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TROUBLESHOOTING SECTION

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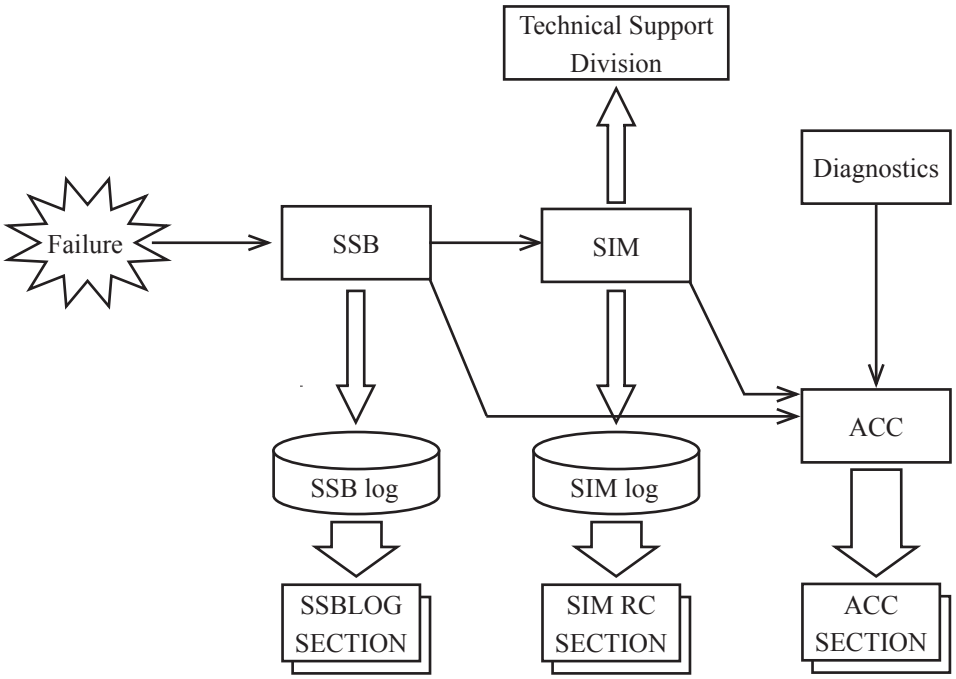
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1. Overview of TRBL

The figure below shows the flowchart of creating and reporting the SIM and SSB after the Storage System has detected a failure. It also shows the section of maintenance manual which should be referred to. Since the storage system starts its maintenance work based on the SIM and ACC, if a failure occurs check the ACC first and start troubleshooting.

For the failure which does not produce the ACC, isolate the failed part depending on its phenomenon.

Refer to MAINTENANCE PC SECTION "3.21 Alert Display" for how to check SIM, SSB and ACC by Maintenance Utility.



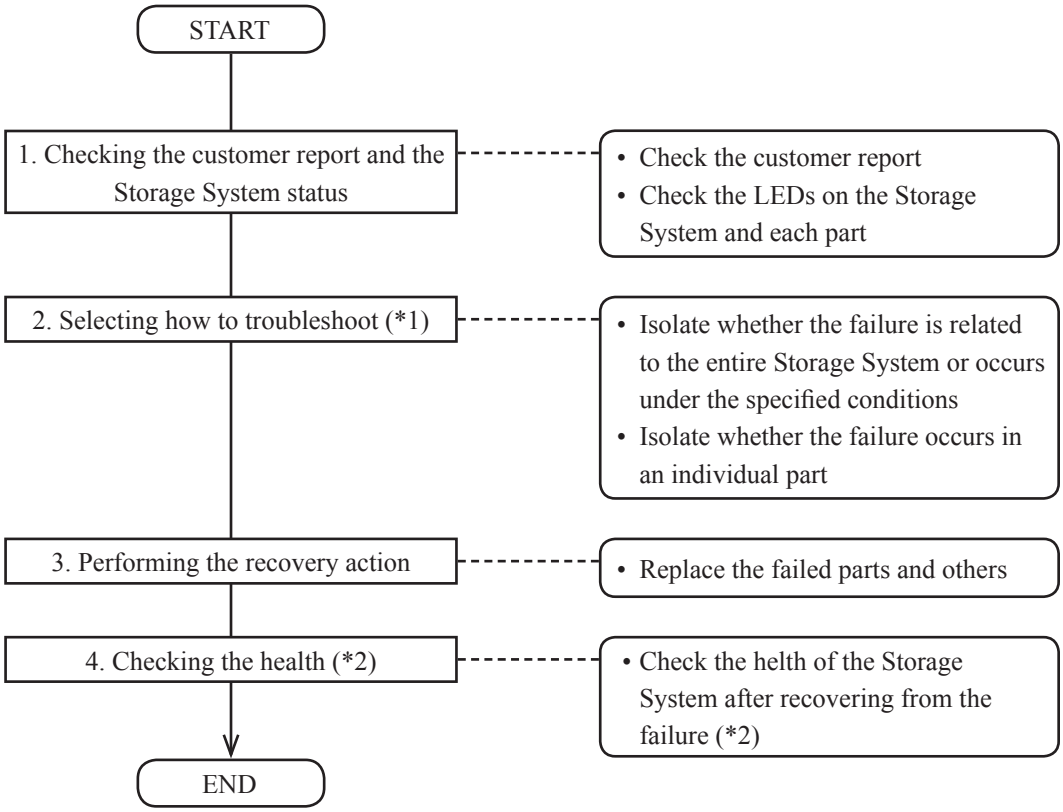
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2. Isolation of Failed Part

Note

The correspondence to the document describing the code system, the text and troubleshooting of the messages that occur during the maintenance work is displayed in MESSAGE SECTION "1. Messages that Occur During Maintenance Work".

When a failure occurs, the following work from Step 1 to 4 is required usually.

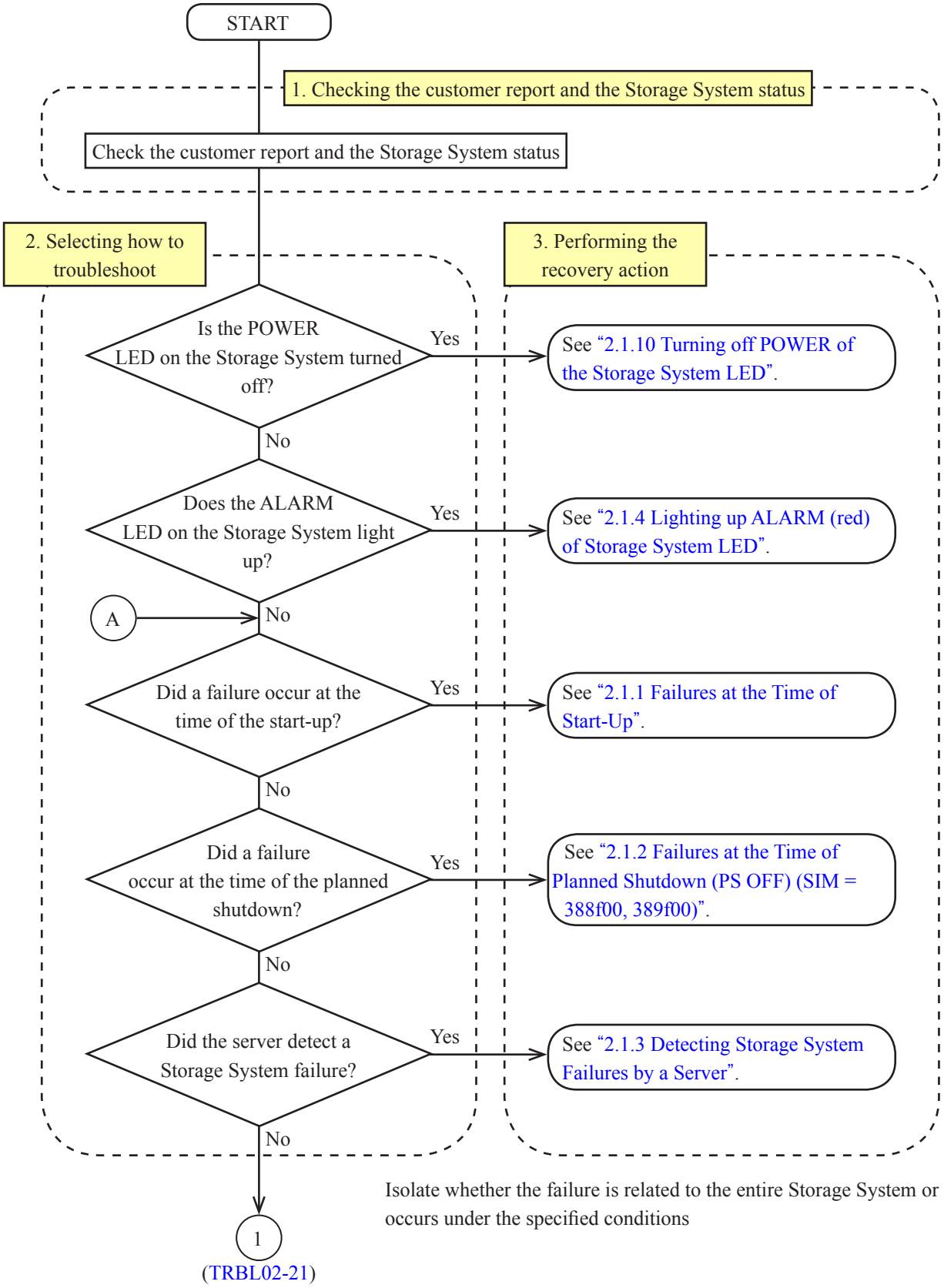


*1: If this applies to the following (a) or (b), the troubleshooting procedure varies. See the corresponding procedure for each case.
(a) When failures occur at the time of the maintenance work, see "2.2 Failure During Operation by Service Personnel".
(b) When failures occur in multiple parts, see "2.4 Failures of Multiple Parts".

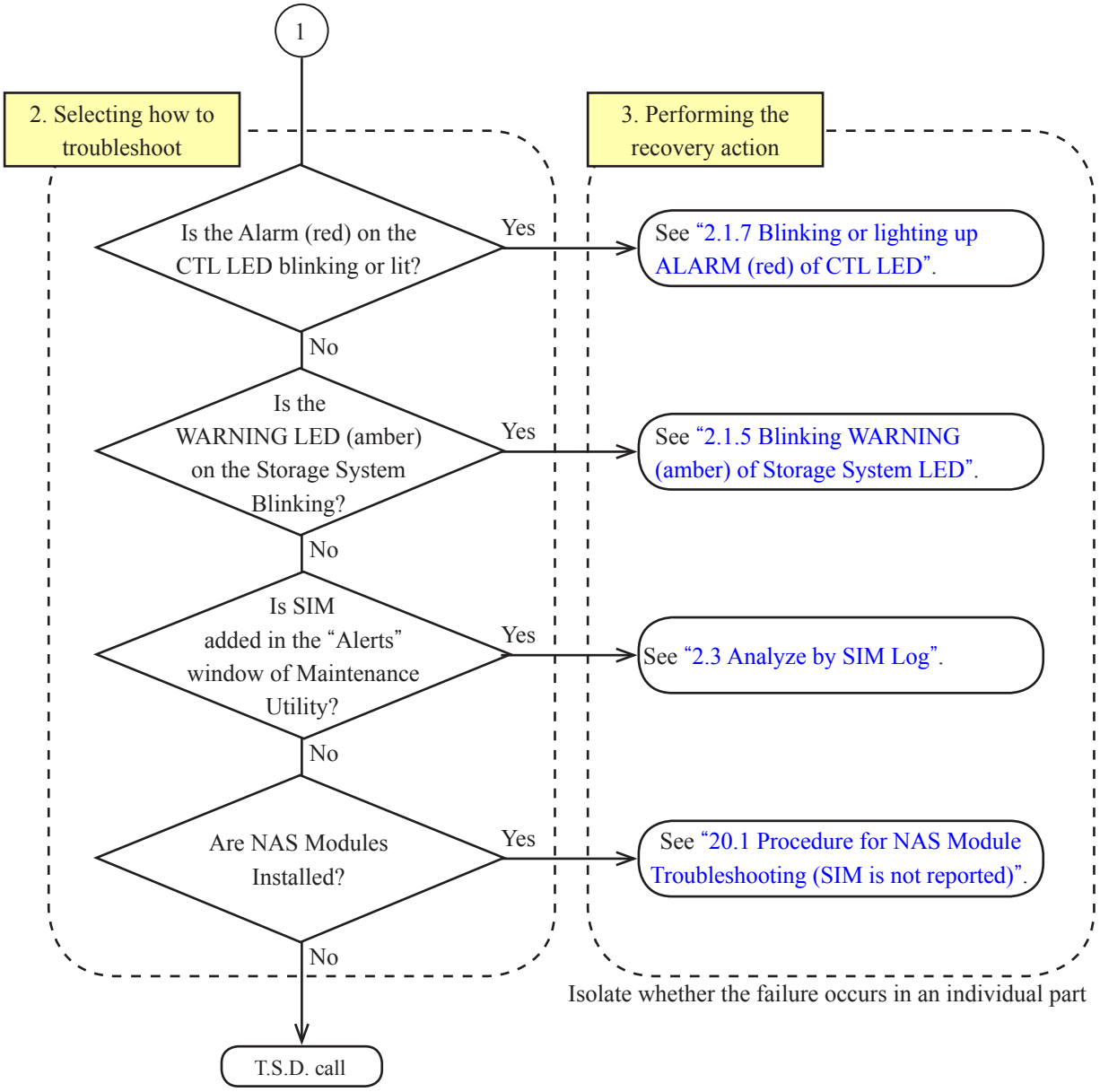
*2: Check the health of the Storage System in accordance with "2.5 Checking the health after restoring the failure" after performing the recovery action.

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2.1 Flow of failed part isolation

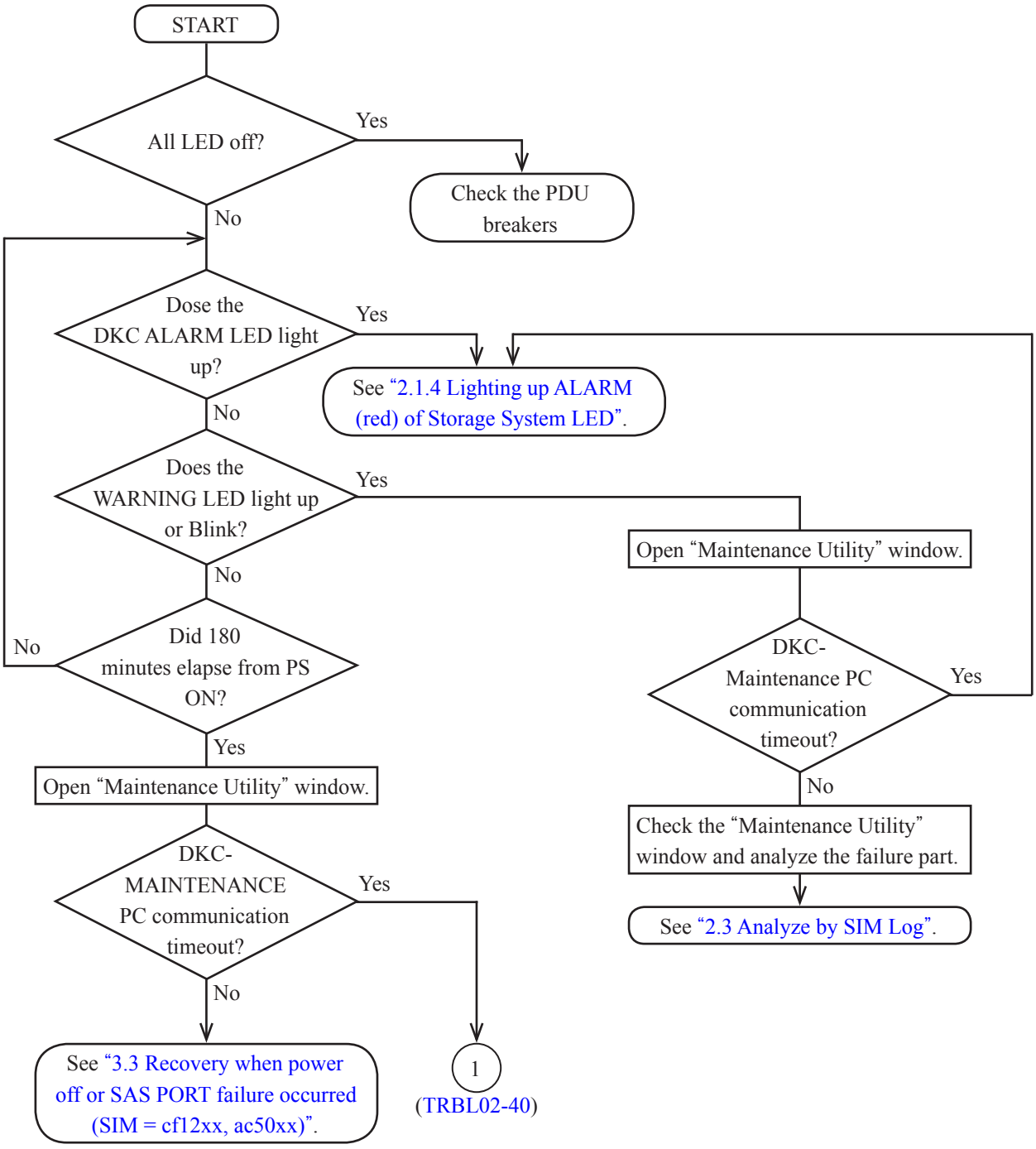


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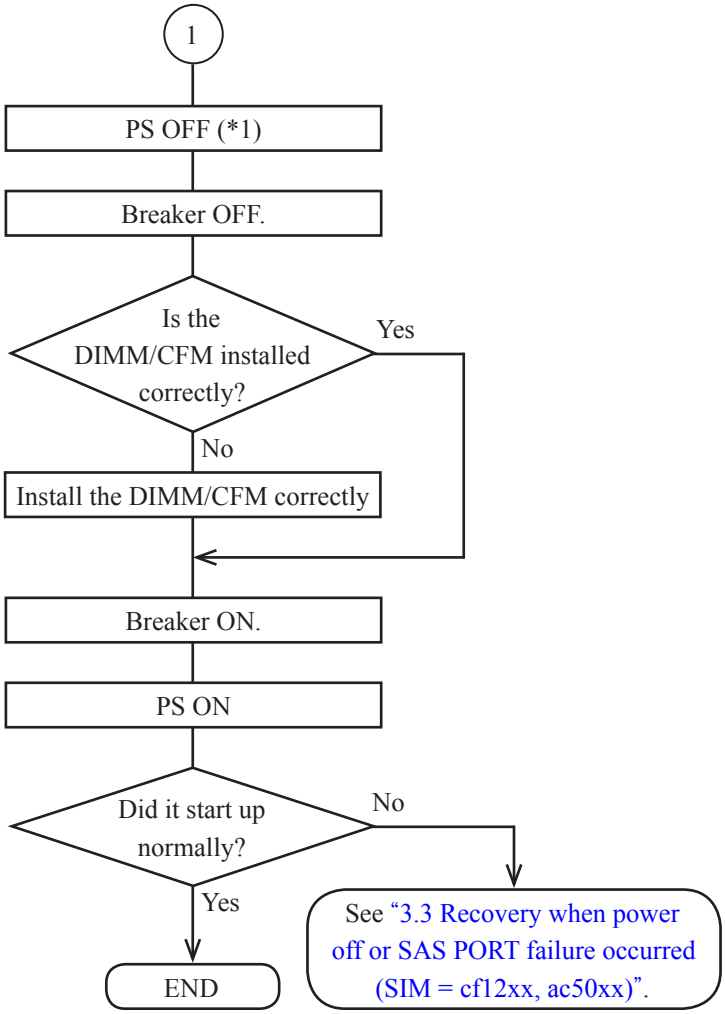


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2.1.1 Failures at the Time of Start-Up



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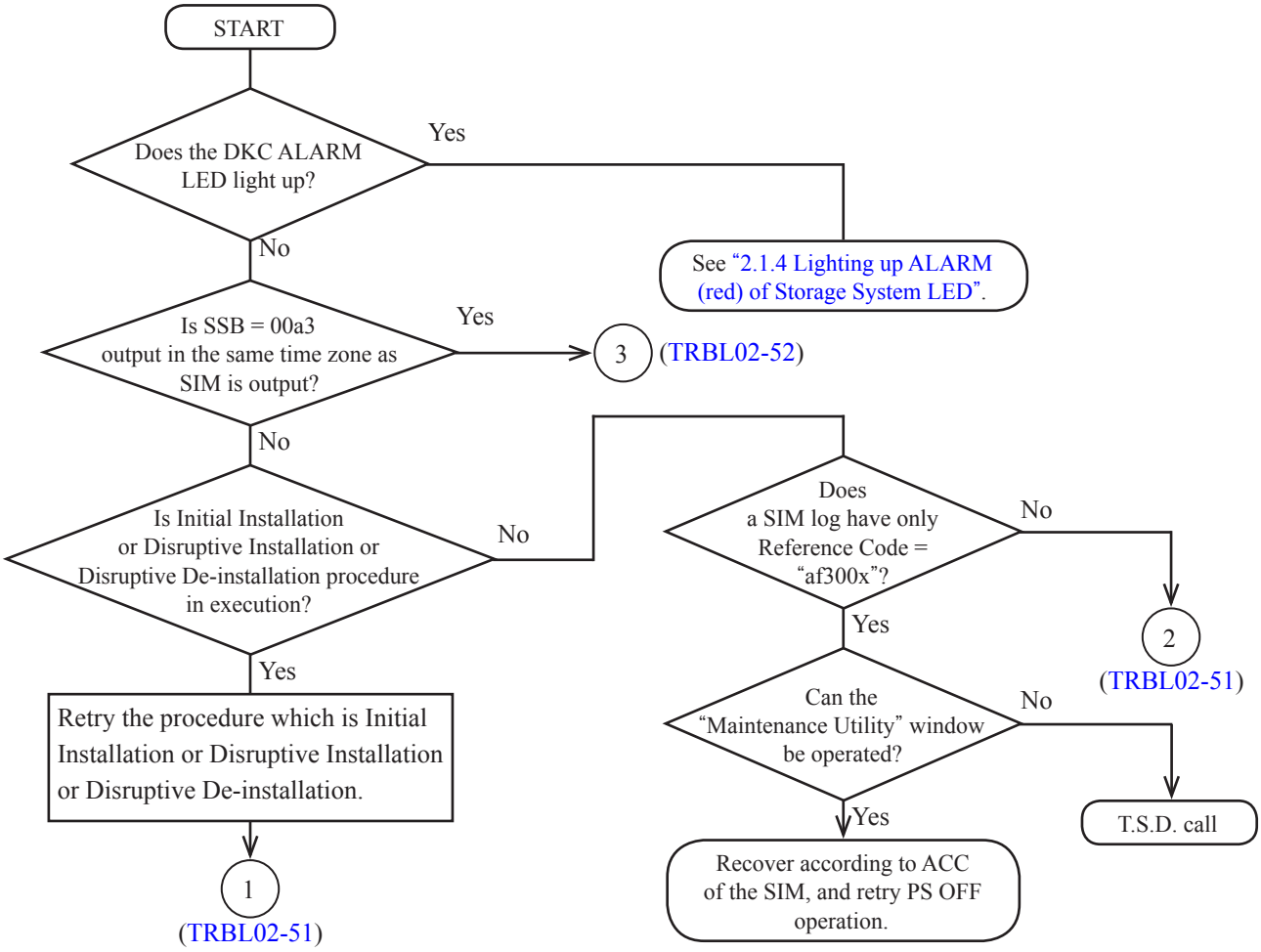


*1: If it does not change to the PS OFF status (POWER LED changes from green to amber) even after waiting for about one minute, go to the next step

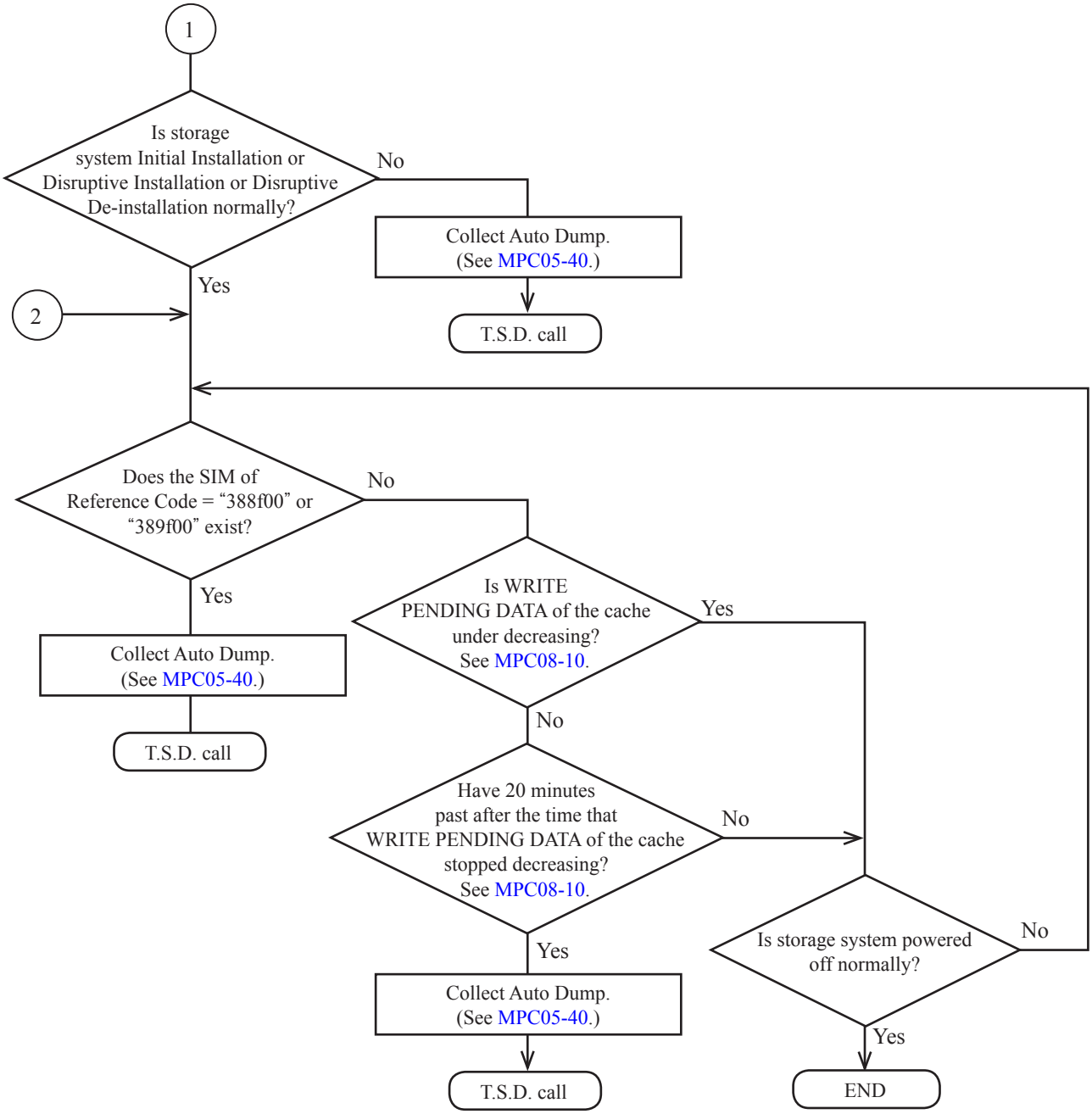
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2.1.2 Failures at the Time of Planned Shutdown (PS OFF) (SIM = 388f00, 389f00)

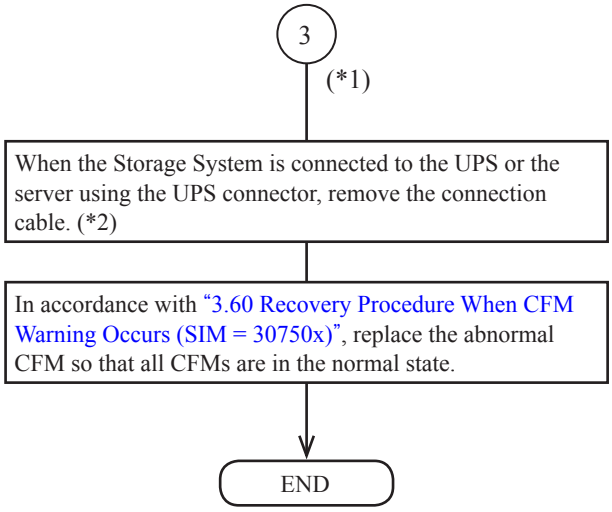
NOTE:
- Reporting the SIM of Reference Code "SIM = 388f00" or "SIM = 389f00" might take 10 minutes or more. Especially, if the emergency destage does not terminate, the reporting might take about one hour.
- Even after the SIM of Reference Code "SIM = 388f00" or "SIM = 389f00" was reported, the planned shutdown processing (PS OFF) might terminate normally.
- While mapping the external storage volume by the Universal Volume Manager function, if the external storage performs the planned shutdown (PS OFF) first or the power failure occurs, the Storage System might not turn off the power by the planned shutdown (PS OFF) (because the Cache Write Pending data for the mapped external volume remains).
  In this case, "SIM = 388f00" that indicates planned shutdown (PS OFF) impossible is reported. To avoid the problem, perform the following procedure.
  1. Start the external storage once.
  2. Disconnect the external storage by the Universal Volume Manager function in the Storage System.
  3. Confirm that the Storage System completed the planned shutdown and it became READY OFF.
  4. Perform the planned shutdown (PS OFF) procedure of the external storage.



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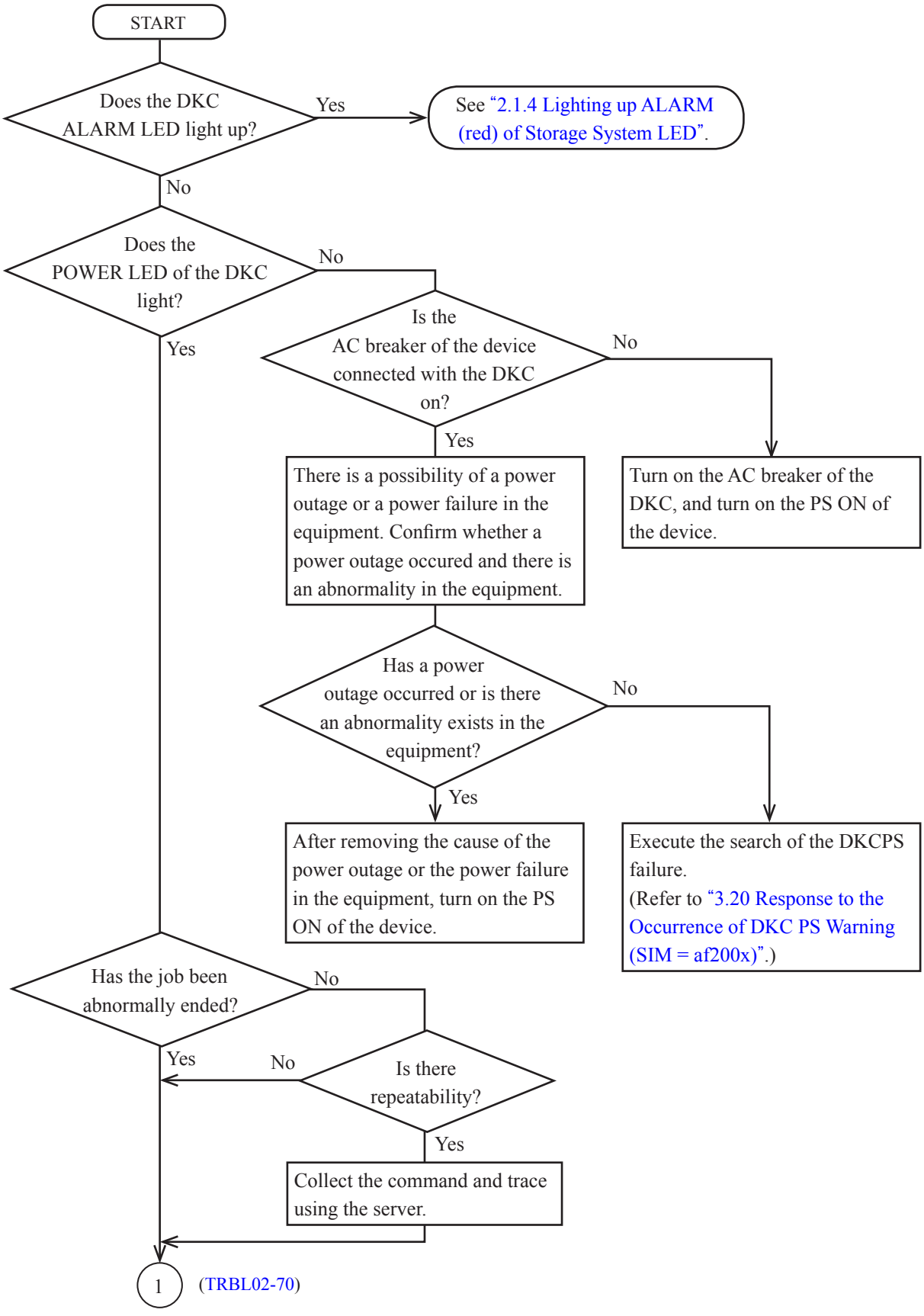


*1. Do not power off the Storage System until all CFMs become the normal state. If you power off the Storage System while abnormal CFMs exist, the customer data might be lost.

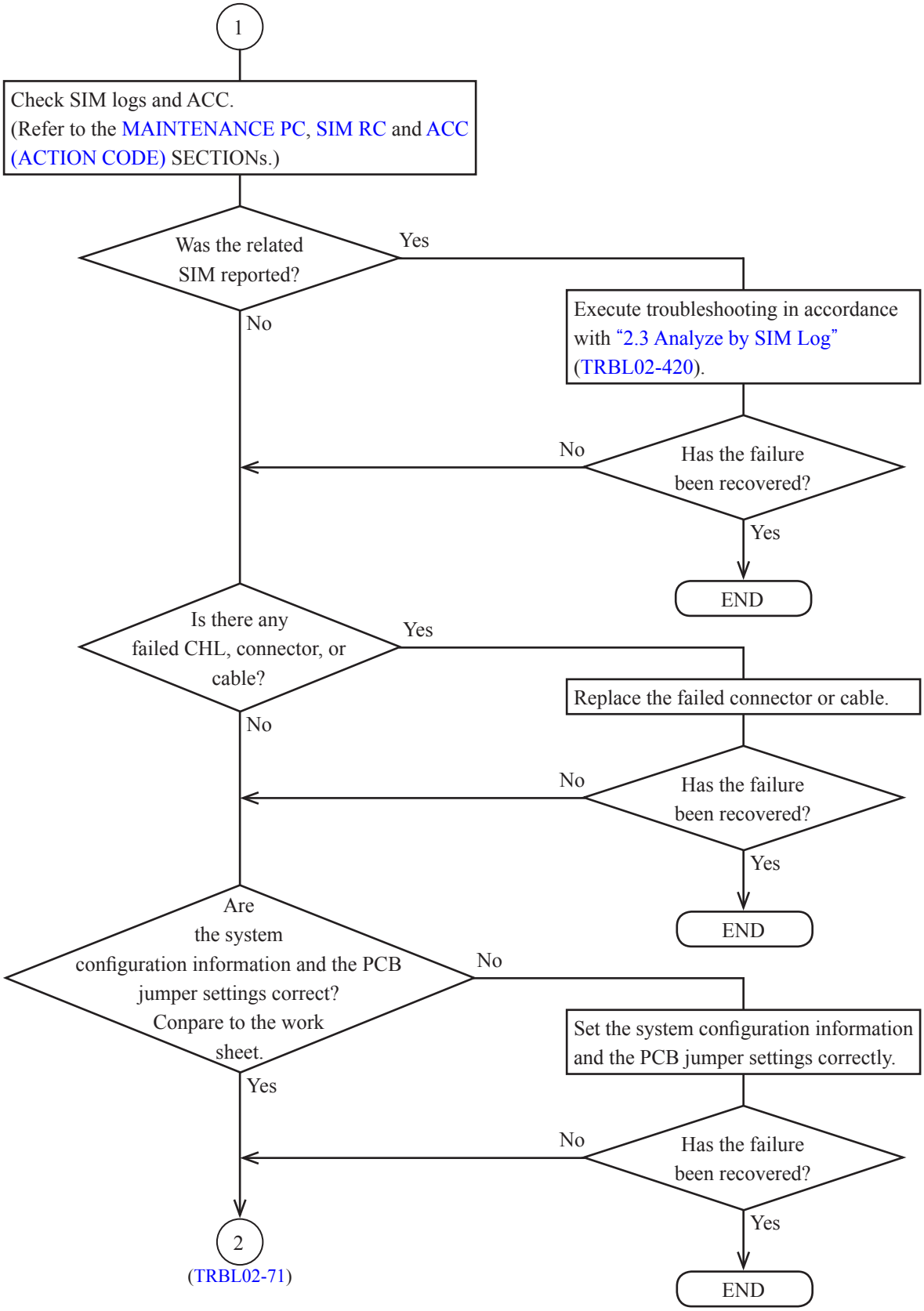
*2: After completing all this recovery procedure, connect the removed connection cable to the UPS connector again.

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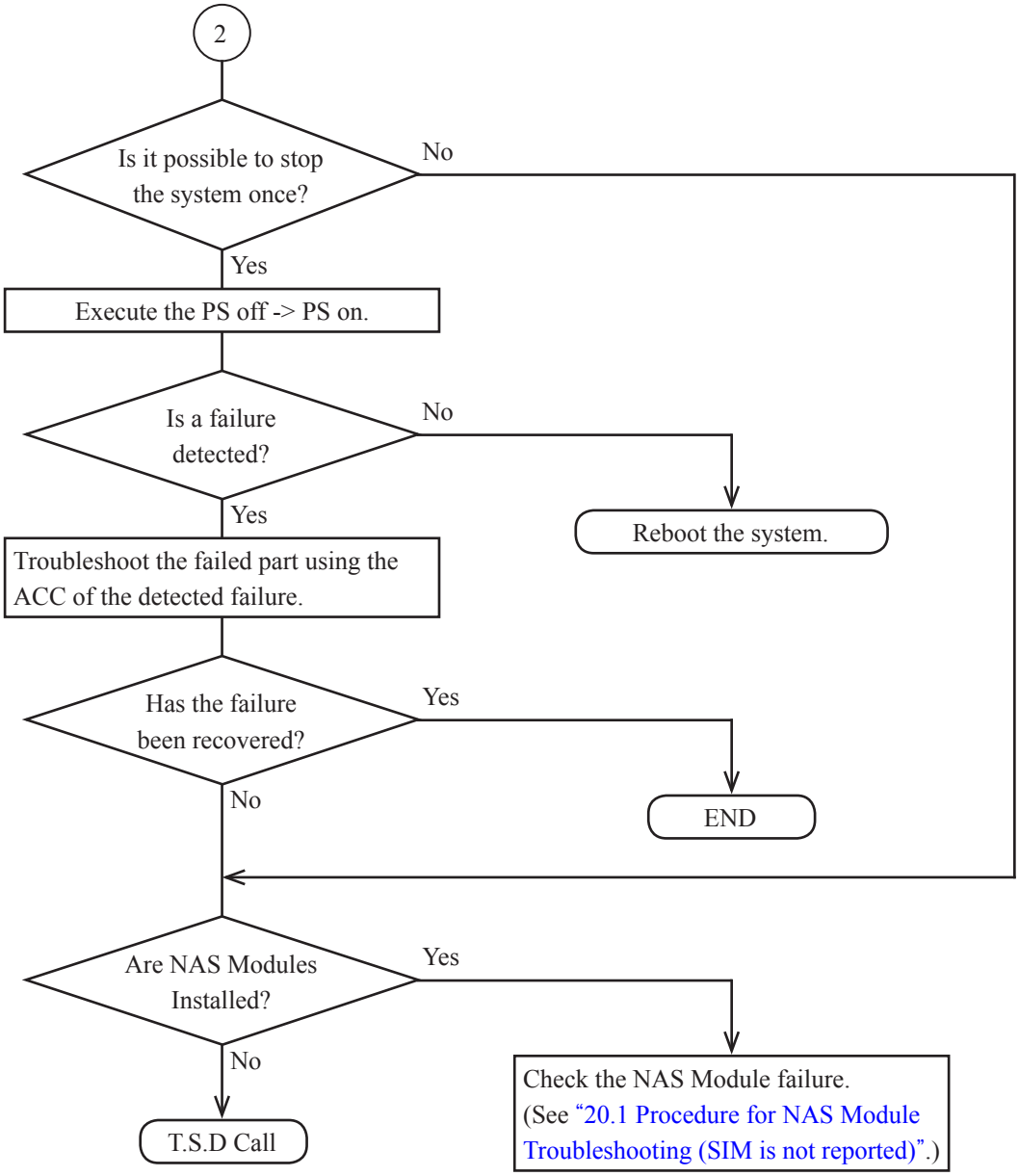
2.1.3 Detecting Storage System Failures by a Server



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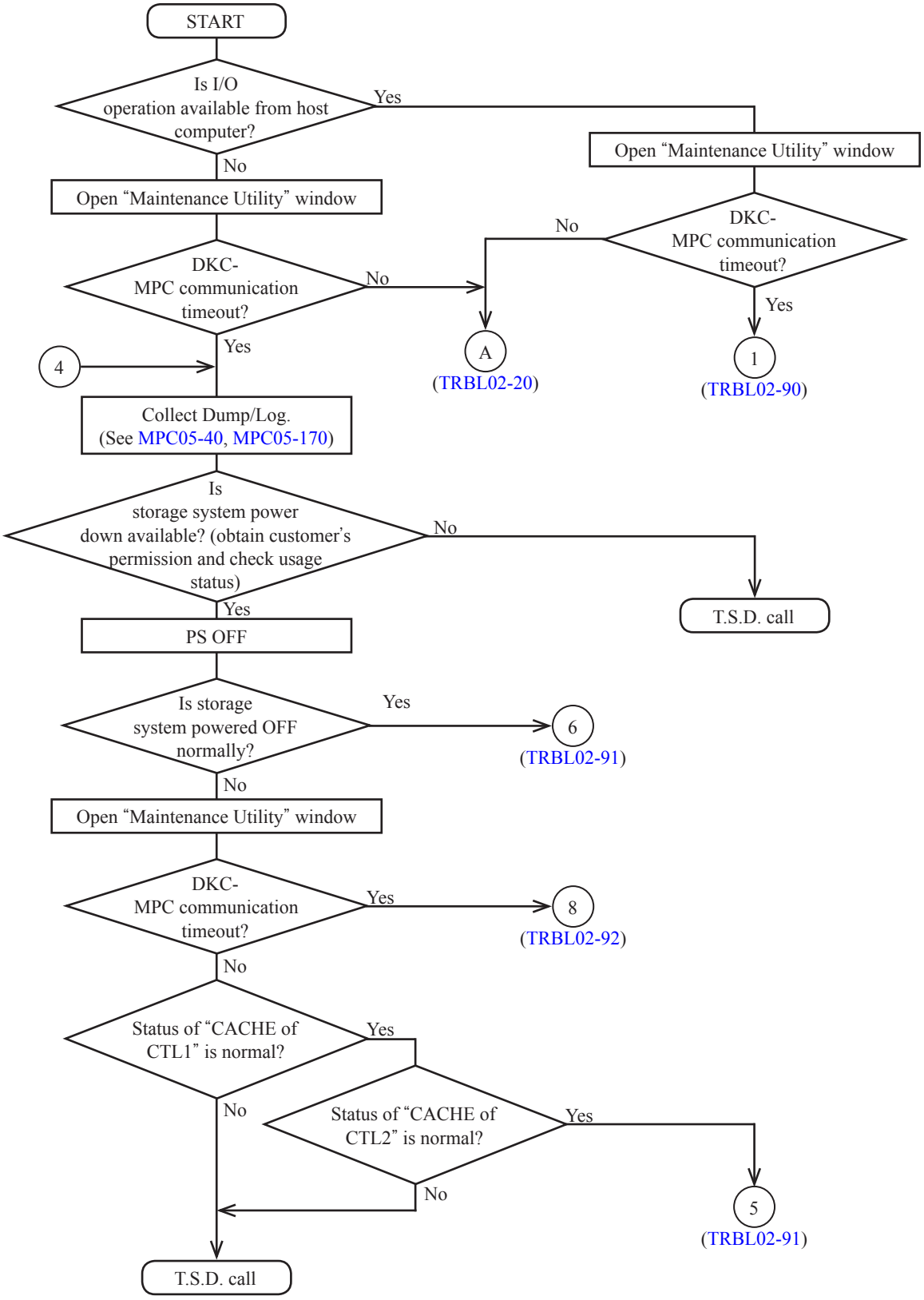


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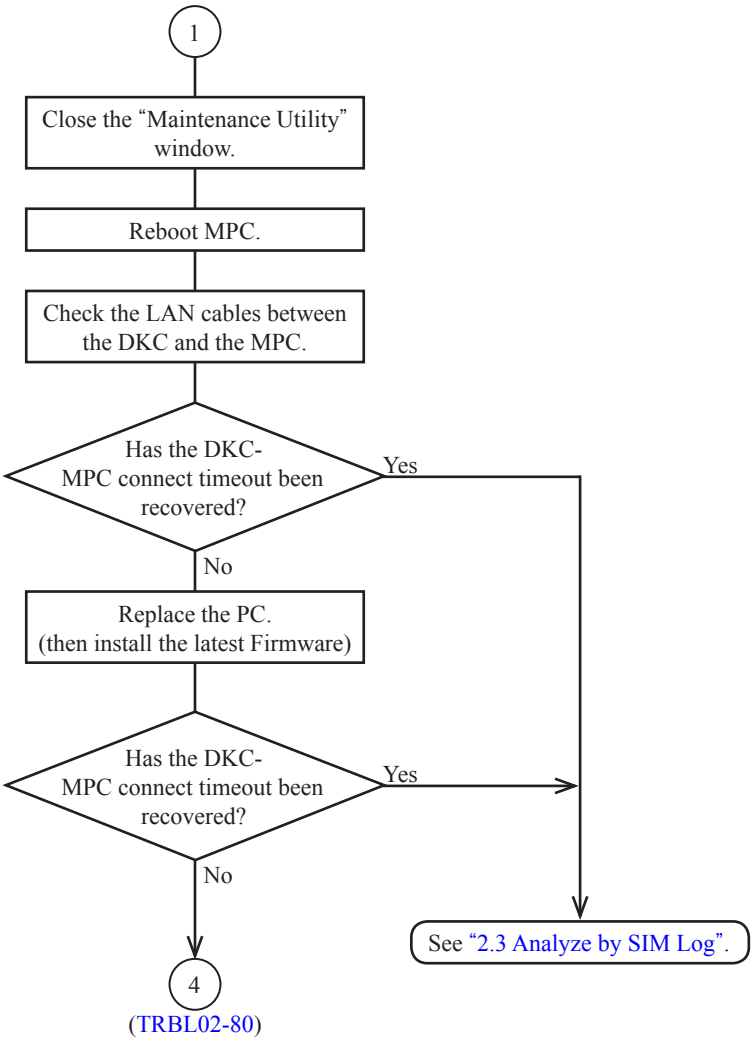


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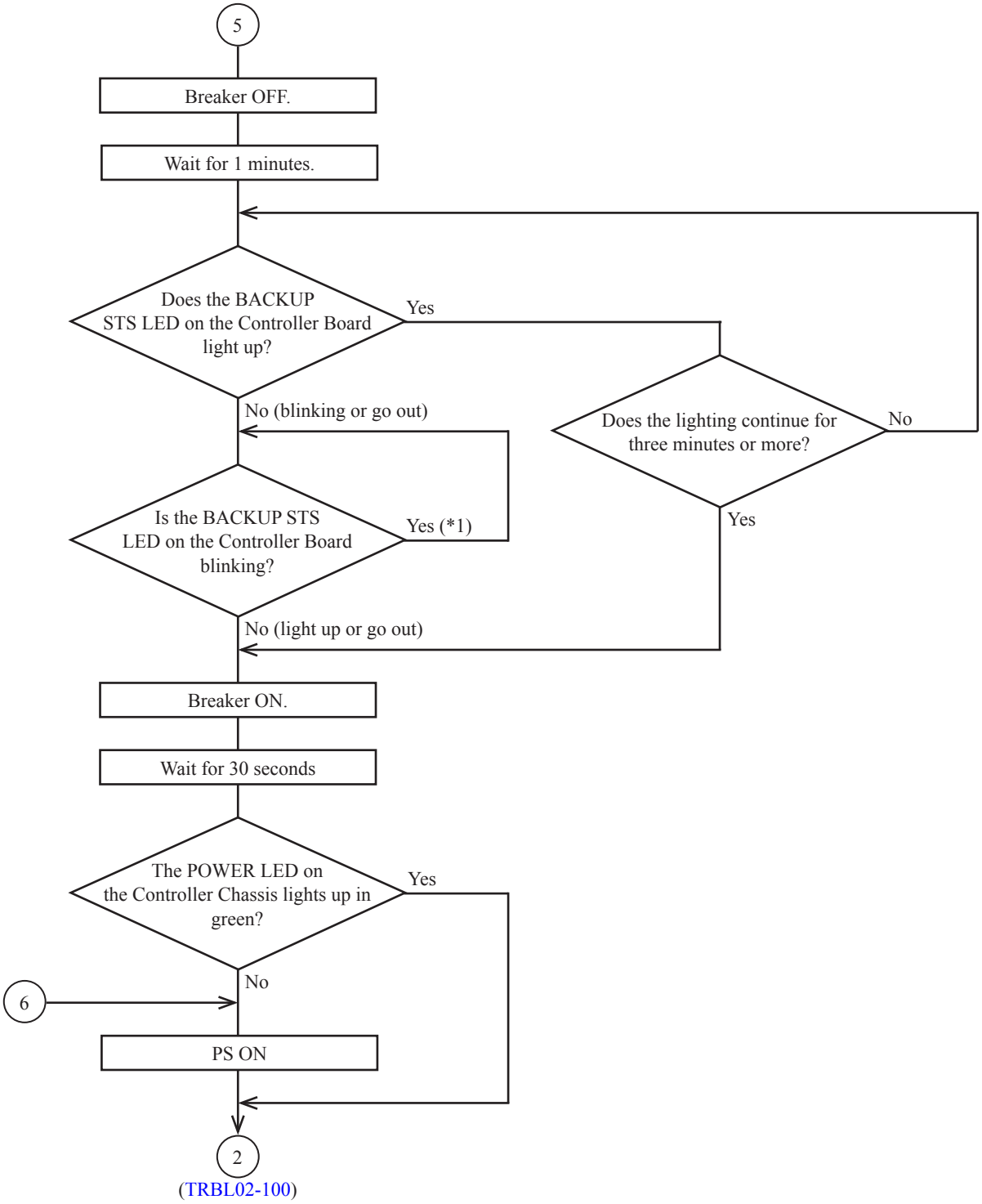
2.1.4 Lighting up ALARM (red) of Storage System LED



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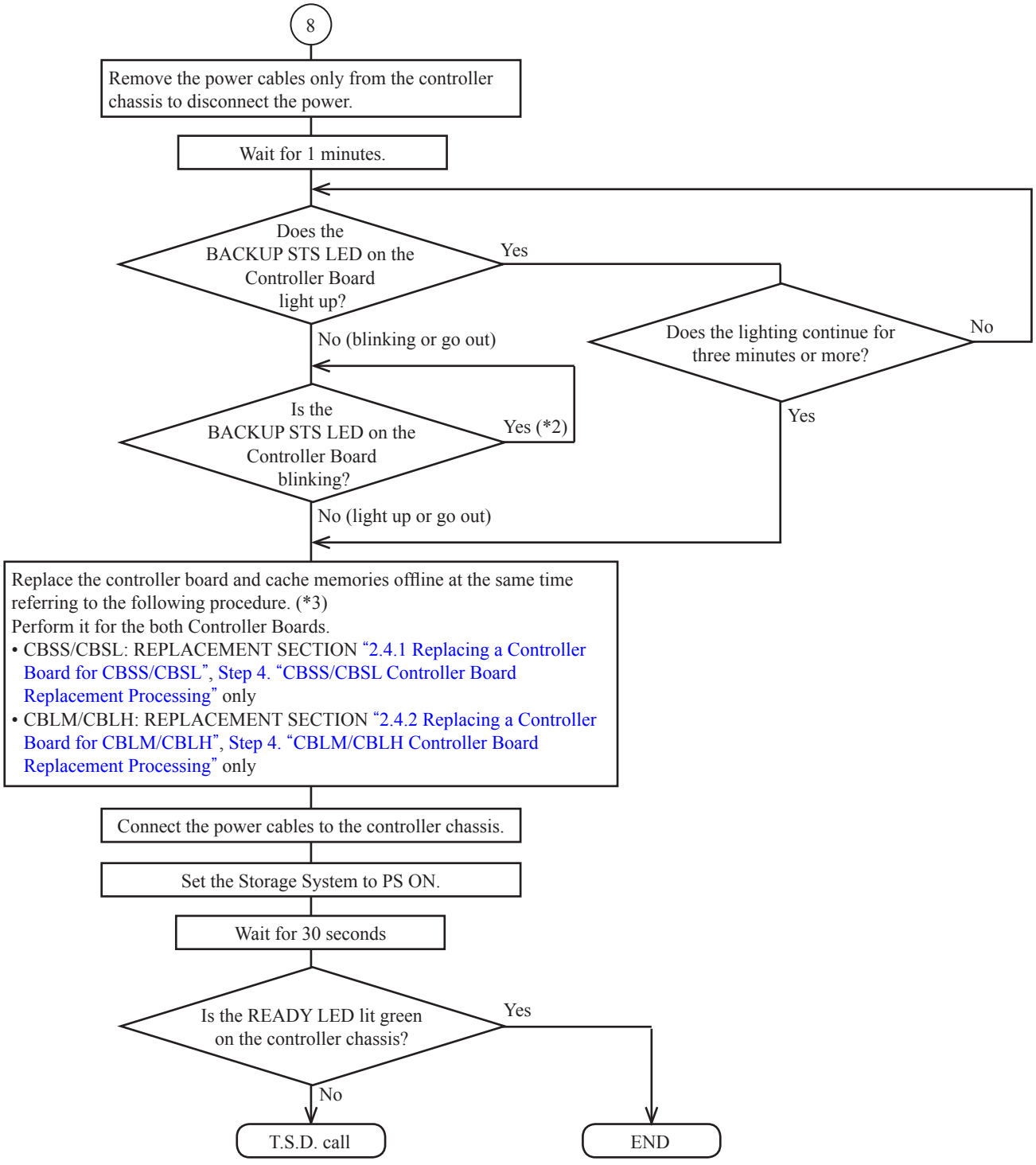


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*1: The blinking duration time of the BACKUP STS LED varies depending on the Storage System models.
VSP G200: 10 minutes
VSP G400: 10 minutes
VSP G600: 10 minutes
VSP G800 :15 minutes

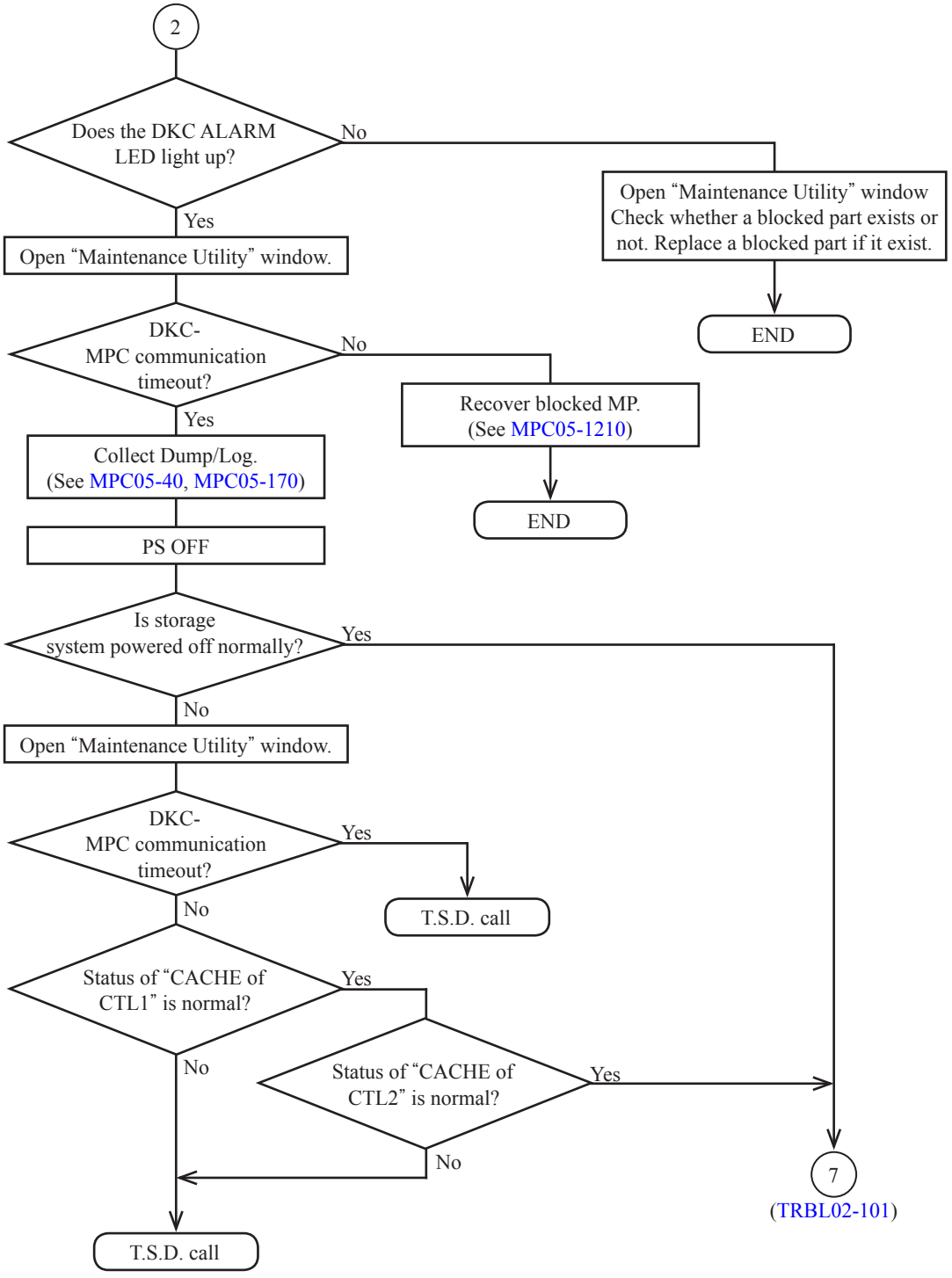
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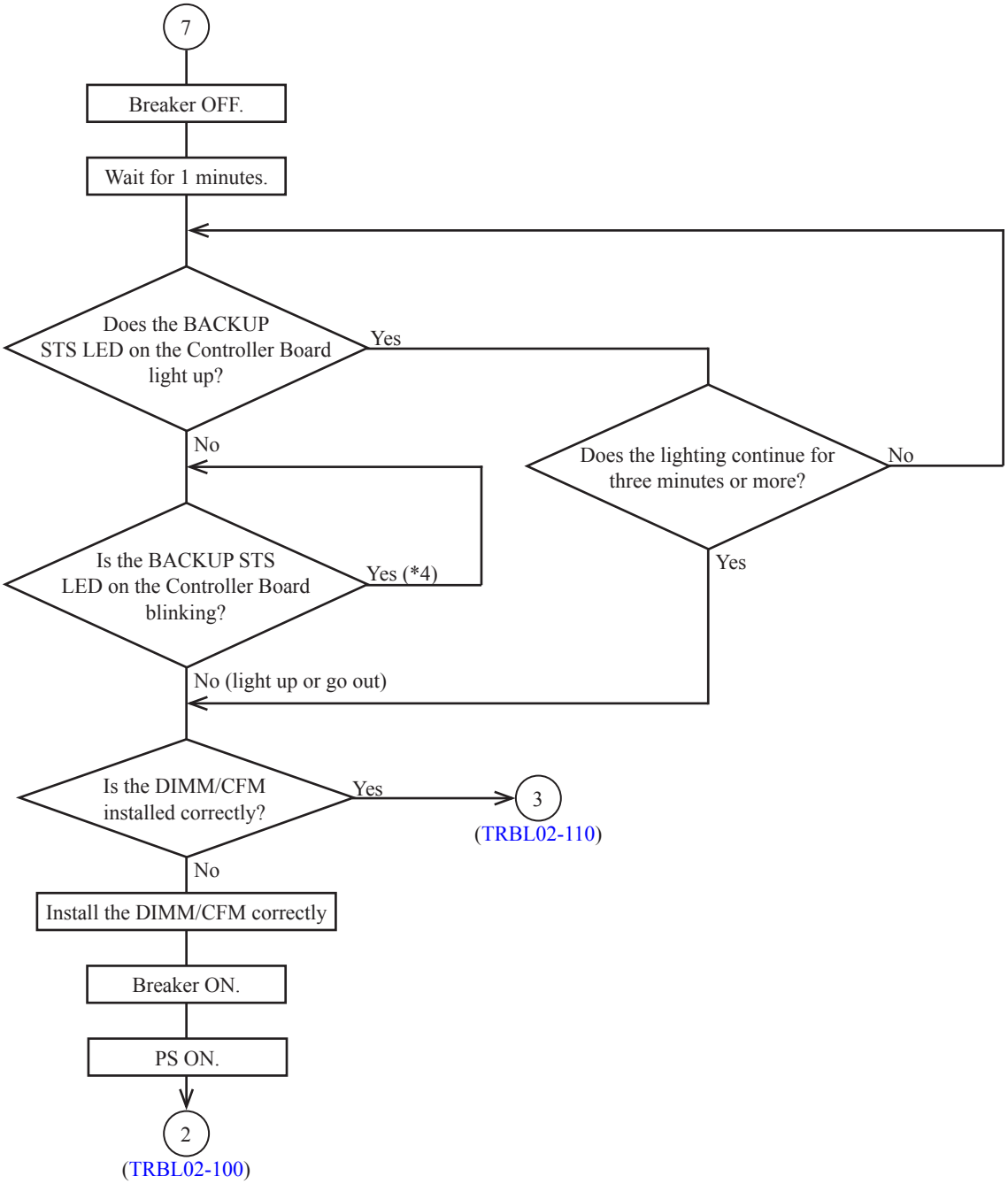
*2: The blinking duration time of the BACKUP STS LED varies depending on the Storage System models.
VSP G200, G400, G600: 10 minutes
VSP G800 :15 minutes

*3: Ignore the item (1) for checking the ALM LED, Step 4 in the procedures to refer to.
Furthermore, in the item (6) for CBSS/CBSL and (3) for CBLM/CBLH, mount all the new cache memories in the same positions on a new controller board instead of "all the Cache Memories (including dust covers if any) mounted on the extracted Controller Board".

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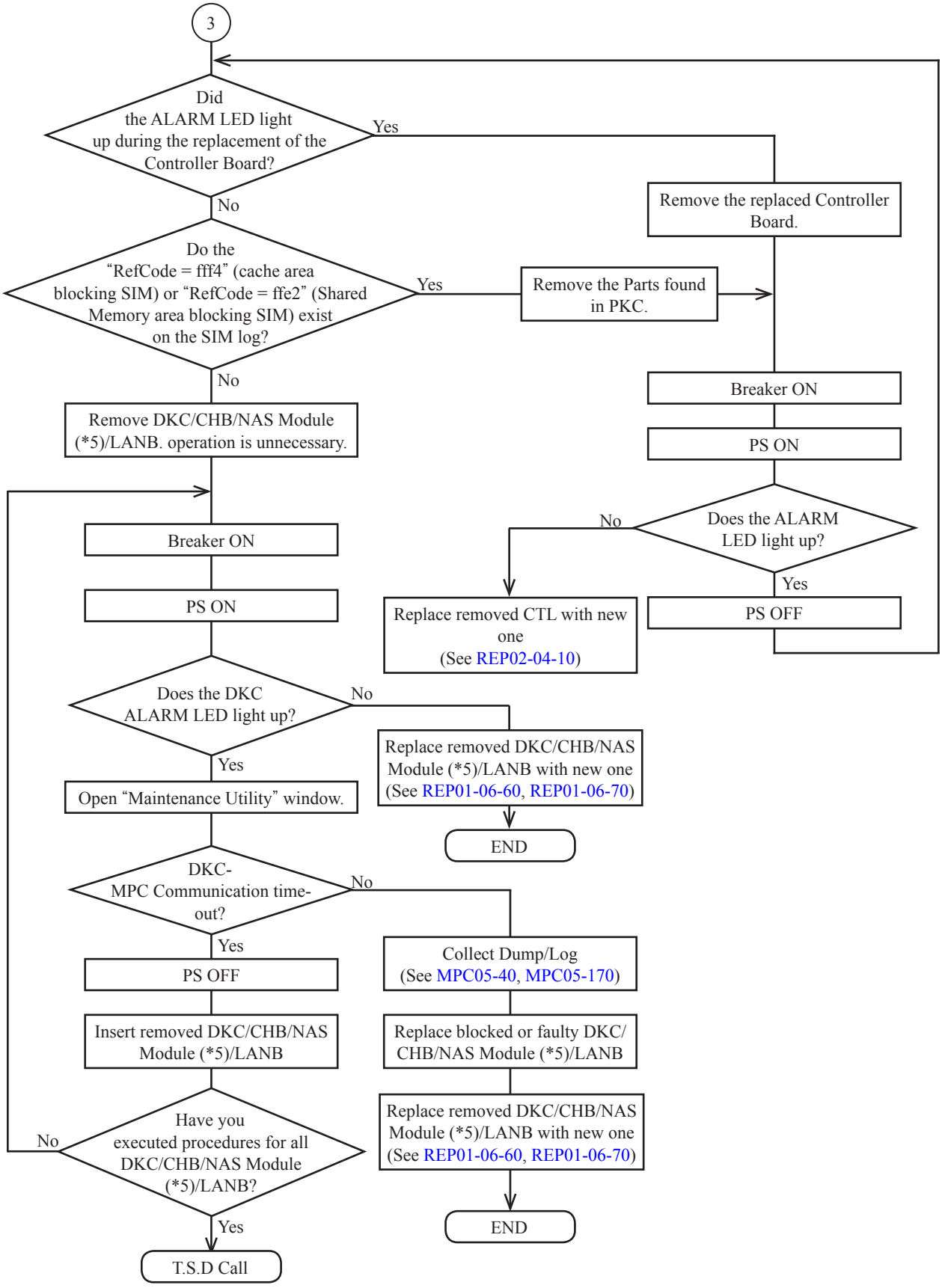


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*4: The blinking duration time of the BACKUP STS LED varies depending on the Storage System models.
VSP G200: 10 minutes
VSP G400: 10 minutes
VSP G600: 10 minutes
VSP G800 :15 minutes

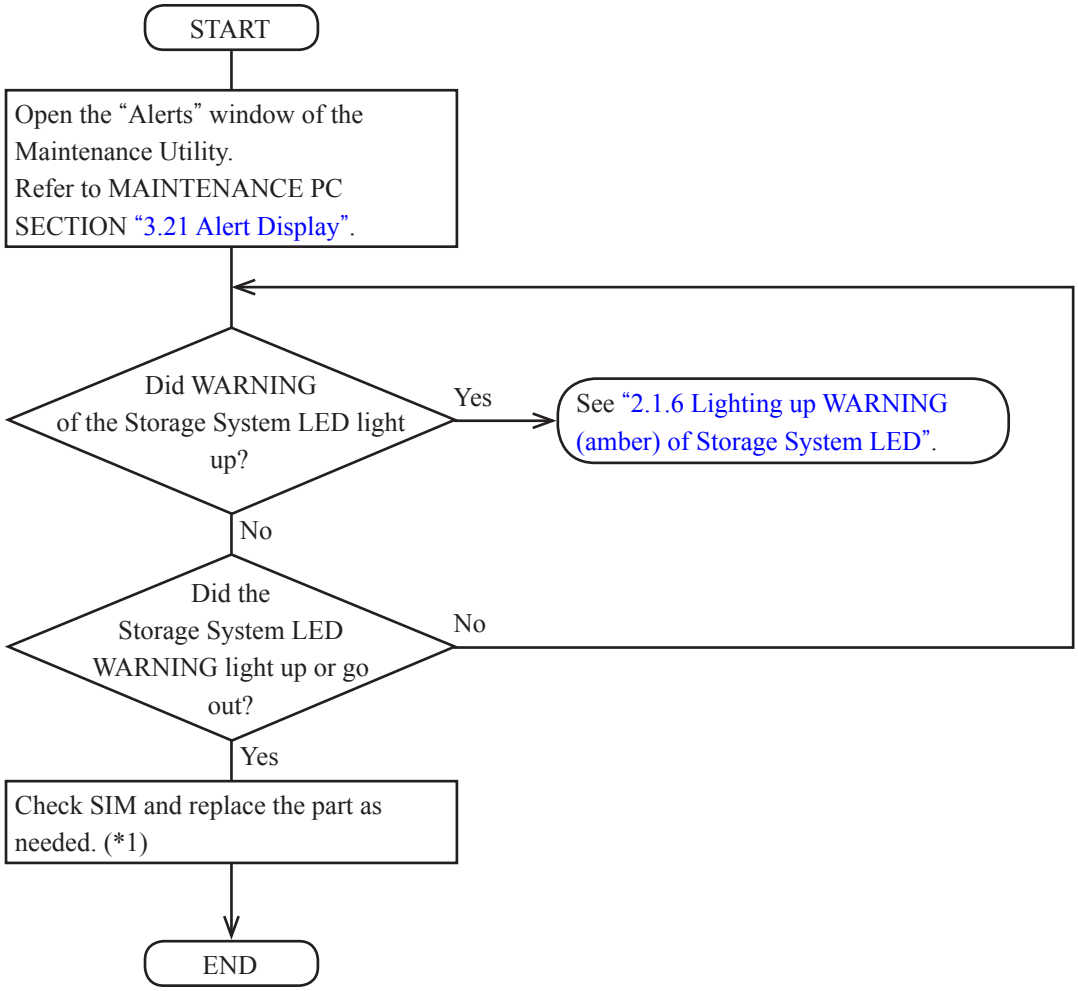
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*5: When NAS Modules are installed, they are also the removal targets.

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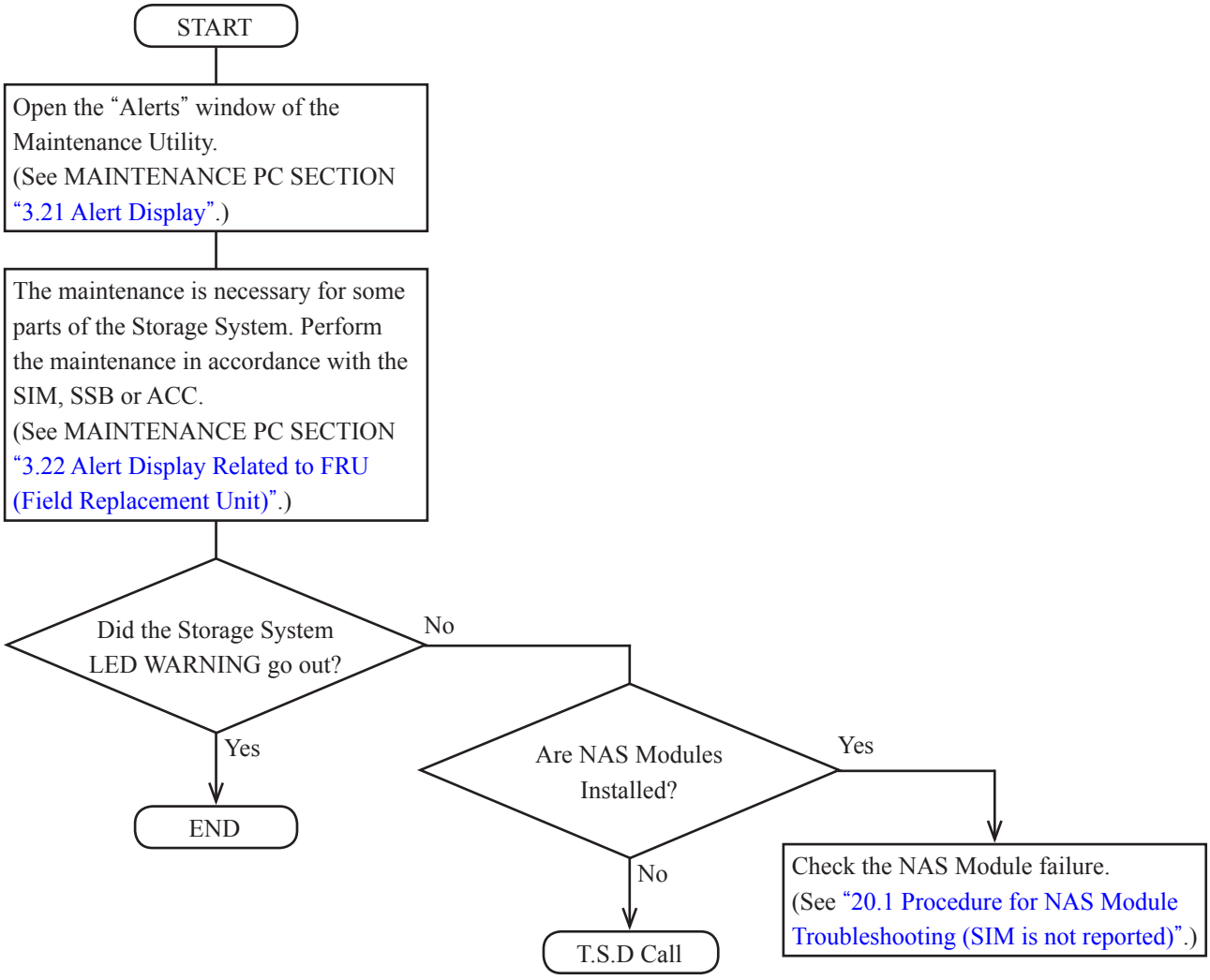
2.1.5 Blinking WARNING (amber) of Storage System LED



*1: Do not replace the following parts.
- PSU (PSU warning, abnormal AC input)
- FAN
- UPS (UPS cable removed)
- battery
- BKM,BKMF

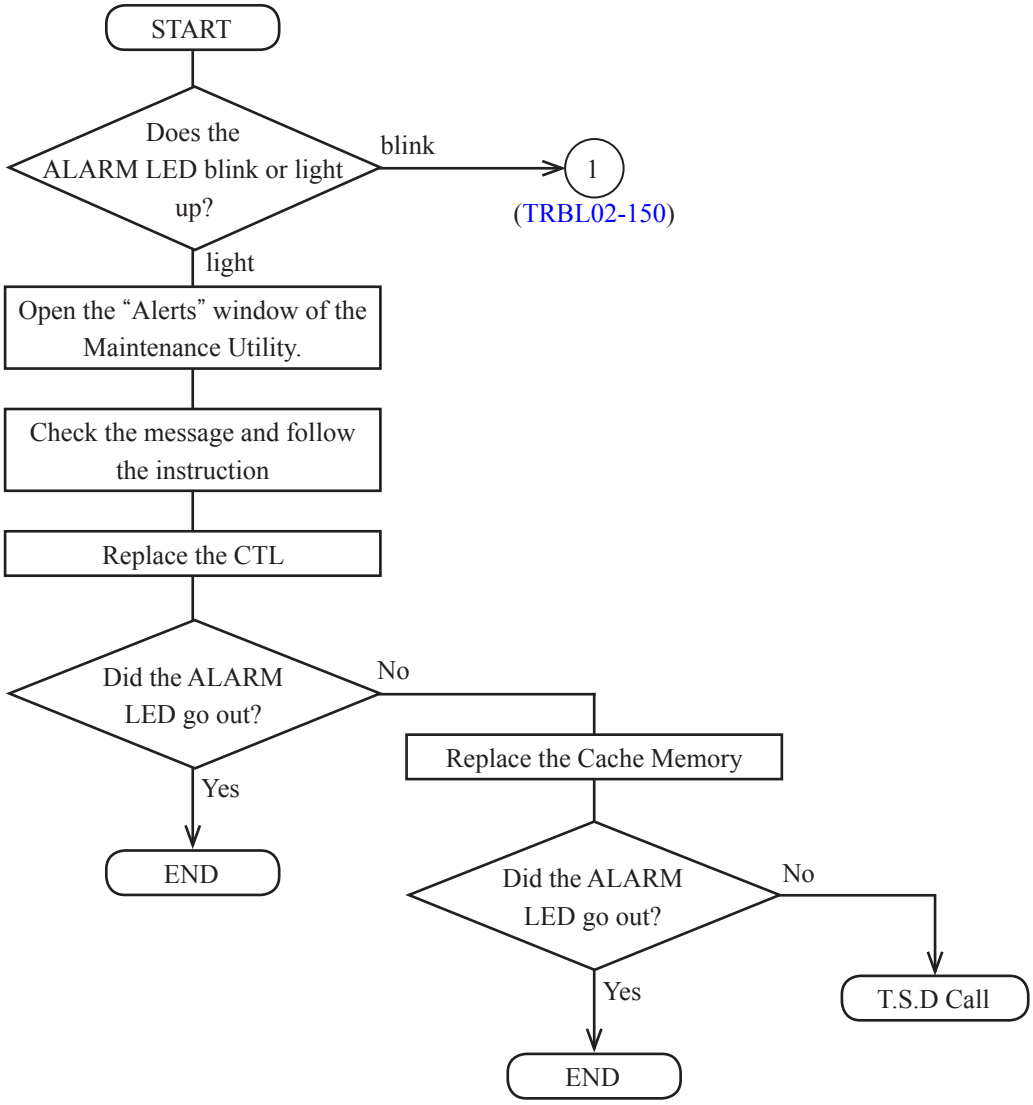
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2.1.6 Lighting up WARNING (amber) of Storage System LED

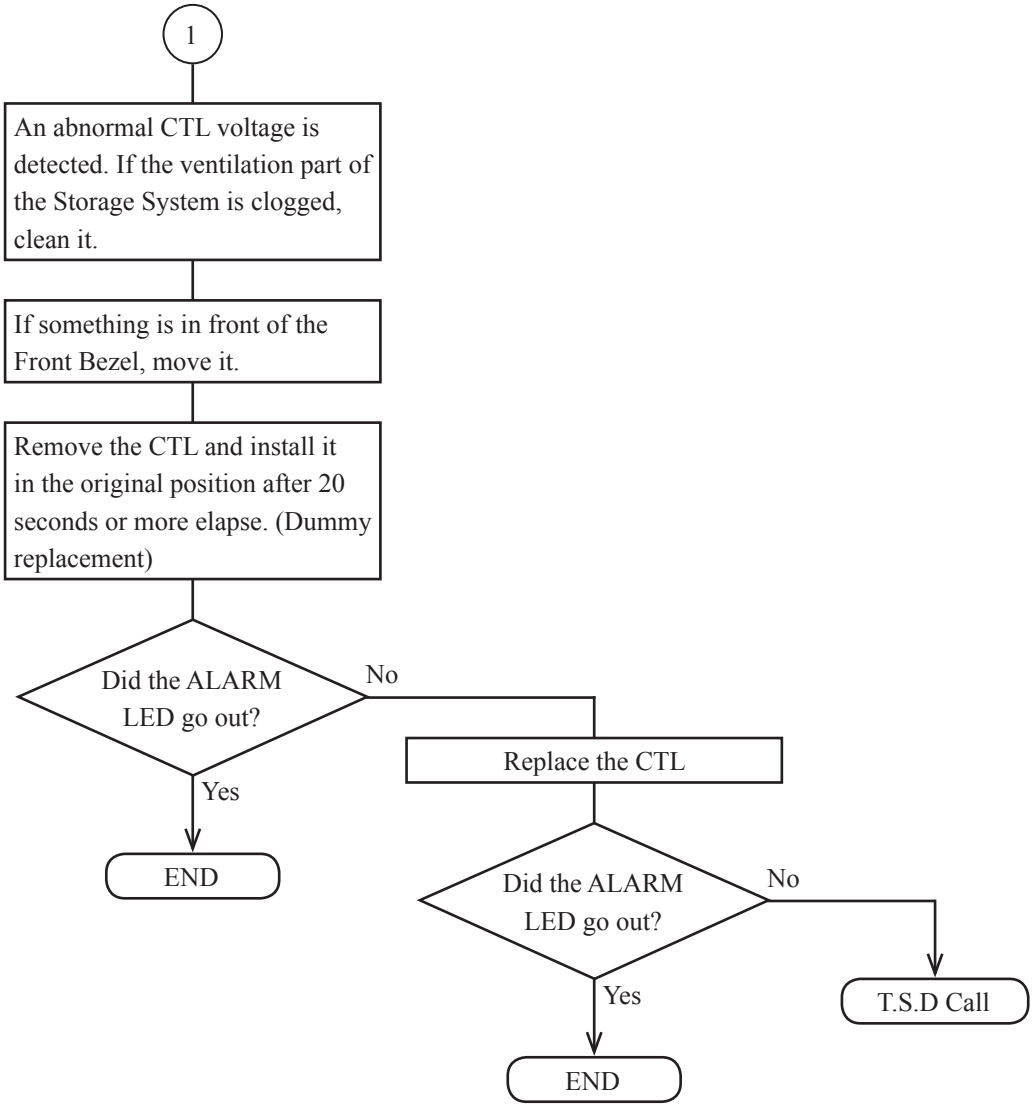


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2.1.7 Blinking or lighting up ALARM (red) of CTL LED

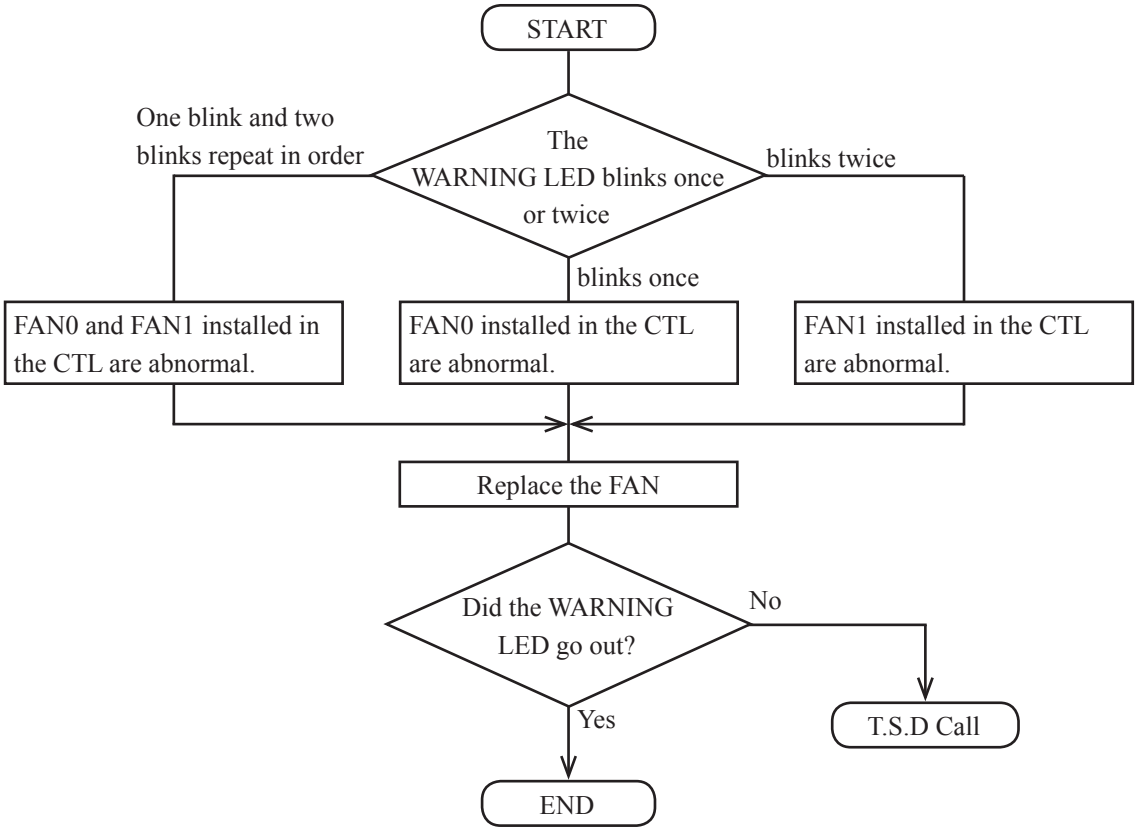


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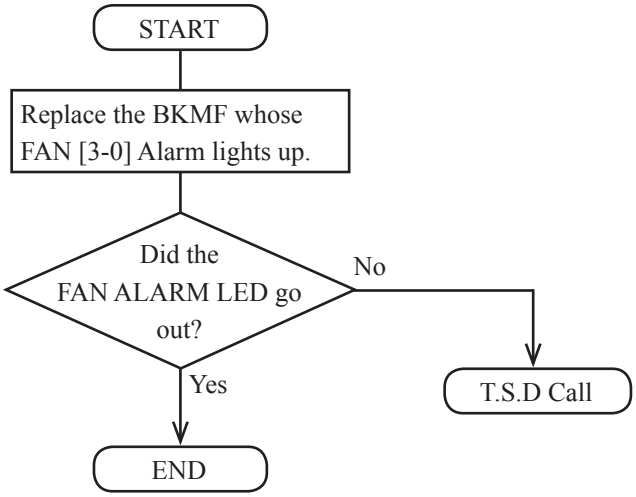
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2.1.8 Blinking WARNING (amber) of CTL LED (CBSS/CBSL)



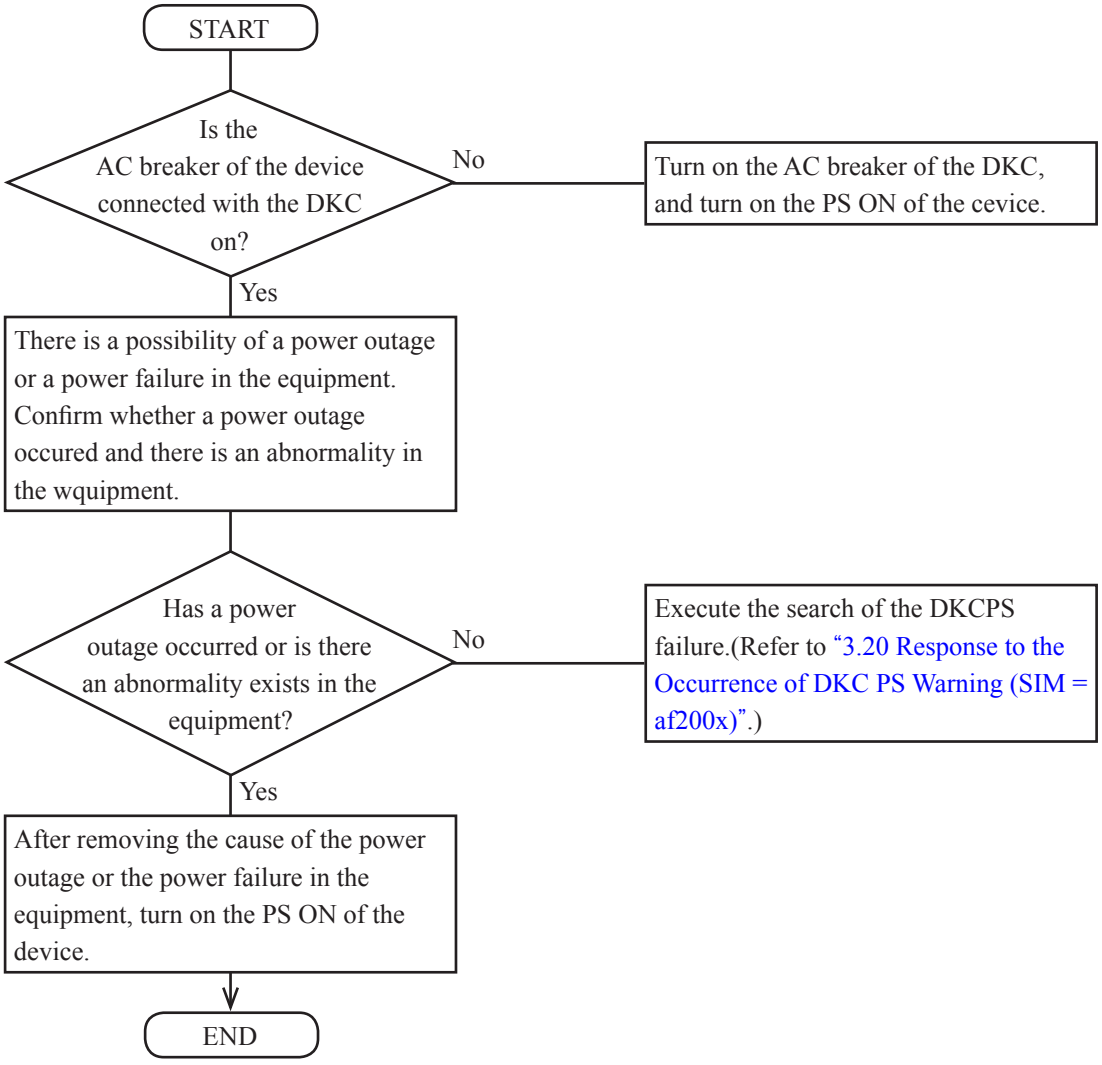
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2.1.9 Lighting up ALARM (red) of FAN LED (CBLM2/CBLM3/CBLH)



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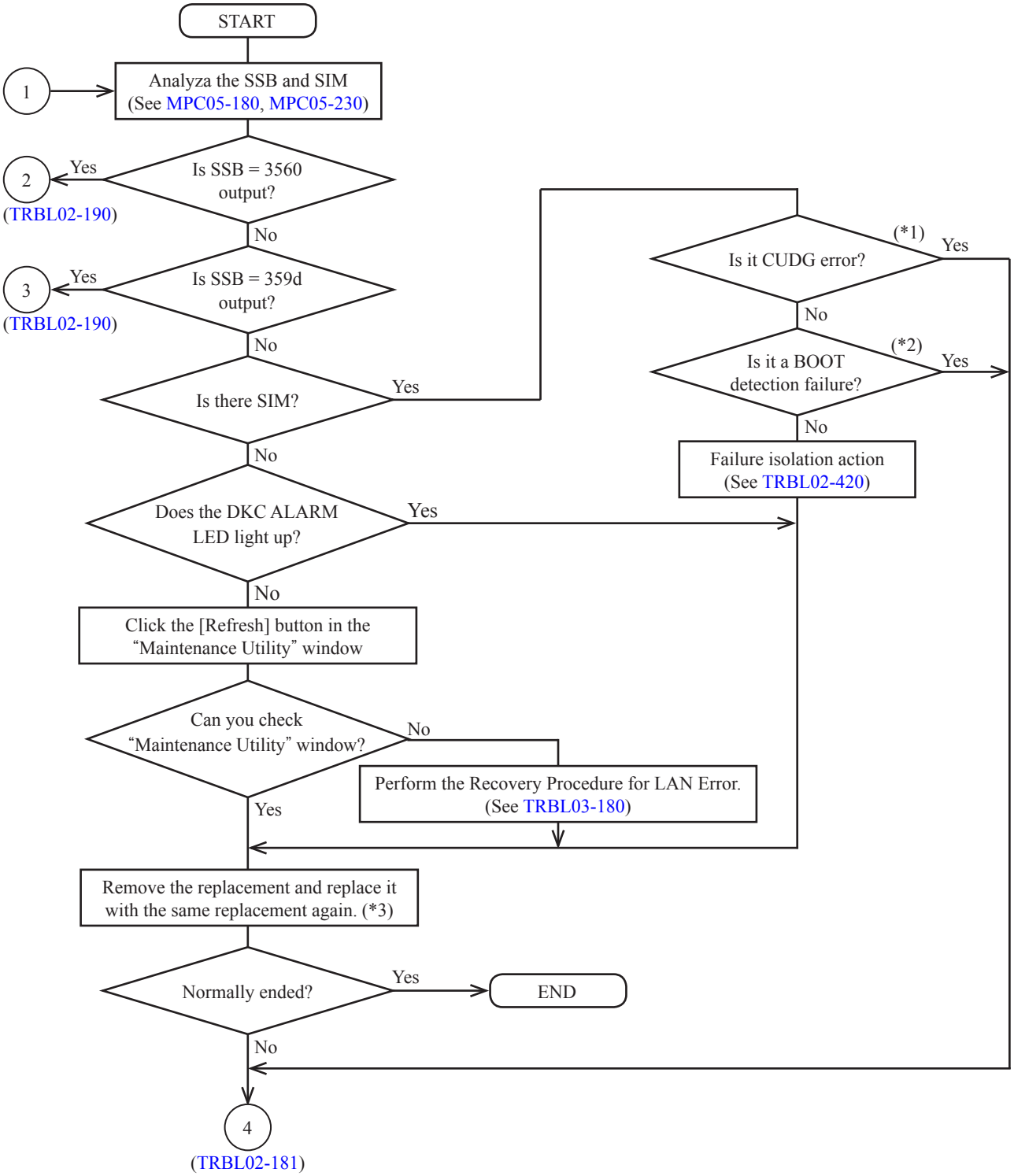
2.1.10 Turning off POWER of the Storage System LED



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2.2 Failure During Operation by Service Personnel

2.2.1 Failures Have Occurred in CTL replacement

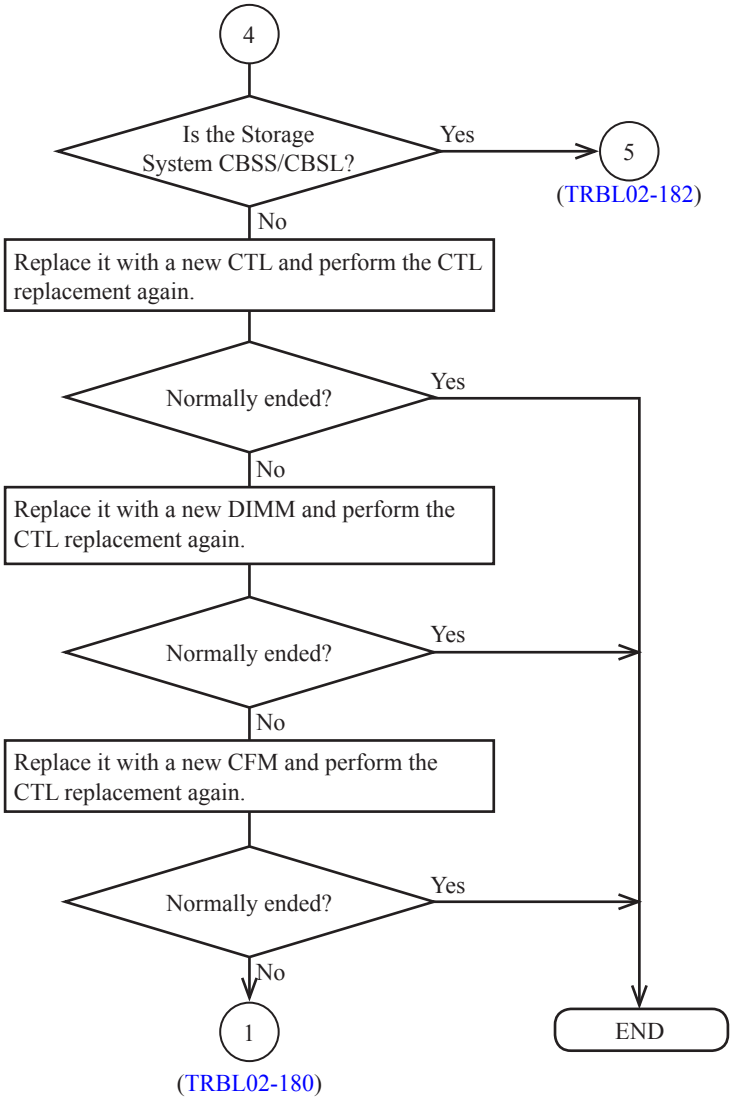


*1: RC=760000 (See SIMRC02-20)

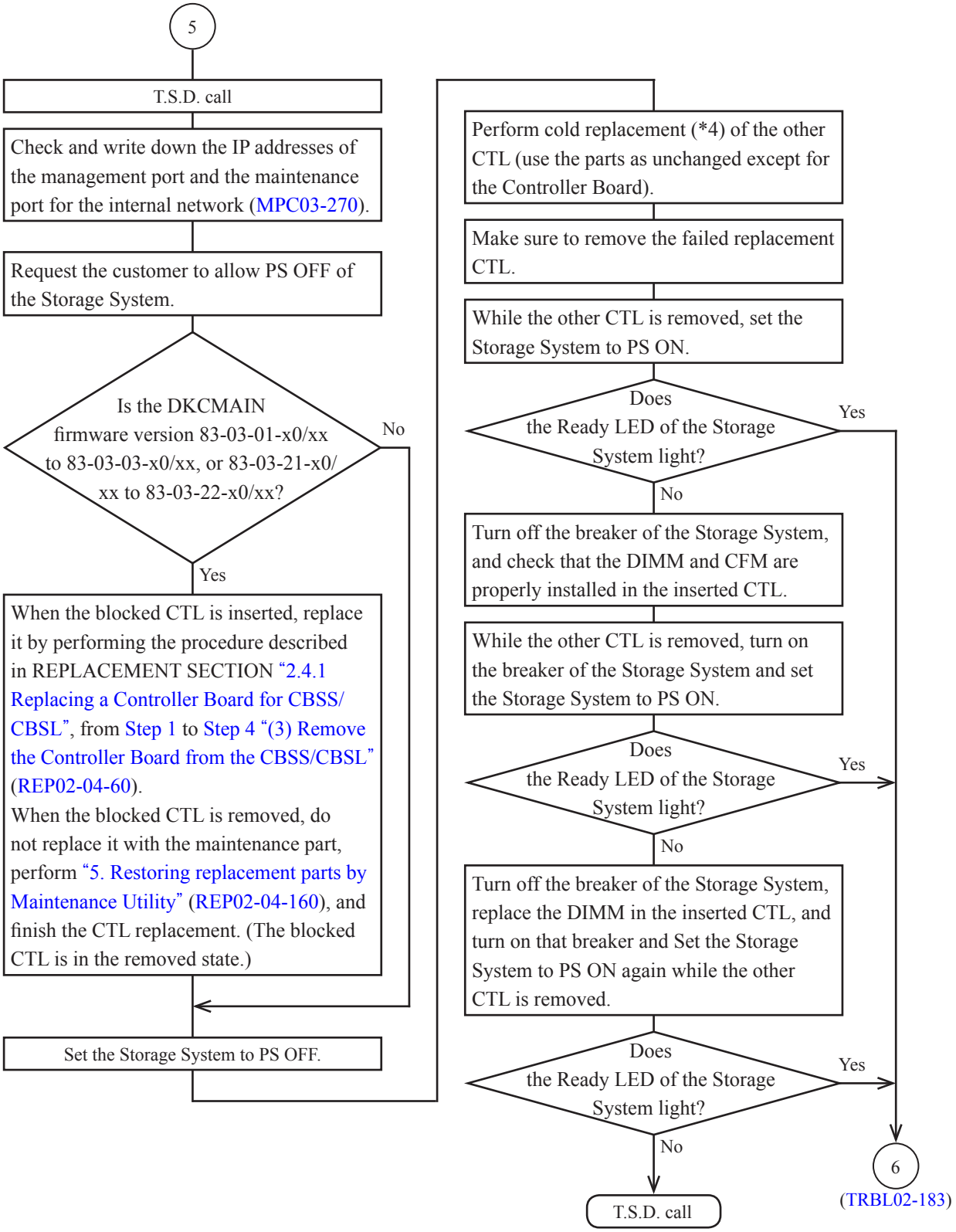
*2: RC=7900xy (See SIMRC02-320)

*3: When removing and inserting the CTL, check that the installation of DIMM/CFM is the same as that shown in the "Maintenance Utility" window. If it is different, install DIMM/CFM correctly.

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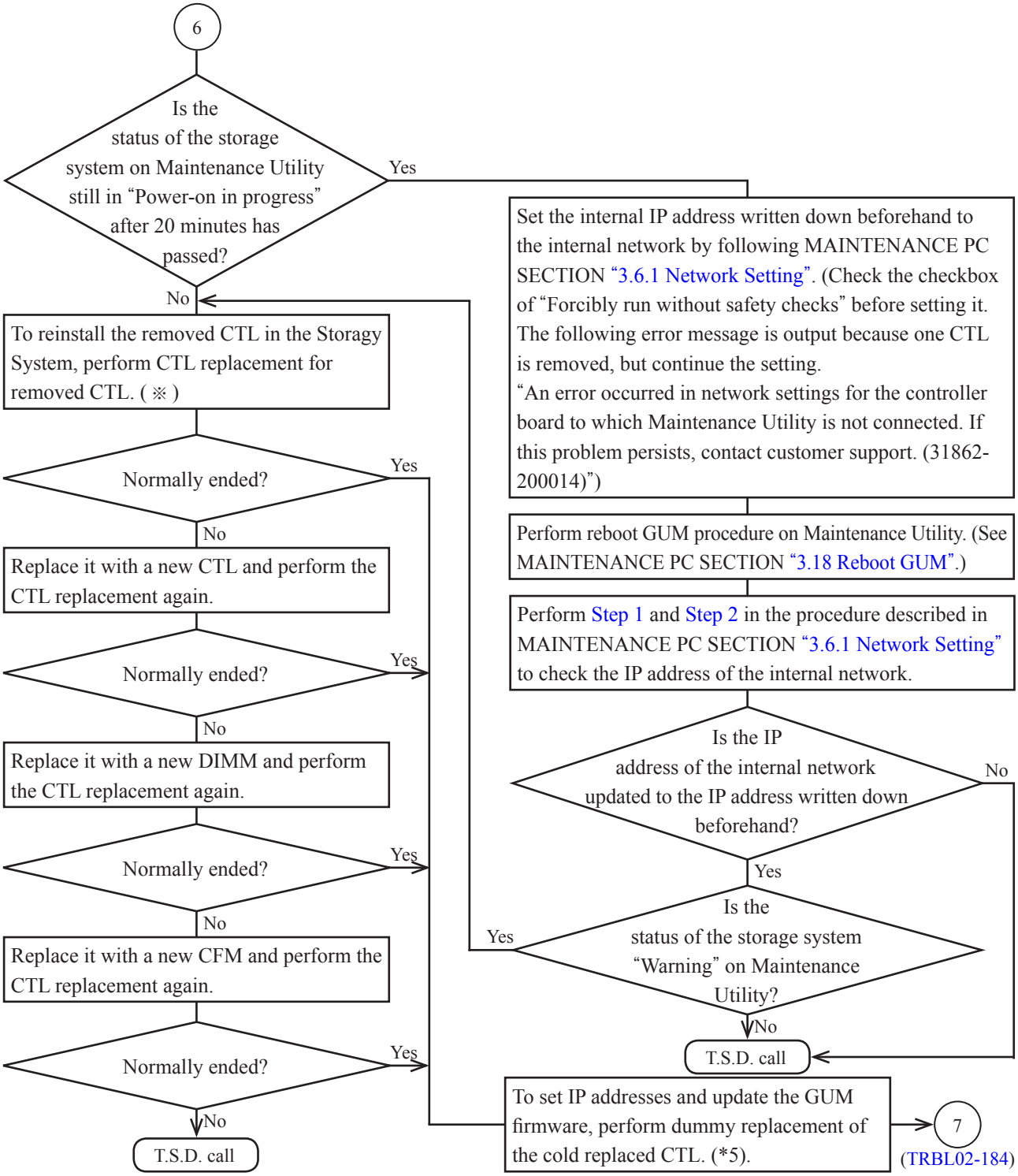


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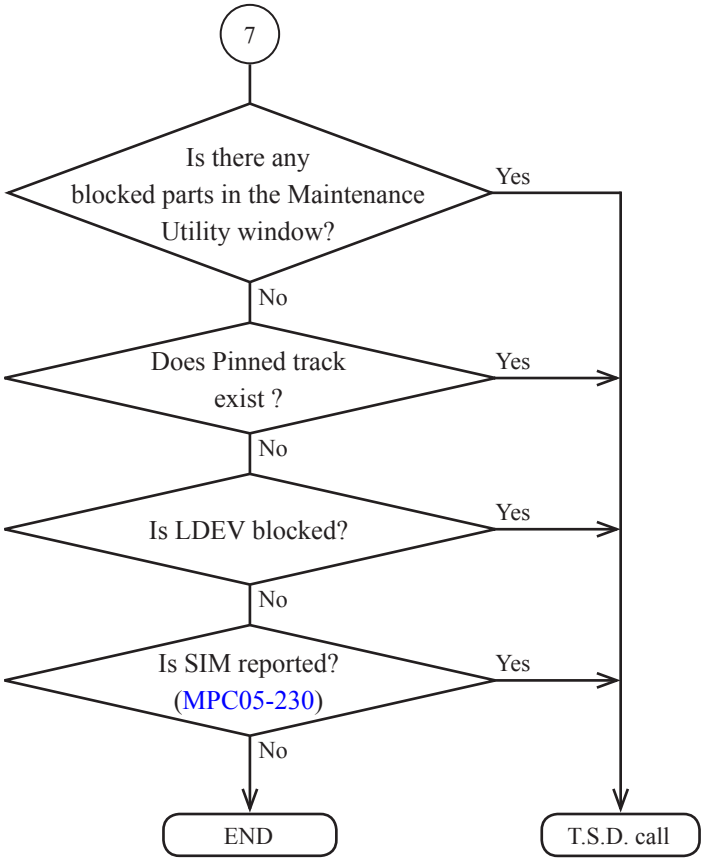
*4: Replace the parts in the PS OFF status.

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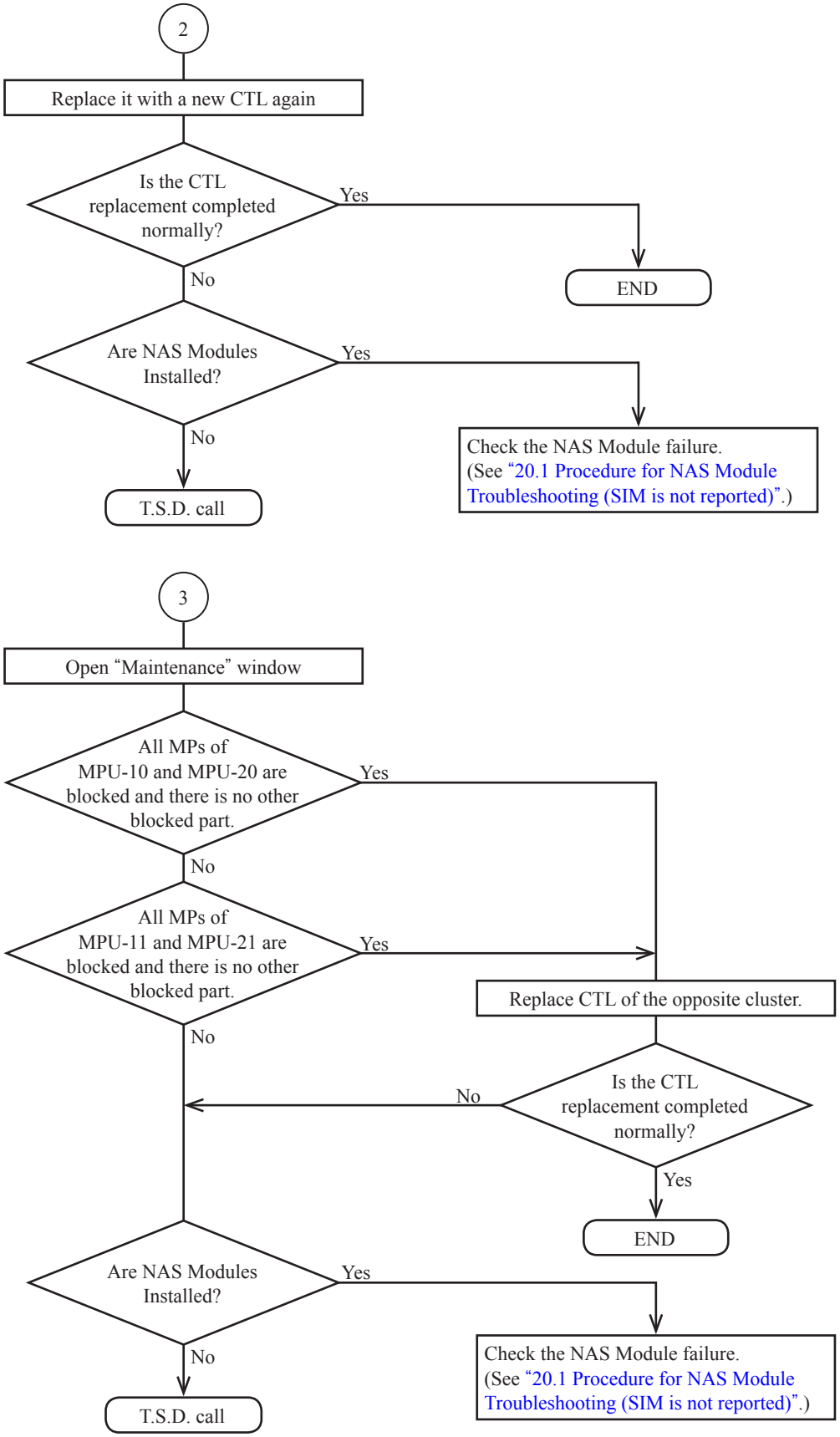


*5: For another procedure for IP address settings, see MAINTENANCE PC SECTION "3.6 Network Setting". For another procedure for GUM firmware update, see FIRMWARE SECTION "3.3.2 Updating Firmware of the Storage System".
However, wait for 15 minutes or longer after (※) has been properly done, and then perform them.
Time required for GUM firmware update:
- Dummy replacement: about 70 minutes
- Updating firmware of the Storage System: about 40 minutes

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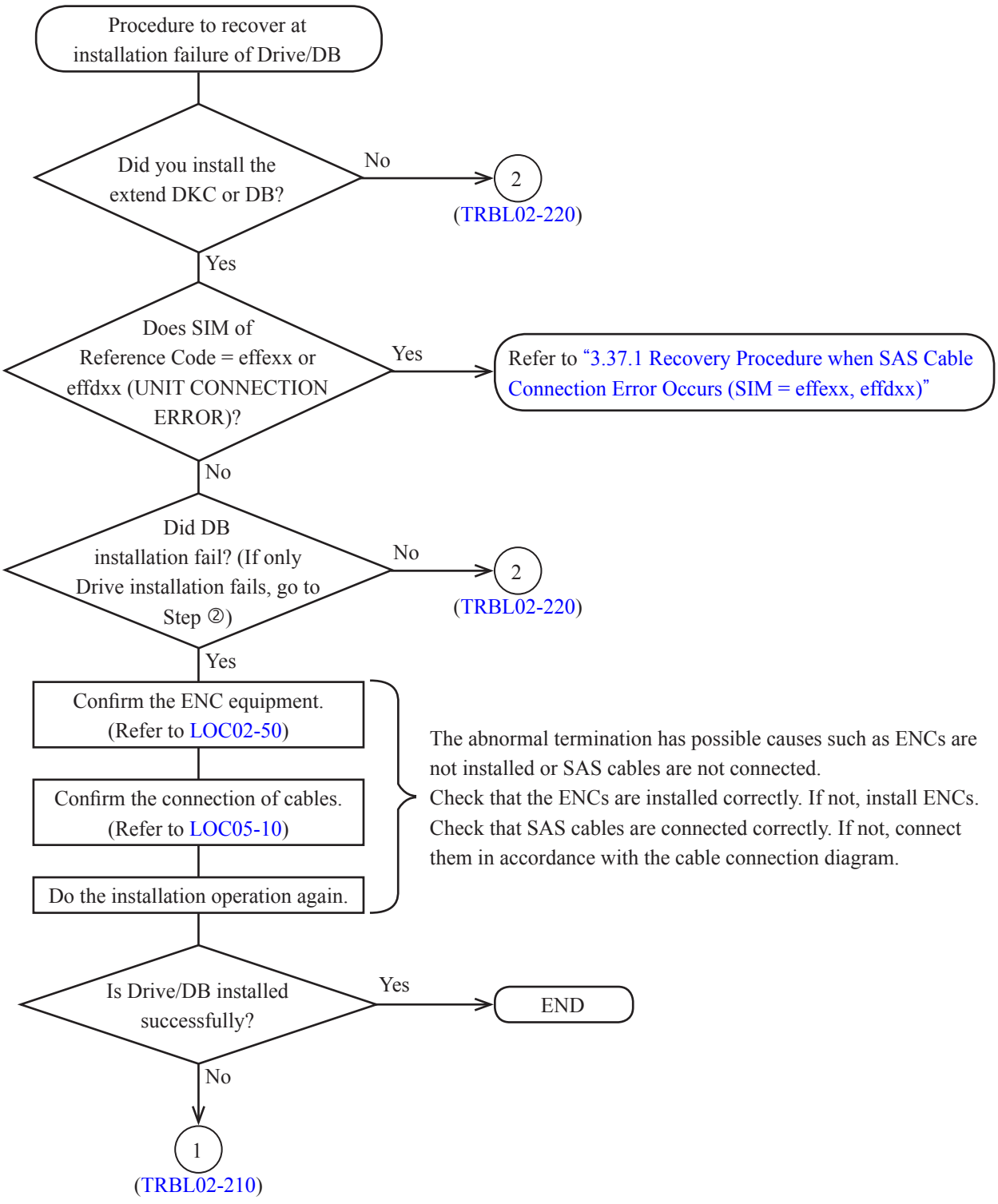


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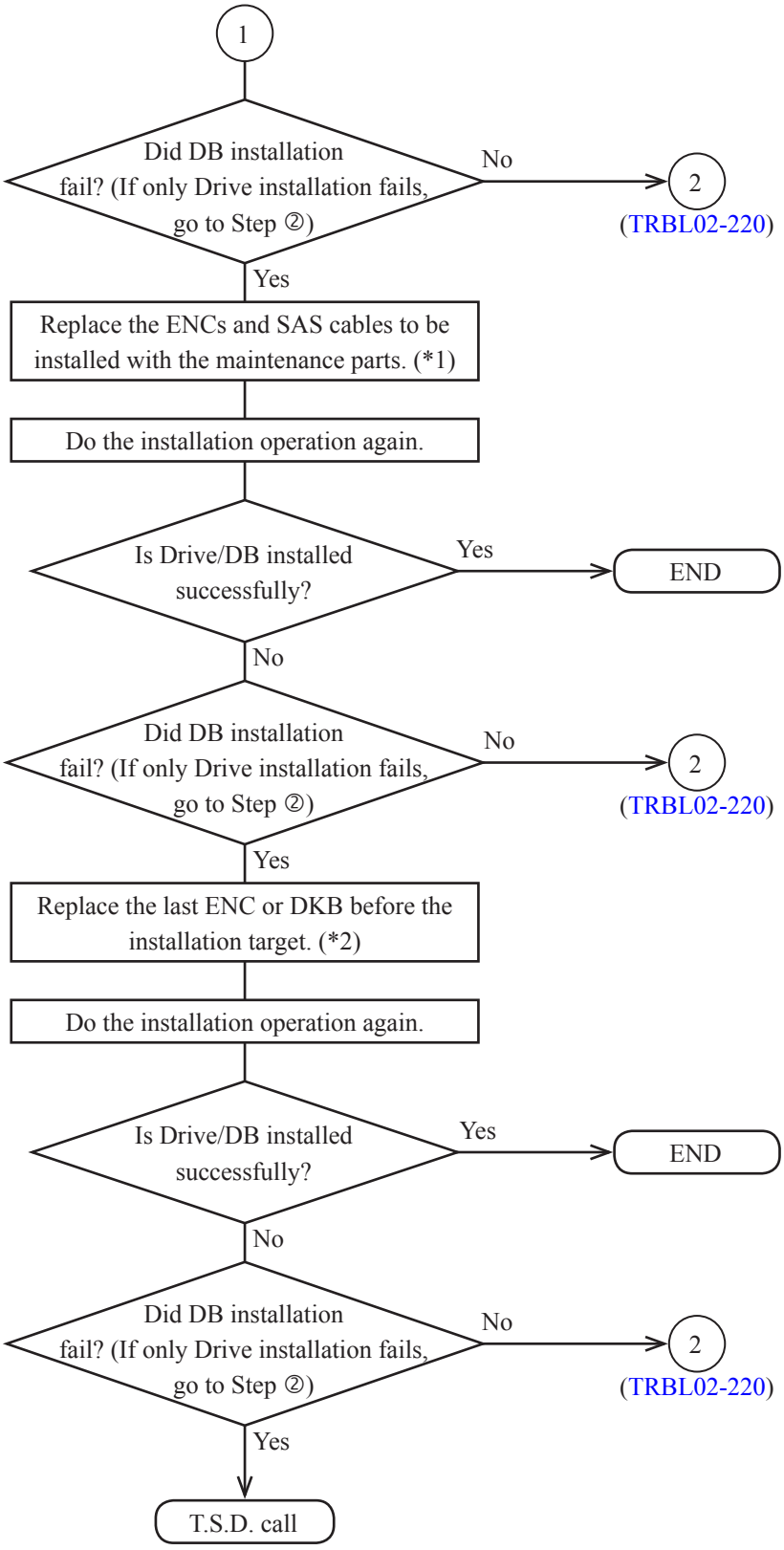
2.2.2 Failures Have Occurred when Installing Drive/DB

Red LED of ENC may light when DKB is re-installed after the MP failure had been occurred during de-installation of DKB.
In that case, please dummy-replace that ENC.

2.2.2.1 Installation Failure of Drive/DB



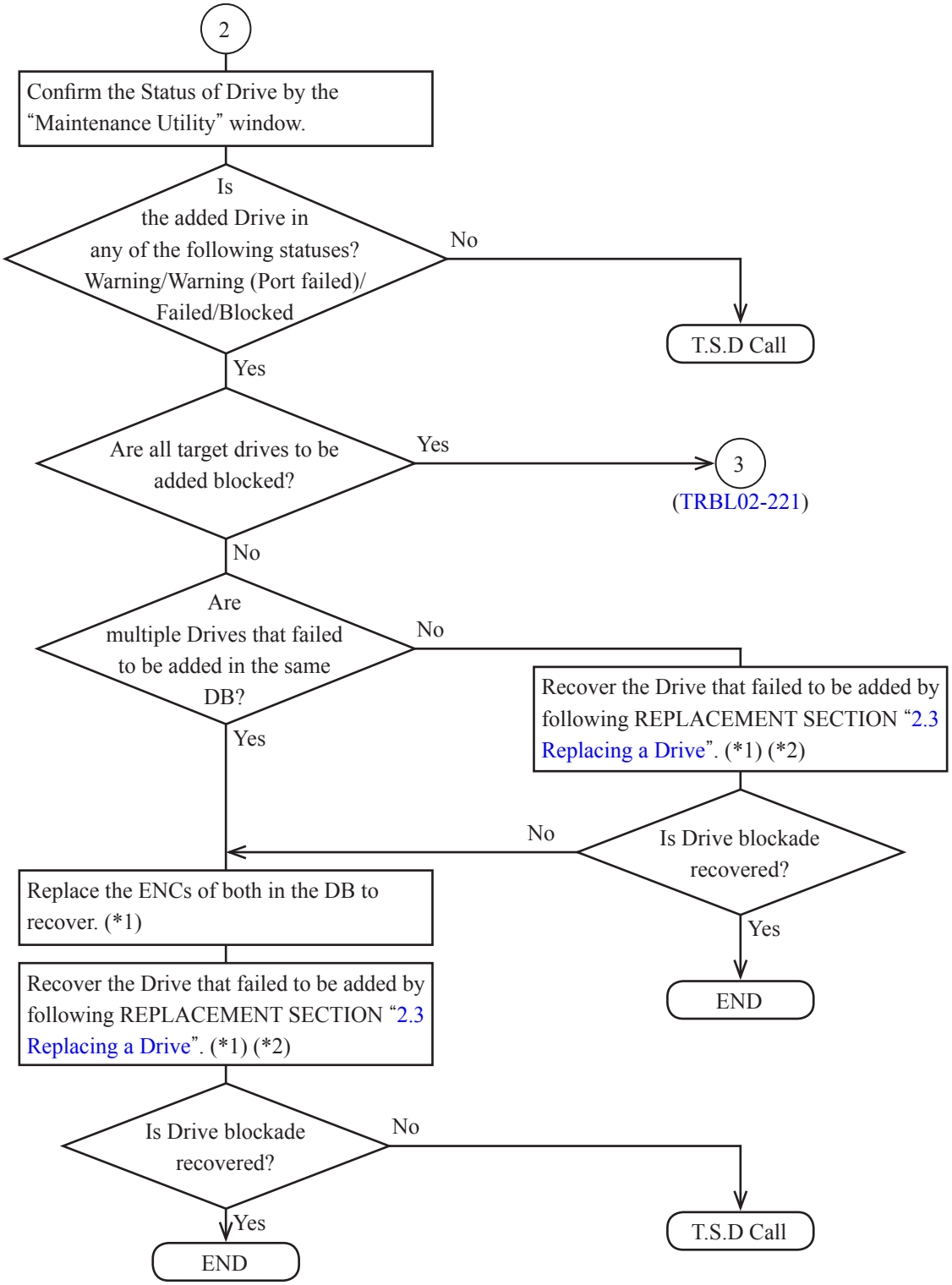
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*1: Replace the ENCs and SAS cables to be installed with the maintenance parts in order from front to back and identify the failed parts.

*2: The connection source of the installed DB may be broken. Replace it with the maintenance part.

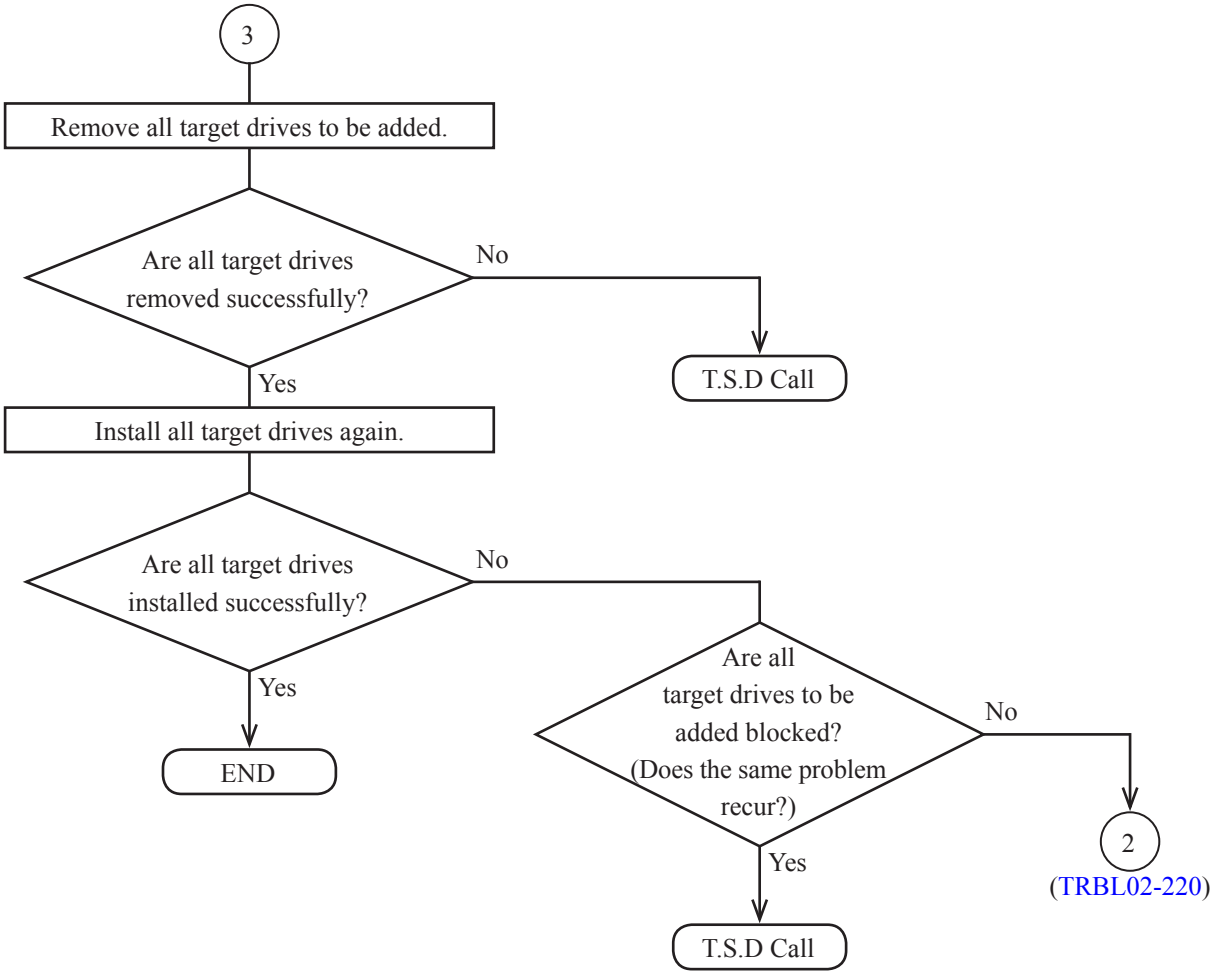
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*1: When the Drive does not recover even if performing dummy replacement three times, replace it with the maintenance part.

*2: Before inserting Drives, check the Drive type names. (Refer to INSTALLATION SECTION "Table 3-20 List of Mountable Drive Model Names".)
When SSB = A7A8 is output, it may be an unsupported Drive. Contact the Technical Support Division.

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2.2.2.2 LED of ENC Turns On after Installing Drive/DB

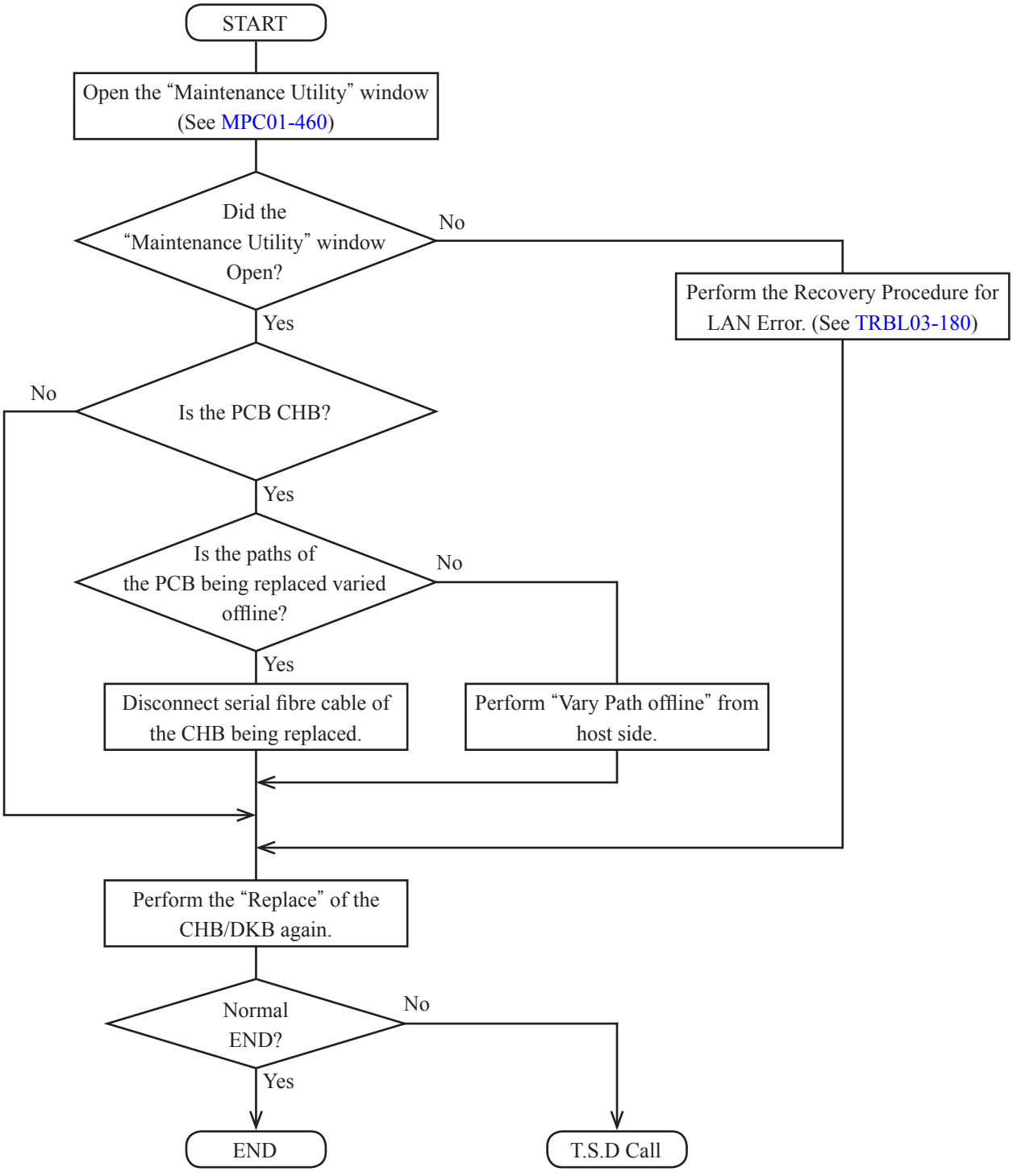
Red LED of ENC may light when DKB is re-installed after the MP failure had been occurred during de-installation of DKB.
In that case, please dummy-replace that ENC.

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2.2.3 Error Recovery Procedure during CHB/DKB replacement

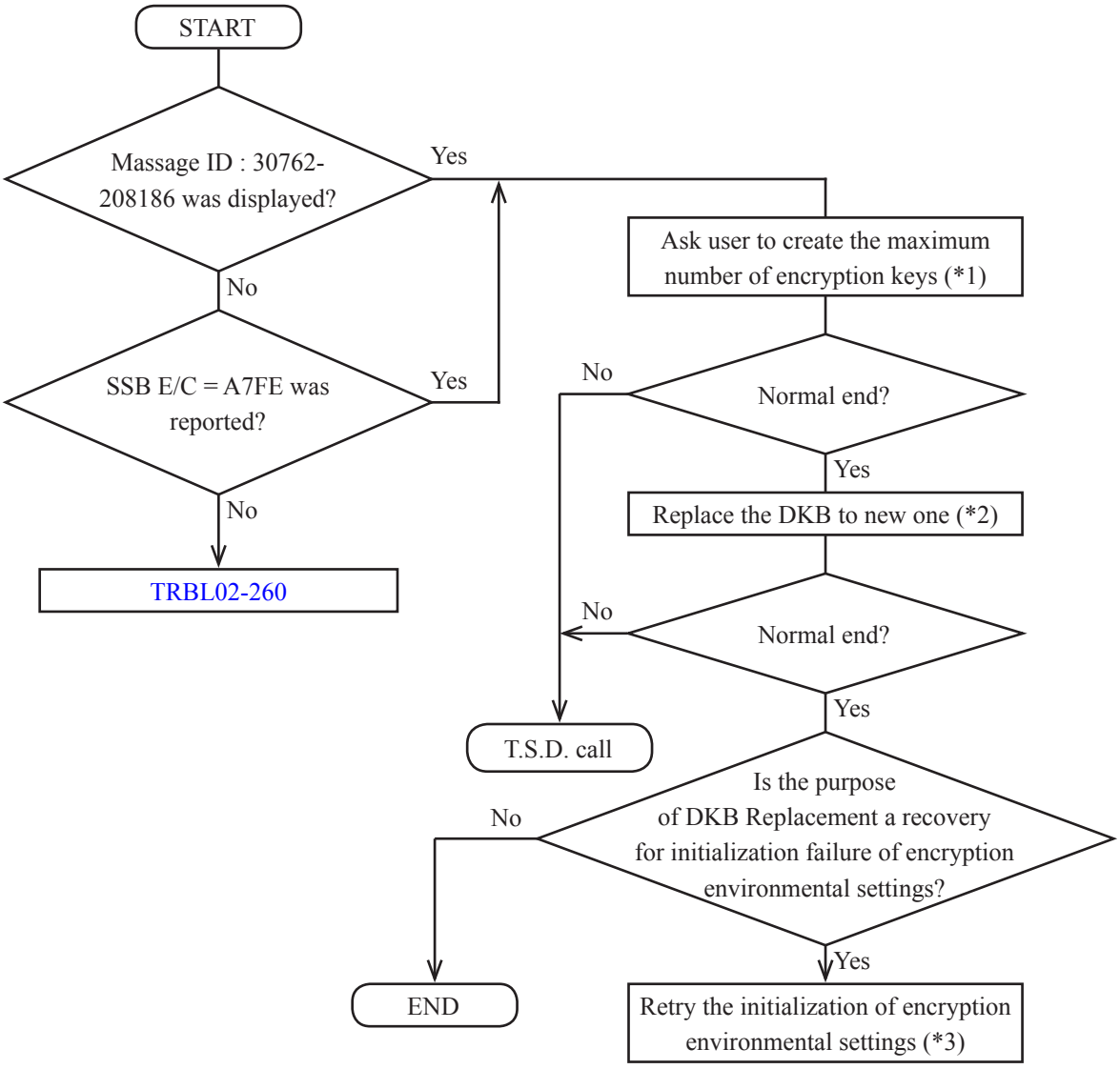
Perform the appropriate recovery procedure according to case 1, 2, 3 or 4.

1. Blocking error occurrence
   When an error message is output while blocking the CHB/DKB, the blockade processing has failed.
   Perform the following recovery processing.



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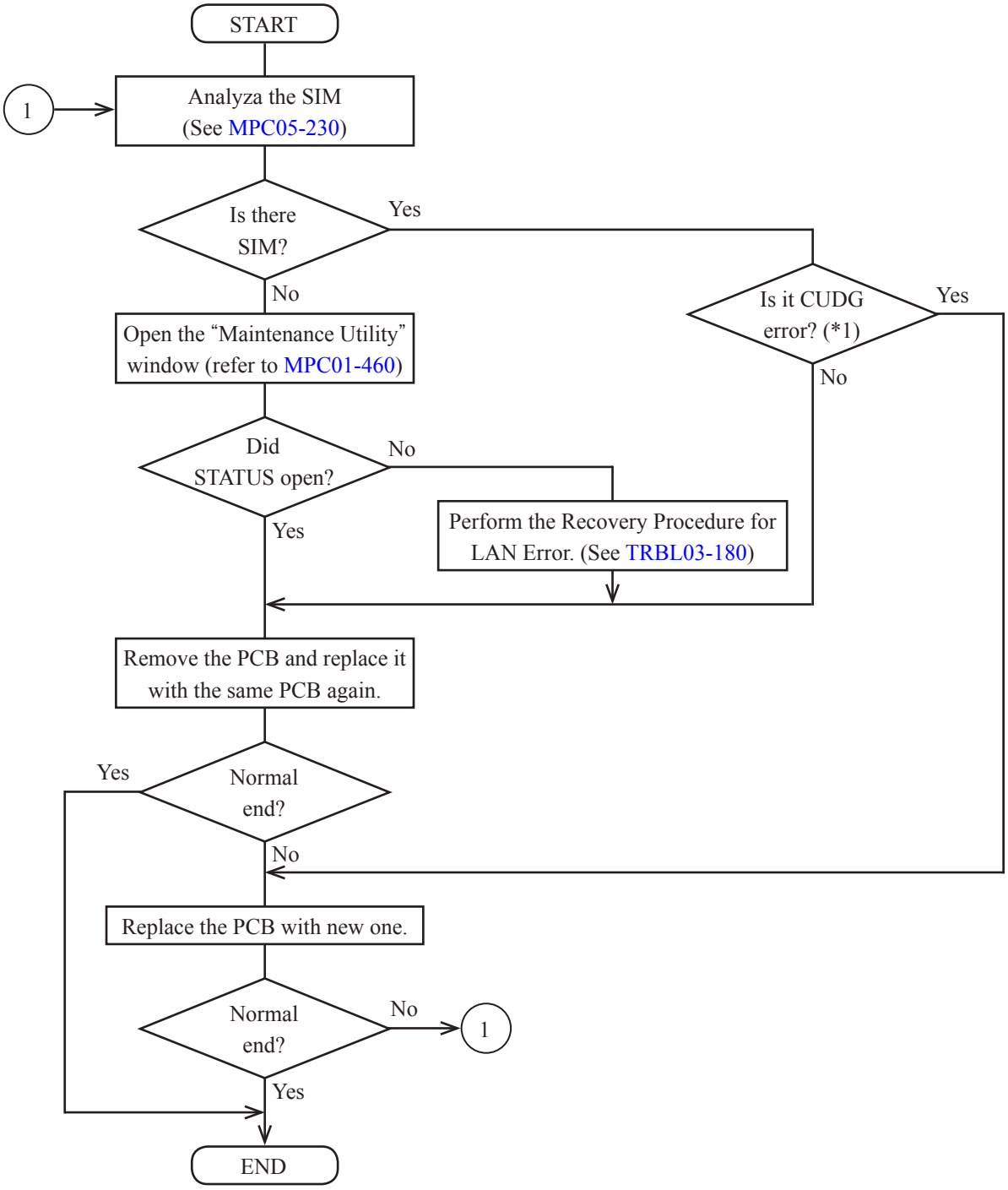
2. Restoring error occurrence
   When an error message is output while blocking the CHB/DKB, the blockade processing has failed. Perform the following recovery processing.



*1: When creating encryption key on the Key Management Server, it may take approximately 20 minutes.
*2: When the DKB replacement was failed with using new part, it is not necessary for you to replace the DKB to new one again.
*3: When you continue to use without initialization, Sparing may fail.

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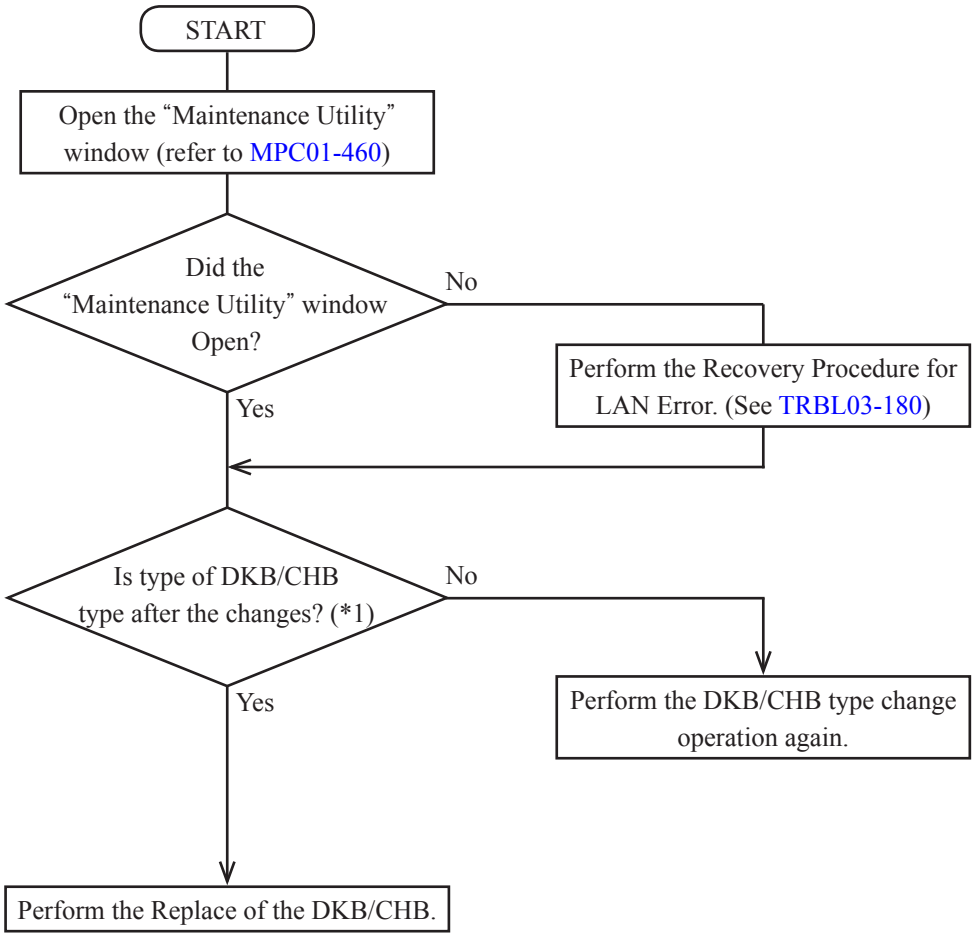
3. In case of failures other than the blockade/recovery processing



*1: Reference code : 760000. (See SIMRC02-20)

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4. Case of the DKB/CHB type change operation

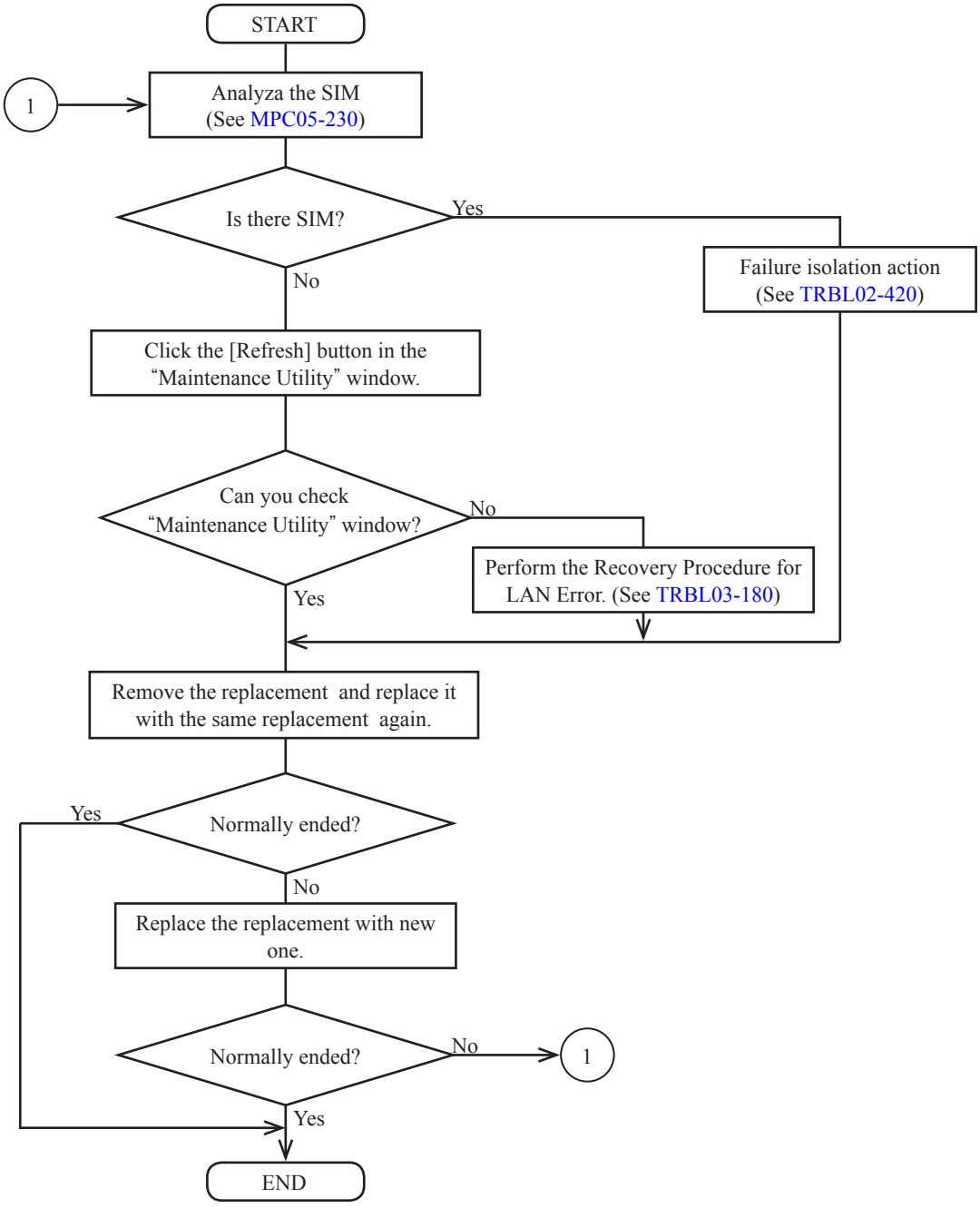


*1: Check the type of CHB by following the procedure below.

1. Select [Maintenance Utility] - [Hardware] - [Other Hardware Maintenance···], and then select [Controller Chassis] in the Maintenance Utility main window.
2. Click the [CHBs] tab in the “Controller Chassis” window, and check that the new CHB type is displayed in the [Type] column of the CHB.

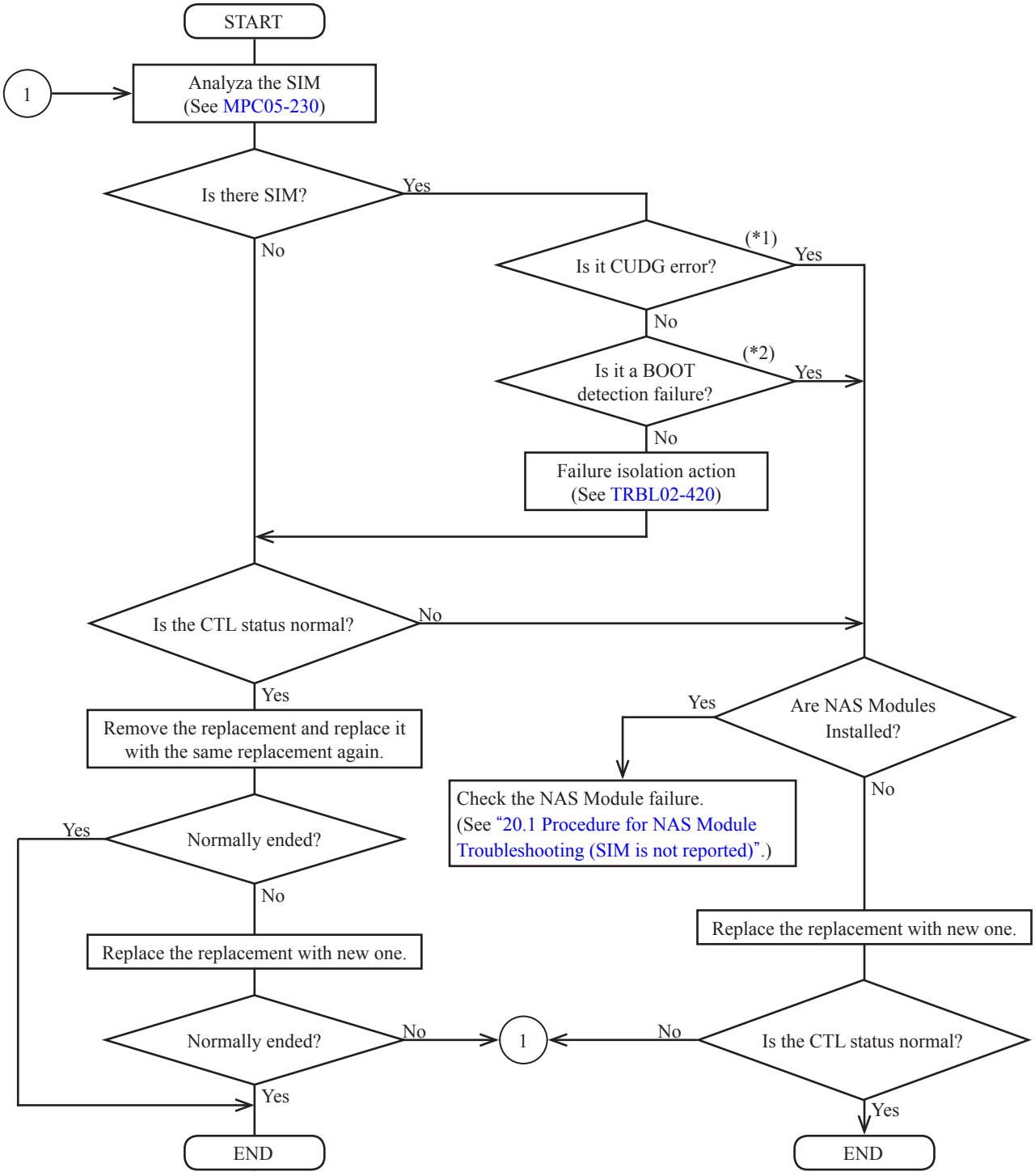
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2.2.4 Error Recovery Procedure during BKM replacement



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2.2.5 Error Recovery Procedure during LANB replacement

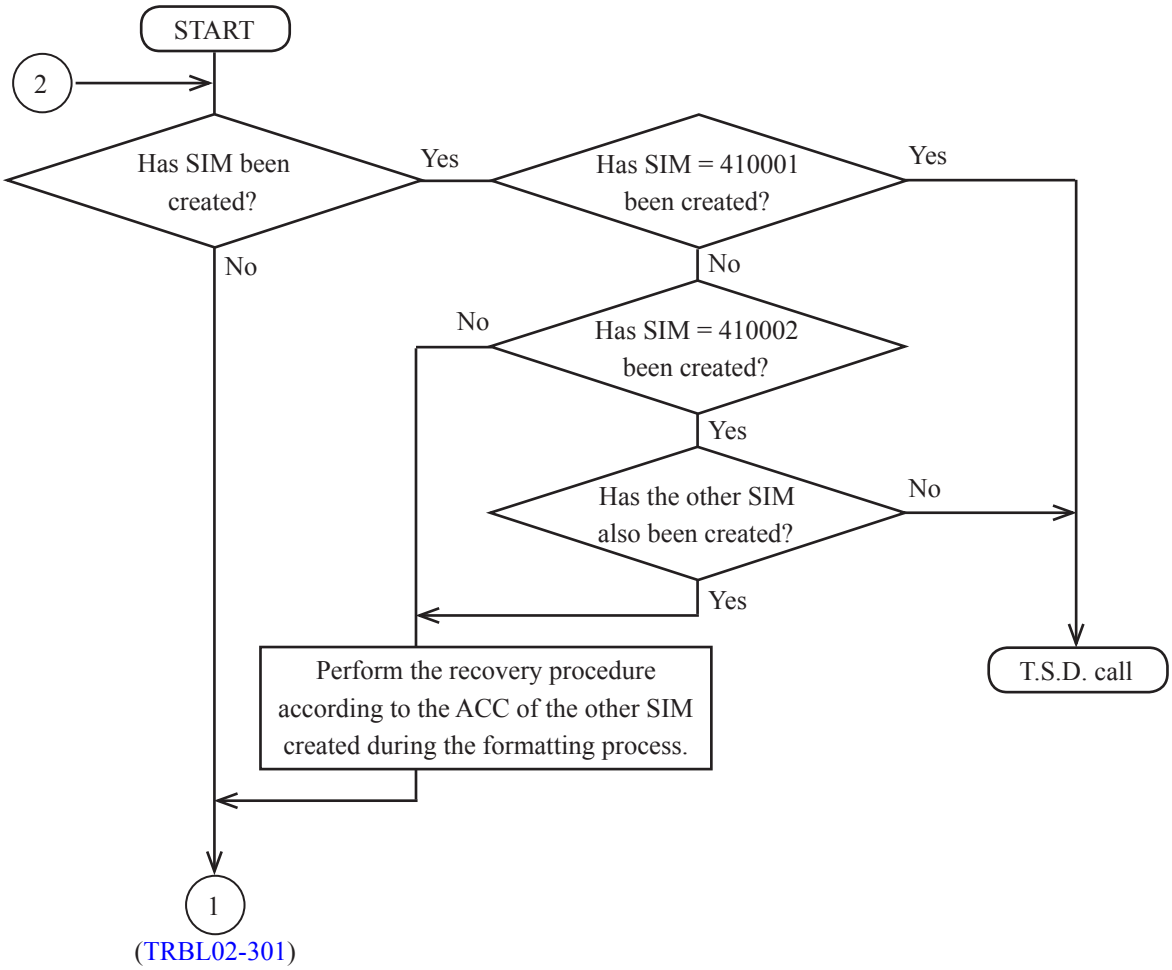


*1: Reference code : 760000. (See SIMRC02-20)
*2: Reference code : 7900xy. (See SIMRC02-320)

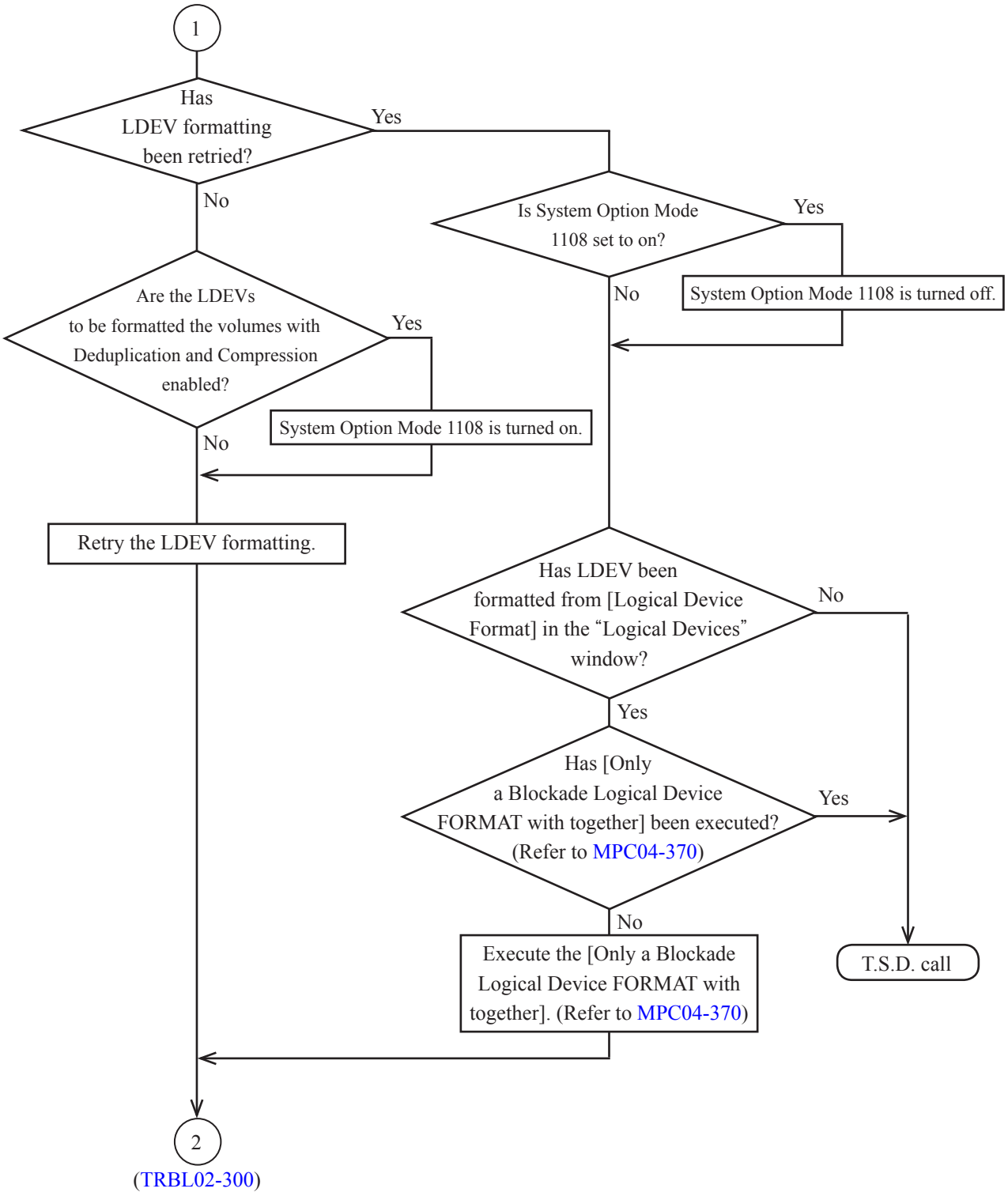
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2.2.6 Recovery procedure when LDEV formatting failed

If “Task Status” of the task formatted in the “Task” window of Storage Navigator is displayed as “Failed” when terminating the LDEV format and if the LDEV formatted in “Logical Device Status” is displayed as “Blocked”, recover the LDEV in the following procedure.



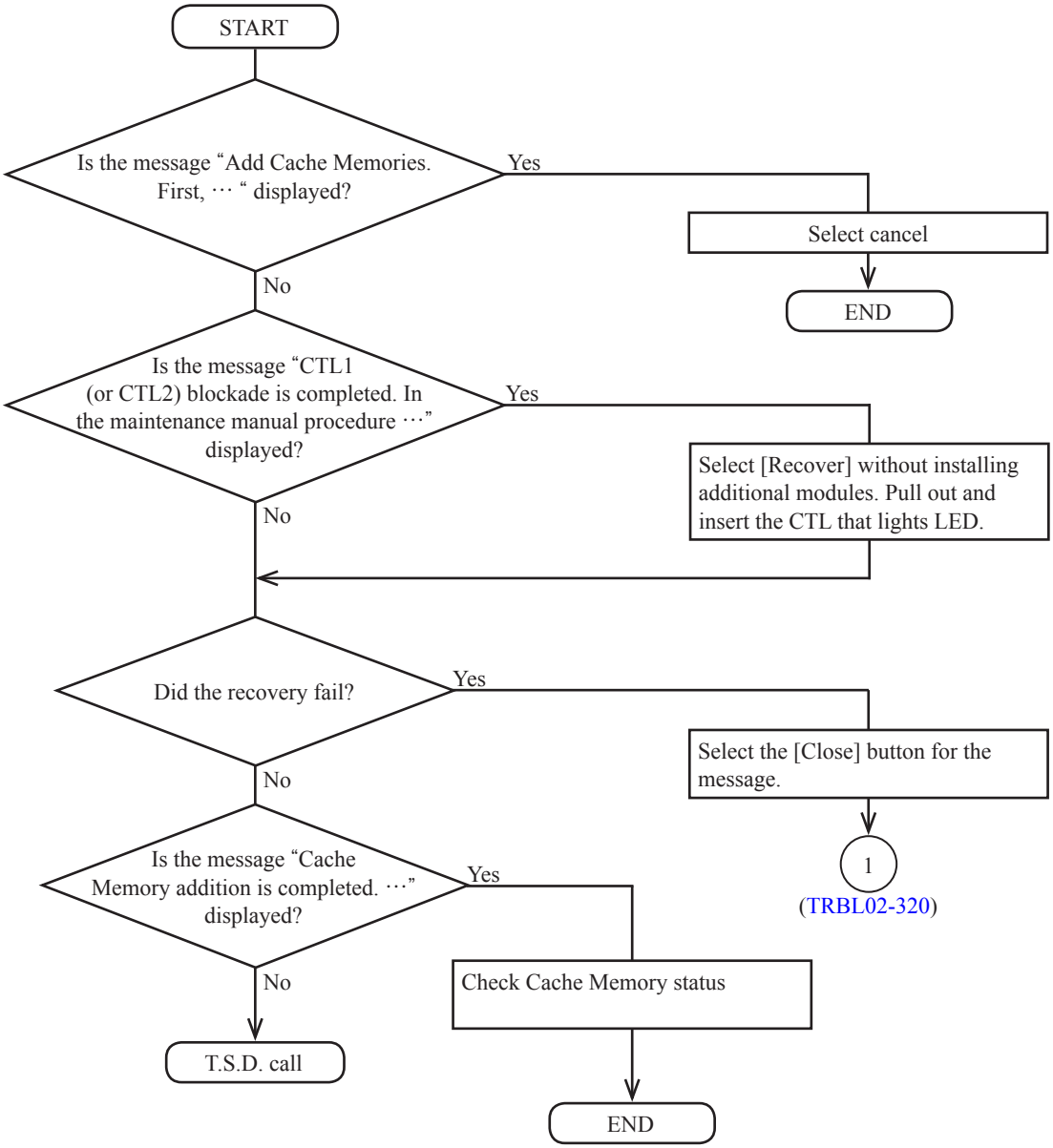
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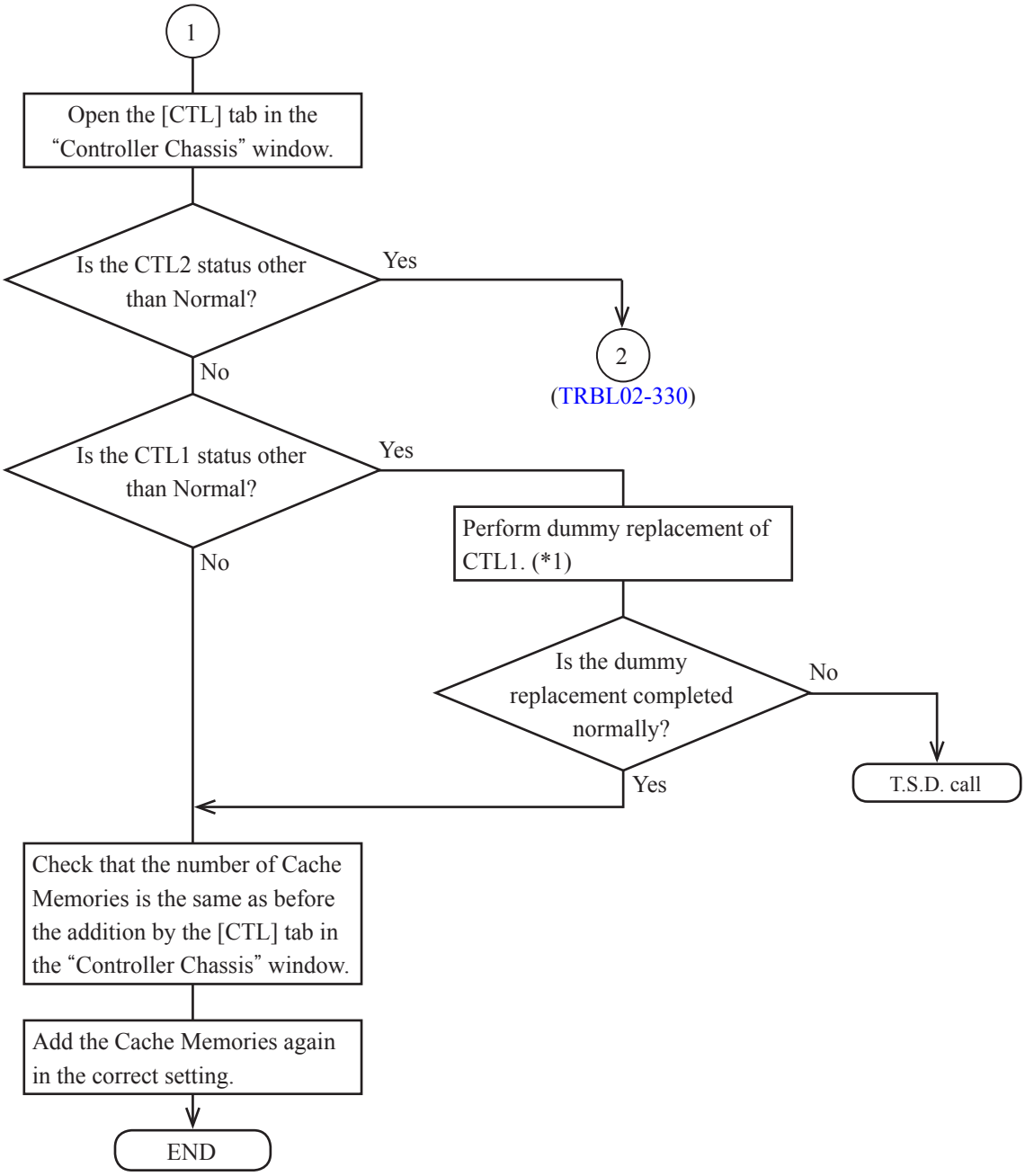
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2.2.7 Recovery from the incorrect setting when adding Cache Memories

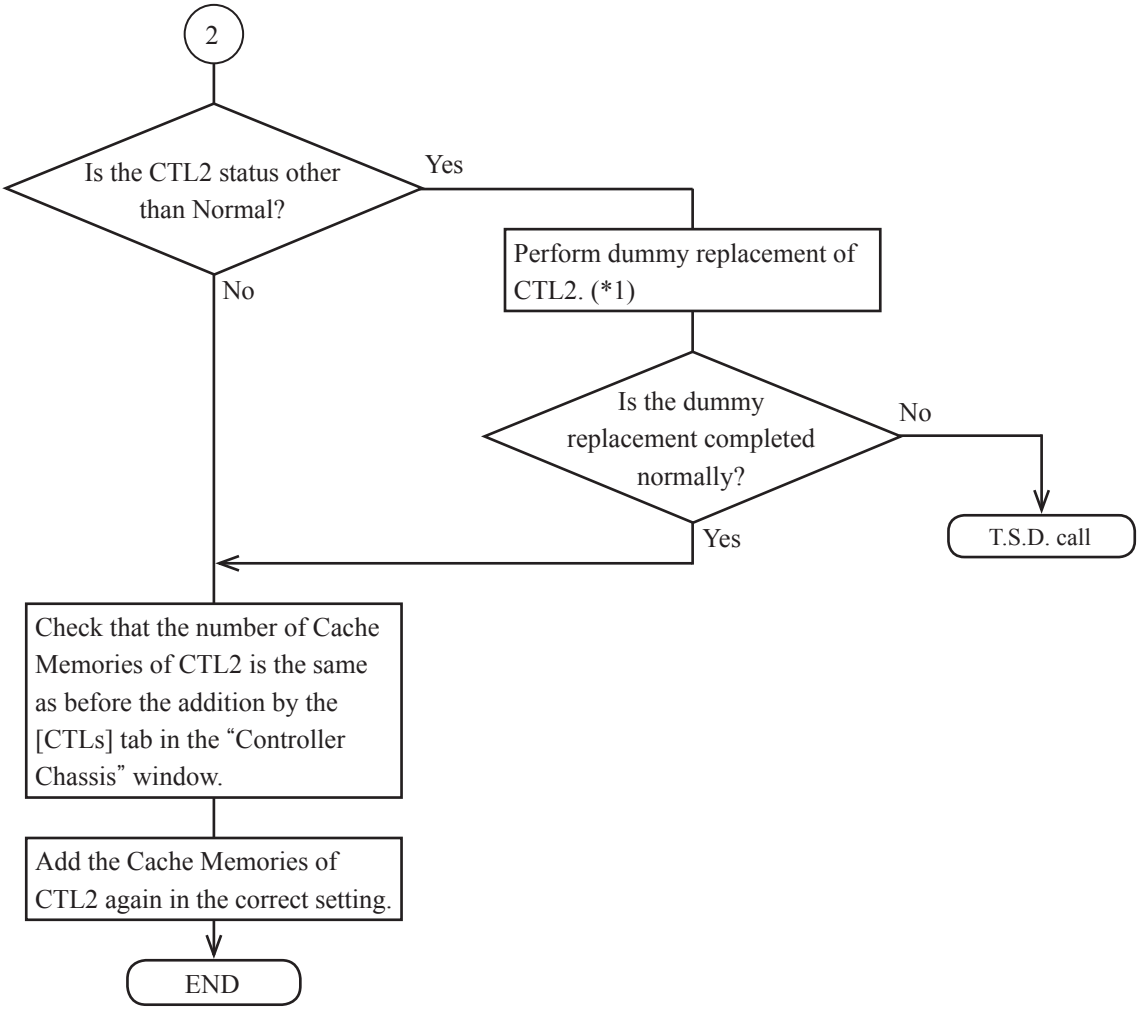
If you find an incorrect setting after the window operation of Cache Memory addition, recover it in accordance with the following procedure.



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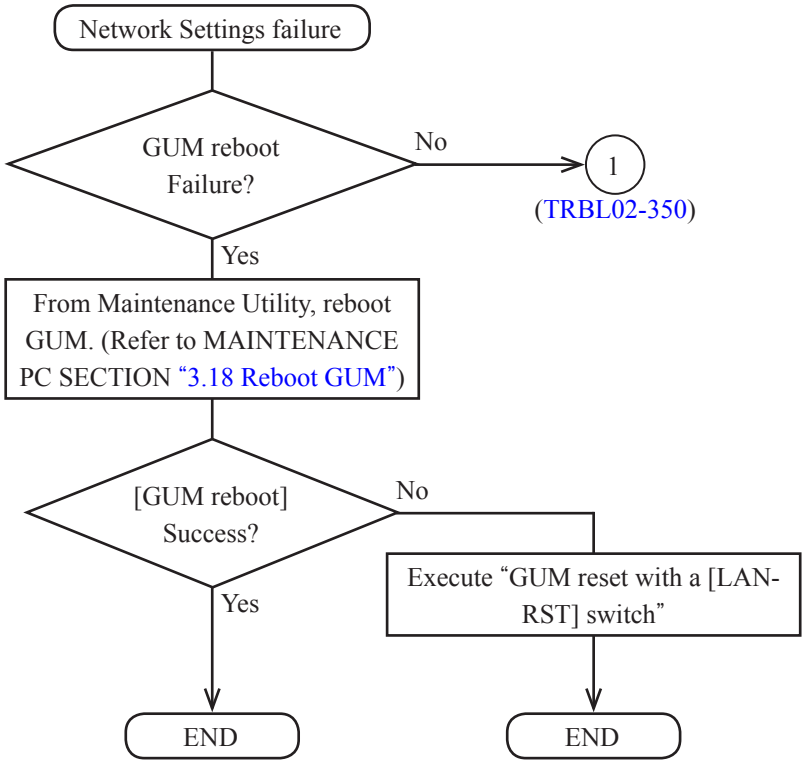
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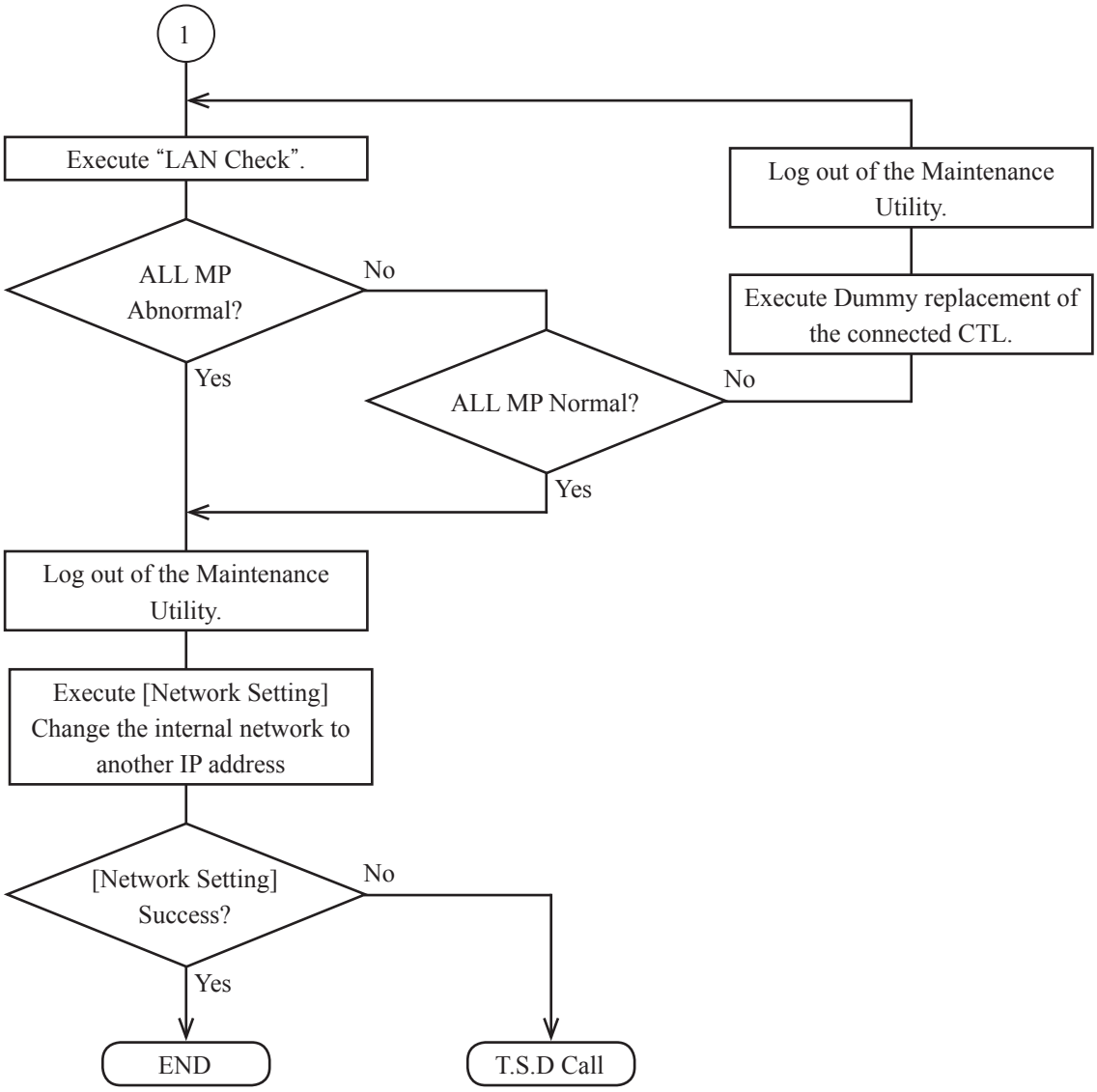
*1: If the added Cache Memories, CFMs and Batteries exist, remove them.

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2.2.8 Recovery Procedure when Change the IP Address failed



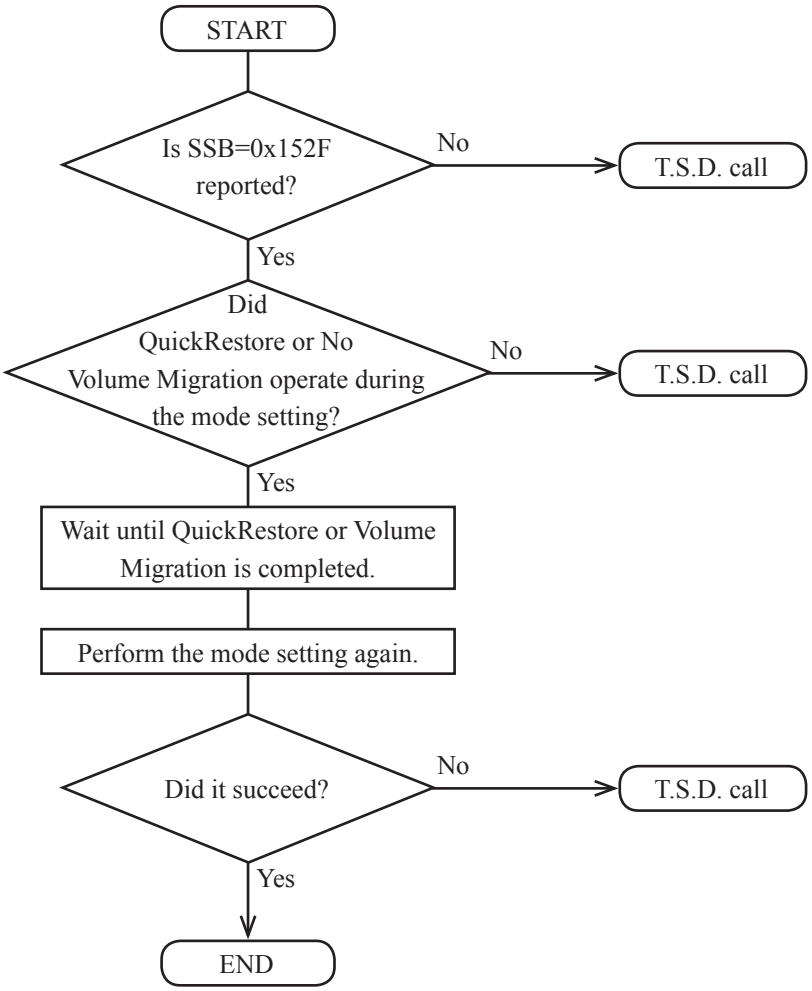
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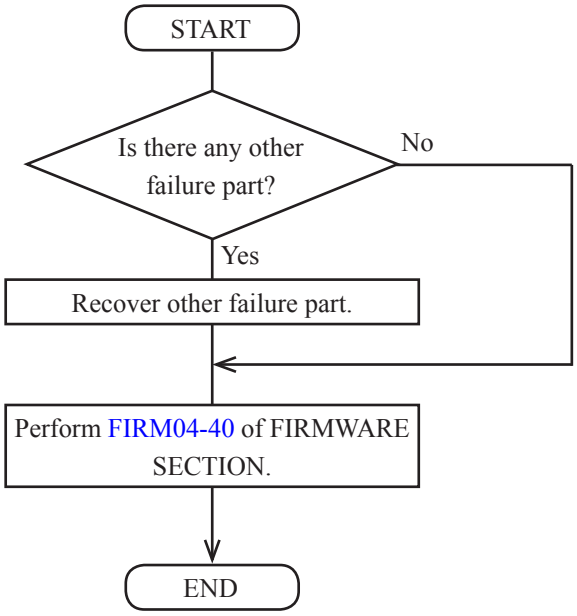
2.2.9 Correspondence at the time of the mode setting failure of System Option

When “Operation was rejected by DKC.” and “Change Configuration was failed.” were displayed during the mode setting execution of System Option, correspond it in the following procedure.



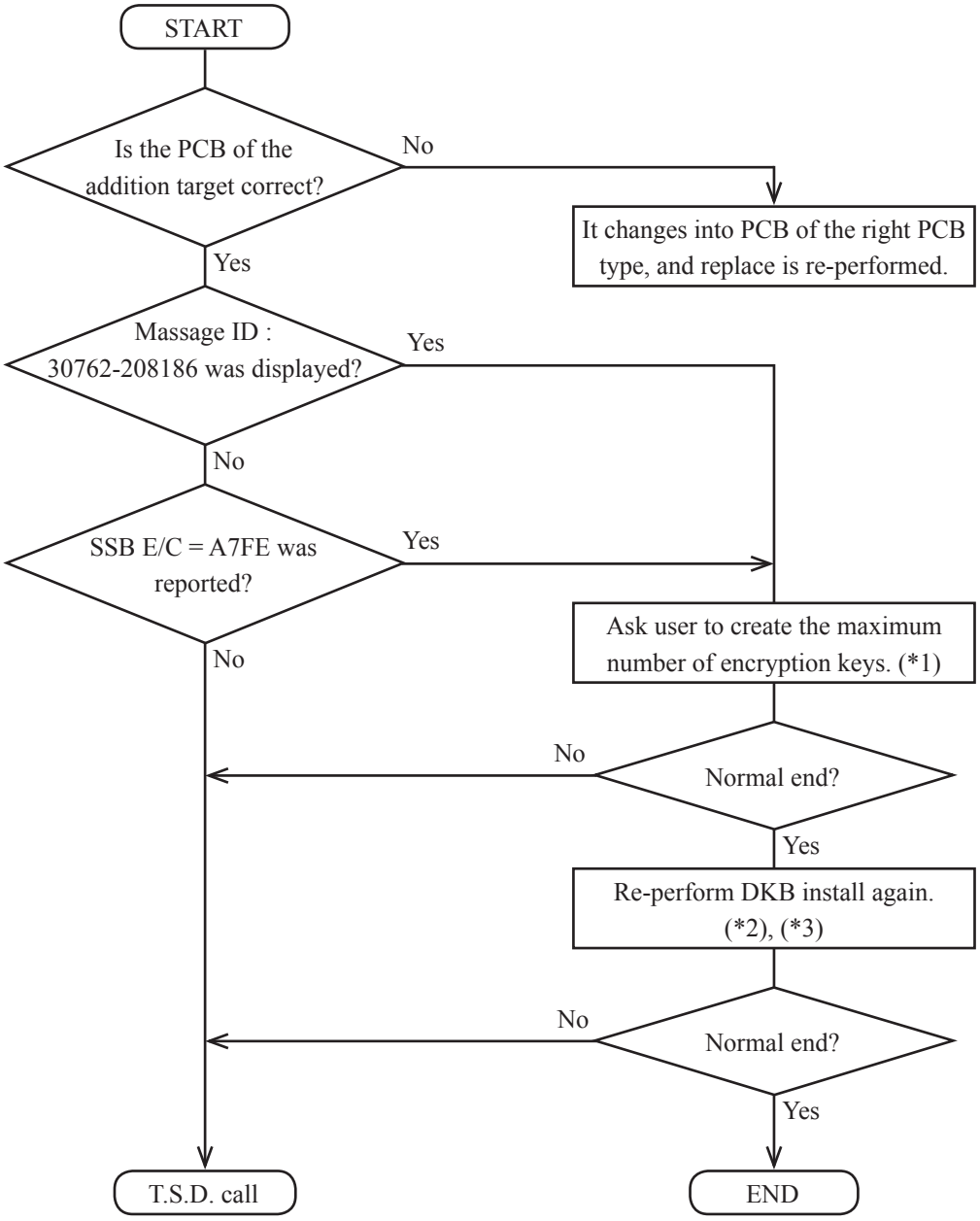
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2.2.10 Firmware version mismatching



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2.2.11 Recovery Procedure for Failure During DKB Installation



*1: When creating encryption key on the Key Management Server, it may take approximately 60 minutes.

*2: When the DKB replacement was failed with using new part, it is not necessary for you to replace the DKB to new one again.

*3: If DKB is blocked, please dummy-replace the DKB.

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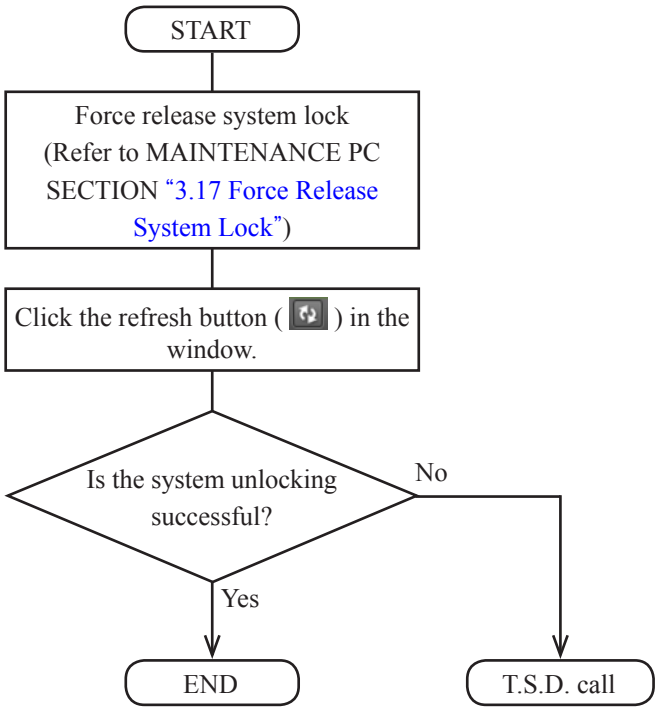
2.2.12 Recovery Procedure for the System Lock during a Setting Change

When performing the following operation while working on a setting change by Storage Navigator or others, the system is locked and inoperable.

- When clocking the [×] button in the upper right of the window of the operating Web browser and closing the window
- When restarting the client PC which uses the Web browser

Perform the recovery in the following procedure.

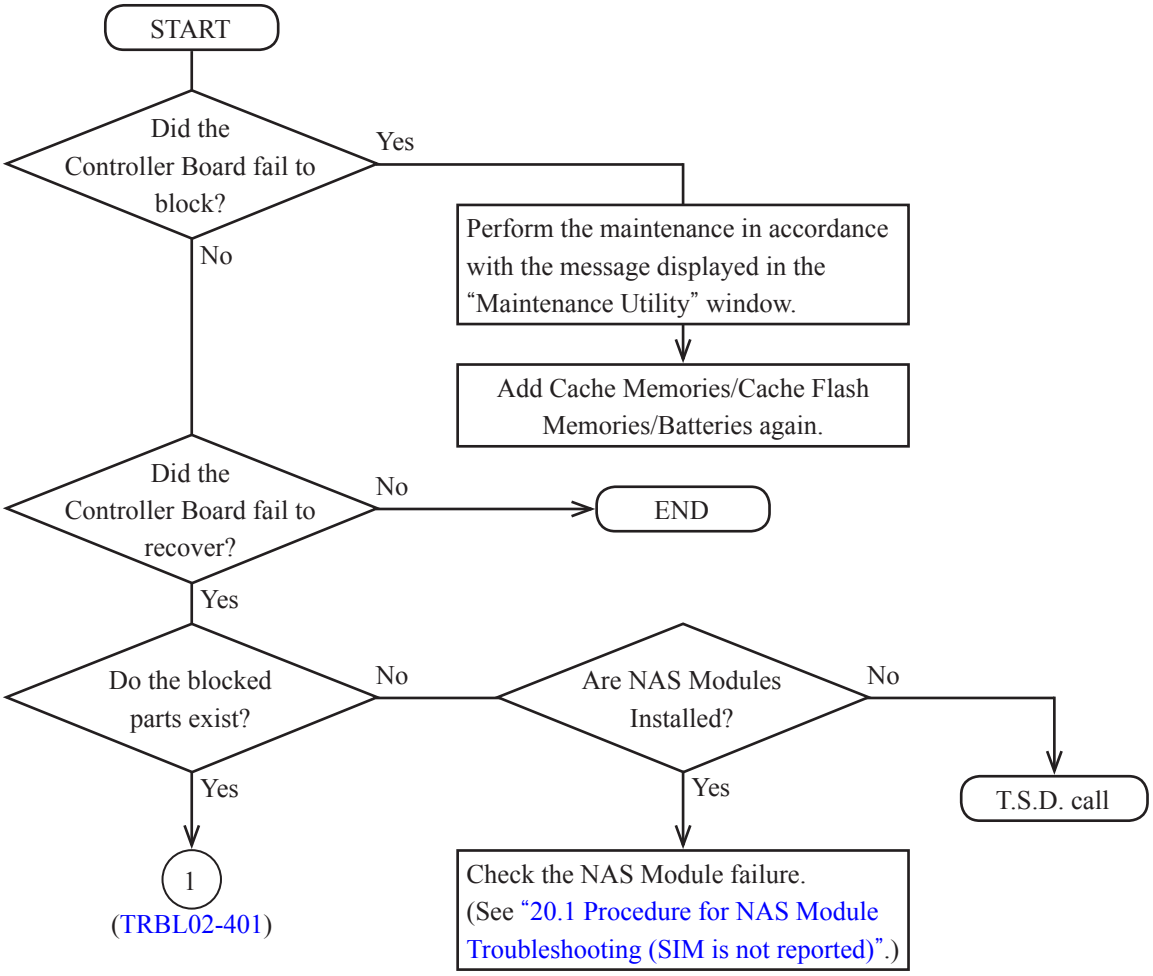
NOTE: If unlocking the system carelessly, it may become an unexpected status. Use this procedure only when it is absolutely necessary.



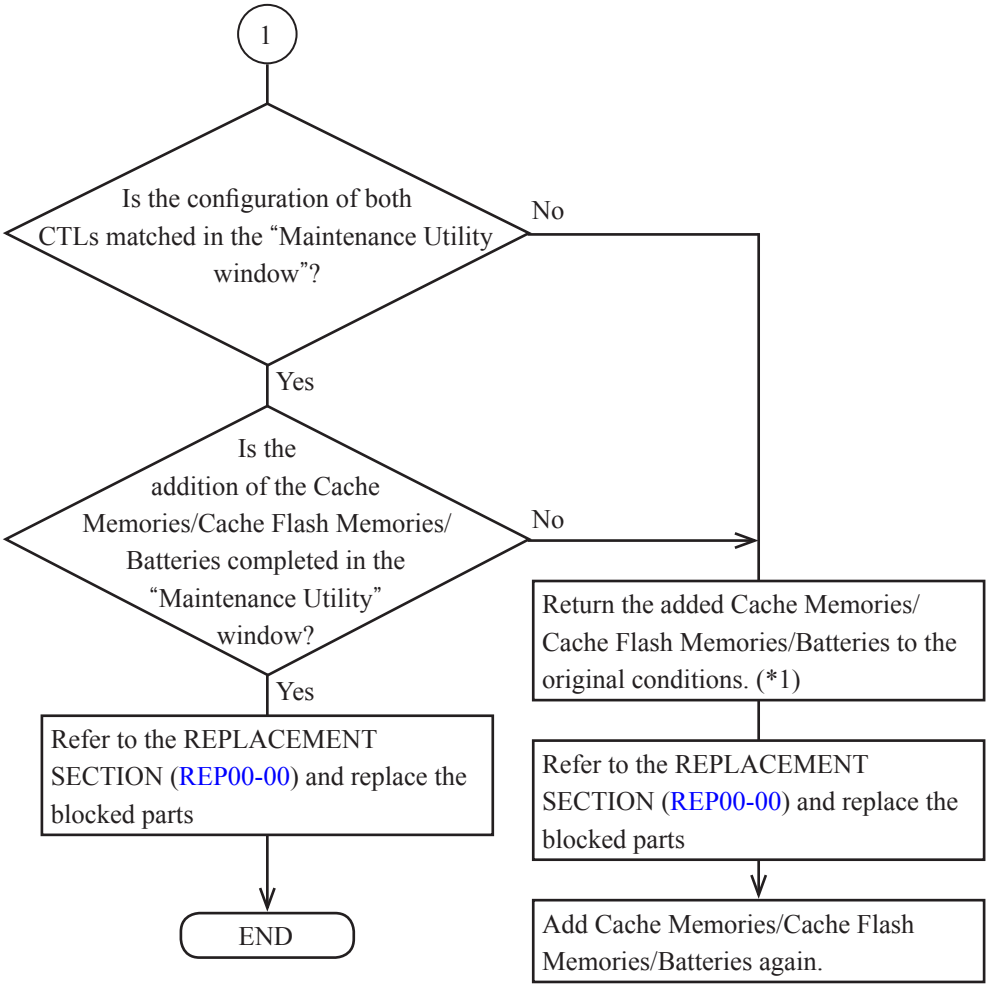
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2.2.13 Error Recovery When Adding Cache Memories/Cache Flash Memories/Batteries

Recover the failures in the following procedure when adding Cache Memories/Cache Flash Memories/ Batteries.



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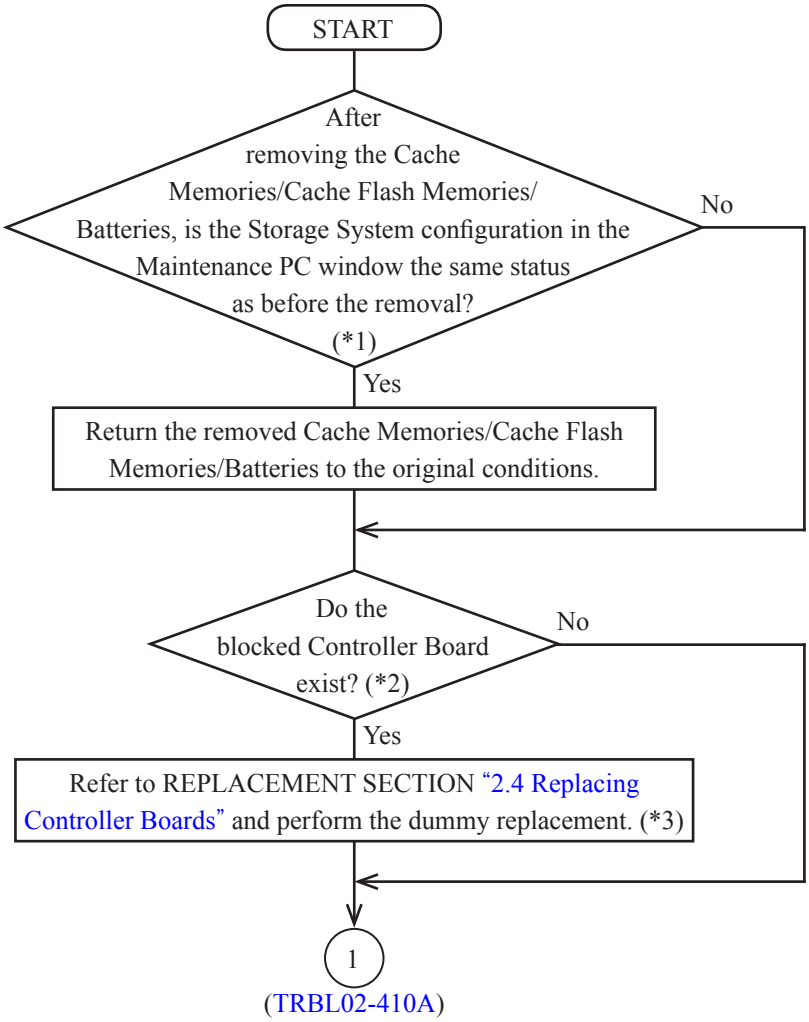


*1: Select [Controller Chassis] in the "Maintenance Utility" window and click the [CTL] tab to check the Cache Memory status.

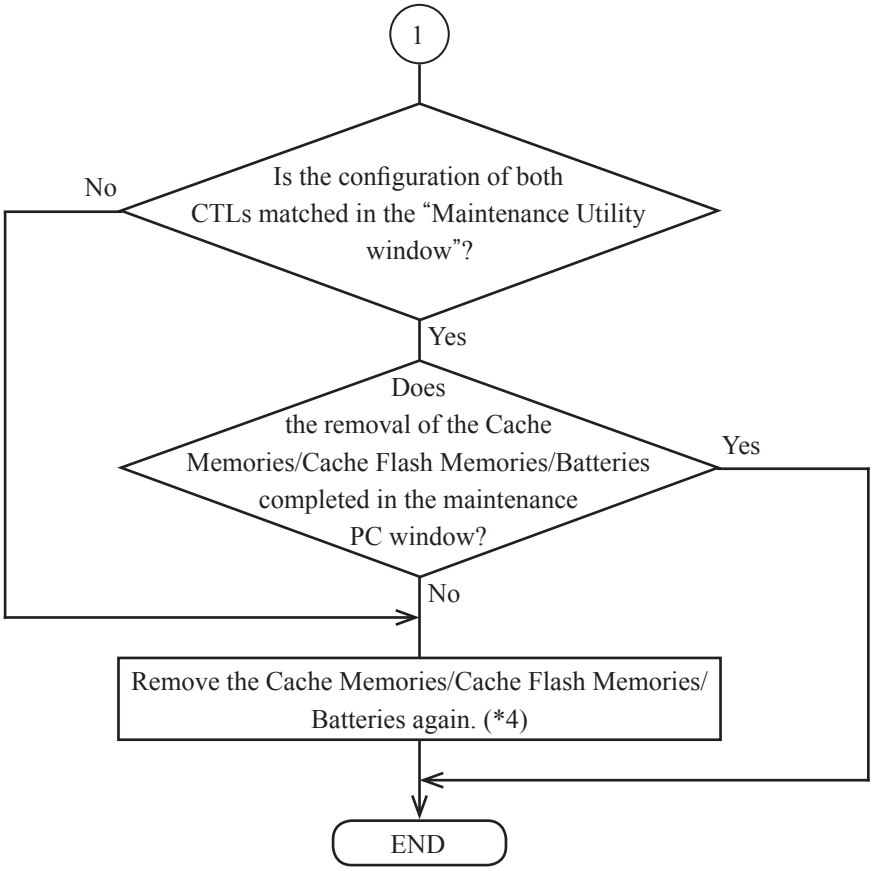
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2.2.14 Error Recovery When Removing Cache Memories/Cache Flash Memories/Batteries

Recover the failures in the following procedure when removing Cache Memories/Cache Flash Memories/ Batteries.



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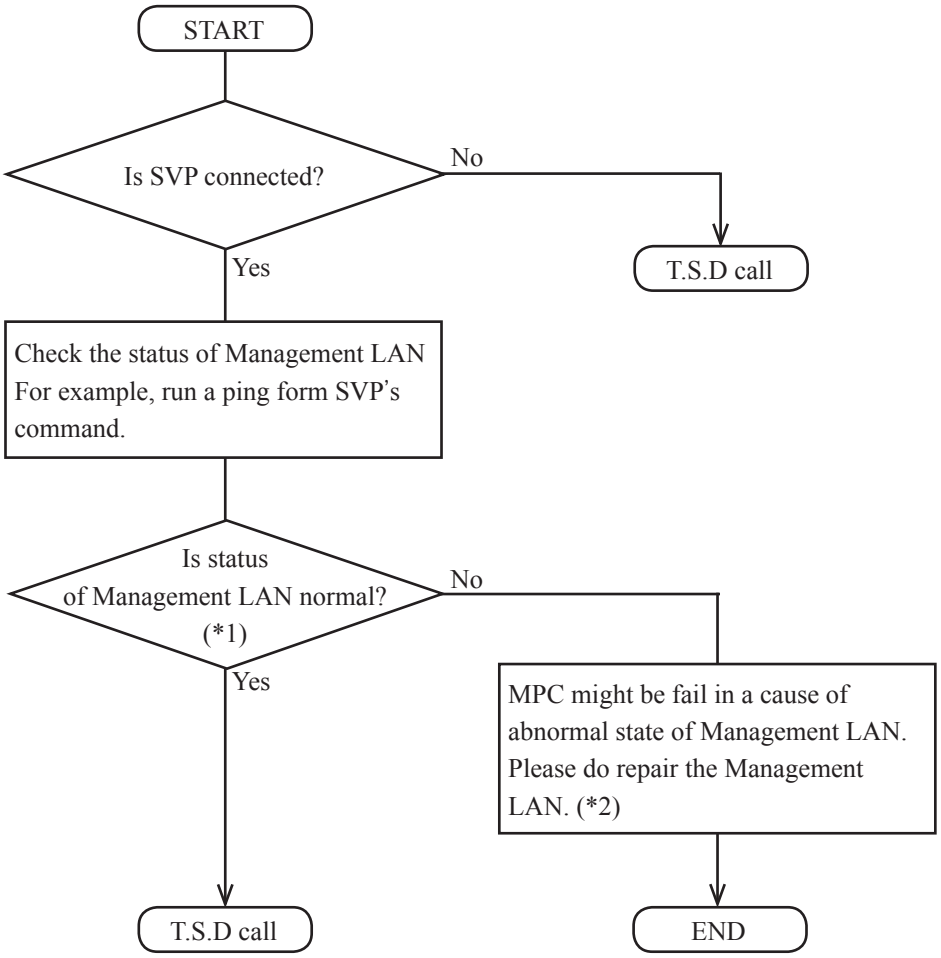


*1: Select [Controller Chassis] in the “Maintenance Utility” window and click the [CTL] tab to check the Cache Memory status.
*2: Check the Controller Board status in the same window as *1.
*3: If the operation is suspended due to reboot of the maintenance PC, perform the dummy replacement of both Controller Boards.
*4: The removal of Controller 1 may be completed depending on the detail of the removal failure. In this case, if removing it again, Controller 2 starts the processing.

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2.2.15 Transmission Failure and Timeout Occur Repeatedly After MPC Reboot

Though maintenance LAN and Maintenance PC Status are normal, Maintenance PC fail in processing execution repeated. In this case, Maintenance PC might fail in a cause of abnormal state of management LAN.



*1: Please check whether ping isn't slow in response.
*2: Ask the customer to perform the recovery operation by the User Guide.

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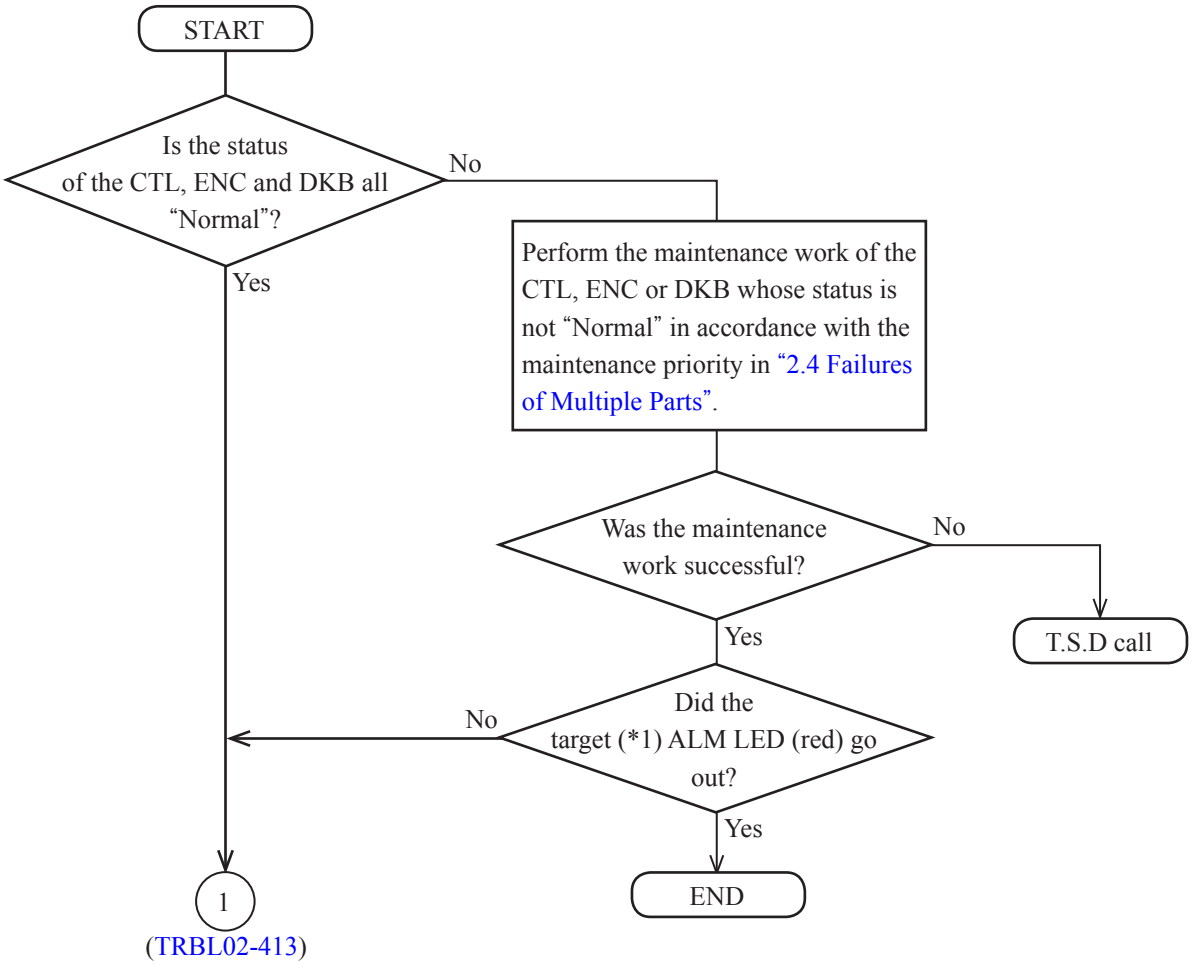
2.2.16 Recovery Procedure when ALM LED (red) is not Turned OFF

Perform this recovery procedure in the following cases.

- When Drive Status is other than “Blocked” and “Failed”
- When PS Status or ENC Status is “Normal”

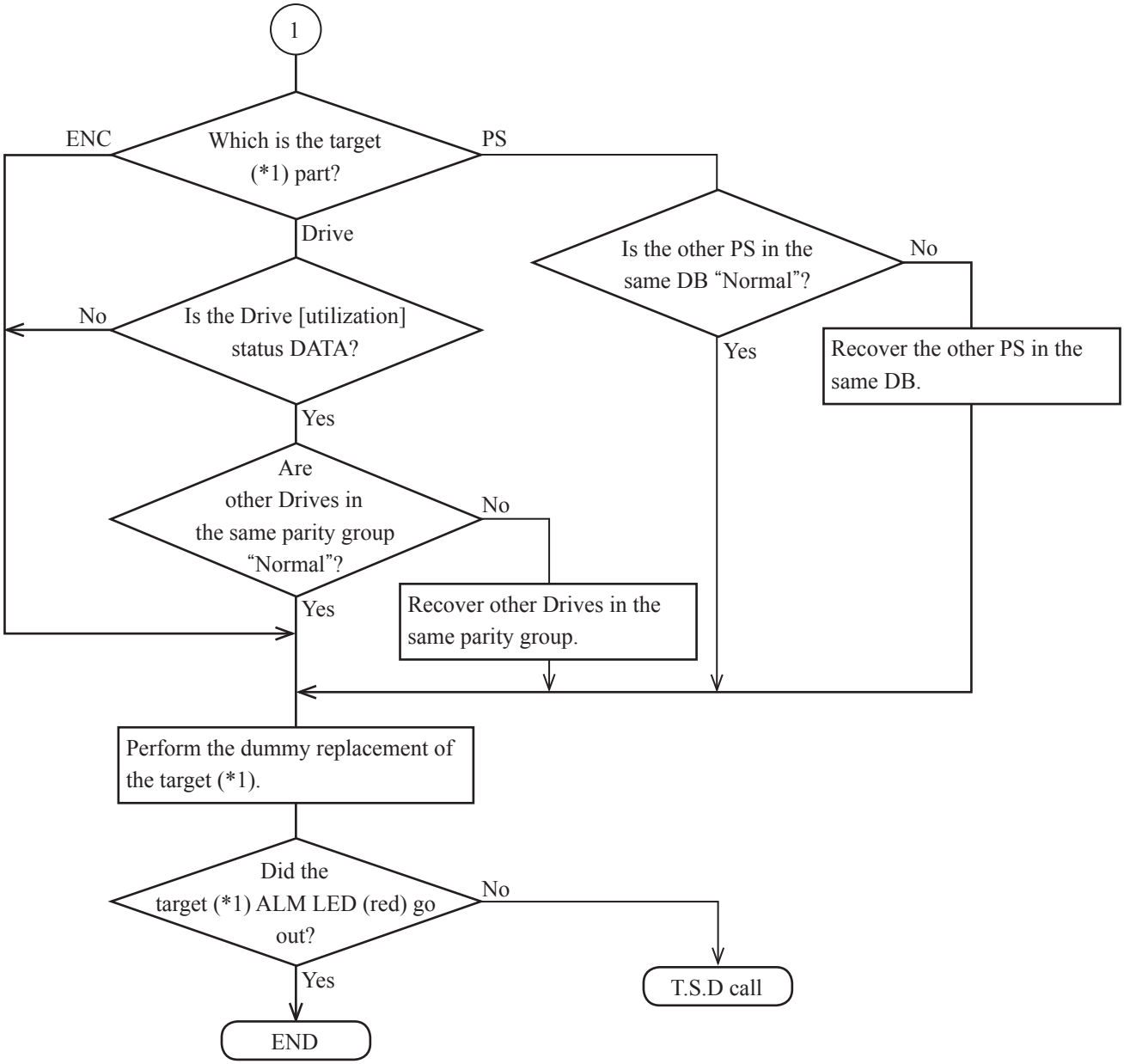
The ALM LED (red) on the Drive, PS or ENC might fail to go out due to the CTL, ENC, DKB or SAS PORT blockade.

Turn off the LED in accordance with the following procedure.
Note that the PS described here is the DBS/DBL/DB60/DBF power supply (DBPS).



*1: The target means a Drive in the status of other than “Blocked” and “Failed” and whose ALM LED (red) lights up, or a PS or ENC whose ALM LED (red) lights up when the PS status or the ENC status is “Normal”.

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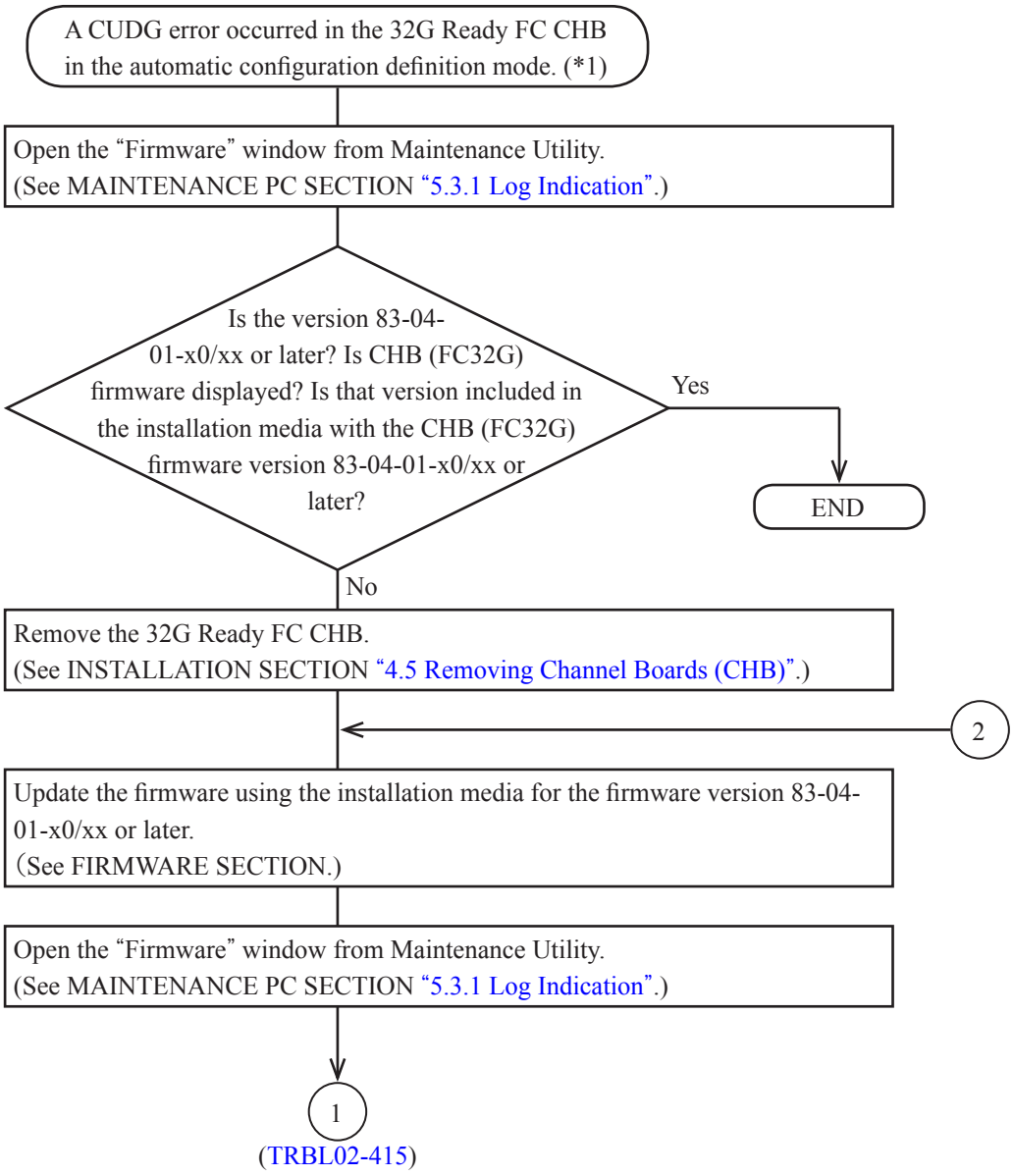


*1: The target means a Drive in the status of other than "Blocked" and "Failed" and whose ALM LED (red) lights up, or a PS or ENC whose ALM LED (red) lights up when the PS status or the ENC status is "Normal".

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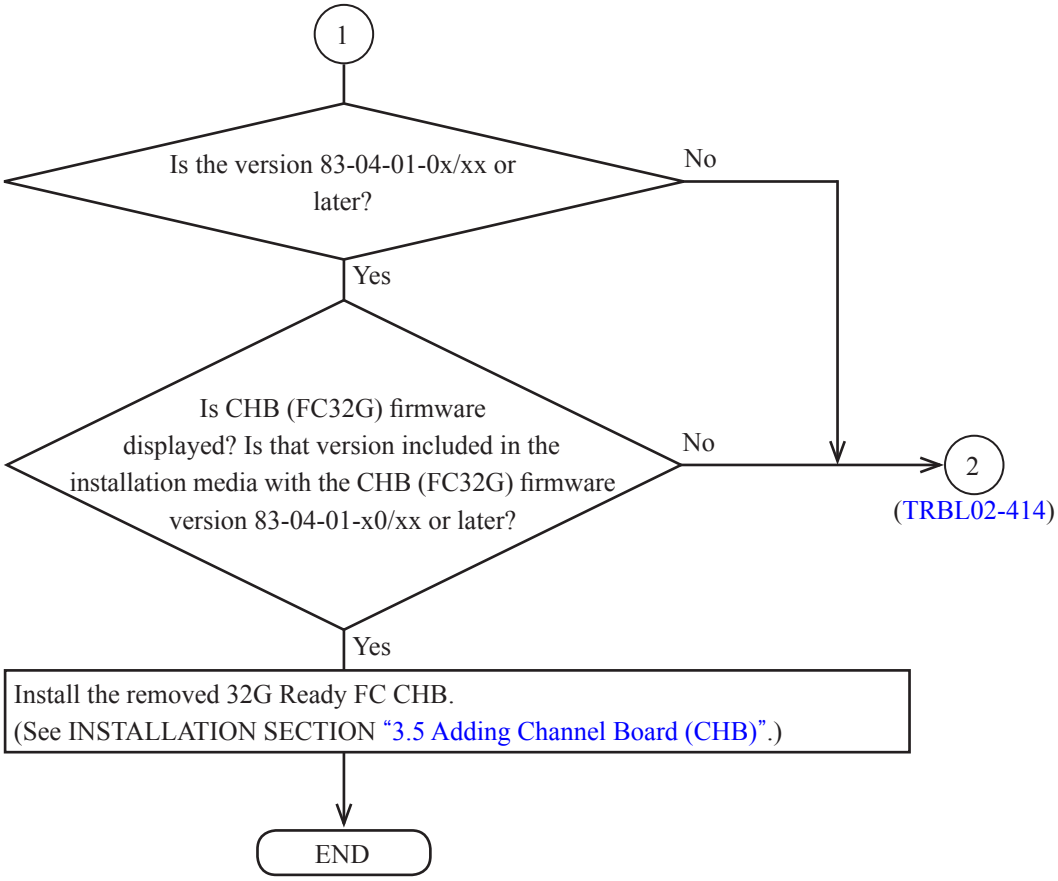
2.2.17 Recovery Procedure when 32G Ready FC CHB is Newly Installed in the Automatic Configuration Definition Mode

When adding 32G Ready 4Port FC CHB is performed using the automatic configuration definition mode without CHB (FC32G) firmware installed, a CUDG error occurs and the CHB is blocked.
Install the firmware by following the procedure below and add the 32G Ready 4Port CHB.
When the CHB is not recovered even if the firmware installation is properly complete, replace the part according to the CUDG3 troubleshooting.



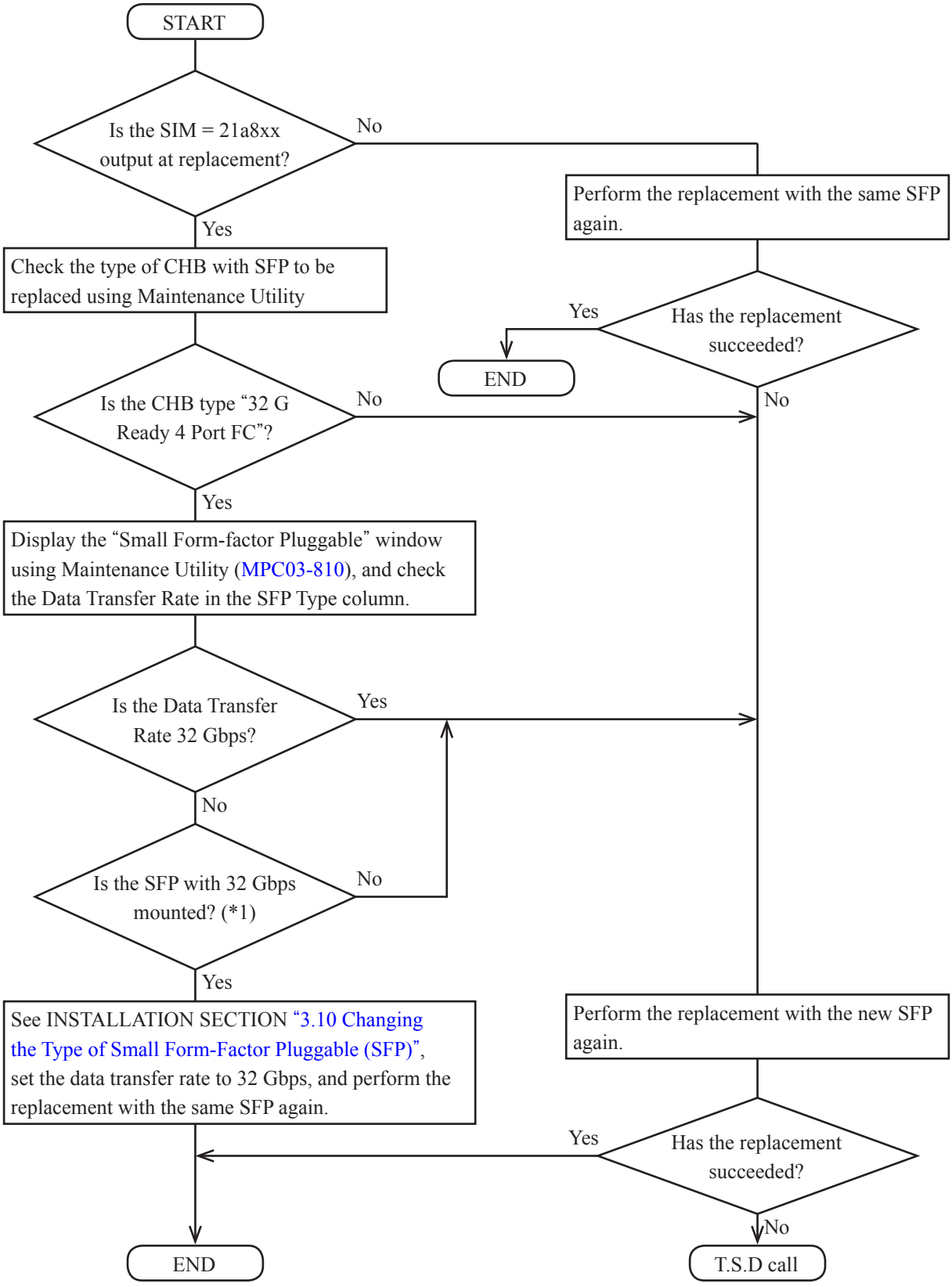
*1: See DIAGNOSIS SECTION "5.1.1 CUDG3 Troubleshooting".

