SY26-3787-1

Systems

OS/VS DADSM Logic

VS1 Release 2
VS2 Release 1

IBM

Second Edition (December 1972)

This edition replaces the previous edition (numbered SY26-3787-0) and its technical newsletter (numbered SN26-8023) and makes them both obsolete.

This edition applies both to Release 2 of OS/VS1 and to Release 1 of OS/VS2, and to all subsequent releases of either system unless otherwise indicated in new editions or technical newsletters.

Significant system changes are summarized under "OS/VS1 Summary or Changes" or "OS/VS2 Summary of Changes" following the Preface. In addition, miscellaneous editorial and technical changes applicable to either or both of OS/VS1 and OS/VS2 have been made throughout the publication. Each technical change is marked by a vertical line to the left of the change.

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PREFACE

The information in this book is intended for programming support representatives and system programmers who maintain the direct-access device space management (DADSM) routines.

The manual has six sections:

- "Introduction," which presents general information about the DADSM routines, the control blocks used (data set control blocks), and the relationship of the data set control blocks (DSCBs) in the volume table of contents (VTOC).
- "Method of Operation," which describes in detail how each DADSM function does its work. Diagrams are used to relate the input and output of each function to the processes. The diagrams also help (1) teach the DADSM techniques to those who are not familiar with them and (2) provide a rapid means of refreshing your knowledge and understanding of DADSM.
- "Program Organization," which presents module-level flowcharts and module descriptions.
- "Directory," which briefly describes each of the DADSM routines, tells how each is called, and cross-references the module names that appear on the microfiche of the assembled source listings, the flowcharts, and method of operation diagrams.
- "Data Areas," which contains the control blocks, common work areas, and tables used by the DADSM routines.
- "Diagnostic Aids," which tells about some of the techniques that are used to find the source of DADSM problems. A cross-reference of the messages issued by the allocate routine is also included.

The book is designed to be used with listings of the assembled source code. For installations using VS2, the VSAM and RPS changes are provided for planning purposes only.

Prerequisite Reading

For general information about the operating system:

- *OS/VS1 Planning and Use Guide*, GC24-5090
- *OS/VS2 Planning and Use Guide*, GC28-0600

For reference information on space allocation:

- *OS/VS Data Management Services Guide*, GC26-3783

For reference and "how-to" information on allocating, extending, and releasing space:

- *OS/VS JCL Services*, GC28-0617
- *OS/VS JCL Reference*, GC28-0618

For reference and "how-to" information on deleting data sets (SCRATCH macro), renaming data sets (RENAME macro), obtaining access to DSCBs (OBTAIN macro), and protecting data sets (PROTECT macro):

- *OS/VS Data Management for System Programmers*, GC28-0631

For details about the System Management Facilities (SMF) records:

- *OS/VS System Management Facilities (SMF)*, GC35-0004

For reference and "how-to" information on using IEHLIST, IBCDASDI, and IEHDASDR:

- *OS/VS Utilities*, GC35-0005

For data area layouts of intercomponent control blocks (for example, the DEB, UCB, and SVRB):

- *OS/VS1 System Data Areas*, SY28-0605
- *OS/VS2 System Data Areas*, SY28-0606

For information concerning access method logic:

- *OS/VS SAM Logic*, SY26-3788
- *OS/VS ISAM Logic*, SY26-3786
- *OS/VS BDAM Logic*, SY26-3789
- *OS/VS Virtual Storage Access Method (VSAM) Logic*, SY26-3818

For information concerning VSAM utilities:

- *OS/VS VSAM Access Method Services*, GC35-0009

OS/VS1 SUMMARY OF CHANGES

Release 2

VSAM Support in DADSM

For installations using VS1, the addition of the virtual storage access method (VSAM) resulted in changes to the extend and obtain routines. VSAM data spaces are allocated and extended as if they were non-ISAM data sets. The VSAM catalog component manages space allocation within these data spaces, by suballocating the space to VSAM data sets. The obtain routine has been modified to read physical extent information for VSAM data sets from the VSAM catalog.

VSAM data spaces cannot reside on split cylinders nor can absolute-track allocation requests be made. Also VSAM data set protection is handled by the VSAM routines and not by VS.

This information is provided for planning purposes only until VSAM is released.

RPS Support Simplified

The implementation of DADSM support for direct-access devices with the rotational position sensing (RPS) feature has been simplified for this release of OS/VS1. The RPS set-up module, IGG029R1, has been eliminated. The function provided by IGG029R1 has been incorporated in the affected DADSM modules. Function and performance of devices with the RPS feature remains unchanged. For installations using OS/VS2, this information is provided for planning purposes only.

Changes for Partial Release

Control is passed to partial release from the close processing routines after writing the file mark on direct-access devices. Also partial release will write back the F1 DSCB on the VTOC and dequeue the VTOC which was previously done in the close and checkpoint/restart routines.

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INTRODUCTION

How To Use This Book

This book is written for system programmers who maintain and alter the design of the direct-access device space management (DADSM) routines. It is intended to provide information at two levels:

1. General information about the DADSM routines and their relationship to the operating system.
2. Specific reference information concerning how each of the routines operates, the control blocks they refer to and change.

The text of the "Introduction" and "Method of Operation" sections provide information at the first level for those who are not familiar with DADSM. The method of operation diagrams should be read in conjunction with the method of operation text by those readers who need information at the first level. Information about using the method of operation diagrams appears before the diagrams.

For readers who are familiar with DADSM processing, the method of operation diagrams are intended as quick reference and refresher material. The cross-references to module names and labels within these modules can be used with the "Program Organization" section to provide detailed reference material.

Terminology Notes

Non-ISAM data sets in this publication refers to SAM, PAM, DAM, and unspecified data sets (usage of EXCP).

VSAM data space is an expression used to describe the physical space on a volume that is maintained for VSAM data sets by the VSAM catalog routines. One or more VSAM data sets may reside in a VSAM data space. The VSAM catalog routines manage the extents allocated to a VSAM data space; the DADSM routines treat a request for a VSAM data space as if it were a request for a non-ISAM data set allocation.

Controlling Space on DASD Volumes

The DADSM routines control allocation of space on direct-access volumes through the volume table of contents (VTOC) of that volume. The VTOC is built when the volume is initialized by the direct-access storage device initialization (IEHDASDR or IBCDASDI) utility program. See "The Volume Table of Contents" for more information about the VTOC.

The VTOC is a collection of data set control blocks (DSCBs). The different types of DSCBs are:

- Free VTOC record DSCB—format-0
- Identifier DSCB—format-1
- Index DSCB—format-2
- Extension DSCB—format-3
- VTOC DSCB—format-4
- Free space DSCB—format-5
- Shared extent DSCB—format-6

Each DSCB corresponds either to a data set or data space currently residing on the volume, or to contiguous, unassigned tracks on the volume. DSCBs for data sets or data spaces are the data set labels, which contain characteristics of the data sets or data spaces and the tracks on which it resides. DSCBs for unassigned tracks indicate the location of unassigned, contiguous tracks.

A function of the direct-access device space management (DADSM) routines of data management assigns tracks on direct-access volumes. These routines are used primarily by job management routines to get space for output data sets. The DADSM routines are also used by data management routines to get or increase space for a data set or data space, and to release space no longer needed.

When space is needed on a volume, the DADSM routines check the VTOC for enough contiguous, available tracks to satisfy the request. If there are not enough contiguous tracks, the request is filled using up to five noncontiguous groups of free tracks. The appropriate DSCBs are modified to reflect the assignment of the tracks.

When space is released, the DADSM routines delete the DSCB of the deleted data set or data space, or modify the DSCB to free unused space in data sets that are kept. A free space DSCB is modified or built to indicate that the tracks containing the affected data set or data space can be reallocated.

DADSM Routines

DADSM's space management routines are concerned with:

- Allocating primary space, which involves finding space for new data sets or data spaces. This is the allocate routine.
- Allocating secondary space, which involves finding additional space for data sets or data spaces that have exceeded their original, primary allocations. This is the extend routine.
- Releasing space, which involves both deleting entire data sets or data spaces that are no longer needed, and freeing unused space in data sets that are being retained. These are the scratch and release routines.

DADSM's VTOC-related service routines are concerned with:

- Changing the names of data sets. This is the rename routine.
- Making control information available for examination. This is the obtain routine.
- Determining the space available on a direct-access volume. This is the LSPACE routine.
- Maintaining the system's password data set, which controls access to data sets and their associated control information. This is the protect routine.

In addition to these two major groups of routines, DADSM performs two minor services for the operating system:

- Provides information for the System Management Facilities (SMF) records.
- Coordinates required changes in channel programs for devices with the Rotational Position Sensing (RPS) feature.

Allocating and Releasing Space on Direct-Access Volumes

The DADSM routines which allocate space (allocate and extend), and release space (scratch and release), add, delete, and modify records of the VTOC. These records are called data set control blocks (DSCBs). To make space available to a new data set or to increase the space allocated to a data set, the appropriate DSCBs of the VTOC are searched for available space; the space is allocated to the data set by writing the description of the space, called an extent, to the data set's DSCB and deleting the extent from the space available for allocation. To release space allocated to a data set, the allocate operation is reversed: the released extent is deleted from the data set's DSCB and added to the DSCB that describes available space.

Components of the operating system use the DADSM routines to allocate and release space in response to data definition (DD) statements. For example, job management (scheduler) routines call the allocate routine to obtain space for a new data set. The end-of-volume component of Open/Close/End-of-Volume (O/C/EOV) calls the extend routine when an existing data set needs more space, and the CVOL function of catalog management calls the extend routine to allocate additional space for a data set. Similarly, job management routines use the scratch routine to delete data sets, and the catalog management routines use the scratch routine to delete a data set when uncataloging involves deleting a data set of a generation data group. Utility programs (IEHPROGM, IEHMOVE, and IEBCOPY) use the scratch and allocate routines. Scratch processing is also available to the system programmer through the SCRATCH macro instruction.

The virtual storage access method (VSAM) allocates and releases space using the DADSM allocate, extend, and scratch routines. These DADSM routines are called by the VSAM catalog routines to allocate, extend, and delete VSAM data spaces.

The release routine is called by the close routine of O/C/EOV to release unused space before a data set is closed and by the reposition-I/O routine of checkpoint/restart.

VTOC-Related Service Routines

Rename, obtain, LSPACE, and protect are routines used to manipulate control information on the VTOC; none allocates or releases space. System macro instructions can be used to invoke the rename, obtain, and protect routines (reference and "how-to" information for these macro instructions is provided in *OS/VS Data Management for System Programmers*).

The rename routine finds the DSCB for a specified data set and changes its name, after verifying that the requested name does not duplicate one already on the volume.

The obtain routine finds the DSCB for a specified data set, then reads the DSCB into virtual storage. The obtain routine is also used to get information about VSAM data sets from the VTOC and VSAM catalog.

The LSPACE routine is called either by a "DISPLAY SPACE" command from the operator or by the System Management Facilities (SMF). The available space on the volume is calculated by searching and totaling the extents of DSCBs indicating and finding the largest available extent on the VTOC. If SMF information is required, an SMF type-19 record is gathered and written to the SMF data set.

The protect routine adds, replaces, deletes, or lists entries in a password data set. When the security protection status of a data set changes, the protect routine also modifies the protection mode indicator field in the protected data set's DSCB.

The Volume Table of Contents

The volume table of contents (VTOC) is a data set consisting of 140-byte control blocks (DSCBs) that describe the contents of a direct-access storage device volume. The VTOC data set resides in a single extent (that is, it is a continuous data set); its address is located in the VOLVTOC field of the standard volume label (see Figure 1). There are seven different kinds of DSCBs. Each has a different purpose, and is, consequently, given a different name and format number. Figure 2 lists each DSCB and its use.

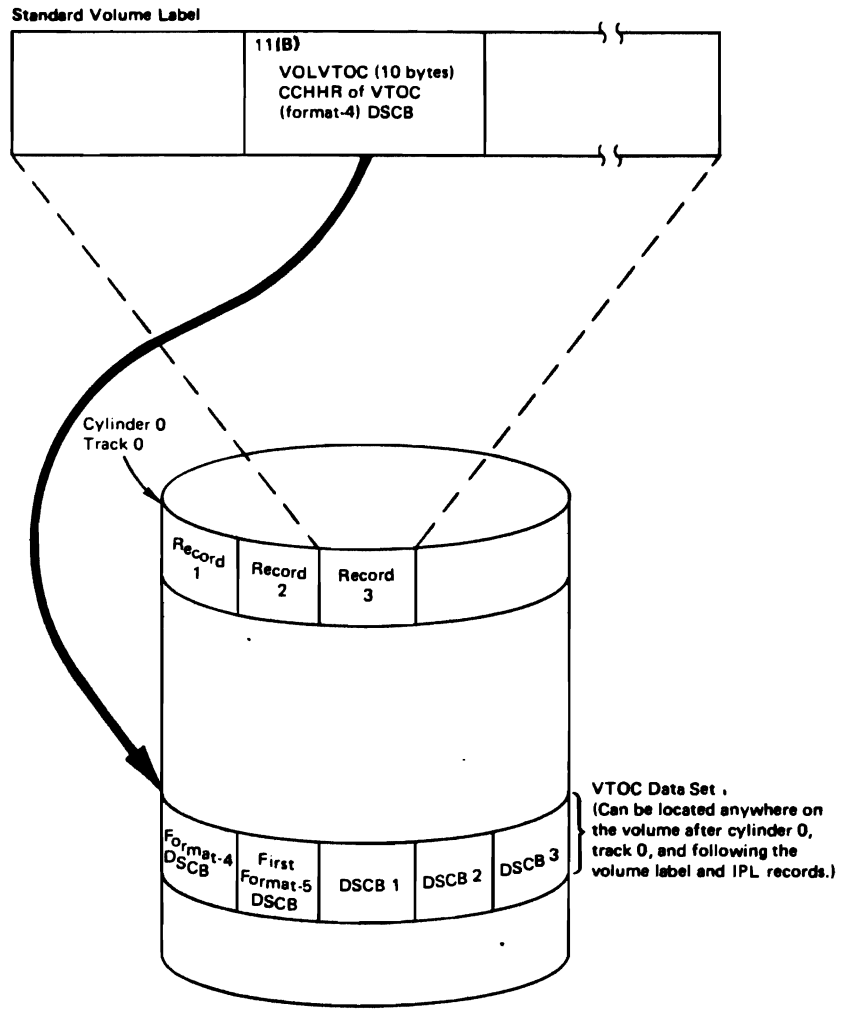


Figure 1. The volume table of contents (VTOC) and how it's located

The first record in every VTOC is the VTOC (format-4) DSCB that describes (1) the device that the volume resides on, (2) the attributes of the volume itself, and (3) the size and contents of the VTOC data set itself.

The format-4 DSCB is followed by a free-space (format-5) DSCB, which lists the extents on the volume that have not been allocated to a data set or VSAM data space. Each format-5 DSCB contains 26 extents. If there are more than 26 available extents on the volume, another format-5 DSCB will be built for every 26 extents. The format-5 DSCBs are chained using the last field of each format-5 DSCB. The third and subsequent DSCBs in the VTOC do not necessarily occupy continuous space, nor do they have any prescribed sequence.

DSCB Name	DSCB Format Number	Function	How Many	How Found
Identifier	1	Describes a data set or VSAM data space and the first three extents.	One for every data set or VSAM data space on the volume, except the VTOC.	Search on key equal to the data set name.
Index	2	Describes the indexes of an ISAM data set.	See"ISAM Data Set Allocation."	Chained from a format-1 DSCB the data set.
Extension	3	Describes the 4th through 16th extents of a data set or VSAM data space. (Data sets and VSAM data spaces are restricted to 16 extents per volume.)	One for each data set or VSAM data space on the volume that has more than three extents.	Chained from a format-2 or a format-1 DSCB for the data set or VSAM data space.
VTOC	4	Describes the extent and contents of the VTOC and volume and device characteristics.	One on each volume.	VOLVTOC field of the standard volume label contains its address. It is always the first record in the VTOC.
Free Space	5	Describes the space on a volume that has not been allocated to a data set or to VSAM (available space).	One for every 26 non-contiguous extents of available space on the volume.	The first format-5 DSCB on the volume is always the second record of the VTOC. If there is more than one format-5 DSCB, it will be chained from the first format-5 DSCB via the DS5PTRDS field of each format-5 DSCB.
Shared Extent	6	Describes the extents shared by two or more data sets (split-cylinder extents).	One for every 26 split-cylinder extents on the VTOC.	The address of the first format-6 DSCB is contained in the DS4F6PTR field of the format-4 DSCB. If there is more than one format-6 DSCB on the volume it will be chained to the first via the DS6PTRDS field of the format-6 DSCB.
Free VTOC Record	0	The unused records in the VTOC, which contain 140 bytes of binary zeros. To delete a DSCB from the VTOC, a format-0 DSCB is written over it.	One for every unused 140-byte record on the VTOC. The DS4DSREC field of the format-4 DSCB is a count of the number of format-0 DSCBs on the VTOC.	Search on key equal to X'00' (sometimes X'00000000').

Figure 2. A tabulation of data set control block (DSCB) format types and their use

A data set or VSAM data space is defined by one, two, or three DSCBs in the VTOC of each volume on which it resides. The number of DSCBs needed to define a data set or VSAM data space is determined by (1) the organization of the data set (ISAM data sets need a format-2 DSCB to describe the index) and (2) the number of extents the data set or VSAM data space occupies (a format-3 DSCB is needed to describe the fourth through the sixteenth extents). Figure 3 shows the general makeup of a VTOC and the DSCBs needed to define two types of data sets (ISAM and non-ISAM).

Data set A (in Figure 3) is an ISAM data set; three DSCBs, a format-1, format-2, and format-3, are required. Data sets B, C, and D could be SAM, PAM, or DAM data sets or VSAM data spaces). Data set B has more than three extents and therefore requires both a format-1 and a format-3 DSCB.

Data sets C and D have three or fewer extents and only need a format-1

DSCB. The format-6 DSCB, pointed to by the format-4 DSCB, is used to keep track of the extents shared by two or more data sets (split-cylinder data sets). For example, if data sets C and D share an extent made up of one or more cylinders, this extent would be described in the format-6 DSCB.

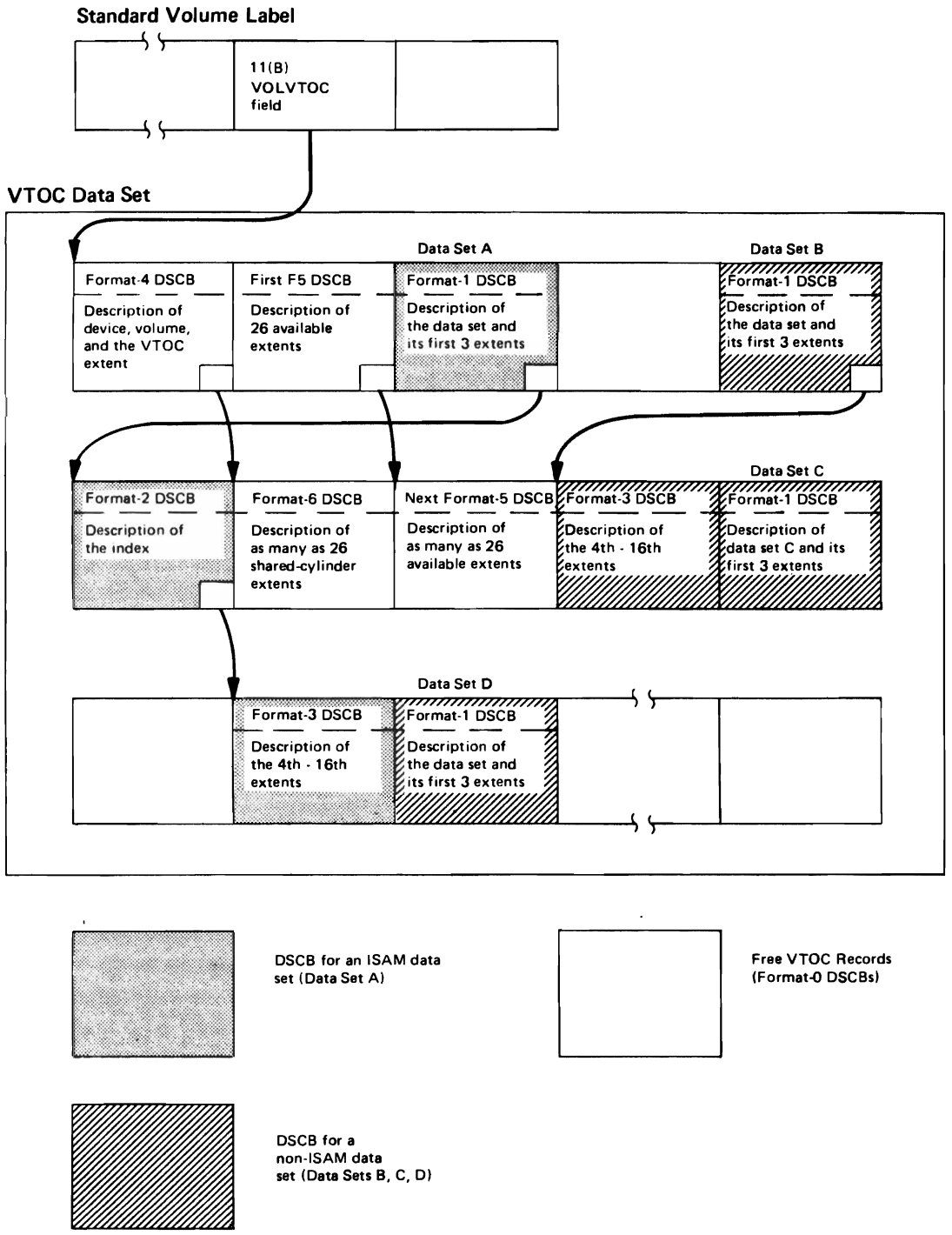


Figure 3. The contents of the VTOC—DSCBs describing data sets

To prepare a volume for use (to initialize it), the IBCDASDI or IEHDASDR utility is used. One of the things these utilities do is build the VTOC. After initialization, this VTOC will contain a format-4 DSCB and a format-5 DSCB. The format-5 DSCB will contain an extent entry for all the free space on the volume; the initial number of extents in the format-5 DSCB is one or two, depending on where the VTOC is located on the volume. If the VTOC is located somewhere other than at the beginning or end of the volume, two extent entries will be needed to describe the free space that precedes and follows it.

Size of the Volume Table of Contents

The number of DSCBs in the VTOC determines the number of data sets or VSAM data spaces that can reside on a volume and is therefore essential information for the DADSM routines that allocate and release space.

The types of direct-access storage devices supported by this operating system and the number of DSCBs that will fit on a single track of each type, are:

Direct-Access Device Type	Number of DSCBs Per Track
IBM 2305-1 Fixed Head Storage (OS/VS2 only)	18/track
IBM 2305-2 Fixed Head Storage	34/track
IBM 2314 Direct-Access Storage Facility	25/track
IBM 2319 Disk Storage	25/track
IBM 3330 Disk Storage	39/track
IBM 3333 Disk Storage	39/track

The DS4DSREC field of the format-4 DSCB contains a count of the number of free VTOC records (format-0 DSCBs) in the VTOC. This count is checked before each allocation. There must be enough free VTOC records for all the DSCBs required to define the data set or VSAM data space, as well as an extent or a combination of extents large enough to contain the data set or VSAM data space. The number of DSCBs needed to define a single data set or VSAM data space can be one, two, or three, depending on (1) whether it is an ISAM data set (a format-2 may be required) and (2) whether the data set has more than three extents (a format-3 DSCB is needed to list the fourth through the sixteenth extent). In addition, the DADSM allocate routine makes sure there is room for an additional format-5 (and format-6 DSCB for split cylinder allocation) in case it is necessary to create one of each during the allocation.

Volume Table of Contents Integrity

In an operating system with only one CPU, two or more tasks may concurrently require access to the same VTOC for the purpose of reading or updating (that is, adding, deleting, or modifying DSCBs) that VTOC. If more than one CPU has access to the same device or devices, it becomes necessary to protect VTOCs from being accessed while the DADSM routines are in process.

To be sure that a VTOC is not changed while the DADSM routines are in process, the DADSM routines issue RESERVE, ENQ, and DEQ macro instructions. These macro instructions provide exclusive control of the VTOC for the task issuing the macro instruction. The RESERVE macro instruction is needed for systems in which more than one CPU is processing concurrently using the same data sets. These macro instructions provide exclusive control of the VTOC for the task issuing the macro instruction. Depending on the macro instruction, the "set-must-complete" option or the "release-must-complete" option may be specified in an operand of the macro instruction. The allocate, extend, scratch, rename, release, LSPACE and protect routines of DADSM issue these macro instructions. Of these routines, only allocate, scratch, and release use SMC=STEP rather than SMC=SYSTEM in the ENQ and RESERVE macros, and RMC=STEP in the DEQ macro. The extend routine uses SMC=STEP if the task is not already in "step-must-complete" mode.

The VSAM catalog routines modify the DS4AMCAT and DS4AMTIM fields of the VTOC (format-4) DSCB. These routines also issue the RESERVE, ENQ, and DEQ macro instructions to maintain exclusive control while making modifications.

Note: When operating in an environment in which direct-access storage devices are not shared between systems, the RESERVE macro instruction defaults to (acts as) an ENQ macro instruction.

If a system fails or a permanent I/O error occurs during allocation of space or during a routine that updates the VTOC, the VTOC will probably be in error. To make sure the error is recorded, the DADSM routines use the DADSM interrupt-recording facility (DIRF). DIRF processing involves turning on a bit in the VTOC at entry to the DADSM function, and turning it off again at exit from that function (see "DADSM Interrupt-Recording Facility" in the "Diagnostic Aids" section).

Extent Format Conversion

All allocations and releasing of space are made in a number of tracks; therefore, each of the formats below must be converted to the relative-track-address format used by DADSM, called the RTA1/RTA2 format. RTA1 is the relative track address of the first track of the extent. RTA2 is the relative track address of the last track plus one. The last track address is increased by one during the conversion process to simplify the calculations performed by the DADSM allocation and space releasing routines.

The three extent formats used are:

DSCB Format	Extent Format	Meaning
1, 3, and 4	CCHH/CCHH	The absolute cylinder (CC) and head address (HH) of the first and last track of the data set
5 (free space)	XXYYZ	The first track of the available area (XX), the number of full cylinders (YY) in the available area, and the number of tracks (Z) in addition to the full cylinders
6 (shared cylinders)	XXYYZ	The first track of the available area (XX), and the number of full cylinders (YY) in the available area; the Z is a count of the number of data sets sharing the cylinders

When an allocation or space release has been completed by the DADSM routines, the extents in RTA1/RTA2 format must again be converted to the appropriate form (XXYYZ for format-5 and format-6 DSCBs or CCHH/CCHH for format-1, and format-3 DSCBs). Two resident routines are used to make the conversion, IECPCNVT to convert from CCHH/CCHH to RTA1/RTA2 and IECPRLTV to reverse the conversion. The conversions from XXYYZ to RTA1/RTA2 (and from RTA1/RTA2 to XXYYZ) for both the format-5 and format-6 are done by the DADSM allocate and space releasing routines.

Support for System Management Facilities (SMF)

Information for SMF is provided by four DADSM routines: release, scratch, rename, and LSPACE. The record type built by three of these routines follows:

DADSM Routine	SMF Record Type
Scratch	17
Rename	18
LSPACE	19

The contents of these record types is presented in *OS/VS System Management Facilities (SMF)*. The logic employed by the scratch routine to determine whether a record is to be built and written to the SMF file is shown in Figure 4.

The LSPACE routine provides SMF information when an LSPACE request is issued by SMF and when end-of-volume, rename, or scratch causes a volume to be demounted. In addition, release provides SMF information by adding the amount of space released with each request to the TCTIOT table for subsequent use in building SMF record types 14 and 15.

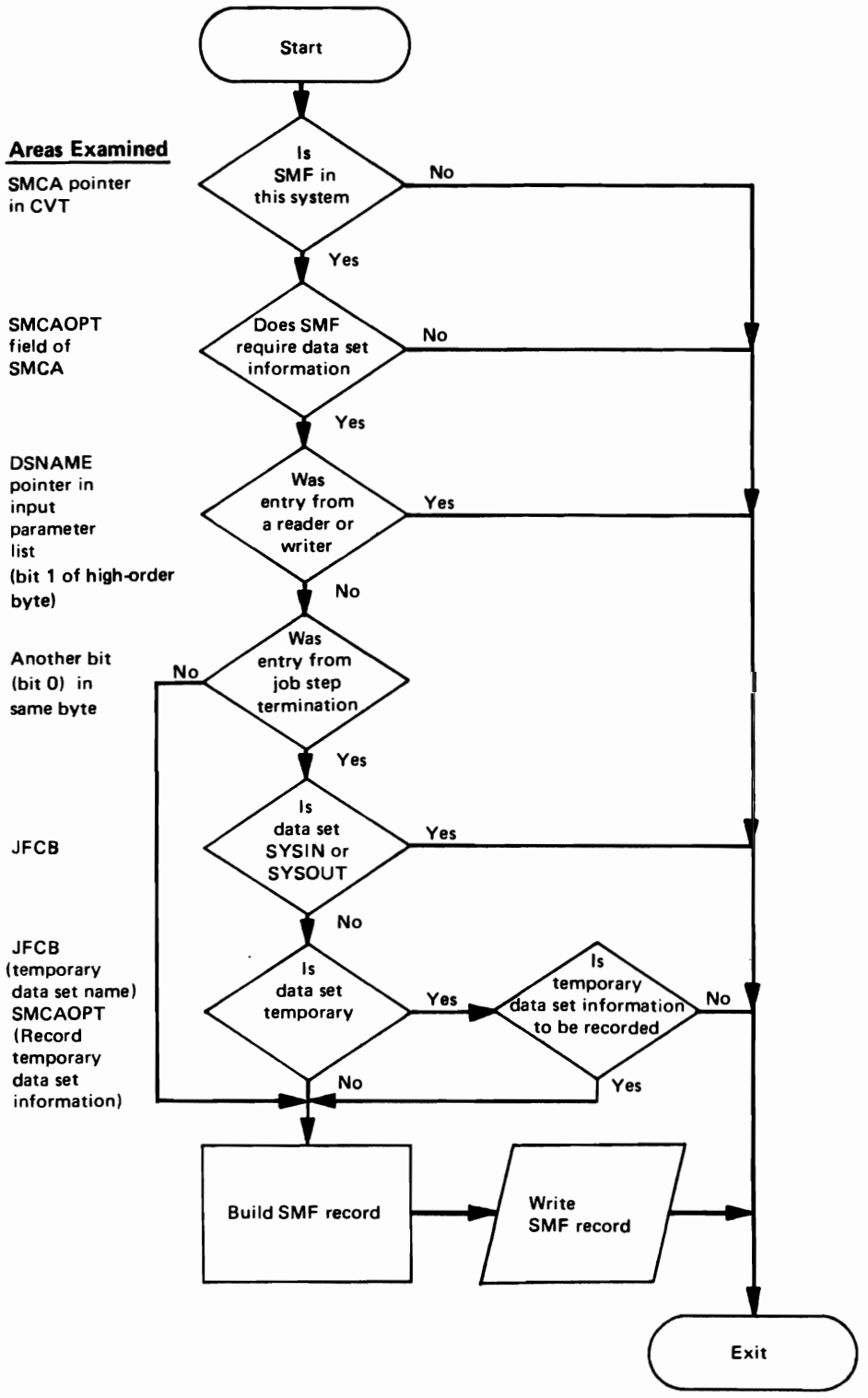


Figure 4. Logic used to determine whether SMF records are needed (scratch routine)

Support for Rotational Position Sensing (RPS)

Devices with the RPS feature (the 3330 and the 2305) require channel programs with the set-sector (SS) command for channel operations. The DADSM routines support RPS device channel programs through the following routines:

1. The obtain and LSPACE routines test for RPS devices, and, if present, modify their channel programs accordingly (this is a simple modification because obtain and LSPACE only read from a volume; they do not write).
2. The allocate, extend, release, and scratch routines get a 128-byte work area, build a new appendage vector table, and load a module (IGG019EK) to insert the set-sector command and convert its value for RPS devices.

The RPS channel program appendage module (IGG019EK) is loaded by the DADSM routines when a device with the RPS feature is to be read from or written to. IGG019EK builds a channel program segment and modifies the channel program in the DADSM work area to perform channel operations for devices with the RPS feature.

IGG019EK has four entry points; the routines associated with these entry points perform the following functions:

- SIO (start I/O) routine—IOS (I/O supervisor) enters this routine before performing an SIO operation. The SIO routine inserts set-sector (SS) commands within the DADSM channel program and then calls a system resident sector-convert routine that establishes the sector values. The SIO routine also establishes pointer references to the other entry points in IGG019EK and then returns control to IOS.
- PGFIX (page fix) routine—IOS enters this routine before performing an SIO operation. The PGFIX routine returns the beginning and ending addresses of the RPS work area to IOS so that IOS can fix this page before the SIO routine is entered.
- XE (abnormal end) routine—IOS enters this routine (1) before attempting error correction when an I/O error is detected and (2) when it has been established that the I/O error is permanent. If the XE routine determines that error correction has not been attempted, it returns control to IOS. If the XE routine determines that a permanent I/O error exists, control is passed to the CE (channel end) routine in IGG019EK.
- CE (channel end) routine—IOS enters the CE routine upon normal completion of an I/O request, and the XE routine enters the CE routine if a permanent I/O error has been established. In either case, the CE routine restores the channel program in the DADSM work area to its non-RPS equivalent and returns control to IOS.

METHOD OF OPERATION

This section describes the functions of the DADSM routines. Diagram 1 is an overview of the other diagrams.

The Allocate Routine

The allocate routine finds unused space on direct-access storage volumes and makes that space available for new data sets. This routine creates a format-1 DSCB (data set control block) for each new data set, and in the format-1 DSCB, writes descriptions of the direct-access storage areas (these descriptions are called extents). Available extents are obtained by searching the format-5 DSCBs on the VTOC. Three sets of routines are employed for making space allocations. Two of the sets of routines actually handle allocation of space (ISAM data set allocation routines and non-ISAM data set allocation routines); the third set converts the VTOC of volumes on which allocations have been made under the Disk Operating System (DOS) to standard format before making an allocation. The non-ISAM allocate routine handles the allocation of VSAM data spaces the same as allocation of non-ISAM data sets. All three sets of routines share the initialization procedures.

These initialization procedures include establishing work areas, building control blocks, and initializing channel programs to read from and write to the VTOC, enqueuing the VTOC using a RESERVE macro instruction, and searching the VTOC for a data set of the same name as the data set requesting allocation. DADSM Interrupt Recording Facility (DIRF) processing is also performed as a part of the initialization procedures (see "DADSM Interrupt Recording Facility" in the "Diagnostic Aids" section). These functions are diagrammed only once for all three sets of routines.

Next it must be determined whether the data set being allocated is on a device on which the last allocation was made by the Disk Operation System (DOS). If it was, the VTOC must be converted to standard format before the allocation is made. Control is passed to the DOS VTOC conversion routines and control will be returned to the allocate routine if the VTOC is converted without encountering any errors. Upon return, the channel program to search the VTOC for a data set of the same name as the data set requesting allocation is reinitiated.

The allocate routine recieves control via an SVC 32. As input, it receives (1) a JFCB or a partial format-1 DSCB and (2) the address of the unit control block (UCB) for the device on which the data set is to be allocated. Requests for ISAM data set allocations also pass a pointer to a data definition (DD) statement entry in the task input-output table (TIOT).

Non-ISAM Data Set or VSAM Data Space Allocation

When initialization procedures have been completed and it has been verified that the non-ISAM data set or VSAM data space allocation request is not for a data set name already on the volume, this routine converts the space requested for data sets directories for partitioned data sets, and VSAM data spaces specified in cylinders and average records (block length) to the equivalent number of tracks.

Finding Free Space on the Volume

The non-ISAM allocate routine reads in the first free space (format-5) DSCB on the VTOC of the specified volume, converts its extent to the RTA-plus-the-number-of-tracks format and searches the extents for an extent with the number of tracks the new data set or VSAM data space requires. If the space is not found in the first format-5

DSCB, the search is continued through the balance of the format-5 DSCBs on the volume until it is found or until the format-5 DSCBs are exhausted. If the volume does not contain enough available space for the data set or VSAM data space, control is returned to the calling routine, which may then specify another volume to be used for the data set or VSAM data space, unless a particular volume serial number has been specified by the user.

When the space is found, the non-ISAM allocate routine builds a table (see the extent table in the "Data Areas" section) of the format-5 extents used to fill the request. The extent table can have as many as five entries. Several different methods of building the extent table are used depending on the options specified:

- *User Labels*—If user labels are specified, the user-label track (or tracks, in the case of split-cylinder requests with user labels) is allocated from the smallest extent in the first format-5 DSCB with enough space. When cylinder requests specify user labels, the user label extent will be taken from tracks that cannot be used to fill cylinder requests. The user label extent is the first entry in the extent table; when the extent table entry has been made, the format-5 DSCB is updated, so that tracks assigned to user labels are no longer available for allocation.
- *Zero Quantity Requests*—For zero-quantity requests (requests that specify no space to be allocated), a format-1 DSCB is built, without extent entries, and written to the VTOC. If user labels are specified in a zero-quantity request, the format-1 DSCB will contain one extent, the user-label extent. Extent entries can be added later to the format-1 DSCB via secondary allocation (see the extend routine).
- *Absolute Track Requests*—For absolute-track allocation requests (requests indicating that the data set is to start at a specific track), the extent containing the specified track is located in the format-5 DSCB. If this extent contains enough space to fill the request, following the specific track, it is entered in the extent table. Absolute-track allocation is the Disk Operating System (DOS) allocation method. It is supported in this operating system to ensure compatibility.
- *Suballocation Requests*—Suballocation requests are requests to allocate space from a data set that was previously defined, in the same job. Instead of searching the format-5 DSCBs for available space, the identifier (format-1) DSCB for the data set from which the suballocation is to be made is located in the VTOC. The space to be suballocated is subtracted from the beginning of the extent of the previously defined data set and entered in a new format-1 DSCB along with information from the job file control block (JFCB).

  The VTOC is enqueued and the new format-1 DSCB is written. The old, modified format-1 DSCB is also written back to the VTOC unless all of its extent was suballocated; if it has all been suballocated, the new format-1 DSCB is written over it to erase it from the VTOC.

  Note that data sets to be suballocated are allowed only a single extent (plus a user-label track extent, if specified); that is, both the old and new format-1 DSCBs created by suballocation will have only one extent (plus a user-label extent).
- *Cylinder and Track Allocation*—For normal, cylinder or track allocation requests, the request type (MXIG, CONTIG, ALX, or no-option-specified, as defined in Figure 5) is determined, and the extents required to fill the request are entered in the extent table.
- *Split-Cylinder Allocation*—The extent table is built for split-cylinder requests (two or more data sets sharing a cylinder or cylinders) as if the request were for a single, contiguous area. The number of tracks to be allocated to each data set sharing the cylinders is determined from the JFCBSPTN field of the JFCB (job file control block) for the data set. Split-cylinder requests require as input two or more chained JFCBs.

Option	Allocation Method
MXIG	Allocate all the storage space in the single largest area on the volume, if that area is equal to or larger than the request.
CONTIG	Allocate the exact amount of space requested from one area on the volume that is equal to or larger than the request.
ALX	Build a list of as many as five areas of available storage that are the largest on the volume. If a user label has been requested, a list of as many as four areas is built. Allocate all the space in as many of the areas found that are equal to or larger than the request.
No Option Specified (blank)	Build a list of as many as five areas that are smaller than but closest in size to the request. If a user label has been requested, a list of as many as four areas is built. If, while building the list, there is found an area equal to the request, allocate that area and disregard the list. If no areas are found equal to the request but areas are found larger than the request, allocate the amount of space requested from the area that is larger than but closest in size to the request, and disregard the list. If all available areas are smaller than the request, and if enough space is available in the areas in the list, allocate the exact amount of the request from among the largest areas found.

Note: For an ISAM data set only the CONTIG and the blank options are valid.

Figure 5. DASD space request options and their associated initial allocation methods

Split-cylinder data sets on drum devices are handled differently, because these data sets do not share cylinders. They are allocated as continuous tracks.

Building Format-1 and Format-3 DSCBs

When enough available space has been found on a volume and the extent table created, identifier (format-1) and extension (format-3) DSCBs are built to describe the newly allocated data set or VSAM data space. Format-3 DSCBs are required only when more than three extents are needed to fill the space request. For zero-quantity requests, only a format-1 DSCB is created; no extent entries are included, unless user labels were specified, making a user-label extent necessary. Split-cylinder data sets pose the additional problem of keeping track of the number of data sets sharing the cylinder or cylinders. This user count is kept in a shared extent (format-6) DSCB, unless the device on which the data set resides is a drum, to which the cylinder concept does not apply and therefore does not require format-6 DSCBs. There is an extent entry in a format-6 DSCB for each shared cylinder extent on the volume. The format-6 DSCB has the same content as the format-5 DSCB, except that the Z of the XXYYZ extent entry is a count of the number of data sets sharing the cylinder(s). The count is used by the scratch routine to determine when a shared extent can be released (see "DSCB Deletion and Split-Cylinder Processing" in the discussion of the scratch function).

Updating the Free Space (Format-5) and VTOC (Format-4) DSCBs

To complete the allocation of a non-ISAM data set or VSAM data space, it is necessary to update the format-5 and format-4 DSCBs to define the new status of the volume.

Updating Format-5 DSCBs: If an entire continuous area has been allocated to the data set or VSAM data space, the format-5 extent entry for that area is completely removed by moving forward by one location all subsequent format-5 extent entries in that DSCB and in other format-5 DSCBs that may be chained to it. If only part of an available area is allocated, the space is taken from the beginning of the area, and the track following the allocated area becomes the new lower boundary of the available area.

If the space to be allocated begins at a specified track address or on a cylinder boundary, the allocation may be made from within an available extent. In that case, the allocation must create a new extent in the format-5, and the spaces preceding and following the allocated space will become two areas identified in two format-5 extents. This causes all

subsequent format-5 extents in that and any chained format-5 DSCBs to be moved back one location.

Updating the VTOC (format-4) DSCB: Two fields of the format-4 DSCB may be updated with each allocation. If a DSCB has been added or removed (that is, if a free VTOC record (format-0 DSCB) has been written over a format-5), the count of the number of format-0 DSCBs (the DS4DSREC field of the format-4 DSCB) must be updated. This count is referred to as the *hole count*. The address of the last format-1 DSCB on the VTOC (the DS4HPCHR field of the format-4 DSCB) will have to be changed every time a new format-1 is added to the end of the VTOC. This address is referred to as the *high-water mark* and is used to terminate channel programs that search the VTOC. For VSAM data spaces, VSAM catalog management updates the DS4AMTIM and DS4AMCAT fields of the format-4 DSCB. When the format-4 DSCB has been updated, this routine frees work areas and dequeues from the VTOC. If a partitioned data set has been allocated, control is passed to the CVOL (control volume) processing routine of catalog management to process the directory. For requests without directories, register 15 is loaded with a zero (successful) completion code and control is returned to the calling routine (that is, the scheduler or the utility program).

Handling Error Conditions: When error conditions are encountered in the non-ISAM allocate routines, they load register 8 with the error code and XCTL to the error-handling routine, which frees work areas, dequeues from the VTOC, loads the error code in register 15 and returns to the calling routine.

ISAM Data Set Allocation

The ISAM data set allocation routine shares the initialization procedures with the non-ISAM data set allocation routine. For an ISAM data set, the procedures include establishing and initializing work areas, building control blocks, reading the format-4 DSCB and the first free space (format-5) DSCB into the work area, and searching the VTOC for a format-1 DSCB with the same name as the data set requesting allocation.

Request Validation

The ISAM allocation routine receives control from the allocate initialization procedures. When control is received the following checks are made:

1. If a duplicate-name DSCB is indicated, the validity of the request must be verified. The duplicate-name request is valid (1) if it is the second or third of a sequence of two or three concatenated DD (data definition) statements that make up the ISAM allocation request and (2) if the same UCB is being used.
2. If a multiple DD statement request is being processed (that is, two or three area types—prime, index, or overflow), the first request must indicate a DD name and the second and subsequent requests must be concatenated with the first (that is, must not have DD names). This information is checked in the DD statement entries in the TIOT.
3. The space request must be in an integral number of cylinders or a number of tracks equivalent to an integral number of cylinders. (All space requests for a given data set must be specified in the same way, either as cylinders or absolute tracks.)
4. Cylinder allocations must be specified as either SPACE = CONTIG or unspecified (no SPACE designation) on the DD statement.
5. Only one of each type of area (index, prime, overflow) is allowed for a data set; they must appear in that order in the input stream.

If any of these conditions is not met, the error exit is taken (see "Error Handling").

If this is the first DD statement in the allocation request, the request validation routines set up the TIOT entry for this and subsequent DD statement entries.

Free Space (Format-5) DSCB Search

Before searching the format-5 DSCBs on the VTOC, the free-space-search routine makes sure there is enough room on the VTOC to write four new DSCBs (format-1, format-2, format-3, and format-5). It is possible that one of each of these DSCBs can be created during a single allocation.

The format-5 DSCB search routine searches all the format-5 DSCBs on a given volume to find enough space to satisfy the request.

The search involves comparing each format-5 DSCB extent in sequence with the requested quantity, which can be specified either as (1) an absolute track on a cylinder boundary and a number of tracks that ends on a cylinder boundary or (2) merely a number of contiguous or non-contiguous cylinders.

For absolute track requests, each extent of the format-5 DSCB is examined to see if the absolute track is in the extent and whether the extent is big enough to fill the request.

Searches for contiguous cylinders look for an extent, in the format-5 DSCB, equal in size to the request. Until an extent of equal size is found, the extent that is larger, but closest in size to the requested space, is saved. As each subsequent larger extent is encountered, its size is compared to the size of the extent that has been saved. The result of the comparison is always to save the smallest extent (of all these larger extents).

If, during the search of the format-5 blocks, an extent exactly equal in size to the space requested is found, that extent is allocated as the requested space and the search ends. Otherwise, the search terminates after all format-5 DSCBs have been searched. If an extent larger than the request has not been found, an error exit is made. If a larger extent has been saved, the requested space is allocated from this extent. This method improves the allocation process in that space is taken from the smallest available extent that will fulfill the request, leaving larger extents intact to fill other requests.

Requests specifying that the allocated cylinders need not be contiguous are handled in the following manner. As the search for space progresses, a five-entry pushdown list is built and maintained. This list contains the largest extents encountered in the search that are not large enough to contain the total request. If an extent larger than the requested space is encountered, the pushdown list is abandoned, and the larger extent is saved. The search is then continued as described for the continuous cylinder requests.

The space requested is allocated either from the extent saved during the search as in the case of a contiguous cylinder request or from entries in the pushdown list. If the pushdown list is used, from two to five of the largest entries in the list are used as needed.

If the request cannot be fulfilled by using any of the preceding methods, an error exit is taken.

When enough space has been found to satisfy the request, a table of extents (the extent table) is built containing at least one and no more than five extents in the form RTA1/RTA2. The extents are entered in ascending relative-track-address order.

Building Format-1, Format-2, and Format-3 DSCBs

Three different methods are used to build and write the format-1, format-2, and format-3 DSCBs for ISAM data sets, depending on (1) whether format-1 and format-2 DSCBs have been created during a previous pass on this volume and (2) whether an embedded index has been requested.

Creating Format-1 DSCBs: If there are no format-1 DSCBs on the volume for this data

set, this routine builds a new format-1 DSCB using the extent table and the JFCB. If an embedded index has been requested, control is passed to the embedded index processing routine, described below, before the format-1 extents have been added. This format-1 build routine also builds a format-3 DSCB if more than three extents are required to satisfy the space request.

Figure 6 shows the conditions under which a format-2 DSCB will be built.

Format-1 DSCB Updating: When a format-1 DSCB for the data set being allocated already exists on the current volume, control is immediately passed to the format-1 DSCB updating routine. There will be a format-1 DSCB in virtual storage when this routine receives control; the format-1 DSCB will have been read in by the allocate initialization procedure or by the multivolume processing routine. Using the extent table as input, this routine adds extents to the identifier (format-1) DSCB or the extension (format-3) DSCB if there are extent locations left in these blocks. One format-3 DSCB will be built if more than three extent locations are needed. The RTA1/RTA2 entries in the extent table are first converted to CCHH/CCHH format using the resident conversion routine.

If an extension DSCB (format-3) is added and there is already an index DSCB (format-2) on the VTOC, a pointer to the new format-3 must be added to the format-2. The last DSCB to be written to the VTOC is the format-1. It is delayed because a pointer to a new format-2 and/or format-3 may have to be added, and because the field

The Complete Request for the Data Set (Given in terms of DD statement parameters)	Current Request (Given in terms of DD statement parameters)	Format-2 DSCB Needs to be Built	Comments
INDEX, PRIME, OVERFLOW	INDEX	Yes	
	PRIME or OVERFLOW (on different volume from INDEX)	No	A format-2 DSCB was built during previous (index) pass. Both the index area and the format-2 DSCB will be on a different volume from the one currently being searched. If the same volume had been specified for both the INDEX request and the current request, a valid duplicate-name format-1 DSCB would have been encountered.
INDEX, PRIME	INDEX	Yes	
	PRIME (on different volume from INDEX)	No	A format-2 DSCB was built during previous (index) pass. If the same volume had been specified, a valid duplicate-name format-1 DSCB would have been encountered.
PRIME, OVERFLOW	PRIME	Yes	For this type of request, an open executor module of the indexed sequential access method (ISAM) will construct an index in the overflow area.
	OVERFLOW	No	A format-2 DSCB was built during previous (prime) pass. As previously described, a valid duplicate-name format-1 DSCB would have been encountered if the same volume had been specified.
PRIME	PRIME	Yes	An open executor module of the indexed sequential access method constructs the index area.

Note: If the DD statement associated with a given ISAM data set has its 'type-of-space' parameter left blank, a request for prime is implied.

Figure 6. Conditions under which format-2 DSCBs are built

in the format-1 DSCB that is a count of the number of extents in the data set must be updated.

Embedded Index Processing: When this routine receives control, the format-1 DSCB, except for the extents, will have been created by the standard request processing routine. The extent table will have at least one entry.

This routine allocates space for the prime area and the index from the space available as indicated in the extent table. The space requested for the prime area is divided into two parts as nearly equal as cylinder boundary requirements permit. The entries in the extent table are then taken in order and assigned as prime extents as necessary to provide allocation for the first half of the prime area. The requested index area is then assigned from the next available track indicated in the extent table. Finally, the remaining space in the extent table is assigned to the other half of the prime area request. Depending on the requirements of the request and the sizes of the extent entries, it is possible to form as many as seven DSCB extents (two for the index and five for the prime area) from the entries in the extent table.

After the extents have been created for the prime and the index areas, this routine first adds as many as three extents to the incomplete format-1 DSCB. If more than three extents have been created, a format-3 DSCB is built to contain all those beyond the first three. As extents are placed in the format-1 (and possibly the format-3) DSCB, the index extents are entered first.

The extent table entries are converted from a relative track address (RTA1/RTA2) form to a cylinder and head (CCHH/CCHH) form as they are entered in the DSCBs. A resident conversion routine is given control to do the conversion.

Because an embedded index is always a first DD statement, it is necessary to construct an index DSCB (format-2). If a format-3 DSCB has been created, it is written to the VTOC. Then the format-2 DSCB is constructed, the address of the format-3 DSCB is placed in a pointer field, and the format-2 DSCB is then written to the VTOC. If a format-3 DSCB was not constructed, a format-2 DSCB is constructed and written out after the last extent entry is placed in the format-1 DSCB.

Once the format-2 DSCB has been written, its address is placed in a pointer field of the format-1 DSCB, and the format-1 DSCB is written.

