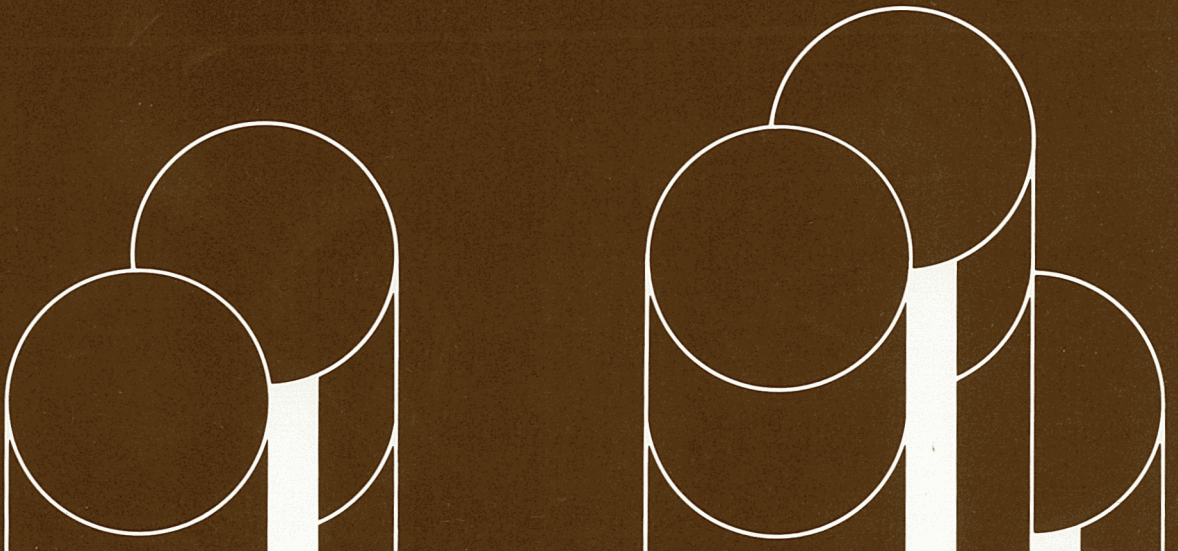IBM Disk Storage
Management Guide

Error Handling

Cross-System

IBM

IBM Disk Storage
Management Guide

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Cross-System

Any reference to an IBM program product in this document is not intended to state or imply that only IBM's program product may be used. Any functionally equivalent program may be used instead.

Preface

The *IBM Disk Storage Management Guide* provides tutorial information and guidance to help you with the physical management of your disk storage. The information is intended for IBM disk storage customers. It is written especially for operations personnel, including operators and system programmers, and others who may have responsibility for disk storage management tasks.

The material is in separate manuals, organized as a set. Each manual has a separate order number, but the manuals as a set have a common Bill of Form Publication Number, GBOF 1205. Manuals in the *IBM Disk Storage Management Guide* are:

Background Reference Information	GA26-1675
Error Handling	GA26-1672

The material in the Guide applies to the following products.

Disk Storage: 3330, 3340, 3344, 3350, 3370, 3375, 3380

Storage Control: 3830-2, ISC, IFA, DDA, FTA, 3880-1, 2, 3, 11, 13

Operating Systems: OS/MVS, OS/VS1. Error records generated under the control of DOS/VSE and VM/370 can be processed by the System Exception reports installed under OS/VS1 and OS/MVS.

IBM Disk Storage Management Guide, Error Handling

This *Error Handling* manual discusses data and equipment errors that can occur in disk storage operations. The focus is on data errors because the Device Support Facilities program enables you to handle this type of error directly. New reports produced by the Environmental Recording, Editing, and Printing (EREP) program are described. These reports help you decide when and how to use the Device Support Facilities program.

Prerequisite

You should be familiar with error definitions given in the *Disk Storage Management* manual, *Background Reference Information*, Publication Number GA26-1675. Refer to the section, "Error Description."

Terminology

The term *recovery* is used to encompass several functions:

- Recovery from an error – meaning to overcome an error by automatic correction or retry and thus allow the operation that was in progress to be continued. These error recovery procedures are performed by the subsystem and system, as described in *Background Reference Information*, Publication No. GA26-1675.

- Recovery from the cause of an error at the source, which is the subject of this *Error Handling* manual.

- Recovery of data, meaning to restore and reconstruct data from another source.

A *hardware service representative* is called a *customer engineer* in IBM.

Programs

Information in the *Error Handling* manual refers to:

- Environmental Recording, Editing, and Printing (EREP) program release 1.3 with the System Exception reports feature.

- Device Support Facilities release 6 and above.

Bibliography

Terminology

	Order Number
IBM Vocabulary for Data Processing Telecommunications, and Office Systems	GC20-1699

Disk Storage

Reference Manual for IBM 3330 Series Disk Storage	GA26-1615
Reference Manual for IBM 3340/3344 Disk Storage	GA26-1619
Reference Manual for IBM 3350 Direct Access Storage	GA26-1638
IBM 3370 Direct Access Storage Description	GA26-1657
IBM 3375 Direct Access Storage Description and User's Guide	GA26-1666
IBM 3380 Direct Access Storage Description and User's Guide	GA26-1664

Storage Control

IBM 3830-2 Storage Control GA26-1617
gives detailed descriptions of
channel commands, and status and
sense information.

IBM Integrated Storage Control GA26-1620
gives detailed descriptions of
channel commands, and status and
sense information.

IBM 3880 Storage Control Description gives detailed descriptions
of channel commands, and status and
sense information.

For 3880 Models 1, 2, and 3	GA26-1661
For 3880 Model 11	GA32-0060
For 3880 Model 13	GA32-0062

IBM Systems/370 Model 115 GA33-1510
Functional Characteristics for
direct disk attachment (DDA).

IBM System/370 Model 125 GA33-1506
Functional Characteristics for
direct disk attachment (DDA).

IBM System/370 Model 135 GA33-3005
Functional Characteristics for
integrated file adapter (IFA).

IBM 4331 Processor Functional GA33-1526
Characteristics for Direct
Storage Device Adapter.

IBM 4341 Processor Functional GA24-3672
*Characteristics and Processor
Complex Configurator*

Programs

Data Facility Data Set Services: SC26-3949
User's Guide and Reference
describes dump and restore functions
for system and standalone users.

Device Support Facilities GC35-0033
describes the commands to initialize
and maintain disk storage volumes
for system and standalone users.

DOS/VSE Messages GC33-5379
lists and interprets the
messages that the system
issues for DOS users.

DOS/VSE System Utilities GC33-5381
describes the utility programs
for DOS users.

Environmental Recording, Editing, GC28-0772
and Printing (EREP) Program
describes the functions of this
program, and the keyword parameters
and control statements for the system
programmer. The manual includes
instructions on preparing the DASDID
and LIMIT control statements used
for the System Exception reports.

OS/VS Message Library: GC38-1001
VS1 System Messages

OS/VS1 Utilities Manual GC26-3901
describes the capabilities of
the OS/VS1 utility programs
and the control statements
used with each for OS/VS1 users.

OS/VS2 Message Library: GC38-1002
VS2 System Messages
describes the messages
issued on the system operator
consoles for OS/VS2 users.

OS/VS2 MVS Utilities GC26-3902
describes how to use OS/VS
utilities under OS/VS2 MVS.
It includes information on
IEHMOVE, IEBGENER, IEBCOPY,
and IEHLIST for MVS users.

VM/370 System Messages GC20-1808
contains both messages and
codes produced by the VM/370.

Table of Contents

Introduction

Reliable and effective performance of your data processing system depends on recognizing and handling errors that may occur in disk storage operations. Techniques are built into the subsystem and system to detect error conditions, and recover from most errors automatically. However, some errors cannot be corrected internally, and others, even though corrected at the time, continue to recur because the cause of the error persists. When this happens, you can evaluate the error situation in relation to your installation, and take appropriate action.

Information and program functions are now provided to allow you to deal directly with disk storage errors. You use these resources to interpret an error situation, and in some cases, remedy the cause of the error to prevent its recurrence. You will benefit by:

- Averting the need to call for outside service for problems that previously required such service
- Maintaining control of your stored data
- Reducing the time spent in problem determination
- Improving the performance of your system

Error Information

First you need information that an error has, in fact, occurred. Then, sufficient details about the error must be obtained to evaluate whether action should be taken, where it should be applied, and the means to be used to recover from the cause of the error.

There are different ways of obtaining error information.

- Messages are displayed at a terminal or console to give immediate notification of an error.
- Lists of error messages may be printed or displayed later to allow review of events that occurred during a given time period.
- Reports based on analysis of error information may be produced to diagnose an error situation.

Traditional Types of Information

Traditional types of error information may not provide the information in a form you need to evaluate an error situation.

System console messages give immediate notification of an error. However, the content of the messages and the conditions that cause them to be issued varies depending on the component or program in control. Most error messages contain information on the type and location of errors and give sense information in hexadecimal code. But the information may not receive attention because it is displayed for such a short time, and messages of disk storage equipment and data checks are not highlighted nor do they require operator action.

Messages displayed at a system console may be stored for later examination. When a system log is printed, all of the messages that were displayed are listed. When a job log is printed, messages applying to the particular job are listed. In both cases, messages on disk storage errors must be extracted from many other messages.

Besides system messages, most programs have procedures for notifying the user of errors, and the user may alert operations personnel that an error has occurred.

The Environmental Recording, Editing, and Printing (EREP) program produces reports based on the contents of a system's error log. Traditionally these reports have been used mostly by service representatives.

New Types of Information – System Exception Reports

To improve the usefulness of error reporting, the EREP program now produces a set of new reports to help you determine the nature of error incidents and make decisions regarding possible recovery actions. These are called System Exception reports.

The System Exception reports describe the type and location of errors and give other needed details. The reports for disk storage:

- Cover all the systems that share the disk storage. The log records of each system are used as a basis for a multisystem report.

- Cover temporary as well as permanent errors. (Temporary errors are those where the data is corrected or the operation is successfully retried automatically.)

- Determine the probable source of the error.

The source of an error is a more reliable basis for recovery than the type of error because a type of error may have different sources. For instance, a data check type of error may be caused by a problem in the controller hardware or by a defect on the disk surface. The source of an error points to where recovery action should be applied and the means to use for recovery.

The EREP reports will be most useful to you in handling data errors. (Data errors are errors detected in the data when it is read.) The reports also provide information that will help you decide if and when to call for a service representative.

Probable Failing Unit

The probable source of an error as defined by the EREP program is referred to as a *probable failing unit* in the System Exception reports.

The categories of probable failing units for disk storage are as follows:

Channel   Refers to a channel of a processor.

Storage control Refers to a 3830, ISC, IFA, DDA, FTA, or 3880. If it is a 3880, it refers to a storage director.

Controller   Refers to the controller of a string of disk storage, usually housed in the A unit of the string.

Device   Refers to the drive and access mechanism physical components.

Volume   Refers to the disks associated with a volume serial number; that is, the disks that can be accessed with a given I/O address.

If the probable failing unit is the channel, storage control, controller, or device, the source of the error is defined as the hardware. The error may be detected during a write, read, or control operation.

If the probable failing unit is defined as a volume, the source of the error is the disk media or something associated with writing or reading data at the media. The exact cause of an error on a volume may be a defect on the disk surface, a change in alignment of the access mechanism, or some unknown contributor such as an electrical interference or temperature deviation during a write or read operation. The error is detected during a read operation and is always a data type error.

Resources for Recovery from Errors

The means used for recovery from an error depends on the source of the error.

Hardware – Service Representative

When the source of an error is a probable failing unit of hardware, a hardware service representative (customer engineer) performs the recovery action. The service representative uses EREP reports and other tools to further isolate the cause of the error.

When the cause of the problem is established, it is usually possible to replace the failing component, which may be a logic card, power component, or other such field replaceable unit (FRU).

Volume – Device Support Facilities

When the source of an error is a probable failing unit of a volume, you use the Device Support Facilities program for recovery. You control recovery actions by using Device Support Facilities commands to perform the functions needed.

A frequent cause of a data type error is a defect on the disk surface. (The term defect applies to anything that interferes with the precise magnetic recording on the surface.) Although the probability is low that such a defect will result in a permanent data error, when it does occur, there are potentially serious consequences in terms of loss of data. You can use Device Support Facilities to treat a problem that is causing a permanent data error or excessive temporary errors.

For error handling, Device Support Facilities checks the surface of the disks and, if defects are confirmed, automatically makes provisions to bypass the defective area.

In addition to checking and bypassing defects in user records, Device Support Facilities has extensive means for reconstructing a home address when data errors occur in this area and then for rewriting home addresses and record zeros.

Checking and bypassing functions are used after it has been determined that the source of a data error is the volume (or media) and not the hardware. This information is provided in the EREP System Exception reports. The EREP program determines a probable failing unit by analysis of error information in the system log. The Device Support Facilities has a function that also helps to distinguish if the hardware is suspected to be the cause of a data error. This is determined by testing certain hardware functions.

Description of Resources

This section describes the System Exception reports printed by the EREP program and the error handling functions provided by the Device Support Facilities program. Later, guidelines will be given on how to use information from the System Exception reports to perform Device Support Facilities functions.

System Exception Reports Description

The EREP program prints a full set of System Exception reports in a single job step; however, you need only three of these reports for information on disk storage errors. The other System Exception reports apply to other components or are intended primarily for service representatives.

