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REPLACEMENT SECTION

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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.
DKC910 is used in a form of rackmount model.

NOTICE:
- During the replacement, the part statuses in the Web Console window, Maintenance Utility window, and Maintenance Utility (Sub Panel) 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 "Starting Maintenance Utility" (MU01-10).)
  - The instruction to use the force execution option is provided in TROUBLESHOOTING SECTION.
  - The instruction is specifically provided by factory.

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 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.

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1.2 Note on Turning Off the Power

⚠ 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.

- 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.

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.

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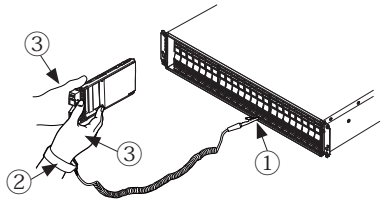
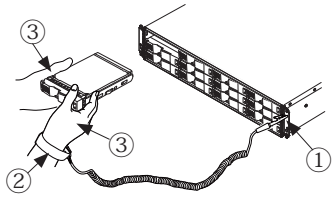
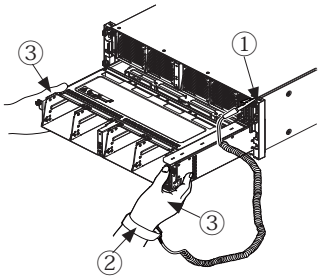
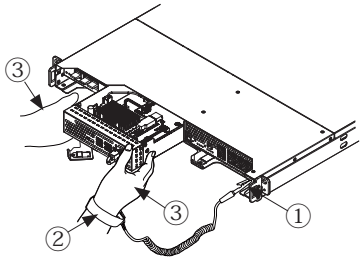
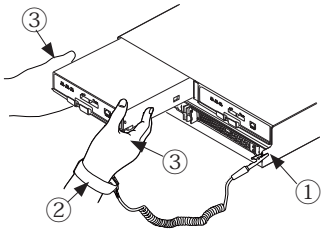
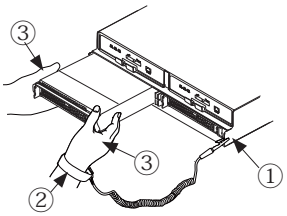
1.3 Note on Installing and Removing Parts

- 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

Front view		
		
Front view	Rear view	
		

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

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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 part in Controller Chassis, Drive Box, or HSNBX, with the storage system powered on, remove the failed part, wait for 20 seconds or more, and then install a replacement part.
- When replacing a part in Controller Chassis, Drive Box, or HSNBX, with the storage system powered on, perform removal of the failed part and installation of a maintenance part in 10 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 part fail at the same time, replace the Power Supply first, duplicate the Power Supply again, and then replace the part. 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.

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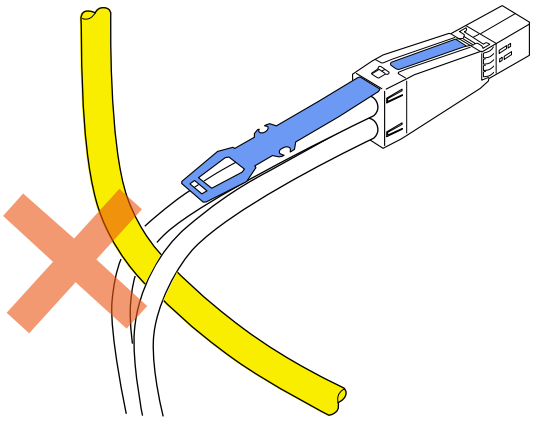
1.5 Note on Cable Routing

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, SAS cable or NVMe 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.
6. The NVMe cable consists of two cables attached to connectors. Be careful not to pass another cable between the two cables.



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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.

1.7 Note on Completing the Work

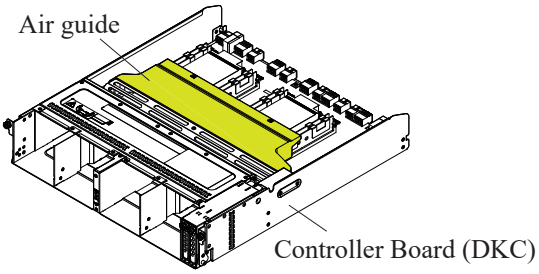
- Close all the external covers when the work is completed. (The cover is to maintain the performance of the Storage System (radio wave noise suppression and others), so that be sure to keep all the external covers closed to operate the Storage System normally.)

1.8 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.

1.9 Note at the Time of Replacement Work

- Do not put anything on the air guide of the DKC during the work.



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1.10 Note on Deleting Remote Paths

For the storage system, 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 (TrueCopy, Universal Replicator, and global-active device).
30762-208204/30762-208205/30762-208207/30762-208208/30762-208209/30762-208213/
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 whether the alternative remote paths exist or not, 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.
If 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

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1.11 Notes on Maintenance Work for the Storage System for which External Paths Are Configured

When replacing a Controller Board, Channel Board (CHB), or the like that has ports, if an external path for Universal Volume Manager is configured on the port to be blocked due to the maintenance work, the error message [30762-208260] might be displayed.
If the message is displayed, ask the customer to add an external path between a port on a CHB in a part other than the target part for maintenance and the external storage system. After the external path is added, resume the replacement work.

If the external path cannot be added, perform the procedure below.

1. Giving an explanation to the customer and asking him or her to stop I/O

   After forcibly blocking the target part for maintenance, you can perform the replacement work. If you do so, the following events occur. However, all of them are automatically recovered after completion of the replacement work.

   (1) The external path that uses the port to be blocked is blocked, and SIM = 21d0xx is reported. After completion of the replacement work, the external path is automatically recovered and SIM = 21d1xx is reported.
   (2) The external volumes that use the blocked external path (see (1)) are blocked, and SIM = efd000 is reported. After completion of the replacement work, the external volumes are automatically recovered.
   (3) The LDEV composed of the blocked external volumes (see (2)) is blocked. After completion of the replacement work, the LDEV is automatically recovered.

   To forcibly block the target part for maintenance, explain the following items to the customer and confirm that he or she accepts them in advance.
   (a) During the maintenance work, SIM = 21d0xx/efd000/21d1xx is reported. After completion of the maintenance work, the storage system is automatically recovered.
   (b) During the maintenance work, I/O to and from the LDEV to be blocked due to the maintenance work must be stopped.

   You can check the external paths, external volumes, and LDEVs that are blocked due to the maintenance work using Storage Navigator by following the procedure below.
   For the Storage Navigator windows, see Universal Volume Manager User Guide.
   (1) From the [Storage Systems] tree, select [External Storage] to open the [External Storage] window.
   (2) On the [External Storage Systems] tab in the [External Storage] window, find the external storage system that is connected by using the port on the CHB in the target part for maintenance among the displayed external storage systems, and click the link for it.
   (3) On the [External Path Groups] tab of the external storage system, click each link for each displayed path group. Repeat Step (3) through Step (6) to check the external paths, external volumes, and LDEVs that are to be blocked.

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(4) In each path group window, check the external paths and external volumes to be blocked.
- If any external path displayed on the [External Paths] tab uses a port on the CHB in the target part for maintenance, the external path will be blocked.
- If all the external paths displayed on the [External Paths] tab use ports on the CHB in the target part for maintenance, all external volumes displayed on the [Mapped Volumes] tab will be blocked. If one or more external paths use ports on a CHB in a part other than the target part for maintenance, the external volumes will not be blocked.

(5) On the [Mapped Volumes] tab of each path group, click the link for the parity group ID of the external volume to be blocked.

(6) In each parity group window, check the LDEVs to be blocked.
- All LDEVs displayed on the [LDEVs] tab will be blocked.

Ask the customer to stop I/O to or from the LDEVs to be blocked due to the maintenance work, if he or she accepts to do so.

2. Resuming the maintenance work
After confirming that the customer has stopped I/O, resume the maintenance work.
Specify the following forcible execution options using Maintenance Utility during the maintenance work.
- Check the checkbox for “Forcibly run without safety checks”.
- Check the checkbox for “Forcibly block”. (This option might not be available depending on the target part for maintenance.)

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1.12 Failure Information Collection in Replacement Work

When replacing some types of parts, you need to collect failure information. In replacement procedures of such parts, you are instructed to collect dumps. However, also for the other replacement procedures in which you are not instructed to collect dumps, the factory might ask you to collect dumps depending on the failure.

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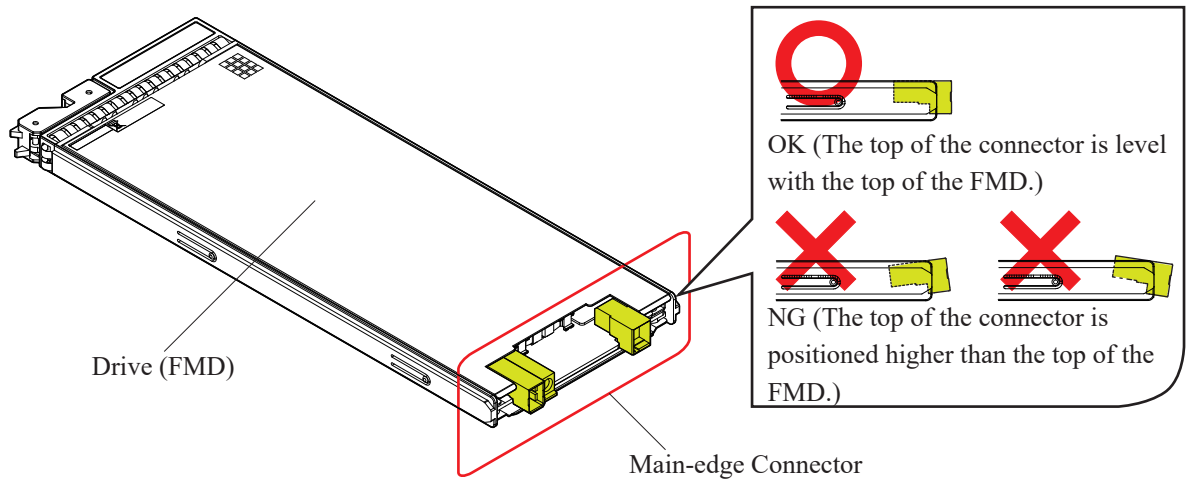
1.13 Notes when Handling the Flash Module Drive (FMD)

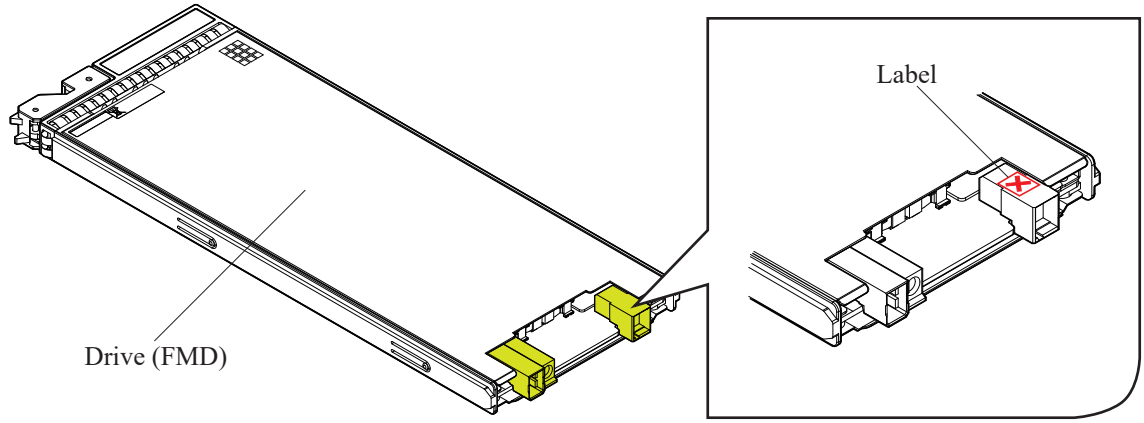
1. Be sure to check that the main edge connector of the drive (FMD) has no deformation, damage, float or sticking of dust before installing the drive (FMD).