Updating the Free Space (Format-5) and VTOC (Format-4) DSCBs

When the format-1, format-2, and format-3 DSCBs have been written to the VTOC, the format-5 DSCBs must be updated to account for the space that has been allocated and is therefore no longer available. The ISAM allocate work area will still contain as many as five extent table entries. These are the extents that must be removed from the format-5 DSCBs, as they now represent extents that have been allocated to the data set. Format-5 DSCBs are created and updated in the way previously described for non-ISAM data set allocation.

The VTOC (format-4) DSCB must be modified to indicate changes in the number of free VTOC records (format-0 DSCBs) in the VTOC. These changes result from adding format-1, format-2, and format-3 DSCBs and adding or deleting format-5 DSCBs. Allocation for the current DD statement entry in the TIOT is now complete. The ISAM allocate routine must determine whether (1) this is a multivolume request and (2) whether this is the last of a series of space-type requests (that is, prime, index, overflow).

Multivolume requests are handled as described in "Multivolume Processing." If the current request was the last of the DD statement entries in the TIOT for this allocation, the virtual storage work area is released, the TIOT fields are restored to their "pre-ISAM allocate" condition, and control is given to the job scheduler. If the current request is not the last of the DD statement entries, indicators are set to provide the necessary

information for the next entry to be processed, virtual storage areas are released, and control is returned to the job scheduler. Processing of the last volume of a multivolume prime request is the same as described for a single-volume request.

Multivolume Processing

This routine is entered to set up a loop in the ISAM allocate routine when an ISAM data set is to be allocated on more than one volume.

When control is passed to this routine from the format-4 DSCB updating routine, the VTOC of the most recently processed volume will have been dequeued. It is necessary, in order to maintain information in virtual storage, to perform several of the functions without returning control to the scheduler or the allocate initialization routine. These, then, are the same operations performed in the allocate initialization routine: enqueuing the VTOC of the new volume using a RESERVE macro instruction, reading the format-4 and first format-5 DSCB into the allocate work area in virtual storage, and searching for a duplicate-name, format-1 DSCB (if found, it is read into virtual storage).

Processing of the multivolume request then continues through the same steps as for a single-volume request (that is, an extent table is built and the format-1, format-2, and format-3 are built as required, the format-5 DSCBs are built and/or modified, and the format-4 DSCB is updated).

Error Handling

When the ISAM data set allocation routine encounters errors, it sets an error code in register 5 and transfer control to the error handling routine. This routine sets an indicator to prohibit the scheduler from giving control again to the ISAM allocate routine.
Note: When there is not enough space on the current volume to make the allocation and the first DD statement of a single-volume request is being processed, the TIOT is returned to its "pre-ISAM allocate" status and control is returned to the scheduler. The scheduler can then request that the allocation be made on another volume, unless the user requested a specific volume. The error-handling routine loads the error code in register 15, and then frees the ISAM allocate work area, dequeues the VTOC, and returns control to the scheduler which issues a message. A cross-reference between messages issued and the error code and the modules that issue each code is in the directory section.

DOS VTOC Conversion

To provide a standard allocation procedure for the Disk Operating System (DOS) user, the DADSM allocate routine includes a routine that converts the VTOC of DOS volumes to standard format. This conversion involves adding format-5 and format-6 DSCBs to the VTOC, and updating the format-4 DSCB.

Initial Conversion Processing

The DOS VTOC conversion routine receives control from the allocate initialization and extend routines when the DOS bit (bit 0 of the DS4VTOCI field) is set in the VTOC (format-4) DSCB. When control is passed, register 7 contains a pointer to the UCB defining the volume to be converted and register 13 points to the allocate work area, which will contain the format-4 DSCB for the volume to be converted, along with an IOB, ECB, channel program, DEB/DCB, and the address of the first format-5 DSCB on the volume.

The DOS VTOC conversion routine first writes zeros over all free space (format-5) DSCBs and shared extent (format-6) DSCBs on the volume. These DSCBs are deleted because they are invalid. Since the DOS bit is on, a DOS allocation has been made on the volume, and the DOS allocate routines do not keep track of (1) available space (2)

shared-cylinder extents or (3) the high-water mark (the highest address of a format-1 DSCB, which appears in the DS4HPCHR field of the format-4 DSCB).

When the format-5 and format-6 DSCBs have been deleted, a new format-5 DSCB is created and initialized to reflect the free space that had been available when the volume was initialized, before any data sets were allocated. The highest track that can be allocated on the volume is calculated from the device characteristics table. The space for volume labels, IPL records if there are any on the volume, and the VTOC is subtracted from the new format-5 DSCB.

Next, the conversion routine reads sequentially through the VTOC and establishes the highest address used for a format-1 DSCB (DS4HPCHR field). The nonsplit-cylinder data set extents in the format-1 and format-3 DSCBs are converted from CCHH/CCHH to RTA1/RTA2 form. Five extents are converted at a time and placed in the extent table. The converted extents are then subtracted from the free space.

Split-Cylinder Processing

If there are split-cylinder data sets on the volume, each format-1 DSCB on the VTOC is read again, and the split-cylinder extents are identified and converted from CCHH/CCHH to RTA1/RTA2 format. As each split-cylinder data set is encountered, its extent is entered in a format-6 DSCB, or, if the extent has already been entered in a format-6 DSCB, the count of number of data sets sharing the extent (the Z in the XXYYZ entry) is increased by one. A test is made to determine whether the split-cylinder data set extent in the extent table overlaps two format-6 extent entries. (This condition can occur when split-cylinder data sets are allocated under DOS; it is not allowed under OS.) If there is an overlap, the two format-6 extent entries are merged into a single extent and their data set counts are added together.

When all of the format-6 DSCBs have been built, chained, and written to the VTOC, they are read in again. The format-6 extents are entered, five at a time, in the extent table, then subtracted from the free space (format-5) DSCBs. When all the extents have been subtracted, they are again read into virtual storage. The format-6 extents are converted to final form (from RTA/number-of-cylinders/number-of- data-sets format to XXYYZ) and written back to the VTOC.

Completion of Conversion Processing

When the split-cylinder processing is complete or when there are no split-cylinder data sets on the volume, the conversion processing is completed by converting the format-5 DSCBs to the final XXYYZ format. The format-5 DSCBs are then written to the VTOC. This routine then turns off the DOS bit (bit 0 of the DS4VTOCI field) and turns on the "converted" bit (bit 4 of the DS4VTOCI field) and writes the format-4 DSCB back to the VTOC. Control is then returned to the calling routine, allocate initialization or extend.

Conversion Limitations

The DOS VTOC conversion routines cannot build accurate format-5 and format-6 DSCBs if:

- A split-cylinder data set is located on cylinder zero.
- A split-cylinder data set is located on the same cylinder as the VTOC.
- A split-cylinder data set is located on the same cylinder as a nonsplit-cylinder data set.
- Two data sets have overlapping extents.

Extending Data Set and VSAM Data Space Allocations (Secondary Allocation)

The extend routine dynamically allocates additional space to sequential data sets or VSAM data spaces that exceed the space allocated to them. Data sets with indexed sequential organization cannot be extended. Non-ISAM data sets can either be extended on the last volume a data set currently occupies, or can be extended on a new volume. The system catalog and a VSAM data space can only be extended on the volume they currently occupy. The data set or VSAM data space can be extended by as many as five non-contiguous extents at a time, but no data set or VSAM data space is allowed to occupy more than 16 extents on a single volume.

The extend routine uses the same methods as the allocate routine when extending on a new volume: it takes space from the format-5 DSCBs, builds a list of extents to be allocated, builds a format-1 DSCB (and a format-3 DSCB if required), then updates the format-5 and format-4 DSCBs.

When extending on the last volume the data set or VSAM data space currently occupies (also referred to as the *current* volume), the extend processing is the same as non-ISAM allocate processing, except that the format-1 DSCB is merely modified or a format-3 DSCB may be built if there isn't one for the data set or VSAM data space on the VTOC. If there is a format-3 DSCB, it is modified.

Split-cylinder data sets are extended differently from other data sets. The space for the extension is allocated on new cylinders, and only the one extended data set can reside on these new cylinders. The cylinders containing the extension are not regarded as part of the original split-cylinder extent, even though they may be contiguous to the original extent. No entry is made in the format-6 DSCB for split-cylinder data set extensions. (VSAM data spaces cannot reside on split cylinders.)

Input to the extend routine includes pointers to (1) the UCB, DEB, and DCB of the data set or VSAM data space to be extended and (2) the O/C/EOV work area defined by IECDSECT, which contains the JFCB for the data set or VSAM data space to be extended, various control blocks and a channel program for reading and writing the DSCBs on the VTOC. Register 13 contains a code to identify the caller (end-of-volume, catalog management, or VSAM catalog) and to indicate whether the extension will be made on the last volume of the data set or VSAM data space, or on a new volume for a data set.

Extend Initialization

Extend processing begins by enqueuing the VTOC of the volume on which the data set or VSAM data space is to be extended. A RESERVE macro instruction with the "set-must-complete" option is issued for the VTOC unless this option has already been set for the task. The VTOC (format-4) DSCB is then read in, the DADSM interrupt recording facility (DIRF) indicator is set (see "DADSM Interrupt Recording Facility"), and the format-4 DSCB may be written back to the VTOC, so that it can be determined if an interrupt that could invalidate the VTOC has taken place during extend processing.

Next, it must be determined whether the data set or VSAM data space being extended is on a device on which the last allocation was made by the Disk Operating System (DOS). If it was, the VTOC must be converted to standard format, before the extension is made. The extend routine (1) gets a work area for saving registers and for use by the DOS VTOC conversion routine, (2) builds the control blocks needed by the I/O supervisor (the DEB/DCB, IOB, and ECB) in the work area, and (3) reads the format-4 DSCB into the work area. Control is passed to the DOS VTOC conversion routine and will be returned when the VTOC has been converted. If no errors are encountered during the conversion (indicated by a return code in register 8), extend processing is continued.

The extend initialization routine determines whether the extension is to be allocated on the current volume or on a new volume by the code passed in register 13 at entry to this routine. If the extension is to be made on a new volume, it is necessary to search the identifier (format-1) DSCBs on the VTOC for a duplicate name, since a duplicate name would be invalid. No search is made when the extension is to be made on the current volume, but it is necessary to determine the *preferred track* (the first track following the end of the data set or VSAM data space being extended).

When the format-4 DSCB has been read into virtual storage, the extend initialization routine converts requests in cylinders and average records (blocks) to tracks and accounts for user labels, if they are requested.

Building the Table of Extents to Be Allocated

The search for available space on the volume begins with the extend routine attempting to allocate space contiguous to the extent of the data set (this is the *preferred* extent). If there is not enough contiguous space to fill the request, the routine builds a pushdown list of extents of as many as five entries representing non-contiguous areas that are smaller than, but closest in size to the requested space. If, while the pushdown list is being built, an extent equal to the request is found, that extent is allocated. If no extent in the format-5 DSCBs equals the request, the extension is allocated from the extent that is larger than and closest in size to the request. If no extent is found that is equal to or larger than the request, the extension is allocated from the pushdown list of extents. As few as two and as many as five of the extents in the pushdown list may be required to fill the request. The request is always filled using the fewest possible number of extents. The extent, or extents, required to fill the request are entered in the extent table.

Building and/or Modifying Format-1 and Format-3 DSCBs

When the extent table has been successfully completed and contains an entry or entries representing the extents to be allocated, the format-1 and/or format-3 DSCBs must be built or modified to indicate the extension.

First the 288-byte extend work area gotten by the extend initialization routine is cleared. If the extension is to be allocated on the current volume, the format-1 DSCB is read into the work area. If the format-1 DSCB is full (that is, it has three extent entries), the format-3 DSCB is read into the work area, if a format-3 DSCB exists for the data set or VSAM data space. If no format-3 DSCB exists for the data set or VSAM data space, one is built.

Then, using the extent table entries, the format-1 and/or format-3 DSCBs are completed and written back to the VTOC; the format-3 is written first, then its address is entered in the format-1 DSCB, which is then written to the VTOC.

For extensions on a new volume, a format-1 DSCB must be built using the information from the JFCB. If there are more than three extent entries in the extent table, a format-3 DSCB must also be built. When completed, the format-3 DSCB is written to the VTOC, its address put in the format-1 DSCB, and the format-1 is written.

Updating the Format-5 DSCBs

The first format-5 DSCB is read into the 300-byte work area, and again using the extent table entries, format-5 DSCBs may be updated, added, or deleted.

If an entire contiguous area has been allocated to the data set or VSAM data space during the extend processing, the format-5 extent entry for that area is completely removed from the format-5 DSCB. The vacated extent in the format-5 DSCB is removed by moving forward by one location all subsequent format-5 extent entries in that DSCB and in other format-5 DSCBs that may be chained to it. If only part of an available area

is allocated, the space is taken from the beginning of the area, and the track following the allocated area becomes the lower boundary of the available area.

If the space to be allocated begins on a cylinder boundary, the allocation may be made from within an available area. In that case, the allocation must create a new extent entry in the format-5 DSCB, and the space preceding and following the allocated space will become two areas identified in two format-5 extents. This causes all subsequent format-5 extents in that and any chained format-5 DSCBs to be moved back one location.

If a free VTOC record (format-0 DSCB) must be written as a result of a format-5 DSCB being removed, the format-0 DSCB is written before the format-4 DSCB is modified.

Updating the Format-4 DSCB

Since this is the end of extend processing, this routine reads in the format-4 DSCB, and tests and resets the DIRF indicator in preparation for writing the format-4 back to the VTOC. This routine also handles error conditions encountered in the previous extend processing (such as too many extents on the volume or not enough free records left on the VTOC), by setting an error return code and returning to the caller.

If entered with no previous errors, this routine writes a format-0 DSCB if requested by the format-5 updating routine, then updates the format-0 count and highest extent used for a format-1 DSCB and writes the modified format-4 DSCB to the VTOC, dequeues the VTOC, and frees work areas.

This routine then sets the XCTL ID to the name of the calling routine, builds the interface required, and returns control to the caller.

Deleting Data Sets and VSAM Data Spaces

The scratch routine is used to reverse the allocation process for all types of data sets and VSAM data spaces. When a data definition (DD) statement specifies that a data set or VSAM data space is to be deleted, the scratch routine will be entered from the scheduler at step termination. The scratch routine is also given control as a result of the issuance of the SCRATCH macro instruction by the problem program, a data set utility program, or the VSAM catalog routines. The extents in the data set's or VSAM's data space identifier (format-1) DSCB and extension (format-3) DSCB are added to a format-5 DSCB, and a free VTOC record (format-0 DSCB) is written over each of the data set's or VSAM's data space format-1, format-2, and format-3 DSCBs. Only ISAM data sets have index (format-2) DSCBs and only data sets or VSAM data spaces with more than three extents on a volume have format-3 DSCBs.

Extents allocated to split-cylinder data sets are not released until all of the data sets sharing a given cylinder extent are deleted.

Scratch Initialization, Volume Verification, and Volume Mounting

When the scratch routine is entered, register 0 will contain either a pointer to a unit control block or all zeros. Register 1 will contain a pointer to a parameter list that (1) indicates whether the purge date is to be overriden, (2) points to the data set name of the data set or VSAM data space to be deleted, and (3) points to a list of one or more volume entries, one for each volume on which the data set resides. Requests to scratch a VSAM data space are made one volume at a time; the parameter list passed by VSAM catalog management will contain only one volume entry. The volume list consists of a 2-byte count of the number of volumes in the data set or VSAM data space to be scratched and a 12-byte entry for each volume of the data set or VSAM data space. The 12-byte entry is used to specify the device code and the volume serial number. Only one data set or VSAM data space can be deleted with each request.

When a UCB pointer is passed in register 0, the scratch routine verifies that the device represented by the UCB is on-line and, in case the volume containing the data set or VSAM data space is not mounted, that a volume currently mounted is eligible for demounting (SYSRES, SYSIN, SYSOUT, and shared volumes cannot be demounted). When (1) no UCB pointer is passed or (2) the device represented by the UCB address passed is not eligible for demounting, the scratch routine searches the UCBs using the UCB lookup table and finds the UCB with the volume serial number that matches the volume serial number passed in the volume list (by way of the scratch parameter list). When the matching volume serial number is found, the UCB is tested (1) to verify that the device it represents is on-line, and (2) to determine whether the volume it represents is eligible for demounting.

If the volume containing the data set or VSAM data space to be scratched is not mounted and a mounted volume can be demounted, a mount message is issued, to which the operator can respond either by replying "MOUNTING" and mounting the volume, or by replying "SKIP". If he mounts the volume, its label is read and the volume number verified (SMF information about the volume being demounted will be collected for systems with the SMF feature). If the operator replies "SKIP", the next volume in the volume list is processed.

The scratch initialization routine builds the control blocks required by the I/O supervisor to read from and write to the VTOC. Next, the VTOC is enqueued using a RESERVE macro instruction with the "set-must-complete" option, and the addresses of the format-4 and the first format-5 DSCBs on the VTOC are converted from relative to absolute (from TTR to CCHHR).

When a data set residing on more than one volume is to be deleted, the scratch routine maintains control until all volumes have been processed. It is possible, however, that, because of a permanent I/O error or because a volume is not mounted, the data set may not be deleted from all volumes. The success or failure (and reason for failure) of the scratch processing is communicated in the last byte of the volume list entry (the scratch status code). Success or failure is also indicated by the return code passed in register 15 when control is returned to the caller.

DSCB Deletion and Split-Cylinder Processing

When it has been verified that the volume containing the data set or VSAM data space to be deleted is mounted, the scratch routine reads in the format-4 DSCB and the format-1 DSCB for the data set or VSAM data space. If the data set is password-protected, control is transferred to the READPSWD module of the open security function. READPSWD verifies the password and returns control.

Next, the purge date for the data set or VSAM data space is checked, if it is not overridden. The format-4 DSCB is processed for DIRF (see "DADSM Interrupt Recording Facility"). The extents of the data set's or VSAM's data space format-1 DSCB (and format-3 DSCBs, if there are any) are entered in the extent table (this table can contain as many as 16 extent entries); when the extents have been converted from CCHH/CCHH to RTA1/RTA2 and entered in the table, a format-0 DSCB is written over the format-1 and format-3 DSCBs. *Note:* Format-2 DSCBs for ISAM data sets are also written over with format-0 DSCBs during this processing.

When the format-1, format-2, and format-3 DSCBs have been deleted, this routine reads in either the format-6 DSCB if a split-cylinder data set is being deleted, or the first format-5 DSCB if no shared extents are involved.

Whether split-cylinder data sets are involved or not, the scratch routine now sorts the extent table into ascending relative track address sequence. However, if the data set is on split cylinders, each extent in the format-6 DSCB is compared with the extent table entries until the appropriate format-6 extent is found. When found, the number of data

sets sharing the extent (the Z of XXYYZ) is decreased by one. If the number of data sets goes to zero, the extent is removed from the format-6 and each subsequent format-6 DSCB extent must be moved up one location to close the vacated space on the VTOC. If the number of users does not go to zero, the format-6 DSCB is written back to the VTOC with only the number of users changed, but the deleted data set's extent must be removed from the extent table, because no space will be made available until all data sets have been deleted from the shared extent. At conclusion of the split-cylinder processing, the first format-5 DSCB is read into virtual storage. *Note:* VSAM data spaces cannot reside on split cylinders.

Updating the Free Space on the Volume (Format-5 DSCB) and the VTOC (Format-4) DSCB

The format-5 DSCBs are updated by sequentially merging the extent table entries with the existing format-5 DSCBs. If the deleted data set shares cylinders with another data set and no space was released, the merge is bypassed. As the format-5 DSCBs are read, their extents are converted from XXYYZ to RTA1/RTA2; before the updated format-5 DSCBs are written back to the VTOC, the extent entries are again converted from RTA1/RTA2 to XXYYZ format.

When the format-5 DSCBs have been updated, the number of free VTOC records (format-0 DSCBs) now on the VTOC must be updated if the number has changed. The format-4 DSCB is then written back to the VTOC and the VTOC is dequeued. If the data set or VSAM data space is on multiple volumes, the scratch routine can now begin to process the next volume. If processing is complete, the return code is loaded in register 15 and control is returned by issuing an SVC 3. If the system has the SMF feature, a type 17 SMF record will be written before control is returned.

Freeing Unused Space (Partial Release)

The release routine deletes extents (area identifications) from the format-1 and/or format-3 DSCBs of a data set, beginning at a specified track or cylinder and continuing to the end of the data set's allocated extent. For example, suppose a data set was allocated three extents at the beginning of a job. During the job, a program writes records up to the second track in the third extent of the data set. If the job specified release of the unused space in the data set, the close routine of O/C/EOV would request the release routine to release the tracks following the last used track of the third extent. If either the original request is a request in cylinders or the ROUND option was specified, the area released begins at the first cylinder boundary following the last track written. The tracks released are returned to available space for future allocation, as is done by the scratch routine.

Note: Release processing of ISAM data sets is not possible because information in overflow areas might be deleted.

The release routine is entered via XCTL from the reposition I/O module of checkpoint/restart and from close processing.

When the release routine is entered, a work area pointed to by register 4 will contain (1) the format-1 DSCB and JFCB for the data set, and (2) the control blocks and a channel program required to read from and write to the VTOC. (This work area is referred to as the O/C/EOV work area.) Register 2 will contain a pointer to the user's DCB and register 10 a pointer the UCB.

Updating Format-1 and Format-3 DSCBs

When entered, the release routine first gets a work area for reading in the format-4 (VTOC) DSCB and format-5 (free space) DSCB, enqueues the VTOC, and reads in the format-4 DSCB using the VTOC address in the unit control block (UCB). After DIRF processing (see "DADSM Interrupt Recording Facility"), this routine determines whether the last track written to on the data set (obtained from the user's DCB) is in an extent of the format-1 DSCB or an extent of the format-3 DSCB.

If this extent is in the format-1 DSCB, its location is calculated. The address of the first track to be released is calculated; the identification of the released extent in CCHH/CCHH is converted to RTA1/RTA2 and entered in the extent table. Any subsequent extents in the format-1 DSCB are also converted and entered in the extent table, and their identifications are removed from the format-1 DSCB. Next, it is determined whether there is a format-3 DSCB on the VTOC for this data set. If so, it is read in, its extents are converted and entered in the extent table, and a free VTOC record (format-0 DSCB) is written over the format-3 DSCB on the VTOC.

If the last track to be written on the data set is contained in the format-3 DSCB, the format-3 DSCB is read in and, again, the location of the first track to be released is calculated. The extents following this track are converted to RTA1/RTA2 format and entered in the extent table. Then the extents are written over with zeros and the format-3 DSCB is written back to the VTOC.

When SMF information is required, the task's TCB will contain a pointer to the timer control table (TCT), and the CVT will contain a pointer to the system management control area (SMCA). If the fourth bit of the SMCAOPT is set to one, data set information is required. Using the extent table, this routine adds the number of released extents and the amount of space released into the appropriate fields of the data set entry in the TCT I/O table of SMF (the calling routine uses this information when it constructs a type-14 or type-15 SMF record).

This routine then writes back the format-1 DSCB whether or not any space has been released. If space is being released, this routine sorts the extent table into ascending RTA sequence, and reads in the first format-5 DSCB.

Updating the Format-5 (Free Space) and Format-4 (VTOC) DSCBs

When the format-1 and format-3 DSCB updating is complete, this routine merges the extent table entries with converted format-5 extents, reconverts the merged extents from RTA1/RTA2 format to XXYYZ, and writes the format-5 DSCBs back to the VTOC.

Format-4 DSCB updating involves first processing for DIRF (see "DADSM Interrupt Recording Facility") then accounting for the number of free VTOC records (format-0 DSCBs) on the VTOC and writing the format-4 DSCB back to the VTOC.

At the conclusion of release processing the release work area is freed and the VTOC is dequeued.

A completion code is returned to the caller in register 1.

The VTOC-Related Service Routines

Renaming Data Sets

Data sets on direct-access volumes are renamed using the RENAME macro instruction (SVC 30), which invokes the rename routine. VSAM can use the rename routine if a data space is established for only one VSAM data set (UNIQUE). The format-1 DSCB of the data set to be renamed is read in (after it is verified that the new name is not already on the volume), the 44-byte name is changed, and the format-1 DSCB is written back to the VTOC. Only a single data set may be renamed by each issuance of the RENAME macro; however, multivolume data sets may be renamed, if either all volumes are mounted simultaneously, or one of the mounted volumes can be demounted (physically and logically).

When the rename routine is entered, register 0 must contain either a pointer to a unit control block or all zeros (no UCB address specified). Register 1 will contain the address of a parameter list that contains pointers to (1) the name of the data set to be renamed, (2) the new name of the data set, and (3) a volume list. The volume list contains a 2-byte count of the number of volumes in the data set to be renamed and a 12-byte entry for each volume of the data set. The 12-byte entry is used to specify the device code and the volume serial number.

If a UCB address is passed in register 0, it must be verified that the device represented is on-line and that the volume represented in the UCB is eligible for demounting (SYSRES, SYSIN, SYSOUT, and shared volumes are not eligible).

If no UCB pointer is passed or if the volume represented by the UCB address passed is not eligible for demounting, a UCB must be found with a volume serial number that matches one of the volume serial numbers in the volume list. When a match is found, the UCB is tested to determine (1) that its device is on-line and (2) whether its volume is eligible for demounting.

When it has been verified that a volume to be renamed is mounted or that a mounted volume can be demounted, the rename routine builds the control blocks and channel programs required by IOS to read from and write to the VTOC. If the volume containing the data set to be renamed is not mounted, a mount message is issued, to which the operator can respond either by replying "MOUNTING" and mounting the volume or by replying "SKIP". If he mounts the volume, its label is read and the volume serial number verified (SMF information about the volume being demounted will be collected for systems with the SMF feature). If the operator replies "SKIP", the next volume in the volume list is processed.

When a data set residing on more than one volume is to be renamed, the rename routine maintains control until all volumes have been processed. It is possible, however, that, because of a permanent I/O error or because a volume cannot be mounted, the data set may not be renamed on all volumes. The success or failure (and reason for failure) of the rename processing is communicated in the last byte of the volume list entry (the rename status code). Success or failure is also indicated by the completion code passed in register 15 when control is returned to the caller.

When a volume containing a data set to be renamed is mounted, the VTOC is searched for a data set name that is the same as the new name in the rename parameter list (a duplicate name is not allowed on the VTOC). Next, the VTOC is enqueued, and the identifier (format-1) DSCB of the data set to be renamed is read in. If the data set is password protected, an exit is taken to the READPSWD module of the open security function, which verifies the password by polling the operator. When the password has been verified, control is returned to rename; the name in the format-1 DSCB is changed,

the format-1 DSCB is written back to the VTOC, and the VTOC is dequeued. If there are additional volumes that contain the data set to be renamed, processing is repeated. If the system includes SMF, type-18 records (see *OS/VS System Management Facilities (SMF)*) will be written when processing is completed. Work areas are then freed, the completion code is loaded, and control is returned to the calling routine.

Reading a DSCB from the VTOC

The obtain routine is entered when the OBTAIN macro (SVC 27) is issued. The function of the obtain routine is to read a DSCB into a work area provided by the caller.

The caller has two options when he issues an OBTAIN macro: he may specify the data set name and receive the data portion (last 96 bytes) of the format-1 DSCB for that data set or VSAM data space and the absolute address of the DSCB (search option), or he may specify the absolute track (CCHHR) of the DSCB he wants (seek option) and receive the complete DSCB (140 bytes). Only one DSCB can be obtained with each issuance of the OBTAIN macro instruction. The volume on which the DSCB resides must be mounted. TSO uses the obtain routine to get information about a VSAM data set or index. However, only the "search" option is available. The data set name for a VSAM data set appears only in a VSAM catalog, not in the VTOC. Therefore, the obtain routine must issue a VSAM LOCATE command to retrieve physical extent information from the VSAM catalog.

When the obtain routine receives control, register 1 points to a parameter list that contains (1) a code specifying the search or seek option, (2) the address of a data set name (search option) or a pointer to the absolute track address (CCHHR) of the DSCB he wants (seek option), (3) the address of the volume serial number of the volume on which the DSCB resides, and (4) the address of a 148-byte work area, into which the DSCB and its absolute track address are read.

Obtain processing begins with getting a work area used for control blocks and channel programs. Next, a search of the UCBs is conducted to find the UCB with the volume serial number that matches the volume serial number passed in the obtain parameter list. If the caller is in problem state, obtain then branches to the resident validity-checking routine to verify that the caller's 148-byte work area has a protection key that matches the key in the current task's TCB. Then obtain builds a DEB and checks for the RPS feature; if it is present on the device, the channel program is modified by adding a CCW that contains an RPS set-sector operand and the sector value, (which is converted before the channel program is executed).

If the search option has been specified, the 96-byte data portion of the format-1 DSCB of the named data set is read into the caller's work area, along with its absolute track address (CCHHR). If the obtain request is for a VSAM data set, the search of the VTOC will fail because a VSAM data set name appears only in a VSAM catalog. The VSAM data space name appears in the format-1 DSCB. Before taking an error exit (no data set name found), the obtain routine checks the format-4 DSCB to determine whether there are VSAM data sets on the volume. If so, the obtain routine issues a VSAM LOCATE command to get extent information from the VSAM catalog. This information is read into the caller's work area.

If the seek option is in effect, the format-4 (VTOC) DSCB is read to verify that the absolute track address of the DSCB specified is in the VTOC extent. Next the complete DSCB is read in over the format-4 DSCB.

Obtain processing is now complete. The obtain work area is freed, the completion code is loaded in register 15, and control is returned to the caller via SVC 3.

Obtaining Information About Free Space on a Volume

The LSPACE routine accumulates information about free space on a volume. This information is used by the System Management Facilities (See "Support for the System Management Facilities (SMF)") and by the "DISPLAY SPACE" command. LSPACE is invoked by the issuance of an SVC 78.

At entry to LSPACE, register 0 points to a UCB, and register 1 indicates the functions to be performed as follows:

- If the three low-order bytes of the register have a nonzero value, space information is to be obtained for the "DISPLAY SPACE" command. The value is a pointer to a 30-byte message area that will receive the space information.
- If the high-order byte of the register is 0, no space information is required for SMF.
- If bit one of the register is set to 1, space information may be required for SMF, depending upon other conditions to be tested.
- If bit zero of the register is set to 1, space information is required for SMF.

The LSPACE routine checks the UCB passed to ensure that it identifies a direct-access device and checks the message area to be sure it is in the user's area (if the user is in program state). LSPACE obtains a work area in which it builds channel programs and their associated control blocks.

Next, a work area is obtained, the I/O supervisor control blocks are built in the work area, and a channel program for reading the format-4 and first format-5 DSCBs is relocated to the work area. If the device has the rotational position sensing (RPS) feature (see "Support for Rotational Position Sensing (RPS)"), the set-sector command is added to the channel program. The resident conversion routine is used to establish the set-sector value. LSPACE then builds the control blocks needed by IOS in the work area.

When the channel program and the control blocks are established, the VTOC is enqueued using a RESERVE macro instruction, and the channel program is executed to read in the format-4 and first format-5 DSCB. The channel program is modified to read in the subsequent format-5 DSCBs on the volume.

The extent, cylinder, and track information is accumulated from the format-5 DSCBs. If SMF information is required, the volume label is read in and a type-19 record (see *OS/VS System Management Facilities (SMF)*) is constructed and written to the SMF data set.

If the "DISPLAY SPACE" command is in effect, the accumulated extent, cylinder, and track information is converted to EBCDIC and moved to the 30-byte message area provided by the caller. The message looks like this:

SPACE=CCCC,TTTT,AAAA/ *cccc,tttt*

Where:

CCCC = Total number of free cylinders

TTTT = Total number of free tracks

AAAA = Total number of free extents

cccc,tttt = Largest contiguous free area in cylinders and tracks

LSPACE processing is now completed by dequeuing the VTOC, freeing the LSPACE work area, loading the completion code in register 15 and the message address in register 1, and returning control to the caller via SVC 3.

Processing Password Data Set Requests

The protect routine is used to add, replace, delete, or list entries in a password data set. The protect routine gains control when the PROTECT macro instruction executes an SVC 98.

Note: Another protection scheme is used for VSAM data spaces. See *OS/VS Virtual Storage Access Method Logic* for a description of the protection provided for VSAM data spaces.

Validity Checking

Input to the protect routine is the address of a parameter list. The size and contents of the parameter list depend on whether a protect routine is going to add, replace, delete, or list an entry in the password data set. See *OS/VS Data Management for System Programmers* , for an explanation of the parameter lists and the functions of the PROTECT macro instruction.

If (1) the parameter list is incomplete, (2) the password name specified in the parameter list is not valid, or (3) there is no password data set, an error code is set. Also, if a buffer address is specified in the parameter list, the buffer address is tested by the validity-checking routine that resides in the system nucleus. The routine determines whether the buffer location has a protection key equal to the protection key in the task control block (TCB) of the routine that issued the PROTECT macro instruction.

If the parameter list information is valid, the protect routine enqueues the system-residence volume, which contains the password data set. An OBTAIN macro instruction is issued to read the format-1 DSCB for the password data set. Next the control blocks needed by IOS are built, and a channel program to search and update the password data set is initialized.

Processing the Password Data Set

The PROTECT request is processed by one of the following four routines:

- The add routine—if the requested function is to add a record to the password data set
- The replace routine—if the requested function is to replace a record in the password data set
- The delete routine—if the requested function is to delete a record in the password data set
- The list routine—if the requested function is to list a record in the password data set

Updating the Format-1 DSCBs

If the function requested is to add an entry to the end of the password data set, the DS1LSTAR field (address of the last block written to the data set) of the format-1 DSCB for the password data set will have to be updated and written back to the VTOC.

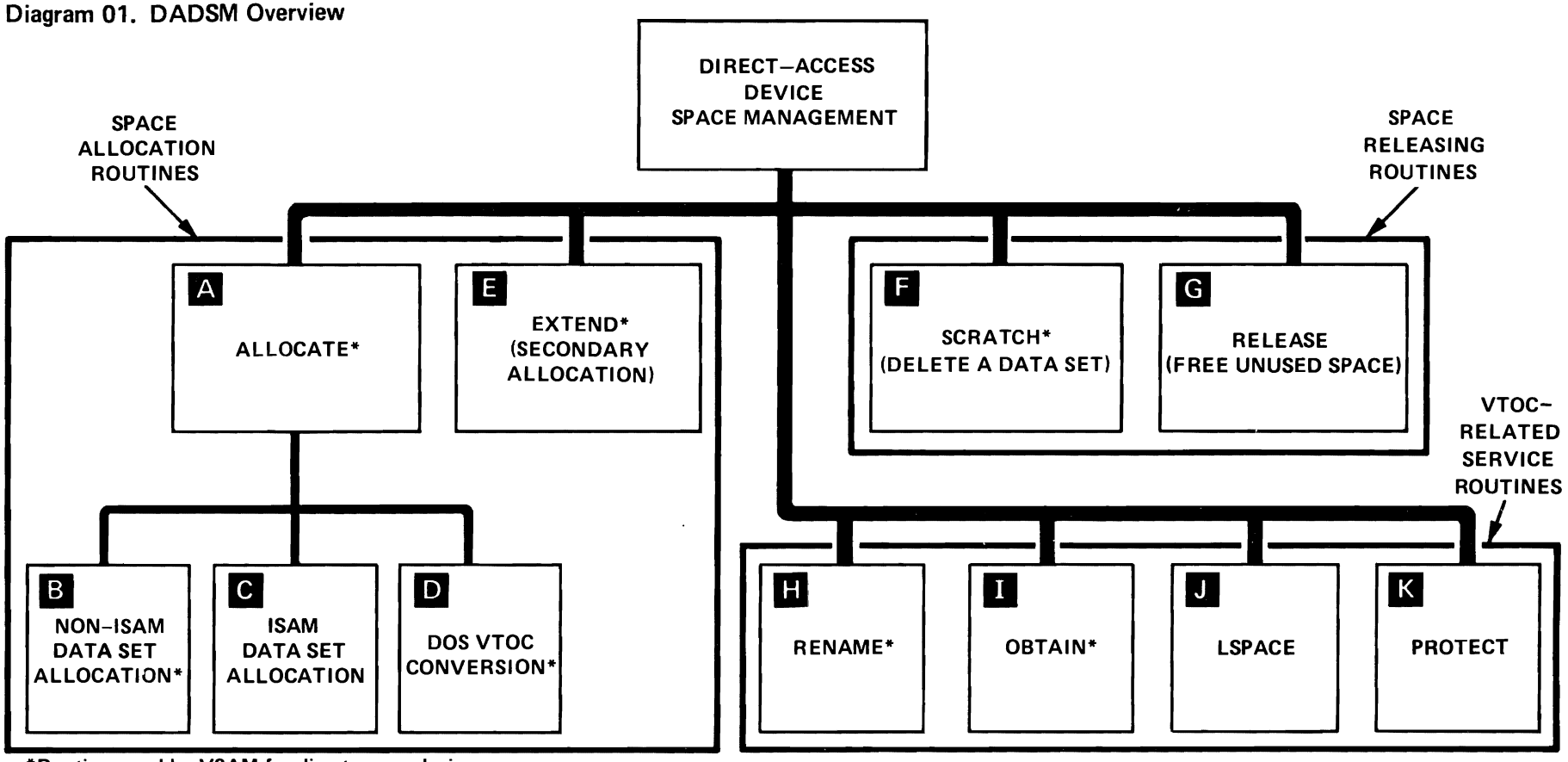
When a data set has been newly protected, it is necessary to change the protection status of the data set. This is done by reading in the format-1 DSCB, modifying the password protection bits of the DS1DSIND field, and writing the format-1 DSCB back to the VTOC. (The VTOC is enqueued during the updating.) The volume that contains the data set is located either (1) by issuing a LOCATE macro instruction if the data set is cataloged or (2) using a user-supplied list of volume serial numbers that is provided as part of the input. The UCBs are searched for volume serial number that matches the number in the volume list. If the newly protected data set resides on multiple volumes, the format-1 DSCB is modified on each volume. When all volumes have been processed, the work areas are freed, a completion code is loaded into register 15 (see *OS/VS*

Data Management for System Programmers), and control is returned to the calling routine.

Method of Operation Diagrams

The method of operation diagrams are organized to help you proceed from a lesser to a greater degree of detail. The overview diagrams (Diagrams 2, 3, 7, 11, 14, 17, and 21) summarize the processing steps and present generalized descriptions of the input and output; these diagrams are to be used to get to lower-level diagrams. These lower-level diagrams contain details about processing in the center (process) block. The numbers on the process steps are cross-referenced on the facing page to extended descriptions of the processing steps, which in turn, are cross-referenced to module names (the names on the microfiche) and labels in these modules where the function is coded.

Diagram 01. DADSM Overview



*Routines used by VSAM for direct-access device space management.

		Diagram
A	ALLOCATE OVERVIEW	2
B	NON–ISAM ALLOCATION	3– 6
C	ISAM ALLOCATION	7–10
D	DOS VTOC CONVERSION	11–13
E	EXTEND	14–16
F	SCRATCH	17–20
G	RELEASE	21–23
H	RENAME	24
I	OBTAIN	25
J	LSPACE	26
K	PROTECT	27

Diagram 02. Allocate Overview

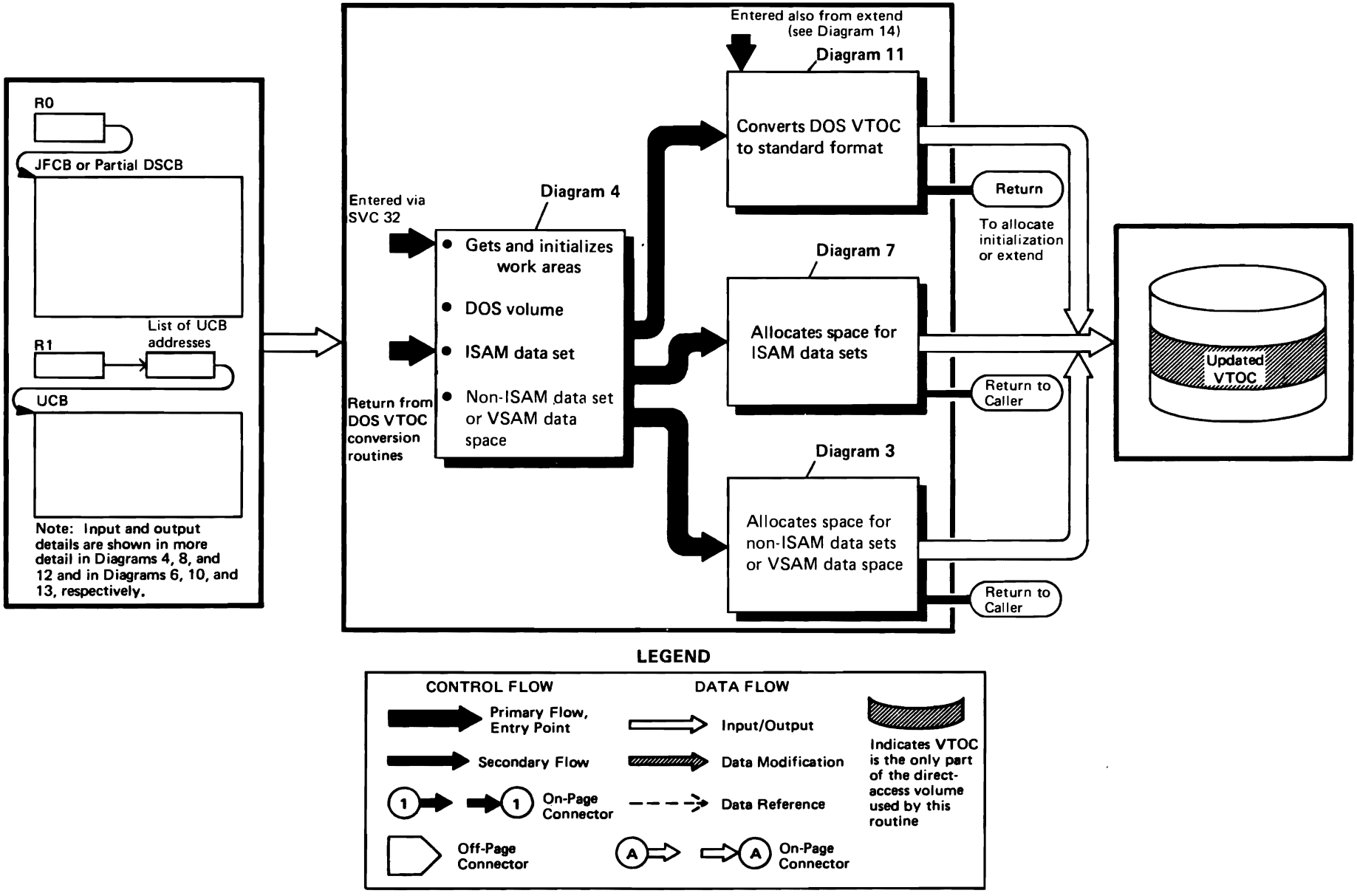


Diagram 03. Non-ISAM Data Set or VSAM Data Space Allocation—Overview

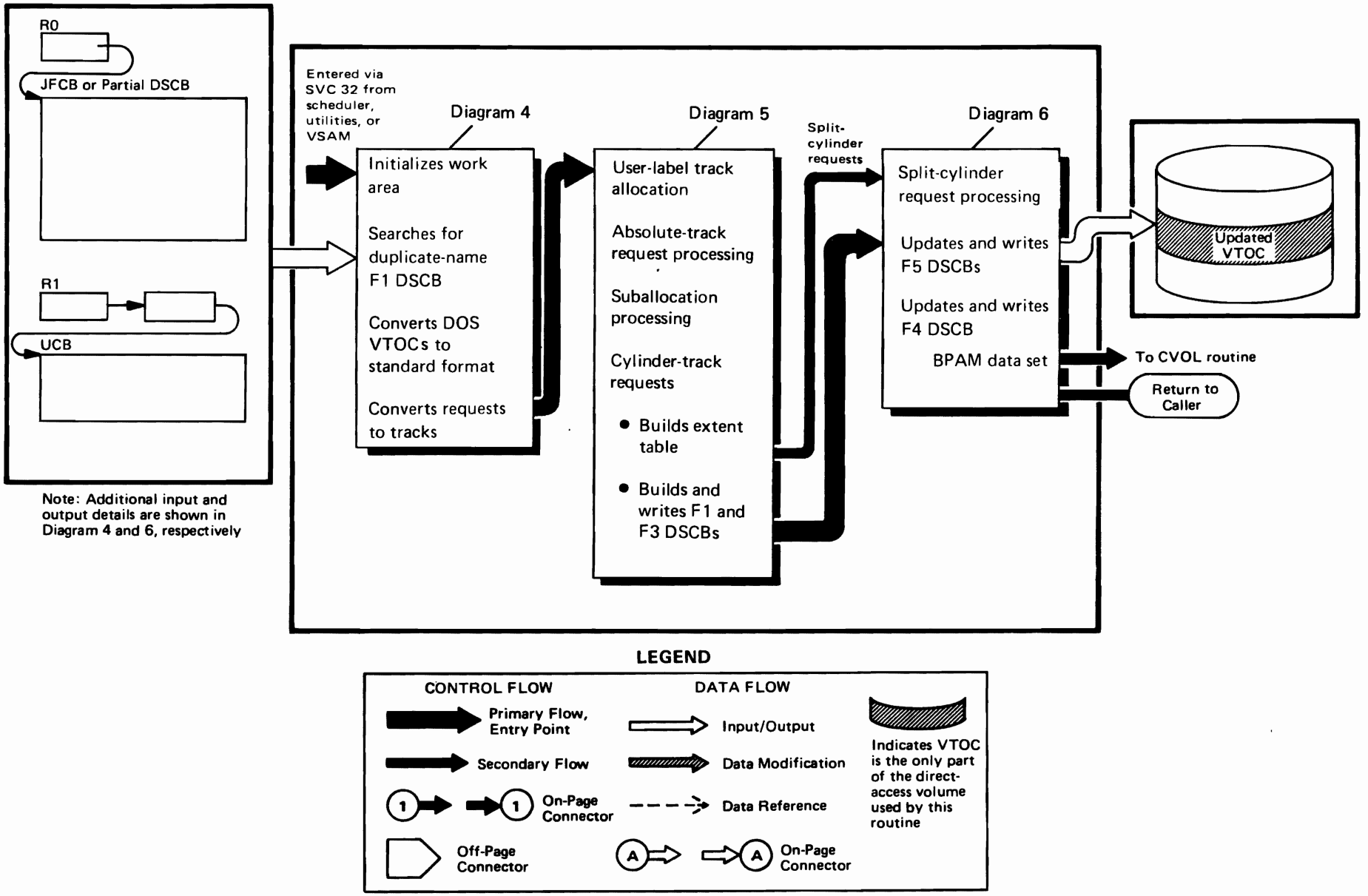


Diagram 04. Allocate Initialization—Duplicate-Name Search and Non-ISAM Allocate Request Conversion

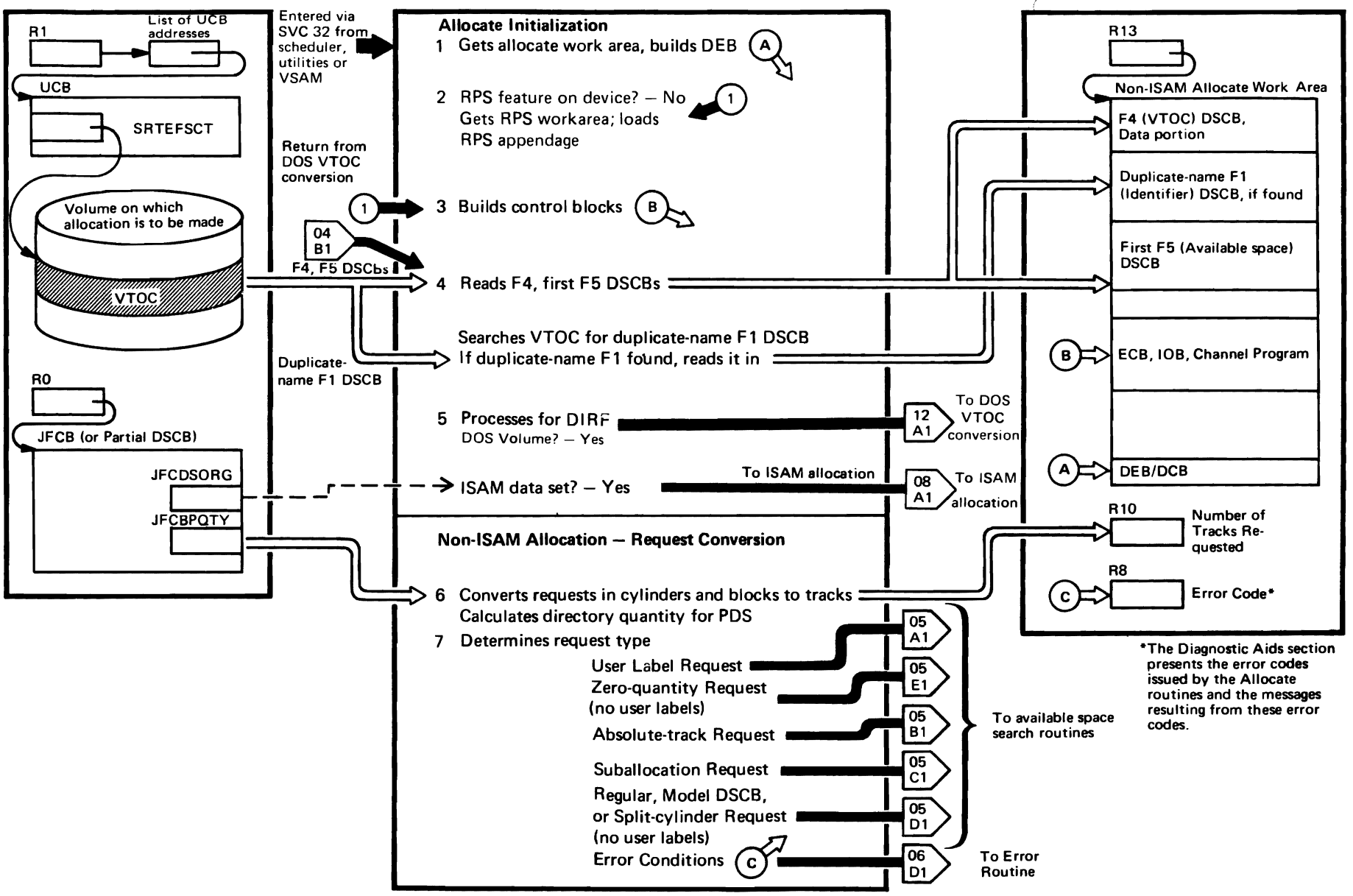


Diagram 04. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Gets 694-byte work area used by all Allocate routines. Builds a DEB in the work area for use in reading from and writing to the VTOC.	BEGINA	IGC0003B
2	Tests for RPS feature. If present, gets 128-byte RPS work area and copies the appendage vector table (AVT) into it. Loads module IGG019EK and enters its address in the AVT. Modifies the DEB in the allocate work area to point to the RPS AVT.	RPSTEST	
3	Builds DCB, IOB, and ECB in the allocate work area. Converts VTOC address from TTR to MBBCCHHR using the resident conversion routine (IECPCNVT)	BEGINA	IGG0325A
4	Relocates a channel program to the allocate work area to read the F4 and first F5 DSCB into virtual storage and to search the VTOC for a duplicate name F1 DSCB. Enqueues the VTOC using a RESERVE macro instruction.	MOVECHPG	
	Reads the F4 and first F5 DSCB and searches all F1 DSCBs on the VTOC for a duplicate name (valid only for ISAM data sets).	EXECUTET	
5	Processes for DIRF: sets/resets the DIRF bit, and if no previous interrupt has occurred, the F4 is written back to the VTOC with the DIRF bit set. If a previous interrupt has occurred, the F4 is not written back. When a DOS volume is encountered, control is transferred to the DIS VTOC conversion routine to convert the VTOC to standard format.	DIRFTEST	
	Determines whether a user label track must be allocated.	DIRBYP3	
	Checks for split-cylinder request (indicated by a pointer to another JFCB). If there are more JFCBs, the channel program is restarted to search the VTOC for a duplicate name for each one.	CHAINTST	
	When a duplicate name F1 DSCB is found on the VTOC, this section verifies than an ISAM data set is being allocated. For ISAM data sets, the channel program is modified, the data portion of the duplicate name DSCB is moved, register 5 is loaded with the address of this task's SVRB, which allows ISAM allocate to get to the current DD card entry. Transfers control to IGG03211 (ISAM allocate).	SAMENAME	IGG0325A (Cont.)
6	Determines what kind of allocation request is being made: in cylinders, in tracks, or in average records. For zero-quantity requests specifying user labels, transfers control to IGG0325K. For zero-quantity requests, transfers control to IGG0325E.	CYLTRKRC	IGG0325B
	Converts cylinder requests to tracks.	MULT	
	Converts average record requests to tracks.	NOCAL	
	For split-cylinder requests, converts percentage of split cylinder requests to tracks, saves number of data sets (number of JFCBs) sharing the cylinder(s).	SHARDCYL	
	Calculates the space required for directories and converts the quantity to tracks.	DIRCAL	
7	For absolute-track requests, transfers control to IGG0325C.	CLEANUP	
	For all allocation requests in tracks (except absolute-track requests), cylinders (including split-cylinder requests), or average records, transfers control to IGG0325D, except when user labels are specified (goes to IGG0325K).	REGULAR	
	For suballocation requests, transfers control to IGG0325S.	SUBALLOC.	

