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This edition applies to Version 1, Release 3, Modification Level 5 of VSE/Advanced Functions, Program Number 5746-XE8 and to subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are made periodically to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/370 and 4300 Processors Bibliography, GC20-0001, for the editions that are applicable and current.

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PREFACE

This book is a guide for application programmers who will use SAM, DAM, ISAM, or VSAM macros to write or process IBM-standard file labels or write PIOCS routines for user-standard or non-standard file labels.

To understand this book, the reader should be familiar with computer systems and basic programming concepts and techniques. VSE System General Information, GC33-6108 lists the other system books and the user books of related products. For detailed guide and reference information on subjects only mentioned here, the following books are referred to in the text:

- VSE/Advanced Functions Data Management Concepts, GC24-5209
- VSE/Advanced Functions Application Programming: Macro User's Guide, SC24-5210
- VSE/Advanced Functions Application Programming: Macro Reference, SC24-5211
- VSE/Advanced Functions System Control Statements, SC33-6095
- VSE/Advanced Functions System Utilities, SC33-6100
- Device Support Facilities, GC35-0033
- Using VSE/VSAM Commands and Macros, SC24-5144
- VSE/VSAM Programmer's Reference, SC24-5145
- VSE/Advanced Functions Diagnosis Reference: Supervisor, LY33-9091.
- VSE/Data Interfile Transfer, Testing, and Operations (DITTO) Program Reference and Operations Manual, SH19-6073

Detailed information on label processing under VSAM can be found in VSE/VSAM Programmer's Reference, SC24-5145.

The program flow of label processing phases is to be found in VSE/Advanced Functions Diagnosis Reference: LIOCS Volumes 1 to 4, LY24-5209 to 5212 and in the VSAM literature.

More titles are listed in the IBM System/370 and 4300 Processors Bibliography, GC20-0001. Terminology is defined in IBM Vocabulary for Data Processing, Telecommunications, and Office Systems, GC20-1699 and, for VSE-specific terms, in VSE/Advanced Functions Data Management Concepts.

The book is divided in the following chapters:

- Chapter 1: INTRODUCTION which discusses types of labels and how they are created.
- Chapter 2: FILE LABEL SPECIFICATIONS which shows in detail which commands, statements, and macros influence label processing.
- Chapter 3: LABEL LAYOUTS AND RULES which shows the exact format of each type of label and the contents of their fields.
- Chapter 4: VOLUME LAYOUTS which shows for each label type where its place is on the volume.

An index helps to find specific information fast.

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SUMMARY OF AMENDMENTS

Version 1 Release 3 Modification Level 5 (1.3.5)

The following changes have been made:

- Support for IBM 3375, a CKD disk device supported like an IBM 3350 has been added.
- Support for IBM 3430, a tape device supported like an IBM 3410, but not attached to a 4331, with 1600 or 6250 bpi, has been added.
- The DLAB, TPLAB, and XTENT job control statements are no longer supported.
- The access methods DAM and ISAM are still supported but no longer recommended.
- The information of both label books has been combined and reorganized.

Version 1 Release 3 Modification Level 0 (1.3.0)

An overview of functions and computing services new with Release 3 of VSE/Advanced Functions is given in Introduction to the VSE System.

Technical Newsletters SN33-9294 and SN33-9295 correct the program number on the title pages and in the edition notice.

CHAPTER 1. INTRODUCTION

This chapter will show briefly what file and volume labels are and what kinds of labels must or can be used. There are two kinds of labels: external and internal. External labels, fastened to the outside of a volume, can be read visually. They are not discussed here. Internal labels are written on the volume in machine-readable form. They are either

- volume labels that are put on the volume by a one-time initialization, or
- file labels that change with the files written on and deleted from the volume.

VOLUME AND FILE LABELS

The following types of labeling are supported under VSE:

	Disk	Diskette	Tape
Volume: Standard	VOL1	VOL1	VOL1
File: IBM-standard	file-name	HDR1	HDR1, EOV1, EOF1
File: User-standard	UHLn, UTLn*	no	UHLn or UTLn*
File: Non-standard	no	no	EBCDIC only
Vol.and F.: Unlabeled	no	no	yes

*) SAM (and DAM) macros only

On disk and diskette volumes, IBM-standard volume and file labels with fixed length and format are required. New disk volumes must be identified (labeled) at the installation that is going to use them. Tape volumes can be used unlabeled. IBM-diskette volumes come already labeled from the factory.

On disk and tape, provision is made to tolerate and ignore additional volume labels (VOL2 to 8). But their reading or creation is not supported under VSE.

On disk and tape, user-standard file labels are supported in addition to IBM-standard file labels. A user routine must be provided to handle them. VSAM (and ISAM) do not support them.

Tape volumes and files may be either labeled or unlabeled. If a labeled file is to be on an unlabeled volume, the routine opening the file asks the operator for a volume serial number. If he just presses ENTER, the system generates a volume label of its own.

Tape files labels may be IBM-standard, with or without user-standard labels in addition, or non-standard type. If files with non-standard labels or unlabeled files are written on a volume with volume labels, those are destroyed. Therefore, standard labeled files and others must be kept on separate volumes.

VOLUME INITIALIZATION

Volume labels (and, for disk volumes, the VTOC label) are written on the volumes when the volumes are initialized in different ways depending on the device type:

Disks are initialized:	by the Dev. Supp. Fac. program
Diskettes are initialized:	in the factory or via VSE/DITTO
Tapes are initialized:	by utility, automatically or via VSE/DITTO

For disk initialization, see Device Support Facilities. The initialization includes writing of the VTOC label.

For diskette re-initialization or tape initialization, see VSE/Data Interfile Transfer, Testing, and Operations Program Reference and Operations Manual.

For tape initialization, see VSE/Advanced Functions System Utilities.

For details on VTOC initialization, see "Place of Disk IBM-Standard File Labels" in Chapter 4.

FILE LABEL SPECIFICATION AND LABEL AREA

You supply the information for IBM-standard file labels to the system by the job control statements **OPTION, EXTENT, AND DLBL OR TLBL** and by a **DTFxx or ACB** macro in the application program. For additional file labels, the **DTFxx** macros in your program must point to your own label processing routine.

For more information, see VSE/Advanced Functions Application Programming: Macro Reference (for DTFxx specification) and Using VSE/VSAM Commands and Macros (for ACB specification). For job control statements, see VSE/Advanced Functions System Control Statements.

IBM-standard file labels are stored in the label area when they are defined. They are written on the volume when the file is opened for output and checked when it is opened for input.

The label area is defined or accessed at IPL time by the **DLA** command. If the DLA command is omitted at IPL, the system generates a new default label area in a default place. In addition, VSAM maintains identifying information for its files in its own VSAM catalog.

The following chapters will discuss in detail:

- The statements, commands, macros, and routines necessary to specify file labels
- The formats and rules of the different types of volume and file labels (including the label record format in the label area)
- The layouts of volumes where these labels are placed by the system
- Diagnostic tools to check label information in label area and VTOC

CHAPTER 2. HOW TO SPECIFY FILE LABELS

This section shows how to specify disk, diskette, and tape file labels and the place and size of the label area.

DLA COMMAND (IPL)

The DLA command has the following operands:

```
DLA  NAME= ,UNIT= ,VOLID= ,DSF= ,CYL= ,NCYL= ,BLK=,NBLK=
```

Under CYL and NCYL (BLK and NBLK), you specify the beginning and the length of the label area.

The default size of the label area is as follows:

3340,3375	3 cylinders
3350	1 cylinder
Other CKD devices	2 cylinders
FBA devices	200 blocks

You can change the size and place of the label area by issuing a new DLA command at IPL. On FBA devices you can change the size during a restore run.

JOB CONTROL STATEMENTS FOR IBM-STANDARD LABELS

Job control offers statements to specify IBM-standard file labels only.

OPTION Statement

There are three possible levels of validity for an IBM-standard label specification. They are chosen by the OPTION statement operands USRLABEL, PARSTD, or STDLABEL. **The names of these operands should not lead to the misunderstanding, that any other labels but IBM-standard file labels are stored here.**

The OPTION statement sets these meanings for the DLBL and TLBL specification(s) following them:

```
USRLABEL: temporary file label for one partition, valid until end of job
PARSTD:   permanent file label for one partition
STDLABEL: permanent label for all partitions
```

Each option can be overwritten at a new job step by an OPTION statement with the same parameter. This means a specification of OPTION PARSTD erases all labels specified previously under that option. And as OPTION USRLABEL is the default, also any new DLBL or EXTENT statement in a following job step erases all temporary labels in that partition.

To avoid this devastating effect, existing PARSTD and STDLABEL labels can be saved by adding new ones in the form:

PARSTD=ADD or STDLABEL=ADD (=DEL is the default)

followed by DLBL and EXTENT statements. As the search for a file label always is done in the sequence

USRLABEL ---> PARSTD ---> STDLABEL

USRLABEL labels override PARSTD labels and STDLABEL labels for one job, and PARSTD labels override STDLABEL labels in one partition. You can have different files for each partition with the same filename (DTF-name) for all partitions. This is used for system input or output files without new DLBL and EXTENT statements each time a compilation or linkage editing function is performed.