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



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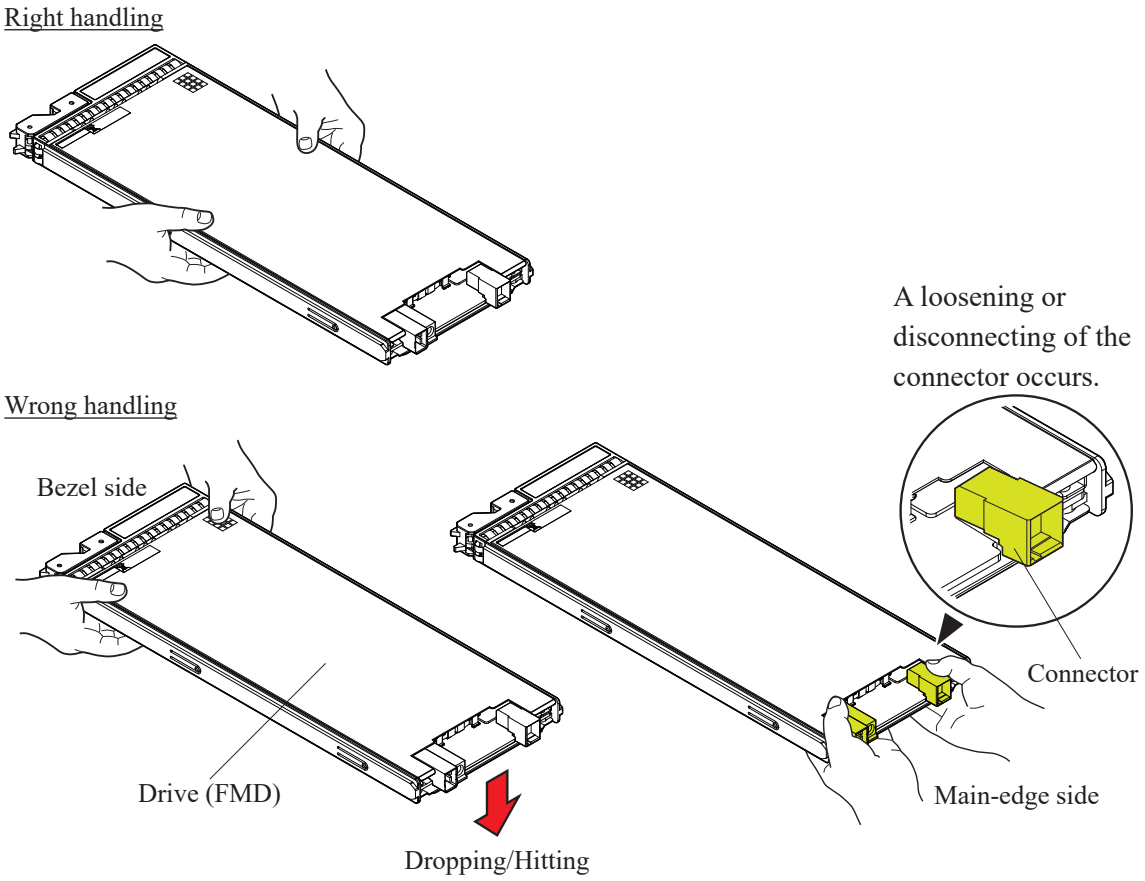
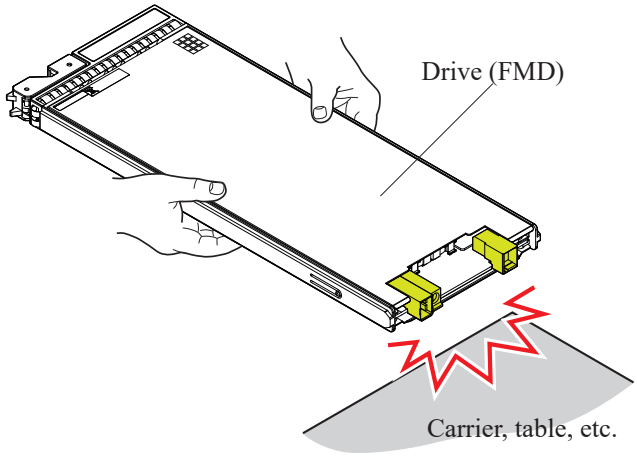
3. When holding the drive (FMD), hold the middle part of the drive (FMD) with both hands.
   Holding the main-edge side or bezel side of the drive (FMD) may cause a breakdown of the drive (FMD) by dropping it under its weight or hitting it against something. Moreover, holding the main-edge side or bezel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

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



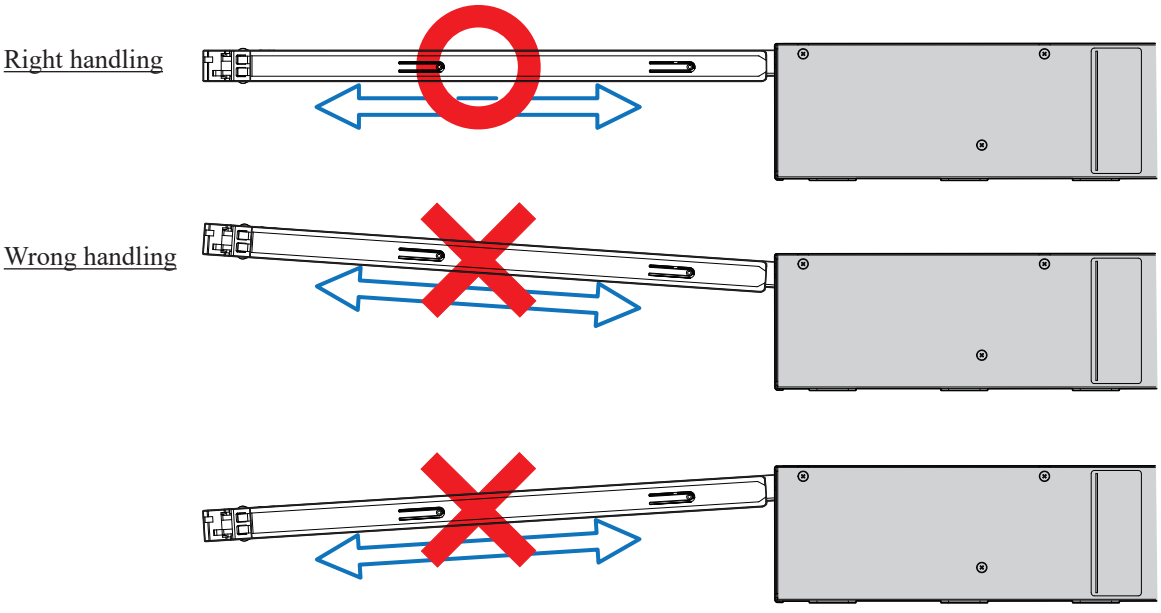
4. When moving the drive (FMD), be careful not to hit it against device or something.
   Hitting the main-edge connector against the device or something may cause damage, distortion or float on the main edge connector.

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)



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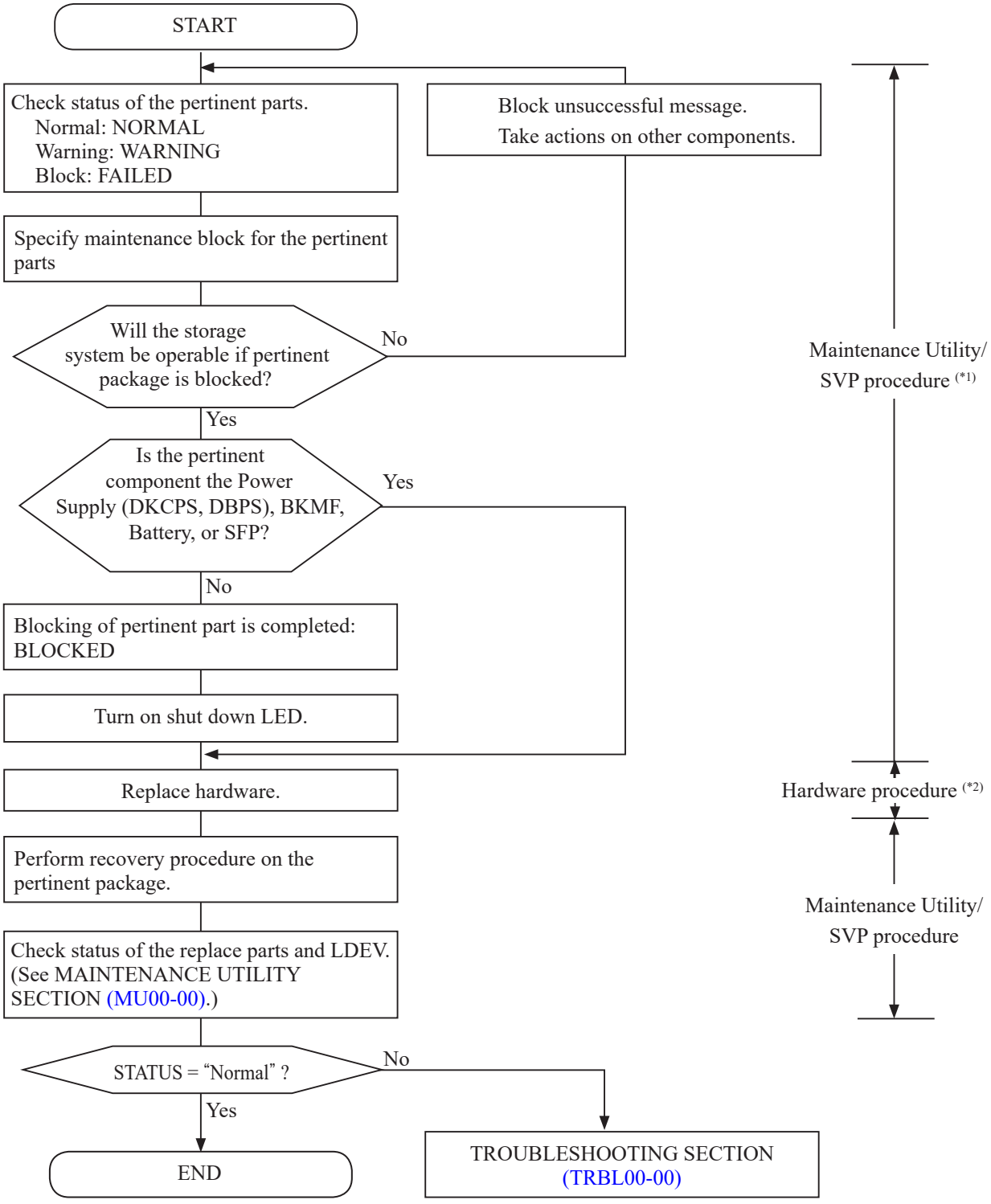
2. Hot Replacement Flowchart



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*1 :Maintenance Utility/SVP processing : Check a status of the replacement target parts by Maintenance Utility/SVP. 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 "1.3 Note on Installing and Removing Parts".

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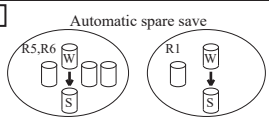
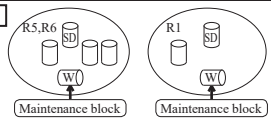
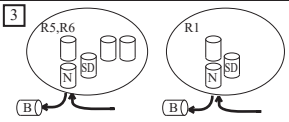
3. Concept of Drive Maintenance

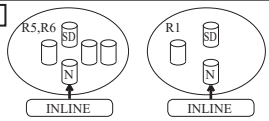
3.1 Drive Maintenance

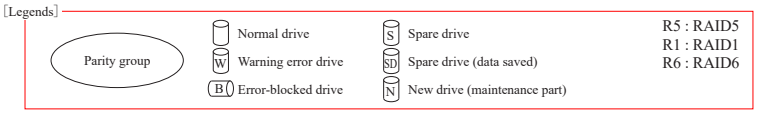
Operations to be performed vary depending on existence of spare drives, or timing when the failure occurred. For details, see the following figures.

[Spare drive present]

[Case 1] When a drive exceeds the warning threshold value (copy back is required)

Condition item		Condition	Procedure		
			Threshold value exceeded	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	○	1 Automatic spare save 	2 	3 
	Block SIM	–			
Other case (secondary measure)			① Block copy source drive (case 2) Block copy destination drive a) Unused spare present (case 6) b) Unused spare absent (case 7)		

Procedure		
INLINE	Copy back	Restoration
4 	5 	6 
① Block new drive (case 8)	① Block copy source drive (case 9) ② 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.

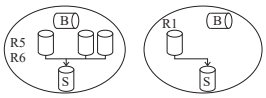
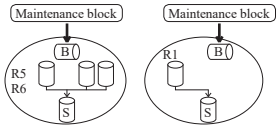
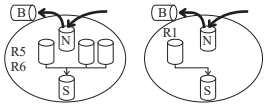
[Spare drive present]

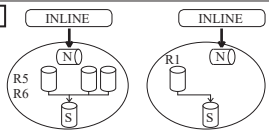
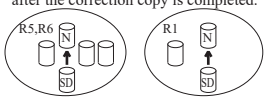
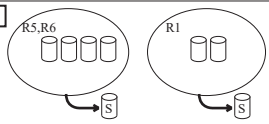
[Case 2] A case where one drive is blocked

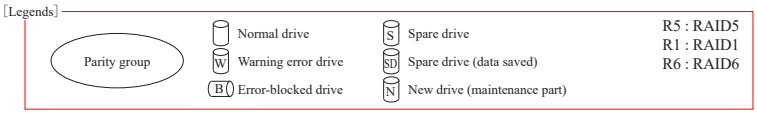
When a spare drive exists, a correction copy from the blocked drive is started automatically.

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.	

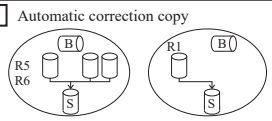
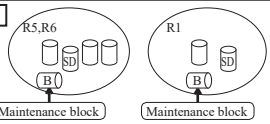
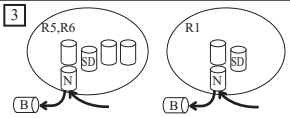
Procedure		
INLINE	Automatic copy back	Restoration
4 	5 The copy back is started automatically after the correction copy is completed. 	6 
① Block new drive (case 8)	Block copy source drive (case 9) Block copy destination drive (case 8)	



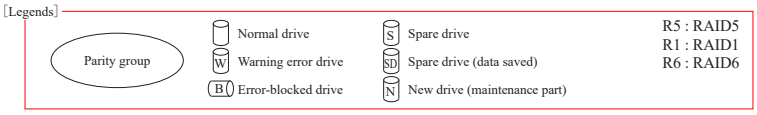
NOTE: In the RAID1 system, two drives form a mirroring pair and the two mirroring pairs (four drives) compose the parity group. In the above diagram, only the two mirroring pairs are shown.

[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.