Diagram 05. Non-ISAM Allocation—Free Space Search and F1/F3 DSCB Building

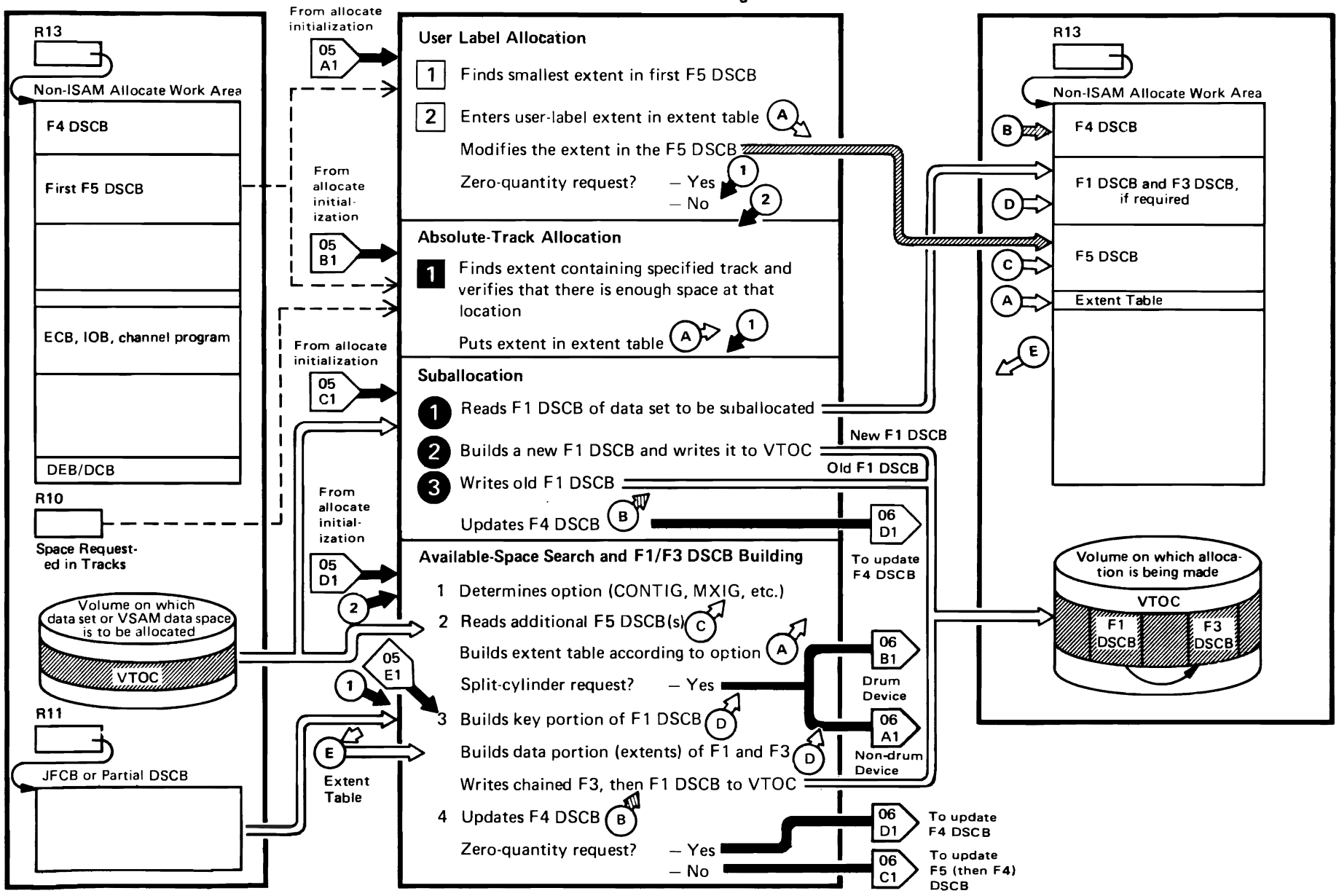


Diagram 05. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Converts first F5 DSCB extents from XXYYZ format to RTA and the number of tracks. Finds smallest extent that has the number of tracks needed.	START	IGG0325K
2 Determines request type (in cylinders, tracks, or average records) and makes an entry in the extent table for the user-label track (or tracks, for split-cylinder requests). Modifies the F5 extent from which the user-label track was taken.	TESTYPE	
Transfers control according to request type: zero-quantity request (to IGG0325E), regular cylinder/track request (IGG0325D).	EXIT	
1 This routine searches the F5 DSCBs until the extent containing the absolute track requested is found; when found, this routine determines whether there is enough available space at the specified location to fill the request.	RESET	IGG0325C
Moves the F5 extent that fills the request to the extent table. Transfers control to IGG0325E.	INSERTL0	
1 Modifies the channel program and reads the F1 DSCB.	SUBALLOC	IGG0325S
Verifies that the data set or VSAM data space was originally allocated contiguously.	DSFOUND	
Creates new F1 DSCB extents and updates the old F1 DSCB extents. Transfers control to IGG0325M.	MODNEWF1	
Verifies that there is enough space in the extent to fill the request. Enters the extents to be suballocated in the extent table.	EXTOK	
2 Enqueues the VTOC, builds an F1 DSCB for the new data set or VSAM data space, writes the new F1 and, if not all of the old F1 DSCB extent was suballocated, the old F1 is written back to its original location. (If all of the old F1 was suballocated, the new F1 DSCB is written over it.)	BLDF1	IGG0325M
3 Updates the high-water mark (DS4HPCHR) and the number of F0s (if changed) in the F4 DSCB. Sets high-order byte of register 8 to X'FF' and transfers control to IGG0325H to conclude processing.	UPDTF4	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Converts extents of the first F5 DSCB from XXYYZ to RTA and the number of tracks format, when not entered from the user-label routine (IGG0325K); Determines request option: CONTIG, MXIG, ALX, or no-option specified.	START	IGG0325D
2 Searches F5 DSCBs and builds entries for the extent table according to the option specified:		
• CONTIG request	CONTIG	
• No option specified	BLANK	
• MXIG or ALX	ALX	
Builds a pushdown list of as many as five extents (four if user labels were specified) when more than one extent is required to fill the request.	PSHDOWN	
Transfers control according to request type: split-cylinder request on a drum device (IGG0325J), split-cylinder request on a device other than a drum (IGG0325L), or non-split-cylinder request (IGG0325E).	LOADPTR	
Sorts extent table into ascending RTA sequence.	FIRSTPAS	IGG0325E
3 Branches to subroutine that builds an F1 DSCB and an F3 DSCB, if required. Branches to the resident conversion routine to convert extent table entries from RTA1/RTA2 to CCHHCCHH and enters them in the F1 or F3 DSCB.	START1	
When a partial F1DSCB has been supplied, builds the F1 using the partial DSCB as a model.	BLDF1B	
Builds an F1 DSCB from the JFCB information.	BLDF1A	
Builds an F3 DSCB and chains it to the F1 DSCB.	BLDF3	
4 Updates the hole count (DS4DSREC) and high-water mark (DS4HPCHR) in the F4 DSCB, if necessary.	OLDHIWAT	

Diagram 06. Non-ISAM Allocation—Split-cylinder Data Set Allocation and F5 and F4 DSCB Updating

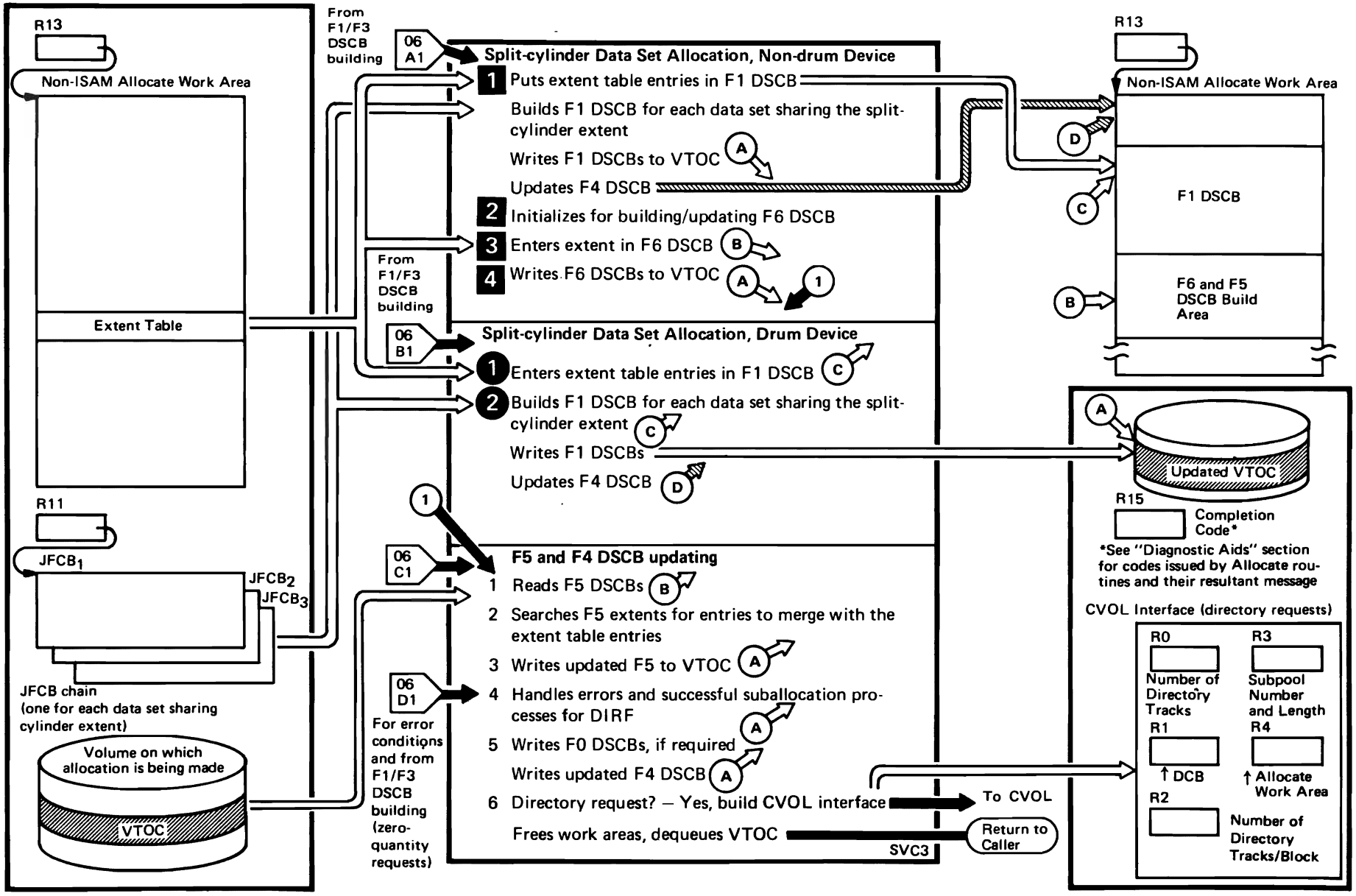
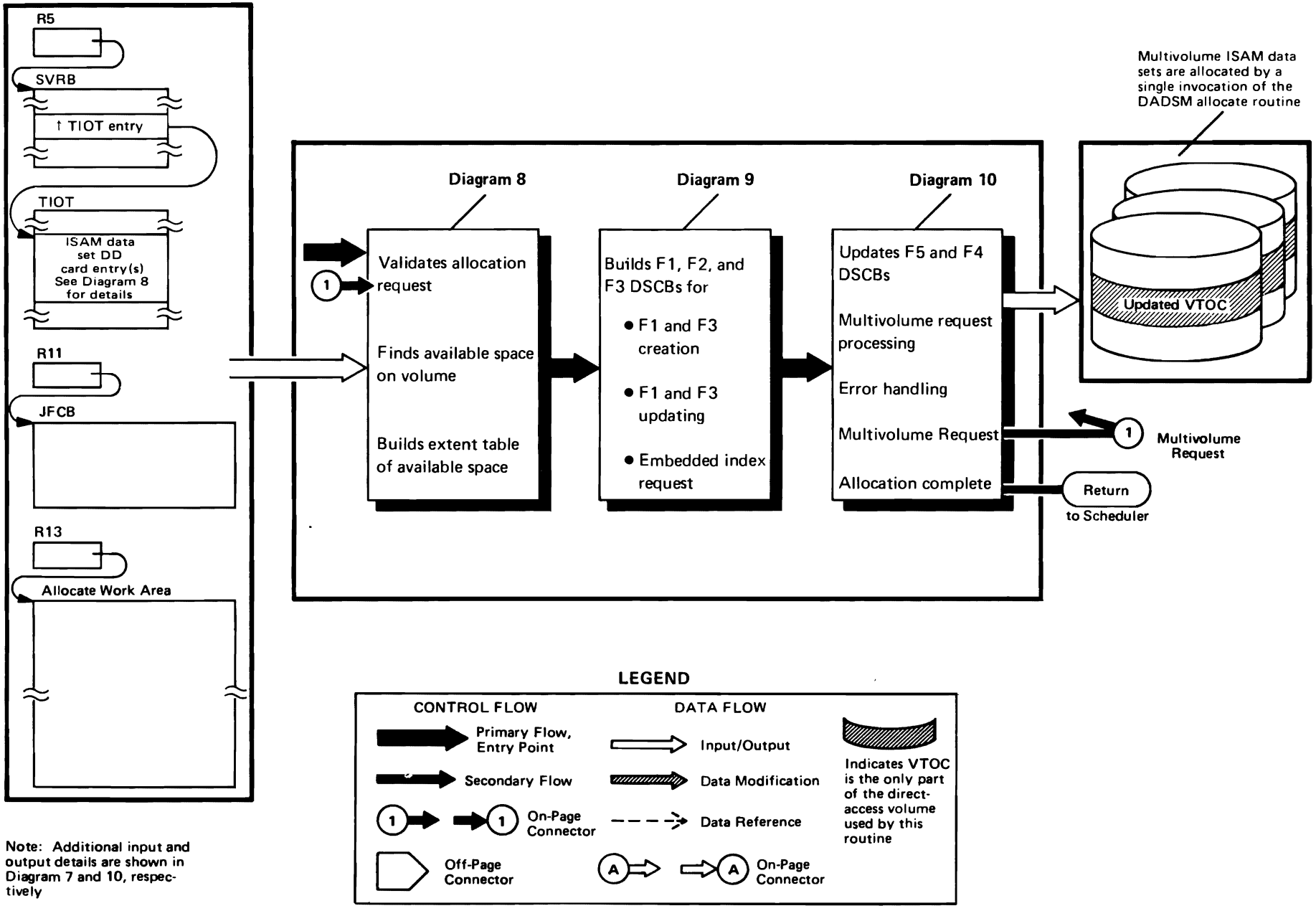


Diagram 06. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 This module is entered when a split-cylinder allocation is requested for a volume on any DASD except a drum.	BLDF1F3	IGG0325L
Links to the resident conversion routine (IECPCNVT) to convert the RTA1 entry in the extent table to CCHH and verify boundary alignment, then enters the converted extent in the F1 DSCB. If the first extent is the user-label extent, this routine completes the DS1EXT1 field for the user label, then converts the second extent table entry from RTA1 to CCHH and enters it in the F1 DSCB.	RESET1	
Determines whether user labels are requested.	UPPEREXT	
Calculates and converts the RTA2 entry; enters the CCHH in the F1 DSCB.	SKIPUSER	
Calculates RTA1/RTA2 of next split-cylinder data set to be allocated. Enqueues VTOC.	NEXTRTA	
Builds an F1 DSCB using information in the JFCB for each data set sharing the cylinders. Writes F1 DSCB to VTOC.	BLDF1A	
For the second and subsequent data sets sharing the cylinders, this routine calculates the CCHHCCHH and enters it in the DS1EXT1 field of each data set's F1 DSCB.	SHARED	
Updates the F4 DSCB and transfers control to IGG0325F.	OLDHIWAT	
2 Initializes pointers and counters, clears the F6 DSCB output area. Determines if there is an F6 DSCB currently on the volume, and if not, branches to a subroutine that searches for a hole (F0 DSCB) over which the new F6 can be written.	BLDF6	IGG0325F
If there is already an F6 DSCB on the VTOC, reads in the first and subsequent F6 DSCBs. Searches the F6 for an available location to enter the split-cylinder extent.	READF6	
3 Branches to a subroutine that converts the extent table entry from RTA1/RTA2 to XXYYZ format and moves the converted extent to the F6 DSCB. If no more DSCBs are to be built for split-cylinder data sets, transfers control to IGG0325F.	TBLSRCH	
4 Chains and writes new/modified F6 DSCBs to the VTOC. If more than one entry in the extent table (user labels are requested), sorts the extent table into ascending RTA sequence.	WRITEF6	
Transfers control to IGG0325G.	LASTF6	
1 This module is entered when a split-cylinder data set is to be allocated on a volume residing on a drum. Links to the resident conversion routine (IECPCNVT) to convert the RTA1 of the first extent table entry to CCHH format and enters it in the F1 DSCB. If the first entry is for a user label, this routine completes the DS1EXT1 field for the user label, then converts the RTA1 of the second extent table entry to CCHH format and enters it in the F1 DSCB.	START1	IGG0325J
Updates the DS1EXT1 field for each data set sharing the extent.	SHARED	
2 When the data set extent has been converted and entered in the F1 DSCB, this routine completes the rest of the F1, using information from the JFCB. Issues an ENQ macro instruction (with the set-must-complete option). Links to a subroutine that writes the F1 DSCB to the VTOC.	BLDF1	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
Updates the hole count and high-water mark (DS4DSREC and DS4HPCHR fields, respectively) of the F4 DSCB, if necessary.	OLDHIWAT	IGG0325J (Cont.)
Checks for more split-cylinder data sets to be allocated. If all have been allocated, restores the extent table, and tests for user labels. If a user-label request has been processed, the extent table is sorted into ascending RTA sequence. Transfers control to IGG0325G.	SPLITEST	
1 Initializes pointers and counters, clears F5 DSCB output area. If the first F5 DSCB is not in virtual storage, branches to a subroutine that reads it in. Branches to a subroutine that converts the F5 extents from XXYYZ format to RTA1/RTA2.	DADSMSTR	IGG0325G
2 Determines when and where the extent table entries should be merged with the F5 DSCB extents.	DUELOOP	
Merges extent table entries with the F5 DSCB extents if the space is allocated from the beginning or middle of an F5 extent.	ALTEREX	
Merges extent table entries with the F5 DSCB extents if the space is allocated from the end of an F5 extent or if it takes all of the extent.	TOTALL	
3 When a new F5 DSCB has been created, searches for a hole (F0 DSCB) on the VTOC over which the new F5 can be written.	SEARCH	
Converts RTA1/RTA2 entries to XXYYZ format in the updated/new F5 DSCB. Chains the F5 DSCB, completes the fields and branches to a subroutine that writes the F5 to the VTOC.	WRITEF5	
When the second and subsequent F5 DSCBs must be read into virtual storage, this routine links to a subroutine that reads in the next F5 and then converts its extents from XXYYZ to RTA1/RTA2.	SAVEID	
Branches to a subroutine that writes the last F5 DSCB to the VTOC; transfers control to IGG0325H.	WRITEFNL	
4 Sets/resets DIRF bit; tests for successful entry from the suballocate routine. Tests DIRF indicator; if there was a previous interrupt or if a permanent I/O error has been encountered, returns to caller without writing the F4 back to the VTOC.	START	IGG0325H
Calculates the TTR or converts the CCHHR of each non-split-cylinder data set to TTR format and stores it in the JFCB.	CONVERT	
5 If an F0 DSCB is to be written (when an F5 DSCB is to be removed), this section branches to a subroutine that writes the F0 DSCB.	TSTZERO	
Modifies the channel program and links to a subroutine that writes the modified F4 DSCB to the VTOC.	WRITEF4	
6 When directory processing is required, this section links to a subroutine that dequeues the VTOC. Loads registers required by CVOL and transfers control via XCTL to IGG0CLF2.	TSTDIR	
Entered for non-directory requests, this section dequeues the VTOC, loads the completion code, releases the allocate work area (if RPS feature is present, deletes IGG019EK and releases RPS work area) and returns control to the caller via SVC 3.	GOODEND	

Diagram 07. ISAM Allocation—Overview



Note: Additional input and output details are shown in Diagram 7 and 10, respectively

Diagram 08. ISAM Allocation—Request Validation and Free-Space Search

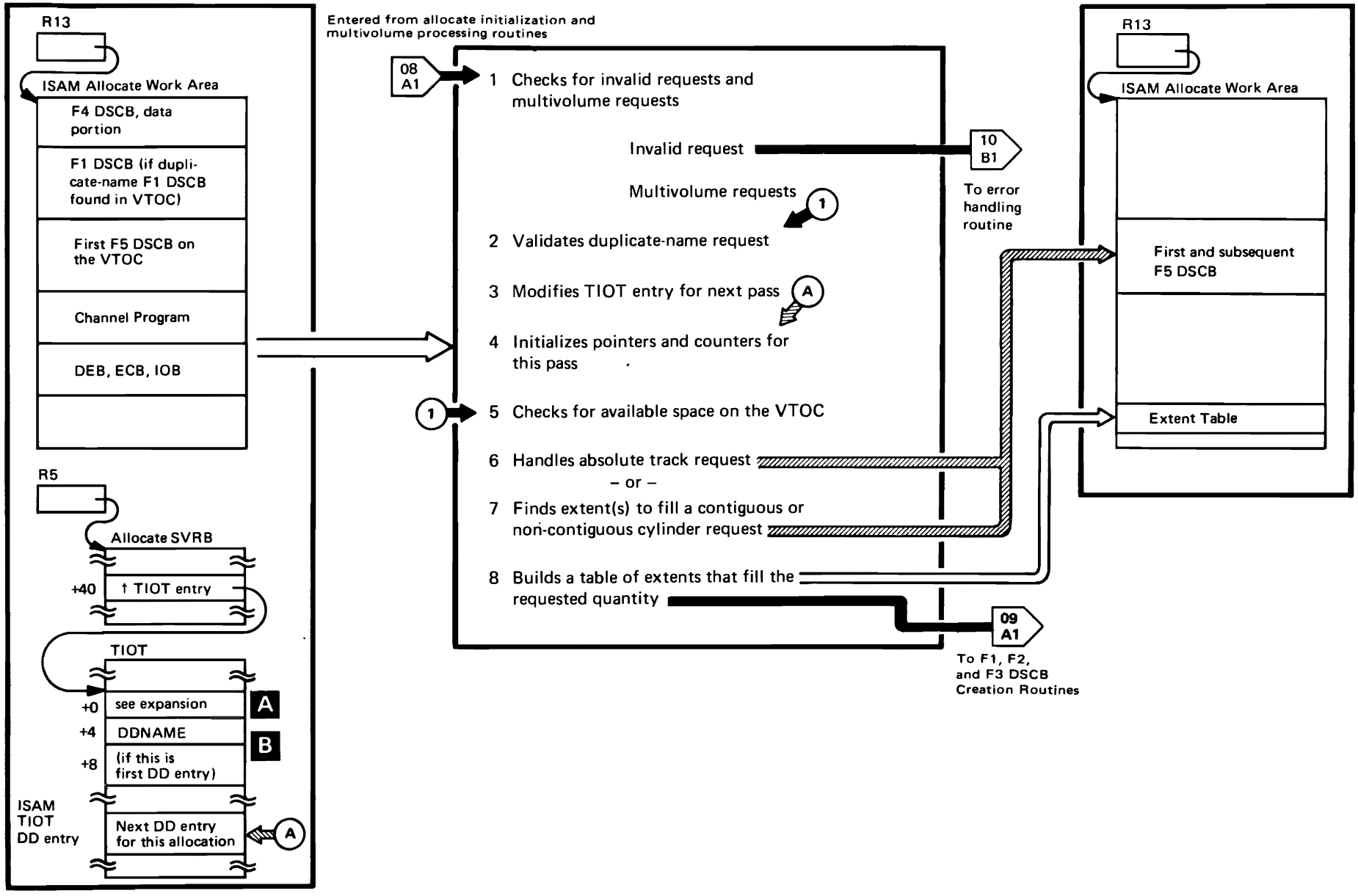
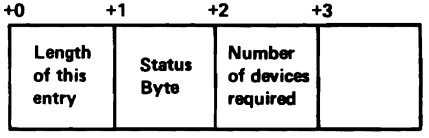


Diagram 08. (Continued)

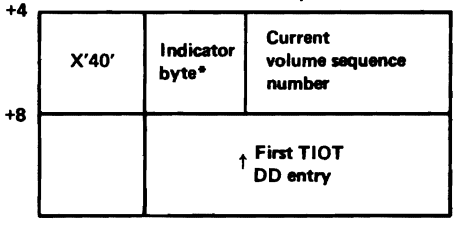
	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Determines whether this is a cylinder or absolute-track request.	ALPHA	IGG03211
	Checks for entry from the multivolume-loop module; if multivolume request, transfers control to next load (IGG03212); checks validity of duplicate-name F1 DSCB if one has been found.	CHECK	
2	Verifies that pointer to first DD statement entry is not blank.	MORETHAN	
	Verifies UCBs for this and preceding request are same for duplicate-name requests.	CONTINUE	
	Calculates the address of legitimate duplicate-name F1 DSCB.	LEGITIMT	
3	For the first DD statement, determines if a second DD statement exists for this ISAM allocation, checks validity of request type (that is, absolute track, cylinder) and space type (index, prime, overflow). Sets bit in the next TIOT entry to indicate request type and space type of this TIOT entry.	AROUND	
	For second or third DD statement, ensures that request type (contiguous cylinder, overflow, etc.) is appropriate.	NONAME	
4	Sets up work area for this pass: TIOT entry pointer, primary quantity requested, directory quantity, absolute track address, UCB pointer.	MOVEFLDS	
	Sets XCTL ID for transfer to IGG03212.	REJOIN	
5	Checks for four available records (F0 DSCBs) on the VTOC.	ALPA	IGG03212
	Sets up channel program to read F5 DSCBs.	GOREAD	
	Sets up the F5 DSCB in virtual storage to search for available extents.	SUCCIO	
6	For absolute-track requests:		
	• Ensures that quantity requested is on cylinder boundaries.	NONEHERE	
	• Finds the extent that contains the specified tracks.	COMPRTA	
	• Unless the last F5 extent has been reached, determines whether the last F5 extent will fill the request.	CHECKOUT	
	• When the extent containing the specified track is found, determines whether the space is available.	STOPHERE	
	• Converts XXYYZ of F5 extent to RTA1/RTA2 and builds a one-entry extent table.	GOODQTY	
	• If there is more than one F5 DSCB on the VTOC, reads in next F5.	UPDATESK	
7	For contiguous requests in cylinders, finds smallest F5 extent on the volume that fills the request.	CYLREQ	
	For non-contiguous (no-option-specified) requests in cylinders, finds the smallest extent that fills the request or builds and sorts by RTA a five-entry list of the largest extents encountered that are insufficient to fill the request.	BLANK	
8	Selects the extents (from two to all five) that are needed from the list just built to fill the request. Enters the extents selected in the extent table.	PICKLIST	

A



B

For second or third DD entry



*Indicator byte

0	1	2	3	4	5	6	7	
0	0	•	•	•	•	•	•	– Absolute-track request
0	1	•	•	•	•	•	•	– Blank area-type request
1	1	•	•	•	•	•	•	– Contiguous space request
•	•	1	•	•	•	•	•	– Second DD statement
•	•	•	•	•	•	•	1	– Index requested
•	•	•	•	•	•	1	•	– Prime area requested
•	•	•	•	•	1	•	•	– Overflow area requested

Diagram 09. ISAM Allocation—F1, F2, F3 DSCB Updating

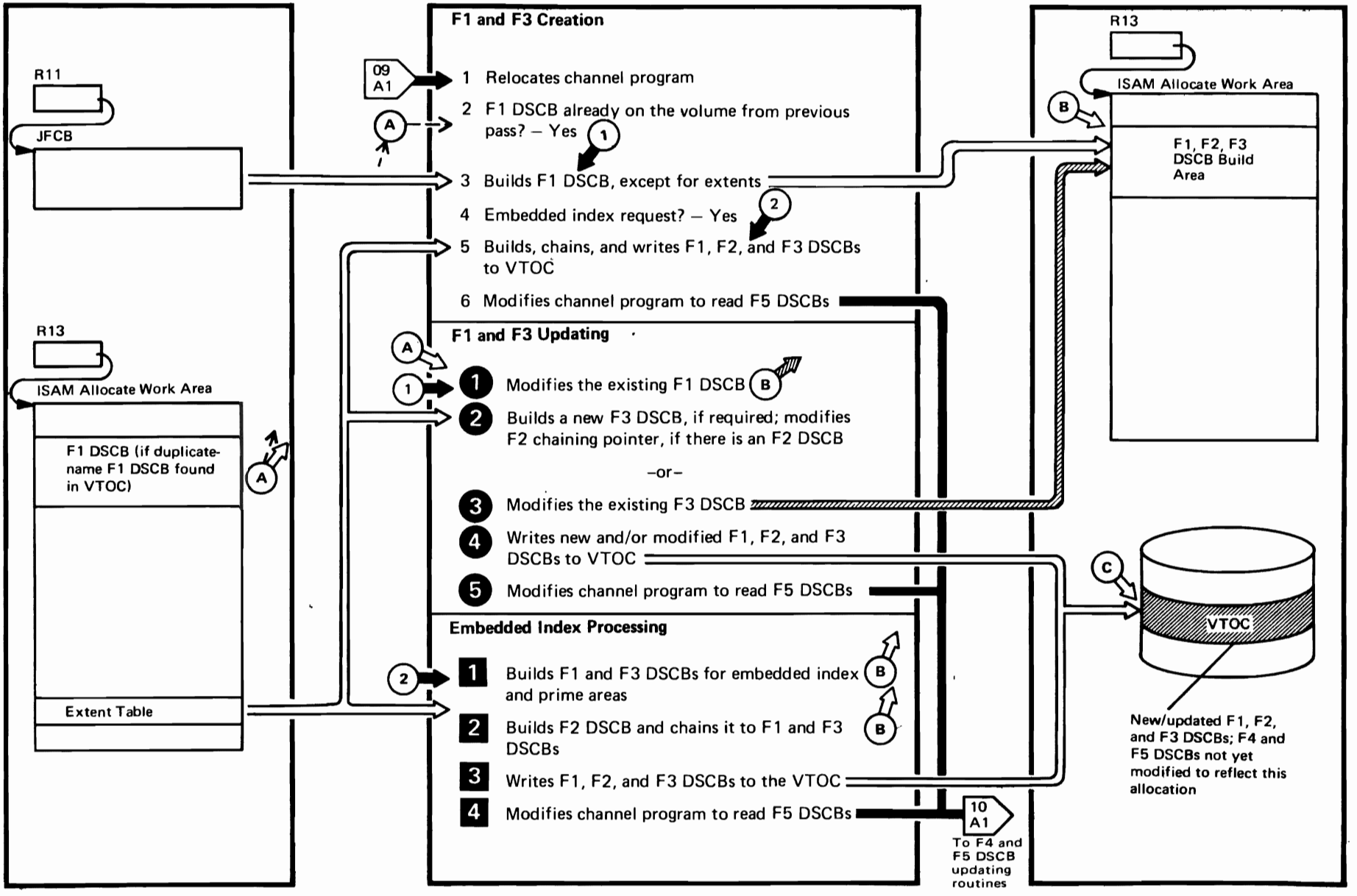
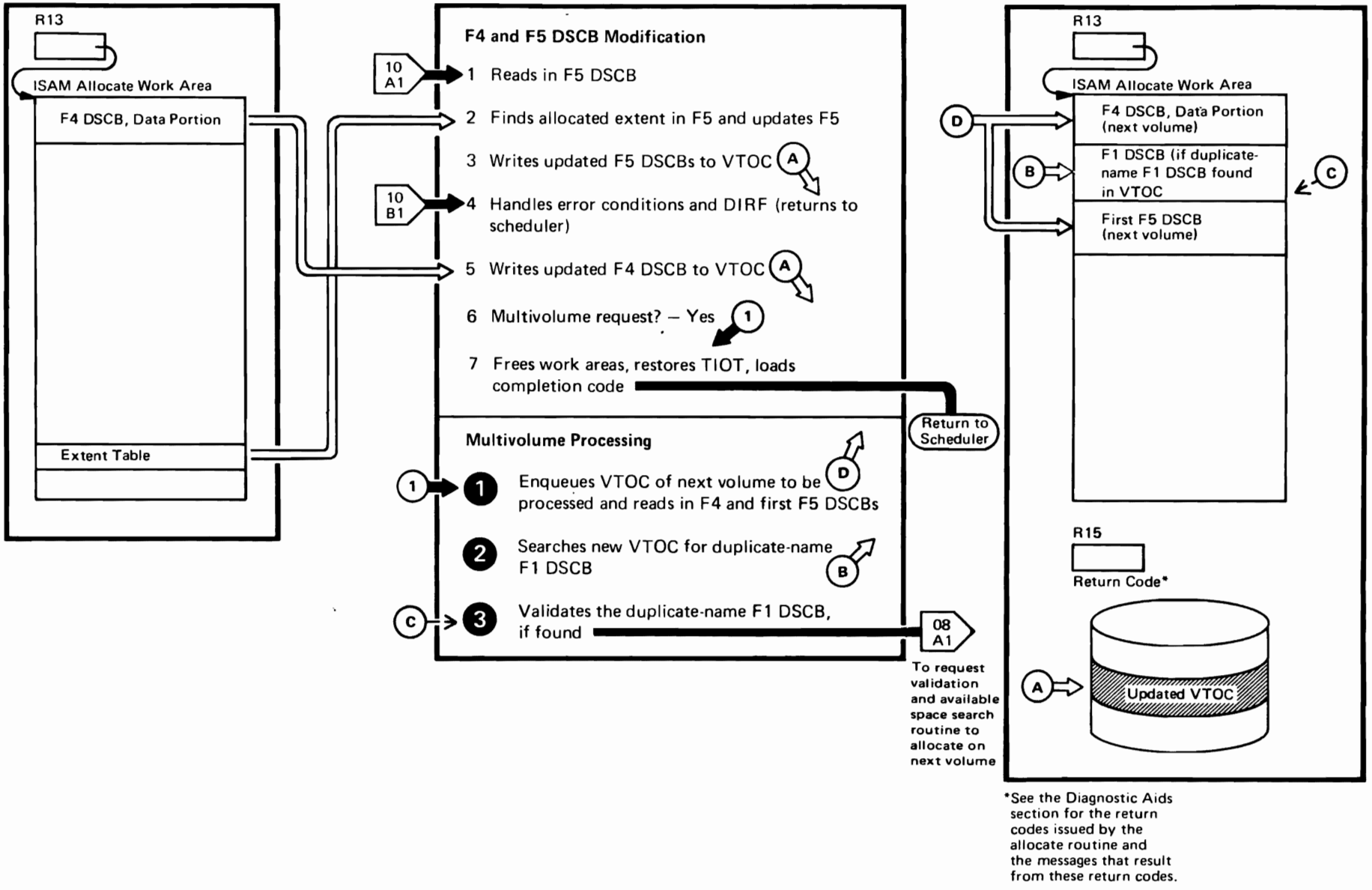


Diagram 09. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Relocates channel program for reading and writing F1, F2, and F3 DSCBs for this and subsequent loads.	BETA	IGG03213
2 Determines whether F1 DSCB already exists; if so, transfers control to IGG03214.	FINE	
3 Builds all but extent fields of F1 DSCB.	FROMJFCB	
For second or third DD statement case, updates volume sequence number. Puts volume serial number in F1 DSCB.	NOTFIRST	
4 Tests for an embedded-index request and if one is specified, transfer control to IGG03215.	FILLEXTS	
5 Fills in extents in F1 DSCB, builds an F3 and fills in its extents if required.	LOOP1	
Tests whether an F2 DSCB is needed, and, if so, builds it; chains F1 to F2 DSCB.	ENTERED	
Finds an F0 DSCB (hole) for new F1, F2, or F3 DSCB. Sets up channel program for writing F1, F2, and F3 DSCBs to VTOC.	CHANGE2	
Checks for enqueuing on VTOC with a set-must-complete, and if required, does so.	CHKSMC	
Links to resident conversion routine to convert RTA1/RTA2 of extent table to CCHHCCHH for F1 and F3 DSCBs.	LOOP	
6 Relocates channel program for updating F5 DSCBs. Sets XCTL ID for transfer to IGG03216.	XCTLDADS	
(1) When this routine receives control, there will be an F1 DSCB in virtual storage from the previous pass. Determines whether an F3 needs to be built and if not, adds extents to the F1 until maximum (3) is reached or until the extent table entries are all processed.	F1EXISTS	IGG03214
Writes F1 to the VTOC.	ENTER	
(2) If no F3 exists, builds F3 DSCB extents until extent table entries are exhausted.	F3BUILD	
When all extents are filled, writes F3 to VTOC.	DONE	
(3) If there is an F2 DSCB on the volume, reads it in, updates the pointer to the F3, and writes it back to the VTOC.	UPDATF2	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
If there is already an F3 DSCB on the VTOC for this data set, reads in F2 to find address of F3.	F3EXISTS	IGG03214 (Cont.)
Finds the first available extent in the F3, adds an extent to the F3 for each extent table entry.	ISAF3	
Writes the F3 to the VTOC. Updates the number of extents in the F1 DSCB.	THRU	
(4) Does a set-must-complete enqueue on the VTOC if required; links to IOS to read and write from the VTOC.	EXEC	
(5) Sets up channel program for updating the F5s. Sets XCTL ID for transfer to IGG03216.	XCTLDADS	
Branches to resident conversion routine (IECPCNVT) to convert RTA1/RTA2 of extent table to CCHHCCHH format for F1 and F3 DSCBs.	LOOP	
(1) Converts cylinder requests to tracks.	OMEGA	IGG03215
Finds the middle of the prime area requested using extent table entries.	NEXTA	
Determines how much space from the middle of the next extent table entry is needed for the index.	ICK	
Splits extent table entry into prime and index areas.	CHECK	
Puts number of index extents into the F1 DSCB; converts index entries for the F1 and F3 DSCBs from RTA1/RTA2 to CCHHCCHH.	OUTPULL	
Converts prime area entries for F1 and F3 DSCBs from RTA1/RTA2 format to CCHHCCHH. When F1 DSCB extents are exhausted, builds an F3 to contain the rest of the extent table entries.	GETPRIME	
(2) Builds the F2 DSCB; chains F2 to F1.	BUILDF2	
(3) Branches to the resident conversion routine (IECPCNVT) to convert RTA to CCHH.	LOOP	
Relocates channel program to write F1, F2, F3s to VTOC.	WRITEF1	
Enqueues on VTOC (with set-must-complete, if required).	SEARCHF0	
(4) Relocates channel program for updating the F5 DSCB and sets XCTL ID for transfer to IGG03216.	XCTLDADS	

Diagram 10. ISAM Allocation—F5 and F4 Modification and Multivolume Processing



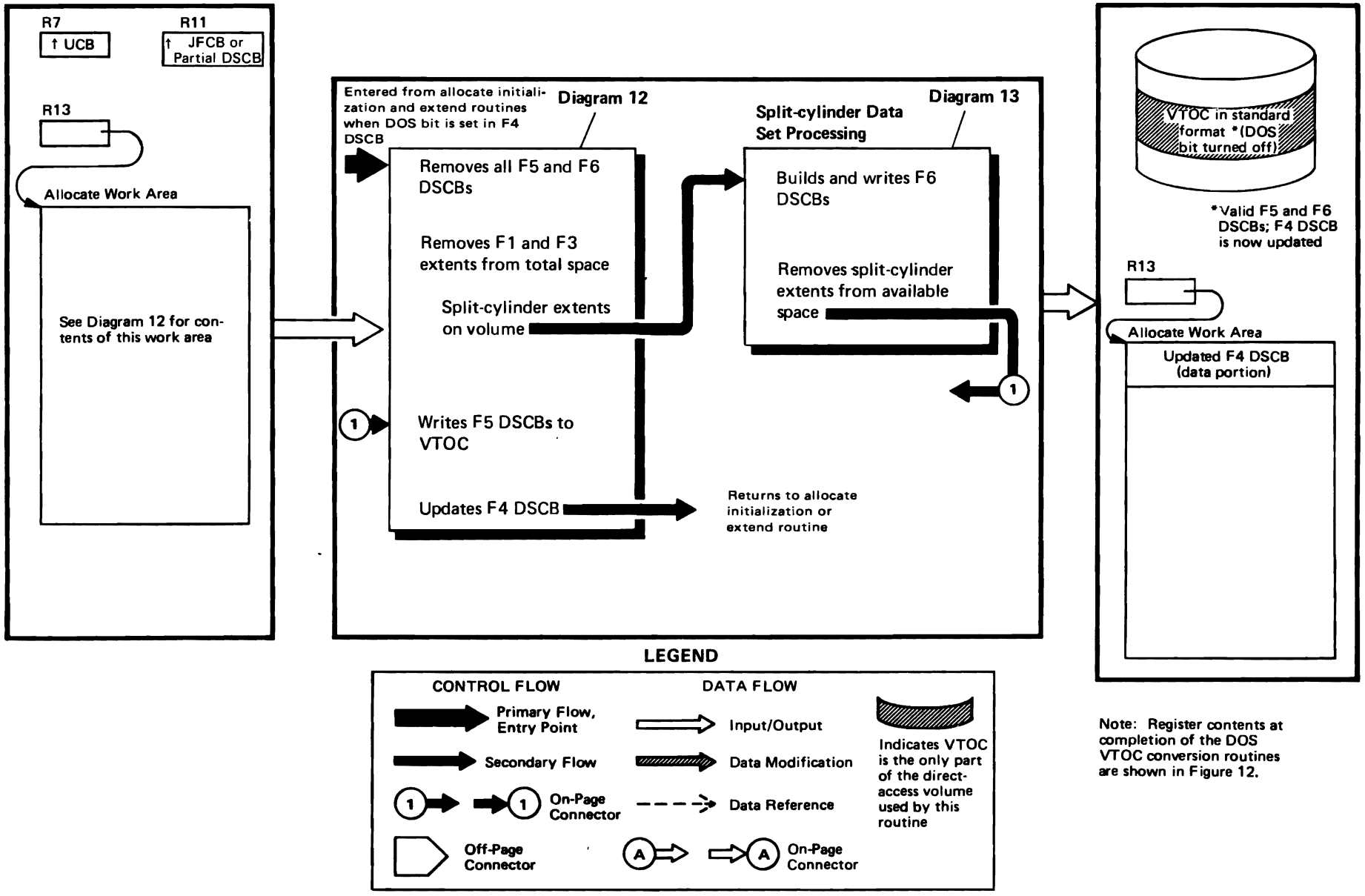
*See the Diagnostic Aids section for the return codes issued by the allocate routine and the messages that result from these return codes.

Diagram 10. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Calculates the TTR of the F1 DSCB and stores it in the JFCB.	CONVERT	
	Initializes F5 output area; initializes pointers to input and output areas; reads in first F5 DSCB.	DADSMSTR	IGG03216
	Determines when an extent table entry is to be merged into the F5 DSCBs.	DUELOOP	
	Reads first and additional F5 DSCBs. Resets input pointers and counters. Converts extents from CCHHCCHH to RTA1/RTA2 format.	SAVEID	
2	Merges an extent table entry to add available space to the beginning or middle of an existing F5 extent.	ALTEREX	
	Merges extent table entries that are returning available space to the end of an existing F5 extent or adding an extent.	TOTALL	
	Searches for a hole (F0 DSCB) in the VTOC where a new F5 DSCB can be written.	CHEXT	
3	Converts the RTA1/RTA2 entries to XXYYZ format, inserts F5 chain pointer, completes F5 fields, and writes the F5 DSCB to the VTOC.	WRITEF5	
4	Tests for error condition, and if found, tests DIRF setting; if there was a previous interrupt, takes error exit; if there was no previous interrupt, tests for permanent I/O error; if found, takes error exit; if not a permanent I/O error, forces an F4 to be written to the VTOC, then takes an error exit to return to scheduler.	DELTA	IGG03217
5	Resets DIRF indicator, updates the number of F0s left on VTOC, relocates a channel program and writes the F4 to the VTOC. Tests for a multivolume request. For multivolume requests, updates UCB counter, checks for completion of the multivolume allocation. Increments number of tracks just allocated from total to be allocated and sets up amount to be allocated and absolute track (if requested) on the next volume.	NOERROR	
	Checks to see if allocation is successful, and if not successful and not the first DD statement, sets up a dummy absolute-track request so that no further attempt to allocate will be made.	MISTAKE	

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
6	Dequeues on this volume and transfers control to IGG03218 for duplicate-name search on multivolume request.	MIXED	IGG03217 (Cont.)
7	Checks for successful allocation. Fills a TIOT entry for the third DD statement for multiple DD statement requests.	ALLOUT	
	If allocation is completed, restores TIOT to the way it was before entering the allocate routine.	OUT	
	Dequeues on VTOC.	FINAL	
	Frees RPS work area if one has been established.	FINAL2	
	Frees allocate work area and returns control to scheduler (calling routine).	CONTINUE	
1	Relocates the channel program for reading in the F4 DSCB and first F5 DSCB and for searching the VTOC for a duplicate name on the next volume to be processed. Updates the UCB pointer in the DEB. Saves pointer to TIOT DD entry.	RELOCCP	IGG03218
	Links to resident conversion routine to convert VTOC relative track address to absolute address (MBBCCHHR). Issues a RESERVE macro instruction to enqueue on the VTOC of next volume.	ZEROCLR	
2	Reads in data portion of F4 DSCB and the first F5, searches for a duplicate-name F1 on the VTOC, and reads in the duplicate-name F1 DSCB, if found.	EXECUTET	
	Sets/resets then tests DIRF indicator. Determines whether a duplicate-name F1 DSCB has been found.	CHECK	
3	Determines whether the duplicate-name DSCB is valid. Calculates the address of the duplicate-name F1 DSCB.	SAMENAME	
	Saves F1 and F5 addresses and transfers control to the first load of ISAM allocate (IGG03211).	NOTBOS	

Diagram 11. DOS VTOC Conversion—Overview



Note: Register contents at completion of the DOS VTOC conversion routines are shown in Figure 12.

