REPLACEMENT SECTION

Contents

NOTICE: Unless otherwise stated, "firmware version" in this section indicates DKCMAIN firmware.

1. Before Starting Replacement Work

This section explains procedures for replacing parts which are specified as maintenance parts and identified as failed parts through troubleshooting, etc.
DW850 is used in a form of rackmount model.

NOTICE:
- During the replacement, the part statuses in the "Web Console", "Maintenance Utility", and "Maintenance" windows might be displayed differently from the actual statuses. (Example: The CHBs during the replacement processing are displayed as the [Normal] status.) In that case, complete the running maintenance operation, and then refresh the display information in each window.
- In the following cases, start the Maintenance Utility from the Web Console window. (See MAINTENANCE PC SECTION "2.7.1 Starting the Maintenance Utility window from the Web Console window".)
  - The instruction to use the force execution option is provided in TROUBLESHOOTING SECTION.
  - The instruction is specifically provided by factory.

1.1 Before Starting Replacement Work

Take notice of the following when performing a maintenance work for the Storage System. Notes for work are described with "NOTE". Read and understand them well before performing the maintenance.

1.1.1 Note at the Time of the Unpacking

- Unpack it indoor.
  Especially, do not unpack it in such places with the outdoor dust, the direct sunlight, and the infiltration of rainwater.
- Work on the unpacking in the place where a rapid difference of temperature does not occur.
  It may have dew condensation when it is unpacked in the place where a difference of temperature is extreme.
  Further, if the part that remains at high or low temperature in transport is installed in the Storage System, it may not operate normally.

1.1.2 Note on Turning Off the Power

- The user data may be lost unless the power is turned off in the correct procedure.
- Since the power feeding to the Storage System is duplicated, when turning off the power, remove the power cables from two Power Supply per Storage System.

⚠ WARNING

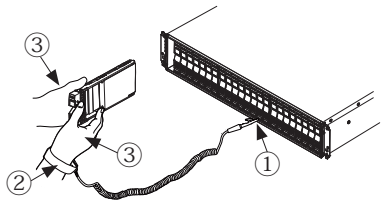
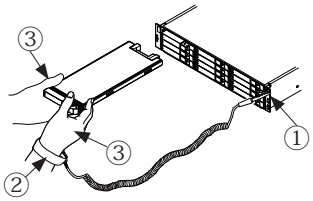
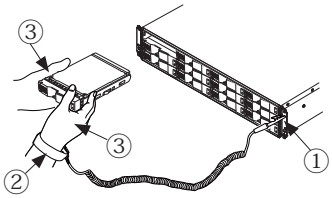
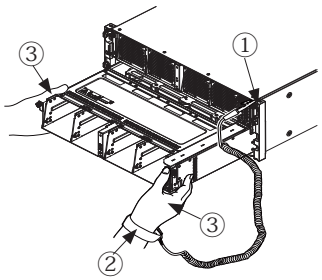
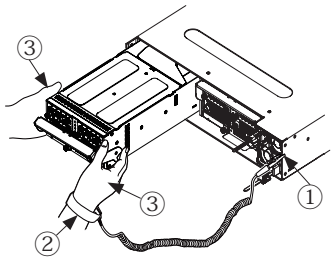
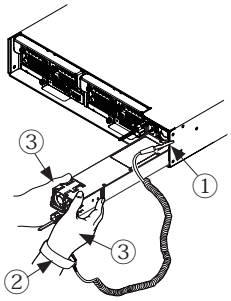
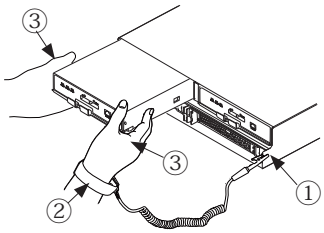
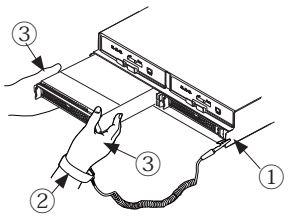
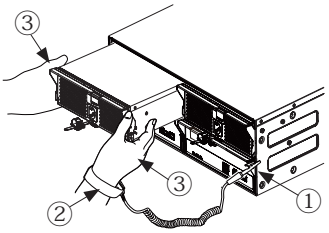
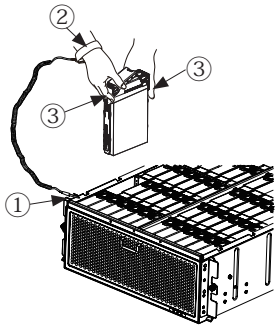
When doing a hot replacement of a part, do not wear metallic accessories or a watch so as to avoid an electric shock. Be careful not to touch any of live parts with a screwdriver, etc.

NOTICE:
- Do not disassemble or remodel parts for maintenance. Otherwise, a failure or a serious accident may be caused. Be sure to replace parts in units of formally defined maintenance part.
- When replacing the Power Supply, do it in haste after preparing a replacement Power Supply and arranging cables, etc. so that they do not disturb the replacement.

1.1.3 Note on Installing and Removing Parts

- Generally, each part is installed with high-precision components. Remove and install the part gently so as not to give it any shock.
- Be sure to wear a wrist strap connected to the Storage System before starting and do not take it off until you finish.
- When you install a Drive, Controller Board, Channel Board, Disk Board and ENC support its metal part with your hand that has the wrist strap. You can discharge static electricity by touching the metal plate.

Table 1-1 Attaching the Wrist Strap

<table>
<tr><td colspan="3">Front view</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Front view</td><td colspan="2">Rear view</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td colspan="3">Rear view</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Top view</td><td colspan="2" rowspan="2">① : The clip side of wrist strap: Connect this to the metal part on the frame of the Storage System
② : A wrist strap (Be sure to wear this before starting maintenance.)
③ : Support the part by touching its metal part (metal plate) with your fingers</td></tr>
<tr><td>  </td></tr>
</table>

1.1.4 Notes at the Time of the Replacement

- Backup user data.
  Backup user data in the Storage System by the operation on the host computer side.
- When replacing a Drive, Controller Board, Cache Memory, Channel Board, Disk Board, BKMF, BKM, ENC, FAN, and Power Supply while a Storage System is powered on, replace those units 20 seconds or more after their respective failed units are removed.
- When replacing the Drive, Controller Board, Cache Memory, Channel Board, Disk Board, BKMF, BKM, ENC, FAN and Power Supply while the Storage System power is turned on, complete the replacement within ten minutes. Otherwise, a Storage System down may occur because of an abnormal temperature rise. Perform the part replacement in haste.
- When the Power Supply and another module fail at the same time, replace the Power Supply first, duplicate the Power Supply again, and then replace the module. Otherwise, a Storage System down may occur because of an abnormal temperature rise.
- When inserting a component, do it completely to the end and quickly. If the insertion is made incompletely or extremely slowly, it is possible that the recovery from the error fails.
- When an allowable time limit for part replacement is specified in the replacement procedure, observe the time limit.
- With only the main switch power off, Power Supply is supplied. In this situation, do not leave the components removed from the Storage System for a long time. Because of an abnormal temperature, the Power Supply alarm can be given.
- Please execute the maintenance work according to the instruction when an abnormal Storage System and another failure message have been generated the diagnosis and after the diagnosis terminates.
- Connect only the regular parts defined in the “Maintenance Manual” for the maintenance parts.
- When there is a cover on the connector of the new parts, remove the cover of the connector part to be used.
- Do not work behind DB60 for a long time.

1.1.5 Note on Cable Routing

1. Handling of cables on the floor
   - Protect cables which cannot be accommodated by the Storage System and thus laid on the floor or cables which cross a passage with cable protecting duct, etc.
   - Do not make inter-Storage System cables apart from the floor but lay them on the floor.
2. Handling of under-floor cables when the Storage System is installed on the free access floor.
   - Give excess lengths to cables routed under the floor so that they can easily be laid on the slab. Do not make them to be hung dangling.
3. How to route cables
   - Give adequate margin of length to cables to withstand earthquakes, etc.
   - Route cables giving them excess lengths lest they should disturb replacement of part to be done for maintenance.
   - When using cable protecting duct, be careful not to damage or break cables by catching them.
4. Be sure to insert or pull out a cable by holding its connector with your hand. If you pull a cable, trouble may be caused.
5. When bending the Interface cable or SAS cable to connect it, give it a bend with a long radius (not less than 30 mm) so as not to apply the cable and the connector excessive stresses.

1.1.6 Note on Restarting

- When restarting the Storage System, turn off the main switch (after the POWER LED goes out), and then turn on the main switch after waiting for one minute or more.

1.1.7 Note on Completing the Work

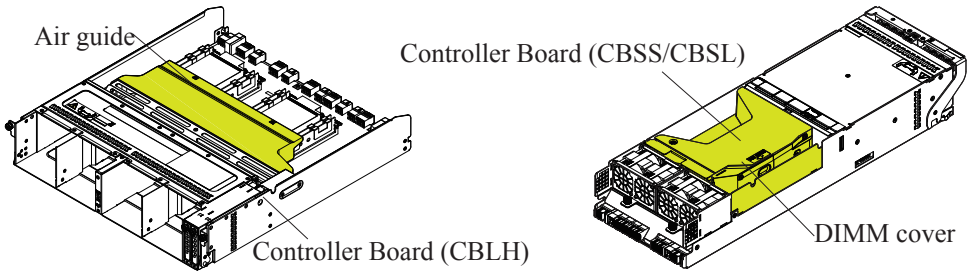
- Close all the external covers when the work is completed. (The cover is to maintain the performance of the Storage System (radio wave noise suppression and others), so that be sure to keep all the external covers closed to operate the Storage System normally.)

1.1.8 Notes while the Storage System Is Being Started

- Because the status where the Storage System is being started is in the middle of the transition to the status of the power turned on (Ready status) from the status of the power turned off, do not replace the parts while the Storage System is being started.
- Replace the parts after the Storage System become the Ready status.

1.1.9 Note at the Time of Replacement Work

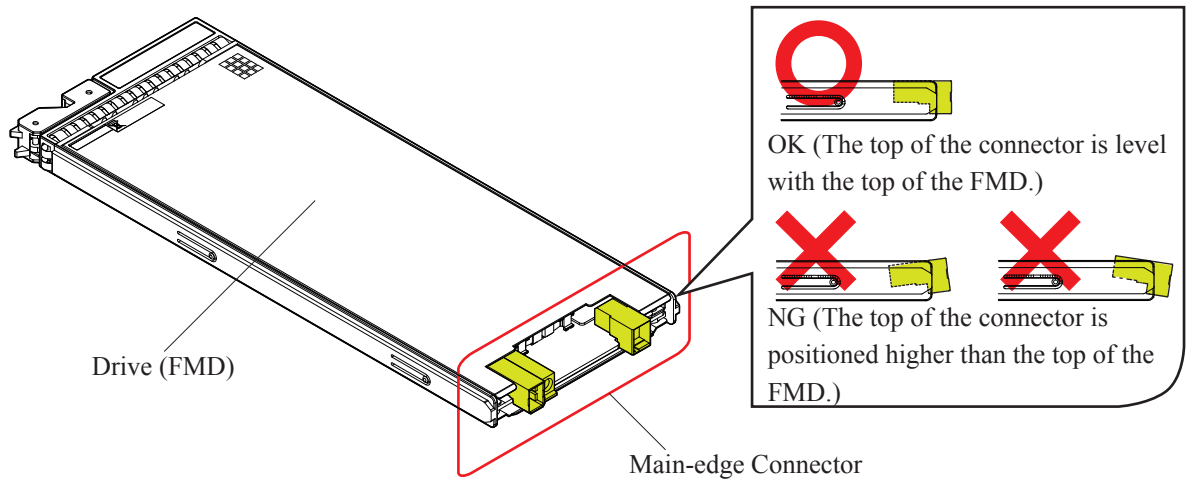
- Do not put anything on the air guide of the CBLH or the DIMM cover of the CBSS/CBSL or push the air guide or the DIMM cover during the work.



1.1.10 Notes when Handling the Flash Module Drive (FMD)

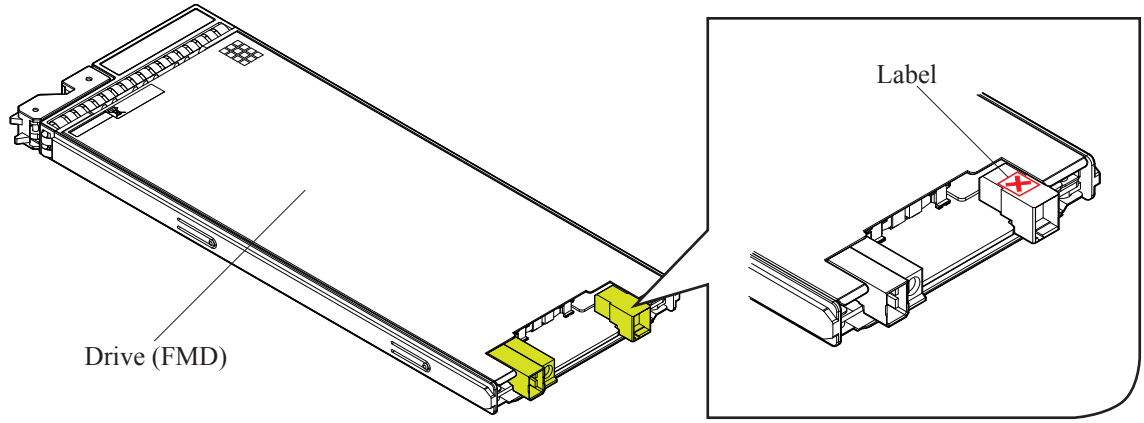
1. Be sure to check that the main edge connector of the drive (FMD) has no deformation, damage, float or sticking of dust before installing the drive (FMD).

Figure 1-1 Checking connectors



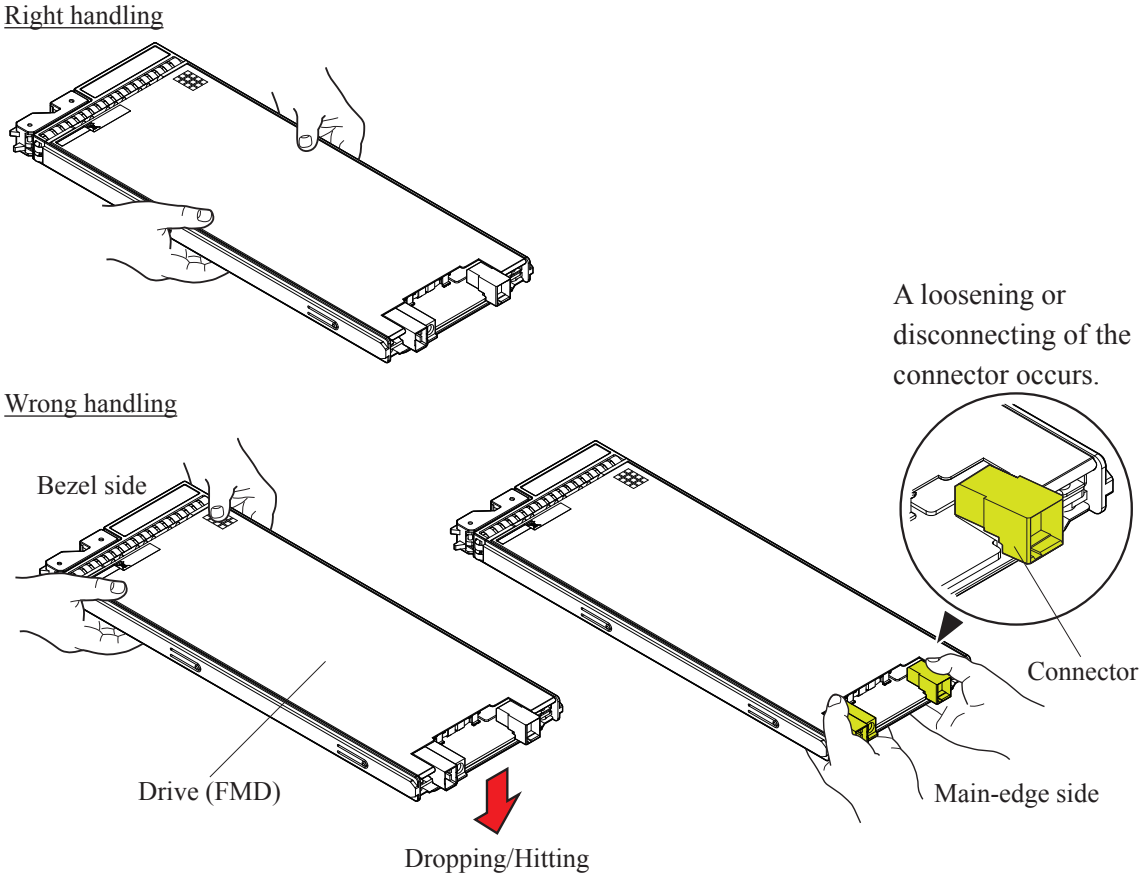
2. When there is a float or a position gap in a connector, mark it with a label, etc.

