

z/VM  
7.3

*DFSMS/VM Planning Guide*



**Note:**

Before you use this information and the product it supports, read the information in [“Notices” on page 27.](#)

This edition applies to version 7, release 3 of IBM® z/VM® (product number 5741-A09) and to all subsequent releases and modifications until otherwise indicated in new editions.

Last updated: 2022-09-07

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## About This Document

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Data Facility Storage Management Subsystem/Virtual Machine (DFSMS/VM) is an IBM® z/VM® feature that improves productivity by providing storage management for Shared File System (SFS) storage and Removable Media Services (RMS), and by easing the task of moving minidisks from one physical device to another.

## Intended Audience

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This document is a guide for system programmers and storage administrators who need to plan for the installation and use of DFSMS/VM.

You should have an understanding of z/VM, SFS file pools, and SFS storage groups. If you have not already done so, you should read the *z/VM: General Information* and the *z/VM: CMS User's Guide* (especially the overview of SFS), and at least browse the SFS part of the *z/VM: CMS File Pool Planning, Administration, and Operation*.

## Where to Find More Information

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See “Bibliography” on page 31 at the back of this document.

## Links to Other Documents and Websites

The PDF version of this document contains links to other documents and websites. A link from this document to another document works only when both documents are in the same directory or database, and a link to a website works only if you have access to the Internet. A document link is to a specific edition. If a new edition of a linked document has been published since the publication of this document, the linked document might not be the latest edition.



## How to Send Your Comments to IBM

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To send us your comments, go to [z/VM Reader's Comment Form \(https://www.ibm.com/systems/campaignmail/z/zvm/zvm-comments\)](https://www.ibm.com/systems/campaignmail/z/zvm/zvm-comments) and complete the form.

### **If You Have a Technical Problem**

Do not use the feedback method. Instead, do one of the following:

- Contact your IBM service representative.
- Contact IBM technical support.
- See [IBM: z/VM Support Resources \(https://www.ibm.com/vm/service\)](https://www.ibm.com/vm/service).
- Go to [IBM Support Portal \(https://www.ibm.com/support/entry/portal/Overview\)](https://www.ibm.com/support/entry/portal/Overview).



# Summary of Changes for z/VM: DFSMS/VM Planning Guide

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This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line (|) to the left of the change.

## SC24-6277-73, z/VM 7.3 (September 2022)

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This edition supports the general availability of z/VM 7.3. Note that the publication number suffix (-73) indicates the z/VM release to which this edition applies.

## SC24-6277-01, z/VM 7.2 (September 2020)

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This edition supports the general availability of z/VM 7.2.

## SC24-6277-00, z/VM 7.1 (September 2018)

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This edition supports the general availability of z/VM 7.1.



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# Chapter 1. Before You Start to Plan for Your System

Data Facility Storage Management Subsystem/VM (DFSMS/VM) is a feature of z/VM, which improves productivity by offering tools for managing three aspects of storage in your system: storage groups within the Shared File System (SFS), minidisks, and Removable Media Services (RMS). With DFSMS/VM, you can manage system storage through DFSMS commands that run under CMS and through the Interactive Storage Management Facility (ISMF).

SFS is a CMS file system for sharing CMS files among users through the use of file pools. A *file pool* is a collection of minidisks that contains files for a number of users. DFSMS/VM manages user files within a file pool more efficiently than the users can themselves.

The RMS support of DFSMS/VM provides the interface to the IBM 3495 Tape Library Dataserver.

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## Space Management

Through DFSMS/VM Function Level 221, the storage administrator can apply space management policies to files in SFS file pools by assigning management classes to SFS files and directories. Each management class contains a set of migration and expiration criteria which tell DFSMS/VM how to manage SFS files. When a file meets the expiration criteria of its management class, it becomes eligible for erasure by DFSMS/VM. When a file meets the migration criteria of its management class, it becomes eligible to be migrated (compacted and moved) to secondary storage. Secondary storage consists of migration level 1 (ML1) and if desired, migration level 2 (ML2). ML1 is an SFS file space. ML2 is a Tivoli® Storage Manager (TSM) storage repository on DASD or tape.

DFSMS/VM assigns management classes automatically through the automatic class selection (ACS) process. Through this process, a file acquires a management class in one of three ways:

- It is assigned a specific management class.
- It inherits the management class of its parent directory.
- It inherits the system default management class.

Migrated files are recalled automatically whenever the file owner or an authorized user accesses the file. The automatic recall of a file can be suppressed by issuing the CMS SET RECALL command. A file can also be recalled by a DFSMS/VM command.

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## Minidisk Management

DFSMS/VM also assists you in managing CMS minidisks by providing a fast, reliable data mover and minidisk checker. With DFSMS/VM, managing minidisks becomes an automated process that:

- Uses the DFSMS/VM high-performance data mover to move minidisks quickly and efficiently
- Performs many preparatory, directory update, and cleanup tasks automatically, eliminating steps you would normally do manually
- Allows you to move data to new DASD during prime shift by performing directory updates in place and offering options that help you control and minimize the impact on VM users.

The minidisk checker included with DFSMS/VM evaluates the integrity of a CMS minidisk by checking its file structure and reporting the results to you.

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## Removable Media Services

DFSMS/VM Function Level 221 provides a high-level interface to automated tape functions provided by the IBM 3495 Tape Library Dataserver. If you are installing an IBM 3495 in the VM environment, the RMS support of DFSMS/VM can be invoked by your tape management system to:

- Automate mounting and demounting of tape cartridges

## Before You Plan Your System

- Establish and manage logical groups of cartridges for scratch pools and application data
- Associate logical groups of cartridges with the automatic cartridge loading capabilities of library tape drives
- Control input and output of IBM 3495 library cartridges
- Provide information about library resources and library requests that are being processed.

The interface to the IBM 3495 functions are provided as a subset of DFSMS/VM commands and as a set of the Callable Service Library (CSL) application programming interfaces. RMS support eliminates the need for your tape management system and users to be aware of the IBM 3495.

If you have an IBM 3495 installed, several types of planning are required. For example, the interaction of your tape management system with the interface must be defined, and the standard device configuration planning must take place. These tasks are described in the *z/VM: DFSMS/VM Removable Media Services*.

## Interactive Storage Management Facility

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Most DFSMS/VM functions are available through the Interactive Storage Management Facility (ISMF) that is provided with the product. ISMF is designed to be easy to learn, incorporating operations familiar to ISPF users. It has many features and operations similar to its z/OS<sup>®</sup>™ environment counterpart, providing a consistent user interface for storage management tasks in both environments. (You can also perform many DFSMS/VM functions independently, using commands that run under CMS.)

ISMF offers:

- Menus from which you choose the application you want to use or the task you want to perform.
- Entry panels that contain default values and prompts. On some entry panels, values you enter are saved, allowing you to use those panels again in last-use mode.
- List panels that display information in tabular format and allow you to initiate operations and your own user extensions against the list entries.

ISMF provides on-line information through the ISPF help facility. You can display help information from any ISMF panel simply by pressing a predefined PF key. You can obtain information related to the task you are currently performing, or you can use the help facility index to go directly to specific information you want to view.

## Migrating from a Previous Release of DFSMS/VM

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If you are migrating from a previous release of DFSMS/VM, see the *Program Directory for DFSMS/VM Function Level 221* for instructions.

## Planning Overview

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Thorough planning will help you to begin using the functions of DFSMS/VM Function Level 221 quickly and efficiently. This book suggests a planning process that includes the following steps:

1. Analyze your system environment.
2. Decide who to authorize as storage administrators and how to authorize them.
3. Plan how you will install DFSMS/VM within your existing system.

Work sheets, starting on page [Appendix A](#), “[Planning Activities Checklist](#),” on page 21, are provided to help you track your progress.



## Chapter 2. Analyzing Your System Environment

To plan effectively for the DFSMS/VM Function Level 221 functions, you need to understand your current environment and how you can use these functions on your system. Decisions about how you use the functions affect how you set up DFSMS/VM.

You need to ensure that you have the processors and programs required to use DFSMS/VM. You also need to consider if any of your non-IBM software or in-house software might conflict with DFSMS/VM.

DFSMS/VM Function Level 221:

- Operates on all processors supported by z/VM 7.3. See *z/VM: General Information* for further information.
- Is supported on z/VM 7.3 and requires the VMSYS file pool.

