                                                                               017200
                                                                               017300
C-----------------------------------------------------------------------------  017400
CR          WEIGHTING SPECTRUM (TYPE 3)                                     -  017500
C                                                                           -  017600
CC          PRESENT IF IYOS.NE.0                                            -  017700
C                                                                           -  017800
CL     (PHIC(I),I=1,NINTC)                                                  -  017900
C                                                                           -  018000
CD     PHIC                 FINE GROUP WEIGHTING SPECTRUM.                  -  018100
CD     NINTC                NUMBER OF FINE ENERGY GROUPS.                   -  018200
C                                                                           -  018300
C-----------------------------------------------------------------------------  018400
                                                                               018500
                                                                               018600
C-----------------------------------------------------------------------------  018700
CR          MATERIAL SPECIFICATIONS (TYPE 4)                                -  018800
C                                                                           -  018900
CC          ALWAYS PRESENT                                                  -  019000
C                                                                           -  019100
CL     (NUCID(I),ADEN(I),CCONC(I),FCONC(I),NELMO(I),TEMP(I),ALIAS(I),       -  019200
CL    1ISOOUT(I),I=1,NOI)                                                   -  019300
C                                                                           -  019400
CD     NUCID                NUCLIDE IDENTIFICATION ON LIBRARY TAPE (REAL*8)-  019500
CD     ADEN                 ATOMIC CONCENTRATIONS USED TO COMPUTE HOMO-     -  019600
CD                          GENIZED MACROSCOPIC CROSS SECTIONS FOR USE IN   -  019700
CD                          FUNDAMENTAL MODE CALCULATIONS                   -  019800
CD                          (ATOMS/CC * 1.E-24).                            -  019900
CD     CCONC                NUCLIDE CONCENTRATIONS IN OUTER REGION          -  020000
CD                          (ATOMS/CC * 1.E-24).                            -  020100
CD     FCONC                NUCLIDE CONCENTRATIONS IN FUEL PIN              -  020200
CD                          (ATOMS/CC * 1.E-24).                            -  020300
CD     NELMO                NELMO.GT.0, LEGENDRE TREATMENT USED FOR         -  020400
CD                          ELASTIC SCATTERING FOR MATERIAL NUCID. (NELMO   -  020500
CD                          SHOULD BE 0 FOR HYDROGEN).                      -  020600
CD     TEMP                 NUCLIDE TEMPERATURE (DEGREES K).                -  020700
CD     ALIAS                MATERIAL NAME SPECIFIED BY USER.                -  020800
CD     ISOOUT               MATERIAL FLAG.                                  -  020900
CD                          = 0, NO ALIAS NAME SPECIFIED BY USER. DO NOT    -  021000
CD                               ADD MATERIAL TO XS.ISO DATA SET.           -  021100
CD                          = 1, ALIAS NAME IS SPECIFIED BY USER. ADD THIS  -  021200
CD                               MATERIAL TO XS.ISO SET.                    -  021300
C                                                                           -  021400
C-----------------------------------------------------------------------------  021500
                                                                               021600
                                                                               021700
C-----------------------------------------------------------------------------  021800
CR          BROAD GROUP SPECIFICATIONS (TYPE 5)                             -  021900
C                                                                           -  022000
CC          ALWAYS PRESENT                                                  -  022100
C                                                                           -  022200
CL     (CGB(I),LGBN(I),I=1,NOBGB)                                           -  022300
C                                                                           -  022400
CD     CGB                  BROAD GROUP UPPER ENERGY BOUNDARY.              -  022500
CD     LGBN                 LETHARGY GROUP BOUNDARY.                        -  022600
CD     NOBGB                NUMBER OF BROAD GROUP ENERGY BOUNDARIES.        -  022700
C                                                                           -  022800
C-----------------------------------------------------------------------------  022900
                                                                               023000
                                                                               023100
C-----------------------------------------------------------------------------  023200
CR          ADDITIONAL BROAD GROUP SPECIFICATIONS (TYPE 6)                  -  023300
C                                                                           -  023400
CC          ALWAYS PRESENT                                                  -  023500
C                                                                           -  023600
CL     (RELU(I),I=1,NOBGB)                                                  -  023700
C                                                                           -  023800
CD     RELU                 LETHARGY FROM UPPER ENERGY LIMIT OF PROBLEM TO  -  023900
CD                          UPPER ENERGY BOUNDARY OF BROAD ENERGY GROUP.    -  024000
```

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CD    NOBGB              NUMBER OF BROAD GROUP ENERGY BOUNDARIES.       -  024100
C                                                                       -  024200
C-----------------------------------------------------------------------  024300
                                                                         024400
CEOF                                                                     024500
```

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C*********************************************************************  000100
C                                                                       -  000200
C                        PREPARED 2/15/71 AT ANL                        -  000300
C                                                                       -  000400
CF          XS.INSCT                                                    -  000500
CE          FINE GROUP INELASTIC CROSS SECTIONS                         -  000600
C                                                                       -  000700
C*********************************************************************  000800
                                                                         000900
                                                                         001000
CD    KFIN               NUMBER OF INTEGRATION LIMIT BOUNDARIES.        001100
CD    NINTC              NUMBER OF FINE ENERGY GROUPS.                  001200
CD    N2N                FLAG FOR (N,2N) REACTION.                      001300
CD    NGSTAT             NUMBER OF FINE GROUPS IN STATISTICAL REGION.   001400
CD    NGN2N              NUMBER OF FINE GROUPS IN (N,2N) REGION.        001500
                                                                         001600
                                                                         001700
C-----------------------------------------------------------------------  001800
CS          FILE STRUCTURE                                              -  001900
CS                                                                      -  002000
CS          RECORD TYPE                              PRESENT IF         -  002100
CS          ================================         ===================-  002200
CS     ********** (REPEAT FOR ALL MATERIALS)                            -  002300
CS     *    SPECIFICATIONS                           ALWAYS             -  002400
CS     *  ****** (REPEAT FOR ALL DISCRETE LEVELS)                       -  002500
CS     *  *  DISCRETE CONTROL                        NLEVLS.GT.0        -  002600
CS     *  *  DISCRETE CROSS SECTIONS                 NLEVLS.GT.0        -  002700
CS     *  ******                                                        -  002800
CS     *    STATISTICAL CONTROL                      NSTAT.GT.0         -  002900
CS     *    STATISTICAL CROSS SECTIONS               NSTAT.GT.0         -  003000
CS     *                                                                -  003100
CS     *    (N,2N) CONTROL                           N2N.GT.0           -  003200
CS     *    (N,2N) CROSS SECTIONS                    N2N.GT.0           -  003300
CS     *********                                                        -  003400
C                                                                       -  003500
C-----------------------------------------------------------------------  003600
                                                                         003700
                                                                         003800
C-----------------------------------------------------------------------  003900
CR          SPECIFICATIONS (TYPE 1)                                     -  004000
C                                                                       -  004100
CC          ALWAYS PRESENT                                              -  004200
C                                                                       -  004300
CL    NLEVLS,NSTAT                                                      -  004400
C                                                                       -  004500
CD    NLEVLS             NUMBER OF DISCRETE LEVELS.                     -  004600
CD    NSTAT              FLAG FOR STATISTICAL TREATMENT FOR             -  004700
CD                       INELASTIC SCATTERING.                          -  004800
```

