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TROUBLESHOOTING SECTION

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Contents

1. Overview of TRBL TRBL01-10
1.1 Flow of Troubleshooting TRBL01-12
1.2 Checking Customer Report and Storage System Status TRBL01-20

2. Isolation of Failed Part TRBL02-01-10
2.1 Analyze by SIM Log TRBL02-01-10
2.2 Failure Reported by Customer TRBL02-02-10
2.2.1 OS Cannot Recover the Storage System Failure (MIH, Job ABEND) TRBL02-02-20
2.2.2 OS Has Detected Storage System Failure (ICC, CC = 3) TRBL02-02-40
2.2.3 ALARM LED on the HSNPANEL Turns On TRBL02-02-80
2.2.4 Failure When Turning On the Power TRBL02-02-100
2.2.5 The Power Cannot Be Turned Off TRBL02-02-110
2.2.6 MESSAGE LED on the HSNPANEL is Blinking TRBL02-02-130
2.2.7 CACHE Failure (Both Sides) Occurred TRBL02-02-140
2.2.8 Operation of the Storage System Stops TRBL02-02-150
2.2.9 When There Is a Performance Problem of the SVP TRBL02-02-170
2.3 Flow of failed part isolation TRBL02-03-10
2.3.1 Blinking or lighting up of LED (red) on CTL ALM TRBL02-03-40
2.4 Failure During Operation by Service Personnel TRBL02-04-10
2.4.1 Error Recovery Procedure when Removing/Inserting CTL TRBL02-04-10
2.4.2 Failures Have Occurred when Installing Drive/DB TRBL02-04-40
2.4.2.1 Installation Failure of Drive/DB TRBL02-04-40
2.4.2.2 LED of ENC Turns On after Installing Drive/DB TRBL02-04-80
2.4.3 Error Recovery Procedure during CHB/DKB replacement TRBL02-04-90
2.4.4 Error Recovery Procedure during BKMF/Battery/CFM replacement and LANB blockade TRBL02-04-130
2.4.5 Error Recovery Procedure during LANB replacement TRBL02-04-140
2.4.6 Recovery procedure when LDEV formatting failed TRBL02-04-150
2.4.7 Recovery Procedure When Changing IP Address Failed TRBL02-04-170
2.4.8 Recovery from the incorrect setting when adding Cache Memories TRBL02-04-210
2.4.9 Error Recovery When Adding Cache Memories/Cache Flash Memories TRBL02-04-240
2.4.10 Error Recovery When Removing Cache Memories/Cache Flash Memories TRBL02-04-260
2.4.11 Micro-program Version Mismatching TRBL02-04-280
2.4.12 Correspondence at the time of the mode setting failure of System Option ... TRBL02-04-290
2.4.13 Recovery Procedure for Failure During DKB Installation TRBL02-04-300
2.4.14 Recovery Procedure for the System Lock during a Setting Change TRBL02-04-310
2.4.15 Recovery Procedure when ALM LED (red) is not Turned OFF TRBL02-04-320
2.4.16 Recovery Procedure at SFP Replacement TRBL02-04-340
2.4.17 Recovery Procedure when Procedure for Small Form-Factor Pluggable (SFP) Data Transfer Rate Change fails TRBL02-04-350
2.4.18 Recovery Procedure When Performing Maintenance Work of HIE/ISW/X-path TRBL02-04-370

2.4.19 Recovery Procedure When Performing Maintenance Work of SAS Cable/ENC TRBL02-04-380
2.4.20 Recovery Procedure When SVP Switching Failed TRBL02-04-390
2.4.21 Recovery Procedure for Error Parts Detected by LAN Check TRBL02-04-440
2.4.22 Troubleshooting When Adding Controller Chassis TRBL02-04-450
2.4.22.1 Recovery Procedure When Adding Controller Chassis Fails TRBL02-04-450
2.4.22.2 Recovery Action Corresponding to Each "Not available"-displayed Area TRBL02-04-490
2.4.22.3 Determining Whether the Adding Procedure of Controller Chassis Needs to Be Performed Again TRBL02-04-500
2.4.22.4 Required Work before Performing the Adding Procedure of Controller Chassis Again TRBL02-04-510
2.4.23 Troubleshooting When Removing Controller Chassis TRBL02-04-520
2.4.23.1 Recovery Procedure When Removing Controller Chassis Fails TRBL02-04-520
2.4.24 Troubleshooting When Adding Controller Board TRBL02-04-540
2.4.24.1 Recovery Procedure When Adding Controller Board Fails TRBL02-04-540
2.4.24.2 Recovery Action Corresponding to Each "Not available"-displayed Area TRBL02-04-580
2.4.24.3 Determining Whether the Adding Procedure of Controller Board Needs to Be Performed Again TRBL02-04-600
2.4.24.4 Required Work before Performing the Adding Procedure of Controller Board Again TRBL02-04-610
2.4.25 Troubleshooting When Removing Controller Board TRBL02-04-620
2.4.25.1 Recovery Procedure When Removing Controller Board Fails TRBL02-04-620
2.5 Failures of Multiple Parts TRBL02-05-10
2.6 Checking Normality TRBL02-06-10

3. Recovery Method of the Shared Platform Failure TRBL03-01-10
3.1 SFP Module Failure Detection (SIM = 21a8xx, 21aaxx) TRBL03-01-10
3.2 Action When Audit Log FTP Transfer Failure Is Detected (SIM = 7c0300) TRBL03-02-10
3.3 Response to a FLASH DRIVE/ENCRYPTION PG LDEV FORMAT Failure (SIM = 41000x) TRBL03-03-10
3.4 Recovery Procedure for Detected Invalid SIM Data (SIM = 7c0500) TRBL03-04-10
3.5 Recovery when power off or SAS/NVMe PORT failure occurred (SIM = cf12xx, cf22xx, ac50xx) TRBL03-05-10
3.6 Recovery Procedure for the SAS PORT Temporary Failure (SIM = cf11xx) TRBL03-06-10
3.7 Recovery Procedure for DKC Blockade (SIM = 30a100) TRBL03-07-10
3.8 Action When Time Synchronization Failed (SIM = 7ffa0x) TRBL03-08-10
3.9 Recovery Procedure for LDEV Blockade due to Micro-program Error (SIM = 3a0xyy) TRBL03-09-10
3.10 Recovery Procedure for Abnormal End of DumpTool (SIM = 7c0400) TRBL03-10-10
3.11 Recovery procedure of SIM occurrence during battery charge (SIM = fe0000) TRBL03-11-10
3.12 Action when Cache Write Through by battery factor is detected (SIM = fe0100, fe0200) TRBL03-12-10

3.13 Isolation and Recovery Procedure for Common SAS/NVMe Failure (SIM = db0xxx, db1xxx, db2xxx, db3xxx, db4xxx, db5xxx, db6xxx, db7xxx) TRBL03-13-10
3.14 Recovery Procedure for LAN Error TRBL03-14-10
3.14.1 Recovery Procedure When an Internal LAN Failure Occurs (SIM = 7d01xx) . TRBL03-14-10
3.14.2 Recovery Procedure When a LAN Failure Occurs between CTL (SIM = 7d02xx) TRBL03-14-30
3.15 Recovery Procedure for the Failure on the Occurrence of Unmatched Memory Installation Capacity (SIM = ffe800)..... TRBL03-15-10
3.16 Recovery Procedure When Cache Correctable Error Is Detected (SIM = fff0xx) ... TRBL03-16-10
3.17 Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx) TRBL03-17-10
3.18 Recovery Procedure When CMs Are Blocked in One Cluster (SIM = fff40x)..... TRBL03-18-10
3.19 PS Warning Error (af20xx, af51xx, af52xx, afb1xx, af21xx, af61xx, af62xx, afb3xx)..... TRBL03-19-10
3.20 Recovery Procedure When Duplex SVP Setting Failed (SIM = bfe3a2)..... TRBL03-20-10
3.21 Recovery Procedure When CHK3 Threshold Over Occurred (SIM = 3072xy) TRBL03-21-10
3.22 Recovery Procedure for Warning of Channel Board/Disk Board/ Interconnect Channel Board Type (SIM RC = 3c9500) TRBL03-22-10
3.23 Response to the Occurrence of External Temperature Warning or Alarm (SIM = af110x, af120x) TRBL03-23-10
3.24 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)..... TRBL03-24-10
3.25 Isolation Procedure for Failed Part in CACHE Volatilization (SIM = ffe700, ffcd0x, ffcfyx, 610002) TRBL03-25-10
3.26 Receiving WCHK1 Dump (SIM = 3080xx) TRBL03-26-10
3.27 Isolation and Recovery Procedure for Drive Link Rate Error (SIM = dbcxxx, dbdxxx, dbexxx, dbfxxx)..... TRBL03-27-10
3.28 Drive failure recovery procedure..... TRBL03-28-10
3.28.1 In the case of normal termination (SIM RC = 4b8xxx, 4b9xxx, 4c8xxx, 4c9xxx)..... TRBL03-28-30
3.28.2 In the case of termination with a warning (SIM RC = 4bexxx, 4bfxxx, 4cexxx, 4cfxxx)..... TRBL03-28-40
3.28.3 In the case of termination owing to abortion (SIM RC = 4bcxxx, 4bdxxx, 4ccxxx, 4cdxxx) TRBL03-28-60
3.28.4 In the case of abnormal termination (SIM RC = 4baxxx, 4bbxxx, 4caxxx, 4cbxxx)..... TRBL03-28-70
3.28.5 Correction access status TRBL03-28-200
3.28.6 Parity group blockade..... TRBL03-28-210
3.28.7 Preventive maintenance..... TRBL03-28-220
3.29 Recovery Procedure for Pinned Track TRBL03-29-10

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3.30 Recovery Procedure for SVP Failure TRBL03-30-10
3.30.1 SVP Power Trouble Shooting TRBL03-30-10
3.30.2 When Connection to SVP (Remote Computer) Cannot Be Made TRBL03-30-40
3.30.2.1 SVP OS Recovery Procedure TRBL03-30-52
3.30.3 About Other SVP Troubles TRBL03-30-60
3.31 Web Console Failure Recovery TRBL03-31-10
3.31.1 Web Console Trouble Shooting TRBL03-31-10
3.32 Procedure for Responding to the Used Endurance of Flash Drives and Flash Module Drives (FMDs) (SIM = 50axxx, 50bxxx, 50cxxx, 50dxxx) TRBL03-32-10
3.33 Response to the Occurrence of Battery Warning (SIM = fffa0x) TRBL03-33-10
3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx) TRBL03-34-10
3.35 Recovery Procedure for SVP RAS Switch #1 remains (SIM = bf85a3, bf86a3) TRBL03-35-10
3.36 Recovery Procedure When DB External Temperature Abnormality is detected (SIM = af7000, af7100) TRBL03-36-10
3.37 Reclaiming the control pages inside the DP-VOL(s) TRBL03-37-10
3.38 Recovery Procedure for Standby SVP Failure (SIM = 7ff2xx) TRBL03-38-10
3.39 Response to the Detection of Uninstalled CFM (SIM = aff20x) TRBL03-39-10
3.40 Response to the Occurrence of BKMF Warning (SIM = af400x) TRBL03-40-10
3.41 Procedure for responding to the product program expiration (SIM = 7ff7xx) TRBL03-41-10
3.42 Procedure for responding to an excess of the allowed capacity (SIM = 7ff8xx) TRBL03-42-10
3.43 Procedure for responding to the prerequisite program product expiration (SIM = 7ff9xx) TRBL03-43-10
3.44 Recovery Procedure when a GUM Failure Occurs (SIM = aff1xx) TRBL03-44-10
3.45 Response to the Detection of Unmounted Channel Board (SIM = 3c9600) TRBL03-45-10
3.46 Procedure for Responding to the Micro-program Exchange Failure due to Cache High Load (SIM = eb8xxx, eb9xxx) TRBL03-46-10
3.47 Recovery Procedure When DKC Warning Occurs (SIM = 7d090x) TRBL03-47-10
3.48 Recovery Procedure When an MP Error Occurs (SIM = 7d06xy) TRBL03-48-10
3.49 (Blank) TRBL03-49-10
3.50 Recovery Procedure When the Part Installation Error Occurs (SIM = ffd400) TRBL03-50-10
3.51 Recovery Procedure When the Panel Switch Warning (SIM = af4dxx) TRBL03-51-10
3.52 Response to a Loss of the DKC Audit Log (SIM = 180000) TRBL03-52-10
3.53 Recovery Procedure When CFM Failure Occurs (SIM = 30750x) TRBL03-53-10
3.54 (Blank) TRBL03-54-10
3.55 Recovery Procedure When an Incorrect CFM Type or a Shortage of CFM is detected (SIM = fe030x) TRBL03-55-10
3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx) TRBL03-56-10
3.57 Procedure When HSNBX External Temperature Warning Occurs (SIM = afb0xx) TRBL03-57-10
3.58 Procedure When ISWPS AC Warning Occurs (SIM = afb3xx) TRBL03-58-10

3.59 Procedure When HSNBX Thermal Monitor Warning Occurs (SIM = afb5xx) TRBL03-59-10
3.60 Incorrect Setting of HSNBX Panel JP (SIM = afb6xx)..... TRBL03-60-10
3.61 HSNBX Panel JP Setting Warning (SIM = afb7xx) TRBL03-61-10
3.62 Warning When HSNBX PS ON/OFF I/F Inconsistency Occurs (SIM = afb8xx)..... TRBL03-62-10
3.63 Recovery Procedure When the USB Interface Error Occurs (SIM = bfe407) TRBL03-63-10
3.64 Recovery Procedure for LAN Error/SVP Failure (SIM = 73xx00, 1400x0)..... TRBL03-64-10
3.65 Recovery from initialization failure of Flash Module Drive (SIM = 4c4xxx, 4c5xxx) TRBL03-65-10
3.66 Recovery Procedure for Processor Blockade (SIM = 3073xx)..... TRBL03-66-10
3.67 Recovery Procedure When the SAS CTL Failure Is Detected (SIM = cf13xx) TRBL03-67-10

4. Recovery from Mainframe Platform Failure TRBL04-10
4.1 Recovery Procedure for Mainframe Pinned Track TRBL04-10
4.2 Recovery Procedure When WDCP Information Is Lost (SIM = ffde01, ffde02, ffde03). TRBL04-110

5. Recovery from Open Platform Failure TRBL05-10
5.1 Recovery Procedure for a Failure on Host Fibre Channel Interface TRBL05-10
5.1.1 Outline TRBL05-10
5.1.1.1 Possible Failures and causes of them TRBL05-10
5.1.1.2 Matters must be or desirable to be checked TRBL05-20
5.1.2 Recovery Procedure When Device Is Not Recognized TRBL05-50
5.1.3 Procedure for Checking Storage System Port Status TRBL05-90
5.1.4 Procedure for Checking Normalcy of the Processor TRBL05-100
5.1.5 Procedure for Checking LUN Status Information TRBL05-110
5.1.6 Isolation Procedure for Fibre Channel Failure.....TRBL05-120
5.2 Pinned track recovery TRBL05-170
5.2.1 Pinned Tracks.....TRBL05-170
5.2.2 Error Types TRBL05-180
5.2.2.1 ECC/LRC Error TRBL05-210
5.2.2.2 Write Error TRBL05-230
5.2.2.3 External VOL Write Error TRBL05-240
5.2.2.4 External VOL Read Error TRBL05-240
5.2.3 Procedure for Erasing Pinned Track TRBL05-250
5.2.3.1 HP-UX Procedure TRBL05-340
5.2.3.2 Procedure on Windows.....TRBL05-500
5.2.3.3 Procedure on Solaris TRBL05-770
5.2.3.4 Procedure on AIX, VMWare ESX, Linux.....TRBL05-960
5.2.3.5 List of Pin Track Tool Directories TRBL05-1110
5.2.3.6 ECC/LRC Error Recovery Processing of DP pool-VOL.....TRBL05-1120
5.2.3.7 Recovery from External VOL Write Error.....TRBL05-1160
5.2.3.8 Recovery from External VOL Read Error.....TRBL05-1180
5.2.3.9 Recovery Processing of the Device in the External Storage System TRBL05-1200
5.2.3.10 Using Failed LBA Output Tool.....TRBL05-1230

5.3 (Blank) TRBL05-1250
5.4 Recovery Procedure for AL_PA Conflict (SIM = 2190xy) TRBL05-1270
5.5 Recovery Procedure for a Failure on Host iSCSI Interface TRBL05-1290
5.5.1 Outline TRBL05-1290
5.5.1.1 Possible Failures and causes of them TRBL05-1290
5.5.1.2 Matters must be or desirable to be checked TRBL05-1300
5.5.2 Recovery Procedure When Device Is Not Recognized TRBL05-1310
5.5.3 Procedure for Checking Storage System Port Status TRBL05-1360
5.5.4 Procedure for Checking Normalcy of the Processor TRBL05-1370
5.5.5 Procedure for Checking LUN Status Information TRBL05-1380
5.6 Recovery Procedure When Disconnection of Host Is Detected during ISCF Micro-Program Exchange (SIM = 3c97xx) TRBL05-1390

6. Recovery from ShadowImage for Mainframe/ShadowImage/FlashCopy (R) V2/ FlashCopy (R) SE Failure TRBL06-10
6.1 Recovery Procedure for Pinned Track TRBL06-10
6.2 Recovery Procedure for ShadowImage for Mainframe/ShadowImage/ Mainframe Fibre DM Suspended Pair (SIM = 47dxyy, 7ff102, 47e700) TRBL06-20
6.3 Recovery Procedure for FlashCopy (R) V2/FlashCopy (R) SE Option Failure (SIM = 4b2xyy, 4b4xyy, 7ff105, 47e500) TRBL06-70
6.3.1 Recovery Procedure for a Failure When FlashCopy (R) V2/FlashCopy (R) SE Cooperated with TrueCopy for Mainframe (SIM = 4b2xyy, 47e500) TRBL06-110
6.4 Output of Online Path Information (SSB EC= 2084) TRBL06-120
6.4.1 Output Information TRBL06-120
6.4.2 To Continue the Operation TRBL06-140
6.5 Initialization Procedure for ShadowImage TRBL06-150

7. Recovery from TrueCopy for Mainframe/TrueCopy Failure TRBL07-10
7.1 Recovery Procedure for TrueCopy for Mainframe Failure TRBL07-10
7.2 Recovery Procedure for TrueCopy Failure TRBL07-20
7.3 Recovery Procedure for TrueCopy for Mainframe/TrueCopy Pinned Track TRBL07-210
7.4 Recovery Action for Path Status Error TRBL07-240
7.5 Recovery Procedure for Related to BCM Operation Error TRBL07-270
7.6 Recovery Procedure when zHyperWrite Function is Disabled TRBL07-280
7.7 Failure Recovery Procedure and Planned Shutdown Procedure of the TC-UR Configuration (Multi Target/Cascade) TRBL07-310
7.7.1 Failure Recovery Procedure of the TC-UR Configuration (Multi Target/Cascade) TRBL07-310
7.8 Failure Recovery Procedure and Planned Shutdown Procedure of the TC-UR Delta Configuration (Multi Target) TRBL07-460
7.8.1 Failure Recovery Procedure of the TC-UR Delta Configuration (Multi Target) TRBL07-460

7.9 DKC Planned Shutdown Procedure of the TC-UR Configuration (Multi Target) TRBL07-530
7.9.1 Planned Shutdown Procedure of the PDKC TRBL07-530
7.9.2 Planned Shutdown Procedure of the LDKC TRBL07-560
7.9.3 Planned Shutdown Procedure of the RDKC TRBL07-580
7.10 DKC Planned Shutdown Procedure of the TC-UR Configuration (Cascade) TRBL07-600
7.10.1 Planned Shutdown Procedure of the PDKC TRBL07-600
7.10.2 Planned Shutdown Procedure of the IDKC TRBL07-630
7.10.3 Planned Shutdown Procedure of the RDKC TRBL07-660
7.11 DKC Planned Shutdown Procedure of the TC-UR Delta Configuration (Multi Target) TRBL07-680
7.11.1 Planned Shutdown Procedure of the PDKC TRBL07-680
7.11.2 Planned Shutdown Procedure of the LDKC TRBL07-710
7.11.3 Planned Shutdown Procedure of the RDKC TRBL07-730
7.12 Planned Shutdown Procedure of All DKCs in 3DC Configuration TRBL07-750

8. Forced Outage and Restart of HSNBX/DKC/DKU TRBL08-10
8.1 Non volatilization power-off and restarting procedure TRBL08-20
8.2 Forced volatilization (full) power-off and restarting procedure 1-1 ..... TRBL08-80
8.3 Forced volatilization (full) power-off and restarting procedure 1-2 ..... TRBL08-100
8.4 Forced volatilization (part) power-off and restarting procedure 2-1 ..... TRBL08-130
8.5 Forced volatilization (part) power-off and restarting procedure 2-2 ..... TRBL08-150

9. Recovery from UR Failure TRBL09-10
9.1 Recovery Procedure for UR Failure TRBL09-10
9.2 Procedure for Recovering UR Pair TRBL09-80
9.3 Force Delete Pair Operation TRBL09-110
9.4 Force Delete JNL Group Operation TRBL09-130
9.5 Procedure for UR Pinned Track Recovery and Journal Volume Replacement TRBL09-140
9.6 Failure Recovery Procedure and Planned Shutdown Procedure of the UR-UR delta Configuration TRBL09-190
9.6.1 Failure Recovery Procedure of the UR-UR delta Configuration TRBL09-190
9.6.2 DKC Planned Shutdown Procedure of the UR-UR delta Configuration TRBL09-510
9.6.2.1 Planned Shutdown Procedure of the PDKC TRBL09-510
9.6.2.2 Planned Shutdown Procedure of the LDKC TRBL09-570
9.6.2.3 Planned Shutdown Procedure of the IDKC TRBL09-590
9.6.2.4 Planned Shutdown Procedure of the RDKC TRBL09-620

10. Recovery from Thin Image Failure TRBL10-10
10.1 Recovery Procedure for Thin Image Failure due to SM Volatilization (SIM = 47ec00) TRBL10-10
10.2 Recovery Procedure for Thin Image Failure (SIM = 4b3xyy, 7ff104) TRBL10-20
10.3 Recovery Procedure for Pool Failure (SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx) TRBL10-40
10.4 Recovery Procedure for Pool Failure (SIM = 603000) TRBL10-100
10.5 Recovery Procedure for Thin Image pool-VOL ECC/LRC Error TRBL10-110
10.6 Recovery Procedure for Thin Image Failure (SIM = 670000) TRBL10-120
10.7 Recovery Procedure for Thin Image pool-VOL Failure TRBL10-130

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11. Recovery from Volume Migration Failure TRBL11-10
11.1 Recovery Procedure for Volume Migration Failure TRBL11-20
11.2 Output of Online Path Information (SSB EC = 2084) TRBL11-70
11.2.1 Output information TRBL11-70
11.2.2 To Continue the Operation TRBL11-90

12. Recovery from Mainframe Fibre Data Migration Failure (SIM = 21d4xx, efd400, 47dxyy, 47e700) TRBL12-10

13. Recovery from Dynamic Provisioning or Dynamic Tiering or active flash Failure TRBL13-10
13.1 Recovery Procedure for pool-VOL Blockade (When Two (Three in RAID6) or More Are Blocked in the RAID Gr the pool-VOL Belongs) TRBL13-10
13.2 Recovery Procedure for Pool Failure (SIM = 623xxx) TRBL13-80
13.3 Recovery Procedure for Pool Failure (SIM = 624000) TRBL13-150
13.4 Recovery Procedure for Pool Failure (SIM = 62b000) TRBL13-160
13.5 Recovery Procedure for pool-VOL Blockade (SIM = 627xxx) TRBL13-170
13.6 Procedure for Releasing Protect Attribute of Data Retention Utility (SIM = 628000) TRBL13-190
13.7 Deleting Procedure for Pool at the time of pool-VOL Blockade (When External Volume the pool-VOL Belongs Is Removed) TRBL13-200
13.8 Initialization Procedure for Pool TRBL13-210
13.9 Recovery Procedure for Dynamic Provisioning by Turning Off the Power and Volatilizing PS ON TRBL13-230
13.10 Disabling Procedure for Accelerated Compression Setting of Parity Group TRBL13-250
13.11 Recovery Procedures from Failures on Pool Creation, Expansion, and Deletion TRBL13-270
13.12 Recovery Procedure When Automatic Pool Capacity Expansion Failed due to a Pool-associated Factor (SIM = 632xxx) TRBL13-360

14. External Storage Maintenance TRBL14-10
14.1 Maintenance of External Storage TRBL14-10
14.1.1 Considerations When Performing Maintenance Work on External Storage TRBL14-10
14.1.2 Maintenance (Isolation) Procedure for a Failure on External Storage (SIM = 21d0xy, 21d2xy, efd000, ef5xxx, ff5xxx) TRBL14-40
14.1.3 Procedure for Operating Storage Navigator TRBL14-50
14.2 Recovery Procedure for External Device Failure TRBL14-60
14.2.1 Recovery Procedure for Path Failure While Device is Blocked (SIM = 21d0xy, efd000) TRBL14-60
14.2.2 Recovery Procedure for Path Single Failure (SIM = 21d0xy) TRBL14-80
14.2.3 Recovery Procedure for External Storage system Path Response Time Out Threshold Over (SIM = 21d2xy) TRBL14-110
14.2.4 Action When External Device and External Volume Are Not Recognized TRBL14-120
14.3 Elimination Procedure for Pinned Data on External Storage TRBL14-140
14.4 Procedure for Operating External Device LBA Conversion Tool TRBL14-160
14.5 Considerations When Performing Data Recovery on External Volume TRBL14-290

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15. Recovery from SNMP Failure TRBL15-10
15.1 SNMP Ping Test Trouble Shooting TRBL15-10
15.2 When Trap Cannot Be Received While Ping Reaches Manager PC Prepared by Customer TRBL15-20
15.3 SNMP Trap Information TRBL15-30

16. MP Blockade Reset Function TRBL16-10

17. Failure recovery of Encryption License Key TRBL17-10
17.1 Recovery procedure when acquisition failure from key management server (SIM = 661000, 661001) TRBL17-10
17.2 Recovery procedure for Encryption key threshold warning and depletion (SIM = 660100, 660200) TRBL17-30
17.3 Recovery procedure of DKB failure when restoring Encryption Keys TRBL17-40

18. Recovery from global-active device functions Failure TRBL18-10
18.1 Recovery Procedure for global-active device functions Failure TRBL18-10
18.1.1 Recovery Procedure at Failure Suspension of a GAD Pair (SIM = ddxyzz) TRBL18-20
18.1.2 Recovery Procedure at LDEV Block in the GAD Pair (SIM = 3a0xyy, db8xxx, db9xxx, dbaxxx, dbbxxx, ef8xxx, ef9xxx) TRBL18-70
18.1.3 Procedure to Recover Data from Backup Data at LDEV Failure in the GAD Environment TRBL18-90
18.1.4 Recovery Procedure of the Pinned Track in the GAD Environment TRBL18-110
18.1.5 Recovery Procedure at Quorum Disk Failure (SIM = def0xx) TRBL18-180
18.1.6 Recover Path Failure Between a GAD Pair in the GAD Environment TRBL18-210
18.2 Recovery Procedure When a Failure Occurred While Creating/ Resynchronizing a GAD Pair TRBL18-240
18.3 Failure Recovery Procedure and Maintenance Procedure of the GAD-UR delta Configuration TRBL18-260
18.3.1 Failure Recovery Procedure of the GAD-UR delta Configuration TRBL18-260
18.3.2 GAD-UR delta Configuration Maintenance Procedure TRBL18-400
18.3.2.1 Maintenance Procedure TRBL18-400
18.3.2.2 Planned Shutdown Procedure of the DKC of the GAD-UR delta Configuration TRBL18-420

19. Recovery from Differential area error TRBL19-10
19.1 Recovery Procedure for Differential area blocking (SIM = 4d1xyy) TRBL19-10

20. (Blank) TRBL20-10

21. dedupe and compression Error Recovery TRBL21-10

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21.1 Recovery Procedure for dedupe and compression Operation Error (SIM = 680001) ... TRBL21-10
21.2 Recovery Procedure for Operation Error in Deleting Capacity-Saving-Enabled DP-VOLs (without blocking/formatting) (SIM = 680002) ... TRBL21-60
21.3 Recovery Procedure when Operation Error of Deduplication System Data Volume Automatic Deletion is Detected (SIM = 681xxx) ... TRBL21-90
21.4 Recovery Procedure when Deduplication System Data Volumes are Suspended (SIM = 682000) ... TRBL21-100

22. Troubleshooting when performing dump collection ... TRBL22-10
22.1 Procedure when dump collection is normally completed (SIM = 7c0900) ... TRBL22-10
22.2 Procedure when dump collection is abnormally terminated (SIM = 7c0a00) ... TRBL22-20

23. Dump Collection Troubleshooting ... TRBL23-10

24. Recovery Procedure for GUM Information Recover Failure (SIM = 7d08xx) ... TRBL24-10

25. Recovery Procedure for GUM Version Warning (SIM = 7d0axx) ... TRBL25-10

26. CUDG Troubleshooting (SIM = 760000, SSB E/C = 3306) ... TRBL26-10

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1. Overview of TRBL

Automatic log dump collection can be operated on SVP micro version 90-01-41/00 or later. The overview of the operation is described below.

- The automatic log dump collection is the function to automatically collect dumps of Rapid/Normal/Detail type when a SIMs or SSB shown below is reported. (See "Setting Automatic Log Dump Collection" (SVP02-26-10).)
  - SIM: SIMs with an error level, Moderate, Serious, or Acute, and with a service report. Maintenance personnel can change the target SIMs for the automatic log dump collection.
  - SSB: SSBs that are specified as the targets for the automatic log data collection. Maintenance personnel can set the target SSBs.
- If the 'Log Dump Ex Tool' window is displayed in the SVP window, dumps are being collected by the automatic log dump collection. (The Log Dump Ex Tool window is displayed with the SVP micro version 90-01-41/00 or later.)
- The [Dump Abort] button is disabled at the start of each dump collection due to the initialization processing.

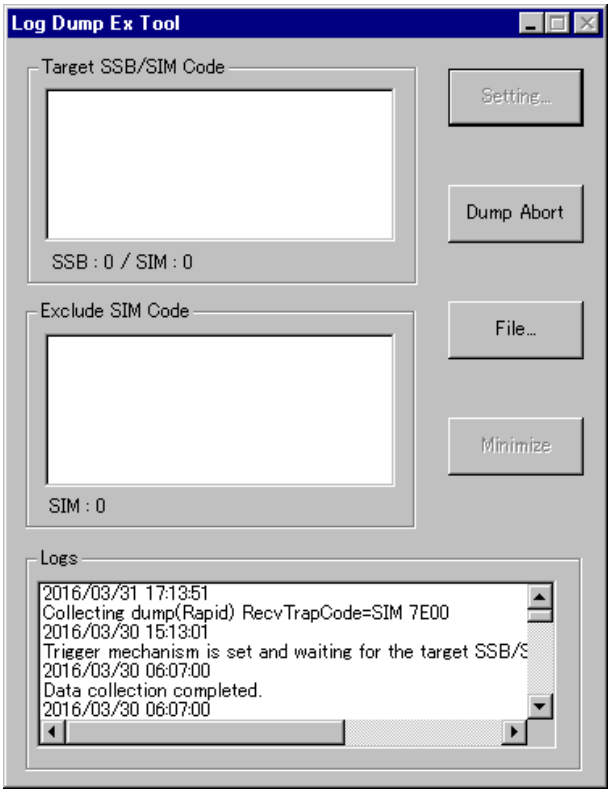


Table 1-1 SIM codes and automatic log dump collection operations

Reported code on SIM log	Automatic log dump operation	Action
7c0800 only (Dump collection starts)	Collecting dumps	—
7c0900 (Dump collection ends normally)	Ends dump collection normally	See TRBL22-10
7c0A00 (Dump collection ends abnormally)	Fails to collect dumps	See TRBL22-20
7c0B00 (Cancellation of the dump collection completed)	Stops dump collection	—

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- To perform SVP operations such as maintenance during automatic dump collection, cancel the automatic dump collection. For details, see “Aborting Dump Collection during Automatic Dump Collection”. (See (SVP02-26-170).)
- When you click [Dump Abort], the message “Abort processing failed.” might be displayed in the Logs box. In such a case, wait for about two minutes, and then try it again. If the message is displayed again, contact the Technical Support Division.
- If you click the [Dump Abort] button at the time of completion of a dump collection, the automatic log dump collection might not be aborted. In such a case, wait for a while, and then click the button again.
- When maintenance operations are performed by the maintenance personnel, the dump collection by the automatic log dump collection function is not executed.

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1.1 Flow of Troubleshooting

Perform troubleshooting procedures according to the following cases if a failure notification is received.

1. If a failure notification is sent by the customer:
   (1) Checking the customer report and the Storage System status (1.2 Checking Customer Report and Storage System Status)
   (2) Selecting how to perform troubleshooting and performing the recovery actions (2.3 Flow of failed part isolation)
   (3) Checking the normality (2.6 Checking Normality)
2. If a failure occurs during the additional installation, uninstallation, and preventive replacement:
   Perform troubleshooting procedures in accordance with each recovery procedure in "2.4 Failure During Operation by Service Personnel".
3. If a failure occurs during the micro-program exchange:
   Perform troubleshooting procedures in "Trouble Recovery Procedure in Exchanging Micro-programs" (MICRO05-10).

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1.2 Checking Customer Report and Storage System Status

Check the customer report and the status of the Storage System according to the following check items to identify how to perform troubleshooting first.

Check items	Check results	How to check
Checking the customer report		
Did the server detect a Storage System failure?		Check with the customer.
Did a failure occur at the time of the start-up of the Storage System?		
Did a failure occur at the time of the planned shutdown?		
Checking the LED status		
Is the PS ON LED on the HSNPANEL off?		For the LED position and LED status, see (LOC03-10).
Is the ALARM LED (red) on the CTL blinking or lit?		For the LED position and LED status, see (LOC03-80).
Is the ALARM LED (red) on the HSNPANEL lit?		For the LED position and LED status, see (LOC03-10).
Is the MESSAGE LED (amber) on the HSNPANEL lit?		
Checking the alerts		
Is SIM added?		On the Alerts window of the Maintenance Utility, check that SIM has been added since the last maintenance work.
Did multiple failures occurred? (* 1)		From the [Hardware] menu of the Maintenance Utility, select all of chassis, and then check the graphic on each chassis to see how many parts the failure icon (or) indicates.

*1: If failures have occurred on multiple parts (part types), the corrective actions need to be taken on a part with the highest priority first.
Before selecting how to perform troubleshooting, see "2.5 Failures of Multiple Parts" to check the priority of corrective actions.

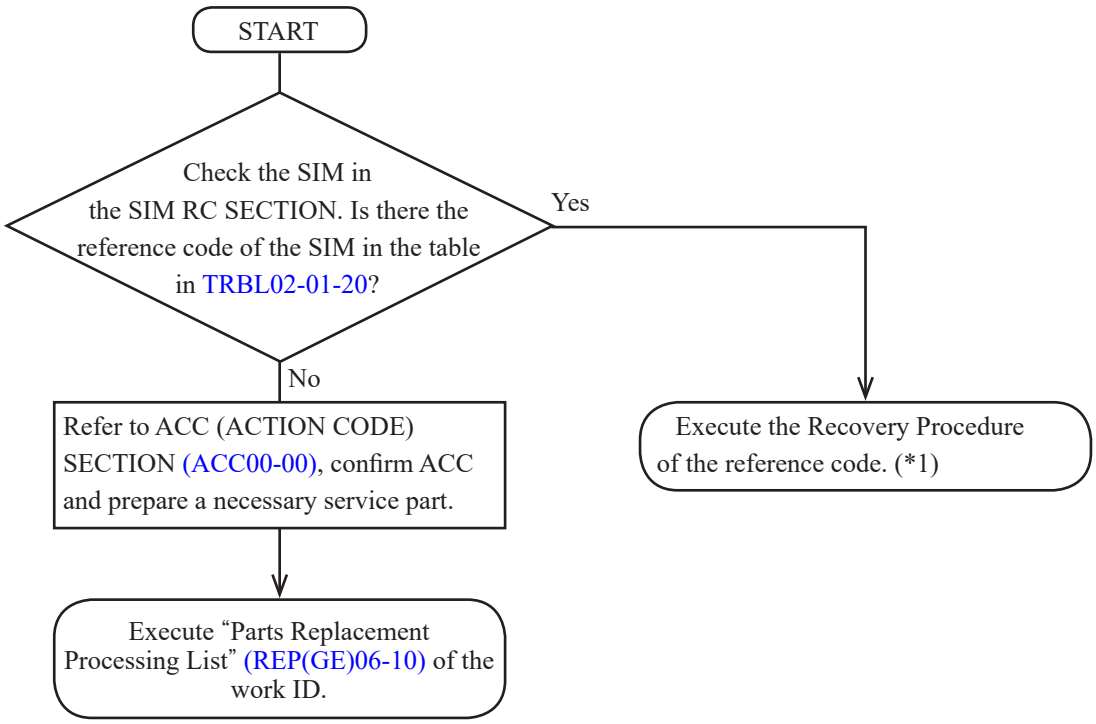
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2. Isolation of Failed Part

2.1 Analyze by SIM Log

Not only when the SIM is automatically reported by the remote maintenance function, but when either of the following occurs, take action according to the workflow shown below.

- In another trouble shooting workflow, you are instructed to perform the maintenance work according to the SIM.
- Unrecovered SIMs remain in the “Alerts” tab in the main window of the Maintenance Utility.



*1: If you finished the Maintenance, delete the log and SIM complete. (SVP02-08-10)

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Reference Code	Recovery Procedure
21a8xx, 21aaxx	3.1 SFP Module Failure Detection (SIM = 21a8xx, 21aaxx)
7c0300	3.2 Action When Audit Log FTP Transfer Failure Is Detected (SIM = 7c0300)
410001, 410002	3.3 Response to a FLASH DRIVE/ENCRYPTION PG LDEV FORMAT Failure (SIM = 41000x)
7c0500	3.4 Recovery Procedure for Detected Invalid SIM Data (SIM = 7c0500)
cf12xx, cf22xx, ac50xx	3.5 Recovery when power off or SAS/NVMe PORT failure occurred (SIM = cf12xx, cf22xx, ac50xx)
cf11xx	3.6 Recovery Procedure for the SAS PORT Temporary Failure (SIM = cf11xx)
30a100	3.7 Recovery Procedure for DKC Blockade (SIM = 30a100)
7ffa0x	3.8 Action When Time Synchronization Failed (SIM = 7ffa0x)
3a0xyy	3.9 Recovery Procedure for LDEV Blockade due to Micro-program Error (SIM = 3a0xyy)
7c0400	3.10 Recovery Procedure for Abnormal End of DumpTool (SIM = 7c0400)
fe0000	3.11 Recovery procedure of SIM occurrence during battery charge (SIM = fe0000)
fe01xx, fe02xx	3.12 Action when Cache Write Through by battery factor is detected (SIM = fe0100, fe0200)
db0xxx, db1xxx, db2xxx, db3xxx, db4xxx, db5xxx, db6xxx, db7xxx	3.13 Isolation and Recovery Procedure for Common SAS/NVMe Failure (SIM = db0xxx, db1xxx, db2xxx, db3xxx, db4xxx, db5xxx, db6xxx, db7xxx)
7d01xx, 7d02xx	3.14 Recovery Procedure for LAN Error
ffe800	3.15 Recovery Procedure for the Failure on the Occurrence of Unmatched Memory Installation Capacity (SIM = ffe800)
fff0xx	3.16 Recovery Procedure When Cache Correctable Error Is Detected (SIM = fff0xx)
db8xxx, db9xxx, dbaxxx, dbbxxx, ef8xxx, ef9xxx	3.17 Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx)
fff40x	3.18 Recovery Procedure When CMs Are Blocked in One Cluster (SIM = fff40x)
af20xx, af51xx, af52xx, afb1xx, af21xx, af61xx, af62xx, afb3xx	3.19 PS Warning Error (af20xx, af51xx, af52xx, afb1xx, af21xx, af61xx, af62xx, afb3xx)
bfe3a2	3.20 Recovery Procedure When Duplex SVP Setting Failed (SIM = bfe3a2)
3072xy	3.21 Recovery Procedure When CHK3 Threshold Over Occurred (SIM = 3072xy)
3c9500	3.22 Recovery Procedure for Warning of Channel Board/Disk Board/Interconnect Channel Board Type (SIM RC = 3c9500)
af110x, af120x	3.23 Response to the Occurrence of External Temperature Warning or Alarm (SIM = af110x, af120x)
af100x	3.24 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)
ffe700, ffcd0x, ffcfxx, 610002	3.25 Isolation Procedure for Failed Part in CACHE Volatilization (SIM = ffe700, ffcd0x, ffcfyx, 610002)
3080xx	3.26 Receiving WCHK1 Dump (SIM = 3080xx)
dbcxxx, dbdxxx, dbexxx, dbfxxx	3.27 Isolation and Recovery Procedure for Drive Link Rate Error (SIM = dbcxxx, dbdxxx, dbexxx, dbfxxx)
4b8xxx, 4b9xxx, 4c8xxx, 4c9xxx, 4bexxx, 4bfxxx, 4cexxx, 4cfxxx, 4bcxxx, 4bdxxx, 4ccxxx, 4cdxxx, 4baxxx, 4bbxxx, 4caxxx, 4cbxxx, eb6xxx, eb7xxx	3.28 Drive failure recovery procedure

(To be continued)

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(Continued from the preceding page)

Reference Code	Recovery Procedure
50axxx, 50bxxx, 50cxxx, 50dxxx	3.32 Procedure for Responding to the Used Endurance of Flash Drives and Flash Module Drives (FMDs) (SIM = 50axxx, 50bxxx, 50cxxx, 50dxxx)
fffa0x	3.33 Response to the Occurrence of Battery Warning (SIM = fffa0x)
effexx, effdxx	3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)
bf85a3, bf86a3	3.35 Recovery Procedure for SVP RAS Switch #1 remains (SIM = bf85a3, bf86a3)
af7000, af7100	3.36 Recovery Procedure When DB External Temperature Abnormality is detected (SIM = af7000, af7100)
7ff2xx	3.38 Recovery Procedure for Standby SVP Failure (SIM = 7ff2xx)
aff20x	3.39 Response to the Detection of Uninstalled CFM (SIM = aff20x)
af400x	3.40 Response to the Occurrence of BKMF Warning (SIM = af400x)
7ff7xx	3.41 Procedure for responding to the product program expiration (SIM = 7ff7xx)
7ff8xx	3.42 Procedure for responding to an excess of the allowed capacity (SIM = 7ff8xx)
7ff9xx	3.43 Procedure for responding to the prerequisite program product expiration (SIM = 7ff9xx)
aff1xx	3.44 Recovery Procedure when a GUM Failure Occurs (SIM = aff1xx)
3c9600	3.45 Response to the Detection of Unmounted Channel Board (SIM = 3c9600)
eb8xxx, eb9xxx	3.46 Procedure for Responding to the Micro-program Exchange Failure due to Cache High Load (SIM = eb8xxx, eb9xxx)
7d090x	3.47 Recovery Procedure When DKC Warning Occurs (SIM = 7d090x)
7d06xy	3.48 Recovery Procedure When an MP Error Occurs (SIM = 7d06xy)
ffd400	3.50 Recovery Procedure When the Part Installation Error Occurs (SIM = ffd400)
af4d0x	3.51 Recovery Procedure When the Panel Switch Warning (SIM = af4dxx)
180000	3.52 Response to a Loss of the DKC Audit Log (SIM = 180000)
30750x	3.53 Recovery Procedure When CFM Failure Occurs (SIM = 30750x)
fe030x	3.55 Recovery Procedure When an Incorrect CFM Type or a Shortage of CFM is detected (SIM = fe030x)
cf88xx, 2160xx, 2161xx, 2162xx	3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx)
afb0xx	3.57 Procedure When HSNBX External Temperature Warning Occurs (SIM = afb0xx)
afb3xx	3.58 Procedure When ISWPS AC Warning Occurs (SIM = afb3xx)
afb5xx	3.59 Procedure When HSNBX Thermal Monitor Warning Occurs (SIM = afb5xx)
afb6xx	3.60 Incorrect Setting of HSNBX Panel JP (SIM = afb6xx)
afb7xx	3.61 HSNBX Panel JP Setting Warning (SIM = afb7xx)
afb8xx	3.62 Warning When HSNBX PS ON/OFF I/F Inconsistency Occurs (SIM = afb8xx)
bfe407	3.63 Recovery Procedure When the USB Interface Error Occurs (SIM = bfe407)
73xx00, 1400x0	3.64 Recovery Procedure for LAN Error/SVP Failure (SIM = 73xx00, 1400x0)
4c4xxx, 4c5xxx	3.65 Recovery from initialization failure of Flash Module Drive (SIM = 4c4xxx, 4c5xxx)
3073xx	3.66 Recovery Procedure for Processor Blockade (SIM = 3073xx)
cf13xx	3.67 Recovery Procedure When the SAS CTL Failure Is Detected (SIM = cf13xx)
ffde01, ffde02, ffde03	4.2 Recovery Procedure When WDCP Information Is Lost (SIM = ffde01, ffde02, ffde03)
2190xy	5.4 Recovery Procedure for AL_PA Conflict (SIM = 2190xy)
3c97xx	5.6 Recovery Procedure When Disconnection of Host Is Detected during ISCF Micro-Program Exchange (SIM = 3c97xx)

(To be continued)

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(Continued from the preceding page)

Reference Code	Recovery Procedure
47dxyy, 7ff102, 47e700, 4b2xyy, 4b4xyy, 7ff105, 47e500	6. Recovery from ShadowImage for Mainframe/ShadowImage/FlashCopy (R) V2/ FlashCopy (R) SE Failure
d4xyyy, d4eyyy, d4dyyy, 2180xy, 2182xy	7. Recovery from TrueCopy for Mainframe/TrueCopy Failure
2180xy, dcxyyy, dcexzz, dcfxzz	9. Recovery from UR Failure
47ec00	10.1 Recovery Procedure for Thin Image Failure due to SM Volatilization (SIM = 47ec00)
4b3xyy, 7ff104	10.2 Recovery Procedure for Thin Image Failure (SIM = 4b3xyy, 7ff104)
601xxx, 602xxx, 604xxx, 605xxx, 606xxx	10.3 Recovery Procedure for Pool Failure (SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx)
603000	10.4 Recovery Procedure for Pool Failure (SIM = 603000)
670000	10.6 Recovery Procedure for Thin Image Failure (SIM = 670000)
47fyxx, 7ff106	11. Recovery from Volume Migration Failure
21d4xx, efd400, 47dxyy, 47e700	12. Recovery from Mainframe Fibre Data Migration Failure (SIM = 21d4xx, efd400, 47dxyy, 47e700)
623xxx	13.2 Recovery Procedure for Pool Failure (SIM = 623xxx)
624000	13.3 Recovery Procedure for Pool Failure (SIM = 624000)
62b000	13.4 Recovery Procedure for Pool Failure (SIM = 62b000)
627xxx	13.5 Recovery Procedure for pool-VOL Blockade (SIM = 627xxx)
628000	13.6 Procedure for Releasing Protect Attribute of Data Retention Utility (SIM = 628000)
632xxx	13.12 Recovery Procedure When Automatic Pool Capacity Expansion Failed due to a Pool-associated Factor (SIM = 632xxx)
21d0xy, 21d2xy, efd000, ef5xxx, ff5xxx	14.1 Maintenance of External Storage
21d0xy, efd000, 21d2xy	14.2 Recovery Procedure for External Device Failure
660100, 660200, 661000, 661001	17. Failure recovery of Encryption License Key
ddxyzz, 2180xy, dee0xx, def0xx	18. Recovery from global-active device functions Failure
4d1xyy	19.1 Recovery Procedure for Differential area blocking (SIM = 4d1xyy)
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)
681xxx	21.3 Recovery Procedure when Operation Error of Deduplication System Data Volume Automatic Deletion is Detected (SIM = 681xxx)
682000	21.4 Recovery Procedure when Deduplication System Data Volumes are Suspended (SIM = 682000)
7c0900	22.1 Procedure when dump collection is normally completed (SIM = 7c0900)
7c0a00	22.2 Procedure when dump collection is abnormally terminated (SIM = 7c0a00)
7d07xx	T.S.D.call
7d08xx	24. Recovery Procedure for GUM Information Recover Failure (SIM = 7d08xx)
7d0axx	25. Recovery Procedure for GUM Version Warning (SIM = 7d0axx)
760000	26. CUDG Troubleshooting (SIM = 760000, SSB E/C = 3306)
46axxx, 46bxxx	Collect “Normal” type dumps, and then contact the Technical Support Division.

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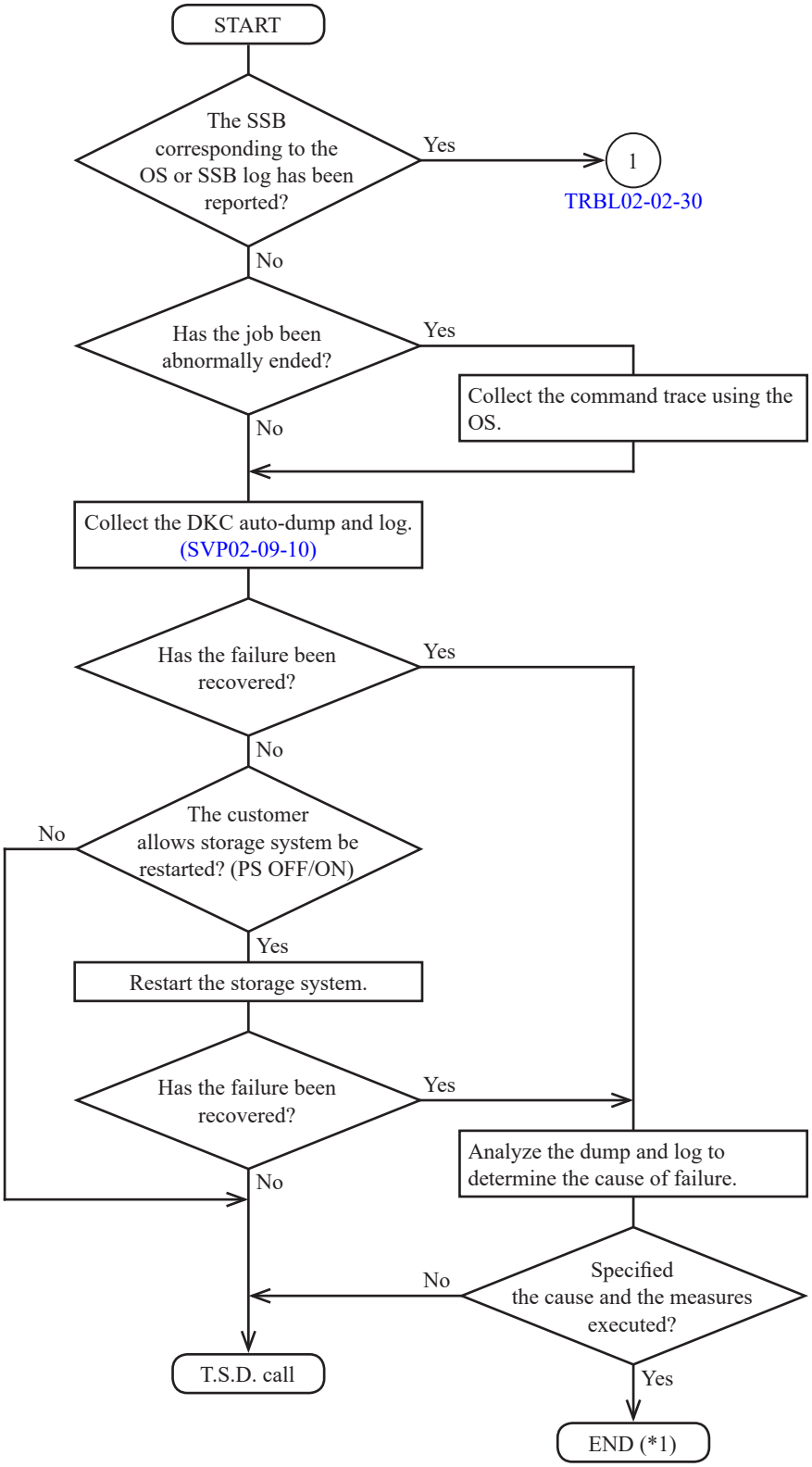
2.2 Failure Reported by Customer

Isolate the failed part depending on the following phenomenon.

[1] OS Cannot Recover the Storage System Failure (MIH, Job ABEND) ---------- TRBL02-02-20
[2] OS Has Detected Storage System Failure (ICC, CC = 3) ---------- TRBL02-02-40
[3] ALARM LED on the HSNPANEL Turns On ---------- TRBL02-02-80
[4] Failure When Turning On the Power---------- TRBL02-02-100
[5] The Power Cannot Be Turned Off ---------- TRBL02-02-110
[6] MESSAGE LED on the HSNPANEL is Blinking---------- TRBL02-02-130
[7] CACHE Failure (Both Sides) Occurred ---------- TRBL02-02-140
[8] When There Is a Performance Problem of the SVP---------- TRBL02-02-170

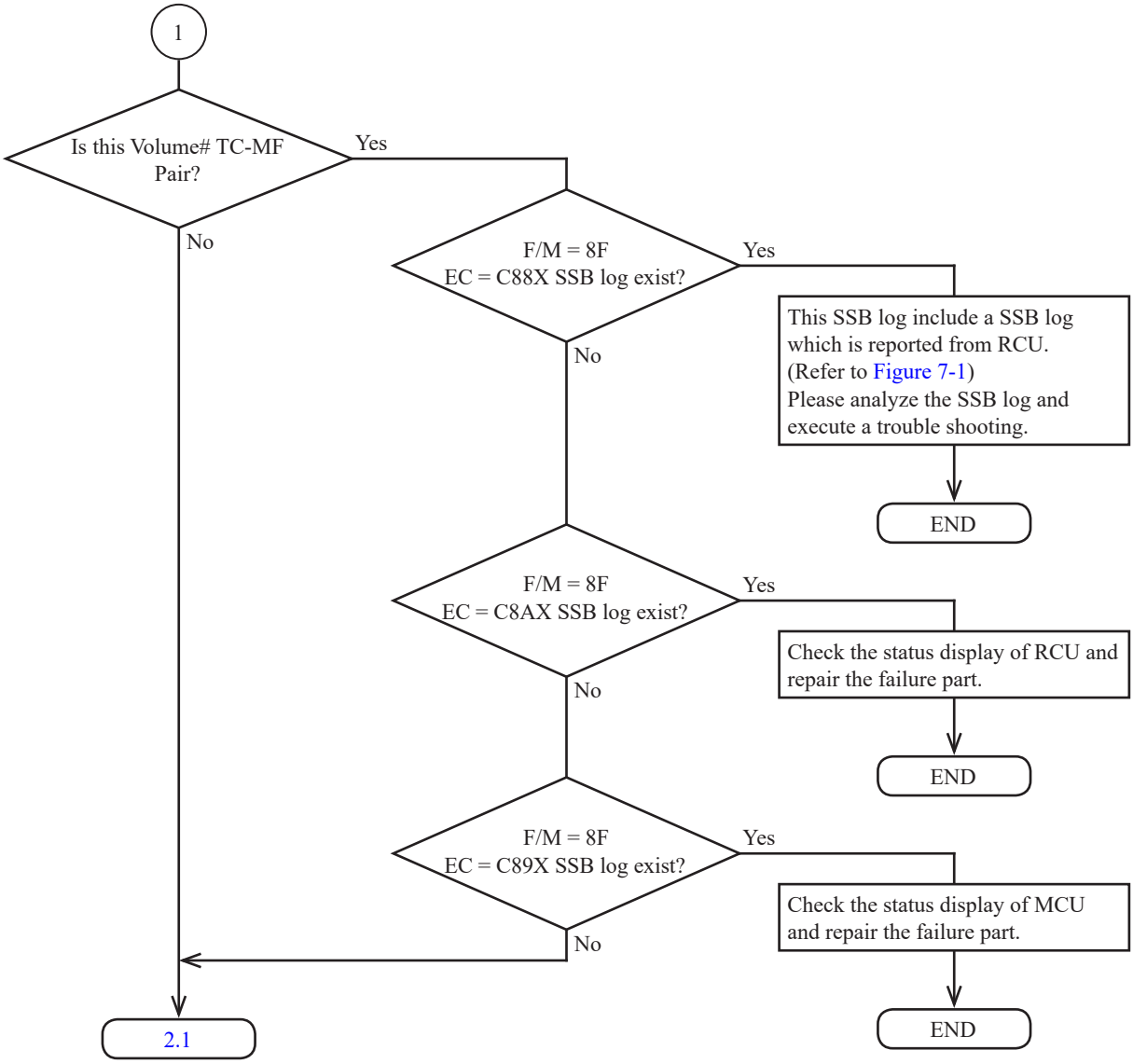
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2.2.1 OS Cannot Recover the Storage System Failure (MIH, Job ABEND)



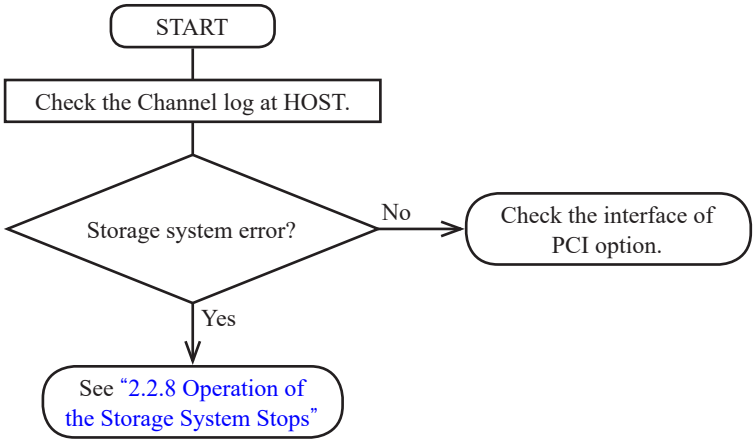
*1: If you finished the Maintenance, delete the log and SIM complete. (SVP02-08-10)

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2.2.2 OS Has Detected Storage System Failure (ICC, CC = 3)



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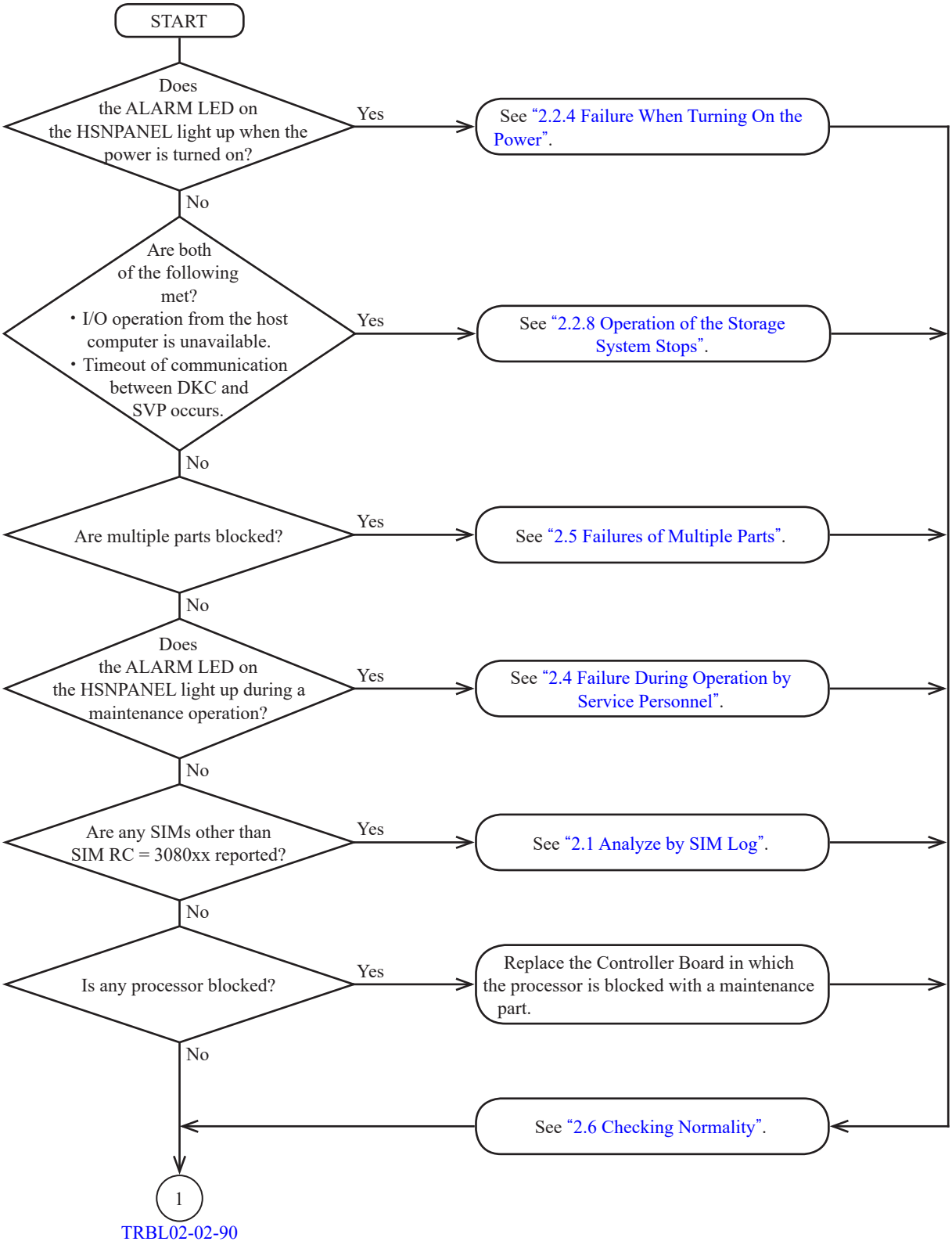
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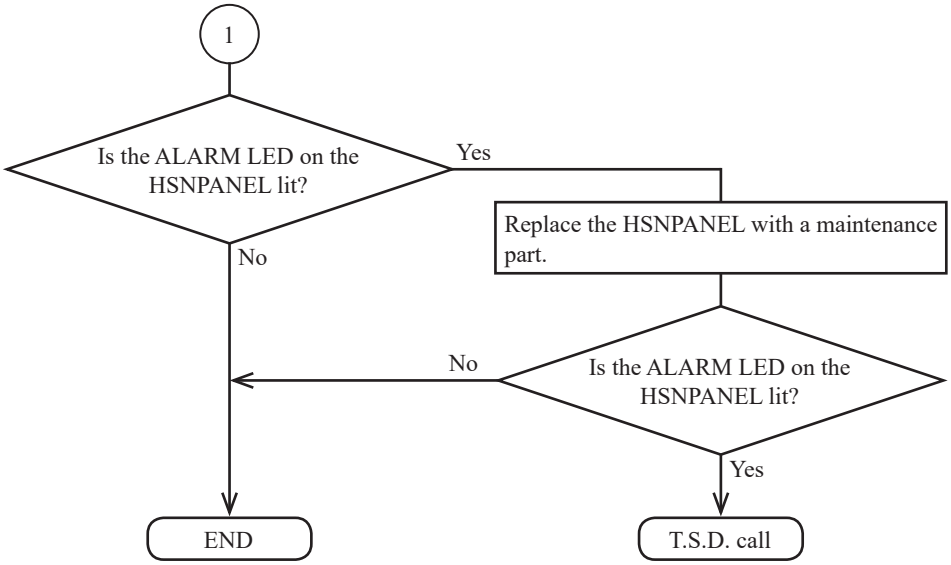
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2.2.3 ALARM LED on the HSNPANEL Turns On

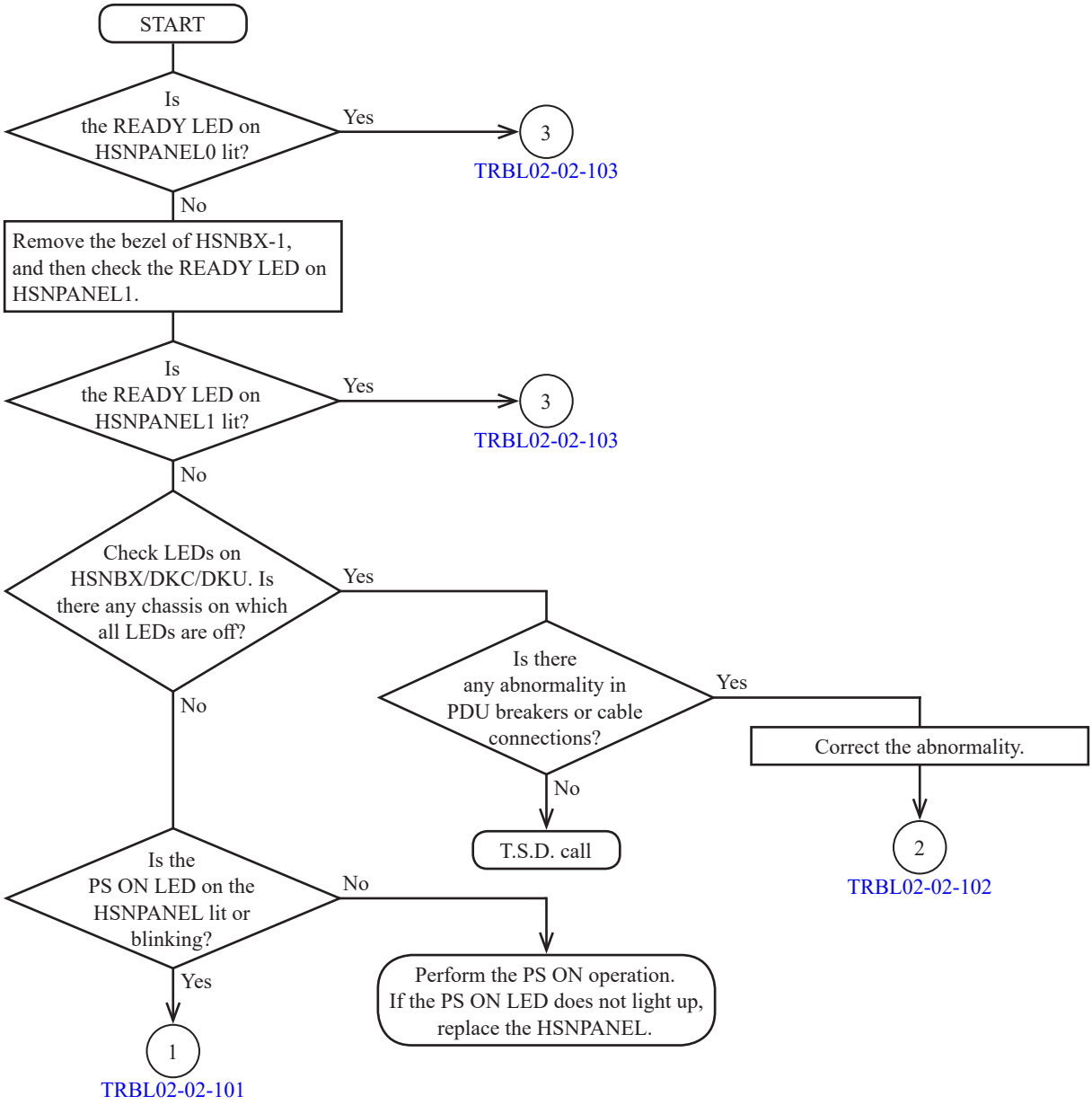


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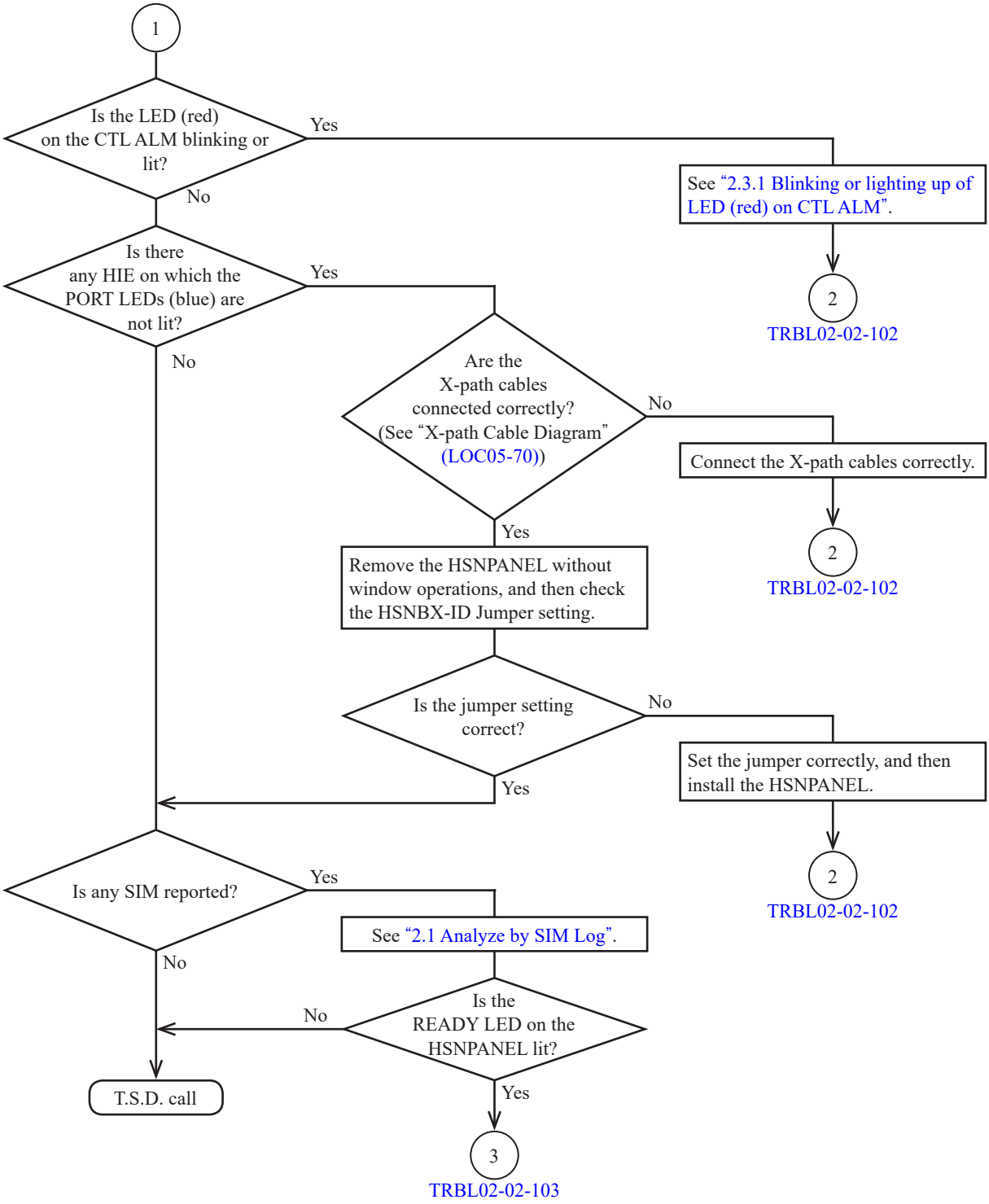