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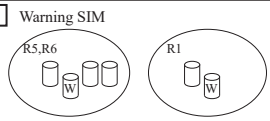
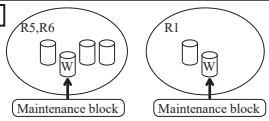
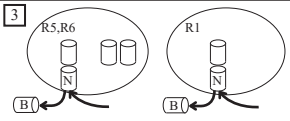
[Spare drive absent]

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

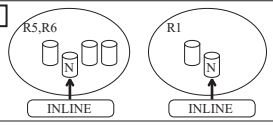
Condition item		Condition	Procedure		
			Threshold value exceeded	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	○	1 Warning SIM	2	3
	Block SIM	–			
Other case (secondary measure)					

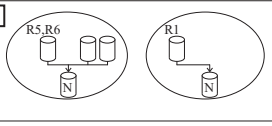






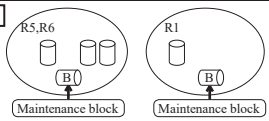
Procedure		
INLINE	Correction copy	Restoration
4	5	6
① Block new drive (case 5)	① Block copy destination drive (case 5)	

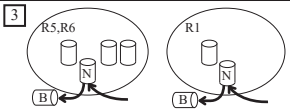




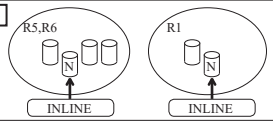
[Case 4] When a drive is blocked (without spare drive)

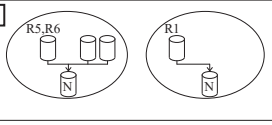
Condition item		Condition	Procedure		
			Block one drive	Maintenance block	Drive replacement
Threshold value exceeded	Warning SIM	–	1	2	3
	Block SIM	○			
Other case (secondary measure)					

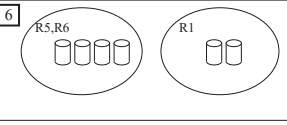




Procedure		
INLINE	Correction copy	Restoration
4	5	6
① Block new drive (case 5)	① Block copy destination drive (case 5)	







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.

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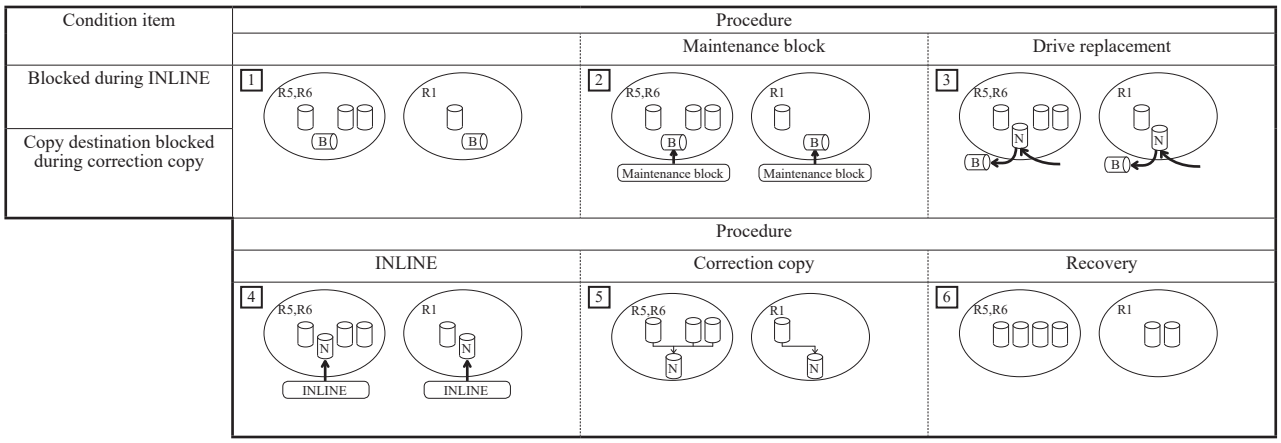
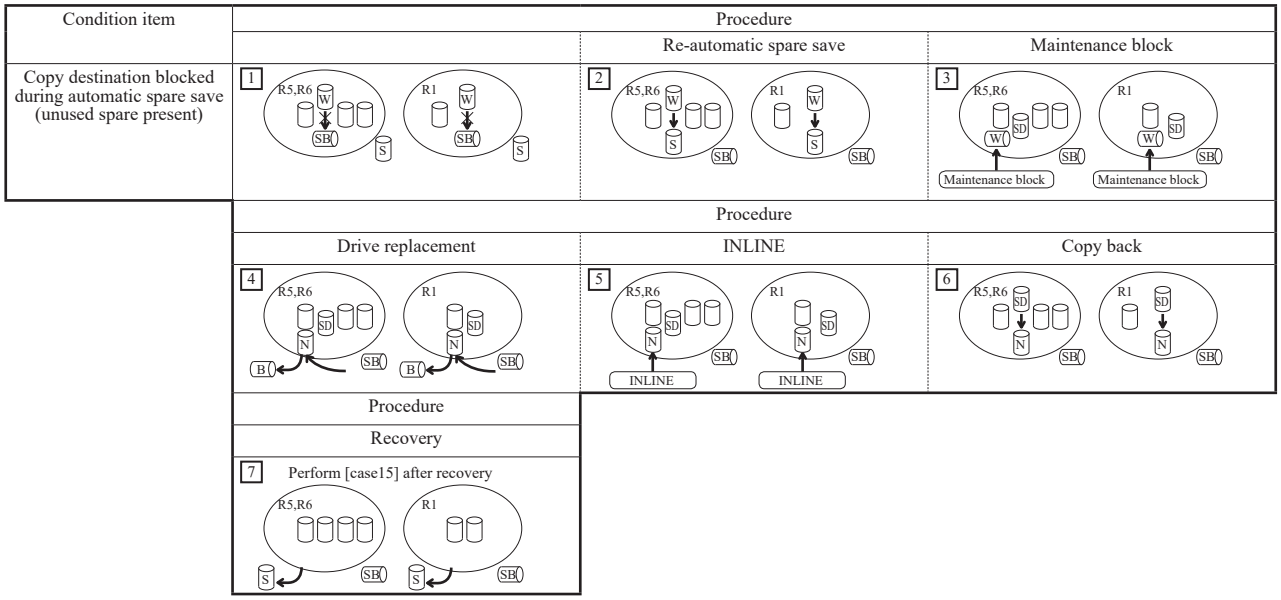
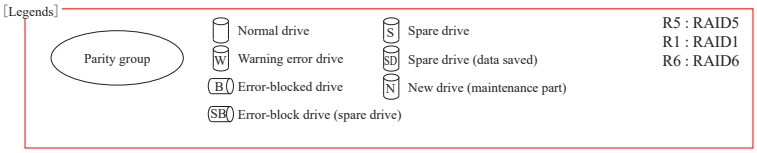
[Case in which a secondary failure occurred during recovery]

[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.

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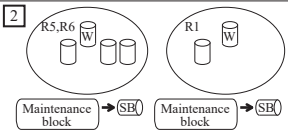
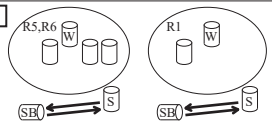
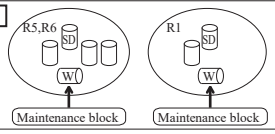
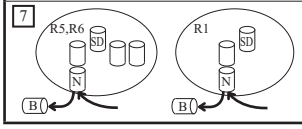
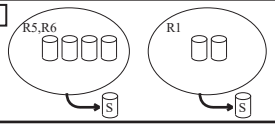
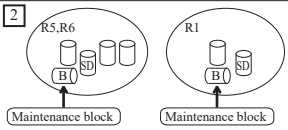
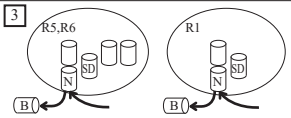
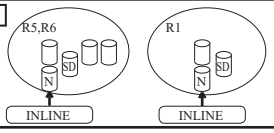
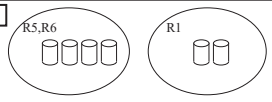
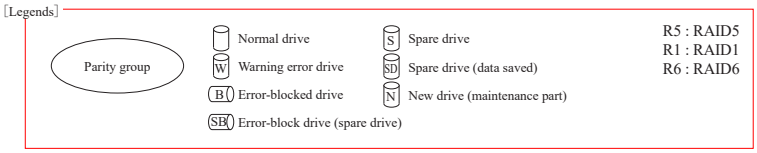
[Case in which a secondary failure occurred during recovery]

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

Condition item	Procedure		
	Copy destination block	Maintenance block on spare	Spare drive replacement
Copy destination blocked during automatic spare save (unused spare absent)	1 	2 	3 
	Procedure		
	INLINE	Spare save (Start manually)	Maintenance block
	4 	5 	6 
	Procedure		
	Drive replacement	Copy back	Restoration
	7 	8 	9 

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

Condition item	Procedure		
	New drive block	Maintenance block	Drive replacement
New drive blocked (spare saved)	1 	2 	3 
New drive blocked (correction copy performed)			
Copy destination blocked during copy back			
	Procedure		
	INLINE	Copy back	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.

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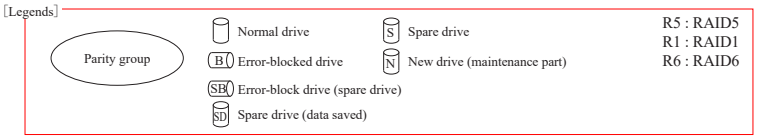
[Case in which a secondary failure occurred during recovery]

[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 R5,R6 / R1 — Abnormal copy back termination	2 R5,R6 / R1 — B() : Copy destination drive status : Blocked/Spare	3 R5,R6 / R1 — Dummy replacement / Dummy replacement
	Procedure		
	Spare drive replacement	Starting correction copy automatically	Recovery
	4 R5,R6 / R1 — Replacing with maintenance parts / Replacing with maintenance parts — N() : Drive status : Reserved/Spare	5 R5,R6 / R1	6 R5,R6 / R1

*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.

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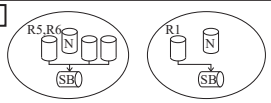
[Case in which a secondary failure occurred during recovery]

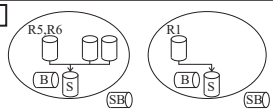
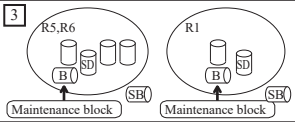
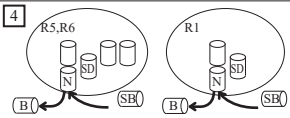
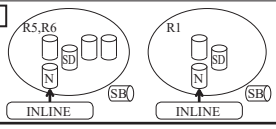
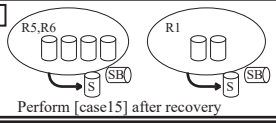
[Case 10] A case where the copy destination drive is blocked during the automatic correction copy (and a unused spare drive exists)

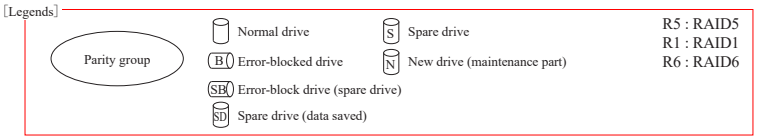
When the blocked drive has been replaced through performance of the operation for Case 2.1, go to Case 10.1 or otherwise, go to Case 10.2.

[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.

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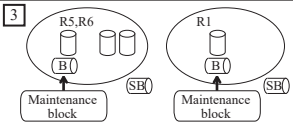
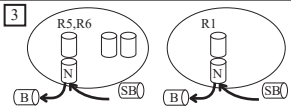
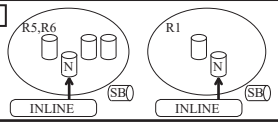
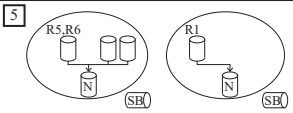
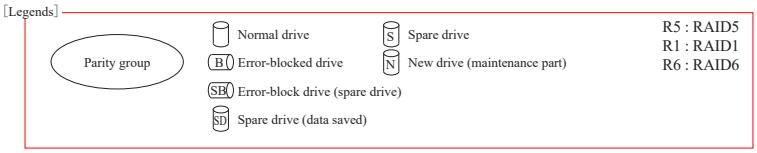
[Case in which a secondary failure occurred during recovery]

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

Condition item	Procedure		
		Maintenance block	Drive replacement
Copy destination blocked during automatic correction copy (unused spare absent)	1  NOTE: When the blocked drive is replaced in the case 2, same as a case 10.1, collection copy starting automatically.	3 	3 
	Procedure		
	INLINE	Correction copy	Restoration
	4 	5 	6  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.