DLBL and EXTENT Statements for Disk and Diskette Devices

You define new IBM-standard file labels or give information to check existing volume and IBM-standard file labels for disk via DLBL and EXTENT job control statements.

The DLBL statement for disk has the following operands:

```
// DLBL filename,file-id,date,codes,DSF,BUFSP= ,CAT= ,
        BLKSIZE= ,CISIZE= ,DISP= ,RECORDS= ,RECSIZE=
```

For diskette, the DLBL statement has only the following operands:

```
// DLBL filename,file-id,date,DU
```

The DLBL statement identifies the file by the same (file)name which is used for the DTFxx macro in the program. All other operands are optional, that is, default values are supplied.

The EXTENT statement for disk has the following operands:

```
// EXTENT logical-unit,volume-serial-number,type,sequence-number,
      relative-track|block,number-of-tracks|blocks,
      split-cylinder-track
```

The EXTENT statement names the logical unit specified in the corresponding ASSGN statement and describes the extent for creating or checking IBM-standard file labels and for checking the "volume serial number" on the volume where the extent belongs. Some EXTENT fields are optional. This depends on the macro support used. For a SAM input file on a single volume, the EXTENT statement may be omitted if the DTFxx operand DEVADDR is specified. However, if one EXTENT statement is supplied, all extents created for the file must be specified if they are to be accessed.

The beginning of the extent is specified under the name of "relative track or block". It must be calculated by device for CKD devices from the cylinder-track address. The CKD devices have the following numbers of tracks per cylinder available for file extents:

Device	Number of Tracks per Cylinder
2311	10
2314, 2319	20
3330, 3333	19
3340	12
3350	30
3375	12

The first available track is track 1.

Therefore, if the address is cylinder 15, track 7 on a 3350, the relative track is 15 x 30 + 7 = 457.

For diskette, the EXTENT statement has only the following operands:

```
// EXTENT logical-unit,volume-serial-number,type
```

as the extent limits are determined automatically from available space on the diskette. Here, all EXTENT fields are optional.

Job Control Examples for Disk and Diskette Files

The first is an example of label specification for a SAM file of two extents on disk which has to be updated.

```
// JOB UPDATE
// ASSGN SYS005,190
// ASSGN SYS007,191
// DLBL DISKOUT,'SEQUENTIAL DISK FILE',83/003,SD
// EXTENT SYS005,111111,1,0,1600,300
// EXTENT SYS007,222222,1,1,0031,450
// DLBL DISKIN,'SEQUENTIAL DISK FILE',83/003,SD
// EXTENT SYS005,111111,1,0,1600,300
// EXTENT SYS007,222222,1,1,0031,450
// EXEC UPDATE
/&
```

The same file here is input to the program and, after changes to data, output from the program.

The second is an example of job control for a diskette file of three extents, all on different volumes.

```
// JOB USE DISKETTE FILE
// ASSGN SYS004,060
// DLBL OUT,'DISKETTE',83/003,DU
// EXTENT SYS004,987652,1
// EXTENT SYS004,987653,1
// EXTENT SYS004,987654,1
// EXEC USEDIK
/&
```

TLBL Statements for Tape Files

You create a new IBM-standard file label or give information to check existing volume and IBM-standard file labels for tape with a TLBL job control statement.

The TLBL statement has a slightly different form depending on which code is used for data representation on the tape, EBCDIC or ASCII.

For EBCDIC:

```
// TLBL filename,file-id,date,FILE-SERIAL-NUMBER,VOLUME-SEQUENCE-NUMBER,
     file-sequence-number,generation-number,version-number
```

For ASCII:

```
// TLBL filename,file-id,date,SET-IDENTIFIER,FILE-SECTION-NUMBER,
     file-sequence-number,generation-number,version-number
```

All TLBL operands other than filename are optional, that is, a default is supplied.

To start processing a labeled multi-volume file at some volume other than the first, you supply TLBL information for EBCDIC code as follows:

- Parameter 4:'file-serial-number' contains the volume serial number of the first volume of the set (not the volume being processed).
- Parameter 5:'volume-sequence-number' contains the sequence number of the volume that will be processed first in this run.
- Parameter 6:'file-sequence-number' contains the sequence number of the file to be processed, if this is a multi-file, multi-volume set.

All other fields contain the same information as for a start with the first volume.

DTF AND ACB MACROS

Types of DTFxx Macros Used

Depending on I/O macro support used, different file definition macros must be specified.

Recommended Level of Organization:	Definition Macro:
SAM for disk	DTFSD, DTFDI*
SAM for diskette	DTFDU, DTFDI*
SAM for tape	DTFMT, DTFSR, DTFDI*
SAM in VSAM Managed Space for disk	DTFSD, DTFDI*
VSAM for disk	ACB**
PIOCS for disk, diskette, or tape	DTFPH***

Still Supported:	Definition Macro:
DAM for disk	DTFDA
ISAM for disk	DTFIS

*) DTFDI gives the same flexibility the system files have when you have data on SYSRDR, SYSIPT, SYSLST, and SYSPCH. These files may be assigned to unit record, tape, or disk devices at execution time. DTFDI gives device independence.

**) VSAM does not use DTFxx macros. Label information is specified through a utility program, Access Method Services, and through job control statements. Labels describe VSAM data spaces; files are described in the VSAM catalog. A VSAM processing program is connected to a file through an ACB (Access Method Control Block) instead of a DTFxx.

***) When you use PIOCS macros in your program to handle a file with IBM-standard labels, this file must be defined by a DTFPH macro.

Use of DTFxx Macros to Supply Label Information

The following DTFxx operands are given to handle the various types of labels.

disk	IBM-standard:	------	XTNTXIT=name (DAM, optional)
	User-standard:	------	LABADDR=name
diskette	IBM-standard:	------	
tape	IBM-standard:	FILABL=STD	
	User-standard:	FILABL=STD	LABADDR=name
	Non-standard:	FILABL=NSTD	LABADDR=name
	Unlabeled:	FILABL=NO	EOFADDR=name

USER-STANDARD LABEL ROUTINE

If you want to use user-standard file labels in addition to the IBM-standard labels you must

- write your own label routine to write or check these user-standard labels. In this routine you build an 80-byte label with the first four bytes being UHL1 or UTL1. The symbolic address of this label you load into register 1 and then issue a LBRET macro to return control to IOCS.

- specify LABADDR in the DTFxx macro in your program to indicate to IOCS to branch to your label routine after processing the IBM-standard labels.

IOCS then establishes the first track of the first data area extent as user-standard label area, as extent sequence 0 and extent type '40'. See IBM-standard label, field 22. IOCS then writes your user-standard file label(s) on the volume.

The LBRET macro has as only operand a number: 1, 2, or 3.

- A LBRET 3 macro permits IOCS to update a label on the device and pass you the next one (not for tape).

- A LBRET 2 macro permits reading the next label.

- A LBRET 1 macro terminates processing of user-standard labels.

For more information on the user-standard label routine and the LBRET macro, see VSE/Advanced Functions Application Programming: Macro User's Guide, SC24-5210, and VSE/Advanced Functions Application Programming: Macro Reference, SC24-5211

When PIOCS macros are used for a file and the DTFPH macro is specified with the LABADDR operand, only header labels are checked but no trailer labels.

NON-STANDARD LABEL ROUTINE

Non-standard labels are used for EBCDIC-code tape files only.

You supply the information for creating and checking non-standard header and trailer labels in a label routine in your application program. The address of this label routine in the program then is specified in the DTFxx entry LABADDR=name.

In this label routine, you issue PIOCS macros to read or write the labels. You set up a command control block by issuing a CCB macro, and write a channel program consisting of CCWs.

You define your label read-in or read-out area. At the end of your routine, you return control to IOCS by issuing a LBRET 2 macro.

PROCESSING UNLABELED FILES

Only tape files may be unlabeled.

If DTFxx FILABL=NO is specified or the operand is omitted, IOCS assumes that a file does not contain labels, regardless of what is actually written on the tape. The functions performed by IOCS then consist merely of reading or writing tape marks and reading or writing data.

Unlabeled Input Files

IOCS assumes the end of the input file when it reads the tape mark that follows the last data record. It branches to your end-of-file routine specified in DTFxx EOFADDR=name. In this routine, you check if it is an end-of-file or an end-of-volume condition, normally by requesting a reply from the operator.

On end-of-file, your program does what is required for the end of your data.

On end-of-volume, your program must issue a FEOV macro. Then IOCS updates the active drive number if an ASSGN statement has specified an alternate drive (ALT) for the file and switches to the alternate drive. Else a message goes to the operator.

If multiple files on the same volume are to be read in sequence, the DTFxx entry REWIND=NORWD must be specified for each file. This causes the tape to be positioned correctly each time for the next file to be opened.

To position the tape for the first file on the reel, the programmer can include a CNTRL REW macro or a job control MTC REW statement or the operator can position the tape at the load point.