```
C                                                                       -  004900
C-----------------------------------------------------------------------  005000
                                                                         005100
                                                                         005200
C-----------------------------------------------------------------------  005300
CR          DISCRETE CONTROL (TYPE 2)                                   -  005400
C                                                                       -  005500
CC          PRESENT IF NLEVLS.GT.0                                      -  005600
C                                                                       -  005700
CL    KFIN                                                              -  005800
C                                                                       -  005900
C-----------------------------------------------------------------------  006000
                                                                         006100
                                                                         006200
C-----------------------------------------------------------------------  006300
CR          DISCRETE CROSS SECTIONS (TYPE 3)                            -  006400
C                                                                       -  006500
CC          PRESENT IF NLEVLS.GT.0                                      -  006600
C                                                                       -  006700
CL    (IG(K),LG(K),SAV(K),K=1,KFIN)                                     -  006800
C                                                                       -  006900
CD    IG                  INITIAL GROUP FROM WHICH NEUTRON ORIGINATES.  -  007000
CD    LG                  LOWER GROUP INTO WHICH NEUTRON GOES AFTER     -  007100
CD                        LOSING ENERGY ASSOCIATED WITH THIS LEVEL.     -  007200
CD    SAV                 DISCRETE CROSS SECTION FROM FINE GROUP IG TO  -  007300
CD                        FINE GROUP LG.                                -  007400
C                                                                       -  007500
C-----------------------------------------------------------------------  007600
                                                                         007700
                                                                         007800
C-----------------------------------------------------------------------  007900
CR          STATISTICAL CONTROL (TYPE 4)                                -  008000
C                                                                       -  008100
CC          PRESENT IF NSTAT.GT.0                                       -  008200
C                                                                       -  008300
CL    NGSTAT                                                            -  008400
C                                                                       -  008500
C-----------------------------------------------------------------------  008600
                                                                         008700
                                                                         008800
C-----------------------------------------------------------------------  008900
CR          STATISTICAL CROSS SECTIONS (TYPE 5)                         -  009000
C                                                                       -  009100
CC          PRESENT IF NSTAT.GT.0                                       -  009200
C                                                                       -  009300
CL    (PIN(J,K),K=1,NINTC)-----NOTE STRUCTURE BELOW-----                -  009400
C                                                                       -  009500
C     DO 1 J=1,NGSTAT                                                   -  009600
C   1 READ(N) *LIST AS ABOVE*                                           -  009700
C                                                                       -  009800
CD    PIN                 STATISTICAL CROSS SECTION SCATTERING FROM   -  009900
CD                        FINE GROUP J TO FINE GROUP K.                 -  010000
C                                                                       -  010100
C-----------------------------------------------------------------------  010200
                                                                         010300
                                                                         010400
C-----------------------------------------------------------------------  010500
CR          (N,2N) CONTROL (TYPE 6)                                     -  010600
C                                                                       -  010700
CC          PRESENT IF N2N.GT.0                                         -  010800
C                                                                       -  010900
CL    NGN2N                                                             -  011000
C                                                                       -  011100
C-----------------------------------------------------------------------  011200
                                                                         011300
                                                                         011400
C-----------------------------------------------------------------------  011500
CR          (N,2N) CROSS SECTIONS (TYPE 7)                              -  011600
C                                                                       -  011700
CC          PRESENT IF N2N.GT.0                                         -  011800
C                                                                       -  011900
CL    (QIN(J,K),K=J,NINTC)-----NOTE STRUCTURE BELOW-----                -  012000
C                                                                       -  012100
C     DO 2 J=1,NGN2N                                                    -  012200
C   2 READ(N) *LIST AS ABOVE*                                           -  012300
C                                                                       -  012400
CD    QIN                 (N,2N) CROSS SECTION SCATTERING FROM FINE   -  012500
CD                        GROUP J TO FINE GROUP K.                      -  012600
C                                                                       -  012700
C-----------------------------------------------------------------------  012800
                                                                         012900
CEOF                                                                     013000
```

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C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.I.RES     (FILE 1)                                    -
CE          RESOLVED RESONANCE MICROSCOPIC ULTRAFINE GROUP           -
CF          CROSS SECTIONS, FILE 1                                   -
C                                                                    -
CN                       THIS IS FILE 1 OF A TWO-FILE DATA SET       -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                  -
C                                                                    -
CL          NINT1R,NOI                                               -
C                                                                    -
CD    NINTIR             NUMBER OF RESOLVED RESONANCE GROUPS.        -
CD    NOI                NUMBER OF ISOTOPES.                         -
C                                                                    -
C--------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.I.RES     (FILE 2)                                    -
CE          RESOLVED RESONANCE MICROSCOPIC ULTRAFINE GROUP           -
CE          CROSS SECTIONS, FILE 2                                   -
C                                                                    -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET       -
C                                                                    -
C*********************************************************************

C--------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                          PRESENT IF          -
CS          ==================================   ===================-
CS                                                                   -
CS    ********* (REPEAT NINT1R TIMES)                                -
CS    *     RESOLVED CROSS SECTIONS              NINT1R.GT.0         -
CS    *********                                                      -
CS          WEIGHTING SPECTRA                    NINT1R.GT.0         -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          RESOLVED CROSS SECTIONS (TYPE 1)                         -
C                                                                    -
CC          PRESENT IF NINT1R.GT.0                                   -
C                                                                    -
CL    (AMICAP(I),AMIFIS(I),I=1,NOI)                                  -
C                                                                    -
CD    AMICAP             RESOLVED CAPTURE RESONANCE MICROSCOPIC      -
CD                       CROSS SECTION.                              -
CD    AMIFIS             RESOLVED FISSION RESONANCE MICROSCOPIC      -
CD                       CROSS SECTION.                              -
CD    NOI                NUMBER OF MATERIALS.                        -
C                                                                    -
CN                       CROSS SECTIONS ARE ORDERED FROM LOW ENERGY  -
CN                       GROUPS TO HIGH ENERGY GROUPS.               -
C                                                                    -
C--------------------------------------------------------------------

C--------------------------------------------------------------------
CR          WEIGHTING SPECTRA (TYPE 2)                               -
```

```
C                                                                       -  004900
CC          PRESENT IF NINT1R.GT.0                                      -  005000
C                                                                       -  005100
CL    (PHIIN(I),PHIOUT(I),I=1,NINT1R)                                   -  005200
C                                                                       -  005300
CD    PHIIN                 WEIGHTING SPECTRA FOR RESONANCE CROSS     -  005400
CD                          SECTIONS, INSIDE FUEL PIN.                -  005500
CD    PHIOUT                WEIGHTING SPECTRA FOR RESONANCE CROSS     -  005600
CD                          SECTIONS, OUTSIDE FUEL PIN.               -  005700
CD    NINT1R                NUMBER OF RESOLVED RESONANCE GROUPS.      -  005800
C                                                                       -  005900
CN                          WEIGHTING SPECTRA ARE ORDERED FROM LOW ENERGY  -  006000
CN                          GROUPS TO HIGH ENERGY GROUPS.             -  006100
C                                                                       -  006200
C------------------------------------------------------------------------  006300
                                                                           006400
CEOF                                                                       006500
```

```
C***********************************************************************  000100
C                                                                       -  000200
C                           PREPARED 2/15/71 AT ANL                     -  000300
C                                                                       -  000400
CE          XS.ISO          (FILE 1)                                    -  000500
CE          MICROSCOPIC GROUP CROSS SECTIONS, FILE 1                    -  000600
C                                                                       -  000700
CN                          THIS IS FILE 1 OF A FOUR-FILE DATA SET      -  000800
CN                          CONTAINING MICROSCOPIC GROUP CROSS SECTIONS.  -  000900
C                                                                       -  001000
C***********************************************************************  001100
                                                                           001200
                                                                           001300
CD    NGROUP                NUMBER OF BROAD ENERGY GROUPS IN SET.       001400
CD    NISO                  NUMBER OF ISOTOPES IN SET.                  001500
                                                                           001600
                                                                           001700
C------------------------------------------------------------------------  001800
CR          FILE SIZE (TYPE 1)                                          -  001900
C                                                                       -  002000
CC          ALWAYS PRESENT                                              -  002100
C                                                                       -  002200
CL    NGROUP,NISO                                                       -  002300
C                                                                       -  002400
C------------------------------------------------------------------------  002500
                                                                           002600
                                                                           002700
C------------------------------------------------------------------------  002800
CR          ISOTOPE NAMES (TYPE 2)                                      -  002900
C                                                                       -  003000
CC          ALWAYS PRESENT                                              -  003100
C                                                                       -  003200
CL    (ISONAM(I),I=1,NISO),(LOCA(I),I=1,NISO1),(TEMP(I),I=1,NISO),      -  003300
CL   1(TNAME(I),I=1,NISO)                                               -  003400
C                                                                       -  003500
CC    NISO1=NISO+1                                                      -  003600
C                                                                       -  003700
CD    ISONAM(I)             LOCAL NAME OF I-TH ISOTOPE (REAL*8).      -  003800
CD    LOCA(I)               NUMBER OF RECORDS IN FILE 2 OF XS.ISO TO BE  -  003900
CD                          SKIPPED TO READ DATA FOR ISOTOPE I. LOCA(1)=0.  -  004000
CD    TEMP(I)               TEMPERATURE OF I-TH ISOTOPE.              -  004100
CD    TNAME                 I-TH ISOTOPE NAME AS GIVEN IN ENDF/B FILES.  -  004200
C                                                                       -  004300
C------------------------------------------------------------------------  004400
                                                                           004500
                                                                           004600
C------------------------------------------------------------------------  004700
CR          GROUP STRUCTURE (TYPE 3)                                    -  004800
```

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C                                                                       -  004900
CC          ALWAYS PRESENT                                              -  005000
C                                                                       -  005100
CL    ICHI,(E(I),I=1,NGP1),(U(I),I=1,NGP1),(VEL(I),I=1,NGROUP)          -  005200
C                                                                       -  005300
CC    NGP1=NGROUP+1                                                     -  005400
C                                                                       -  005500
CD    ICHI                  FISSION SPECTRUM FLAG FOR SET.            -  005600
CD                          ICHI=0, NO SET CHI                        -  005700
CD                              =1, SET CHI VECTOR                    -  005800
CD                              =NGROUP, SET CHI MATRIX               -  005900
CD    E(I)                  ENERGY BOUNDARIES OF GROUPS. E(1) IS      -  006000
CD                          THE MAXIMUM ENERGY.                       -  006100
CD    U(I)                  LETHARGY BOUNDARIES OF GROUPS. U(1)=0.    -  006200
CD    VEL(I)                NEUTRON SPEED FOR GROUP I,                -  006300
CD                          1. DIVIDED BY THE AVERAGE RECIPROCAL GROUP -  006400
CD                          SPEED   1./(1./V).                        -  006500
C                                                                       -  006600
C-----------------------------------------------------------------------  006700
                                                                         006800
                                                                         006900
C-----------------------------------------------------------------------  007000
CR          SET FISSION SPECTRUM (TYPE 4)                               -  007100
C                                                                       -  007200
CC          PRESENT IF ICHI.NE.0                                        -  007300
C                                                                       -  007400
CL    ((CHI(I,J),I=1,ICHI),J=1,NGROUP)                                  -  007500
C                                                                       -  007600
CD    CHI(I,J)              FISSION SPECTRUM INCIDENT IN GROUP I,     -  007700
CD                          BORN IN GROUP J.                          -  007800
C                                                                       -  007900
C-----------------------------------------------------------------------  008000
                                                                         008100
                                                                         008200
CEOF                                                                     008300
```

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C*********************************************************************  000100
C                                                                       -  000200
C                         PREPARED 2/15/71 AT ANL                       -  000300
C                                                                       -  000400
CE          XS.ISO        (FILE 2)                                      -  000500
CE          MICROSCOPIC GROUP CROSS SECTIONS, FILE 2                    -  000600
C                                                                       -  000700
CN                        THIS IS FILE 2 OF A FOUR-FILE DATA SET        -  000800
CN                        CONTAINING MICROSCOPIC GROUP CROSS SECTIONS.  -  000900
C                                                                       -  001000
C*********************************************************************  001100
                                                                         001200
                                                                         001300
C-----------------------------------------------------------------------  001400
CS          FILE STRUCTURE                                              -  001500
CS                                                                      -  001600
CS             RECORD TYPE                          PRESENT IF          -  001700
CS             ==============================       ====================-  001800
CS     ************(REPEAT FOR ALL ISOTOPES)                            -  001900
CS     *          ISOTOPE NAME                     ALWAYS              -  002000
CS     *          ISOTOPE HEADING                  ALWAYS              -  002100
CS     *          ISOTOPE FISSION SPECTRUM         ICHI.GT.0           -  002200
CS     *   *********(REPEAT FOR ALL GROUPS)                             -  002300
CS     *   *      PRINCIPAL CROSS SECTIONS         ALWAYS              -  002400
CS     *   *********                                                    -  002500
CS     *                                                               -  002600
CS     *   *********(REPEAT FOR EACH SCATTERING ORDER                   -  002700
CS     *   *          L=1,LMAX, WHERE LMAX IS THE                      -  002800
CS     *   *          LARGEST OF LIN, LEL, AND LN2N.                   -  002900
CS     *   *           SEE ISOTOPE HEADING RECORD.)                    -  003000
CS     *   *  ******(REPEAT FOR ALL GROUPS)                             -  003100
CS     *   *  *  INDEX FOR SCATTERING GROUP          ALWAYS             -  003200
CS     *   *  *  INELASTIC SCATTERING                LIN.GE.L           -  003300
CS     *   *  *  ELASTIC SCATTERING                  LEL.GE.L           -  003400
CS     *   *  *  (N,2N) SCATTERING                   LN2N.GE.L          -  003500
CS     ************                                                     -  003600
C                                                                       -  003700
C-----------------------------------------------------------------------  003800
                                                                         003900
                                                                         004000
CD    LELDN                 NUMBER OF ELASTIC DOWNSCATTER GROUPS.       004100
CD    LELUP                 NUMBER OF ELASTIC UPSCATTER GROUPS.         004200
CD    LINDN                 NUMBER OF INELASTIC DOWNSCATTER GROUPS.     004300
CD    LINUP                 NUMBER OF INELASTIC UPSCATTER GROUPS.       004400
CD    LN2NDN                NUMBER OF (N,2N) DOWNSCATTER GROUPS.        004500
CD    LN2NUP                NUMBER OF (N,2N) UPSCATTER GROUPS.          004600
CD    NGROUP                NUMBER OF ENERGY GROUPS IN THE SET.         004700
                                                                         004800
```