The three System Exception reports you will use for disk storage error handling are:

- System Error Summary (Part 2)
- Subsystem Exception, DASD
- DASD Data Transfer Summary

Later, each report will be illustrated along with instructions on how to read it.

System Error Summary (Part 2)

The System Error Summary (Part 2) report applies to disk storage and tape storage. The report lists *each incident of a permanent I/O error*. The type of error may be a data check or an equipment check. The errors are in sequence according to the time they occurred. Each error incident has the *job name* of the job in progress. A *probable failing unit* is given for each of the errors.

This report is helpful if there is a problem while running a particular job and you want to determine if any type of I/O error occurred at the time. The report also is helpful in giving a quick perspective of all permanent I/O errors during the time covered by the report.

Subsystem Exception, DASD

The Subsystem Exception, DASD, report applies only to *disk storage*. The report lists *accumulated permanent and temporary errors*. The accumulated errors are given for each unit in the probable failing unit category. For example, each volume with errors is listed in the volume category. The accumulated total will include each permanent error listed in the System Error Summary (Part 2). Description of the type of error depends on the probable failing unit.

- If the probable failing unit is a *hardware* component, permanent and temporary errors can be a *data, control, or equipment type of error*.

- If the probable failing unit is a *volume*, both permanent and temporary errors are *always a data type of error*.

The hardware probable failing units are listed first and the volume probable failing units are listed last.

Usage, in terms of *number of thousands seeks and number of megabytes read,* is given for each unit reporting errors. This information can be used along with the total number of errors for the unit to assist in evaluating whether recovery action should be taken.

The DASD exception report will bring to your attention any problems related to disk storage operation that may need further investigation and treatment. If the span of error records in the report covers more than three days, a message is printed at the top of the report. A report that spans longer than three days may not provide the most accurate probable failing unit indication because corrective action may have been taken.

To improve the report's usefulness, *you can establish limits for the number of temporary data errors* acceptable in your installation. Probable failing units with temporary data errors below this limit will not be printed. Limits can be set for each type of error and for each storage control type and disk storage type. (Limits should not be set for 3375 and 3380s because temporary data errors have a threshold established in the subsystem.) Limit control statements are used to make these specifications. If there are units that have errors that are not reported because the errors did not exceed the limit, a message gives the total number of such units.

DASD Data Transfer Summary

The DASD Data Transfer Summary report also applies to *disk storage* but *only to data check type errors.* It gives *details* of data errors. All volumes that were listed in the DASD exception report (where they are listed with a total count of errors) are given in this report with details of the data errors for that volume.

Detailed information is provided for all permanent data errors, because permanent errors are logged in the system error log. For temporary errors, the information is provided *if* the error description (not just the count) is logged in the system error log. Whether a temporary error is logged depends on the disk storage product type and the area in which the error occurs. Logging is described in the manual, *Background Reference Information,* Publications No. GA26-1675.

The DASD Data Transfer Summary has two sections, one for *Volume* probable failing units and one for *Other* probable failing units. The same type of information about the data errors is provided in both sections, but the means for recovery action is different.

For data errors in the *Volume* section, you can use Device Support Facilities for recovery action.

For data errors in the *Other* section, a service representative is needed.

System Exception Reports, Comparison Summary

System Error Summary	Subsystem Exception, DASD	DASD Data Transfer Summary
Tape and disk storage devices	DASD devices	DASD devices
Permanent errors: equipment and data checks	Permanent and temporary errors: equipment and data checks	Permanent and temporary errors: data checks
Each incident	Accumulated totals	Details by volume
Probable failing unit: hardware and volume	Probable failing unit: hardware and volume	Probable failing unit: volume and other
	Number of thousands of seeks Number of megabytes read	

Device Support Facilities Description

The Device Support Facilities program has functions for initialization and maintenance of disk storage volumes. Commands for error handling appear in both categories.

Error Handling Functions

The Device Support Facilities program provides for checking disk surfaces to determine if there are defects on the media. (Data cannot consistently be written correctly on a defective area, and this results in detection of errors when the data is read.) If there are defects on the surface, the program arranges to bypass them, so that no new data is written in the defective area. These surface checking functions are specified with parameters of the INSPECT and INIT commands.

Surface Checking

Surface checking is done by writing and reading sets of special bit patterns. The checks range in complexity from primary tests to advanced tests. The advanced tests require more time and, in general, provide more reliable surface inspection.

Writing special bit patterns on the track for surface checking destroys any data already on the track. Before the write and read tests are started, user data can sometimes be saved by the Device Support Facilities program or it can be moved to a backup device by using a dump or copy program.

Checking can be done on individual tracks or blocks, or on all of the tracks or blocks of a volume.

The determination as to whether there is a defect is based on the repeatability of errors. If errors recur in the same area, that area of the track is determined to be defective.

The INSPECT command of Device Support Facilities provides for surface checking of specific tracks or blocks suspected of having a problem. When checking specific tracks or blocks, the advanced tests for the particular disk storage type are used where applicable. The Preserve parameter causes existing data to be saved, if it can be read.

All tracks or blocks can be checked with the INIT command. Checking all of a volume is first done with a set of primary patterns that accomplish a high-level sifting to expose possible errors. The suspected errors are then subjected to an advanced, and more time-consuming, set of patterns where applicable. With the INIT command, Device Support Facilities does not preserve data; therefore, you must use another program to copy the entire volume to another device before using the INIT command or the data will be destroyed. Use of the INIT command is not limited to the installation process.

For count, key, and data devices, all tracks also can be checked with the INSPECT command. INSPECT All Tracks performs the same type of checking as INIT Check. However, the process is generally faster with the INIT command. This is because an entire volume usually can be copied faster before executing INIT than data can be preserved a track or block at a time, as required while executing INSPECT All Tracks.

Bypassing Defects

If surface defects are confirmed by surface checking with the advanced tests, the defects are bypassed automatically.

Bypassing Defects on Count, Key, and Data Devices

When defects are confirmed, the defective area on a track is skipped and another location on the same track is used. A certain number of defective areas on a track can be skipped. Space at other locations on the track is already reserved so it does not subtract from that available for user records when making space calculations. If this reserved space is exhausted, the entire track is surface-checked again. If too many defects remain, the track is flagged as defective and an alternate track is assigned. This technique of skip displacement applies for the 3340, 3344, 3350, 3375, and 3380. The number of skips that can be made per track differs for device types:

3340 and 3344	1 skip
3350	3 skips
3375 and 3380	7 skips

With the 3330, defective areas on a track cannot be skipped. Instead, an alternate track is assigned if there are defects on the track. This applies only for permanent data errors.

All disk storage types reserve certain tracks for assignment as alternates.

In addition to the program automatically bypassing defects, the user can specify that alternate tracks are to be unconditionally assigned to specific tracks. With this function, Device Support Facilities does not perform checking functions.

When defective areas on a track are skipped or an alternate track is assigned to replace a defective primary track, the Device Support Facilities program handles all of the associated record keeping. When defective areas are skipped, the skip displacement information is recorded in the home address area of the track. If an alternate track is assigned, the defective track is flagged in the home address area, and record 0 is rewritten. (Record 0 carries the alternate and primary track associations: R0 of the defective primary track contains the address of the alternate track, and R0 of the alternate track contains the address of the defective primary track.)

When specific tracks or all tracks are checked, the home address and record zero are always rewritten.

If tracks previously flagged as defective are found to be usable while surface checking with the INSPECT or INIT command, they are reclaimed for use if the Reclaim option is specified.

Bypassing Defects on Fixed-Block Architecture Devices

With fixed-block architecture devices, defective blocks are flagged defective and an alternate block is assigned. The alternate block is usually on the same cylinder if a block is available.

The user can specify that alternate blocks are to be unconditionally assigned for specific blocks. With this function, Device Support Facilities does not perform surface checking.

When alternate blocks are assigned, Device Support Facilities handles all of the associated record keeping. The alternate block information is recorded in the ID area that precedes the data area.

If blocks previously flagged as defective are found to be usable while surface checking with the INIT command, the blocks are reclaimed for use with the Reclaim option of the INIT command.

Rewriting Home Address and Record Zero

After checking the surface of specific tracks or all tracks, Device Support Facilities rewrites the home address and record zero on count, key, and data devices. If the program detects data errors in the home address or record zero while performing surface checking, it handles the problem automatically.

Besides Device Support Facilities detection of home address errors while surface checking, data errors in the home addresses may be recognized from sense information in error reports. In this case, functions are available for you to deliberately rewrite home addresses and record zeros.

If data checks occur in the home address of more than one track, there may also be a potential problem reading home addresses of other tracks. The problem usually can be handled by rewriting the home addresses of all the tracks on the volume with the Device Support Facilities INIT command with the Validate parameter. The addresses are rewritten without checking the surface for possible defects.

Device Support Facilities attempts to reconstruct and rewrite the home address in the original location on the track. If it is not possible to rewrite the home address in the same location, attempts are made to move it to a different location on the track on 3340, 3344, 3350, 3375, and 3380 devices. This relocation does not subtract from the available track capacity.

Hardware and Data Verification Tests

Functions provided with the ANALYZE command help distinguish whether a data error was caused by a hardware problem. These functions are for device types that have non-removable head and disk assemblies. Hardware tests exercise various hardware components by trying seek, write, and read operations. These operations are done on the tracks used for maintenance. Results are reported in diagnostic messages. With the ANALYZE command, only permanent errors are reported.

The ANALYZE command also has data verification tests to test the readability of user records.

Device Support Facilities Error Handling Functions, Comparison Summary

ANALYZE Command (No Scan)	INSPECT Command (Tracks)	INIT Command (Check)
Exercises hardware.	Surface-checks specific tracks (or blocks)	Surface-checks all tracks (or blocks) on volume.
	Writes and reads advanced test patterns.	Writes and reads primary test patterns. If defects are detected, writes and reads advanced test patterns.
Reports a drive failure in diagnostic message.	Bypasses surface defects. Rewrites HAs and ROs on count, key, and data devices.	Bypasses surface defects. Rewrites HAs and ROs on count, key, and data devices.

		INIT Command (Validate)
		Rewrites all HAs and ROs on count, key, and data devices. Does not check the surface.

How to Read the EREP System Exception Reports

The following pages show you how to read the EREP System Exception reports for information on data errors. It is suggested that you review these pages and then return to them for reference as needed.

Errors are categorized by type and recoverability.

- Error types described are equipment checks and data checks.

- Recoverability defines an error as temporary or permanent. A temporary error is one that was corrected or recovered with retry by the subsystem or system error recovery procedures. A permanent error is one that could not be corrected or recovered by these procedures.

How to Read the Title Line

The title of each EREP report appears at the top left side of the page. Titles as they appear in the EREP printout are shown for:

- System Error Summary (Part 2)
- Subsystem Exception DASD
- DASD Data Transfer Summary
  Probable Failing Unit - Volume
  Probable Failing Unit - Other

To the right of the title, in the center of the page, are dates. First is the date the report was printed. Below this are the dates of the period covered by the report.

The dates are based on a day-of-year calendar, where days are counted consecutively starting with January 1. The date is given as five numbers. The first three numbers are the days of the year. For example, 261 is September 18. (Many business calendars also give the day of the year in this manner.) The next two numbers are the last two numbers of the year, for example, 81.

```
O   DASD  DATA  TRANSFER  SUMMARY                    REPORT  DATE  261  81
    PROBABLE  FAILING  UNIT  -  OTHER                PERIOD  FROM  260  81
                                                             TO    261  81

O   DASD  DATA  TRANSFER  SUMMARY                    REPORT  DATE  261  81
    PROBABLE  FAILING  UNIT  -  VOLUME               PERIOD  FROM  260  81
                                                             TO    261  81

O   SUBSYSTEM   EXCEPTION                            REPORT  DATE  261  81
             DASD                                    PERIOD  FROM  260  81
                                                             TO    261  81

O   SYSTEM  ERROR  SUMMARY                           REPORT  DATE  261  81
         ( PART  2 )                                 PERIOD  FROM  260  81
                                                             TO    261  81

                            PHYSICAL
O     TIME         JOBNAME    CPU    ID      TYPE   PCUA   SCUA   VOLUME    ERROR  DESCRIPTION

    DATE  260/81

O   00:55:07:52   BATCH13     B   XX-74-03   3330   0783   0785   EDSWK3   PERMANENT  EQUIPMENT  C
    01:31:38:95   DPHSM313    B   78-7C-06   3350   079E   079E   HSM313   PERMANENT  DATA  CHECK
    01:43:56:36   DPHSM313    B   78-7C-06   3350   079E   079E   HSM313   PERMANENT  EQUIPMENT  C
    01:54:43:84   DPHSM313    A   78-7C-06   3350   079E   079E   HSM313   PERMANENT  DATA  CHECK
    01:40:21 ''   DD101APC    A   88-7C- '                                PERMANENT  DATA  C'
```

Figure 1. Titles in System Exception Reports

How to Read the System Error Summary (Part 2)

Item		Description
TIME	[1]	This column gives the date and time the errors occurred. The date shown in this column is the date the error occurred. All of the errors in the example were on the same day, 260/81 (September 17, 1981). The times shown in this column are for each of the permanent errors. The first four numbers apply to the hours and minutes. For example, the first error occurred at 00:55 (12:55 AM). The next four numbers are seconds and hundredths of seconds.
JOBNAME	[2]	This column gives the name of the job in progress when the permanent error occurred. The name is up to eight alphanumeric characters assigned by the programmer. In the example, two data checks occurred while job DPHSM313 was in progress.
CPU	[3]	The alphabetic characters in this column identify the CPU that received the error record. In the period covered in this report, three CPUs, with alphabetic identifiers B, A, and E, reported errors. At the bottom of the report, the alphabetic identifiers for all of the CPUs covered by the report are given with their model and serial numbers. In the example, CPU A is a S/370 Model 168 with serial number 090021. Two of the CPUs, C and D, had no permanent tape or disk storage errors during the period of the report.
PHYSICAL ID	[4]	This column shows a 6-digit physical ID required by the EREP program. The first two digits refer to the storage control, the next two to the controller, and the final two to the device (access mechanism) in use when the error occurred. For example, three permanent errors occurred when running job DPHSM313, while storage control 78, controller 7C, and device 06 were in use. The physical ID represents either a real physical ID set with switches or a physical ID made up especially for the EREP program.
TYPE	[5]	This column gives the product number. In the example, the 3330, 3350, and 3370 disk storage reported permanent errors. The 3420 tape storage also reported errors. **Note:** *The DASD reports of this same date may include other disk storage types, such as the 3380, which were not included in the System Summary, because they had no permanent errors. The DASD reports include both permanent and temporary errors.*
PCUA	[6]	You do not need the information in this column.
SCUA	[7]	This column shows a 3-digit unit address (preceded by a zero) that identifies a channel, storage control, controller, and device. The SCUA is the address actually used for selection and is the address from which sense information was received. In the example, disk storage with SCUAs of 785, 79E, 89C, and 383 reported data checks.
VOLUME	[8]	This column gives the 6-digit volume serial number that identifies the volume in use at the address when the errors occurred.
ERROR DESCRIPTION	[9]	This column defines the kind of error. They may be equipment or data checks. They are all permanent.
PROBABLE FAILING UNIT	[10]	This column names the probable source of the error as determined by the EREP program. It may be a channel, storage control, controller, device, or volume. In the sample report, there are two probable failing units of device and seven of volume.