An unlabeled tape file can be read backward if it has not been written in the data conversion mode (7-track). Because of special error-recovery procedures, unlabeled ASCII tapes (without any leading tape mark) may be read backward.

Unlabeled Output Files

FIRST RECORD: IOCS writes a tape mark as the first record (unless the user specified DTFxx TPMARK=NO) starting at the location where the tape is positioned. Thus if the tape has been rewound to the load point, IOCS warns the operator if it finds a volume label there before it writes the tape mark or data over any label(s) that is already on the tape.

LAST RECORD: When a CLOSE macro is issued after all records for a file have been processed, IOCS writes two tape marks after the last block of data records. If the reflective marker at the end of the tape is found before the end of the output file or if a FEOV macro is issued, IOCS writes one tape mark.

MULTI-VOLUME FILE: If the next I/O macro after the reflective marker at the end of the tape is a CLOSE, an end-of-file condition exists. If, however, the next macro is a PUT or a FEOV (forced end-of-volume) macro, an end-of-volume condi-

tion exists. On end-of-volume, IOCS writes a tape mark and switches to the alternate drive. If none has been specified, the operator is requested to mount a new volume. IOCS positions the new tape at the load point and writes a tape mark, unless DTFxx TPMARK=NO has been specified.

MULTI-FILE VOLUME: Multiple files can be written on the same volume in the same operation without repositioning the tape, by specifying DTF REWIND=NORWD for each file. With this specification, the tape stops behind the file just written.

AMERICAN NATIONAL STANDARD LABELS

VSE processes tape files written in the American National Standard Code for Information Interchange (ASCII), in addition to tape files written in EBCDIC. ASCII is based on the specifications of the American National Standards Institute, Inc. and standard labels for ASCII files are referred to as American National Standard standard labels. ASCII files may be unlabeled or labeled with American National Standard standard or user-standard labels. Non-standard labels are not permitted on ASCII files.

This section briefly summarizes the differences in specifications and processing of ASCII and EBCDIC standard labeled files. The ASCII volume and file labels are shown in Figure 3-11 on page 3-10 and Figure 3-13 on page 3-11.

The differences between the ASCII tape volume label and the EBCDIC tape volume label fields are as follows:

Field Number	EBCDIC Name	ASCII Name	Hex Displacement EBCDIC	Hex Displacement ASCII
4	Security byte	Accessibility	A	A
7	Reserved	Owner ID	1F	25
8	Owner ID	Reserved	29	33
9	Reserved	Standard byte	33	4F

Additional volume labels (VOL2-VOL8) are tolerated for EBCDIC files only. ASCII has the optional user volume labels (UVL1-UVL9) instead. VSE ignores these labels on input and does not create them on output.

The default for the version number in the American National Standard file label is 00; the EBCDIC label version number defaults to 01.

EOV labels on an EBCDIC tape file are followed by one tape mark; on an ASCII tape file these labels are followed by two tape marks.

When an ASCII file is processed, IOCS translates the labels from ASCII into EBCDIC (on input) and from EBCDIC into ASCII (on output). Two translate tables are in the SVA for this purpose. Their address is stored in SYSCOM X'74 to 77'.

Tapes to be used for ASCII files may be initialized with American National Standard standard labels by the IBM-supplied program Initialize Tape.

CHAPTER 3. LABEL FORMATS AND RULES

VOLUME LABELS ON DISK

LAYOUT: Figure 3-1 shows the format of volume labels on disk.

Fields D1 and D2 appear with the same contents as key area (fields K1 and K2) before the data area of the label shown here. The displacement is in hex notation, counting from the beginning of the label.

Displ.	Field	Length	Content
0	D1	3	Identifier: VOL. Checked by IOCS
3	D2	1	Ignored by VSE
4	D3	6	Volume serial number. From EXTENT statement
A	D4	1	Security byte used by OLTEP
B	D5	5	VTOC address. Used by IOCS
10	D6	5	Blank
15	D7	4	CI-size for FBA, blanks for CKD
19	D8	4	Number of blocks per CI for FBA, blanks for CKD
1D	D9	4	Number of labels per CI for FBA, blanks for CKD
21	D10	4	Blank
25	D11	E	Owner code for LVTOC listing
33	D12	1C	Blank
4F	D13	1	1 = FBA; 0 = CKD

Figure 3-1. Disk Volume Label

RULES: The volume label has a 4-byte key area and an 80-byte data area. Both the key area and the first four bytes of the data area always contain the characters "VOL1" for the first volume label. Additional volume labels are ignored by VSE.

IBM-STANDARD FILE LABELS ON DISK

LAYOUT: Figure 3-2 on page 3-2 to Figure 3-4 on page 3-4 show IBM-standard label formats for disk files, that is, the first IBM-standard file label, the continuation label, and the VTOC label.

Displ.	Field	Length	Content
0	K1	2C	File-ID: 1-35 bytes if generation number and version number are specified, else 1 to 44. From DLBL or IOCS. Under VSAM, data space name generated by VSAM catalog routines. Generation number: Gnnn Version number: Vnn From IOCS, VSAM routines, or AMS command DEFINE
2C	D1	1	Format ID: 1. Written by IOCS on output
2D	D2	6	Volume serial no. of first volume of the file. Written by IOCS
33	D3	2	Volume sequence number within the file. From IOCS
35	D4	3	Creation date: yyddd. By IOCS from SYSCOM
38	D5	3	Expiration date, from DLBL or system (creation date + 7 as default)
3B	D6	1	Number of extents of the file on this volume
3C	D7	1	Used by OS/VS
3D	D8	1	Reserved
3E	D9	D	System code: IBMDOSVS. Written by IOCS
4B	D10	3	Date of last access: yyddd; not used by VSE
4E	D10A	2	Reserved
50	D10B	2	Number of blocks per CI for FBA, blanks for CKD
52	D11	2	File type: hex 0008 for VSAM hex 2000 for DAM hex 4000 for SAM (default) hex 8000 for ISAM From DLBL. Checked against type of DTF
54	D12	1	Used by OS/VS. IOCS writes 0
55	D13	1	Flags for optional areas used for ISAM file: Bit 2: Master index Bit 3: Independent overflow area Bit 4: Cylinder overflow area From DTF and EXTENT
56	D14	2	Byte length of ISAM blocks, from DTF
58	D15	2	Record length of ISAM files. From DTF
5A	D16	1	Key length of ISAM blocks. From DTF
5B	D17	2	Key field location in ISAM block. From DTF
5D	D18	1	Flags: Bit 0: Last volume (SAM only) Bit 3: File security. From DLBL
5E	D19	1	Original space request was: Bit 1: in blocks 4: for continuous extent 5: for maximum continuous extent 6: not under specified minimum

Figure 3-2 (Part 1 of 2). IBM-Standard Disk File Label (Format-1)

Displ.	Field	Length	Content
5F	D19A	3	Used by OS/VS. IOCS writes blanks
62	D20	5	Used by OS/VS. IOCS writes zeros
67	D21	2	Start of next record to end-of-data distance
69	D22	1	Type of extent:(from EXTENT)
		(default)	01: (prime) data area or data space extent
			02: independent overflow area extent
			04: master/cylinder index area extent
			40: extent for user-standard labels
			80: split cylinder extent (SAM)
6A	D23	1	Sequence number of extent in the file. From EXTENT or IOCS
6B	D24	4	Extent lower limit (cchh), from EXTENT
6F	D25	4	Extent upper limit (cchh), from EXTENT

The fields D22 - D25 are now repeated twice as D26 - D33 to describe the next two extents still allowed on this label.

87	D34	5	Address of next label for the file on this volume. Written and used by IOCS

Figure 3-2 (Part 2 of 2). IBM-Standard Disk File Label (Format-1)

Displ.	Field	Length	Content
0	K1	4	Key code for continuation label(03030303) Written by IOCS
4	K2	1	Type of extent, from EXTENT:
			01 = data extent (default)
			80 = split cylinder extent
5	K3	1	Extent sequence number (3 or more)
6	K4	4	Extent lower limit (cchh), from EXTENT
A	K5	4	Extent upper limit (cchh), from EXTENT

The fields K2 to K5 are repeated three times as K6 - K17, to describe the extents 2, 3, and 4 of the key area.

2C	D1	1	Continuation label code: EBCDIC 3, from IOCS

The fields K2 to K5 are now repeated nine more times as D2 - D37, to describe the nine extents of the data area.

87	D38	5	Address of next contin.label (cchhr or 0bbbb) or zeros. From SAM IOCS only

Figure 3-3. IBM-Standard Disk File Continuation Label (Format-3)

Every field in this label, except the VSAM indicators (D9A), is written by DSF at initialization time.