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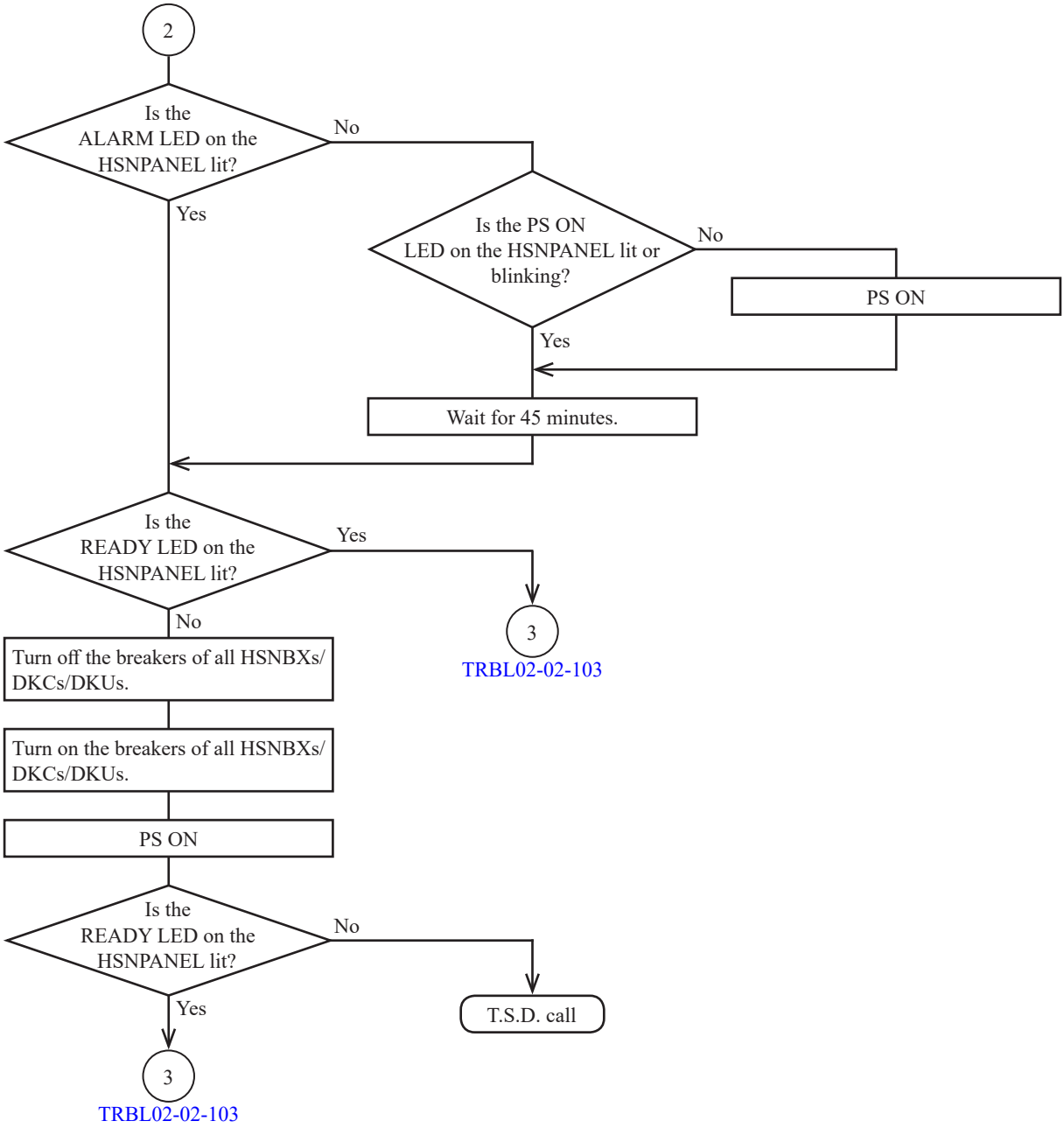
2.2.4 Failure When Turning On the Power



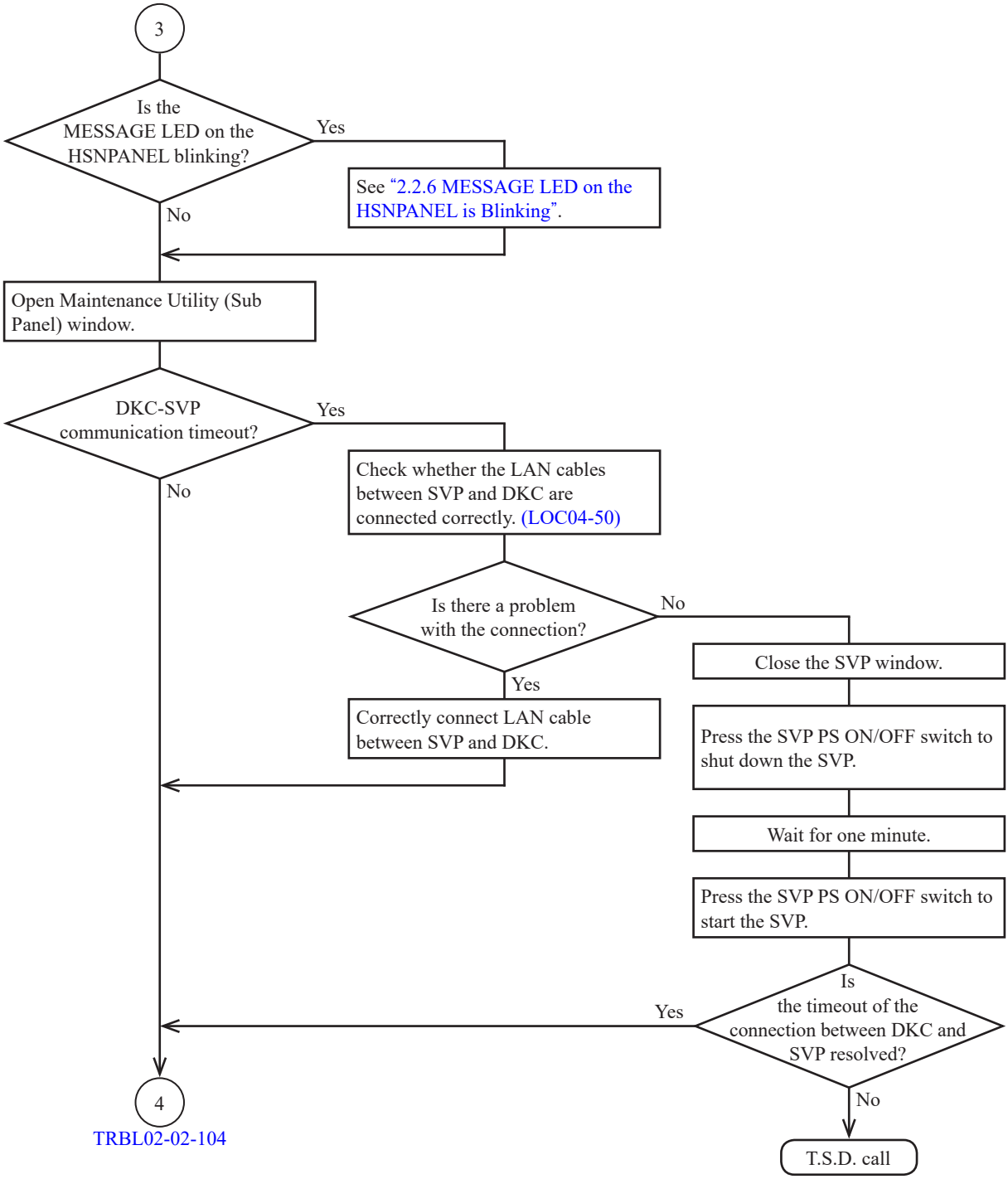
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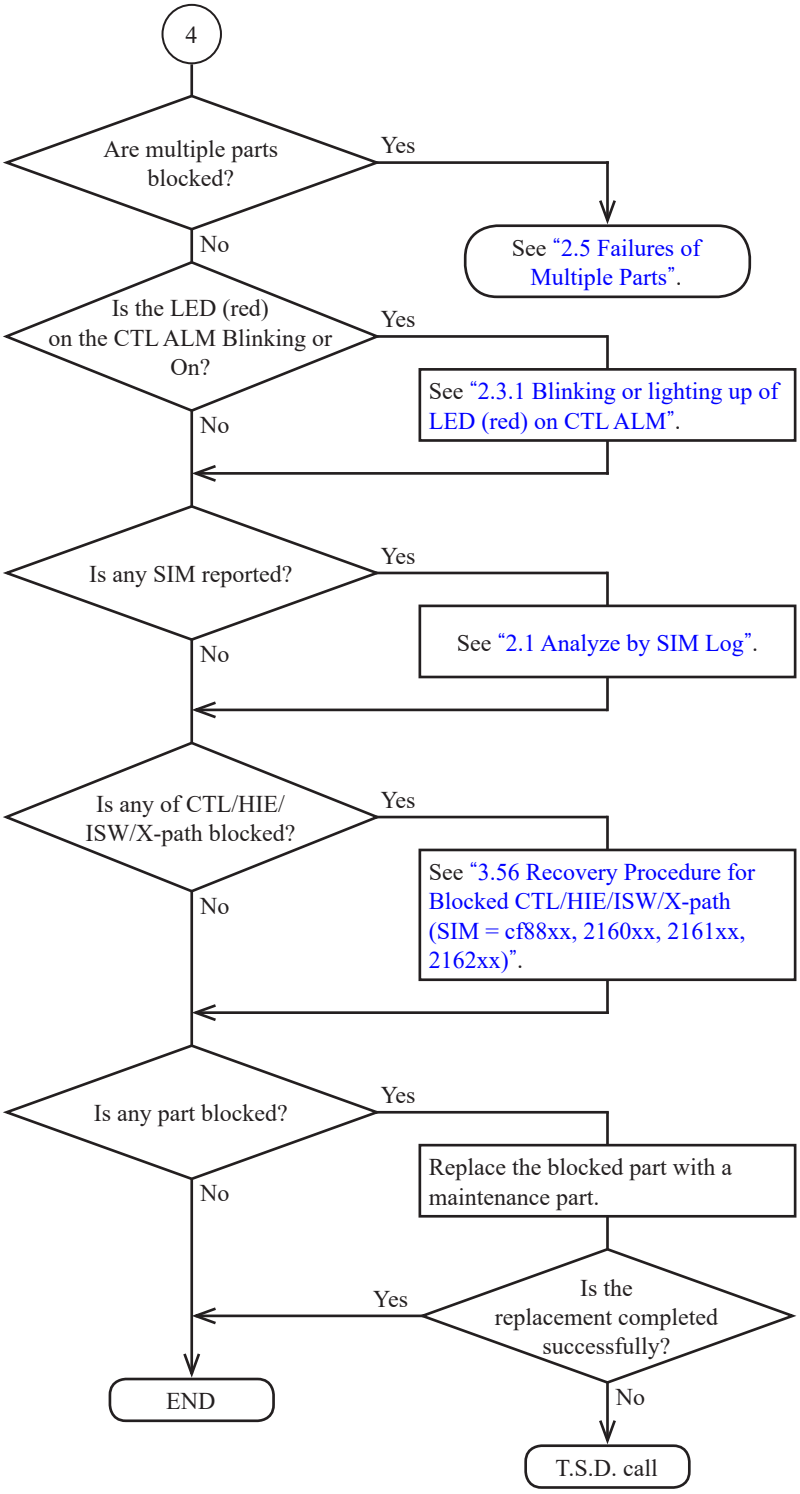
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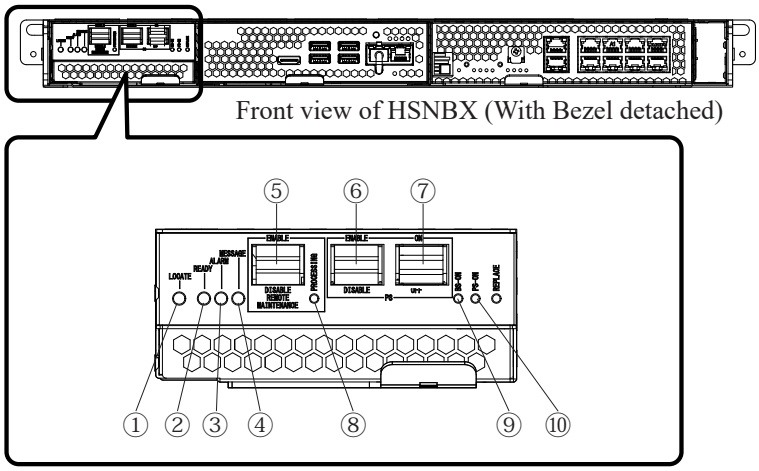
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2.2.5 The Power Cannot Be Turned Off

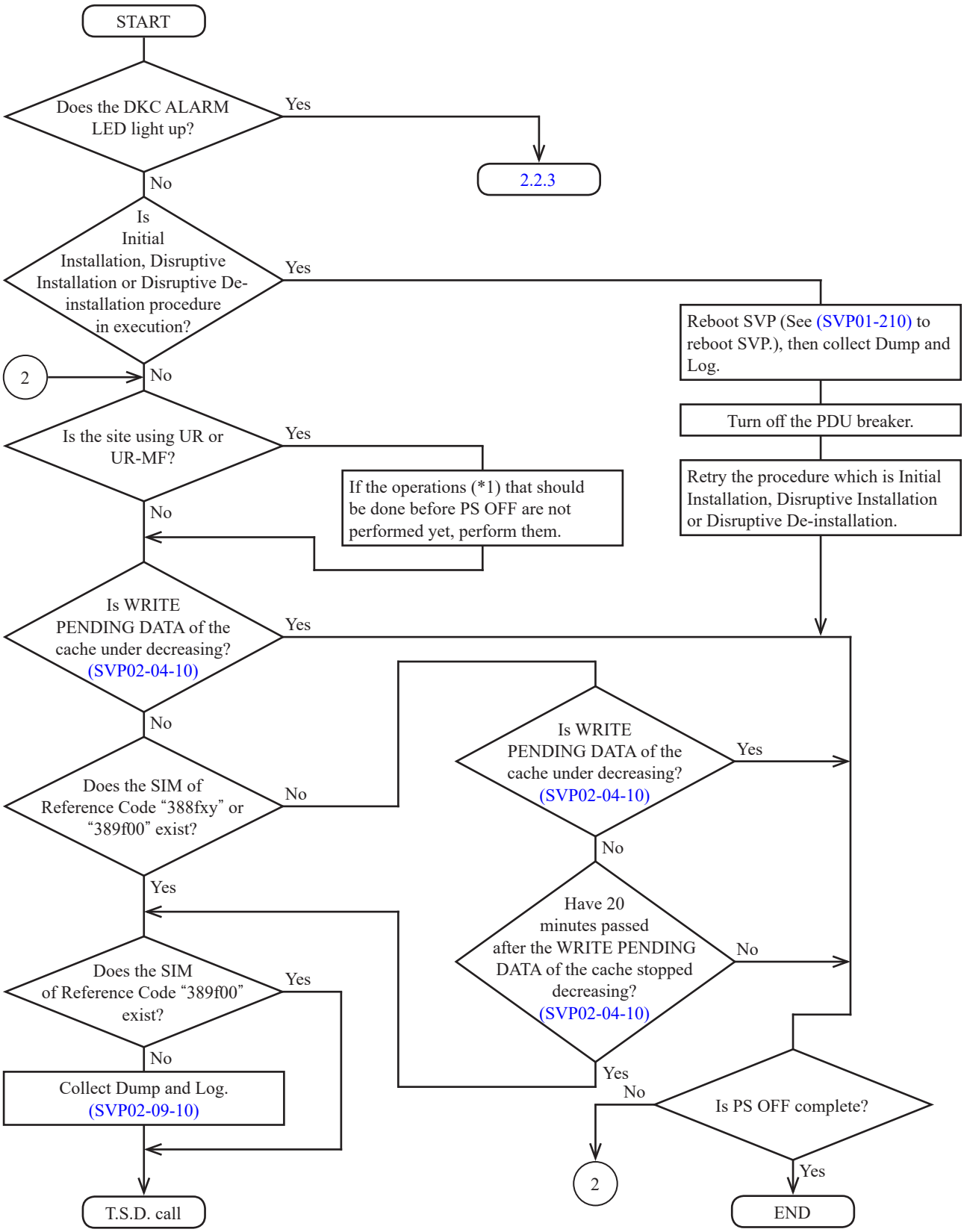
NOTE:
- Reporting the SIM of Reference Code “SIM = 388f00” or “SIM = 389f00” might take 10 minutes or more. Especially, if the emergency destage does not terminate, the reporting might take about one hour.
- Even after the SIM of Reference Code “SIM = 388f00” or “SIM = 389f00” was reported, the planned 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.
- In the case SIM = 62axxx is output for a pool that contains a virtual volume with capacity saving enabled, PS OFF cannot be performed. Take the following procedure:
  1. Perform non-volatile PS off for the storage system. (“8.1 Non volatilization power-off and restarting procedure”)
  2. While holding the PS SW ENABLE switch (⑥) on the HSNPANEL in the ENABLE position, turn on the PS ON/PS OFF switch (⑦) and confirm that the PS ON LED (⑩) turns green. (LOC03-10)

Figure 2-1 Switch and LEDs of HSNPANEL



  3. Ask the user to take the actions as indicated in SIM = 62axxx.
  4. While holding the PS SW ENABLE switch (⑥) on the HSNPANEL in the ENABLE position, turn off the PS ON/PS OFF switch (⑦).

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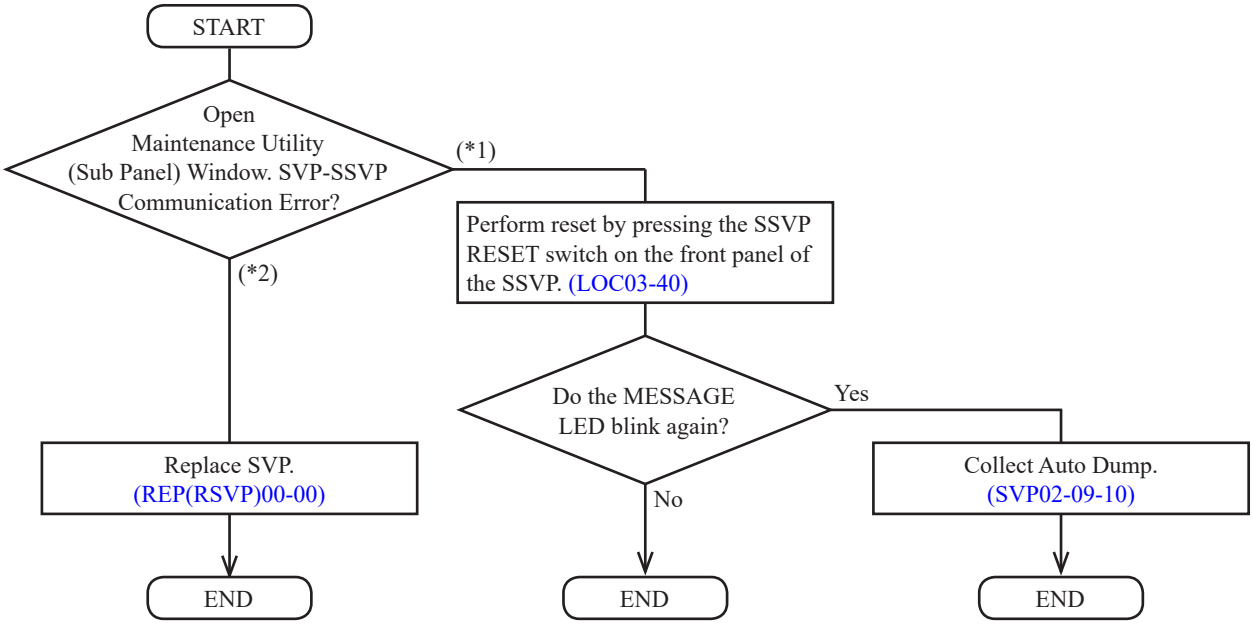


*1: For the operations that should be done before PS OFF, see “Powering-off the primary or secondary storage system” in Hitachi Universal Replicator User Guide or Hitachi Universal Replicator for Mainframe User Guide.

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2.2.6 MESSAGE LED on the HSNPANEL is Blinking

The following is the recovery procedure when the MESSAGE LED on the HSNPANEL is blinking.



*1: Maintenance Utility (Sub Panel) window is displayed without message of the communication error.

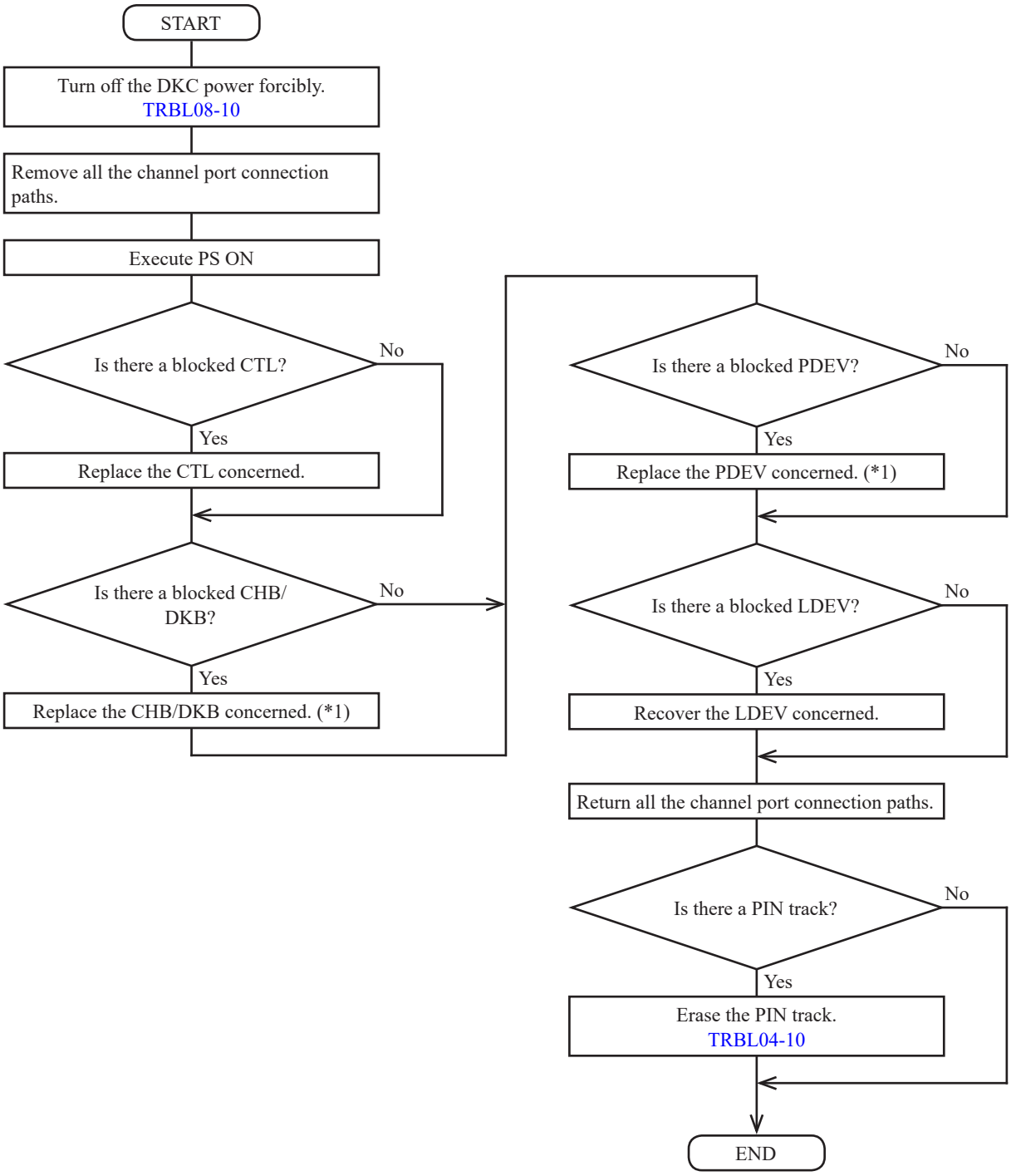
*2:
- SVP window cannot display.
- Maintenance Utility (Sub Panel) window cannot display.
- The message of the communication error exists.

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2.2.7 CACHE Failure (Both Sides) Occurred

If a failure occurs in the normal side of the CACHE while one side of the CACHE or SM is blocked, you will not be able to access a part or all of the data on the CACHE. This status is called a CACHE double-sided failure, and the following SIM may be reported incidentally. If you cannot recover the device in the recovery procedure corresponding to each SIM, recover it according to the following processing flow.

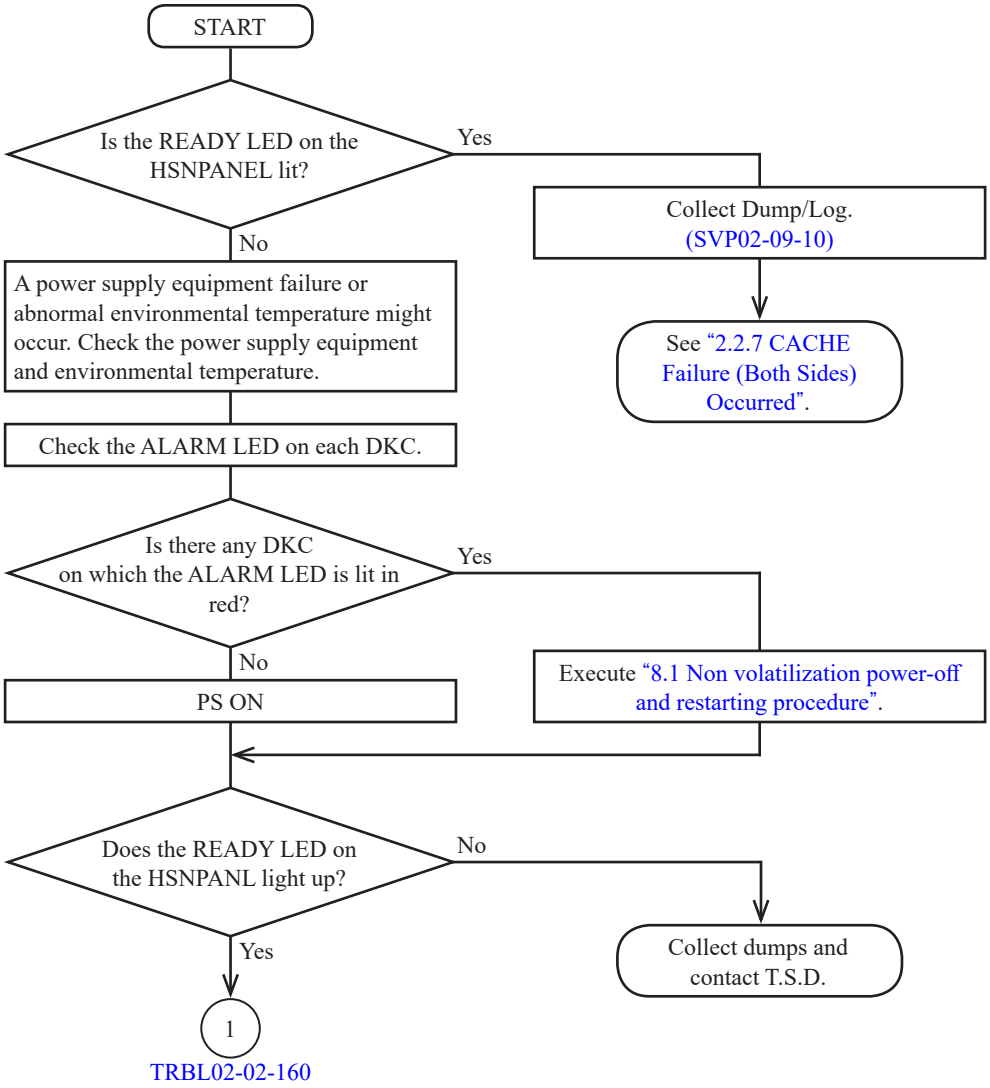
[SIM which may be reported at the time of a CACHE double-sided failure]
RC = 3073xx, 3080xx, ff4xyy, db4xxx, db5xxx, db6xxx, db7xxx, efyxxx



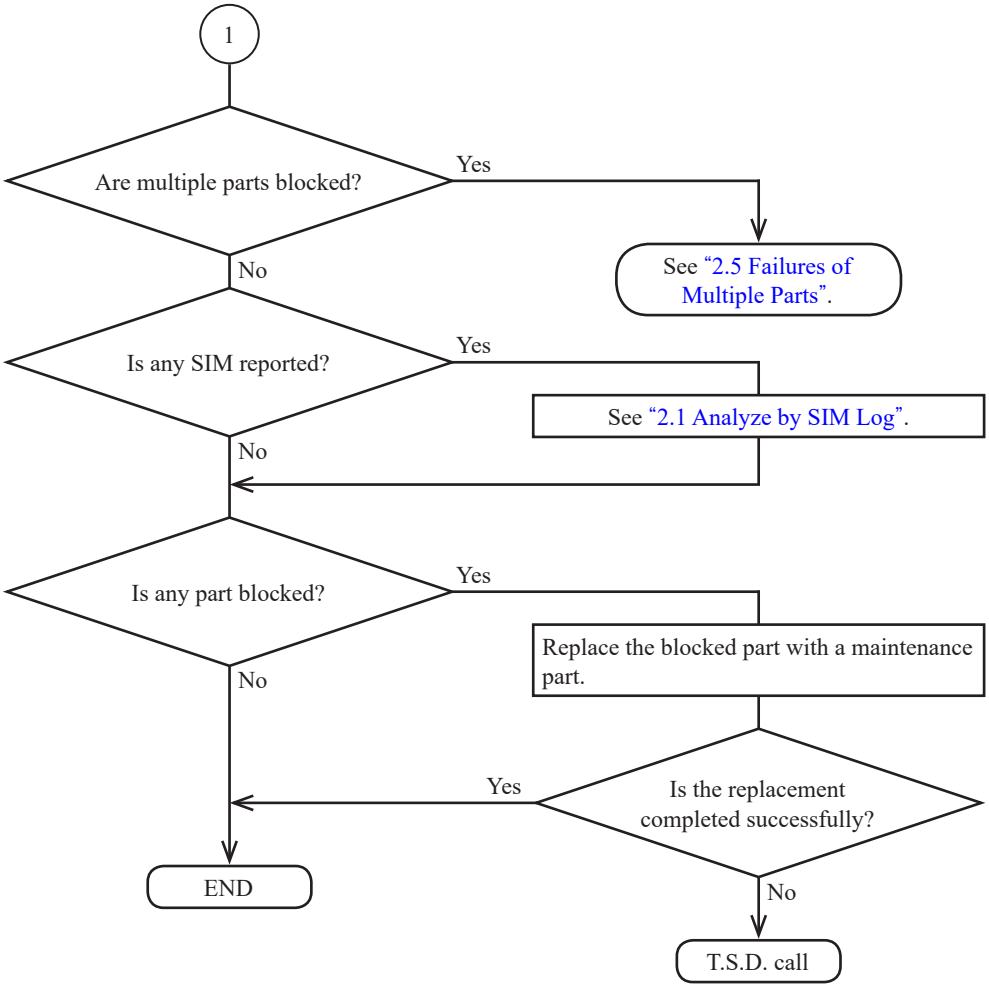
*1: If the blockade factor is definitely a CACHE double-sided failure, dummy replacement is possible.

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2.2.8 Operation of the Storage System Stops



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2.2.9 When There Is a Performance Problem of the SVP

If a high CPU usage rate of the SVP, slow operation of the SVP or Storage Navigator/Web Console, or similar phenomenon occurs, collect the performance information of the SVP and dumps during the occurrence of that phenomenon and send them to the Technical Support Division.

NOTE:
- Collect dumps immediately after collecting the performance information. It takes about one hour to collect the performance information.
- During the collection of the performance information and dumps, the performance of the SVP might be affected. The SVP operation might become much slower depending on the workload.

Collect the performance information and dumps by following the procedure below.

Required Condition
The collection procedure must be performed under the condition where a high CPU usage rate of the SVP, slow operation of the SVP or Storage Navigator/Web Console, or similar phenomenon is occurring. If the collection procedure is performed when that phenomenon does not occur, an accurate analysis is not possible at the Technical Support Division.

1. Start the command prompt as Administrator on the SVP.
   Select [Start]-[Windows System], right-click the displayed [Control Prompt], and then select [More]-[Run as administrator].

2. Change the current directory to the directory in which the performance information collection tool exists.
   `cd /d C:\DKC200\mp\pc`

3. Run the following command:
   `GetSVPPerfInfo.bat C:\Result`
   - "`C:\Result`" is the output directory of the performance information. Specify an absolute path.
     You can omit the output directory. If you omit it, the performance information is output in the following directory:
     `C:\DKC200\tmp\PerfLog`
     You cannot specify a Maintenance PC drive folder for the output directory.

4. The performance information collection tool is executed, and "Executing…" is displayed on the screen.
   Do not click or close the command prompt window during the execution.

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5. When the execution is completed, the message shown below is displayed on the screen. It takes about one hour for the execution to be completed.

   SVP Performance Information tool is completed.

6. Check that the following files are output in the specified directory.
   - CounterResult_YYYYMMDDhhmmss.blg: Windows performance monitor log
   - ProcessList_YYYYMMDDhhmmss.csv: Information of the processes run on the SVP

7. Close the command prompt.

8. Collect "Normal" type dumps. (SVP02-09-10)

   NOTE: Collect dumps immediately after collecting the performance information. If you collect dumps after a long time has passed from the completion of the performance information collection, an accurate analysis is not possible.

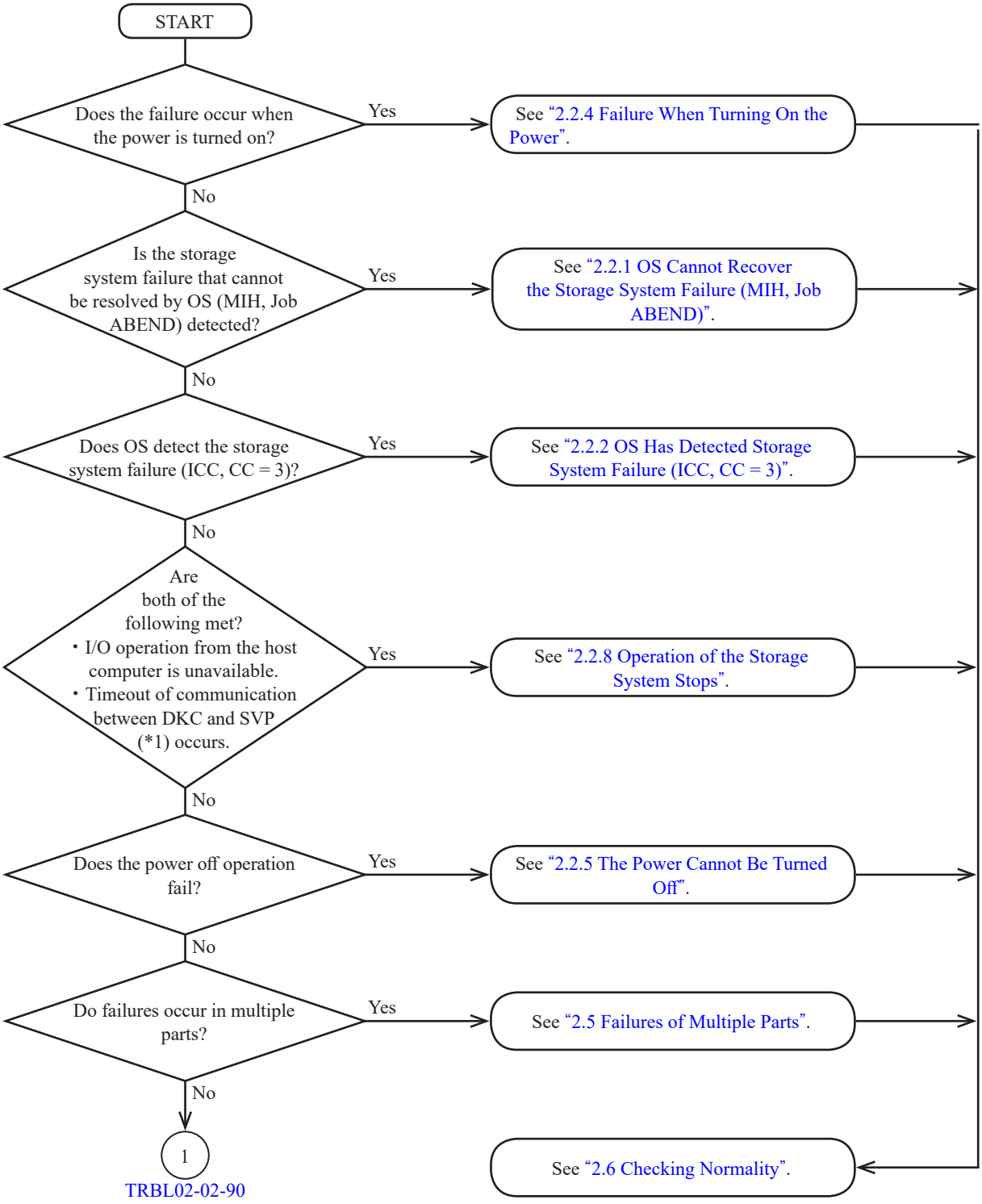
9. Send the performance information file and dump files to the Technical Support Division.

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2.3 Flow of failed part isolation

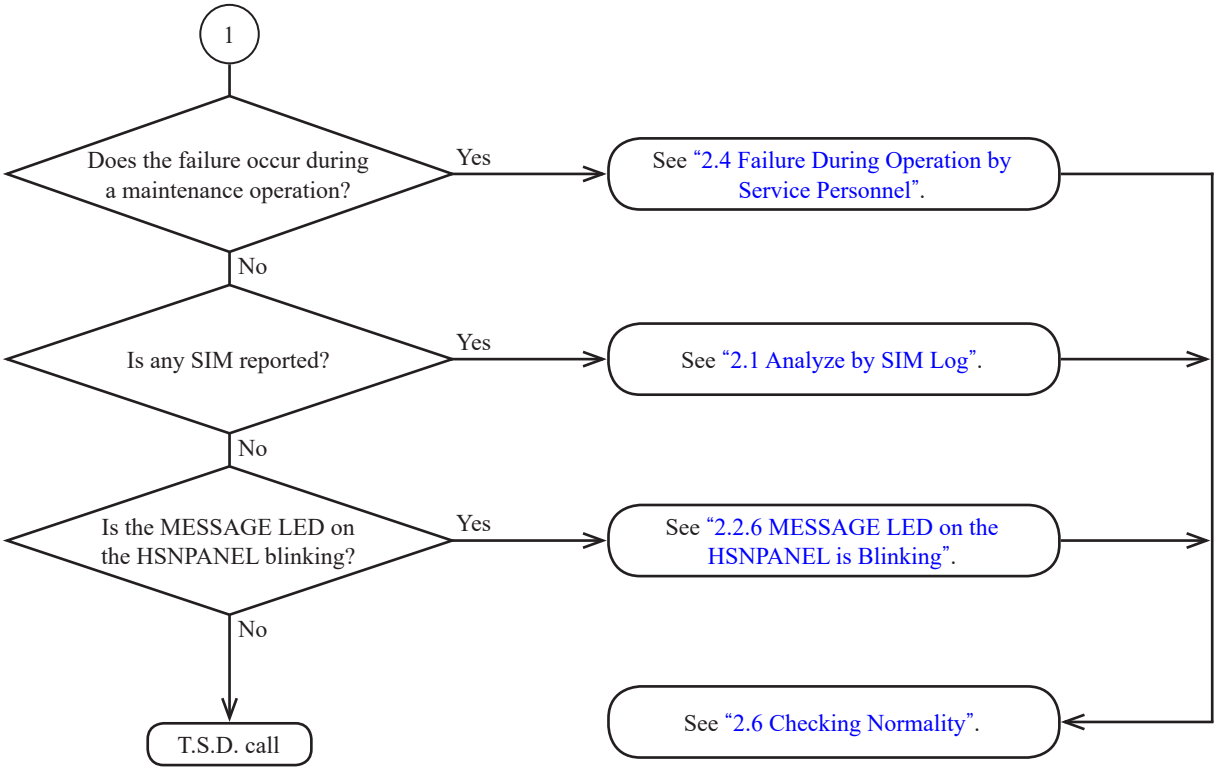
The flowcharts on the next pages, and then perform the recovery actions.

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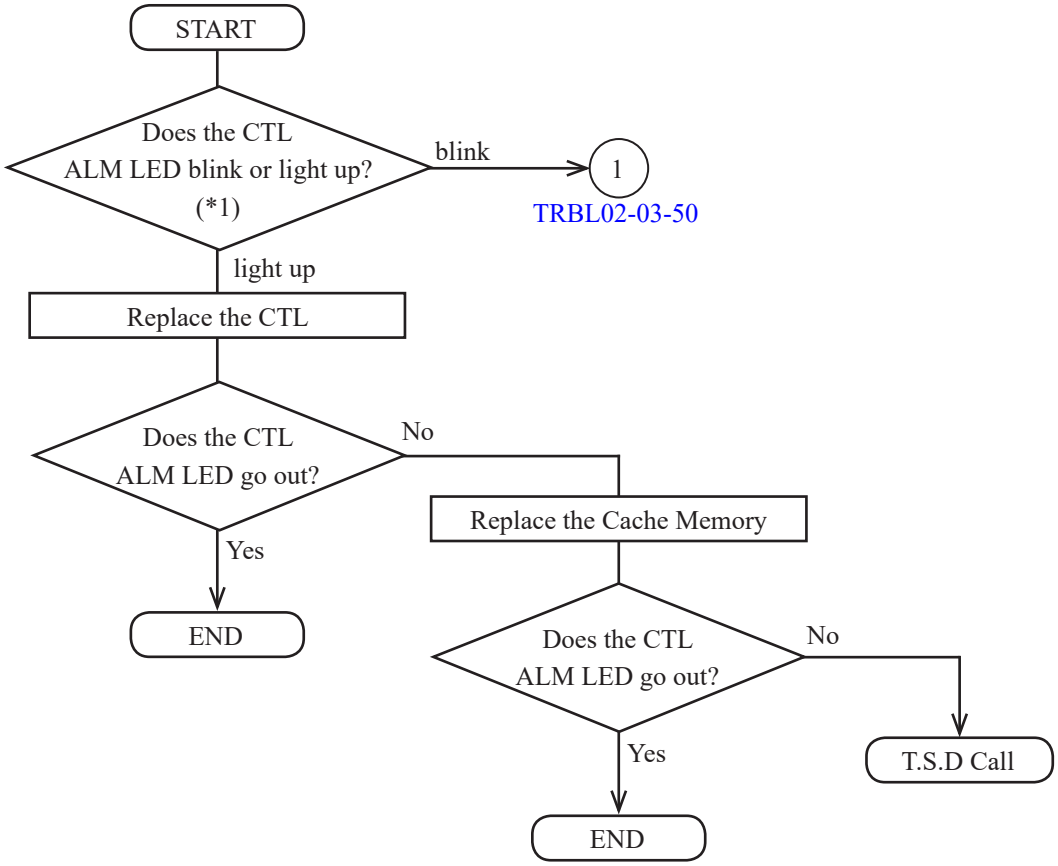
*1: Check in the Maintenance Utility (Sub Panel) window on the SVP.
If you cannot log in to the SVP, see "3.30 Recovery Procedure for SVP Failure".

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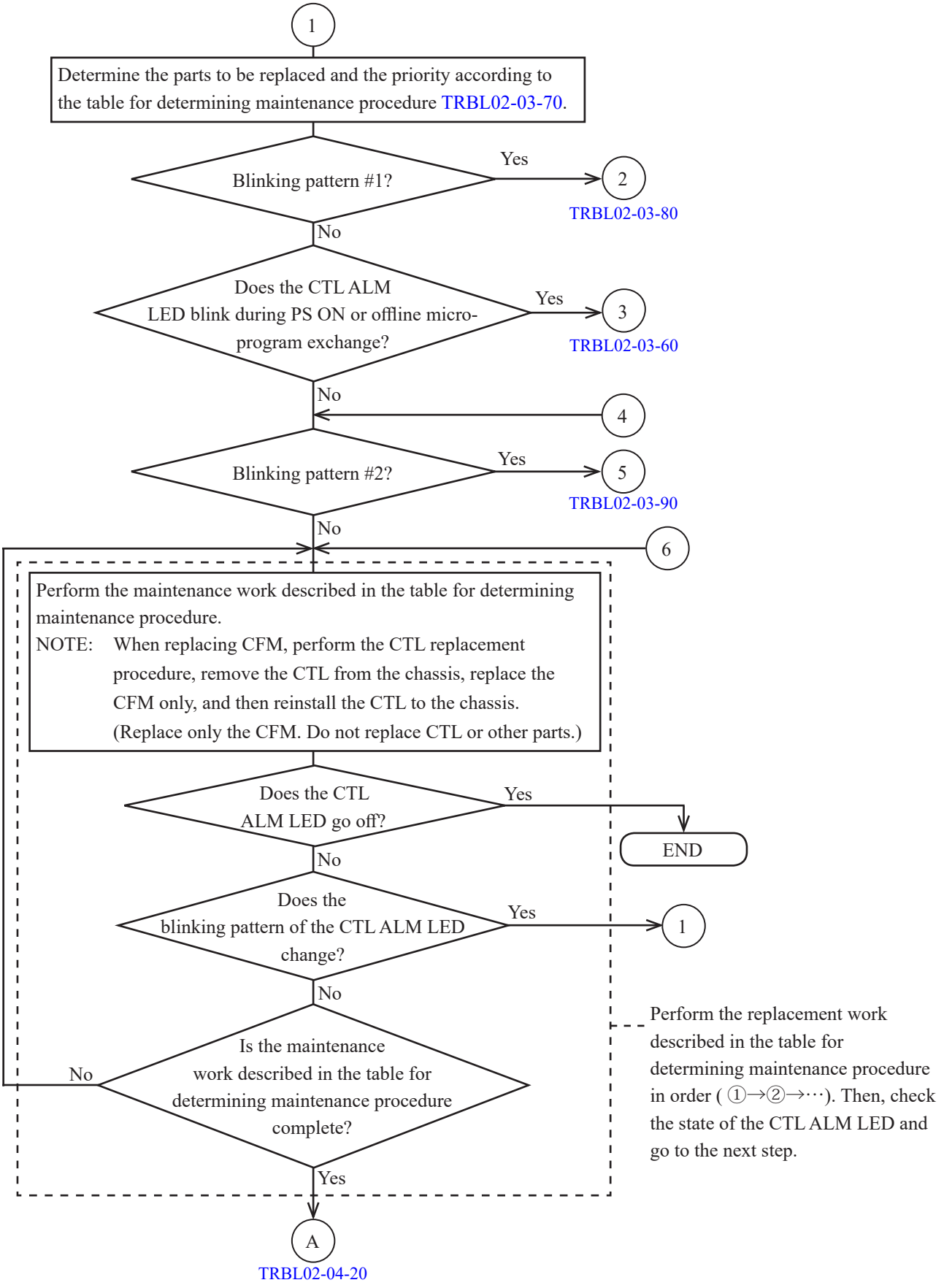
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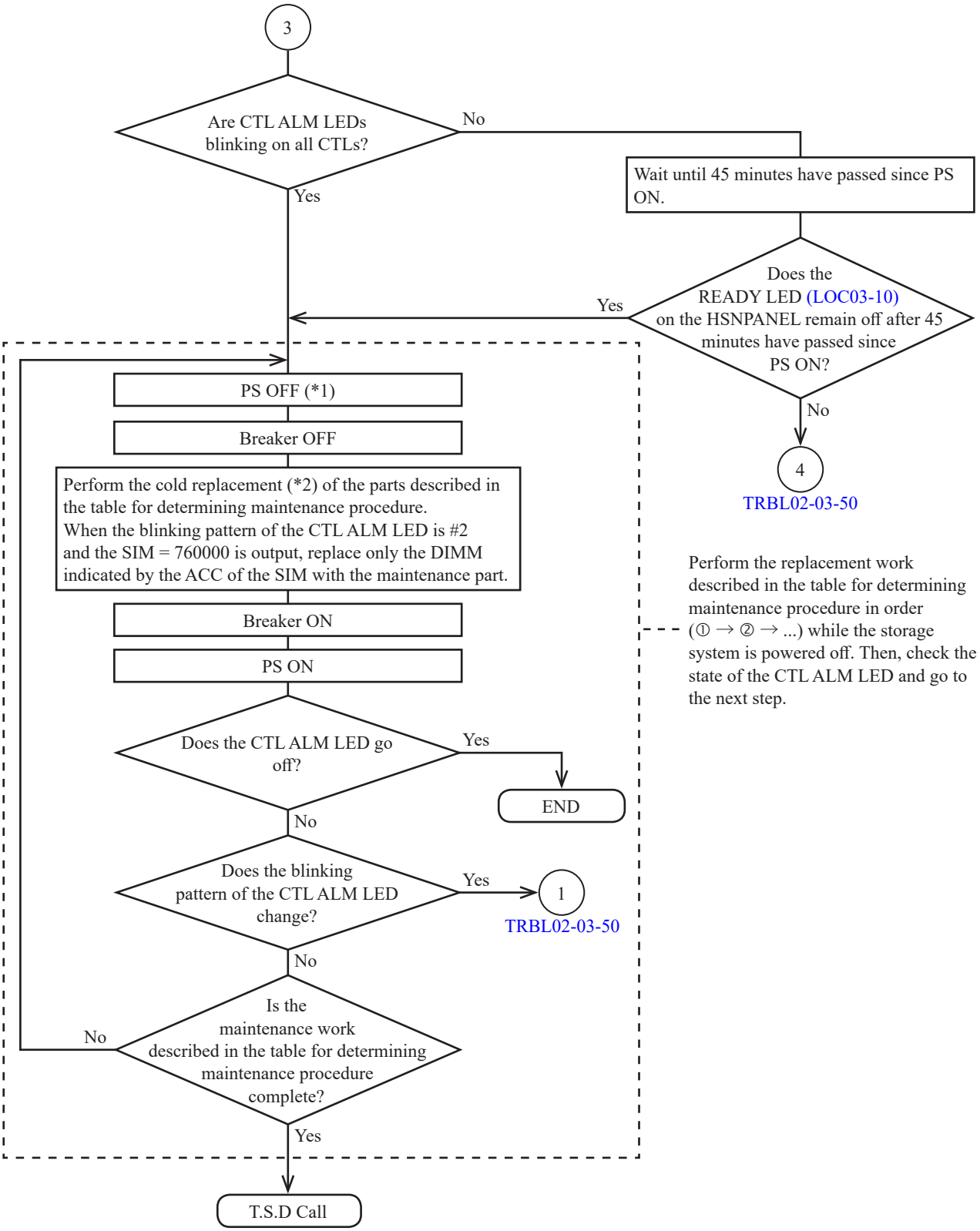
2.3.1 Blinking or lighting up of LED (red) on CTL ALM



*1: The LED might start blinking after 10 seconds of lighting. See the blinking patterns in the table for determining maintenance procedure TRBL02-03-70.

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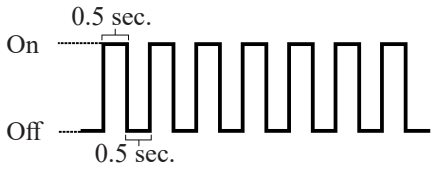
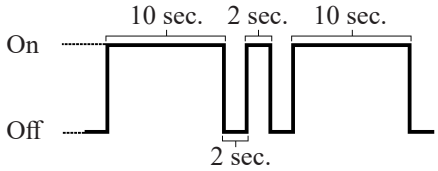
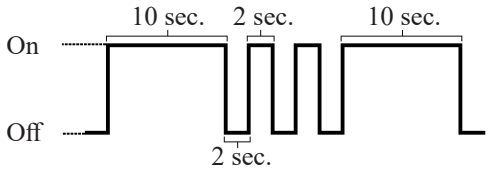
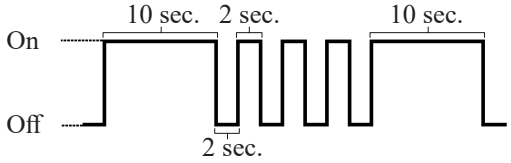
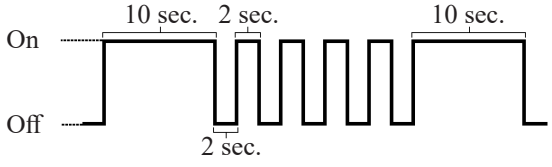


*1: If the storage system is not powered off (the light of the POWER LED does not change from green to amber) when about 1 minute has passed, go to the next step.

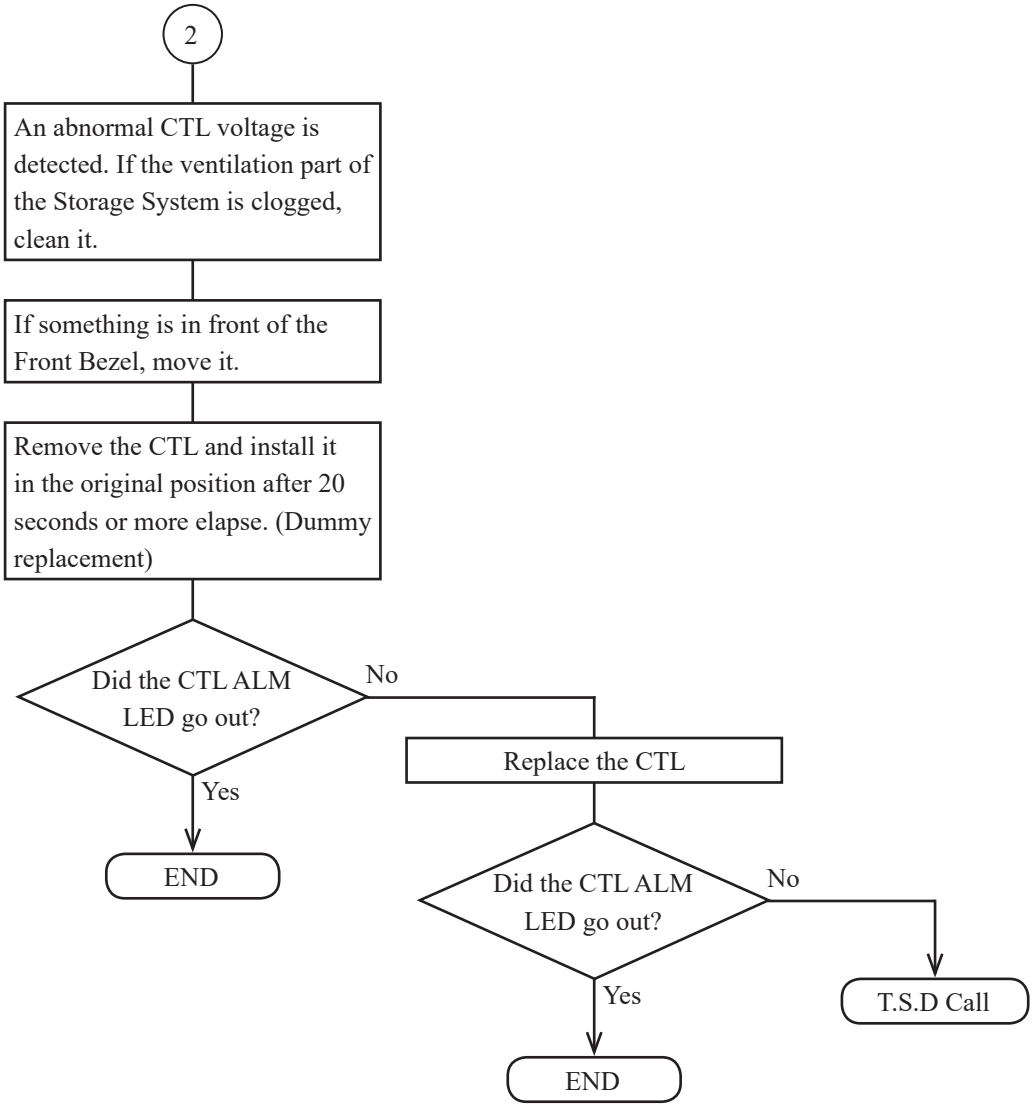
*2: Replace the parts while the storage system is powered off.

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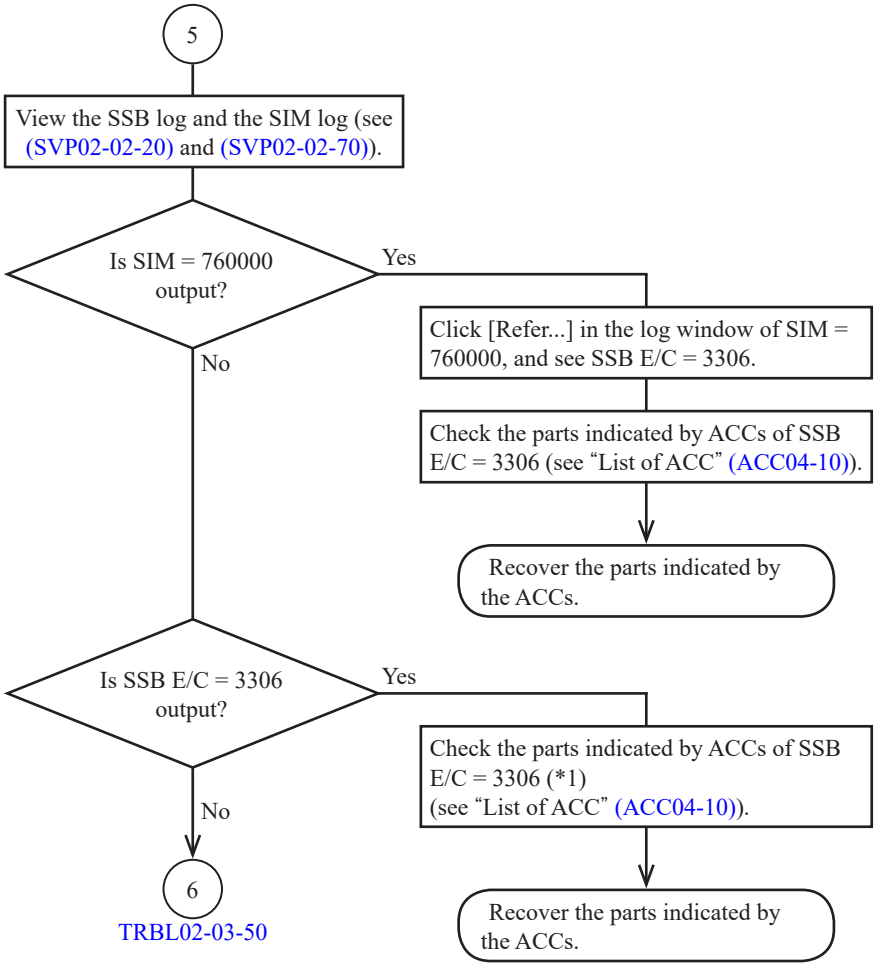
Table 2-1 Table for determining maintenance procedure

#	CTL ALM LED Blinking Pattern	Maintenance Procedure
1	 → Blinks in 1-second intervals.	An abnormal CTL voltage is detected. If the ventilation part of the storage system is clogged, clean it. If something is in front of the Front Bezel, move it. ① Remove the CTL and install it in the original position after 20 seconds or more elapse. (Dummy replacement) ② Replace the CTL where the LED is blinking with a maintenance part.
2	 → Blinks (On: 2 seconds, Off: 2 seconds) once after 10 seconds of lighting.	① Replace all DIMMs installed in the CTL where the LED is blinking. NOTE: Before replacing DIMMs, check the DIMM types and the number of installed DIMMs are correct. If they are not correct, make them correct, and then insert the CTL again. ② Replace the CTL where the LED is blinking with a maintenance part.
3	 → Blinks (On: 2 seconds, Off: 2 seconds) 2 times after 10 seconds of lighting.	① Replace the CFM-x10 or CFM-x20 (x: DKC No. (0, 1, 2, 3, 4. or 5)), which is installed in a CTL where the LED is blinking, with a maintenance part. NOTE: Before replacing the CFM, check the CFM types and the number of installed CFMs are correct. If they are not correct, make them correct, and then insert the CTL again. ② Replace the CTL where the LED is blinking with a maintenance part. ③ Replace all DIMMs installed in the CTL where the LED is blinking with maintenance parts.
4	 → Blinks (On: 2 seconds, Off: 2 seconds) 3 times after 10 seconds of lighting.	① Replace the CTL where the LED is blinking with a maintenance part. ② Replace all DIMMs installed in the CTL where the LED is blinking with maintenance parts.
5	 → Blinks (On: 2 seconds, Off: 2 seconds) 4 times after 10 seconds of lighting.	① Replace the CTL where the LED is blinking with a maintenance part.

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*1: If multiple SSB E/C = 3306 are output, see the five earliest SSBs among SSB E/C = 3306 output in about the same time.
If any ACC of the SSBs indicates DIMM:
Replace the DIMM. If the problem is not resolved, SSB E/C = 3306 is output again.
If any ACC of the SSBs does not indicate DIMM:
Perform the recovery action for the common part indicated by the largest number of ACCs of the SSBs. If there are multiple common parts, perform the recovery actions according to "Table 2-2 Priority Table" in "2.5 Failures of Multiple Parts". If the problem is not resolved, SSB E/C = 3306 is output again.