Diagram 12. DOS VTOC Conversion—Initialization, Non-split Cylinder Data Set Conversion and Termination

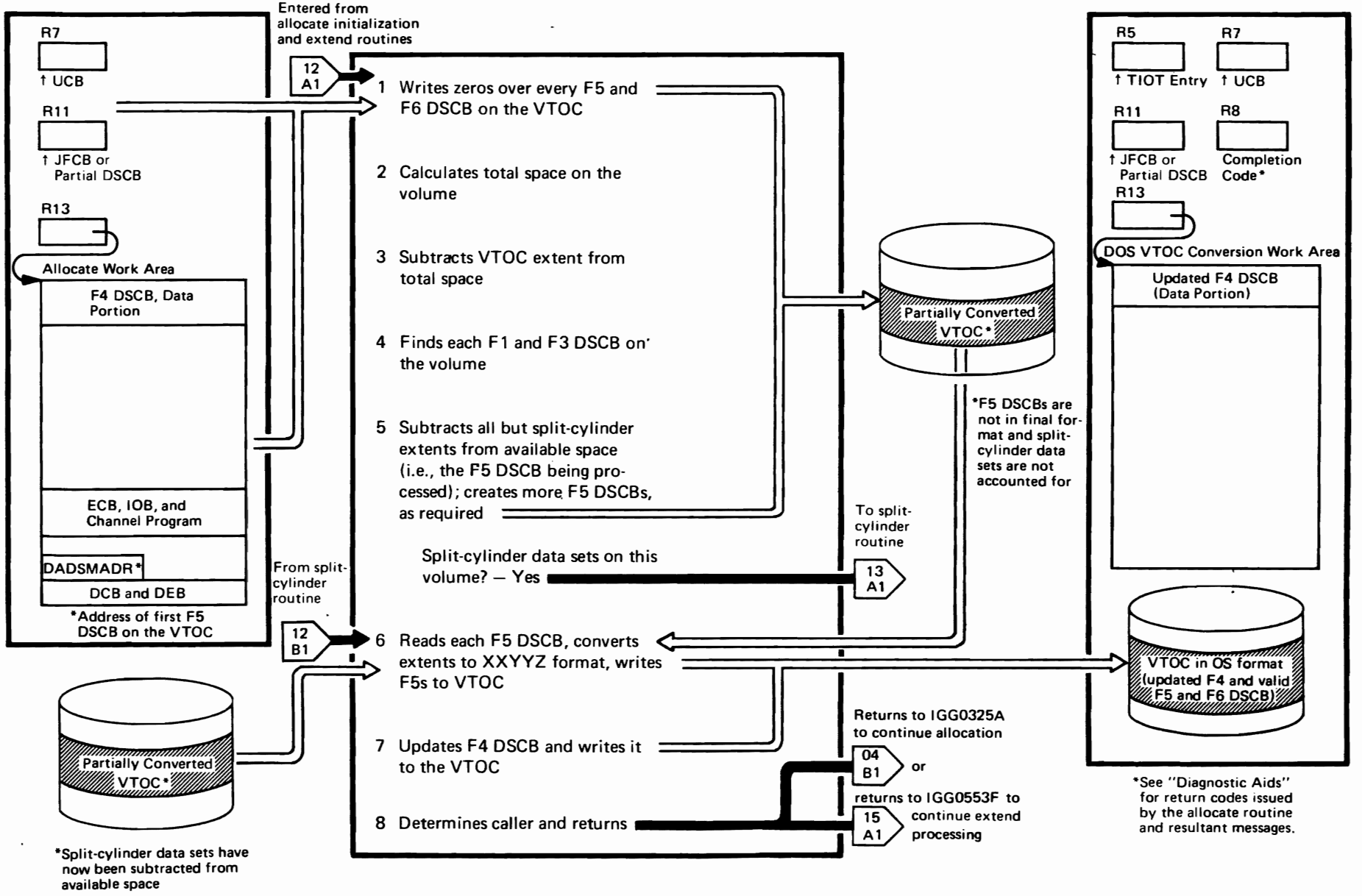


Diagram 12. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Relocates channel program to read and zero out F5 and F6 DSCBs.	IGG0325Z	IGG0325Z
	Calculates number of DSCBs in the VTOC.	NOCYL	
	Reads and zeroes out all existing F5 and F6 DSCBs.	READNEXT	
	Tests for F6 DSCBs on the volume. If there are F6s, prepares to zero them out.	ZEROF6	
2	Calculates the highest track that can be allocated on the volume (as if no data sets existed on the volume).	STARTF5	
	Determines if volume is used for initial program loading (IPL) and calculates lowest track that could be allocated on the volume (as if no data sets existed on the volume).	HIGHTK	
	Converts the VTOC extent to RTA1/RTA2 format.	SUBTVTOC	
3	Determines if VTOC begins on the lowest track. If so, it subtracts the VTOC extent from the total space on the volume.	CONT	
	If the VTOC does not begin on the lowest track, this section subtracts the VTOC extent from the total space on the volume.	CHECK2	
	Reads the first zeroed out F5 DSCB and transfers control to IGG0325P.	HOLECNT	
4	Tests to determine whether every DSCB in the VTOC has been read. If not, it reads the next DSCB.	TESTSW	IGG0325P
	Tests if an F1, F2, or F3 DSCB has been read. If so, it decrements the number of unused DSCBs.	F1ORF3	
	Tests if an F1 DSCB was read in. If so, it updates the high-water mark. Initializes pointers and counter to convert the F1 extent(s) to RTA1/RTA2 format.	CHECK1	
	Tests if an F3 DSCB was read in. If so, initializes pointers and counters to convert the F3 extent(s) to RTA1/RTA2 format.	CHECK3	
	Converts all non-split-cylinder data set extents to RTA1/RTA2 format and enters them in the extent table.	CONVERT	
	When the extent table contains five entries, this routine sorts the entires into ascending RTA sequence.	ORDER	
5	This routine compares each entry in the extent table with the F5 extents. When the F5 extent is found that contains the extent table entry, this routine subtracts the tracks allocated to the entry from the F5 extent, if this extent comes at the beginning or end of the F5 extent or takes all of the extent.	NEWCOMP	
	Subtracts the tracks allocated to the entry from the F5 extent when the extent table entry is in the middle of the F5 extent (results in the creation of two F5 extents).	TWOEXTS	
	When the first F5 is filled (26 extents completed), this routine sets up parameters and transfers control to IGG0325R.	PREPPARM	

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
	When all five extent table entries have been sorted and subtracted, this routine determines whether the F1 or F3 DSCB contains more extents to be converted or whether the next DSCB must be read.	RETURNPT	IGG0325P (Cont.)
	When all the DSCBs have been read, this routine branches to a subroutine that sorts and subtracts any remaining entries in the extent table and writes the F5 to the VTOC. If there are split-cylinder data sets on the volume, it transfers control to IGG0325Q. Otherwise it transfers control to IGG0325T.	FINISH5	
	Compares each entry in the extent table with the extents of the current F5.	BEGNCOMP	IGG0325R
	Moves all of the extents in the current F5 forward to wipe out an extent that was totally allocated. Determines if there are chained F5 DSCBs.	WIPEOUT	
	Zeroes out the last extent in an F5 or zeroes out the last F5 in the chain.	NEXTCOMP	
	Modifies an F5 extent when the allocated extent begins at the beginning of the F5 extent.	REPLACE	
	Writes the modified F5 to the VTOC and rereads the current F5.	WRITENOW	
	Reads next F5 in the chain and moves an extent from the beginning of this F5 to the end of the previous F5. Writes out the previous F5.	MERGERTN	
	Determines if there are more entries to be subtracted. If not, it reads the first F5 and transfers control back to IGG0325W (if split-cylinder extents were subtracted) or to IGG0325P.	UPDATR	
	Determines if the allocated extent is within the F5 extent. If not, it points to the next F5 extent or reads in the next F5 in the chain.	MORECK	
	Modifies an F5 extent when the extent table entry ends at the same place as the F5 extent (that is, their RTA2s are equal). Writes the F5.	REPLACE2	
	Modifies an F5 extent when the extent table entry falls in the middle of the F5 extent. Writes the F5. Reads next F5 in chain and moves the last extent from the previous F5 to the beginning of the next F5.	EXPANDCK	
	Creates a new F5 and moves the last extent of a previous F5 into it. Writes the new F5 and decrements the number of unused DSCBs.	FINXPAND	
6	Reads the first F5.		IGG0325T
	Converts each F5 extent from RTA1/RTA2 to XXYYZ format.	CONVNEXT	
	Inserts the F5 indicator bytes and the F5 identification byte. Writes the F5 and reads the next F5 in the chain.	MOVEMORE	
7	When all the F5s have been read, converted, and written back, this section turns off the DOS bit in the F4, turns on the "converted" bit, and writes the F4 to the VTOC. It sets completion code in R8 and transfers control to the calling module (IGG0325A or IGG0553F).	TURNOFF	

Diagram 13. DOS VTOC Conversion—Split-Cylinder Data Sets

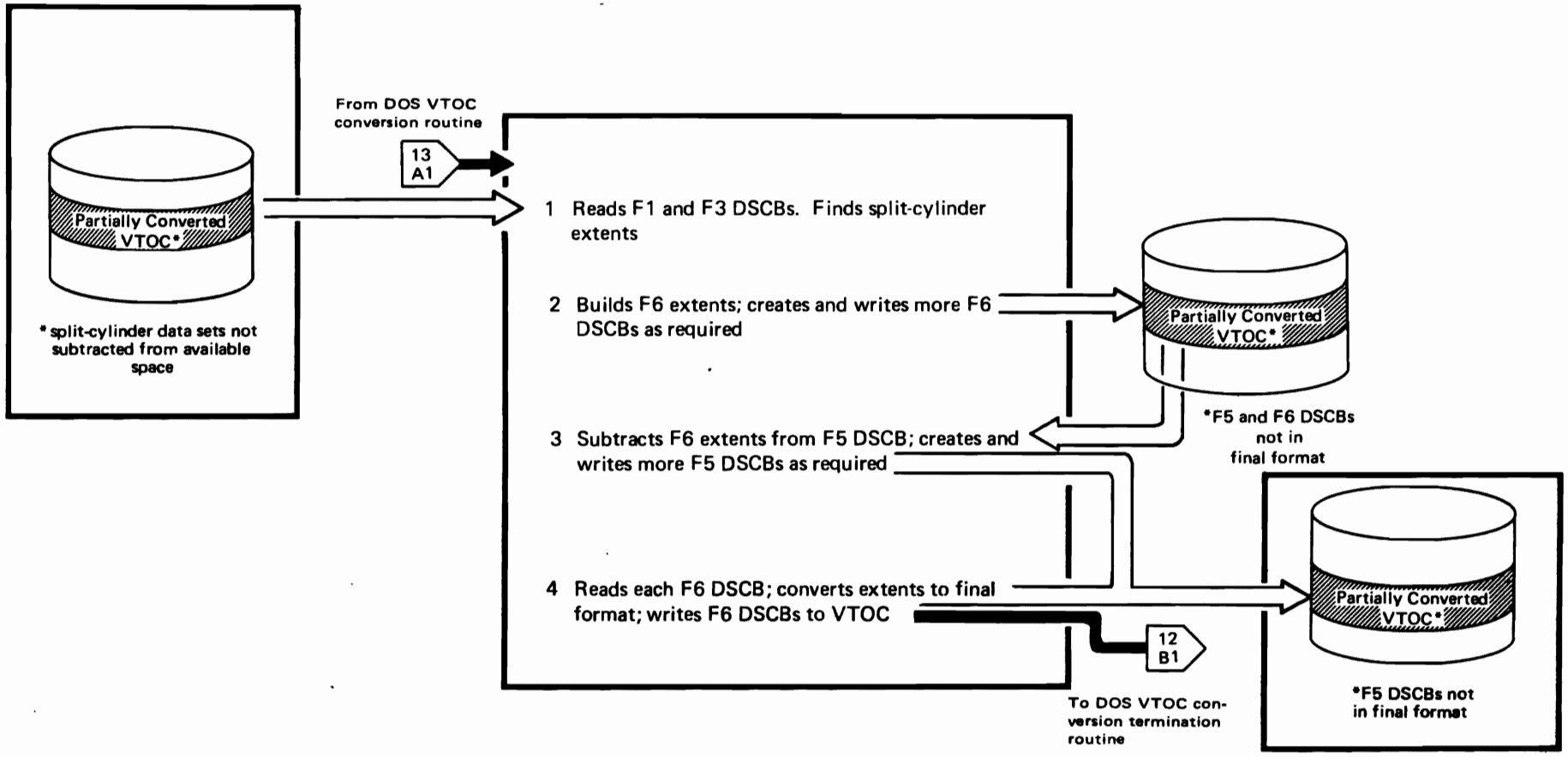


Diagram 13. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Finds the first unused DSCB in the VTOC and initializes the F6 pointer in the F4.	BUILDF6	IGG0325Q
	Tests to determine whether all DSCBs in the VTOC have been read. If not, reads the next DSCB.	READNEXT	
	Determines whether an F1 or F3 DSCB has been read. If so, it initializes a pointer and a counter to be used in testing for split-cylinder extents.	TESTF1	
	Tests if the next extent is a split-cylinder extent.	TESTNEXT	
	Converts a split-cylinder extent from CCHH/CCHH to RTA1/RTA2 format.	CONVERT	
	If the RTA1/RTA2 was the first split-cylinder extent, it builds the first F6.	CONT	
	If the RTA1/RTA2 was not the first split-cylinder extent, this section transfers control to IGG0325U.	XCTL325U	
	When all DSCBs have been read and tested for split-cylinder data set extents, this section writes out the F6 and transfers control to IGG0325W.	XCTL325W	
2	Compares the RTA1/RTA2 just converted to the F6 extent. If it lies within the F6 extent, it transfers control to IGG0325V to check for F6 overlapping.	COMPARE	IGG0325U
	If the split-cylinder extent does not lie within the F6 extent, this section updates pointers and counters to compare it with the next F6 extent or reads in the next F6 in the chain.	NOLAP	
	Creates a new F6 with the split-cylinder extent as the first entry. Chains the new F6 to the previous F6 and writes the old and new F6 DSCBs.	NEWF6	
	Rereads the first F6 and transfers control back to IGG0325Q.	RD1STF6	
	Creates a new F6 extent in the current F6 DSCB if the split-cylinder extent lies between two F6 extents. If this new F6 extent overlaps the F6 following it, control is transferred to IGG0325V.	NEWENTRY	
	Moves all F6 extents one extent to the right and writes the F6 to the VTOC.	MOVE	
	If the F6 is chained, this section reads in the next F6 and continues to move each F6 extent to the right.	LASTF6CK	
	If the split-cylinder extent lies totally within an existing F6 extent, this section increments the data set count by one and writes the F6 to the VTOC.	NEWDSCNT	

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
	For a new F6 extent this routine moves the RTA1/RTA2 of the split-cylinder extent into the F6 and initializes the data set count to one.	NEWEXTST	IGG0325U (Cont.)
	Tests if the newly created F6 extents end before the next F6 extent begins. It reads in the next F6 if the new F6 extent is the last extent in the current F6.	AGAIN	IGG0325V
	If the new F6 extent did not overlap another F6 extent or after all overlapping F6 extents have been combined into one extent, this section restores the original F6 and transfers control back to IGG0325U.	RESTORE	
	Combines two F6 extents.	COMBINE	
	Moves all extents in the current F6 forward to wipe out the extent that was just combined.	WIPEOUT	
	Writes a F0 over the last F6, zeroes out the F6 chaining pointer in the previous F6, and writes out this F6.	COMPLAST	
	Tests if the split-cylinder extent ends within the updated F6 extent.	LASTCOMP	
	Reads in next F6 in chain and moves its first extent into the end of the previous F6. Writes the previous F6 to VTOC.	MERGERTN	
3	Reads the first F5 and the first F6 DSCB.	BUILDTBL	IGG0325W
	Adds an F6 extent to the extent table.	ADDENTRY	
	Initializes pointers and counters and transfers control to IGG0325R to subtract the entries in the extent table from the free space in the F5 DSCBs.	SUBTRACT	
	Updates pointers to the next F6 extents to be added to the extent table. Reads in the F6 when all the extents from the previous F6 have been added. After all F6 extents have been subtracted from the F5 DSCBs, it rereads the first F6.	RETURNPT	
4	Converts the F6 extents from RTA1/RTA2/number of data sets to RTA/number-of-shared-cylinders/number of data sets format.	FINISHF6	
	Inserts the F6 indicator bytes and the F6 identifier byte. Writes the F6 and reads the next F6 in the chain. After all the F6 DSCBs have been converted, transfers control to IGG0325T.	MOVE	

Diagram 14. Extend Overview

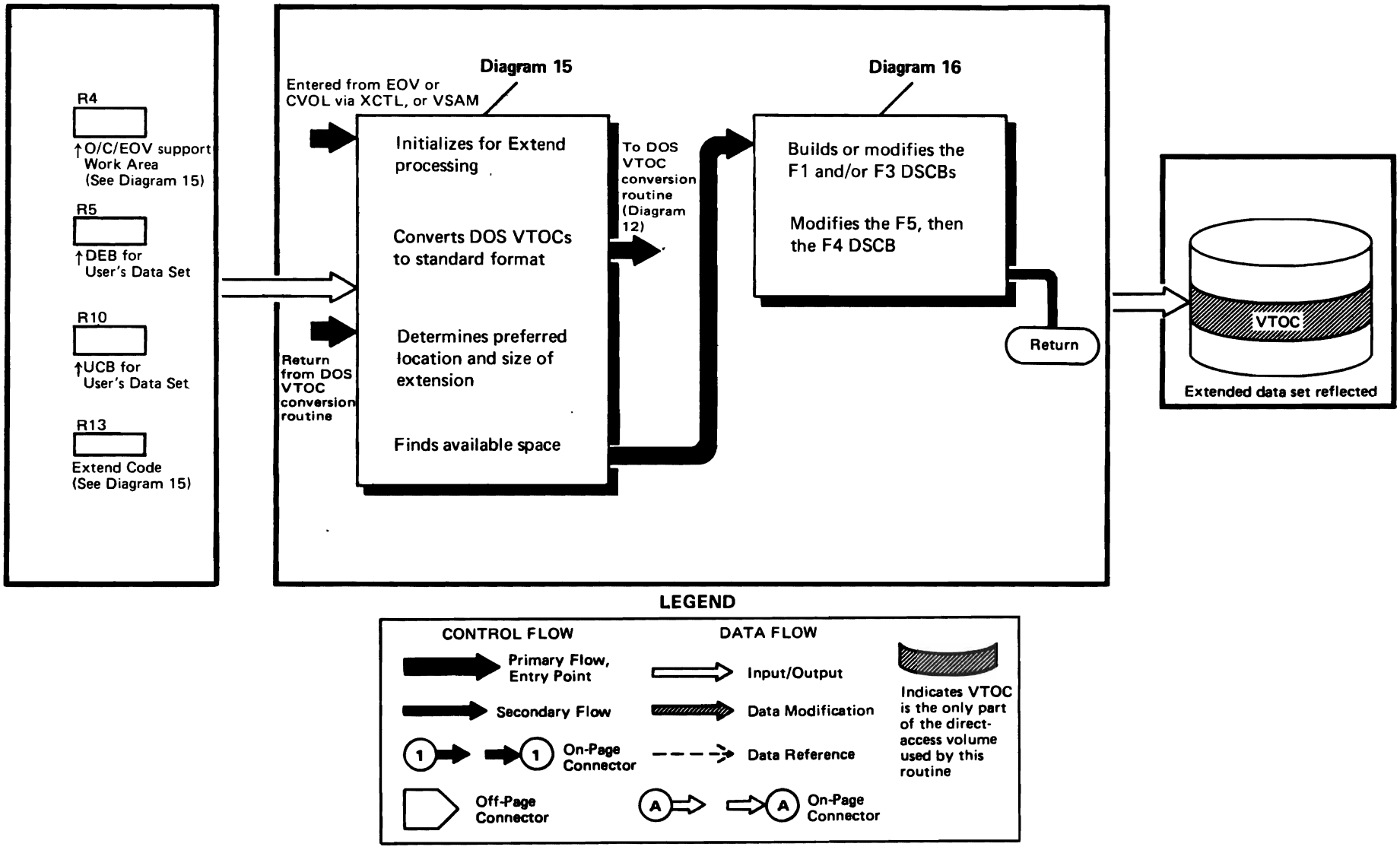


Diagram 15. Extend—Initialization and Free-Space Search

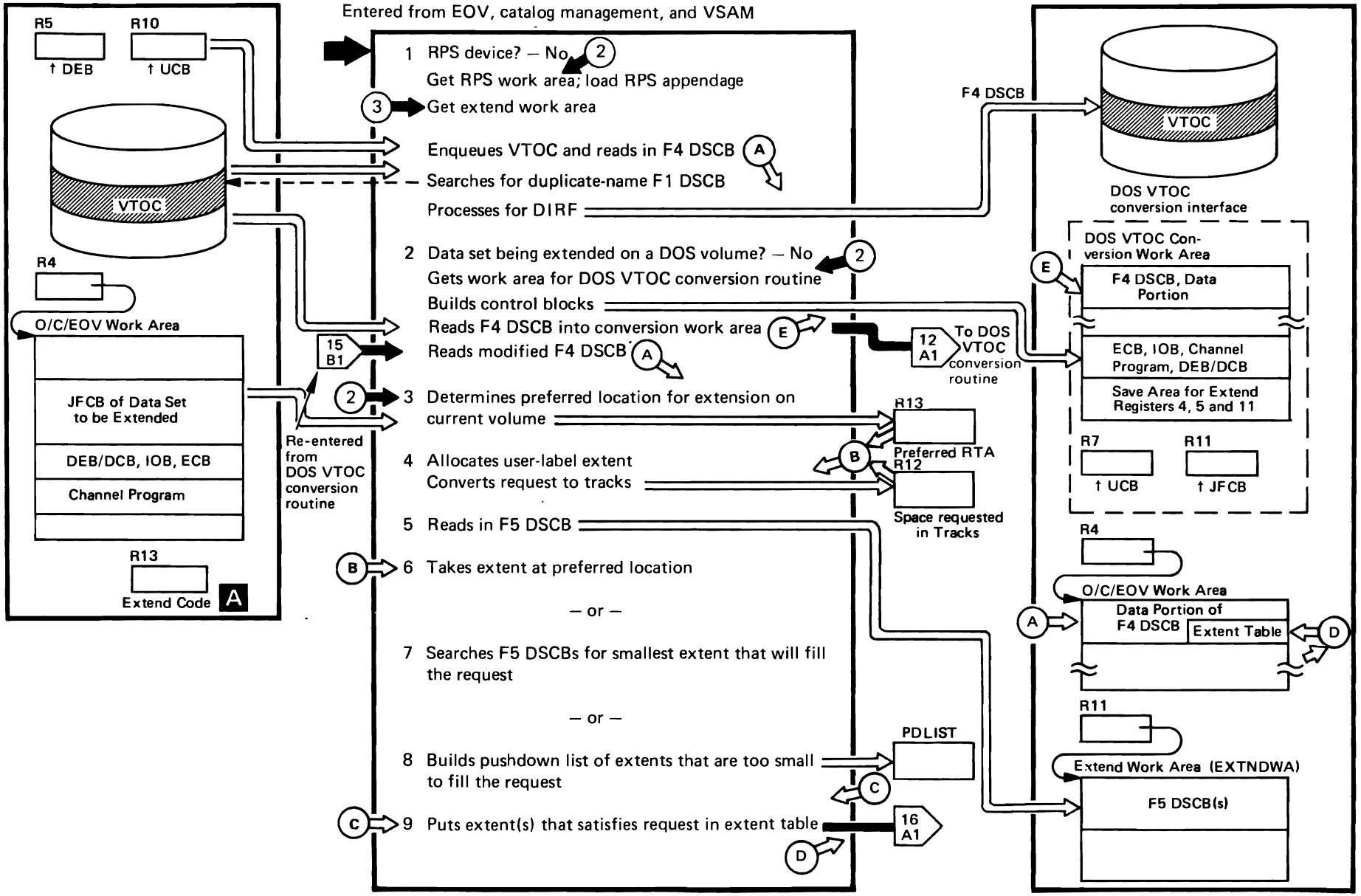


Diagram 15. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Entered (1) from EOV when a data set is to be extended, (2) from CVOL when a catalog is to be extended, or (3) from VSAM when data space is to be extended. This routine initializes the IOS interface for reading from the VTOC. Relocates a channel program to read the F4 and F1 DSCBs.	BEGIN	IGG0553A
Tests for RPS feature. If present, gets 128-byte RPS work area and copies the appendage vector table (AVT) into it. Loads module IGG019EK and enters its address in the AVT. Modifies the DEB in the O/C/EOV work area to point to the RPS AVT.	NOSUBUCB	
Links to resident conversion routine to convert VTOC address from relative track address to absolute (CCHHR). Relocates channel program to read the F4 DSCB and to search for a duplicate-name F1 DSCB. Gets a 288-byte work area. Enqueues on the VTOC using a RESERVE macro instruction. If extending on the current volume of the data set, the CCWs are altered so that no search of the F1 DSCBs for a duplicate name is made. The DIRF bit is set/reset and the F4 DSCB is written back to the VTOC so that a system failure during this processing would be recorded.	SUBUCB	
Tests for invalid, duplicate-name F1 DSCB and for a data set allocated by DOS.	SKIPWR	
Exits to error handling routine (last load of extend) when an invalid duplicate-name F1 DSCB or a permanent I/O error is encountered.	NOROOM	
2 This module is entered when a data set on a DOS volume is to be extended. The VTOC must be converted to standard format by the DOS VTOC conversion routine before the extension is made. It is also reentered when the VTOC conversion is complete. This section of code tests for first or second entry; if first entry, a 708-byte work area is obtained, set to all zeros, and registers 4, 5, and 11 are saved in the last 12 bytes of the work area.	BEGIN	IGG0553F
The DEB/DCB, IOB, and ECB are built in the DOS VTOC conversion work area. The F4 DSCB for the volume is read into the DOS VTOC conversion work area and control is transferred to IGG0325Z to convert the VTOC.	BLDDCB	
This section of code is entered when this module is entered for the second time (after the VTOC has been converted to standard format). Restores the extend registers and frees the DOS VTOC conversion work area. Tests for errors in conversion processing, and, if there were none, reads the modified F4 DSCB into the O/C/EOV work area, repeats the search for a duplicate-name format-1 DSCB, and passes control to IGG0553G. If an error has occurred, passes control to IGG0553E.	ERRORTST	
3 Verifies that there are at least three free VTOC records.	BEGIN	IGG0553G
For current-volume allocations, converts last track used by the data set to be extended from relative to absolute address. This track is used as the preferred location for the extension.	COMPRTA	
Converts primary quantity requests in cylinders to tracks.	CYLTRKRC	
For requests in records, converts to tracks and calculates overhead.	INRECORD	
If the request specifies rounding to cylinder boundary, this routine increments to next cylinder boundary.	ROUNDUP	IGG0553G (Cont.)
4 Accounts for user labels, if requested.	CLEANUP	IGG0553B
5 Relocates a channel program to read in the first F5 DSCB.	BEGIN	
Links to IOS to read in the first and succeeding F5 DSCBs.	READF5	
Converts XXYYZ of F5 extents to RTA and the number of tracks. Rounds cylinder requests to cylinder boundaries. Sets up input and output pointers and number-of-extents counter.	SETUP	
Tests for twenty-sixth F5 extent and, if it is the last extent, determines whether there is another F5. If there is, it is read in.	TESTLOC	
Exits to last load on error conditions. Transfer control to next load on successful completion.	XCTLHERE	
6 Begins the search of the F5 DSCBs for space to fill the request by determining if the F5 extent being examined is the preferred location and if enough space is available at that location.	BEGSURCH	
7 Compares extent just found, which is larger than request, with extent being held to determine which is closest in size to the request. If the new extent is closer in size, it becomes the "held" extent.	COMPARE	
8 If no extent has been held, compares extent just found, which is smaller than request, with the smallest of the five entries in the pushdown list and saves the larger extent. It then arranges the modified pushdown list in decreasing size order.	QTNOTAVL	
9 When quantity and preferred track are available, builds a one-entry extent table.	ONEDADSM	
If an extent has been held (that is, an extent has been found equal to or larger than the request), builds a one-entry extent table.	FILLIT	
The extents in the pushdown list are examined to determine if two or more of the extents can be used to fill the request. If so, the extents that satisfy the request are entered in the extent table.	PICKLIST	

A Extend Code

- 01 – Extend a data set on current volume (EOV request)
- 02 – Extend a catalog (catalog management request)
- 04 – Extend a data set on a new volume (EOV request)
- 129(X'81') – Extend a data set or data space (VSAM request)

Diagram 16. Extend—DSCB Updating

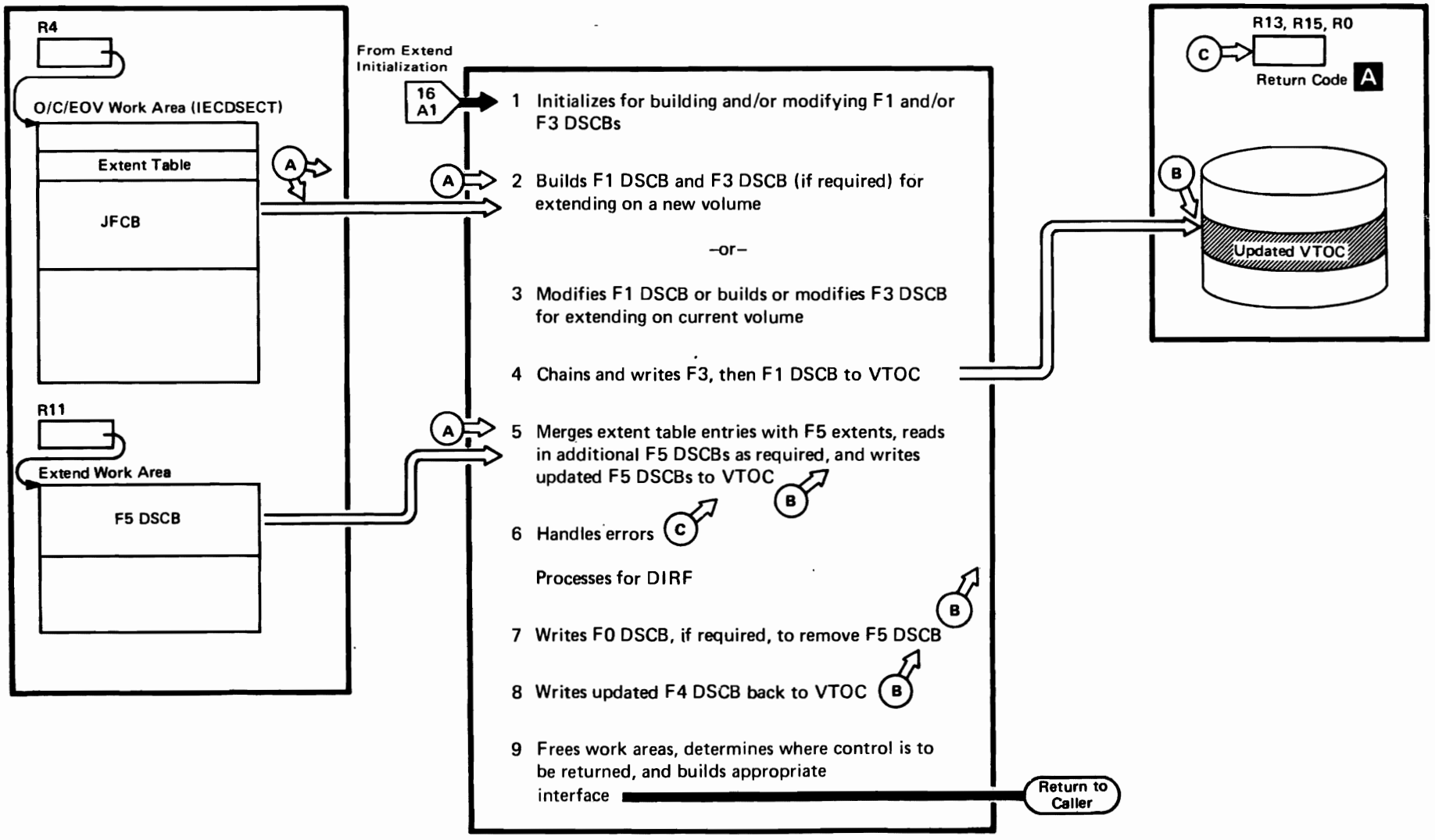


Diagram 16. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Clears first 280 bytes of the extend work area, gets pointer to extent table and number of extent entries in extent table.	BEGIN	IGG0553C
2 Reads F1 DSCB to virtual storage if extending on current volume.	READF1	
Determines whether extents to be added will bring total for data set to more than 16. If so, returns to caller via last load. Determines whether extent(s) can be added to the F1 and whether an F3 needs to be built.	NVL	
If an F3 DSCB already exists for this data set, this routine reads it into extend work area.	NOTF1	
For extensions on new volumes, builds a new F1 from the JFCB.	BUILDF1	
3 Converts RTA1/RTA2 from extent table to CCHHCCHH and moves converted extents to the F1 or F3 DSCB being built or modified. Accounts for user label track.	STLOOP	
Links to the resident conversion routine to convert the RTA1/RTA2 to CCHHCCHH.	RTACONVT	
4 If no F3 exists for this data set, this routine searches for a hole (F0 DSCB).	WRTOUTF3	
When there is already an F3 on the volume or after a hole has been found, this routine writes the F3 to the VTOC.	GOTIDF3	
Chains F1 DSCB to F3 DSCB if an F3 exists, sets number of extents in the F1. If extending on a new volume, this routine does a search of the VTOC for an F0 DSCB, over which the new F1 can be written.	WRITEF1	
Writes the F1 DSCB to the VTOC. Saves F1 address and modifies channel program to read and write the F5 and F4 DSCBs.	GOTIDF1	
Successful completion; puts address of extent table in register 2. Transfers control to IGG0553D.	RETRNEX	
Error exit for permanent I/O errors and for data sets requesting more than 16 extents on a volume. Transfers control to IGG0553E.	RETURN	
5 Gets F5 input work area address, initializes pointers and counters, and modifies channel program to read first F5 DSCB. Reads first F5 DSCB.	DADSMSTR	IGG0553D
Determines when and where extent table should be merged into the output for the F5 DSCB.	DUELOOP	
Merges the extent table entries with the F5 DSCB extents if allocation is made from the beginning or middle of an F5 extent.	ALTEREX	
Merges the extent table entries with the F5 extent when the allocation is made from the end of the F5 extent or if all of the extent is allocated.	TOTALL	
Converts F5 extents from RTA1/RTA2 to XXYYZ format and writes the F5 to the VTOC.	WRITEF5	
Determines whether there is more than one F5 DSCB on the VTOC.	CHECAIN	
Writes the last F5 to VTOC.	WRITEFNL	
Sets XCTL ID for transfer to the routine that modifies the F4 DSCB.	XCTLHERE	
Finds an F0 DSCB over which the new F5 DSCB can be written.	CHEXT	
If more F5 DSCBs have been read from the VTOC than have been written back, this routine sets an indicator to cause the next load (F4 DSCB updating routine) to write an F0.	TSTZERO	
When the second and subsequent F5 DSCBs are to be read into virtual storage, this routine resets input pointers and extent counter, then initiates the read operation.	READF5	
6 Resets DIRF switch and tests DIRF bit in the F4 DSCB.	CHKIOERR	IGG0553E
Checks for permanent I/O error passes from previous routines.	NOTZERO	
Modifies the channel program and reads the F4 DSCB to virtual storage. Resets the DIRF bit in the F4 DSCB.	WRITEF4	
7 Determines whether an F0 DSCB needs to be written to the VTOC. If so, this routine modifies the channel program and writes the F0 DSCB.	START	
Determines whether the F4 DSCB has been modified; if so, reads the F4 DSCB.	CHECKF4	
8 Updates the F0 DSCB count and the address of the highest extent used for an F1 DSCB in the F4 DSCB. Writes the F4 DSCB to the VTOC.	SKPRESET	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
9 Dequeues the VTOC, frees the extend work area (if RPS feature is present on device, deletes 1GG019EK and frees RPS work area) and determines whether to exit to the catalog, EOV or VSAM routine. For EOV and VSAM, loads appropriate return code in register 13. return code in register 13.	EXITHERE	
For normal return to EOV or VSAM, loads the address of the SVRB into register 15, restores the calling routines registers (2 through 12) and transfers control.	TESTRTN	
When a catalog has been extended, restores catalog routine's registers 9, 10, and 11, puts UCB address in register 11, and DCB address in register 1. If no error has occurred, sets register 0 to a negative value and transfers control to IGC0002H, sets XCTL ID for return to CVOL routine (IGC0002H).	CATEXIT	
For error conditions, loads register 15 with an error code and exits via SVC 3.	IOERROR	

A **Return Code**

- **To EOV:**
  - **1(1) . . . . . successful secondary allocation on current volume**
  - **4(4) . . . . . successful secondary allocation on new volume**
  - **–1(–1) . . . . . error in secondary allocation on current volume**
    - **fewer than three free VTOC records (format-0 DSCBs)**
    - **quantity not available**
    - **too many extents (more than 16) for the data set on this volume**
  - **–4(–4) . . . . . error in secondary allocation on the new volume**
    - **duplicate name on the new volume**
    - **fewer than three free VTOC records (format-0 DSCBs)**
    - **quantity not available**
  - **–8(–8) . . . . . unable to convert DOS VTOC to standard format**
  - **–22(–16) . . . . . permanent I/O error**
- **To Catalog Management (CVOL):**
  - **R0 = negative . . . . successful secondary allocation. Return via XCTL.**
  - **Error returns (via SVC 3) with:**
  - **R15 = 8 . . . . quantity not available, fewer than three free VTOC records (format-0 DSCBs), or a duplicate name found on the new volume.**
  - **= 12 . . . permanent I/O error**
  - **= 48 . . . unable to convert DOS VTOC to standard format**
- **To VSAM**
  - **129(81) . . . . . successful secondary allocation on current volume**
  - **–129(–81) . . . . error in secondary allocation on new volume**
    - **fewer than three free VTOC records (format-0 DSCBs)**
    - **quantity not available**
    - **too many extents (more than 16) for the data space on this volume**
  - **–8(–8) . . . . . unable to convert DOS VTOC to standard format**
  - **–22(–16) . . . . . permanent I/O error encountered during secondary allocation**

Diagram 17. Scratch Overview

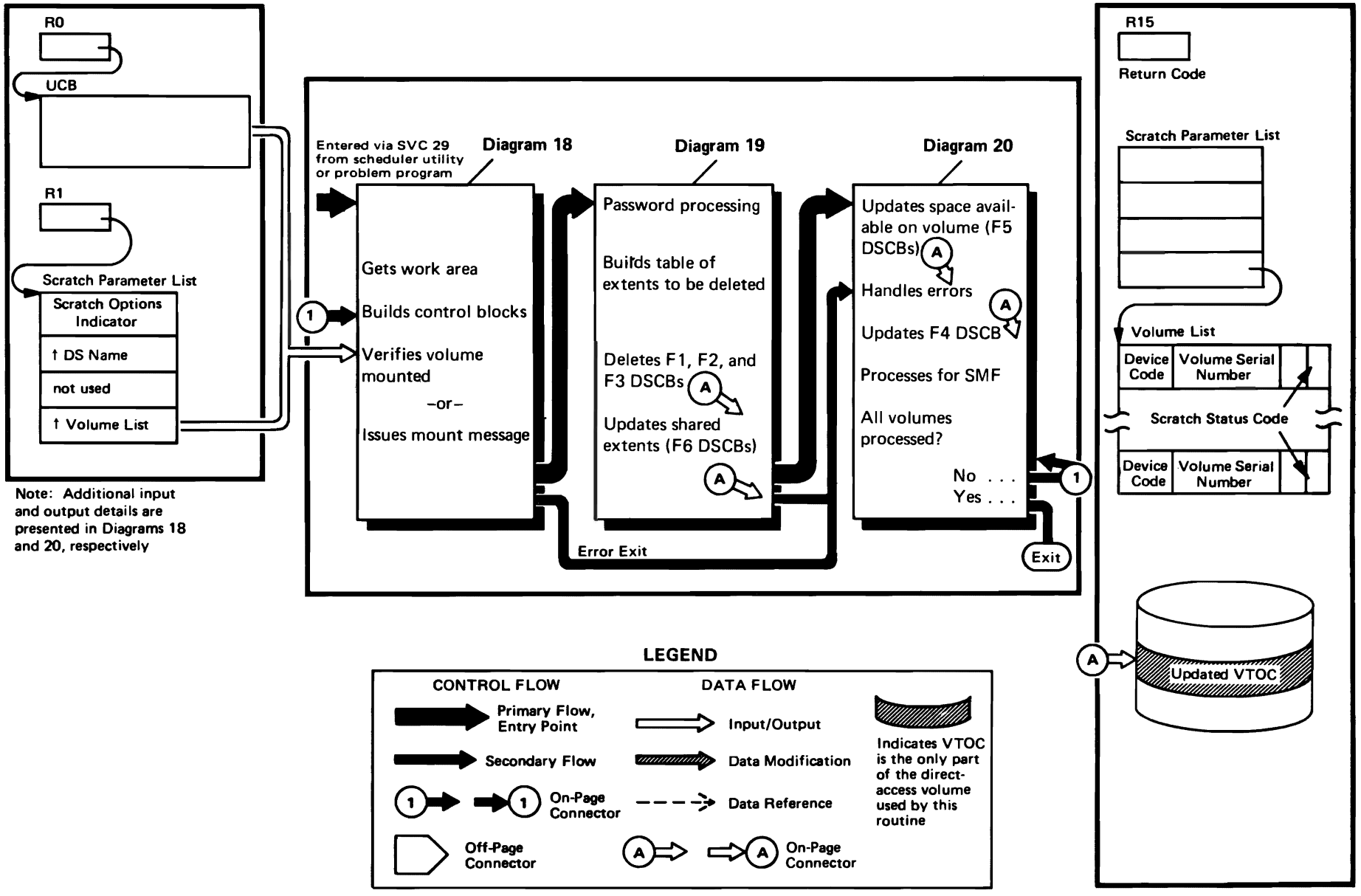


Diagram 18. Scratch—Initialization, Volume Mounting and Volume Verification

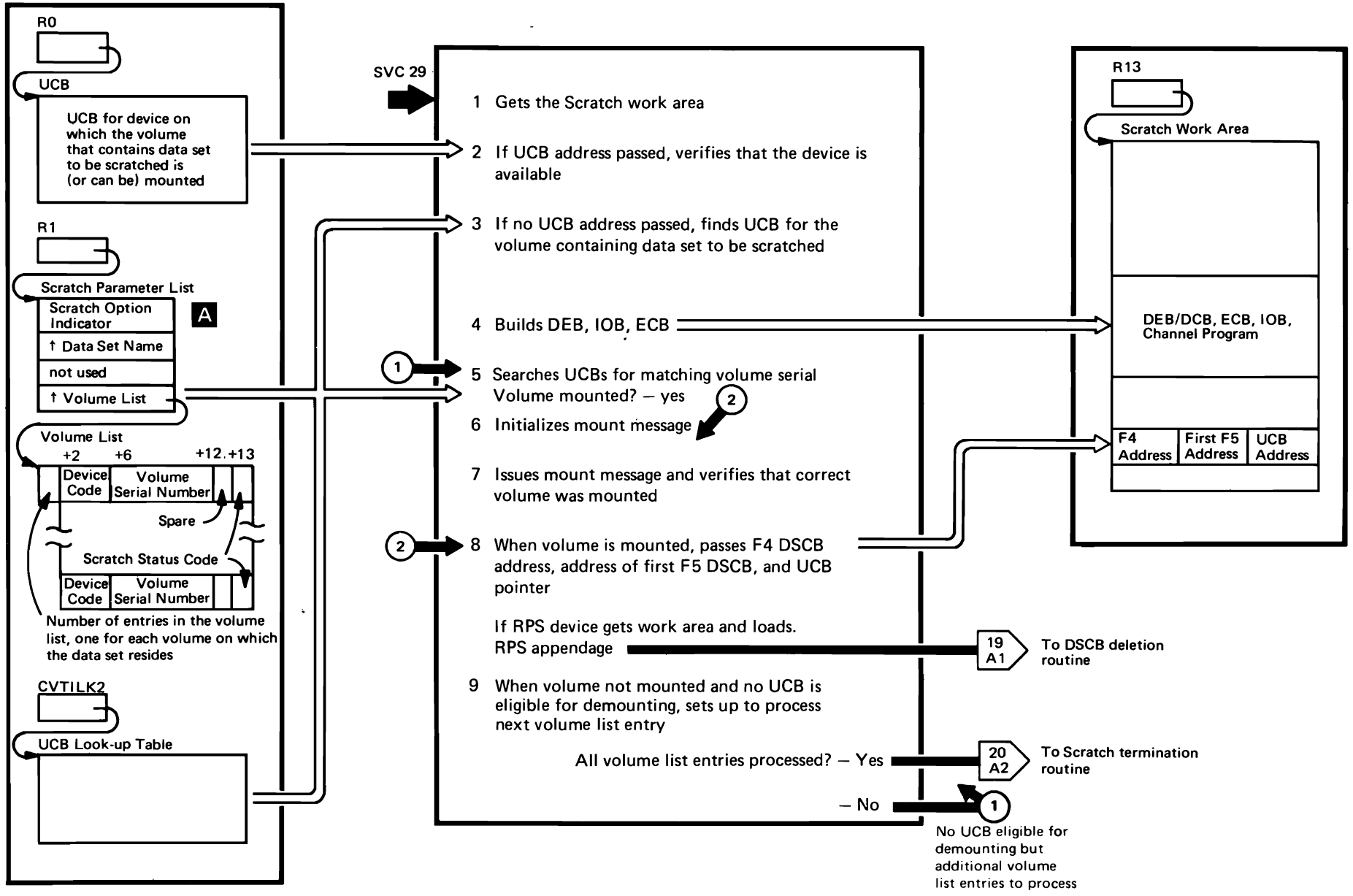


Diagram 18. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Gets 688-byte work area. Checks for request from caller in supervisor state; if not, branches to resident address validation routine (IEAVOL00) to verify that the volume list has the same protection key as the TCB.	BEGIN	IGC00021
2 When caller passes a UCB pointer in register 0, branches to a subroutine that verifies that the volume on the device is eligible for demounting and that the device is on-line. If a sub-UCB pointer was passed, calculates the address of the main UCB.	USERSUCB	
3 When no UCB pointer is passed or if the UCB passed in register 0 is not eligible for demounting, branches to a subroutine that searches the UCBs for the UCB with a volume serial number that matches the current volume list entry; when the matching volume serial number is found, branches to a subroutine that verifies that the device represented is on-line and eligible for demounting.	FINDUNIT	
Verifies that a UCB found in the UCB table search or a UCB passed by the calling routine is on-line and that its volume is eligible for demounting.	TESTUCB	
Searches the UCBs (via the UCB lookup table) for a UCB with a volume serial number that matches the current volume list entry.	FINDUCB	
Saves the UCB pointer that has been verified; sets up the XCTL parameter list in the extended save area of the scratch SVRB and transfers control to IGG0290E.	PRIMUCB	
When there are no entries in the volume list or when the validity check of the volume list address fails, control is passed to IGG0290D to clean up and exit.	ERREXIT	
4 Builds a DEB, ECB, and IOB with the information required by IOS to read to and write from the VTOC for the volume from which the data set is to be deleted. Tests for a valid (not zero) volume serial number and if none is indicated, sets register 14 (branch register) to zero and passes control to IGG0290E (Cont.)	BLDBLKS	IGG0290E
5 Searches the UCBs for a UCB with a volume serial number that matches the volume serial number of the current entry in the volume list. If a matching UCB is found and the volume serial number of the UCB matches the volume serial number passed, the branch register (register 14) is set to 4 to indicate the volume is mounted; the XCTL ID is set to transfer control to IGG0290F.	FINDUCB	
If no matching volume serial number can be found in the UCBs for the system, the pointer to the primary UCB is checked to see if a UCB address was passed by the calling routine. If no matching volume serial number can be found in the UCBs and no UCB address was passed by the calling routine, the branch register is set to zero, to indicate that the next volume in the volume list should be processed, and control is passed to IGG0290F.	ENDADDR	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
6 If no matching UCB was found and a UCB address was passed to scratch, a mount message is prepared and register 14 is set to 12 to indicate a mount message is to be issued.	MOUNT	IGG0290E (Cont.)
When a volume is to be demounted, determines whether SMF processing is requested and if so, issues an SVC 78 (LSPACE) to collect the information needed.	TESTSMF	
Puts unit name and volume serial number in the mount message to operator, initializes message buffer for the operator's reply, sets up the channel program and transfers control to IGG0290F.	SETMESG	
7 This routine begins with a branch table based on a code passed from IGG0290E. If none of the branches are taken (that is, the branch register contains a value of 12), the condition at entry is that a data set is to be scratched from a volume which is not mounted. This routine branches to a subroutine that issues a mount message, reads in the volume label, verifies that it is the correct volume, and returns. This routine now converts the address of the F4 DSCB from CCHHR to TTR and stores it and the volume serial number in the UCB.	BEGIN	IGG0290F
8 Issues mount message, tests and processes for TSO, links to IOS to read the volume label, and verifies that the correct volume has been mounted, if the operator replies "MOUNTING". If the operator replies "SKIP" to the mount message, this routine sets the status code to X'06' in the volume list.	MOUNT	
When a data set to be scratched is already mounted (the branch register contains a value of 4), this routine modifies the UCB address in the DEB, then updates volume list pointer and counter for next pass. Tests for RPS feature. If present, gets 128-byte RPS work area and copies the appendage vector table (AVT) into it. Loads module IGG019EK and enters its address in the AVT. Modifies the DEB in the scratch work area to point to the RPS AVT.	MOUNTED	
Converts address of the F5 DSCB from TTR to CCHHR for search. Enqueues on the VTOC using a RESERVE macro instruction with set-must-complete option. Transfers control to IGG0290A.	GETTR0F5	
9 When no valid volume serial number has been found in the volume list and no UCB pointer has been passed by the calling routine (branch register was set to zero), this routine tests to see whether a primary UCB for an on-line device has been found; if not, an X'05' error code is set in the volume list for this entry and, if this is last entry on the volume list, transfers control to IGG0290D. If this is not last entry, transfers control to IGG0290E.	TESTVOL	

A Scratch option indicator
41 00 50 00 – override purge date
41 00 40 00 – no override

Diagram 19. Scratch—DSCB Deletion and Split-Cylinder DSCB Updating

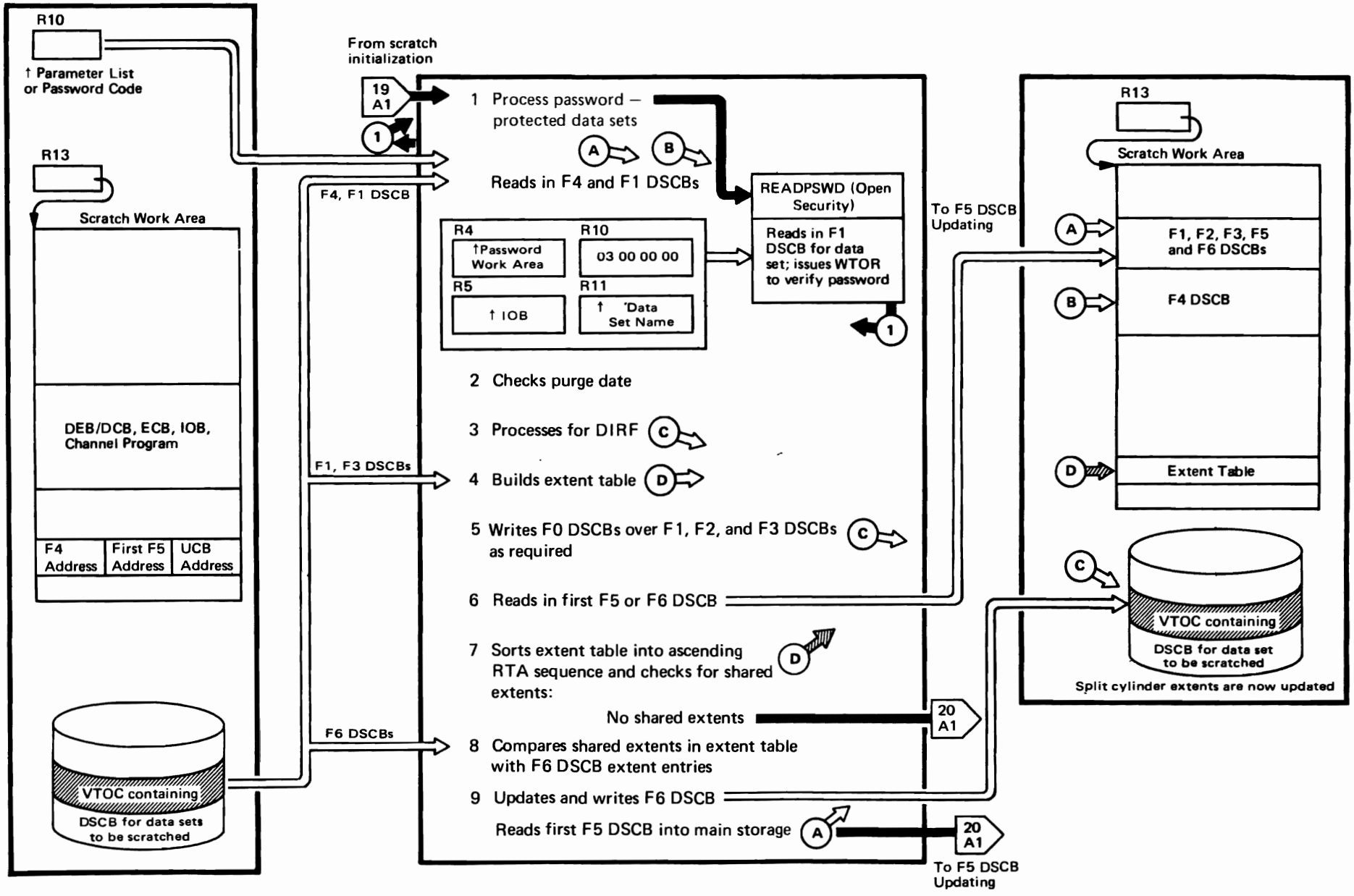


Diagram 19. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 This routine is entered from scratch initialization and reentered from READPSWD; the calling routine is determined from the contents of register 10. (1) If this is the first entry to this module, register 10 will contain a pointer to the scratch parameter list (2) If reentered from READPSWD: 00 00 00 00 – Password verified 10 00 00 00 – I/O or password error 20 00 00 00 – No F1 DSCB found	BEGIN	IGG0290A
Tests for an entry from READPSWD. If this is not an entry from the READPSWD module, this module relocates a channel program to read into main storage the F4 DSCB and F1 DSCB for the data set to be scratched.		
Tests to verify that an F1 has been read in; if no F1 has been read in, an X'01' code (DSCB not found on VTOC) is set in the scratch status code in the volume list, and processing is discontinued on that volume (transfers control to IGG0290D).	EXECUTE	
This routine determines whether the data set has security protection; if password has not already been checked, this routine transfers control to the READPSWD module of open security (see *O/C/EOV Logic*).	NEWDSCB	
When this module is entered from READPSWD and register 10 contains a zero, indicating that the password has been successfully checked, this routine restores registers and addresses used in password processing.	PASSOKAY	
2 If the data set is not security-protected, this routine receives control after the F1 DSCB has been read in. If the purge date for the data set has not been overridden (indicator set in scratch parameter list), this routine verifies that the purge date is passed. If it is not passed, a code of X'03' is set in the volume list and control is passed to IGG0290D.	NAMEOKAY	
3 Checks the number of extents to be deleted, and if there are more than 16, sets the DOS bit in the DS4VTOCI field, then writes the modified F4 DSCB back to the VTOC (this is done so that the next time an allocation is made on the volume, the DOS VTOC conversion routine will be executed in order to correct the F5 and F6 DSCBs).	BLDTAB	IGG0299A
Sets/resets the DIRF bit and tests for previous premature termination of a DADSM function, and if no interrupt has occurred, writes the F4 back to the VTOC. Again sets/resets DIRF bit for writing out in IGG0290D.	MOVECCW	
If no premature termination has occurred or after the F4 has been written back to the VTOC, this routine sets/resets the DIRF bit. Then the channel program is modified to write an F0 DSCB over the F1 and read in an F2 and/or an F3 if they exist on the VTOC.	SKPWR	
Determines whether there is a DSCB in virtual storage with extents to be converted.	TESTPTR	
4 When F3 DSCBs are read in, sets up work area and branches to a subroutine that converts the F3 extents to RTA1/RTA2 format. Calls a subroutine that branches to the resident conversion routine to convert the F1 extents from CCHHR to RTA1/RTA2 and enters them in the extent table. Enters an X'FF' for split-cylinder extents.	MOREXTS	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
Links to the resident conversion routine to convert the F1 and F3 extents from CCHHR to RTA1/RTA2 format and stores each converted extent in the extent table.	CVTEXTS	IGG0290A (Cont.)
5 Links to a subroutine that writes an F0 over an F1 or F3 DSCB whose extents have previously been converted and entered in the extent table. When the F0 is written, the channel program then reads in the next DSCB in the chain if there is one. If it is an F2, the process is repeated, zeroing the F2 and reading in the F3 chained.	ZEROUT	
6 When there are no more F1, F2, or F3 DSCBs in the chain, this routine inserts in the CCW the address of the F6 DSCB for split-cylinder data sets or the F5 DSCB for non-split-cylinder data sets, so that one or the other is read in by the channel program that writes the last F0 DSCB.	LASTDSCB	
Modifies a channel program that searches for F0 DSCBs and reads or writes F6 DSCBs. If there are no entries in the extent table, an exit to IGG0290D is taken.	BEGIN	IGG0290B
7 Sorts the extent table into ascending RTA sequence.	NEWPASS	
Tests for shared cylinders and exits to IGG0290D if not present. Sets ups pointers and counters to build or modify an F6 DSCB.	TESTCYLS	
8 Checks each extent entry in the extent table to determine whether it represents a shared extent. Searches for the extent in the F6 DSCB. When found, the number of data sets sharing the extent is decremented by one. If the number of data sets reaches zero, the XXYYZ for this extent is converted to RTA1/RTA2 and moved to the extent table.	COMPARE	
When an entry in the extent table is encountered that does not share cylinders, this routine increments the extent table pointers and counter.	NOTSPLIT	
9 When data sets other than the one being scratched are still using the extent currently being examined, this routine moves the extent (with a decremented number of data sets) to the output area to be written back to the VTOC.	MOVEEXT	
When all the F6 DSCB extents have been compared with the split-cylinder extent in the extent table, and when this F6 is chained to another F6, this routine reads in the next F6 in the chain.	CHECKIN	
Determines whether there are still extent locations in the F6 being built and, if not, whether any entries have been made in the F6 DSCB being built in virtual storage. If no entries have been made, F0 DSCB is written over the last F6 in the VTOC.	CHECKOUT	
When extent entries have been made in an F6 output DSCB, this routine determines whether a chaining pointer needs to be put in the F6 before it is written out. A pointer is not needed if (1) there is only one entry left in the extent table and it is for a split-cylinder extent, and (2) there is only one extent left in the input F6 DSCB that has a data set count of one and is contained in the single extent in the extent table. When any one of the above conditions is not met, a pointer is added to the F6 and the F6 is written back to the VTOC.	DADSOUT1	
When there are no unprocessed entries in the extent table, this routine reads into virtual storage the first F5 DSCB on the VTOC and sets up XCTL ID to transfer control to IGG0290C.	ENDUPD2	