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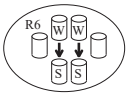
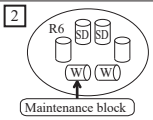
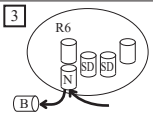
[Spare drive present]

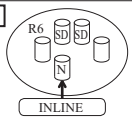
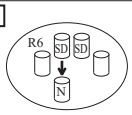
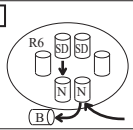
[Case 12] RAID6 When two drives exceed the warning threshold value

Condition item		Condition
Threshold value exceeded	Warning SIM	○
	Block SIM	–
Other case (secondary measure)		

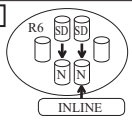
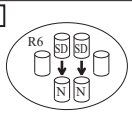
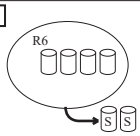
Procedure

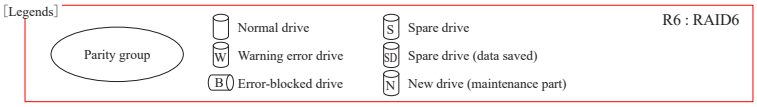
Threshold value exceeded	Maintenance block	Replacement of the first drive
1 Automatic saving(s) to the spare drive allowed to be made up to twice 	2  Proceed the drive to the next step when the copying from it is completed. It is not necessary to wait until the copying from the two drives is completed.	3 
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)	



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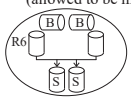
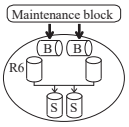
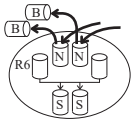
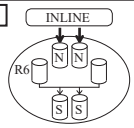
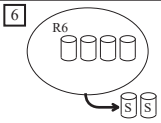
[Spare drive present]

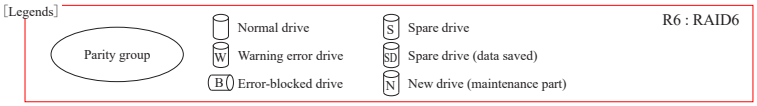
[Case 13] RAID6 When two drives are blocked

- 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)	NOTE: 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)	



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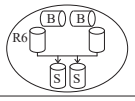
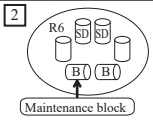
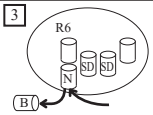
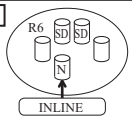
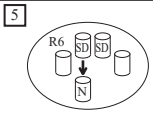
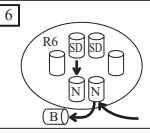
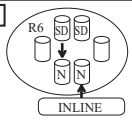
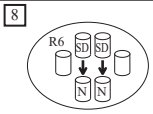
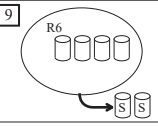
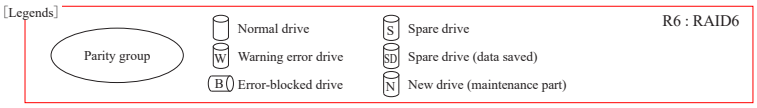
[Spare drive present]

[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)	



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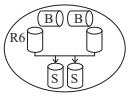
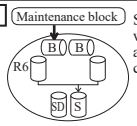
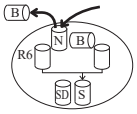
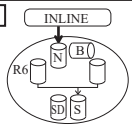
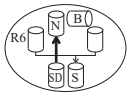
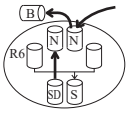
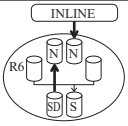
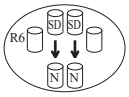
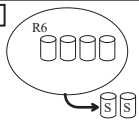
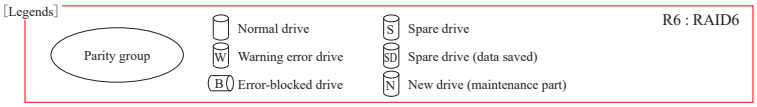
[Spare drive present]

[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)	



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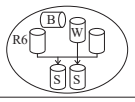
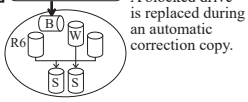
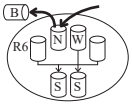
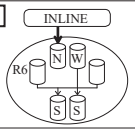
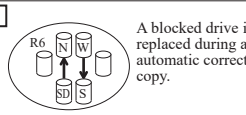
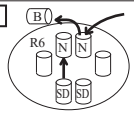
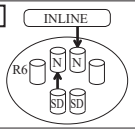
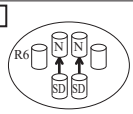
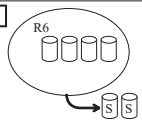
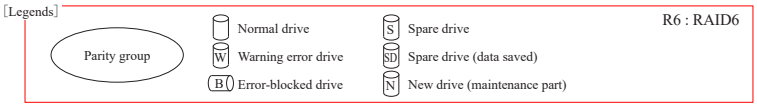
[Spare drive present]

[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 INLINE 	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 INLINE 	8 	9 
			① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)	



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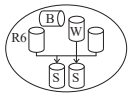
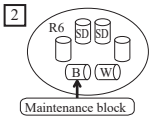
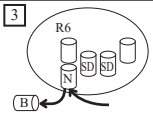
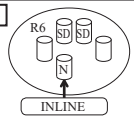
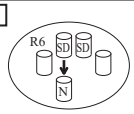
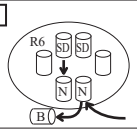
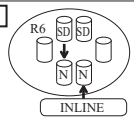
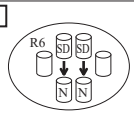
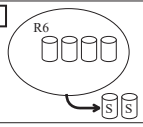
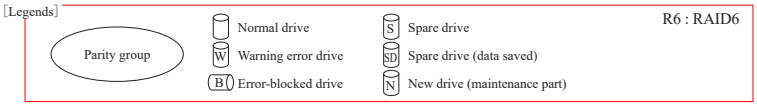
[Spare drive present]

[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)	



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[Other Cases]

[Case 15] Spare drive blocked

Condition item		Condition
Threshold value exceeded	Warning SIM	
	Block SIM	
Failure block SIM		○
Other case (secondary measure)		

Procedure		
Spare drive block	Maintenance block	Drive replacement
1 R5,R6 R1 SB SB	2 R5,R6 R1 Maintenance block → SB Maintenance block → SB	3 R5,R6 R1 SB ⇄ S SB ⇄ S

Procedure	
INLINE	Restoration
4 R5,R6 R1 INLINE → S INLINE → S	5 R5,R6 R1 S S

① Block spare drive (case 15)

[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.

Condition item		Condition
Threshold value exceeded	Warning SIM	
	Block SIM	○ or ○
Failure block SIM		

Procedure		
Failure at redundancy level of 0 or higher	Parity group block	Maintenance block
1 R5,R6 B E R1 B E	2 R5,R6 B E R1 B E Maintenance block Maintenance block	3 R5,R6 B E R1 B E Maintenance block Maintenance block

Procedure		
1 drive replacement	INLINE	1 drive restoration
4 R5,R6 B N B R1 B N B	5 R5,R6 B N R1 B N INLINE INLINE	6 R5,R6 N R1 B N

Procedure		
All drive restoration	LDEV format	Recovery with backup data
7 Perform maintenance block-drive recovery on blocked drives R5,R6 N N R1 N N	8 R5,R6 N N R1 N N LDEV format LDEV format	9 Back up Back up R5,R6 R1

Procedure	
Restoration	
10 R5,R6 R1	

[Legends]

Parity group

Normal drive
Error-blocked drive
Error-block drive (spare drive)
Spare drive (data saved)
Spare drive
New drive (maintenance part)

R5 : RAID5
R1 : RAID1
R6 : RAID6

[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 Unusual noise, etc. / Unusual noise, etc. R5,R6 S / R1 S	2 R5,R6 S / R1 S	3 R5,R6 SD B Maintenance block / R1 SD B Maintenance block
	① Block copy source drive (case 4) ② Block copy destination drive (case 7)	

Procedure		
Drive replacement	INLINE	Copy back
4 R5,R6 SD N B / R1 SD N B	5 R5,R6 SD N INLINE / R1 SD N INLINE	6 R5,R6 SD N / R1 SD N
	① Block new drive (case 8)	① Block copy source drive (case 9) ② Block copy destination drive (case 8)

Procedure
Restoration
7 R5,R6 S / R1 S

[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 Unusual noise, etc. / Unusual noise, etc. R5,R6 / R1	2 R5,R6 Maintenance block / R1 Maintenance block	3 R5,R6 N B / R1 N B

Procedure		
INLINE	Correction copy	Restoration
4 R5,R6 N INLINE / R1 N INLINE	5 R5,R6 N / R1 N	6 R5,R6 / R1
① Block new drive (case 5)	① Block new drive (case 5)	

[Legends]

Parity group

Normal drive
Error-blocked drive
Error-block drive (spare drive)
Spare drive (data saved)
Spare drive
New drive (maintenance part)

R5 : RAID5
R1 : RAID1
R6 : RAID6

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.

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4. About the Storage Media Used for 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	DVD-ROM	DVD-R for micro-program storage. Used for installation or micro-program download in time of micro FC.	DVD Drive of maintenance PC	Attached to the device

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5. How to Interpret the Replace Procedure

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 "List of ACC" (ACC04-10)) from Parts Replacement Process Table in "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 "6. Parts Replacement Processing List".
   - Take actions according to that match the work ID.

NOTE: Refer to "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 "5.3 Procedure before PDEV Replacement and Correction Copy" and "5.4 Confirmation Procedure".

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 "6. Parts Replacement Processing List".
2. Take actions according to the procedure number that matches the work ID.

NOTE: Refer to "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 "5.3 Procedure before PDEV Replacement and Correction Copy" and "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 5-1 <Controller Board>

Work ID	Part Name	Procedure	Replacing Time (*1) (*2)
RCTL	Controller Board	Replacing a Controller Board ("Controller Board REPLACEMENT PROCESSING" (REP(RCTL)00-00))	30 min

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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 5-2 Check Items before PDEV Replacement

#	Items checked	Procedure
1	Failure Count	“Threshold Counter Display” (Refer to "Management of drive threshold values" (SVP02-07-10))
2	ORM Over Rate	“ORM Over Rate HDD# Display” (Refer to "Online read margin (ORM)" (SVP02-05-10))
3	Write Error Failed Track Rate	“Pinned Track” (Refer to "Pin Slot Information" (SVP03-07-10))

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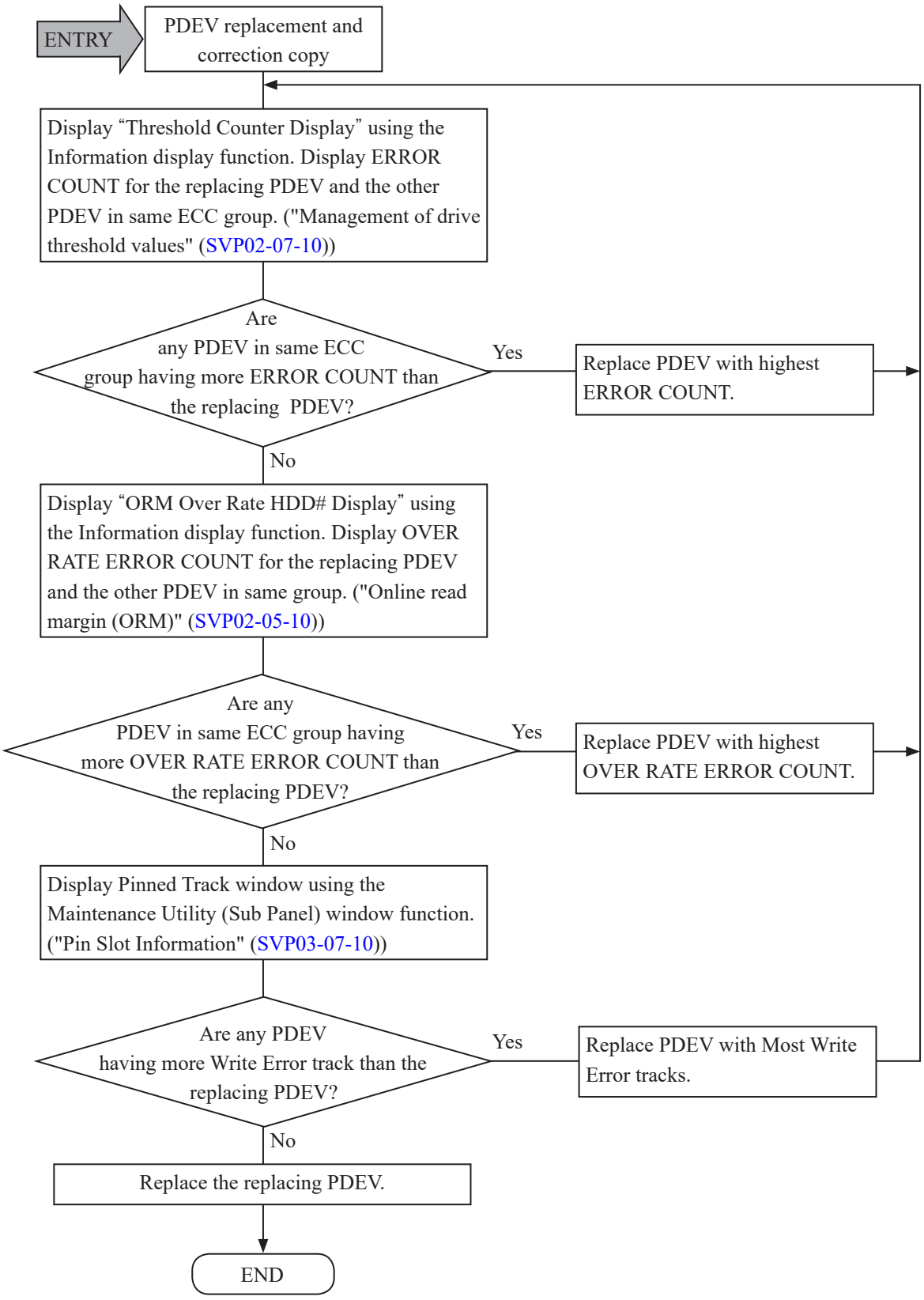
5.4 Confirmation Procedure