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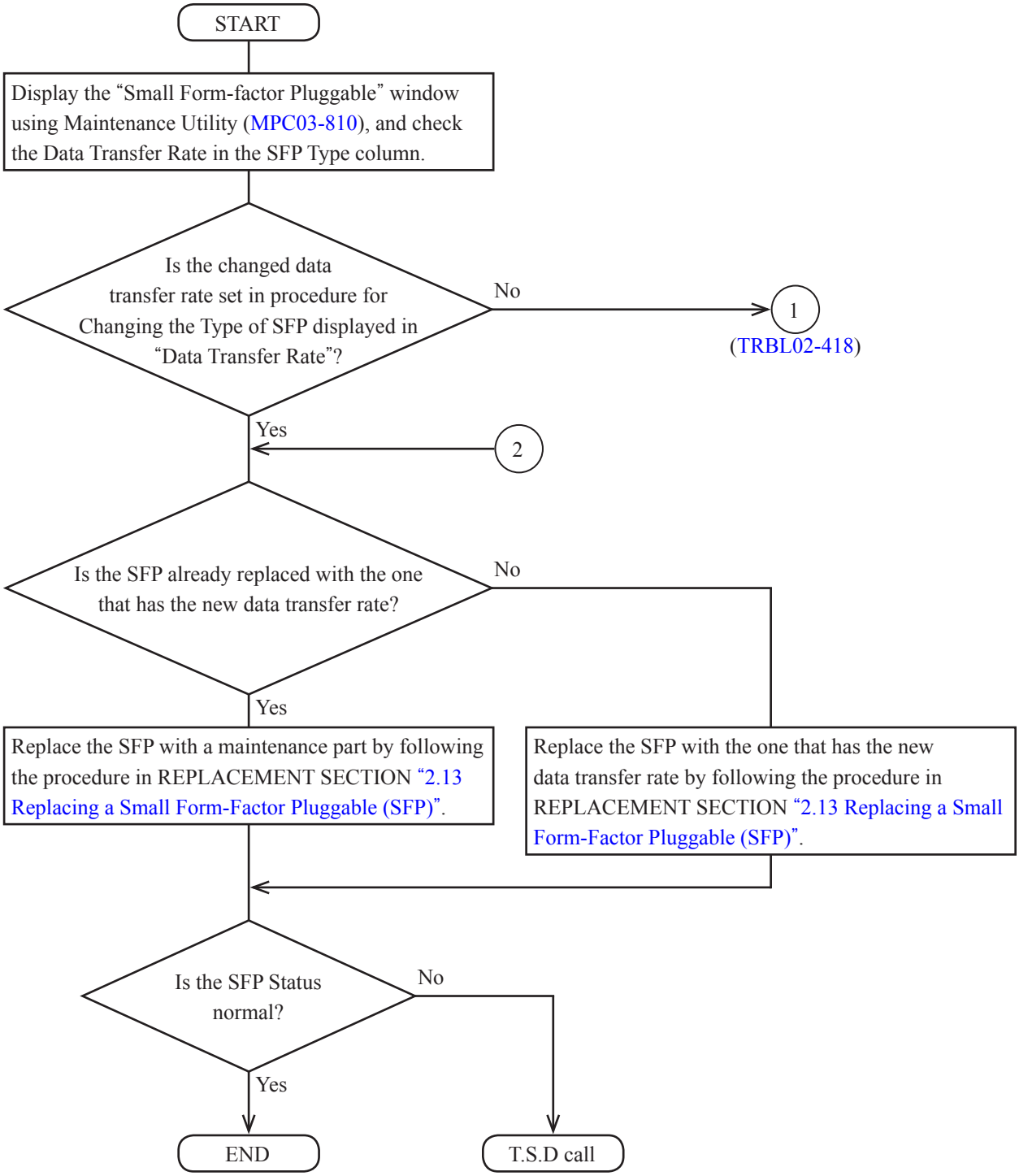
2.2.18 Recovery Procedure at SFP Replacement



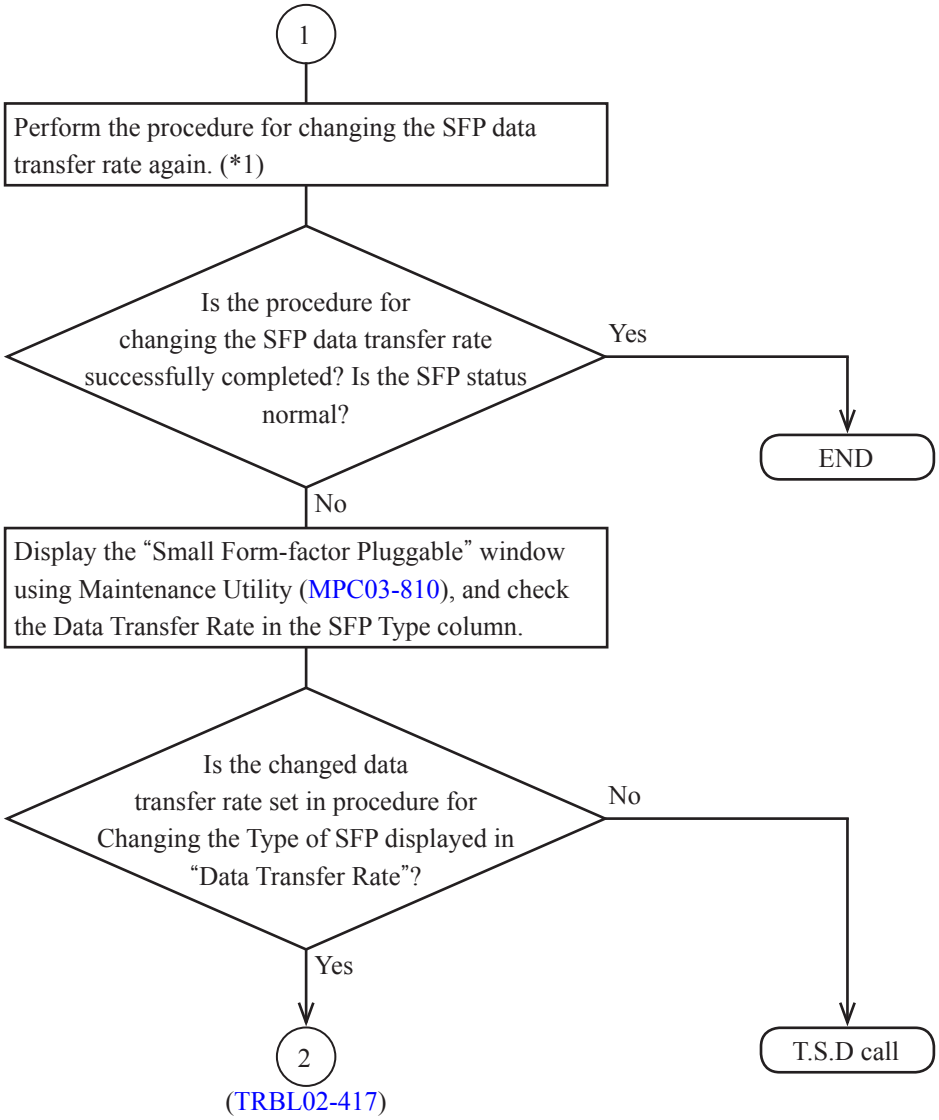
*1: Check the record at the time of delivery, or remove the SFP and check the appearance. See INST03-10-60, INST03-10-130, INST03-10-200.

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2.2.19 Recovery Procedure when Procedure for Small Form-Factor Pluggable (SFP) Data Transfer Rate Change fails



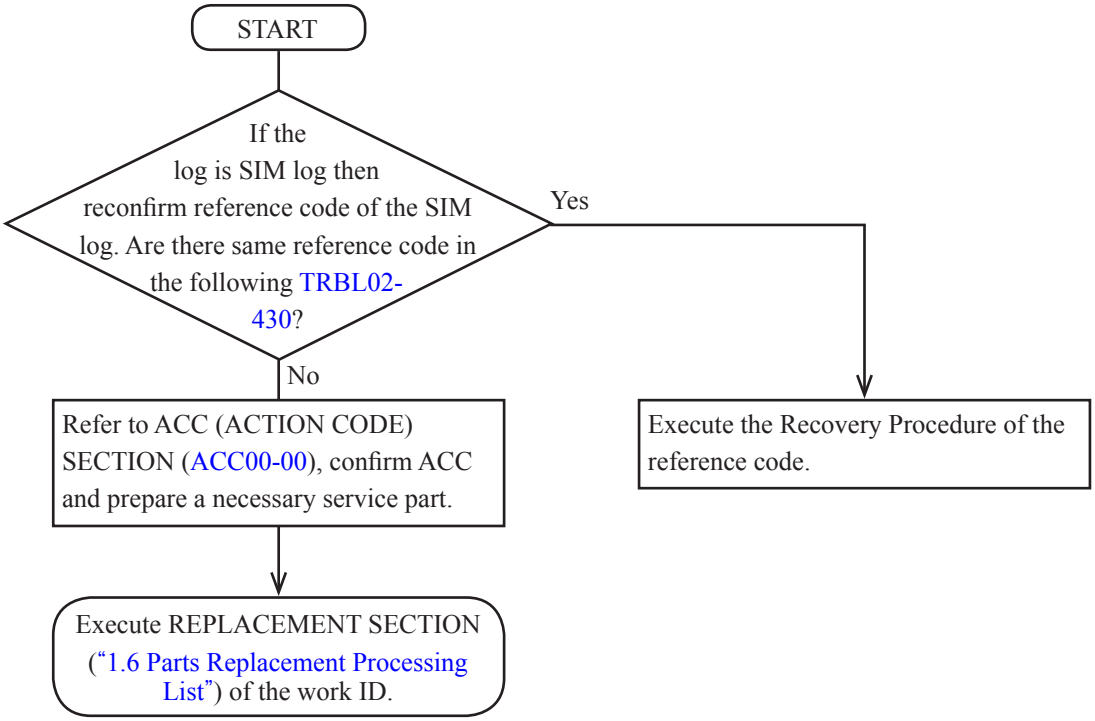
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*1: When an SFP with the changed data transfer rate is already inserted, perform dummy replacement (Pull out the SFP and then insert it into the same port).

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2.3 Analyze by SIM Log



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Reference Code	Recovery Procedure
21a8xx, 21aaxx	3.1 SFP Module Failure Detection (SIM = 21a8xx, 21aaxx)
410001, 410002	3.2 Response to a FLASH DRIVE/ENCRYPTION PG LDEV FORMAT Failure (SIM = 41000x)
cf12xx, ac50xx	3.3 Recovery when power off or SAS PORT failure occurred (SIM = cf12xx, ac50xx)
7ffa00	3.4 Action When Time Synchronization Failed (SIM = 7ffa00)
3a0xyy	3.5 Recovery Procedure for LDEV Blockade due to Firmware Error (SIM = 3a0xyy)
50exxx	3.6 Recovery Procedure When FMD No Charging Occurred (SIM = 50exxx)
fe0000	3.7 Recovery procedure of SIM occurrence during battery charge (SIM = fe0000)
fe01xx, fe02xx	3.8 Action when Cache Write Through by battery factor is detected (SIM = fe0100, fe0200)
df6xxx, df7xxx, df8xxx, df9xxx	3.9 Isolation and Recovery Procedures for Common SAS Error (SIM = df6xxx, df7xxx, df8xxx, df9xxx)
7d01xx, 7d02xx	3.10 Recovery Procedure for LAN Error (SIM = 7d01xx,7d02xx)
fff50x	3.11 Recovery Procedure for the Failure on Both Sides of CACHE at the Time of Starting (SIM = fff50x)
ffe30x, ffe800	3.12 Recovery Procedure for the Failure on the Occurrence of Unmatched Memory Installation Capacity (SIM = ffe30x, ffe800)
dfaxxx, dfbxxx, ef9xxx	3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)
af110x, af120x	3.14 Response to the Occurrence of External Temperature Warning or Alarm (SIM = af110x, af120x)
af100x	3.15 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)
af420x	3.16 Response to the Detection of Invalid CEDT(SIM = 399f0x)
aff20x	3.17 Response to the Detection of Uninstalled CFM (SIM = aff20x)
af400x	3.18 Response to the Occurrence of BKM or BKMF Warning (SIM = af400x)
fffexx	3.19 Response to the Detection of Forced Volatilization Warning (SIM = fffe0x)
af200x	3.20 Response to the Occurrence of DKC PS Warning (SIM = af200x)
af60xx	3.21 Response to the Detection of Abnormal DBPS Input Voltage (SIM = af60xx)
399e0x, 399f0x, af000x	3.22 Response to the Detection of Invalid CEMODE (SIM = 399e0x)
3072xy	3.23 Recovery Procedure for the Case Where the CHK3 Threshold Over Occurs (SIM = 3072xy)
3c9500	3.24 Recovery Procedure for Warning of Channel Board/Disk Board Type (SIM RC = 3c9500)
ffce0x, ffcfxx 610002	3.25 Isolation Procedure for Failed Part in CACHE Volatilization (SIM = ffce0x, ffcfyx, 610002)
dfcxxx, dfdxxx	3.26 Isolation and Recovery Procedure for Drive Link Rate Error (SIM = dfcxxx, dfdxxx)
452xxx, 462xxx, 455xxx, 465xxx, 454xxx, 464xxx, efcxxx, 453xxx, 463xxx	3.27 Drive failure recovery procedure
50bxyy, 50cxyy	3.31 Procedure for Responding to the Used Endurance of Flash Drives and Flash Module Drives (FMDs) (SIM = 50bxyy, 50cxyy)
50dxyy	3.32 Procedure for Responding to the Flash Module Drive Built-in Battery Warning (SIM = 50dxyy)
39a000	3.33 Procedure for Responding to the Excess of Upper Limit Temperature of Long-life Support (SIM = 39a000)

(To be continued)

(Continued from the preceding page)

Reference Code	Recovery Procedure
7ff7xx	3.34 Procedure for responding to the product program expiration (SIM = 7ff7xx)
7ff8xx	3.35 Procedure for responding to an excess of the allowed capacity (SIM = 7ff8xx)
7ff9xx	3.36 Procedure for responding to the prerequisite program product expiration (SIM = 7ff9xx)
effcxx, effexx, effdxx	3.37 Recovery Procedure when Cable Connection Error Occurs (SIM = effcxx, effexx, effdxx)
af7000, af7100	3.38 When Detecting Abnormal DB External Temperature (SIM = af7000, af7100)
af210x	3.39 Response to the Detection of Abnormal DKC PS Input Voltage (SIM = af210x)(Use AC input voltage)
fffa0x	3.40 Response to the Occurrence of Battery Warning (SIM = fffa0x)
aff1xx	3.41 Recovery Procedure when a GUM Failure Occurs (SIM = aff1xx)
7d05xx	3.42 Recovery procedure when an alert notification failure occurs (SIM = 7d05xx)
7d03xx,7d04xx	3.43 Response to a loss of the GUM audit log and the warning issuance (unsent audit log occurrence) (SIM = 7d03xx, 7d04xx)
aff0xx	3.44 Response when UPS warning occurs (SIM = aff0xx)
af50xx	3.45 Response to the Occurrence of DB PS Warning (SIM = af50xx)
3c9600	3.46 Response to the Detection of Unmounted Channel Board (SIM = 3c9600)
efexxx	3.47 Procedure for Responding to the Firmware Replacement Failure due to Cache High Load (SIM = efexxx)
cf11xx	3.48 Recovery Procedure for the SAS PORT Temporary Failure (SIM = cf11xx)
50f000	3.49 Procedure for Responding to the Flash Module Drive Firmware Version Warning (SIM = 50f000)
7d0900	3.50 Recovery Procedure When DKC Warning Occurs (SIM = 7d0900)
7d06xy	3.51 Recovery Procedure When an MP Error Occurs (SIM = 7d06xy)
2154xx	3.53 Recovery Procedure When SWPK is Blocked (SIM = 2154xx)
ffd400	3.55 Recovery Procedure When the Part Installation Error Occurs (SIM = ffd400)
4c4xxx	3.56 Recovery Procedure When Flash Module Drive Initialization Fails (SIM = 4c4xxx)
af4d0x	3.57 Recovery Procedure When the Panel Switch Warning (SIM = af4d0x)
3073xx	3.58 Recovery Procedure When Processor Is Blocked (SIM = 3073xx)
180000	3.59 Response to a Loss of the DKC Audit Log (SIM = 180000)
30750x	3.60 Recovery Procedure When CFM Warning Occurs (SIM = 30750x)
4d1xyy	3.61 Recovery Procedure for Differential Area Blocking (SIM = 4d1xyy)
cf880x	3.62 Recovery Procedure for CTL Blocking (SIM = cf880x)
2190xy	4.4 Recovery Procedure for AL_PA Conflict (SIM = 2190xy)
47dxyy, 47e700, 4b0xyy, 47e600, 4b2xyy, 47e500, 4b4xyy, 7ff102	5. ShadowImage Error Recovery
d4xyyy, dbxyyy, d48yyy, d4eyyy, dbeyyy, d4dyyy, dbdyyy, 2180xy, 2182xy	6. TrueCopy Error Recovery
47ec00	8.1 Recovery Procedure for Thin Image Failure due to SM Volatilization (SIM = 47ec00)
4b3xyy, 7ff104	8.2 Recovery Procedure for Thin Image Failure (SIM = 4b3xyy, 7ff104)

(To be continued)

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(Continued from the preceding page)

Reference Code	Recovery Procedure
601xxx, 602xxx, 604xxx, 605xxx, 606xxx	8.3 Recovery Procedure for Pool Failure (SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx)
603000	8.4 Recovery Procedure for Pool Failure (SIM = 603000)
670000	8.6 Recovery Procedure for Thin Image Failure (SIM = 670000)
47fyxx	9. Recovery from Volume Migration Failure
623xxx	10.2 Recovery Procedure for Pool Failure (SIM = 623xxx)
624000	10.3 Recovery Procedure for Pool Failure (SIM = 624000)
625000, 62b000	10.4 Recovery Procedure for Pool Failure (SIM = 625000, 62b000)
627xxx	10.5 Recovery Procedure for pool-VOL Blockade (SIM = 627xxx)
628000	10.6 The release procedure for the Protection attribute of Data Retention Utility (SIM = 628000)
21d0xy, 21d2xy, efd000, ef5xxx, ff5xxx	11.1.2 Maintenance (Isolation) Procedure for a Failure on External Storage (SIM = 21d0xy, 21d2xy, efd000, ef5xxx, ff5xxx)
21d0xy, efd000, 21d2xy	11.2 Recovery Procedure for External Device Failure
660100, 660200, 661000	13. Failure recovery of Encryption License Key
7d07xx	T.S.D.call
7d08xx	16. Recovery Procedure for GUM Information Recover Failure (SIM = 7d08xx)
7d0axx	17. Recovery Procedure for GUM Version Warning (SIM = 7d0axx)
307b0x	20.3 Response to Unified Hypervisor blockade When Starting Unified Hypervisor (SIM = 307b0x)
e0000x	20.4 Recovery Procedure for Unified Hypervisor Failure (SIM = e0000x)
e001xy	20.5 Recovery Procedure for NASFW Failure (SIM = e001xy)
e0020x	20.6 Recovery Procedure for Hypervisor Network Module Failure (SIM = e0020x)
e0040x	20.7 Recovery Procedure When File Service Is Down Due to Excess of Threshold Uniquely Owned by NASFW (= NAS OS) (SIM = e0040x)
e005x2	20.8 Recovery Procedure for NASFW Failure (SIM = e005x2)
e0060x	20.9 Recovery Procedure for Unified Hypervisor Part Failure (SIM = e0060x)
e007x2	20.10 Recovery Procedure for NASFW Boot Failure (MBR Corruption) (SIM = e007x2)
e008x2	20.11 Recovery Procedure for Unified Hypervisor Failure (Boot Disk Access Error) (SIM = e008x2)
e0090x	20.12 Recovery Procedure for NASFW Boot Failure (During Start Up or Maintenance) (SIM = e0090x)
680001	21.1 Recovery Procedure for dedupe and compression Operation Error (SIM = 680001)
680002	21.2 Recovery Procedure for Operation Error in Deleting Capacity-Saving-Enabled DP-VOLs (without blocking/formatting) (SIM = 680002)
505xyy, 508xyy	Collect Dump/Log/FMD Dump and T.S.D.call

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2.4 Failures of Multiple Parts

When failures have occurred in multiple parts and actions need to be taken during the system operation, follow the priority described in this page and start from the higher priority.
Table 2-1 indicates that the smaller number in the “Priority” item has the higher priority.

However, in the following cases, go to the next priority maintenance work.
- When all failures are not restored even if performing the high priority maintenance work.
- When the maintenance work fails or stops.

Table 2-1

priority	action part	maintenance work
1	CTL	Replace
2	DKB	Replace
3	SWPK	Replace
4	PCP	Replace
5	PECB/PCIe cable	Replace
6	CHB	Replace
7	ENC	Replace
8	CFM	Replace
9	BKM/BKMF	Replace
10	LAN	Replace
11	HDD	Replace
12	LDEV	Format or Restore
13	other hardware (*1)	Replace
14	NAS Module (*2)	Replace or Restore
15	Firmware (*3)	Update Firmware

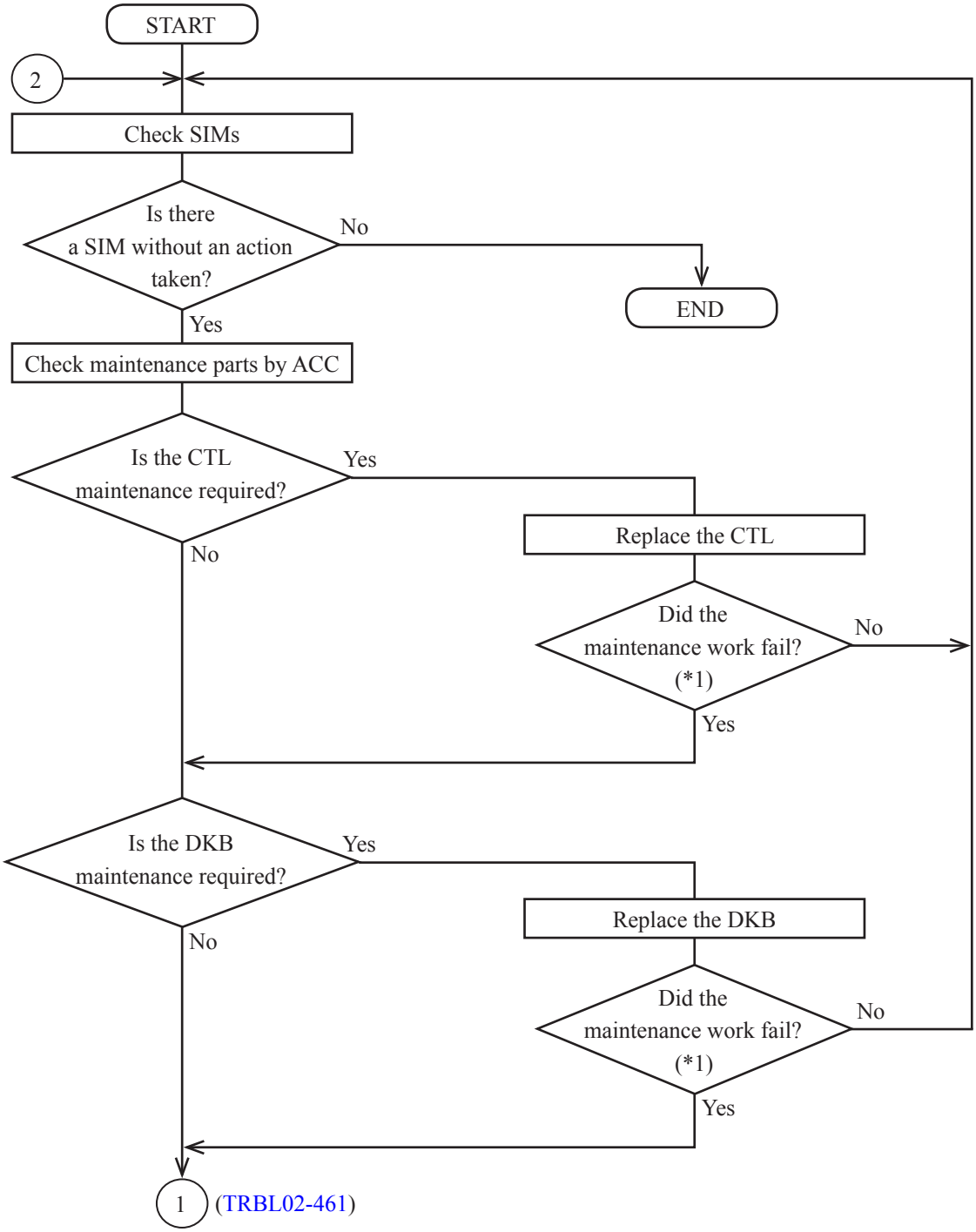
When the DKCPSU warning (SIM = af200x) is reported, preferentially perform the operation described in “3.20 Response to the Occurrence of DKC PS Warning (SIM = af200x)”(TRBL03-350).

When the CPU abnormal temperature (SIM = af10xx) is reported, perform “3.15 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)”(TRBL03-300).

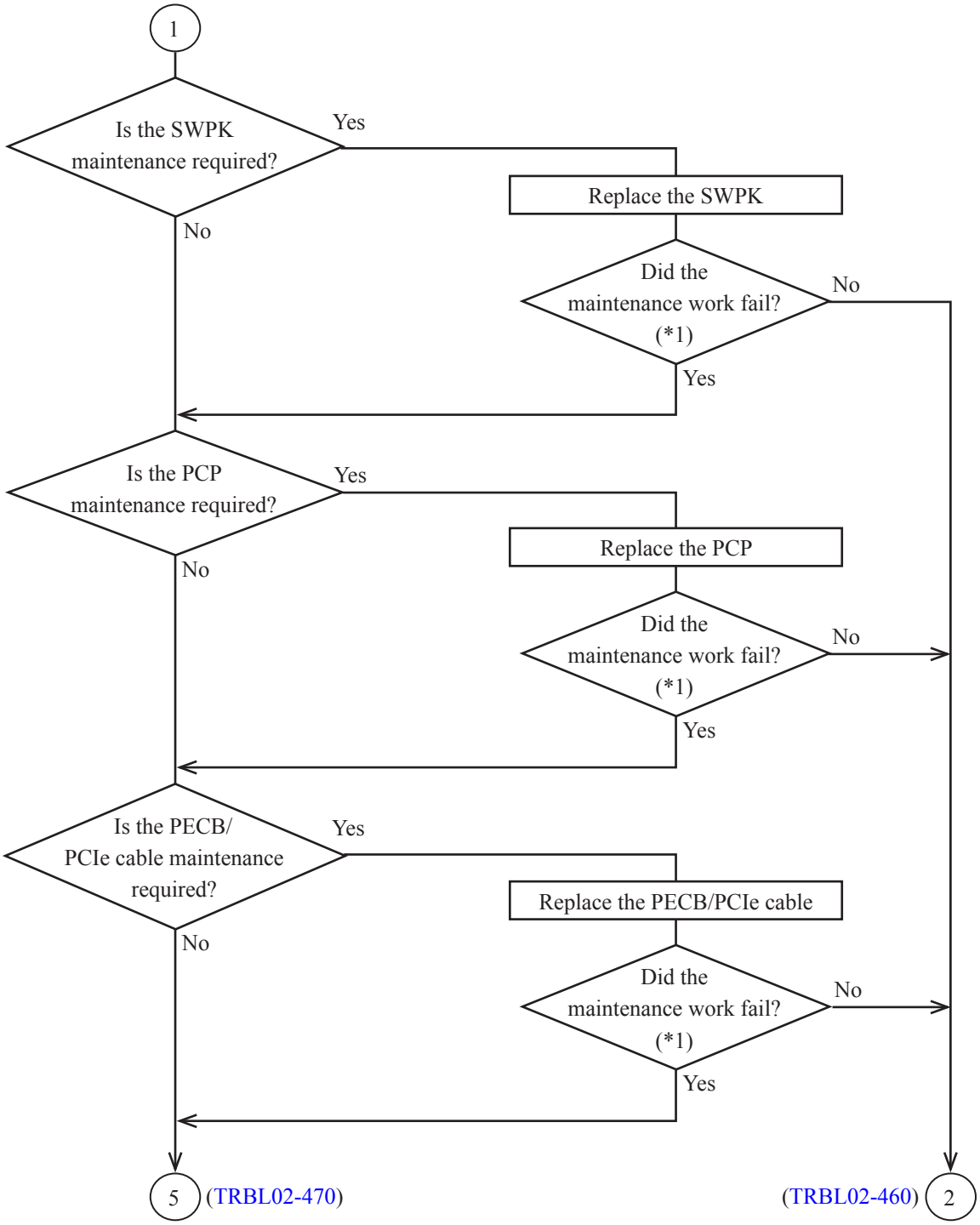
*1: This does not includes NAS Modules, NAS DIMM and NAS SFP.
*2: This inculudes NAS DIMM and NAS SFP. When NAS Modules are installed, perform the maintenance in accordance with the maintenance priority from in TRBL02-500
*3: This includes NASFWINST, Unified Hypervisor, NASFW and NAS Manager when the NAS modules are installed.

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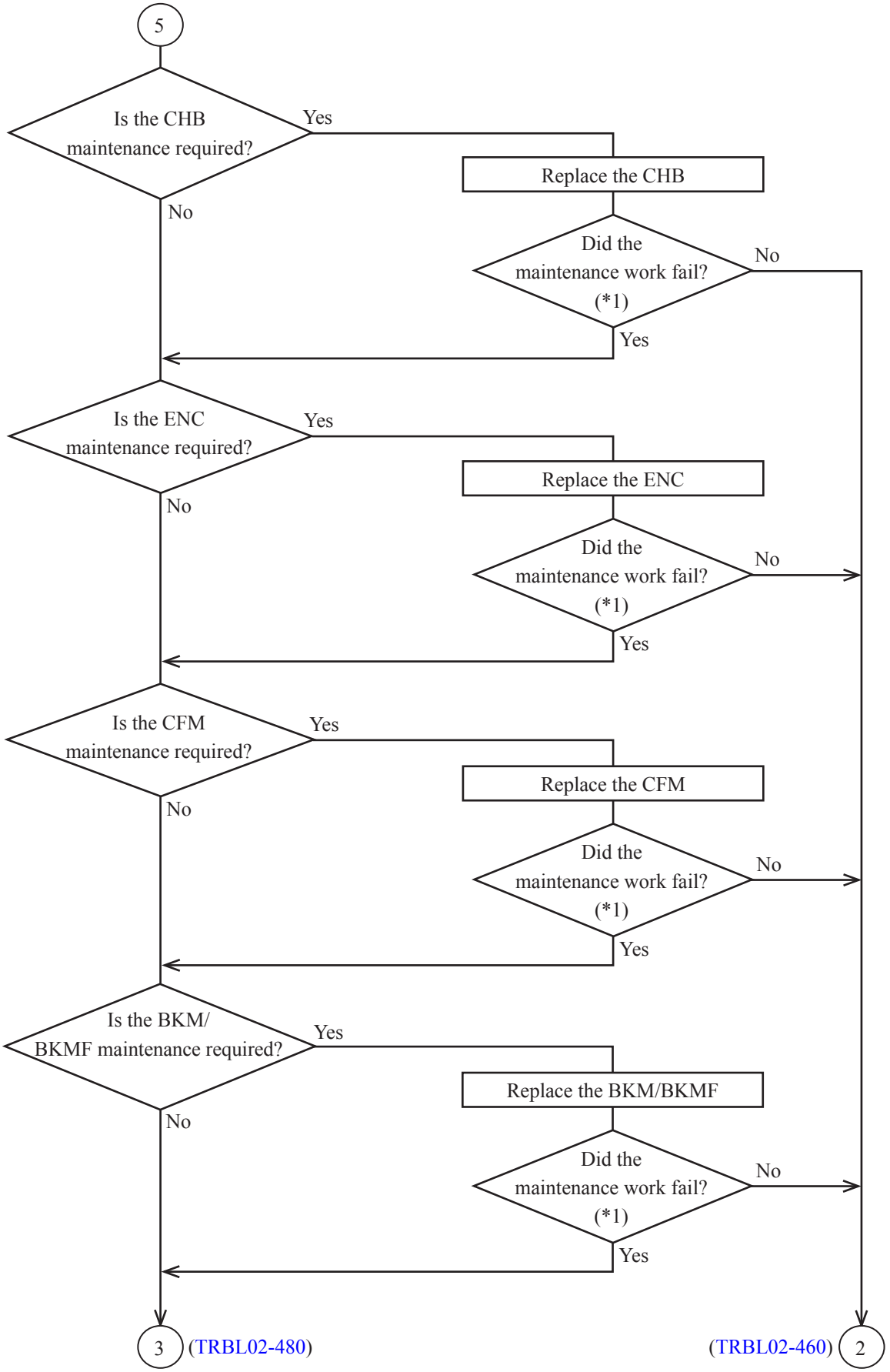
Maintenance priority flow



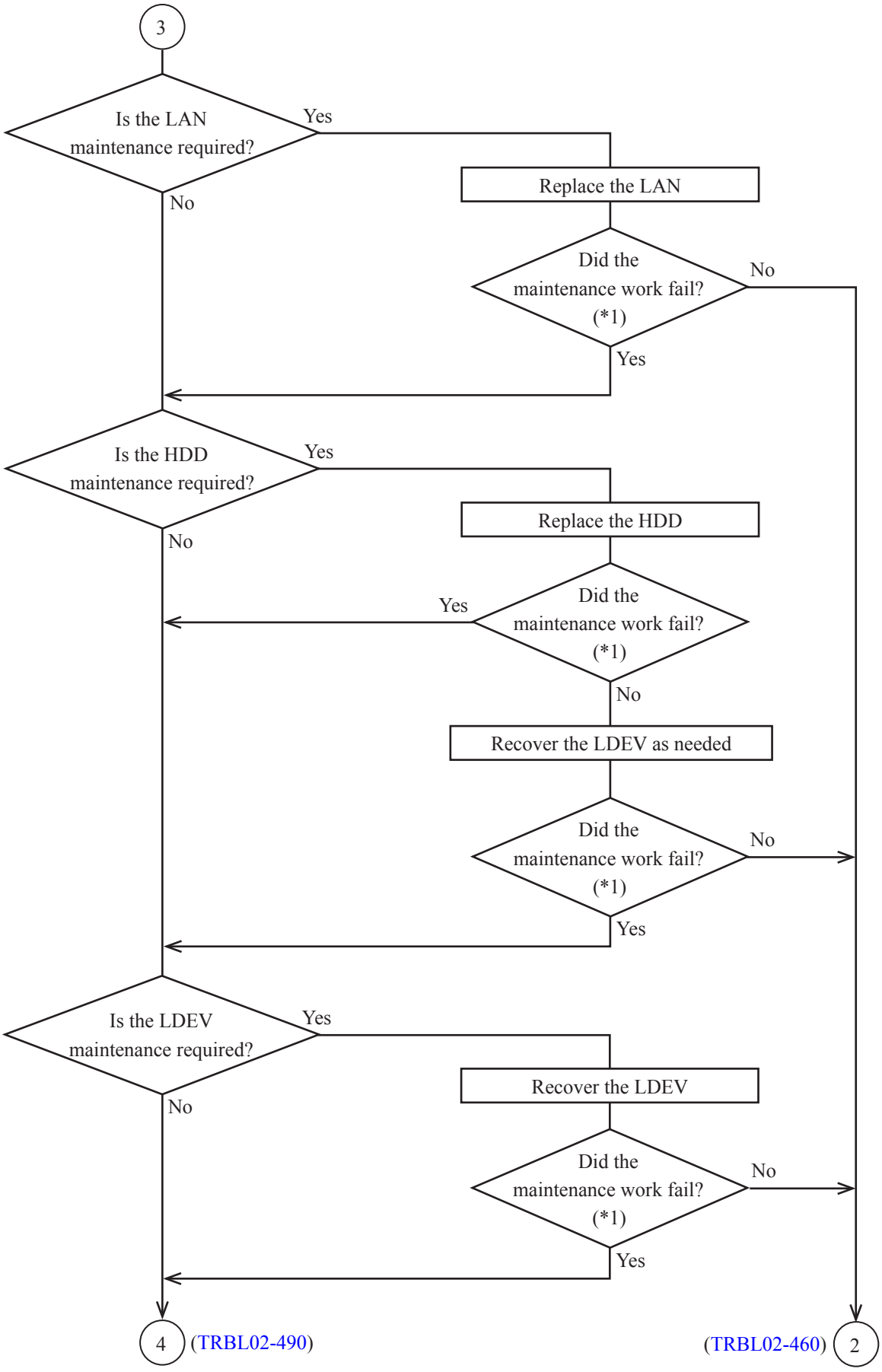
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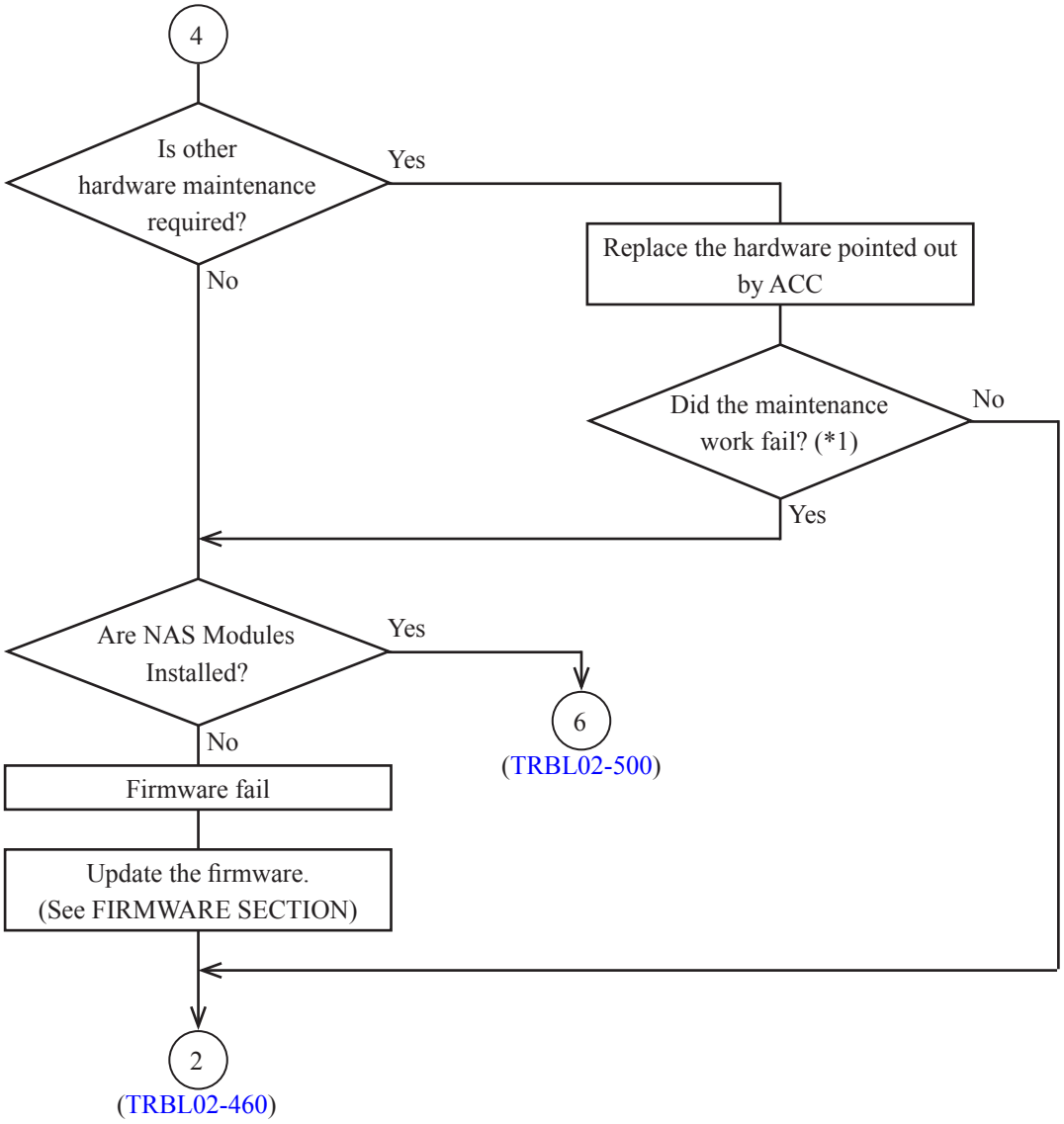
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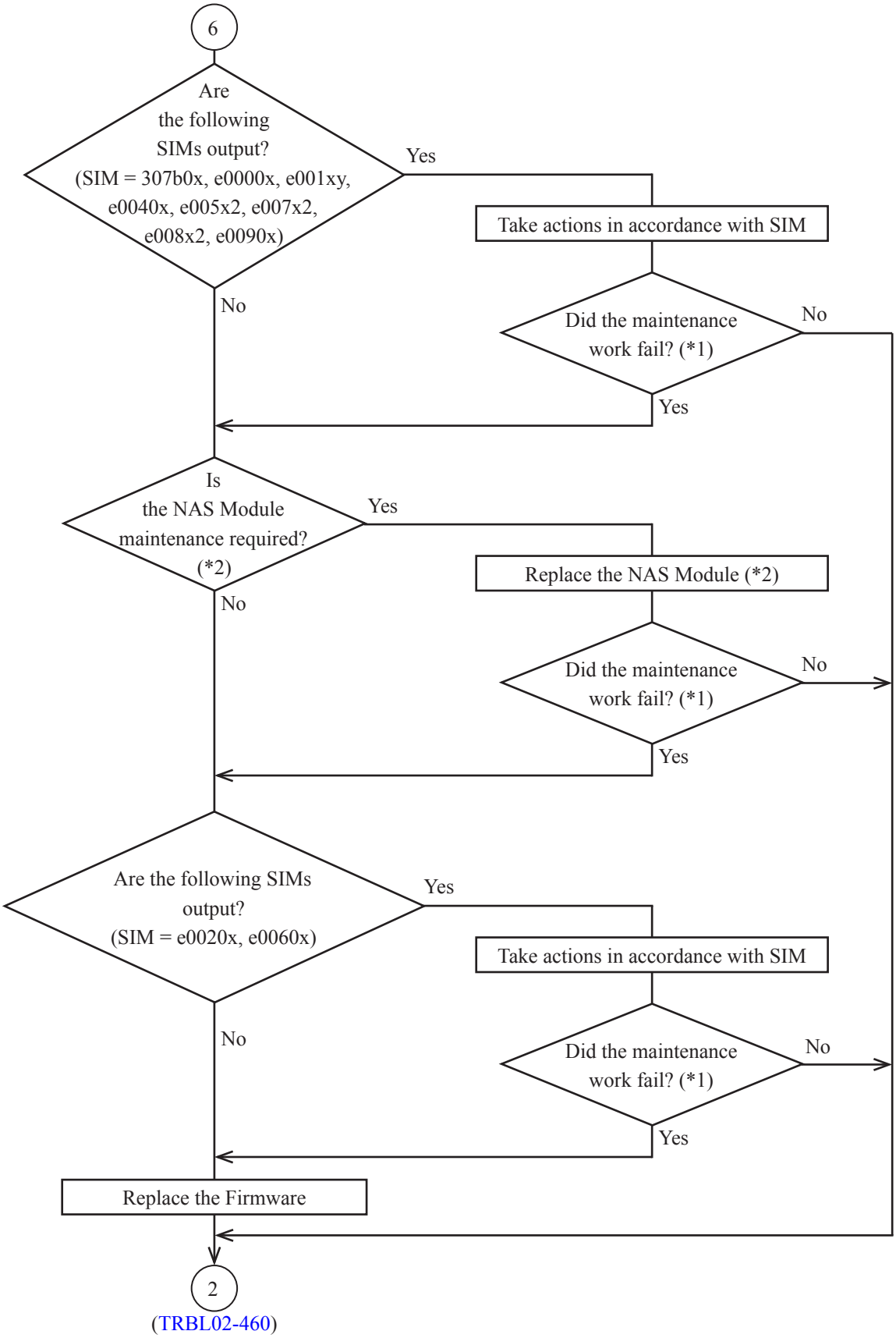


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*1: When the maintenance work stops.

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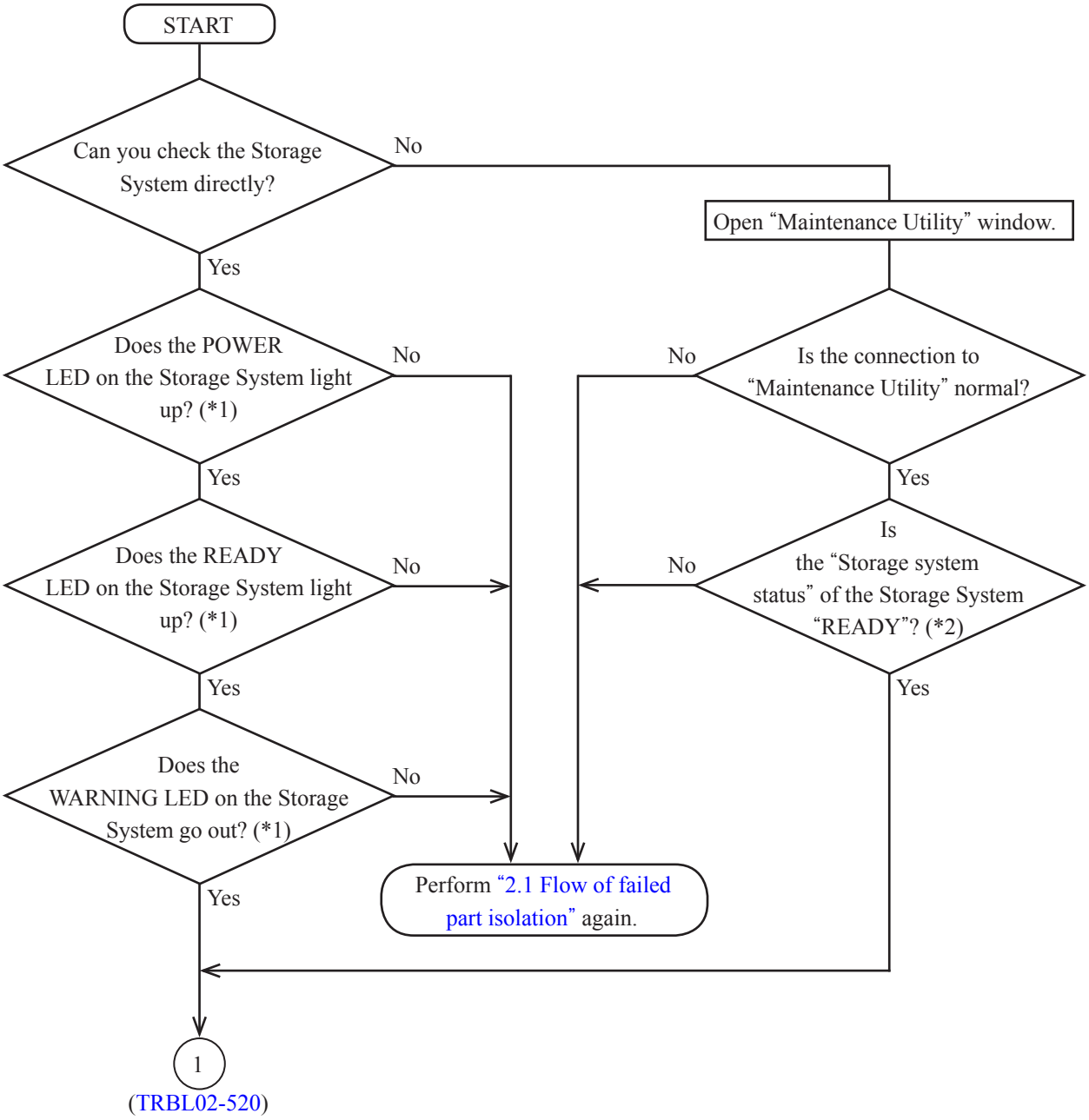


*1: When the maintenance work stops.
*2: This includes NAS DIMM and NAS SFP.

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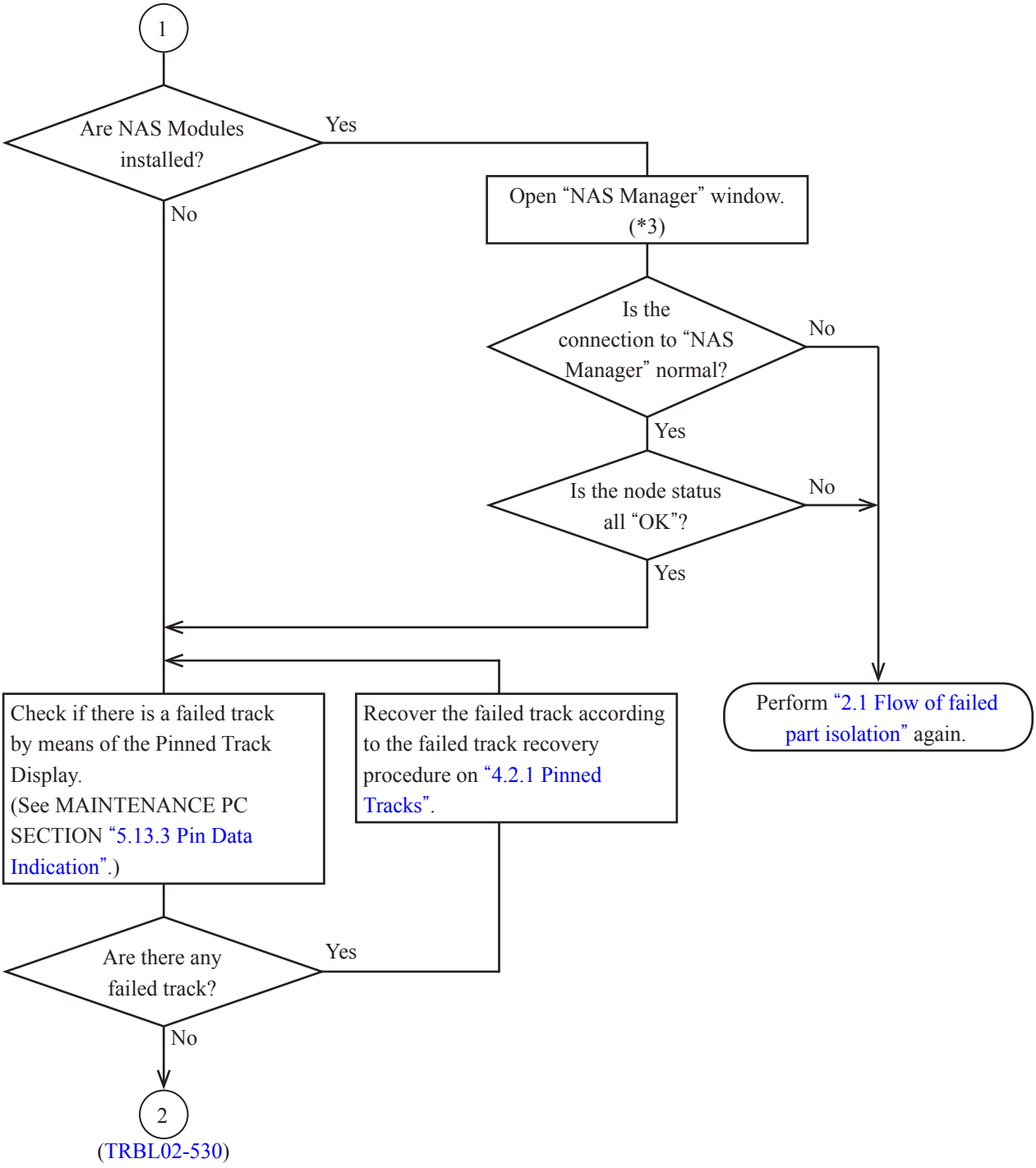
2.5 Checking the health after restoring the failure

Check whether the Storage System is restored to the normal status in accordance with the following flow after recovering from the failure.



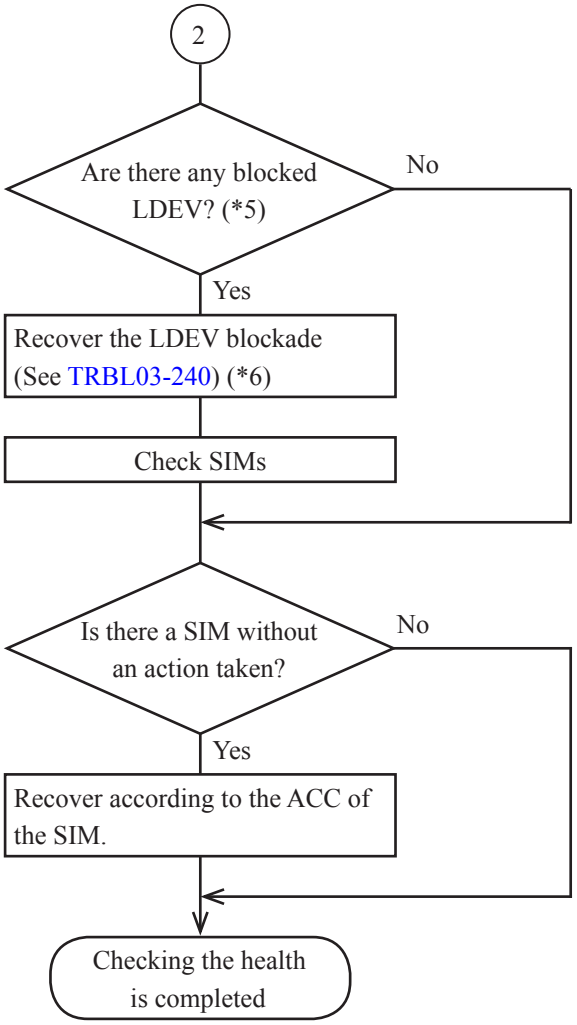
*1: See LOCATION SECTION “3.1 Switches and LEDs of Controller Chassis”.
*2: See MAINTENANCE PC SECTION “1.8.2.7 Navigation Area Configuration”.

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*3: See MAINTENANCE PC SECTION "6.1.1 Logging int NAS Manager".
*4: See MAINTENANCE PC SECTION "6.3 Confirming the Node Status".

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*5: Unformatted LDEVs are out of the target.

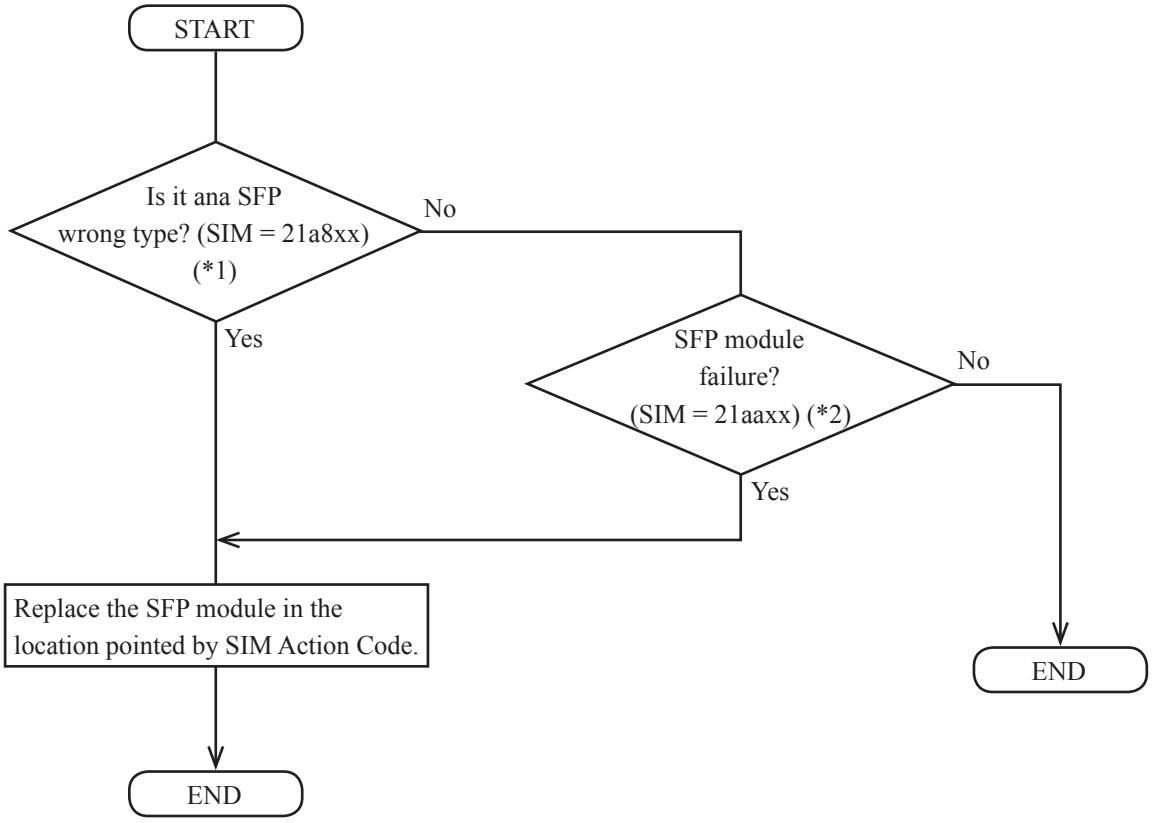
*6: A case that a contact to the Technical Support Division is necessary exists in "3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)". When the LDEV blockade cannot be solved, be sure to contact the Technical Support Division and follow the judgment.

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3. Recovery Method of the Shared Platform Failure

3.1 SFP Module Failure Detection (SIM = 21a8xx, 21aaxx)

The recovery procedure when an SFP module failure occurs is indicated.



*1: SFP wrong type factors
- When a LongWave SFP is used in the ShortWave setting port and a ShortWave SFP is used in the LongWave setting port.
- When an unsupported SFP transceiver is installed.
- When the information on the SFP is not recognized correctly.

*2: SFP module failure factors
- When SFP module hardware failure is occurred.
- When an unsupported SFP transceiver is installed.

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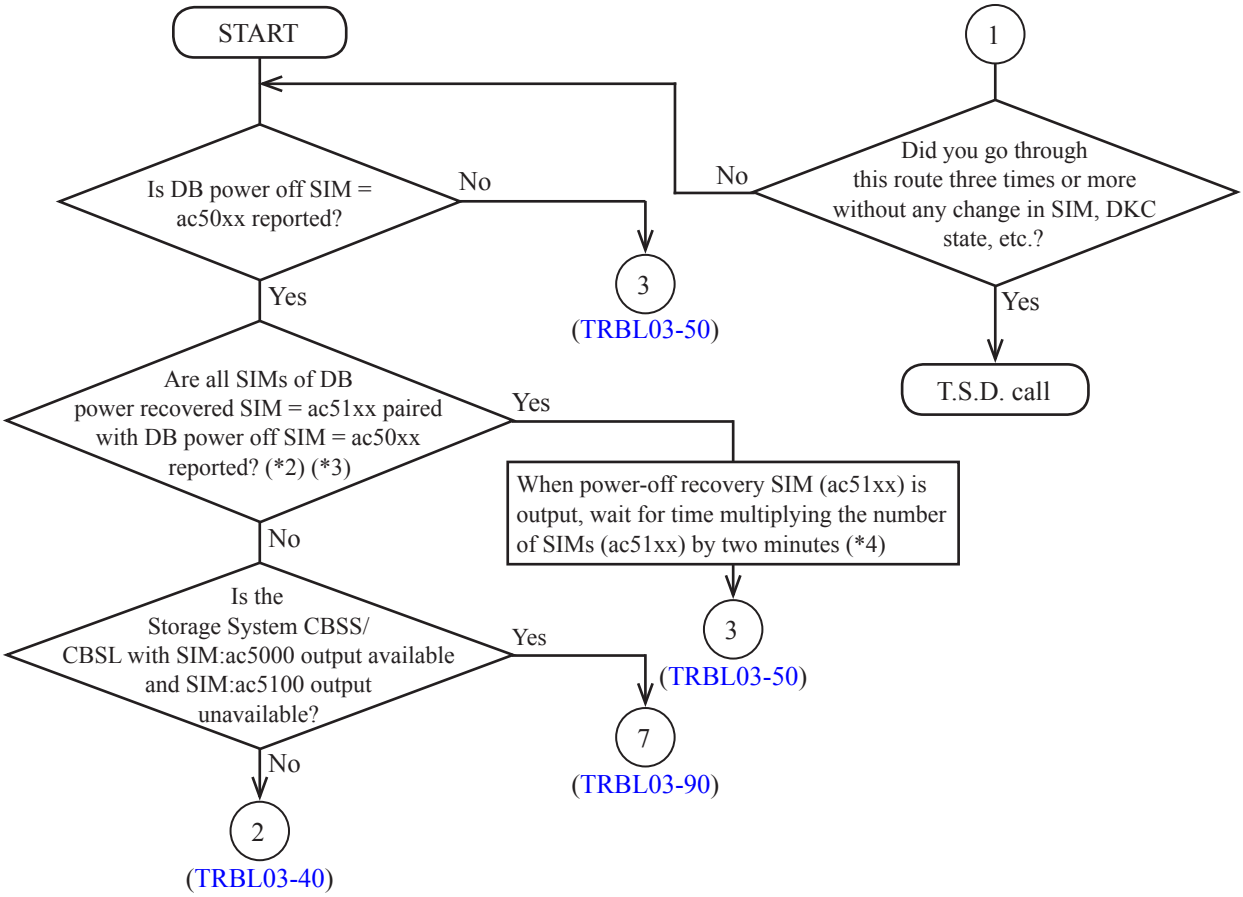
3.2 Response to a FLASH DRIVE/ENCRYPTION PG LDEV FORMAT Failure (SIM = 41000x)

See “2.2.6 Recovery procedure when LDEV formatting failed”.

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3.3 Recovery when power off or SAS PORT failure occurred (SIM = cf12xx, ac50xx)

When multiple SAS PORT blockages (SIM = cf12xx) and DB power off (SIM = ac50xx) occur at the same time, recover them according to the following procedures. (*1)



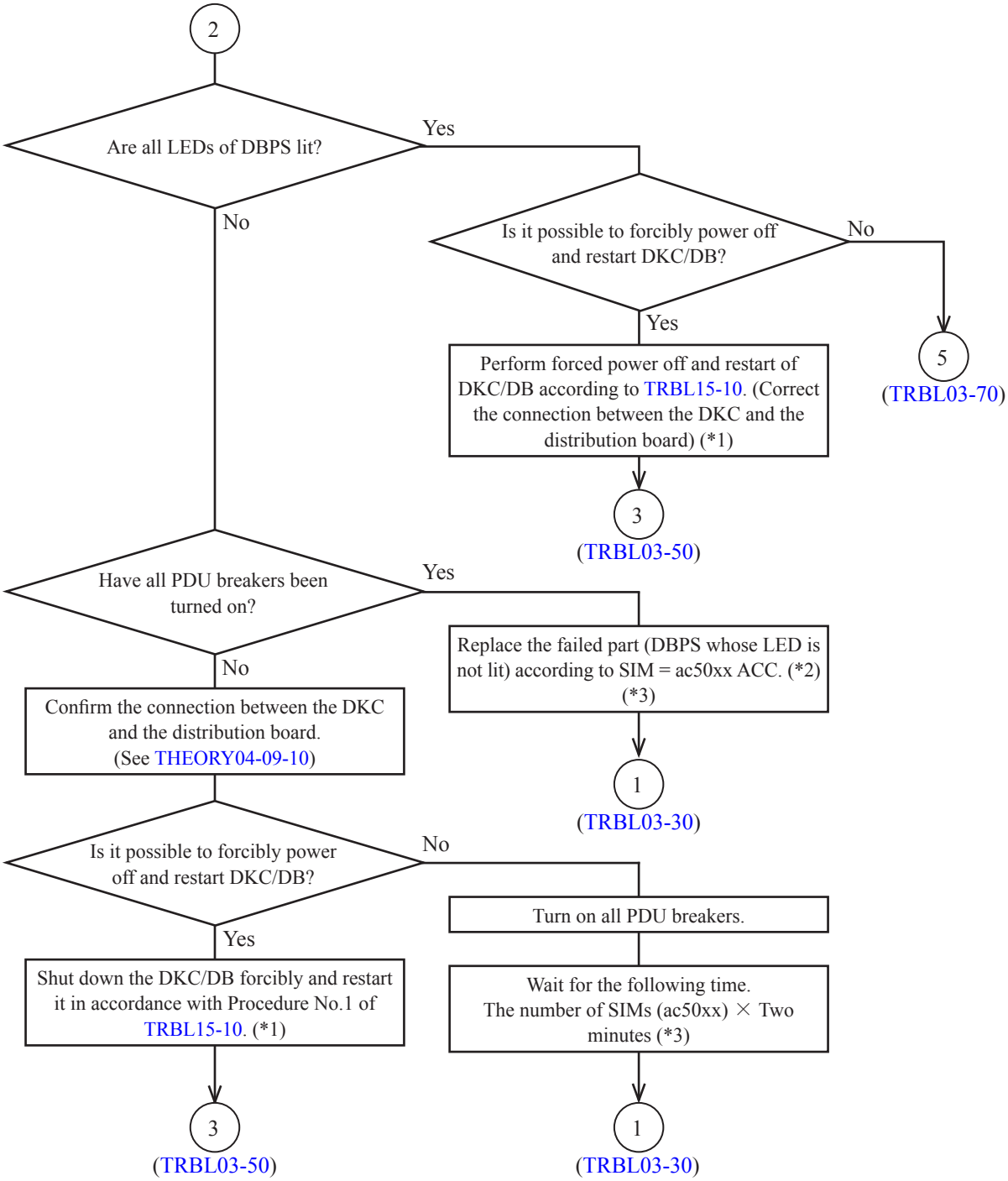
*1: Priorities of maintenance of parts indicated by ACC depend on the parts to be maintained. When both
SIM = cf12xx and ac50xx are output, perform maintenance in the following priority order.
When there is no applicable part in the parts indicated by ACC, perform maintenance for the part of the second priority.
Priority High > Low:
PDU breaker Switch ON (ac50xx) > DBPS replacement (ac50xx) > ENC replacement (cf12xx) > DKB replacement (cf12xx) > SAS cable replacement (cf12xx) > ENC replacement (ac50xx) > SAS cable replacement (ac50xx) > DKB replacement (ac50xx)
(Power supply: Prioritize ac50xx, ENC/DKB/SAS cable: Prioritize cf12xx)

*2: When DBPS replacement, PDU ON etc. is performed, check SIM after two minutes.
“xx” in SIM = ac50xx indicates the Drive box number (hexadecimal). When DB power is recovered, SIM = ac51xx whose xx is the same as that of SIM = ac50xx is output.

*3: When both of the two SAS PORTS connected to the Drive box in which DB power is not recovered are blocked, even if power feeding to the Drive box in which DB is powered off is recovered, SIM = ac51xx is not output. If the situation occurs, call T.S.D.

*4: When replacing PDU ON, DBPS and others, check SIMs after two minutes or more elapse. It requires about two minutes to recover the LDEV after DB power-off recovery SIM is output.

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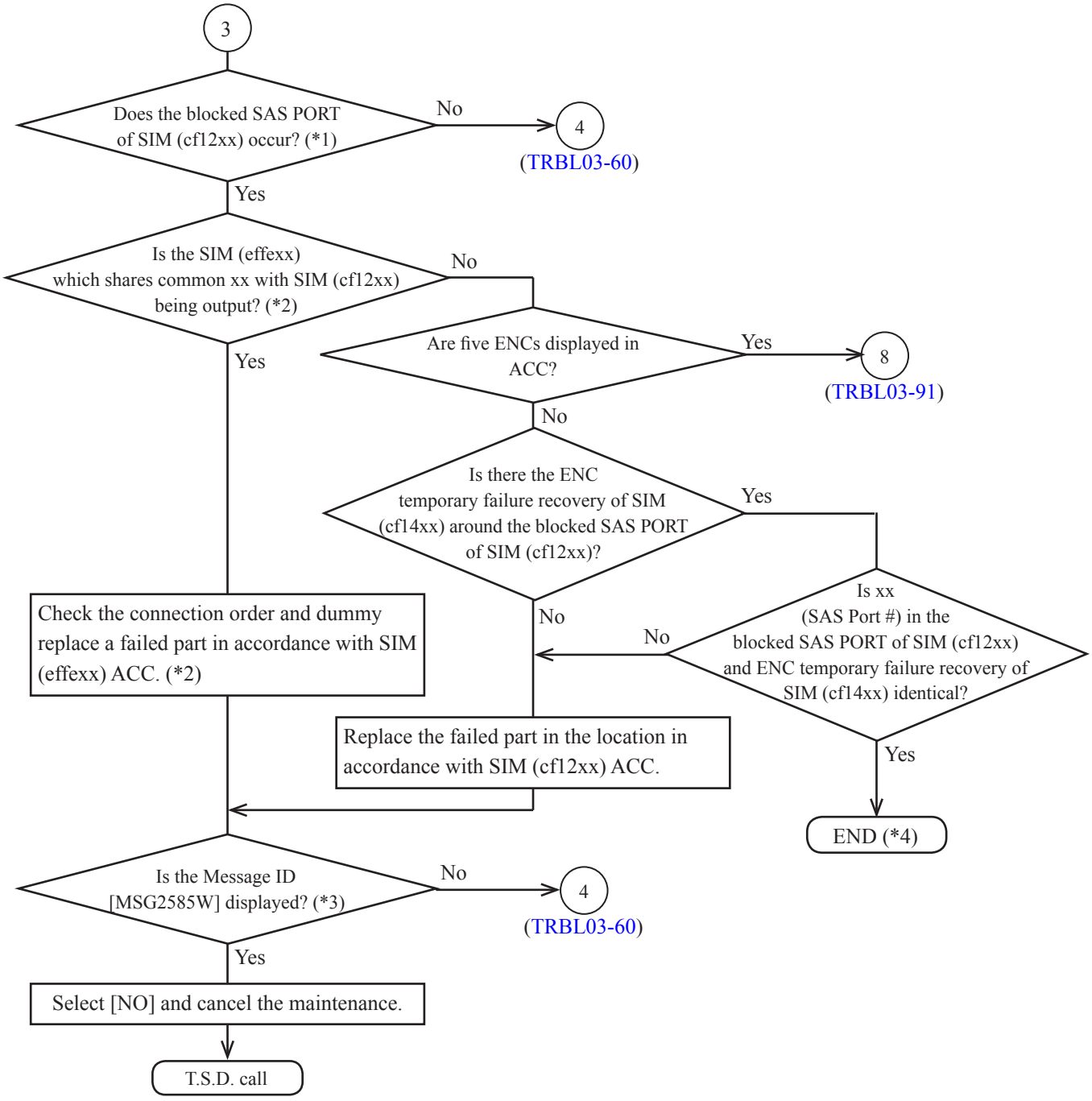


*1: If DKC/DB is forcibly powered off and rebooted, DB power interruption recovery SIM is not output. Furthermore, the forcible power off is different from the normal power off procedure, confirm with the Technical Support Division and perform the operation.

*2: If you cannot replace DPBS, call T.S.D.

*3: If PDU on, DBPS replacement and so on are executed, check SIM after waiting for more than 2 minutes. Note that around 2 minutes are required from output of DB power interruption recovery SIM to LDEV recovery.

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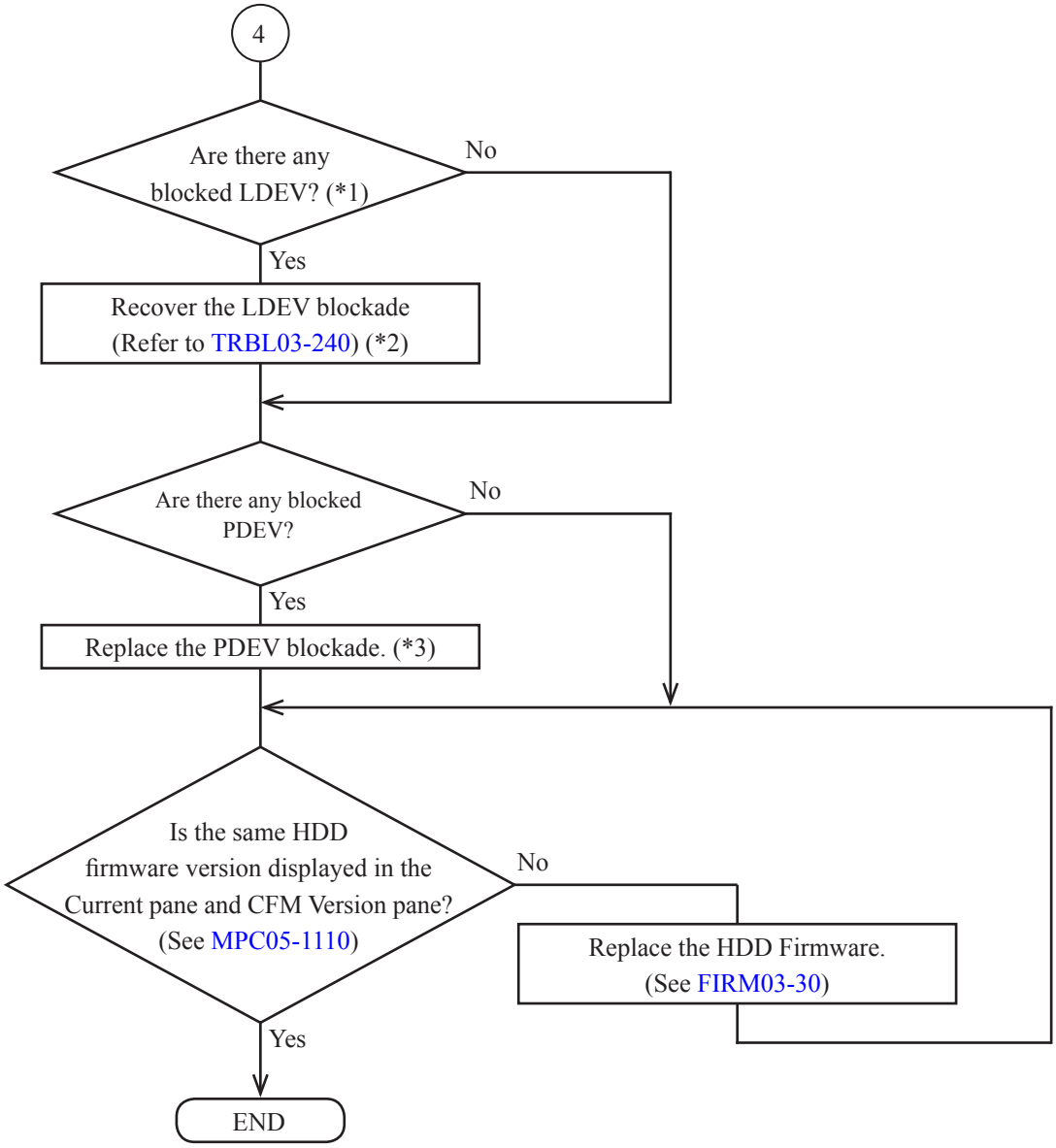
*1: The xx in cf12xx, effexx represents SAS Port number xx (hexadecimal).

*2: For the detail of the connection order, see "3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)".

*3: [MSG2585W] A warning of <Important CAUTION> "When you continue this operation, customer's DATA is LOST. Are you sure you want to continue this operation?".

*4: The ENC temporary failure recovery of SIM (cf14xx) reports that the blocked SAS PORT of SIM (cf12xx) on the SAS Port # shown by xx due to the ENC temporary failure has been recovered automatically. Therefore, no action is required such as part replacement for the blocked SAS PORT of SIM (cf12xx). To user inquiries, inform them to that effect.
If any blocked SAS PORT of SIM (cf12xx) with a different xx exists, ask the service personnel for maintenance.

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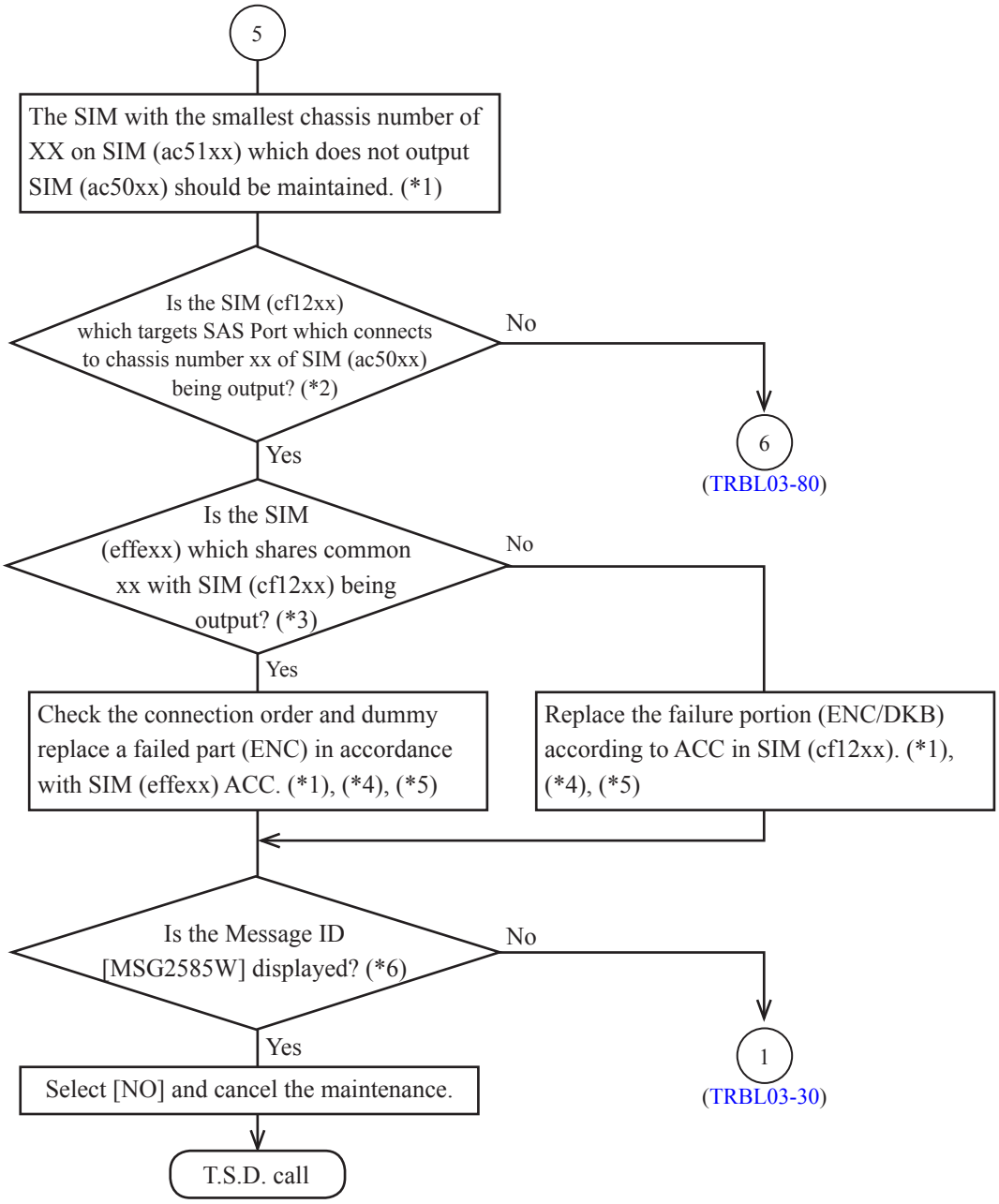


*1: Unformatted LDEVs are out of the target.

*2: A case that a contact to the Technical Support Division is necessary exists in "3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)".
When the LDEV blockade cannot be solved, be sure to contact the Technical Support Division and follow the judgment.

*3: Perform dummy replacement first. When the dummy replacement fails, a Drive failure due to the power-off is considered. Perform replacement in a new Drive.

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*1: If the multiple power interruption SIM (ac50xx) which does not output the power interruption recovery SIM (ac51xx) are output, execute in ascending order of the unit number (xx).

*2: ac50xx represents chassis number xx (hexadecimal). The xx in cf12xx, effexx represents SAS Port number (hexadecimal).

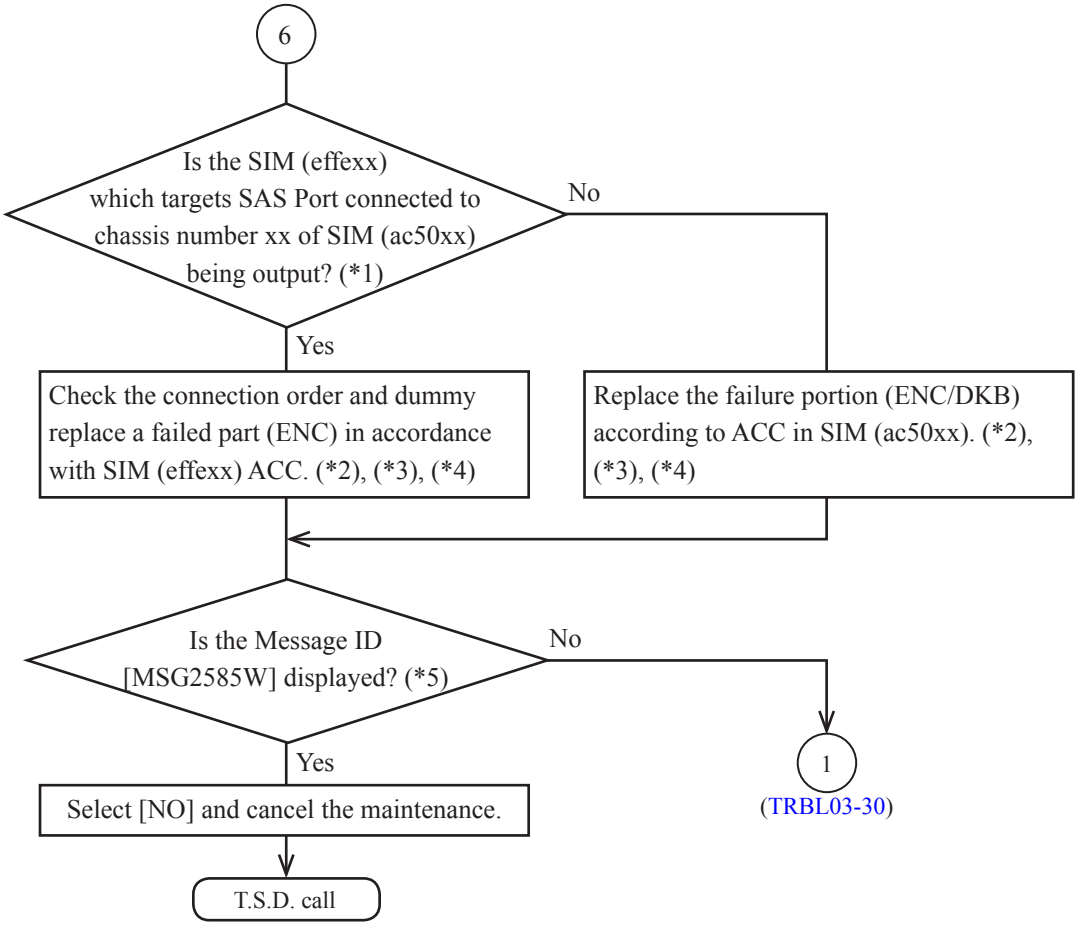
*3: For the detail of the connection order, see "3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)".

*4: SIM (cf11xx, cf12xx) which is related to not replaced SAS Port may be reported after the replacement.

*5: For the detail of the connection order, see "3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)".

*6: [MSG2585W] A warning of <Important CAUTION> "When you continue this operation, customer's DATA is LOST. Are you sure you want to continue this operation?".

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*1: ac50xx represents chassis number xx (hexadecimal). The xx in effexx represents SAS Port number (hexadecimal). For the detail of the connection order, see "3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)".

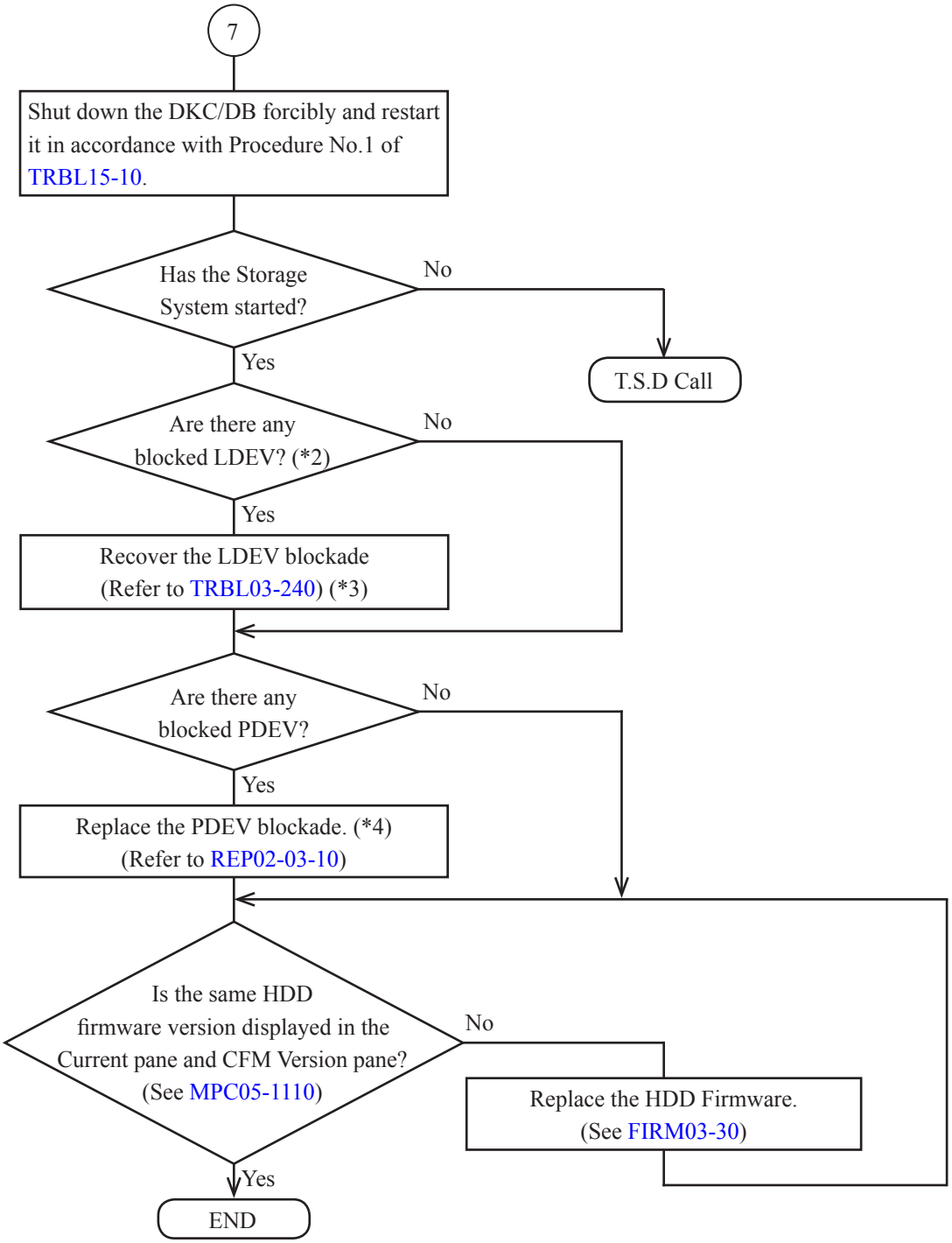
*2: If the multiple power interruption SIM (ac50xx) which does not output the power interruption recovery SIM (ac51xx) are output, execute in ascending order of the unit number (xx). In case that ac50xx with the identical "xx" unit numbers have been output, execute ACC at the side of earlier SIM output on ahead.

*3: SIM (cf11xx, cf12xx) which is related to not replaced SAS Port may be reported after the replacement.

*4: For the detail of the connection order, see "3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)".

*5: [MSG2585W] A warning of <Important CAUTION> "When you continue this operation, customer's DATA is LOST. Are you sure you want to continue this operation?".

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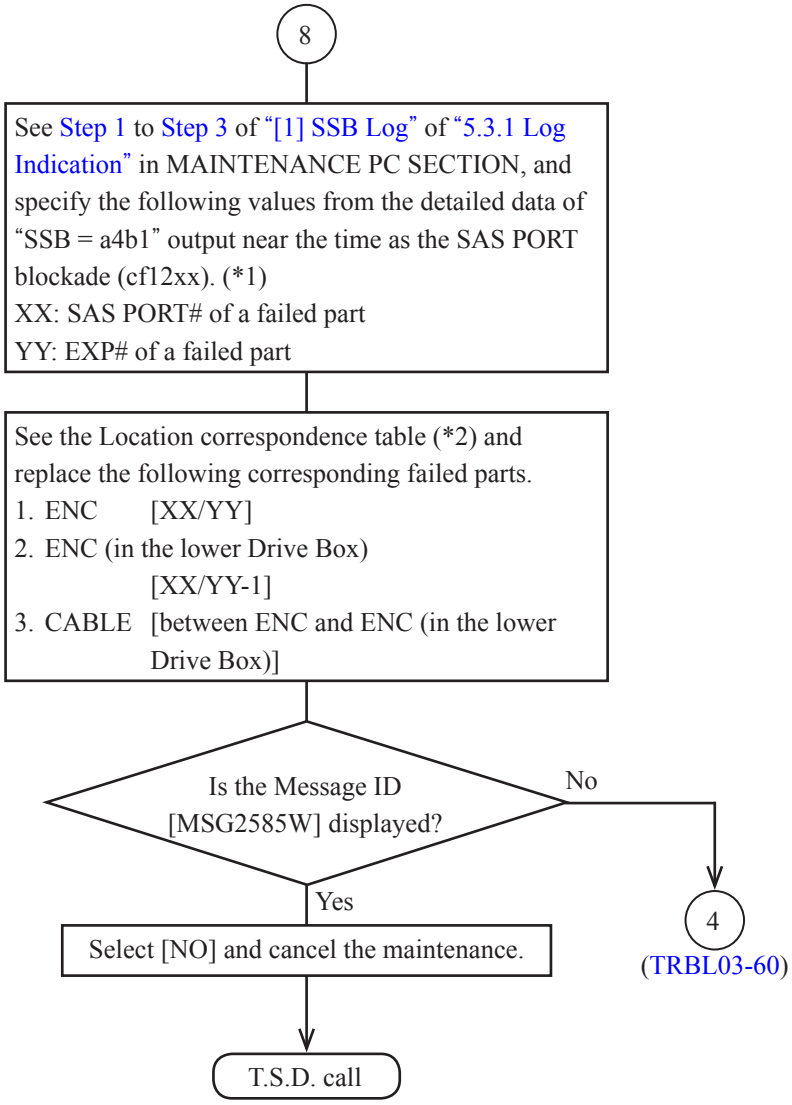
*1: If DKC/DB is forcibly powered off and rebooted, DB power interruption recovery SIM is not output. Furthermore, the forcible power off is different from the normal power off procedure, confirm with the Technical Support Division and perform the operation.

*2: Unformatted LDEVs are out of the target.

*3: A case that a contact to the Technical Support Division is necessary exists in "3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)".When the LDEV blockade cannot be solved, be sure to contact the Technical Support Division and follow the judgment.

*4: Perform dummy replacement first. When the dummy replacement fails, a Drive failure due to the power-off is considered. Perform replacement in a new Drive.

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*1: SSB detailed information

```
          +0x0     +0x4     +0x8     +0xC
00000000: 7404190b 00279f00 b1a40000 00aa2000
00000010: 00000000 00002e0d 00000000 00000004
00000020: 00000000 0000009f a4b1d84f 74920000
00000030: 00000000 0000ff9f 00000000 00000000
00000040: d84f7492 80eeeeee eeeeeeee eeeeeeee
00000050: 21120083 00000000 100000ee 00010000
00000060: 800f0021 ffffffff 01210503 00000000
00000070: 02010046 00XXYY00 10000000 00100302
```

XX: SAS PORT# of a failed part
YY: EXP# of a failed part

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*2: Location correspondence table

• VSP G200

SASPORT#	EXP#	ENC	SASPORT#	EXP#	ENC
00	0	00-1	02	0	00-2
01	1	01-1	03	1	01-2
	2	02-1		2	02-2
	3	03-1		3	03-2
	4	04-1		4	04-2
	5	05-1		5	05-2
	6	06-1		6	06-2
	7	07-1		7	07-2

• VSP G400, G600

SASPORT#	EXP#	ENC	SASPORT#	EXP#	ENC
00	0	00-1	02	0	00-2
	1	02-1		1	02-2
	2	04-1		2	04-2
	3	06-1		3	06-2
	4	08-1		4	08-2
	5	10-1		5	10-2
	6	12-1		6	12-2
	7	14-1		7	14-2
	8	16-1		8	16-2
	9	18-1		9	18-2
	10	20-1		10	20-2
	11	22-1		11	22-2
01	0	01-1	03	0	01-2
	1	03-1		1	03-2
	2	05-1		2	05-2
	3	07-1		3	07-2
	4	09-1		4	09-2
	5	11-1		5	11-2
	6	13-1		6	13-2
	7	15-1		7	15-2
	8	17-1		8	17-2
	9	19-1		9	19-2
	10	21-1		10	21-2
	11	23-1		11	23-2

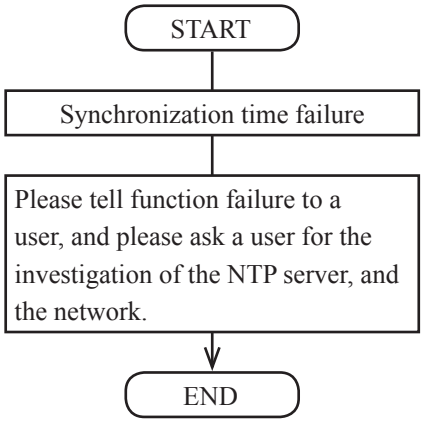
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• VSP G800

SASPORT#	EXP#	ENC	SASPORT#	EXP#	ENC
00	0	00-1	08	0	00-2
	1	04-1		1	04-2
	2	08-1		2	08-2
	3	12-1		3	12-2
	4	16-1		4	16-2
	5	20-1		5	20-2
01	0	01-1	09	0	01-2
	1	05-1		1	05-2
	2	09-1		2	09-2
	3	13-1		3	13-2
	4	17-1		4	17-2
	5	21-1		5	21-2
02	0	02-1	10	0	02-2
	1	06-1		1	06-2
	2	10-1		2	10-2
	3	14-1		3	14-2
	4	18-1		4	18-2
	5	22-1		5	22-2
03	0	03-1	11	0	03-2
	1	07-1		1	07-2
	2	11-1		2	11-2
	3	15-1		3	15-2
	4	19-1		4	19-2
	5	23-1		5	23-2
04	0	24-1	12	0	24-2
	1	28-1		1	28-2
	2	32-1		2	32-2
	3	36-1		3	36-2
	4	40-1		4	40-2
	5	44-1		5	44-2
05	0	25-1	13	0	25-2
	1	29-1		1	29-2
	2	33-1		2	33-2
	3	37-1		3	37-2
	4	41-1		4	41-2
	5	45-1		5	45-2
06	0	26-1	14	0	26-2
	1	30-1		1	30-2
	2	34-1		2	34-2
	3	38-1		3	38-2
	4	42-1		4	42-2
	5	46-1		5	46-2
07	0	27-1	15	0	27-2
	1	31-1		1	31-2
	2	35-1		2	35-2
	3	39-1		3	39-2
	4	43-1		4	43-2
	5	47-1		5	47-2

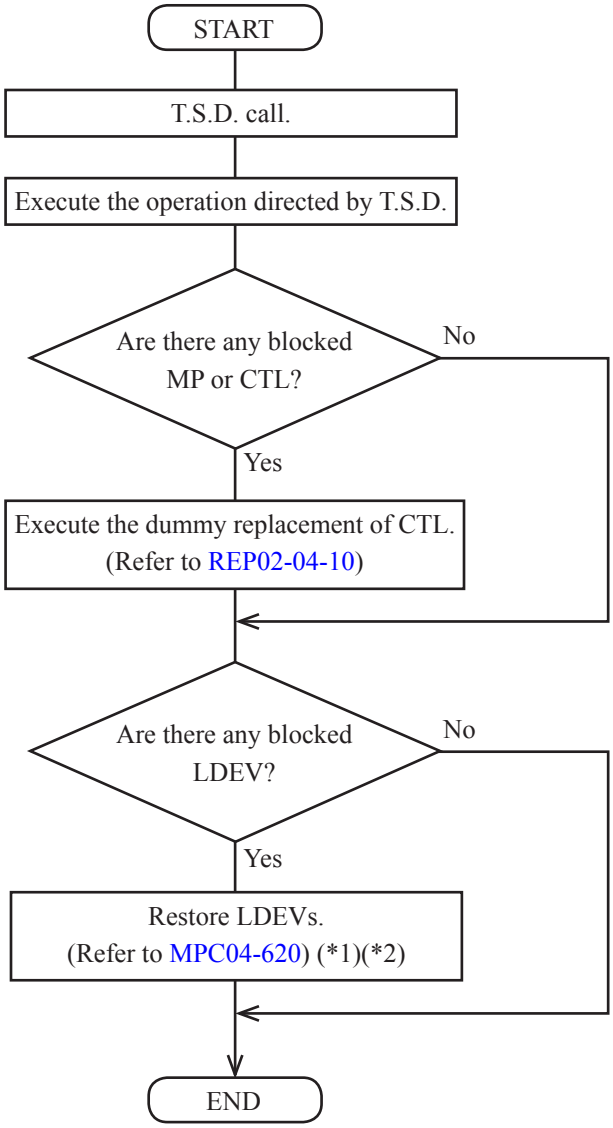
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3.4 Action When Time Synchronization Failed (SIM = 7ffa00)



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3.5 Recovery Procedure for LDEV Blockade due to Firmware Error (SIM = 3a0xyy)

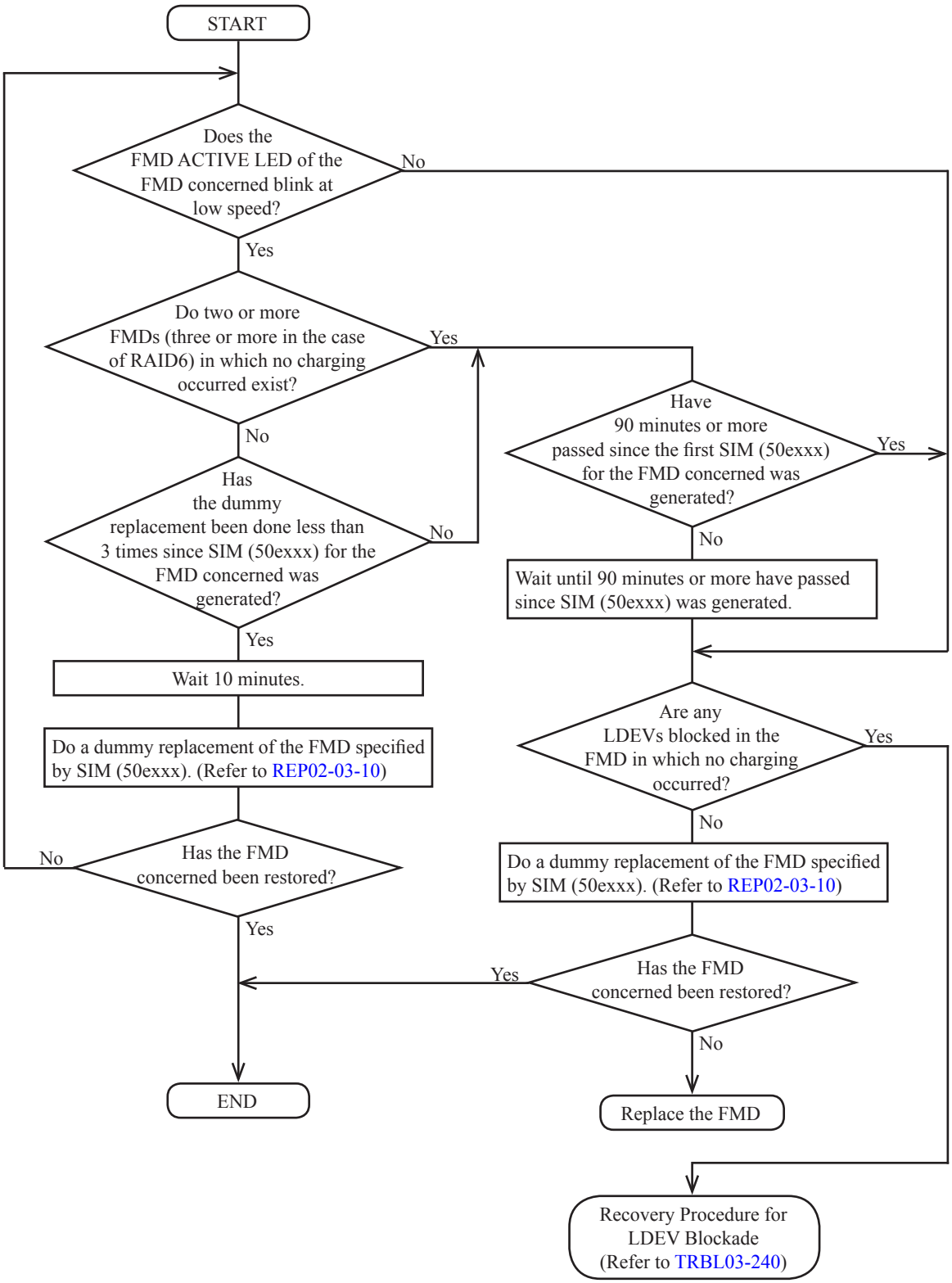


*1: Delete [TrueCopy / Universal Replicator / ShadowImage / Volume Migration / Thin Image / global-active device] pairs that use the LDEV before restoring the LDEV. After the recovery flow completes, create pairs again.

*2: When recovering the LDEV used in a GAD pair, recover the LDEV in accordance with the procedure described in TRBL18-50.

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3.6 Recovery Procedure When FMD No Charging Occurred (SIM = 50exxx)

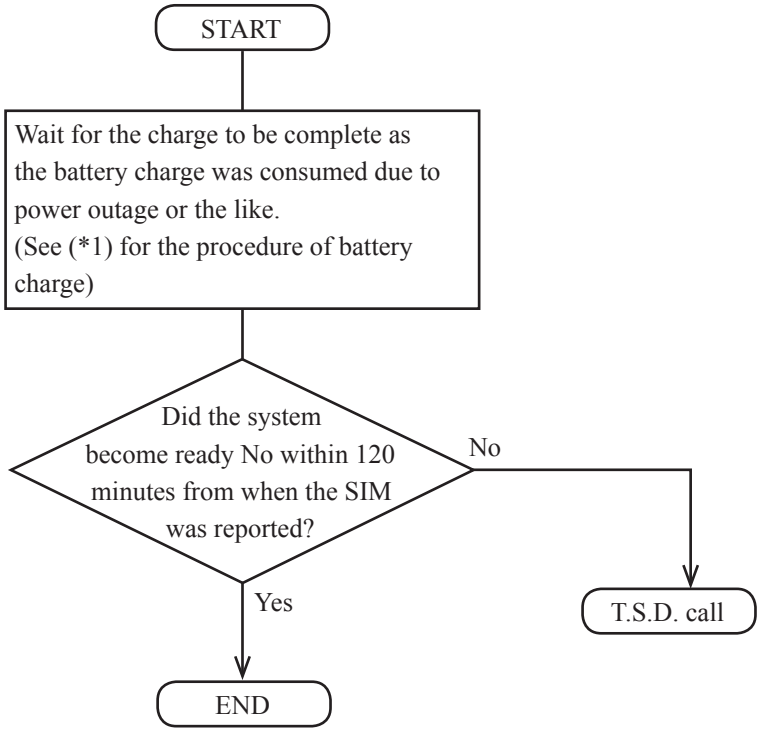


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3.7 Recovery procedure of SIM occurrence during battery charge (SIM = fe0000)

If this SIM is reported, the battery charge level is below 30% and the system is waiting for start up.
It takes a maximum of 120 minutes until the battery charge level becomes 30% or more.

For details, THEORY OF OPERATION SECTION "4.6.4 Hardware Component" - "5. Battery".



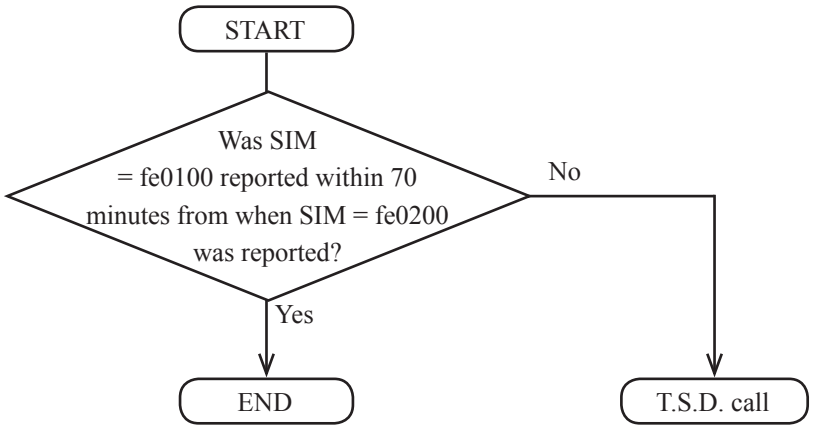
*1: Turn on the breakers on the PDPs and the PDUs, which makes the POWER LED lit, and then charge the batteries until the STATUS LED (See LOCATION SECTION "Table 3-2 Function of Controller Board (CBSS/CBSL) LEDs") goes from blinking (charge in progress) to solid (charge completed).

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3.8 Action when Cache Write Through by battery factor is detected (SIM = fe0100, fe0200)

If SIM = fe02xx is reported, the battery charge level is below 50% and the system operates in cache write through mode. It takes a maximum of 70 minutes until the battery charge level becomes 50% or more. SIM = fe0100 is reported when the battery charge level becomes 50% or more.

For details, THEORY OF OPERATION SECTION “4.6.4 Hardware Component” - ”5. Battery”.



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3.9 Isolation and Recovery Procedures for Common SAS Error (SIM = df6xxx, df7xxx, df8xxx, df9xxx)

When a port error SIM for a drive (PDEV) is reported, this section provides the procedures for judging whether the error is caused by the pertinent drive error or common SAS error, and how to recover the error.

As a HDD port error SIM managed in each PDEV, a Port temporary error (REF code = df6xxx, df7xxx) is reported when a warning is issued, and Port blocking (REF code = df8xxx, df9xxx) is reported when the equipment is blocked (Upper 6bit of xxx: CDEV#, Lower 6bit of xxx: RDEV#).

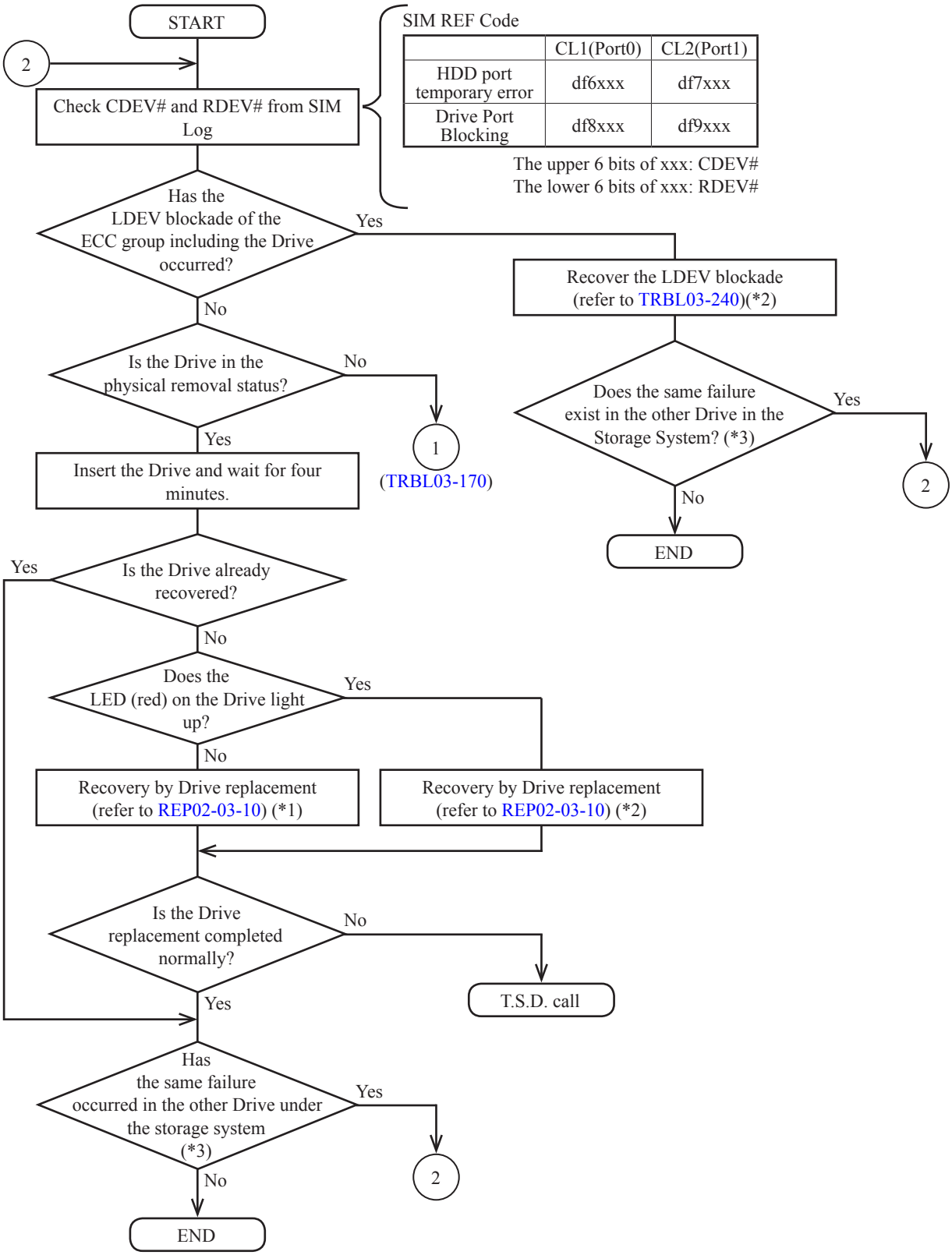
Possible causes for the malfunction are:

(1) Failure of drive specified in FPC
(2) Defects in SAS Chip on DKB
(3) Defects in SAS Loop (SAS cable, ENC)
(4) Other drive failure
(5) DB platter failure
(6) Removal of Drive whose ALM LED (red) does not light up

Before performing the maintenance and replacement only for the failed drive, follow these isolation and recovery procedures to check that a common SAS port error occurs on other PDEVs on the same SAS I/F. If a common error exists, perform the appropriate recovery for the common error parts.

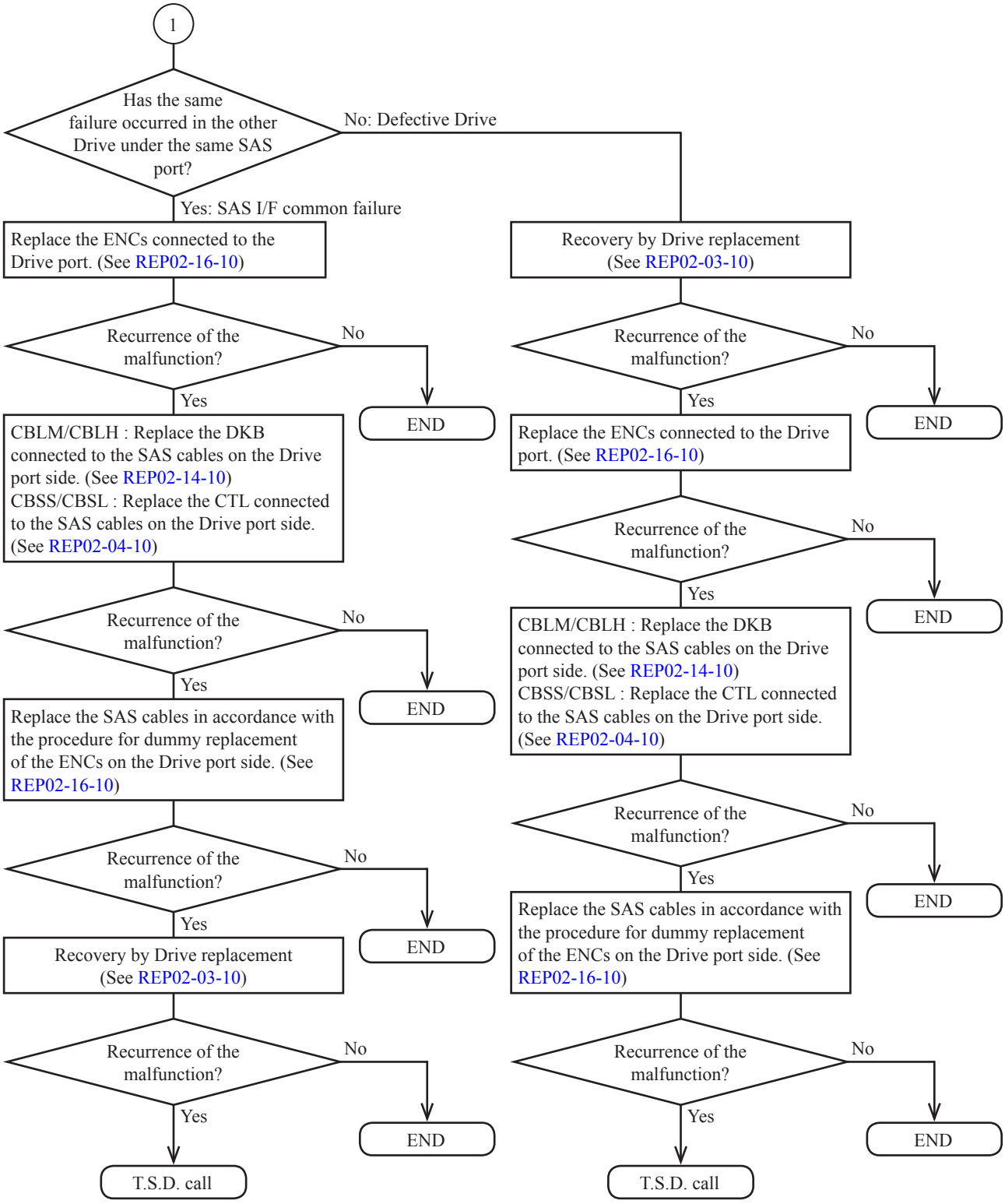
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Common SAS Error Isolation Procedure



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*1: Open Maintenance Utility and block the Drive. Check that the ALM LED (red) lights up and replace it. For Drive replacement, perform the dummy replacement again and if it fails, replace the Drive with a new Drive.
*2: Perform the dummy replacement again.
When the dummy replacement fails, replace the Drive with a new Drive.
*3: SIMs for other Drives which are not maintained: df6xxx, df7xxx, df8xxx, df9xxx



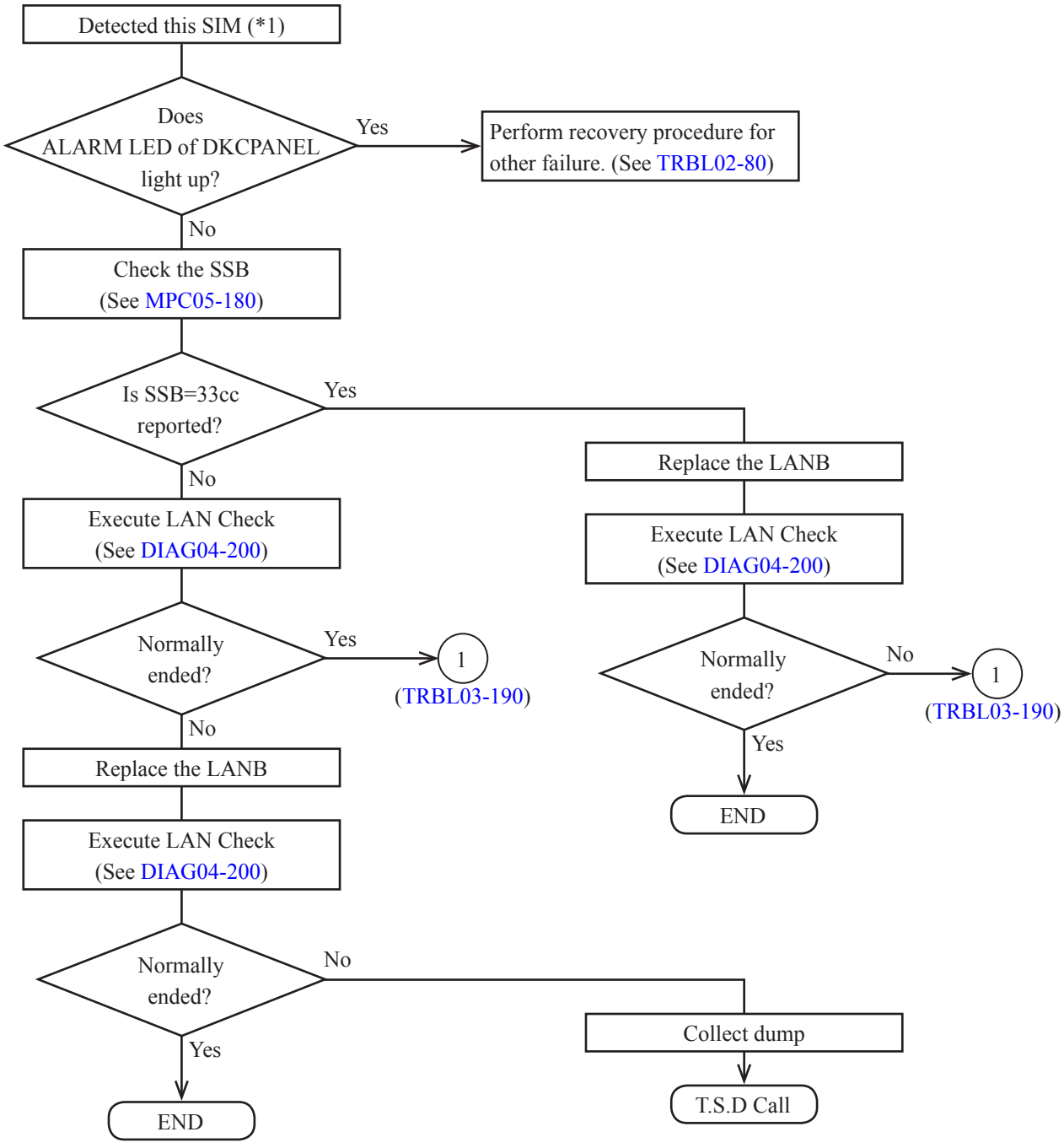
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3.10 Recovery Procedure for LAN Error (SIM = 7d01xx,7d02xx)

3.10.1 Recovery Procedure When a Internal LAN Failure Occurs (SIM = 7d01xx)

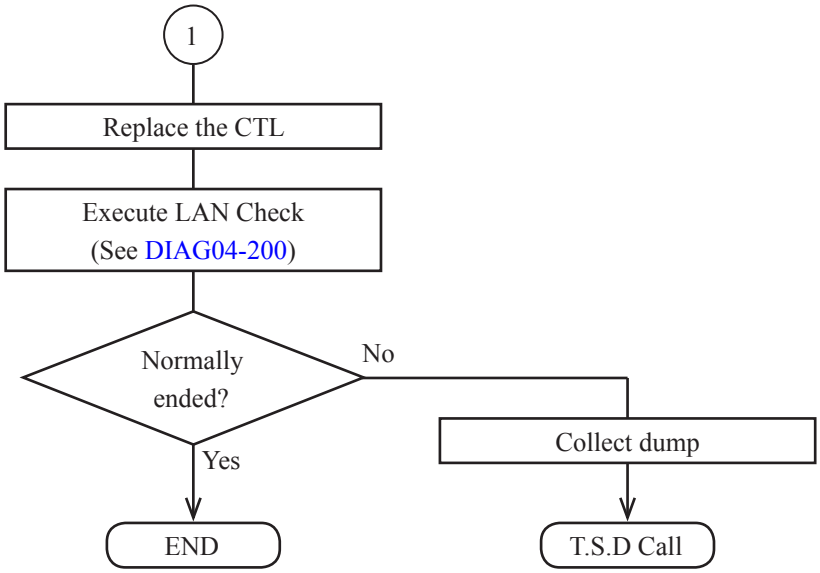
⚠ CAUTION

The storage system that detected this SIM may fell into serious error state due to DKC processor abnormality. Therefore, restore the storage system according to the following flow immediately. (*1)



*1: This SIM might not be generated at LAN error.

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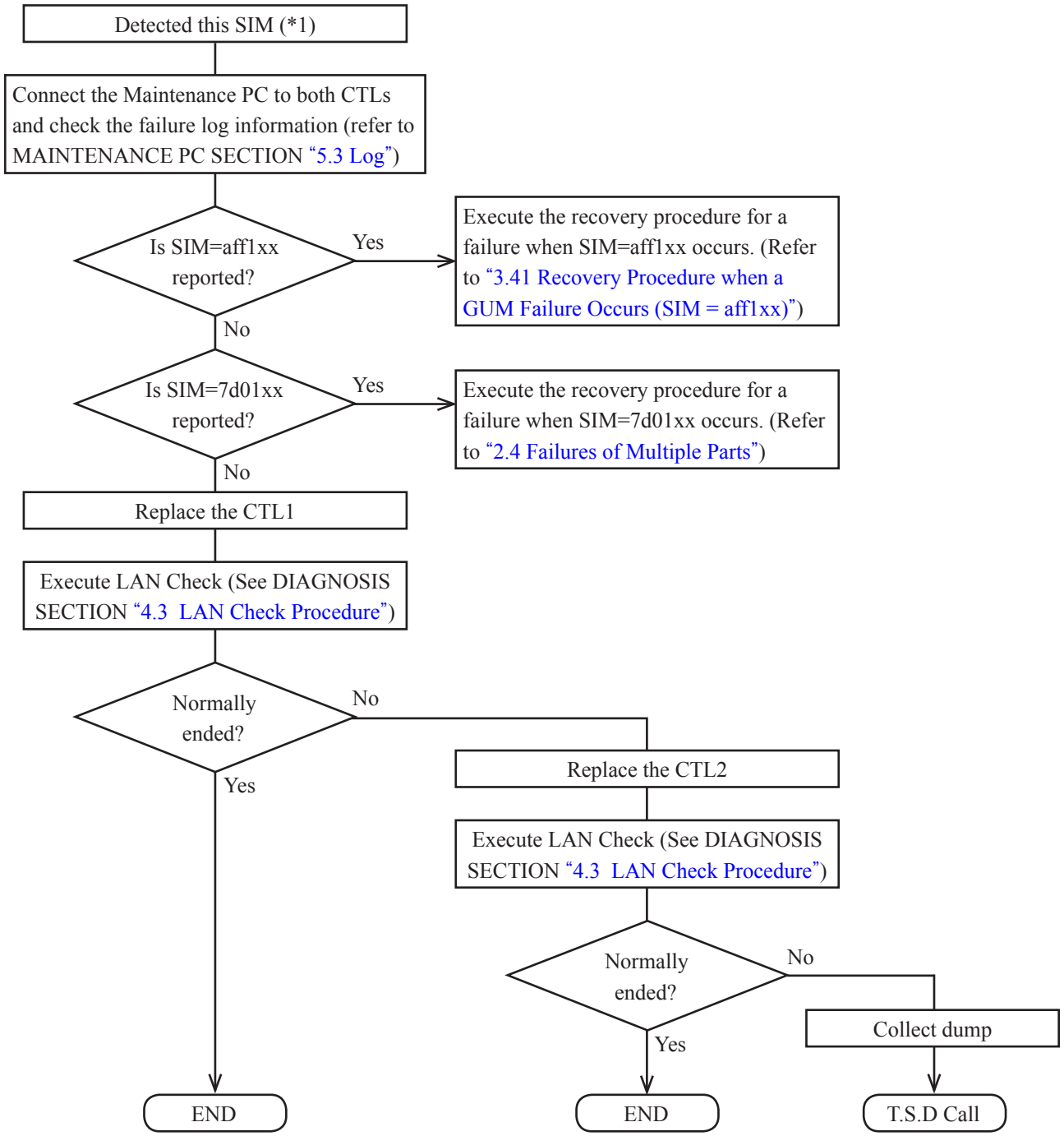


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3.10.2 Recovery Procedure When a LAN Failure Occurs between CTL (SIM = 7d02xx) (2U Controller Chassis)

⚠ CAUTION

The storage system that detected this SIM may fell into serious error state due to DKC processor abnormality. Therefore, restore the storage system according to the following flow immediately. (*1)



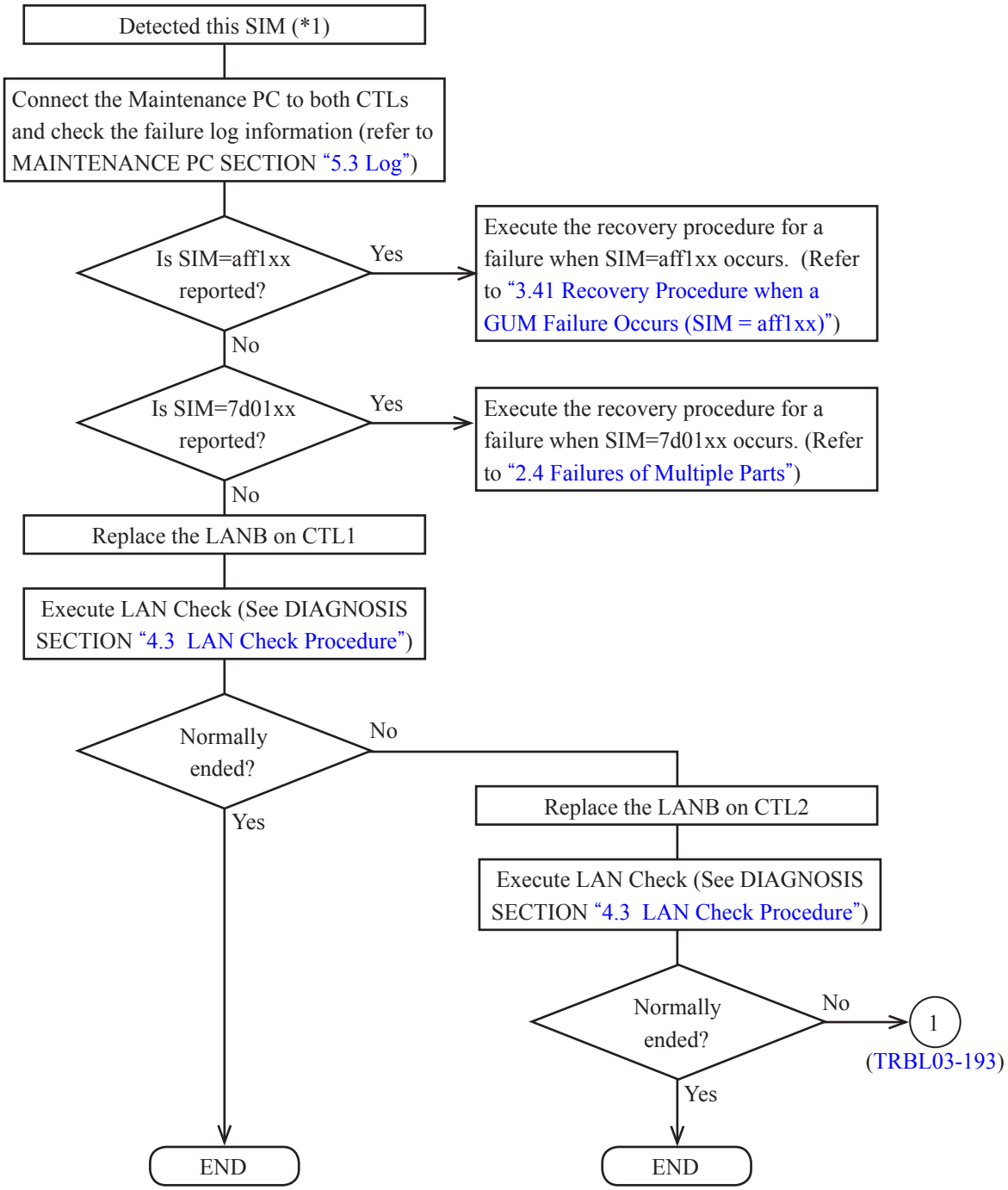
*1: This SIM might not be generated at LAN error.

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3.10.3 Recovery Procedure When a LAN Failure Occurs between CTL (SIM = 7d02xx) (4U Controller Chassis)

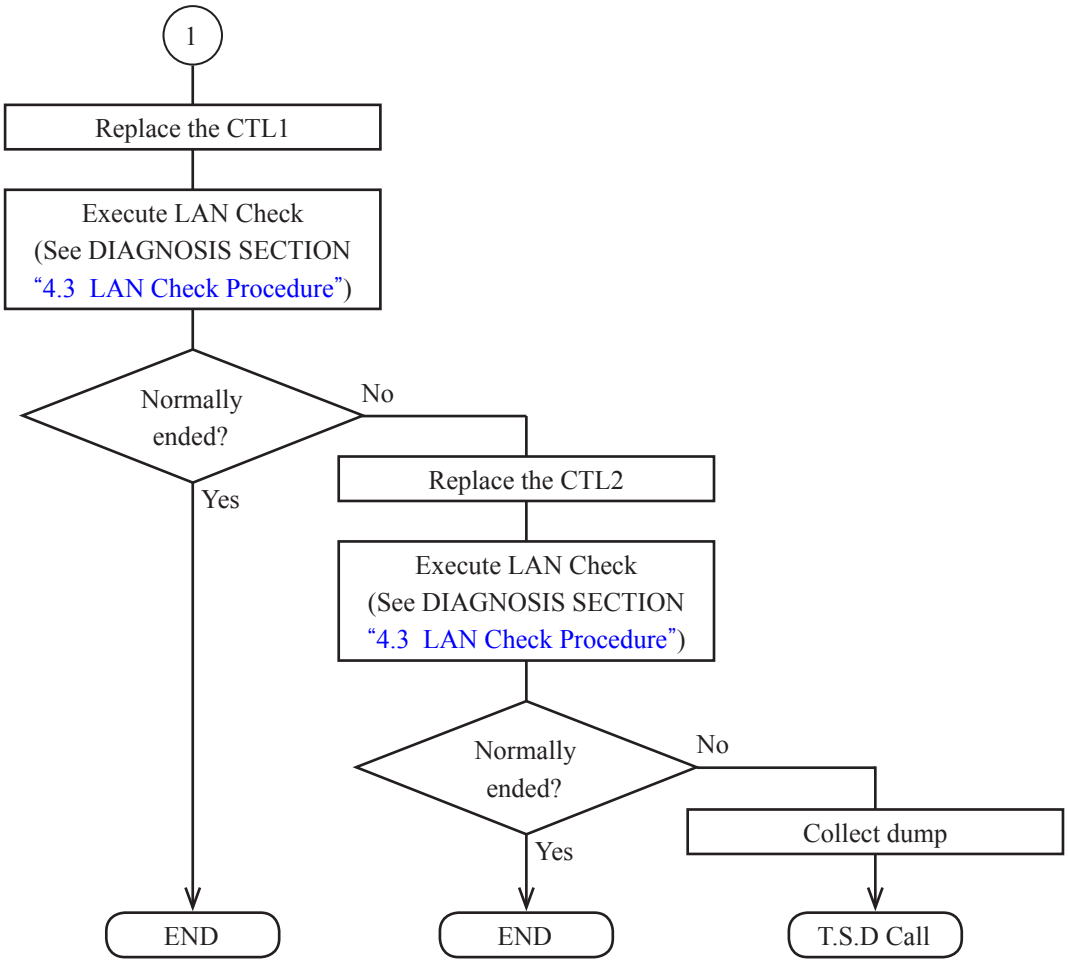
⚠ CAUTION

The storage system that detected this SIM may fell into serious error state due to DKC processor abnormality. Therefore, restore the storage system according to the following flow immediately. (*1)



*1: This SIM might not be generated at LAN error.

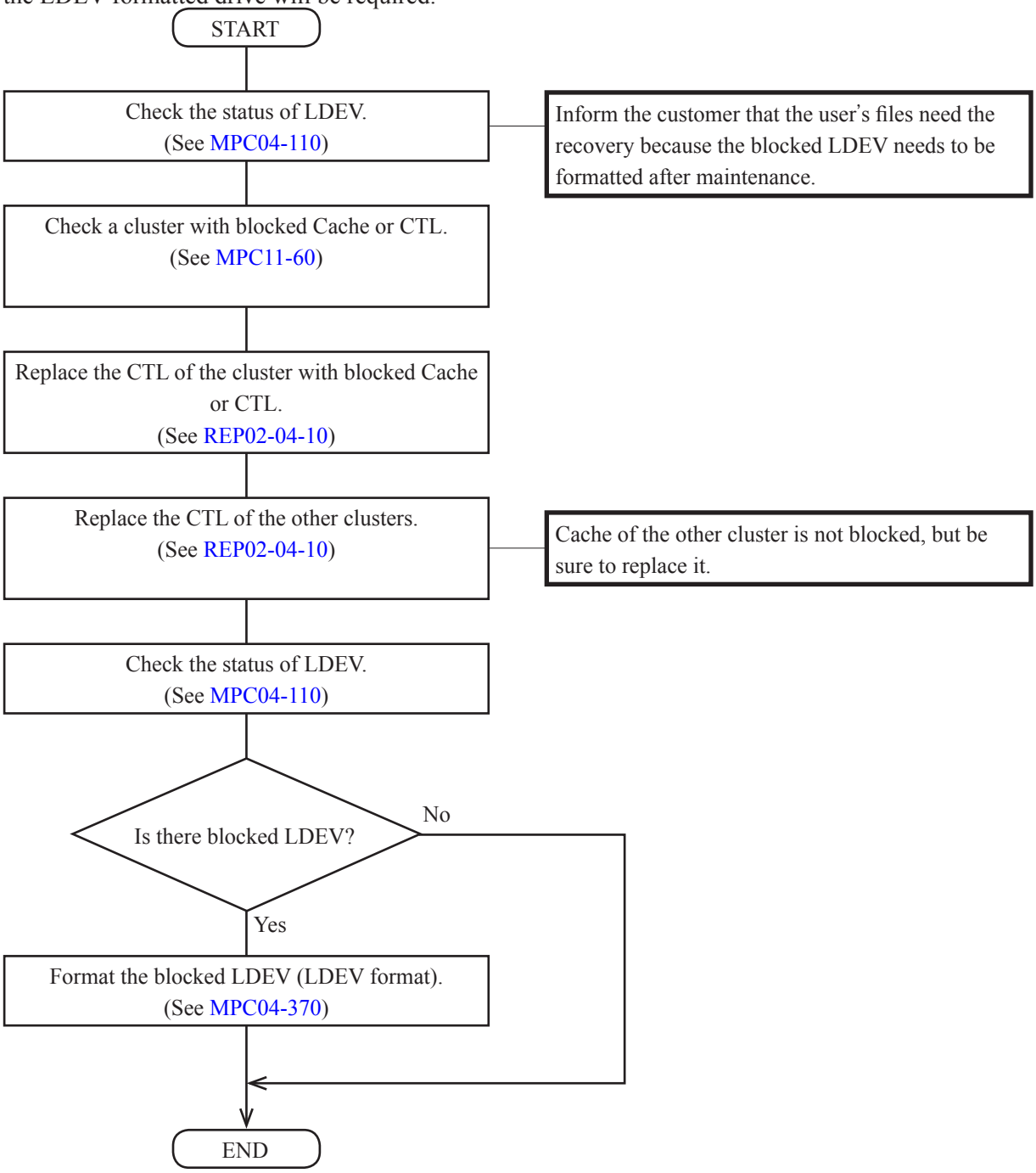
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3.11 Recovery Procedure for the Failure on Both Sides of CACHE at the Time of Starting (SIM = fff50x)

This procedure is to recover errors of the both sides of cache at powering on the storage system.
At this time, if pending data (non-written data to the drive) exists on the cache, the drive will be blocked and the LDEV formatted drive will be required.

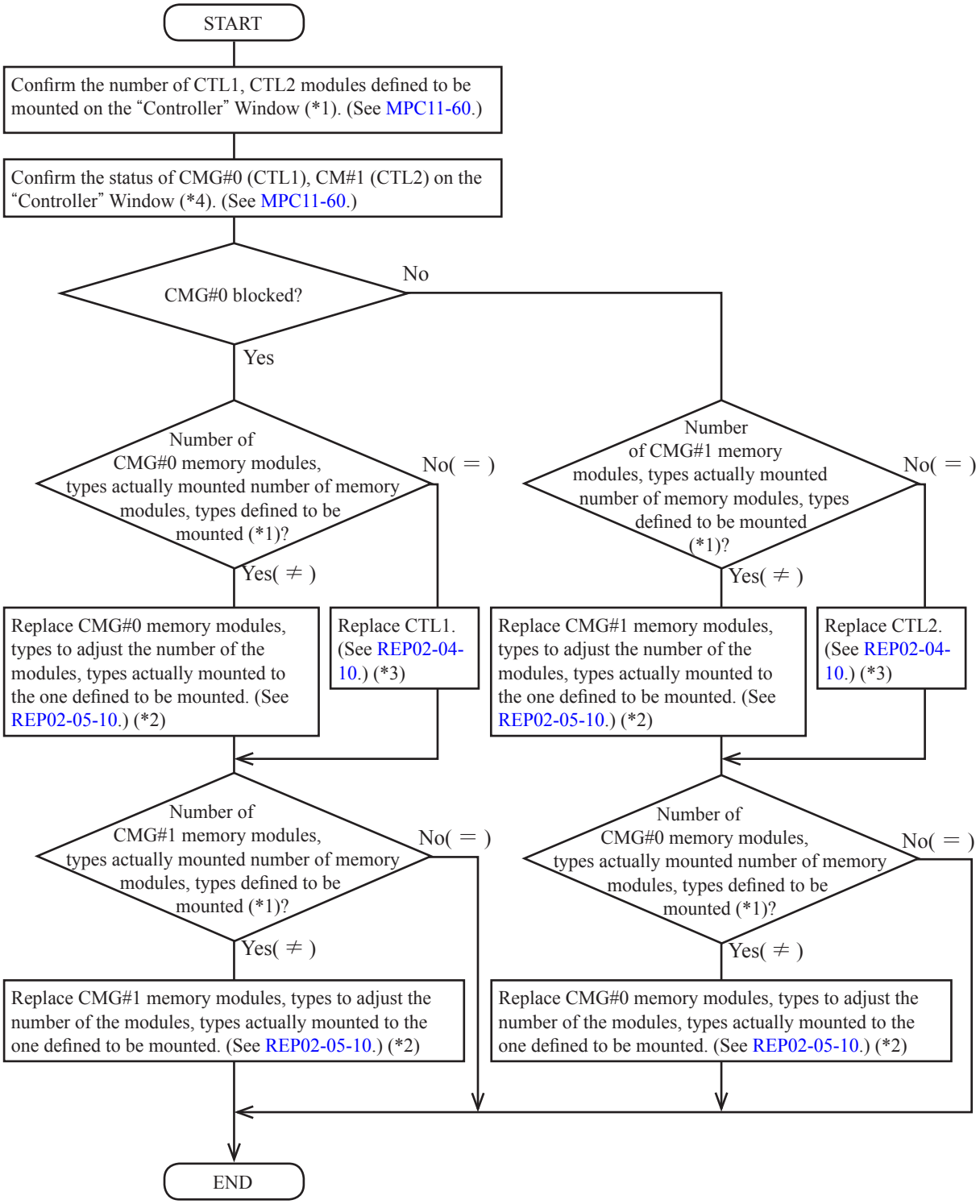


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3.12 Recovery Procedure for the Failure on the Occurrence of Unmatched Memory Installation Capacity (SIM = ffe30x, ffe800)

SIM-RC=ffe30x (The mounted SM capacities inequality error) should be recovered following the procedure below.

This error occurs if an SM is blocked because the mounted SM capacity differs between CTL1 and CTL2. Therefore, the number of memory modules, types mounted must be adjusted correctly to recover this error.

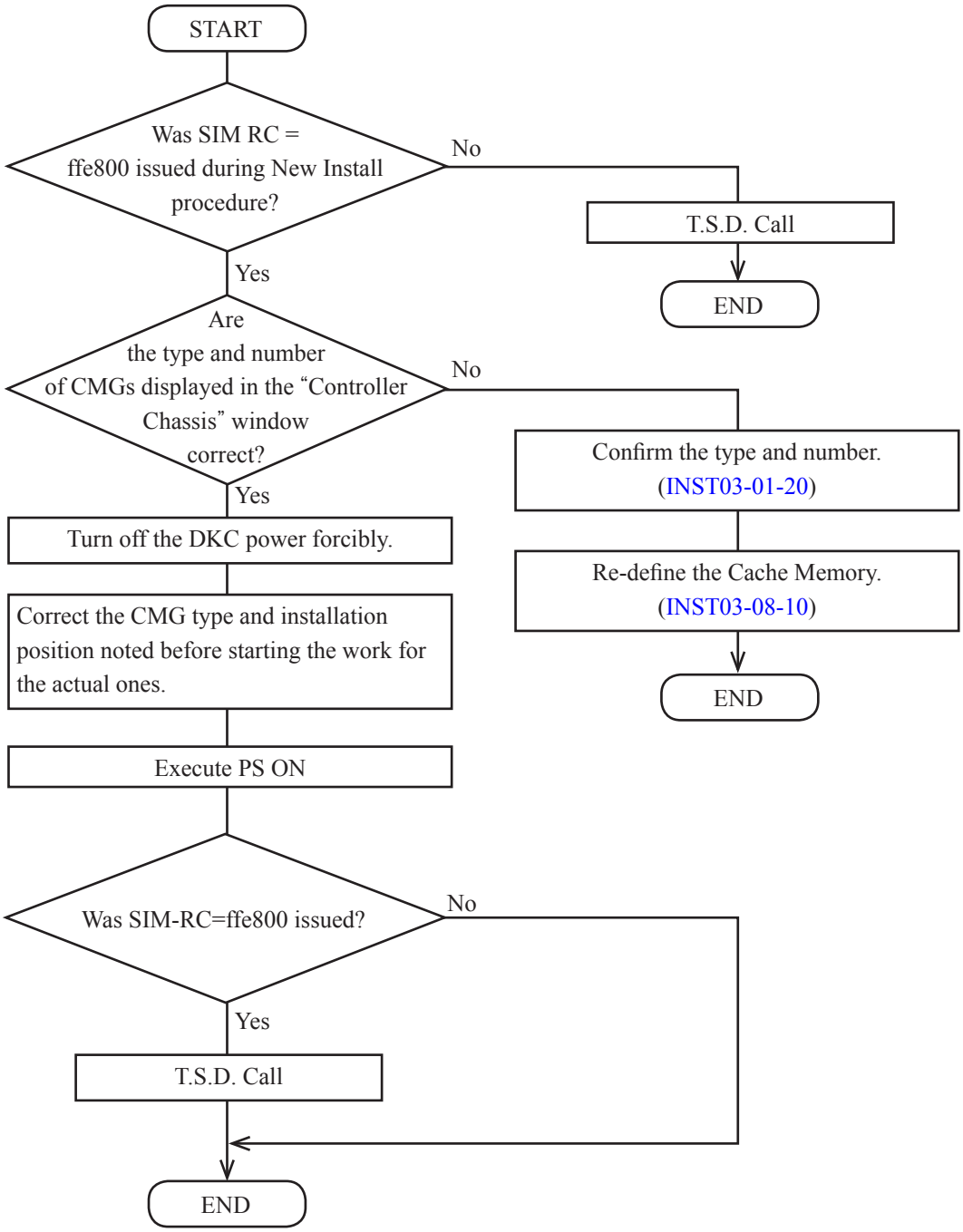


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*1: Number of memory modules indicated not to be “not-mounted” on the status screen.
*2: Confirm the number of mounted memory modules, types to adjust it.
*3: No need to adjust the number of memory modules, types mounted nor replace any of them.
*4: The VSP G200 installs CMG#0 only.

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SIM-RC=ffe80x should be recovered following the procedure below.
This SIM indicates that “Installation type and set type of CMGs” or “Installed number and set number of CMGs” are unmatched, so that they need to be matched. Click the [CTL] tab in the “Controller Chassis” window of “Maintenance Utility” window before starting the work and take notes on CMG types and installation positions.



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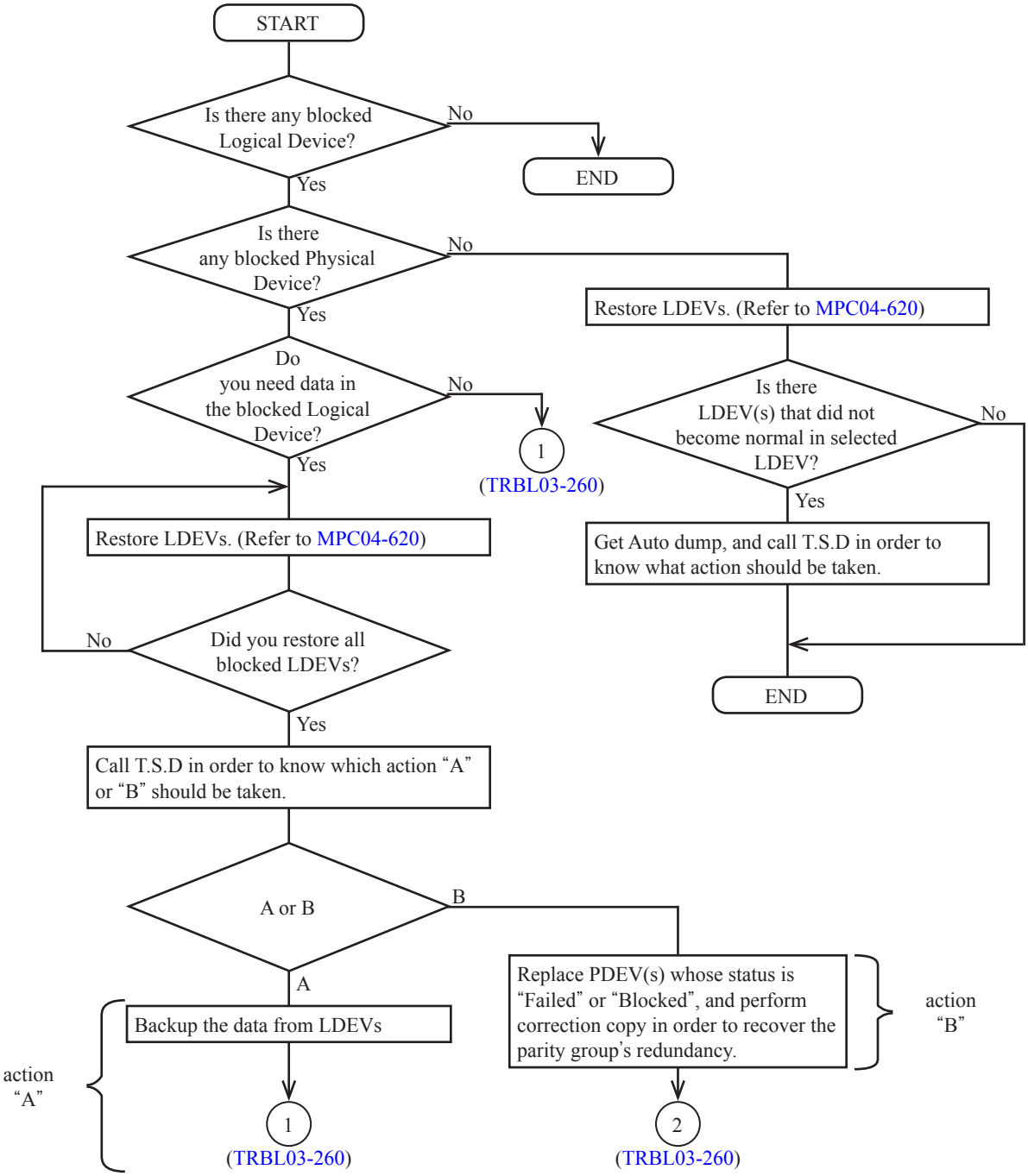
3.13 Recovery Procedure for LDEV Blockade (SIM = ef9xxx, dfaxxx, dfbxxx)

When LDEVs are blocked in the case of blocking several PDEVs (SIM RC=ef9yxx, dfayxx, dfbyxx), perform the following recovery procedures.
Be sure to call T.S.D. before you perform PDEV replace. It causes a DATA-LOSS in some cases.

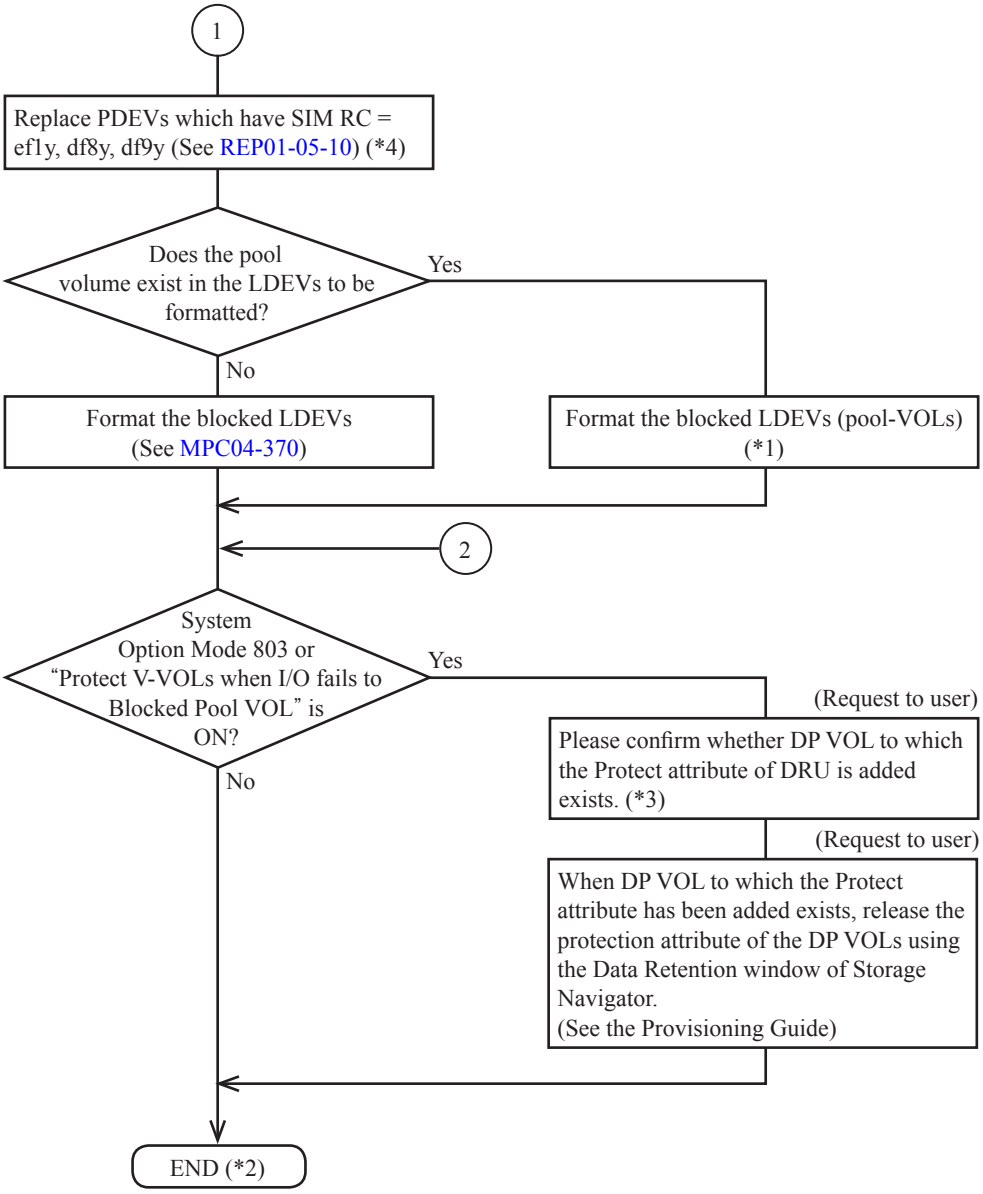
> **⚠ CAUTION**
>
> When you execute a Recovery Procedure for LDEV Blocking, you must delete the TC-MF pair. After recovering it, if necessary, you execute establish pair.

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SIM RC = ef9yxx, dfayxx, dfbyxx



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*1: See TRBL10-10 of the case of Dynamic Provisioning.
See TRBL08-80 of the case of Thin Image.

*2: Please confirm it whether to use Audit Log Buffer for the customer when LDEV to be formatted is a system disk. If using it, please make the function being used Disable once after formatting LDEV and set it to Enable again afterwards.

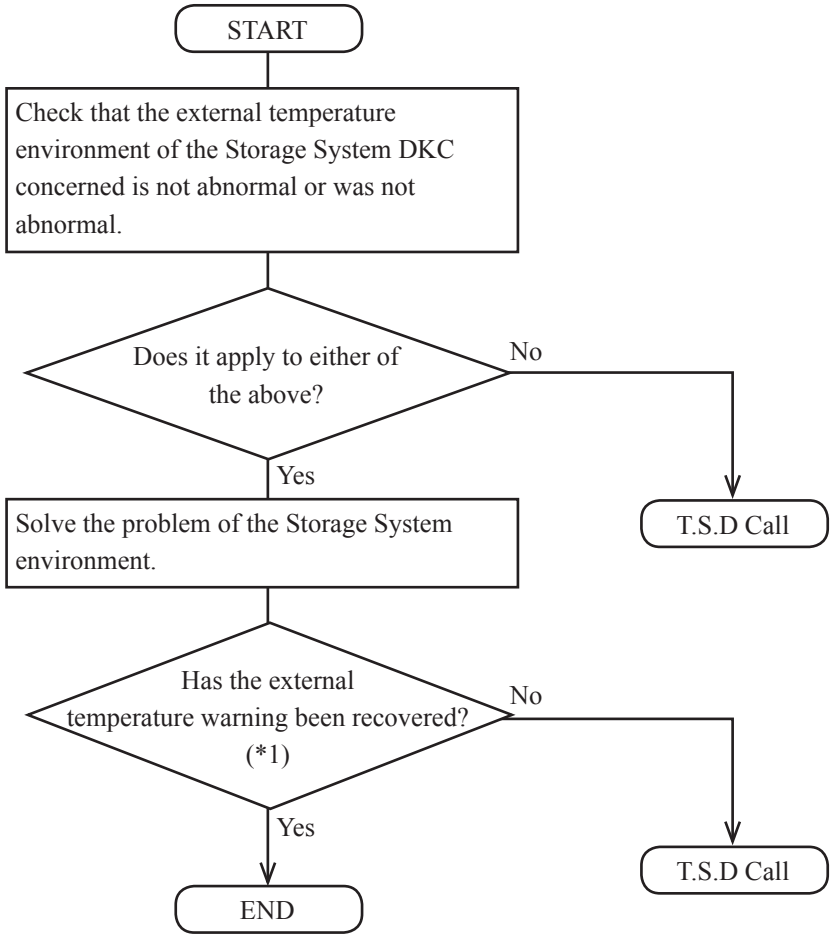
*3: Please specify the following condition for the filter using Virtual Volumes tab of Pools: Volume tabs to display DP-VOL to which the Protect attribute is added in all DP-VOL related to concerned POOL. (Please make Access Attribute column visible if it is hidden.)
• Please input "protect" specifying the access attribute for conditional expression.
See "System Administrator Guide" for details.

*4: When PDEV replacement fails and the following conditions (a) and (b) are met, check the box of "Forcibly run without safety checks", and then replace the PDEV again.
(a) Data in the blocked LDEV is not needed.
(b) Only "30762-208312" is output as error code when PDEV replacement fails.

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3.14 Response to the Occurrence of External Temperature Warning or Alarm (SIM = af110x, af120x)

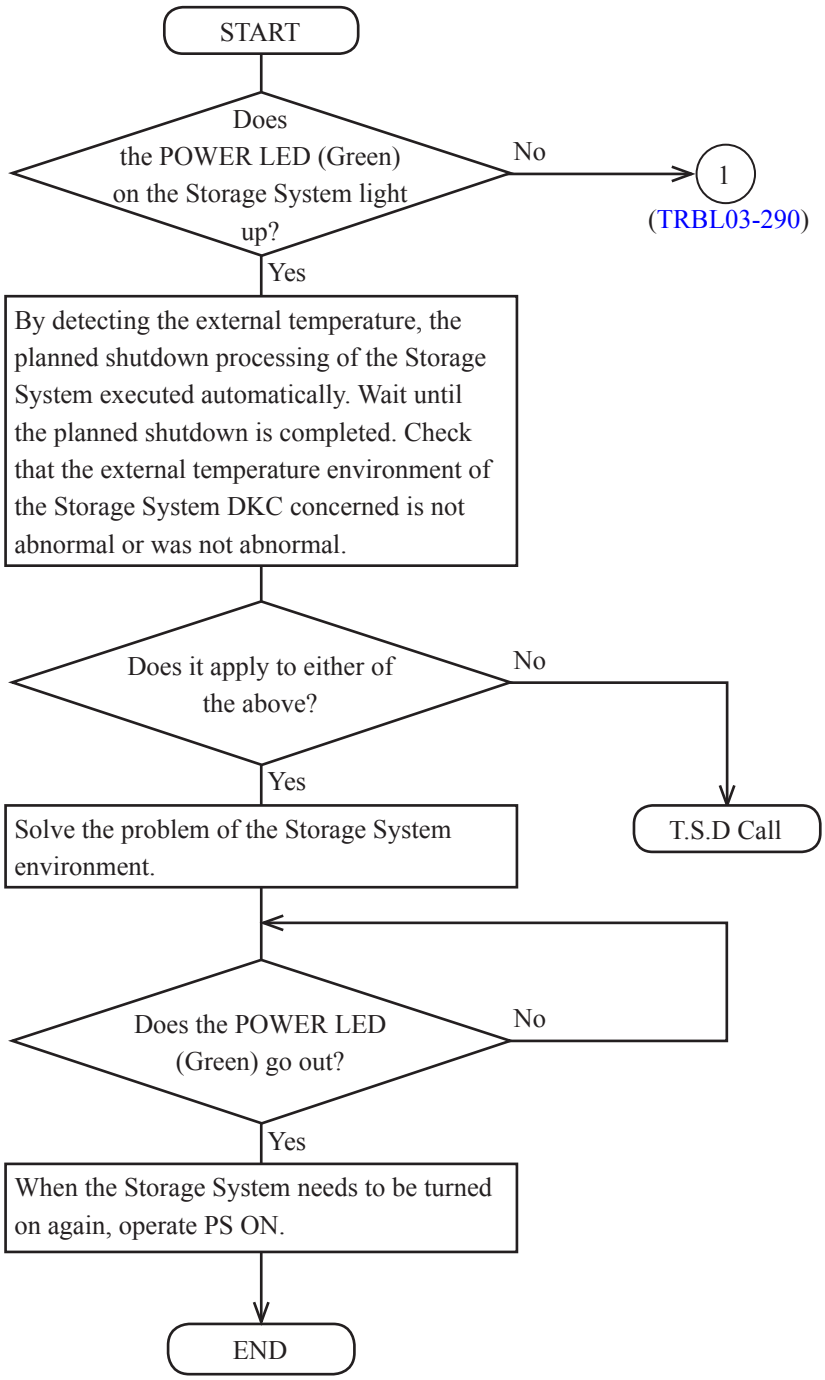
1. Response to the Occurrence of External Temperature Warning



*1: The recovery status of the external temperature warning can be verified by using the detailed information of the SSB “f602”.
If the detailed data Byte43.bit[3:0] in the SSB “f602” is “1”, this value shows that the external temperature warning has been recovered.

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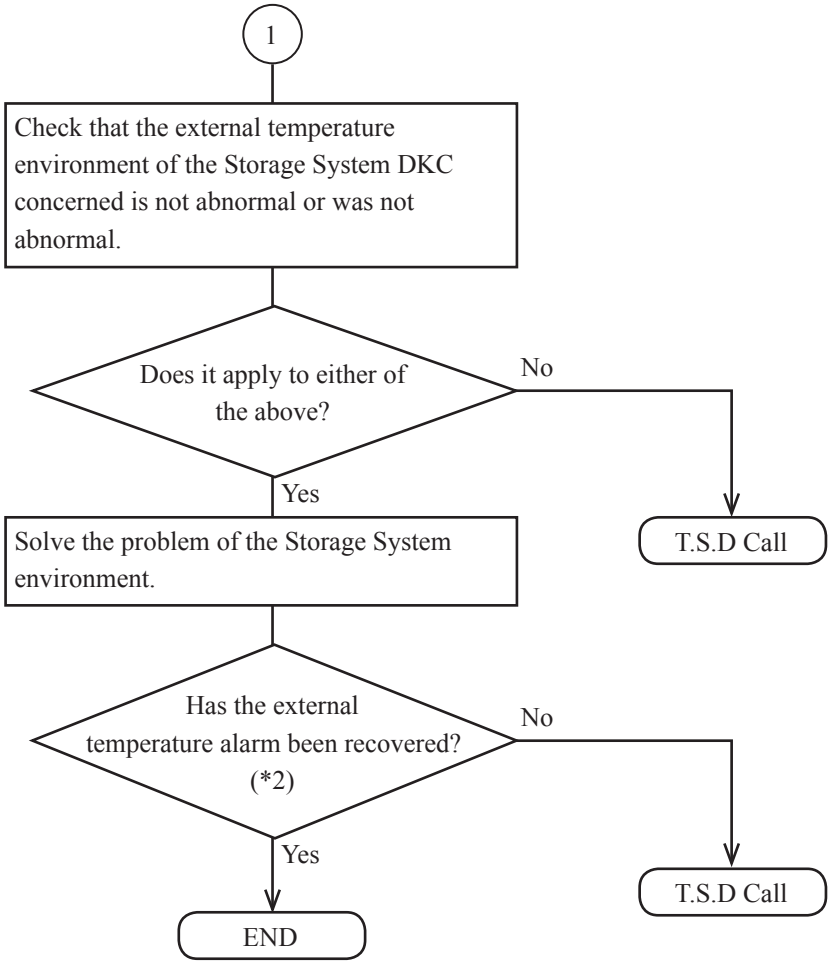
2. Response to the Occurrence of External Temperature Alarm



[Special instructions when contacting the Technical Support Division]

- Collect a Normal Dump.
- Check that no failure has occurred in the intake/exhaust duct on the front side (intake side) and rear side (exhaust side) of the DKC.
- Check that the external temperature environment is not abnormal or was not abnormal.

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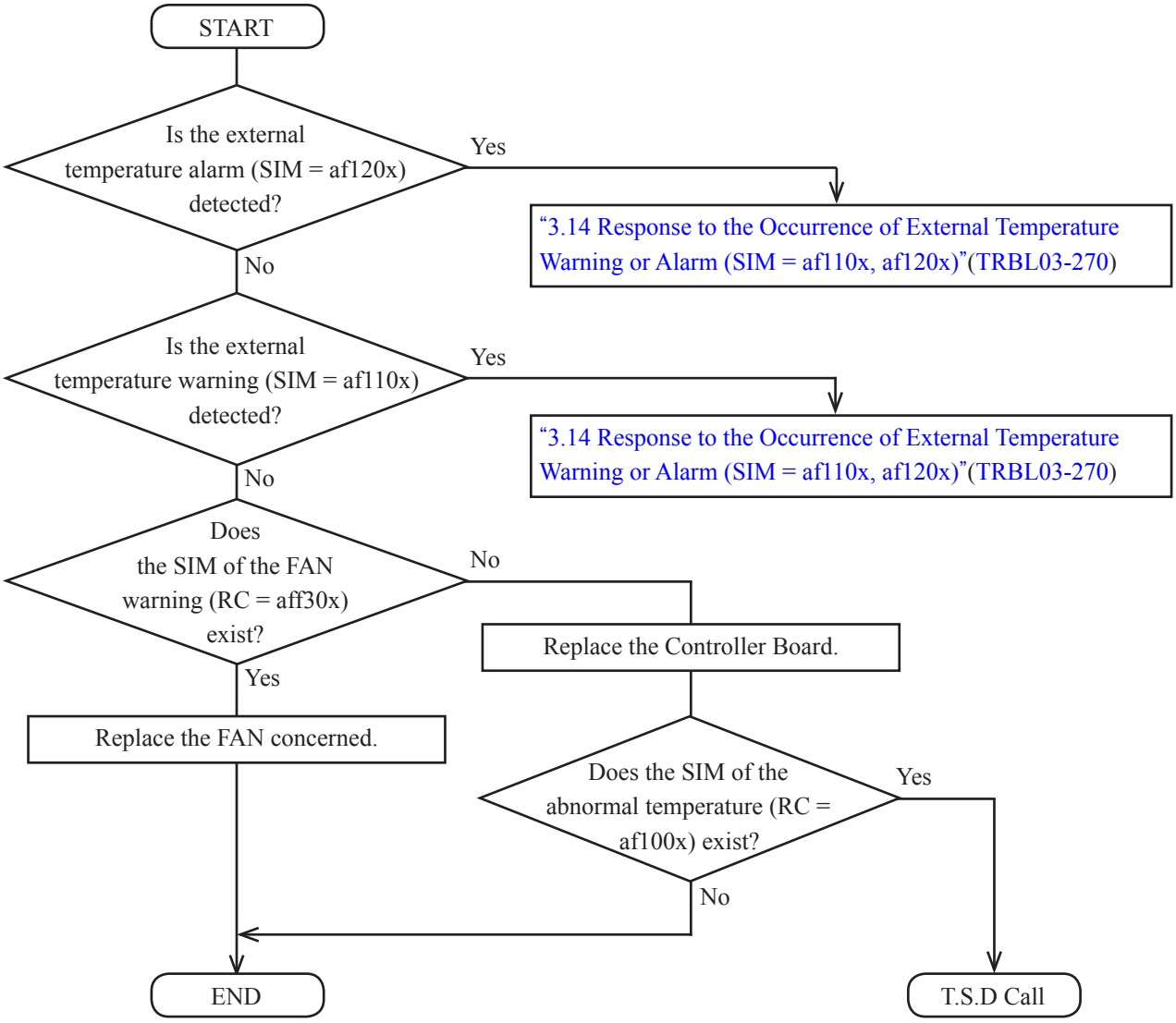
*2: The recovery status of external temperature alarm can be verified by using the detailed information of the SSB “f602”.
If the detailed data Byte43.bit[3:0] in the SSB “f602” is “2”, this value shows that the external temperature alarm has been recovered.

[Special instructions when contacting the Technical Support Division]

- Collect a Normal Dump.
- Check that no failure has occurred in the intake/exhaust duct on the front side (intake side) and rear side (exhaust side) of the DKC.
- Check that the external temperature environment is not abnormal or was not abnormal.

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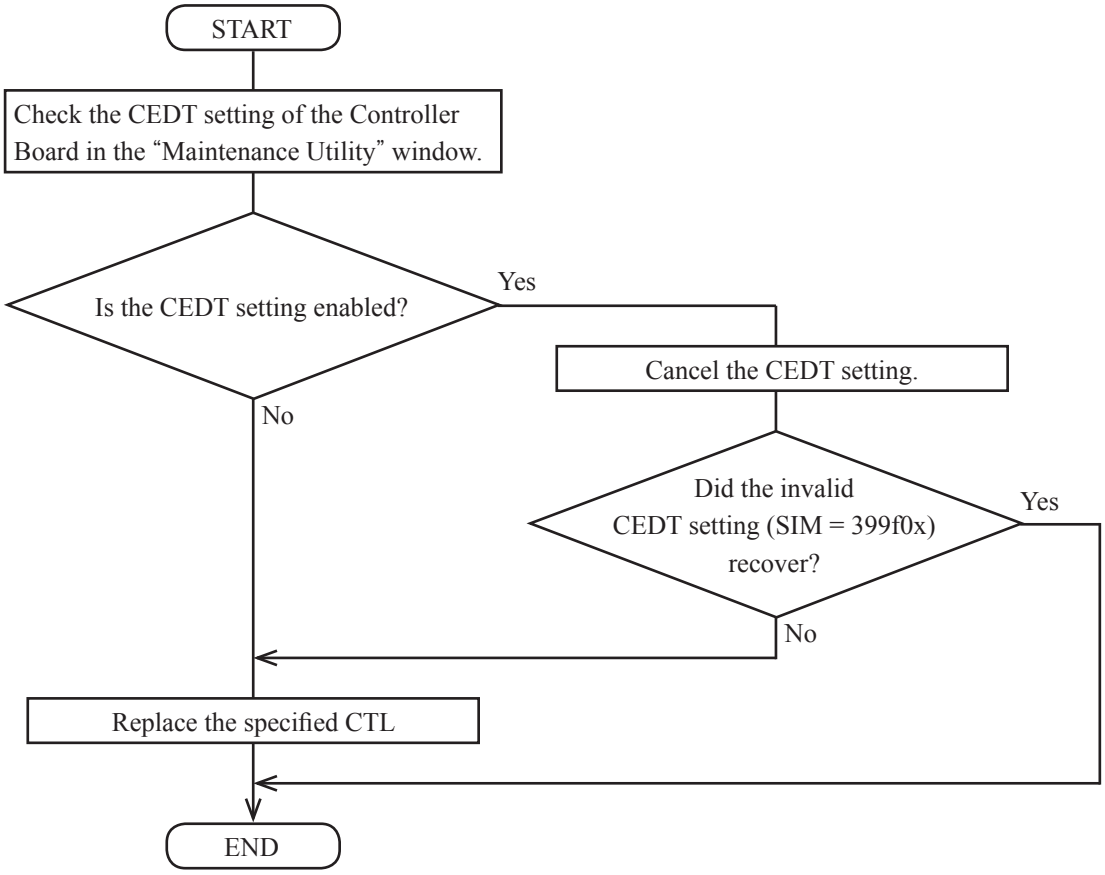
3.15 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)



NOTE: When the CPU temperature becomes normal, the system is Ready. When replacing the FAN, there is a case which needs time of about one hour until the CPU becomes the normal temperature.

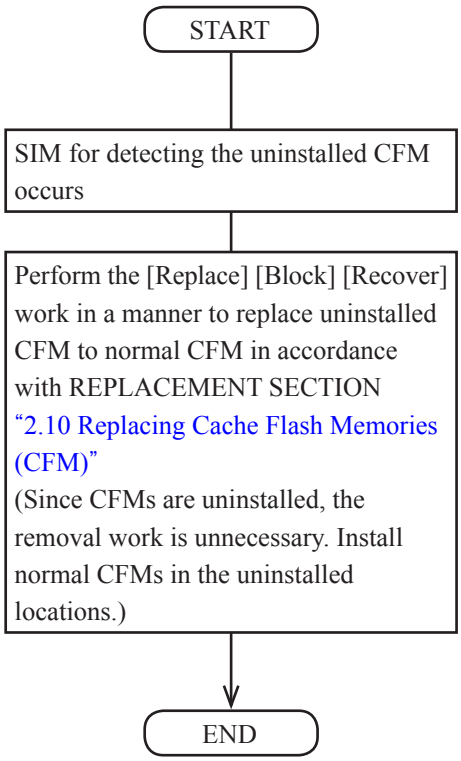
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3.16 Response to the Detection of Invalid CEDT(SIM = 399f0x)



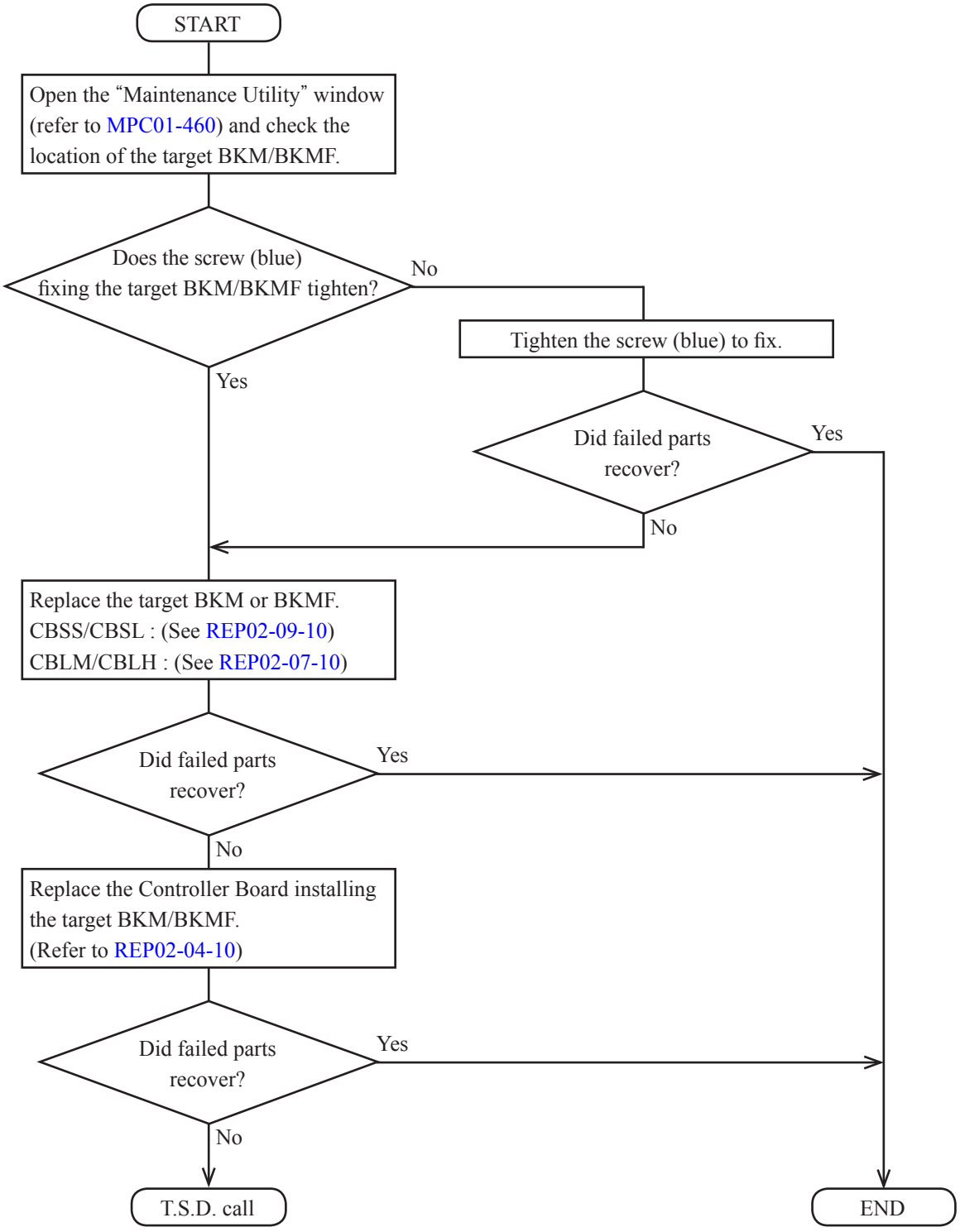
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3.17 Response to the Detection of Uninstalled CFM (SIM = aff20x)



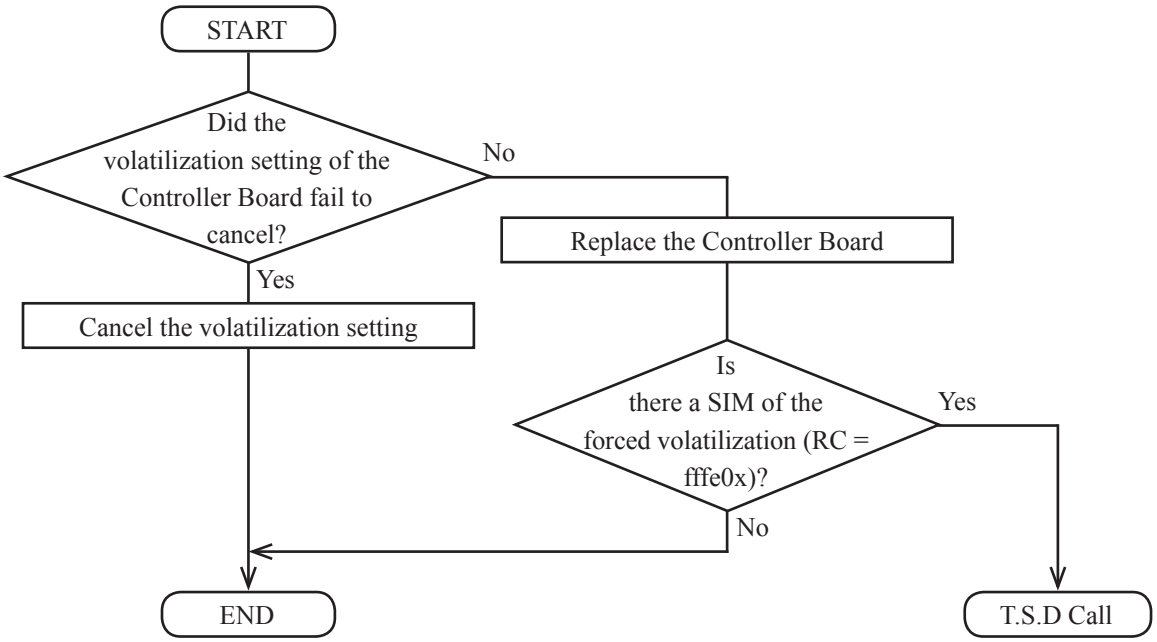
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3.18 Response to the Occurrence of BKM or BKMF Warning (SIM = af400x)



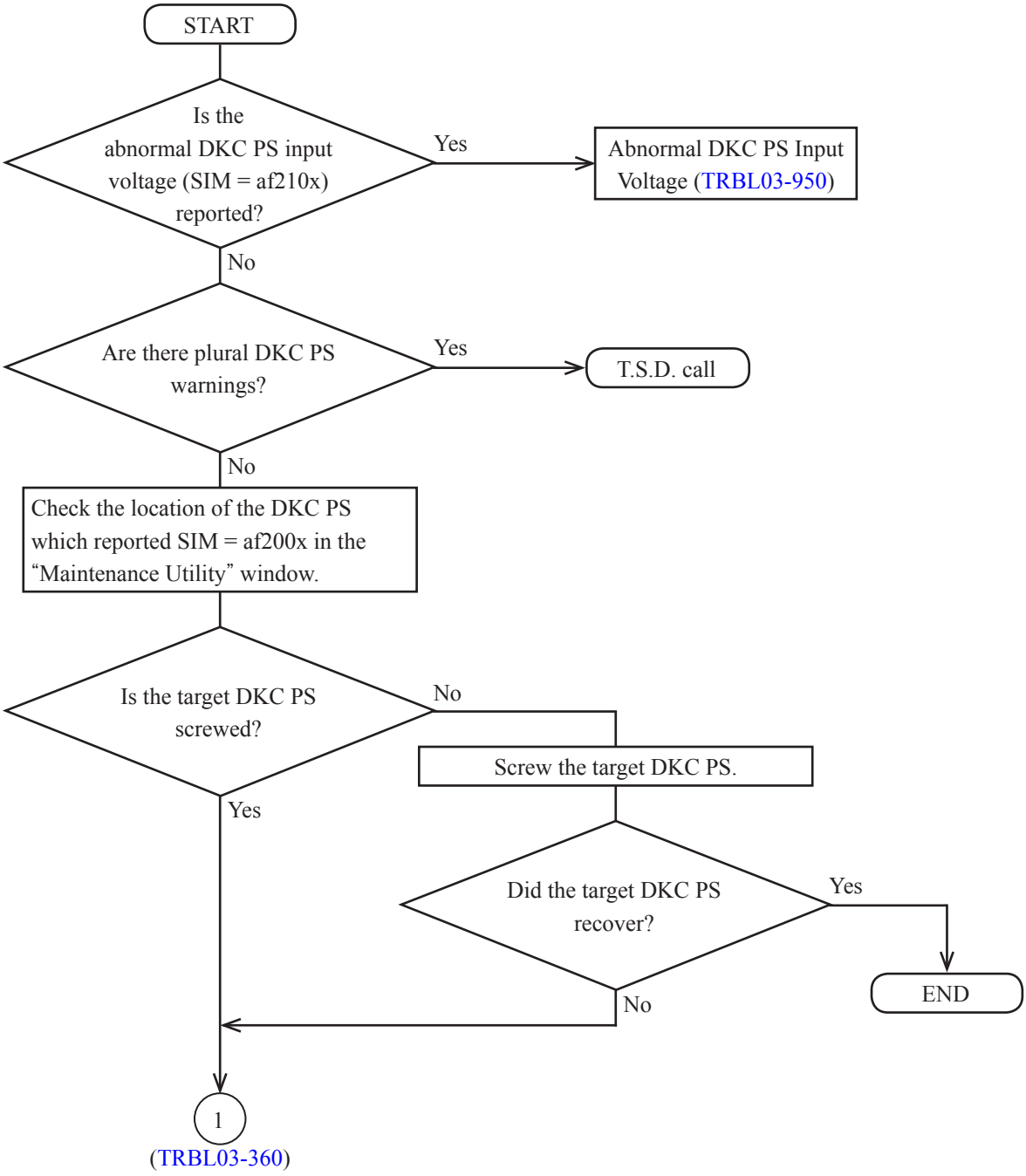
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3.19 Response to the Detection of Forced Volatilization Warning (SIM = fffe0x)

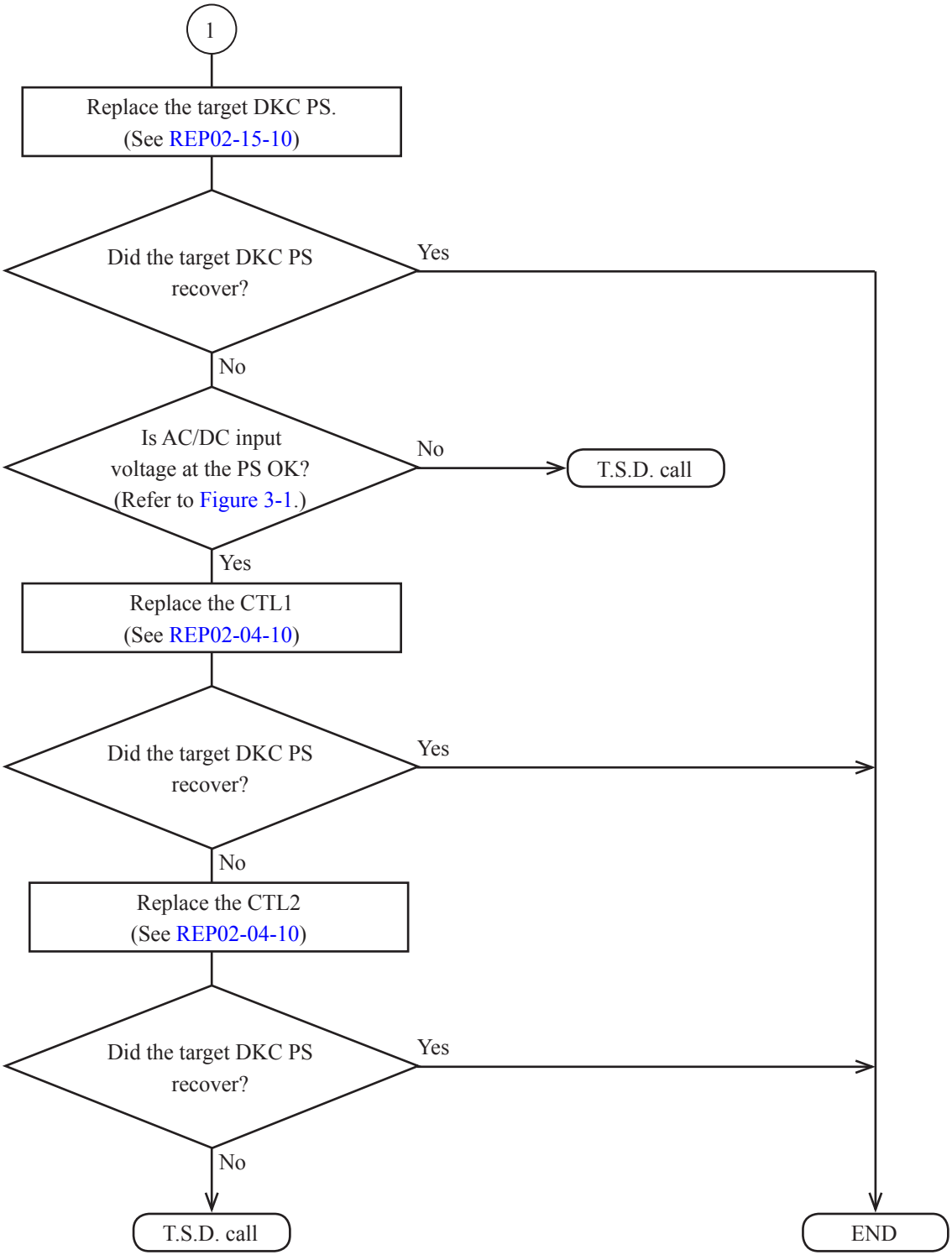


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3.20 Response to the Occurrence of DKC PS Warning (SIM = af200x)

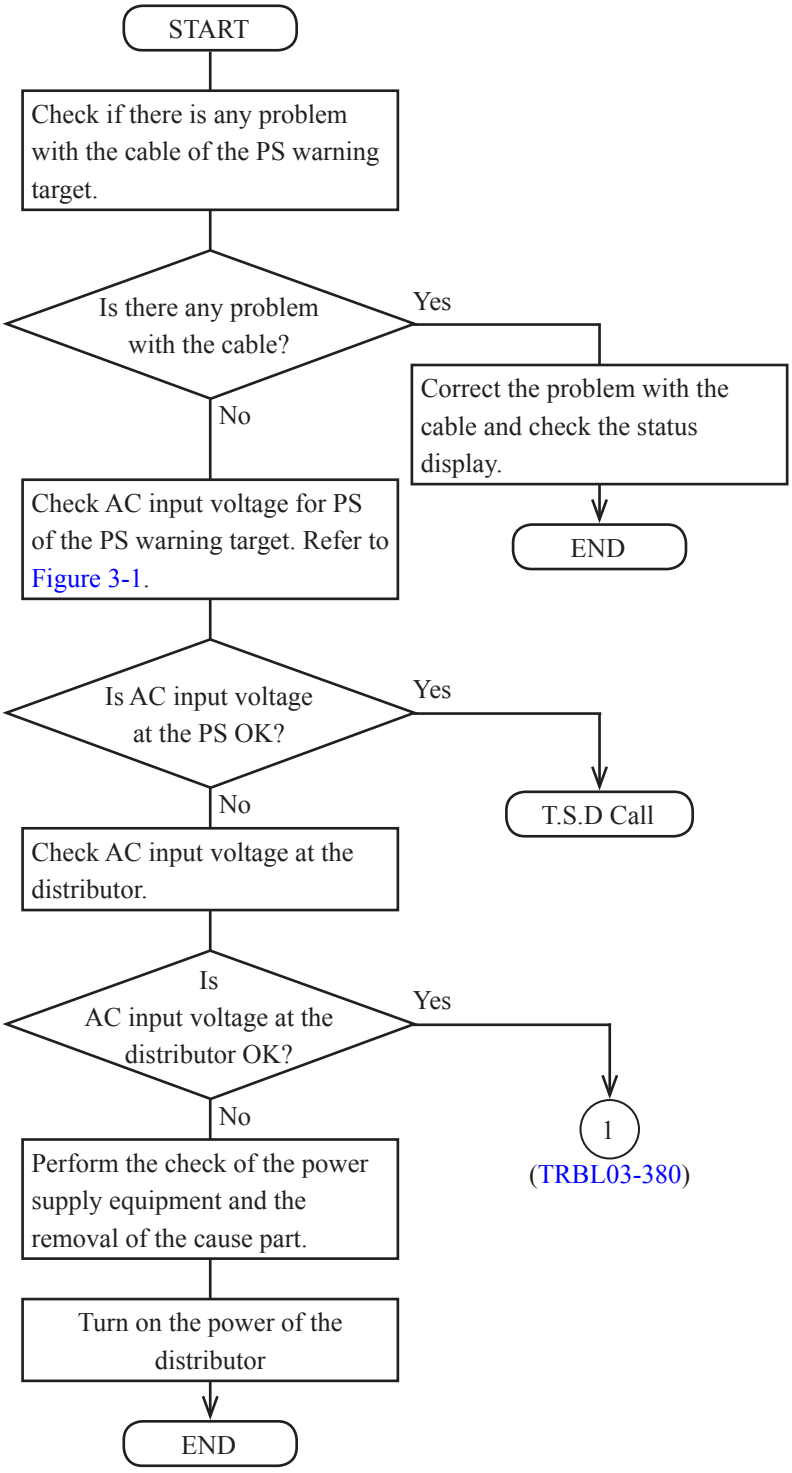


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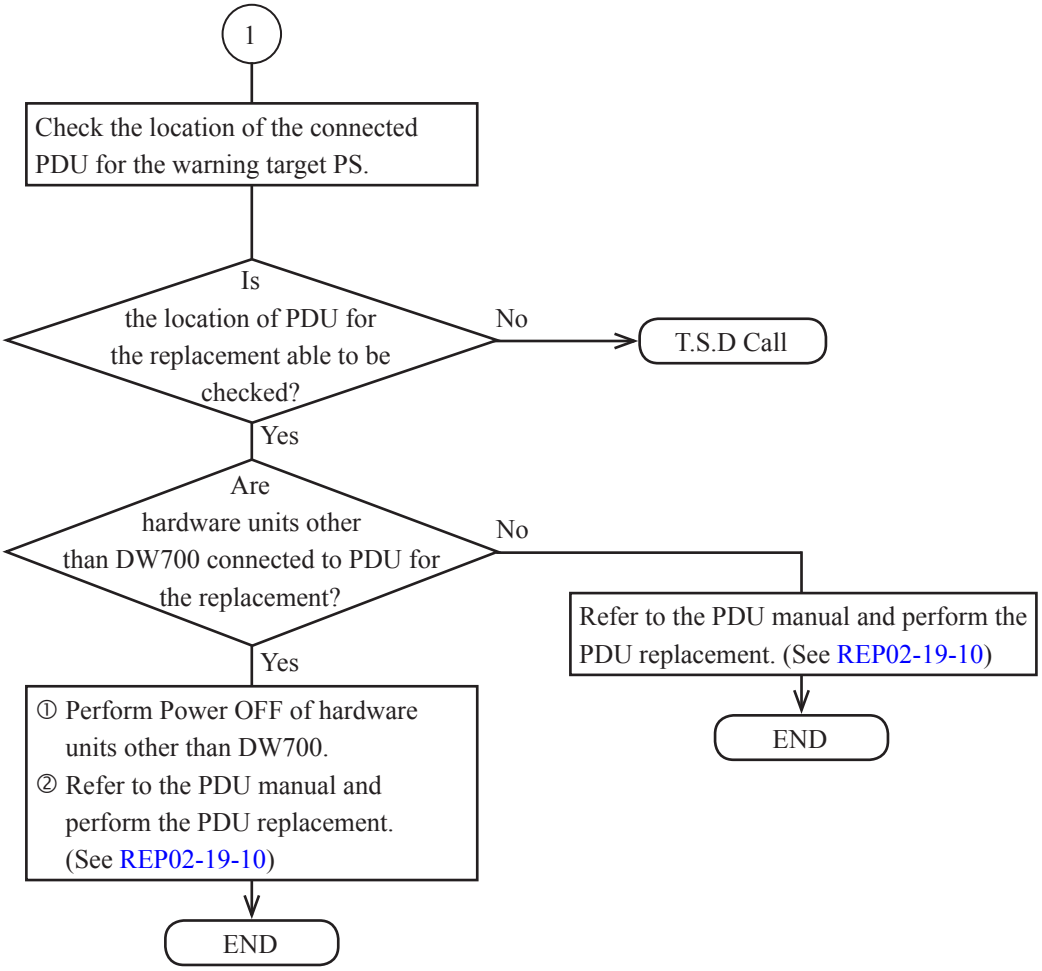


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3.21 Response to the Detection of Abnormal DBPS Input Voltage (SIM = af60xx)

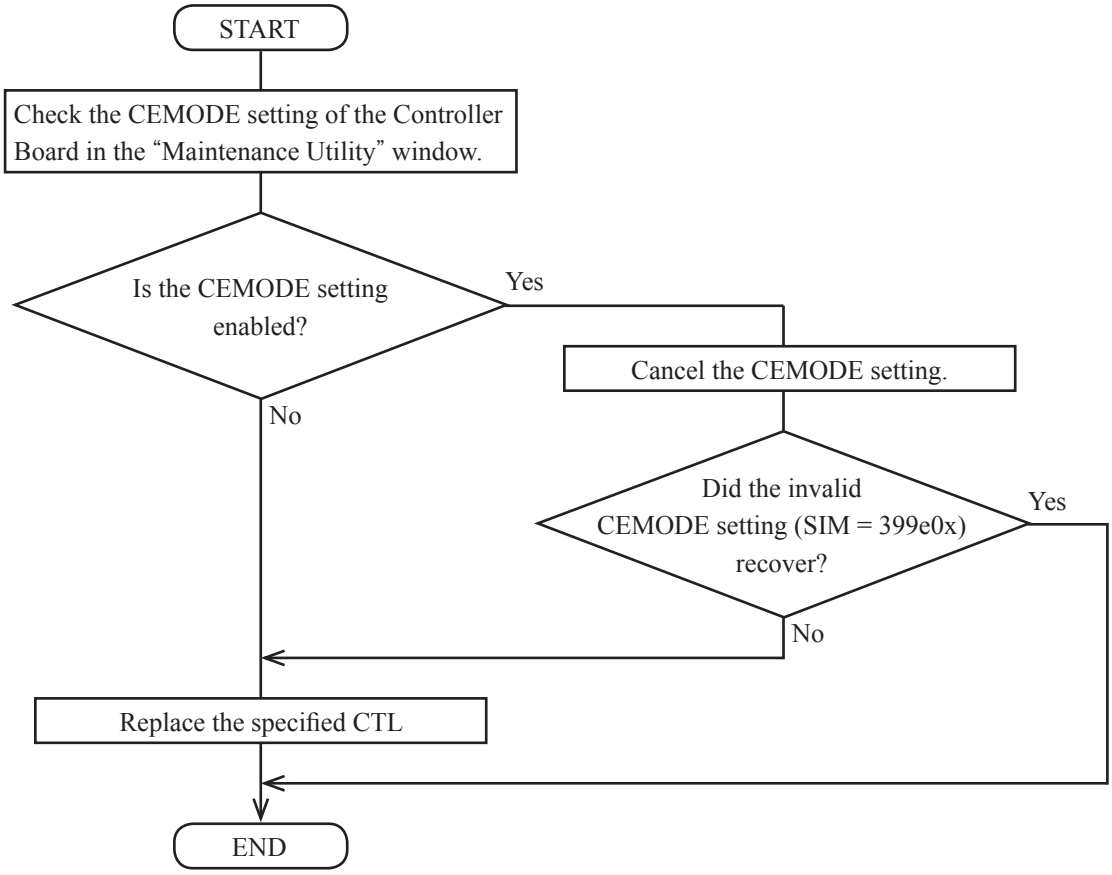


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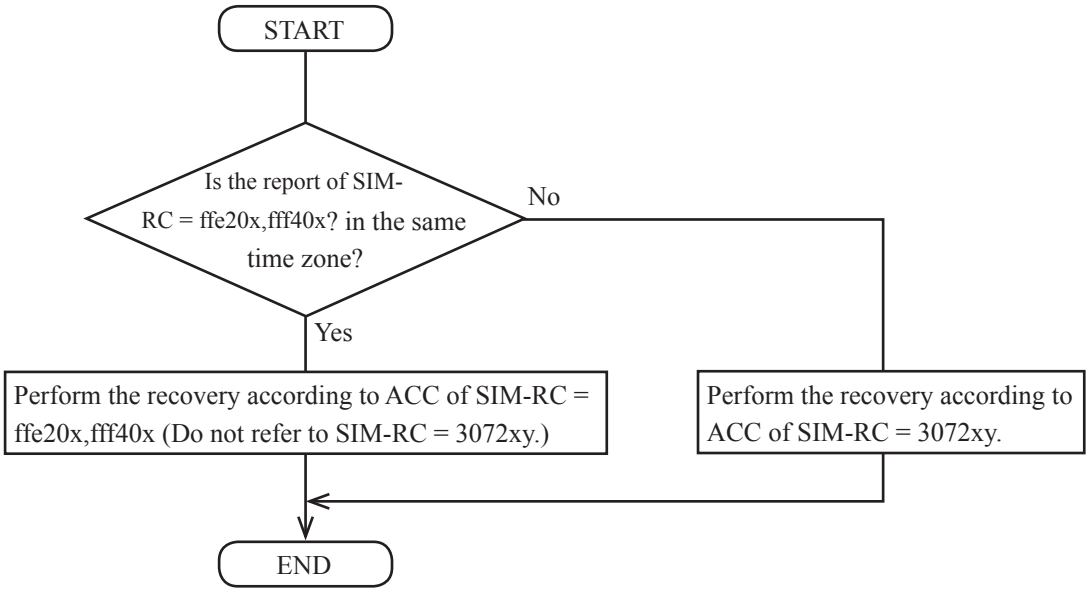
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3.22 Response to the Detection of Invalid CEMODE (SIM = 399e0x)



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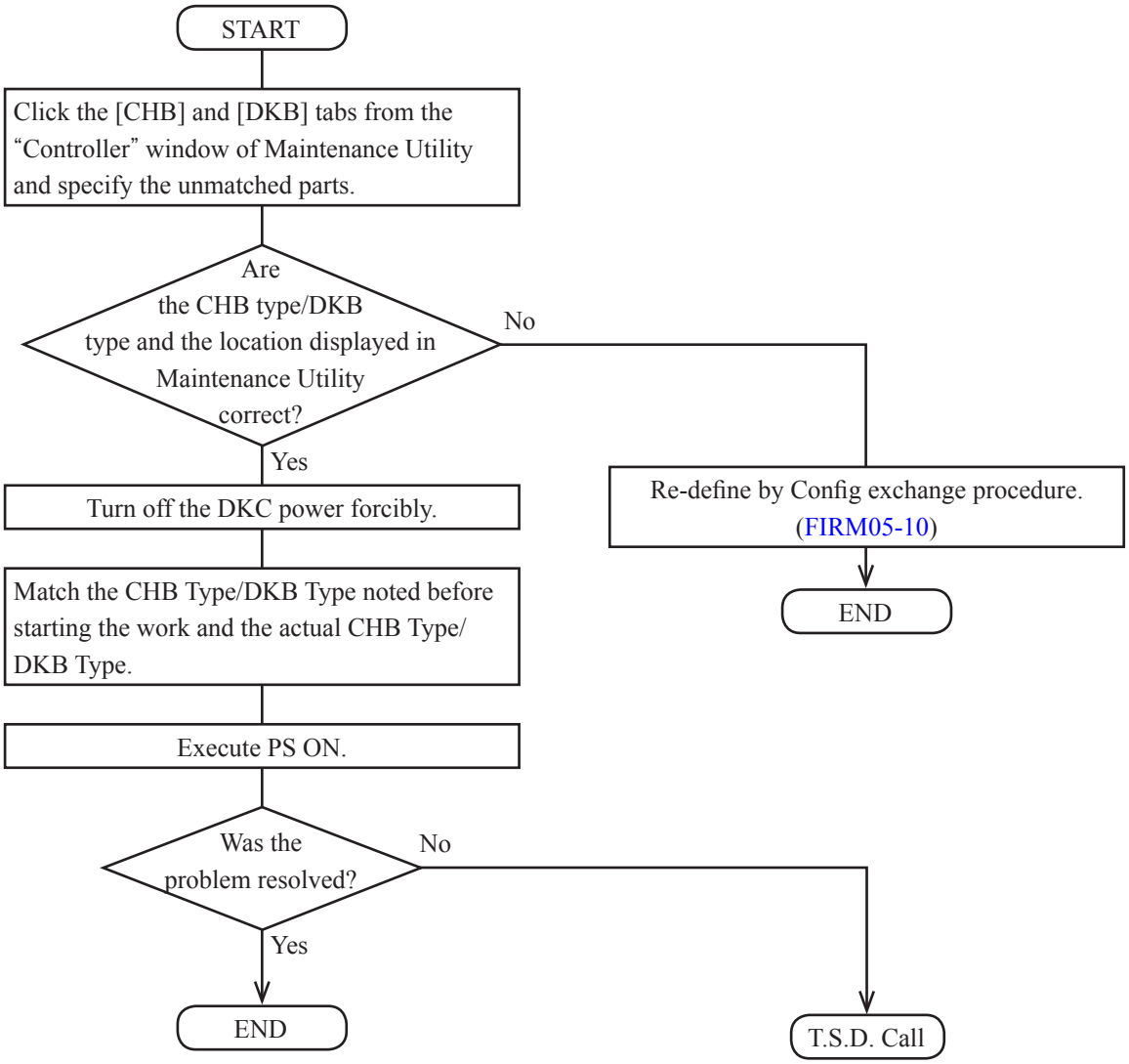
3.23 Recovery Procedure for the Case Where the CHK3 Threshold Over Occurs (SIM = 3072xy)



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3.24 Recovery Procedure for Warning of Channel Board/Disk Board Type (SIM RC = 3c9500)

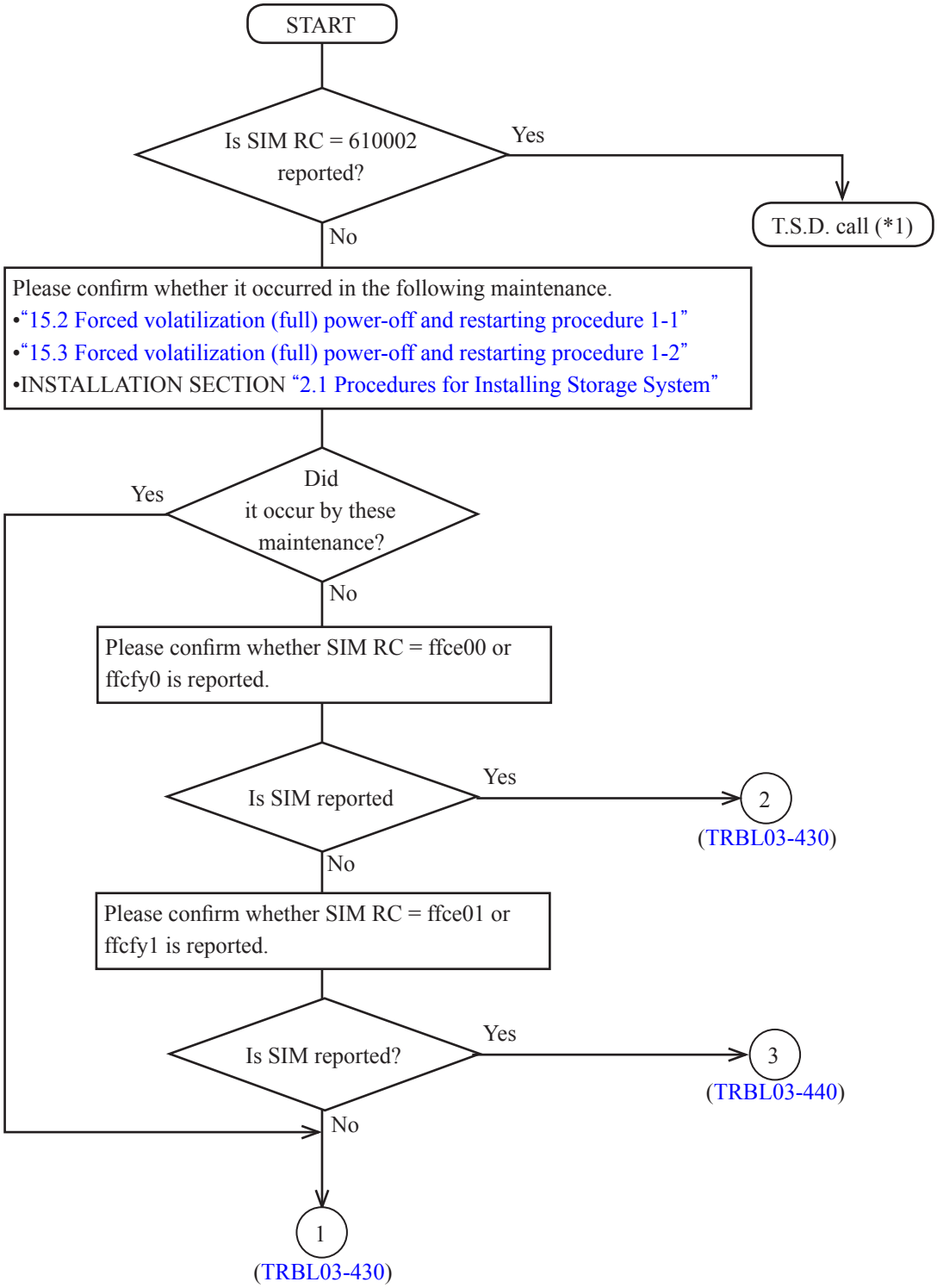
When “Types of installed Channel Boards and Disk Boards” and “Types of defined Channel Boards and Disk Boards” differ at the time of start-up, SIM RC = 3c9500 is issued. When it is issued, they need to be matched. Furthermore, before starting the work, click the [CHB] and [DKB] tabs in the “Controller” window of Maintenance Utility and take notes on the Channel Board and Disk Board types.



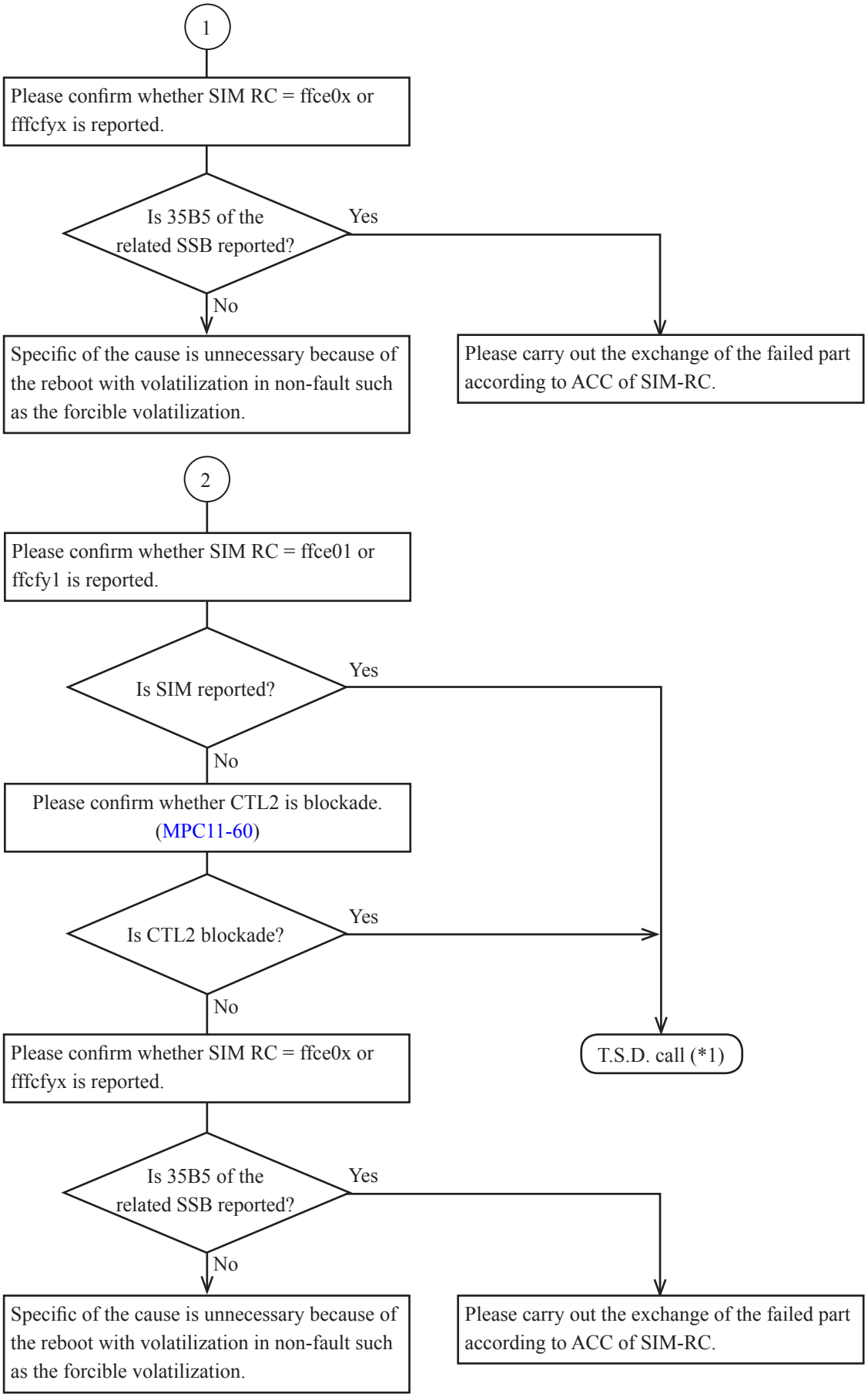
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3.25 Isolation Procedure for Failed Part in CACHE Volatilization (SIM = ffce0x, ffcfyx, 610002)

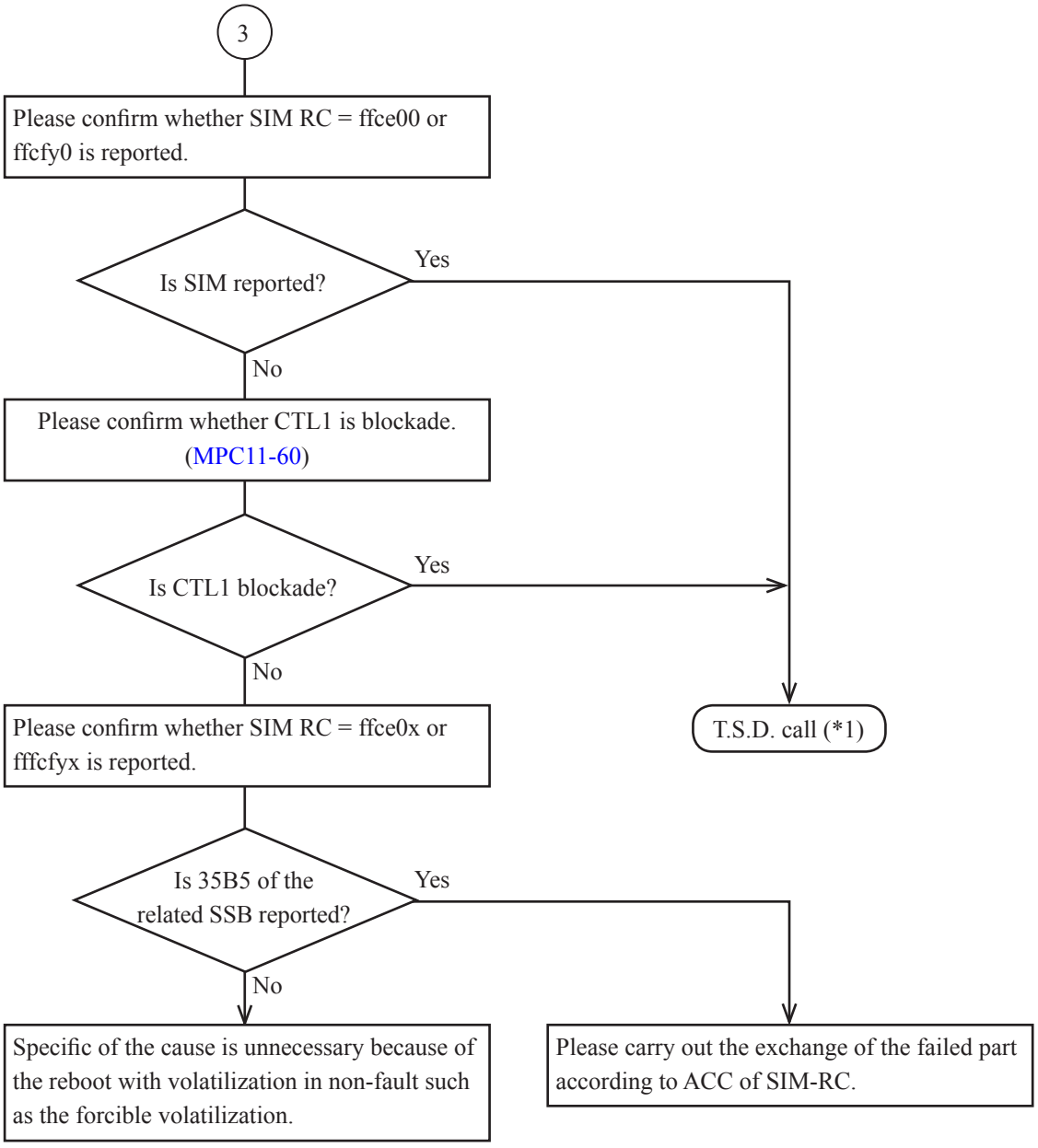
At the time of the cash volatilization, you carry out the recovery of the involved site according to the ACC of SIM-RC or the detailed information that it is displayed the following procedure by SSB window to classify involved sites after enforcement.



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(*1) The SM information is not restored. DKC is in following condition.

Name of the P.P.	Phenomenon
TC	Differential bitmap is deleted. All copies in next resynchronization or being executed will be copied.
GAD	Differential bitmap is deleted. All copies in next resynchronization or being executed will be copied.
UR	Differential bitmap is deleted. All copies in next resynchronization or being executed will be copied.
SI	Refer to (*2)
VM	Percentage that VM pairs are synchronized goes down to 0% (differential bitmap is cleared) and copy processing time takes long.
Quick Format	Data will be lost from LDEV that carrying out Quick Format.
Dynamic Provisioning/ Dynamic Tiering/ active flash	The data stored in HDP-VOL is lost.

(*2) PS OFF phenomenon varies according to a ShadowImage pair state before carrying out PS OFF.

Name of the P.P.	Pair Status (Open Pair Status/MF Pair Status)	Phenomenon
SI	COPY (PD)/Pending	Percentage that P-VOL and S-VOL are synchronized goes down to 0% and copy processing time takes long.
	PAIR/Duplex	Percentage that P-VOL and S-VOL are synchronized goes down to 0%.
	COPY (SP)/SP-Pend	Pair Status turns into PSUE/Suspend.
	PSUS (SP)/V-Split	Pair Status turns into PSUE/Suspend.
	PSUS/Split	Percentage that P-VOL and S-VOL are synchronized goes down to 0% and copy processing time will takes long in next resynchronization.
	COPY (RS)/Resync	Percentage that P-VOL and S-VOL are synchronized goes down to 0% and copy processing time takes long.
	COPY (RS-R)/Resync-R	Percentage that P-VOL and S-VOL are synchronized goes down to 0% and copy processing time takes long.
	PSUE/Suspend	None

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3.26 Isolation and Recovery Procedure for Drive Link Rate Error (SIM = dfcxxx, dfdxxx)

This section describes the method to judge whether a link rate error of a specific drive (PDEV) is caused by a drive failure or an ENC failure and the recovery method when a link rate error SIM is reported.

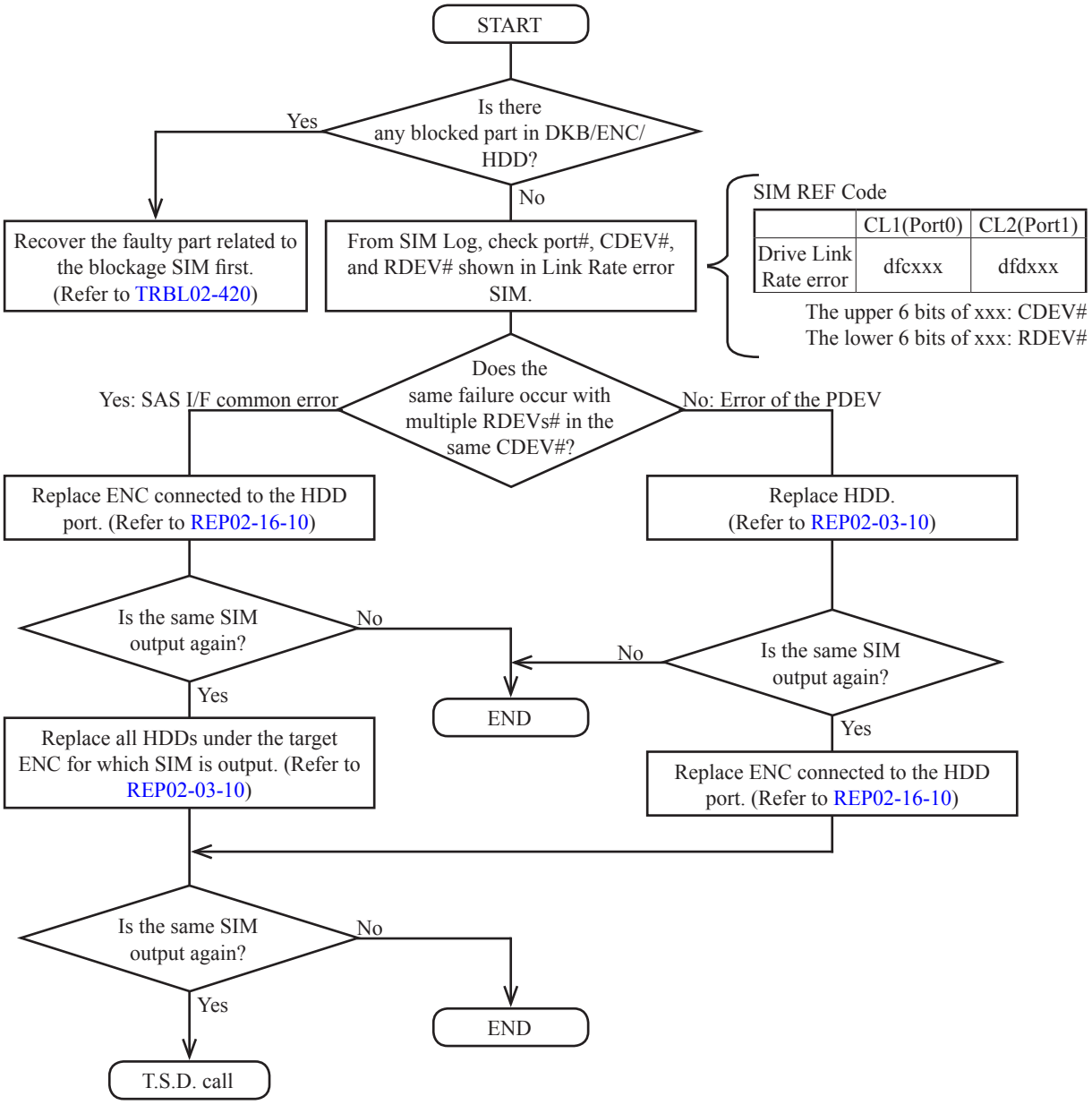
With this SIM, when setting Link Rate for each drive port of each PDEV fails, a drive port link rate error of Path 0 (REF code = dfcxxx) or a drive port link rate error of Path 1 (REF code = dfdxxx) is reported (The upper 6 bits of xxx: CDEV#, The lower 6 bits of xxx: RDEV#).