Diagram 20. Scratch—Format-5 and Format-4 DSCB Updating

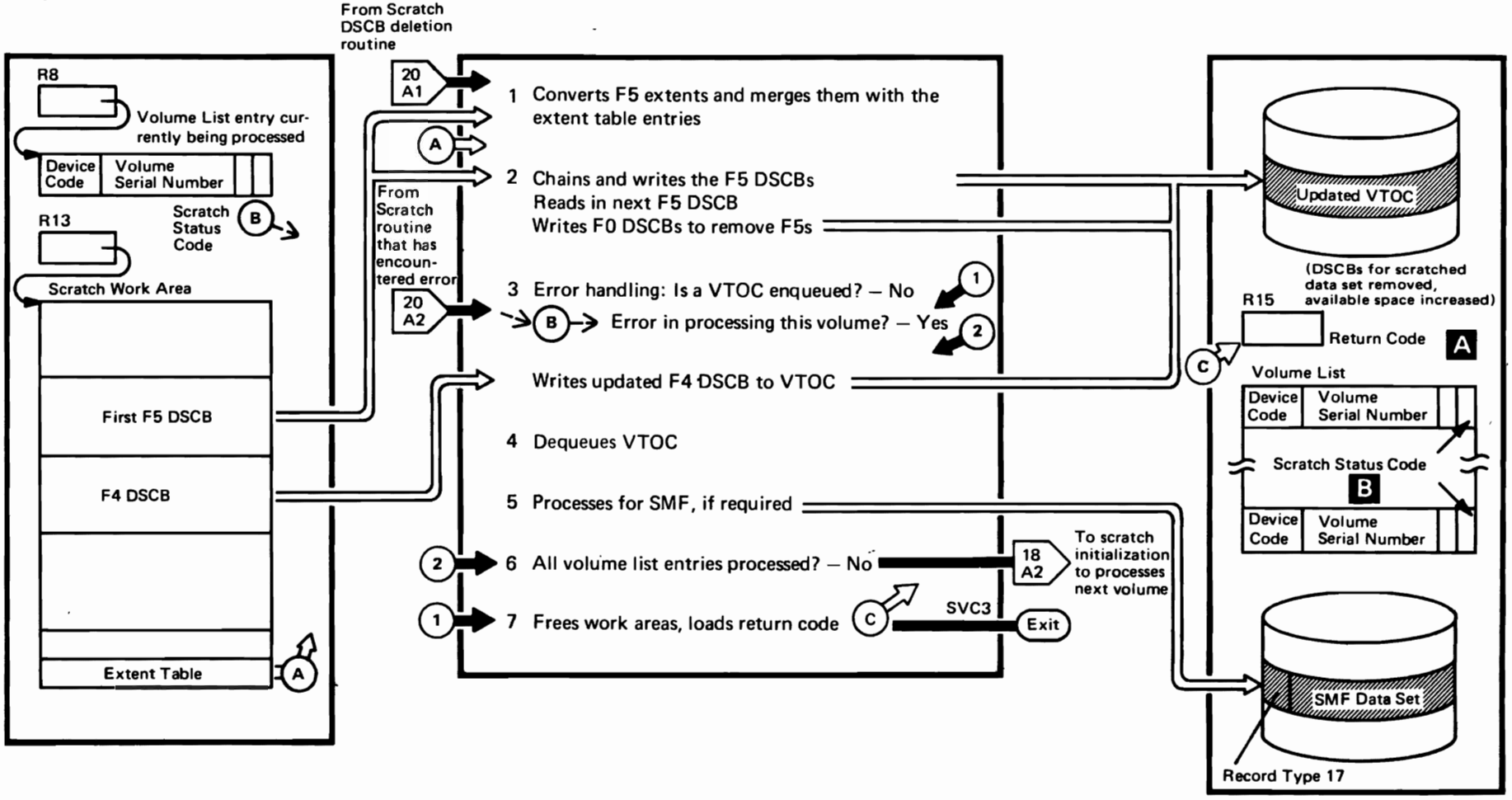


Diagram 20. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Checks to see that there is an entry in the extent table; if not, transfers control to IGG0290D. Sets up F5 chaining pointers in input and output F5 work areas. Calls a subroutine that links to the resident conversion routine to convert the XXYYZ of the first F5 to RTA1/RTA2.	BEGUN	IGG0290C
	Converts XXYYZ of F5 extents to RTA1/RTA2. Sets up extent counters and pointers.	CVTORTAO	
	Compares the RTA1/RTA2 of the extent table entries with the RTA1/RTA2 of the F5 DSCB to determine where to merge the extent table entries.	MERGE1	
	This section determines when an F5 DSCB needs to be written to the VTOC and when a new F5 needs to be read in.	OUTPUT1	
	Modifies a channel program and links to IOS to read in the second and subsequent F5 DSCBs, then calls a subroutine to convert the F5 extents from XXYYZ to RTA1/RTA2.	DADSMIN	
2	Determines whether two F5 output extents are contiguous and if so, combines them into a single extent.	COLLAPSE	
	Converts the F5 output extents from RTA1/RTA2 to XXYYZ, modifies the channel program to write the F5 to the VTOC, and branches to a subroutine that links to IOS to write the F5 to the VTOC.	DADSMOUT	
	When a new F5 DSCB has been built and an F0 must be found to write it over, this routine branches to a subroutine that searches for an F0 on the VTOC.	FINDHOLE	
3	If a VTOC is enqueued, a test is made to determine whether errors have been encountered while processing this volume; if no errors have been encountered, the number of F0 DSCBs (holes) on the VTOC is updated and the F4 DSCB is written back to the VTOC.	BEGIN	IGG0290D
4	Dequeues VTOC. Tests for password error and if found, enters code in the Scratch status code byte in the volume list and sets ERCODE to X'08'.	TESTEXT	
5	When the scratch processing is successful, this section tests for SMF requests and builds and writes a type-17 SMF record (see *OS/VS SMF,* for a description of the type-17 record).	TESTSMF	
6	Determines whether all entries in the volume list have been processed. If not, sets XCTL ID to transfer control to IGG0290E to continue processing.	TESTLAST	
	Frees scratch work area (and RPS work area, if present), sets return code in register 15, and issues an SVC 3.	EXIT	

A Return Code

- 0 Successful scratch.
- 4 No volumes containing any part of the data set were mounted, nor did register contain the address of a unit that was available for mounting a volume of the data set to be scratched.
- 8 An unusual condition was encountered on one or more volumes.
- 12 Invalid volume list (This return code is not accompanied by the setting of a status code).

B Scratch Status Code

- 0 The DSCB for the data set has been deleted from the VTOC on the volume pointed to.
- 1 The VTOC of this volume does not contain the DSCB to be deleted.
- 2 The macro instruction failed when the correct password was not supplied by the console operator or TSO terminal operator in the two attempts allowed, or the user tried to scratch a VSAM data space.
- 3 The DSCB was not deleted because either the OVRD option was not specified or the retention cycle had not expired.
- 4 A permanent I/O error was found when processing this volume.
- 5 It could not be verified that this volume was mounted nor was there a unit available for mounting the volume.
- 6 The operator was unable to mount this volume.

Diagram 21. Release Overview

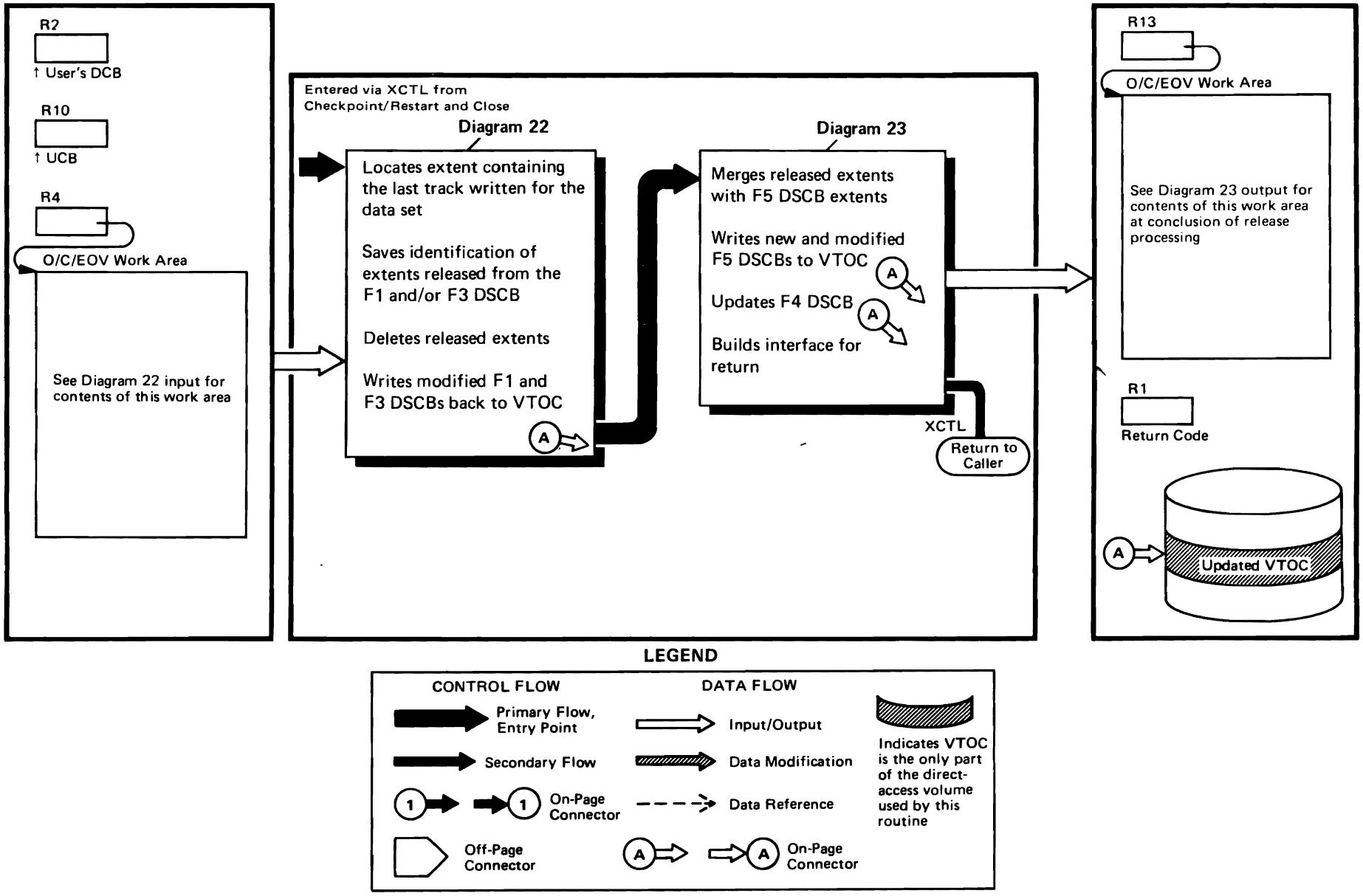


Diagram 22. Release—F1 and F3 DSCB Updating

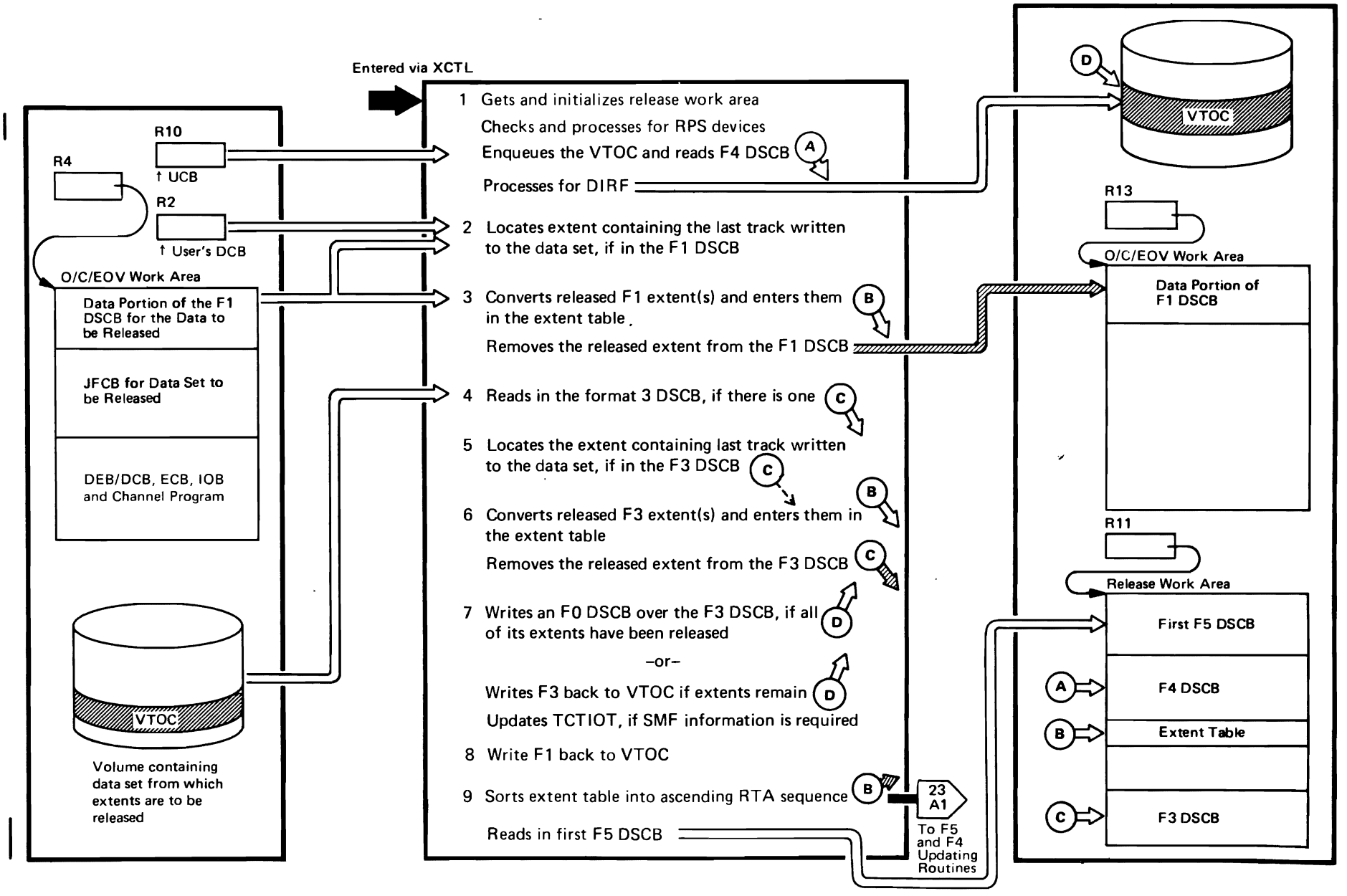


Diagram 22. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Entered from the reposition I/O module of checkpoint/restart or from a close function of O/C/EOV, this routine gets a work area for the release routines. Branches to a subroutine that locates this task's first SVRB and saves the calling routines registers in the SVRB's extended save area; initializes a channel program, and picks up the F4 (VTOC) DSCB address from the UCB. Enqueues the VTOC using a RESERVE macro instruction with the set-must-complete option. Branches to a subroutine to read in the F4 DSCB and then determines that there is at least one F0 DSCB (hole) on the VTOC in case a new F5 DSCB must be added in subsequent processing.	BEGINA	IGG020P1
	Finds and returns a pointer to the extended save area of first SVRB for this task. Finds and returns a pointer to the extended save area of first SVRB for this task. If entered from close, tests for the RPS feature. If present, gets 128-byte RPS work area and copies the appendage vector table (AVT) into it. Loads module IGG019EK and enters its address in the AVT. Modifies the DEB in the Close work area to point to the RPS AVT.	FINDSVRB SETVTOC GETFDAD	
	This section sets/resets and tests the DIRF indicator, and if no previous interrupt has occurred, writes the F4 to the VTOC with the DIRF bit set.		
	Checks the number of extents indicated in the F1 DSCB in the O/C/EOV work area, and if not zero, determines the request type used to allocate the space originally (cylinder, average record, or track request) and branches accordingly.	ROUNDCYL	
	Determines whether the last track written to the data set to be released was on a cylinder boundary, and if not, rounds the extent to the next cylinder boundary.	SAVEFMT3 F1RUTINE	
	Determines whether the extent to be released is in the F1 or F3 DSCB and branches accordingly.	CYLREQ	
2	Locates the extent containing the last track written when it is in an F1 DSCB. When found, the request type (cylinder or rounded record) is determined.		
3	Determines whether last track written is the last track of the extent. If not the last track, this routine inserts the new end of the extent (last track actually used), and links to a subroutine that converts the CCHH to RTA1/RTA2 and enters it in the extent table.		

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
	When the last track written is the last track of an extent in an F1 DSCB, this routine determines whether there is an F3 DSCB. If there is no F3 DSCB and the extent containing the last track written is not the last extent of the data set, this routine branches to a subroutine that calls the resident conversion routine to convert the CCHHCCHH of any subsequent extents to RTA1/RTA2 format. These extents are entered in the extent table.	CHECKLST	IGG020P1 (Cont.)
4	Checks to see if there is an F3 for this data set, and if so, modifies the channel program and reads in the F3 DSCB.	CHECKF3	IGG020P2
5	Locates the extent containing the last track written when that last track written is in the F3 DSCB.	BEGINA	
6	When the F3 extent containing the address of the last track written is located, this routine links to a subroutine that converts the portion of the extent that is to be released and any subsequent extents in the F3 DSCB from CCHHCCHH to RTA1/RTA2 format and enters them in the extent table.	LSTRACK	
	Calls the resident conversion routine to convert the F3 extents from CCHH to RTA1/RTA2. Enters the converted extents in the extent table.	CVTORTA	
7	When all extents are released from an F3 DSCB, this section modifies the channel program and links to a subroutine that writes an F0 DSCB over the released F3 DSCB.	WRITEZRO	
	Updates the F1 DSCB with the number of extents remaining in the volume for the data set. Tests for SMF and if present, makes the required entries in TCTIOT.	UPDATEF1	
8	Writes back the F1 DSCB to the VTOC. If no space is being released, transfers control to IGG020P3.	BEGINA	IGG020D0
9	Sorts extent table into ascending RTA sequence. Relocates channel program for reading and writing F5 DSCBS. Links to a subroutine to read in first F5 DSCB.	NEWPASS RELOCATE RDDSCB	

Diagram 23. Release—F5 and F4 DSCB Updating

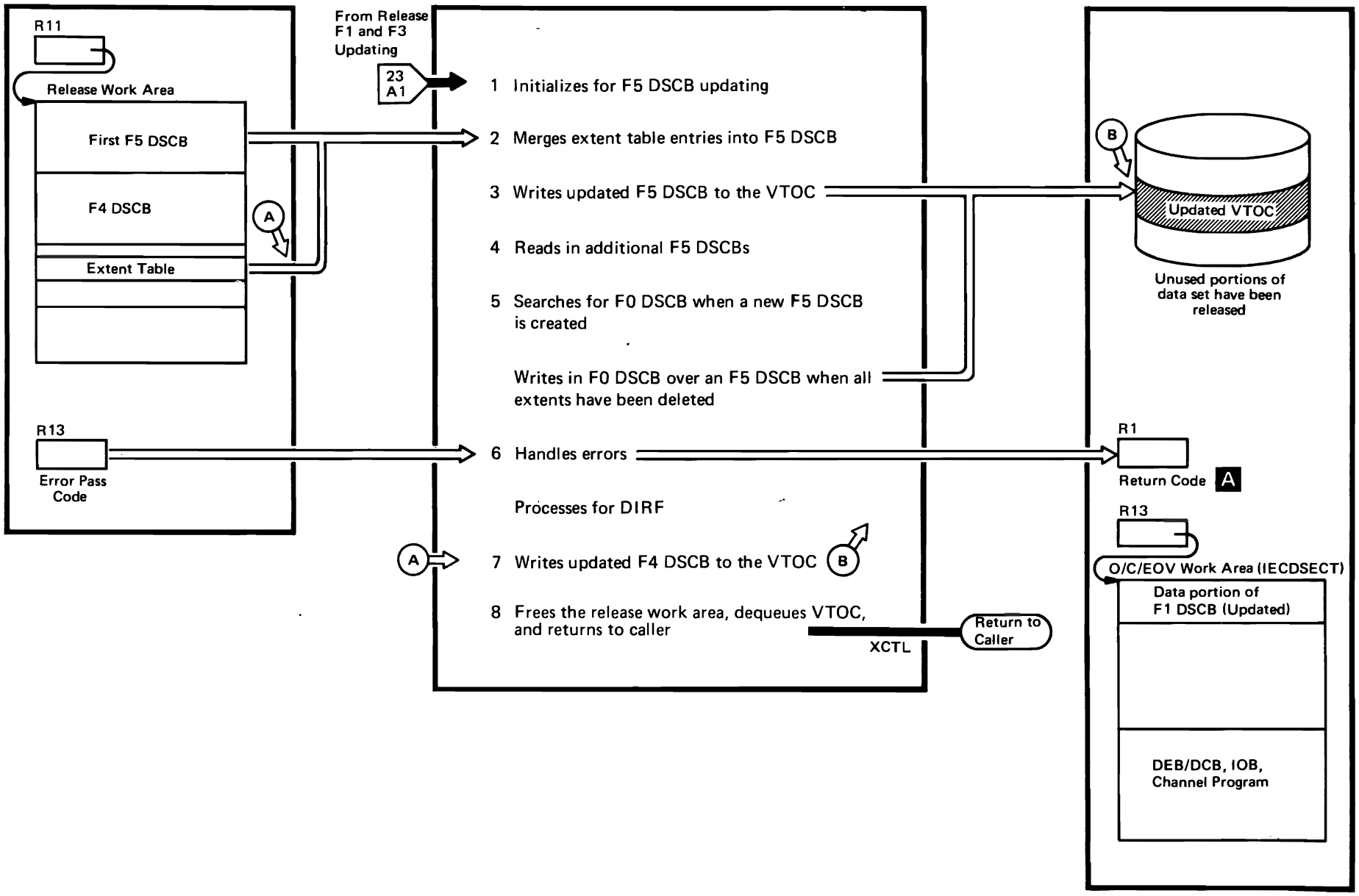


Diagram 23. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Sets up F5 chain pointers, extent counters, and clears output area.	BEGUN	IGG020D1
2	Merges extent table entries with the F5 DSCBs read in.	MERGE1	
	Creates a single extent for each set of contiguous extents.	COLLAPSE	
	Determines when to write an F0 or an F5 DSCB.	OUTPUT1	
3	Converts the RTA1/RTA2 extents to XXYYZ, then links to a subroutine that writes the F5 DSCBs to the VTOC.	DADSMOUT	
4	Modifies the channel program and links to a subroutine that reads in an F5 DSCB, then a second subroutine that converts the F5 extents from XXYYZ to RTA1/RTA2.	DADSMIN	
	Converts the F5 extents from XXYYZ to RTA1/RTA2 format.	VTORTA0	
5	Determines when it is necessary to find the address of an F0 DSCB, over which a new F5 DSCB is to be written.	FINDHOLE	
6	Tests for error entries and if a permanent I/O error has occurred, no F4 DSCB is written.	IGG020P3	IGG020P3
	If there was a change in the number of F0 DSCBs (holes) on the VTOC during release processing, the hole count is updated.	NOERROR	

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
	The DIRF bit is set/reset and tested, if a previous interrupt has occurred, the F4 DSCB is not written back to the VTOC.	TESTDIRF	IGG020P3 (Cont.)
7	Sets up channel program, then writes the F4 DSCB.	WRTF4	
8	Frees release work area (frees RPS work area and deletes (IGG019EK if RPS feature is present on device).	NOWRT	
	Dequeues VTOC and returns to caller.	CONTINUE	

A Return Code

- 0 – No errors detected
- 2 – Unable to find extent in F1 DSCB
- 4 – Unable to find extent in F3 DSCB
- 8 – Unable to find match for key when attempting to write back F1 DSCB
- 16 – Permanent I/O error
- 32 – No space in VTOC

Diagram 24. Rename

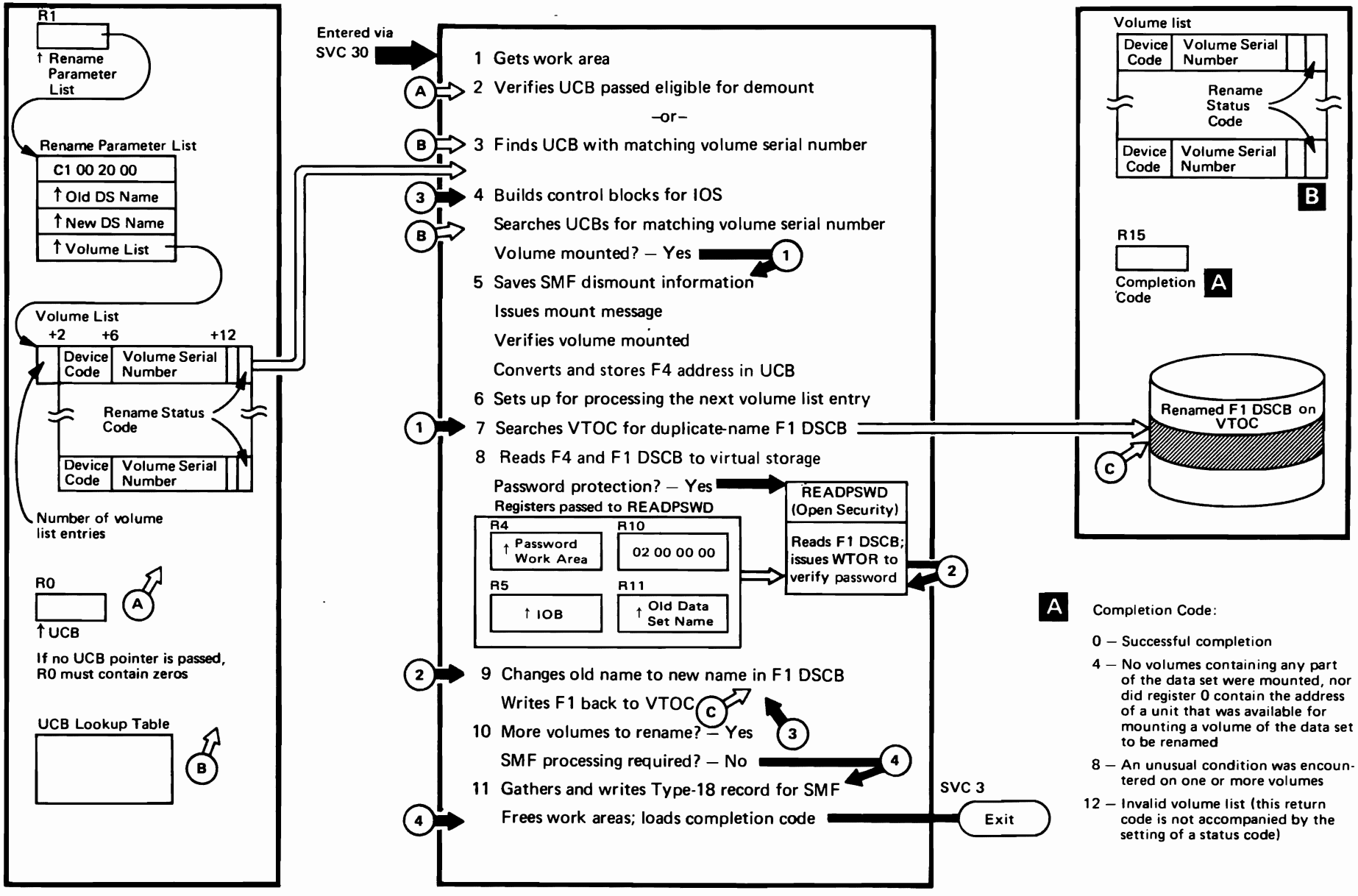


Diagram 24. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Enables interrupts and gets 496-byte work area. Checks for request from caller in supervisor state; if not, branches to resident address validation routine (IEAVOL00) to verify that the volume list has the same protection key as the TCB.	BEGIN	IGC00030
2 When a UCB pointer is passed, branches to a subroutine that verifies that the volume on the device represented by this UCB can be demounted and that the device is on-line.	USERSUCB	
3 When no UCB pointer is passed or if the UCB passed in register 0 is not eligible for demounting, branches to a subroutine that searches the UCBs for the UCB with a volume serial number that matches the current volume list entry; when the matching volume serial number is found, branches to a subroutine that verifies that the device represented is on-line and eligible for demounting.	FINDUNIT	
Searches the UCBs (via the UCB lookup table) for a UCB with a volume serial number that matches the current volume list entry.	FINDUCB	
Verifies that a UCB found in the UCB table search or a UCB passed by the calling routine is on-line and that its volume is eligible for demounting.	TESTUCB	
Saves the UCB pointer that has been verified.		
When there are no entries in the volume list or when the validity check of the volume list address fails, loads return code of 8 in register 15, frees work area, and returns control via SVC 3.	PRIMUCB EXIT	
4 Completes DEB/DCB, and IOB with the information required by IOS to read the volume label. Branches to a subroutine to determine whether the current entry in the volume list is mounted.	BEGIN	IGG03002
Searches the UCBs for a UCB with a volume serial number that matches the volume serial number of the current entry in the volume list.	FINDUCB	
5 When a volume is demounted and SMF information is required, this section issues an SVC 78 (LSPACE).	LSPACE	
Sets up mount message and issues a WTOR macro instruction. When a TSO task is renaming a data set, special message processing is required.	CLEARVOL	
Waits for operator to reply "MOUNTING" or "SKIP". If reply is "SKIP", sets rename status code to X'06', increments to next volume in volume list, and sets completion code to 8.	MOUNT02	
When volume has been mounted, this routine reads in the volume label, verifies the volume serial number, converts the VTOC (F4 DSCB) address from MBBCCHHR to TTR0 format, sets the mounting indicator in the UCB, and moves the TTR0 to the UCB.	SETIND	
Sets rename status code in volume list to X'05' and the completion code to 8,	NODEVICE	
When processing is complete and no SMF information is required, frees rename work area, loads the completion code in register 15 and issues an SVC 3 to return control.		
6 When the volume containing the data set to be renamed is mounted, this section increments pointers and counters for processing the volume list entry and passes control to IGG03001 via XCTL.	MOUNTED	

EXTENDED DESCRIPTION	LABEL	MODULE NAME
7 Tests for entry from the password processing routine (READPSWD); if not entered from READPSWD, the VTOC is enqueued by issuing a RESERVE macro instruction. Relocates a channel program that is used to search the VTOC for a F1 DSCB with the same name as the new name pointed to by the third word of the rename parameter list. Branches to a subroutine that links to IOS to perform the duplicate-name search.	BEGIN	IGG03001
8 Modifies channel program and branches to a subroutine that reads in the F4 DSCB and the F1 DSCB of the same name as the old name pointed to by the second word of the rename parameter list. Checks DS1DSIND field of F1 DSCB for password-protection; if the data set is password-protected, the proper interface is established and control is passed to the READPSWD module of the open security function of O/C/EOV.	NAMEOKAY	
9 If password processing is successful or if the data set to be renamed is not password-protected, the new data set name is written over the old data set name, and the F1 DSCB is written back to the VTOC at its original location.	PSWDOKAY	
Dequeues the VTOC, and if processing is not complete, passes control to IGG03002.	FINISH	
10 When processing is complete, a test is made for the SMF feature; if present and data set records are required, control is passed to IGG03003 to record the SMF information.	TESTSMF	
When processing is complete and no SMF information is required, frees rename work area, loads the completion code in register 15 and issues an SVC 3 to return control.	LEAVE	
11 Gets additional virtual storage if needed; builds type-18 SMF record: time, job log-number, user identification, zero-record indicators, old and new data set names, and volume serial number. Issues an SMFWTM macro to write the record.	BEGIN	IGG03003
Frees SMF and rename work areas, as required; loads register 15 with completion code and returns via SVC 3.	FREECORE	

B Rename Status Code

- 0 The DSCB for the data set has been renamed in the VTOC on the volume pointed to.
- 1 The VTOC of this volume does not contain the DSCB to be renamed.
- 2 The macro instruction failed when the correct password was not supplied in the two attempts allowed, or the user tried to rename a VSAM data space.
- 3 A DSCB containing the new name already exists in the VTOC of this volume.
- 4 A permanent I/O error was found when processing this volume.
- 5 A device for mounting this volume was unavailable.
- 6 The operator was unable to mount this volume.

Diagram 25. Obtain

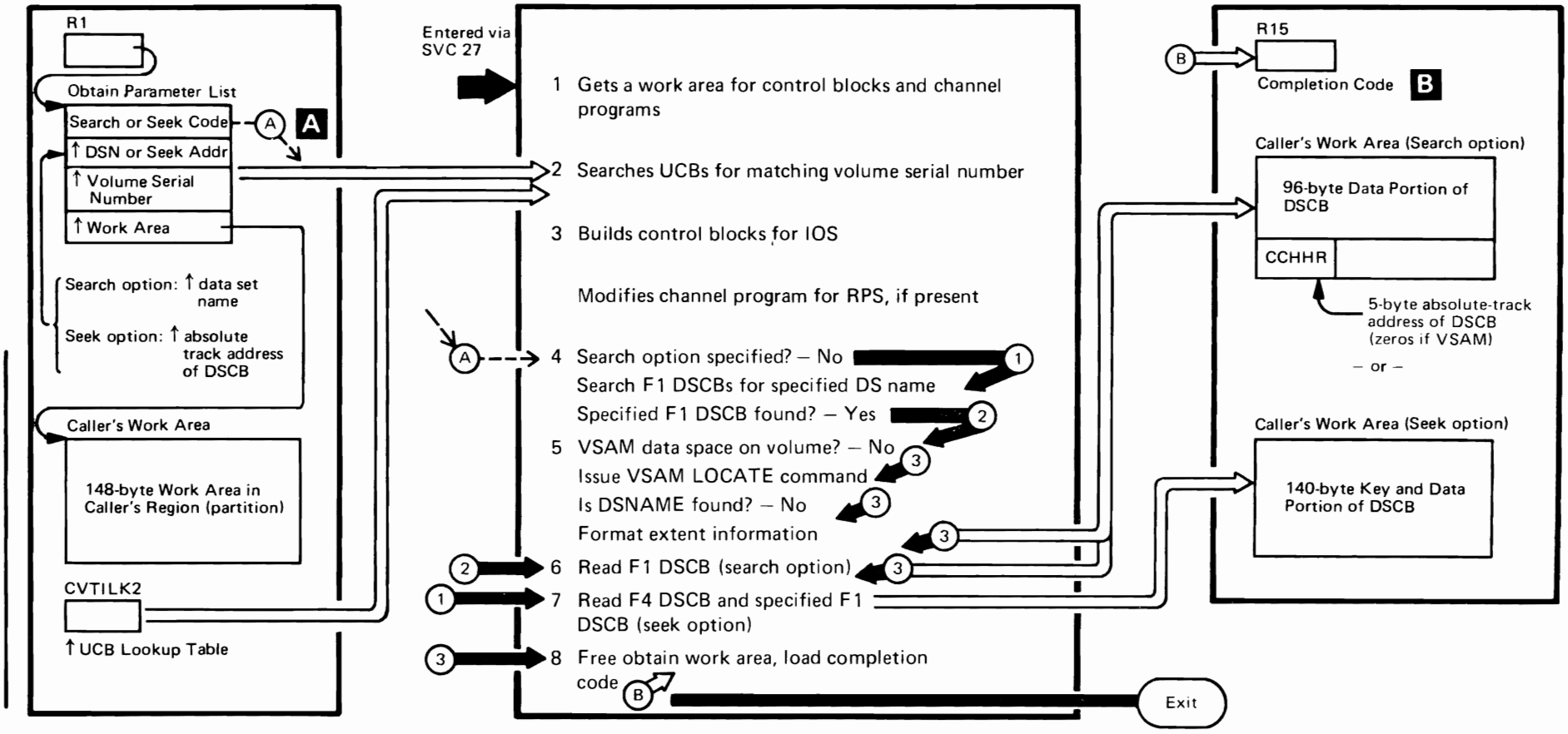


Diagram 25. (Continued)

EXTENDED DESCRIPTION	LABEL	MODULE NAME
1 Gets a 208-byte work area for the control blocks, seek address, and channel program for reading the DSCB. Calls a subroutine that links to the resident validity checking routine to verify that (1) both the beginning and ending address of the work area in the parameter list have the same protection key as the TCB for this task and (2) that the work area begins on a fullword boundary.	BEGIN	IGC0002G
2 Searches the UCBs (using the UCB lookup table) for the UCB with a volume serial number that matches the volume serial number passed in the volume list. When a match is found, verifies that the device represented by the UCB is on-line.	UCBLOOP	
3 When the appropriate UCB has been located, this section builds a DEB/DCB, IOB, and ECB, then checks for the RPS feature on the device. If RPS is present, the set sector command is inserted and a different CCW address is moved to the IOB. The F4 (VTOC) DSCB address is picked up from the UCB, converted from TTR to MBBCCHHR, and stored as the seek address.	PRIMUCB	
4 Checks the parameter list to determine whether the search or seek option has been specified. If search was specified, searches the VTOC for the format-1 DSCB with the specified data set name. If this is a DOS volume, it may be necessary to search the complete VTOC, since DOS does not use the last F1 address (the "high-water mark").	MAINUCB	
5 When the search option is specified and no format-1 DSCB is found during the search of the VTOC, this step checks the DS4AMCAT field of the format-4 DSCB to determine whether there are VSAM data spaces on the volume.	NODSCB	
If there are, this step issues a VSAM LOCATE command to get the physical extents of the named data set from the VSAM catalog. This step then formats the extent information in the caller's work area.	IGC0102G	IGC0102G
6 When the specified format-1 DSCB has been found, this step reads it into the caller's work area.	EXECIO	IGC0002G
7 When the seek option is specified, this section relocates a channel program to read in the F4 DSCB for the volume.	SEEKDSCB	IGC0002G (Cont.)
Moves the VTOC extent (DS4VTOCE) to the DEB; verifies that the seek address passed is within the VTOC (F4 DSCB) extent. The channel program is then modified to read in the DSCB at this seek address.	FIX	
If the RPS feature is present, this routine sets up the RPS channel program with the additional CCW and the set-sector command value, then reads in the F4 DSCB and the specified DSCB (seek option) or the named DSCB (search option).	EXECIO	
8 Loads completion code (ERCODE) in register 15, frees the Obtain work area and issues an SVC 3 to return to the caller.	LEAVE	

A Search or Seek Code
Search = C1 00 00 00
Seek = C0 80 00 00

B Completion Code

- 0 Successful obtain
- 4 The required volume was not mounted.
- 8 SEARCH option: The format-1 DSCB was not found in the VTOC of the specified volume.
  SEEK option: No valid format-4 DSCB exists on the specified volume.
- 12 A permanent I/O error was found when processing the specified volume.
- 16 Invalid work area pointer.
- 20 CCHH not within boundaries of VTOC extent (Seek option).

Diagram 26. LSPACE

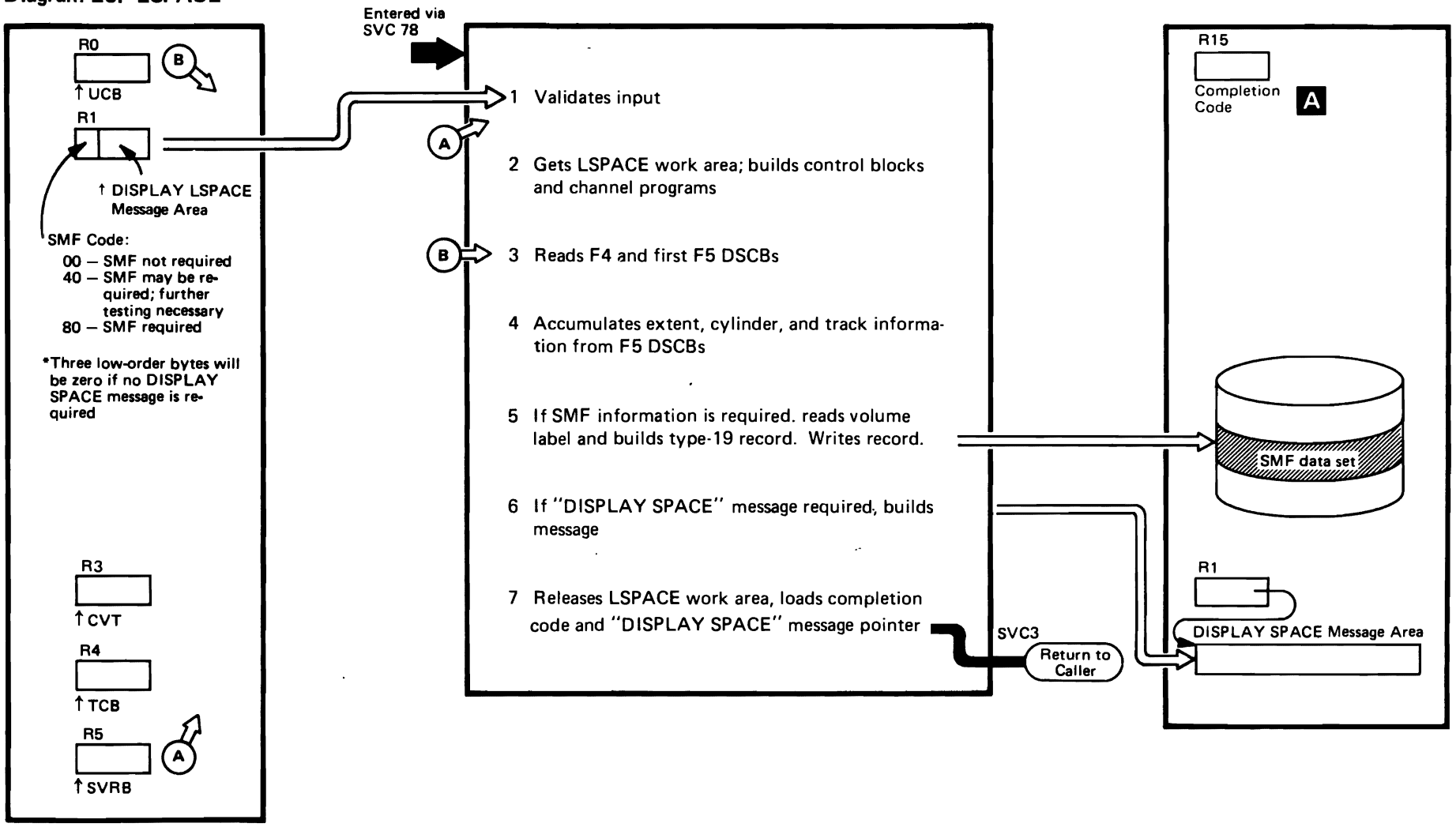


Diagram 26. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Validates SMF indicator; checks for supervisor state, and if not in supervisor state, branches to the resident validity checking routine to verify that the beginning and ending addresses of the message area have the same protection key as the TCB for this task.	BEGIN	IGC0007H
	Determines whether SMF processing is required.	BEGINA	
2	Gets a work area for LSPACE processing and builds a DEB/DCB, IOB, and ECB in the work area. Checks for an RPS feature on the device; if present, builds the set-sector CCW and puts the CCW0 address in the IOB.	BEGINC	
	Converts TTR of the F4 (VTOC) DSCB to MBBCCHHR. Relocates the channel program to the LSPACE work area and initializes it to read the F4 DSCB and the first F5 DSCB. Issues a RESERVE macro instruction to enqueue the VTOC. Sets up to transfer control to IGC0107H.	GOCVT	
	When (1) the UCB address passed in register 0 is not for a direct-access device, (2) an invalid parameter is passed in the LSPACE parameter list, or (3) the UCB represents a device that is not ready, this section sets up the error message, frees the work area, loads a completion code in register 15, and returns to the caller via SVC 3.	EXIT	
3	Reads the F4 and first F5 DSCB.	BEGIN	IGC0107H
4	Relocates the channel program to read subsequent F5 DSCBs (RPS modifications are made for RPS devices).	SETNXT	
	Totals the cylinders and tracks in the F5 extents; saves the largest extent encountered; counts the number of extents.	ADDIN	
	Checks to determine whether all F5s on VTOC have been read; if not, branches to read the next one.	CHECKOUT	
5	Tests for SMF requirements, and, if required, modifies channel program to read the volume label and branches to the routine that reads the label.	TESTSMF	
	Builds type-19 SMF record (see *OS/VS System Management Facilities* for a description of the type-19 record). Writes the record. Tests to determine whether a "DISPLAY SPACE" message is required.	BLDSMF	

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
6	When "DISPLAY SPACE" message is required, links to a routine to unpack and convert to decimal the information required, then moves the message to the 30-byte message area.	INITCVT	1GC0107H (Cont.)
	Dequeues the VTOC, tests for error exits and sets up error messages, if required.	SETDEQ	
	Frees the LSPACE work area, loads the completion code in register 15, the message location in register 1 and returns to the caller.	FREE	

A Completion Code and Resultant Message

Code	Message	ondition
0	None	Successful LSPACE processing
4	LSPACE-PERMANENT I/O ERROR	I/O error while reading DSCBs
8	LSPACE-NON-STANDARD OS VOLUME	Last allocation on this volume made under DOS
12	LSPACE-INVALID PARAMETER (or) LSPACE-NOT A DIRECT ACCESS VOL (or) LSPACE-UCB NOT READY	UCB address invalid UCB not for direct access device UCB-not-ready bit is on indicating device not ready
16	None	Invalid message area address or SMF indicator

Diagram 27. Protect

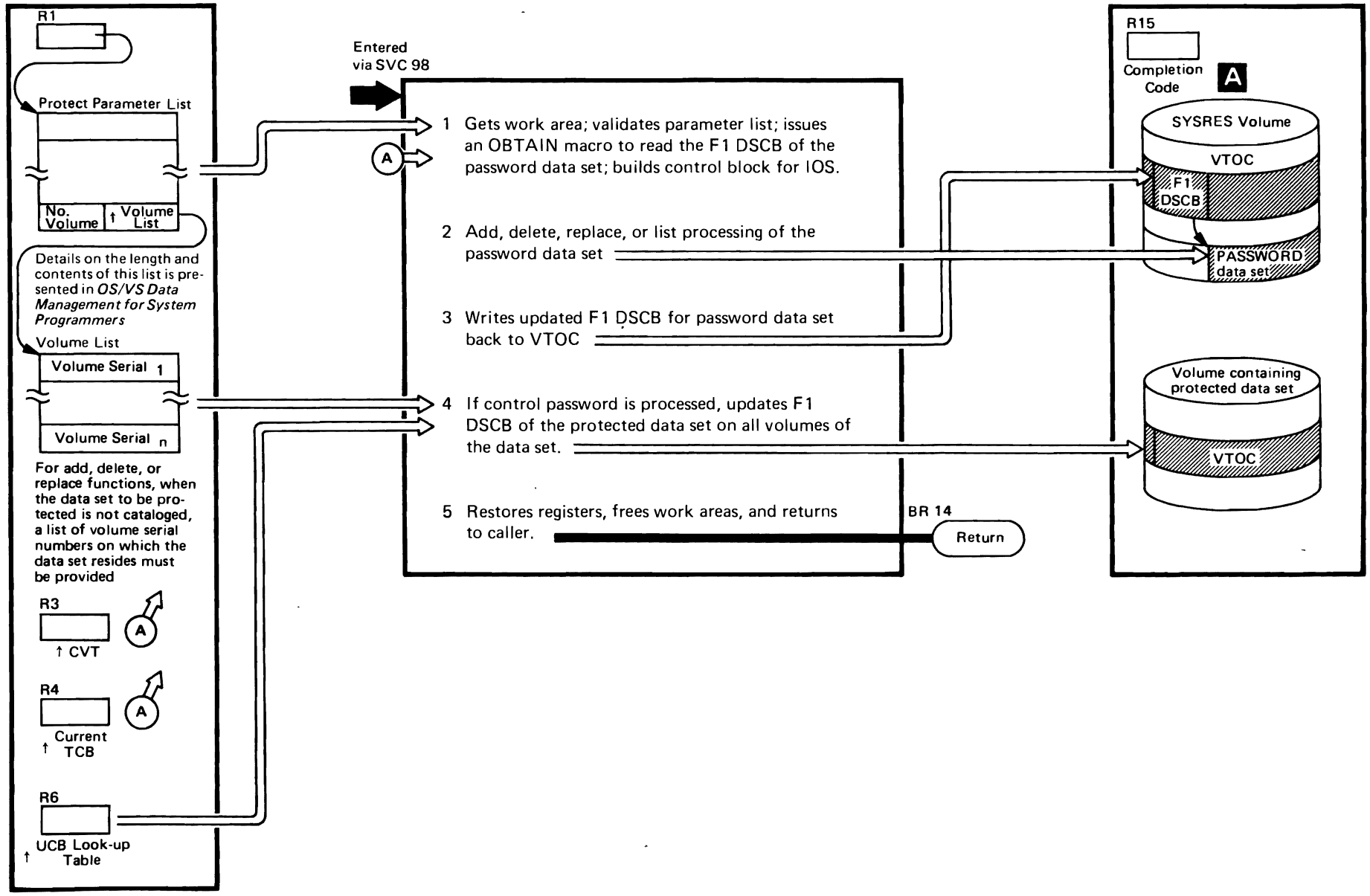


Diagram 27. (Continued)

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
1	Gets a work area for building I/O supervisor control blocks and reading in the F1 DSCB for the password data set. Validates the parameter list pointed to by register 1. Validates parameter list entries.	INITCOR	IGC0009H
	Determines whether a password data set entry is to be added, replaced, deleted, or listed. Verifies that the buffer address (list request) passed has the same storage protection key as the current TCB.	CHK001	
	Sets up a parameter list for enqueuing the password data set and issues an ENQ macro instruction. If an entry is to be added to the password data set, a second ENQ is issued.	CHKEND	
	Determines the record capacity constant of the SYSRES device. Gets a work area (subpool 251) for use by obtain routine. Issues the OBTAIN macro instruction to read in the F1 DSCB for the password data set. Builds control blocks and a channel program for subsequent processing.	TABREC	
2	A branch table routes requests based on the contents of register 10, which were established in the previous routine.	ENT010	IGC0109H
	This section links to a routine that builds the protection mode indicator byte, then links to a second subroutine that builds the balance of the 80-byte data area.	COM050	
	Modifies channel program and links to a subroutine that searches the password data set for the 44-byte name specified in the parameter list. When the data set name is found, this routine links to a routine that issues an EXCP to search for the 44-byte data set name plus the 8-byte password.	ADD010	
	When a data set name is being replaced, this section links to a subroutine that searches the password data set; the search is to verify that the new name is not already in the password data set.	COM005	
	Entered when a password record is being deleted, this routine links to a sub-routine that searches for the record to be deleted.	COM010	
	Entered when a record is to be listed, this routine links to a subroutine that searches for the specified record. The 80 bytes including the counter, protection mode indicator, and optional, 77-byte data field are read into the buffer provided by the requestor.	LST010	
	When a new record is to be added to the end of the password data set, this routine sets up the IOB seek field of the last block written to track. If there is no room to write another block to the track, this routine obtains the next track address.	ENBLK010	
	Using the input parameter list, this routine creates the protection mode byte for the password being added or replaced. For control passwords, an indicator is set to indicate F1 DSCB updating.	BLDMD010	
	Creates the 80-byte data field for a password data set record.	BLDEN010	
	Searches password data set and writes new records or replaces records in the password data set.	SRCH020	
	Error handling routine; loads register 11 with error return code.	ERET040	
	Exit routine; dequeues the enqueued password data set, sets up XCTL ID, and issues SVC 7 (XCTL) to transfer control to IGC0209H.	RET010	
	Tests for error entries and sets up enqueue and dequeue lists.	IGC0209H	IGC0209H

	EXTENDED DESCRIPTION	LABEL	MODULE NAME
3	If the F1 DSCB for the password data set is to be updated, enqueues the SYSRES VTOC, updates the DS1LSTAR field (address of last block written), and links to a subroutine that writes the DSCB back to the VTOC. The SYSRES VTOC is then dequeued.	UPDATE	IGC0209H (Cont.)
4	When a control password is being changed, this routine first checks for a volume list provided by the user. If no volume list was provided, a LOCATE macro instruction is issued to create a volume list.	SETFLAG	
	Searches the UCBs for the UCB of a mounted volume with a volume serial number that matches the volume serial number in the volume list.	LOOKUP	
	When the UCB has been located, interrupts are disabled while the user count is incremented, then re-enabled.	MATCHID	
	Issues an OBTAIN macro to read in the data portion (last 96 bytes) of the F1 DSCB of the data set being protected.	GETDSCB	
	Determines whether the protection status bits of the F1 DSCB are to be modified. If no change of protection status is required, an exit is taken, via BR14.	FLAGDS	
	Entered when the protection status bits must be modified, enqueues the VTOC, reissues the OBTAIN macro instruction, modifies the status bits, writes the F1 DSCB back to the VTOC, then dequeues the VTOC.	NQ	
5	When each F1 DSCB is written back to its VTOC, a check is made for additional entries in the volume list. Another pass through this module is made for each volume list entry. When all volume list entries have been processed, the work areas are freed, registers 0, 1, and 15 are restored, the return address of the calling routine is loaded in register 14, and control is returned to the caller via a branch on register 14.	STATUSOK	

A **Completion Code**

Register 15	Explanation
0	The updating of the password data set was successfully completed.
4	The password of the data set name was already in the password data set.
8	The password of the data set name was not in the password data set.
12	A control password is required or the one supplied is incorrect.
16	The supplied parameter list was incomplete or incorrect.
20	There was an I/O error in the password data set.
**24	The password data set was full.
28	The validity check of the buffer address failed.
*32	The LOCATE macro failed. LOCATE's return code is in register 1 and the number of indexes searched is in register 0.
*36	The OBTAIN macro failed. OBTAIN's return code is in register 1.
*40	The DSCB could not be updated.
44	The password data set does not exist.
*48	Tape data set can not be protected.
*52	Data set in use.