Disp.	Field	Length	Content
0	K1	2C	Key code for VTOC label: 44 times 04
2C	D1	1	VTOC label identifier: EBCDIC 4.
2D	D2	5	Used by OS/VS
32	D3	2	Number of available file label spaces in VTOC at initialization (tracks x cylinder minus 2)
34	D4	4	Address of next alternate track (cchh), for FBA: zeros. From DSF
38	D5	2	Number of alternate tracks left. For FBA zeros From DSF
3A	D6	1	Flags: Bit 0: always on Bit 3: Volume reserved for emulators Bit 5: VTOC being updated by VSAM
3B	D7	1	Extent count. Always 1. VTOC is 1 extent
3C	D8	2	Reserved
3E	D9	E	CKD device constants: (FBA: zeros)
3E		2	Number of cylinders
40		2	Tracks per cylinder
42		2	Track length
44		1	Overhead bytes for I*
45		1	Overhead bytes for L*
46		1	Overhead bytes for K*
47		1	Flag byte Bit 4: I or L value* has two bytes for 3350 Bit 7: A tolerance is added to each record except the last on a track
48		2	Tolerance** per device type
4A		1	Number of labels on VTOC track per device
4B		1	Reserved

*) I = for a record with key area
L = for a last record with key area on a track
K = for a key area

**)The tolerance is added to the length of a record if bit 7 in the flag byte is on.

Figure 3-4 (Part 1 of 2). VTOC Label (Format-4)

Displ.	Field	Length	Content
4C	D9A	B	VSAM indicators, from VSAM catalog routines
4C		8	Time when last data space was added
54		1	Ownership byte: Bit 0: Owned by VSAM catalog
55		2	Number of first track of CKD catalog recovery area, for FBA zeros
57	D10A/B	9	Used by OS/VS
60	D10C	4	Number of first block of FBA catalog recovery area, for CKD zeros
64	D10D	5	Reserved
69	D11	1	Extent type: 01 for VTOC extent
6A	D12	1	Extent sequence number: 00 (VTOC has 1 extent)
6B	D13	4	Start address of VTOC (label).
6F	D14	4	End address of VTOC. Used by IOCS
73	D15	19	Zeros

Figure 3-4 (Part 2 of 2). VTOC Label (Format-4)

RULES:

Types: Traditionally, four types of IBM-standard file labels are counted:

- Format-2, used with ISAM only. See Appendix
- Format-4, the VTOC file label, written at initialization
- Format-1, the normal disk file label for the first 3 extents
- Format-3, a file continuation label for the next 13 extents

Size: An IBM-standard file label is 140 bytes long and consists of a 44-byte key area and a 96-byte data area.

The VTOC: All IBM-standard file labels on a volume are in the VTOC, a directory of all files on the volume. The VTOC itself is a file also and has its own file label, the VTOC label. The VTOC is located where you specify it when you initialize your volume. The address of the VTOC is saved in the volume label.

Under VSAM a data space can be described by a file label; the characteristics of the files that occupy that space are described in the VSAM catalog. You do not name a VSAM data space; the 44-byte key area contains a name assigned by VSAM. However, if a data space contains the data (or the index) of only one VSAM file (called a unique file), the 44-byte key area automatically contains the name you gave to the data or the index.

Several Volumes: For several volumes of one file or VSAM data space, the file label is repeated in the VTOC of each volume. The file label on each volume describes the portion of the file or VSAM data space on that volume and its extents.

USER-STANDARD FILE LABELS ON DISK

LAYOUT: Figure 3-5 shows user-standard disk file labels (header and trailer).

Displ.	Field	Length	Content
0	K1	3	UHL or UTL
3	K2	1	Label sequence number: 1 to 8 for header labels 0 to 7 for trailer labels
4	D1	3	Same as field K1
7	D2	1	Label sequence number: 1 to 8 for all
8	D3	4C	User's label information

Figure 3-5. User-Standard Disk File Labels (Header and Trailer)

RULES: User-standard labels may be included for SAM or DAM files. VSAM and ISAM do not support them.

User-standard labels are header labels located and processed before the data of the file, and trailer labels located before and processed after the data of the file.

These labels have a 4-byte key area and an 80-byte data area. Both the key area and the first four bytes of the data area contain UHLn or UTLn; the remaining 76 bytes of the data area contain user-chosen data. A maximum of eight header and eight trailer labels may be written to describe a file.

There is always one header and one trailer label more written than specified. This extra label has only a 4 byte key area and no data area.

An example of a file for which five header labels and four trailer labels were specified is shown in Figure 3-6 on page 3-7 .

Label#	Key Area	Data Area
1	UHL1	UHL1 + 76 bytes of label data fields
2	UHL2	UHL2 "
3	UHL3	UHL3 "
4	UHL4	UHL4 "
5	UHL5	UHL5 "
6	UHL6	
7	UTL0	UTL1 + 76 bytes of label data fields
8	UTL1	UTL2 "
9	UTL2	UTL3 "
10	UTL3	UTL4 "
11	UTL4	

Here follow the data.

Figure 3-6. User-Standard Disk File Labels (5 UHLs and 4 UTLs Specified)

If only header labels are specified, one UTL0 label without data is written by the system. An example is shown in Figure 3-7 where only 3 header labels were specified.

Label#	Key Area (4 bytes)	Data Area (80 bytes)
1	UHL1	UHL1 + 76 bytes of label data fields
2	UHL2	UHL2 "
3	UHL3	UHL3 "
4	UHL4	
5	UTL0	

Here follow the data.

Figure 3-7. User-Standard Disk File Labels (3 UHLs Specified)

You can include definitions or descriptions of your file in addition to those provided by the standard labels. For example, you may want to identify end-of-volume as opposed to end-of-file conditions, or you may have subcategories that you want to define for your files, or you may want to maintain an audit trail in these labels without the system security standards.

VOLUME LABELS ON DISKETTE

LAYOUT: Figure 3-8 shows the format of a diskette volume label.

Displ.	Field	Length	Content
0	D1	3	Label ID: VOL
3	D2	1	Ignored by VSE
4	D3	6	Volume serial number from EXTENT
A	D4	1	Accessibility indicator: S or Blank. From DTF
B	D5,D6	1A	Reserved
25	D7	E	Name or code of volume owner
33	D8	1C	Reserved
4F	D9	1	Label standard level: W

Figure 3-8. Diskette Volume Label

RULES: A diskette volume has one volume label of 80 bytes. It is located on track 0, sector 7 and begins by VOL.

(IBM-STANDARD) FILE LABELS ON DISKETTE

LAYOUT: Figure 3-9 shows the format of the diskette file label.

Displ.	Field	Length	Content
0	D1	3	Label ID: HDR
3	D2	1	Label sequence number: 1
4	D3	1	Blank
5	D4	8	File-ID from DLBL or system
D	D5	9	Blanks
16	D6	5	Record length. From IOCS
1B	D7	1	Blank
1C	D8	5	Start address of extent: Track and sector. From IOCS
21	D9	1	Blank
22	D10	5	End address of extent: Track and sector. From IOCS
27	D11	1	Blank
28	D12	1	Bypass byte: B or blank: B = job ends on input
29	D13	1	Security byte: S or blank
2A	D14	1	Write protection byte: P or blank
2B	D15	1	Interchange level: blank= sector length 128, unblocked, unspanned, sequential non-blank= job ends on input
2C	D16	1	Volume byte: blank= file complete on this volume C= file continued on next volume L= file ends on this volume
2D	D17	2	Volume sequence number
2F	D18	6	Creation date: YYMMD
35	D19	D	Blanks
42	D20	6	Expiration date: Default= 7 days after output
48	D21	1	Verify byte: V or blank
49	D22	1	Blank
4A	D23	5	End of data address
4F	D24	1	Blank

Figure 3-9. Diskette File Label

RULES: The IBM-standard file label on diskette is 80 bytes long. The key area of 4 bytes always contains the characters HDR1. The 76 byte data area contains the start and end address of the file or of the extent of a file on this volume. As only one extent of each file is on a diskette, no continuation labels are needed.

All IBM-standard file labels for all files on a diskette volume are stored in the VTOC on track 0, sectors 8-26.

Only IBM-standard file labels are supported on diskettes.

VOLUME LABELS ON TAPE

LAYOUT: Figure 3-10 and Figure 3-11 show volume labels for EBCDIC and ASCII tapes.

Displ.	Field	Length	Content
0	D1	3	Label ID: VOL
3	D2	1	Ignored by VSE
4	D3	6	Volume serial number
A	D4	1	Ignored by VSE
B	D5-D7	1E	Reserved
29	D8	A	Volume owner name or code
33	D9	1D	Reserved

Figure 3-10. Tape Volume Label for EBCDIC Code

Displ.	Field	Length	Content
0	D1	3	Label ID: VOL
3	D2	1	Ignored by VSE
4	D3	6	Volume serial number
A	D4	1	Ignored by VSE
B	D5,D6	1A	Reserved
25	D7	E	Name or code of volume owner
33	D8	1C	Reserved
4F	D9	1	Standard byte: 1= file has ANSI standards blank= file does not have ANSI standard

Figure 3-11. Tape Volume Label for ASCII Code

RULES: The volume label for tapes is 80 bytes long and begins by VOL1 for the first volume label. Additional volume labels are ignored by VSE.

IBM-STANDARD FILE LABELS ON TAPE

LAYOUT: Figure 3-12 on page 3-11 and Figure 3-13 on page 3-11 show IBM-standard file labels for tapes.