Possible causes of this failure include:

(1) Failure of the drive
(2) Failure of ENC (EXP)

Therefore before replacing the faulty drive with a service part, isolate the failure and recover it by performing the appropriate recovery procedure.

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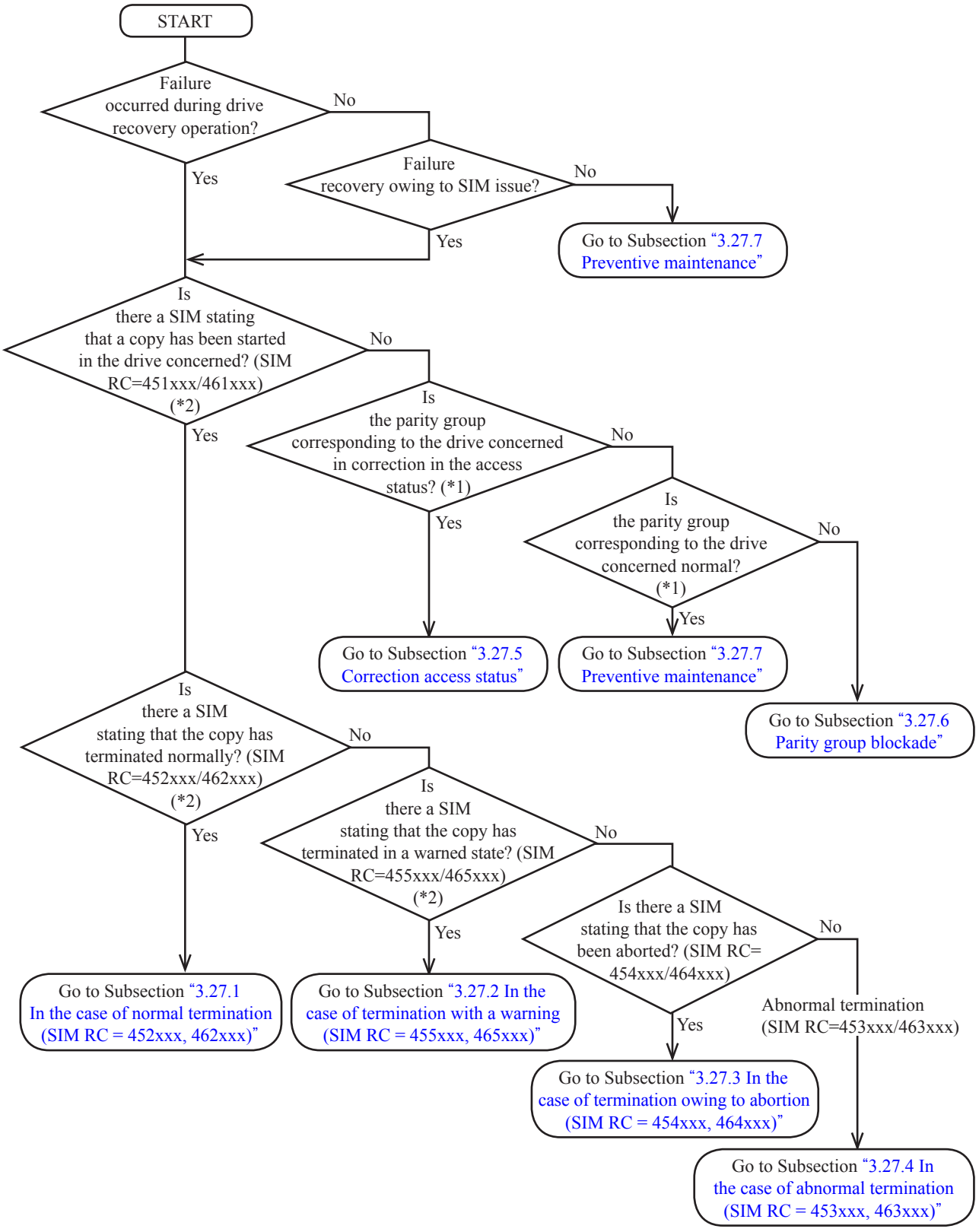
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3.27 Drive failure recovery procedure

Explanation:
Types of the drive copy are shown below. Confirm the copy type and execute the drive recovery procedure.

Copy type	Description	Operation occasion
Correction copy	This is an operation to restore and copy the data of the blocked drive using the data of another drive and parity data when the data drive is blocked. • A correction copy to the spare drive is referred to as another drive correction copy. • A correction copy to the replacement drive which has been installed instead of the blocked drive is referred to as a self-drive correction copy.	• Automatic operation owing to a failure • Operation instructed by the maintenance personnel
Drive copy	This is an operation to copy data to the spare drive from the data drive. A copy automatically performed owing to a warning level failure is referred to as dynamic sparing.	• Automatic operation owing to a failure • Operation instructed by the maintenance personnel
Copy back	This is a copy for returning data which has been copied to the spare drive by another drive correction copy or drive copy to the original data drive.	• Operation instructed by the maintenance personnel

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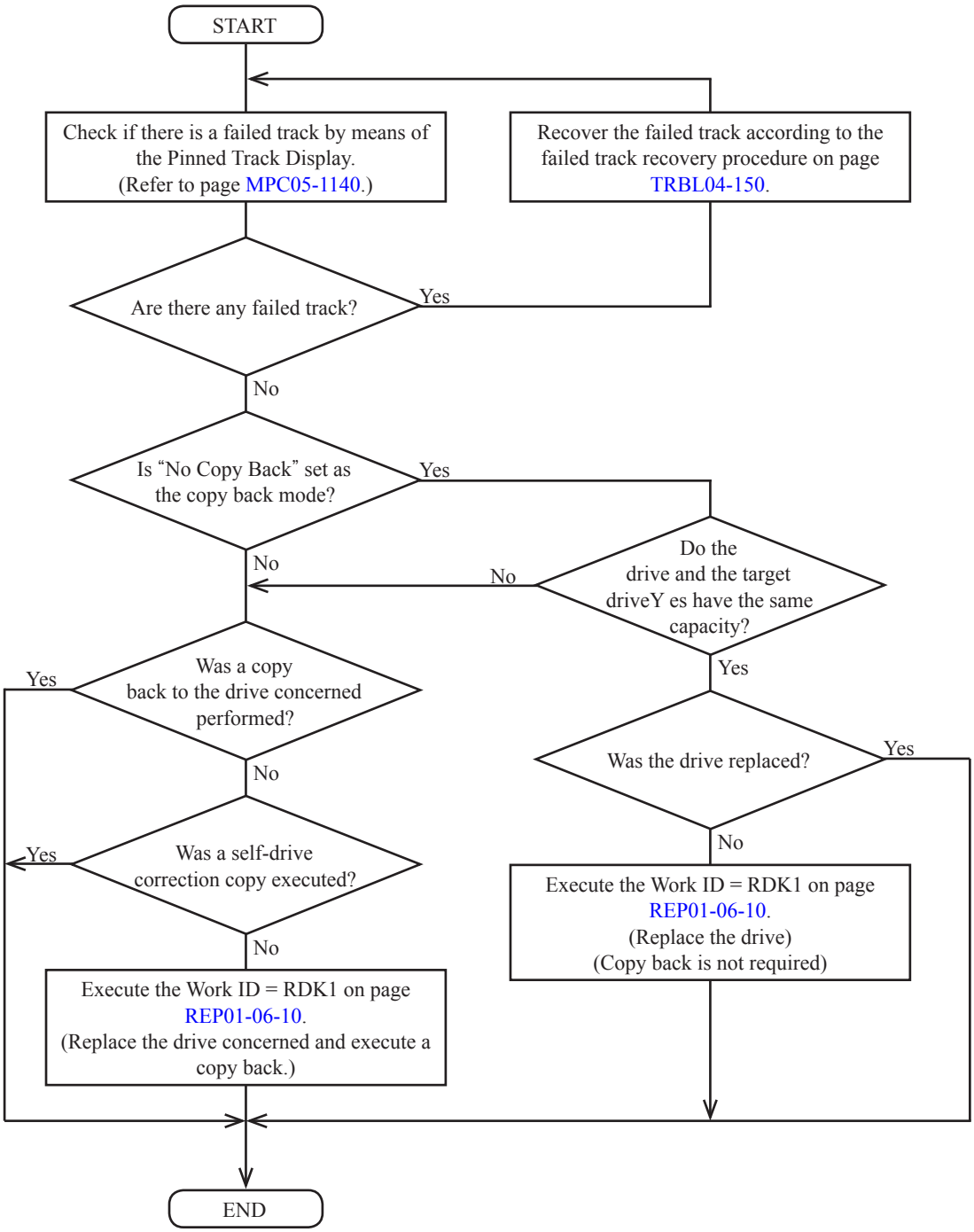
*1: Confirm the status of the parity group corresponding to the drive concerned by means of the status. For the procedure for referring to the status, refer to MAINTENANCE PC SECTION "4.1.2. Verifying LDEVs".

*2: The term "copy" means drive copy, copy back, or correction copy.

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3.27.1 In the case of normal termination (SIM RC = 452xxx, 462xxx)

The procedure below is that used after a drive copy, copy back, or correction copy terminates normally.



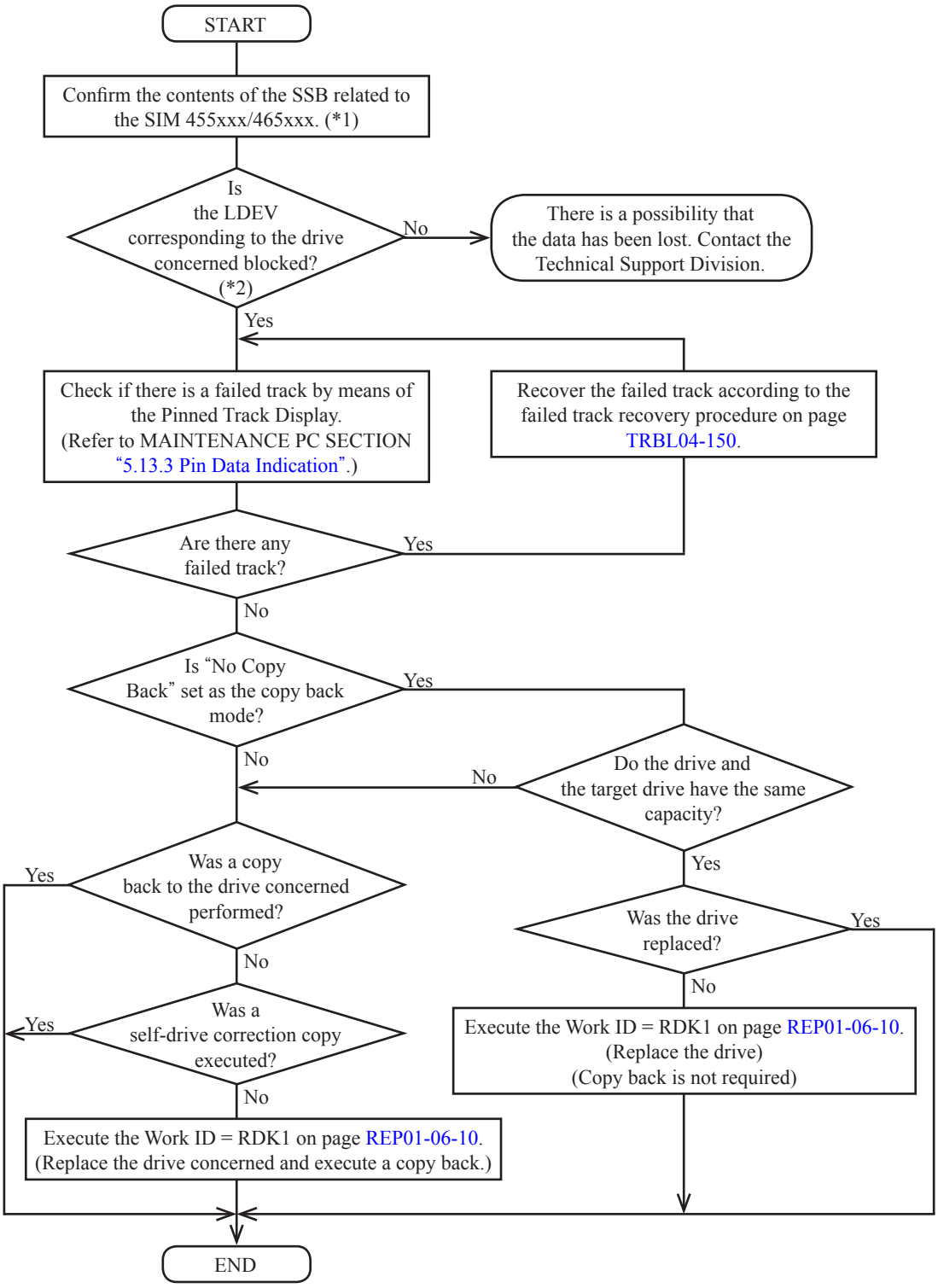
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3.27.2 In the case of termination with a warning (SIM RC = 455xxx, 465xxx)

The procedure explained below is that used when the drive copy, copy back, or correction copy terminates but one of the following is detected:

(1) A failed track was detected, but the copy was continued.

(2) One or more blocked LDEVs were detected in the same parity group. Copy of data of the blocked LDEVs was skipped.



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*1: Meaning of bytes 40 to 7E of SSB F/M=9F EC=9355 related to SIM RC=455xxx/465xxx

Byte (Hex.)	Item	Meaning
40	Number of failed tracks	Number of failed tracks
41	Number of blocked LDEVs	Number of blocked LDEVs
42 : 7D	Blocked LDEV #0 : Blocked LDEV #29	Blocked LDEV No. (Up to 30 LDEVs can be inputted from the top.) However, 0xff is inputted in the unused part.
7E	E.O.D	Means the end of data

*2: Confirm the status of the parity group corresponding to the drive concerned by means of the status. For the procedure for referring to the status, refer to MAINTENANCE PC SECTION “4.1.1 Creating Parity Groups”.

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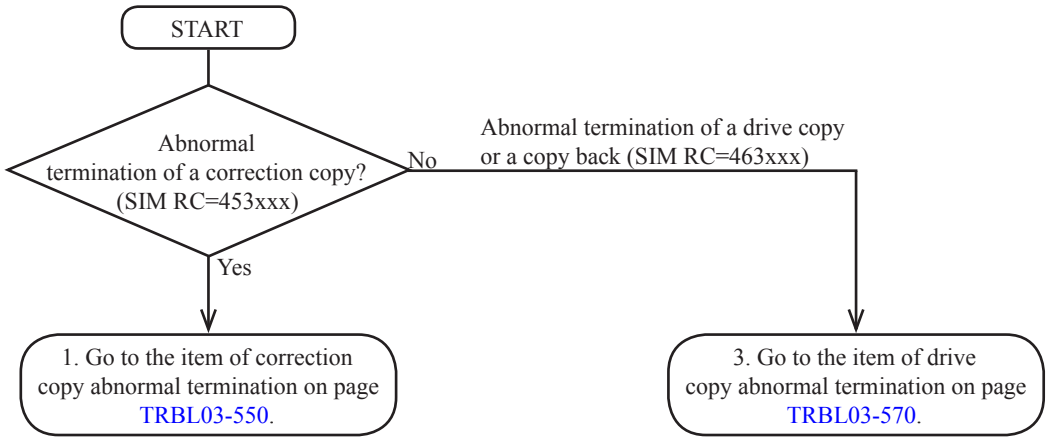
3.27.3 In the case of termination owing to abortion (SIM RC = 454xxx, 464xxx)

The procedure below is that used when a drive copy, copy back, or correction copy is aborted owing to the Maintenance PC operation by the service personnel. Since the status of the drive concerned is that before starting copy, execute the recovery operation for the same drive once again.

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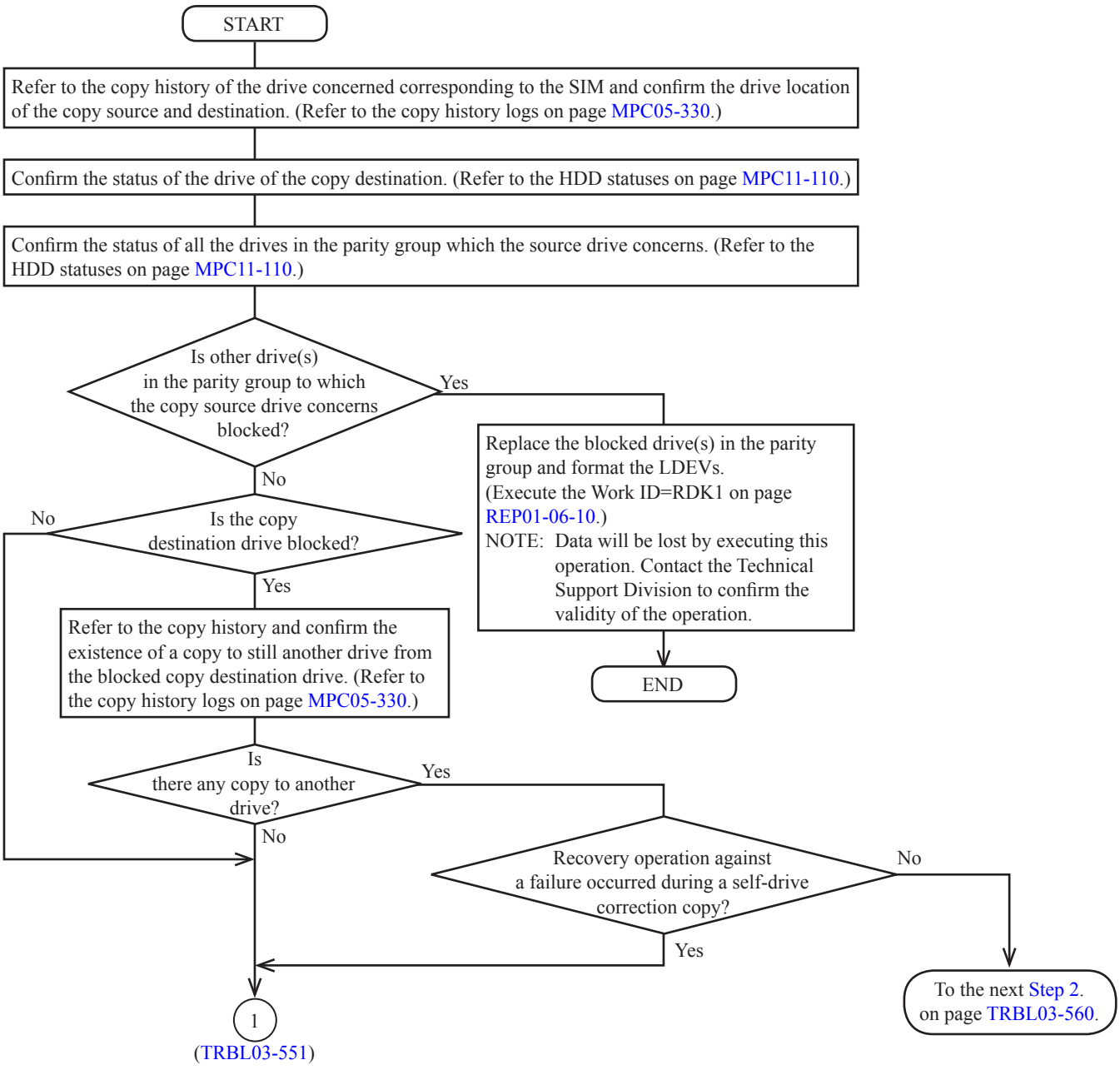
3.27.4 In the case of abnormal termination (SIM RC = 453xxx, 463xxx)

The procedure below is that used when a drive copy, copy back, or correction copy terminates abnormally. Since the recovery procedure may differ depending on the copy type, confirm the description on page TRBL03-480 and execute the following procedure.

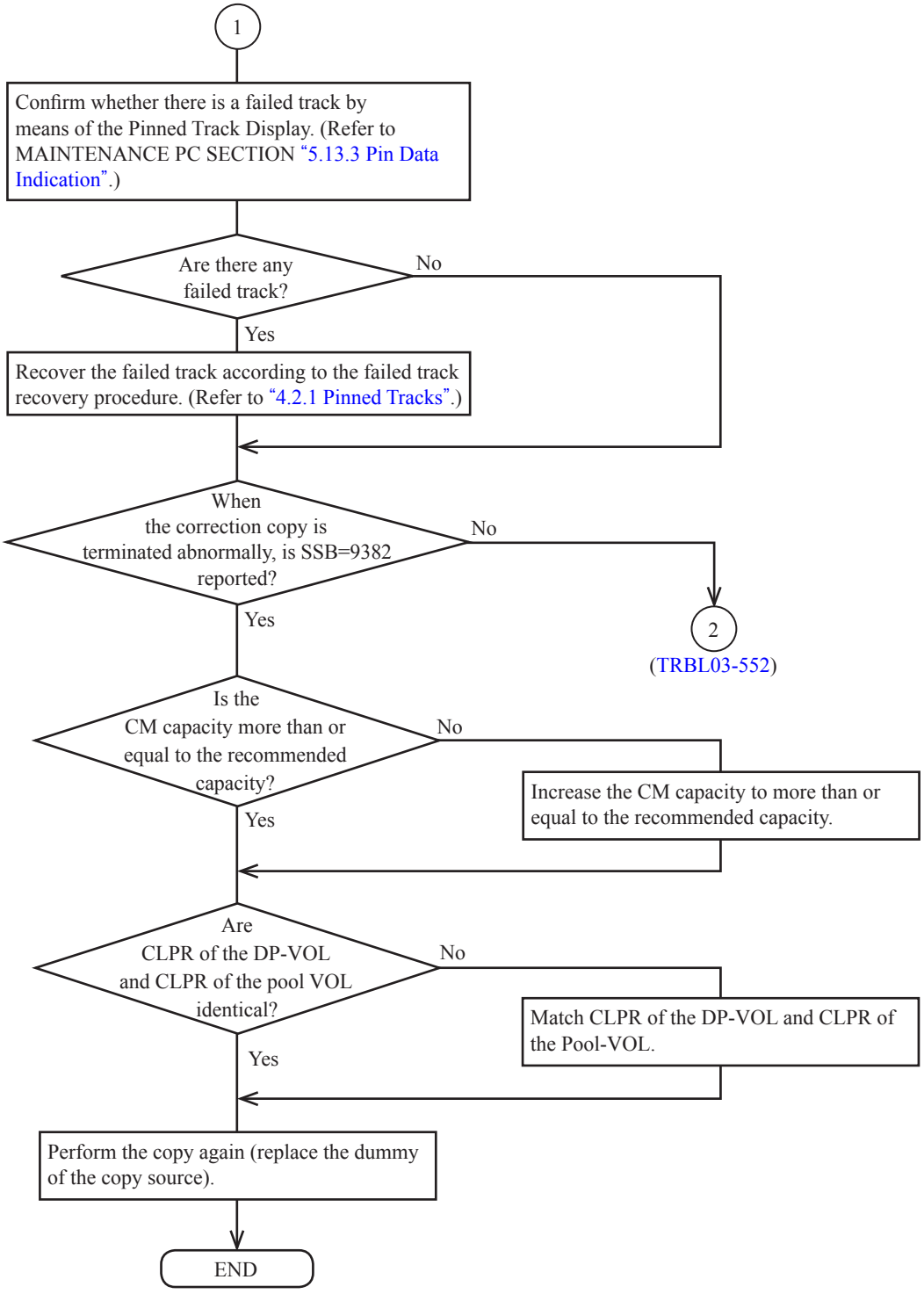


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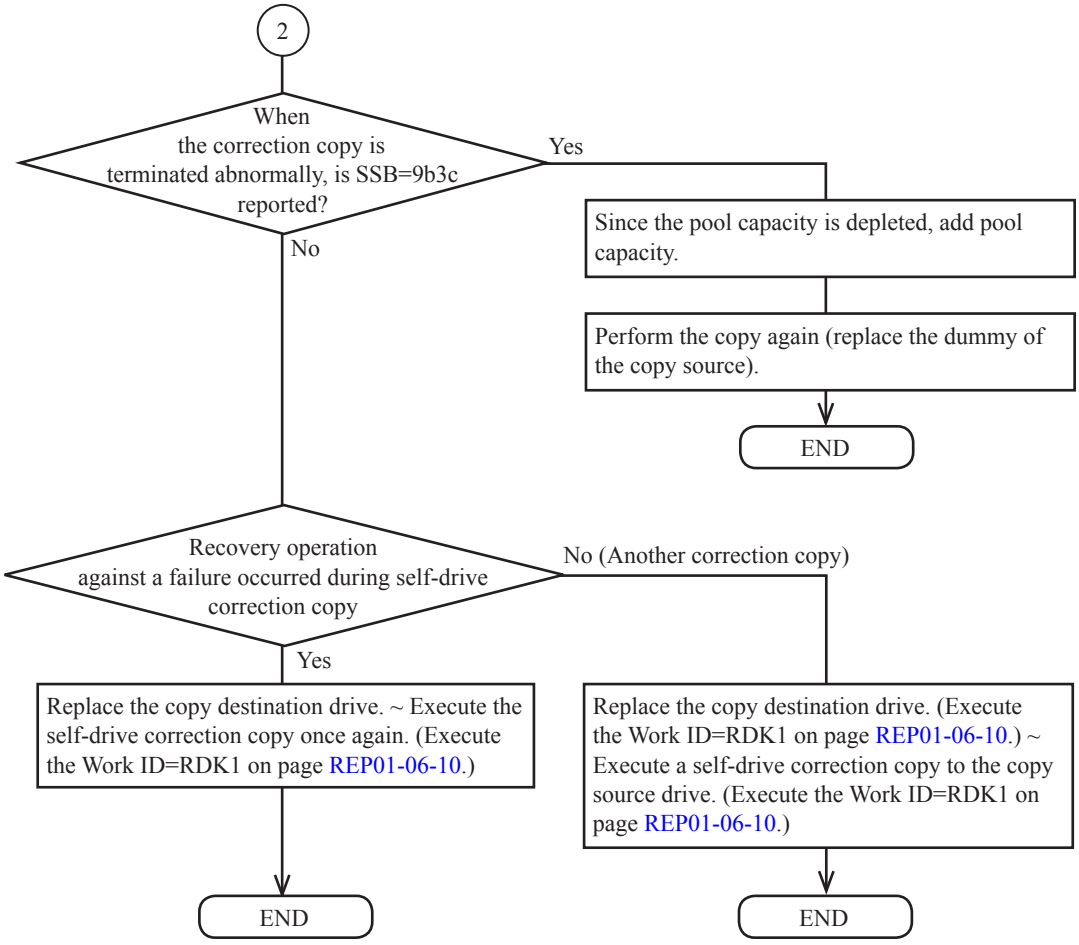
1. In the case of correction copy abnormal termination
   The procedure below is that used when a correction copy terminates abnormally.



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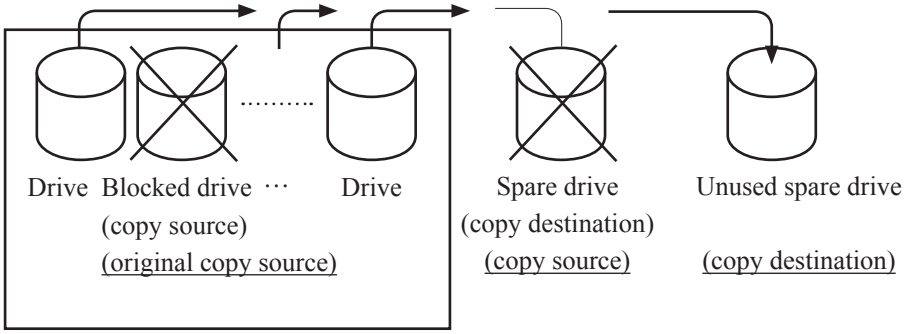


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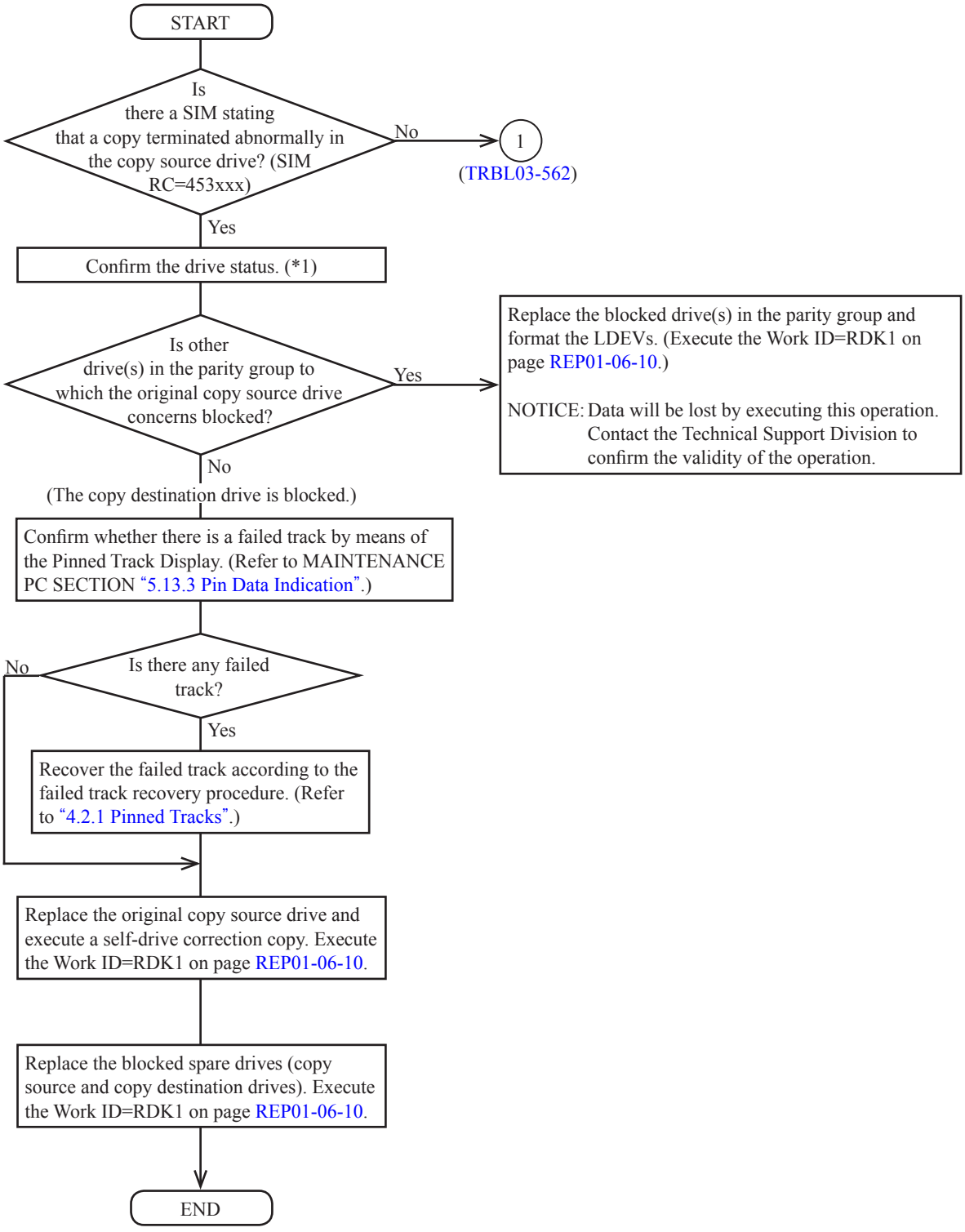


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2. In the case of correction copy abnormal termination (in which an unused spare drive is available)
   This is a case in which a correction copy terminates abnormally owing to a failure in the copy destination drive. However, if an unused spare drive exists, the correction copy is automatically performed to the unused spare drive.
   In the following procedure, the copy source is referred to as a original copy source, the copy destination is referred to as a copy source, and the unused spare drive is referred to as a copy destination.



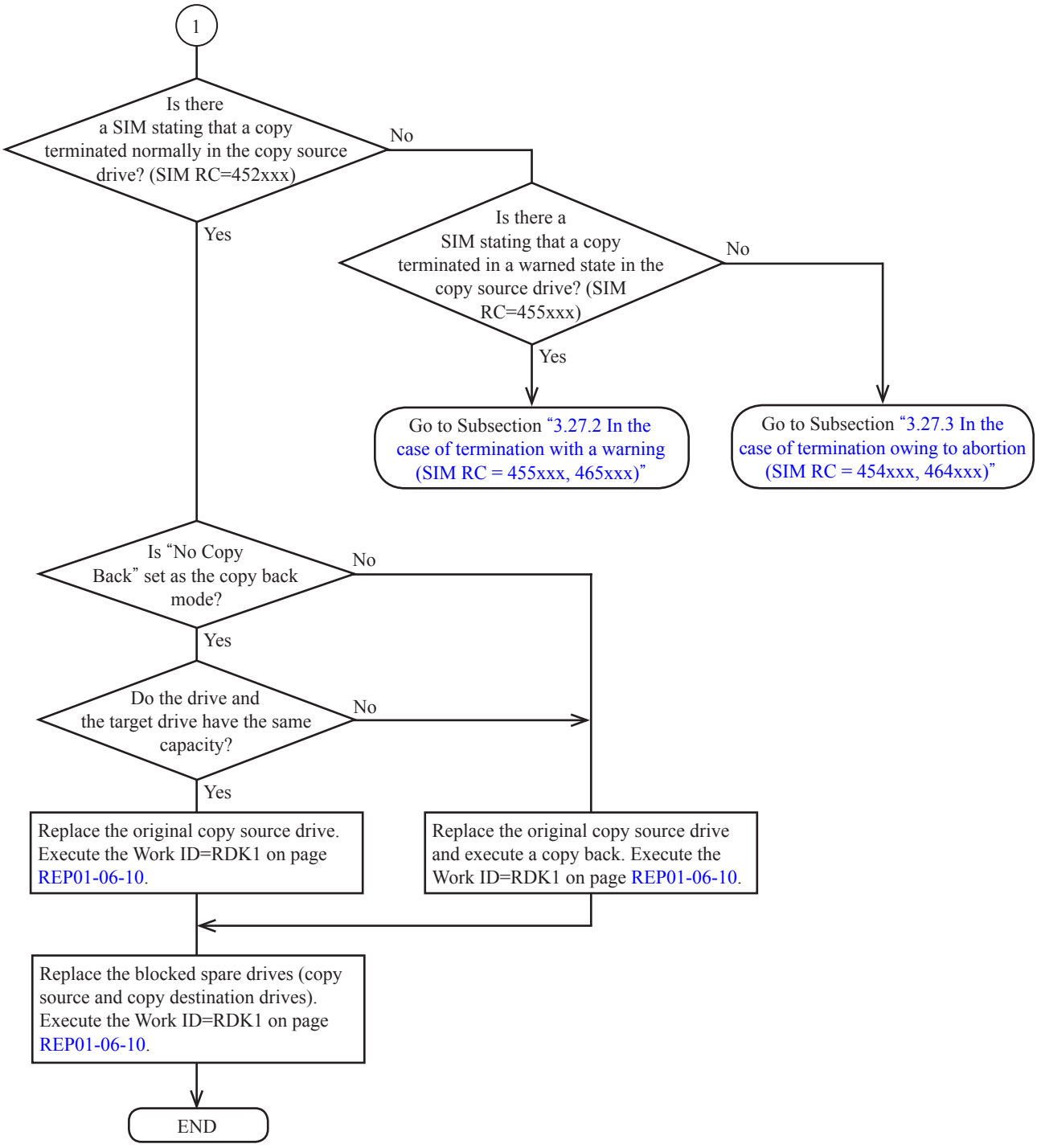
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*1: Confirm the following items.

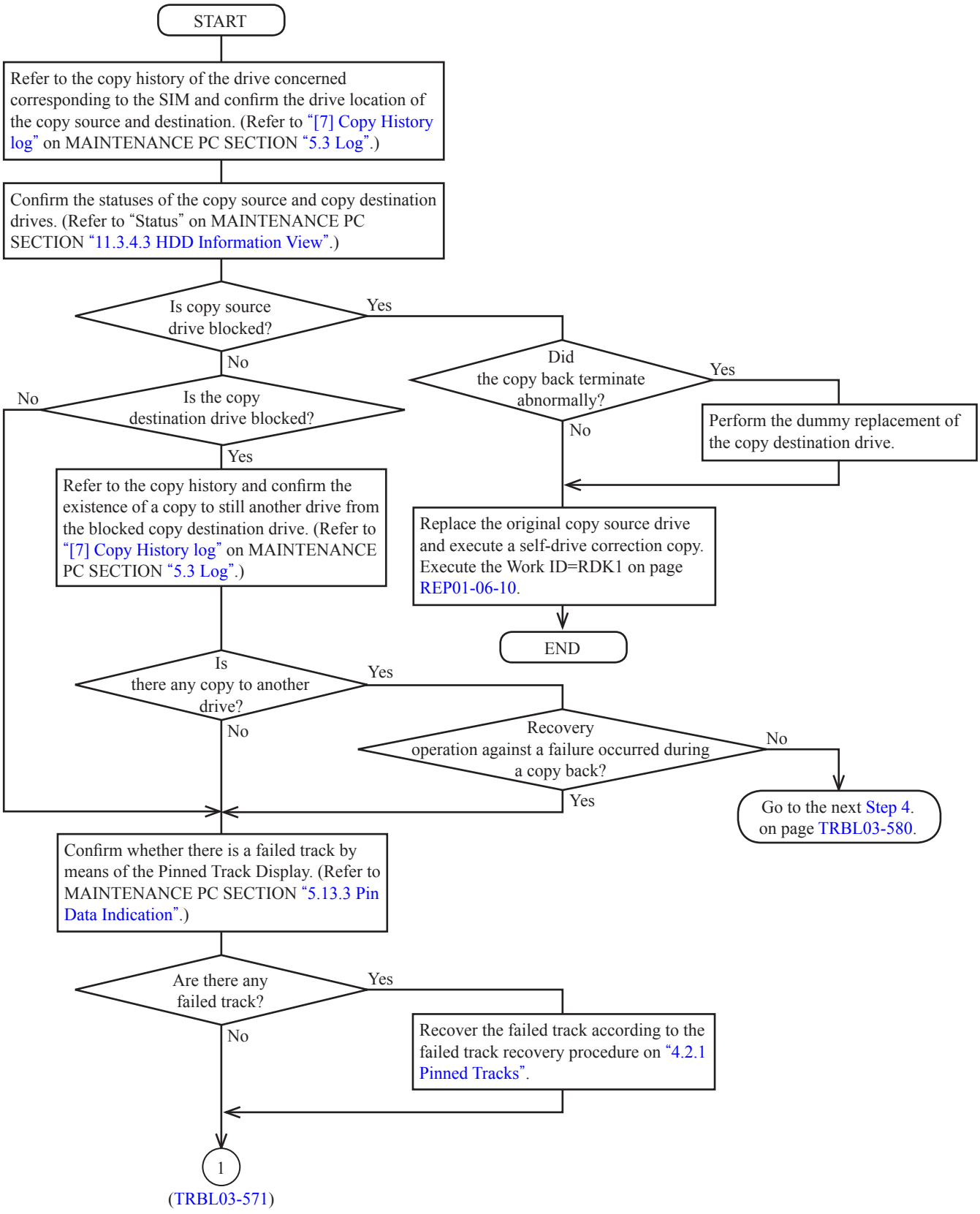
- Confirm the location of the copy source and copy destination drives referring to the copy history. Refer to the copy history log on page MPC05-330.
- Confirm the status of the copy destination drive and the status of all the drives in the parity group which the original copy source drive concerns. Refer to Item (3), HDD status on page MPC11-110.

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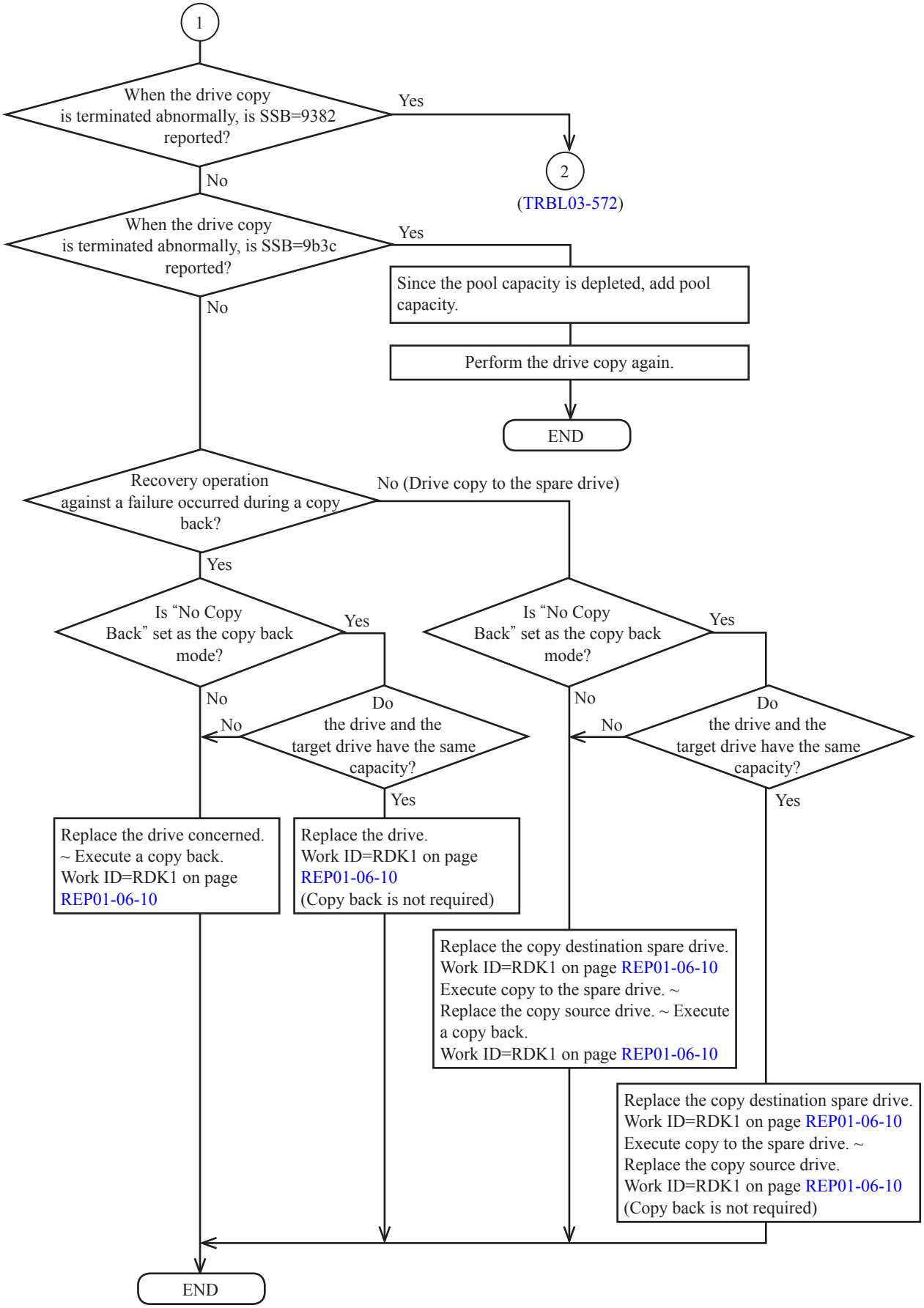


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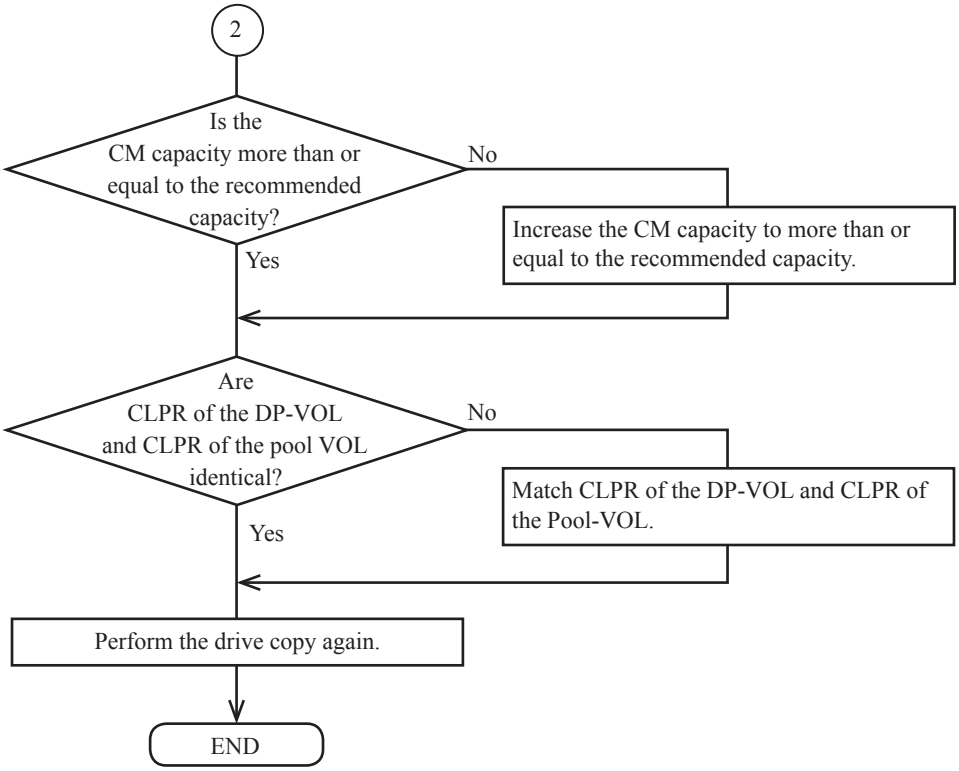
3. In the case of drive copy abnormal termination
   The procedure below is that used when a drive copy or a copy back terminates abnormally.



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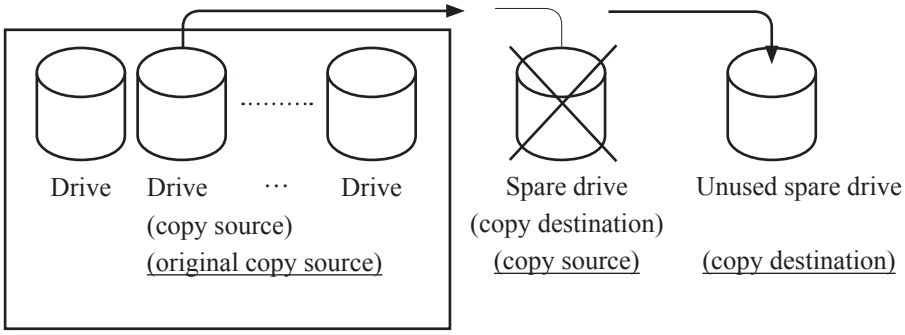


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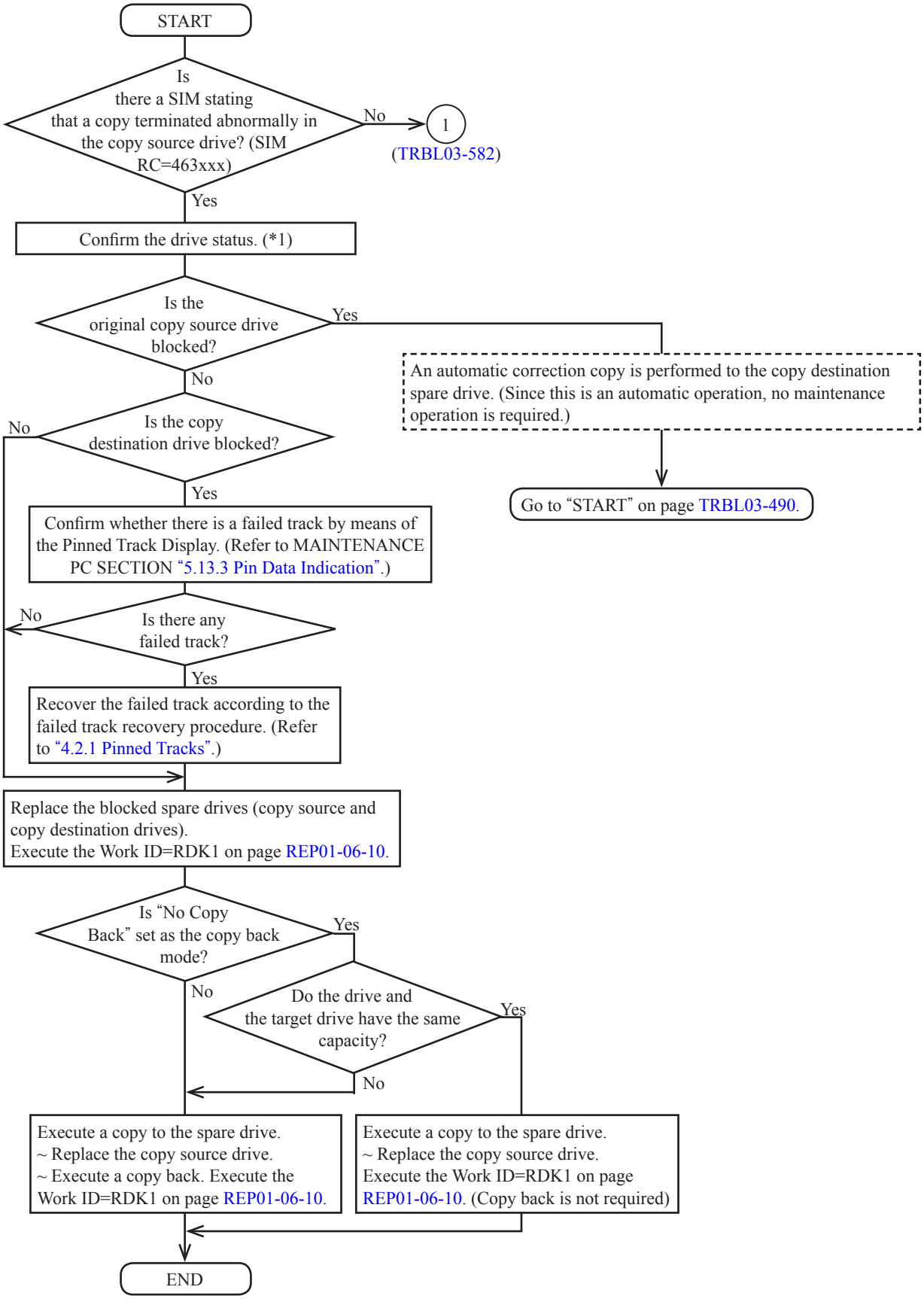


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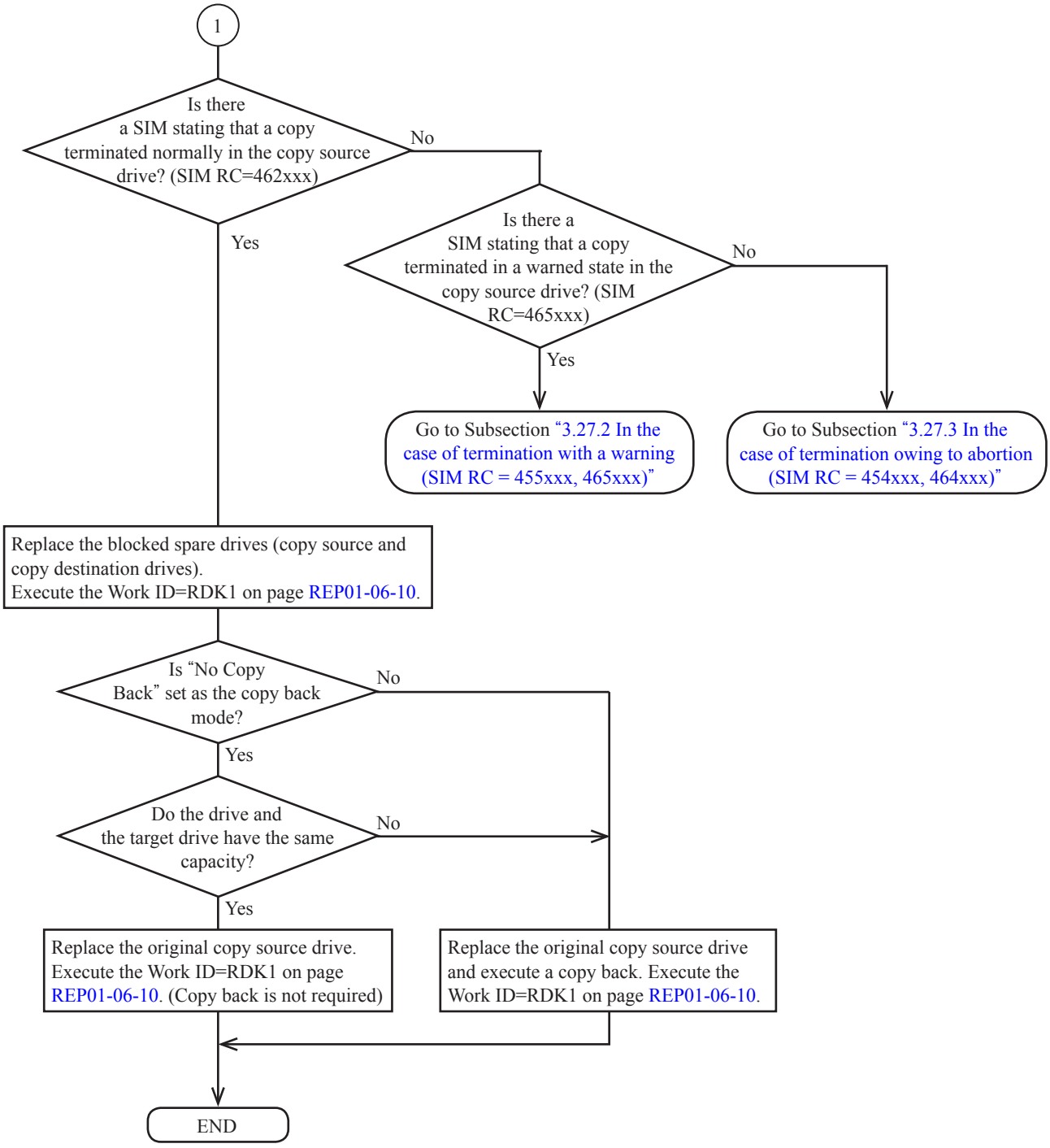
4. In the case of drive copy abnormal termination (in which an unused spare drive is available)
   This is a case in which a drive copy terminates abnormally owing to a failure in the copy destination drive. However, if an unused spare drive exists, the drive copy is automatically performed to the unused spare drive.
   In the following procedure, the copy source is referred to as an original copy source, the copy destination is referred to as a copy source, and the unused spare drive is referred to as a copy destination.



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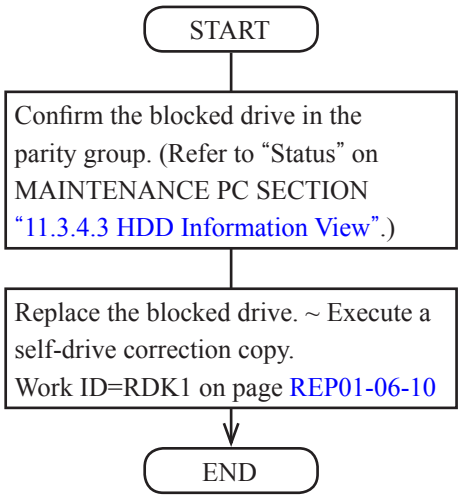
*1: Confirm the following items.

- Confirm the location of the copy source and copy destination drives referring to the copy history. Refer to the copy history log on page MPC05-330.
- Confirm the statuses of the copy destination and the original copy source drives. Refer to Item (3), HDD status on page MPC11-110.

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3.27.5 Correction access status

The procedure below is that used when one drive in the parity group is blocked.

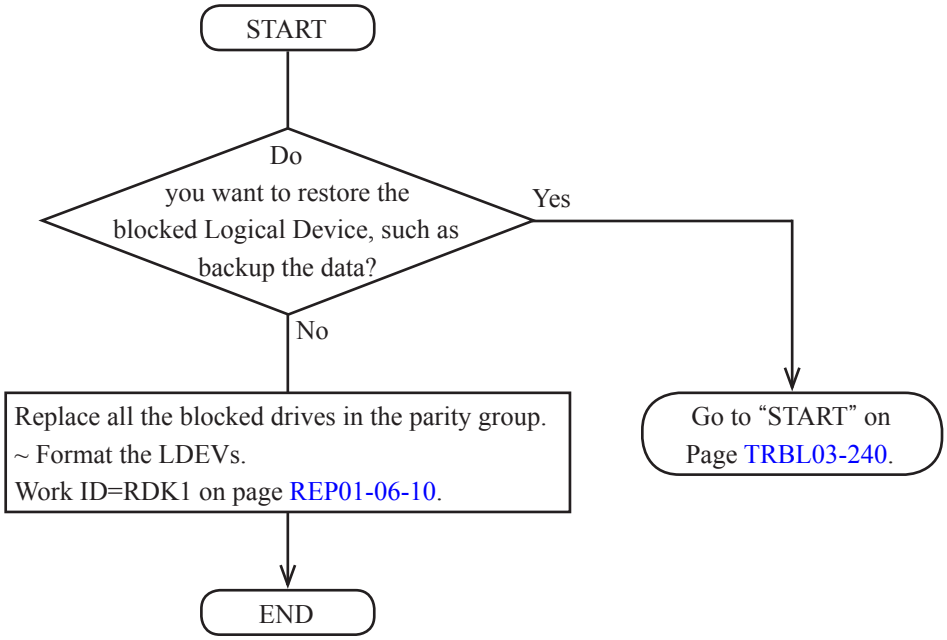


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3.27.6 Parity group blockade

The procedure below is that used when the two or more drives are blocked in the parity group.

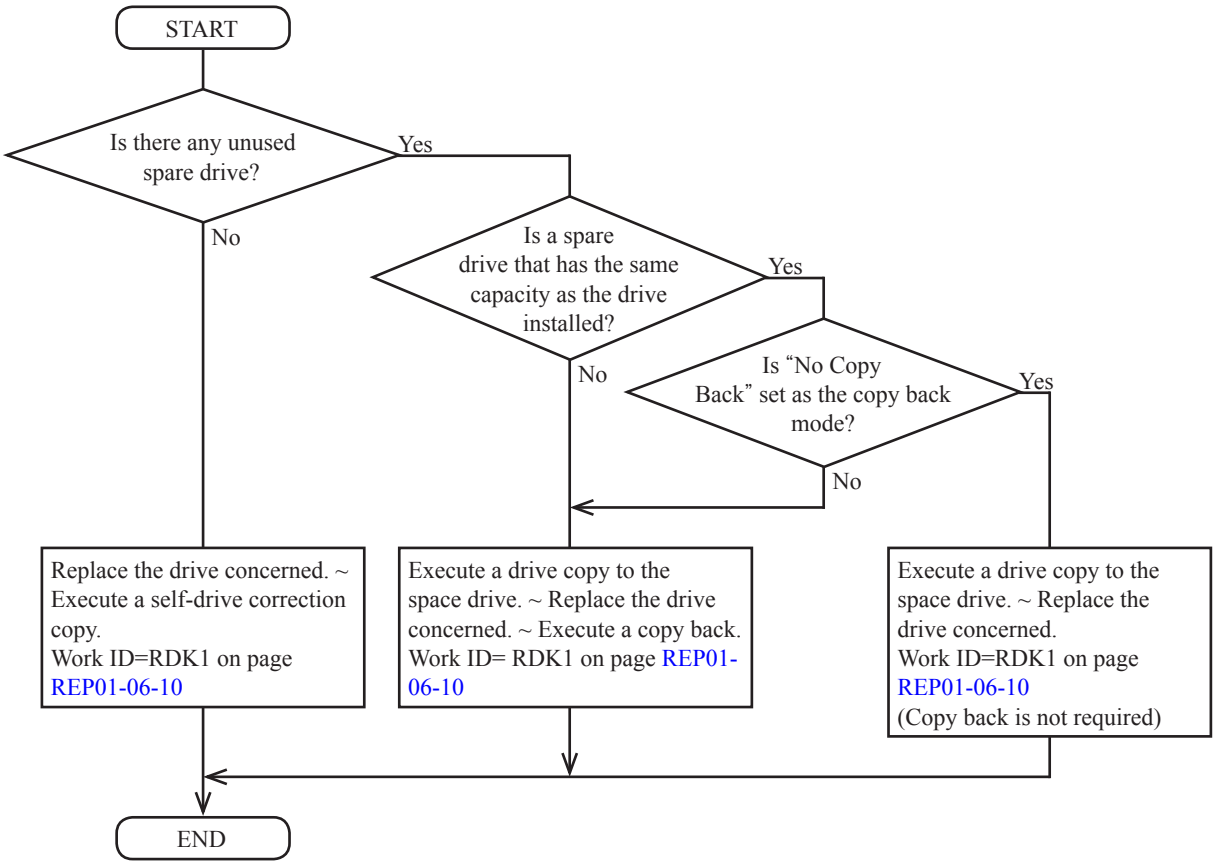
NOTE: Data will be lost when this operation is performed. Contact the Technical Support Division to confirm the validity of the operation.



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3.27.7 Preventive maintenance

The procedure below is that used when the drive is not blocked but it must be replaced.



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3.28 SVP Failure Recovery

Table 3-1 List of Solutions to management server Failures

No.	Failure	Recovery action
1	Management server does not start.	• Check that the power cable is inserted into the outlet and the management server all the way in. • A failure may have occurred in the OS of the management server. Connect the display to the management server and check the status. • When a USB memory or others are inserted into the management server, remove them.
2	Nothing can connect to the management server via network.	• Check that the LAN cables are inserted into the network HUB and the LAN ports of the management server all the way in. • The network setting of the management server and the LAN network may be mismatched. Connect the display to the management server and log in to check the network setting of the management server. • Check that the LAN cable is disconnected.
3	Even if accessing Storage Navigator by the browser, it becomes HTTP404.	• The port 80/443 setting may be disabled in the Firewall setting of the management server. Check the Firewall setting of the management server. • Storage Navigator takes time to start. Wait for a maximum of about 10 minutes.
4	Even if accessing Storage Navigator by the browser, another page is displayed.	• Another Web server such as IIS may be running in the management server.
5	StorageDeviceList cannot start	• Check that the remaining storage capacity of the management server is more than or equal to the recommended capacity to operate the instance manager of Storage Navigator. • Check that the memory capacity of the management server is more than or equal to the recommended capacity to operate the instance manager of Storage Navigator. • Check the OS service of the management server and check that DKCMan is running. • The folder installing the instance manager of Storage Navigator may be deleted or the folder name may be changed.

(To be continued)

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No.	Failure	Recovery action
6	The Storage System cannot be registered in StorageDeviceList.	• Check that the remaining storage capacity of the management server is more than or equal to the recommended capacity to operate Storage Navigator. • Check that the IP address specified by the Storage System registration is in the environment accessed by the management server. • Check that the user ID/password of GUM specified by the Storage System registration is correct.
7	An error occurs in the instance update of Storage Navigator	• The Drive with the media inserted may have a problem.
8	Login to Storage Navigator is impossible	• Check that the management server is running. • Check that the instance manager of Storage Navigator is running. • Check that the user name and password are correct. • Check that the Storage System is running. • Check that the IP address of the Storage System is not changed.
9	Although the display on StorageDeviceList is changed to Normal, Storage Navigator cannot start.	• Storage Navigator takes time to start. Wait for a maximum of about 10 minutes.
10	StorageDeviceList shortcut is not on the desk top	• The user operation may have deleted it. Execute wk\ supervisor\sdlist\ jsansn2sdlinstall.bat in the installation folder.
11	The Storage System cannot be deleted from StorageDeviceList.	Press [Edit] of the Storage System icon on StorageDeviceList. Uncheck the checkbox of [Start service automatically, when the management server is rebooted] and execute [Apply]. After restarting the management server, the Storage System can be deleted by restarting StorageDeviceList.

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3.28.1 Troubleshooting Storage Navigator

3.28.1.1 Troubleshooting Related to Installation and Upgrade

No.	Failure	Recovery action
1	The installation fails and the message is displayed.	• Operate according to the message that has been displayed in the installer and the recovery action. • Check the status of the background services of Storage Navigator to take actions referring to "3.28.1.5 Background Service Log".
2	The installation success message is displayed. However, the Storage Device List will not run or cannot register the storage system.	• Check the status of the background services of Storage Navigator to take actions referring to "3.28.1.5 Background Service Log". • If the collection fails, collect the target files manually.
3	When starting the Update window of Maintenance Utility, "Application Blocked by Java Security" or "Application Blocked by Security Settings" occurs.	The expiration date of the certificate signed in the CTL program may have passed. Perform the exclusion setting in accordance with the following procedure. 1. Click the [All Programs ([All apps] for Windows 10)]-[Java]-[Configure Java] from the Start menu of Windows and open [Java Control Panel]. 2. Click the [Edit Site List...] in the [Security] tab. 3. Add2 the following URL to [Exception Site List] and click the [OK] button. • <http://(IP address of CTL1)> • <http://(IP address of CTL2)> • <https://(IP address of CTL1)> • <https://(IP address of CTL2)> • <http://(IP address of SVP)> • <https://(IP address of SVP)> • <http://(IP address of GUM of CTL1)> • <http://(IP address of GUM of CTL2)> • <https://(IP address of GUM of CTL1)> • <https://(IP address of GUM of CTL2)> If [Security Warning - HTTP Location] was displayed, Click [Continue] button. 4. If the installed Java version is Java 1.7.0_55 or later or Java 1.8.0_5 of later, perform the following setting, too. • From the [Advanced] tab, select (CL) [Do not check (not recommended)] for [Perform certificate revocation checks on]. 5. Close Java Control Panel and restart Internet Explorer.
4	The installation failed by the error [21443-200027], and the error detail code "1072" was displayed.	1. Install Storage Navigator again. (See MAINTENANCE PC SECTION "1.5.4 Maintenance PC Software Installation".) 2. If the error occurs repeatedly, start the Maintenance PC again, and then install Storage Navigator again.

(To be continued)

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No.	Failure	Recovery action
5	The error [21443-200027] occurs at the time of upgrading the SVP software.	When Event Viewer is running, close Event Viewer, and then try to update the SVP software again. If the trouble is not solved, start Task Manager and check that a process whose image name is “BackSvc.exe” or “FrontSvc.exe” exists in the Processes tab window. If such a process exists, run Windows Command Prompt as Administrator and execute the following: sc △ stop △ HtBack sc △ stop △ HtFront △ : En space After executing the above, try to update the SVP software again. Then, run Windows Command Prompt as Administrator without fail and execute the following: sc △ start △ HtFront sc △ start △ HtBack △ : En space If the trouble is not solved, start Task Manager and check that a process whose image name is “Astcmd.exe” or “Astnet.exe” exists in the Processes tab window. If such a process exists, force stop the process and then try to update the SVP software again. If the trouble is not solved, start Task Manager, select [View]-[Select Columns] in the Processes tab window, put a check on “Image path name”, and click the [OK] button. Then, check that a process whose image path name includes the name of the folder in which the SVP software is installed (example: C\Mapp). If such a process exists, force stop the process, and then try to update the SVP software again.

(To be continued)

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No.	Failure	Recovery action
6	The error [21443-005017] occurs at the time of removing the storage management software.	When Event Viewer is running, close Event Viewer, and then try to remove the storage management software again. If the trouble is not solved, start Task Manager and check that a process whose image name is “BackSvc.exe” or “FrontSvc.exe” exists in the Processes tab window. If such a process exists, run Windows Command Prompt as Administrator and execute the following: sc △ stop △ HtBack sc △ stop △ HtFront △ : En space After executing the above, try to remove the storage management software again. Then, run Windows Command Prompt as Administrator without fail and execute the following: sc △ start △ HtFront sc △ start △ HtBack △ : En space If the trouble is not solved, start Task Manager and check that a process whose image name is “Astcmd.exe” or “Astnet.exe” exists in the Processes tab window. If such a process exists, force stop the process and then try to remove the storage management software again. If the trouble is not solved, start Task Manager, select [View]-[Select Columns] in the Processes tab window, put a check on “Image path name”, and click the [OK] button. Then, check that a process whose image path name includes the name of the folder in which the storage management software is installed (example: C\Mapp). If such a process exists, force stop the process, and then try to remove the storage management software again.

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3.28.1.2 Troubleshooting Related to the Initial Setting Command of the SVP

No.	Failure	Recovery action
1	The initial setting command was executed but failed, and a message was displayed.	• Follow the message and coping method displayed by the initial setting command.
2	The initial setting is completed normally but Storage Device List does not start or the Storage System cannot be registered.	• Check the status of the background services of Storage Navigator to take actions referring to "3.28.1.5 Background Service Log". • Gather dump files. If it fails, gather the files manually.

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3.28.1.3 Storage Device List Troubleshooting

Refer to "<Installation Directory of MPC>\wk\supervisor\sdlist\help\sdl_message.html" for the messages that are not described in the following table.

No.	Message ID	Failure	Recovery action	Remarks
1	21542-005011	[Apply] was clicked in the "Add System" window but the "(21542-005011) error" has occurred and Storage System icons cannot be created.	The Drive capacity necessary for creating Storage System icons is insufficient. Secure free capacity of 20 GB or more in the Drive of the installation directory.	
2	21542-005019	[Start Services] was clicked but the "(21542-005019) error" message has occurred and the services cannot start.	Two or more services cannot start at the same time. Stop the running services.	
3	21542-005026	[Apply] was clicked in the "Add System" window but the "(21542-005026) error" has occurred and Storage System icons cannot be created.	Invalid values are set for the IP addresses of the Maintenance PC. 1. Click [MPC IP Address] on the upper right of the [Storage Device List] window and set IP addresses of the Maintenance PC from [Change MPC IP Address]. 2. Click [Start Service] again.	
4		[Error] was displayed in the Storage System icon when restarting the Maintenance PC in the status where [Start Service] of the Storage System icon is "Auto". Clicking [Error] displayed the "(21542-005026) error" in "Status" of "BASE".		

(To be continued)

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No.	Message ID	Failure	Recovery action	Remarks
5	21542-005033	Clicking [Start Service] occurred "(21542-005033) Warning".	The IIS/FTP server is not set. Set the IIS/FTP server by following the procedure MAINTENANCE PC SECTION "1.7 Setting the IIS/FTP Server".	
6		Restarting the Maintenance PC in the status where [Starting Service] of the Storage System icon is "Auto" displayed [Warning] in the Storage System icon. Clicking [Warning] displayed "(21542-005033) Warning" in "Status" of "BASE".		
7	21542-008001	[Warning] was displayed in the Storage System icon. Clicking [Warning] displayed "21542-008001" in "Status".	Processing time-out has occurred in the service in which the error code shown on the left has occurred. • If it occurs repeatedly, refer to the background service log and perform the relevant coping method. • If the background service log does not exist or the phenomenon does not improve despite the copying method was performed, stop the service or reboot the Maintenance PC.	
8	21542-008002	[Warning] (or [Error]) was displayed in the Storage System icon. Clicking [Warning] (or [Error]) displayed "21542-008002" in "Status".	An error has occurred in the service in which the error code shown on the left has occurred. • Refer to the background service log and perform the relevant coping method. • If the background service log does not exist or the phenomenon does not improve despite the copying method was performed, stop the service or reboot the Maintenance PC.	
9	21041-006002	When clicking the Storage System, the "(21041-006002) error" has occurred and Storage Navigator does not start.	The default browser is not set. Set the default browser (or a specified browser) by the installed browser setting, and then execute it again.	

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No.	Message ID	Failure	Recovery action	Remarks
10	21041-006005	At the time of starting StorageDeviceList, the "(21041-006005) error" has occurred and it failed to start.	The communication with the Supervisor service (DKCMan/MAPPAppServer/ MAPPWebServer) has failed. • Select [Control Panel] - [System and Security] - [Administrative Tools] - [Services] from the Windows start menu, and confirm the status of DKCMan, MAPPAppServer and MAPPWebServer is "Started". And then it is restarting Storage Device List as an Administrator. • If the status is not "Start", right-click the service name to execute [Start] or change [Type of Start-up] to [Automatic] from [Property] and restart the Maintenance PC.	
11	21513-008004	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed "21513-008004" in "Status".	• The other Maintenance PC already connected to the storage system to be used. • Stop the services of the storage system running on the PC of the IP address described in the troubleshooting code "TRCOMM000004" of the background service log.	
12	21513-008005	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed "21513-008005" in "Status".	• The IP address for each CLT set in the Add System window and the CTL number set for GUM are not identical. • Correct the IP address setting for each CTL in the Storage Device List.	
13	21513-008006	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed "21513-008006" in "Status".	• The storage system model set in the Add System window and the storage system model set for the storage system are not identical. • Delete the storage system from the Storage Device List once and register it again with the correct storage system model.	
14	21513-008007	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed "21513-008007" in "Status".	• The Config model set in the Add System window and the Config model installed in the storage system are not identical. • Delete the storage system from the Storage Device List once and register it again with the correct Config model.	

(To be continued)

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No.	Message ID	Failure	Recovery action	Remarks
15	21513-008008	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed “21513-008008” in “Status”.	• The serial number set in the Add System window and the serial number set in the storage system are not identical. • Delete the storage system from the Storage Device List once and register it again with the correct serial number.	
16	21513-008009	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed “21513-008009” in “Status”.	• The user name and the password set in Add System window might be incorrect. • Set the user name and the password in the Storage Device List again.	
17	21513-008011	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed “21513-008011” in “Status”.	• The information update failed. • It is updated again automatically. However, if the message does not disappear after waiting for about five minutes, select the corresponding storage system from the Storage Device List. Stop the system, and then restart it. • If the failure does not recover, restart the Maintenance PC.	
18	21513-008012	[Warning] was displayed in the storage system icon. Clicking [Warning] displayed “21513-008012” in “Status”.	• The other Maintenance PC might already connect to the storage system to be used. • Check whether a PC starting the services of the other storage system exists for the storage system to be used. If an Maintenance PC already started the services of the storage system, stop the services.	

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3.28.1.4 Troubleshooting of Storage Navigator other than the Above-Mentioned

No.	Failure	Recovery action
1	Some errors have occurred during the operation after succeeding at the Storage System registration.	• Check the status of the background services of Storage Navigator to take actions referring to “3.28.1.5 Background Service Log”. • Gather dump files. If it fails, gather the files manually.

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3.28.1.5 Background Service Log

Output the logs of the background services that operate the Maintenance PC.
See the background service logs

- Checking that the Maintenance PC has started normally
- Coping method cannot be specified only by the message output from the user interface.

The background service logs are stored in the following directory.
<installDir>\wk\supervisor\system\log

The log files are stored with the following names.

Log File Type	Log File Name
Storage Device List log	system_<Sequential Number>.log
Storage Navigator log	system_<Serial Number>_<Sequential Number>.log

NOTE: installDir ... indicates an installation directory of the Maintenance PC (e.g. C: \Mapp) <Sequential Number> ... A sequential number of a log file is given beginning with 0.

The background services include the following.

- List of background services of Storage Device List

Storage Device List Background Service	Service Name
Storage Device List Server	SDLSrv
SVP RMI- API Forward Server	RMI-API Forward Server
Web Application Server	Web Application Server

- List of background services of Storage Navigator

Storage Navigator List Background Service	Service Name
Web Application Server	Web Application Server
Storage Navigator Server	Storage Navigator
SVP RMI- API Server	RMI-API Server
External authentication relay service	External Authenticator
Communication service	Communication
KMIP Communicator	KMIP Communicator

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The output format of logs is shown below.
[Occurrence Date and Time] [Failure Level] [Troubleshooting Code] [Service Name] [Log Content]

Item	Description
Occurrence Date and Time	Date and time is output in the following format. YYYY/MM/DD hh:mm:ss.SS
Failure level	The following failure levels are output. INFO ... Reference information (start, termination log and others) WARN ... Warning information (Setting values or others are insufficient and operating in the default status.) ERROR ... It cannot start due to an error.
Troubleshooting Code	Troubleshooting codes are output.
Service Name	Service Names are output.
Log Content	Message are output.

The following logs are output in respective background services.
You can check with these logs that the initialization processing of each background service is completed normally and it has started or any errors have occurred while running the service.

```
[2015/01/01 13:00:00.000][INFO][TRSTRN00001][STRN][Initialize Start]
[2015/01/01 13:00:00.000][INFO][TRSTRN00002][STRN][Initialize Normal end]
[2015/01/01 13:00:00.000][WARN][TRSTRN01000][STRN][…]
[2015/01/01 13:00:00.000][INFO][TRSTRN00001][STRN][Terminate Start]
```

Troubleshooting codes and coping methods of respective background services are described below.

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- Storage Device List server

  Example of log output when it is normal:

```
[2015/03/18 15:40:50.372][INFO ] [TRSDLS000001] [SDLSrv] [Initialize Start.]
• • •
[2015/03/18 15:41:28.009][INFO ] [TRSDLS000002] [SDLSrv] [Initialize Normal end.]
```

  Example of log output when it is abnormal:

```
[2015/03/19 17:12:14.551][INFO ] [TRSDLS000006] [SDLSrv] [Terminate Start.]
[2015/03/19 17:12:14.934][ERROR] [TRSDLS000011] [SDLSrv] [System is locked (SN:400001).]
[2015/03/19 17:12:15.216][ERROR] [TRSDLS000008] [SDLSrv] [Terminate Error end.]
```

Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRSDLS000001	INFO	The initialization processing of the Storage Device List server started. Check that TRSDLS000002 is output and the initialization processing is completed normally.
TRSDLS000002	INFO	The initialization processing of the Storage Device List server was completed normally.
TRSDLS000003	ERROR	The initialization processing of the Storage Device List server terminated in error. Refer to the troubleshooting codes output before and after this log and perform the corresponding coping method. 1. If no other error log is output, restart the Maintenance PC. 2. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRSDLS000004	ERROR	The port displayed on the log is unusable. Check whether an application using the port exists. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If it cannot change, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP” and change the port number of “DKCManPrivate”.

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TRSDLS000005	ERROR	The initialization processing of the Storage Device List server timed out. Execute the following procedure to start the Storage Device List server. If the result does not change despite the operation is repeated, restart the Maintenance PC. If the phenomenon does not change after restarting the Maintenance PC, set it up again. 1. Select [Control Panel] - [System and Security] - [Management Tool] - [Services] of Windows. (*1) 2. Select DKCMan from the list and select [Start Services].
TRSDLS000006	INFO	The stop processing of the Storage Device List server started. Check that TRSDLS0000007 is output and the stop processing is completed normally.
TRSDLS000007	INFO	The stop processing of the Storage Device List server was completed normally.
TRSDLS000008	ERROR	The stop processing of the Storage Device List server terminated in error. Refer to the troubleshooting codes output before and after this log and perform the corresponding coping method. If no other error log is output, execute the following procedure for stopping the Storage Device List server. 1. Select [Control Panel] - [System and Security] - [Management Tool] - [Services] of Windows.(*1) 2. Display the DKCMan property and set [Type of Start-up] of the [General] tab to [Manual]. 3. Reboot the Maintenance PC.
TRSDLS000009	ERROR	The Storage Device List server cannot stop because the environment construction processing of the Maintenance PC is in execution. Operate it again after a while.
TRSDLS000010	ERROR	The Storage System with the serial number (SN) displayed on the log does not support the service stop processing. Execute the following procedure for stopping the Storage Device List server. 1. Select [Control Panel] - [System and Security] - [Management Tool] - [Services] of Windows.(*1) 2. Display the DKCMan property and set [Type of Start-up] of the [General] tab to [Manual]. 3. Reboot the Maintenance PC.
TRSDLS000011	ERROR	The system with the serial number (SN) displayed on the log cannot stop the service because another user acquired the lock. Release the lock acquired by another user, and then operate it again.

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TRSDLS000012	ERROR	The stop processing of the Storage Device List server timed out. If it occurs repeatedly, stop the Storage Device List server in the following procedure. 1. Select [Control Panel] - [System and Security] - [Management Tool] - [Services] of Windows. When the user account control of Windows started, select [Continue]. 2. Display the DKCMan property and set [Type of Start-up] of the [General] tab to [Manual]. 3. Reboot the Maintenance PC.
TRSDLS000013	WARN	Service status acquisition failed. If warning does not disappear even after waiting for three minutes, perform the following procedure. 1. Stop this Storage System by Storage Device List and restart it. 2. If not recovered, restart the Maintenance PC. 3. If still not recovered, set up again.

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- SVP RMI- API Forward Server

  Example of log output when it is normal:

  An example of output when it started normally and terminated is shown below.

```
[2015/03/17 15:49:09.638][INFO ][TRRMIS002001][RMI-API Forward Server][Initialize Start.]
[2015/03/17 15:49:16.544][INFO ][TRRMIS002002][RMI-API Forward Server][Initialize Normal end.]
[2015/03/17 18:50:59.982][INFO ][TRRMIS002012][RMI-API Forward Server][Terminate Start.]
[2015/03/17 18:51:00.003][INFO ][TRRMIS002013][RMI-API Forward Server][Terminate Normal end.]
```

  Example of log output when it is abnormal:

  An example of output when it has occurred abnormally is shown below.

```
[2015/03/17 15:49:09.638][INFO ][TRRMIS002001][RMI-API Forward Server][Initialize Start.]
[2015/03/17 15:49:10.001][ERROR][TRRMIS002005][RMI-API Forward Server][Environment is unjust.]
[2015/03/17 15:49:10.102][INFO ][TRRMIS002004][RMI-API Forward Server][Initialize Error end.]
```

Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRRMIS002001	INFO	This is output when the RMI - API Forward Server service starts. To confirm that the RMI - API Forward Server service has started normally, match it to the log and check that TRRMIS002002 is output.
TRRMIS002002	INFO	This is output when the start of the RMI - API Forward Server service is completed normally.
TRRMIS002003	WARN	The RMI - API Forward Server service succeeded to start but a warning has occurred in the processing. Check the troubleshooting codes output through TRRMIS002001 and the log and take actions.
TRRMIS002004	ERROR	The RMI - API Forward Server service failed to start. Check the troubleshooting codes output through TRRMIS002001 and the log and take actions.
TRRMIS002005	ERROR	Acquiring the environment setting information necessary for starting the RMI - API Forward Server service has failed. 1. Restart the Maintenance PC. 2. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRRMIS002006	ERROR	
TRRMIS002007	WARN	
TRRMIS002008	WARN	The ports numbers necessary for the RMI - API Forward Server service are unusable. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If it cannot change, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP” and change the port number of “RMIIFRegist”.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRRMIS002009	WARN	The ports numbers necessary for the RMI - API Forward Server service are unusable. See MAINTENANCE PC SECTION "12.8 Checking the Application Using the Port Number Used by the SVP" to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If it cannot change, see MAINTENANCE PC SECTION "12.1 Changing Port Numbers Used by the SVP" and change the port number of "DKCManPrivate".
TRRMIS002010	WARN	This is the similar to the coping method of TRRMIS002008. Refer to the coping method of TRRMIS002008.
TRRMIS002011	WARN	This is the similar to the coping method of TRRMIS002009. Refer to the coping method of TRRMIS002009.
TRRMIS002012	INFO	This is output when the RMI - API Forward Server service stops. To confirm that the RMI - API Forward Server service is stopped normally, match it to the log and check that TRRMIS002013 is output.
TRRMIS002013	INFO	This is output when the RMI - API Forward Server service is stopped normally.

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- Web Application Server

  Example of log output when it is normal:

  An example of output when it started normally and terminated is shown below.

```
[2015/12/02 16:21:47.113][INFO ][TRMAAS000001][Web Application Server][Initializing]
[2015/12/02 16:21:48.410][INFO ][TRMAAS000002][Web Application Server][Ready]
```

  Example of log output when it is abnormal:

  An example of output when it has occurred abnormally is shown below.

```
[2015/12/03 09:47:22.020][INFO ][TRMAAS000001][Web Application Server][Initializing]
[2015/12/03 09:48:25.004][ERROR][TRMAAS000004][Web Application Server][Failed : Failed to
connect to the starting port of the web server. Port=8080.]
[2015/12/03 09:48:25.174][INFO ][TRMAAS000007][Web Application Server][Stopped]
```

Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRMAAS000001	INFO	This is output when the Web application server starts. To check whether the Web application server is running normally, check whether this troubleshooting code and TRMAAS000002 are output.
TRMAAS000002	INFO	This is output when the Web application server started completely.
TRMAAS000003	WARN	The ports numbers necessary for the Web application server service cannot be used. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, change the port numbers used in other applications among “MAPPWebServer”, “MAPPWebServerHttps”, “RMIClassLoader” and “RMIClassLoaderHttps”. For the operation of changing the port numbers, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP”.
TRMAAS000004	ERROR	The ports numbers necessary for the Web application server service cannot be used. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP” and change the port numbers of “CommonJettyStart”.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRMAAS000005	ERROR	The ports numbers necessary for the Web application server service cannot be used. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP” and change the port numbers of “CommonJettyStop”.
TRMAAS000006	INFO	This is output when the Web application server stops. To check whether the Web application server stopped normally, check whether this troubleshooting code and TRMAAS000007 are output.
TRMAAS000007	INFO	This is output when the Web application server stopped normally and completely.

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- Storage Navigator Server

  Example of log output when it is normal

  ① At the time of start-up:

```
[2015/03/19 18:08:31.046][INFO ][TRSTNA000001][Web Application Server][Initializing]
[2015/03/19 18:08:31.592][INFO ][TRSTNA000002][Web Application Server][Ready]
[2015/03/19 18:09:12.903][INFO ][TRSTNA001001][Storage Navigator][Initializing]
[2015/03/19 18:15:29.387][INFO ][TRSTNA001002][Storage Navigator][Ready]
```

  ② At the time of termination:

```
[2015/03/19 21:11:49.942][INFO ][TRSTNA000004][Web Application Server][Stopping]
[2015/03/19 21:11:50.478][INFO ][TRSTNA001004][Storage Navigator][Stopping]
[2015/03/19 21:11:50.859][INFO ][TRSTNA001005][Storage Navigator][Stopped]
[2015/03/19 21:11:52.209][INFO ][TRSTNA000005][Web Application Server][Stopped]
```

  Example of log output when it is abnormal

  ① At the time of start-up:

```
[2015/03/20 11:15:33.543][INFO ][TRSTNA000001][Web Application Server][Initializing]
[2015/03/20 11:15:34.364][ERROR][TRSTNA000003][Web Application Server][Failed : Failed to start a Storage Navigator.]
```

  ② At the time of termination:

```
[2015/03/20 12:24:36.175][INFO ][TRSTNA000004][Web Application Server][Stopping]
[2015/03/20 12:24:38.931][INFO ][TRSTNA001004][Storage Navigator][Stopping]
[2015/03/20 12:25:40.634][WARN ][TRSTNA001006][Storage Navigator][Stopping : Timeout has occurred in the stop processing of a Storage Navigator.]
[2015/03/20 12:25:45.114][INFO ][TRSTNA000005][Web Application Server][Stopped]
[2015/03/20 12:25:45.652][INFO ][TRSTNA001005][Storage Navigator][Stopped]
```

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Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRSTNA000001	INFO	This is output when the Web Application Server starts up. To confirm that the Web Application Server has started normally, match it to the troubleshooting code and check that TRSTNA000002 is output.
TRSTNA000002	INFO	This is output when the start of the Web Application Server is completed.
TRSTNA000003	ERROR	The Web Application Server has failed to start. 1. Select the relevant Storage System from the Storage Device List, stop it, and then restart it. 2. If not recover, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA000004	INFO	This is output when the Web Application Server stops.
TRSTNA000005	INFO	An error occurred by stopping the Web Application Server. 1. Restart the Maintenance PC. 2. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA000006	ERROR	
TRSTNA000007	WARN	The Storage Navigator service stopped unexpectedly, and then it is restarting. 1. If the phenomenon does not change even after waiting for three minutes, stop the storage system by Storage Device List and restart it. 2. If not recovered, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA000008	ERROR	1. See MAINTENANCE PC SECTION “12.5 Changing Range of Port Numbers to be Allocated Automatically” to change the port number range of “DeviceJettyStart” to the unused range. 2. Restart the Maintenance PC after the change.
TRSTNA000009	ERROR	1. See MAINTENANCE PC SECTION “12.5 Changing Range of Port Numbers to be Allocated Automatically” to change the port number range of “DeviceJettyStop” to the unused range. 2. Restart the Maintenance PC after the change.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRSTNA000010	ERROR	The Web application server is stopped forcibly. This might be output when Maintenance PC restarts while the server is running. 1. Select the relevant Storage System from the Storage Device List, stop it, and then restart it. 2. If not recover, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA000011	ERROR	
TRSTNA001001	INFO	This is output when the Storage Navigator starts. To check whether the Storage Navigator service is starting normally, confirm that this log and TRSTNA001002 are output.
TRSTNA001002	INFO	The Storage Navigator service is starting normally.
TRSTNA001003	WARN	This might be output while the Storage Navigator service is running. When the troubleshooting code is output, the Storage Navigator service is acquiring the information. Therefore, wait for a maximum of 10 minutes after TRSTNA001001 is output. Even if TRSTNA001002 is not output after a lapse of 10 minutes, see System Administrator Guide “Login errors” and take actions.
TRSTNA001004	INFO	This is output when the Storage Navigator service stops. To check whether the Storage Navigator service stopped normally, check whether this troubleshooting code and TRSTNA001005 are output.
TRSTNA001005	INFO	This is output when the Storage Navigator service is stopped completely.
TRSTNA001006	WARN	A time-out has occurred when stopping the Storage Navigator service. 1. If it does not become start completion (TRSTNA001002) at the next start time, restart the Maintenance PC. 2. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA001007	ERROR	The Storage Navigator service stopped forcibly. This might be output when Maintenance PC restarts while the service is running. 1. Stop the storage system by Storage Device List and restart it. 2. If not recovered, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TRSTNA001008	ERROR	

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- SVP RMI- API Server

  Example of log output when it is normal:

  An example of output when it started normally and terminated is shown below.

```
[2015/03/17 15:49:07.750][INFO ][TRRMIS001001][RMI-API Server][Initialize Start.]
[2015/03/17 15:49:08.000][INFO ][TRRMIS001002][RMI-API Server][Initialize Normal end.]
[2015/03/17 15:49:09.638][INFO ][TRRMIS002501][RMI-API Server][Initialize Start.]
[2015/03/17 15:49:16.544][INFO ][TRRMIS002502][RMI-API Server][Initialize Normal end.]
[2015/03/17 15:52:03.405][INFO ][TRRMIS000001][RMI-API Server][Initialize Start.]
[2015/03/17 15:52:19.364][INFO ][TRRMIS000002][RMI-API Server][Initialize Normal end.]
• • •
[2015/03/17 18:50:59.982][INFO ][TRRMIS002510][RMI-API Server][Terminate Start.]
[2015/03/17 18:51:00.003][INFO ][TRRMIS002511][RMI-API Server][Terminate Normal end.]
[2015/03/17 18:51:06.645][INFO ][TRRMIS001006][RMI-API Server][Terminate Start.]
[2015/03/17 18:51:06.927][INFO ][TRRMIS000015][RMI-API Server][Terminate Start.]
[2015/03/17 18:51:08.249][INFO ][TRRMIS000016][RMI-API Server][Terminate Normal end.]
[2015/03/17 18:51:10.695][INFO ][TRRMIS001007][RMI-API Server][Terminate Normal end.]
```

  The start logs of two or more services are output in the SVP RMI - API server. To confirm the normal start of the SVP RMI - API server, check the logs of TRRMIS000002, TRRMIS001002 and TRRMIS002502. Furthermore, to check the normal completion, check the logs of TRRMIS000016, TRRMIS001007 and TRRMIS002511

  Example of log output when it is abnormal:

  An example of output when it has occurred abnormally is shown below.

```
[2015/03/17 15:49:07.750][INFO ][TRRMIS001001][RMI-API Server][Initialize Start.]
[2015/03/17 15:49:08.000][INFO ][TRRMIS001002][RMI-API Server][Initialize Normal end.]
[2015/03/17 15:49:09.638][INFO ][TRRMIS002501][RMI-API Server][Initialize Start.]
[2015/03/17 15:49:16.544][INFO ][TRRMIS002502][RMI-API Server][Initialize Normal end.]
[2015/03/17 15:52:03.405][INFO ][TRRMIS000001][RMI-API Server][Initialize Start.]
[2015/03/17 15:52:03.968][ERROR][TRRMIS000007][RMI-API Server][Port already in use. Port:51100]
[2015/03/17 15:52:04.003][INFO ][TRRMIS000015][RMI-API Server][Terminate Start.]
[2015/03/17 15:52:04.125][INFO ][TRRMIS000016][RMI-API Server][Terminate Normal end.]
```

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Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRRMIS000001	INFO	This is output when the RMI - API Server service starts. The log is output two or more times by retry at the time of error occurrence. To confirm that the RMI - API Server service has started normally, match it to the log and check that TRRMIS000002 is output.
TRRMIS000002	INFO	This is output when the start of the RMI - API Server service is completed normally.
TRRMIS000003	WARN	Reading the environment setting files necessary for the RMI - API Server service failed. 1. Restart the Maintenance PC. 2. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRRMIS000004	WARN	This is operating with the default value indicated in the log content because the acquisition of the environment setting information necessary for the RMI - API Server service failed. 1. Restart the Maintenance PC. 2. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRRMIS000005	WARN	This is operating with the default value indicated in the log content because the acquisition of the environment setting information necessary for the RMI - API Server service failed. 1. Restart the Maintenance PC. 2. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRRMIS000006	WARN	The port number used of the RMI - API Server service is already used. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used in SVP” and change the port numbers of “RMIIFRegist”.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRRMIS000007	ERROR	The port number used of the RMI - API Server service is already used. See MAINTENANCE PC SECTION "12.8 Checking the Application Using the Port Number Used by the SVP" to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION "12.1 Changing Port Numbers Used in SVP" and change the port numbers of "PreRMIServer".
TRRMIS000008	WARN	The file operation indicated by the log content failed in the RMI - API Server service. Another application may access the file. Close all other applications, and then stop the relevant Storage System once from the Storage Device List and restart it.
TRRMIS000009	ERROR	An unexpected error occurred in the RMI - API Server service. 1. Stop the relevant Storage System once and restart it. 2. If the phenomenon does not change after restarting, delete the Storage System from the Storage Device List once and register it again. 3. If it does not recover after registering the Storage System, restart Maintenance PC. 4. If it does not recover after restarting Maintenance PC, uninstall Storage Navigator and then install it and register the Storage System again.
TRRMIS000010	WARN	The connection to the necessary services failed in the RMI - API Server service. 1. Stop the relevant Storage System once and restart it. 2. If the phenomenon does not change after restarting, restart the Maintenance PC. 3. If it does not recover after restarting the Maintenance PC, set it up again.
TRRMIS000011	ERROR	
TRRMIS000012	WARN	The IP address used in the RMI - API Server service is invalid. 1. Check that the IP address of the Maintenance PC set by the Storage Device List is correct and restart the Maintenance PC. 2. If it does not recover after restarting the Maintenance PC, set it up again.
TRRMIS000013	ERROR	

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Troubleshooting code	Failure level	Coping Method
TRRMIS000014	WARN	This is operating with the default value indicated in the log content because the acquisition of the port number used for the RMI - API Server service failed. See MAINTENANCE PC SECTION "12.8 Checking the Application Using the Port Number Used by the SVP" to check if the port number is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION "12.1 Changing Port Numbers Used in SVP" and change the port numbers of "PreRMIServer".
TRRMIS000015	INFO	This is output when the RMI - API Server service terminates. The log is output two or more times by retry at the time of error occurrence. To confirm that the RMI - API Server service is completed normally, match it to the log and check the output of TRRMIS000016 is output.
TRRMIS000016	INFO	This is output when the RMI- API Server service is stopped normally.
TRRMIS000017	WARN	The connection to the necessary services failed in the RMI - API Server service. 1. Restart the Maintenance PC. 2. If it does not recover after restarting the Maintenance PC, set it up again.
TRRMIS000018	ERROR	
TRRMIS000019	ERROR	The file operation indicated in the log content failed in the RMI - API Server service failed. Another application may access the relevant file. Close all other applications.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRRMIS000020	WARN	The client cannot connect to the RMI-API Server because the connection to the necessary service failed in the RMI-API Server service. Check whether DkcId32.dll exists in the following paths. • Windows system directory (example: C:\Windows\system32) • Windows directory (example: C:\Windows) • Directory defined in environment variable PATH When DkcId32.dll exists, delete DLL and restart the Maintenance PC. If it does not recover after restarting the Maintenance PC or DkcId32.dll does not exist in the above path, set up again. This log is output when RMI-API Server detects a connection error even once. Ignore this log when the connection is successful by retry and Storage Navigator (or the client connected by external RMI) is operating normally.
TRRMIS000021	WARN	An unexpected error occurred in the RMI-API Server service. 1. Stop the relevant Storage System once and restart it. 2. If the phenomenon does not change after restarting, delete the Storage System from the Storage Device List once and register it again. 3. If it does not recover after registering the Storage System, restart Maintenance PC. 4. If it does not recover after restarting Maintenance PC, uninstall Storage Navigator and then install it and register the Storage System again.
TRRMIS000022	WARN	
TRRMIS000023	ERROR	
TRRMIS000024	ERROR	
TRRMIS000025	ERROR	
TRRMIS001001	INFO	This is output when starting the RMI - API Server service. To check that the RMI - API Server service has started normally, match it to the log and check that TRRMIS001002 is output.
TRRMIS001002	INFO	This is output when the start of the RMI - API Server service is completed normally.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRRMIS001003	WARN	This is operating with the default value indicated in the log content because the acquisition of the port number used in the RMI -API Server service failed. See MAINTENANCE PC SECTION "12.8 Checking the Application Using the Port Number Used by the SVP" to check if the port number is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If they cannot be changed, see MAINTENANCE PC SECTION "12.1 Changing Port Numbers Used in SVP" and change the port numbers of "PreRMIServer".
TRRMIS001004	WARN	This is operating with the default value indicated in the log content because the acquisition of the environment setting information necessary for the RMI - API Server service failed. 1. Check that the IP address of the Maintenance PC set by Storage Device List is correct and restart the Maintenance PC. 2. If it does not recover after restarting the Maintenance PC, set it up again.
TRRMIS001005	WARN	This is a log waiting for other services necessary for starting the RMI - API Server service. The log is output one in ten minutes and six time at a maximum. 1. If Storage Navigator still cannot start after outputting TRRMIS001002 and outputting the log six times, stop the relevant Storage System once from the Storage Device List and restart it. 2. When TRRMIS001003 and TRRMIS001004 are output with the log, check the coping method of the relevant troubleshooting code together. 3. If the phenomenon does not change after restarting, restart the Maintenance PC. 4. If it does not recover after restarting the Maintenance PC, set it up again.
TRRMIS001006	INFO	This is output when the RMI - API Server service terminates. To confirm that the SVP RMI - API Server service is completed normally, match it to the log and check the output of TRRMIS001007.
TRRMIS001007	INFO	This is output when the RMI - API Server service is stopped normally.

(To be continued)

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Troubleshooting code	Failure level	Coping Method
TRRMIS001008	WARN	A part of the functions of the RMI-API Server services is not operating normally. The Storage System cannot stop normally. Restart the Maintenance PC.
TRRMIS001009	ERROR	An unexpected error occurred in the RMI-API Server service. 1. See “Collecting dump files using the Dump tool” in the User Guide to gather dump files. 2. If the collection fails, see “How to collect dump files manually” in the User Guide to collect the file manually.
TRRMIS001998	ERROR	The RMI-API Server service terminated abnormally.
TRRMIS001999	ERROR	The service stopped forcibly. This message might be output when Maintenance PC restarted while the service is running. Stop the Storage System by Storage Device List once, and then restart it.
TRRMIS002501	INFO	This is output when the RMI - API Server service starts. To confirm that the RMI - API Server service has started normally, match it to the log and check that TRRMIS002502 is output.
TRRMIS002502	INFO	This is output when the start of the RMI - API Server service is completed normally.
TRRMIS002503	WARN	The RMI - API Server service succeeded to start but a warning has occurred in the processing. Check the troubleshooting codes output from TRRMIS002501 to the log and take actions.
TRRMIS002504	ERROR	The RMI - API Server service failed to start. Check the troubleshooting codes output through TRRMIS002501 and the log and take actions.
TRRMIS002505	ERROR	Acquiring the environment setting information necessary for starting the RMI - API Server service has failed. 1. Stop the applicable Storage System by Storage Device List and restart it. 2. If the phenomenon does not change even after restarting it, restart the Maintenance PC. 3. If the phenomenon does not change after restarting the Maintenance PC, set it up again.
TRRMIS002506	ERROR	
TRRMIS002507	ERROR	
TRRMIS002508	ERROR	The ports necessary for the RMI - API Server service are unusable. See MAINTENANCE PC SECTION “12.8 Checking the Application Using the Port Number Used by the SVP” to check if the port number output in logs is not used by a different application. Change the port number of the application if possible, and restart the Maintenance PC. If it cannot change, see MAINTENANCE PC SECTION “12.1 Changing Port Numbers Used by the SVP” and change the port number of “DKCManPrivate”.
TRRMIS002509	ERROR	

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TRRMIS002510	INFO	This is output when the RMI - API Server service stops. To confirm that the RMI - API Server service is stopped normally, match it to the log and check that TRRMIS002511 is output.
TRRMIS002511	INFO	This is output when the RMI - API Server service is stopped normally.
TRRMIS002512	ERROR	The RMI - API Server service has stopped. If the phenomenon does not change after waiting for five minutes, execute the following procedures in order. 1. Stop the relevant Storage System from the Storage Device List and restart it. 2. If not recover, restart the Maintenance PC. 3. If still not recovered, set it up again.
TRRMIS002513	ERROR	The RMI-API Server service stopped forcibly. This error might occur when restarting the Maintenance PC while the service is running. When the Maintenance PC restarted or the Storage System stopped, restart the Storage System by Storage Device List. In other cases, the RMI-API Server service restarts automatically. If the phenomenon does not change after waiting for three minutes, perform the following procedure sequentially. 1. Stop the Storage System by Storage Device List and restart it. 2. If not recovered, restart the Maintenance PC. 3. If still not recovered, set up Storage Navigator again.
TRRMIS002514	ERROR	An error occurred in the communication with the RMI-API Server service. The RMI-API Server service restarts automatically. If the phenomenon does not change after waiting for one minute, perform the following procedure sequentially. 1. Check whether the Maintenance PC IP address set by Storage Device List is correct. If not, set it. 2. If not recovered, stop the Storage System by Storage Device List and restart it. 3. If still not recovered, restart the Maintenance PC. 4. If still not recovered, set up Storage Navigator again.
TRRMIS002515	ERROR	The RMI-API Server service stopped abnormally. Check the troubleshooting codes output from TRRMIS002501 to this log and take necessary actions.

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- External authentication relay service
  Example of log output when it is normal
  ① At the time of start-up:

```
[2015/03/19 18:08:31.265][INFO ][TREXAU000001][External Authenticator][Start.]
[2015/03/19 18:08:31.858][INFO ][TREXAU000002][External Authenticator][Succeeded:Start.]
```

  ② At the time of termination:

```
[2015/03/19 21:11:48.812][INFO ][TREXAU000004][External Authenticator][Stop.]
[2015/03/19 21:11:48.943][INFO ][TREXAU000005][External Authenticator][Succeeded:Stop.]
```

  Example of log output when it is abnormal
  ① At the time of start-up:

```
[2015/03/20 22:15:36.265][INFO ][TREXAU000001][External Authenticator][Start.]
[2015/03/20 22:15:36.364][ERROR][TREXAU000003][External Authenticator][Failed:Start.]
```

  ② At the time of termination:

```
[2015/03/20 22:20:14.317][INFO ][TREXAU000004][External Authenticator][Stop.]
[2015/03/20 22:20:15.113][ERROR][TREXAU000006][External Authenticator][Failed:Stop.]
```

Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TREXAU000001	INFO	This is output when the external authentication relay service starts. To confirm that the external authentication relay service has started normally, match it to the troubleshooting code and check that TREXAU000002 is output.
TREXAU000002	INFO	The External authentication relay service has started normally.
TREXAU000003	ERROR	The External authentication relay service failed to start. 1. Select the relevant Storage System from the Storage Device List, stop it, and then start it. 2. If it does not recover, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TREXAU000004	INFO	This is output when the External authentication relay service stops. To confirm that the external authentication relay serviced is stopped normally, match it to the troubleshooting code and check that TREXAU000002 is output.
TREXAU000005	INFO	This is output when the External authentication relay service stops.

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TREXAU000006	ERROR	An error occurred by stopping the external authentication relay service. 1. If the external authentication relay service does not start normally (TREXAU000002) at the next start time, restart the Maintenance PC. 2. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TREXAU000007	ERROR	The external authentication relay service is not started. 1. Select the relevant Storage System from the Storage Device List, stop it, and then start it. 2. If it does not recover, restart the Maintenance PC. 3. If it does not recover by restarting the Maintenance PC, set up Storage Navigator again.
TREXAU000008	ERROR	The test communication to the HCS server when setting the external authentication link of the HCS server failed. The network setting of the HCS server or the setting of the external authentication may have a problem. Check the setting of the HCS server.
TREXAU000009	ERROR	The connection with the HCS server failed when performing the external authentication for the HCS server. The network setting of the HCS server or the setting of the external authentication may have a problem. Check the setting of the HCS server.
TREXAU0000010	ERROR	The external authentication relay service is stopped forcibly. This might be output when Maintenance PC restarts while the service is running. 1. Stop the relevant Storage System from the Storage Device List and restart it. 2. If not recover, restart the Maintenance PC. 3. If still not recovered, set it up again.
TREXAU0000011	ERROR	

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- Communication service

  Example of log output when it is normal

  An example of output when it started normally and terminated is shown below.

```
[2015/05/27 16:03:04.875][INFO ][TRCOMM000001][Communication]
[Ready : Connection to GUM2 opened.]
[2015/05/27 16:03:16.972][INFO ][TRCOMM000001][Communication]
[Ready : Connection to GUM1 opened.]
• • •
```

  Example of log output when it is abnormal

  An example of output when it has occurred abnormally is shown below.

```
[2015/05/27 16:03:17.288][ERROR][TRCOMM000004][Communication]
[Failed : Connection to GUM2 failed. Already connected MPC's IP Address is (1)10.xx.yy.zz ]
[2015/05/27 16:03:17.428][ERROR][TRCOMM000009][Communication]
[Failed : Authentication failed by GUM2.]
```

Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRCOMM000001	INFO	This is output when completing the communication path connection with GUM normally after the communication service started.
TRCOMM000002	INFO	This is output when completing the device authentication in the communication path to GUM normally after the communication service started.
TRCOMM000003	INFO	This is output when completing the consistency check in the communication path to GUM after the communication service started. (Indicates the state that Serial numbers, Config models, and models are identical)
TRCOMM000004	ERROR	This is output when the other Maintenance PC already connected to the storage system to be used. Stop the services of the storage system running on the PC of the IP address (*1) described in the background service log.
TRCOMM000005	WARN	This is output when detecting that the IP address for each CTL set in the Add System window and the CTL number set for GUM are not identical. Correct the IP Address setting for each CTL in the Storage Device List.
TRCOMM000006	WARN	This is output when detecting that the storage system model set in the Add System window and the storage system model set for the storage system are not identical. Delete the storage system from the Storage Device List once and register it again with the correct storage system model.

*1: If the router converts the IP address, the address might be different from the IP address of the PC itself. In that case, confirm with the network administrator.

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TRCOMM000007	WARN	This is output when detecting that the Config model set in the Add System window and the Config model installed in the storage system are not identical. Delete the storage system from the Storage Device List once and register it again with the correct Config model.
TRCOMM000008	WARN	This is output when detecting that the serial number set in the Add System window and the serial number set in the storage system are not identical. Delete the storage system from the Storage Device List once and register it again with the correct serial number.
TRCOMM000009	ERROR	This is output when authentication fails at connection with GUM. If the troubleshooting code TRCOMM000002 is output within a minute after this log is output, no action is required because it is caused by temporary communication failure. If the troubleshooting code TRCOMM000002 is not output, the user name and password set in the Add System window might not be correct. Set the user name and the password in the Storage Device List again.
TRCOMM000010	INFO	This is output when disconnecting the communication path to GUM after the communication service started.
TRCOMM000011	ERROR	This is output when the information update failed. It is updated again automatically. However, if the "TRCOMM000002" log is not output after waiting for about five minutes from the log output, select the storage system from the Storage Device List. Stop the system, and then restart it. If the failure does not recover, restart the Maintenance PC.
TRCOMM000012	ERROR	The other Maintenance PC might already connect to the storage system to be used. Check whether any other PCs starting the services of the storage system exist for the storage system to be used. If an Maintenance PC already started the services of the storage system, stop the services.
TRCOMM000013	INFO	This is output when the Communication service starts. To check whether the communication service is starting normally, confirm that this log and TRCOMM000002 are output.
TRCOMM000014	INFO	This is output when the communication service stops. To check whether the communication service is stopped normally, confirm that this log and TRCOMM0000015 are output.
TRCOMM000015	INFO	This is output when the communication service stops normally.

(To be continued)

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(Continued from the preceding page)

Troubleshooting code	Failure level	Coping Method
TRCOMM000016	WARN	This is output when the connection with the storage system fails. 1. Check the IP addresses of CTL1 and CTL2 that are set in Storage Device List. 2. If the IP addresses are incorrect, stop the service of this storage system, and then set correct IP addresses. After setting, 3. restart the service. 4. If the IP addresses are correct, check the communication path between the storage system and the Maintenance PC and the GUM operation status.
TRCOMM000017	ERROR	The communication service is terminated abnormally.
TRCOMM000018	ERROR	The communication service is stopped forcibly. This might be output when Maintenance PC restarts while the communication service is running. Stop the service of this storage system by Storage Device List and restart it.

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- KMIP Communicator
  Example of log output when it is abnormal
  An example of output when it has occurred abnormally is shown below.

```
[2015/11/19 10:49:49.617][ERROR][TRKMIP000001][KMIPCom][Failed : SSL settings are invalid.]
```

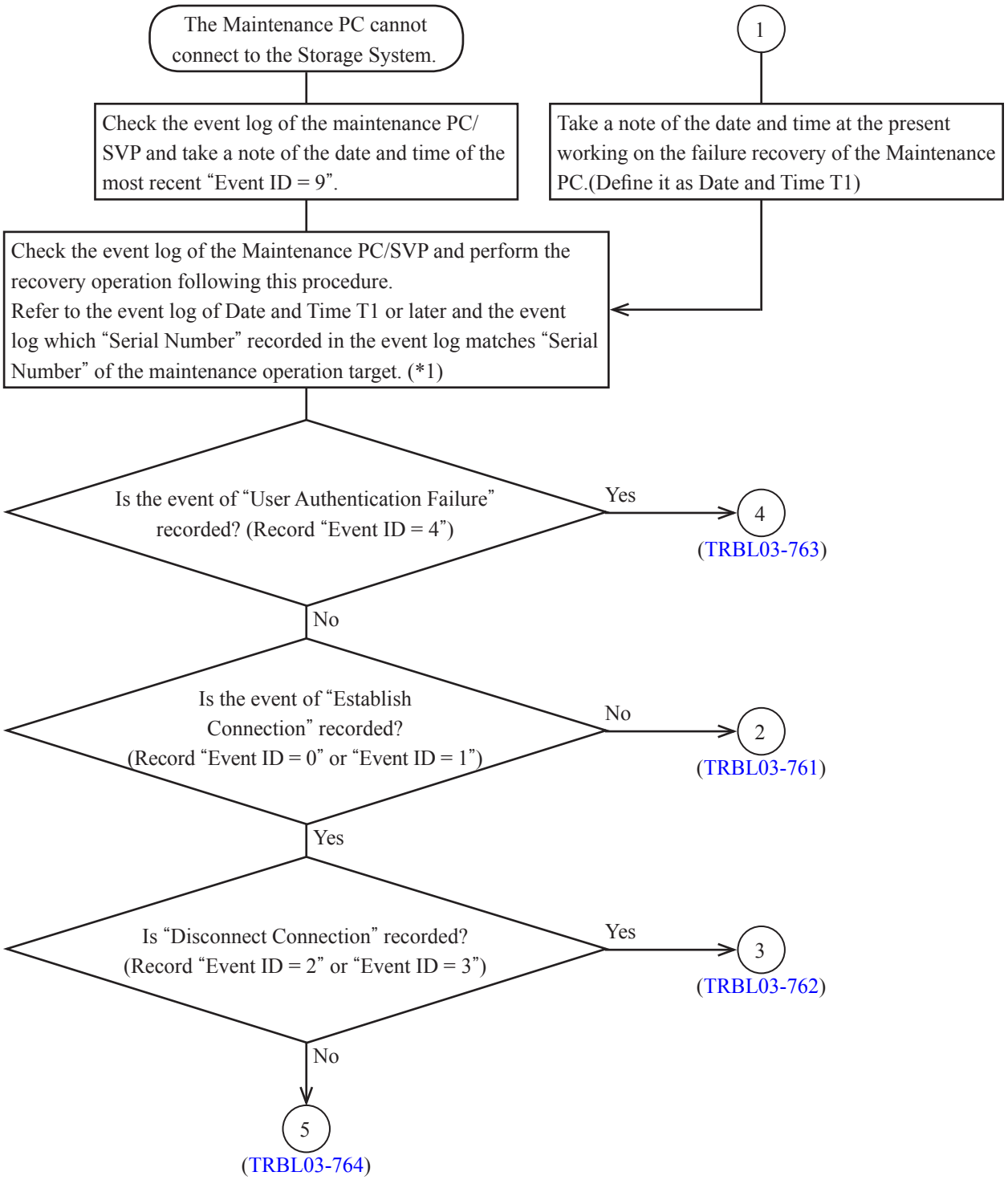
Troubleshooting codes and coping methods are shown below.

Troubleshooting code	Failure level	Coping Method
TRKMIP000001	ERROR	An unexpected error occurred in the KMIP Communicator Server service. See “Collecting dump files using the Dump tool” in the User Guide to gather dump files. If the collection fails, see “How to collect dump files manually” in the User Guide to collect the file manually.

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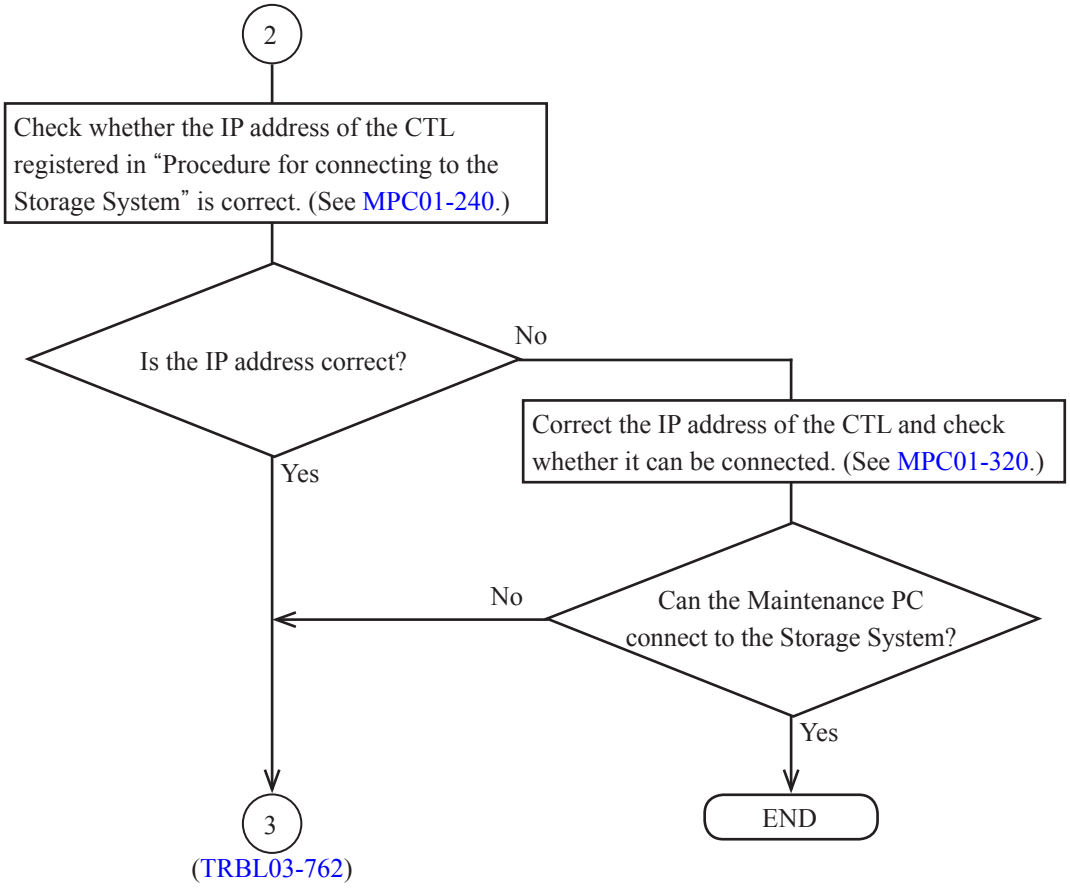
3.29 MPC Failure Recovery

3.29.1 When I cannot be connected from MPC to the GUM or Storage System

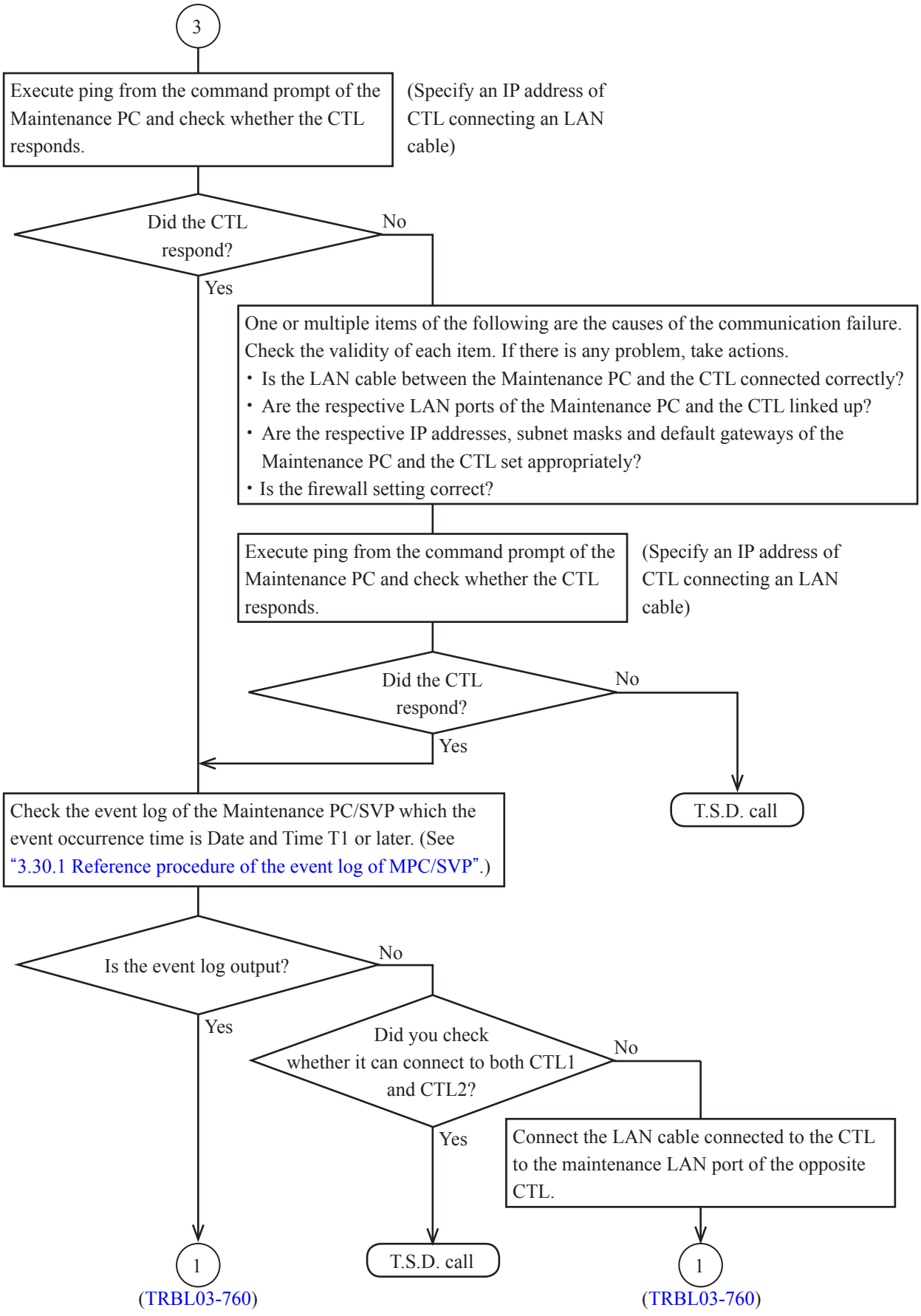


*1: When checking the even logs, sort them by "Date and Time" and operate "Update to the Most Recent Information" to update the event log display to the most recent status, and then check the content. (See "3.30.1 Reference procedure of the event log of MPC/SVP".)

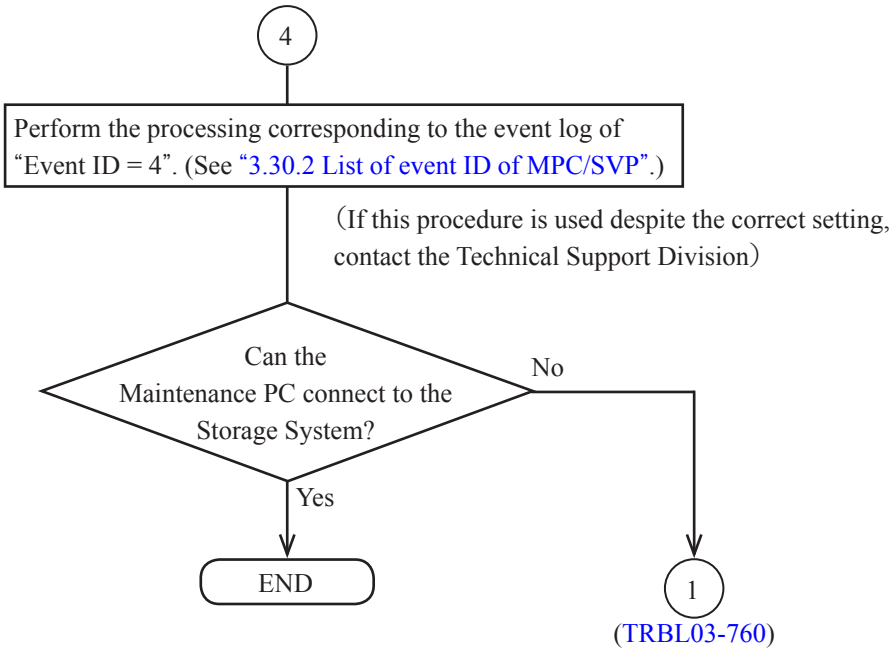
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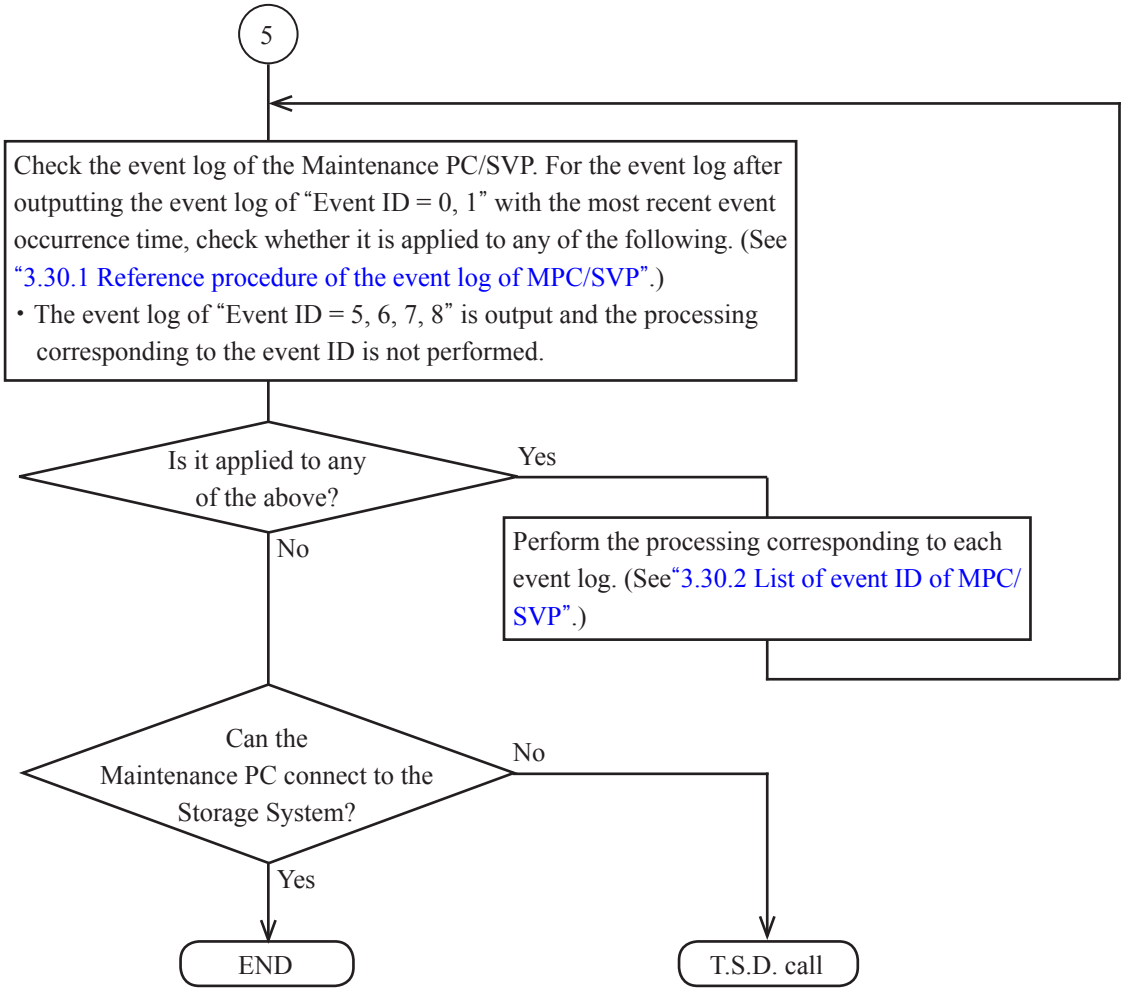
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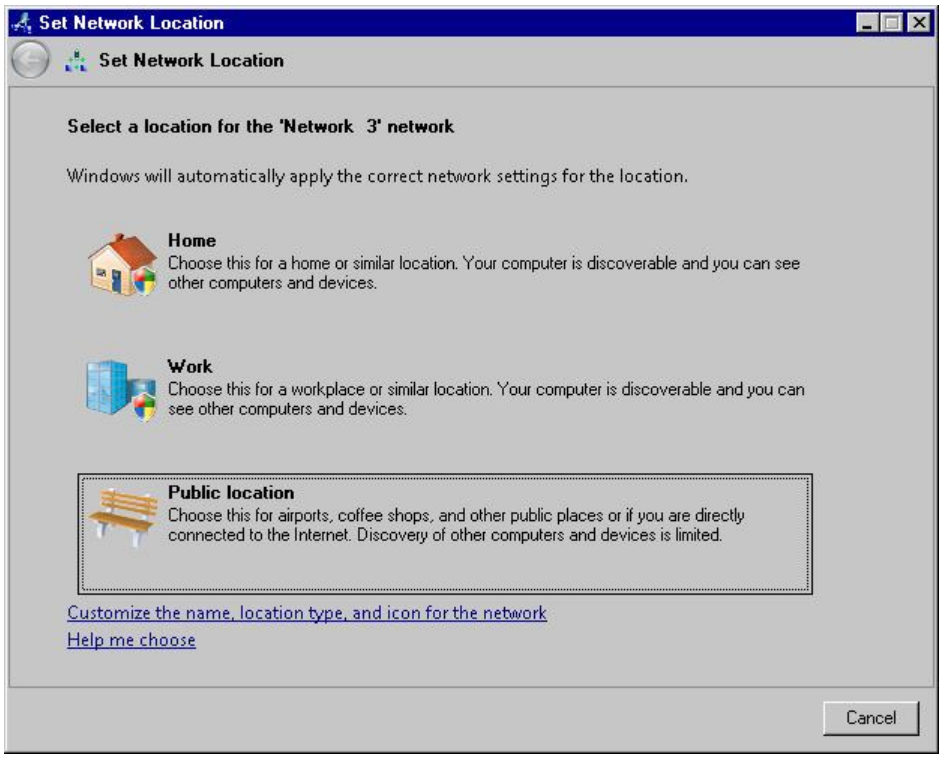


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3.29.2 About Other MPC Troubles

1. Action when the “Set Network Location” dialog is displayed.
   The “Set Network Location” dialog might be displayed in the SVP window at the opportunity when the network environment of Public LAN changed.
   There is no influence on the SVP function by this window being displayed.
   Please close it according to the following procedure.

   (1) The “Set Network Location” dialog.



   (2) How to close the “Set Network Location” dialog.
   Click the [Cancel] button in the lower right of the dialog.

2. Occasionally, if a drive letter is not displayed in the drive drop-down list or if a drive letter is displayed repeatedly in the same drive drop-down list, we have to cut off the connection with the Maintenance PC and then reconnect to the Maintenance PC by the remote connection (MPC) again. After that we should make the drive drop-down list screen redisplay, and then we can continue our maintenance operation.

3. Recovery when you have deleted the software of Maintenance PC by mistake.
   Restore the software of Maintenance PC in the following procedures, when you have deleted the software of Maintenance PC by Windows Explore.

   (1) Confirm the version of the installed software. Prepare for the media of the same version.
   (2) Install again in the media mentioned above.

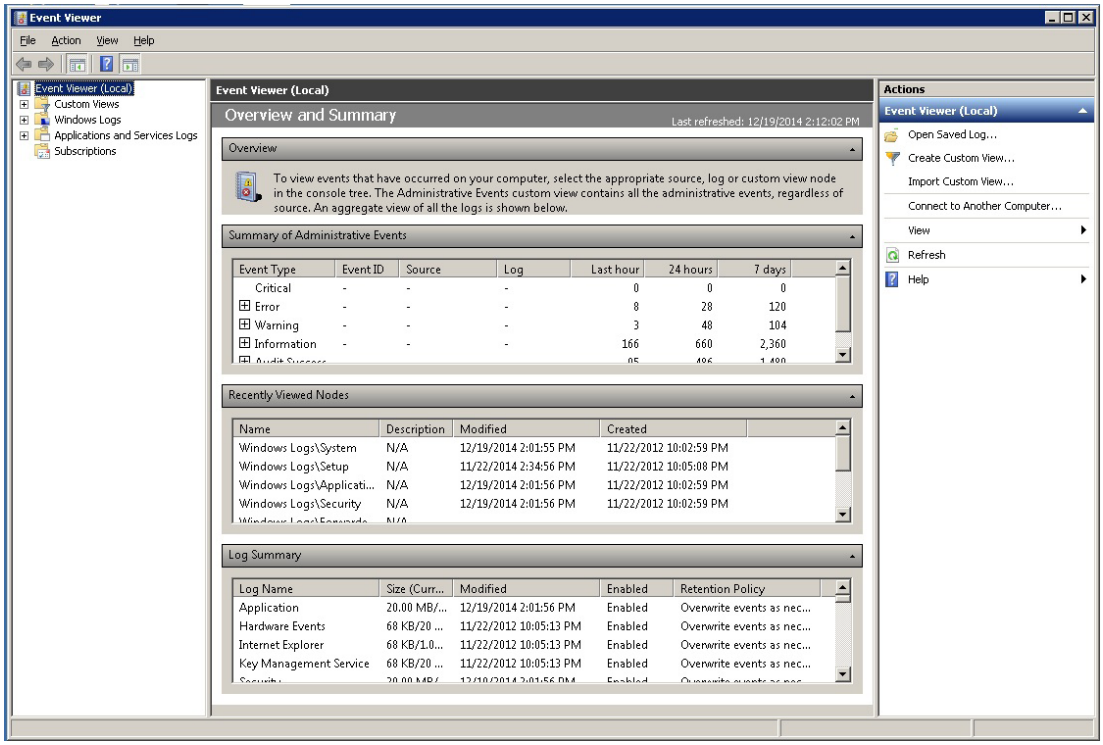
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3.30 Event log of MPC/SVP

You can confirm an event that occurred in Maintenance PC/SVP by referring to event log.

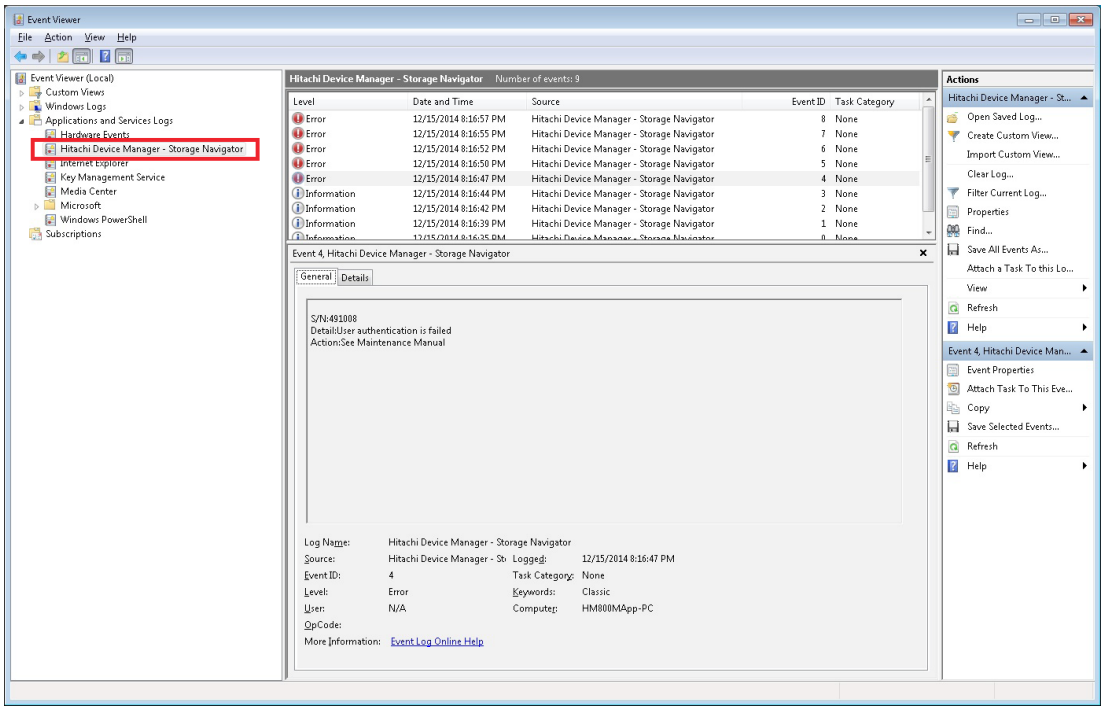
3.30.1 Reference procedure of the event log of MPC/SVP

1. Select [Control Panel]-[Administrative Tools]-[Event Viewer] from the [Start] menu. An Event Viewer window is displayed.



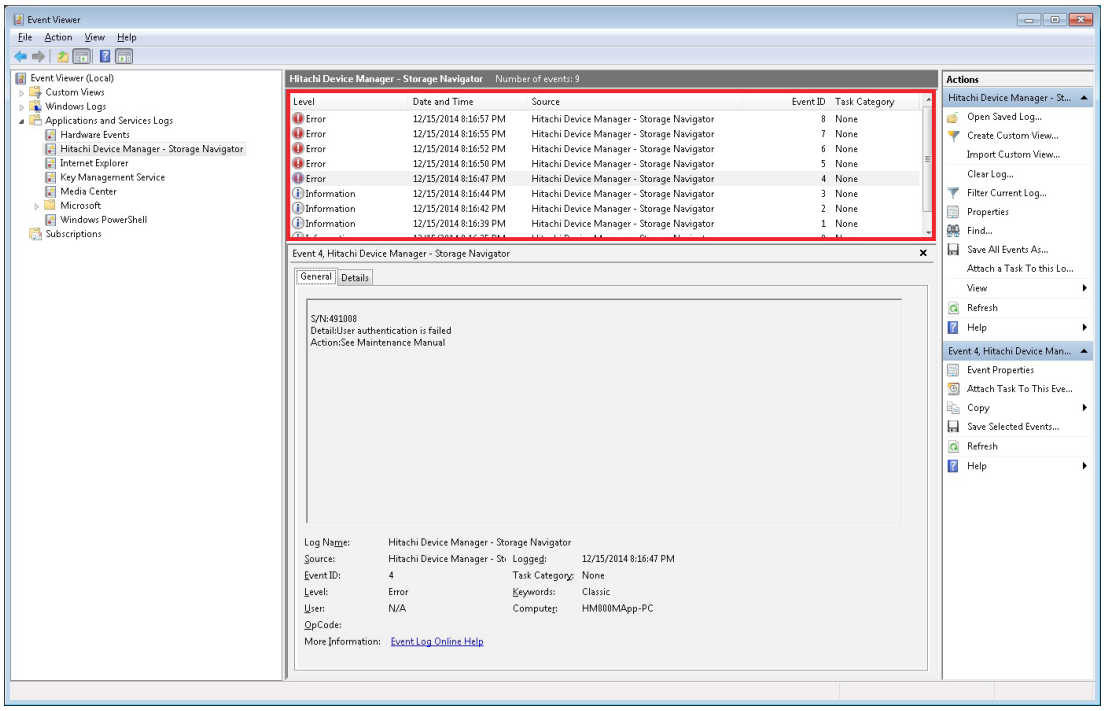
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2. In a tree of the window left side, Select [Applications and Services Logs]-[Hitachi Device Manager - Storage Navigator].



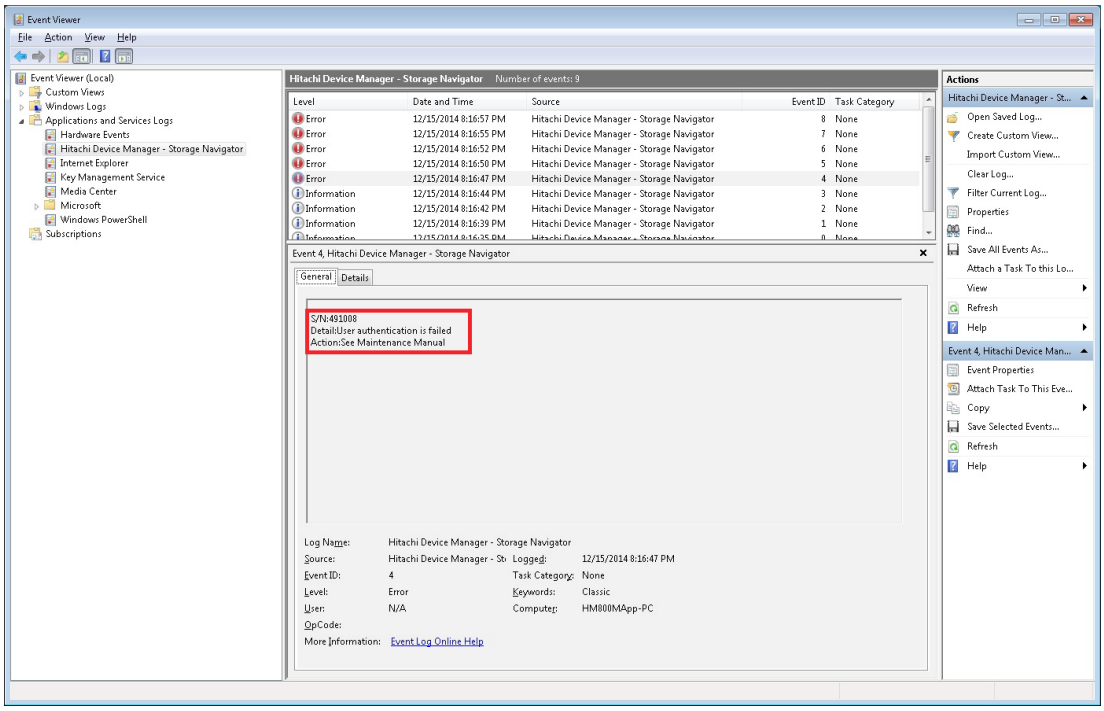
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3. A list of event logs for the events occurred in the service PC/SVP event is displayed at the upper of the center of the “Event Viewer” window.



Item	Description	
Level	Severity of the log	
	Information	Log of the information level
	Warning	Log of the warning level
	Error	Log of the serious error level
Date and Time	The time of day which an event produced	
Source	Fixed with “Hitachi Device Manager – Storage Navigator”	
Event ID	ID of the event log (See “3.30.2 List of event ID of MPC/SVP” for the list of ID.)	
Task Category	Fixed with “None”	

4. Selecting an event from the list of events displays the detailed information of the events in the [General] tab at the lower of the center of the “Event Viewer” window.



Item	Description	
S/N	Serial number of the storage system	
Detail	Contents of the event	
Action	Action for the event	
	No Action	The action is unnecessary
	See Maintenance Manual	Take actions in accordance with the measures described in “3.30.2 List of event ID of MPC/SVP”.

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3.30.2 List of event ID of MPC/SVP

Event ID	Level	Item	Contents
0	Information	Description	Connection to CTL1 has been established
		display of Detail	Connection to CTL1 has been established
		Action	None
1	Information	Description	Connection to CTL2 has been established
		display of Detail	Connection to CTL2 has been established
		Action	None
2	Information	Description	Connection to CTL1 was disconnected
		display of Detail	Connection to CTL1 was disconnected
		Action	None
3	Information	Description	Connection to CTL2 was disconnected
		display of Detail	Connection to CTL2 was disconnected
		Action	None
4	Error	Description	The user authentication to a storage system failed.
		display of Detail	User authentication is failed
		Action	A communication failure might occur between the Maintenance PC/SVP and the GUM/Storage System. Check the status of the connection to the GUM/Storage System in accordance with the procedure from number ③ described in the flow chart of "3.29.1 When I cannot be connected from MPC to the GUM or Storage System". If disconnected, connect the Maintenance PC/SVP and GUM to run again. If connected, check whether [User name] and [Password] set in the "Add System/Edit System" window of the Storage Device List are correct. In the case of a wrong, set right [User name] and [Password] in "Edit System" window of Storage Device List. In the case of a correct, T.S.D. call.

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Event ID	Level	Item	Contents
5	Error	Description	Serial number set in Maintenance PC/SVP is mismatched with serial number of the storage system.
		display of Detail	Serial Number disagreement
		Action	Confirm whether [Serial Number] set in “Add System” window of Storage Device List are not wrong. In the case of a wrong, By the following procedure, register storage system information again. 1. Stop the service of the storage system. (See MAINTENANCE PC SECTION “1.6.4 Stopping/Starting the Service of Storage System”.) 2. Delete the device icon with [X] button in “Storage Device List” window. 3. Register a storage system in correct [Serial Number] in the “Add System of the Storage Device List” window. In the case of a correct, T.S.D. call.
6	Error	Description	System Type set in Maintenance PC/SVP is mismatched with System Type of the storage system.
		display of Detail	System Type disagreement
		Action	Confirm whether [System Type] set in “Add System” window of Storage Device List are not wrong. In the case of a wrong, By the following procedure, register storage system information again. 1. Stop the service of the storage system. (See MAINTENANCE PC SECTION “1.6.4 Stopping/Starting the Service of Storage System”.) 2. Delete the device icon with [X] button in Storage Device List window. 3. Register a storage system in correct [System Type] in the “Add System of the Storage Device List” window. In the case of a correct, T.S.D. call.

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Event ID	Level	Item	Contents
7	Error	Description	Configuration type set in Maintenance PC/SVP is mismatched with Configuration type of the storage system.
		display of Detail	Configuration type disagreement
		Action	Confirm whether configuration type of [Software Version] (MPC01-261) set in “Add System/Edit System” window of Storage Device List are not wrong. In the case of a wrong, By the following procedure, register storage system information again. 1. Stop the service of the storage system. (See MAINTENANCE PC SECTION “1.6.4 Stopping/Starting the Service of Storage System”.) 2. Delete the device icon with [X] button in “Storage Device List” window. 3. Register a storage system in correct configuration type in the “Add System of the Storage Device List” window. In the case of a correct, T.S.D. call.
8	Error	Description	Connection to other side CTL of CTL1/CTL2 set in Maintenance PC/SVP
		display of Detail	Connected to the opposite side controller.
		Action	Confirm whether [IP Address] of CTL1/CTL2 set in “Add System/Edit System” window of Storage Device List are not wrong. In the case of a wrong, set right [IP Address] in “Edit System” window of Storage Device List. In the case of a correct, T.S.D. call.
9	Information	Description	The service of the Storage Navigator instance started
		display of Detail	The service of the Storage Navigator instance started
		Action	None

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Event ID	Level	Item	Contents
16	Error	Description	Connection to CTL1 remains disconnected for a long time
		display of Detail	Connection to CTL1 remains disconnected for a long time
		Action	A communication failure might occur between the Maintenance PC/SVP and the GUM/Storage System. Check the status of the connection to the GUM/Storage System in accordance with the procedure from number ③ described in the flow chart of "3.29.1 When I cannot be connected from MPC to the GUM or Storage System". If disconnected, connect the Maintenance PC/SVP and GUM to run again. If connected, check whether [User name] and [Password] set in the "Add System/Edit System" window of the Storage Device List are correct. In the case of a wrong, set right [User name] and [Password] in "Edit System" window of Storage Device List. In the case of a correct, T.S.D. call.
17	Error	Description	Connection to CTL2 remains disconnected for a long time
		display of Detail	Connection to CTL2 remains disconnected for a long time
		Action	A communication failure might occur between the Maintenance PC/SVP and the GUM/Storage System. Check the status of the connection to the GUM/Storage System in accordance with the procedure from number ③ described in the flow chart of "3.29.1 When I cannot be connected from MPC to the GUM or Storage System". If disconnected, connect the Maintenance PC/SVP and GUM to run again. If connected, check whether [User name] and [Password] set in the "Add System/Edit System" window of the Storage Device List are correct. In the case of a wrong, set right [User name] and [Password] in "Edit System" window of Storage Device List. In the case of a correct, T.S.D. call.

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Event ID	Level	Item	Contents
18	Error	Description	Connection to CTL1/CTL2 remains disconnected for a long time
		display of Detail	Connection to CTL1/CTL2 remains disconnected for a long time
		Action	A communication failure might occur between the Maintenance PC/SVP and the GUM/Storage System. Check the status of the connection to the GUM/Storage System in accordance with the procedure from number ③ described in the flow chart of "3.29.1 When I cannot be connected from MPC to the GUM or Storage System". If disconnected, connect the Maintenance PC/SVP and GUM to run again. If connected, check whether [User name] and [Password] set in the "Add System/Edit System" window of the Storage Device List are correct. In the case of a wrong, set right [User name] and [Password] in "Edit System" window of Storage Device List. In the case of a correct, T.S.D. call.

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3.31 Procedure for Responding to the Used Endurance of Flash Drives and Flash Module Drives (FMDs) (SIM = 50bxyy, 50cxyy)

The SIMs indicate the write endurance (Used Endurance) threshold over of MLC Flash Drives and Flash Module Drives (FMD).

1. The SIMs are reported for the first time when the rate of write endurance reaches 95%, and then reported each time the percenrage rises by 1%.
   Replace the data drive while using the spare drive.
   - Copy the data in the data drive to the spare drive and remove the data drive.
   - Install a new data drive and copy the data to the new data drive from the spare drive.

2. When the rate of write endurance reaches 99% (*1), Dynamic Sparing (*2) starts to run.
   Replace the data drive where Dynamic Sparing is complete.

   *1: See “Used Endurance Indicator” in the ORM window (MPC05-420) to check if the drive reaches 99% of the write endurance.
   When a drive reaches 99% of the write endurance, SIM = 50bxyy (Flash drive End of life) or SIM = 50cxyy (Flash module drive End of life) is reported.

   *2: SIMs of Dynamic Sparing generated at 99% of write endurance of Flash Drives (SSDs) and Flash Module Drives (FMDs):
   ef2xyy (Drive blockade (Effect of Dynamic sparing normal end))
   461xyy (Dynamic sparing start)
   462xyy (Dynamic sparing normal end)

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3.32 Procedure for Responding to the Flash Module Drive Built-in Battery Warning (SIM = 50dxyy)

- This SIM is the lifetime reaching SIM of the Flash Module Drive built-in Battery.
  The Battery lifetime is affected by the environmental temperature.
  The Battery lifetime for each environmental temperature is as shown below and it does not occur within six years of the normal maintenance period under the Storage System use environment (16 to 32 degrees C).

Environment temperature	Lifetime
25 degrees or less	10 years
28 degrees	8 years
30 degrees	7 years
32 degrees	6.2 years

- SIM is notified first when the Battery lifetime reaches 95% and notified for every six hours.

- Even if the Battery lifetime reaches 100%, the backup is not immediately disabled. However, a Battery error may occur and get the dynamic sparing operation, when the endurance reaches 95%, replace the Battery before it reaches 100% (about between 100 to 180 days).

- The recovery procedure is as follows.
  [Case occurred before six years passed]
  Replace the normal Flash Module Drives. (Refer to REP02-03-10)

  [Case occurred after six years passed]
  (1) Gathering information
  Gather the following information.
  (a) Product model name of the SIM target Drive
  (b) Location of the SIM target Drive
  (c) RAID group number of the SIM target Drive
  (d) Used Endurance Indicator for each location of all the Flash Drive in the RAID group Check it by Used Endurance Indicator in the “ORM” window on the Maintenance PC (refer to MPC05-410)

  NOTE: SIM is notified first when the Battery lifetime reaches 95% and notified for every six hours. When the Flash Module Drive is not replaced soon, change the Battery lifetime rate threshold value from 95% to 98%. (Refer to MPC05-410)

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(2) Contacting the customer/service personnel/SE

When the Flash Module Drive built-in Battery reaches the lifetime, “Replace and Add” (overhaul correspondence) is required.

Inform the customer/service personnel/SE of the gathered information and ask for issuance of “Replace and Add”.

In case of “Replace and Add”, we recommend replacing the Drives exceeding the Battery lifetime rate of 90% in the RAID group in bulk.

(3) Replacing Drives

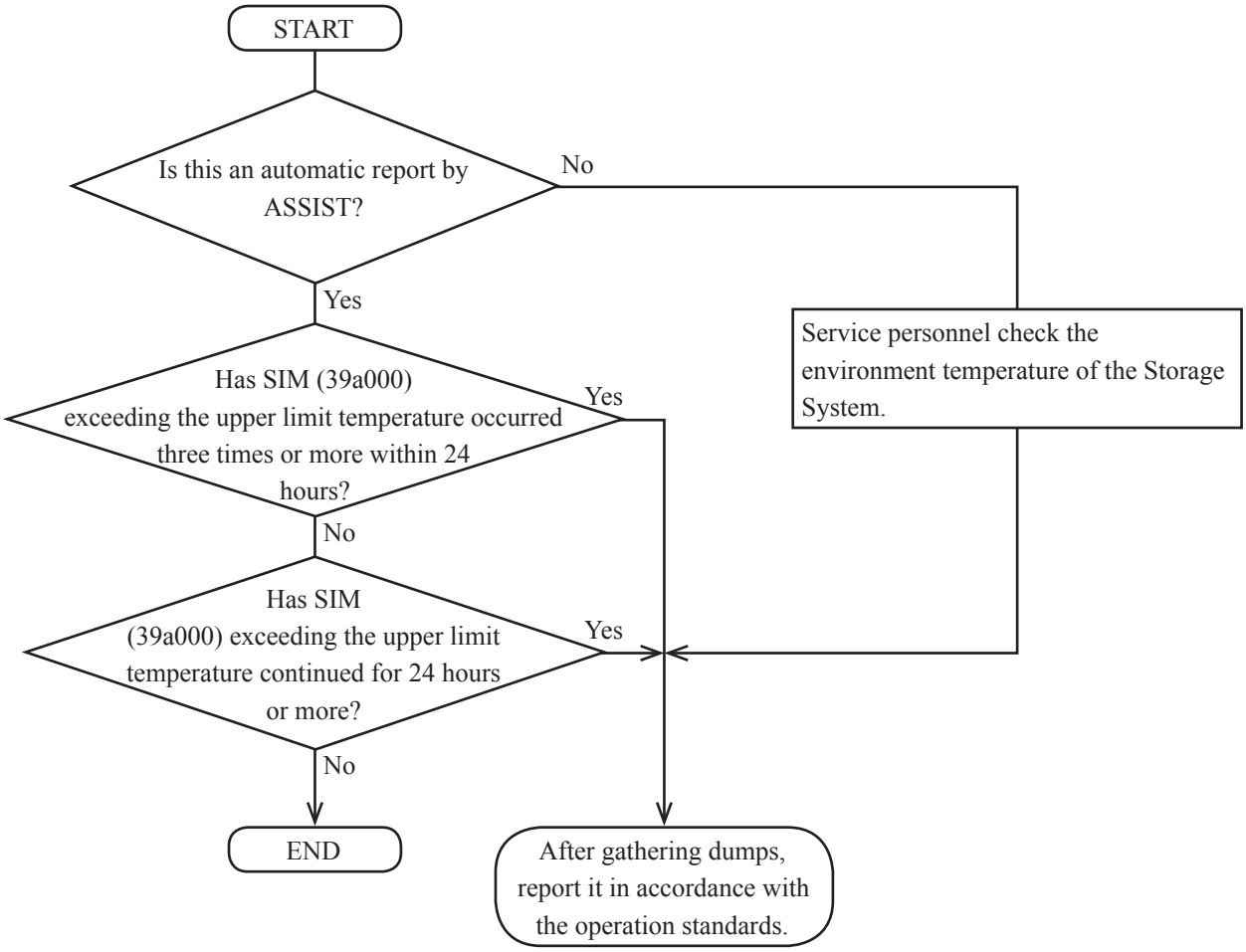
When the customer/service personnel/SE arranges the addition work as the replacement work, add Drives in accordance with the procedure.

Refer to the following for the addition procedure.

INSTALLATION SECTION “3.3 Adding Drives”

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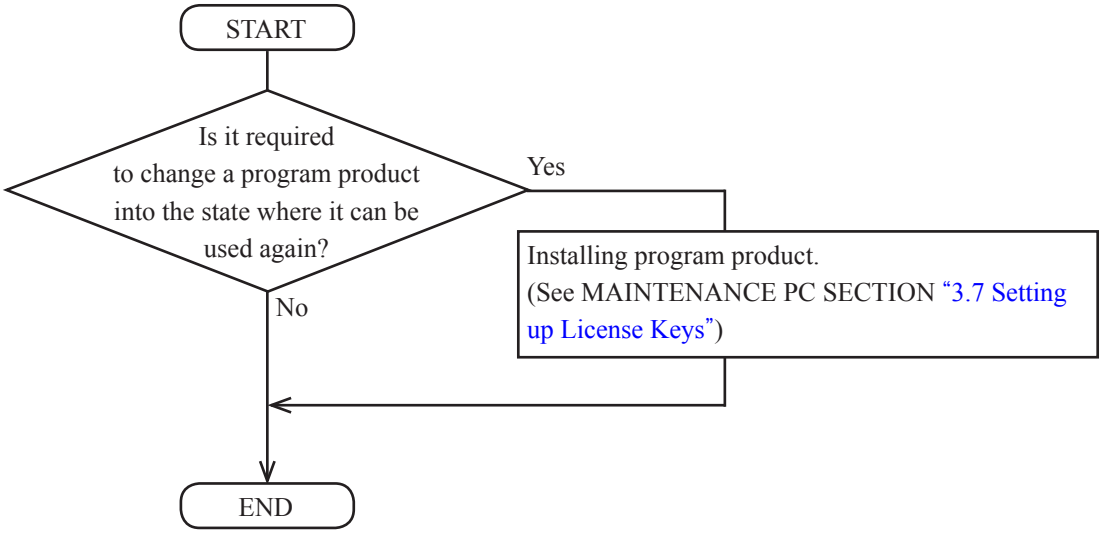
3.33 Procedure for Responding to the Excess of Upper Limit Temperature of Long-life Support (SIM = 39a000)



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3.34 Procedure for responding to the product program expiration (SIM = 7ff7xx)

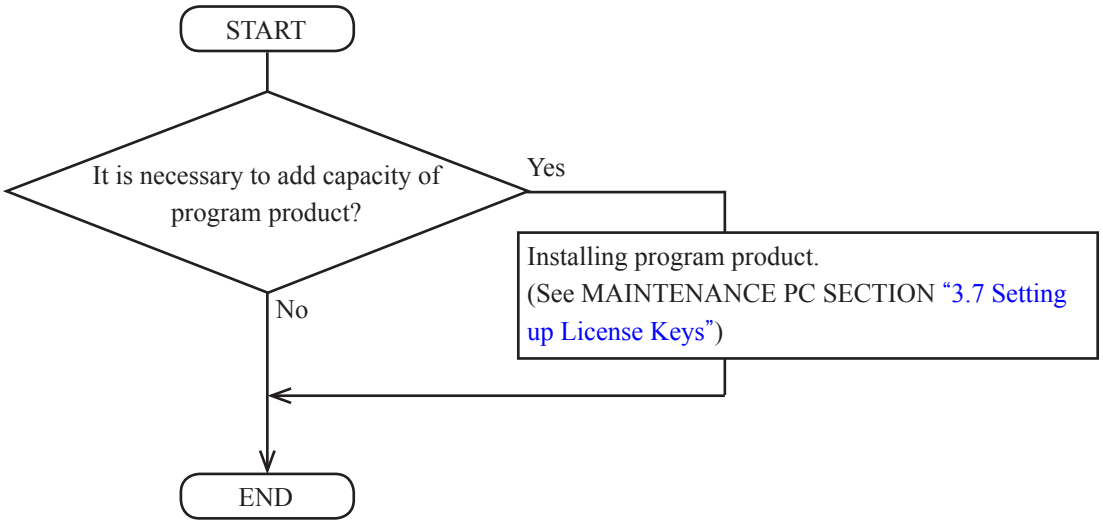
If this SIM is reported, the term of validity of the program product was lost.
About of which program product the term was lost, please refer to 7ff7xx of SIMRC02-10.



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3.35 Procedure for responding to an excess of the allowed capacity (SIM = 7ff8xx)

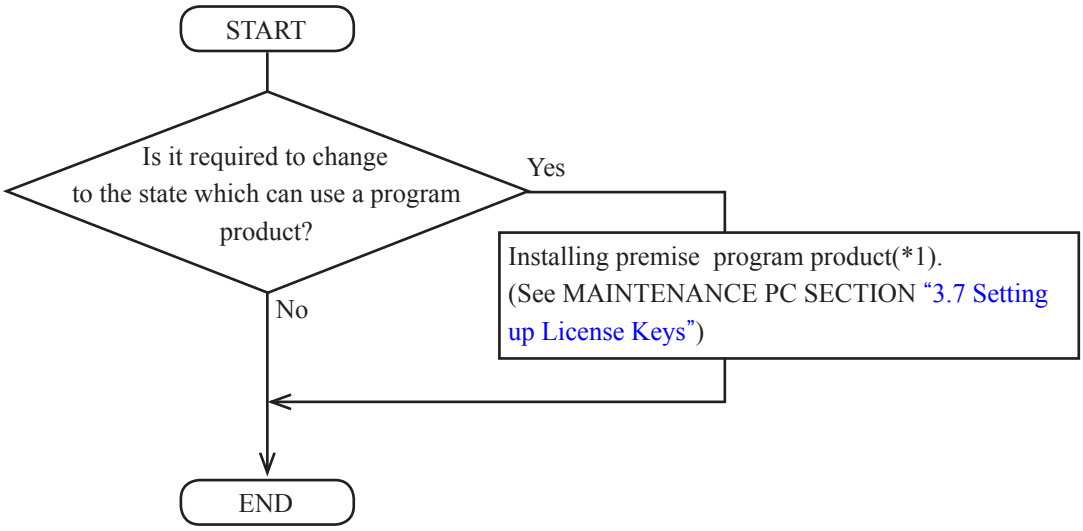
If this SIM is reported, The capacity of the validity of a program product was exceeded.
About of which program product is excess of capacity, please refer to 7ff8xx of SIMRC02-10.



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3.36 Procedure for responding to the prerequisite program product expiration (SIM = 7ff9xx)

If this SIM is reported, A program product cannot be used by the term of validity of the premise program product.
About whether it became impossible which program product to use, please refer to 7ff9xx of SIMRC02-10.



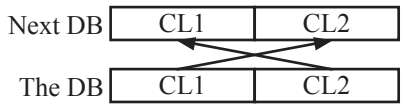
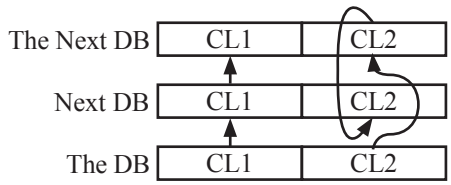
*1: About which program product will be the requisite, (See MAINTENANCE PC SECTION "3.7 Setting up License Keys".)

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3.37 Recovery Procedure when Cable Connection Error Occurs (SIM = effcxx, effexx, effdxx)

3.37.1 Recovery Procedure when SAS Cable Connection Error Occurs (SIM = effexx, effdxx)

The recovery procedure when incorrect recognition of DB location is detected at the processing to initialization on backend SAS is as follows.
This SIM might occur by the CTL, DKB, ENC and other failures.
The SAS cable connection error (REF code = effexx) or the Expander failure (REF code = effdxx) is reported (xx: SAS Port#) as the SIM of the failure managed by each SAS Port.
As a cause of the error, it is assumed that one of the following failures occurs in the reported SAS port or in another SAS port of the opposite cluster.
There is the case that plural PDEV(s) on the SAS port concerned blockade when this SIM occurs at the time of a boot, but PDEV(s) blockade recovers in a procedure of this chapter.
When this troubleshooting is performed during the initial installation, check that the system configuration is initialized after the recovery.

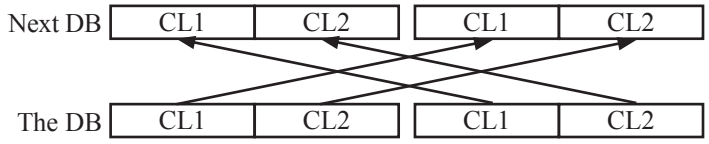
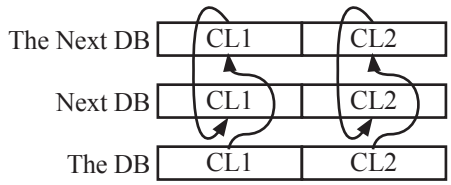
No.	Assumed cause	Details
1	SAS cable is connected with wrong ENC (*1)	• Connected cluster is wrong.  • Connected with different ENCs between clusters. 

*1: See LOCATION SECTION “5.1 SAS Cable Diagram” for right connection.

(To be continued)

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(Continued from preceding page)

No.	Assumed cause	Details
1	SAS cable is connected with wrong ENC (*1)	• Connected with wrong DB. 
2	SAS cable is not connected or the number of DBs is insufficient (*1)	As the number of set DBs and the number of actually recognized DBs are different, SAS cable is not connected or the number of DBs is not enough.
3	Connection order of DBs is wrong (*1)	Because of wrong connection, the connection order of DB is switched. 
4	Power is not supplied to DB	There is any DB to which the power is not supplied.
5	The type of the connected DB is incorrect	The specified DB type (DBS/DBL/DB60/DBF) is inconsistent with the DB type that is actually recosgnized.
6	SAS Ports in both CL are blocked	When DKB in both CL or ENC has failure and cannot access to DB.
7	SAS cable is connected to wrong Port of ENC (*1)	• The SAS Cable is connected with OUT , not IN. • The SAS Cable is connected with IN, not OUT.

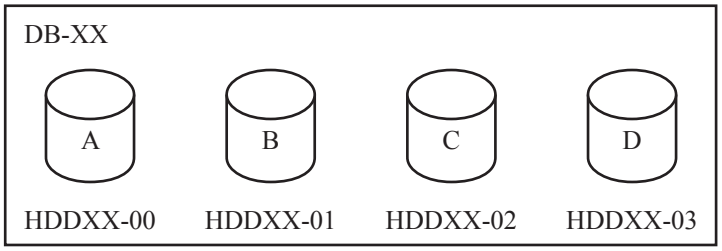
*1:See LOCATION SECTION “5.1 SAS Cable Diagram” for right connection.

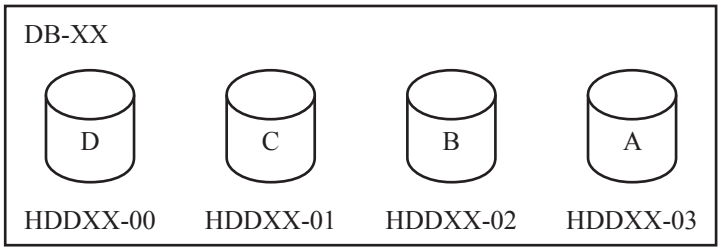
(To be continued)

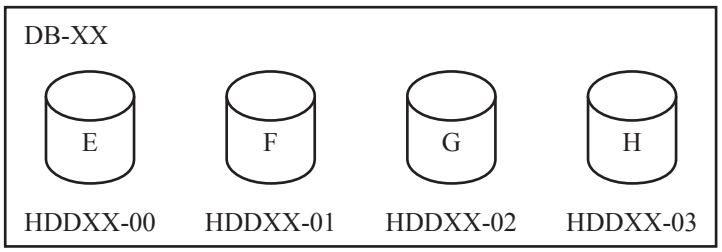
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(Continued from preceding page)

<table>
<tr><th>No.</th><th>Assumed cause</th><th>Details</th></tr>
<tr><td>8</td><td>All Drives in the DB are replaced.</td><td>All Drives in the DB are replaced.

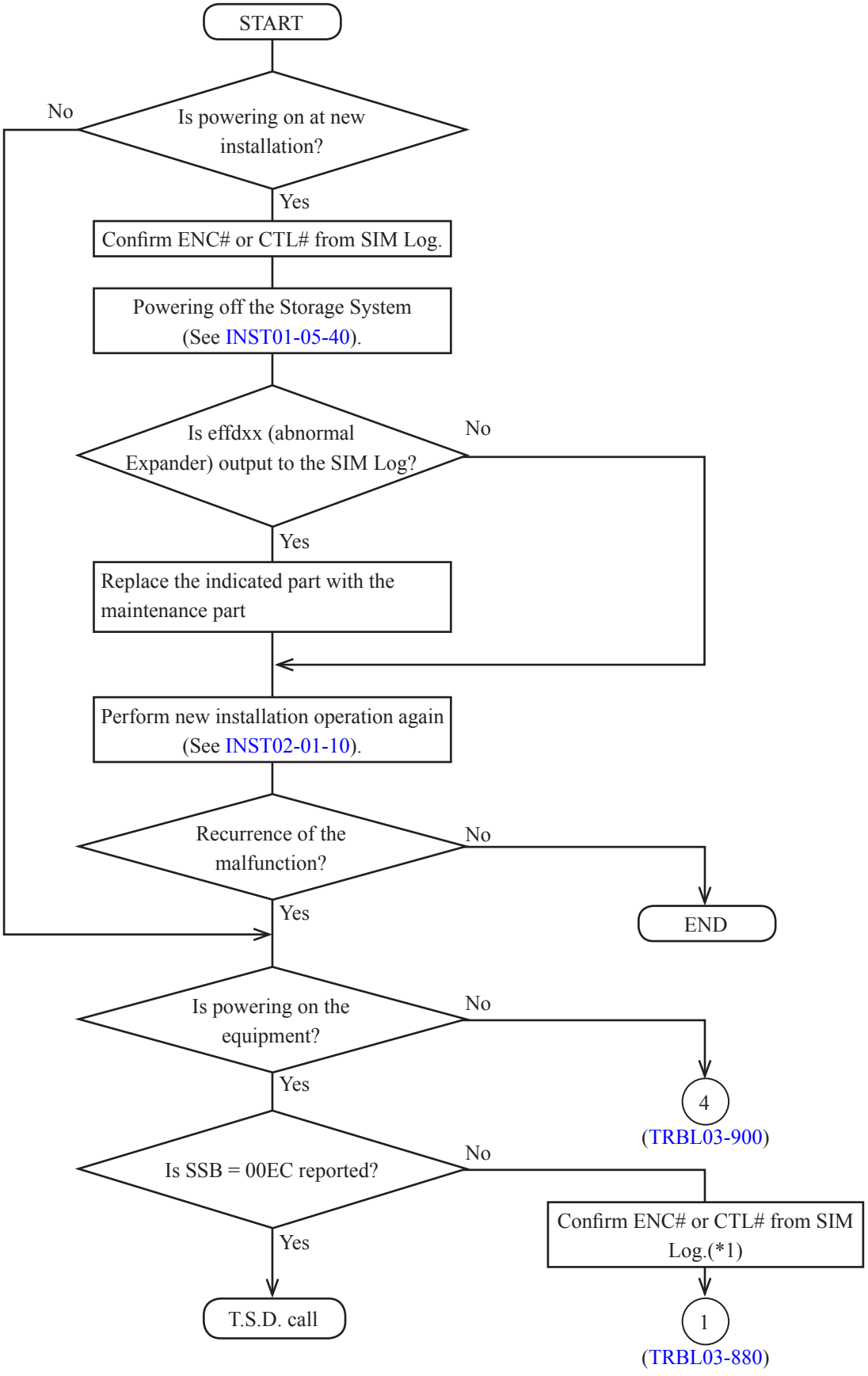
[Before restarting the Storage System/Before recovering DB power-off]
 

[After restarting the Storage System/After recovering DB power-off]
• All Drive locations in the DB are changed.
 

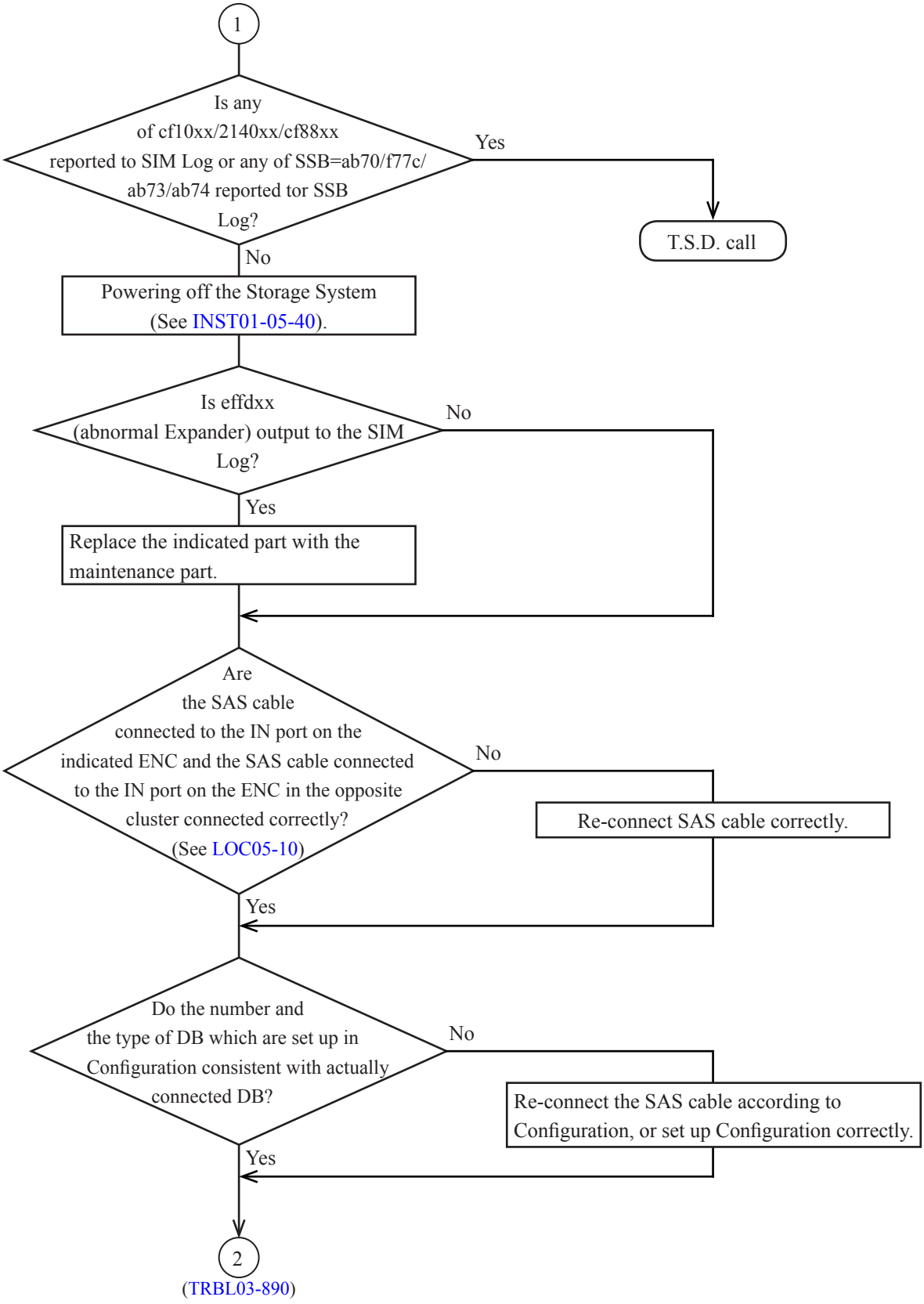
• All Drives in the DB are changed.
 
</td></tr>
<tr><td>9</td><td>Failures other than stated above occur.</td><td>The access to DB is abnormal due to the CTL/MP failures or other failures.</td></tr>
</table>

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[Recovery procedure for SAS cable connection failure]

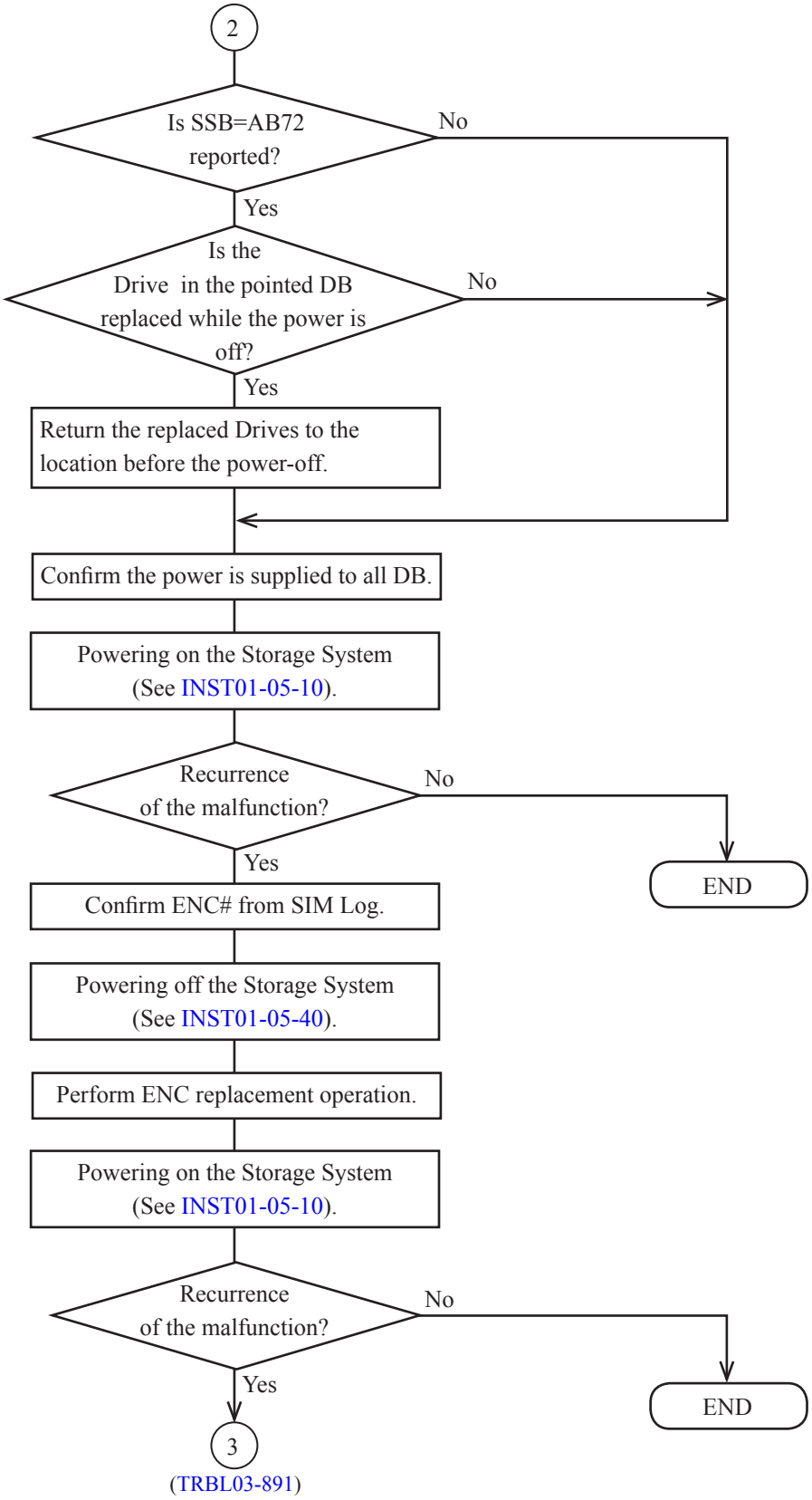


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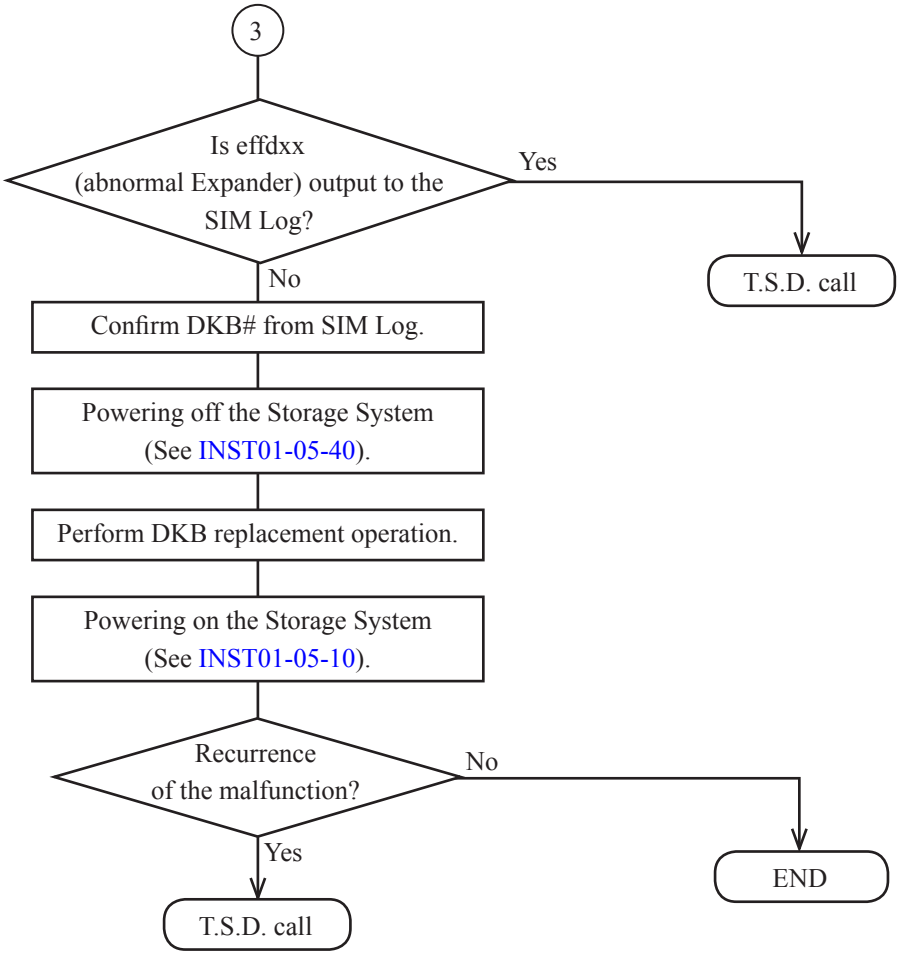


*1: Before power off, check the Configuration.

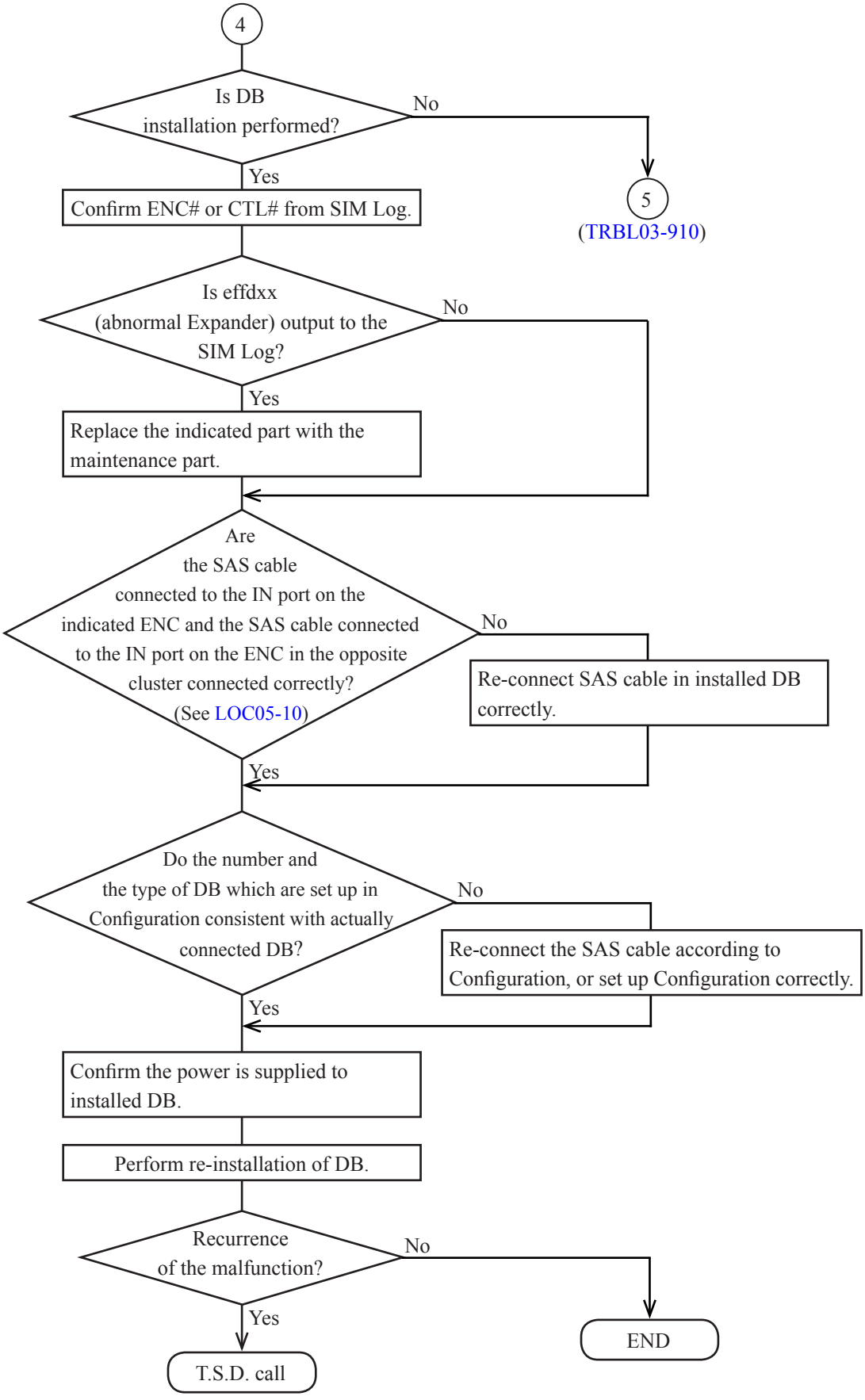
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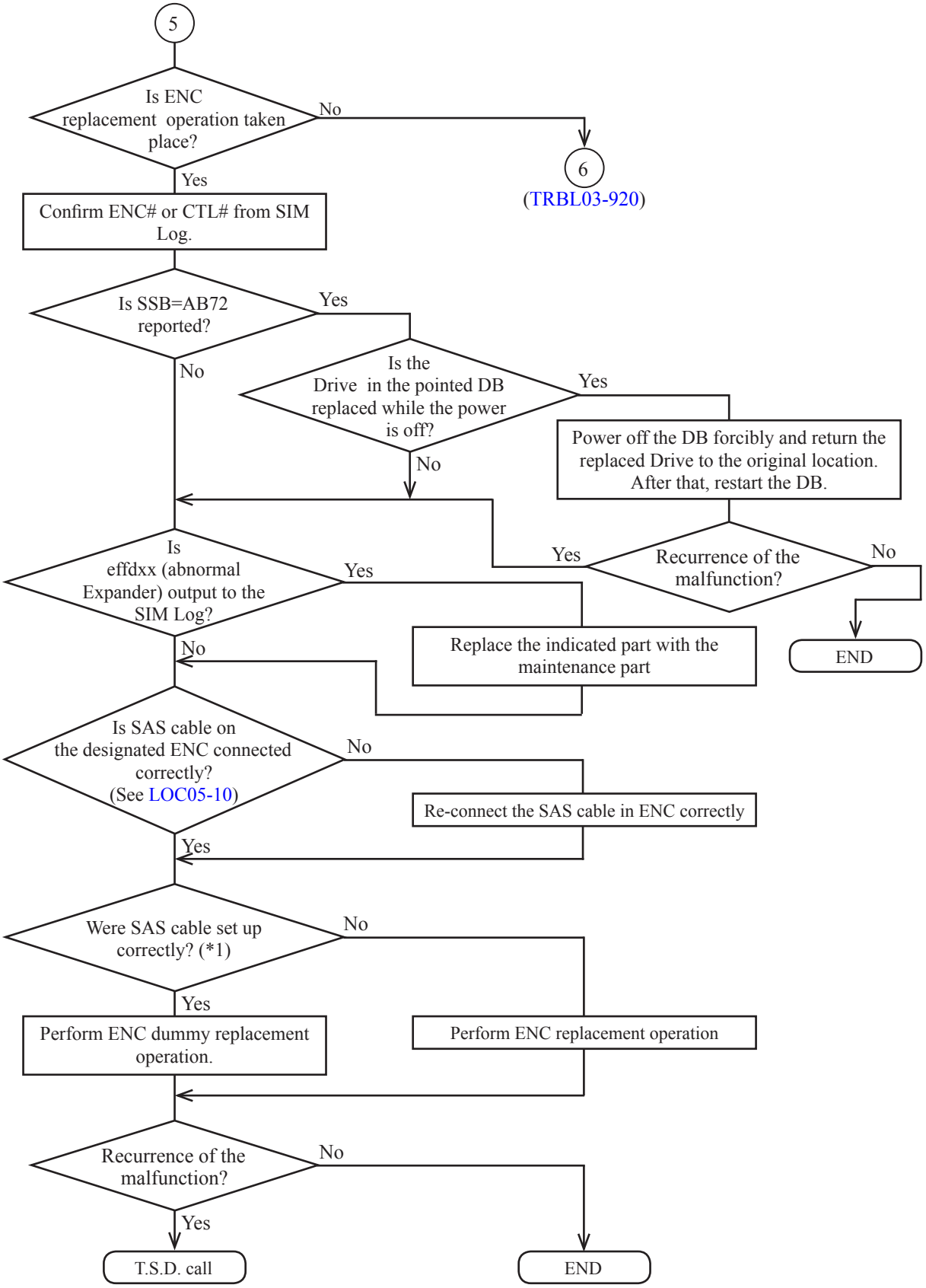
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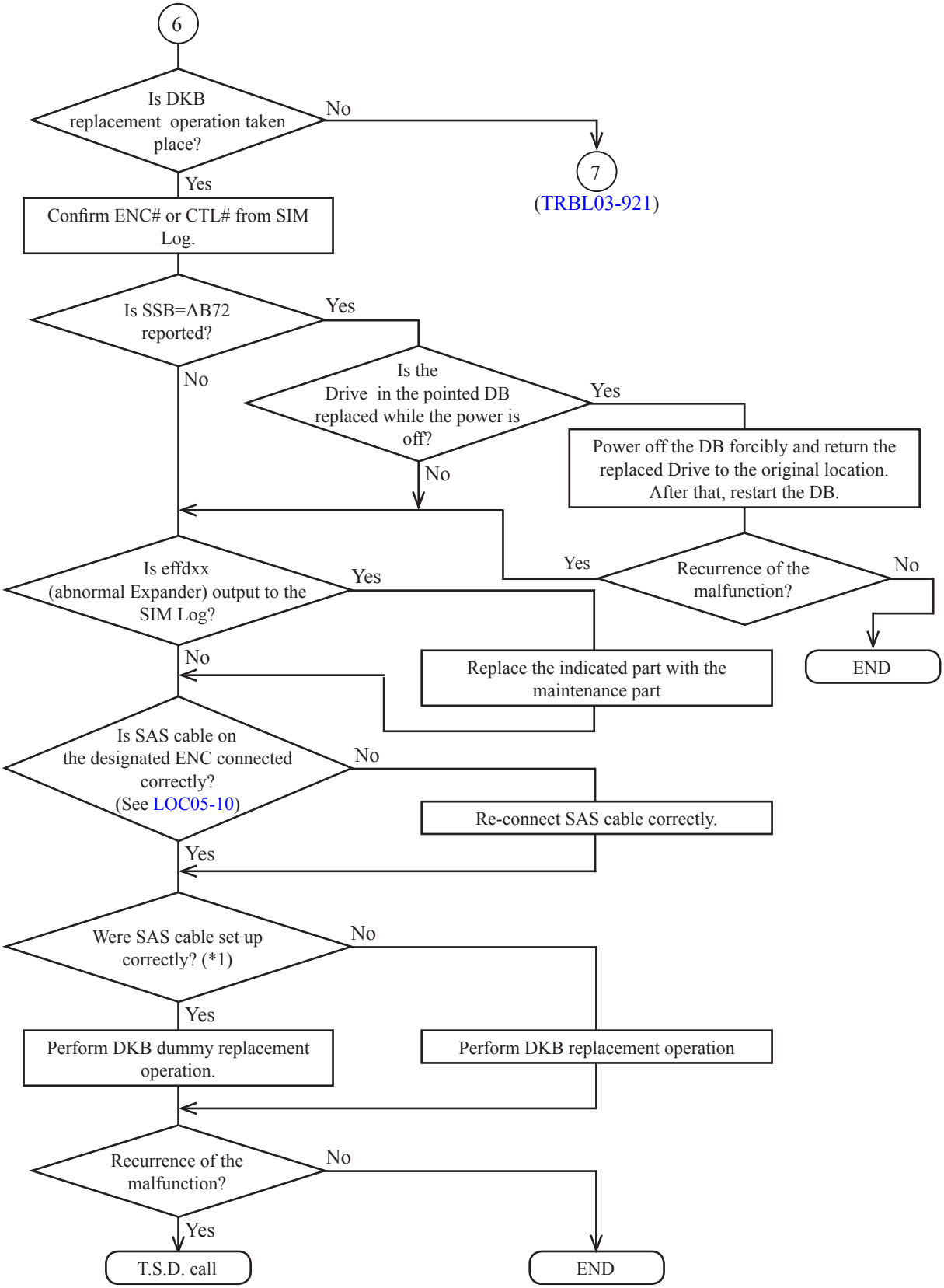


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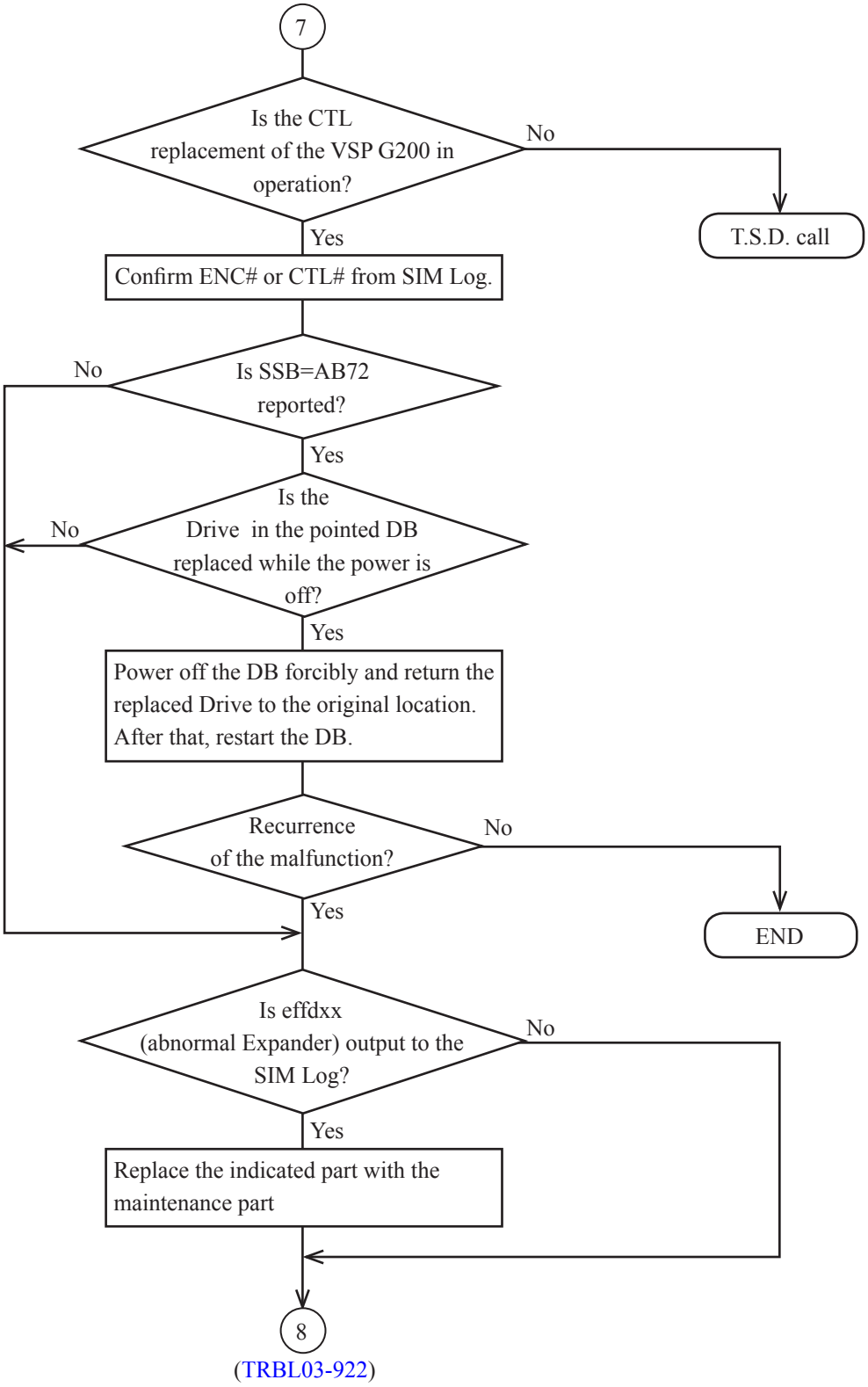
*1: When the replacement failed because of wrong connection of SAS cable setting, make recovery by replacement operation as the failure was not caused by ENC failure.

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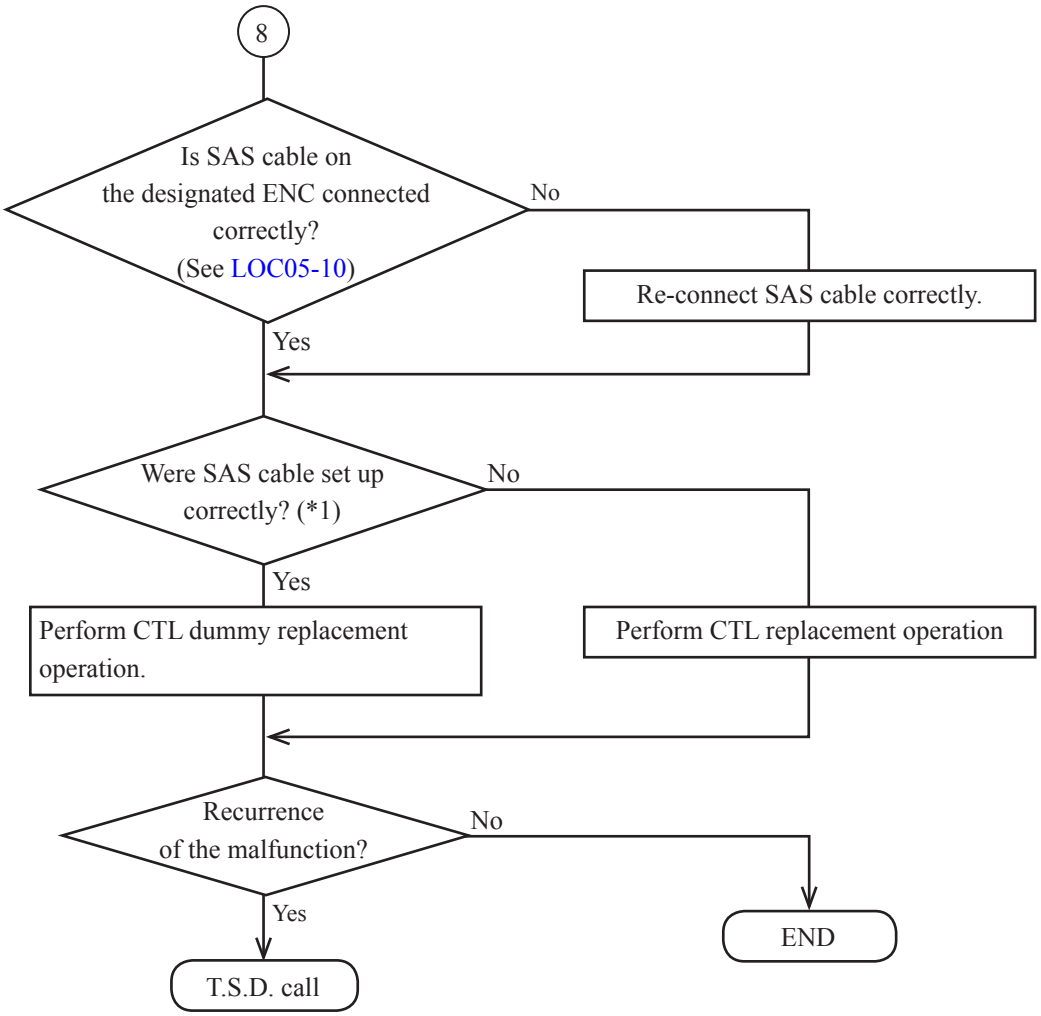


*1: When the replacement failed because of wrong connection of SAS cable setting, make recovery by replacement operation as the failure was not caused by DKB failure. If not recovered by the dummy replacement, perform the normal replacement.

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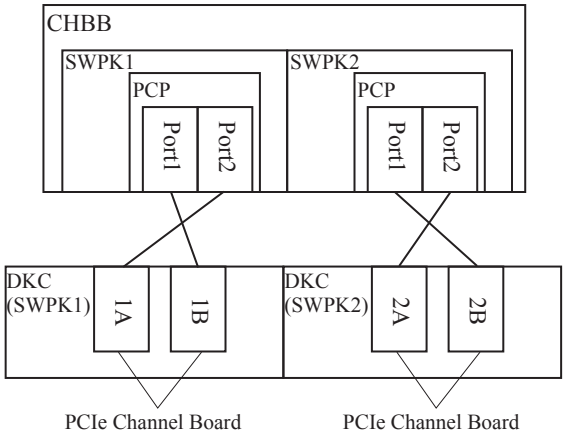


*1: When the replacement failed because of wrong connection of SAS cable setting, make recovery by replacement operation as the failure was not caused by CTL failure. If not recovered by the dummy replacement, perform the normal replacement.

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3.37.2 Recovery Procefure when PCIe Cable Connection Error Occurs (SIM = effcxx)

This section describes the recovery procedure when the PCIe cable connection error was detected in the initialization of the Channel Board Box (CHBB).
As a SIM for failure managed per DKC Slot, PCIe cable connection error (REF code =effcxx) is reported. (xx: PECB #)
This SIM is reported once by switch package (SWPK) at the timing of detecting the PCIe cable connection error.
Review the connection of the PECB other than PECB # indicated by SIM because multiple connection errors might exist.
Any of the following errors might have occurred as a cause of this failure.

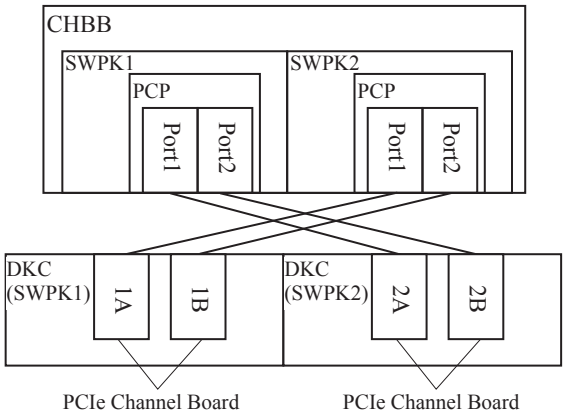
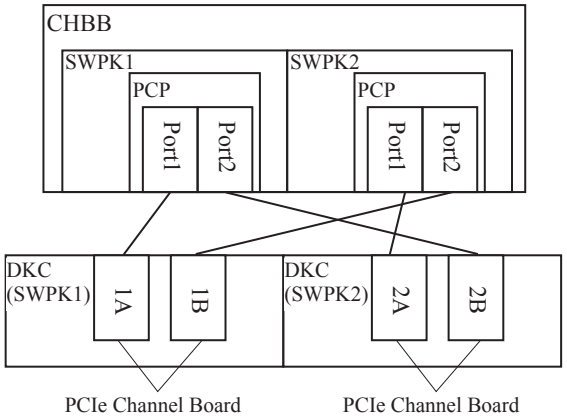
No.	Assumed cause	Details
1	PCP Port of the connection destination is incorrect. (*1)	• PCP Port to be connected is reversed. 

*1: Refer to INSTALLATION SECTION “2.10.1.3 Connecting PCIe Cables” for the correct connection.

(To be continued)

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(Continued from preceding page)

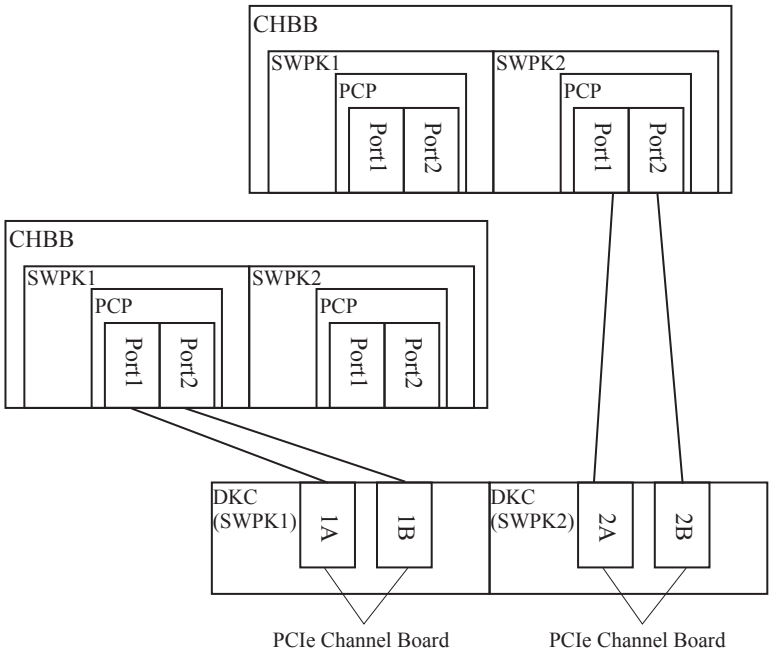
No.	Assumed cause	Details
2	PCP of the connection destination is incorrect. (*1)	• Connected to PCP Port of reverse SWPK.  • Slot1B and 2B are connected to PCP Port of reverse SWPK. 

*1: Refer to INSTALLATION SECTION "2.10.1.3 Connecting PCIe Cables" for the correct connection.

(To be continued)

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(Continued from preceding page)

No.	Assumed cause	Details
3	CHBB of the connection destination is incorrect. (*1)	• SWPK1 and SWPK2 are connected to different CHBBs. 

*1: Refer to INSTALLATION SECTION “2.10.1.3 Connecting PCIe Cables” for the correct connection.

(To be continued)

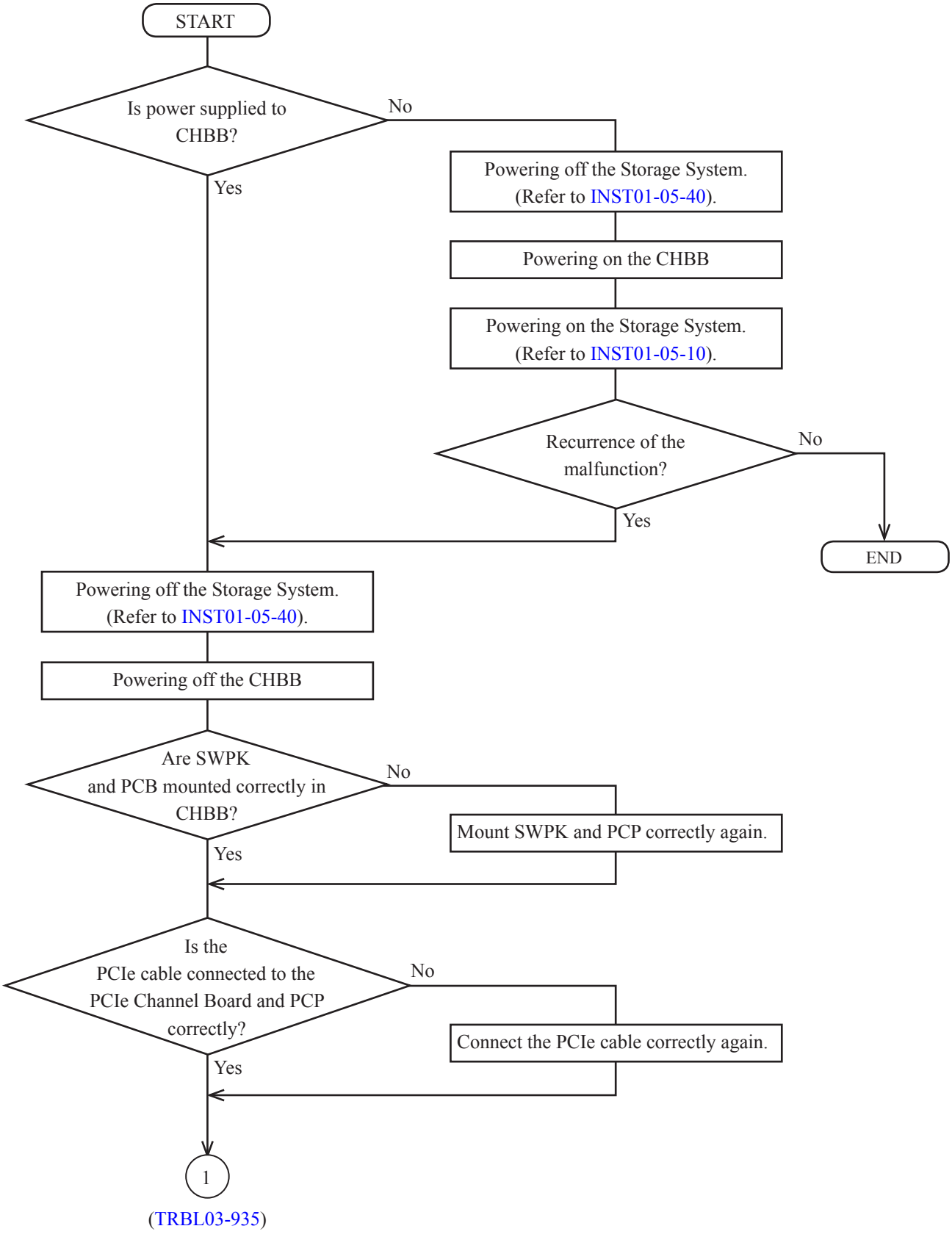
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(Continued from preceding page)

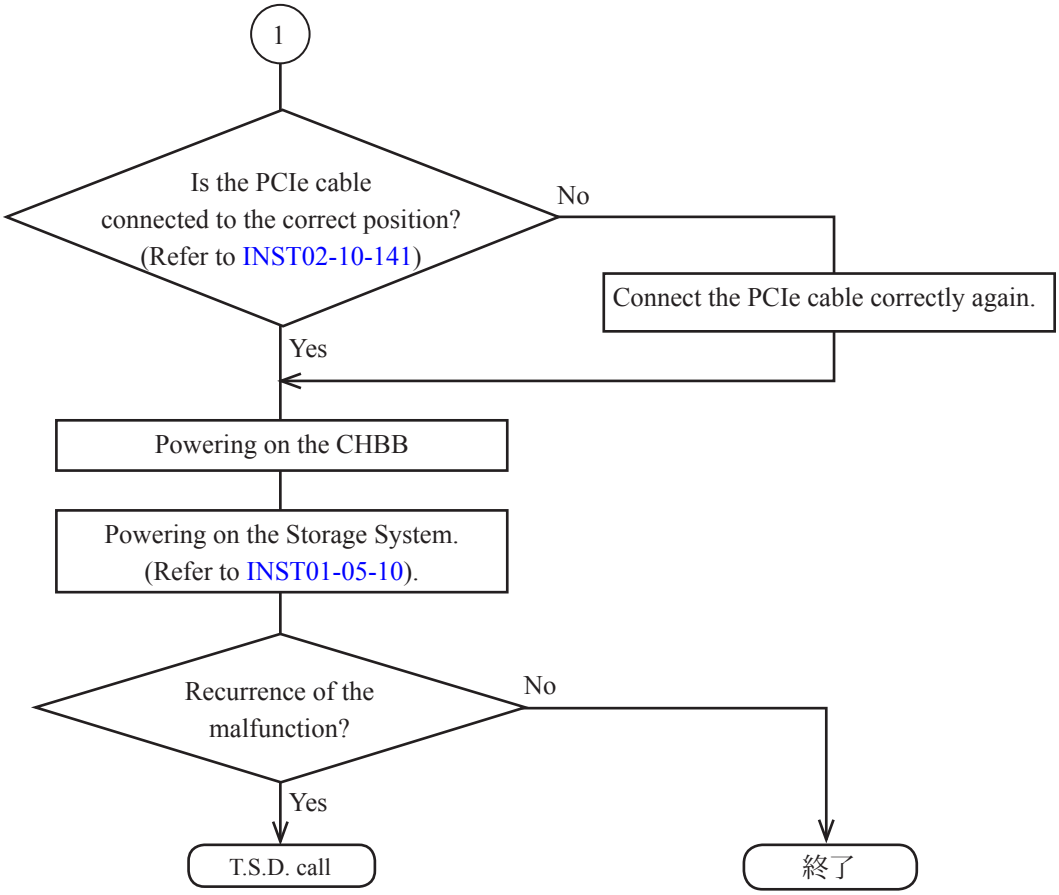
No.	Assumed cause	Details
4	The PCIe cable is not connected.	The PCIe cable is not connected to the PCIe Channel Board or PCP.
5	SWPK or PCP is not mounted.	SWPK or PCP is not mounted on CHBB.
6	Power is not supplied to CHBB.	Power is not supplied to CHBB.

