

C141-F059-01EN

**MHS2060AT, MHS2040AT
MHS2030AT, MHS2020AT**

DISK DRIVES

MAINTENANCE MANUAL

The Fujitsu logo consists of the word "FUJITSU" in a bold, sans-serif font. Above the letter "I" are two interlocking circles, which are the traditional symbol for the company.

FOR SAFE OPERATION

Handling of This Manual

This manual contains important information for using this product. Read thoroughly before using the product. Use this product only after thoroughly reading and understanding especially the section "Important Alert Items" in this manual. Keep this manual handy, and keep it carefully.

FUJITSU makes every effort to prevent users and bystanders from being injured or from suffering damage to their property. Use the product according to this manual.

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The contents of this manual may be revised without prior notice.

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Revision History

(1/1)

Edition	Date	Revised section (*1) (Added/Deleted/Altered)	Details
01	2002-07-15	—	—

1 Section(s) with asterisk () refer to the previous edition when those were deleted.

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Preface

This manual describes the MHS2060AT, MHS2040AT, MHS2030AT and MHS2020AT 2.5-inch hard disk drives with a built-in controller that is compatible with the ATA interface.

This manual explains, in detail, how to maintain the disk drives.

This manual assumes that users have a basic knowledge of hard disk drives and their application in computer systems.

This manual consists of the following two chapters:

Overview of Manual

CHAPTER 1 Maintenance and Diagnosis

This chapter explains MHS2060AT, MHS2040AT, MHS2030AT and MHS2020AT maintenance requirements, operation verification, and troubleshooting.

CHAPTER 2 Removal and Replacement Procedure

This chapter explains the procedure for removing and replacing MHS2060AT, MHS2040AT, MHS2030AT and MHS2020AT.

Abbreviations

This section lists the abbreviated terms and their full words used in this manual.

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In this manual, disk drives may be referred to as drives, or devices.

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Conventions for Alert Messages

This manual uses the following conventions to show the alert messages. An alert message consists of an alert signal and alert statements. The alert signal consists of an alert symbol and a signal word or just a signal word.

The following are the alert signals and their meanings:



This indicates a hazardous situation *could* result in *minor or moderate personal injury* if the user does not perform the procedure correctly. This alert signal also indicates that damages to the product or other property *may* occur if the user does not perform the procedure correctly.

IMPORTANT

This indicates information that could help the user use the product more efficiently.

In the text, the alert signal is centered, followed below by the indented message. A wider line space precedes and follows the alert message to show where the alert message begins and ends. The following is an example:

(Example)



Don't install or remove a PCA or connect or disconnect a cable or connector plug when the drive is powered. This may give you an electric shock.

The main alert messages in the text are also listed in the "Important Alert Items."

Operating Environment

This product is designed to be used in offices or computer rooms.

For details regarding the operating environment of use, refer to the Product Manual (C141-E171-01EN).

Attention

Please forward any comments you may have regarding this manual.

To make this manual easier for users to understand, opinions from readers are needed. Please write your opinions or requests on the Comment at the back of this manual and forward it to the address described in the sheet.

Liability Exception

"Disk drive defects" refers to defects that involve adjustment, repair, or replacement.

Fujitsu is not liable for any other disk drive defects, such as those caused by user misoperation or mishandling, inappropriate operating environments, defects in the power supply or cable, problems of the host system, or other causes outside the disk drive.

Important Alert Items

Important Alert Messages

The important alert messages in this manual are as follows:

This manual uses the key alert messages given below.

The following manual also contains notes on safety precautions:



A hazardous situation *could* result in *minor* or *moderate personal injury* if the user does not perform the procedure correctly. Also, damage to the predate or other property, *may* occur if the user does not perform the procedure correctly.