Therefore, for each probable failing unit, we have a job name, a CPU, a physical ID, a product type, a unit address, and a volume serial number. If the probable failing unit is a volume, we need only the volume serial number to find the volume in the two DASD reports.

As a summary example: on 260/81 at 01:31, while job DPHSM313 was running on CPU B (168 serial 060740) at a 3350 (selected by unit address 79E), volume HSM313 had a permanent data check. The probable failing unit was the volume. [11]

```
                                                     ┌─┐  ┌─┐
                                                     │7│  │8│
  SYSTEM ERROR SUMMARY                               └─┘  └─┘  REPORT DATE 261 81
 ┌─┐     (PART 2)   ┌─┐   ┌─┐  ┌─┐      ┌─┐  ┌─┐              PERIOD FROM 260 81   ┌─┐                              ┌──┐
 │1│                │2│   │3│  │4│      │5│  │6│                     TO  261 81    │9│                              │10│
 └─┘                └─┘   └─┘  └─┘      └─┘  └─┘                                   └─┘                              └──┘
                                  PHYSICAL                                                                       PROBABLE
    TIME          JOBNAME   CPU    ID     TYPE  PCUA  SCUA  VOLUME   ERROR DESCRIPTION                           FAILING UNIT

  DATE 260/81

  00:55:07:52     BATCH13    B   XX-74-03  3330  0783  0785  EDSWK3   PERMANENT EQUIPMENT CHECK                   DEVICE
  01:31:38:95     DPHSM313   B   78-7C-06  3350  079E  079E  HSM313   PERMANENT DATA CHECK                        VOLUME
  01:43:56:36     DPHSM313   B   78-7C-06  3350  079E  079E  HSM313   PERMANENT EQUIPMENT CHECK                   DEVICE
  01:54:43:84     DPHSM313   A   78-7C-06  3350  079E  079E  HSM313   PERMANENT DATA CHECK                        VOLUME
  01:40:31:42     BP101APC   A   88-7C-04  3350  079C  089C  SPRTH4   PERMANENT DATA CHECK                        VOLUME
  01:43:26:34     BP101APC   A   88-7C-04  3350  079C  089C  SPRTH4   PERMANENT DATA CHECK                        VOLUME
  02:14:12:64     BP101APC   A   88-7C-04  3350  079C  089C  SPRTH4   PERMANENT DATA CHECK                        VOLUME
  13:10:33:28     SYSTEM     E   XX-11-03  3370  0383  0383  MARKCI   PERMANENT DATA CHECK                        VOLUME
  16:33:22:95     ESR        B    N/A      3420  0674  0674           END DATA/CRC CHECK                          .VOLUME

  *******************************************************************************************************************************

  CPU    MODEL    SERIAL NUMBER

  A      0168     090021
  B      0168     060740
  C      3033     020482
  D      3033     020024
  E      4341     011617
```

Figure 2. System Summary (Part 2) Example

How to Read the Subsystem Exception, DASD

Item	Description
PROBABLE FAILING UNIT [1]	This column is organized by probable failing unit categories: channel (CHAN), storage control unit (SCU), controller (CONT), device (DEV), and volume (VOL). All of the units in each category that had errors are listed with probable failing unit identifiers and product type number. The following digit identifiers are used to identify probable failing units. When a physical ID is used to identify a probable failing unit, the physical ID represents either a real physical ID set with switches or a physical ID made up especially for the EREP program based on an address. CHAN - channel address digit followed by xx (for example 02xx). SCU - physical ID of storage control or storage director (for example 18-xx-xx). CONT - physical ID of controller (for example, xx-22-xx). No controller is shown in the illustration. DEV - physical ID of controller and device (for example, xx-7C-06). VOL - serial number of volume (for example HSM313). For example, there was an error at a device probable failing unit with the physical ID xx-7C-06 on a 3350. There also was an error on a volume probable failing unit with serial number HSM313 on a 3350. (If both of the errors were reported from the same 3350, the physical addresses, to the right, will be the same.)
FAILURE AFFECT [2]	You do not need the information in this column.
CPU [3]	As in the System Error Summary (Part 2), the alphabetic identifiers in this column identify the CPU that received the error records. At the bottom of the report, the alphabetic identifiers for all of the CPUs covered by the report are given with their model and serial numbers.
PHYSICAL ADDRESS [4]	This column contains an identifier of a serviceable unit. It is a 3-digit physical address (preceded by a zero) or a 6-digit physical ID for units that have physical IDs (set with switches). For example, the physical address 79E, belonging to a 3350, is listed twice, once for device and once for volume.
TOTALS [5] PERM TEMP	This column gives the total permanent errors and total temporary errors for each unit with errors. For example, scanning down the probable failing unit column to volume, HSM313 had a total of 2 permanent errors and volume MARKCI had 1 permanent and 19 temporary errors. If the probable failing unit is a *volume*, the permanent and temporary error is *always a data error* associated with a read operation. Values for temporary data errors at a volume do not represent the same thing for all disk storage types. • For 3330, 3340, 3344, 3350, and 3370 disk storage types, the value is the *total number of data errors for that volume*. For example, volume MARKCI had a total of 19 temporary data errors. Because there can be only two digits in the temporary column, the highest number of temporary errors printed is 99. Even though 99 is printed, there may actually have been more than 99 temporary errors attributed to that probable failing unit. You may wish to establish limits that will apply to your installation. • For 3375 or 3380, the value is the *number of times the temporary data error rate threshold was exceeded on that volume.* For example, volume VM8001 exceeded the data error rate threshold one time. These device thresholds are established for the product by IBM, and the threshold value is the same for all devices of that product type.
IMPACT OF TEMPORARY ERRORS [6]	You do not need the information in these columns when the probable failing unit is a volume, because volume errors are always associated with a read operation. (The abbreviations are interpreted as follows: EQU CHK = equipment check, SKS = seeks, RD = read, OVRN = overrun. OTHER refers to items B, C, D, and I as defined on the top line across the columns.)
USAGE [7]	The usage column gives the total number of seeks (times 1000) and total number of megabytes read during the period the permanent or temporary errors occurred at that volume. For example, during the period when volume HSM313 had two permanent read errors, there were 18,000 seek operations and 504 megabytes read.
UNK [8]	A statement about unknowns may be printed after the regular listings. Such an unknown indicates that records were logged that should not have been, or a probable failing unit could not be determined from the sense information.

At the bottom of the report is the number of units excluded due to limits that were set by the installation on temporary errors reported. In the example, there were no units excluded.

SUBSYSTEM EXCEPTION
DASD [1]   [2]   [3]   [4]   [5]   REPORT DATE 261 81   [6]   [7]
PERIOD FROM 260 81
TO 261 81

B-BUSOUT PARITY CHK   C-CHECK DATA CHK   D-DISKETTE CHK   I-INVOKED OFFSETS

PROBABLE FAILING UNIT	FAILURE AFFECT	CPU	PHYSICAL ADDRESS	---TOTALS--- PERM	TEMP	---IMPACT OF TEMPORARY ERRORS--- EQU CHK	SKS	RD	OVRN	OTHER	---USAGE--- 1000 SKS	MB. READ
CHAN 02XX	CHAN/SCU		TOTAL		3					3	N/A	N/A
		A	0280		1					1	3	32
		A	02B3		2					2	99	1530
SCU 18-XX-XX 3830	CHAN/SCU		TOTAL		2	2					N/A	N/A
		B	0745		2	2					3	118
DEV XX-7C-06 3350	DEV		TOTAL	1							N/A	N/A
		B	079E	1							18	504
VOL SPRTH4 3350	DATAXFR		TOTAL	3							N/A	N/A
		A	079C	3							41	392
HSM313 3350	DATAXFR		TOTAL	2							N/A	N/A
		AB	079E	2							18	504
MARKCI 3370	DATAXFR		TOTAL	1	19	19					N/A	N/A
		E	0383	1	19	19					6	850
BALIBT 3330	DATAXFR		TOTAL		99	99					N/A	N/A
		B	0218		99	99					20	920
USPET 3340	DATAXFR		TOTAL		30	30					N/A	N/A
		B	0238		30	30					241	8343
VM8001 3380	DATAXFR		TOTAL		1	1					N/A	N/A
		C	06-10-00		1	1					131	3878
[8] UNK	UNKNOWN		TOTAL								N/A	N/A
		B	0709									

0 UNIT(S) EXCLUDED DUE TO LIMITS

CPU	MODEL	SERIAL NUMBER
A	0168	090021
B	0168	060740
C	3033	020482
D	3033	020024
E	4341	011617

** ENTRIES WITH AN ASTERISK INDICATE THAT DASDID CARDS WERE NOT FOUND FOR THE UNIT.
NOTE: "IMPACT OF TEMPORARY ERRORS" IS THE NUMBER OF TIMES ERROR THRESHOLD HAS BEEN EXCEEDED.
NOTE: BLANK ENTRIES INDICATE ZERO VALUES OR NOT APPLICABLE. N/A = NOT AVAILABLE.
NOTE: ZERO ENTRIES INDICATE RECORDS EXIST IN EREP REPORTS BUT THRESHOLDS WERE NOT EXCEEDED.

Figure 3. Subsystem Exception, DASD Example

How to Read the DASD Data Transfer Summary

Recall that this report has a *Volume* section and an *Other* section. Only the volume section will be explained. All of the errors in this section are data errors with volume probable failing units.

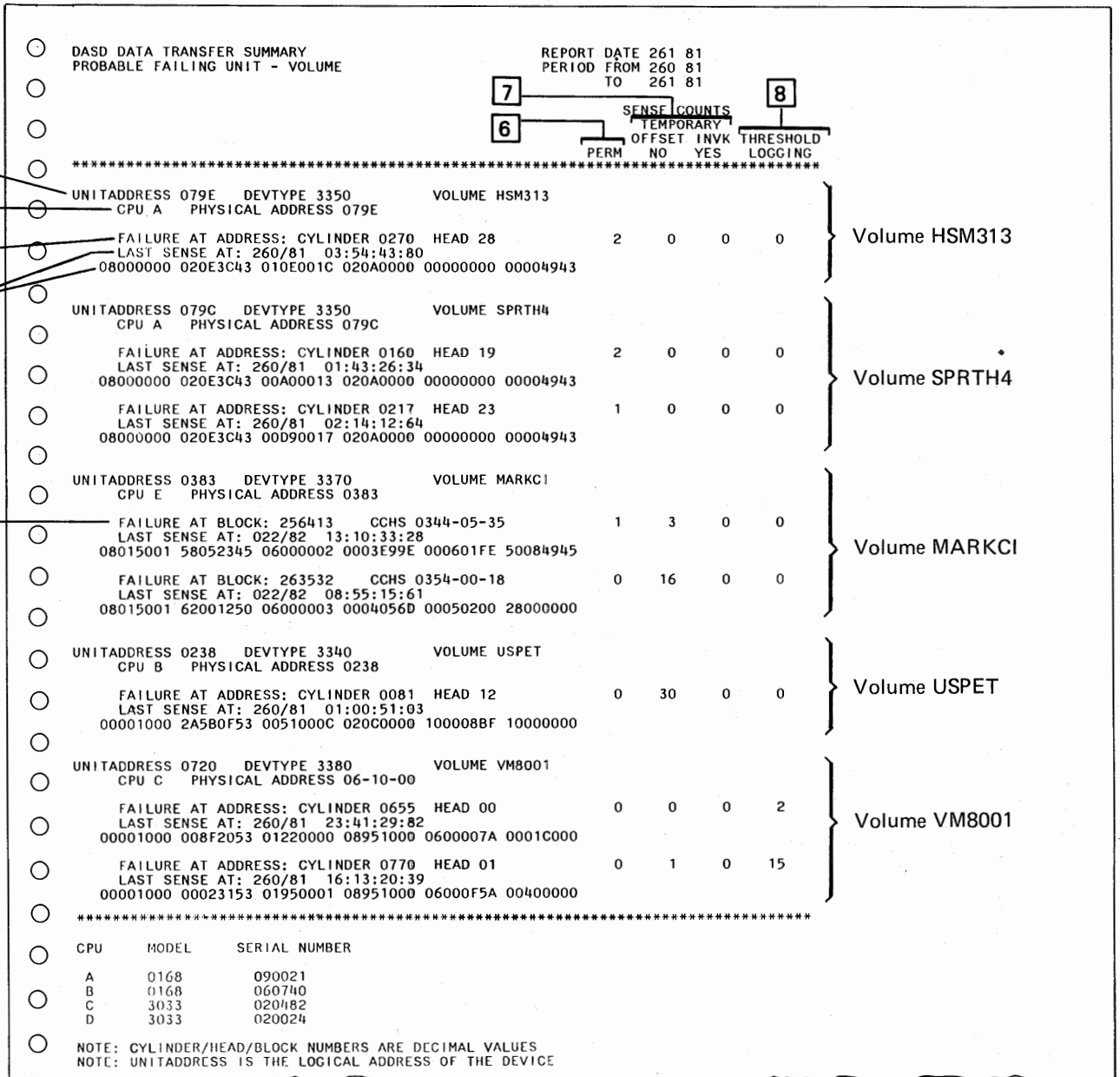| Item	Description
FIRST LINE [1]	Each volume is listed beginning with the unit address used to select the volume, then the device type, and then the volume serial number. For example, the first volume shows Unit Address 79E, Device Type 3350, Volume HSM313.
SECOND LINE [2]	For each volume, a CPU and physical address are given. For example, the first volume shows CPU A, Physical Address 79E.