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[Recovery procedure for PCIe cable connection error]

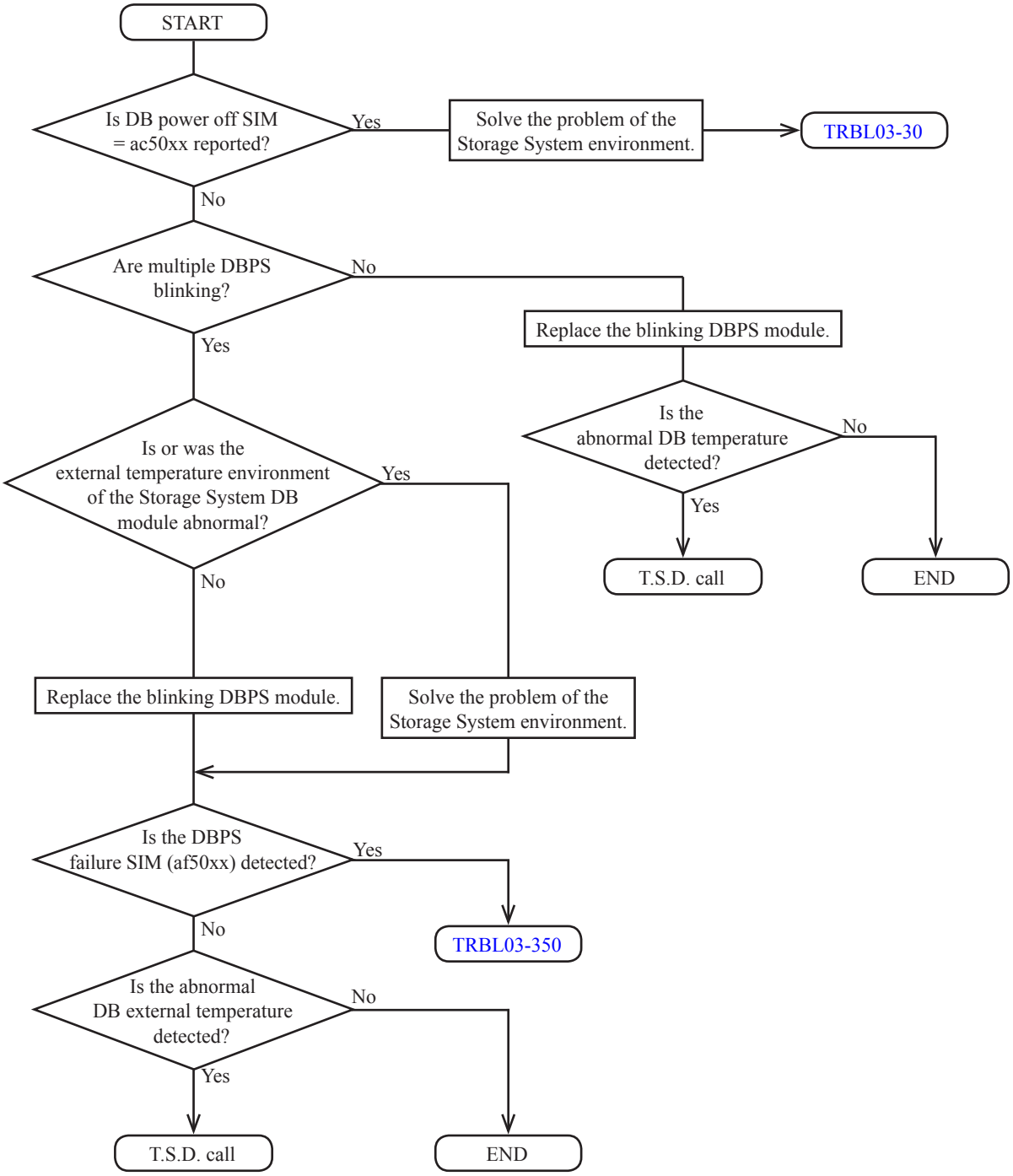


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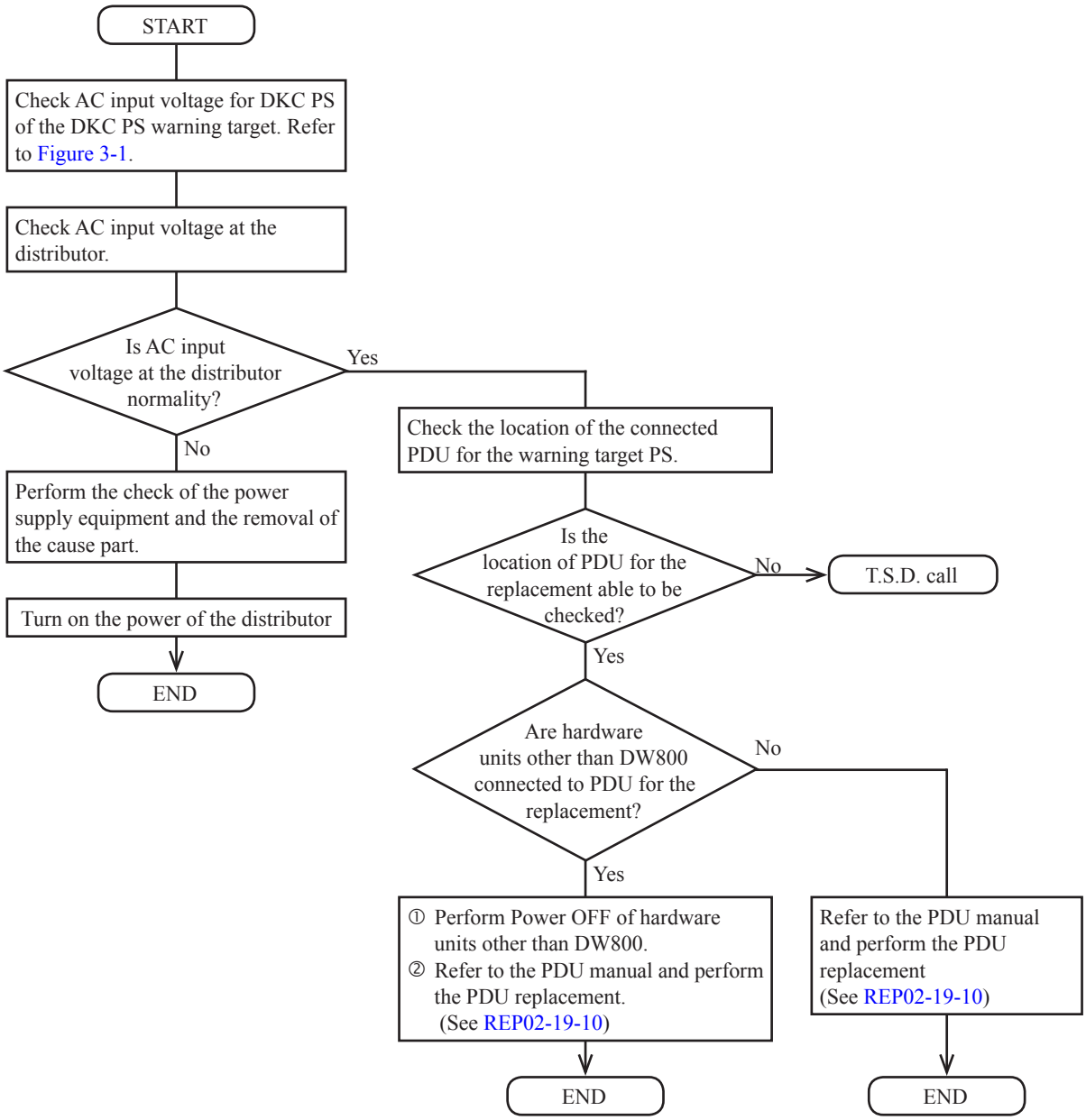
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3.38 When Detecting Abnormal DB External Temperature (SIM = af7000, af7100)



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3.39 Response to the Detection of Abnormal DKC PS Input Voltage (SIM = af210x)(Use AC input voltage)



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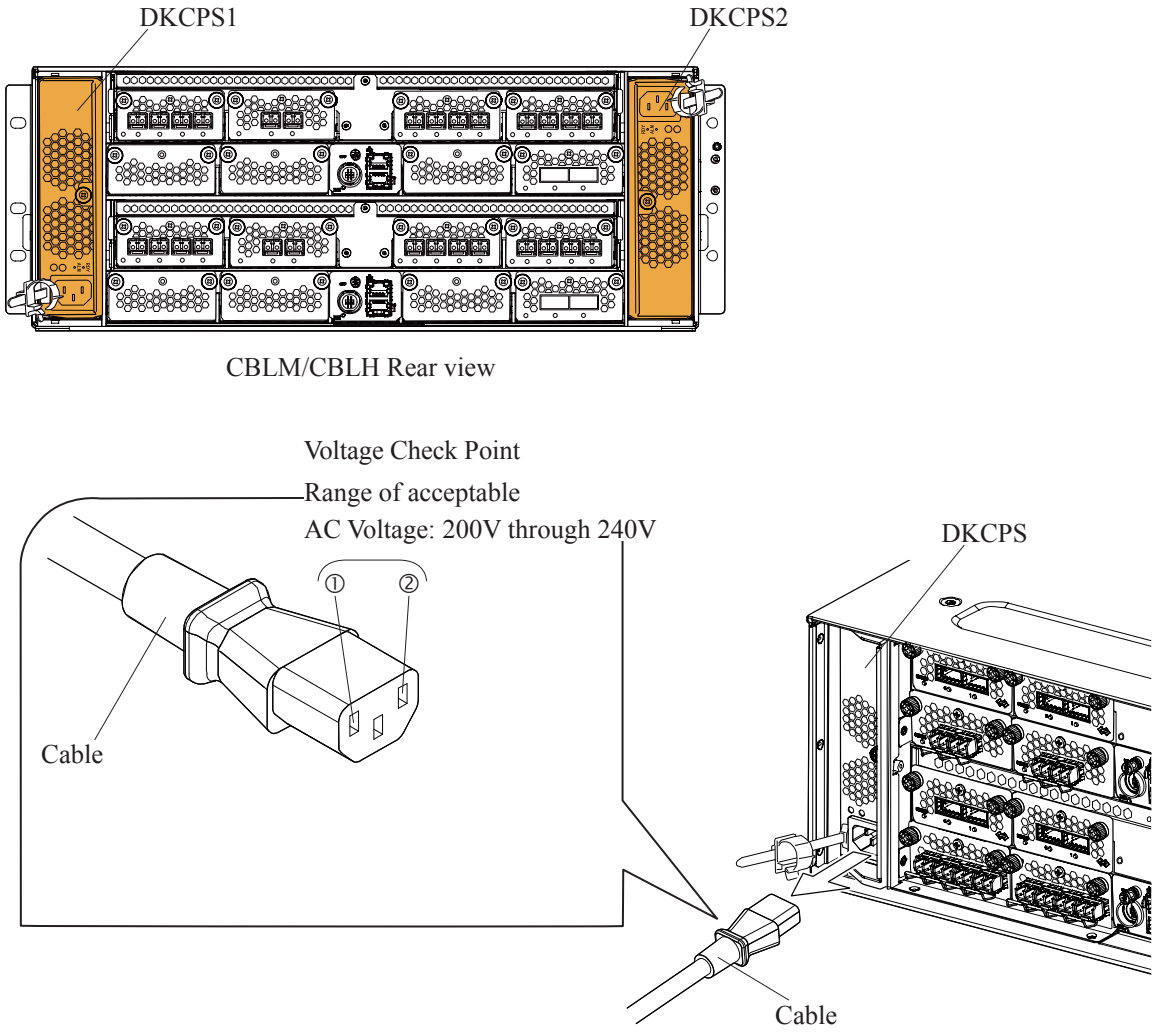
[AC Input voltage check]

(1) Remove the cable of target PS.

(2) Measure AC input voltage at terminal of removed cables.

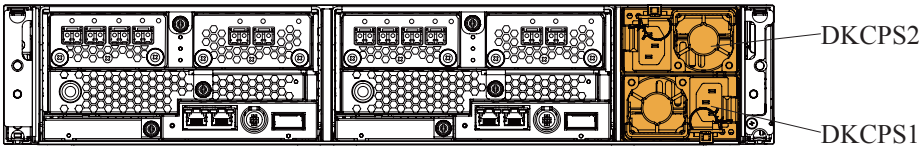
Figure 3-1 AC Input Voltage Check

CBLM/CBLH

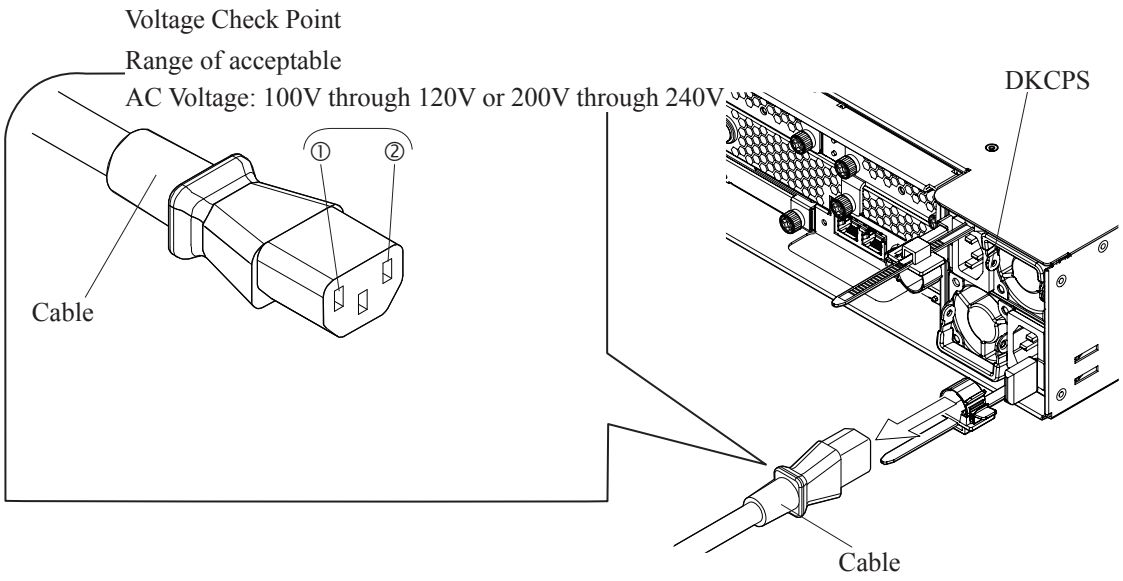


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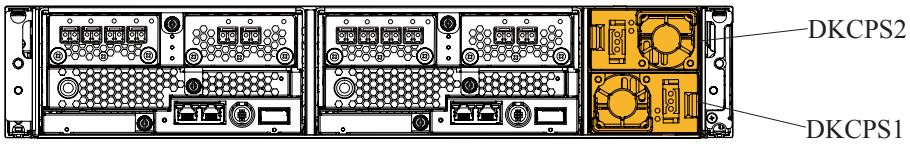
CBSS/CBSL



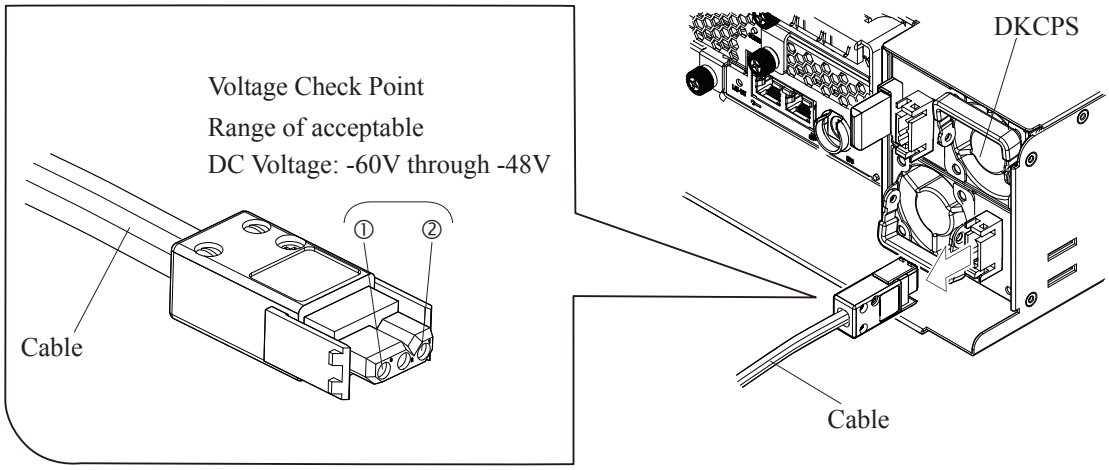
CBSS/CBSL Rear view



CBSSD/CBSLD

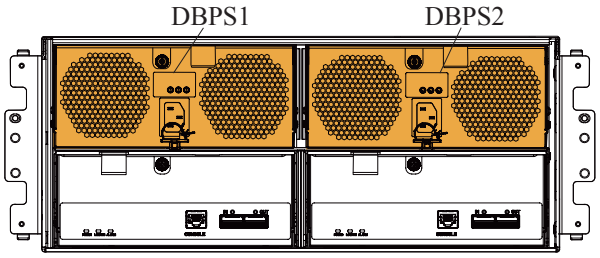


CBSSD/CBSLD Rear view

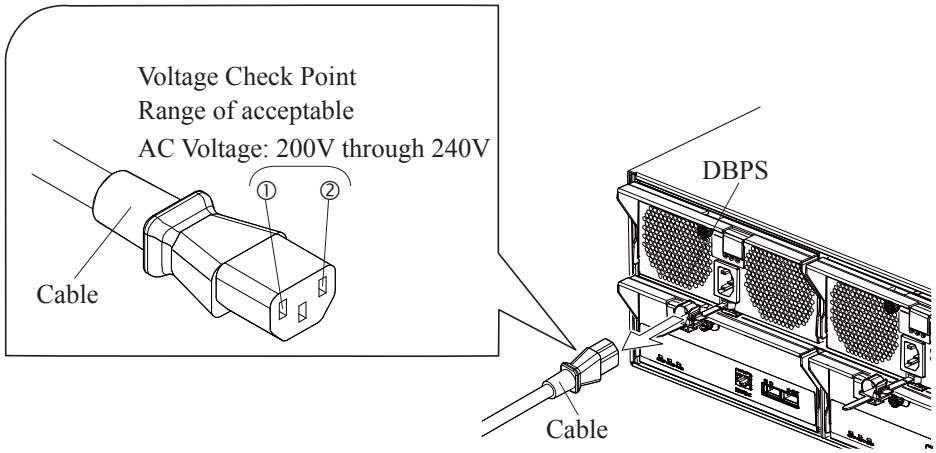


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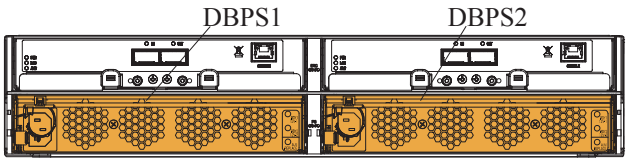
DB60



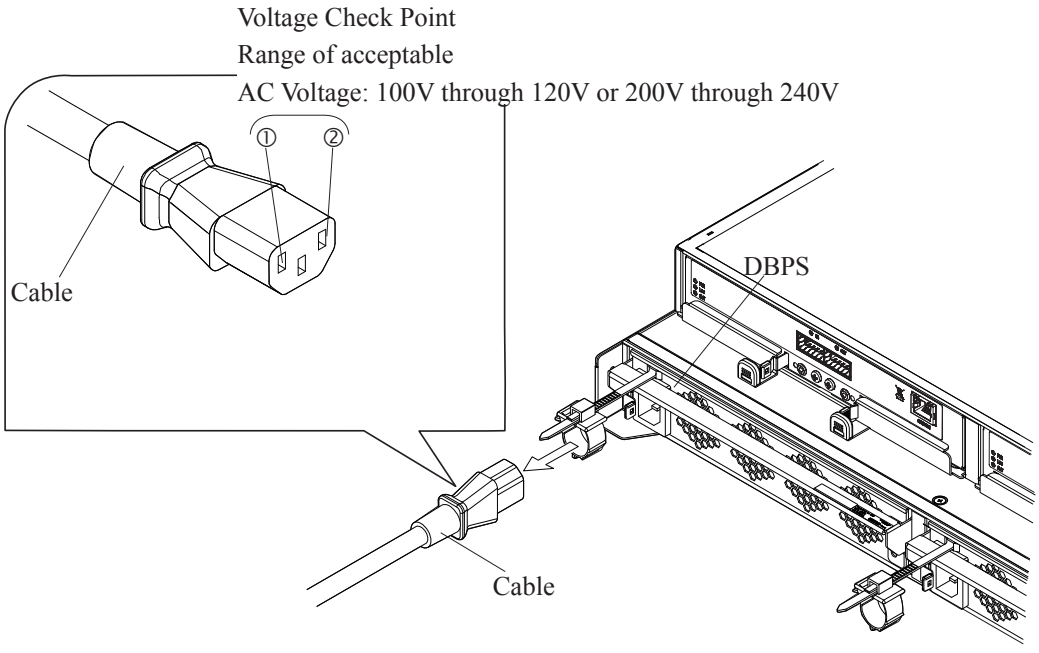
DB60 Rear view



DBF

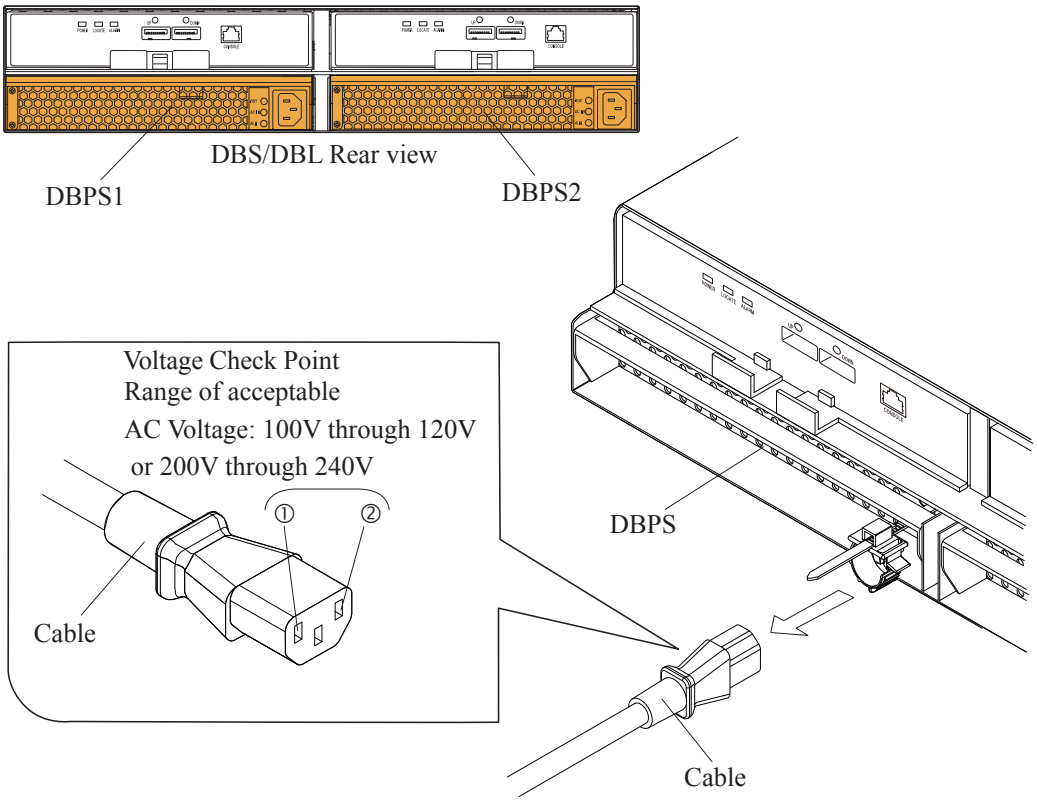


DBF Rear view

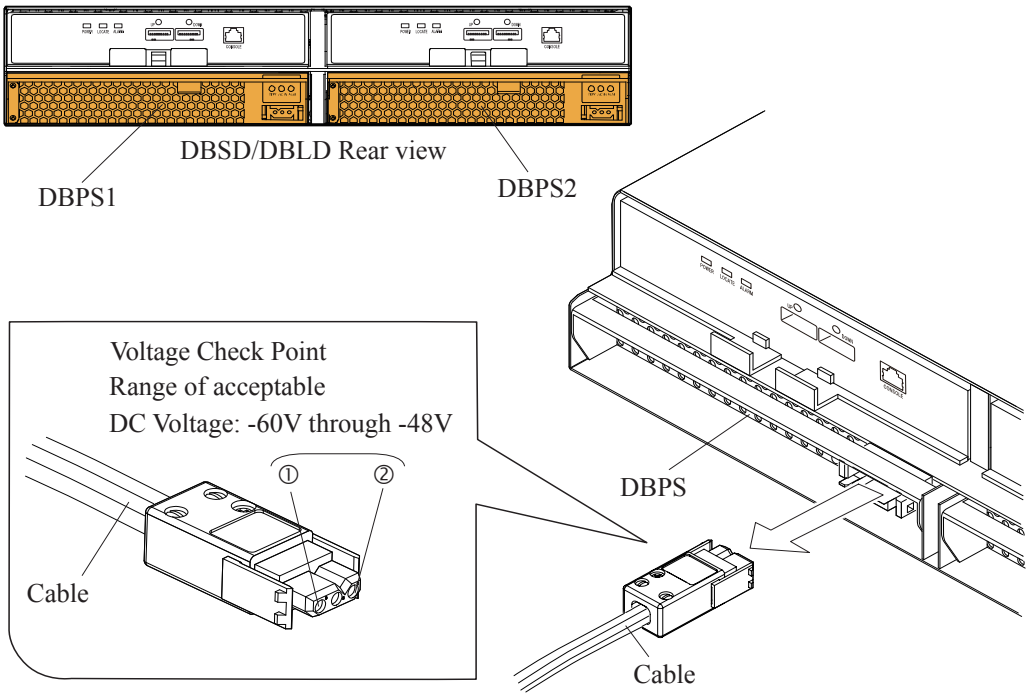


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DBS/DBL

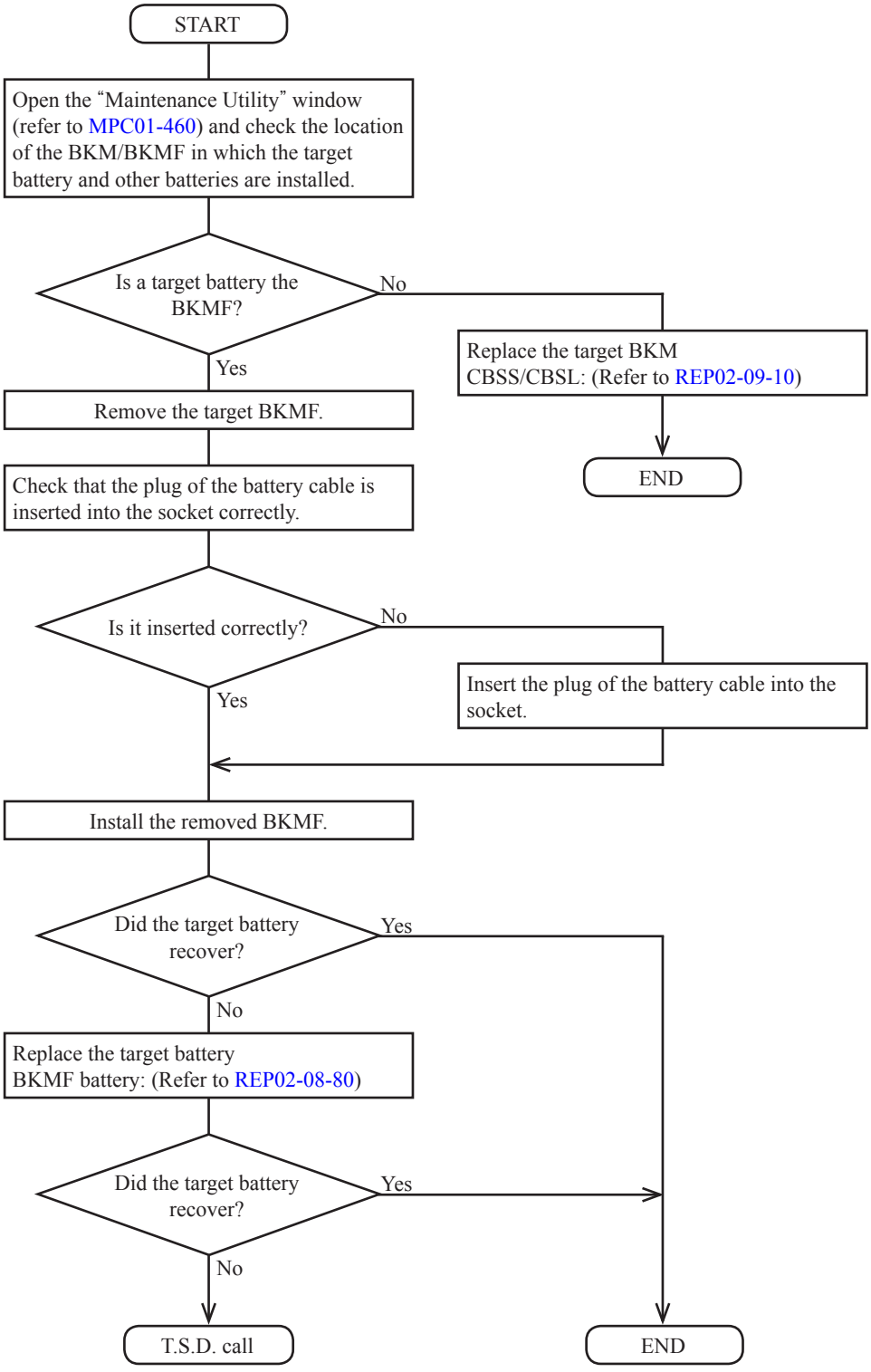


DBSD/DBLD



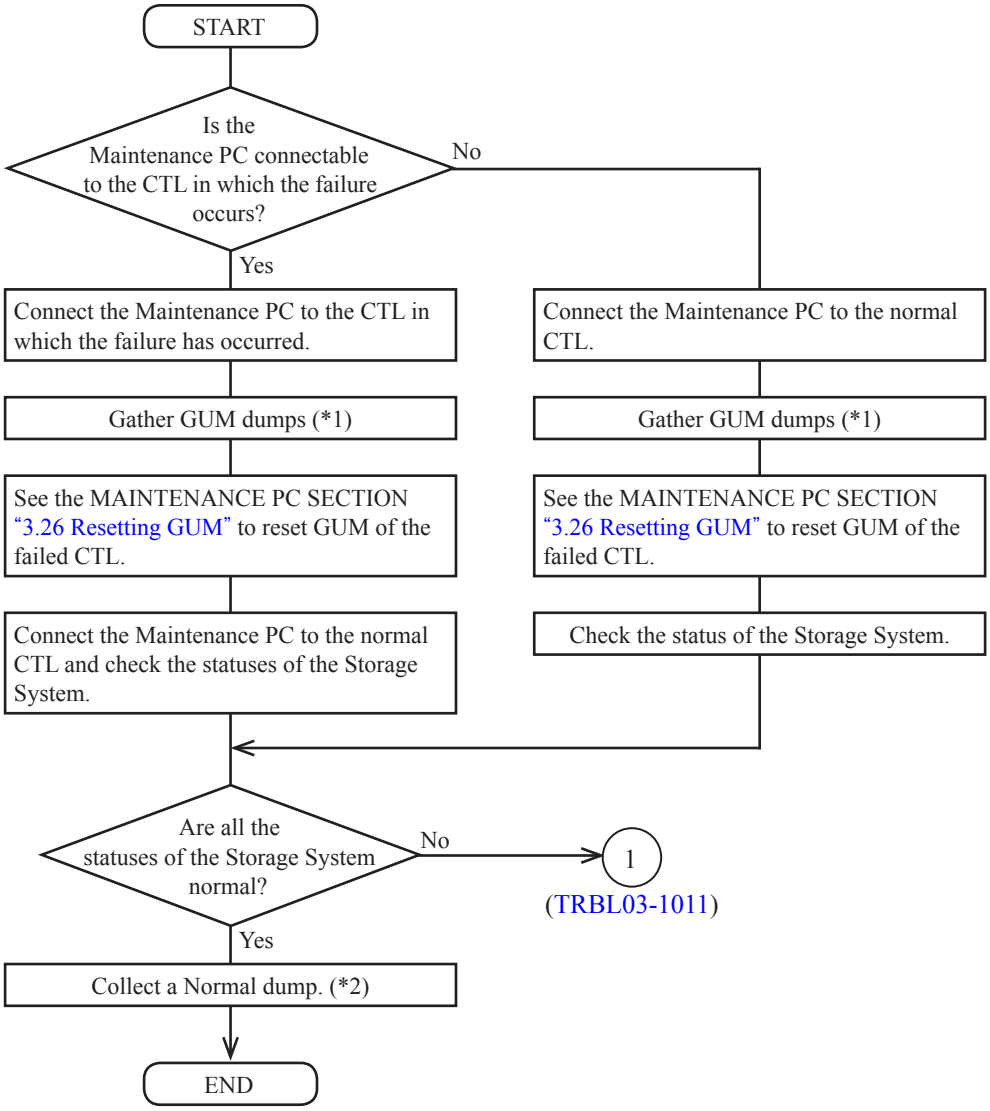
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3.40 Response to the Occurrence of Battery Warning (SIM = fffa0x)

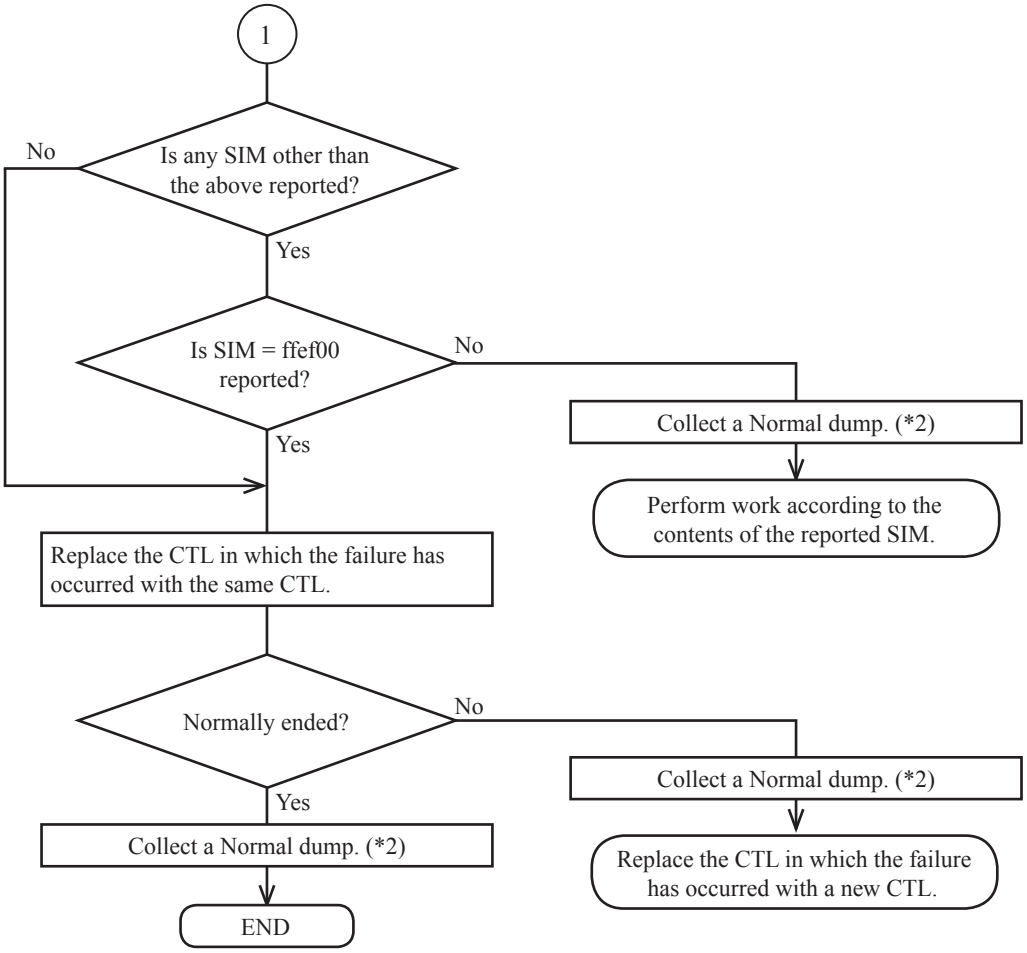


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3.41 Recovery Procedure when a GUM Failure Occurs (SIM = aff1xx)



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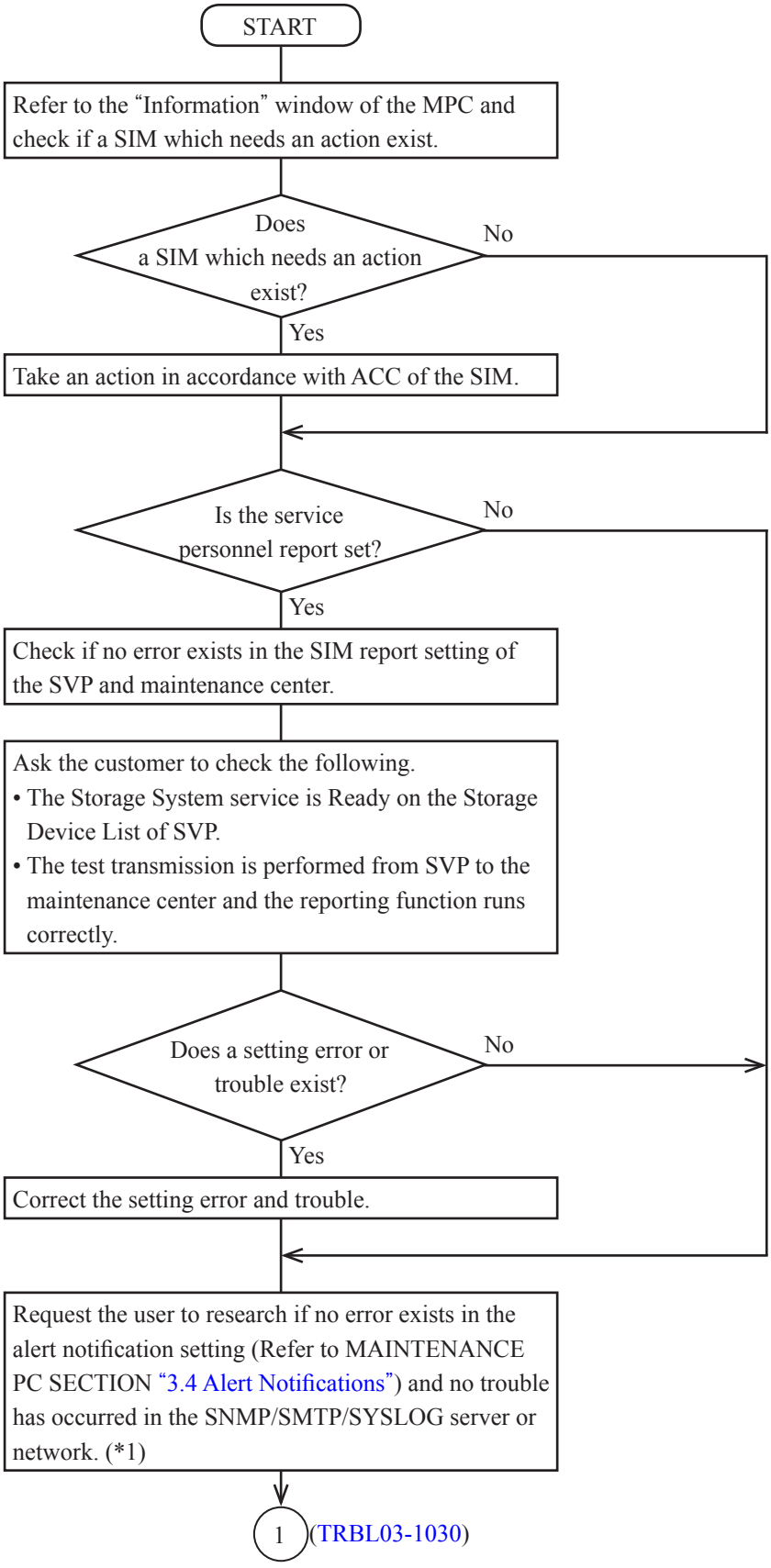


*1: Select “GUM” in the Auto Dump type selection.
Dump gathering may fail, but proceed to the next work.

*2: Regardless of the success or failure of the dump collection in (*1), collect Normal Dump while the Maintenance PC is connected to the normal CTL.
After that, send both the dump collected in (*1) and the newly collected Normal Dump.
Also, when collecting Normal Dump, change the file name of the dump collected in (*1) to hdcp_gum.tgz or others so that the dump name is not overwritten.

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3.42 Recovery procedure when an alert notification failure occurs (SIM = 7d05xx)



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*1: For GUM firmware version 83-03-24/00-04-01 or later, or 83-04-00/04-03-01 or later, a communication path through which the alert notification failed can be identified by referring to Byte 44 in the associated SSB detailed data.
The SIM whose alert notification failed can be identified by referring to the associated SSB as well.
For detailed SSB data, see the following table and output example.

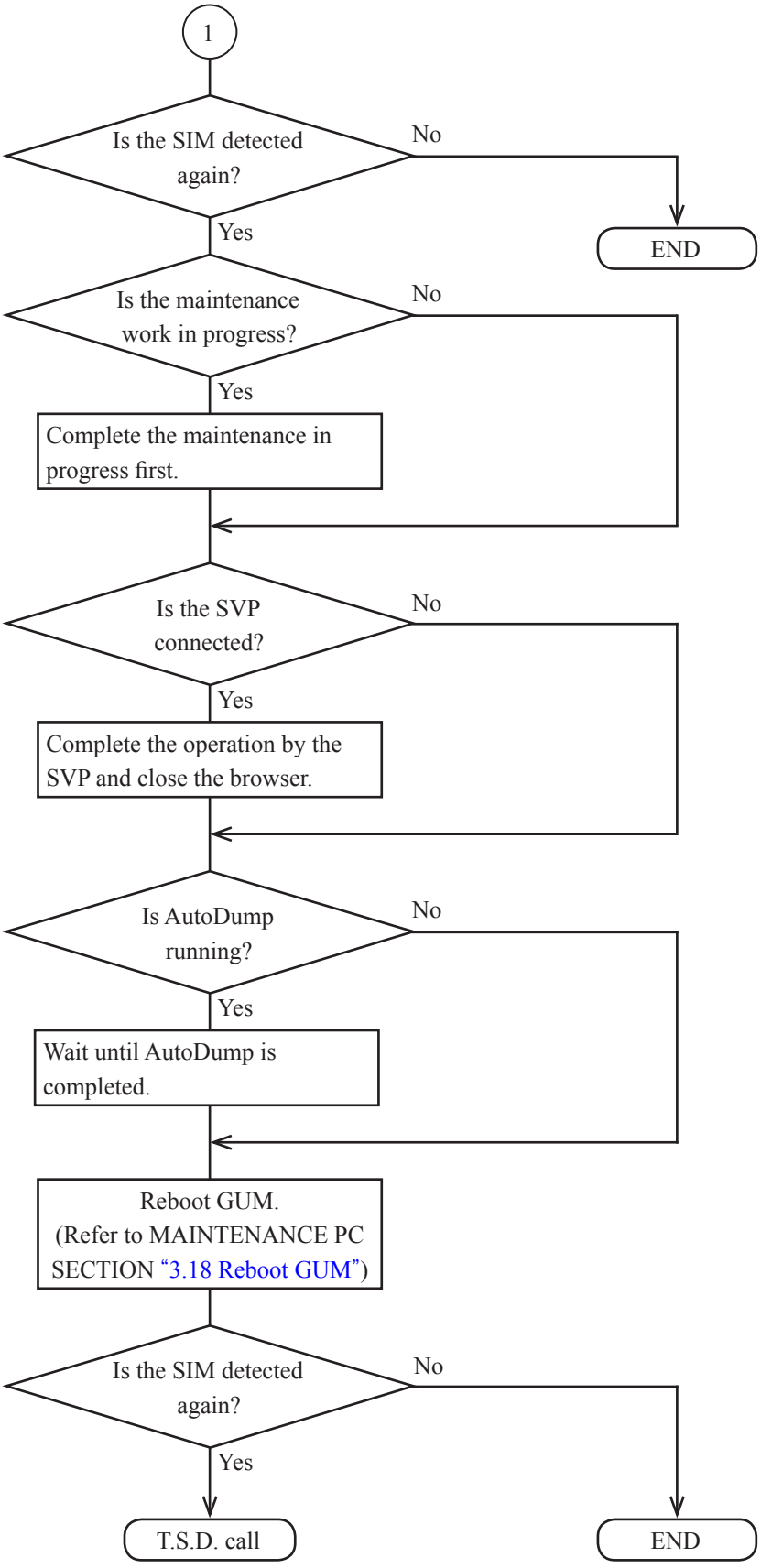
No.	Byte (Hex.)	Item	Meaning
①	40 - 42	Reference code of the SIM whose alert notification failed	Example : 0x7d0a00 → 7d0a00
②	44	Communication path where the error occurred	01 : email 02 : syslog 04 : snmp 08 : assist
③	48 - 4d	Date and time when the SIM to notify the alert notification failure was generated	Written every byte in hexadecimal Add 1900 to year. Example : 7408030b 0936 Year : 0x74 (116) 2016 Month : 0x08 (8) August Day : 0x03 (3) 3 days Hour : 0x0b (11) 11 hour Minute : 0x09 (9) 9 minutes Second : 0x36 (54) 54 seconds
④	56 - 57	Alert ID of the SIM whose alert notification failed	Written in hexadecimal (little endian) Example : 51f0 → 0xf051 (61521)

Example of associated SSB byte data output

```
          +0x0     +0x4     +0x8     +0xC
00000000: 7408030c 01198c00 e033fcb6 eadc2857
00000010: 40d10c00 090328f4 000027f4 090362ff
00000020: 10000000 e4fa018c 00ff0000 e4fa2c80
00000030: 33e00000 0000ff8c 30e88e80 c8f290b6
00000040: 7d0a0000 01000000 7408030b 0936e000
00000050: 00000000 00002000 00000000 000051f0
00000060: 00000000 00000000 00000000 00000000
00000070: 00000000 00000000 00000000 00000000
```

① ② ③ ④

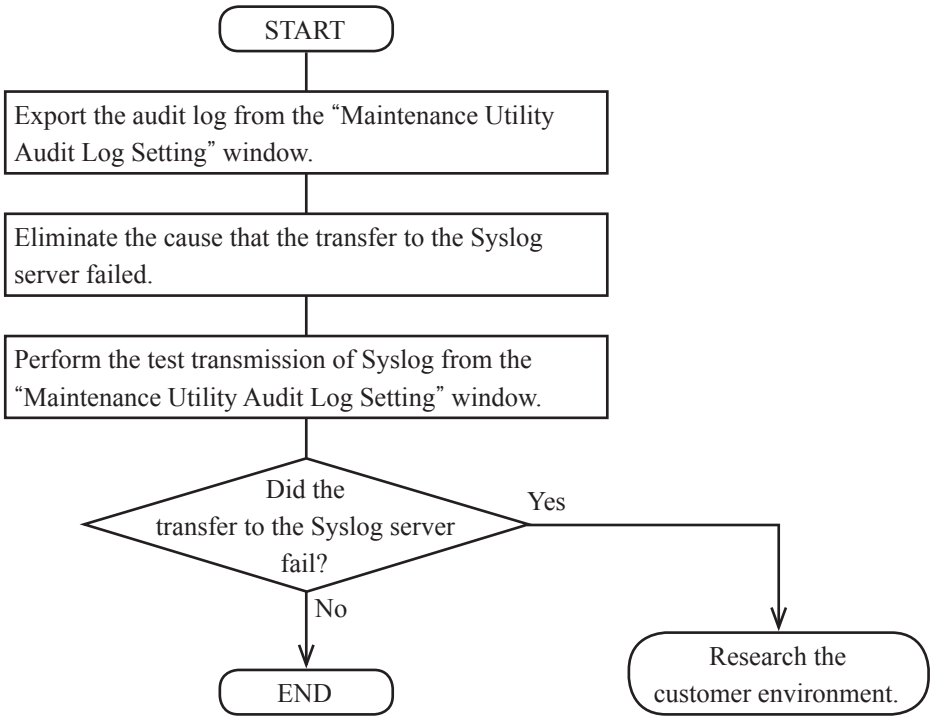
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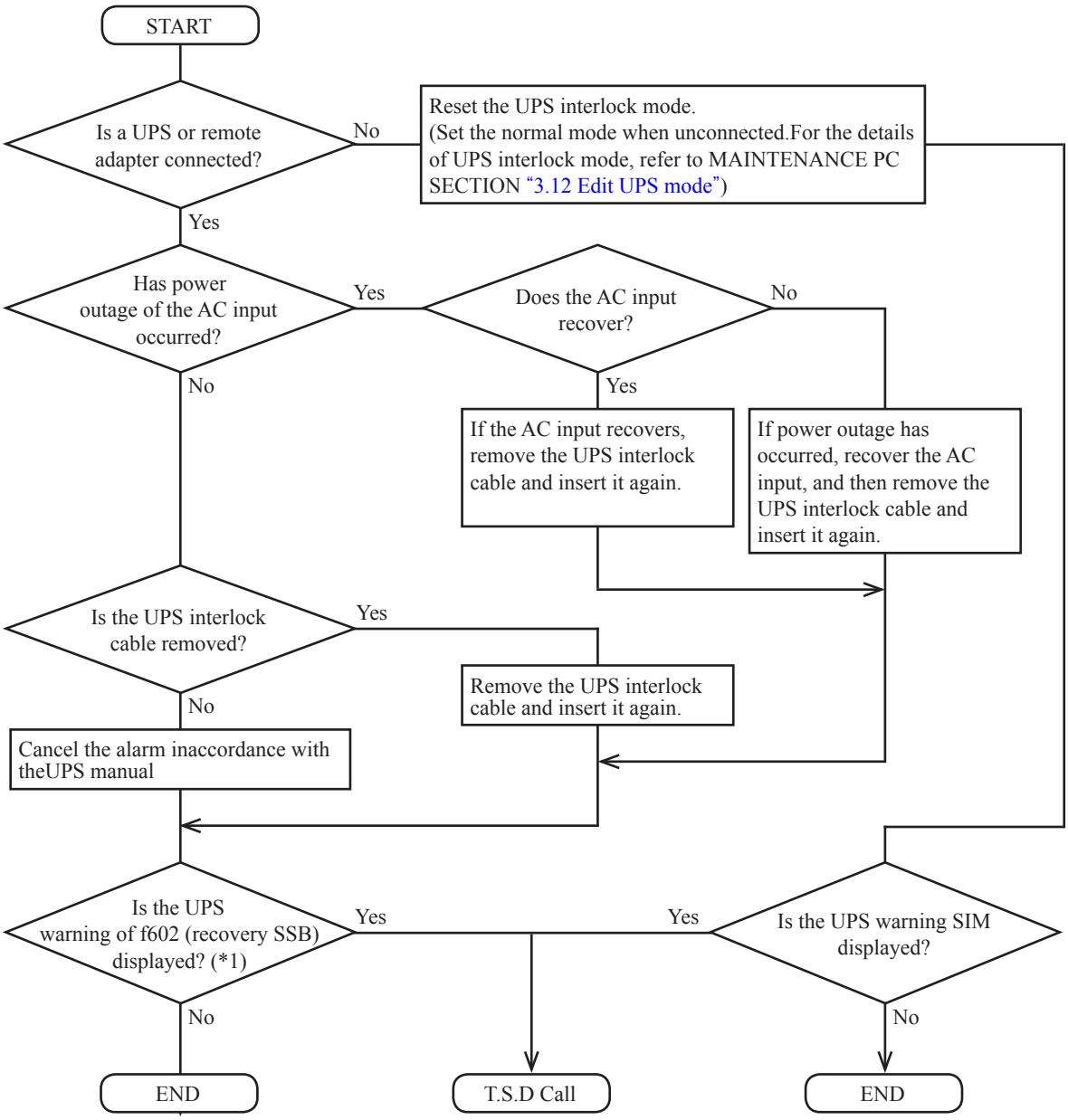
3.43 Response to a loss of the GUM audit log and the warning issuance (unsent audit log occurrence) (SIM = 7d03xx, 7d04xx)

Recovery procedure when the GUM audit log is lost and the GUM audit log waning is issued (unsent audit log occurs) is shown below.



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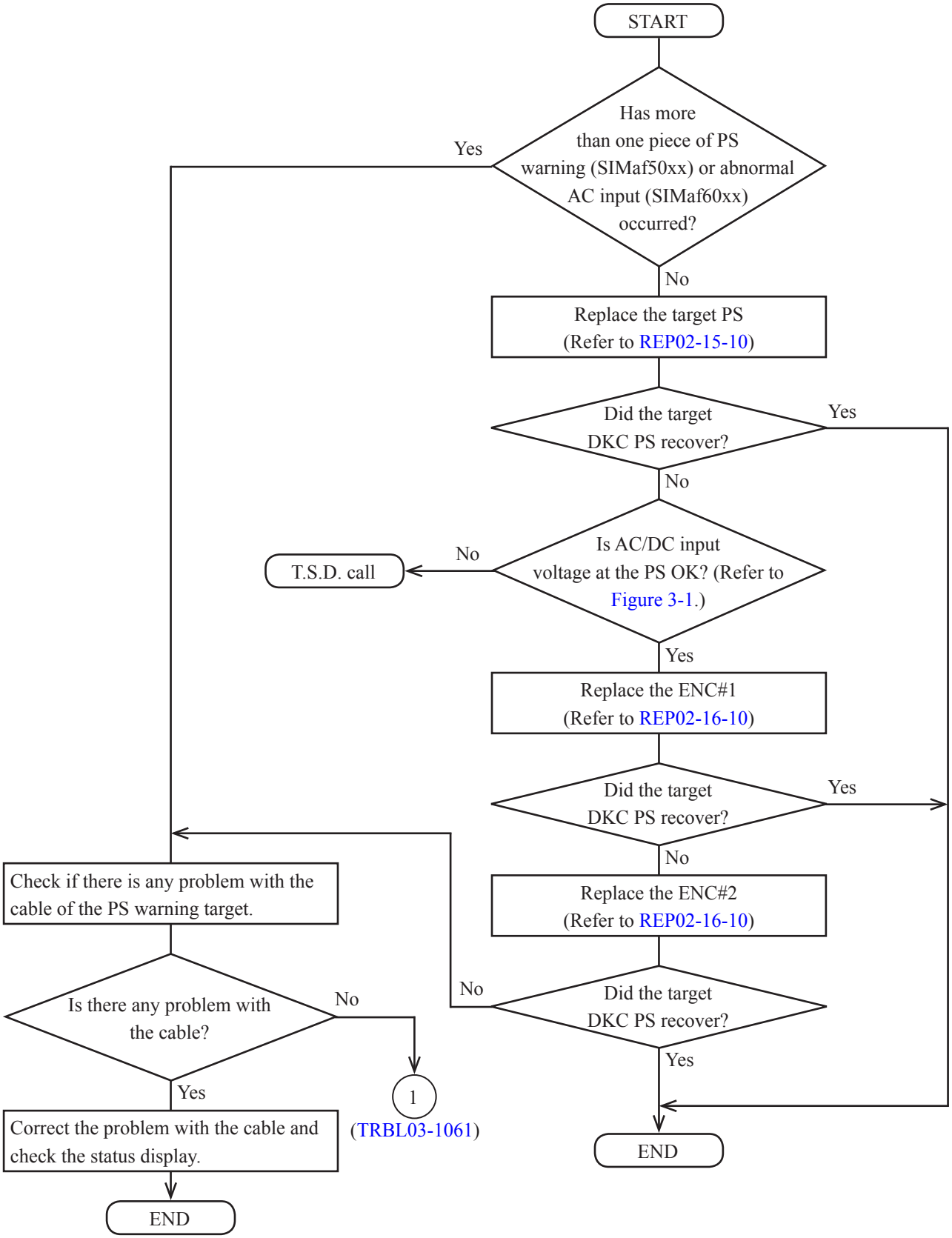
3.44 Response when UPS warning occurs (SIM = aff0xx)



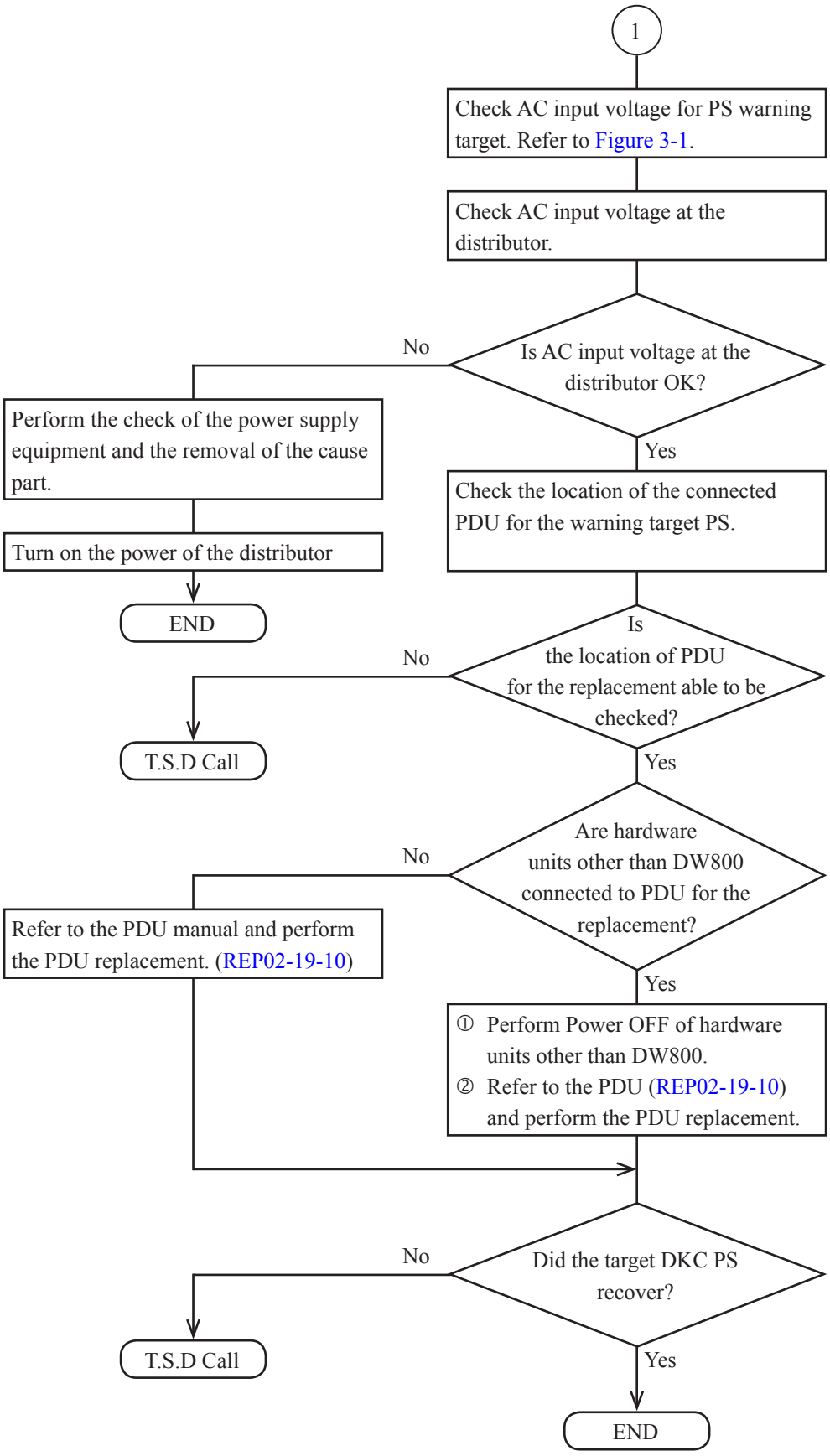
*1: When the value of Byte43 in the error data of SSB = f602 is 0x17, the UPS warning is displayed.

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3.45 Response to the Occurrence of DB PS Warning (SIM = af50xx)



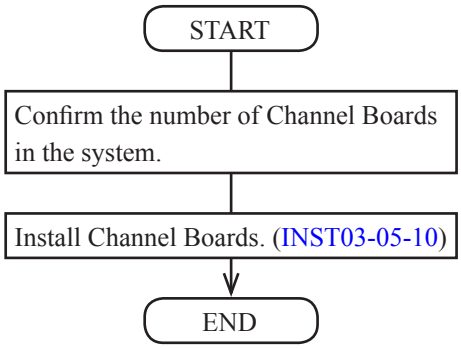
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3.46 Response to the Detection of Unmounted Channel Board (SIM = 3c9600)

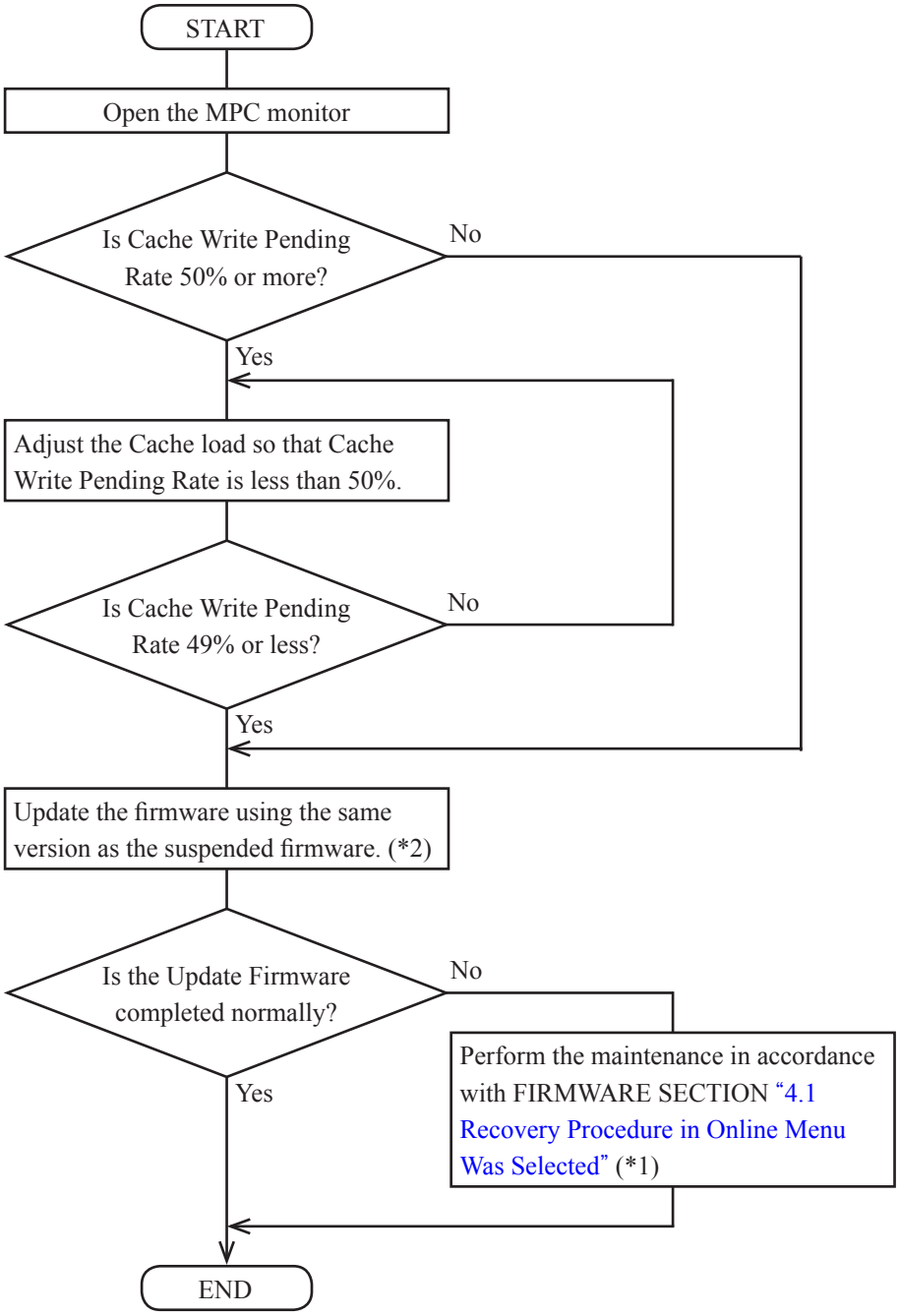
When there are no Channel Boards mounted at the time of start-up, SIM RC = 3c9600 is issued. In this case, please install Channel Boards.



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3.47 Procedure for Responding to the Firmware Replacement Failure due to Cache High Load (SIM = efexxx)

Since the write pending data on the Cache is large, the Drive Firmware replacement was suspended. To restart the Firmware replacement, reduce the Cache load and execute it.



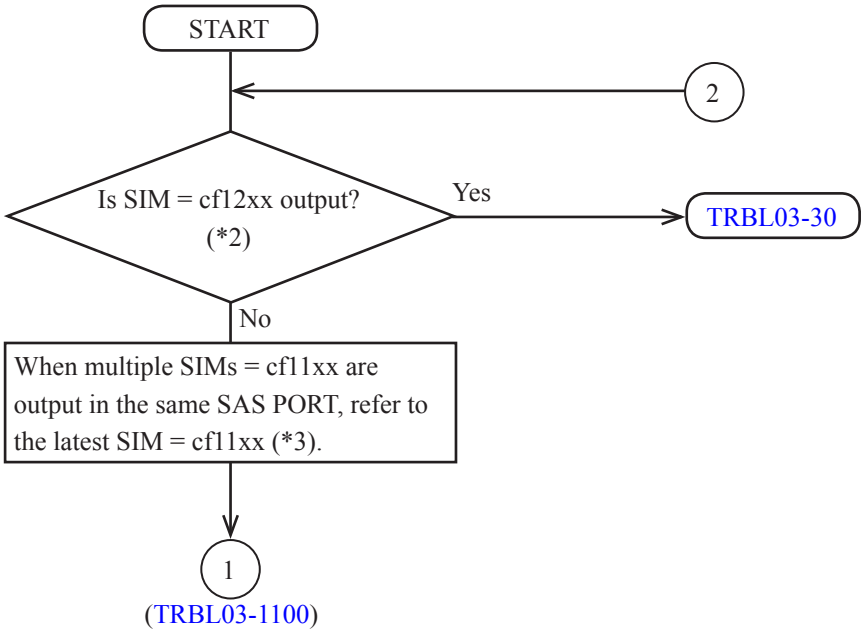
*1: When the same failure occurs repeatedly, contact the Technical Support Division.

*2: If the update is performed with the firmware version before replacement instead of the suspended one, the drive firmware version might not be consistent.

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3.48 Recovery Procedure for the SAS PORT Temporary Failure (SIM = cf11xx)

The SAS PORT temporary failure (SIM = cf11xx) indicates that the SAS PORT is partially blocked (*1). When the SAS PORT blockade (SIM = cf12xx) is not output, the SAS PORT is usable, but the early replacement is recommended.

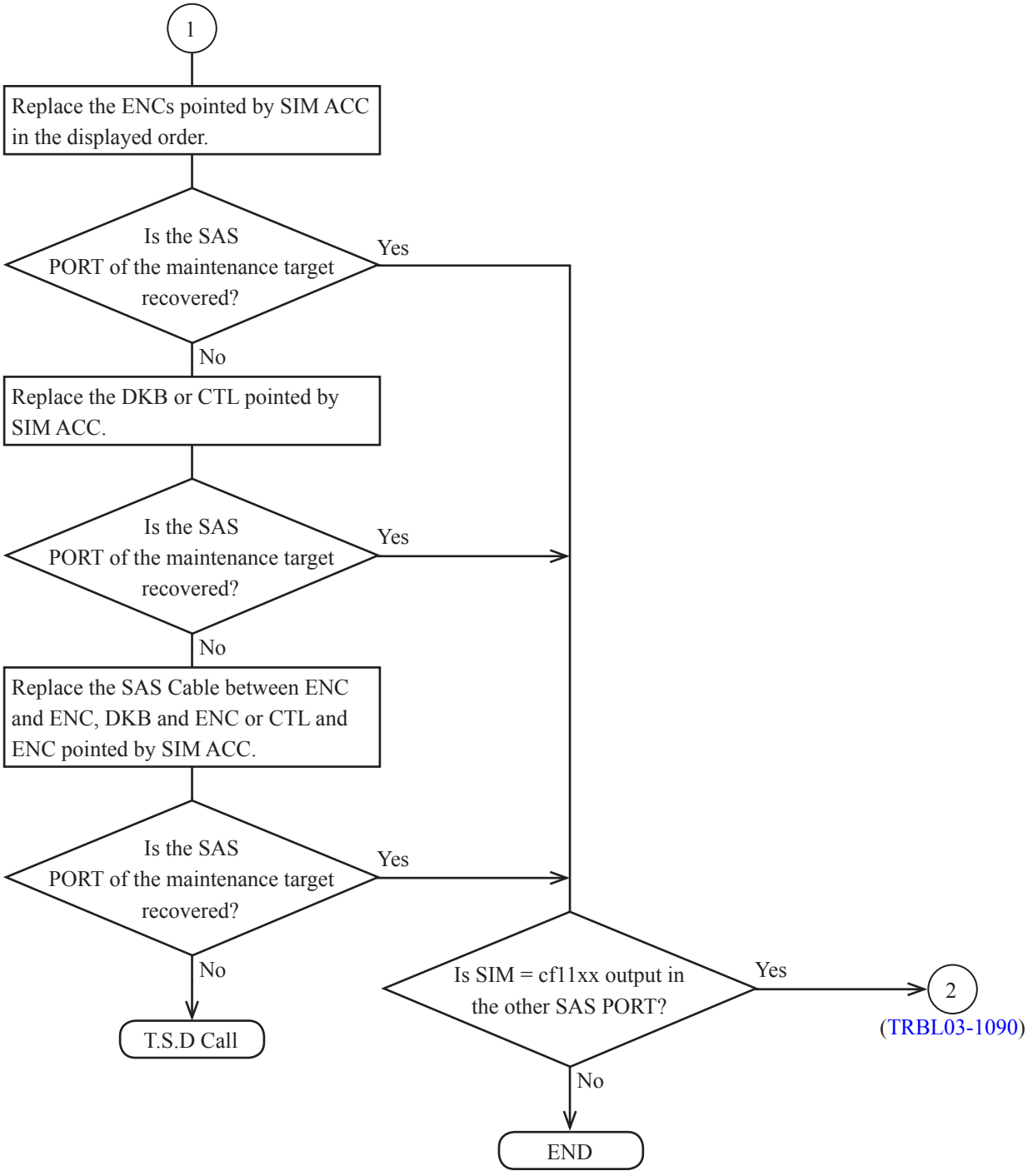


*1: There are four paths in the SAS Cable and this indicates that one of them is blocked. If four paths are all blocked, it is the SAS PORT blockade and (SIM = cf12xx) is output.

*2: When SIM = cf12xx is output, replace the part pointed by SIM = cf12xx first and recover the SAS PORT
When SIM = cf11xx has occurred in the different SAS PORT from SIM = cf12xx, the recovery processing of SIM = cf11xx is required after recovering SIM = cf12xx. The part xx of SIM = cf11xx and SIM = cf12xx indicates the SAS PORT number.

*3: If failures have occurred in multiple parts in the same SAS PORT, SIM = cf11xx which was output last displays all the replacement parts in the SAS PORT. The part xx of SIM = cf11xx indicates the SAS PORT number.

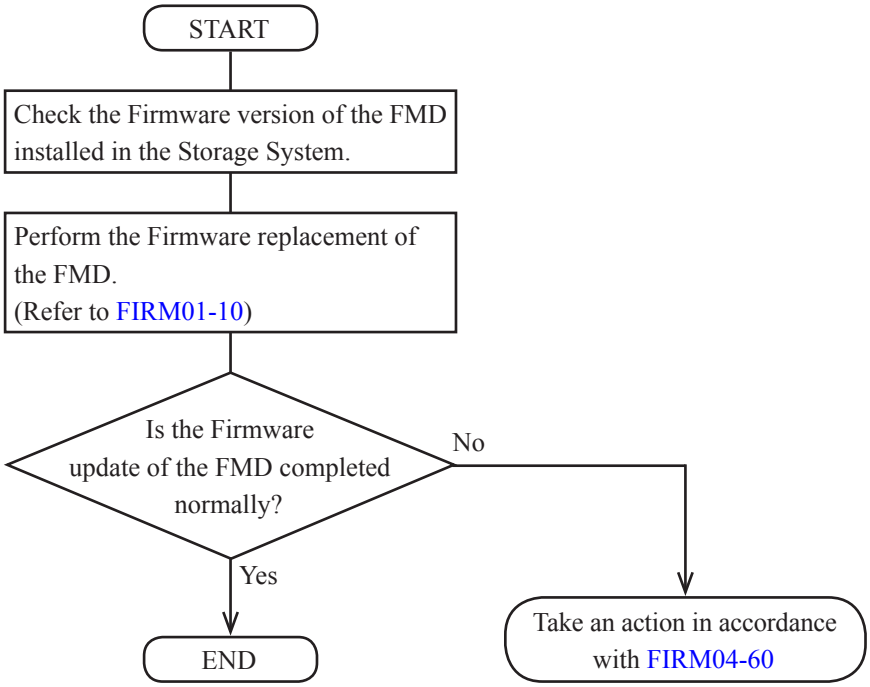
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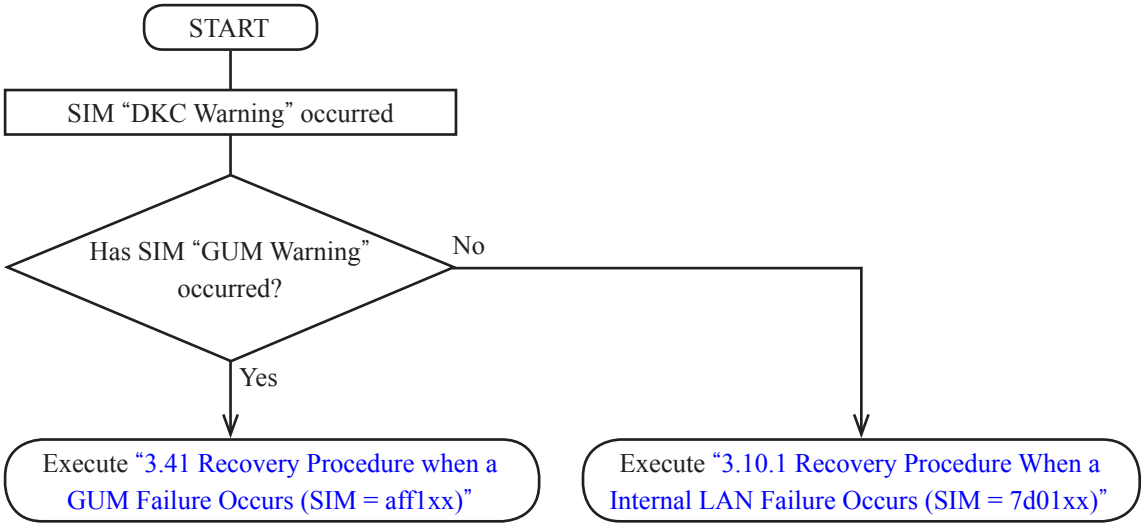
3.49 Procedure for Responding to the Flash Module Drive Firmware Version Warning (SIM = 50f000)

The Flash Module Drive Firmware installed in the Storage System is not the latest version. Update the Flash Module Drive to the latest Firmware in accordance with the following flow.
Be careful that if you perform the high-speed LDEV Format without updating it to the latest version, it becomes the low-speed format.



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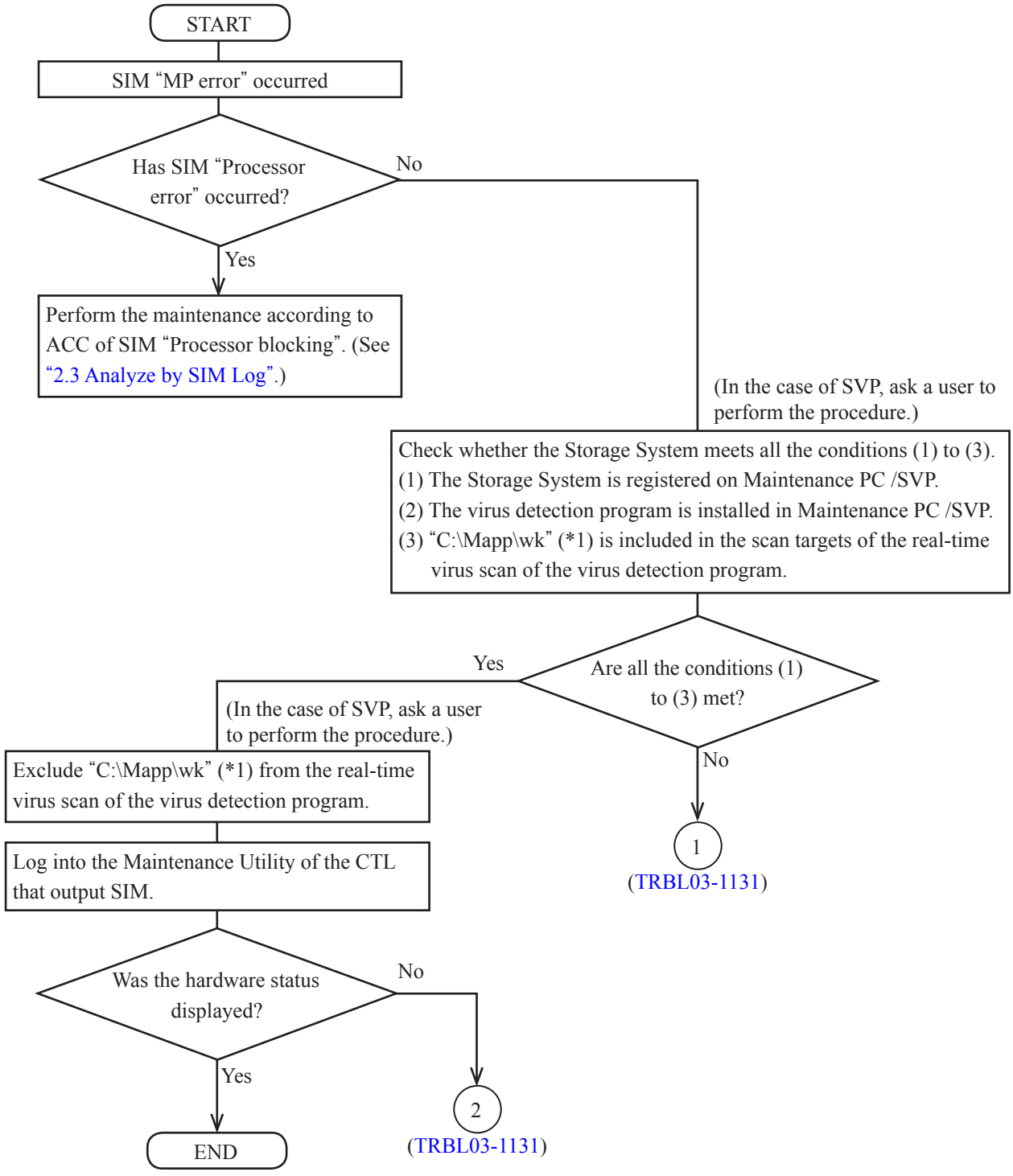
3.50 Recovery Procedure When DKC Warning Occurs (SIM = 7d0900)



NOTE: There is no problem if SIM=7d0900 is output when performing the offline firmware update.
Furthermore, there is no problem if the Storage System status of the “Maintenance Utility” window becomes Failed.
The Storage System status changes to Ready when the offline firmware update is completed.

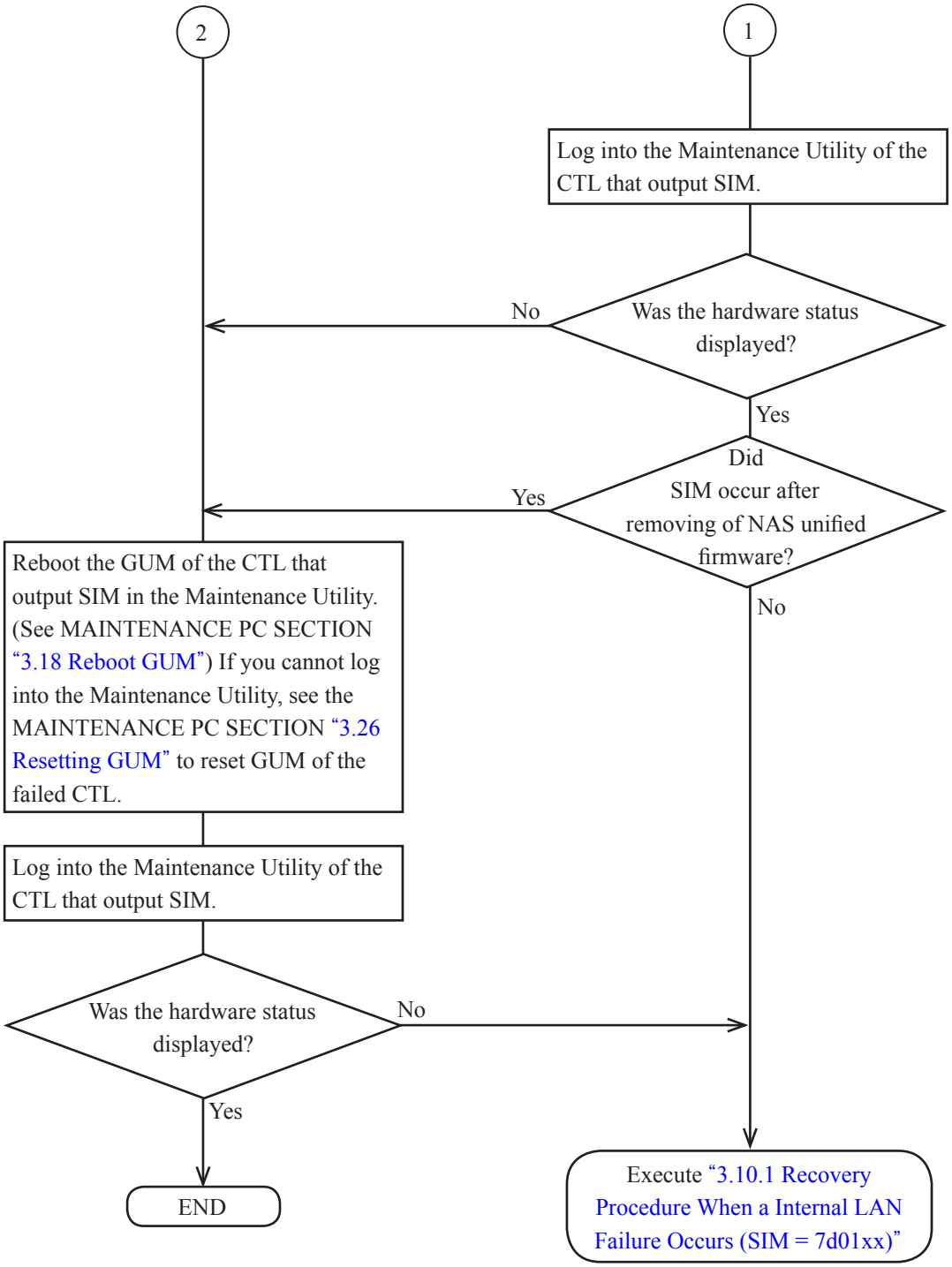
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3.51 Recovery Procedure When an MP Error Occurs (SIM = 7d06xy)



*1: “C:\Mapp” is the installation directory of Storage Navigator.
If you specified an installation directory other than “C:\Mapp ”, replace “C:\Mapp\wk” with the directory that you specified.

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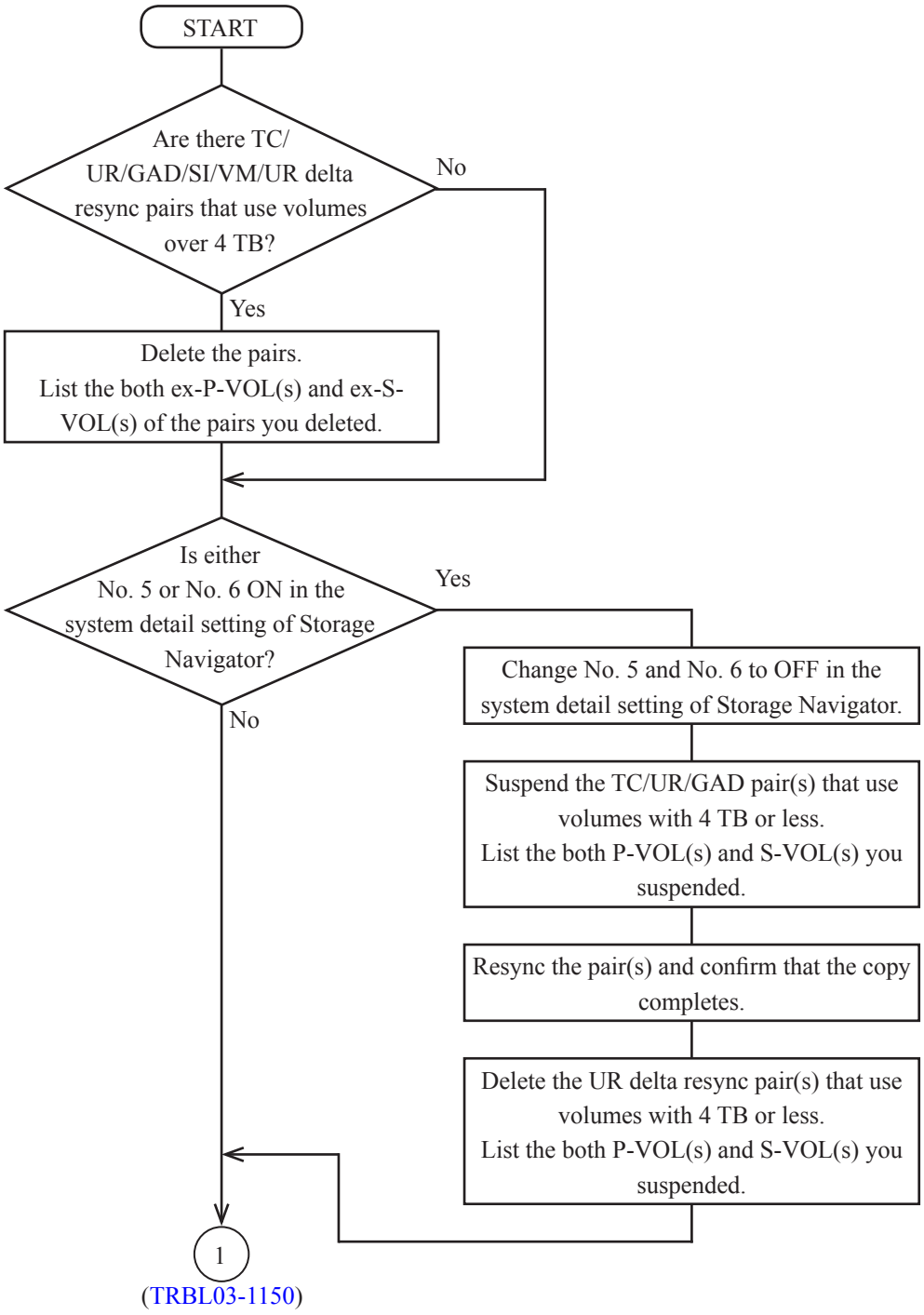


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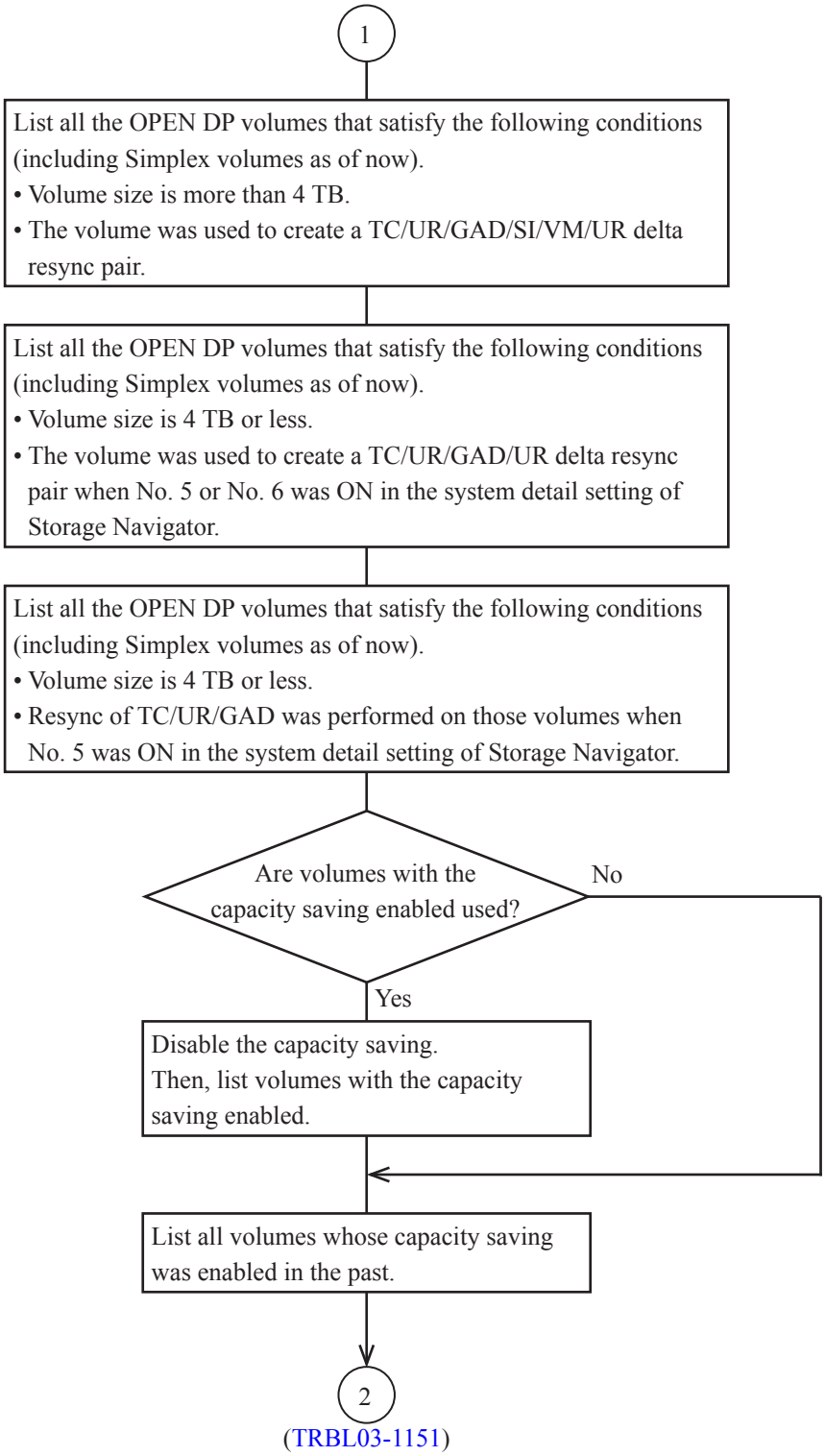
3.52 Workflow for Lowering the Firmware Version to the Version Not Supporting the Control Pages Inside the DP-VOL

NOTICE: Perform the following procedure first, and then update the Firmware (See FIRMWARE SECTION) again. Note that data back-up might be necessary before performing this procedure.

3.52.1 Workflow for Selecting the Target Volumes for Reclaiming the Control Pages Inside the DP-VOL(s)

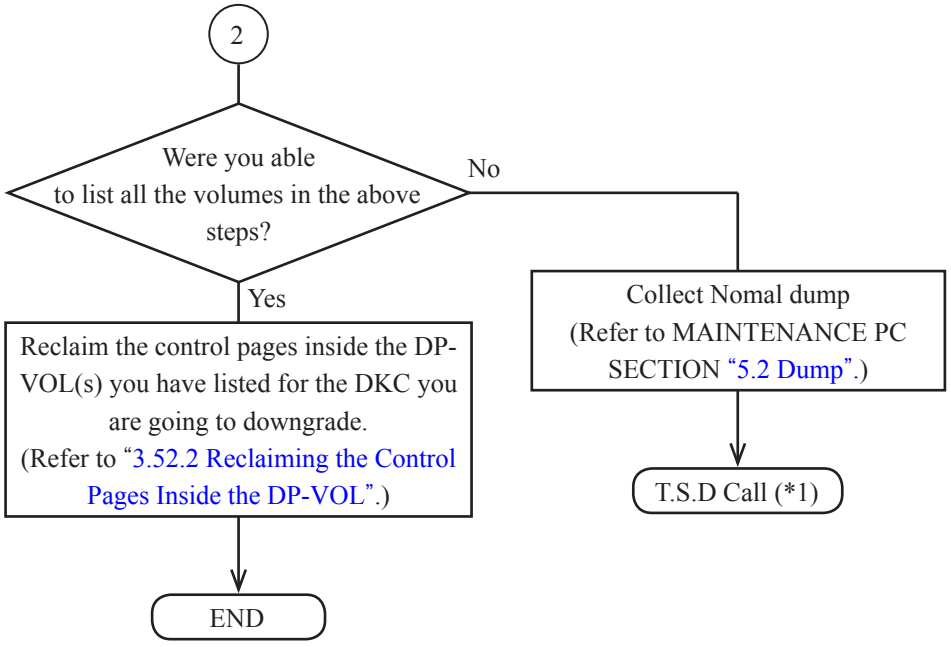


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(TRBL03-1151)

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*1: Collect a normal autodump and upload it.
The factory will list all the target volumes that you need to reclaim the control pages.

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3.52.2 Reclaiming the Control Pages Inside the DP-VOL

There are following two methods to reclaim the control pages inside the DP-VOL(s).
Select either method according to the condition.

Condition	Method
All of the following are met: • Capacity Saving is disabled. • The volume(s) is already backed up or can be backed up. • The LDEV can be formatted or deleted. (The TC/UR/GAD/SI/VM ex-S-VOLs can also be used as a backup.)	1 or 2
All of the following are met: • Capacity Saving is disabled. • The volume(s) is not backed up yet or cannot be backed up.	2

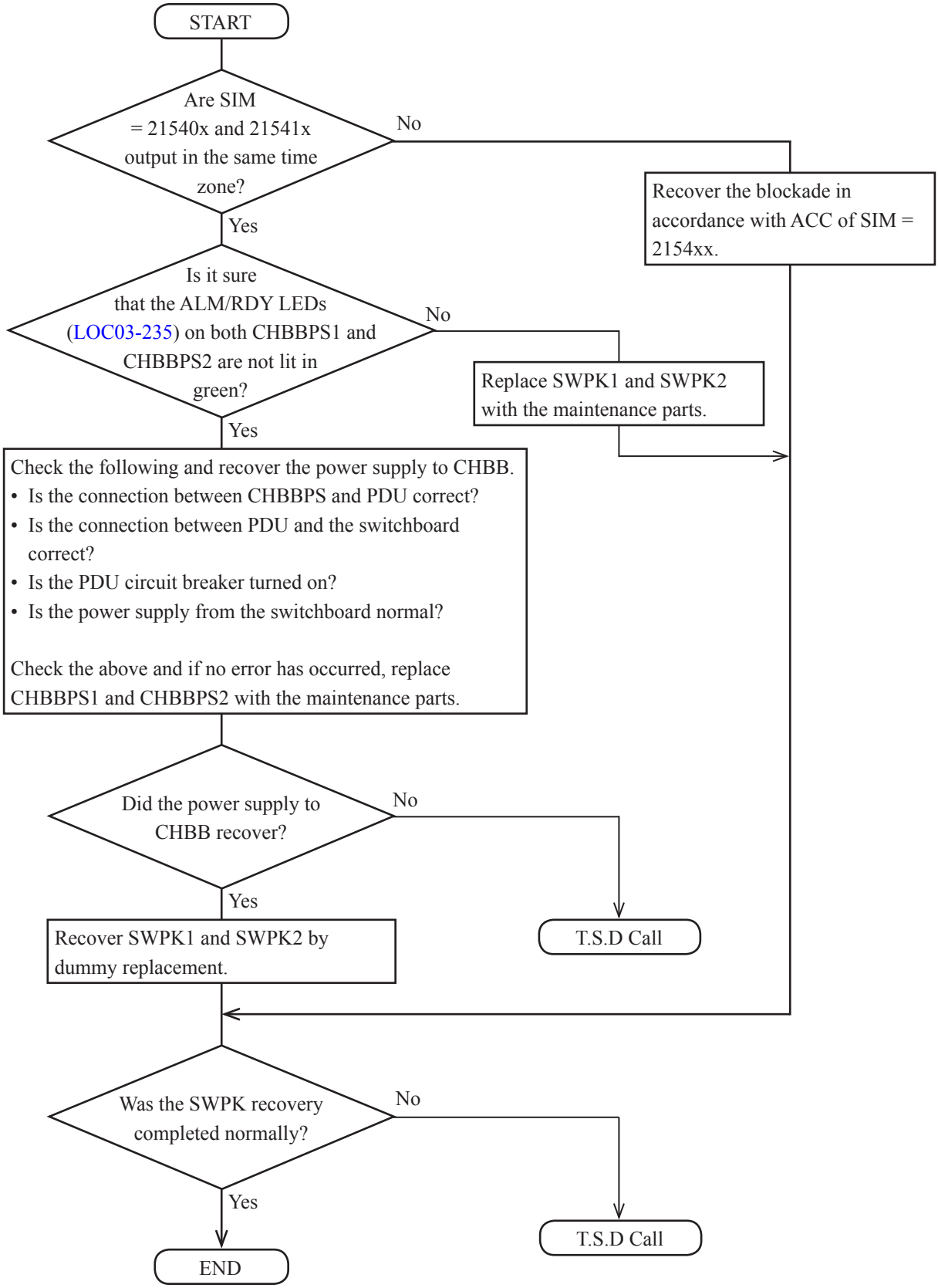
NOTE: Method 1 is usually a way quicker than Method 2 to complete.
By using Method 2, you can keep DR configuration during this process.

1. Formatting or decreasing LDEV (Method 1)
   (1) Delete the TC/UR/GAD pairs with 4 TB or less.
   (2) Take a backup of the target LDEVs if you have not at this point.
   (3) If you select to format the target LDEV(s), set System Option Mode 867 to ON before to do so.
   (4) Format or delete the target LDEV(s).
   (5) If you set System Option Mode 867 to ON in the step (3), set it to OFF after formatting the LDEV(s).
   (6) After you downgrade the firmware version, restore the volumes from the backup if necessary.

2. Reclaiming zero pages (Method 2)
   (1) Set System Option Mode 755 to OFF if it is ON.
   (2) If a pool is blocked, restore it.
   (3) Execute Reclaim Zero Pages with RAID Manager or Device Manager – Storage Navigator.
      (a) If you choose to execute with Device Manager – Storage Navigator, confirm the completion of Reclaim Zero Pages on the View Pool Management Status window.
      (b) If you choose to execute with RAID Manager, confirm the completion of Reclaim Zero Pages using the raidcom get ldev command.
   (4) If you set System Option Mode 755 to OFF on the step (1), set it to ON.

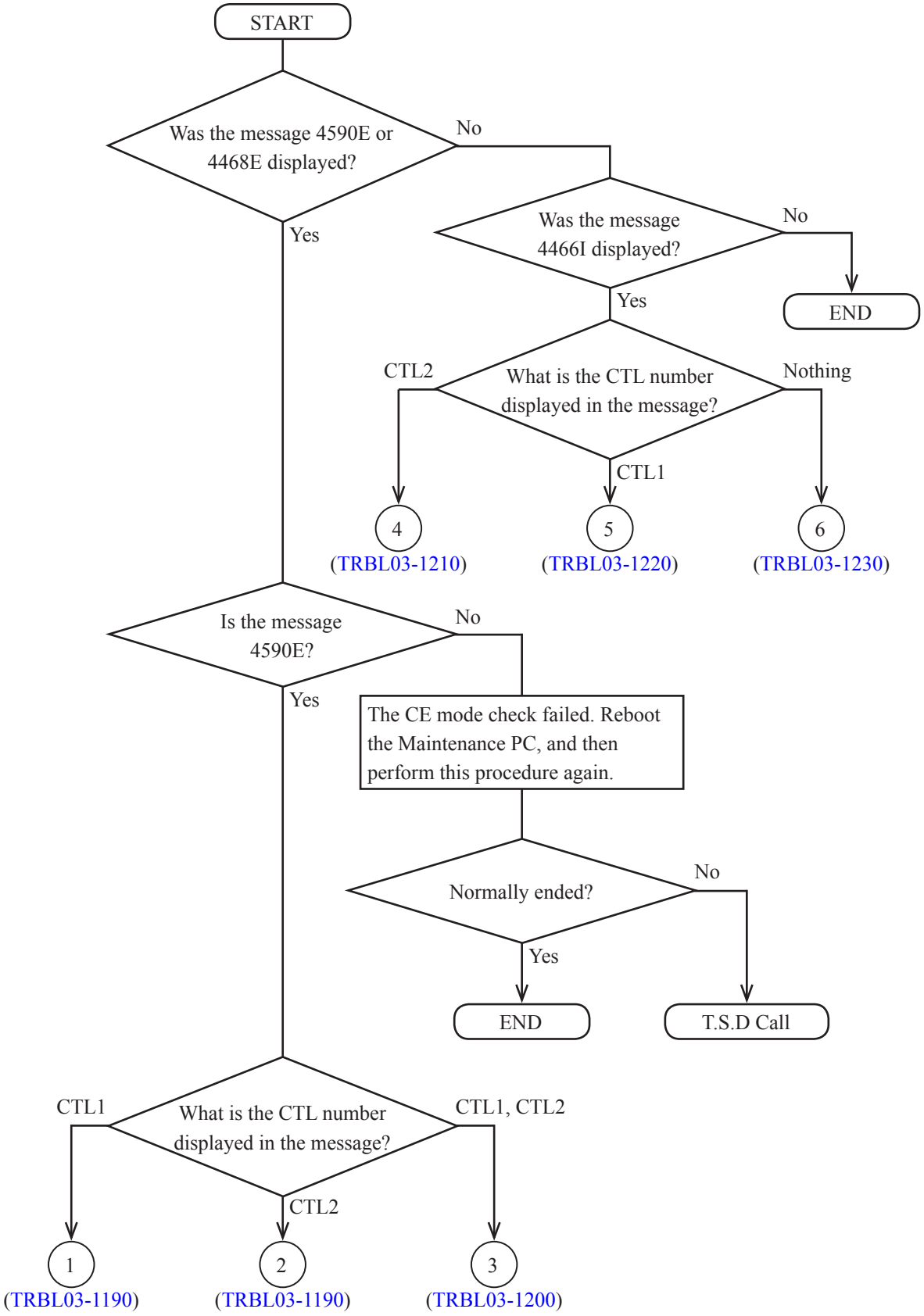
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3.53 Recovery Procedure When SWPK is Blocked (SIM = 2154xx)

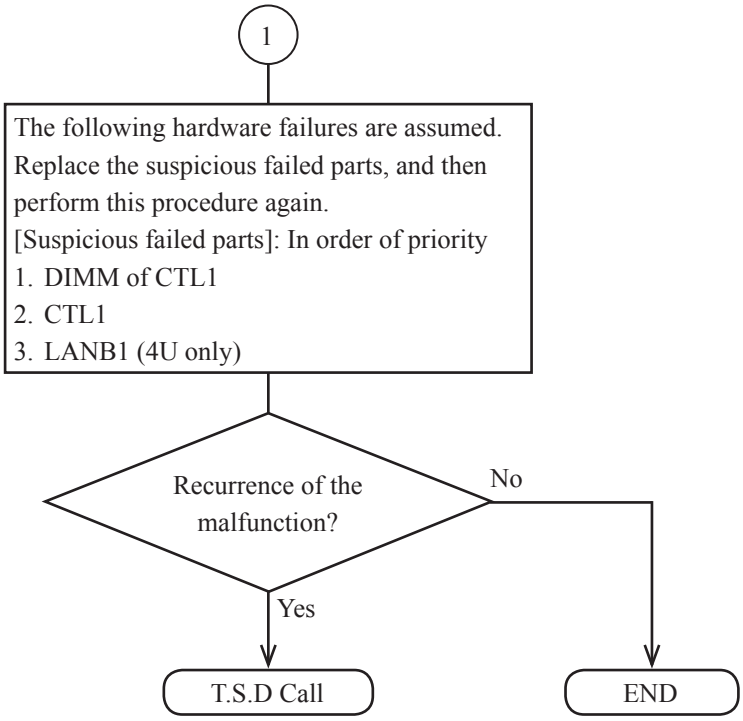


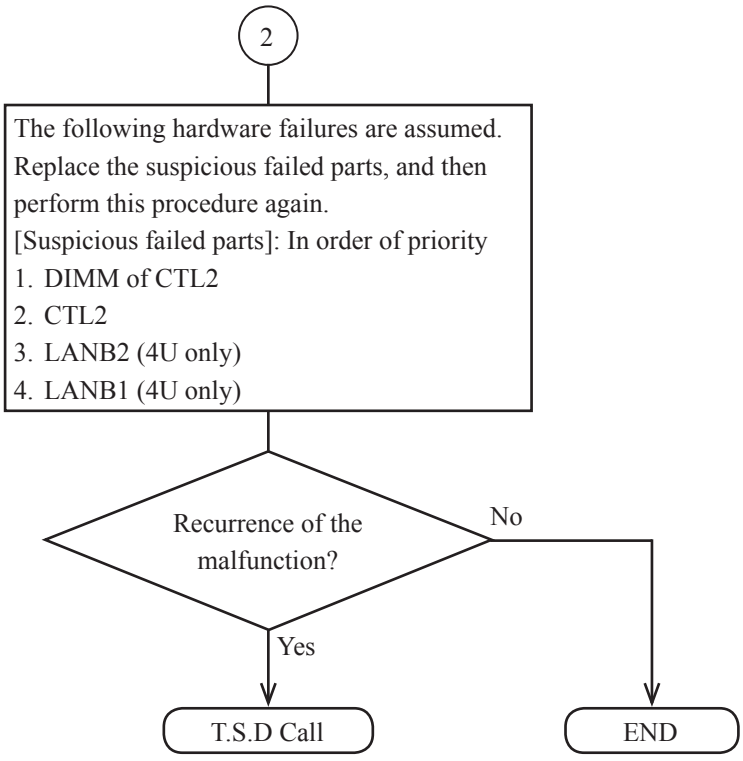
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3.54 Recovery Procedure When the Initial Installation Fails

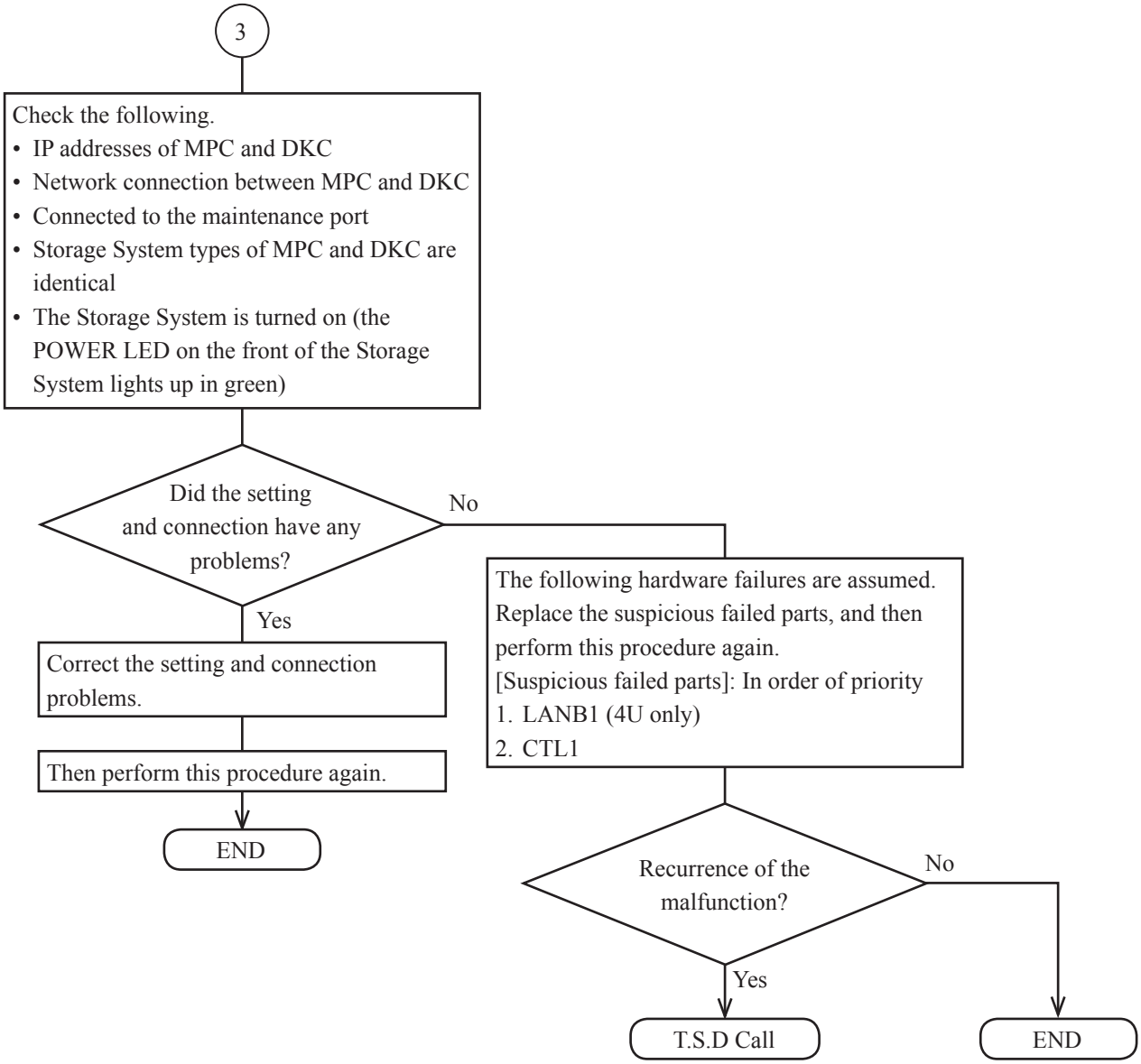


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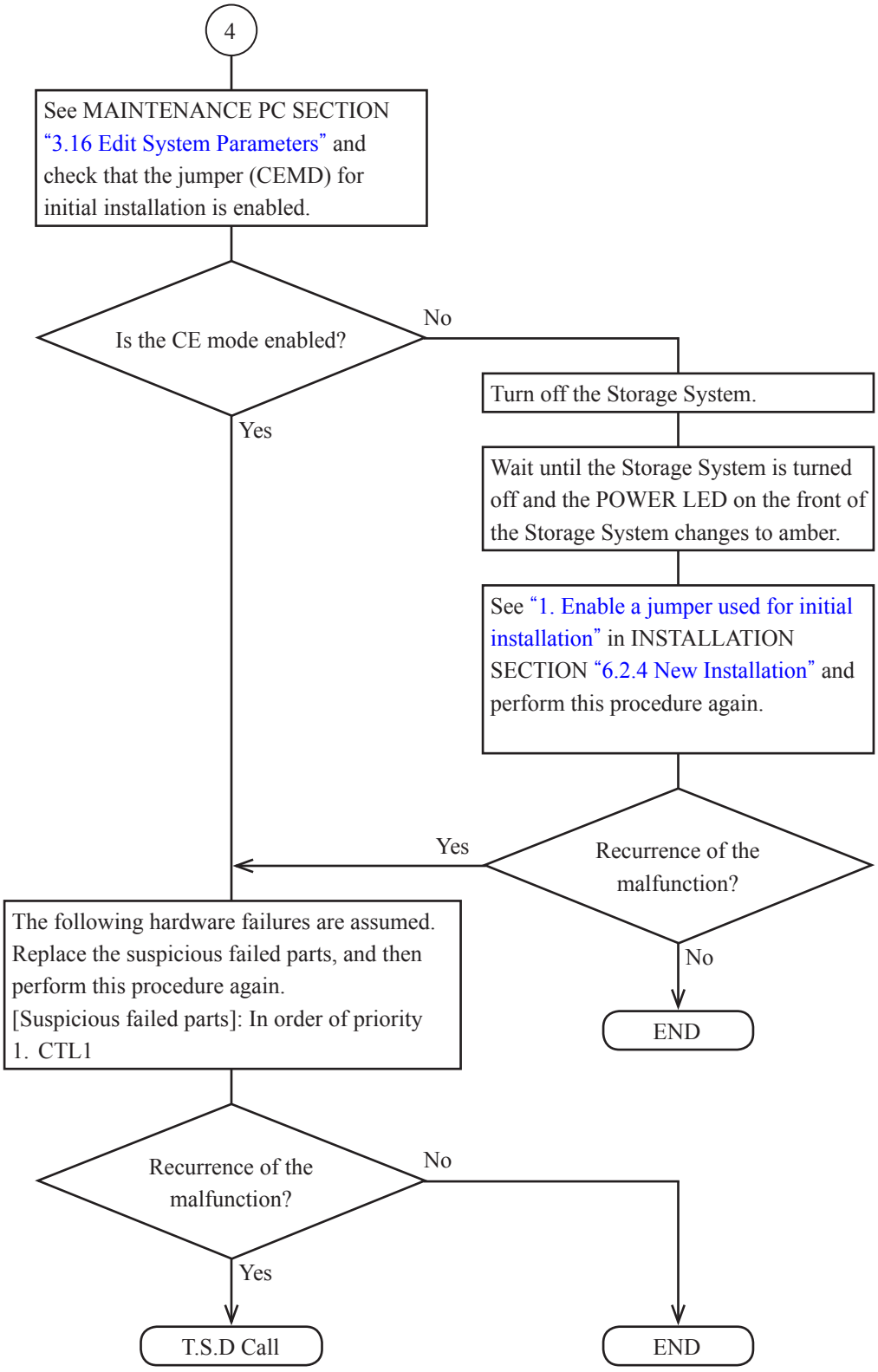




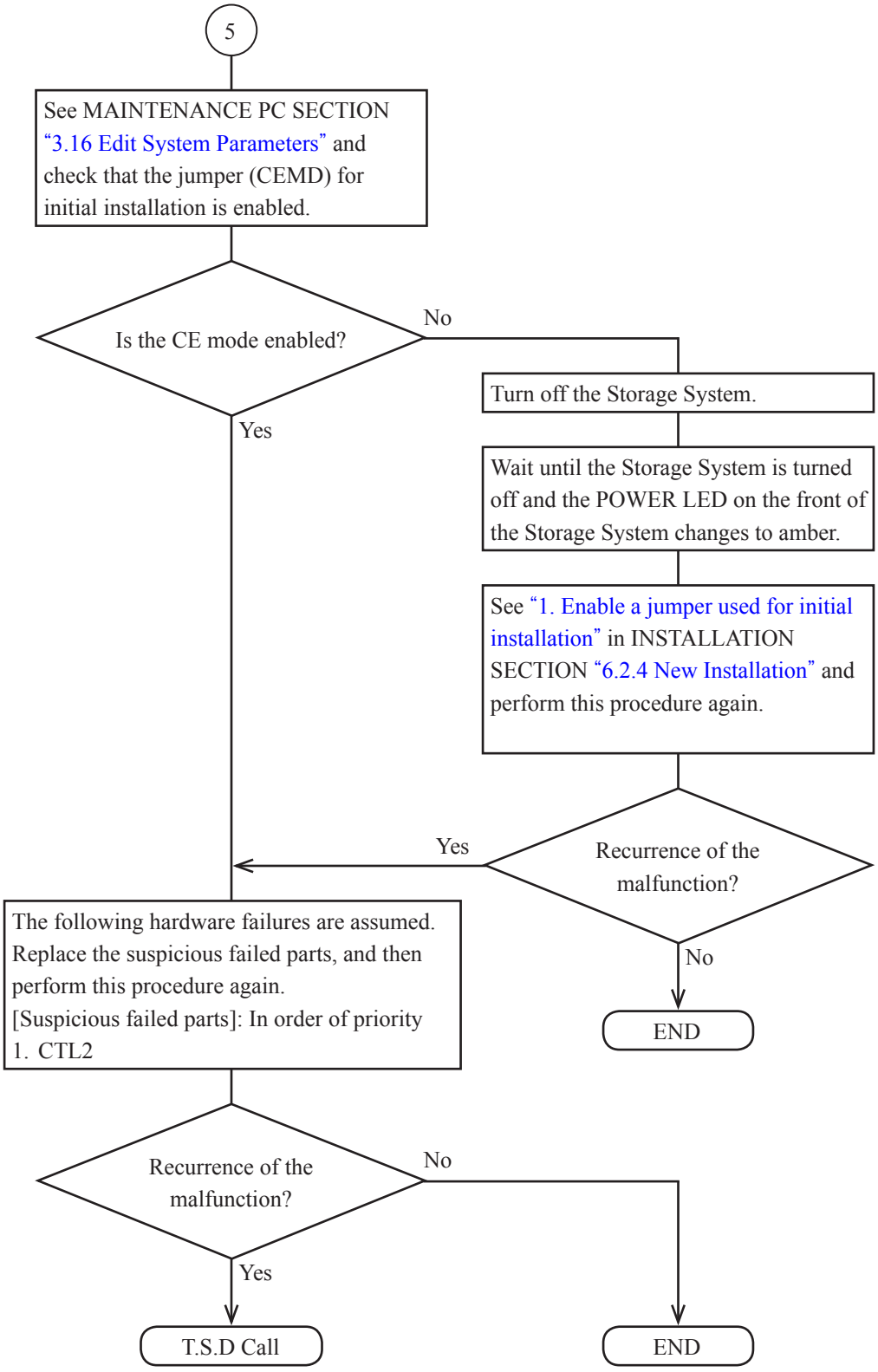
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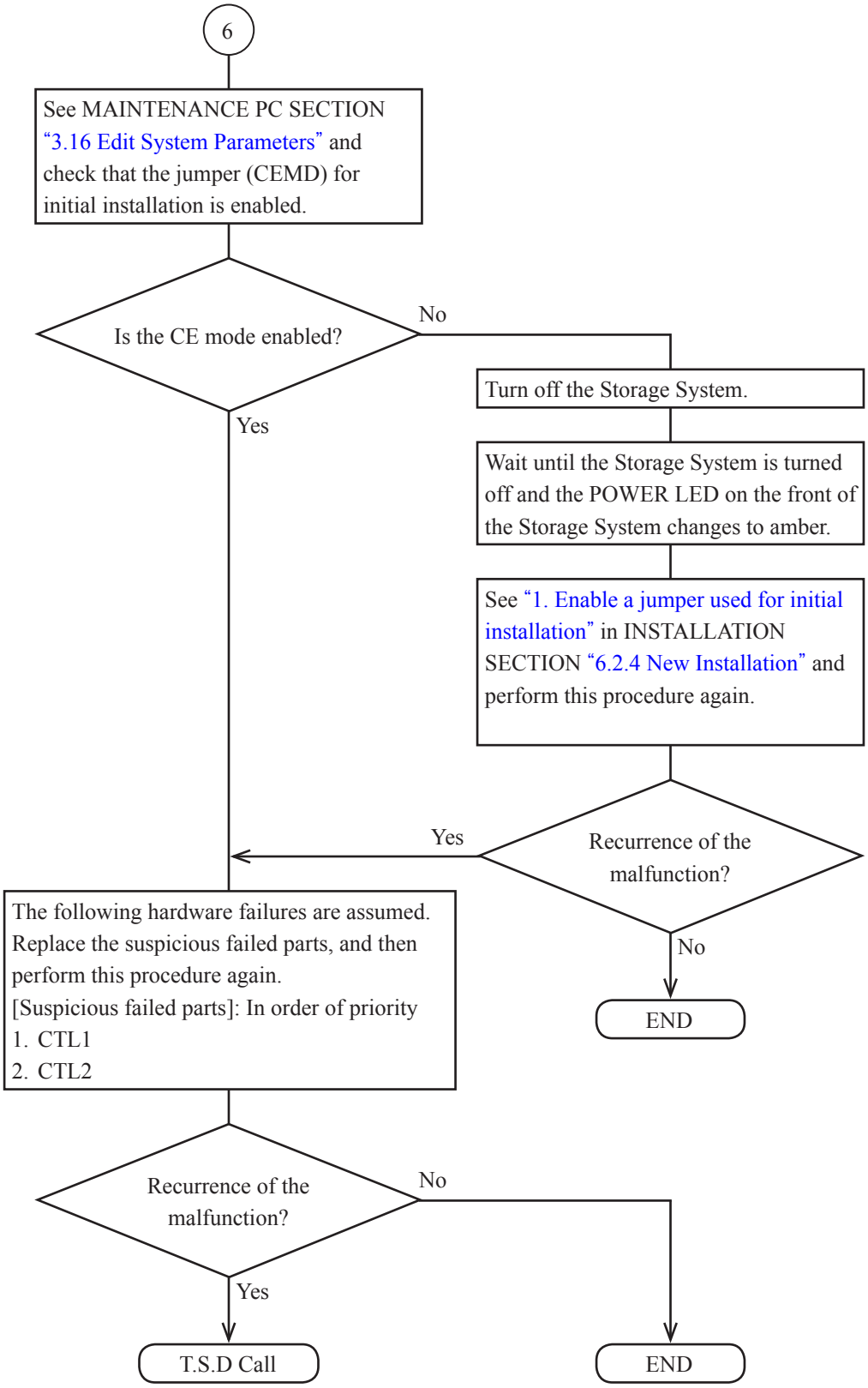
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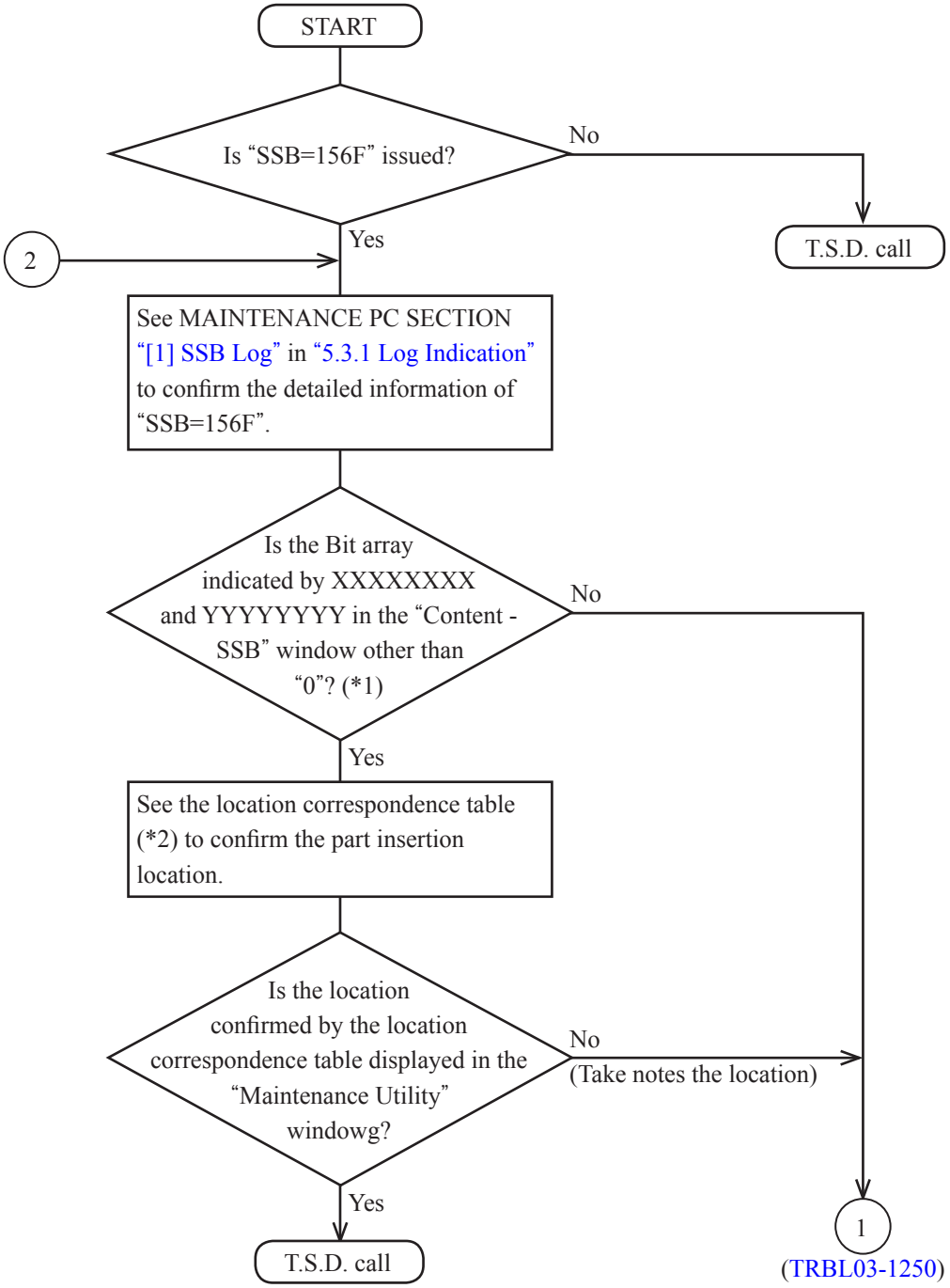
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3.55 Recovery Procedure When the Part Installation Error Occurs (SIM = ffd400)

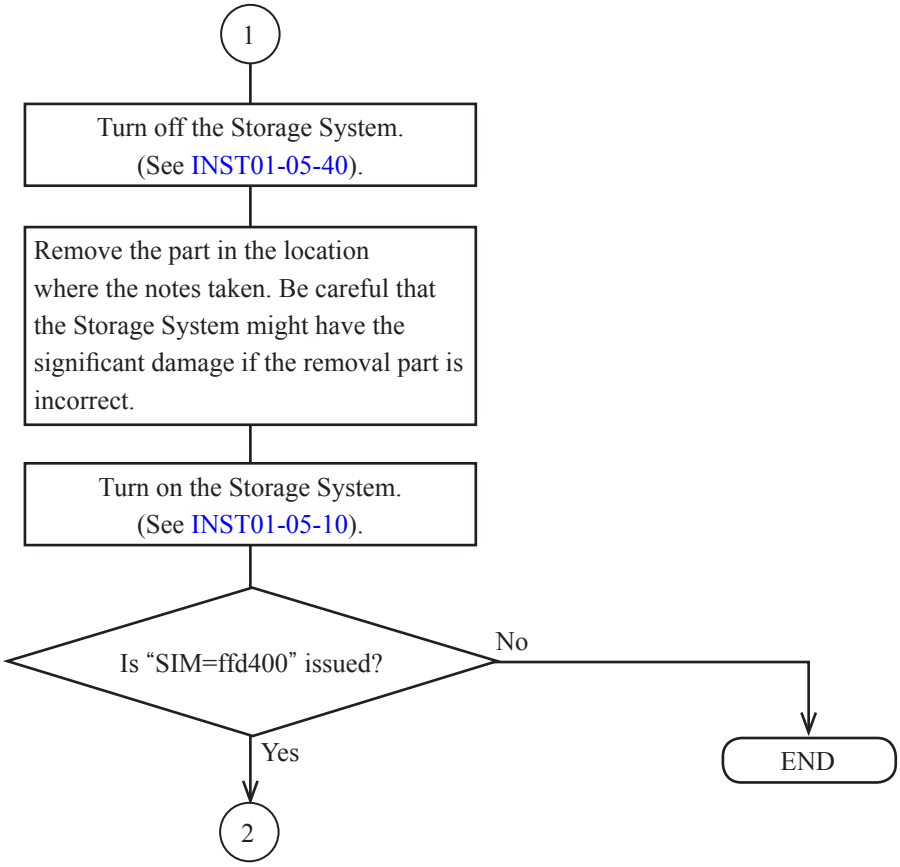
SIM = ffd400 notifies that the part, that is not embedded in the configuration, is inserted into the Storage System.
In this case, removing the part from the Storage System is required by identifying the part type/location in accordance with the following procedure.

⚠ CAUTION

If the removal target part is incorrect, the Storage System might have the significant damage.



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*1: SSB detailed information

	+0x0	+0x4	+0x8	+0xC
00000000:	720a0914	32149f04	156f0000	00aa2000
00000010:	00000000	000004dd	00000000	00000004
00000020:	00000000	0000009f	156f0000	00000000
00000030:	00000000	0000ff9f	00000000	00000000
00000040:	00000000	00000000	XXXXXXXX	YYYYYYYY

XXXXXXXX: CFM detection location (leftmost 1 bit is SSD #0)

YYYYYYYY: PECB detection location (leftmost 1 bit is SLOT #0)

*2: Location correspondence table

• CFM location correspondence table

Bit location	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Part location (CFM-xx)	10	11	20	21	Unused											
Bit location	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Part location (CFM-xx)	Unused															

• PECB location correspondence table

Bit location	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Part location (Slot-xx)	1A	1B	1C	1D	1E	1F	Unused									
Bit location	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Part location (Slot-xx)	2A	2B	2C	2D	2E	2F	Unused									

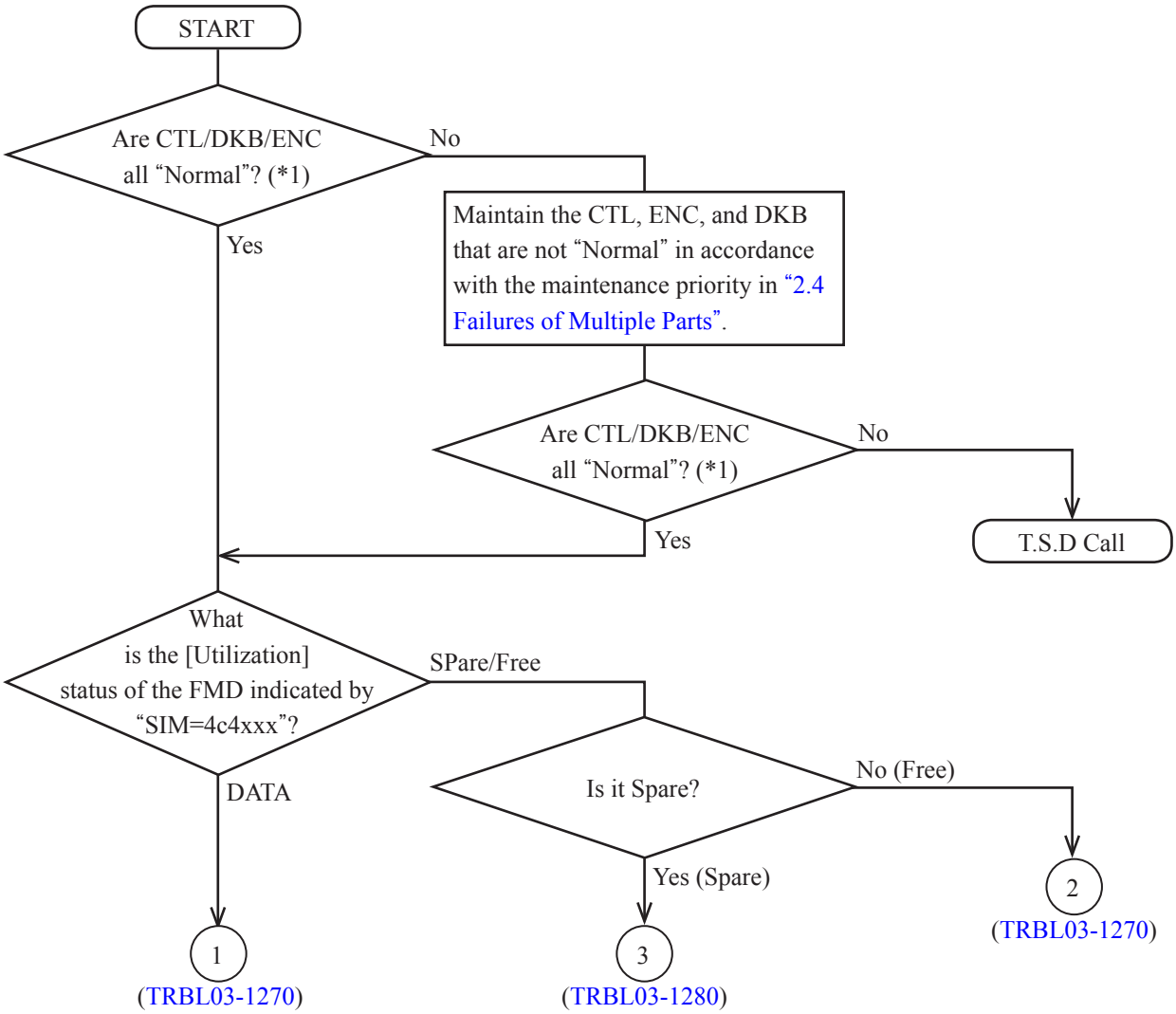
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3.56 Recovery Procedure When Flash Module Drive Initialization Fails (SIM = 4c4xxx)

This SIM is output if Flash Module Drive (FMD) initialization fails. The following triggers are considered.

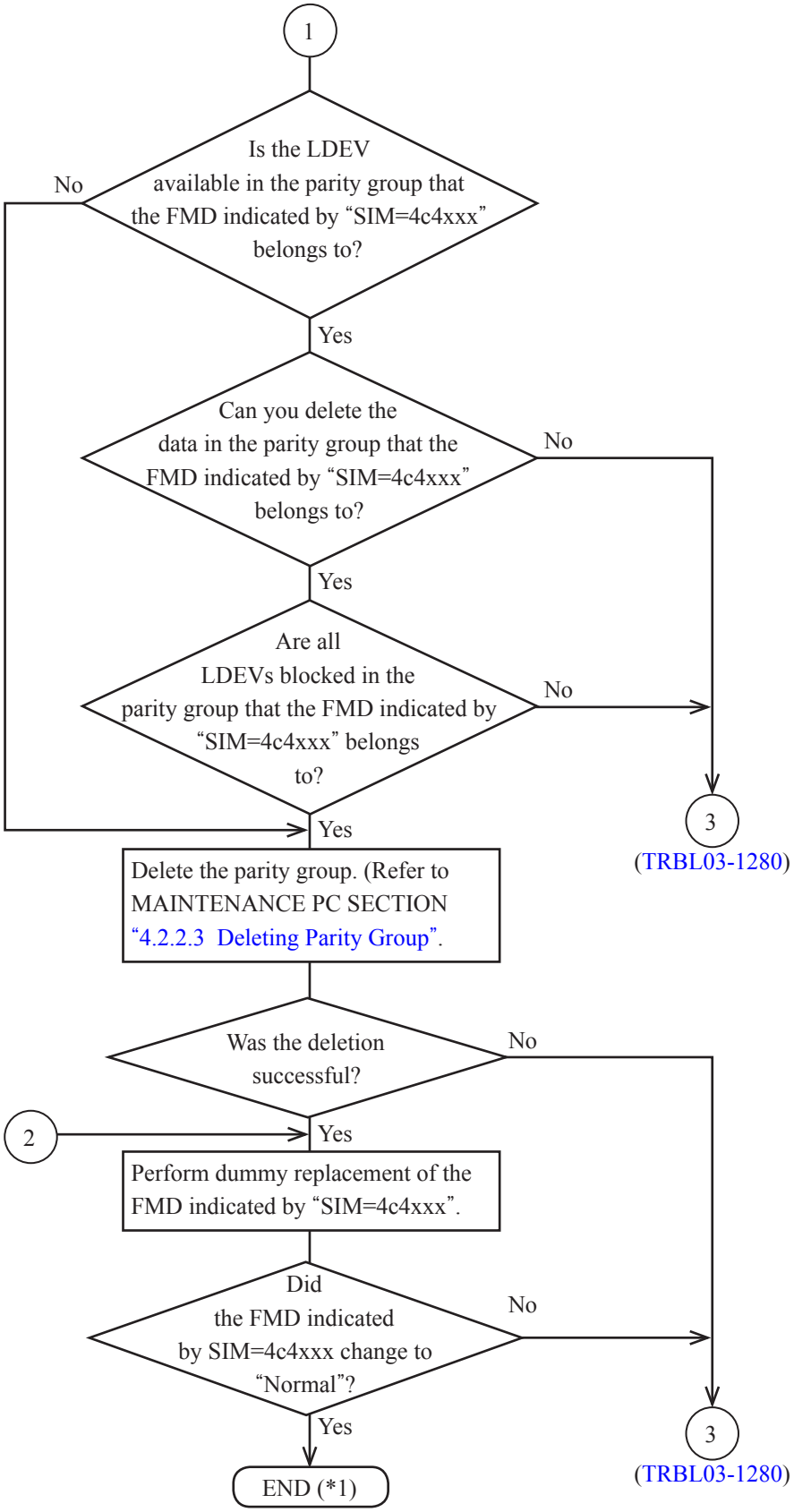
- Spinning up
- Creating parity group
- Formatting parity group
- PSON
- Adding FMD
- Allocating spare

The cause of failing Flash Module Drive (FMD) initialization is a defect of individual FMD or FMD might be involved in other failures. Recover it in accordance with the following recovery procedure.



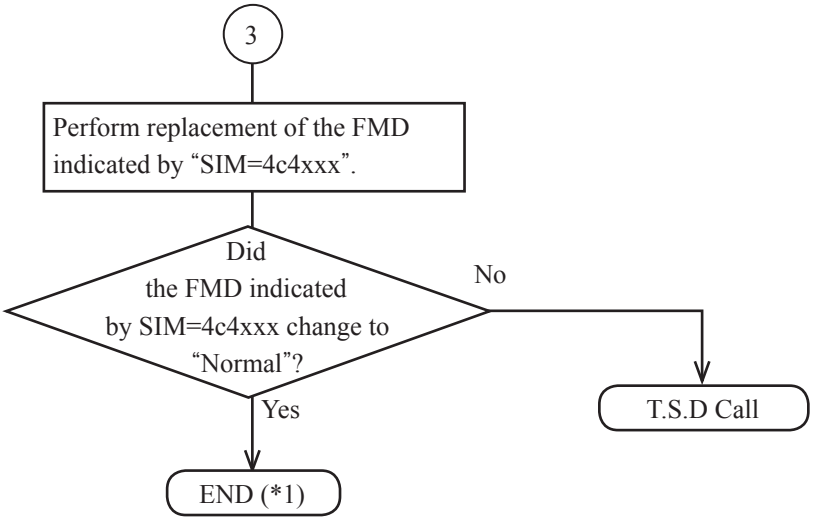
*1: It might be involved in the CTL/DKB/ENC failure. Recover the CTL/DKB/ENC before starting the recovery processing.

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*1: If the parity group is deleted, create a parity group and format it as needed.

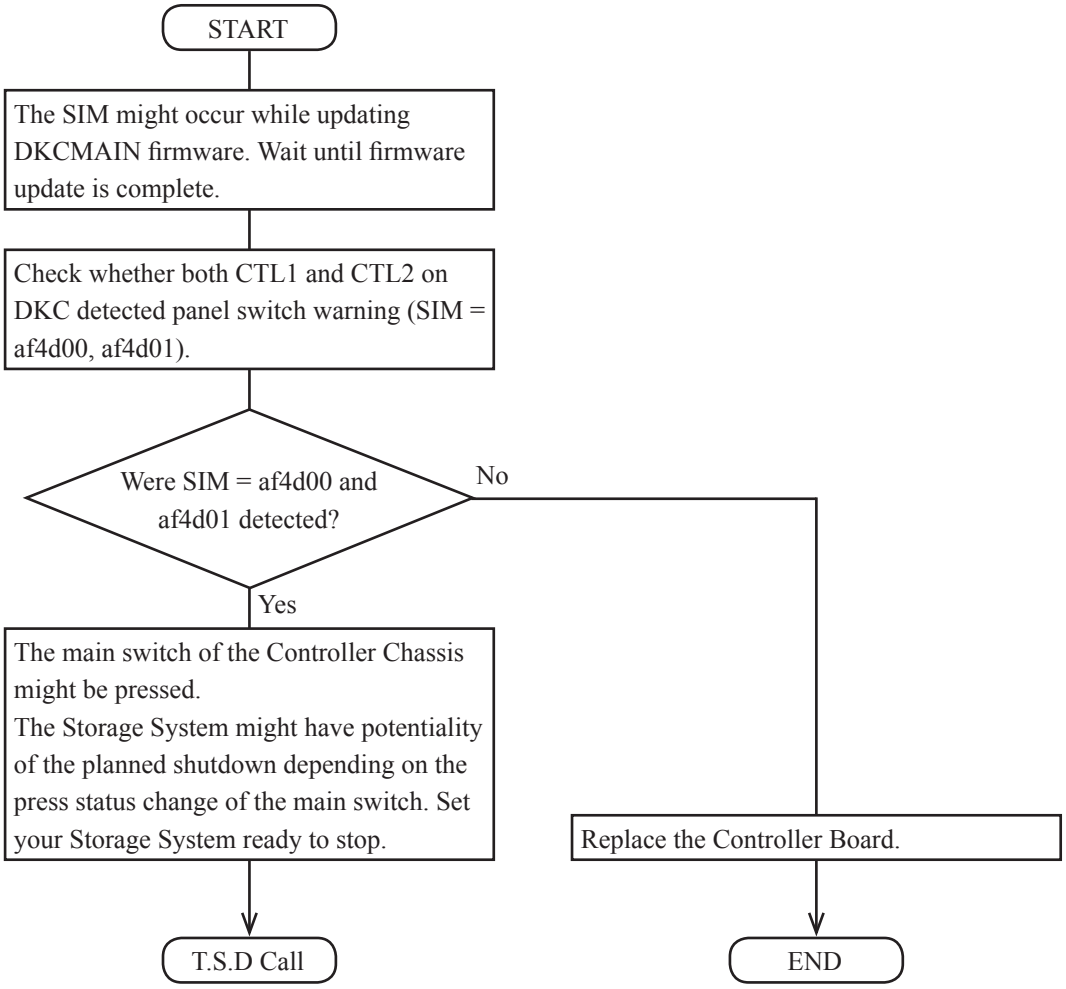
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*1: If the parity group is deleted, create a parity group and format it as needed.

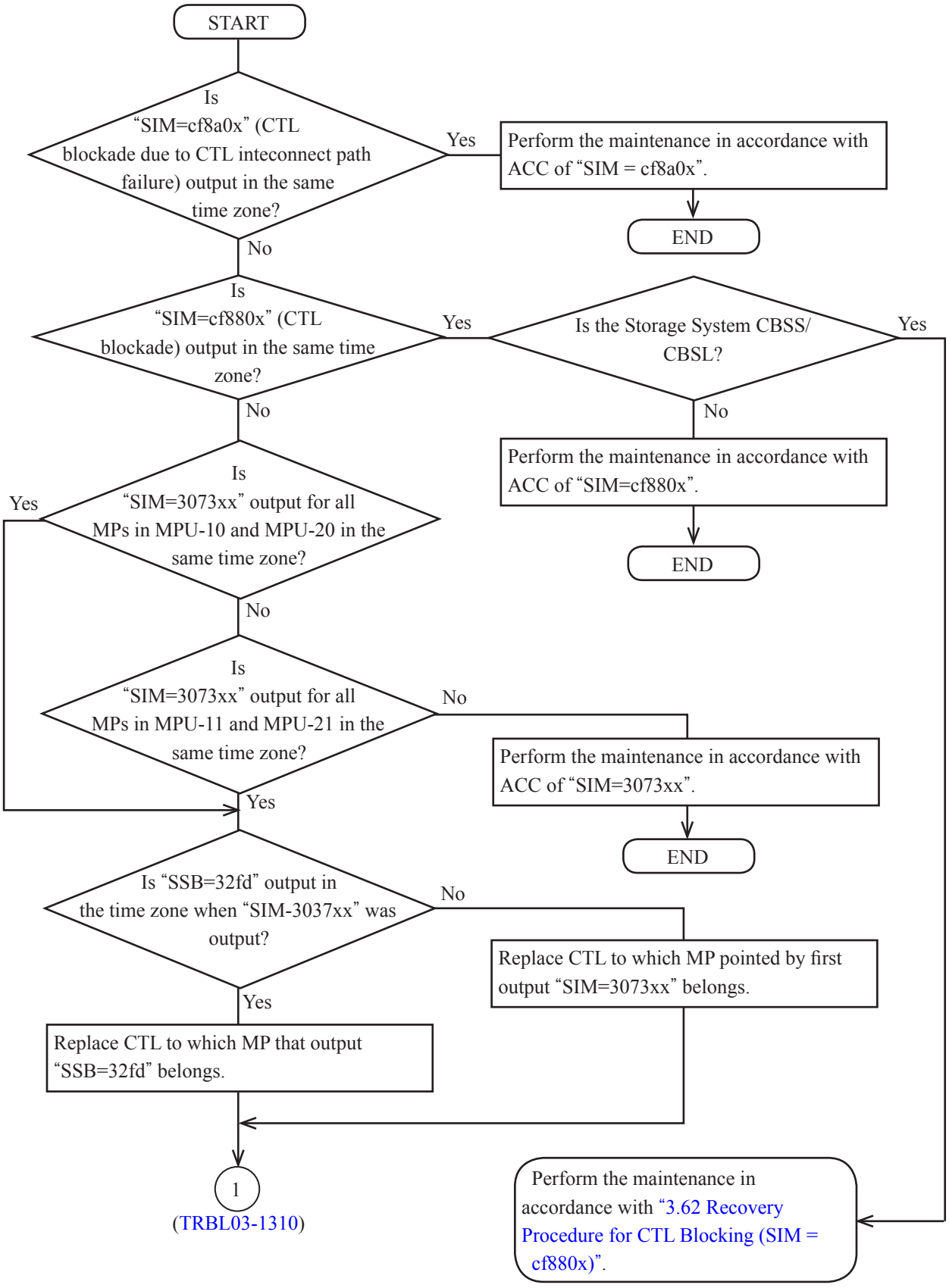
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3.57 Recovery Procedure When the Panel Switch Warning (SIM = af4d0x)

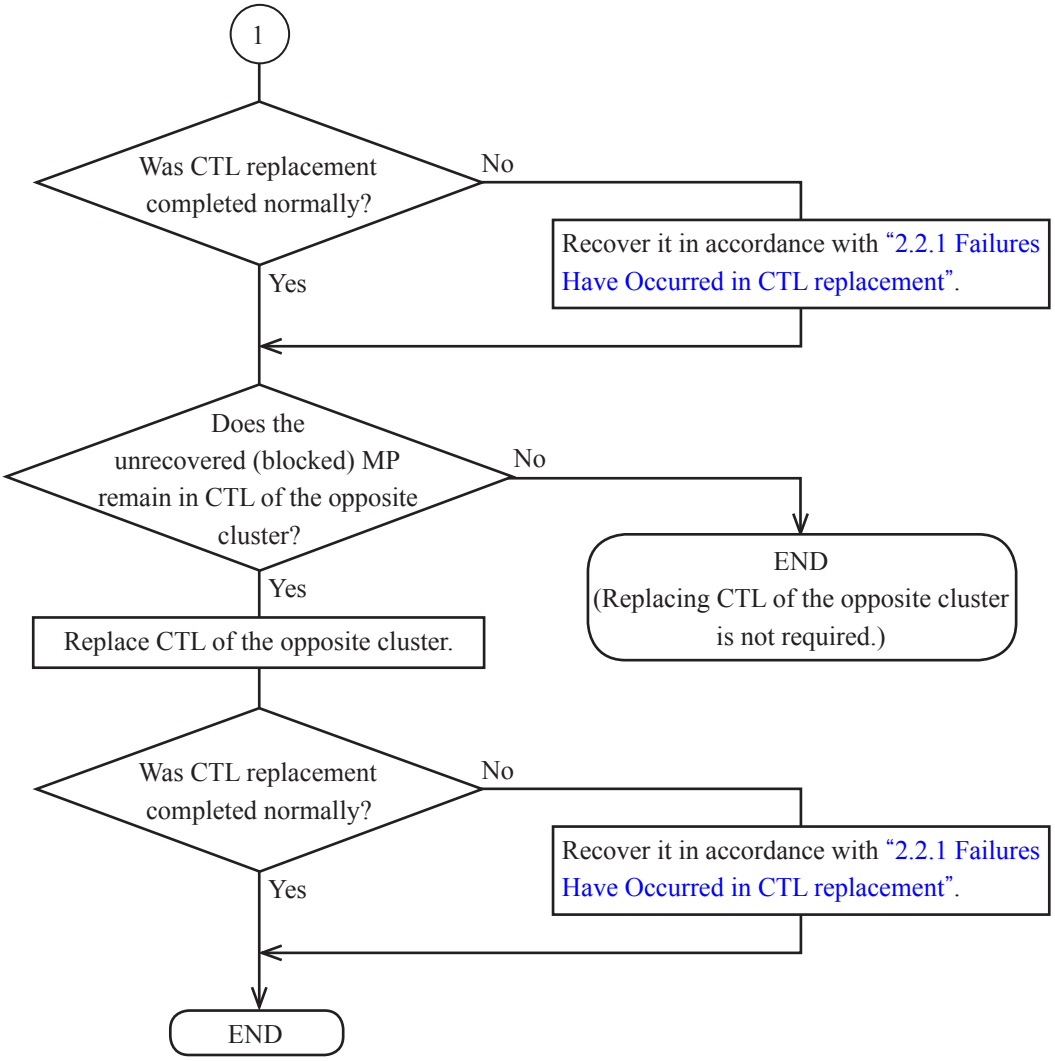


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3.58 Recovery Procedure When Processor Is Blocked (SIM = 3073xx)

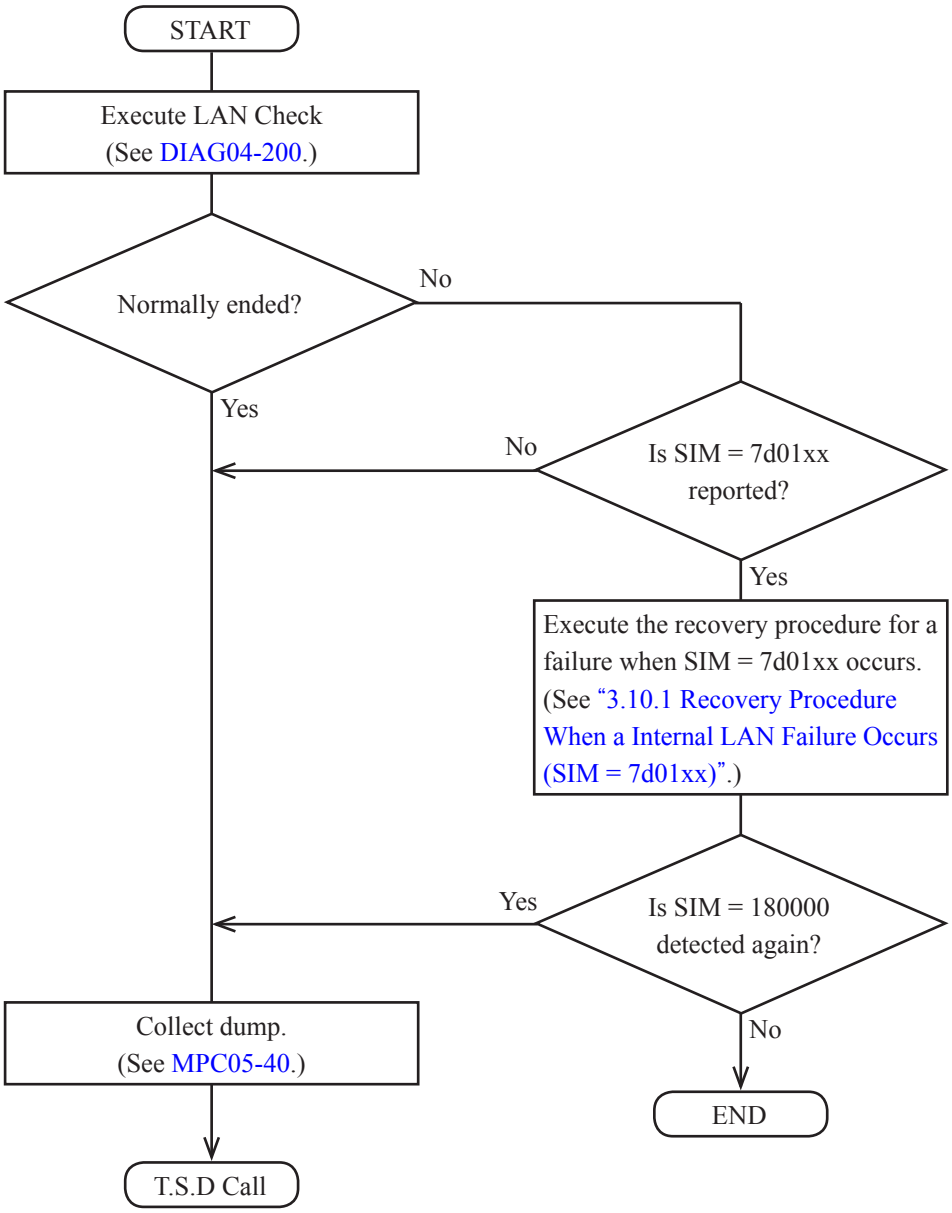


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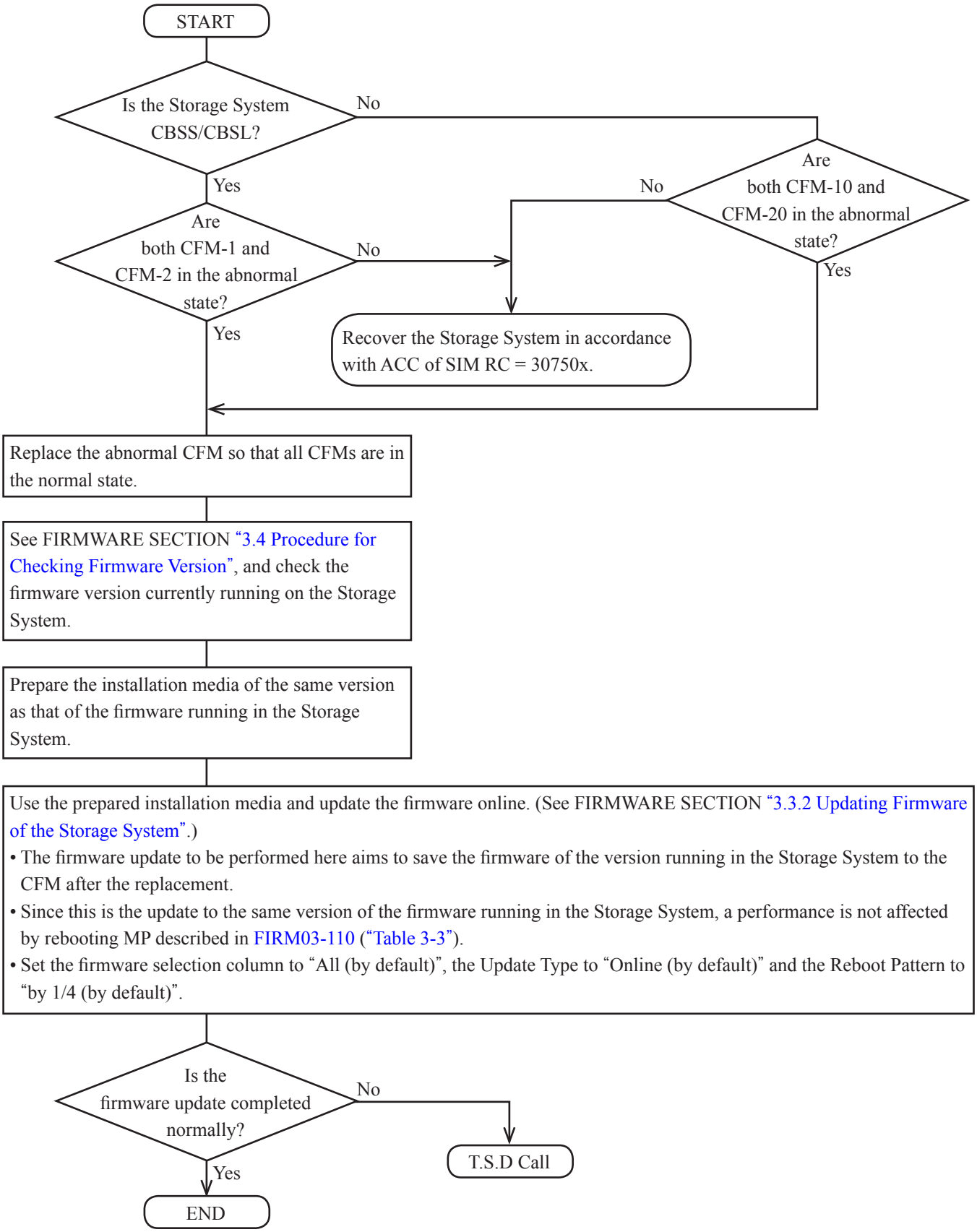
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3.59 Response to a Loss of the DKC Audit Log (SIM = 180000)



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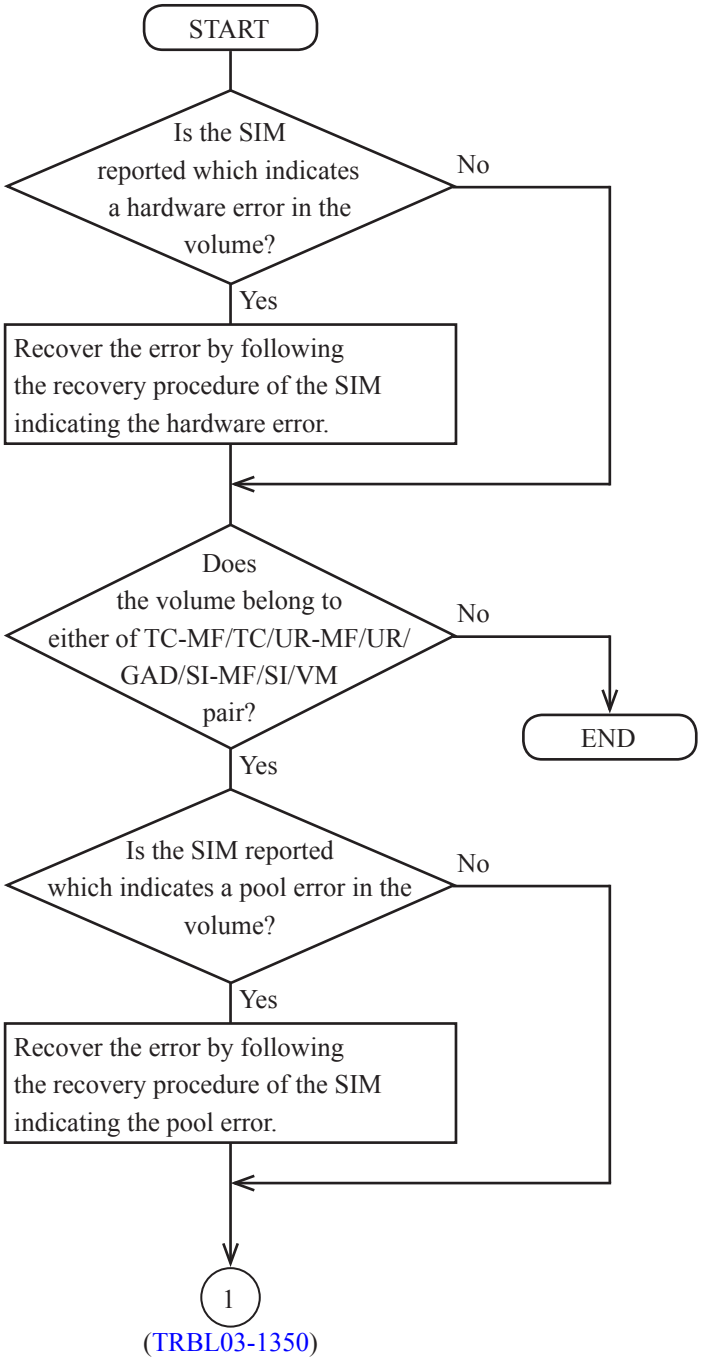
3.60 Recovery Procedure When CFM Warning Occurs (SIM = 30750x)



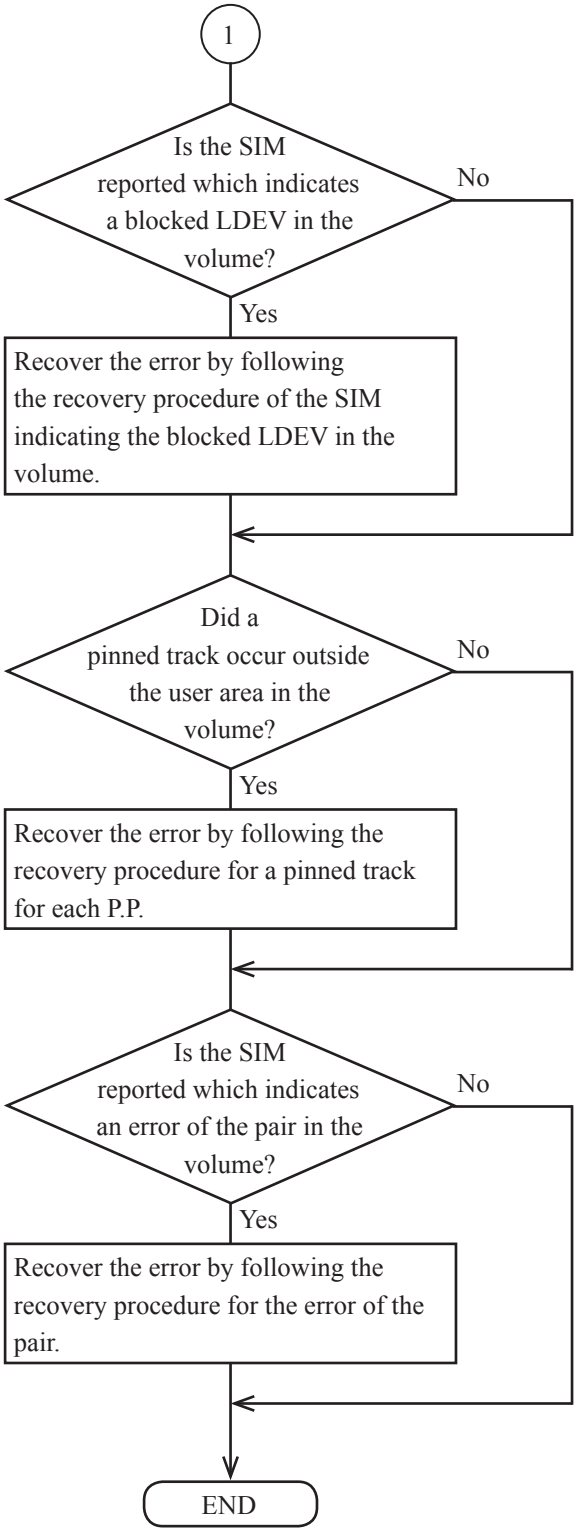
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3.61 Recovery Procedure for Differential Area Blocking (SIM = 4d1xyy)

This SIM indicates that the pair differential area is blocked caused by a hardware error. Recover it in accordance with the following procedure. Note that, when resynchronizing the pair next time, all the data of the primary volume is copied to the secondary volume.



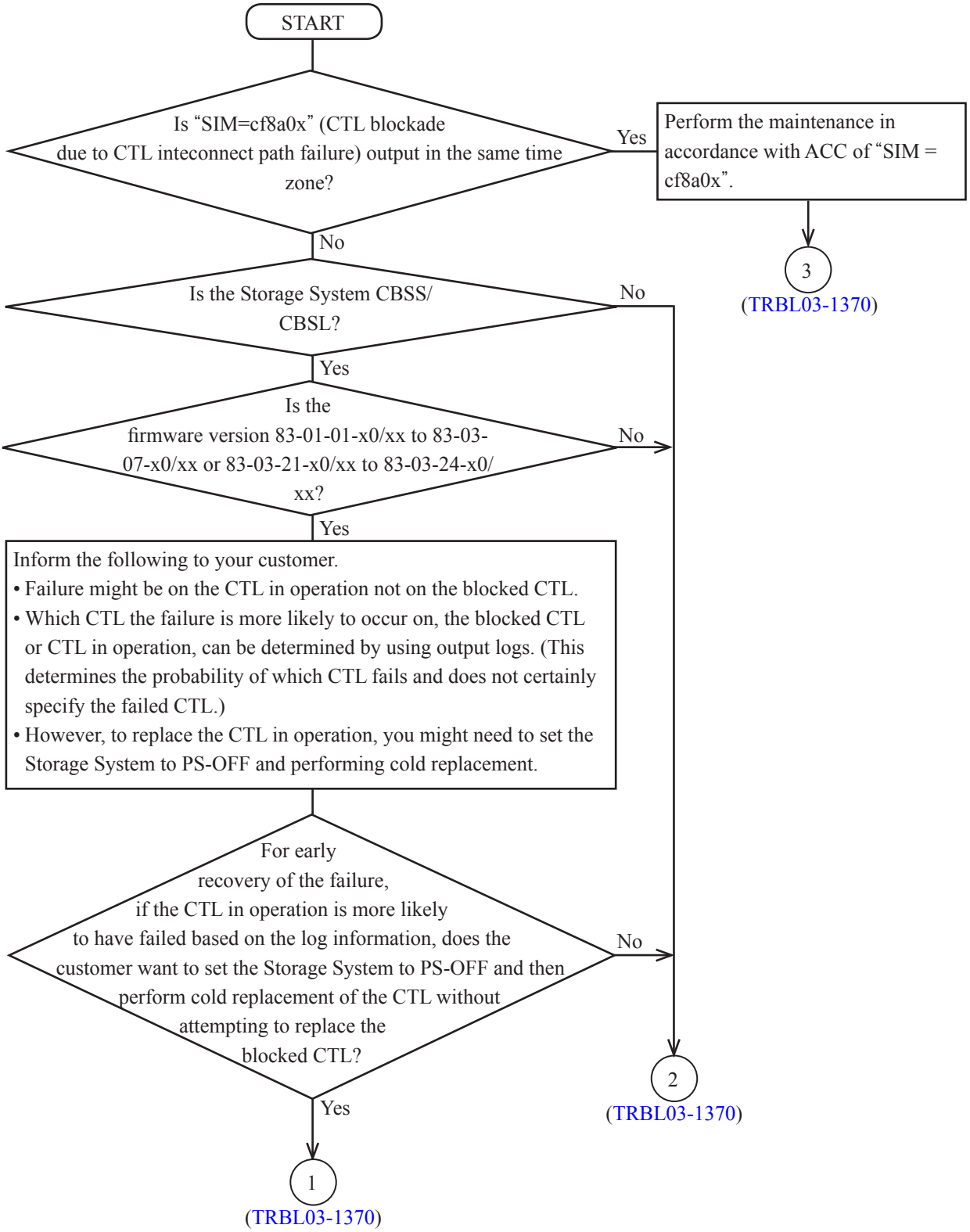
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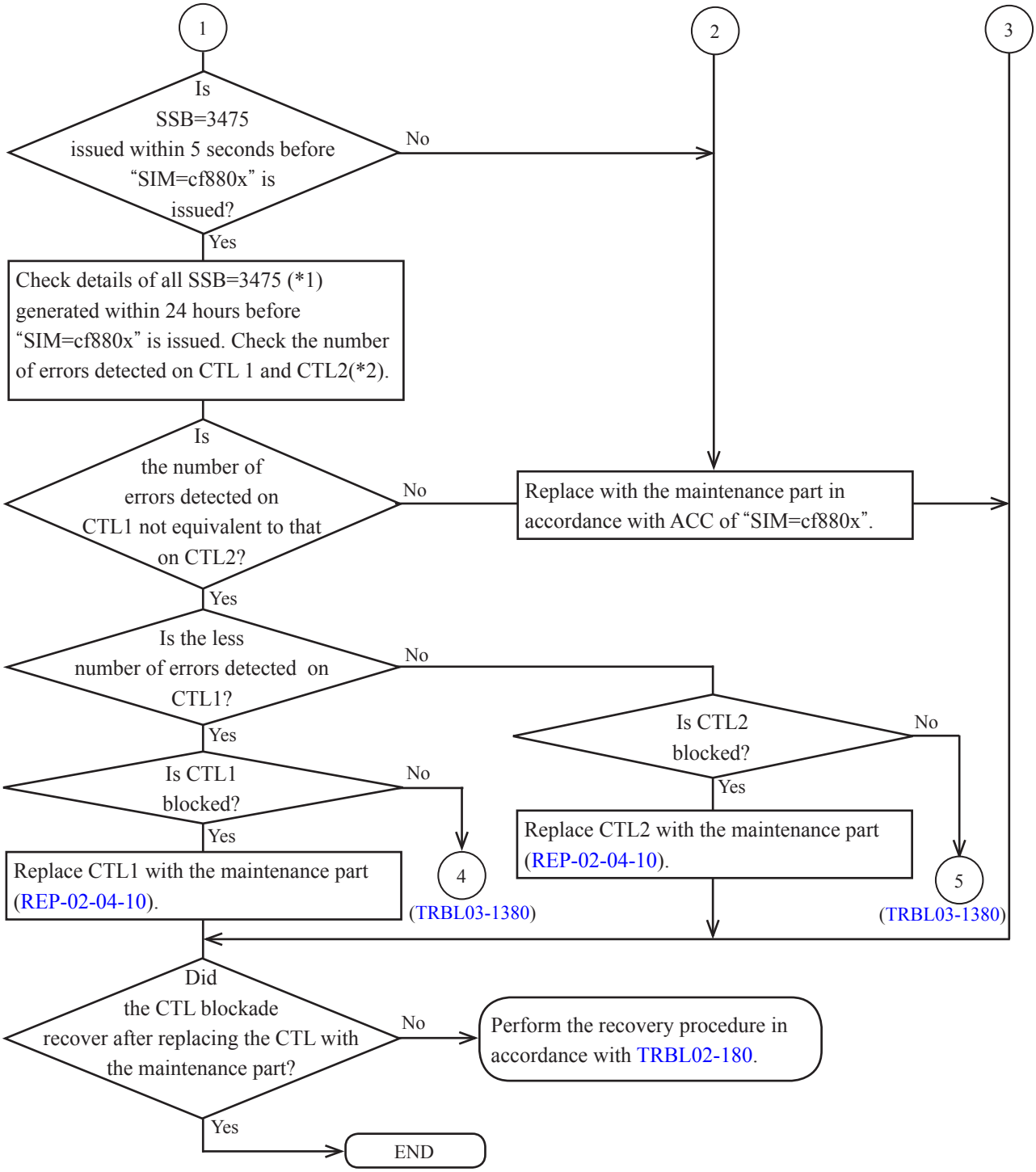
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3.62 Recovery Procedure for CTL Blocking (SIM = cf880x)

When the Storage System is CBSS/CBSL, you might need to set the Storage System to PS-OFF and then perform cold replacement of CTL.



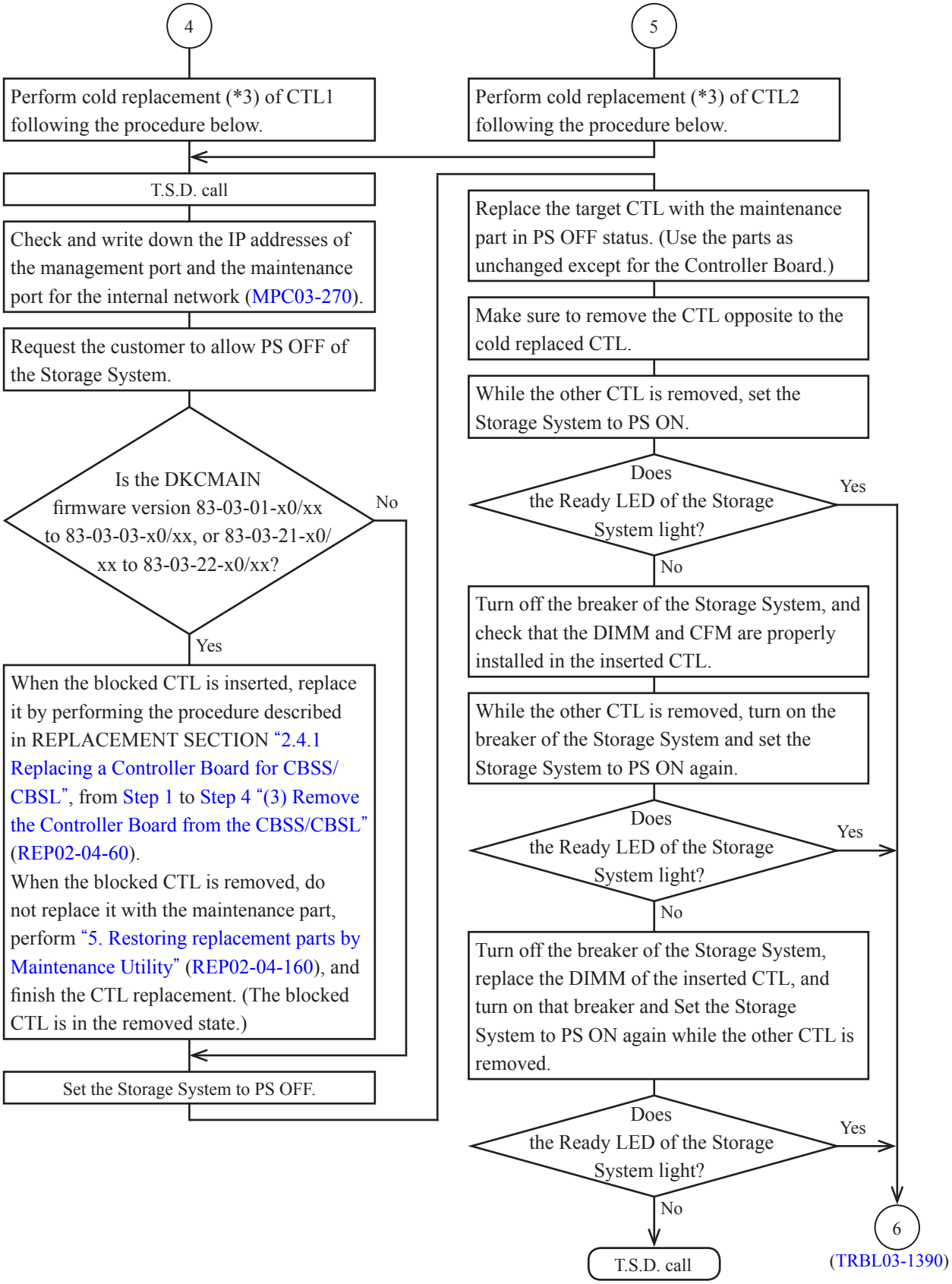
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*1: See MAINTENANCE PC SECTION "5.3.1 Log Indication"-"[1] SSB Log". Up to 128 of SSB=3475 might have occurred. If many, use the SSB Search Condition dialog described in "(1) SSB Search Condition dialog".

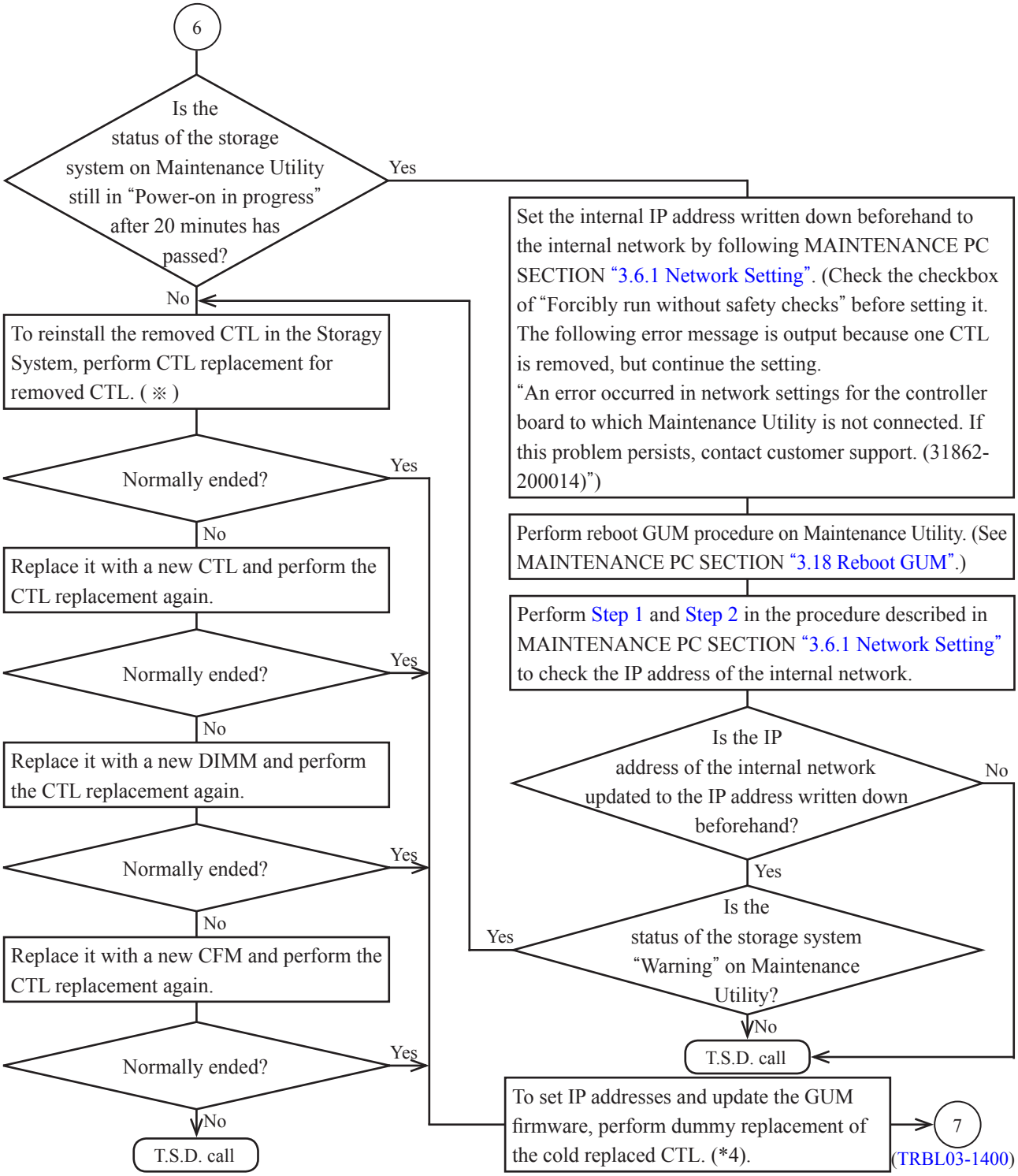
*2: Calculating the number of detected errors
(a) Check SSB of "Error Code=3475" resulting from *1.
(b) Check the value of SSB "Micro Processor" in (a), and:
- For MP10-xx or MP11-xx, add 1 (one) to the number of errors detected on CTL1.
- For MP20-xx or MP21-xx, add 1 (one) to the number of errors detected on CTL2.

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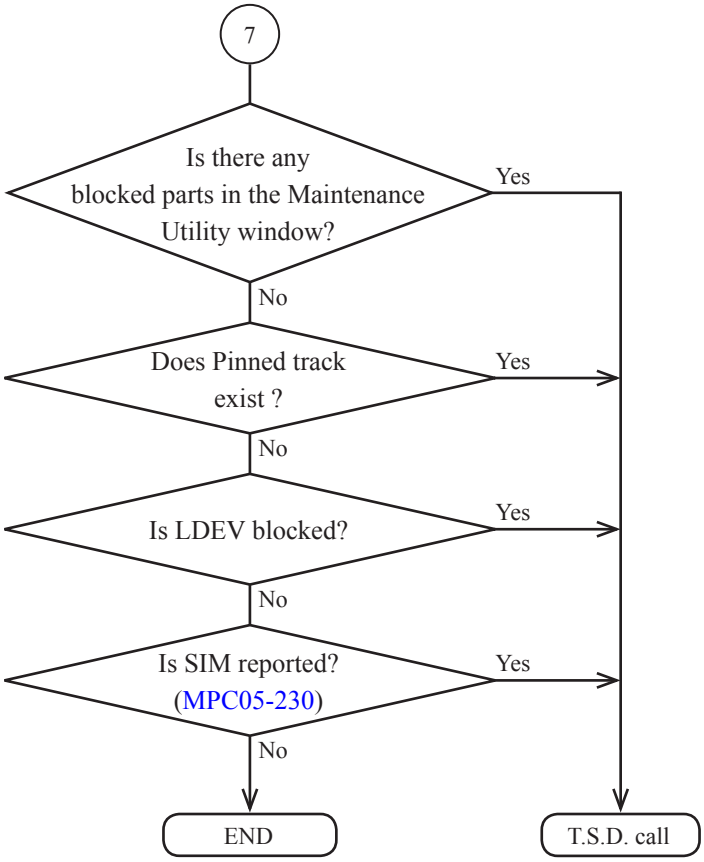
*3: Replace the parts in the PS OFF status.

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*4: For another procedure for IP address settings, see MAINTENANCE PC SECTION "3.6 Network Setting". For another procedure for GUM firmware update, see FIRMWARE SECTION "3.3.2 Updating Firmware of the Storage System".
However, wait for 15 minutes or longer after (※) has been properly done, and then perform them.
Time required for GUM fimware update:
• Dummy replacement: about 70 minutes
• Updating firmware of the Storage System: about 40 minutes

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4. Recovery from Open Platform Failure

4.1 Recovery Procedure for a Failure on Host Fibre Channel Interface

4.1.1 Outline

The Fibre host device may fail to recognize the volumes for the Fibre of the Storage System correctly due to failures or incorrect settings of the devices between the Storage System and the Fibre Channel host device. These failures include a cable disconnection improper connection, a Fibre channel board error on the Fibre host side and improper disk connection work on the Fibre host side (e.g. insufficient cable insertion or an insertion error).
The failure recovery method in the field when such failures occur is described.

4.1.1.1 Possible Failures and causes of them

Table 4-1 Possible error and cause

No.	Possible error	Cause
1	Storage System LDEV is not recognized by Fibre initiator	(1) SCSI installation, i.e. recognition and connecting procedure from SCSI initiator is not executed correctly (2) Problem of Optical cable or connection (3) Problem of Fibre initiator. Fibre board, device driver version, parameters, etc. (4) SCSI path definition from GUM (5) The Host Reserve status is left uncanceled. (6) Problem of FC switch (7) Other

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4.1.1.2 Matters must be or desirable to be checked

Item	Checkpoint	Check method
1	Is the READY LED on the DKC on?	Check the storage system visually.
2	Is the LED of the port, which corresponds to the failed SCSI port, on? Open the System window from Action menu of Storage Navigator main window and check whether the port status indicator is on.	Check the storage system visually.
3	Is the location of the CHB port correctly understood?	Refer to LOC02-90.
4	Is the status of the FCP corresponding to the failed SCSI path normal?	Check if the FCP is normal by selecting the PCB status in the “Maintenance Utility” window and viewing the statuses of the FCP (see page TRBL04-80).
5	Is the Optical cable connected to the fibre channel board of the server firmly?	Pull out and then insert the cable connector.
6	Is it a problem of the cable?	Replace the cable.
7	Is the SFP of the PCB normal?	SIM: Check if the 21a8 is output. Make sure of the type and status (Short or Long) of the SFP through the CHB information concerned in the “Maintenance Utility” window. Pull out and then inset the SFP.
8	Did not the AL-PA duplicate in the fibre channel?	SIM: Check if the 2190 is output.
9	Is the topology not wrong?	Turn on/off the Fabric setting. Make sure which is adopted, the FC-AL or Point to Point?
10	Is the path from the MPC set correctly?	Check the SCSI path of the port concerned.
11	Is the device defined as the SCSI path normal?	Check the LU status information in the “Maintenance” window.
12	Is the setting of the driver normal?	Check the setting of the driver.
13	Is the HBA normal?	Replace the HBA.
14	Is the fibre channel port correct?	Check the fibre channel information (on page TRBL04-100) of the Monitor.

(To be continued)

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(Continued from the preceding page)

Item	Checkpoint	Check method
15	Are the combinations of PCB types and the equipment to be connected correct?	If the type of PCB is 4HF8, make sure the channel speed of the equipment (HBA, switch, etc) to be connected is not 1 Gbps. *: If the type of PCB is 4HF8, set the host channel speed from any one of 2 Gbps/4 Gbps/8 Gbps since the channel speed of 1G is not supported. If the type of PCB is 2HF16, make sure the channel speed of the equipment (HBA, switch, etc) to be connected is not 1 Gbps/2 Gbps. *: If the type of PCB is 2HF16, set the host channel speed from any one of 4 Gbps/8 Gbps/16 Gbps since the channel speed of 1 Gbps/2 Gbps is not supported. If the type of PCB is 2HS10, make sure the channel speed of the equipment (HBA, switch, etc) to be connected is not 1 Gbps/2 Gbps/4 Gbps/8 Gbps. When the CHB type is 4HF32 with 16 Gbps SFP installed, check that devices for connection such as HBA and switches are not 1 Gbps/2 Gbps/32 Gbps. *: “When the CHB type is 4HF32, the port with 16 Gbps SFP installed does not support 1 Gbps/2 Gbps/32 Gbps for the channel speed. Set the host channel speed at 4 Gbps/8 Gbps/16 Gbps. When the CHB type is 4HF32 and the 32 Gbps SFP is installed on the port, check that devices for connection such as HBA and switches are not 1 Gbps/2 Gbps/4G bps. *: When the CHB type is 4HF32 and the 32 Gbps SFP is installed on the port, 1 Gbps/2 Gbps/4 Gbps are not supported for the channel speed. Set the host channel speed at 8 Gbps/16 Gbps/32 Gbps.

(To be continued)

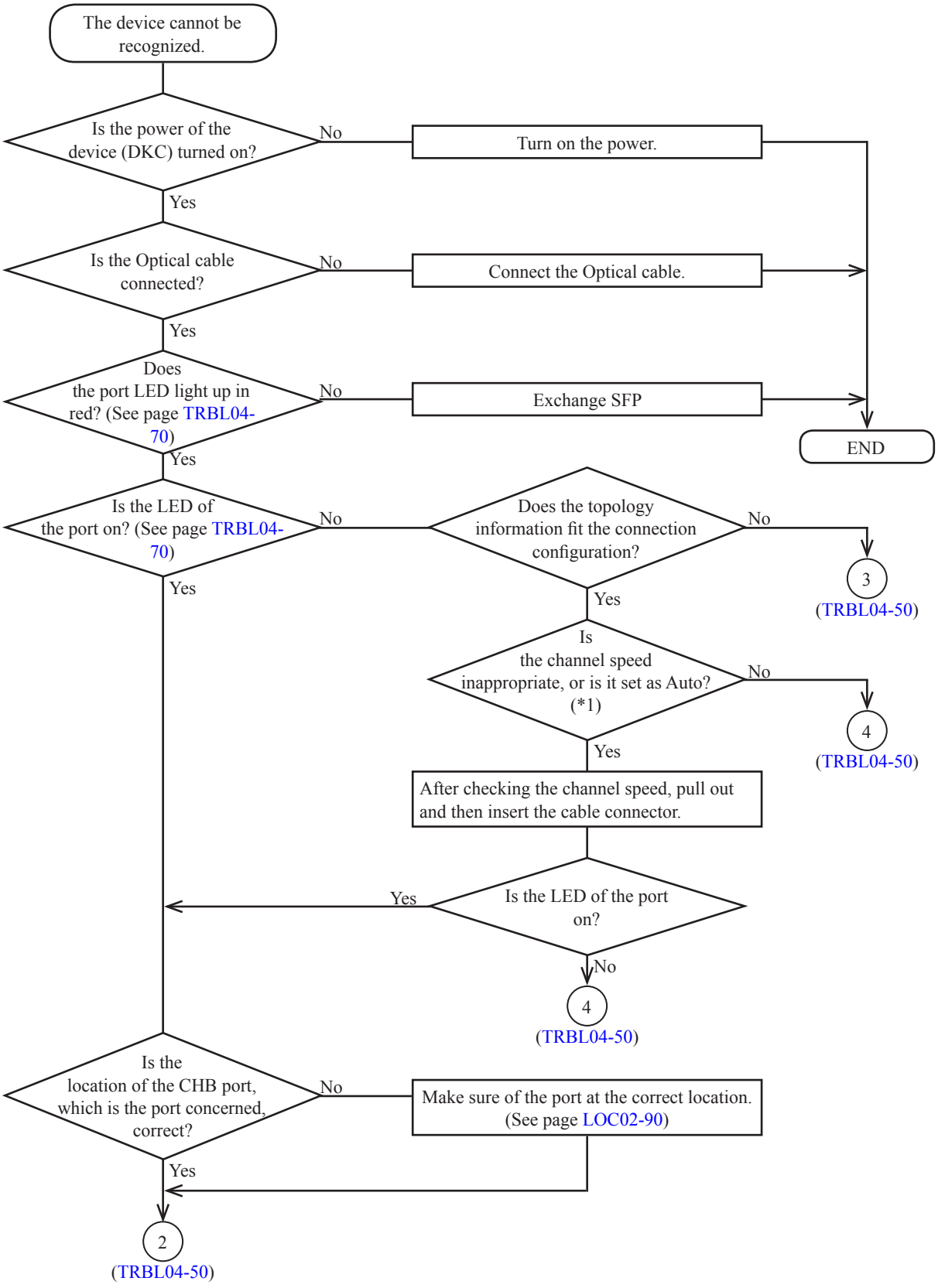
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(Continued from the preceding page)

Item	Checkpoint	Check method
16	Is FC switch normal?	Check if the status of the connection port is Link up. Replace the SFP and the FC cable. Check for a failure on FC switch.
17	Are the settings for FC switch correct?	Check if the topology for FC switch is set to Point to Point. Check if the port speed for FC switch is set to the same as the port speed for DKC.
18	Is the Zoning setting correct?	Check if the WWN of the port on DKC and the WWN of the port on the connected device are set to the same zone. Check if the port on FC switch connected to the port on DKC and the port on FC switch connected to the port on the external device are set to the same zone.

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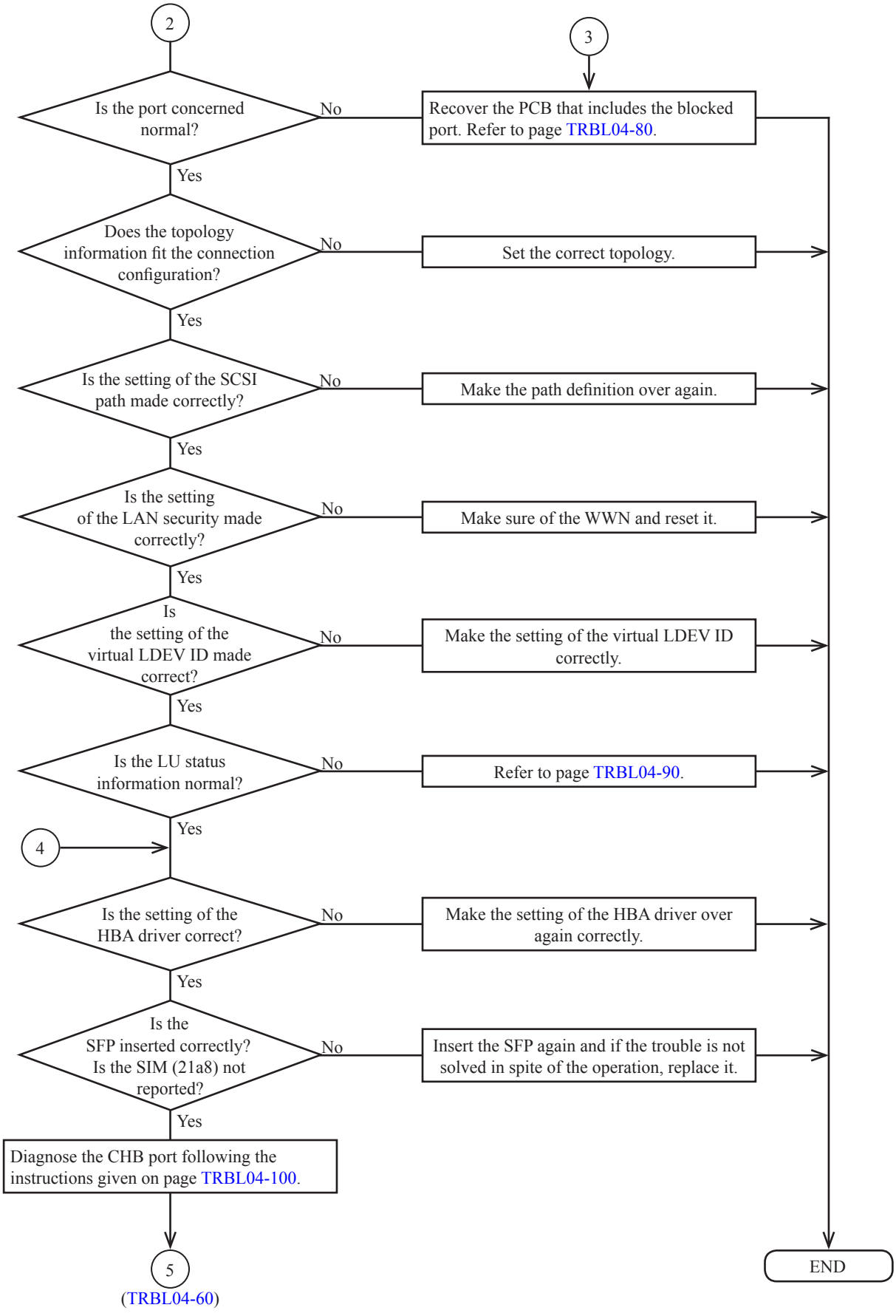
4.1.2 Recovery Procedure When Device Is Not Recognized



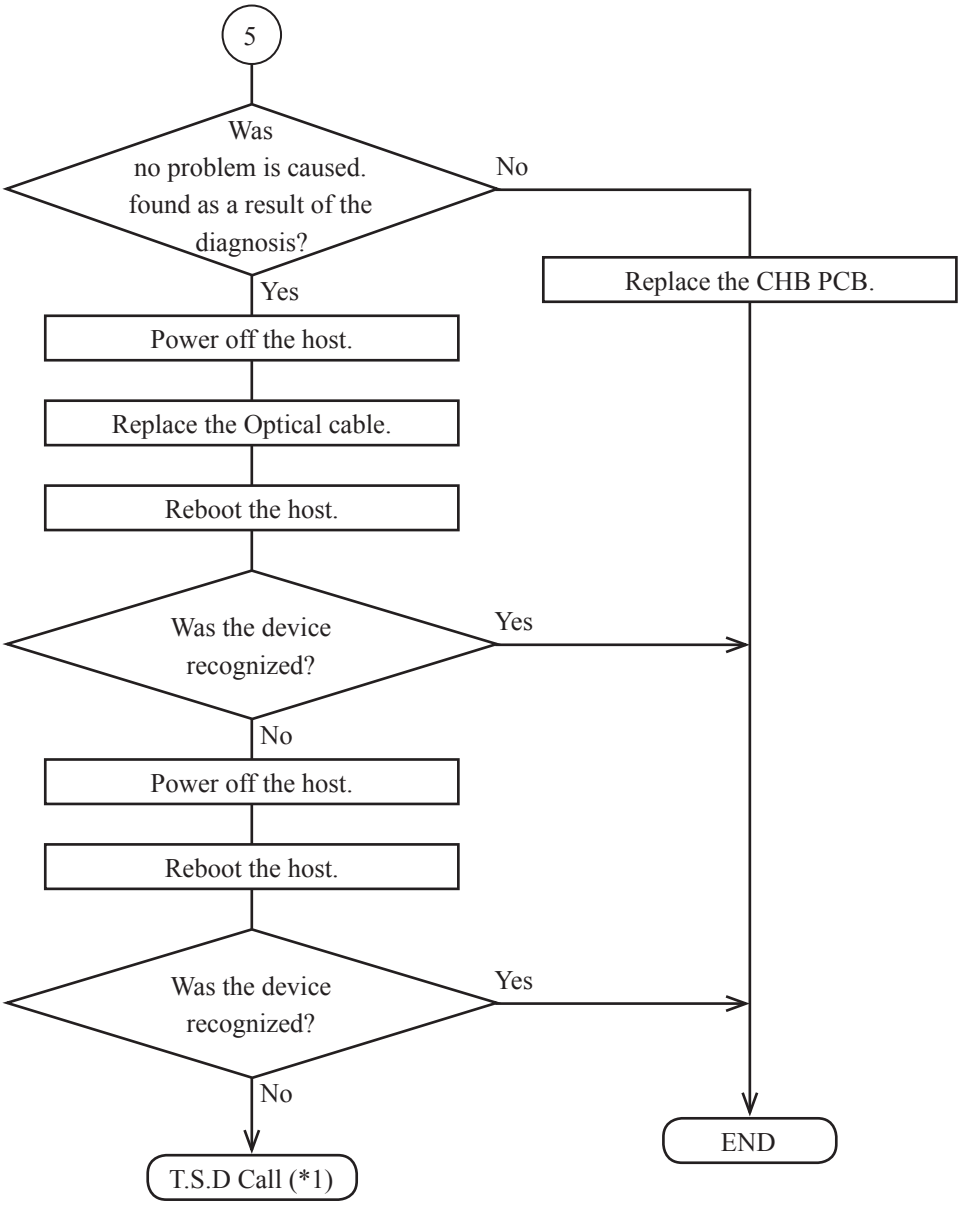
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*1: See Step 15 in "4.1.1.2 Matters must be or desirable to be checked".

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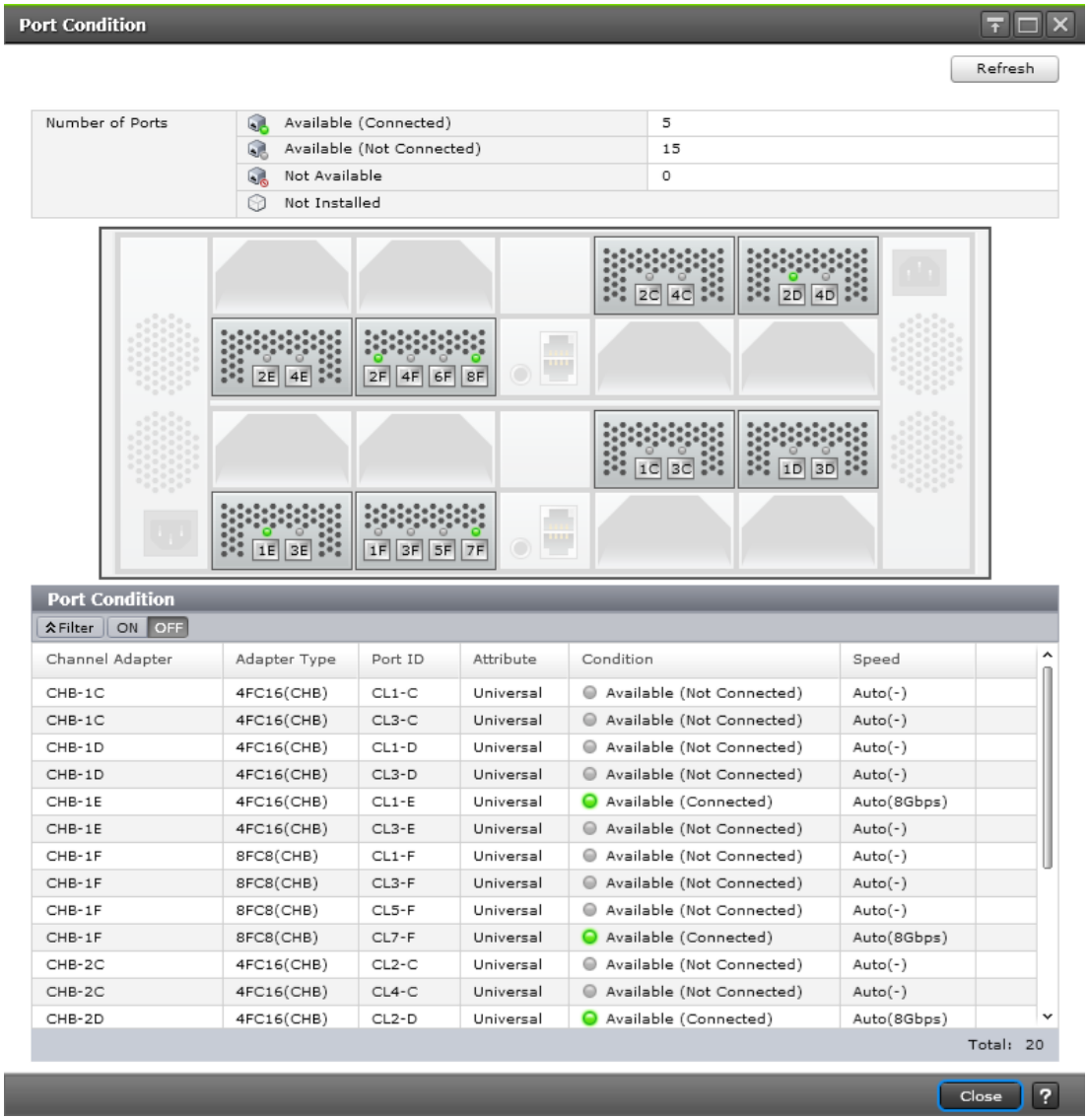


*1: Send the following information to the Technical Support Division (T.S.D.).
- Device configuration of the host
- Version of the OS
- Whether the OS is patched or not
- Version of the driver
- Model number of the fibre channel board
- Dump information on the DKC
- Syslogs and/or Messages
- Logs of software when the alternative path exists
- Fibre channel monitoring information if available

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4.1.3 Procedure for Checking Storage System Port Status

The port information of the destination Storage System is displayed in the “Port Status” window ([Action] – [Component Maintenance] – [View Port Location]) of Web Console.



In the “Port Condition” box, the statuses of the ports are displayed in the image of the practical storage system.

Channel Adapter, Adapter type, Port ID, Attribute and Condition are displayed for the each port.
The statuses of the displays of the port status are explained below.

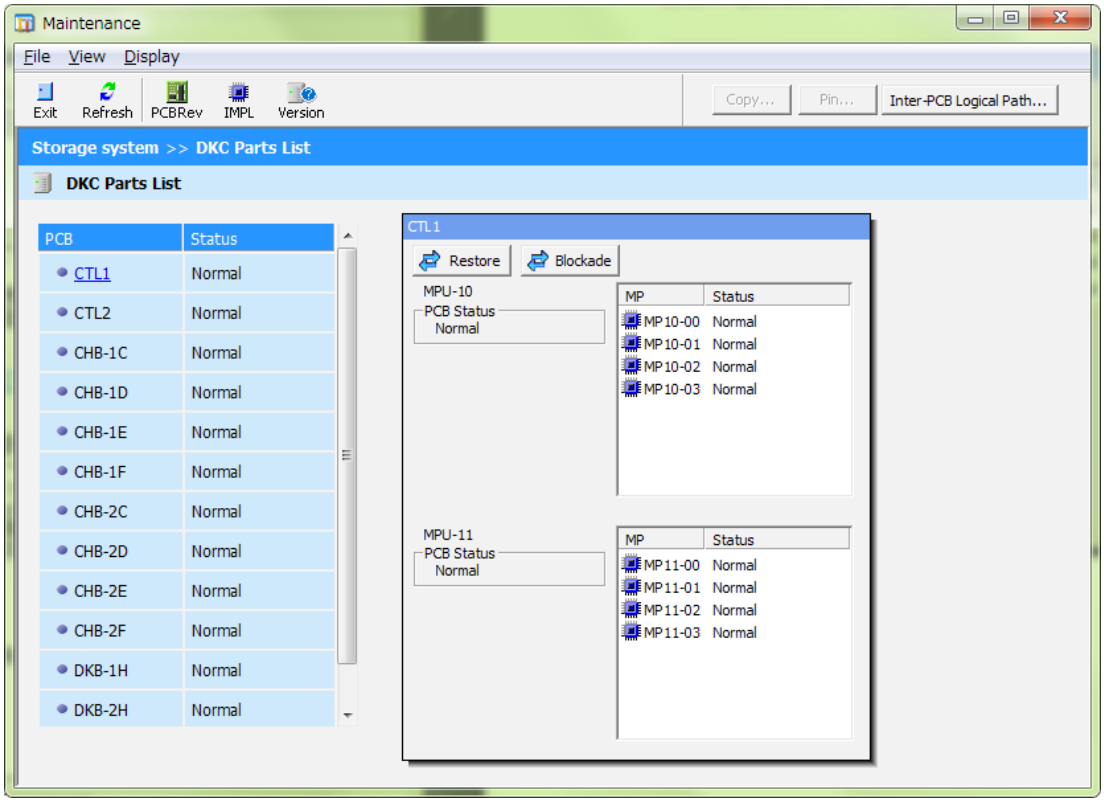
Port Condition	Means
Available (Connected)	The port is installed and in use.
Available (Not Connected)	The port is installed and ready for use.
Not Available	The port is installed and not ready for use (blocked).
Not Installed	The port is not installed or out of use.

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4.1.4 Procedure for Checking Normalcy of the Processor

Select the DKC in the “Maintenance” window, and check the normalcy of the processor in the following window.

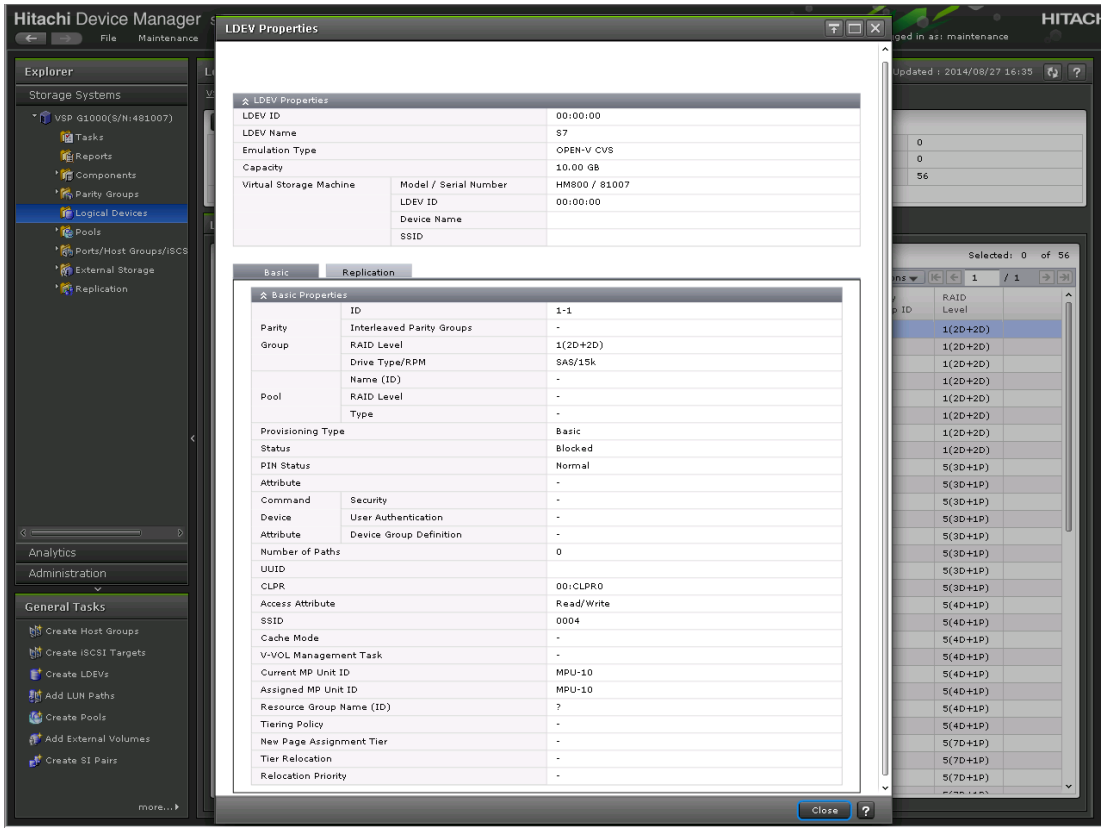
When they are normal, “Normal” is displayed in the Status column as shown below.



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4.1.5 Procedure for Checking LUN Status Information

Select [Logical Device] from the [Storage System] tree on Web Console and display the [LDEVs] tag.
Clicking [LDEV ID] of the reference LDEV displays the detail window information.
Check if the displayed status information is not Blockade or Reserve. If the displayed status is not Normal, it is highly possible that the device cannot be recognized because of the status.
Therefore, call the T.S.D. having the following window attached.



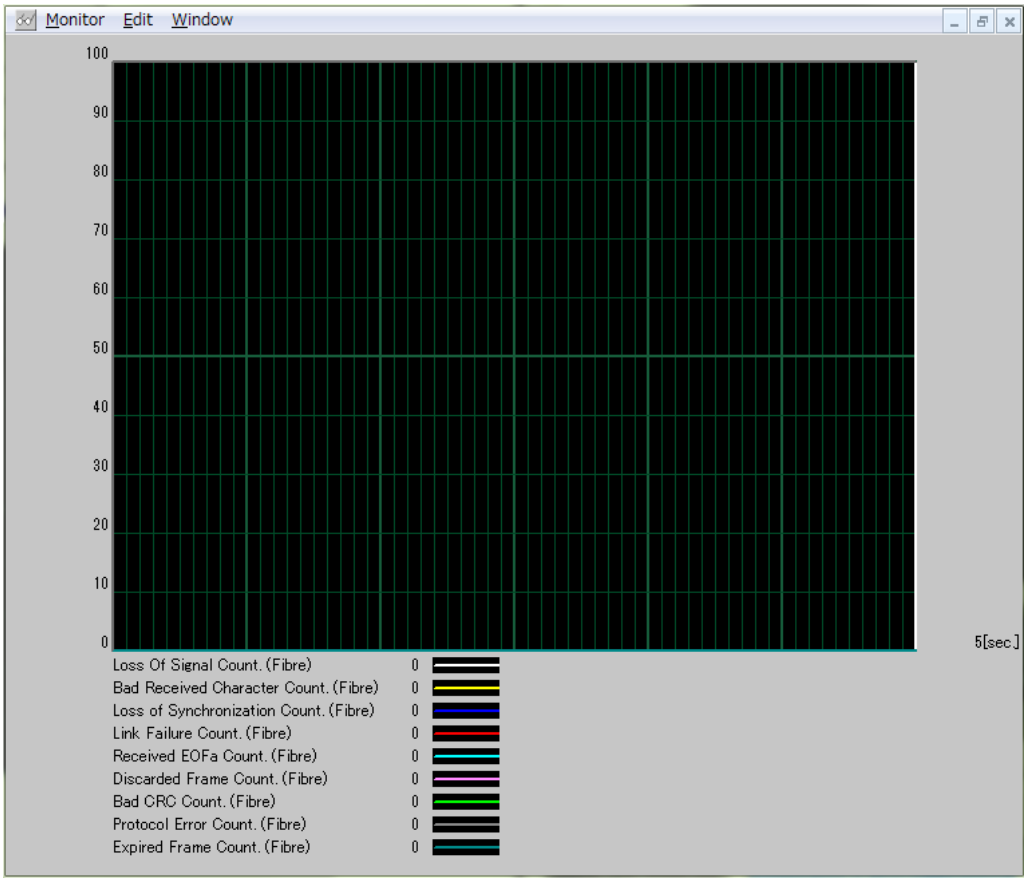
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4.1.6 Isolation Procedure for Fibre Channel Failure

Select the following items in the “MPC Monitor” window and check the counts at the time when the device recognition is executed.
When the count has been made, it is possible that a part of the path concerned has a problem. Therefore, locate the part according to an estimation suggested by the port information.
The counts are displayed at intervals of five seconds.
The counts are not advanced normally, but they are advanced when a link failure occurs or a problem occurs in the storage system port or a connected device.
Locate the failed part according to the actions listed for the count that has been advanced.

If the device cannot be recognized in spite of the locating actions, call the T.S.D.

	Monitor type	Information Monitor
1	Port	Loss of Signal Count (Fibre)
2		Bad Received Character Count (Fibre)
3		Loss of Synchronization Count (Fibre)
4		Link Failure Count (Fibre)
5		Received EOFa Count (Fibre)
6		Discarded Frame Count (Fibre)
7		Bad CRC Count (Fibre)
8		Protocol Error Count (Fibre)
9		Expired Frame Count (Fibre)



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Table 4-2 Table for Locating Part in which a Fibre Channel Failure Occurs

Item	Name	Description	Estimated cause	Actions to be taken
1	Loss Of Signal Count	• This information shows the count of the losses of signals detected by the Fibre I/F controller. (The loss of signal: A state in which the optical input signal cannot be sensed.)	• The optical signal is not output from the connected port. • Break of the connecting cable. • The connecting cable connector is not inserted correctly.	• Check whether the optical signal is emitted from the connected port. • Pulling out and reinsertion of the connecting cable connector. • Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the connecting cable. • Replacement of the CHB PCB.
2	Bad Received Character Count	• This information shows the count of failures in the 8-bit/10-bit conversion. (The failure: A state in which characters cannot be converted.)	• Degradation of the optical signal emitted from the connected port. • Break of the connecting cable. (contact failure) • Imperfect insertion of the connecting cable connector. • Auto Negotiation of the connected port. [2HF16: 4-16 Gbps] [4HF8: 2-8 Gbps] [4HF32 (16 Gbps SFP): 4-16 Gbps] [4HF32 (32 Gbps SFP): 8-32 Gbps] (This is not a problem.) • Pulling out and reinsertion of the cable connector. [2HF16: 4-16 Gbps] [4HF8: 2-8 Gbps] [4HF32 (16 Gbps SFP): 4-16 Gbps] [4HF32 (32 Gbps SFP): 8-32 Gbps] (This is not a problem.) • Reboot or tuning on/off of the host/Switch. (This is not a problem.)	• Pulling out and reinsertion of the connecting cable connector. • Replacement of the connecting cable. • Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the CHB PCB.

(To be continued)

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Item	Name	Description	Estimated cause	Actions to be taken
3	Loss of Synchronization Count	• This information shows the count of failures in the signal synchronization. (The phenomenon: The optical signal can be sensed but no synchronization pattern can be sensed.)	• Degradation of the optical signal emitted from the connected port. • Break of the connecting cable. (contact failure) • Auto Negotiation of the connected port. [2HF16: 4-16 Gbps] [4HF8: 2-8 Gbps] [4HF32 (16 Gbps SFP): 4-16 Gbps] [4HF32 (32 Gbps SFP): 8-32 Gbps] (This is not a problem.) • Pulling out and reinsertion of the cable connector. (This is not a problem.) • Reboot or tuning on/off of the host/Switch. (This is not a problem.)	• Pulling out and reinsertion of the connecting cable connector. • Replacement of the connecting cable. • Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the CHB PCB.
4	Link Failure Count	• This information shows the count of the link failures detected. (The phenomena: The optical signal cannot be sensed, the state, in which the synchronizing pattern cannot be sensed, has lasted longer than 100ms, or the Lip signal cannot be sensed when the loop is constructed. (the protocol on the other port side is abnormal))	• Degradation of the optical signal emitted from the connected port. • Break of the connecting cable. (contact failure) • Imperfect insertion of the connecting cable connector. • Auto Negotiation of the connected port. [2HF16: 4-16 Gbps] [4HF8: 2-8 Gbps] [4HF32 (16 Gbps SFP): 4-16 Gbps] [4HF32 (32 Gbps SFP): 8-32 Gbps] (This is not a problem.) • Pulling out and reinsertion of the cable connector. (This is not a problem.) • Reboot or tuning on/off of the host/Switch. (This is not a problem.)	• Pulling out and reinsertion of the connecting cable connector. • Replacement of the connecting cable. • Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the CHB PCB.

(To be continued)

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Item	Name	Description	Estimated cause	Actions to be taken
5	Received EOFa Count	• This information shows the count of reception of the EOFa's. (The phenomenon: A frame sent from the other port was received but it was invalidated by the delimiter.)	• A problem of the frame output from the host. • A problem of the frame output from the Switch. • A problem of the quality of the signals transmitted between the host and Switch.	• Replacement of the SFP between the HBA and Switch. • Replacement of the cable between the HBA and Switch. • Replacement of the HBA.
6	Discarded Frame Count	• This information shows the count of discard of received frames that were illegal. (The phenomenon: A frame sent from the other port was received but it was invalid.)	• A problem of the quality of the signals transmitted between the host and Switch. • A problem of the frame output from the host. • A problem of the frame output from the Switch.	• An amount of flowing data between the host and Switch differs from that between the Switch and DKC. Reduce the amount of data that flows into the Switch.
7	Bad CRC Count	• This information shows the count of frames, in which the CRC errors occurred when the valid EOF's were received. (The phenomenon: A CRC error occurred in the frame received from the other port.)	• A problem of the quality of the signals transmitted between the host and Switch. • A problem of the frame output from the host. • A problem of the frame output from the Switch.	• Pulling out and reinsertion of the connecting cable. • Replacement of the connecting cable. • Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the CHB PCB.
8	Protocol Error Count	• This information shows the count of reception of the LRRs at the times of the linking up. • (The phenomena: A protocol error in the communication with the other port or reception of a unexpected sequence in the linking up sequence.)	• A problem of the timing in the sequence of the linking up with the connected port. (This is not a problem if the linking up can be done.)	• Replacement of the SFP of the Switch. • Replacement of the HBA. • Replacement of the SFP of the CHB PCB. • Replacement of the CHB PCB.

(To be continued)

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Item	Name	Description	Estimated cause	Actions to be taken
9	Expired Frame Count	• This information shows the count of frames each of which was discarded because a state in which it could not be sent lasted so long that the retention expired. (The state was such that the frame was waiting for the R-RDY of the other port.)	• A problem of the quality of the signals transmitted between the host and Switch. • A problem of the frame output from the host. • A problem of the frame output from the Switch.	• Replacement of the SFP between the HBA and Switch. • Replacement of the cable between the HBA and Switch. • Replacement of the HBA. • An examination of the host/Switch. (An inquiry of the manufacturer.)

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4.2 Pinned track recovery

4.2.1 Pinned Tracks

A pinned track may occur triggered by a hardware failure.
This section explains the pinned track and indicates the recovery procedure.
The following notifies the occurrence of the pinned track.

- Report of the Permanent Data Check failure
- Continuous report of CHK2 in the same track
- SIM report of the failure track (pinned track) occurrence

SIM REF.CODE	Meaning	Comment
ef4xyy	Unable to write to PDEV on a track.	x : CU number (*1) yy : LDEV number
ff4xyy	Unable to read from cache on a track.	
ef5xyy	Unable to write a track to a device in the external Storage System.	
ff5xyy	Unable to read a track from a device in the external Storage System.	

*1: CU number is detected only lower figure in SIM-RC (x‘0’ - x‘f’).
For additional information, see [Error Location] of [Content SIM] in “[2] SIM Log” in MAINTENANCE PC SECTION “5.3.1 Log Indication”.

To recover pinned tracks, the following information about the pinned track to be recovered are necessary.

- Address in LDEV (LDEV number)
- First and last LBA of stripe including the pinned track (*1)
- Error type of the pinned track
- PDEV number including the pinned track

These information can be obtained by MAINTENANCE PC SECTION “5.13.3 Pin Data Indication”.

*1: LBA : Logical Block Address

Following explains the error types of pinned tracks and shows reference for recovery. For the volumes other than the following, refer to “4.2.2 Error Types”.

Pinned Tracks Volume	References
TrueCopy Volume	“6.2 Pinned Track Recovery Procedure for TrueCopy”
UR Data Volume or Journal Volume	“7.4 Procedure for UR Pinned Track Recovery and Journal Volume Replacement”
Thin Image Pool Volume	“8.7 Recovery Procedure for Thin Image pool-VOL Failure”
global-active device pair volume or Quorum disk volume	“18.1.4 Recovery Procedure of the Pinned Track in the GAD Environment”

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4.2.2 Error Types

Pinned track has 7 error types as follows.

Display on MPC		Meaning	Cause	Recovery method
Slot	Reason			
–	Write Error	Unable to write to PDEV.	Drive error	"4.2.2.2 Write Error"
DATA	ECC/LRC Error	Unable to read from Cache. (Data slot except CMPD, Meta and FPTD)	Cache error	"4.2.2.1 ECC/LRC Error"
PRTY	ECC/LRC Error	Unable to generate parity.	Cache error	–
CMPD (*1)	ECC/LRC Error	Unable to read from Cache. ("compressed/deduplicated data" in LDEVs with Capacity Saving enabled)	Cache error	Specify the failed LBA using the failed LBA output tool before performing ECC/ LRC Error Recovery Processing. (See "4.2.3.10 Using Failed LBA Output Tool")
Meta (*1)	ECC/LRC Error	Unable to read from Cache. (Metadata in LDEVs with Capacity Saving enabled)	Cache error	Perform either of the following: • LDEV format on LDEVs with Capacity Saving enabled. (See "Provisioning Guide".) • Specify deduplication system data volumes from Storage Navigator and perform the LDEV format on them. (See "Provisioning Guide".) (*3)
FPTD (*2)	ECC/LRC Error	Unable to read from Cache. (Deduplication system data volumes)	Cache error	Specify deduplication system data volumes from Storage Navigator and perform the LDEV format on them. (See "Provisioning Guide".) (*3)
DATA	External VOL Write Error	Unable to write to a device in the external Storage System.	Device failure of external Storage System	"4.2.2.3 External VOL Write Error"
DATA	External VOL Read Error	Unable to read from a device in the external Storage System.	Device failure of external Storage System	"4.2.2.4 External VOL Read Error"

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*1: Only LDEVs with Capacity Saving enabled.
*2: Only LDEVs with Deduplication System Data Volume enabled.
*3: For Command Control Interface, use the [raidcom initialize pool] command instead of the LDEV format on the deduplication system data volumes.

The following document explains each error type of the pinned track and shows the recovery flow chart for the ECC/LRC Error in the OPEN-VOL and for the External VOL Read Error of the external Storage System device.
For UR data volumes or journal volumes, the flowcharts for recovery are shown in “7.4 Procedure for UR Pinned Track Recovery and Journal Volume Replacement”.
For Pool volumes of Thin Image, the flowcharts for recovery are shown in “8.7 Recovery Procedure for Thin Image pool-VOL Failure”.

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4.2.2.1 ECC/LRC Error

Cause

- An ECC/LRC type of a pinned track occurs when a CHK2 error occurs during data transfer between cache and channel, or between cache and drive. If it is a temporary error, such as transfer timeout, the error may be recovered and the PIN may be deleted by retrying the operation. When the retry operation fails because the track is the dirty data, Permanent Data Check may occur, and data will be lost. The host has to reconstruct the data using the backup file etc.
- An ECC/LRC type of a pinned track occurs when the host failed to write data to the cache due to the failures in two or more drives (In RAID6, 3 or more drives). If it is a temporary failure, the PIN may be deleted when the host retries the operation. However, data check will be reported to the host.
- When a parity track cannot be created due to a drive failure etc., an ECC/LRC type of a pinned track occurs, and only the data will be destaged. The ECC/LRC type of a pinned track will be recovered when the entire stripe is written.
- When the data cannot be read from the source drive during correction copy, the target track cannot be recovered. As a result, the track will become an ECC/LRC pinned track. This will lead to Permanent Data Check, and the original data will be lost.
- This error occurs when the emergency destage, which is performed because of a cache failure or a cache maintenance operation or P/S OFF, failed due to TOV etc., and the error could not be recovered despite retrying. If the error occurs when the power is being turned off (P/S OFF), the power will be turned off while the dirty data is still stored in the cache. The data will be retained by the battery. The emergency destage will be performed again when the power is turned on (P/S ON), and the pinned track will be recovered.

Result of host I/O operation

When a track with an ECC/LRC Error is accessed, the result of the host I/O operation is as follows;

- If the read in the track is possible, the host I/O operation ends normally.
- If it isn't possible to read a track, "(03)h: Medium Error" or "(0b)h: Abort" to I/O operation is reported to the host. In this case, data is lost.