Task	Alert message	Page
Maintenance	Static, Damage <ol style="list-style-type: none">1. Don't install or remove a PCA or connect or disconnect a cable or connector plug when the drive is powered. This may give you an electric shock.2. Keep away from mechanical assemblies in the unit during operation. This may cause injuries.3. Avoid dangerous detergent when the disk drive is cleaned.	1-2

Task	Alert message	Page
Maintenance	<p>Device damage</p> <ol style="list-style-type: none"> 1. Before touching a PCA or the drive, wear a wrist strap and perform the human body grounding to discharge static electricity from your body. This will prevent irreparable damage to the PCA and the head of the drive. 2. Don't install or remove a PCA or connect or disconnect a cable or connector plug when the drive is powered. This will prevent electrical damage to the disk drive. 3. Operating the disk drive with one or more PCA missing will be unpredictable. Only power the drive with all boards installed. 4. Avoid any detergent which may cause short circuits when cleaning assemblies. 5. Keep all vents open opened and unblocked. Avoid other conditions which may cause circuits to overheat. 6. A ribbon type cable has one line marked. Ensure that this line is always connected to pin 1 of the cable connector. 7. Do not apply excessive force to the cover under any circumstances. Doing so may cause irreparable damage to the cover. 	1-2
	<p>Device damage</p> <p>The DE is completely sealed. Do not open the DE in the field.</p>	1-3
	<p>Data corruption</p> <p>When asking for repair, save all data stored in the disk drive beforehand. Fujitsu Limited is not responsible for any loss of data during service and repair.</p>	1-4
	<p>Device damage</p> <p>The disk enclosure must never to be opened in the field. Opening the disk enclosure may cause irreparable damage.</p>	1-13

Task	Alert message	Page
Maintenance	Damage or Device damage <ol style="list-style-type: none">1. Perform any removal after the system power is completely disconnected. The cable must not be disconnected and the screws that attach the drive must not be removed with the power ON.2. Do not move the drive until it comes to a complete stop (about 30 s after the power is turned OFF).3. Perform the human body grounding to discharge any static electricity from your body.(Be sure to wear a wrist strap)	2-2

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Manual Organization

MHS2060AT, MHS2040AT
MHS2030AT, MHS2020AT

DISK DRIVES
PRODUCT MANUAL
(C141-E171)

1. Device Overview
2. Device Configuration
3. Installation Conditions
4. Theory of Device Operation
5. Interface
6. Operations

MHS2060AT, MHS2040AT
MHS2030AT, MHS2020AT

DISK DRIVES
MAINTENANCE MANUAL

<This manual>

1. Maintenance and Diagnosis
2. Removal and Replacement Procedure

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CHAPTER 1 Maintenance and Diagnosis

- | | |
|-----|---------------------------|
| 1.1 | Maintenance |
| 1.2 | Operation Confirmation |
| 1.3 | Troubleshooting Procedure |

This chapter describes the maintenance, diagnosis, operation check, and troubleshooting of the disk drive. The following are explained:

- Rules for regular maintenance and troubleshooting
- Display of maintenance level (field and factory)
- Display of machine revision number and number change in the field
- Tools and test devices needed for each maintenance level
- Standard testing for each maintenance level
- Recommended procedure for troubleshooting and fault diagnosis

1.1 Maintenance

1.1.1 Rules for maintenance

The following cautions must be observed to prevent injury during troubleshooting or maintenance.

CAUTION

Static, Damage

1. Don't install or remove a PCA or connect or disconnect a cable or connector plug when the drive is powered. This may give you an electric shock.
2. Keep away from mechanical assemblies in the unit during operation. This may cause injuries.
3. Avoid dangerous detergent when the disk drive is cleaned.

The following cautions must be observed to avoid damaging the disk drive during troubleshooting and maintenance.

CAUTION

Device damage

1. Before touching a PCA or the drive, wear a wrist strap and perform the human body grounding to discharge static electricity from your body. This will prevent irreparable damage to the PCA and the head of the drive.
2. Don't install or remove a PCA or connect or disconnect a cable or connector plug when the drive is powered. This will prevent electrical damage to the disk drive.
3. Operating the disk drive with one or more PCA missing will be unpredictable. Only power the drive with all boards installed.
4. Avoid any detergent which may cause short circuits when cleaning assemblies.
5. Keep all vents open and unblocked. Avoid other conditions which may cause circuits to overheat.
6. A ribbon type cable has one line marked. Ensure that this line is always connected to pin 1 of the cable connector.
7. Do not apply excessive force to the cover under any circumstances. Doing so may cause irreparable damage to the cover.