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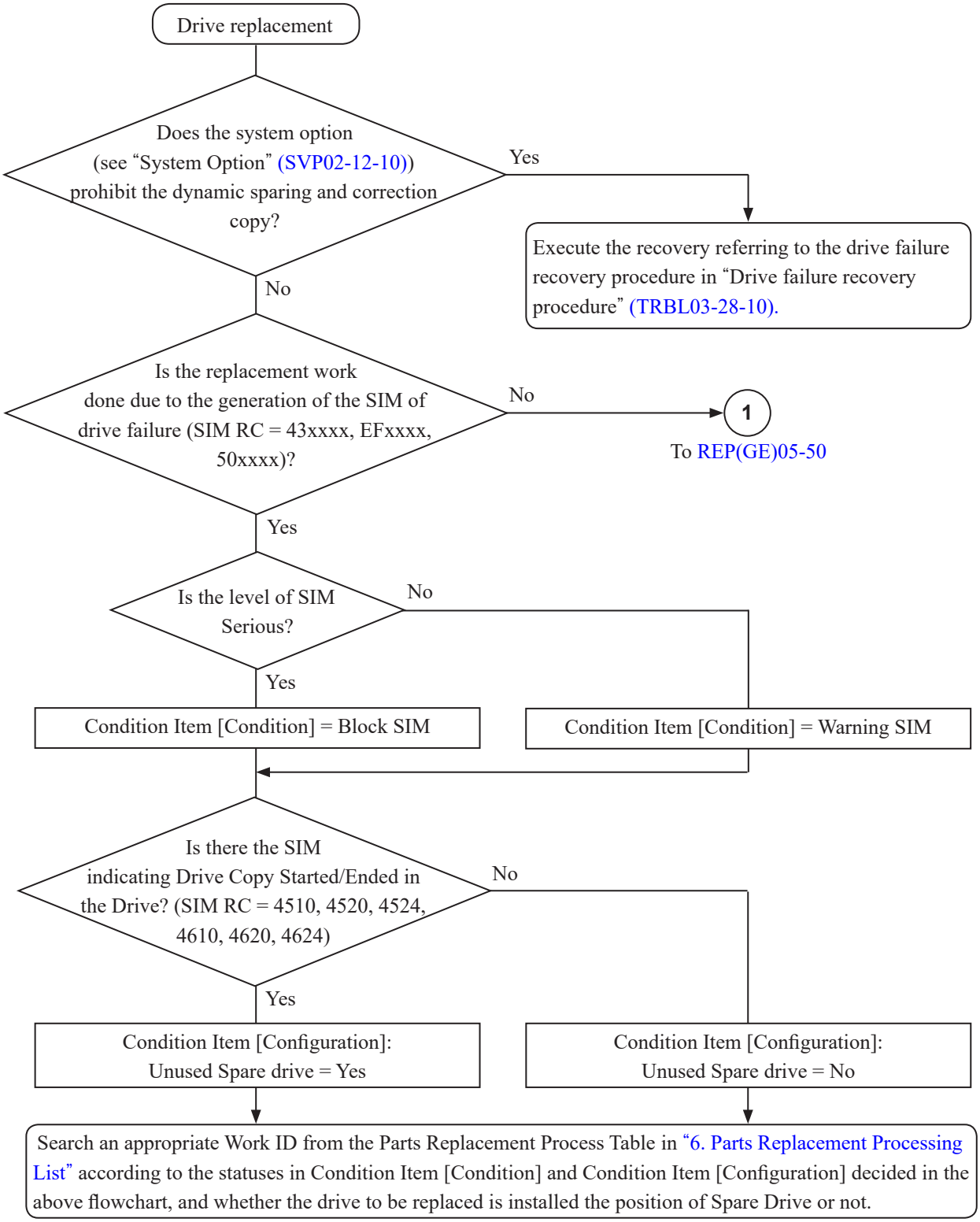
5.5 How to Search a Work ID to Replace a Drive

NOTICE: When a work ID cannot be found by this procedure or when multiple errors in Drives, refer to "Drive failure recovery procedure" (TRBL03-28-10).



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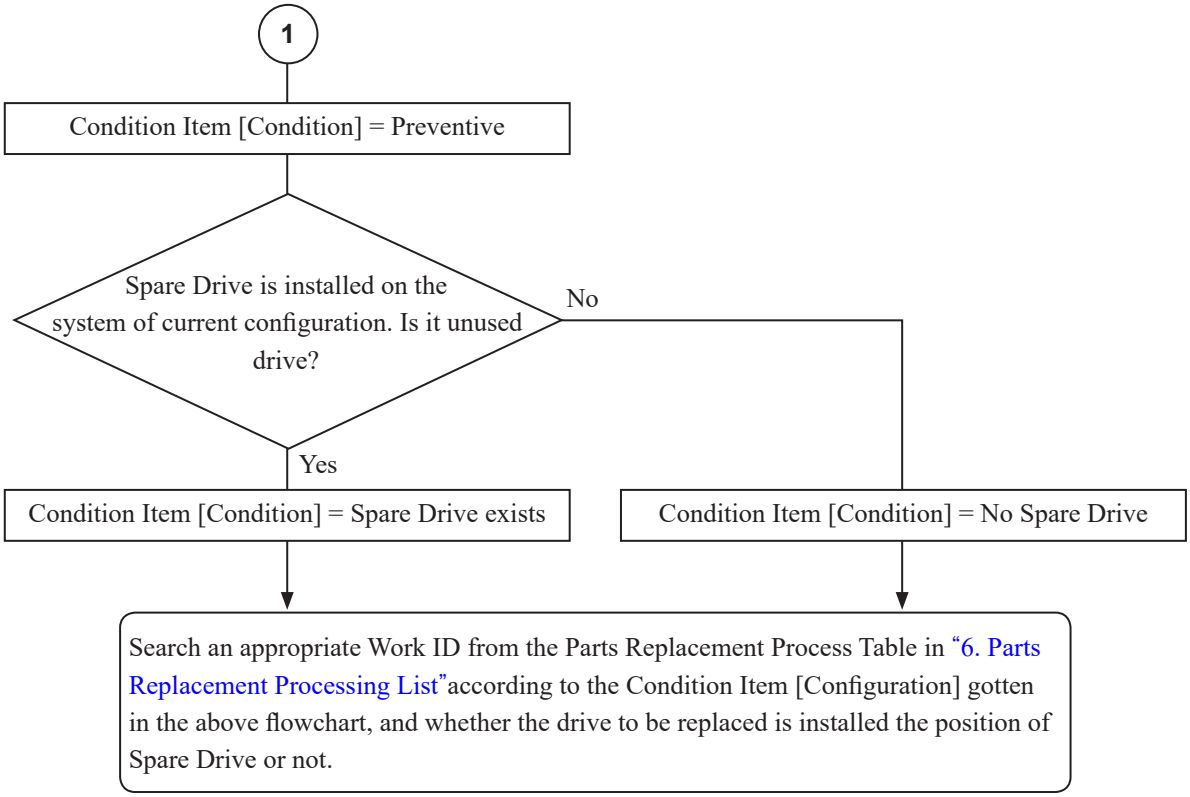

----------<<Example>>----------

- 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	Unused Spare drive				
		Warning SIM	Block SIM						
RDK1	Data Drive	×	×	—	Yes	Replacing a Drive ("DRIVE REPLACEMENT PROCESSING" (REP(RDK1)00-00))	20 min	Drive replace ~ Copy back	Case 1 Case 2

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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							
		Warning SIM	Block SIM	Preventive	Unused Spare drive				
RDK1	Data Drive (*3)	×	×	-	Yes	Replacing a Drive (“DRIVE REPLACEMENT PROCESSING” (REP(RDK1)00-00))	20 min	Drive replace ~ Copy back	Case 1 Case 2 Case 19 Case 21
	Data Drive (*3)	-	-	×	Yes	Replacing a Drive (“DRIVE REPLACEMENT PROCESSING” (REP(RDK1)00-00))	-	Copy to Spare drive ~ Drive replace ~ Copy back	Case 17 Case 24
	Data Drive (*3) (*6)	×	×	×	No	Replacing a Drive (“DRIVE REPLACEMENT PROCESSING” (REP(RDK1)00-00))	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 (“DRIVE REPLACEMENT PROCESSING” (REP(RDK1)00-00))	-	LDEV formatting after replacing all the HDDs blocked in a parity group (*5)	Case 16
	Spare Drive (*3)	-				Replacing a Drive (“DRIVE REPLACEMENT PROCESSING” (REP(RDK1)00-00))	20 min	Spare drive replace	Case 15

*1: See "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 "Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx)" (TRBL03-17-10).
*5: Confirm the parity group and the LDEV No. corresponding to the HDD through the STATUS.
*6: See "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 "Drive failure recovery procedure" (TRBL03-28-10).

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*8: Drive copy time

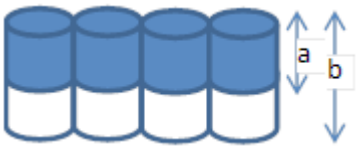
- In the case of RAID1 (2D+2D), the copy time of the primary HDD and that of the secondary HDD are the same.
- When CVS is used, the copy time is proportional to the amount of LDEV assigned in the parity group.

  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 FMD 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 “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: 1.6 TB FMD (RAID5 3D+1P) b = 1.6 TB × 3 = 4.8 TB

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 “Provisioning Guide for Open Systems”.

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(3) Estimation of copy time

The value in the following table × C (%) × D (%).

Table 6-1 No I/O, Copy Mode = Interleave Medium

Drive type	Copy type	Copy time	
		OPEN-V	Other than OPEN-V
H10R0 (7.2 krpm)	Drive copy	19 h 40 m	19 h 40 m
	Correction copy	19 h 40 m	19 h 40 m
H14R0 (7.2 krpm)	Drive copy	27 h 30 m	27 h 30 m
	Correction copy	27 h 30 m	27 h 30 m
J2R4 (10 krpm)	Drive copy	3 h 40 m	3 h 40 m
	Correction copy	3 h 40 m	3 h 40 m
M960 (SAS SSD)	Drive copy	20 m	20 m
	Correction copy	20 m	20 m
M1T9 (SAS SSD)	Drive copy	35 m	35 m
	Correction copy	45 m	35 m
M3R8 (SAS SSD)	Drive copy	1 h 20 m	1 h 20 m
	Correction copy	1 h 20 m	1 h 20 m
M7R6 (SAS SSD)	Drive copy	2 h 20 m	2 h 20 m
	Correction copy	2 h 20 m	2 h 20 m
M15R (SAS SSD)	Drive copy	4 h 40 m	4 h 40 m
	Correction copy	4 h 40 m	4 h 40 m
M30R (SAS SSD)	Drive copy	9 h 10 m	9 h 10 m
	Correction copy	9 h 10 m	9 h 10 m
R1R9 (NVMe SSD)	Drive copy	35 m	35 m
	Correction copy	35 m	35 m
R3R8 (NVMe SSD)	Drive copy	1 h 10 m	1 h 10 m
	Correction copy	1 h 10 m	1 h 10 m
R7R6 (NVMe SSD)	Drive copy	2 h 20 m	2 h 20 m
	Correction copy	2 h 20 m	2 h 20 m
R15R (NVMe SSD)	Drive copy	4 h 40 m	4 h 40 m
	Correction copy	4 h 40 m	4 h 40 m
Q6R4 (FMD)	Drive copy	3 h 00 m	3 h 00 m
	Correction copy	3 h 00 m	3 h 00 m
Q13R (FMD)	Drive copy	6 h 00 m	6 h 00 m
	Correction copy	6 h 00 m	6 h 00 m

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*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 processing.

*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.

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2. Controller Board

Work ID	Part Name	Procedure	Replacing Time (*1)
RCTL	Controller Board	Replacing a Controller Board (“Controller Board REPLACEMENT PROCESSING” (REP(RCTL)00-00))	30 min.
RCM1	Cache Memory	Replacing a Cache Memory (“Cache Memory REPLACEMENT PROCESSING” (REP(RCM1)00-00))	20 min.
RCFM	Cache Flash Memory	When a Controller Board is “Normal”: Replace the Cache Flash Memory (“Cache Flash Memory (CFM) REPLACEMENT PROCESSING” (REP(RCFM)00-00)) When a Controller Board is blocked: Perform the procedure for replacing the Controller Board (“Controller Board REPLACEMENT PROCESSING” (REP(RCTL)00-00)) 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 Micro-program exchange 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 “Web Console” (WEBCON02-10).
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 “Verifying License” (WEBCON03-1970).)
3. Select [Storage Systems]-[Logical Devices]. (See “Managing Logical Device” (WEBCON03-560).) If there is not an LDEV whose attribute is Quorum Disk, go to Step 5.
4. Check the Write Pending Rate referring to “Monitoring” (SVP02-04-10). 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 “Controller Board REPLACEMENT PROCESSING” (REP(RCTL)00-00)).

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3. Channel Board, Disk Board

Work ID	Part Name	Procedure	Replacing Time
RCHB	Channel Board	Replacing a Channel Board (CHB) (“Channel Board (CHB) REPLACEMENT PROCESSING” (REP(RCHB)00-00))	20 min.
RDKB	Disk Board	Replacing a Disk Board (“DKB REPLACEMENT PROCESSING” (REP(RDKB)00-00))	20 min.

If a failure occurs in replacing a Channel Board or a Disk Board, see “Error Recovery Procedure during CHB/DKB replacement” (TRBL02-04-90).