*For these return codes, the password data set has been updated, but the DSCB has not been flagged to indicate the protected status of the data set.
**For this return code, a message is written to the console indicating that the password data set is full.

PROGRAM ORGANIZATION

The DADSM routines are type-4 supervisor call (SVC) routines. In VS1 systems, they are loaded from SYS1.SVCLIB and executed in the pageable supervisor transient area in loads no larger than 2048 bytes (one page).

In VS2 systems, the DADSM routines (and all other SVCs) are moved from SYS1.SVCLIB to SYS1.LPALIB at system generation. At system initialization, the DADSM routines are made resident in virtual storage in 4096-byte pages of the link pack area (LPA), which is pageable.

The DADSM routines transfer control among themselves via the XCTL macro instruction and return control to the calling routine using an SVC 3 (EXIT), except for release and extend, which return control via XCTL. The Directory indicates how each of the DADSM routines receives control.

Module descriptions and module-level flowcharts for each DADSM function follow.

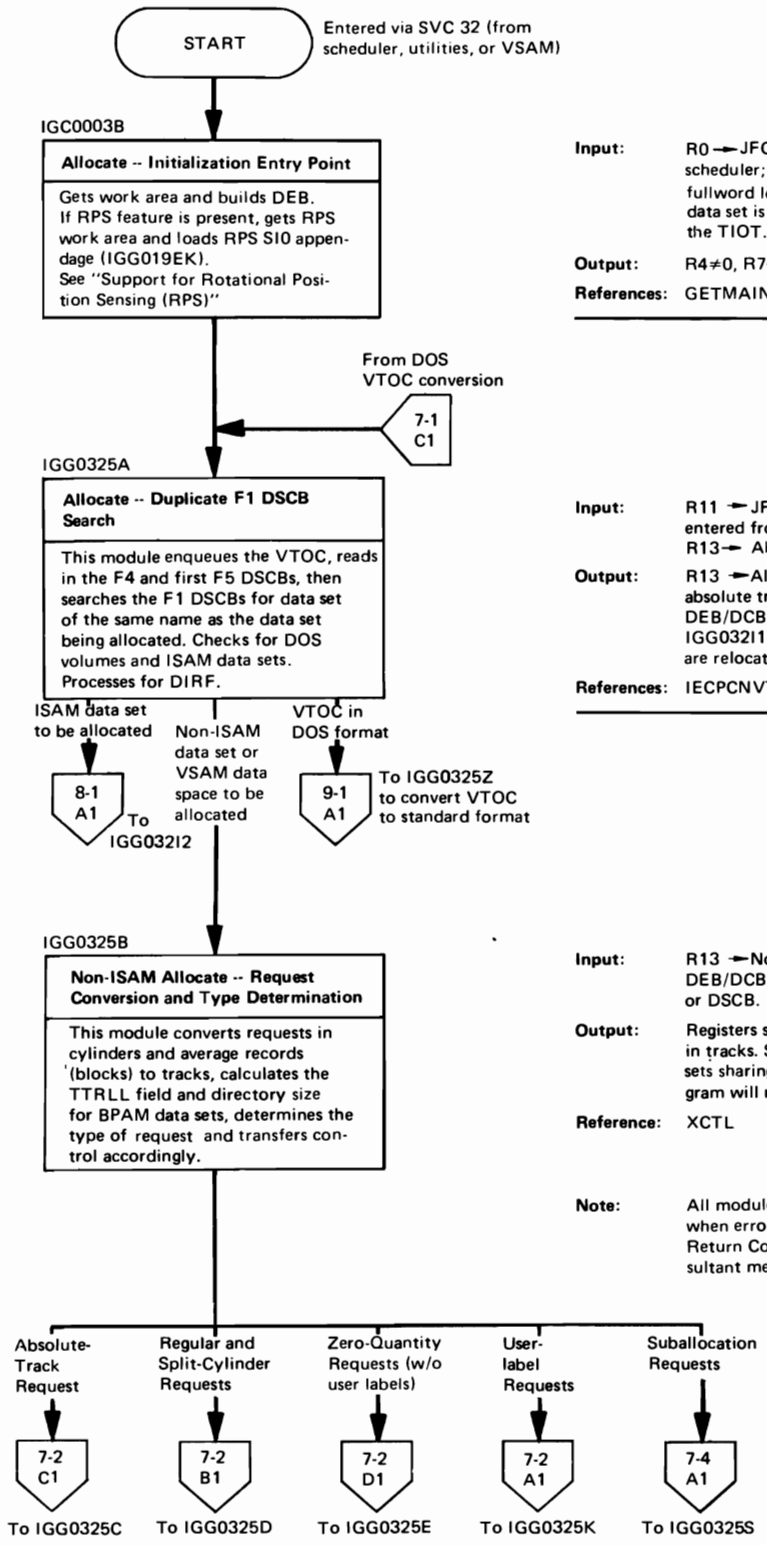
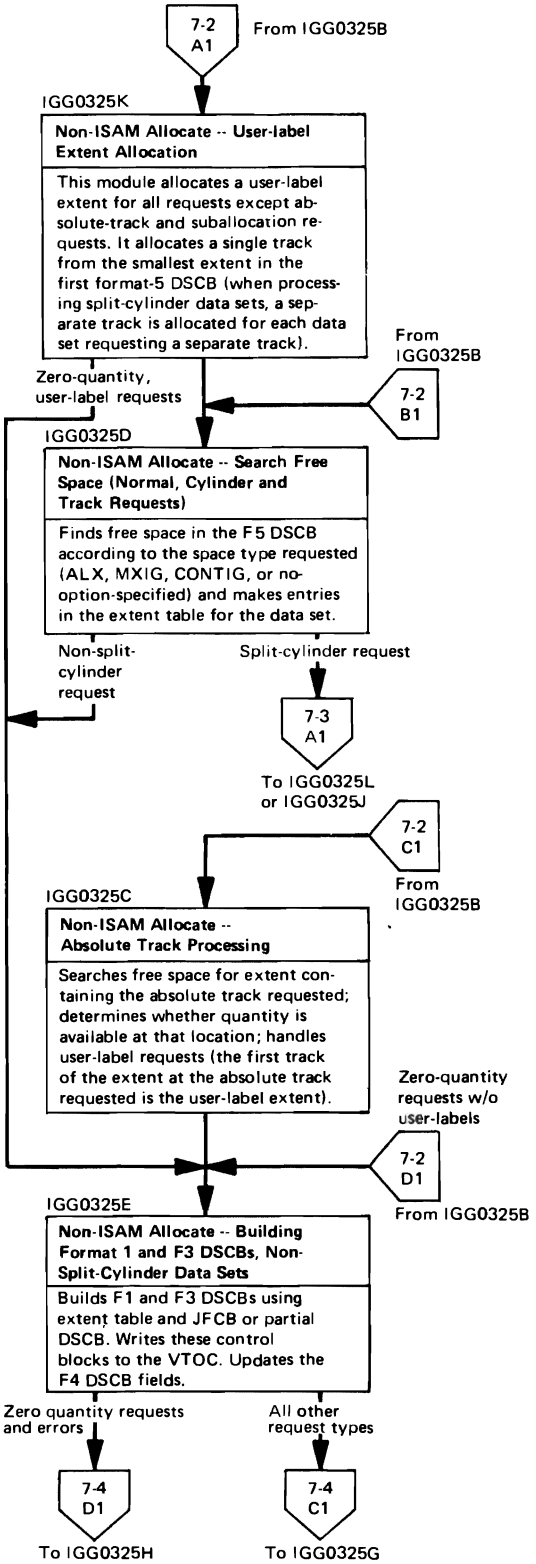


Figure 7. (Part 1 of 4) Allocate Initialization and Non-ISAM Allocation



Input: R13 → non-ISAM Allocate work area (data portion of F4 DSCB and first F5 DSCB and their addresses, DEB/DCB, IOB, ECB, channel program to read F5 DSCBs), R11 → JFCB or partial F1 DSCB.

Output: R13 → work area (contents of work area unchanged, except user-label extent(s) will be added to the extent table and removed from the F5 DSCB).

Reference: XCTL

Input: R13 → non-ISAM Allocate work area (contents same as IGG0325K input), R10 = space requested in tracks, and R11 → JFCB or partial F1 DSCB.

Output: Work area now contains extent table entires for allocated extents; first F5 DSCB may not be in virtual storage.

References: EXCP, WAIT, XCTL

Input: Same as input to IGG0325K; in addition R10 = space requested in tracks.

Output: R13 → non-ISAM Allocate work area (first F5 may have been overwritten with subsequent F5s, extent table contains a single entry; otherwise contents of work area unchanged).

References: EXCP, WAIT, XCTL

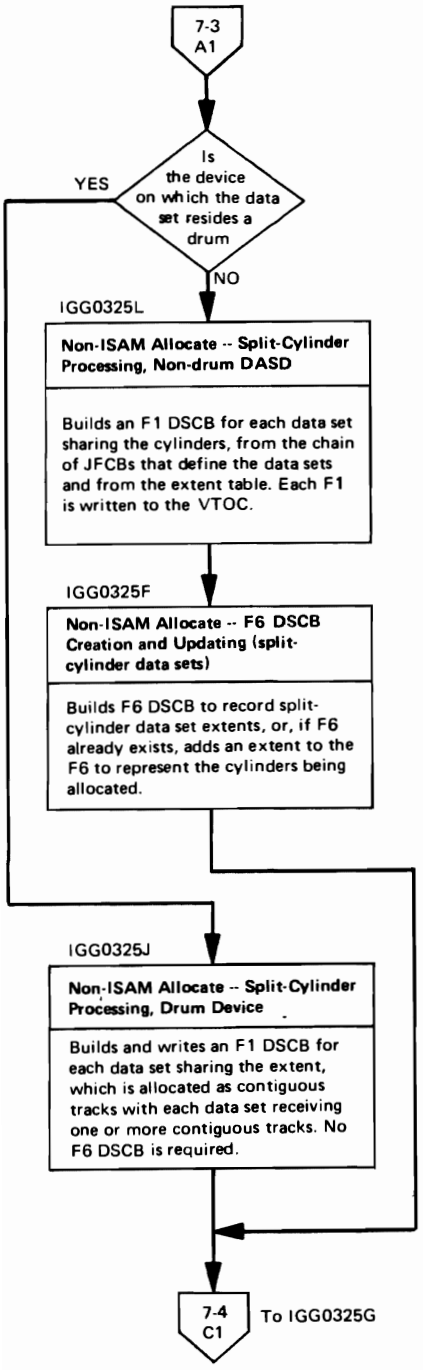
Input: Same as input to IGG0325K; in addition, the work area will contain the extents allocated to this request in the extent table, if it is not a zero-quantity request; the channel program will have been modified to write F1 and F3 DSCBs.

Output: F1 and F3 DSCBs to the VTOC. Registers and work areas are as at input. If directories were requested, the absolute track address (CCHH) of the first F1 extent will be saved in the work area. To IGG0325H for zero-quantity requests -- R8 = 0; for error conditions, R8 = error code (non-zero).

References: IECPCNVT, EXCP, WAIT, ENQ (set-must-complete), XCTL

Note: All modules transfer control to IGG0325H when error conditions are encountered; see "Allocate Return Codes and Messages" in the Diagnostic Aids section for error codes and resultant messages.

Figure 7. (Part 2 of 4) Allocate Initialization and Non-ISAM Allocation



Input: R13→non-ISAM Allocate work area (F4 DSCB and its address, address of first F5 DSCB, DEB/DCB, IOB, ECB, channel program to search for F0 DSCBs and write F1 DSCBs, extent table, which contains an extent describing the cylinder extent and the user-label extents, if requested, SPARE field contains number of data sets sharing the cylinders), R11→first JFCB in the chain.

Output: F1 DSCBs written to VTOC. Registers and data areas are as at input.

References: EXCP, WAIT, ENQ (set-must-complete), XCTL

Input: Registers and work area contents are unchanged from IGG0325L input.

Output: New or updated F6 DSCB written to VTOC. Register and work area contents same as at input.

References: EXCP, WAIT, XCTL

Input: Same as input to IGG0325L.

Output: F1 DSCBs will have been written to the VTOC, one for each data set sharing the contiguous track extent.

References: EXCP, WAIT, ENQ (set-must-complete), XCTL

Note: All modules transfer control to IGG0325H when error conditions are encountered; see "Allocate Return Codes and Messages" in the Diagnostic Aids section for error codes and resultant messages.

Figure 7. (Part 3 of 4) Allocate Initialization and Non-ISAM Allocation

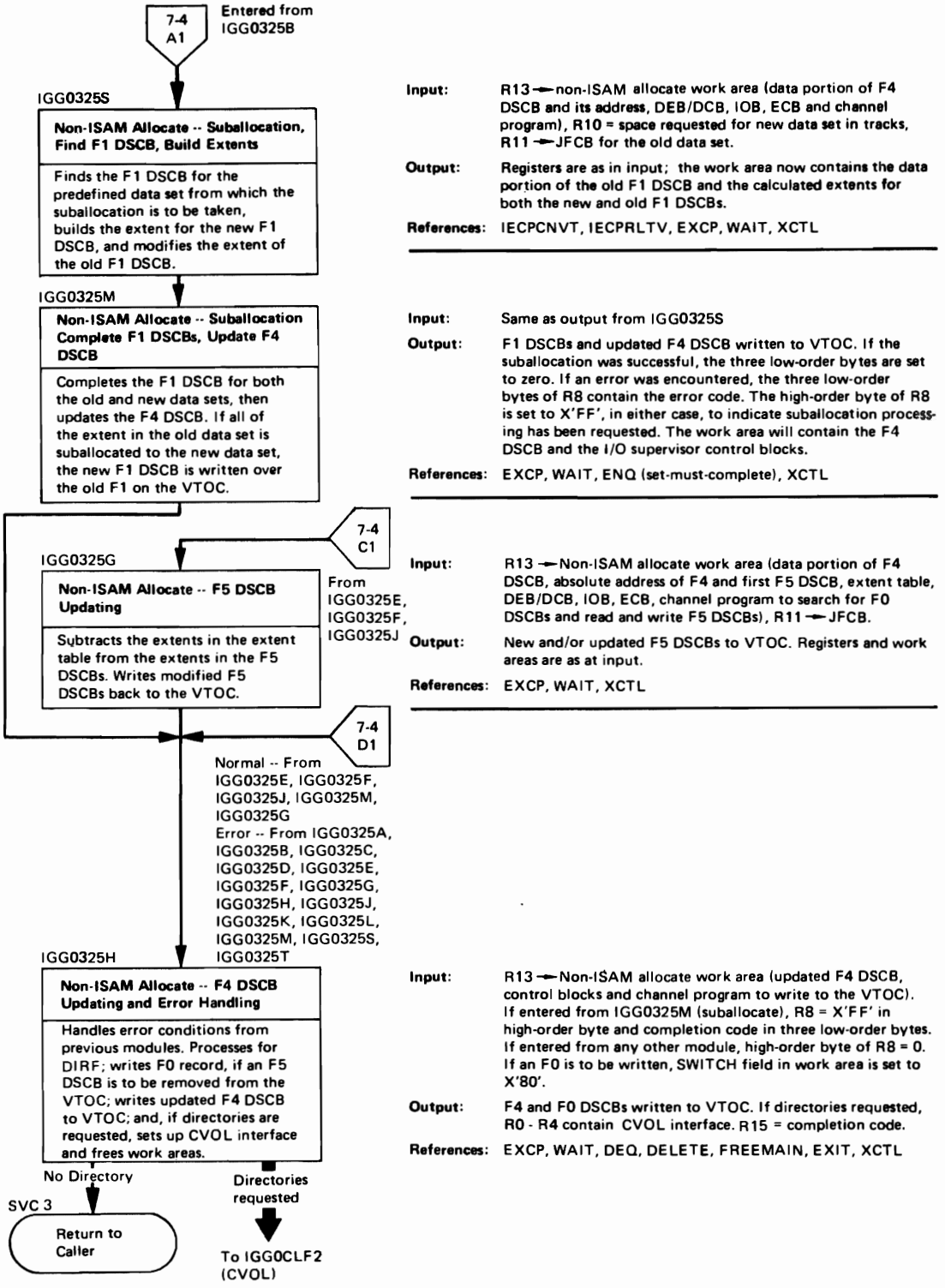
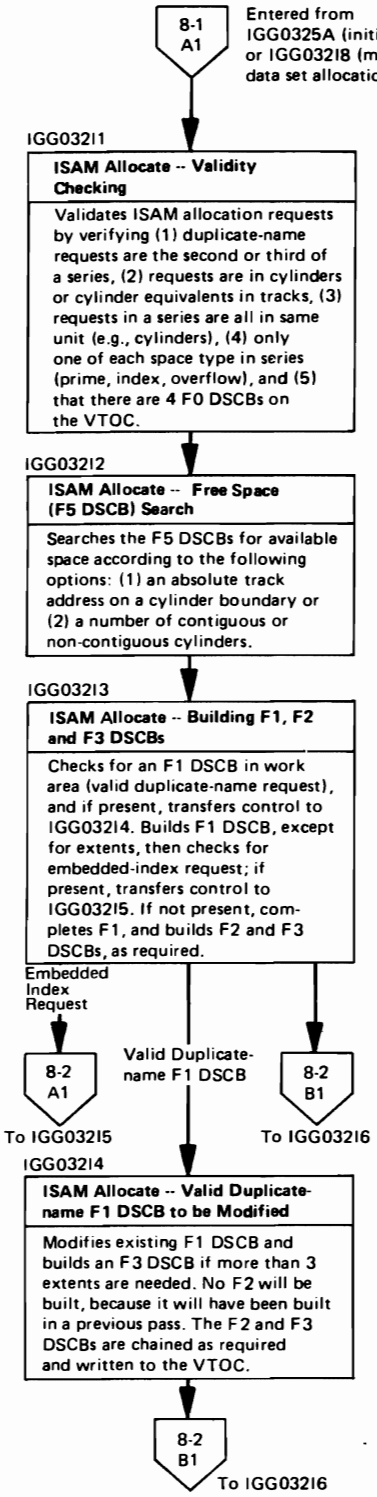


Figure 7. (Part 4 of 4) Allocate Initialization and Non-ISAM Allocation



Input: R11→JFCB, R13→ISAM allocate work area (SAVEREGB→DD statement entry in TIOT for this request, F4 DSCB, first F5 DSCB, F1 DSCB if a duplicate-name F1 DSCB was found, DEB/DCB, IOB, ECB, channel program).

Output: Registers and work area as at input; in addition, the work area now contains a pointer to the UCB for this pass, the amount of space requested, and the absolute track address, if an absolute-track request is being processed.

Reference: XCTL

Input: Same as output from IGG03211

Output: Registers as at input. One or more extent table entries will now be contained in the work area (DADSMTBL) and the first F5 DSCB may or may not be in the work area.

References: EXCP, WAIT, XCTL

Input: Same as output from IGG03212

Output: To IGG03216 -- work area is as at input. An F1 DSCB (and F2 and F3 DSCBs, as required) will have been written to the VTOC.
To IGG03214 -- the valid duplicate-name F1 DSCB will be contained in the work area, which is as at input.
To IGG03215 -- A new F1 DSCB, except for extents, will have been built in the work area.

References: EXCP, WAIT, ENQ (set-must-complete), XCTL

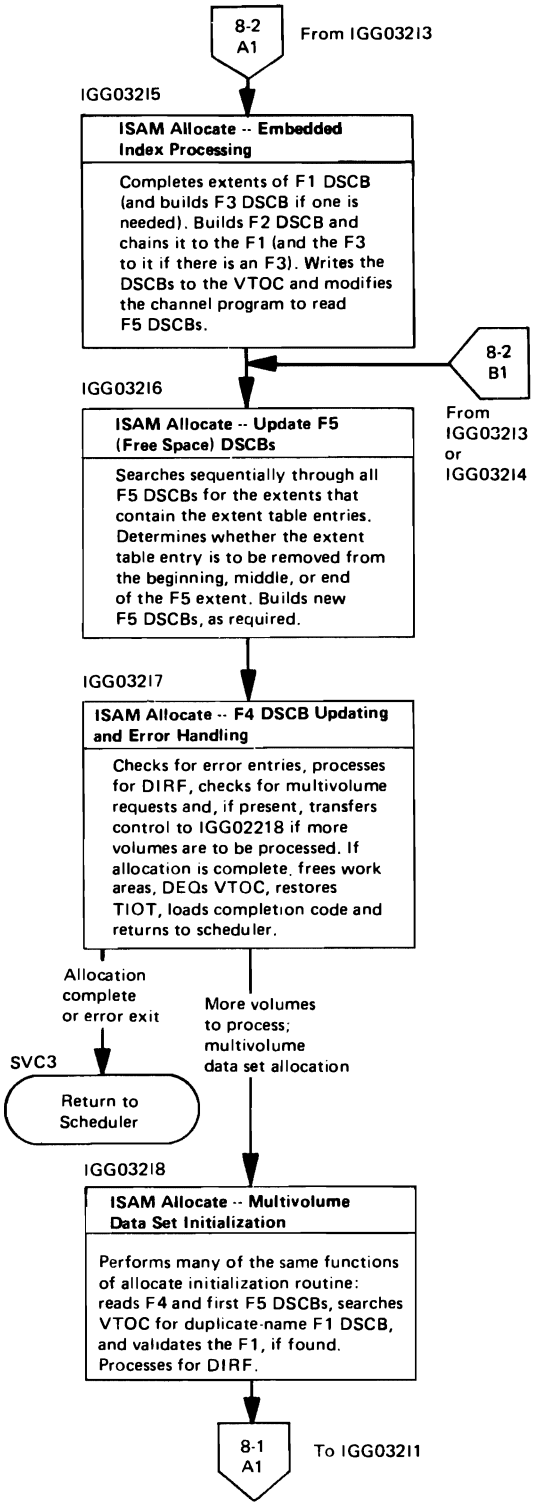
Input: R13→ISAM allocate work area (valid duplicate-name F1 DSCB, extent table with one or more entries, F4 DSCB, DEB/DCB, IOB, ECB, channel program).

Output: Updated F1 DSCB and an F3 DSCB if one is needed. Work area contents as at entry.

References: EXCP, WAIT, ENQ (set-must-complete), XCTL

Note: All modules transfer control to IGG03217 on error conditions; see "Allocate Return Codes and Messages" for the error codes issued by each module and the resultant messages.

Figure 8. (Part 1 of 2) ISAM Allocation



Input: R13→ISAM allocate work area (new F1 DSCB, except for extents, extent table with one or more entries, F4 DSCB, DEB/DCB, IOB, ECB, channel program).

Output: F1 and F2 (and F3 if needed) DSCBs chained and written to VTOC. Work area contents unchanged.

References: IECPCNVT, EXCP, WAIT, ENQ (set-must-complete), XCTL

Input: R13—ISAM allocate work area (extent table with one or more entries, F4 DSCB, address of first F5 DSCB)

Output: Updated F5 DSCBs written to VTOC. Work area now contains only F4 DSCB and I/O Supervisor control blocks and channel program.

References: EXCP, WAIT, XCTL

Input: Error entries (from IGG03211, IGG03212, IGG03213, IGG03214, IGG03215, IGG03216, IGG03218) -- R5 = error code.
Normal entry (from IGG03216) -- R5 = 0, R13→ISAM allocate work area (F4 DSCB, ECB, DEB/DCB, IOB, channel program).

Output: Updated F4 DSCB written to VTOC.
To IGG03218 -- R13→ISAM allocate work area (UCB counter field (CTR) contains a count of the number of volumes on which the prime area has been allocated). CTR field used to calculate the address of UCB for next volume. R10→DD Statement entry in TIOT.
To Scheduler -- R15 = completion code

References: EXCP, WAIT, FREEMAIN, DELETE, DEQ, XCTL, EXIT

Input: R10→DD statement entry in TIOT. R13→ISAM allocate work area (CTR field used to calculate address of UCB for this pass, DEB/DCB, IOB, ECB, channel program).

Output: R13→work area (F4 DSCB, first F5 DSCB, F1 DSCB if valid duplicate-name DSCB found, DEB/DCB with new UCB pointer in DEB, IOB, ECB).

References: IECPCNVT, EXCP, WAIT, RESERVE (enqueues VTOC of next volume to be processed), XCTL

Figure 8. (Part 2 of 2) ISAM Allocation

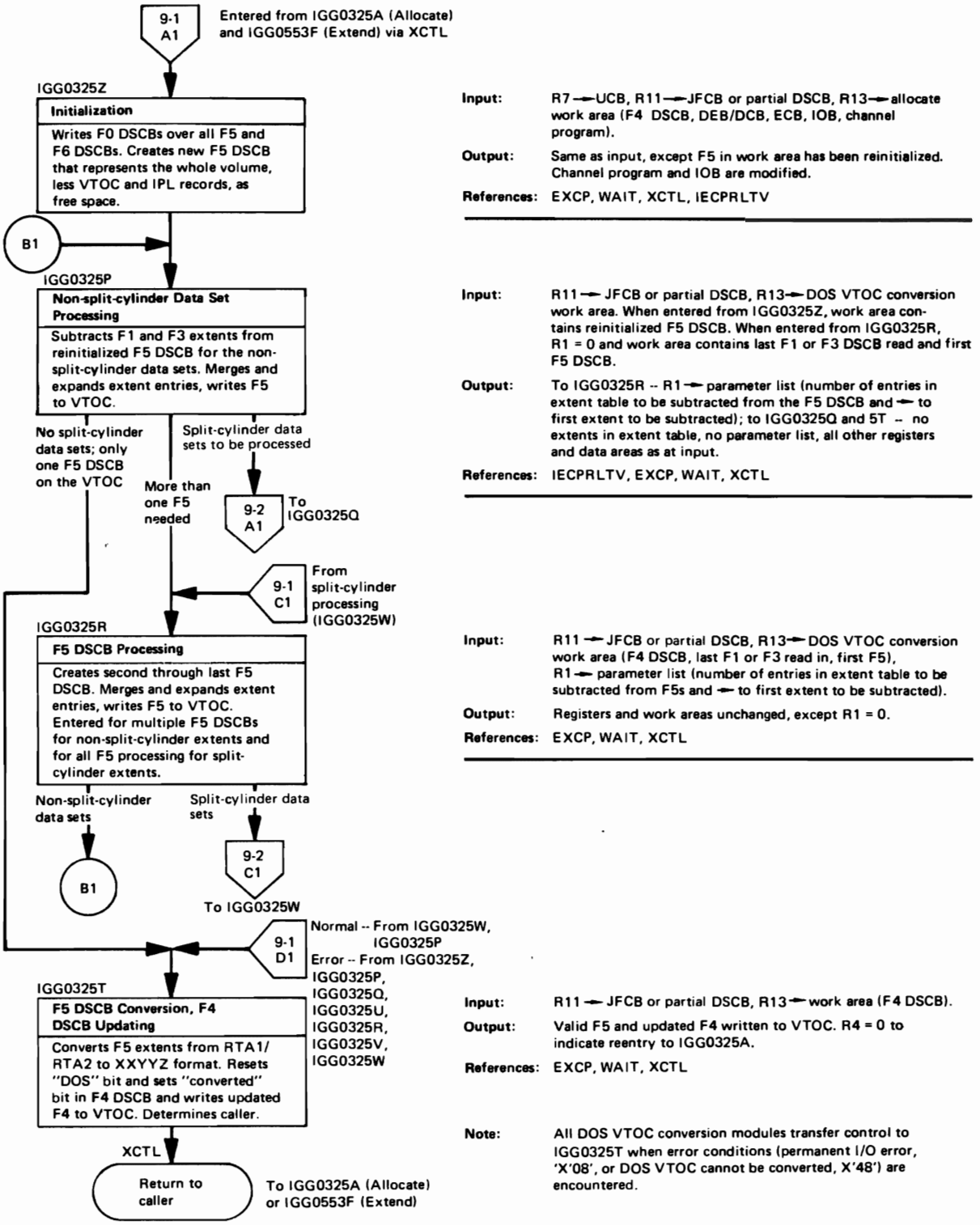
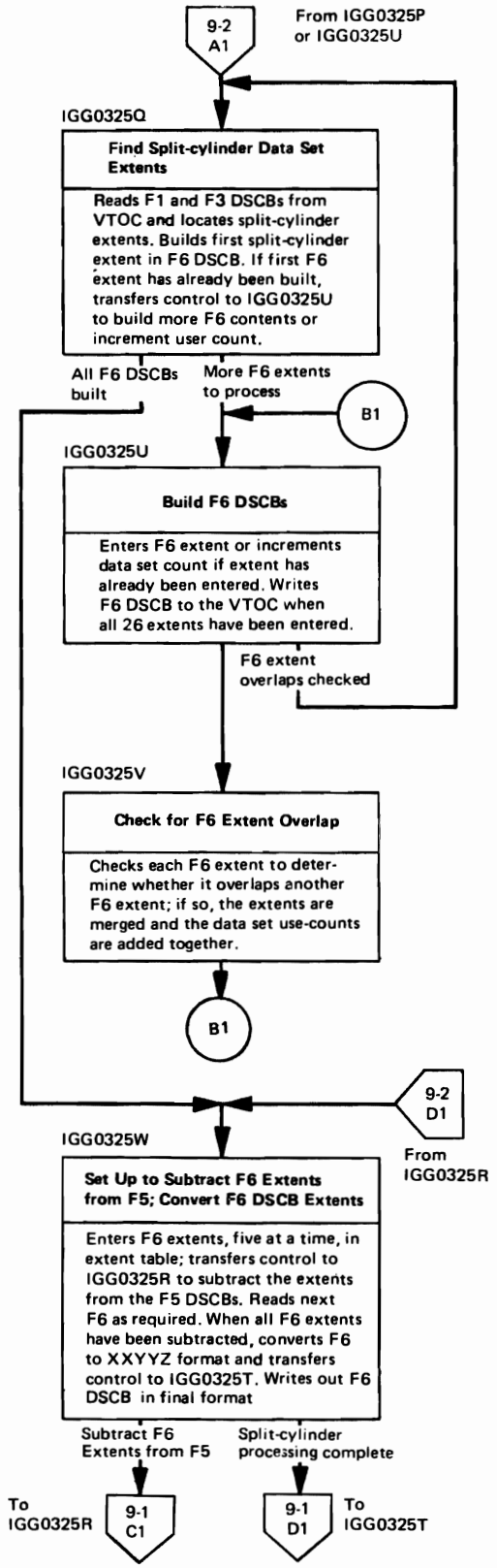


Figure 9. (Part 1 of 2) DOS VTOC Conversion Routine



Input: R11→JFCB or partial DSCB, R13→DOS VTOC work area. From IGG0325P, work area contains F4 DSCB with valid DS4HPCHR field. From IGG0325U, work area contains F4 and first F6 DSCBs; R1 = 0 to indicate reentry from IGG0325U.

Output: To IGG0325U -- R11→JFCB or partial DSCB, R13→DOS VTOC conversion work area (F4 DSCB, last F1 or F3 DSCB read, first F6 DSCB). R6→current shared-cylinder entry in extent table. R6→first F6 extent.
To IGG0325W -- R11→JFCB or partial DSCB, R13→DOS VTOC work area (F4 DSCB).

References: IECPRLTV, EXCP, WAIT, XCTL

Input: From IGG0325Q R11→JFCB or partial DSCB, R13→DOS VTOC conversion work area (F4 DSCB, last F1 or F3 DSCB read in, first F6 DSCB), R6→RTA1/RTA2 entry in extent table, R8→first F6 extent.
From IGG0325V -- R13→work area (F4 DSCB, current F6 DSCB), R6→RTA1/RTA2 of data set, R7 = extent number being compared, R8→current F6 extent, R10 = number of extents in last F6, R1 = 0 to indicate reentry from IGG0325V.

Output: To IGG0325Q -- R13→work area (F4 and first F6 DSCBs), R1 = 0 to indicate reentry from IGG0325U.
To IGG0325V -- R13→work area (F4 and first F6 DSCBs), R6→RTA1/RTA2 of data set, R7 = extent number being compared, R8→current F6 extent, R10 = number of extents in last F6.

References: EXCP, WAIT, XCTL

Input: R11→JFCB or partial DSCB, R13→DOS VTOC conversion work area (F4 DSCB and F6 DSCB being compared), R6→RTA1/RTA2 of data set, R7 = number of the extent being compared, R8→current extent, R10 = number of extents in last F6 DSCB.

Output: Same as input except R1 = 0 to indicate reentry from IGG0325V.

References: EXCP, WAIT, XCTL

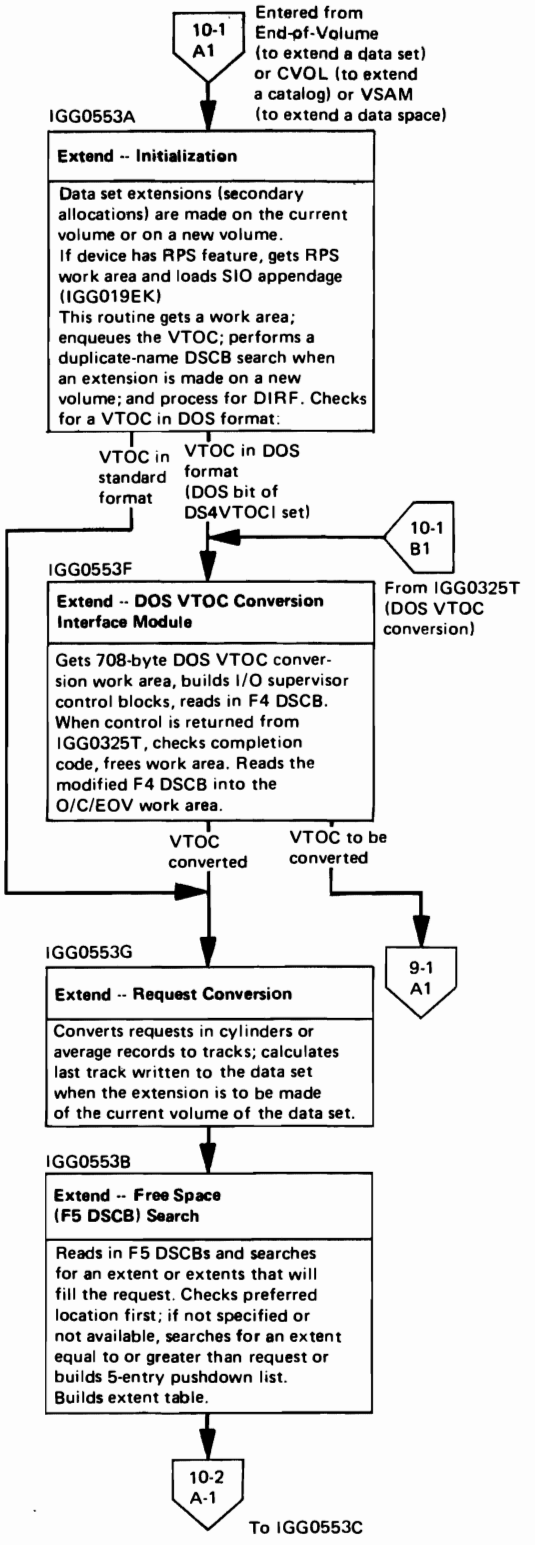
Input: R11→JFCB or partial DSCB, R13→DOS VTOC conversion work area.
From IGG0325Q -- work area contains only F4 DSCB.
From IGG0325R -- first F5 DSCB will also be in the work area and R1 = 0.

Output: To IGG0325R -- R11→JFCB or partial DSCB, R13→work area (extent table entries, F4 DSCB, first F5 DSCB), R1→parameter list (number of extents to be subtracted and→first extent).
To IGG0325T -- R11→JFCB or partial DSCB, R13→work area (F4 DSCB and first F5 DSCB). Format 6 DSCBs are in final format, F5 DSCBs in temporary format.

References: EXCP, WAIT, XCTL

Note: All DOS VTOC conversion modules transfer control to IGG0325T when error conditions (permanent I/O error, X'OC', or DOS VTOC cannot be converted, X'48') are encountered.

Figure 9. (Part 2 of 2) DOS VTOC Conversion Routine



Input: R2→DCB of data set to be extended, R4→O/C/EOV work area (JFCB of data set to be extended, I/O supervisor control blocks, channel program), R5→DEB of data set to be extended, R10→UCB, R13 = entry conditions (Diagram 15).

Output: R4→O/C/EOV work area (contents as at input). R5→DEB, R11→Extend work area.

References: IECPCNVT, IECPRLTV, GETMAIN, EXCP, WAIT, RESERVE, XCTL, LOAD, MODESET

Input: From IGG0553A – same as IGG0553A Output. From IGG0325T -- R8 = completion code.

Output: To IGG0325T -- R7→UCB, R13→DOS VTOC conversion work area (F4 DSCB, address of first F5 DSCB, DEB/DCB, IOB, ECB, channel program, contents of R4, R5, and R11, SPARE field = X'80' to indicate entry from extend). To IGG0553G -- same as output from IGG0553A.

References: GETMAIN, FREEMAIN, XCTL, EXCP, WAIT

Input: R4→O/C/EOV work area (F4 DSCB, address of first F5 DSCB, JFCB, DEB/DCB, IOB, ECB, channel program for reading from and writing to the VTOC), R5→DEB, R11→Extend work area.

Output: R12 = space requested in tracks, R13 = relative track address of preferred location, R11→Extend work area, R4→work area which is unchanged.

References: IECPRLTV, XCTL

Input: See IGG0553G Output.

Output: R4→O/C/EOV work area (same as at input, except that the extent table will now contain one or more entries), R11→Extend work area.

References: EXCP, WAIT, XCTL

Note: When error conditions are encountered, all extend modules transfer control to IGG0553E with entry code (or modified entry code) in R13.

Figure 10. (Part 1 of 2) Extend

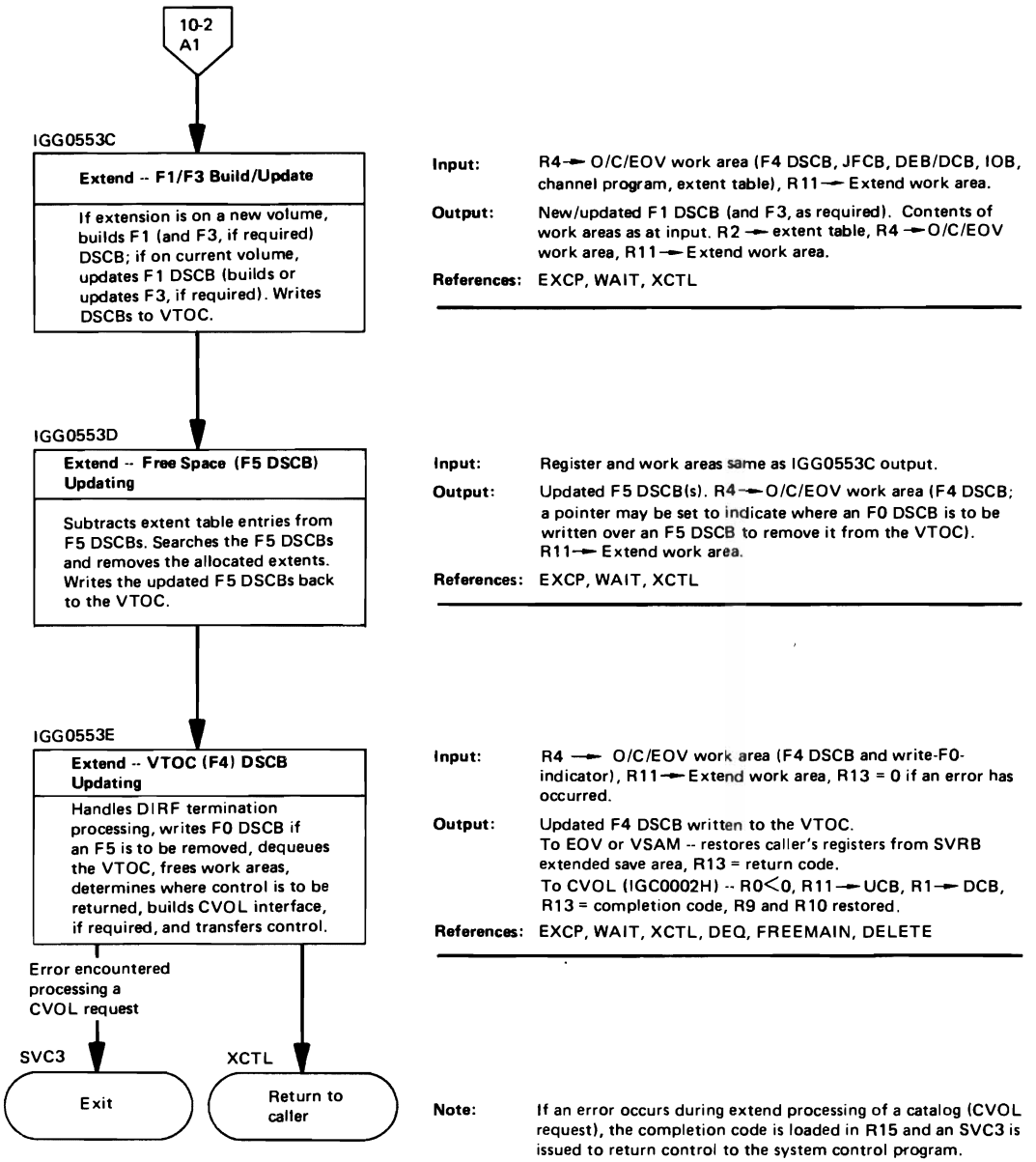
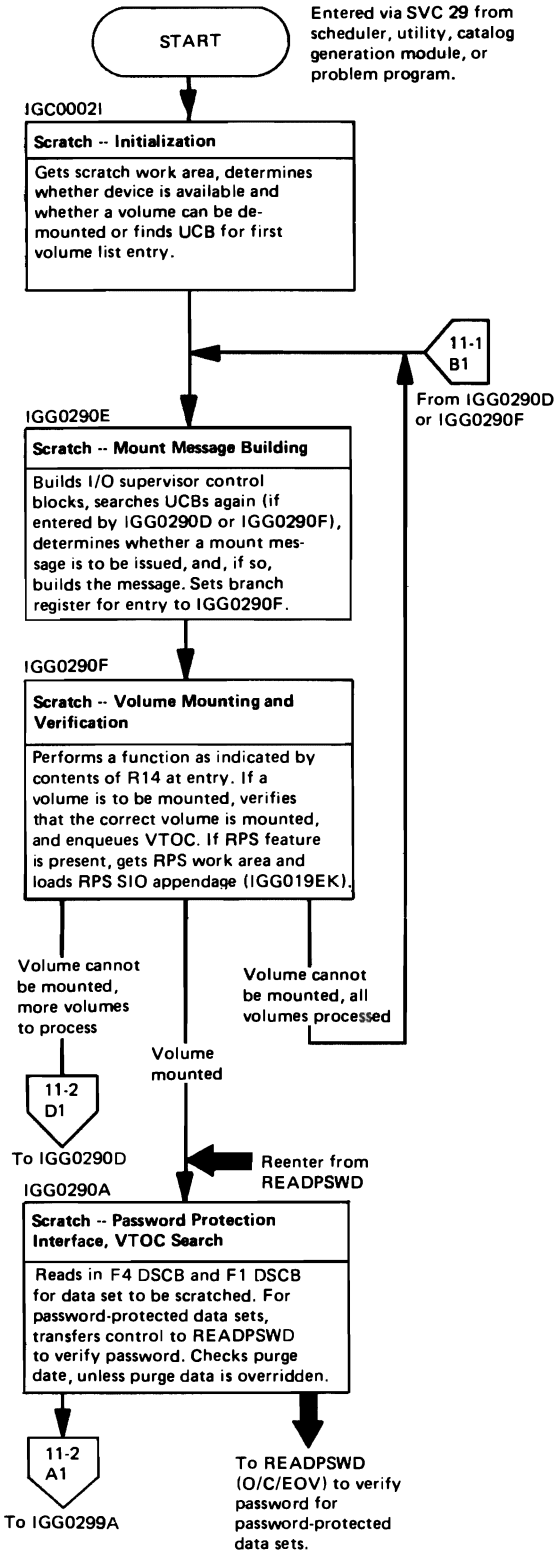


Figure 10. (Part 2 of 2) Extend



Input: R0 → UCB or = 0, R1 → Scratch parameter list (see Diagram 18 for contents)

Output: R13 → Scratch work area (PRUCBPTR field → UCB).

References: GETMAIN, XCTL, MODESET

Input: See IGC0002I output, above.

Output: R13 → Scratch work area (DEB/DCB, ECB, IOB, channel program to read volume label)
R8 → current volume list entry, R14 = branch code:
0 -- no device available on which to mount the volume
4 -- volume is mounted
12 -- mount message to be issued, non-2321 DASD

References: XCTL, LSPACE (when a volume is to be demounted and SMF information is required)

Input: See IGG0290E output.

Output: To IGG0290A -- Issues message to operator if a volume is to be mounted. R8 → current volume list entry, R13 → Scratch work area (DEB/DCB, IOB, ECB, absolute track address of F4 and F5 DSCBs). To IGG0290E and IGG0290D -- sets scratch status code for current volume in volume list entry.