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C-----------------------------------------------------------------------
CR          ISOTOPE NAME (TYPE 1)
C
CC          ALWAYS PRESENT
C
CL    ISONAM
C
CD    ISONAM              ISOTOPE NAME (REAL*8).
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ISOTOPE HEADING RECORD (TYPE 2)
C
CL    ICHI,LIN,LEL,LN2N
C
CD    ICHI                ISOTOPE FISSION SPECTRUM FLAG.
CD                        ICHI=-1, ISOTOPE USES PROMPT FISSION SPECTRUM
CD                                 FOR SET.
CD                            =0, ISOTOPE IS NOT FISSIONABLE.
CD                            =1, ISOTOPE USES OWN PROMPT FISSION
CD                                SPECTRUM WHICH IS NOT INCIDENT-ENERGY-
CD                                DEPENDENT (VECTOR).
CD                            =NGROUP, ISOTOPE USES OWN PROMPT FISSION
CD                                SPECTRUM WHICH IS INCIDENT-ENERGY-
CD                                DEPENDENT (MATRIX).
CD    LIN                 MAXIMUM ORDER OF INELASTIC SCATTERING.
CD                        LIN=0, NO SCATTERING.
CD                            =1, ISOTROPIC SCATTERING.
CD                            =2, LINEAR ANISOTROPIC SCATTERING.
CD    LEL                 MAXIMUM ORDER OF ELASTIC SCATTERING.
CD                        LEL=0, NO SCATTERING.
CD                            =1, ISOTROPIC SCATTERING.
CD                            =2, LINEAR ANISOTROPIC SCATTERING.
CD    LN2N                MAXIMUM ORDER OF (N,2N) SCATTERING.
CD                        LN2N=0, NO SCATTERING.
CD                            =1, ISOTROPIC SCATTERING.
CD                            =2, LINEAR ANISOTROPIC SCATTERING.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          ISOTOPE FISSION SPECTRUM (TYPE 3)
C
CC          PRESENT IF ICHI.GT.0 (SEE ISOTOPE HEADING RECORD)
C
CL    ((CHI(I,J),I=1,ICHI),J=1,NGROUP)
C
CD    CHI(I,J)            FISSION SPECTRUM INCIDENT IN GROUP I,BORN
CD                        IN GROUP J.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          PRINCIPAL CROSS SECTIONS (TYPE 4)
C
CC          ALWAYS PRESENT
C
CL    J,STR,SCAP,SNALF,SNP,ANISO,SFIS,FISNU
C
CD    J                   GROUP INDEX.
CD    STR                 TRANSPORT CROSS SECTION.
CD    SCAP                RADIATIVE CAPTURE (N,GAMMA) CROSS SECTION.
CD    SNALF               (N,ALPHA) CROSS SECTION.
CD    SNP                 (N,P) CROSS SECTION.
CD    ANISO               ISOTROPIC ELASTIC SELF-SCATTERING CONSISTENT
CD                        WITH ANISOTROPIC TOTAL CROSS SECTION.
CD                        ANISO, WHEN ADDED TO THE SUM OF ALL EVENTS
CD                        WHICH REMOVE A NEUTRON FROM THE GROUP,
CD                        YIELDS THE TOTAL GROUP CROSS SECTION.
CD    SFIS                FISSION CROSS SECTION, PRESENT IF ICHI.NE.0.
CD    FISNU               NUMBER OF FISSION NEUTRONS PER FISSION TIMES
CD                        FISSION CROSS SECTION, PRESENT IF ICHI.NE.0.
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          INDEX FOR SCATTERING GROUP (TYPE 5)
C
CC          PRESENT IF LIN+LEL+LN2N.NE.0
C           (SEE ISOTOPE HEADING RECORD)
C
CL    LINUP,LINDN,LELUP,LELDN,LN2NUP,LN2NDN
C
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          INELASTIC SCATTERING (TYPE 6)
C
CC          PRESENT IF LIN.GE.CURRENT SCATTERING ORDER
```

```
C           (SEE ISOTOPE HEADING RECORD)                                  -  014500
C                                                                         -  014600
CL    SINL(J+LINUP),SINL(J+LINUP-1),...,SINL(J),...,SINL(J-LINDN)         -  014700
C                                                                         -  014800
CD    SINL(K)            INELASTIC SCATTERING, GROUP K TO GROUP J.        -  014900
C                                                                         -  015000
C-----------------------------------------------------------------------   015100
                                                                          015200
                                                                          015300
C-----------------------------------------------------------------------   015400
CR          ELASTIC SCATTERING (TYPE 7)                                   -  015500
C                                                                         -  015600
CC          PRESENT IF LEL.GE.CURRENT SCATTERING ORDER                    -  015700
C           (SEE ISOTOPE HEADING RECORD)                                  -  015800
C                                                                         -  015900
CL    SELT(J+LELUP),SELT(J+LELUP-1),...,SELT(J),...,SELT(J-LELDN)         -  016000
C                                                                         -  016100
CD    SELT(K)            ELASTIC SCATTERING, GROUP K TC GROUP J.          -  016200
C                                                                         -  016300
C-----------------------------------------------------------------------   016400
                                                                          016500
                                                                          016600
C-----------------------------------------------------------------------   016700
CR          (N,2N) SCATTERING (TYPE 8)                                    -  016800
C                                                                         -  016900
CC          PRESENT IF LN2N.GE.CURRENT SCATTERING ORDER                   -  017000
C           (SEE ISOTOPE HEADING RECORD)                                  -  017100
C                                                                         -  017200
CL    SN2N(J+LN2NUP),SN2N(J+LN2NUP-1),...,SN2N(J),...,SN2N(J-LN2NDN)      -  017300
C                                                                         -  017400
CD    SN2N(K)            (N,2N) SCATTERING, GROUP K TO GROUP J.           -  017500
C                                                                         -  017600
C-----------------------------------------------------------------------   017700
                                                                          017800
                                                                          017900
CEOF                                                                      018000
```

```
C*********************************************************************   000100
C                                                                         -  000200
C                        PREPARED 2/15/71 AT ANL                          -  000300
C                                                                         -  000400
CF          XS.ISO       (FILE 3)                                         -  000500
CE          MICROSCOPIC GROUP CROSS SECTIONS, FILE 3                      -  000600
C                                                                         -  000700
CN                       THIS IS FILE 3 OF A FOUR-FILE DATA SET           -  000800
CN                       CONTAINING MICROSCOPIC GROUP CROSS SECTIONS.     -  000900
C                                                                         -  001000
C*********************************************************************   001100
                                                                          001200
                                                                          001300
C-----------------------------------------------------------------------   001400
CS          FILE STRUCTURE                                                -  001500
CS                                                                        -  001600
CS          RECORD TYPE                                PRESENT IF         -  001700
CS          ==================================         ===================-  001800
CS          ISOTOPE NAMES                              ALWAYS             -  001900
CS          DELAYED NEUTRON DECAY CONSTANTS            NFAM.GT.0          -  002000
CS                                                                        -  002100
CS     *********(REPEAT FOR ALL DELAYED NEUTRON                           -  002200
CS     *        FAMILIES IN SET)                                          -  002300
CS     *        DELAYED NEUTRON EMISSION SPECTRUM         NFAM.GT.0       -  002400
CS     *********                                                          -  002500
C                                                                         -  002600
C-----------------------------------------------------------------------   002700
                                                                          002800
                                                                          002900
CD    NFAM               TOTAL NUMBER OF DELAYED NEUTRON PRECURSOR        003000
CD                       FAMILIES IN SET.                                 003100
                                                                          003200
                                                                          003300
C-----------------------------------------------------------------------   003400
CR          ISOTOPE NAMES (TYPE 1)                                        -  003500
C                                                                         -  003600
CC          ALWAYS PRESENT                                                -  003700
C                                                                         -  003800
CL    NISOD,NFAM,(TNAME(I),I=1,NISOD),(LOCA(I),I=1,NISOD)                 -  003900
C                                                                         -  004000
CD    NISOD              NUMBER OF ISOTOPES WITH DELAYED NEUTRON DATA.    -  004100
CD    TNAME(I)           ENDF/B NAME OF I-TH ISOTOPE (REAL*8).            -  004200
CD    LOCA(I)            NUMBER OF RECORDS IN FILE 4 OF XS.ISO TO BE      -  004300
CD                       SKIPPED TO READ DATA FOR ISOTOPE I. LOCA(1)=0.   -  004400
C                                                                         -  004500
C-----------------------------------------------------------------------   004600
                                                                          004700
                                                                          004800
```

```
C-----------------------------------------------------------------------
CR          DELAYED NEUTRON DECAY CONSTANTS (TYPE 2)                  -
C                                                                     -
CC          PRESENT IF NFAM.GT.0                                      -
C                                                                     -
CL    (FLAM(I),I=1,NFAM)                                              -
C                                                                     -
CD    FLAM(I)             DELAYED NEUTRON PRECURSOR DECAY CONSTANT    -
CD                        FOR FAMILY I.                               -
C                                                                     -
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          DELAYED NEUTRON EMISSION SPECTRUM (TYPE 3)                -
C                                                                     -
CC          PRESENT IF NFAM.GT.0                                      -
C                                                                     -
CL    (CHID(J),J=1,NGROUP)                                            -
C                                                                     -
CD    CHID(J)             THE DELAYED NEUTRON EMISSION SPECTRUM INTO  -
CD                        GROUP J FOR FISSION IN ANY GROUP.           -
CD    NGROUP              NUMBER OF ENERGY GROUPS IN SET              -
CD                        (SEE FILE 1 OF XS.ISO).                     -
C                                                                     -
C-----------------------------------------------------------------------
CEOF
```