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4. Other Parts

Work ID	Part Name	Procedure	Replacing Time
RBKM	BKMF	Replacing a BKMF (“BKMF REPLACEMENT PROCESSING” (REP(RBKM)00-00))	10 min.
RBTR	Battery	Replacing a Battery (“Battery REPLACEMENT PROCESSING” (REP(RBTR)00-00))	10 min.
RPSU	Power Supply	Replacing a Power Supply (“PSU REPLACEMENT PROCESSING” (REP(RPSU)00-00))	10 min.
RSFP	Small Form-Factor Pluggable	Replacing a Small Form-Factor Pluggable (SFP) (Follow the flowchart in (REP(RSFP)00-00) to decide which replacement procedure to perform, and then perform “SFP REPLACEMENT PROCESSING” (REP(RSFP)00-00) or “Changing the Type of Small Form-Factor Pluggable (SFP)” (INST(AD)09-01-10).)	5 min.
RLAB	LAN Board	Replacing a LAN Board (“LAN Board REPLACEMENT PROCESSING” (REP(RLAB)00-00))	20 min. (*3)
HBOX	Controller Chassis	Replacing a Controller Chassis (“BOX REPLACEMENT PROCESSING” (REP(HBOX)00-00))	60 min. (*1) (*2)
HBZL	Front Bezel	Replacing a Front Bezel (“Bezel REPLACEMENT PROCESSING” (REP(HBZL)00-00))	5 min.
RENC	ENC	Replacing a ENC (“ENC REPLACEMENT PROCESSING” (REP(RENC)00-00))	10 min.
HBOX	Drive Box	Replacing a Drive Box (“BOX REPLACEMENT PROCESSING” (REP(HBOX)00-00))	40 min. (*1) (*2)
RSC1	SAS Cable/NVMe Cable	Replacing a SAS/NVMe Cables (“SAS/NVMe Cables REPLACEMENT PROCESSING” (REP(RSC1)00-00)) (*4)	10 min.
RSVP	SVP	Replacing a SVP (“SVP REPLACEMENT PROCESSING” (REP(RSVP)00-00))	(*5)
RPNL	HSNPANEL	Replacing a HSNPANEL (“HSNPANEL REPLACEMENT PROCESSING” (REP(RPNL)00-00))	10 min.
RSSV	SSVP	Replacing a SSVP (“SSVP REPLACEMENT PROCESSING” (REP(RSSV)00-00))	35 min.
RISW	ISW	Replacing a ISW (“ISW REPLACEMENT PROCESSING” (REP(RISW)00-00))	25 min.
RHIE	HIE	Replacing a HIE (“HIE REPLACEMENT PROCESSING” (REP(RHIE)00-00))	20 min.

(To be continued)

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(Continued from the preceding page)

Work ID	Part Name	Procedure	Replacing Time
RFNI	FAN (ISW)	Replacing a FAN (ISW) (“ISWFAN REPLACEMENT PROCESSING” (REP(RFNI)00-00))	27 min.
RIPS	ISWPS	Replacing a ISWPS (“ISWPS REPLACEMENT PROCESSING” (REP(RIPS)00-00))	10 min.
HSNB	HSNBX	Replacing a HSNBX (“HSNBX REPLACEMENT PROCESSING” (REP(HSNB)00-00))	60 min.
RXPC	X Path cable	Replacing a X Path cable (“X-path cable REPLACEMENT PROCESSING” (REP(RXPC)00-00))	10 min.
RXRS	X-path related parts Replacement (Restore)	Replacing a X-path related parts Replacement (Restore) (“X-path related parts REPLACEMENT PROCESSING (Restore)” (REP(RXRS)00-00))	50 min.
RXSR	X-path related parts Replacement (Skip Restore)	Replacing a X-path related parts Replacement (Skip Restore) (“X-path related parts REPLACEMENT PROCESSING (Skip Restore)” (REP(RXSR)00-00))	50 min.
HPDU	PDU	Replacing a PDU (“PDU REPLACEMENT PROCESSING” (REP(HPDU)00-00))	30 min
RLAN	LAN cable	Replacing a LAN cable (“LAN cable REPLACEMENT PROCESSING” (REP(RLAN)00-00))	10 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 Micro-program exchange time is not included. (The destaging operation takes 30 minutes to two hours.)

*4: For the DKC-F910I-MPC10/MPC10P/MPC20/MPC20P/MPC30/MPC30P/MPC1H/MPC1HP cable, replace the SAS adapter first. If it is not recovered even after replacing the SAS adapter, replace the cable.

*5:
- 40 minutes: Replacing time when the SVP High Reliability Kit is not installed, or when the Standby SVP is replaced with the maintenance part in the configuration containing the SVP Reliability Kit
- 85 minutes: Replacing time when the Master SVP is replaced with the maintenance part in the configuration contains the SVP Reliability Kit

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7. Availability of the Online Maintenance When Program Product Is Used

7.1 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	—	×	×	×	×	×	×

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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.

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7.2 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	—	×	×	×	×

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7.3 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	—	×	×	×	×	×	×

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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	—	×	×	×	×	×	×

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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	—	×	×	×	×	×	×

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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.

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7.4 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 (*3)
	Recovery	—	×	×	×
	Format	—	×	×	03005-068884 (*3)
	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	—	×	×	×

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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	—	×	×	×	×

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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.
*3: For the configuration where volumes are not set as quorum disks, the maintenance is available.

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7.5 Availability of the Online Maintenance When XRC Is Used

× : Maintenance is available.

Message is displayed in the following case.

Refer to “Device Manager-Storage Navigator Messages”.

Component	Maintenance Type	During initial copy		Established		Suspend	
		Primary	Secondary	Primary	Secondary	Primary	Secondary
Logical Device	Blockade	**	**	**	**	**	**
	Recovery	**	**	**	**	**	**
	Format	**	**	**	**	**	**
	Verify	×	×	×	×	×	×
Disk	Replace	×	×	×	×	×	×
Controller Board	Replace	*	×	*	×	*	×
Channel Board	Replace	×	×	×	×	×	×
Disk Board	Replace	×	×	×	×	×	×

*: When a maintenance operation is needed while XRC is being used, I/O’s for XRC pair volumes or XRC itself should be stopped before the maintenance operation.
If the maintenance operation must be done while XRC is being used, you must confirm that the usage of Sidefile monitor is less than 20% of total Cache capacity by monitoring each combination of cache memory and CLPR usage before you start the maintenance operation. Only when the usage of Sidefile monitor is less than 20% of total Cache capacity, you can proceed the maintenance operation.
Refer to “Monitoring” (SVP02-04-10) about Sidefile monitor.

**: When a maintenance operation is needed while XRC is being used, XRC should be stopped before the maintenance operation.

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8. How to Open/Close Door or Attach/Remove Front Bezel/Rear Door

8.1 How to Attach/Remove Front Bezel

⚠ CAUTION

Attach or remove the Front Bezel carefully following the procedure. Otherwise, you may hurt your fingers by pinching them.

NOTICE:
- 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 finish. See “1.3 Note on Installing and Removing Parts”.
- The Front Bezels of UBX/SBX/FBX/NBX, DKC and HSNBX are different in size.
- When installing or removing the Front Bezel, try not to operate the main switch incorrectly with the hook or the ON/OFF button of the Front Bezel.

8.1.1 UBX/SBX/FBX/NBX

A key is necessary to attach or remove a Front Bezel.

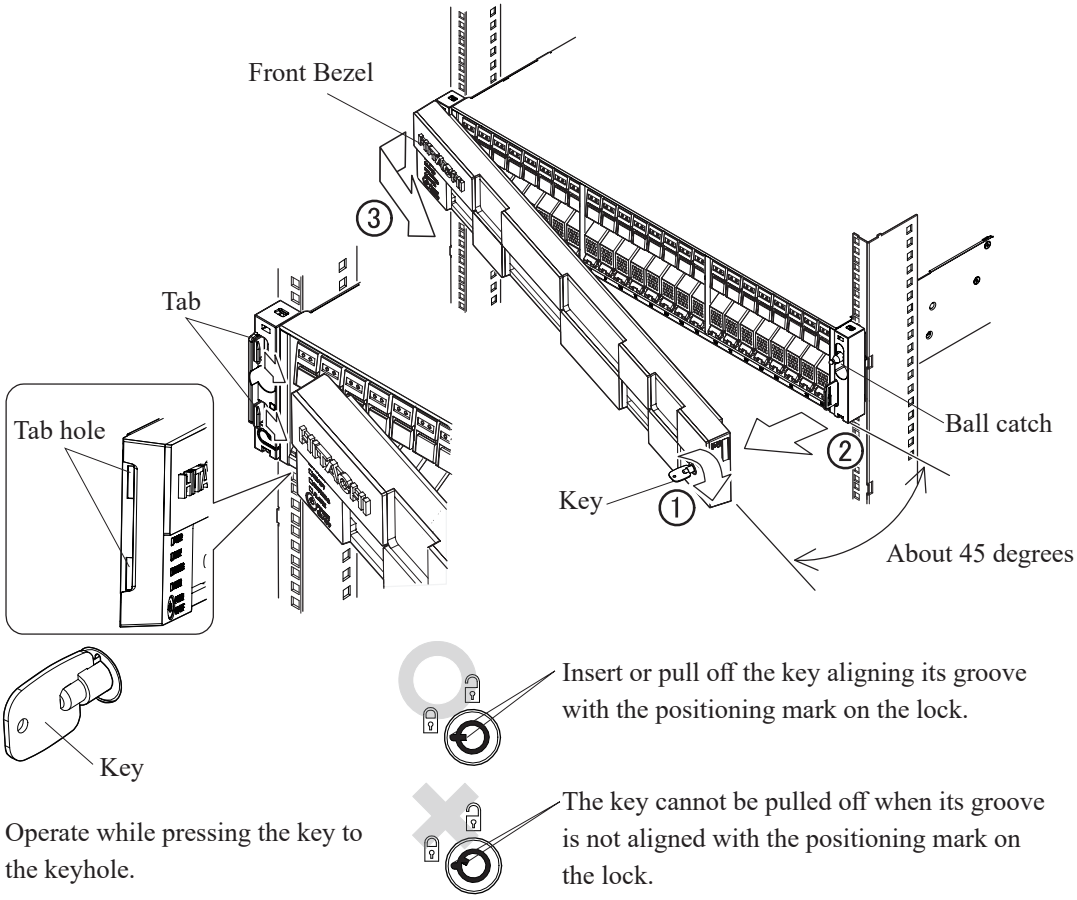
1. Procedure for removal
   (1) Insert the key into the keyhole on the Front Bezel and release the Lock of the Front Bezel (①).
   (2) Pull the key toward you while holding the lower right portion of the Front Bezel, and then disengage the right side of the Front Bezel from the ball catch (②).

      NOTE : When disengaging the Front Bezel, work with the opening angle between the Front Bezel and the Storage System of up to 45 degrees.
      Do not force the Front Bezel open too wide. Otherwise, a damage of Front Bezel may be caused.

   (3) Remove the Front Bezel from the left tabs while pulling, and then remove it (③).

      NOTE: When removing Front Bezel, don't push left side of Front Bezel.

Figure 8-1 Procedure for Removing Front Bezel



NOTE : • When inserting and turning the key, have it inserted completely. If it is turned when it is inserted half way, a damage of it may be caused.
• When removing the key after locking up the Front Bezel, pull it off aligning its groove with the positioning mark on the lock.
When the key is pulled off in the state where its groove is not aligned with the positioning mark on the lock, a damage of the lock may be caused.

2. Procedure for attachment
   (1) Unlock the Front Bezel with the key, and hold the key and bottom of Front Bezel with your both hands.
   (2) Insert the tabs on the left front side of the Storage System into the tab holes on the Front Bezel (①).

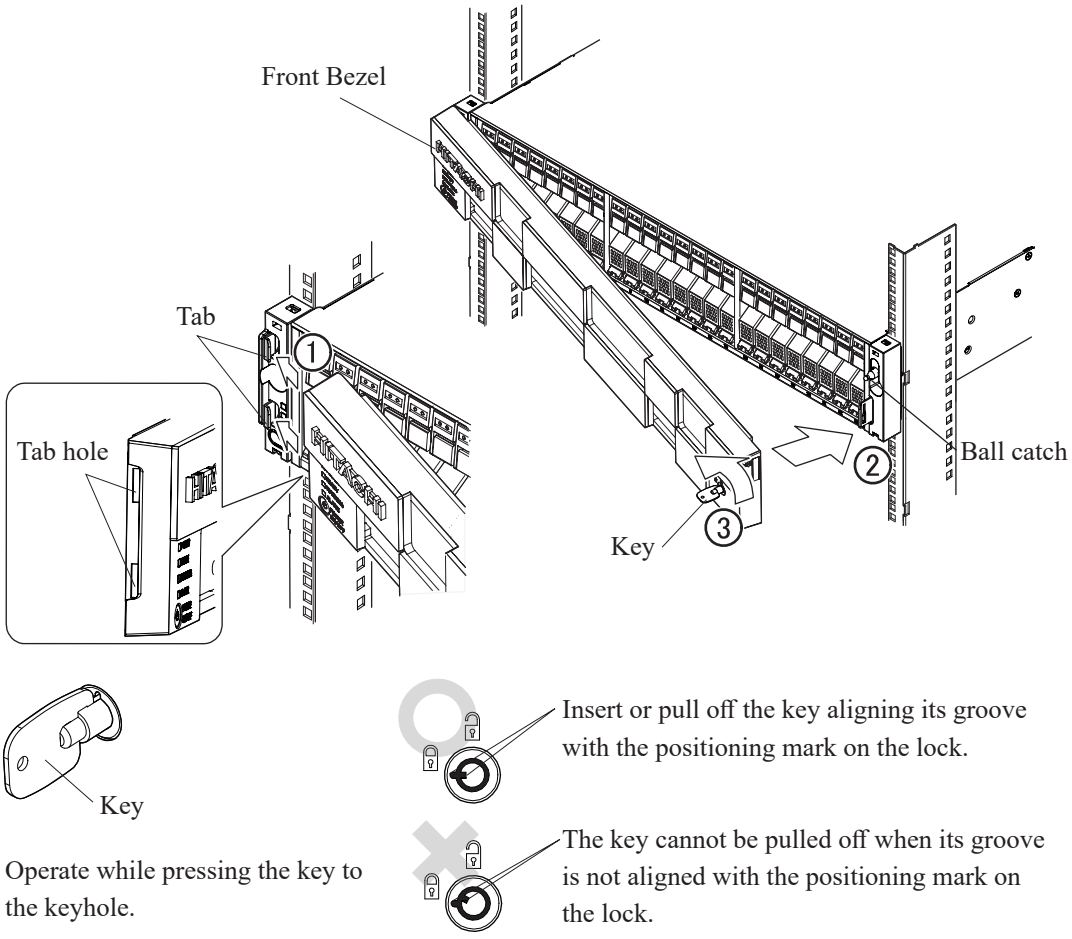
       NOTE: When inserting Front Bezel, don't push left side of Front Bezel.