If you choose to install the RMS, space management, or minidisk management functions of DFSMS/VM, you will need to install some of the following programs:

- Language Environment® support included with z/VM, if you plan to use the space management function of DFSMS/VM, or if other hosts on the network plan to use TCP/IP to communicate with DFSMS/VM for Removable Media Services support.
- IBM Compiler for REXX/370 (program number 5695-013) and IBM Library for REXX/370 (program number 5695-014), if you plan to write and compile your own ACS REXX exit for space management.
- PDF Version 3 Release 2.0 (program number 5684-123) or later release with applicable APARs, or BROWSE available with the CMS component of z/VM if you wish to browse or edit within the ISMF panels for space management or minidisk management.
- If the Migration Level 2 (ML2) function of DFSMS/VM is used, Tivoli® Storage Manager Extended Edition for z/OS and z/VM, V5.2 (5698-A11), Tivoli Storage Manager for z/OS and z/VM, V5.2 (5698-A13), or Tivoli Storage Manager for VM (5697-TS9) is required. All three of these program numbers have been withdrawn from marketing, and service has been discontinued.
- TCP/IP Level 610, provided with z/VM, if you plan to access the IBM 3495 Tape Library Dataserver from processors capable of 3490/3490E tape operations but incapable of controlling 3495 tape library (foreign host support).
- ISPF Version 3 Release 2.0 (program number 5684-043) or later to run the ISMF part of DFSMS/VM to support the minidisk and space management functions.
- DirMaint FL610 provided with z/VM or an equivalent directory maintenance product, for the minidisk management functions of DFSMS/VM.
- RACF® Security Server for z/VM or an equivalent product, to control access to DFSMS/VM commands.

A different security program can be used, or you can choose not to use one. If you use a security program other than RACF Security Server for z/VM you may need to modify an installation-wide exit. See [“Using Other Security Facilities”](#) on page 12 for more information.

### Planning Your New Space Management Environment

After you have analyzed your system environment, you need to take a closer look at how to manage your SFS files and directories in a space management environment. Careful planning now will make the installation easier and have you ready to start using the space management function sooner.

This section contains some guidelines on:

- Choosing which file pools to manage
- Deciding how to manage files
- Defining management classes

- Choosing the ACS process and method
- Deciding when and where DFSMS/VM should migrate and erase files
- Using an installation-wide exit to control migration and erasure
- Placing files under DFSMS/VM control

### Choosing Which SFS File Pools to Manage

You need to decide which file pools to manage with DFSMS/VM. Any file pool can be managed by DFSMS/VM; however, you will probably want to place file pools under DFSMS management one by one. The best candidates would be those file pools that have the least amount of space to spare.

DFSMS/VM can manage any file that you choose, with these restrictions:

- Only files in SFS file pools can be managed with DFSMS/VM.
- Files in a directory control (DIRCONTROL) directory cannot be migrated, but can be assigned expiration criteria by DFSMS/VM. To take full advantage of the DFSMS/VM functions, put your files in a directory with FILECONTROL attributes.
- Files in file spaces starting with “DFSMS” are not managed by DFSMS/VM.

In addition, you may have further restrictions unique to your system.

### Deciding How DFSMS/VM Manages Files

DFSMS/VM gives you flexibility in determining how it manages files and which files it manages for you. You need to decide on the criteria for low-activity files and expired files. You can have DFSMS/VM:

- erase expired files
- erase expired files and migrate low-activity files to secondary storage (either ML1 or ML2)
- move files from ML1 to ML2.

The details of how DFSMS/VM manages your files depends on a number of things that you should think about and plan for before you begin using DFSMS/VM. For example, you might consider an accounting month summary file to be a low-activity file only a week after its last use, whereas a file with more activity, such as the weekly payroll file, becomes a low-activity file a month or more after its last use.

### Choosing Which Files to Erase

DFSMS/VM helps you manage your storage space by erasing files when they meet your expiration criteria. This is part of the function of the DFSMS MANAGE command. As part of your planning for DFSMS/VM, decide which files, if any, will be eligible to be expired. You tell DFSMS/VM when to consider files expired through management classes assigned to the files.

Work with your users and your management to determine how you can match DFSMS/VM’s ability to erase expired files with their needs. Have them help you to determine if they have files that:

- Should never be erased
- Can be erased after a number of days has passed since they were created
- Can be erased after a number of days has passed since they were last referenced (a file is *referenced* when it is read from or written to)
- Can be erased both after a number of days has passed since they were created, and after nonusage (*nonusage* is when a number of days has passed since the files were last referenced)

At the same time, gather information on how you can distinguish among these kinds of files. Factors such as the file owner, the file pool name, the file name, the file type, and the directory name are examples of how you may distinguish between them. These distinguishing characteristics are needed when you set up automatic class selection (ACS) processing for your system.

For example, a user may have files with a file type of TEMP that can easily be re-created from other files if they are ever needed again. Through ACS processing, you can have DFSMS/VM assign a management class with an expiration date that is one week after last use to files with the file type TEMP.

You need to decide whether DFSMS/VM can erase a file entirely when it expires, or whether it can erase only the file data and leave the file access structure intact. For example, suppose you are the owner of a file that a number of users access to deposit data for a quarterly status report. The other users access the file through aliases that they have created. After the status report has been completed for the quarter, the file is no longer needed. You could let DFSMS/VM erase the file, but then you have to create a new one for the next quarter and give the contributing users access to the file again. And then each of the users has to create an alias to access that file again.

For this kind of file, a better way might be to have DFSMS/VM erase only the *data* in the file. Even though the file contains no data, the file and its structure remain, and the users still have access to it. Using the *Expiration Disposition* field of the management class, you can tell DFSMS/VM what to erase. This means less work for you and your users, and it frees space on your DASD.

## Choosing Which Files to Migrate

DFSMS/VM helps you manage your storage space by migrating files when they meet your migration criteria. This function is done by the DFSMS MANAGE command. You need to decide when files are considered low-activity and can be migrated. DFSMS/VM uses the low-activity criteria described in the management classes that you assign to the files through ACS processing.

Work with users and management to determine how to handle migration of files. Files are easily recalled from secondary storage, so most files can be migrated after a reasonable time. Understanding how users create and use their files can help you to determine what that reasonable time is. For example, perhaps a user creates a file one day, works with the file for a week, occasionally refers to it in the next few months, but seldom refers to it after six months. You can tell DFSMS/VM to migrate the file to ML1 when it is not used for a week, and then move it to ML2 after 4 months on ML1. Recalling files from tape takes longer than recalling files from DASD. Depending on the type of storage medium used, recall time will be affected.

The needs of your system also determine what files to migrate, and when and where to migrate them. Limits on DASD space within file pools or SFS storage groups may dictate a shorter time before a file is considered low-activity. Through the management class definition, you can permit or prevent migration of the file. If you permit migration of the file, you must specify when the file is to be considered a low-activity file and ready for migration. In doing so, you should also consider the following:

- When should the file be migrated?
- Should the file be migrated to ML1 or ML2?
- If the file is on ML1 should it be moved to ML2?
- If the file is being moved from ML1 to ML2, how long will the file be on ML1 before being moved to ML2?

As you did for files with different expiration requirements, gather information on how you can distinguish among files with different migration requirements. Factors such as the file owner, the file pool name, the file name, the file type, file size, and the directory name are again examples of how you might distinguish among them. These distinguishing characteristics are needed when you set up automatic class selection (ACS) processing for your system.

## Defining Management Classes

The key to how space management works is the management class. Every file to be managed by DFSMS/VM must have a management class assigned to it, must inherit one from the parent directory, or use the system default. Through the ISMF Management Class Application panel, a management class name is associated with migration and expiration characteristics that you define. Defining management classes is a required step towards having your storage managed by DFSMS/VM. You need to have a management class for each collection of files that have similar migration and expiration requirements. Define management classes to do any of the following:

- Identify old and unused files which can be erased from primary storage
- Migrate old or infrequently used files to secondary storage
- Allow certain files to migrate only by command to secondary storage
- Specify how long you want to keep the migrated files on secondary storage before erasing them
- Specify how long migrated files remain on ML1 before moving to ML2

For example, you might decide that all files on your system can be managed in one of the following ways:

- Do not expire the file, but migrate directly to ML2 after 90 days of nonusage.
- Do not migrate, migrate to ML2 after 30 days nonusage.
- Migrate the file to ML1 after 7 days of nonusage and never move to ML2. Expire 30 days from date of last reference.
- Expire 21 days from date of last reference but do not migrate.
- Expire 3 days after date of creation but do not migrate.
- Migrate to ML1 after 7 days of nonusage and move to ML2 after 1 month on ML1. Expire the file 1 year after date of last reference.
- Do not expire the file, but migrate it to ML1 after 14 days of nonusage and never move it to ML2.
- Do not expire the file, but migrate it to ML2 after 14 days of nonusage.
- Do not expire the file but migrate it to ML1 after 1 week of nonusage, and then move it to ML2 after 1 year on ML1.
- Expire after 200 days nonusage and after 365 days from the creation date.

You will need a separate management class for each of these and you will need to define them through ISMF. (See [z/VM: DFSMS/VM Storage Administration](#) for more information on defining management classes.)