Figure 1-2 Marking of defective connectors



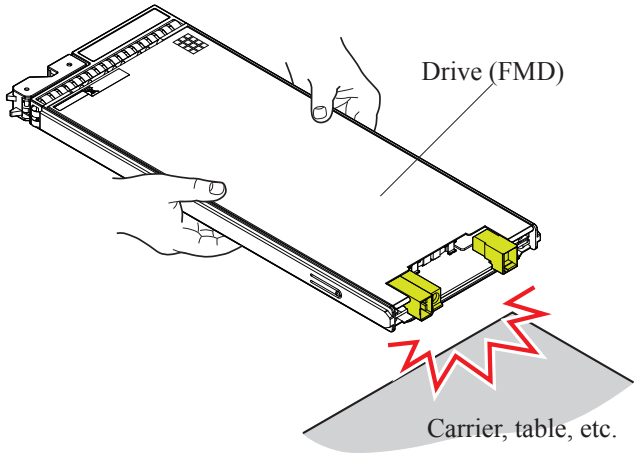
3. When holding the drive (FMD), hold the middle part of the drive (FMD) with both hands.
   Holding the main-edge side or bezel side of the drive (FMD) may cause a breakdown of the drive (FMD) by dropping it under its weight or hitting it against something. Moreover, holding the main-edge side or bezel side of the drive (FMD) may cause a loosening or disconnecting of the connector.

Figure 1-3 Handling of the Drive (FMD) (at maintenance)



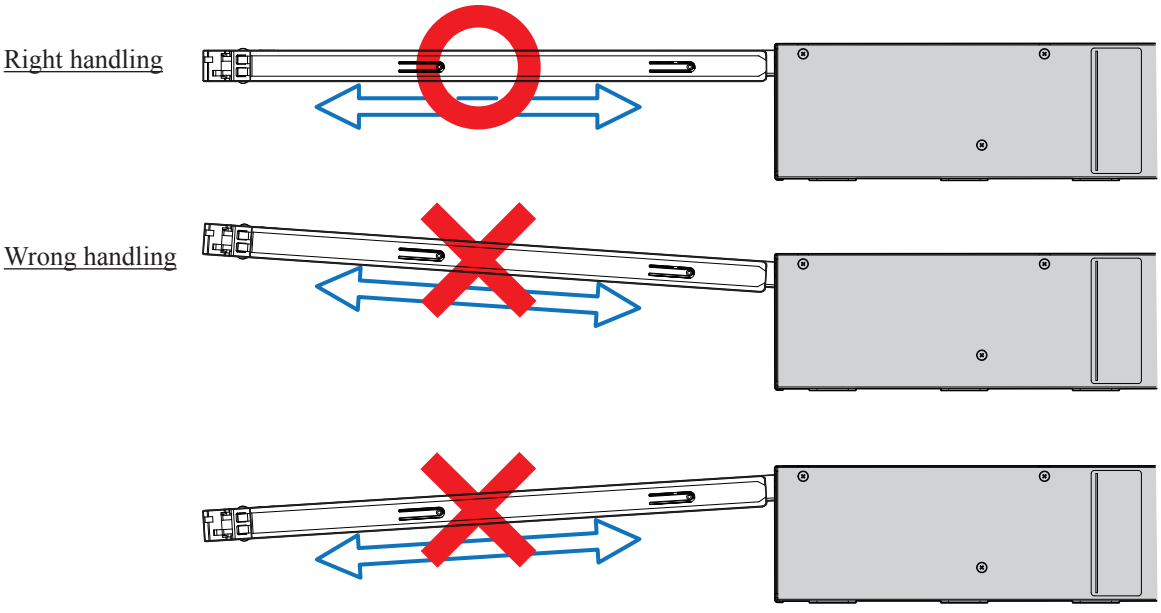
4. When moving the drive (FMD), be careful not to hit it against device or something.
   Hitting the main-edge connector against the device or something may cause damage, distortion or float on the main edge connector.

Figure 1-4 Handling of the Drive (FMD) (at moving)



5. Installing and removing the drive (FMD) at an angle may damage the connector. When installing and removing the drive (FMD), install and remove it straight horizontally.

Figure 1-5 Handling of the Drive (FMD) (at Installation and Removal)



1.1.11 Note on Deleting Remote Paths

For VSP Gx00/Fx00, the error code shown below might be reported during the maintenance replacement of CTL, CHB and so on when the remote paths are set in the storage system that uses the remote copy (True Copy, Universal Replicator, and global-active device).
30762-208204/30762-208205/30762-208206/30762-208207/30762-208208/
30762-208209/30762-208213/30762-208363/30762-208364/30762-208365/30762-208366

NOTE: Check that any error codes other than those listed above are not reported.

When the error is reported, the target part needs to be forcibly blocked at the time of component replacement. Check the presence or absence of replacement remote paths and inform the customer that the ports will be blocked.
After you check the above, check the checkbox of “Forcibly run without safety checks” and continue the replacement work.
It there is the checkbox of “Forcibly block”, check the checkbox, too and perform the maintenance work.

The settings of the storage systems at the remote side that are not the target of the maintenance also need to be checked.
Log in to Storage Navigator of each storage system to check the settings.
For the check procedure, refer to the following.

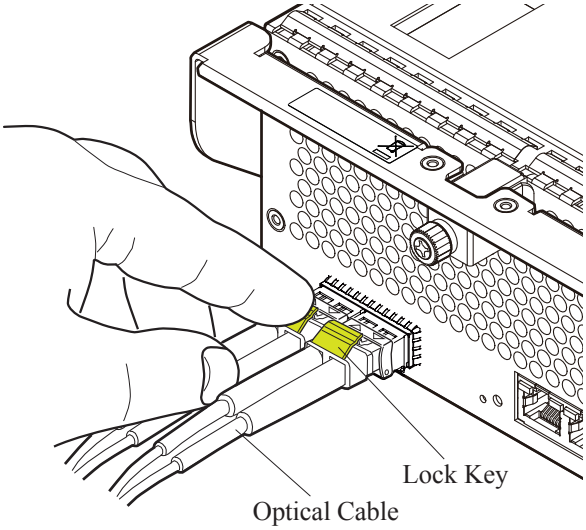
Table 1-2 Reference Documents for Checking the Presence or Absence of Replacement Paths

P.P.	Reference documents for path check procedure
True Copy	Hitachi TrueCopy User Guide
Universal Replicator	Hitachi Universal Replicator User Guide
global-active device	Global-Active Device User Guide

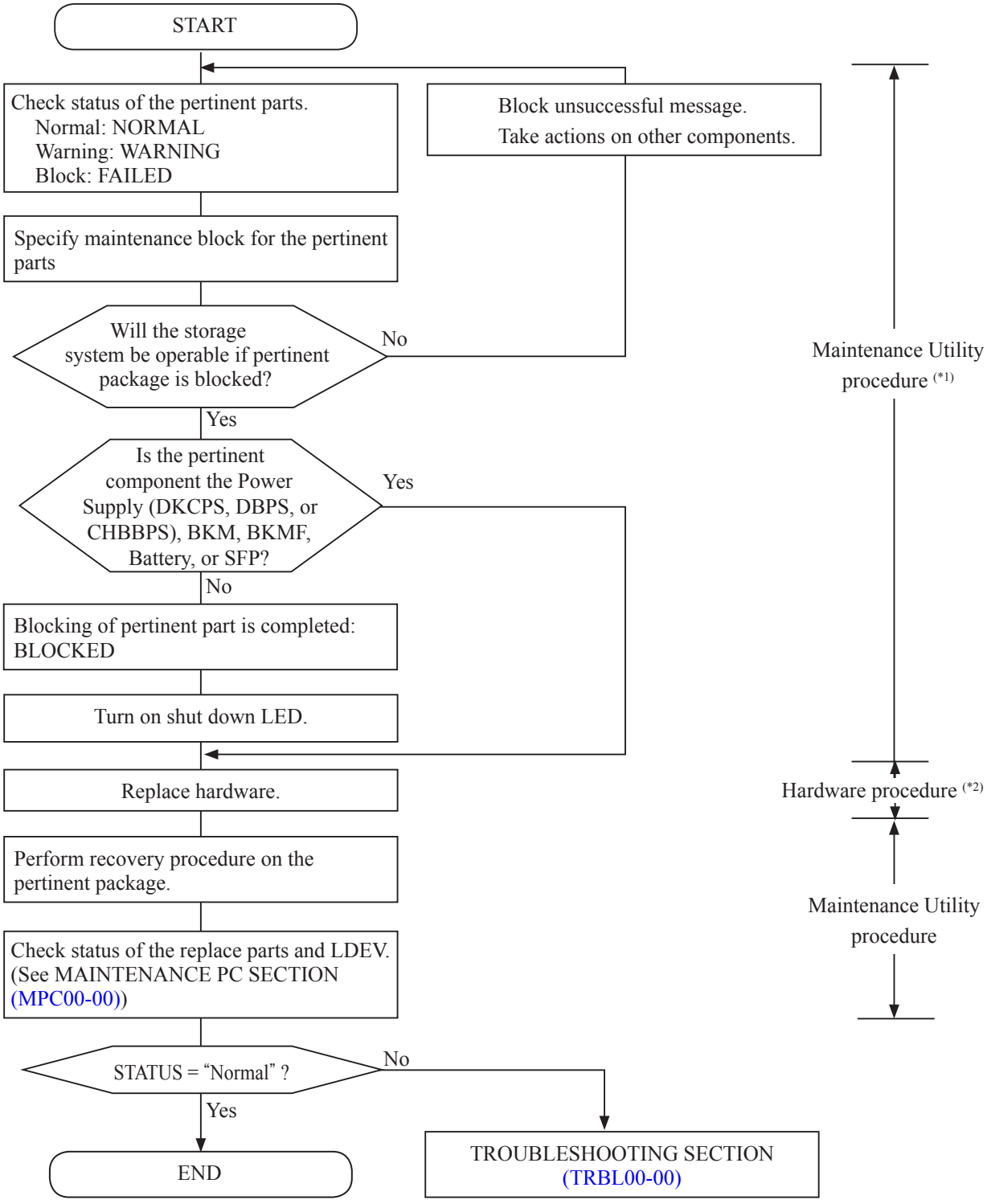
1.1.12 Notes on Removing Optical Cables

Do not press the lock key for the optical cable too firmly because that might damage the cable.

Figure 1-6 Removing Optical Cables



1.2 Hot Replacement Flowchart



*1 : Maintenance Utility processing : Check a status of the replacement target parts by Maintenance Utility. Issue an instruction when a maintenance blockade is necessary and enable hot-swap.

*2 : Hardware processing : A process of removing a parts to be replaced and installing a maintenance package. To prevent part failures caused by static electrical charge built up on your own body, be sure to wear a wrist strap connected to the Storage System before starting and do not take it off until you terminate. Refer to "1.1.3 Note on Installing and Removing Parts".

1.3 Concept of Drive Maintenance

1.3.1 Copy Back Mode

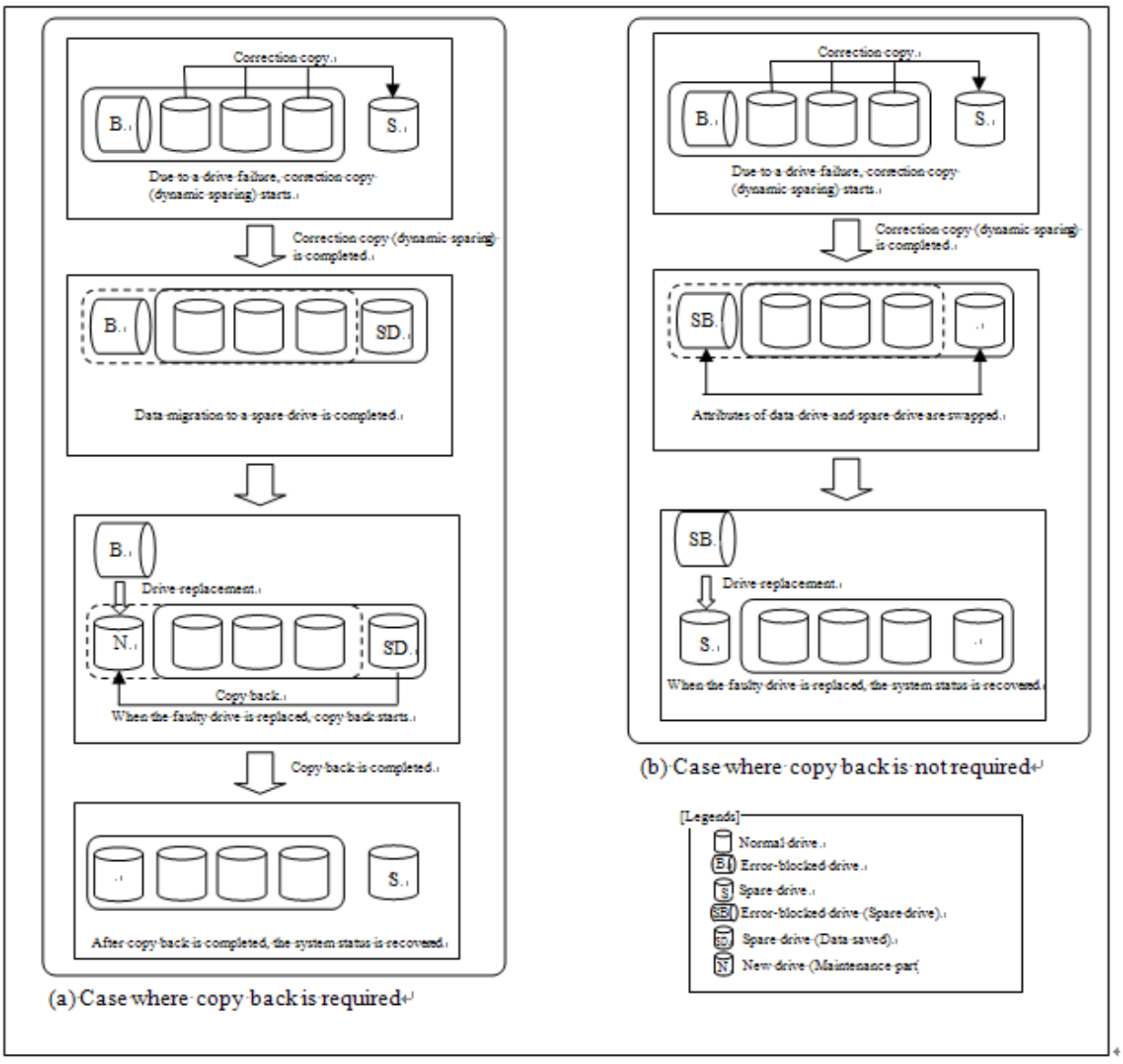
By changing the Copy Back Mode setting from Web Console, it is possible to switch whether copy back is required.

Table 1-3 Copy Back Mode Setting and Need for Copy Back

No.	Copy Back Mode setting	Whether copy back is required
1	Enable	Required
2	Disable	Not required (*1)

*1: When the drive capacity of the source Drive is different from that of the spare drive, copy back needs to be performed.

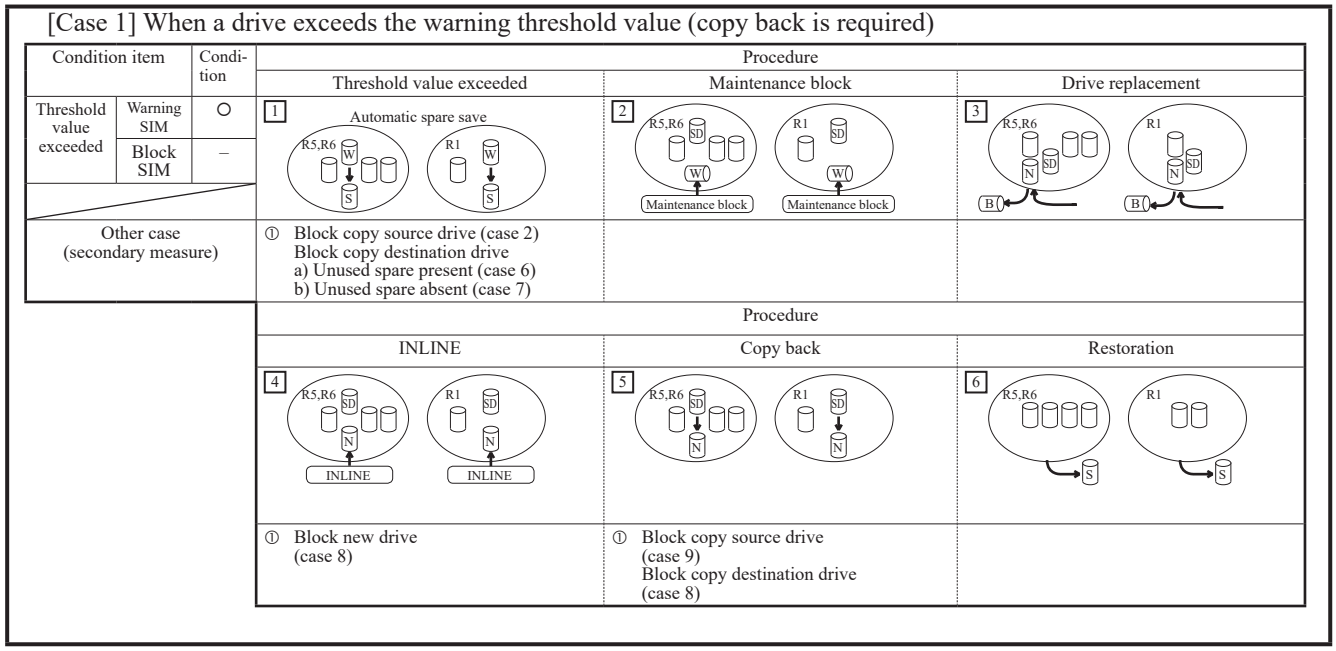
Figure 1-7 Maintenance Flow when Copy Back Is Required/Not Required

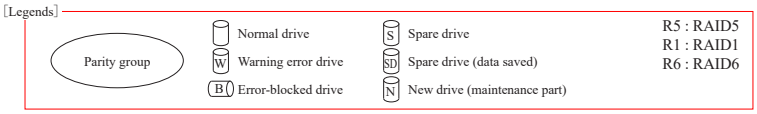


1.3.2 Drive Maintenance

Operations to be performed vary depending on the Copy Back Mode setting, existence of spare drives, or timing when the failure occurred. For details, see the following figures.