   (3) Fix the Front Bezel by pressing the right side of the Front Bezel to engage it with the ball catch on the front side of the Storage System (②).

       NOTE: When fixing Front Bezel, don't push left side of Front Bezel.

   (4) Lock the Front Bezel with the key (③).

Figure 8-2 Procedure for Attaching Front Bezel



NOTE : • When inserting and turning the key, have it inserted completely. If it is turned when it is inserted half way, a damage of it may be caused.
• When removing the key after locking up the Front Bezel, pull it off aligning its groove with the positioning mark on the lock.
When the key is pulled off in the state where its groove is not aligned with the positioning mark on the lock, a damage of the lock may be caused.

8.1.2 DKC

A key is necessary to attach or remove a Front Bezel.

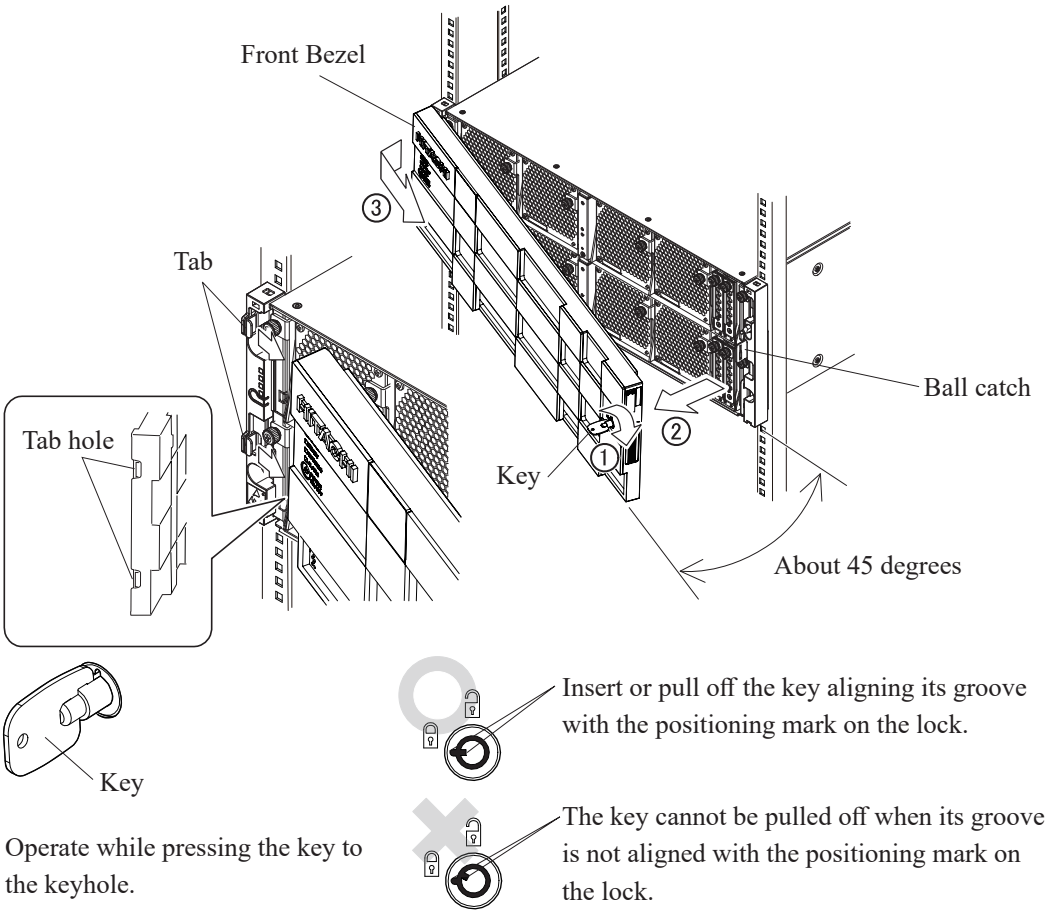
1. Procedure for removal
   (1) Insert the key into the keyhole on the Front Bezel and release the Lock of the Front Bezel (①).
   (2) Pull the key toward you while holding the lower right portion of the Front Bezel, and then disengage the right side of the Front Bezel from the ball catch (②).

      NOTE : When disengaging the Front Bezel, work with the opening angle between the Front Bezel and the Storage System of up to 45 degrees.
      Do not force the Front Bezel open too wide. Otherwise, a damage of Front Bezel may be caused.

   (3) Remove the Front Bezel from the left tabs while pulling, and then remove it (③).

      NOTE: When removing Front Bezel, don't push left side of Front Bezel.

Figure 8-3 Procedure for Removing Front Bezel (DKC)



NOTE : • When inserting and turning the key, have it inserted completely. If it is turned when it is inserted half way, a damage of it may be caused.
• When removing the key after locking up the Front Bezel, pull it off aligning its groove with the positioning mark on the lock.
When the key is pulled off in the state where its groove is not aligned with the positioning mark on the lock, a damage of the lock may be caused.

2. Procedure for attachment
   (1) Unlock the Front Bezel with the key, and hold the key and bottom of Front Bezel with your both hands.
   (2) Insert the tabs on the left front side of the Storage System into the tab holes on the Front Bezel (①).

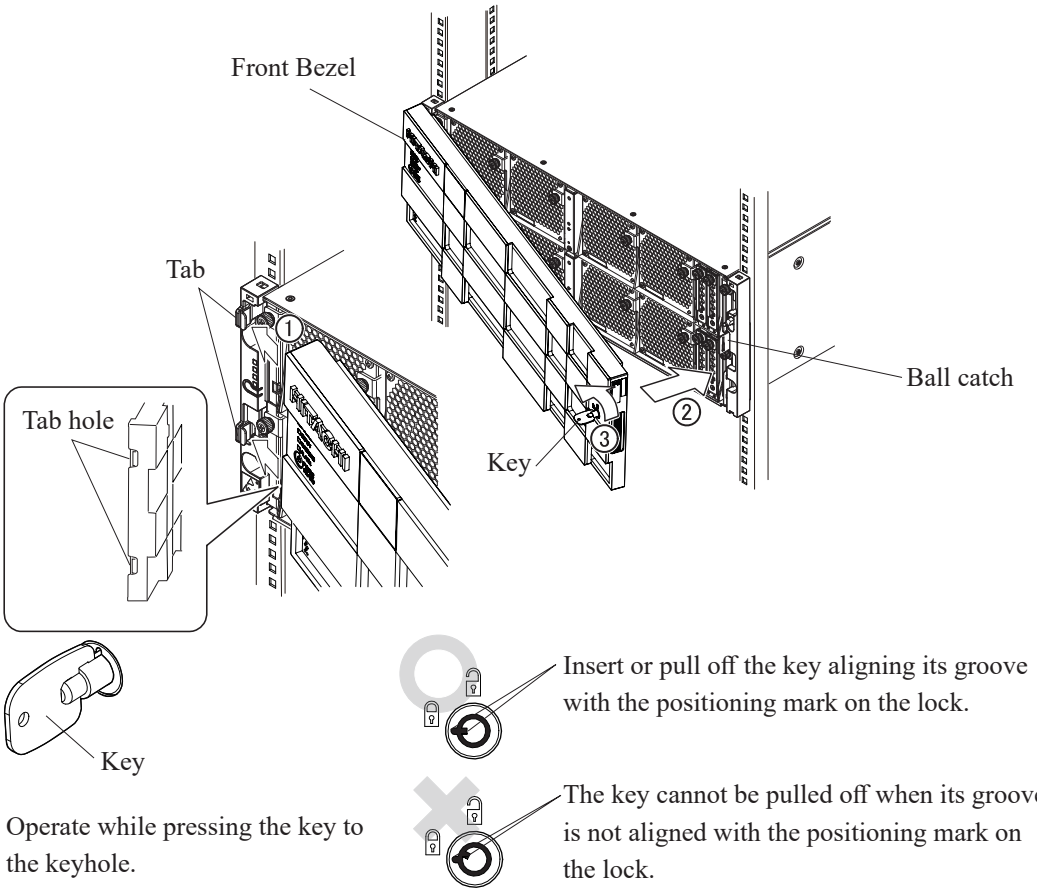
       NOTE: When inserting Front Bezel, don't push left side of Front Bezel.

   (3) Fix the Front Bezel by pressing the right side of the Front Bezel to engage it with the ball catch on the front side of the Storage System (②).

       NOTE: When fixing Front Bezel, don't push left side of Front Bezel.

   (4) Lock the Front Bezel with the key (③).

Figure 8-4 Procedure for Attaching Front Bezel (DKC)



NOTE : • When inserting and turning the key, have it inserted completely. If it is turned when it is inserted half way, a damage of it may be caused.
• When removing the key after locking up the Front Bezel, pull it off aligning its groove with the positioning mark on the lock.
When the key is pulled off in the state where its groove is not aligned with the positioning mark on the lock, a damage of the lock may be caused.

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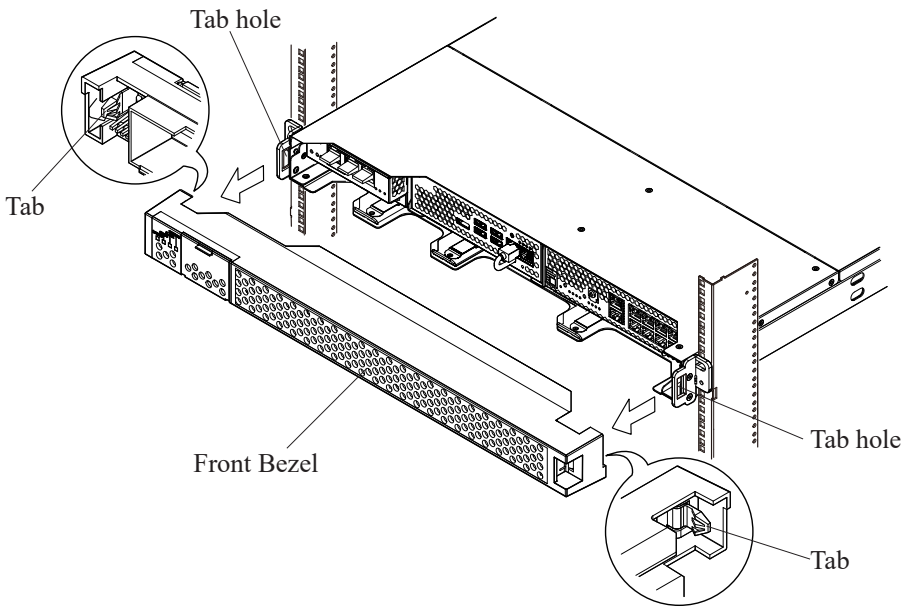
8.1.3 HSNBX

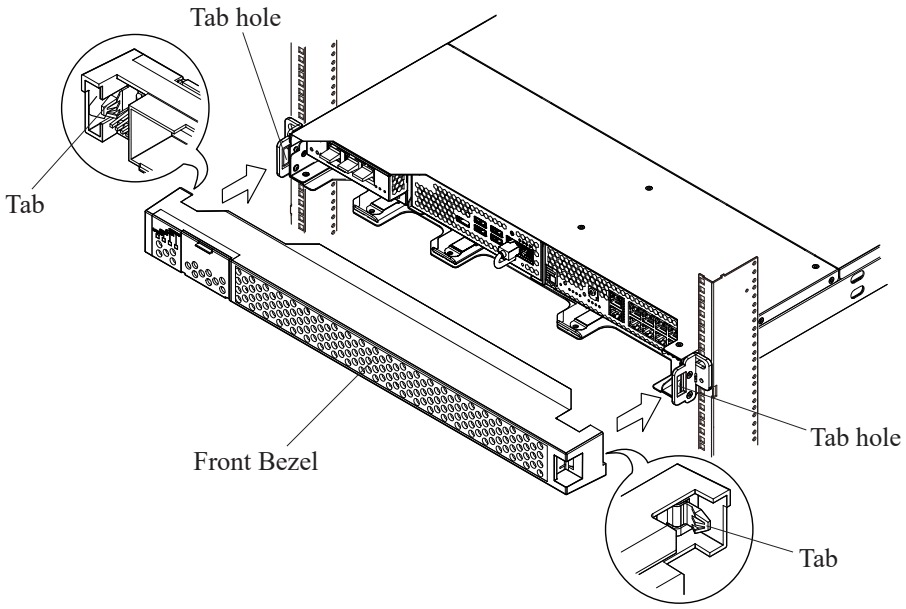
1. Removal of Front Bezel
   To remove the Front Bezel, pull it toward you.

Figure 8-5 Removal of Front Bezel



2. Attachment of Front Bezel
   To attach the Front Bezel, insert the tabs on the Front Bezel into the tab holes on the front side of HSNBX, and then press the Front Bezel against the HSNBX.