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Recovery Method

A track with ECC/LRC Error means that the original data for the track may be lost. Therefore, we recommend to a customer that a recovery of the data for the track with ECC/LRC Error in the OPEN-VOL should be performed from a backup file etc.
A recovery method for the track with ECC/LRC Error in the OPEN-VOL is as follows;

1. It change into the state that I/O is not issued from connection server.
   (It changes into the state that there is not a process/JOB on a server. Details apply to the procedure of each servers side.)
2. Check whether a blocked CHB part exists or not. Restore a blocked CHB part if it exist.
3. Obtains the LDKC number and the CU-LDEV number which the pinned track occurred by MAINTENANCE PC SECTION "5.13.3 Pin Data Indication" and the head and the last LBAs of the pinned track.
4. Executes the "showrel" tool and examine the relation in fault LDEV and the device which the file system recognizes.
5. Checks a volume on the file system which is composed of the device and also checks data in the volume. (Using the command like sum)
6. Requests the customer the recovery of the data with "I/O error" or "read error" from a backup file, etc.
7. Confirms pinned track information by MAINTENANCE PC SECTION "5.13.3 Pin Data Indication". If there is not a display of the pinned track and the system test result is normal, the recovery is ended.
   If a new pinned track occurs, back to the process of hard error recovery.
8. If an old pinned track display is left, executes the Pin Track Tool.
9. For the "slot:PRTY" display, the Pin Track Tool isn't necessary.
   It is automatically recovered when the pinned track of the "slot:DATA" display is recovered.
10. If MAINTENANCE PC SECTION "5.13.3 Pin Data Indication" doesn't indicate LBAs of pinned track, this indicates that a pinned track occurred OPEN-VOL other than the user area.

    In the case of other than DP volumes, perform the following:
    • Back up the data, and then execute the PIN deletion by the LDEV formatting.

    In the case of DP volumes, perform the following:
    [When Capacity Saving is disabled]
    Execute the "3.52.2 Reclaiming the Control Pages Inside the DP-VOL".

    [When only Compression of Capacity Saving is enabled]
    Back up the data, and then execute the PIN deletion by the LDEV formatting.

    [When Compression and Deduplication of Capacity Saving are enabled]
    → Go to [A] (TRBL21-10)

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4.2.2.2 Write Error

Cause

Write Error type of a pinned track is caused when the data de-staging process to the PDEV failed due to a drive failure. When a drive failure occurs, the drive itself and the DKC perform the following recovery procedure. A write Error occurs when the following recovery procedure failed.

- Medium failure : Automatic reallocation of alternate sector.
- Other failure : Alternate path retry.

Write Error count information per PDEV is stored in DKC. When a Write Error count exceeds the threshold value, the PDEV is blocked. One PDEV blocked per parity group will not stop the DKC operation to the parity group. When a track with Write Error is accessed by the host after the PDEV is blocked, the Write Error status will reset.

Result of host I/O operation

Any access to a track with Write Error will be successful.

Recovery Method

The PDEV containing a track with Write Error is replaced. At this time, if the blocked PDEV already exist within the parity group, first replace the blocked PDEV which already exists. Next, replace the PDEV containing a track with Write Error. Also, if there are many PDEVs containing a track with Write Error, check the ORM Display on the MPC Panel, then replace the PDEV with the Highest Error Rate. A track with Write Error is recovered by a correction copy.

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4.2.2.3 External VOL Write Error

Cause

When write processing is performed for a device in an external Storage System and Check Condition (Medium Error) is received due to a Drive failure of the external Storage System, External VOL Write Error is set.

Recovery Method

Recover the external Storage System, and then perform either of the following procedures.

- Perform dummy replacement of the Controller Board.
- Set the System Option Mode 833 to ON, and then set it to OFF after disconnecting the external volume. When disconnecting the external volume, if the LDEV created from the target external volume is defined in the DP pool, all the DP volumes created from the corresponding DP pool need to be blocked in advance.

NOTE: After recovering the device in the external Storage System, you can remove pinned track of the external devices by writing I/O from the host. However, please note that the customer data stored in external devices is destroyed. Because the data will be overwritten by the I/O.

4.2.2.4 External VOL Read Error

Cause

When read processing from the device in the external Storage System is performed, and Check Condition (Medium Error) is received due to a Drive failure in the external Storage System, External VOL Read Error is set.

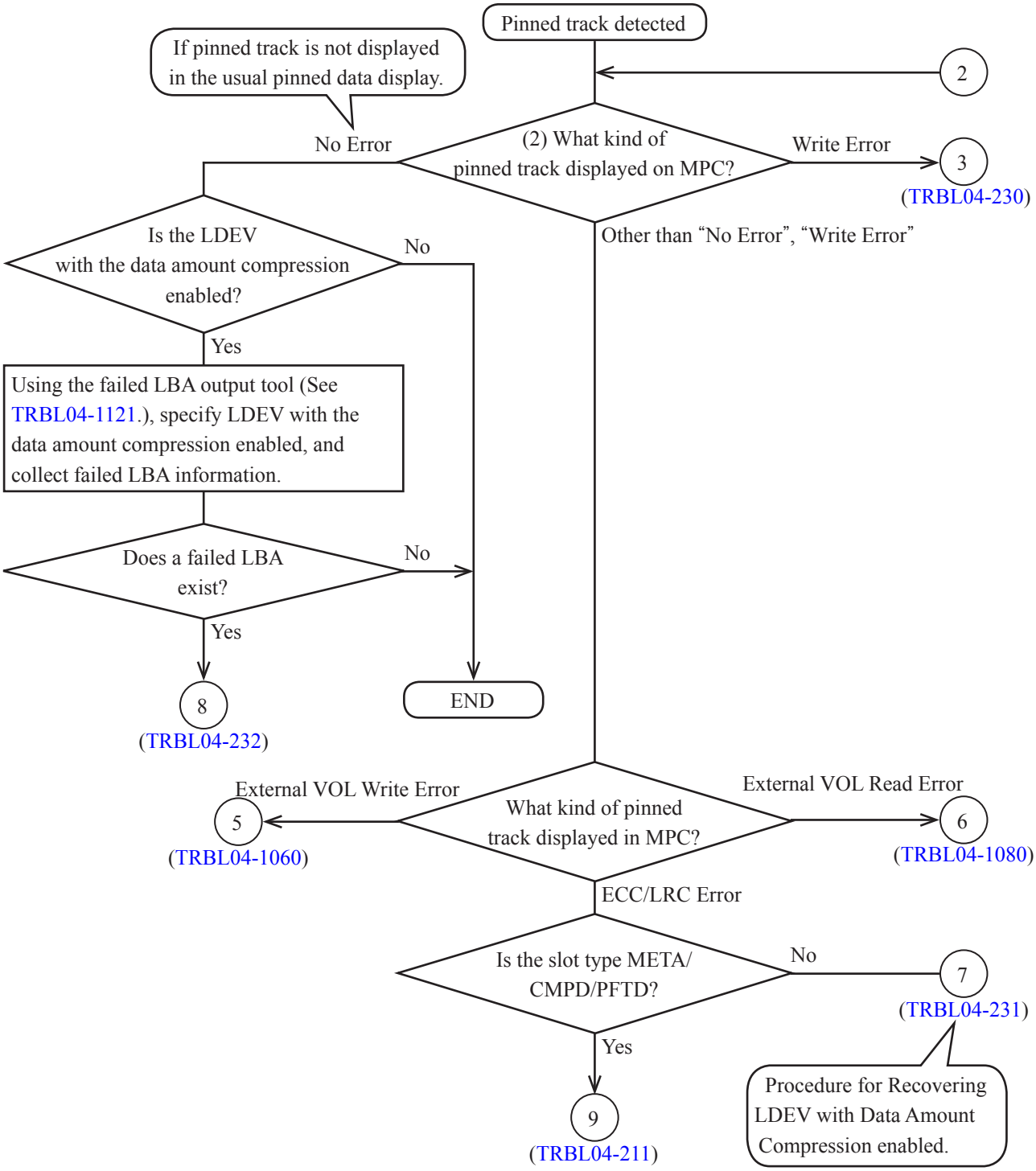
Recovery Method

After recovering the device in the external Storage System, perform a dummy replacement of the Controller Board.

NOTE: After recovering the device in the external Storage System you can remove pinned track of the external devices by writing I/O from the host. However, please note that the customer data stored in external devices is destroyed. Because the data will be overwritten by the I/O.

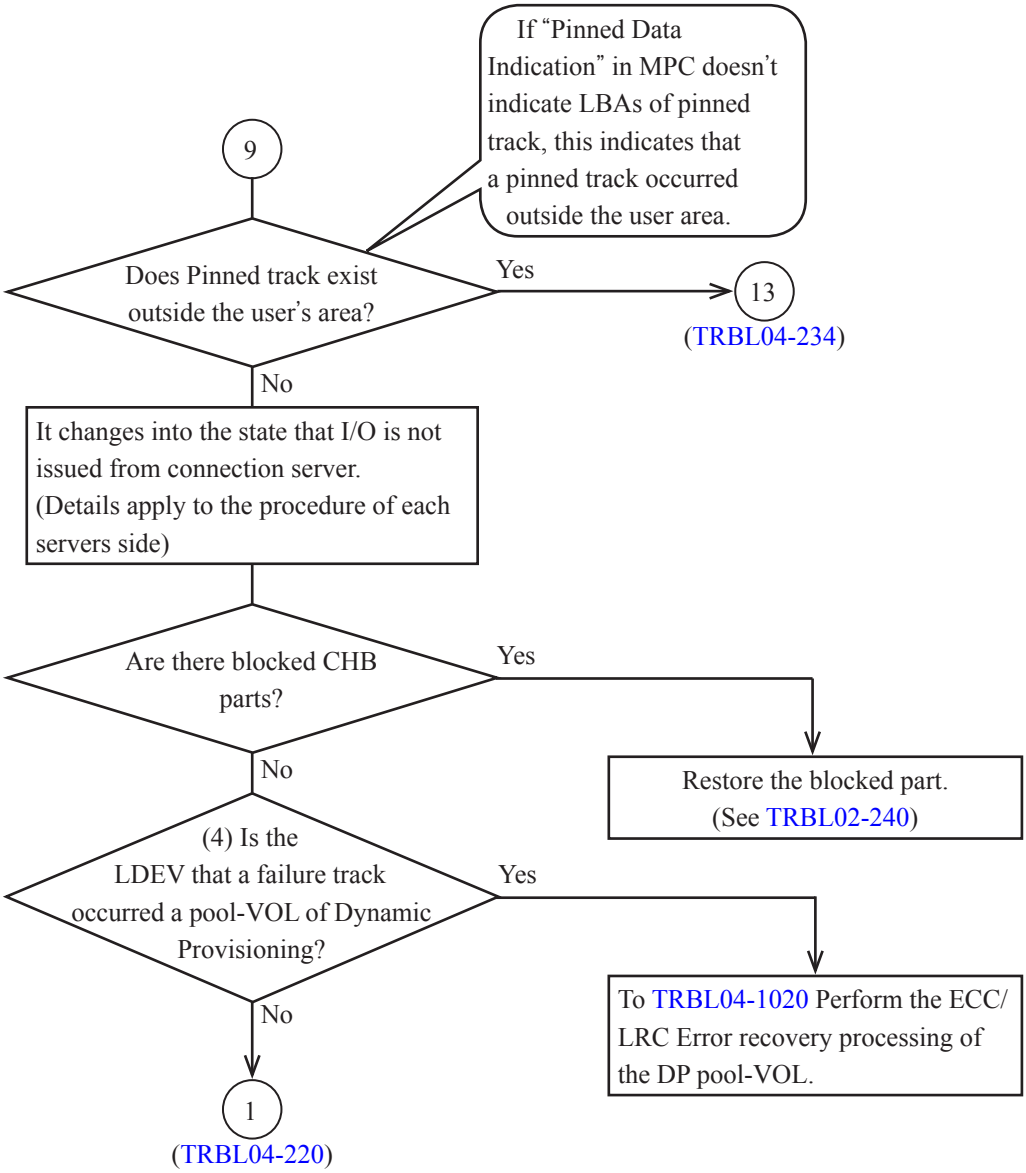
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4.2.3 Procedure for Erasing Pinned Track

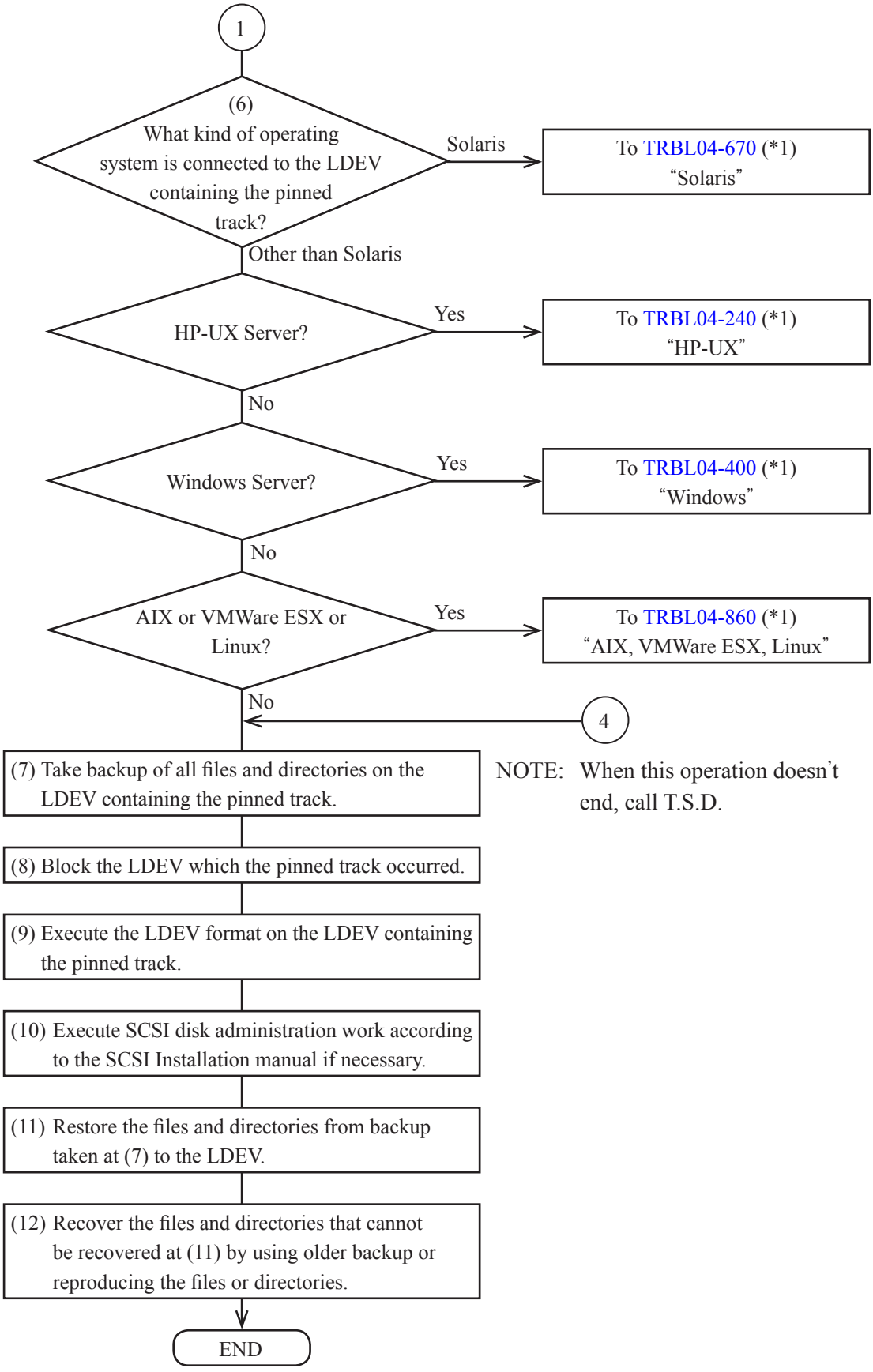


NOTE: If you want to use the tool in this page, confirm to the technical support division about using this tool.
If operating system is not Solaris, HP-UX, Windows, AIX, and VMWare ESX, Linux a procedure peculiar to the operating system does not exist.

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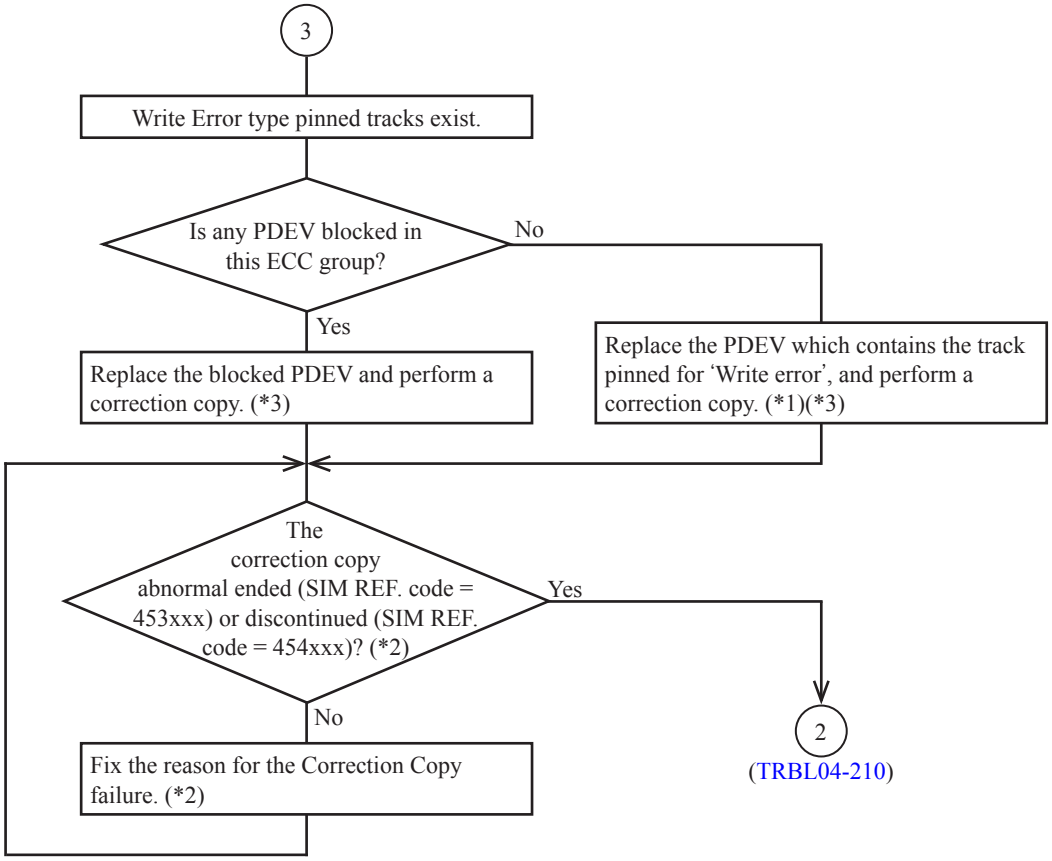


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*1: If the Pinned track is not erased by these actions, please start recovery action from ④.

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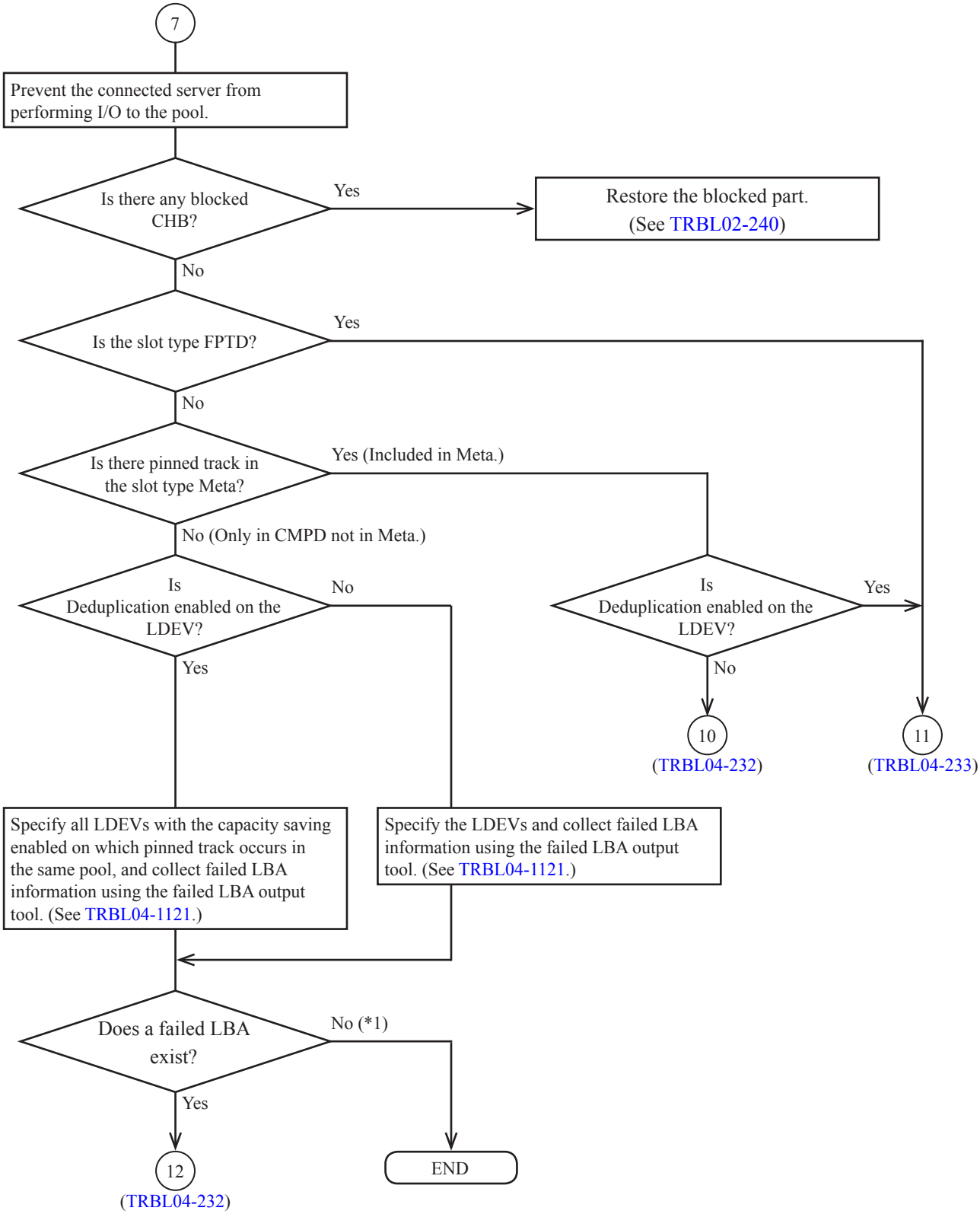


*1: If spare drives are available, you can perform Drive copy instead of Correction copy.

*2: When executing the Drive copy, the SIM REF. code for abnormal termination is 463xxx and that for suspension is 464xxx.

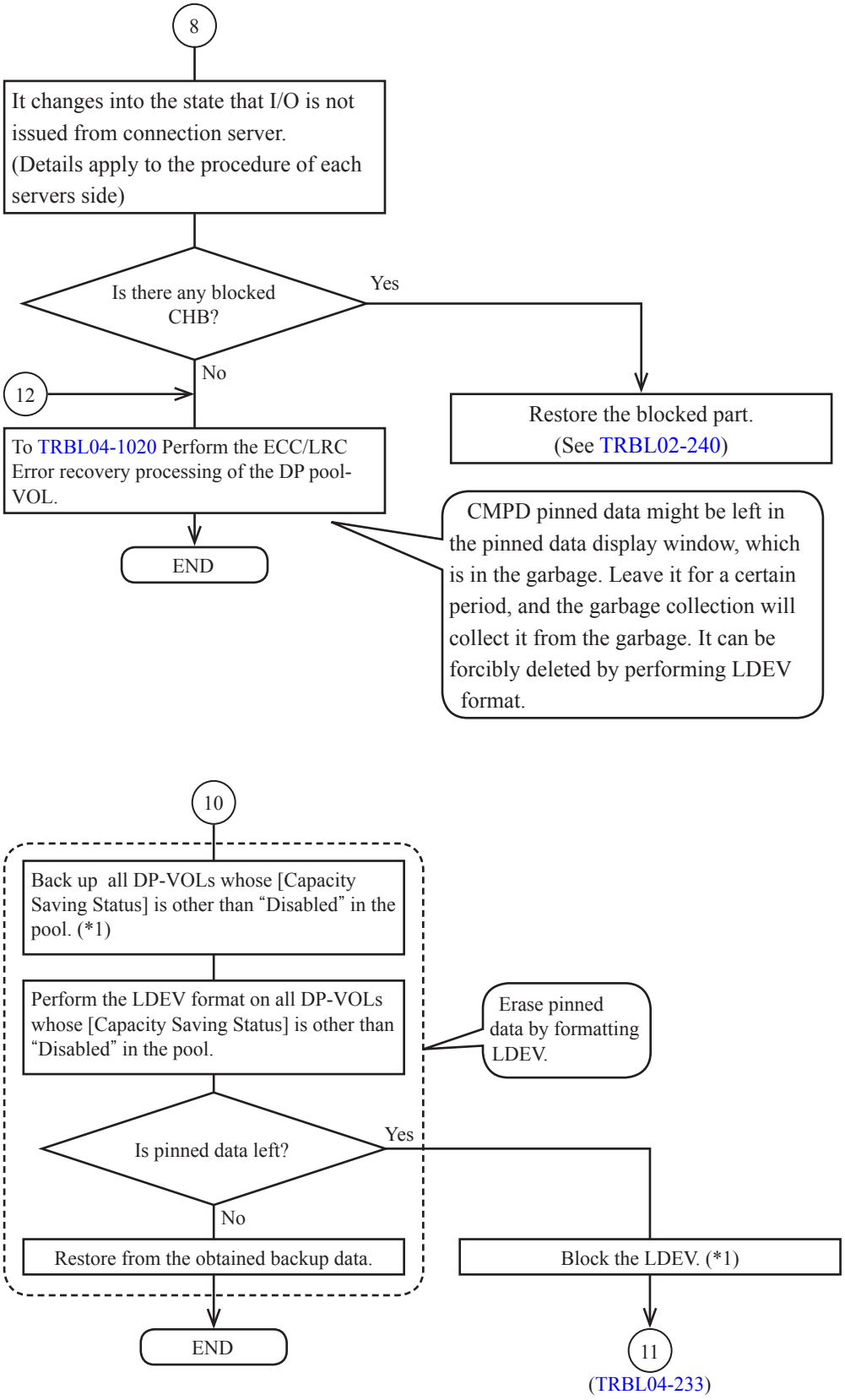
*3: If only "30762-208312" is output as error code when PDEV replacement fails, check the box for "Forcibly run without safety checks" in "(5) <Block Drive>", step 3, "2.3.1 Before Replacing Drive", REPLACEMENT SECTION, and then replace the PDEV again.

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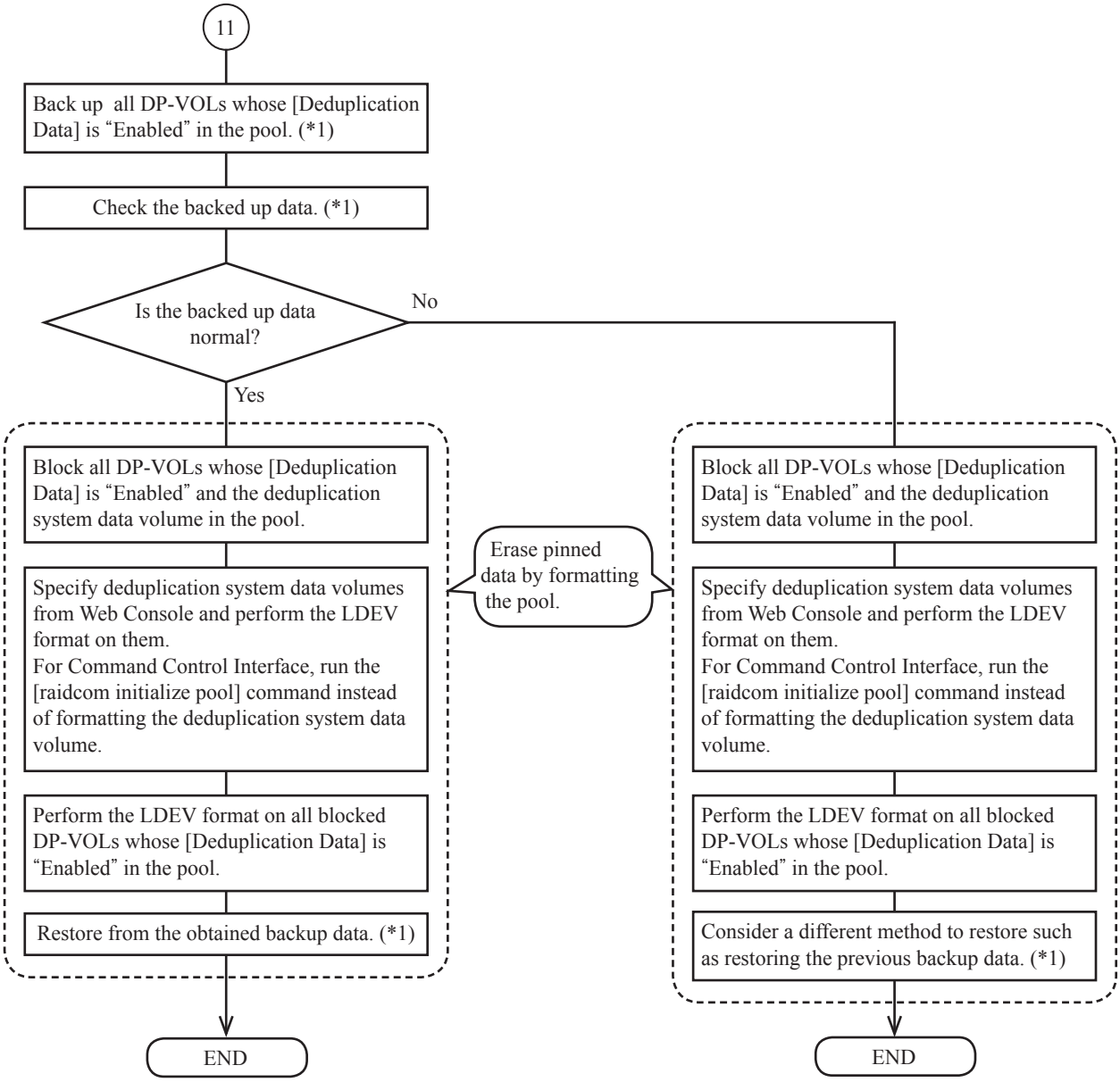
*1: CMPD pinned data might be left in the“Pinned Track” window after the ECC/LRC error recovery processing is performed. But the customer data is not affected unless failed LBA is detected by using the “Failed LBA output tool”. In a certain period of time, it is removed by the garbage collection. It can be forcibly removed by performing the LDEV format.

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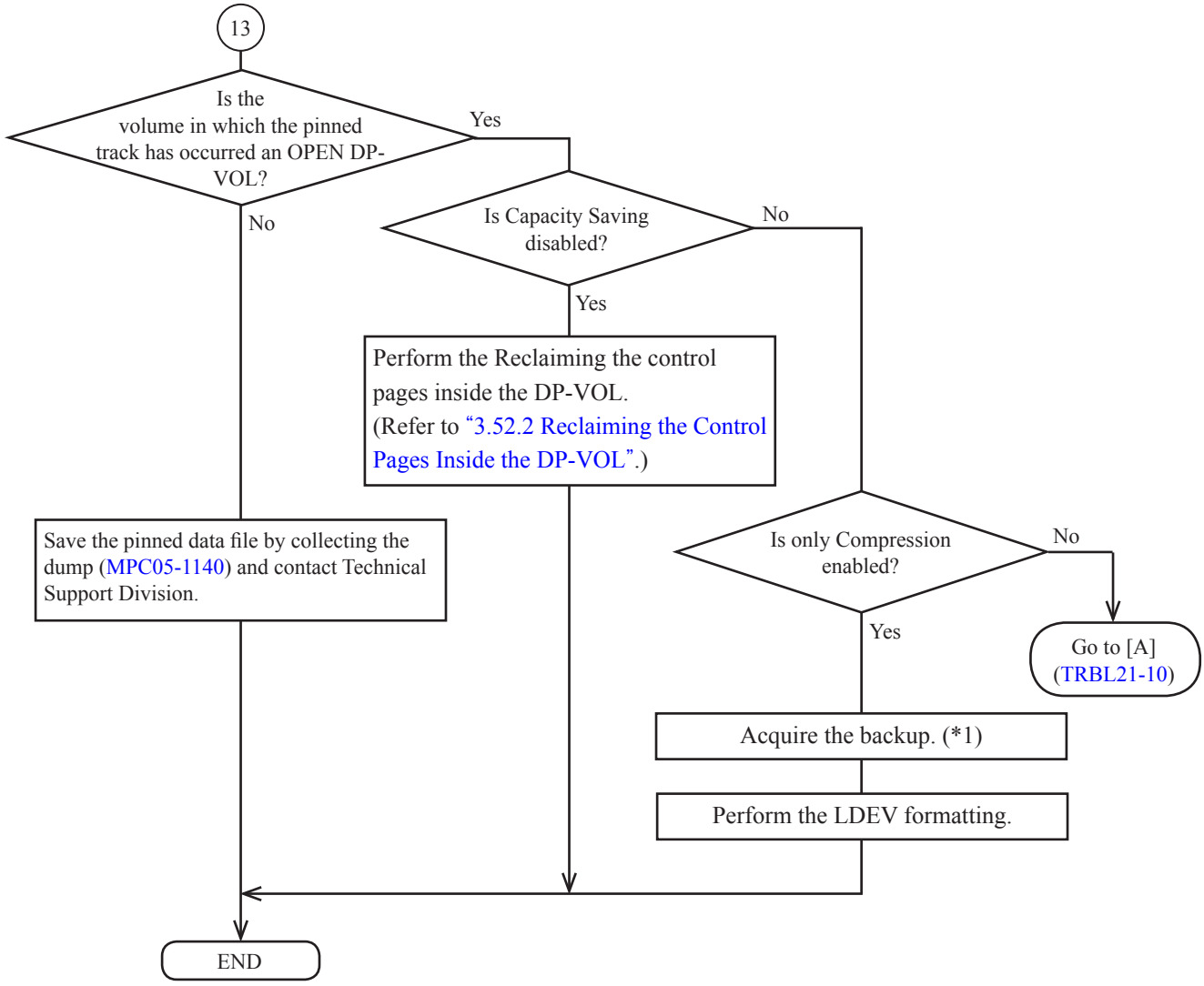
*1: Ask the SE or user to perform the operation.

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*1: Ask the SE or user to perform the operation.

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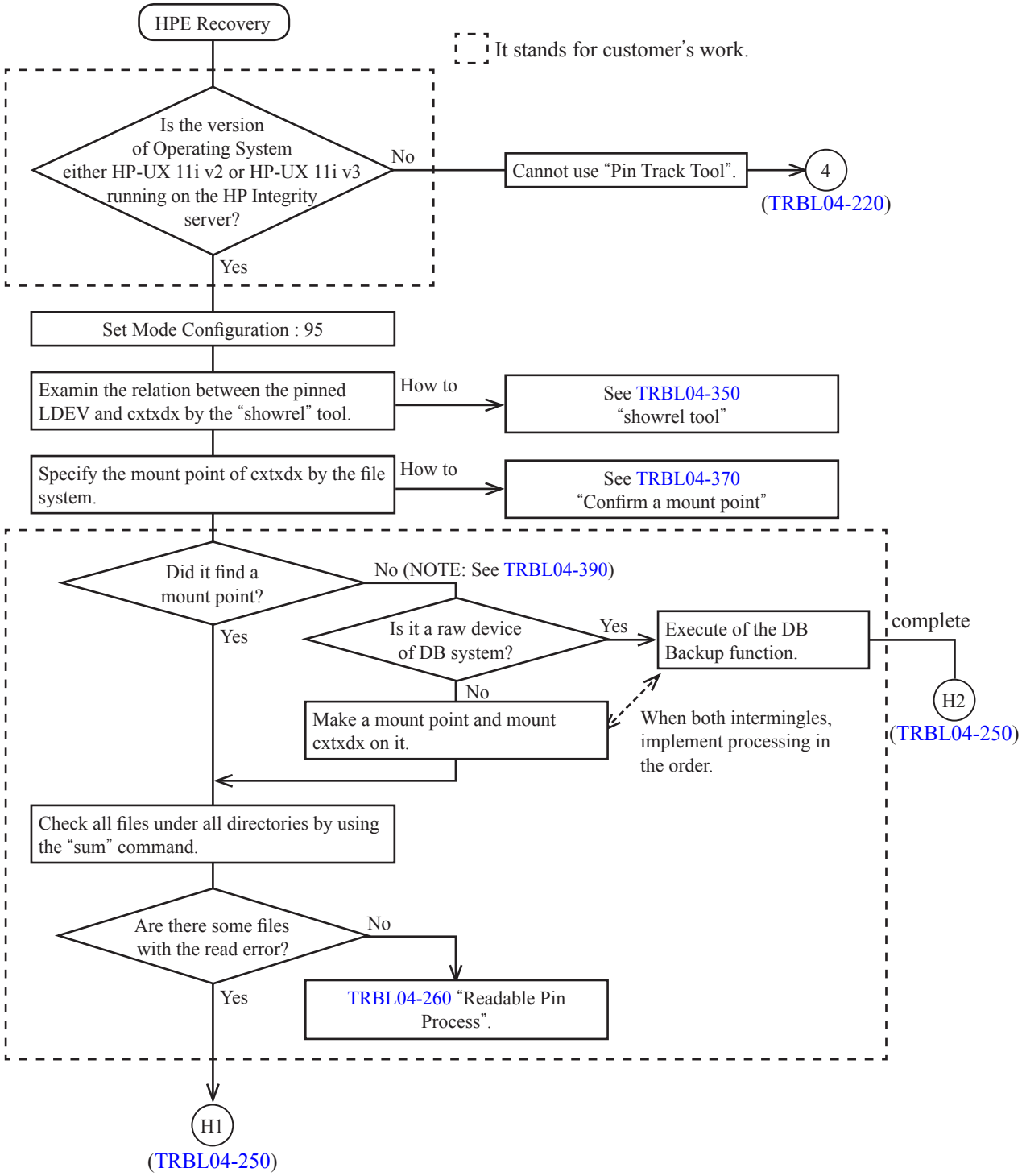
*1: Ask the SE or user to perform the operation.

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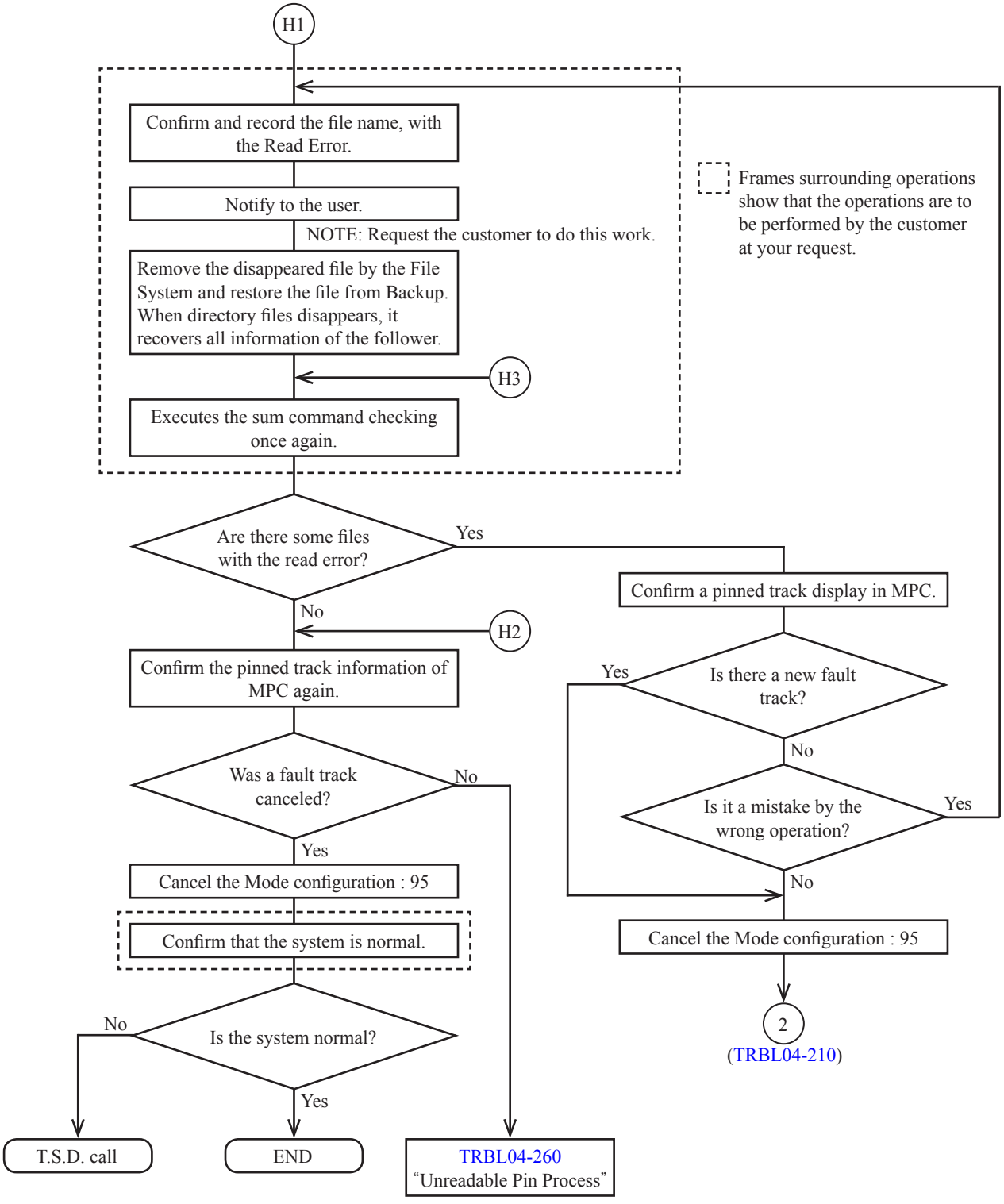
4.2.3.1 HP-UX Procedure

This chapter shows the pinned track erasing flow about the HP-UX system.

Procedure Flow



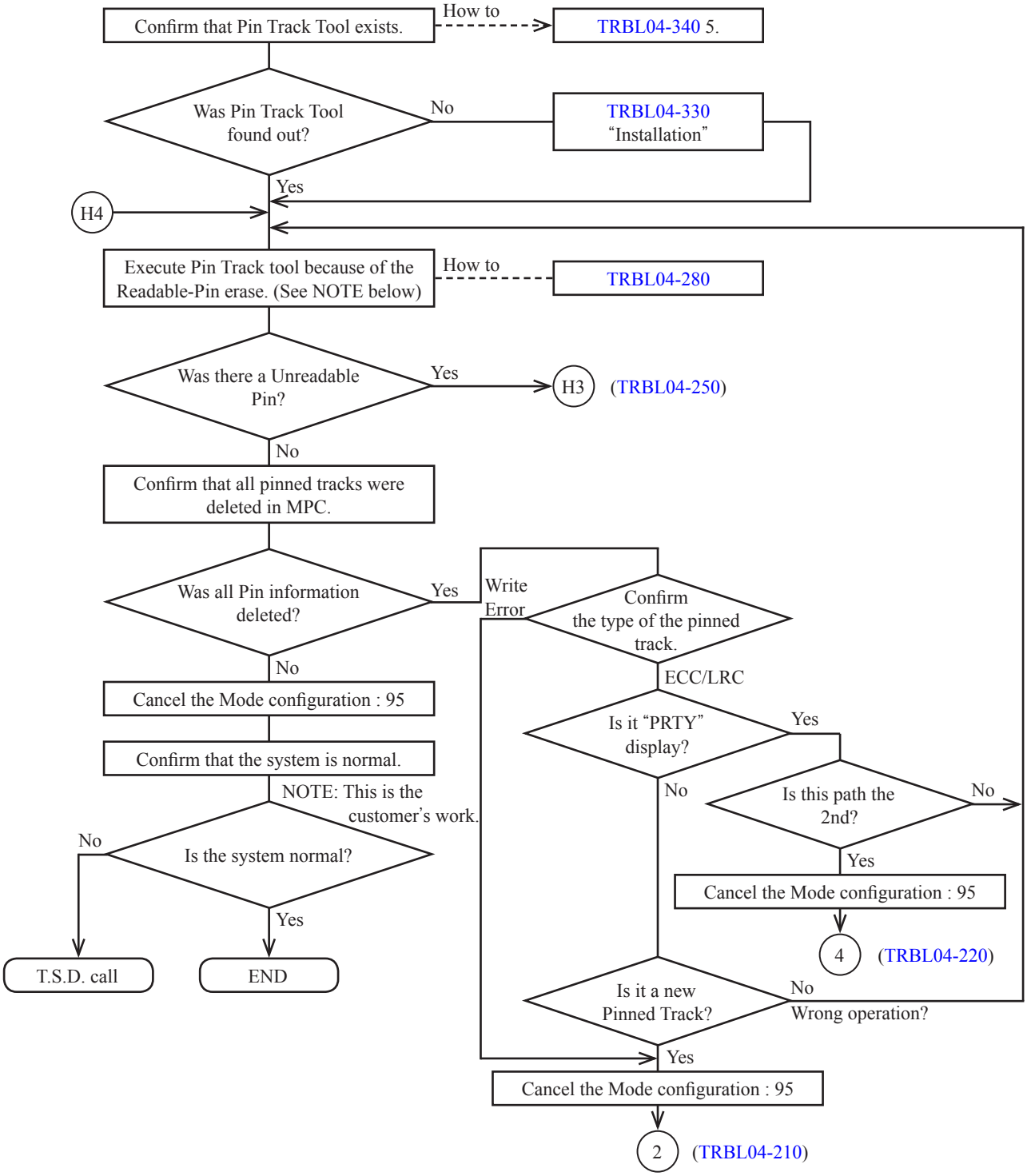
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Readable Pin Process

The erasing flow in the readable pinned track by Pin Track Tool is as follows.

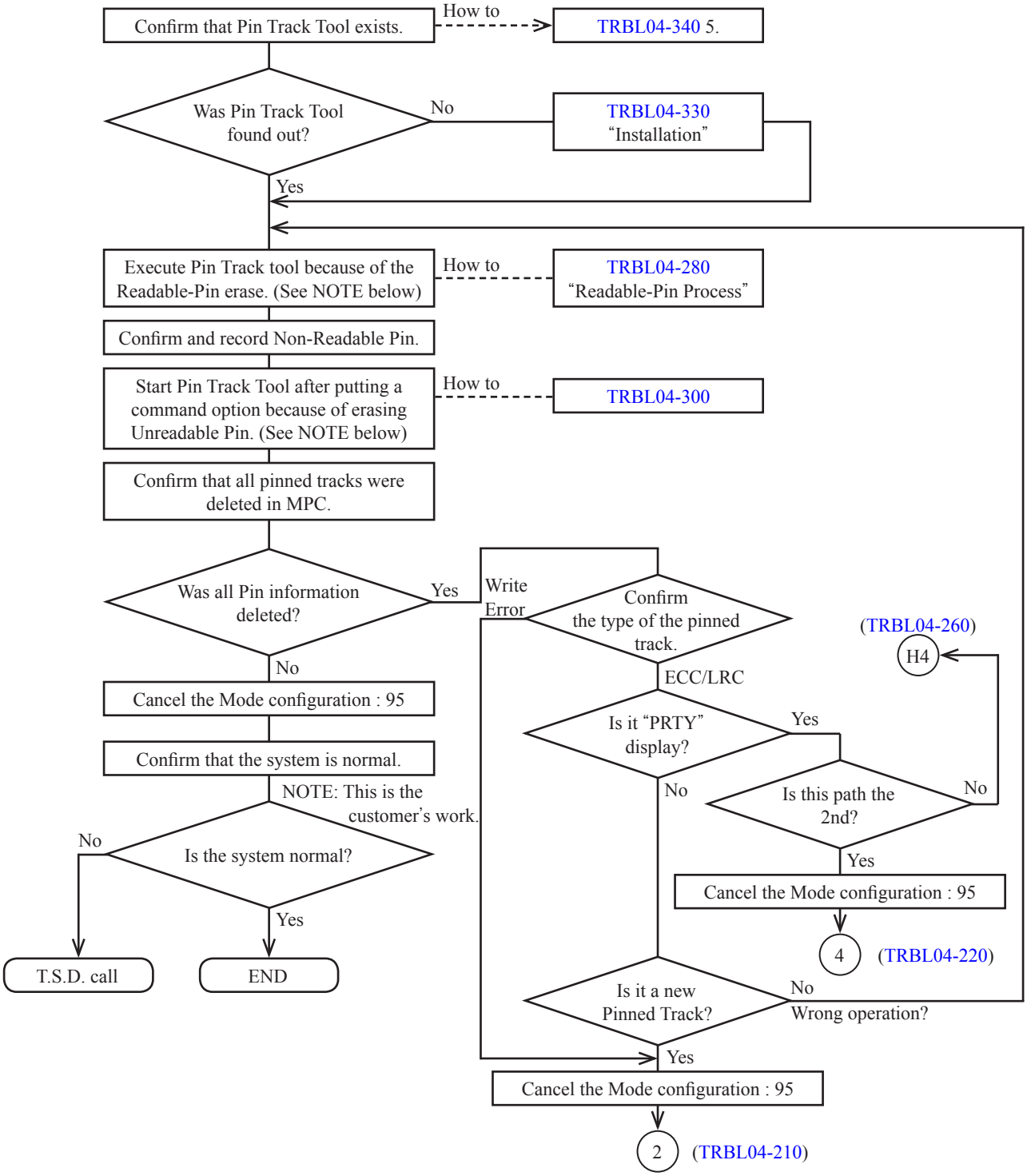


NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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Unreadable Pin Process

The erasing flow in the unreadable pinned track by Pin Track Tool is as follows.



NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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Operation of Readable-Pin Process (HP-UX)

This clause describes how to operate the Pin Track Tool to erase Readable-Pin.

<Operation>

1. Move to the directory of the Pin Track Tool.
   # cd /usr/raidopen/pinhp

2. Execute the Pin Track Tool without a command option.
   # ./pinhp.exe -log (Put pass "./")

   NOTE: This option "-log" collects detailed logs.
   However, when processing LBA with (60)h length, the log becomes about 400KB.
   Be careful of the available capacity of the disk. (refer to TRBL04-360)

3. According to the question, input the appropriate information.
   # ./pinhp.exe -log
   Input Device Name -> /dev/rdsk/c3t0d0
   Input Start LBA Data -> 180
   Input End LBA Data -> 1df
   → (Input the LBA number which was acquired from MPC.
   Do not input the LBA of the "slot:PRTY" display.)
   Input Next LBA ?(Y/N) -> n (When there still is a fault track in the same Device, it inputs "y".)
   Input Next Device ?(Y/N) -> n (When erasing different Device at the same time, it inputs "y".)

4. Because an input data list is displayed, check the input information.

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0	0000000000000180	00000000000001DF

Before you try to proceed the readable pin,
please check the pin information on MPC.
If the pin data have been cleared, please do not try to proceed the pin track again.
Do you want to do the process of the readable Pin?
Please input[y/n(default n)]:y

When the input is not collect, input "n" or just hit [Return] and then start the procedure again from (2).
Confirm whether or not a pinned track is deleted from the display of Maintenance PC.
When the data is already deleted, input "n" or just hit [return]. When canceled, input "y" and [return].

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5. When the Pin is judged, Unreadable through the pin type judgment, go to TRBL04-300.

Unreadable Pin:		
Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0	0000000000000180	00000000000001DF

NOTE: This tool recognizes an inputted range as the 1 processing unit.
Therefore, the range where Unreadable pin exists is displayed in the inputted range.

6. When Pin Track Tool ends, a log file (month -day -hour -minute -second .log) is made on the same directory. (Eg:0614200552.log)
As for the log file, the execution result of the Pin Track processing is recorded.
Confirm that processing was normally ended (there is “Pin Track Process completed” in the log file).

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Operation of Unreadable Pin Process (HP-UX)

This clause describes how to operate the Pin Track Tool to erase Unreadable Pin.

<Operation>

1. Move to the directory of the Pin Track Tool.
   # cd /usr/raidopen/pinhp

2. Put a command option and execute a pin recovery tool.
   # ./pinhp.exe -f -log (Put command option "-f")

   NOTE: This option "-log" collects detailed logs.
   However, when processing LBA with (60)h length, the log becomes about 400KB.
   Be careful of the available capacity of the disk. (refer to TRBL04-360)

3. According to the question, input the appropriate information.
   # ./pinhp.exe -f -log
   Input Device Name -> /dev/rdsk/c3t0d0
   Input Start LBA Data-> 180
   Input End LBA Data -> 1df
   → Input the LBA number which was acquired from MPC. Do not input the LBA of the "slot:PRTY" display.
   Input Next LBA ?(Y/N) -> n (when there still is a fault track in the same device, it input "y".)
   Input Next Device ?(Y/N) -> n (When erasing different device at the same time, it inputs "y".)

4. Because an input data list is displayed, check the input information.

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0	0000000000000180	00000000000001DF
Before you try to proceed the readable pin,		
please check the pin information on MPC.		
If the pin data have been cleared, please do not try to proceed the pin track again.		
Do you want to do the process of the readable Pin?		
Please input[y/n(default n)]:y		

   When the Input is not correct, input "n" or just hit [Return] and then start the procedure again From (2).
   Confirm whether or not a pinned track is deleted from the display of Maintenance PC.
   When the data is already deleted, input "n" or just hit [return]. When canceled, input "y" and [return].

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5. When Unreadable Pin is judged, the following message is displayed.

```
Unreadable Pin:
Device Name              Start LBA              End LBA
/dev/rdsk/c3t0d0         0000000000000180       00000000000001DF
Do you want to do the process of the unreadable Pin?
WARNING! if you input 'y',Pin Blocks will be over written by '0'.
Please input[y/n(default n)]:y
```

When erasing by the "0" writing to Unreadable Pin, input "y" and [Return].

NOTE: This tool recognizes an inputted range as the 1 processing unit.
Therefore, the range where Unreadable pin exists is displayed in the inputted range.

6. When "y" is chosen by (5), the check message is displayed at once for every number of inputs.
In case of plural number input, an operator can cancel the pin recovery processing for the device which you does not want to execute.

```
Unreadable Pin:
Device Name              Start LBA              End LBA
/dev/rdsk/c3t0d0         0000000000000180       00000000000001DF
Do you want to do the process of the unreadable Pin?
WARNING! if you input 'y',Pin Blocks will be over written by '0'.
Please input[y/n(default n)]:y
Do you want to do the process of the unreadable Pin? (The strip of LBA is 0000000000000180-
00000000000001DF). (Y/N)
```

7. When Pin Track Tool ends, a log file (month -day -hour -minute -second .log) is made on the same directory. (Eg:0614200552.log)
As for the log file, the execution result of the Pin Track processing is recorded.
Confirm that processing was normally ended (there is "Pin Track Process completed" in the log file).

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How to read the Read Test for whole of a disk (HP-UX)

This chapter describes how to discover the Unreadable Pin on select device.
This processing requires long time.

1. Move to the directory of the Pin Track Tool.
   # cd /usr/raidopen/pinhp

2. Execute the Pin Track Tool without a command option.
   # ./pinhp.exe -all (The "-f" will become invalid if this option is used.)

3. According to the question, input the appropriate information.
   # ./pinhp.exe –all
   Input Device Name -> /dev/rdsk/c3t0d0
   Input Next Device ?(Y/N) ->n (Recommend to "n") (When erasing different Device at the same time, it inputs "y")

4. The Input data list is displayed.

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0	0000000000000000	00000000001F2285

   Show all domain of LAB which is specified device, and execute.

5. When Pin Track Tool ends, a log file (month -day -hour -minute -second .log) is made on the same directory. (Eg:0614200552.log)
   The log when two area (120-17F, 1E023F) of Unreadable Pin exists in specified DeviceName becomes as follows.

```
Input Device Name = /dev/rdsk/c3t0d0
ERROR: Read Error LBA 0000000000000120-000000000000017F
ERROR: Read Error LBA 00000000000001E0-000000000000023F
```

NOTE: The area and number of Unreadable Pin listed by other factors here may differ from the area and number of Unreadable Pin displayed by Maintenance PC.

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Installation of Pin Track Tool (HP-UX)

This clause describes the installation of Pin Track Tool.

The preliminary preparation

If work logs need to be collected by the Pin Track Tool, confirm that there is the disk capacity for collecting in the work log.

An installation procedure from the tape device (Eg: 4mmDDS-DAT) is shown below.

Installation

1. Login to the host as “root”.

2. Move to the install area by the “cd” command and make a directory “raidopen”.
   # cd /usr (Eg: Move to the “/usr”)
   # mkdir raidopen (Eg: Make the directory “raidopen”)

3. Move to the created directory and copy a file from the tape by the “tar” command.
   # cd raidopen (Eg: Move to the “raidopen”)

   -In case of DDS-DAT-(Device Name depends on each host)
   # mt -t /dev/rmt/0m rew (Eg: Rewing a tape)
   # tar -xvf /dev/rmt/0m (Eg: copy a file from the tape.)
   # tar -xvf ./pinhpXX.tar (Eg: copy the tar file for HP-UX)

   -In case of CD-ROM-(Device Name depends on each host)
   # mount -F cdfs -o cdcase /dev/dsk/c2t6d0 SD_CDROM (Eg: mount the CD-ROM)
   # tar -xvf /SD_CDROM/program/ment/pintrack/hp_ux/pinhpXX.tar
   (Eg: copy a file from the CD-ROM.)

4. After the thawing is complete, confirm a file name.
   # cd ./pinhp (Eg: Move to the directory made by the thawing.)
   # ls -l (Eg: Display a file list.)

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5. Refer to the contents of "Ver-Rev.txt" file and confirm each file size of the list.
   # more /usr/raidopen/pinhp/Ver-Rev.txt display contents of the file

```
HITACHI RAID storage system PinTrackTool for HP-UX
       Ver XX-YY-/Z (Revision ID)
All right reserved, Copyright (c) 1999,2015, Hitachi Ltd.
File size (Bytes)  pinhp.exe (Module ID)
File size (Bytes)  showrelh.exe (Module ID)
```

   Confirm that the contents of "Ver-Rev.txt" and a list of the "ls -l" command are identical.

File preservation and the way of removing Pin Track Tool

• Log-File preservation

1. Compress the log file made by the pin recovery.
   # cd /usr/raidopen/pinhp (Eg: Move to the working directory.)
   # mkdir ./log (Eg: Make to the directory for Log-file.)
   # mv *.log ./log (Eg: Move logfiles to the directory for Log-file.)
   # tar -cvf pinlog.tar ./log (Eg: Make the tar file from logdir.)
   # compress pinlog.tar (Eg: Compress the "pinlog.tar" file.)

2. Preserve the log file at the tape and rewind it.
   # tar -cvf /dev/rmt/0m pinlog.tar.Z (Eg: Preserve log file)
   # mt -t /dev/rmt/0m rew (Eg: rewind the tape)

• The way of removing Pin Track Tool

The removal of the Pin Track Tool deletes all bottoms of the installed directory.

   # cd / (Eg: Move to the root directory.)
   # \rm -r /usr/raidopen/pinhp* (Eg: Deletes all bottoms of the installed directory)

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The acquisition of the device information (HP-UX)

This chapter describes the tool “showrel” to acquire the device information.

1. Move to the installed directory.
   # cd /usr/raidopen/pinhp

2. Input commands as follows.
   # ./showrelh.exe (Put the path “./”)

<Display Example>

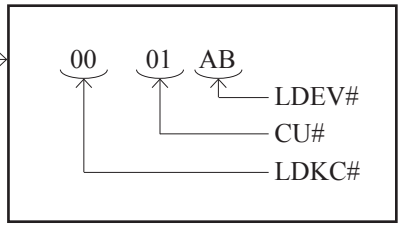
The display depends on the specification of the storage system.

For the Hitachi specification, it is displayed as follows.

```
#./showrelh.exe

    Device File      ---> Port  Serial# LDKC# LDEV#

    /dev/rdsk/c0t0d1 ---> CL1M   301234    00  01A6
    /dev/rdsk/c0t0d2 ---> CL1M   301234    00  01A7
    /dev/rdsk/c0t0d3 ---> CL1M   301234    00  01A8
    /dev/rdsk/c0t0d4 ---> CL1M   301234    00  01A9
    /dev/rdsk/c0t0d5 ---> CL1M   301234    00  01AA
    /dev/rdsk/c0t0d6 ---> CL1M   301234    00  01AB
```



For the OEM specification, it is displayed as follows.

The point of view of LDKC:CU:LDEV# is the same.

```
#./showrelh.exe

Device File          ---> Port  Serial#  LDKC# LDEV#

    /dev/rdsk/c7t2d1 ---> CL2E  00310028    00  03C0
    /dev/rdsk/c7t2d2 ---> CL2E  00310028    00  03C1
    /dev/rdsk/c7t2d3 ---> CL2E  00310028    00  03C2
    /dev/rdsk/c7t2d4 ---> CL2E  00310028    00  03C3
    /dev/rdsk/c7t2d5 ---> CL2E  00310028    00  03C4
    /dev/rdsk/c7t2d6 ---> CL2E  00310028    00  03C5
```

“LDEV#” is composed of the CU number and the LDEV number. Confirm LDKC#, CU# and LDEV# with the pinned track displayed in Maintenance PC and specify a clearing device file.

Device File name is input information to Pin Track Tool.

(Example)

Above mentioned “For the Hitachi specification”,

LDKC# = 00, LDEV# = 01AB → Device File = /dev/rdsk/c0t0d6

NOTE: In the case of HP-UX, If there is LDEV that is non given LUN#, LDKC#= 00 / LDEV#= 159F or LDKC#= FF / LDEV#= FFFF are displayed to LUN# non-given a definition by showrelh.exe

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The way of collecting detailed information (HP-UX)

It is possible to collect the detailed information of the erasing process when putting a command option to Pin Track Tool and starting the process.

./ pinhp.exe (-f) -log

Like the following, it outputs read data and write data in the log file.

<Display Example>

Unreadable LBA is displayed by "*".

```
Input Device Name = /dev/rdsk/c1t0d0
Input Start LBA = 0000000000000180
Input End LBA = 00000000000001DF
/dev/rdsk/c1t0d0, Start LBA = 0000000000000180, End LBA = 00000000000001df readable Pin
Track read error
Read Data: Top Pin No = 0000000000000180
  00000000: ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000010: ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000020: ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000030: ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000040: ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
• • •
Read Data:  Top Pin No=0000000000000181
• • •
Read Data:  Top Pin No=0000000000000182
• • •
Read Data:  Top Pin No=0000000000000183
• • •
Read Data:  Top Pin No=00000000000001DF
  000001A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Read Data (After Writing): Top Pin No=00000000000001DF
  000001A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Write Data:  Top Pin No=0000000000000180
• • •
  00000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000030: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
• • •
• • •
• • •
  0000BFC0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFD0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFE0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFF0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
/dev/rdsk/c1t0d0, Start LBA=0000000000000180, End LBA=00000000000001DF Pin Track process
completed!!
```

Unreadable data!

Execute LBA!

NOTE: In the processed range, log information is recorded.

This log is executing read processing by the 1 LBA unit.

It is indicated data which is read, written, and compared.

This log shows to have processed all ranges in the writing at once.

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The way of examining Mount Point which has a Pinned Track (HP-UX)

NOTE: As for the following work, request a system administrator to operate.

1. Input the “vgdisplay” command and to display a Volume Group list.
   # vgdisplay -v

2. Specify “lvol(/dev/vgx/lvolx)” which is composed of Physical Volume(cxtxdx) with the Pinned Track.

<Display Example>

```
--- Volume groups ---
VG Name                     /dev/vg11
VG Write Access             read/write
VG Status                   available
Max LV                      255
Cur LV                      1
Open LV                     1
Max PV                      16
Cur PV                      4
Act PV                      4
Max PE per PV               1016
VGDA                        8
PE Size (Mbytes)            4
Total PE                    2344
Alloc PE                    2000
Free PE                     344
Total PVG                   0
Total Spare PVs             0
Total Spare PVs in use      0

--- Logical volumes ---
LV Name                     /dev/vg11/lvol1
LV Status                   available/syncd
LV Size (Mbytes)            8000
Current LE                  2000
Allocated PE                2000
Used PV                     4


--- Physical volumes ---
PV Name                     /dev/dsk/c9t1d0
PV Status                   available
Total PE                    586
Free PE                     0

PV Name                     /dev/dsk/c9t1d1
PV Status                   available
Total PE                    586
Free PE                     0

PV Name                     /dev/dsk/c9t1d2
PV Status                   available
Total PE                    586
Free PE                     0

PV Name                     /dev/dsk/c9t1d3
PV Status                   available
Total PE                    586
Free PE                     344
```

Volume Group Name

“/dev/vg11/lvol1” is made in a Volume Group (“/dev/vg11”)

PV(cxtxdx) which composes volume group “/dev/vg11” is displayed.

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3. Check if "./etc/fstab" is displayed.
   #cat /etc/fstab

4. Specify all the mount points for PV which was confirmed in "vgdisplay".

<Display Example>

```
# System /etc/fstab file.  Static information about the file systems
# See fstab(4) and sam(1M) for further details on configuring devices.
/dev/vg00/lvol3 / vxfs delaylog 0 1
/dev/vg00/lvol1 /stand hfs defaults 0 1
/dev/vg00/lvol4 /tmp vxfs delaylog 0 2
/dev/vg00/lvol5 /home vxfs delaylog 0 2
/dev/vg00/lvol6 /opt vxfs delaylog 0 2
/dev/vg00/lvol7 /usr vxfs delaylog 0 2
/dev/vg00/lvol8 /var vxfs delaylog 0 2
/dev/vg00/lvol10 /home1 vxfs rw,suid,nolargefiles,delaylog,datainlog 0 2
/dev/vg11/lvol1 /open vxfs delaylog 0 4
```

mount point (in bold)

5. Input the "bdf" command and confirm the mount point.
   #bdf

<Display Example>

```
Filesystem          kbytes      used     avail     %used     Mounted on
/dev/vg00/lvol3      86016     26109     56212       32%     /
/dev/vg00/lvol1      67733     31932     29027       52%     /stand
/dev/vg00/lvol8     512000    159876    331072       33%     /var
/dev/vg00/lvol7     614400    428475    174362       71%     /usr
/dev/vg00/lvol4      32768      1131     29663        4%     /tmp
/dev/vg00/lvol6     258048    102174    146171       41%     /opt
/dev/vg00/lvol10   1544192      2858   1445062        0%     /home1
/dev/vg00/lvol5      20480      6078     13595       31%     /home
/dev/vg11/lvol1    8192000   3149893   4726982       40%     /open
```

6. Determine Mount Point to check by the "sum" command.

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The attention item for HP-UX

This clause explains notes when using Pin Track Tool.

The notes for use of the Pin Track Tool

1. Specify the start and end LBAs (*1) in Maintenance PC for the setting range of Pin Track Tool. 1 slot is composed of 96 LBAs ((60)h LBA).
   *1: One slot of OPEN-VOL is composed of 512LBAs.
2. Pin Track Tool is not a tool to recover data. Therefore, when Unreadable Pin occurs, it is necessary to be restored using the backup data of the customer.
3. There is a case that O/S patch is prepared which has an influence to the pinned track read operation. The patch information of OS may change at frequent intervals. Confirm the latest information. Request the system administrator to install patch. When the system administrator judges this action may impact on the system, cancel the Mode Configuration:95 and return to TRBL04-220 ④.
4. When it isn't possible to use Pin Track Tool, use the LDEV Format to clear.
5. Because HP-UX executing retry to read the pinned track where it isn't possible to read many times, It sometimes takes 12 hours maximum about processing 1 slot.

The erasing process of Pinned Track on the DB (HP-UX, Solaris)

DB has two types of the Pinned Track erasing.

1. Raw device-based Data Base type :
   Without passing O/S, by the physical level, the data base soft wear manages a disk. (It is managed by the LBA unit on the physical level.)
   The device of local type isn't mounted on File System. Then, it has a powerful backup function.
2. File system-based Data Base type :
   Mounted an File System.

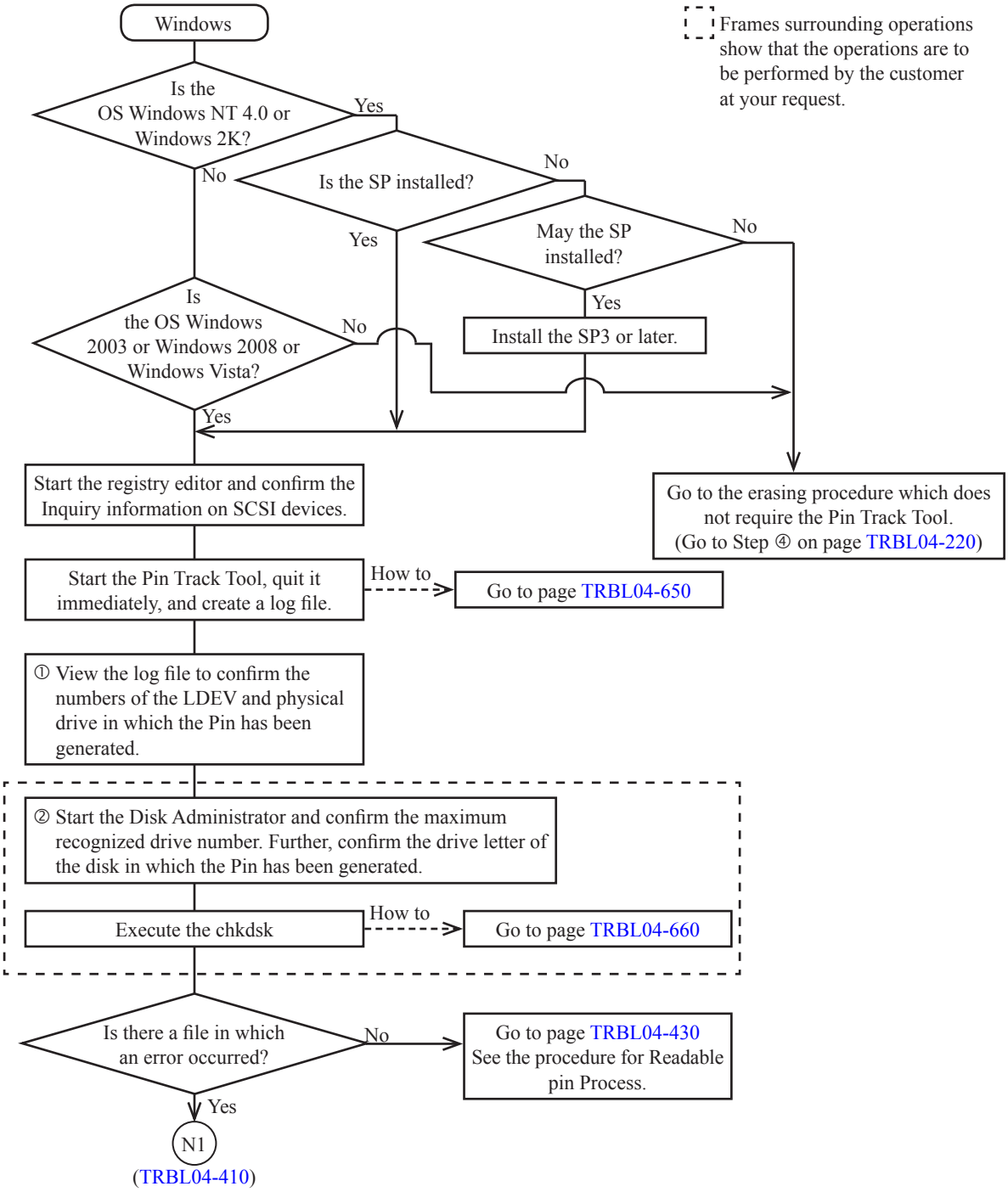
In case of 2, it is necessary to be restored from the backup data.
In case of 1, it be restored by the backup-restore feature of the DBMS.

If a pin is left after the data recovers, erase a pin by the Pin Track Tool.
The most important thing is to execute the recovery function in the DB software.

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4.2.3.2 Procedure on Windows

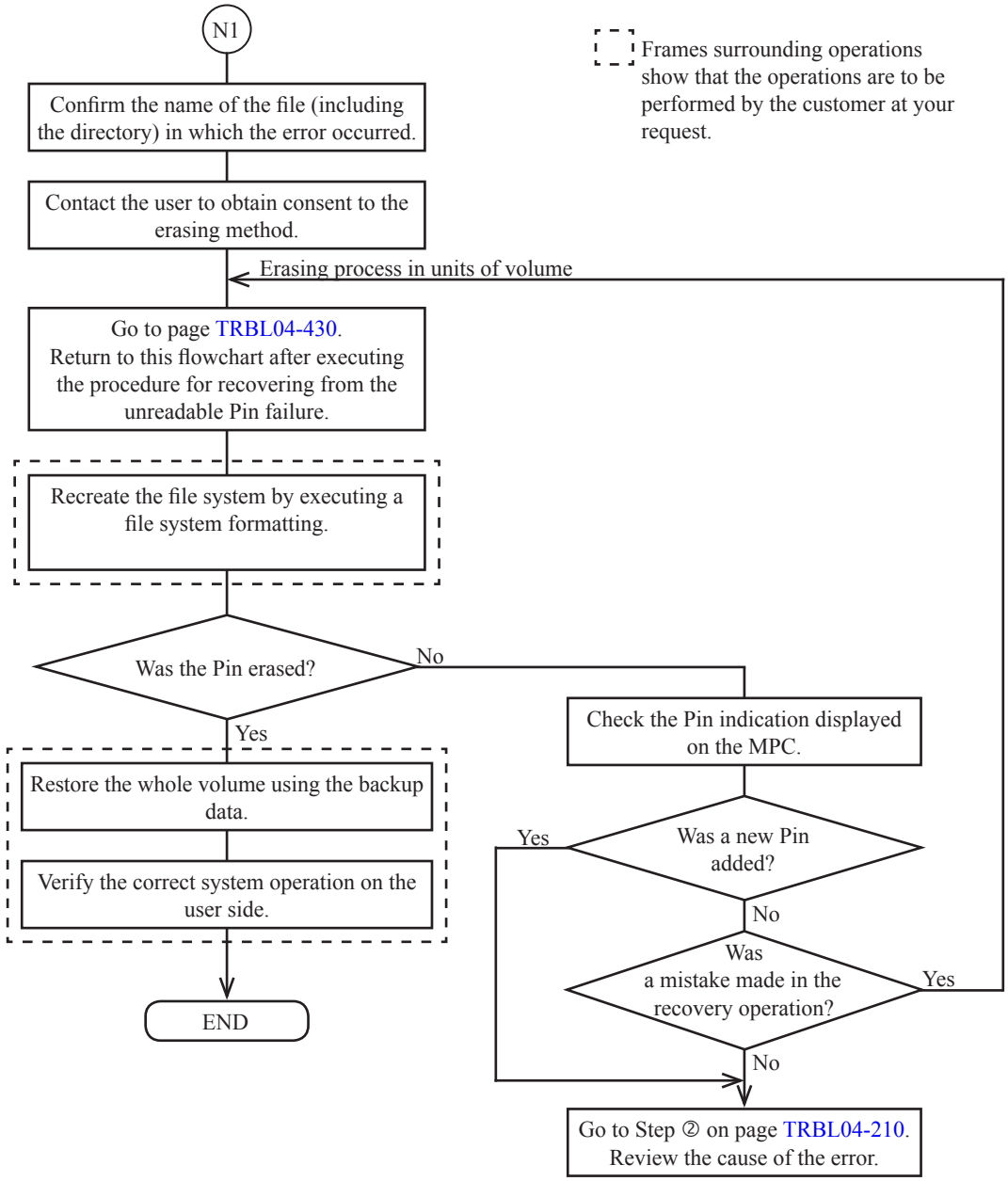
- The following is an erasing procedure to be used when a Pin failure occurs on Windows.



NOTE: The tools in this section will be distributed from the TRC centers at the time of need.

NOTE: The installation of the SP must be done by a system administrator at your request. The installation must be consented to by the system administrator because some programs cannot run depending on the SP version.
Windows can be operated even by guest OS on VMWare.

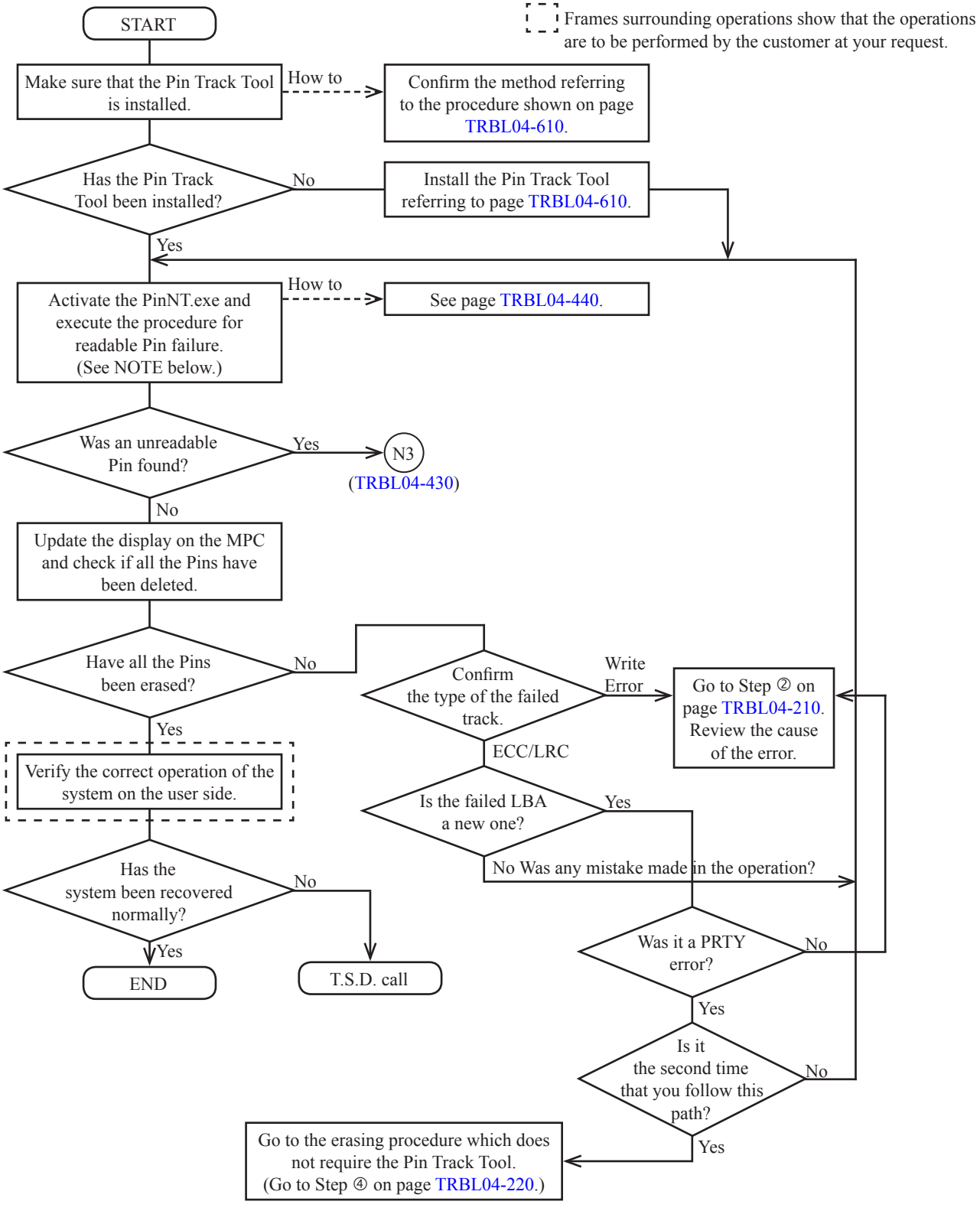
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NOTE: When the Chkdsk is executed, the sector (equivalent to one LBA) with a Pin failure is treated as a faulty sector.
Therefore, the effective capacity is decreased because the sector is treated as an unusable one under the control of Windows even after the Pin information is cleared by the Pin Track Tool.
Only the formatting of the disk concerned can recover the effective capacity, however, it causes data on the disk to be lost.

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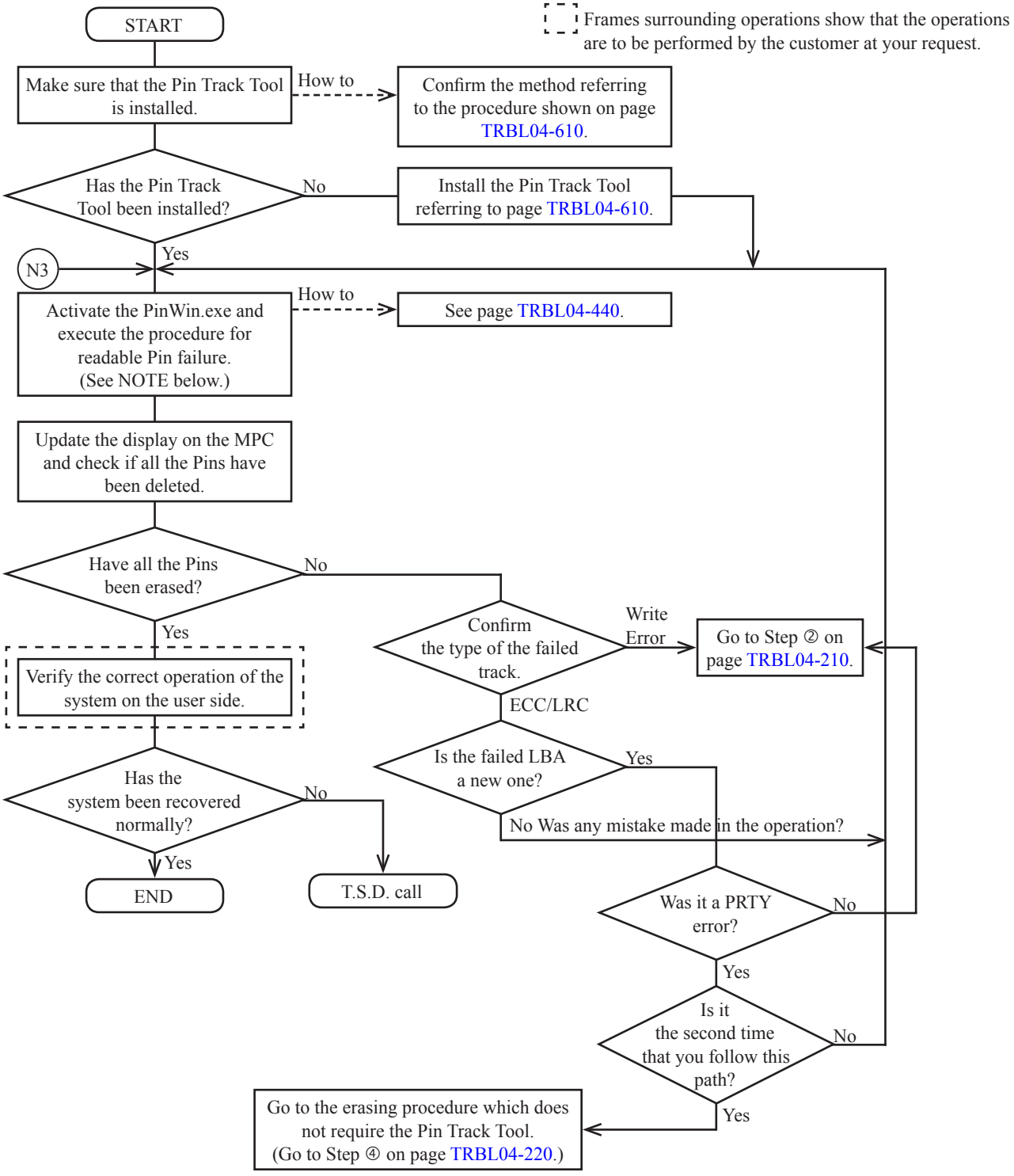
Unreadable Pin Process (Windows)



NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

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Unreadable Pin Process (Windows)



NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

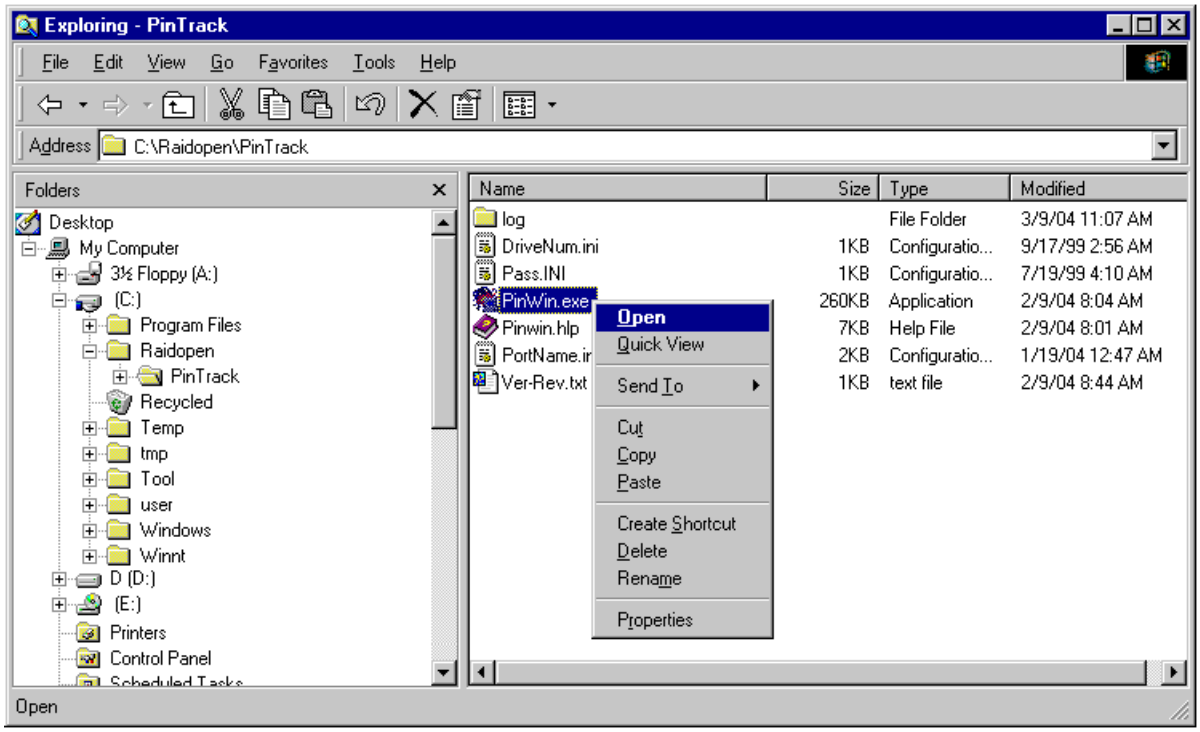
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Operation of Readable Pin Process (Windows)

The following explains how to operate the Pin Track Tool for erasing a readable Pin.
The procedure for erasing a readable Pin is to be firstly applied to all types of Pins.
A Pin which cannot be erased by the readable Pin erasing process will be erased by a process which treats it as an unreadable Pin.

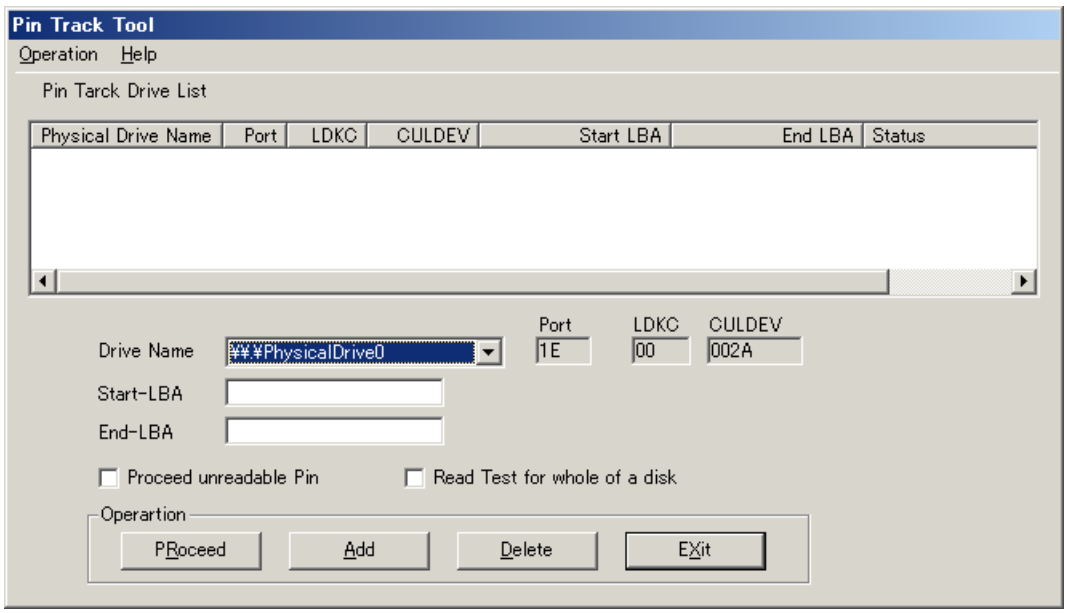
NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. Activate the PinWin.exe
   - Execute the PinWin.exe in the folder in which the tool is installed after activating it by selecting "Open" by clicking it with the right mouse button or double-clicking it with the left mouse button.



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- When the PinWin.exe is executed, the following window is displayed.

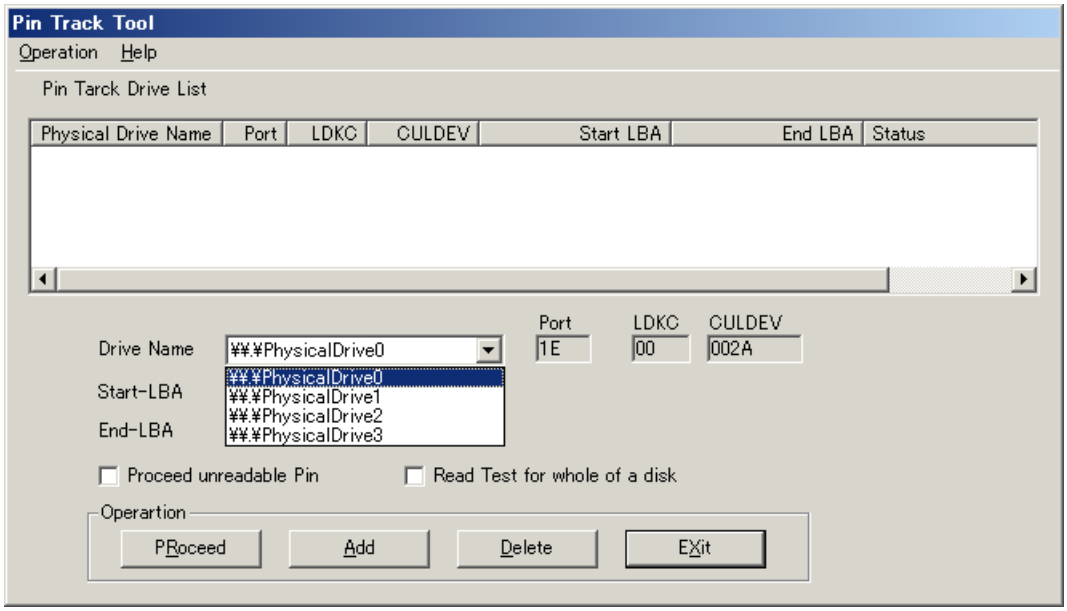


2. Input the information, which has been got from the Maintenance PC, on the device from which the Pin is to be erased.

NOTE: You can enter two or more Pins in order.

(1) Find a name of a drive to which the LDEV in which the Pin has been generated is allocated.

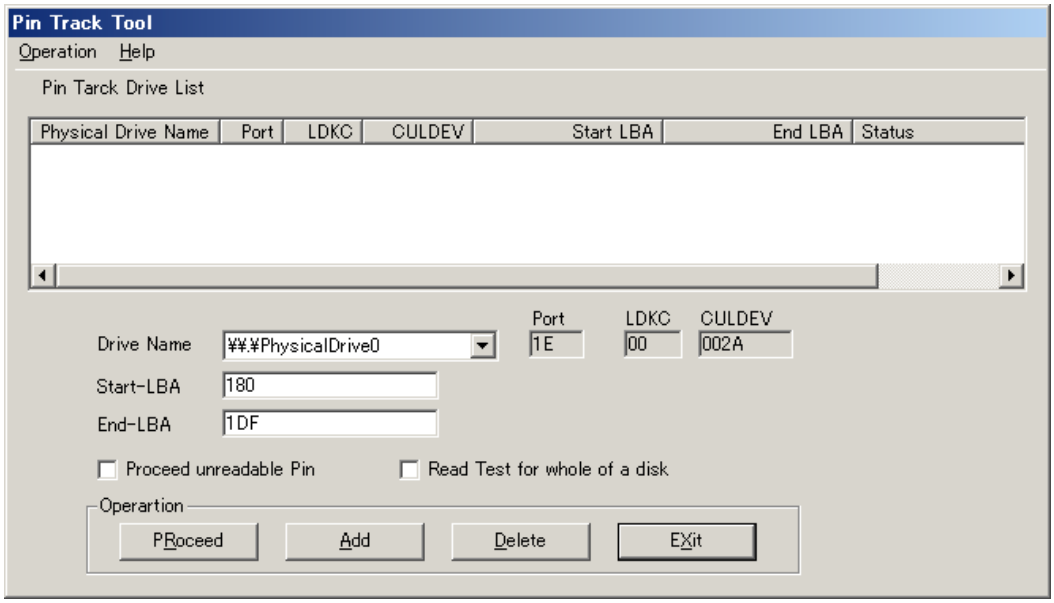
- Select a physical drive for which the LDEV number of the device in which the Pin has been generated is displayed using an acquired port number (e.g. 1J for CL1J).



NOTE: The drive names are not sorted in order of the drive numbers.

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Input the Start LBA and End LBA of the drive input in Step (1) to specify the range where the Pin has been generated.

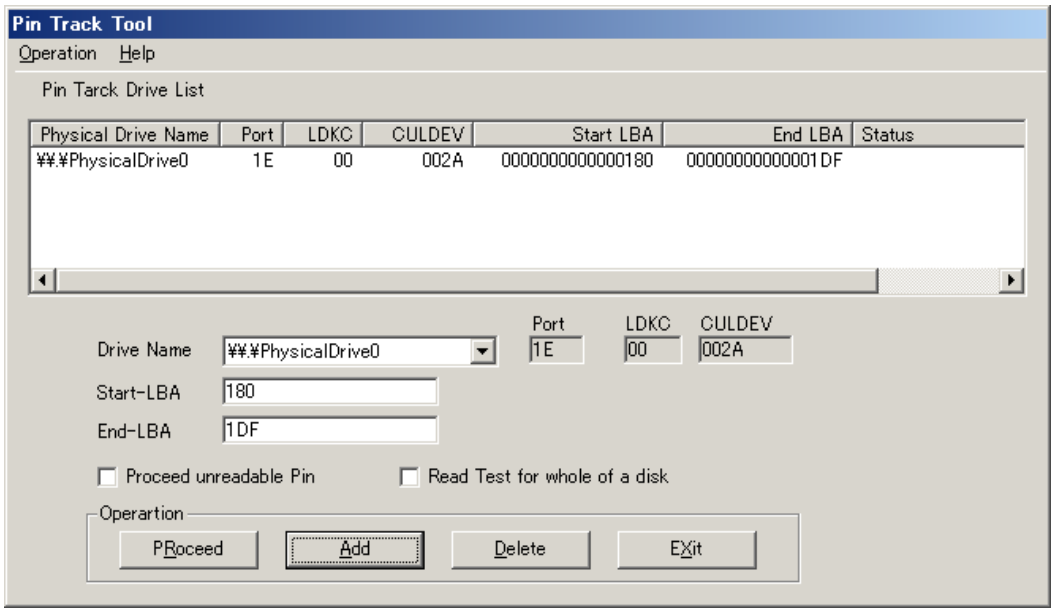


- When specifying the LBAs, the allowable range for them is as follows.
  [End LBA - Start LBA ≤ 0x1FF]

  Input the range of the or 0x1FF shown on the Maintenance PC.

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3. Add the input device to the Pin Track Device List.
   - When the "Add" button is clicked after making sure that the selected and input items are correct, the drive is added to the list.



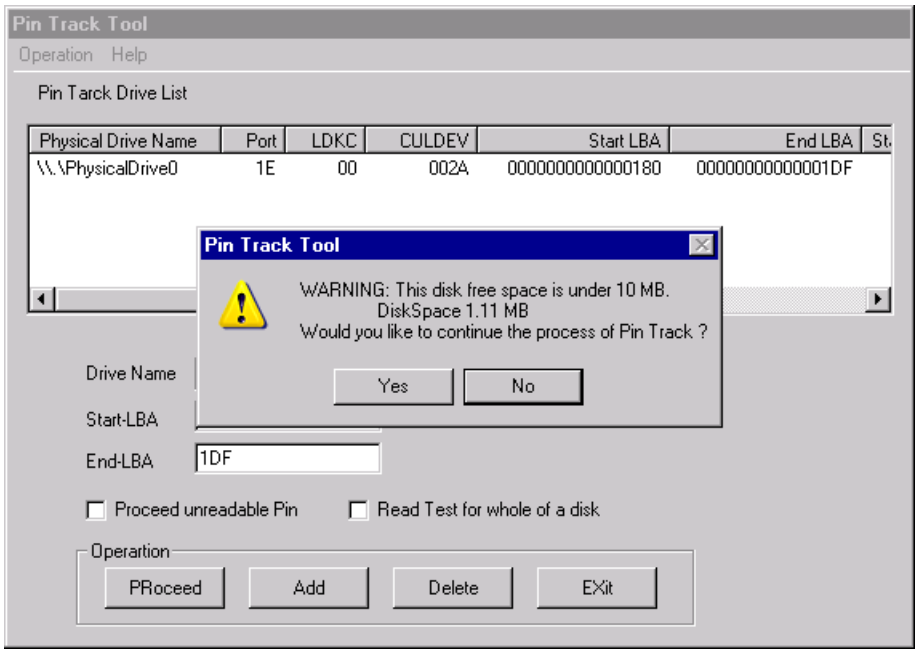
4. Erase the readable Pin.
   - Check if the input information is correct. When correcting it, select the device and input the LBA over again by selecting the item concerned from the list and clicking the "Delete" button.
   - When you want to add two or more devices, you can do it by repeating the input.
     When they are added, the Pin erasing process is applied to them in an ascending order of the listing.

     NOTE: Since the readable Pin is to be erased here, do not check off the check box of the Unreadable PIN.

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- When no wrong input is found, click the “PRoceed” button to erase the readable Pin.

When the “PRoceed” button is clicked, the program checks whether a free area for outputting a log is ensured in the current drive in which the Pin Track Tool is installed.
If the free area is less than 10 MB, the following dialog box is displayed to warn it.



The current free area on the disk is displayed in the dialog box. A free area of approximately 400KB is required for (60)h length SLOT to erase a Pin. When the necessary free area is provided, the processing can be continued.

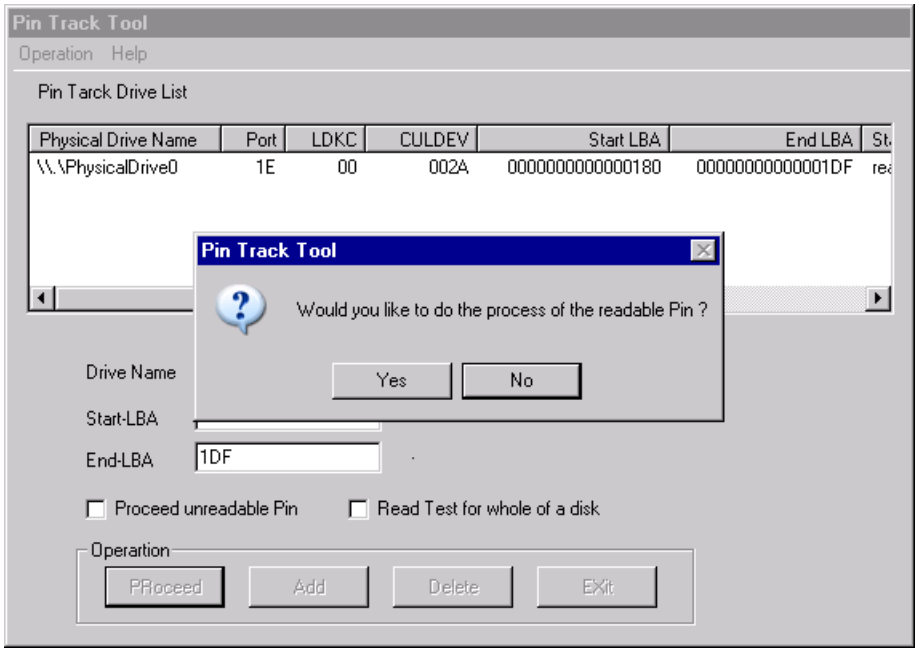
NOTE: Install the program in a drive in which the enough free area can be ensured.

When [Yes] is selected, the processing is continued. If the disk capacity is less than that required for the log, as large log file as can be accommodated is acquired.
Normally, select “Yes” only when the free area is enough.

When [No] is selected, the routine is returned to the main window. If the option has been checked off, it is cancelled. Ensure a free area in the drive, put the collected log file in order, or install the program in another drive.

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When the “PRoceed” button is clicked to continue the processing, the status of each drive is displayed in the main window and the following dialog box is displayed.

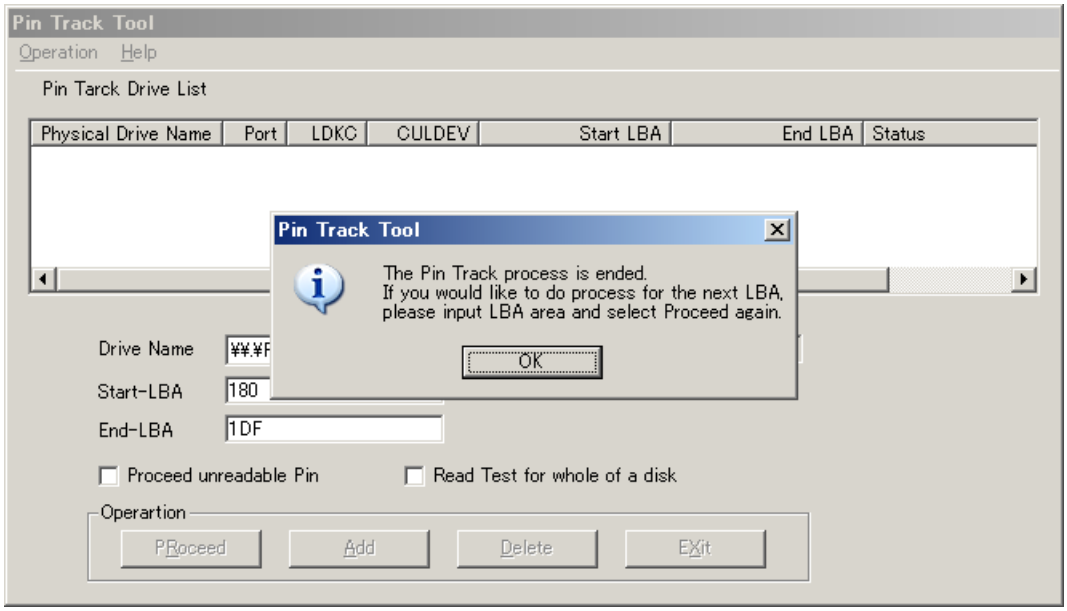


When “readable-pin” is displayed in the “Status” column, it shows that the slot is a readable Pin.
When “Unreadable-pin” is displayed in the “Status” column, it shows that the slot is an unreadable Pin.

- Update the display on the Maintenance PC before executing the erasing process and check if the Pin of the input device has been erased.
  When the Pin has already been erased, click the “No” button to return to the main window.
  When the Pin has not been erased, click the “Yes” button to erase the readable Pin.

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5. The Pin erasing process is executed.
   When the Pin erasing process is executed, the following dialog box is displayed.



When the Pin erasing process completes normally, the items are deleted from the list automatically.
Confirm the execution result of the Pin erasing process in the log file.

- Open the PinTrack.log file in the folder in which the tool is installed by using a memo pad, etc.

```
2000/03/27 13:22:16 Pin Track Tool started.

\\.\PhysicalDrive0
                      No information

\\.\PhysicalDrive1
                      Product Serial R500 50330036 0042
                      Port Number    1E
                      LDKC Number    00
                      LDEV Number    002A
                      Disk Capacity  2461040640 bytes
                      Maximum LBA    000000000049583F

\\.\PhysicalDrive2
\\.\PhysicalDrive3
\\.\PhysicalDrive4


\\.\PhysicalDrive9
                      Product Serial R500 50330036 0023
                      Port Number    2F
                      LDKC Number    00
                      LDEV Number    0017
                      Disk Capacity  2461040640 bytes
                      Maximum LBA    000000000049583F

Read Data: Top Pin No=0000000000000180
  00000000:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

  0000BFE0:00 00 00 00 00 00 00 00 00 00 00 00 3E BC 12 E6
  0000BFF0:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Read Data  (After Writing):  Top Pin No=0000000000000180
  00000000:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

  0000BFE0:00 00 00 00 00 00 00 00 00 00 00 00 3E BC 12 E6
  0000BFF0:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Write Data: Top Pin No=0000000000000180
  00000000:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

  0000BFE0:00 00 00 00 00 00 00 00 00 00 00 00 3E BC 12 E6
  0000BFF0:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

2000/03/27 13:23:13
\\.\PhysicalDrive9,Start LBA=0000000000000180,End LBA=00000000000001DF,The Pin Track
process is completed.
2000/03/27 13:23:48 Pin Track Tool is exited.
```

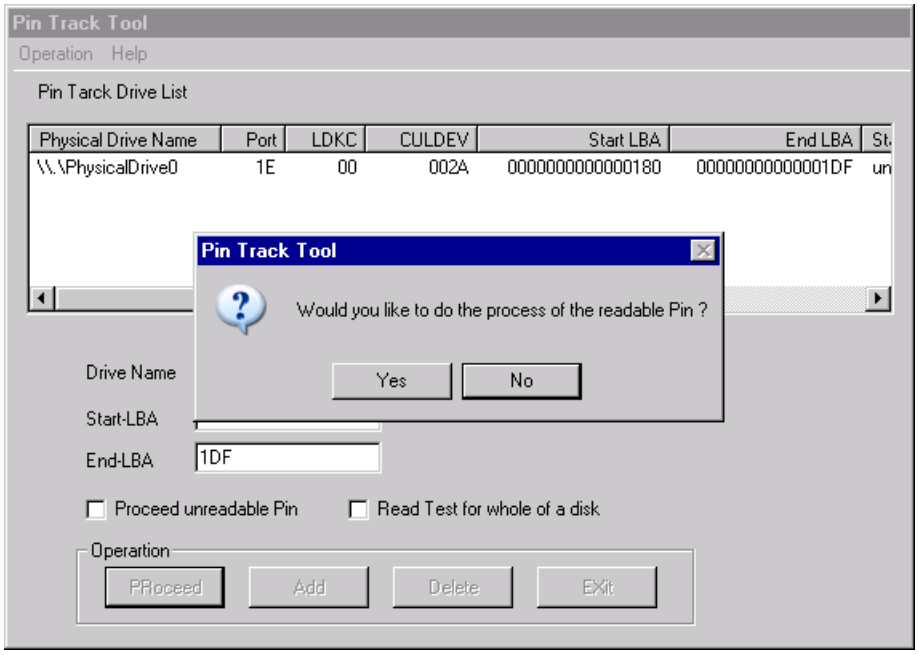
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The log file is backed up to the log folder under the directory in which the tool is installed with a name given as “PinTrack-year-month-date-hours-minutes-seconds.log”.

- When “The Pin Track process is completed.” is displayed in the log file, it means that the Pin has been erased. View the display on the Maintenance PC to confirm that the Pin has been erased.

6. When you erase another readable Pin successively, repeat the procedure from Step (2).

- When an unreadable Pin exists in the device added to the list.
  When the “PRoceed” button is pressed in the case where an unreadable Pin exists in the list, the following is displayed.



“unreadable” is displayed in the “Status” column showing that the slot is an unreadable Pin. In this case, the Pin is not erased even if the procedure for erasing a readable Pin is executed and the device is not deleted from the list as follows.

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The log when two area (120-17F, 1E023F) of Unreadable Pin exists in specified Drive Name (PhysicalDrive2) becomes as follows.

```
2002/09/03 14:17:55 Pin Track Tool started.

¥¥.¥PhysicalDrive0
    No information
¥¥.¥PhysicalDrive1
    Product Serial No information
    Port Number NG
    LDKC Number NG
    LDEV Number NG
    Disk Capacity 0 bytes
    Maximum LBA FFFFFFFFFFFFFFFF

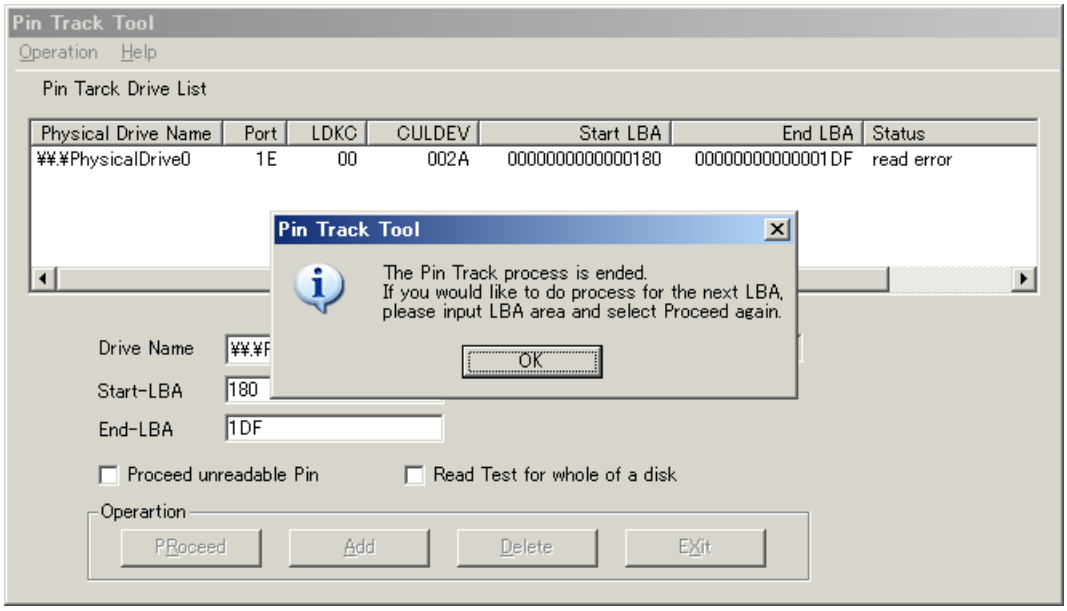
¥¥.¥PhysicalDrive2
    Product Serial HITACHI R5016F700009
    Port Number 1K
    LDKC Number 00
    LDEV Number 0009
    Disk Capacity 2461040640 bytes
    Maximum LBA 000000000049583F

2002/09/03 14:18:00
¥¥.¥PhysicalDrive2, Start LBA=0000000000000120, End LBA=000000000000017F,
An error occurred when reading.
2002/09/03 14:18:00
¥¥.¥PhysicalDrive2, Start LBA=00000000000001E0, End LBA=000000000000023F,
An error occurred when reading.
2002/09/03 14:18:40 Pin Track Tool is exited.
```

Device information is recorded here. When displayed on [Product Serial] as [No information], it is a device besides an object.

It is listed here when there is area of Unreadable Pin.

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When the status is changed to “read error” and the device remains in the list, go to Subsection TRBL04-550, “Operation of Unreadable Pin Process”.

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Operation of Unreadable Pin Process (Windows)

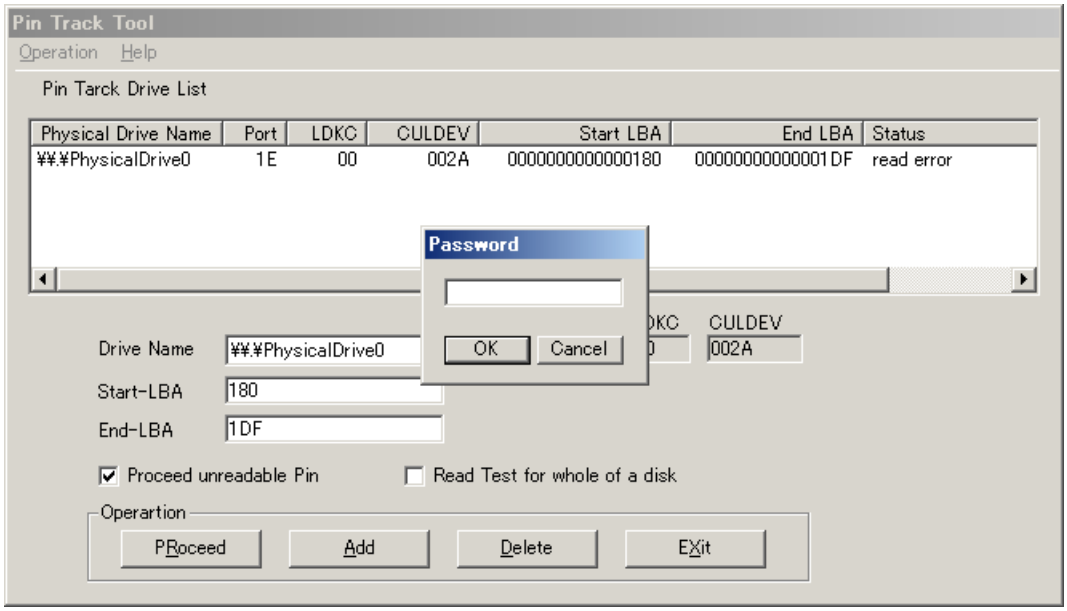
The following explains how to operate the Pin Track Tool for erasing an unreadable Pin. Since the procedure for erasing a readable Pin is to be applied to all the Pins first,
follow the procedure below after executing the procedure given in Subsection TRBL04-440, "Operation of Readable Pin Process".

NOTE : - On an SIM reported owing to a use of the Pin Track tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. When the log file (PinTrack.log) is open, close it.

2. Reconfirm the device, which was not deleted from the list when the readable Pin erasing process was executed, and the display on the Maintenance PC.

3. Specify the unreadable Pin erasing process.
After confirming that the input information is correct, check off the check box of the Unreadable Pin.
When it is checked off, the password dialog box is displayed.

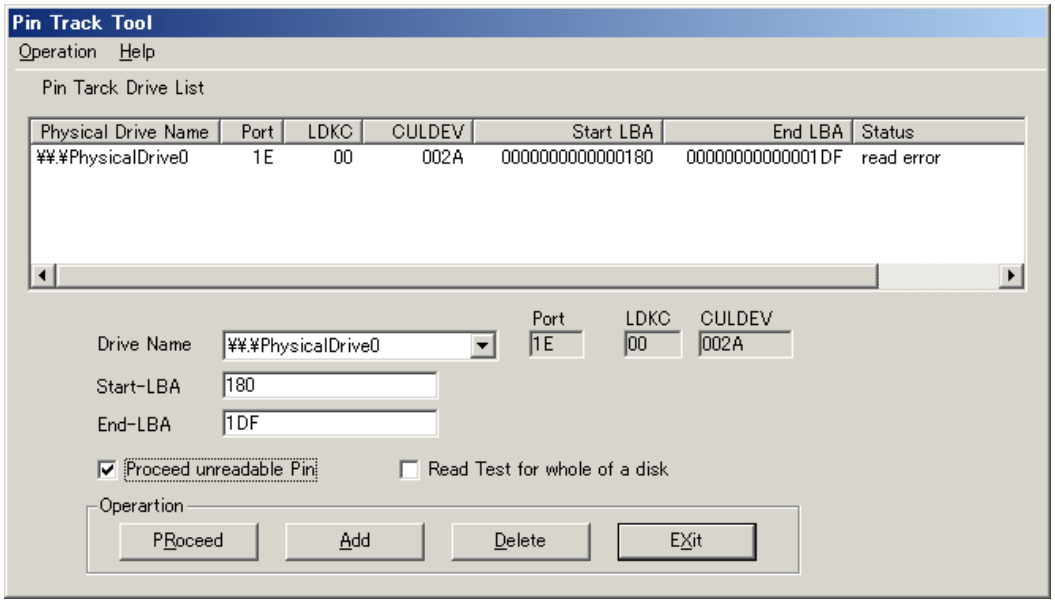


The password is to be obtained from the Technical Support Division. Without the password, the unreadable Pin cannot be erased.
Input the password and click the "OK" button.
When the correct password is input, the check box is checked off.

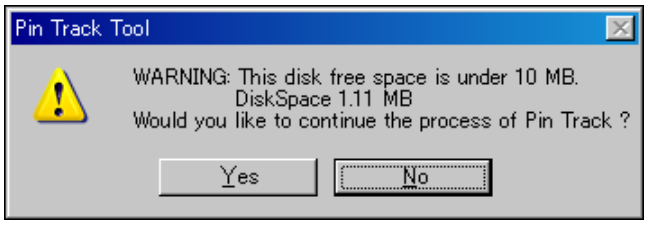
If the box is not checked off although the correct password has been input, copy the Pass.INI file in the folder in which the tool is installed from the media for installation again.

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4. Erase the unreadable Pin.
   - Check off the check box. When no wrong input is found, click the "PRoceed" button to erase the unreadable Pin.



When the "PRoceed" button is clicked, the program checks whether a free area for outputting a log is ensured in the current drive in which the Pin Track Tool is installed.
If the free area is less than 10 MB, the following dialog box is displayed to warn it.



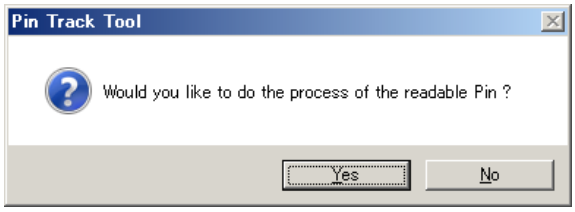
The current free area on the disk is displayed in the dialog box. A free area of approximately 400KB is required for (60)h length SLOT to erase a Pin. When the necessary free area is provided, the processing can be continued.

NOTE: Install the program in a drive in which the enough free area can be ensured.

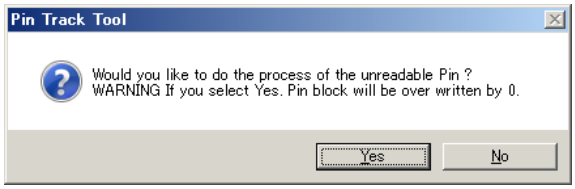
When "Yes" is selected, the processing is continued. If the disk capacity is less than that required for the log, as large log file as can be accommodated is acquired.
Normally, select "Yes" only when the free area is enough.

When "No" is selected, the routine is returned to the main window. If the option has been checked off, it is cancelled. Ensure a free area in the drive, put the collected log file in order, or install the program in another drive.

When the “PRoceed” button is clicked to continue the processing, the following dialog box is displayed.

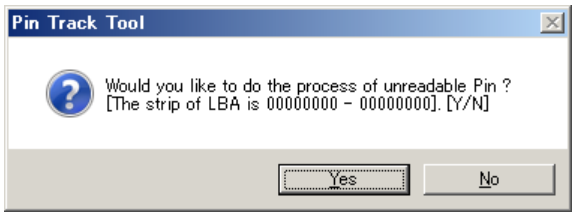


Try to erase the readable Pin first. When the readable Pin Track process cannot be executed when the “Yes” is clicked here, the following dialog box is displayed.



A dialog box for confirming whether to execute the unreadable Pin Track process is displayed. Execution of the unreadable Pin Track process must be decided carefully because it overwrites the Pin blocks with “0” data.

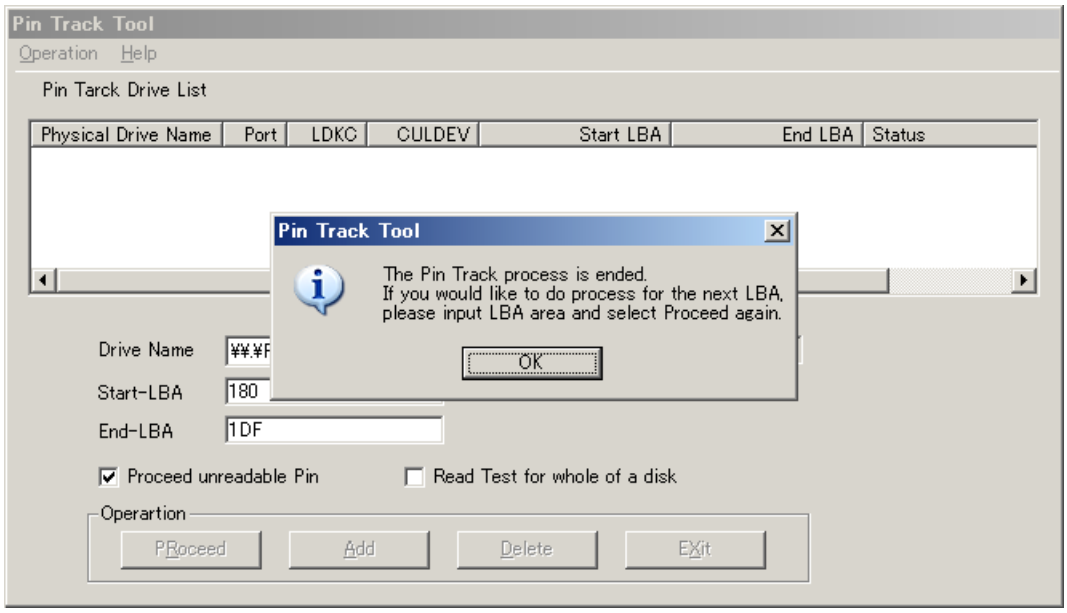
In case of the unreadable pin erasing operation, Confirmation of execution is demanded every contents in the pin track drive list. Operator can select execution or cancellation for each operation.



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- Update the display on the Maintenance PC before executing the unreadable Pin Track process and check if the Pin of the input device has been erased. When the Pin has already been erased, click the "No" button to return to the main window.

- When the Pin has not been erased, click the "Yes" button to erase the unreadable Pin. When the "Yes" button is clicked, the unreadable Pin Track process is executed and the following window is displayed.



5. Check the log of the Pin Track Tool.
   - Open the PinTrack.log file in the folder in which the tool is installed by using a memo pad, etc.
     The log file is backed up to the log folder under the directory in which the tool is installed with a name given as "PinTrack-year-month-date-hours-minutes-seconds.log".
   - When "Pin Track process is completed" is displayed in the log file, it means that the Pin has been erased.
     View the display on the Maintenance PC to confirm that the Pin has been erased.

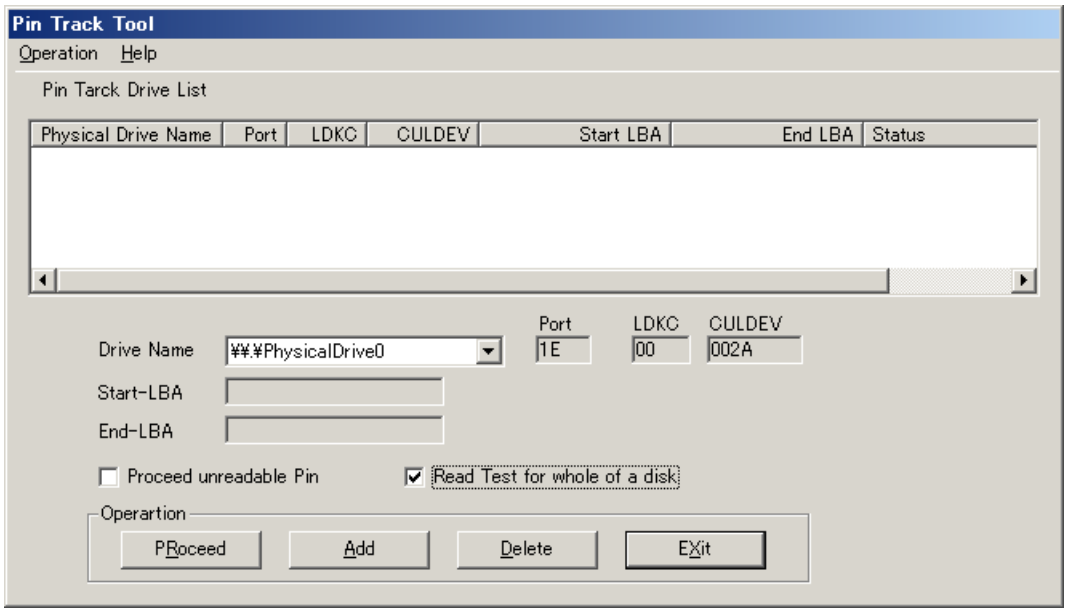
6. When you proceed another Pin successively, repeat the "Operation of Readable Pin Process" in TRBL04-440.

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How to Read Test for whole of a disk (Windows)

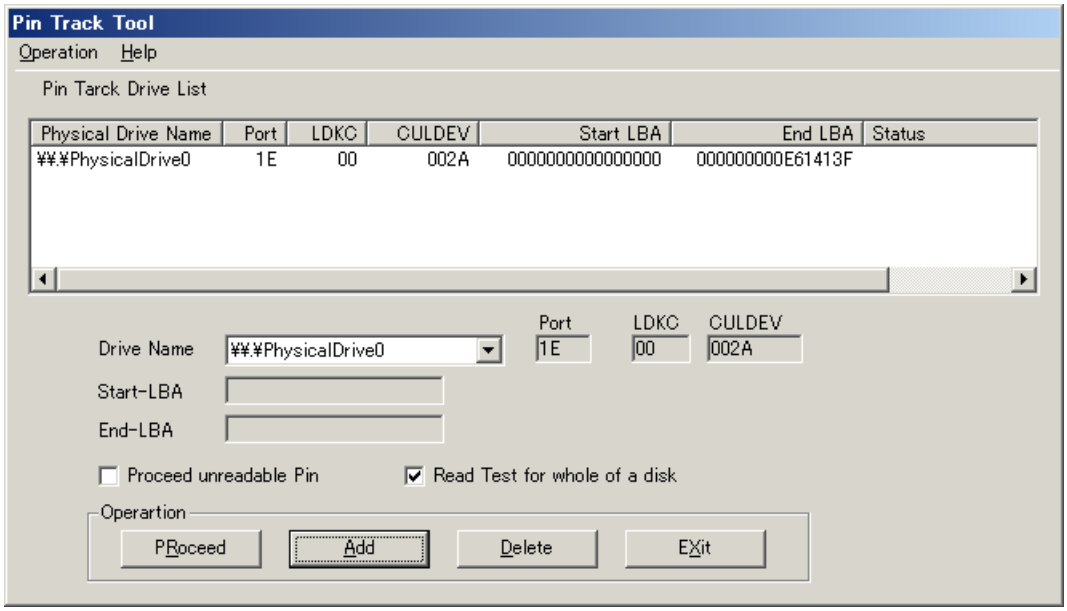
This chapter describes how to discover the Unreadable Pin on select device.
This processing requires long time.

1. If a check box “Read Test for whole of a disk” is clicked, it becomes impossible to input “Start LBA” and “End LBA”.
   (Then all the contents currently displayed on the Pin Track Drive List are cleared.)



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2. Select a device name and click the add button, Drive and all domain of LBA which are specified by the pin track drive list are indicated.



3. All LBA in the selected device is started by clicking “PRoceed” button.
(This function is only reading and writing is not performed.)

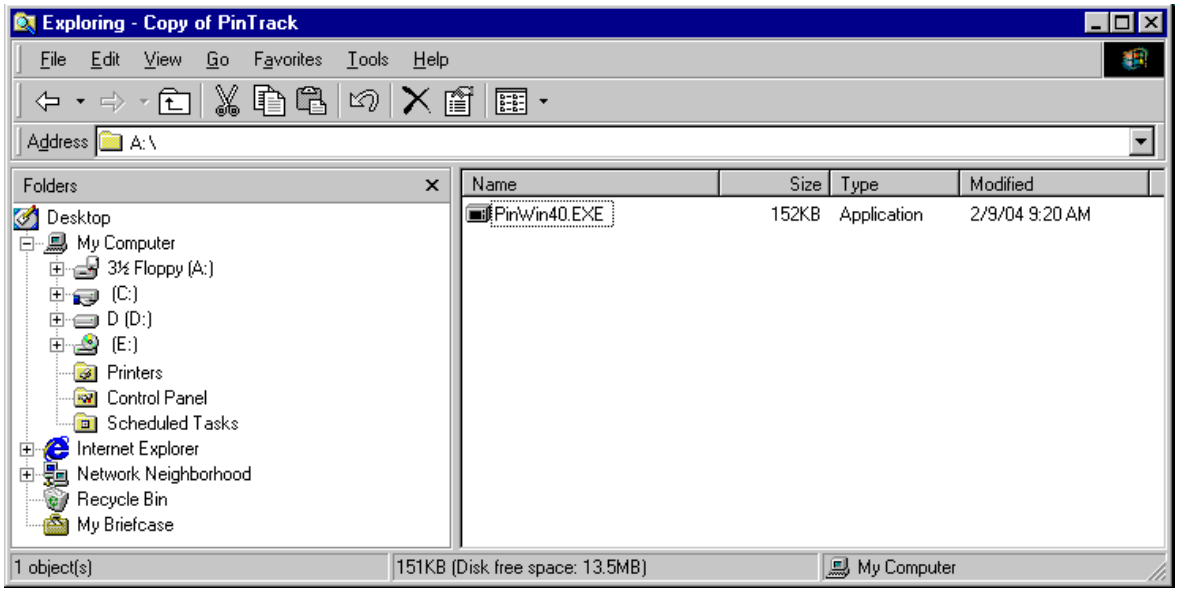
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Installation of Pin Track Tool (Windows)

NOTE: Perform the installation only when it is required.

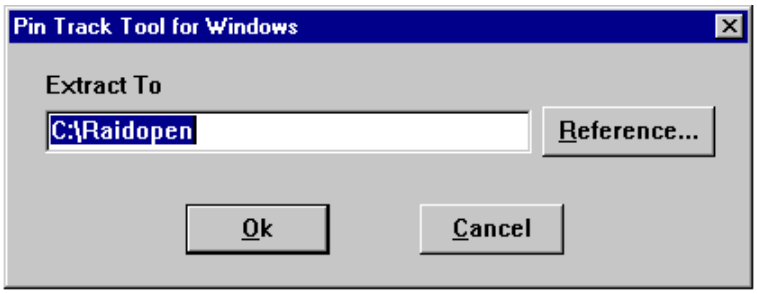
<Preparation>
The Pin Track Tool is provided being contained in one 3.5-inch floppy disk or CD-ROM. A free area of more than 10 MB is required on the disk on which the program is to be installed as the area for collecting a log. The size of the log file is approximately 400 KB per one erasing process for (60)h length SLOT. The log is collected in the log folder under the folder in which the tool is to be installed each time the Pin erasing process completes.
Since the log is collected after the processing, prepare an empty floppy disk.

<Copying from floppy disk to local disk>
1. Logon to the Windows system as administrator permission.
2. Execute the Explorer, and open the Floppy disk or CD-ROM



For CD-ROM, the path is different.
(Example : X:\Program\Ment\PINTRACK\WIN\)

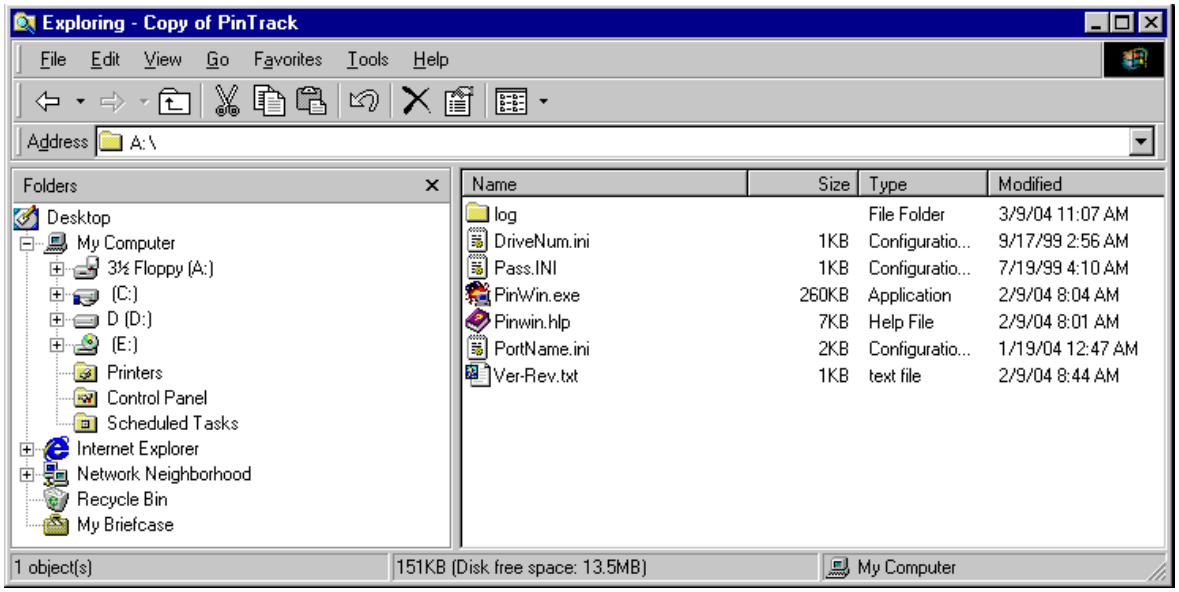
3. When executing the PinWinxx.exe., the following dialog is displayed.



4. If you specify an extracting folder and click the [OK] button, Pin Track Tool is extracted by itself.

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- Check the file name and file size displaying on the following windows.



The execution file name is PinWin.exe. When the PinWin.exe is executed, a log file, PinTrack.log, is created in the folder in which the tool has been installed. When the program is quit, the log file is copied to the log folder with a name given as “PinTrack-year-month-date-hours-minutes-seconds.log”.

- Log file
  In the log file, only the head LBA of Read/Write data of specified device is recorded. It can also record Read/Write data of all the LBAs.

  NOTE: When logs of all the LBAs are recorded, a log file of approximately 400 KB is created for (60)h length SLOT for each erasing process in the list. Therefore, be careful of the free capacity on the disk on which the tool is installed.

When a log of only the head LBA is recorded, open the DriveNum.ini file in the folder in which the tool is installed and replace “LogMode=1” with “LogMode=0”.

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Data in the log file is recorded in the format shown below.

```
2000/03/27 13:22:16 Pin Track Tool started.

\\.\PhysicalDrive0
                      No information

\\.\PhysicalDrive1
                      Product Serial R500 50430036 0042
                      Port Number    1E
                      LDKC Number    00
                      LDEV Number    002A
                      Disk Capacity  2461040640 bytes
                      Maximum LBA    000000000049583F

2000/03/27 13:23:13
\\.\PhysicalDrive1,Start LBA=0000000000000180, LBA=00000000000001DF,An error occurred
when reading.

Read Data: Top Pin No=0000000000000180
  00000000:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000010:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  00000020:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **

  0000BFE0:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  0000BFF0:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **

Read Data: Top Pin No=0000000000000181
Read Data: Top Pin No=0000000000000182

Read Data: Top Pin No=00000000000001DF
  0000BFE0:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
  0000BFF0:** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **


Write Data: Top Pin No=0000000000000180
  00000000:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

  0000BFE0:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFF0:00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

2000/03/27 13:24:13
\\.\PhysicalDrive9,Start LBA=0000000000000180,End LBA=00000000000001DF,The Pin Track
process is completed.
2000/03/27 13:24:48 Pin Track Tool is exited.
```

[Displayed items]

Time when the program was started	:	Date and time are indicated.
SCSI device information	:	Port No., LDKC No., LDEV No., disk capacity, maximum LBA, etc. are displayed.
Read log	:	Readable Pins in a specified LBA range are displayed in the lump. Unreadable Pins are displayed for each LBA. Each unreadable Pin is recorded with an asterisk (*).
Write log	:	Pins in a specified LBA range are displayed in the lump.
Entered information	:	Selected devices, Start LBA, and End LBA are displayed.
Error information	:	When a Pin is unreadable, “read error” is displayed. Besides, when an error occurs in the program, details of it are displayed.
Time when the program is quit	:	Date and time are displayed.

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Log file saving and de-installation

NOTE: Perform the de-installation only when it is required.

<Saving of log file>

1. Save the log file which executed Pin Track Tool.
   Execute Explorer to open the folder in which the tool is installed.
2. Insert the empty floppy disk prepared for the log collection and copy the whole log directory to the floppy disk.
3. Delete the files under the log directory if they are not necessary.

<De-installation of Pin Track Tool>

To uninstall the Pin Track Tool, delete all the files concerned by deleting the whole PinTrack folder in which the tool is installed.

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Acquisition of disk information

You can confirm information of the disk connected to windows by viewing the log file.

1. Execute the PinWin.exe.
2. When the window is displayed, open the PinTrack.log file.
3. A list of the connected devices is recorded in the file.

<Log file>

- For disks other than the storage system, “No Information” is displayed.
- Since the disk information is acquired using the OS function, the recording order in the log may vary.

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Identification of files affected by Pin failure

When a drive letter possible to have a Pin failure is found, identify files affected by the failure using the chkdsk command.

1. Execute Explorer, click the drive concerned by the right mouse button, and display the property.
2. Open the tool tab and click “Check” in the “Error Check”.
3. Check off all the check disk options and click the “Start” button.
4. When the dialog box is displayed, follow the instruction given in it.
5. Perform the above operations for all the drives concerned.

Verification of files and recovery of them using backup

When a file is repaired or partially deleted by the chkdsk command, verify whether the file is normal.
When the file was partially deleted or broken, delete the file and restore it using the backup.
After the file is recovered normally, check the Pin status. If a Pin remains, erase it by executing the readable Pin Track process first.

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4.2.3.3 Procedure on Solaris

The following is an erasing procedure to be used when a Pin failure occurs on Solaris.

⚠ CAUTION

In Solaris, disk device is shown as cXtYdZsN, which denotes controller, SCSI target ID, logical unit number, and slice (partition). One LDEV can be logically divided into eight portions, s0 to s7, and the each portion can be used as a disk drive. For a slice, a capacity can be set in units of cylinder, and the user accesses each slice treating it as a disk drive having LBAs starting from LBA 0.

In Solaris, note that some restrictions on the Pin erasing are induced by handling the disk drive as cXtYdZsN.

- Ensure a free capacity on the disk on which the Pin Track Tool is to be installed.
  The showrel tool, which identifies device files of Solaris according to the LDEV and LBA range shown on the MPC, creates a temporary file on the disk in order to acquire device information. If the free capacity on the disk is insufficient, the information cannot be displayed accurately.
- The Pin erasing process cannot be applied to all the LBAs.
  In Solaris, the last two cylinders are not allocated to the file system because they are reserved as alternate cylinders. The remedy for it is limited to an elimination of unreadable LBAs in the file system.
- The Pin Track Tool cannot be used against a Pin including the inaccessible cylinder.
  In the case where cylinders are divided to be allocated to slices and there exist cylinders which are not allocated to any of the slices, if a Pin including such a range is generated, the Pin shown on the MPC cannot be erased because I/Os cannot be issued. The remedy for it is limited to an elimination of unreadable LBAs in the file system.
- When an unreadable Pin is generated in the head LBA, the Pin cannot be erased.
  The management information including the device geometry is recorded in the range of LBA0x0 to 0x1FF to the slot#15. If a Pin including this range is generated, the device cannot be recognized to be a disk by the OS. Format the LDEV following the maintenance manual.

(To be continued)

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⚠ CAUTION

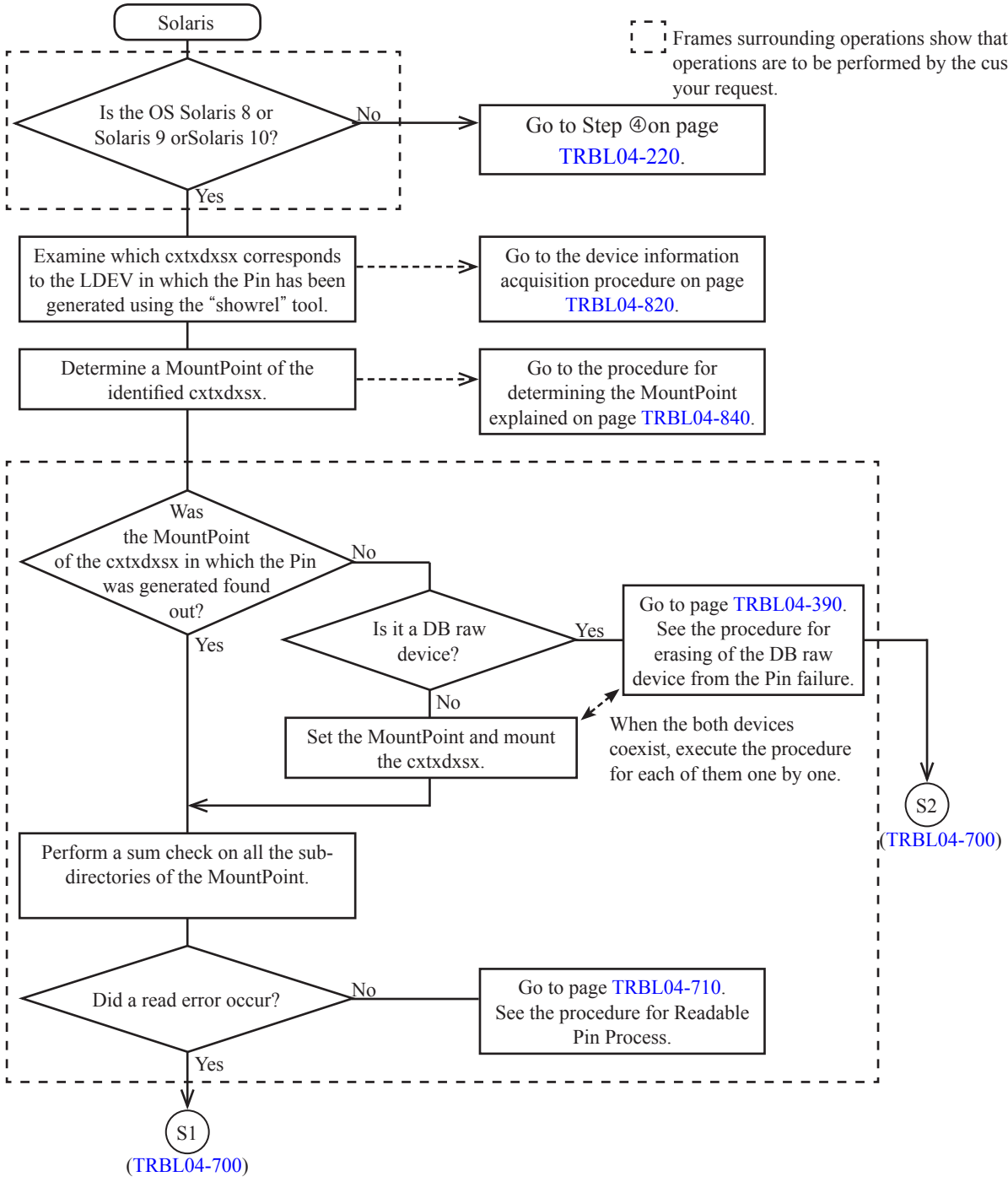
(Continued from the preceding page)

- Specify the LBA to be input in the Pin Track Tool correctly.
  When the input LBA is wrong, Solaris judges the specified range to be an unreadable Pin. Even if you try to apply the unreadable Pin Track process to it specifying the range, a write error will be caused and it is not erased. Make sure that the input LBA is correct before executing the process.
- After executing the Pin Track process, verify that the processing has completed normally referring to a log.
  To verify the execution result of the Pin Track process, refer to the log file. Read/write errors are not displayed on the screen. Furthermore, check if the input information was correct when a write error occurred as described above.

When you have to eliminate the unreadable LBA in the file system on the above conditions, operate according to the flowchart on the following pages.

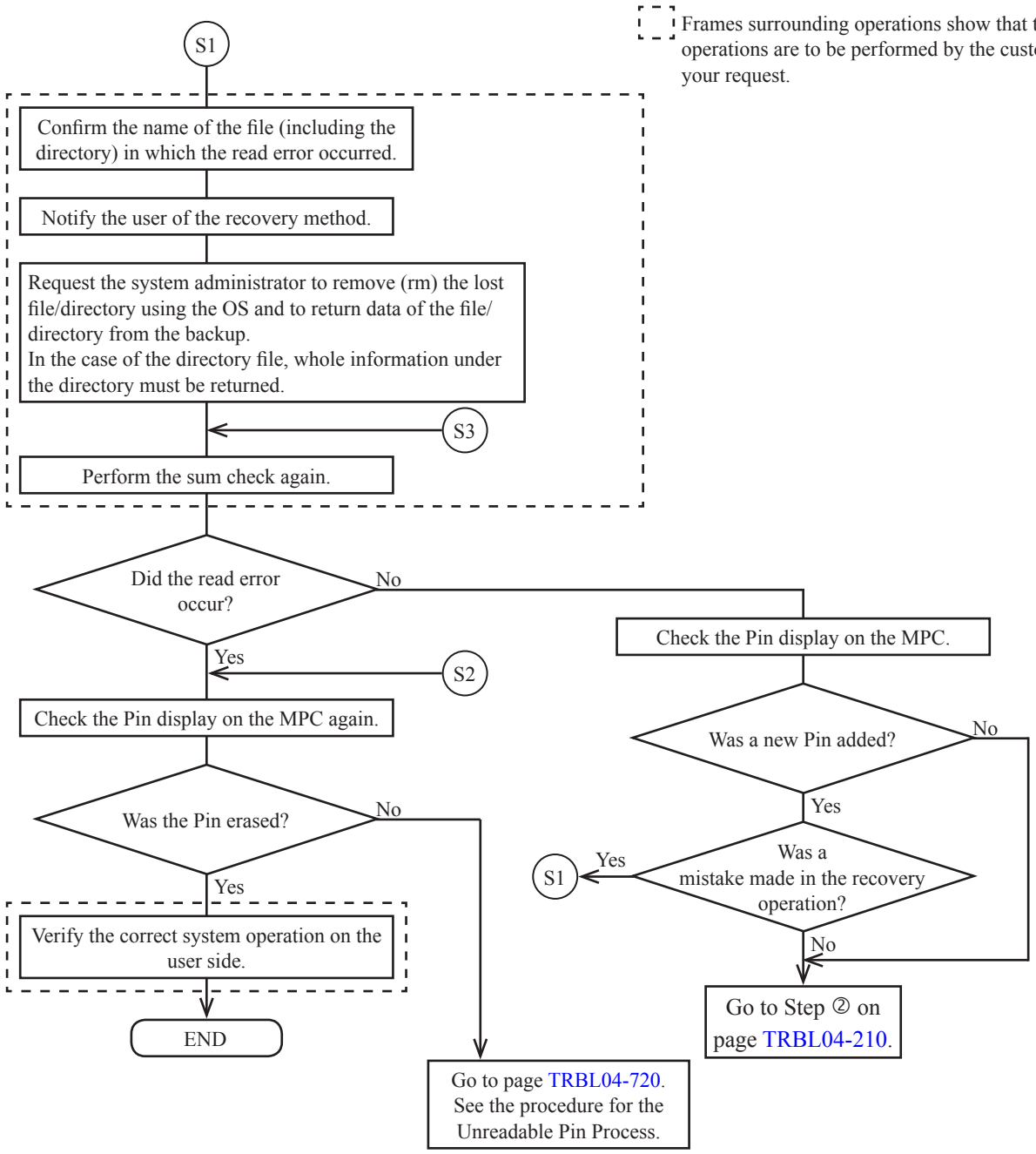
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- The following is an erasing procedure to be used when a Pin failure occurs on Solaris.



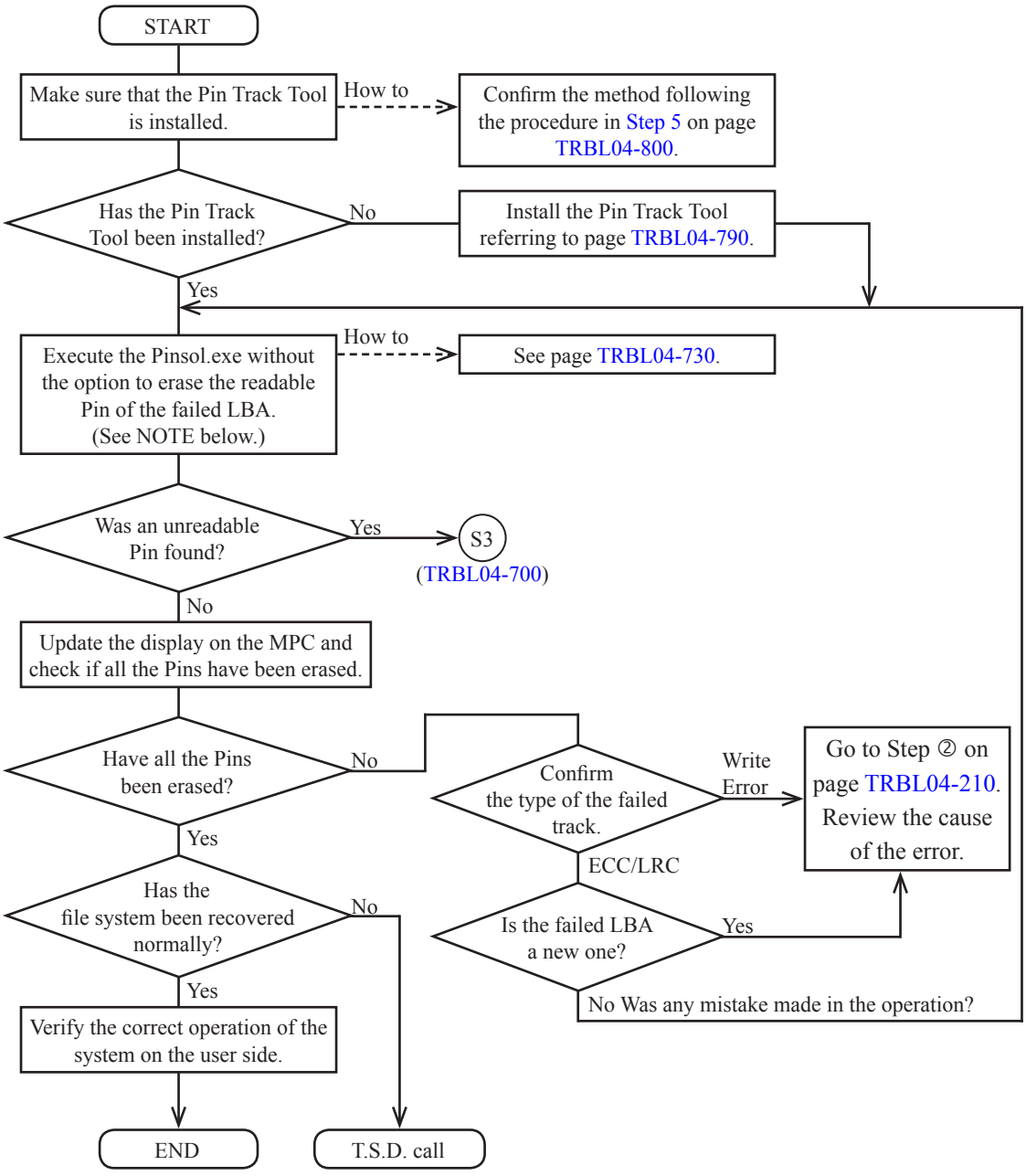
NOTE: The tools in this section will be distributed from the TRC centers at the time of need.

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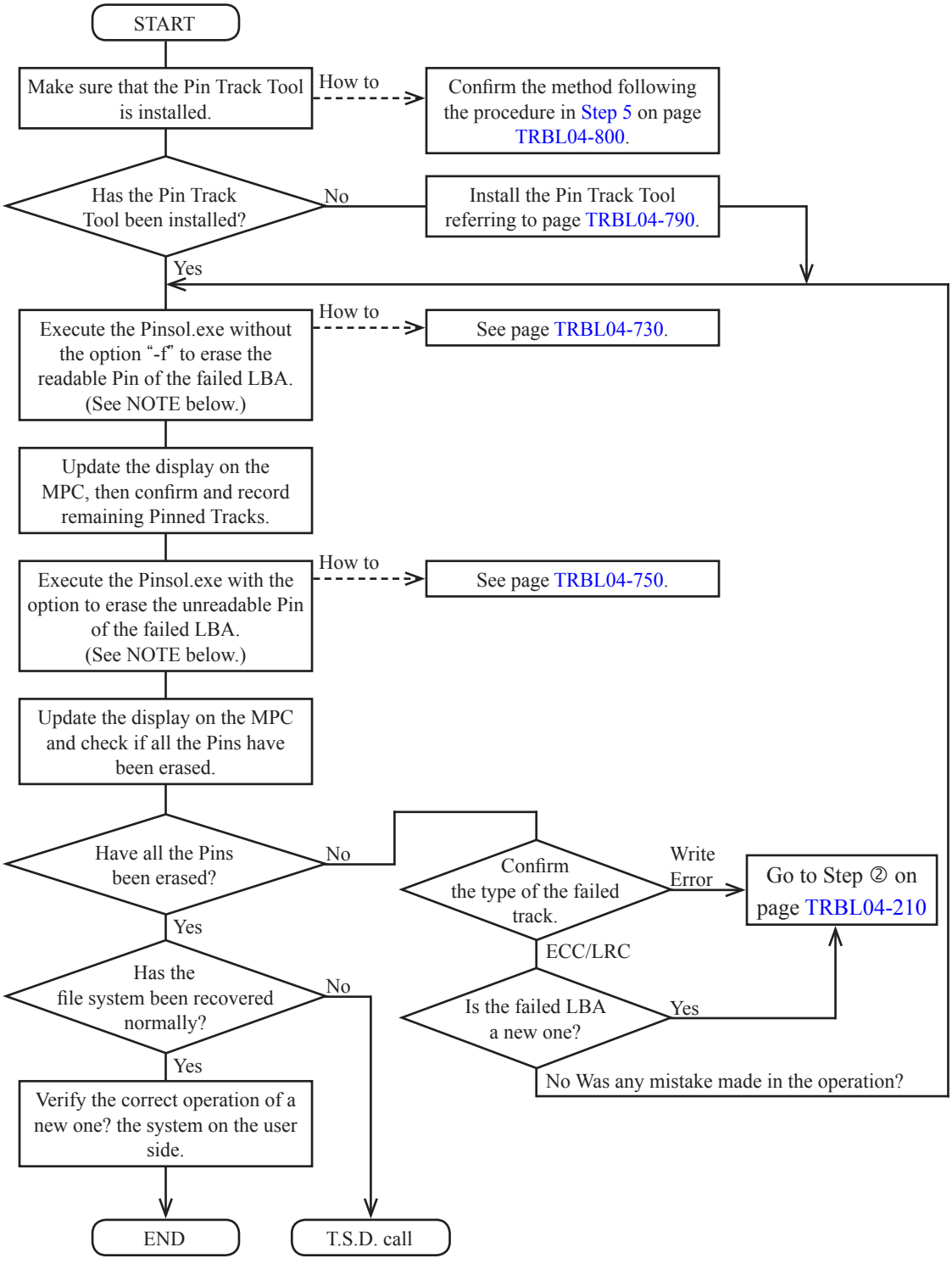
Readable Pin Process (Solaris)



NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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Unreadable Pin Process (Solaris)



NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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Operation of Readable Pin Process (Solaris)

The following explains how to operate the Pin Track Tool for erasing a readable Pin.

NOTE : - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. Move to the directory of the installed Pin Track Tool.
   #cd /usr/raidopen/pinsol

2. Execute the pinsol.exe without the option.
   # ./pinsol.exe -log Execute with a path "./".

3. Input the following information in response to questions.
   # ./pinsol.exe -log
   Input Device Name -> /dev/rdsk/c3t0d0s2 Input the cxtydzsn.
   Input Start LBA Data-> 180 Input the Start LBA.
   Input End LBA Data-> 1df Input the End LBA.
   Input Next LBA? (Y/N) ->n When two or more LBAs exist in the same device, input "y".
   Input Next Device ? (Y/N) ->n (Input of "n" is recommended.)
   When erasing Pins of two or more devices simultaneously, input "y".

   To input the LBA, convert the LBA of the LDEV shown by the Maintenance PC into the slice of Solaris the device file of which corresponds to the LBA, and input the slice. For the conversion of indication between the LBA and slice, refer to "Acquisition of Device Information" (TRBL04-820).
   The showrel tool may display the two or more corresponding LBAs depending on the slice structure. In this case, the same LBA range is possible to be designated as different slices. Execute the Pin erasing process for the LBAs in the list shown by the showrel one by one in a descending order, and check the display on the Maintenance PC each time.

   NOTE: When the input LBA does not exist in the device file of the specified slice, it is judged to be an unreadable Pin and causes a write error if the operation is continued leaving it as it is. Make sure that the input information is correct before starting the processing and that the Pin has been erased normally referring to the log after the processing terminates.

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4. Since the input data and a message for confirming whether to erase the Pin, check if the input data is correct.

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0s2	0000000000000180	00000000000001DF

Before you try to proceed the readable pin,
please check the pin information on MPC.
If the pin data have been cleared, please do not try to proceed the pin track again.
Do you want to do the process of the readable Pin?
Please input[y/n(default n)]:y

If the input data is incorrect, input “n” or simply press the “Return” key and perform the data input over again from Step (2).
Update the display on the Maintenance PC and check if the Pin concerned has been erased following the message.
When the Pin has already been erased, terminate the processing by inputting “n” or simply press the “Return” key.
When the Pin has not been erased, input “y” and press the “Return” key.

5. When the Pin is judged unreadable through the Pin type judgment, go to TRBL04-750.

Unreadable Pin:

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0s2	0000000000000180	00000000000001DF

6. When the Pin Track Tool is quit, a log file is created on the same directory.
The log file name is given as “mm-dd-hh-m‘m’-ss.log” (m: month; d: date; h: hours; m’: minutes; s: seconds).
Example:
0614200552.log means a log file created at 5 minutes and 52 seconds after 20 o’clock on June 14.

In the log file, the execution result of the Pin Track process is recorded. Make sure that the process has completed normally by checking if “pin track process complete” is displayed.

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Operation of Unreadable Pin Process (Solaris)

The following explains how to operate the Pin Track Tool for erasing an unreadable Pin.

NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. Move to the directory of the installed Pin Track Tool.
   # cd /usr/raidopen/pinsol

2. Execute the pinsol.exe with the option.
   # ./pinsol.exe -f -log When "-f" is added, the unreadable LBA is overwritten with "0" data.

3. Input the following information in response to questions.
   # ./pinsol.exe -f -log
   Input Device Name -> /dev/rdsk/c3t0d0s2 Input the cxtydzsn.
   Input Start LBA Data-> 180 Input the Start LBA.
   Input End LBA Data-> 1df Input the End LBA.
   Input Next LBA ?(Y/N) ->n When two or more LBAs exist in the same device, input "y".
   Input Next Device ?(Y/N) ->n (Input of "n" is recommended.)
   When erasing Pins of two or more devices simultaneously, input "y".

   To input the LBA, convert the LBA of the LDEV shown by the Maintenance PC into the slice of Solaris the device file of which corresponds to the LBA, and input the slice. For the conversion of indication between the LBA and slice, refer to "Acquisition of device information" (TRBL04-820).
   The showrel tool may display the two or more corresponding LBAs depending on the slice structure. In this case, the same LBA range is possible to be designated as different slices. Execute the Pin erasing process for the LBAs in the list shown by the showrel one by one in a descending order, and check the display on the Maintenance PC each time.

   NOTE: When the input LBA does not exist in the device file of the specified slice, it is judged to be an unreadable Pin and causes a write error if the operation is continued leaving it as it is. Make sure that the input information is correct before starting the processing and that the Pin has been erased normally referring to the log after the processing terminates.

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4. Since the input data and a message for confirming whether to erase the Pin, check if the input data is correct.

```
Device Name              Start LBA              End LBA
/dev/rdsk/c3t0d0s2       0000000000000180       00000000000001DF
Before you try to proceed the readable pin,
please check the pin information on MPC.
If the pin data have been cleared, please do not try to proceed the pin track again.
Do you want to do the process of the readable Pin?
Please input[y/n(default n)]:y
```

If the input data is incorrect, input “n” or simply press the “Return” key and perform the data input over again from Step (2).
Update the display on the Maintenance PC and check if the Pin concerned has been erased following the message.
When the Pin has already been erased, terminate the processing by inputting “n” or simply press the “Return” key.
When the Pin has not been erased, input “y” and press the “Return” key.

5. The following message is displayed and the Pin is judged unreadable through the Pin type judgment.

```
Unreadable Pin:
Device Name              Start LBA              End LBA
/dev/rdsk/c3t0d0s2       0000000000000180       00000000000001DF
Do you want to do the process of the unreadable Pin?
WARNING! if you input ‘y’, Pin Blocks will be over written by ‘0’.
Please input[y/n(default n)]:y
```

In the Pin Track Process, the window may be changed into monochrome, and the following message may be showed on the window. In the case, please do not pay attention to them. After 3 minutes or so, the window will back to originally status.
Example:

```
This is a message which it is displayed on the monochromic window.
WARNING: /sbus@if, 0/fc0@1, 0/sd@0, 0(sd15)
Error for Command: read                 Error Level: Retryable (or Fatal)
Requested Block: 766560                 Error Block: 766560
Vender: HP                              Serial Number: 0450F4290000
Sense key: Media Error
ASC: 0x11 (unrecovered read error), ASCQ: 0x0, FRU: 0x0
```

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6. When “y” is chosen by 5, the check message is displayed at once for every number of inputs.
   In case of plural number input, an operator can cancel the pin recovery processing for the device which you does not want to execute.

```
Unreadable Pin:
Device Name              Start LBA              End LBA
/dev/rdsk/c3t0d0s2       0000000000000180       00000000000001DF
Do you want to do the process of the unreadable Pin?
WARNING! if you input ‘y’, Pin Blocks will be over written by ‘0’.
Please input[y/n(default n)]:y
Do you want to do the process of the unreadable Pin? (The strip of LBA is 0000000000000180-
00000000000001DF). (Y/N)
```

7. When Pin Track Tool ends, a log file (month -day -hour -minute -second .log) is made on the same directory. (Eg:0614200552.log)
   As for the log file, the execution result of the Pin Track processing is recorded. Make sure that the process has completed normally by checking if “pin track process complete” is displayed.

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How to read the Read Test for whole of a disk (Solaris)

This chapter describes how to discover the Unreadable Pin on select device.
This processing requires long time.

1. Move to the directory of the Pin Track Tool.
   # cd /usr/raidopen/pinsol

2. Execute the Pin Track Tool without a command option.
   # ./pinsol.exe -all (The "-f" will become invalid if this option is used.)

3. According to the question, input the appropriate information.
   # ./pinsol.exe –all
   Input Device Name -> /dev/rdsk/c3t0d0s2
   (Please input the slice which indicate the whole device.) (Usually indicated "s2".)
   Input Next Device ?(Y/N) ->n
   (Recommend to "n") (When erasing different Device at the same time, it inputs "y")

4. The Input data list is displayed.

Device Name	Start LBA	End LBA
/dev/rdsk/c3t0d0s2	0000000000000000	00000000001F2285

   Show all domain of LAB which is specified device, and execute.

5. When Pin Track Tool ends, a log file (month -day -hour -minute -second .log) is made on the same directory. (Eg:0614200552.log)
   The log when two area (120-17F, 1E023F) of Unreadable Pin exists in specified DeviceName becomes as follows.

```
Input Device Name = /dev/rdsk/c3t0d0s2
ERROR: Read Error LBA 0000000000000120-000000000000017F
ERROR: Read Error LBA 00000000000001E0-000000000000023F
```

NOTE: The area and number of Unreadable Pin listed by other factors here may differ from the area and number of Unreadable Pin displayed by Maintenance PC.

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Installation of Pin Track Tool (Solaris)

NOTICE: Perform the installation only when it is required.

<Preparation>
Since the Pin Track Tool is provided being contained in a 4-mm DDS DAT or 3.5-inch floppy disks, a drive for installing it is necessary in the host device which controls the Pin erasing operation or on the network which includes the device concerned.
Acquire a name for the device beforehand.
Besides, ensure a free area on the disk necessary for a log collection because a log of approximately 400 bytes per failed track is output for (60)h length SLOT when the log is collected using the pintool.

NOTE: If the free capacity on the disk is insufficient, the whole information cannot be collected.

The showrel tool for LBA-slice conversion ensures a memory and creates a temporary file in order to acquire device information. Make sure that the memory capacity (larger than 128MB/CPU) and the disk free capacity (larger than 10MB) sufficient for the server are ensured.

<Copying from media to disk>
1. Login to the host as “root”.

2. Move to the install directory by the “cd” command and make a directory “raidopen”.
   # cd /usr (Move to the “/usr”)
   # mkdir raidopen (Make the directory “raidopen”)
   # cd raidopen (Move to the “raidopen”)

3. Move to the created directory and copy the files from the distribution medium.
   <In the case of DDS DAT> (device name depends on each host.)
   # mt -t /dev/rmt/0 rew (Rewind a tape.)
   # tar -xvf /dev/rmt/0 (Copy a file from the tape.)
   # tar –xvf pinsolXX.tar (Copy the tar file for Solalis.)
   <In case of the Floppy disk or CD-ROM>
   # volcheck recognize a floppy disk or CD-ROM
   confirm the label, and copy the files from the distribution medium.
   # tar -xvf /floppy/no_name/PINSOLxx.TAR (Floppy)
   # tar -xvf /cdrom/zzzz/program/ment/pintrack/solaris/pinsolXX.tar (CD-ROM)

   NOTE: (The volume label (no_name) and directory name (zzzz) is depend on the system.)

   If the copy from the floppy disk to the disk ends, it takes out a floppy disk.
   # eject Eject the medium.

   If necessary, it pushes an eject button and it takes out a floppy disk.

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4. After the thawing is complete, confirm the file name.
   # cd ./pinsol (Move to the directory made by the thawing.)
   # ls -l (Display a file list.)

5. Refer to the contents of the "Ver-Rev.txt" file and confirm each file size of the list.
   # more /usr/raidopen/pisol/Ver-Rev.txt display contents of the file

```
HITACHI RAID storage system Pin Track Tool for Solaris
              Ver XX-YY-/Z (Revision ID)
All right reserved, Copyright (c) 1999,2014, Hitachi Ltd.
File Size (Bytes)  pinsol.exe (Module ID)
File Size (Bytes)  showrels.exe (Module ID)
File Size (Bytes)  port.dat (Module ID)
```

Refer to the contents of "Ver-Rev.txt" file and confirm each file size of the list.

Saving of log file and de-installation of Pin erasing tool

NOTICE: Perform the de-installation only when it is required.

<Saving of log file>
In order to save the log file created through the Pin erasure, compress the file.

```
# cd /usr/raidopen/pinsol                          Move to the execution directory.
# mkdir ./log                                      Create a directory for the log file.
# mv *.log ./log                                   Move the log file to the logdir.
# tar -cvf pinlog.tar ./log                        Create the tar file.
# compress pinlog.tar                              Compress the tar file.
```

Save the log file to the media.

```
# tar -cvf /dev/rmt/0 pinlog.tar.Z                                  (In the case of DDS DAT)
# tar -cvf /vol/dev/rdiskette0/unlabeled pinlog.tar.Z               (In the case of floppy disk (tar))
# cp pinlog pinlog.tar.Z /vol/dev/rdiskette0/raidopen               (In the case of floppy disk (DOS))
```

<De-installation of Pin Track Tool>
To uninstall the Pin Track Tool, delete all the files concerned by deleting the whole directory in which the tool is installed.

```
# cd /                                             Move to the root directory.
# \rm -r /usr/raidopen/pinsol*                     Delete files created under the /usr/raidopen.
                                                   When "\" is added, the alias is invalidated.
```

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Procedure for collecting detail log

You can acquire detailed information on the erasing process from the Pin failure by adding the option to the Pin Track Tool.

Method of use: ./pinsd.exe(-f) -log

By executing the above, you can acquire data which was read and written in the process for erasing from the Pin failure.

Example:

```
Input Device Name = /dev/rdsk/c1t0d0s2
Input Start LBA = 0000000000000180
Input End LBA = 00000000000001DF
/dev/rdsk/c1t0d0s2, Start LBA=0000000000000180, End LBA=00000000000001df readable Pin
Track read error
Read Data:  Top Pin No=0000000000000180
  00000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000030: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
• • •
Read Data:  Top Pin No=0000000000000181
• • •
Read Data:  Top Pin No=0000000000000182
• • •
Read Data:  Top Pin No=0000000000000183
• • •
Read Data:  Top Pin No=00000000000001DF
  000001A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  000001F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Write Data:  Top Pin No=0000000000000180
• • •
  00000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000010: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000020: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000030: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  00000040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
• • •
• • •
• • •
  0000BFC0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFD0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFE0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0000BFF0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
/dev/rdsk/c1t0d0s2, Start LBA=0000000000000180, End LBA=00000000000001DF Pin Track
Process is complete!!
```

The log size is approximately 400 KB per one Pin erasure for (60)h length SLOT.
When the -log option is not added, data for each LBA is recorded for each of reading and writing.

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Acquisition of device information (how to use showrel tool) on Solaris

When the program has been installed, confirm the failed track information.

1. Move to the installed directory.
   # cd /usr/raidopen/pinsol Moving of the directory

2. Execute the following program

```
# ./showrels.exe                          Add the ./ path and execute.
Input LDKC -> 00                          Input the LDKC# shown on the MPC.
Input LDEV -> 000A                        Input the CU:LDEV# shown on the MPC.
Input Start LBA -> 0000000000044000       Input the start LBA shown on the MPC.
Input End LBA -> 000000000004405F         Input the End LBA shown on the MPC.
```

Input example and output result.

```
# ./showrels.exe
Input LDKC -> 00
Input LDEV -> 0123
Input Start LBA -> 000000000000ABE0
Input End LBA -> 000000000000AC3F

DeviceName=c0t1d0s6 Port=1A LDKC=00 LDEV=0123
           Start=0000000000000FA0 End=0000000000000FFF
```

The LDKC number is indicated with the number of two figures. The LDEV number is indicated with the CU:LDEV number of four figures. Confirm the LDKC number, CU number and LDEV number of the Pin displayed on the Maintenance PC and identify the slice of the device file. The device file name identified here is used as the input information in the process for the Pin failure.

NOTE:
- The showrel tool issues commands peculiar to the storage system to all the disk devices in order to acquire device information. Therefore, when the command is issued to a disk other than the storage system such as a built-in disk, an error (Illegal Request) may be reported to the system. It is not a problem, though.
- When an unreadable Pin is generated in the slot#15 including the head LBA in which the disk management information is recorded, the device information cannot be acquired because the disk becomes unable to respond to the OS.
- The disk device of the object may not be labeled when "Error: Target devices do not exist." is output.

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The following may be displayed depending on the setting of the slice.

When there is no information of the input LDEV in the device management table.

```
LDKC=00,LDEV=010C   This is not a target disk.
```

Check if the input LDEV number is correct.

When an LDEV which does not belong to any slice is input

```
DeviceName=c2t3d0s6 Port=1D LDKC=00 LDEV=0189 The target LBA is missing or invalid.
```

In this case, the Pin shown on the Maintenance PC cannot be erased. However, it does not have any effect on the file system.

When a Pin extends over multiple slices

```
DeviceName=c0t1d0s5 Port=1A LDKC=00 LDEV=000A
           Start=0000000000001357 End=0000000000001387
DeviceName=c0t1d0s1 Port=1A LDKC=00 LDEV=000A
           Start=0000000000000000 End=000000000000002F
```

When it is displayed that a Pin extends over multiple slices, specify the LBA displayed for each slice when executing the pinsol.exe. The Pin cannot be erased unless all the range concerned are processed by the pinsol.exe.

When an LDEV is allocated to multiple ports

```
DeviceName=c1t1d0s6 Port=1A LDKC=00 LDEV=0123
           Start=0000000000000FA0 End=0000000000000FFF
DeviceName=c0t3d0s6 Port=1C LDKC=00 LDEV=0123
           Start=0000000000000FA0 End=0000000000000FFF
```

When an LDEV is displayed at the different ports with the same LBA range of the slice, a single LDEV is allocated to multiple ports. In this case, specify any one of the devices to execute the pinsol.exe.

When multiple LBAs are displayed for an LDEV

```
DeviceName=c0t3d0s2 Port=1A LDKC=00 LDEV=0123
           Start=0000000000000FA0 End=0000000000000FFF
DeviceName=c0t3d0s6 Port=1A LDKC=00 LDEV=0123
           Start=0000000000000FA0 End=0000000000000FFF
```

When two slices are displayed with the same LBA range for an LDEV, a slice to which the same cylinder is allocated may exist. Normally one of the slices is 2. In this case, specify a device described ahead in order to execute the pinsol.exe. If the Pin is not erased when the Maintenance PC display is checked after the Pin erasing process has terminated normally, execute the pinsol.exe for another device.

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Procedure for determining MountPoint (on Solaris)

NOTICE: The following operation must be performed by the system administrator at your request checking result at each step.

Display by the showrel

When the showrel explained in TRBL04-820 is used, the LDKC number, and the LDEV number shown on the Maintenance PC and to which device file the range between the Start LBA and End LBA corresponds are displayed. Refer to TRBL04-820, “How to use showrel tool”.

Display by prtvtoc

Input “#prtvtoc <raw-device-name>” to display the slice list and find out all the slices in which Pins have been generated.

```
* /dev/rdsk/c0t1d0s5 partition map
*
* Dimension:
*  512 bytes/sector
*  80 sectors/tarck
*  9 tracks/cylinder
*  720 sectors/cylinders
*  2500 cylinders
*  1151 accsessible cylinders
*
* Flags:
* 1: unmountable
* 10: read-only
*
*                         First     Sector  Last
* Partition  Tag  Flags   Sector    Count   Sector  Mount Directory
      0       2    00       0      76320  76319
      1       3    0176320142480 208799
      2       5    00       0      828720 828719
      5       6    00   208800     131760 340559   /opt
      6       4    00   340560     447120 787679   /usr
      7       8    00   787680     41040  828719   /export/home
```

You can confirm the current MountPoint by viewing the display of the Mount Directory.

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Determination using /etc/vfstab

Find out the MountPoint where the /dev/dsk/cxtydzsn is mounted using the #cat/etc/fstab.

```
# cat /etc/vfstab
#device         device          mount           FS      fsck    mount   mount
#to mount       to fsck         point           type    pass    at boot options
fd      -       /dev/fd fd      -       no      -
/proc   -       /proc   proc    -       no      -
/dev/dsk/c0t3d0s1       -       -       swap    -       no      -
/dev/dsk/c0t3d0s0       /dev/rdsk/c0t3d0s0      /       ufs     1   no   -
/dev/dsk/c0t3d0s6       /dev/rdsk/c0t3d0s6      /usr    ufs     1   no   -
/dev/dsk/c0t3d0s3       /dev/rdsk/c0t3d0s3      /var    ufs     1   no   -
/dev/dsk/c0t3d0s7       /dev/rdsk/c0t3d0s7      /export/home    ufs     2   yes
-
/dev/dsk/c0t1d0s7       /dev/rdsk/c0t1d0s7      /export/home1   ufs     3   yes
-
swap    -       /tmp    tmpfs   -       yes     -
#
```

You can make sure whether the object device is mounted automatically or not.

Determination using df

Reconfirm the “Ivol name” and “mount point” recognized by the filesystem using the #df -k.

```
# df -k
Filesystem          kbytes    used     avail   capacity  Mounted on
/dev/dsk/c0t3d0s0    76767    17735    58956        24%  /
/dev/dsk/c0t3d0s6   738902   552048   185931        75%  /usr
/proc                    0        0        0         0%  /proc
fd                       0        0        0         0%  /dev/fd
/dev/dsk/c0t3d0s3    30807    17911    12866        59%  /var
/dev/dsk/c0t3d0s7    53535     7923    45559        15%  /export/home
/dev/dsk/c0t1d0s7   489702   189635   299578        39%  /export/home1
swap                121856      212   121644         1%  /tmp
/dev/dsk/c1t0d0s0  7095037  2163405  4860682        31%  /open-0
/dev/dsk/c1t1d0s0  7095757  2049632  4975168        30%  /open-0
#
```

You can make sure whether the object device is being mounted currently or not.

Decide the MountPoint to be checked by the “sum” command following the procedure above.

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4.2.3.4 Procedure on AIX, VMWare ESX, Linux

The following shows how to erase a pin failure on AIX, VMWare ESX, Linux.

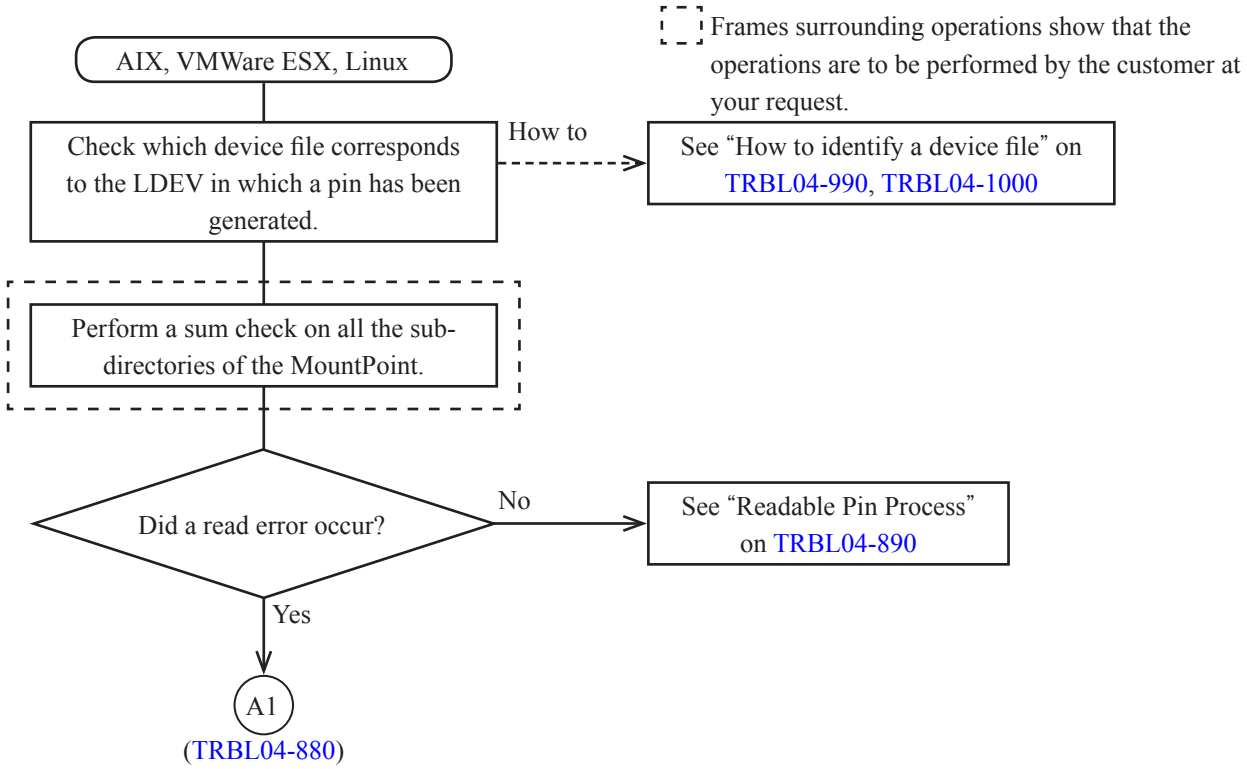
⚠ CAUTION

- Ensure a free capacity on the disk on which the Pin Track Tool is to be installed.
- When an unreadable pin is generated in the head LBA, the pin cannot be erased.
  The management information including the device geometry is recorded in the range of LBA0x0 to 0x1FF to the slot#15. If a pin including this range is generated, the device cannot be recognized to be a disk by the OS. Format the LDEV following the maintenance manual.
- Specify the LBA to be input in the Pin Track Tool correctly.
  The host cannot determine whether or not a pin has been generated in the input LBA. It performs a pin recovery or erases an unreadable pin for the input LBA. Therefore, if you input information improperly, data may be lost.
- After executing the pin track process, see the log to confirm that it has completed normally.

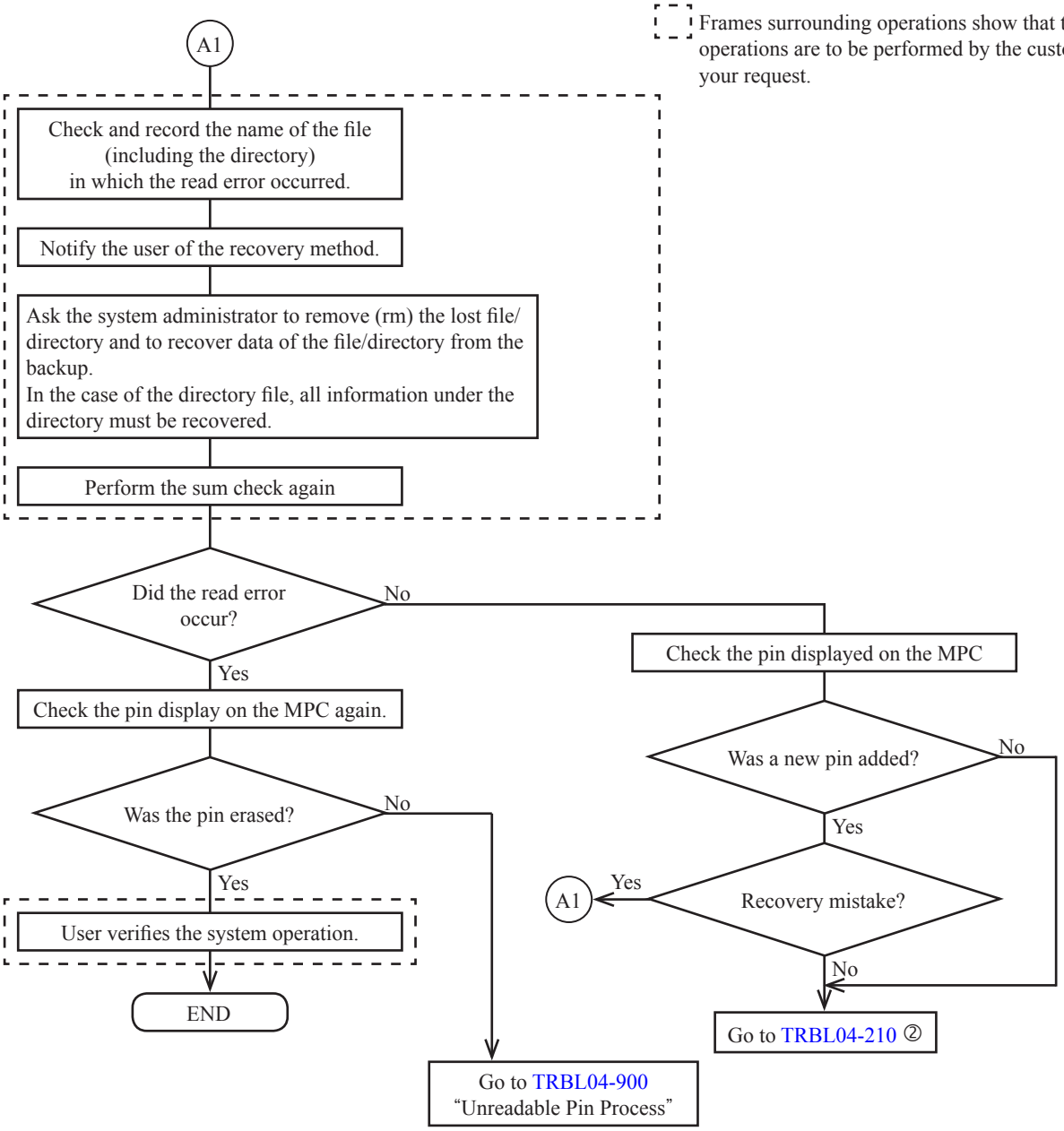
To delete the unreadable LBA in the file system under the above-described conditions, perform operations according to the flowchart on the following pages.

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- The flow shows the procedure in the case a pin failure occurs on AIX, VMWare ESX, Linux.

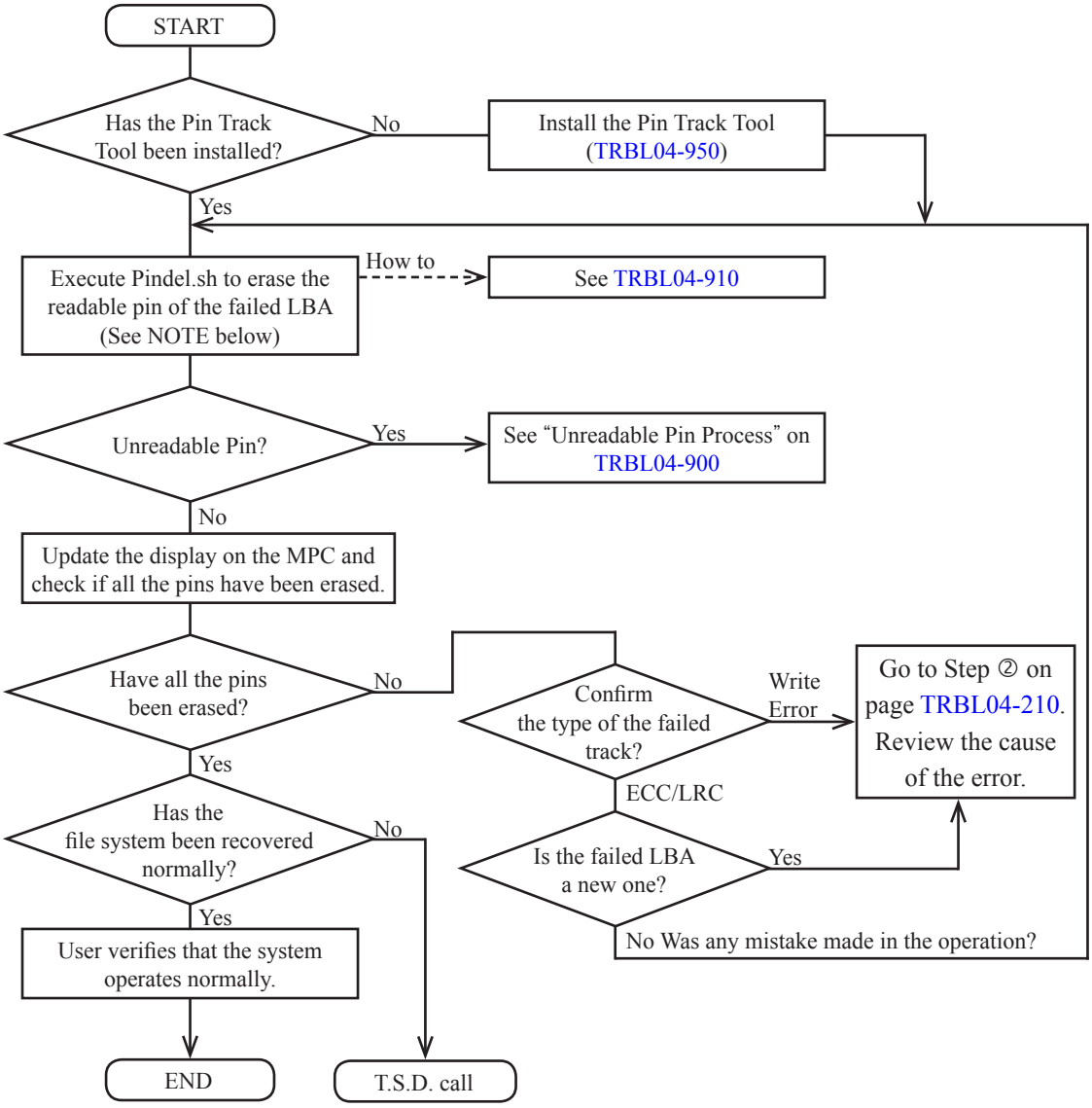


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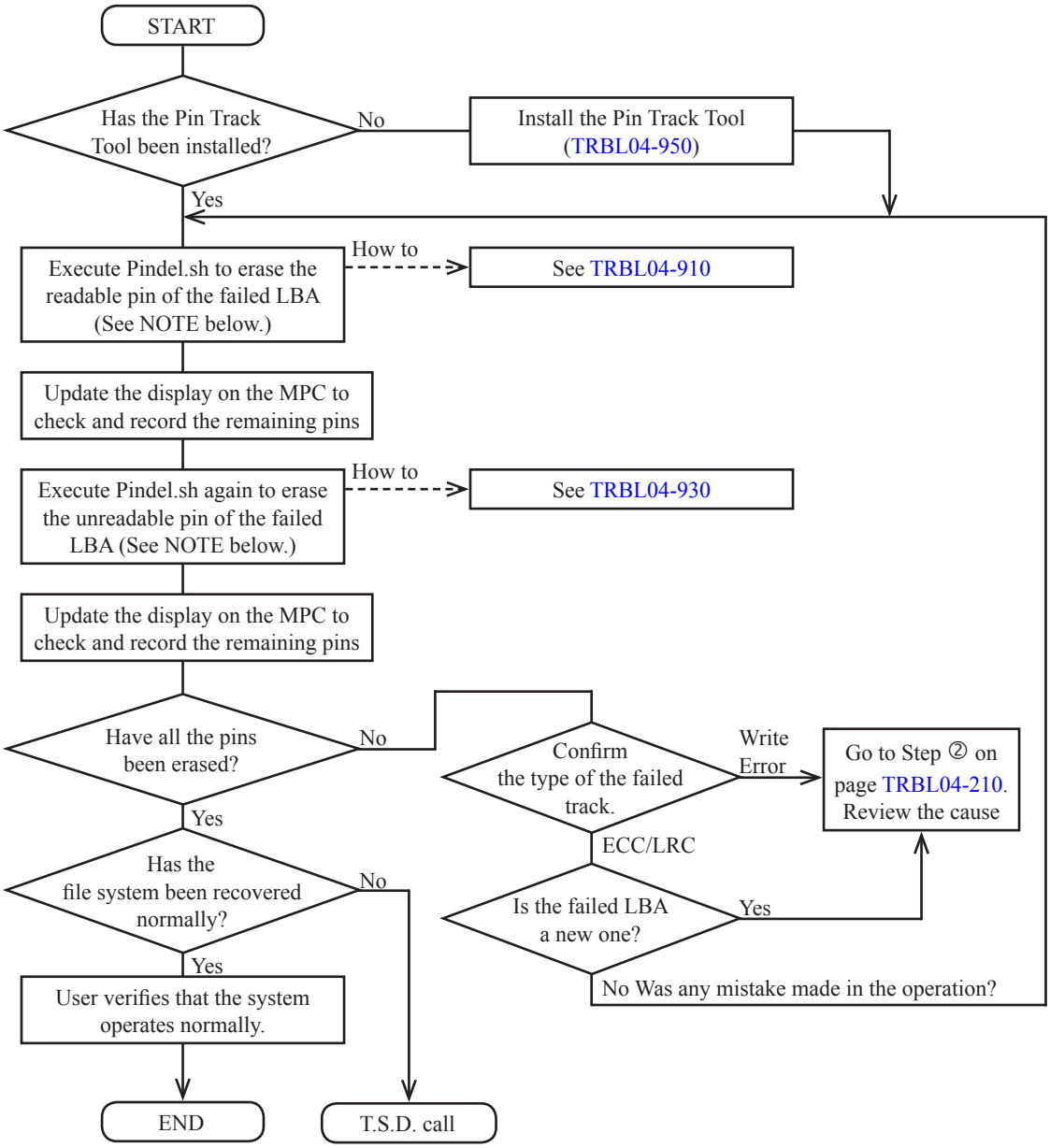
Readable Pin Process (AIX, VMWare ESX, Linux)



NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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Unreadable Pin Process (AIX, VMWare ESX, Linux)



NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and a SIM may be reported.

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How to erase Readable Pin (AIX, VMWare ESX, Linux)

The following explains how to operate the Pin Track Tool to erase a readable pin.
(The tool is available also on Tru64.)

NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. Move to the directory of the installed Pin Track Tool.
   # cd /usr/raidopen/pinsh

2. Execute the Pindel.sh without the option.
   # ./Pindel.sh

3. Input the following information in response to questions.
   # ./Pindel.sh
   Pin Recovery Tool Ver. 01-03 start.
   (If you want to cancel the program,please input “q”.)
   Input Device Name ->/dev/rhdisk69 Input the RAW device file name (/dev/rhdiskXX)
   Input Start LBA Data ->20000 Input the Start LBA
   Input End LBA Data ->201ff Input the End LBA

   When you make an input mistake and want to redo it from the start, enter “q”. The program will stop.

   Before inputting an LBA, check which device file on the AIX host corresponds to the LBA of the LDEV displayed on the Maintenance PC. See TRBL04-990 “How to identify a device file”.

⚠ CAUTION

Make sure to specify the RAW device file for the device file.
Do not specify a block device.

The device file name in the above example is for AIX.
The file name of the RAW device file of Linux is of the form /dev/raw/rawXX.
Input the LBA to the Pin Track Tool accurately.
If you input it improperly, data loss may occur.

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4. When the LBA is read successfully, the following messages are displayed.

```
Please wait. Now Reading Pin...
Finished.
Before you try to proceed the readable pin,
please check the pin information on MPC.
If the pin track has been cleared,
please do not try to proceed the pin recovery again.
Do you want to do the process of the readable Pin?(Y/N)
```

   Follow the messages and refresh the display on the Maintenance PC to see if the pin has been cleared.
   If it has been cleared, enter “n” to exit.
   If not, enter “y”.

5. When the pin is judged as an “unreadable pin” through the pin type judgment as follows, go to TRBL04-930.

```
Please wait. Now Reading Pin...
Failed.
Do you want to do the process of the unreadable Pin? (The strip of LBA is 0x20000-0x201ff)(Y/N)
```

6. When the Pindel.sh starts, a log file will be created on the same directory.
   The log file name is given as “MM-dd-hh-mm-ss.log”.
   <Example>
   0614200552.log → Log file created on June 14 at 20:05:52 (hour:minutes:seconds).

   In the log file, the execution result of erasing the pin is recorded. Make sure that the process has completed normally by confirming that “Pin Recovery process completed!!” is displayed.

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How to erase unreadable pin (AIX, VMWare ESX, Linux)

The following explains how to operate the Pin Track Tool to erase an unreadable pin.
(The tool is available also on Tru64.)

NOTE: - On an SIM reported owing to a use of the Pin Track Tool -
When two or more Pins have been generated in the LBAs adjacent in the same LU, a generation of a new temporary Pin caused by the parity calculation performed in the Pin Track process may occur and an SIM may be reported.

1. Move to the directory of the installed Pin Track Tool.
   # cd /usr/raidopen/pinsh

2. Execute the Pindel.sh
   # ./Pindel.sh

3. Input the following information in response to questions.
   # ./Pindel.sh
   Pin Recovery Tool Ver. 01-03 start.
   (If you want to cancel the program,please input “q”.)
   Input Device Name ->/dev/rhdisk69 Input the RAW device file name (/dev/rhdiskXX)
   Input Start LBA Data ->20000 Input the Start LBA
   Input End LBA Data ->201ff Input the End LBA

   When you make an input mistake and want to redo it from the start, enter “q”. The program will stop.

   Before inputting an LBA, check which device file on the AIX host corresponds to the LBA of the LDEV displayed on the Maintenance PC. See TRBL04-990 “How to identify a device file”.

⚠ CAUTION

Make sure to specify the RAW device file for the device file.
Do not specify a block device.

The device file name in the above example is for AIX.
The file name of the RAW device file of Linux is of the form /dev/raw/rawXX.
Input the LBA to the Pin Track Tool accurately.
If you input it improperly, data loss may occur.

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4. When the LBA is read successfully, the following messages are displayed.

```
Please wait. Now Reading Pin...
Finished.
Before you try to proceed the readable pin,
please check the pin information on MPC.
If the pin track has been cleared,
please do not try to proceed the pin recovery again.
Do you want to do the process of the readable Pin?(Y/N)
```

   Follow the messages and refresh the display on the Maintenance PC to see if the pin has been cleared.
   If it has been cleared, enter “n” to exit.
   If not, enter “y”.

5. When the pin is judged as an “unreadable pin” through the pin type judgment as follows, the following message is displayed.

```
Please wait. Now Reading Pin...
Failed.
Do you want to do the process of the unreadable Pin? (The strip of LBA is 0x20000-0x201ff)(Y/N)
```

6. “Y” is selected in 5, data will be erased for the LBA area in which a pin is generated. When it succeeds, the following message will be displayed.
   When an error occurs, follow the procedure described in TRBL04-900 to review the cause of the failure.

```
Please wait. Now Clearing Pin ...
Finished.
Pin Recovery process completed!! (unreadable Pin)
```

7. When the Pindel.sh ends, a log file will be created on the same directory.
   The log file name is given as “mm-dd-hh-mm-ss.log”.
   <Example>
   0614200552.log → Log file created on June 14 at 20:05:52 (Hour:Minutes:Seconds).

   In the log file, the execution result of erasing the pin is recorded. Make sure that the process has completed normally by confirming that “Pin Recovery process completed!!” is displayed.

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Installation of Pin Track Tool

NOTICE: Perform the installation only when it is required.

<Preparation>
Since the Pin Track Tool is provided being contained in a 4-mm DDS DAT or 3.5-inch floppy disks, a drive for installing it is necessary in the host device which controls the Pin erasing operation or on the network which includes the device concerned.
Acquire a name for the device beforehand.
Besides, ensure a free area on the disk necessary for a log collection because a log of approximately 400 bytes per failed track is output for (60)h length SLOT when the log is collected using the pintool.

NOTE: If the free capacity on the disk is insufficient, the whole information cannot be collected.

<Copying from media to disk>
1. Login to the AIX machine as “root”.

2. Move to the install directory by the “cd” command and make a directory “raidopen”.
   # cd /usr (Move to the “/usr”)
   # mkdir raidopen (Make the directory “raidopen”)
   # cd raidopen (Move to the “raidopen”)

3. Execute the following command to decompress pinshXX.tar and copy the files from the medium to the created directory.

   # tar -xvf /cdrom/zzzz/program/ment/pintrack/sh/pinshXX.tar (CD-ROM)

   NOTE: The directory name (zzzz) may be different.

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4. After the file is decompressed, confirm the file name.
   # cd ./pinsh (Move to the directory created as a result of the decompression)
   # ls -l (Display a file list.)

5. Specify the –ver option and execute Pindel.sh to confirm the version.
   # ./Pindel.sh -ver

```
HITACHI RAID storage system Pin Track Tool for AIX,Tru64,VMWare ESX,Linux
              Ver XX-YY
All right reserved, Copyright (c) 2007-2015, Hitachi Ltd.
File size(Bytes)  Pindel.sh      (Module ID)
```

Confirm that the contents of the file above and the data displayed with the ls command are consistent.

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Saving the log file and uninstalling Pin Track Tool

NOTICE: Perform the uninstallation only when it is required.

<Saving the log file>
To save the log file created through the pin recovery, compress the file.

# cd /usr/raidopen/pinsh	Move to the execution directory.
# mkdir ./log	Create a directory for the log file.
# mv *.log ./log	Move the log file to logdir.
# tar -cvf pinlog.tar ./log	Create a tar file.

Save the log file to the media.

# tar -cvf /dev/rmt/0 pinlog.tar.Z	(In the case of DDS DAT)
# tar -cvf /vol/dev/rdiskette0/unlabeled pinlog.tar.Z	(In the case of floppy disk (tar))
# cp pinlog pinlog.tar.Z /vol/dev/rdiskette0/raidopen	(In the case of floppy disk(DOS))

<Uninstalling the Pin Track Tool>
To uninstall the Pin Track Tool, delete all the files concerned by deleting the whole directory in which the tool is installed.

# cd /	Move to the root directory.
# \rm -r /usr/raidopen/pinsh*	Delete files created under /usr/raidopen. When “\” is added, the alias is invalidated.

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How to identify a device file (AIX)

The following shows an example of associating a device file, which is to be the input information of the Pin Track Tool, with the LDEV in which a pin is generated.

1. Execute the following command to display a list of disk devices that are enabled on the AIX.

   lsdev -C -c disk

   The result of execution is as follows. “Available” devices are the disk devices that can receive I/Os.

   ```
   # lsdev -C -c disk
   .........
   .........
   hdisk65 Defined 06-08-02        Hitachi Disk Array (Fibre)
   hdisk66 Defined 06-08-02        Hitachi Disk Array (Fibre)
   hdisk67 Defined 06-08-02        Hitachi Disk Array (Fibre)
   hdisk68 Available 06-08-02      Hitachi Disk Array (Fibre)
   hdisk69 Available 06-08-02      Hitachi Disk Array (Fibre)
   hdisk70 Available 06-08-02      Hitachi Disk Array (Fibre)
   ```

2. Next, execute the following command to check the details of the “Available” devices (Example for hdisk69).

   lsattr -E -l hdisk69|grep lun_id

   The result of execution is as follows.

   ```
   # lsattr -E -l hdisk69|grep lun_id
   lun_id        0x1000000000000    Logical Unit Number ID
   ```

   The result shows that the LDEV of the LUN = 1 is associated with hdisk69.
   When the LDEV with the pin is LDKC:CU:LDEV = 00:08:05 and LUN = 1, the corresponding device file is hdisk69.
   You can check LUN in the LUNM window on the Web Console.

   In this case, specify a RAW device file /dev/rhdisk69 to the Pin Track Tool.
   (Do not specify a block device (/dev/hdisk69). Data loss may occur.)

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How to identify a device file (VMWare ESX, Linux)

The following shows an example of associating a device file, which is to be the input information of the Pin Track Tool, with the LDEV in which a pin is generated.

1. Execute the following command to display a list of disk devices that are enabled on the VMWare ESX, Linux.

   cat /proc/scsi/scsi

   The result of execution is as follows. The one whose "Model" is " (OPEN-V)" are the LU devices that can receive I/Os.

```
# cat /proc/scsi/scsi
.....
Host: scsi3 Channel: 00 Id: 00 Lun: 00
  Vendor: HITACHI  Model: OPEN-V          Rev: 5008
  Type:   Direct-Access                   ANSI SCSI revision: 03
Host: scsi3 Channel: 00 Id: 00 Lun: 01
  Vendor: HITACHI  Model: OPEN-V          Rev: 5008
  Type:   Direct-Access                   ANSI SCSI revision: 03
```

2. Next, the disk device name corresponding to a peculiar Lun number is confirmed by the following commands. First of all, the file to which it refers by the following commands is confirmed.

   # ls -la /var/log/messages*

   The result of execution is as follows.

```
-rw-------  1 root  root  18423  Jun  11 10:11 /var/log/messages
-rw-------  1 root  root  36883  Jun   8 04:03 /var/log/messages.1
-rw-------  1 root  root   1560  Jun   1 04:03 /var/log/messages.2
-rw-------  1 root  root  19539  May  25 04:03 /var/log/messages.3
-rw-------  1 root  root   2604  May  18 04:03 /var/log/messages.4
```

   The file date looks for the latest one by the above-mentioned. /var/log/messages is the latest here.

   Next, the following commands are executed.

   # more /var/log/messages

The result of execution is as follows.

```
# more /var/log/messages
.....
Jun 11 10:09:32 x86AS30 kernel: Attached scsi disk sdb at scsi3, channel 0, id 0, lun 0
Jun 11 10:09:32 x86AS30 kernel: Attached scsi disk sdc at scsi3, channel 0, id 0, lun 1
.....
```

The result shows that the LDEV of the LUN = 1 is associated with sdb from “Attached scsi disk”.
When the LDEV with the pin is LDKC:CU:LDEV = 00:08:05 and LUN = 1, the corresponding device file is sdb.
You can check LUN in the LUNM window on the Maintenance PC or Web Console.

In this case, because the block device file of the object becomes /dev/sdb, the device file specified for Pin Track Tool becomes RAW device file linked with /dev/sdb.
(Do not specify a block device (/dev/sdb). Data loss may occur.)

First of all, to confirm linked the RAW device files, the following commands are executed.

```
# raw -qa
```

The execution result is as follows.

```
/dev/raw/raw1: bound to major 8, minor 0
/dev/raw/raw2: bound to major 8, minor 1
.....
```

Next, the following commands are executed. It corresponds to the numerical value of major that the figure that is behind “disk” is respectively in the above-mentioned result and minor.

```
# ls -l /dev/sdb
```

The execution result is as follows.

```
brw-rw---- 1 root disk 8, 0 May 6 2008 sdb
```

Therefore, the RAW device file becomes /dev/raw/raw1.

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4.2.3.5 List of Pin Track Tool Directories

- /program/MENT/pintrack/readme-e.txt

- /program/MENT/pintrack/HP-UX/pinhpXX.tar
- /program/MENT/pintrack /Sh/pinshXX.tar
- /program/MENT/pintrack /Solaris/pinsolXX.tar
- /program/MENT/pintrack /Windows/PinWinxx.exe

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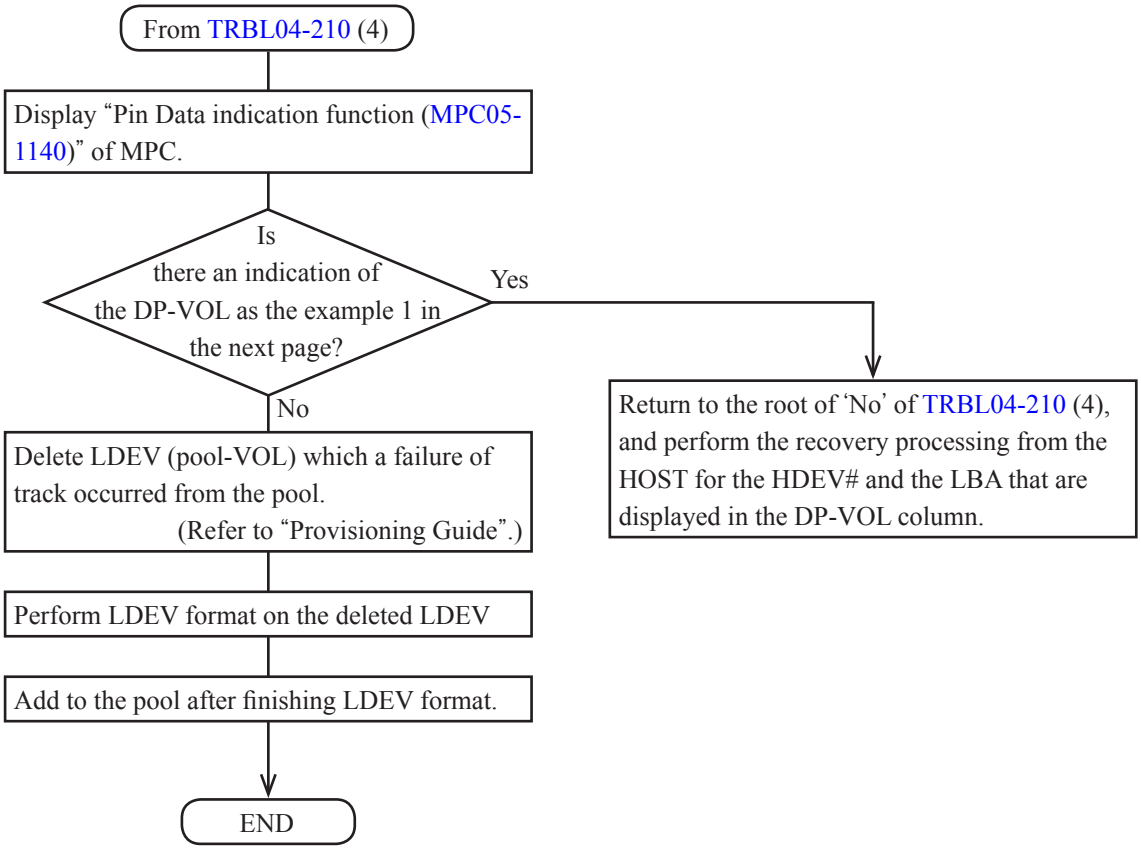
4.2.3.6 ECC/LRC Error Recovery Processing of DP pool-VOL

When an ECC/LRC Error occurs in a pool-VOL, perform the following recovery method because an I/O cannot be issued directly from the HOST for the track concerned.

NOTE1 : In case of a Write Error, perform TRBL04-230 as well as the normal VOL and recover it.

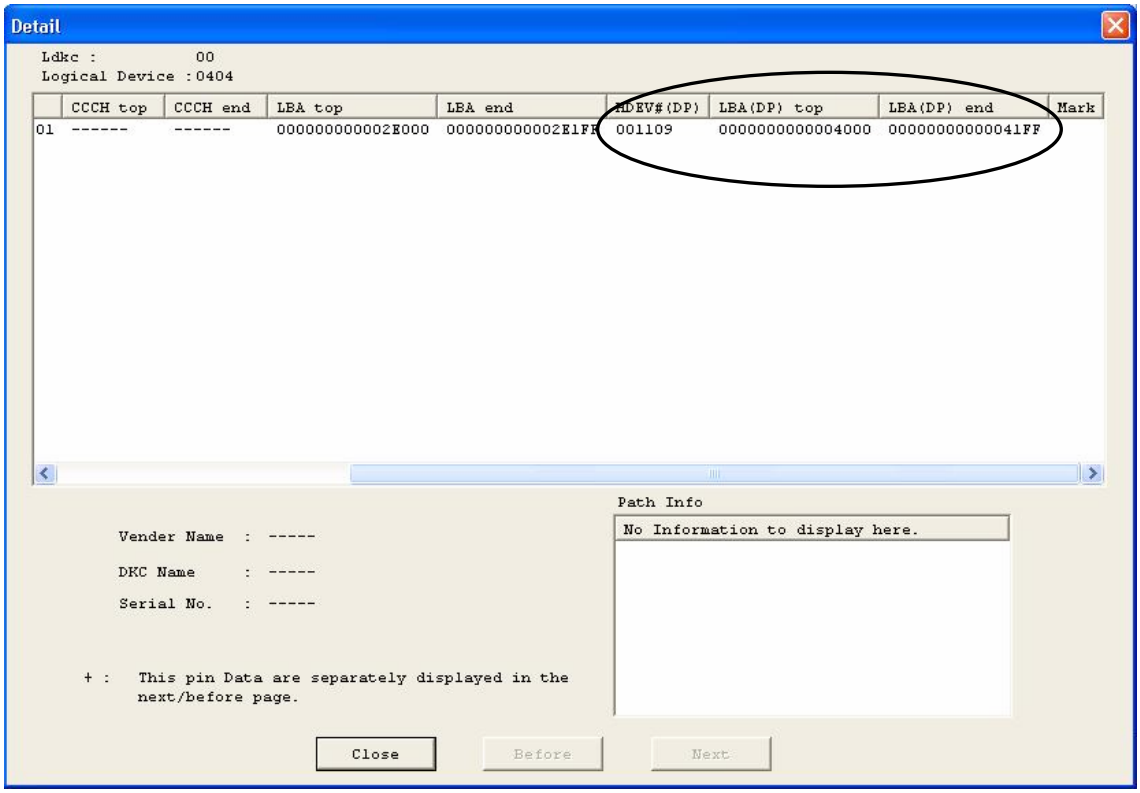
NOTE2 : The LDEV that a POOL ID is displayed on the logical device window is a pool-VOL.

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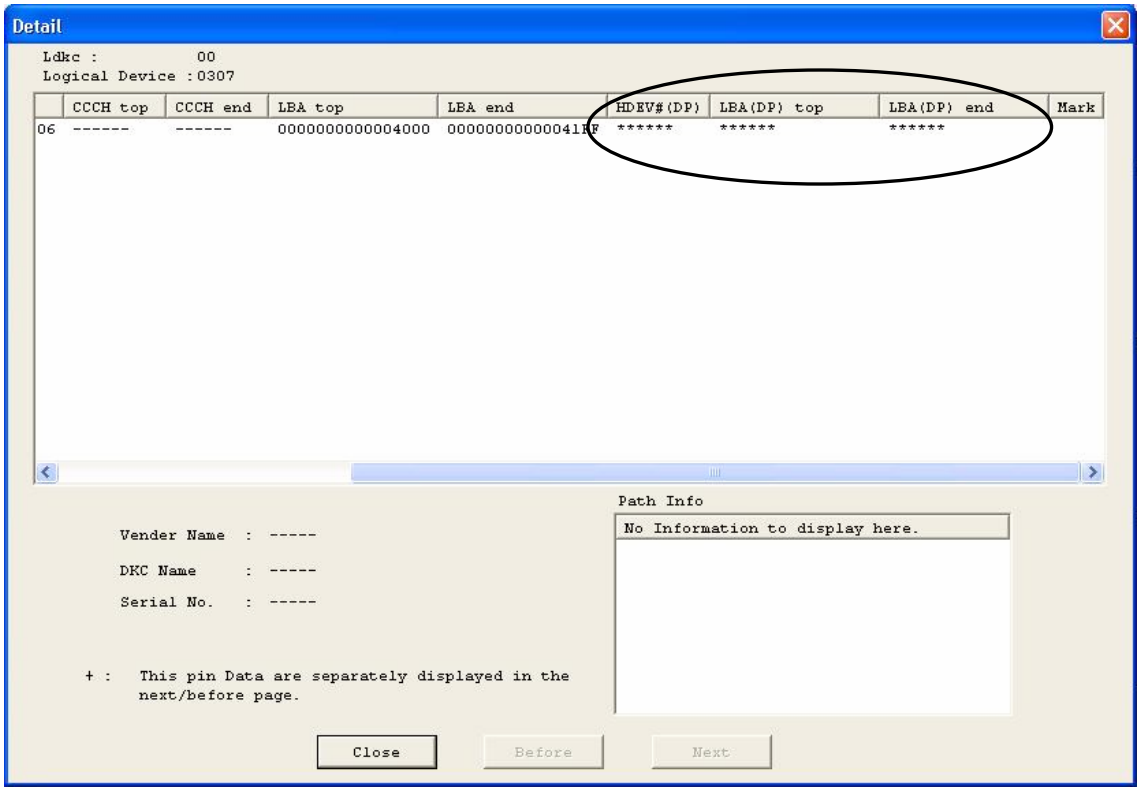
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Example 1: When there is an indication of a DP-VOL



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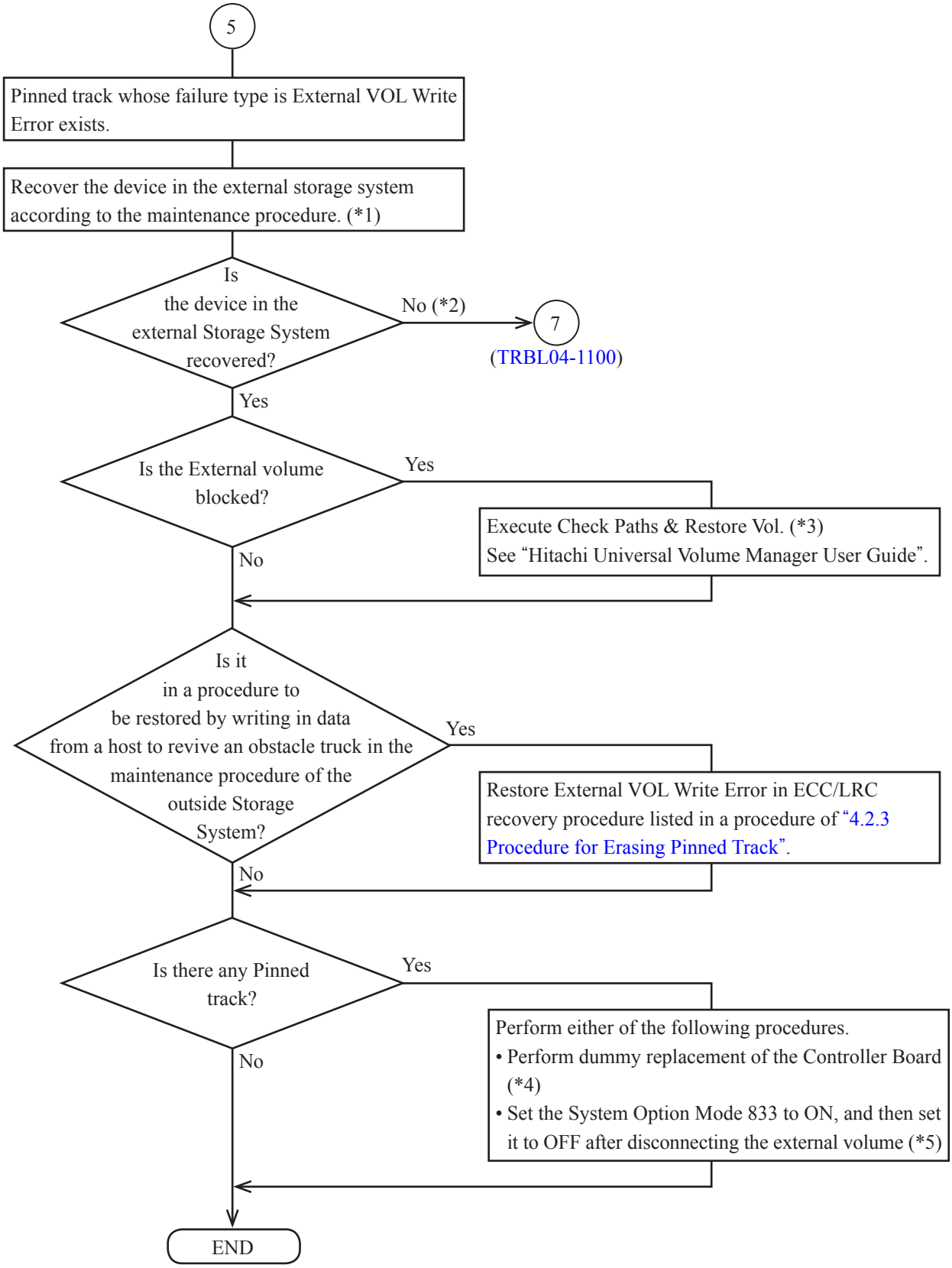
Example 2: When there is no indication of a DP-VOL



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4.2.3.7 Recovery from External VOL Write Error

When an External VOL Write Error occurs, perform the following recovery procedure.