## Naming Management Classes

When you define the management classes, give them meaningful names that help you when you need to update your system's ACS processing scheme. A list of possible names is shown in [Table 1 on page 6](#). Your management class names should describe the kind of files that DFSMS/VM is managing, and they should be broad enough to be meaningful even though the storage management requirements may change. Then the only change you have to make to the file is the management class attributes. For example, in [Table 1 on page 6](#), the accounting department wants their files migrated after 90 days. Later, they decide to migrate after 30 days. You can easily meet their requirements by changing the attributes but the management class name still reflects the file owners.

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*Table 1. Example of Management Class Names*

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<b>Management Class Name</b>	<b>Comments</b>
ACNTDEPT	These files describe the financial status of the company. Don't expire these files but migrate the data after 90 days; move to ML2 after 120 days.
PURCHASE	These files list the parts and supplies ordered by the company. Expire 600 days from date of last reference but migrate the data after 7 days of nonusage. Do not move to ML2.
MANUCTRL	These files contain the manufacturing schedules for the month. Expire 21 days after last reference and do not migrate.
ORDRDEPT	These files contain customer orders waiting to be filled. Expire after 12 months but migrate on command only to ML2.
BILLING	These files contain the customer billings waiting for payment. Do not expire but migrate to ML1 after 14 days of nonusage; then move to ML2 10 days later.

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Table 1. Example of Management Class Names (continued)

Management Class Name	Comments
TAXDEPT	These files contain the federal, state, and local tax reports of the company and its employees. Do not expire but migrate to ML1 after 6 months of nonusage; migrate to ML2 60 months later.
TEMPREPT	These files contain daily reports. Expire them 3 days after creation and do not migrate.

## Choosing the ACS Process

Through ACS processing, DFSMS/VM assigns or changes the management classes for files and directories. ACS processing occurs whenever you (or a user):

- Create a file
- Create a directory
- Place a storage group under DFSMS/VM management by using the DFSMS CONVERT command
- Manage (with the DFSMS MANAGE command) a storage group that has files or directories without management classes
- Migrate by command a file without a management class
- Recall a file managed by DFSMS/VM

ACS has access to many of the characteristics of a file or directory, including the user ID of the owner of the file; the fully qualified file name; size, logical record length, record format, the file space, and the directory in which the file resides or is being created. By setting up the ACS process to use these characteristics, you allow ACS to make a knowledgeable choice for a management class for the file.

When you create a file, you may choose the way your system handles ACS processing for file creation by selecting one of the following options:

- Run ACS processing, which assigns the management class at time of file creation
- Defer ACS processing until the file is converted, managed, or migrated by command
- Assign the null management class to the file, which indicates that the management class of the directory or default management class is used (inherited) when it is processed by DFSMS/VM

## Choosing the ACS Method

You need to choose how DFSMS/VM does ACS processing for your system. DFSMS/VM offers you flexibility for doing that task. You can use any combination of the following methods:

- Write an ACS routine in ACS language
- Write an ACS REXX installation-wide exit
- Write an ACS module installation-wide exit

You should base your decision of which method to use on the needs of the system and on the experience of the storage administrator. The ACS routine is compatible with the z/OS™ ACS routine.

## ACS Routine

Using the ACS routine allows you to use the facilities of the ACS language. ISMF applications help you to develop and to test the ACS routine. The ACS language provides control constructs and pattern matching, and you can validate the routine before it is placed into production.

The ACS routine cannot perform loops or call external routines. Using this routine minimizes the possibility of errors at run time, but decreases the flexibility of the routine.

The ACS routine language is the same in DFSMS/VM as it is in z/OS with new variables for VM. This allows z/OS users to apply their working knowledge of ACS in z/OS directly to VM. You can use a routine written for z/OS in DFSMS/VM although not all of the variables in the routine may have meaning in VM. Decisions based on variables that have no meaning in VM may need to be changed. Using the new VM variables should be considered for ACS processing. See [z/VM: DFSMS/VM Storage Administration](#) for more information on writing ACS processing routines.

### ACS REXX Exit

DFSMS/VM allows an installation-written ACS REXX exit to be used along with the ACS routine or instead of it. Using the ACS REXX exit allows you to use the set of operators, instructions, and built-in functions of REXX. This exit may issue CMS or CP commands and may call external routines. However, you must use caution to avoid infinite loops, calling of external routines that could end abnormally, and assignment of management classes that do not exist in the active configuration. Unlike the ACS routine, the ACS REXX exit cannot be validated. For better performance, plan to compile your ACS REXX routines. See [z/VM: DFSMS/VM Storage Administration](#) for more information on writing ACS REXX exits.

### ACS Module Exit

DFSMS/VM allows an installation-written ACS module exit to be used instead of the ACS routine and ACS REXX exit, or along with them. The ACS module exit must be written in assembler language. Using the ACS module exit, allows you to perform tasks that cannot be done by the ACS routine alone (however, these tasks can generally be performed by the ACS REXX exit). You can call the ACS routine again from this exit. However, you must use caution to avoid infinite loops, calling of external routines that could end abnormally, and assignment of management classes that do not exist. Unlike the ACS routine, the ACS module exit cannot be validated. Because of its complexity and the possibility of error, other methods should be considered before using the module exit. See [z/VM: DFSMS/VM Storage Administration](#) for more information on writing ACS module exits.

## Deciding When and Where DFSMS/VM Migrates and Erases Files

Using the DFSMS `MANAGE` command lets you control when the migration of files or the erasing of expired files occurs. Because this command can use substantial processing time, you need to plan a time to issue this command to minimize its effects on users. That does not mean, however, that you should seldom issue the command. Plan to use the `MANAGE` command on a regular basis so as to guarantee space for storage group activity.

The `levels` option on the `MANAGE` command lets you choose which migration level you want to migrate to ML1, ML2, or both. For example, this could be very helpful if you want to ensure that migration to ML2 tape occurs at a time when operators are available to mount tapes. You could have `MANAGE` migrate files to ML1 during times when operators are not available. Then during times when operators are available, use the `MANAGE` command to move the ML1 files to ML2 tape and, if you choose, primary storage to ML2 tape.

Little penalty is incurred by running the `MANAGE` command frequently. DFSMS/VM migrates or expires files only if the data in the SFS storage group occupies space at or above a high threshold value. But you need to decide what that threshold value should be. By setting the high and low threshold values, you are determining how much space you want to use in the SFS storage group.

For example, you might set the high threshold at 85% and the low threshold at 50%. If an SFS storage group is 75% full, DFSMS/VM takes no action when the `MANAGE` command is issued for this SFS storage group. But, if the SFS storage group is 90% full, DFSMS/VM erases all files that have expired and then checks the storage group space again. If the space being used is still above the low threshold (50%), then eligible files are migrated. Once DFSMS/VM starts migrating, it migrates files only until the space occupied by data in the SFS storage group is just below the low threshold.

If you issue the `MANAGE` command infrequently, set thresholds too high or too low, many more files may no doubt have expired or become eligible for migration. This means that more processing is required when the command is finally issued. If there is too much processing to do, the system may not have enough time to complete the commands during the time you have planned for it, for example, during

hours of low usage. You also run the risk of SFS storage groups filling up with files that have expired and should have been erased or migrated. Therefore, to take full advantage of the capabilities of DFSMS/VM, you need to determine how often to run the MANAGE command and what the optimum thresholds are.

One way to ensure that you run the MANAGE command on a regular basis is to write an EXEC that issues the command on various days of the week, or at various times of the day. You can also use an automated tool, for example IBM Operations Manager for z/VM, to ensure the MANAGE command is run regularly. Timers can be set up to start one MANAGE cycle each night. With REXX and a simple timer program, you can set up DFSMS/VM to process the MANAGE command at a time that has the least effect on the production systems.

## Using an Installation-Wide Exit for Migration and Erasure

During the processing of the DFSMS MANAGE command, files may be migrated or erased. DFSMS/VM provides an installation-wide exit, named FSMMECHK, to monitor this process and, if you wish, prevent migration or erasure from occurring. To ensure data availability, make sure that a backup copy of the file exists before the file is migrated or becomes eligible for erasure. Use this exit to check for a backup copy before having DFSMS/VM take any action against the file. You can write the exit so that if a backup does not exist, the file is not migrated or erased. (If you schedule file backup more frequently than file migration, you may never need to use this exit.) See [z/VM: DFSMS/VM Customization](#) for more information on this exit.

## Placing Files under DFSMS/VM Control

Files that were created before installation of DFSMS/VM Function Level 220 or in file pools do not have management classes assigned to them and therefore are not managed by DFSMS/VM. Files in file pools that were not managed by DFSMS/VM Function Level 220 do not have management classes assigned to them. The DFSMS CONVERT and DFSMS MANAGE commands (introduced in DFSMS/VM Function Level 220) allows these files and directories to be converted for space management. These commands invoke the conversion process by initiating ACS processing for each file and each directory with no management class.