FAILURE AT ADDRESS [3] OR FAILURE AT BLOCK [5]	For each volume, one or more addresses are given where errors occurred. For count, key, and data devices, addresses are cylinder and head numbers. (The hexadecimal cylinder and head numbers are translated to decimal values for the report, but are in hexadecimal in the sense information.) For example, volume HSM313 at a 3350 with unit address 79E had errors at the address:
	
	   Cylinder 0270, Head 28
	
	For fixed-block architecture devices, addresses are block numbers (in decimal), and cylinder, head, and sector numbers (in decimal). For example, volume MARKCI at a 3370 selected with unit address 383 had errors at the address:
	
	   Block 256413, CCHS 0344-05-35

SENSE INFORMATION [4]	Below each address is the date and time of the last sense record and 24 bytes of sense information, in hexadecimal. If more than one error is reported for an address, the sense information applies to the *last* error. The only sense information you may need are the last four digits, which contain a symptom code. 00000000 00000000 00000000 00000000 00000000 0000xxxx
PERM TEMPORARY [6] [7]	Error counts for permanent and temporary data errors are shown on the right side of volume information, with titles above the column. Values for temporary errors are interpreted as follows. Note that under Temporary, there are two possibilities: Offset Invoked *No* or *Yes*. For 3330, 3340, 3350, 3370: The values under Temporary are *all logged temporary data errors.* The value is always listed under Offset Invoked *No*. The number 0 always appears under Threshold Logging. For example, Volume USPET had 30 temporary logged data errors. For 3375 and 3380: The values under Temporary Offset Invoked No are the *number of times the data error rate threshold for the volume* was exceeded. The value under Temporary Offset Invoked Yes is the number of times the offset threshold was exceeded. For example, volume VM8001 exceeded the error rate threshold one time and an offset was **not** invoked.
THRESHOLD LOGGING [8] (Temporary Errors)	Only the 3375 and 3380 will have values under the Threshold Logging columns. For these device types, the value under Threshold Logging is the *number of errors* at that address *while the string was in logging mode*. For example, 3380 volume VM8001 exceeded the temporary data error threshold 1 time, and there are 15 errors logged at cylinder 0770, head 01. Also there are 2 errors logged at the other address. Other volumes on the string also may have values under the Threshold Logging column although there are no values under the other error columns. This is because *all* volumes on the string are placed in logging mode when *any* volume causes logging mode to begin. No examples are shown.
	It is possible for 3330, 3350, and 3370 disk storage to have temporary data errors that were not logged, and therefore, no cylinder and head numbers are available. The volumes are listed after all the listings. None are shown in the example. The error will be included in the error count in the DASD exception report.

```
DASD DATA TRANSFER SUMMARY                    REPORT DATE 261 81
PROBABLE FAILING UNIT - VOLUME                PERIOD FROM 260 81
                                                    TO   261 81          [8]
                                         [7]        SENSE COUNTS
                                         [6]          TEMPORARY
                                                    OFFSET  INVK   THRESHOLD
                                               PERM   NO    YES    LOGGING
[1]  ****************************************************************************
[2]  UNITADDRESS 079E   DEVTYPE 3350        VOLUME HSM313
        CPU A   PHYSICAL ADDRESS 079E
[3]      FAILURE AT ADDRESS: CYLINDER 0270   HEAD 28        2     0     0      0       Volume HSM313
         LAST SENSE AT: 260/81  03:54:43:80
[4]   08000000 020E3C43 010E001C 020A0000 00000000 00004943

     UNITADDRESS 079C   DEVTYPE 3350        VOLUME SPRTH4
        CPU A   PHYSICAL ADDRESS 079C

         FAILURE AT ADDRESS: CYLINDER 0160   HEAD 19        2     0     0      0
         LAST SENSE AT: 260/81  01:43:26:34
      08000000 020E3C43 00A00013 020A0000 00000000 00004943                          Volume SPRTH4

         FAILURE AT ADDRESS: CYLINDER 0217   HEAD 23        1     0     0      0
         LAST SENSE AT: 260/81  02:14:12:64
      08000000 020E3C43 00D90017 020A0000 00000000 00004943

     UNITADDRESS 0383   DEVTYPE 3370        VOLUME MARKCI
        CPU E   PHYSICAL ADDRESS 0383
[5]      FAILURE AT BLOCK: 256413     CCHS 0344-05-35        1     3     0      0
         LAST SENSE AT: 022/82  13:10:33:28
      08015001 58052345 06000002 0003E99E 000601FE 50084945                          Volume MARKCI

         FAILURE AT BLOCK: 263532     CCHS 0354-00-18        0    16     0      0
         LAST SENSE AT: 022/82  08:55:15:61
      08015001 62001250 06000003 0004056D 00050200 28000000

     UNITADDRESS 0238   DEVTYPE 3340        VOLUME USPET
        CPU B   PHYSICAL ADDRESS 0238

         FAILURE AT ADDRESS: CYLINDER 0081   HEAD 12        0    30     0      0       Volume USPET
         LAST SENSE AT: 260/81  01:00:51:03
      00001000 2A5B0F53 0051000C 020C0000 100008BF 10000000

     UNITADDRESS 0720   DEVTYPE 3380        VOLUME VM8001
        CPU C   PHYSICAL ADDRESS 06-10-00

         FAILURE AT ADDRESS: CYLINDER 0655   HEAD 00        0     0     0      2       Volume VM8001
         LAST SENSE AT: 260/81  23:41:29:82
      00001000 008F2053 01220000 08951000 0600007A 0001C000

         FAILURE AT ADDRESS: CYLINDER 0770   HEAD 01        0     1     0     15
         LAST SENSE AT: 260/81  16:13:20:39
      00001000 00023153 01950001 08951000 06000F5A 00400000
     ****************************************************************************
     CPU    MODEL     SERIAL NUMBER

      A     0168      090021
      B     0168      060740
      C     3033      020482
      D     3033      020024

     NOTE: CYLINDER/HEAD/BLOCK NUMBERS ARE DECIMAL VALUES
     NOTE: UNITADDRESS IS THE LOGICAL ADDRESS OF THE DEVICE
```

Figure 4. DASD Data Transfer Summary Example

How to Quickly Find Volume Information

In the following illustration, volume probable failing units are circled in each report.

System Error Summary (Part 2)

```
SYSTEM ERROR SUMMARY                          REPORT DATE 261 81
       (PART 2)                               PERIOD FROM 260 81
                                                      TO  261 81

                              PHYSICAL                                                      PROBABLE
        TIME      JOBNAME CPU    ID    TYPE PCUA SCUA VOLUME  ERROR DESCRIPTION           FAILING UNIT

   DATE 260/81

   00:55:07:52  BATCH13   B  XX-74-03  3330 0783 0785 EDSWK3  PERMANENT EQUIPMENT CHECK      DEVICE
   01:31:38:95  DPHSM313  B  78-7C-06  3350 079E 079E HSM313  PERMANENT DATA CHECK           VOLUME
   01:43:56:36  DPHSM313  B  78-7C-06  3350 079E 079E HSM313  PERMANENT EQUIPMENT CHECK      DEVICE
   01:54:43:84  DPHSM313  A  78-7C-06  3350 079E 079E HSM313  PERMANENT DATA CHECK           VOLUME
   01:40:31:42  BP101APC  A  88-7C-04  3350 079C 089C SPRTH4  PERMANENT DATA CHECK           VOLUME
   01:43:26:34  BP101APC  A  88-7C-04  3350 079C 089C SPRTH4  PERMANENT DATA CHECK           VOLUME
   02:14:12:64  BP101APC  A  88-7C-04  3350 079C 089C SPRTH4  PERMANENT DATA CHECK           VOLUME
   13:10:33:28  SYSTEM    E  XX-11-03  3370 0383 0383 MARKCI  PERMANENT DATA CHECK           VOLUME
   16:33:22:95  ESR       B  N/A       3420 0674 0674         END DATA/CRC CHECK             VOLUME

   ****************************************************************************************************

   CPU    MODEL    SERIAL NUMBER

   A      0168     090021
   B      0168     060740
   C      3033     020482
   D      3033     020024
   E      4341     011617
```

Subsystem Exception DASD

```
SUBSYSTEM  EXCEPTION                           REPORT DATE 261 81
           DASD                                PERIOD FROM 260 81
                                                       TO  261 81
B-BUS OUT PARITY CHK    C-CHECK DATA CHK    D-DISKETTE CHK    I-INVOKED OFFSETS
PROBABLE                                                   ---IMPACT OF TEMPORARY ERRORS---    ---USAGE---
FAILING         FAILURE              PHYSICAL  ---TOTALS---  EQU                                1000    MB.
UNIT            AFFECT     CPU       ADDRESS   PERM  TEMP    CHK   SKS   RD   OVRN   OTHER       SKS    READ
****************************************************************************************************
CHAN  02XX      CHAN/SCU             TOTAL          3                            3              N/A    N/A
                           A         0280           1                            1              3      32
                           A         02B3           2                            2              99     1530
---------------+----------+--------+--------+-----+-------+------+-----+-----+--------+-------+------+------+
SCU  18-XX-XX   CHAN/SCU             TOTAL          2     2                                      N/A    N/A
                           B         0745           2     2                                      3      118
---------------+----------+--------+--------+-----+-------+------+-----+-----+--------+-------+------+------+
VOL  SPRTH4     DATAXFR              TOTAL          3                                            N/A    N/A
     3350                  A         079C           3                                            41     392

     HSM313     DATAXFR              TOTAL          2                                            N/A    N/A
     3350                  AB        079E           2                                            18     504

     MARKCI     DATAXFR              TOTAL          1    19                           19         N/A    N/A
     3370                  E         0383           1    19                           19         6      850

     BALIBT     DATAXFR              TOTAL              99                           99          N/A    N/A
     3330                  B         0218              99                           99          20     920

     USPET      DATAXFR              TOTAL              30                           30          N/A    N/A
     3340                  B         0238              30                           30          241    8343

     VM8001     DATAXFR              TOTAL               1                            1          N/A    N/A
     3380                  C         06-10-00           1                            1          131    3878
```

DASD Data Transfer Probable Failing Unit — Volume

```
DASD DATA TRANSFER SUMMARY                    REPORT DATE 261 81
PROBABLE FAILING UNIT - VOLUME                PERIOD FROM 260 81
                                                      TO  261 81

                                              SENSE COUNTS
                                                 TEMPORARY
                                              OFFSET INVK THRESHOLD
                                              PERM  NO   YES  LOGGING
   ****************************************************************************************************

   UNITADDRESS 079E    DEVTYPE 3350           VOLUME HSM313
      CPU A    PHYSICAL ADDRESS 079E

      FAILURE AT ADDRESS: CYLINDER 0270  HEAD 28         2    0    0    0
      LAST SENSE AT: 260/81  03:54:43:80
      08000000 020E3C43 010E001C 020A0000 00000000 00004943


   UNITADDRESS 079C    DEVTYPE 3350           VOLUME SPRTH4
      CPU A    PHYSICAL ADDRESS 079C

      FAILURE AT ADDRESS: CYLINDER 0160  HEAD 19         2    0    0    0
      LAST SENSE AT: 260/81  01:43:26:34
      08000000 020E3C43 00A00013 020A0000 00000000 00004943
```

Guidelines for Recovery Action

The following guidelines explain how to use the EREP System Exception reports to interpret an error situation and to determine which error handling function of Device Support Facilities to use to treat the cause of a data error. You will need to evaluate the error situation in relation to the circumstances in your installation, such as the job in progress and the data set being used at the time. For instance, the same error that would cause you to take prompt action if it occurred in a catalog data set might be disregarded if it occurred on a volume being used for scratch purposes.