[Spare drive present]





NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

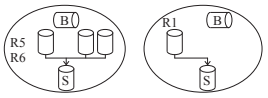
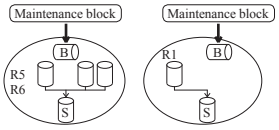
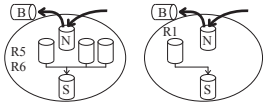
[Spare drive present]

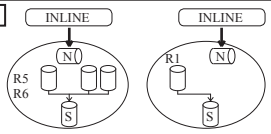
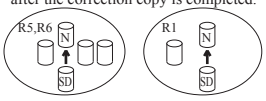
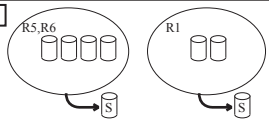
[Case 2] A case where one drive is blocked

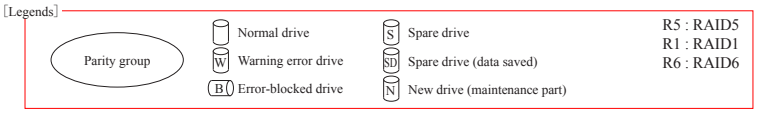
When a spare drive exists, a correction copy from the blocked drive is started automatically.

In this case, go to Case 2.1 when the blocked drive is to be replaced during the correction copy from it and a copy back that follows is to be made automatically, or go to Case 2.2 when the blocked drive is to be replaced after the correction copy is completed.

[Case 2.1] A case where one drive is blocked and it is replaced during an automatic correction copy is made from it

Condition item		Condition	Procedure		
			Block one drive	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy 	2 A blocked drive is replaced during an automatic correction copy. 	3 A blocked drive is replaced during an automatic correction copy. 
	Block SIM	○			
Other case (secondary measure)			① When a copy destination drive is blocked a) Unused spare present (case 10) b) Unused spare absent (case 11)	NOTE: When the blocked drive is replaced while the automatic correction copy is being made from it, the copy back written in Item [5] is started automatically. When you replace the drive after the automatic correction copy is completed, refer to Case 2.2.	

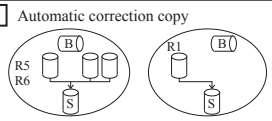
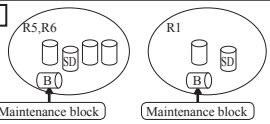
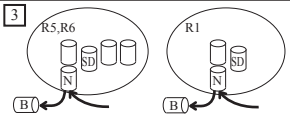
Procedure		
INLINE	Automatic copy back	Restoration
4 	5 The copy back is started automatically after the correction copy is completed. 	6 
① Block new drive (case 8)	Block copy source drive (case 9) Block copy destination drive (case 8)	



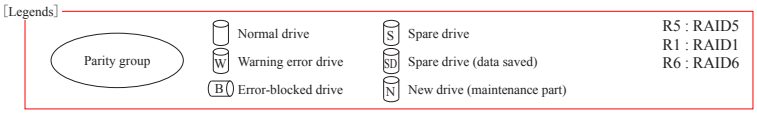
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Spare drive present]

[Case 2.2] A case where one drive is blocked and it is replaced after an automatic correction copy is made from it

Condition item		Condition	Procedure		
			Block one drive	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy 	2 	3 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)		

Procedure		
INLINE	Copy back	Restoration
4 	5 	6 
① Block new drive (case 8)	Block copy source drive (case 9) Block copy destination drive(case 8)	

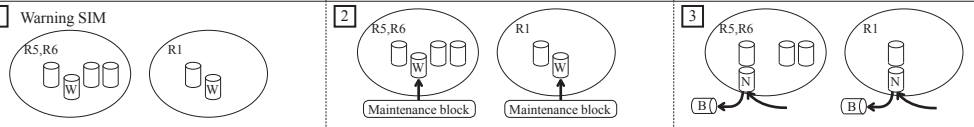


NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

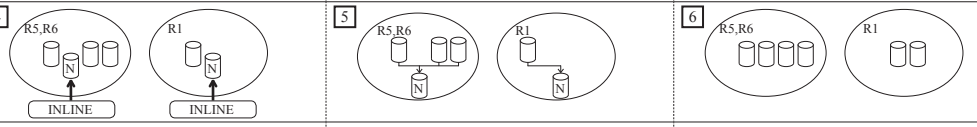
[[Spare drive absent]

[Case 3] When a drive exceeds the warning threshold value (without spare drive)

Condition item		Condition	Procedure: Threshold value exceeded	Procedure: Maintenance block	Procedure: Drive replacement
Threshold value exceeded	Warning SIM	○	1 Warning SIM	2	3
	Block SIM	–			
Other case (secondary measure)					

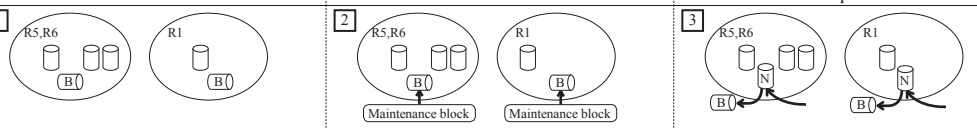


Procedure: INLINE	Procedure: Correction copy	Procedure: Restoration
4	5	6
① Block new drive (case 5)	① Block copy destination drive (case 5)	

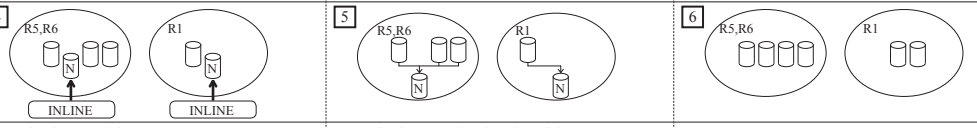


[Case 4] When a drive is blocked (without spare drive)

Condition item		Condition	Procedure: Block one drive	Procedure: Maintenance block	Procedure: Drive replacement
Threshold value exceeded	Warning SIM	–	1	2	3
	Block SIM	○			
Other case (secondary measure)					



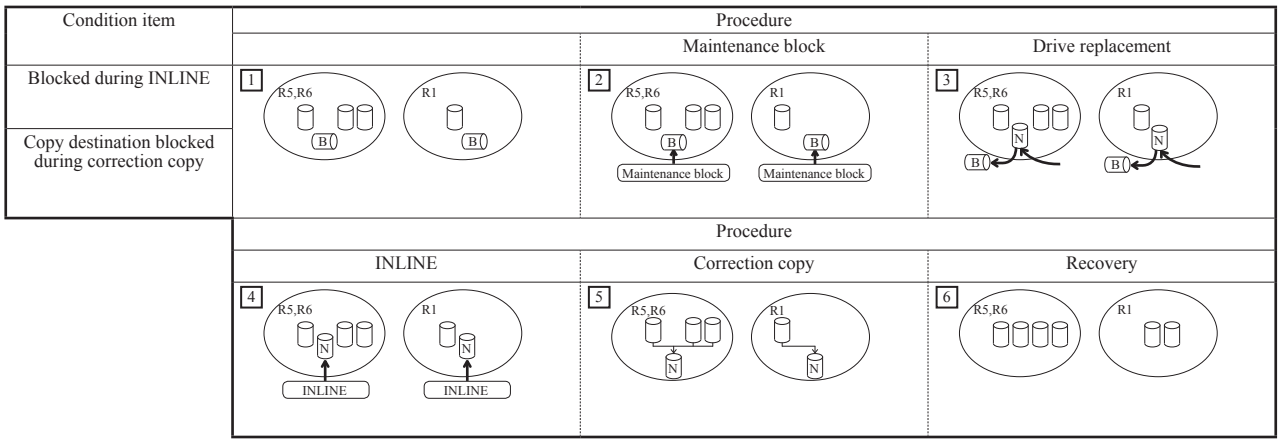
Procedure: INLINE	Procedure: Correction copy	Procedure: Restoration
4	5	6
① Block new drive (case 5)	① Block copy destination drive (case 5)	



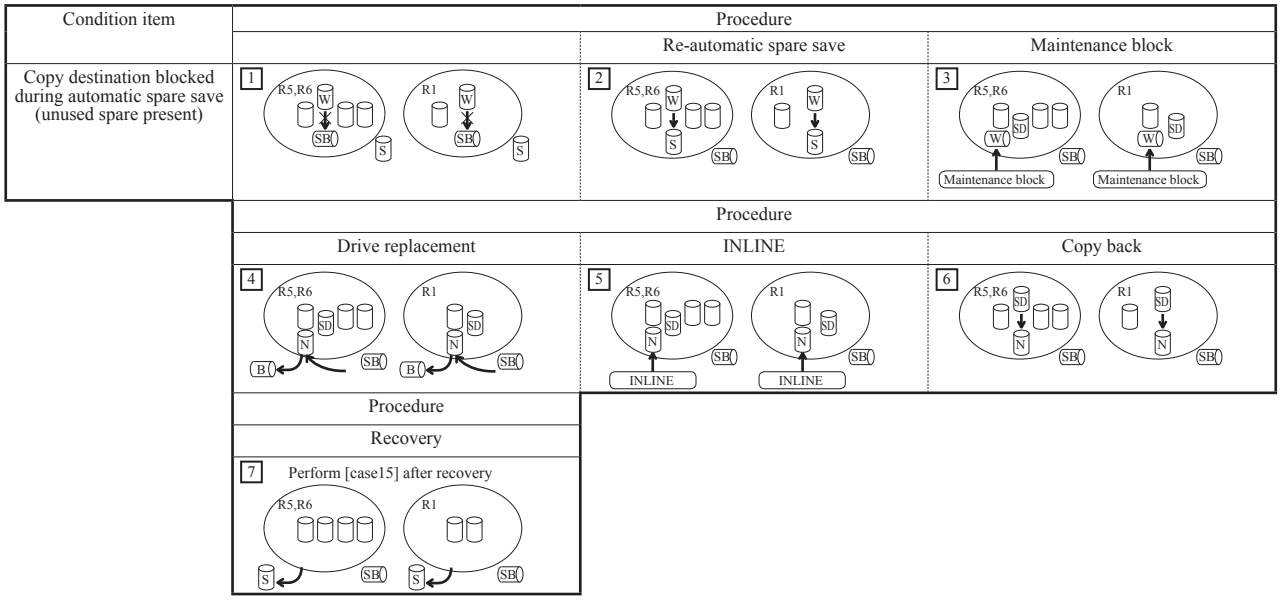
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

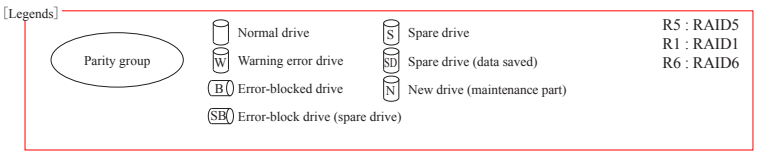
[Case in which a secondary failure occurred during recovery]

[Case 5] When a copy destination is blocked during the correction copy



[Case 6] When a copy destination is blocked during the automatic saving to the spare drive

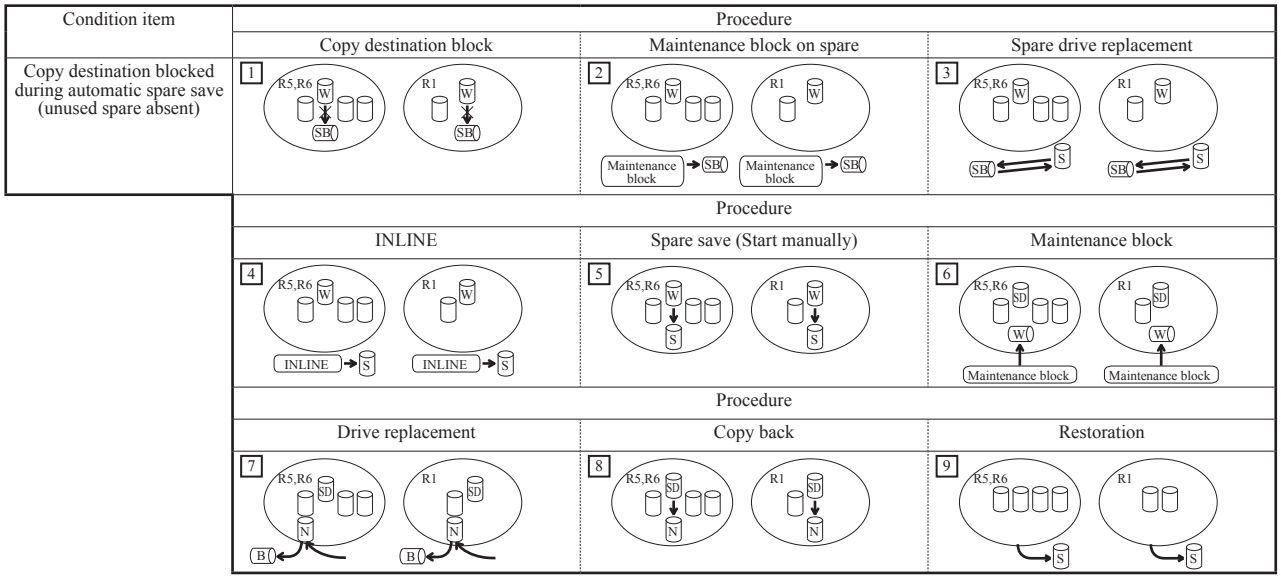




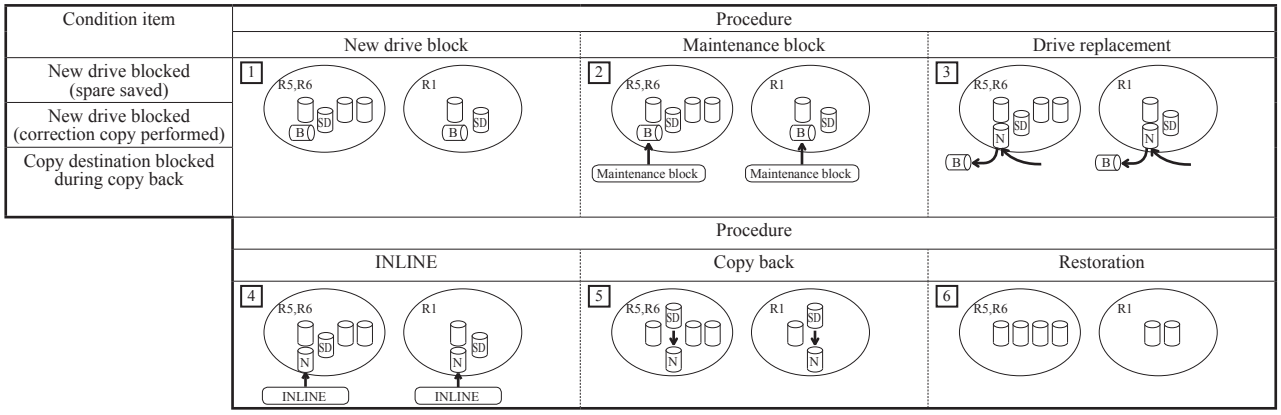
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

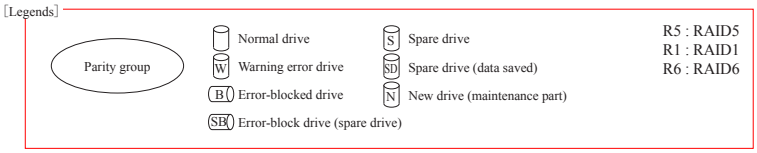
[Case in which a secondary failure occurred during recovery]

[Case 7] When a copy destination drive is blocked during the automatic saving to the spare drive (without unused spare drive)



[Case 8] When the new drive is blocked during the copy back

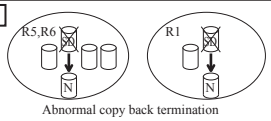
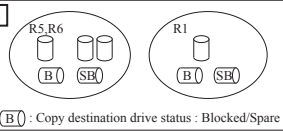
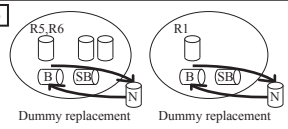


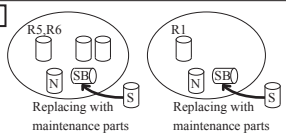
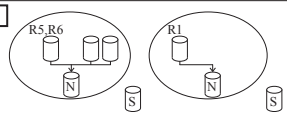
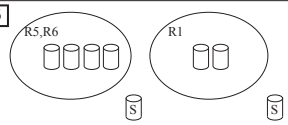


NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

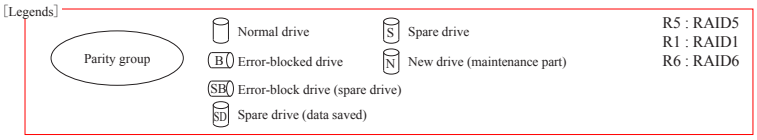
[Case in which a secondary failure occurred during recovery]

[Case 9] When a copy source drive is blocked during the copy back

Condition item	Procedure		
	Copy source block	Copy destination automatic maintenance block at the time of abnormal copy back termination	Dummy replacement of copy destination drive (*1)
Copy source blocked during copyback	1 	2 	3 

Procedure		
Spare drive replacement	Starting correction copy automatically	Recovery
4 	5 	6 

*1: A message indicating the copy disabled is displayed at the time of dummy replacement of the copy destination drive, but the copy does not start at this step. Go to the next step.