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*1: It should be done in the external Storage System. The user needs to ask the service personnel of the external Storage System to perform the maintenance operation of the Storage System. (If the external Storage System is Hitachi storage, recover the faulty part according to the Maintenance Manual.)

*2: Because data on device of external Storage System cannot be secured with this case, it is not possible to recommend it. However, because the maintenance (Example: Update Firmware) of VSP Gx00 controlled so that pinned track may exist can be executed, it is likely to execute it in an urgent case to give priority to the recovery of hardware failure of VSP Gx00 unit.

*3: It should be done using Storage Navigator. Ask the customer to perform the recovery operation by using Storage Navigator according to the User Guide.

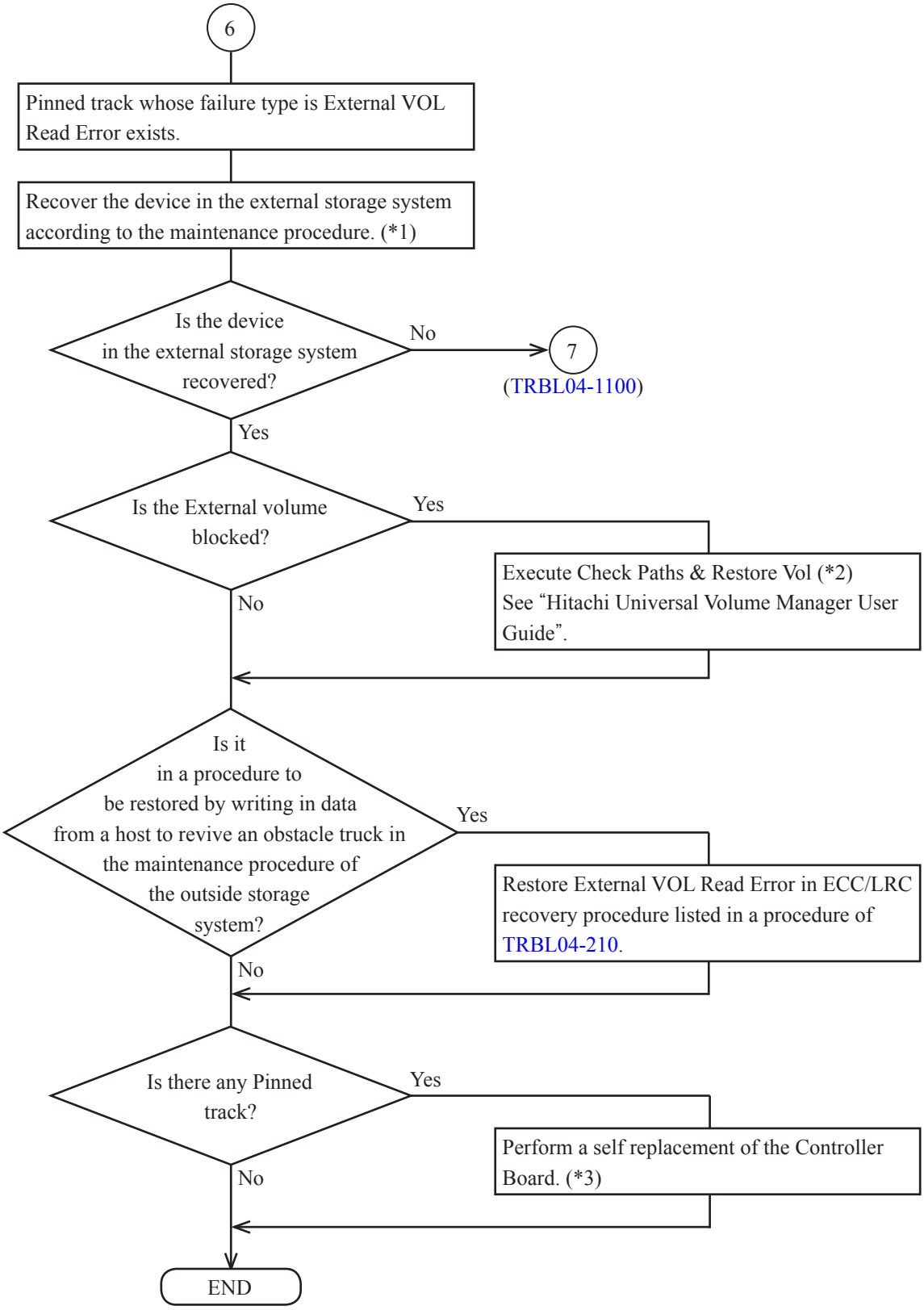
*4: Execute dummy replacement of either Controller Board 1 or Controller Board 2. Please see REPLACEMENT SECTION "2.4 Replacing a Controller Board" to know how to replace.

*5: When disconnecting the external volume, if the LDEV created from the target external volume is defined in the DP pool, all the DP volumes created from the corresponding DP pool need to be blocked in advance.

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4.2.3.8 Recovery from External VOL Read Error

When an External VOL Read Error occurs, perform the following recovery procedure.



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*1: It should be done in the external storage system. The user needs to ask the service personnel of the external storage system to perform the maintenance operation of the storage system. (If the external storage system is Hitachi storage, recover the faulty part according to the maintenance manual.)

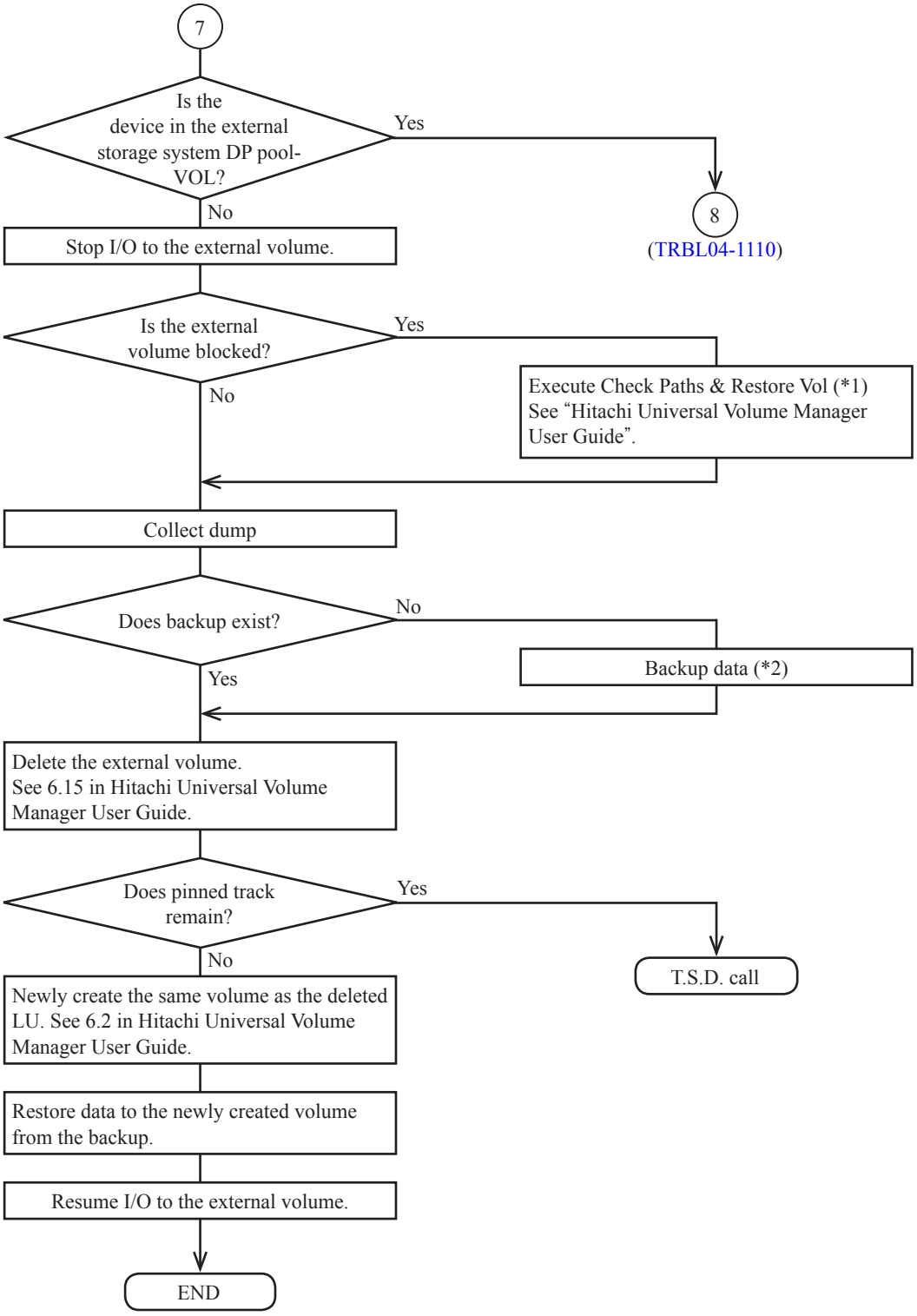
*2: It should be done using Storage Navigator. Ask the customer to perform the recovery operation by using Storage Navigator according to the User Guide.

*3: Execute dummy replacement of either Controller Board 1 or Controller Board 2. Please refer to REP02-04-10 to know how to replace.

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4.2.3.9 Recovery Processing of the Device in the External Storage System

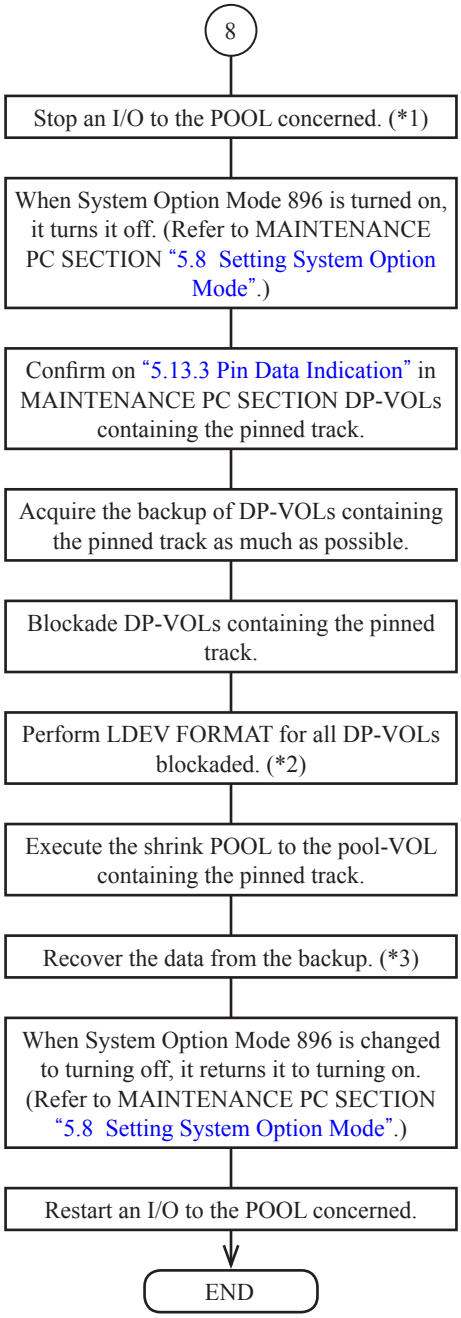
When the device of an external storage system is not recovered, perform the following recovery procedure.



*1: It should be done using Storage Navigator. Ask the customer to perform the recovery operation by using Storage Navigator according to the User Guide.

*2: Backup may fail with a pinned track (address). In such a case, it is necessary to rerun backup from the next address by skipping the address of the pinned track.

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*1: It is necessary to stop an I/O, so that other DP-VOLs should not use the area released by LDEV FORMAT again.

*2: The area of pool-VOL allocated in DP-VOL is released by turning on System Option Mode 867 and performing LDEV FORMAT to DP-VOL.
As a result, the area where pinned track occurred is separated from DP-VOL.

*3: Please be careful when restoring data from a backup.
If data is backed up per volume (DP-VOL), unallocated areas in the volume are also backed up. Therefore when the data is restored, a write operation is performed also for the unallocated areas, and the areas become allocated (though with zero data), resulting in an increase in the used pool capacity. If many DP-VOLs are restored at a time, the pool may become full.
To restore DP-VOLs, perform the following procedure for each of all DP-VOLs.
(1) Restore the data from the backup
(2) Perform the Reclaim Zero Pages processing

NOTE: When data is restored per file from the backup, only the consumed (allocated) areas are restored from the backup, so you do not have to perform the Reclaim Zero Pages processing.

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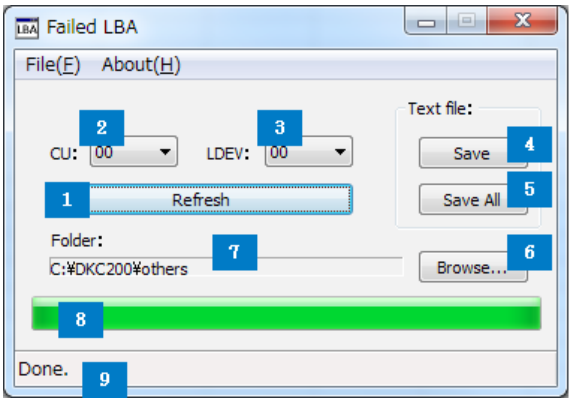
4.2.3.10 Using Failed LBA Output Tool

This section describes the failed LBA output tool that specifies pinned track.

To start the tool:

1. Move to the directory where the tool is installed.
   C:\Mapp\ wk\83xxxxyyyyyy\DKC200\MP\PC
2. Perform the following program.
   DrdFailedLba.exe

Description of Failed LBA dialog box:



#	Dialog box display item	Details
1	[Refresh] button	Collected a list of HDEVs with the data amount compression enabled. Data collection results are displayed in the CU# and LDEV# combo-boxes. Selecting [Refresh] from the [File] menu results in the same process.
2	CU# combo box	Displays a list of numbers of failed CUs for HDEV.
3	LDEV# combo box	Displays a list of numbers of failed LDEVs with the data amount compression enabled.
4	[Save] button	Outputs LBA information specified by the CU#/LDEV# combo boxes to a text file. Selecting [Save] from the [File] menu results in the same process. By default, information is output to C:\Mapp\wk\83xxxxyyyyyy\ DKC200\OTHERS as a file named FailLBA_HDEVxxxxxxxx.txt (xxxxxxxx: HDEV number). If a file with the same name exists in the directory for output, the file is overwritten. The directory for output can be changed by using the [Browse] button.

(To be continued)

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(Continued from preceding page)

#	Dialog box display item	Details
5	[Save All] button	Outputs LBA information for all HDEVs in the CU#/LDEV# combo boxes to a text file. A file is output for each HDEV#. Selecting [Save All] from the [File] menu results in the same process. By default, information is output to C:\Mapp\wk\83xxxxyyyyyy\DKC200\OTHERS as a file named FailLBA_HDEVxxxxxxxx.txt (xxxxxxxx: HDEV number). If a file with the same name exists in the directory for output, the file is overwritten. The directory for output can be changed by using the [Browse] button.
6	[Browse...] button	Changes directories to output a text file. Selecting [Browse...] from the [File] menu results in the same process. The changed directory for output is effective until the failed LBA output tool is finished. It returns to the default directory at the next startup.
7	File output path display	Displays the directory that is currently set to output a text file.
8	Progress bar	Displays the progress of processing.
9	Status bar	Displays supplementary information on the menu items and a short message.
--	[×] button	Finishes [Failed LBA Output Tool]. Finishes the tool during information collection (in processing). Selecting [End] from the [File] menu results in the same process.

Output file example:

Output file image

```
LBA Information Report.
------------------------------------------------------------
HDEV: 00000000
------------------------------------------------------------
LBA Top(hex), LBA End(hex), Ref.HDEV,Slot,Reason
------------------------------------------------------------
0000001200000034,000000AB000000CD,00000000,META,Write error
0000006700000089,000000CD000000EF,--------,CMPD,ECC/LRC error
```

Troubleshooting information:

The following table shows error messages output by the failed LBA output tool.

Error type	ID	Message
Connection error	0117	Connection error occurred. SVP-DKC
File I/O	1063	File I/O error has occurred.
Reject DKC	2467	Operation was rejected by DKC.
Windows error	2451	An error occurred in the Windows system.
Logical error	2231	Logical error has occurred.\nReboot the SVP and retry the operation.

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4.3 Procedure for Getting Dump and Recovering CHB in the case of CHB Protocol Control LSI Failure

4.3.1 Outline

If a system failure of the protocol control LSI that is installed in 2HF16 channel board occurs, a port failure (SIM=2120xx) that blocks the 16G channel port that is controlled by the LSI occurs. In this case, the SSB code that shows the protocol control LSI failure is reported from DKC, and you need to get the dump information to analyze the system failure of the protocol control LSI. This section describes the procedure for getting dump and recovering the faulty part.

Table 4-3 SSB code reported when CHB protocol LSI failure occurs

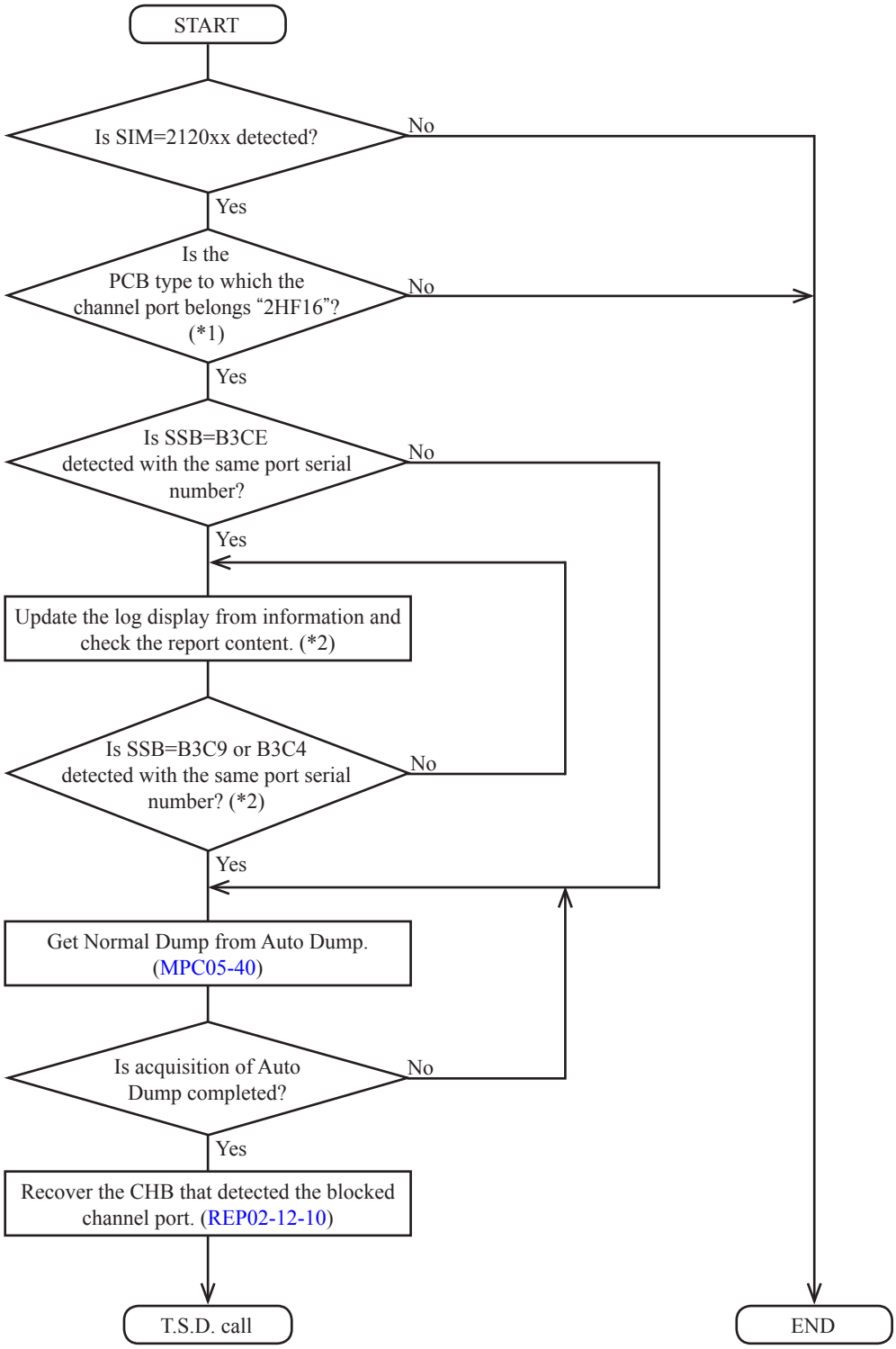
#	SSB code	Description	Remarks
1	B3CE	A system failure of the protocol control LSI was detected	It is reported when a protocol control LSI failure is detected. Collection of dump information starts in DKC.
2	B3C4	Dump collection of the protocol control LSI is stopped, and you can get dump	It may be reported when an MP failure is detected, or a power cycle, MP maintenance, Update Firmware or 2HF16 CHB maintenance is performed during dump collection of the protocol control LSI.
3	B3C9	Dump collection of the protocol control LSI is completed, and you can get dump	It is reported when dump collection of the protocol control LSI is completed. After that, if acquisition of Normal Dump is not completed, or if 2HF16 that detected the failure is not recovered, dump collection of the protocol control LSI is not performed when a new failure is detected.

Table 4-4 Matters must be or desirable to be checked

#	Check point	Check method
1	Is the channel port serial number that detected a blocked channel port (SIM reference code=2120xx) an 16G channel port?	Confirm that the channel port serial number shown in SIM=2120xx in Information is consistent with the faulty channel port serial number shown in Maintenance and the PCB type is 2HF16.
2	Is a blocked channel port detected, and is SSB code=B3CE detected around the same time?	See SIM and Log in Information to check if SIM: 2120xx and SSB: B3CE were detected in the same channel port around the same time.

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4.3.2 Method to Get Dump and Recover CHB in the case of Protocol Control LSI Failure



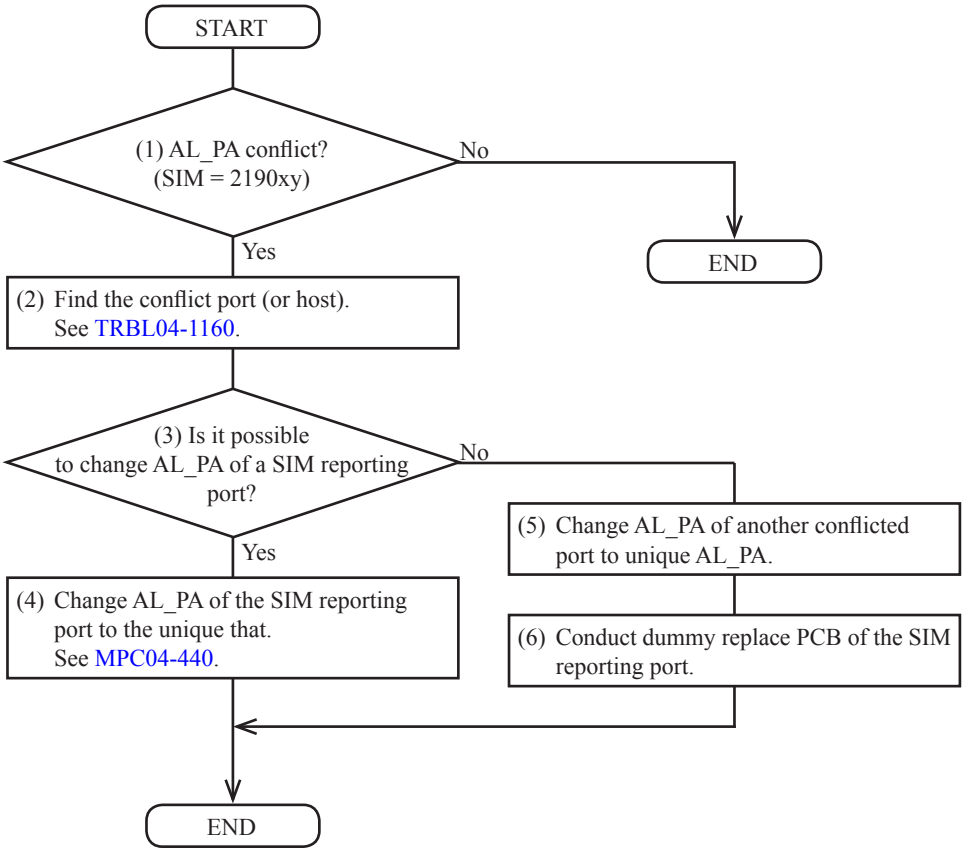
*1: If it is not 2HF16, check the type of PCB that detected the failure and the applicable action item.

*2: The time required from when the blocked channel port is detected until the SSB code that shows the end of Dump collection is reported in the case of the protocol control LSI failure of 2HF16 is about 20 minutes.

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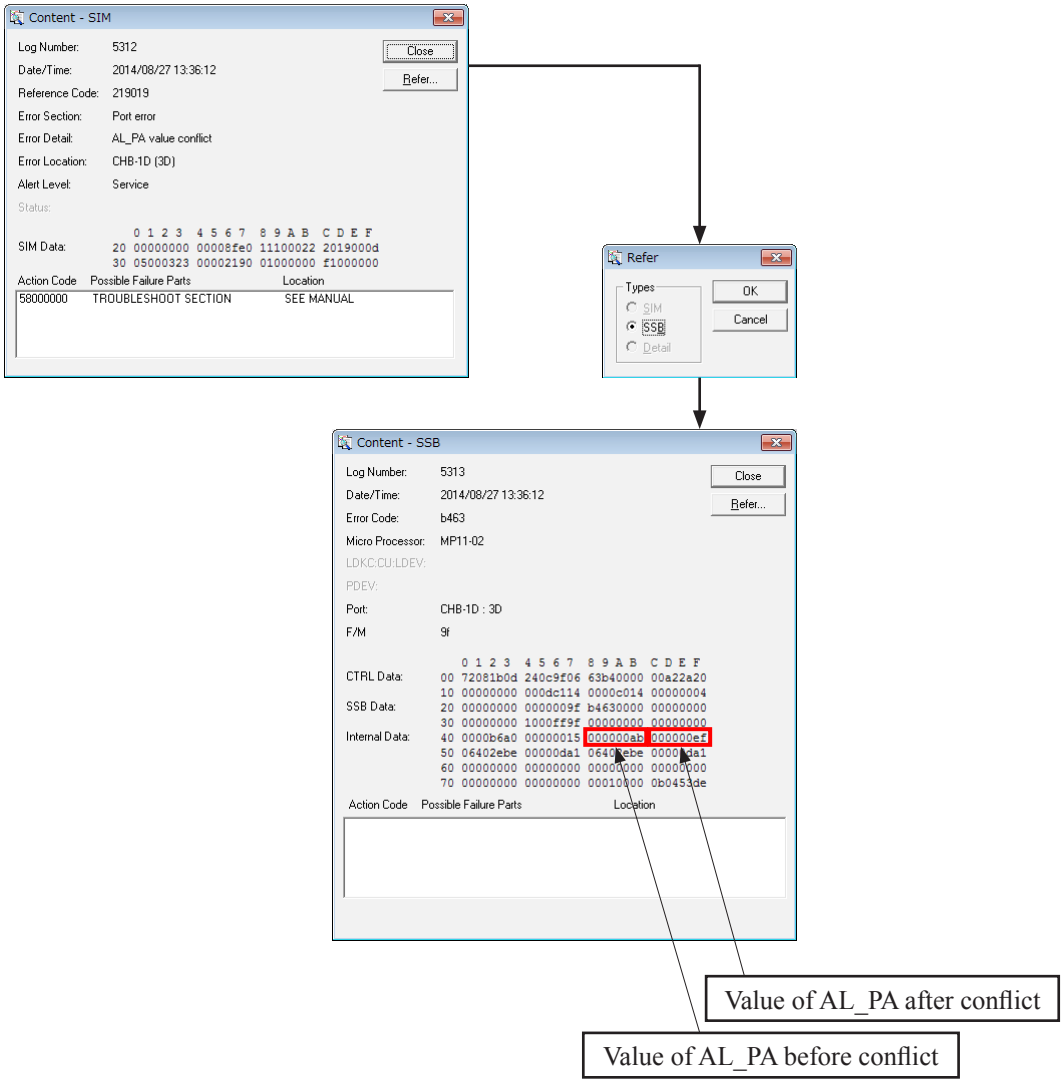
4.4 Recovery Procedure for AL_PA Conflict (SIM = 2190xy)

The following flow chart is a recovery procedure in the case where AL_PA of the nodes (CHB port, Host's Fibre channel port) which exist on the same loop overlaps. Before performing the following recovery procedure, the AL_PA of a SIM reporting port is automatically changed into an other AL_PA from previously given AL_PA. But AL_PA doesn't affect the values on Maintenance PC.



NOTE: Whether AL_PA of (3) is changed or not depends on the condition under operation.

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1. Please refer to the SSB corresponded to the SIM (=2190xy) to specify values of AL_PA before/after conflict.
2. When the value of AL_PA before conflict is determined, please find CHB port or Host's Fibre channel port whose AL_PA conflicts with this port.

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4.5 Recovery Procedure for a Failure on Host iSCSI Interface

4.5.1 Outline

The failure that the iSCSI host device cannot recognize the iSCSI volume of the Storage System correctly may occur due to device failures and incorrect settings including the following.

- Cable disconnection and incorrect connection between the Storage System and the iSCSI host device
- iSCSI board trouble on the iSCSI host side
- Incorrect Disk connection work from the iSCSI host side (for example, insufficient cable insertion and incorrect insertion)
- Other failures

The failure recovery method in the field when such failure occurs is described.

4.5.1.1 Possible Failures and causes of them

No.	Possible error	Cause
1	LDEV is not recognized by iSCSI initiator.	(1) SCSI installation, i.e. recognition and connecting procedure from SCSI initiator is not executed correctly. (2) Problem of iSCSI cable or connection. (3) Problem of iSCSI initiator. iSCSI board, device driver version, parameters, etc. (4) SCSI path definition from Storage Navigator. (5) The Host Reserve status is left uncanceled. (6) Other

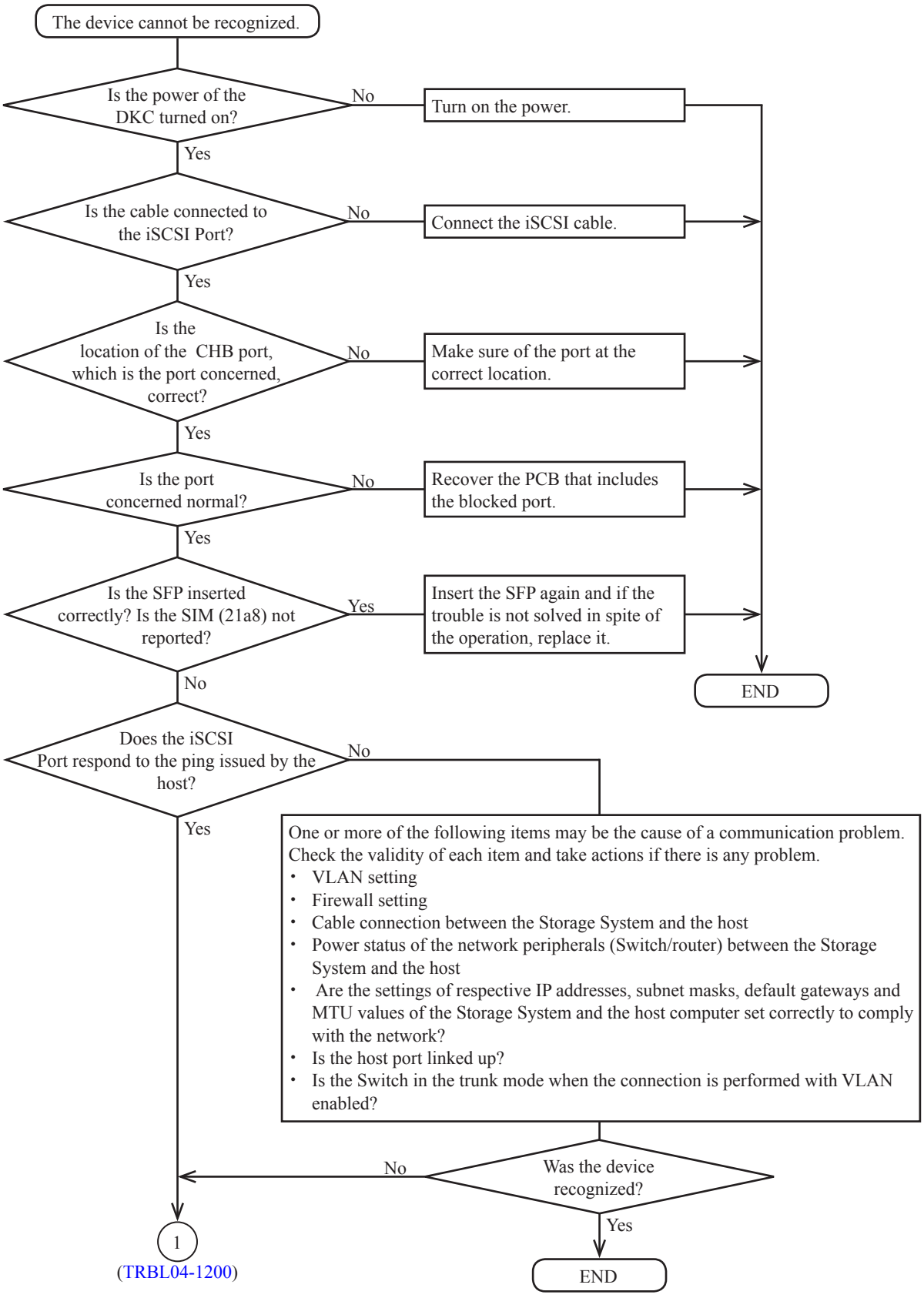
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4.5.1.2 Matters must be or desirable to be checked

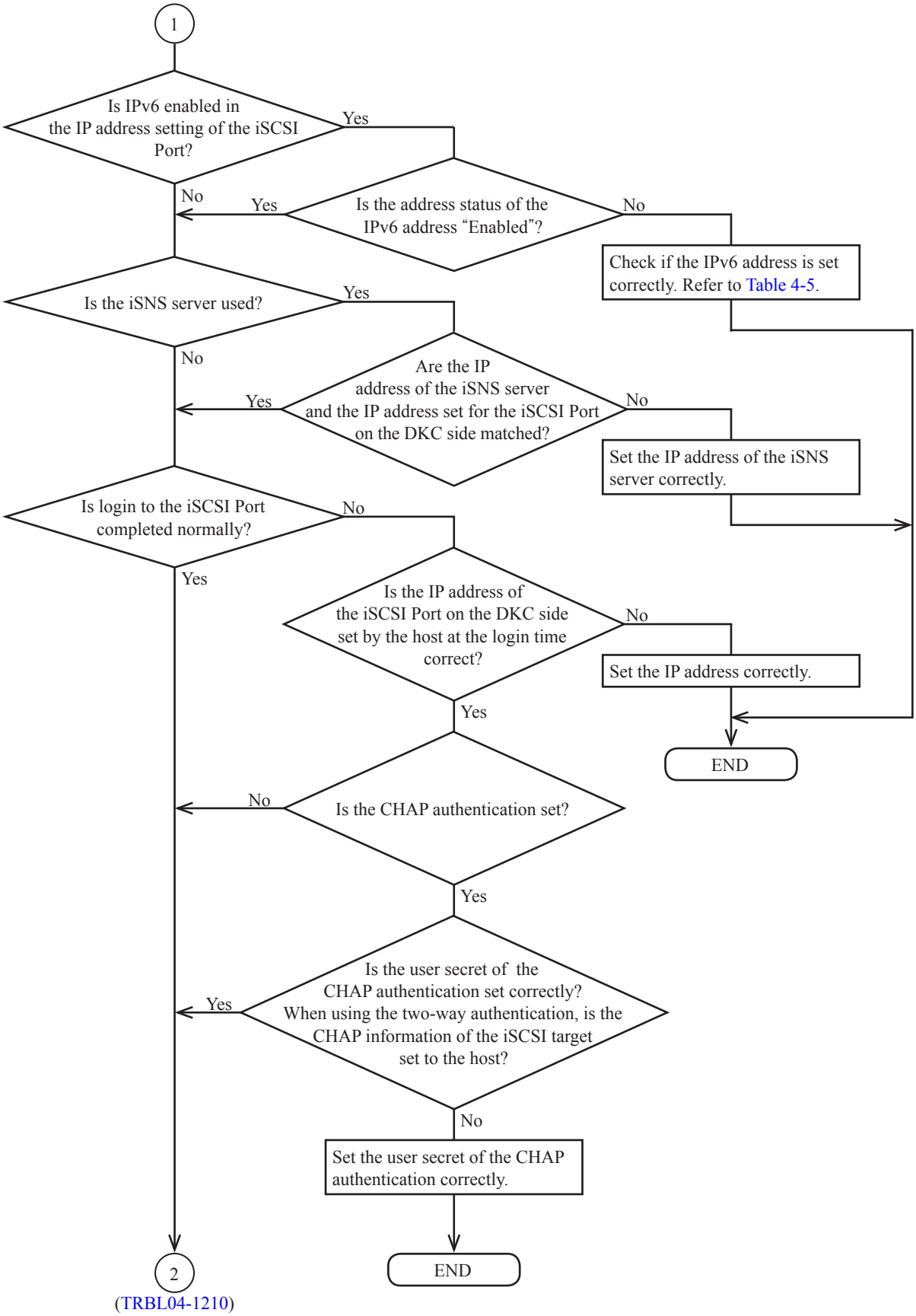
No.	Checkpoint	Check method
1	Is the READY LED on the DKC on?	Check the storage system visually.
2	Is the LED of the port, which corresponds to the failed SCSI port, on? Open the System window from Action menu of Storage Navigator main window and check whether the port status indicator is on.	Check the storage system visually.
3	Is the location of the CHB port correctly understood?	Refer to LOCATION SECTION “4.1 Channel Interface”.
4	Is the status of the FCP corresponding to the failed SCSI path normal?	Check if the FCP is normal by selecting the PCB status in the “Maintenance Utility” window and viewing the statuses of the FCP (see page TRBL04-80).
5	Is the iSCSI cable connected to the iSCSI board of the server firmly?	Pull out and then insert the cable connector.
6	Is it a problem of the cable?	Replace the cable.
7	Is the SFP of the PCB normal?	SIM: Check if the 21A8 is output. Make sure of the type and status (Short or Long) of the SFP through the CHB information concerned in the “Maintenance Utility” window. Pull out and then inset the SFP.
8	Is the path from the Storage Navigator set correctly?	Check the SCSI path of the port concerned.
9	Is the device defined as the SCSI path normal?	Check the LU status information in the “Maintenance” window.
10	Is the CNA of the NIC/iSCSI normal?	Replace the CNA of the NIC/iSCSI or update the driver version.
11	Is the setting of the connection target device normal?	Check if the MTU (Maximum Transmission Unit) value on the Switch side is the same as the MTU value on the host side, DKC side and iSCSI Port side.
12		When the VLAN setting is enabled, check if the Port setting on the Switch side is in the trunk mode.
13	Is the Ping for the iSCSI Port normal?	Check the settings of the IP address, subnet mask and default gateway of the iSCSI Port. When connected by the IPv6 address, check if the IPv6 address status of the iSCSI Port is enabled.
14	Is Login to the iSCSI Port completed normally?	When the CHAP setting is enabled, check if the CHAP User/ Secret setting is correct.

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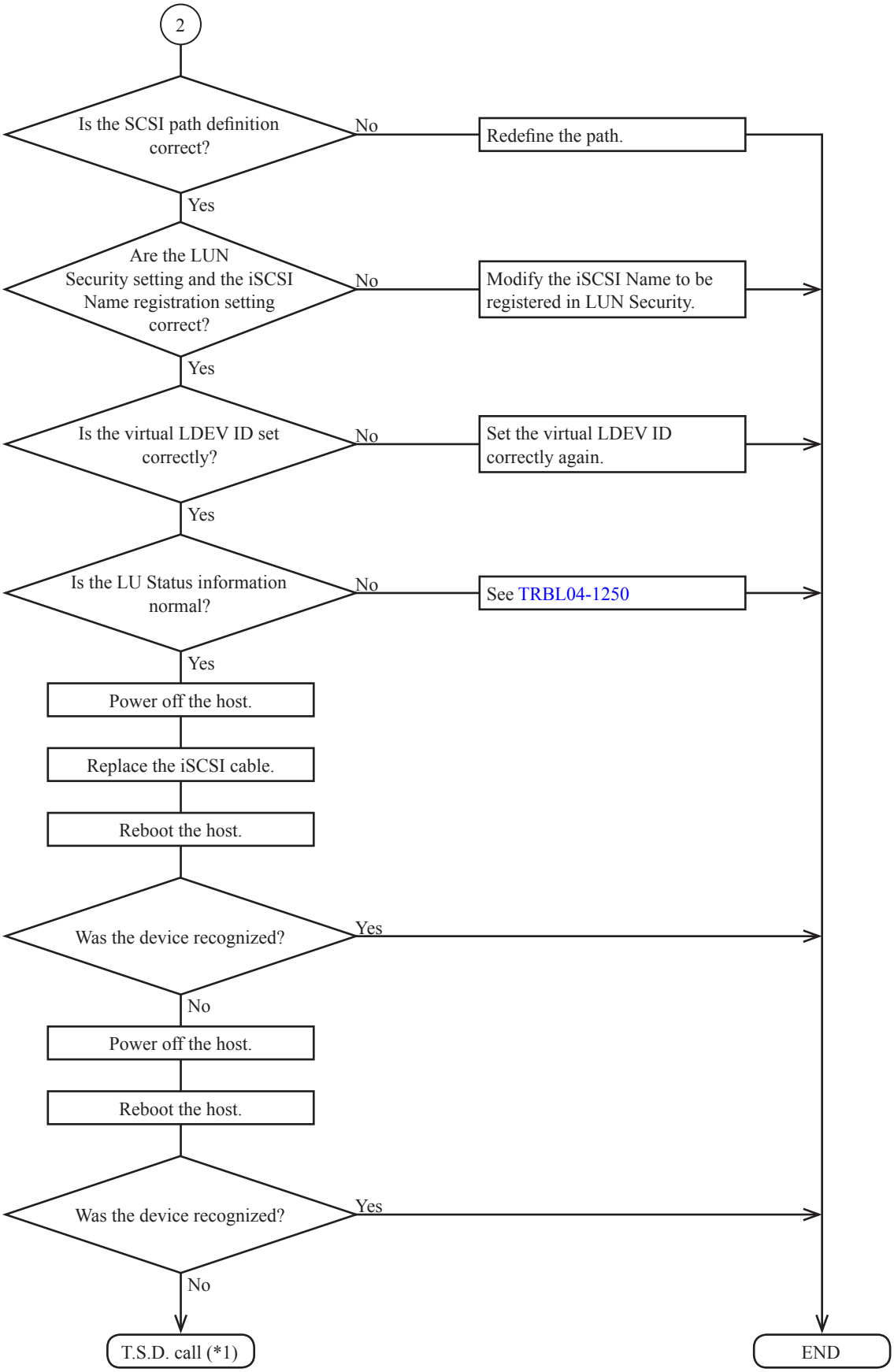
4.5.2 Recovery Procedure When Device Is Not Recognized



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*1: Send the following information to the Technical Support Division (T.S.D.).
- Device configuration of the host
- Version of the OS
- NIC/CNA version
- Version of the driver
- Model number of the iSCSI board
- Dump information on the DKC
- Syslogs and/or Messages
- Logs of software when the alternative path exists
- Packet capture information

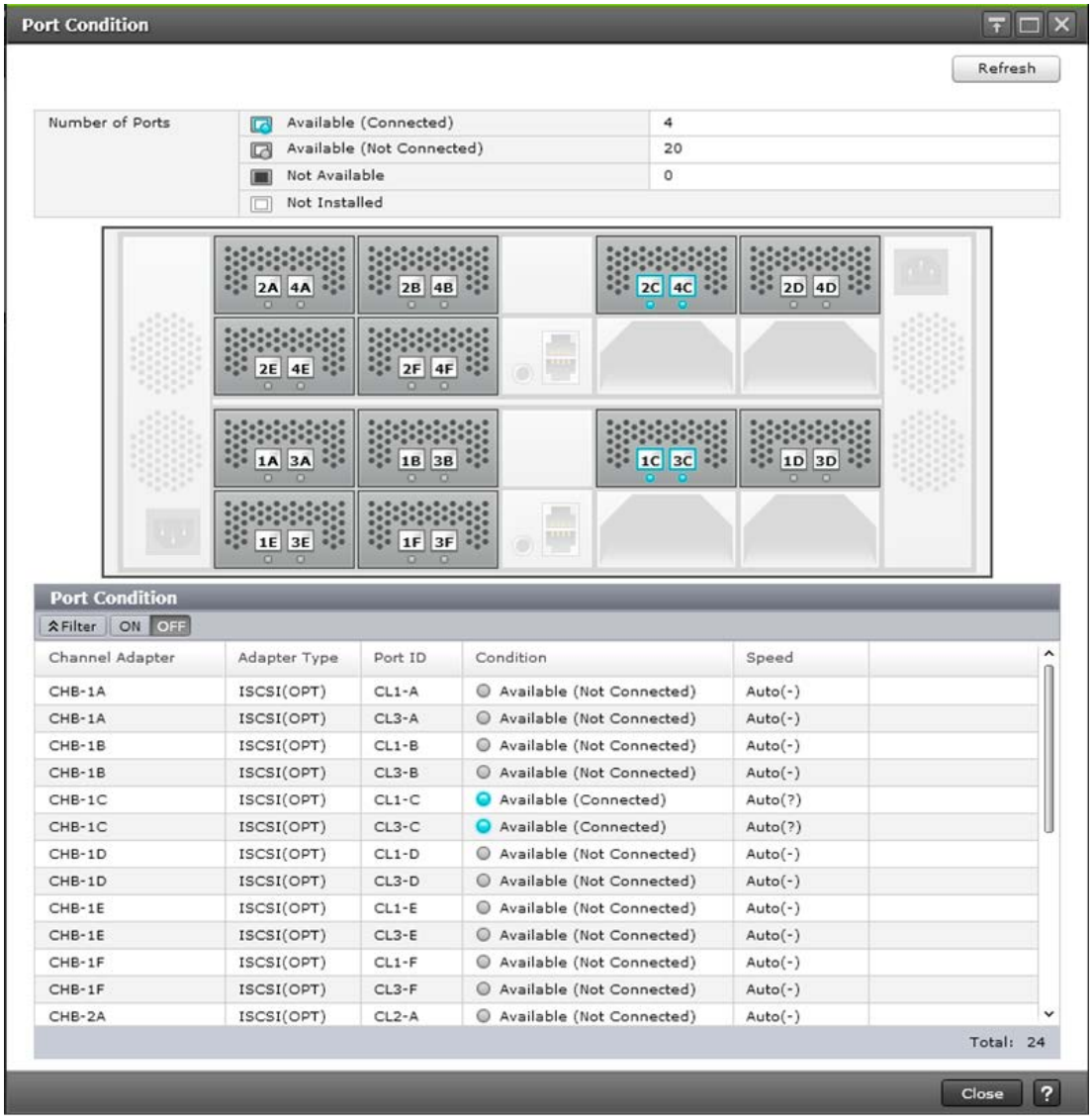
Table 4-5 iSCSI IPv6 Connection Failure Troubleshooting Table

Check Item		Troubleshooting
Are the correct values set to the IPv6 address and default gateway address of the iSCSI Port to be connected?		The IPv6 address and default gateway of the iSCSI Port are generated automatically. When setting them manually, set the appropriate value to the customer's environment.
Address status display of the IPv6 address of the iSCSI Port	Checking	Checking if the IPv6 address and the address of the other host in the connection network are not duplicated. Check that the transition is enabled.
	Enabled	The IPv6 address of the iSCSI Port is not duplicated. The address is set correctly and normal.
	Disabled	The iSCSI Port is linked down. When using the IPv6 address of the iSCSI Port, check that the cable is connected correctly.
	Duplicated	The IPv6 address of the iSCSI Port and the address of the other host in the connection network are duplicated. Set an unduplicated optional IPv6 address manually.
	Unconfirmed	The IPv6 address of the iSCSI Port is duplicated with the address in the same iSCSI Port. Set an unduplicated optional IPv6 address in the iSCSI Port manually for the IPv6 address of the iSCSI Port.
Is the correct value set for the MTU size?		The IPv6 Link MTU size indicates the MTU size current value on the network. When the MTU size and the Link MTU size set for the iSCSI Port of the Storage System differ, the MTU size of the host or the router/Switch is different from that of the Storage System. Set the MTU size to be the same value.
Is the IPv6 address set correctly in the remote path setting of the IPv6 address?		The IPv6 address needs to be enabled. Enable the IPv6 address in both local and remote iSCSI Ports to set the remote path.

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4.5.3 Procedure for Checking Storage System Port Status

The port information of the destination Storage System is displayed in the “Port Status” window ([Action] – [Component Maintenance] – [View Port Location]) of Web Console.



In the “Port Condition” box, the statuses of the ports are displayed in the image of the practical storage system.
Channel Adapter, Adapter type, Port ID, Attribute and Condition are displayed for the each port.
The statuses of the displays of the port status are explained below.

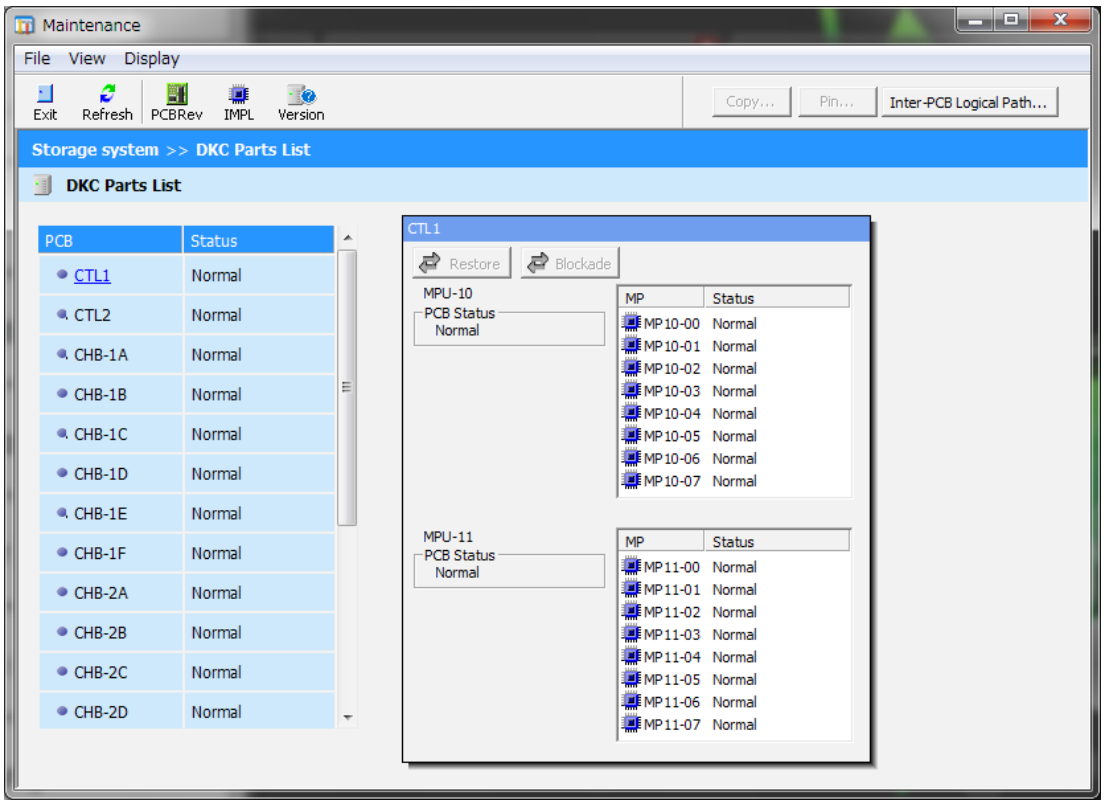
Port Condition	Port Means
Available(Connected)	The port is installed and in use.
Available(Not Connected)	The port is installed and ready for use.
Not Available	The port is installed and not ready for use (blocked).
Not Installed	The port is not installed or out of use.

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4.5.4 Procedure for Checking Normalcy of the Processor

Select the DKC in the “Maintenance” window, and check the normalcy of the processor in the following window.

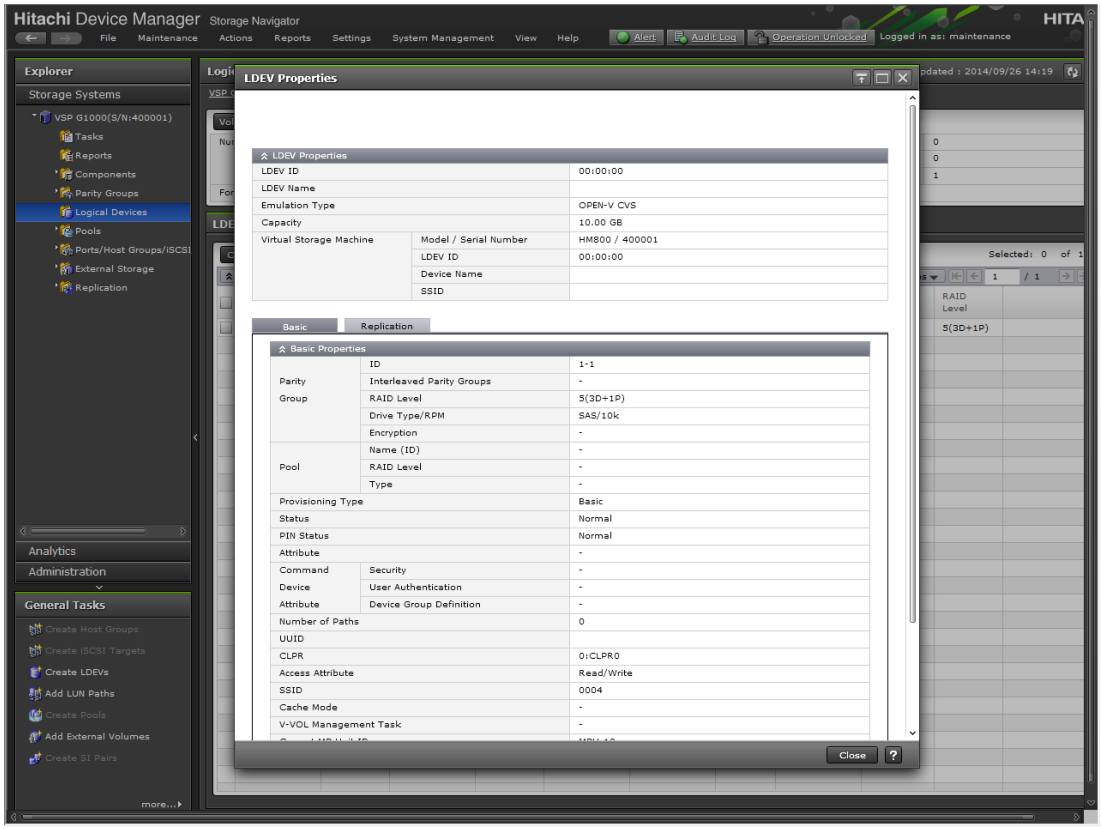
When they are normal, “Normal” is displayed in the Status column as shown below.



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4.5.5 Procedure for Checking LUN Status Information

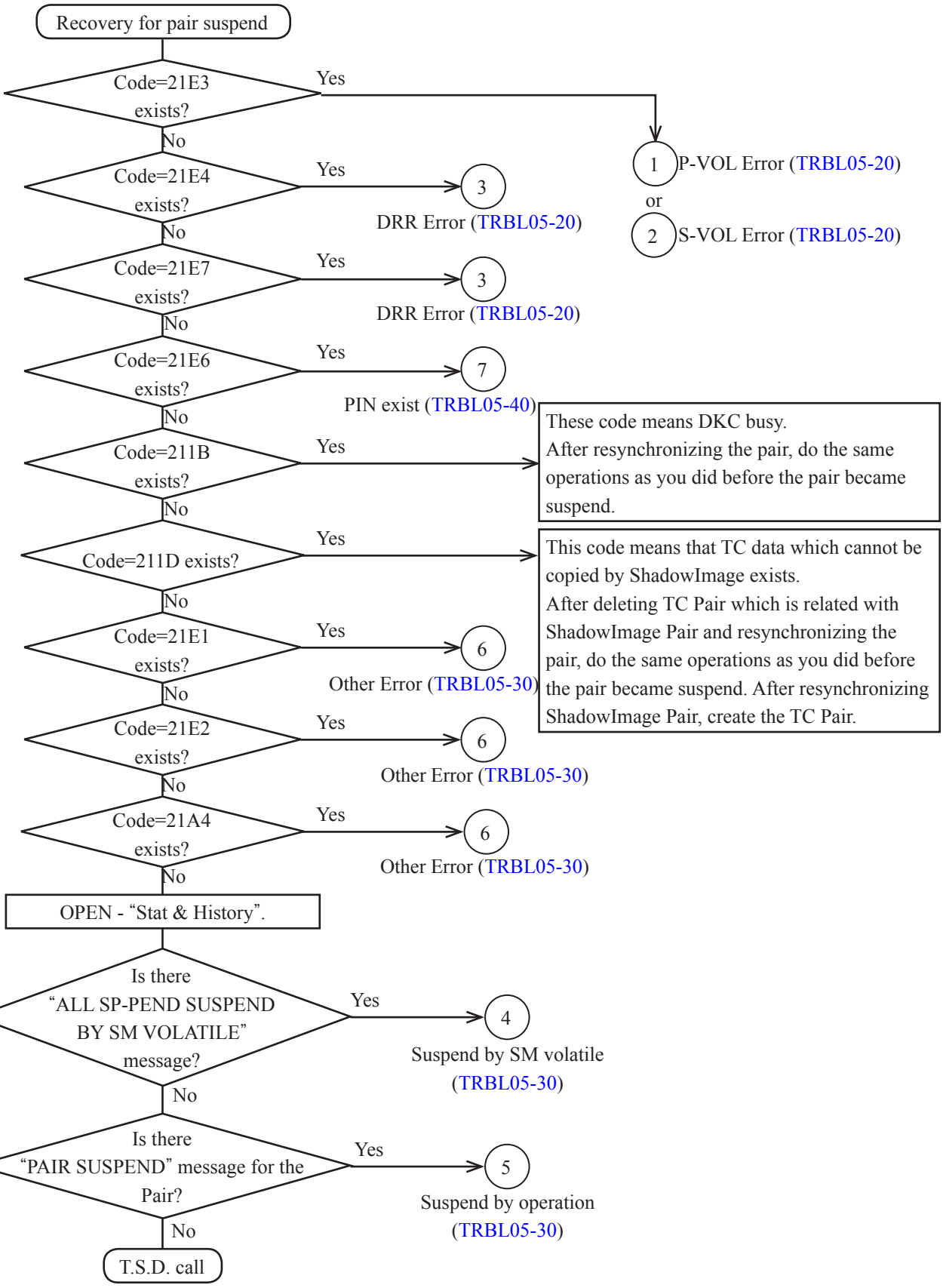
Select [Logical Device] from the [Storage System] tree on Web Console and display the [LDEVs] tag.
Clicking [LDEV ID] of the reference LDEV displays the detail window information.
Check if the displayed status information is not Blockade or Reserve. If the displayed status is not Normal, it is highly possible that the device cannot be recognized because of the status.
Therefore, call the T.S.D. having the following window attached.



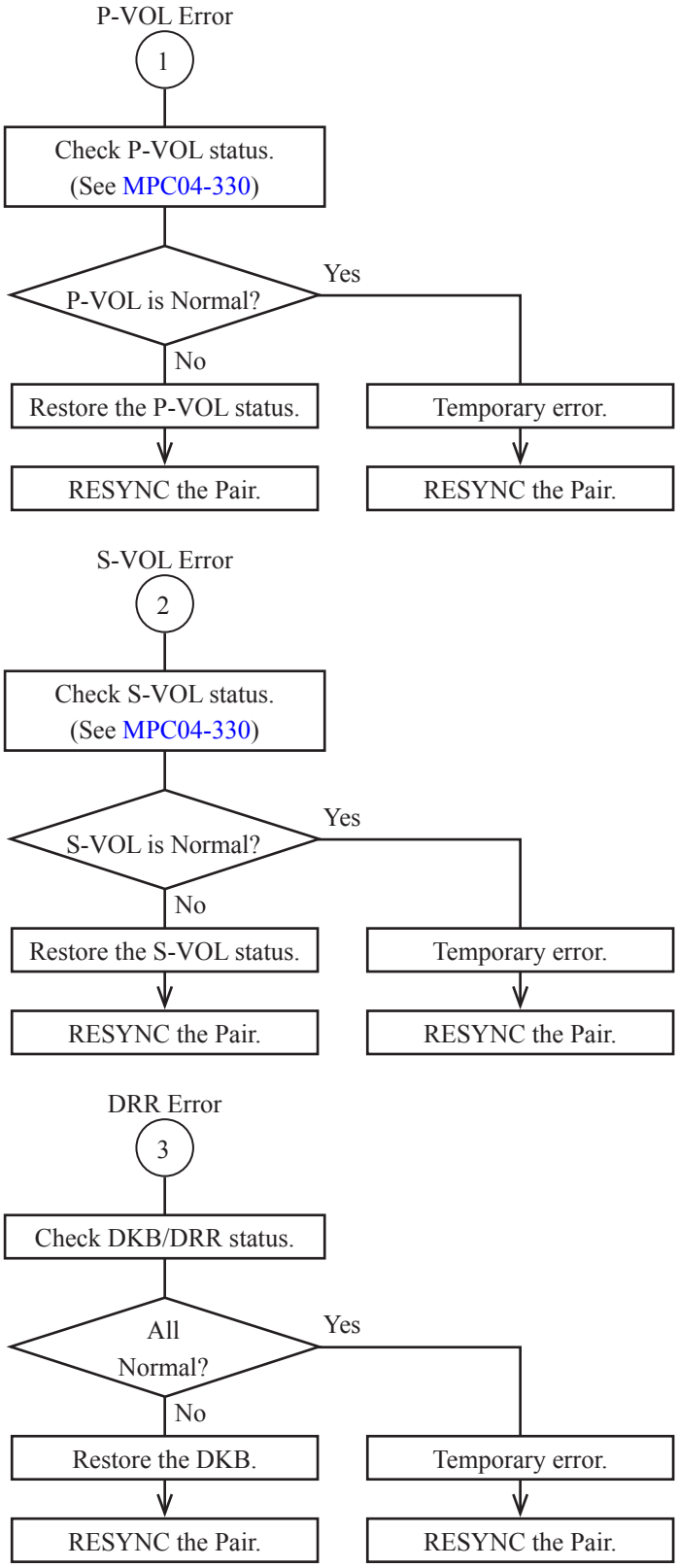
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5. ShadowImage Error Recovery

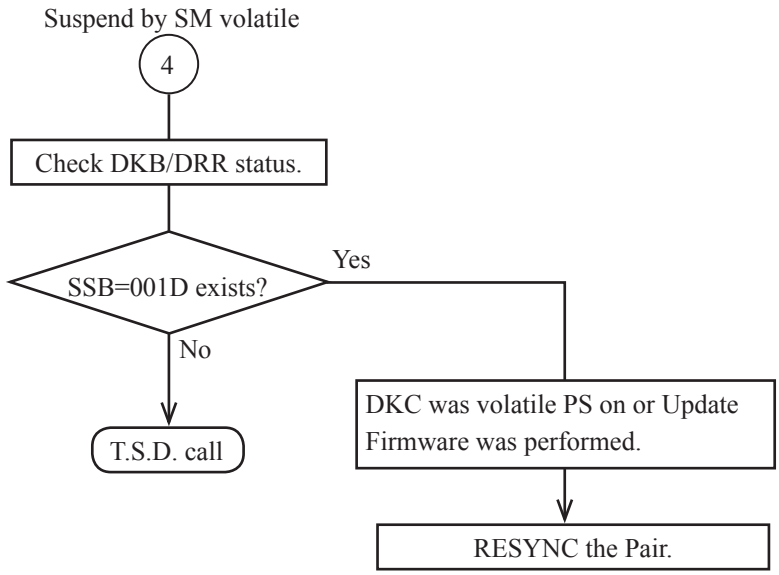
5.1 Recovery Procedure for ShadowImage Suspend Pair (SIM = 47dxyy, 7ff102, 47e700)

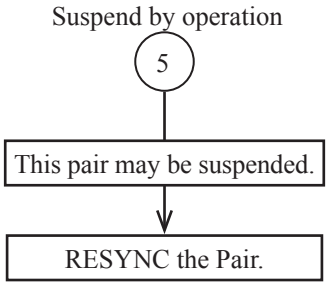


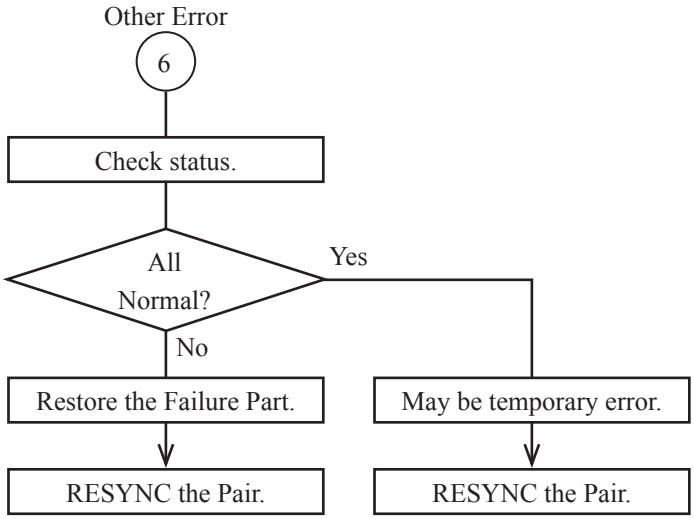
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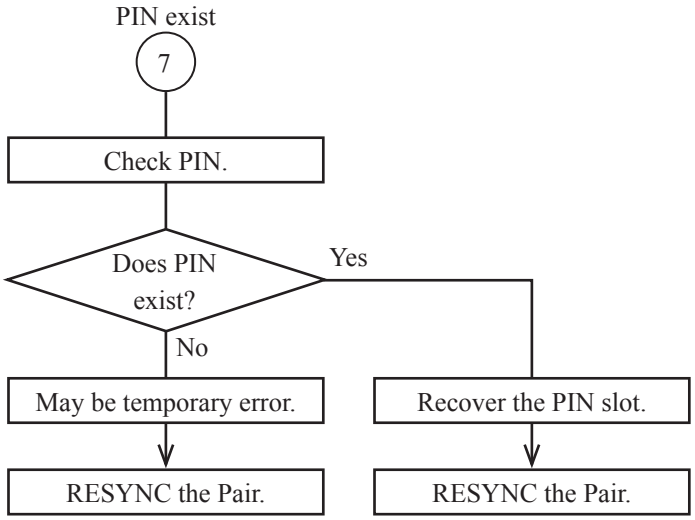
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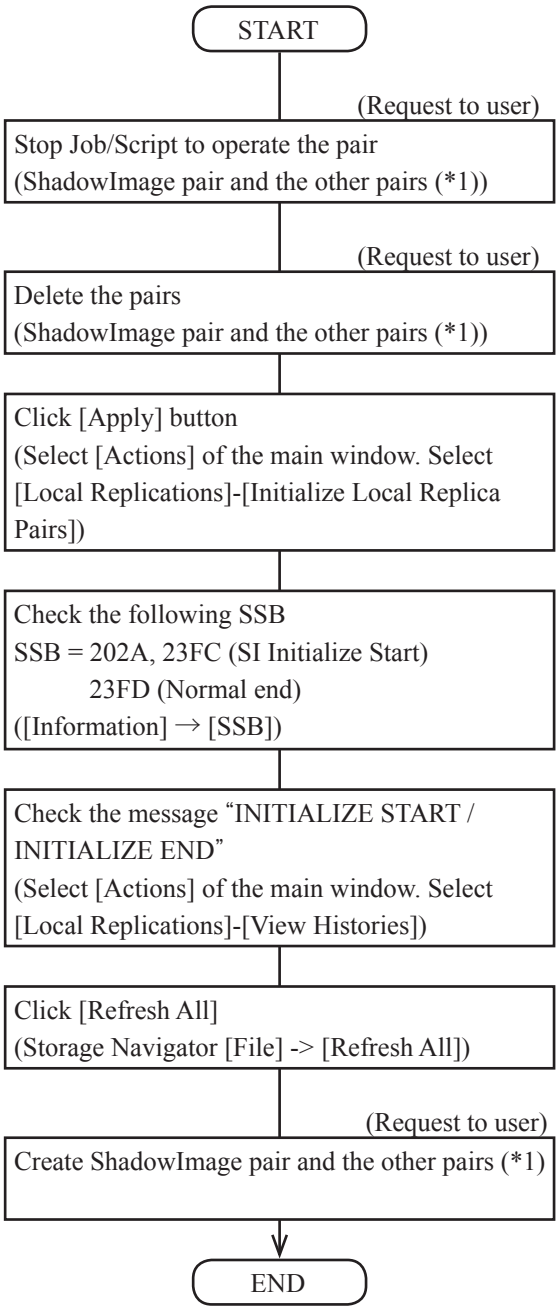


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5.2 ShadowImage Initialize procedure



SSB LIST (After pressing [Initialize] button, the following SSB are of no matter)
9693,afb2,afb3

*1: When the [Initialize] button is pressed, pairs formed by the following P.P. are also deleted.
[ShadowImage / Volume Migration / Thin Image]

NOTE1 : Perform the operation only when it is directed by the Technical Service Division.

NOTE2 : For the password, refer to the Technical Service Division.

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6. TrueCopy Error Recovery

6.1 TrueCopy Error Recovery Procedure

A TrueCopy pair suspension or a TrueCopy pass blockade may occur owing to hardware errors.
This section explains the recovery procedure against them.
Occurrences of TrueCopy errors can be known through the following.

- TrueCopy error message on the Syslog outputted by the RAID manager/TrueCopy (*1)
- Report of a TrueCopy pass blockade occurrence by the SIM
- Report of a TrueCopy pair suspension occurrence by the SIM

Table 6-1 TrueCopy SIM REF.CODE

SIM REF. CODE	Meaning	Remarks
d4xy-yy	TrueCopy pair suspend	x: 0 - 2, 4 - 6 or F yyy: LDEV number
2180-xy	TrueCopy pass blockade	x: CHB PCB # y: Port# in PCB
2182-xy	MCU has received the notification of communication line error detection from extender.	x: CHB PCB # y: Port# in PCB

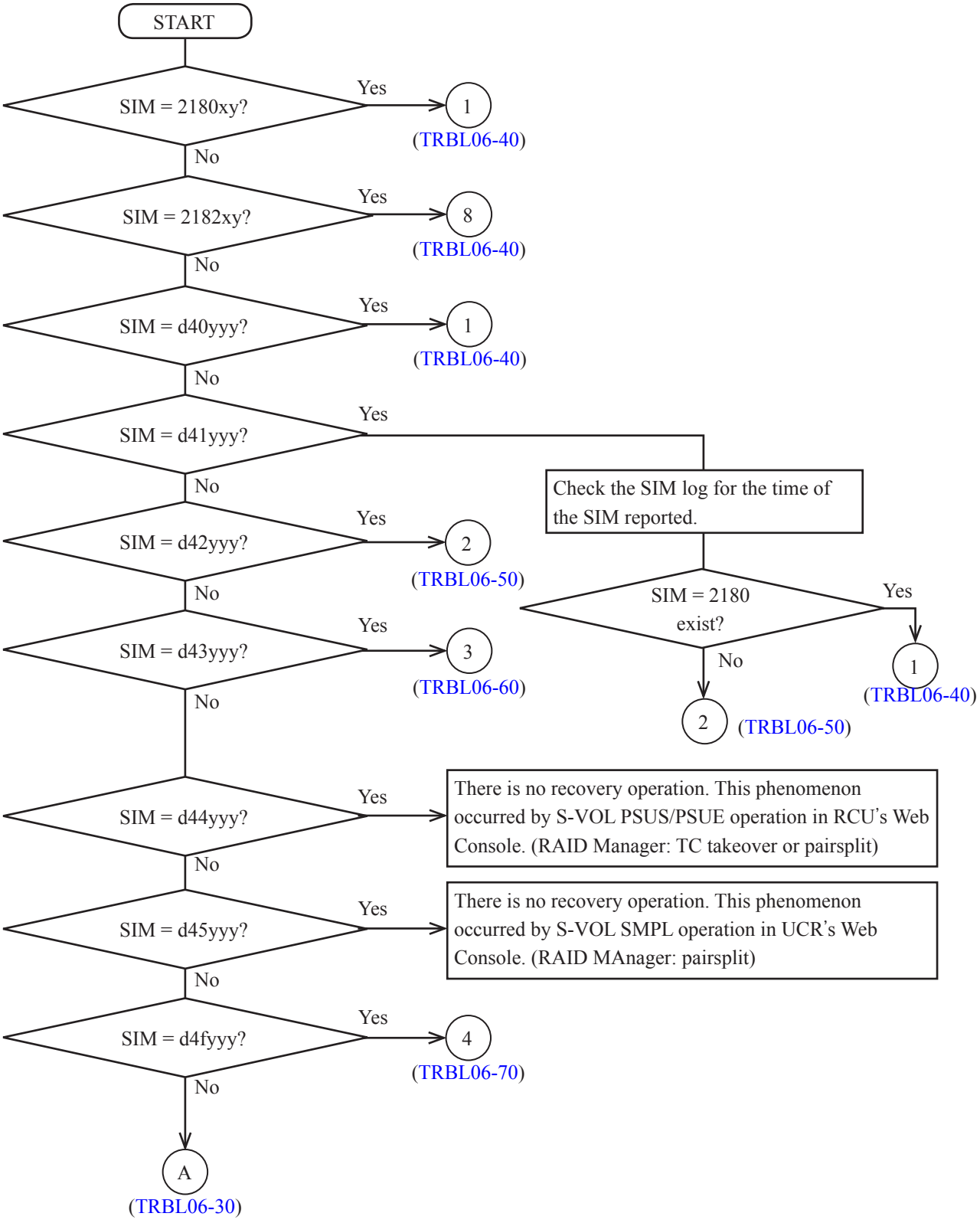
When a message indicating that a TrueCopy pair error has occurred is displayed on the Syslog, check the SIM log of the connected DKC and confirm the conformance of the message on the Syslog with the SIM logged on the DKC side before starting the recovery using the following flow chart (TRBL06-20).

*1: When the TrueCopy pair is suspended, the RAID manager/TrueCopy displays the following message on the Syslog.

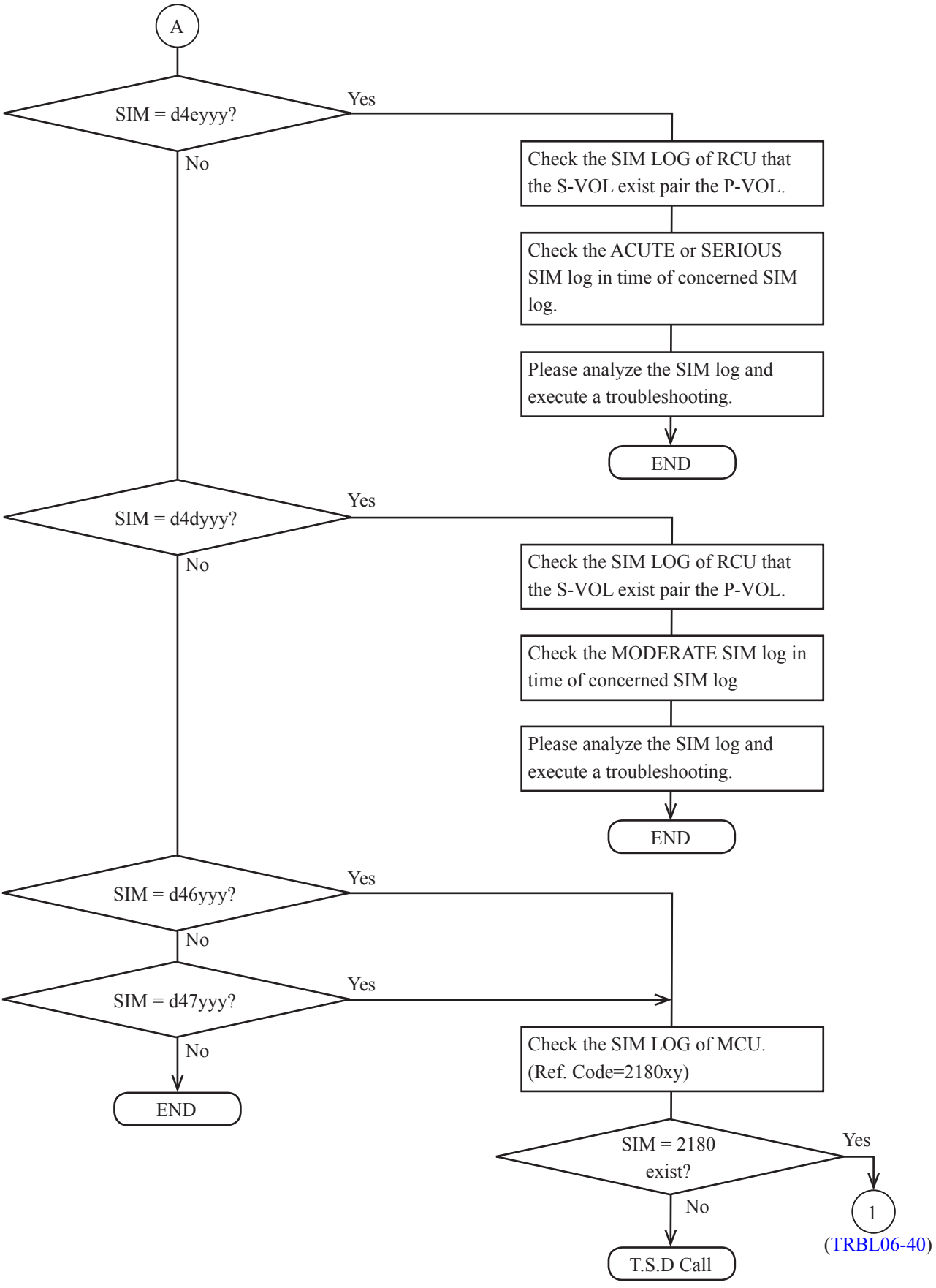
[HORCM_102] Detected a suspending status on this paired volume (Volume: ○○○, code: 0x0X).
○○○○ : Volume name
0x0X : Factor code (The item [d4x] of SIM RC SECTION is referred to.)

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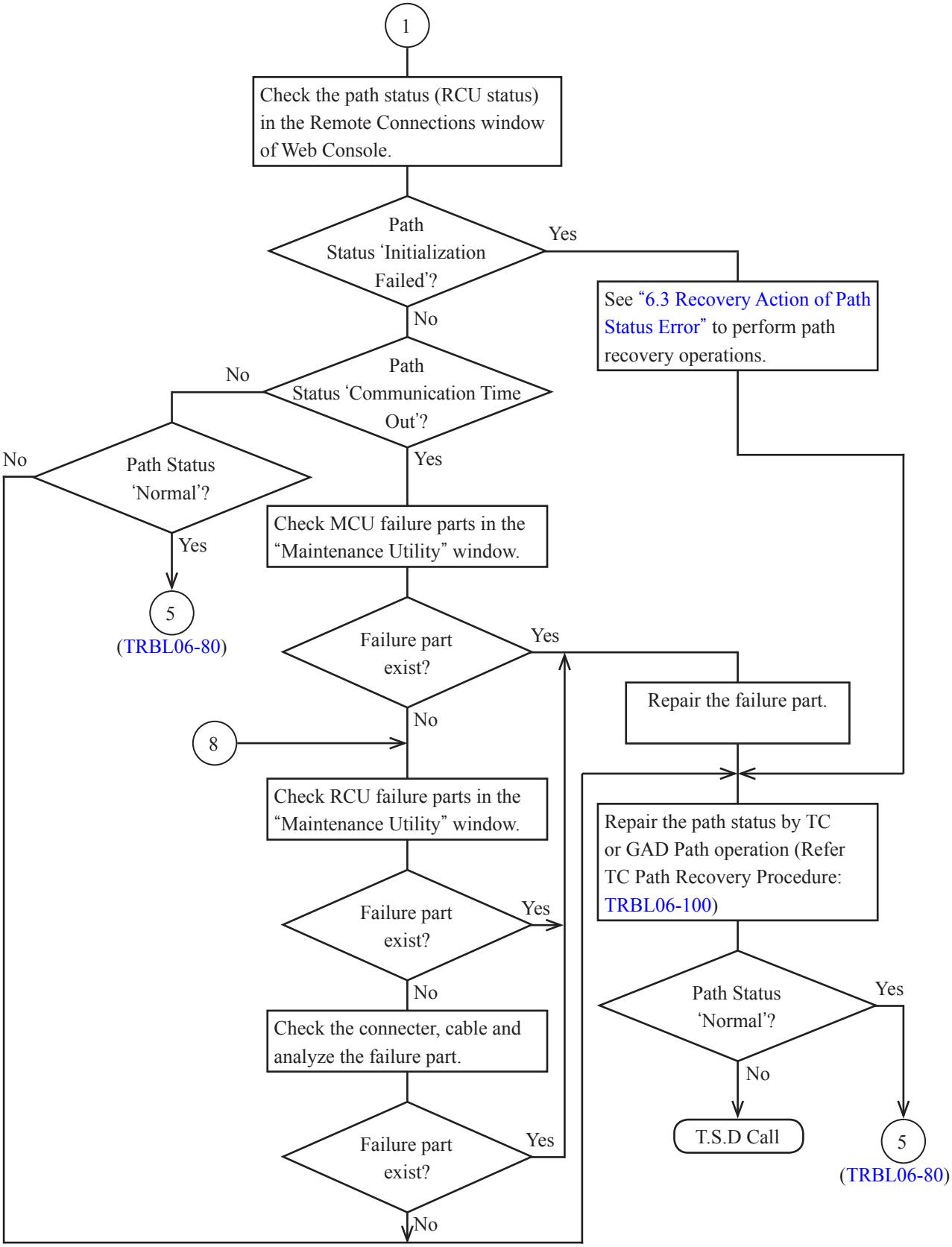
6.1.1 Recovery for TrueCopy Error



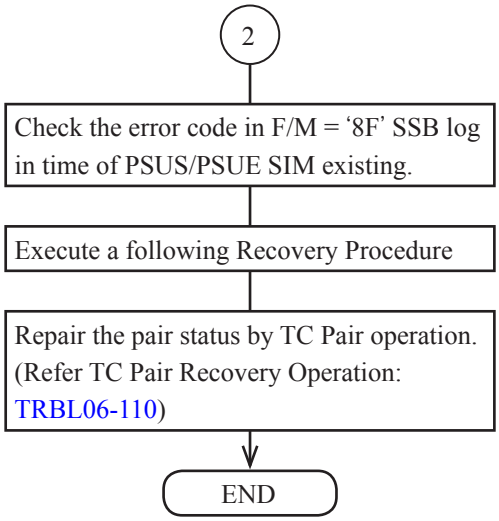
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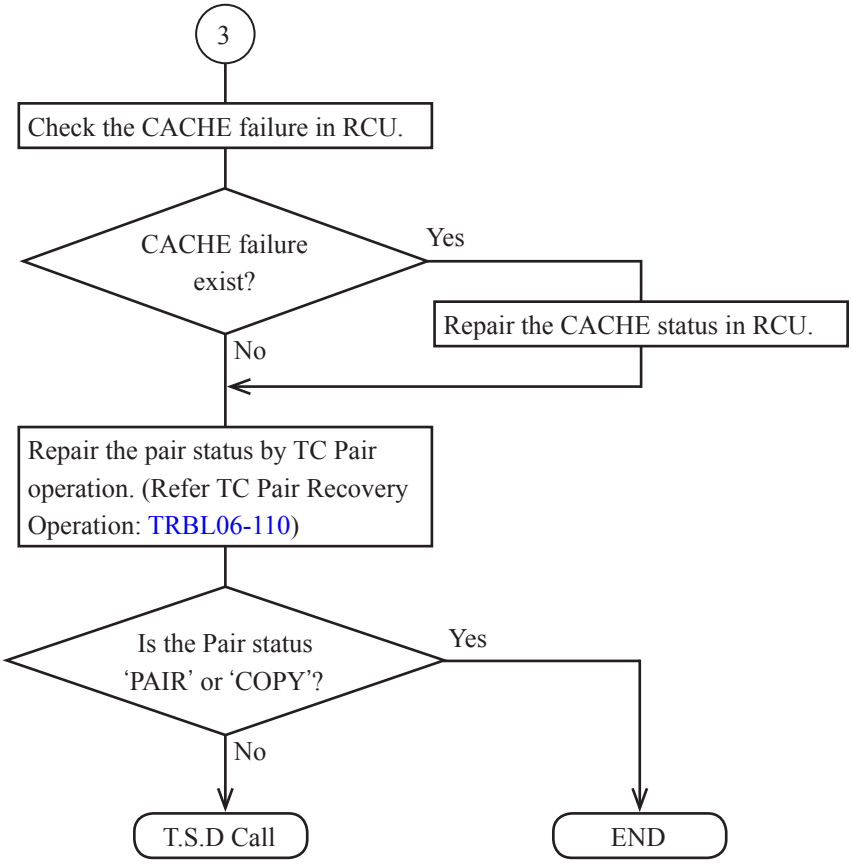
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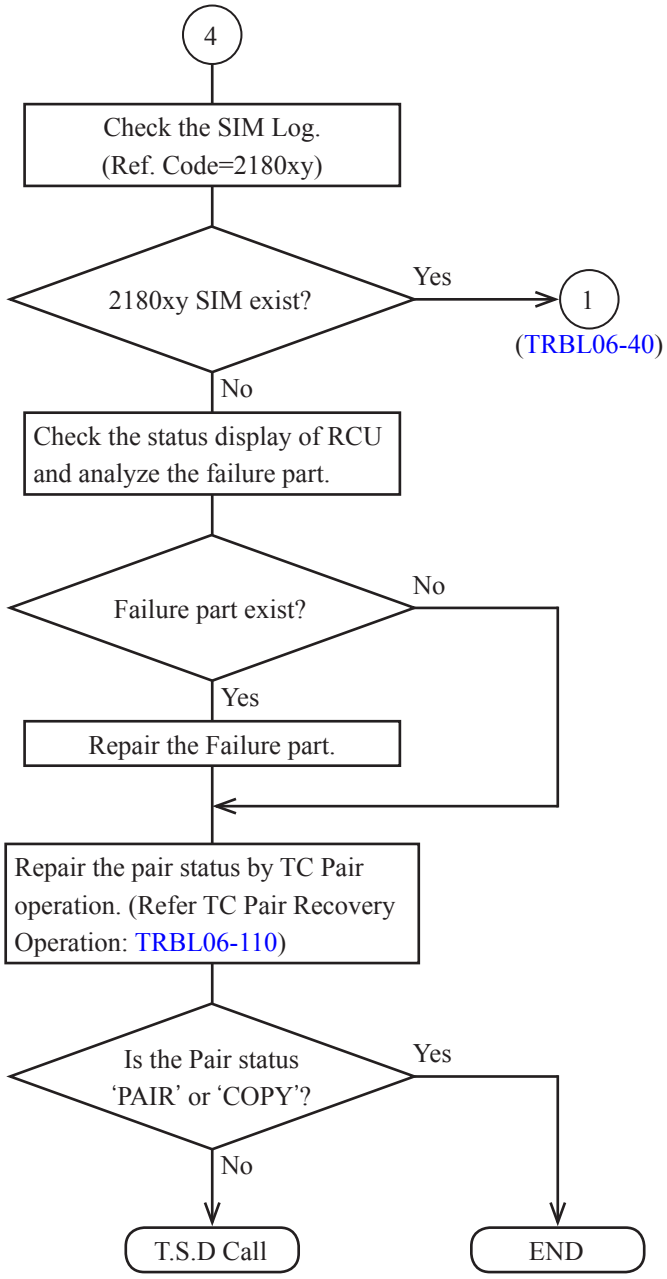
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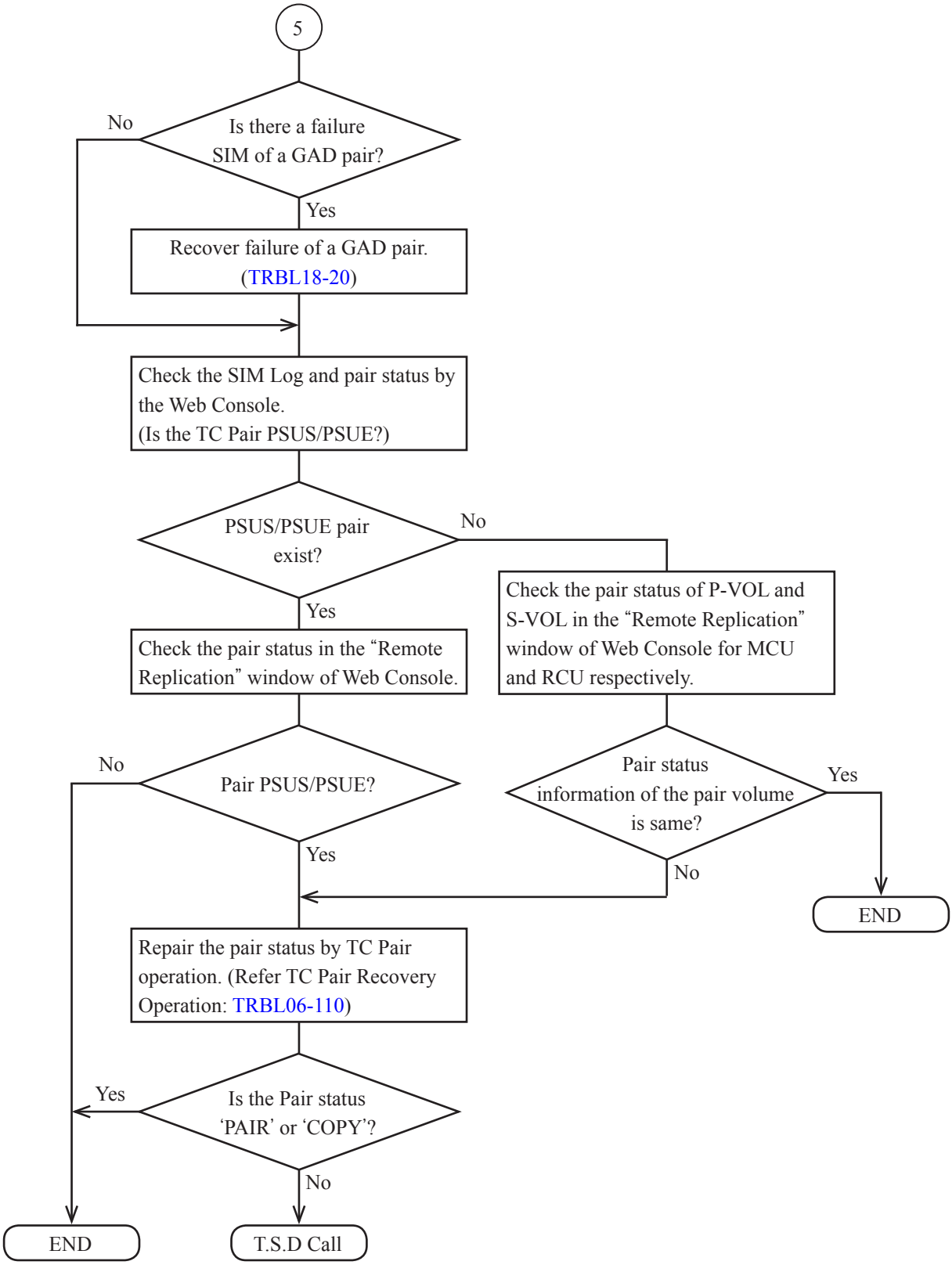
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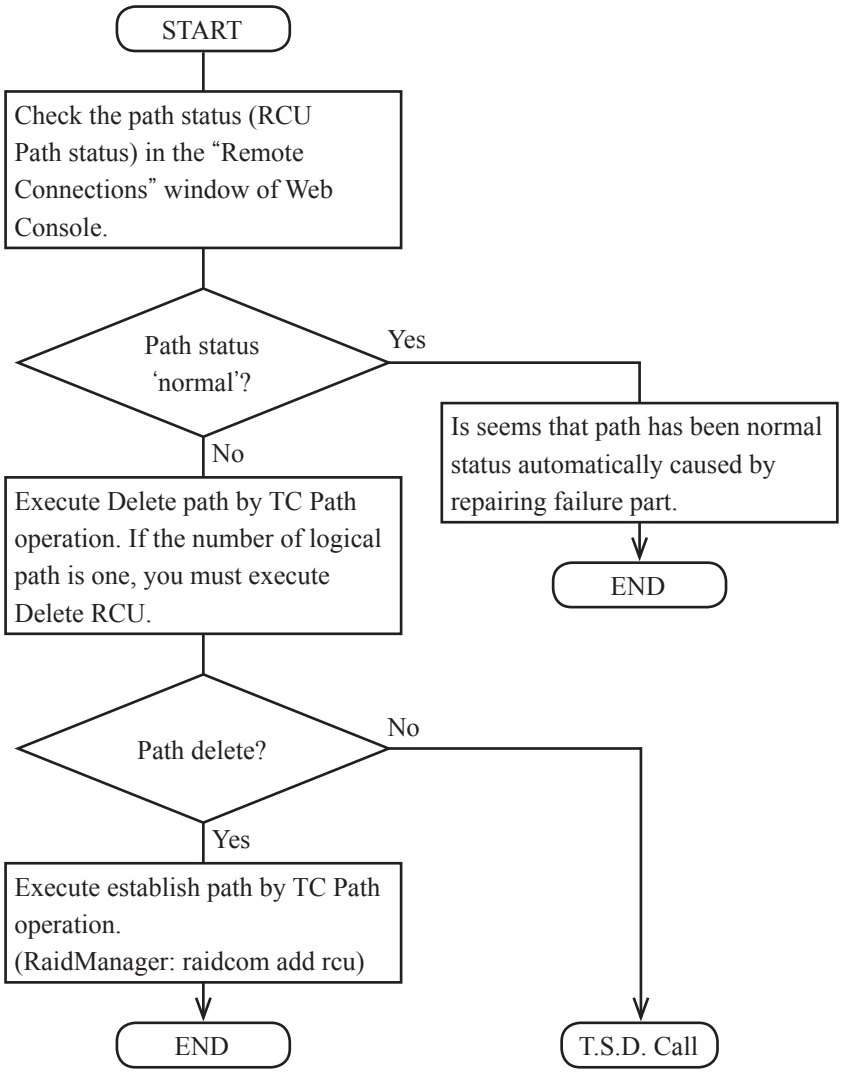


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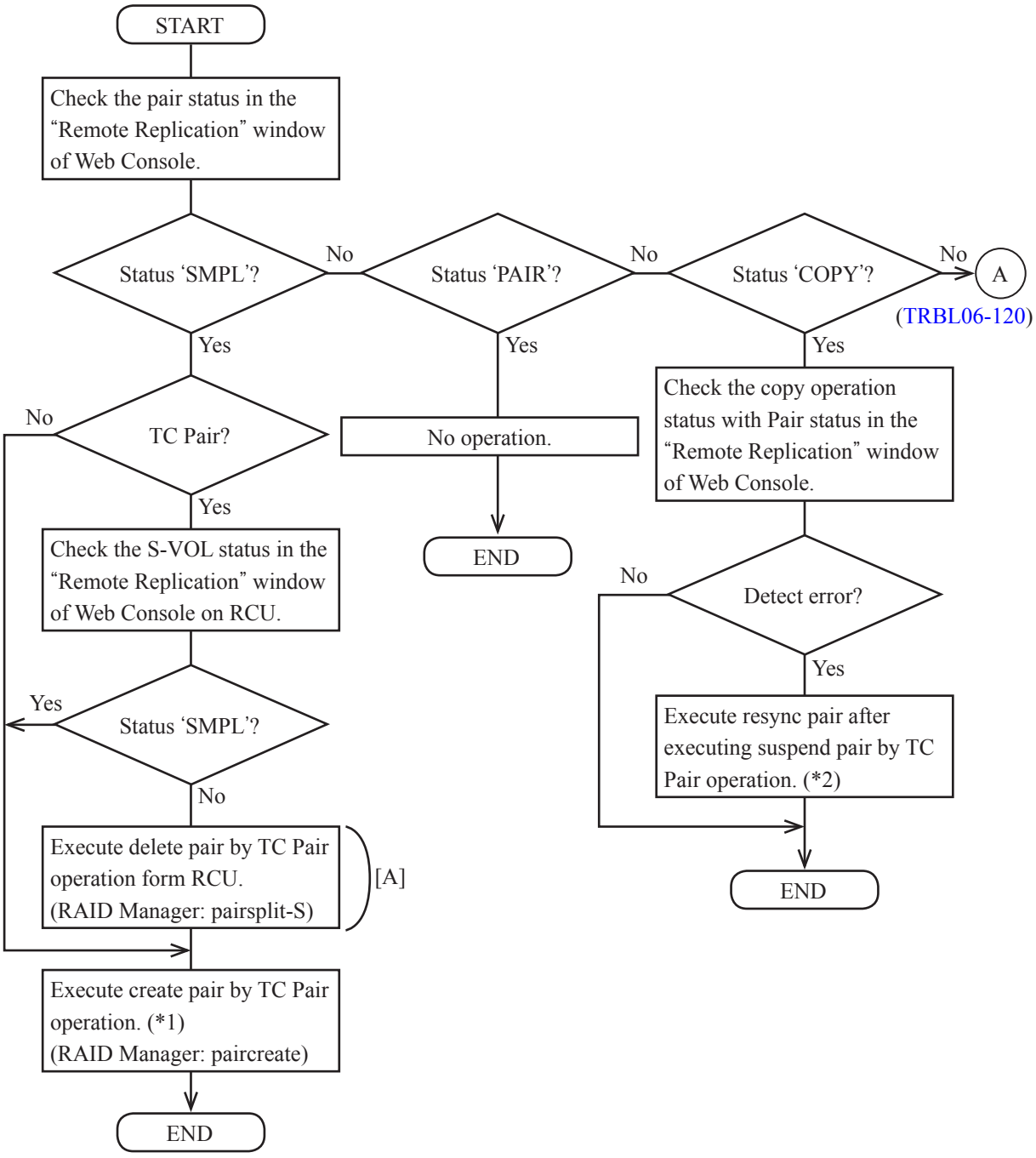
6.1.2 TureCopy Path Recovery Procedure



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6.1.3 TC Pair Recovery Operation

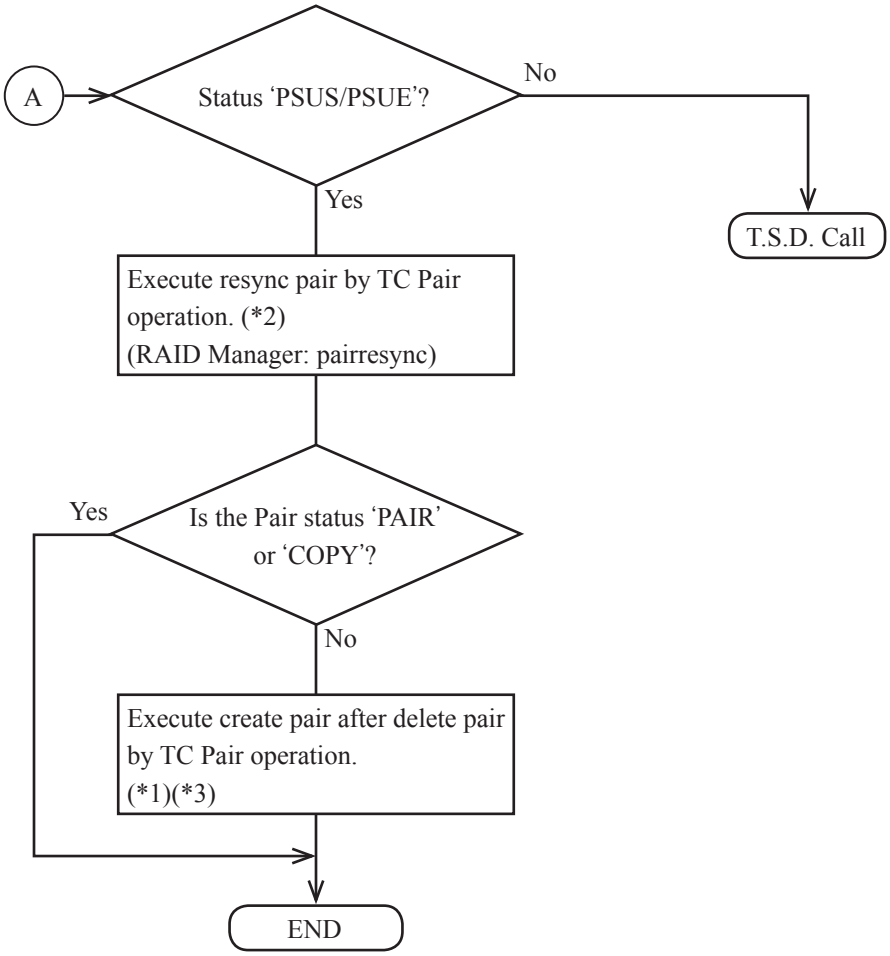
TC Pair Recovery Operation (1/2)



*1: If delete pair operation is executed according to [A], please create pair operation to these TC pairs.
*2: For the RAID Manager, issue the Pairresync command after the Pairsplit command is issued.

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TC Pair Recovery Operation (2/2)



*1: If delete pair operation does not complete, please try force delete pair operation.
*2: If TrueCopy pair detail is 'SSWS (S-VOL Swapping)' on the RAID manager (pairdisplay-fc), please execute resync pair operation (pairresync-swaps).
*3: For the RAID Manager, issue the Paircreate command after the Pairsplit-S command is issued.

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6.1.4 Procedure when the host hangs

If a host hangs up while it is writing data in TrueCopy P-VOLs, data difference between paired P-VOL and S-VOL may occur because of reasons as follows.

1. A write command didn't finish normally for some reason in DKC and it reported check condition to the host, but because of the hang-up, the host didn't retry the command.
2. During a process of a write command in DKC, a reset message was issued from the host and stopped the write command process, but because of the hang-up, the host didn't retry the command.

In this case, since write data of the last write command before hang-up was not written on the disk completely, please restart the job in order to complete the aborted command.

6.1.5 Recovery procedure when an error of TrueCopy pair operation occurs

When either MCU or RCU is in a highly loaded condition, a pair operation (a command for paircreate, pairsplit, or pairsplit-S) from a RAID Manager to one or multiple TrueCopy pair volume(s) may fail in (EX_CMDRJE or EX_CMDIOE). In this case, please check the pair status of the volumes that are objects of the operation. If the status is the same as before the pair operation, please retry the same pair operation.

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6.1.6 Special note of pair recovery procedure when SIM=d4fy-yy is generated

The special note in the recovery procedure from Web Console when this SIM is generated when Paircreate or the Resync operation is executed, and the state of the pair enters the following states is shown below.

■ When this SIM is generated when Resync is operated

It ..state of the pair.. ..following.. explains the deletion of the object pair (make to SMPL) on the RCU side when becoming P-VOL = SMPL, S-VOL = PAIR or COPY.

The recovery procedure:

Please execute the recovery work referring to this TROUBLESHOOTING SECTION usually.

(1) For TrueCopy

The Delete pair operation is executed to S-VOL, and it wishes the execution of Pair create again.

■ When this SIM is generated when Resume is operated

The state of the pair is P-VOL = PSUS/PSUE, S-VOL = PAIR or COPY.

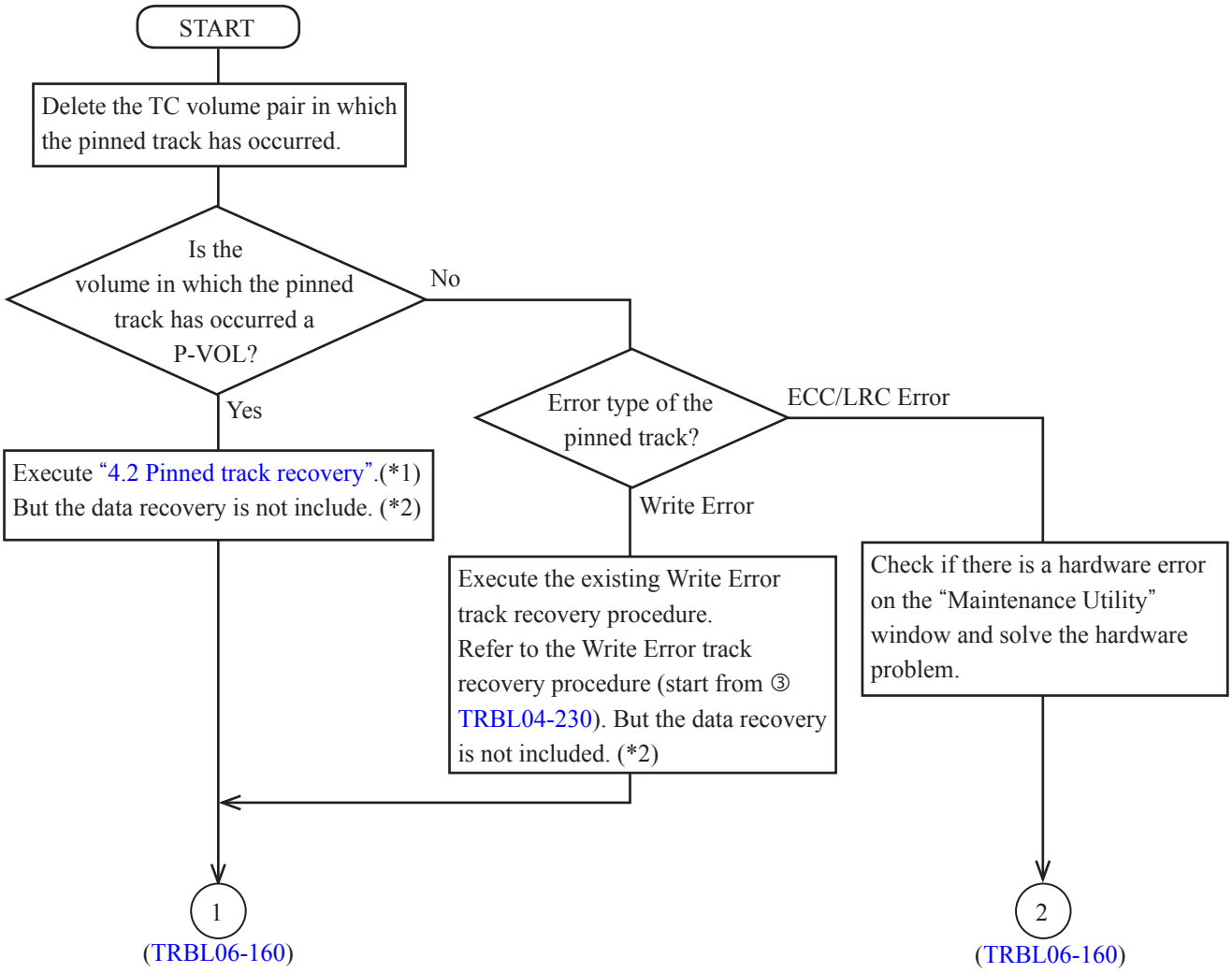
The recovery procedure:

Please execute the recovery work referring to this TROUBLESHOOTING SECTION usually.

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6.2 Pinned Track Recovery Procedure for TrueCopy

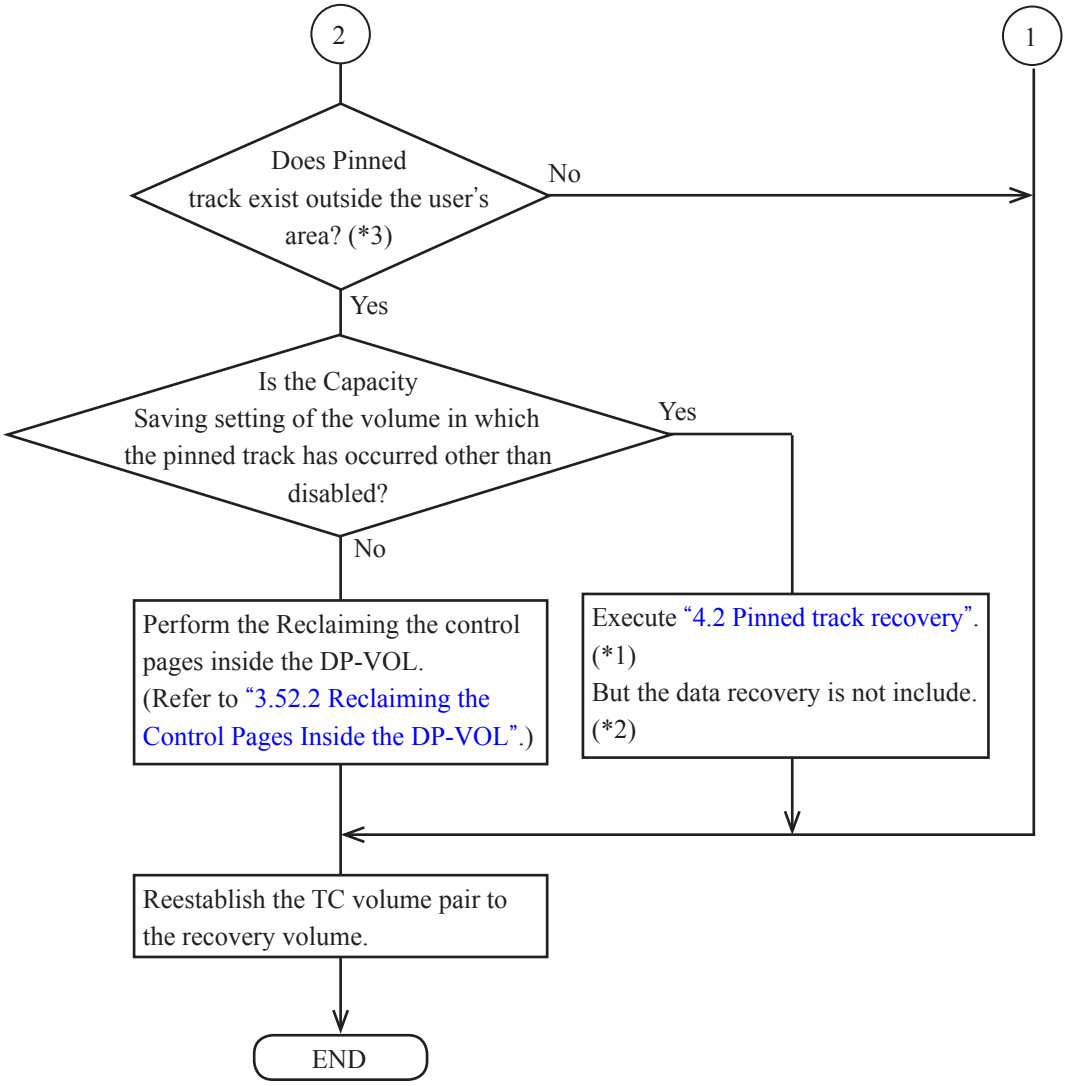
Pinned track recovery procedure for TrueCopy is as follows.



*1: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a TC volume pair.
However, the LDEV formatting or the analyze command executing is not required if the pinned track is a DP volume and out of the user area.

*2: Data is recovered by resetting TC volume pair.

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*1: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a TC volume pair.
However, the LDEV formatting or the analyze command executing is not required if the pinned track is a DP volume and out of the user area.

*2: Data is recovered by resetting TC volume pair.

*3: If MAINTENANCE PC SECTION "5.13.3 Pin Data Indication" does not indicate LBAs of pinned track, this indicates that a pinned track occurred outside the user area.

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6.3 Recovery Action of Path Status Error

Path Status	Factor	Recovery Action
“Nothing”	Establishing path or deleting path	Delete the path with “Edit Path” or “Delete RCU”, add a new path with “Edit Path” or “Add RCU”.
“Initialization Failed”	Incorrect the physical connection between the MCU and RCU	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings.(Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn't work.	Correct the path relay equipment settings or repair it.
“Communication Time Out”	Blockade of the MP or Port on the MCU.	Repair the MP status or Port status on the MCU.
“Resource Shortage (MCU)”	MCU resource over.	Too many path in the MCU or the RCU. Delete the paths and RCUs not currently in use.
“Resource Shortage (RCU)”	RCU resource over.	
“Serial Number Mismatch”	Incorrect the RCU S/N or Controller ID. (Fibre connection)	Delete the path with “Delete RCU”, add a new path with the correct RCU S/N and Controller ID with “Add RCU” again.
	Incorrect the physical connection between the MCU and RCU.	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings. (Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn’t work.	Correct the path relay equipment settings or repair it.

(To be continued)

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(Continued from the preceding page)

Path Status	Factor	Recovery Action
“Invalid Port”	Specified port is not existence on the MCU.	Delete the path with “Edit Path” or “Delete RCU”, add a new path with correct port on MCU again.
	Incorrect specified port type “Fibre”.	Delete the path with “Edit Path” or “Delete RCU”, add a new path with correct port type “Fibre” again.
“RCU Port Number Mismatch”	Incorrect the specified RCU port.	Delete the path with “Edit Path” or “Delete RCU”, and add a new path with correct RCU port again.
	Incorrect the physical connection between the MCU and RCU.	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings. (Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn’t work.	Correct the path relay equipment settings or repair it.
“RCU Port type Mismatch”	Incorrect specified RCU port.	Delete the path with “Edit Path” or “Delete RCU”, and add a new path with correct RCU port again.

(To be continued)

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(Continued from the preceding page)

Path Status	Factor	Recovery Action
“Communication Failed”	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	The path relay equipment doesn’t work.	Repair the path relay equipment
“Logical Blockade”	MCU Port doesn’t work.	Repair the port status on the MCU.
	RCU Port doesn’t work.	Repair the port status on the RCU, and delete the path with “Edit path” or “Delete RCU” and add the path with “Edit path” or “Add RCU” again.
	The path relay equipment doesn’t work.	Repair the path relay equipment, and delete the path with “Edit path” or “Delete RCU” and add the path with “Edit path” or “Add RCU” again.
	Broken the connection cable physically.	Replace the broken cable, and delete the path with “Edit path” or “Delete RCU” and add the path with “Edit path” or “Add RCU” again.
“Program Error”	Detected program error.	Delete the path with “Edit path” or “Delete RCU”, and add the path with “Edit path” or “Add RCU” again.

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7. Recovery from UR Failure

7.1 Recovery Procedure for UR Failure

The UR pair suspension or UR path blockade may occur triggered by a hardware failure.
This section contains explanation of the UR failure and procedures for recovery from the failure. Occurrence of the UR failure can be known through the following.

- SIM report on occurrence of path blockade
- SIM report on occurrence of pair suspension
- UR failure message in the Syslog output by RAID Manage/UR or RAID Manager/TT, in the case of the UR (Open)*1

SIM REF.CODE	Meaning	Remarks
2180-xy	Path blockade	x: CHB PCB # y: Port# in PCB
dcxy-yy	UR pair suspension	x: 0 to 2, 4 to A, or F yyy: LDEV number
dcex-zz	JNL overflow warning	x: 0 to 3 zz: Journal group number
dcfx-zz	Read JNL interruption	x: 0 to 3 zz: Journal group number

The UR supports the Force Delete Pair function. When recovery from the failure using an ordinary procedure is unsuccessful, take a recovery action performing Force Delete Pair operation.

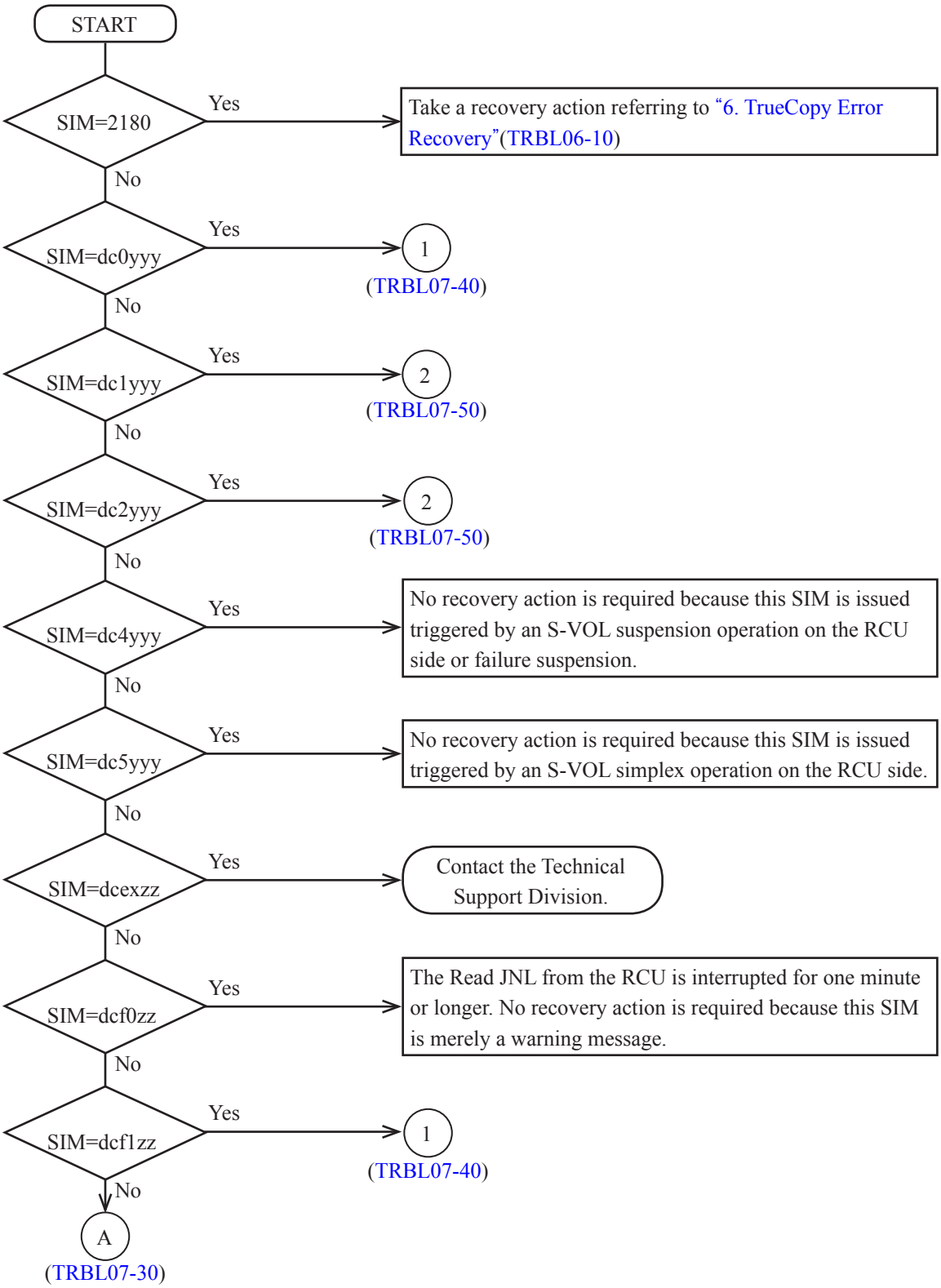
*1: When an UR pair is suspended, RAID Manager/UR or RAID Manager/TT displays the following message in the Syslog.

[HORCM_102] Deleted a suspending status on this paired volume (Volume:〇〇〇, code:XXXX).
〇〇〇〇 : Volume name
XXXX : Factor code

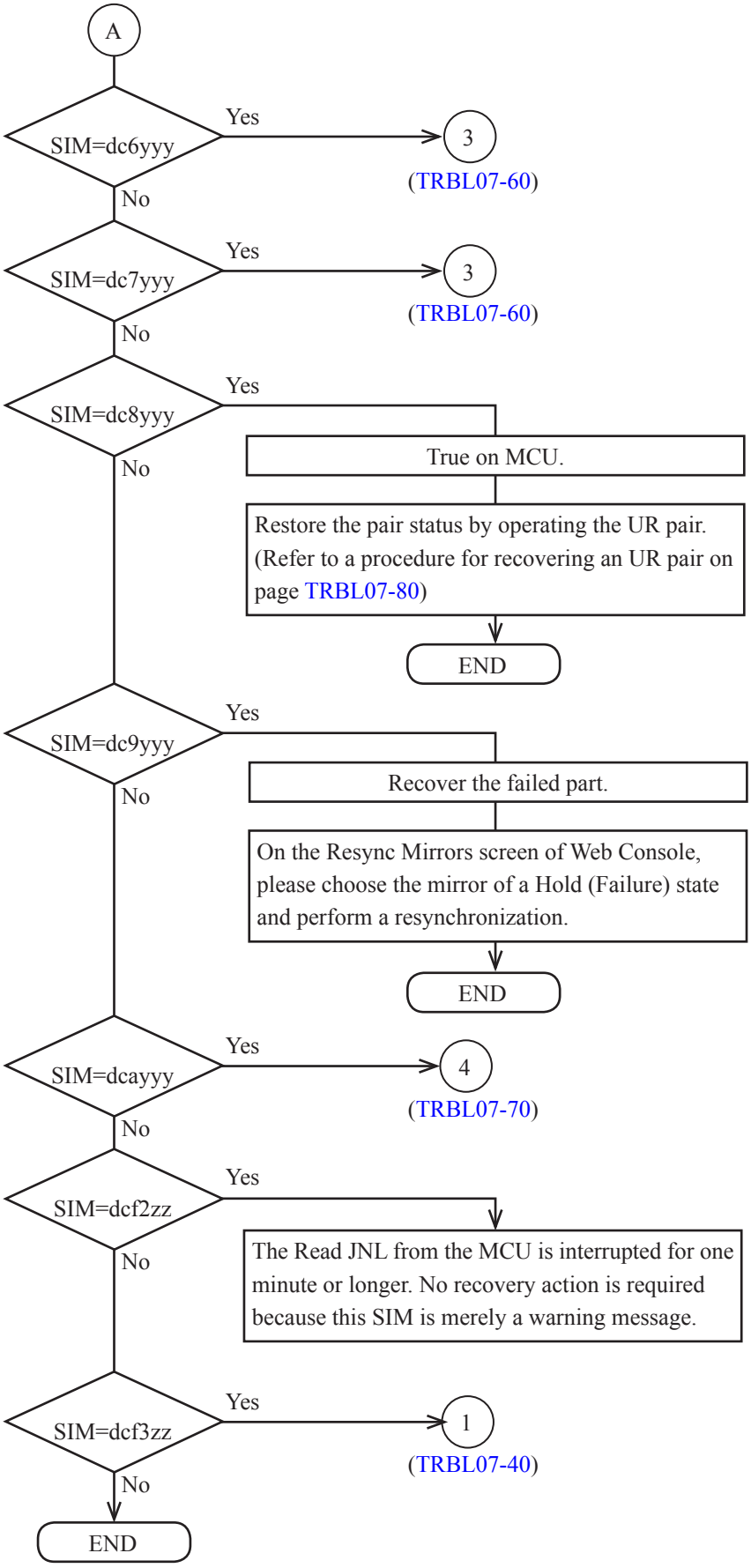
When a message that informs of occurrence of an UR pair failure is displayed in the Syslog, it is required to check the SIM(s) of the connected DKC and understand correspondence of messages in the Syslog to SIMs logged on the DKC side before starting the recovery action.

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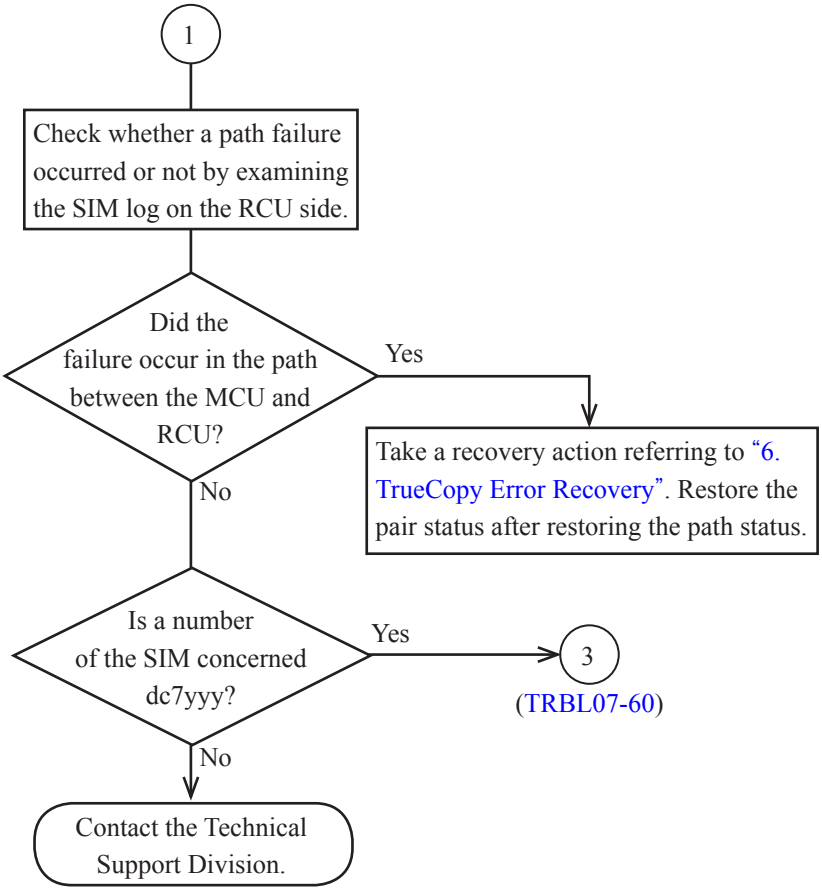
[Recovery from the UR failure]



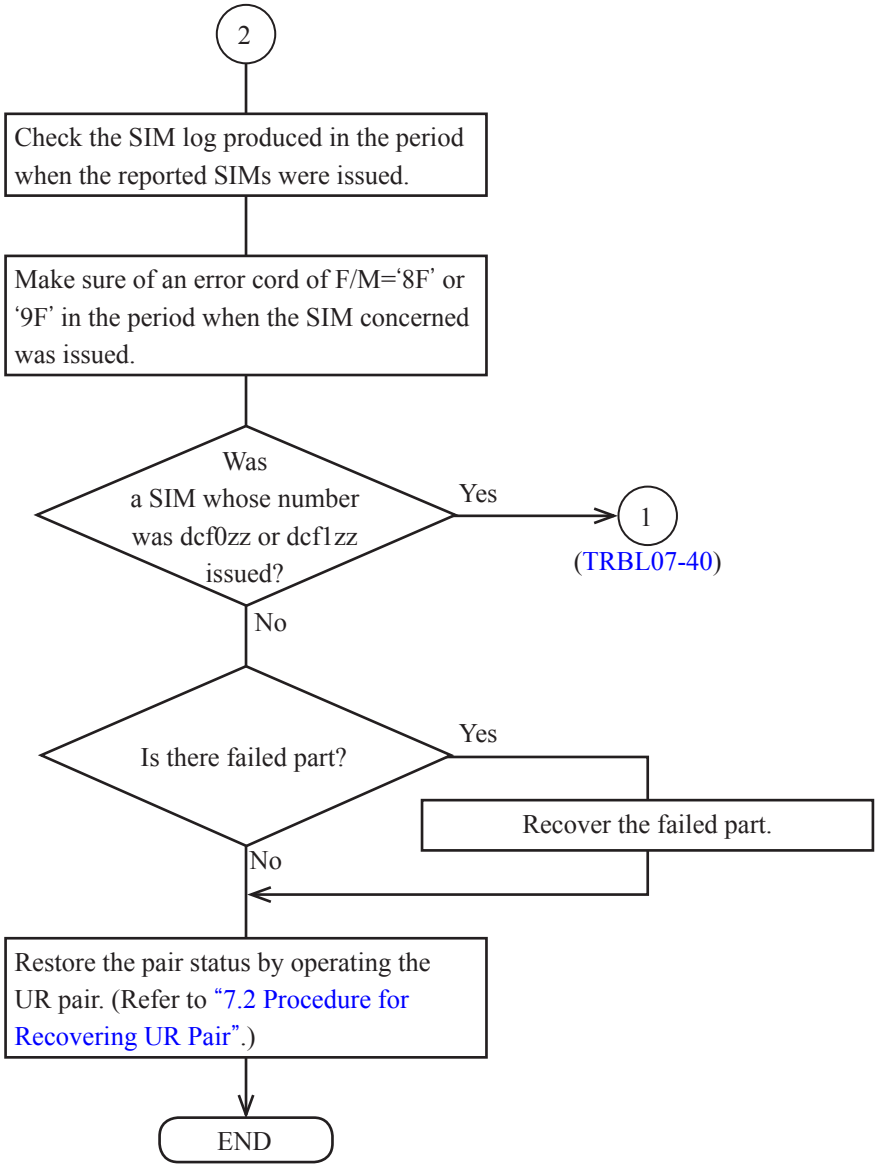
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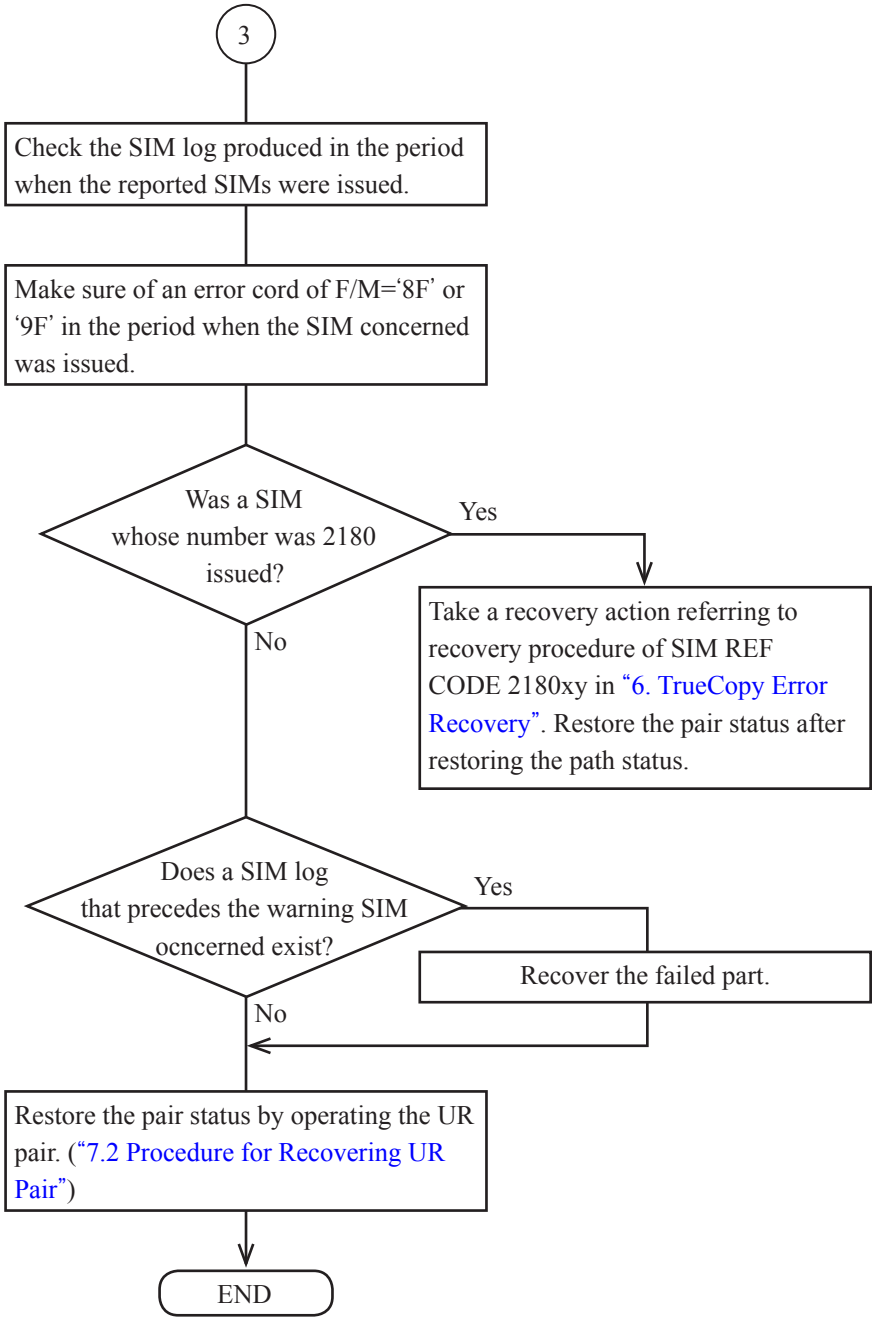
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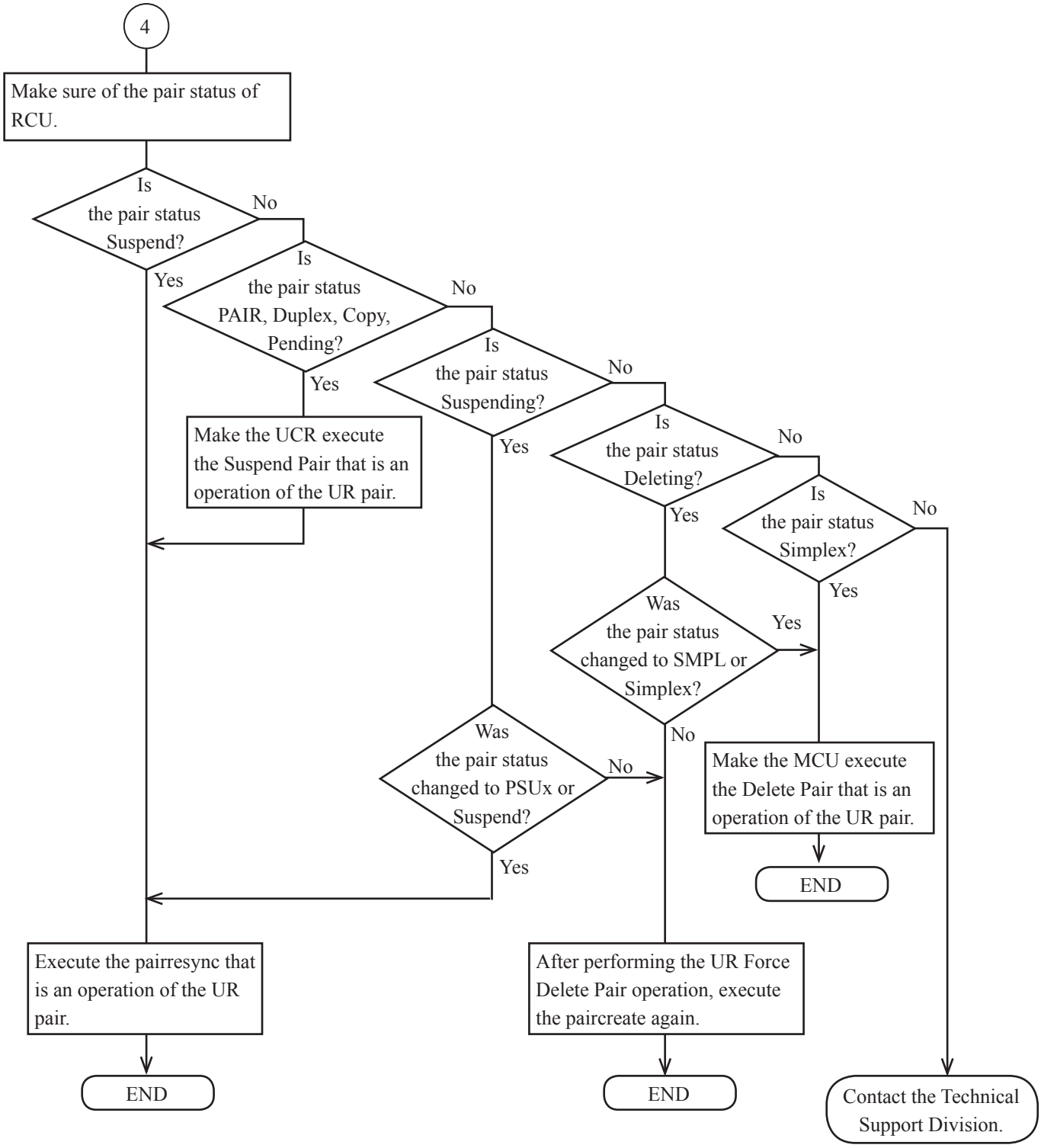
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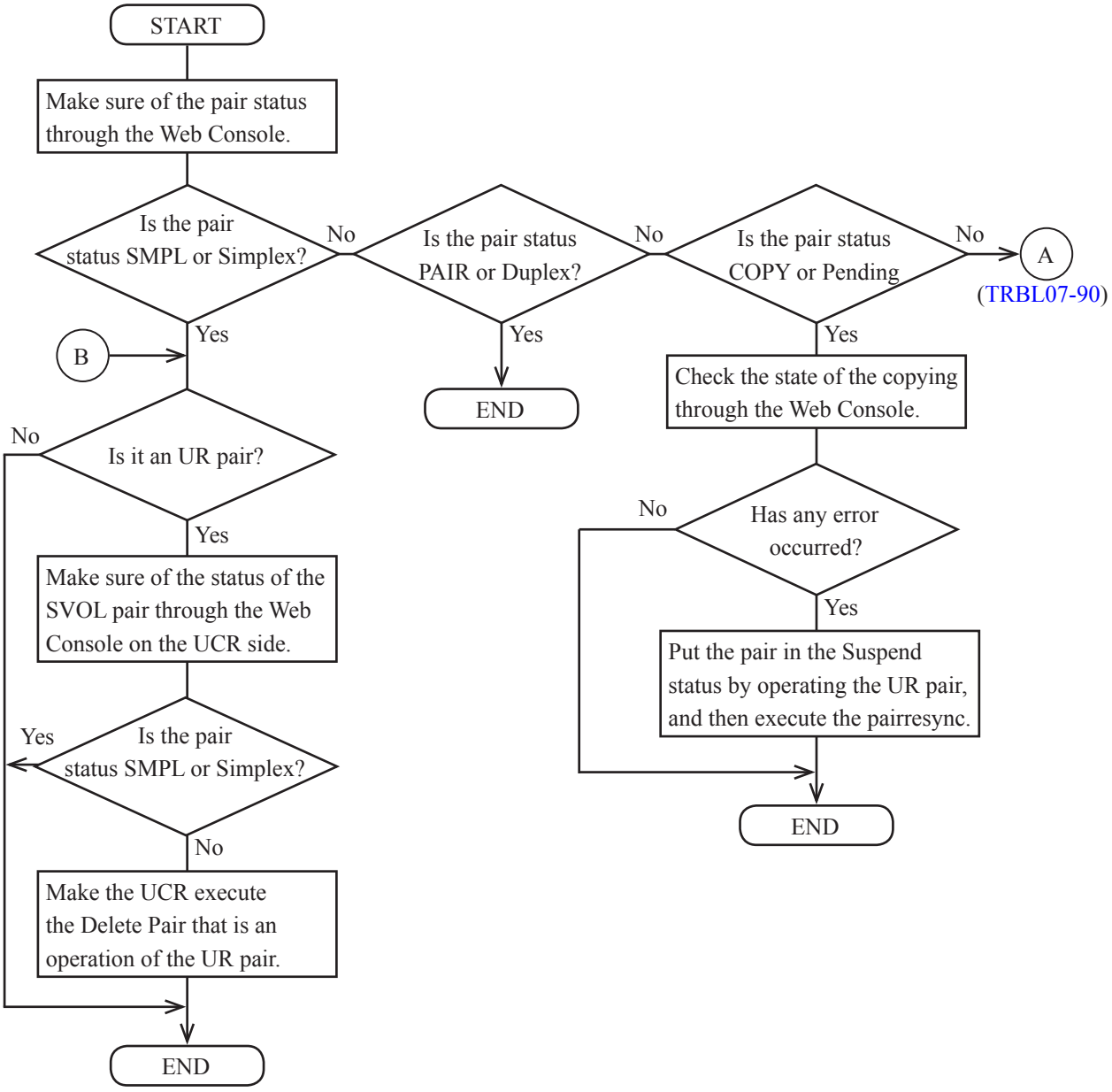


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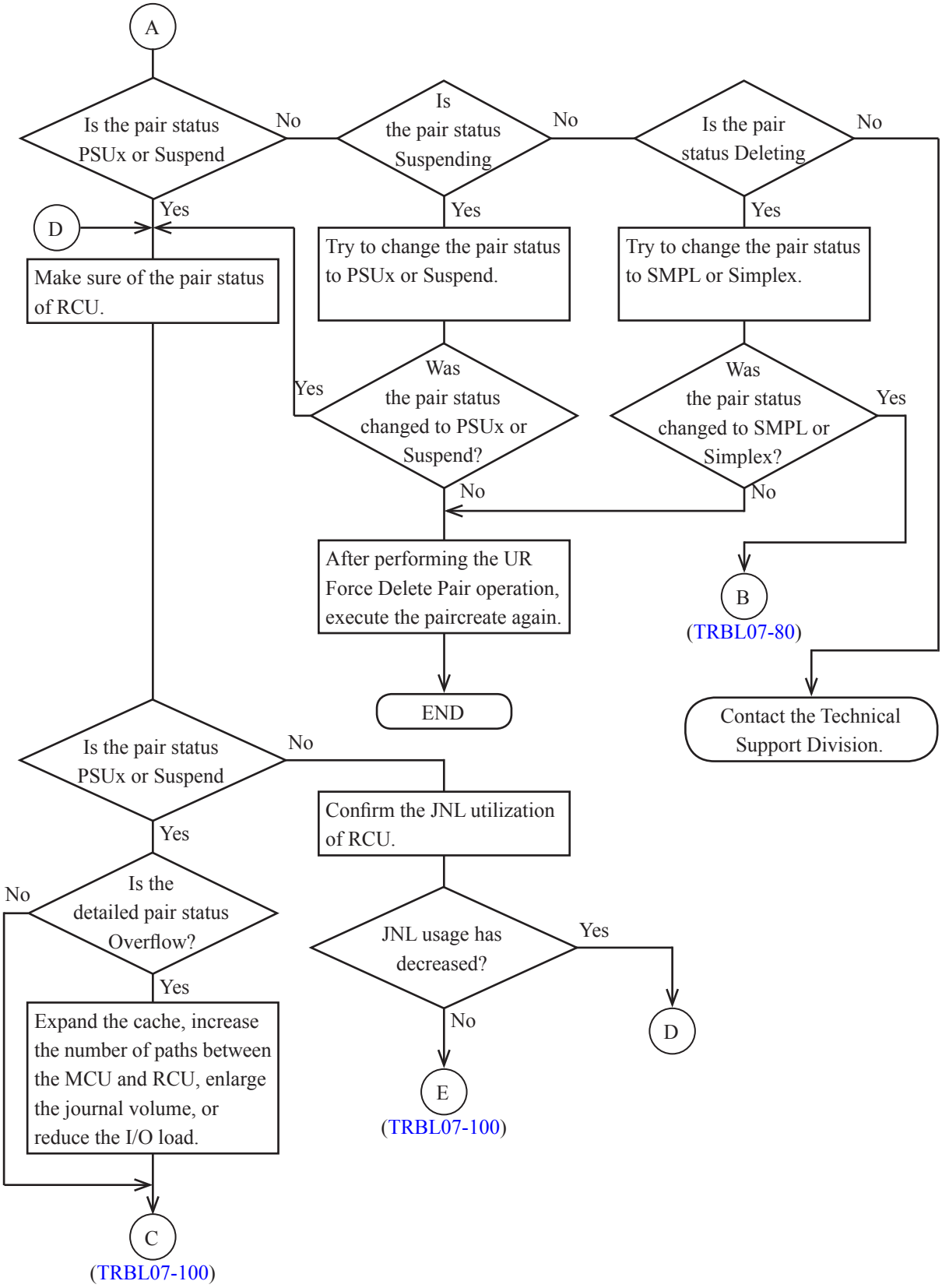


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7.2 Procedure for Recovering UR Pair



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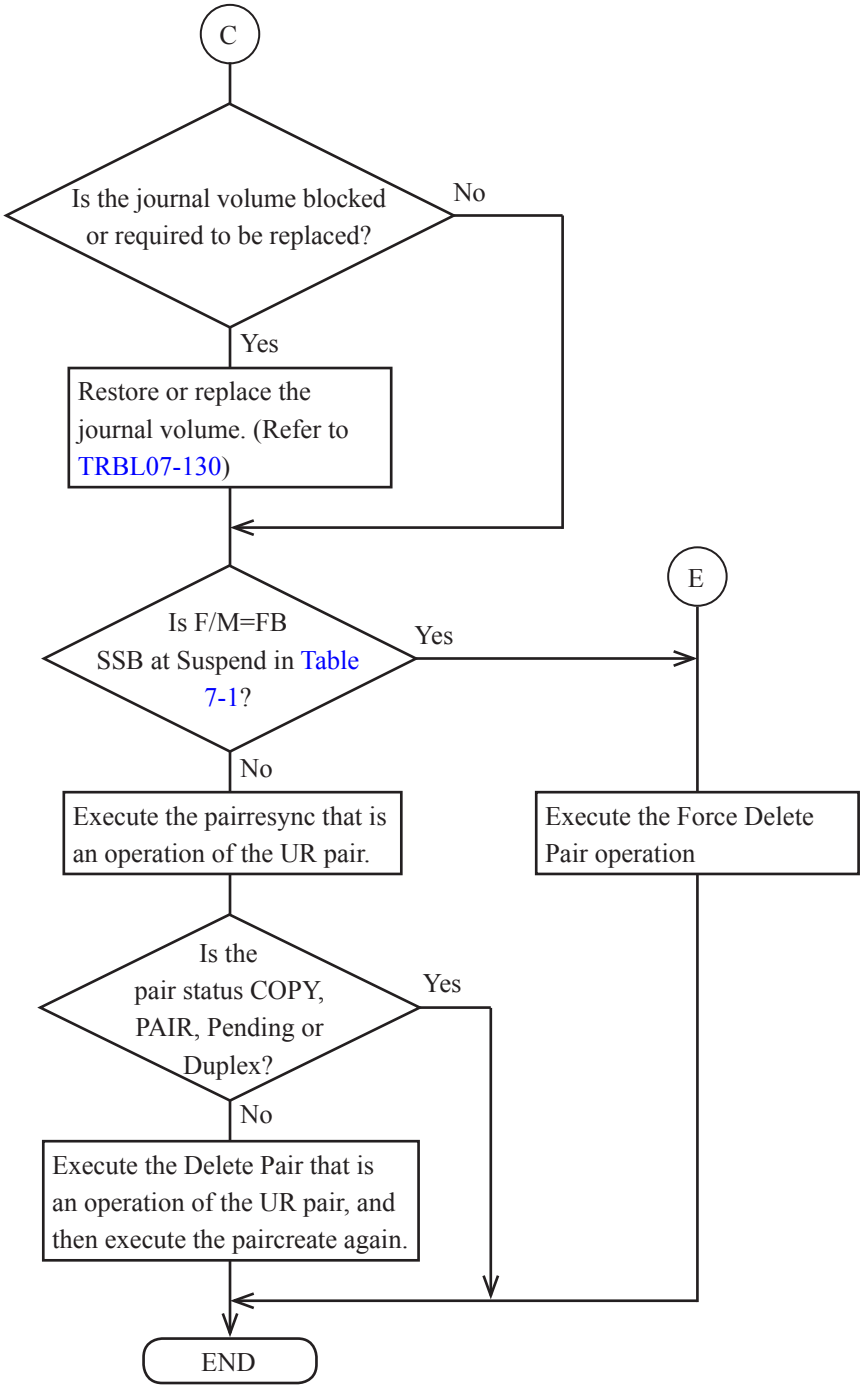


Table 7-1 Force Delete Pair Target F/M=FB SSB

No.	F/M	Error Code	Meaning
1	FB	EF60 to EF66	JNL-cache remains with the device of remote-side.

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7.3 Force Delete Pair Operation

The Force Delete Pair operation is a remedy function for the cases where an UR pair is put in the following abnormal states. Apply this function to both of the MCU and RCU.

- The pair was suspended owing to a trouble such as a failure and the pair status did not change but remained as Suspend.
- Though the Delete Pair or Suspend Pair operation terminated normally, the pair status remained as Deleting or Suspend.
- Please do not execute the Force Delete operation when all pairs in JNL Group are the pair status of Duplex or DuplexPend.

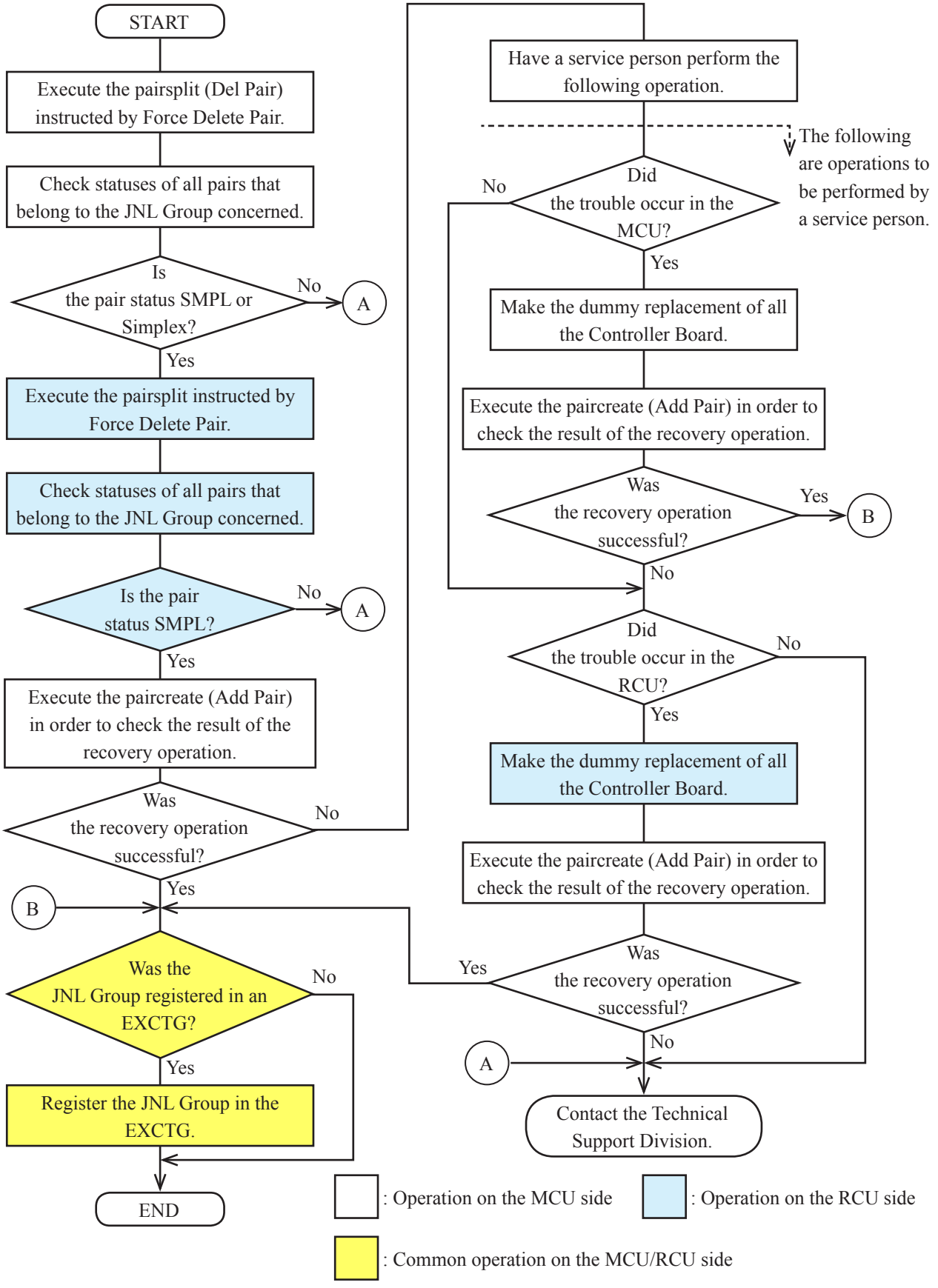
⚠ CAUTION

- All the data volumes that belong to the group (JNLG) concerned are placed in the Simplex status because Force Delete Pair operates in the Group mode.
- As a result of performance of Force Delete Pair operation on the MCU side, data that has not been transferred to the RCU is abandoned.
  As a result of performance of Force Delete Pair operation on the RCU side, data that has not been authorized is abandoned.
- There is a possibility that host I/O to the pair concerned becomes time out when the pair status of Duplex/DuplexPend exists in JNL Group.

After the Force Delete Pair operations for the MCU and RCU are completed, perform the paircreate operation again in order to make sure that the pair has got out from the abnormal state.
When doing that, specify the JNL Group number as the same value as former one.

If the pair status is not restored in spite of the Force Delete Pair operation, make dummy replacement of all the Controller Board for the storage system concerned.

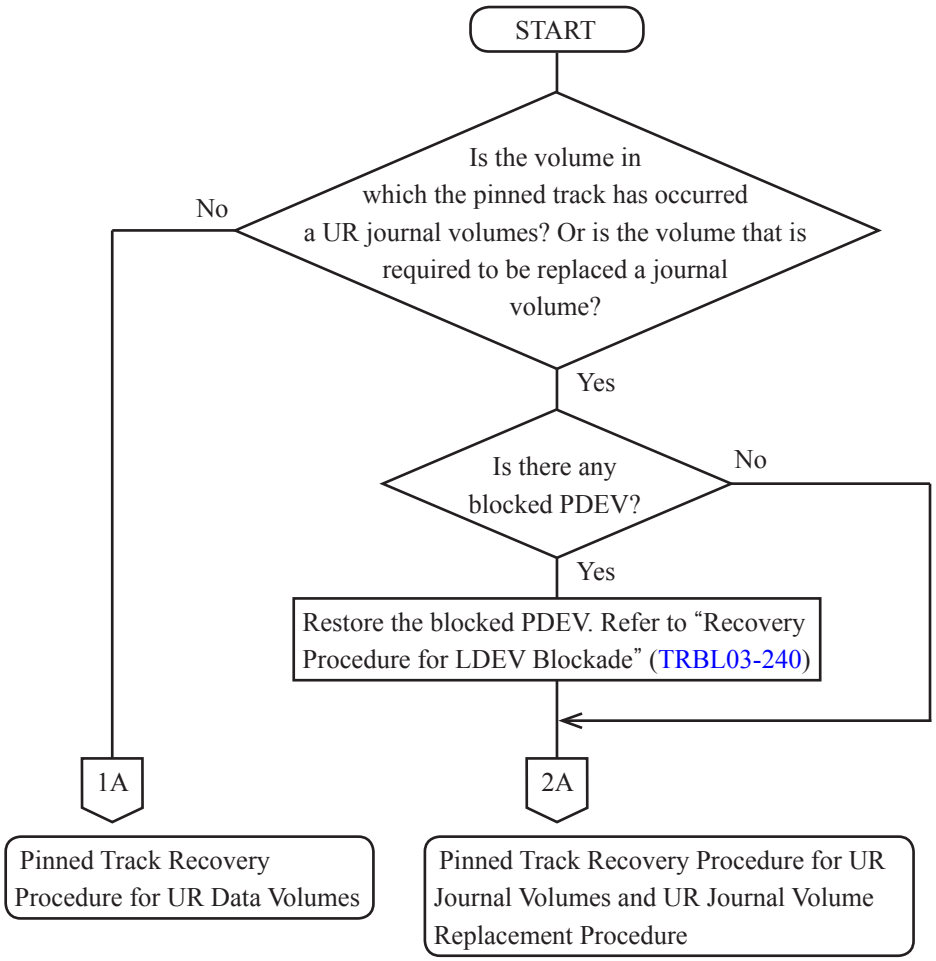
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7.4 Procedure for UR Pinned Track Recovery and Journal Volume Replacement

Procedure for UR pinned track recovery and journal volume replacement is as follows.



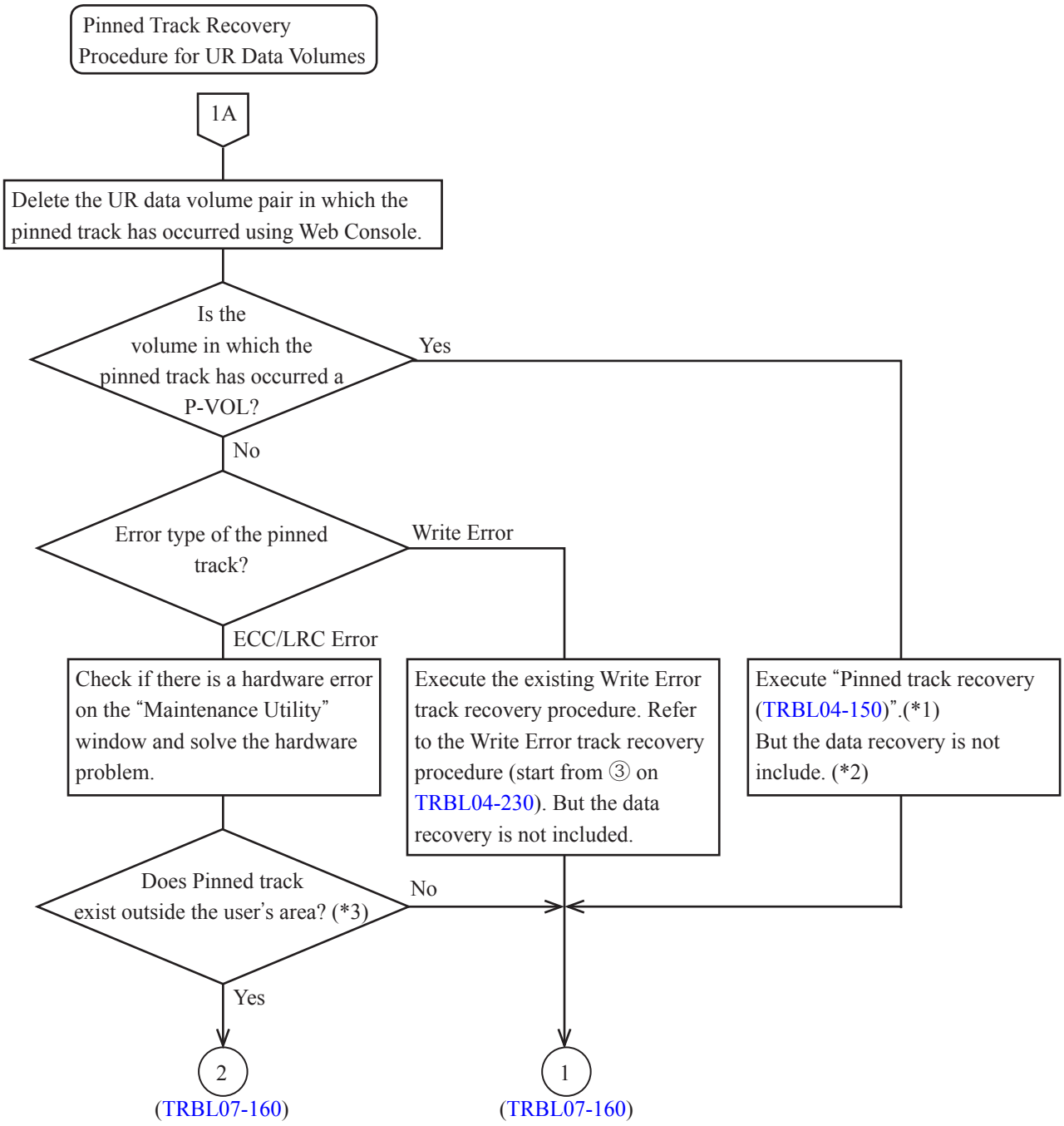
NOTE: If the pinned track has occurred in both P-VOL and S-VOL, recover the volumes according to the following sequence.

UR : ① P-VOL → ② S-VOL

If the pinned track has occurred in both data volumes and journal volumes, recover the volumes according to the following sequence.

① data volumes → ② journal volumes

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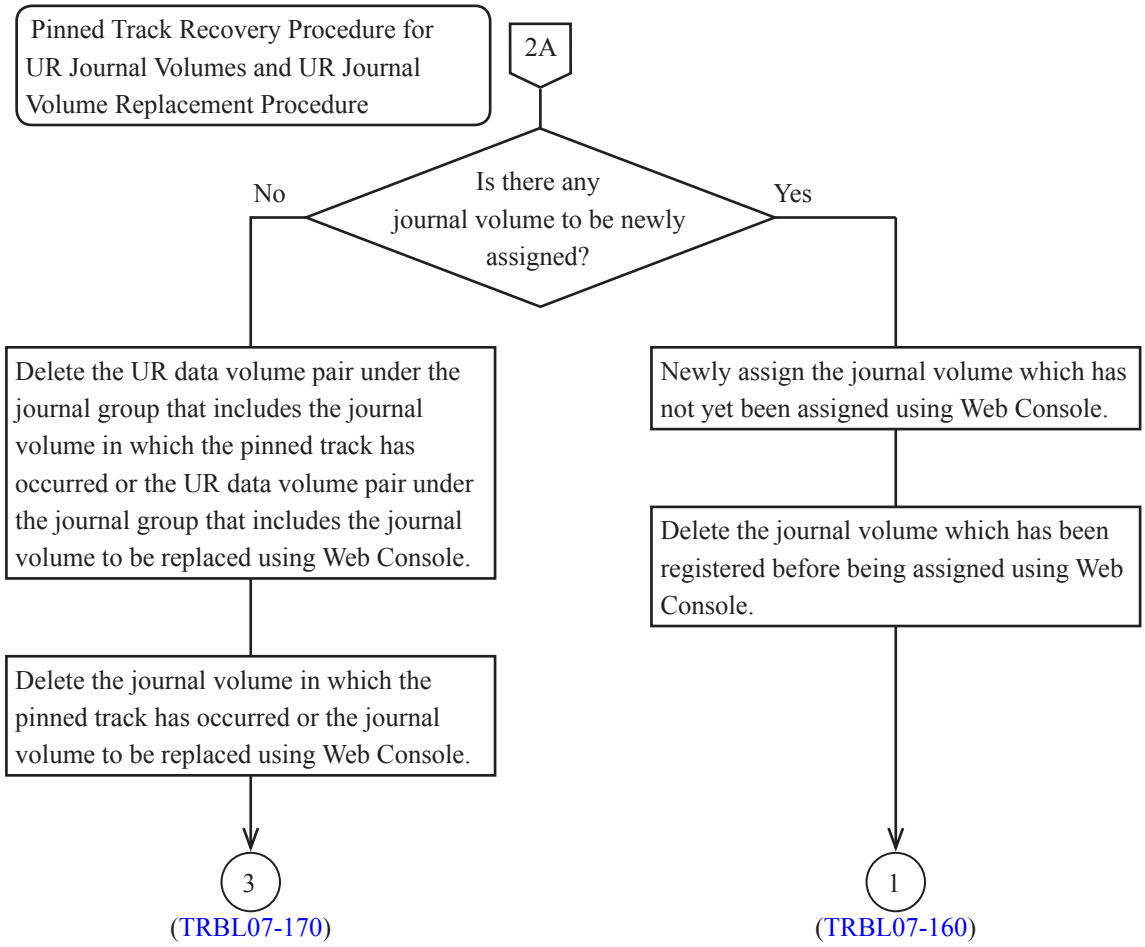


*1: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a UR volume pair.
However, the LDEV formatting or the analyze command executing is not required if the pinned track is a DP volume and out of the user area.

*2: Data is recovered by resetting UR volume pair.

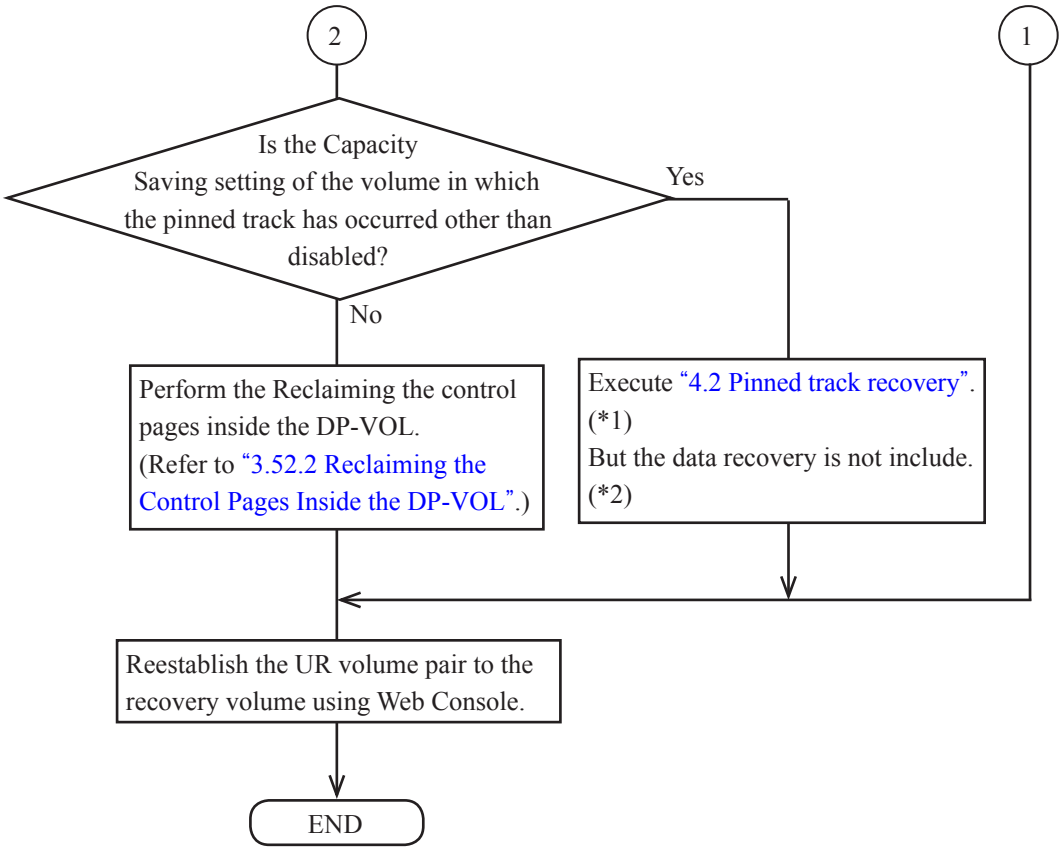
*3: If MAINTENANCE PC SECTION "5.13.3 Pin Data Indication" doesn't indicate LBAs of pinned track, this indicates that a pinned track occurred outside the user area.

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NOTE: If the journal volume to be assigned exists, prioritize recovery or replacement of UR pair. After the recovery of UR pair, format the blocked virtual volume to reduce the recovery or replacement time.

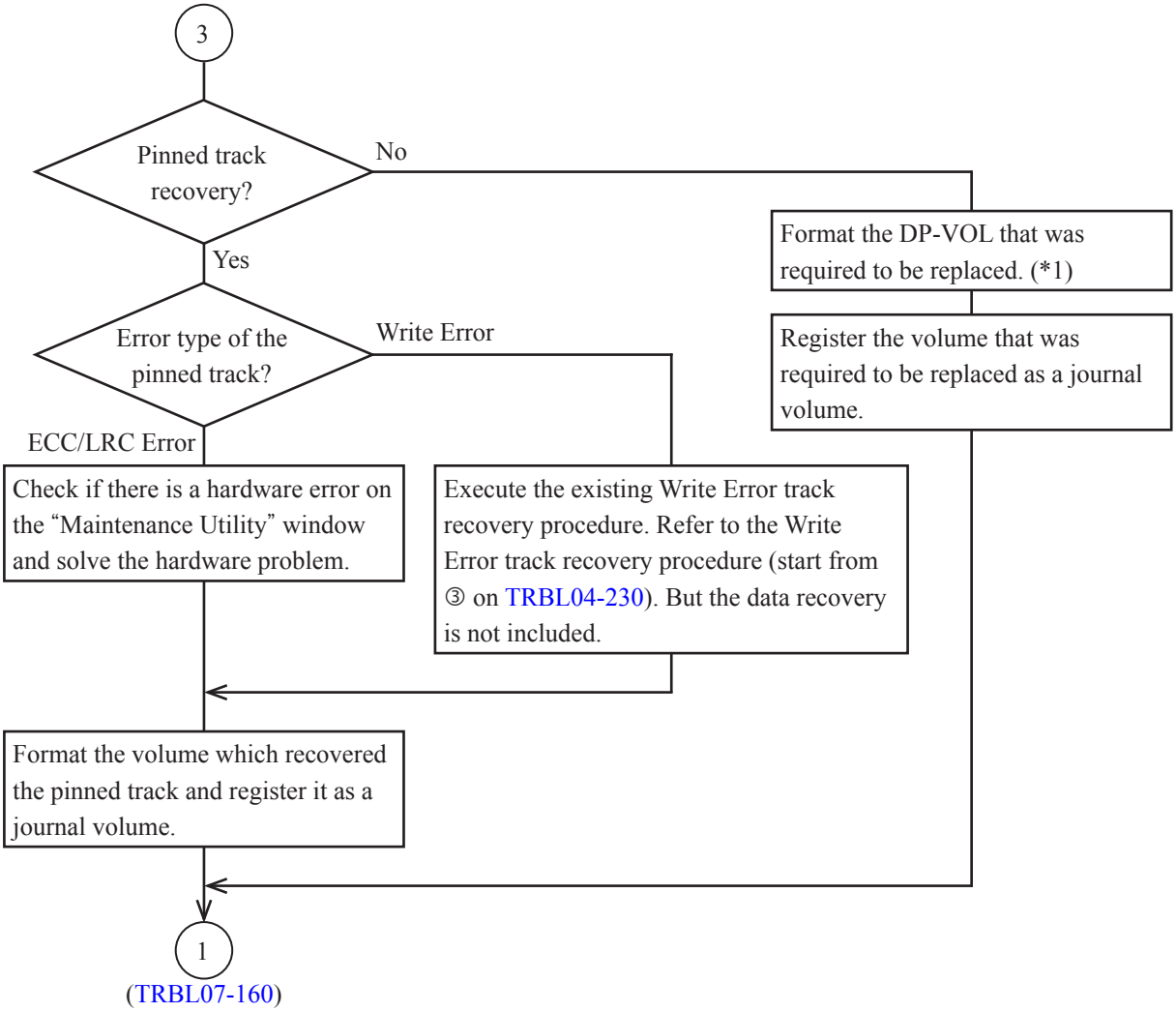
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*1: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a UR volume pair.
However, the LDEV formatting or the analyze command executing is not required if the pinned track is a DP volume and out of the user area.

*2: Data is recovered by resetting UR volume pair.

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*1: If DP-POOL VOL is blocked, execute LDEV format after DP-POOL VOL is recovered (Check the timing described in "Recovery processing at the time of pool-VOL blockade"(TRBL10-10). Register the volume that was required to be replaced as a journal volume after completion of recovery procedure.

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7.5 Failure Recovery Procedure and Planned Shutdown Procedure of the UR-UR delta Configuration

Since the UR-UR delta configuration consists of the three Universal Replicators, the description of the UR-UR delta configuration of the failure recovery procedure and the planned shutdown procedure are defined as follows.
For the UR-UR delta configuration, see the section related to the 3DC configuration by the three Universal Replicator sites in “Universal Replicator User’s Guide”.

UR-UR delta Configuration	Definition of the Description
UR between PDKC-LDKC (IDKC (*1))	UR1
UR between PDKC-RDKC (multi target configuration), or UR between IDKC-RDKC (cascade configuration)	UR2
UR delta configuration between LDKC-RDKC (multi target configuration), or UR delta (cascade configuration) between PDKC-RDKC.	UR delta

*1: Storage system in the intermediate site of IDKC (Intermediate DKC) and UR (Cascade Configuration)

7.5.1 Failure Recovery Procedure of the UR-UR delta Configuration

The following is the table of pair statuses in the event of a single point of failure and the recovery procedure summary. The UR delta pair status in each table indicates the pair status displayed in RAID Manager.
Also, the value in the parentheses indicates the pair status displayed by Storage Navigator.
This failure recovery procedure describes the recovery procedure to maintain the disaster discovery configuration.

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1. Multi Target Configuration: Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
–	[Normal Operation]	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
1	PDKC → LDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LDKC → PDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	• 448 = ON and 449 = OFF: After communication break detection, immediately UR pair failure suspend. • 448 = OFF and 449 = OFF: UR pair failure suspend Once communication is severed a certain period of time. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR1 pair resync in PVOL.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	LDKC → RDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	RDKC → LDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	PDKC → RDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RDKC → PDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	• 448 = ON and 449 = OFF: After communication break detection, immediately UR pair failure suspend. • 448 = OFF and 449 = OFF: UR pair failure suspend Once communication is severed a certain period of time. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR2 pair resync in PVOL.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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(Continued from the preceding page)

No.	Item	Mirror ID	Pair Status				Recovery operation
7	Path failure for remote command device	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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2. Multi Target Configuration: Pool Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL pool full	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR1 swap suspend in LVOL. 2. Delta resync (Swap resync the UR delta). 3. Failure recovery site (Expand the pool capacity). 4. UR1, UR2 pairs recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PVOL pool failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR1 swap suspend in LVOL. 2. Delta resync (Swap resync the UR delta). 3. Failure recovery site (See to TRBL10-10). 4. UR1, UR2 pairs recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	LVOL pool full	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**PFUS**	1. UR1 failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR1 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	LVOL pool failure	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**SSUE**	1. UR1 failure suspension is detected. 2. Failure recovery site (See to TRBL10-10). 3. UR1 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
5	RVOL pool full	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR2 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RVOL pool failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site (See TRBL10-10). 3. UR2 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR-UR configuration is reconfigured depending on the pair status.

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3. Multi Target Configuration: Journal Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS**	LVOL (UR1 SVOL)	**PFUS**	1. UR1, UR2 failure suspensions are detected. (*1) 2. Failure recovery site (Expand the journal volume capacity). 3. UR1, UR2 resync in PVOL. If failover occurs: 1. UR1, UR2 failure suspensions are detected. (*1) 2. UR1 swap suspend in LVOL. 3. Delta resync (Swap resync the UR delta). 4. Failure recovery site (Expand the journal volume capacity). 5. UR1 swap resync in LVOL.
		1	PVOL (UR2 PVOL)	**PFUS**	RVOL (UR2 SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PDKC journal volume failure	0	PVOL (UR1 PVOL)	**PFUS**	LVOL (UR1 SVOL)	**SSUE**	1. UR1, UR2 failure suspensions are detected. 2. UR1 swap suspend in LVOL. 3. Delta resync (Swap resync the UR delta). 4. Failure recovery site. 5. UR1 swap resync in LVOL. *: If the UR (PVOL-RVOL) pair status is HLDE, delta recovery is performed from PVOL.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	LDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS (*2)**	LVOL (UR1 SVOL)	**PFUS (*2)**	1. For the recovery procedure when PDKC journal volume is full, see the recovery operation for #1. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
4	LDKC journal volume failure	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**PSUE**	1. UR1 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR1 resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume full	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. For the recovery procedure when PDKC journal volume is full, see the recovery operation for #1. (*1)
		1	PVOL (UR2 PVOL)	**PFUS (*2)**	RVOL (UR2 SVOL)	**PFUS (*2)**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RDKC journal volume failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 pair resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	

*1: When a communication line error occurs, only UR with the error might have the journal volume full (in PFUS pair status). If so, recover the failed part, and then resync the UR.

*2: The LDKC or RDKC pair status does not become PFUS until the PDKC journal volume becomes full. Thus, the LDKC or RDKC journal volume can be expanded until the PDKC journal volume becomes full.

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4. Multi Target Configuration: Journal Volumes (Pool Volumes) (*1)

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC journal volume pool full	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**SSUE**	1. UR1, UR2 failure suspensions are detected. 2. UR1 swap suspend in LVOL. 3. Delta resync (Swap resync the UR delta). 4. Failure recovery site. 5. UR1 swap resync in LVOL. *: If the UR (PVOL-RVOL) pair status is HLDE, delta recovery is performed from PVOL.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PDKC journal volume pool failure	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**SSUE**	1. UR1, UR2 failure suspensions are detected. 2. UR1 swap suspend in LVOL. 3. Delta resync (Swap resync the UR delta). 4. Failure recovery site. 5. UR1 swap resync in LVOL. *: If the UR (PVOL-RVOL) pair status is HLDE, delta recovery is performed from PVOL.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	LDKC journal volume pool full	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**PSUE**	1. UR1 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR1 resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
4	LDKC journal volume pool failure	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**PSUE**	1. UR1 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR1 resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume pool full	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	
6	RDKC journal volume pool failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 resync in PVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	

*1: Recovery procedures for failure in the pool of DP-VOLs registered as journal volumes are described. The pool full status might occur when the capacity of journal volumes is defined more than that of all unused pool volumes.

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5. Multi Target Configuration: LDEV

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR1 swap suspend in LVOL. 2. Delta resync (Swap resync the UR delta). 3. Failure recovery site. 4. UR1, UR2 pairs recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LVOL failure	0	PVOL (UR1 PVOL)	**PSUE**	LVOL (UR1 SVOL)	**SSUE**	1. UR1 failure suspension is detected. 2. Failure recovery site. 3. UR1 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RVOL failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. UR2 pair recovery. (*1)
		1	PVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	Remote command device failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. Failure recovery site.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR-UR configuration is reconfigured depending on the pair status.

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6. Multi Target Configuration: Storage system

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC failure (SM/CM Non-Volatile)	0	PVOL (UR1 PVOL)	PAIR (*1)	LVOL (UR1 SVOL)	PAIR (*1)	1. UR1 swap suspend in LVOL. 2. Delta resync (Swap resync the UR delta). 3. DKC recovery. 4. UR1 swap resync in LVOL.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LDKC failure (SM/CM Non-Volatile)	0	PVOL (UR1 PVOL)	PAIR (*2)	LVOL (UR1 SVOL)	PAIR (*2)	1. DKC recovery.
		1	PVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	1. DKC recovery.
		1	PVOL (UR2 PVOL)	PAIR (*3)	RVOL (UR2 SVOL)	PAIR (*3)	
		2	LVOL (UR delta PVOL)	SSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR pair information of PDKC (PVOL) is retained, which changes the UR1 pair state to PSUE/SSUE after PDKC (PVOL) PS is on.

*2: If you have SOM 449 = OFF in PDKC, the UR1 pair status becomes PSUE/SSUE, and UR1 resync is required after the DKC recovery.

*3: If you have SOM 449 = OFF in PDKC, the UR2 pair status becomes PSUE/SSUE, and UR2 resync is required after the DKC recovery.

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7. Cascade Configuration: Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
–	[Normal Operation]	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
1	PDKC → IDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	IDKC → PDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	• 448 = ON and 449 = OFF: After communication break detection, immediately UR pair failure suspend. • 448 = OFF and 449 = OFF: UR pair failure suspend Once communication is severed a certain period of time. 1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site (Recover paths). 3. If UR1 is suspended, pair resync UR1 in PVOL. When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	IDKC → RDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	RDKC → IDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	• 448 = ON and 449 = OFF: After communication break detection, immediately UR pair failure suspend. • 448 = OFF and 449 = OFF: UR pair failure suspend Once communication is severed a certain period of time. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	PDKC → RDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RDKC → PDKC Path failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
7	Path failure for remote command device	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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8. Cascade Configuration: Pool Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL pool full	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR1 swap suspend in IVOL. 2. Failure recovery site (Expand the pool capacity). 3. UR1 pair recovery in IVOL. 4. UR1 swap suspend in PVOL. 5. UR1 swap resync in PVOL. 6. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PVOL pool failure	0	PVOL (UR1 PVOL)	PAIR (*2)	IVOL (UR1 SVOL)	PAIR (*2)	1. UR1 swap suspend in IVOL. 2. Failure recovery site (See TRBL10-10). 3. UR1 pair recovery in IVOL. 4. UR1 swap suspend in PVOL. 5. UR1 swap resync in PVOL. 6. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	IVOL pool full	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**PFUS**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site (Expand the pool capacity). 3. UR1 pair recovery in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
4	IVOL pool failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site (See TRBL10-10). 3. UR1 pair recovery in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR (*2)	RVOL (UR2 SVOL)	PAIR (*2)	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RVOL pool full	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR2 pair recovery in IVOL.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**PFUS**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RVOL pool failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site (See TRBL10-10). 3. UR2 pair recovery in IVOL.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR-UR configuration is reconfigured depending on the pair status.

*2: The pair status is PSUE during UR2 pair creation or resynchronization.

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9. Cascade Configuration: Journal Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS**	IVOL (UR1 SVOL)	**PFUS**	1. UR1 failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR1 pair resync in PVOL. If failover occurs: 1. UR1 failure suspension is detected. 2. UR1 swap suspend in IVOL. 3. Failure recovery site (Expand the journal volume capacity). 4. UR1 swap resync in IVOL. 5. UR1 swap suspend in PVOL. 6. UR1 swap resync in PVOL. 7. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PDKC journal volume failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. UR1 failure suspension is detected. 2. UR1 swap suspend in IVOL. 3. Failure recovery site. 4. UR1 swap resync in IVOL. 5. UR1 swap suspend in PVOL. 6. UR1 swap resync in PVOL. 7. UR2 pair resync in IVOL. 8. UR delta the delta recover.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	IDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS (*1)**	IVOL (UR1 SVOL)	**PFUS (*1)**	1. UR1, UR2 failure suspensions are detected. (*1) 2. Failure recovery site (Expand the journal volume capacity). 3. UR1 pair resync in PVOL. 4. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	**PFUS**	RVOL (UR2 SVOL)	**PFUS**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
4	IDKC journal volume failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site. 3. UR1 pair resync in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS (*2)**	IVOL (UR1 SVOL)	**PFUS (*2)**	1. UR1, UR2 failure suspensions are detected. (*2) 2. Failure recovery site (Expand the journal volume capacity). 3. UR1 pair resync in PVOL. 4. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	**PFUS (*2)**	RVOL (UR2 SVOL)	**PFUS (*2)**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RDKC journal volume failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 pair resync in IVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	

*1: The pair status of IDKC UR1 SVOL does not become PFUS until the PDKC journal volume becomes full. Thus, the IDKC journal volume can be expanded until the PDKC journal volume becomes full.

*2: The IDKC or RDKC pair status does not become PFUS until the PDKC journal volume becomes full. Thus, the IDKC or RDKC journal volume can be expanded until the PDKC journal volume becomes full.

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10. Cascade Configuration: Journal Volumes (Pool Volumes) (*1)

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC journal volume pool full	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. UR1 failure suspension is detected. 2. UR1 swap suspend in IVOL. 3. Failure recovery site. 4. UR1 swap resync in IVOL. 5. UR1 swap suspend in PVOL. 6. UR1 swap resync in PVOL. 7. UR2 pair resync in IVOL. 8. UR delta the delta recover.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PDKC journal volume pool failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. UR1 failure suspension is detected. 2. UR1 swap suspend in IVOL. 3. Failure recovery site. 4. UR1 swap resync in IVOL. 5. UR1 swap suspend in PVOL. 6. UR1 swap resync in PVOL. 7. UR2 pair resync in IVOL. 8. UR delta the delta recover.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	**PSUE (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	IDKC journal volume pool full	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site. 3. UR1 pair resync in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
4	IDKC journal volume pool failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site. 3. UR1 pair resync in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume pool full	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 pair resync in IVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	
6	RDKC journal volume pool failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. Delete UR delta. 4. UR2 pair resync in IVOL. 5. Create UR delta. 6. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	**PSUE (HLDE)**	

*1: Recovery procedures for failure in the pool of DP-VOLs registered as journal volumes are described. The pool full status might occur when the capacity of journal volumes is defined more than that of all unused pool volumes.

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11. Cascade Configuration: LDEV

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR1 swap suspend in IVOL. 2. Failure recovery site. 3. UR1 pair recovery in IVOL. 4. UR1 swap suspend in PVOL. 5. UR1 swap resync in PVOL. 6. UR2 pair resync in IVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	IVOL failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	1. Delta resync (Pair resync the UR delta in PVOL). 2. Failure recovery site. 3. UR1 pair recovery in PVOL. (*1) *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR (*2)	RVOL (UR2 SVOL)	PAIR (*2)	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RVOL failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. UR2 failure suspension is detected. 2. Failure recovery site. 3. UR2 pair recovery in IVOL.
		1	IVOL (UR2 PVOL)	**PSUE**	RVOL (UR2 SVOL)	**SSUE**	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	Remote command device failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. Failure recovery site. 2. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR-UR configuration is reconfigured depending on the pair status.

*2: The pair status is PSUE during UR2 pair creation or resynchronization.

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12. Cascade Configuration: Storage system

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC failure (SM/CM Non-Volatile) (*1)	0	PVOL (UR1 PVOL)	PAIR (*1)	IVOL (UR1 SVOL)	PAIR (*1)	1. UR1 swap suspend in LVOL. 2. DKC recovery. 3. UR1 swap resync in LVOL. 4. UR1 swap suspend in PVOL. 5. UR1 swap resync in PVOL. 6. UR2 pair resync in LVOL.
		1	IVOL (UR2 PVOL)	PAIR	RVOL (UR2 SVOL)	PAIR	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	IDKC failure (SM/CM Non-Volatile)	0	PVOL (UR1 PVOL)	PAIR (*2)	IVOL (UR1 SVOL)	PAIR (*2)	1. Delta resync (Pair resync the UR delta in PVOL). 2. DKC recovery. 3. UR1 pair resync in PVOL. *: When it is for the multi target operation, the following recovery procedure is not required. 4. Delete UR delta and UR2. 5. Create UR2 pair. 6. Create UR delta. 7. Assign the remote command device for the journal mirror ID in each site.
		1	IVOL (UR2 PVOL)	PAIR (*2)	RVOL (UR2 SVOL)	PAIR (*2)	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	1. DKC recovery.
		1	IVOL (UR2 PVOL)	PAIR (*3)	RVOL (UR2 SVOL)	PAIR (*3)	
		2	PVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: UR pair information of PDKC (PVOL) is retained, which changes the UR1 pair state to PSUE/SSUE after PDKC (PVOL) PS is on.

*2: UR pair information of IDKC (IVOL) is retained, which changes the UR1, UR2 pair status to PSUE/SSUE after IDKC (IVOL) PS is on.

*3: If you have SOM 449 = OFF in IDKC, the UR2 pair status becomes PSUE/SSUE, and UR2 resync is required after the DKC recovery.

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7.5.2 DKC Planned Shutdown Procedure of the UR-UR delta Configuration

Following is the procedure of the planned shutdown (PS OFF/ON) of the PDKC/LDKC (IDKC)/ RDKC in the UR-UR delta configuration (multi target/cascade).
Because suspending all UR pairs related to DKC to be set to PS OFF is recommended when DKC is set to PS OFF, the procedure that complies with it is shown.
The UR delta pair status in each table indicates the pair status displayed in Raid Manager. Also, the value in the parentheses indicates the pair status displayed by Storage Navigator.
This planned shutdown procedure describes the planned shutdown procedure to maintain the disaster discovery configuration.

7.5.2.1 Planned Shutdown Procedure of the PDKC

Table 7-2 Planned Shutdown Procedure of the PDKC of the UR-UR delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	Stop of host I/O to the PDKC	Suspend I/O from host to the PDKC (switch the operation to LDKC).	
2	UR1 pair swap suspension	Execute UR1 pair swap suspension in the LDKC. ↓ UR1 pair swap suspension PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PSUS** LDKC [PS ON] UR1 SVOL: **SSWS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap suspension % pairsplit -g UR1 -RS -IH1

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
3	Delta recync (Swap resync the UR delta)	Execute the delta recync in LDKC (Swap resync the UR delta). ↓ Delta recync PDKC [PS ON] UR1 PVOL: **PSUS** UR delta PVOL: **SSUS (HOLD)** LDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#Delta recync % pairresync -g URdelta -swaps -IH1
4	Start of host I/O to the LDKC	Consolidate host I/O to the LDKC.	
5	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF] UR1 PVOL: PSUS UR delta PVOL: **SSUS (HOLD)** LDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
–	During planned shutdown		
6	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON] UR1 PVOL: **PSUS** UR delta PVOL: **SSUS (HOLD)** LDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
7	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
8	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
9	UR1 pair swap resync	Execute UR1 pair swap resync in the LDKC. ↓ UR1 pair swap resync PDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** LDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap resync % pairresync -g UR1 -swaps -IH1

(To be continued)

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(Continued from the preceding page)

<table>
<tr><th>No.</th><th>Procedure item</th><th>Description
(Underlining means a part that changes from the previous status.)</th><th>Note
(RM command, etc.)</th></tr>
<tr><td>10</td><td>Stop of host I/O to the PDKC</td><td>Suspend I/O from host to the LDKC (return the operation to PDKC).</td><td></td></tr>
<tr><td>11</td><td>UR1 pair swap suspension</td><td>Execute UR1 pair swap suspension in the PDKC.
↓ UR1 pair swap suspension
PDKC [PS ON]
UR1 SVOL: <u>SSWS</u>
UR delta PVOL: SSUS (HOLD)
LDKC [PS ON]
UR1 PVOL: PSUS
UR2 PVOL: <u>PSUS</u>
RDKC [PS ON]
UR2 SVOL: <u>SSUS</u>
UR delta SVOL: SSUS (HOLD)</td><td>#UR1 pair swap suspension
% pairsplit -g UR1 -RS -IH0</td></tr>
<tr><td>12</td><td>Delta recync (Swap resync the UR delta)</td><td>Execute the delta recync in PDKC (Swap resync the UR delta).
↓ Delta recync
PDKC [PS ON]
UR1 SVOL: SSWS
UR2 PVOL: <u>PAIR</u>
LDKC [PS ON]
UR1 PVOL: PSUS
UR delta PVOL: <u>SSUS (HOLD)</u>
RDKC [PS ON]
UR2 SVOL: <u>PAIR</u>
UR delta SVOL: <u>SSUS (HOLD)</u></td><td>#Delta recync
% pairresync -g UR2 -swaps -IH1</td></tr>
<tr><td>13</td><td>Start of host I/O to the PDKC</td><td>Consolidate host I/O to the PDKC.</td><td></td></tr>
<tr><td>14</td><td>UR1 pair swap resync</td><td>Execute UR1 pair swap resync in the PDKC.
↓ UR1 pair swap resync
PDKC [PS ON]
UR1 PVOL: <u>PAIR</u>
UR2 PVOL: PAIR
LDKC [PS ON]
UR1 SVOL: <u>PAIR</u>
UR delta PVOL: SSUS (HOLD)
RDKC [PS ON]
UR2 SVOL: PAIR
UR delta SVOL: SSUS (HOLD)</td><td>#UR1 pair swap resync
% pairresync -g UR1 -swaps -IH0</td></tr>
</table>

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Table 7-3 Planned Shutdown Procedure of the PDKC of the UR-UR delta Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	Stop of host I/O to the PDKC	Suspend I/O from host to the PDKC (switch the operation to IDKC).	
2	UR1 pair swap suspension	Execute UR1 pair swap suspension in the IDKC. ↓ UR1 pair swap suspension PDKC [PS ON] UR1 PVOL: **PSUS** UR delta PVOL: **SSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap suspension % pairsplit -g UR1 -RS -IH1
3	Start of host I/O to the IDKC	Consolidate host I/O to the IDKC.	
4	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF] UR1 PVOL: **PSUS** UR delta PVOL: **SSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	

(To be continued)

(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	During planned shutdown		
5	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON] UR1 PVOL: **PSUS** UR delta PVOL: **SSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
6	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
7	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
8	UR1 pair swap resync	Execute UR1 pair swap resync in the IDKC. ↓ UR1 pair swap resync PDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** IDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap resync % pairresync -g UR1 -swaps -IH1
9	Stop of host I/O to the IDKC	Suspend I/O from host to the IDKC (return the operation to PDKC).	
10	UR1 pair swap suspension	Execute UR1 pair swap suspension in the PDKC. ↓ UR1 pair swap suspension PDKC [PS ON] UR1 SVOL: **SSWS** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PSUS** RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap suspension % pairsplit -g UR1 -RS -IH0

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
11	Start of host I/O to the PDKC	Consolidate host I/O to the PDKC.	
12	UR1 pair swap resync	Execute UR1 pair swap resync in the PDKC. ↓ UR1 pair swap resync PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PSUS** RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair swap resync % pairresync -g UR1 -swaps -IH0
13	UR2 pair resync	Execute UR2 pair resync in the IDKC. ↓ UR2 pair resync PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR2 pair resync % pairresync -g UR2 -IH1

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7.5.2.2 Planned Shutdown Procedure of the LDKC

Table 7-4 Planned Shutdown Procedure of the LDKC of the UR-UR delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	UR1 pair suspension	Execute UR1 pair suspension in the PDKC. ↓ UR1 pair suspension PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair suspension % pairsplit -g UR1 -IH0
2	LDKC PS OFF	Set the LDKC to PS OFF. ↓ PS OFF PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** LDKC [PS OFF] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
–	During planned shutdown		
3	LDKC PS ON	Set the LDKC to PS ON. ↓ PS ON PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
5	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
6	UR1 pair resync	Execute UR1 pair resync in the PDKC. ↓ UR1 pair resync PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair resync % pairresync -g UR1 -IH0

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7.5.2.3 Planned Shutdown Procedure of the IDKC

Table 7-5 Planned Shutdown Procedure of the IDKC of the UR-UR delta Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	Delta recync (recync the UR delta pair)	Execute the delta recync in PDKC (recync the UR delta pair) ↓ Delta recync PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#Delta recync % pairresync -g URdelta -IH0
2	UR1 pair suspension	Execute UR1 pair suspension in the IDKC. ↓ UR1 pair suspension PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair suspension % pairsplit -g UR1 -IH0
3	IDKC PS OFF	Set the IDKC to PS OFF. ↓ PS OFF PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** IDKC [PS OFF] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	During planned shutdown		
4	IDKC PS ON	Set the IDKC to PS ON. ↓ PS ON PDKC [PS ON] UR1 PVOL: **PSUS** UR2 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **SSUS** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
5	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
6	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
7	UR1 pair resync * In the case of the multi target operation, No.8 through No.10 of the recovery procedure are not required.	Execute UR1 pair resync in the PDKC. ↓ UR1 pair resync PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR1 pair resync % pairresync -g UR1 -IH0
8	UR2 pair deletion	Delete UR2 pair in PDKC. * UR delta pair is also deleted. ↓ UR2 pair deletion PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **SMPL** IDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SMPL** RDKC [PS ON] UR2 SVOL: **SMPL** UR delta SVOL: **SMPL**	#UR2 pair deletion % pairsplit -g URdelta -S -IH0

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
9	UR2 pair creation	Create UR2 pair in IDKC (between IDKC-RDKC). ↓ UR2 pair creation PDKC [PS ON] UR1 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR**	#UR2 pair creation % paircreate -g UR2 -jp 1 -js 2 -IH1
10	UR delta pair creation (*1)	Create delta pair in PDKC (between PDKC-RDKC). ↓ UR delta pair creation PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR delta pair creation % paircreate -g URdelta -jp 0 -js 2 -nocsus -IH0

*1: Remote command device setting is released by deleting the UR pair. Therefore, the remote command device must be assigned for the journal mirror ID in each site after creating the UR delta pair.

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7.5.2.4 Planned Shutdown Procedure of the RDKC

Table 7-6 Planned Shutdown Procedure of the RDKC of the UR-UR delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	UR2 pair suspension	Execute UR2 pair suspension in the PDKC. ↓ UR2 pair suspension PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PSUS** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	#UR2 pair suspension % pairsplit -g UR2 -IH0
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PSUS** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** ↓ PS OFF RDKC [PS OFF] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
–	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PSUS** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** ↓ PS ON RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
5	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
6	UR2 pair resync	Execute UR2 pair resync in the PDKC. ↓ UR2 pair resync PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** LDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **SSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR2 pair resync % pairresync -g UR2 -IH0

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Table 7-7 Planned Shutdown Procedure of the RDKC of the UR-UR delta Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC is under operation. PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	
1	UR2 pair suspension	Execute UR2 pair suspension in the IDKC. ↓ UR2 pair suspension PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PSUS** RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	#UR2 pair suspension % pairsplit -g UR2 -IH1
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PSUS** ↓ PS OFF RDKC [PS OFF] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
–	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PSUS** ↓ PS ON RDKC [PS ON] UR2 SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	

(To be continued)

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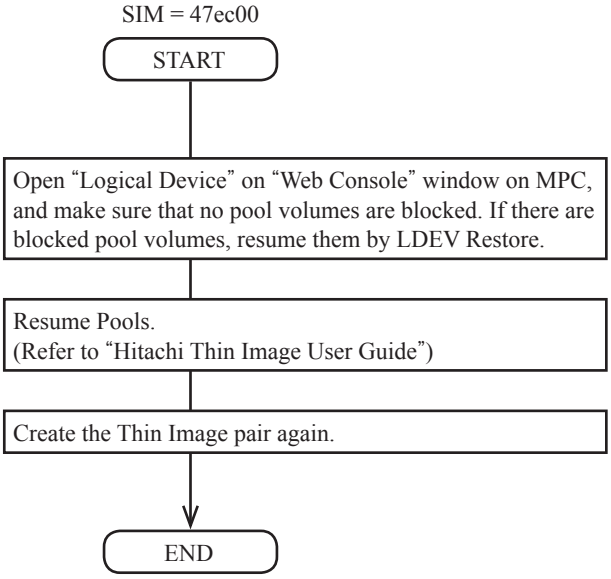
(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
5	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
6	UR2 pair resync	Execute UR2 pair resync in the IDKC. ↓ UR2 pair resync PDKC [PS ON] UR1 PVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **PAIR** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#UR2 pair resync % pairresync -g UR2 -IH1

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8. Recovery from Thin Image Failure

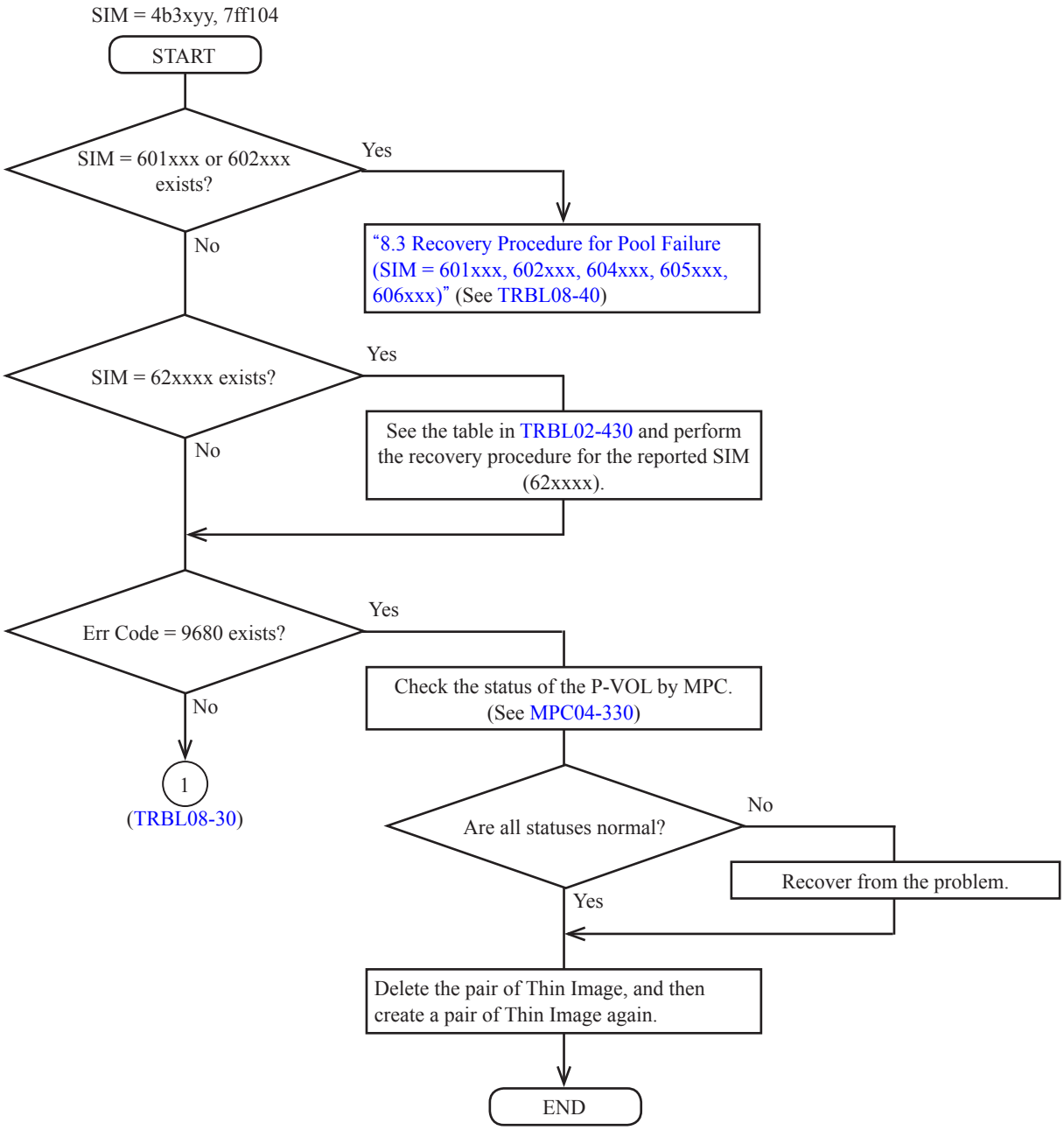
8.1 Recovery Procedure for Thin Image Failure due to SM Volatilization (SIM = 47ec00)



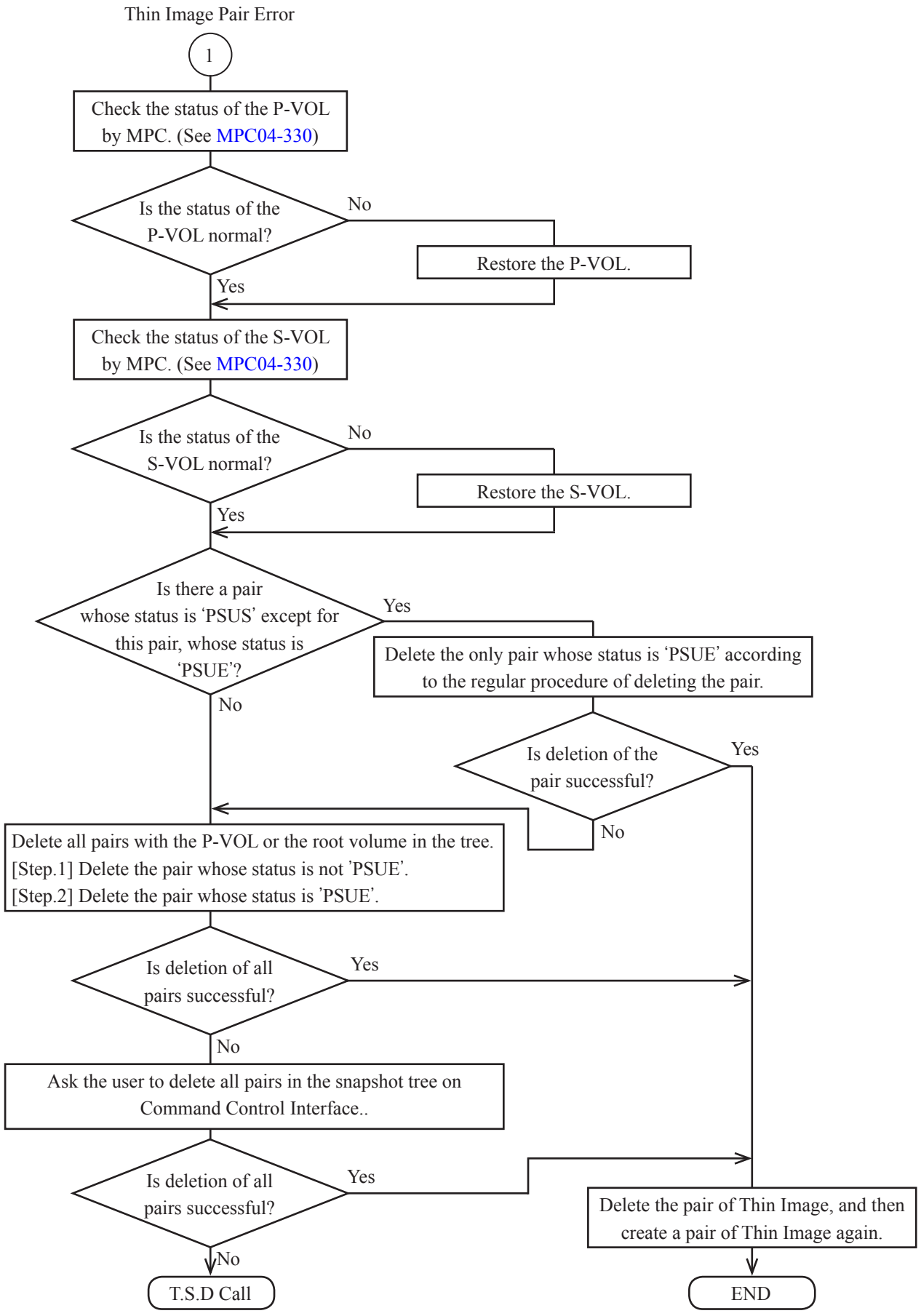
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8.2 Recovery Procedure for Thin Image Failure (SIM = 4b3xyy, 7ff104)

The procedure for recovery from a failure occurs in a pair of Thin Image is explained below.



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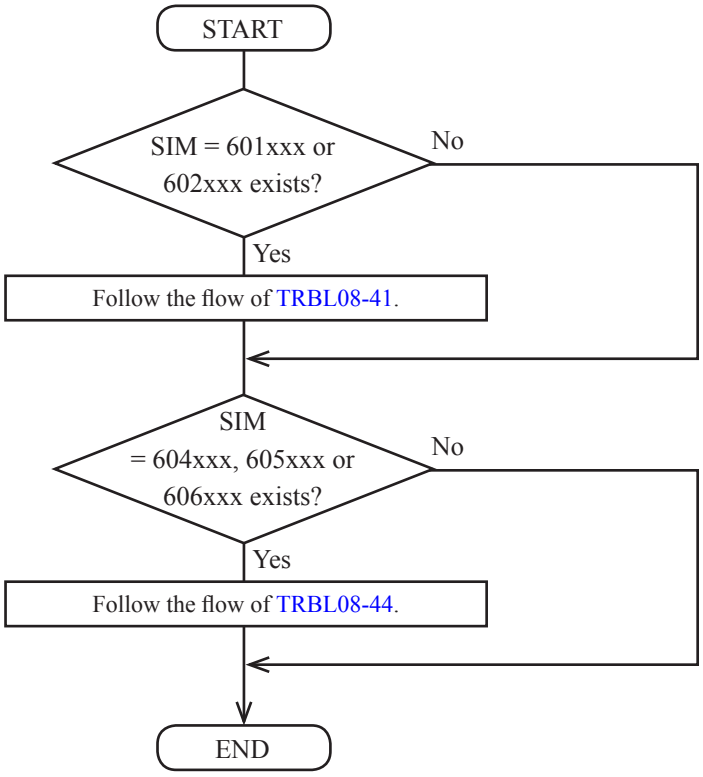


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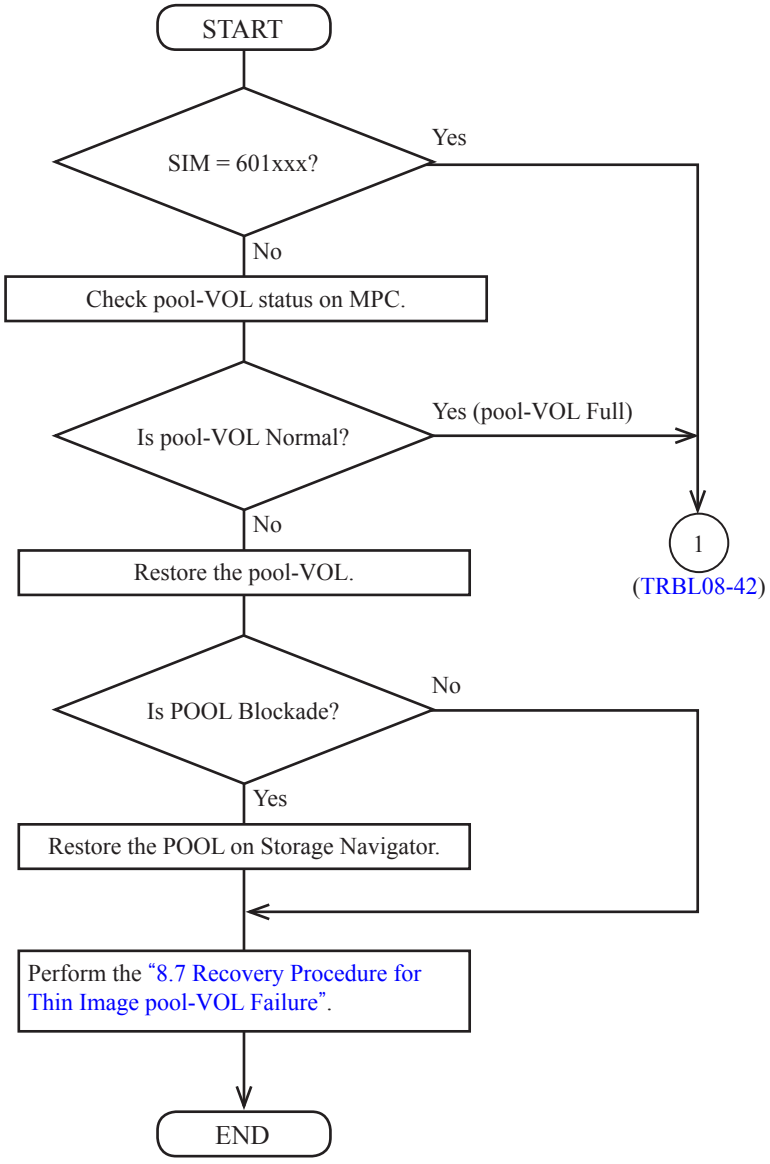
8.3 Recovery Procedure for Pool Failure (SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx)

The procedure for recovery from a failure occurs in the Pool is explained below.

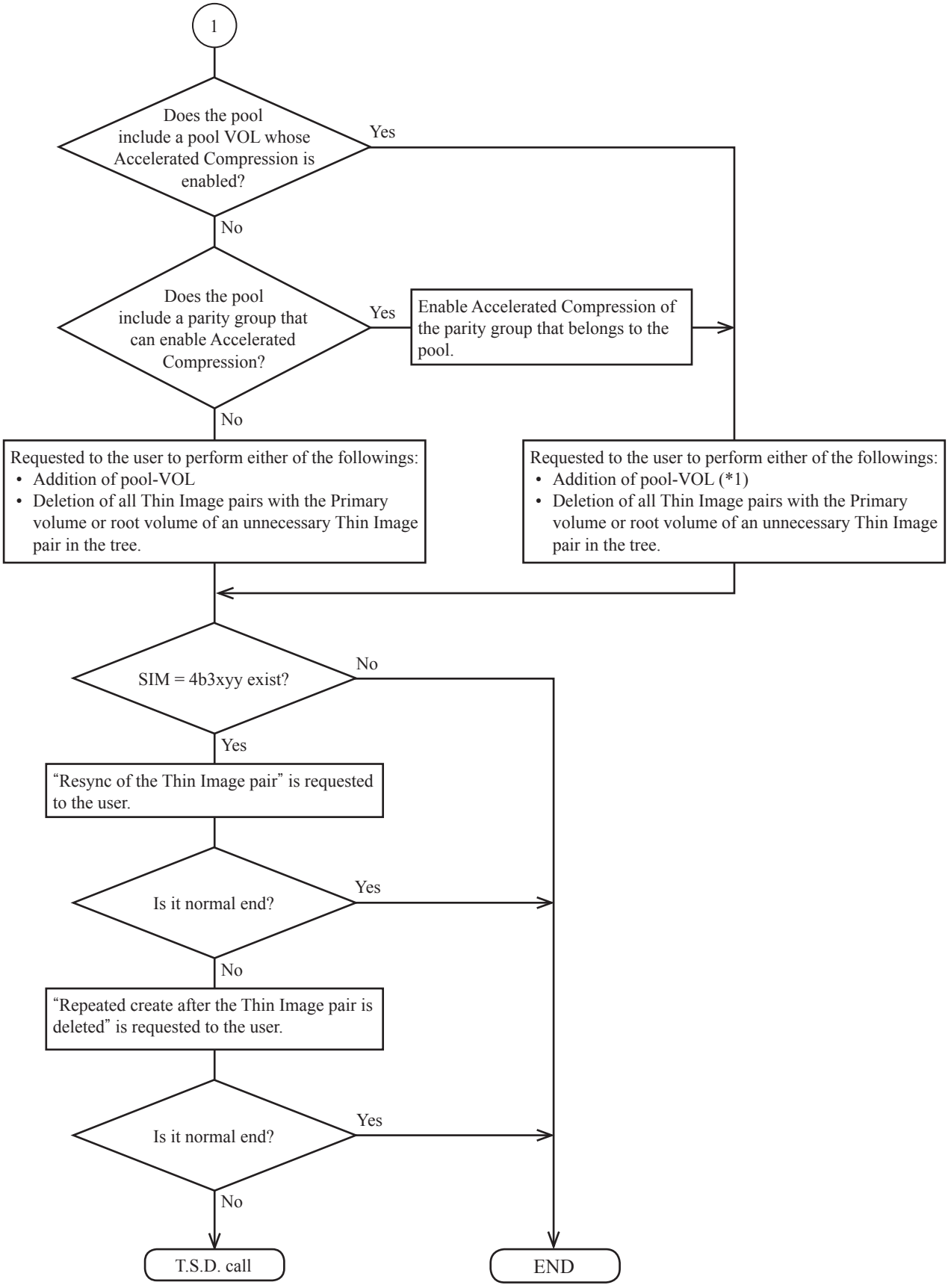
SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx



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*1: The logical capacity required for resolving SIM is calculated by the following formula (1).

Formula (1)
Required logical capacity = (Logical usage of pool / Threshold value of pool) – Logical capacity of pool before expansion

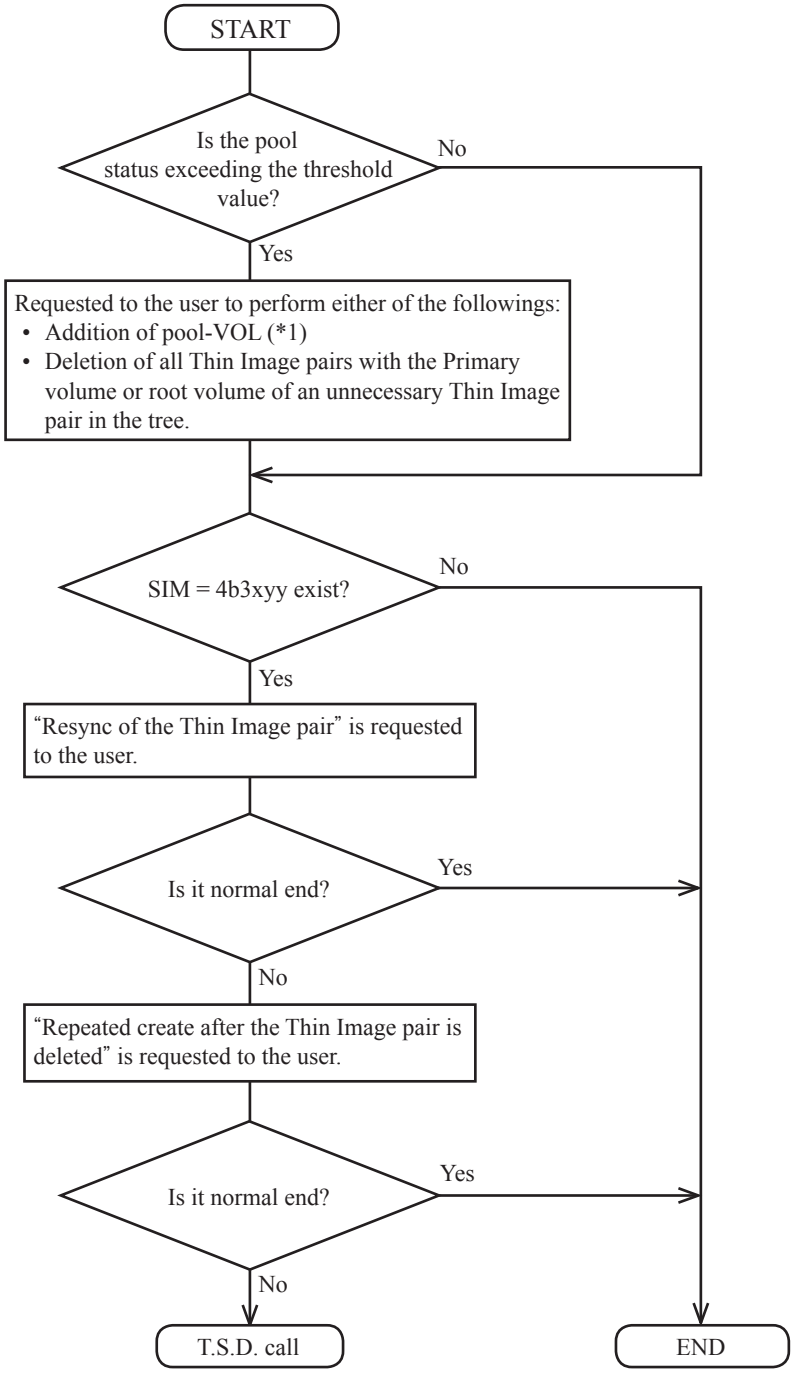
To expand the pool by creating LDEVs in the free space of the parity group whose Accelerated Compression is enabled, we recommend that the total LDEV capacity (required logical capacity) to be created in the parity group meets the following conditions.