Although guidelines are given, the procedures you implement to handle errors should be tailored to suit the unique requirements and performance objectives of your particular installation.

The most effective control of operations can be achieved by reviewing error information and performing recovery on a regular basis, so that error situations do not accumulate. For most situations, your recovery actions with Device Support Facilities can be scheduled at a convenient time for minimum impact on system performance.

Error Handling During Normal Production

These guidelines apply to errors that occur during normal production with EREP reports available.

Known Problem

Examine

Routine Investigation

Examine

System Summary (Part 2)

If determined to be permanent disk storage error

Examine

Subsystem Exception, DASD

If determined to be volume probable failing unit and action is required | If determined to be hardware probable failing unit and action is required

Call

Hardware Service Representative

Examine

DASD Data Transfer, Volume

For permanent or excessive temporary data checks, determine location of errors

Use

Device Support Facilities program

Figure 5. Steps in Error Handling

Steps in Error Handling

Print the EREP System Exception reports every day and review them for error information.

Use the System Summary (Part 2), when needed, to investigate a known problem. If you have been notified that an error occurred when a particular job was in progress or at a particular time, examine the System Error Summary (Part 2) to determine if the problem may have been caused by a permanent I/O error. If there is a permanent error associated with a disk storage, examine the Subsystem Exception, DASD.

Use the Subsystem Exception, DASD, to determine whether there are hardware problems requiring a hardware service representative or data errors you should handle with the Device Support Facilities program. Use the report for routine review of possible permanent or temporary disk storage errors and for known permanent disk storage errors found in the System Summary (Part 2).

Are there hardware probable failing units with errors? These are listed as channel, storage control, controller, and device.

Are there volume probable failing units with data errors? Volumes are listed after all the hardware probable failing units. All errors at a volume are data errors.

For each probable failing unit category, look for the device type and probable failing unit identifier. For volumes, this is the volume serial number. Then read across the column to find the total permanent and temporary errors.

With information obtained from the Subsystem Exception, DASD, use these guidelines.

- If a hardware probable failing unit has a permanent error, call a hardware service representative.

- If a volume probable failing unit has a permanent error, proceed to the DASD Data Transfer Summary.

- If a volume probable failing unit has temporary errors, decide whether the temporary errors are excessive. All temporary errors, up to a maximum of 99, are reported for the 3330, 3340, 3344, 3350, and 3370. If you establish a threshold for your installation to limit the number of temporary errors reported, this threshold number may then be used as the criterion for judging whether temporary errors are excessive. For the 3375 and 3380, a listing in the temporary column indicates the established threshold has been exceeded. If this occurs one or more times, action with Device Support Facilities is recommended. (Temporary errors and their impact will be discussed later.) If the temporary errors are excessive, proceed to the DASD Data Transfer Summary.

In this example:

1. A device probable failing unit, identified by xx-7C-06, on a 3350 with physical address 79E has one permanent error.

2. A volume probable failing unit, identified by SPRTH4, on a 3350 with physical address 79C has three permanent errors.

3. A volume probable failing unit, identified by HSM313, on a 3350 with physical address 79E, has two permanent errors. Note that this is the same physical address as in item 1.

4. A volume probable failing unit, identified by MARKCI, on a 3370 with physical address 383 has one permanent error and 19 temporary errors.

5. In addition, the following volumes have only temporary errors. Volume BALIBT on a 3330 has 99, or more, temporary errors. Volume USPET on a 3340 has 30 temporary errors. Volume VM8001 on a 3380 has exceeded the temporary threshold one time.

```
SUBSYSTEM  EXCEPTION                          REPORT DATE 261 81
           DASD                               PERIOD FROM 260 81
                                                      TO   261 81
B-BUS OUT PARITY CHK   C-CHECK DATA CHK   D-DISKETTE CHK   I-INVOKED OFFSETS
PROBABLE                                           ---IMPACT OF TEMPORARY ERRORS---   ---USAGE---
FAILING          FAILURE            PHYSICAL   ---TOTALS---   EQU                       1000   MB.
UNIT             AFFECT    CPU      ADDRESS    PERM TEMP      CHK  SKS  RD  OVRN OTHER   SKS   READ
*********************************************************************************************
CHAN  02XX       CHAN/SCU            TOTAL       3                            3         N/A   N/A
                           A         0280        1                            1          3    32
                           A         02B3        2                            2         99   1530
---------------+----------+---------+--------+------+------+------+-----+-----+-----+-----+------+
SCU  18-XX-XX    CHAN/SCU            TOTAL       2    2                                 N/A   N/A
     3830                  B         0745        2    2                                  3   118
---------------+----------+---------+--------+------+------+------+-----+-----+-----+-----+------+
DEV  XX-7C-06    DEV                 TOTAL       1                                      N/A   N/A
     3350                  B         079E        1                                      18   504
---------------+----------+---------+--------+------+------+------+-----+-----+-----+-----+------+
VOL  SPRTH4      DATAXFR             TOTAL       3                                      N/A   N/A
     3350                  A         079C        3                                      41   392

     HSM313      DATAXFR             TOTAL       2                                      N/A   N/A
     3350                  AB        079E        2                                      18   504

     MARKCI      DATAXFR             TOTAL       1   19                 19              N/A   N/A
     3370                  E         0383        1   19                 19               6   850

     BALIBT      DATAXFR             TOTAL           99                 99              N/A   N/A
     3330                  B         0218           99                 99               20   920

     USPET       DATAXFR             TOTAL           30                 30              N/A   N/A
     3340                  B         0238           30                 30              241   8343

     VM8001      DATAXFR             TOTAL            1                  1              N/A   N/A
     3380                  C         06-10-00         1                  1              131   3878
```

1 → DEV XX-7C-06 / 3350
2 → VOL SPRTH4 / 3350
3 → HSM313 / 3350
4 → MARKCI / 3370
5 → USPET / 3340

For the situations from the example, the following actions are indicated:

1. A service representative should be called for the error with the hardware probable failing unit in item 1.

2. The DASD Data Transfer Summary should be examined for the permanent errors reported at volume SPRTH4 on a 3350 in item 2.

3. A volume probable failing unit with the same physical address (79E) as in item 1 has an error in item 3. Because there is evidence of a hardware problem, further investigation of the volume problem will be determined by the hardware service representative called for the 3350 as described in item 1.

4. The DASD Data Transfer Summary should be examined for the errors reported at volume MARKCI on a 3370.

5. For the temporary errors of item 5, the DASD Data Transfer Summary should be examined for the errors on VM8001 at a 3380. Further investigation of the errors at BALIBT and USPET depends on the requirements of your installation.

Use the DASD Data Transfer Summary to determine the track or block addresses where data errors occurred on a given volume. These are the tracks or blocks that should be checked with Device Support Facilities for possible defect skipping or alternate block assignment.

The way the functions of Device Support Facilities are used depends on the number of track or block addresses with errors and whether the errors are permanent or temporary.

Using the volume serial number obtained from the Subsystem Exception, DASD, find the same volume serial number on the DASD Data Transfer Summary. Confirm that the device type and physical address are the same as those for the volume in the Subsystem Exception, DASD.

How many times does Failure at Address *appear for that volume?* This gives the number of track or block addresses with data errors on that volume.

Are the errors permanent or temporary? For each track or block address, look to the right to find whether the data error at that address is permanent or temporary. (The permanent errors are listed first.)

With the information obtained from the DASD Data Transfer Summary, the following steps can be used as **general guidelines.** (Later, other considerations will be discussed and specific guidelines will be given for each device type.)

- Take measures to protect data, depending on whether errors are permanent or temporary and on the Device Support Facilities command used. This important consideration will be discussed later.

- For devices with a removable disk pack or data module, you may try moving it to another drive. (There is a risk in moving a 3330 pack.) If data errors do not recur, call a hardware service representative to investigate a possible hardware problem.

  For devices with non-removable head and disk assemblies, use the Device Support Facilities ANALYZE command with the No Scan parameter. If a drive problem is reported in a message, call a hardware service representative to investigate a possible hardware problem.

  If data errors did recur when the pack or module was moved or if no hardware problem was reported when executing the ANALYZE command, proceed to the next item.

- If a few addresses have errors, use the Device Support Facilities INSPECT command to check each track or block that has errors. Obtain the track or block address from the DASD Data Transfer Summary. (A track address is given as cylinder and head numbers. In other manuals, the address is sometimes referred to as cylinder and tracks. They mean the same. A block address for fixed-block architecture device types is given as a relative block number.)

  If many addresses have errors, or if the home addresses should be rewritten, use the Device Support Facilities INIT command to check all of the tracks or blocks on the volume, or call a hardware service representative.

In the example:

☐1 Volume HSM313 on a 3350 shows one track address with two permanent data errors. This same volume was used in the Subsystem Exception, DASD example, but because there was a hardware probable failing unit at the same physical address a service representative was recommended. However, if there was not a hardware probable failing unit with the same address, the one track on this volume should be checked with Device Support Facilities.

☐2 Volume SPRTH4 on a 3350 has permanent errors at two tracks. Both tracks should be checked with Device Support Facilities. The track addresses are cylinder 0160, head 19 and cylinder 0217, head 23.

☐3 Volume MARKCI on a 3370 has one permanent error and three temporary errors at one block address. This block should be checked with Device Support Facilities. Whether you check block 263532 because of its 16 temporary errors depends on the requirements of your installation.

☐4 Volume USPET on a 3340 has 30 temporary errors at one track address, which probably should be checked with Device Support Facilities. The 30 errors might be because the track had defects in more than one place or because the same data was frequently read.

☐5 Volume VM8001 on a 3380 has no permanent errors, but the temporary error threshold was exceeded one time, with errors at four track addresses. (Temporary errors on 3380 and 3375, and which tracks to check, will be discussed later.)

☐6 Volume BALIBT on a 3330 is listed at the bottom of the report, but with no cylinder and head numbers because the errors were not logged. This can also happen for a 3350 and 3370. (Temporary errors for 3330, 3370, and 3350 will be discussed later.)

```
DASD DATA TRANSFER SUMMARY                          REPORT DATE 261 81
PROBABLE FAILING UNIT - VOLUME                      PERIOD FROM 260 81
                                                       TO    261 81

                                                    SENSE COUNTS
                                                     TEMPORARY
                                                    OFFSET INVK THRESHOLD
                                             PERM    NO   YES  LOGGING
*****************************************************************************

UNITADDRESS 079E   DEVTYPE 3350        VOLUME HSM313
    CPU A    PHYSICAL ADDRESS 079E

    FAILURE AT ADDRESS: CYLINDER 0270  HEAD 28      2     0    0 ·    0
    LAST SENSE AT: 260/81  03:54:43:83
    08000000 020E3C43 010E001C 020A0000 00000000 00004943


UNITADDRESS 079C   DEVTYPE 3350        VOLUME SPRTH4
    CPU A    PHYSICAL ADDRESS 079C

    FAILURE AT ADDRESS: CYLINDER 0160  HEAD 19      2     0    0     0
    LAST SENSE AT: 260/81  01:43:26:34
    08000000 020E3C43 00A00013 020A0000 00000000 00004943

    FAILURE AT ADDRESS: CYLINDER 0217  HEAD 23      1     0    0     0
    LAST SENSE AT: 260/81  02:14:12:64
    08000000 020E3C43 00D90017 020A0000 00000000 00004943


UNITADDRESS 0383   DEVTYPE 3370        VOLUME MARKCI
    CPU E    PHYSICAL ADDRESS 0383

    FAILURE AT BLOCK: 256413    CCHS 0344-05-35     1     3    0     0
    LAST SENSE AT: 022/82  13:10:33:28
    08015001 58052345 06000002 0003E99E 000601FE 50084945

    FAILURE AT BLOCK: 263532    CCHS 0354-00-18     0    16    0     0
    LAST SENSE AT: 022/82  08:55:15:61
    08015001 62001250 06000003 0004056D 00050200 28000000


UNITADDRESS 0238   DEVTYPE 3340        VOLUME USPET
    CPU B    PHYSICAL ADDRESS 0238

    FAILURE AT ADDRESS: CYLINDER 0081  HEAD 12      0    30    0     0
    LAST SENSE AT: 260/81  01:00:51:03
    00001000 2A5B0F53 0051000C 020C0000 100008BF 10000000


UNITADDRESS 0720   DEVTYPE 3380        VOLUME VM8001
    CPU C    PHYSICAL ADDRESS 06-10-00

    FAILURE AT ADDRESS: CYLINDER 0655  HEAD 00      0     0    0     2
    LAST SENSE AT: 260/81  23:41:29:82
    00001000 008F2053 01220000 08951000 0600007A 0001C000

    FAILURE AT ADDRESS: CYLINDER 0770  HEAD 01      0     1    0    15
    LAST SENSE AT: 260/81  16:13:20:39
    00001000 00023153 01950001 08951000 06000F5A 00400000

    FAILURE AT ADDRESS: CYLINDER 0328  HEAD 02      0     0    0     2
    LAST SENSE AT: 260/81  22:34:11:07
    00001000 00481253 01480002 195C1000 0600072A 00100000

    FAILURE AT ADDRESS: CYLINDER 0532  HEAD 07      0     0    0     2
    LAST SENSE AT: 260/81  23:14:05:02
    00001000 00142753 00A70007 07811000 06000284 06000000

-------------------------------------------------------------------
THE FOLLOWING ENTRIES HAVE ONLY MDR RECORD TYPES. THEREFORE, NO CYLINDER/HEAD
ADDRESSES ARE REPORTED. SEE THE EXCEPTION REPORT FOR THE ERROR COUNTS.

UNITADDRESS 0218   DEVTYPE 3330        VOLUME BALIBT
    CPU B    PHYSICAL ADDRESS 0218
*****************************************************************************
```

1

2

3

4

5

6

Considerations for Permanent and Temporary Errors

A permanent data check usually requires recovery action. If you receive immediate notification of the error, you will probably follow a standard procedure and attempt to rerun the job. The error, though permanent, may have been caused by a transient condition, and may not be repeated when the operation is retried. If the permanent error is repeated, the information needed for processing the job may have to be obtained from a backup copy. Then, at a more convenient time, you can take recovery action with Device Support Facilities using information obtained from the DASD Data Transfer Summary.