```
C***********************************************************************
C                                                                     -
C                         PREPARED 2/15/71 AT ANL                     -
C                                                                     -
CF          XS.ISO        (FILE 4)                                    -
CE          MICROSCOPIC CROSS SECTIONS, FILE 4                        -
C                                                                     -
CN                        THIS IS FILE 4 OF A FOUR-FILE DATA SET      -
CN                        CONTAINING MICROSCOPIC GROUP CROSS SECTIONS.-
C                                                                     -
C***********************************************************************
C-----------------------------------------------------------------------
CS          FILE STRUCTURE                                            -
CS                                                                    -
CS          RECORD TYPE                                 PRESENT IF    -
CS          ==================================          ==============-
CS    *********(REPEAT FOR ALL ISOTOPES WITH                          -
CS    *          DELAYED DATA)                                        -
CS    *     ISOTOPE NAMES                               ALWAYS        -
CS    *  ******(REPEAT FOR NOFAM FAMILIES)                            -
CS    *  *  DELAYED NEUTRON FAMILY                      NOFAM.GT.0    -
CS    *********                                                      -
C                                                                     -
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          ISOTOPE NAMES (TYPE 1)                                    -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    TNAME,NOFAM                                                     -
C                                                                     -
CD    TNAME               ENDF/B ISOTOPE NAME (REAL*8).               -
CD    NOFAM               NUMBER OF FAMILIES TO WHICH FISSION IN THIS -
CD                        ISOTOPE CONTRIBUTES DELAYED NEUTRON PRECURSORS.-
C                                                                     -
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          DELAYED NEUTRON FAMILY (TYPE 2)                           -
C                                                                     -
CC          PRESENT IF NOFAM.GT.0                                     -
C                                                                     -
CL    NUMFAM,(GNUD(J),J=1,NGROUP)                                     -
```

```
C                                                                       -  004900
CD     NUMFAM              DELAYED NEUTRON PRECURSOR FAMILY INDEX,      -  005000
CD                         1.LE.NUMFAM.LE.NFAM.                         -  005100
CD     GNUD(J)             NUMBER OF NEUTRONS EMITTED INTO DELAYED      -  005200
CD                         FAMILY NUMFAM PER FISSION IN ENERGY GROUP J. -  005300
CD     NGROUP              NUMBER OF ENERGY GROUPS IN SET               -  005400
CD                         (SEE FILE 1 OF XS.ISO).                      -  005500
C                                                                       -  005600
C-----------------------------------------------------------------------   005700
                                                                          005800
CEOF                                                                      005900
```

```
C***********************************************************************  000100
C                                                                       -  000200
C                          PREPARED 2/15/71 AT ANL                      -  000300
C                                                                       -  000400
CF          XS.ISO2        (FILE 1)                                     -  000500
CE          PROBLEM-DEPENDENT MICROSCOPIC GROUP                         -  000600
CE          CROSS SECTIONS, FILE 1                                      -  000700
C                                                                       -  000800
CN                         THIS IS FILE 1 OF A FOUR-FILE DATA SET       -  000900
CN                         CONTAINING THE SUBSET OF DATA SET XS.ISO WHICH -  001000
CN                         IS NEEDED FOR RUNNING A GIVEN PROBLEM. THIS  -  001100
CN                         DATA SET ALSO CONTAINS CHANGES IN THE        -  001200
CN                         MICROSCOPIC GROUP CROSS SECTIONS PRODUCED    -  001300
CN                         USING TYPE 20 CARDS OF DATA SET A.NIP. THE   -  001400
CN                         STRUCTURE IS THE SAME AS THAT OF FILE 1 OF   -  001500
CN                         XS.ISO.                                      -  001600
C                                                                       -  001700
C***********************************************************************  001800
                                                                          001900
CEOF                                                                      002000
```

```
C*********************************************************************  000100
C                                                                     -  000200
C                        PREPARED 2/15/71 AT ANL                      -  000300
C                                                                     -  000400
CF          XS.ISO2      (FILE 2)                                     -  000500
CE          PROBLEM-DEPENDENT MICROSCOPIC GROUP                       -  000600
CF          CROSS SECTIONS, FILE 2                                    -  000700
C                                                                     -  000800
CN                       THIS IS FILE 2 OF A FOUR-FILE DATA SET       -  000900
CN                       CONTAINING THE SUBSET OF DATA SET XS.ISO WHICH -  001000
CN                       IS NEEDED FOR RUNNING A GIVEN PROBLEM. THIS  -  001100
CN                       DATA SET ALSO CONTAINS CHANGES IN THE        -  001200
CN                       MICROSCOPIC GROUP CROSS SECTIONS PRODUCED    -  001300
CN                       USING TYPE 20 CARDS OF DATA SET A.NIP. THE   -  001400
CN                       STRUCTURE IS THE SAME AS THAT OF FILE 2 OF   -  001500
CN                       XS.ISO.                                      -  001600
C                                                                     -  001700
C*********************************************************************  001800
                                                                        001900
CEOF                                                                    002000
```

```
C*********************************************************************  000100
C                                                                     -  000200
C                        PREPARED 2/15/71 AT ANL                      -  000300
C                                                                     -  000400
CF          XS.ISO2      (FILE 3)                                     -  000500
CE          PROBLEM-DEPENDENT MICROSCOPIC GROUP                       -  000600
CE          CROSS SECTIONS, FILE 3                                    -  000700
C                                                                     -  000800
CN                       THIS IS FILE 3 OF A FOUR-FILE DATA SET       -  000900
CN                       CONTAINING THE SUBSET OF DATA SET XS.ISO WHICH -  001000
CN                       IS NEEDED FOR RUNNING A GIVEN PROBLEM. THE   -  001100
CN                       STRUCTURE IS THE SAME AS THAT OF FILE 3 OF   -  001200
C                        XS.ISO.                                      -  001300
C                                                                     -  001400
C*********************************************************************  001500
                                                                        001600
CEOF                                                                    001700
```

```
C*********************************************************************
C                                                                   -
C                        PREPARED 2/15/71 AT ANL                    -
C                                                                   -
CF          XS.ISO2      (FILE 4)                                   -
CF          PROBLEM-DEPENDENT MICROSCOPIC GROUP                     -
CF          CROSS SECTIONS, FILE 4                                  -
C                                                                   -
CN                       THIS IS FILE 4 OF A FOUR-FILE DATA SET     -
CN                       CONTAINING THE SUBSET OF DATA SET XS.ISO WHICH -
CN                       IS NEEDED FOR RUNNING A GIVEN PROBLEM. THE -
CN                       STRUCTURE IS THE SAME AS THAT OF FILE 4 OF -
CN                       XS.ISO.                                    -
C                                                                   -
C*********************************************************************

CFOF
```

```
C*********************************************************************
C                                                                   -
C                        PREPARED 2/15/71 AT ANL                    -
C                                                                   -
CF          XS.M.ANI                                                -
CF          ANISOTROPIC MACROSCOPIC MATERIAL CROSS SECTIONS         -
C                                                                   -
C*********************************************************************

C---------------------------------------------------------------------
CS          FILE STRUCTURE                                          -
CS                                                                  -
CS          RECORD TYPE                              PRESENT IF     -
CS          ==================================       ===============-
CS          SPECIFICATIONS                           ALWAYS         -
CS                                                                  -
CS     ******** (REPEAT FOR ALL MATERIALS)                          -
CS     *    MATERIAL DESCRIPTION                    ALWAYS         -
CS     *  ****** (REPEAT FOR EACH SCATTERING                        -
CS     *  *       ORDER L, L=1,LNO-1)                              -
CS     *  *  ANISOTROPIC SCATTERING                 LNO.GT.1       -
CS     ********                                                     -
C                                                                   -
C---------------------------------------------------------------------

CD     LASCAT            LENGTH OF SCATTERING LIST, LASCAT=MAXUP+1+
CD                       NUMBER OF GROUPS OF DOWNSCATTERING.
CD     NGROUP            NUMBER OF ENERGY GROUPS.

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                 -
C                                                                   -
CL     NMAT,NUMANI,NGROUP,MAXLNO,MAXUPS,MAXDNS,(CNAME(I),I=1,NMAT)  -
C                                                                   -
CD     NMAT              NUMBER OF MATERIALS.                      -
CD     NUMANI            NUMBER OF MATERIALS WITH ANISOTROPIC      -
CD                       COMPONENTS.                               -
CD     MAXLNO            MAXIMUM SCATTERING ORDER IN THE SET.      -
CD                       MAXLNO=0, NO SCATTERING.                  -
CD                             =1, ISOTROPIC SCATTERING.           -
CD                             =2, LINEAR ANISOTROPIC SCATTERING.  -
CD     MAXUPS            MAXIMUM NUMBER OF GROUPS OF UPSCATTERING. -
CD     MAXDNS            MAXIMUM NUMBER OF GROUPS OF DOWNSCATTERING. -
CD     CNAME             MATERIAL LABELS.                          -
C                                                                   -
```

```
C-----------------------------------------------------------------------
CR          MATERIAL DESCRIPTION (TYPE 2)
C
CC          ALWAYS PRESENT
C
CL    LNO,MAXUP,LASCAT
C
CD    LNO                 SCATTERING ORDER FOR THIS MATERIAL.
CD                        LNO=0, NO SCATTERING.
CD                           =1, ISOTROPIC SCATTERING.
CD                           =2, LINEAR ANISOTROPIC SCATTERING.
CD    MAXUP               NUMBER OF GROUPS OF UPSCATTERING FOR THIS
CD                        MATERIAL.
C
C-----------------------------------------------------------------------
C-----------------------------------------------------------------------
CR          ANISOTROPIC SCATTERING (TYPE 3)
C
CC          PRESENT IF LNO.GT.1
C
CL    ((SCAT(K,J),K=1,LASCAT),J=1,NGROUP)
C
CD    SCAT                TOTAL MACROSCOPIC MATERIAL ANISOTROPIC
CD                        CROSS SECTION FOR SCATTERING ORDER L INTO
CD                        GROUP J FROM GROUP INDEXED BY K.  K
CD                        REFERENCES J+MAXUP,J+MAXUP-1,...,J,J-1,...,
CD                        J-NUMBER OF GROUPS OF DOWNSCATTERING.
C
C-----------------------------------------------------------------------

CEOF
```

```
C***********************************************************************
C
C                         PREPARED 2/15/71 AT ANL
C
CE          XS.M.AUX
CE          AUXILIARY MACROSCOPIC MATERIAL CROSS SECTIONS
C
C***********************************************************************

C-----------------------------------------------------------------------
CS          FILE STRUCTURE
CS
CS          RECORD TYPE                          PRESENT IF
CS          ==================================   ======================
CS          SPECIFICATIONS                       ALWAYS
CS     ********* (REPEAT FOR ALL MATERIALS)
CS     *    MATERIAL DESCRIPTION                 ALWAYS
CS     *  ****** (REPEAT FOR EACH SCATTERING ORDER
CS     *  *        L=1,LNO IF LNO.GT.0).
CS     *  *  SCATTERING DESCRIPTION              ALWAYS
CS     *  *  INELASTIC SCATTERING                LIN.GE.L
CS     *  *  ELASTIC SCATTERING                  LEL.GE.L
CS     *  *  (N,2N) SCATTERING                   LN2N.GE.L
CS     *  *  TOTAL INELASTIC                     LIN.GE.L
CS     *  *  TOTAL ELASTIC                       LEL.GE.L
CS     *  *  TOTAL (N,2N)                        LN2N.GE.L
CS     *********
C
C-----------------------------------------------------------------------

CD    LSCAT               LENGTH OF SCATTERING LIST FOR THE GIVEN
CD                        MATERIAL AND SCATTERING ORDER.
CD    NGROUP              NUMBER OF ENERGY GROUPS.