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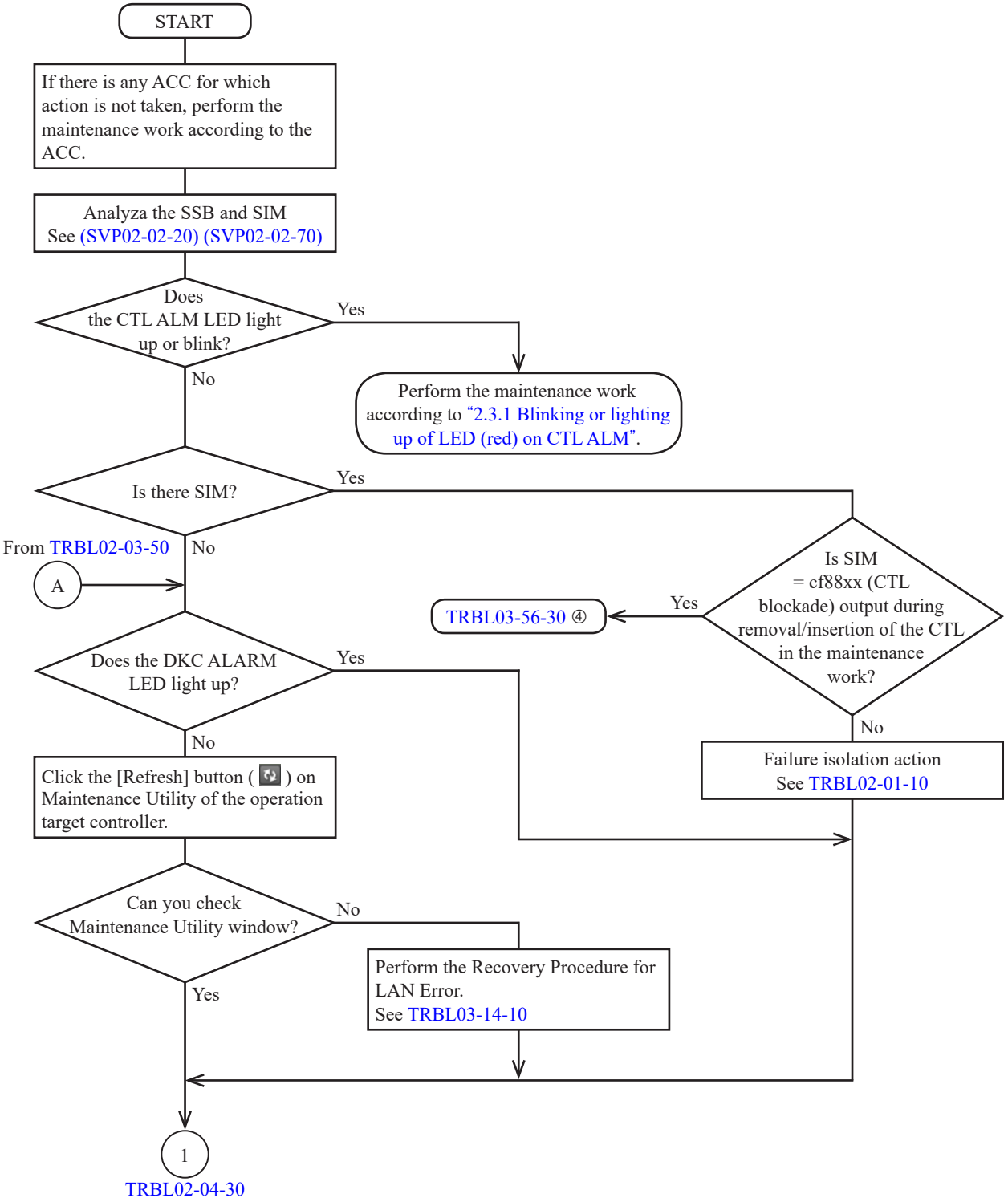
2.4 Failure During Operation by Service Personnel

2.4.1 Error Recovery Procedure when Removing/Inserting CTL

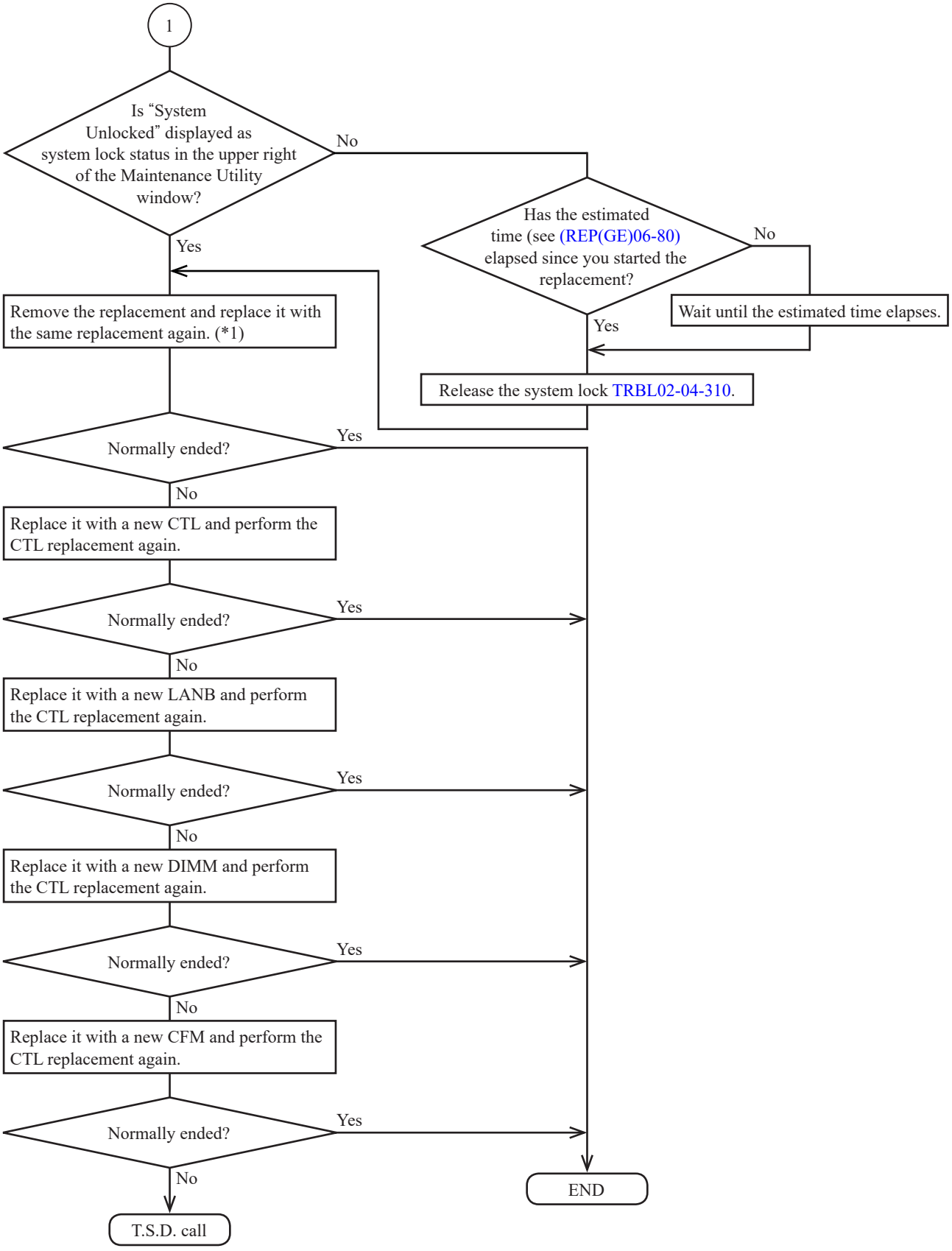
The maintenance procedure when removing/inserting the CTL is as follows.

■	REPLACEMENT SECTION
	Controller Board REPLACEMENT PROCESSING (REP(RCTL)00-00)
	Cache Memory REPLACEMENT PROCESSING (REP(RCM1)00-00) (Perform the following procedure only when the failure is not resolved even after the retry of DIMM replacement and the CTL is blocked)
	LAN Board REPLACEMENT PROCESSING (REP(RLAB)00-00) (Perform the following procedure only when the CTL is blocked)
■	INSTALLATION SECTION
	Changing Cache Memory/Cache Flash Memory (INST(AD)07-01-10) (Perform the following procedure only when the failure is not resolved even after the additionally installed DIMM is replaced with the replacement part and the CTL is blocked)

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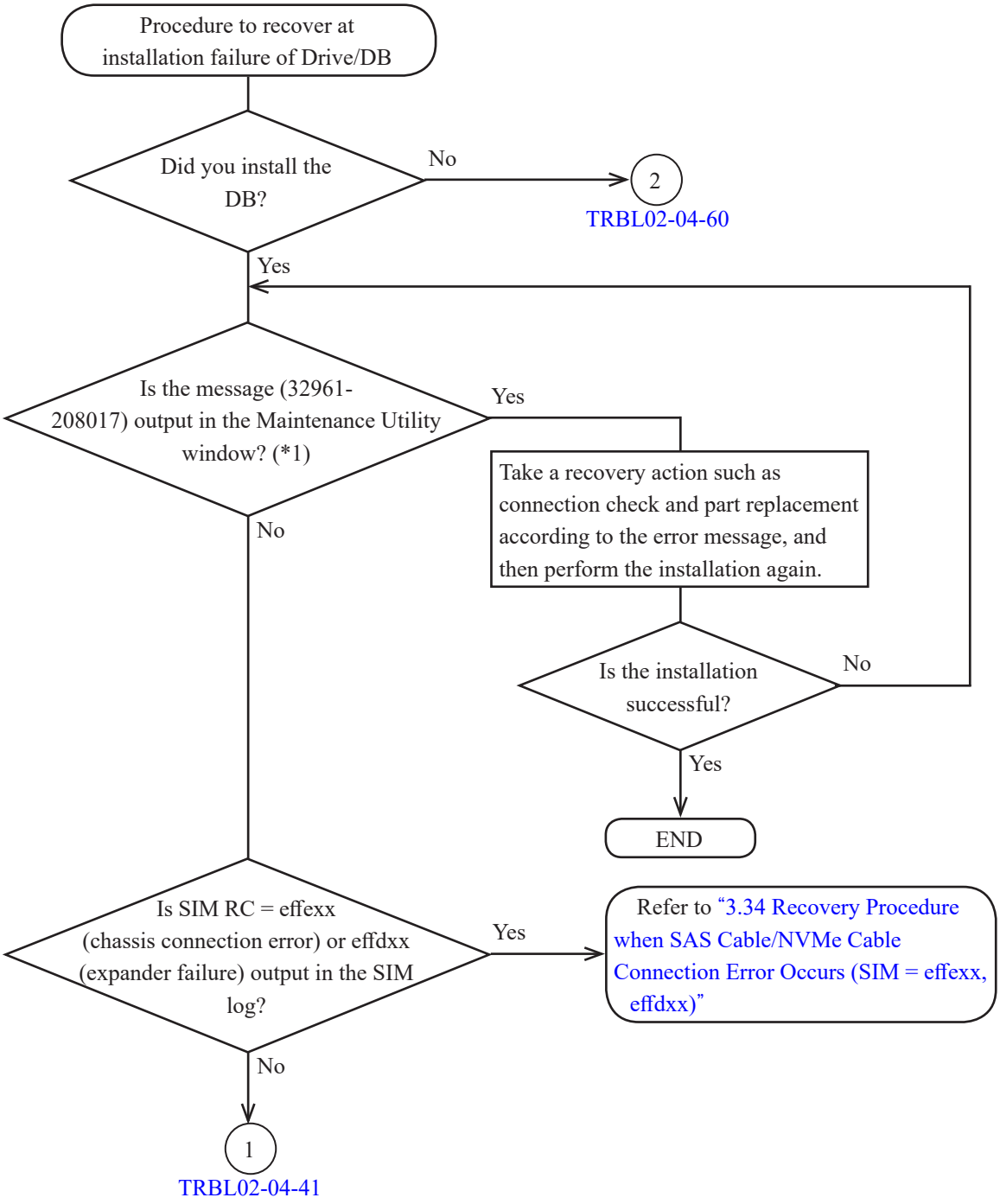
*1: When removing and inserting the CTL, check that the installation of DIMM/CFM is the same as that shown in the Maintenance Utility window. If it is different, install DIMM/CFM correctly.

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2.4.2 Failures Have Occurred when Installing Drive/DB

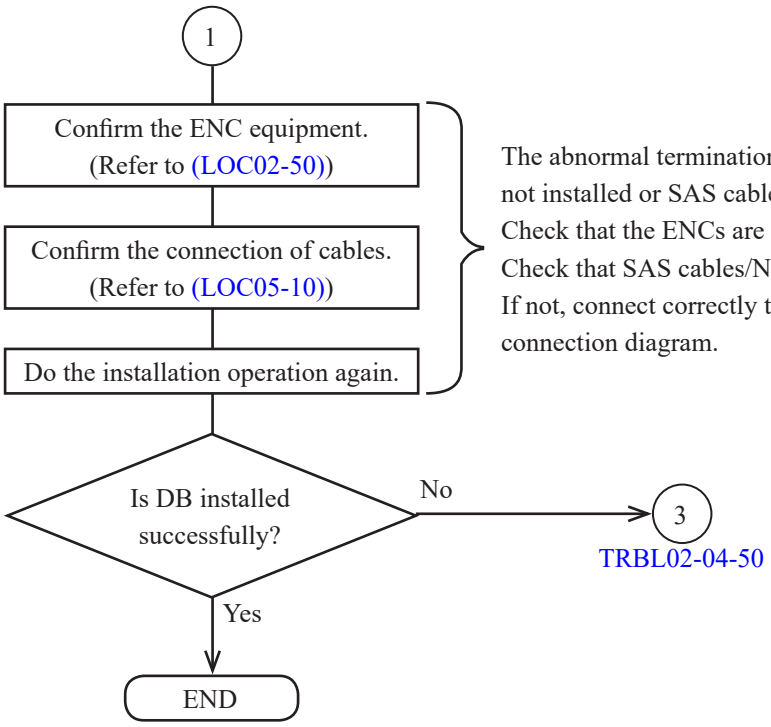
Red LED of ENC may light when DKB is re-installed after the MP failure had been occurred during de-installation of DKB.
In that case, please dummy-replace that ENC.

2.4.2.1 Installation Failure of Drive/DB



*1: If the same part is indicated repeatedly and you have passed this route three times or more, go to "No".

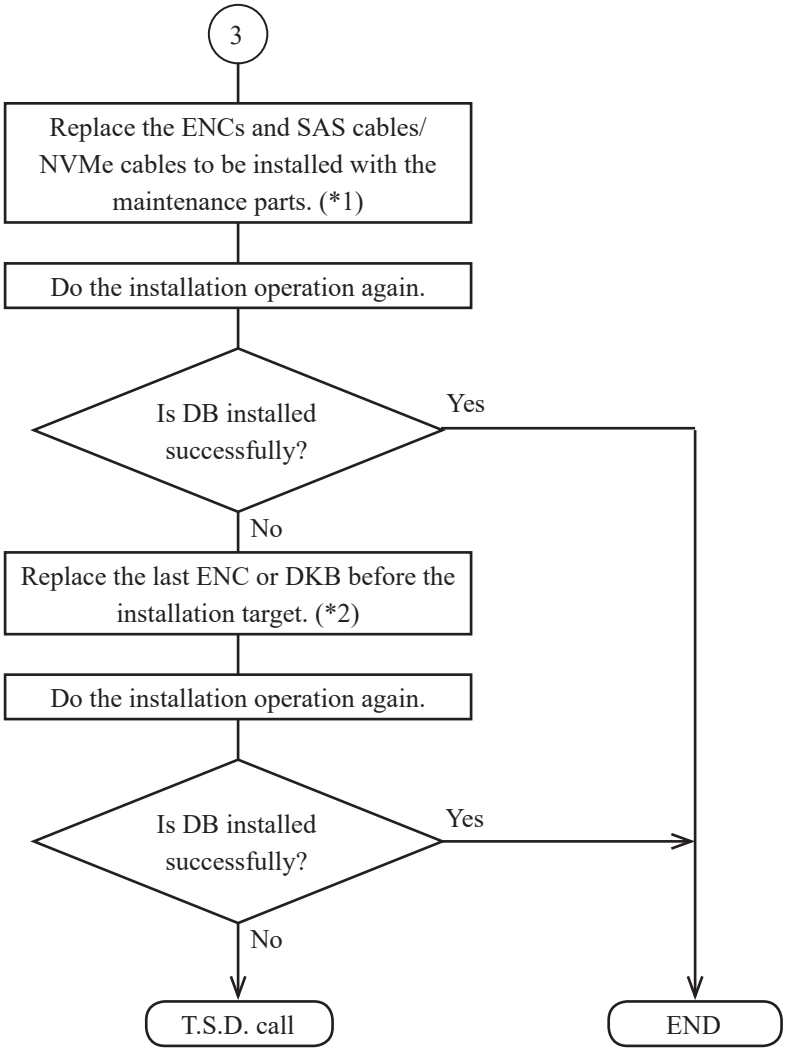
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The abnormal termination has possible causes such as ENCs are not installed or SAS cables/NVMe cables are not connected.
Check that the ENCs are installed correctly. If not, install ENCs.
Check that SAS cables/NVMe cables are connected correctly. If not, connect correctly them in accordance with the cable connection diagram.

TRBL02-04-50

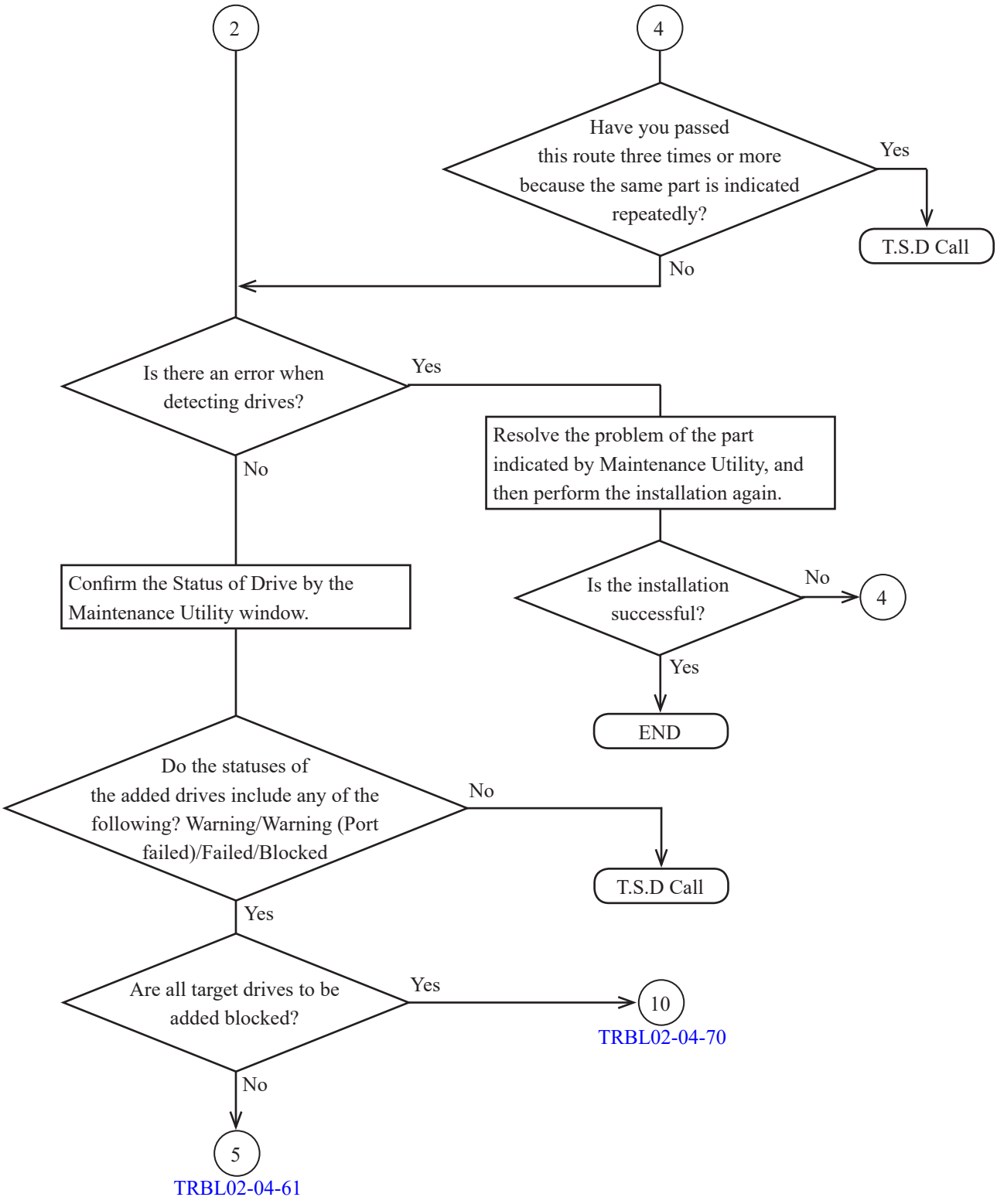
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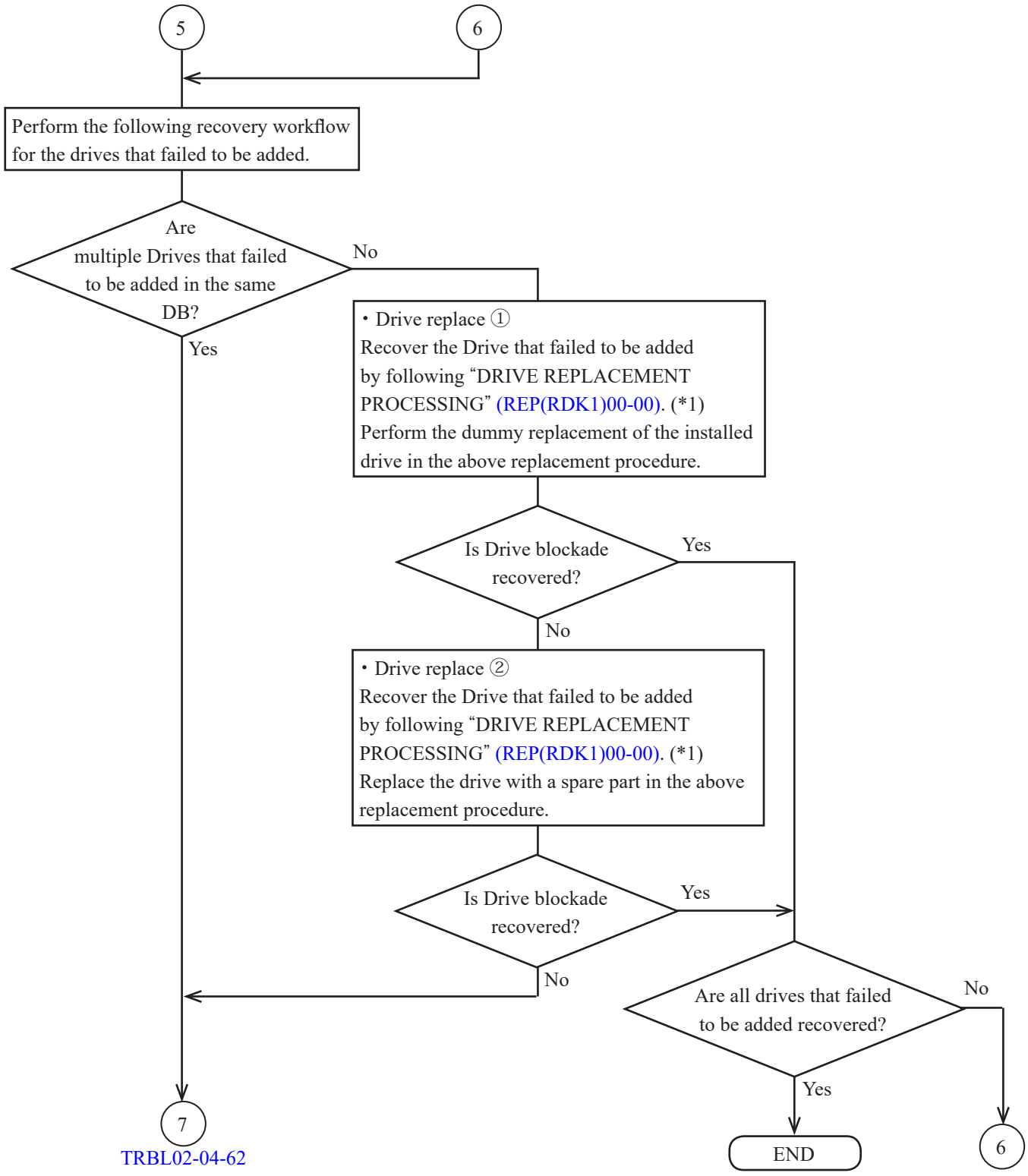
*1: Replace the ENCs and SAS cables/NVMe cables to be installed with the maintenance parts in order from front to back and identify the failed parts.

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

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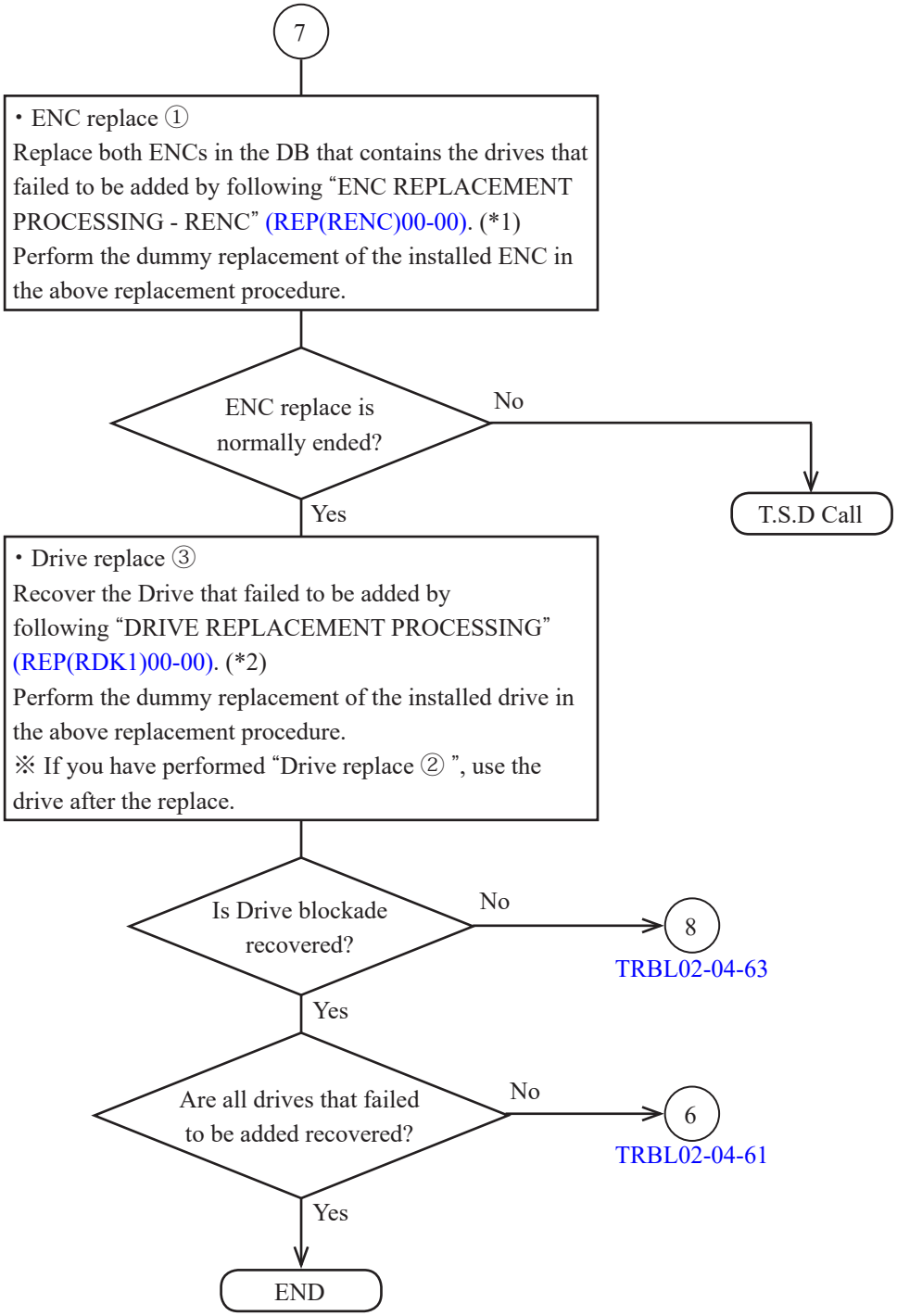


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*1: Before inserting Drives, check the Drive type names. (Refer to "Table List of Mountable Drive Model Names" (INST(AD)03-01-20) and "Table Maintenance Parts List" (PARTS03-10).) When SSB = A7A8 is output, it may be an unsupported Drive. Contact the Technical Support Division.

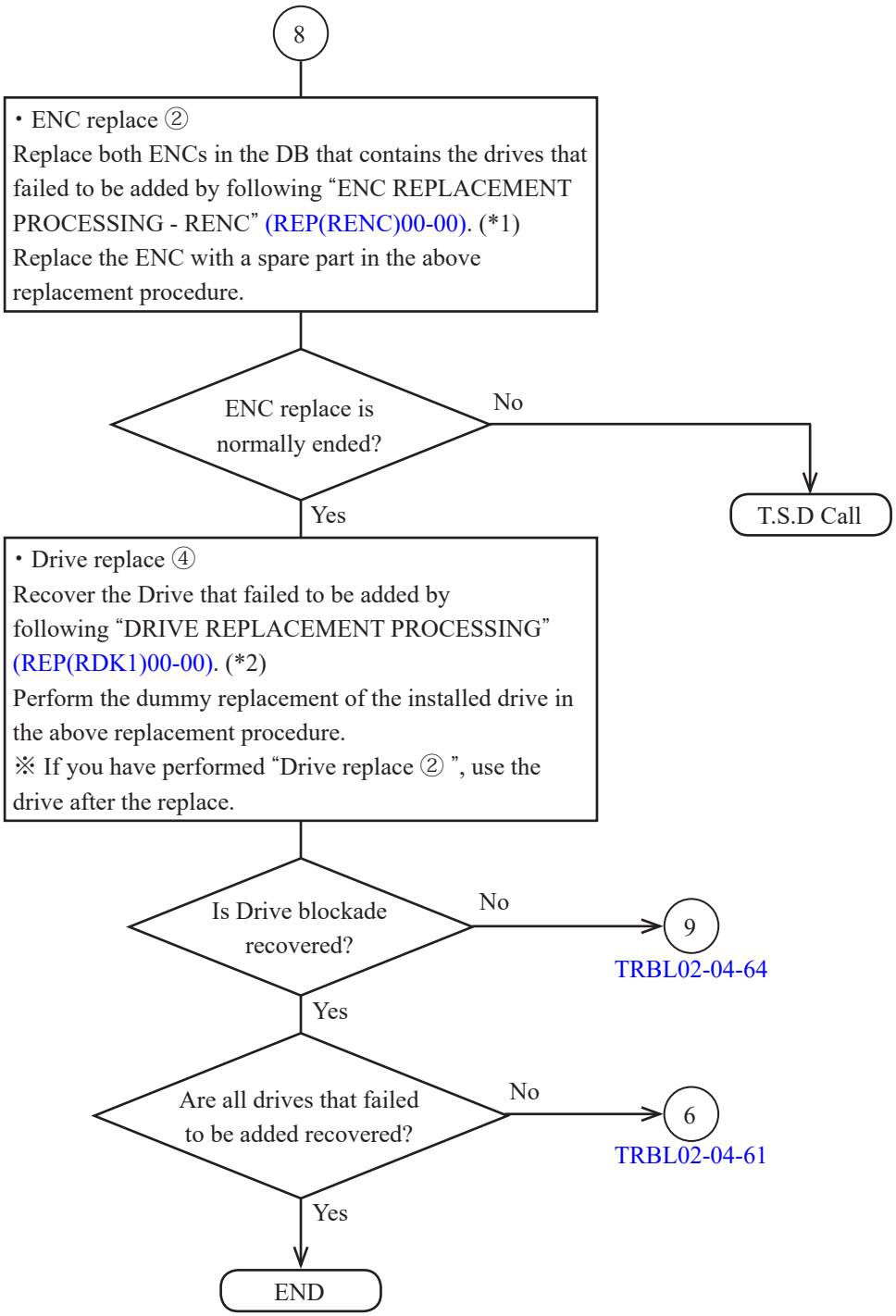
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*1: For the drive number and the DB number, see "THEORY OF OPERATION SECTION ATTACHMENT DB Number - C/R Number Matrix" (THEORYATT00-00) "DB Number - CR Number Matrix 1" and "DB Number - CR Number Matrix 2".

*2: Before inserting Drives, check the Drive type names. (Refer to "Table List of Mountable Drive Model Names" (INST(AD)03-01-20) and "Table Maintenance Parts List" (PARTS03-10).) When SSB = A7A8 is output, it may be an unsupported Drive. Contact the Technical Support Division.

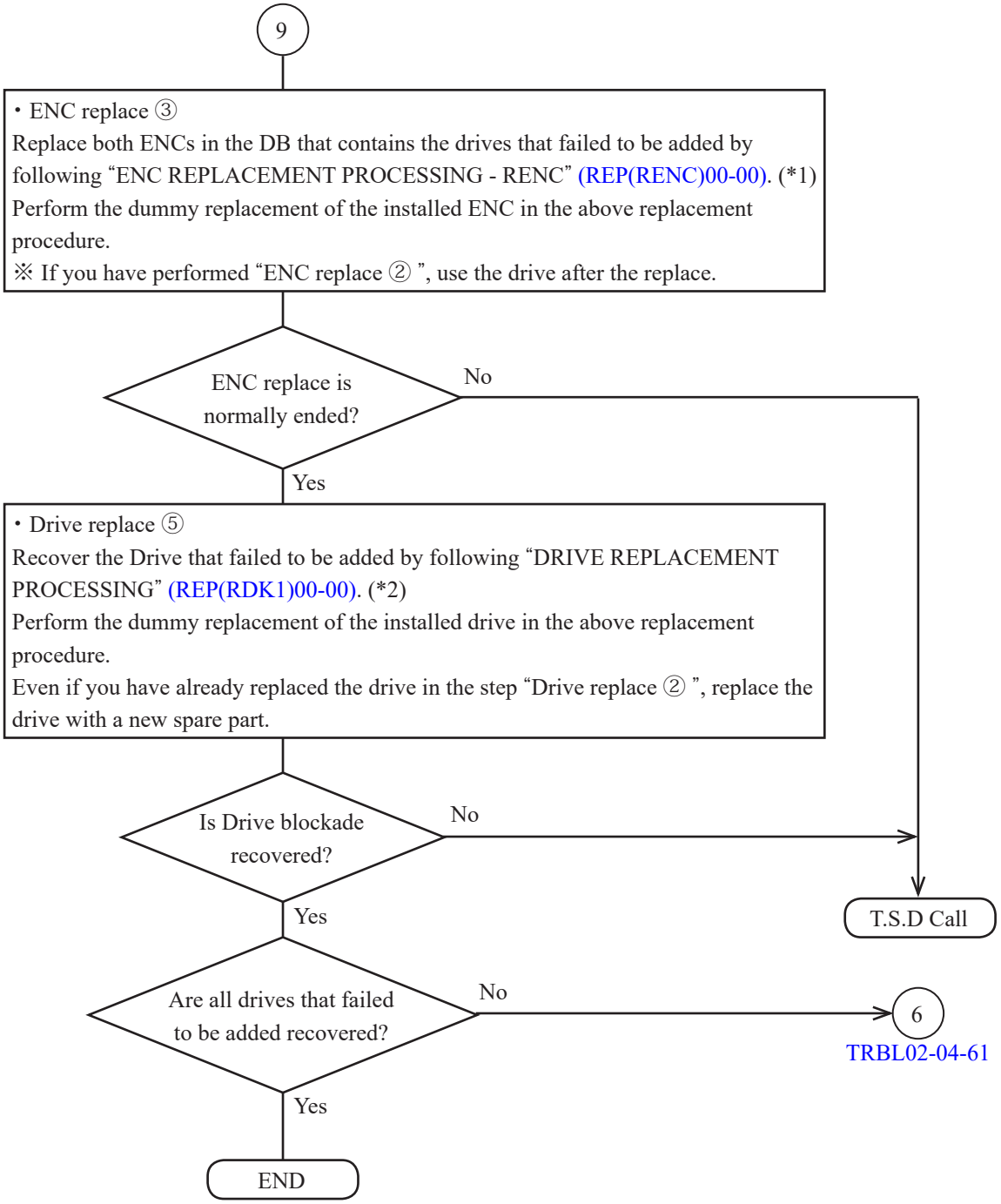
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*1: For the drive number and the DB number, see “THEORY OF OPERATION SECTION ATTACHMENT DB Number - C/R Number Matrix” (THEORYATT00-00) “DB Number - CR Number Matrix 1” and “DB Number - CR Number Matrix 2”.

*2: Before inserting Drives, check the Drive type names. (Refer to “Table List of Mountable Drive Model Names” (INST(AD)03-01-20) and “Table Maintenance Parts List” (PARTS03-10).) When SSB = A7A8 is output, it may be an unsupported Drive. Contact the Technical Support Division.

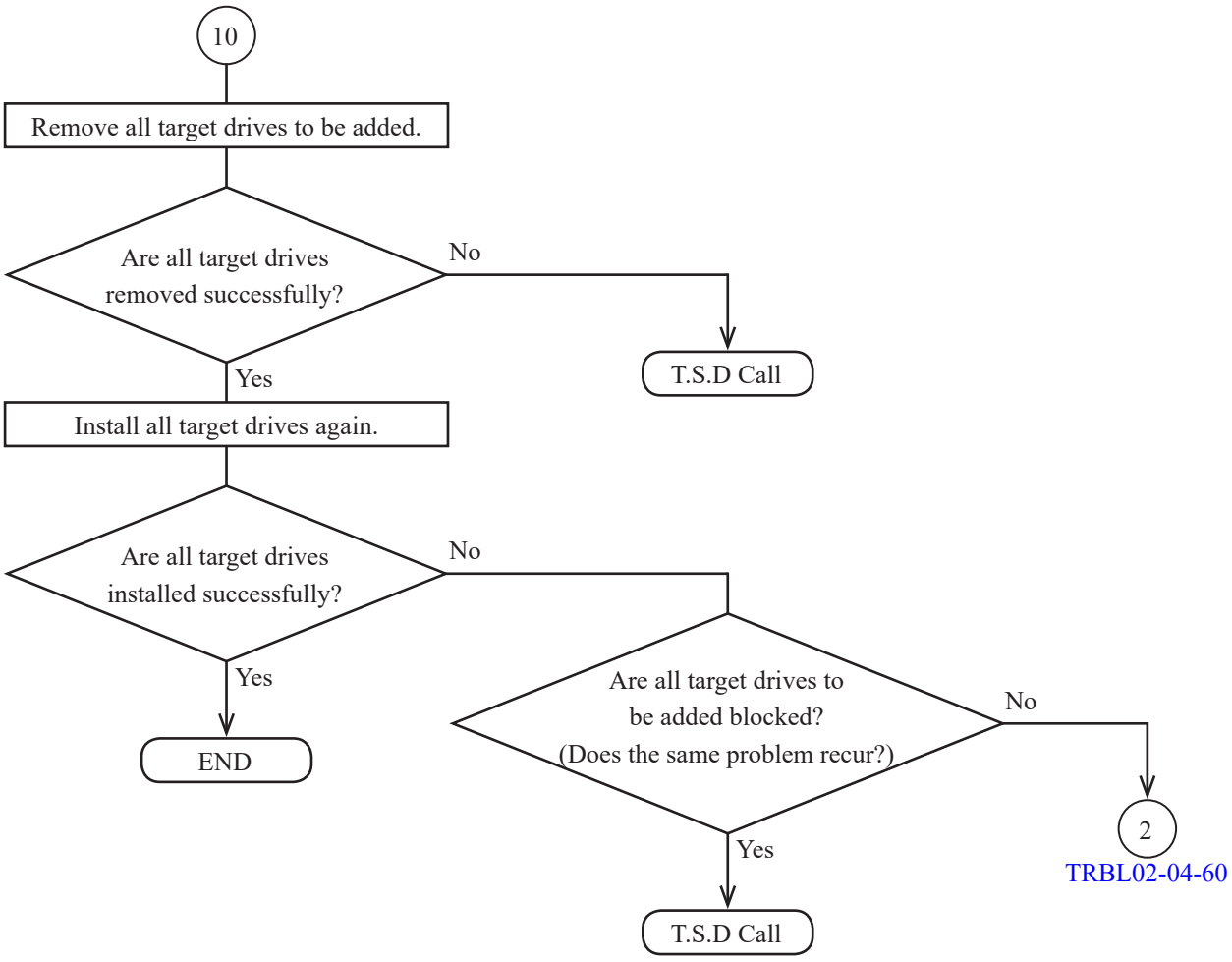
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*1: For the drive number and the DB number, see "THEORY OF OPERATION SECTION ATTACHMENT DB Number - C/R Number Matrix" (THEORYATT00-00) "DB Number - CR Number Matrix 1" and "DB Number - CR Number Matrix 2".

*2: Before inserting Drives, check the Drive type names. (Refer to "Table List of Mountable Drive Model Names" (INST(AD)03-01-20) and "Table Maintenance Parts List" (PARTS03-10).)
When SSB = A7A8 is output, it may be an unsupported Drive. Contact the Technical Support Division.

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2.4.2.2 LED of ENC Turns On after Installing Drive/DB

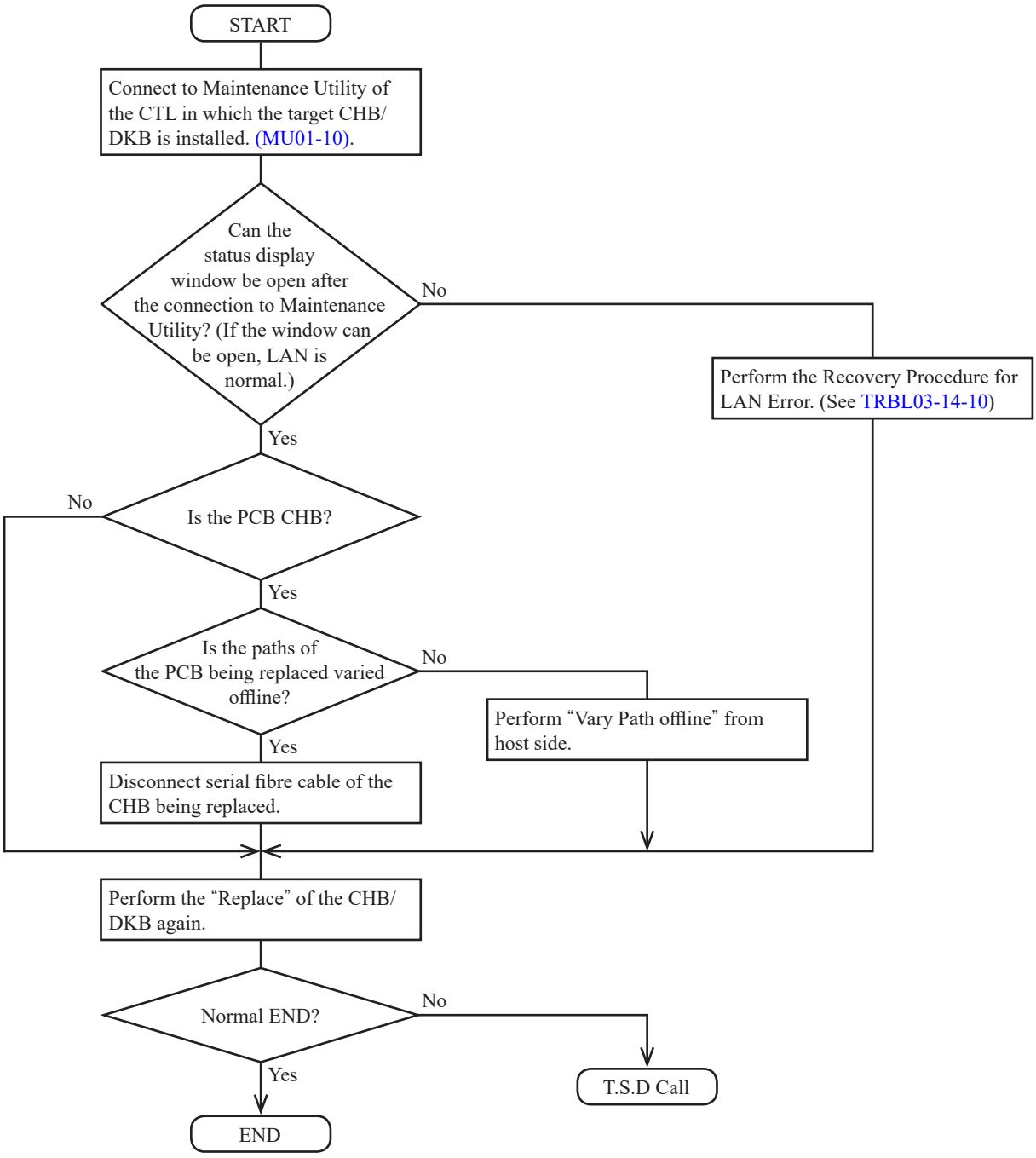
Red LED of ENC may light when DKB is re-installed after the MP failure had been occurred during de-installation of DKB.
In that case, please dummy-replace that ENC.

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2.4.3 Error Recovery Procedure during CHB/DKB replacement

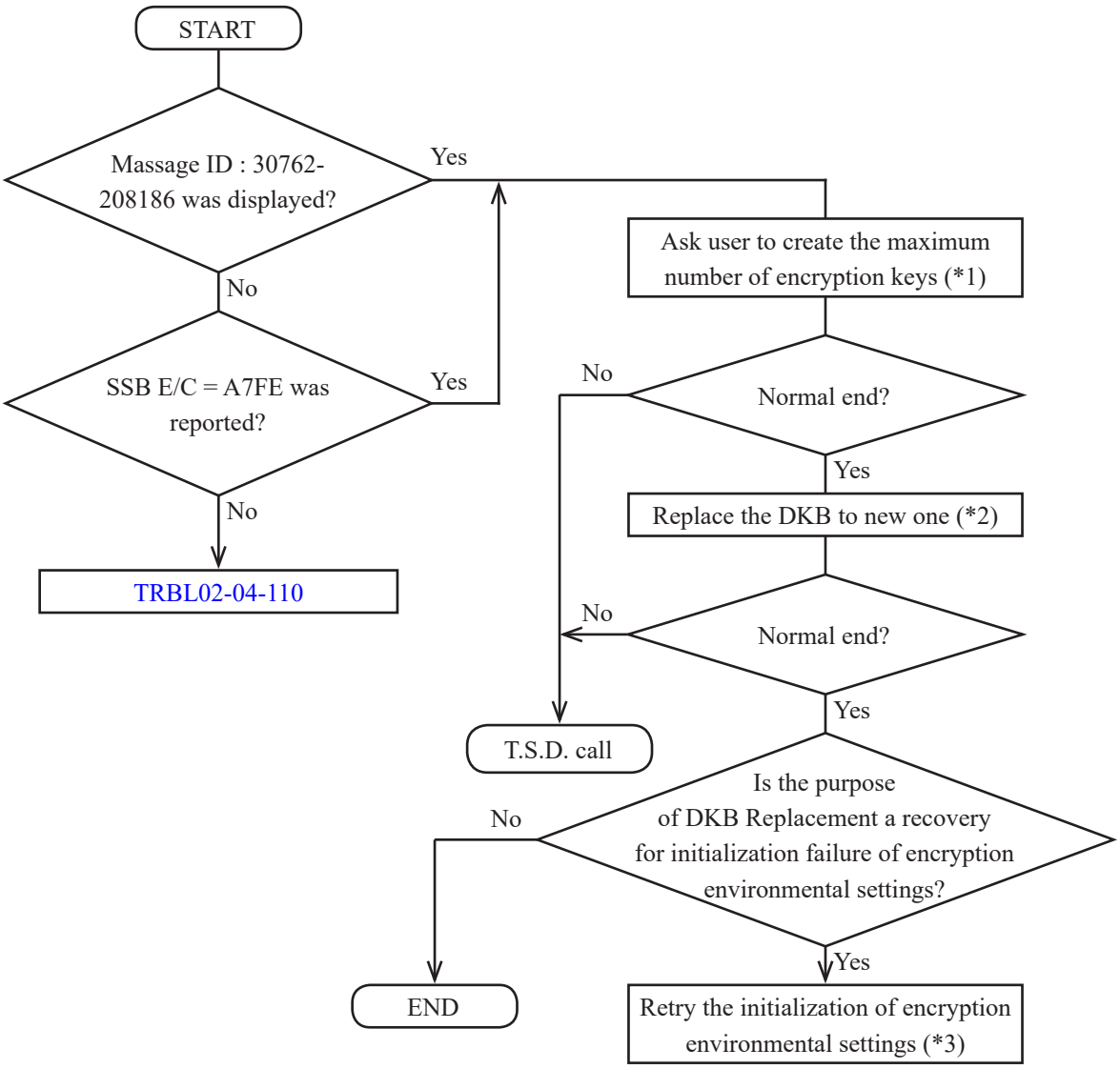
Perform the appropriate recovery procedure according to case 1, 2, 3 or 4.

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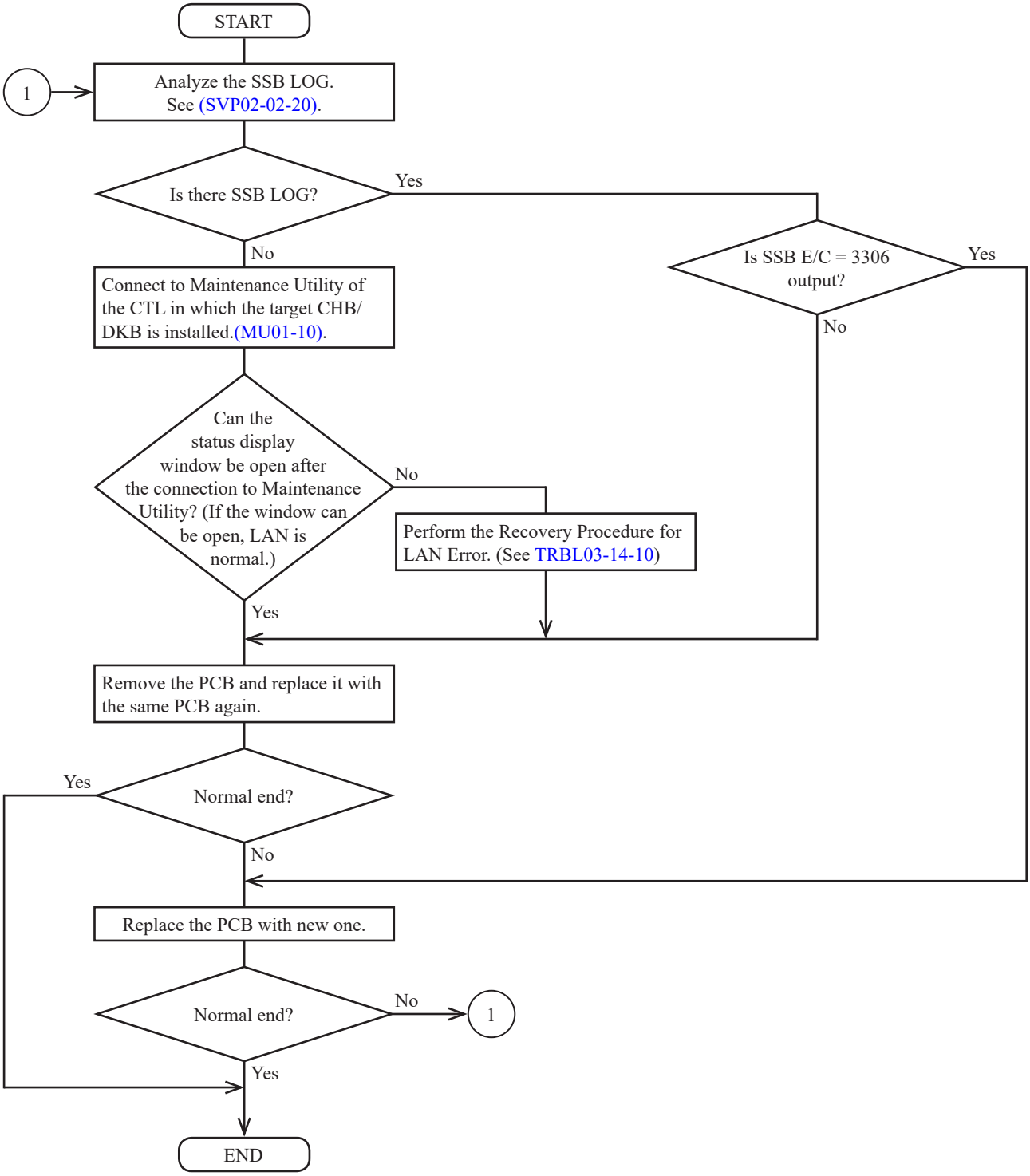
2. Restoring error occurrence
   When an error message is output while blocking the CHB/DKB, the blockade processing has failed. Perform the following recovery processing.



*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.

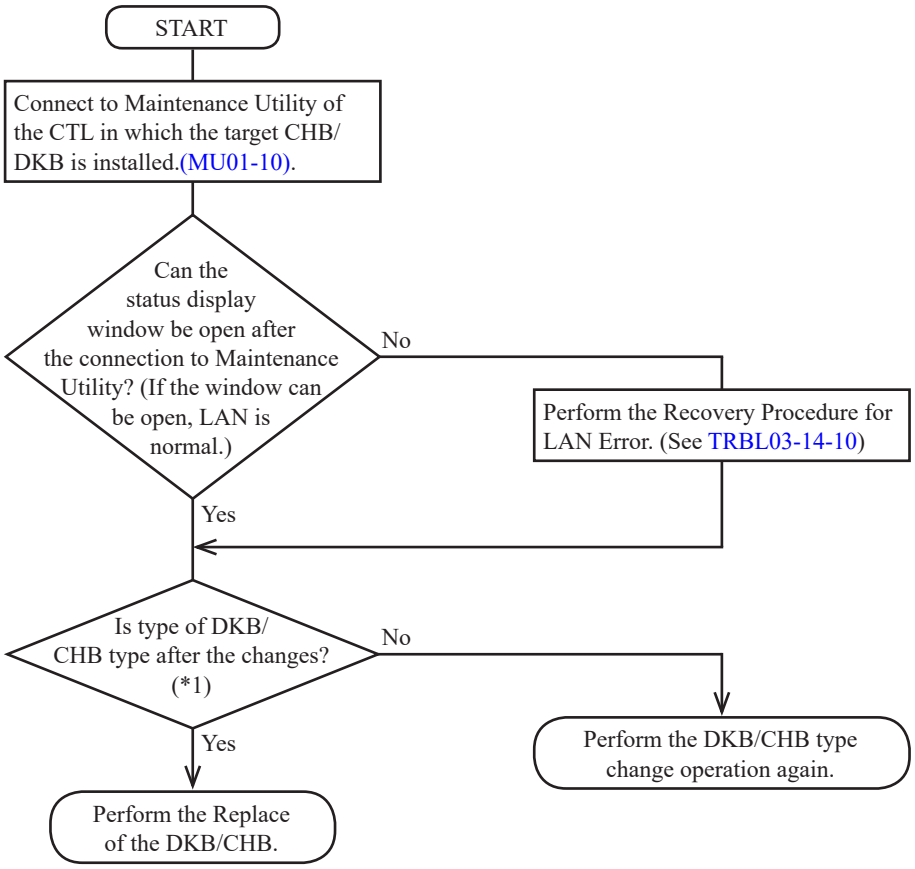
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3. In case of failures other than the blockade/recovery processing



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4. Case of the DKB/CHB type change operation

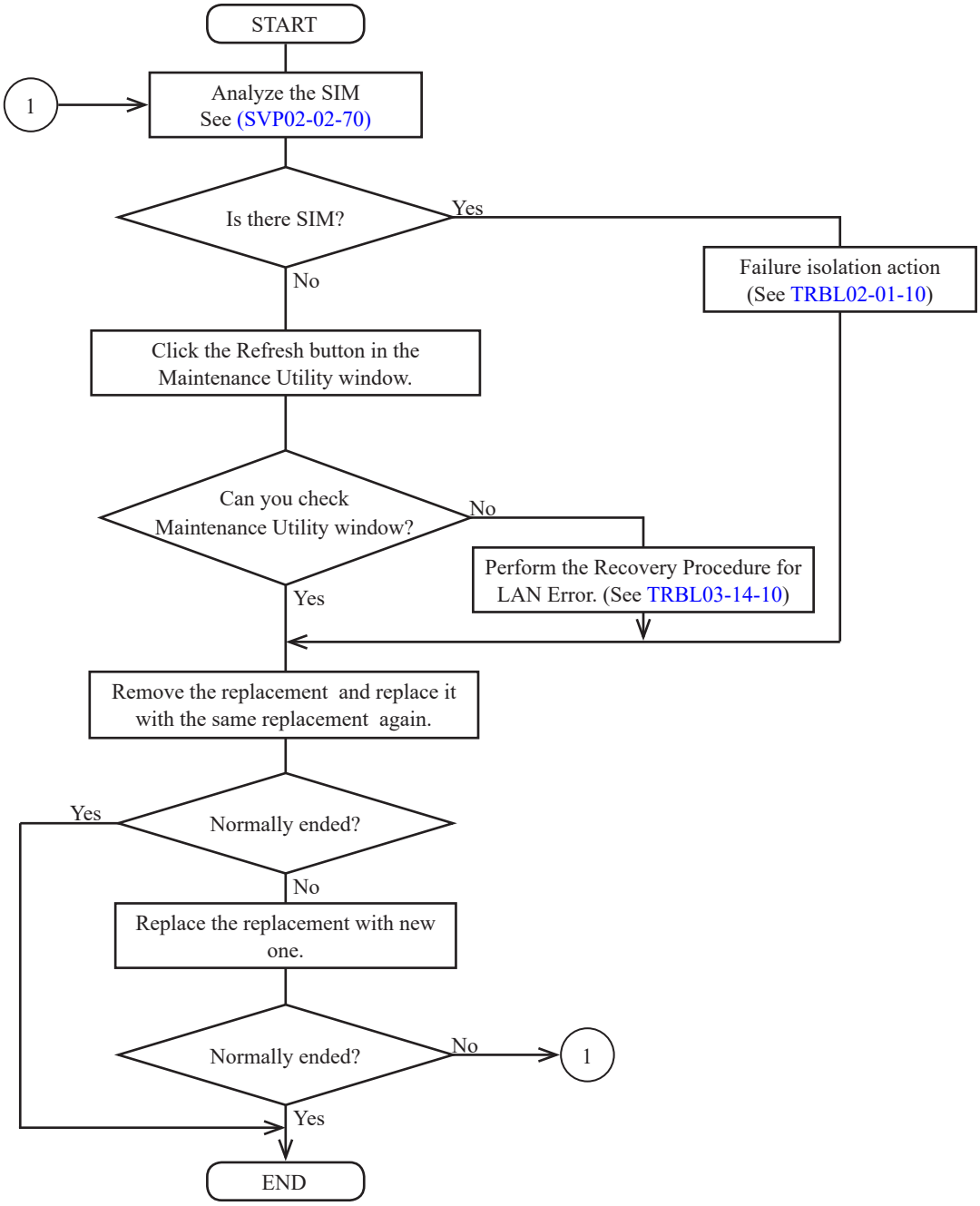


*1: Check the type of CHB by following the procedure below.

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.

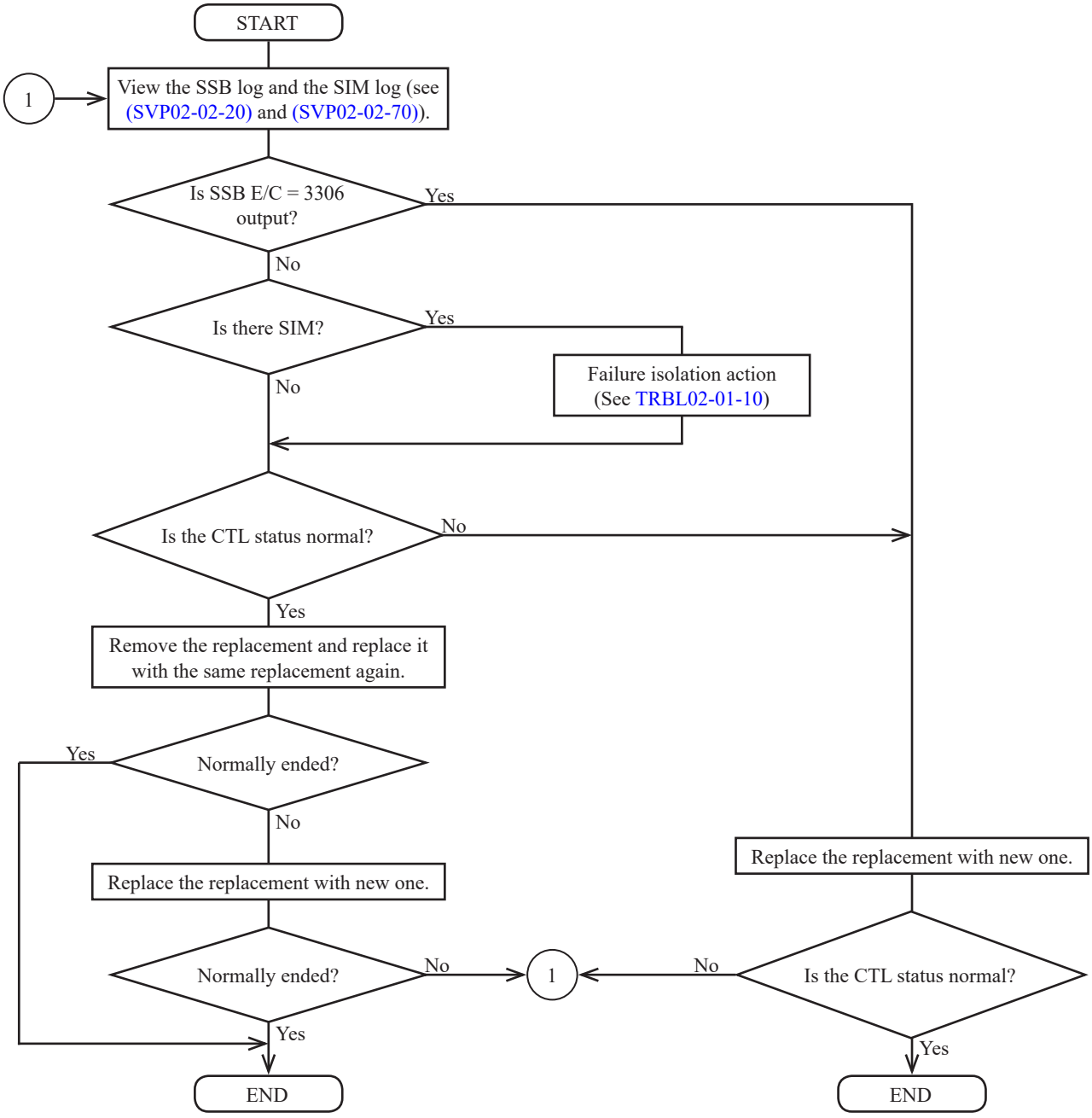
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2.4.4 Error Recovery Procedure during BKMF/Battery/CFM replacement and LANB blockade



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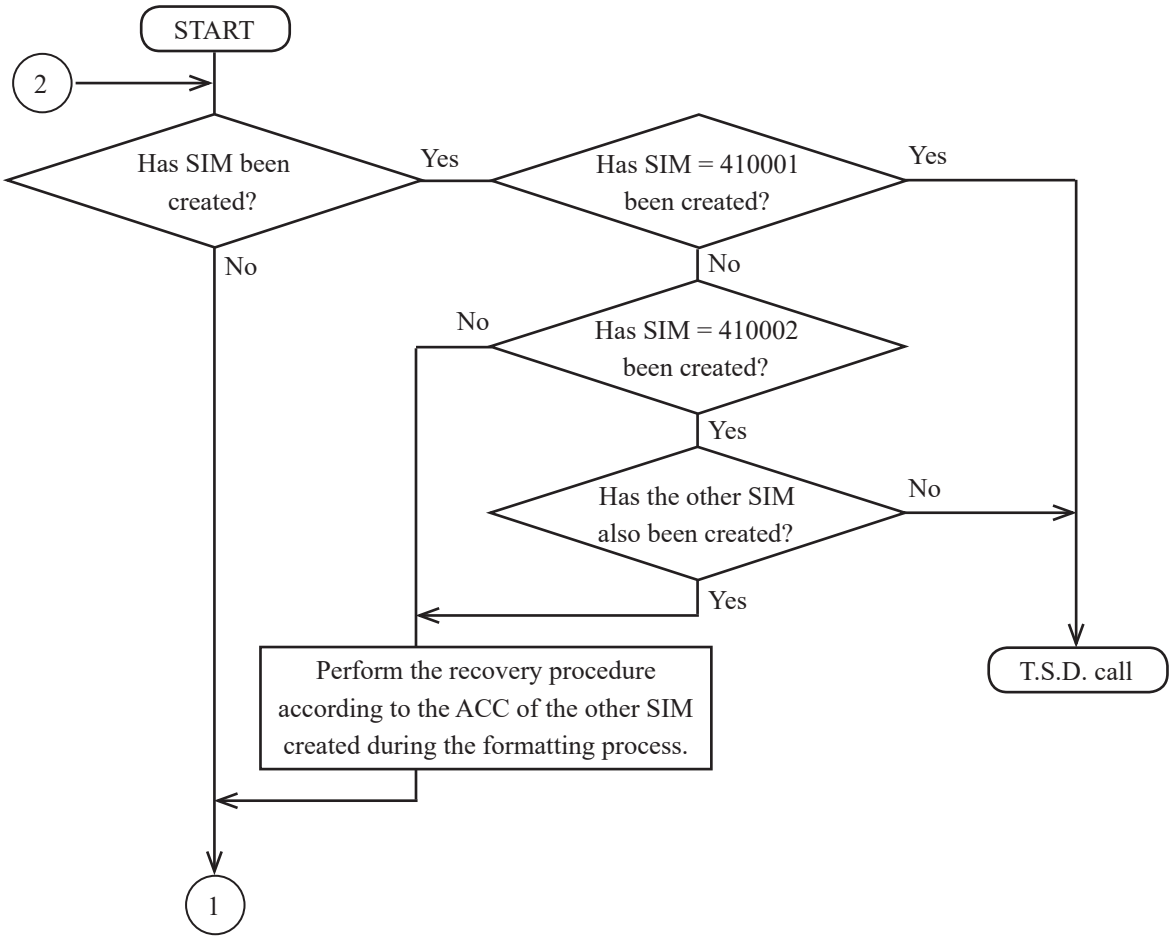
2.4.5 Error Recovery Procedure during LANB replacement



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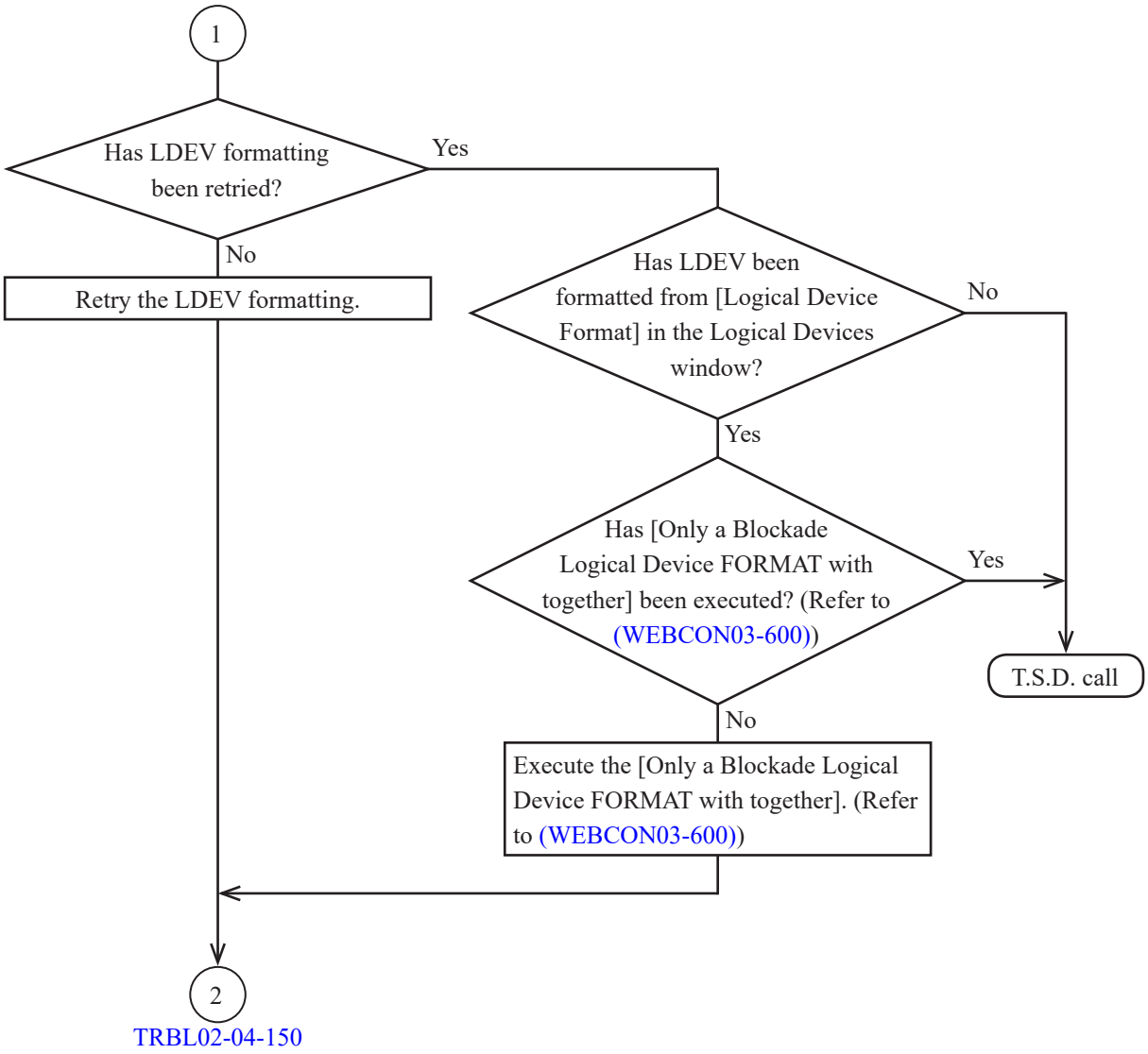
2.4.6 Recovery procedure when LDEV formatting failed

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.