Use the DFSMS CONVERT command when you are converting a file pool to a DFSMS/VM managed file pool, or if you make significant changes to the way management classes are assigned. You may also use the DFSMS MANAGE command when you have files and directories that have no management class. This command automatically converts files and directories that have been created without management classes, in addition to expiring and migrating files.

If you have used the space management function in DFSMS/VM Function Level 220 and you want to take advantage of the ML2 capability, you need to analyze your system and determine what changes need to be made. If you change the way management classes are assigned, you will need to run the CONVERT command with the REDETERMINE option.





## Chapter 3. Authorizing Users

You need to define a plan both for authorizing users and determining who needs to be authorized as a storage administrator. Since functions such as moving minidisks and erasing expired files are potentially harmful to the integrity and security of your system, you must restrict their use to storage administrators. General users also need some access to DFSMS/VM, for example, to get information about the management classes set up on the system. Make sure that only those users with the knowledge of and the responsibility for certain DFSMS/VM functions perform those functions, while at the same time others can get the information they need.

You control who uses DFSMS/VM in one of the following ways:

- By using RACF Security Server for z/VM, which allows you to restrict the use of individual DFSMS/VM commands.
- By listing users authorized to perform storage administrator functions in the DFSMS authorization file.
- By using a different security method to authorize users.

### Migrating from DFSMS/VM Function Level 210 to 221:

The DGTQAUTH EXEC used in DFSMS/VM 210 has been replaced with the FSMVAUTH CSL routine that was introduced in DFSMS/VM 220. If you have modified DGTQAUTH, you can continue to use DGTQAUTH by replacing the FSMVAUTH CSL routine. See [z/VM: DFSMS/VM Customization](#) for more information on the FSMVAUTH CSL routine.

## Using RACF Security Server for z/VM for Security

RACF® is a software security product that protects information by controlling access to it. RACF controls what users can do on the system and protects your resources. It provides this security by identifying and verifying users, authorizing users to access protected resources, and recording and reporting any attempts to access your information.

RACF Security Server for z/VM retains information about users, resources, and access authorities in profiles stored in a special RACF file. There are two types of profiles: *discrete* and *generic*. A discrete profile contains security information about a single file, user, or resource. A generic profile contains security information about multiple files, users, or resources that may have similar characteristics and therefore require a similar level of protection.

For DFSMS/VM, you define profiles in RACF's FACILITY resource class. You can create a single generic profile (STGADMIN.\*) to protect all DFSMS/VM commands. The RMS RACF *entities* are a subset of DFSMS/VM RACF *entities* and can be protected with a single generic profile (STGADMIN.RM.\*). The [z/VM: DFSMS/VM Customization](#) provides the RACF entities for DFSMS/VM.

You can also create discrete profiles to specify authorization command-by-command, user-by-user, if you need that flexibility. For example, suppose you have several people who have duties as storage administrators, and one who acts as the lead storage administrator. You may give all storage administrators the authority to issue DFSMS MANAGE commands, but only the lead storage administrator authority to issue DFSMS CONVERT commands. You may give the system operator the authority only to issue the DFSMS STOP command.

For more information on using RACF, see [z/VM: RACF Security Server Security Administrator's Guide](#). For instructions on using RACF to protect DFSMS/VM, see [z/VM: DFSMS/VM Customization](#).

## Using the DFSMS Authorization File

The simplest and least sophisticated of your options for authorizing users is to decide who will be permitted to perform storage administrator functions, then list their user IDs in the DFSMS authorization file located in directory VMSYS:DFSMS.CONTROL. Users listed in the file can then perform functions allowed only for storage administrators. Users not listed are considered general users, and can perform

## Authorizing Users

only limited functions through DFSMS/VM. To keep your system under control, only a small number of users should be designated as storage administrators.

For instructions on how to use this file, see [z/VM: DFSMS/VM Customization](#).

## Using Other Security Facilities

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You can use a security facility other than RACF Security Server for z/VM. If you choose a security facility that uses the RACROUTE macro, as RACF Security Server for z/VM does, you simply install that program instead of RACF Security Server for z/VM. DFSMS/VM uses whatever program answers to the RACROUTE macro. For more information on this macro, see the *External Security Interface (RACROUTE) Macro Reference*.

If your security facility does not use the RACROUTE macro or if you choose to devise your own method, you must customize the authorization process by replacing the installation-wide exit, FSMVAUTH. For more information on how to use this installation-wide exit, see [z/VM: DFSMS/VM Customization](#).

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## Chapter 4. Planning for Installation

Planning for DFSMS/VM includes considering how to install DFSMS/VM with your existing system. One of the most obvious things to plan for is the DASD space for the DFSMS/VM product code, but there are other things as well. Here is what we suggest you plan for:

- Verifying the DFSMS/VM control file defaults
- Setting up DFSMS/VM server virtual machines to use
- Setting up a TSM virtual machine for ML2
- Starting DFSMS/VM
- Generating accounting records
- Logging DFSMS/VM messages
- Utilizing DFSMS/VM Migration Capabilities
- Defining Coordinated Resource Recovery
- Backing up and recovering migrated files
- Storage requirements

For more information on installing DFSMS/VM, see the *Program Directory for DFSMS/VM Function Level 221*.

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### Verifying the DFSMS/VM Control File Defaults

A sample of the DFSMS/VM control file (DGTVCNTL DATA) is provided with the product. It contains a list of keywords, each with a value specified. You can use these values or change them to meet your system requirements.

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### Setting Up Virtual Machines for DFSMS/VM to Use

Whenever you issue a DFSMS command or use ISMF, DFSMS/VM accomplishes that task through virtual machines that it controls. These virtual machines can be the DFSMS master and servers, minidisk servers, and the RMS master. DFSMS/VM uses these virtual machines to accomplish its work as follows:

- The DFSMS master handles both space management and minidisk management operations.
- The DFSMS servers called *DFSMS machines* handle the space management operations such as migration, recall, and expiration of SFS files.
- The minidisk servers, called *minidisk machines*, handle minidisk management operations, such as moving and checking minidisks, and the building of minidisk lists.
- The removable media services master handles all RMS-related requests such as mounting or demounting cartridges, assigning cartridge categories to library devices, and providing library information.

Before you install DFSMS/VM, you will need to decide which functions (space management, minidisk management, or removable media services) you want to use. You can use just one of them, all three, or any combination of the three. When you have decided which functions you will use, set up only the virtual machines you will need.

Because DFSMS/VM in one system is independent of DFSMS/VM in any other, you must define the virtual machines in each system. For example, you could have the DFSMS virtual machines on one system and the RMS virtual machine on another. If you plan to install DFSMS/VM on multiple systems, you will need to define the virtual machines in each system.

If you do not already have a previous release of DFSMS/VM installed and want minidisk management, you need to think about how often and how much moving and checking of minidisks you will be doing. In the

DFSMS/VM control file, the default is three minidisk server machines. If you are moving a large amount of data from old to new DASD, you may need more than three. You can initially define as many as you need and then, when you finish moving the data to the new DASD, reduce that number.

The DFSMS/VM control file default for the number of the DFSMS server machines needed for space management is three. How many server machines you need depends on a number of factors, including:

- Whether or not you invoke ACS processing each time a file is created
- The number of file pools you manage
- The number of and size of the files in the file pools
- How fast you want DFSMS/VM to respond to automatic recalls
- How many storage groups are being processed by the MANAGE command at a time.

The requirements for the master and server machines can be produced using VMSES/E. See [z/VM: DFSMS/VM Customization](#) for further information about using VMSES/E. User IDs for these machines are provided in the DFSMS/VM control file, but you may change them if you wish.

## Setting Up a TSM Virtual Machine for ML2

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DFSMS/VM Function Level 221 uses the Tivoli Storage Manager for VM (TSM) server as the repository for ML2 data. In addition to being a data repository, the TSM server provides tape processing and inventory management.

An installation using DFSMS/VM Function Level 221 ML2 support must set up a TSM server as the ML2 repository. It is recommended that this TSM server be dedicated exclusively for use by DFSMS/VM to keep ML2 data separate from other client data. Also, this server must be installed on the same VM system as the DFSMS master and server machines.

It is also recommended that the ML2 repository in TSM be set up primarily as tape storage. However, an installation may want to add some intermediate DASD levels in TSM to be used as ML2 DASD staging areas to ML2 tape. DFSMS/VM is just another client to TSM, and ML2 data will be subject to normal TSM processing based on whatever storage levels are established.

If you decide to share the TSM server with other applications besides DFSMS/VM, no other application may use the node or owner 'DFSMS'.

And if you share the TSM server with non-DFSMS/VM applications, there may be a performance penalty if the other applications are active when DFSMS/VM is active.

TSM has much flexibility in its hierarchy of storage for data, allowing you a great amount of flexibility in configuring the hierarchy. Ultimately, keep in mind that the purpose of DFSMS/VM using DFDSM™ as a repository is to provide ML2 to tape capability.