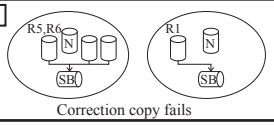
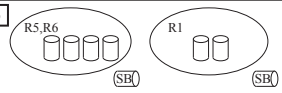
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Case in which a secondary failure occurred during recovery]

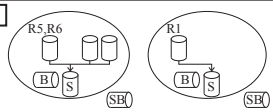
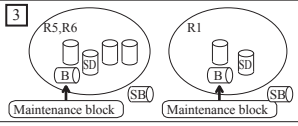
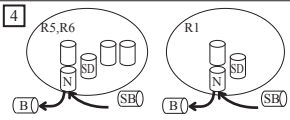
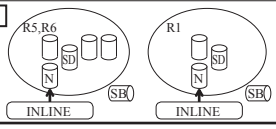
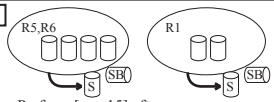
[Case 10] A case where the copy destination drive is blocked during the automatic correction copy (and a unused spare drive exists)

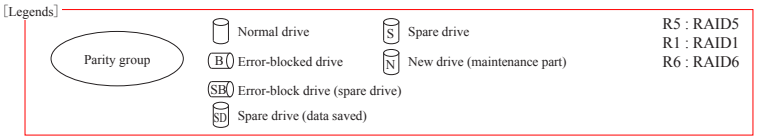
When the blocked drive has been replaced through performance of the operation for Case 2.1, go to Case 10.1 or otherwise, go to Case 10.2.

[Case 10.1] When the blocked drive has been replaced through performance of the operation for Case 2.1

Condition item	Procedure		
	Copy destination block	Starting correction copy automatically	Maintenance block
Copy destination blocked during automatic correction copy (unused spare present)	1  Correction copy fails	2 	3  Perform [case15] after recovery

[Case 10.2] When the operation for Case 2.1 has not been performed

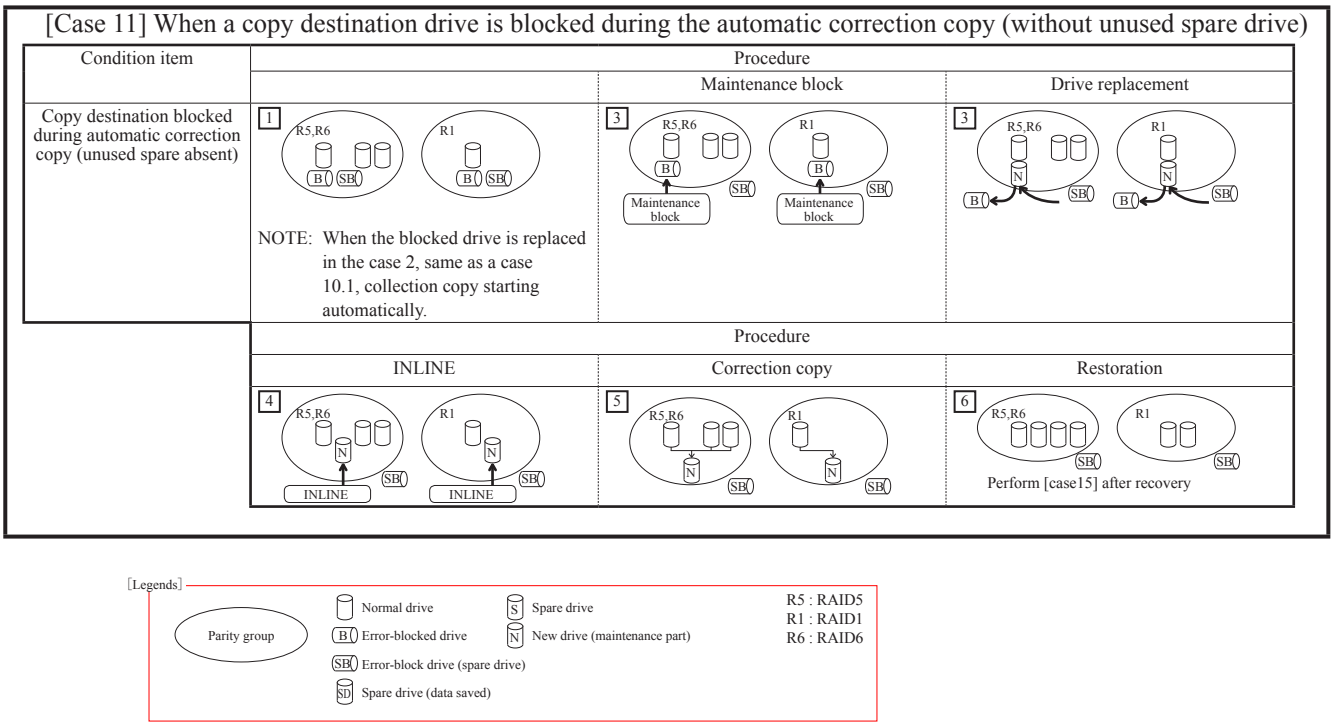
Condition item	Procedure		
	Copy destination block	Re-automatic correction copy	Maintenance block
Copy destination blocked during automatic correction copy (unused spare present)	1 	2 	3 
	Procedure		
	Drive replacement	INLINE	Copy back
	4 	5 	6 
	Procedure		
	Recovery		
	7  Perform [case15] after recovery		



NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Case in which a secondary failure occurred during recovery]

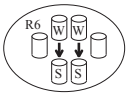
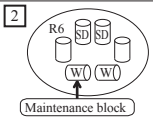
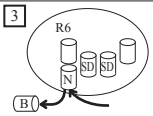
[Case 11] When a copy destination drive is blocked during the automatic correction copy (without unused spare drive)

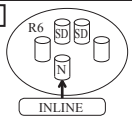
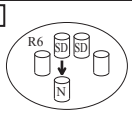
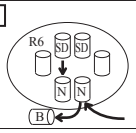


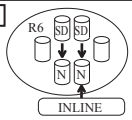
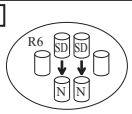
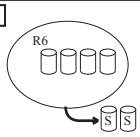
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

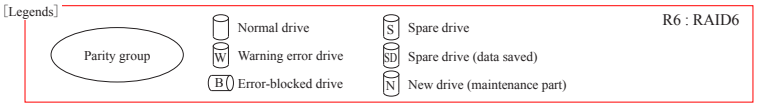
[Spare drive present]

[Case 12] RAID6 When two drives exceed the warning threshold value

Condition item		Condition	Procedure		
			Threshold value exceeded	Maintenance block	Replacement of the first drive
Threshold value exceeded	Warning SIM	○	1 Automatic saving(s) to the spare drive allowed to be made up to twice 	2  Proceed the drive to the next step when the copying from it is completed. It is not necessary to wait until the copying from the two drives is completed.	3 
	Block SIM	–			
Other case (secondary measure)			① Block copy source drive (case 2) ② Block copy destination drive a) Unused spare present (case 6) b) Unused spare absent (case 7)		

Procedure		
INLINE test of the first drive	Copy back to the first drive	Replacement of the second drive during the copy back to the first drive
4 	5 	6 
① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	

Procedure		
INLINE test of the second drive	Copy back to the second drive	Restoration
7 	8 	9 
① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	

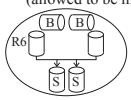
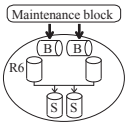
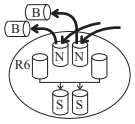


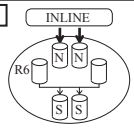
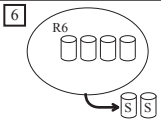
[Spare drive present]

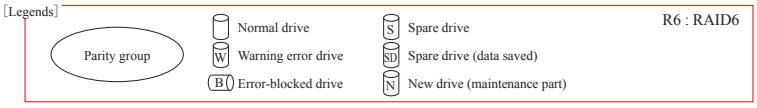
[Case 13] RAID6 When two drives are blocked

- When you replace the two blocked drives while making an automatic correction copy from them, go to Case 13.1.
- When you replace the two blocked drives after making an automatic correction copy from them, go to Case 13.2.
- When you replace one of the two blocked drives from each of which an automatic correction copy is being made, go to Case 13.3.

[Case 13.1] RAID6 A case where the two drives are blocked and they are replaced while an automatic correction copy is made from it

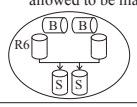
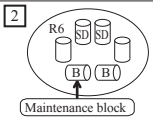
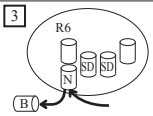
Condition item		Condition	Procedure		
			Detachment of the two drives	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy (allowed to be made up to twice) 	2 A blocked drive is replaced during an automatic correction copy. 	3 A blocked drive is replaced during an automatic correction copy. 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)	NOTICE: When the blocked drive is replaced while an automatic correction copy is being made from it, the copy back written in Item [5] is started automatically. When you replace the drive after the automatic correction copy is completed, refer to Case 13.2.	

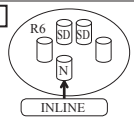
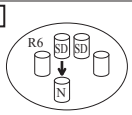
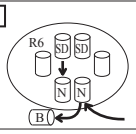
Procedure		
INLINE test	Copy back	Restoration
4 	5 The copy-back is started automatically after the correction copy is completed. 	6 
① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive(case 8)	

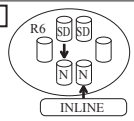
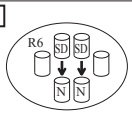
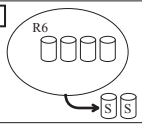


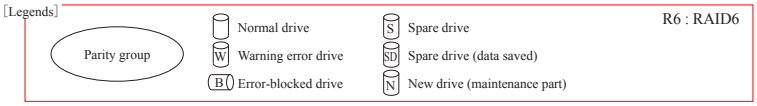
[Spare drive present]

[Case 13.2] RAID6 A case where the two drives are blocked and they are replaced after an automatic correction copy is made from it

Condition item		Condition	Procedure		
			Detachment of the two drives	Maintenance block	Replacement of the first drive
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy or copies allowed to be made up to twice 	2 	3 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)		

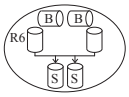
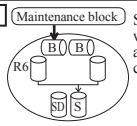
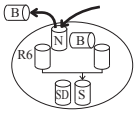
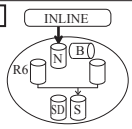
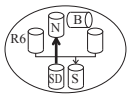
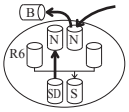
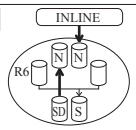
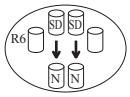
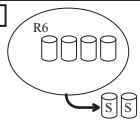
	Procedure		
	INLINE test of the first drive	Copy back to the first drive	Replacement of the second drive during the copy back to the first drive
	4 	5 	6 
	① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	

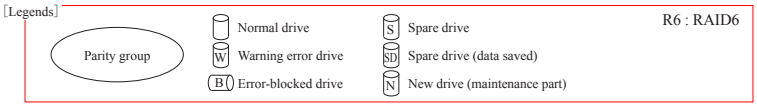
	Procedure		
	INLINE test of the second drive	Copy back to the second drive	Restoration
	7 	8 	9 
	① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	



[Spare drive present]

[Case 13.3] RAID6 A case where the two drives are blocked and they are an automatic correction copy from one of the drives is in progress and that from the other drive is completed

Condition item		Condition	Procedure		
			Detachment of the two drives	Maintenance block	Replacement of the first drive
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy or copies allowed to be made up to twice. 	2 Maintenance block Select the drive which is completed automatic correction copy. 	3 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)		
			Procedure		
			INLINE test of the first drive	Copy back to the first drive	Replacement of the second drive during the copy back to the first drive
			4 INLINE 	5 	6  Make a copy back to the first drive, and then replace the second drive while an automatic correction copy is being made from the second drive.
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	
			Procedure		
			INLINE test of the second drive	Copy back to the second drive	Restoration
			7 INLINE 	8  When an automatic correction copy from the second drive is completed, a copy back to the second drive is started automatically in the same way as Case 2.1.	9 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	

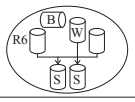
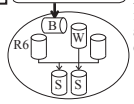
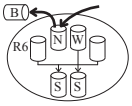
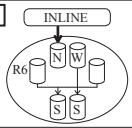
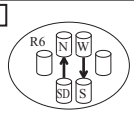
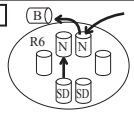
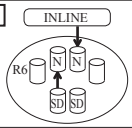
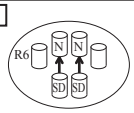
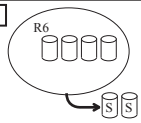


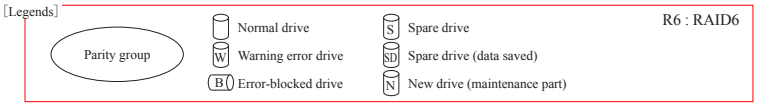
[Spare drive present]

[Case 14] RAID6 When a drive is blocked and another drive exceeds the warning threshold value

- When replacing a blocked drive while an automatic correction copy is being made from it, go to Case 14.1.
- When replacing a blocked drive after the automatic correction copy from it is completed, go to Case 14.2.