When a temporary data check occurs, the affected data is available for processing, so the operation in progress continues without interruption. The question is whether the time and resources required for the subsystem and system error recovery procedures cause significant impact on performance. In general, the impact on performance is not regarded as significant enough to take time and system resources to use Device Support Facilities, unless the frequency of temporary data checks is excessive or they occur in the same place repeatedly and the data is frequently used.

Your action can eliminate two possible causes of temporary data checks, even though you cannot always determine the cause before taking recovery action. If the data error was caused by a transient electrical interference when the data was written, the problem is usually eliminated by reading the data and then rewriting it when data is preserved by Device Support Facilities or when copied to a different device and then restored. If the error was caused by a defect on the disk surface, the defect can be bypassed with Device Support Facilities.

Specific treatment of temporary errors depends on the device type, but for all devices it is recommended that you use Device Support Facilities immediately after you dump the volume to another device for routine backup. Use the INSPECT command to surface-check specific tracks or blocks and bypass defective areas or the INIT command with the Check parameter to surface-check all of the volume and bypass defective areas. This routine procedure will eliminate the cause of most temporary errors and prevent the accumulation of such errors.

Use of Device Support Facilities

Security Functions

When used with an operating system, Device Support Facilities implements security functions. Refer to the Device Support Facilities manual for information on these security functions and what you can do to obtain surface checking of these areas.

Check Number Specification

The Check parameter of the Device Support Facilities INSPECT and INIT commands includes a specification for a check number.

With primary tests, which are used for the first phase of checking all tracks, specification of this check number controls the number of check passes made. This means that when checking all of the tracks with the INIT command, you can control the number of passes made with primary patterns. The highest number recommended is three.

With advanced tests, the number of passes is controlled by the program for disk storage types that have defect skipping: 3340, 3344, 3350, 3375, and 3380. A check number should be specified, although the program disregards it for these tests. For the 3330 and fixed-block devices which do not have defect skipping, Check (3) is recommended when using the INSPECT command to check specific tracks.

Results When Surface Checking

With the INSPECT and INIT commands, Device Support Facilities will reliably locate defects that cause permanent data checks. The surface checking functions are also an effective means for determining defects that can cause temporary errors, but the degree of effectiveness varies with the test patterns used for checking.

When checking all tracks on a volume (using the INIT command), the defects detected may not appear to be consistent if the command is issued more than one time. Defects may not be detected when the function is performed the first time, but if the command is issued again, defects may be detected, and this inconsistency may persist on subsequent runs. This happens when checking the surface of all tracks because the program first uses primary test patterns, which save time but do not permit as refined an analysis as the more advanced patterns. Any defects detected with these primary patterns are then subjected to the advanced tests and defects that are confirmed are bypassed.

A defect detected on a subsequent run is associated with a very small surface irregularity. Such irregularities may be detected under slightly varying conditions. A data check resulting from this type of defect is correctable with the ECC and, therefore, is a temporary error. These small defects are not likely to cause permanent errors and should not be a cause of concern unless the number is very excessive. If they should appear excessive, consult your hardware service representative.

Data Protection

The specific guidelines for each device type, which follow this section, make recommendations for protecting your data in every way possible.

When checking specific tracks with the Device Support Facilities INSPECT command, the Preserve parameter is the default. If the program cannot read the data because of a permanent data check, it terminates processing of that track.

When checking a track because of a permanent data check, it is likely that the permanent data check will again occur, but because of the possibility that the data might be readable, the specific guidelines recommend trying the Preserve parameter, even for permanent data checks. If the data cannot be read, you can specify that checking proceed with the No Preserve parameter.

When checking a track because of a temporary data check, it is likely that the data can be read and preserved by Device Support Facilities.

With the **Preserve** parameter, data is temporarily saved in main storage and **the data can be lost** if the system or program terminates abnormally. With the **No Preserve** option, **any data on the track will be destroyed.** For these reasons, it is recommended that before using the Device Support Facilities checking function, an effort should be made to copy the data to another device whenever possible. Use a copy utility or dump and restore program that is appropriate for your operating system.

With the INIT command, Device Support Facilities does not preserve data. You must copy any data on the volume to another device or **data on the volume will be destroyed by execution of the INIT command.** Use a copy utility or dump and restore program that is appropriate for your operating system.

(While reading data to be preserved or moved to a backup device, the standard error correction and recovery procedures for the device are used, when using an operating system.)

Commands and Parameters for Error Handling

The specific guidelines for each device type, which follow this section, give the Device Support Facilities commands and parameters required for performing recovery actions for data errors at a probable failing unit of volume. In addition, you will need to include the addressing information applicable to your situation.

You may also wish to use some of the optional parameters described in the Device Support Facilities manual. There are optional parameters to verify a volume serial ID, reclaim a track that has been previously bypassed as defective, and for security processing.

If-Then-Else Statement Sequence

The specific guidelines for each device type, which follow this section, include the Device Support Facilities If-Then-Else statement sequence to control command execution. Using this sequence, you can specify more than one operation, with execution of the second operation dependent on the results of the first operation. You specify the results to be compared by using the comparison operator condition code, Lastcc. If the comparison is true, the next operation is executed.

Failure to Execute Command

If Device Support Facilities cannot execute a command because of a hardware problem, call a hardware service representative. The hardware problem will be reported as an equipment check in a Device Support Facilities message.

Use of Other Manuals

It is intended that the guidelines in this Error Handling Manual be used with reference details obtained from other manuals.

When to Use the EREP Manual

Refer to *Environmental Recording, Editing, and Printing Program*, Order Number GC28-0772, for information on how to obtain the System Exception reports. The EREP manual contains information needed for making up a physical ID for use by the EREP program and for establishing limits on temporary errors that are printed in the Subsystem Exception, DASD, report. These specifications are made with DASDID and LIMIT control statements.

When to Use Device Support Facilities Manual

Refer to *Device Support Facilities User's Guide and Reference,* Order Number GC35-0033, for detailed programming instructions.

The Device Support Facilities manual includes differences in systems and standalone environments, differences in operating systems, and differences in online and offline execution.

Where to Find Data Copy Information

Refer to the utility manuals or *Device Facilities Data Set Services* program manual for information on how to copy data from one device to another. These manuals are listed in the bibliography in the Preface.

Specific Guidelines by Device Type

The following pages provide tables with specific error handling guidelines for each device type.

After using the recommended recovery actions, review the DASD Data Transfer Summary on subsequent days to verify that the same tracks or blocks treated with the Device Support Facilities do not again show errors.

If the recommended recovery actions do not correct the problem or if a call for a service representative is the recommended action, you should have the following information available for use by the service representative.

- System Exception reports obtained before recovery action was taken.
- Device Support Facilities output.
- System Exception reports obtained after recovery action was attempted.

To use the tables, select the device and condition you need to treat. Your recovery actions are described for each condition. Identify the condition based on information obtained for the DASD Data Transfer Summary, as described in "Steps in Error Handling."

The tables are preceded by any special instructions needed for each device type. (Guidelines for the 3375 and 3380 are combined because they are identical.)

When using the guidelines in the tables you will need to refer to the *Device Support Facilities* manual for the precise syntax to use in specifying commands and parameters.

The tables for each device type are arranged in the order in which conditions should be treated. If a volume shows more than one condition in the DASD Data Transfer Summary, treat the condition with the highest priority first. By first treating the condition with the highest priority that applies, you may take care of any other existing conditions of a lesser priority.

Following is an index to the tables for each device type, with the conditions arranged in the priority you should treat them.

Be cautious about moving the disk pack to another drive. If there is a serious defect on the disk, **it is possible to damage a head at the other drive.**

For permanent data checks, Device Support Facilities automatically assigns an alternate track if defects on the track are confirmed with surface checking.

For temporary checks, with cylinder and head numbers, you can use the INSPECT command to unconditionally assign an alternate track without surface checking the track.

If excessive temporary data checks are reported in the DASD exception report, but cylinder and head numbers are not given in the DASD data transfer report, you can use the INIT command with Check (3). If surface defects are confirmed, the cylinder and head numbers of the tracks are reported in Device Support Facilities messages. Or you can call a hardware service representative to put the device in logging mode to obtain this information. You can then use the INSPECT command to unconditionally assign an alternate track, if you decide to take action.

Before deciding to assign an alternate track for temporary errors, consider the consequence that when data is later read or written, time will be required to detour to the alternate track and return to the normal data location.

3330 Condition 1: Permanent data check at 1 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

You may try moving pack to another drive and attempt to read data. If data check does not occur, call a service representative for possible hardware problems. If data check does occur, return disk pack to original drive.
 	
Use appropriate utility or program to attempt to copy data from track temporarily to another device.
 	
Use the following Device Support Facilities command sequence for each track.
 	
INSPECT   Tracks (cccc hhhh) -
           Check (3) -
           Assign -
           Preserve
If Lastcc = 8
then
INSPECT   Tracks (cccc hhhh) -
           Check (3) -
           Assign -
           No Preserve
	Preserves data from track if it can be read. Checks surface of tracks. If data check is repeatable, flags track and assigns alternate track automatically.
	
	Rewrites HA and R0.
	
	If data was preserved, restores data to alternate track.
		If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy. Otherwise restore data from copy created before error occurred and update as needed.

3330 Condition 2: Temporary data checks at 1 to 10 track addresses, when you wish to assign an alternate track.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Move pack to another drive and attempt to read data. If data check does not occur, call service representative for possible hardware problem. If data check does occur, return pack to original drive.
 	
Use appropriate utility or program to copy data from tracks temporarily to another device.
 	
Use the following Device Support Facilities command sequence for each track.
 	
INSPECT   Tracks (cccc hhhh) -
          No Check -
          Assign -
          Preserve
	Preserves data from track if it can be read. Does *not* surface check. Unconditionally flags primary track *specified by programmer* and assigns alternate track. Rewrites HA and RO. Restores data to alternate track.	If INSPECT executed and data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try to use INSPECT with No Preserve.

3330 Condition 3: Temporary data checks with no track address (cylinder and head numbers), when you wish to determine the location of errors.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Move pack to another drive and attempt to read data. If data check does not occur, call service representative for possible hardware problem. If data check does occur, return pack to original drive. Use appropriate utility or program to copy data to another device. Use Device Support Facilities INIT Check (3).	Checks surface of all tracks. If temporary data checks are repeatable, gives message with cylinder and head numbers of tracks with defects. Rewrites HA and RO of all tracks. Rewrites volume label and VTOC.	Use Device Support Facilities INSPECT command as for condition 2 temporary data checks to unconditionally assign alternate track. Restore data from temporary copy.

3330 Conditions 4 and 5: Permanent or temporary data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative		

Error Handling for the 3340

Special Instructions

There are no special instructions for the 3340.

3340 Condition 1: Permanent data check at 1 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Move data module to different drive and attempt to read data. If data check does not occur, call service representative for possible hardware problem. If data check does occur, return data module to original drive.
 	
Use appropriate utility or program to attempt to copy data from tracks temporarily to another device.
 	
Use the following Device Support Facilities command sequence for each track.
 	
INSPECT   Tracks (cccc hhhh) -
            Check (1) -
            Assign -
            Preserve
If Lastcc = 8
then
INSPECT   Track (cccc hhhh) -
            Check (1) -
            Assign -
            No Preserve
	Preserves data if it can be read. Checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.	If data was preserved, eliminate temporary copy. If not preserved, restore from temporary copy. Otherwise, restore from copy created before error occurred and update as needed.

3340 Condition 2: Temporary data checks at 1 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Move data module to different drive and attempt to read data. If data checks do not occur, call service representative for possible hardware problem. If data checks do occur, return data module to original drive.
 	
Use appropriate utility or program to copy data from tracks temporarily to another drive.
 	
Use the following Device Support Facilities command sequence for each track.
 	
INSPECT   Tracks (cccc hhhh) -
            Check (1) -
            Assign -
            Preserve
	Preserves data if it can be read. Checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.	If INSPECT executed and data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try to use INSPECT with No Preserve.

3340 Condition 3: Permanent data checks on 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative		

3340 Condition 4: Temporary data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Move data modules to another drive and attempt to read data. If data checks do not occur, call service representative for possible hardware problem. If data checks do occur, use appropriate utility or program to copy data to another device. Use Device Support Facilities INIT Check (3).	Checks surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	Restore data from temporary copy.

Error Handling for 3344

Special Instructions

There are no special instructions for the 3344.

3344 Condition 1: Permanent data checks at 3 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use Device Support Facilities, ANALYZE No Scan If ANALYZE test does not detect hardware problems, use appropriate utility or Data Set Services to copy as much data as possible temporarily to another device.	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."	If "Suspected Drive Problem" message, use appropriate utility or program to dump as much data as possible to another device. Call service representative for possible hardware problem.