DFSMS/VM will use TSM's database as the inventory for ML2 data. This TSM database must be protected just as a primary storage catalog (or inventory) would be. It should be backed up regularly, protected from unauthorized access, and probably mirrored. These processes are already associated with the TSM server, but they become even more critical with DFSMS/VM Function Level 221; with migrated data, TSM now contains the primary versions of many files.

The TSM server should be managed through its normal administrative interfaces.

## Starting DFSMS/VM

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You need to define a logon process for the virtual machines. For DFSMS/VM to start working, the master and server virtual machines that perform DFSMS/VM functions must be logged on. The logon process can be automatic or manual. Automatically logging of the DFSMS master machine and the TSM server machine is recommended whenever the VM system is IPLed. If the DFSMS machines are not operating, you will not be able to recall your migrated data. It is important for machines to be operating to allow users to access data. You should also allow the master machine to log on its servers.

Manually logging on the master and servers can be done but it is not recommended as an alternative to the automatic process. However, if you choose this method, keep in mind that the master machine must have sufficient time to complete its initialization before you manually log on server machines. See [z/VM: DFSMS/VM Customization](#) for additional information about establishing a logon process.

## Generating Accounting Records

DFSMS/VM offers the ability to generate accounting records. Two kinds of records are generated: user records and system records. User records are generated for command processing (including automatic recall and ACS processing during file and directory creation). System records are generated for DFSMS/VM overhead tasks; for example, DFSMS/VM initialization and logging. DFSMS/VM accounting records include elapsed time, CPU time, command name, blocks moved (for migrate, move, recall, and erase) and cylinders moved (for minidisk move). You need to decide if you want to generate DFSMS/VM accounting records.

The generation of accounting records is controlled in two ways:

1. Use the DFSMS\_ACCOUNTING and RM\_ACCOUNTING keywords in the DFSMS/VM control file to indicate if accounting records should be generated at all.
2. Use an installation-wide exit to alter or suppress the generation of accounting records.

See [z/VM: DFSMS/VM Storage Administration](#) and [z/VM: DFSMS/VM Customization](#) for more information on DFSMS/VM accounting.

## Logging DFSMS/VM Messages

DFSMS/VM presents messages in four categories: severe, error, warning, and informational.

With the DFSMS/VM control file keywords DFSMS\_LOG\_TO\_CONSOLE, DFSMS\_LOG\_TO\_FILE, RM\_LOG\_TO\_CONSOLE, and RM\_LOG\_TO\_FILE, you specify where and on which level messages are logged. See [z/VM: DFSMS/VM Messages and Codes](#) for a description of message level codes. You must specify at the least, the logging of severe messages with one of these keywords. If you choose to log the messages to a file, you have to specify the file pool and file space where you want the message log to reside.

The following are meanings of the message categories:

Category	Meaning
Severe	A component of DFSMS/VM abends or otherwise terminates because of some condition.
Error	DFSMS/VM cannot perform a function because of a condition that DFSMS/VM does not expect.
Warning	DFSMS/VM has performed the function correctly, but the results may not be what the command issuer expects.
Informational	DFSMS/VM has performed the function correctly, and the results are what the command issuer expects.

Depending on the severity category you decide to use, logging to a file can take up a large amount of DASD space. However, it does provide you with a greater level of detail, such as date, time stamp, and request ID. If an error occurs while DFSMS/VM is logging to a file, then the messages are logged to the console. You may experience some performance penalties logging to files with the message level at four; however, there is little penalty when the message level is between zero and three.

Because the DASD space may fill up quickly, plan to have DFSMS/VM manage the log files for you. For example, define a management class to expire the log files after one day. If you do have DFSMS/VM manage the log files, don't use a directory ID that begins with DFSMS. DFSMS/VM will not manage a file space with an ID that begins with DFSMS. Also, consider placing the log files in a storage group by

themselves. DFSMS/VM keeps the current day's log file open continuously. An open log file will prevent you from backing up the storage group containing that file while DFSMS/VM is running.

## Utilizing DFSMS/VM Migration Capabilities

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If you choose to use the migration capabilities of DFSMS/VM, you must select a location for secondary storage. Secondary storage can be either ML1, or ML1 and ML2. The type of secondary storage you choose depends on your management class selection. For ML1, you need to set up an SFS file space, while ML2 requires a TSM repository. If only ML2 is used for storage, you must still specify a file space for ML1, even though it will be of minimal size. Global resource ID and LU name combinations must be unique for all DFSMS/VM systems within the Transparent Services Access Facility (TSAF) collection. These are specified in the DFSMS/VM control file as GLOBAL\_RESOURCE\_ID and FULLY\_QUALIFIED\_LUNAME.

### ML1 Considerations

ML1 file space can be placed in either a local or a global file pool. A restriction is that the system file pool VMSYS cannot be specified as the file pool for ML1.

It is recommended that ML1 be in a file pool that is separate from the files being managed. Even though it is not recommended, you may place ML1 in the same file pool as the files being managed. If you choose to locate ML1 in the same file pool as the files that are migrated, you must place ML1 in its own SFS storage group within the file pool.

### ML2 Considerations

ML2 data can only be placed in a TSM repository. It is recommended that you dedicate a TSM server to DFSMS/VM whose repository holds only ML2 data.

TSM policies can be specified so that data stored in TSM archive and backup repositories can be erased. However, TSM policies should be specified so that active data stored in ML2 by DFSMS/VM is not erased. This ensures DFSMS/VM maintains control of its data.

## An Example of Identifying Secondary Storage

The system environment shown in [Figure 1 on page 17](#) illustrates some things to consider when identifying secondary storage.

In our example, two VM systems with DFSMS/VM are connected using the TSAF. Each system has four file pools, two of which are for user files. The VMSYS file pool on each system contains system data such as program product files; it does not contain user files. The VMSYSR file pool on each system is the file pool for the Coordinated Resource Recovery (CRR) server.

In System 1, the VMSYS, VMSYSR, and VMSYS1 file pools are local file pools. GLOBAL1 is a global file pool, meaning that it is known to both systems through the TSAF collection. Users on both systems can access files on GLOBAL1. The lines connecting the DFSMS master virtual machines with the file pools, indicates that DFSMS/VM manages the VMSYS1 and GLOBAL1 file pools.

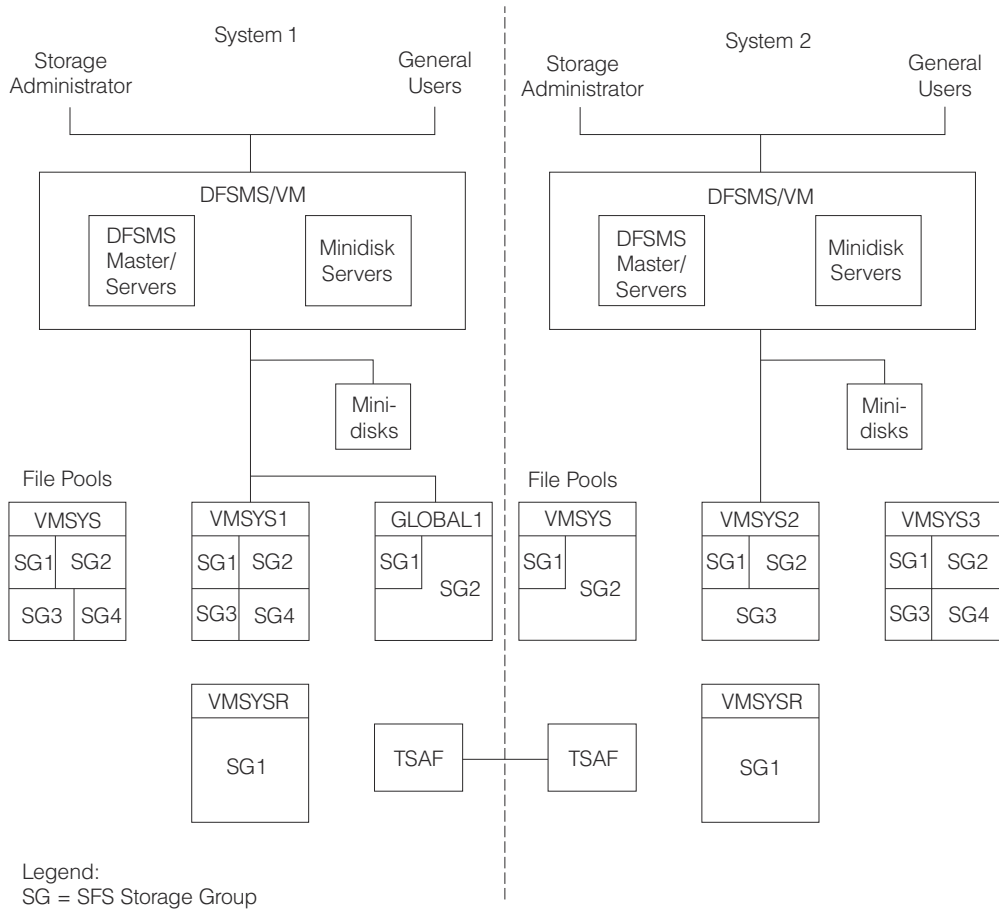


Figure 1. A Sample System Environment

In System 2, all four file pools are local. Users on System 1 cannot access files stored in the file pools of System 2. Only VMSYS2 is managed by DFSMS/VM, so files in file pool VMSYS3 do not expire nor can they be migrated by DFSMS/VM.