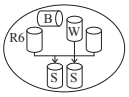
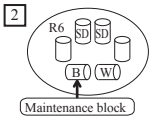
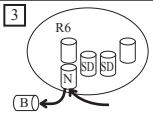
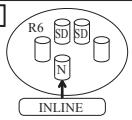
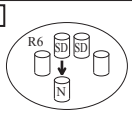
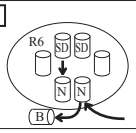
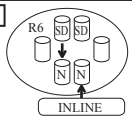
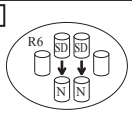
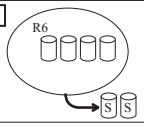
[Case 14.1] When replacing a blocked drive while an automatic correction copy is being made from it

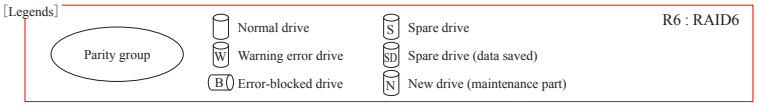
Condition item		Condition	Procedure		
			Detachment of the two drives	Maintenance block	Replacement of the first drive
Threshold value exceeded	Warning SIM	–	1 Automatic correction copy + Automatic saving to the spare disk 	2 Maintenance block A blocked drive is replaced during an automatic correction copy. 	3 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)	NOTE: When an automatic saving to a spare drive is completed before this operation is performed, the following Items [6] and [7] may be executed in advance.	
			Procedure		
			INLINE test of the first drive	Copy back to the first drive	Replacement of the second drive during the copy back to the first drive
			4 	5  A blocked drive is replaced during an automatic correction copy.	6 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	
			Procedure		
			INLINE test of the second drive	Copy back to the second drive	Restoration
			7 	8 	9 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	



[Spare drive present]

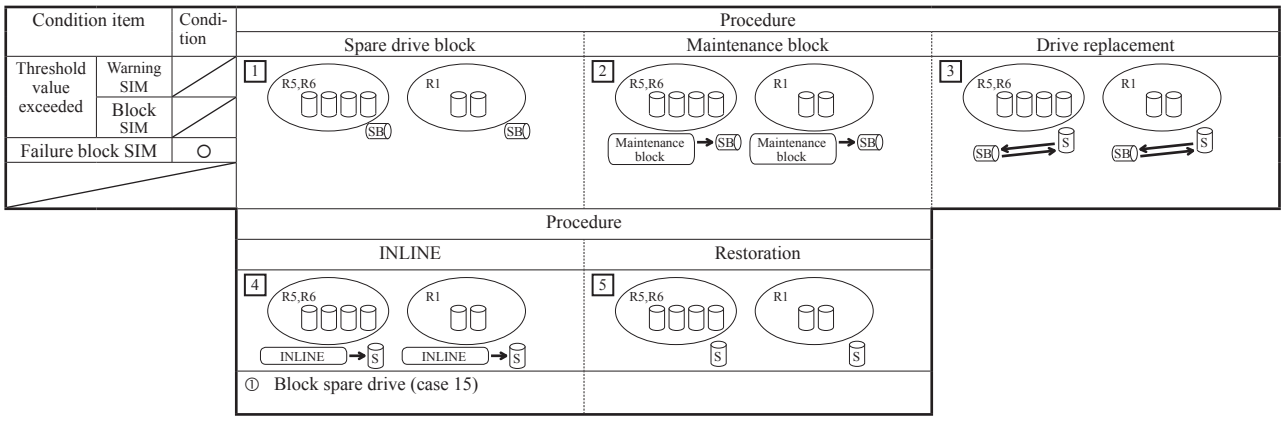
[Case 14.2] When replacing a blocked drive after the automatic correction copy from it is completed

Condition item		Condition	Procedure		
			Detachment of the two drives	Maintenance block	Replacement of the first drive
Threshold value exceeded	Warning SIM	○	1 Automatic correction copy + Automatic saving to the spare disk 	2  Proceed the drive to the next step when the copying from it is completed. It is not necessary to wait until the copying from the two drives is completed.	3 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (case 10) b) Unused spare absent (case 11)		
			Procedure		
			INLINE test of the first drive	Copy back to the first drive	Replacement of the second drive during the copy back to the first drive
			4 	5 	6 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	
			Procedure		
			INLINE test of the second drive	Copy back to the second drive	Restoration
			7 	8 	9 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	



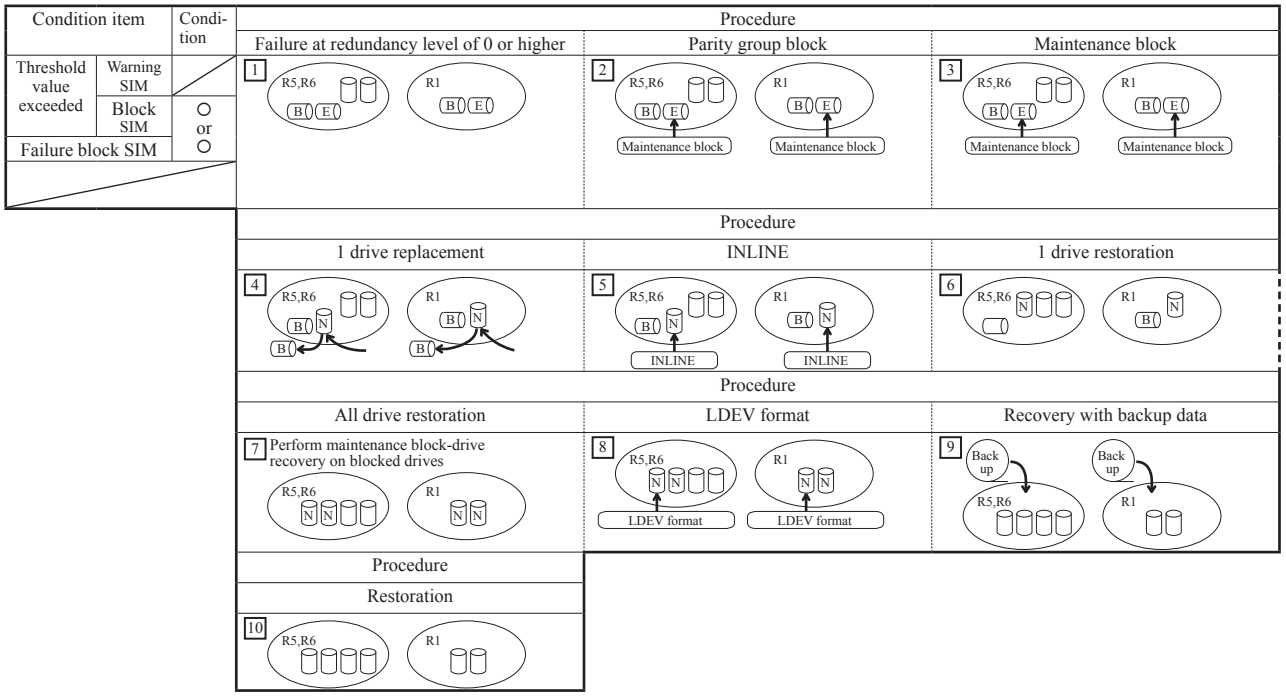
[Other Cases]

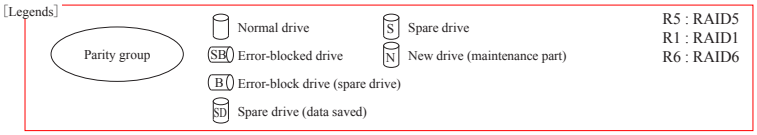
[Case 15] Spare drive blocked



[Case 16] Case in which a block level failure occurred in a normal drive with a redundancy level of 0

RAID5 : When two or more drives are blocked in a parity group.
RAID1 : When two drives are blocked in a Mirroring pair.
RAID6 : When three or more drives are blocked in a parity group.

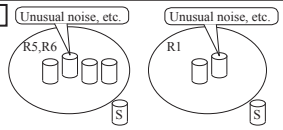
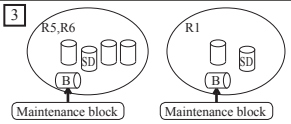


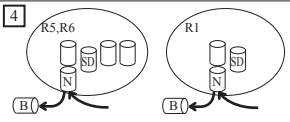
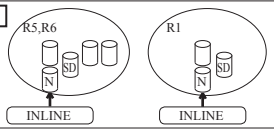


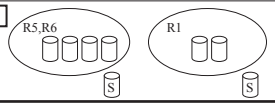
[Other Cases]

[Case 17] Preventive drive replacement 1

Condition item		Condition
Threshold value exceeded	Warning SIM	–
	Block SIM	–
Others (unusual noise, etc.)		○
Spare drive		○
Other case (secondary measure)		

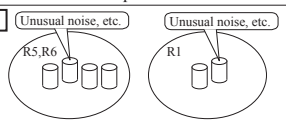
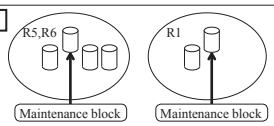
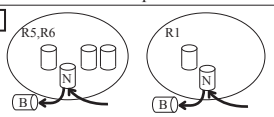
Procedure		
Replacement	Spare save	Maintenance block
1 	2 	3 
	① Block copy source drive (case 4) ② Block copy destination drive (case 7)	

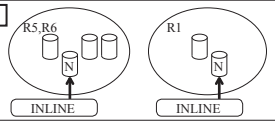
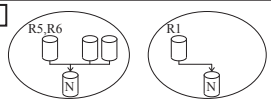
Procedure		
Drive replacement	INLINE	Copy back
4 	5 	6 
	① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)

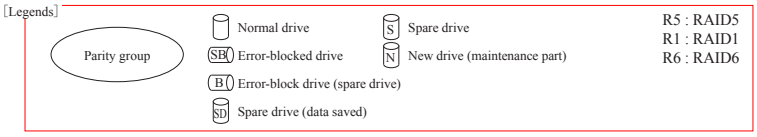
Procedure
Restoration
7 

[Case 18] Preventive drive replacement 2

Condition item		Condition
Threshold value exceeded	Warning SIM	–
	Block SIM	–
Others (unusual noise, etc.)		○
Spare drive		–
Other case (secondary measure)		

Procedure		
Replacement	Maintenance block	Drive replacement
1 	2 	3 

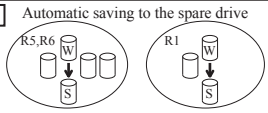
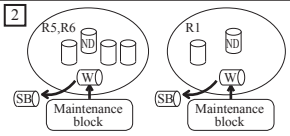
Procedure		
INLINE	Correction copy	Restoration
4 	5 	6 
① Block new drive (case 5)	① Block new drive (case 5)	

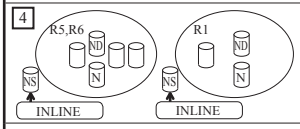
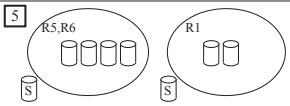


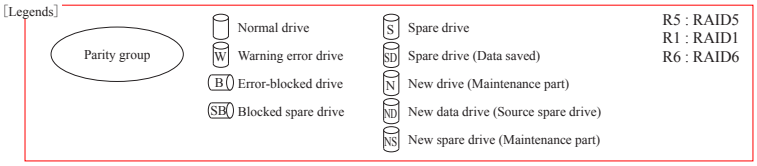
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Copy back is not required]

[Case 19] When a drive exceeds the warning threshold value

Condition item		Condition	Procedure		
			Threshold value exceeded	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	○	1 Automatic saving to the spare drive 	2 	3 
	Block SIM	—			
Other case (secondary measure)			① Block copy source drive (Case 20) ② Block copy destination drive a) Unused spare present (Case 21) b) Unused spare absent (Case 22)		

Procedure		
INLINE	Restoration	
4 	5 	



NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

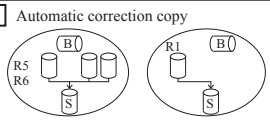
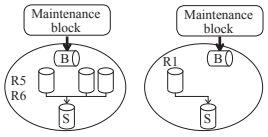
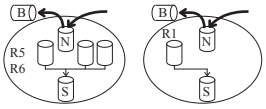
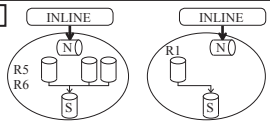
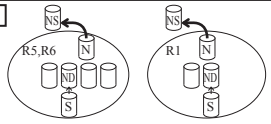
[Copy back is not required]

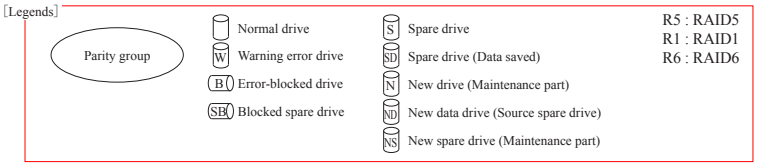
[Case 20] A drive is blocked

When there is a spare drive, correction copy is automatically activated.

- In this case, to replace a drive during correction copy, go to Case 20.1.
- To replace a drive after correction copy is completed, go to Case 20.2.

[Case 20.1] A drive is blocked. Drive replacement during an automatic correction copy

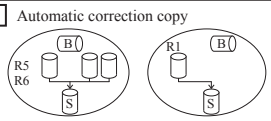
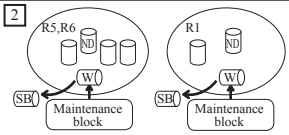
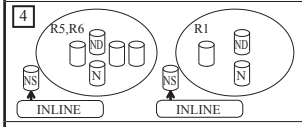
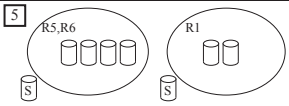
Condition item		Condition	Procedure		
			Blockage of a drive	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	—	1 Automatic correction copy 	2 Replacement of the blocked drive during automatic correction copy 	3 Replacement of the blocked drive during automatic correction copy 
	Block SIM	○			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (Case 23) b) Unused spare absent (Case 11)		
			Procedure		
			INLINE	Restoration	
			4 	5 	

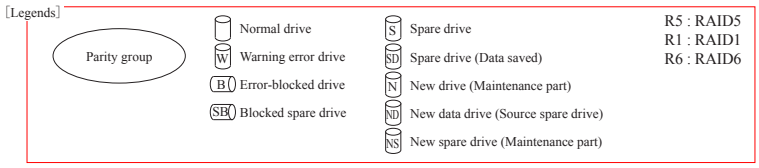


NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Copy back is not required]

[Case 20.2] A drive is blocked. Drive replacement after an automatic correction copy

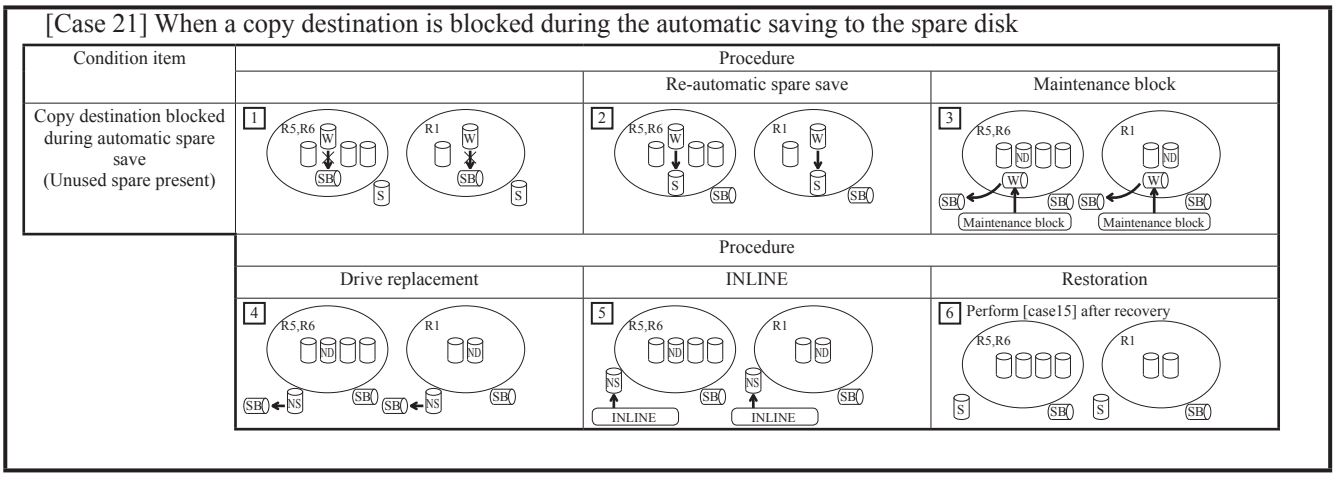
Condition item		Condition	Procedure		
			Blockage of a drive	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	○	1 Automatic correction copy 	2 	3 
	Block SIM	—			
Other case (secondary measure)			① Block copy destination drive a) Unused spare present (Case 23) b) Unused spare absent (Case 11)		
			Procedure		
			INLINE	Restoration	
			4 	5 	

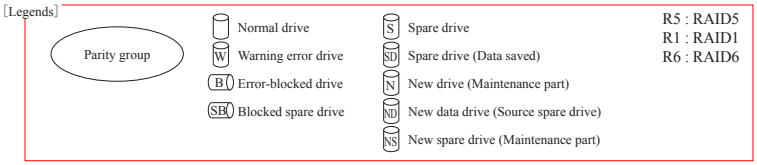


NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Case in which a secondary failure occurred during recovery]

[Case 21] When a copy destination is blocked during the automatic saving to the spare disk

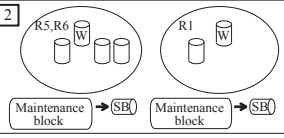
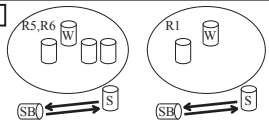
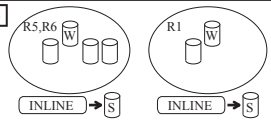
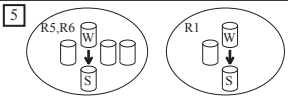
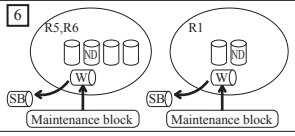
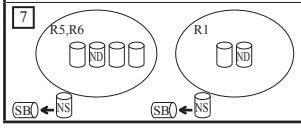
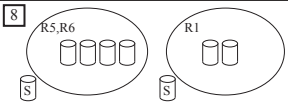


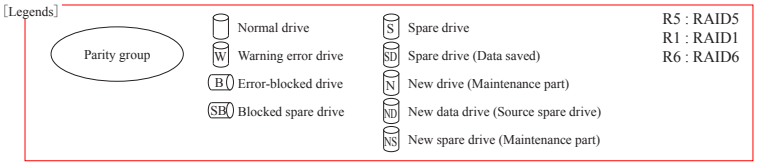


NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Case in which a secondary failure occurred during recovery]

[Case 22] When a copy destination is blocked during the automatic saving to the spare disk (without unused spare drive)

Condition item	Procedure		
		Maintenance block on spare	Spare drive replacement
Copy destination blocked during automatic spare save (Unused spare absent)	1 	2 	3 
	Procedure		
	INLINE	Spare save	Maintenance block
	4 	5 	6 
	Procedure		
	Drive replacement	Restoration	
	7 	8 	



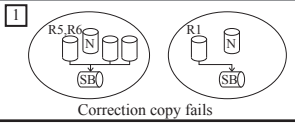
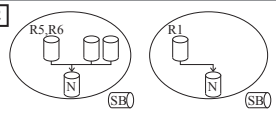
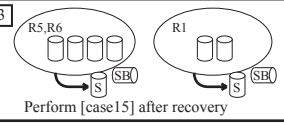
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[Case in which a secondary failure occurred during recovery]

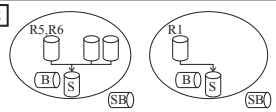
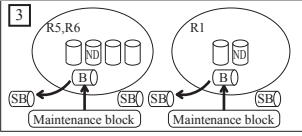
[Case 23] When a copy destination is blocked during the automatic correction copy (Unused spare drive exists)

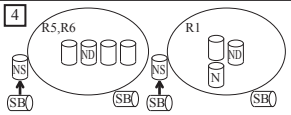
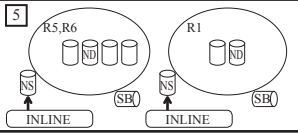
- When Case 20.1 was performed and the blocked drive has been replaced, go to Case 23.1.
- In other cases, go to Case 23.2.