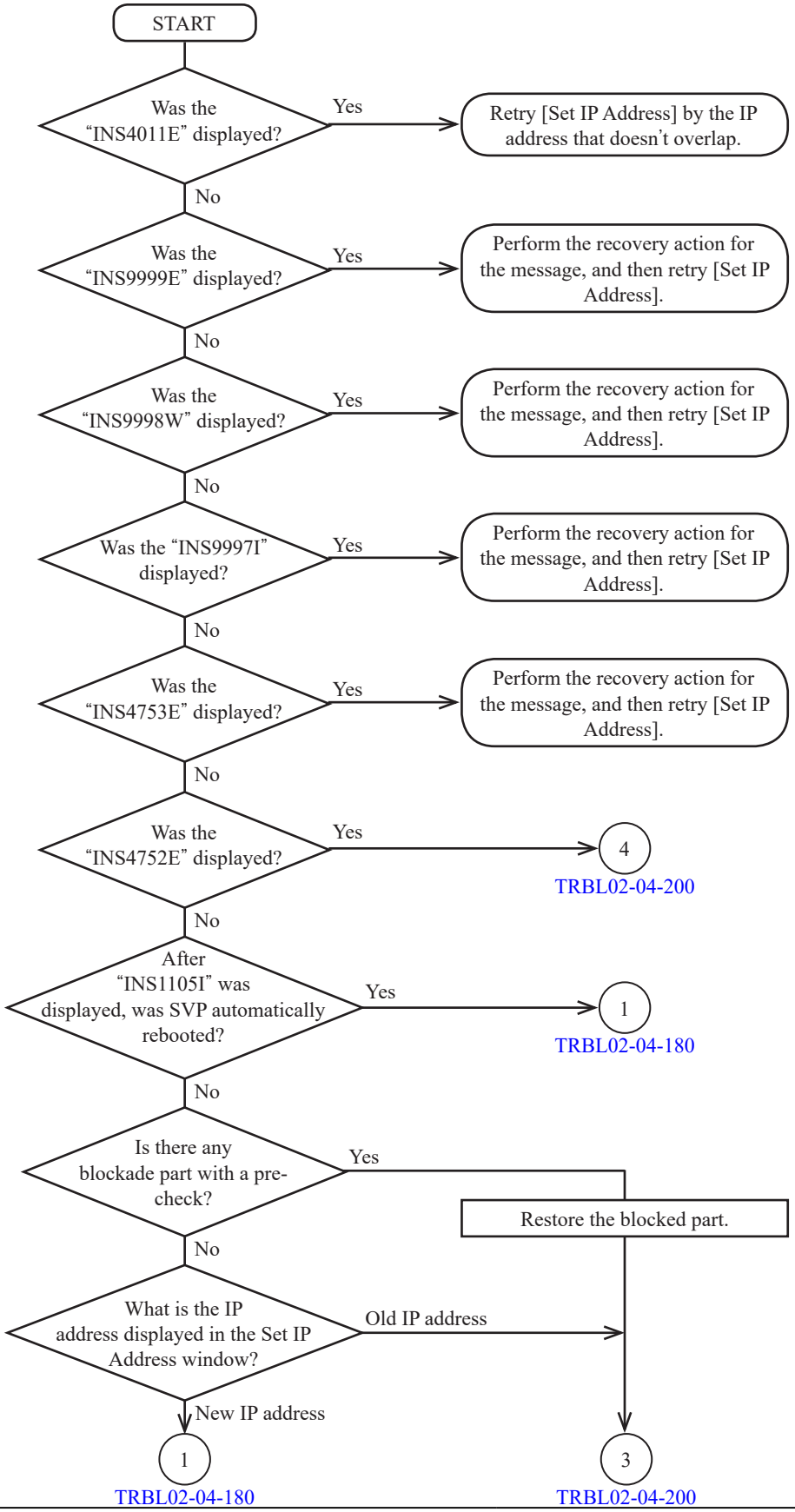
TRBL02-04-160

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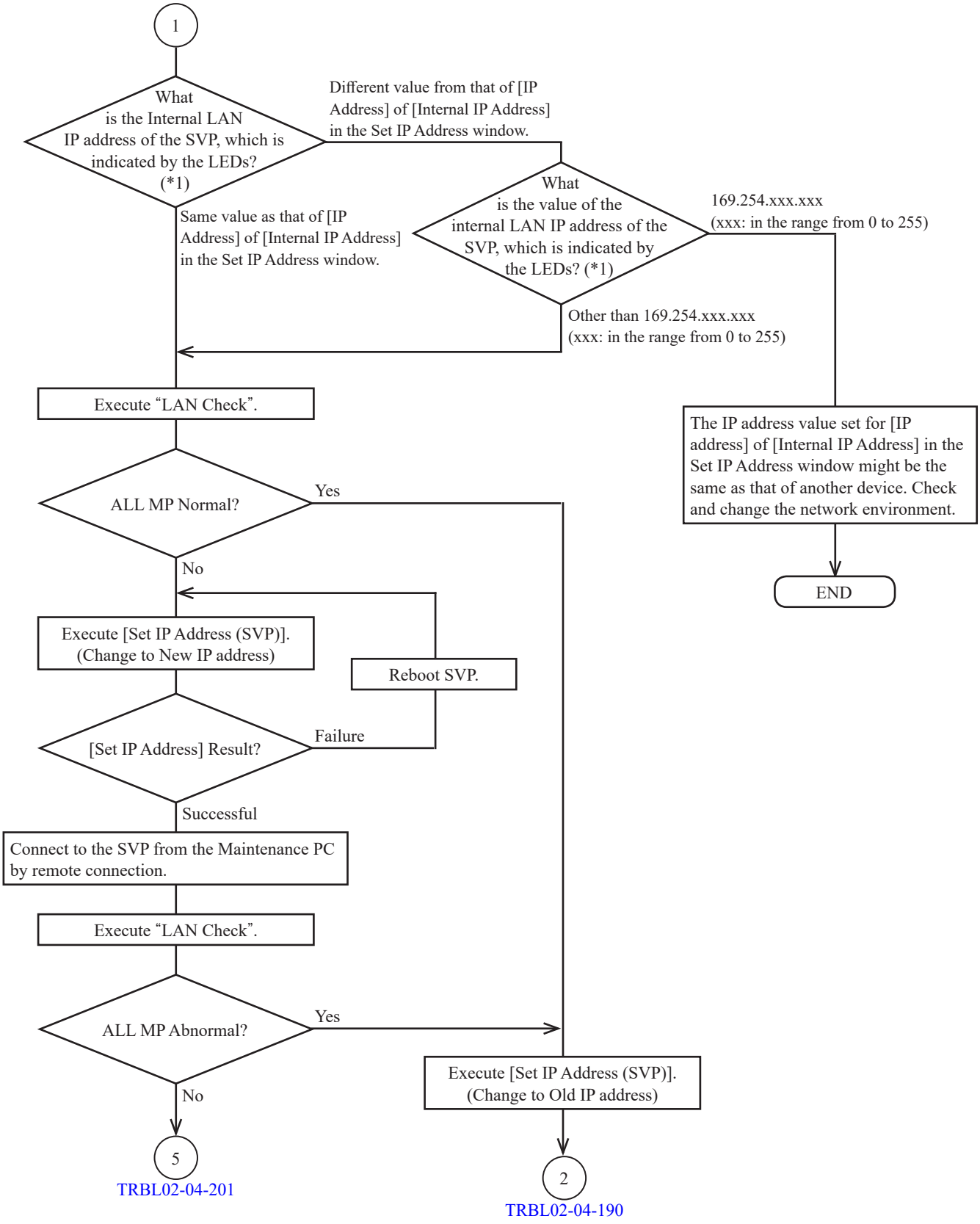


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2.4.7 Recovery Procedure When Changing IP Address Failed

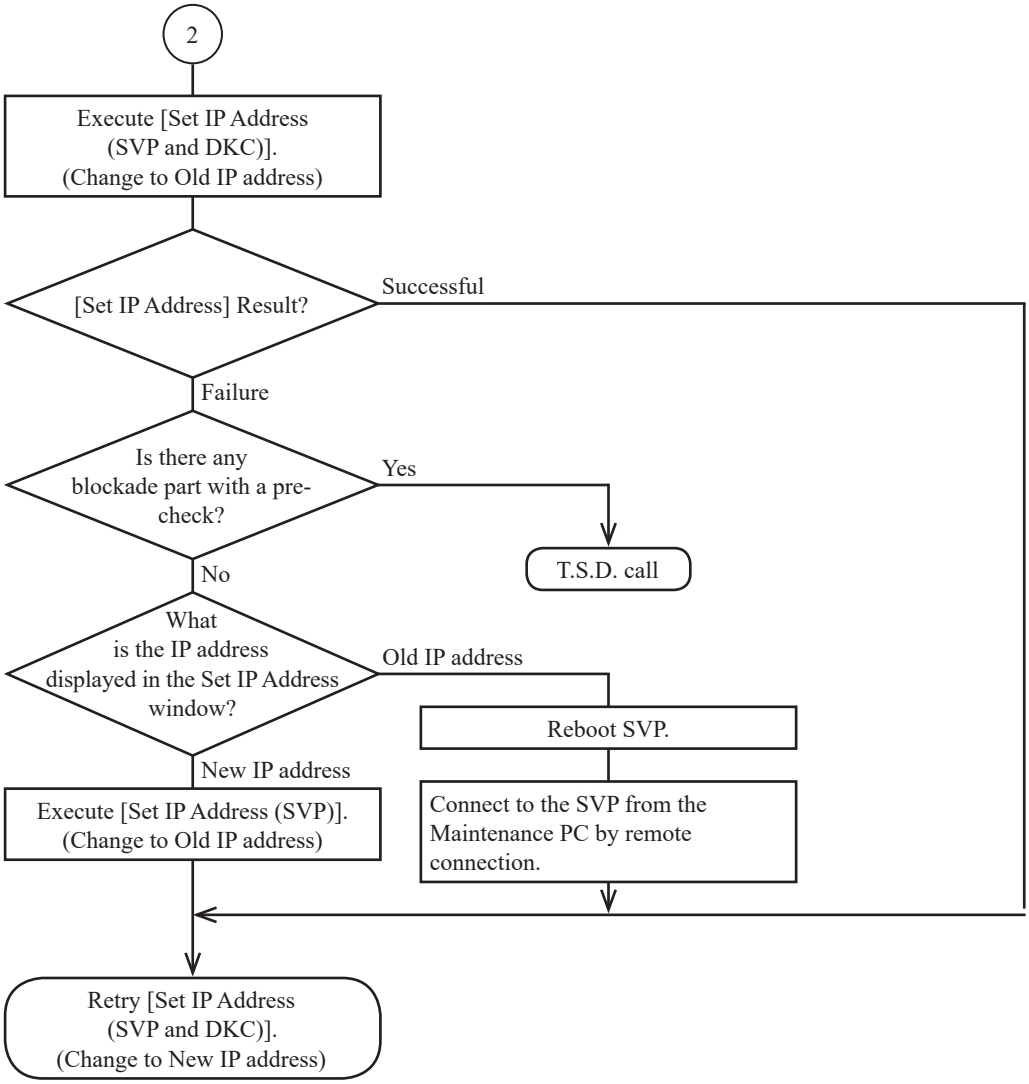


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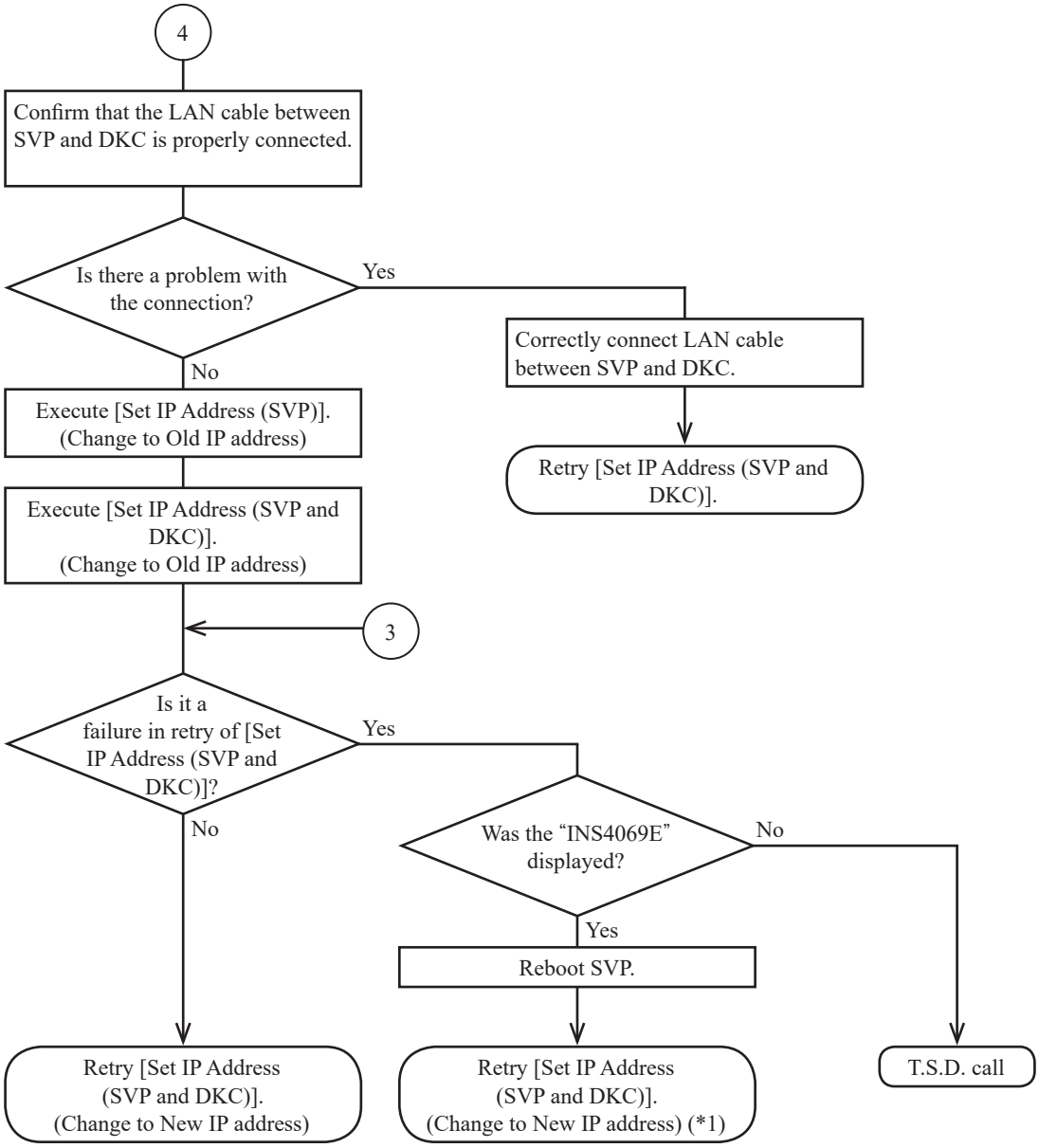


*1: Check the IP address according to "Display of IP address of SVP" (LOC03-43).

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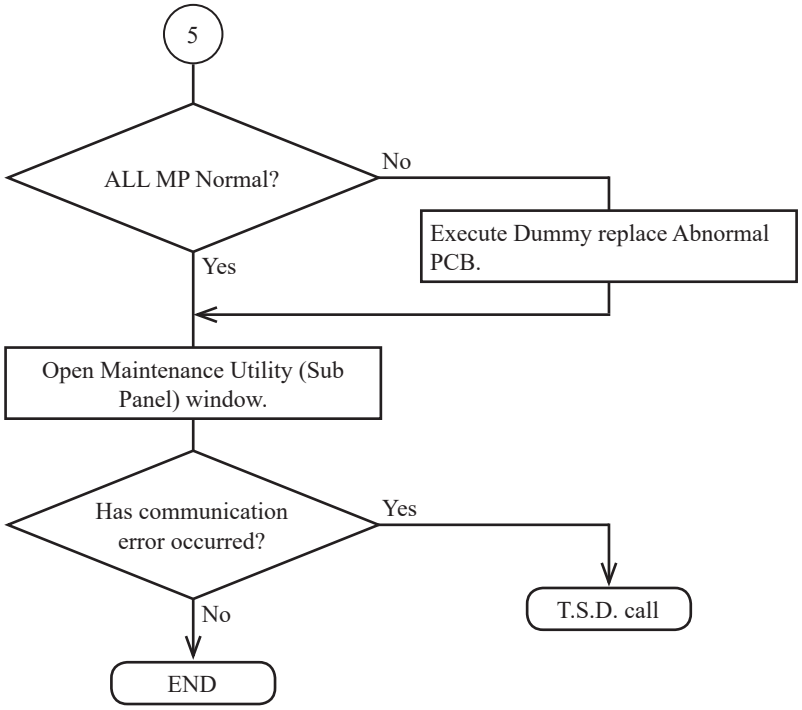


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*1: If the IP address change fails though [Set IP Address (SVP and DKC)] is retried after SVP reboot, replace the SVP before retrying [Set IP Address (SVP and DKC)].

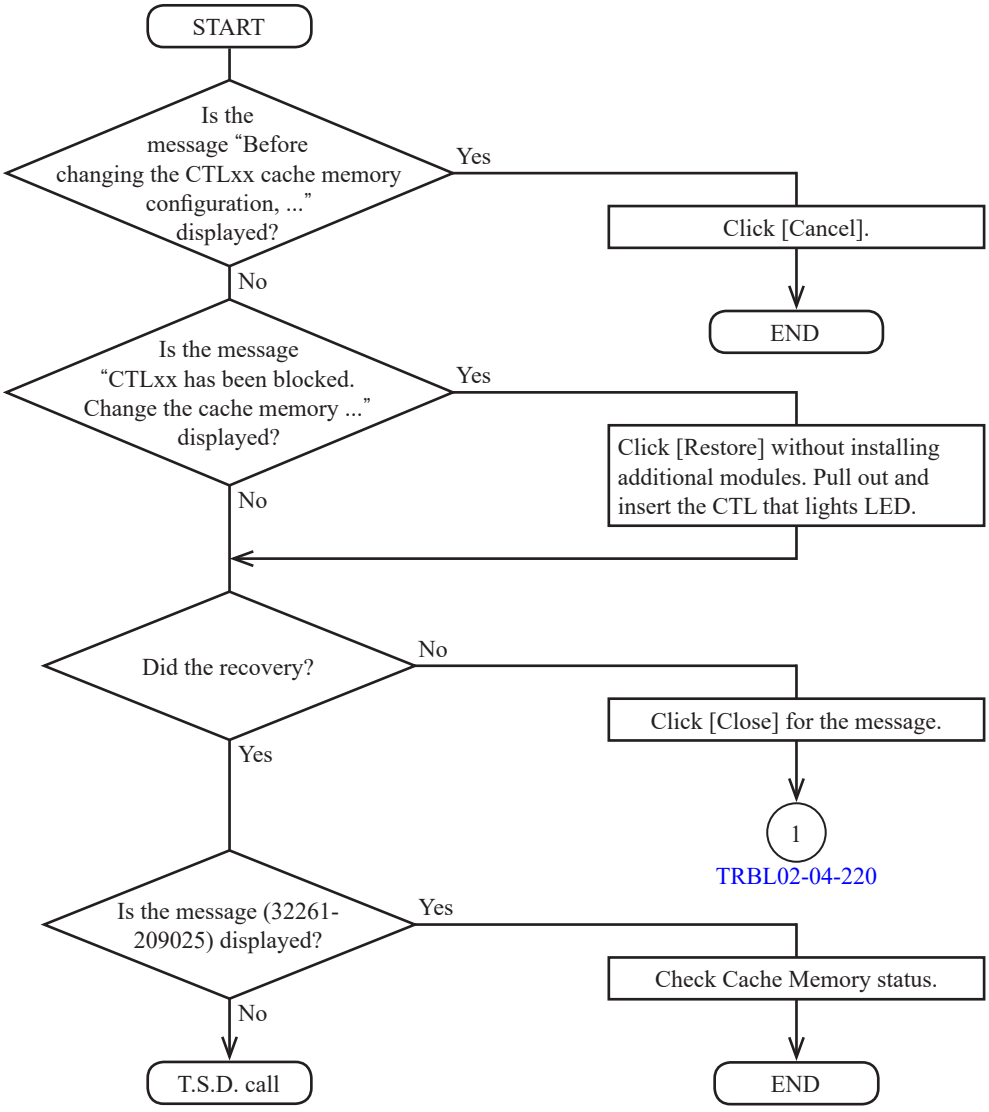
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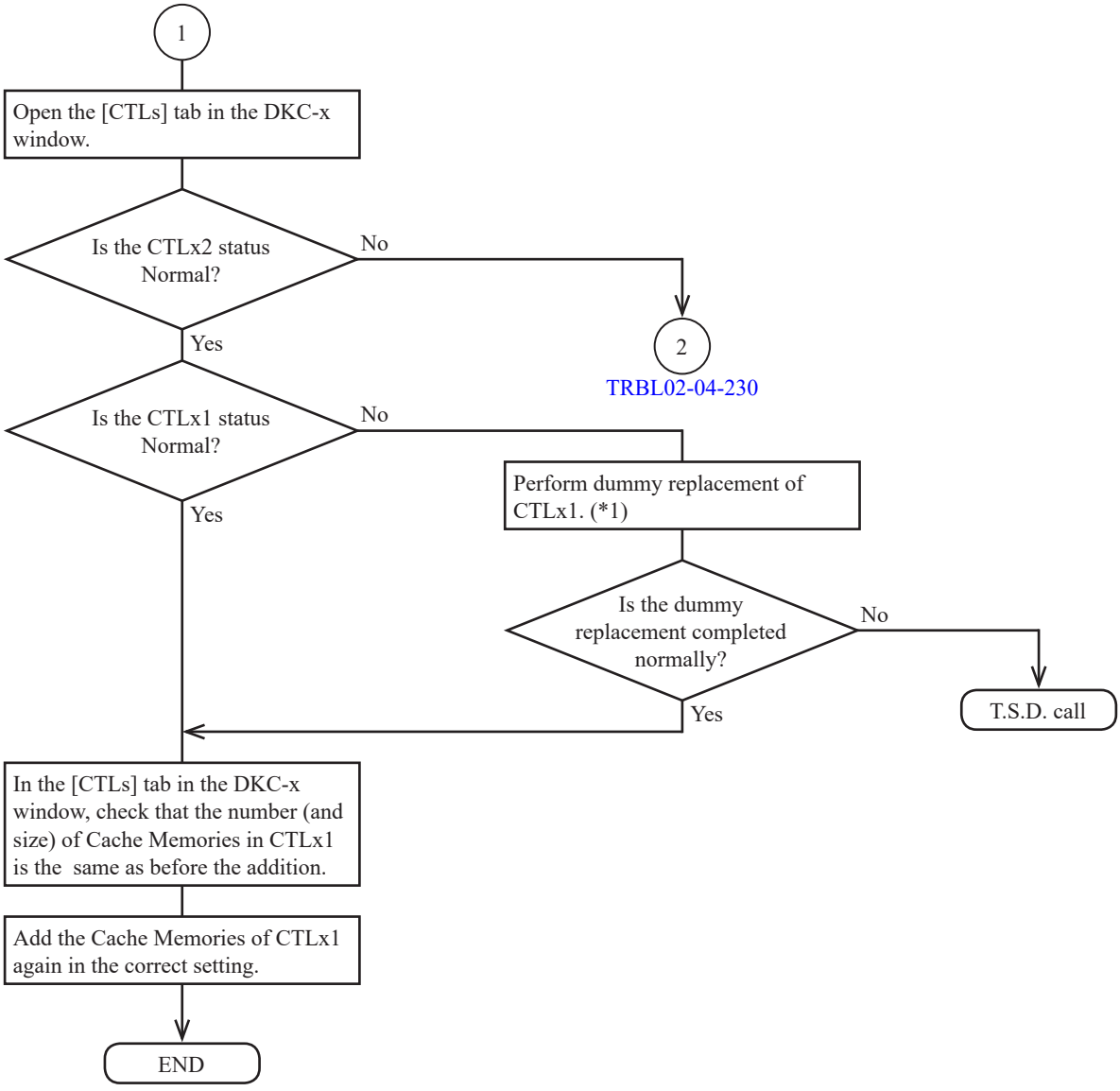
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2.4.8 Recovery from the incorrect setting when adding Cache Memories

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

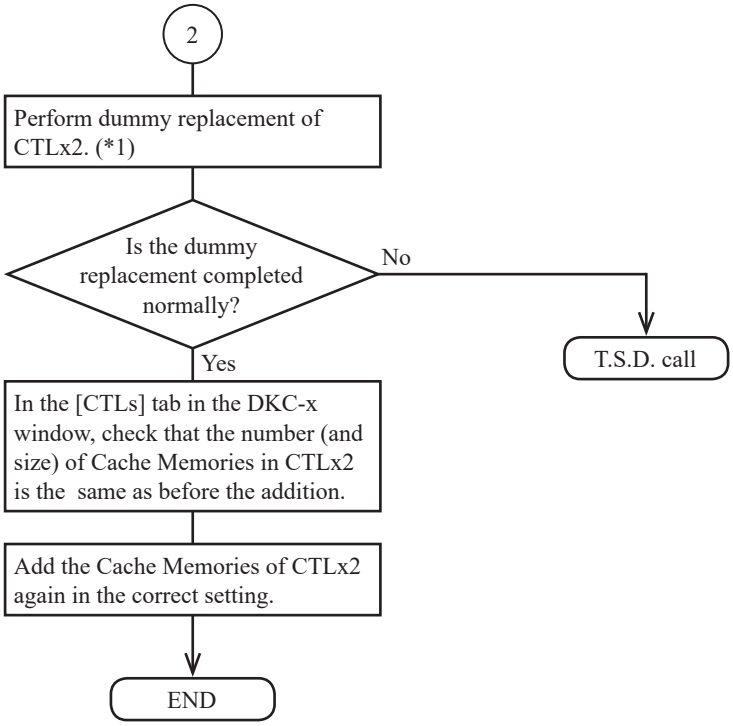


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*1: If the added Cache Memories, Cache Flash Memories exist, remove them.

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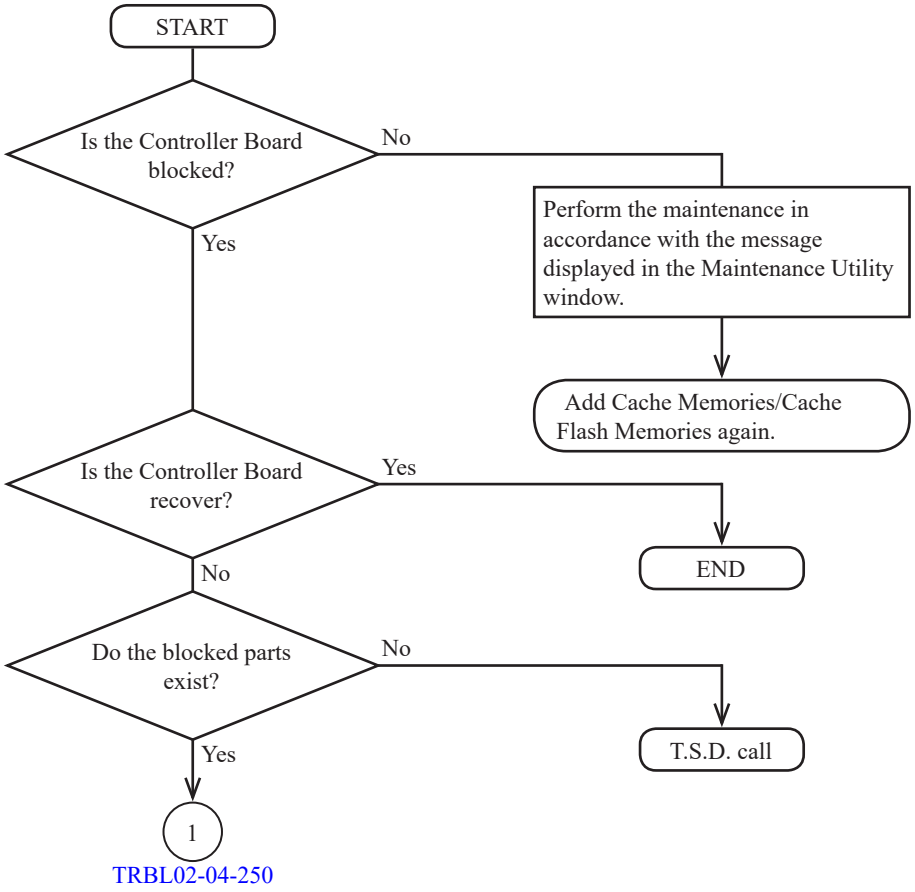


*1: If the added Cache Memories, Cache Flash Memories exist, remove them.

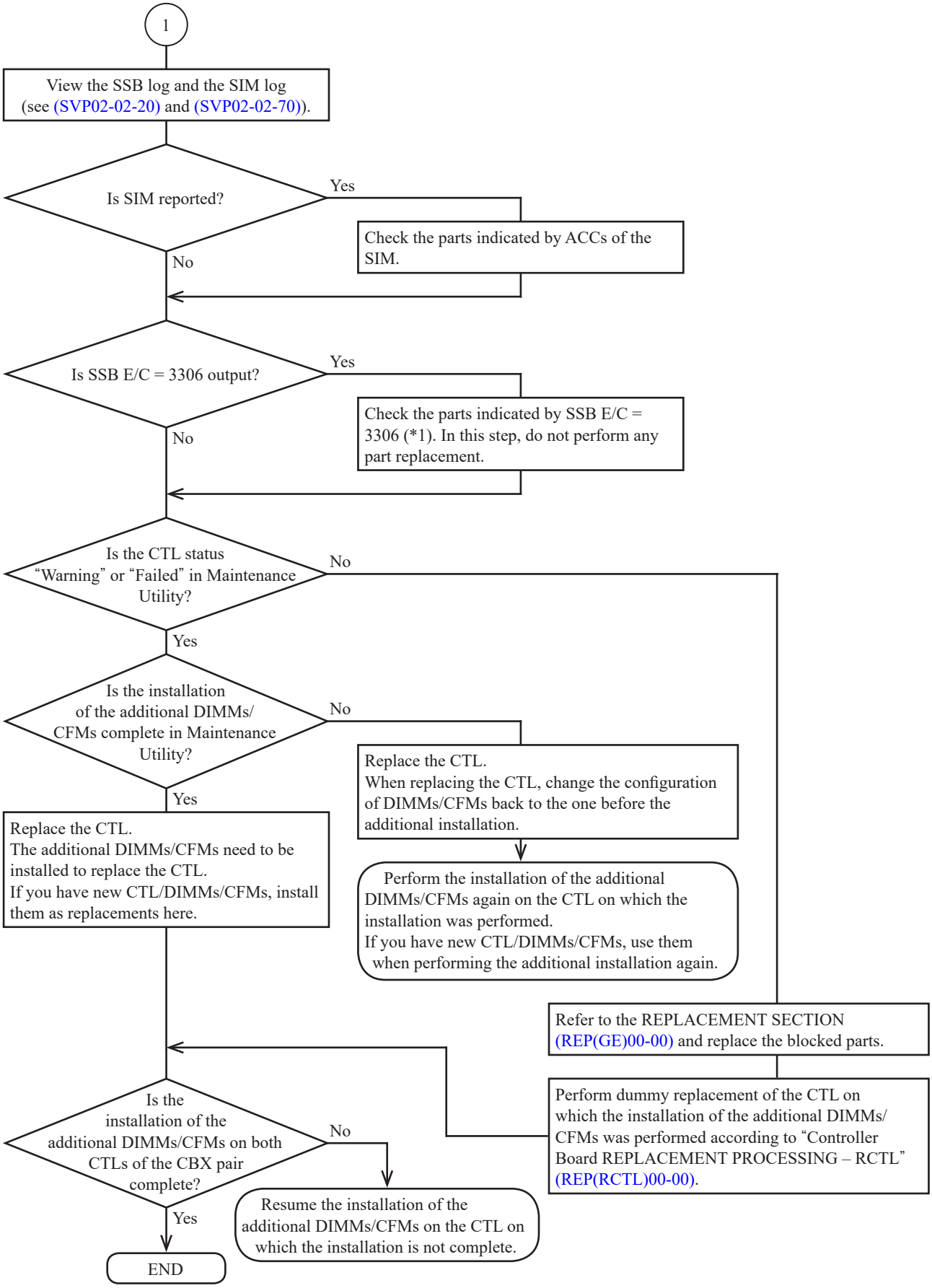
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2.4.9 Error Recovery When Adding Cache Memories/Cache Flash Memories

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



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*1: If multiple SSB E/C = 3306 are output, see the five earliest SSBs among SSB E/C = 3306 output in about the same time.

If any ACC of the SSBs indicates DIMM:

Replace the DIMM. If the problem is not resolved, SSB E/C = 3306 is output again.

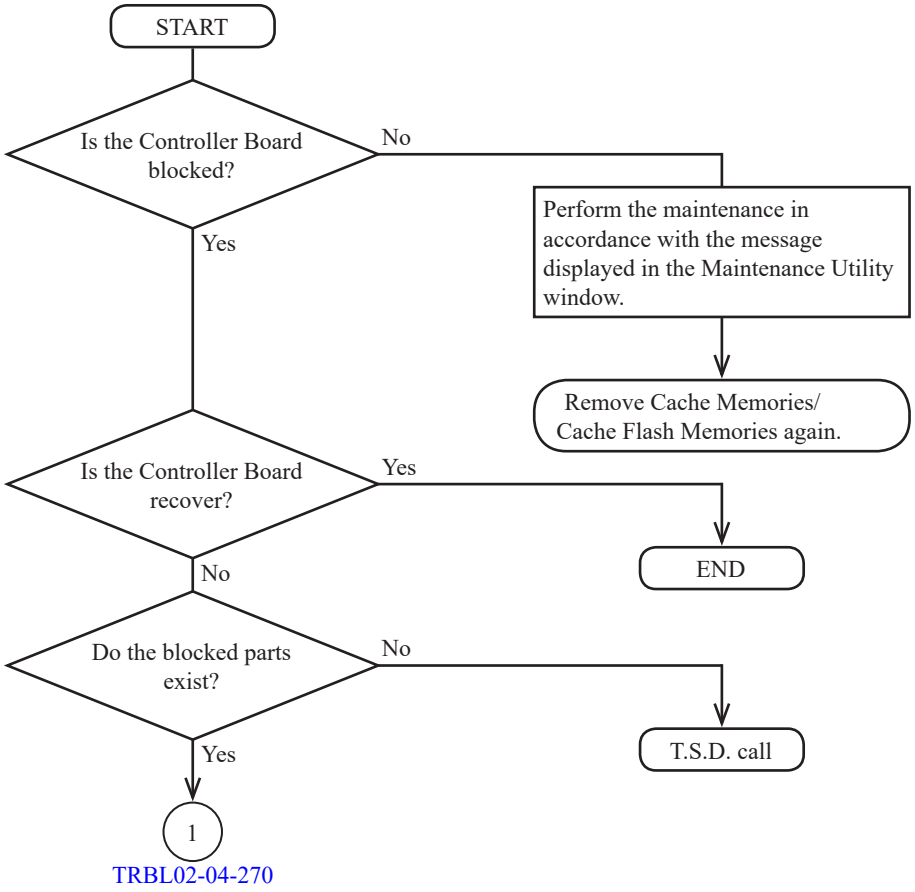
If any ACC of the SSBs does not indicate DIMM:

Perform the recovery action for the common part indicated by the largest number of ACCs of the SSBs. If there are multiple common parts, perform the recovery actions according to "Table 2-2 Priority Table" in "2.5 Failures of Multiple Parts". If the problem is not resolved, SSB E/C = 3306 is output again.

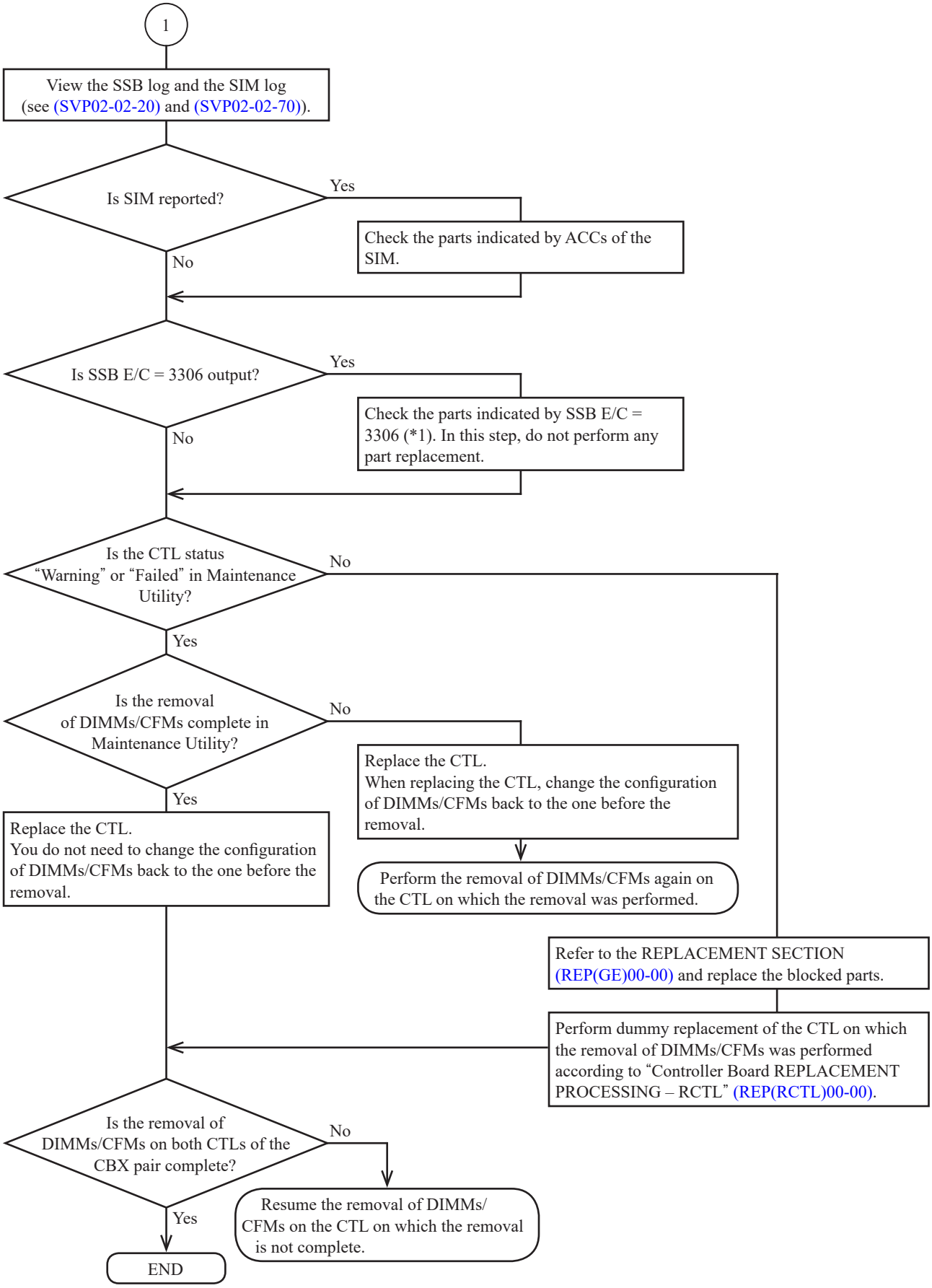
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2.4.10 Error Recovery When Removing Cache Memories/Cache Flash Memories

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



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*1: If multiple SSB E/C = 3306 are output, see the five earliest SSBs among SSB E/C = 3306 output in about the same time.

If any ACC of the SSBs indicates DIMM:

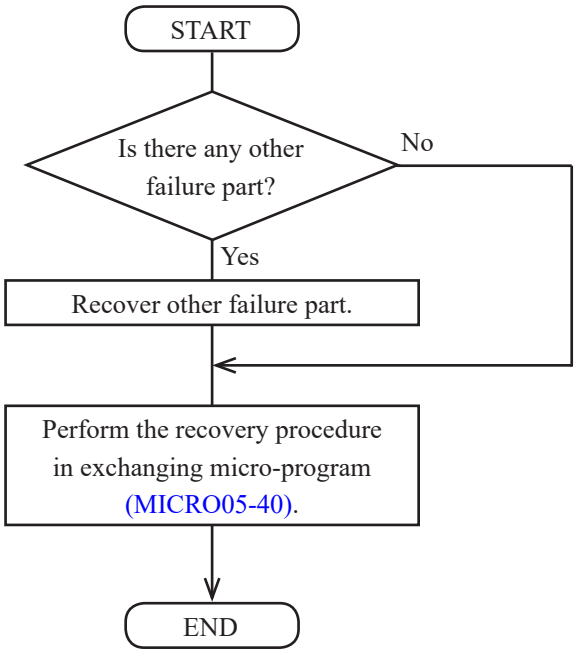
Replace the DIMM. If the problem is not resolved, SSB E/C = 3306 is output again.

If any ACC of the SSBs does not indicate DIMM:

Perform the recovery action for the common part indicated by the largest number of ACCs of the SSBs. If there are multiple common parts, perform the recovery actions according to "Table 2-2 Priority Table" in "2.5 Failures of Multiple Parts". If the problem is not resolved, SSB E/C = 3306 is output again.

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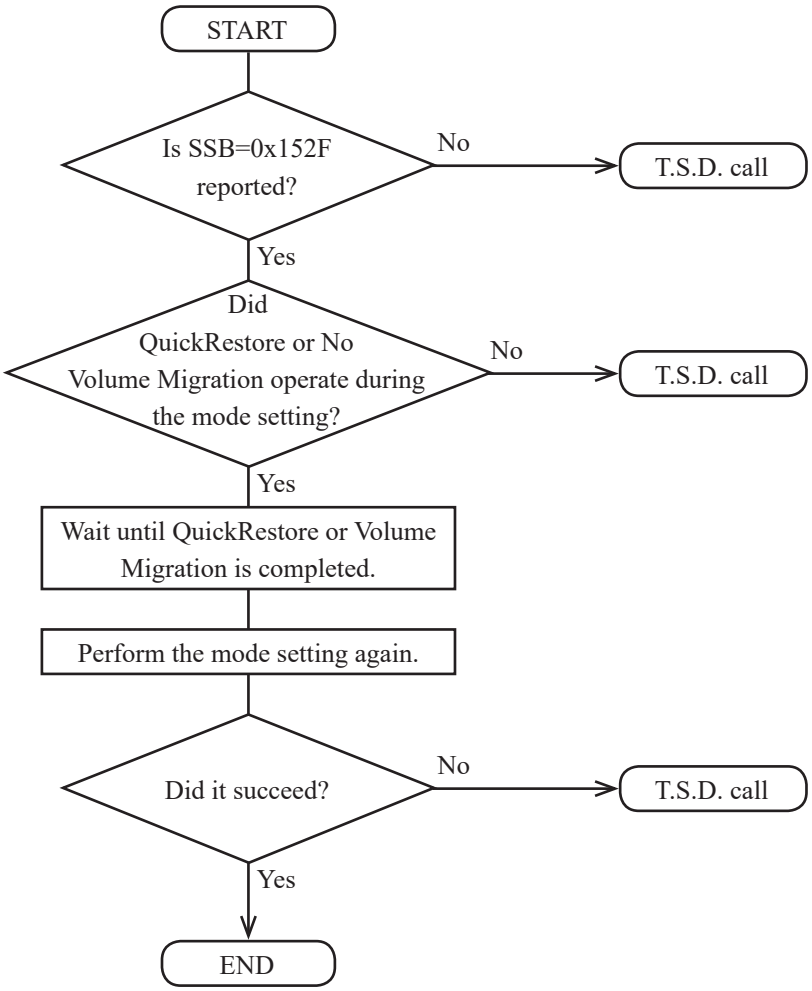
2.4.11 Micro-program Version Mismatching



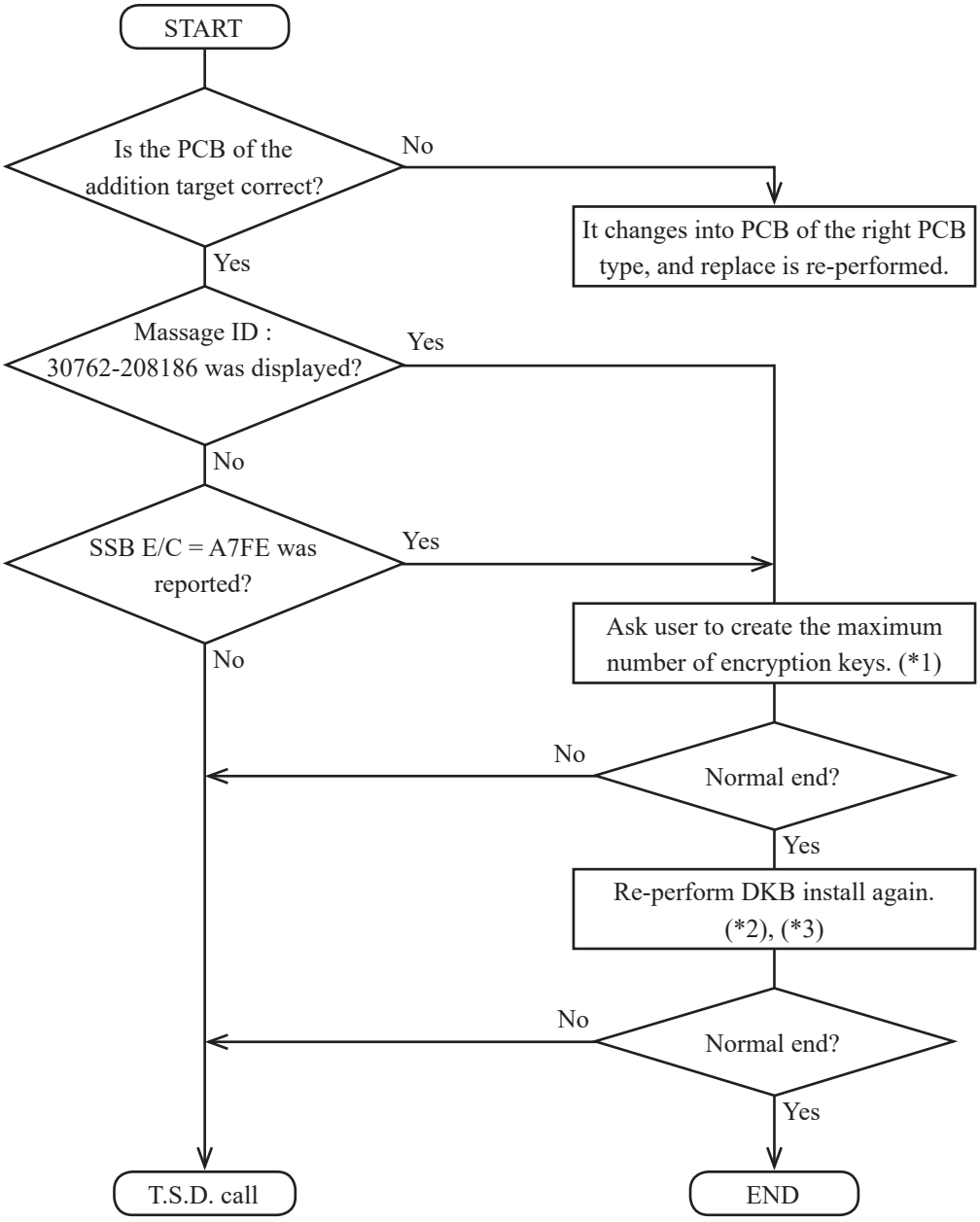
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2.4.12 Correspondence at the time of the mode setting failure of System Option

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.



2.4.13 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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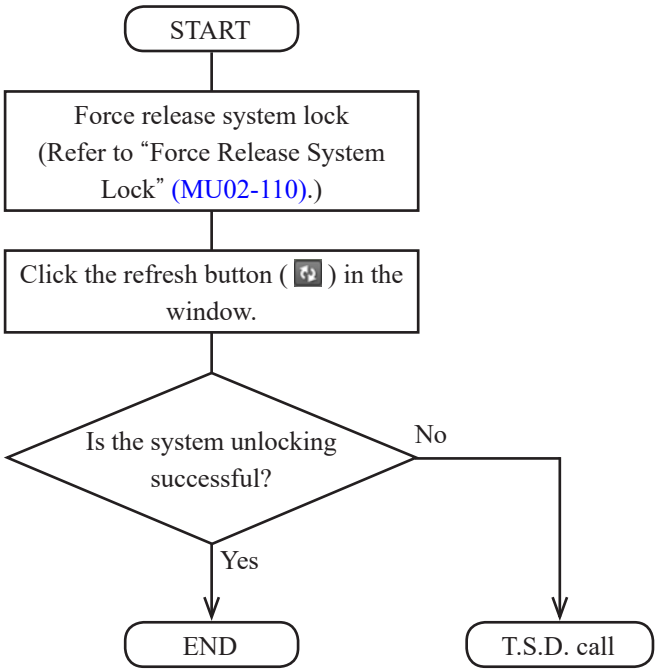
2.4.14 Recovery Procedure for the System Lock during a Setting Change

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.



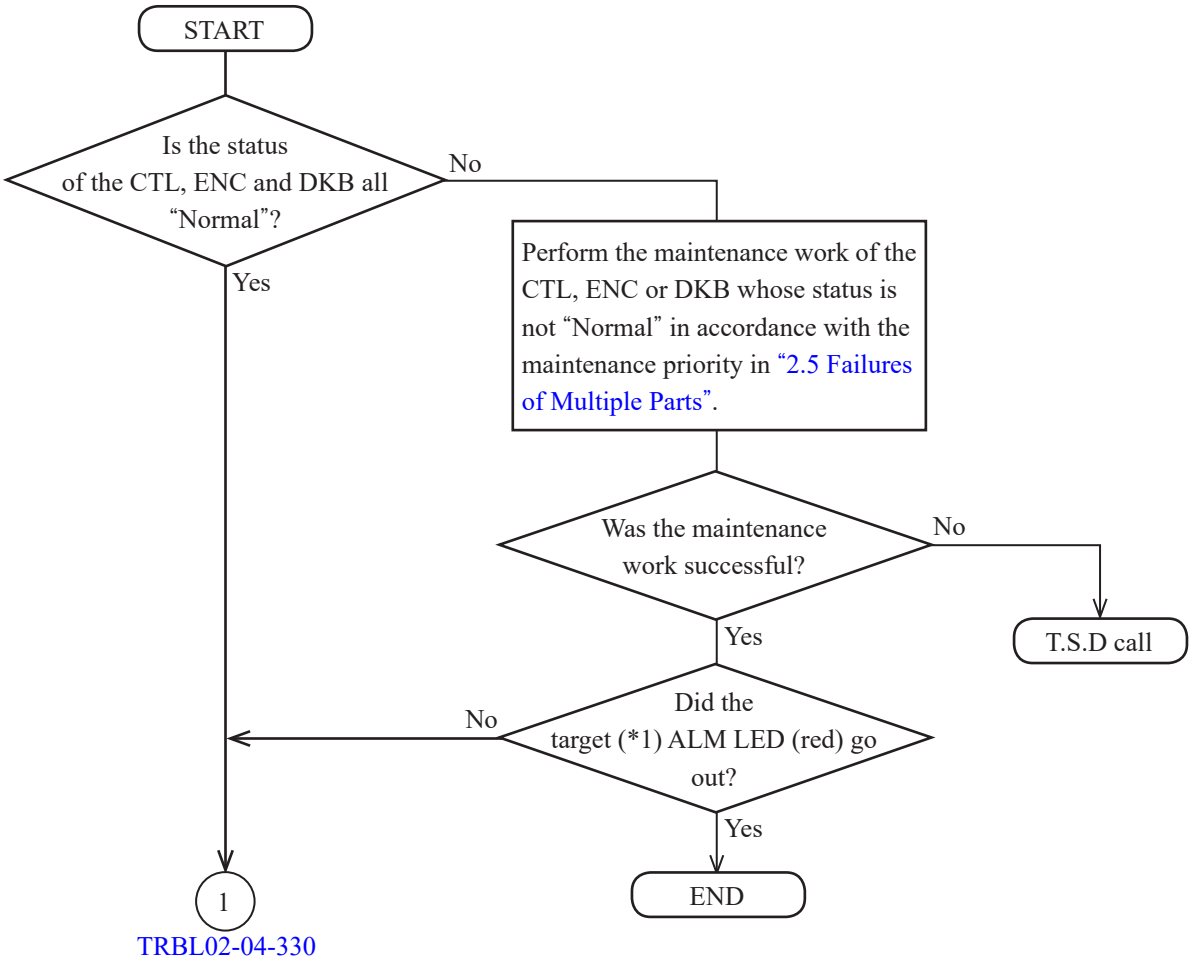
2.4.15 Recovery Procedure when ALM LED (red) is not Turned OFF

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”

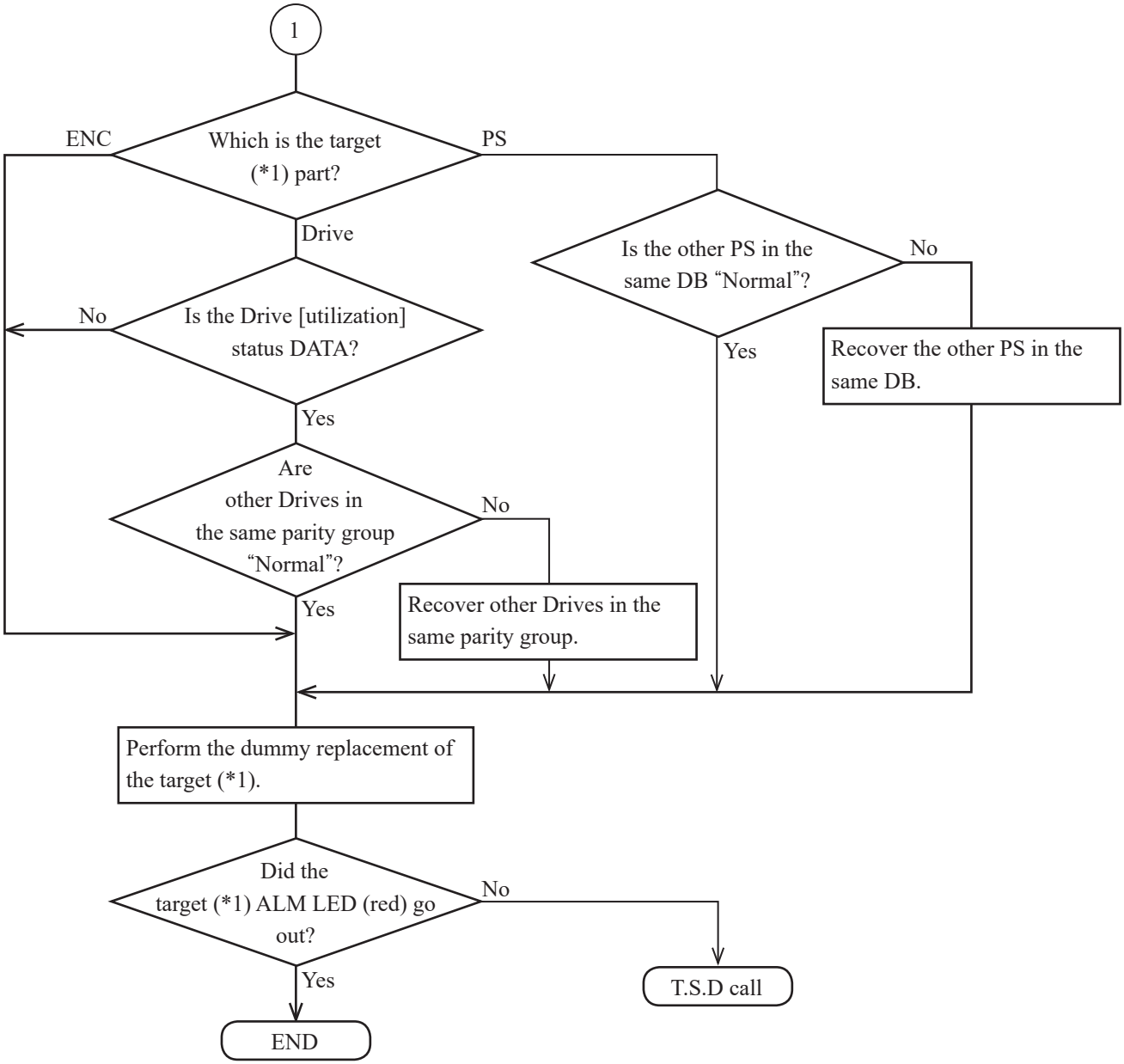
The ALM LED (red) on the Drive, PS or ENC might fail to go out due to the CTL, ENC, DKB or SAS PORT blockade/NVMe PORT blockade.

Turn off the LED in accordance with the following procedure.
Note that the PS described here is the DBS2/DBF3/DBL/DBN 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”.

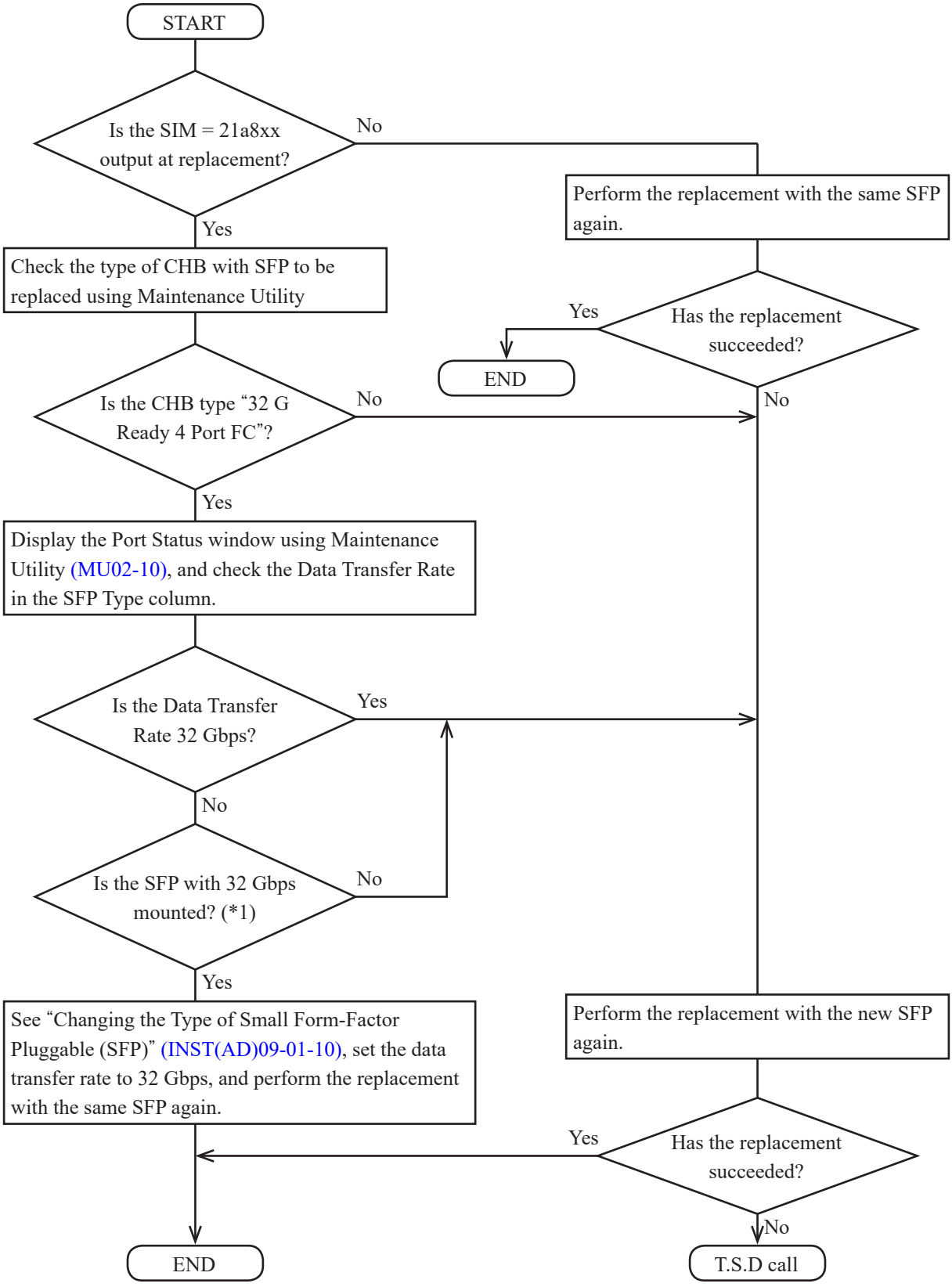
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*1: The target means a Drive in the status of other than "Blocked" and "Failed" and whose ALM LED (red) lights up, or a PS or ENC whose ALM LED (red) lights up when the PS status or the ENC status is "Normal".

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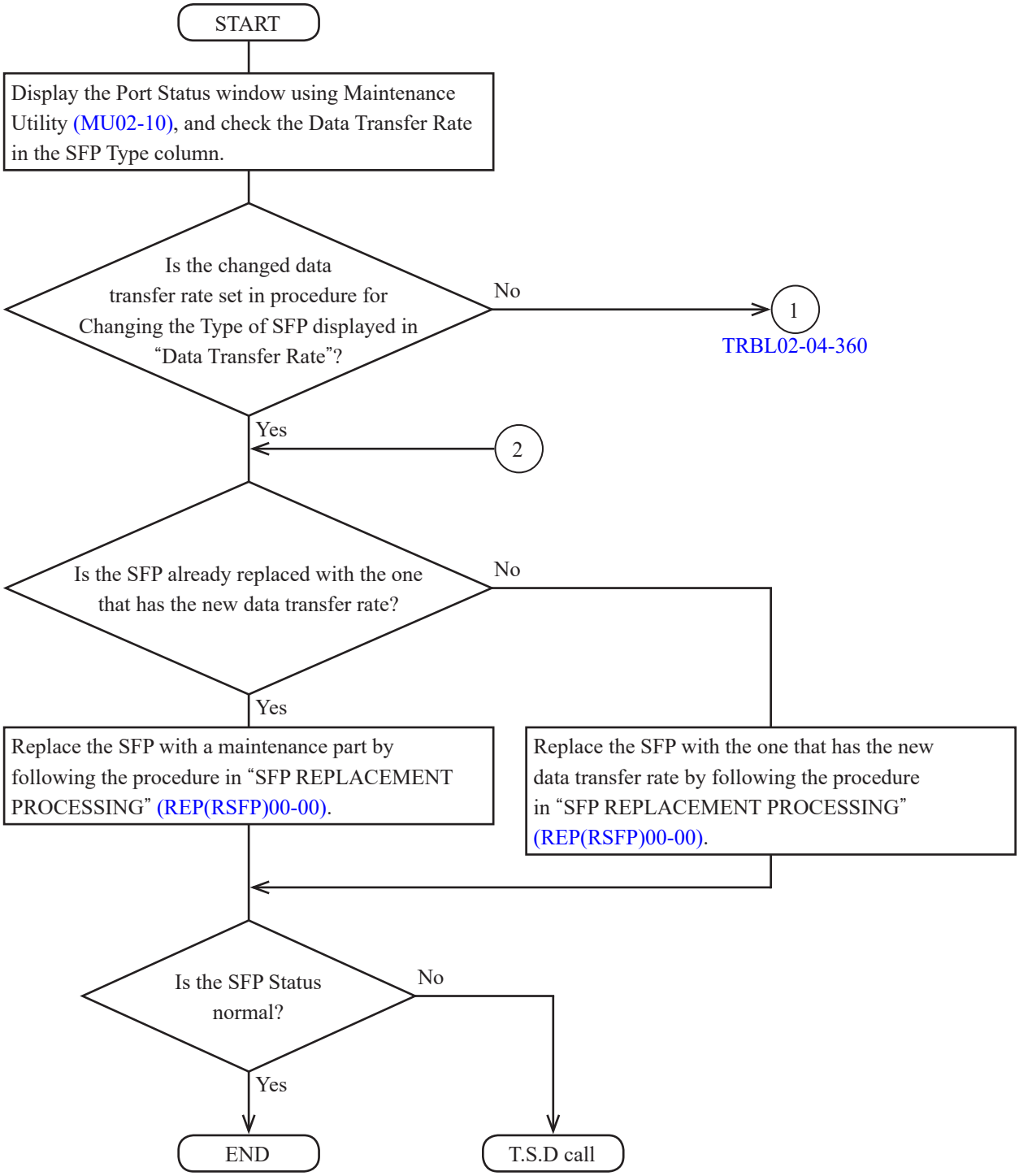
2.4.16 Recovery Procedure at SFP Replacement



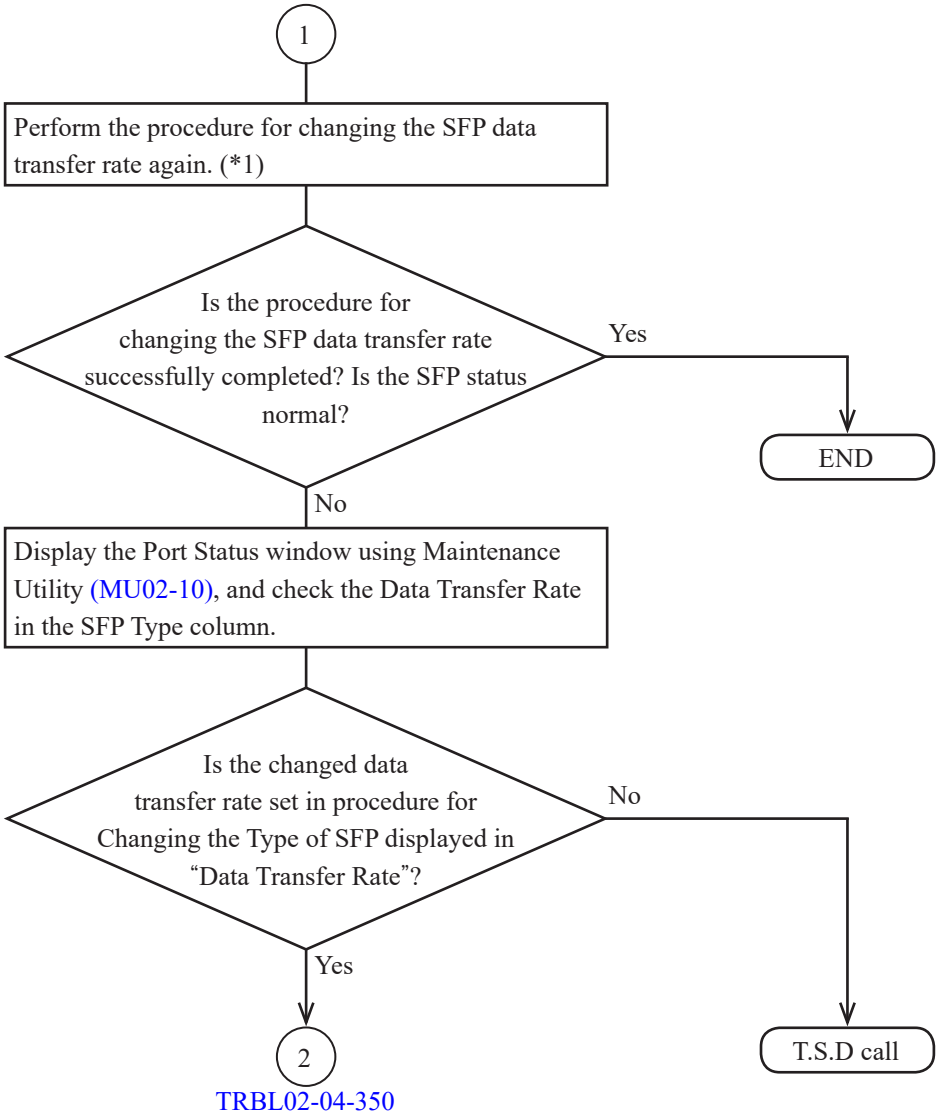
*1: Check the record at the time of delivery, or remove the SFP and check the appearance. See (INST(AD)09-01-70).

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2.4.17 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).

2.4.18 Recovery Procedure When Performing Maintenance Work of HIE/ISW/X-path

Perform "3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx)".