For each system, you must identify the secondary storage holding the migrated files. For ML1, you have three choices: identify a file space in a local file pool, identify a file space in a global file pool, or identify no file space at all. The ID of these file spaces must start with the letters DFSMS. For ML2, there are two choices: define ML2, or do not define ML2. Using [Figure 1 on page 17](#), we will see how you might do each of these.

**Reminder:** If only ML2 is used, you must still specify ML1 even though its size will be minimal.

- Identify a file space in a local file pool.

You might choose file pool VMSYS1 for ML1 in System 1, and VMSYS3 for ML1 in System 2. Even though VMSYS3 is not managed by DFSMS/VM, you *can* use it for ML1. You also need to decide on a name for the file space itself. For our example, we chose DFSMS01 for System 1, and DFSMS02 for System 2.

You tell DFSMS/VM the location of secondary storage in the control file (DGTVCNTL DATA) with the key word MIGRATION\_LEVEL\_1. So for System 1, you can specify:

```
MIGRATION_LEVEL_1 SFS VMSYS1:DFSMS01.
```

and for System 2:

```
MIGRATION_LEVEL_1 SFS VMSYS3:DFSMS02.
```



You can also give the same name to the file spaces for both systems, because DFSMS/VM can keep track of which data is from which system. For example, you can specify DFSMS01 for System 2, as well.

```
MIGRATION_LEVEL_1 SFS VMSYS3:DFSMS01.
```

- Identify a file space in a global file pool.

GLOBAL1 is the only global file pool in this TSAF collection. In this case, you can name the ML1 file space DFSMS, because DFSMS/VM in both systems uses the same file space. On both systems, you would specify the following in their control files:

```
MIGRATION_LEVEL_1 SFS GLOBAL1:DFSMS.
```

Placing ML1 in a global file pool can be useful when one or more of the systems in a TSAF collection has limited DASD resources. This allows you to migrate files from a system that lacks resources to a system that has the resources. However, you need to weigh the advantages of centralizing your migrated files against being able to reliably access those files. Using a global file pool for ML1 is not recommended if there is a potential for the communication links to fail. By using a global file pool for ML1, System 2 relies on System 1 to access its own migrated files. If System 1 is not available, DFSMS/VM on System 2 is not able to recall any migrated files because the data is physically located on System 1.

- Identify no file space.

If you do not want to migrate files, leave the following statement as a comment or delete it from the control file:

```
* MIGRATION_LEVEL_1 SFS
```

With no file space for ML1 specified, DFSMS/VM can only erase files that have expired. Any attempt to migrate a file will fail because there is no secondary storage available.

## Defining Coordinated Resource Recovery

The Coordinated Resource Recovery (CRR) server coordinates any work that occurs between two different file pools. You need to define a CRR if:

- Your work directory is not in the same file pool as the one being managed.
- You are installing other programs that require CRR.

See *z/VM: CMS File Pool Planning, Administration, and Operation* for further information about CRR.

## Backing Up and Recovering Migrated Files

Almost every storage group should be backed up regularly. The only ones that you would not back up are those that contain files that you can afford to lose at any time. Each time you back up SFS storage groups that are managed by DFSMS/VM, the files that have been migrated to secondary storage are also backed up.

**Note:** The SFS FILEPOOL BACKUP utility makes copies of data migrated to ML1; however, for ML2 it only makes copies of the ML2 entries in the DFDSM database. No copy is made of the data migrated to ML2 since ML2 data probably resides on tape. Backing up the ML2 entries provides you with the ability to recover ML2 data after a loss of the primary storage entry (either the whole storage group or the individual files can be recovered from a media failure or accidental erasure.) This type of support requires no tape mounts for either backup or recovery. It is recommended that DFSMS management class definitions be coordinated with installation backup procedures to guarantee every file is backed up before it is eligible to be migrated.

The following commands are available to back up and recover files that are in SFS storage groups: FILEPOOL BACKUP, FILEPOOL RESTORE, and FILEPOOL FILELOAD. These commands process the secondary storage files during backup and recovery of the primary storage group.



To issue these commands, you must have at least read-authority to the DFSMS control file and to the DFSMS/VM product disk. When you issue the FILEPOOL BACKUP command, all files that have been migrated to secondary storage are backed up. When you issue the FILEPOOL RESTORE command, all files that had been migrated and backed up are recovered to secondary storage in migrated status. When you issue the FILEPOOL FILELOAD command, all individual files are restored.

When deciding how to backup secondary storage, consider the location of the log files and work directory. Put the log files and work directory (because they do not require back up) in a storage group that is separate from other data. If they are put in the same storage group as data needing to be backed up, you cannot back up that data while DFSMS/VM is running because the log files and work directory files are open. Therefore, consider placing the log files and work directory in a storage group that is separate from other data, or plan to back up that storage group when DFSMS/VM is not running.

**Attention:**

If you already have another method for backing up and restoring storage groups, make sure that the migrated files are backed up and recovered at the same time as the primary files. Failure to do so may result in the loss of data.

## Storage Requirements

You need to plan how much storage space is required in order to install and use DFSMS/VM. This section provides some guidelines for determining space allocation for:

- DFSMS/VM product code and virtual machines
- Work area for DFSMS/VM
- ML1 storage requirements
- ML2 storage requirements
- Other DFSMS/VM files

### DFSMS/VM Product Code, Virtual Machines and Work Area

You can determine the storage requirements of the DFSMS/VM product code and virtual machines using the VMSES/E command VMFINS INSTALL. Refer to Table 2 on page 19 for the minimum storage requirements. Using the VMFINS INSTALL command with the PLAN option creates a planning information file that lists the size (how many blocks) and the block sizes (2K, 4K) of the product code and of the DFSMS/VM virtual machines. You can then convert the size and block size to cylinders for your particular DASD type using the VMSES/E VMFCNVT command. See [z/VM: VMSES/E Introduction and Reference](#) for more information about these commands.

<i>Table 2. Minimum Requirements for DFSMS/VM</i>		
<b>DFSMS/VM</b>	<b>4K blocks</b>	<b>3390 DASD</b>
Product Code	28800	164
DFSMS Master	2	1
RMS Master	2	1
Work Area	4000	N/A
<b>Note:</b> The numeric value for 3390 DASD is in cylinders.		

**Note:** If you are running only minidisk and space management or if you are running only ATL (automated tape library), the number of blocks for the work area can be 2000. You may need to increase the number of blocks to handle your concurrent activity requirements.

The space required to install a language feature is included in the above figures.

### ML1 Storage Requirements

Ideally, to be more efficient, store less active files on less expensive, slower-speed DASD, and more active files on more expensive, higher-speed DASD. DFSMS/VM helps you attain this efficiency if you specify the system's slower DASD as the location of ML1.

Because ML1 is specified as an SFS file space, you cannot directly specify slower DASD as the location of ML1. However, you can do it indirectly by choosing an SFS storage group where the minidisks that make up the group are on slower DASD.

How much DASD space you need for ML1 depends on your installation's data reference patterns and the management classes established. Use the following formula to estimate DASD space requirements for ML1:

$$\frac{\text{(Number of 4K blocks in all file pools to be managed)} \times \text{(Percentage of less active data expected to be stored on ML1)}}{3}$$

If you choose to migrate all files to ML2 (without any going to ML1), then your storage requirements for ML1 will be minimal.

### ML2 Storage Requirements

Because of its low cost, removability, and high capacity, tape should be your primary media for ML2 storage. Using tape as a storage resource frees up DASD space that can be used for ML1. You may migrate some files directly to ML2, bypassing ML1, depending on the management class assigned. Therefore, the minimum amount of space you need for ML2 should at least equal the storage requirements of ML1. However, if the TSM server is set up to use DASD as intermediate storage, plan to have enough DASD to hold the data before it is moved to tape. Some factors to consider are:

- When are operators available to mount tape?
- How long will you keep the data on ML2 DASD?
- Will there be an automated tape library available?

### Other DFSMS/VM Files

You need approximately 500 blocks of storage for DFSMS in the VMSYS file pool to hold the DFSMS/VM control file and other files that DFSMS/VM needs.