Use the following Device Support Facilities command sequence for **each** track.
 	
INSPECT   Track (cccc hhhh) –
          Check (1) –
          Assign –
          Preserve
If Lastcc = 8
then
INSPECT   Tracks (cccc hhhh) –
          Check (1) –
          Assign –
          No Preserve
	Executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect. If allowable defects are exhausted, flags the track and assigns alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.	If INSPECT executed, do the following. If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3344 Condition 2: Permanent data check at 1 or 2 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to attempt to copy data from track temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
  Do
    INSPECT   Track (cccc hhhh) –
               Check (1) –
               Assign –
               Preserve
    If Lastcc = 8
    then
    INSPECT   Tracks (cccc hhhh) –
               Check (1) –
               Assign –
               No Preserve
End
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect. If allowable defects are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.
		If "Suspected Drive Problem" message, call hardware service representative for possible hardware problem.
		
		If INSPECT executed, do the following. If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3344 Condition 3: Temporary data checks at 1 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to copy data from tracks, temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
INSPECT   Track (cccc hhhh) -
          Check (1) -
          Assign -
          Preserve
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes IN-SPECT. If data can be preserved, checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. Restores data.
		If "Suspected Drive Problem" message, call hardware service representative for possible hardware problem.
		
		If INSPECT executed, and data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try INSPECT with No Preserve.

3344 Condition 4: Permanent data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative		

3344 Condition 5: Temporary data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (3)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call hardware service representative for possible hardware problem. If INIT executed, restore data from temporary copy.

Error Handling for 3350

Special Instructions

If permanent or temporary data checks occur on 3 to 10 tracks, examine the last four characters of the sense information for each track address. (Recall that sense information is given in the DASD Data Transfer Summary.) These last four digits of the sense information are a symptom code. If they are 4940 or 4941 at 3 or more tracks, special treatment is needed, as described in the table for condition 1. If you cannot copy your data, a hardware service representative may be able to help you.

If excessive temporary data checks are reported in the Subsystem Exception report, but cylinder and head numbers are not given in the DASD Data Transfer Summary, you can use the INIT command to check all of the tracks on the volume, as described in the table for condition 5.

A 3350 processing in 3330 emulation mode may be examined as a 3330 by following the specific guidelines given for the 3330. Instead of moving the pack to another drive, use the ANALYZE No Scan function to determine if there is a suspected drive problem. If checking the 3350 as a 3330 device, defects will not be skipped. However, you may wish to perform error handling as it applies to a 3350 to obtain defect skipping. To do this, follow these steps:

1. Copy the 3330 volumes to another device.

2. Call a hardware service representative to put the device in 3350 (native) mode.

3. Use the Device Support Facilities INIT command with Check (3). The program will surface-check all of the disks of the 3350 head and disk assembly, and skip any defects.

4. Have a hardware service representative put the device back into emulation mode.

5. Re-initialize the 3330 volumes using the INIT command with Validate.

6. Restore the data that was copied to another device.

3350 Condition 1: Permanent or temporary data checks when 3 to 10 track addresses show sense bytes with last four digits 4940 or 4941.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utilities or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (1)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks the surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative for possible hardware problem. If INIT executed, restore data from temporary copy.

3350 Condition 2: Permanent data checks at 3 to 10 track addresses. The following instructions do not apply if 3 or more track addresses show 4940 or 4941 in the last four digits of the sense bytes. Instead, go to the instructions for condition 1.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use Device Support Facilities, ANALYZE No Scan.
 	
If ANALYZE hardware test passes, use appropriate utility or Data Set Services to copy as much data as possible temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
INSPECT   Track (cccc hhhh) -
                  Check (1) -
                  Assign -
                  Preserve
If Lastcc = 8
then
INSPECT   Tracks (cccc hhhh) -
                  Check (1) -
                  Assign -
                  No Preserve
	Exercises hardware. If ANALYZE test detects hardware problem, issue diagnostic message, "Suspected Drive Problem."
	
	Executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.
		If "Suspected Drive Problem" message, use appropriate utility or program to copy as much data as possible to another device. Call service representative for possible hardware problem.
		
		If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3350 Condition 3: Permanent data checks at 1 or 2 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to attempt to copy data from track temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
  Do
    INSPECT   Track (cccc hhhh) -
              Check (1) -
              Assign -
              Preserve
    If Lastcc = 8
    then
    INSPECT Track (cccc hhhh) -
              Check (1) -
              Assign -
              No Preserve
End
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect. If allowable skips are exhausted; flags the track and assigns an alternate track automatically. Rewrites HA and RO. If data was preserved, restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed, do the following.
		
		If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3350 Condition 4: Temporary data checks at 1 to 10 track addresses (with cylinder and head numbers). The following instructions do not apply if 3 or more track addresses show 4940 or 4941 in the last four digits of the sense bytes. Instead, go to condition 1.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to copy data from tracks, temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
INSPECT   Track (cccc hhhh) -
              Check (1) -
              Assign -
              Preserve
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. If data can be preserved, checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and RO. Restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed and data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try INSPECT with No Preserve.

3350 Condition 5: Temporary data checks but with no track addresses (cylinder and head numbers).

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (3)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks the surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative. If INIT executed, restore data from temporary copy.

3350 Condition 6: Permanent data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative.		

3350 Condition 7: Temporary data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (3)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative for possible hardware problem. If INIT executed, restore data from temporary copy.

Error Handling for 3370

Special Instructions

There are no special instructions for the 3370.

3370 Condition 1: Permanent data checks at 3 to 10 block addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use Device Support Facilities, ANALYZE No Scan. If ANALYZE test does not detect hardware problems, use appropriate utility or Data Set Services to copy as much data as possible from *all volumes of head disk assembly* temporarily to another device.	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."	If "Suspected Drive Problem" message, use appropriate utility or diagram to dump as much data as possible from *all volumes of head disk assembly* temporarily to another device. Call service representative for possible hardware problem.

Use the following Device Support Facilities command sequence for **each** block.
 	
INSPECT   Block (rbn)
          Check (1) -
          Assign -
          Preserve
If Lastcc = 8
then
INSPECT   Block (rbn)
          Check (1) -
          Assign -
          No Preserve
	Executes INSPECT. Preserves data from block if it can be read. Checks surface of blocks. If defect confirmed, flags defective block and assigns alternate blocks. If data was preserved, restores data.	If data was preserved, eliminate temporary copy. If not preserved, restore from temporary copy, or from copy created before error occurred and update as needed.

3370 Condition 2: Permanent data check at 1 or 2 block addresses

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to attempt to copy data from track temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** block.
 	
ANALYZE No Scan
If Lastcc < 8
then
 Do
  INSPECT   Block (rbn) -
           Check (1) -
           Assign -
           Preserve
 If Lastcc = 8
 then
  INSPECT   Block (rbn) -
           Check (1) -
           Assign -
           No Preserve
 End
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. Preserves data if it can be read. Checks surface of blocks. If defect confirmed, flags defective block and assigns alternate block. If data was preserved, restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed, do the following.
		
		If data was preserved, eliminate temporary copy. If not preserved, restore from temporary copy, or from copy created before error occurred and update as needed.

3370 Condition 3: Temporary data checks with 1 to 10 block addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to copy data from tracks, temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** block.
 	
ANALYZE No Scan
If Lastcc < 8
then
INSPECT   Block (rbn)
         Check (1) -
         Assign -
         Preserve
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. If data can be preserved, checks surface of blocks. If defect confirmed, flags defective block and assigns alternate block. Restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed, do the following. If data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try INSPECT with No Preserve.

3370 Condition 4: Temporary data checks with no block addresses (block numbers).

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (3)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks the surface of all blocks. If defect confirmed, flags defective block and assigns alternate block. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative. If INIT executed, restore data from temporary copy.

3370 Condition 5: Permanent data checks at 11 or more block addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative		

3370 Condition 6: Temporary data checks at 11 or more block addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (3)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks the surface of all blocks. If defect confirmed, flags defective block and assigns alternate blocks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative. If INIT executed, restore data from temporary copy.

Error Handling for 3375 and 3380

Special Instructions

Temporary errors may be recovered without offset invoked or with offset invoked. (When offset is invoked, the error is successfully recovered by retrying the operation with the head in an offset position on the track.) Treatment of temporary errors with offset invoked and without offset invoked are treated differently, as described in the condition tables. The following describes which tracks to treat under the two circumstances.

With Offset Invoked

If temporary errors are retried with offset invoked, it may be necessary to rewrite the home address. Errors recovered by retry with offset invoked are listed for the 3375 and 3380 in the DASD Data Transfer Summary under the Offset Invk Yes column. The illustration shows that offset was invoked on many scattered tracks of the volume. If offset was invoked on 3 or more tracks, special treatment is needed as described in the table for condition 1. It is recommended that surface checking also be performed.

```
O   DASD DATA TRANSFER SUMMARY                          REPORT DATE 261 81
    PROBABLE FAILING UNIT - VOLUME                      PERIOD FROM 260 81
O                                                               TO   261 81

                                                        SENSE COUNTS
O                                                         TEMPORARY
                                                        OFFSET INVK THRESHOLD
                                                   PERM  NO   YES  LOGGING
    *************************************************************************

    UNITADDRESS 0720   DEVTYPE 3380       VOLUME ZZZZZZ
O      CPU C    PHYSICAL ADDRESS XX-10-00
                                                                          Offset
O      FAILURE AT ADDRESS: CYLINDER 0355  HEAD 00      0    0    2    0   Invoked
       LAST SENSE AT: 118/81  23:41:29:82
O      00001000 008F2053 01220000 08951000 0600007A 0001C000

O      FAILURE AT ADDRESS: CYLINDER 0355  HEAD 01      0    0    1    0
       LAST SENSE AT: 118/81  14:23:39:42
O      00001000 008F2053 01220000 08951000 0600007A 0001C000

       FAILURE AT ADDRESS: CYLINDER 0770  HEAD 02      0    0    3    0
O      LAST SENSE AT: 118/81  16:13:20:39
       00001000 00023153 01950001 08951000 06000F5A 00400000

O      FAILURE AT ADDRESS: CYLINDER 0328  HEAD 05      0    0    2    0
       LAST SENSE AT: 118/81  22:34:11:07
       00001000 00481253 01480002 195C1000 0600072A 00100000
```

With Offset Not Invoked

For temporary errors, it is recommended that action be taken whenever the error rate threshold is exceeded 1 or more times. Examine the DASD Data Transfer Summary report to determine which tracks to check when the temporary threshold has been exceeded. The value in the temporary column is listed beside the address (cylinder and head numbers) where an operation was in progress when the data error rate threshold for the volume was exceeded. This does not necessarily mean this cylinder and head is the one to check. Errors could have been accumulating at other tracks on the volume until a single error at this failure address caused the threshold to overflow.

To determine which tracks to check for temporary errors, refer to the examples in the illustration. *Add the value in the temporary column to the value in the threshold logging column.* The failure addresses with the *highest total values* are the tracks for corrective action. Refer to the three examples. In each case, the volume has exceeded the threshold two times, but the distribution of errors is different in each example. The tracks with the highest totals are indicated. When more than one track had many errors, both tracks should be checked, as in example 3.

```
   DASD DATA TRANSFER SUMMARY                          REPORT DATE 261 81
   PROBABLE FAILING UNIT - VOLUME                      PERIOD FROM 260 81
                                                              TO    261 81

                                                      SENSE COUNTS          Threshold
                                                        TEMPORARY           Exceeded
                                                      OFFSET INVK THRESHOLD
                                                 PERM  NO   YES  LOGGING
   ************************************************************************************

   UNITADDRESS 0720    DEVTYPE 3380          VOLUME ZZZZZZ
       CPU C    PHYSICAL ADDRESS XX-10-00

       FAILURE AT ADDRESS: CYLINDER 0655   HEAD 00      0      0    0      2
       LAST SENSE AT: 118/81   23:41:29:82
       00001000 008F2053 01220000 08951000 0600007A 0001C000

       FAILURE AT ADDRESS: CYLINDER 0770   HEAD 01      0      2    0     15    = 17
       LAST SENSE AT: 118/81   16:13:20:39
       00001000 00023153 01950001 08951000 06000F5A 00400000

       FAILURE AT ADDRESS: CYLINDER 0328   HEAD 02      0      0    0      2
       LAST SENSE AT: 118/81   22:34:11:07
       00001000 00481253 01480002 195C1000 0600072A 00100000

       FAILURE AT ADDRESS: CYLINDER 0532   HEAD 07      0      0    0      2
       LAST SENSE AT: 118/81   23:14:05:02
       00001000 00142753 00A70007 07811000 06000284 06000000


   UNITADDRESS 0720    DEVTYPE 3380          VOLUME ZZZZZZ
       CPU C    PHYSICAL ADDRESS XX-10-00

       FAILURE AT ADDRESS: CYLINDER 0655   HEAD 00      0      0    0      2
       LAST SENSE AT: 118/81   23:41:29:82
       00001000 008F2053 01220000 08951000 0600007A 0001C000

       FAILURE AT ADDRESS: CYLINDER 0770   HEAD 01      0      1    0     15    = 16
       LAST SENSE AT: 118/81   16:13:20:39
       00001000 00023153 01950001 08951000 06000F5A 00400000

       FAILURE AT ADDRESS: CYLINDER 0328   HEAD 02      0      1    0      2
       LAST SENSE AT: 118/81   22:34:11:07
       00001000 00481253 01480002 195C1000 0600072A 00100000

       FAILURE AT ADDRESS: CYLINDER 0532   HEAD 07      0      0    0      2
       LAST SENSE AT: 118/81   23:14:05:02
       00001000 00142753 00A70007 07811000 06000284 06000000


   UNITADDRESS 0720    DEVTYPE 3380          VOLUME ZZZZZZ
       CPU C    PHYSICAL ADDRESS XX-10-00

       FAILURE AT ADDRESS: CYLINDER 0655   HEAD 00      0      0    0      2
       LAST SENSE AT: 118/81   23:41:29:82
       00001000 008F2053 01220000 08951000 0600007A 0001C000

       FAILURE AT ADDRESS: CYLINDER 0770   HEAD 01      0      1    0     15    = 16
       LAST SENSE AT: 118/81   16:13:20:39
       00001000 00023153 01950001 08951000 06000F5A 00400000

       FAILURE AT ADDRESS: CYLINDER 0328   HEAD 02      0      0    0     22    = 22
       LAST SENSE AT: 118/81   22:34:11:07
       00001000 00481253 01480002 195C1000 0600072A 00100000
```

Example 1

Example 2   Highest Total Errors

Example 3

3375 and 3380 Condition 1: Temporary data checks with offset invoked at 3 or more track addresses. (Refer to the special instructions for guidance on determining when offset is invoked.)