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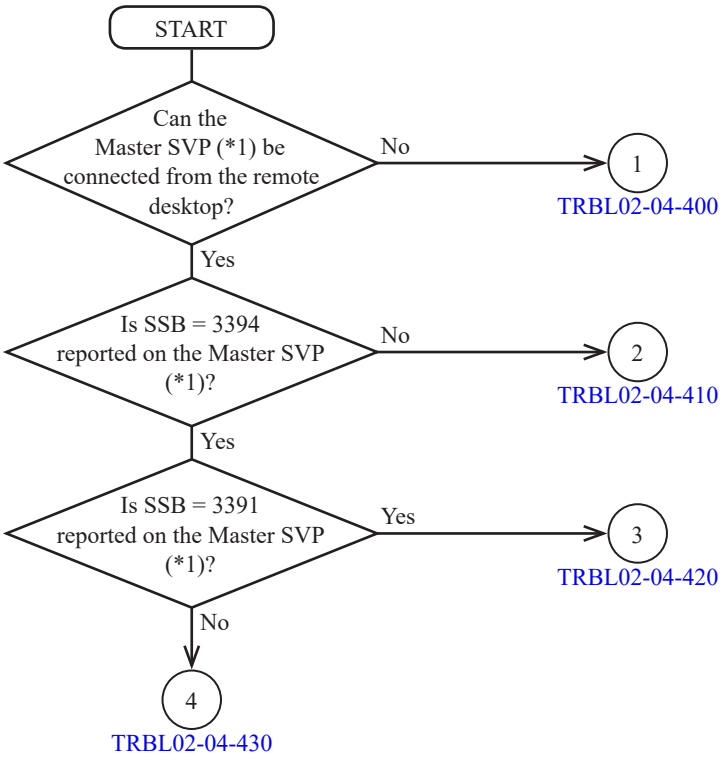
2.4.19 Recovery Procedure When Performing Maintenance Work of SAS Cable/ENC

Perform a recovery procedure according to SIM/ACC. If the problem persists, contact the Technical Support Division.
The following are typical SIMs that might be reported when maintenance work of SAS cable/ENC is performed.

SIM RC	Error name	Recovery procedure
cf11xx	SAS PORT (WideLink) is partially blocked	3.6 Recovery Procedure for the SAS PORT Temporary Failure (SIM = cf11xx)
cf12xx	SAS PORT blocked	3.5 Recovery when power off or SAS/NVMe PORT failure occurred (SIM = cf12xx, cf22xx, ac50xx)
effexx	Chassis connection error	3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)

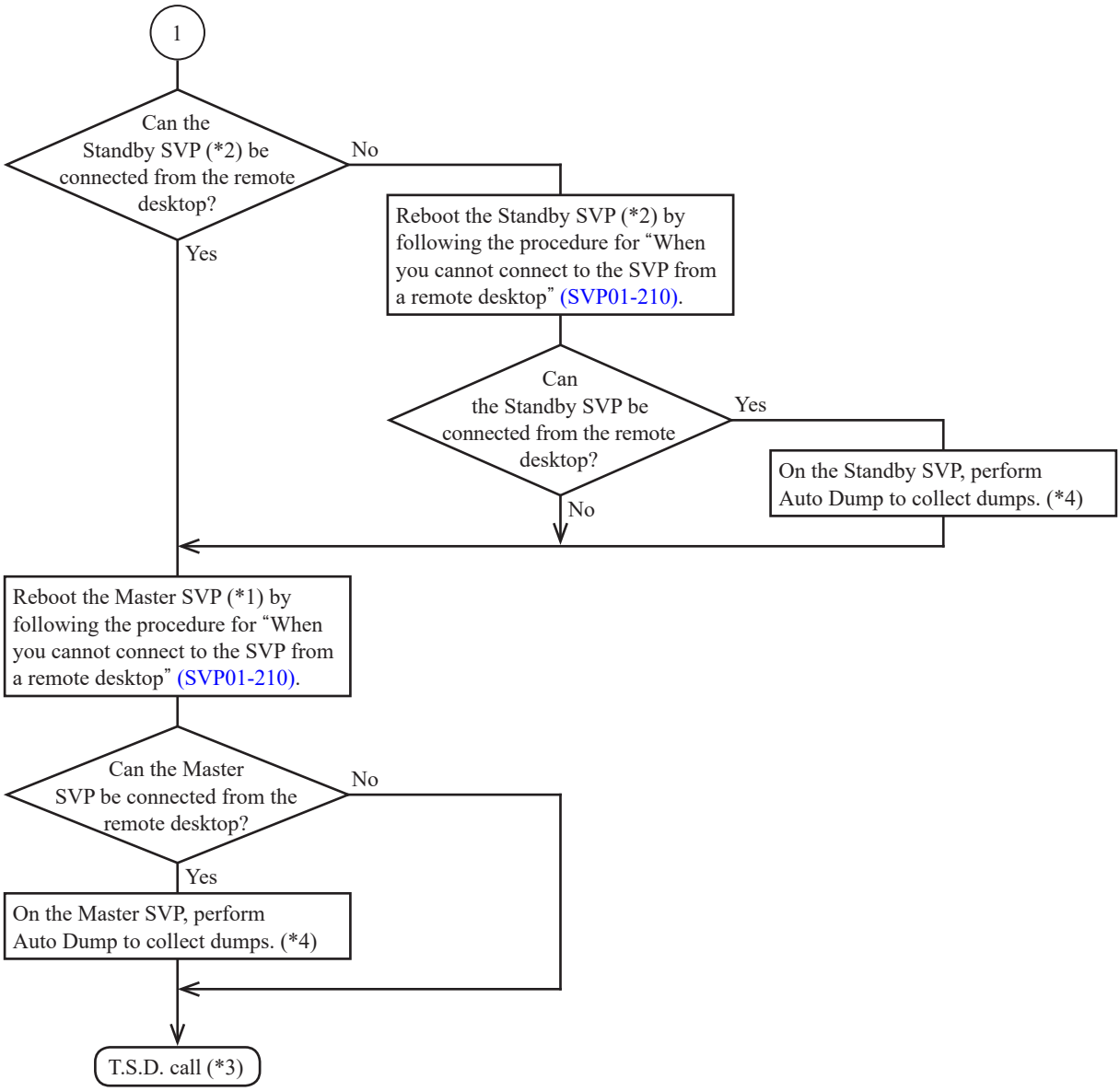
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2.4.20 Recovery Procedure When SVP Switching Failed



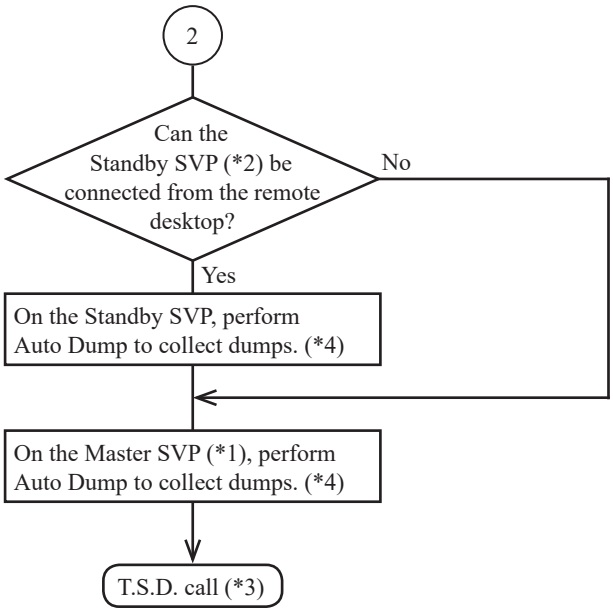
*1: “Master SVP” is the Master SVP before executing the SVP switching.

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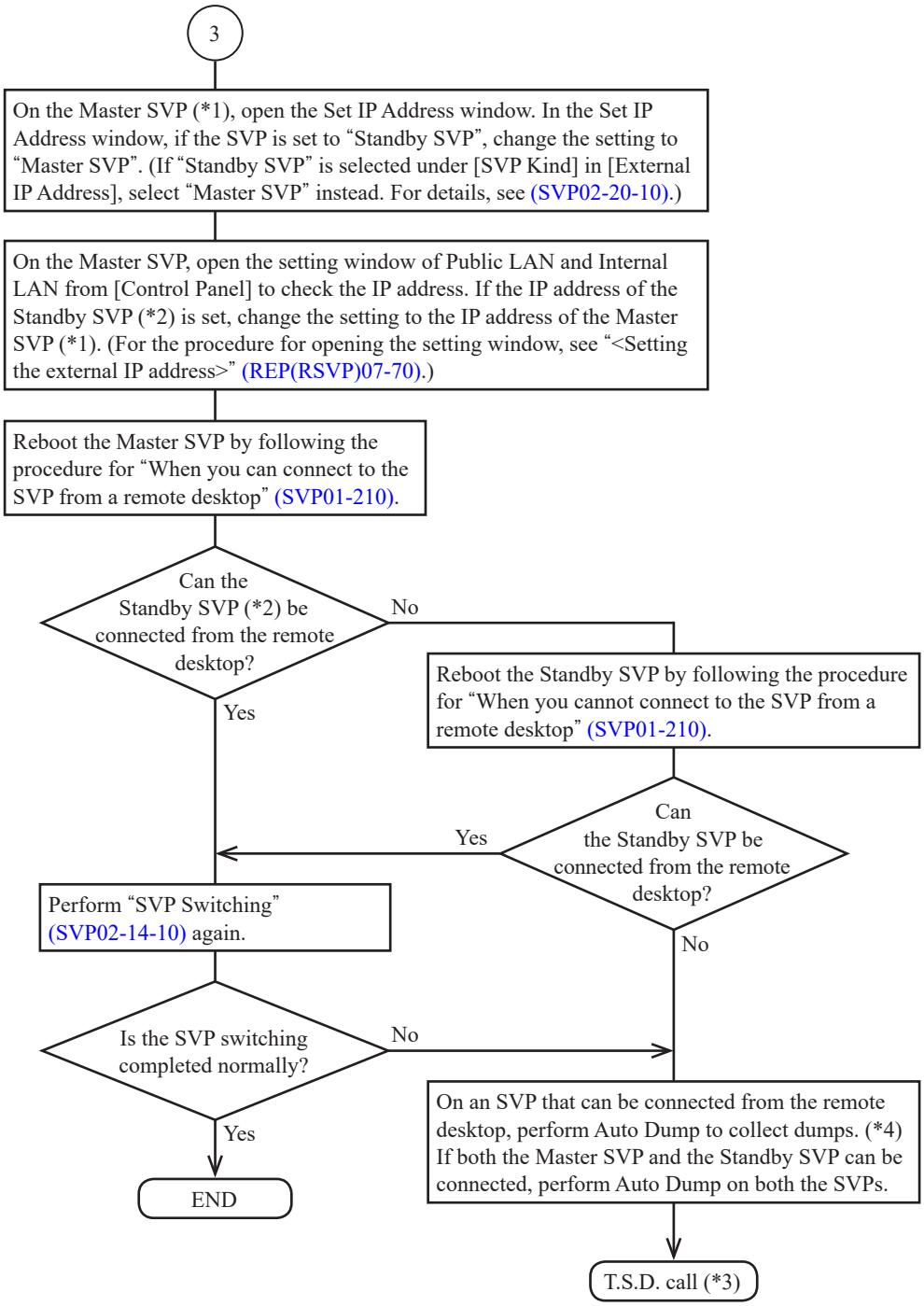
*1: "Master SVP" is the Master SVP before executing the SVP switching.
*2: "Standby SVP" is the Standby SVP before executing the SVP switching.
*3: The Technical Support Division might tell you to replace the SVP with new spare part SVP.
*4: If you have collected dumps by using the automatic log dump collection function, you do not need to perform Auto Dump.
When performing Auto Dump to collect dumps, stop the automatic log dump collection function (see "Aborting Dump Collection during Automatic Dump Collection" (SVP02-26-170)).

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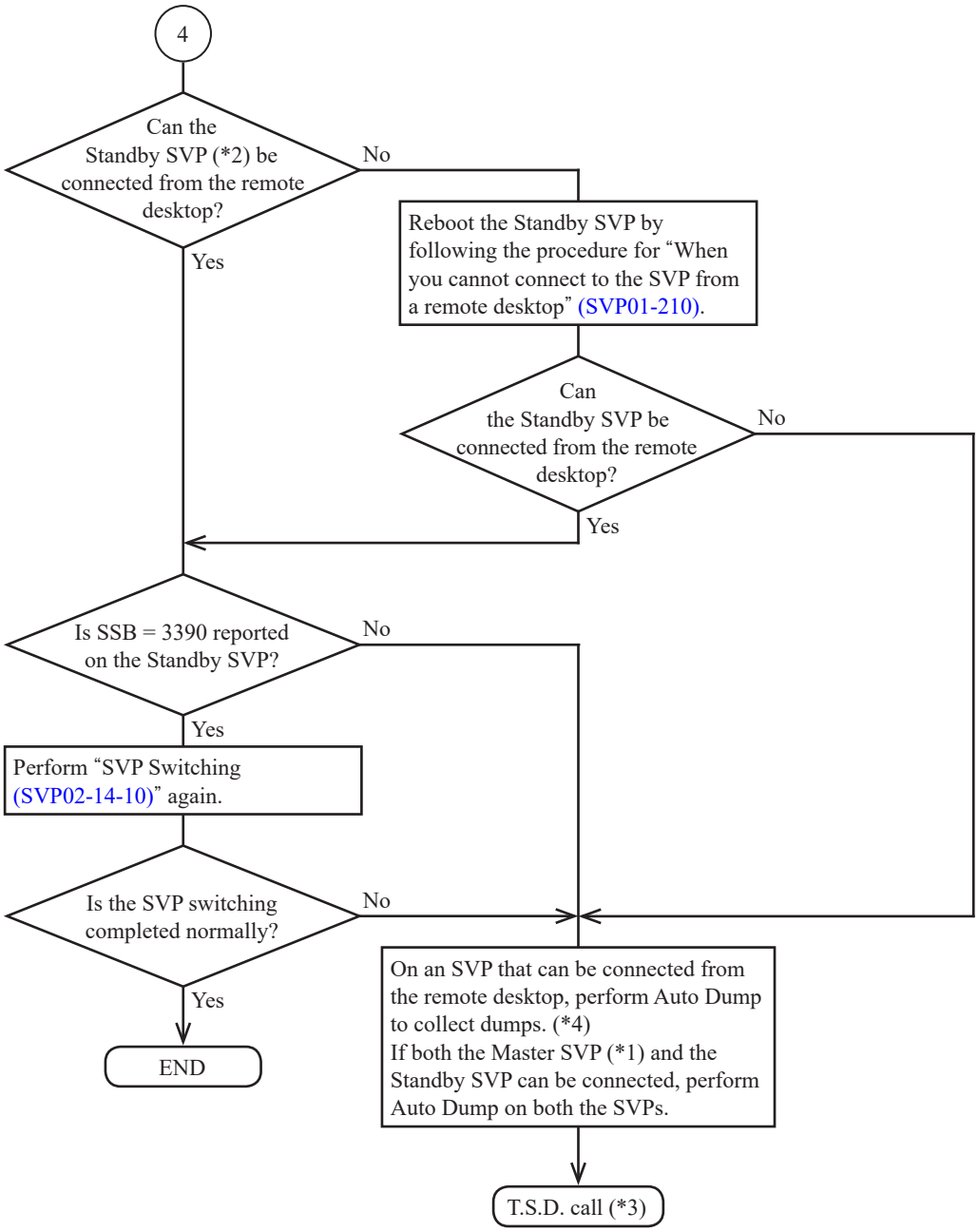
*1: "Master SVP" is the Master SVP before executing the SVP switching.
*2: "Standby SVP" is the Standby SVP before executing the SVP switching.
*3: The Technical Support Division might tell you to replace the SVP with new spare part SVP.
*4: If you have collected dumps by using the automatic log dump collection function, you do not need to perform Auto Dump.
When performing Auto Dump to collect dumps, stop the automatic log dump collection function (see "Aborting Dump Collection during Automatic Dump Collection" (SVP02-26-170)).

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*1: "Master SVP" is the Master SVP before executing the SVP switching.
*2: "Standby SVP" is the Standby SVP before executing the SVP switching.
*3: The Technical Support Division might tell you to replace the SVP with new spare part SVP.
*4: If you have collected dumps by using the automatic log dump collection function, you do not need to perform Auto Dump.
When performing Auto Dump to collect dumps, stop the automatic log dump collection function (see "Aborting Dump Collection during Automatic Dump Collection" (SVP02-26-170)).

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*1: "Master SVP" is the Master SVP before executing the SVP switching.
*2: "Standby SVP" is the Standby SVP before executing the SVP switching.
*3: The Technical Support Division might tell you to replace the SVP with new spare part SVP.
*4: If you have collected dumps by using the automatic log dump collection function, you do not need to perform Auto Dump.
When performing Auto Dump to collect dumps, stop the automatic log dump collection function (see "Aborting Dump Collection during Automatic Dump Collection" (SVP02-26-170)).

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2.4.21 Recovery Procedure for Error Parts Detected by LAN Check

When you check SIMs and you do not find any SIMs indicating errors troubleshoot problems as follows:
In the result window of LAN Check, check the lighting state of each button, and then choose a recovery procedure from the items #1 through #4 in the matrix below according to the corresponding blinking pattern. Perform the steps in the chosen procedure in sequence while executing LAN Check after each step. When no problem is found in the result window of LAN Check, end the procedure.
If the blinking pattern changes, perform another recovery procedure according to the corresponding blinking pattern.

#	SVP button	SSVP button	GUM button	MPU button	Error details	Recovery procedure
1	Blinking	Blinking or not blinking	Blinking or not blinking	Blinking or not blinking	All installed MPs are unable to communicate.	(1) Reboot the SVP (SVP01-210). (2) Reset the HUB for the blinking SSVP (LOC03-43). (3) Reset the blinking SSVP (LOC03-41). (4) Check the LAN cable connection between the blinking SSVP and each DKC, and that between the SSVPs. (INST(IN)09-03-10). (5) Perform the dummy replacement of the blinking SSVP ((REP(GE)06-100), Work ID = RSSV). (6) Reset the blinking GUM (MU02-180). (7) Check for SIMs. When SIMs are reported, end this procedure and perform recovery procedures for the SIMs. When no SIMs are reported, contact the Technical Support Division.
2	Not blinking	Blinking	Blinking or not blinking	Blinking or not blinking	MPs in all DKCs connected to the blinking SSVP are unable to communicate.	(1) Reset the HUB for the blinking SSVP (LOC03-43). (2) Reset the blinking SSVP (LOC03-41). (3) Check the LAN cable connection between the blinking SSVP and each DKC, and that between the SSVPs. (INST(IN)09-03-10). (4) Perform the dummy replacement of the blinking SSVP ((REP(GE)06-100), Work ID = RSSV). (5) Reset the blinking GUM (MU02-180). (6) Check for SIMs. When SIMs are reported, end this procedure and perform recovery procedures for the SIMs. When no SIMs are reported, contact the Technical Support Division.

(To be continued)

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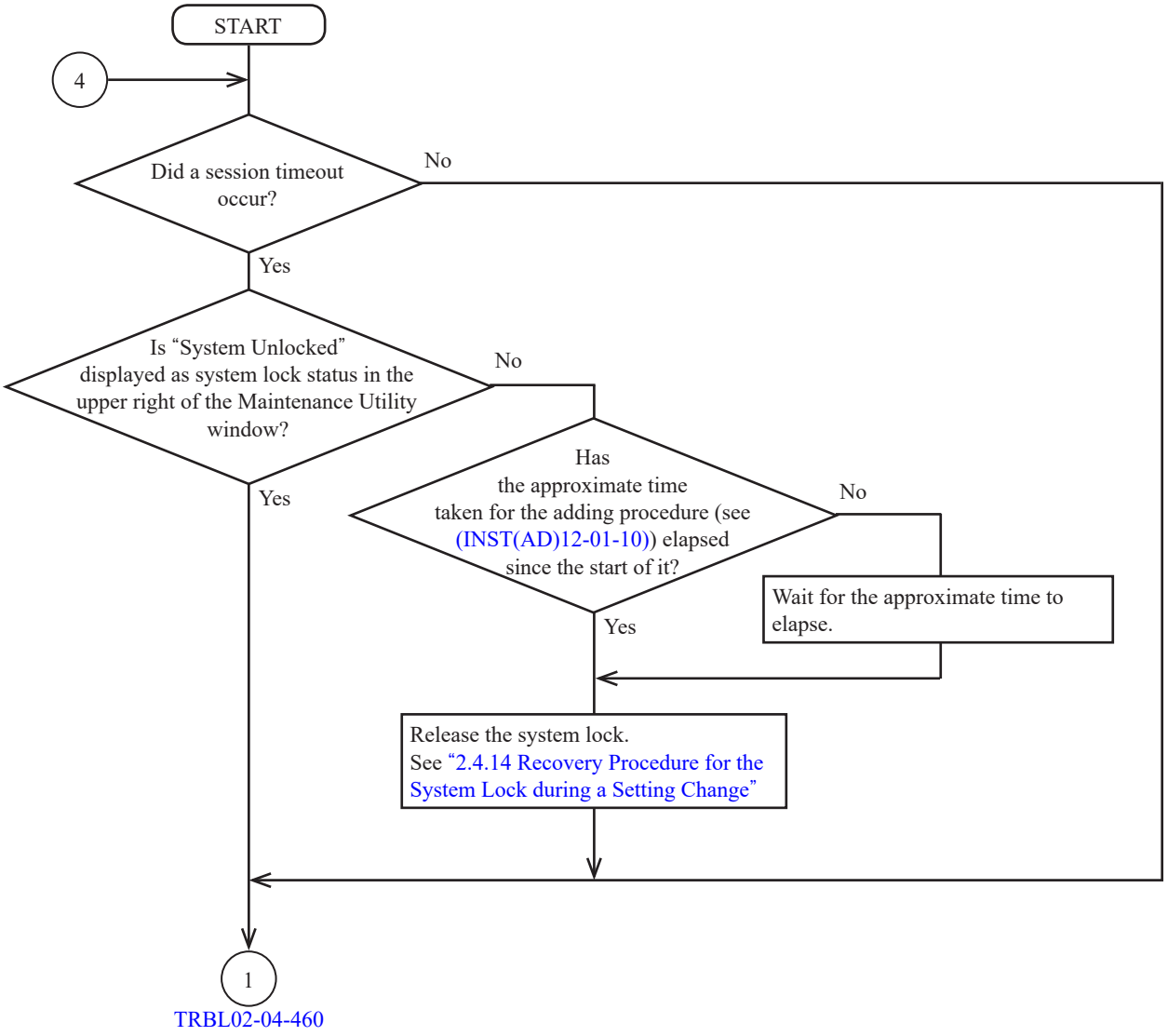
(Continued from the preceding page)

#	SVP button	SSVP button	GUM button	MPU button	Error details	Recovery procedure
3	Not blinking	Not blinking	Blinking	Blinking or not blinking	The connection between SSVP and DKC might be incorrect. The CTL might be in the abnormal state. (For VSP 5100 and VSP 5100H) The LAN cable connection between CTL and CTL might be incorrect.	(1) Check the LAN cable connection between each SSVP and each DKC, and that between the SSVPs. (INST(IN)09-03-10). (For VSP 5100 and VSP 5100H) Check the LAN cable connection between CTL and CTL. (INST(IN)09-03-70), (INST(IN)09-03-80) (2) Reboot the SVP (SVP01-210). (3) Reset the blinking GUM (MU02-180). (4) Perform the dummy replacement of the CTL containing the blinking part ((REP(GE)06-80), Work ID = RCTL). (5) Check for SIMs. When SIMs are reported, end this procedure and perform recovery procedures for the SIMs. When no SIMs are reported, contact the Technical Support Division.
4	Not blinking	Not blinking	Not blinking	Blinking	There are no responses from MPs.	(1) Check for SIMs. When SIMs are reported, end this procedure and perform recovery procedures for the SIMs. When no SIMs are reported, contact the Technical Support Division.

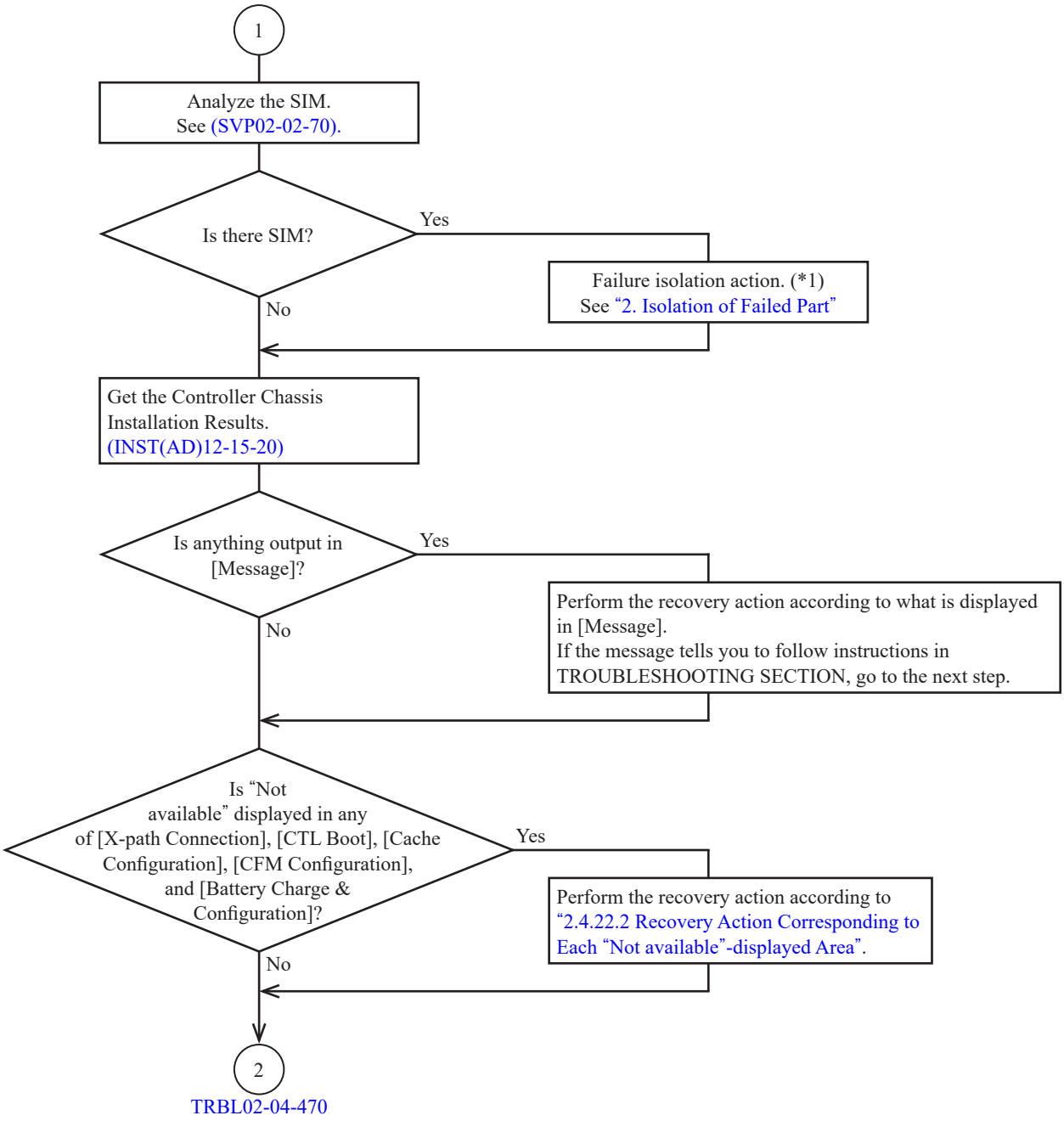
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2.4.22 Troubleshooting When Adding Controller Chassis

2.4.22.1 Recovery Procedure When Adding Controller Chassis Fails

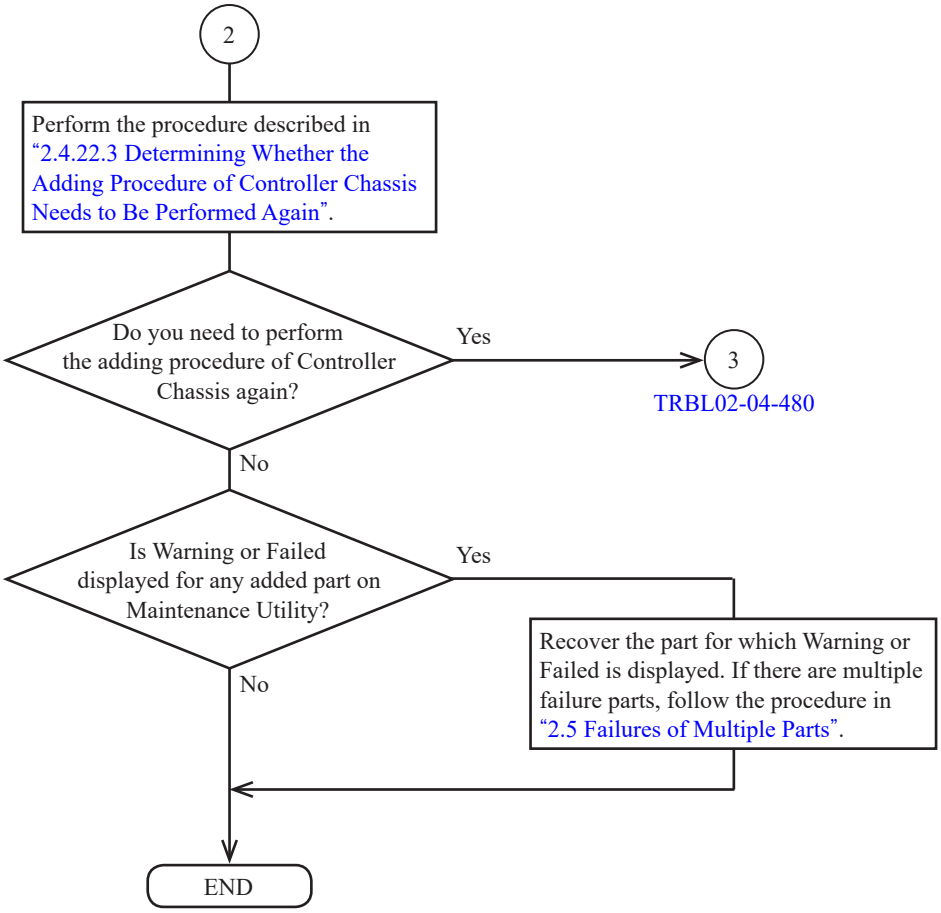


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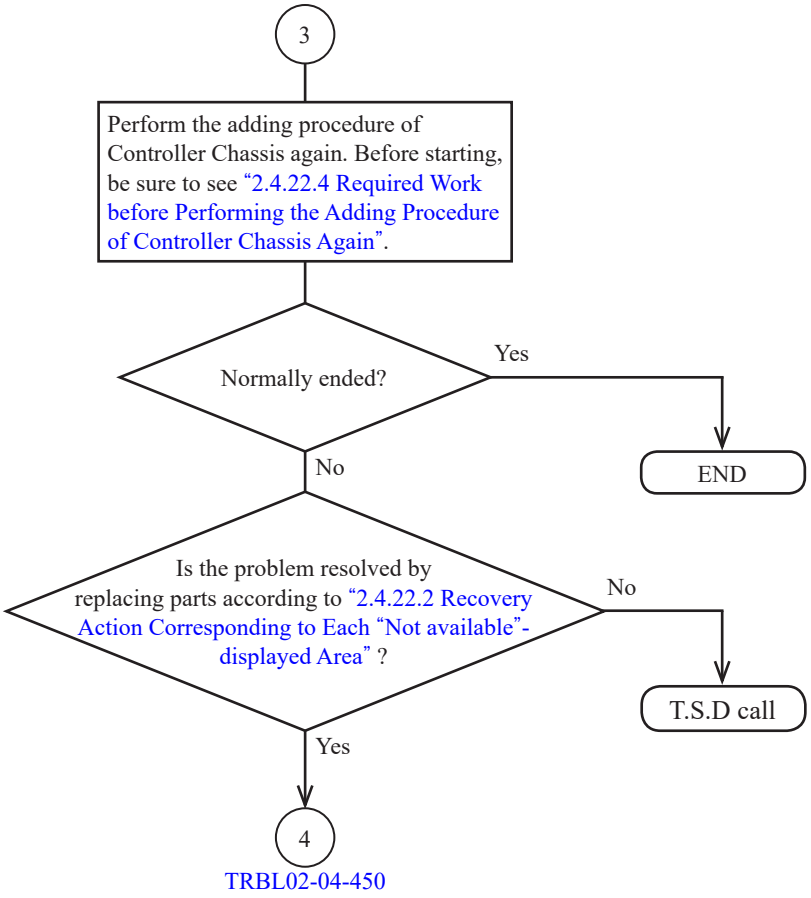


*1: During the adding procedure of Controller Chassis, a failure might be detected in an added part while the part seems to be not installed in the Maintenance Utility window.
If, in such a case, you cannot perform the recovery action for the part indicated by SIM, you do not need to do the recovery action. Just complete the SIM log (see (SVP02-08-10)).

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2.4.22.2 Recovery Action Corresponding to Each "Not available"-displayed Area

In the Controller Chassis Installation Results, confirm the area in which "Not available" is displayed, and perform the corresponding recovery action shown in the table below.
When "Checking" is displayed for some parts, the judgement of "Available" or "Not available" for the parts is in progress. After performing recovery actions for the parts for which "Not available" is displayed, perform the "2.4.22.4 Required Work before Performing the Adding Procedure of Controller Chassis Again".
If the problem persists, any of the added parts might have a failure.
In such a case, perform the "2.4.22.4 Required Work before Performing the Adding Procedure of Controller Chassis Again" again by using a new part in place of the part that has a failure.

Area in which "Not available" is displayed	Cause of failure	Recovery action
X-path Connection	• Wrong connection or poor contact of X-path • Wrong installation location or poor contact of HIE • Poor contact of CTL	Perform all the following five steps in order: 1. Check the connection destination of the X-path cable for which "Not available" is displayed. If the X-path cable is connected to a wrong destination, correct the connection without operating Maintenance Utility. 2. If "Not available" is displayed for all X-path cables connected to HIEs installed in a particular CTL, remove the CTL, and insert it fully, without operating Maintenance Utility. 3. If "Not available" is displayed for all X-path cables connected to a particular HIE, check that the HIE is installed in the correct location. Then, remove the HIE, and insert it fully, without operating Maintenance Utility. 4. If "Not available" is displayed for a single X-path cable, remove the X-path cable, and insert it fully, without operating Maintenance Utility. 5. "Not available" might be displayed due to a failure in a CTL/HIE/ISW/X-path that is already installed before the adding procedure. Check the status of those parts in the Maintenance Utility window. If "Failed" or "Warning" is displayed, perform "3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx)".
	Failure in other than the added part	
CTL Boot	• Installation rule infringement of Cache/CFM • Poor contact of CTL	Check whether Cache/CFM are correctly installed in the CTL for which "Not available" is displayed, according to "Cache Memory Installation Pattern" (INST(GE)03-04-30). Then, remove the CTL, and insert it fully, without operating Maintenance Utility.
Cache Configuration	Installation rule infringement or poor contact of Cache/CFM	Check whether the type and number of Cache/CFM, for which "Not available" is displayed, in a CBX pair match the installation rule shown in (INST(GE)03-04-30). Remove Cache/CFM, and insert Cache/CFM fully, without operating Maintenance Utility.
CFM Configuration		
Battery Charge	• Wrong installation location or poor contact of battery • Lack of battery charge	Perform all the following two steps in order: 1. Check whether the installation locations of both batteries in the CTL for which "Not available" is displayed are correct. Then, remove the batteries, and insert them fully, without operating Maintenance Utility. 2. The batteries in the CTL might be not sufficiently charged. Wait for 180 minutes, or until the STATUS LEDs (LOC03-80) on the CTL change from blinking (charge is in process) to on (charge is complete).
Battery Configuration	Wrong installation location or poor contact of battery	Check whether batteries are installed in correct locations in the CTL for which "Not available" is displayed. Remove batteries, and insert them fully, without operating Maintenance Utility.

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2.4.22.3 Determining Whether the Adding Procedure of Controller Chassis Needs to Be Performed Again

Follow the method shown below to determine whether the adding procedure of Controller Chassis needs to be performed again.

○ Determination based on the part status display in the Maintenance Utility window

In the Maintenance Utility window of a CTL other than the target CTLs for the adding procedure, check the part installation status.

- When all the target parts (CTL/Cache/CFM/Battery/HIE) for the adding procedure are displayed as if they are not installed

  Perform the adding procedure of Controller Chassis again.

- When all the target parts (CTL/Cache/CFM/Battery/HIE) for the adding procedure are displayed as if they are installed and the statuses of all target CTLs for the adding procedure are “Failed” or “Warning”

  Perform the adding procedure of Controller Chassis again after removing Controller Chassis.

- When all the target parts (CTL/Cache/CFM/Battery/HIE) for the adding procedure are displayed as if they are installed and the status of any of the target CTLs for the adding procedure is “Normal”

  You do not need to perform the adding procedure of Controller Chassis again.

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2.4.22.4 Required Work before Performing the Adding Procedure of Controller Chassis Again

> **⚠ CAUTION**
>
> Take extra care not to accidentally disconnect power supply to Controller Chassis in operation.

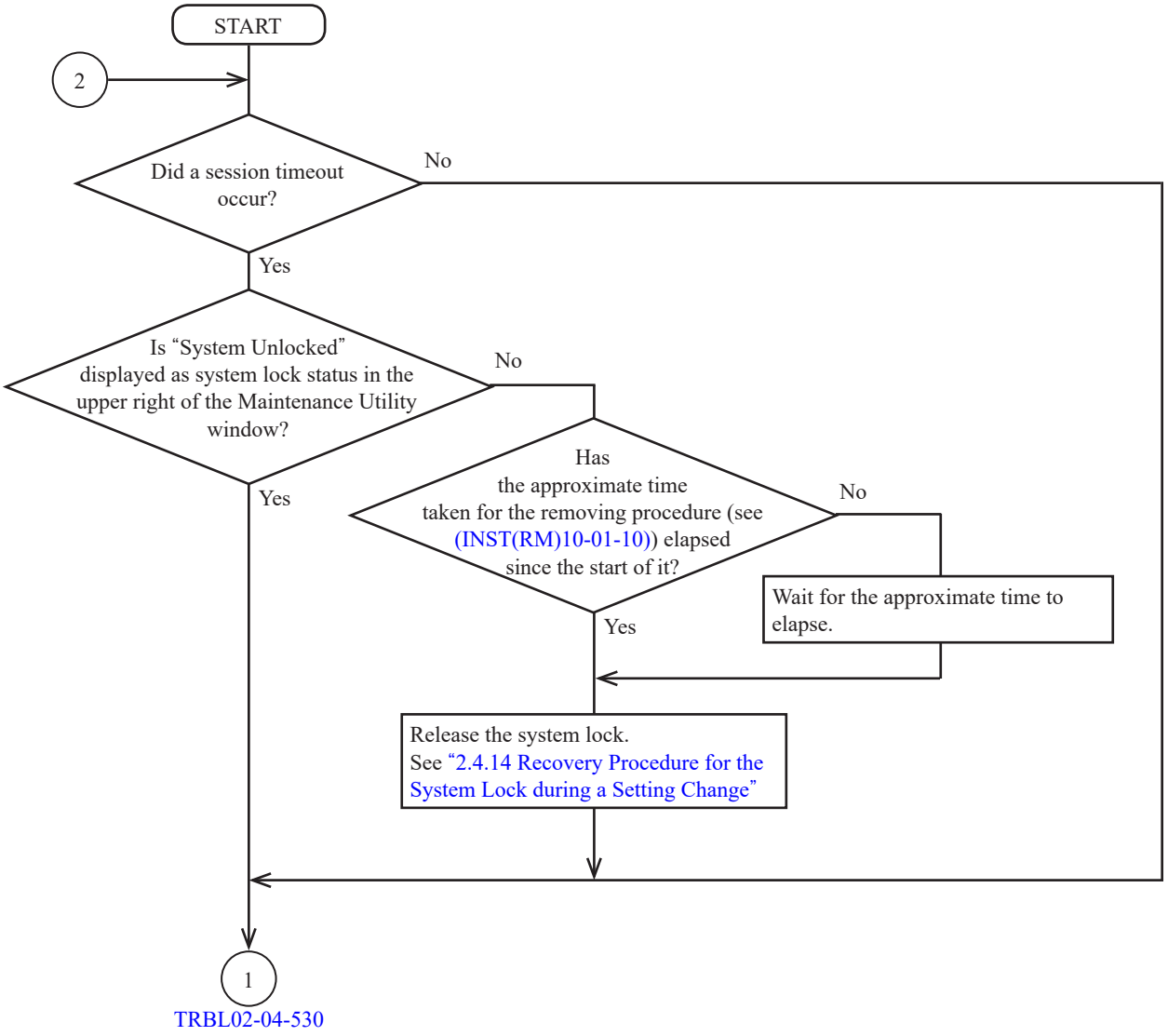
When performing the adding procedure of Controller Chassis again after the adding procedure fails, disconnect power supply to the target Controller Chassis for the adding procedure once by following the steps below.

1. Remove the AC cables from the power supplies in the target Controller Chassis for the adding procedure.
2. Wait for the BACKUP STS LED on the CTL to go off.
   *: It takes up to about 20 minutes until the LED goes off.
3. Connect the removed AC cables to the power supplies in the target Controller Chassis for the adding procedure.
4. Perform the adding procedure of Controller Chassis (INST(AD)12-01-10).

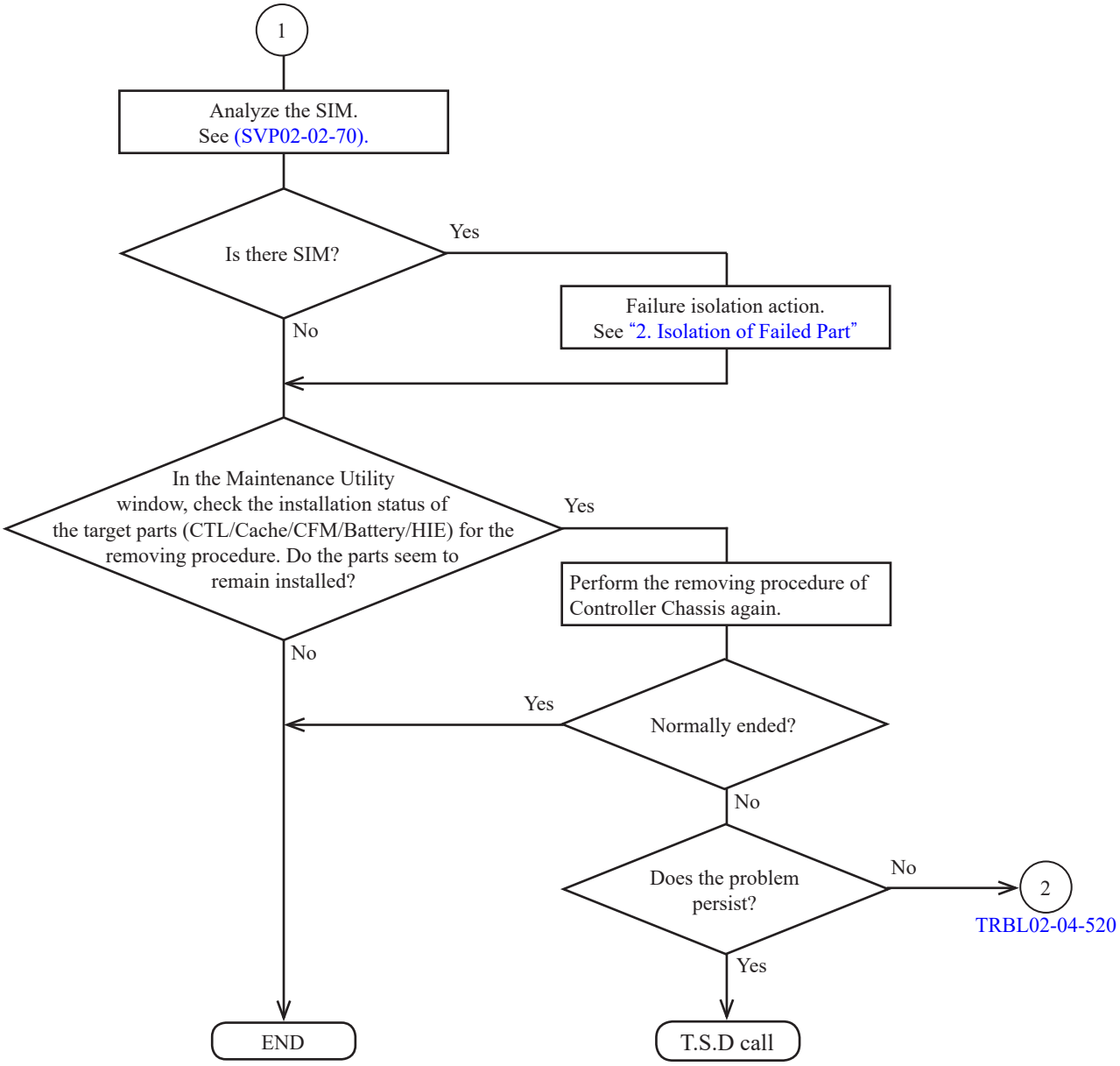
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2.4.23 Troubleshooting When Removing Controller Chassis

2.4.23.1 Recovery Procedure When Removing Controller Chassis Fails



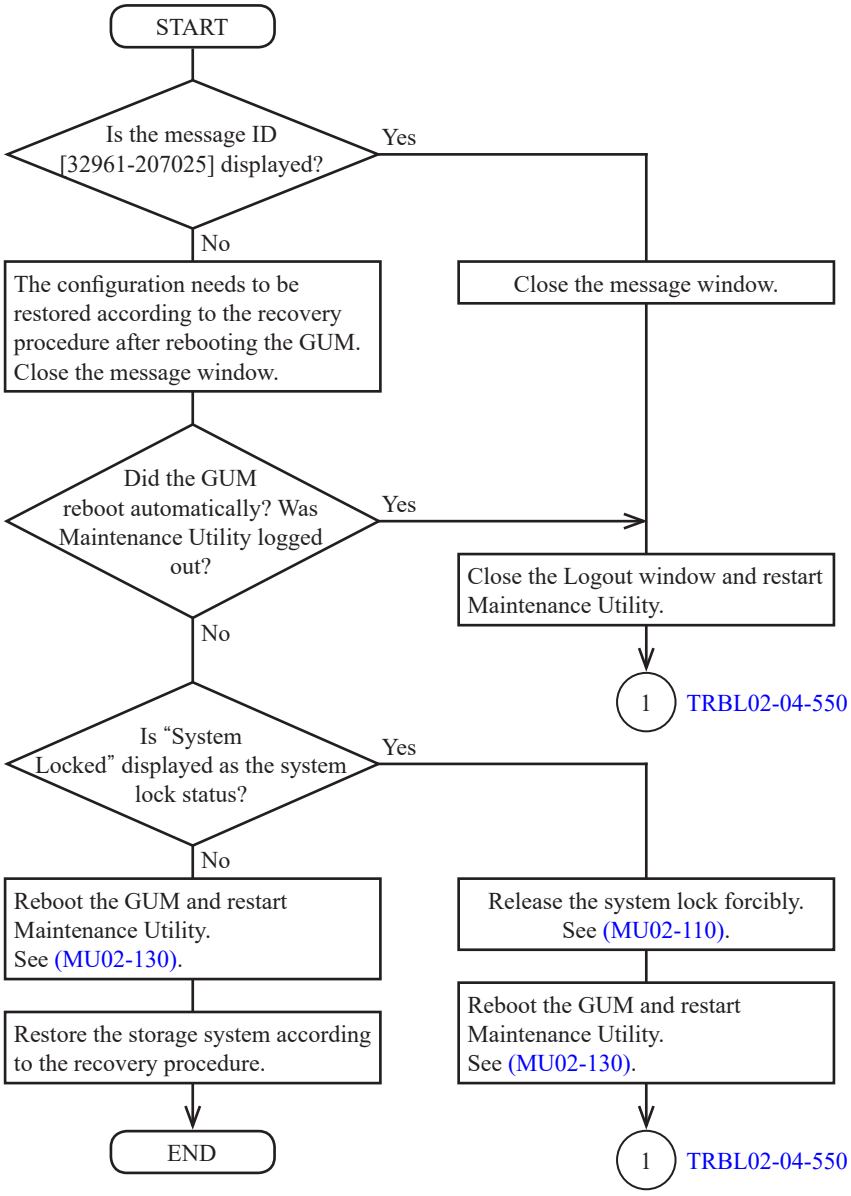
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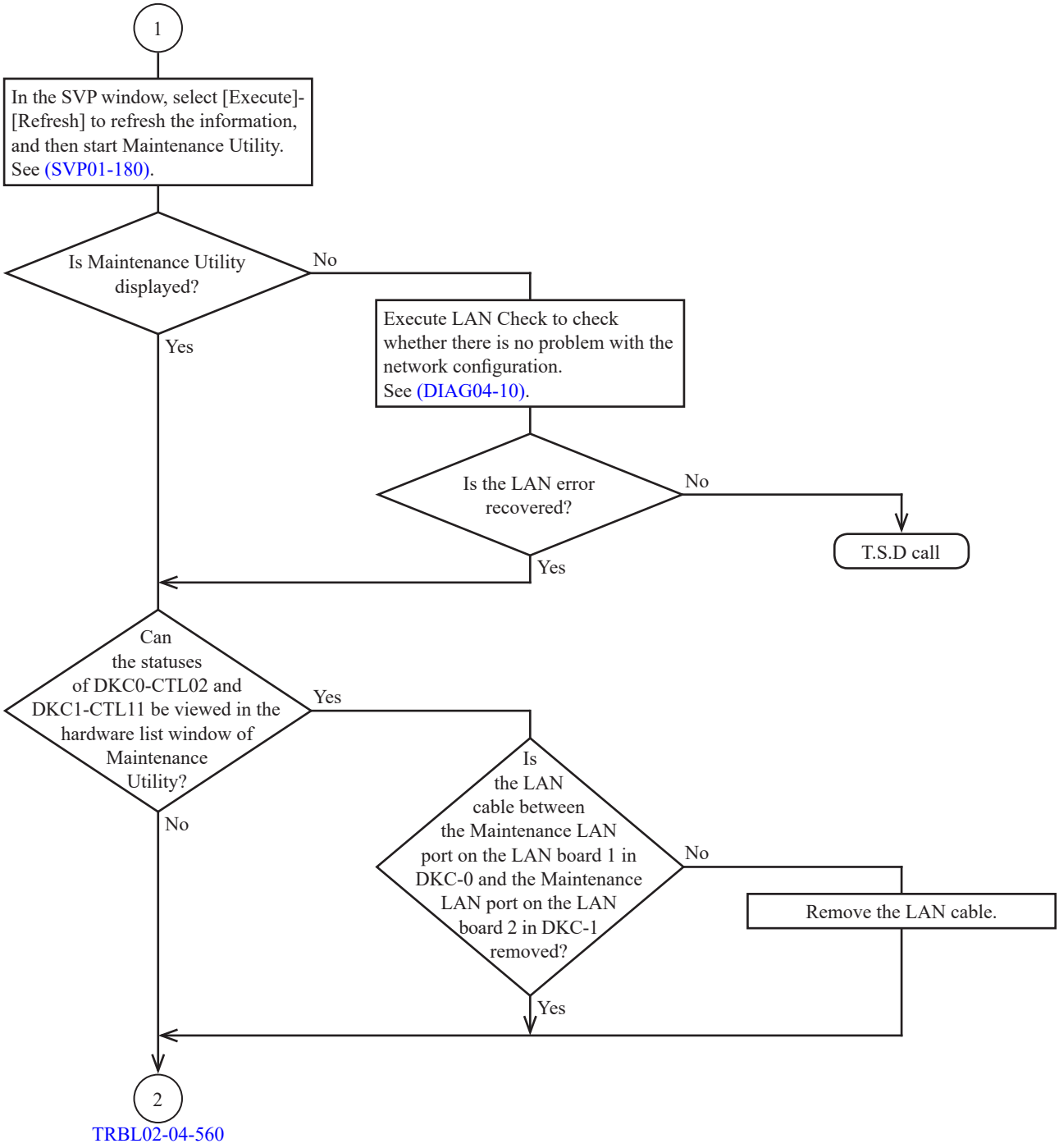
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2.4.24 Troubleshooting When Adding Controller Board

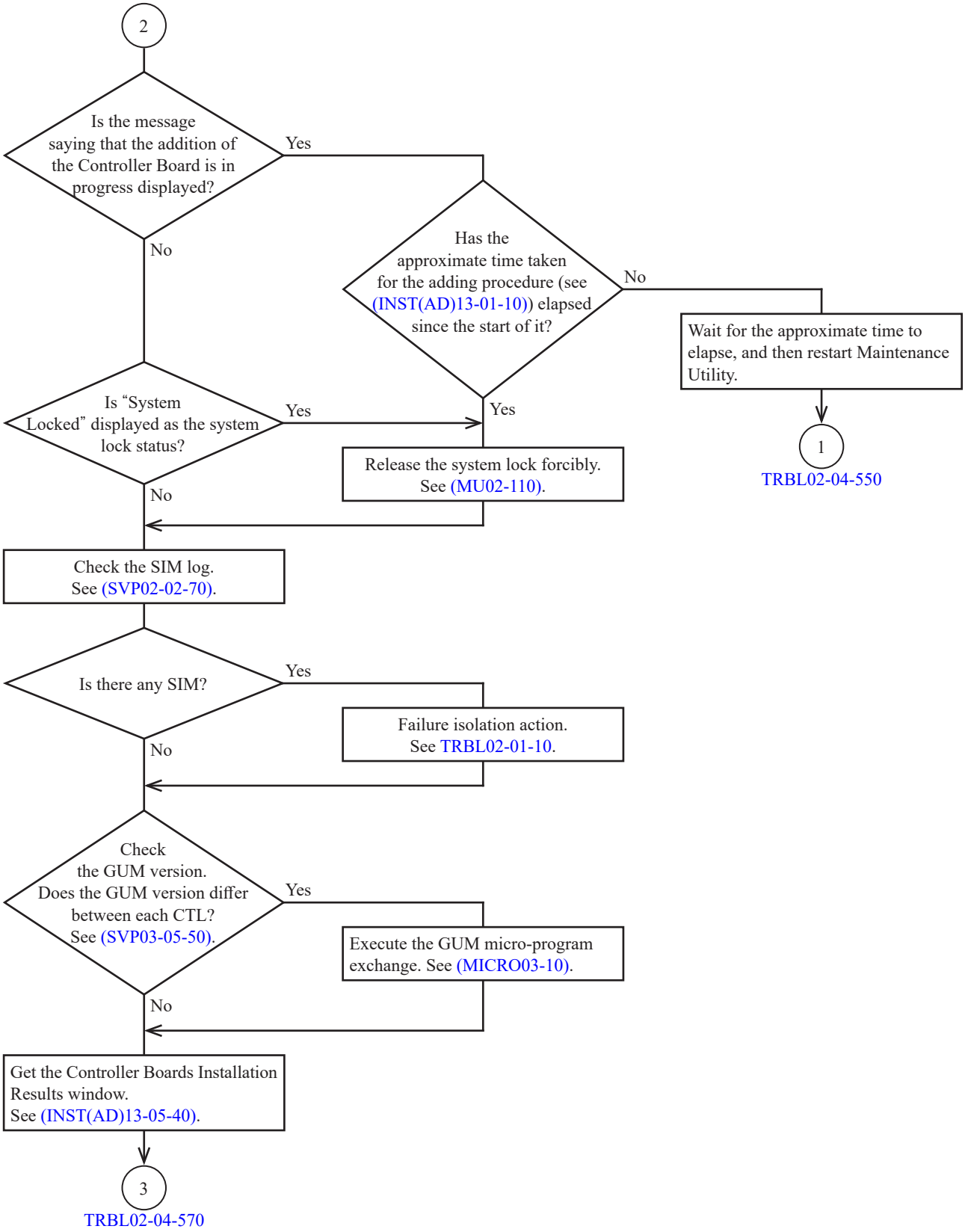
2.4.24.1 Recovery Procedure When Adding Controller Board Fails



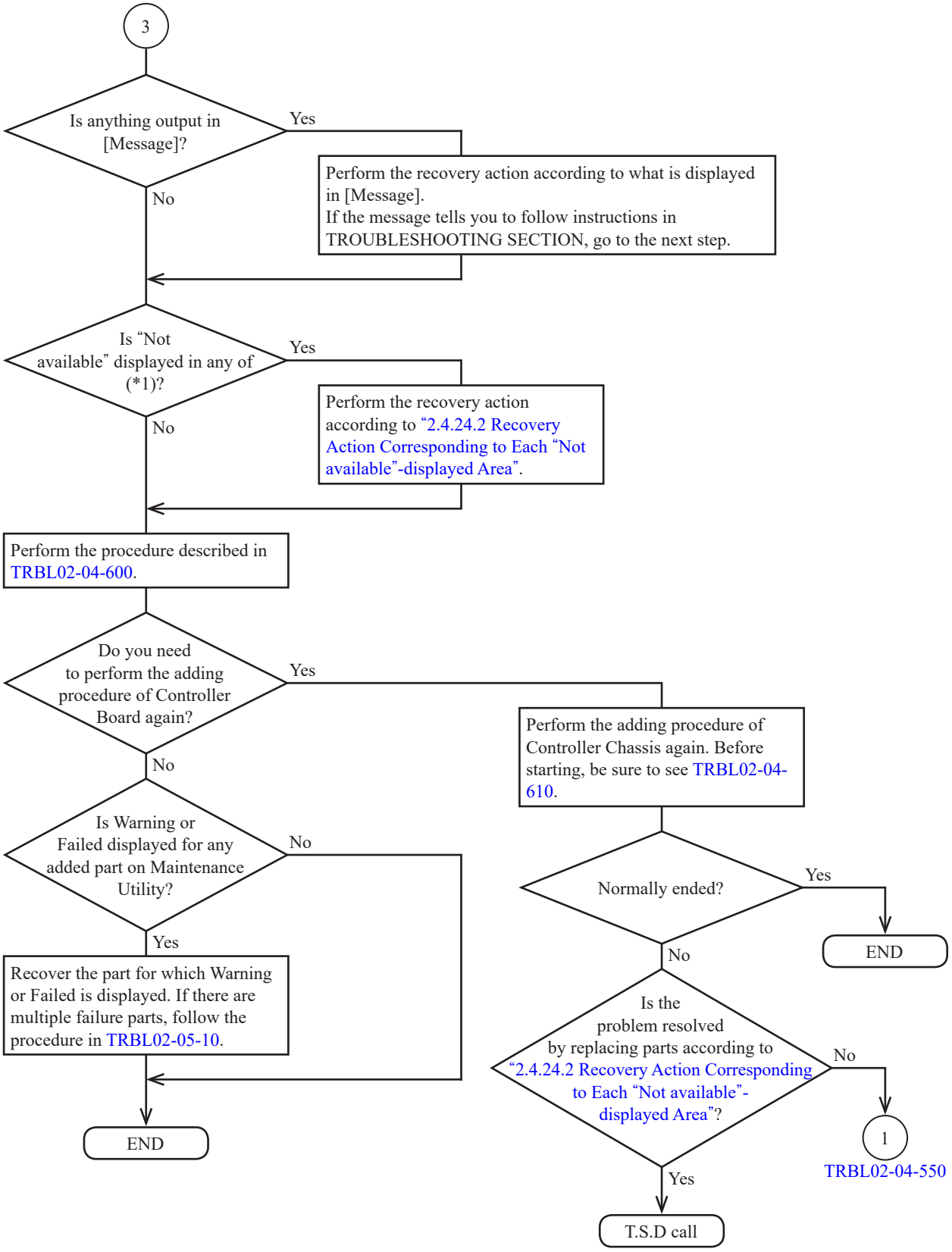
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*1: [X-path Connection], [CTL Boot], [Cache Configuration], [CFM Configuration], [Battery Charge & Configuration], [CHB Configuration], [DKB Configuration]

2.4.24.2 Recovery Action Corresponding to Each "Not available"-displayed Area

Perform the recovery action according to the area in which "Not available" is displayed.
If "Checking" is displayed, the area is not judged yet. After performing the recovery action of the area in which "Not available" is displayed, perform the adding procedure of Controller Board again.

Area in which "Not available" is displayed	Cause of failure	Recovery action
X-path Connection	• Wrong connection or poor contact of X-path • Wrong installation location or poor contact of HIE • Poor contact of CTL	Perform all the following five steps in order: 1. Check the connection destination of the X-path cable for which "Not available" is displayed. If the X-path cable is connected to a wrong destination, correct the connection without operating Maintenance Utility. 2. If "Not available" is displayed for all X-path cables connected to HIEs installed in a particular CTL, remove the CTL, and insert it fully, without operating Maintenance Utility. 3. If "Not available" is displayed for all X-path cables connected to a particular HIE, check that the HIE is installed in the correct location. Then, remove the HIE, and insert it fully, without operating Maintenance Utility. 4. If "Not available" is displayed for a single X-path cable, remove the X-path cable, and insert it fully, without operating Maintenance Utility. 5. "Not available" might be displayed due to a failure in a CTL/HIE/ISW/X-path that is already installed before the adding procedure. Check the status of those parts in the Maintenance Utility window. If "Failed" or "Warning" is displayed, perform "3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx)".
	Failure in other than the added part	
CTL Boot	Poor contact of CTL	Remove and insert the CTL for which "Not available" is displayed without operating Maintenance Utility, and fix it firmly.
Cache Configuration CFM Configuration	Installation rule infringement or poor contact of Cache/CFM	Check whether the type and number of Cache/CFM, for which "Not available" is displayed, in a CBX pair match the installation rule shown in (INST(GE)03-04-30). Then, remove and insert Cache/CFM without operating Maintenance Utility, and fix them firmly.
Battery Charge	Lack of battery charge	The batteries in the CTL for which "Not available" is displayed are not sufficiently charged. Wait for up to 180 minutes until the STATUS LEDs (LOC03-80) change from blinking (charge is in process) to on (charge is complete).
Battery Configuration	Wrong installation location or poor contact of battery	Check whether batteries are installed in correct locations in the CTL for which "Not available" is displayed. Remove batteries, and insert them fully, without operating Maintenance Utility.

(To be continued)

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(Continued from the preceding page)

Area in which "Not available" is displayed	Cause of failure	Recovery action
CHB Configuration	Wrong installation location, wrong type, or poor contact of CHB	Check whether the installation location of the CHB for which "Not available" is displayed is correct and whether the CHBs installed in the same locations in two CBXs in a pair are the same type. Then, remove and insert the CHB without operating Maintenance Utility, and fit it firmly.
DKB Configuration	Wrong installation location, wrong type, or poor contact of DKB	Check whether the installation location of the DKB for which "Not available" is displayed is correct and whether all DKBs installed in the CBX pair are the same type. Then, remove and insert the DKB without operating Maintenance Utility, and fit it firmly.

After performing the recovery action, retry the adding procedure of Controller Board.
If the problem persists even after performing the recovery action, the Controller Board might be faulty. In such a case, replace the Controller Board with a new one, and then retry the adding procedure of Controller Board.

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2.4.24.3 Determining Whether the Adding Procedure of Controller Board Needs to Be Performed Again

Follow the method shown below to determine whether the adding procedure of Controller Board needs to be performed again.

○ Determination based on the part status display in the Maintenance Utility window

In the Maintenance Utility window of a Controller Board other than the target Controller Boards for the adding procedure, check the part installation status.

- When all the target parts (CTL/Cache/CFM/Battery/HIE/CHB/DKB) for the adding procedure are displayed as if they are not installed

  Perform the adding procedure of Controller Board again.

- When all the target parts (CTL/Cache/CFM/Battery/HIE/CHB/DKB) for the adding procedure are displayed as if they are installed and the statuses of all target Controller Boards for the adding procedure are “Failed” or “Warning”

  Perform the adding procedure of Controller Board again after removing Controller Board.

- When all the target parts (CTL/Cache/CFM/Battery/HIE/CHB/DKB) for the adding procedure are displayed as if they are installed and the status of any of the target Controller Boards for the adding procedure is “Normal”

  You do not need to perform the adding procedure of Controller Board again.

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2.4.24.4 Required Work before Performing the Adding Procedure of Controller Board Again

> **⚠ CAUTION**
>
> Be careful not to remove and install a Controller Board in operation.

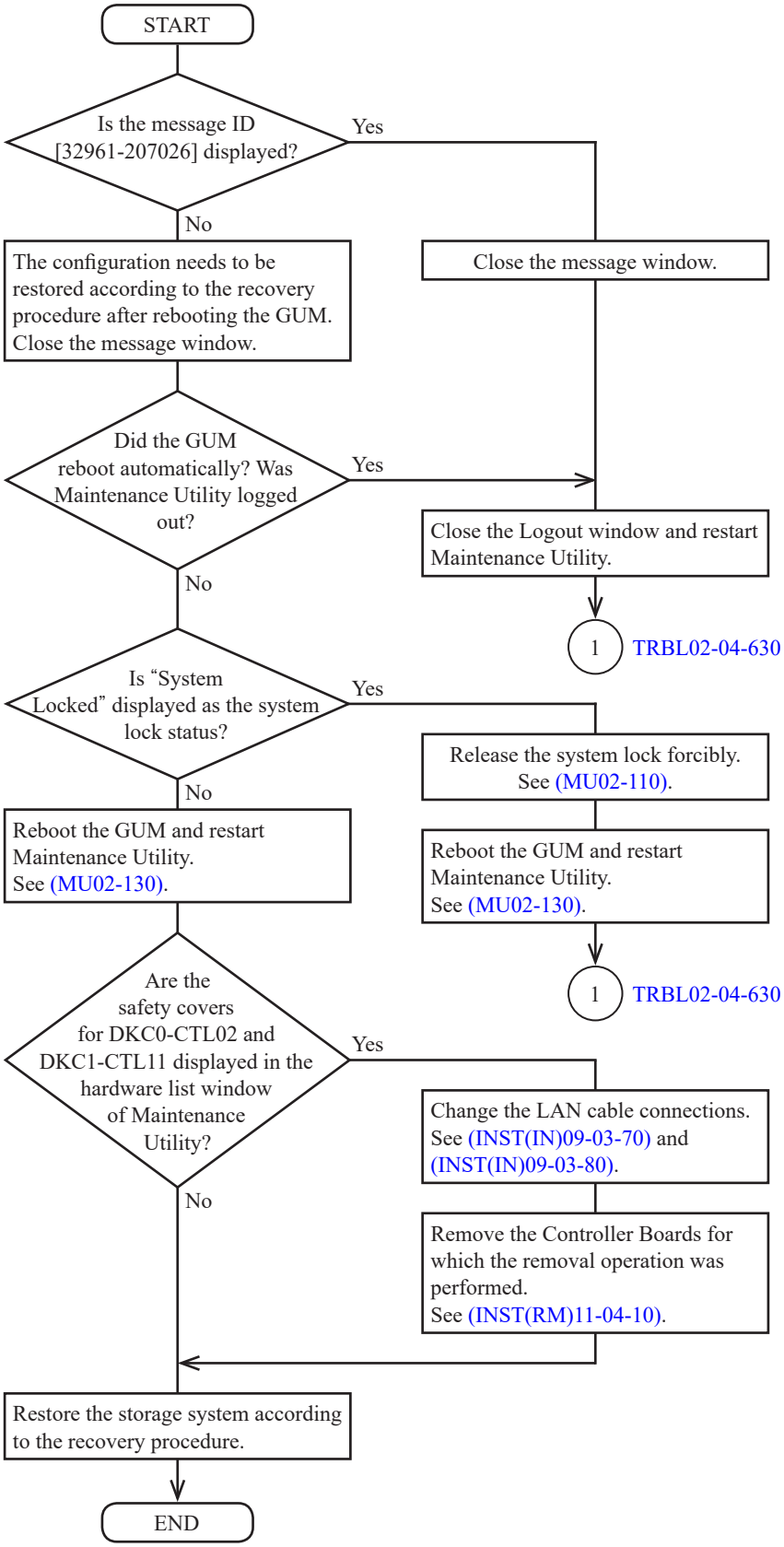
If the adding procedure of Controller Board fails and you retry the procedure, you need to remove the Controller Board and install it again.
Perform the following steps.