References: IECPCNVT, TPUT, WTOR, RESERVE (set-must-complete), EXCP, WAIT, XCTL, LOAD

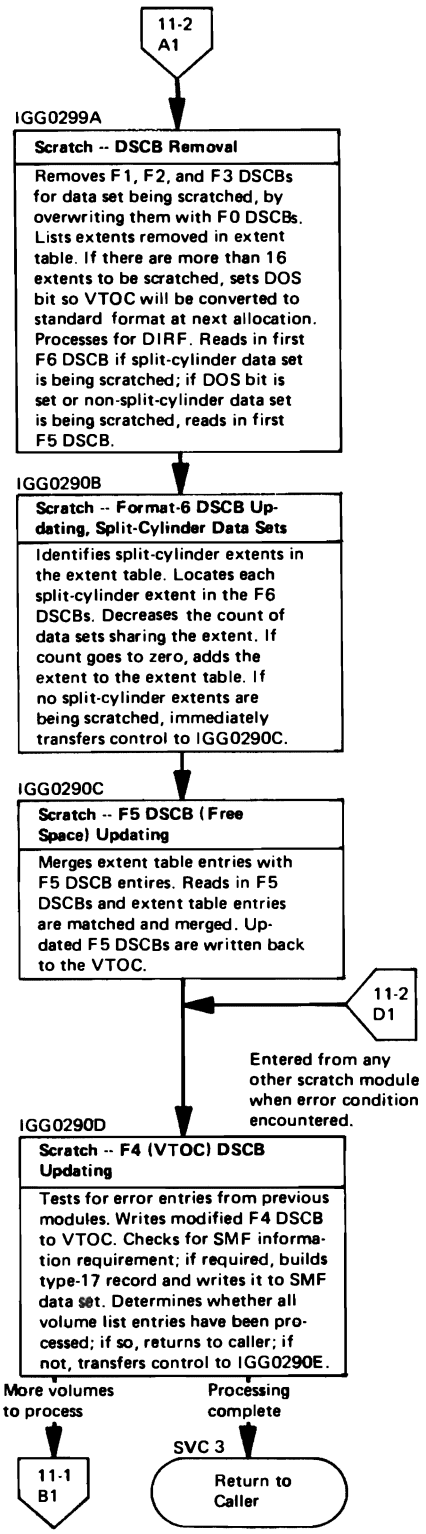
Input: From IGG0290F -- see IGG0290F output.
From READPSWD -- R10 = password status code, R13 → Scratch work area (OLPLPTR → Scratch parameter list, DEB, DCB, IOB, channel program).

Output: To READPSWD -- R4 → password work area, R5 → IOB, R10 = X'03' in high order byte to identify scratch request, R11 → data set name. To IGG0299A -- R13 → Scratch work area (DEB/DCB, IOB, ECB, channel program, F1 DSCB, F4 DSCB, address of first F5 DSCB).

References: EXCP, WAIT, XCTL

Note: When error conditions are encountered, all scratch modules except IGG0290E, which sets no error indicator, set the appropriate error code in the scratch status byte of the current volume list entry and transfer control to IGG0290D. IGG0290F first checks to see if processing is complete, and, if not, transfers control to IGG0290E.

Figure 11. (Part 1 of 2) Scratch



Input: R13 → scratch work area (F4 DSCB, F1 DSCB, address of first F5 DSCB, DEB/DCB, IOB, ECB, channel program)

Output: F1, F2, and F3 DSCBs for data set being scratched will have been overwritten with F0 DSCBs. R13 → scratch work area (contents as at input, except it now contains extent table entries and the first F6 DSCB if a split-cylinder data set is being scratched, or the first F5 DSCB if a non-split-cylinder data set is being scratched). F4 DSCB will have been written a VTOC with DIRF bit set. R8 → volume list entry being processed.

References: IECPRLTV, EXCP, WAIT, XCTL

Input: R13 → scratch work area (F4 DSCB, first F6 DSCB if split-cylinder data sets to be scratched, F5 DSCB if non-split-cylinder data set to be scratched, DEB/DCB, IOB, ECB, channel program, extent table with split-cylinder extents marked with X'FF'.)

Output: Updated F6 DSCBs written to VTOC. Extent table now contains only free extents (split-cylinder extents with the other data sets continuing to reside in the extent have been removed from extent table. R13 → scratch work area (F4 DSCB, extent table, first F5 DSCB, DEB/DCB, IOB, ECB, channel program). R8 → volume list entry.

References: EXCP, WAIT, XCTL

Input: R13 → scratch work area (F4 DSCB, first F5 DSCB, extent table, DEB/DCB, IOB, ECB, channel program).

Output: Updated F5 DSCBs written back to VTOC. Work area now contains only F4 DSCB and I/O supervisor control blocks. R8 → current volume list entry.

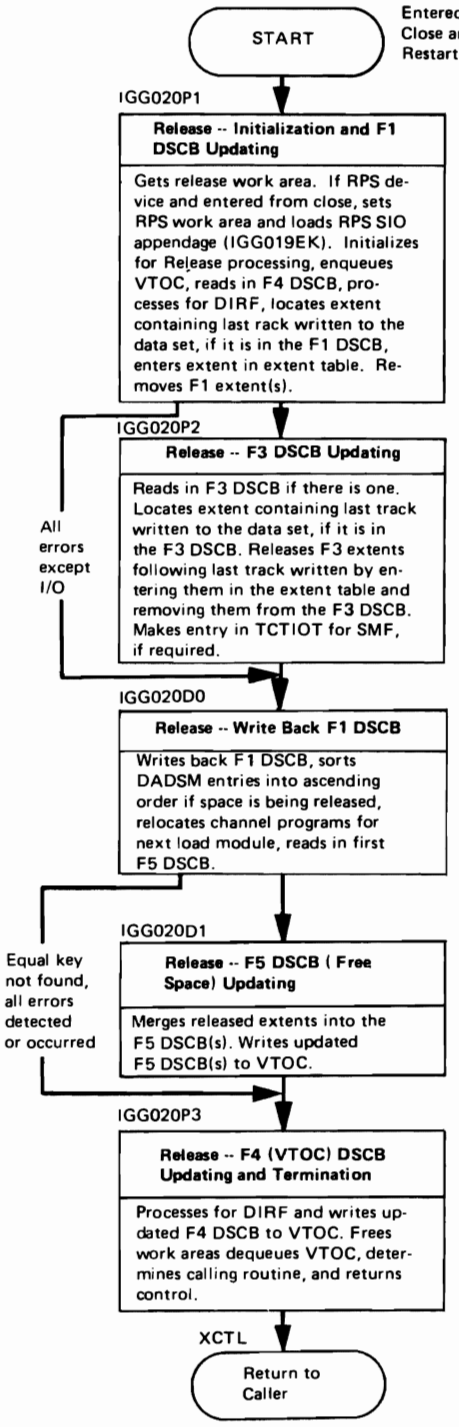
References: EXCP, WAIT, XCTL

Input: Error condition -- ERCODE field in scratch work area will contain an error code and current volume list entry will contain the scratch status code.
Normal -- R13 → scratch work area (updated F4 DSCB, I/O supervisor control blocks).

Output: Updated F4 DSCB written to VTOC. SMF type 17 record written to SMF data set, as required.
Return to caller -- volume list entries will contain scratch status code, R15 = return code.
To IGG0290E -- R8 → next volume list entry to be processed.

References: DEQ (release-must-complete), EXCP, WAIT, EXIT, GETMAIN, FREEMAIN, DELETE, SMFWTM, TIME, XCTL.

Figure 11. (Part 2 of 2) Scratch



Input: R2 → DEB of data set to be released, R4 → O/C/EOV work area (data portion of F1 DSCB, JFCB of data set to be released, DEB/DCB, IOB, ECB, channel program). R10 → UCB of data set to be relased.

Output: R13 → O/C/EOV work area (F1 DSCB, DEB/DCB, IOB, ECB, channel program). R11 → release work area (F4 DSCB, extent table if F1 DSCB extent(s) were released). F4 DSCB will have been written to VTOC with DIRF bit set.

References: IECPCNVT, IECPRLTV, RESERVE (set-must-complete), EXCP, WAIT, GETMAIN, XCTL, LOAD

Input: See IGG020P1 output.

Output: Modified F3 written to VTOC, or if all extents were released in the F3 DSCB, an F0 DSCB will be written over it. TCTIOT will be updated if SMF information has been requested. Number of extents remaining on the volume for this data set will be updated in the F1 DSCB, R11 → release work area (F3 DSCB if there is one, F4 DSCB, extent table).

References: IECPRLTV, EXCP, WAIT, XCTL

Input: See IGG020P2 output; also R2 contents. If R2 contains anything other than a zero or negative value, an error (other than I/O error) was detected in either IGG020P1 or IGG020P2.

Output: F1 DSCB written back to VTOC, DADSM table sorted in ascending order, first F5 DSCB read in.
R11 → release work area (first F5 DSCB, F4 DSCB, sorted extent table)
R13 → I/O support work area (updated F1 DSCB)

References: EXCP, WAIT, XCTL

Input: R11 → release work area (F4 DSCB, first F5 DSCB, extent table).

Output: Updated F5 DSCBs to VTOC.

References: EXCP, WAIT, XCTL

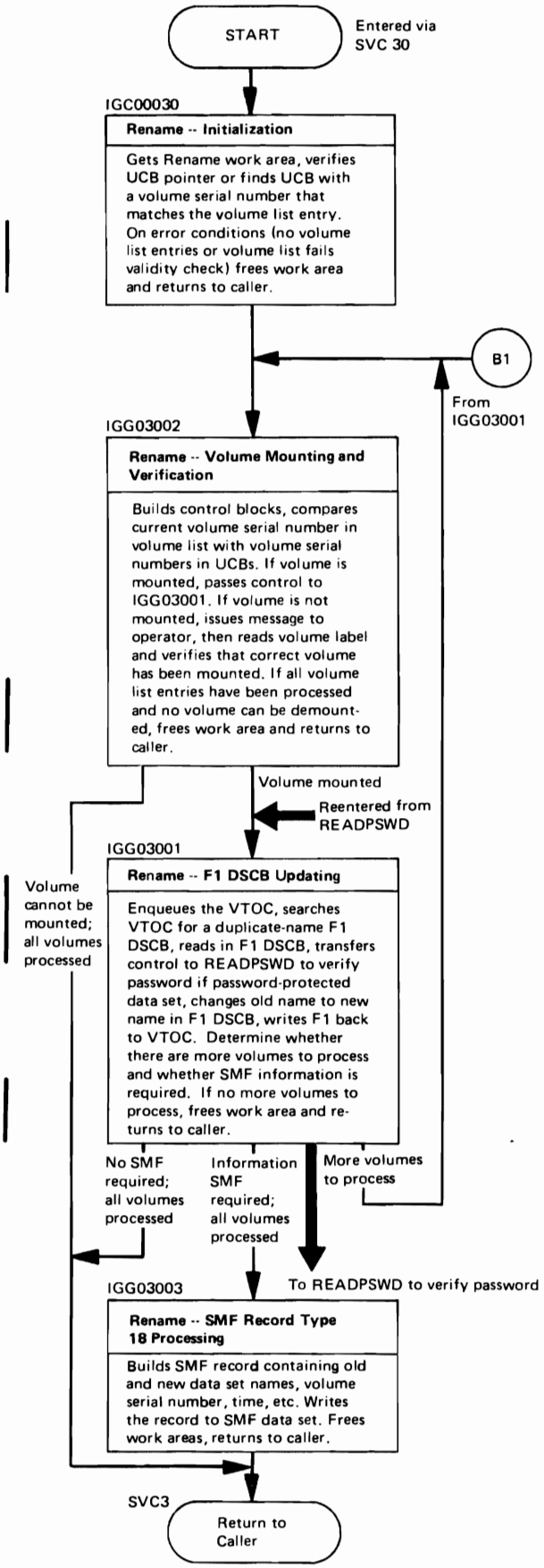
Input: Error -- R2 = error code (permanent I/O error, no space in VTOC, equal key not found when trying to write back F1 DSCB, or extent not found). Normal -- R11 → release work area (updated F4 DSCB), R13 → O/C/EOV work area (F1 DSCB, DEB/DCB, IOB, ECB, channel program).

Output: F4 DSCB written to VTOC. Updated F1 DSCB in O/C/EOV work area. The release work area will have been freed, as well as the RPS work area, if one existed.

References: EXCP, WAIT, FREEMAIN, DELETE, XCTL

Note: All release modules transfer control to IGG020P3 when I/O errors are encountered. IGG020P1 or IGG020P2 transfers control to IGG020D0 for all errors except I/O. IGG020P2 also transfers control to IGG020D0 for normal processing. IGG020D0 then writes back the F1 DSCB in the VTOC and, if an error was detected in IGG020P1 or IGG020P2, or if an error occurred in IGG020D0, control is transferred to IGG020P3.

Figure 12. Release



Input: R1 → rename parameter list (see Diagram 24 for contents). R0 → UCB or = 0.

Output: R13 → rename work area (PRUCBPTR field → UCB for volume that contains the data set to be renamed or to a UCB for a volume that can be demounted). R15 = error code, if an error was encountered.

References: GETMAIN, FREEMAIN, XCTL, EXIT, MODESET

Input: See IGC00030 Output.

Output: If a volume is to be demounted, a WTOR macro instruction will be issued, and, if SMF information is requested, an LSPACE macro instruction (SVC 78) will be issued to write an SMF record type 19 to the SMF data set. R13 → rename work area (DEB/DCB, IOB, ECB, channel program). R15 = error code if error was encountered.

References: WTOR, TPUT, WAIT, FREEMAIN, LSPACE, EXIT, XCTL

Input: R13 → Rename work area (DEB/DCB, IOB, ECB, channel program). From READPSWD -- R10 = password status code, R13 rename work area (OLD PLPTR → rename parameter list).

Output: To READPSWD -- R4 → password work area, R5 → IOB, R10 = X'02 00 00 00' to identify rename request, R11 old data set name. To IGG03002 (more volumes to process) -- renamed F1 DSCB has been written to VTOC. To IGG03003 (SMF information required) -- R13 → rename work area (OLDPLPTR → rename parameter list). Return to caller -- R15 = completion code.

References: RESERVE, FREEMAIN, EXCP, WAIT, DEQ, EXIT, XCTL

Input: R13 → rename work area (OLD PLPTR → rename parameter list, which is used to access the old and new data set name and volume serial number).

Output: SMF record type 18 to SMF data set. R15 = rename completion code.

References: GETMAIN, FREEMAIN, EXIT, TIME, SMFWTM

Note: When error conditions are encountered, all rename modules return to caller via SVC 3 (EXIT) after setting an error code in R15 and freeing work areas.

Figure 13. Rename

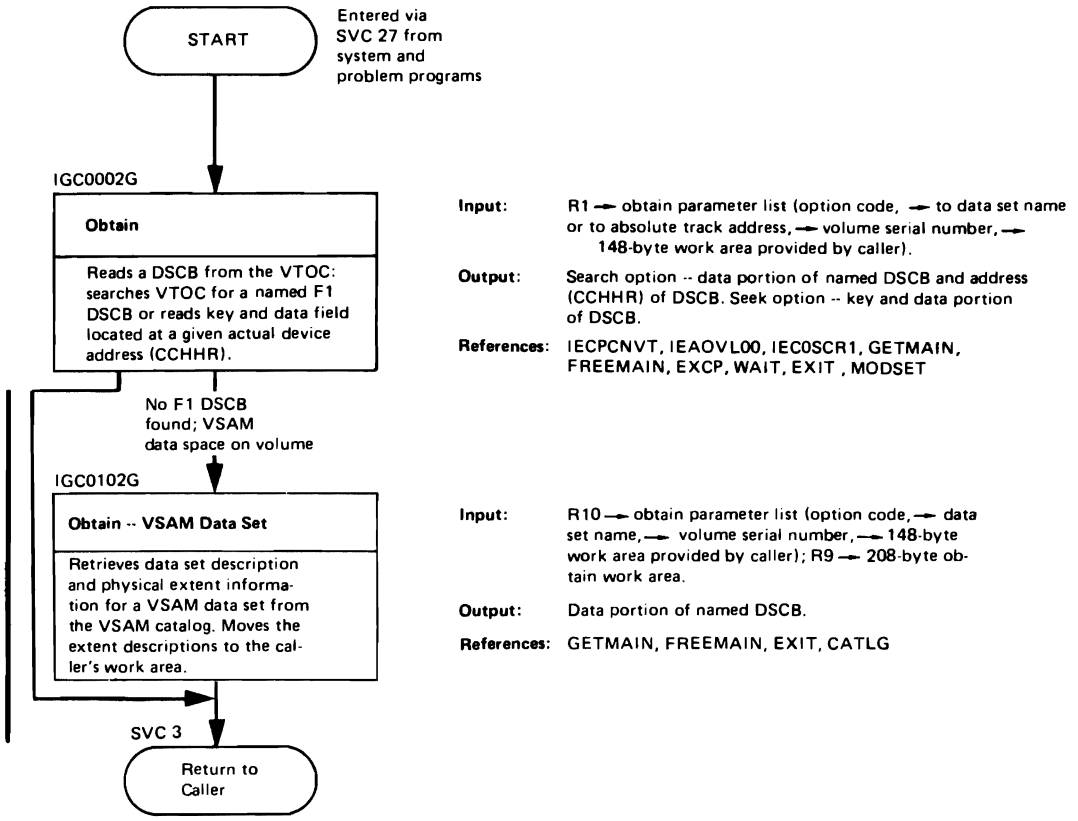
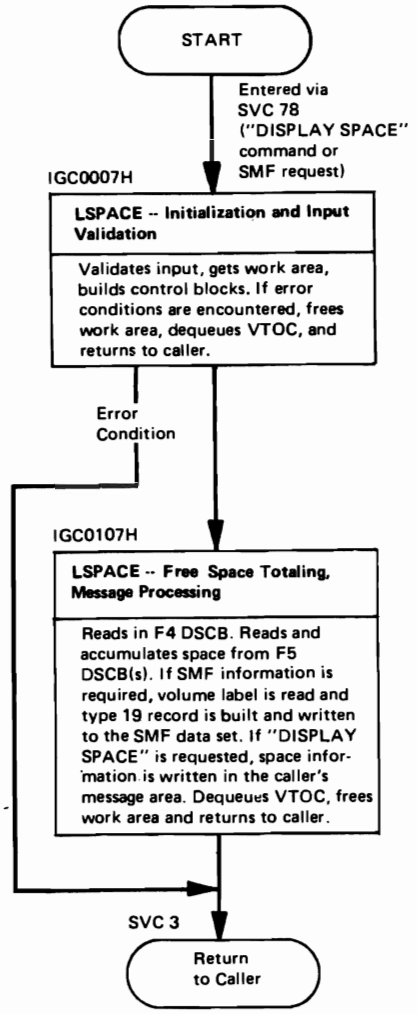


Figure 14. Obtain



Input: R0 → UCB, R1 = SMF code in high order byte and → message area for "DISPLAY SPACE" command in low order bytes), R3 → CVT, R4 → TCB, R5 → SVRB.

Output: R13 → LSPACE work area (DEB/DCB, IOB, ECB, channel program to read F4 and first F5 DSCB, absolute address of F4 DSCB). If the device has the RPS feature, the channel program will have been modified to contain a set-sector command. If an error is encountered, an error message will be moved to the caller's message area. R15 = completion code.

References: IEAOVL00, IECPCNVT, IEC0SCR1, GETMAIN, FREEMAIN, XCTL, EXIT, MODESET, RESERVE

Input: See output from IGC0007H

Output: If SMF information is requested, a type 19 record is written to the SMF data set. If "DISPLAY SPACE" command has been issued, accumulated extent, cylinder, and track information will be moved to the caller's message area.

References: IEC0SCR1, EXCP, WAIT, FREEMAIN, DEQ, TIME, SMFWTM, EXIT

Figure 15. LSPACE

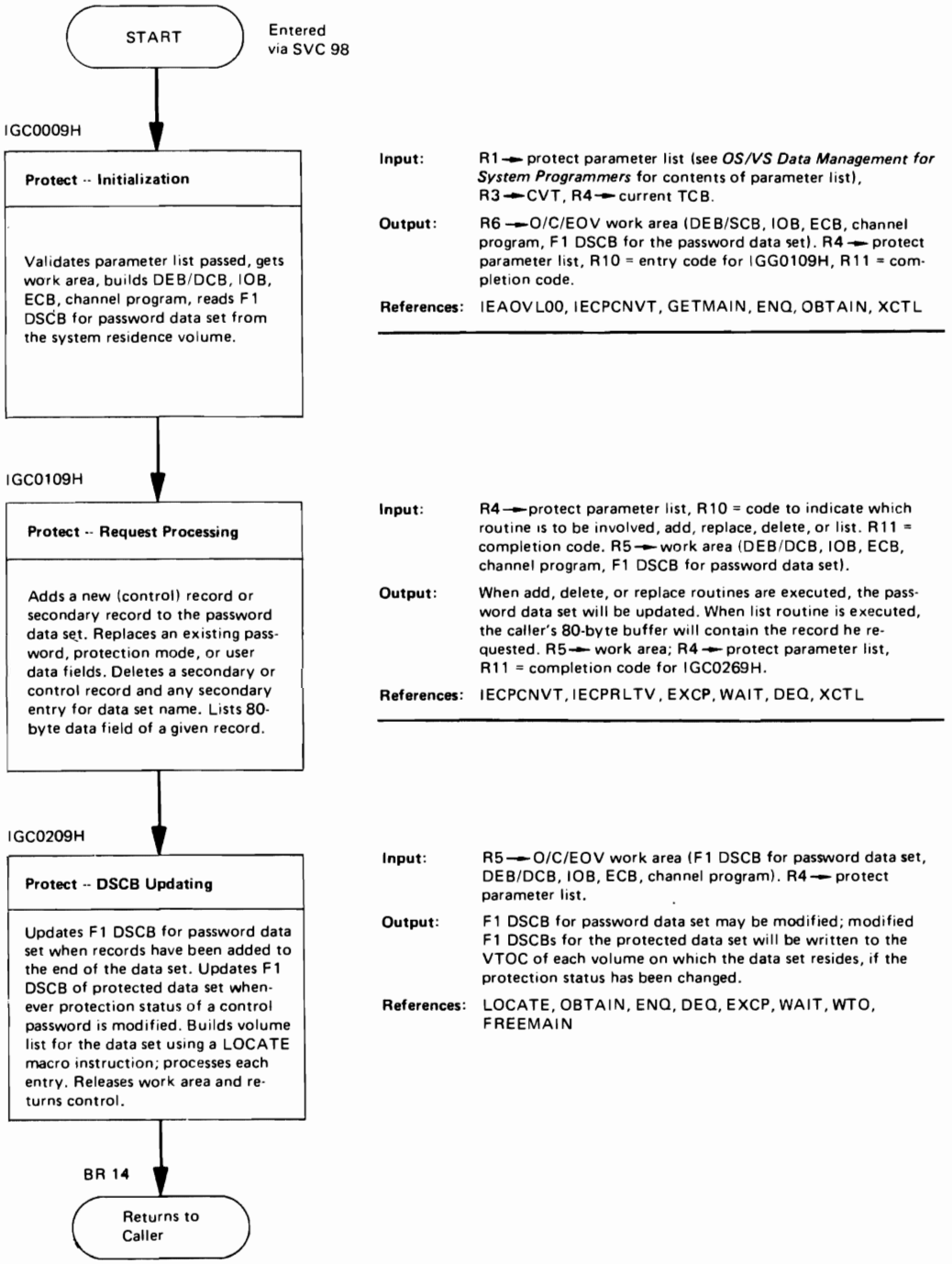


Figure 16. Protect

MODULE DIRECTORY

This section contains a table that cross-references the DADSM modules with the function of each module, the method of operation diagram, and the module flowchart.

Module Name	Module Function	Method of Operation Diagram	Module Flowchart
IGC0002G	Obtain	25	14
IGC0002I	Scratch—initialization	18	11, Part 1 of 2
IGC0003B	Allocate—initialization entry point	4	7, Part 1 of 4
IGC00030	Rename—initialization	24	13
IGC0007H	LSPACE—initialization and input validation	26	15
IGC0009H	Protect—initialization	27	16
IGC0102G	Obtain—VSAM data set	25	14
IGC0107H	LSPACE—initialization and input validation	26	15
IGC0109H	Protect—request processing	27	16
IGC0209H	Protect—DSCB updating	27	16
IGG019EK	RPS channel program appendage module*	None	None
IGG020D0	Release—write back F1 DSCB	22	12
IGG020D1	Release—F5 DSCB (free space) updating	23	12
IGG020P1	Release—initialization and F1 DSCB updating	22	12
IGG020P2	Release—F3 DSCB updating	22	12
IGG020P3	Release—F4 (VTOC) DSCB updating and termination	23	12
IGG0290A	Scratch—password protection interface, VTOC search	19	11, Part 1 of 2
IGG0290B	Scratch—F6 DSCB updating, split-cylinder data sets	19	11, Part 2 of 2
IGG0290C	Scratch—F5 DSCB (free space) updating	20	11, Part 2 of 2
IGG0290D	Scratch—F4 (VTOC) DSCB updating	20	11, Part 2 of 2
IGG0290E	Scratch—mount message building	18	11, Part 1 of 2
IGG0290F	Scratch—volume mounting and verification	18	11, Part 1 of 2
IGG0299A	Scratch—DSCB removal	19	11, Part 2 of 2
IGG03001	Rename—F1 DSCB updating	24	13
IGG03002	Rename—volume mounting and verification	24	13
IGG03003	Rename—SMF record type-18 processing	24	13
IGG032I1	ISAM allocate—verify checking	8	8, Part 1 of 2

*For a description of this module, see "Support for Rotational Position Sensing (RPS)."

Module Name	Module Function	Method of Operation Diagram	Module Flowchart
IGG0321I2	ISAM allocate—free space (F5 DSCB) search	8	8, Part 1 of 2
IGG0321I3	ISAM allocate—building F1, F2, and F3 DSCBs	9	8, Part 1 of 2
IGG0321I4	ISAM allocate—valid duplicate name F1 DSCB to be modified	9	8, Part 1 of 2
IGG0321I5	ISAM allocate—embedded index processing	9	8, Part 2 of 2
IGG0321I6	ISAM allocate—update F5 (free space) DSCBs	10	8, Part 2 of 2
IGG0321I7	ISAM allocate—F4 DSCB updating and error handling	10	8, Part 2 of 2
IGG0321I8	ISAM allocate—multivolume data set initialization	10	8, Part 2 of 2
IGG0325A	Allocate—duplicate F1 DSCB search	4	7, Part 1 of 4
IGG0325B	Non-ISAM allocate—request conversion and type determination	4	7, Part 1 of 4
IGG0325C	Non-ISAM allocate—absolute track processing	5	7, Part 2 of 4
IGG0325D	Non-ISAM allocate—search free space (normal, cylinder, and track requests	5	7, Part 2 of 4
IGG0325E	Non-ISAM allocate—building F1 and F3 DSCBs, non-split-cylinder data sets	5	7, Part 2 of 4
IGG0325F	Non-ISAM allocate—F6 DSCB creation and updating (split-cylinder data sets)	6	7, Part 3 of 4
IGG0325G	Non-ISAM allocate—F5 DSCB updating	6	7, Part 4 of 4
IGG0325H	Non-ISAM allocate—F4 DSCB updating and error handling	6	7, Part 4 of 4
IGG0325J	Non-ISAM allocate—split-cylinder processing, drum device	6	7, Part 3 of 4
IGG0325K	Non-ISAM allocate—user-label extent allocation	5	7, Part 2 of 4
IGG0325L	Non-ISAM allocate—split-cylinder processing, non-drum DASD	6	7, Part 3 of 4
IGG0325M	Non-ISAM allocate—suballocation complete F1 DSCBs, update F4 DSCB	5	7, Part 4 of 4
IGG0325P	Non-split-cylinder data set processing	12	9, Part 1 of 2
IGG0325Q	Find split-cylinder data set extents	13	9, Part 2 of 2
IGG0325R	F5 DSCB processing	12	9, Part 1 of 2
IGG0325S	Non-ISAM allocate—suballocation, find F1 DSCB, build extents	5	7, Part 4 of 4
IGG0325T	F5 DSCB conversion, F4 DSCB updating	12	9, Part 1 of 2

Module Name	Module Function	Method of Operation Diagram	Module Flowchart
IGG0325U	Build F6 DSCBs	13	9, Part 2 of 2
IGG0325V	Check for F6 extent overlap	13	9, Part 2 of 2
IGG0325W	Set up to subtract F6 extents from F5; convert F6 DSCB extents	13	9, Part 2 of 2
IGG0553A	Extend—initialization	15	10, Part 1 of 2
IGG0553B	Extend—free space (F5 DSCB) search	15	10, Part 1 of 2
IGG0553C	Extend—F1/F3 build/update	16	10, Part 2 of 2
IGG0553D	Extend—Free space (F5 DSCB) updating	16	10, Part 2 of 2
IGG0553E	Extend—VTOC (F4) DSCB updating	16	10, Part 2 of 2
IGG0553F	Extend—DOS VTOC conversion interface	15	10, Part 1 of 2
IGG0553G	Extend—request conversion	15	10, Part 1 of 2

DATA AREAS

This section contains descriptions of the work areas and tables used by the DADSM routines. The fields of data set control blocks (DSCB) referenced, modified, or deleted by DADSM are also included for ease of reference.

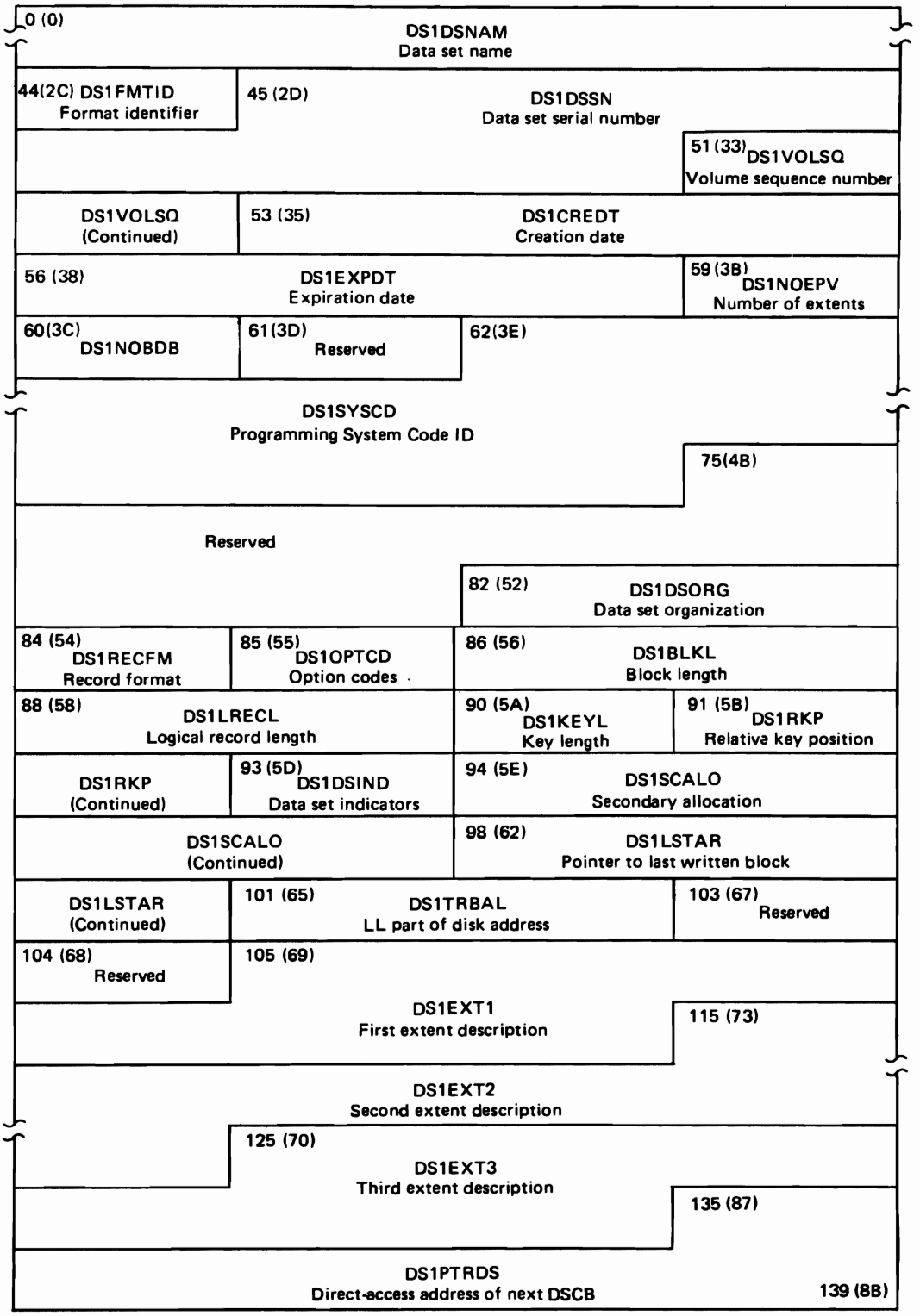
Offsets into the control blocks and work areas are shown in both decimal and hexadecimal notation.

Data Set Control Block (DSCB) Formats

One or more DSCBs are used to describe the data set. Each DSCB is 140 bytes, consisting of a 44-byte key and a 96-byte data portion. The format-0 DSCB is 140 bytes of binary zeros.

Identifier (Format-1) DSCB

The identifier data set control block (DSCB) describes the characteristics and up to three extents of a data set. For data sets having indexed sequential organization, additional characteristics are specified in an index (format-2) DSCB pointed to by the format-1 DSCB. Additional extents are described in an extension (format-3) DSCB pointed to by the format-1 DSCB (or format-2 when the data set has indexed sequential organization). A data set can have a maximum of 16 extents on one volume.



Data Set Control Block—Format-1

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
0(0)	44	DS1DSNAM		Data set name. If a VSAM data space is established for only one data set, this is the true name of the VSAM data set. If a data space is established so that it is shared among more than one data set, this name is a system generated name.
44(2C)	1	DS1FMTID		Format identifier. This field contains X'F1'.
45(2D)	.6	DS1DSSN		Data set serial number. This field is identical to the contents of the volume serial number field in the volume label of the first or only volume on which the data set resides.
51(33)	...2	DS1VOLSQ		Volume sequence number in binary. Indicates the order of this volume relative to the first volume on which the data set resides.
53(35)	.3	DS1CREDT		Creation date, in the form ydd. y—year: 00-99 dd—day: 1-366
56(38)	3	DS1EXPDT		Expiration date, in the form ydd (as above). Indicates the year and the day of the year the data set may be purged. If neither a retention period nor an expiration date has been specified, ydd is zero.
59(3B)	...1	DS1NOEPV		Number of separate extents in which the data set resides on this volume. This count does not include the extent describing a user's label track.
60 (3C)	1	DS1NOBDB		Number of bytes used in the last PDS directory block. A value of zero indicates that the last available block is not being used.
61 (3D)	.1			Reserved.
62 (3E)	..13	DS1SYSCD		System code. An EBCDIC code that uniquely identifies the operating system. The first three characters are IBM. The remaining characters are the system code assigned to the creating system.
75 (4B)	...7			Reserved.
82(52)	..2	DS1DSORG		Data set organization.
		Byte 1		*Code*
		1...		IS Indexed sequential organization.
		.1..		PS Physical sequential organization.
		..1.		DA Direct organization.
		...1		CX BTAM or QTAM line group.
		.... 1...		CQ QTAM direct-access message queue.
		.... .1..		MQ QTAM problem program message queue.
		.... ..1.		PO Partitioned organization.
		1		U Unmovable—the data contains location-dependent information.
83(53)		*Byte 2*		
		1...		GS Graphics organization.
		.1..		TX TCAM line group.
		..1.		TQ TCAM message queue.
		.... 1...		AM VSAM organization.
		.... .1..		TR TCAM 3705.
		...x ..xx		Reserved bits.

Data Set Control Block—Format-1

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
84(54)	1	DS1RECFM		Record format.
				Code
		10..		F Fixed length record format.
		01..		V Variable length record format.
		11..		U Undefined length record format.
		..1.		T Track overflow.
		...1		B Blocked: may not occur with undefined (U).
		.... 1...		S Fixed length record format: Standard blocks, no truncated blocks, or unfilled tracks are embedded in the data set. Variable length record format: Spanned records.
		.... .10.		A ASA control character.
		.... .01.		M Machine control character.
		.... .00.		No control character.
		0		Always zero.
85(55)	. 1	DS1OPTCD		Option code—same as DCBOPTCD field in DCB.
86(56)	. . 2	DS1BLKL		Block length for fixed length records or maximum blocksize for variable or undefined length records.
88(58)	2	DS1LRECL		Format F records: Record length. Format U records: Zero. Format V records - Unspanned record format: Maximum record length. Spanned record format - Records up to 32,756 bytes: Maximum record length. Records exceeding 32,756 bytes: X'8000'.
90(5A)	. . 1	DS1KEYL		Key length. The length (1-255 bytes) of the key of the data records in the data set. A value of zero indicates that no key exists.
91(5B)	. . . 2	DS1RKP		Relative key position in the data block.
93(5D)	. 1	DS1DSIND		Data set indicators.
		1...		This is the last volume on which this data set normally resides.
		..1.		Block length must always be an 8-byte multiple.
		...x .x..		Data set security.
		...1 .0..		Password is required to read or write.
		...1 .1..		Password is required to write but not to read.
		.x.. x.xx		(Reserved bits)
94(5E)	. . 4	DS1SCALO		Allocation parameters. Type of request issued for the initial allocation and to be used for subsequent extensions.
		Byte 1		Original request was:
		00..		In tracks relative to a specific location. No secondary allocation will be allowed.
		01..		In blocks (physical records).
		10..		In tracks.
		11..		In cylinders.
		..xx		(Reserved bits)
		.... 1...		For a continuous extent.
		.... .1..		For the maximum continuous extent on the volume.
		.... ..1.		For the five (or less) largest extents that are greater than or equal to a specified minimum.
		1		In records, to be rounded up to a cylinder boundary.

Data Set Control Block—Format-1

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
95(5F)		Byte 2-4		Secondary allocation quantity. Number of blocks, tracks, or cylinders to be requested at end of data set when processing a sequential or partitioned data set.
98(62)	. . 3	DS1LSTAR		The last-block pointer identifies the last block written in a sequential or partitioned organization data set. It is in the format TTRL (LL is defined under the next field name): TT — Relative address of track containing the last block. R — Block number on that track.
101(65)	. 2	DS1TRBAL		LL portion of the format given in DS1LSTAR. LL — Number of bytes remaining on track following the block. *Note:* If both fields contain binary zeros, the last block pointer does not apply.
103(67)	. . . 2			Reserved.
105(69)	. 10	DS1EXT1		Extent description for the first extent. This extent description is also used in format-3 and format-4 DSCBs.
105(69)		Byte 1		Data set extent type indicator.
			00	Following 9 bytes do not indicate any extent.
			01	The extent contains the data blocks (user's blocks), or is a prime area (for indexed sequential data sets).
			02	The extent is an overflow area (for indexed sequential data sets only).
			04	The extent is an index area (for indexed sequential data sets only).
			40	The first extent description describes the user label extent.
			80	The extent described is sharing one or more cylinders with one or more data sets.
			81	The extent described begins and ends on cylinder boundaries, that is, the extent is composed of one or more cylinders.
106(6A)		Byte 2		Extent sequence number (M) Uniquely identifies each separate extent on a given volume for a data set. For all organizations but indexed sequential, the first extent of the data set on each volume is identified with zero in this field. The first extent on each volume of an indexed sequential data set is identified with a value of one in the field. Additional extents on the volume are identified with sequentially increasing binary values. This field is always zero for an extent field pointing to a user label track.
107(6B)		Bytes 3-6		Lower limit of this extent (CCHH). Contains the cylinder and the track address specifying the starting point of this extent.
111(6F)		Bytes 7-10		Upper limit of this extent (CCHH). Contains the cylinder and track address specifying the ending point of this extent.
115(73)	. . . 10	DS1EXT2		Extent description for the second extent. Same format as DS1EXT1 field.

Data Set Control Block—Format-1

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
125(7D)	. 10	DS1EXT3		Extent description for the third extent. Same format as DS1EXT1 field.
135(87)	. . . 5	DS1PTRDS		Pointer to a format-2 DSCB, if it is the first volume of a data set with indexed sequential organization, or pointer to a format-3 DSCB if data set has sequential or direct organization (or is the second or greater volume of a data set with indexed sequential organization) and has more than 3 extents. This pointer has the format CCHHR. Contains binary zeros if no additional DSCB is pointed to.

Index (Format-2) DSCB

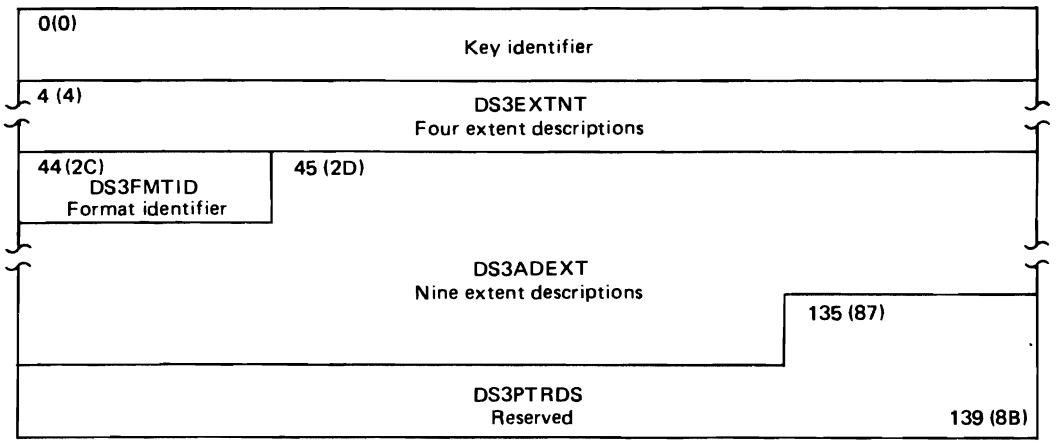
The index data set control block (DSCB) describes characteristics of a data set having indexed sequential organization. It is pointed to by an identifier (format-1) DSCB which contains additional data set characteristics and up to three extent descriptions. Additional extents are described in an extension (format-3) DSCB pointed to by the format-2 DSCB. Only five fields of the format-2 DSCB are filled in by DADSM:

1. The key identifier field at offset 0, which is set to X'02', identifies the control block as a format-2 DSCB.
2. The DS2FMTID field, at offset 44(2C), which identifies the control block as a format-2 DSCB is set to X'F2'.
3. The DS2CYLOV field at offset 52(34) contains the number of tracks of cylinder overflow area on each cylinder.
4. The DS2NOTRK field which contains the number of tracks occupied by the highest level index.
5. The DS2PTRDS field, at offset 135(87), which points to the format-3 DSCB if there is one for the data set on the volume.

Refer to *OS/VS1 System Data Areas* or *OS/VS2 System Data Areas* for definition of this control block.

Extension (Format-3) DSCB

The extension data set control block (DSCB) describes up to thirteen additional extents that cannot be described in an identifier (format-1) DSCB. It is pointed to by a format-1 or format-2 DSCB. Descriptions of the fields follow the illustration.

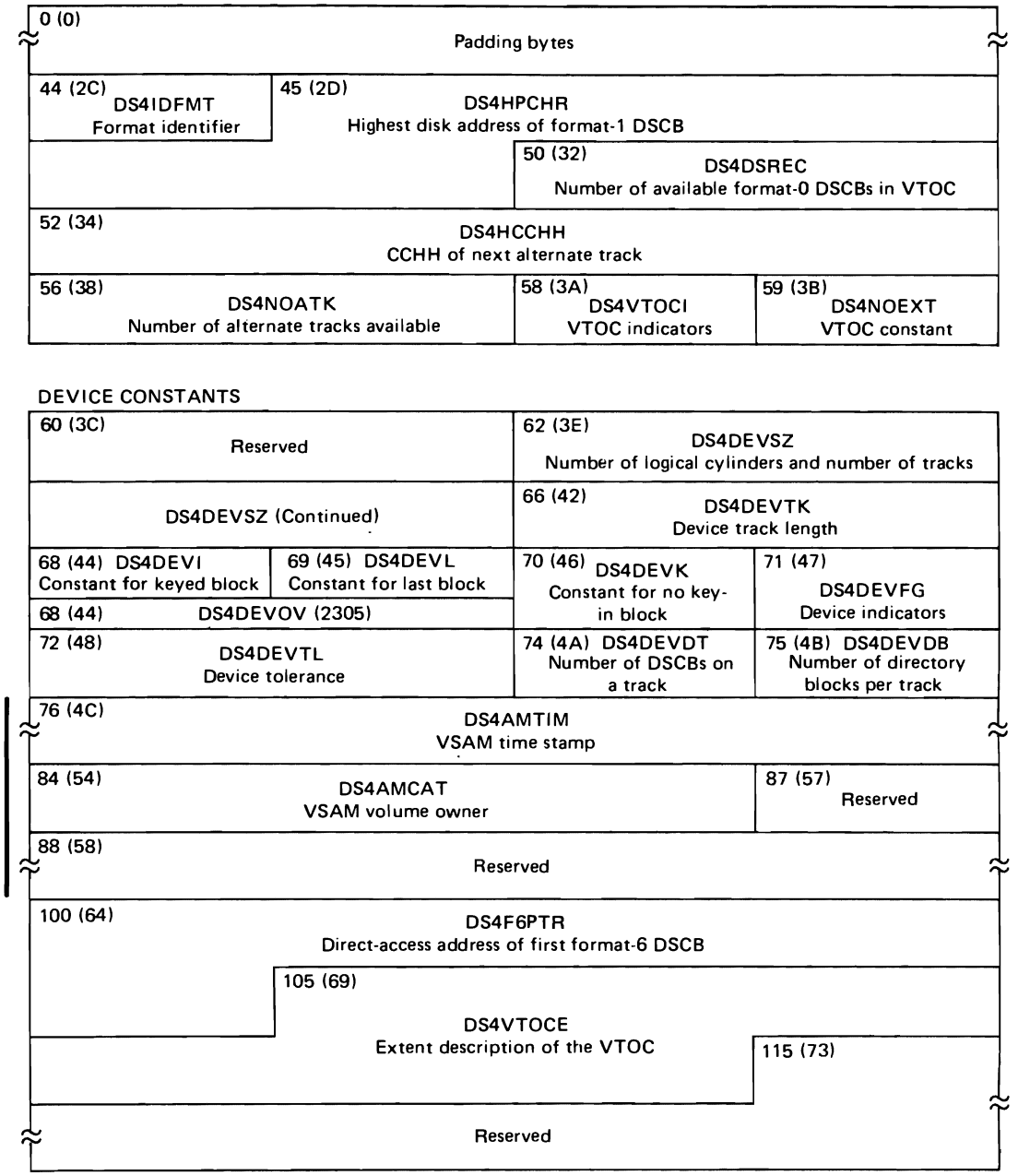


Data Set Control Block—Format-3

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
0(0)	4	(Key identifier)	03	A X'03' in each byte.
4(4)	40	DS3EXTNT		Extent (in key)—four 10-byte fields identical to the DS1EXT1 field in the format-1 DSCB.
44(2C)	1	DS3FMTID	F3	Format identifier—X'F3'.
45(2D)	. 90	DS3ADEXT		Additional extent—nine 10-byte fields identical to the DS1EXT1 field in the format-1 DSCB.
135(87)	. . . 5	DS3PTRDS		Reserved—contains binary zeros.

VTOC (Format-4) DSCB

The VTOC data set control block (DSCB) describes the volume table of contents (VTOC) data set. It is always the first DSCB in the VTOC.



Data Set Control Block—Format-4

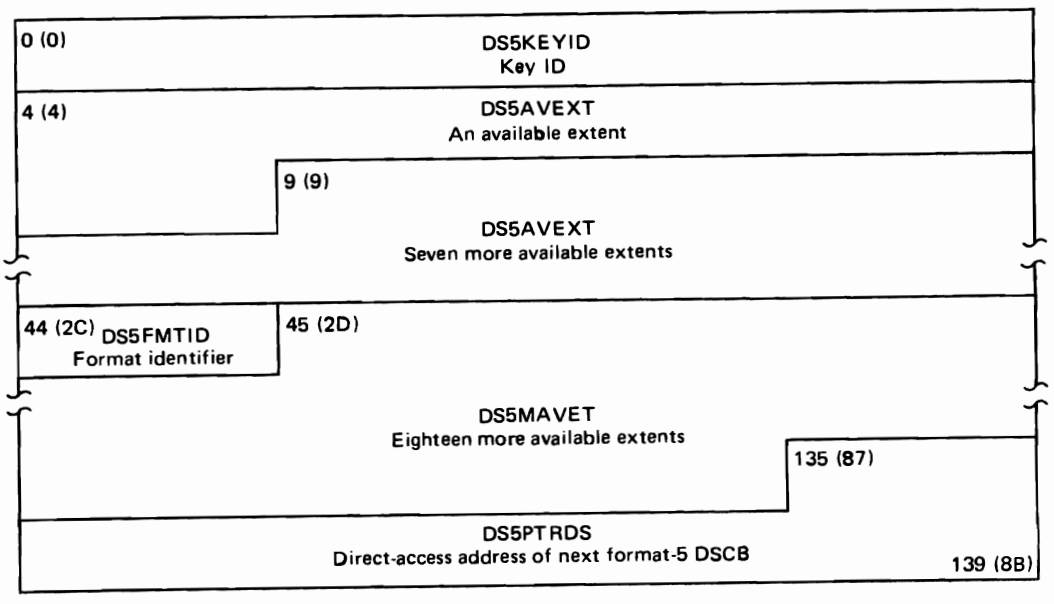
Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
0(0)	44	(Padding)	04	X'04' in each byte.
44(2C)	1	DS4IDFMT	F4	Format identifier, X'F4'.
45(2D)	. 5	DS4HPCHR		Highest address previously used for a format-1 DSCB. The address is in the format CCHHR.
50(32)	. . 2	DS4DSREC		Number of available format-0 DSCBs in the VTOC.
52(34)	4	DS4HCCHH		CCHH of next alternate track available.
56(38)	2	DS4NOATK		Number of alternate tracks remaining.
58(3A)	. . 1	DS4VTOCI		VTOC Indicators.
		1...		Either no format-5 DSCBs exist or they do not reflect the true status of the volume.
		.... 1...		Accurate format-5 and format-6 DSCBs now exist and bit 0 has been turned off. This volume may contain data sets produced by the IBM Disk Operating System (DOS); IBM Operating System (OS) access methods may not be able to process these data sets.
		.... .1..		A DADSM function has been prematurely terminated. Possible VTOC errors exist.
		.xxx ..xx		(Reserved bits)
59(3B)	. . . 1	DS4NOEXT	01	X'01' to indicate the VTOC is one extent.
60(3C)	2			Reserved.
				Device Constants (DS4DEVxx) The following fields describe the device on which this volume was mounted when the VTOC was created.
62(3E)	. . 4	DS4DEVSZ		Device size.
62(3E)		Bytes 1-2		Number of logical cylinders. A logical cylinder is the smallest collection of two or more tracks that can be processed by a set file mask CCW (X'1F').
64(40)		Bytes 3-4		Number of tracks per logical cylinder.
66(42)	. . 2	DS4DEVTK		Device track length. Number of available bytes on a track exclusive of home address and record zero.
68(44)	2	DS4DEVOV		Overhead bytes for any keyed block on the 2305. If bit 4 of the device indicators field (bit 71.4 of DSCB4) is set to one, this field (DS4DEVOV) is used as a single 2-byte field containing a binary count of the number of bytes (overhead bytes) occupied by the count field, gaps, and check bytes of a keyed record.
If bit 71.4 is zero, the field (DS4DEVOV) consists of the following subfields:				
68(44)	1	DS4DEVI		Contains a count of the number of bytes (overhead bytes) occupied by the count field, gaps, and check bits of a keyed record that *is not* the last record on a track.
69(45)	. 1	DS4DEVL		Contains a count of the number of bytes (overhead bytes) occupied by the count field, gaps, and check bits of a keyed record that *is* the last record on a track.
70(46)	. . 1	DS4DEVK		The number of overhead bytes to be subtracted from DS4DEVI, DS4DEVL, or DS4DEVOV if the block has no key field.