1.1.2 Maintenance requirements

(1) Preventive maintenance

The disk drive needs no preventive maintenance, not even the air filter needs to be changed.



Device damage

The DE is completely sealed. Do not open the DE in the field.

(2) Service life

In situations where management and handling are correct, the life of the disk drive is five years when the DE surface temperature is less than 48°C. When the DE surface temperature exceeds 48°C, the life is five years or 20,000 hours of operation, whichever occurs first. Refer to Section 1.7 and 3.2 in Product Manual.

(3) Exchangeable parts in field

The PCA and the DE cannot be replaced separately in the field. Replace the whole disk drive.

(4) Service system and repair

Fujitsu Limited has a disk drive service system and repair facility. When making a request for repair or parts replacement, you should provide related information usually including:

- a) Model name of disk drive, part number (P/N), disk drive revision number, manufacture serial number (S/N), and date of manufacture of the disk drive
- b) Circumstances when the fault occurred
 - Date of trouble occurred
 - System configuration
 - Environmental conditions (including temperature, humidity, and voltage)
- c) Fault history of the drive
- d) Details of the fault
 - Description of the fault
 - Issued command and specified parameters
 - Status (Status/Error register)
 - Interval of the fault
 - Other information for fault diagnosis

**Data corruption**

When asking for repair, save all data stored in the disk drive beforehand. Fujitsu Limited is not responsible for any loss of data during service and repair.

(5) Notes on handling

a. General notes

- a) Vibrations and shocks more severe than allowed will cause fatal damage to the device so be very careful. Be especially careful when unpacking the device.
- b) Do not leave the device in a dusty environment.
- c) Because the device uses GMR (giant MR head) and static sensitive CMOS semiconductors take the following precautions, be careful of the handling on the following points after the device is unpacked.
 - Use an antistatic mat, etc. in the environment for handling the equipment. The worker should also be physically grounded (e.g., wearing a wrist strap).
 - Hold by the DE section, do not directly touch the PCA unit unnecessarily.

b. Unpacking

- a) Use a flat workplace, find which side of the pack is up and be careful not to have the wrong side facing upwards. Do not place the device directly on a hard table, place it on something soft such as a rubber mat.
- b) Be careful not to apply any excessive force to the packed device when removing the shock absorbing material.
- c) When taking the device out of the antistatic bag, be especially careful not to apply any excessive force to the PCA or to the interface connector section.
- d) Never ever remove the DE seal label and screws and the DE cover.

c. Installation

- a) When the power is ON, do not change the switch setting, or connecting, or disconnecting connectors.
- b) Do not move the device or disconnect connectors with the power ON or until the disk drive unit comes to a complete stop after the power is turned OFF (about 30 seconds).

d. Packaging

- a) Place the device in an antistatic vinyl bag along with a desiccant (silica gel).

- b) It is recommended that you use the shock absorption cushion material and packaging that contained the device when it was delivered by Fujitsu.

If the same packaging material cannot be used, use a shock absorbent box that will transmit shocks directly to the device. When using this type of box, adequately protect the PCA surface and interface connector section.

- c) Place a label showing which side is up and clearly stating the notes on handling on the outside of the packaging.

e. Delivery

- a) As a rule, deliver as it is packaged and keep the up side up.
- b) If delivering a single drive after it is unpacked, take it only a short distance. Also, use shock absorbent material to protect it against shock and vibration. Deliver an unpacked device in either of the allowable packed positions. Refer to Section 3.2 of *the MHS2060AT, MHS2040AT, MHS2030AT, MHS2020AT Disk Drives Product Manual*.

f. Storage

- a) Store in dampproof packaging.
- b) Take care that the environmental requirements satisfy the non-operating environmental specifications described in Section 1.4 of *the MHS2060AT, MHS2040AT, MHS2030AT, MHS2020AT Disk Drives Product Manual*.
- c) To prevent condensation, do not subject the device to sudden changes of temperature.