Figure 8-6 Attachment of Front Bezel



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8.2 How to Open/Close the Rear Door of RKU Rack Frame

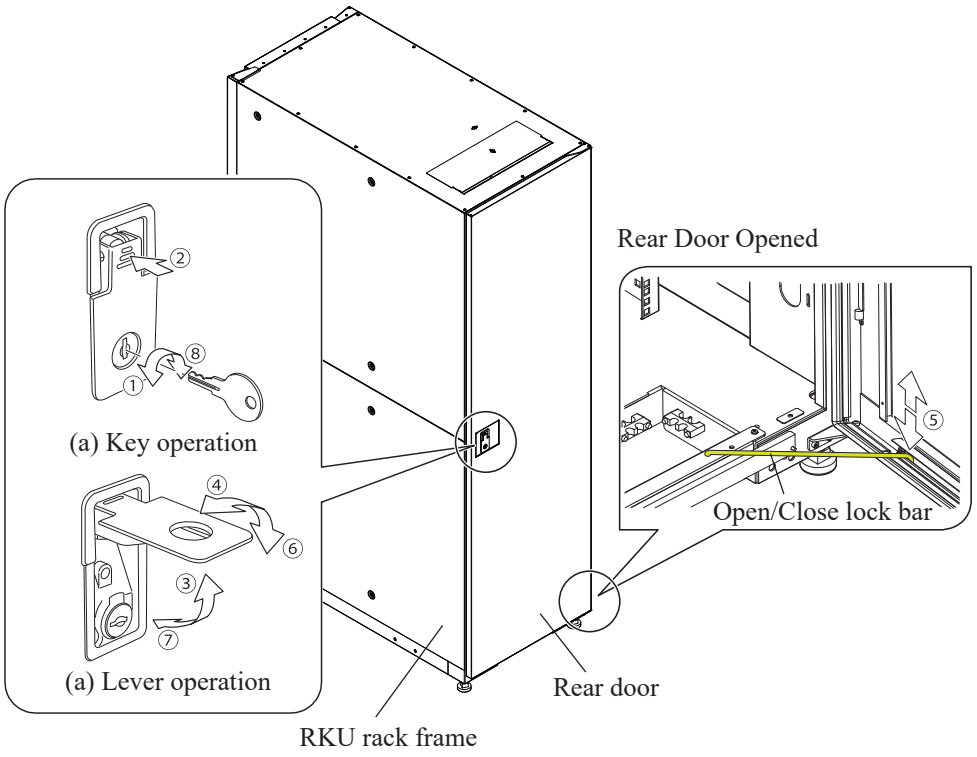
> **⚠ CAUTION**
>
> Open or close the door carefully following the procedure. Otherwise, you may hurt your fingers by pinching them.

For the procedure for removing and installing the Front Bezel, refer to "8.1 How to Attach/Remove Front Bezel".

1. Procedure for opening rear door
   (1) Insert the key to the keyhole on the rear door, and turn the key to the left to open lock (①).
   (2) Push the upper part of the lever, and raise the lower part of the lever toward (②, ③).
   (3) Turn the lever to the left, and pull the lever toward, and then open the rear door (④).

2. Procedure for closing rear door
   (1) Lift the open/close lock bar on the bottom of the back of the rear door to release the lock (⑤).
   (2) Close the rear door, and push and turn the lever to the right (⑥).
   (3) Push down the lever, and push the lower part of the lever (⑦).
   (4) Insert the key to the keyhole on the rear door, and turn the key to the right to lock (⑧).

Figure 8-7 Procedure for Opening/Closing Rear Door



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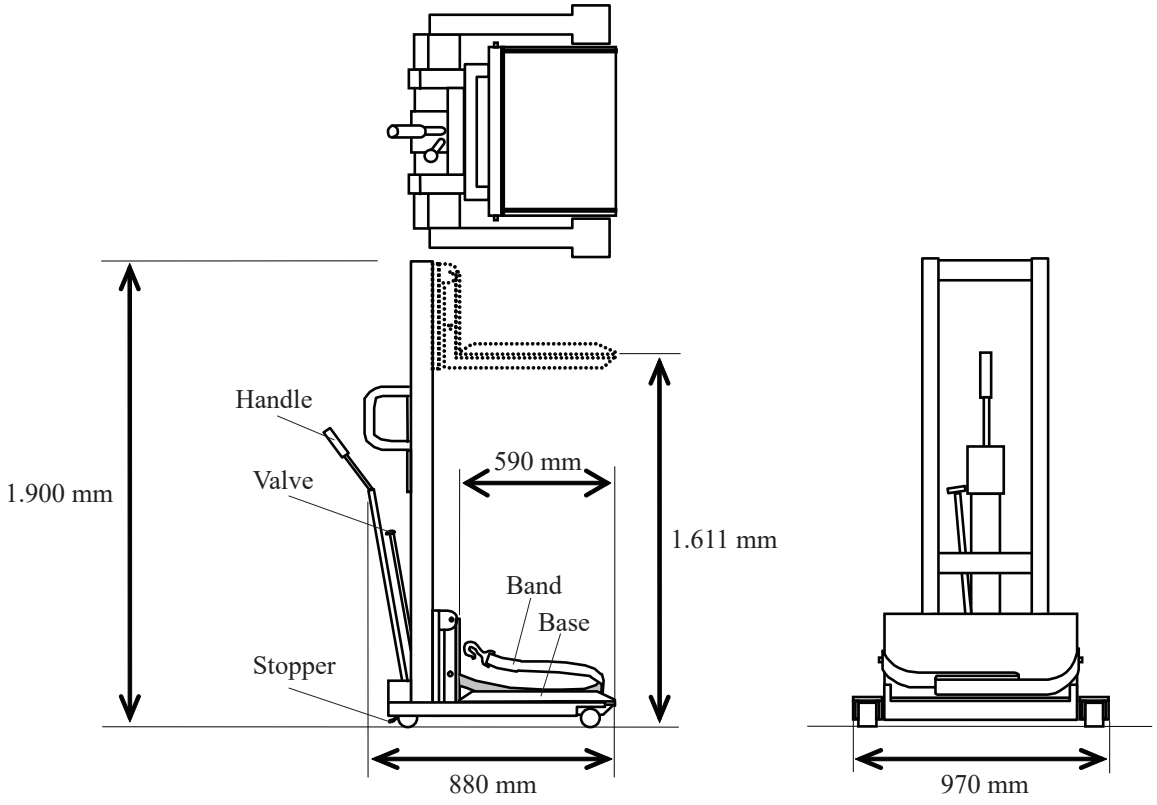
8.3 Putting the Chassis on the Lifter

⚠ CAUTION

- Rack mounting and lifter operation should only be conducted by a person who has been trained and qualified since the Storage System could turn over or a worker could be caught under the Storage System.
- Be sure to perform the operation with two or more workers.
- Work carefully because the mass of the single DKC is about 75 kg, SBX is about 24 kg, UBX is about 27 kg, FBX is about 38 kg, NBX is about 21 kg, and HSNBX is about 15 kg.

Figure 8-8 shows appearance of the special lifter.

Figure 8-8 Appearance of the Special Lifter



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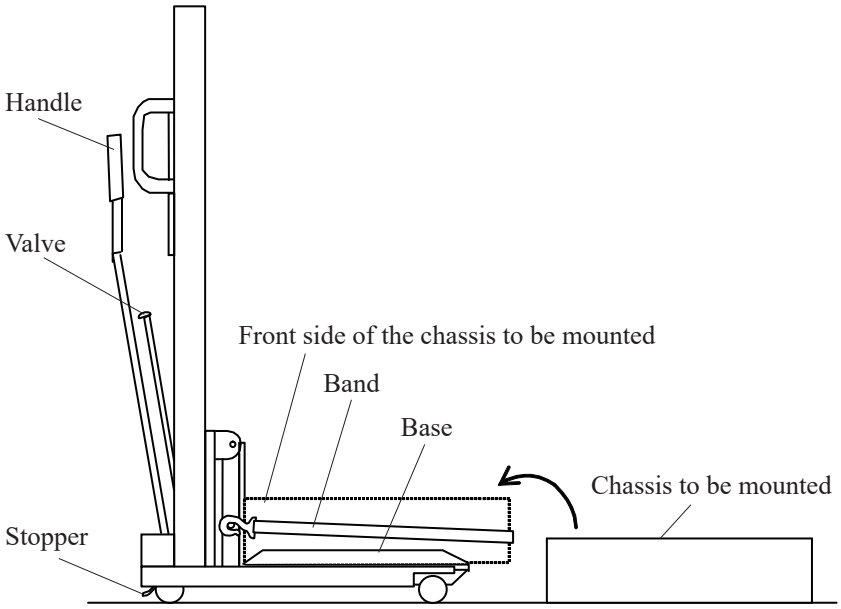
1. Bring the special lifter close to the chassis to be mounted in the rack and apply the brake to the lifter.

   NOTE : When putting the chassis on the special lifter, be sure to remove the Front Bezel beforehand.

2. Put the chassis on the special lifter.
   Put the chassis with its Front Bezel removed on the lifter.
3. Secure the chassis to the lifter with a band of the lifter.
   Bind the chassis with the band tightly by fitting the length of the belt to the chassis.

Figure 8-9 Putting the Chassis on the Special Lifter



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9. Starting the Window for Maintenance Work

Connect the Maintenance PC to the Storage System, and then start the window for maintenance work.

- Starting Web Console (WEBCON02-50)
- Starting SVP window (SVP01-30)
- Starting Maintenance Utility (MU01-10)
- Starting Maintenance Utility (Sub Panel) (MU01-80)

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10. Specifying the Installation Location by Using the Locate LED

1. Turn on Locate LED
   Refer to “Turn on Locate LED” (MU02-40).

2. Turn off Locate LED
   Refer to “Turn off Locate LED” (MU02-70).

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11. Processing Method of Batteries

⚠ CAUTION

The Battery is an industrial waste. This is treated as specially-controlled waste. Dispose of it following the directions given by the manufacturer or according to the Waste Management Law.

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11.1 Recycling

⚠ DANGER

- Do not disassemble the case, do not modify it, or do not peel off the label. There are high voltage parts inside: If you attempt any of these actions, you may get an electrical shock or burn.
- Do not disassemble the battery; this may cause short circuits inside or outside of the battery. If the components are exposed to the air, the battery may cause overheat, burst or ignite. Disassembling the battery may expose you to the alkaline solution, which can be dangerous.
- Do not cut the output cable. Do not modify the connector. If you attempt any of these actions, you may get an electrical shock or burn. A short-circuit may cause abnormal chemical reactions inside the battery which leads to overheating, bursting or ignition.
- Follow the instructions when you recharge the battery pack. If you recharge it in a way different from specified here, it may cause the following problems: The battery may become charged excessively; excessive current may be produced; or the battery cannot be recharged. As a result, the battery may leak, become overheated, burst, or ignite.
- Do not use excessive force when you connect the battery pack to the charger or other devices. If you cannot connect it easily, check the positive and negative are correct for the connector. If you connect the battery in reverse, it will be charged incorrectly and abnormal chemical reactions may occur inside. As a result, the battery may become overheated, burst or ignite.
- Do not connect the battery to a power receptacle. If you apply an excessive amount of voltage to the battery, it may produce excessive current making the battery overheat, burst or ignite.
- Do not use or leave the battery where the temperature can become high, such as, near a fire or a heating element. High temperatures may damage the battery′s separator, which may cause short circuit, making it overheat, burst or ignite.
- Do not incinerate the battery pack or heat it. If you do so, the insulator may melt, the safety fuse/mechanism may be damaged, or the electrolyte may gush out. As a result, the battery may become burst, explode or ignite.
- Do not connect the negative terminal to the positive with metal wire. Do not carry or store the battery with other metal parts. This may cause a short circuit or produce excessive current which can cause the battery to leak, overheat, burst or ignite.
- Do not let the battery become wet by soaking it in the water or seawater. If the battery gets wet, a short circuit may occur and an excessive amount of current may be produced causing abnormal chemical reactions inside. As a result, the battery may become overheated, burst or ignite.

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⚠ DANGER

- Do not nail the battery, hit it with a hammer, or stamp on it. The battery may be broken or dented and a short circuit may occur inside. As a result, the battery may become overheated, burst or ignite.
- Do not solder directly to the battery. If you do so, heat will melt the insulator and damage the safety fuse/mechanism. As a result, the battery may leak or may become overheated, burst or ignite.
- Do not recharge the battery where there is a high temperature, such as near a fire. This may cause abnormal chemical reactions inside the battery and it may become overheated, burst or ignite. High temperatures may also cause deterioration of performance/life of the battery.
- Do not place the battery pack in the microwave oven or under high pressure. Either of these actions will rapidly heat the battery or break its seals: As a result, the battery may become overheated, burst or ignite.
- If you find anything strange or unusual with the battery when you use/carry/store it, remove the battery from the device and stop using it. For example, strange smells, strange colors, or deformation are a sign you must stop using the battery.
- If it takes longer than the specified time to complete recharging, stop recharging the battery: Otherwise, the battery may become overheated, burst or ignite.
- If the battery leaks and gets into your eyes, immediately flush your eyes with clean water (tap water) and do not rub your eye. Then visit the doctor immediately. If you do not seek any treatment for your eyes, problems may occur later. Because the battery uses highly concentrated alkaline as electrolyte, it may burn or you may lose your sight if it contacts your skin or eyes. If the battery′s liquid contacts your skin or eyes, you must flush them with plenty of clean water and visit the doctor at once.

1. Parts to be recycled
   The batteries used in the Storage System are a sealed Nickel-hydride rechargeable battery.
   These batteries are valuable resources which can be recycled.
   When you replace them or dispose of a used Storage System, please cooperate in the recycling.
   How to dispose of the battery which becomes useless owing to replacement etc. is shown below.

2. Display of recycling mark
   The following three-arrow recycling mark shows that the sealed Nickel-hydride rechargeable battery is a part to be recycled. A label bearing the mark is affixed on the battery.

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3. Specifications of lead battery

Table 11-1 Specifications of Sealed Nickel-hydride Rechargeable Battery

	Battery
Manufacturer	FDK CORPORATION
Model	8HR-4/3FAUPC-2-HRS
Voltage (V)	9.6
Capacity (mAh)	5480

4. Disposal and safety in storage
Before storing a sealed Nickel-hydride rechargeable battery, cover its terminals with electric tape, etc. to prevent a short circuit. Store it separately from batteries of other type such as dry battery.