## Appendix A. Planning Activities Checklist

- \_\_ 1. Analyze your system environment. Consider how you can use DFSMS/VM functions on your system in general.
- \_\_ 2. Make sure your system environment is ready.
  - \_\_ a. Hardware
  - \_\_ b. Software

See the *Program Directory for DFSMS/VM Function Level 221* for detailed information about DFSMS/VM software requirements.
- \_\_ 3. VMSYS file pool established.
- \_\_ 4. Decide how to manage file pools.
  - \_\_ a. Choose the file pools to manage.
  - \_\_ b. Decide on management classes needed. Use [Appendix B, “Planning for ACS and Management Classes,”](#) on page 23 to record your decisions and file selection criteria.
  - \_\_ c. Choose method for ACS processing.
- \_\_ 5. Decide if you want DFSMS/VM to issue accounting records.
- \_\_ 6. Decide on a method to authorize users. The options are:
  - \_\_ a. Use RACF Security Server for z/VM, or an equivalent product.
  - \_\_ b. Use the authorization file DGTVAUTH DATA, a list of user IDs authorized to be storage administrators.
  - \_\_ c. Use a security product that uses the RACROUTE MACRO.
  - \_\_ d. Customize the installation-wide exit FSMVAUTH to use either a security product that does not use the RACROUTE MACRO, or an internally written method.
- \_\_ 7. Plan for installing DFSMS/VM.
  - \_\_ a. Decide on the number of server machines to set up for DFSMS/VM.
  - \_\_ b. Ensure that space required for DFSMS/VM product code and files is available.
    - DFSMS/VM product files
    - Master and server virtual machines minidisks
    - Migration level 1 storage
    - Log files
    - Work directory
  - \_\_ c. Decide on secondary storage (ML1, or both ML1 and ML2)
    - \_\_ i) Choose the location of ML1 (file pool and DASD).
    - \_\_ ii) Estimate the DASD space needed for ML1.
 

Refer to [“ML1 Storage Requirements”](#) on page 20 for information on estimating storage requirements.
    - \_\_ iii) Name a TSM server, if ML2 is used.
    - \_\_ iv) Estimate the DASD/tape space needed for ML2.
 

Refer to [“ML2 Storage Requirements”](#) on page 20 for information on estimating storage requirements.
  - \_\_ d. Decide how to log on the master and server virtual machines to start DFSMS/VM. Modify execs, if appropriate.
  - \_\_ e. Use CRR file pool if DFSMS is supporting more than one file pool.

## Planning Activities Checklist

- \_\_ 8. Schedule time to install and customize DFSMS/VM.
- \_\_ 9. Order any supporting documentation you may need.

---

## Appendix B. Planning for ACS and Management Classes

The management class assigned to a file is the key to how DFSMS/VM manages that file for you. You need to carefully consider what management classes your system and your users need and how to assign them. You can have as many management classes as you feel are needed to manage your files and it is not necessary to use every field on the work sheet. A sample work sheet is on page [Table 3 on page 24](#).

A blank work sheet is also provided for you to record your decisions. You can make as many copies of the work sheet on page [Table 4 on page 25](#) as you need. After DFSMS/VM is installed, use the work sheet to define the management classes through the ISMF Management Class Application panel and to help when writing your ACS routine or exit. See [“Backing Up and Recovering Migrated Files” on page 18](#) for more information on coordinating management class definitions with your installation’s backup procedures.

## ACS and Management Class Work Sheet (Sample)

<i>Table 3. ACS and Management Class Work Sheet (Sample)</i>			
<b>Field</b>			
Management class name <i>File name: 1–8 characters</i>	ORDRDEPT	BILLING	TEMPREPT
Description 1–120 characters	Customer orders for WRIGHT Products INC.	Customer invoices to be billed	Anyone’s temporary files
Expire after days nonusage <i>Values allowed:</i> 1–9999 NOLIMIT	365	NOLIMIT	NOLIMIT
Expire since creation <i>Values allowed:</i> 1–9999 (days) NOLIMIT	NOLIMIT	NOLIMIT	3
Expiration disposition <i>Values allowed:</i> DATA (only file data is erased) ALL (entire file is erased)	All	All	All
Migrate to ML1 after days of nonusage <i>Values allowed:</i> 0–9999 NOLIMIT	NOLIMIT	14	
Move to ML2 after days on ML1 <i>Values allowed:</i> 0–9999 NOLIMIT	0	10	
Space management technique <i>Values allowed:</i> MIGRATE NONE	MIGRATE	MIGRATE	NONE
ACS Selection Criteria	Any directory with a top- level name of ‘WRIGHT’ and the lowest-level name of ‘ORDER’.	The owner’s name starts with ‘PROD’ and the file name is not ‘PAYROLL’.	The owner’s name does not start with ‘PROD’ and the file type is ‘LISTING’ or begins with ‘TEMP’.

## ACS and Management Class Work Sheet

<i>Table 4. ACS and Management Class Work Sheet</i>			
<b>Field</b>			
Management class name <i>File name:</i> 1–8 characters			
Description 1–120 characters			
Expire after days nonusage <i>Values allowed:</i> 1–9999 NOLIMIT			
Expire since creation <i>Values allowed:</i> 1–9999 (days) NOLIMIT			
Expiration disposition <i>Values allowed:</i> DATA (only file data is erased) ALL (entire file is erased)			
Migrate to ML1 after days of nonusage <i>Values allowed:</i> 0–9999 NOLIMIT			
Move to ML2 after days on ML1 <i>Values allowed:</i> 0–9999 NOLIMIT			
Space management technique <i>Values allowed:</i> MIGRATE NONE			
ACS selection criteria			





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# Bibliography

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This topic lists the publications in the z/VM library. For abstracts of the z/VM publications, see [z/VM: General Information](#).

## Where to Get z/VM Information

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The current z/VM product documentation is available in [IBM Documentation - z/VM \(https://www.ibm.com/docs/en/zvm\)](https://www.ibm.com/docs/en/zvm).

## z/VM Base Library

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### Overview

- [z/VM: License Information](#), GI13-4377
- [z/VM: General Information](#), GC24-6286

### Installation, Migration, and Service

- [z/VM: Installation Guide](#), GC24-6292
- [z/VM: Migration Guide](#), GC24-6294
- [z/VM: Service Guide](#), GC24-6325
- [z/VM: VMSES/E Introduction and Reference](#), GC24-6336

### Planning and Administration

- [z/VM: CMS File Pool Planning, Administration, and Operation](#), SC24-6261
- [z/VM: CMS Planning and Administration](#), SC24-6264
- [z/VM: Connectivity](#), SC24-6267
- [z/VM: CP Planning and Administration](#), SC24-6271
- [z/VM: Getting Started with Linux on IBM Z](#), SC24-6287
- [z/VM: Group Control System](#), SC24-6289
- [z/VM: I/O Configuration](#), SC24-6291
- [z/VM: Running Guest Operating Systems](#), SC24-6321
- [z/VM: Saved Segments Planning and Administration](#), SC24-6322
- [z/VM: Secure Configuration Guide](#), SC24-6323

### Customization and Tuning

- [z/VM: CP Exit Customization](#), SC24-6269
- [z/VM: Performance](#), SC24-6301

### Operation and Use

- [z/VM: CMS Commands and Utilities Reference](#), SC24-6260
- [z/VM: CMS Primer](#), SC24-6265
- [z/VM: CMS User's Guide](#), SC24-6266
- [z/VM: CP Commands and Utilities Reference](#), SC24-6268

- [z/VM: System Operation](#), SC24-6326
- [z/VM: Virtual Machine Operation](#), SC24-6334
- [z/VM: XEDIT Commands and Macros Reference](#), SC24-6337
- [z/VM: XEDIT User's Guide](#), SC24-6338

## Application Programming

- [z/VM: CMS Application Development Guide](#), SC24-6256
- [z/VM: CMS Application Development Guide for Assembler](#), SC24-6257
- [z/VM: CMS Application Multitasking](#), SC24-6258
- [z/VM: CMS Callable Services Reference](#), SC24-6259
- [z/VM: CMS Macros and Functions Reference](#), SC24-6262
- [z/VM: CMS Pipelines User's Guide and Reference](#), SC24-6252
- [z/VM: CP Programming Services](#), SC24-6272
- [z/VM: CPI Communications User's Guide](#), SC24-6273
- [z/VM: ESA/XC Principles of Operation](#), SC24-6285
- [z/VM: Language Environment User's Guide](#), SC24-6293
- [z/VM: OpenExtensions Advanced Application Programming Tools](#), SC24-6295
- [z/VM: OpenExtensions Callable Services Reference](#), SC24-6296
- [z/VM: OpenExtensions Commands Reference](#), SC24-6297
- [z/VM: OpenExtensions POSIX Conformance Document](#), GC24-6298
- [z/VM: OpenExtensions User's Guide](#), SC24-6299
- [z/VM: Program Management Binder for CMS](#), SC24-6304
- [z/VM: Reusable Server Kernel Programmer's Guide and Reference](#), SC24-6313
- [z/VM: REXX/VM Reference](#), SC24-6314
- [z/VM: REXX/VM User's Guide](#), SC24-6315
- [z/VM: Systems Management Application Programming](#), SC24-6327
- [z/VM: z/Architecture Extended Configuration \(z/XC\) Principles of Operation](#), SC27-4940