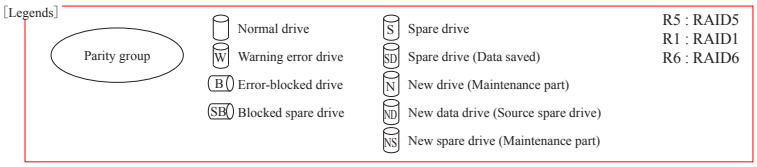
[Case 23.1] The blocked drive has been replaced in [Case 20.1]

Condition item	Procedure		
		Starting self-drive correction copy automatically	Maintenance block
Copy destination blocked during automatic correction copy (Unused spare absent)			

[Case 23.2] [Case 20.1] is not performed

Condition item	Procedure		
		Re-automatic correction copy	Maintenance block
Copy destination blocked during automatic correction copy (Unused spare present)			

	Procedure		
	Drive replacement	INLINE	Restoration
			

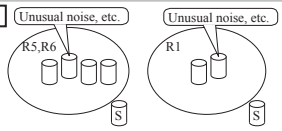
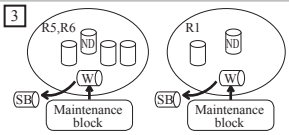


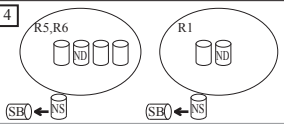
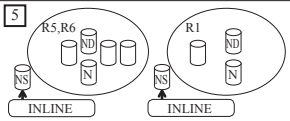
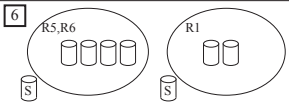
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

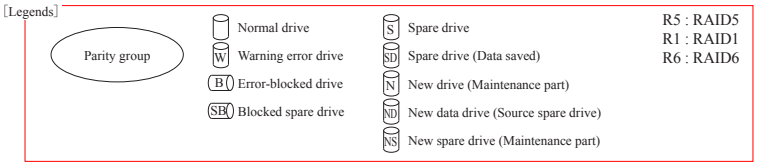
[Case in which copy back is not required]

[Case 24] Preventive drive replacement 1

Condition item		Condition
Threshold value exceeded	Warning SIM	—
	Block SIM	—
Others (unusual noise, etc.)		○
Spare drive		○
Other case (secondary measure)		

Procedure		
Drive replacement	Spare save	Maintenance block
1 Unusual noise, etc. / Unusual noise, etc. 	2 	3 
	① Block copy source drive (Case 4) ② Block copy destination drive (Case 22)	

Procedure		
Drive replacement	INLINE	Restoration
4 	5 	6 

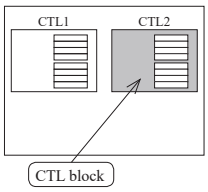
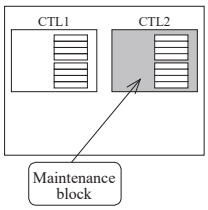
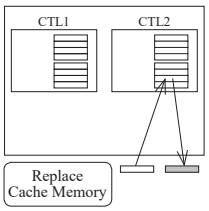


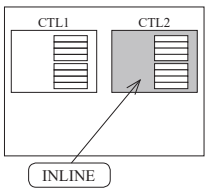
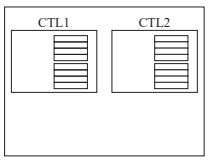
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

1.4 Concept of Cache Memory Maintenance

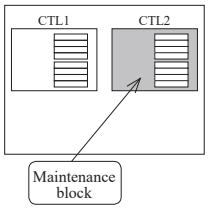
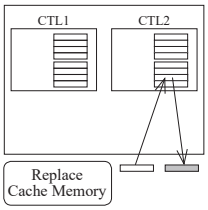
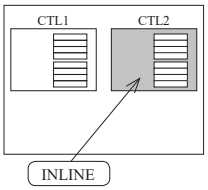
The status of the CTL varies according to the SIM Reference Code. For details, see Case 1 or Case 2 below.

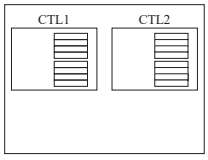
[Case 1] Failure block

Condition item		Condition	Procedure: Block	Procedure: Maintenance block	Procedure: Replace Cache Memory
Threshold value exceeded	Warning SIM	—	1 	2 	3 
	Block SIM	○			
CTL		○			
Cache Memory space: 32G ~ 1024G					

Procedure: INLINE	Procedure: Restoration
4 	5 

[Case 2] Warning SIM preventive replacement

Condition item		Condition	Procedure: Maintenance block	Procedure: Replace Cache Memory	Procedure: INLINE
Threshold value exceeded	Warning SIM	○	1 	2 	3 
	Block SIM	—			
CTL		○			
Cache Memory space: 32G ~ 1024G					

Procedure: Restoration
4 

1.5 How to Interpret the Replace Procedure

1.5.1 In Case of Replacement when SIM Has Occurred

1. Search a work ID which coincides with the work ID corresponding to SIM ACC (PKC) (refer to ACC SECTION "4. List of ACC") from Parts Replacement Process Table in "1.6 Parts Replacement Processing List".
   Search a work ID corresponding to the pertinent condition if "Condition Item" is described in Parts Replacement Process Table.
2. If the work ID is found,
   • Take actions according to that match the work ID.
3. If no work ID is found,
   • Search a work ID corresponding to SIM ACC (PKC and error details) from Parts Replacement Process Table in "1.6 Parts Replacement Processing List".
   • Take actions according to that match the work ID.

NOTE: Refer to "1.5.5 How to Search a Work ID to Replace a Drive" for the procedure for searching a work ID to replace a drive.
When replacing a drive, be sure to refer to "1.5.3 Procedure before PDEV Replacement and Correction Copy" and "1.5.4 Confirmation Procedure".

1.5.2 In Case of Replacement when SIM Has Not Occurred

1. Search a work ID corresponding to the part to be replaced from Parts Replacement Process Table in "1.6 Parts Replacement Processing List".
2. Take actions according to the procedure number that matches the work ID.

NOTE: Refer to "1.5.5 How to Search a Work ID to Replace a Drive" for the procedure for searching the work ID to replace a drive.
When replacing a drive, be sure to refer to "1.5.3 Procedure before PDEV Replacement and Correction Copy" and "1.5.4 Confirmation Procedure".

----------<Example>----------

Condition to replace
• SIM has occurred.
• Work ID corresponding to SIM ACC PKC is RCTL

Search an applicable Work ID identified by shaded area in the following sample of Parts Replacement Process Table under the above conditions.

Table 1-4 <Controller Board>

Work ID	Part Name	Procedure	Replacing Time (*1)(*2)
RCTL	Controller Board	Replacing a Controller Board ("2.4 Replacing a Controller Board")	30 min

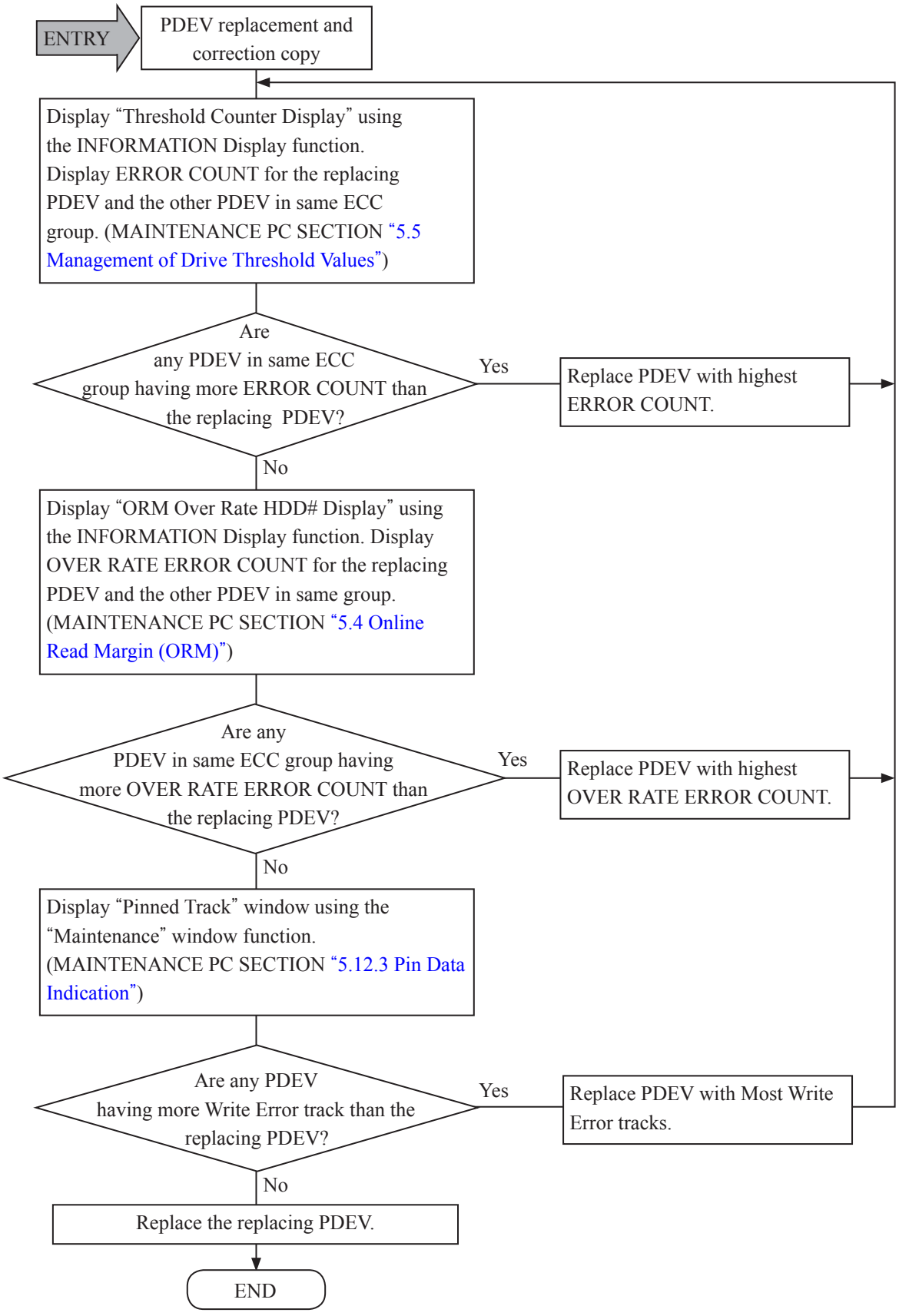
1.5.3 Procedure before PDEV Replacement and Correction Copy

NOTICE: Instructions before blocking and replacing PDEV with a drive failure are listed below: When replacing unblocked PDEV, redundancy in the ECC group is lost. Therefore, during PDEV replacement, the other PDEV in the same ECC group is blocked by a drive failure, all the LDEV in the ECC group is blocked. Accordingly, to prevent the above problem, check the status of PDEV other than the PDEV to be replaced in the same ECC group before PDEV replacement. When a PDEV having more drive failures than the replacing PDEV exists, replace the PDEV with the highest drive failures.

Table 1-5 Check Items before PDEV Replacement

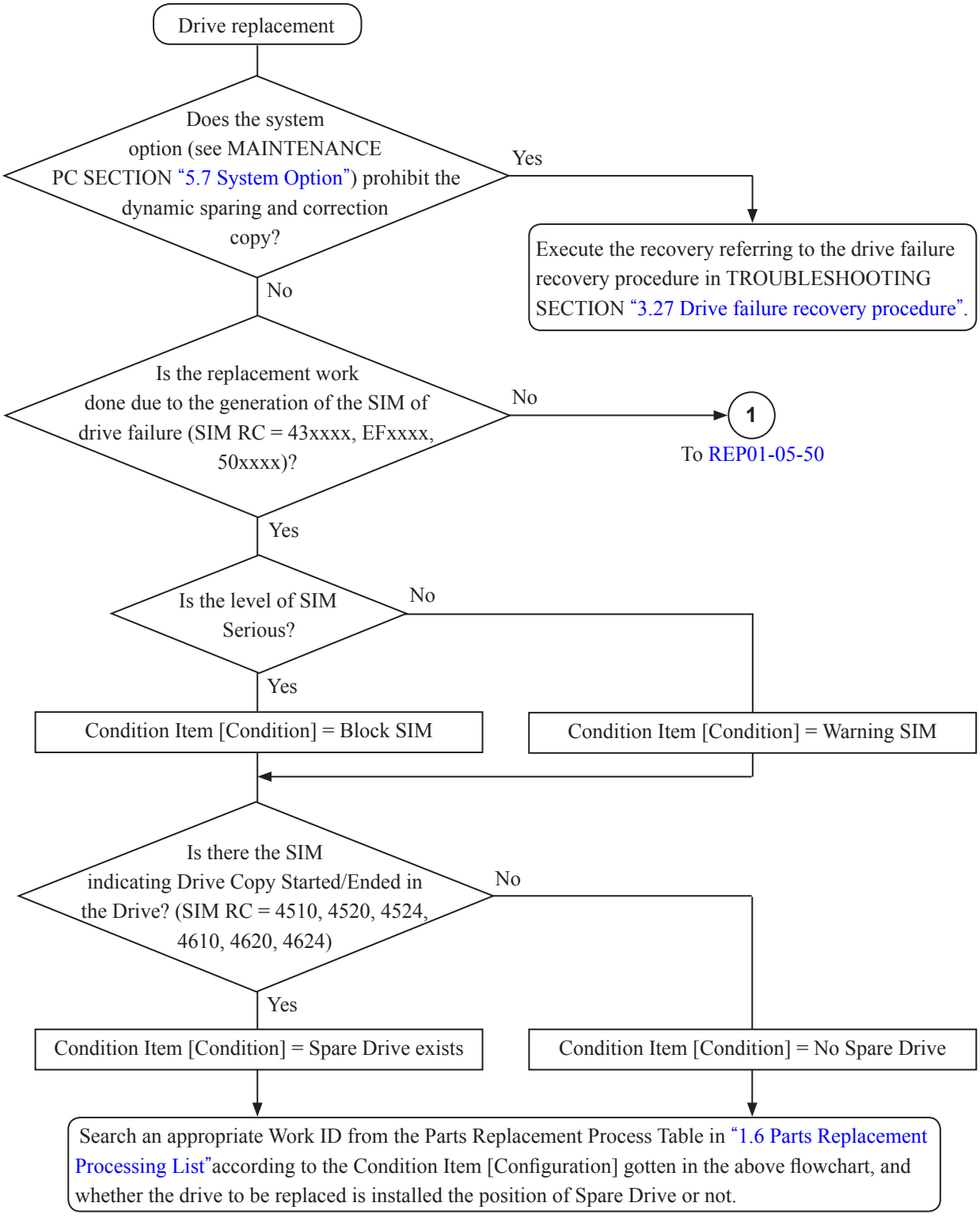
#	Items checked	Procedure
1	Failure Count	"Threshold Counter Display" (Refer to MAINTENANCE PC SECTION "5.5 Management of Drive Threshold Values")
2	ORM Over Rate	"ORM Over Rate HDD# Display" (Refer to MAINTENANCE PC SECTION "5.4 Online Read Margin (ORM)")
3	Write Error Failed Track Rate	"Pinned Track Display" (Refer to MAINTENANCE PC SECTION "5.12.3 Pin Data Indication")