C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)
C
CL    NMAT,NGROUP,MAXLNO,(CNAME(I),I=1,NMAT)
C
CD    NMAT                NUMBER OF MATERIALS.
CD    MAXLNO              MAXIMUM SCATTERING ORDER IN THE SET.
CD                        MAXLNO=0, NO SCATTERING.
CD                              =1, ISOTROPIC SCATTERING.
CD                              =2, LINEAR ANISOTROPIC SCATTERING.
CD    CNAME               MATERIAL LABELS.
```

```
C                                                                       -  004900
C-----------------------------------------------------------------------  005000
                                                                         005100
                                                                         005200
C-----------------------------------------------------------------------  005300
CR          MATERIAL DESCRIPTION (TYPE 2)                               -  005400
C                                                                       -  005500
CC          ALWAYS PRESENT                                              -  005600
C                                                                       -  005700
CL    LNO,LIN,LEL,LN2N,(SCAP(I),I=1,NGROUP),(SNALF(I),I=1,NGROUP),      -  005800
CL   1(SNP(I),I=1,NGROUP)                                               -  005900
C                                                                       -  006000
CD    LNO                 MAXIMUM SCATTERING ORDER OF THIS MATERIAL.    -  006100
CD                        LNO IS THE LARGEST OF LIN, LEL, OR LN2N.      -  006200
CD    LIN                 INELASTIC SCATTERING ORDER OF THIS MATERIAL.  -  006300
CD                        LIN=0, NO SCATTERING.                         -  006400
CD                           =1, ISOTROPIC SCATTERING.                  -  006500
CD                           =2, LINEAR ANISOTROPIC SCATTERING.         -  006600
CD    LEL                 ELASTIC SCATTERING ORDER OF THIS MATERIAL.    -  006700
CD                        LEL=0, NO SCATTERING.                         -  006800
CD                           =1, ISOTROPIC SCATTERING.                  -  006900
CD                           =2, LINEAR ANISOTROPIC SCATTERING.         -  007000
CD    LN2N                (N,2N) SCATTERING ORDER OF THIS MATERIAL.     -  007100
CD                        LN2N=0, NO SCATTERING.                        -  007200
CD                           =1, ISOTROPIC SCATTERING.                  -  007300
CD                           =2, LINEAR ANISOTROPIC SCATTERING.         -  007400
CD    SCAP                MACROSCOPIC MATERIAL (N,GAMMA) CROSS SECTION. -  007500
CD    SNALF               MACROSCOPIC MATERIAL (N,ALPHA) CROSS SECTION. -  007600
CD    SNP                 MACROSCOPIC MATERIAL (N,P) CROSS SECTION.     -  007700
C                                                                       -  007800
C-----------------------------------------------------------------------  007900
                                                                         008000
                                                                         008100
C-----------------------------------------------------------------------  008200
CR          SCATTERING DESCRIPTION (TYPE 3)                             -  008300
C                                                                       -  008400
CC          PRESENT IF LNO.GT.0                                         -  008500
C                                                                       -  008600
CL    NUP,LSCAT                                                         -  008700
C                                                                       -  008800
CD    NUP                 NUMBER OF GROUPS OF UPSCATTERING FOR THIS     -  008900
CD                        MATERIAL AND ORDER OF SCATTERING.             -  009000
C                                                                       -  009100
C-----------------------------------------------------------------------  009200
                                                                         009300
                                                                         009400
C-----------------------------------------------------------------------  009500
CR          INELASTIC SCATTERING (TYPE 4)                               -  009600
C                                                                       -  009700
CC          PRESENT IF LIN.GE.CURRENT SCATTERING ORDER                  -  009800
C                                                                       -  009900
CL    ((XINEL(K,J),K=1,LSCAT),J=1,NGROUP)                               -  010000
C                                                                       -  010100
CD    XINEL               MACROSCOPIC MATERIAL INELASTIC SCATTERING     -  010200
CD                        CROSS SECTION INTO GROUP J FROM THE GROUP     -  010300
CD                        INDEXED BY K, FOR THIS SCATTERING ORDER. K    -  010400
CD                        REFERENCES J+NUP,J+NUP-1,...,J,J-1,...,       -  010500
CD                        J-NUMBER OF GROUPS OF DOWNSCATTERING.         -  010600
C                                                                       -  010700
C-----------------------------------------------------------------------  010800
                                                                         010900
                                                                         011000
C-----------------------------------------------------------------------  011100
CR          ELASTIC SCATTERING (TYPE 5)                                 -  011200
C                                                                       -  011300
CC          PRESENT IF LEL.GE.CURRENT SCATTERING ORDER                  -  011400
C                                                                       -  011500
CL    ((XEL(K,J),K=1,LSCAT),J=1,NGROUP)                                 -  011600
C                                                                       -  011700
CD    XFL                 MACROSCOPIC MATERIAL ELASTIC SCATTERING       -  011800
CD                        CROSS SECTION, INDEXED AS INELASTIC SCATTERING.-  011900
C                                                                       -  012000
C-----------------------------------------------------------------------  012100
                                                                         012200
                                                                         012300
C-----------------------------------------------------------------------  012400
CR          (N,2N) SCATTERING (TYPE 6)                                  -  012500
C                                                                       -  012600
CC          PRESENT IF LN2N.GE.CURRENT SCATTERING SCATTERING            -  012700
C                                                                       -  012800
CL    ((XN2N(K,J),K=1,LSCAT),J=1,NGROUP)                                -  012900
C                                                                       -  013000
CD    XN2N                MACROSCOPIC MATERIAL (N,2N) CROSS SECTION,    -  013100
CD                        INDEXED AS INELASTIC SCATTERING.              -  013200
C                                                                       -  013300
C-----------------------------------------------------------------------  013400
                                                                         013500
                                                                         013600
C-----------------------------------------------------------------------  013700
CR          TOTAL INELASTIC SCATTERING (TYPE 7)                         -  013800
C                                                                       -  013900
CC          PRESENT IF LIN.GE.CURRENT SCATTERING ORDER                  -  014000
C                                                                       -  014100
CL    (XTIR(J),J=1,NGROUP)                                              -  014200
C                                                                       -  014300
CD    XTIR                TOTAL MACROSCOPIC MATERIAL INELASTIC          -  014400
```

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CD                    SCATTERING CROSS SECTION.                          -  014500
C                                                                        -  014600
C-----------------------------------------------------------------------  014700
                                                                         014800
                                                                         014900
C-----------------------------------------------------------------------  015000
CR          TOTAL ELASTIC SCATTERING (TYPE 8)                            -  015100
C                                                                        -  015200
CC          PRESENT IF LEL.GE.CURRENT SCATTERING ORDER                   -  015300
C                                                                        -  015400
CL    (XTER(J),J=1,NGROUP)                                               -  015500
C                                                                        -  015600
CD    XTER            TOTAL MACROSCOPIC MATERIAL ELASTIC                 -  015700
CD                    SCATTERING CROSS SECTION.                          -  015800
C                                                                        -  015900
C-----------------------------------------------------------------------  016000
                                                                         016100
                                                                         016200
C-----------------------------------------------------------------------  016300
CR          TOTAL (N,2N) CROSS SECTION (TYPE 9)                          -  016400
C                                                                        -  016500
CC          PRESENT IF LN2N.GE.CURRENT SCATTERING ORDER                  -  016600
C                                                                        -  016700
CL    (XTN2NR(J),J=1,NGROUP)                                             -  016800
C                                                                        -  016900
CD    XTN2NR          TOTAL MACROSCOPIC MATERIAL (N,2N)                  -  017000
CD                    CROSS SECTION.                                     -  017100
C                                                                        -  017200
C-----------------------------------------------------------------------  017300
                                                                         017400
CEOF                                                                     017500
```

```
C*********************************************************************  000100
C                                                                        -  000200
C                     PREPARED 2/15/71 AT ANL                            -  000300
C                                                                        -  000400
CF          XS.M.MIN                                                     -  000500
CF          MACROSCOPIC MATERIAL CROSS SECTIONS                          -  000600
C                                                                        -  000700
C*********************************************************************  000800
                                                                         000900
                                                                         001000
C-----------------------------------------------------------------------  001100
CS          FILE STRUCTURE                                               -  001200
CS                                                                       -  001300
CS          RECORD TYPE                          PRESENT IF              -  001400
CS          ==================================   ======================-  001500
CS          SPECIFICATIONS                       ALWAYS                  -  001600
CS          SET CHI                              ISCHI.GT.0              -  001700
CS                                                                       -  001800
CS     ********* (REPEAT FOR ALL MATERIALS)                              -  001900
CS     *     MATERIAL SPECIFICATIONS             ALWAYS                  -  002000
CS     *  ****** (REPEAT FOR ALL ENERGY GROUPS)                          -  002100
CS     *  *  MATERIAL MACROSCOPIC CROSS SECTIONS  ALWAYS                 -  002200
CS     *********                                                         -  002300
CS                                                                       -  002400
CS          SET DELAYED CHI                      ISCHID.GT.0             -  002500
C                                                                        -  002600
C-----------------------------------------------------------------------  002700
                                                                         002800
                                                                         002900
CD    ISCHI           PROMPT FISSION SPECTRUM FLAG. ISCHI=0 IF           003000
CD                    THERE IS NO SET-WIDE PROMPT CHI. ISCHI=1 IF        003100
CD                    THERE IS A SET-WIDE PROMPT CHI VECTOR.             003200
CD                    ISCHI=NGROUP IF THERE IS A SET-WIDE PROMPT CHI     003300
CD                    MATRIX.                                            003400
CD    NGROUP          NUMBER OF ENERGY GROUPS.                           003500
CD    ICHI            PROMPT FISSION SPECTRUM FLAG FOR THIS              003600
CD                    MATERIAL. ICHI=-1 IF MATERIAL USES THE             003700
CD                    SET-WIDE PROMPT CHI GIVEN IN SET CHI RECORD        003800
CD                    BELOW. ICHI=0 IF MATERIAL IS NOT                   003900
CD                    FISSIONABLE. ICHI=1 FOR MATERIAL PROMPT CHI        004000
CD                    VECTOR. ICHI=NGROUP FOR MATERIAL PROMPT CHI        004100
CD                    MATRIX.                                            004200
CD    NUP             NUMBER OF GROUPS OF UPSCATTERING FOR THIS          004300
CD                    MATERIAL.                                          004400
CD    NDN             NUMBER OF GROUPS OF DOWNSCATTERING FOR THIS        004500
CD                    MATERIAL.                                          004600
CD    ICHID           DELAYED FISSION SPECTRUM FLAG FOR THIS             004700
CD                    MATERIAL. ICHID=-1 IF MATERIAL USES                004800
```

```
CD                      SET-WIDE DELAYED CHI GIVEN IN SET DELAYED CHI
CD                      RECORD BELOW. ICHID=0 IF MATERIAL IS NOT
CD                      FISSIONABLE. ICHID=1 FOR MATERIAL DELAYED
CD                      CHI VECTOR. ICHID=NGROUP FOR MATERIAL
CD                      DELAYED CHI MATRIX.
C-----------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)                                   -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    NMAT,NGROUP,ISCHI,NFMAT,NFAM,MAXUP,MAXDN,(CNAME(I),I=1,NMAT),   -
CL   1ISCHID                                                          -
C                                                                     -