## Diagnosis

- [z/VM: CMS and REXX/VM Messages and Codes](#), GC24-6255
- [z/VM: CP Messages and Codes](#), GC24-6270
- [z/VM: Diagnosis Guide](#), GC24-6280
- [z/VM: Dump Viewing Facility](#), GC24-6284
- [z/VM: Other Components Messages and Codes](#), GC24-6300
- [z/VM: VM Dump Tool](#), GC24-6335

## z/VM Facilities and Features

---

### Data Facility Storage Management Subsystem for z/VM

- [z/VM: DFSMS/VM Customization](#), SC24-6274
- [z/VM: DFSMS/VM Diagnosis Guide](#), GC24-6275
- [z/VM: DFSMS/VM Messages and Codes](#), GC24-6276
- [z/VM: DFSMS/VM Planning Guide](#), SC24-6277

- [z/VM: DFSMS/VM Removable Media Services](#), SC24-6278
- [z/VM: DFSMS/VM Storage Administration](#), SC24-6279

## Directory Maintenance Facility for z/VM

- [z/VM: Directory Maintenance Facility Commands Reference](#), SC24-6281
- [z/VM: Directory Maintenance Facility Messages](#), GC24-6282
- [z/VM: Directory Maintenance Facility Tailoring and Administration Guide](#), SC24-6283

## Open Systems Adapter

- [Open Systems Adapter-Express Customer's Guide and Reference](#) (<https://www.ibm.com/support/pages/node/6019492>), SA22-7935
- [Open Systems Adapter-Express Integrated Console Controller User's Guide](#) (<https://www.ibm.com/support/pages/node/6019810>), SC27-9003
- [Open Systems Adapter-Express Integrated Console Controller 3215 Support](#) ([https://www.ibm.com/docs/en/SSLTBW\\_2.1.0/com.ibm.zos.v2r1.ioa/ioa.htm](https://www.ibm.com/docs/en/SSLTBW_2.1.0/com.ibm.zos.v2r1.ioa/ioa.htm)), SA23-2247
- [Open Systems Adapter/Support Facility on the Hardware Management Console](#) ([https://www.ibm.com/docs/en/SSLTBW\\_2.1.0/com.ibm.zos.v2r1.ioa/ioa.htm](https://www.ibm.com/docs/en/SSLTBW_2.1.0/com.ibm.zos.v2r1.ioa/ioa.htm)), SC14-7580

## Performance Toolkit for z/VM

- [z/VM: Performance Toolkit Guide](#), SC24-6302
- [z/VM: Performance Toolkit Reference](#), SC24-6303

## RACF Security Server for z/VM

- [z/VM: RACF Security Server Auditor's Guide](#), SC24-6305
- [z/VM: RACF Security Server Command Language Reference](#), SC24-6306
- [z/VM: RACF Security Server Diagnosis Guide](#), GC24-6307
- [z/VM: RACF Security Server General User's Guide](#), SC24-6308
- [z/VM: RACF Security Server Macros and Interfaces](#), SC24-6309
- [z/VM: RACF Security Server Messages and Codes](#), GC24-6310
- [z/VM: RACF Security Server Security Administrator's Guide](#), SC24-6311
- [z/VM: RACF Security Server System Programmer's Guide](#), SC24-6312
- [z/VM: Security Server RACROUTE Macro Reference](#), SC24-6324

## Remote Spooling Communications Subsystem Networking for z/VM

- [z/VM: RSCS Networking Diagnosis](#), GC24-6316
- [z/VM: RSCS Networking Exit Customization](#), SC24-6317
- [z/VM: RSCS Networking Messages and Codes](#), GC24-6318
- [z/VM: RSCS Networking Operation and Use](#), SC24-6319
- [z/VM: RSCS Networking Planning and Configuration](#), SC24-6320

## TCP/IP for z/VM

- [z/VM: TCP/IP Diagnosis Guide](#), GC24-6328
- [z/VM: TCP/IP LDAP Administration Guide](#), SC24-6329
- [z/VM: TCP/IP Messages and Codes](#), GC24-6330

- *z/VM: TCP/IP Planning and Customization*, SC24-6331
- *z/VM: TCP/IP Programmer's Reference*, SC24-6332
- *z/VM: TCP/IP User's Guide*, SC24-6333

## Prerequisite Products

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### Device Support Facilities

- Device Support Facilities (ICKDSF): User's Guide and Reference ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350033/\\$file/ickug00\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350033/$file/ickug00_v2r5.pdf)), GC35-0033

### Environmental Record Editing and Printing Program

- Environmental Record Editing and Printing Program (EREP): Reference ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350152/\\$file/ifc2000\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350152/$file/ifc2000_v2r5.pdf)), GC35-0152
- Environmental Record Editing and Printing Program (EREP): User's Guide ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350151/\\$file/ifc1000\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5gc350151/$file/ifc1000_v2r5.pdf)), GC35-0151

## Related Products

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### z/OS

- *Common Programming Interface Communications Reference* (<https://publibfp.dhe.ibm.com/epubs/pdf/c2643999.pdf>), SC26-4399
- z/OS and z/VM: Hardware Configuration Definition Messages ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sc342668/\\$file/cbdrm100\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sc342668/$file/cbdrm100_v2r5.pdf)), SC34-2668
- z/OS and z/VM: Hardware Configuration Manager User's Guide ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sc342670/\\$file/eequ100\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sc342670/$file/eequ100_v2r5.pdf)), SC34-2670
- z/OS: Network Job Entry (NJE) Formats and Protocols ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa320988/\\$file/hasa600\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa320988/$file/hasa600_v2r5.pdf)), SA32-0988
- z/OS: IBM Tivoli Directory Server Plug-in Reference for z/OS ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa760169/\\$file/glpa300\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa760169/$file/glpa300_v2r5.pdf)), SA76-0169
- z/OS: Language Environment Concepts Guide ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380687/\\$file/ceea800\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380687/$file/ceea800_v2r5.pdf)), SA38-0687
- z/OS: Language Environment Debugging Guide ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5ga320908/\\$file/ceea100\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5ga320908/$file/ceea100_v2r5.pdf)), GA32-0908
- z/OS: Language Environment Programming Guide ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380682/\\$file/ceea200\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380682/$file/ceea200_v2r5.pdf)), SA38-0682
- z/OS: Language Environment Programming Reference ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380683/\\$file/ceea300\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380683/$file/ceea300_v2r5.pdf)), SA38-0683
- z/OS: Language Environment Runtime Messages ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380686/\\$file/ceea900\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380686/$file/ceea900_v2r5.pdf)), SA38-0686
- z/OS: Language Environment Writing Interlanguage Communication Applications ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380684/\\$file/ceea400\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa380684/$file/ceea400_v2r5.pdf)), SA38-0684
- z/OS: MVS Program Management Advanced Facilities ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa231392/\\$file/ieab200\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa231392/$file/ieab200_v2r5.pdf)), SA23-1392
- z/OS: MVS Program Management User's Guide and Reference ([https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa231393/\\$file/ieab100\\_v2r5.pdf](https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosv2r5sa231393/$file/ieab100_v2r5.pdf)), SA23-1393



## **XL C++ for z/VM**

- [XL C/C++ for z/VM: Runtime Library Reference](#), SC09-7624
- [XL C/C++ for z/VM: User's Guide](#), SC09-7625

## **Additional Publications**

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This section lists other publications that you may find helpful.

*z/OS: XL C/C++ Programming Guide*, SC09-4765

*ISPF for VM Dialog Management Guide*, SC34-4009

*Tivoli® Storage Manager for OS/390® Edition: VM Server Program*, GI10-0556

*Tivoli Storage Manager for VM Program Directory*, GI10-0557

*IBM Enhanced 3490E Model F Tape Subsystem Installation, Planning, and Operator's Guide*, GG32-0378

*IBM TotalStorage® Enterprise Automated Tape Library (3494) Introduction and Planning Guide*, GA32-0448

*IBM TotalStorage Enterprise Automated Tape Library (3494) Operator's Guide*, GA32-0449

*IBM Magstar® Virtual Tape Server: Implementation Guide*, SG24-2229

*IBM Magstar 3494 Tape Libraries: A Practical Guide*, SG24-4632

*Lights Out! Advanced Tape Automation Using VM/ESA*, GG24-4347

*IBM Compiler and Library for SAA REXX/370 User's Guide and Reference*, SH19-8160



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Product Number: 5741-A09

Printed in USA

SC24-6277-73