1. Remove the target Controller Board for the adding procedure from the DKC.
2. Install the target Controller Board for the adding procedure in the DKC.
3. Perform the adding procedure of Controller Board (INST(AD)13-01-10).

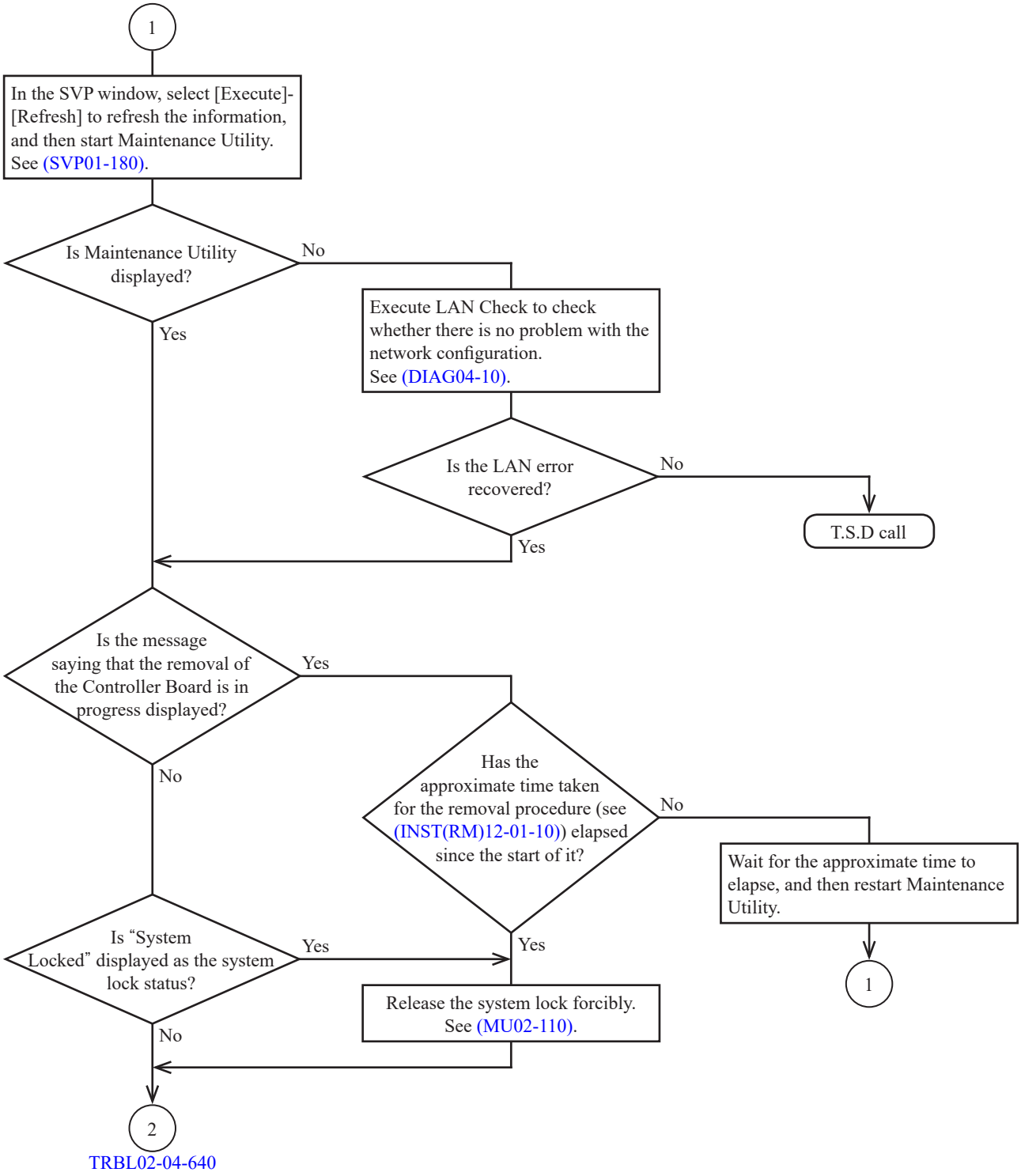
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2.4.25 Troubleshooting When Removing Controller Board

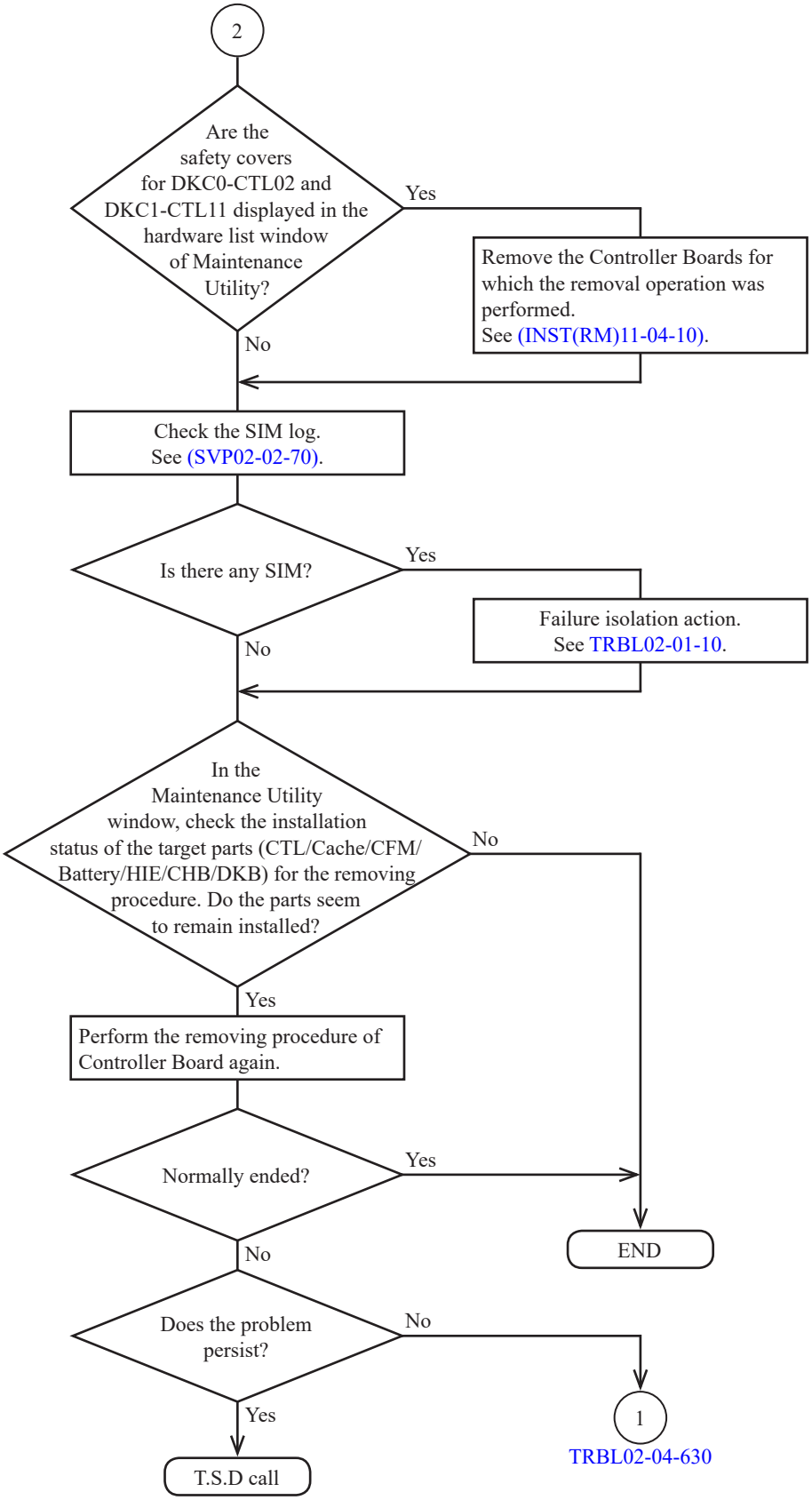
2.4.25.1 Recovery Procedure When Removing Controller Board Fails



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2.5 Failures of Multiple Parts

When failures have occurred in multiple parts and actions need to be taken during the system operation, perform maintenance actions in order of higher priority regardless of the error levels of SIMs. The smaller number in the "priority" column in Table 2-2 in this page indicates the higher priority. For more details of the order of maintenance actions, see "Maintenance priority flow" on the next page.
However, if the following SIMs are reported, take action to recover these SIMs first.

- When the DKCPS warning (SIM = af200x) is reported, preferentially perform the operation described in "3.19 PS Warning Error (af20xx, af51xx, af52xx, afb1xx, af21xx, af61xx, af62xx, afb3xx)".
- When the CPU abnormal temperature (SIM = af10xx) is reported, perform "3.24 Response to the Detection of CPU Abnormal Temperature (SIM = af100x)".

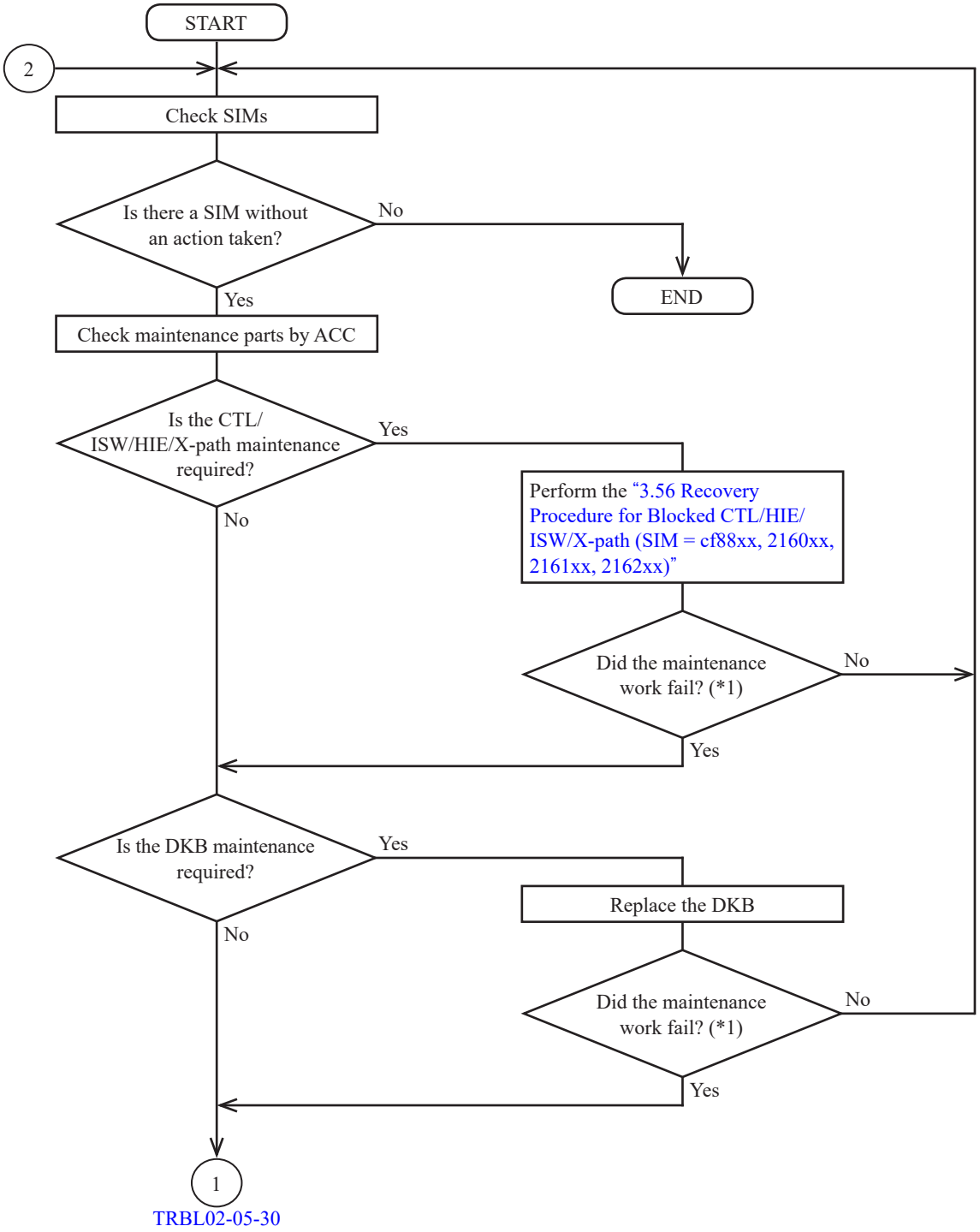
Table 2-2 Priority Table

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.		
priority (*1)	action part	maintenance work
1	CTL	Replace
	ISW	Replace
	HIE	Replace
	X-path	Replace
2	DKB	Replace
3	CHB	Replace
4	ENC	Replace
5	CFM	Replace
6	BKMF	Replace
7	LANB	Replace
8	HDD	Replace
9	LDEV	Format or Restore
10	other hardware	Replace
11	Micro-program	Replace

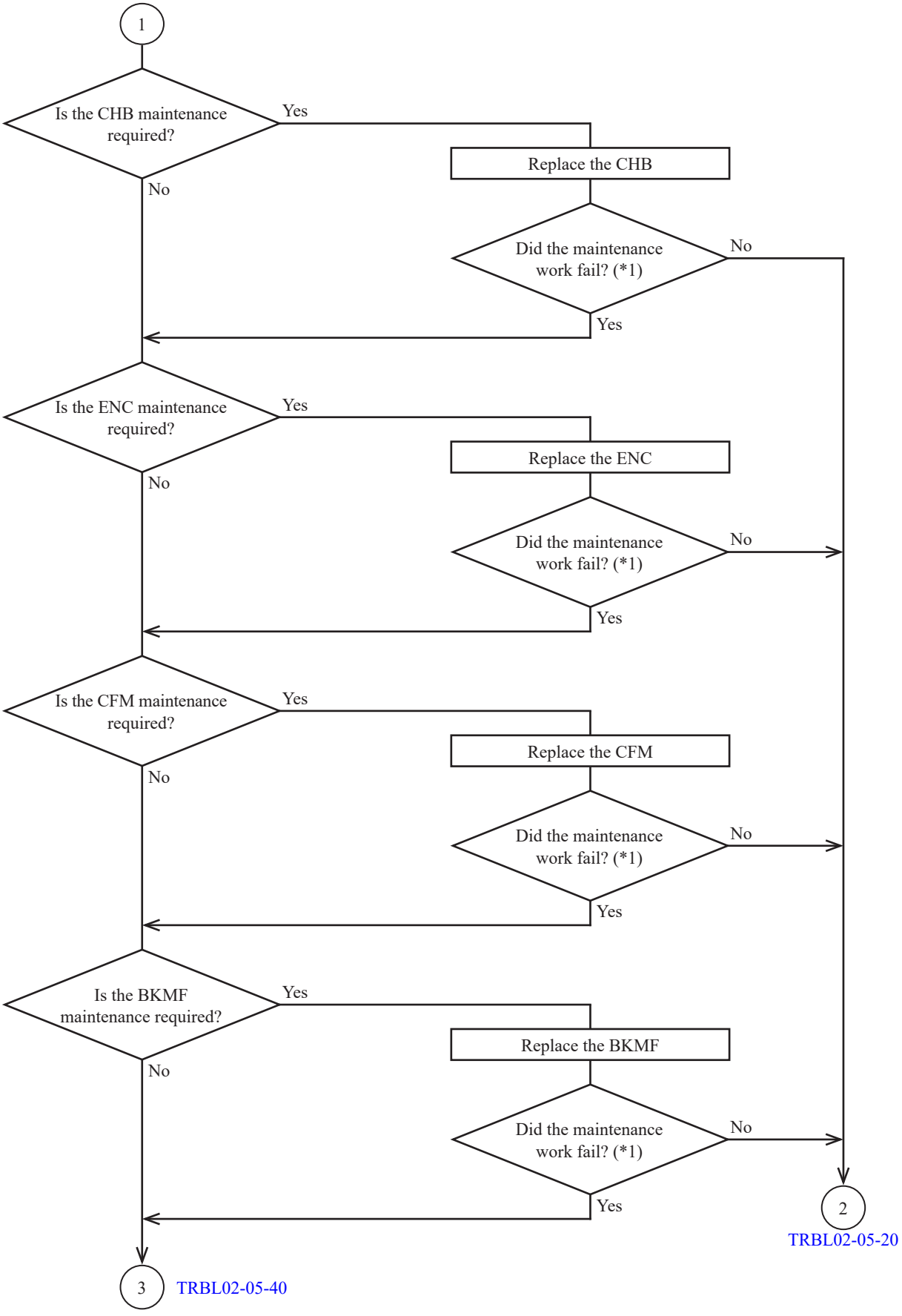
*1: Please check "Maintenance priority flow" on the next page for details.

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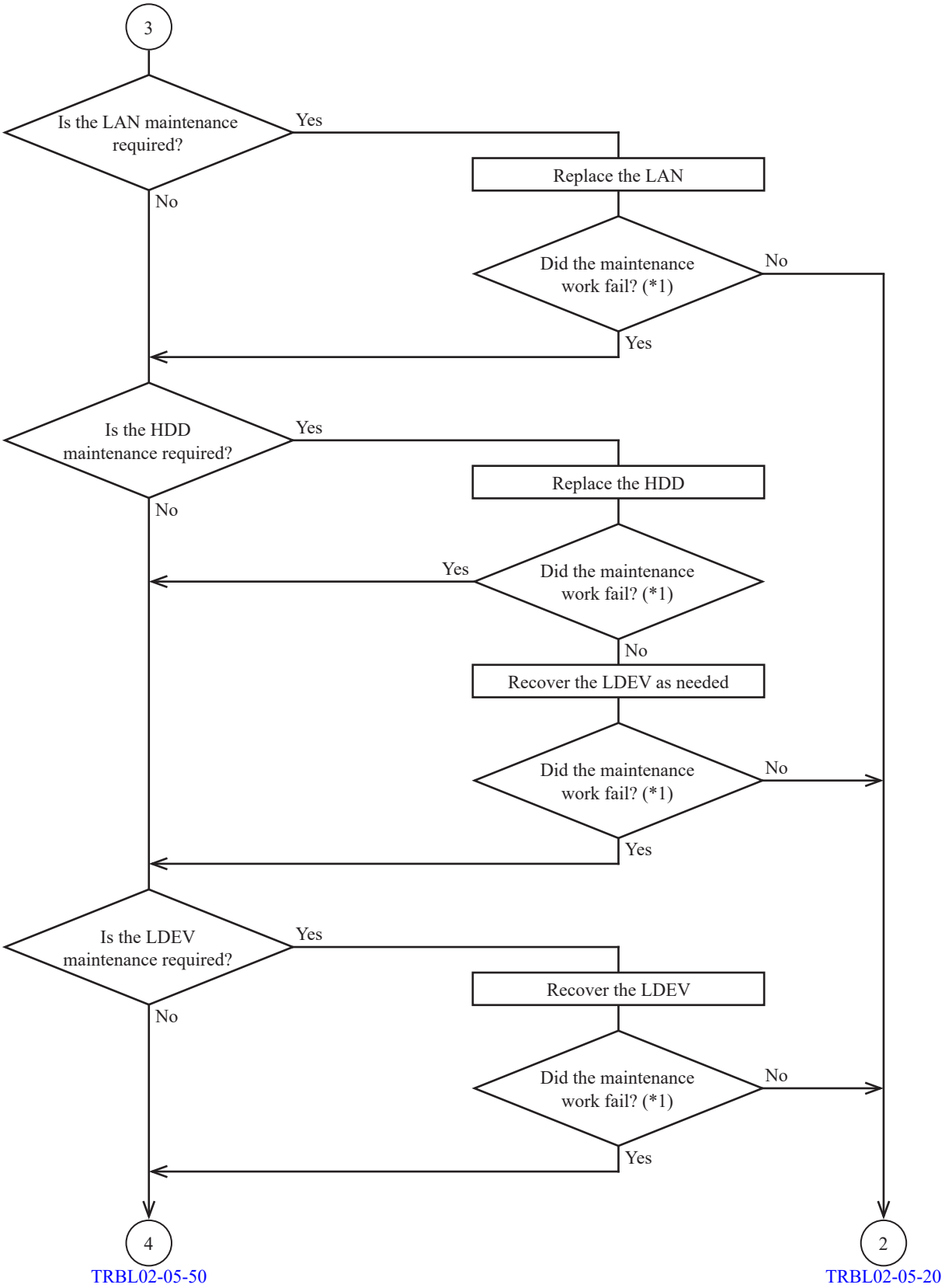
Maintenance priority flow



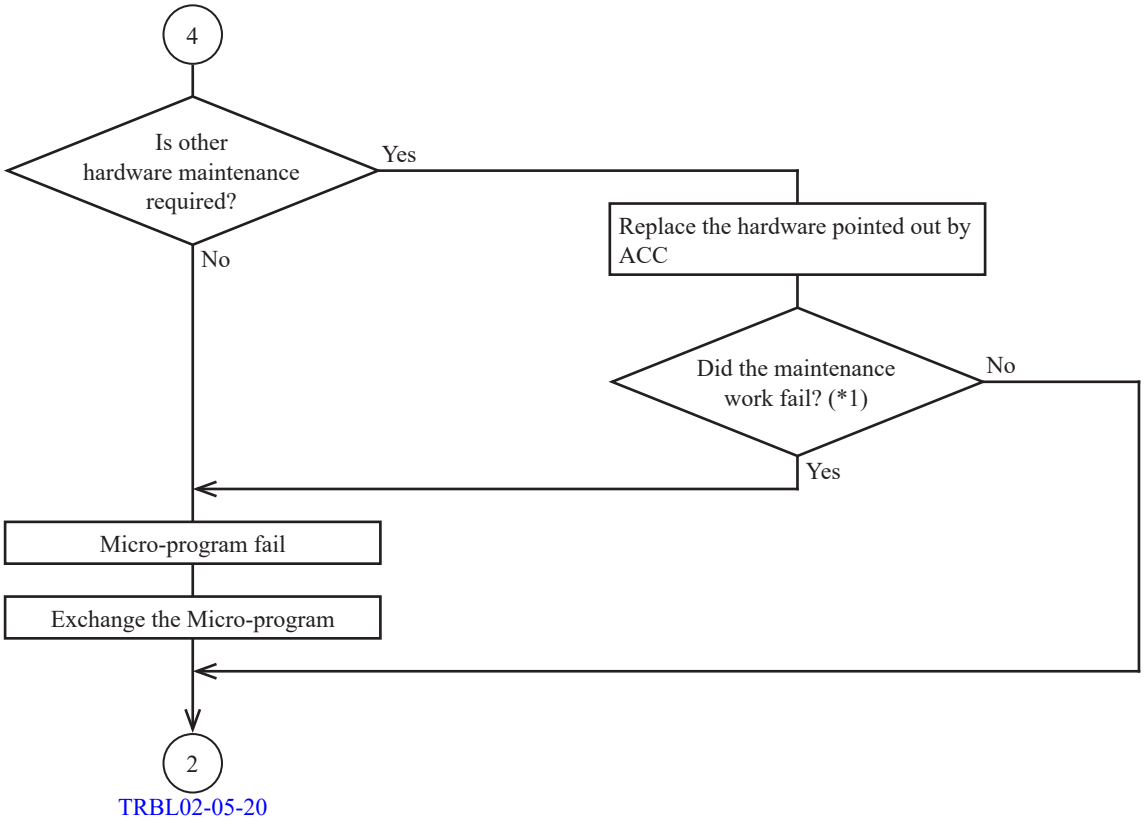
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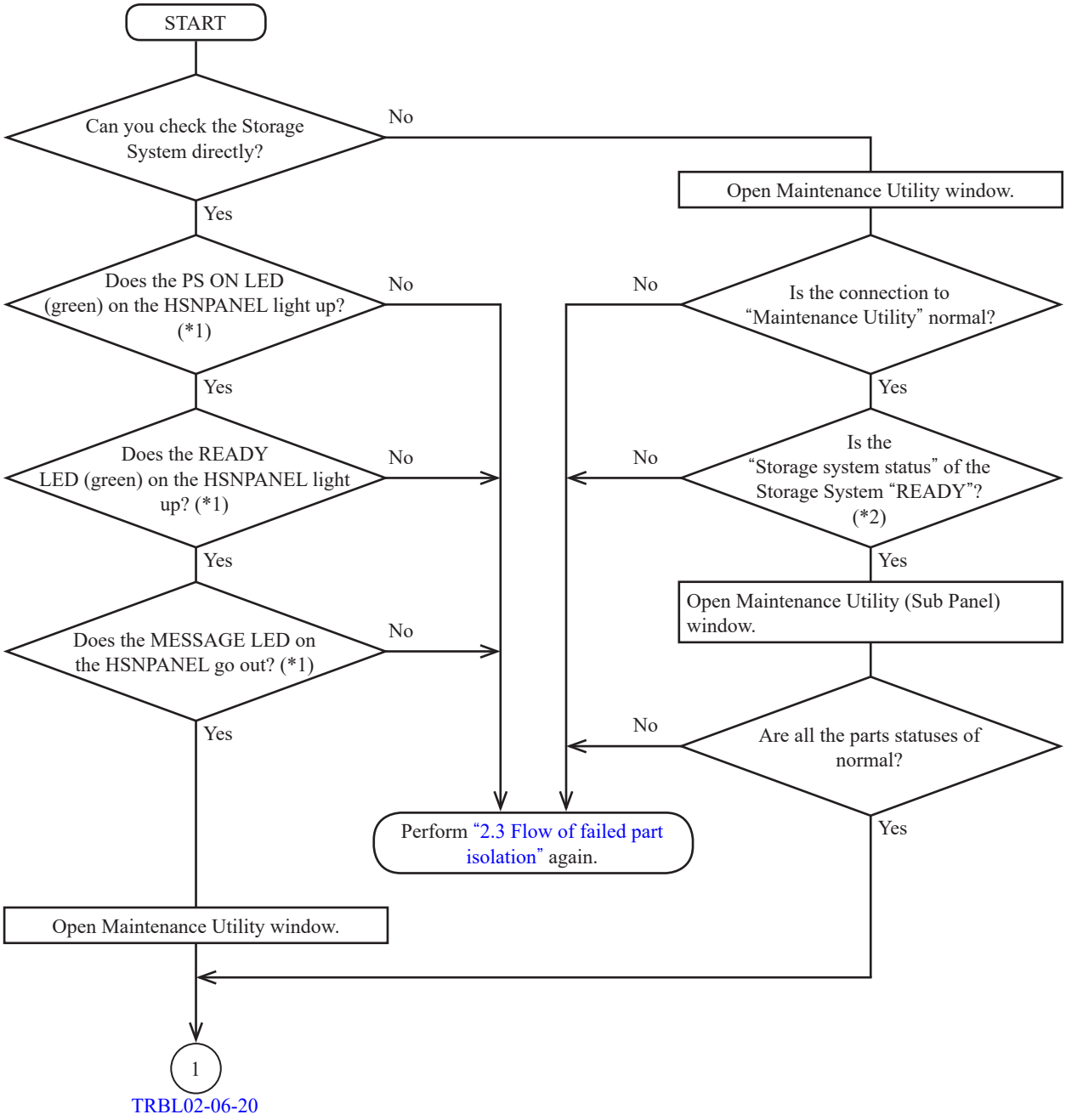


*1: Including the case when the maintenance work is suspended.

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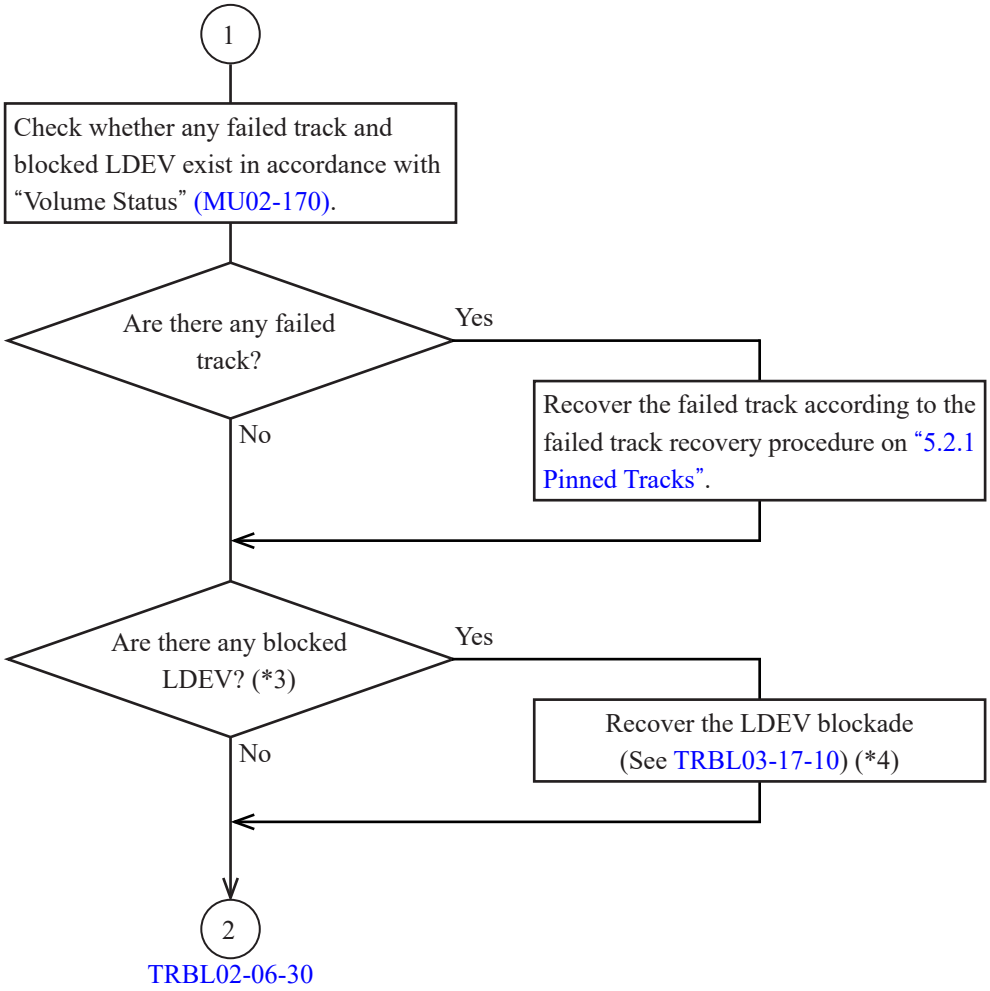
2.6 Checking Normality

Check that the storage system is in the normal state in accordance with the following flow:



*1: See "Switches and LEDs of HSNPANEL" (LOC03-10).
*2: See "Navigation Area" (MU03-30).

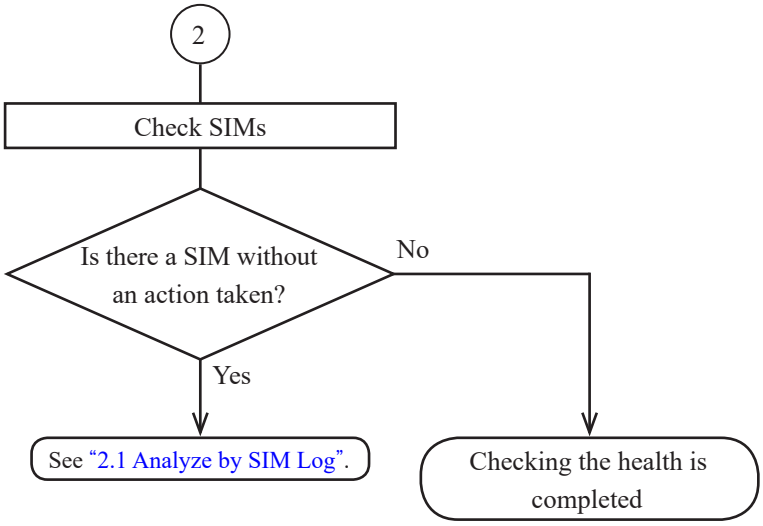
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*3: Unformatted LDEVs are out of the target. Furthermore, the customers might intentionally block the LDEVs due to the LDEV formatting or shredding. If any blocked LDEV exists, ask the customers whether the LDEV blockade needs to be recovered.

*4: A case that a contact to the Technical Support Division is necessary exists in "3.17 Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx)". When the LDEV blockade cannot be solved, be sure to contact the Technical Support Division and follow the judgment.

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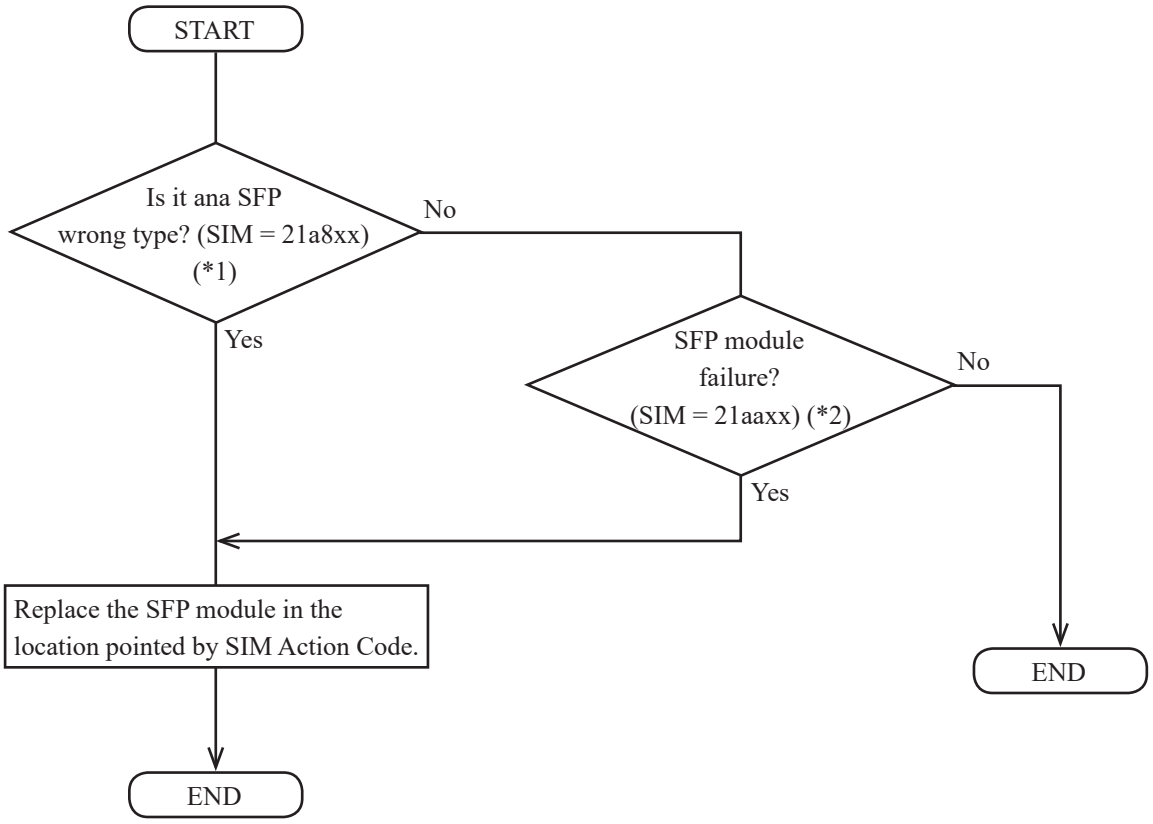


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3. Recovery Method of the Shared Platform Failure

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.

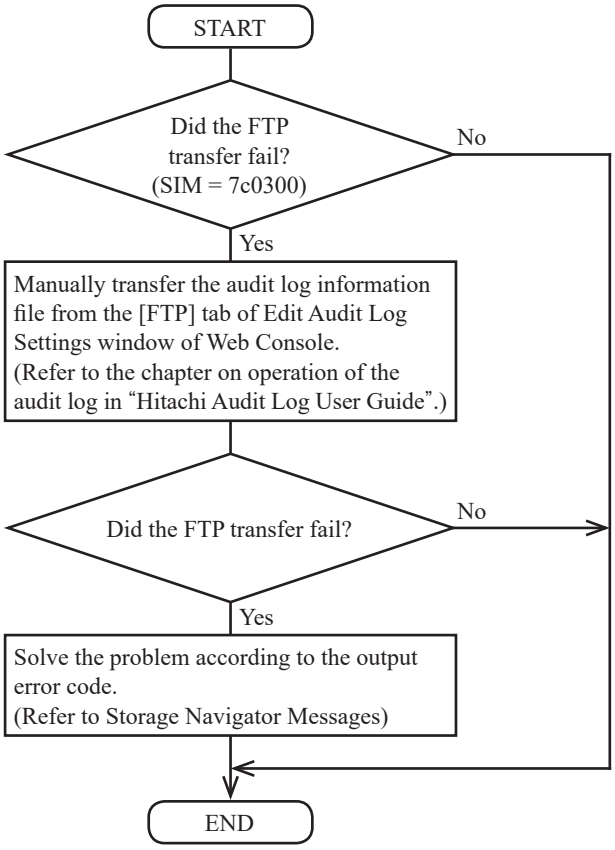
*2: SFP module failure factors
- When SFP module hardware failure is occurred.
- When an unsupported SFP transceiver is installed.

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3.2 Action When Audit Log FTP Transfer Failure Is Detected (SIM = 7c0300)

The recovery procedure when an audit log FTP transfer failure occurs is shown below.

NOTE: If the SIM is reported when the FTP servers are set to Disable in the [FTP] tab in the Edit Audit Log Settings window of Web Console , there is no problem. Just complete the SIM.



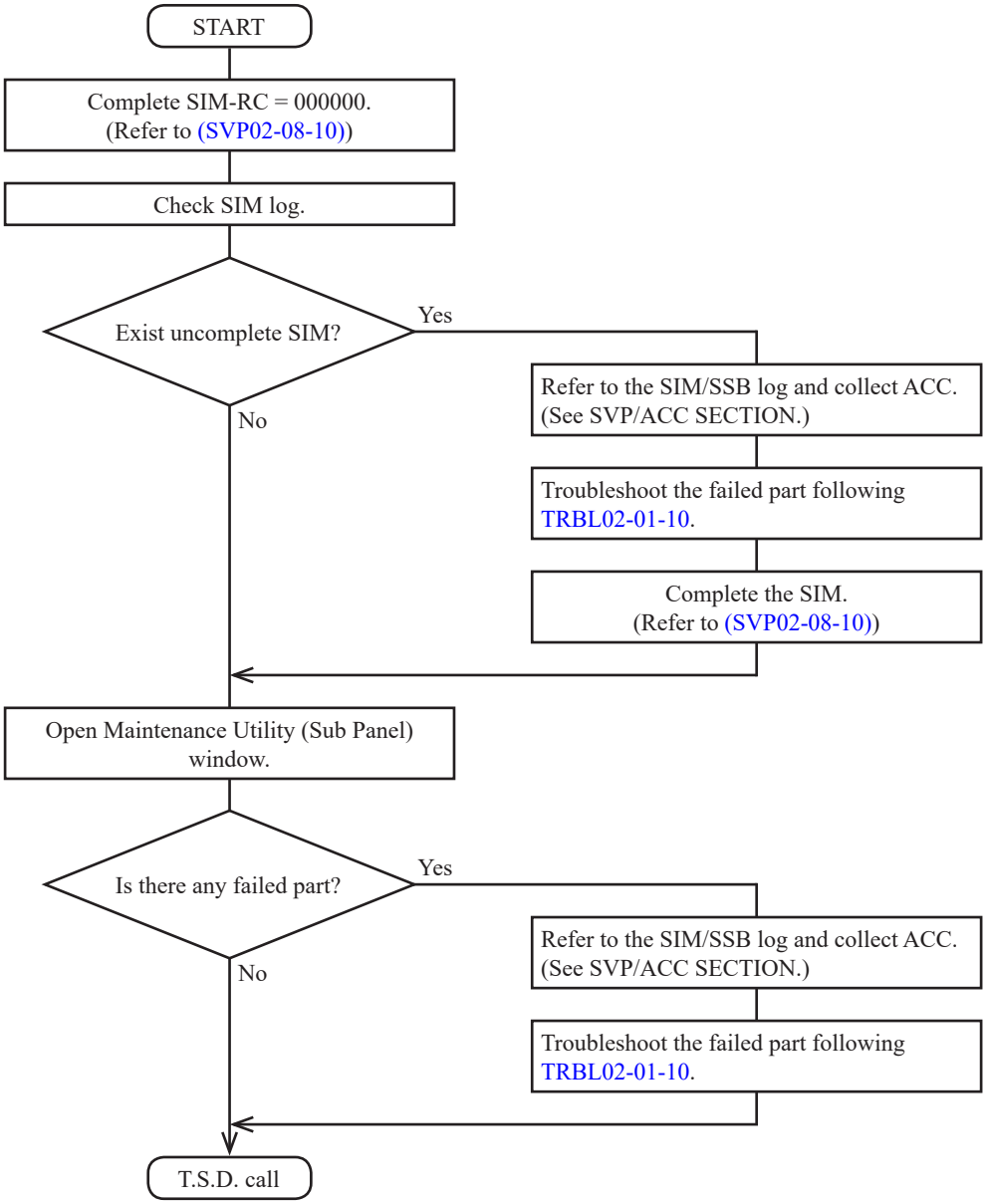
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3.3 Response to a FLASH DRIVE/ENCRYPTION PG LDEV FORMAT Failure (SIM = 41000x)

See "2.4.6 Recovery procedure when LDEV formatting failed".

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3.4 Recovery Procedure for Detected Invalid SIM Data (SIM = 7c0500)



NOTE: When SIM = 000000 is logged, SSB 3358 is logged whenever open [Information]-[Log]-[SIM] Window. If delete SIM Log (Refer to (SVP02-03-10)), the detection of this SSB stops.

3.5 Recovery when power off or SAS/NVMe PORT failure occurred (SIM = cf12xx, cf22xx, ac50xx)

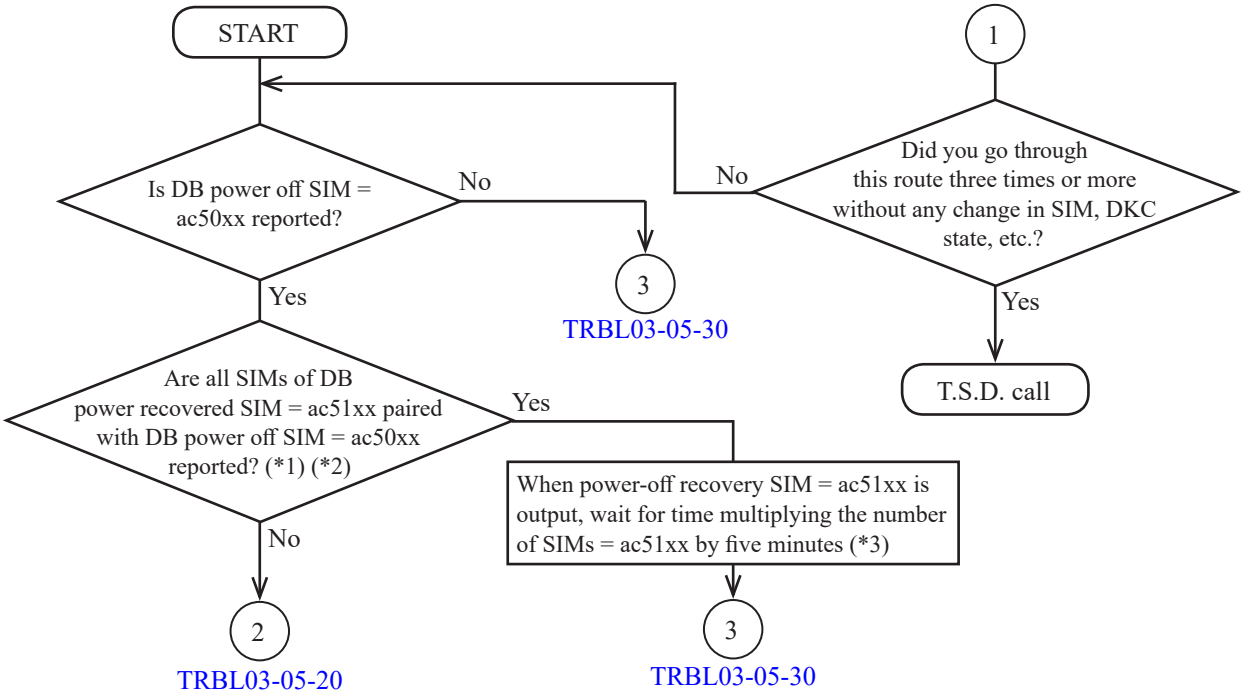
> **⚠ CAUTION**
>
> The Message ID [2585W] might be displayed during the following recovery procedure.
> Do not click [Yes] because customer data is lost.
> Contact the Technical Support Division according to the workflow.

When multiple SAS PORT blockages (SIM = cf12xx), NVMe PORT blockages (SIM = cf22xx) and DB power off (SIM = ac50xx) occur at the same time, recover them according to the following procedures.
Priorities of maintenance of parts indicated by ACC depend on the parts to be maintained. When both SIM = cf12xx, cf22xx, 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.

Maintenance parts	ac50xx	cf12xx or cf22xx
PDU breaker Switch ON	1	-
DBPS replacement	2	-
ENC replacement	6	3
DKB replacement	8	4
SAS cable/NVMe cable replacement (*1)	7	5

*1: When replacing SAS cables/NVMe cables, perform the dummy replacement of the ENCs to which the cables are connected (see (REP(RENC)00-00)).

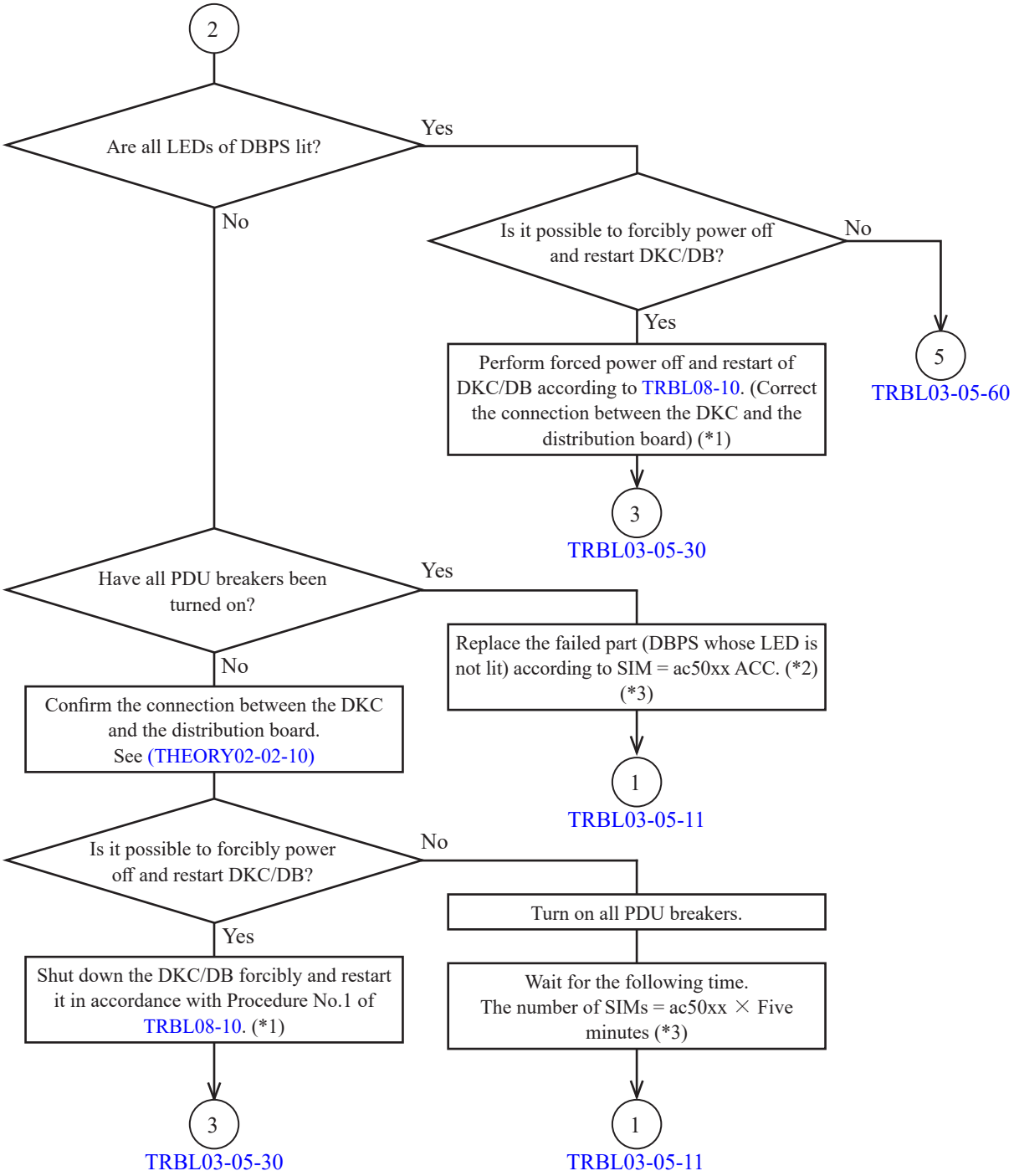
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*1: When DBPS replacement, PDU ON etc. is performed, check SIM after five minutes. "xx" in SIM = ac50xx indicates the Drive box number (hexadecimal). When DB power is recovered, SIM = ac51xx whose xx is the same as that of SIM = ac50xx is output.

*2: When all of SAS PORTS/NVMe 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.

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

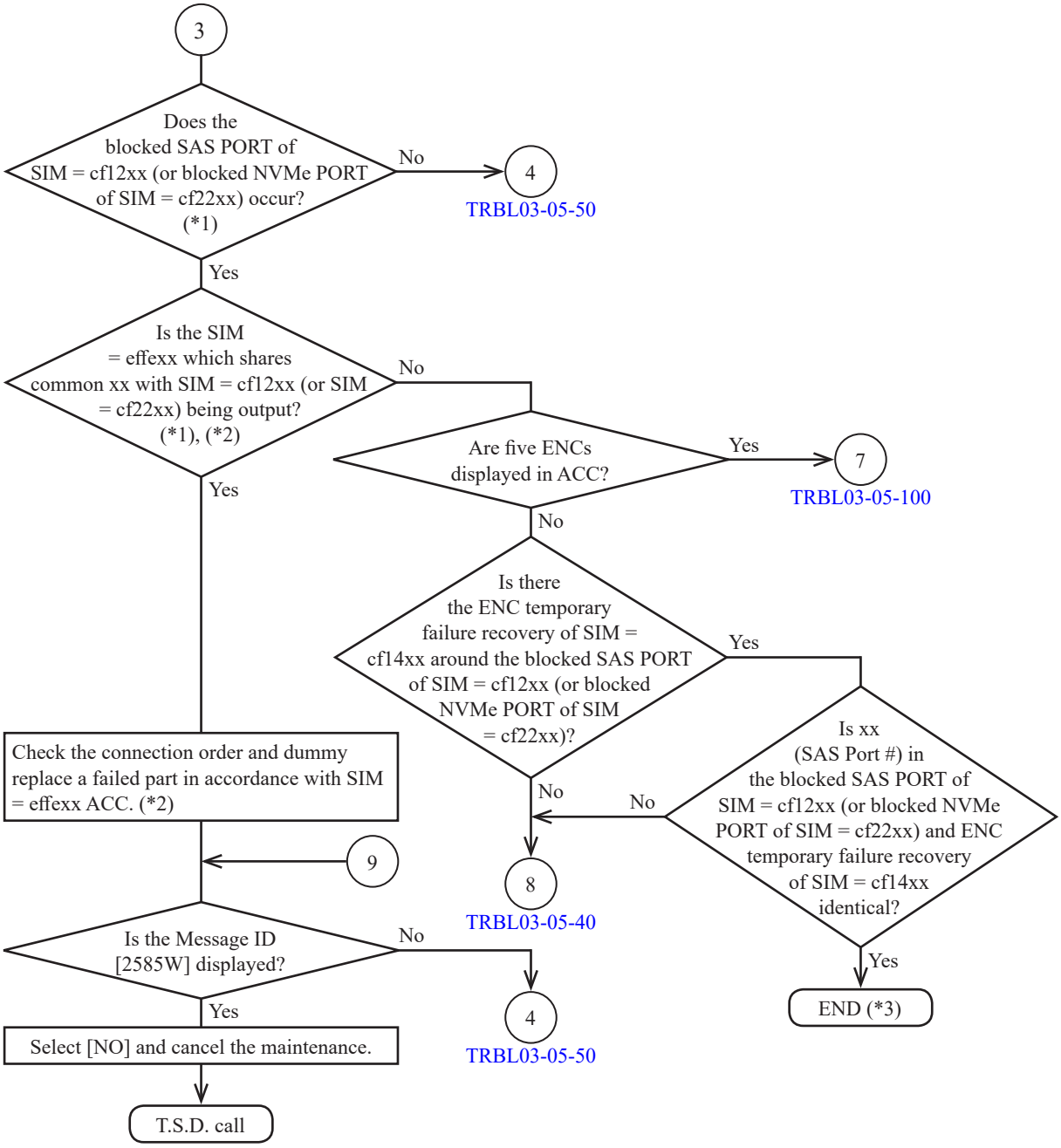


*1: If DKC/DB is forcibly powered off and rebooted, DB power interruption recovery SIM is not output. Furthermore, the forcible power off is different from the normal power off procedure, confirm with the Technical Support Division and perform the operation.

*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 5 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.

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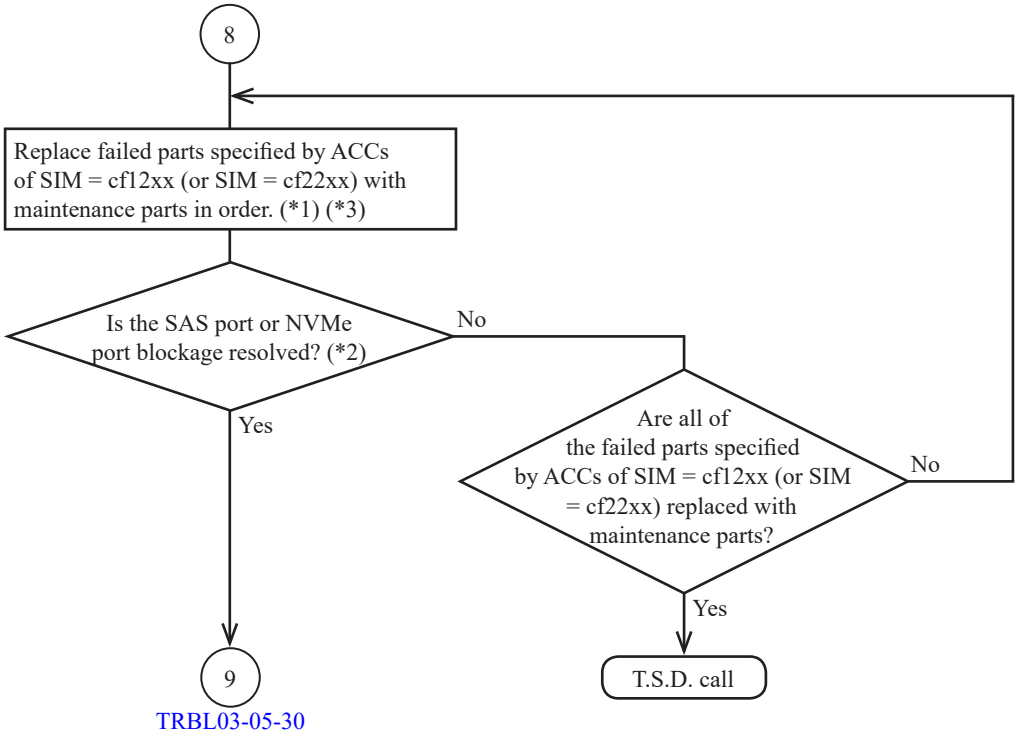


*1: The xx in cf12xx, cf22xx, effexx represents SAS Port number xx (hexadecimal) or NVMe Port number xx (hexadecimal).

*2: For the detail of the connection order, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

*3: The ENC temporary failure recovery of SIM = cf14xx reports that the blocked SAS PORT of SIM = cf12xx (or NVMe PORT of SIM = cf22xx) on the SAS Port#/NVMe 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 (or NVMe PORT of SIM = cf22xx). To user inquiries, inform them to that effect.
If any blocked SAS PORT of SIM = cf12xx (or NVMe PORT of SIM = cf22xx) with a different xx exists, ask the service personnel for maintenance.

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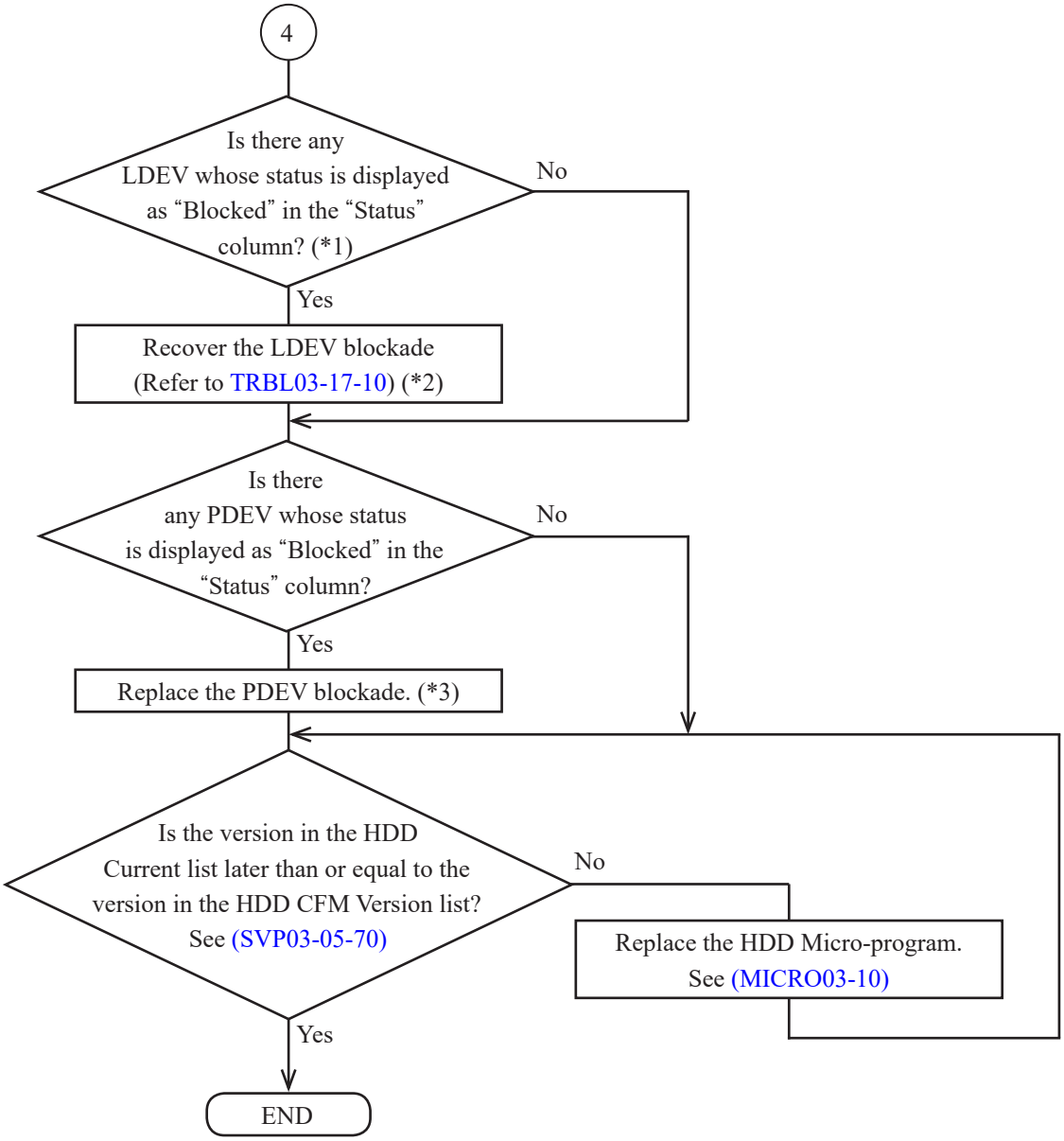


*1: When the target of replacement is ENC, there are cases where multiple ENCs are displayed in Maintenance Utility. In this case, instead of replacing all ENCs with maintenance parts, replace only the first ENC indicated in ACC of SIM = cf12xx (or SIM = cf22xx) with maintenance parts. However, the ENCs not to be replaced with maintenance parts need to be powered off. Remove and insert those ENCs when replacing the first ENC with a maintenance part.

*2: You can check whether the blockage is resolved by using the Maintenance Utility. Check that the status of the DKB equipped with the SAS port/NVMe port is Normal.

*3: When replacing SAS cables/NVMe cables, perform the dummy replacement of the ENCs to which the cables are connected (see (REP(RENC)00-00)).

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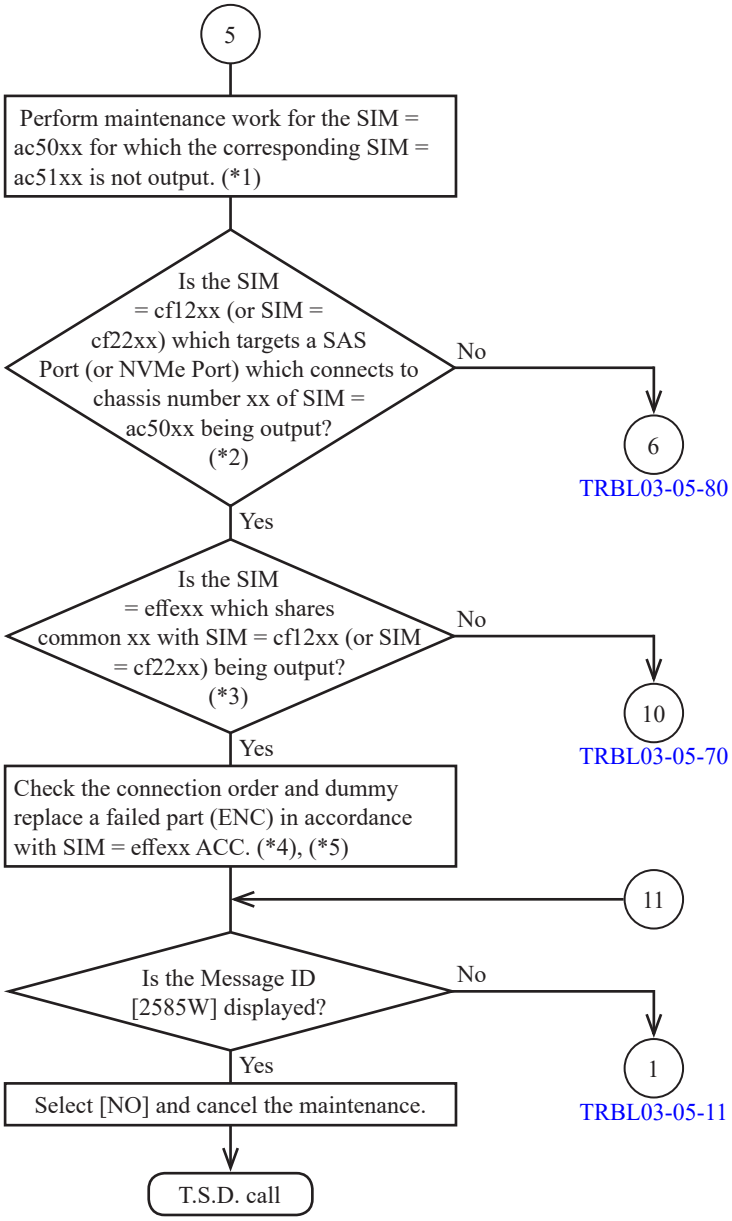


*1: Unformatted LDEVs are out of the target.

*2: A case that a contact to the Technical Support Division is necessary exists in “3.17 Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx)”. 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 with a new drive.

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*1: If multiple power interruption SIMs = ac50xx, for which the corresponding power interruption recovery SIMs = ac51xx are not output, are output, perform maintenance work in ascending order of the unit number (xx).

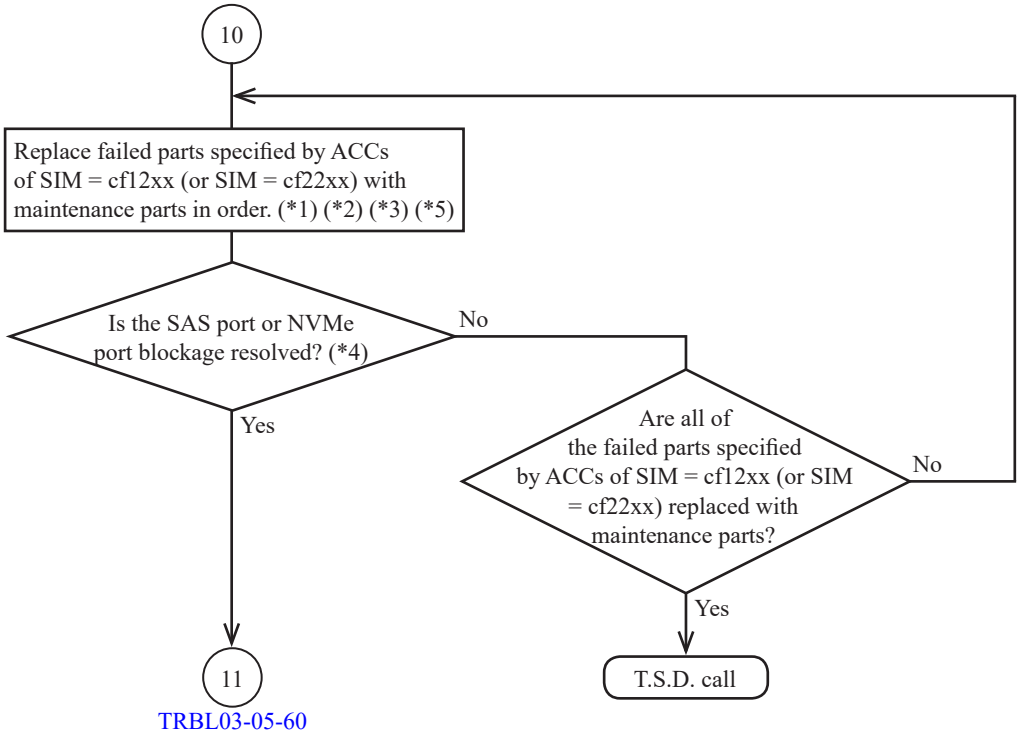
*2: ac50xx represents chassis number xx (hexadecimal). The xx in cf12xx, cf22xx, effexx represents SAS Port number (hexadecimal)/NVMe Port number (hexadecimal).

*3: For the detail of the connection order, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

*4: SIM = cf11xx, cf12xx, cf22xx which is related to not replaced SAS Port/NVMe Port may be reported after the replacement.

*5: If the chassis connection error (SIM = effexx) is output after the replacement/dummy replacement, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

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*1: When the target of replacement is ENC, there are cases where multiple ENCs are displayed in Maintenance Utility. In this case, instead of replacing all ENCs with maintenance parts, replace only the first ENC indicated in ACC of SIM = cf12xx (or SIM = cf22xx) with maintenance parts. However, the ENCs not to be replaced with maintenance parts need to be powered off. Remove and insert those ENCs when replacing the first ENC with a maintenance part.