CD    NMAT              NUMBER OF MATERIALS.                          -
CD    NFMAT             NUMBER OF FISSIONABLE MATERIALS.              -
CD    NFAM              TOTAL NUMBER OF FAMILIES OF DELAYED NEUTRON   -
CD                      PRECURSORS IN THE SET.                        -
CD    MAXUP             MAXIMUM NUMBER OF GROUPS OF UPSCATTERING FOR  -
CD                      THE SET.                                      -
CD    MAXDN             MAXIMUM NUMBER OF GROUPS OF DOWNSCATTERING    -
CD                      FOR THE SET.                                  -
CD    CNAME             MATERIAL LABELS.                              -
CD    ISCHID            DELAYED FISSION SPECTRUM FLAG. ISCHID=0 IF    -
CD                      THERE IS NO SET-WIDE DELAYED CHI. ISCHID=1    -
CD                      IF THERE IS A SET-WIDE DELAYED CHI VECTOR.    -
CD                      ISCHID=IGM IF THERE IS A SET-WIDE DELAYED     -
CD                      CHI MATRIX.                                   -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          SET CHI (TYPE 2)                                          -
C                                                                     -
CC          PRESENT IF ISCHI.GT.0                                     -
C                                                                     -
CL    ((CHI(I,J),I=1,ISCHI),J=1,NGROUP)                               -
C                                                                     -
CD    CHI               PROMPT FISSION FRACTION INTO GROUP J FROM     -
CD                      GROUP I. IF ISCHI=1, THE LIST REDUCES TO      -
CD                      (CHI(J),J=1,NGROUP), WHERE CHI(J) IS THE      -
CD                      FISSION FRACTION INTO GROUP J.                -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          MATERIAL SPECIFICATIONS (TYPE 3)                          -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    ICHI,(NUP(I),I=1,NGROUP),(NDN(I),I=1,NGROUP),ICHID              -
C                                                                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          MATERIAL MACROSCOPIC GROUP CROSS SECTIONS (TYPE 4)        -
C                                                                     -
CC          ALWAYS PRESENT                                            -
C                                                                     -
CL    J,XA,XTOT,XREM,XTR,XF,XNF,(CHI(I),I=1,ICHI),                    -
CL   1(XSCATU(I),I=1,NUP(J)),XSCATJ,(XSCATD(I),I=1,NDN(J)),           -
CL   2(DNXNF(L),L=1,NFAM),((DNCHI(I,L),I=1,ICHID),L=1,NFAM)           -
C                                                                     -
CD    J                 GROUP NUMBER (GROUP 1 IS HIGHEST IN ENERGY).  -
CD    XA                ABSORPTION CROSS SECTION.                     -
CD    XTOT              TOTAL CROSS SECTION.                          -
CD    XREM              REMOVAL CROSS SECTION, TOTAL CROSS SECTION    -
CD                      FOR REMOVING A NEUTRON FROM GROUP J DUE TO ALL -
CD                      PROCESSES.                                    -
CD    XTR               TRANSPORT CROSS SECTION.                      -
CD    XF                FISSION CROSS SECTION, PRESENT ONLY IF        -
CD                      ICHI.NE.0.                                    -
CD    XNF               TOTAL NUMBER OF NEUTRONS EMITTED PER FISSION  -
CD                      TIMES XF, PRESENT ONLY IF ICHI.NE.0.          -
CD    CHI               PROMPT FISSION FRACTION INTO GROUP J FROM     -
CD                      GROUP I, PRESENT ONLY IF ICHI.GT.0. IF ICHI=1, -
CD                      THE LIST REDUCES TO THE SINGLE NUMBER CHI,    -
CD                      WHICH IS THE PROMPT FISSION FRACTION INTO     -
CD                      GROUP J.                                      -
CD    XSCATU            TOTAL SCATTERING CROSS SECTION INTO GROUP J   -
CD                      FROM GROUPS J+NUP(J),J+NUP(J)-1,...,J+2,J+1,  -
CD                      PRESENT ONLY IF NUP(J).GT.0.                  -
CD    XSCATJ            TOTAL SELF-SCATTERING CROSS SECTION FROM      -
CD                      GROUP J TO GROUP J.                           -
CD    XSCATD            TOTAL SCATTERING CROSS SECTION INTO GROUP J   -
CD                      FROM GROUPS J-1,J-2,...,J-NDN(J), PRESENT     -
CD                      ONLY IF NDN(J).GT.0.                          -
CD    DNXNF             NUMBER OF DELAYED NEUTRONS EMITTED PER FISSION -
CD                      TIMES XF FOR PRECURSOR FAMILY L, PRESENT      -
CD                      ONLY IF NFAM.GT.0 AND ICHID.NE.0.             -
CD    DNCHI             DELAYED NEUTRON FISSION FRACTION INTO GROUP J -
CD                      FROM GROUP I FOR PRECURSOR FAMILY L,          -
```

```
CD                    PRESENT ONLY IF NFAM.GT.0 AND ICHID.GT.0.      -  014500
CD                    IF ICHID=1, THE LIST REDUCES TO                -  014600
CD                    (DNCHI(L),L=1,NFAM) WHERE DNCHI(L) IS THE      -  014700
CD                    DELAYED FISSION FRACTION INTO GROUP J FOR      -  014800
CD                    FAMILY L.                                      -  014900
C                                                                    -  015000
C-----------------------------------------------------------------------  015100
                                                                         015200
                                                                         015300
C-----------------------------------------------------------------------  015400
CR          SET DELAYED CHI (TYPE 5)                                 -  015500
C                                                                    -  015600
CC          PRESENT IF ISCHID.GT.0                                   -  015700
C                                                                    -  015800
CL    ((CHID(I,J),I=1,ISCHID),J=1,NGROUP)----NOTE STRUCTURE BELOW----- -  015900
C                                                                    -  016000
C     DO 1 L=1,NFAM                                                  -  016100
C   1 READ(N) *LIST AS ABOVE*                                        -  016200
C                                                                    -  016300
CD    CHID                DELAYED FISSION FRACTION INTO GROUP J FROM -  016400
CD                        GROUP I FOR PRECURSOR FAMILY L. IF ISCHID=1, -  016500
CD                        THE LIST REDUCES TO (CHID(J),J=1,IGM), WHERE -  016600
CD                        CHID(J) IS THE DELAYED FISSION FRACTION INTO -  016700
CD                        GROUP J FOR PRECURSOR FAMILY L.            -  016800
C                                                                    -  016900
C-----------------------------------------------------------------------  017000
                                                                         017100
CEOF                                                                     017200
```

```
C***********************************************************************  000100
C                                                                      -  000200
C                         PREPARED 2/15/71 AT ANL                      -  000300
C                                                                      -  000400
CF          XS.SORS                                                    -  000500
CE          FISSION SOURCE GROUP DATA                                  -  000600
C                                                                      -  000700
C***********************************************************************  000800
                                                                         000900
C-----------------------------------------------------------------------  001000
CR          ULTRAFINE GROUP FISSION DATA (TYPE 1)                      -  001100
C                                                                      -  001200
CC          PRESENT ONLY FOR AN ULTRAFINE GROUP PROBLEM                -  001300
C                                                                      -  001400
CL    NINT,(SORSF(I),I=1,NINT)                                         -  001500
C                                                                      -  001600
CD    NINT                NUMBER OF ULTRAFINE ENERGY GROUPS.         -  001700
CD    SORSF               NORMALIZED ULTRAFINE GROUP FISSION SPECTRUM. -  001800
C                                                                      -  001900
C-----------------------------------------------------------------------  002000
                                                                         002100
                                                                         002200
C-----------------------------------------------------------------------  002300
CR          FINE GROUP FISSION DATA (TYPE 2)                           -  002400
C                                                                      -  002500
CC          ALWAYS PRESENT                                             -  002600
C                                                                      -  002700
CL    NINTC,(SORS(I),I=1,NINTC)                                        -  002800
C                                                                      -  002900
CD    NINTC               NUMBER OF FINE ENERGY GROUPS.              -  003000
CD    SORS                NORMALIZED FINE GROUP FISSION SPECTRUM.    -  003100
C                                                                      -  003200
C-----------------------------------------------------------------------  003300
                                                                         003400
CEOF                                                                     003500
                                                                         003600
```

```
C*********************************************************************
C                          PREPARED 2/15/71 AT ANL
C
CE          XS.THRM
CE          THERMAL CROSS SECTIONS
C
C*********************************************************************

C---------------------------------------------------------------------
CR          THERMAL CROSS SECTIONS (TYPE 1)
C
CC          PRESENT IF USER HAS SUPPLIED THERMAL CROSS SECTIONS
C
CL    CTH,FTH,GFTH,SNATH,SNPTH,TRTH,
CL   1(THC(I),THF(I),THNA(I),THNP(I),THNU(I),THTR(I),I=1,NOI)
C
CD    CTH                 HOMOGENIZED MACROSCOPIC THERMAL CAPTURE
CD                        CROSS SECTION.
CD    FTH                 HOMOGENIZED MACROSCOPIC THERMAL FISSION
CD                        CROSS SECTION.
CD    GFTH                HOMOGENIZED MACROSCOPIC THERMAL NU*FISSION
CD                        CROSS SECTION.
CD    SNATH               HOMOGENIZED MACROSCOPIC THERMAL (N,ALPHA)
CD                        CROSS SECTION.
CD    SNPTH               HOMOGENIZED MACROSCOPIC THERMAL (N,P)
CD                        CROSS SECTION.
CD    TRTH                HOMOGENIZED MACROSCOPIC THERMAL TRANSPORT
CD                        CROSS SECTION.
CD    THC                 MICROSCOPIC THERMAL GROUP CAPTURE
CD                        CROSS SECTION.
CD    THF                 MICROSCOPIC THERMAL GROUP FISSION
CD                        CROSS SECTION.
CD    THNA                MICROSCOPIC THERMAL GROUP (N,ALPHA)
CD                        CROSS SECTION.
CD    THNP                MICROSCOPIC THERMAL GROUP (N,P) CROSS SECTION.
CD    THNU                NUMBER OF NEUTRONS EMITTED PER FISSION IN
CD                        THE THERMAL GROUP.
CD    THTR                MICROSCOPIC THERMAL GROUP TRANSPORT
CD                        CROSS SECTION.
CD    NOI                 NUMBER OF MATERIALS.
C
C---------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                          PREPARED 2/15/71 AT ANL
C
CE          XS.UNRES    (FILE 1)
CE          PARAMETERS RELATED TO THE MICROSCOPIC UNRESOLVED
CE          RESONANCE CROSS SECTIONS
C
CN                        THIS IS FILE 1 OF A TWO-FILE DATA SET
C
C*********************************************************************

C---------------------------------------------------------------------
CR          SPECIFICATIONS (TYPE 1)
C
CC          ALWAYS PRESENT
C
CL    NUNRES
C
CD    NUNRES              NUMBER OF MATERIALS WITH UNRESOLVED CAPTURE
CD                        OR FISSION RESONANCES.
C
C---------------------------------------------------------------------

CEOF
```

```
C*********************************************************************
C                                                                    -
C                        PREPARED 2/15/71 AT ANL                     -
C                                                                    -
CF          XS.UNRES     (FILE 2)                                    -
CE          MICROSCOPIC UNRESOLVED RESONANCE CROSS SECTIONS          -
C                                                                    -
CN                       THIS IS FILE 2 OF A TWO-FILE DATA SET       -
C                                                                    -
C*********************************************************************

CD     NUNRES            NUMBER OF MATERIALS WITH UNRESOLVED CAPTURE
CD                       OR FISSION RESONANCES.

C---------------------------------------------------------------------
CS          FILE STRUCTURE                                           -
CS                                                                   -
CS          RECORD TYPE                              PRESENT IF      -
CS          ==================================       ================-
CS                                                                   -
CS     ********* (REPEAT FOR EACH MATERIAL)                          -
CS     *  ****** (REPEAT FOR ALL ISOTOPES)                           -
CS     *  *  MICROSCOPIC CROSS SECTIONS                NUNRES.GT.0   -
CS     *  *******                                                    -
CS     *********                                                     -
C                                                                    -
C---------------------------------------------------------------------

C---------------------------------------------------------------------
CR          MICROSCOPIC CROSS SECTIONS (TYPE 1)                      -
C                                                                    -
CC          PRESENT IF NUNRES.GT.0                                   -
C                                                                    -
CL     LZ,ISN,NI,NP,(EN(I),SCUN(I),SFUN(I),I=1,NP)                   -
C                                                                    -
CD     LZ                MATERIAL IDENTIFICATION NUMBER.             -
CD     ISN               NUMBER OF ISOTOPES FOR MATERIAL.            -
CD     NI                DUMMY INDEX NOW SET TO 1.                   -
CD     NP                NUMBER OF POINTS OF DATA.                   -
CD     EN                ENERGY POINTS.                              -
CD     SCUN              CAPTURE CROSS SECTION.                      -
CD     SFUN              FISSION CROSS SECTION.                      -
C                                                                    -
C---------------------------------------------------------------------

CEOF
```