1.1.3 Maintenance levels

Because of its compact size and special repair requirements, it is recommended that the whole disk drive be replaced. This section describes maintenance on two levels.

(1) Field maintenance (disk drive replacement)

- Replacement at the user site.
- Disk drive replacement requires ordinary tools.
- Usually, the user, retailer, seller, or OEM trader will replace the drive.

(2) Factory maintenance (parts replacement)

- Only Fujitsu can perform maintenance at this level.
- This includes maintenance training and assisting other OEM traders. The OEM trader usually assists the retailer and seller.
- Use the factory level tools and test equipment. This includes recommended spare parts and repairing or replacing various parts.

1.1.4 Disk drive revision number

The disk drive revision number is a single alphabetic character followed by a single alphanumeric character. It is stuck on the DE and marked on the revision number label. Figure 1.1 shows the disk drive revision number label format.

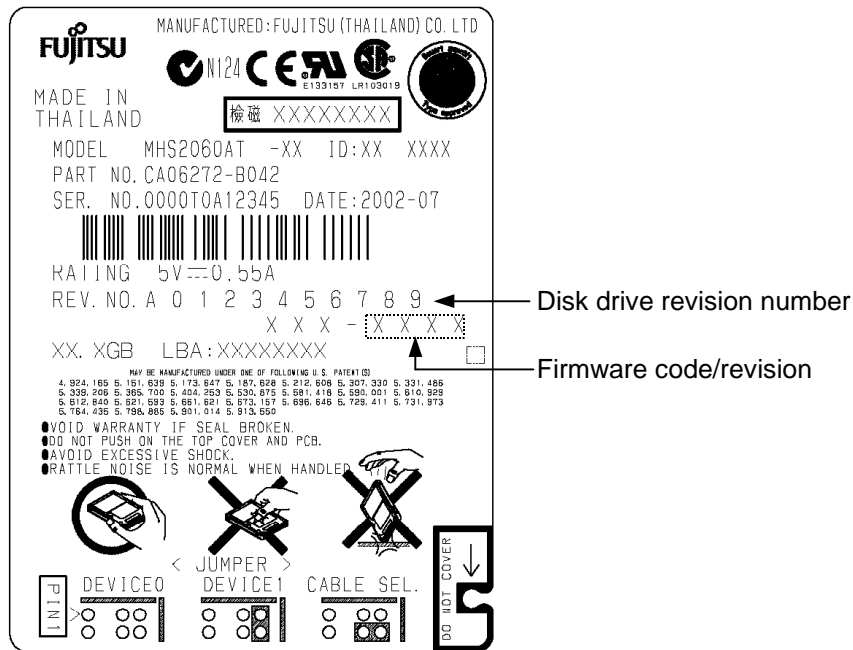


Figure 1.1 Disk drive revision number label

(1) Revision number marking at delivery

The machine revision number is indicated by crossing out up to the relevant number in the relevant alphabetic character row using = marks (see Figure 1.2).

(2) Revision number change in the field

When a part is replaced in the field or other modifications are made, the machine revision number may need to be changed. The level is indicated by crossing out the relevant number in the relevant alphabetic character row using ; marks (see Figure 1.2).

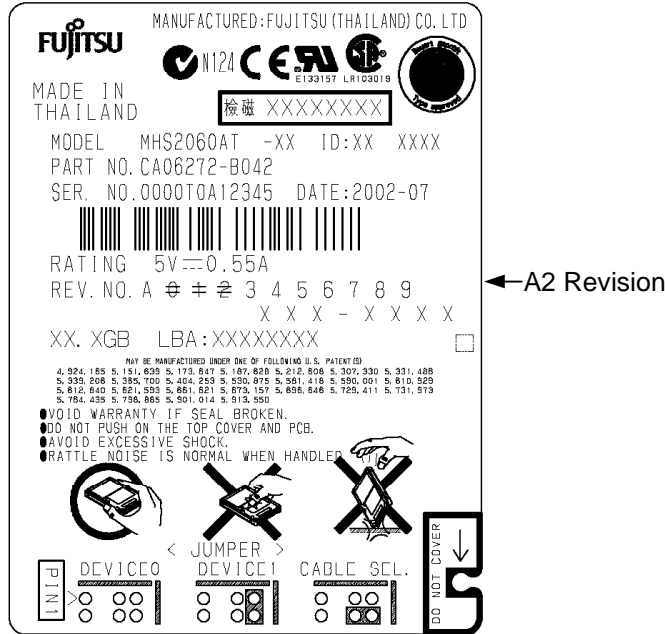
(3) Firmware code and revision

First 2-digit indicates a firmware code and rest 2-digit indicates its revision.