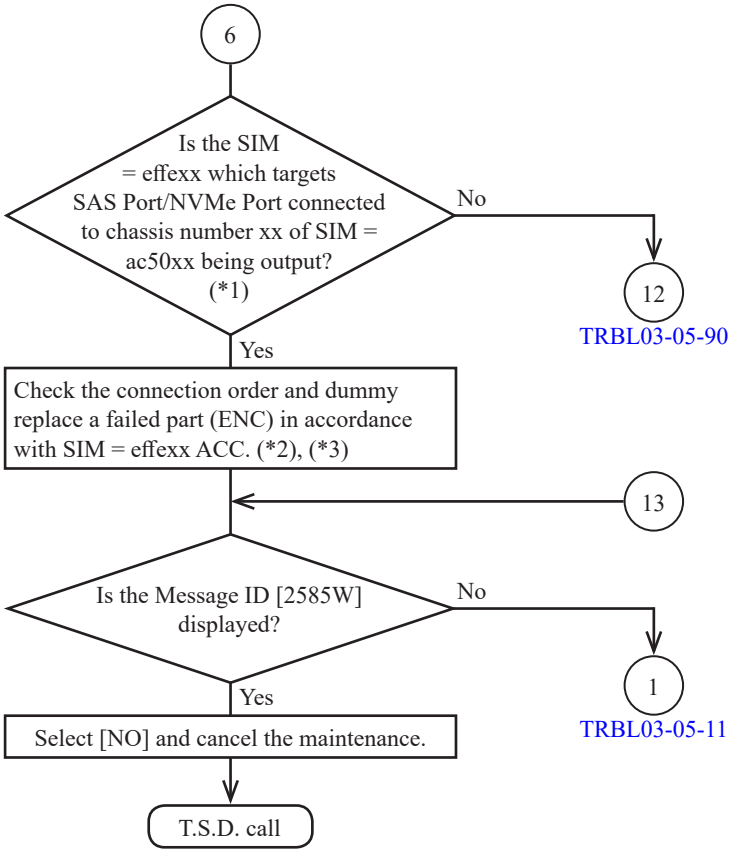
*2: SIM = cf11xx, cf12xx, cf22xx which is related to not replaced SAS Port/NVMe Port may be reported after the replacement.

*3: If the chassis connection error (SIM = effexx) is output after the replacement/dummy replacement, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

*4: You can check whether the blockage is resolved by using the Maintenance Utility. Check that the status of the DKB equipped with the SAS port/NVMe port is Normal.

*5: When replacing SAS cables/NVMe cables, perform the dummy replacement of the ENCs to which the cables are connected (see (REP(RENC)00-00)).

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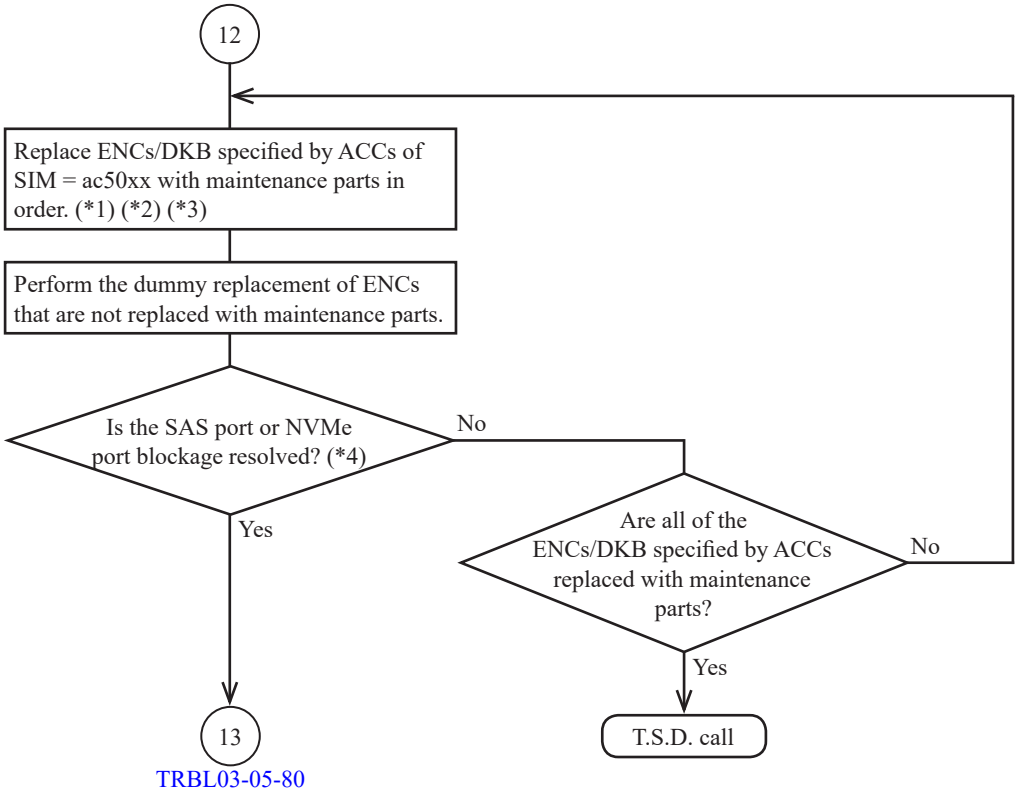


*1: ac50xx represents chassis number xx (hexadecimal). The xx in effexx represents SAS Port number (hexadecimal)/NVMe Port number (hexadecimal). For the detail of the connection order, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

*2: SIM = cf11xx, cf12xx, cf22xx which is related to not replaced SAS Port/NVMe Port may be reported after the replacement.

*3: If the chassis connection error (SIM = effexx) is output after the replacement/dummy replacement, see "3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)".

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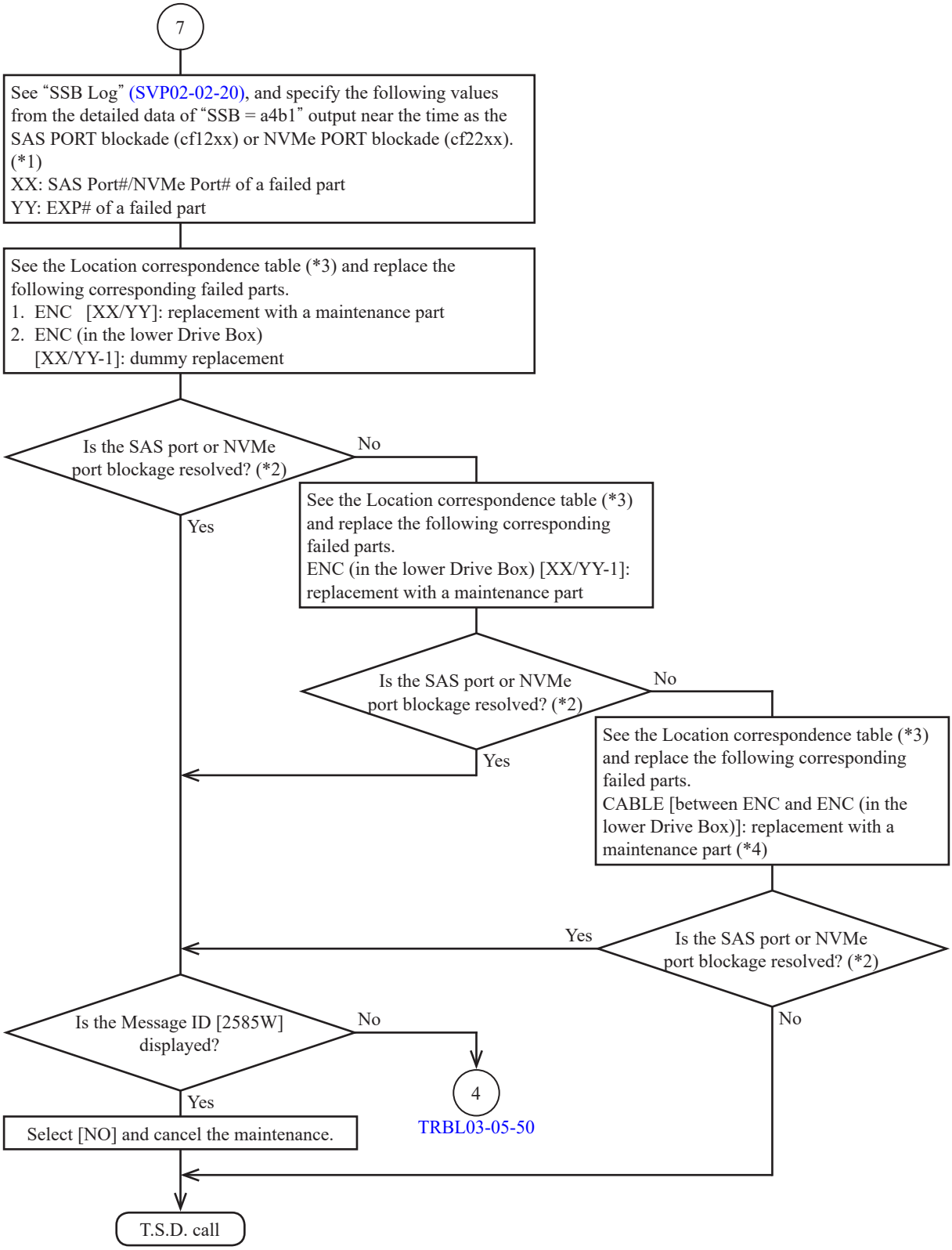
*1: In the Content-SIM window of the SVP, multiple ACCs specifying ENCs/DKB in which failures might have occurred are displayed. Replace the ENCs/DKB with maintenance parts in order from the one displayed on the top of the list until the SAS port/NVMe port blockage is resolved.

*2: SIM = cf11xx, cf12xx, cf22xx which is related to not replaced SAS Port/NVMe Port may be reported after the replacement.

*3: If the chassis connection error (SIM = effexx) is output after the replacement/dummy replacement, see “3.34 Recovery Procedure when SAS Cable/NVMe Cable Connection Error Occurs (SIM = effexx, effdxx)”.

*4: You can check whether the blockage is resolved by using the Maintenance Utility.
Check that the status of the DKB equipped with the SAS port/NVMe port is Normal.

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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#/NVMe Port# of a failed part
YY: EXP# of a failed part

*2: You can check whether the blockage is resolved by using the Maintenance Utility.
Check that the status of the DKB equipped with the SAS port/NVMe port is Normal.

*3: Location correspondence table

SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘00’ x‘18’	x‘00’	000-1	-	x‘04’ x‘1c’	x‘00’	000-2	-
	x‘01’	008-1	008-1		x‘01’	008-2	008-2
	x‘02’	016-1	016-1		x‘02’	016-2	016-2
	x‘03’	024-1	024-1		x‘03’	024-2	024-2
	x‘04’	032-1	032-1		x‘04’	032-2	032-2
	x‘05’	040-1	040-1		x‘05’	040-2	040-2
	x‘06’	048-1	048-1		x‘06’	048-2	048-2
	x‘07’	056-1	056-1		x‘07’	056-2	056-2
x‘01’ x‘19’	x‘00’	002-1	-	x‘05’ x‘1d’	x‘00’	002-2	-
	x‘01’	010-1	010-1		x‘01’	010-2	010-2
	x‘02’	018-1	018-1		x‘02’	018-2	018-2
	x‘03’	026-1	026-1		x‘03’	026-2	026-2
	x‘04’	034-1	034-1		x‘04’	034-2	034-2
	x‘05’	042-1	042-1		x‘05’	042-2	042-2
	x‘06’	050-1	050-1		x‘06’	050-2	050-2
	x‘07’	058-1	058-1		x‘07’	058-2	058-2

(To be continued)

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SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘02’	x‘00’	004-1	-	x‘06’	x‘00’	004-2	-
x‘1a’	x‘01’	012-1	012-1	x‘1e’	x‘01’	012-2	012-2
	x‘02’	020-1	020-1		x‘02’	020-2	020-2
	x‘03’	028-1	028-1		x‘03’	028-2	028-2
	x‘04’	036-1	036-1		x‘04’	036-2	036-2
	x‘05’	044-1	044-1		x‘05’	044-2	044-2
	x‘06’	052-1	052-1		x‘06’	052-2	052-2
	x‘07’	060-1	060-1		x‘07’	060-2	060-2
x‘03’	x‘00’	006-1	-	x‘07’	x‘00’	006-2	-
x‘1b’	x‘01’	014-1	014-1	x‘1f’	x‘01’	014-2	014-2
	x‘02’	022-1	022-1		x‘02’	022-2	022-2
	x‘03’	030-1	030-1		x‘03’	030-2	030-2
	x‘04’	038-1	038-1		x‘04’	038-2	038-2
	x‘05’	046-1	046-1		x‘05’	046-2	046-2
	x‘06’	054-1	054-1		x‘06’	054-2	054-2
	x‘07’	062-1	062-1		x‘07’	062-2	062-2
x‘08’	x‘00’	000-1	-	x‘0c’	x‘00’	000-2	-
x‘10’	x‘01’	008-1	009-1	x‘14’	x‘01’	008-2	009-2
	x‘02’	016-1	017-1		x‘02’	016-2	017-2
	x‘03’	024-1	025-1		x‘03’	024-2	025-2
	x‘04’	032-1	033-1		x‘04’	032-2	033-2
	x‘05’	040-1	041-1		x‘05’	040-2	041-2
	x‘06’	048-1	049-1		x‘06’	048-2	049-2
	x‘07’	056-1	057-1		x‘07’	056-2	057-2
x‘09’	x‘00’	002-1	-	x‘0d’	x‘00’	002-2	-
x‘11’	x‘01’	010-1	011-1	x‘15’	x‘01’	010-2	011-2
	x‘02’	018-1	019-1		x‘02’	018-2	019-2
	x‘03’	026-1	027-1		x‘03’	026-2	027-2
	x‘04’	034-1	035-1		x‘04’	034-2	035-2
	x‘05’	042-1	043-1		x‘05’	042-2	043-2
	x‘06’	050-1	051-1		x‘06’	050-2	051-2
	x‘07’	058-1	059-1		x‘07’	058-2	059-2
x‘0a’	x‘00’	004-1	-	x‘0e’	x‘00’	004-2	-
x‘12’	x‘01’	012-1	013-1	x‘16’	x‘01’	012-2	013-2
	x‘02’	020-1	021-1		x‘02’	020-2	021-2
	x‘03’	028-1	029-1		x‘03’	028-2	029-2
	x‘04’	036-1	037-1		x‘04’	036-2	037-2
	x‘05’	044-1	045-1		x‘05’	044-2	045-2
	x‘06’	052-1	053-1		x‘06’	052-2	053-2
	x‘07’	060-1	061-1		x‘07’	060-2	061-2

(To be continued)

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SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘0b’	x‘00’	006-1	-	x‘0f’	x‘00’	006-2	-
x‘13’	x‘01’	014-1	015-1	x‘17’	x‘01’	014-2	015-2
	x‘02’	022-1	023-1		x‘02’	022-2	023-2
	x‘03’	030-1	031-1		x‘03’	030-2	031-2
	x‘04’	038-1	039-1		x‘04’	038-2	039-2
	x‘05’	046-1	047-1		x‘05’	046-2	047-2
	x‘06’	054-1	055-1		x‘06’	054-2	055-2
	x‘07’	062-1	063-1		x‘07’	062-2	063-2
x‘20’	x‘00’	064-1	-	x‘24’	x‘00’	064-2	-
x‘38’	x‘01’	072-1	072-1	x‘3c’	x‘01’	072-2	072-2
	x‘02’	080-1	080-1		x‘02’	080-2	080-2
	x‘03’	088-1	088-1		x‘03’	088-2	088-2
	x‘04’	096-1	096-1		x‘04’	096-2	096-2
	x‘05’	104-1	104-1		x‘05’	104-2	104-2
	x‘06’	112-1	112-1		x‘06’	112-2	112-2
	x‘07’	120-1	120-1		x‘07’	120-2	120-2
x‘21’	x‘00’	066-1	-	x‘25’	x‘00’	066-2	-
x‘39’	x‘01’	074-1	074-1	x‘3d’	x‘01’	074-2	074-2
	x‘02’	082-1	082-1		x‘02’	082-2	082-2
	x‘03’	090-1	090-1		x‘03’	090-2	090-2
	x‘04’	098-1	098-1		x‘04’	098-2	098-2
	x‘05’	106-1	106-1		x‘05’	106-2	106-2
	x‘06’	114-1	114-1		x‘06’	114-2	114-2
	x‘07’	122-1	122-1		x‘07’	122-2	122-2
x‘22’	x‘00’	068-1	-	x‘26’	x‘00’	068-2	-
x‘3a’	x‘01’	076-1	076-1	x‘3e’	x‘01’	076-2	076-2
	x‘02’	084-1	084-1		x‘02’	084-2	084-2
	x‘03’	092-1	092-1		x‘03’	092-2	092-2
	x‘04’	100-1	100-1		x‘04’	100-2	100-2
	x‘05’	108-1	108-1		x‘05’	108-2	108-2
	x‘06’	116-1	116-1		x‘06’	116-2	116-2
	x‘07’	124-1	124-1		x‘07’	124-2	124-2
x‘23’	x‘00’	070-1	-	x‘27’	x‘00’	070-2	-
x‘3b’	x‘01’	078-1	078-1	x‘3f’	x‘01’	078-2	078-2
	x‘02’	086-1	086-1		x‘02’	086-2	086-2
	x‘03’	094-1	094-1		x‘03’	094-2	094-2
	x‘04’	102-1	102-1		x‘04’	102-2	102-2
	x‘05’	110-1	110-1		x‘05’	110-2	110-2
	x‘06’	118-1	118-1		x‘06’	118-2	118-2
	x‘07’	126-1	126-1		x‘07’	126-2	126-2

(To be continued)

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SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘28’	x‘00’	064-1	-	x‘2c’	x‘00’	064-2	-
x‘30’	x‘01’	072-1	073-1	x‘34’	x‘01’	072-2	073-2
	x‘02’	080-1	081-1		x‘02’	080-2	081-2
	x‘03’	088-1	089-1		x‘03’	088-2	089-2
	x‘04’	096-1	097-1		x‘04’	096-2	097-2
	x‘05’	104-1	105-1		x‘05’	104-2	105-2
	x‘06’	112-1	113-1		x‘06’	112-2	113-2
	x‘07’	120-1	121-1		x‘07’	120-2	121-2
x‘29’	x‘00’	066-1	-	x‘2d’	x‘00’	066-2	-
x‘31’	x‘01’	074-1	075-1	x‘35’	x‘01’	074-2	075-2
	x‘02’	082-1	083-1		x‘02’	082-2	083-2
	x‘03’	090-1	091-1		x‘03’	090-2	091-2
	x‘04’	098-1	099-1		x‘04’	098-2	099-2
	x‘05’	106-1	107-1		x‘05’	106-2	107-2
	x‘06’	114-1	115-1		x‘06’	114-2	115-2
	x‘07’	122-1	123-1		x‘07’	122-2	123-2
x‘2a’	x‘00’	068-1	-	x‘2e’	x‘00’	068-2	-
x‘32’	x‘01’	076-1	077-1	x‘36’	x‘01’	076-2	077-2
	x‘02’	084-1	085-1		x‘02’	084-2	085-2
	x‘03’	092-1	093-1		x‘03’	092-2	093-2
	x‘04’	100-1	101-1		x‘04’	100-2	101-2
	x‘05’	108-1	109-1		x‘05’	108-2	109-2
	x‘06’	116-1	117-1		x‘06’	116-2	117-2
	x‘07’	124-1	125-1		x‘07’	124-2	125-2
x‘2b’	x‘00’	070-1	-	x‘2f’	x‘00’	070-2	-
x‘33’	x‘01’	078-1	079-1	x‘37’	x‘01’	078-2	079-2
	x‘02’	086-1	087-1		x‘02’	086-2	087-2
	x‘03’	094-1	095-1		x‘03’	094-2	095-2
	x‘04’	102-1	103-1		x‘04’	102-2	103-2
	x‘05’	110-1	111-1		x‘05’	110-2	111-2
	x‘06’	118-1	119-1		x‘06’	118-2	119-2
	x‘07’	126-1	127-1		x‘07’	126-2	127-2
x‘40’	x‘00’	128-1	-	x‘44’	x‘00’	128-2	-
x‘58’	x‘01’	136-1	136-1	x‘5c’	x‘01’	136-2	136-2
	x‘02’	144-1	144-1		x‘02’	144-2	144-2
	x‘03’	152-1	152-1		x‘03’	152-2	152-2
	x‘04’	160-1	160-1		x‘04’	160-2	160-2
	x‘05’	168-1	168-1		x‘05’	168-2	168-2
	x‘06’	176-1	176-1		x‘06’	176-2	176-2
	x‘07’	184-1	184-1		x‘07’	184-2	184-2

(To be continued)

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SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘41’	x‘00’	130-1	-	x‘45’	x‘00’	130-2	-
x‘59’	x‘01’	138-1	138-1	x‘5d’	x‘01’	138-2	138-2
	x‘02’	146-1	146-1		x‘02’	146-2	146-2
	x‘03’	154-1	154-1		x‘03’	154-2	154-2
	x‘04’	162-1	162-1		x‘04’	162-2	162-2
	x‘05’	170-1	170-1		x‘05’	170-2	170-2
	x‘06’	178-1	178-1		x‘06’	178-2	178-2
	x‘07’	186-1	186-1		x‘07’	186-2	186-2
x‘42’	x‘00’	132-1	-	x‘46’	x‘00’	132-2	-
x‘5a’	x‘01’	140-1	140-1	x‘5e’	x‘01’	140-2	140-2
	x‘02’	148-1	148-1		x‘02’	148-2	148-2
	x‘03’	156-1	156-1		x‘03’	156-2	156-2
	x‘04’	164-1	164-1		x‘04’	164-2	164-2
	x‘05’	172-1	172-1		x‘05’	172-2	172-2
	x‘06’	180-1	180-1		x‘06’	180-2	180-2
	x‘07’	188-1	188-1		x‘07’	188-2	188-2
x‘43’	x‘00’	134-1	-	x‘47’	x‘00’	134-2	-
x‘5b’	x‘01’	142-1	142-1	x‘5f’	x‘01’	142-2	142-2
	x‘02’	150-1	150-1		x‘02’	150-2	150-2
	x‘03’	158-1	158-1		x‘03’	158-2	158-2
	x‘04’	166-1	166-1		x‘04’	166-2	166-2
	x‘05’	174-1	174-1		x‘05’	174-2	174-2
	x‘06’	182-1	182-1		x‘06’	182-2	182-2
	x‘07’	190-1	190-1		x‘07’	190-2	190-2
x‘48’	x‘00’	128-1	-	x‘4c’	x‘00’	128-2	-
x‘50’	x‘01’	136-1	137-1	x‘54’	x‘01’	136-2	137-2
	x‘02’	144-1	144-1		x‘02’	144-2	144-2
	x‘03’	152-1	153-1		x‘03’	152-2	153-2
	x‘04’	160-1	161-1		x‘04’	160-2	161-2
	x‘05’	168-1	169-1		x‘05’	168-2	169-2
	x‘06’	176-1	177-1		x‘06’	176-2	177-2
	x‘07’	184-1	185-1		x‘07’	184-2	185-2
x‘49’	x‘00’	130-1	-	x‘4d’	x‘00’	130-2	-
x‘51’	x‘01’	138-1	139-1	x‘55’	x‘01’	138-2	139-2
	x‘02’	146-1	147-1		x‘02’	146-2	147-2
	x‘03’	154-1	155-1		x‘03’	154-2	155-2
	x‘04’	162-1	163-1		x‘04’	162-2	163-2
	x‘05’	170-1	171-1		x‘05’	170-2	171-2
	x‘06’	178-1	179-1		x‘06’	178-2	179-2
	x‘07’	186-1	187-1		x‘07’	186-2	187-2

(To be continued)

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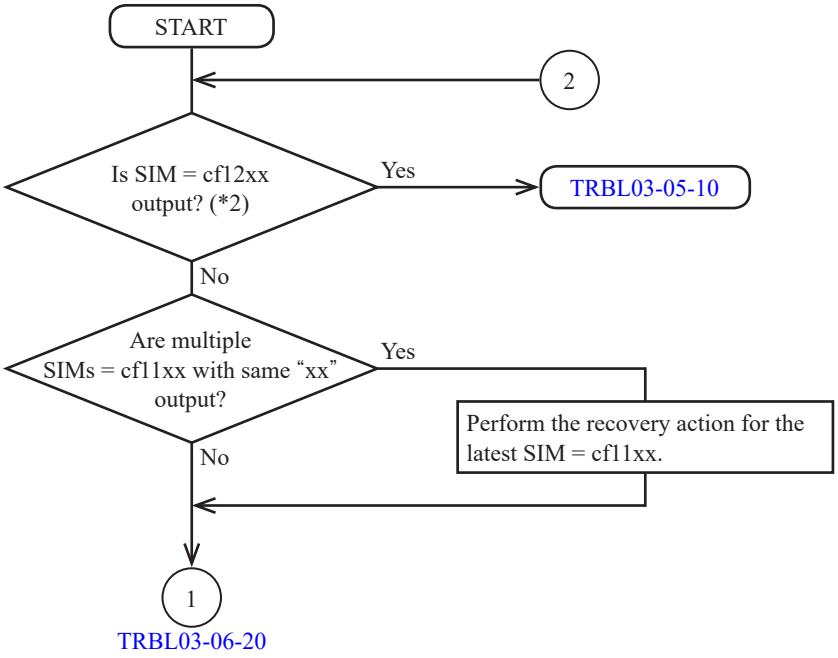
SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)	SAS Port#/ NVMe Port#	EXP#	ENC (DBS2/DBF3/ DBN)	ENC (DBL)
x‘4a’ x‘52’	x‘00’	132-1	-	x‘4e’ x‘56’	x‘00’	132-2	-
	x‘01’	140-1	141-1		x‘01’	140-2	141-2
	x‘02’	148-1	149-1		x‘02’	148-2	149-2
	x‘03’	156-1	157-1		x‘03’	156-2	157-2
	x‘04’	164-1	165-1		x‘04’	164-2	165-2
	x‘05’	172-1	173-1		x‘05’	172-2	173-2
	x‘06’	180-1	181-1		x‘06’	180-2	181-2
	x‘07’	188-1	189-1		x‘07’	188-2	189-2
x‘4b’ x‘53’	x‘00’	134-1	-	x‘4f’ x‘57’	x‘00’	134-2	-
	x‘01’	142-1	143-1		x‘01’	142-2	143-2
	x‘02’	150-1	151-1		x‘02’	150-2	151-2
	x‘03’	158-1	159-1		x‘03’	158-2	159-2
	x‘04’	166-1	167-1		x‘04’	166-2	167-2
	x‘05’	174-1	175-1		x‘05’	174-2	175-2
	x‘06’	182-1	183-1		x‘06’	182-2	183-2
	x‘07’	190-1	191-1		x‘07’	190-2	191-2

*4: When replacing SAS cables/NVMe cables, perform the dummy replacement of the ENCs to which the cables are connected (see (REP(RENC)00-00)).

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

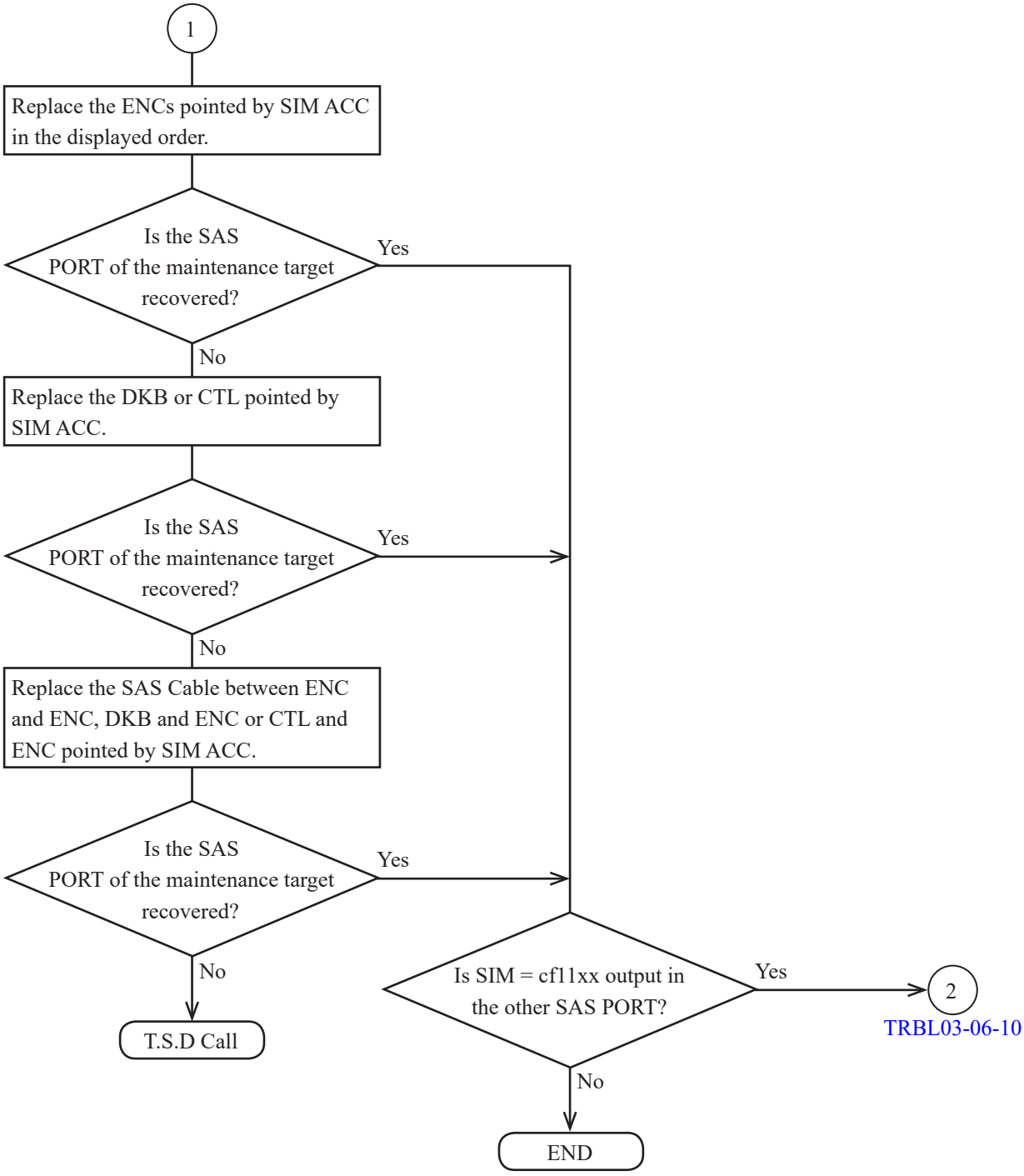
The SAS PORT temporary failure (SIM = cf11xx) indicates that the SAS PORT is partially blocked (*1). When the SAS PORT blockade (SIM = cf12xx) is not output, the SAS PORT is usable, but the early replacement is recommended.



*1: There are four paths in the SAS Cable and this indicates that one or more 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.

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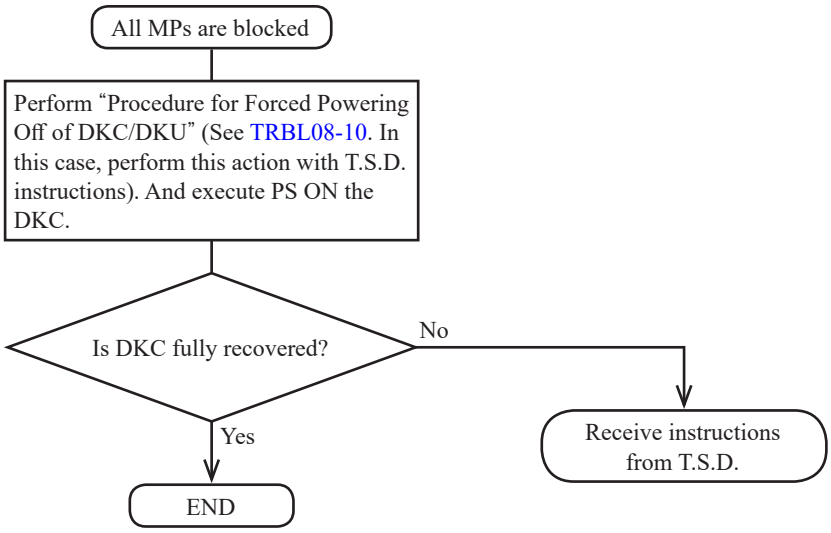


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3.7 Recovery Procedure for DKC Blockade (SIM = 30a100)

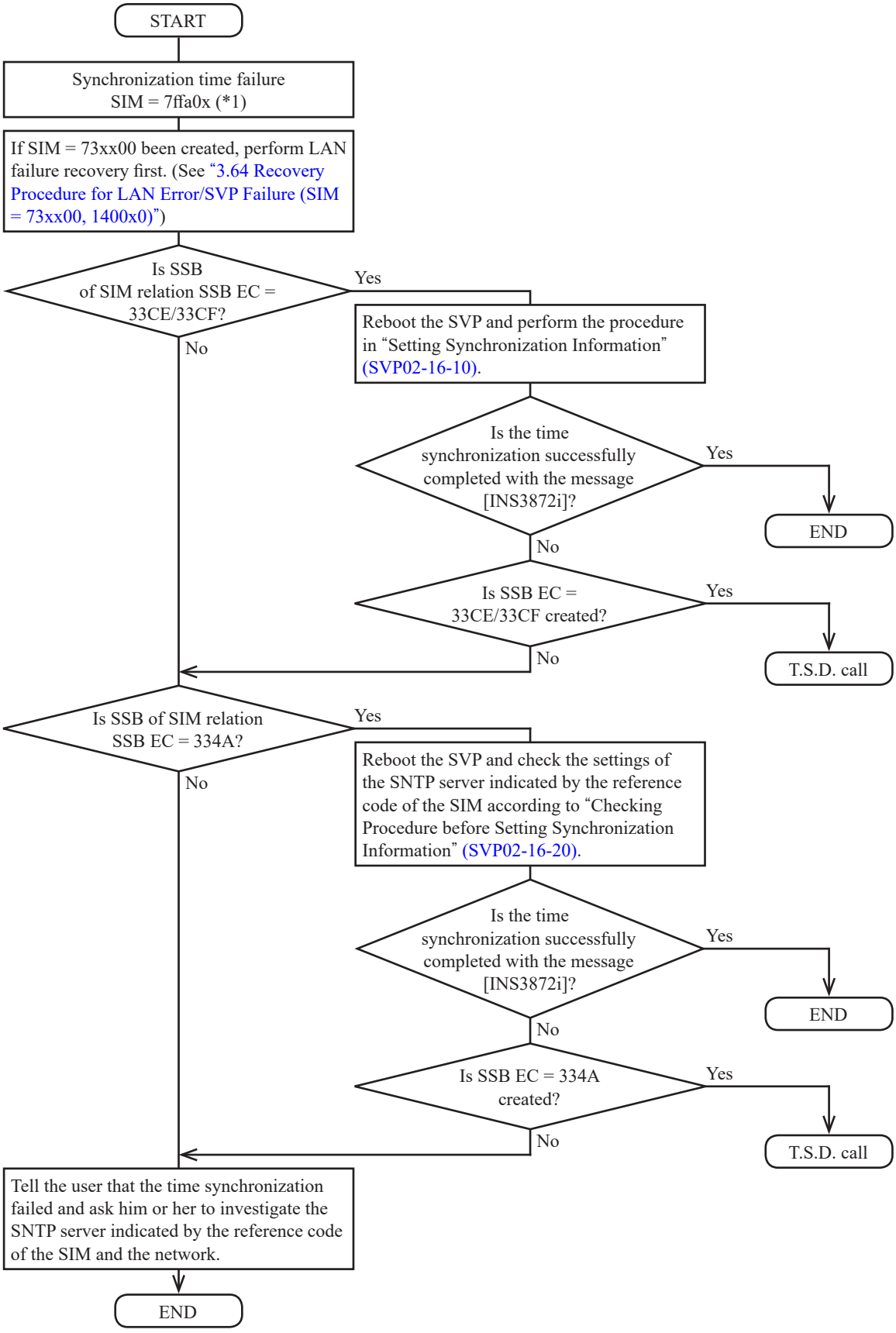
CAUTION

Perform this action that a special procedure is included in, by instructions of T.S.D.



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3.8 Action When Time Synchronization Failed (SIM = 7ffa0x)



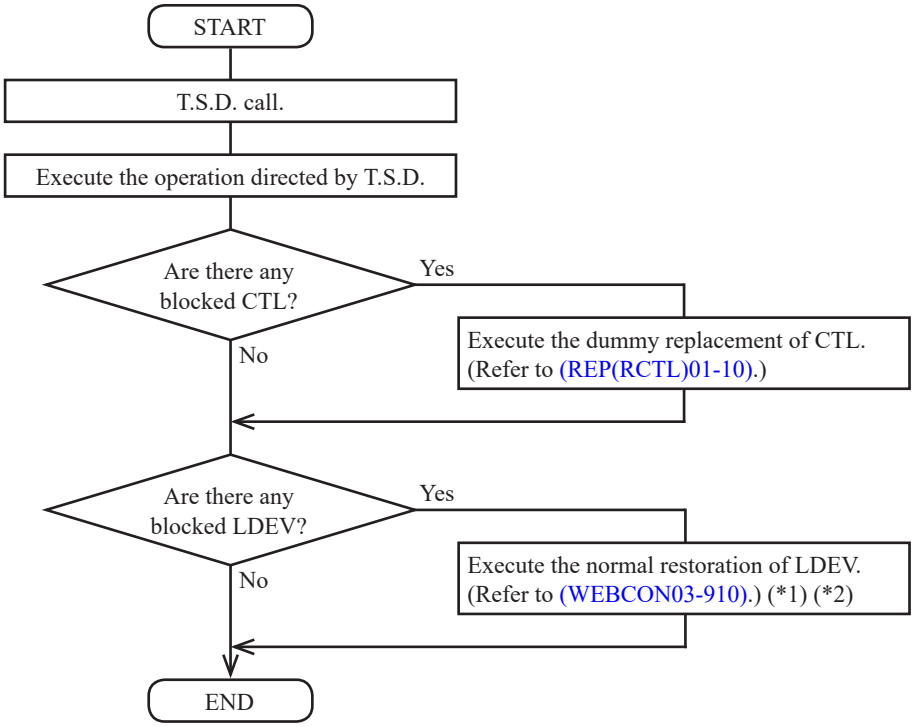
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*1: Content of x

x	SNTP server priority of Synchronization Information setting
0	Priority one
1	Priority two
2	Priority three
3	Priority four
4	Priority five

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3.9 Recovery Procedure for LDEV Blockade due to Micro-program Error (SIM = 3a0xyy)

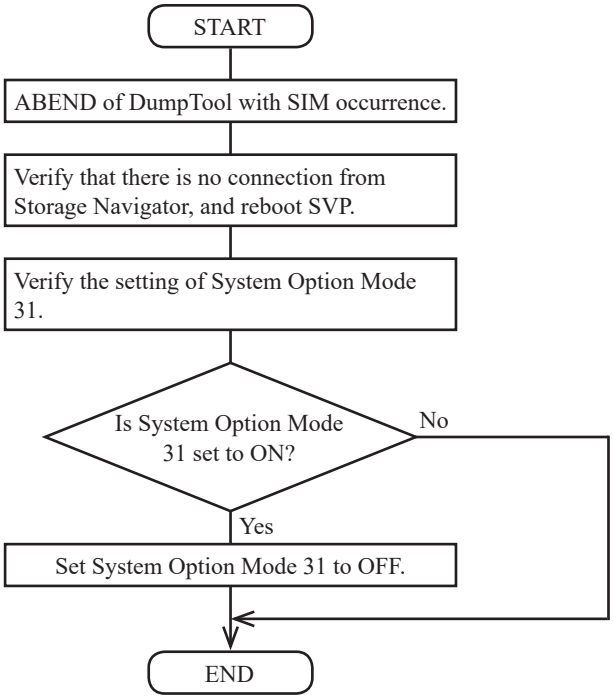


*1: Delete [TrueCopy / Universal Replicator / ShadowImage / Volume Migration / Thin Image / XRC / FlashCopy (R) V2 / FlashCopy (R) SE / global-active device] pairs that use the LDEV before restoring the LDEV. After the recovery flow completes, create pairs again.
When you delete FlashCopy (R) V2 / FlashCopy (R) SE pairs, please execute following procedure.
If a LDEV to be restored has both source and target extents of relationships with other LDEVs not to be maintained, please perform following procedure (1), (2) and (3).
(1) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please specify a LDEV to be restored as TDEVN. In addition, please don't specify extent option such as XTNTLST.
(2) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please don't specify extent option such as XTNTLST.
(3) Perform forcible Withdraw by specifying TDEVN, and DDSW(NO) options. Please don't specify SDEVN option and extent option such as XTNTLST.
The other cases, please perform following procedure (1) and (2).
(1) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please don't specify extent option such as XTNTLST.
(2) Perform forcible Withdraw by specifying TDEVN, and DDSW(NO) options. Please don't specify SDEVN option and extent option such as XTNTLST.

*2: When recovering the LDEV used in a GAD pair, recover the LDEV in accordance with the procedure described in TRBL18-70.

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3.10 Recovery Procedure for Abnormal End of DumpTool (SIM = 7c0400)

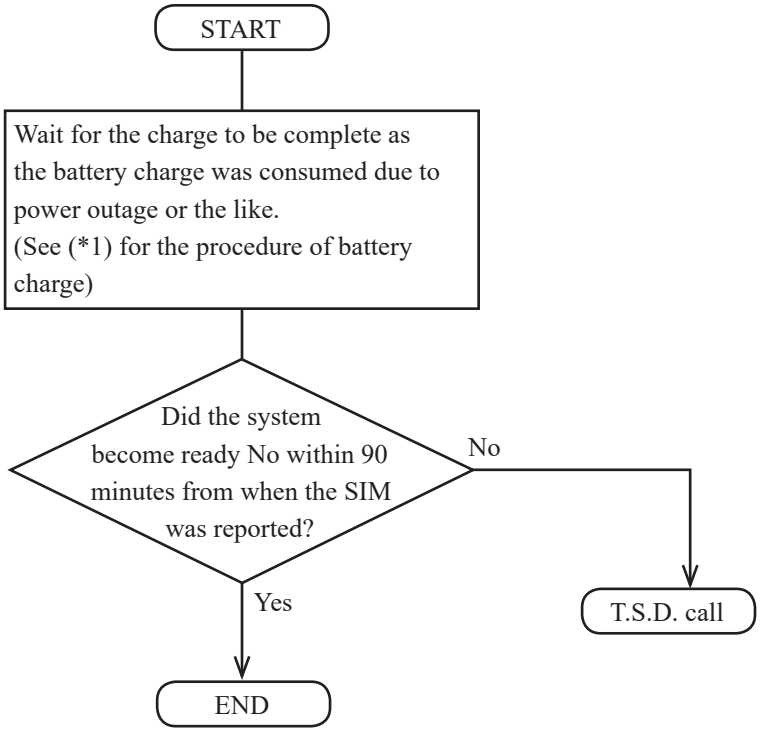


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3.11 Recovery procedure of SIM occurrence during battery charge (SIM = fe0000)

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 90 minutes until the battery charge level becomes 30% or more.

For details, (THEORY01-05-50).



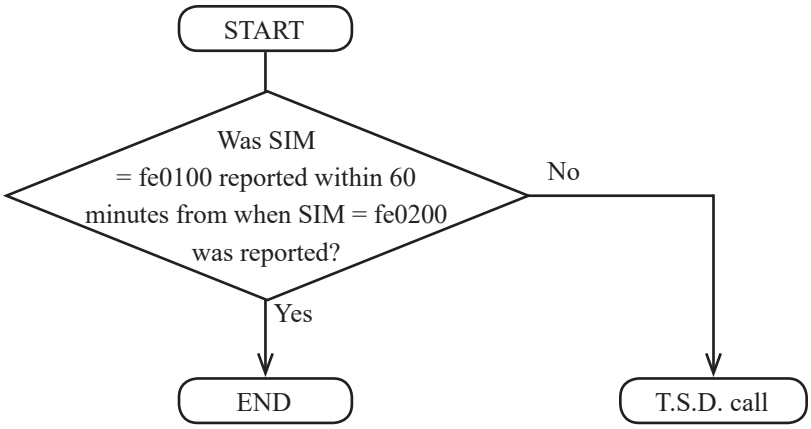
*1: Turn on the breakers on the PDPs and the PDUs, which makes the POWER LED lit, and then charge the batteries until the STATUS LED (See (LOC03-80)) goes from blinking (charge in progress) to solid (charge completed).

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3.12 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 60 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, (THEORY01-05-50).



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3.13 Isolation and Recovery Procedure for Common SAS/NVMe Failure (SIM = db0xxx, db1xxx, db2xxx, db3xxx, db4xxx, db5xxx, db6xxx, db7xxx)

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, SAS I/F error, or NVMe I/F error, and how to recover the error.

As a HDD port error SIM managed in each PDEV, a Port temporary error (REF code = db0xxx, db1xxx, db2xxx, db3xxx) is reported when a warning is issued, and Port blocking (REF code = db4xxx, db5xxx, db6xxx, db7xxx) is reported when the equipment is blocked. See (“THEORY OF OPERATION SECTION ATTACHMENT” (THEORYATT00-00)).

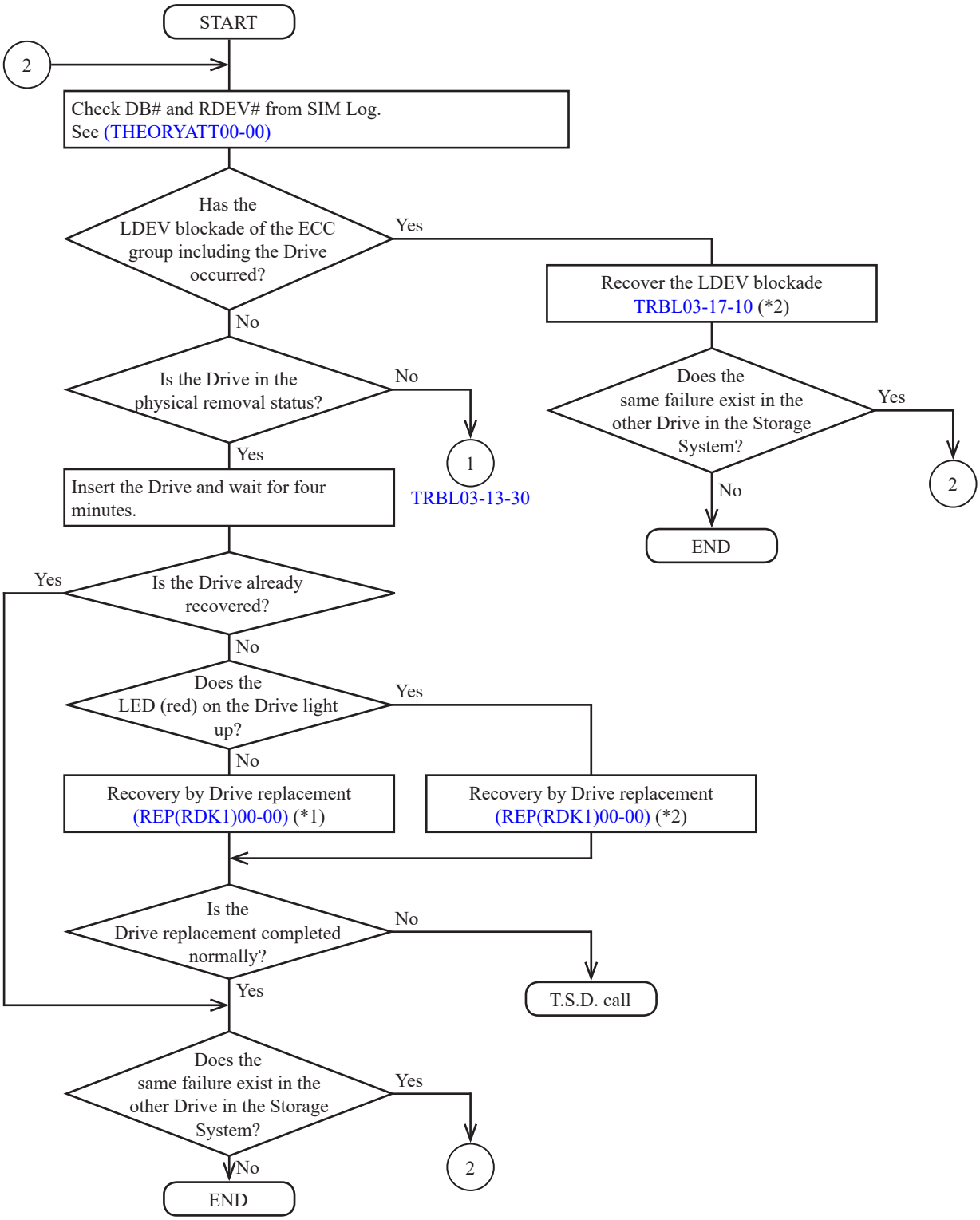
Possible causes for the malfunction are:

(1) Failure of drive specified in FPC
(2) For SAS connection: Defects in SAS Chip on DKB
    For NVMe connection: Defects in PSW on DKB
(3) For SAS connection: Defects in SAS I/F (SAS cable, ENC)
    For NVMe connection: Defects in NVMe I/F (NVMe 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, NVMe I/F. If a common error exists, perform the appropriate recovery for the common error parts.

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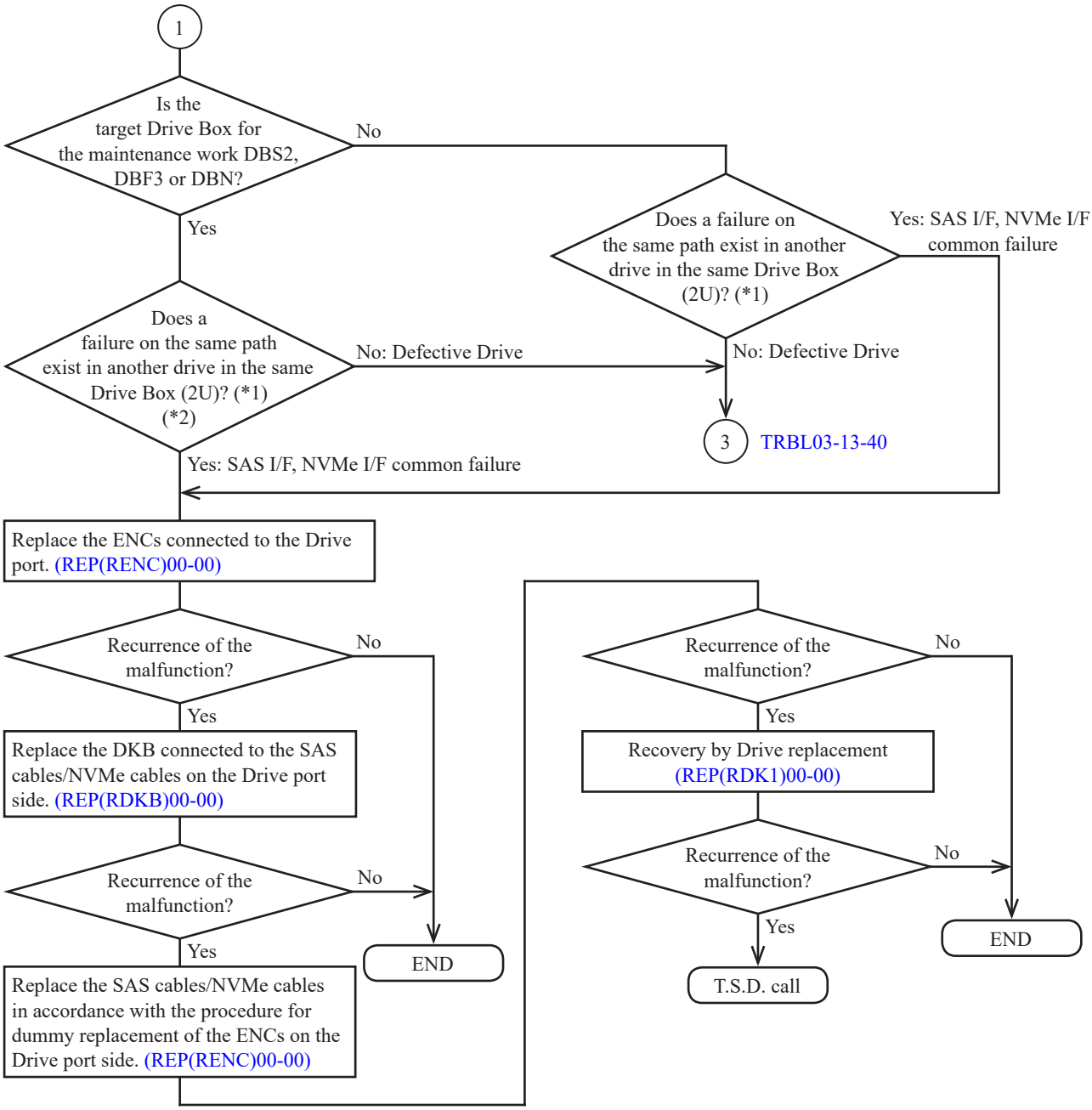
Common SAS Error Isolation Procedure



*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.

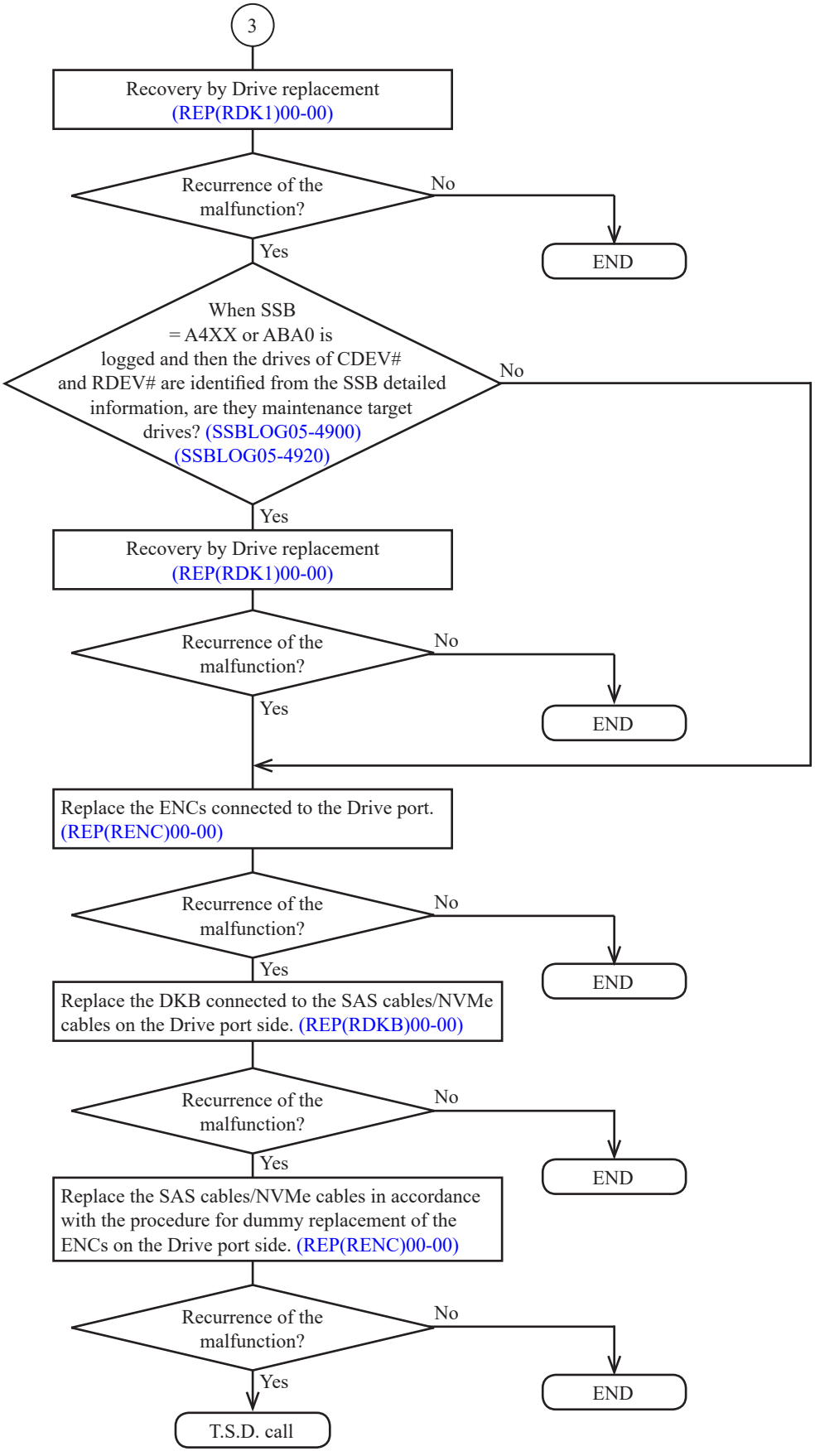
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*1: The relation between SIMs and paths is shown below.
Path 0: db0xxx, db1xxx, db4xxx, and db5xxx
Path 1: db2xxx, db3xxx, db6xxx, and db7xxx
Check whether a SIM indicating the same Drive Box and path as those of the target SIM is output.
How to identify DB# by "xxx" is shown in "THEORY OF OPERATION SECTION ATTACHMENT" (THEORYATT00-00).

*2: Two consecutive DB# are assigned to each DBS2/DBF3/DBN (2U).
On Maintenance Utility, two consecutive DB# are shown as "DB-000 & 001".
Read "in the same Drive Box (2U)" as "in two consecutive DB# (2U)" when performing this workflow.
For combinations of consecutive DB#, see (SIMRC02-600).

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*1: SSB detailed information

The case of Byte36: bit0-3 = D & Byte26: bit4-7 = 0 & Byte27: bit0-2 = 0

```
SSB detailed information
              +0x0         +0x4         +0x8         +0xC
00000000:     7404190b     00279f00     b1a40000     00aa2000
00000010:     00000000     00002e0d     00000000     00000004
00000020:     00000000     00000000     a4b1d84f     7492XX00
00000030:     00000000     0000d0YY     00000000     00000000
00000040:     d84f7492     80eeeeee     eeeeeeee     eeeeeeee
00000050:     21120083     00000000     100000ee     00010000
00000060:     800f0021     ffffffff     01210503     00000000
00000070:     02010046     00000000     10000000     00100302
```

XX: CDEV

YY: RDEV

The case of Byte36: bit0-3 = E & Byte26: bit4-7 = 0

```
SSB detailed information
              +0x0         +0x4         +0x8         +0xC
00000000:     7404190b     00279f00     b1a40000     00aa2000
00000010:     00000000     00002e0d     00000000     00000004
00000020:     00000000     00000000     a4b1d84f     7492XX00
00000030:     00000000     0000e0YY     00000000     00000000
00000040:     d84f7492     80eeeeee     eeeeeeee     eeeeeeee
00000050:     21120083     00000000     100000ee     00010000
00000060:     800f0021     ffffffff     01210503     00000000
00000070:     02010046     00000000     10000000     00100302
```

XX: CDEV

YY: RDEV

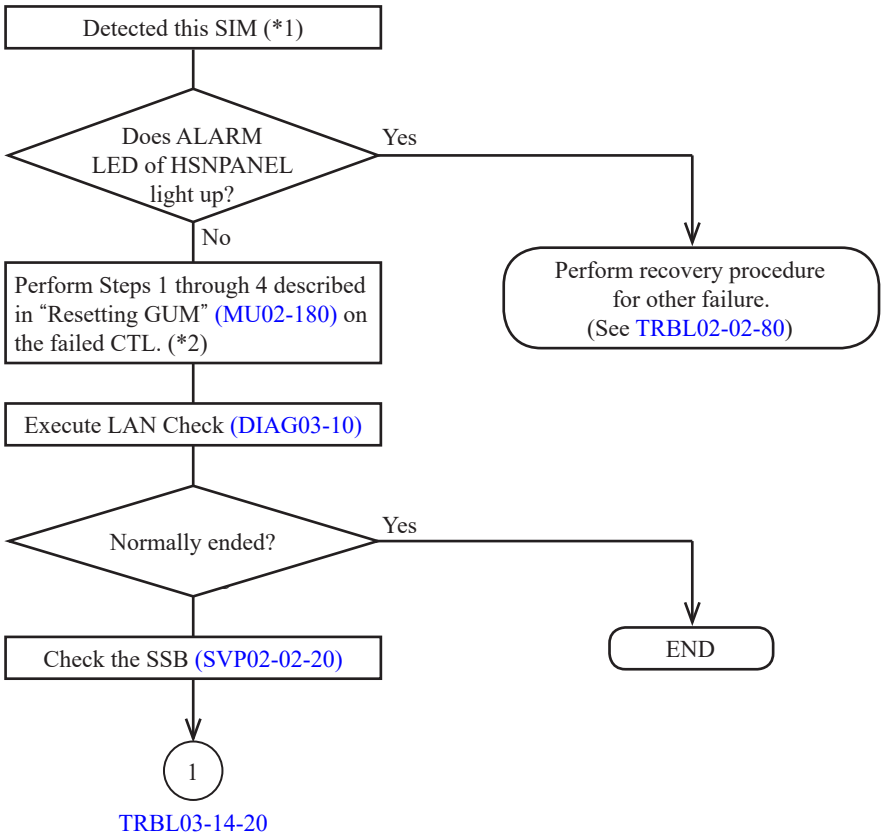
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3.14 Recovery Procedure for LAN Error

3.14.1 Recovery Procedure When an 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)



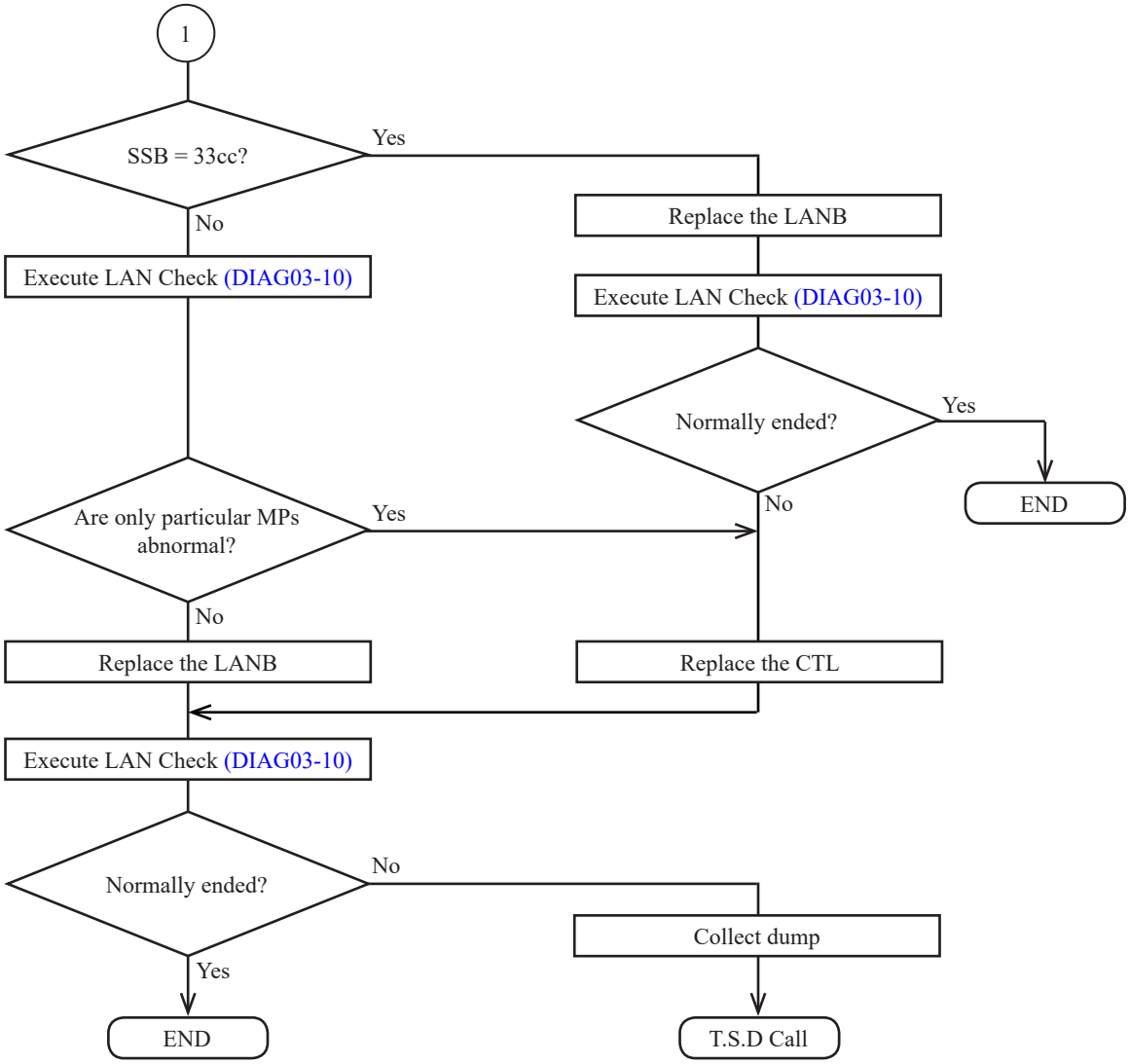
*1: This SIM might not be generated at LAN error.

*2: The first digit of "xx" in the SIM code indicates the CBX number (0 to 5). The second digit indicates the CTL number (0 or 1). The correspondence between SIM codes and CTL locations is shown in the table below.