Formula (2)
Total LDEV capacity to be crated ≤ (Physical capacity of the parity group / (1 – Reduction ratio)) – Pool VOL capacity of the parity group before pool expansion

In the case of (Required logical capacity) ≤ (Total LDEV capacity to be created), fill in a shortage of the logical capacity by the free space in the parity group whose Accelerated Compression is enabled.
In the case of (Required logical capacity) > (Total LDEV capacity to be created), fill in a difference of the logical capacity by adding a parity group to expand the pool.

* Convert the percentage to a fraction for the threshold value of the pool and the reduction ratio. For example, if the threshold value of the pool is 80 %, handle it as Threshold value of pool = 80/100 in the above formula.

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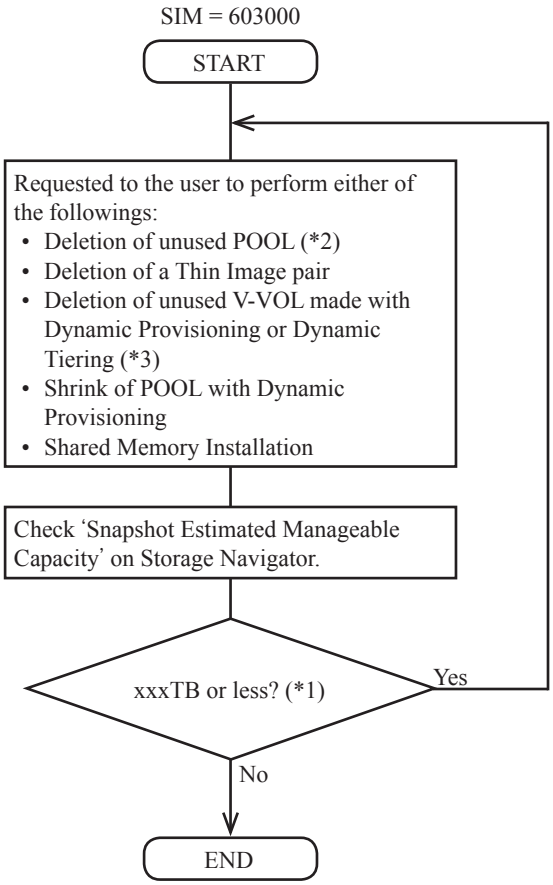
*1: To revolve SIM, add a parity group to expand the pool.
The required physical capacity to resolve SIM is calculated by the following formula (1).

Formula (1)
Required physical capacity = (Physical usage of pool / Threshold value of pool) – Physical capacity of pool before expansion

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8.4 Recovery Procedure for Pool Failure (SIM = 603000)

The procedure for recovery from a failure occurs in the Pool is explained below.



*1: The VSP G200 is less than or equal to 12 TB and the VSP G400, G600 and the VSP G800, less than or equal to 20 TB.

*2: The procedure for deleting capacity saving-enabled V-VOLs by the pool is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in "Provisioning Guide".
For Command Control Interface, the deduplication function needs to be disabled on the pool using the raidcom modify pool command because V-VOLs are deleted before deleting Deduplication System Data Volume.

*3: The procedure for deleting specified capacity saving-enabled V-VOLs is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in "Provisioning Guide".

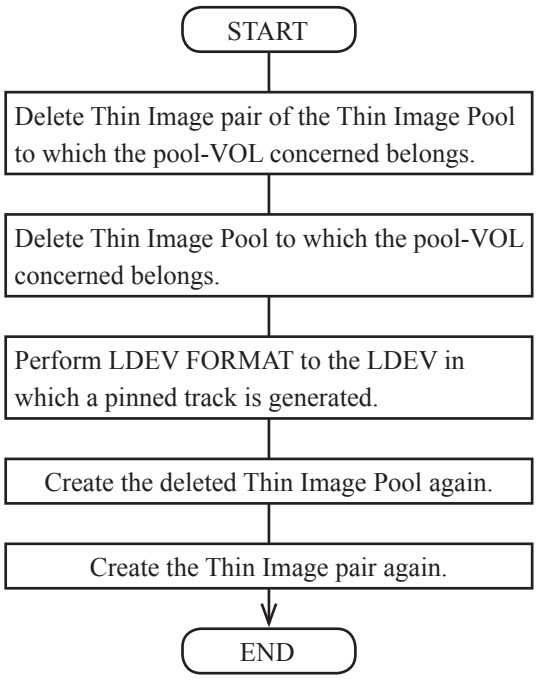
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8.5 Recovery Procedure for Thin Image pool-VOL ECC/LRC Error

When an ECC/LRC Error occurs in a pool-VOL, perform the following recovery method because an I/O cannot be issued directly from the HOST for the track concerned.

NOTE1 : In case of a Write Error, perform TRBL04-230 as well as the normal VOL and recover it.

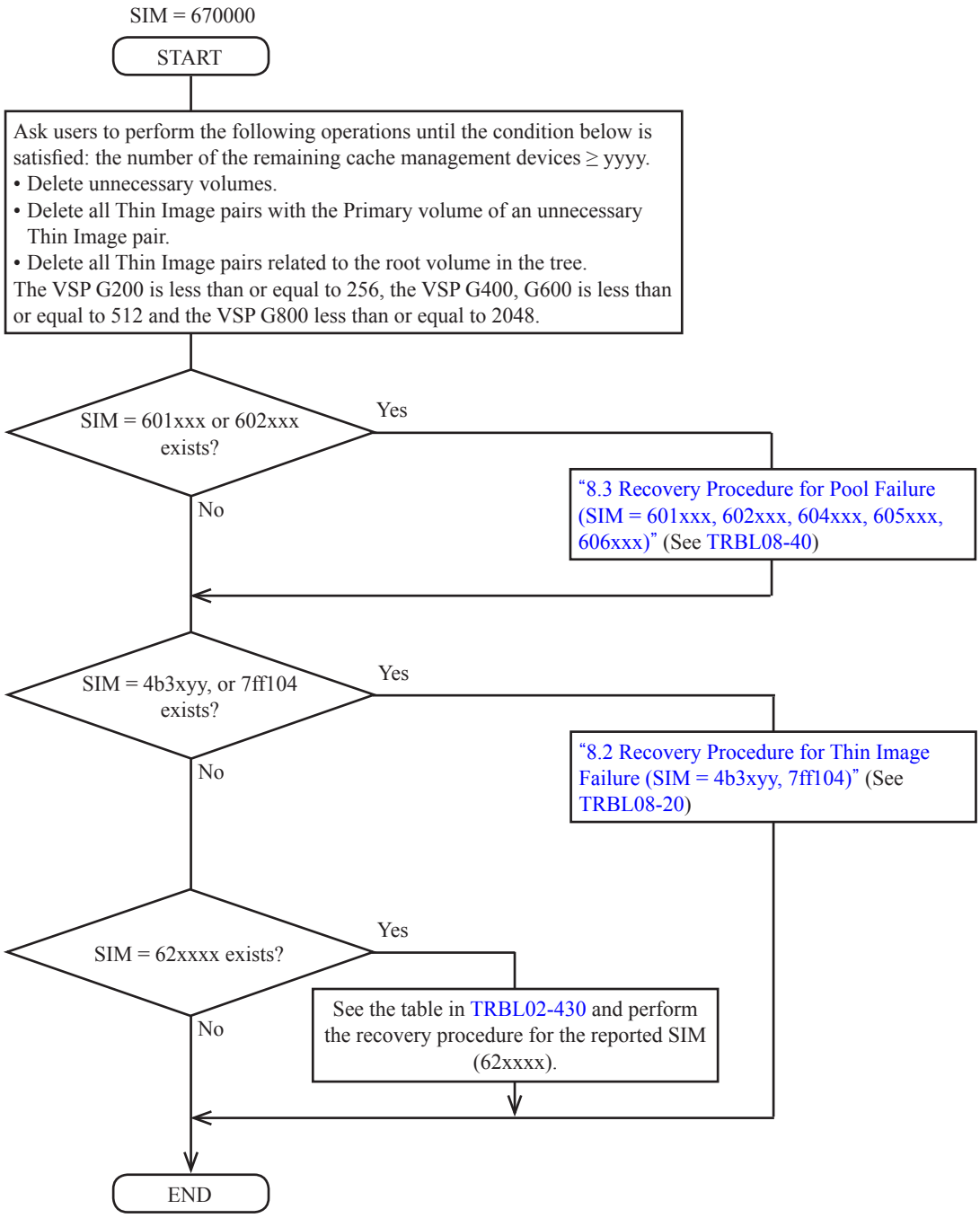
NOTE2 : The LDEV that a POOL ID is displayed on the logical device window of the "Maintenance" Window is a pool-VOL.



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8.6 Recovery Procedure for Thin Image Failure (SIM = 670000)

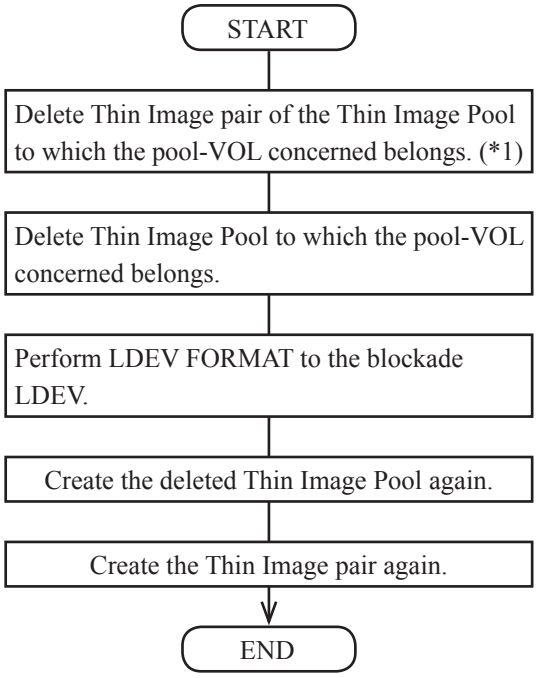
The procedure to recovery from a Thin Image failure is explained below.



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8.7 Recovery Procedure for Thin Image pool-VOL Failure

The procedure for recovery from a failure occurs in a pool-VOL of Thin Image is explained below.



*1 When the deletion of Thin Image pair fails and the pair status is changed PSUE, Thin Image pair can be deleted by executing it again.
If the deletion fails again, delete all pairs in the snapshot tree.

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9. Recovery from Volume Migration Failure

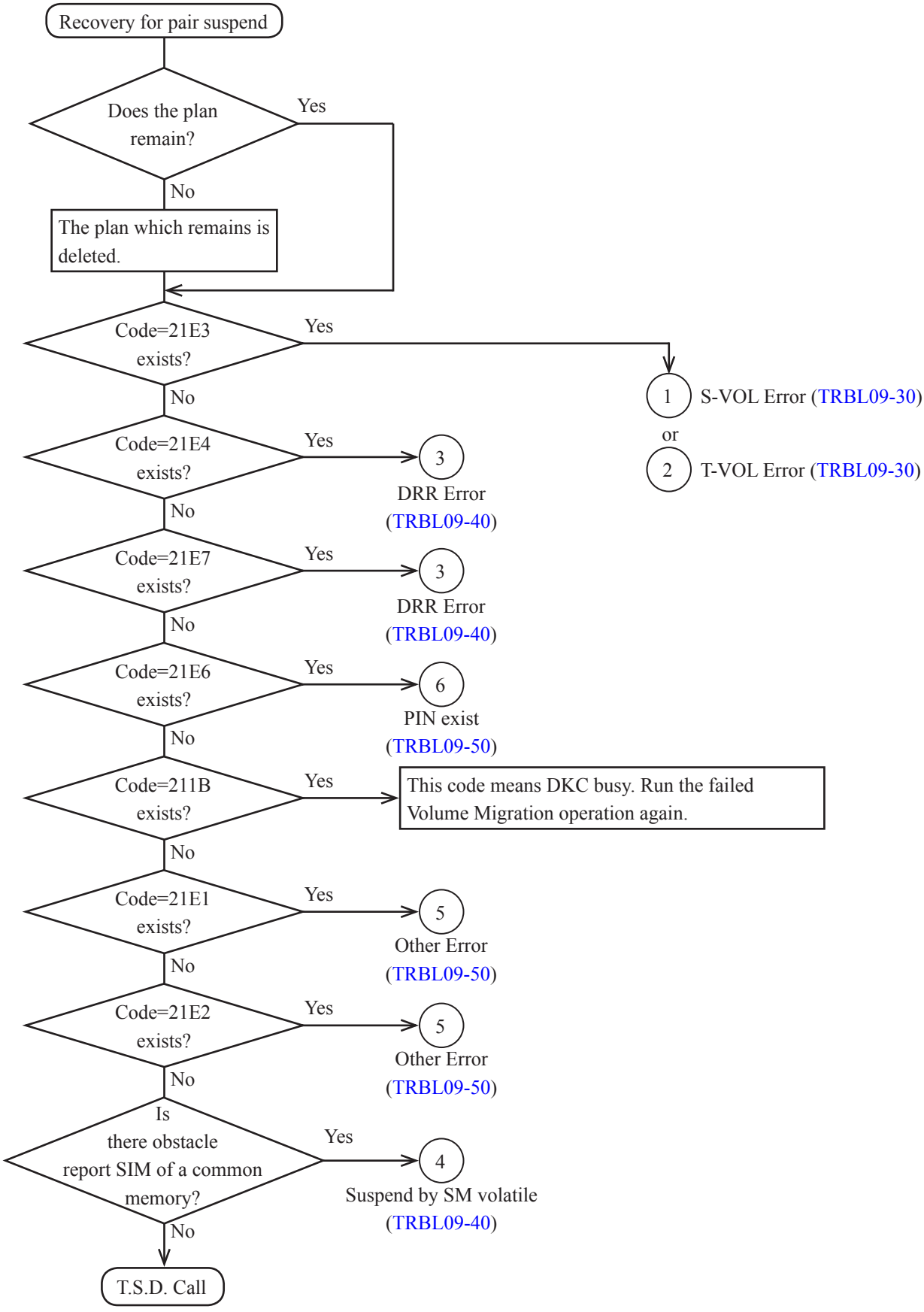
When it lapses into the state where a system does not expect, volume move processing of Volume Migration sometimes carries out an unusual end. In this case, the state of S-VOL and T-VOL which was during movement is not changing from the state before movement. So, there is no necessity of daring carry out recovery to resume VOL move processing. Please resume processing after checking states, such as a hard part, with reference to SSB/SIM.
Please carry out recovery procedure with reference to the following flowchart.

Table 9-1 Volume Migration SIM REF.CODE

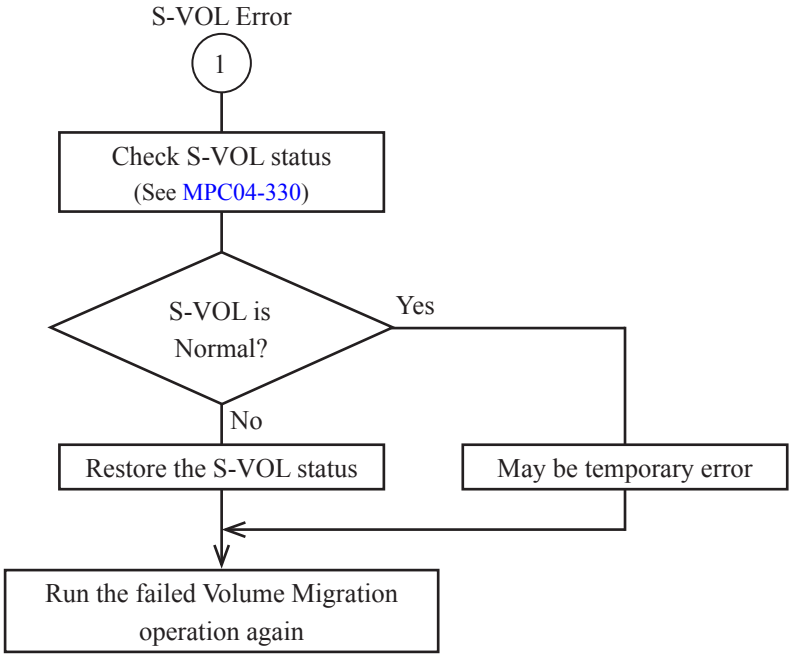
SIM REF. CODE	meaning	comment
47fyxx 7ff106	Volume Migration VOL Move unusual end	yxx: The lower 12 bits of Target Volume #. y = The lower 4 bits of CU# xx = LDEV#

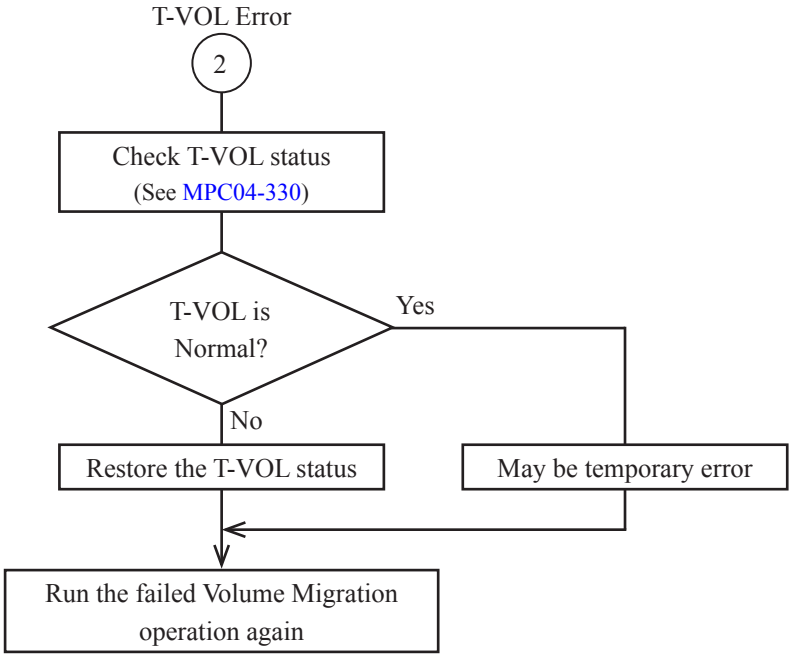
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9.1 Recovery Procedure for Volume Migration Failure

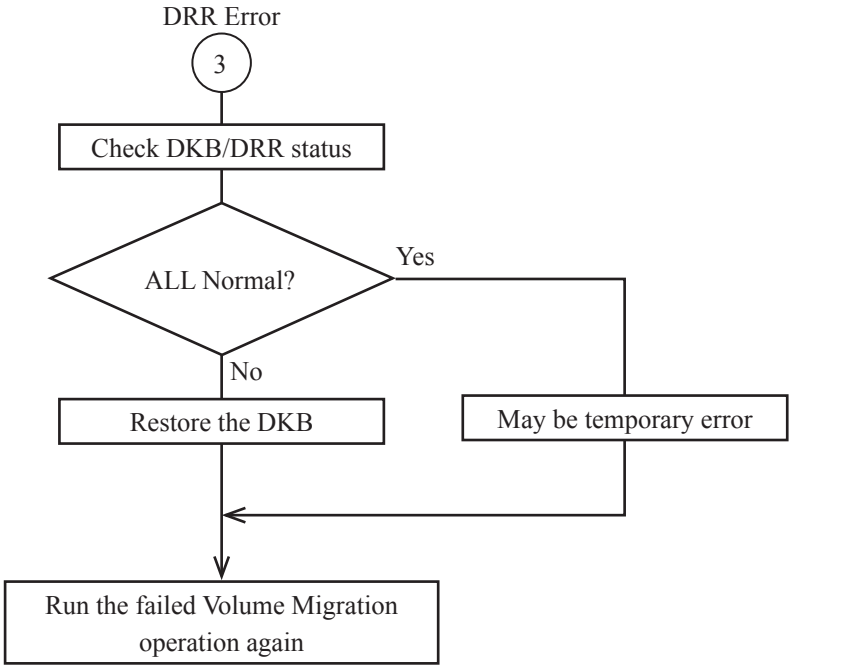


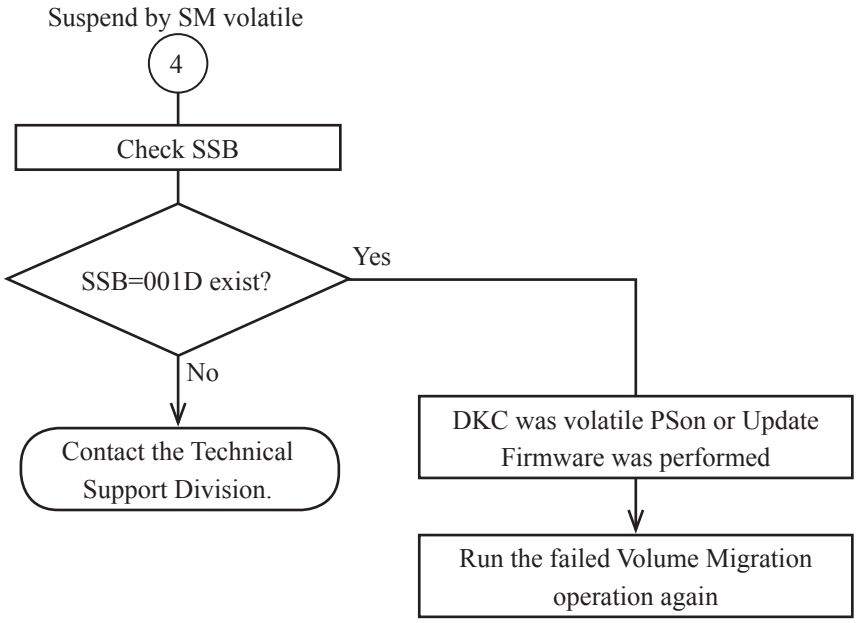
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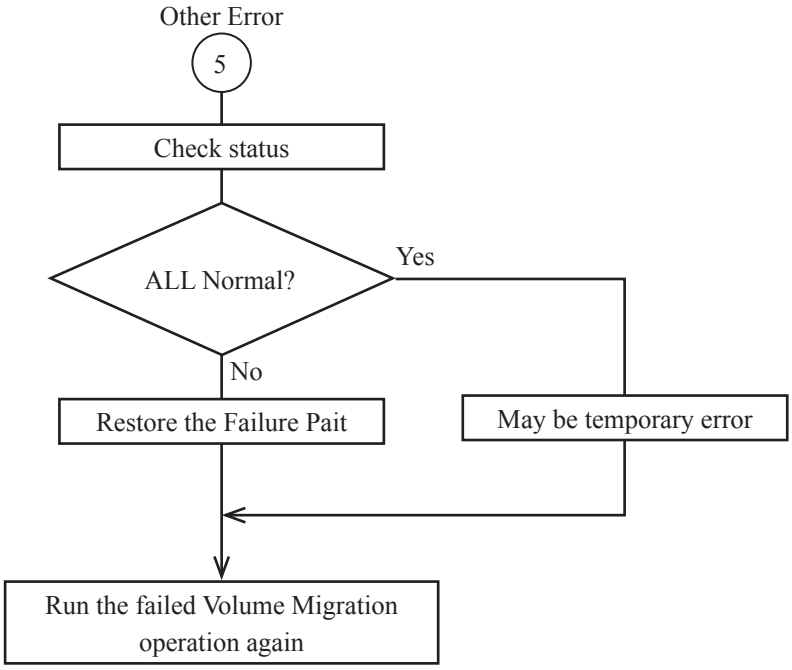


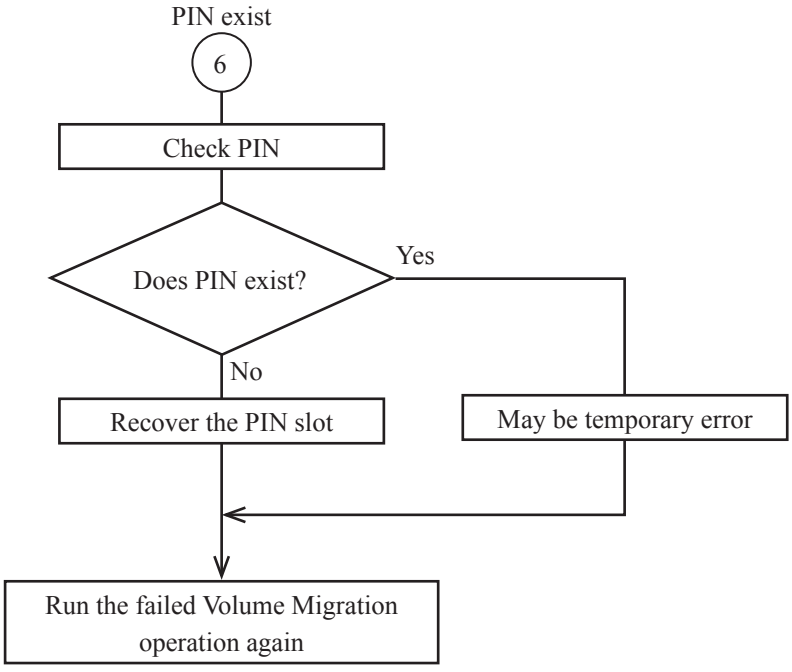
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10. Failure recovery of Dynamic Provisioning

10.1 Recovery Procedure for pool-VOL Blockade (When Two (Three in RAID6) or More Are Blocked in the RAID Gr the pool-VOL Belongs)

Dynamic Provisioning become as follows. In this case, data cannot be recovered.

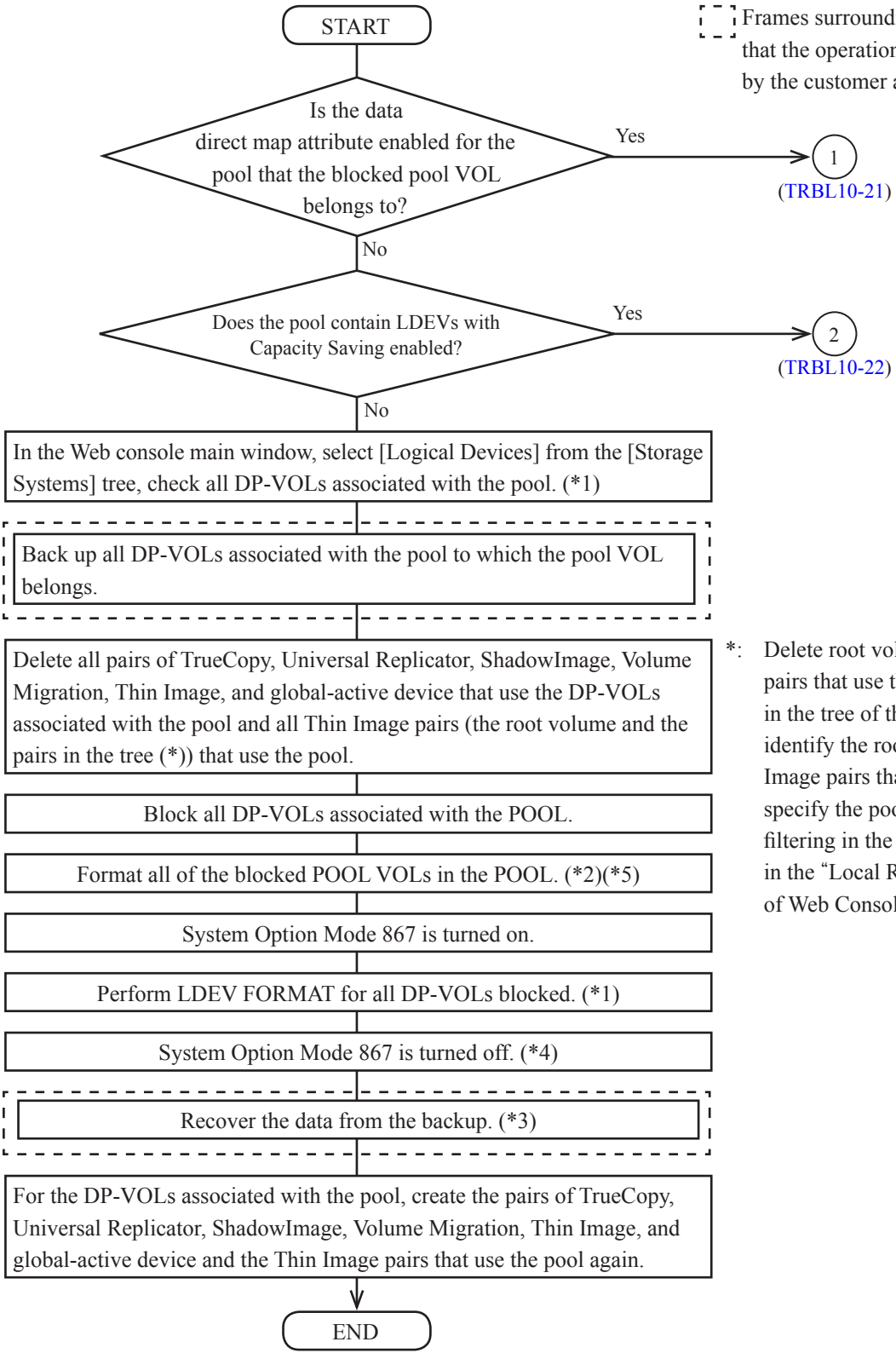
Item	Status
DP-VOL status	Normal
POOL status	Warning
pool-VOL status	Normal + Blocked (only LDEV is blocked in RAID Gr where two or more (three or more in case of RAID6) are blocked)
I/O access	Partially possible (Access to normal pool-VOL is possible.)
Association with DP-VOL and POOL	Yes

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Recovery method

Perform the recovery processing in the following flow.

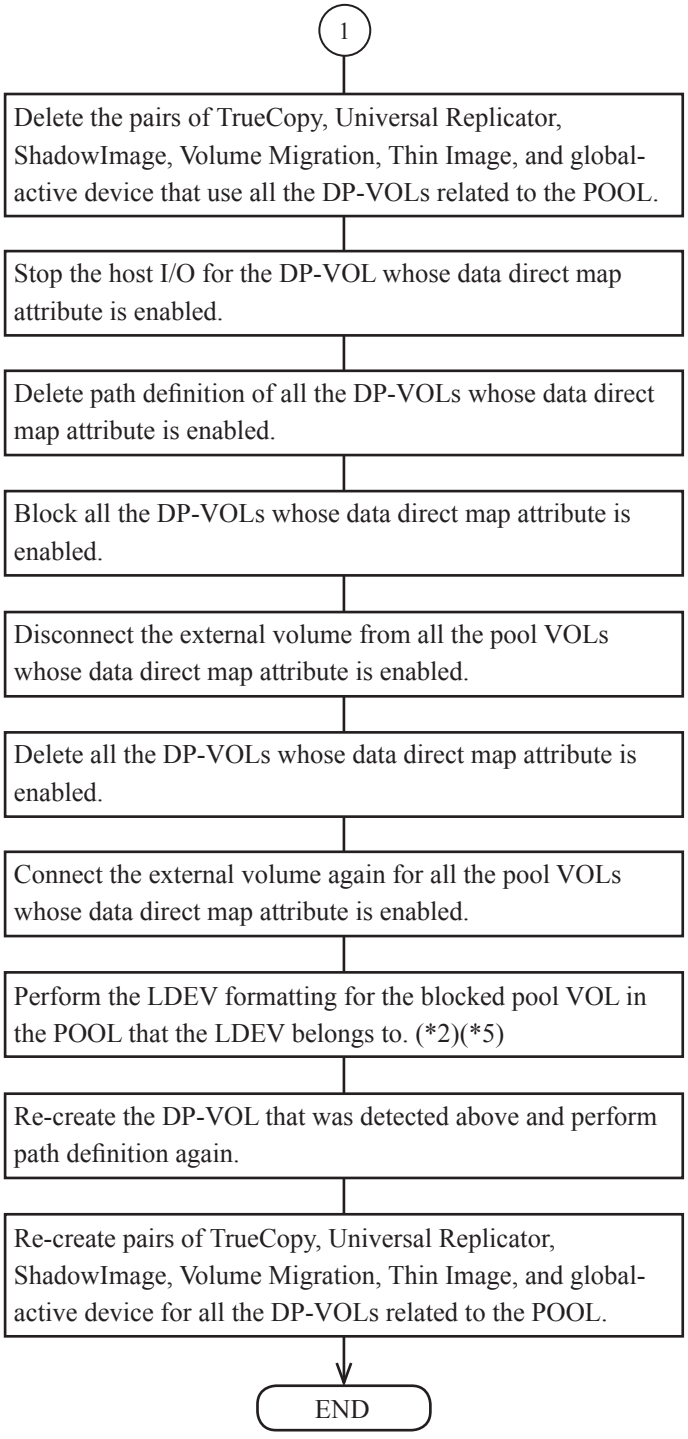
Recovery processing at the time of pool-VOL blockade



Frames surrounding operations show that the operations are to be performed by the customer at your request.

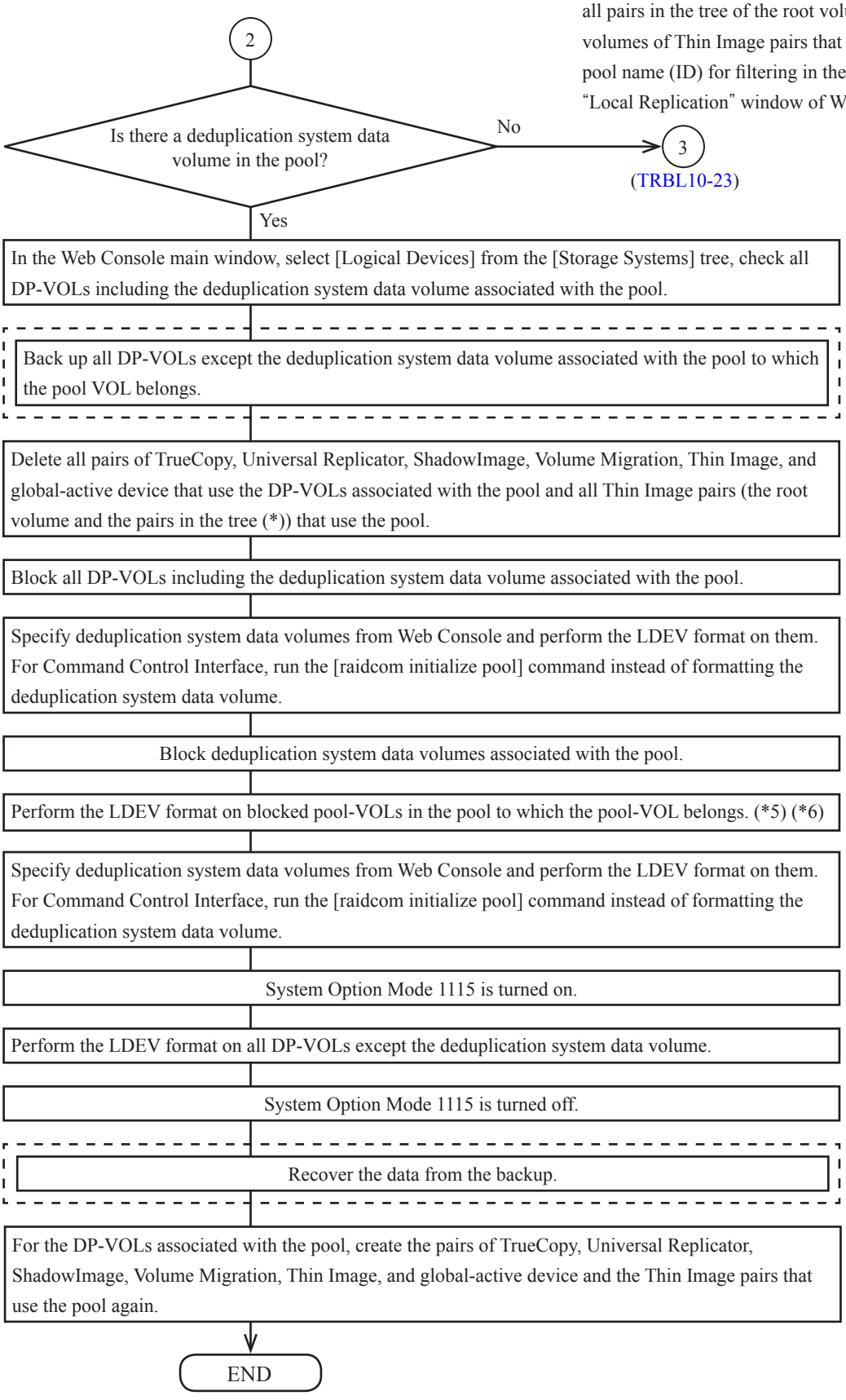
*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the “Local Replication” window of Web Console.

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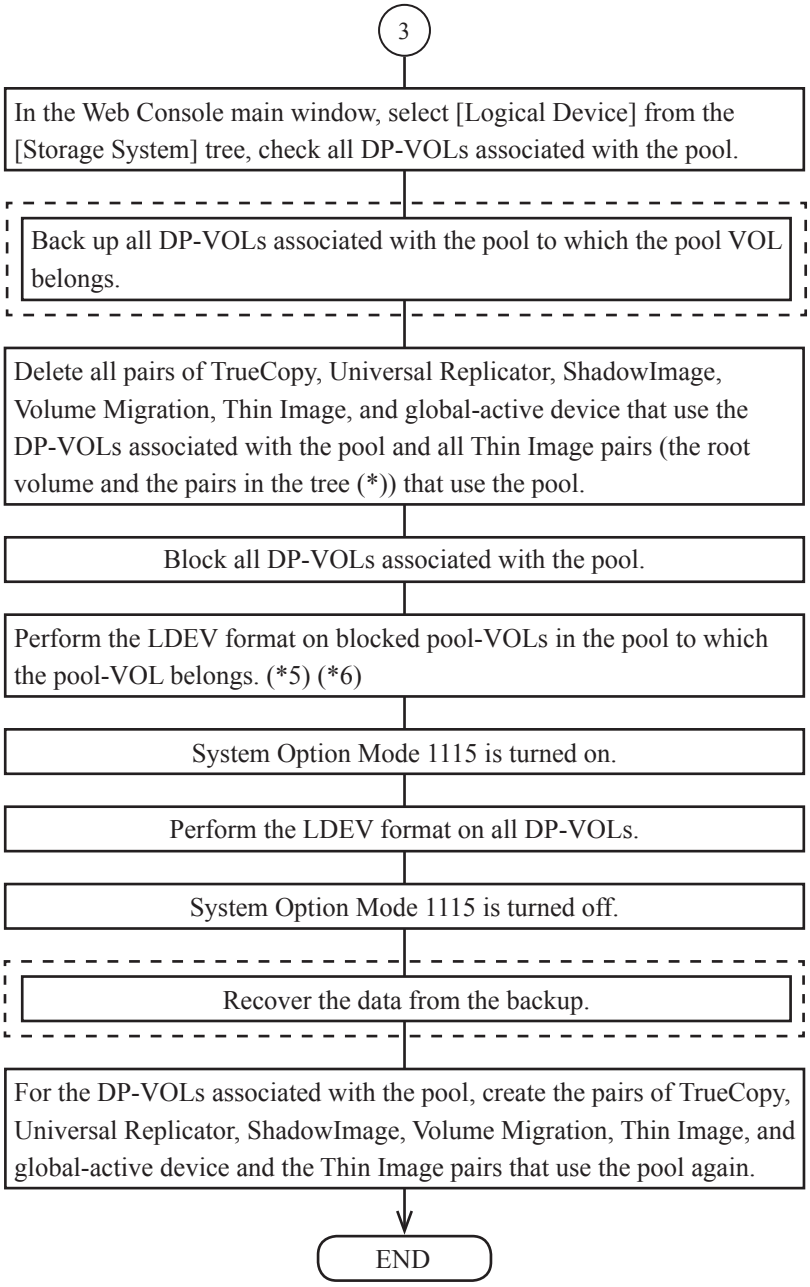


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*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the "Local Replication" window of Web Console.



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*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the “Local Replication” window of Web Console.

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*1: Please specify the following two conditions for the filter to display all DP-VOL related to concerned POOL.
- Please input the concerned pool name (ID) specifying the pool name (ID) for conditional expression.
- Please select 'DP' specifying the provisioning type for conditional expression.

Please see "System Administrator Guide" about the operating instruction of the filter.

*2: Please specify the following two conditions for the filter to display pool-VOL in POOL that has been blockaded.
- Please input the concerned pool name (ID) specifying the pool name (ID) for conditional expression.
- Please select pool-VOL specifying the attribute for conditional expression. Please see "Hitachi Command Suite User Guide" or "System Administrator Guide" about the operating instruction of the filter.

*3: Please be careful when restoring from backup as restorations from a VOL can be large contain both consumed and unconsumed areas and you will need to perform (1) and (2):
(1) Recover the data from the backup.
(2) Reclaim Zero Pages processing.

Therefore you need to perform (1) and (2) each time you restore a whole DP-VOL from a backup. If you restore data from a backup in the unit of file, you do not need to do "zero page reclaim" because only consumed area will be restored from the backup.

*4: Turn off System Option Mode 867 only when it is turned on in this recovery procedure. If it has already been turned on, do not turn it off.

*5: When FMD (NFHAx-QxxxSS) is included in the RAID group to which the pool VOLs belong, perform the parity group format instead of the LDEV format. (see MAINTENANCE PC SECTION "4.2.2.4 Formatting Parity Group")

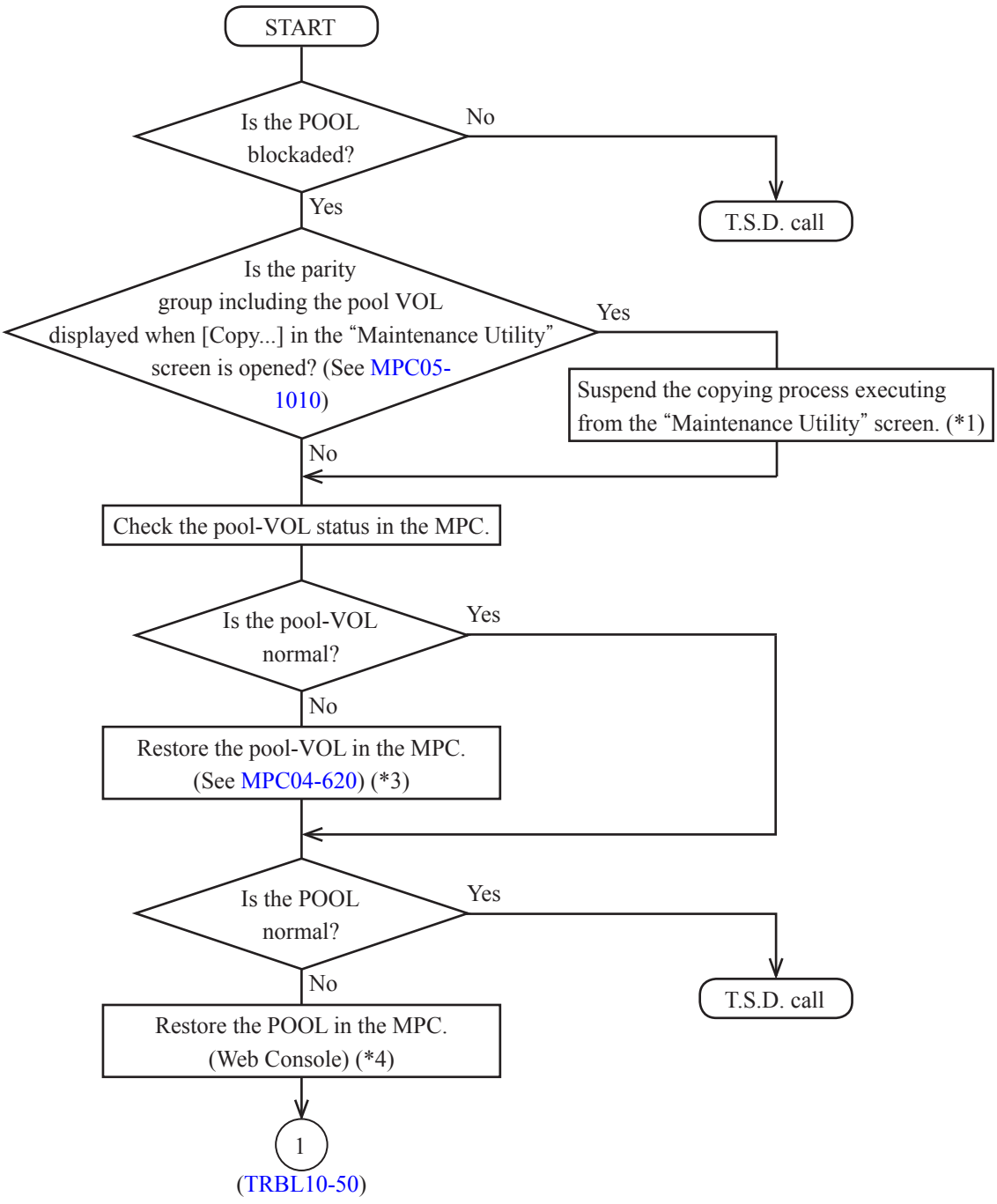
*6: You don't have to perform LDEV format on pool-VOLs which have already been recovered by other operations.

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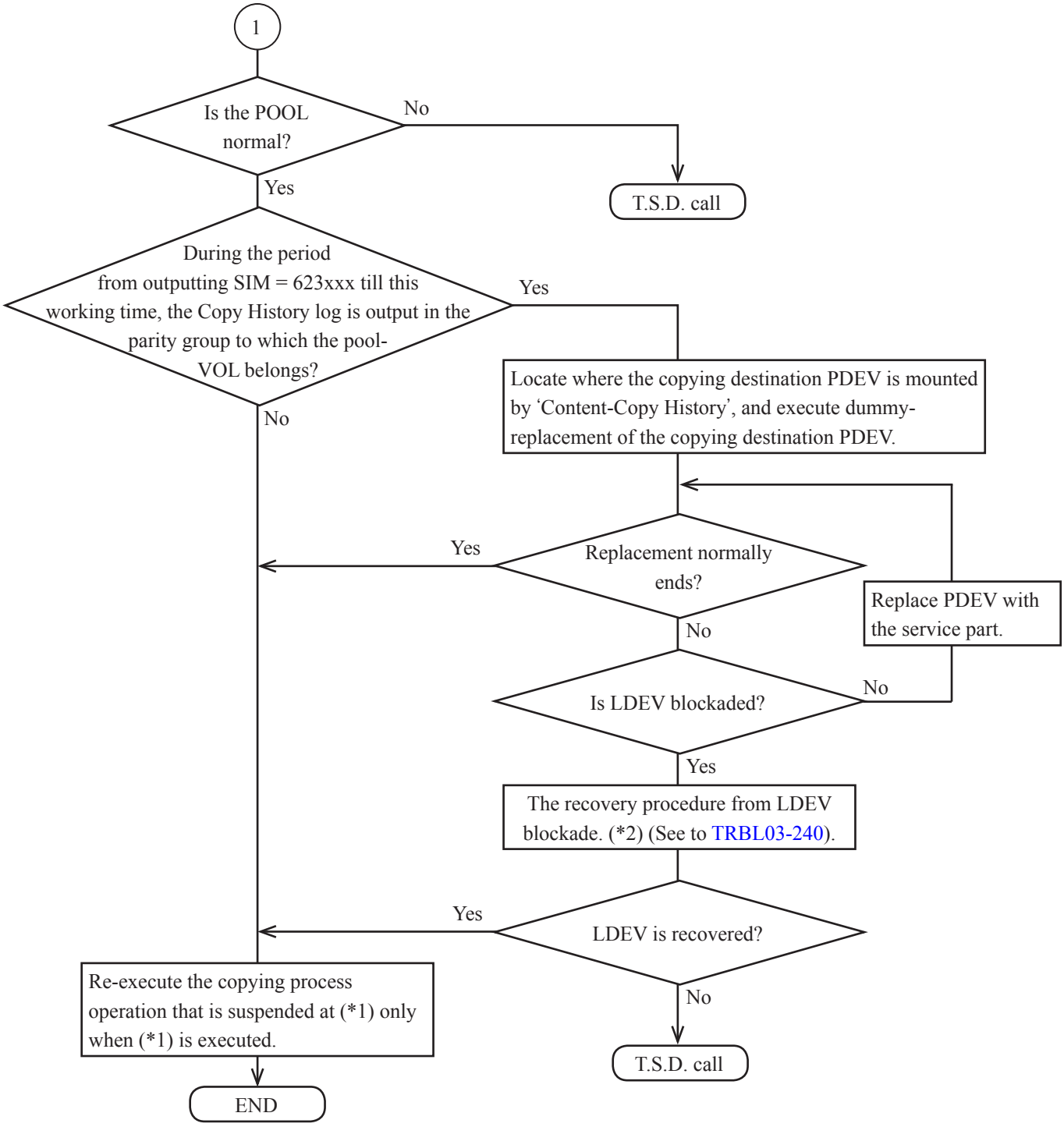
10.2 Recovery Procedure for Pool Failure (SIM = 623xxx)

The recovery procedure for the failure of the pool used in the Dynamic Provisioning is shown here.

NOTE: Procedure to recover DP-VOL:
Please recover the pool of Dynamic Provisioning referring to “Provisioning Guide”.
DP-VOL recovers by recovering the pool of Dynamic Provisioning.
Please confirm all the pool of Dynamic Provisioning has recovered when DP-VOL is not recovered.
Please execute LDEV format or execute force LDEV recovery from after all the pool of Dynamic Provisioning has recovered.



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*1: Set Maintenance PC to [Modify Mode], and suspend the copying process that is executing by [Other] -> [Drive Interrupt].

*2: Be sure to choose “B” for “the action to be taken” in the flowchart of the recovery procedure from LDEV blockade. When “A” is mistakenly chosen, data recovery will fail.

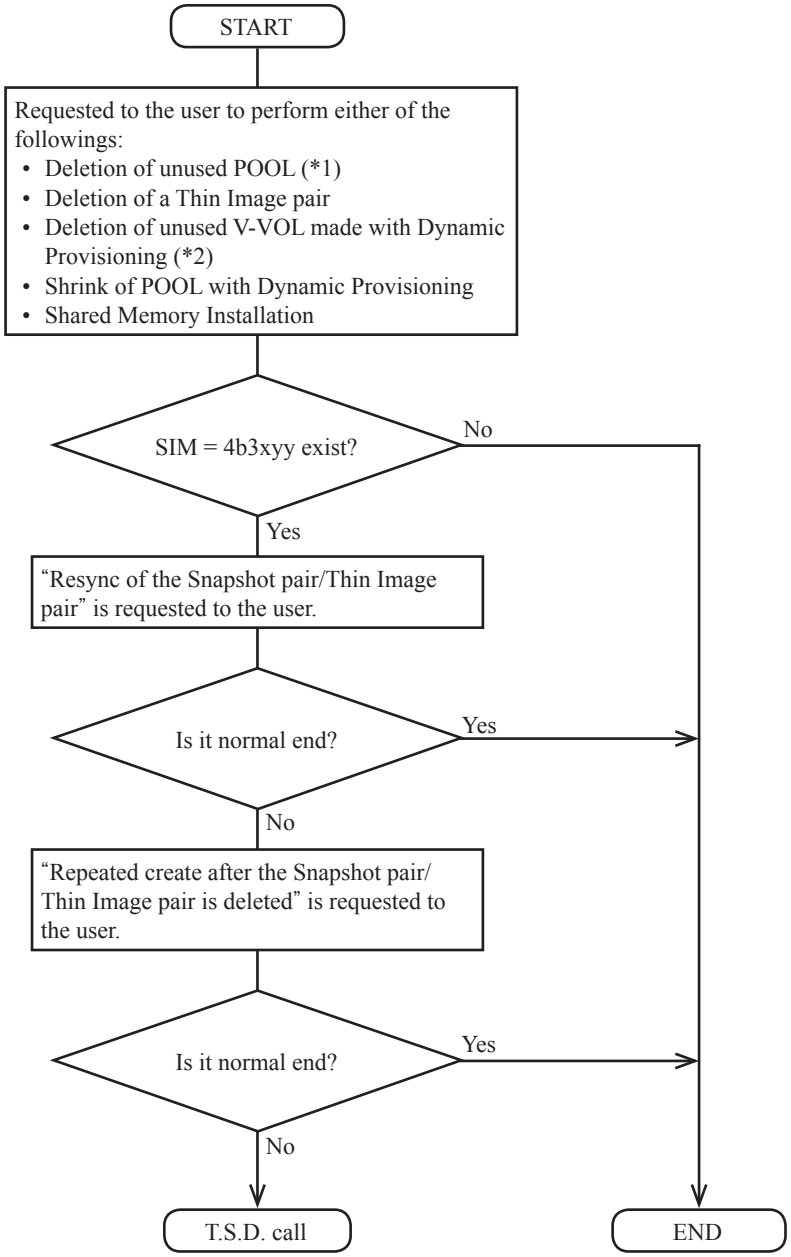
*3: When the status of the pool-VOL is not changed into “Normal”, collect the Auto dump and ask the Technical Supports Division (T.S.D.) for what action should be taken.

*4: This operation restores the information indicating the data storage location of the DP-VOL that was lost due to volatilization of SM from the system pool VOL.

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10.3 Recovery Procedure for Pool Failure (SIM = 624000)

The recovery procedure for the failure of the pool used in the Dynamic Provisioning or Thin Image is shown here.



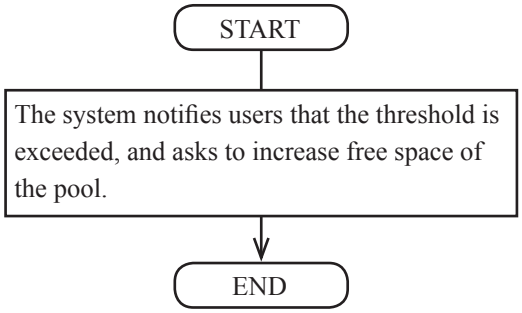
*1: The procedure for deleting capacity saving-enabled V-VOLs by the pool is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in "Provisioning Guide".
For Command Control Interface, the deduplication function needs to be disabled on the pool using the raidcom modify pool command because V-VOLs are deleted before deleting Deduplication System Data Volume.

*2: The procedure for deleting specified capacity saving-enabled V-VOLs is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in "Provisioning Guide".

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10.4 Recovery Procedure for Pool Failure (SIM = 625000, 62b000)

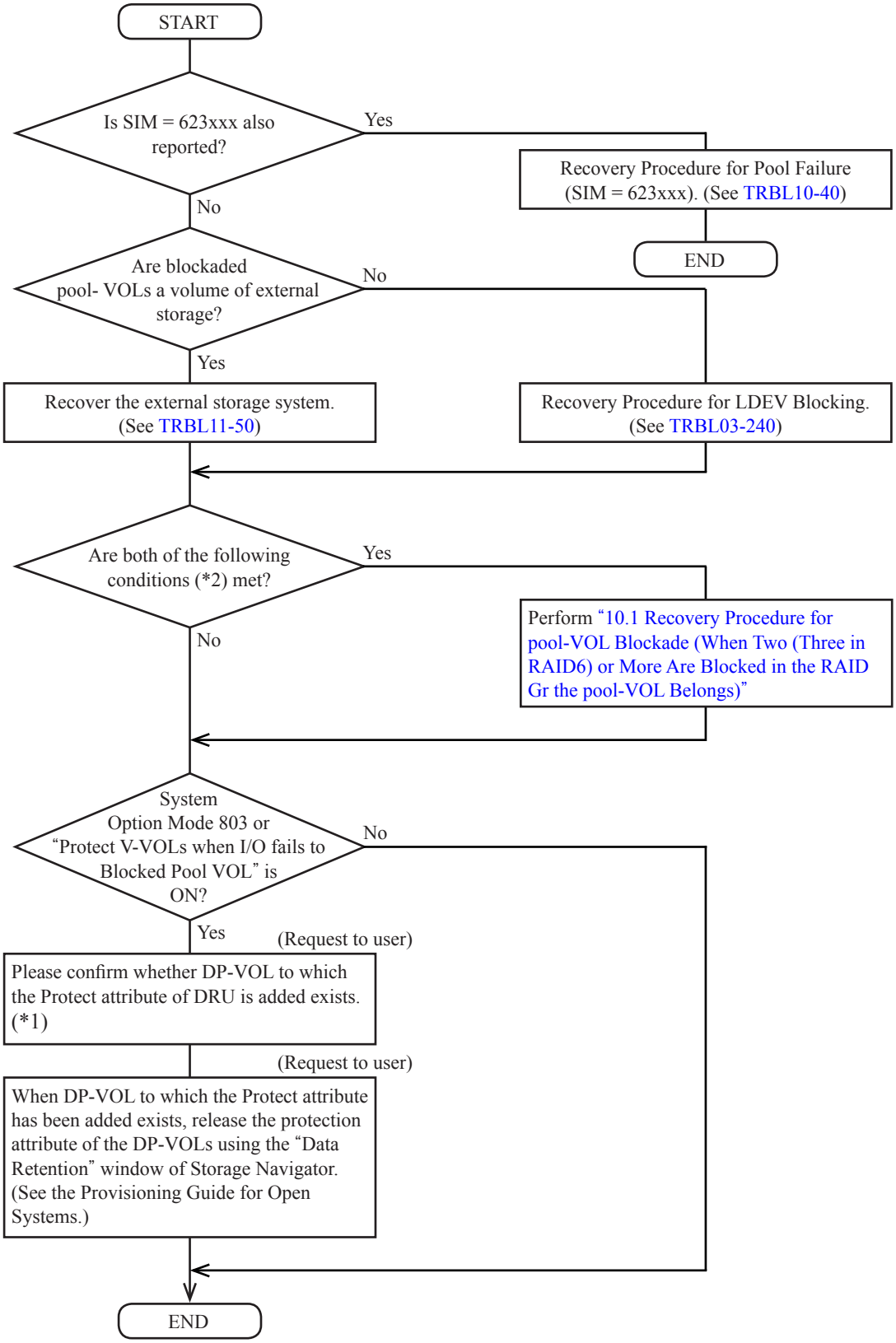
The recovery procedure for the failure of the pool used in the Dynamic Provisioning is shown here.



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10.5 Recovery Procedure for pool-VOL Blockade (SIM = 627xxx)

The recovery procedure for the pool-VOL blockaded used in the Dynamic Provisioning is shown here.



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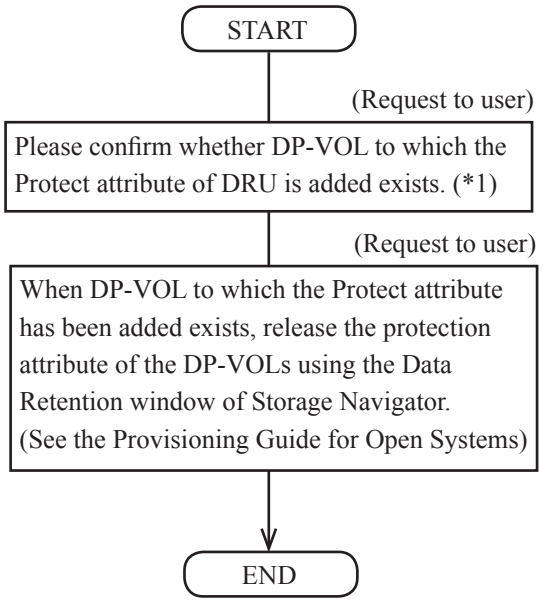
*1: Please specify the following condition for the filter using Virtual Volumes tab of Pools: Volume tabs to display DP-VOL to which the Protect attribute is added in all DP-VOL related to concerned POOL. (Please make Access Attribute column visible if it is hidden.)
- Please input "protect" specifying the access attribute for conditional expression.
  See "System Administrator Guide" for details.

*2: 1. You have performed operations which cannot ensure data consistency (for example, format) to recover the blocked pool-VOLs.
2. You haven't performed "Recovery Procedure for pool-VOL Blockade".

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10.6 The release procedure for the Protection attribute of Data Retention Utility (SIM = 628000)

The release procedure for the Protection attribute of Data Retention Utility set to the Dynamic Provisioning or Dynamic Tiering or active flash is shown here.



*1: Please specify the following condition for the filter using Virtual Volumes tab of Pools: Volume tabs to display DP-VOL to which the Protect attribute is added in all DP-VOL related to concerned POOL. (Please make Access Attribute column visible if it is hidden.)

- Please input “protect” specifying the access attribute for conditional expression. See “System Administrator Guide” for details.

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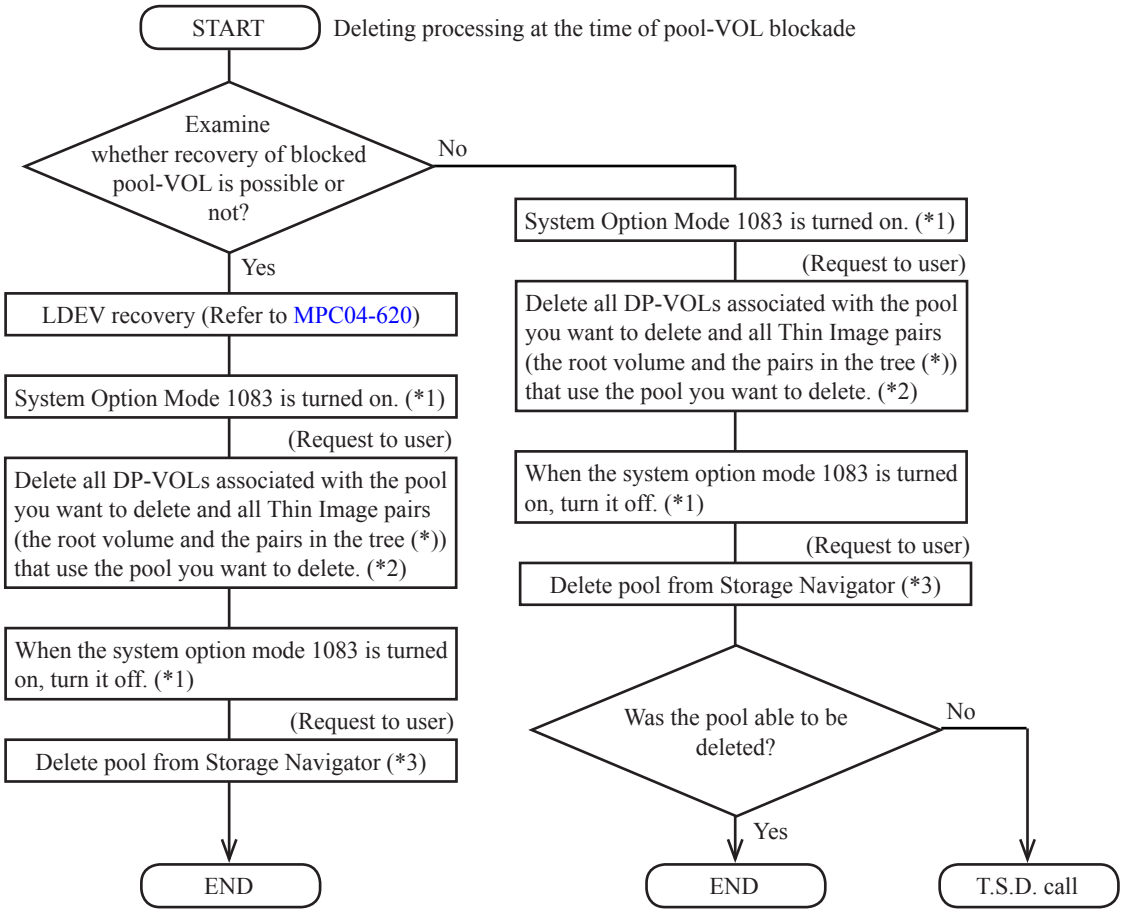
10.7 Deleting Procedure for Pool at the time of pool-VOL Blockade (When External Volume the pool-VOL Belongs Is Removed)

Dynamic Provisioning become as follows. In this case, data cannot be recovered.

Item	Status
DP-VOL status	None
POOL status	Normal (usage rate > 0%)
pool-VOL status	Blocked
I/O access	Impropriety
Association with DP-VOL and POOL	None (Note that the association is being released and exists internally)

Recovery method

Perform the recovery by the following flow.



*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the "Local Replication" window of Web Console.

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*1: When the DP-VOL has data direct mapping attribute.

*2: The procedure for deleting specified capacity saving-enabled V-VOLs is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in “Provisioning Guide”.

*3: The procedure for deleting capacity saving-enabled V-VOLs by the pool is different from that for capacity saving-disabled V-VOLs. Delete them by following the procedure described in “Provisioning Guide”.
For Command Control Interface, the deduplication function needs to be disabled on the pool using the raidcom modify pool command because V-VOLs are deleted before deleting Deduplication System Data Volume.

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10.8 Initialization Procedure for Pool

NOTE 1: When Initialize Pools executed, the pool of all Dynamic Provisioning/Thin Image is blockaded.

NOTE 2: In the case [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/global-active device] use virtual volumes of Dynamic Provisioning, delete all [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/global-active device] pairs that use the virtual volumes before performing Initialize Pools. In addition, delete all the journal volumes of Universal Replicator that use the virtual volumes. After Initialize Pools completes, create [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/global-active device] pairs again. During Initialize Pools, don't create [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/global-active device] pairs with virtual volumes of Dynamic Provisioning. In the case create those pairs, initialize and paircreate operation may fail.

NOTE 3: Delete all Thin Image pairs before performing Initialize Pools. After Initialize Pools completes, create Thin Image pairs again. During Initialize Pools, don't create Thin Image pairs. In the case create Thin Image pairs, initialize and paircreate operation may fail.

NOTE 4: Stop the LDEV format on the LDEV on which the DP-VOL with [Compression] or the [Deduplication and Compression] of Capacity Saving enabled exists in the Storage System before performing Initialize Pools. If Initialize Pools is performed without stopping the LDEV format, the initialization may fail.

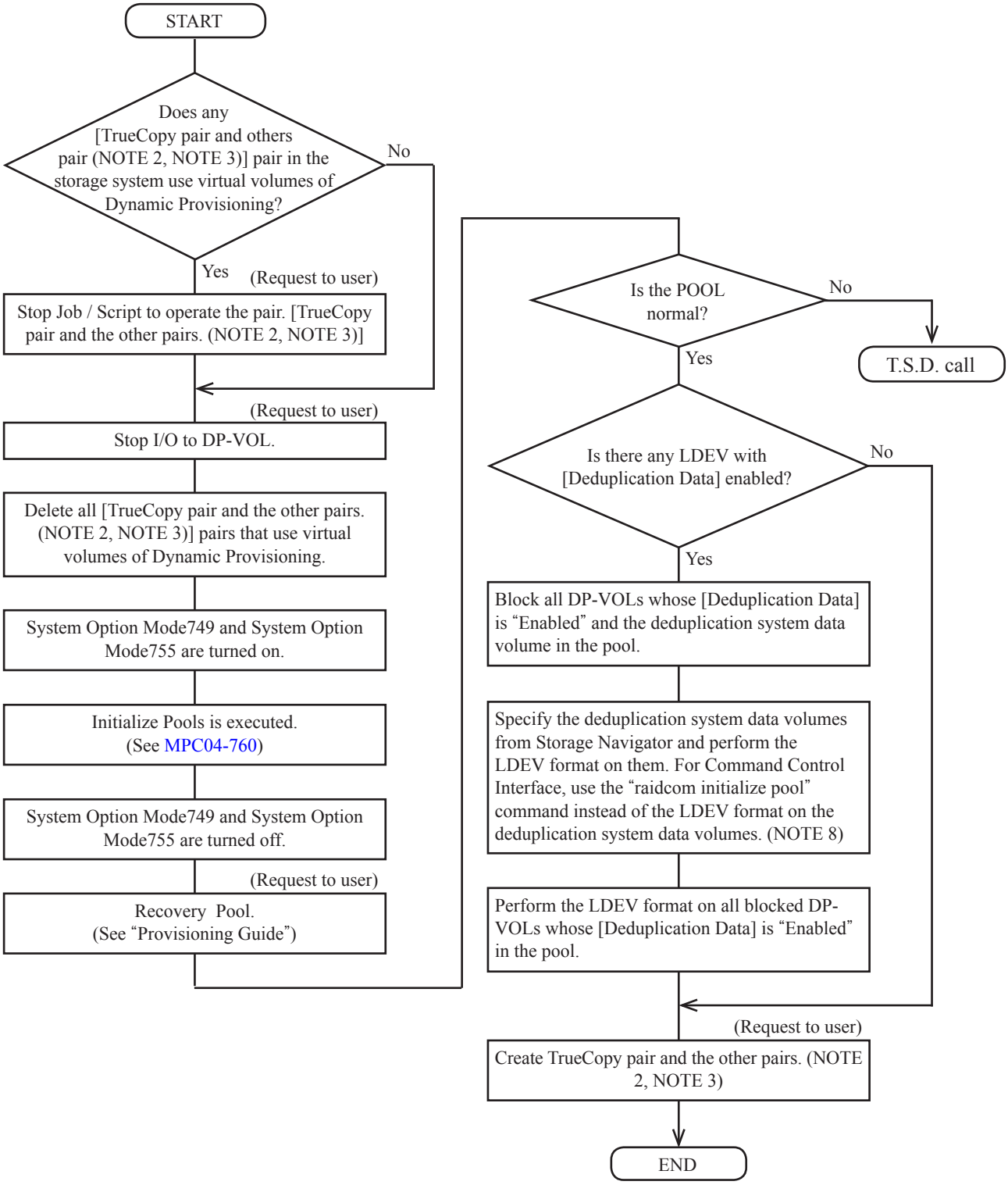
NOTE 5: Do not execute the maintenance of Dynamic Provisioning until the pool restores normally after executing Initialize Pools.

NOTE 6: Perform the operation only when it is directed by the Technical Support Division.

NOTE 7: For the password, refer to the Technical Support Division.

NOTE 8: Ask the SE or user to perform the operation.

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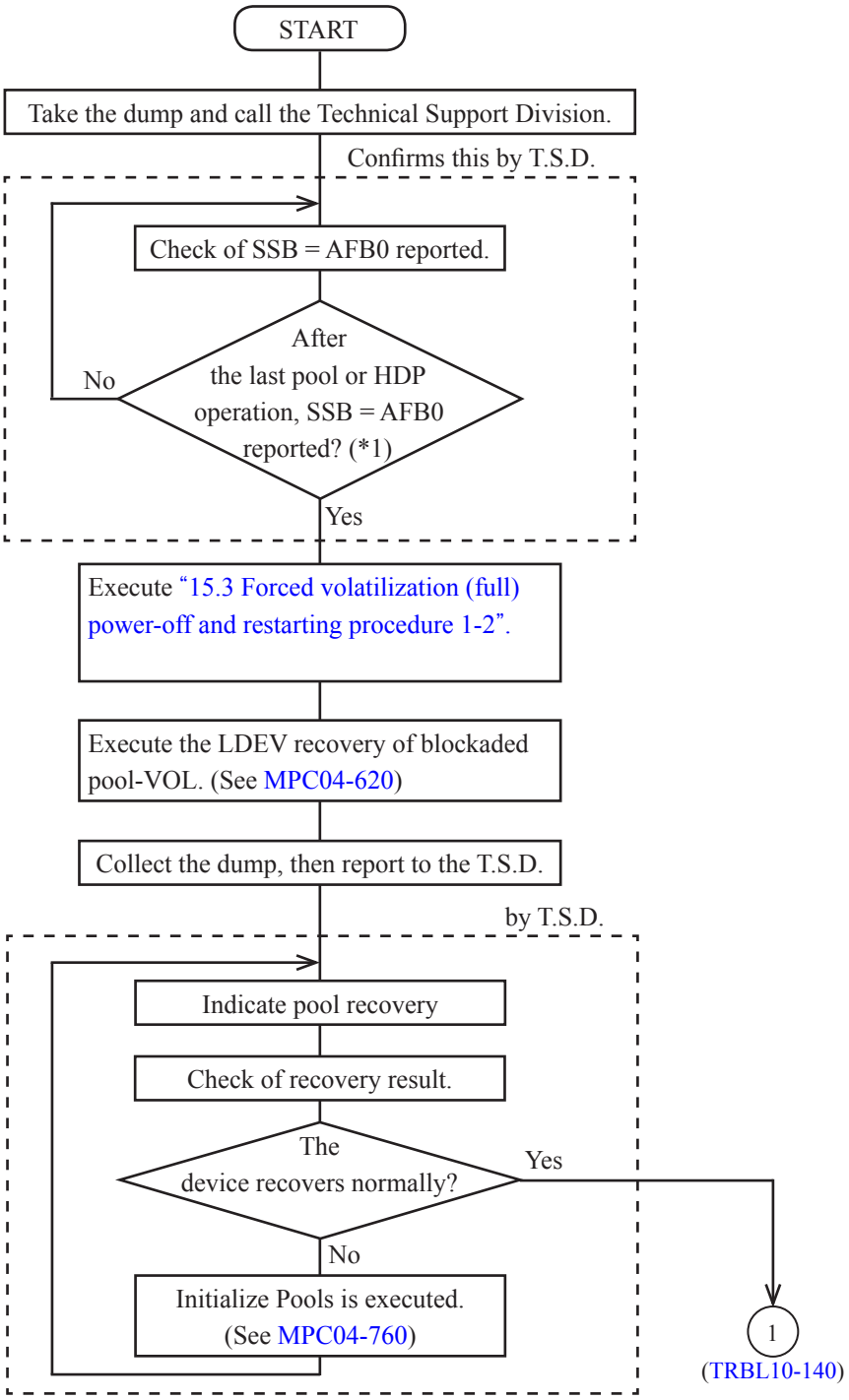


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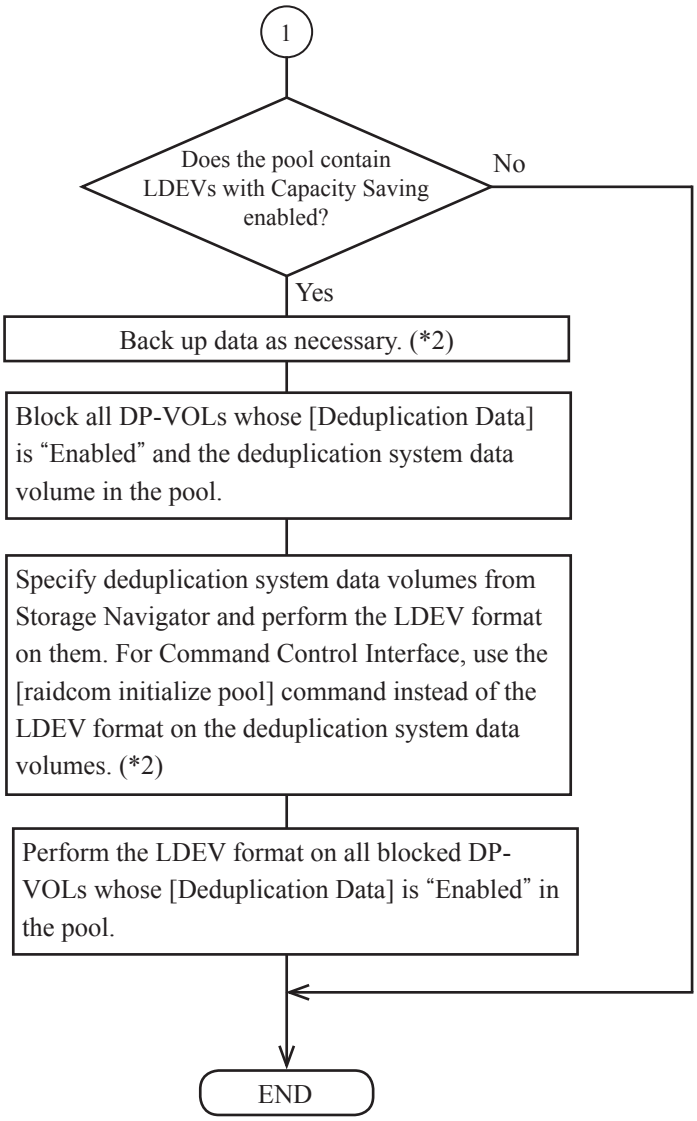
10.9 Recovery Procedure for Dynamic Provisioning by Turning Off the Power and Volatilizing PS ON

⚠ CAUTION

This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the Technical Support Division.



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*1: Please confirm SSB EC=AFB0 was output after the last following operation is executed.

<Operation that should confirm report of SSB EC=AFB0>
- Pool making/pool-VOL addition/pool-VOL deletion/Pool deletion
- DP-VOL making/DP-VOL deletion/DP-VOL capacity expansion
- Quick Restore of ShadowImage using DP-VOL
- Volume Migration using DP-VOL

From the operation to the report of SSB, it usually takes about 40 minutes. However, when the configuration change is repeated, it might take several hours to do it.

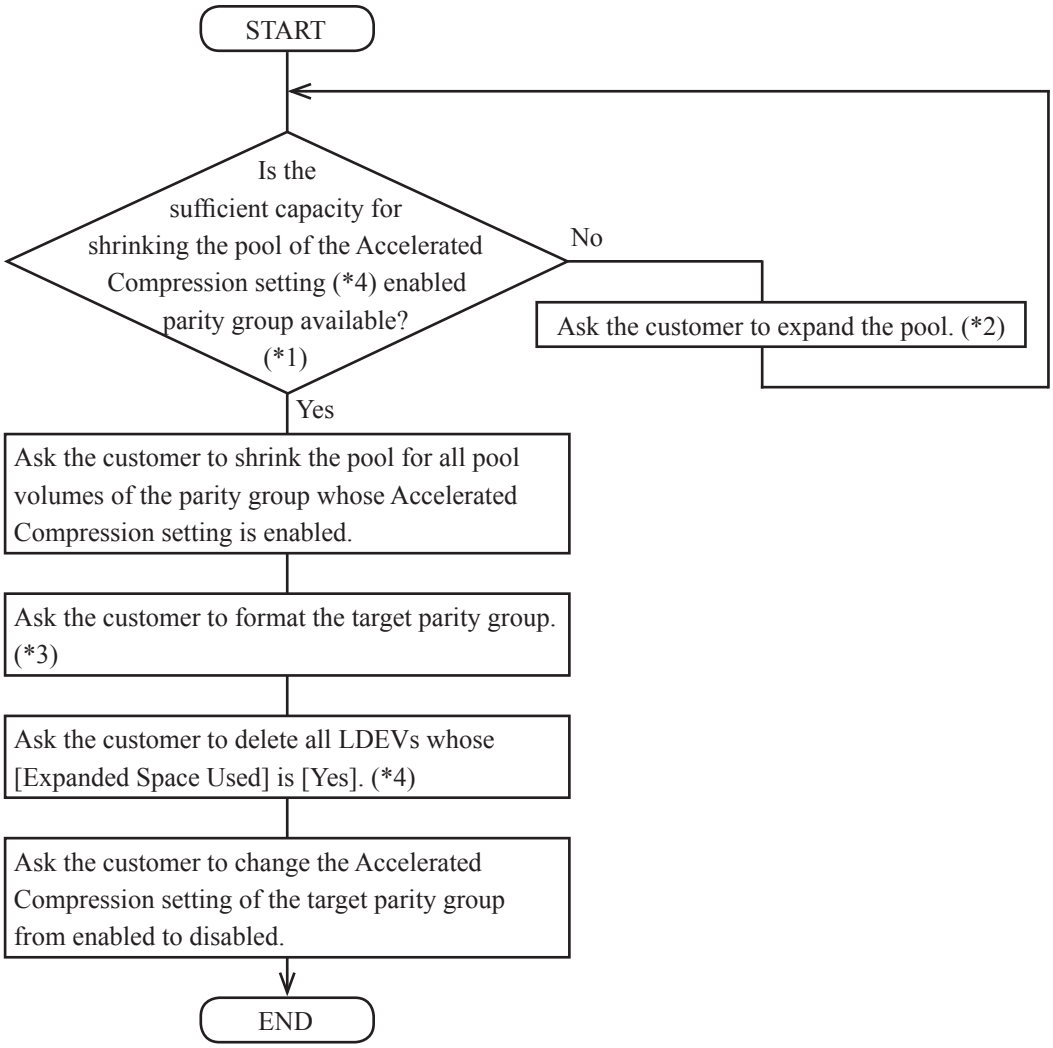
*2: Ask the SE or user to perform the operation.

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10.10 Disabling Procedure for Accelerated Compression Setting of Parity Group

⚠ CAUTION

Confirm whether the sufficient capacity required for shrinking the pool along with the disabling Accelerated Compression setting is available before performing this operation.



*1: Confirm the customer whether the target pool can be shrunk using the following determination formula.
Determination formula: Pool usage < Pool capacity after shrinking (NOTE) × Depletion threshold value

NOTE: Pool capacity after shrinking
= Pool capacity before shrinking – Total capacity of pool volumes whose Accelerated Compression setting is enabled
When the determination formula is met: Yes
When the determination formula is not met: No

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*2: Add larger capacity than the total capacity of the pool volumes whose Accelerated Compression setting is enabled. Add LDEVs whose Accelerated Compression setting is disabled.

*3: Format the drives of the target parity group by specifying the parity group. If incorrect LDEVs are specified, the Accelerated Compression setting is not disabled.
See MAINTENANCE PC SECTION "4.2.2.4 Formatting Parity Group".

*4: For the Accelerated Compression setting and Expanded Space Used, see "Provisioning Guide for Open Systems".

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11. External Storage Maintenance

11.1 Maintenance of External Storage

The following is a collection of matters to be given considerations when doing maintenance works or failure recovery actions for the external storage connected by means of the Universal Volume Manager function.

11.1.1 Considerations When Performing Maintenance Work on External Storage

NOTICE: Before you change settings of the external storage, you must delete the external volume mapping after executing [Disconnect external volumes]. After you change settings of the external storage, you must remap the external volume. If you do not remap the volume, the external volume cannot be used in the DW800 storage system.
The examples of external storage settings which require the re-mapping of external volume are as follows:

(a) Changing WWNs of every target ports which connect to the DW800 storage system
(b) Changing the serial number of the external storage
(c) Changing LUNs of volumes of the external storage
(d) Reducing the volume capacity of the external storage so that the volume capacity is smaller than when volume mapping was performed

Besides, re-mapping is required for Universal Volume Manager after you change external storage settings that require modification on the host side when hosts are connected directly to a external storage.

In the above case (a), if you do NOT change WWNs of EVERY target ports, you do not have to delete the external volumes.
The following procedure is the way to change settings of the external storage without deleting the external volumes:

1. Changing WWNs of part of target ports which connect to the DW800 storage system. After the process, external paths using the target ports are blocked.
2. Adding new external paths using the target ports.
3. Deleting the blocked external paths.

Before you delete the external volume mapping, make sure that the volume has no LU paths, and that the volume is not a component of any pairs (such as TrueCopy pairs).
For detailed information on deleting the external volume mapping, see section “Hitachi Universal Volume Manager User Guide” - “Deleting external volume mapping”.
For detailed information on mapping external volume, see section “Hitachi Universal Volume Manager User Guide” - “Mapping an external volume”.

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NOTICE: When the following conditions 1 and 2 are met, perform "10.1 Recovery Procedure for pool-VOL Blockade (When Two (Three in RAID6) or More Are Blocked in the RAID Gr the pool-VOL Belongs)" for the pool-VOLs after recovering the devices of the external storage system.

1. The devices of the external storage system to be maintained are used as pool-VOLs.
2. You have performed operations which cannot ensure data consistency (for example, format) to recover the devices of the external storage system.

When a maintenance work is done on the external Storage System side, an SIM report (Assist report) may be issued by the Storage System side during the maintenance work. When doing a maintenance work for the external Storage System side, therefore, set the REMOTE MAINTENANCE switch on the Storage System side to DISABLE before starting the work.
Check the SIM and its contents after the maintenance work is completed to judge whether the SIM is one of those that are to be issued during maintenance works shown in "11.6 Appendix" If the SIM is the one described above, execute the reset the switch to ENABLE. If not, take actions according to the customer's conditions (urgency).
Do the maintenance works for the external Storage System side following guidelines explained below.

When doing a maintenance work for the external Storage System side

1. Make sure that an alternative path (in the Normal status) exists between the Storage System and the external Storage System. (See [Procedure 1] in "11.1.3 Procedure for Operating Storage Navigator".)
2. When an alternative path exists correctly between the clusters of the Storage System side, leave it as it is and do the maintenance work following procedures for the external Storage System side.
3. If no alternative path exists, have the customer stop access to the server concerned and perform the operation (Disconnect External Volume) to disconnect the external Storage System side concerned on the Storage System side. (See [Procedure 2] in "11.1.3 Procedure for Operating Storage Navigator".)
4. Do the maintenance work following the procedure for the external Storage System side.
5. After the maintenance work for the external Storage System side is completed, perform the operation (Reconnect External Volumes) to reconnect the external Storage System side concerned on the Storage System side. (See [Procedure 3] in "11.1.3 Procedure for Operating Storage Navigator".)

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NOTE

- Even if the alternative path exists, the SIM (21d0) informing of the path blockade is reported via the Storage System side when the path is switched to the alternative path. In this case, the path status on the Storage System side is recovered from the blockade automatically when a factor, which caused the blockade, on the external Storage System side is removed.
- Because the external Storage System side is in the Single Path mode when it is the SANRISE 9500V series device, a path with a high priority is switched back automatically as the path to be used when it is restored. In the maintenance work, make sure that the path has been switched back after the maintenance work for the external Storage System side (Hitachi storage only) is completed. (See [Procedure 4] in "11.1.3 Procedure for Operating Storage Navigator".)
- Because the external Storage System side is in the Multiple Path mode when it is the SANRISE 2000 Series or SANRISE 9900V series or AMS2000 series or HUS / SANRISE USP, NSC / USP V, USP VM / VSP / HUS VM / VSP G1000, VSP Gx00 device, make sure that the path is recovered from the blockade (the path status is changed to Normal). Further, check the SIM and its contents after all the maintenance works are completed to judge whether the SIM is one of those that are to be issued during maintenance works shown in "11.6 Appendix". If the SIM is the one described above, execute the turn on the Assist report.

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11.1.2 Maintenance (Isolation) Procedure for a Failure on External Storage (SIM = 21d0xy, 21d2xy, efd000, ef5xxx, ff5xxx)

The following SIMs may be reported by the Storage system when a failure occurs in the external storage or during a maintenance work. In such a case, specify the maintenance work following the procedure shown below.

1. In the case of the Hitachi external storage (SANRISE series device), check if an Assist report has been sent from both of the Storage system and the external storage.
   When only a SIM (21d0xy, 21d2xy, efd000, ef5xxx or ff5xxx) informing of a failure in the external storage is issued by the Storage system and a failure is also reported by the external storage, it is highly possible that the SIM (21d0xy, 21d2xy, efd000, ef5xxx or ff5xxx) is issued by the Storage system according to the failure that has occurred in the external storage.
   In this case, specify a cause of the failure according to the failure information of the external storage.

2. Basically, take actions following instructions given in the TROUBLESHOOTING SECTION according to the contents of the SIM reported to the Storage system.

3. If you fail to specify the cause or solve the trouble finally, contact the Technical Supports Division (T.S.D.). In such a case, send dumps / traces of both the Storage system and the external storage (Hitachi external storage only) to the T.S.D.
   Procedure for a dump from the Storage system: Refer to MAINTENANCE PC SECTION "5.2 Dump".

4. When the external storage is not Hitachi-manufactured, send only the dump from the Storage system to the T.S.D. Besides, request the customer to make the external storage recover from the failure.

Table 11-1

SIM code	SSB code	Host report	Detailed description	References
efd0	AD10	Issued	Blockade of the external device	TRBL11-50
21d0	AD11	Issued	Blockade of the path connecting the external device	TRBL11-50 TRBL11-60
21d1	AD12	Not issued	Recovery of the path connecting the external device	
21d2	AD60	Issued	Response time-out of external device	TRBL11-80
ef5x	89CB	Not issued	Abnormal end of Write in External storage system	TRBL04-150
ff5x	89CC	Not issued	Abnormal end of Read in External storage system	TRBL04-150

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11.1.3 Procedure for Operating Storage Navigator

[Procedure 1] Procedure to make sure of existence of an alternative path between the Storage System and the external storage
See the chapter on the external volume in “Hitachi Universal Volume Manager User Guide”.
In the path setting window, make sure that a path in the “Normal” status exists in the “Configured path” besides the path to be maintained.

[Procedure 2] Procedure for disconnecting the external storage (Disconnect External Volume operation)
See the chapter on the external volume in “Hitachi Universal Volume Manager User Guide”.

[Procedure 3] Procedure for reconnecting the external storage (Reconnect External Volumes Operation)
See the chapter on the external volume in “Hitachi Universal Volume Manager User Guide”.

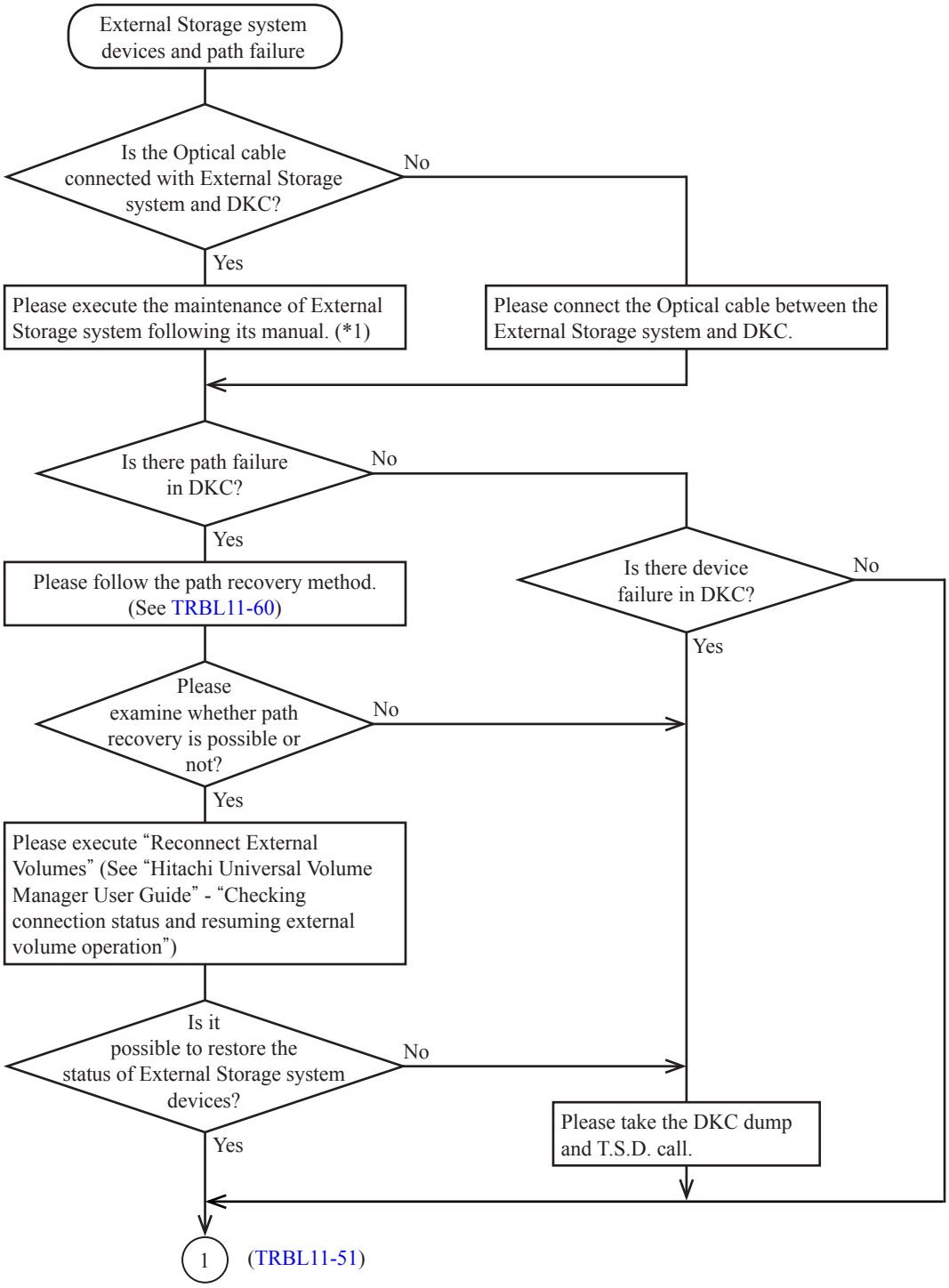
[Procedure 4] Procedure for making sure that the alternative path has been switched back
See the chapter on the external volume in “Hitachi Universal Volume Manager User Guide”.
In the path setting window, make sure that the status of the path to be maintained in the “Configured path” is “Normal.” If the status is not “Normal,” close the path setting window once. Display the path setting window again after waiting for a while (about five minutes).

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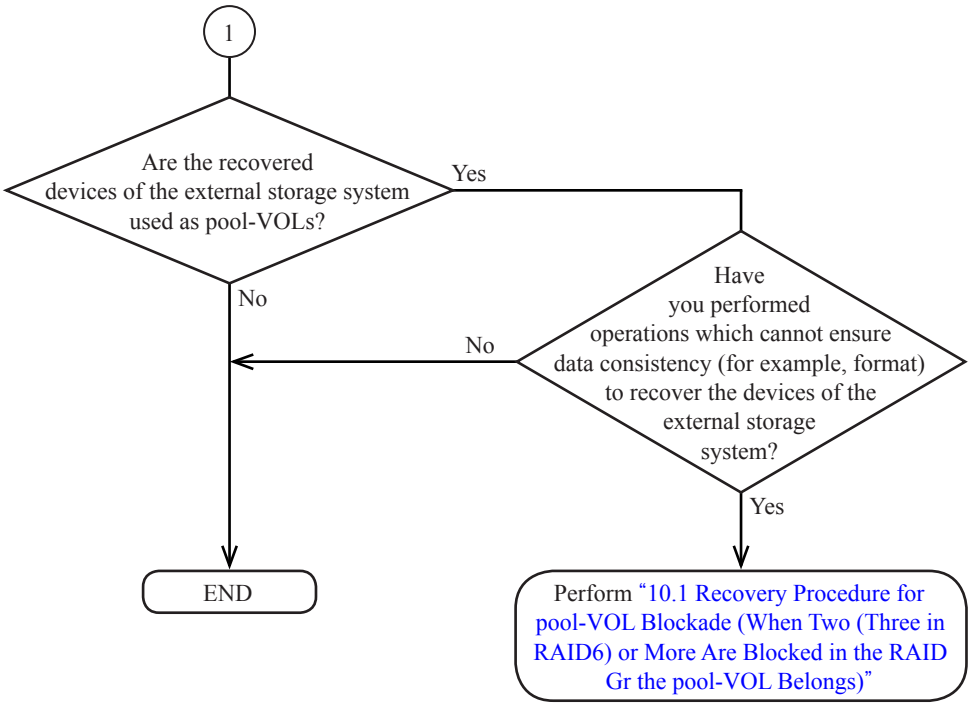
11.2 Recovery Procedure for External Device Failure

The following is the recovery procedure when the External Devices Error (SIM = 21d0-xy, efd000) is occurred.

11.2.1 Recovery Procedure for Path Failure While Device is Blocked (SIM = 21d0-xy, efd000)



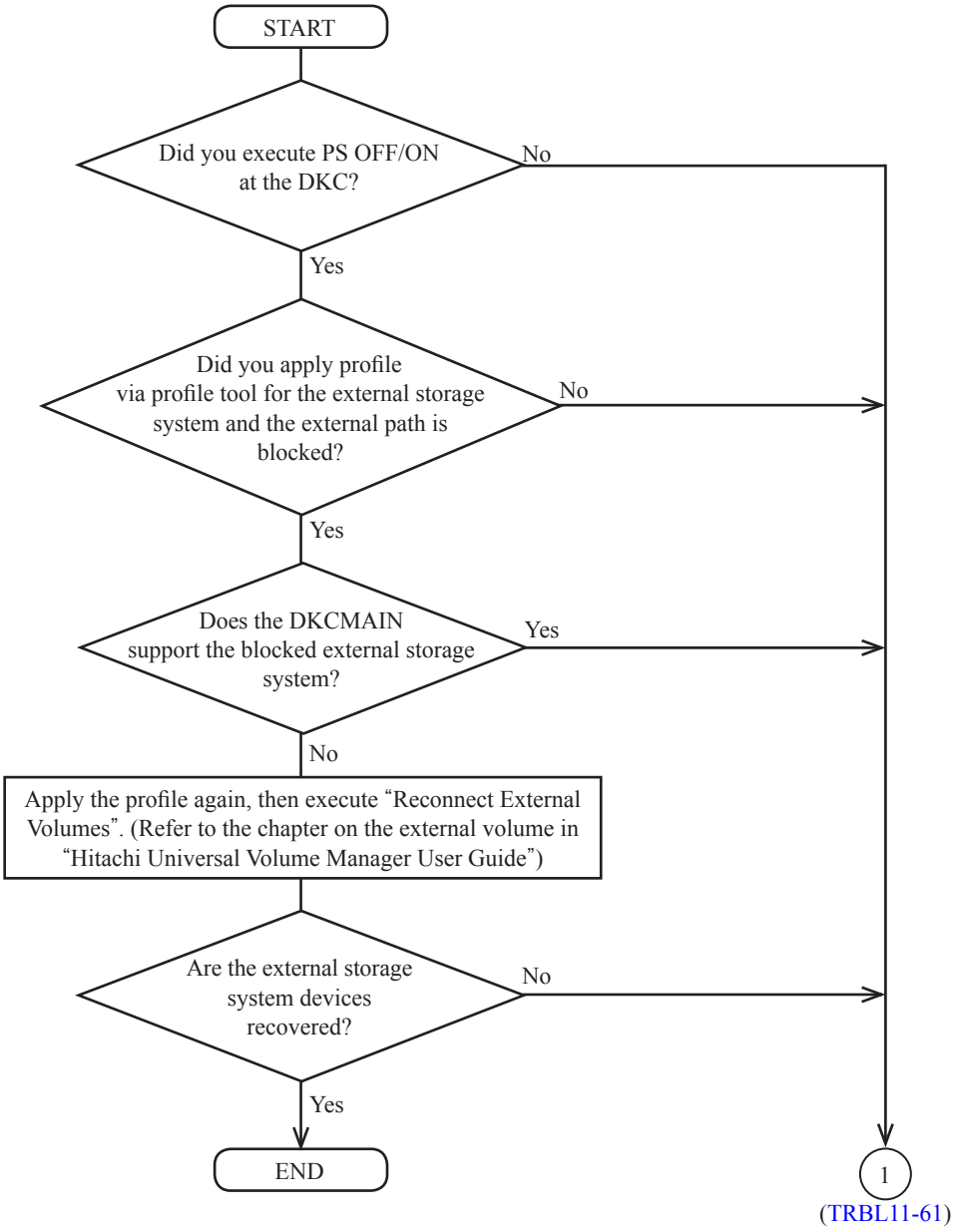
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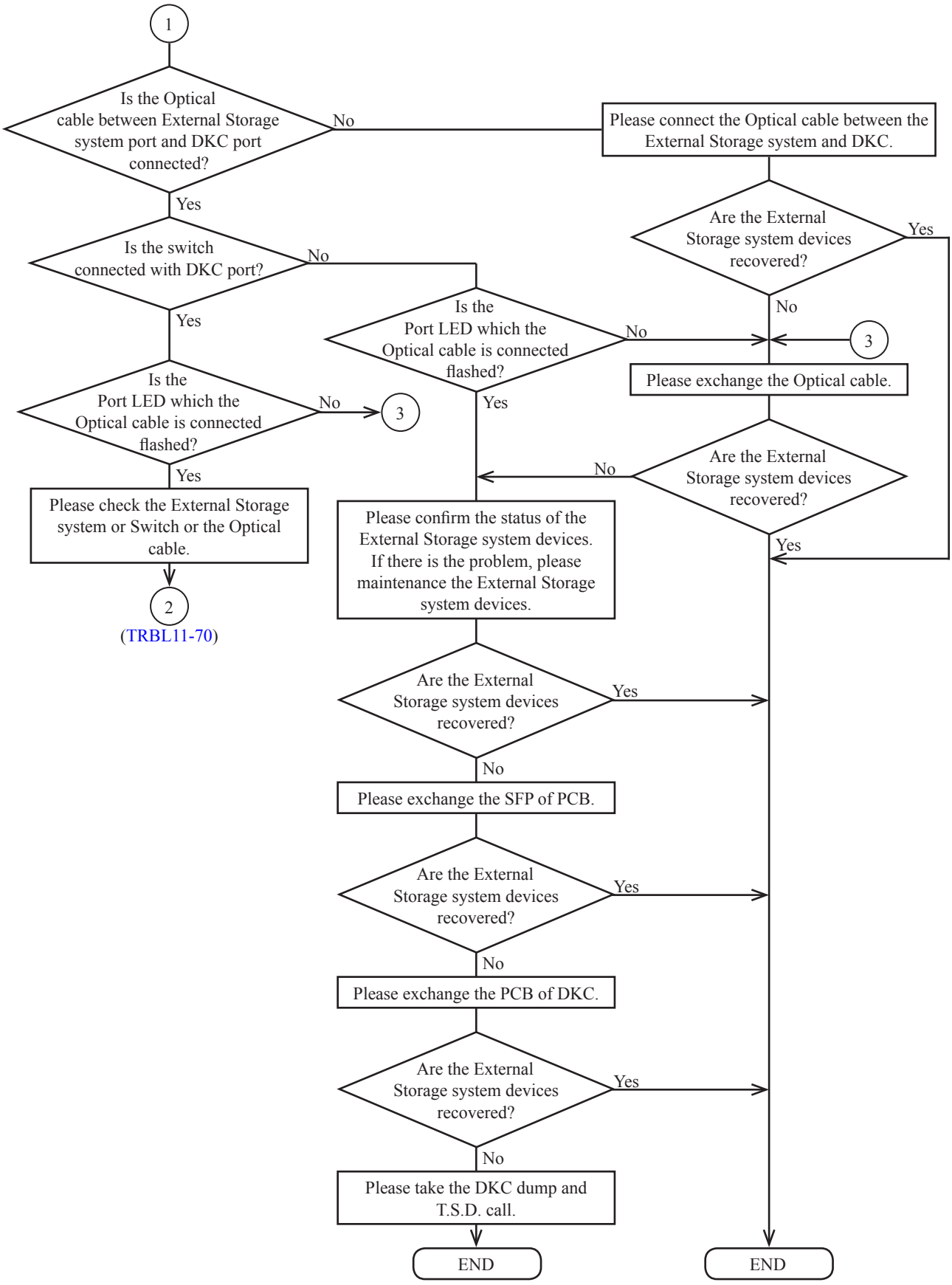
*1: If the data of the blocked device is unnecessary, you can format the device at the external storage system to recover it.
When the formatted devices of the external storage system are used as pool-VOLs, it meets the condition to perform "10.1 Recovery Procedure for pool-VOL Blockade (When Two (Three in RAID6) or More Are Blocked in the RAID Gr the pool-VOL Belongs)", which is mentioned at the end of the flowchart.
As the flowchart shows, make sure that you perform it just before the end of the flowchart.

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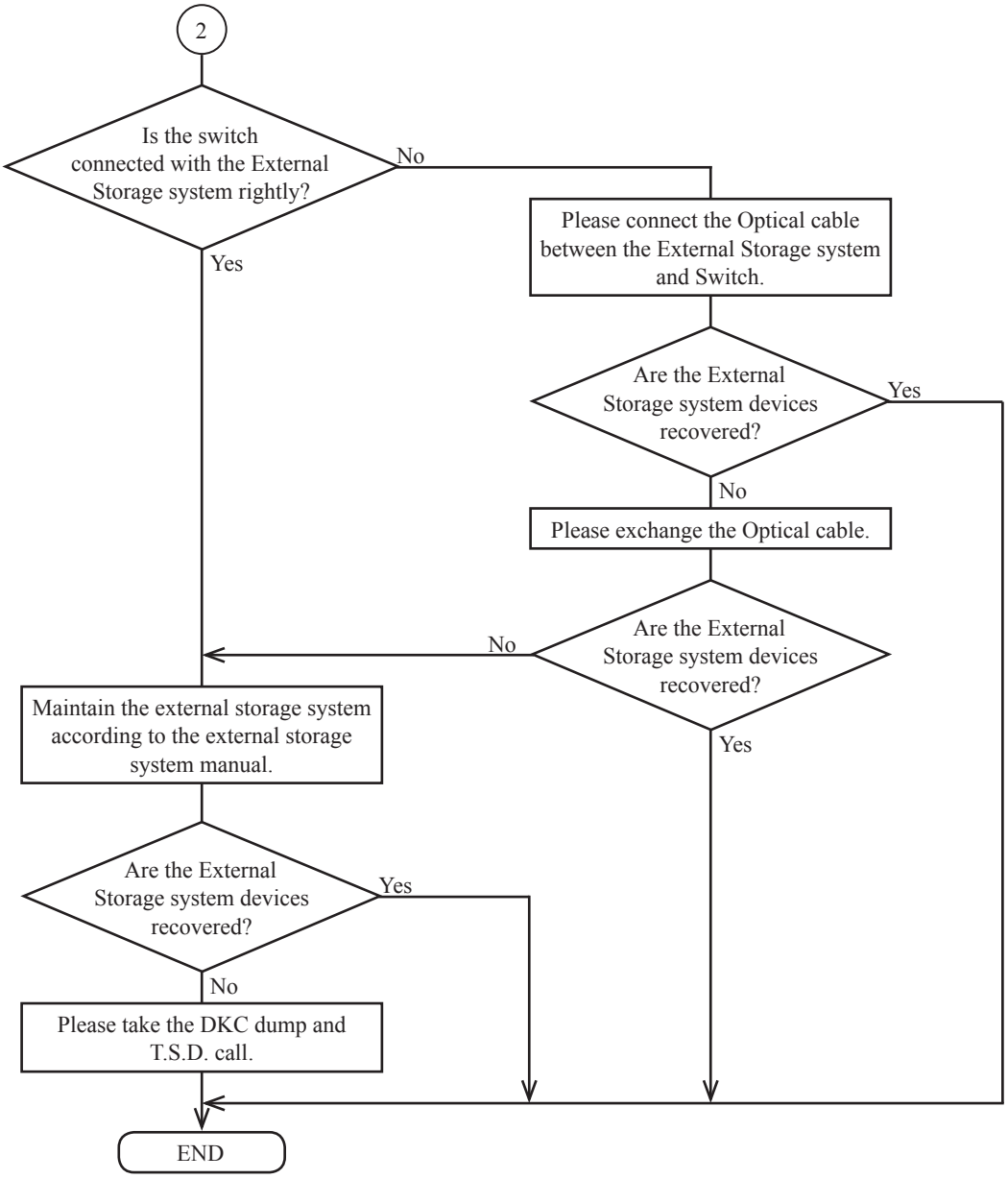
11.2.2 Recovery Procedure for Path Single Failure (SIM = 21d0-xy)



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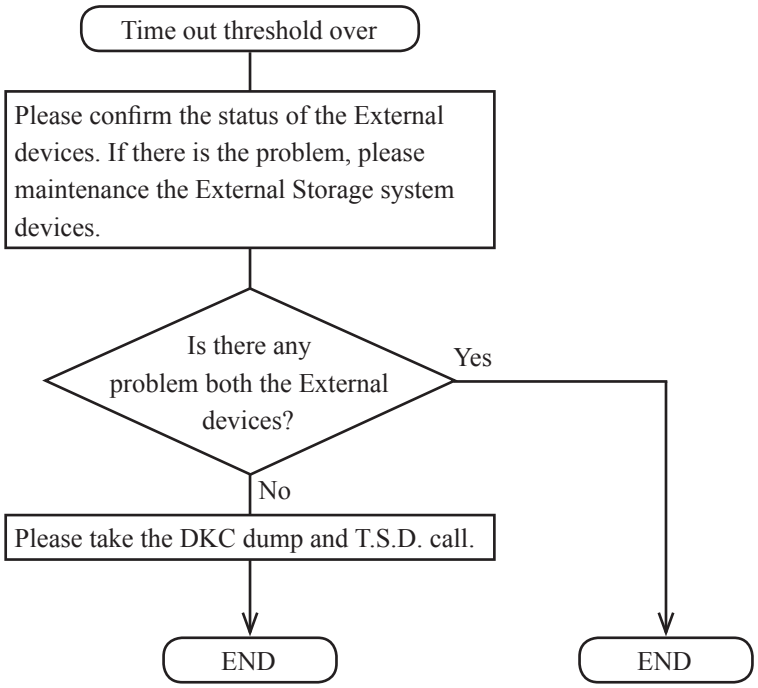
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11.2.3 Recovery Procedure for External Storage system Path Response Time Out Threshold Over (SIM = 21d2-xy)

SIM = 21d2-xy



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11.2.4 Action When External Device and External Volume Are Not Recognized

Check the detailed data of EC=ACF0 (the result of discovery is an unsupported device), and perform the coping method shown in the table below.
However, since it is deterred for five minutes in units of MP, EC=ACF0 is reported only once, even if there are two or more factors. When there are two or more factors, remove the factors and execute it again five minutes later from the previous execution.

Table 11-2 Detailed format of SSB EC=ACF0

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
10																
20								9	F	A	C	F	0	Factor code		
30	LUN (*)															
40											WWN of external storage (*)					
50	WWN (continued)															
60																
70																

*: The information may not be stored depending on the factor.

Factor code	Content	Coping Method
0x00000000	• The information of the external storage acquired by the Port (WWN) discovery is not in the profile information. • The external device is the LU for storage management.	• Connect the storage supported by UVM. • Apply the Firmware version of Storage System which supported the storage concerned. • Install the profile tool supporting the storage concerned. • When the LU for storage management (Universal Xport, etc.) exists, define the LU for data of LU number smaller than the LU number or delete the LU for storage management from the port concerned.
0x00000003	• The remote command device of the external storage was discovered by the cascade connection.	• Do not perform the cascade connection of the remote command device. • Make the remote command device invisible from DW800.

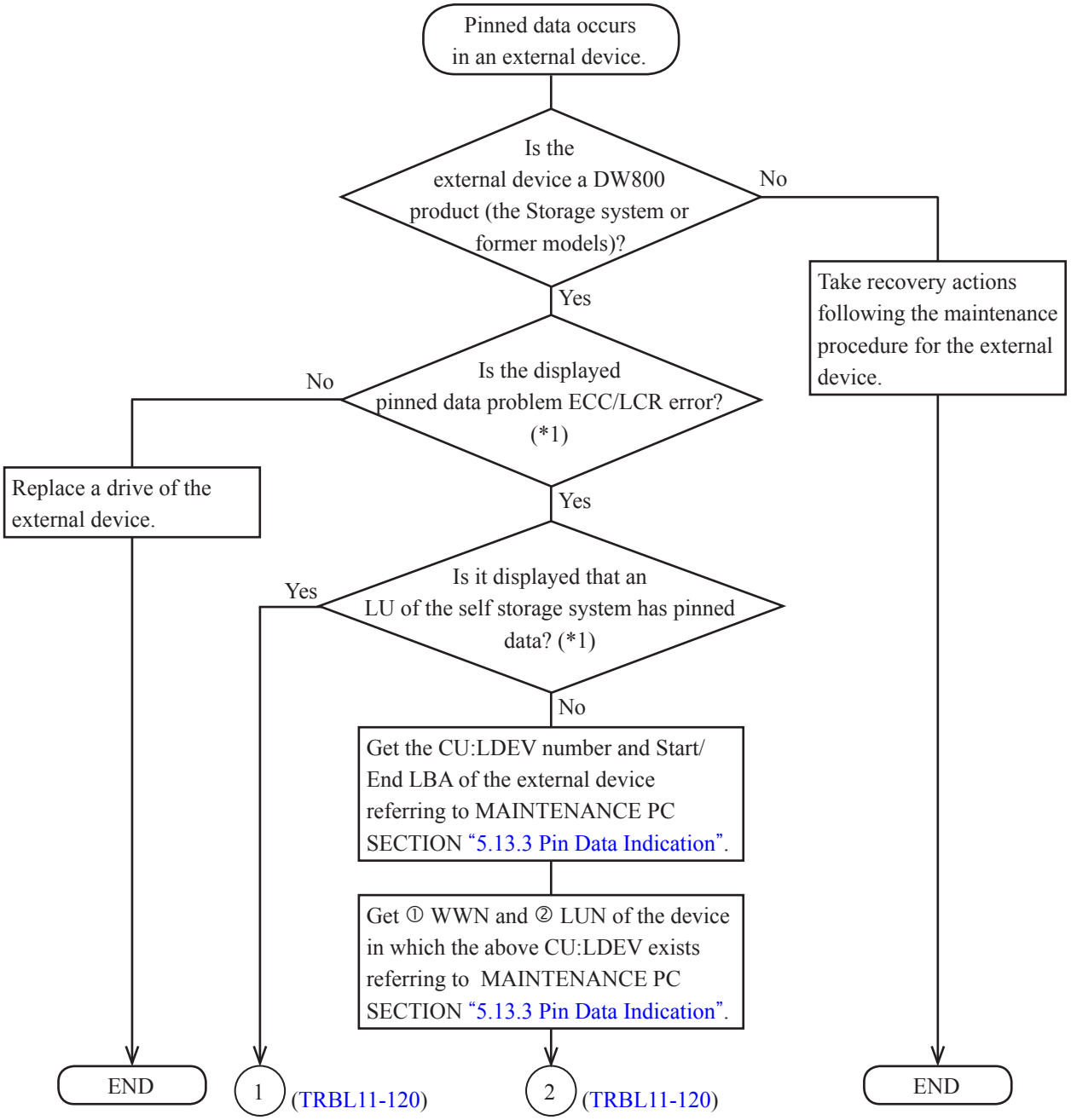
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Factor code	Content	Coping Method
0x00000006	• The information of the external device acquired by the LDEV (LU) discovery is not in the profile information. • The external device is the LU for storage management.	• Connect the storage supported by UVM. • Apply the Firmware version of Storage System which supported the storage concerned. • Install the profile tool supporting the storage concerned. • Set the LU for storage management invisible from Storage System.
0x00000007	• The device concerned is other than the direct access device.	• Check the status of the external storage and the external device, and make it normal.
0x00000008	• The capacity of the external device is less than the supported capacity of UVM.	• Make the capacity of the external device more than or equal to the capacity supported by UVM. • Define the device concerned so that it is invisible from DW800.
0x00000009	• The Report LUN information cannot be acquired. • The LU definition is not performed to the connection port of the external storage.	• Check the status of the external storage and the external device, and make it normal. • Perform the LU definition to the connection port of the external storage.
0x0000000A	• Login for the external storage failed.	• Check the status of the port on the external storage side, and make it normal. • Perform the WWN registration, etc. on the external storage side, and make the login from DW800 possible.
0x0000000B	• The external device returned RESERVATION CONFLICT.	• Cancel Reserve of the external device.
0x0000000C	• An error response was returned when sending the command to the external device.	• Check the status of the external storage and the external device, and make it normal.
0x0000000E	• The abnormal command response occurred a total of eight times or more for one device.	• Check the status of the external storage and the external device, and make it normal.
0x0000000F	• Emulation type of the external device is not supported.	• Define the device concerned so that it is invisible from DW800. • Change host mode to any mode except “4C UVM” at the port of external storage. • Change emulation type to any type, which is supported, at the external device.
0x00000010	• There is no information about valid LUN at “Report LUN”. • The LU definition is not performed to the connection port of the external storage.	• Check the status of the external storage and the external device, and make it normal. • Perform the LU definition to the connection port of the external storage.
Others	• The acquisition of the information of the external storage and the external device failed.	• Check the status of the external storage and the external device, and make it normal.

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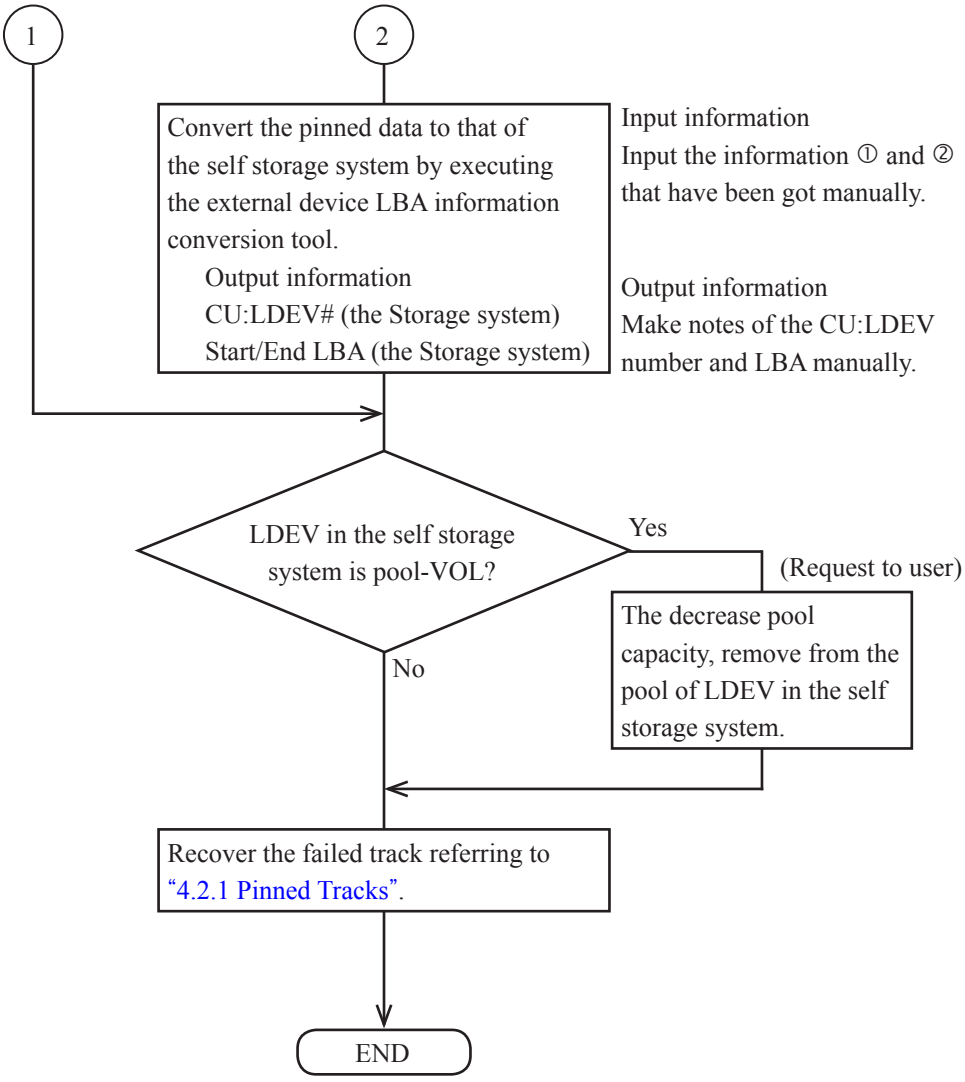
11.3 Elimination Procedure for Pinned Data on External Storage

A procedure for eliminating pinned data when it occurs in an external device is shown below.



*1: For the PIN indication, see "5.13.3 Pin Data Indication".

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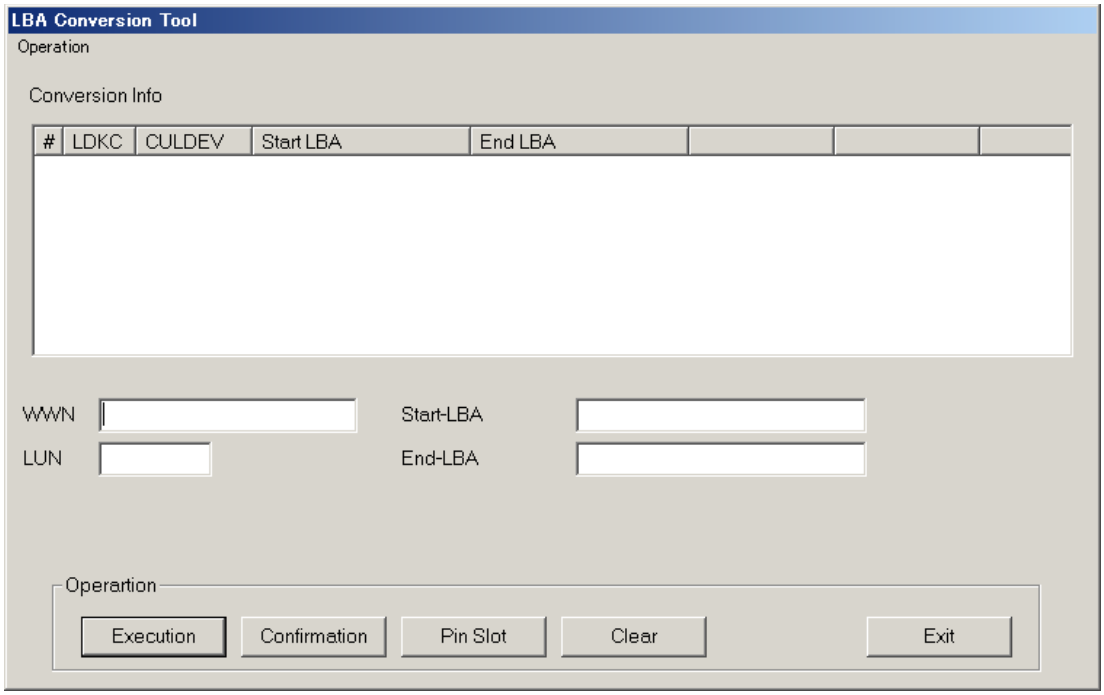
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11.4 Procedure for Operating External Device LBA Conversion Tool

1. On the Maintenance PC, enter “C:\Mapp\wk\83xxxxxxxxxx\DKC200\mp\pc\LbaCon.exe” in the search box from the [Start] button to start LbaCon.exe.

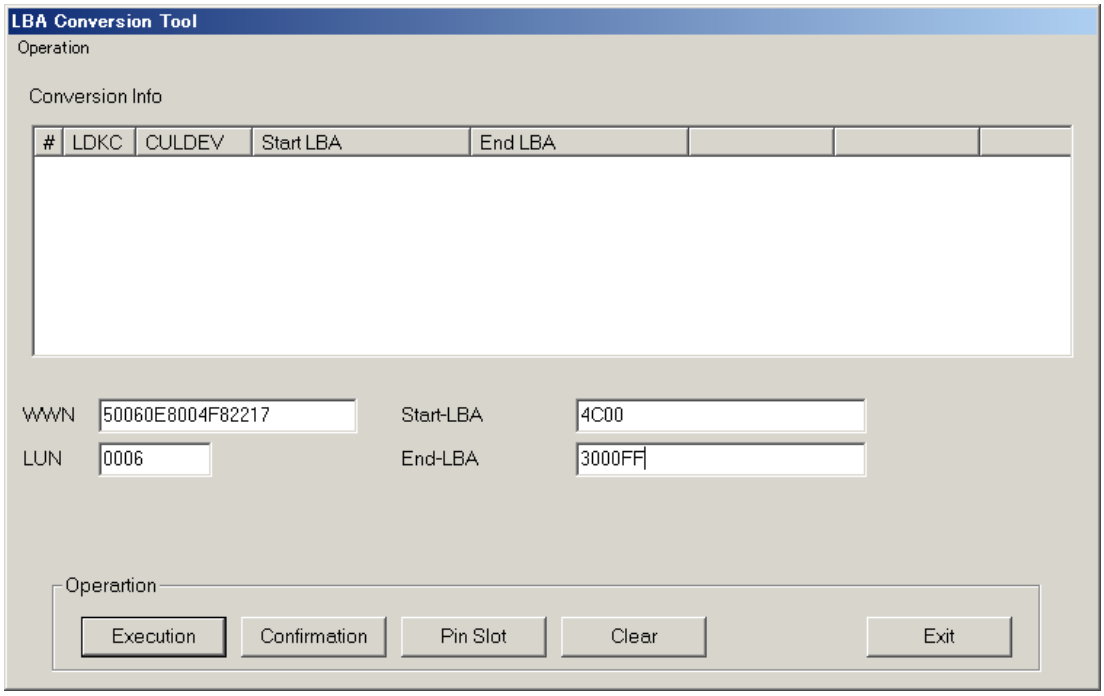
   NOTE: “83xxxxyyyyyy” is a directory to be created when creating a Storage System icon.
   xxxx: “6000” in case of [VSP G800]
   “4000” in case of [VSP G400/G600]
   “2000” in case of [VSP G200]
   yyyyyy: serial number

   When the above operation is performed, the following window is displayed.



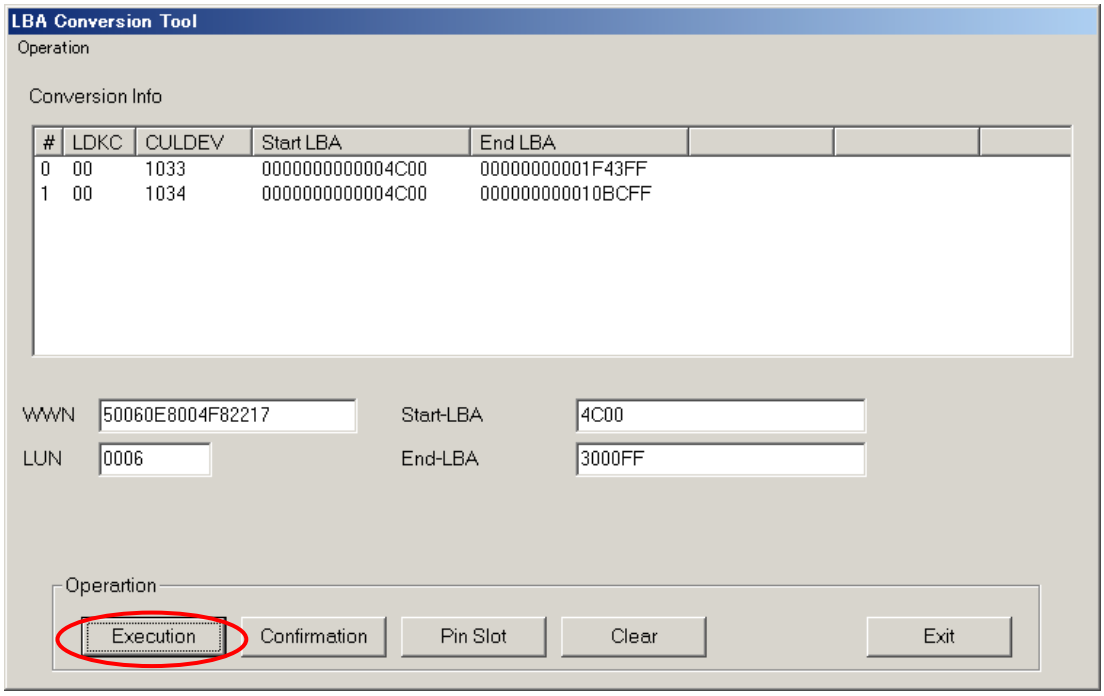
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2. <Entering the information to be converted>
   Enter the WWN, LUN, and Start and End LBA



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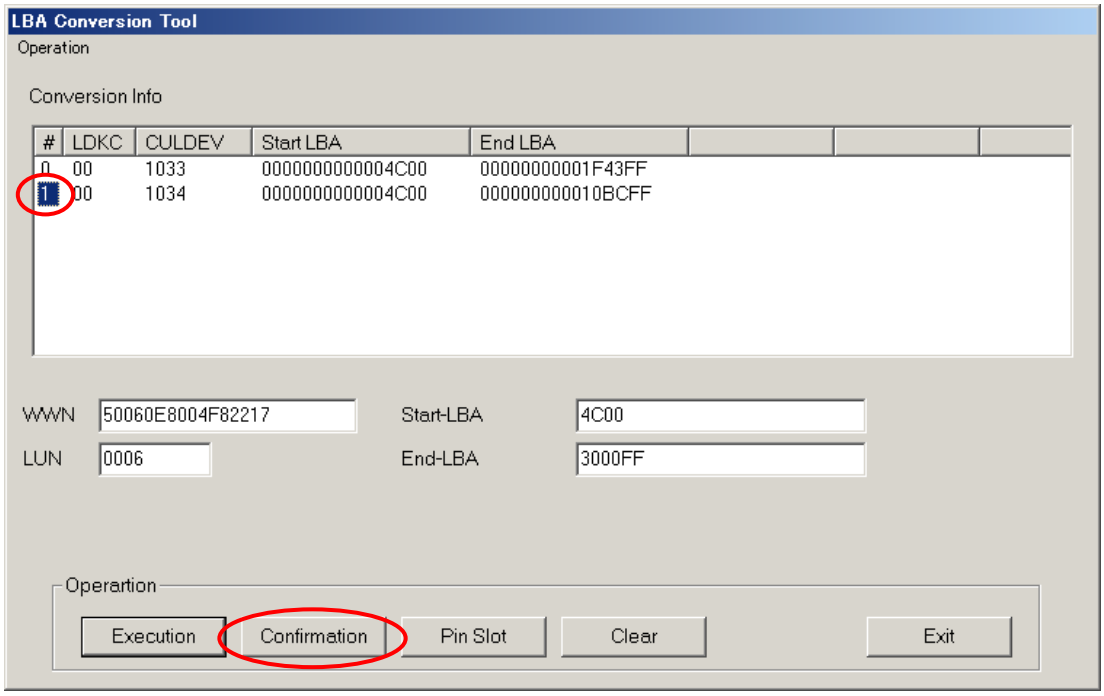
3. <Executing the conversion>
   When you press the [Execution] button after making sure that the information you have entered is correct, the converted LDKC#, CULDEV#, start LBA and end LBA for the Start and End LBA is displayed in the Conversion Info list.



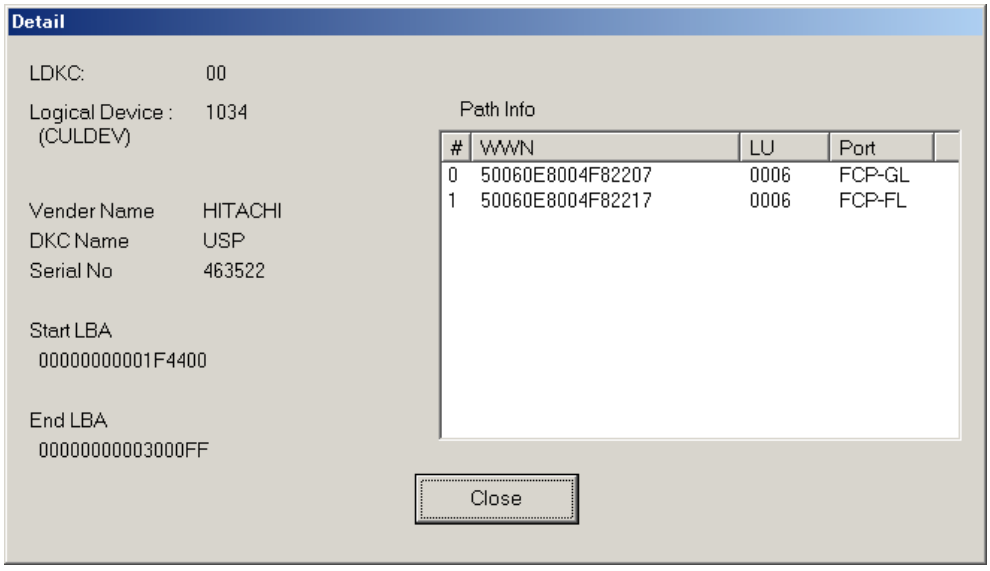
You can also execute the conversion by selecting the [Execution] button from the [Operation] menu bar.

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4. <Verifying the converted information>
   Click an item number of the converted information (in the "#" column) and press the [Confirmation] button.



When the process is completed, the LDKC number and the CULDEV number for the Start and End LBA for the external device, and the Vender Name, DKC Name, Serial No, and path information of the external device are displayed.

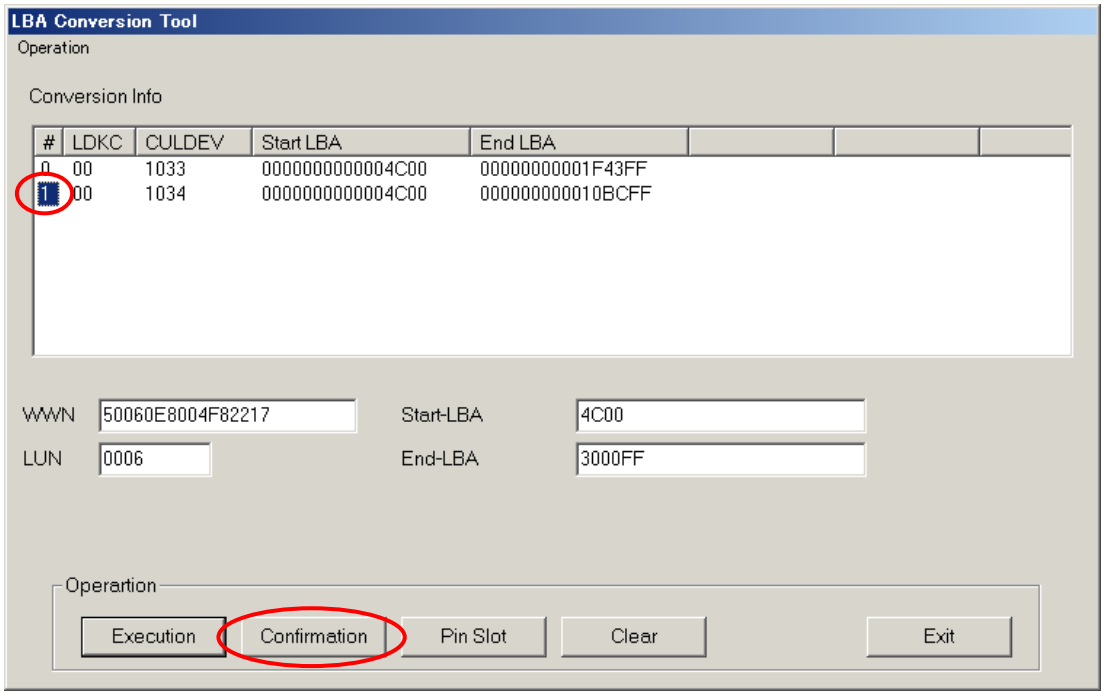


NOTE: Up to eight (the maximum number of paths) pieces of path information are displayed.

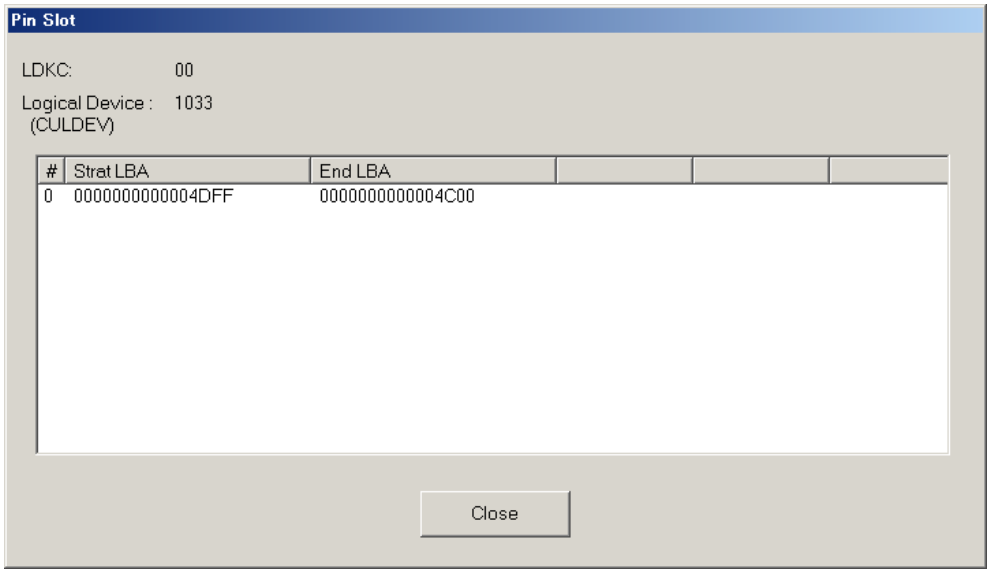
You can also execute this process by selecting the [Confirmation] button from the [Operation] menu bar besides pressing the [Execution] button.

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5. <Displaying the Pin Slot>
   Click an item number of the converted information (in the "#" column) and press the [Pin Slot] button.



When the process is completed, the Start and End LBA of the slot concerning the converted LBA is displayed. (Display of the Start/End LBA in the case where the Pin Erasure Tool is used: The display is done for each slot.)

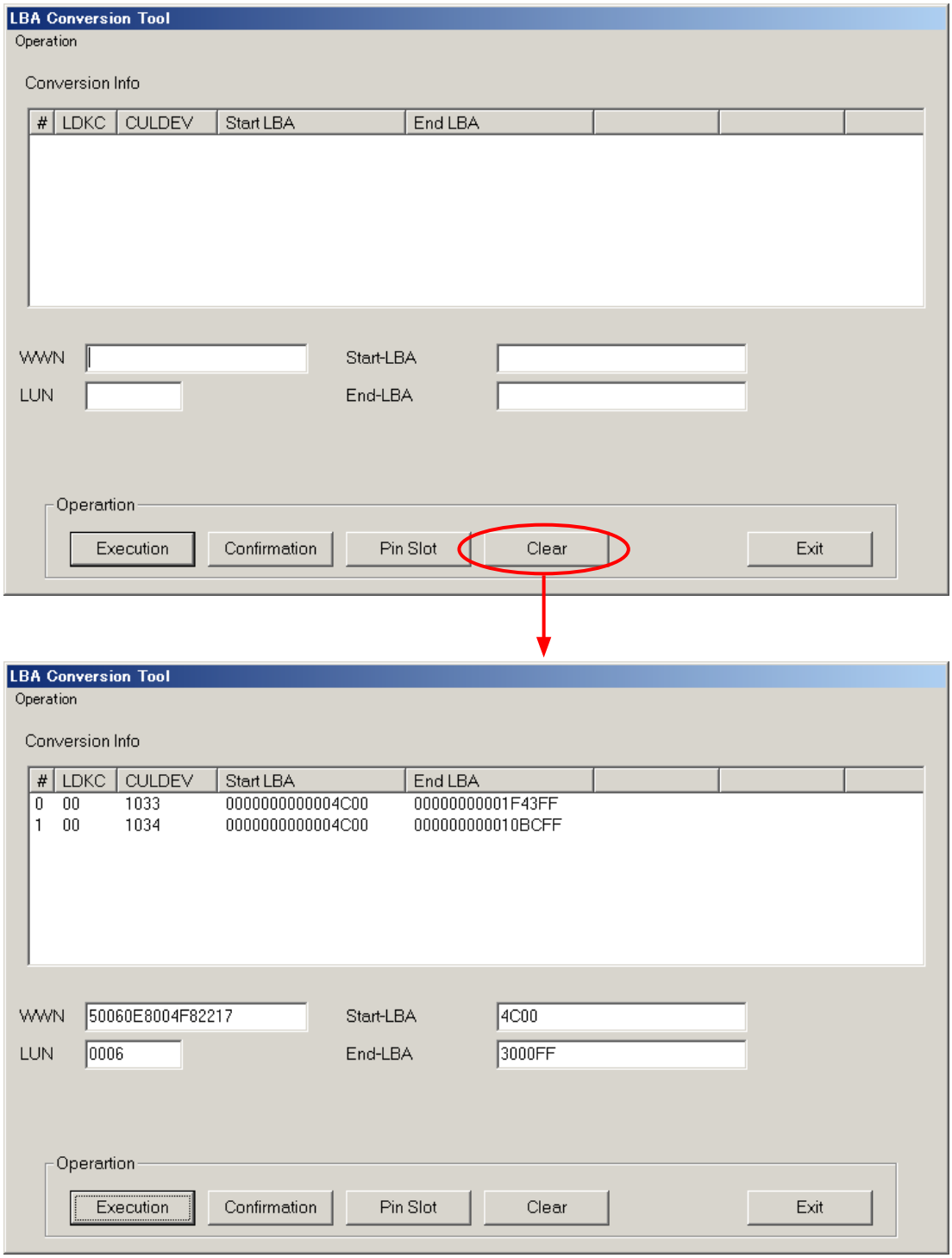


NOTE:
- Up to 128 pieces of information can be displayed.
- When the terminal slot is displayed, it may be displayed as smaller than one slot size.

You can also execute this process by selecting the [Pin Slot] button from the [Operation] menu bar besides pressing the [Execution] button.

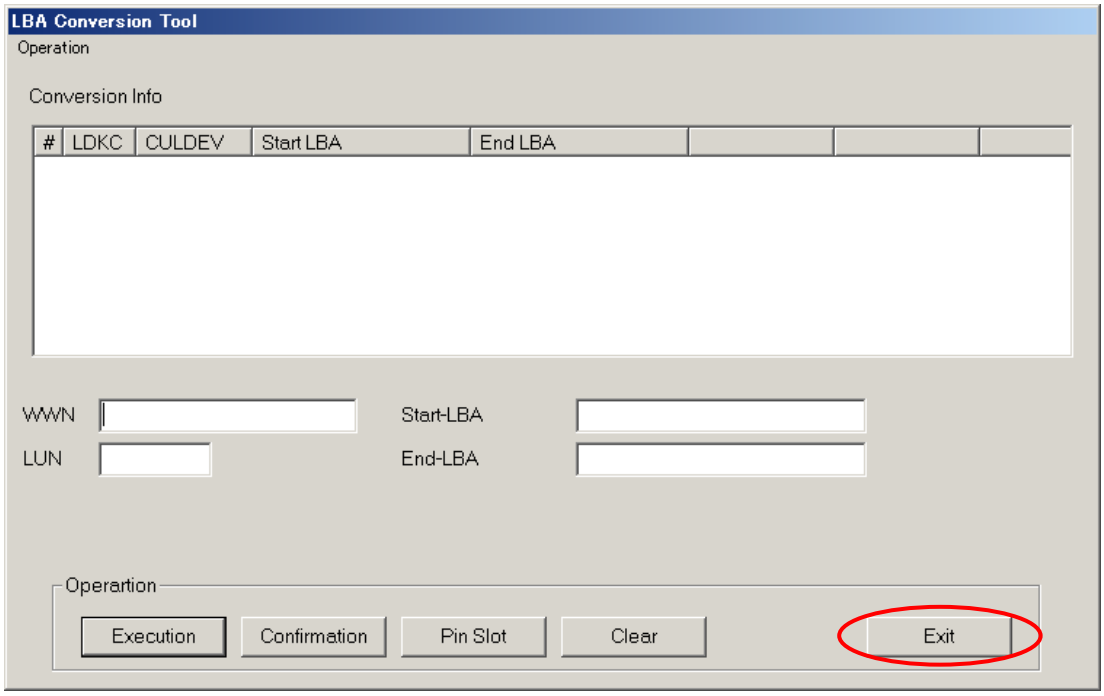
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6. <Procedure for erasing information displayed in the main window>
   When you press the [Clear] button in the main window, information displayed in the window is erased.



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7. <Procedure for quitting the tool>
   To quit the tool, press the [Exit] button in the main window.

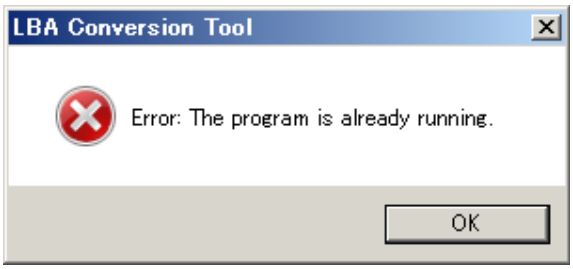


You can also execute this process by selecting the [Exit] button from the [Operation] menu bar besides pressing the [Execution] button.

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8. <Warning and error dialog boxes>
Warning and error dialog boxes are shown below.

(1) Warning about start of the tool
When the following dialog box is displayed, the tool has already been started.



(2) Input error
When the following dialog box is displayed, the data that has been entered is incorrect. Check the data that you entered.



(3) WWN error
When the following dialog box is displayed, the WWN that has been entered does not exist. Check the WWN that you entered.



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(4) External device error

When the following dialog box is displayed, the external device corresponding to the WWN and LUN that have been specified does not exist.

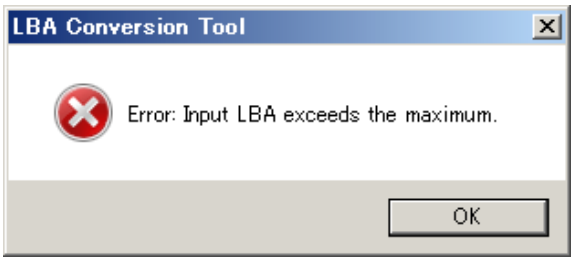
Check the WWN and LUN that you entered.



(5) LBA specification error

When the following dialog box is displayed, the value of the specified LBA exceeds the maximum LBA value of the device.

Check the LBA value that you entered.



(6) Memory reservation error

When the following dialog box is displayed, the memory failed to be reserved.



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(7) Config error

When the following dialog box is displayed, the configuration information could not be got correctly.



(8) Device error

When the following dialog box is displayed, the LDEV corresponding to the specified LBA does not exist.



(9) Item specification error

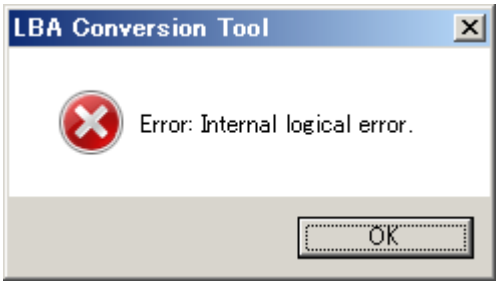
When the following dialog box is displayed, the item was not specified at the time of the verification and the Pin Slot display.



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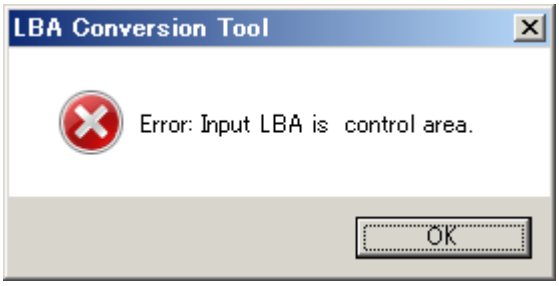
(10) Internal logical error

When the following dialog box is displayed, an error occurred in the internal logic.



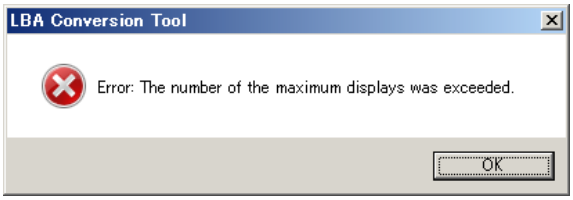
(11) Control area specification error

The specified LBA (CCCH) is a control area.



(12) Error of maximum number of displayed items

The number of displayed items in the PINSLOT window exceeded the allowable maximum value.



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11.5 Considerations When Performing Data Recovery on External Volume

Because write data to an external LDEV is stored in the cache of the Storage system once and then written to an LU of the external device by means of the asynchronous destaging operation, it is possible that Write Pending Data remains in the cache of the Storage system when a failure occurs in the external device. Therefore, it is required to make data restoration being conscious of the Write Pending Data.

1. When making restoration using backup data of a host
   (1) Restore an LU of the external device.
   (2) Restore a virtual LDEV of the Storage system.
   (3) Restore the data using backup data of a host.

2. When making restoration using backup data of the Storage system function
   (1) Restore an LU of the external device.
   (2) Restore a virtual LDEV of the Storage system.
   (3) Restore the data using the Storage system function.

3. When making restoration using backup data of the external device
   (1) Restore an LU of the external device.
   (2) Restore a virtual LDEV of the Storage system.
   (3) Make the Storage system execute the “Disconnect External Volumes” for the LU concerned. (The Write Pending Data is written to the external device.)
   (4) Make the external device restore the LU data of the external device using the backup data.
   (5) Restore the virtual LDEV by making the Storage system execute the “Reconnect External Volumes” for the virtual LDEV.

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11.6 Appendix

SIMs Possible to Be Detected in the DW800 Side during a Maintenance or Recovery Work Being Done for SANRISE AMS/9500V when SANRISE AMS/9500V Series Device Is Used as External Storage

				SIM reported by the Storage system	
No	Maintenance operation for AMS/9500V	Effect on the Storage system	Operation of the Storage system	①	②
1	CTL replacement	Link Down	Switching to alternative path or path blockade *1	○	○
2	Reboot (storage system)	Link Down	Switching to alternative path or path blockade *1	○	○

No	Failure occurs in AMS/9500V	Effect on the Storage system	Operation of the Storage system	①	②
1	Power stoppage	Link Down	Path detachment → Virtual volume blockade	○	○
2	CTL detachment	Link Down	Switching to alternative path or path blockade *1	○	○
3	CTL automatic reboot	Link down for two minutes	Switching to alternative path or path blockade *1	○	○
4	FC path failure	CRC error, frequent occurrence of Lip, etc.	Path blockade depending on frequency of failures *1	○	○

No	Field maintenance operation for AMS/9500V	Effect on the Storage system	Operation of the Storage system	①	②
1	Update Firmware (with storage system power on or off)	Link Down	Switching to alternative path or path blockade *1	○	○
2	Deliberate shutdown	Link Down	Switching to alternative path or path blockade *1	○	○

*1: LDEV is blockaded when no alternative path exists.

① 21d0xy Blockade of an external storage path

② efd000 Blockade of an external storage device

③ 21d2xy Excess of threshold value of path response time

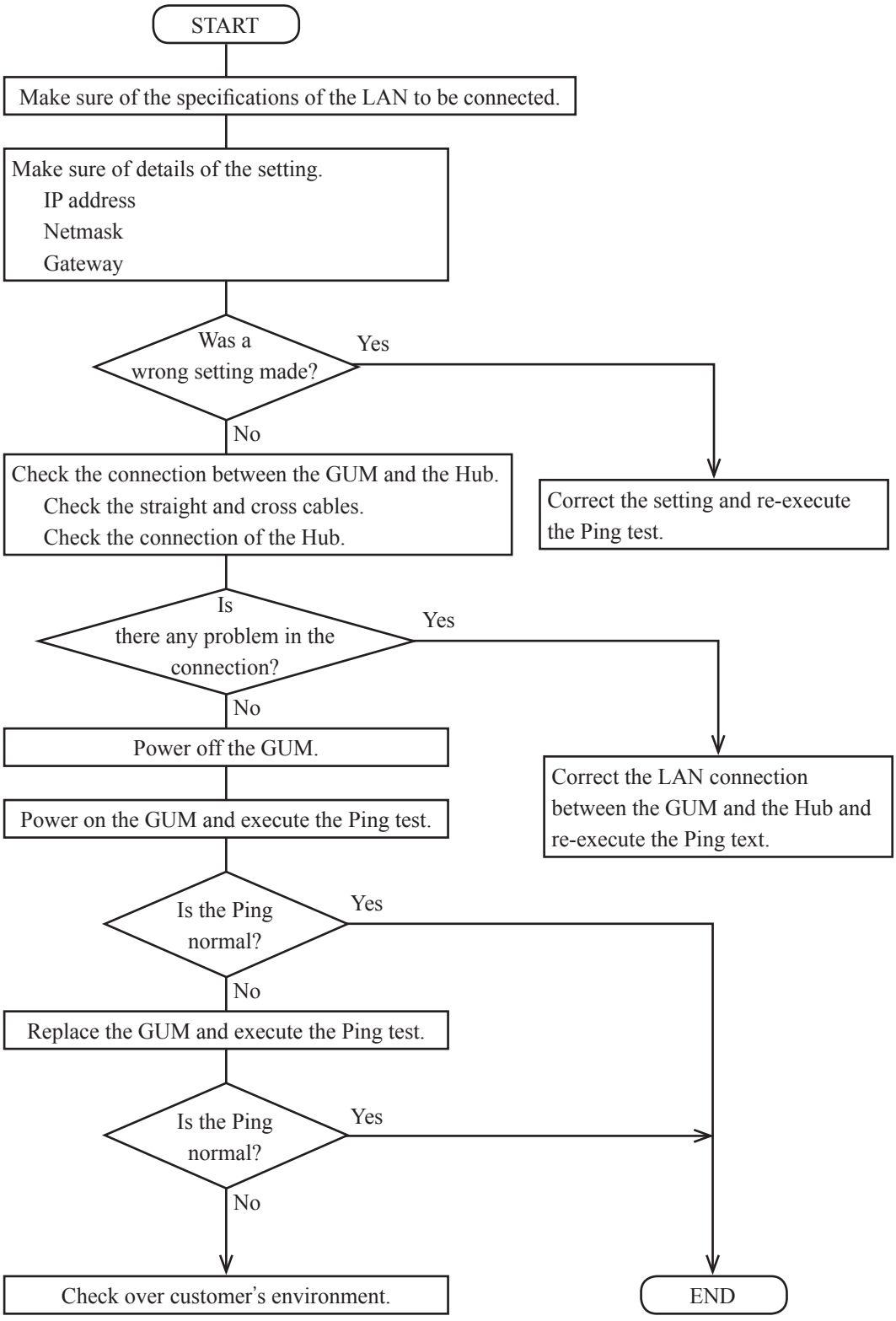
As to ③, it may occur when a process is delayed because of a failure occurs in the AMS/9500V series or FC path and the time limit is exceeded.

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12. Recovery from SNMP Failure

A procedure for coping with a trouble occurs during a check to be done after installation of a P.P. of the SNMP is shown below.

12.1 Recovery Procedure for SNMP Ping Test



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12.2 When Trap Cannot Be Received While Ping Reaches Manager PC Prepared by Customer

1. Check the settings of Enable in the “SNMP Setting” window on the confirmation GUM.
   (1) Check if “ENABLE” is selected
   → If not, it choose.

   (2) Check if the Community name has been added.
   → If not, add it.

   (3) Check if the setting of the Enable is that in which the Manager PC concerned is specified as a receiver of the trap.
   → If it is wrongly specified, make the trap receiver to be added with or changed to the IP address of the Manager PC.

   (4) In the case of the cold start trap at the time when the GUM is rebooted
   Check if the setting on the Manager side is that in which the trap of the cold start can be received.
   → Check if the setting is not the one in which only the failure trap is received by means of a masking.

2. When the Firewall/Gateway exists in the network between the GUM and the PC prepared by a customer, check if the UDPs of the Ports #161 and #162 allow the passing.
   → Ask the customer to change the setting to allow the passing.

3. Check the customer's Manager for the setting of the trap reception.
   → Ask the customer to check if the setting is correct.

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12.3 SNMP Trap Information

Failure information supported by the SNMP is shown below.

1. Specifications of the extended trap

Item	Specification	Remarks
SNMP Community	Community name that is set	
PDU Type	Trap PDU	
Enterprise ID	Agent identifier	
Agent IP Address	Agent IP address	
Generic Trap Code	Enterprise Specific	
Specific Trap Code	See the following "2. Specific trap codes".	
Extended Trap PDU	See the following "3. Extended trap PDU".	

2. Specific trap codes

   Each of these codes is shown as the Kind in a trace file.

Code	Name	Meaning
1	RaidEventAcute	Report on failure occurrence: Storage system shut off completely.
2	RaidEventUserSerious	Report on failure occurrence: Operation of a failed part shut off.
3	RaidEventUserModerate	Report on failure occurrence: A partial failure occurred.
4	RaidEventUserService	Report on failure occurrence: A slight failure occurred.
100	RaidCommandFinished	Report on completion of execution of a requested command

3. Extended trap PDU

   The following is information notified to the Manager as the trap.

Name	Type	Description
EventTrapSerialNumber	Integer	Serial number of the Controller Chassis in which a failure occurred.
EventTrapNickname	DisplayString	Nickname of the storage system in which a failure occurred.
EventTrapREFCODE	DisplayString	Reference code of a failure: See SIM RC SECTION (SIMRC00-00).
EventTrapPartsID	Object IDENTIFIER	Part in which a failure occurred.

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13. Failure recovery of Encryption License Key

13.1 Recovery procedure when acquisition failure from key SVP (SIM = 661000)

Key encryption key acquisition from key management server at the time of DKC start is failed. All volumes can't be accessed. Communication re-establishment with the key management server, PS OFF and PS ON are necessary for restoration.
Please restore the communication with the key management server and the volumes according to the following procedures.

NOTICE: When key encryption key acquisition at the time of DKC start is failed, DKB/ENC/HDD replacement, CEK Rekey, enabling/disabling data encryption at parity group, initializing encryption environmental settings will be failed. Please restore the DKC before replacement according to the following procedures.

NOTICE: When the firmware version is less than 83-02-01-x0/xx for DKCMAIN (83-02-01-x0/xx for SVP), perform the following before turning on the Storage System.
(1) Click the buttons [Control Panel] – [System] – [Advance Setting of System] – [Environment Variable (N)] on the PC in which the SVP is installed.
(2) When the "Environment Variable" window is displayed, select [Path] of [System Environment Variable (S)] and click the [Edit (I)] button.
(3) Add the following to the end of the variable value (if the installation destination of the SVP was changed from the default, replace the part of "C:\Mapp" with the installation directory).
"C:\Mapp\OSS\java\bin;"

1. Give notice to customer
   Please give notice to customer and ask their Security Administrator (View & Modify) to do the following operations.

   (1) Start the SVP.

   (2) Connection with the key management server
   Key acquisition from key management server at the time of DKC start is failed. Please check if LAN cables are connected to SVP correctly, and then Security Administrator confirm that the connection between SVP and the key management server is established using [Sever Configuration Test : Check] of Edit Encryption Environmental Settings of Storage Navigator.
   If the [Server Configuration Test] is failed, the key management server may be not working or the communication error may occur between SVP and the key management server. Please ask a customer to recover them.

2. Recovery of the device by maintenance personnel
   After the completion of customer's operations above, please do PS OFF and PS ON. And then please confirm that all volumes are restored.

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13.2 Recovery procedure for Encryption key threshold warning and depletion (SIM = 660100, 660200)

The rest of Encryption Keys are less than threshold warning level or zero. If there is no free encryption key, drive installation, drive replacement and DKB replacement fails. Please give notice to customer and ask them to create encryption keys.

The following SIMs are reported:

SIM = 660100 : This SIM is reported when there is no free encryption key.

SIM = 660200 : This SIM is reported when the rest of free encryption key reaches warning threshold level. The threshold level is variable number that depends on the number of installed spare drives and the number of installed DKB.

The recovery procedure is as follows.

When this SIM occurs at the time of Initialize Encryption Environmental Settings, this recovery procedure is not necessary.

1. Give notice to customer
   - If there is no free encryption key, drive installation, drive replacement and DKB replacement fails. Please give notice to customer and ask them to create encryption keys. The creation of the maximum number of keys is recommended.
   - A user who have Security Administrator (View & Modify) role can create encryption keys.
   - The following number of keys are needed

     Drive installation, drive replacement : 1 encryption key per drive

     DKB replacement : 3 encryption keys per DKB

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13.3 Recovery procedure of DKB failure when restoring Encryption Keys

If the latest Encryption Keys have not been restored for the reason that Certificate Encryption Keys have been rekeyed after the backup, encryption DKB may be blocked.
Please execute not the dummy replacement but the replacement all encryption DKBs under technical support division's guidance, even if not all encryption DKBs are blocked.

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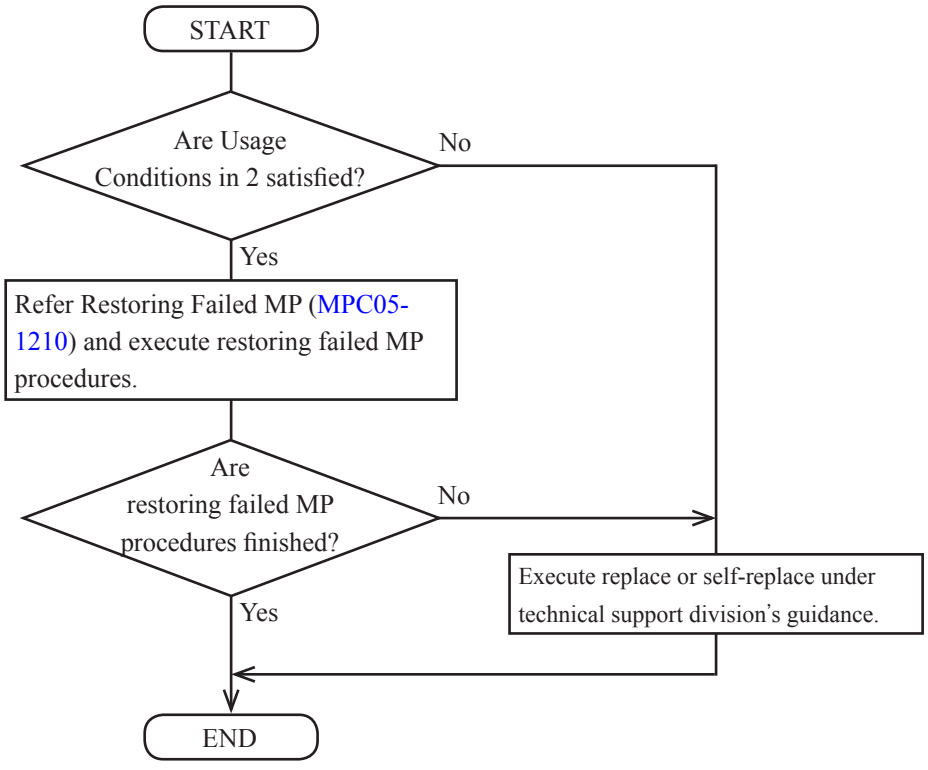
14. MP Blockade Reset Function

1. Usage Guideline
   - This is a special function to recover a MP blockade operation without the need to self-replace the card under certain conditions specified below.
   - To use this function, please open a case with your Technical Support Division and proceed under their guidance.

2. Usage Conditions
   - To recover a MP in which WCHK1 occurred due to a Firmware.
     Eg.) Cache of WCHK1 is EC = 1644.
   - Requested as a recovery procedure for an issue notified by an Early Notice/Alert.
   - Requested by following the procedure described in Maintenance Manual.

   Not to be used to recover hardware failures.

3. MP Reset Procedure Flowchart



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15. Forced Outage and Restart of DKC/DB

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down may be caused if it is performed without due notice.

There are four ways of Forced Powering Off. Please refer to a way which is appropriate for your work.

No.	Section Title	Volatilizing data in SM/CM	Storing data in SM/CM in CFMs (*1)	Turning off DB breakers	Page
1	Forced Outage and Restarting Procedure for Non-Volatile	Non-volatilization (Data in SM/CM is restored from CFMs.)	Yes	Yes	TRBL15-20 (*2)
2	Forced volatilization (full) power-off and restarting procedure 1-1	Volatilization (All data in SM/CM is deleted.)	No	Yes	TRBL15-80 (*4)
3	Forced volatilization (full) power-off and restarting procedure 1-2	Volatilization (All data in SM/CM is deleted.)	No	Yes	TRBL15-100 (*2)
5	Forced volatilization (part) power-off and restarting procedure 2-1	Volatilization (Only specific data (*3) in SM/CM is restored from CFMs.)	Yes	No	TRBL15-130 (*5)
6	Forced volatilization (part) power-off and restarting procedure 2-2	Volatilization (Only specific data (*3) in SM/CM is restored from CFMs.)	Yes	Yes	TRBL15-150

*1: When data in SM/CM is stored in CFMs, batteries are used. Therefore, energy in batteries is consumed.

*2: If data in SM/CM cannot be stored in CFMs, No.1 and No.5 ways are not available.
Check that Battery/CFM is normal in advance.

*3: Only management information of both Quick Format and HDP is restored from CFMs. The other data in SM/CM is deleted.

*4: Forced volatilization (full) procedure 1-2 is a procedure when the system parameter editing is impossible.
When the editing is possible, use Procedure 1-1 in accordance with the instructions by the Technical Support Division.

*5: Forced volatilization (part) procedure 2-2 is a procedure when PSOFF is impossible. To execute PSOFF, use Procedure 2-1 in accordance with the instructions by the Technical Support Division.

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15.1 Non volatilization power-off and restarting procedure

When this procedure is executed, the AC input of the power supply of the DKC and the DB is compulsorily cut off, and the power supply is turned off immediately. The data in the CM is stored to the CFM, and is restored to the cache memory after restart.
To restart system of SM/CM volatilizing, refer to “15.2 Forced volatilization (full) power-off and restarting procedure 1-1” and “15.3 Forced volatilization (full) power-off and restarting procedure 1-2”.

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down may be caused if it is performed without due notice.
- Check that A jumper used for cache memory volatilization is not Enable before performing the operation. If you perform it in the Enable status, a customer data loss may be caused.

1. Display “Maintenance Utility” window.

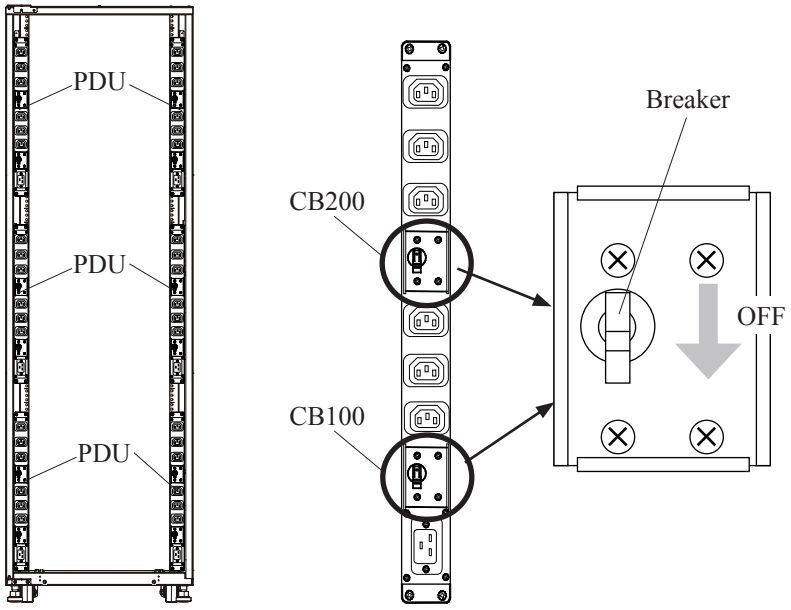
2. Check whether there is blinking part in all CM PCBs and the batteries installed in the device.

   <When there is a blinking part>
   Try this procedure again after recovering the problem part, except when other instructions exist from T.S.D.

   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click the [Exit], close “Maintenance Utility” window, and go to the next section.

3. Turn off the PDU breakers that are connected to the DKC.

Figure 15-1 Turning Off PDU Breaker



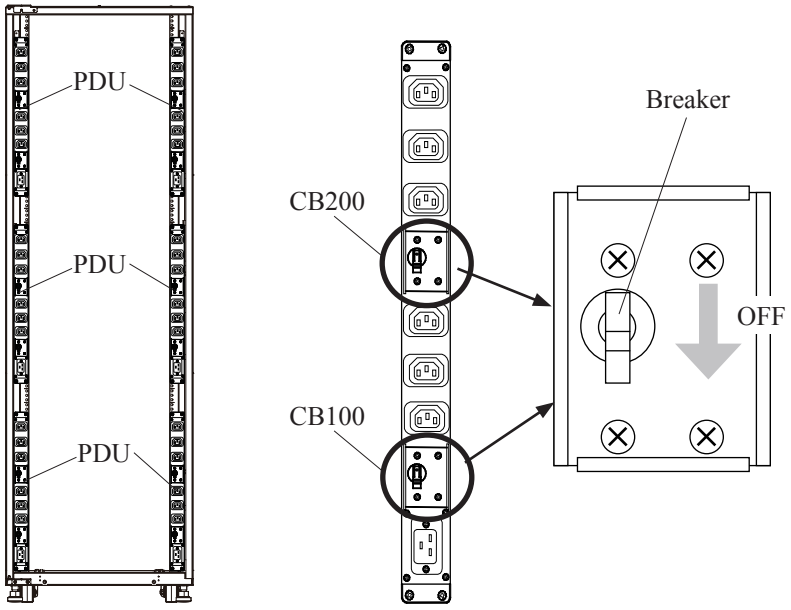
Rear view of rack frame Front view of PDU

For information about the Hitachi Universal V2 rack used with HDS VSP storage systems, refer to the Hitachi Universal V2 Rack Reference Guide(MK-94HM8035).

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4. Turn off the PDU breakers that are connected to the DB.

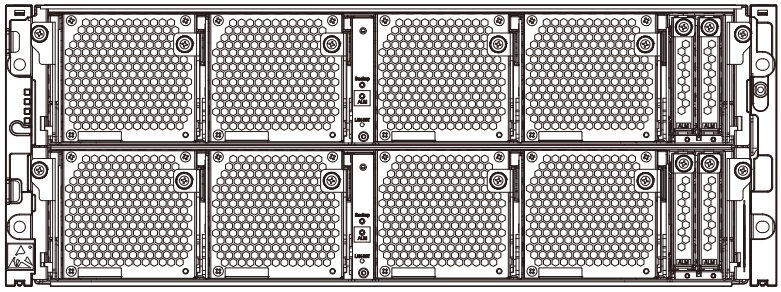
Figure 15-2 Turning Off PDU Breaker



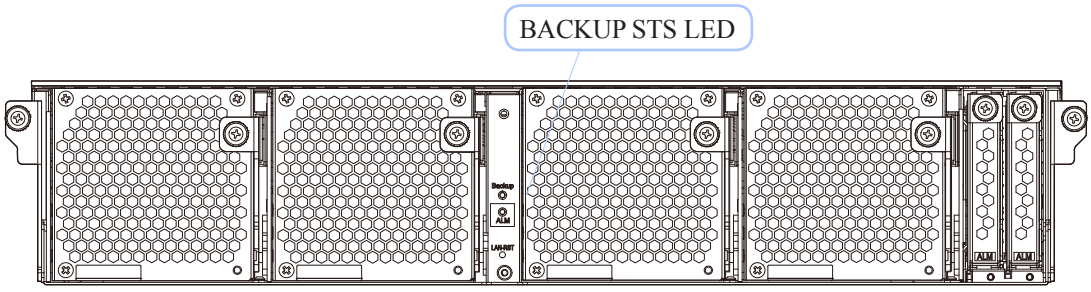
Rear view of rack frame Front view of PDU

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5. Wait for 30 seconds or more until the BACKUP STS LED blinks (low-speed).
   CBLM/CBLH

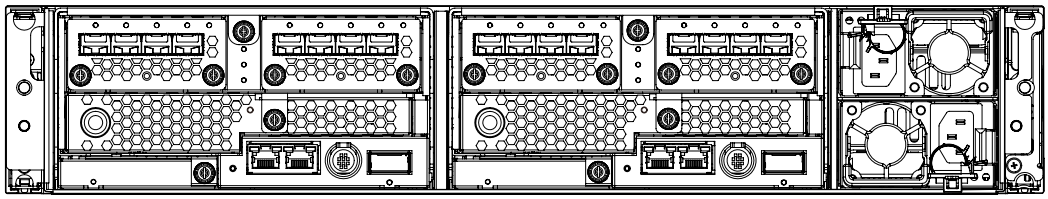


Front of CBLM/CBLH

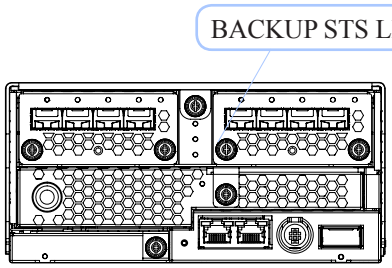


Controller Board (CBLM/CBLH)

CBSS/CBSL



Rear of CBSS/CBSL

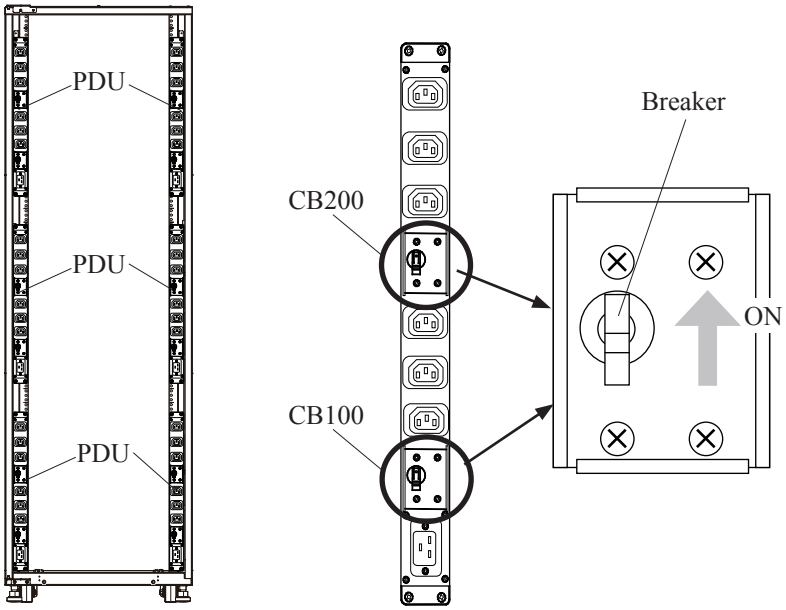


Controller Board (CBSS/CBSL)

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6. Turn on the PDU breakers that are connected to the DB.

Figure 15-3 Turning On PDU Breaker

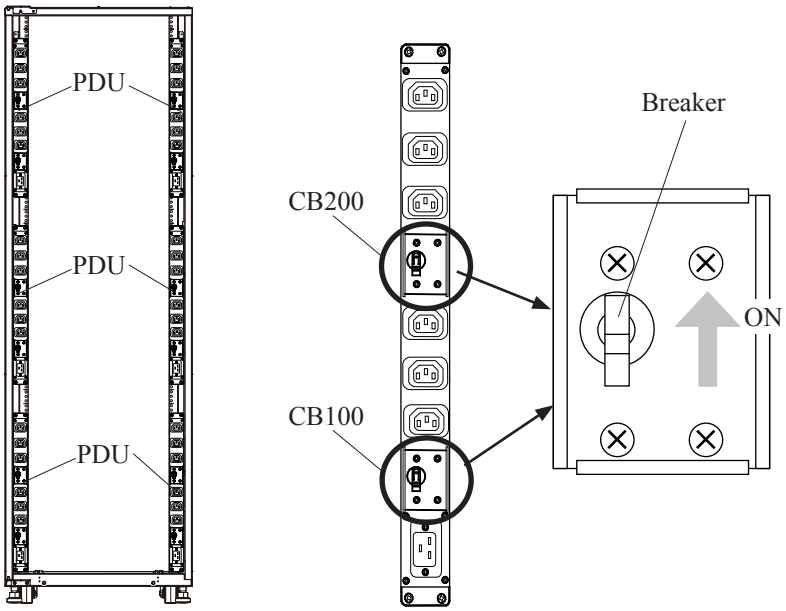


Rear view of rack frame Front view of PDU

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7. Turn on the PDU breakers that are connected to the DKC.

Figure 15-4 Turning On PDU Breaker



Rear view of rack frame Front view of PDU

8. After the Backup LED changes from blinking (low-speed) to going out, the Storage System power turns on automatically.

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15.2 Forced volatilization (full) power-off and restarting procedure 1-1

When this procedure is executed, the AC input of the power supply of the DKC and the DB is compulsorily cut off, and the power supply is turned off immediately. Using this procedure, the data in the CM is not stored to the CFM. Therefore, when you restart the system the SM/CM is volatile.
To restart the system and not to volatilize the SM/CM, refer to "15.1 Non volatilization power-off and restarting procedure" (TRBL15-20).

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down, loss of user data or loss of configuration information may be caused if it is performed without due notice.
- The DKC processor failure forcible volatile warning (fffe0x) may occur during this work.
- The forced volatilization procedures have four types. Since the SM volatilization ranges differ, follow the instructions by the Technical Support Division for which to work on.
- After this Operation was completed, please refer the FIRMWARE SECTION "5. Config Exchange Procedure", and re-perform Config Version Up with the media of the version same as Config on the device by all means.

1. Display "Maintenance Utility" window.

2. Check whether there is blinking part in all CM PCBs and the batteries installed in the device.

   <When there is a blinking part>
   Try this procedure again after recovering the problem part, except when other instructions exist from T.S.D.

   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click the [Exit], close "Maintenance Utility" window, and go to the next section.

3. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and change A jumper used for cache memory volatilization to Enable.

4. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-1 (TRBL15-30).

5. Turn off the PDU breakers that are connected to the DB.
   → Refer to Figure 15-2 (TRBL15-40).

6. Wait for 30 seconds or more until the BACKUP STS LED goes out.

7. Turn on the PDU breakers that are connected to the DB.
   → Refer to Figure 15-3 (TRBL15-60).

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8. Turn on the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-4 (TRBL15-70).

9. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and check that A jumper used for cache memory volatilization is Disable. Turning off/on the Storage System changes A jumper used for cache memory volatilization to Disable automatically. Be sure to confirm that the status is Disable. When using it in the Enable status, turning off the Storage System due to power outage or others may cause a loss of the customer data.

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15.3 Forced volatilization (full) power-off and restarting procedure 1-2

When this procedure is executed, the AC input of the power supply of the DKC and the DB is compulsorily cut off, and the power supply is turned off immediately. Using this procedure, the data in the CM is not stored to the CFM. Therefore, when you restart the system the SM/CM is volatile.
To restart the system and not to volatilize the SM/CM, refer to "15.1 Non volatilization power-off and restarting procedure" (TRBL15-20).

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down, loss of user data or loss of configuration information may be caused if it is performed without due notice.
- The forced volatilization procedures have four types. Since the SM volatilization ranges differ, follow the instructions by the Technical Support Division for which to work on.
- After this Operation was completed, please refer the FIRMWARE SECTION "5. Config Exchange Procedure", and re-perform Config Version Up with the media of the version same as Config on the device by all means.
- Do not change location of Cache Memory and CFM after turning off the PDU breakers because loss of user data or configuration information may be caused.

1. Display "Maintenance Utility" window.

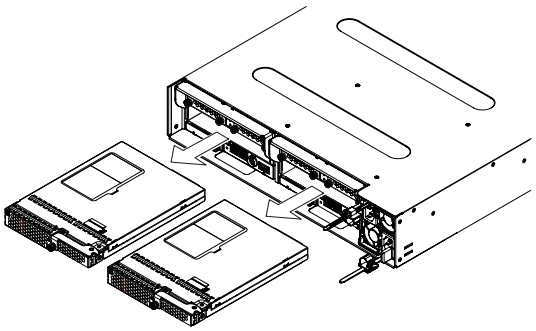
2. Check whether there is blinking part in all CM PCBs and the batteries installed in the device.

   <When there is a blinking part>
   Try this procedure again after recovering the problem part, except when other instructions exist from T.S.D.

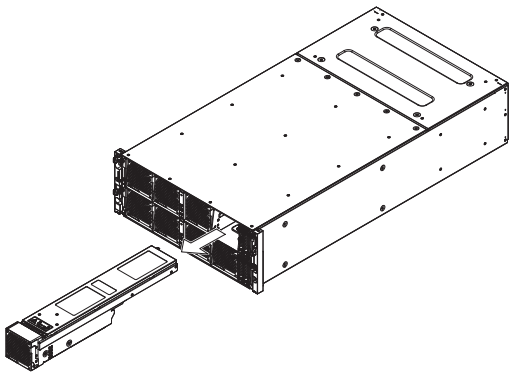
   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click the [Exit], close "Maintenance Utility" window, and go to the next section.

3. Remove the BKM or BKMF
   When they are CBSS or CBSL, refer to LOCATION SECTION "2.4.1.1 BKM" to remove BKM-1 and BKM-2.
   When they are CBLM or CBLH, refer to LOCATION SECTION "2.4.2.1 BKMF" to remove BKMF-13 and BKMF-23.

CBSS/CBSL



CBLM/CBLH



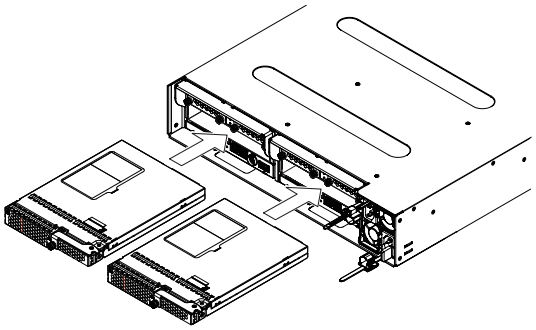
4. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-1 (TRBL15-30).

5. Turn off the PDU breakers that are connected to the DB.
   → Refer to Figure 15-2 (TRBL15-40).

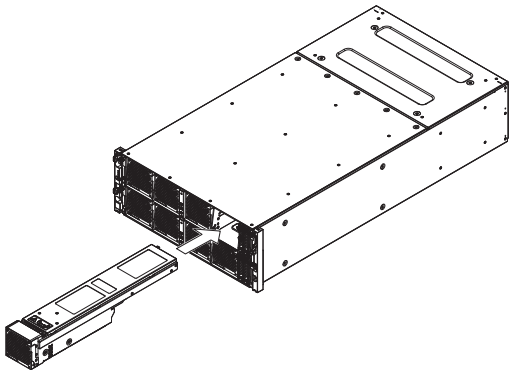
6. Wait for 30 seconds or more until the BACKUP STS LED goes out.

7. Attach the BKM or BKMF
   When they are CBSS or CBSL, refer to LOCATION SECTION "2.4.1.1 BKM" to attach BKM-1 and BKM-2.
   When they are CBLM or CBLH, refer to LOCATION SECTION "2.4.2.1 BKMF" to attach BKMF-13 and BKMF-23.

CBSS/CBSL



CBLM/CBLH



8. Turn on the PDU breakers that are connected to the DB.
   → Refer to Figure 15-3 (TRBL15-60).

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9. Turn on the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-4 (TRBL15-70).

10. Refer to INSTALLATION SECTION "1.5.1 Storage System Power On", and turn on the POWER ON/OFF switch.

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15.4 Forced volatilization (part) power-off and restarting procedure 2-1

Performing this work forcibly disconnects the AC input of DKC and DB power. It does not only turn off the power immediately but also does not recover the save data on the Cache SSD on the SM/CM. Therefore, the SM/CM volatilizes after restarting.

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down, loss of user data or loss of configuration information may be caused if it is performed without due notice.
- The DKC processor failure forcible volatile warning (fffe0x) may occur during this work.
- The forced volatilization procedures have four types. Since the SM volatilization ranges differ, follow the instructions by the Technical Support Division for which to work on.
- After this Operation was completed, please refer the FIRMWARE SECTION "5. Config Exchange Procedure", and re-perform Config Version Up with the media of the version same as Config on the device by all means.
- Do not change location of Cache Memory and CFM after turning off the PDU breakers because loss of user data or configuration information may be caused.

1. Display "Maintenance Utility" window.

2. Check whether there is blinking part in all CM PCBs and the batteries installed in the device.

   <When there is a blinking part>
   Try this procedure again after recovering the problem part, except when other instructions exist from T.S.D.

   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click the [Exit], close "Maintenance Utility" window, and go to the next section.

3. Refer to INSTALLATION SECTION "1.5.2 Storage System Power Off (Sequential Shutdown)" and turn off the main switch. Press the main switch on the front of the Controller Chassis for about three seconds to turn it off.

4. Check that the POWER LED on the front of the Storage System changes from green to amber.
   It takes about 10 minutes at a maximum to change the LED to amber. After the POWER LED lights up in amber, the ACT LED (green) on the Drive may be blinking, but it is not a problem.

5. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and change A jumper used for cache memory volatilization to Enable.

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6. Refer to INSTALLATION SECTION "1.5.1 Storage System Power On" and turn on the main switch.

7. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and change A jumper used for cache memory volatilization to Disable.

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15.5 Forced volatilization (part) power-off and restarting procedure 2-2

Performing this work forcibly disconnects the AC input of DKC and DB power. It does not only turn off the power immediately but also does not recover the save data on the Cache SSD on the SM/CM. Therefore, the SM/CM volatilizes after restarting.

⚠ CAUTION

- This operation supposes a special case such as a recovery from a failure unlike the usual powering off operation. Do not perform this operation without a direction given by the T.S.D. because a system down, loss of user data or loss of configuration information may be caused if it is performed without due notice.
- The DKC processor failure forcible volatile warning (fffe0x) may occur during this work.
- The forced volatilization procedures have four types. Since the SM volatilization ranges differ, follow the instructions by the Technical Support Division for which to work on.
- After this Operation was completed, please refer the FIRMWARE SECTION "5. Config Exchange Procedure", and re-perform Config Version Up with the media of the version same as Config on the device by all means.
- Do not change location of Cache Memory and CFM after turning off the PDU breakers because loss of user data or configuration information may be caused.

1. Display "Maintenance Utility" window.

2. Check whether there is blinking part in all CM PCBs and the batteries installed in the device.

   <When there is a blinking part>
   Try this procedure again after recovering the problem part except when other instructions exist from T.S.D.

   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click the [Exit], close "Maintenance Utility" window, and go to the next section.

3. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-1 (TRBL15-30).

4. Turn off the PDU breakers that are connected to the DB.
   → Refer to Figure 15-2 (TRBL15-40).

5. Wait until the BACKUP STS LED changes from blinking (low-speed) to going out.
   Note that it takes about 20 minutes at a maximum until all LEDs go out.

6. Remove the BKM or BKMF
   When they are CBSS or CBSL, refer to LOCATION SECTION "2.4.1.1 BKM" to remove BKM-1 and BKM-2.
   When they are CBLM or CBLH, refer to LOCATION SECTION "2.4.2.1 BKMF" to remove BKMF-10 and BKMF-20.

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7. Turn on the PDU breakers that are connected to the DB.
   → Refer to Figure 15-3 (TRBL15-60).

8. Turn on the PDU breakers that are connected to the DKC.
   → Refer to Figure 15-4 (TRBL15-70).

9. Take an interval of 30 seconds or more.

10. Attach the BKM or BKMF
    When they are CBSS or CBSL, refer to LOCATION SECTION "2.4.1.1 BKM" to attach BKM-1 and BKM-2.
    When they are CBLM or CBLH, refer to LOCATION SECTION "2.4.2.1 BKMF" to attach BKMF-10 and BKMF-20.

11. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and change A jumper used for cache memory volatilization to Enable.

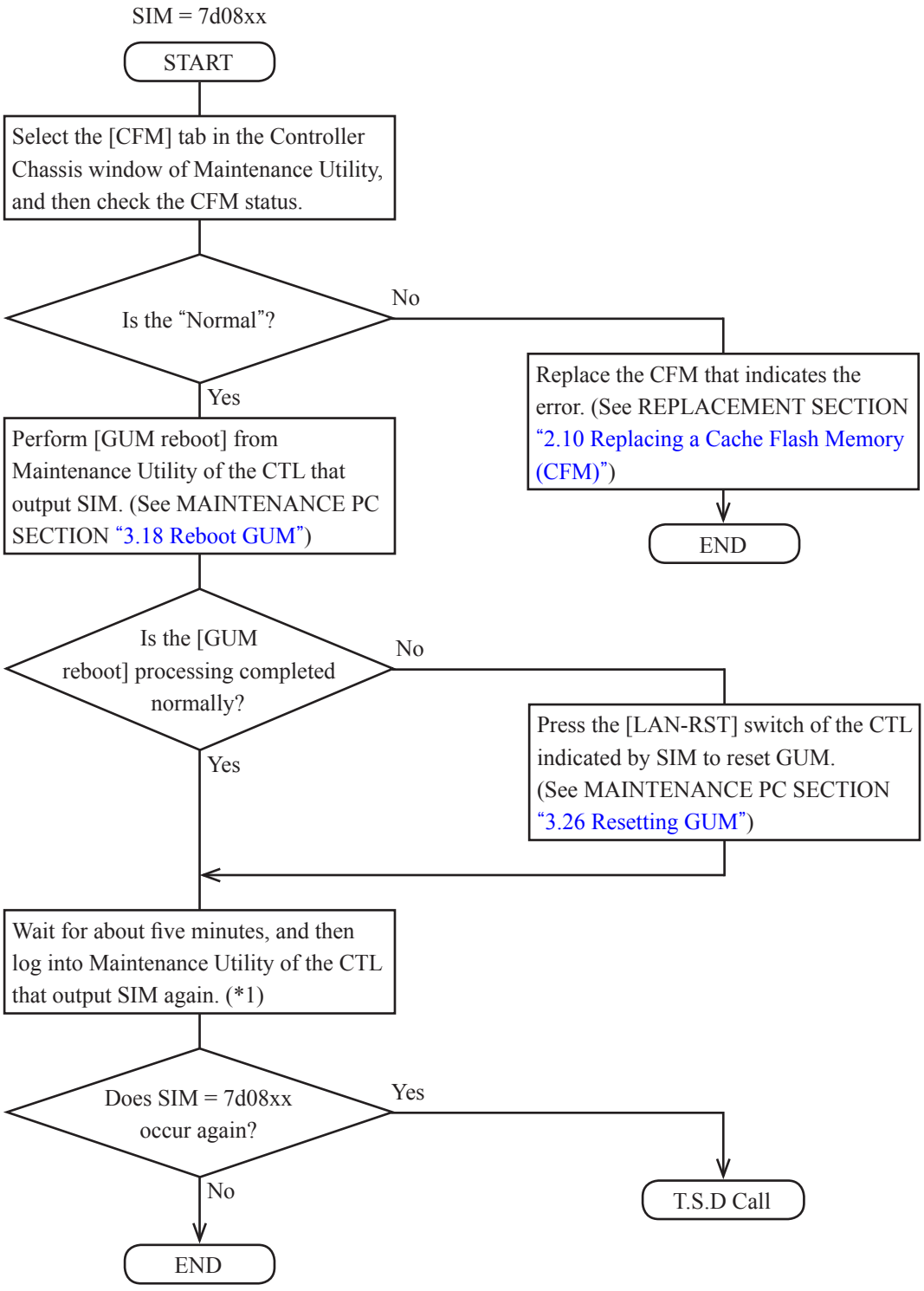
12. Refer to INSTALLATION SECTION "1.5.1 Power ON Procedure", and turn on the POWER ON/OFF switch.

13. Wait until it becomes READY.

14. Refer to MAINTENANCE PC SECTION "3.16 Edit System Parameters" and change A jumper used for cache memory volatilization to Disable.

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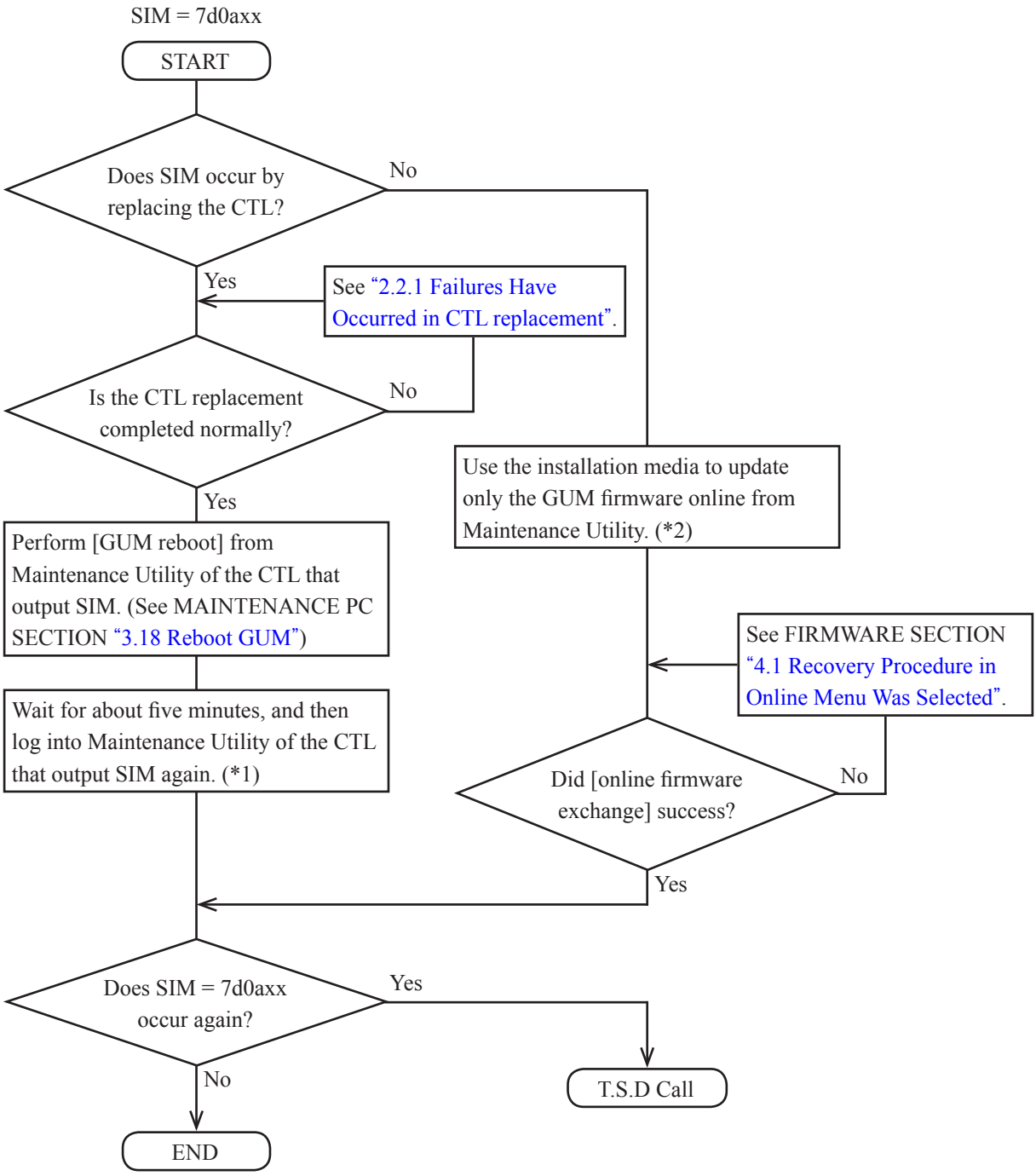
16. Recovery Procedure for GUM Information Recover Failure (SIM = 7d08xx)



*1: If you cannot log in, wait for about one to two minutes to log in again. It might take a maximum of 20 minutes to be able to log in.

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17. Recovery Procedure for GUM Version Warning (SIM = 7d0axx)



*1: If you cannot log in, wait for about one to two minutes to log in again. It might take a maximum of 20 minutes to be able to log in.

*2: The GUM firmware can be updated either by [When updating firmware collectively] or [When updating firmware separately].
To update only the GUM firmware, check only the checkbox of GUM when confirming the updated contents of the firmware.

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18. Recovery from Global-active Device Functions Failure

18.1 Recovery Procedure for Global-active Device Functions Failure

Failure suspension of a GAD pair, path block between a GAD pair, and Quorum Disk block may occur triggered by hardware failure and so on. This chapter shows explanation and recovery procedures of failure in GAD functions.

Failure occurrence in GAD functions can be detected by the following.

- SIM report of failure suspension of a GAD pair
- SIM report of path block between a GAD pair
- SIM report of Quorum Disk block

Table 18-1 GAD SIM REF.CODE

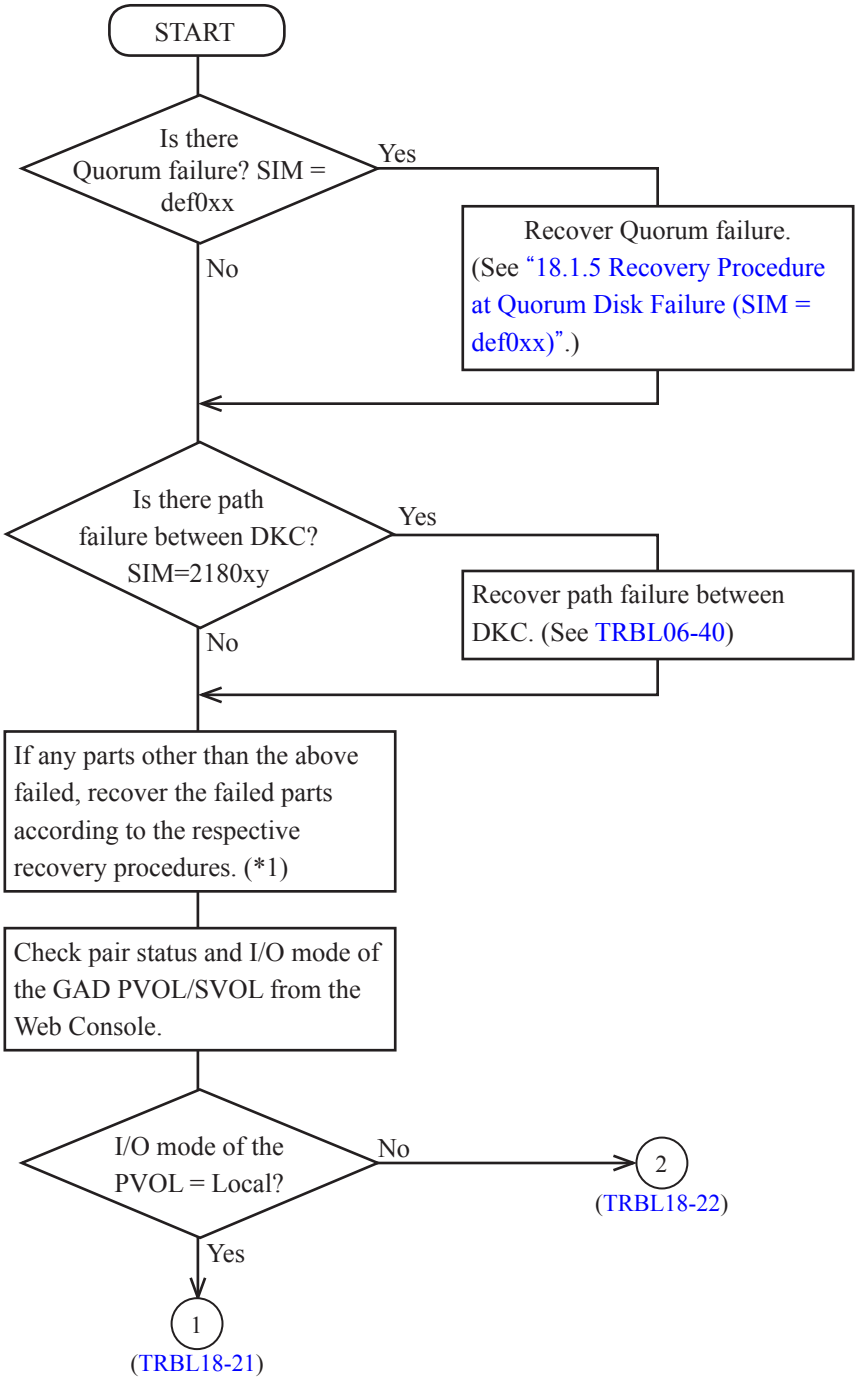
SIM REF.CODE	Meaning	Remarks
ddxyzz	Failure suspension of a GAD pair	X: Failure suspension type (0 to 3) Y: The lowest digit of CU number ZZ: LDEV number
2180-xy	Path block between a GAD pair	X: CHB PCB # Y: Port# in PCB
dee0xx	Quorum Disk recovery	XX: Quorum Disk ID
def0xx	Quorum Disk block	XX: Quorum Disk ID

The following flow charts describe recovery procedures for each type of failure in GAD.

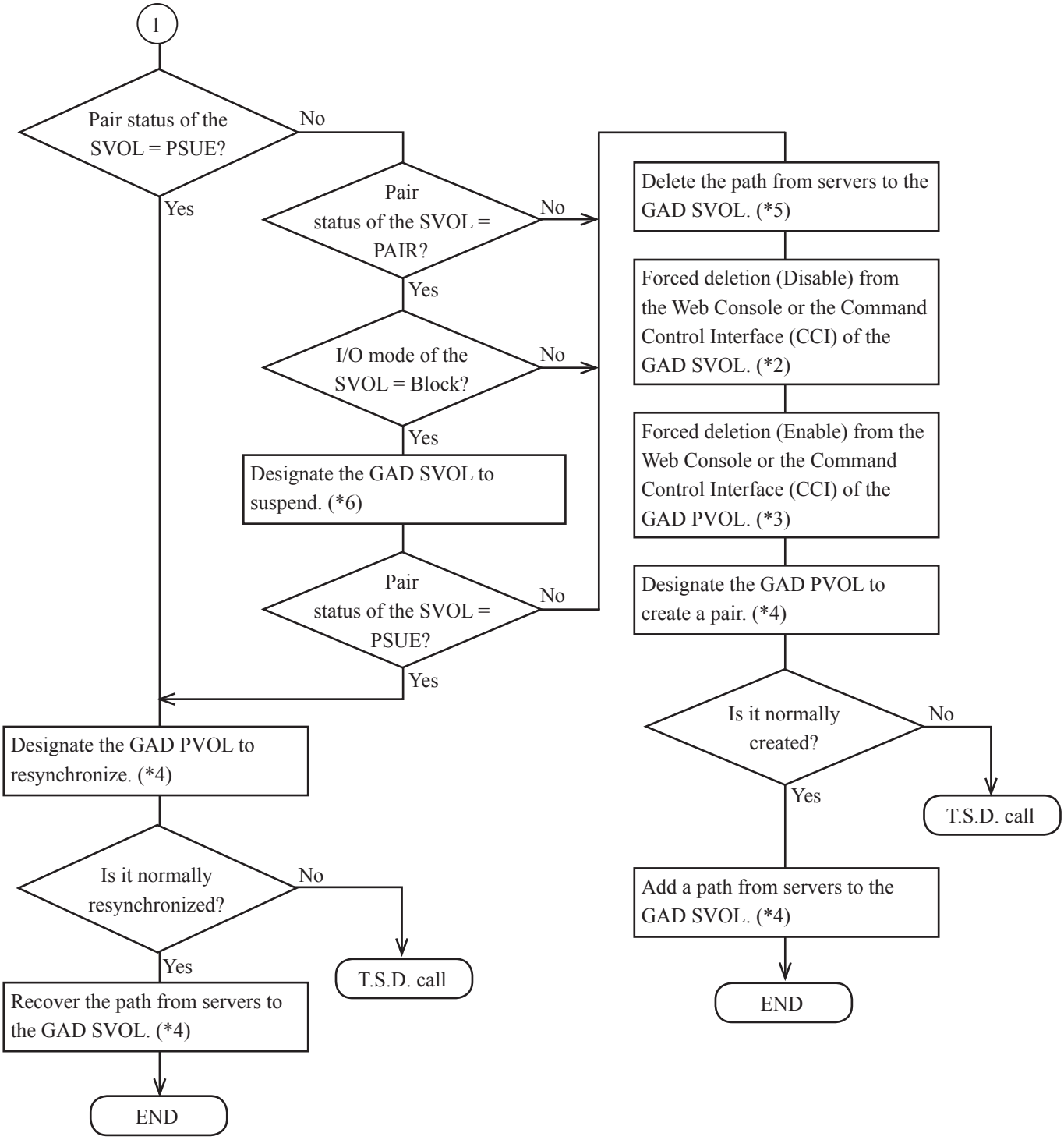
Additionally, the failure recovery procedure at path block occurrence between a GAD pair is identical with the failure recovery procedure in TrueCopy function, and the procedure is described in TRBL06-40.

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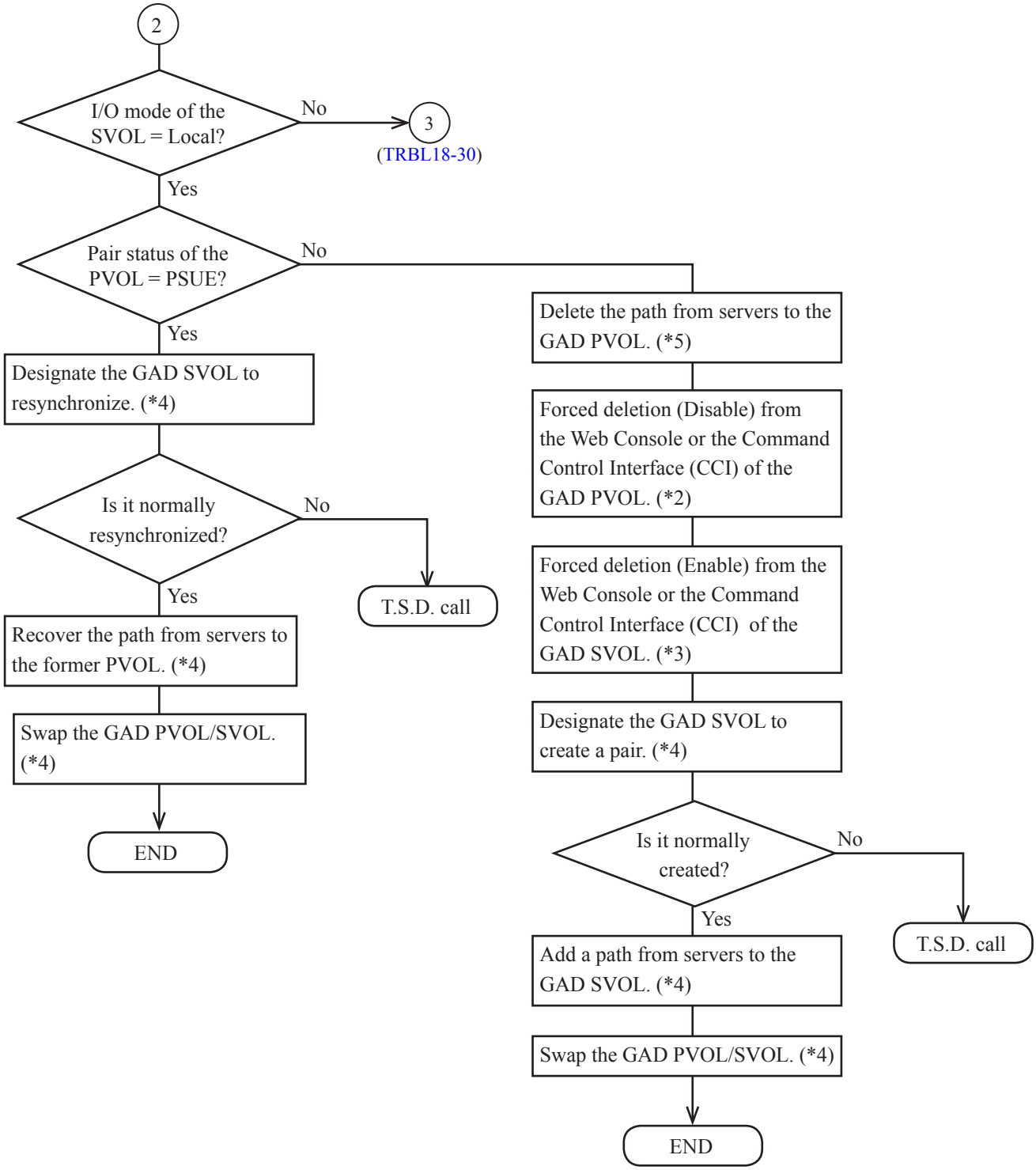
18.1.1 Recovery Procedure at Failure Suspension of a GAD Pair (SIM = ddxyzz)



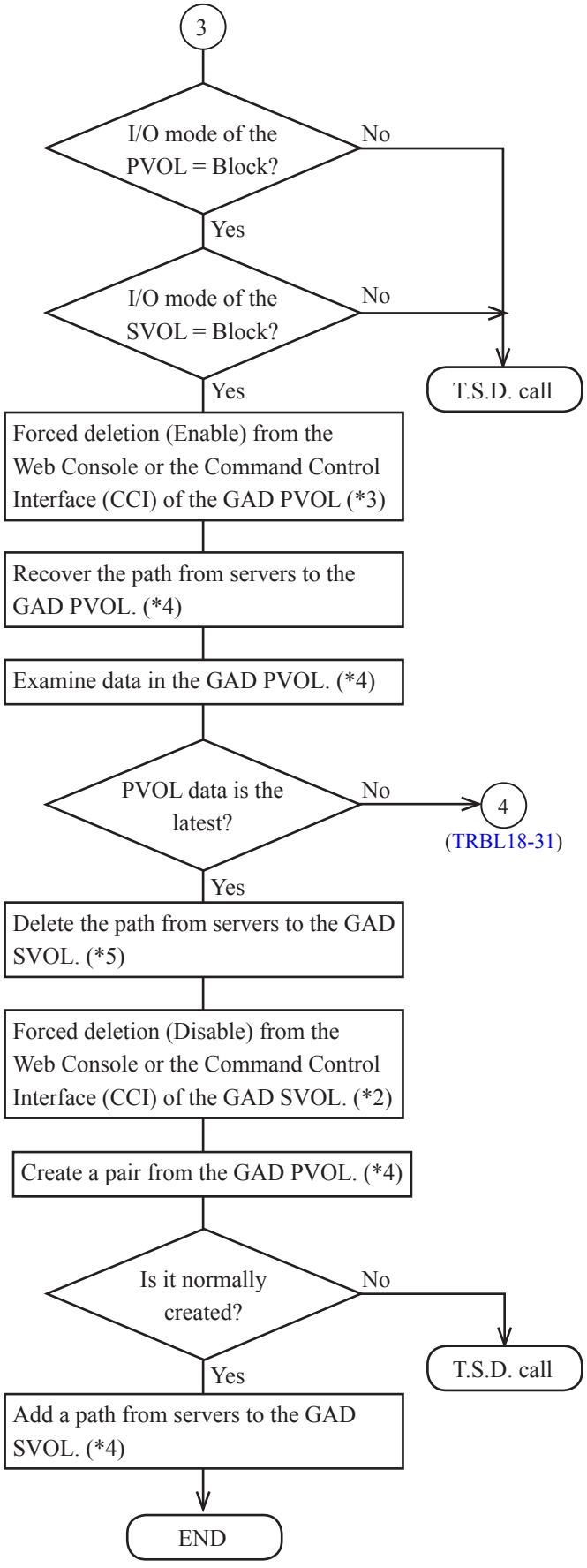
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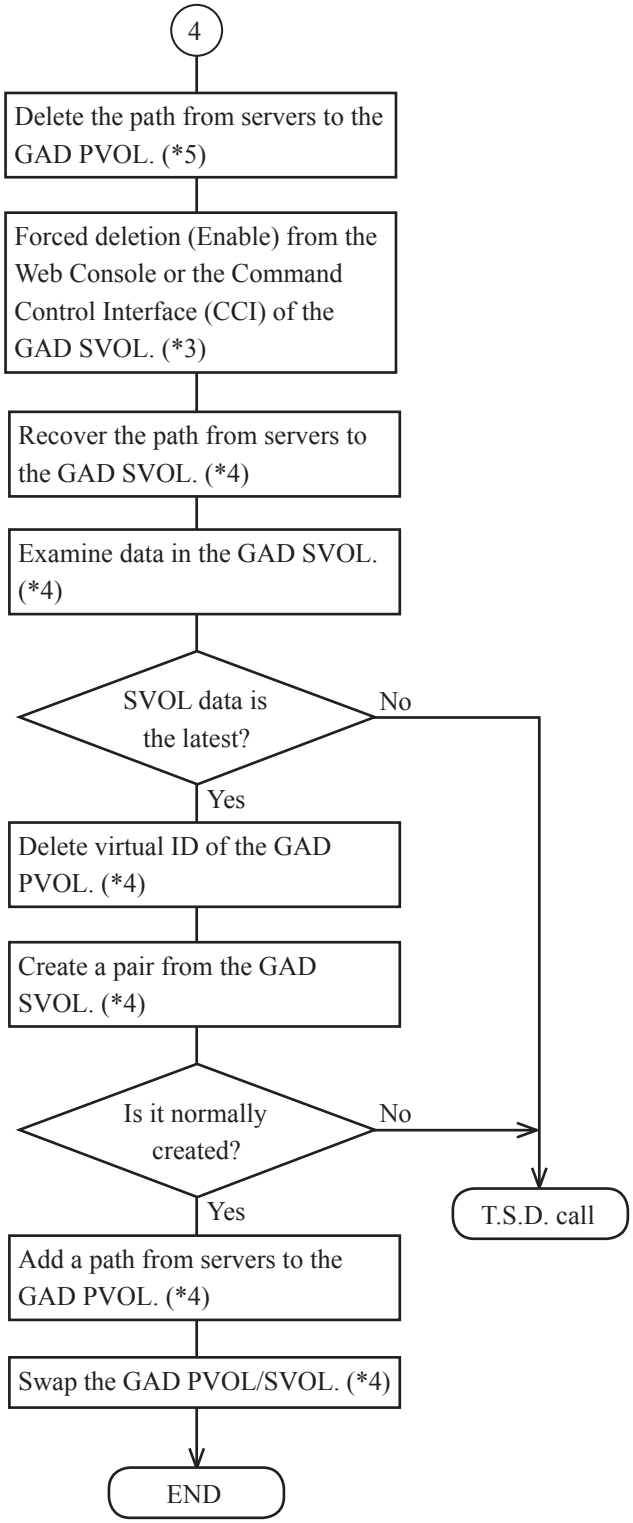
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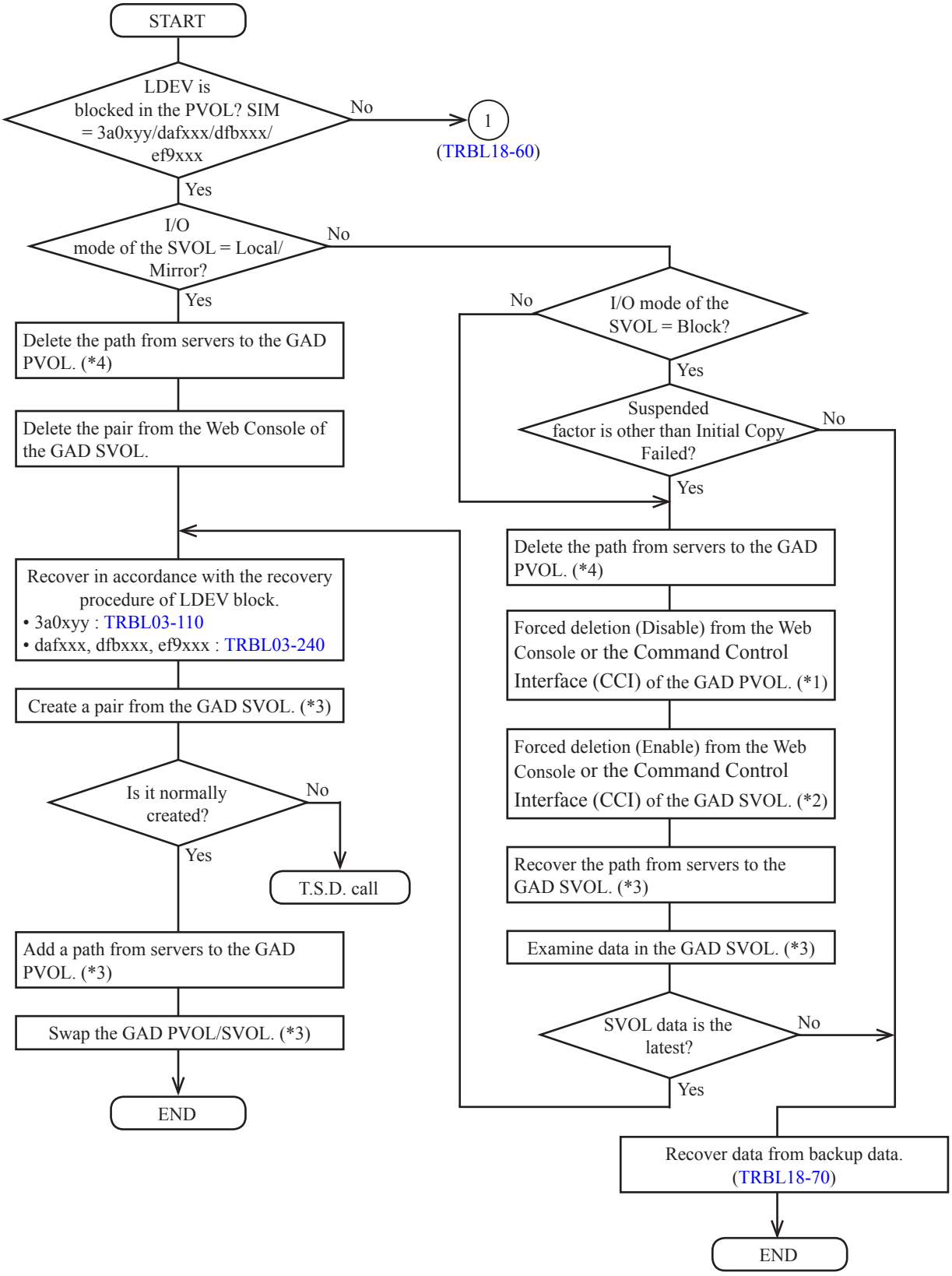


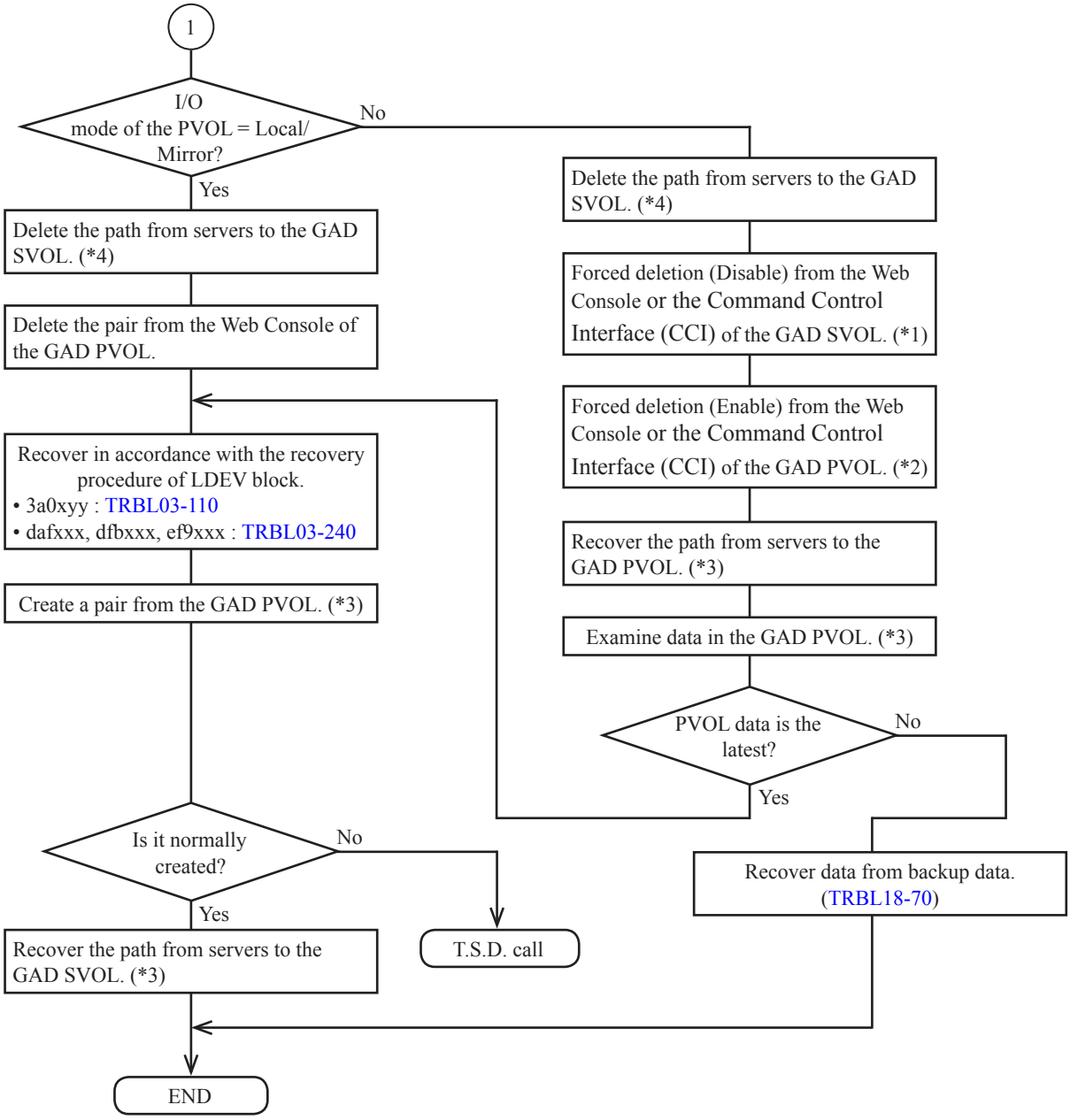
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*1: When an LDEV is blocked in a GAD pair, recover in accordance with the recover procedure at LDEV block occurrence (TRBL18-50).
*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, forced deletion (Disable) is unnecessary.
*3: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, ask the customer to configure virtual LDEV ID instead of forced deletion (Enable).
*4: Ask the customer to perform operation.
*5: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.
*6: Ask the customer to perform operation. Even if using consistency group, perform suspend operation for each pair.