APPENDIX A: Cataloged Procedures for ARC System Library Maintenance

There are five cataloged procedures for the purpose of library maintenance, where library maintenance also includes producing the load modules in the ARC System. The procedures are named ARCUCLP, ARCCLP, ARCLP, ARCUALP, and ARCALP.

The procedures depend on the five libraries:

1. Dnn.SOURCE
2. Dnn.SEGLIB
3. Dnn.OVERLAY
4. Dnn.MODLIB
5. Dnn.MACLIB

where nn are the 1st two characters of the volume serial number for the disk volume (DISKnn).

The cataloged procedure ARCREUS is used to mark certain load modules REUSable (see Chapter 3, IV.D).

Figure 31 lists the attributes of the various cataloged procedures and the listings are given in Figs. 32 through 36.

Procedure	Update	Compile		Link Edit	NCAL	Symbolic Parameters	
		FTH	ASM			DISKNO=	MEMBER=
ARCUCLP	X	X		X	X	nn	name*
ARCCLP		X		X	X	nn	name*
ARCLP				X		nn	name*
ARCUALP	X		X	X	X	nn	name*
ARCALP			X	X	X	nn	name*

*'name' is the member name in the partitioned data set that is modified.

Fig. 31. Attributes of ARC System Library Maintenance Cataloged Procedures

```
MEMBER NAME  ARCUCLP
//ARCUCLP PROC COMPILE=FORTRANH,EDTIF='((0,NE,UPD),(5,LT,FTH))',
//             EDTOPTS='LET,LIST,MAP,NCAL',EDTREGN=260K,
//             LIBRARY='SYS1.FORTLIB',LSIZE='(252K,100K)',
//             MEMBER=DUMMY,OBJDISP='(OLD,DELETE)',
//             OBJECT='&OBJT',OBJROOM='(3200,(40,10),RLSE)',
//             OBJUNIT=DISK,OPTIONS='OPT=2',DISKNO=XX,
//             REGN=260K,UPDIF='(0,NE,UPD)'
//UPD     EXEC  PGM=IEBUPDTE,REGION=&REGN
//SYSUT1    DD UNIT=2314,DISP=(OLD,PASS),VOL=SER=DISK&DISKNO,
//             DSN=D&DISKNO..SOURCE
//SYSUT2    DD UNIT=2314,DISP=(OLD,PASS),VOL=SER=DISK&DISKNO,
//             DSN=D&DISKNO..SOURCE
//SYSPRINT DD  UNIT=(CTC,,DEFER)
//FTH     EXEC  PGM=&COMPILE,REGION=&REGN,PARM='&OPTIONS',COND=&UPDIF
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1511)
//SYSLIN    DD  UNIT=&OBJUNIT,DSNAME=&OBJECT,SPACE=&OBJROOM,
//             DISP=(MOD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSUT1    DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSPRINT))
//SYSIN     DD DISP=SHR,DSN=D&DISKNO..SOURCE(&MEMBER)
//EDT     EXEC  PGM=LINKEDIT,PARM='&EDTOPTS,SIZE=&LSIZE',
//             REGION=&EDTREGN,COND=&EDTIF
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(LRECL=121,BLKSIZE=1573)
//SYSUT1    DD  SPACE=(3072,(20,10),RLSE),
//             UNIT=DISK,DCB=BLKSIZE=6144
//SYSLIB    DD  DSNAME=SYS1.AMDLIB,DISP=SHR
//          DD  DSNAME=&LIBRARY,DISP=SHR
//SYSLMOD   DD UNIT=2314,DISP=OLD,VOL=SER=DISK&DISKNO,
//             DSN=D&DISKNO..SEGLIB(&MEMBER)
//SYSLIN    DD  DSNAME=*.FTH.SYSLIN,DISP=&OBJDISP
//          DD  DDNAME=SYSIN
//DEL           EXEC PGM=IEFBR14,COND=((0,NE,UPD),(5,GE,FTH))
//DELETE DD DSNAME=*.FTH.SYSLIN,DISP=&OBJDISP
//*
//*       ************************************************************
//*
//*       ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE
//*       LOUIS C. JUST  BLDG 221, ROOM C-207
//*
//*       ************************************************************
//*
```

Fig. 32. Listing of Cataloged Procedure ARCUCLP

```
MEMBER NAME  ARCCLP                                                     00000100
//ARCCLP PROC COMPILE=FORTRANH,EDTIF='(5,LT,FTH)',                      X00000200
//            EDTOPTS='LET,LIST,MAP,NCAL',EDTREGN=260K,                 X00000300
//            LIBRARY='SYS1.FORTLIB',LSIZE='(252K,100K)',               X00000400
//            MEMBER=DUMMY,OBJDISP='(OLD,DELETE)',                      X00000500
//            OBJECT='&OBJT',OBJROOM='(3200,(40,10),RLSE)',             X00000600
//            OBJUNIT=DISK,OPTIONS='OPT=2',DISKNO=XX,                   X00000700
//            REGN=260K                                                  00000800
//FTH    EXEC  PGM=&COMPILE,REGION=&REGN,PARM='&OPTIONS'                 00000900
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1511) 00001000
//SYSLIN   DD  UNIT=&OBJUNIT,DSNAME=&OBJECT,SPACE=&OBJROOM,             X00001100
//             DISP=(MOD,PASS),DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)      00001200
//SYSUT1   DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSPRINT))              00001300
//SYSIN    DD DISP=SHR,UNIT=2314,VOL=SER=DISK&DISKNO,                    X00001400
//             DSN=D&DISKNO..SOURCE(&MEMBER)                             00001500
//EDT    EXEC  PGM=LINKEDIT,PARM='&EDTOPTS,SIZE=&LSIZE',                X00001600
//             REGION=&EDTREGN,COND=&EDTIF                               00001700
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(LRECL=121,BLKSIZE=1573)            00001800
//SYSUT1   DD  SPACE=(3072,(20,10),RLSE),                                X00001900
//             UNIT=DISK,DCB=BLKSIZE=6144                                00002000
//SYSLIB   DD  DSNAME=SYS1.AMDLIB,DISP=SHR                               00002100
//         DD  DSNAME=&LIBRARY,DISP=SHR                                  00002200
//SYSLMOD  DD DISP=OLD,UNIT=2314,VOL=SER=DISK&DISKNO,                    X00002300
//             DSN=D&DISKNO..SEGLIB(&MEMBER)                             00002400
//SYSLIN   DD  DSNAME=*.FTH.SYSLIN,DISP=&OBJDISP                         00002500
//         DD  DDNAME=SYSIN                                              00002600
//DEL          EXEC PGM=IEFBR14,COND=(5,GE,FTH)                         00002700
//DELETE DD DSNAME=*.FTH.SYSLIN,DISP=&OBJDISP                            00002800
//*                                                                      00002900
//*       ********************************************************     00003000
//*                                                                      00003100
//*       ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE         00003200
//*       LOUIS C. JUST  BLDG 221, ROOM C-207                            00003300
//*                                                                      00003400
//*       ********************************************************     00003500
//*                                                                      00003600
```