Note:

For a change of revision number after delivery, Fujitsu issues a “Change Request/Notice” and the disk drive revision number after the change. When a change is made at the user site, the revision number level should be changed as described above.

Revision number mark when delivered



Revision number change in the field

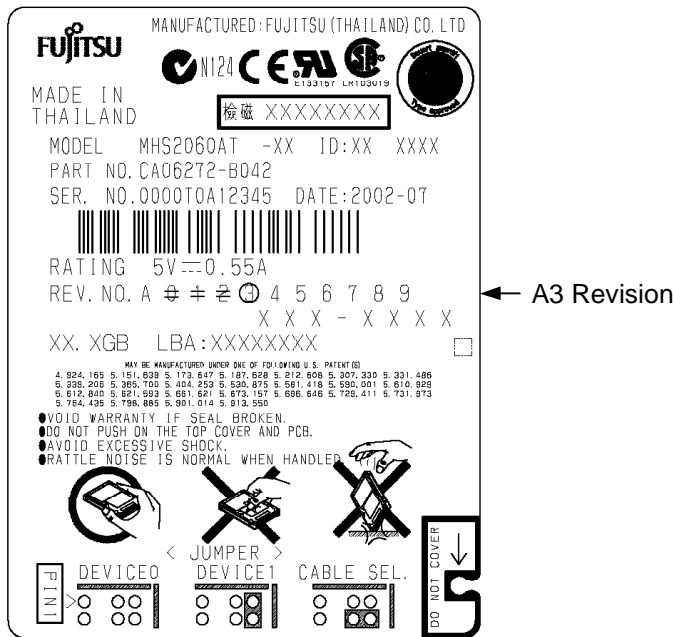


Figure 1.2 Display of disk drive revision number

1.1.5 Tools and test equipment

At the field maintenance level, only ordinary hand tools are required for troubleshooting and repairing the disk drive. Special tools and test equipment is not required.

Factory level tools and test equipment are beyond the scope of this manual.

1.1.6 Self-diagnostics

The disk drive has the following self-diagnostics. These self-diagnostics allow normal basic operation of an isolated disk drive can be checked.

- Initial self-diagnostics
- Offline self-diagnostics (EXECUTE DRIVE DIAGNOSTIC [DIAGNOSTIC] command)

1.1.7 Test

The disk drive test can be divided into the following three levels.

- Operating test (See Subsection 1.2.1, “Operating test.”)
- Diagnostic test (See Subsection 1.2.2, “Diagnostic test.”)

Figure 1.3 shows the relationship between the test level and troubleshooting.

Tables 1.1 and 1.2 show the check contents.