Data Set Control Block—Format-4

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
71(47)	. . . 1	DS4DEVFG		Device indicators.
		xxxx .xx.		(Reserved bits).
		.... 1...		The keyed record overhead field (DS4DEVI) is used as a 2-byte field to specify the overhead required by a keyed record as in the case of the 2305.
		1		A tolerance factor must be applied to all but the last record on the track.
72(48)	2	DS4DEVTL		Device tolerance. Value, which when divided by 512, is used to determine effective length of a block on a track.
74(4A)	. . 1	DS4DEVDT		Number of full DSCBs that can be contained on one track (44-byte key plus 96-byte data length).
75(4B)	. . . 1	DS4DEVDB		Number of full PDS directory blocks that can be contained on one track (8-byte key plus 256-byte data length).
76(4C)	8	DS4AMTIM		A time stamp, expressed in System/370 timer limits, that indicates when a VSAM data space was created or dumped using IEHDASDR.
84(54)	3	DS4AMCAT		If the volume has no VSAM data spaces, this field is X'00'. If the volume has at least one VSAM data space, this field is X'80'.
100(64)	5	DS4F6PTR		Pointer to the first format-6 DSCB. This pointer has the form CCHHR. It contains binary zeros when not in use.
105(69)	. 10	DS4VTOCE		VTOC extent. Contents and meaning are the same as DS1EXT1 in the format-1 DSCB.

Free Space (Format-5) DSCB

The free space data set control block (DSCB) describes the amount of available space on the volume that can be allocated to a data set. Up to 26 available extents can be recorded in one format-5 DSCB. Additional extents are described in other format-5 DSCBs. The first format-5 DSCB follows the VTOC (format-4) DSCB.

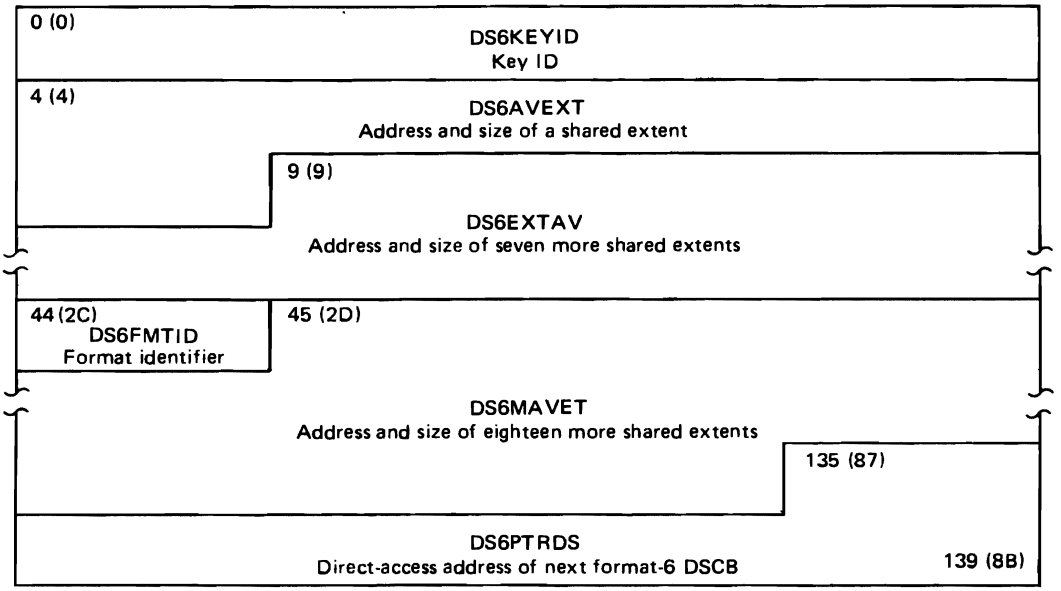


Data Set Control Block—Format-5

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
0(0)	4	DS5KEYID	05	Key identification—X'05' in each byte.
4(4)	5	DS5AVEXT		Available extent. Describes an extent of space available for allocation to a data set.
4(4)		Bytes 1-2		Relative track address, in binary, of the first track in the extent. The relative track address is relative to the first track on the volume, which has a relative track address of 0.
6(6)		Bytes 3-4		The number, in binary, of entirely unused cylinders in this extent.
8(8)		Byte 5		The number, in binary, of unused tracks in the extent in addition to those contained in the unused cylinders.
9(9)	. 35	DS5EXTAV		Available extents. Seven 5-byte fields identical in format to the DS5AVEXT field. Each set, if it is used, describes a different extent. The extents are in the ascending order of their first track addresses.
44(2C)	1	DS5FMTID		Format identifier—X'F5'.
45(2D)	. 90	DS5MAVET		Available extents. Eighteen 5-byte fields identical in format to the DS5AVEXT field.
135(87)	. . . 5	DS5PTRDS		The CCHHR address of the next format-5 DSCB if it exists. If none exists, this field contains binary zeros.

Shared Extent (Format-6) DSCB

This data set control block (DSCB) is used for shared cylinder allocation. It describes the extent of space (one or more continuous cylinders) that are being shared by two or more data sets. Up to 26 extents can be described in one format-6 DSCB. Additional extents are described in other format-6 DSCBs. The format-6 DSCB is pointed to by the format-4 DSCB. Descriptions of the fields follow the illustration.

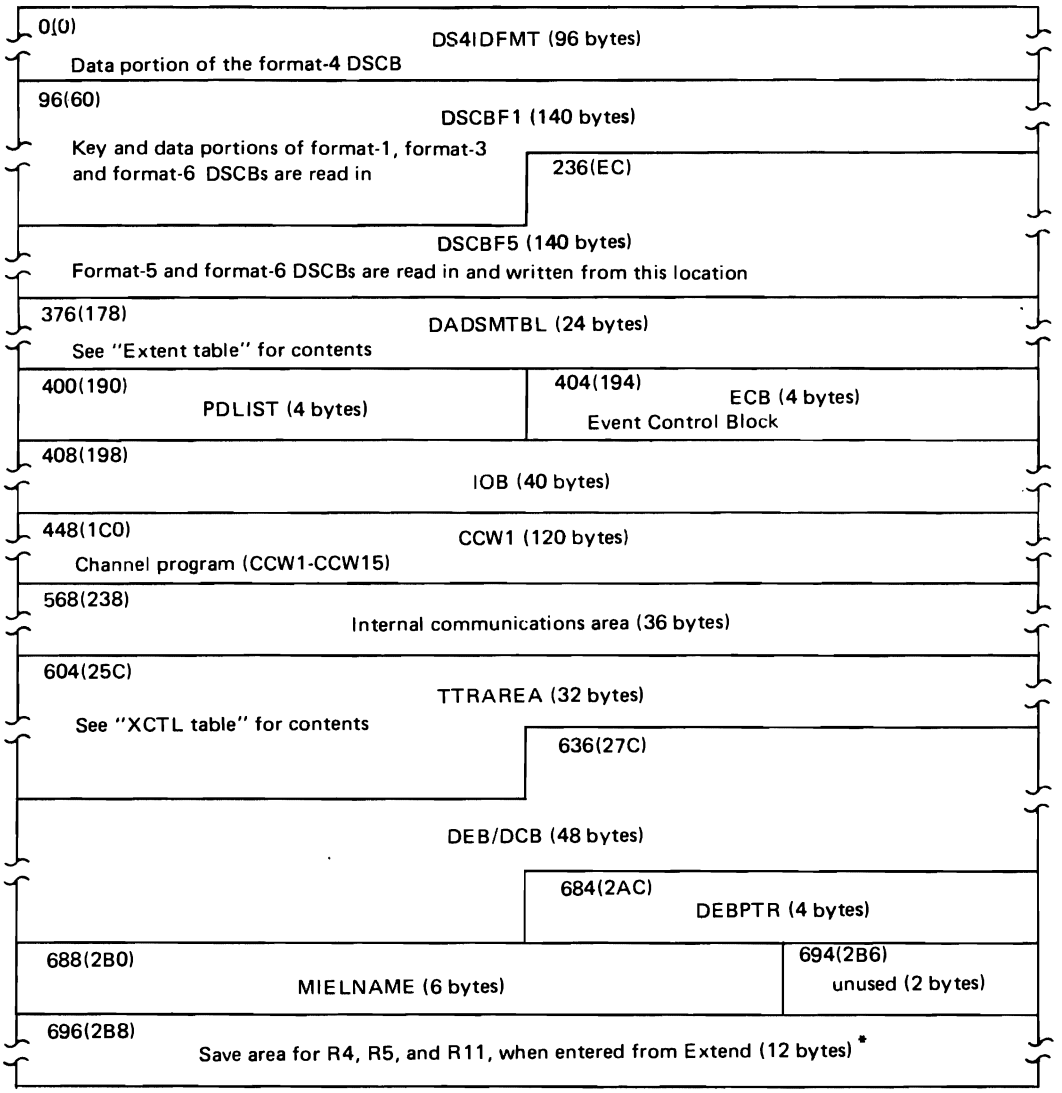


Data Set Control Block—Format-6

Offset	Bytes and Alignment	Field Name	Hex. Dig.	Field Description, Contents, Meaning
0(0)	4	DS6KEYID	06	Key identification—X'06' in each byte.
4(4)	5	DS6AVEXT		Extent of space (one or more continuous cylinders) that is being shared by one or more data sets.
4(4)		Bytes 1-2		Relative track address of the first cylinder.
6(6)		Bytes 3-4		Number of full cylinders being shared.
8(8)		Byte 5		Number of data sets sharing the extent.
9(9)	. 35	DS6EXTAV		Shared extents. Seven 5-byte fields identical in format to DS6AVEXT. The fields are in relative track address sequence.
44(2C)	1	DS6FMTID	F6	Format identifier—X'F6'.
45(2D)	. 90	DS6MAVET		Shared extents. Eighteen 5-byte fields identical in format to DS6AVEXT.
135(87)	. . . 5	DS6PTRDS		CCHHR address of the next format-6 DSCB, if there is another. If none exists, this field is set to binary zeros.

DOS VTOC Conversion Work Area

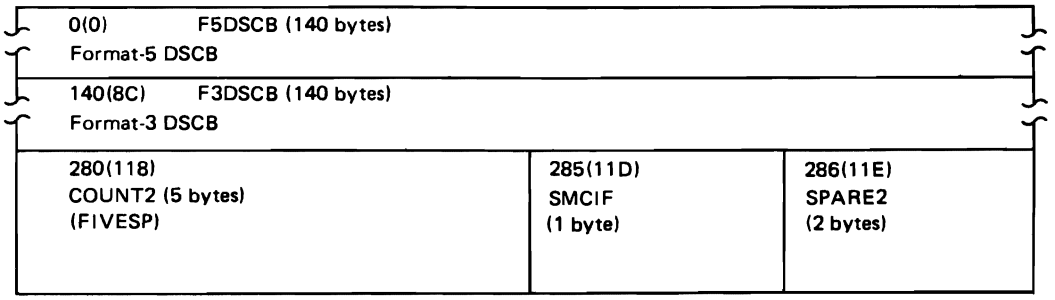
The DOS VTOC conversion routine establishes and uses this work area to read from and write to the VTOC and for internal communications.



*Used by Extend only

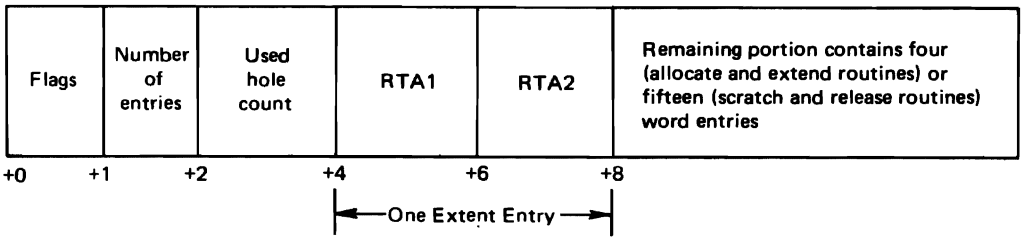
Extend Work Area

The extend routine gets and uses this work area to read from and write to the VTOC. The O/C/EOV work area is also used by the extend routine.



Extent Table

The extent (or DADSM) table is used to pass descriptions of allocated or released space extents between modules of the allocate, extend, scratch, and release routines. The extent table used in the allocate and extend routines is 24 bytes long and can contain up to 5 extent entries. The table used in the scratch and release routines is 68 bytes long to accommodate up to 16 extent entries.



The information contained in the *flags* field differs for each routine and can be determined by examining the program listing.

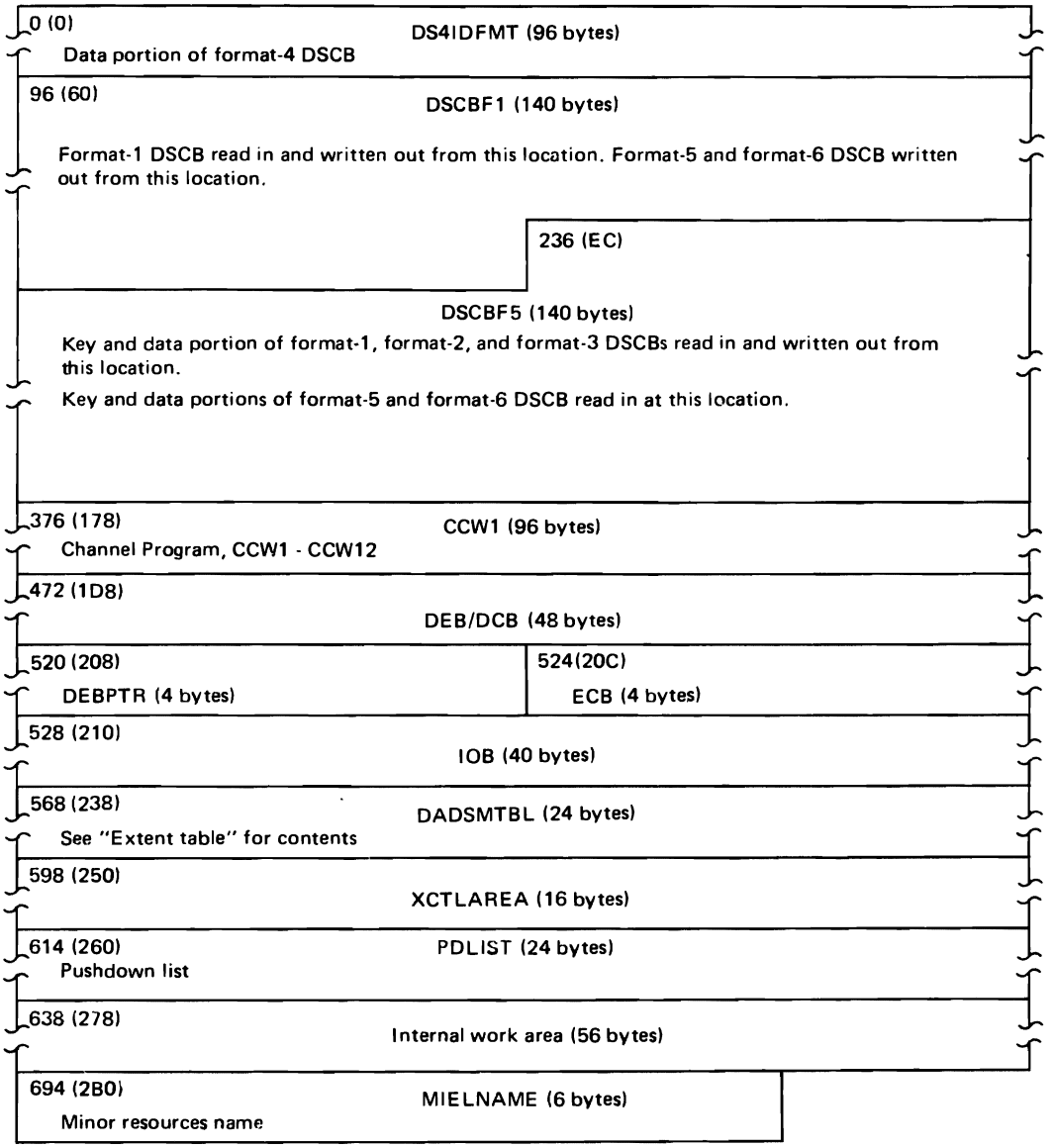
The *number of entries* field contains the count of the number of extent entries in the extent table.

The *used-hole field* contains the count of the number of format-1, format-2, format-3, format-5, and format-6 DSCBs added to and removed from the VTOC during allocation or releasing space.

Each extent entry contains two binary numbers: RTA1 and RTA2. RTA1 is the relative track address of the first track of an extent area; RTA2 is the relative track address of the last track of the area, plus one. A relative track address is a binary number representing the displacement of the track from the first track of the volume. For example, the relative track address of track seven, cylinder zero is seven. The relative track address of track 3 on cylinder 2 is 23, if the volume has ten tracks per cylinder.

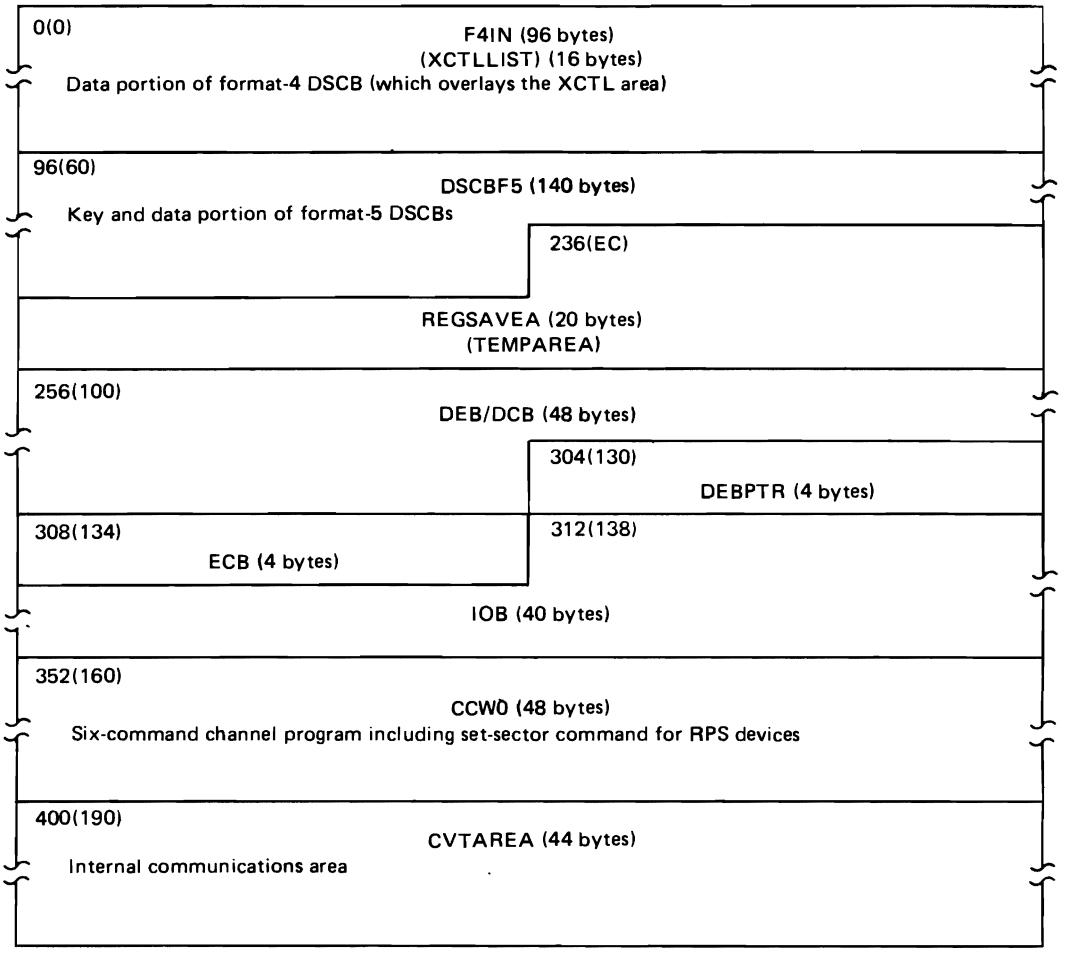
ISAM Allocate Work Area

This work area is used by the ISAM allocate routine to read from and write to the VTOC and for internal communications.



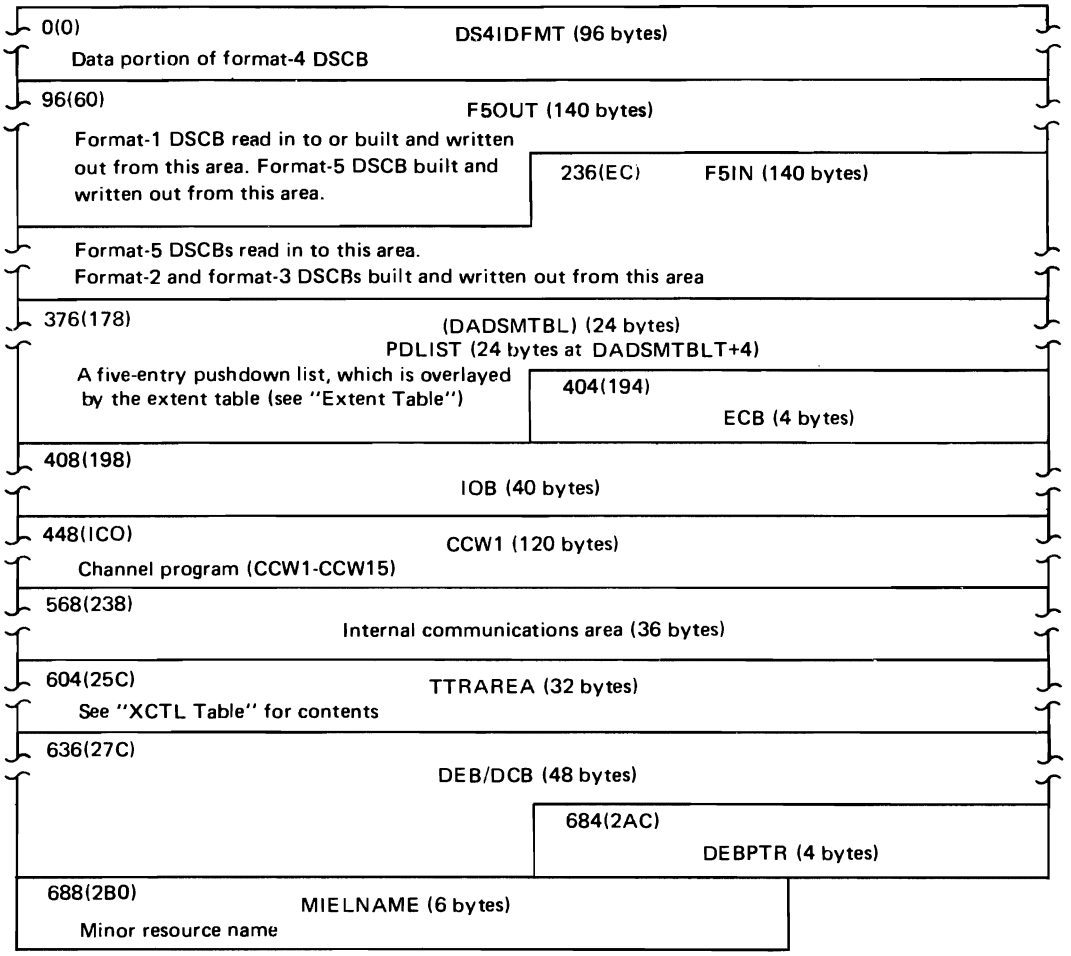
LSPACE Work Area

This work area is used by the LSPACE routine to read from the VTOC and to provide internal communications.



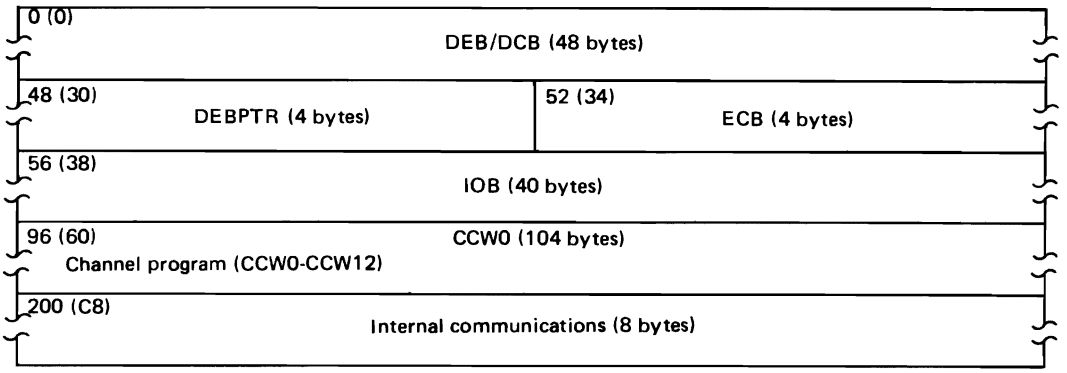
Non-ISAM Allocate Work Area

This work area is used by the non-ISAM allocate routine to read from and write to the VTOC and for internal communications.

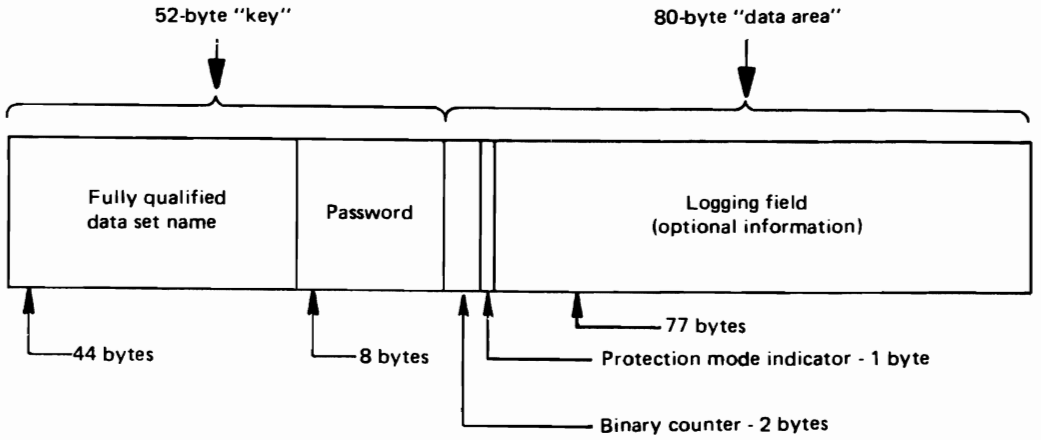


Obtain Work Area

This work area is used by the obtain routine to read from and write to the VTOC, and for internal communications.



Password Data Set Record Format



When a password-protected data set is opened, the password entered by the operator is matched against the 52-byte "key" area. The data set name and password must be left-justified in their areas and all unused bytes must be blanks (X'40'). The password may be one to eight alphameric characters. When the password record is generated, the counter field is set to zero (X'0000') or any initial value the user desires. Each time the data set is successfully opened (except when the data set is deleted or renamed), the binary counter is incremented by one.

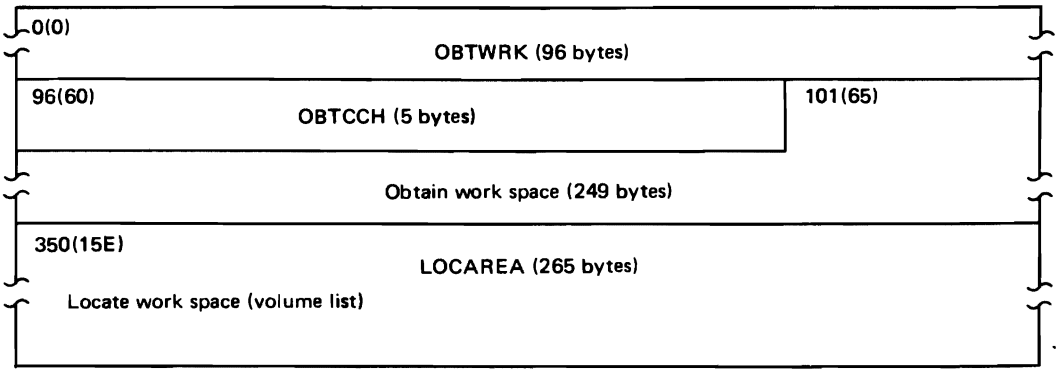
The protection mode indicator field can be set to any of four values:

- X'00' to indicate that the password is a secondary password and the protected data set is to be read only.
- X'80' to indicate that the password is the control password and the protected data set is to be read only.
- X'01' to indicate that the password is a secondary password and the protected data set is to be read and written.
- X'81' to indicate the password is the control password and the protected data set is to be read and written.

Since the DSCB of the protected data set is updated only when the control password is changed, it is possible to request protection attributes for secondary passwords that conflict with the protection attributes of the control password. The 77-byte logging field can contain any type of logging information that the installation chooses (for example, the date on which the counter was reset or the previous password used).

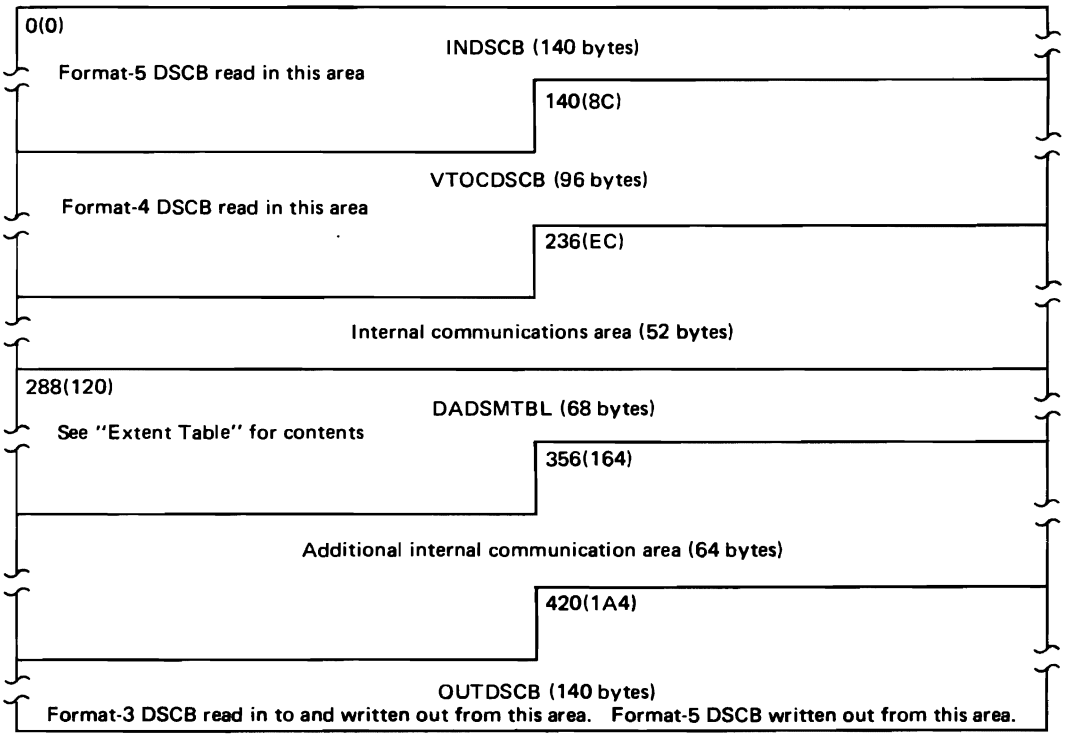
Protect Work Area

This work area is used by the protect routine to read from and write to the VTOC, using the OBTAIN macro instruction.



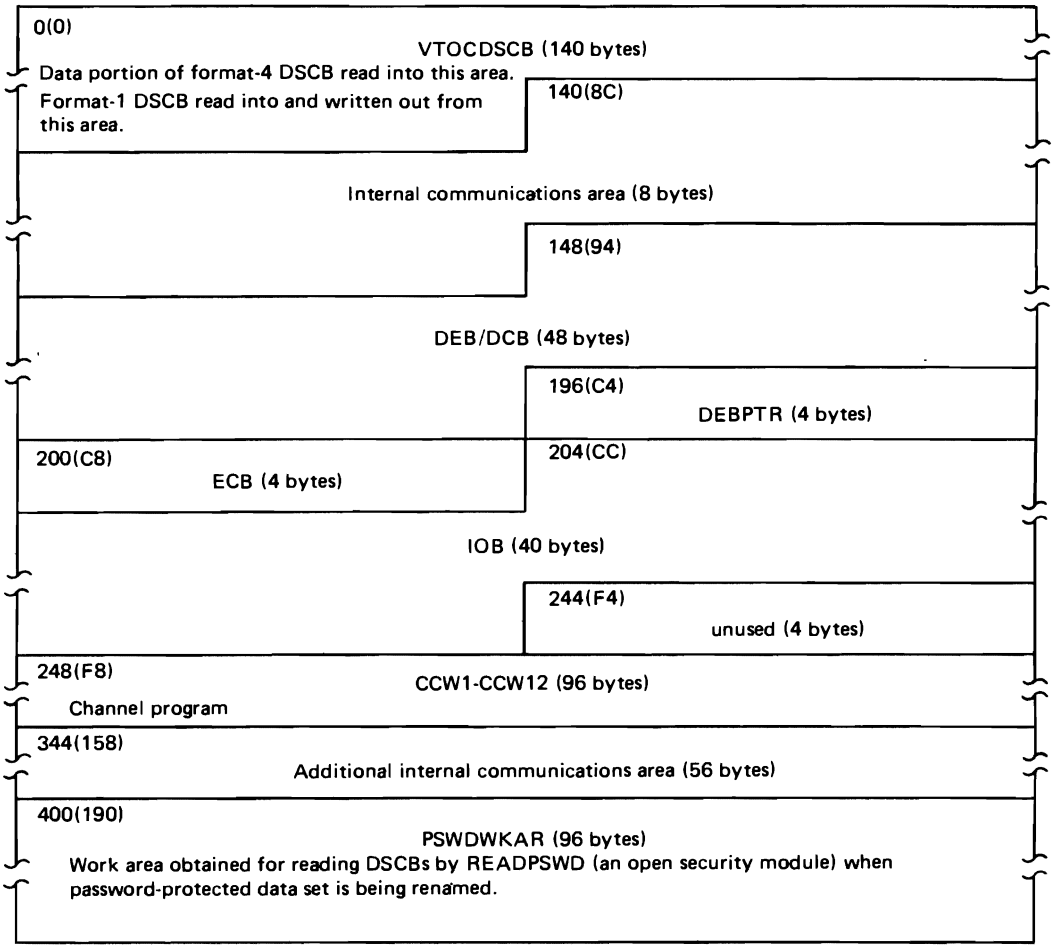
Release Work Area

This work area is used by the release routine for reading from and writing to the VTOC and for internal communications.



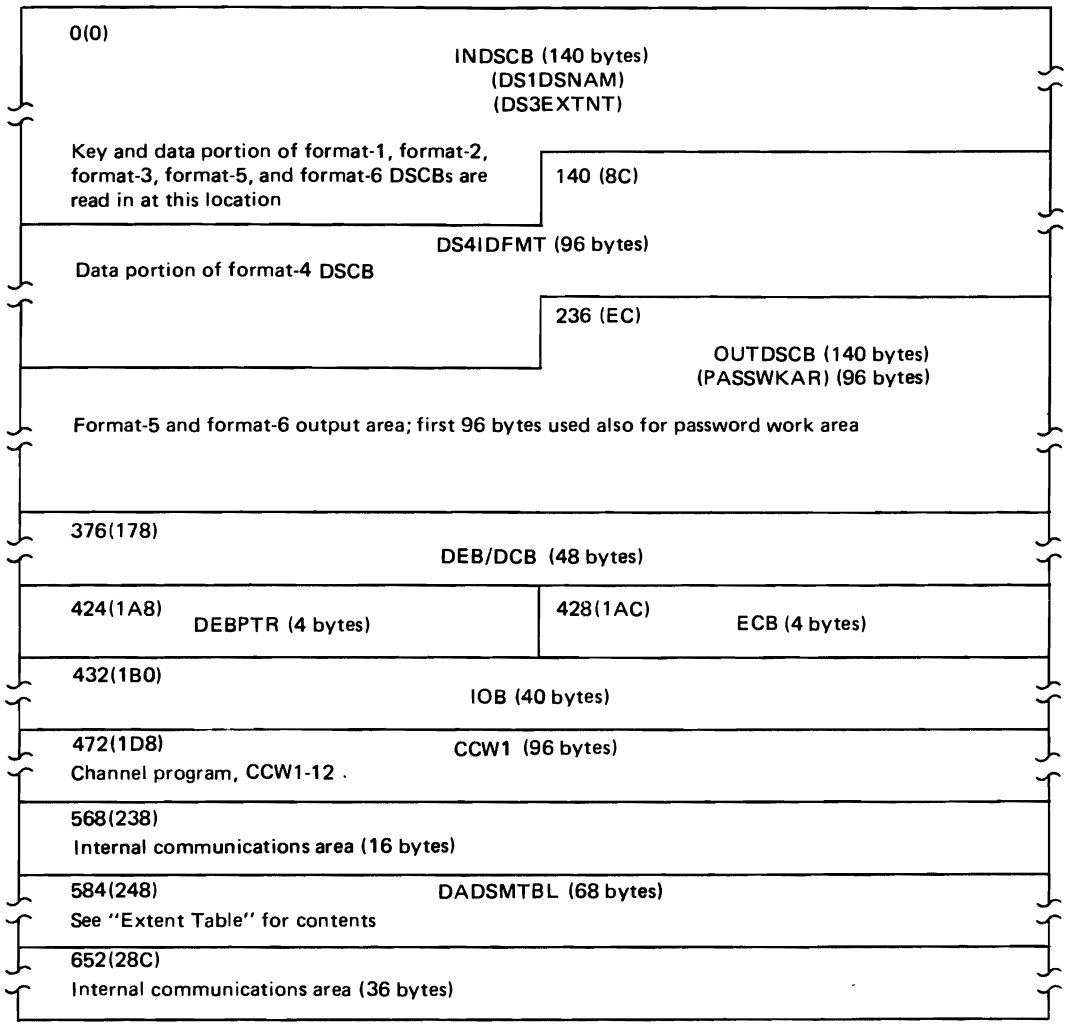
Rename Work Area

This work area is used by the rename routine for reading from and writing to the VTOC and for internal communications.



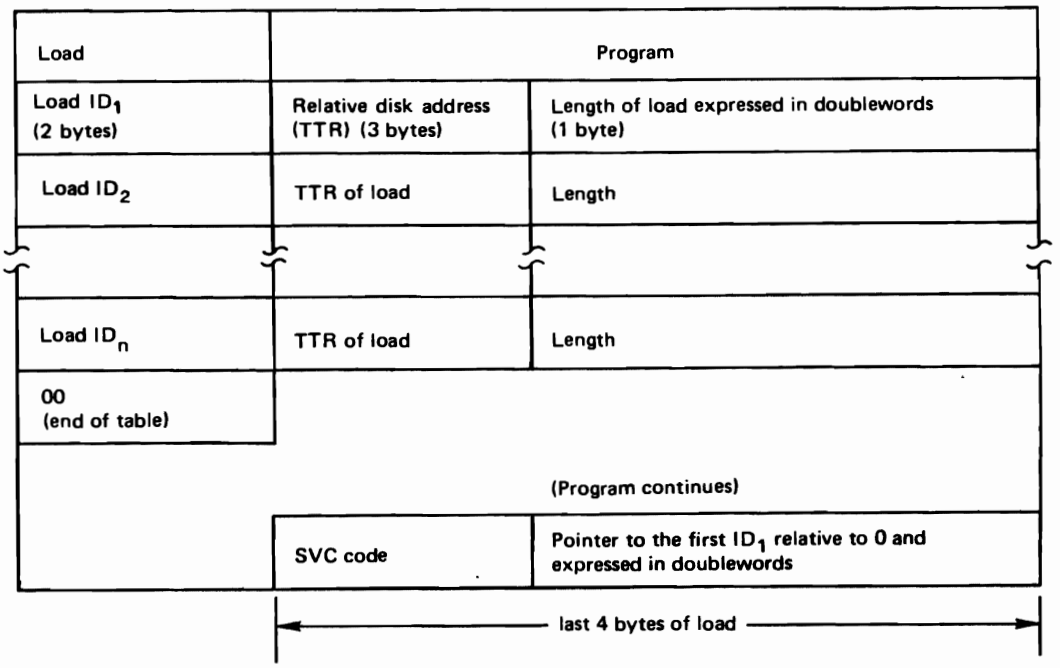
Scratch Work Area

This work area is used by the scratch routine for reading from and writing to the VTOC. It contains the control blocks and channel program used by the I/O supervisor for reading from and writing to direct-access devices. It also contains areas used for internal communications by the scratch routine.



XCTL (Transfer Control) Table

The XCTL table is used to transfer control: (1) between modules of the non-ISAM allocate routine and (2) between modules of the scratch routine. There is an XCTL table starting on a doubleword boundary in each load of the scratch and non-ISAM allocate routines. The table consists of the other load IDs to which control can be transferred. Each entry consists of the load ID, its relative disk address (TTR) and the length of the load. For OS/VS1, the TTRs are inserted by the IEHIOSUP utility program when the system is generated. For OS/VS2, the DADSM routines are resident in virtual storage in the pageable link pack area (LPA); therefore, the *TTR* and *Length* fields are not used. The last four bytes of a load consist of a supervisor-call (SVC) pointing to the beginning of the XCTL table. The pointer is expressed in doublewords from the beginning of the load.



DADSM Interrupt Recording Facility (DIRF)

If a system fails during a function in which the VTOC is being updated (allocate, extend, scratch, or release processing), or a permanent I/O error occurs when a DSCB is being read from or written to the VTOC, the VTOC may be in error. To ensure that the errors caused by the interruption of DADSM processing are detected, an indicator is set in the VTOC when entering space allocation and releasing space functions. The indicator is reset at exit, if no permanent I/O error has occurred. The logic of DIRF processing in the allocate routine is presented in Figure 17. The logic used by scratch, release, and rename is quite similar.

When VTOC problems are encountered, the VTOC of the volume should be printed out so that the DIRF bit can be examined. The IEHLIST utility (see "Listing a Volume Table of Contents" in *OS/VS Utilities*, GC35-0005) can be used to print the VTOC; an example of job control language (JCL) follows:

```
//               EXEC   PGM=IEHLIST
//DD1            DD     UNIT=2314,VOL=(PRIVATE,RETAIN,SER=111111),
//                      DISP=OLD
//SYSPRINT       DD     SYSOUT=A
//SYSIN          DD     *
    LISTVTOC             DUMP,VOL=2314=111111
/*
```

Note: The PRIVATE subparameter is required on the //DD1 DD statement to ensure that the VTOC being processed is not updated during the listing process.

If bit 5 of the DS4VTOCI field at offset 58(X'3A') in the format-4 DSCB is on (set to 1), a system failure or a permanent I/O error has occurred.

It is sometimes possible to correct a VTOC that is in error by setting the DOS bit (bit 0 of the DS4VTOCI field) to one and resetting the DIRF bit (bit 5 of the DS4VTOCI field) to zero, then, as soon as possible, executing a JCL statement to request an allocation. The result of the allocation request is the invocation of the DOS VTOC conversion routine, which calculates available space and rebuilds the free space (format-5) and shared extent (format-6) DSCBs and corrects some of the fields of the VTOC (format-4) DSCB.

An example of the JCL follows:

```
//             EXEC     PGM=IMASPZAP
//SYSLIB       DD       DSN=FORMAT4.DSCB,VOL=SER=111111,
//                      DISP=OLD
//SYSPRINT     DD       SYSOUT=A
//SYSIN        DD       *
    CCHHR                0000000101   absolute track address of
                                      the format 4 DSCB
    VERIFY     3A        04
    REP        3A        80
/*
```

The following job control language (JCL) statements will invoke the DOS VTOC conversion routine, which will correct the VTOC:

```
//         EXEC     PGM=IEFBR14
//DD1      DD       UNIT=2314,VOL=SER=111111,
                    SPACE=(TRK,(0))
/*
```

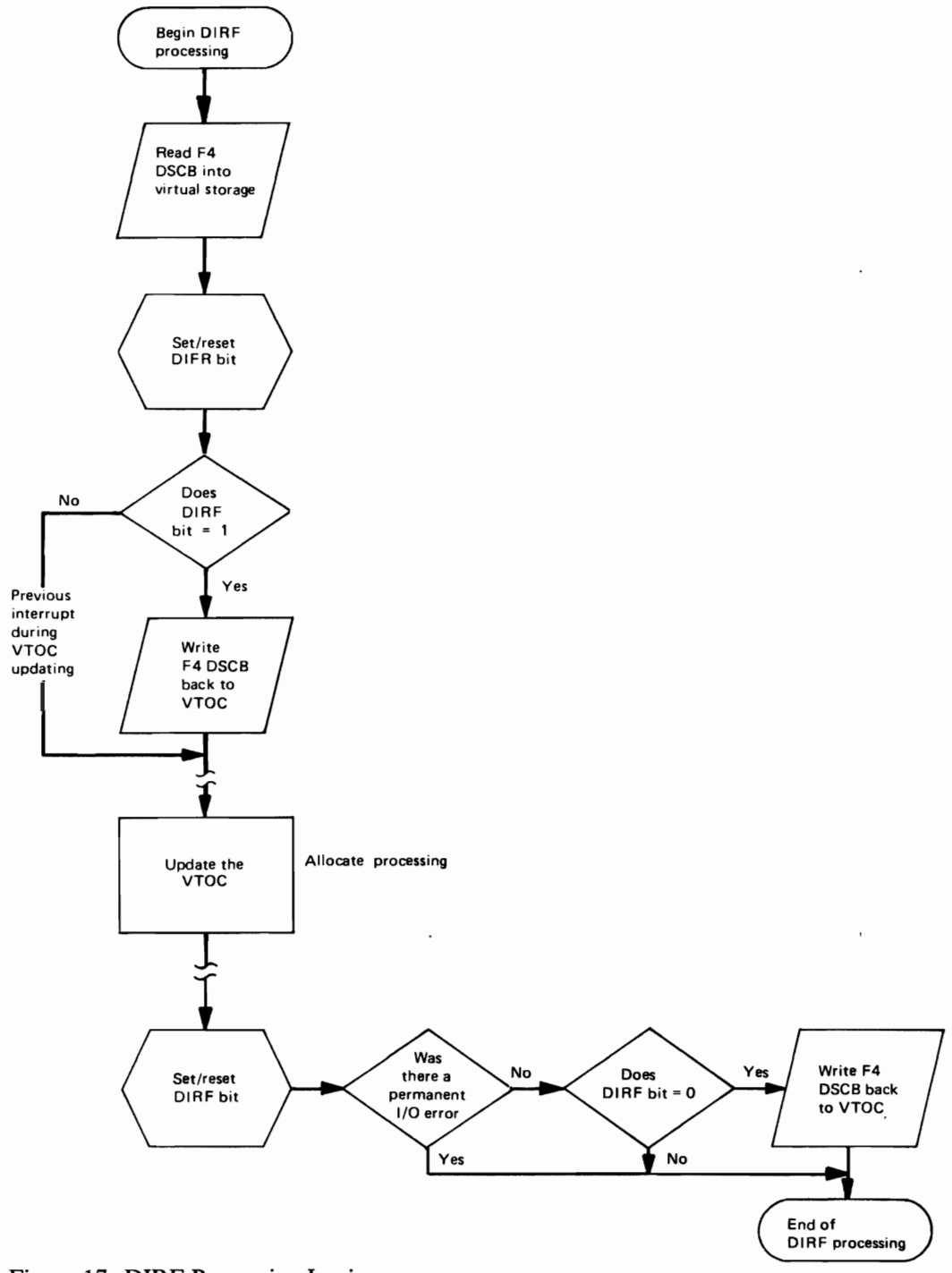


Figure 17. DIRF Processing Logic

Using Other Utilities to Diagnose VTOC Problems

It is sometimes useful to use the IEHLIST utility before and after the execution of the JCL that is causing a VTOC problem. This will provide two copies of the VTOC for comparison.

IEHLIST will sometimes fail to print all records of a VTOC that is in error. The IEHDASDR utility can be executed to print all the VTOC records.

Allocate Return Codes and Messages

Return Code	Message Identification	Text	Issued by
X'04'	IEF253I	Direct Access—Duplicate Name on Volume	IGG0325A, IGG032I1, IGG032I8
X'08'	IEF254I	Direct Access—No Space in VTOC	IGG0325B, IGG0325C, IGG0325D, IGG0325S, IGG032I2
X'0C'	IEF255I	Direct Access—Permanent I/O Error	IGG0325A, IGG0325C, IGG0325D, IGG0325E, IGG0325F, IGG0325G, IGG0325H, IGG0325J, IGG0325L, IGG0325M, IGG0325P, IGG0325Q, IGG0325R, IGG0325S, IGG0325T; IGG0325U, IGG0325V, IGG0325W, IGG0325Z, IGG032I2, IGG032I3, IGG032I4, IGG032I5, IGG032I6, IGG032I7, IGG032I8
X'10'	IEF256I	Direct Access—Absolute Track Not Available	IGG0325C, IGG032I2
X'14'	IEF257I	Direct Access—Space Requested Not Available	IGG0325C, IGG0325D, IGG0325K, IGG0325S, IGG032I2, IGG032I7
X'18'	IEF258I	Direct Access—Invalid Record Length	IGG0325A
X'1C'	IEF260I	Wrong DSORG or DISP	IGG032I1, IGG032I3
X'20'	IEF261I	No Prime Area Request for ISAM Data Set	IGG032I1
X'24'	IEF262I	Prime Area Must be Requested Before OVFLOW	IGG032I1
X'28'	IEF263I	Space Request Must Begin on Cylinder Boundary	IGG032I2
X'2C'	IEF264I	Duplication of DSNAME Elements Not Allowed—Same Area Requested Twice	IGG032I1
X'30'	IEF265I	Number of Tracks Requested is Too Large for Split Request	IGG0325B
X'34'	IEF266I	Invalid JFCB or Partial DSCB Pointer	IGG0325A
X'38'	IEF140I	Directory Space Requested is Larger Than Amount Available on This Volume	IGG0325B, IGG0325E
X'40'	IEF273I	Invalid User-Label Request	IGG0325A
X'44'	IEF146E	Duplicate Data Set Names Within a Split-Cylinder Request	IGG0325A
X'48'	IEF454I	DOS VTOC Cannot be Converted to OS VTOC	IGG0325P, IGG0325R, IGG0325V
X'4C'	IEF127I	No Space Parameter Given for New Data Set	IGG0325C, IGG032I1
X'50'	IEF128I	Invalid Request for ISAM Index	IGG032I1
X'54'	IEF129I	Multivolume Index Not Allowed	IGG032I1
X'58'	IEF130I	DSNAME Element Wrong—Must be PRIME, INDEX, or OVFLOW	IGG032I1
X'5C'	IEF131I	Multivolume OVFLOW Request Not Allowed	IGG032I1
X'60'	IEF132I	SPACE Parameter Wrong—CYL and ABSTR Conflict	IGG032I1
X'64'	IEF133I	SPACE Parameter Wrong—CYL and CONTIG Conflict	IGG032I1
X'68'	IEF134I	Subparameter Wrong in Space Parameter—Must be CYL or ABSTR	IGG032I1
X'6C'	IEF135I	Primary Space Request May Not be Zero	IGG032I2, IGG0325C
X'70'	IEF136I	Duplication in Allocation—Index Area Requested Twice	IGG032I1
X'74'	IEF137I	SUBALLOC Data Set Not Found	IGG0325S
X'78'	IEF138I	SUBALLOC Data Set Has More Than 1 Extent—Not Allowed	IGG0325S
X'7C'	IEF139I	SUBALLOC Data Set is Password Protected	IGG0325S
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X'84'	IEF145I	Space Request Must be ABSTR for DOS Volume	IGG032I1
X'88'	IEF144I	Cannot Suballocate From a Split Cylinder Data Set	IGG0325S
X'8C'	IEF141I	Index Request Must Precede Prime for ISAM Data Set	IGG032I1
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