Displ.	Field	Length	Content
0	D1	3	Label ID: HDR, EOF, or EOV
3	D2	1	Label sequence number: 1
4	D3	11	File-ID from TLBL
15	D4	6	Volume serial number of the volume where the file begins
1B	D5	4	Volume sequence number within the file
1F	D6	4	File sequence number on the volume
23	D7	4	Version number of the file
27	D8	2	Sub-version number
29	D9	6	Creation date: yyddd
2F	D10	6	Expiration date: yyddd
35	D11	1	Ignored by VSE
36	D12	6	Number of blocks; used in trailer labels only
3C	D13	D	System code: IBMDOSVS
49	D14	7	Reserved

Figure 3-12. IBM-Standard Tape File Label for EBCDIC Code

Displ.	Field	Length	Content
0	D1	3	Label ID: HDR, EOF, or EOV
3	D2	1	Label sequence number: 1
4	D3	11	File-ID from TLBL
15	D4	6	Volume serial number of first volume of the file
1B	D5	4	Volume sequence number within the file
1F	D6	4	File sequence number within volume(s)
23	D7	4	Version number of the file
27	D8	2	Sub-version number
29	D9	6	Creation date: yyddd
2F	D10	6	Expiration date: yyddd
35	D11	1	Ignored by VSE
36	D12	6	Number of blocks written; only in trailer label
3C	D13	D	System code: IBMZLB followed by two blanks
49	D14	7	Reserved

Figure 3-13. IBM-Standard Tape File Label for ASCII Code

RULES: IBM-standard file labels are 80 bytes long. Each file has a header and a trailer label which have the same format, for reading the tape forward or backward. The first four characters of each label identify the particular label:

```
header label  -- HDR1
trailer label -- EOF1 at the end of a file
                 EOV1 at the end of a volume but not of the file
```

Additional labels (HDR2 to 8) are ignored by VSE.

USER-STANDARD FILE LABELS ON TAPE

LAYOUT: Figure 3-14 shows user-standard file label format for tapes.

Displ.	Field	Length	Content
0	D1	3	Label ID: UHL or UTL
3	D2	1	Label sequence number: 1 to 8
4	D3	4C	User's label information

Figure 3-14. User-Standard Tape File Label

RULES: User-standard labels are header labels located and processed before the data of the file, and trailer labels located and processed after the file. Header and trailer labels are identified by:

```
User header labels  UHLn
User trailer labels UTLn
```

n may be 1 to 8.

User-standard file labels are 80 bytes long. The first four bytes contain UHLn or UTLn and the remaining 76 bytes contain user data.

You can include definitions or descriptions of the file in addition to that in the IBM-standard labels. For example, you may have a unique numbering system for file identification or you may have subcategories that you want to define for the files, or you may want to maintain an audit trail in these labels.

NON-STANDARD FILE LABELS ON TAPE

RULES: Non-standard labels are only supported on EBCDIC code tape labels. They may have any length, do not have a specified identification in the first four characters, and do not have a fixed format. They may contain whatever information the user desires, and in any arrangement. They are completely the responsibility of the user. He should, however, use some of the features found in

standard labels. For example: header labels must be distinguished from trailer labels, end-of-file trailer labels must be distinguished from end-of-volume trailer labels, and some name or number must identify the file to which the label belongs.

When files with non-standard labels or unlabeled files are written on a volume, the volume label is destroyed. Therefore, these files can only be written on volumes that are not expected to be used again for files with standard labels.

LABEL RECORDS IN THE LABEL AREA

When the system reads the DLBL or TLBL and EXTENT statements, it first stores the label information in the label area. The format of the label records in this area is not quite the same as the actual labels on the device. It is shown in VSE/Advanced Functions Diagnosis Reference: Supervisor, which is available as optional material.

CHAPTER 4. WHERE LABELS ARE PLACED

DISK VOLUME

Place of Disk Volume Labels

On CKD volumes, the volume label always starts on the third record on cylinder 0, track 0. The first two records are IPL records on a system volume and zero on other volumes.

On FBA volumes, the volume label is the first record in the first FBA block.

Place of Disk IBM-Standard File Labels (VTOC)

The VTOC contains the IBM-standard file labels for all files on the volume. The first label defines the VTOC itself. The second label in the VTOC is a label marked format-5, that is used by OS/VS only. The other labels in the VTOC define files or a VSAM data space on the volume. The labels are written in the order in which the corresponding EXTENT statements were processed and the files or VSAM data spaces are created.

Figure 4-1 shows the general format of a disk VTOC with a VTOC label and all the IBM-standard file labels together.

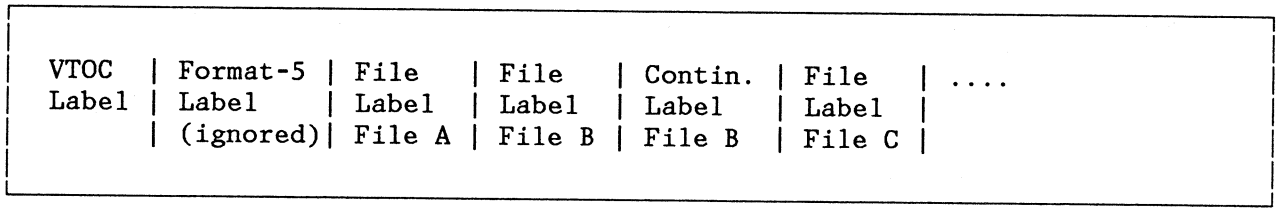

Figure 4-1. General VTOC Format for a Disk Volume

Location and length of the VTOC are specified at initialization and the address of the VTOC is saved in the volume label. The initialization program then provides for each label in the VTOC a 44-byte key field and a 96-byte data field and fills them with binary zeros. The label information is written into these fields when each file is created. The initializing program also writes the label for the VTOC itself as the first record.

The VTOC may be placed anywhere on the volume, except in the system area on a SYSRES device or in the areas reserved for alternate use.

The VTOC of an FBA volume can contain 3 to 999 file labels. It can start on any block except blocks 0 and 1. For each label on FBA, there is a 3-byte RDF and for the CI one 4-byte CIDF to be counted, so that a calculation

CI-Size minus 4 divided by 143

will yield the number of labels that fit in a given CI. This number is written in the volume label at displacement 1D.

On FBA devices, the following blocks are available for VTOC placement:

3310: 2 to 126,000
3370: 2 to 557,984

Alternate blocks for FBA devices are assigned by DSF.

For CKD devices, the cylinder distribution is the following:

Device	VTOC on Cyls.	Altern. Track Cyls.
2311,2314,2319	0 - 199	200 - 202
3330 Mods. 1+2	0 - 403	404 - 410
3330 Mod. 11	0 - 807	808 - 814
3340 Mod. 35	0 - 347	348
3340 Mod. 70	0 - 695	696 - 697
3350	0 - 554	555 - 559
3375	0 - 945	946

The limits for the IBM 3330 apply also to the 3333 and 3350 in 3330-1 mode.

The limits for the IBM 3330-11 also apply to the 3350 in 3330-11 mode.

The limits for the IBM 3340 apply also to the 3344.

The VTOC must be on one cylinder and on one or more full tracks, except when it is placed in its standard location on cylinder 0, track 0.

Cylinder 0, track 0 of each volume contains the following records:

- 0: Alternate track assignment (track descriptor)
- 1 and 2: IPL records for SYSRES volumes, else zeros
- 3: Volume label(s)
- The rest to end of track 0: VTOC, if standard location was specified at initialization (and it is not a SYSRES), else not used

For ISAM files, if the prime data area takes several volumes, the VTOC for the first volume must precede the prime data area. On the last volume, the VTOC may be on cylinder 0 or it may follow the prime data area. On all other volumes, the VTOC must be on cylinder 0.

Place of Disk User-Standard File Labels

User-standard labels on disk are written on the first track of the first extent allotted for data on CKD devices or on the first control interval (CI) for FBA devices, on each volume. Therefore, the first extent on a CKD device must be a minimum of two tracks. Your data records then start with the second track in the extent, whether the labels require a full track or not.

Disk Volume Layout Examples

This section shows the arrangement of labels on volumes, cylinders, and tracks as IOCS or VSAM write them on output files and expect them on input files.

The illustrations show

- how the cylinders on the volume are used
- the tracks with volume labels and VTOC
- the extent fields D22-D25, displacement 69-73, of each file label in the VTOC, showing the start and end address for the extent

Figure 4-2 shows one file on one volume with standard VTOC location (cylinder 0, track 0, record 4 to end of track) on an IBM 3330 Model 1 or 2.

1. Cylinder Distribution

Cyl.0	Cyl.1–403	Cyl.404–410
Volume Label(s) and VTOC	Data	Alternate Tracks

2. Cylinder 0 Track 0

Records: 0	1 – 2	3 ff	VTOC		
Track Descri-ptor	Zeros	Volume Label(s)	VTOC Label	Format-5 Label*	IBM Std File Label(s)

3. Extent Fields: File and VTOC Labels, Displacement 69 – 73

	Label Type	Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
VTOC Label	1	0	0	0	0	18
Std.File Label**	1	0	1	0	403	18

Notes:
*) The Format-5 label is not used by VSE.
**)The file label here specifies a single extent for data records which fills cylinders 1 to 403.