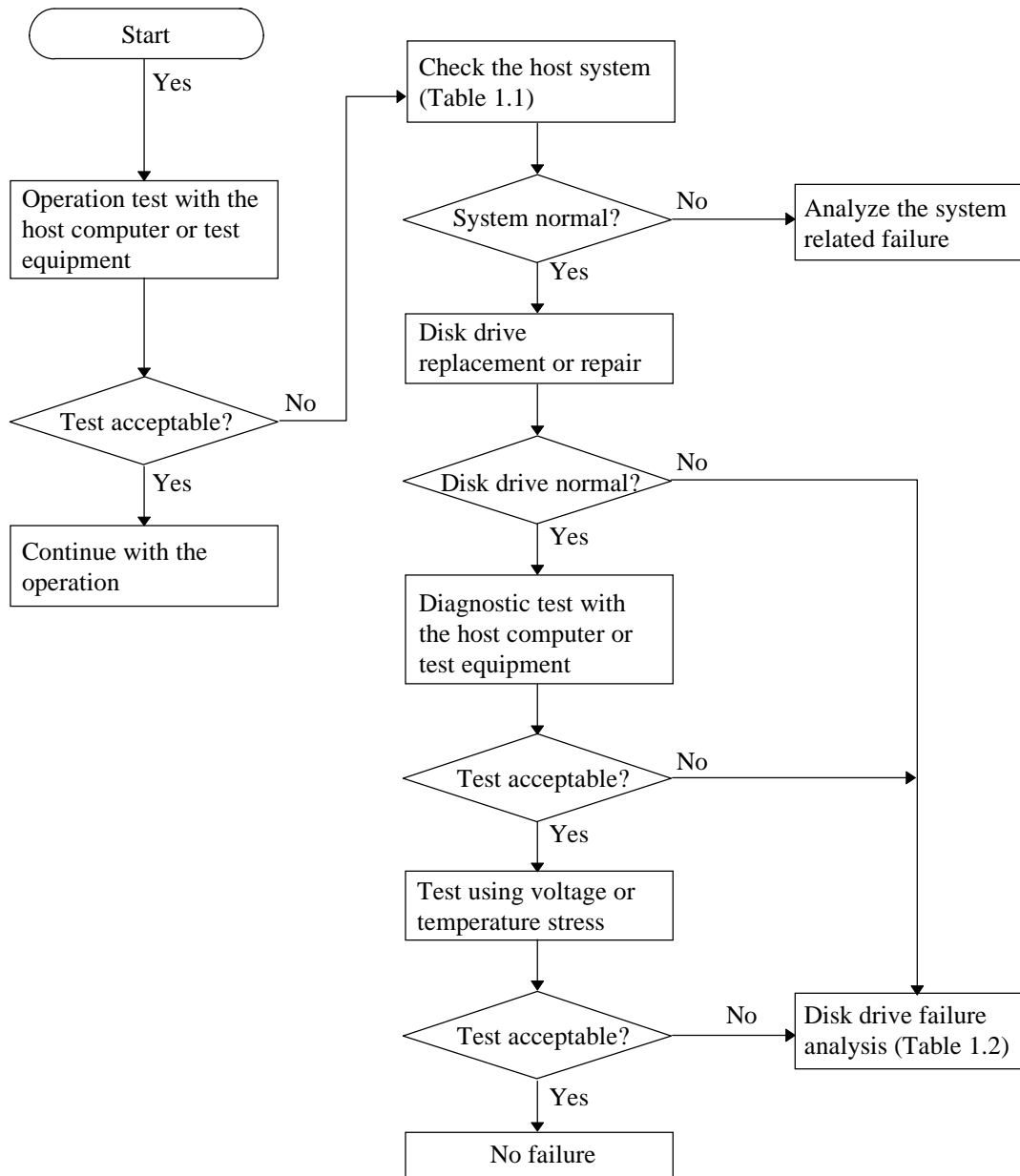


Figure 1.3 Test flowchart

Table 1.1 Status register contents

Status bit	Contents
BIT0=1	Shown in Table 1.2
BIT1, 2	Normal.
BIT3=1 BIT4=1 BIT5=1 BIT6=0 BIT7=1	<ol style="list-style-type: none"> (1) Check whether vibration is transmitted because of the way the disk drive is mounted. (2) Check the power, cable, and connector. (3) If it is concluded that the disk drive is the cause, replace the disk drive.

Table 1.2 Disposition for error register contents

Error bit	Method of disposition
BIT0 BIT1 BIT4 BIT6	If it is concluded that the disk drive is the cause, replace the drive.
BIT2 BIT7	<ol style="list-style-type: none"> (1) Check the status of the host, cable, and drive. (2) If it is concluded that the disk drive is the cause, replace the drive.

1.2 Operation Confirmation

1.2.1 Operation test

When the host computer is processing data, the disk drive monitors disk drive operation errors including data, command, and seek errors. The host is notified of the error that the disk drive detected and the user is notified of its result.

The user may notice intermittent and indefinite failures such as overlong execution time, abnormal noise, abnormal odor, or failures in particular processes.