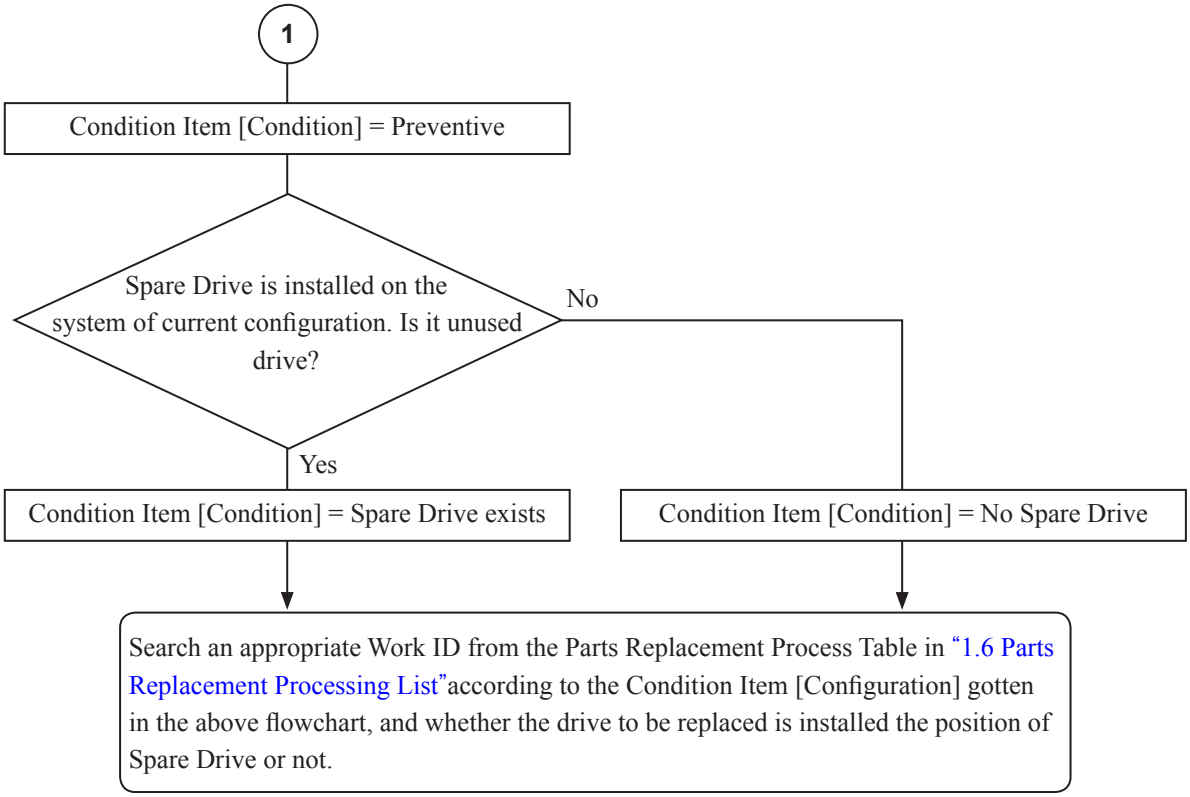
1.5.4 Confirmation Procedure



1.5.5 How to Search a Work ID to Replace a Drive

NOTICE: When a work ID cannot be found by this procedure or when multiple errors in Drives, refer to TROUBLESHOOTING SECTION "3.27 Drive failure recovery procedure".





----------<<Example>>----------

- SIM has occurred.
- Level of the occurred SIM is not "Serious". = Condition Item[Condition] is "Warning SIM".
- There is the SIM that RC is 4510 in the drive. = Condition Item[Configuration] is "Unused spare drive exists".
- The drive to be replaced is not a spare drive. = "Data Drive"

NOTE: Under the above conditions, the shaded area is searched from Parts Replacement Process List (sample). Therefore, in this example Work ID should be RDK1.

<Data Drive, Spare Drive>

Work ID	Parts Name	Condition Item				Procedure	Reference information		
		Condition			Config-uration		Replacing time	Outline	Case
		Failure		Preventive					
		Warning SIM	Block SIM		Unused Spare drive				
RDK1	Data Drive	×	×	—	Yes	Replacing a Drive ("2.3 Replacing a Drive")	20 min	Drive replace ~ Copy back	Case 1 Case 2

1.6 Parts Replacement Processing List

NOTE: If a message other than the described is displayed, refer to “Device Manager-Storage Navigator Messages”.

1. Data Drive, Spare Drive>

Work ID	Parts Name	Condition Item				Procedure	Reference information		
		Condition			Config-uration		Replacing time (*2) (*8) (*9) (*10) (*11)	Outline(*1)	Case
		Failure		Preventive	Unused Spare drive				
		Warning SIM	Block SIM						
RDK1	Data Drive (*3)	×	×	-	Yes	Replacing a Drive (“2.3 Replacing a Drive”)	20 min	Drive replace ~ Copy back	Case 1 Case 2 Case 19 Case 21
	Data Drive (*3)	-	-	×	Yes	Replacing a Drive (“2.3 Replacing a Drive”)	-	Copy to Spare drive ~ Drive replace ~ Copy back	Case 17 Case 24
	Data Drive (*3) (*6)	×	×	×	No	Replacing a Drive (“2.3 Replacing a Drive”)	20 min	Drive replace ~ Correction copy	Case 3 Case 4 Case 18
	Data Drive (*3)	Case that two or more drives in a same parity group are blocked. As to RAID 6, when three or more drives are blocked. (*4) (*7)				Replacing a Drive (“2.3 Replacing a Drive”)	-	LDEV formatting after replacing all the HDDs blocked in a parity group (*5)	Case 16
	Spare Drive (*3)	-				Replacing a Drive (“2.3 Replacing a Drive”)	20 min	Spare drive replace	Case 15

*1: See "1.3 Concept of Drive Maintenance".
*2: This time does not include copy back time of data in HDD. Refer to (*8) for the HDD copy time.
*3: Parts Name indicates attribute of a drive.
Data Drive: The Drive is installed in the position for a Drive except Spare Drive (Data Drive).
Spare Drive: The Drive is installed in the position for a Spare Drive.
*4: When the work procedure in the case of two or more Drives blocked in the same parity group (as to RAID 6, three or more Drives) is executed, the data will be erased. Ask the Technical Support Division about the appropriateness of the operation. When you want to restore LDEV status for the purpose of data backup, please go to TROUBLESHOOTING SECTION "3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)".
*5: Confirm the parity group and the LDEV No. corresponding to the HDD through the STATUS. Refer to MAINTENANCE PC SECTION "9.3.4.3 HDD Information View" for the procedure for referring to STATUS.
*6: See "1.5.3 Procedure before PDEV Replacement and Correction Copy".
*7: In case of RAID6, when two HDDs are blocked in the parity group, you can start the replacement from either of two HDDs.

NOTE: If a Work ID cannot be found or if multiple drive failures have occurred, see TROUBLESHOOTING SECTION "3.27 Drive failure recovery procedure".

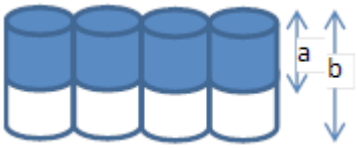
*8: HDD copy time

- In the case of RAID1 (2D+2D), the copy time of the primary HDD and that of the secondary HDD are the same.
- The copy time of RAID1 (4D+4D) is the same as RAID1 (2D+2D).
- When CVS is used, the copy time is proportional to the amount of LDEV assigned in the parity group.

  Eg:
  - If the amount of LDEV assigned is 50%, the copy time is half the above-mentioned values.
  - When the LDEV eight times the write guaranteed capacity of the parity group is assigned using the Accelerated Compression, the eightfold copy time is required.

- When the parity group is used for DP/DT/DT (active flash)-POOL, depending on the POOL used amount, the copy time becomes shorter than the above-mentioned values.
- When the copy is executed while executing the Quick Format, the copy might be completed earlier than the above-mentioned values because the area under the format is not copied.
- When the Accelerated Compression function of FMC is used, the copy time is longer than the time in the following tables. Calculate the copy time by using the following formula.

(1) Percentage of defined LDEVs in a PG (Parity Group) (%): C (%)
C(%) = Total capacity of LDEVs in a PG (a) / Physical data capacity of a PG (b)



Item	PG capacity	How to check/calculate capacity
a	Total capacity of LDEVs in a PG	See the“Parity Groups window” section in Provisioning Guide for Open Systems.
b	Physical data capacity of a PG (excluding parity)	Physical capacity of a drive × The number of data drives Eg: 1.6TB FMD (RAID5 3D+1P) b = 1.6TB × 3 = 4.8TB

NOTE: When the Accelerated Compression function is used for FMDs, “a” might be larger than “b”.

(2) Utilization rate of Pool (%): D(%)
Check the utilization rate seeing the“Pools window” section in Provisioning Guide for Open Systems.

(3) Estimation of copy time
The value in the following tables × C (%) × D (%).

(4) CBXSS/CBXSL, No I/O, OPEN-V : Copy Mode = Interleave Medium

HDD type	Copy type	RAID1	RAID5/6	
			Group 1	Group 2
6R0H9M (7.2 krpm)	Drive copy	15h 20m	←	←
	Correction copy	13h 30m	14h 30m	17h 40m
10RH9M (7.2 krpm)	Drive copy	25h 30m	←	←
	Correction copy	22h 30m	24h 00m	29h 20m
600JCMC (10 krpm)	Drive copy	1h 30m	←	←
	Correction copy	1h 10m	1h 30m	1h 40m
1R2JCMC (10 krpm)	Drive copy	3h 00m	←	←
	Correction copy	2h 30m	3h 00m	3h 20m
2R4JGM (10 krpm)	Drive copy	5h 20m	←	←
	Correction copy	4h 40m	5h 20m	6h 30m
480MGM (SSD)	Drive copy	40m	←	←
	Correction copy	40m	50m	1h 30m
960MGM (SSD)	Drive copy	1h 20m	←	←
	Correction copy	1h 20m	1h 40m	2h 50m
1R9MGM (SSD)	Drive copy	2h 40m	←	←
	Correction copy	2h 40m	3h 30m	5h 40m
3R8MGM (SSD)	Drive copy	5h 20m	←	←
	Correction copy	5h 20m	7h 00m	11h 40m
7R6MGM (SSD)	Drive copy	10h 40m	←	←
	Correction copy	10h 40m	13h 50m	23h 30m
15RMGM	Drive copy	24h 40m	←	←
	Correction copy	22h 50m	31h 40m	51h 10m

• Group 1: RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P) and RAID6 (6D+2P)
• Group 2: RAID6 (12D+2P, 14D+2P)

(5) CBSS/CBSL, No I/O, OPEN-V : Copy Mode = Interleave Medium

HDD type	Copy type	RAID1	RAID5/6	
			Group 1	Group 2
6R0H9M/6R0HLM (7.2 krpm)	Drive copy	12h 20m	←	←
	Correction copy	12h 20m	12h 00m	12h 20m
10RH9M/10RHLM (7.2 krpm)	Drive copy	19h 50m	←	←
	Correction copy	19h 50m	19h 40m	20h 50m
600JCMC (10 krpm)	Drive copy	1h 20m	←	←
	Correction copy	1h 00m	1h 10m	1h 20m
1R2JCMC/1R2J7MC (10 krpm)	Drive copy	2h 30m	←	←
	Correction copy	2h 20m	2h 30m	2h 30m
2R4JGM/2R4J8M (10 krpm)	Drive copy	4h 00m	←	←
	Correction copy	3h 40m	4h 20m	4h 40m
480MGM (SSD)	Drive copy	40m	←	←
	Correction copy	40m	30m	50m
960MGM (SSD)	Drive copy	1h 10m	←	←
	Correction copy	1h 10m	1h 00m	1h 30m
1R9MGM (SSD)	Drive copy	2h 30m	←	←
	Correction copy	2h 30m	2h 00m	2h 50m
3R8MGM (SSD)	Drive copy	5h 20m	←	←
	Correction copy	5h 20m	4h 10m	6h 00m
7R6MGM (SSD)	Drive copy	10h 40m	←	←
	Correction copy	10h 40m	8h 20m	12h 00m
15RMGM (SSD)	Drive copy	20h 00m	←	←
	Correction copy	19h 00m	17h 10m	26h 30m

• Group 1: RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P) and RAID6 (6D+2P)
• Group 2: RAID6 (12D+2P, 14D+2P)

(6) CBLH1, No I/O, OPEN-V : Copy Mode = Interleave Medium

HDD type	Copy type	RAID1	RAID5/6	
			Group 1	Group 2
6R0H9M/6R0HLM (7.2 krpm)	Drive copy	12h 20m	←	←
	Correction copy	12h 20m	12h 00m	12h 20m
10RH9M/10RHLM (7.2 krpm)	Drive copy	19h 50m	←	←
	Correction copy	19h 50m	19h 40m	20h 50m
600JCMC (10 krpm)	Drive copy	1h 20m	←	←
	Correction copy	1h 00m	1h 10m	1h 20m
1R2JCMC/1R2J7MC (10 krpm)	Drive copy	2h 30m	←	←
	Correction copy	2h 20m	2h 30m	2h 30m
2R4JGM/2R4J8M (10 krpm)	Drive copy	4h 00m	←	←
	Correction copy	3h 40m	4h 20m	4h 40m
480MGM (SSD)	Drive copy	40m	←	←
	Correction copy	40m	30m	50m
960MGM (SSD)	Drive copy	1h 10m	←	←
	Correction copy	1h 10m	1h 00m	1h 30m
1R9MGM (SSD)	Drive copy	2h 30m	←	←
	Correction copy	2h 30m	2h 00m	2h 50m
3R8MGM (SSD)	Drive copy	5h 20m	←	←
	Correction copy	5h 20m	4h 10m	6h 00m
7R6MGM (SSD)	Drive copy	10h 40m	←	←
	Correction copy	10h 40m	8h 20m	12h 00m
15RMGM (SSD)	Drive copy	20h 00m	←	←
	Correction copy	19h 00m	17h 10m	26h 30m
3R2FN (FMD)	Drive copy	6h 40m	←	←
	Correction copy	6h 40m	3h 40m	4h 40m
7R0FP (FMD)	Drive copy	14h 50m	←	←
	Correction copy	14h 50m	7h 20m	9h 20m
14RFP (FMD)	Drive copy	29h 40m	←	←
	Correction copy	29h 40m	14h 40m	18h 40m

• Group 1: RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P) and RAID6(6D+2P)
• Group 2: RAID6 (12D+2P, 14D+2P)

(7) CBLH2, No I/O, OPEN-V : Copy Mode = Interleave Medium

HDD type	Copy type	RAID1	RAID5/6	
			Group 1	Group 2
6R0H9M/6R0HLM (7.2 krpm)	Drive copy	12h 20m	←	←
	Correction copy	12h 20m	12h 00m	12h 20m
10RH9M/10RHLM (7.2 krpm)	Drive copy	19h 50m	←	←
	Correction copy	19h 50m	19h 40m	20h 50m
600JCMC (10 krpm)	Drive copy	1h 20m	←	←
	Correction copy	1h 00m	1h 10m	1h 20m
1R2JCMC/1R2J7MC (10 krpm)	Drive copy	2h 30m	←	←
	Correction copy	2h 20m	2h 30m	2h 30m
2R4JGM/2R4J8M (10 krpm)	Drive copy	4h 00m	←	←
	Correction copy	3h 40m	4h 20m	4h 40m
960MGM (SSD)	Drive copy	1h 10m	←	←
	Correction copy	1h 10m	1h 00m	1h 30m
1R9MGM (SSD)	Drive copy	2h 30m	←	←
	Correction copy	2h 30m	2h 00m	2h 50m
3R8MGM (SSD)	Drive copy	5h 20m	←	←
	Correction copy	5h 20m	4h 10m	6h 00m
7R6MGM (SSD)	Drive copy	10h 40m	←	←
	Correction copy	10h 40m	8h 20m	12h 00m
15RMGM (SSD)	Drive copy	20h 00m	←	←
	Correction copy	19h 00m	17h 10m	26h 30m
3R2FN (FMD)	Drive copy	6h 40m	←	←
	Correction copy	6h 40m	3h 40m	4h 40m
7R0FP (FMD)	Drive copy	14h 50m	←	←
	Correction copy	14h 50m	7h 20m	9h 20m
14RFP (FMD)	Drive copy	29h 40m	←	←
	Correction copy	29h 40m	14h 40m	18h 40m

• Group 1: RAID5 (3D+1P, 4D+1P, 6D+1P, 7D+1P) and RAID6(6D+2P)
• Group 2: RAID6 (12D+2P, 14D+2P)

*9: The drive copy to the spare drive of the RAID1 is copied from the drive (normal drive) of the pair of which the failure occurred.
(Because there is a case where a failure occurs in the copy source drive and the copy time is delayed in the usual form that performs copying from the drive of which the failure occurred.)
However, the copy back (copy from the spare drive to the data drive) is copied from the spare drive as usual.

*10: Time changes by the Device constitution and the Internal re-try processing (Head positioning, Handling of re-covered process).
Please make a range to 1.5 times of above time an aim.