Figure 4-2. Disk Volume Layout: One File, VTOC in Standard Place

Figure 4-3 on page 4-5 shows one file on one volume with a VTOC of one track on cylinder 100, track 1 on an IBM 3330 Model 1 or 2.

1. Cylinder Distribution

Cyl.0 Track 0	Cyl.0 Track 1 to Cyl.99 End	Cyl.100 Track 1	Cyl.100 Track 2 to Cyl.403 End	Cylinders 404 - 410
Volume Label(s)	Data	VTOC	Data	Alternate Tracks

2. Cylinder 0 Track 0

Records: 0	1 - 2	3 ff	to End of Track
Track Descri-ptor	Zeros	Volume Label(s)	Unused

3. Cylinder 100 Track 1

Records: 0	VTOC		
Track Descri-ptor	VTOC Label	Format-5 Label*	IBM-Standard File Label(s)

4. Extent Fields: File and VTOC Labels, Displacement 69 - 73

	Label Type	Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
VTOC Label	1	0	100	1	100	1
Standard File Labels**	1	0	0	1	99	18
	1	1	100	2	403	18

Notes:
*) The Format-5 label is not used by VSE.
**)The file labels here specify two extents for data records.

Figure 4-3. Disk Volume Layout: One File, VTOC in Specified Place

Figure 4-4 on page 4-6 shows a disk file which fills two volumes and partly a third one.

1. Cylinder Distribution

	Cyl.0	Cyl.1–403	Cyl.404–410
Volumes 1 and 2	Volume Label(s) and VTOC	Data	Alternate Tracks
Volume 3		1 – 100: Data	

2. Cylinder 0 Track 0 on Each Volume

Records:	0	1 – 2	3 ff	VTOC		
	Track Descriptor	Zeros	Volume Label(s)	VTOC Label	Format-5 Label*	IBM Std File Label(s)

3. Extent Fields: File and VTOC Labels, Displacement 69 – 73

	Label Type	Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
VTOC Label: All Volumes	1	0	0	0	0	18
Std.File Labels:						
Volume 1 **	1	0	1	0	403	18
Volume 2	1	1	1	0	403	18
Volume 3	1	2	1	0	100	18

Notes:
*) The Format-5 label is not used by VSE.
**)The file labels here specify a single extent for each volume.

Figure 4-4. Disk Volume Layout: Three-Volume File, VTOCs in Standard Place

Figure 4-5 shows a multi-file disk volume with multi-extent disk files on a 3330 Model 1 or 2.

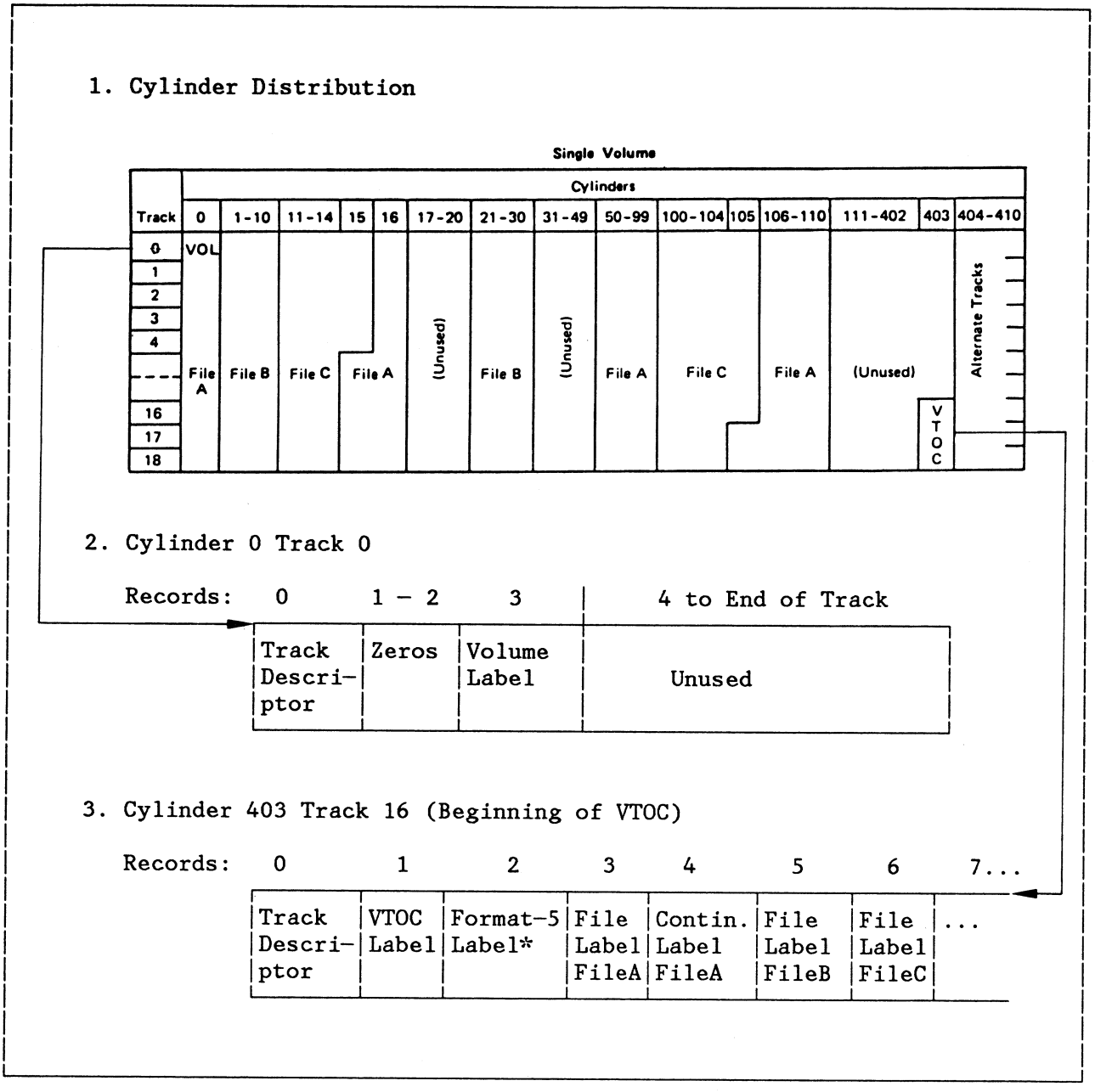

Figure 4-5 (Part 1 of 2). Disk Volume Layout: Multi-File Volume

4. Extent Fields: File and VTOC Labels, Displacement 69 - 73

File	Label Type	Extent Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
A File Labels :	1	0	0	1	0	18
	1	1	15	5	16	18
	1	2	50	0	99	18
A Contin.Label:	1	3	105	17	110	18
B File Labels :	1	0	1	0	10	18
	1	1	21	0	30	18
C File Labels :	1	0	11	0	15	4
	1	1	100	0	105	16
— VTOC Label :	1	0	403	16	403	18

Note:
*) The Format-5 label is not used by VSE.

Figure 4-5 (Part 2 of 2). Disk Volume Layout: Multi-File Volume

Figure 4-6 on page 4-9 shows disk files with user-standard labels on an IBM 2311.

1. Cylinder Distribution

Cyl.	Volume 1					Volume 2			
	0–49	50–159	160–198	199	200–202	0–150	151–198	199	200–202
	File A	File B	File A	V TOC	Alt. Tr.	File A	File C	V TOC	Alt. Tr.

2. Cylinder 0

Track	Cylinder 0 (for both volumes)
0	Zeros | VOL1 |
1	File A UHL1–UHL8, UTL0–UTL7
2	File A data
	.
	.
	.
9	File A data

3. First Cylinders of Extents:

Cylinder 50

Track	
0	File B UHL1–UHL8, UTL0–UTL7
1	File A data
	.
	.
9	File A data

Cylinder 151

File C data*
.
.
.
File C data

Cylinder 160

Track	
0	File A data
1	.
	.
	.
9	File A data

Note: *) File C has no user-standard labels specified.

Figure 4–6 (Part 1 of 2). Disk Volume Layout: Files with User-Standard Labels

4. VTOC on Cylinder 199

Volume 1

Track Descri-ptor	VTOC Label	Format-5 Label*	IBM-Standard File Labels		
			File A	File B	

Volume 2

Track Descri-ptor	VTOC Label	Format-5 Label*	IBM-Standard File Labels		
			File A	File C	

5. Extent Fields: File and VTOC Labels, Displacement 69 - 73

Volume 1:

	Label Type	Extent Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
A File Labels :	blank**	0	0	1	0	1
	1	1	0	2	49	9
	1	2	160	0	198	9
B File Labels :	blank**	0	50	0	50	0
	1	1	50	1	159	9
— VTOC Label :	1	0	199	0	199	9

Volume 2:

	Label Type	Extent Seq. Number	Start Address Cyl.	Start Address Tr.	End Address Cyl.	End Address Tr.
A File Labels :	blank**	0	0	1	0	1
	1	1	0	2	150	9
C File Label :	1	1	151	0	198	9
— VTOC Label :	1	0	199	0	199	9

Notes: *) The Format-5 Label is ignored by VSE.
**) Label type for user-standard label area.