The failure reported in the operation test will need further investigation. To ascertain the cause of the disk drive failure reported, the disk drive can be replaced. Failures in the operation test are often not caused by the host system. For example, not having enough power supply reserve, a loose cable connection, no timing and mechanical reserves, or relationship with other systems.

In normal operation, the disk drive itself or the host determines the processing (return or halt) following the detected failure state.

To troubleshoot the failure reported in the test at this level, accurately reproduce the condition that caused the failure. Then, by replacing the disk drive, try to separate the fault from the other sections of the disk drive host system.

1.2.2 Diagnostic test

The diagnostic test is used to separate a confirmed disk drive failure to a disk drive subassembly or to check the disk drive performance. A test of this level usually includes a specific disk drive function or concentrated execution of a group of functions. The test is usually performed by a factory engineer and not where the failure was reported. The disk drive is tested using another host computer or test equipment.

To troubleshoot the disk drive failure in the diagnostic test, the engineer will reproduce the failure condition. The engineer then isolates the failure to a subassembly or part of the disk drive.

The procedures used in a test of this level great depend on the test equipment used. It is beyond the range of this manual.

1.3 Troubleshooting Procedure

1.3.1 Troubleshooting procedure

This section describes the troubleshooting procedures for a disk drive failure at field maintenance level described in Subsection 1.1.3.

In this section, troubleshooting is made to isolate the reported failure to the disk drive or a host system. Usually, troubleshooting is necessary only when a cause of failure is uncertain or unknown. When a cause of failure is clear (for example, abnormal sound in the DE or burnt parts on the PCA), a level of troubleshooting is low.

1.3.2 Troubleshooting disk drive replaced in field

It is recommended that the whole drive be replaced in maintenance of this level. If replacing the drive corrects the fault, return the old drive to the factory for testing and repair. If the new drive shows the same fault as the one that was removed, the failure is elsewhere in the system.

System level troubleshooting, shown in Table 1.3, is performed at the user site to isolate the reported failure to the disk drive or system.

Table 1.3 System level and field troubleshooting

Check to be made	Recommended work
DC power voltage level	Confirm that the DC power voltage is within $\pm 5\%$ of the standard value. When measured at pins 41 and 42 of the power supply connector, the +5 VDC must be 4.75 to 5.25 VDC.
DC power ripple noise	Check that the maximum ripple at +5 VDC power is less than 100 mV peak to peak and 200 mV peak to peak respectively.
Power-interface cable connection	Confirm that the AT interface cable is properly connected at the disk drive, power supply section, and control unit.
Switch setting	Confirm that the switch on the disk drive control PCA is set for normal operation with the host computer. Refer to Section 3.4 of <i>the MHS2060AT, MHS2040AT, MHS2030AT, MHS2020AT Disk Drives Product Manual</i> for switch setting.
System cable	Confirm that all cable connections throughout the system correctly connected.
System diagnostic test	To further isolate the failure, if it can be done, execute the system level diagnostic routine described in the host computer manual.
Intermittent or indefinite error	<p>Check the AC voltage level at the power supply section and recheck the DC voltage level at the disk drive power supply connector.</p> <p>If the AC voltage level is abnormal, or if there is a lot of electrical noise, notify the user.</p> <p>If the DC voltage level is unstable, replace the power supply section.</p> <p>If possible, replace the disk drive. If the fault remains, the disk drive is not the case. For suggestions to isolate the failure further, refer to the hardware and software manuals provided with the system.</p>

1.3.3 Troubleshooting at factory

When the trouble is recovered by replacing the drive at field (Subsection 1.3.2), troubleshoot the replaced drive to isolate the trouble to the subassembly parts.

To shorten the troubleshooting time and repairing time, gather the data, such as environmental data and other information, from the user and then return the failed drive to the factory with the media defect list to repair.

At the factory, user environment is made and a reappearance test is performed. To reappearance a same trouble at user, the failed drive is connected to the host system. If no trouble occurs by the normal test, the reappearance test is performed by adding the voltage/temperature load using a disk drive tester or tools according to the user environment.

When a trouble reappeared, troubleshoot the cause of failure. Then, replace the failed unit or parts.