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utilities or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (1)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate automatically. Rewrites HA and R0 on each track of volume, if possible. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative for possible hardware problem. If INIT executed, restore data from temporary copy.

3375 and 3380 Condition 2: Permanent data checks on 3 to 10 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use Device Support Facilities, ANALYZE No Scan If ANALYZE hardware test passes, use appropriate utility or Data Set Services to copy as much data as possible from *all volumes of head disk assembly* temporarily to another device. Use the following Device Support Facilities command sequence for **each** track. INSPECT Track (cccc hhhh) - 　　　　　 Check (1) - 　　　　　 Assign - 　　　　　 **Preserve** If Lastcc = 8 then INSPECT Track (cccc hhhh) - 　　　　　 Check (1) - 　　　　　 Assign - 　　　　　 **No Preserve**	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." Executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect. If allowable skips are exhausted, flags the track and assigns alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.	If "Suspected Drive Problem" message, use appropriate utility or program to dump as much data as possible from *all volumes of head disk assembly* temporarily to another device. Call service representative for possible hardware problem. If INSPECT executed, do the following. If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3375 and 3380 Condition 3: Permanent data check at 1 or 2 track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to attempt to copy data from track temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
  Do
    INSPECT   Track (cccc hhhh) -
              Check (1) -
              Assign -
              Preserve
    If Lastcc = 8
    then
    INSPECT   Track (cccc hhhh) -
              Check (1) -
              Assign -
              No Preserve
End
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. Preserves data from track if it can be read. Checks surface of tracks. Skips defect and uses displacement location on same track. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. If data was preserved, restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed, do the following. If data was preserved, eliminate temporary copy. If not preserved, restore data from temporary copy, or from copy created before error occurred and update as needed.

3375 and 3380 Condition 4: Temporary data checks when threshold exceeded with errors at 1 to 10 track addresses. The following instructions do not apply if offset was invoked at 3 or more track addresses. Instead, go to condition 1.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action

Use appropriate utility or program to copy data from tracks, temporarily to another device.
 	
Use the following Device Support Facilities command sequence for **each** track.
 	
ANALYZE No Scan
If Lastcc < 8
then
INSPECT   Track (cccc hhhh) -
           Check (1) -
           Assign -
           Preserve
	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem."
	
	If ANALYZE test does not detect hardware problem, executes INSPECT. If data can be preserved, checks surface of tracks. Skips defect and uses displacement location on same track. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0. Restores data.
		If "Suspected Drive Problem" message, call service representative for possible hardware problem.
		
		If INSPECT executed and data was preserved, eliminate temporary copy.
		
		If data could not be preserved, you may wish to try INSPECT with No Preserve.

3375 and 3380 Condition 5: Permanent data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Call hardware service representative.		

3375 and 3380 Condition 6: Temporary data checks at 11 or more track addresses.

Your Action	Device Support Facilities Actions	Your Response to Device Support Facilities Action
Use appropriate utility or program to copy data from volume temporarily to another device. Use Device Support Facilities ANALYZE No Scan If Lastcc < 8 then INIT Check (2)	Exercises hardware. If ANALYZE test detects hardware problem, issues diagnostic message, "Suspected Drive Problem." If ANALYZE test does not detect hardware problem, executes INIT. Checks surface of all tracks. Skips defects. If allowable skips are exhausted, flags the track and assigns an alternate track automatically. Rewrites HA and R0 of all tracks. Rewrites volume label and VTOC.	If "Suspected Drive Problem" message, call service representative for possible hardware problem. If INIT executed, restore data from temporary copy.

Impact of Error on Data

Your first concern when there is a disk storage error is the impact on the data and the operation in progress. Permanent equipment and data checks usually cause the operation to be abnormally terminated, depending on the program in control.

The impact of an error on data, as well as error recovery actions, depends on the source of the error and the type of operation in progress when the error occurred. The source of the error determines the amount of data affected by the error situation.

In addition to the following discussion, refer to Figure 6.

When the Source is the Hardware

Validity of Data

During a write operation, a hardware problem can cause an equipment check, but no data check. If an equipment check occurs during a write operation, there is a possibility the data may not be written correctly on the disk. The probability of creating a data error under this circumstance is slight because the system error recovery procedures automatically retry the operation repeatedly. However, if the retry procedures are not successful, the equipment check is permanent and the data being written may not be valid. An error created under this circumstance may go undetected as a data error on a subsequent read. Therefore, you should consider rewriting the data after the hardware problem is remedied by a service representative.

During a read operation, a hardware problem can cause an equipment check or a data check. Assuming the data was written correctly, it can be read correctly once the hardware problem is remedied by a service representative.

Determination of the operation in progress when an error occurred can usually be obtained from the job log.

Accessibility of Data

When the source of an error is the hardware, the continued accessibility of data depends on whether the probable failing unit is one of the components in the path (channel, storage control, or controller) or the device.

Path Component

If the hardware probable failing unit is one of the components in the path, data may still be accessible from the device over another path made up of a different configuration of components. Whether or not an alternate path can be configured depends on the product type involved, the channel and string switches available, and whether there is an alternate controller.

If another path can be configured with alternate components, there are no restrictions on the continued writing and reading of data at the attached disk storage. Use of an alternate path when there is an error is under control of the operating system.

Device

If the hardware probable failing unit is the device, the data is temporarily not accessible.

If a 3330 or 3340, the disk pack or data module can be moved to another drive. However, with a 3330 disk pack you must be cautious about doing this as a serious defect on a disk surface may damage a head at the other drive. If a non-removable head and disk assembly, the data, if required immediately, usually must be obtained from a backup source and restored to a different device. Or if immediate access to the data is not required, the data can be obtained from the failing unit after it has been restored to operation.

In many cases, a failing device can be serviced while other devices in the same unit or string continue to be used.

When the Source is a Volume

When the source of an error is a volume probable failing unit, only a portion of the data is affected.

The data affected can still be read if it is a temporary data check, because automatic error recovery procedures successfully retried the operation or reconstructed the data. If the error was permanent, and the condition continues, the affected data is lost. It can only be obtained from a backup copy, but it can usually be rewritten on the same volume at a different location or at the same location after using the Device Support Facilities surface checking function.

Probable Failing Unit	Data Affected	Recovery
Channel Storage control (storage director)	All DASD strings connected. If permanent error, data is temporarily not obtainable through probable failing unit.	If alternate components are available, data can continue to be written and read through another path. If the error is permanent and continuous, service for the probable failing unit is required to restore use.
Controller	All volumes on string. If permanent error, data is temporarily not obtainable through probable failing unit.	If there is an alternate controller on 3350, 3375, and 3380, data can continue to be written and read through the other controller. If the error is permanent and continuous, service for the probable failing unit is required to restore use.
Device	Volume or volumes at a physical device. If permanent error, data is temporarily not obtainable from probable failing unit.	If removable media, the disk can be moved to another drive where data can be written and read. (**Note:** *Refer to 3330 caution on previous page.*) If non-removable media, the data is not immediately available except from backup source. If the error is permanent and continuous, service for the probable failing unit is required to restore use.
Volume	Portion of data on volume. If the error is a temporary type (because it was recovered by the subsystem or system), the data is obtainable from the probable failing unit. If the error is permanent and continuous, the primary copy of the data is lost.	A secondary copy of the lost data may be obtainable from backup source. Device Support Facilities program can remedy the cause of the error in most cases.

Figure 6. Effect of Error on Availability of Data

Glossary

CCHH	cylinder/head (track address)		**MB**	megabytes
CCW	channel command word		**MVS**	Multiple Virtual Storage
CPU	central processing unit		**OS/VS**	Operating System/Virtual Storage
DDA	Direct Disk Adapter		**PCUA**	primary channel unit address
DOS	Disk Operating System		**RACF**	Resource Access Control Facility
ECC	error correction code		**rbn**	relative block number
EREP	environmental recording, editing, and printing program		**R0**	record zero
			SCUA	secondary channel unit address
FTA	File Tape Adapter		**VM**	Virtual Memory
HA	home address (of track)		**VSAM**	virtual storage access method
ID	identification		**VTOC**	volume table of contents
IFA	Integrated File Adapter			

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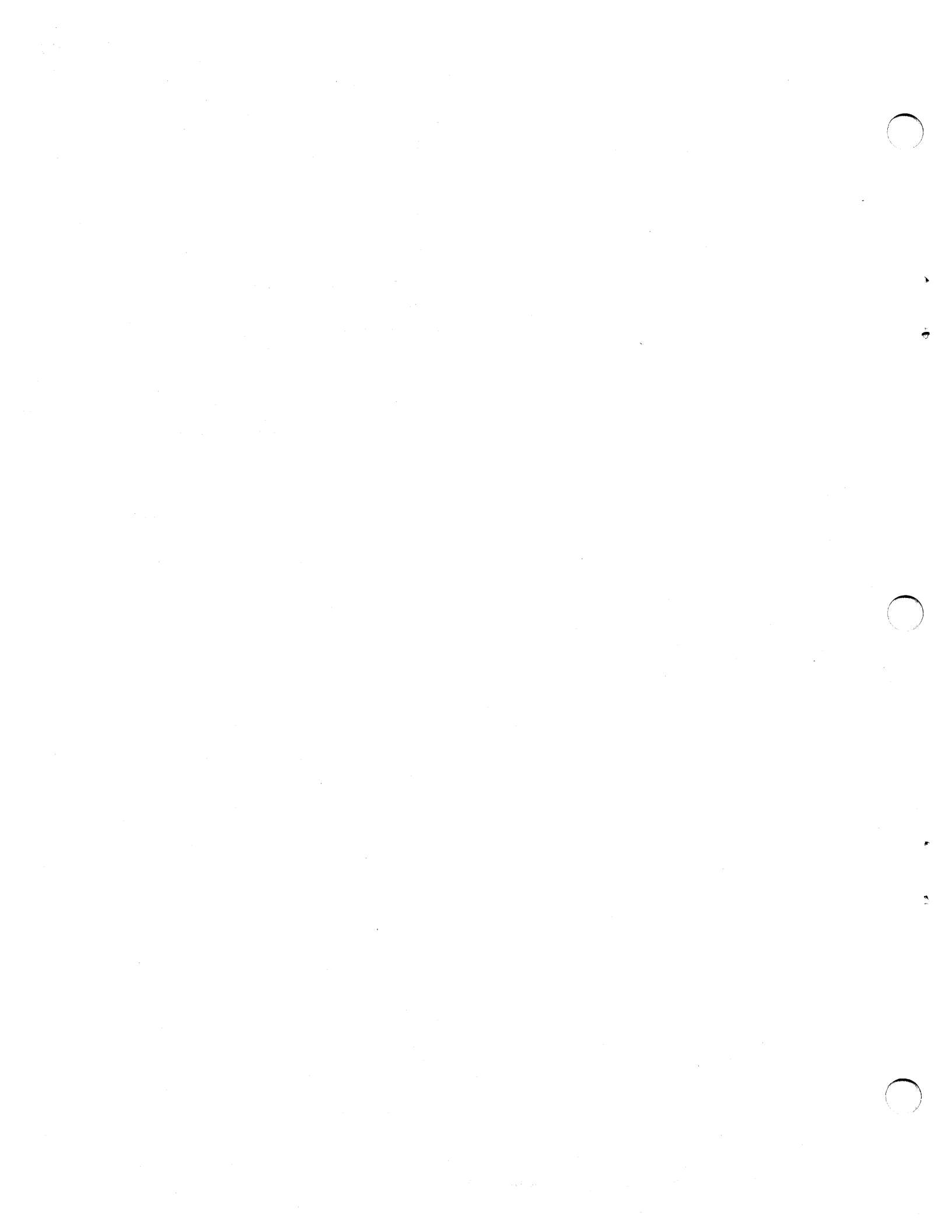
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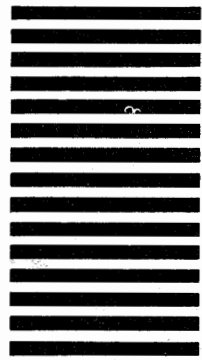
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