Figure 4-6 (Part 2 of 2). Disk Volume Layout: Files with User-Standard Labels

Figure 4-7 shows a multi-volume VSAM layout with the relationship between the catalog, labels, data space, and files.

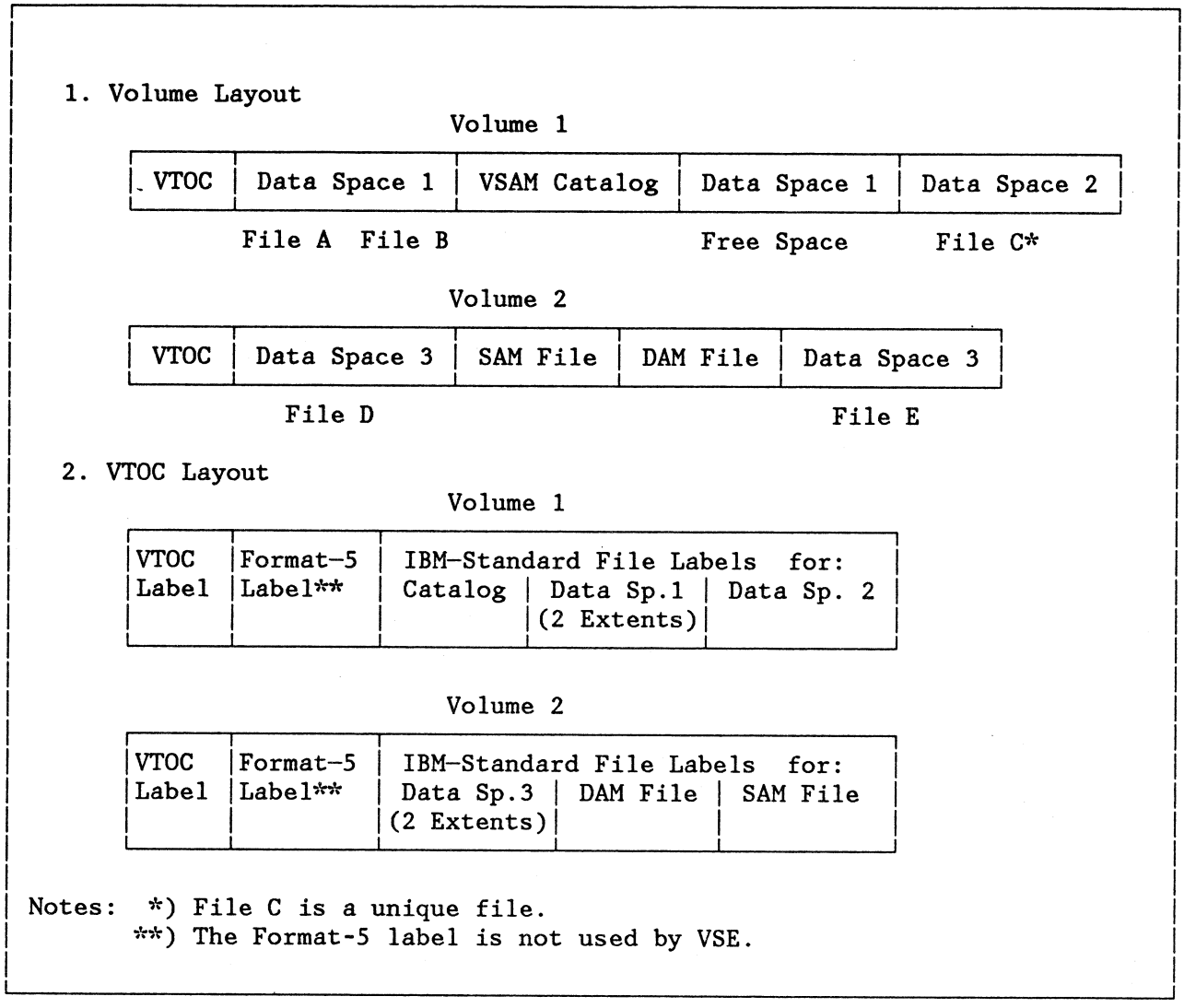

Figure 4-7. Disk Volume Layout With VSAM Data Spaces

DISKETTE VOLUME

Place of Diskette Labels

The diskette volume label is placed on track 0, sector 7.

All IBM-standard diskette file labels are stored together in the VTOC on track 0, sectors 8 to 26. The VTOC is formatted at initialization by the factory. Label records are written into the formatted spaces when each file is created.

Diskette Volume Layout Examples

The following layouts are possible:

One file on a single volume
One file on several volumes
Several files on one volume
Several files on several volumes

But there can be only one extent per file on one volume.

Files begin on track boundary. IOCS OPEN modules allocate space for the file on the track following the last unexpired or write-protected file on the diskette.

Track 0 of each volume contains the following:

Sectors 1 and 4 - Reserved
Sector 5 - Error Map
Sector 6 - Reserved
Sector 7 - Volume label
Sectors 8 to 26 - File labels

Files of data are written on tracks 1 - 73.

TAPE VOLUME

Place of Tape Labels

Tape volume labels are always the first record on the volume.

IBM-standard tape file labels are located immediately before and after the file, that is, a header label precedes each file and a trailer label follows each file.

User-standard labels on a tape always follow IBM-standard header and trailer labels. They are never written on a volume without IBM-standard labels.

Tape Volume Layout Examples

On tape, each label is followed by an interblock gap. Each label and each tape mark constitutes such a block, as opposed to data blocks which may consist of any number of records.

A tape mark separates a set of labels from the data records. Tape marks also separate multiple files on a volume and indicate the end of records on a volume. Two tape marks follow the end of the last file on a volume.

IOCS writes these tape marks automatically unless you specified TPMARK=NO in the DTF.

Figure 4-8 on page 4-13 to Figure 4-10 on page 4-14 show various tape volume layouts with different file labels.

1. Single-Volume File

Minimum Label Set

Volume Label	File Label	Tape Mark	Data Records	Tape Mark	File Label	Tape Mark	Tape Mark

Maximum Label Set

Volume Label	File Label	User Labels	T. M.	Data Records	T. M.	File Label	User Labels	T. M.	T. M.

2. Multi-Volume File

First and Following Volumes

Volume Label	File Label	Tape Mark	Data Records	Tape Mark	File Label	Tape Mark

Last Volume

Volume Label	File Label	Tape Mark	Data Records	Tape Mark	File Label	Tape Mark	Tape Mark

3. Multi-file Volume

Vol. Label	File Label	T. M.	FileA Data	T. M.	File Label	T. M.	File Label	T. M.	FileB Data	T. M	File Label	T. M.	T. M.