As this level maintenance is made by a factory, this maintenance level is beyond the scope of this manual.



Device damage

The disk enclosure must never to be opened in the field. Opening the disk enclosure may cause irreparable damage.

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CHAPTER 2 Removal and Replacement Procedure

- | | |
|-----|--------------------|
| 2.1 | Spare Parts |
| 2.2 | Disk Drive Removal |

This chapter explains the procedure for removing and replacing the disk drive. It is assumed that the reader has a thorough knowledge of replacing the complete disk drive and replacing the power-interface cable.

When carrying out these procedures, note the following items.

- Be sure to wear a wrist strap when removing the disk drive from the host system.
- The disk drive must have been removed from the host system.
- A power-interface cable to the disk drive must be disconnected.
- Mounting is done by reversing the steps for removal.

To carry out maintenance properly, observe the following:

- Place removed screws and other parts where they will not get lost or damaged.
- Keep a record of all maintenance work.
- Tighten screws securely but not excessively.
- Before touching the PCA, perform the FG (frame ground) to discharge any static electricity from your body. This ensures that the worker will not electrically damage the PCA.
- Do not push the DE cover under any circumstances.

2.1 Spare Parts

See Table 2.1 for the model and parts numbers to order the replacement disk drive.

Table 2.1 Model and parts numbers

Model	Part number	Formatted capacity	Mounting screw
MHS2060AT	CA06272-B042	60 GB	M3 (depth 3)
MHS2040AT	CA06272-B83100DX	40 GB	
MHS2030AT	CA06272-B022	30 GB	
MHS2020AT	CA06272-B82200DY	20 GB	

2.2 Disk Drive Removal

The method and procedures to demount the disk drive to check the jumper terminal, change the jumper position, or replace the device differ depend on the system cabinet structure. Therefore, for actual working procedures, the specific conditions necessary for each system must be determined. The general removal procedures, with notes, is as follows.

- a) Disconnect the power-interface cable.
- b) Remove the screws that attach the drive and remove the drive from the system cabinet.
- c) When storing or transporting the drive, pack it an antistatic bag.

To protect the device from damage and prevent the worker getting hurt, observe the following cautions and precautions in Subsection 1.1.1.

CAUTION

Damage or Device damage

1. Perform any removal after the system power is completely disconnected. The cable must not be disconnected and the screws that attach the drive must not be removed with the power ON.
2. Do not move the drive until it comes to a complete stop (about 30 s after the power is turned OFF).
3. Perform the human body grounding to discharge any static electricity from your body. (Be sure to wear a wrist strap)

Acronyms and Abbreviations

A		H	
ABRT	Aborted command	HA	Host adapter
AC	Alternating current	HDD	Hard disk drive
AIC	Automatic idle control	I	
AMNF	Address mark not found	IDNF	ID not found
ATA	AT attachment	IRQ14	Interrupt request 14
AWG	American Wire Gauge	L	
B		M	
BBK	Bad block detected	LED	Light emitting diode
BIOS	Basic input-output system	O	
C		P	
CORR	Corrected data	PCA	Printed circuit assembly
CH	Cylinder high register	PIO	Programmed input-output
CL	Cylinder low register	P/N	Parts number
CM	Command register	R	
CMOS	Complementary metal-oxide semiconductor	RLL	Run-length-limited
CSR	Current sense register	S	
CSS	Contact start/stop	SA	System area
CY	Cylinderregister	SC	Sector count register
D		SG	Signal ground
dBA	dB A-scale weighting	SN	Sector number register
DC	Direct current	ST	Status register
DE	Disk enclosure	S/N	Serial number
DH	Device/head register	T	
DRDY	Drive ready	TPI	Tracks per inches
DRQ	Data request bit	TRONF	Track 0 not found
DSC	Drive seek complete	Typ	Typical
DWF	Drive write fault	G	
E		F	
ECC	Error checkingand correction	FR	Features register
ER	Error register	G	
ERR	Error	H	
F		I	
GB	Giga byte	L	

U

UNC Uncorrectable ECC error

V

VCM Voice coil motor

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