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18.1.2 Recovery Procedure at LDEV Block in the GAD Pair (SIM = 3a0xyy, dafxxx, dfbxxx, ef9xxx)





*1: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, forced deletion (Disable) is unnecessary.

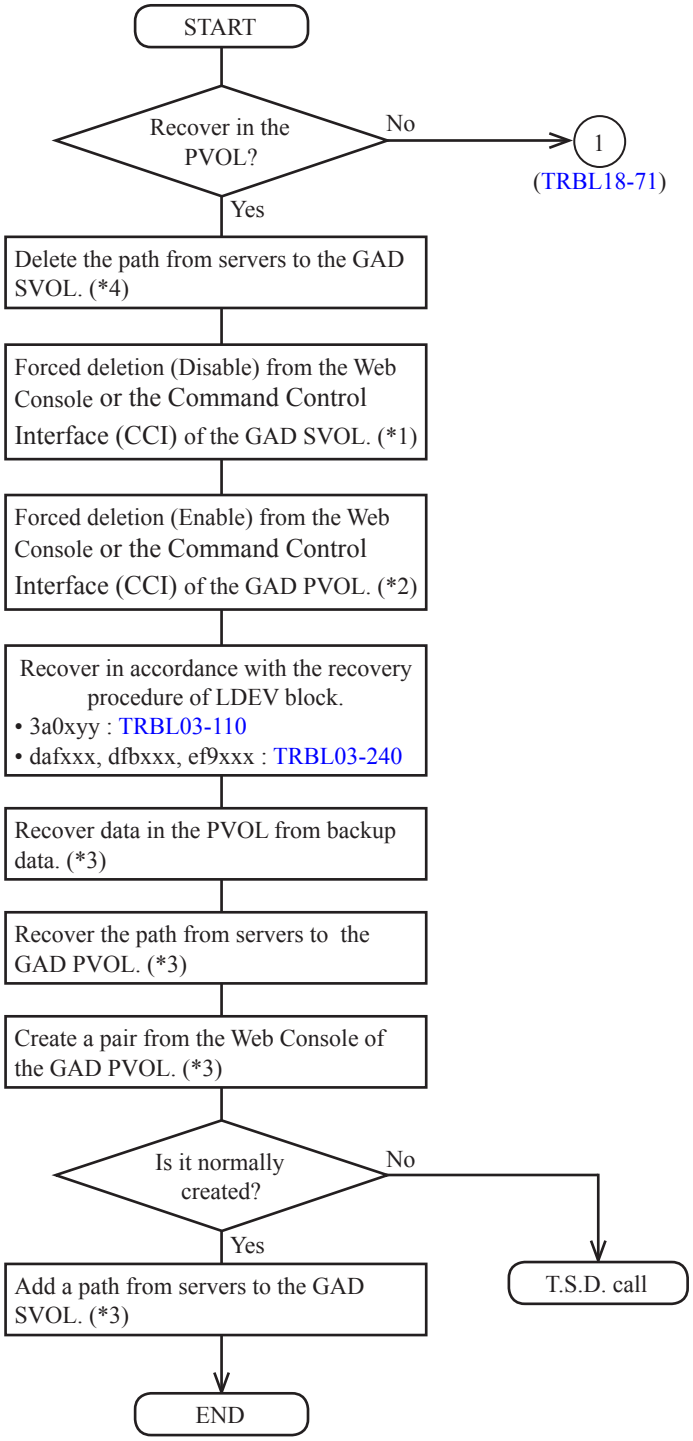
*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, ask the customer to configure virtual LDEV ID instead of forced deletion (Enable).

*3: Ask the customer to perform operation.

*4: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

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18.1.3 Procedure to Recover Data from Backup Data at LDEV Failure in the GAD Environment



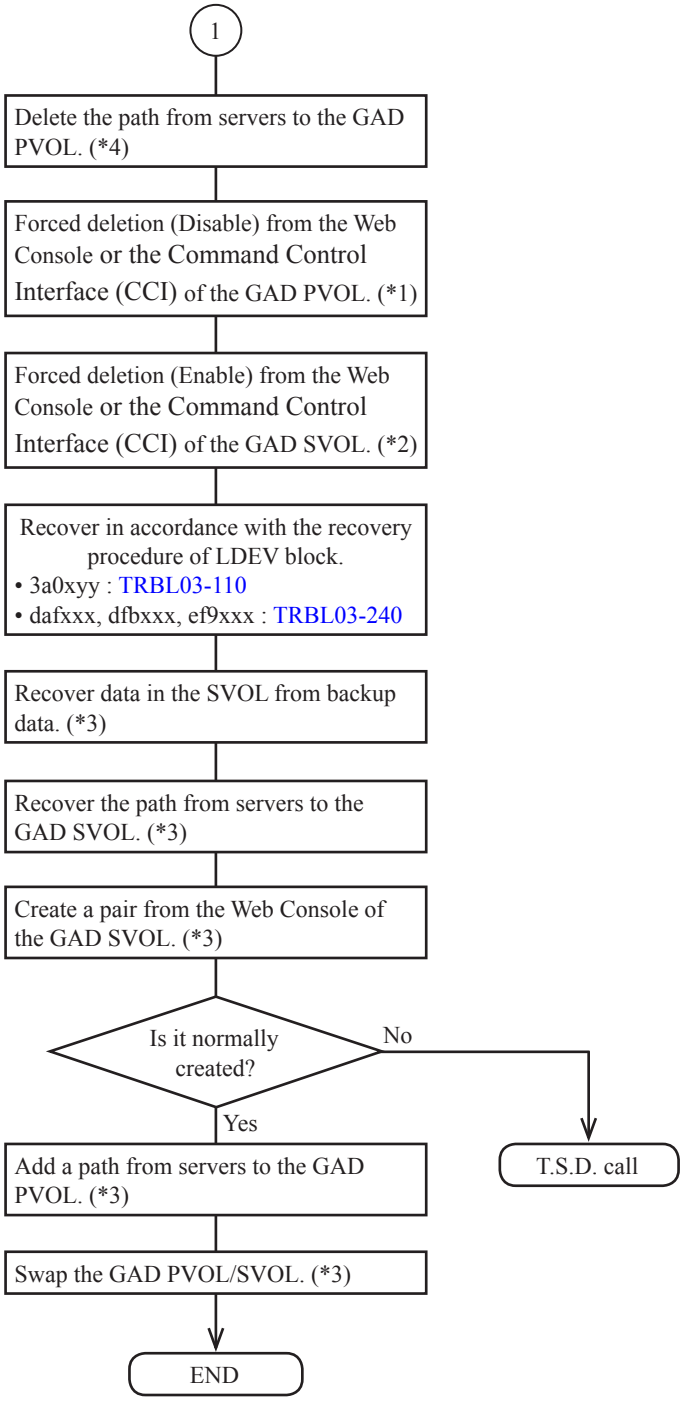
*1: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, forced deletion (Disable) is unnecessary.

*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, ask the customer to configure virtual LDEV ID instead of forced deletion (Enable).

*3: Ask the customer to perform operation.

*4: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

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*1: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, forced deletion (Disable) is unnecessary.

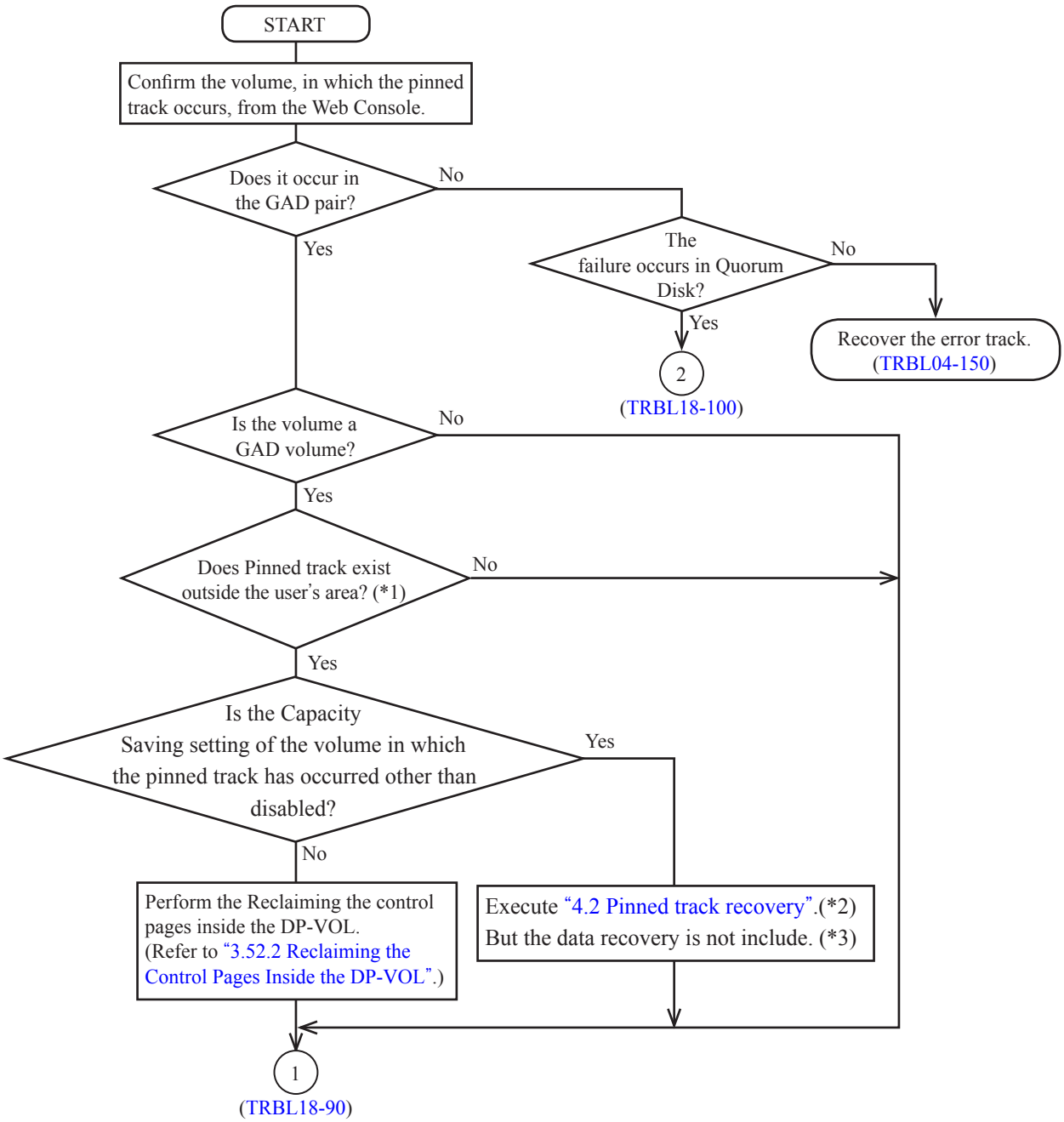
*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, ask the customer to configure virtual LDEV ID instead of forced deletion (Enable).

*3: Ask the customer to perform operation.

*4: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

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18.1.4 Recovery Procedure of the Pinned Track in the GAD Environment

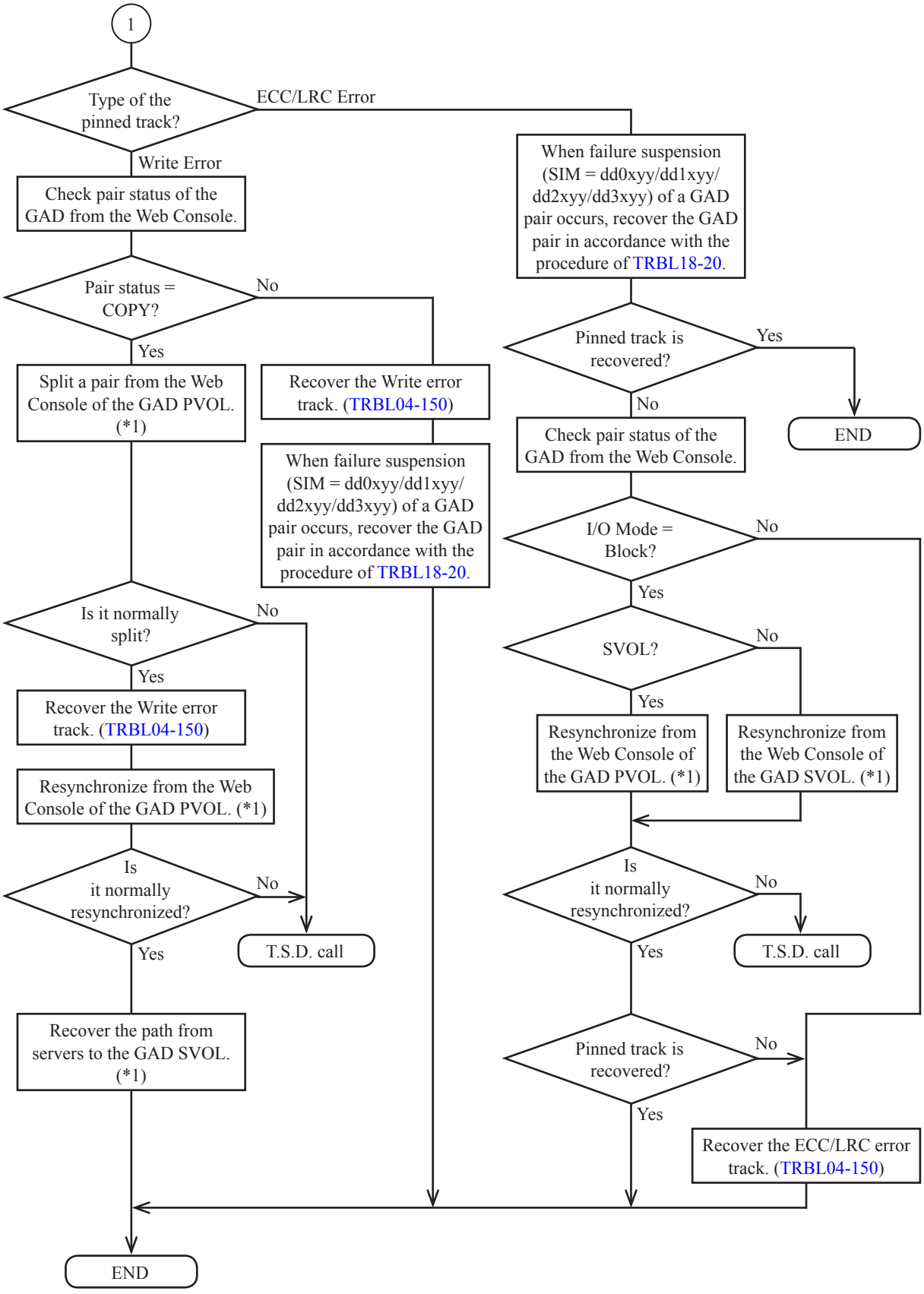


*1: Indicates that a PIN event occurred in the management area if the CC (Cylinder) information or the HH (Head) information of the PIN data displayed on the Maintenance PC was outside the user's area. (The number of user cylinders can be referred on the 'Customized Volume Size Define' of the MPC Refer Configuration.)

*2: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a GAD volume pair.
However, the LDEV formatting or the analyze command executing is not required if the pinned track is a DP volume and out of the user area.

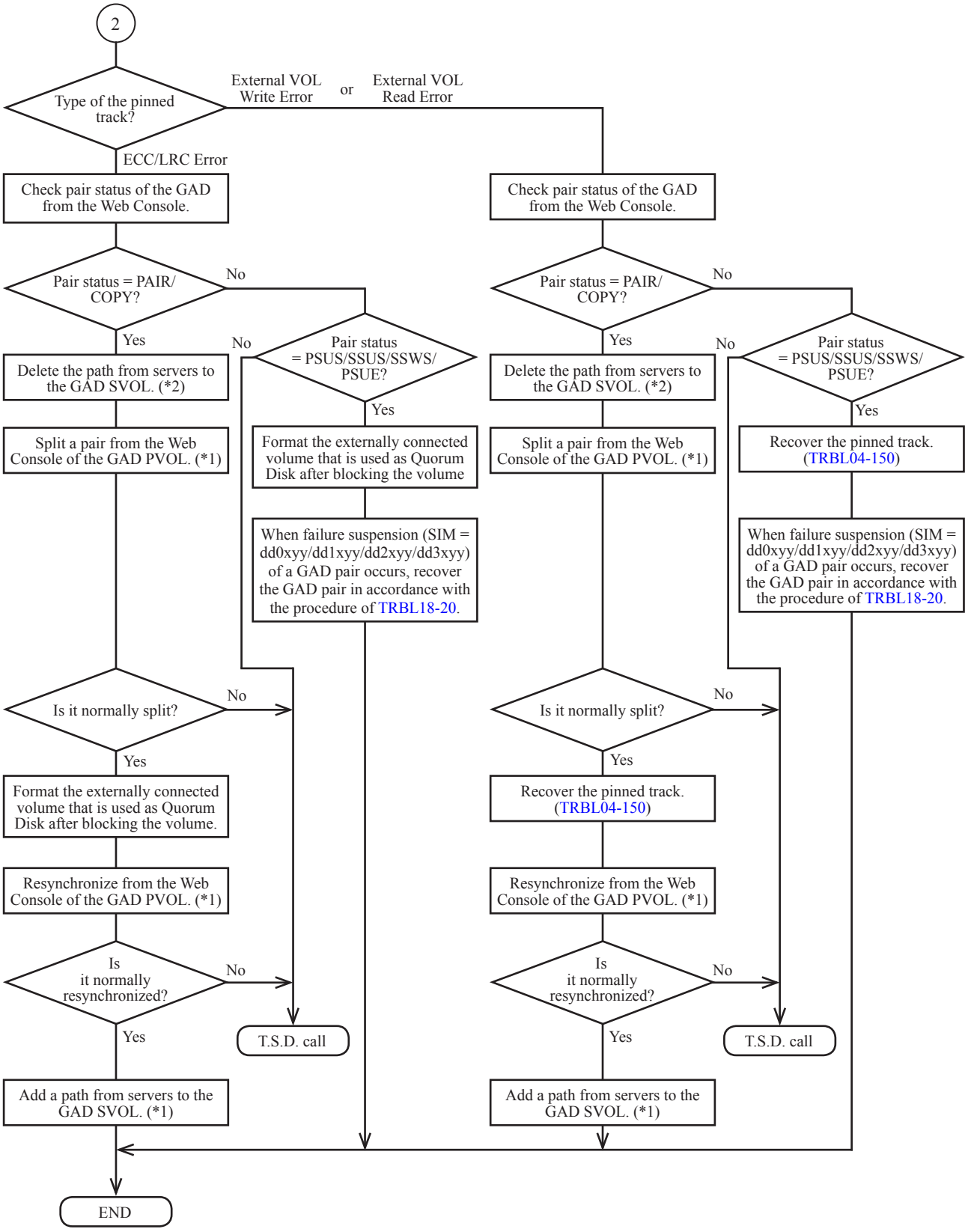
*3: Data is recovered by resetting GAD volume pair.

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*1: Ask the customer to perform operation.

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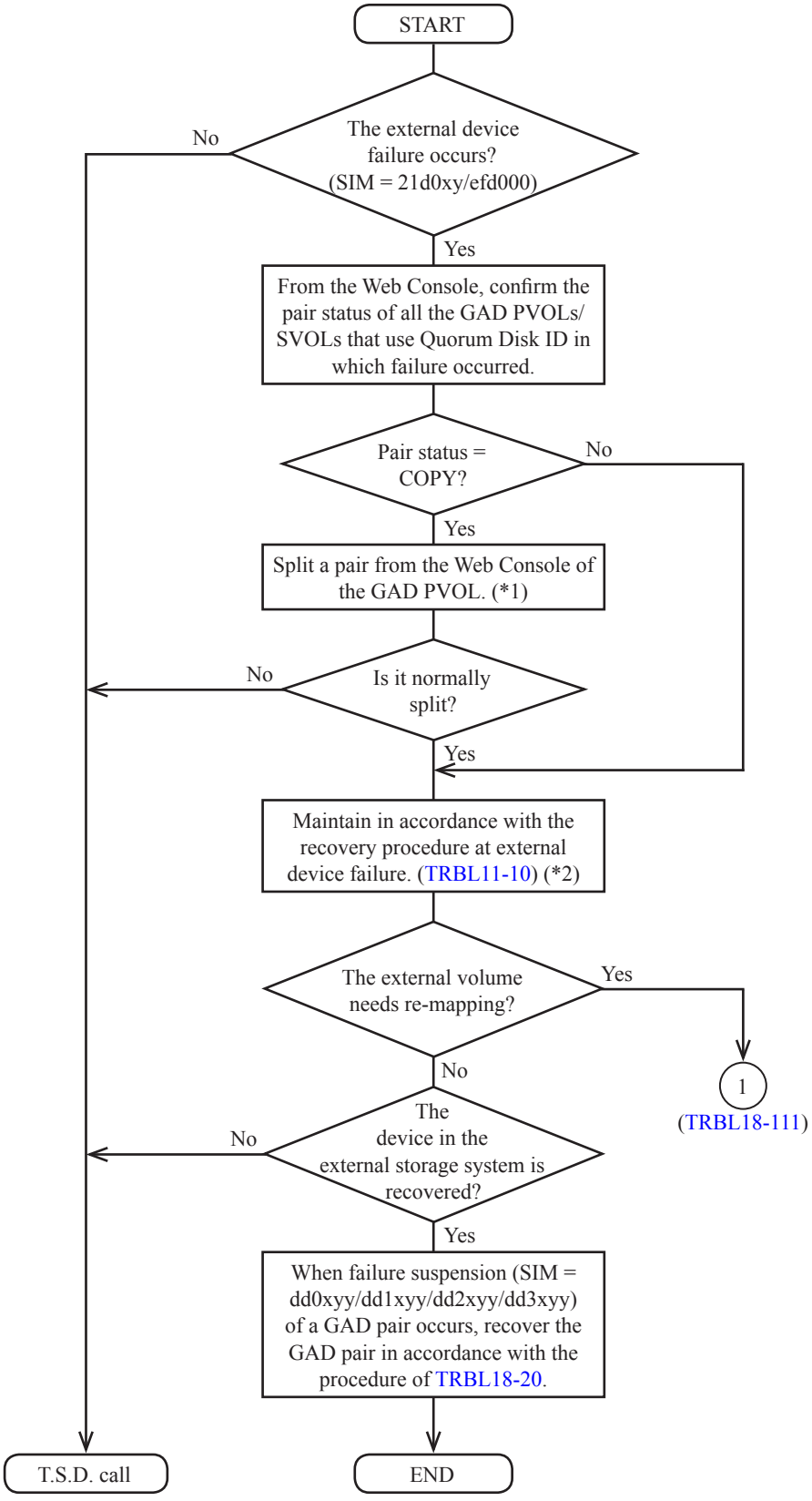


*1: Ask the customer to perform operation.

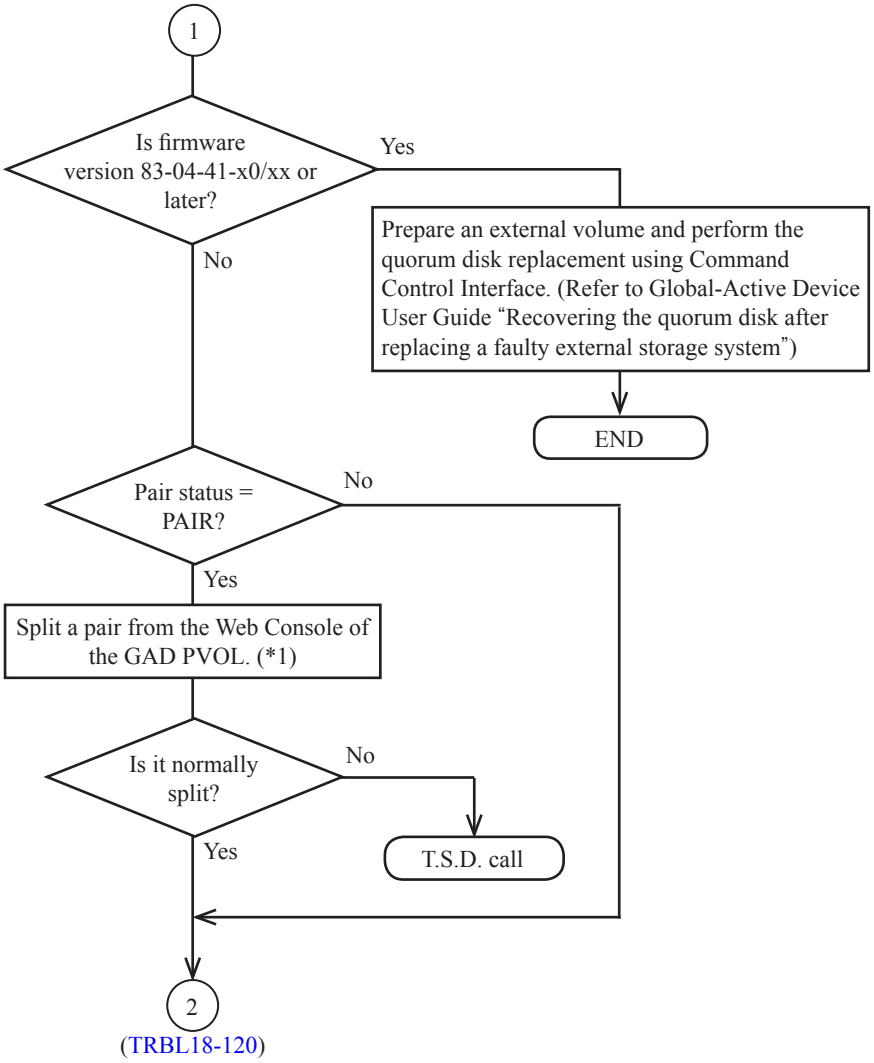
*2: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

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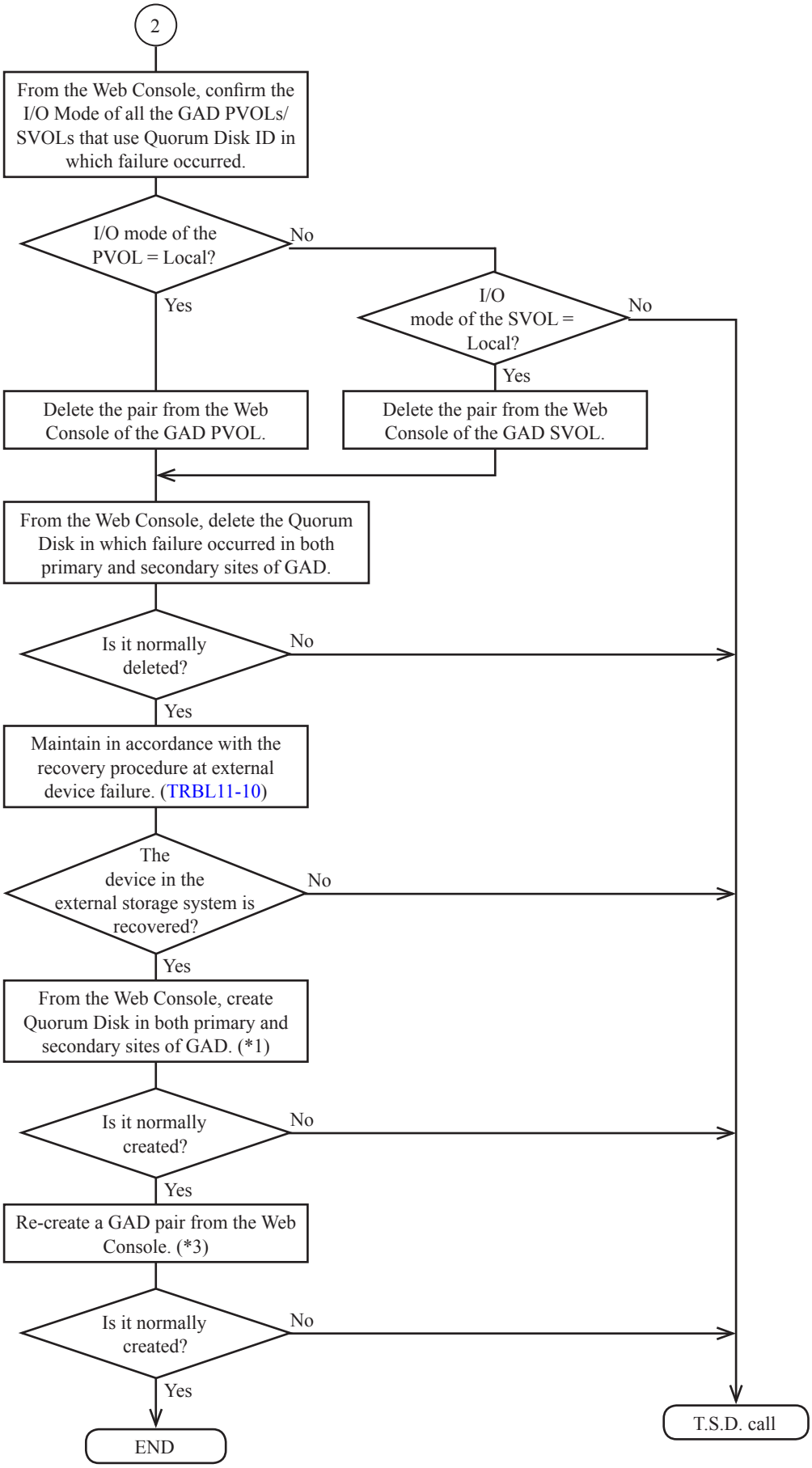
18.1.5 Recovery Procedure at Quorum Disk Failure (SIM = def0xx)



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*1: Ask the customer to perform operation.

*2: When the recovery procedure at external device failure (TRBL11-10) requires re-mapping operation of the external volume, after deleting all the GAD pairs that use Quorum Disk in which failure occurred, delete the Quorum Disk in which failure occurred and then recover the external volume.
If the DKCMAIN micro-program version is 83-04-41-x0/xx or later, you can perform the recovery procedure for the external volume without deleting GAD pairs by preparing a new external volume and then performing the quorum disk replacement (CCI [raidcom replace quorum] command).

*3: Ask the customer to perform operation.
If the GAD pairs are deleted from Web Console of the GAD PVOL, be sure to re-create the GAD pairs from the Web Console of the GAD PVOL.
If the GAD pairs are deleted from Web Console of the GAD SVOL, be sure to re-create the GAD pairs from the Web Console of the GAD SVOL.

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18.1.6 Recover Path Failure Between a GAD Pair in the GAD Environment

Path Status	Factor	Recovery Action
“Nothing”	Establishing path or deleting path	Delete the path with “Edit Path” or “Delete RCU”. Add a new path with “Edit Path” or “Add RCU”.
“Initialization Failed”	Incorrect the physical connection between the MCU and RCU	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings.(Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn't work.	Correct the path relay equipment settings or repair it.
“Communication Time Out”	Blockade of the MP or Port on the MCU.	Repair the MP status or Port status on the MCU.
“Resource Shortage (MCU)”	MCU resource over.	Too many path in the MCU or the RCU. Delete the paths and RCUs not currently in use.
“Resource Shortage (RCU)”	RCU resource over.	
“Serial Number Mismatch”	Incorrect the RCU S/N or Controller ID. (Fibre connection)	Delete the path with “Delete RCU”. Add a new path with the correct RCU S/N and Controller ID with “Add RCU” again.
	Incorrect the physical connection between the MCU and RCU.	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings. (Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn’t work.	Correct the path relay equipment settings or repair it.

(To be continued)

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Path Status	Factor	Recovery Action
“Invalid Port”	Specified port is not existence on the MCU.	Delete the path with “Edit Path” or “Delete RCU”. And add a new path with correct port on MCU again.
	Incorrect specified port type “Serial/Fibre”.	Delete the path with “Edit Path” or “Delete RCU”. And add a new path with correct port type “Serial/Fibre” again.
	Specified MCU port type is not Initiator.	Change the channel type of the MCU port to Initiator.
	Incorrect the specified CU of MCU. (Serial connection)	Delete the path with “Edit Path” or “Delete RCU”. And add a new path with correct CU again.
	Incorrect the specified link address. (Serial connection)	When MCU and RCU connects directly, set the link address to except “00”. When MCU and RCU does not connect directly, set the link address to “00”.
	Exists the same path.	Confirm the MCU port , link address or RCU port, and logical address or CU#. And delete the path with “Edit Path”.
“RCU Port Number Mismatch”	Incorrect the specified RCU port.	Delete the path with “Edit Path” or “Delete RCU”. And add a new path with correct RCU port again.
	Incorrect the physical connection between the MCU and RCU.	Correct the physical path connection between the MCU, RCU and the path relay equipment.
	Incorrect the Port topology settings. (Fibre connection)	Setup the port topology of the both MCU and RCU correctly.
	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	Broken the connection cable physically.	Replace the broken cable.
	Incorrect the path relay equipment settings or the path relay equipment doesn't work.	Correct the path relay equipment settings or repair it.

(To be continued)

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Path Status	Factor	Recovery Action
“RCU Port type is not RCU Target”	Incorrect specified RCU port.	Delete the path with “Edit Path” or “Delete RCU”. And add a new path with correct RCU port again.
	Specified RCU port type is not RCU Target.	Change the channel type of the RCU port to RCU Target.
“Communication Failed”	Blockade of the MP or Port on the RCU.	Repair the MP status or Port status on the RCU.
	The path relay equipment doesn’t work.	Repair the path relay equipment
“Logical Blockade”	MCU Port doesn’t work.	Repair the port status on the MCU.
	RCU Port doesn’t work.	Repair the port status on the RCU. And delete the path with “Edit path” or “Delete RCU”. Add the path with “Edit path” or “Add RCU” again.
	The path relay equipment doesn’t work.	Repair the path relay equipment. And delete the path with “Edit path” or “Delete RCU”. And add the path with “Edit path” or “Add RCU” again.
	Broken the connection cable physically.	Replace the broken cable. And delete the path with “Edit path” or “Delete RCU”. Add the path with “Edit path” or “Add RCU” again.
“Program Error”	Detected program error.	Delete the path with “Edit path” or “Delete RCU”. And add the path with “Edit path” or “Add RCU” again.

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18.2 Recovery Procedure When a Failure Occurred While Creating/Resynchronizing a GAD Pair

The following are recovery procedures when an operation fails due to occurrence of a failure etc. while creating or resynchronizing a GAD pair and the pair status of the P-VOL and S-VOL is the following status.

■ When a GAD pair creation operation fails

- If the pair status is “PVOL = SMPL”, “SVOL ≠ SMPL”;

Recovery procedure:
From the Web Console or the Command Control Interface (CCI), perform forced deletion (Disable) operation to the SVOL and retry pair creation operation.

- If pair creation operation is performed from the RM/CLI and is failed by SSB = D004, FA03;
- If pair creation operation is performed from the web console and is failed by 06205-008704 (W) in the Storage Navigator message;

Recovery procedure 1:

1. A failure may occur in a path between the MCU and RCU. Check the path status between the MCU and RCU.

---

2. When checking the path status finds a failure, remove the failure factors and then confirm the path status is normal.

---

3. After recovering the normal path status, perform pair creation operation again to the pair where pair creation failed.

   Additionally, when pair creation operation cannot be performed or fails due to factors such as an unrecoverable path failure, follow the recovery procedure 2 below to perform forced deletion operation of the pair.

Recovery procedure 2:

1. Identifying the pair that needs forced deletion operation
   - When performing pair creation operation from the web console;
     The pair that is found to be an error by confirming the task status where pair creation operation is performed from the task window.
   - When pair creation operation is performed from the RM/CLI;
     The foremost pair among the pairs where the pair status of both PVOL and SVOL is “SMPL” by confirming the pair status of the GAD pairs defined in the configuration definition file, by the pairdisplay command.

---

2. Forced deletion operation
   From the logical device list of the web console, select the VOL designated as “SVOL”, and then perform [More Actions] – [Force Delete Pairs (GAD Pairs)].

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■ When a resynchronization operation fails

The recovery procedure is as follows when the pair status is P-VOL = PSUx, S-VOL = COPY.

From the web console, perform resynchronization again.

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18.3 Failure Recovery Procedure and Maintenance Procedure of the GAD-UR delta Configuration

18.3.1 Failure Recovery Procedure of the GAD-UR delta Configuration

The reference codes reported in the GAD-UR delta configuration are the same as the reference codes of the TC + UR configuration and GAD configuration.

Table 18-2 Reference codes that are reported at the time of the journal volume failure of UR delta pair

REF code		Error description	Error level	Host report
22	23			
62	3x	Detection of DP pool failure (The journal volume also fails.)	Moderate	YES
62	7x	DP pool VOL failure (The journal volume also fails.)	Moderate	YES
dc	ex	The journal volume failure (The UR journal is full.)	Moderate	No
dc	1x	Pair volume failure (P-VOL suspension) A failure is detected in the PDKC.	Serious	YES (Repeated report)

The following is the table of pair statuses in the event of a single point of failure and the recovery procedure summary. In each table, the value in the parentheses for GAD pair status indicates I/O mode and the value in the parentheses for UR delta pair status indicates pair status displayed in RAID Manager or journal volume's mirror status. To complete the delta resync operation, keep updating I/O from the host for about two minutes.

No.	Failure Recovery Procedure	Reference page
1	"1. Path between DKC"	TRBL18-200
2	"2. Pool Volumes"	TRBL18-230
3	"3. Journal Volumes"	TRBL18-250
4	"5. LDEV (LDEV Blockade)"	TRBL18-270
5	"6. Storage system"	TRBL18-280

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1. Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
–	[Normal Operation]	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
1	PDKC → LDKC Path failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. (Recover paths) 3. GAD resync by PVOL. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
2	LDKC → PDKC Path failure	0	PVOL (GAD PVOL)	**PSUE (Block)**	LVOL (GAD SVOL)	**SSWS (Local)**	1. GAD failure suspension is detected. 2. Delta resync. 3. Failure recovery site. (Recover paths) 4. GAD resync by LVOL. (*1) 5. GAD swap suspend. 6. Delta resync. 7. GAD swap resync. (*1)
		1	**PVOL (UR delta PVOL)**	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	**HOLD (SSUS/ SJNS)**	
		2	**LVOL (UR PVOL)**	**PAIR**	RVOL (UR SVOL)	**PAIR**	
3	LDKC → RDKC Path failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. Failure recovery site. (Recover paths)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	RDKC → LDKC Path failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. Failure recovery site. (Recover paths)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
5	PDKC → RDKC Path failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. Failure recovery site. (Recover paths)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
6	RDKC → PDKC Path failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	• SOM448 = ON and SOM449 = OFF: After communication break detection, immediately UR pair failure suspend. • SOM448 = OFF and SOM449 = OFF: UR pair failure suspend Once communication is severed a certain period of time. Any of the above, the recovery in the following procedure. 1. Failure recovery site. (Recover paths) 2. UR resync by PVOL. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
7	PDKC - External storage Path failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. (Recover paths) 3. GAD resync by PVOL. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
8	LDKC - External storage Path failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. (Recover paths) 3. GAD resync by PVOL. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

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*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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2. Pool Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL pool full	0	PVOL (GAD PVOL)	**PSUE (Block)**	LVOL (GAD SVOL)	**SSWS (Local)**	1. GAD failure suspension is detected. 2. Delta resync. 3. Failure recovery site. 4. GAD pair recovery. (*1) 5. GAD swap suspend. 6. Delta resync. 7. GAD swap resync. (*1)
		1	**PVOL (UR delta PVOL)**	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	**HOLD (SSUS/ SJNS)**	
		2	**LVOL (UR PVOL)**	**PAIR**	RVOL (UR SVOL)	**PAIR**	
2	PVOL pool failure	0	PVOL (GAD PVOL)	**PSUE (Block)**	LVOL (GAD SVOL)	**SSWS (Local)**	1. GAD failure suspension is detected. 2. Delta resync. 3. Failure recovery site. 4. GAD pair recovery. (*1) 5. GAD swap suspend. 6. Delta resync. 7. GAD swap resync. (*1)
		1	**PVOL (UR delta PVOL)**	**HOLDING (PSUE/ PJNS)**	**RVOL (UR delta SVOL)**	**HOLD (SSUS/ SJNS)**	
		2	**LVOL (UR PVOL)**	**PAIR**	**RVOL (UR SVOL)**	**PAIR**	
3	LVOL pool full	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. 3. GAD pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	LVOL pool failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. 3. GAD pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
5	RVOL pool full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery. (*1)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
6	RVOL pool failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery. (*1)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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3. Journal Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	Primary journal volume full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*1)
		1	PVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
2	Primary journal volume failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*1)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
3	Local journal volume full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HLDE (PSUE/ PJES)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	Local journal volume failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HLDE (PSUE/ PJES)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
5	Remote journal volume full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*1)
		1	PVOL (UR PVOL)	**PFUS (*2)**	RVOL (UR SVOL)	**PFUS (*2)**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

(To be continued)

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No/	Item	Mirror ID	Pair Status				Recovery operation
6	Remote journal volume failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*1)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

*2: The pair status of RDKC does not become PFUS until the PDKC journal volume becomes full. Thus, the RDKC journal volume can be expanded until the PDKC journal becomes full.

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4. Journal Volumes (Pool Volumes) (*1)

No.	Item	Mirror ID	Pair Status				Recovery operation
1	Primary journal volume pool full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*2)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
2	Primary journal volume pool failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*2)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
3	Local journal volume pool full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover. (*2)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HLDE (PSUE/ PJES)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	Local journal volume pool failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover. (*2)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HLDE (PSUE/ PJES)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
5	Remote journal volume pool full	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*2)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

(To be continued)

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No/	Item	Mirror ID	Pair Status				Recovery operation
6	Remote journal volume pool failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR resync by PVOL. (*2)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

*1: Recovery procedures for failure in the pool of DP-VOLs registered as journal volumes are described. The pool full status might occur when the capacity of journal volumes is defined more than that of all unused pool volumes.

*2: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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5. LDEV (LDEV Blockade)

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL failure	0	PVOL (GAD PVOL)	**PSUE (Block)**	LVOL (GAD SVOL)	**SSWS (Local)**	1. GAD failure suspension is detected. 2. Delta resync. 3. Failure recovery site. 4. GAD pair recovery. (*1) 5. GAD swap suspend. 6. Delta resync. 7. GAD swap resync. (*1)
		1	**PVOL (UR delta PVOL)**	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	**HOLD (SSUS/ SJNS)**	
		2	**LVOL (UR PVOL)**	**PAIR**	RVOL (UR SVOL)	**PAIR**	
2	LVOL failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. 3. GAD pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
3	RVOL failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. GAD failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery. (*1)
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PSUE**	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	Quorum Disk volume failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. (Quorum Disk) 3. GAD pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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6. Storage system

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PDKC failure (SM/CM Non-Volatile) (*1)	0	PVOL (GAD PVOL)	**PSUE (Block)**	LVOL (GAD SVOL)	**SSWS (Local)**	1. GAD failure suspension is detected. 2. Delta resync. 3. DKC recovery. 4. UR (Mirror ID 1) delete. 5. UR delta pairs (Mirror ID 1) reconstruct. 6. GAD swap resync. (*2) 7. GAD swap suspend. 8. Delta resync. 9. GAD swap resync. (*2)
		1	PVOL (UR PVOL) (*1)	**PSUE** (*1)	**RVOL (UR delta SVOL)**	**HOLD (SSUS/ SJNS)**	
		2	**LVOL (UR PVOL)**	**PAIR**	**RVOL (UR SVOL)**	**PAIR**	
2	LDKC failure (SM/CM Non-Volatile)	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. DKC recovery. 3. GAD resync by PVOL. (*2)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	1. DKC recovery. 2. UR failure suspension is detected. 3. UR resync by PVOL. (*2)
		1	PVOL (UR PVOL)	PAIR (*3)	RVOL (UR SVOL)	PAIR (*3)	
		2	LVOL (UR delta PVOL)	HOLD (PSUS/ PJNS) (*3)	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	
4	External storage failure	0	PVOL (GAD PVOL)	**PSUE (Local)**	LVOL (GAD SVOL)	**PSUE (Block)**	1. GAD failure suspension is detected. 2. Failure recovery site. 3. GAD resync by PVOL. (*2)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**HOLDING (PSUE/ PJNS)**	RVOL (UR delta SVOL)	HOLD (SSUS/ SJNS)	

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*1: Rest UR pair information of PDKC (PVOL), that UR pair state is changed to failure suspend after PS ON of PDKC (PVOL).

*2: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

*3: If you have a SOM449 = OFF in PDKC, UR pair status PSUE, LVOL of UR delta pair state changes to HOLDING.

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18.3.2 GAD-UR delta Configuration Maintenance Procedure

As a basic principle of maintenance, downgrade micro-programs, and then operate in accordance with the maintenance procedure.
When only host is to be maintained, no operation of storage is needed.
For planned shutdown of the DKC of the GAD-UR delta configuration, see "18.3.2.2 Planned Shutdown Procedure of the DKC of the GAD-UR delta Configuration".

18.3.2.1 Maintenance Procedure

The following maintenance procedure lists a procedure including recovery operation on the host side.

No.	Maintenance part	Procedure	Note
1	P Site (DKC + Host)	1. Execute GAD Swap suspension. 2. [Automatic] Delta Resync. 3. Perform maintenance. 4. Execute GAD Swap Resync. (*1) 5. Execute GAD Swap suspension. 6. [Automatic] Delta Resync. 7. Execute GAD Swap Resync. (*1)	
2	PDKC	↑	
3	P Host	No storage operation is needed.	Because I/O is available in the PDKC/LDKC, no storage operation is needed.
4	L Site (DKC + Host)	1. Suspend GAD. 2. erform maintenance. 3. Resync GAD. (*1)	
5	LDKC	↑	
6	L Host	No storage operation is needed.	Because I/O is available in the PDKC/LDKC, no storage operation is needed.
7	R Site (DKC + Host)	1. Suspend UR. 2. Perform maintenance. 3. Resync UR. (*1)	
8	RDKC	↑	
9	R Host	No storage operation is needed.	Because I/O is available in the PDKC/LDKC, no storage operation is needed.

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No.	Maintenance part	Procedure	Note
10	P/L Site simultaneous maintenance (DKC + Host)	1. Suspend GAD. 2. Execute UR Swap suspension. 3. Perform maintenance. 4. Execute UR Swap resync. 5. Execute UR Swap suspension. 6. Execute UR swap resync. 7. Resync GAD. (*1)	

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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18.3.2.2 Planned Shutdown Procedure of the DKC of the GAD-UR delta Configuration

No.	Planned Shutdown Procedure	Reference page
1	"1. Planned Shutdown Procedure of the PDKC"	TRBL18-320
2	"2. Planned Shutdown Procedure of the LDKC"	TRBL18-350
3	"3. Planned Shutdown Procedure of the RDKC"	TRBL18-380
4	"4. Planned Shutdown Procedure of External Storage (when host I/O continues to the PDKC)"	TRBL18-400
5	"5. Planned Shutdown Procedure of External Storage (when host I/O continues to the LDKC)"	TRBL18-440

Following is the procedure of the planned shutdown (PS OFF/ON) of the PDKC/LDKC/RDKC/ external storage for Quorum in the GAD-UR delta configuration.
Because it is recommended to suspend all GAD pairs or UR pairs related to the DKCs that are to be set to PS OFF when the DKCs are set to PS OFF, the procedure to comply with it is shown.

1. Planned Shutdown Procedure of the PDKC

Table 18-3 Planned Shutdown Procedure of the PDKC of the GAD-UR delta Configuration

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC/LDKC are under operation, and the RDKC is stand-by. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	(*1)
1	Stop of host I/O to the PDKC	Stop I/O from host to the PDKC, and consolidate host I/O to the LDKC.	
2	GAD pair swap suspension	Execute GAD pair swap suspension in the LDKC. ↓ GAD pair swap suspension PDKC [PS ON] GAD PVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#GAD pair swap suspension % pairsplit -g GRPMirror0 -RS -IH1

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
3	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF] GAD PVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	
–	During planned shutdown		
4	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	
5	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
6	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
7	GAD pair swap resync	Execute GAD pair swap resync in the LDKC. ↓ GAD pair swap resync PDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#GAD pair swap resync % pairresync -g GRPMirror0 -swaps -IH1
8	Restart of host I/O to the PDKC	Restart I/O from host to the PDKC. (*1)	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
9	UR delta pair configuration construction completed status	PDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** LDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	(*2)

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

*2: To resume the operation in the primary site, see the description of replacing the primary volume and secondary volume of the GAD pair in “Global-Active Device User Guide”.

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2. Planned Shutdown Procedure of the LDKC

Table 18-4 Planned Shutdown Procedure of the LDKC of the GAD-UR delta Configuration

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC/LDKC are under operation, and the RDKC is stand-by. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	(*1)
1	Stop of host I/O to the LDKC	Stop I/O from host to the LDKC, and consolidate host I/O to the PDKC.	
2	GAD pair suspension	Suspend the GAD pairs in the PDKC. ↓ GAD pair suspension PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#GAD pair suspension % pairsplit -g GRPMirror0 -IH0
3	LDKC PS OFF	Set the LDKC to PS OFF. ↓ PS OFF PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** LDKC [PS OFF] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	During planned shutdown		
4	LDKC PS ON	Set the LDKC to PS ON. ↓ PS ON PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	
5	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
6	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
7	GAD pair resync	Resync the GAD pairs in the PDKC. ↓ GAD pair resync PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#GAD pair resync % pairresync -g GRPMirror0 -IH0
8	Restart of host I/O to the LDKC	Restart I/O from host to the LDKC. (*1)	
9	UR delta pair configuration construction completed status	PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	

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*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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3. Planned Shutdown Procedure of the RDKC

Table 18-5 Planned Shutdown Procedure of the RDKC of the GAD-UR delta Configuration

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC/LDKC are under operation, and the RDKC is stand-by. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	
1	UR pair suspension	Suspend the UR pairs in the PDKC. ↓ UR pair suspension PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PSUS** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PSUS** UR delta SVOL: **HOLD**	#UR pair suspension % pairsplit -g GRPMirror1 -IH0
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PSUS** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS OFF] UR SVOL: **PSUS** UR delta SVOL: **HOLD** ↑ PS OFF	

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PSUS** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PSUS** UR delta SVOL: **HOLD** ↑ PS ON	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
5	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
6	UR pair resync	Resync the UR pairs in the PDKC. ↓ UR pair resync PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#UR pair resync % pairresync -g GRPMirror1 -IH0
7	UR delta pair configuration construction completed status	Resync the UR pairs in the PDKC. ↓ UR pair resync PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	

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4. Planned Shutdown Procedure of External Storage (when host I/O continues to the PDKC)

Table 18-6 Planned Shutdown Procedure of External Storage of the GAD-UR delta Configuration (when host I/O continues to the PDKC)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC/LDKC are under operation, and the RDKC is stand-by. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	
1	Stop of host I/O to the LDKC	Stop I/O from host to the LDKC, and consolidate host I/O to the PDKC.	
2	GAD pair suspension	Execute GAD pair suspension in the PDKC. ↓ GAD pair suspension PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	
3	Disconnection of Quorum disk	Disconnect Quorum disk (external volume) connection in the PDKC and RDKC. ↓ Disconnection of Quorum disk PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** ↓ Disconnection of Quorum disk LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#External volume disconnection % raidcom disconnect external_grp -ldev_id <quorum ldev#> -IH0 (or -IH1)

(To be continued)

(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
4	External storage PS OFF	Set external storage to PS OFF. PDKC [PS ON]: GAD PVOL: **PSUS** (Local); UR PVOL: **PAIR** LDKC [PS OFF]: GAD SVOL: **PSUS** (Block); UR delta PVOL: **HOLDING** ↓ PS OFF External storage [PS OFF] RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **HOLD**	
–	During planned shutdown		
5	External storage PS ON	Set external storage to PS ON. PDKC [PS ON]: GAD PVOL: **PSUS** (Local); UR PVOL: **PAIR** LDKC [PS ON]: GAD SVOL: **PSUS** (Block); UR delta PVOL: **HOLDING** ↓ PS ON External storage [PS ON] RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **HOLD**	
6	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
7	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
8	Reconnection of Quorum disk	Reconnect Quorum disk (external volume) in the PDKC and RDKC. ↓ Reconnection of Quorum disk / ↓ Reconnection of Quorum disk PDKC [PS ON]: GAD PVOL: **PSUS** (Local); UR PVOL: **PAIR** LDKC [PS ON]: GAD SVOL: **PSUS** (Block); UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **HOLD**	#External volume reconnection % raidcom check_ext_storage external_grp -ldev_id <quorum ldev#> -IH0 (or -IH1)

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
9	Confirmation of Quorum disk connection	Confirm connection from the PDKC and RDKC to Quorum disk. ↓ Confirmation of Quorum disk connection PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** ↓ Confirmation of Quorum disk connection LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#Confirmation of external volume connection % raidcom get external_grp -external_grp_id <quorum external group id> -IH0 (or -IH1)
10	Confirmation of Quorum disk recognition	Confirm external volumes of the PDKC and RDKC are recognized as Quorum disk. ↓ Confirmation of Quorum disk recognition PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** ↓ Confirmation of Quorum disk recognition LDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#Confirmation of Quorum disk recognition % raidcom get ldev -ldev_id <quorum ldev#> -IH0 (or -IH1)
11	SIM deletion	If SIMs related to the Quorum disk block are generated in the PDKC/LDKC, delete the SIMs.	
12	GAD pair resync	After procedure item "Reconnection of Quorum disk" is completed and more than five minutes have passed, resync the GAD pairs in the PDKC. ↓ GAD pair resync PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	#GAD pair resync % pairresync -g GRPMirror0 -IH0
13	Restart of host I/O to the LDKC	Restart I/O from host to the LDKC. (*1)	

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
14	UR delta pair configuration construction completed status	PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	

*1: Perform the following operation.

1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

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5. Planned Shutdown Procedure of External Storage (when host I/O continues to the LDKC)

Table 18-7 Planned Shutdown Procedure of External Storage of the GAD-UR delta Configuration (when host I/O continues to the LDKC)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
–	Initial status	The PDKC/LDKC are under operation, and the RDKC is stand-by. PDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** LDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLD** External storage [PS ON] RDKC [PS ON] UR SVOL: **PAIR** UR delta SVOL: **HOLD**	(*1)
1	Stop of host I/O to the PDKC	Stop I/O from host to the PDKC, and consolidate host I/O to the LDKC.	
2	GAD pair swap suspension	Execute GAD pair swap suspension in the LDKC. ↓ GAD pair swap suspension PDKC [PS ON] GAD PVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#GADpair swap suspension % pairsplit -g GRPMirror0 -RS -IH1
3	Disconnection of Quorum disk	Disconnect Quorum disk (external volume) connection in the PDKC and RDKC. ↓ Disconnection of Quorum disk PDKC [PS ON] GAD PVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** ↓ Disconnection of Quorum disk LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#Disconnection of the external volume % raidcom disconnect external_grp -ldev_id <quorum ldev#> -IH0 (or -IH1)

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
4	External storage PS OFF	Set external storage to PS OFF. PDKC [PS ON] GAD PVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** ↓ PS OFF External storage [PS OFF] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	
–	During planned shutdown		
5	External storage PS ON	Set external storage to PS ON. PDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** ↓ PS ON External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	
6	Confirmation of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
7	SIM deletion	If SIMs related to the path block are generated in each DKC, delete the SIMs.	
8	Reconnection of Quorum disk	Reconnect Quorum disk (external volume) in the PDKC and RDKC. ↓ Reconnection of Quorum disk PDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** ↓ Reconnection of Quorum disk LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#Reconnection of the external volume % raidcom check_ext_storage external_grp -ldev_id <quorum ldev#> -IH0 (or -IH1)

(To be continued)

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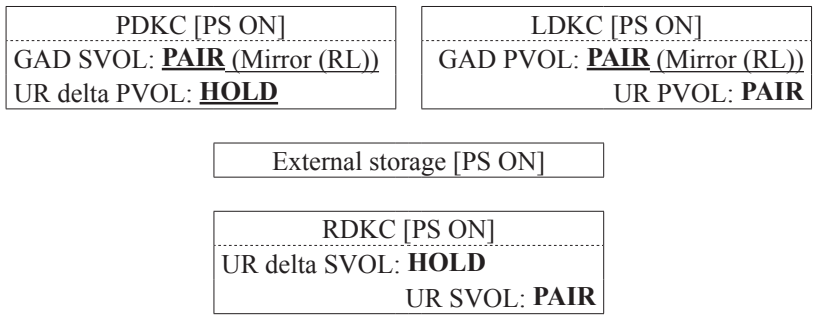
(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
9	Confirmation of Quorum disk connection	Confirm connection from the PDKC and RDKC to Quorum disk. ↓ Confirmation of Quorum disk connection PDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** ↓ Confirmation of Quorum disk connection LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#Confirmation of external volume connection % raidcom get external_grp -external_grp_id <quorum external group id> -IH0 (or -IH1)
10	Confirmation of Quorum disk recognition	Confirm external VOLs of the PDKC and RDKC are recognized as Quorum disk. ↓ Confirmation of Quorum disk recognition PDKC [PS ON] GAD SVOL: **PSUS** (Block) UR delta PVOL: **HOLDING** ↓ Confirmation of Quorum disk recognition LDKC [PS ON] GAD SVOL: **SSWS** (Local) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#Confirmation of Quorum disk recognition % raidcom get ldev -ldev_id <quorum ldev#> -IH0 (or -IH1)
11	SIM deletion	If SIMs related to the Quorum disk block are generated in the PDKC/LDKC, delete the SIMs.	
12	GAD pair swap resync	After procedure item "Reconnection of Quorum disk" is completed and more than five minutes have passed, execute GAD pair swap resync in the LDKC. ↓ GAD pair swap resync PDKC [PS ON] GAD SVOL: **PAIR** (Mirror (RL)) UR delta PVOL: **HOLDING** LDKC [PS ON] GAD PVOL: **PAIR** (Mirror (RL)) UR PVOL: **PAIR** External storage [PS ON] RDKC [PS ON] UR delta SVOL: **HOLD** UR SVOL: **PAIR**	#GAD pair swap resync % pairresync -g GRPMirror0 -swaps -IH1
13	Restart of host I/O to the PDKC	Restart I/O from host to the PDKC. (*1)	

(To be continued)

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(Continued from the preceding page)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
14	UR delta pair configuration construction completed status		(*2)

*1: Perform the following operation.

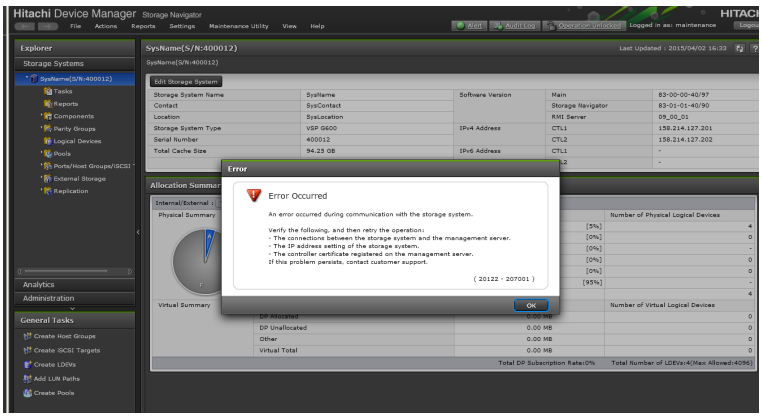
1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from RAID Manager, confirm that the primary volume status of the UR delta resync pair changes from “PSUE” to “PSUS”. At the same time, confirm that the mirror status of the journal volume in the primary site of the UR delta resync pair is “PJNS”.
   - To check the pair status from Storage Navigator, confirm that the primary volume status of the UR delta resync pair changes from “HOLDING” to “HOLD”.

*2: To resume the operation in the primary site, see the description of replacing the primary volume and secondary volume of the GAD pair in “Global-Active Device User Guide”.

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19. Recovery Procedure when the Maintenance Utility from Hitachi Device Manager (Storage Navigator) Fails to Start or a Communication Error Occurs between SVP and DKC

Example: An error message example displayed when the Maintenance Utility fails to start.



In the case that an IP address of the user LAN is default value (CTL1: 192.168.0.16/CTL2: 192.168.0.17), this failure may occur. If this failure occurs, take the following recovery procedure.

1. Connect the Maintenance PC and the Maintenance LAN of the CTL1 with a LAN cable.

2. Set IPv4 address and subnet mask of the Maintenance PC to 10.0.0.15 and 255.255.255.0, respectively. Default value of the Maintenance LAN at a factory shipment is 10.0.0.16 (CTL1). If the IP address of the Maintenance LAN was modified, set the IPv4 address and subnet mask values of the Maintenance PC according to the modified value.

3. Start up the Web browser on the Maintenance PC and input the IP address of the Maintenance LAN.
   CTL1: http://10.0.0.16
   If modified, input the modified IP address.

4. When the “Maintenance Utility” window opens, input a user name and a password and then, press the “Login“ button.

5. Click the “Network Settings” button on the “Set Up Network Settings” menu on the “Maintenance Utility” window and then, change the “IPv4 Address” for both CTL1 and CTL2 to the following IP address.
   CTL1: 192.168.0.26 (provisional value)
   CTL2: 192.168.0.27 (provisional value)

6. After changing the IP addresses, the Maintenance Utility will automatically reboot to apply its setting. Wait for about five minutes.

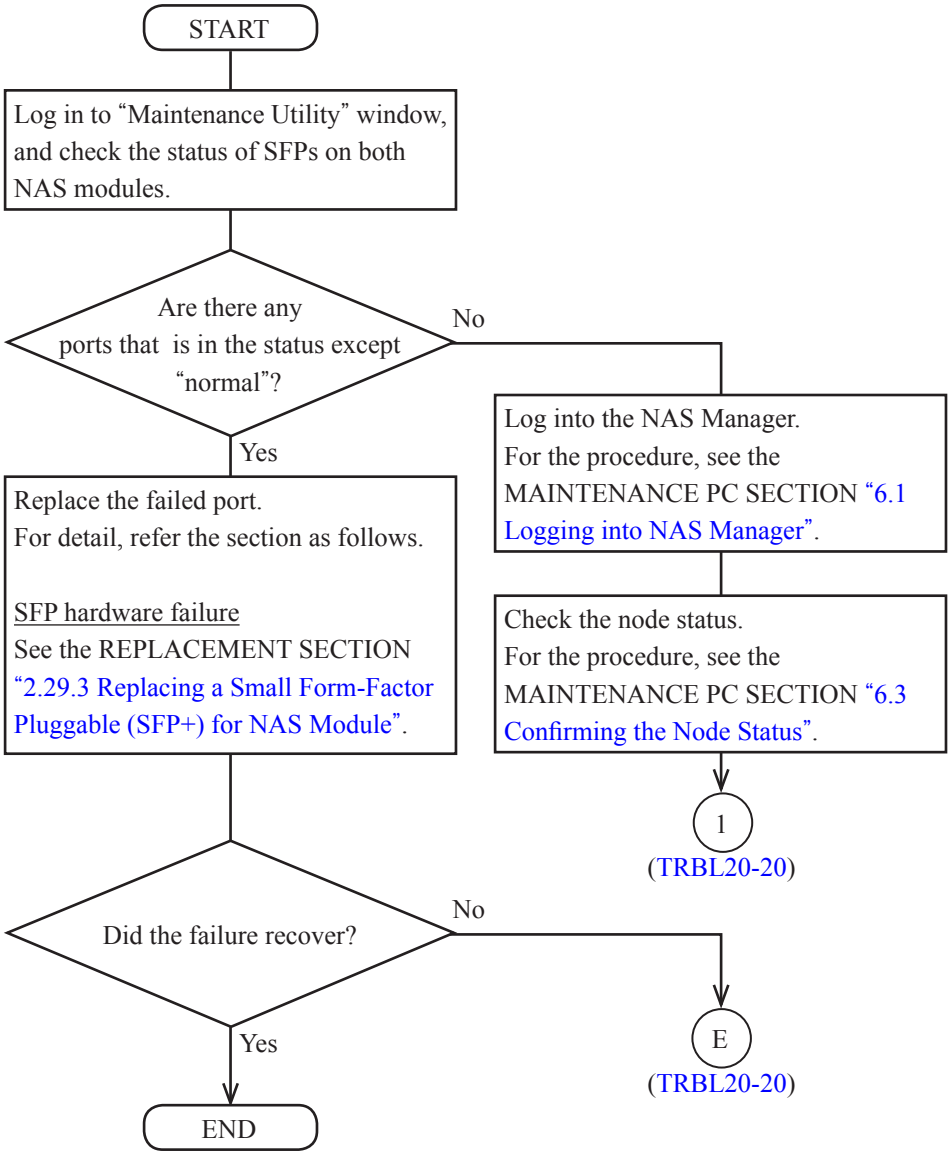
7. Execute the aforementioned procedure from Step 3 to Step 6 again to change the “IPv4 Addresses” for both CTL1 and CTL2 to the following IP address (default value).
   CTL1: 192.168.0.16 (default value)
   CTL2: 192.168.0.17 (default value)

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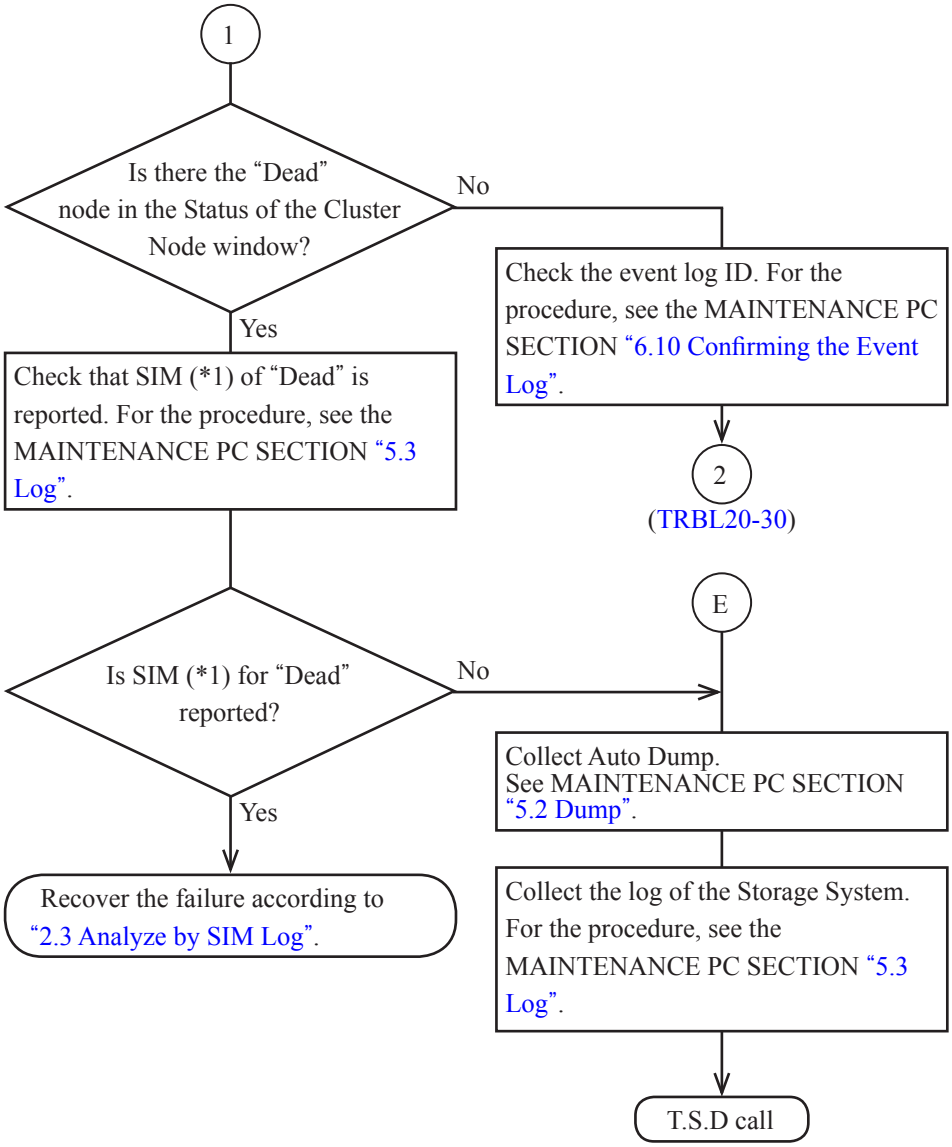
20. NAS Module Troubleshooting

20.1 Procedure for NAS Module Troubleshooting (SIM is not reported)

This section describes the troubleshooting flow when an error occurs in the NAS module and SIM is not reported.

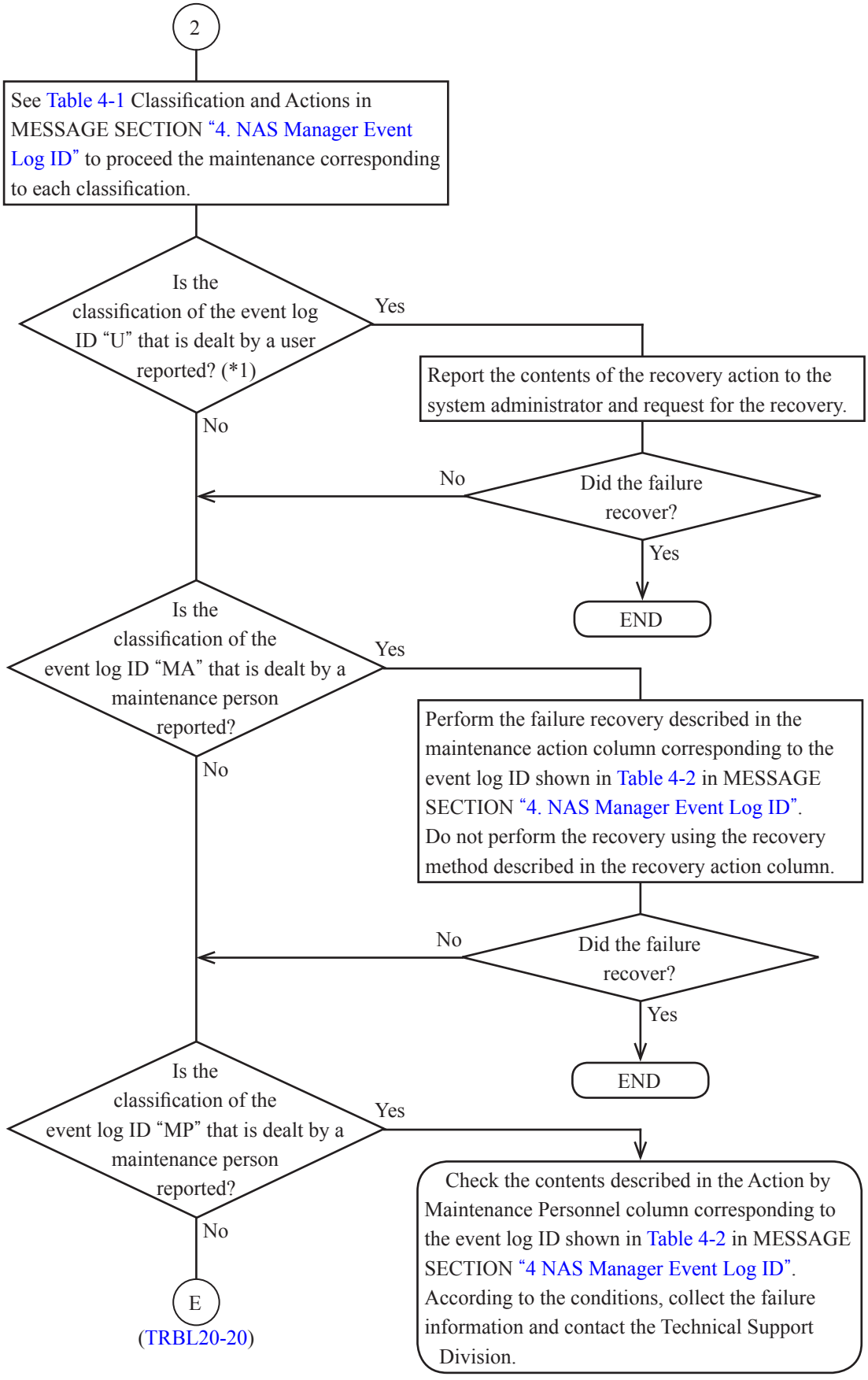


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*1: SIM = 307b0x/e0000x/e001xy/e0020x/e0040x/e005x2/e0060x/e007x2/e008x2/e0090x

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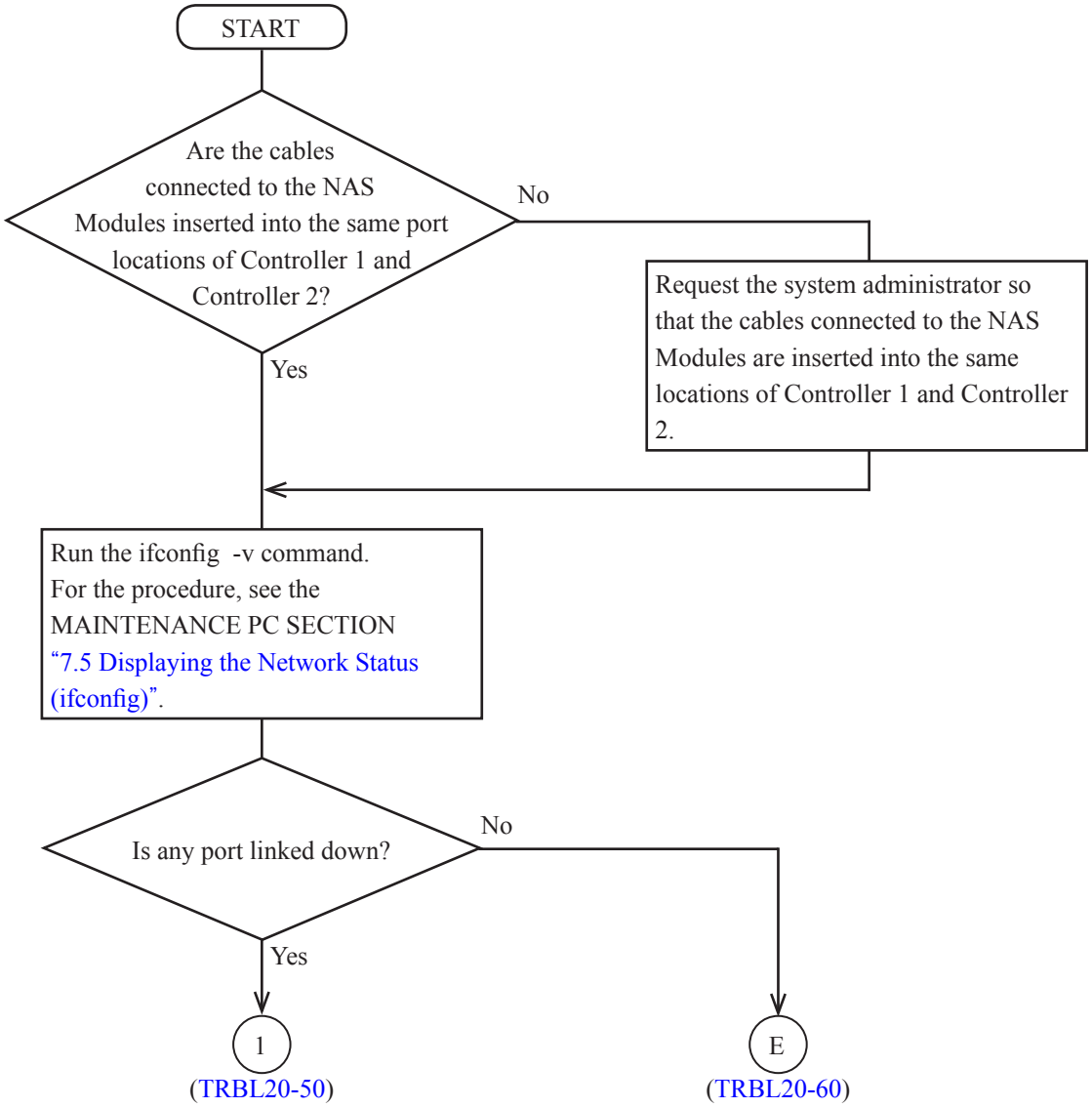


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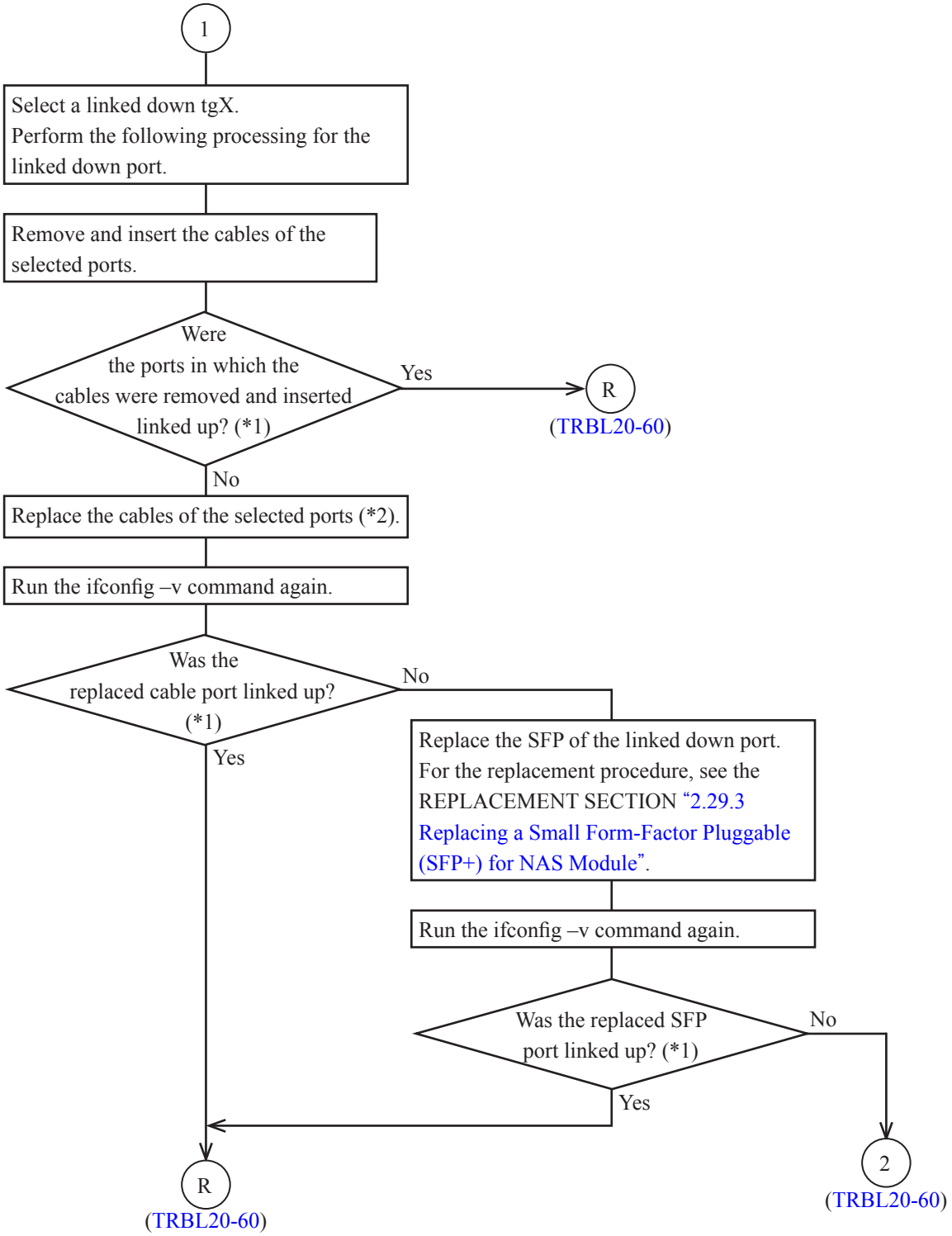
20.2 Isolating NAS Module Failure

20.2.1 Isolating Data LAN Failure

Isolate the data LAN (tg1~tg6) failure as shown below.



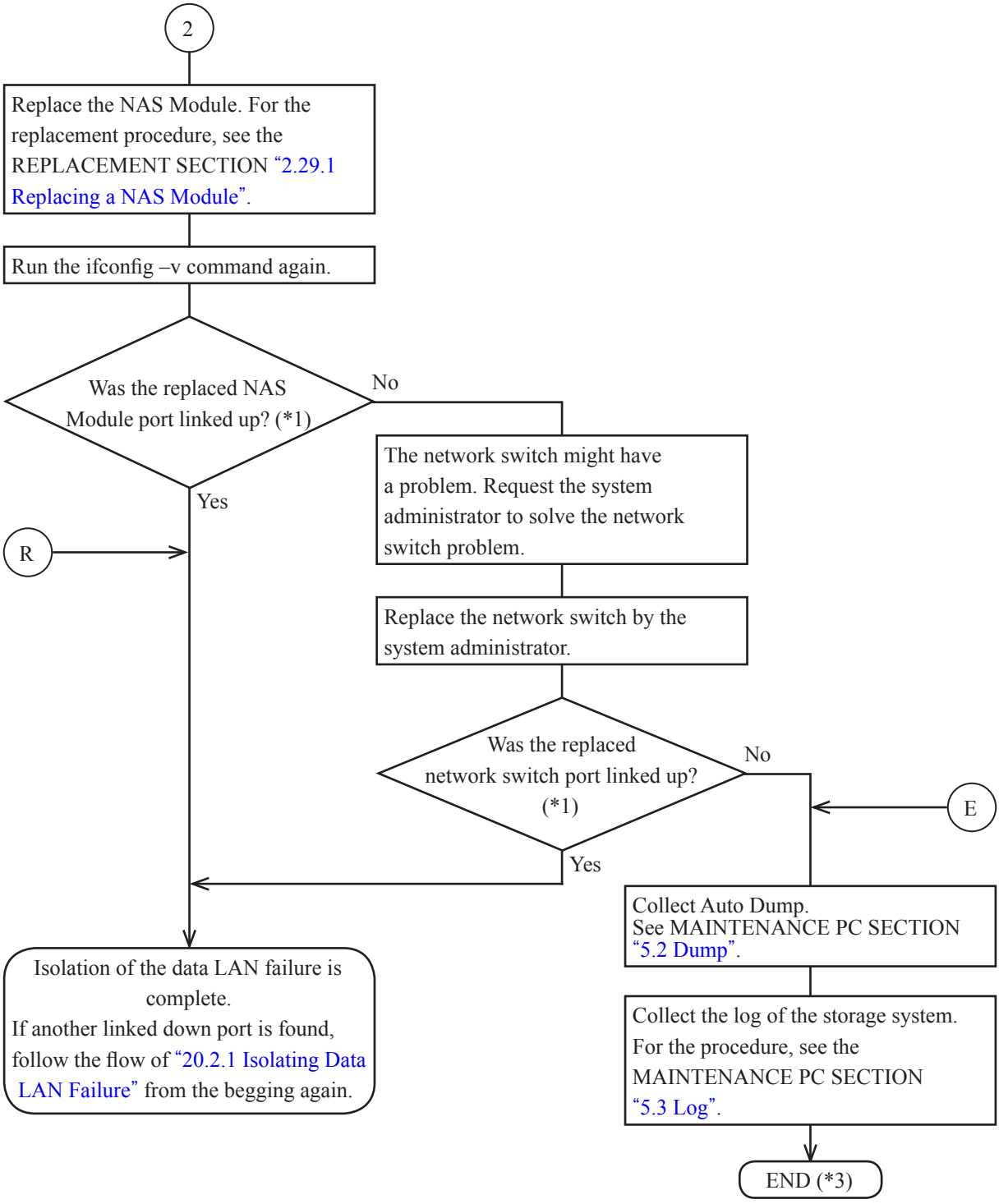
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*1: See MAINTENANCE PC SECTION "7.5 Displaying the Network Status (ifconfig)" for the port link-up.

*2: If the cables connected to the data LAN (tg1 to tg6) are provided by Hitachi, the maintenance personnel replace them. If the cables are provided by other than Hitachi, request the system administrator for the replacement.

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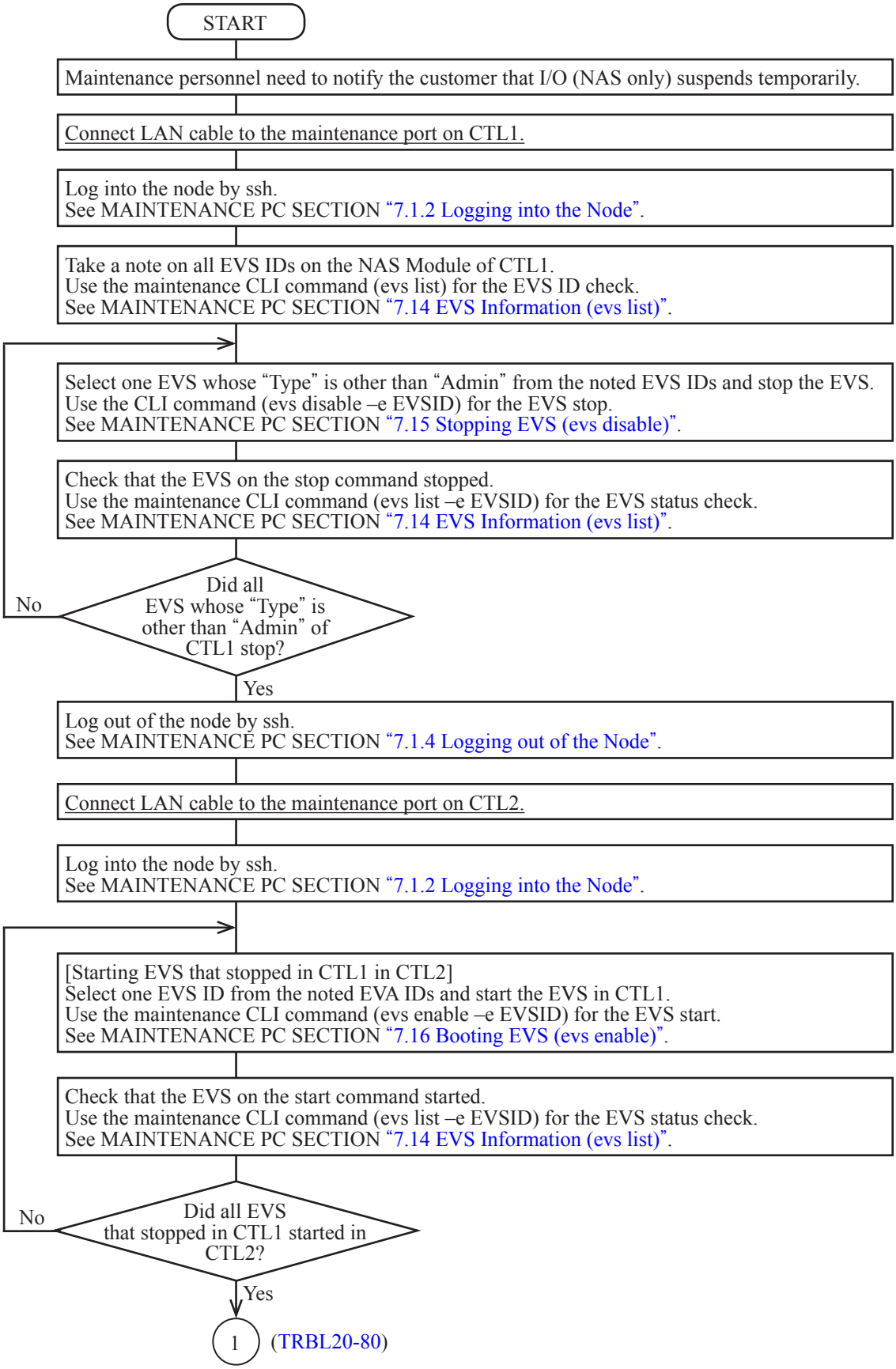


*1: See MAINTENANCE PC SECTION "7.5 Displaying the Network Status (ifconfig)" for the port link-up.

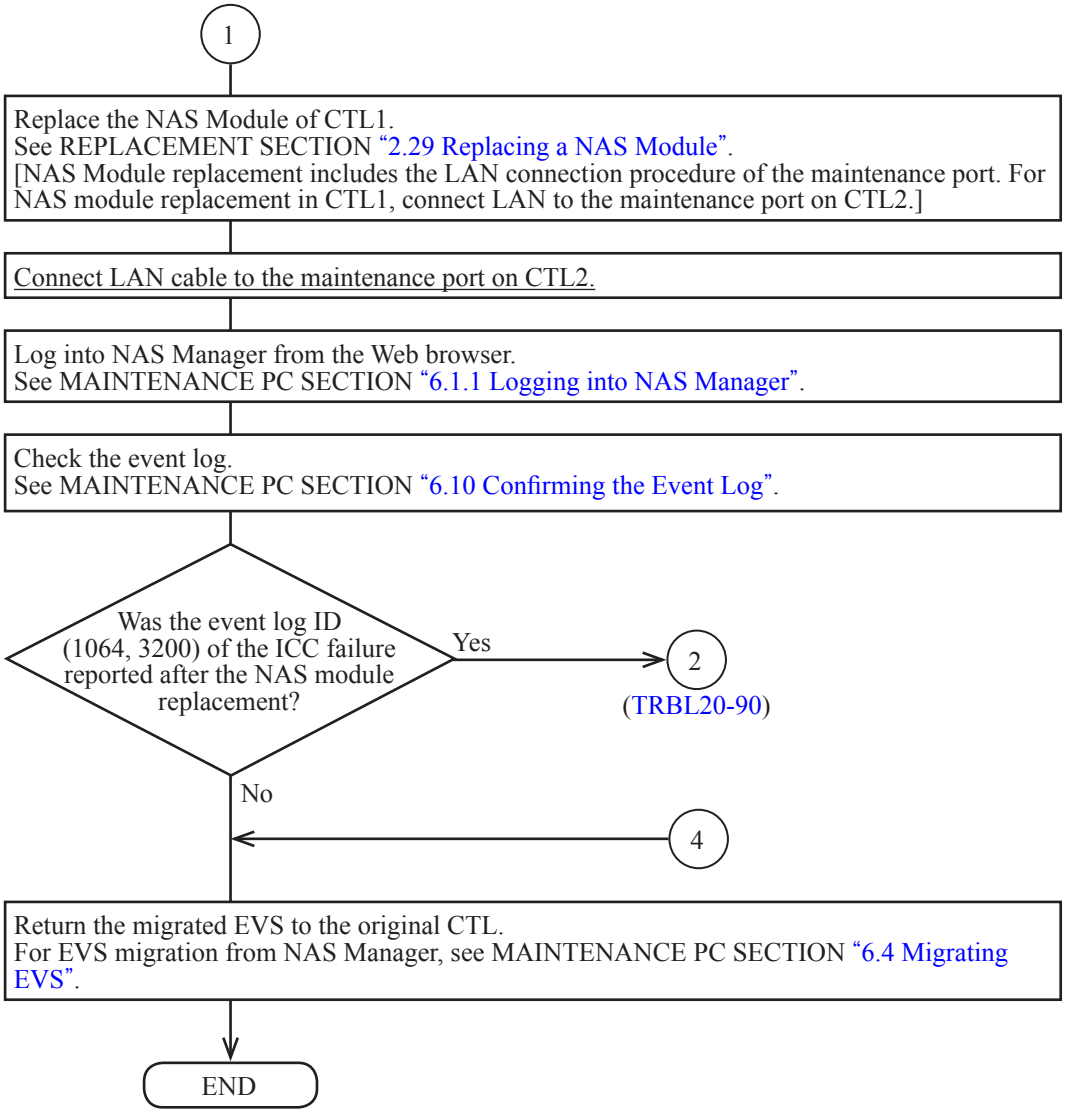
*3: After the completion of this processing, return to the call source and continue the maintenance action.

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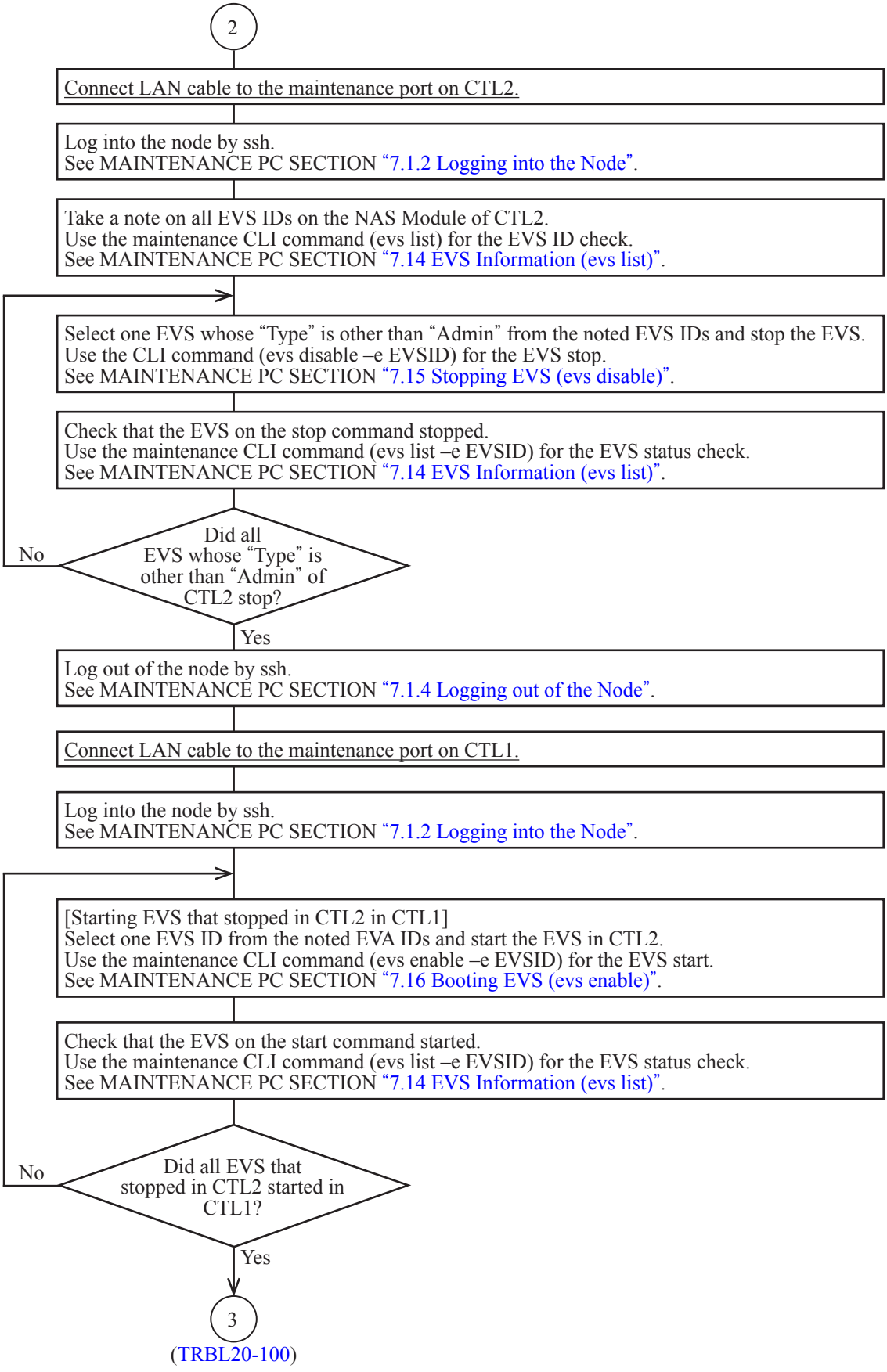
20.2.2 Recovery from ICC Failure



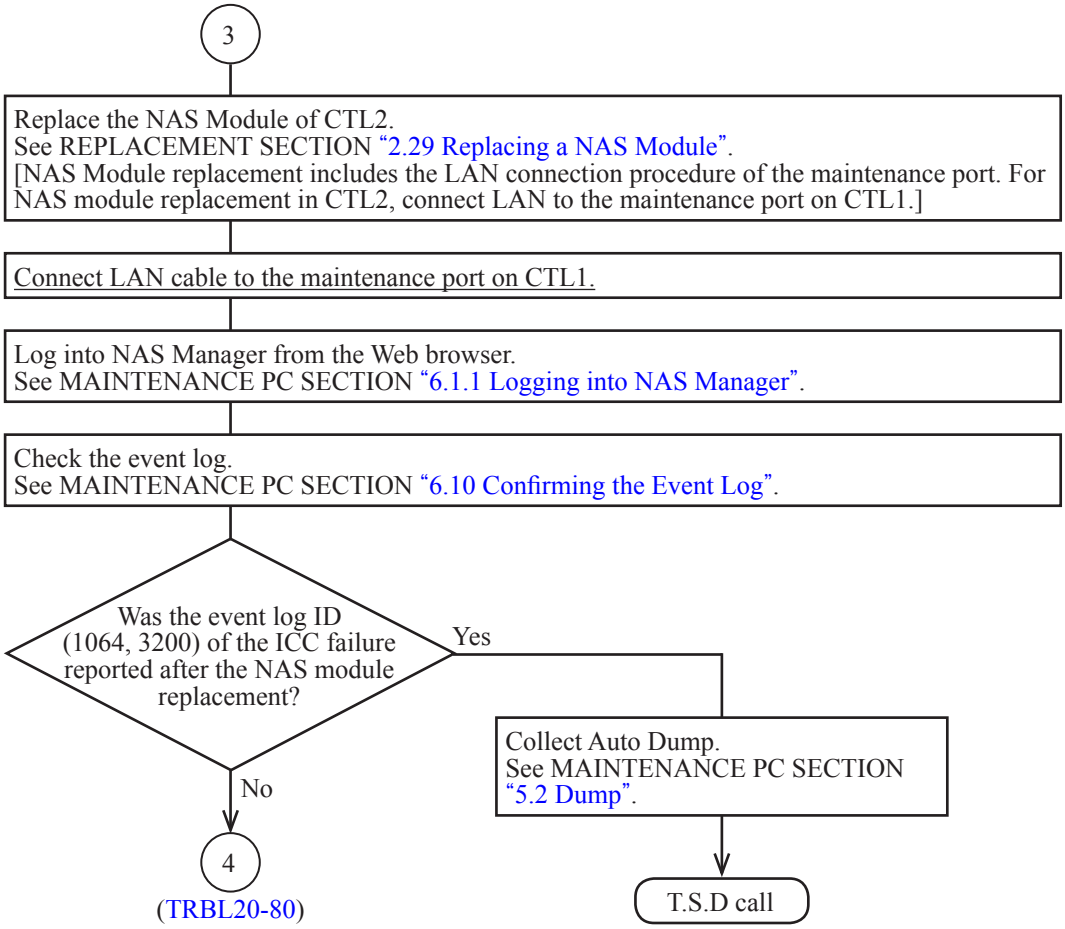
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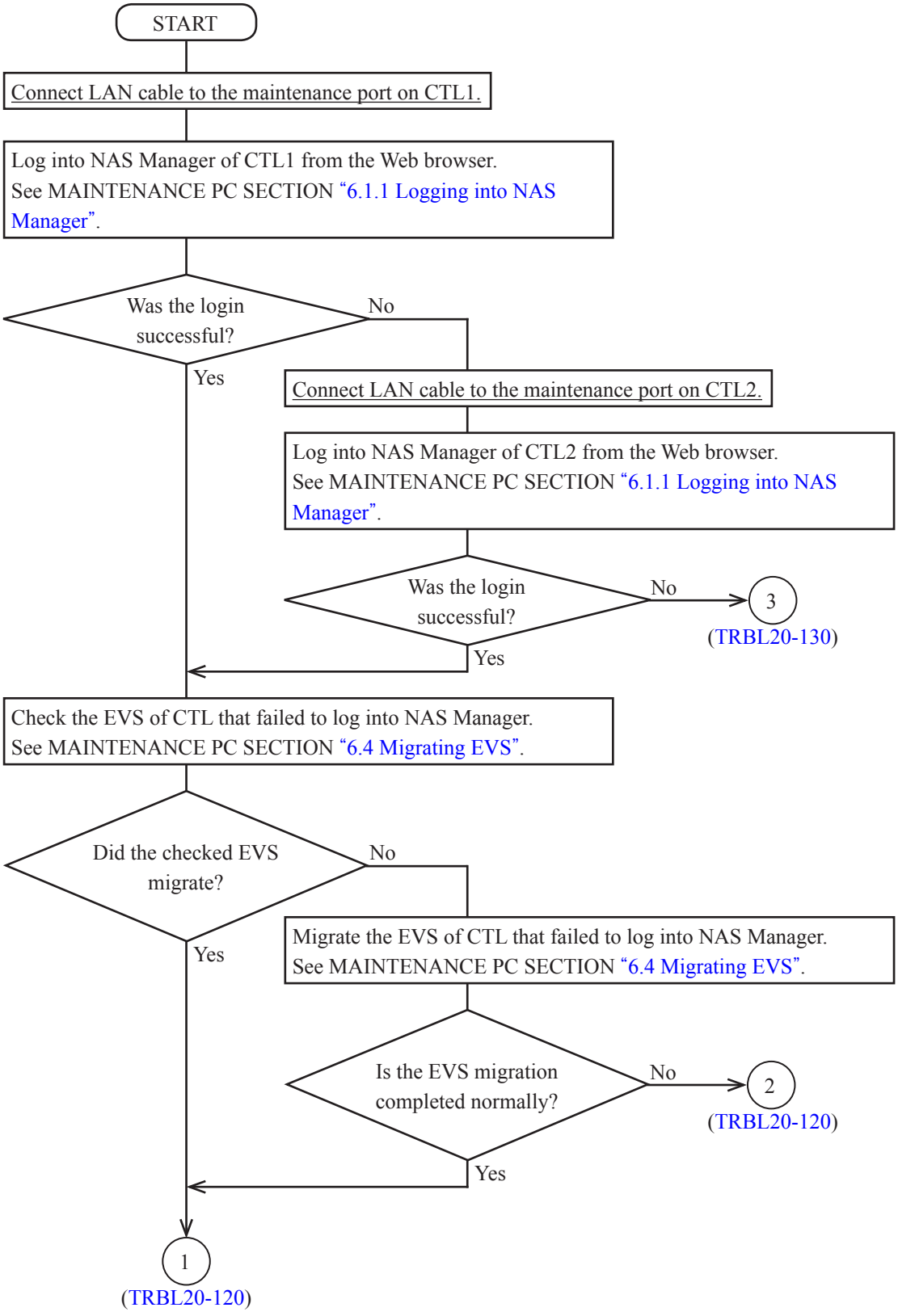


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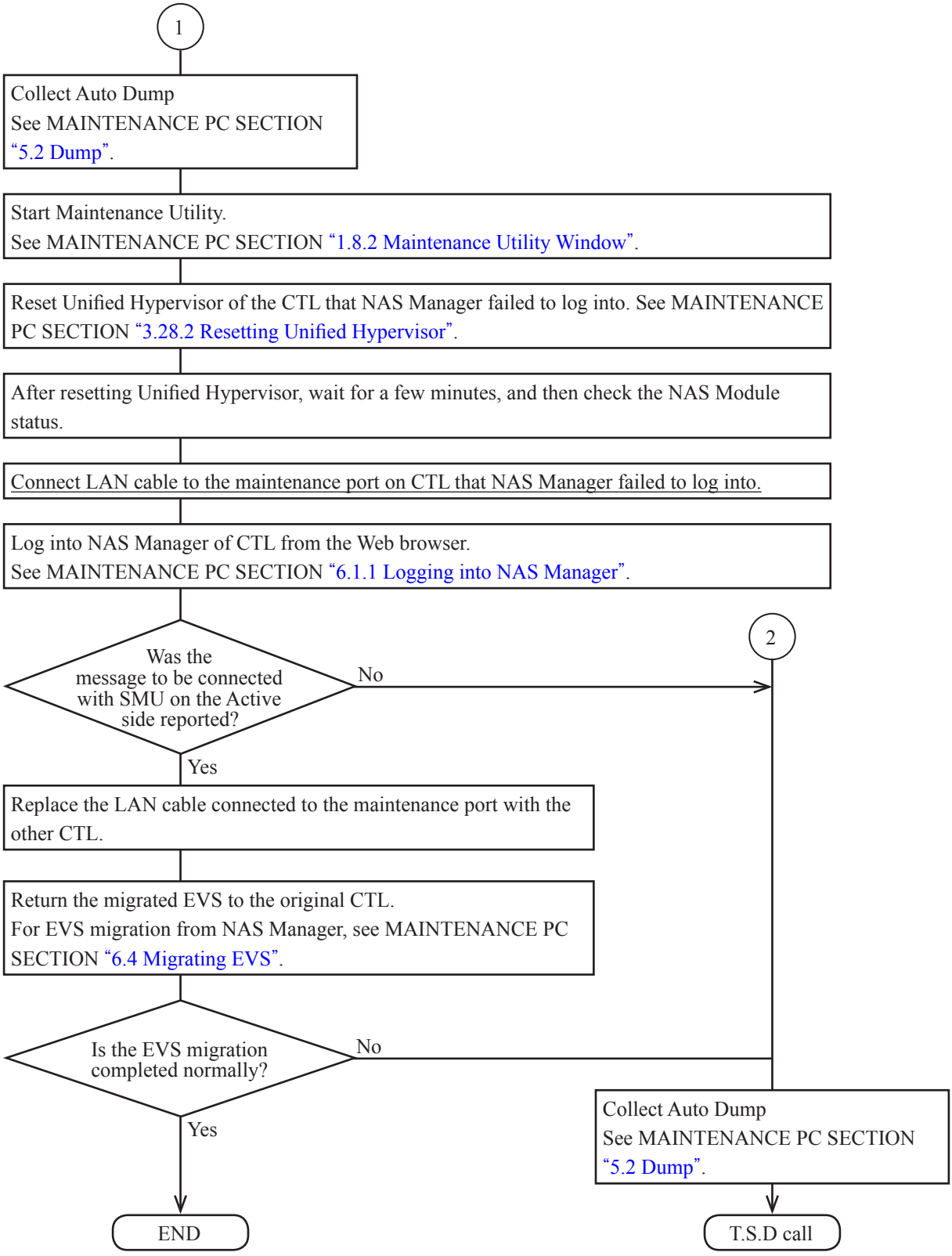


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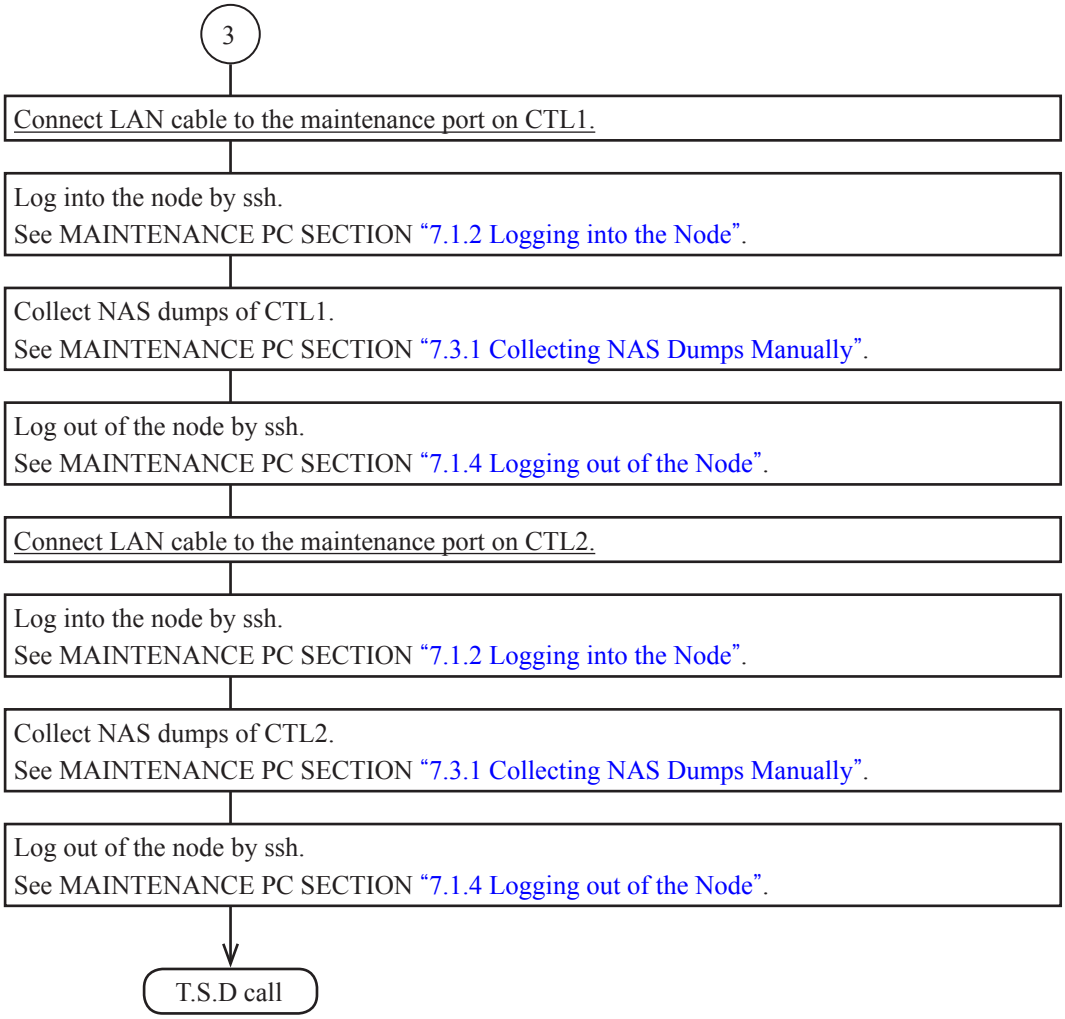
20.2.3 Recovery from SMU Failure



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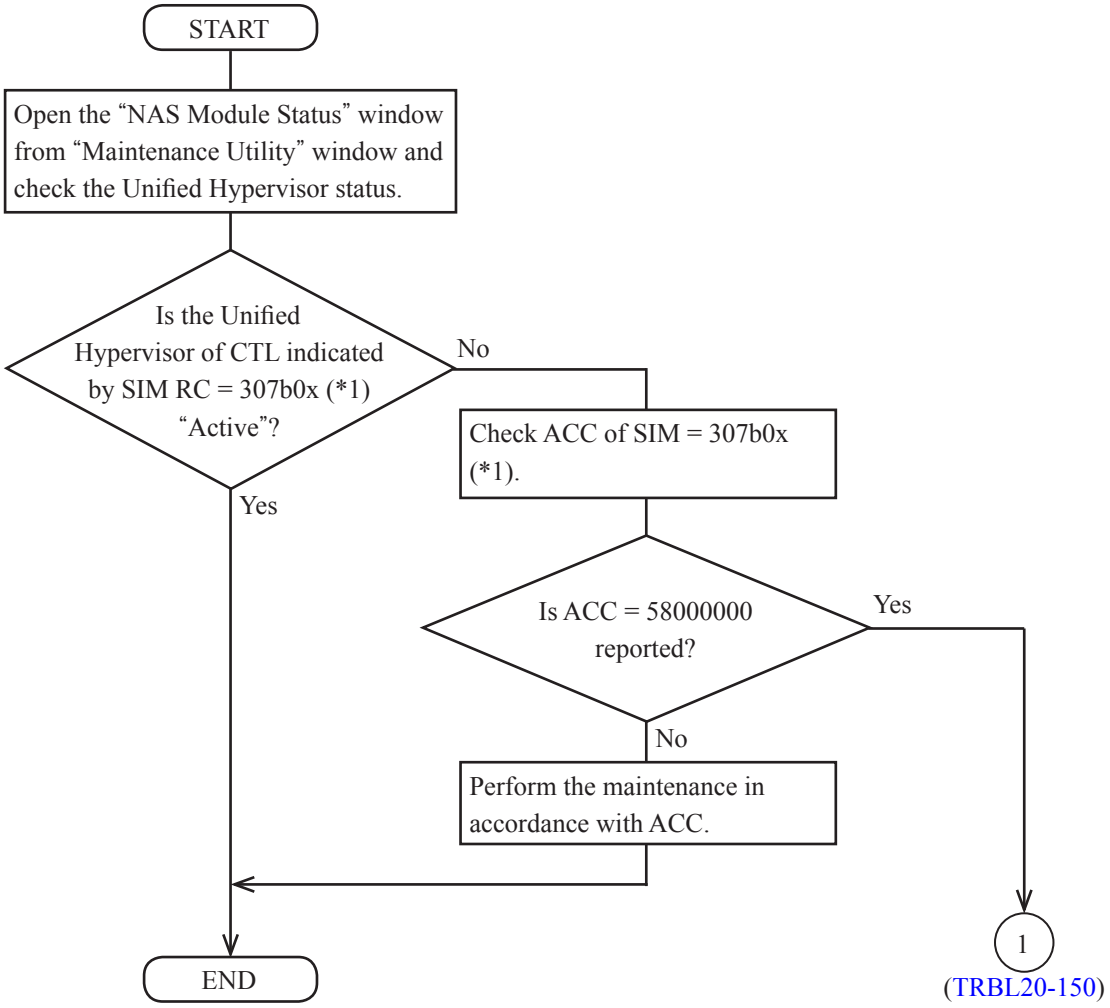


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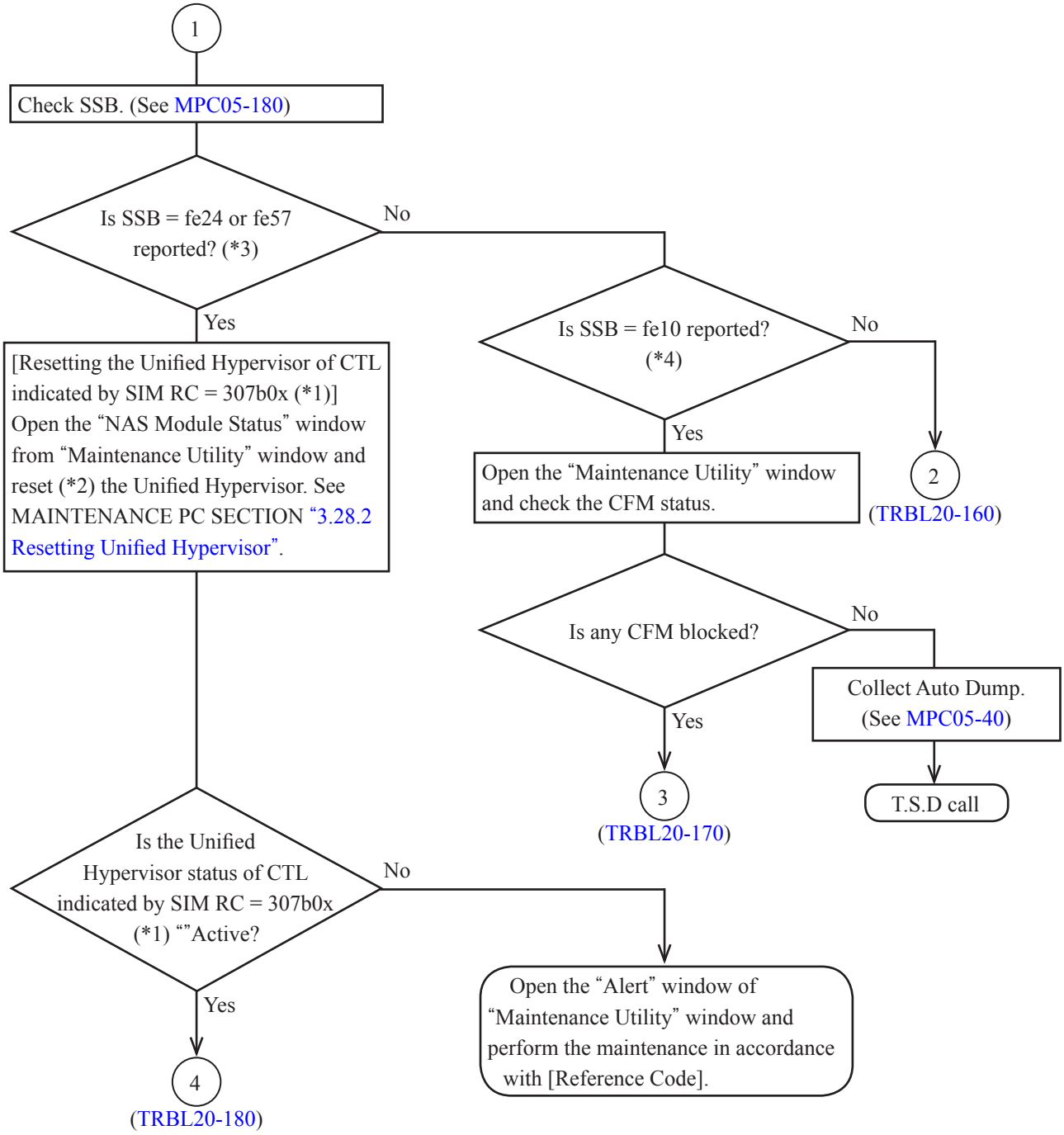
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20.3 Response to Unified Hypervisor blockade When Starting Unified Hypervisor (SIM = 307b0x)



*1: x of SIM RC = 307b0x indicates CTL#. (x = 0: CTL1, x = 1: CTL2)

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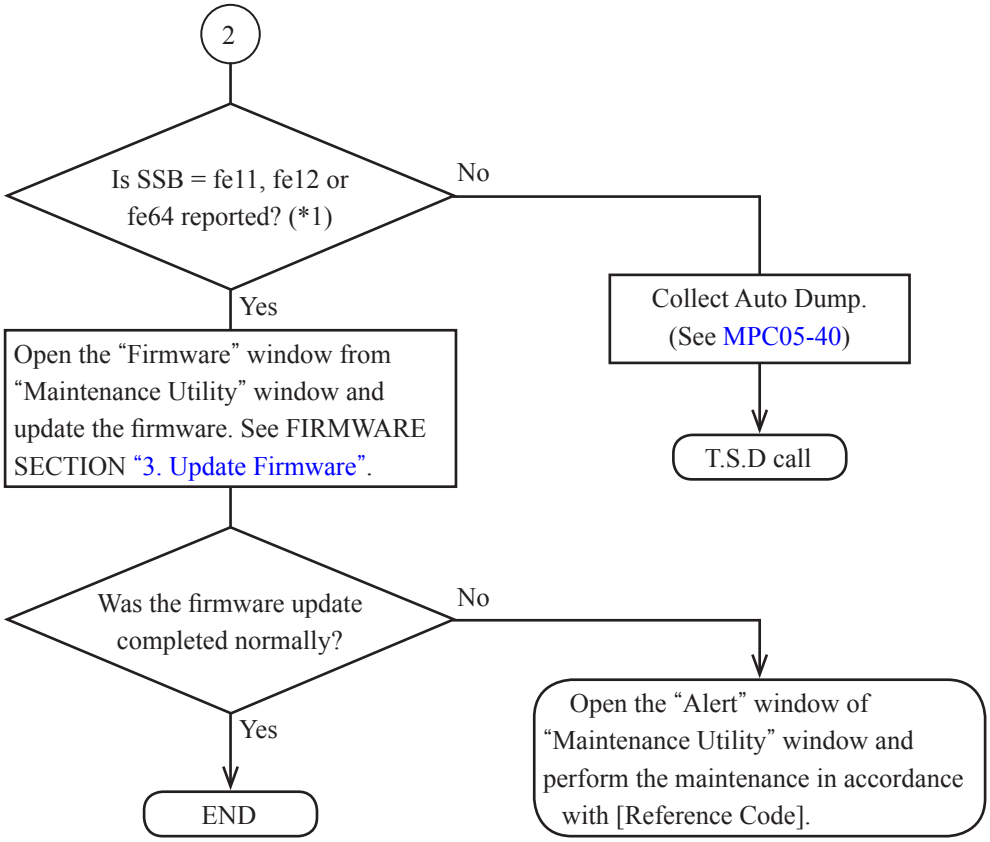
*1: x of SIM RC = 307b0x indicates CTL#. (x = 0: CTL1, x = 1: CTL2)

*2: If resetting of the Unified Hypervisor fails, perform the maintenance in accordance with the output instructions.

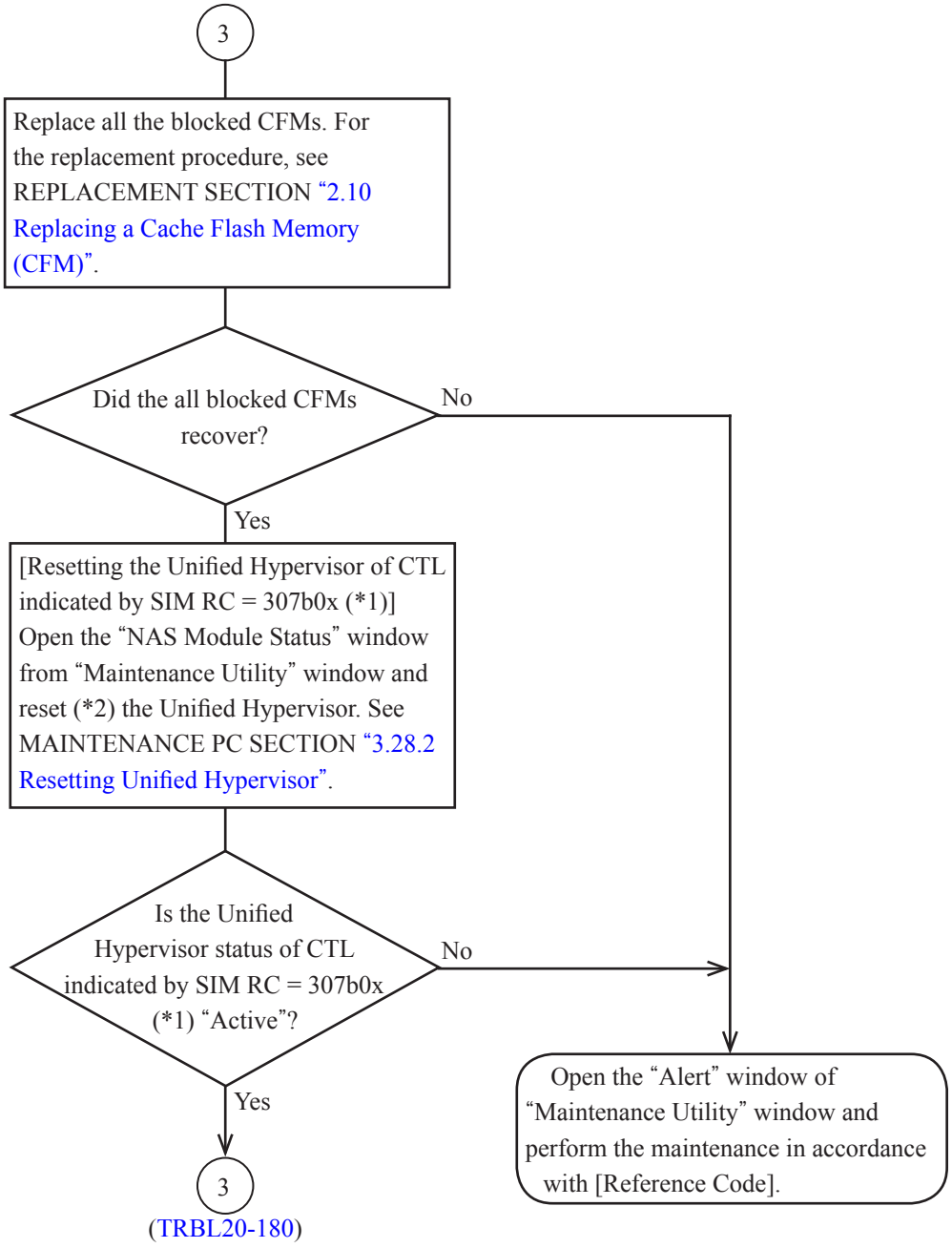
*3: SSB = fe24/fe57 is reported when an error is detected by the prior check at the time of starting Unified Hypervisor.

*4: SSB = fe10 is reported when Unified Hypervisor Firmware read fails at the time of starting Unified Hypervisor.

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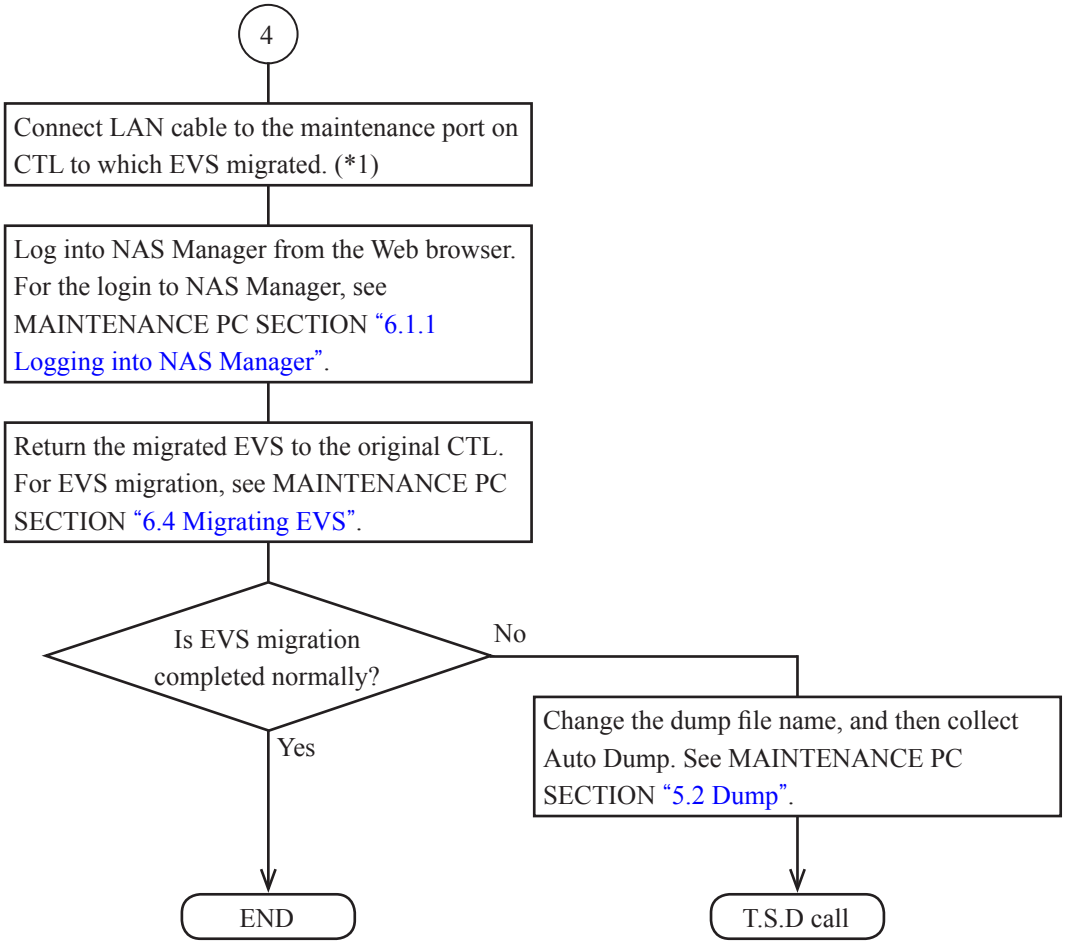
*1: SSB = fe11/fe12/fe64 is reported when an error is detected by Unified Hypervisor Firmware at the time of starting Unified Hypervisor.



*1: x of SIM RC = 307b0x indicates CTL#. (x = 0: CTL1, x = 1: CTL2)

*2: If resetting of the Unified Hypervisor fails, perform the maintenance in accordance with the output instructions.

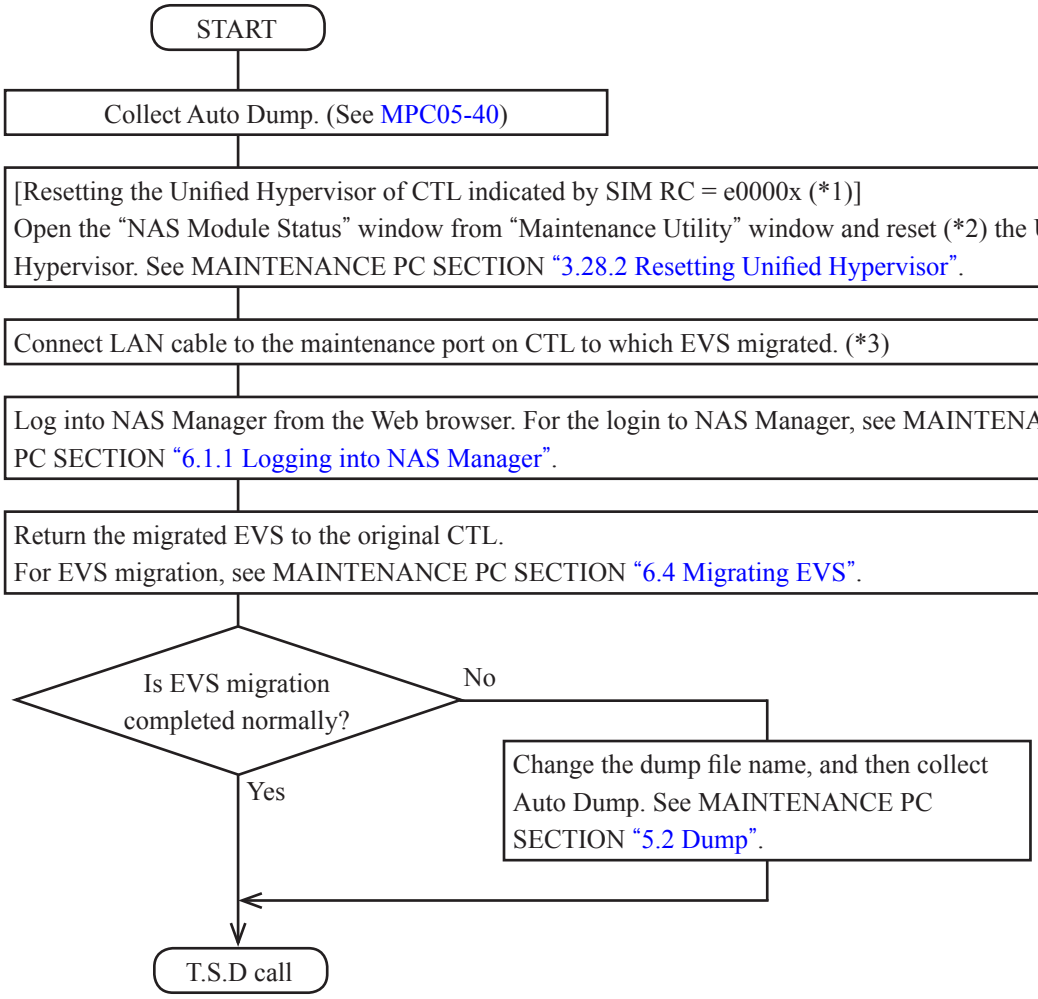
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*1: The EVS migration destination is identified by SIMRC = 307b0x.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

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20.4 Recovery Procedure for Unified Hypervisor Failure (SIM = e0000x)



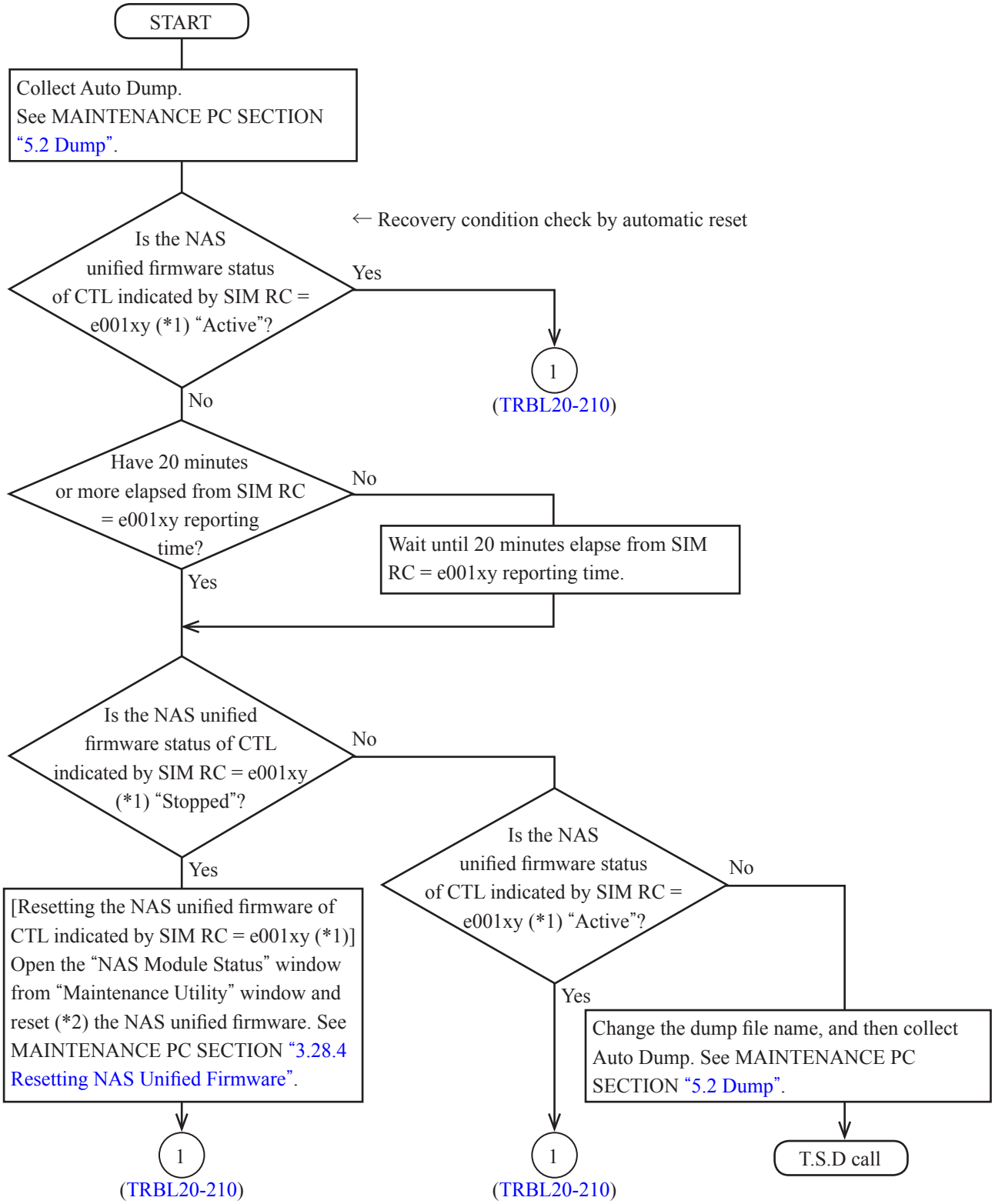
*1: x of SIM RC = e0000x indicates CTL#. (x = 0: CTL1, x = 1: CTL2)

*2: If resetting of the Unified Hypervisor fails, perform the maintenance in accordance with the output instructions.

*3: The EVS migration destination is identified by SIMRC = e0000x.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

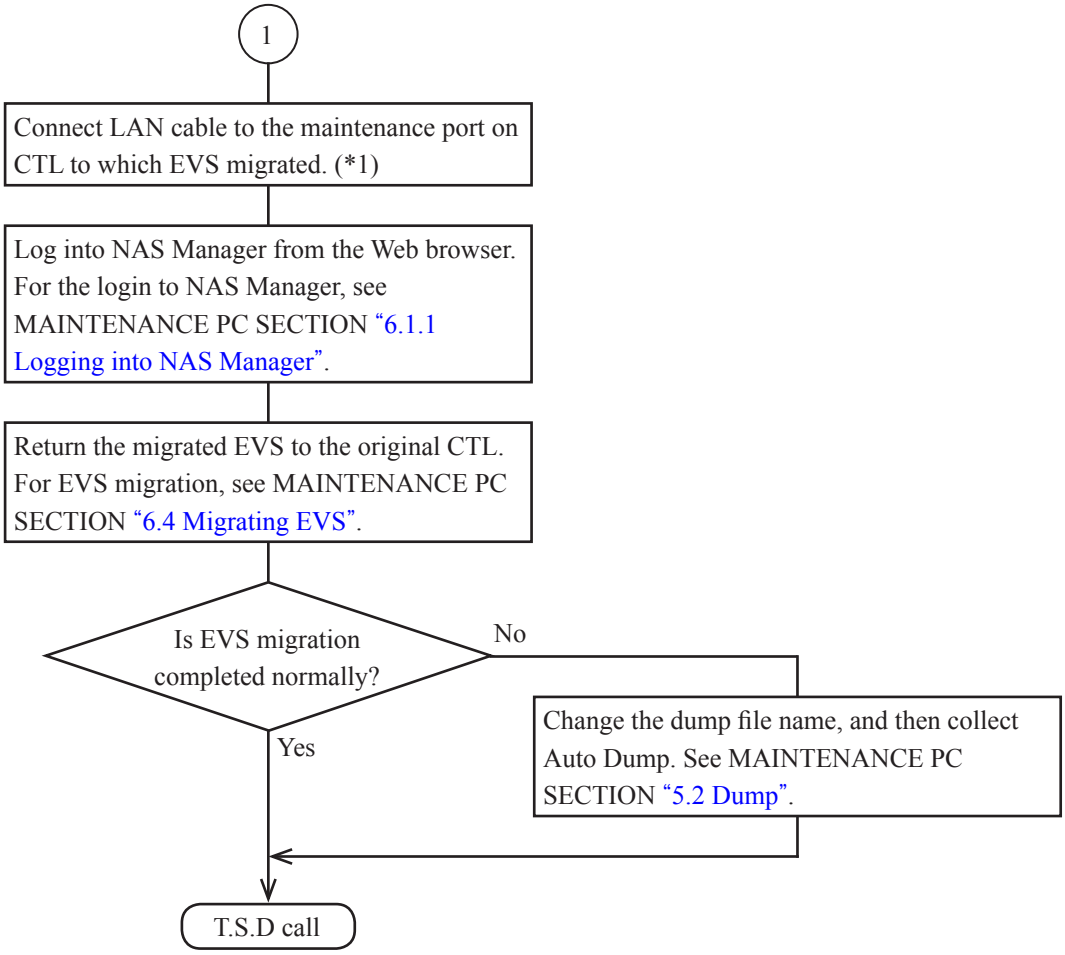
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20.5 Recovery Procedure for NASFW Failure (SIM = e001xy)



*1: x of SIM RC = e001xy indicates CTL# (x = 0: CTL1, x = 1: CTL2) and y indicates LPAR# (0 to 3).
*2: If resetting of the NAS unified firmware fails, perform the maintenance in accordance with the output instructions.

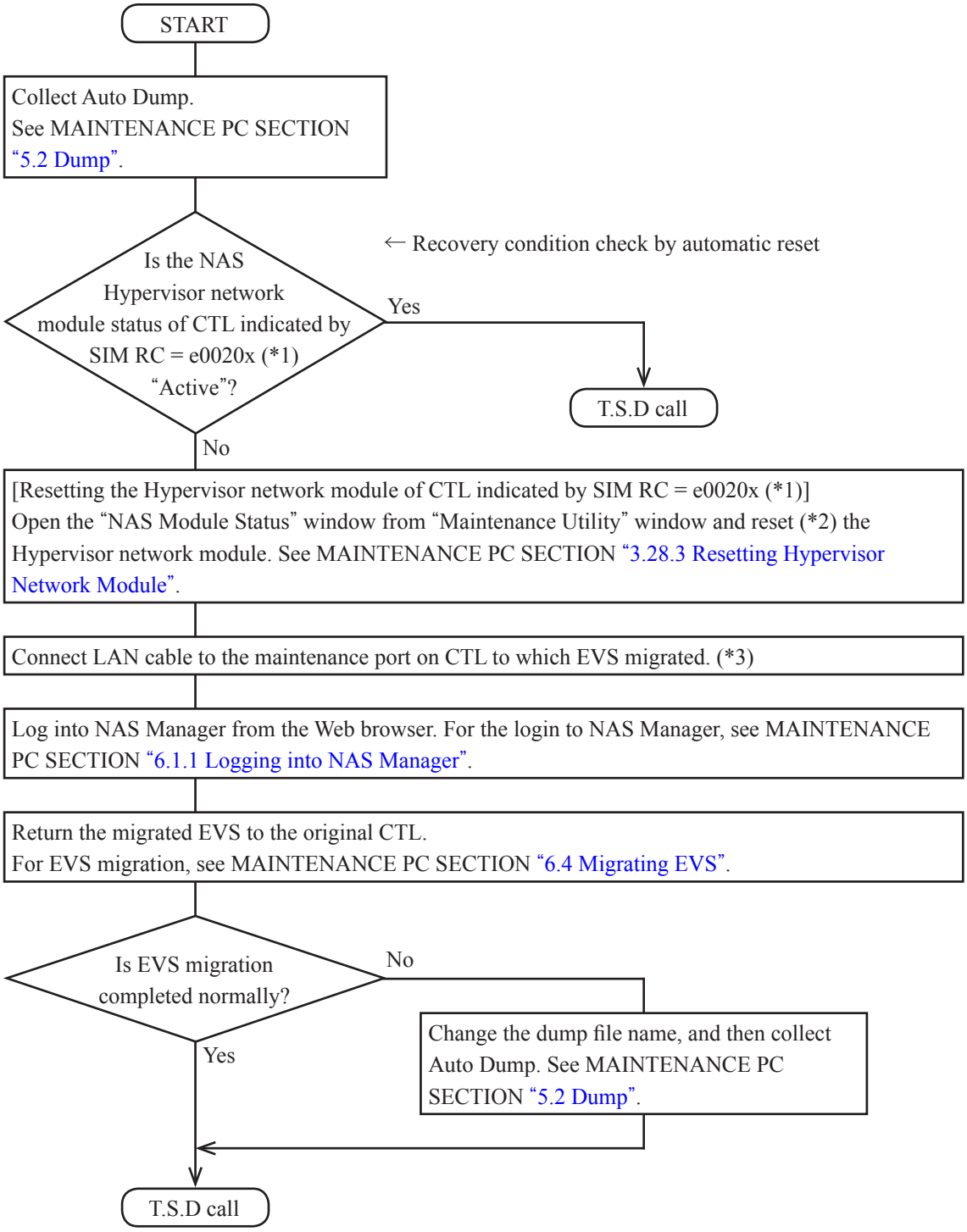
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*1: The EVS migration destination is identified by SIMRC = e001xy.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

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20.6 Recovery Procedure for Hypervisor Network Module Failure (SIM = e0020x)



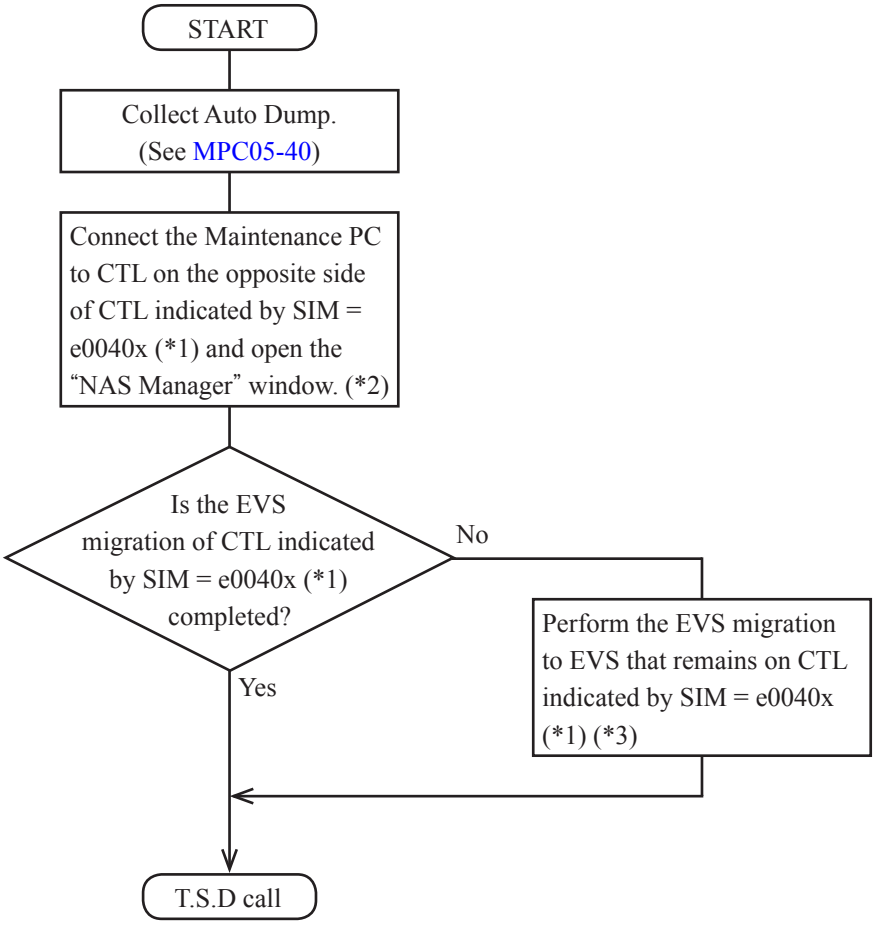
*1: x of SIM RC = e0020x indicates CTL#. (x = 0: CTL1, x = 1: CTL2)

*2: If resetting of the Hypervisor network module fails, perform the maintenance in accordance with the output instructions.

*3: The EVS migration destination is identified by SIMRC = e0020x.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

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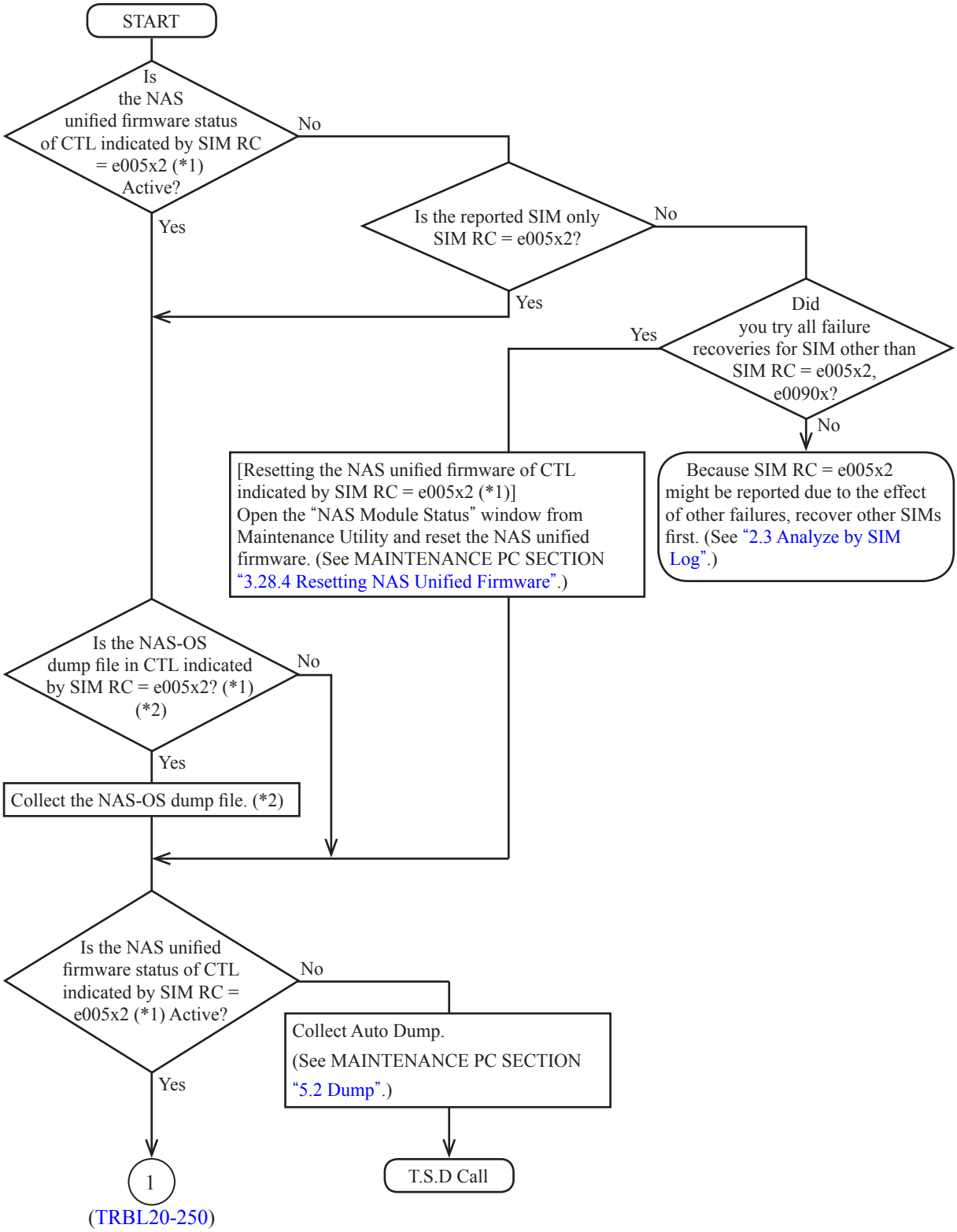
20.7 Recovery Procedure When File Service Is Down Due to Excess of Threshold Uniquely Owned by NASFW (= NAS OS) (SIM = e0040x)



*1: xx of SIM RC = e0040x indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)
*2: See MAINTENANCE PC SECTION "6.1.1 Logging into NAS Manager".
*3: See MAINTENANCE PC SECTION "6.4.1 Migration before the Maintenance Operation".

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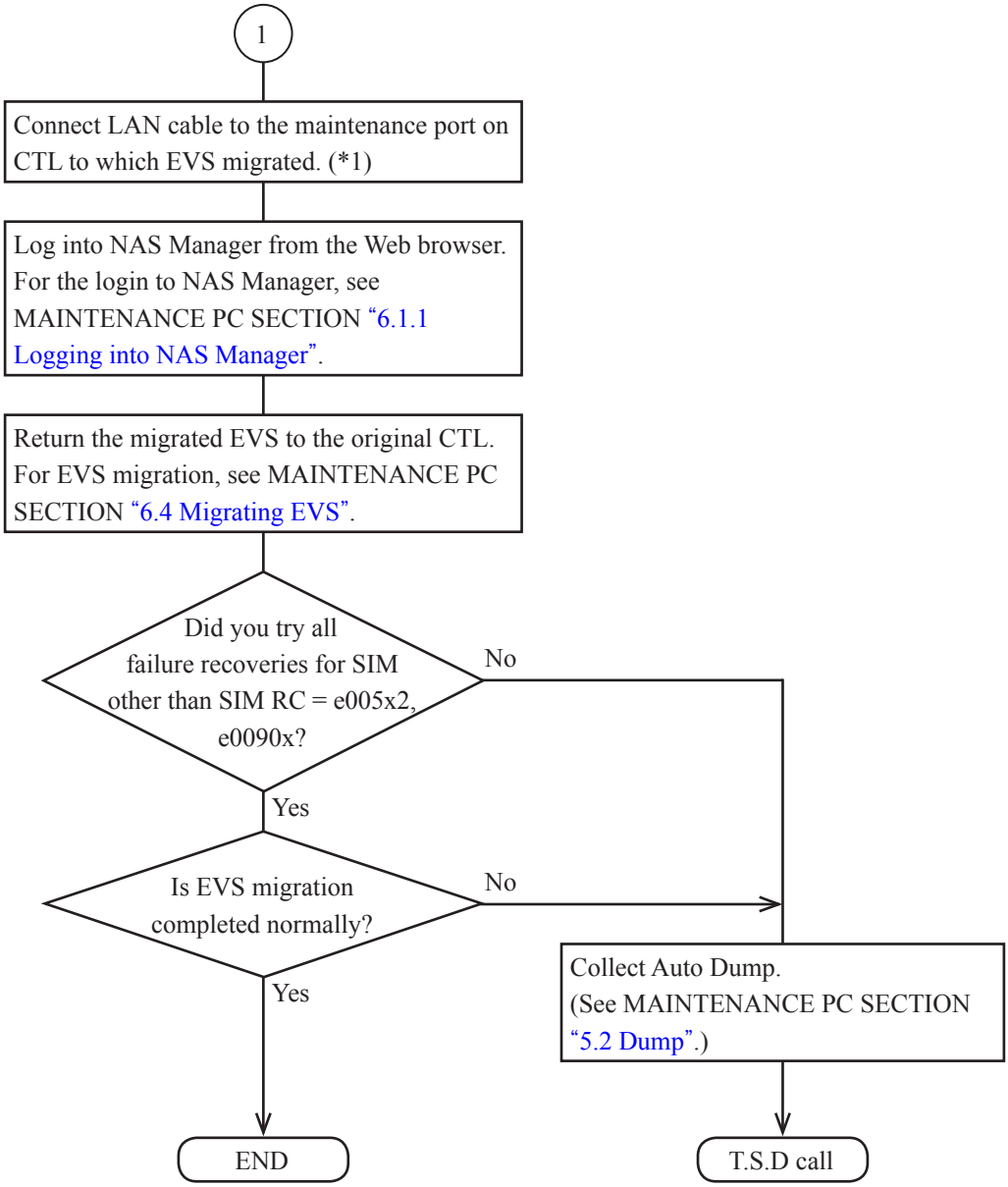
20.8 Recovery Procedure for NASFW Failure (SIM = e005x2)



*1: x of SIM RC = e005x2 indicated CTL#. (x = 0 : CTL1, x = 1 : CTL2)

*2: See MAINTENANCE PC SECTION "7.3.2 Collecting NAS-OS Dumps" for the NAS-OS dump file.

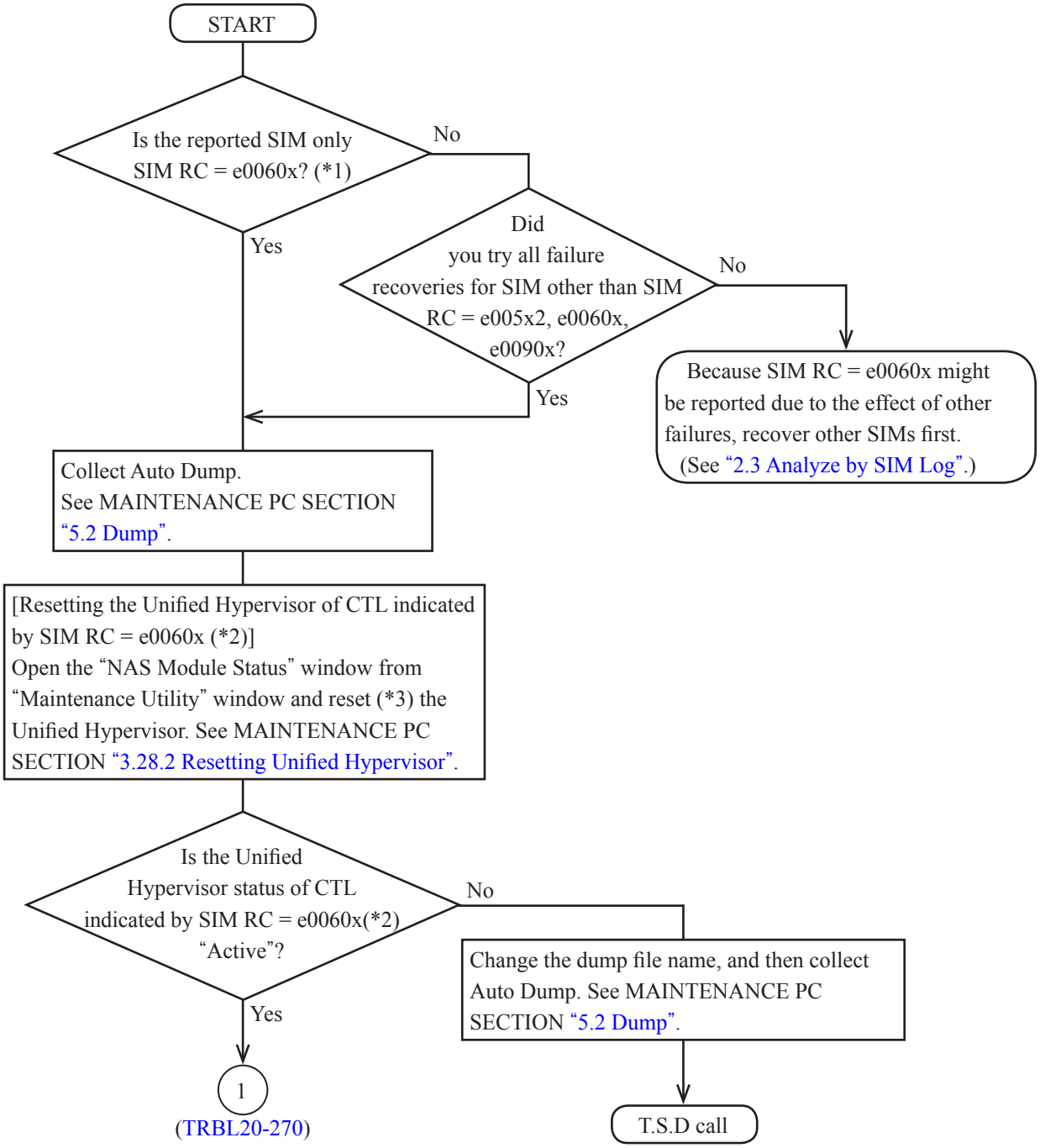
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*1: The EVS migration destination is identified by SIMRC = e005x2.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

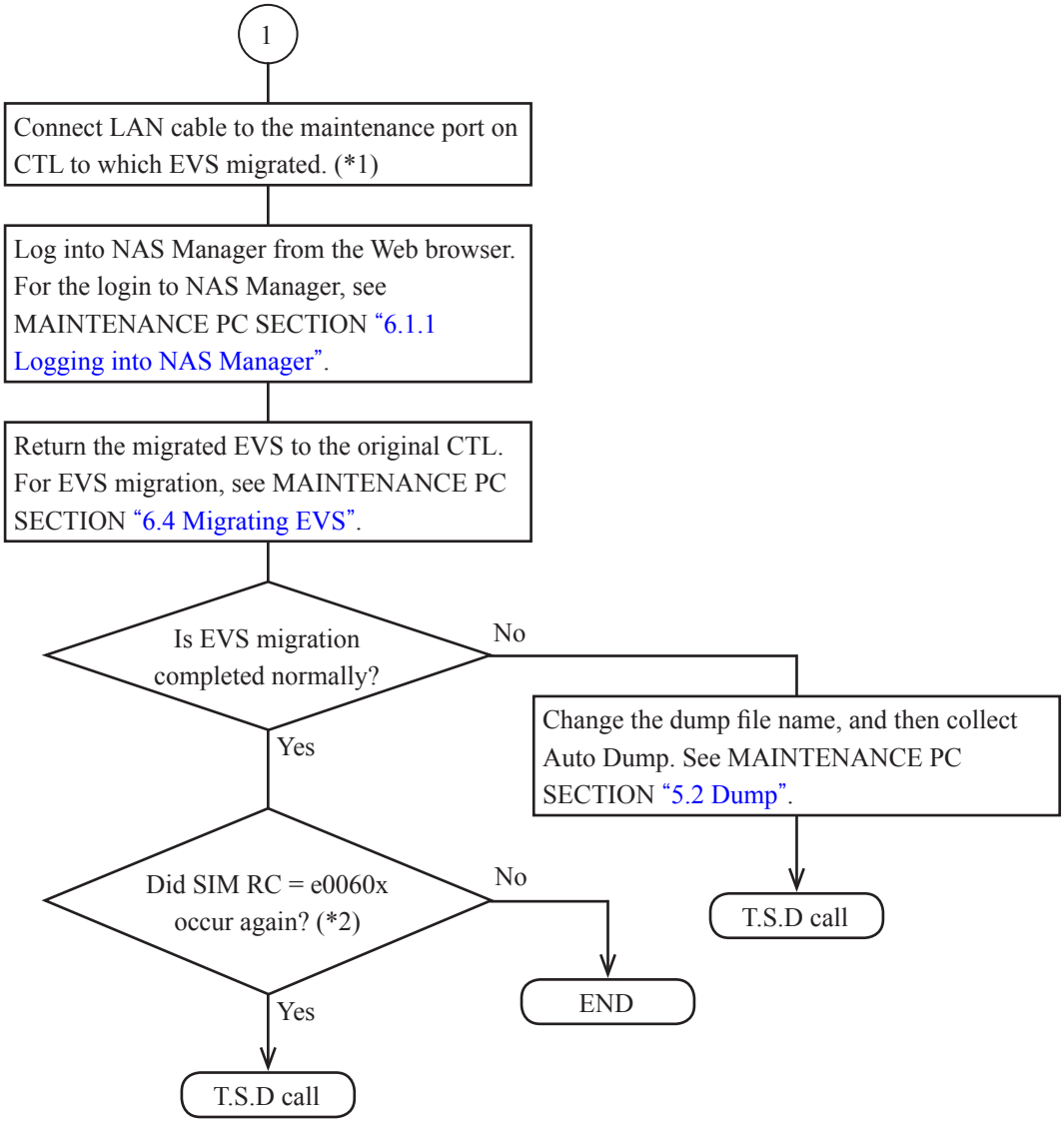
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20.9 Recovery Procedure for Unified Hypervisor Part Failure (SIM = e0060x)



*1: If multiple SIM RCs are reported, perform the maintenance of SIM RC = e0060x last.
*2: x of SIM RC = e0060x indicates CTL#. (x = 0 : CTL1, x = 1: CTL2)
*3: If resetting of the Unified Hypervisor fails, perform the maintenance in accordance with the output instructions.

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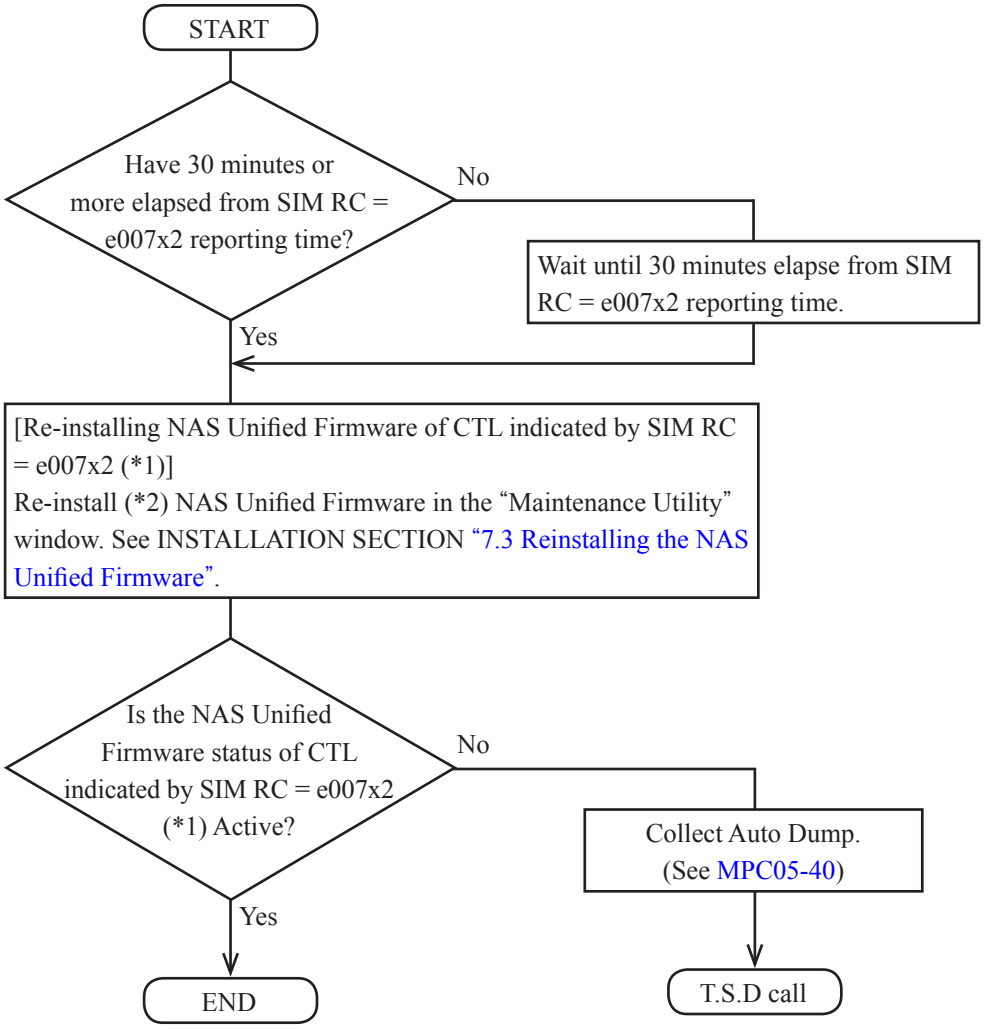


*1: The EVS migration destination is identified by SIMRC = e0060x.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

*2: x of SIM RC = e0060x also targets the same SIM RC.

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20.10 Recovery Procedure for NASFW Boot Failure (MBR Corruption) (SIM = e007x2)

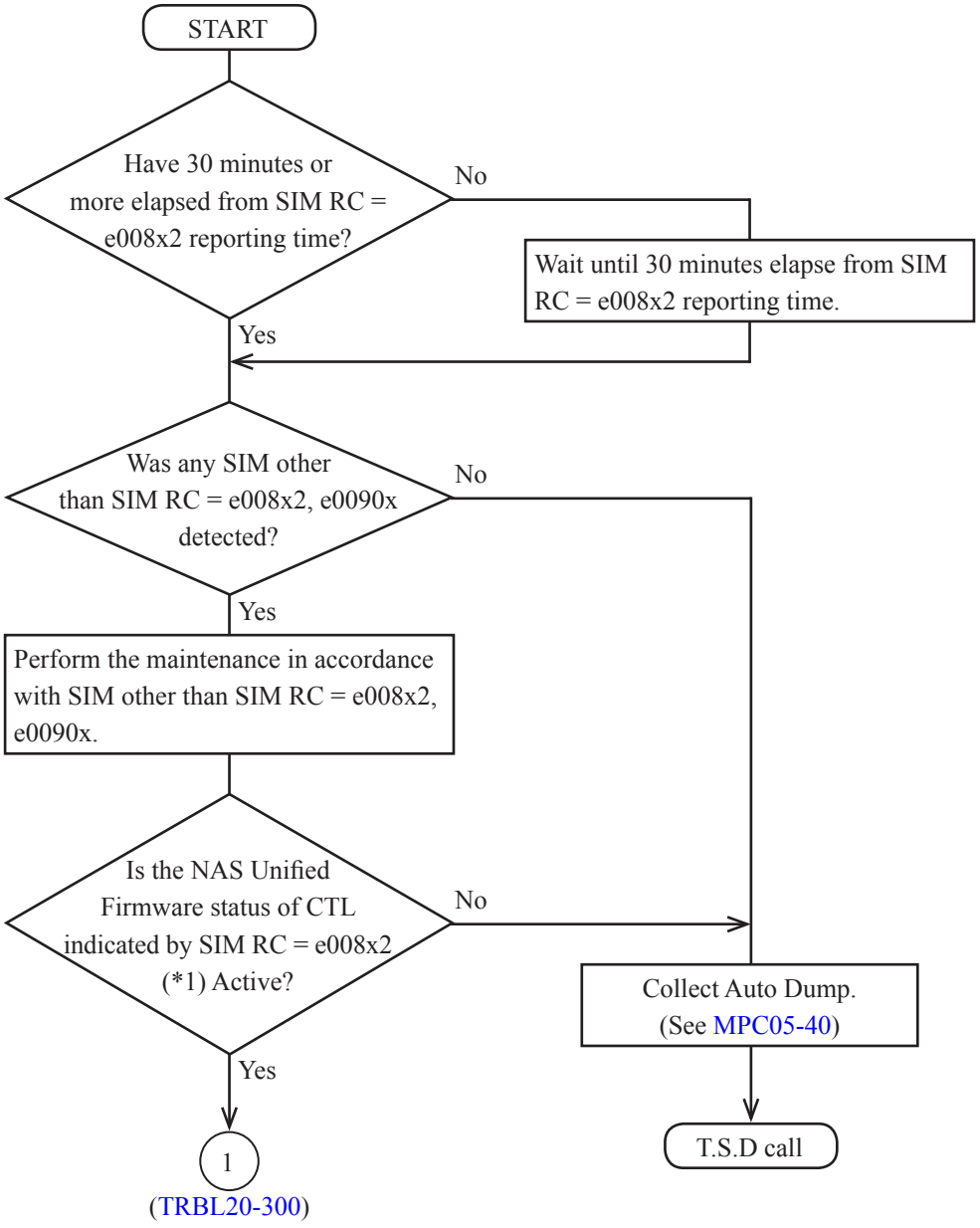


*1: x of SIM RC = e007x2 indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)

*2: If NAS Unified Firmware re-installation fails, perform the maintenance in accordance with the output instruction.

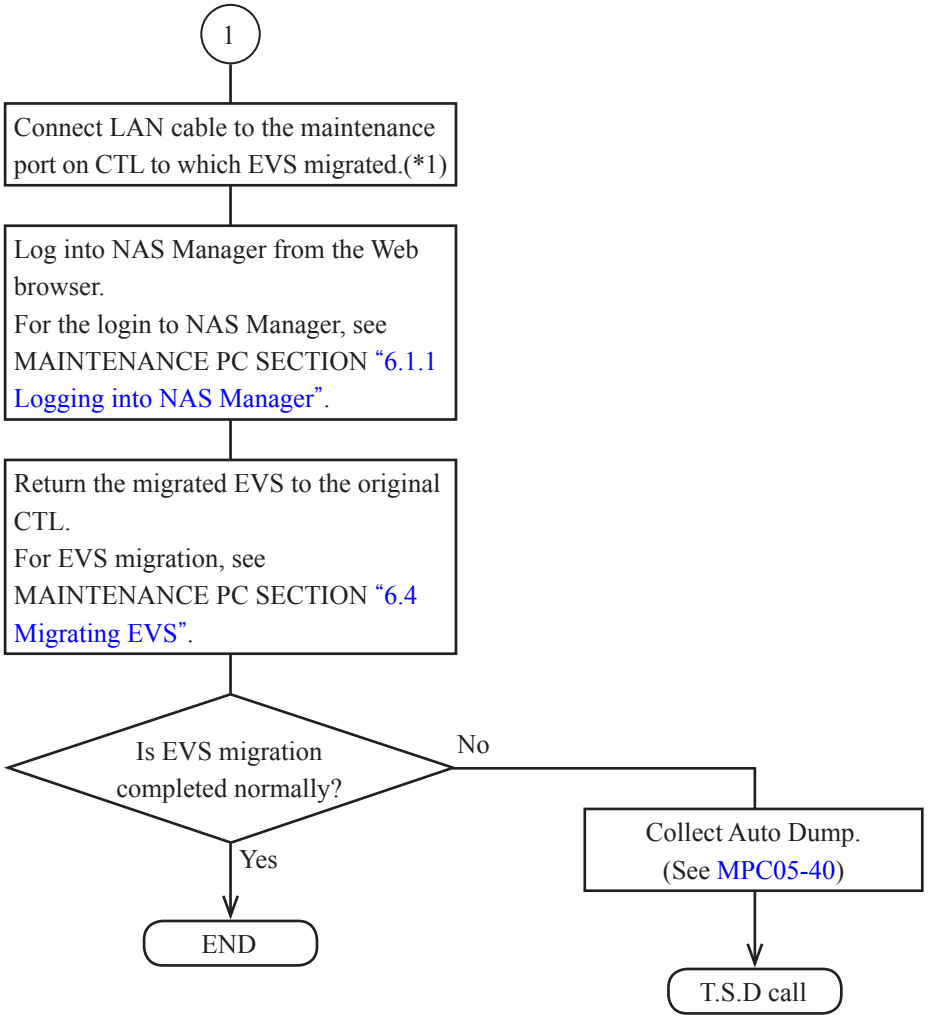
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20.11 Recovery Procedure for Unified Hypervisor Failure (Boot Disk Access Error) (SIM = e008x2)



*1: x of SIM RC = e008x2 indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)

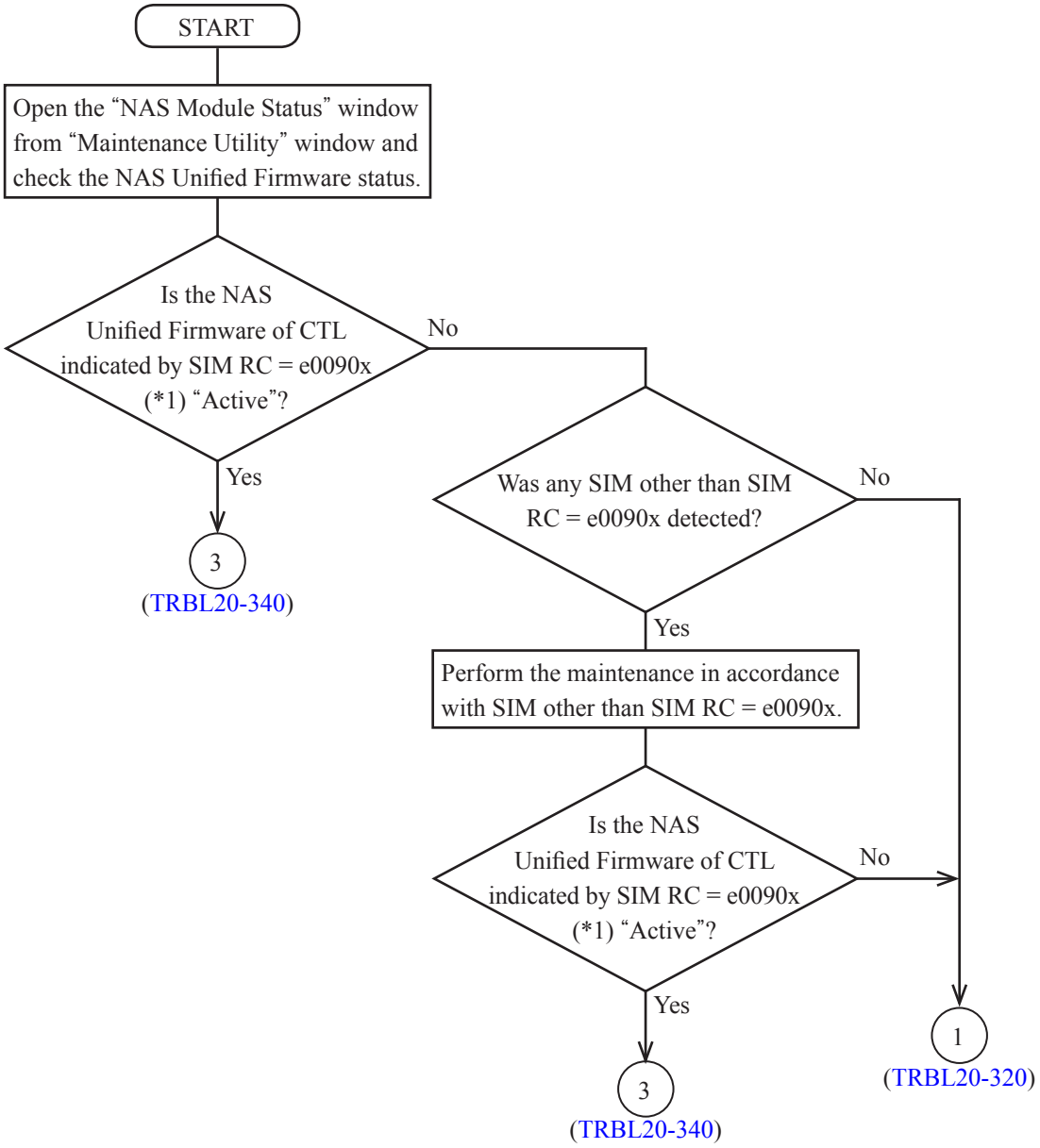
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*1: The EVS migration destination is identified by SIM RC = e008x2.
When x = 0, CTL1 is reset and EVS migrated to CTL2
When x = 1, CTL2 is reset and EVS migrated to CTL1

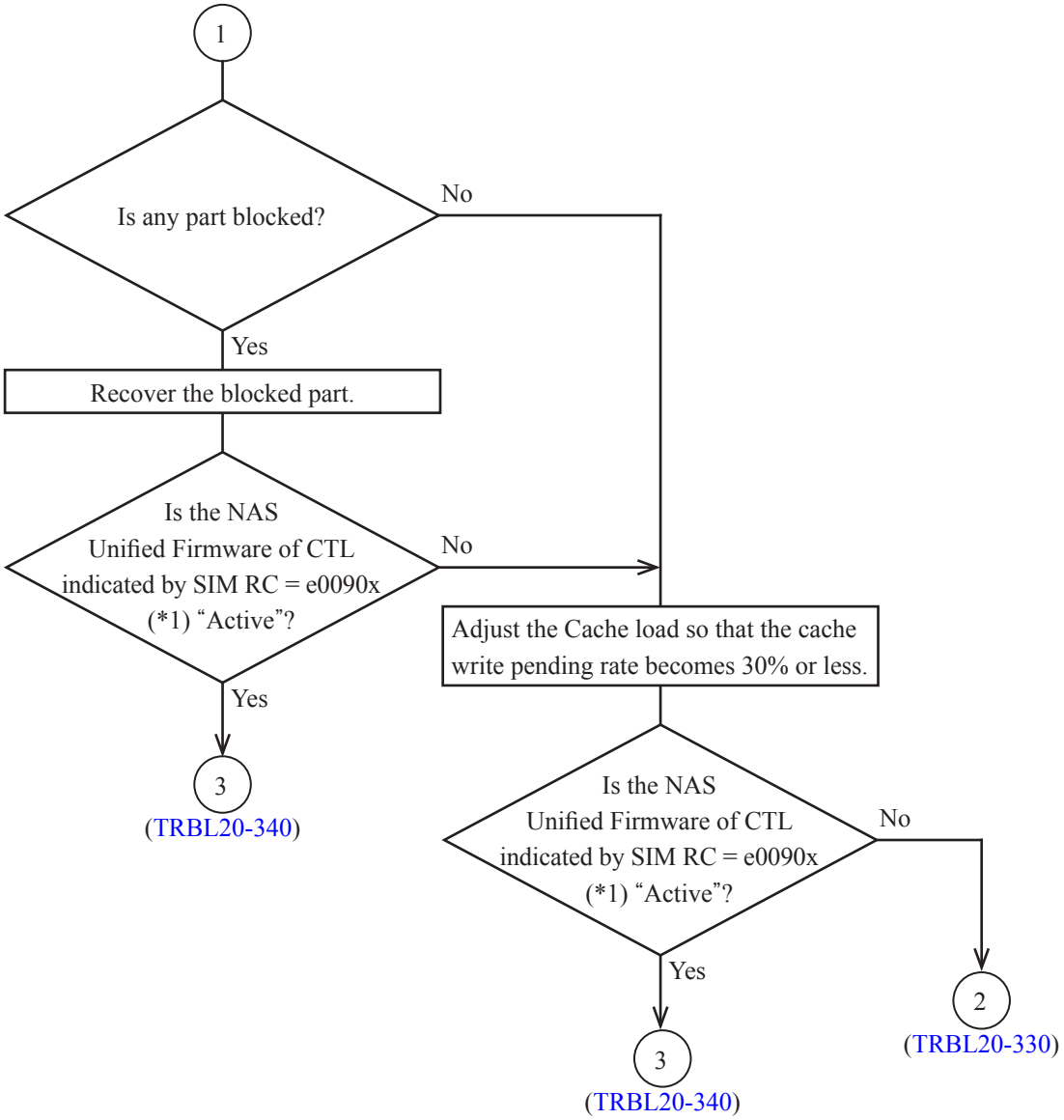
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20.12 Recovery Procedure for NASFW Boot Failure (During Start Up or Maintenance) (SIM = e0090x)

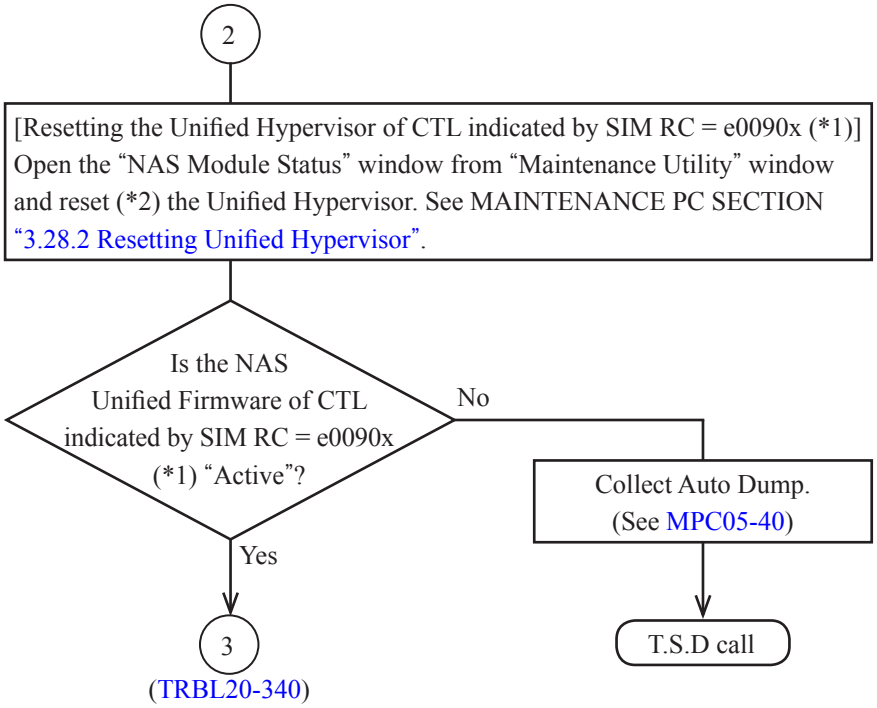


*1: x of SIM RC = e0090x indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)

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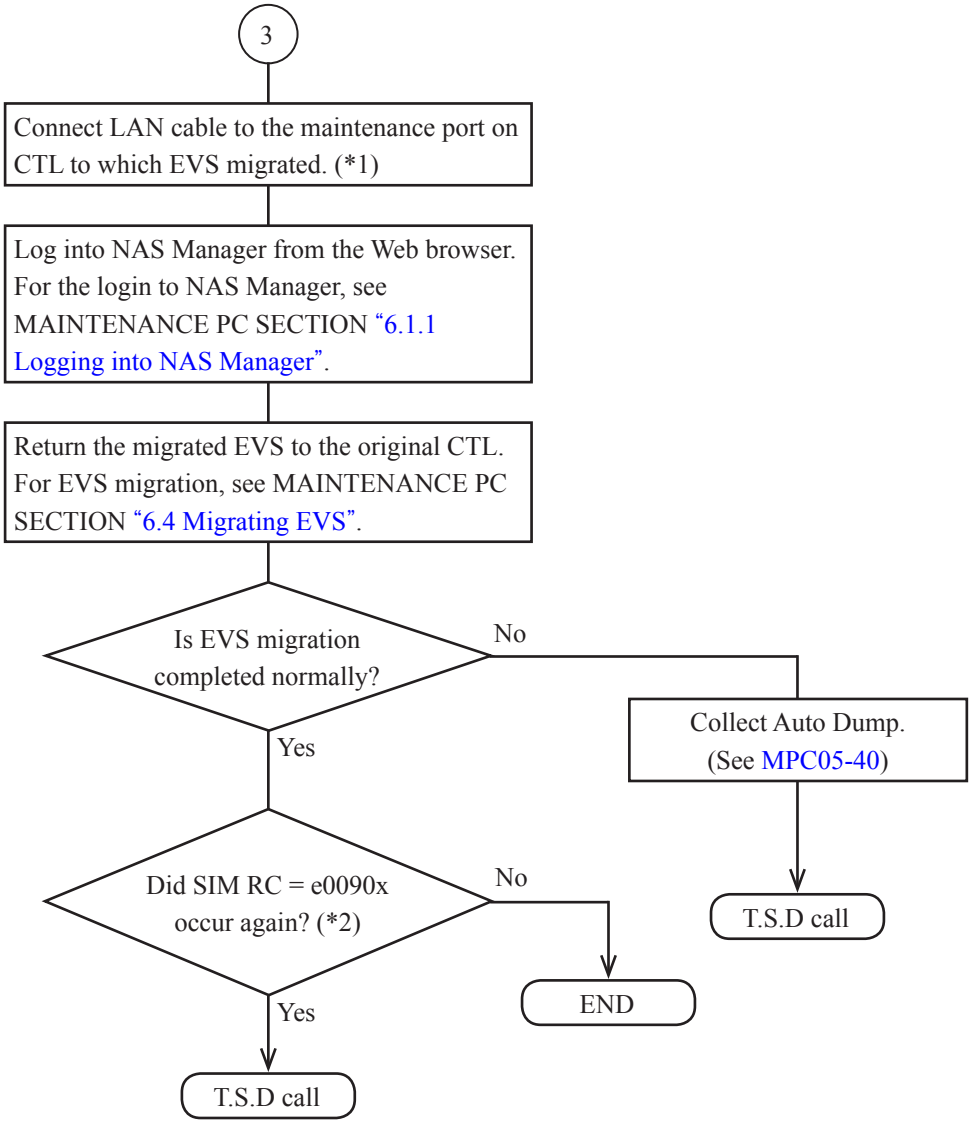
*1: x of SIM RC = e0090x indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)



*1: x of SIM RC = e0090x indicates CTL#. (x = 0 : CTL1, x = 1 : CTL2)

*2: If resetting of the Unified Hypervisor fails, perform the maintenance in accordance with the output instructions.

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*1: The EVS migration destination is identified by SIMRC = e0090x.
When x = 0, CTL1 is reset and EVS migrated to CTL2.
When x = 1, CTL2 is reset and EVS migrated to CTL1.

*2: x of SIM RC = e0090x also targets the same SIM RC.

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20.13 Common Troubleshooting when NAS Modules are Installed

No.	Failure	Recovery action
1	The maintenance work is not allowed because the Cache write pending rate exceeds 30%. (*1)	The maintenance work might fail due to the delay of the access to the system LU of NAS OS that operates during the maintenance work. If it fails, consult with the administrator, and then perform either of the following procedures. • Wait for a while, and then perform the maintenance work again. • Request the administrator to reduce the access load to the Storage System.

*1: To check the Cache write pending rate, see MAINTENANCE PC SECTION "8. Monitoring".

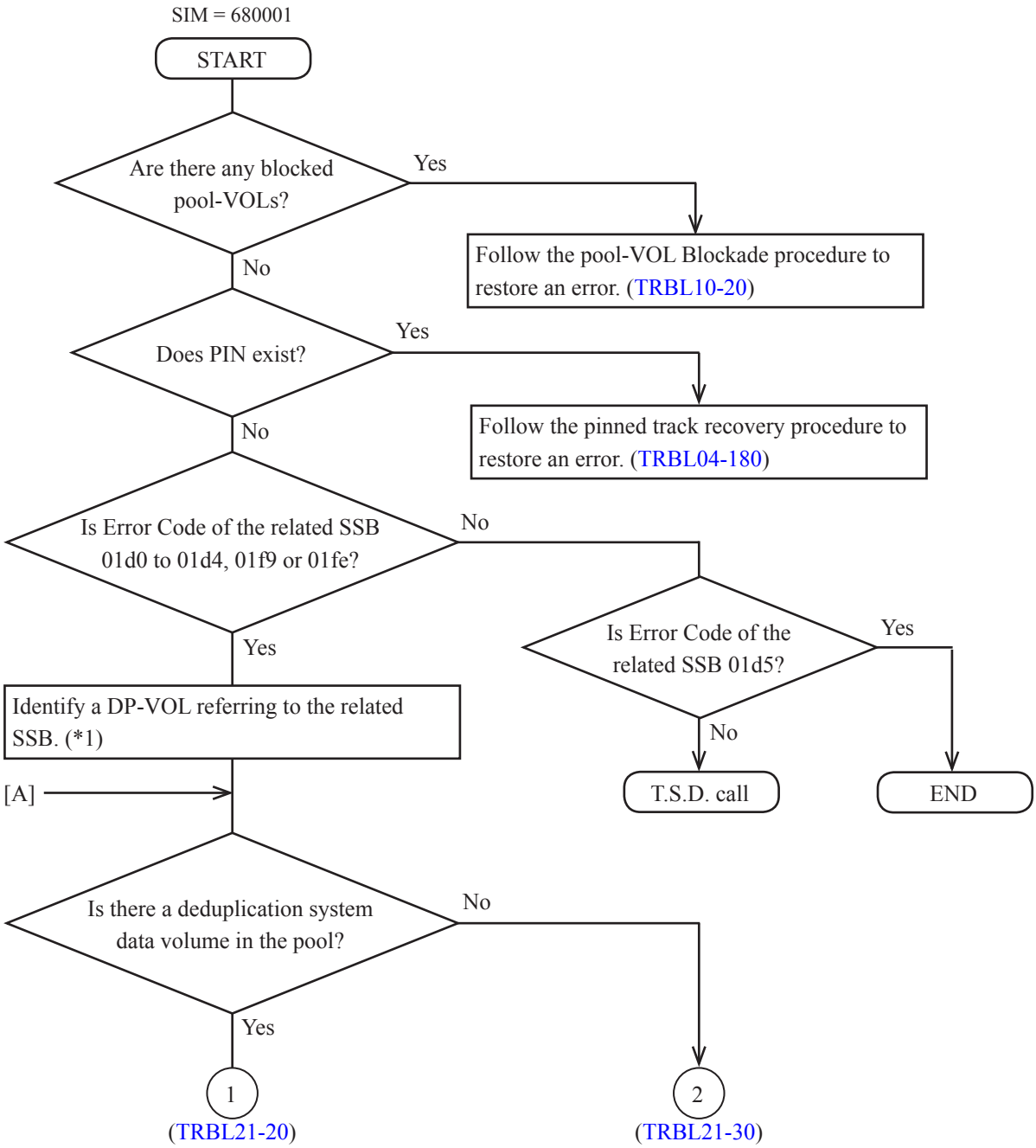
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21. dedupe and compression Error Recovery

21.1 Recovery Procedure for dedupe and compression Operation Error (SIM = 680001)

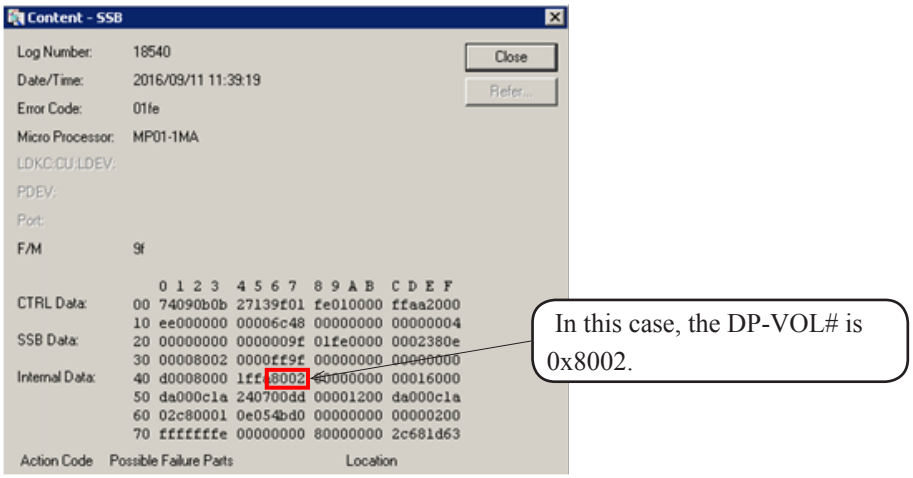
NOTICE: When the following conditions 1 and 2 are met, perform "10.1 Recovery Procedure for pool-VOL Blockade (When Two (Three in RAID6) or More Are Blocked in the RAID Gr the pool-VOL Belongs)" instead of the following procedure.
1. Error Code of the related SSB is 01d6.
2. Operations which cannot ensure data consistency (for example, format) have been performed for the volumes of external storage used as pool-VOLs.

The following describes a procedure for restoring a dedupe and compression operation error.

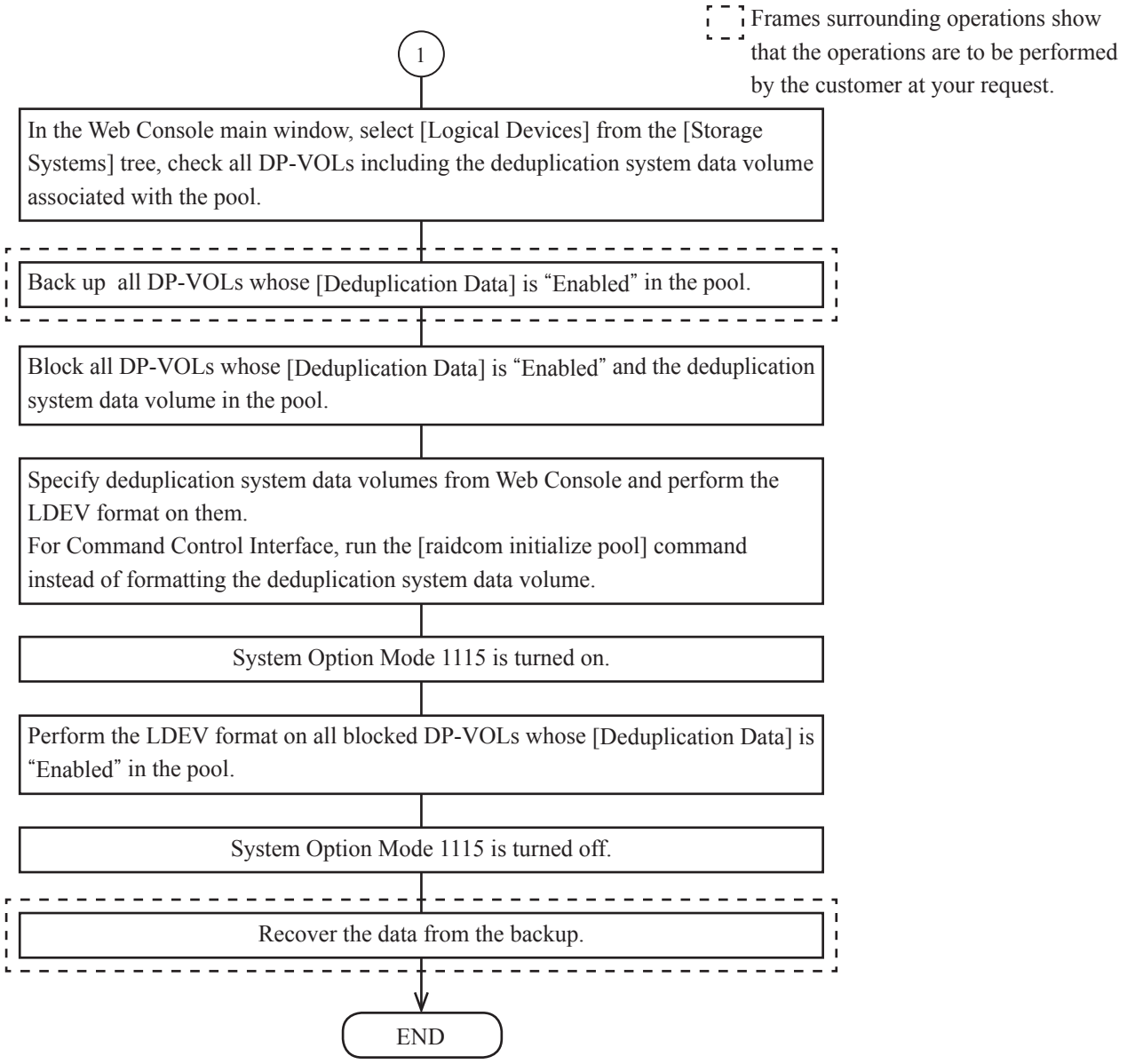


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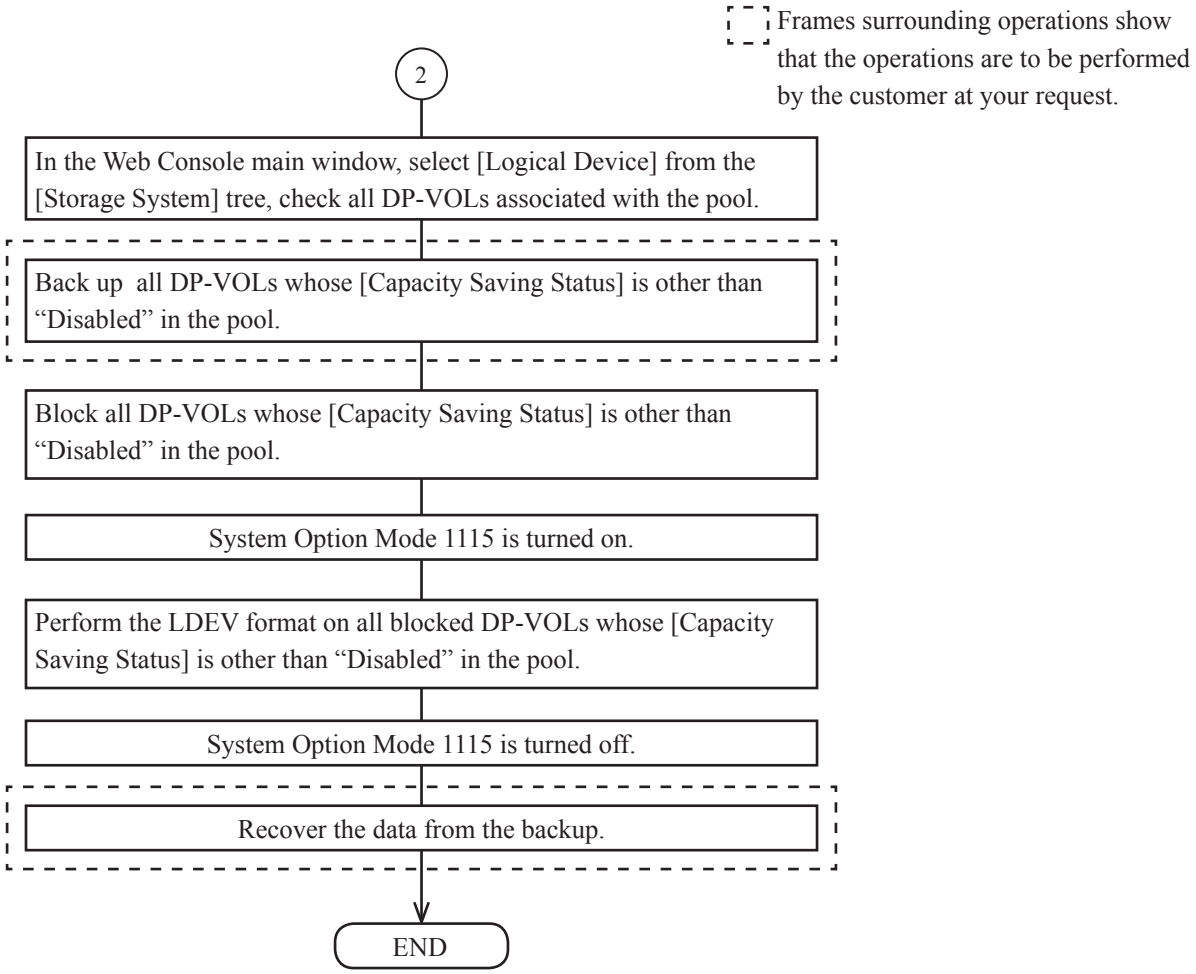
*1: For a DP-VOL#, refer to SSB: 01d0 to 01d4, 01f9 or 01fe (byte 0x46 to 0x47).



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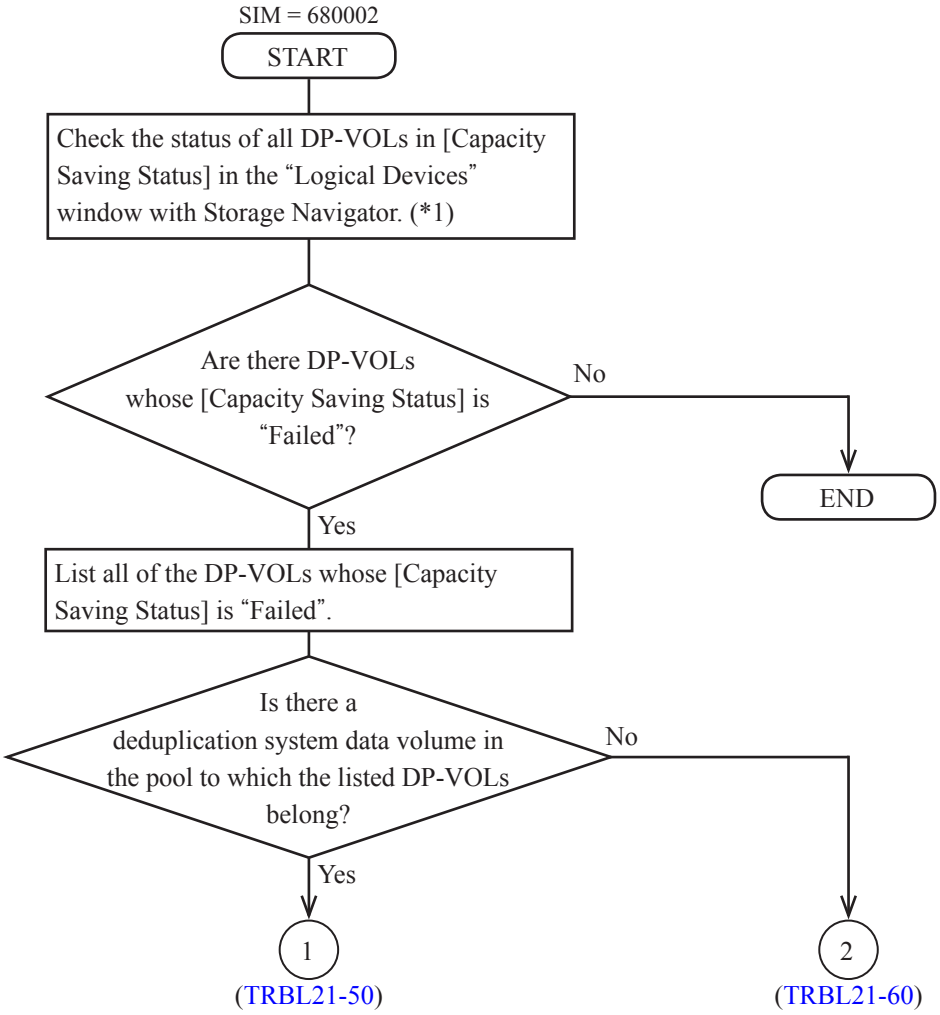
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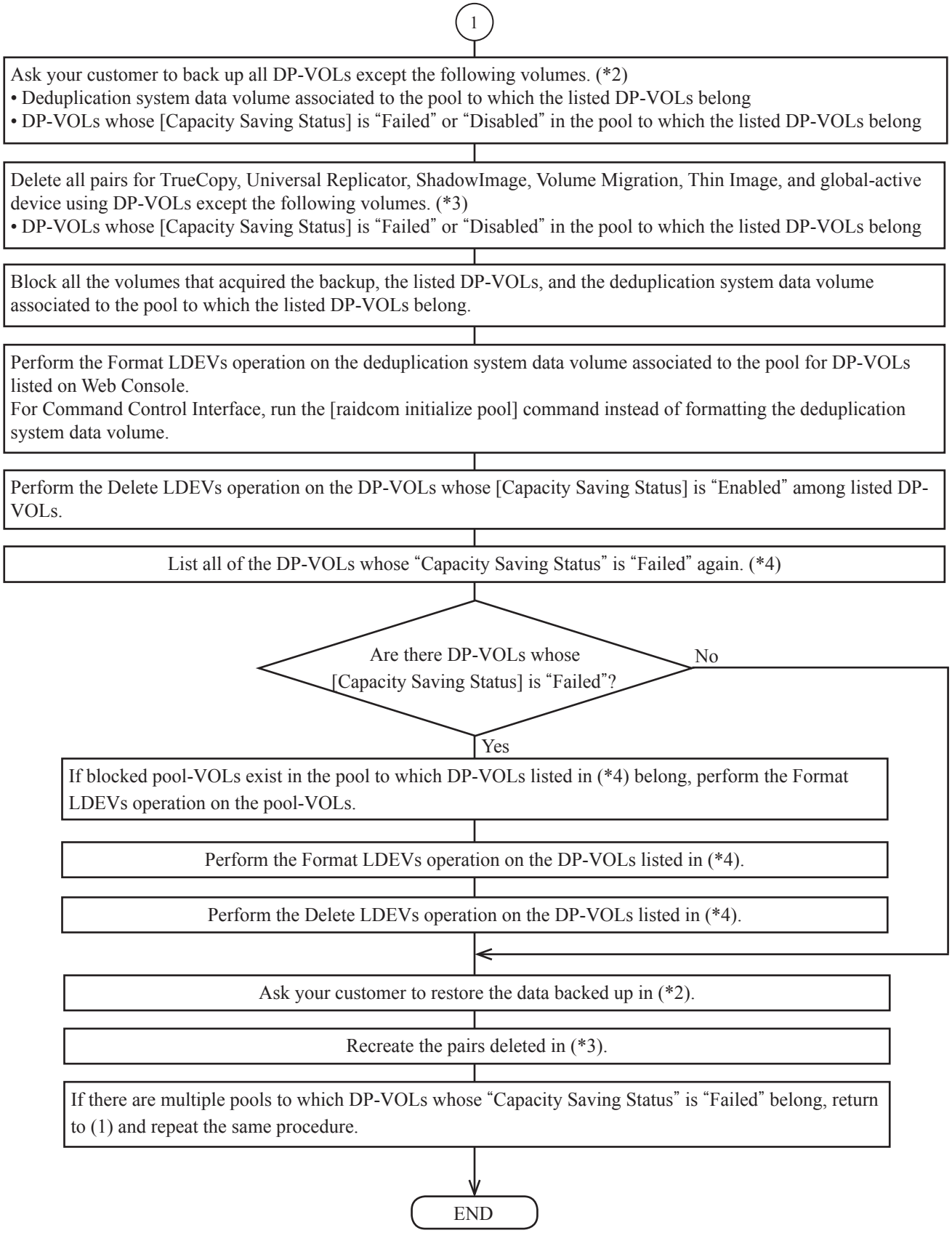
21.2 Recovery Procedure for Operation Error in Deleting Capacity-Saving-Enabled DP-VOLs (without blocking/formatting) (SIM = 680002)

The following is the recovery procedure when SIM “680002” is output.

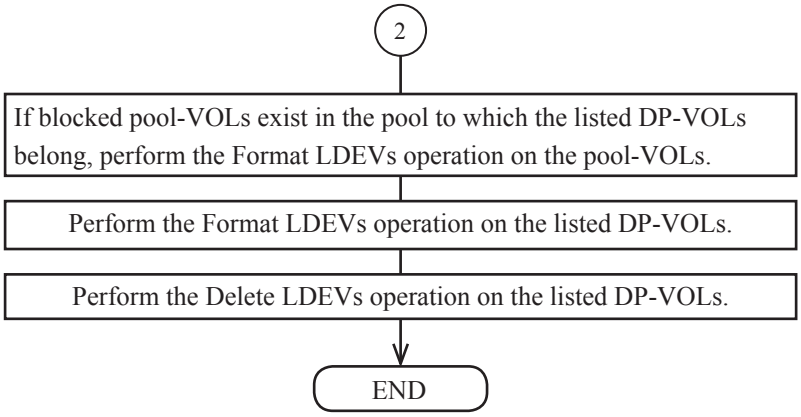


*1: This item does not appear in the default state. To display the item, change the setting in the “Column Settings” window. For details about the “Column Settings” window, see “System Administrator Guide”

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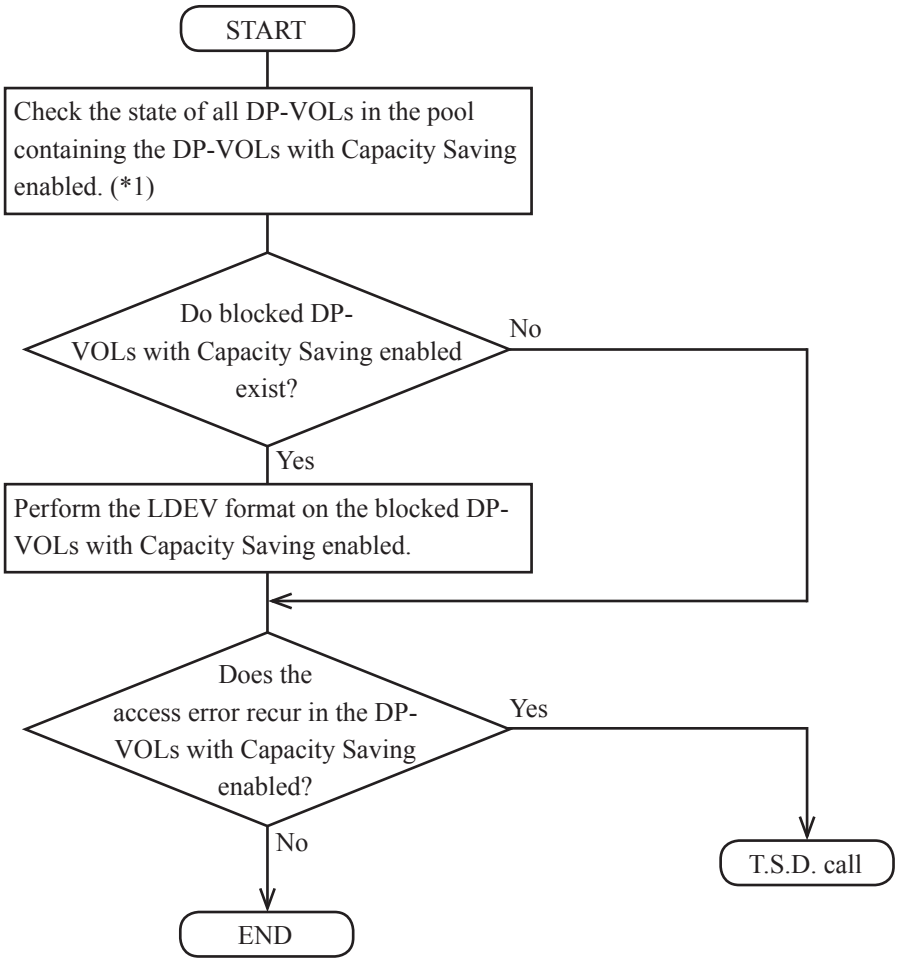


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21.3 Recovery Procedure when DP Volumes with Capacity Saving Enabled are Blocked after Power-on is Performed or after Offline Firmware Update following the Interruption of the LDEV Format is Performed

Recovery procedure when either of (1) or (2) occurs.

(1) DP volumes with Capacity Saving enabled are blocked.
(2) An access error occurs in DP volumes with Capacity Saving enabled.



*1: For the check procedure, refer to [Virtual Volumes] tab in [Pools: Volume] tabs or “Logical Devices” window in “Provisioning Guide”.

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22. Dump Collection Troubleshooting

1. How to deal with a trouble in dump collection

No.	Trouble	Action
1	DKC dump is not stored.	All MPs in DKC might be down. Check the MP operating condition according to "3. How to check MP operating condition". If all MPs are down, you need to recover them by startup with volatilization and so on. Confirm with the Technical Support Division and perform the operation. The installation status of Maintenance PC or SVP might be abnormal. Collect the dump manually through the command line using Maintenance PC (See MAINTENANCE PC SECTION "5.2 Dump") or SVP (customer PC) and send it.
2	GUM dump is not stored.	Because user ID and password are wrong, GUM cannot be accessed. When collecting dump, user ID and password are required. Check them. [Collecting dump using Maintenance PC] 1. Check the user ID and password that are required for connecting to DKC on Maintenance PC. 2. Confirm that you can log in to Maintenance Utility with the user ID and password you checked 3. Collect the dump from Maintenance PC again. [Collecting dump using SVP] 1. When registering a storage system to Storage Device List, check if the entered user ID and the password are entered correctly, and confirm that SN starts. 2. If SN does not start, check that you can log in to Maintenance Utility with the user ID and password you entered 3. Collect the dump using SVP again [Collecting dump using GUM (Maintenance Utility)] The dump collection from GUM is performed after the login to Maintenance Utility, so a dump collection failure due to the incorrect user ID and password does not occur. Therefore, when you successfully collect the dump from GUM, you can exclude the possibility of a failure due to the incorrect user ID and password.
3		GUM Warning might occur, or GUM might be down. reboot GUM and try dump collection again. For GUM reboot operations, see MAINTENANCE PC SECTION "3.18 Reboot GUM".

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2. Action to be taken when MP in the DKC side is down, and dump cannot be collected

In dump collection, dump in the DKC side, SVP dump, and Maintenance PC dump are collected. If MP in the DKC side is down, dump in the DKC side cannot be collected.
In this case, you need to determine whether MP is down, and take an action to recover MP. In this case, use the following analysis procedure to determine it.

When GUM is running, you can collect dump through GUM and determine whether MP is running from the GUM dump.

(1) Collect GUM dump from Maintenance Utility.
* It is supported only with firmware version 83-02-01-x0/xx or later. With firmware versions earlier than 83-02-01-x0/xx, collect dump from maintenance PC or SVP.

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3. How to check MP operating condition

Extract the GUM dump by using the GUM dump decompression tool (gum_dump) and make it readable by using the GUM trace read tool (gum_Trace_cnv).

\gum1\tmp\hitachi\gumdump\var\log\hitachi\Trace27.log.txt

Check the operating condition of MP from the above file.
It is output in the following format. Search it with "27 0003" after the time stamp. The log of the operating condition of MP is output in the matching line.

[S model]

```
2016/07/20 17:55:12.318546  00 27 0003 00 00 21 00 0D 83 00 EE 01 01 01 01 01 01 01 01
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 01 EE 00 00 00 00 00 00 00 00   } 1 entry
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 02 EE 00 00 00 00 00 00 00 00
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 03 EE 00 00 00 00 00 00 00 00
```

GUM trace number

It means that information indicating MP status is output.

Status of 8 MP cores
00: Not installed
01: Abnormal
02: Normal
The following means that all 8 MPs are abnormal.
01 01 01 01 01 01 01 01

The above is the example log of eight MP cores in the S model.

In the M model, there are 16 cores.
In the H model, there are 32 cores.
The following shows their examples.

In the M model, information of 16 cores. In this example, 8 cores are abnormal (01), and 8 cores are normal (02).

[M model]

```
2016/07/20 17:55:12.318546  00 27 0003 00 00 21 00 0D 83 00 EE 01 01 01 01 01 01 01 01
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 01 EE 02 02 02 02 02 02 02 02
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 02 EE 00 00 00 00 00 00 00 00
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 03 EE 00 00 00 00 00 00 00 00
```

[H model]

```
2016/07/20 17:55:12.318546  00 27 0003 00 00 21 00 0D 83 00 EE 01 01 01 01 01 01 01 01
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 01 EE 01 01 01 01 01 01 01 01
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 02 EE 01 01 01 01 01 01 01 01
2016/07/20 17:55:12.320653  00 27 0003 00 00 21 00 0D 83 03 EE 02 02 02 01 01 01 01 01
```

In the H model, information of 32 cores. In this example, 4 cores are normal (02), and others are down (01).

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4. Checking the heartbeat status of MP

\gum1\tmp\hitachi\gumdump\var\log\hitachi\Trace23.log.txt
Check time when MP HeartBeat is changed.

When MP is abnormal, you can confirm from when the MP is abnormal. Or when the MP status is restored to normal, you can confirm from when the MP status is restored to normal.

The trace is output when response from MP is changed from the non-responsive status to the responsive status and when it is changed from the responsive status to the non-responsive status.

When MP is normal, and the communication with MP is interrupted temporarily, it is logged as the non-responsive status. Therefore determine the MP status according to "3. How to check MP operating condition".

Extract the GUM dump by using the GUM dump decompression tool (gum_dump) and make it readable by using the GUM trace read tool (gum_Trace_cnv).

\gum1\tmp\hitachi\gumdump\var\log\hitachi\Trace23.log.txt

Check the heartbeat status of MP from the above file.
It is output in the following format. Search it with "23 0003" after the time stamp. The log of the MP heartbeat status is output in the matching line.