Fig. 33. Listing of Cataloged Procedure ARCCLP

```
MEMBER NAME  ARCLP                                                      00000100
//ARCLP  PROC  EDTOPTS='LET,LIST,MAP,OVLY',EDTREGN=140K,               X00000200
//             LIBRARY='SYS1.FORTLIB',LSIZE='(132K,32K)',              X00000300
//             MEMBER=DUMMY,DISKNO=XX                                   00000400
//EDT    EXEC  PGM=LINKEDIT,PARM='&EDTOPTS,SIZE=&LSIZE',REGION=&EDTREGN 00000500
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(LRECL=121,BLKSIZE=1573)          00000600
//SYSUT1   DD  SPACE=(3072,(20,10),RLSE),UNIT=DISK,                    X00000700
//             DCB=BLKSIZE=6144                                         00000800
//SEGLIB   DD UNIT=DISK,DISP=SHR,VOL=SER=DISK&DISKNO,                  X00000900
//             DSN=D&DISKNO..SEGLIB                                     00001000
//SYSLIB   DD  DSNAME=SYS1.AMDLIB,DISP=SHR                             00001100
//         DD  DSNAME=&LIBRARY,DISP=SHR                                00001200
//SYSLMOD  DD UNIT=2314,DISP=OLD,VOL=SER=DISK&DISKNO,                  X00001300
//             DSN=D&DISKNO..MODLIB(&MEMBER)                            00001400
//SYSLIN   DD UNIT=DISK,DISP=SHR,VOL=SER=DISK&DISKNO,                  X00001500
//             DSN=D&DISKNO..OVERLAY(&MEMBER)                           00001600
//         DD  DDNAME=SYSIN                                             00001700
//*                                                                     00001800
//*      ************************************************************ 00001900
//*                                                                     00002000
//*      ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE         00002100
//*      LOUIS C. JUST  BLDG 221, ROOM C-207                            00002200
//*                                                                     00002300
//*      ************************************************************ 00002400
//*                                                                     00002500
```

Fig. 34. Listing of Cataloged Procedure ARCLP

```
MEMBER NAME  ARCUALP                                                    00000100
//ARCUALP PROC COMPILE=ASMBLR,EDTIF='((0,NE,UPD),(8,LT,ASM))',         X00000200
//             EDTOPTS='LET,LIST,MAP,NCAL',EDTREGN=260K,               X00000300
//             LIBRARY='SYS1.MACLIB',LSIZE='(252K,100K)',              X00000400
//             MEMBER=DUMMY,OBJDISP='(OLD,DELETE)',                    X00000500
//             OBJECT='&OBJT',OBJROOM='(3200,(40,10),RLSE)',           X00000600
//             OBJUNIT=DISK,OPTIONS='LOAD,NODECK',DISKNO=XX,           X00000700
//             REGN=260K,UPDIF='(0,NE,UPD)'                             00000800
//UPD     EXEC  PGM=IEBUPDTE,REGION=&REGN                              00000900
//SYSUT1    DD UNIT=2314,DISP=(OLD,PASS),VOL=SER=DISK&DISKNO,          X00001000
//             DSN=D&DISKNO..SOURCE                                     00001100
//SYSUT2    DD UNIT=2314,DISP=(OLD,PASS),VOL=SER=DISK&DISKNO,          X00001200
//             DSN=D&DISKNO..SOURCE                                     00001300
//SYSPRINT DD  UNIT=(CTC,,DEFER)                                       00001400
//ASM     EXEC PGM=&COMPILE,PARM='&OPTIONS',REGION=&REGN,COND=&UPDIF   00001500
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(RECFM=FBM,LRECL=121,BLKSIZE=1573) 00001600
//SYSUT1    DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSPRINT))           00001700
//SYSUT2    DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSUT1,SYSPRINT))    00001800
//SYSUT3    DD  SPACE=(CYL,(1,1)),                                    *00001900
//             UNIT=(DISK,SEP=(SYSUT1,SYSUT2,SYSPRINT))                 00002000
//SYSLIB    DD  DSN=D28.MACLIB,DISP=SHR,UNIT=2314,VOL=SER=DISK28       00002100
//          DD  DSNAME=SYS1.AMDMAC,DISP=SHR                            00002200
//          DD  DSNAME=&LIBRARY,DISP=SHR                               00002300
//SYSGO     DD  UNIT=&OBJUNIT,DSNAME=&OBJECT,SPACE=&OBJROOM,          *00002400
//             DISP=(MOD,PASS)                                          00002500
//SYSPUNCH DD  UNIT=(CTC,,DEFER),DCB=(RECFM=FB,LRECL=80,BLKSIZE=80)    00002600
//SYSIN     DD DISP=SHR,DSN=D&DISKNO..SOURCE(&MEMBER)                  00002700
//EDT     EXEC  PGM=LINKEDIT,PARM='&EDTOPTS,SIZE=&LSIZE',              X00002800
//             REGION=&EDTREGN,COND=&EDTIF                              00002900
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(LRECL=121,BLKSIZE=1573)          00003000
//SYSUT1    DD  SPACE=(3072,(20,10),RLSE),                             X00003100
//             UNIT=DISK,DCB=BLKSIZE=6144                               00003200
//SYSLIB    DD  DSNAME=SYS1.AMDLIB,DISP=SHR                            00003300
//          DD DSN=SYS1.FORTLIB,DISP=SHR                               00003400
//SYSLMOD   DD UNIT=2314,DISP=OLD,VOL=SER=DISK&DISKNO,                 X00003500
```

Fig. 35. Listing of Cataloged Procedure ARCUALP

```
//              DSN=D&DISKNO..SEGLIB(&MEMBER)                                  00003600
//SYSLIN DD DSN=*.ASM.SYSGO,DISP=&OBJDISP                                      00003700
//          DD  DDNAME=SYSIN                                                   00003800
//DEL           EXEC PGM=IEFBR14,COND=((0,NE,UPD),(8,GE,ASM))                  00003900
//DELETE DD DSN=*.ASM.SYSGO,DISP=&OBJDISP                                      00004000
//*                                                                            00004100
//*       ************************************************************         00004200
//*                                                                            00004300
//*       ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE               00004400
//*       LOUIS C. JUST  BLDG 221, ROOM C-207                                  00004500
//*                                                                            00004600
//*       ************************************************************         00004700
//*                                                                            00004800
```

Fig. 35 (Contd.)

```
MEMBER NAME  ARCALP                                                     00000100
//ARCALP   PROC COMPILE=ASMBLR,EDTIF='(8,LT,ASM)',                     X00000200
//              EDTOPTS='LET,LIST,MAP,NCAL',EDTREGN=260K,              X00000300
//              LIBRARY='SYS1.MACLIB',LSIZE='(252K,100K)',             X00000400
//              MEMBER=DUMMY,OBJDISP='(OLD,DELETE)',                   X00000500
//              OBJECT='&OBJT',OBJROOM='(3200,(40,10),RLSE)',          X00000600
//              OBJUNIT=DISK,OPTIONS='LOAD,NODECK',DISKNO=XX,          X00000700
//              REGN=260K                                               00000800
//ASM     EXEC PGM=&COMPILE,PARM='&OPTIONS',REGION=&REGN                00000900
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(RECFM=FBM,LRECL=121,BLKSIZE=1573) 00001000
//SYSUT1   DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSPRINT))             00001100
//SYSUT2   DD  SPACE=(CYL,(1,1)),UNIT=(DISK,SEP=(SYSUT1,SYSPRINT))      00001200
//SYSUT3   DD  SPACE=(CYL,(1,1)),                                      *00001300
//              UNIT=(DISK,SEP=(SYSUT1,SYSUT2,SYSPRINT))                00001400
//SYSLIB   DD  DSN=D28.MACLIB,DISP=SHR,UNIT=2314,VOL=SER=DISK28         00001500
//         DD  DSNAME=SYS1.AMDMAC,DISP=SHR                              00001600
//         DD  DSNAME=&LIBRARY,DISP=SHR                                 00001700
//SYSGO    DD  UNIT=&OBJUNIT,DSNAME=&OBJECT,SPACE=&OBJROOM,             *00001800
//              DISP=(MOD,PASS)                                         00001900
//SYSPUNCH DD  UNIT=(CTC,,DEFER),DCB=(RECFM=FB,LRECL=80,BLKSIZE=80)     00002000
//SYSIN    DD DISP=SHR,DSN=D&DISKNO..SOURCE(&MEMBER),                  X00002100
//              UNIT=2314,VOL=SER=DISK&DISKNO                           00002200
//EDT     EXEC  PGM=LINKEDIT,PARM='&EDTOPTS,SIZE=&LSIZE',             X00002300
//              REGION=&EDTREGN,COND=&EDTIF                             00002400
//SYSPRINT DD  UNIT=(CTC,,DEFER),DCB=(LRECL=121,BLKSIZE=1573)           00002500
//SYSUT1   DD  SPACE=(3072,(20,10),RLSE),                             X00002600
//              UNIT=DISK,DCB=BLKSIZE=6144                              00002700
//SYSLIB   DD  DSNAME=SYS1.AMDLIB,DISP=SHR                              00002800
//         DD DSN=SYS1.FORTLIB,DISP=SHR                                 00002900
//SYSLMOD  DD UNIT=2314,DISP=OLD,VOL=SER=DISK&DISKNO,                 X00003000
//              DSN=D&DISKNO..SEGLIB(&MEMBER)                           00003100
//SYSLIN DD DSN=*.ASM.SYSGO,DISP=&OBJDISP                               00003200
//         DD   DDNAME=SYSIN                                            00003300
//DEL           EXEC PGM=IEFBR14,COND=(8,GE,ASM)                       00003400
//DELETE  DD DSN=*.ASM.SYSGO,DISP=&OBJDISP                              00003500
//*                                                                     00003600
//*       ******************************************************** 00003700
//*                                                                     00003800
//*       ANYONE EXPERIENCING DIFFICULTY WITH THIS PROCEDURE SEE        00003900
//*       LOUIS C. JUST  BLDG 221, ROOM C-207                           00004000
//*                                                                     00004100
//*       ******************************************************** 00004200
//*                                                                     00004300
//*                                                                     00004400
```

Fig. 36. Listing of Cataloged Procedure ARCALP

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STP003

3 4444 00033877 2

13

MAT A
N_1

MAT B
N_2

14

COM
N_1 F_1 + F_2 N_2

MAT A F_1
MAT B F_2

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TYPE 14

Pg 239