*11: This includes working hours necessary for replacing parts such as attaching/removing a Front Bezel and opening/closing the door of a rack frame.

2. Controller Board

Work ID	Part Name	Procedure	Replacing Time (*1)
RCTL	Controller Board	Replacing a Controller Board (“2.4 Replacing a Controller Board”)	30 min
RCM1	Cache Memory	Replacing a Cache Memory (“2.5 Replacing a Cache Memory”)	20 min
RCFM	Cache Flash Memory	When a Controller Board is “Normal”: Replace the Cache Flash Memory “2.10 Replacing a Cache Flash Memory (CFM)” When a Controller Board is blocked: Perform the procedure for replacing the Controller Board (“2.4 Replacing a Controller Board”) and remove the Controller Board from the Controller Chassis as described in the procedure. Then, replace the Cache Flash Memory only and return the Controller Board to the Controller Chassis. (The components including the Controller Board can be used, except for the Cache Flash Memory.)	20 min

*1: The destaging time and the Update Firmware time is not included. (The destaging operation takes 30 minutes to two hours.).

NOTICE: Replacing a Controller Board may block Quorum Disk when there is much write pending data in cache.
When Quorum Disk is block, GAD pairs may be suspended by some failures.
We recommend to replace a Controller Board when all the cache write pending rate per CLPR in a Controller Board is less than 40%.

Before starting maintenance operation for the Controller Board, check whether there is a quorum disk and the Cache Write Pending Rate, according to the steps below.

1. Start the Web Console referring to MAINTENANCE PC SECTION “2.5 Starting Web Console”.
2. Select [Maintenance Utility] - [Licenses...] in the “Web Console” window. In the “License Keys” window, if the license of global-active device is “Not Installed”, go to Step 5. (See MAINTENANCE PC SECTION “3.7.7 Verifying License”.)
3. Select [Storage Systems]-[Logical Devices]. (See MAINTENANCE PC SECTION “4.2.3 Managing Logical Device”.) If there is not an LDEV whose attribute is Quorum Disk, go to Step 5.
4. Check the Write Pending Rate referring to MAINTENANCE PC SECTION “6. Monitoring”. If the Write Pending Rate is 40% or less, go to Step 5. If it exceeds 40%, wait until I/O load drops, then go to Step 5.
5. Perform maintenance operation for the Controller Board. (See “2.4 Replacing a Controller Board”.)

3. Channel Board, Disk Board

Work ID	Part Name	Procedure	Replacing Time (*1)
RCHB	Channel Board	Replacing a Channel Board (CHB) (“2.12 Replacing a Channel Board (CHB)”)	20 min
RDKB	Disk Board	Replacing a Disk Board (“2.14 Replacing a Disk Board (DKB)”)	20 min

*1: The destaging time and the Update Firmware time is not included. (The destaging operation takes 30 minutes to two hours.)

If a failure occurs in replacing a Channel Board or a Disk Board, see TROUBLESHOOTING SECTION “2.2.3 Error Recovery Procedure during CHB/DKB replacement”.

4. Other Parts of DKC

Work ID	Part Name	Procedure	Replacing Time(*3)
RFAN	FAN (CBXSS/CBXSL/ CBSS/CBSL)	Replacing a FAN (“2.6 Replacing a FAN”)	10 min
RBK2	BKMF (CBLH)	Replacing a BKMF (“2.7 Replacing a BKMF”)	10 min
RBTR	Battery	Replacing a Battery (“2.8 Replacing a Battery”)	10 min
RBK1	BKM (CBSS/CBSL)	Replacing a BKM (“2.9 Replacing/Preventive Replacement of a BKM”)	10 min
RPSU	Power Supply	Replacing a Power Supply (“2.15 Replacing a Power Supply”)	10 min
RSFP	Small Form-Factor Pluggable	Replacing a Small Form-Factor Pluggable (SFP) (Follow the flowchart in REP02-13-10 to decide which replacement procedure to perform, and then perform “2.13 Replacing a Small Form-Factor Pluggable (SFP)” or INSTALLATION SECTION “3.9 Changing the Type of Small Form-Factor Pluggable (SFP)”.)	5 min
RCML	LAN Board	Replacing a LAN Board (“2.11 Replacing a LAN Board”)	20 min
—	Controller Chassis	Replacing a Controller Chassis (“2.17 Replacing a Controller Chassis/Drive Box”)	60 min (*1) (*2)
—	Front Bezel	Replacing a Front Bezel (“2.18 Replacing the Front Bezel”)	5 min
RENC	ENC	Replacing a ENC (“2.16 Replacing an ENC”)	10 min
—	Drive Box	Replacing a Drive Box (“2.17 Replacing a Controller Chassis/Drive Box”)	DB60: 120 min The others: 40 min (*1) (*2)
RSC1	SAS Cable	Replacing a SAS Cable (“2.20 Replacing a SAS Cable”) (*4)	DBS/DBL/DB60/ DBF: 10 min
RSPK	Switch Package	Replacing a Switch Package (SWPK) (“2.25 Replacing a Switch Package”)	30 min

*1: The time for replacing hardware parts. The time for powering on/off is not included. Consult your customer about the work schedule before starting the work because the storage system needs to be powered off during the replacement work.

*2: The replacement work must be done by two or more personnel.

*3: The destaging time and the Update Firmware time is not included. (The destaging operation takes 30 minutes to two hours.)

*4: For the DW-F800-SCQ1HA cable, replace the SAS adapter first. If it is not recovered even after replacing the SAS adapter, replace the cable.

(To be continued)

(Continued from preceding sheet)

Work ID	Part Name	Procedure	Replacing Time (*3)
RFN2	FAN (CHBB)	Replacing a FAN (CHBB) (“2.26 Replacing a FAN (CHBBFAN)”)	10 min
RPCP	PCIe-cable Connecting Package	Replacing a PCIe-cable Connecting Package (“2.24 Replacing a PCIe-cable Connecting Package”)	20 min
RPEC	PCIe Channel Board	Replacing a PCIe Channel Board (“2.23 Replacing a PCIe Channel Board”)	20 min
RPCC	PCI cable	Replacing a PCI cable (“2.27 Replacing a PCIe Cable”)	10 min
RPCA	• PCIe Channel Board • PCI cable	• Replacing a PCIe Channel Board (“2.23 Replacing a PCIe Channel Board”) • Replacing a PCI cable (“2.27 Replacing a PCIe Cable”)	30 min
—	Channel Board Box	Replacing a Channel Board Box (CHBB) (“2.22 Replacing a Channel Board Box”)	40 min (*1) (*2)

*1: The time for replacing hardware parts. The time for powering on/off is not included. Consult your customer about the work schedule before starting the work because the storage system needs to be powered off during the replacement work.

*2: The replacement work must be done by two or more personnel.

*3: The destaging time and the Update Firmware time is not included. (The destaging operation takes 30 minutes to two hours.)

1.7 Availability of the Online Maintenance When TrueCopy Is Used

× : Maintenance is available.

Message is displayed in the following case.

Refer to "Device Manager-Storage Navigator Messages".

Component	Maintenance Type	Condition	TC path established		During initial copy or pair resynchronization		After completing initial copy or pair resynchronization	
			M-DKC	R-DKC	P-VOL	S-VOL	P-VOL	S-VOL
Logical Device	Blockade	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Recovery	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Format	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Verify	—	×	×	×	×	×	×
HDD canister	Replace	—	×	×	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	30762-208206	30762-208213 30762-208204 (*1)	×	30762-208204 (*1)
		Without Alternate path	×	×	30762-208206	30762-208213 30762-208204 (*1)	×	30762-208204 (*1)
	Replace (Initiator)	With Alternate path	×	×	30762-208206	30762-208213	×	×
		Without Alternate path	×	×	30762-208206 30762-208207	30762-208213	30762-208208	×
Channel Board	Replace (RCU Target)	With Alternate path	×	×	×	30762-208204 (*1)	×	30762-208204 (*1)
		Without Alternate path	×	×	×	30762-208204 (*1)	×	30762-208204 (*1)
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	30762-208207	×	30762-208208	×
Disk Board	Replace	—	×	×	×	×	×	×

Component	Maintenance Type	Condition	Suspended	
			P-VOL	S-VOL
Logical Device	Blockade	—	03005-002515	03005-002515
	Recovery	—	03005-002515	03005-002515
	Format	—	03005-002515	03005-002515
	Verify	—	×	×
HDD canister	Replace	—	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	30762-208204 (*1)
		Without Alternate path	×	30762-208204
	Replace (Initiator)	With Alternate path	×	×
		Without Alternate path	×	×
Channel Board	Replace (RCU Target)	With Alternate path	×	30762-208204 (*1)
		Without Alternate path	×	30762-208204 (*1)
	Replace (Initiator)	With Alternate path	×	×
		Without Alternate path	×	×
Disk Board	Replace	—	×	×

The pair can be suspended if paircreate (pairresync) command is issued during the HDD Canister or the Cache Memory replacement. Please ask your customer before the online maintenance operation.

*1: Might be prevented when the M-DKC that does not make a pair forms a path.

1.8 Availability of the Online Maintenance When ShadowImage Is Used

× : Maintenance is available.

Message is displayed in the following case.

Refer to "Device Manager-Storage Navigator Messages".

Component	Maintenance Type	Condition	Pending/Resync/ SP-PEND	Duplex	Split	Suspend
			S-VOL/P-VOL	S-VOL/P-VOL	S-VOL/P-VOL	S-VOL/P-VOL
Logical Device	Blockade	—	03005-002517	03005-002517	03005-002517	×
	Recovery	—	03005-002517	03005-002517	03005-002517	×
	Format	—	03005-002517	03005-002517	03005-002517	×
	Verify	—	×	×	×	×
HDD canister	Replace	—	×	×	×	×
	Dynamic Sparing	—	×	×	×	×
	Correction Copy	—	×	×	×	×
Controller Board	Replace	—	×	×	×	×
Channel Board	Replace	—	×	×	×	×
		—	×	×	×	×
Disk Board	Replace	—	×	×	×	×

1.9 Availability of the Online Maintenance When UR Is Used

× : Maintenance is available.

Message is displayed in the following case.

Refer to "Device Manager-Storage Navigator Messages".

JNL-GROUP

Component	Maintenance Type	Condition	Path established		Initial		Active	
			M-DKC	R-DKC	M-DKC	R-DKC	M-DKC	R-DKC
Logical Device	Blockade	—	×	×	03005-208121	03005-208121	03005-208121	03005-208121
	Recovery	—	×	×	03005-208121	03005-208121	03005-208121	03005-208121
	Format	—	×	×	03005-208121	03005-208121	03005-208121	03005-208121
	Verify	—	×	×	×	×	×	×
HDD canister	Replace	—	×	×	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
Channel Board	Replace (RCU Target)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
Disk Board	Replace	—	×	×	×	×	×	×

Component	Maintenance Type	Condition	Halting		Stop		Stopping	
			M-DKC	R-DKC	M-DKC	R-DKC	M-DKC	R-DKC
Logical Device	Blockade	—	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121
	Recovery	—	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121
	Format	—	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121	03005-208121
	Verify	—	×	×	×	×	×	×
HDD canister	Replace	—	×	×	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
Channel Board	Replace (RCU Target)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	×	×	×	×
Disk Board	Replace	—	×	×	×	×	×	×

DATA-VOL

Component	Maintenance Type	Condition	Path established		During initial copy or pair resynchronization		After completing initial copy or pair resynchronization	
			M-DKC	R-DKC	P-VOL	S-VOL	P-VOL	S-VOL
Logical Device	Blockade	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Recovery	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Format	—	×	×	03005-002515	03005-002515	03005-002515	03005-002515
	Verify	—	×	×	×	×	×	×
HDD canister	Replace	—	×	×	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	30762-208206 30762-208205 (*1)	30762-208213	30762-208205 (*1)	×
		Without Alternate path	×	×	30762-208206 30762-208205 (*1)	30762-208213	30762-208205 (*1)	×
	Replace (Initiator)	With Alternate path	×	×	30762-208206	30762-208213	×	×
		Without Alternate path	×	×	30762-208206 30762-208205	30762-208207 30762-208213	30762-208205	30762-208208
Channel Board	Replace (RCU Target)	With Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
		Without Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	30762-208205	30762-208207	30762-208205	30762-208208
Disk Board	Replace	—	×	×	×	×	×	×

Component	Maintenance Type	Condition	Suspend		Suspending		Deleting	
			P-VOL	S-VOL	P-VOL	S-VOL	P-VOL	S-VOL
Logical Device	Blockade	—	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515
	Recovery	—	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515
	Format	—	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515	03005-002515
	Verify	—	×	×	×	×	×	×
HDD canister	Replace	—	×	×	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
		Without Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	30762-208205	30762-208209	30762-208205	30762-208209
Channel Board	Replace (RCU Target)	With Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
		Without Alternate path	×	×	30762-208205 (*1)	×	30762-208205 (*1)	×
	Replace (Initiator)	With Alternate path	×	×	×	×	×	×
		Without Alternate path	×	×	30762-208205	30762-208209	30762-208205	30762-208209
Disk Board	Replace	—	×	×	×	×	×	×

*1: Might be prevented when the R-DKC that does not make a pair forms a path.

1.10 Availability of the Online Maintenance When GAD Is Used

× : Maintenance is available.

Message is displayed in the following case.

Refer to “Device Manager-Storage Navigator Messages”.

Component	Maintenance Type	Condition	Path established		Quorum established
			M-DKC	R-DKC	
Logical Device	Blockade	—	×	×	03005-068884
	Recovery	—	×	×	×
	Format	—	×	×	03005-068884
	Verify	—	×	×	×
HDD canister	Replace	—	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	×	×	×
		Without Alternate path	×	×	×
	Replace (Initiator)	With Alternate path	×	×	×
		Without Alternate path	×	×	×
Channel Board	Replace	With Alternate path	×	×	×
		Without Alternate path	×	×	×
Disk Board	Replace	—	×	×	×

Component	Maintenance Type	Condition	Pair status = COPY		Pair status = PAIR	
			P-VOL	S-VOL	P-VOL	S-VOL
Logical Device	Blockade	—	03005-068885	03005-068886	03005-068885	03005-068886
	Recovery	—	03005-068885	03005-068886	03005-068885	03005-068886
	Format	—	03005-068885	03005-068886	03005-068885	03005-068886
	Verify	—	×	×	×	×
HDD canister	Replace	—	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	30762-208363 30762-208205 (*1)	30762-208366 30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
		Without Alternate path	30762-208363 30762-208205 (*1)	30762-208366 30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
	Replace (Initiator)	With Alternate path	30762-208363	30762-208366	×	×
		Without Alternate path	30762-208363 30762-208365	30762-208366 30762-208365	30762-208365	30762-208365
Channel Board	Replace (RCU Target)	With Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
		Without Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
	Replace (Initiator)	With Alternate path	×	×	×	×
		Without Alternate path	30762-208365	30762-208365	30762-208365	30762-208365
Disk Board	Replace	—	×	×	×	×

Component	Maintenance Type	Condition	Pair status = PSUS/PSUE (Local)	Pair status = SSWS (Local)	Pair status = PSUS/PSUE (Block)	Pair status = SSUS/PSUE (Block)
			P-VOL	S-VOL	P-VOL	S-VOL
Logical Device	Blockade	—	03005-068885	03005-068886	03005-068885	03005-068886
	Recovery	—	03005-068885	03005-068886	03005-068885	03005-068886
	Format	—	03005-068885	03005-068886	03005-068885	03005-068886
	Verify	—	×	×	×	×
HDD canister	Replace	—	×	×	×	×
Controller Board	Replace (RCU Target)	With Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
		Without Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
	Replace (Initiator)	With Alternate path	×	×	×	×
		Without Alternate path	×	×	×	×
Channel Board	Replace (RCU Target)	With Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
		Without Alternate path	30762-208205 (*1)	30762-208204 (*2)	30762-208205 (*1)	30762-208204 (*2)
	Replace (Initiator)	With Alternate path	×	×	×	×
		Without Alternate path	×	×	×	×
Disk Board	Replace	—	×	×	×	×

*1: Might be prevented when the R-DKC that does not make a pair forms a path.
*2: Might be prevented when the M-DKC that does not make a pair forms a path.

1.11 About the Storage Media Used for Installation/Maintenance Process

The media showed in following table are attached in storage system, in order to advance installation, maintenance, and failure analysis smoothly. Please implement installation or collect information according to the work procedure indicated in each section.

No.	Media	Description	Installation device	Remarks
1	CD-ROM	CD-R for micro-program storage. Used for installation or micro-program download in time of micro FC.	CD-R Drive of maintenance PC	Attached to the device

1.12 Specifying the Installation Location by Using the Locate LED

1.12.1 Turn on Locate LED

Refer to MAINTENANCE PC SECTION “3.9.1 Turn on Locate LED”.

1.12.2 Turn off Locate LED

Refer to MAINTENANCE PC SECTION “3.9.2 Turn off Locate LED”.