Figure 4-8. Tape Volumes With IBM- and User-Standard Labels

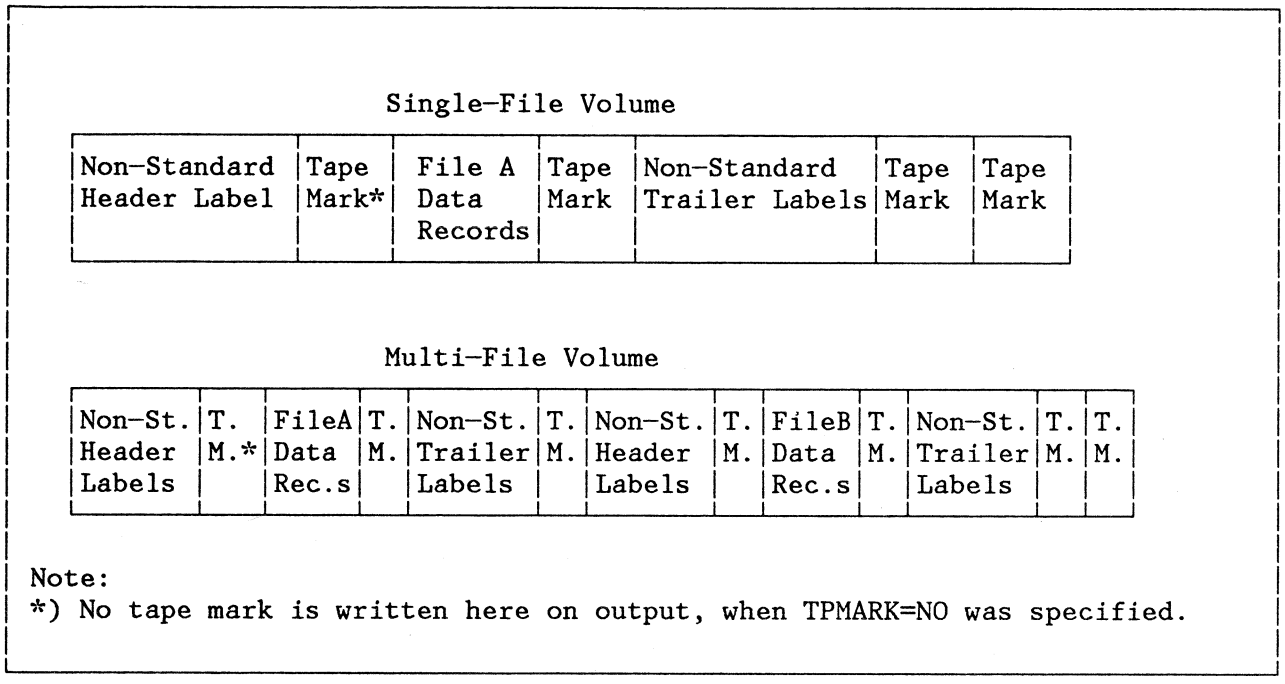

Figure 4-9. Tape Volumes With Non-Standard Labels

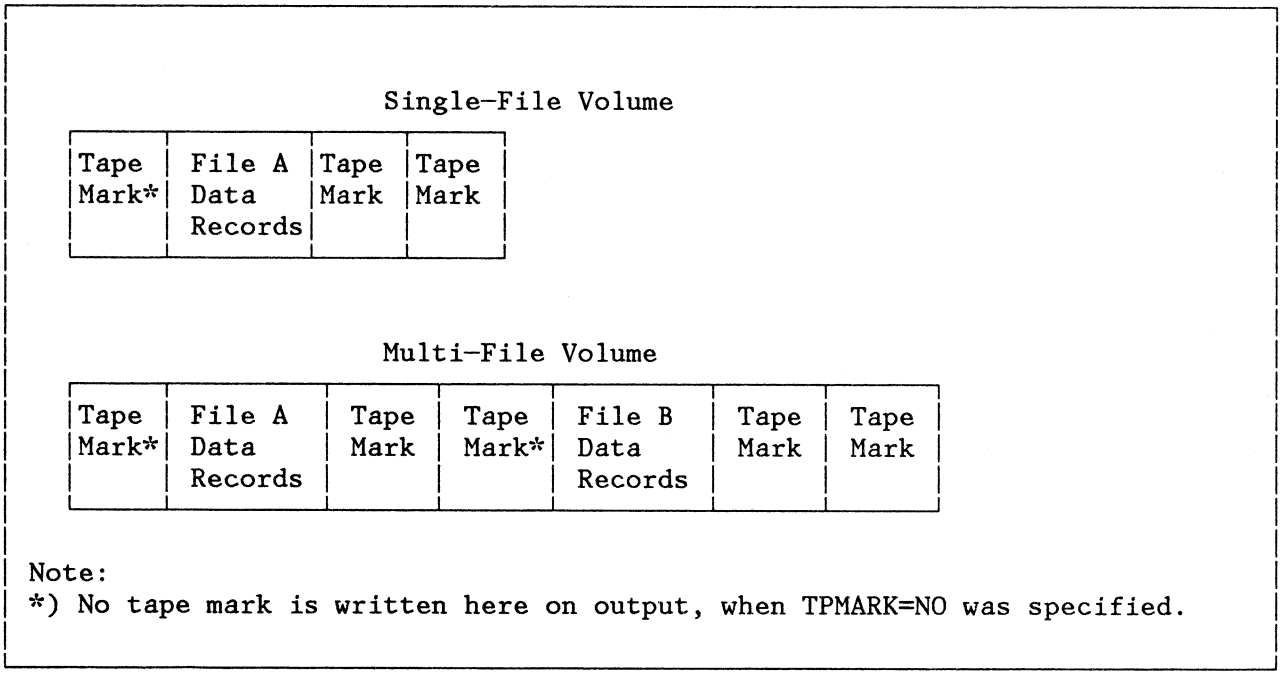

Figure 4-10. Tape Volume With Unlabeled Files

CHAPTER 5. DIAGNOSTIC TOOLS TO DISPLAY LABEL INFORMATION

VTOC LISTINGS

Disk VTOC listings can be obtained by replying CANCELV or DSPLYV to certain LIOCS messages or with the LVTOC program.

You enter the following job in order to get a listing of all labels in the VTOC with the content of selected fields.

```
// JOB jobname
// ASSGN SYS004,cuu*
// ASSGN SYS005,SYSLST
// EXEC LVTOC
```

*)Here you enter the address of the volume whose VTOC you want to display.

LABEL AREA DISPLAY

A listing of all label records in the label area with the contents of selected fields is printed out if you enter:

```
// JOB jobname
// EXEC LSERV
```

APPENDIX A. ISAM FILES

ISAM is not supported for FBA devices, the 3330-11, the 3350, or the 3375, except when they are operated in 3330-1 compatibility mode.

SPECIFICATION RULES FOR ISAM

You supply one DLBL statement for the file, and one EXTENT statement for each extent that the file will occupy on the volume. An EXTENT statement provides the starting address (called relative track) and the number of tracks which indirectly gives the ending address.

The prime data extent and the cylinder index extent are required. The master index and the independent overflow area are optional and, if chosen, need an EXTENT statement each.

The prime data area for a file must be only one extent per volume.

The master and cylinder indexes must be contained in one extent and on the same unit.

The extent sequence number must be in this order:

```
0:       Master index
1:       Cylinder index
2 etc.:  Prime data
last:    Independent overflow

or

0:       Master index
1:       Cylinder index
2:       Independent Overflow
3 etc.:  Prime Data
```

LABEL FORMATS FOR ISAM

In addition to a normal IBM-standard label, the system writes an extra file label for an ISAM file. This label was traditionally called format-2 label. It is not specified at all by the user but generated internally by the system only.

If a file occupies two or more volumes, ISAM writes this ISAM label only on the volume containing the cylinder index.

The statistics in several fields of the ISAM label can be used to determine whether you should reorganize the file:

D12 - Tag deletion count: The number of records you tag for deletion (not processed by ISAM)
D13 - Non-first overflow reference count: The number of times a READ macro causes a search of the overflow area(s) for a record that is the second or higher in an overflow chain
D16 - Prime record count: The number of logical records written in the organized file in the prime data area(s). ISAM accumulates this count during a LOAD operation
D27 - Number of independent overflow tracks: Number of tracks still available in the independent overflow area
D28 - Overflow record count: Number of records written in all the overflow areas for the file
D29 - Cylinder overflow area count: Number of cylinder overflow areas that have been filled

Volume Label

The volume label must be on cylinder 0, track 0, record 3 (except for 3350 operated in 3330-1 compatibility mode).

Prime Data

The prime data area on any volume must start on track 0 of any cylinder except cylinder 0.

Cylinder Overflow Area

Within the prime data area, certain tracks may be reserved for overflow records. These tracks are called cylinder overflow area and must be reserved by specifying the CYLOFL operand in the DTFIS macro.

Track Index

ISAM builds a separate track index for each cylinder used by the file. Track indexes are considered a part of the prime data area. Each track index starts on track 0 of the cylinder that it is indexing. It can occupy a full track, more than one track, or part of a track and share that partially used track with prime data records.

Master and Cylinder Indexes

The master index and the cylinder index are separate from the prime data area and from each other. However, ISAM builds them on one volume into one index area and the address of that combined area is in the IBM-standard label. Therefore, the areas for these indexes must be specified in the EXTENT statements side by side. They can be on the same volume with the prime data or on a separate volume. They even can be on a different type of device from the prime data area.

The cylinder index must immediately follow the master index and they must both be located on one or more successive cylinders.

Multi-Volume Files

For a multi-volume file, all extents (and therefore all volumes) are opened before any data records are written. Thus, all volumes that will contain the file must be on-line and ready at the same time.

For a multi-volume file, the prime data area of the first volume may start on any cylinder (except 0) and must extend through the last track on the volume. On all volumes after the first, the prime data area must start on cylinder 1, track 0 so that IOCS considers the prime data area as one continuous area. On all succeeding volumes (except the last) the prime data area must extend through the last track on the volume. On the last volume, it may end at the end of any cylinder. Thus all volumes, except the first and the last, are completely allotted to the prime data area from cylinder 1, track 0 through the last track on the last cylinder.

For a multi-volume file, the VTOC for the first volume must precede the prime data area. On the last volume, the VTOC may be on cylinder 0 or it may follow the prime data area. On all other volumes, the VTOC must be on cylinder 0.

The master and cylinder index and independent overflow area must be located before the prime data area on the first volume or after the prime data area on the last volume.

APPENDIX B. JOB CONTROL FOR DAM FILES

The following is an example of job control for a DAM file.

```
// JOB USE A DIRECT ACCESS FILE
// ASSGN SYS004,191
// ASSGN SYS005,192
// ASSGN SYS006,193
// DLBL DISK,'DA FILE.LOAD.ADD OR PROCESS',90/001,DA
// EXTENT SYS004,111111,1,0,1700,99
// EXTENT SYS005,123456,1,1,0010,1990
// EXTENT SYS006,123456,1,2,0010,1990
// EXEC USEDAM
```

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