SIM code	CTL location
00	CTL01
01	CTL02
10	CTL11
11	CTL12
20	CTL21
21	CTL22

SIM code	CTL location
30	CTL31
31	CTL32
40	CTL41
41	CTL42
50	CTL51
51	CTL52

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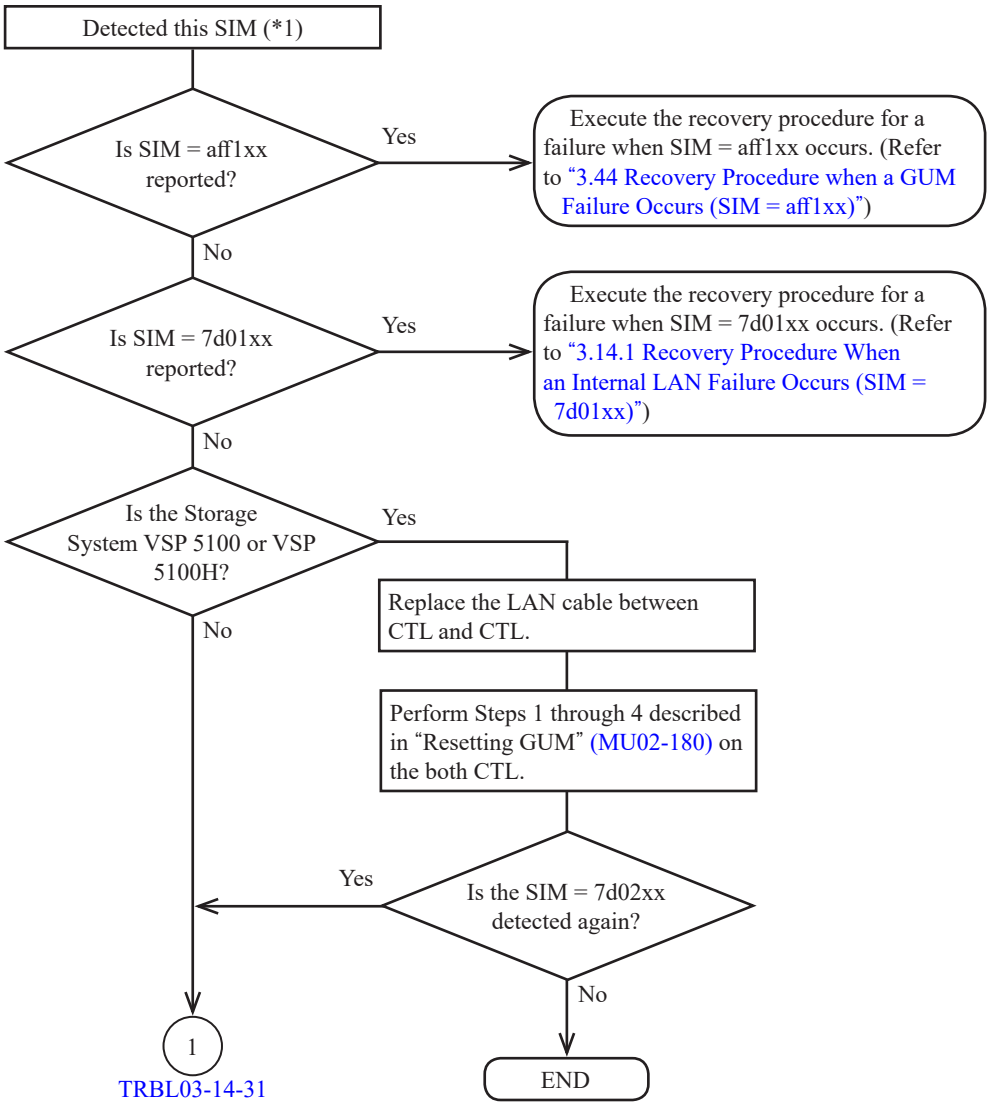


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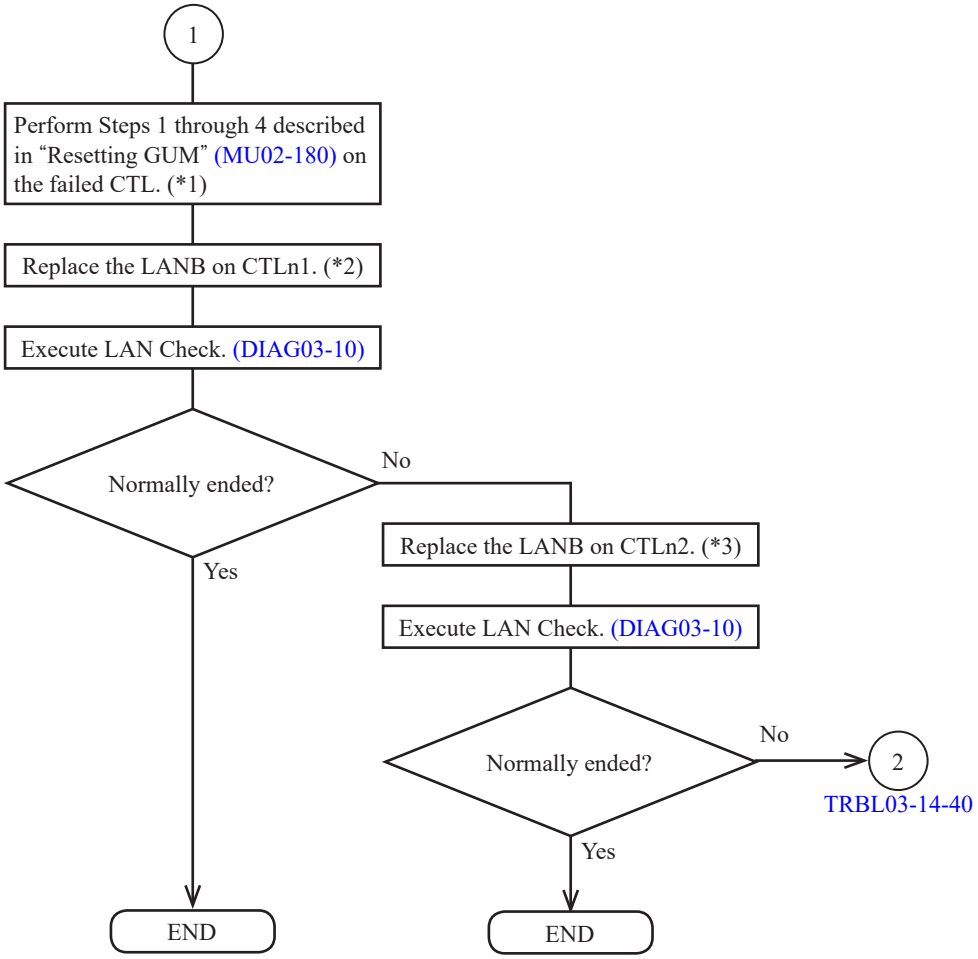
3.14.2 Recovery Procedure When a LAN Failure Occurs between CTL (SIM = 7d02xx)

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.



*1: The first digit of "xx" in the SIM code indicates the CBX number (0 to 5). The second digit indicates the CTL number (0 or 1). The correspondence between SIM codes and CTL locations is shown in the table below.

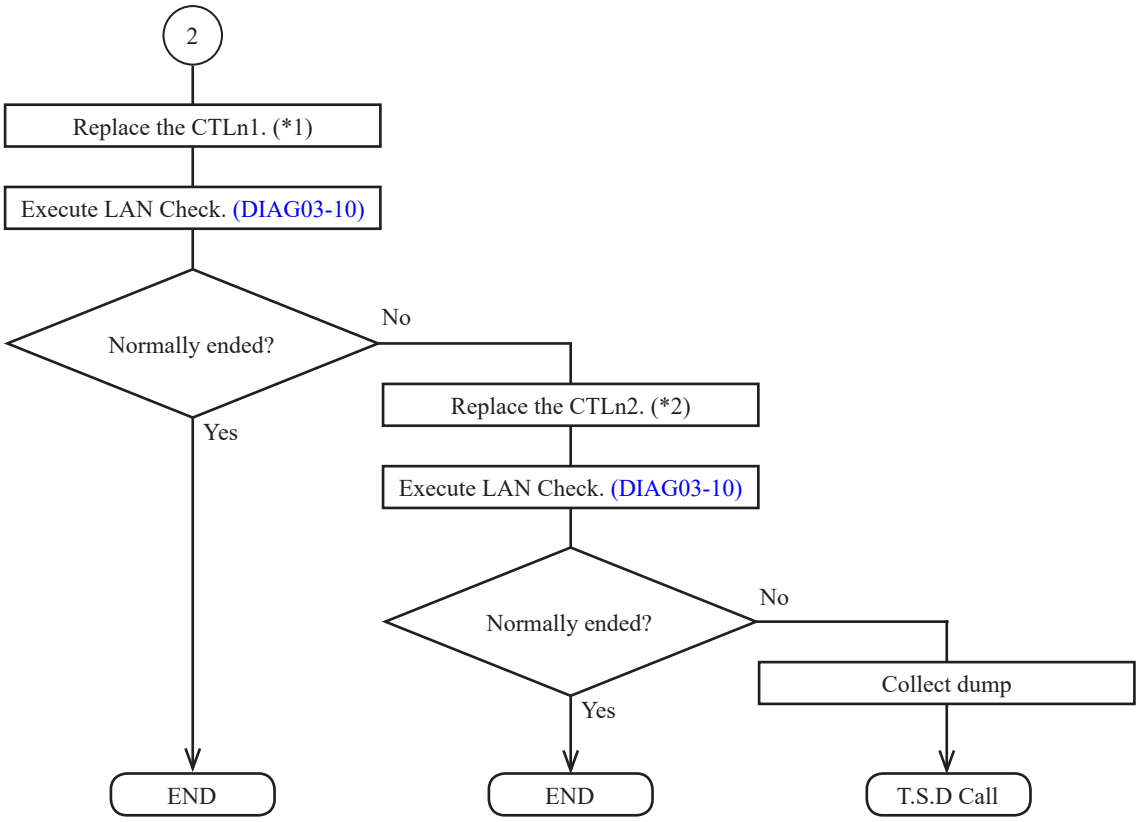
SIM code	CTL location
00	CTL01
01	CTL02
10	CTL11
11	CTL12
20	CTL21
21	CTL22

SIM code	CTL location
30	CTL31
31	CTL32
40	CTL41
41	CTL42
50	CTL51
51	CTL52

*2: Always CTL01 for VSP5100 or VSP5100H.

*3: Always CTL12 for VSP5100 or VSP5100H.

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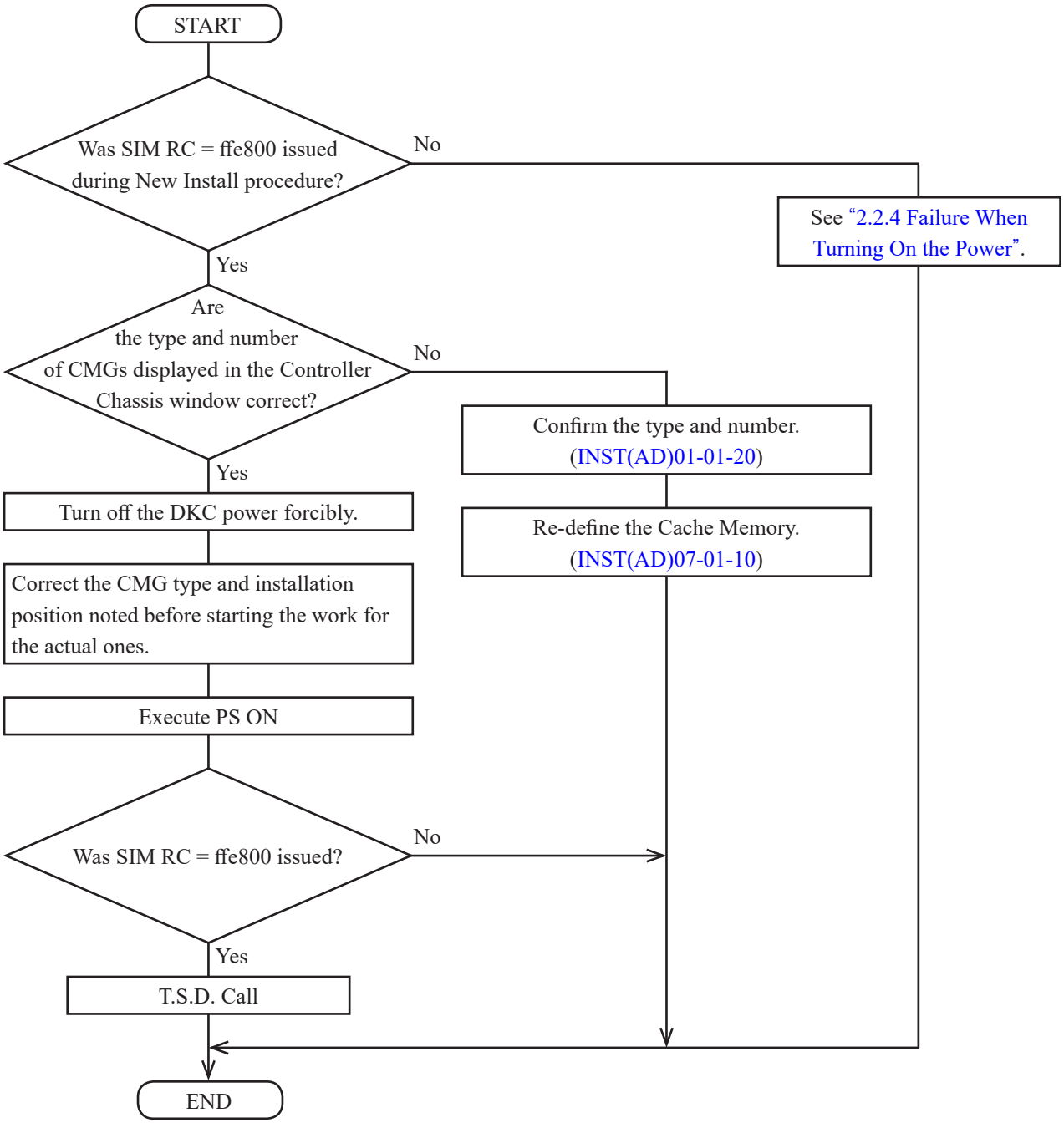


*1: Always CTL01 for VSP5100 or VSP5100H.
*2: Always CTL12 for VSP5100 or VSP5100H.

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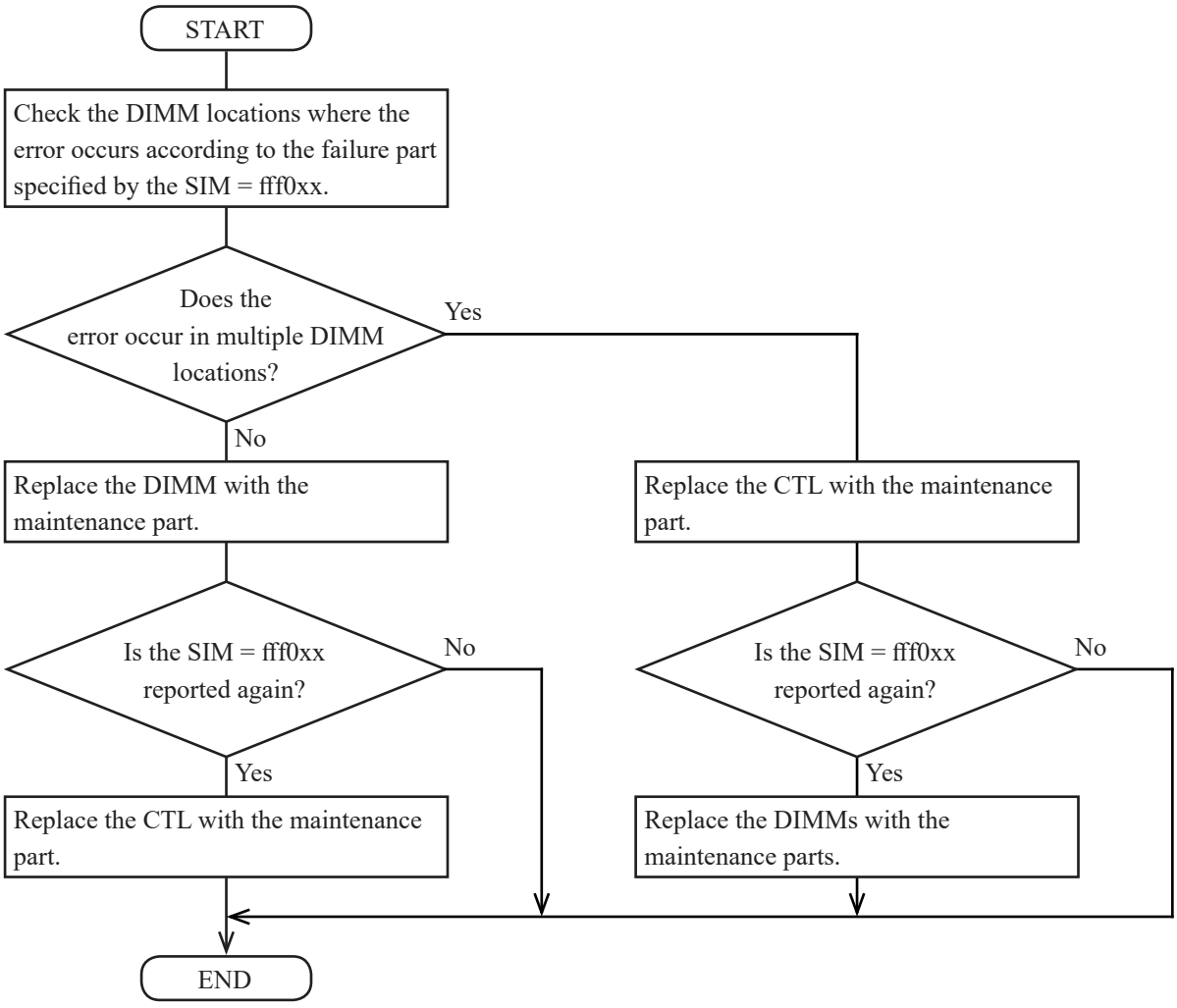
3.15 Recovery Procedure for the Failure on the Occurrence of Unmatched Memory Installation Capacity (SIM = ffe800)

When SIM RC = ffe80x is reported, perform the procedure below.
This SIM indicates that “Installation type and set type of CMGs” or “Installed number and set number of CMGs” are unmatched when the storage system is powered on, so they need to be matched. Before starting the procedure, click the [CTLs] tab in the Controller Chassis window of Maintenance Utility and take notes of CMG types and installation locations.



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3.16 Recovery Procedure When Cache Correctable Error Is Detected (SIM = fff0xx)



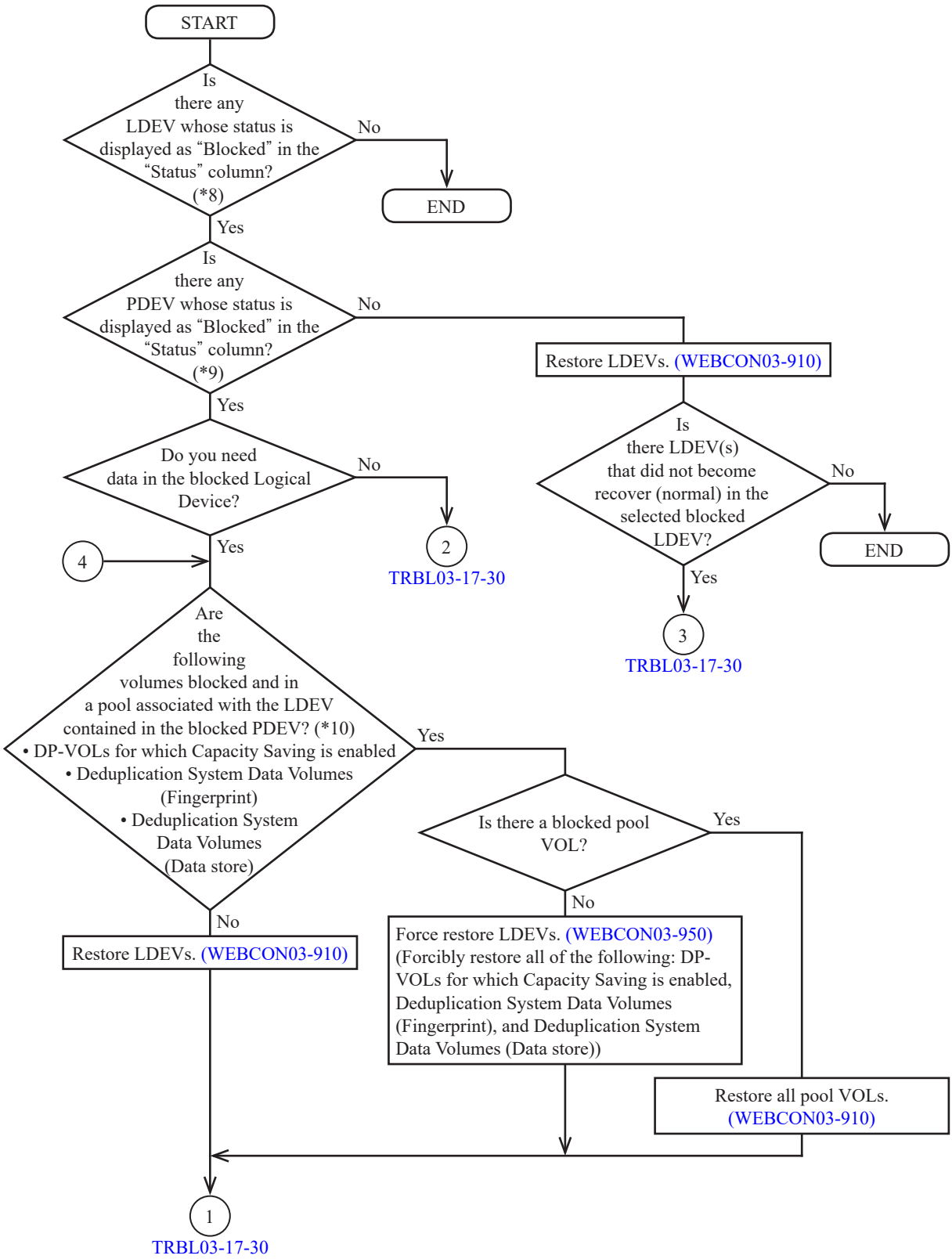
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3.17 Recovery Procedure for LDEV Blockade (SIM = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx)

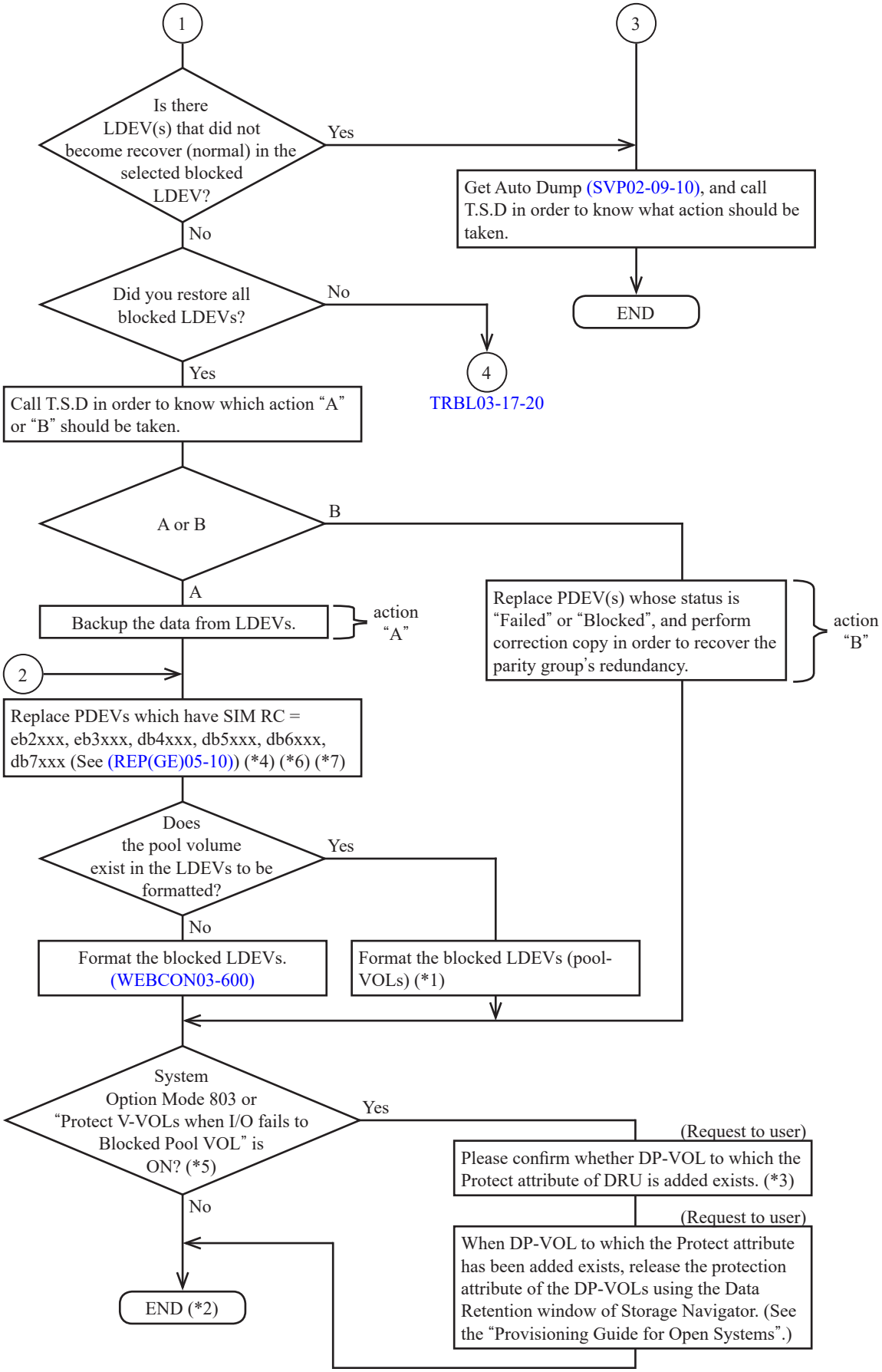
When LDEVs are blocked in the case of blocking several PDEVs (SIM RC = ef8xxx, ef9xxx, db8xxx, db9xxx, dbaxxx, dbbxxx), perform the following recovery procedures.
Be sure to call T.S.D. before you perform PDEV replace. It causes a DATA-LOSS in some cases.

> **⚠ 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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*1: See TRBL13-10 of the case of Dynamic Provisioning.
See TRBL10-130 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) No error code other than shown in (b-1) is included when PDEV replacement fails.
(b-1) "30762-208312", "30762-208307"

*5: Check V-VOL protection function settings when the pool-VOL is blocked in [Protect V-VOLs when I/O fails to Blocked Pool VOL] of the Pools window, or the window displayed after selecting a pool in the Pools window of Storage Navigator.
[Yes] indicates that the V-VOL protection function is set to ON.

*6: If an LDEV to be formatted contains pairs of any of the following types, delete the pairs and then re-create them after restoring the LDEV.
TrueCopy, Universal Replicator, ShadowImage, Volume Migration, Thin Image, XRC, or global-active device.

*7: If you restore the LDEV being used by a global-active device pair, follow the procedure in TRBL18-70.

*8: In the "Parity Groups" window in Web Console, select each parity group to display.
To check LDEV, click the [LDEVs] tab.

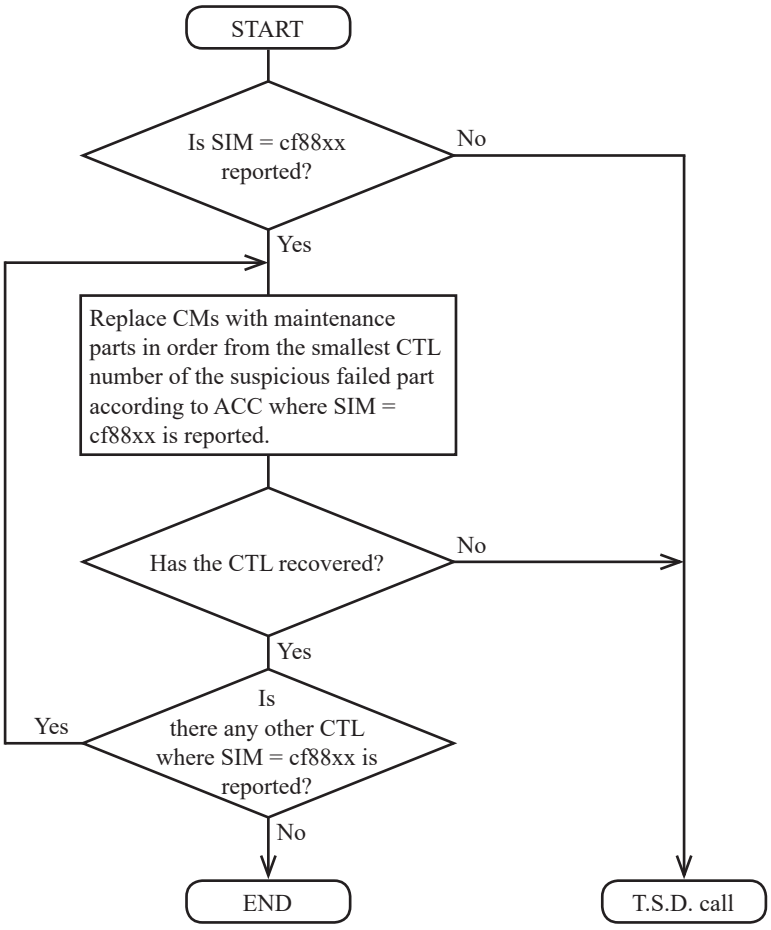
*9: In the "Parity Groups" window in Web Console, select each parity group to display.
To check PDEV, click the [Drives] tab.

*10: How to check the blockade state of DP-VOLs for which Capacity Saving is enabled, Deduplication System Data Volumes (Fingerprint), and Deduplication System Data Volumes (Data store):
In the "Logical Devices" window in Web Console, if [Blocked] is displayed in the [Status] column, the volumes are blocked. For the DP-VOLs for which Capacity Saving is enabled, "Compression" or "Deduplication and Compression" is displayed in [Capacity Saving]. For the two types of Deduplication System Data Volumes, "Deduplication System Data Volume (Fingerprint)" or "Deduplication System Data Volume (Data store)" is displayed in [Attribute].
• The [Capacity Saving] column is not displayed by default. Display the [Capacity Saving] column by using the [Column Settings] button (for details, see "System Administrator Guide").
• To display only the DP-VOLs for which Capacity Saving is enabled, Deduplication System Data Volumes (Fingerprint), and Deduplication System Data Volumes (Data store), specify the column value for the filter. For more details about filtering, refer to "System Administrator Guide".

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3.18 Recovery Procedure When CMs Are Blocked in One Cluster (SIM = fff40x)

The following is the recovery procedure when CMs are blocked in one cluster.



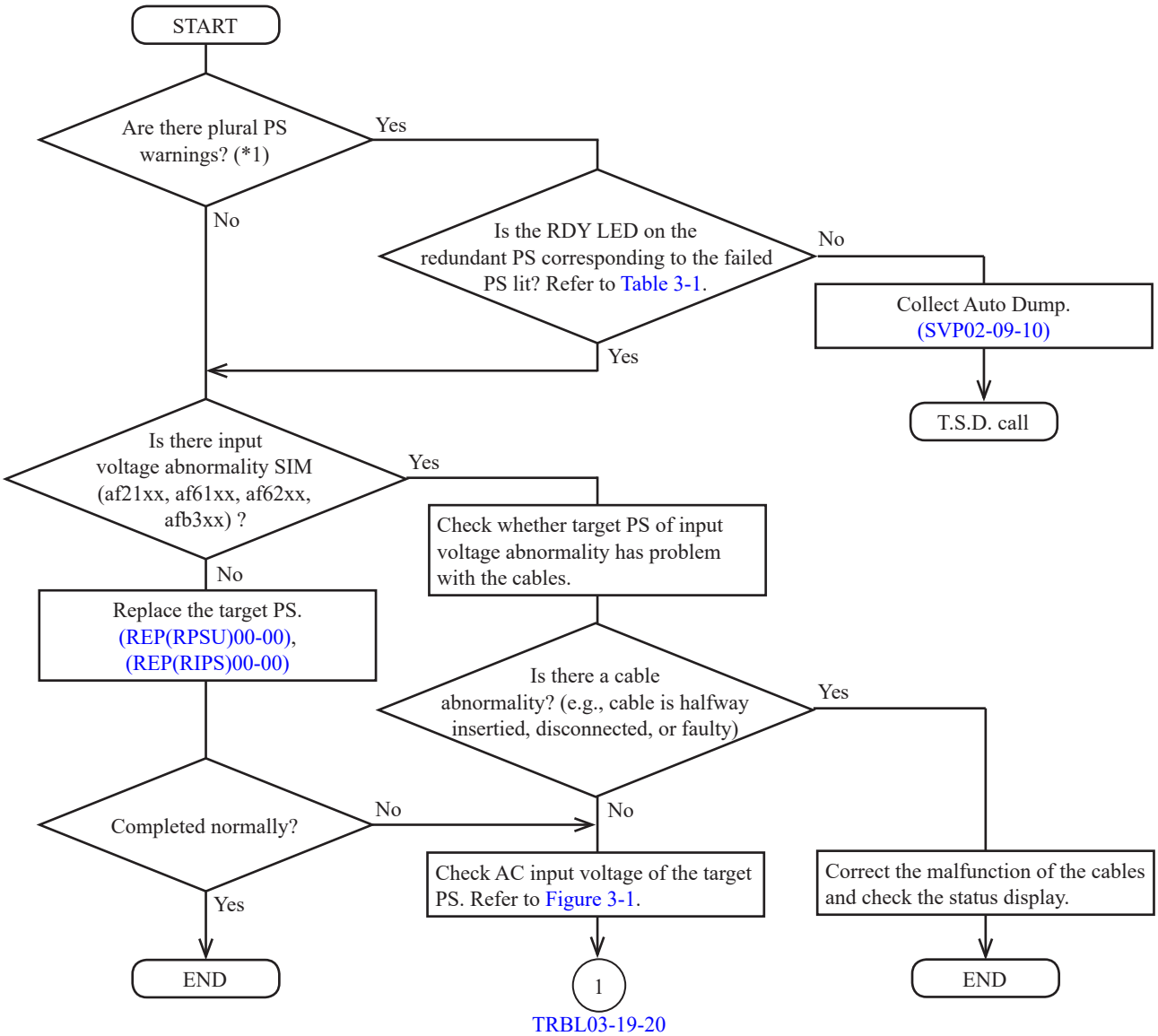
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3.19 PS Warning Error (af20xx, af51xx, af52xx, afb1xx, af21xx, af61xx, af62xx, afb3xx)

Associated SIM and Description

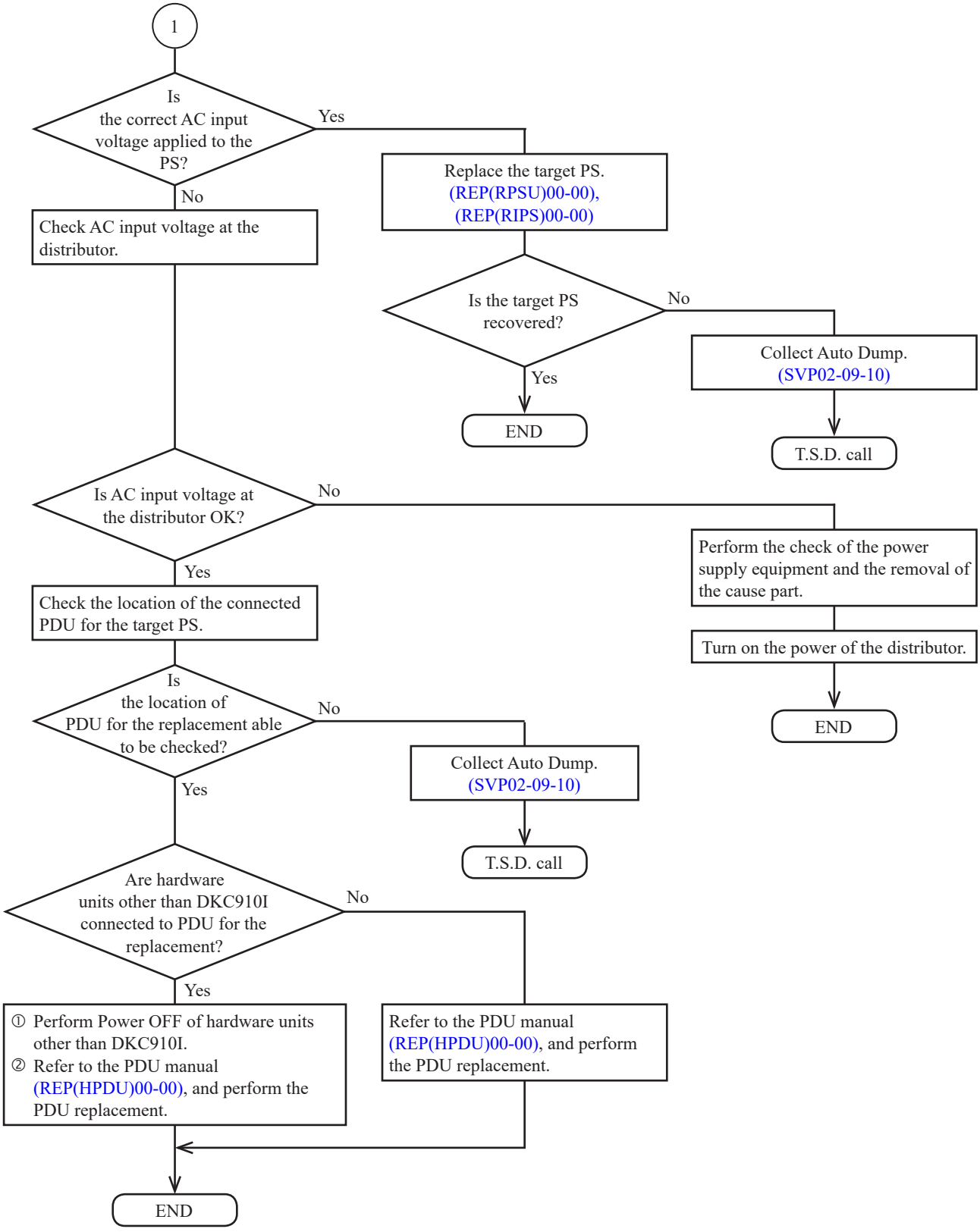
SIM RC	Warning type	Description
af20xx	DKCPS warning	Malfunction of DKCPS
af51xx, af52xx	DBPS warning	Malfunction of DBPS
afb1xx	ISWPS warning	Malfunction of ISWPS
af21xx	DKCPS input voltage abnormality	Abnormal AC input voltage of DKCPS
af61xx, af62xx	DBPS input voltage abnormality	Abnormal AC input voltage of DBPS
afb3xx	ISWPS input voltage abnormality	Abnormal AC input voltage of ISWPS

Check that the PDU breaker is on and that the PS cable ASSY between PDU and DKCPS/DBPS/ISWPS is connected correctly before replacement of DKCPS/DBPS/ISWPS.
When the PDU breaker is off, turn it to on. When the PS cable ASSY is disconnected, connect it.



*1: Refer to (LOC03-60), (LOC03-140), (LOC03-180), (LOC03-210) for Location of the RDY LED for PS.

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Table 3-1 Correspondence Table from PS Warning Location to Redundant PS Location

No.	PS Warning Location		Redundant PS Location	Failed part
1	DKCPSx1	→	DKCPSx2	DKC
2	DKCPSx2	→	DKCPSx1	
3	DBPS zzz-1	→	DBPS zzz-2	SBX
4	DBPS zzz-2	→	DBPS zzz-1	FBX
5	DBPS (zzz+2)-1	→	DBPS (zzz+2)-2	
6	DBPS (zzz+2)-2	→	DBPS (zzz+2)-1	
7	DBPS (zzz+4)-1	→	DBPS (zzz+4)-2	
8	DBPS (zzz+4)-2	→	DBPS (zzz+4)-1	
9	DBPS (zzz+6)-1	→	DBPS (zzz+6)-2	
10	DBPS (zzz+6)-2	→	DBPS (zzz+6)-1	
11	DBPS zzz-1	→	DBPS zzz-2	UBX
12	DBPS zzz-2	→	DBPS zzz-1	
13	DBPS (zzz+1)-1	→	DBPS (zzz+1)-2	
14	DBPS (zzz+1)-2	→	DBPS (zzz+1)-1	
15	DBPS (zzz+2)-1	→	DBPS (zzz+2)-2	
16	DBPS (zzz+2)-2	→	DBPS (zzz+2)-1	
17	DBPS (zzz+3)-1	→	DBPS (zzz+3)-2	
18	DBPS (zzz+3)-2	→	DBPS (zzz+3)-1	
19	DBPS (zzz+4)-1	→	DBPS (zzz+4)-2	
20	DBPS (zzz+4)-2	→	DBPS (zzz+4)-1	
21	DBPS (zzz+5)-1	→	DBPS (zzz+5)-2	
22	DBPS (zzz+5)-2	→	DBPS (zzz+5)-1	
23	DBPS (zzz+6)-1	→	DBPS (zzz+6)-2	
24	DBPS (zzz+6)-2	→	DBPS (zzz+6)-1	
25	DBPS (zzz+7)-1	→	DBPS (zzz+7)-2	
26	DBPS (zzz+7)-2	→	DBPS (zzz+7)-1	
27	ISWPSn1	→	ISWPSn2	HSNBX
28	ISWPSn2	→	ISWPSn1	

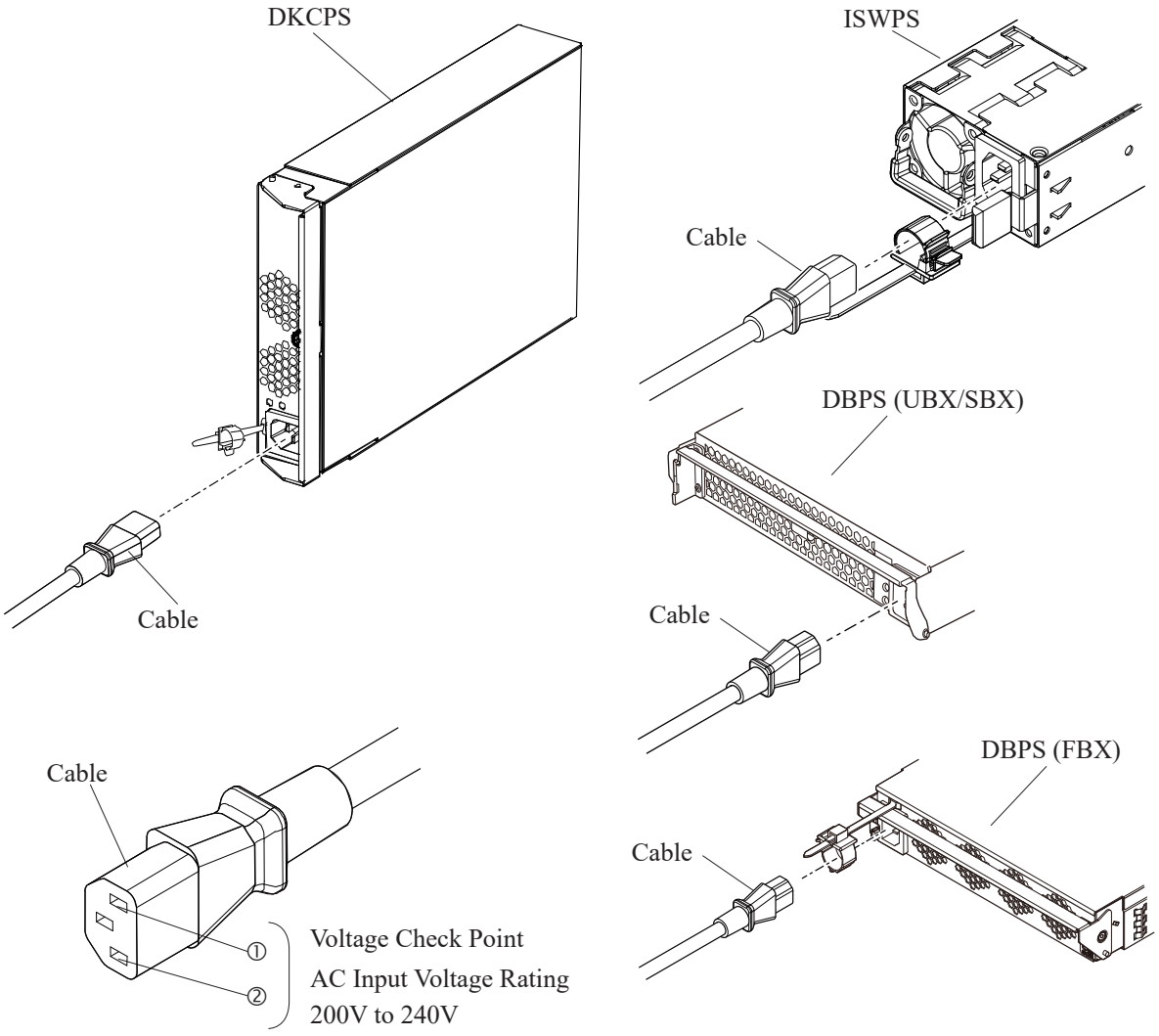
NOTE: For example, if Location of PS warning is “DKCPSx1”, Location of the corresponding redundant PS is “DKCPSx2”. At this time, if the RDY LED (Green) for PS of “DKCPSx2” is lit, it is redundant so that the maintenance replacement of “DKCPSx1”, etc. is possible. If the RDY LED (Green) for PS of “DKCPSx2” is off, it is not redundant so that the maintenance replacement of“DKCPSx1”, etc. is impossible (T.S.D. call).

NOTE: DB-zzz (zzz: 0 to 191)

[AC Input voltage check]

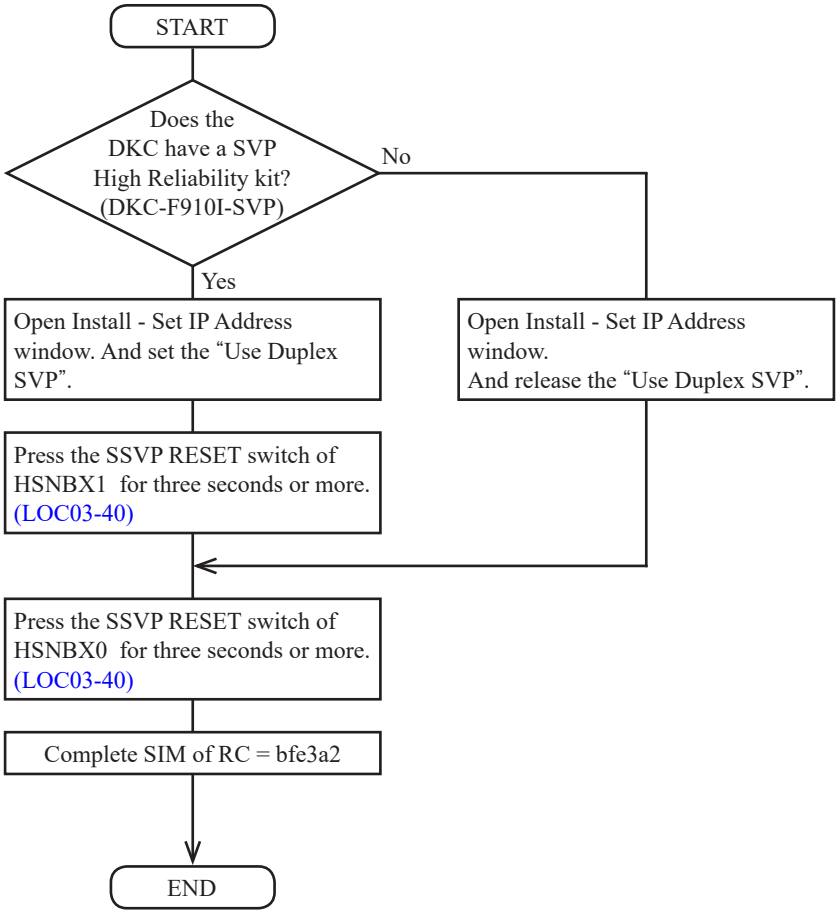
1. Remove the cable of target PS.
2. Measure AC input voltage at terminal of removed cables.

Figure 3-1 AC Input Voltage Check



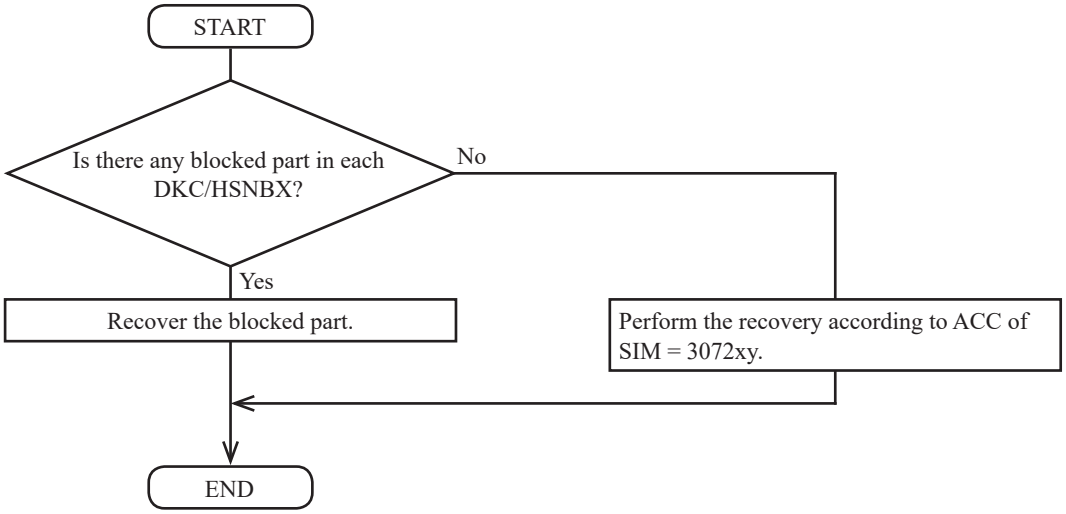
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3.20 Recovery Procedure When Duplex SVP Setting Failed (SIM = bfe3a2)



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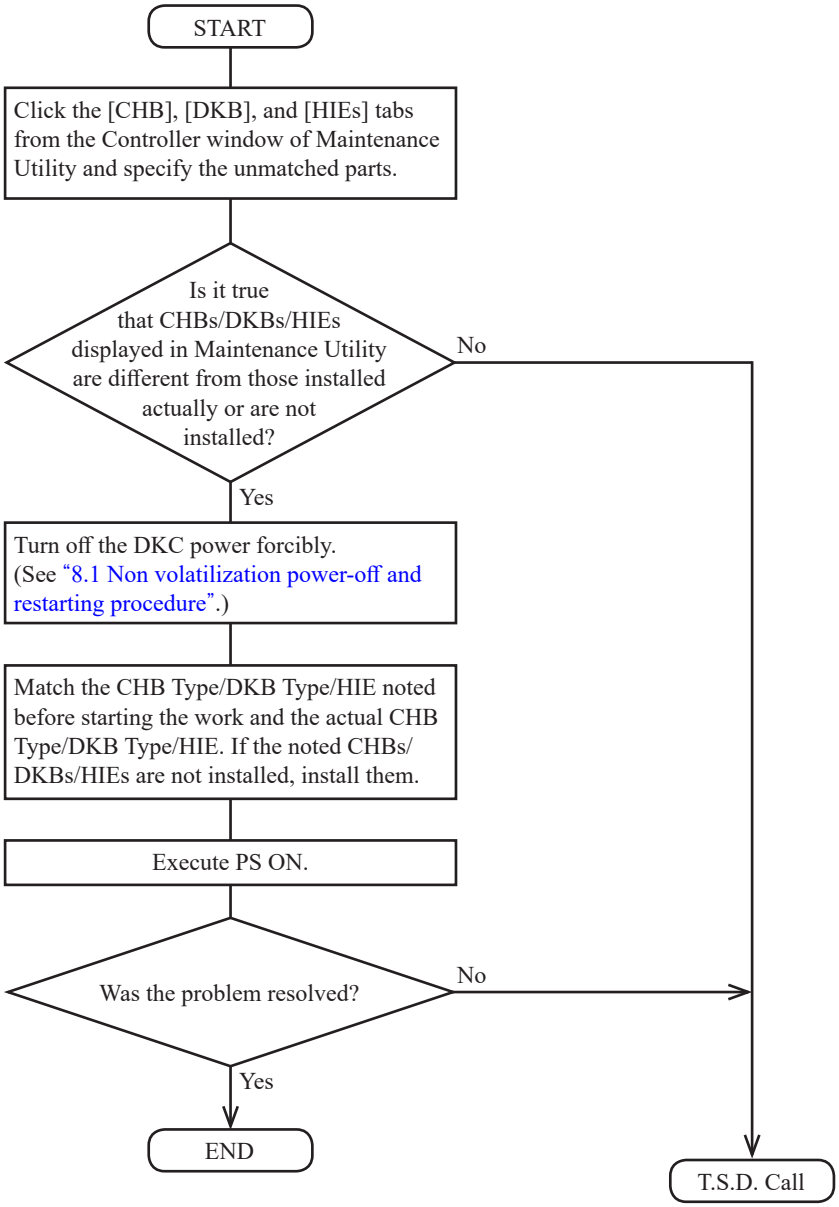
3.21 Recovery Procedure When CHK3 Threshold Over Occurred (SIM = 3072xy)



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

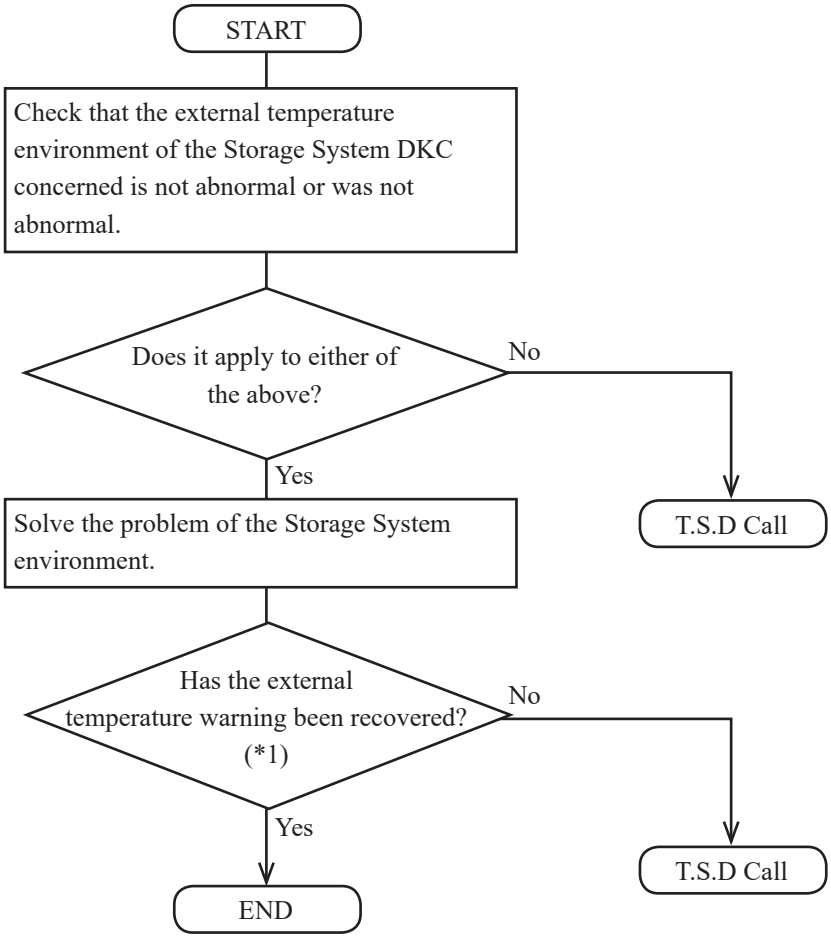
When “Types of installed Channel Boards, Disk Boards, and Interconnect Channel Boards” and “Types of defined Channel Boards, Disk Boards, and Interconnect Channel Boards” differ at the time of start-up, SIM RC = 3c9500 is issued. When it is issued, they need to be matched. Furthermore, before starting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



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

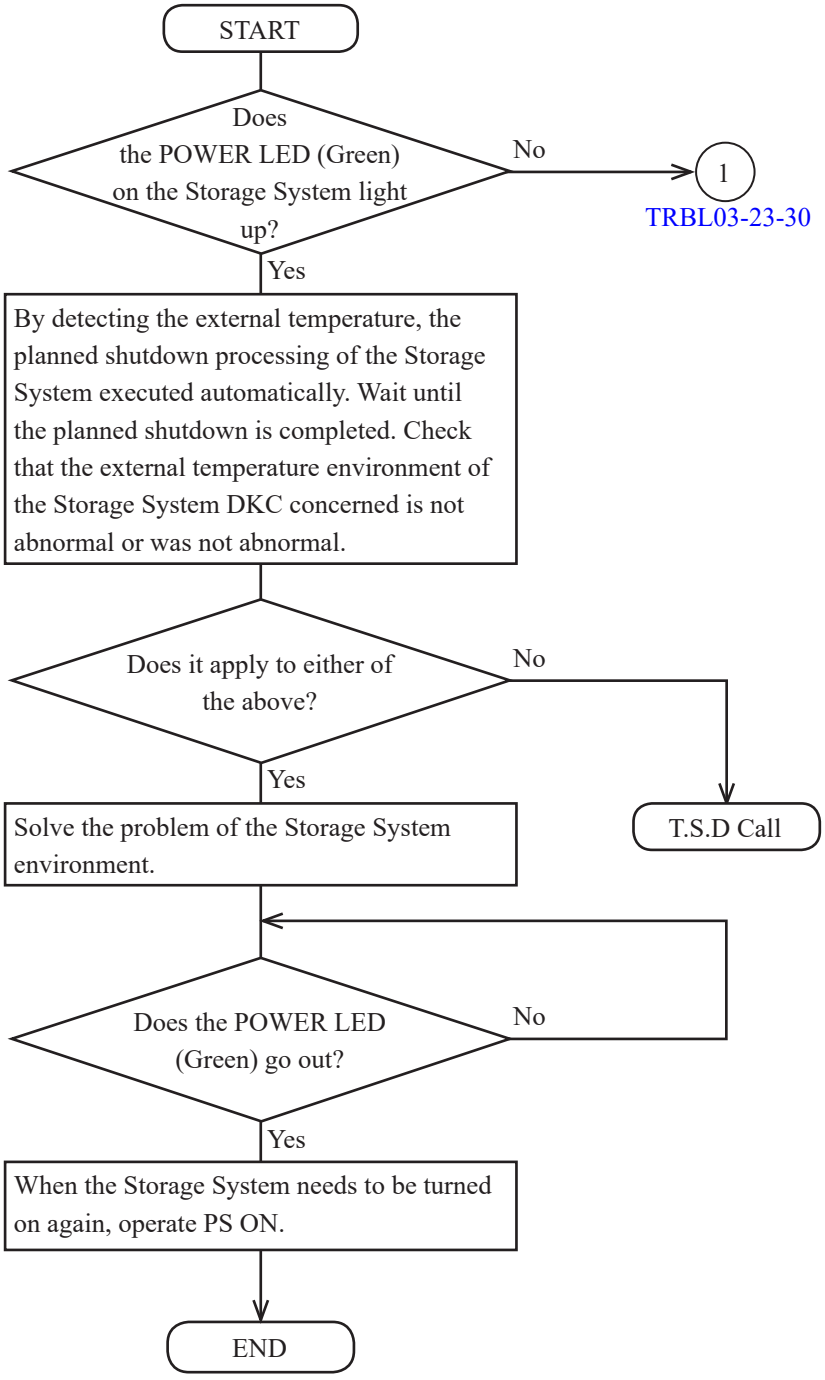
1. Response to the Occurrence of External Temperature Warning



*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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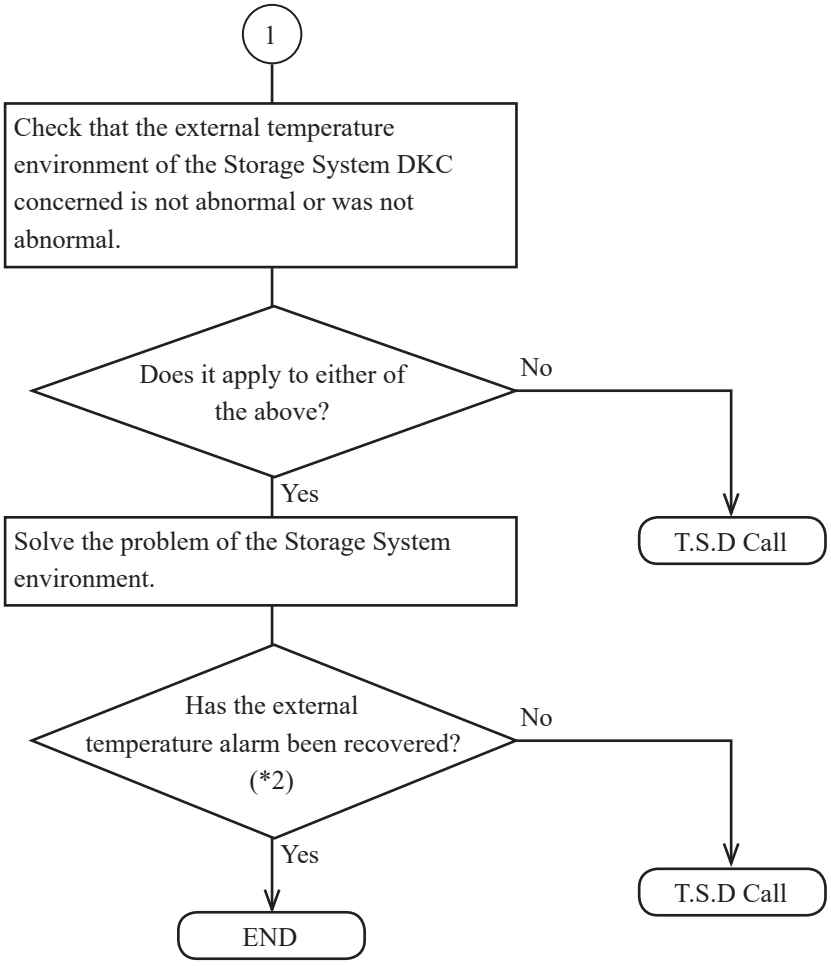
2. Response to the Occurrence of External Temperature Alarm



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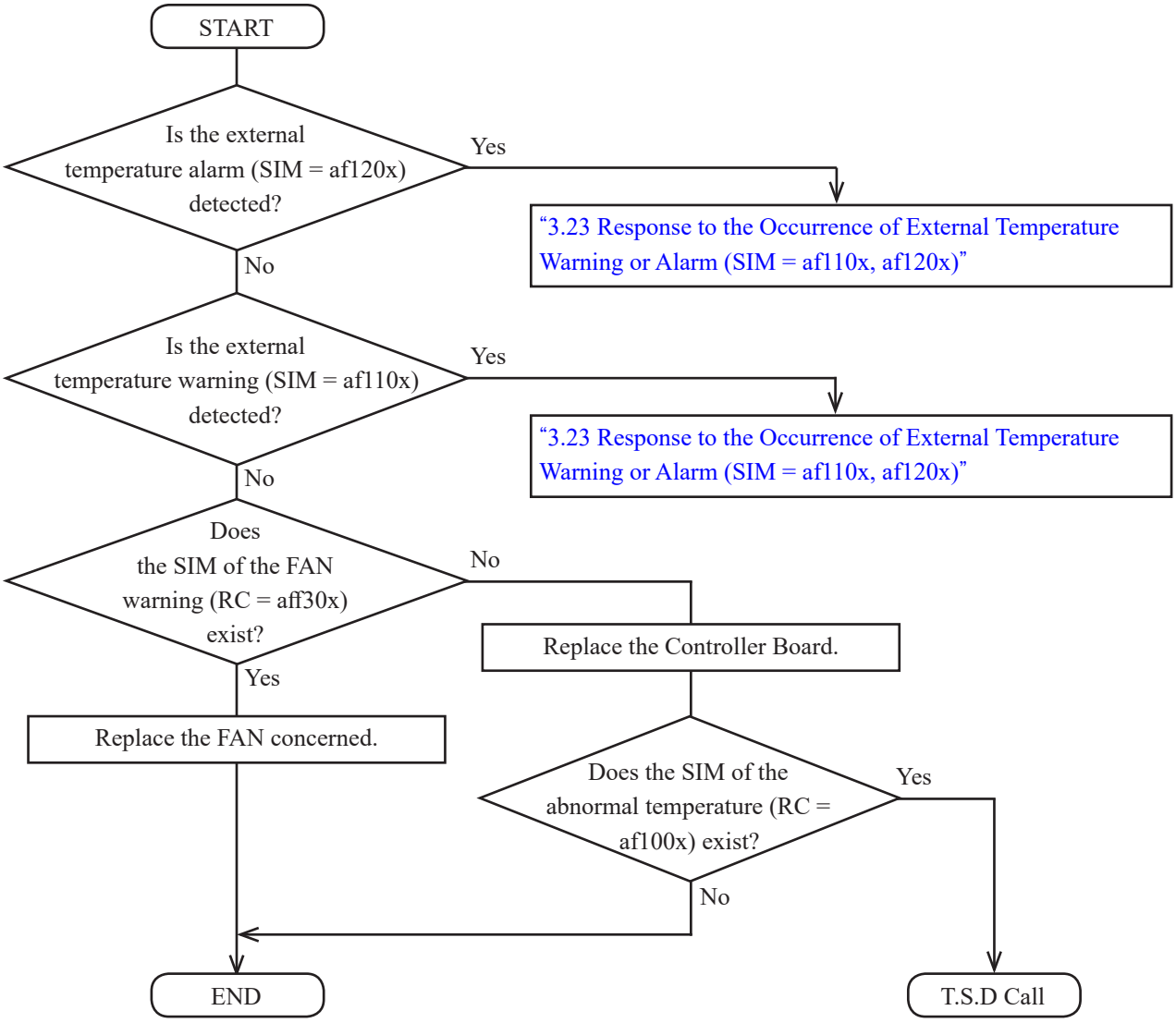
*2: The recovery status of external temperature alarm can be verified by using the detailed information of the SSB “f602”.
If the detailed data Byte43.bit[3:0] in the SSB “f602” is “2”, this value shows that the external temperature alarm has been recovered.

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

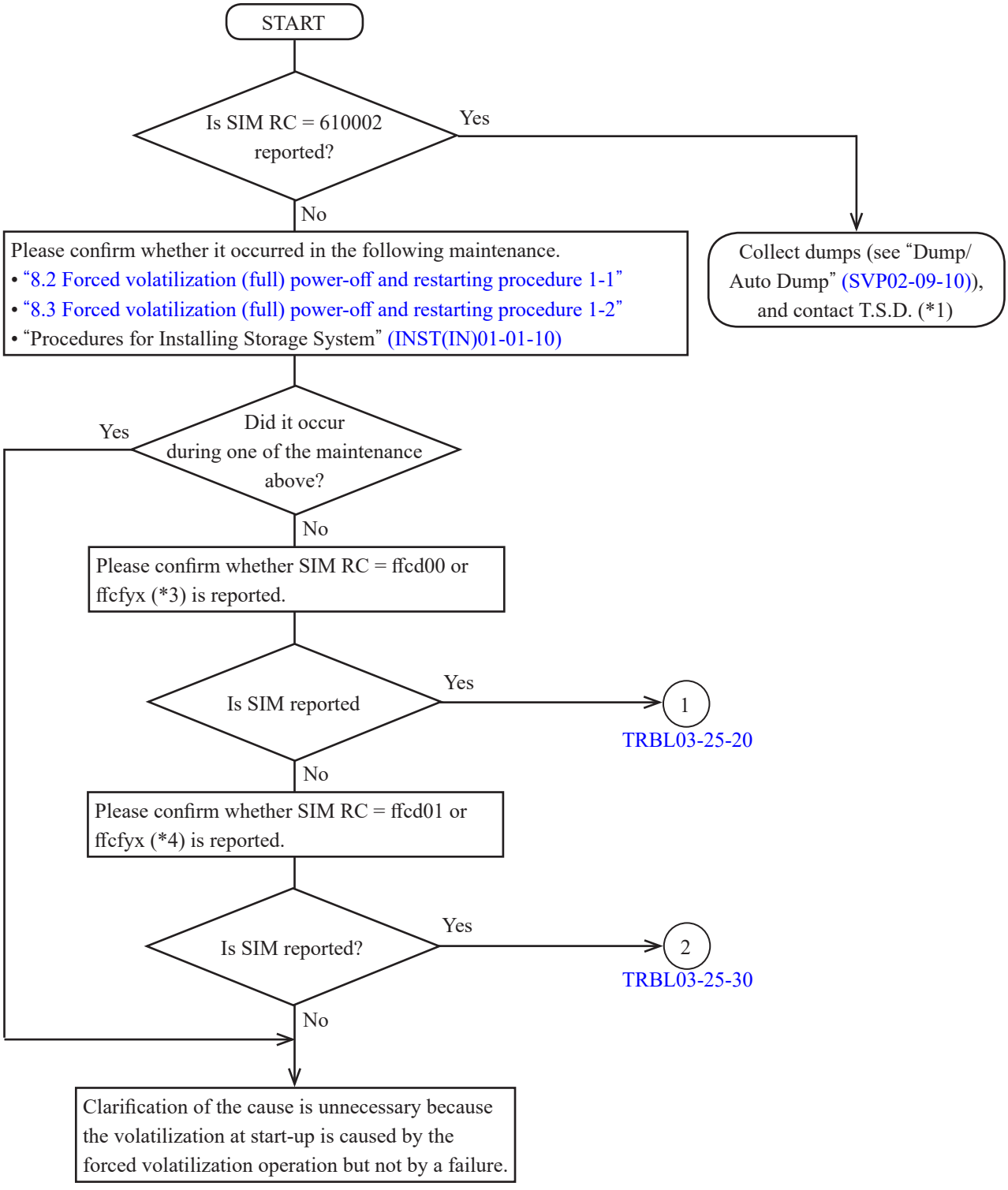


NOTE: When the CPU temperature becomes normal, the system is Ready. When replacing the FAN, there is a case which needs time of about one hour until the CPU becomes the normal temperature.

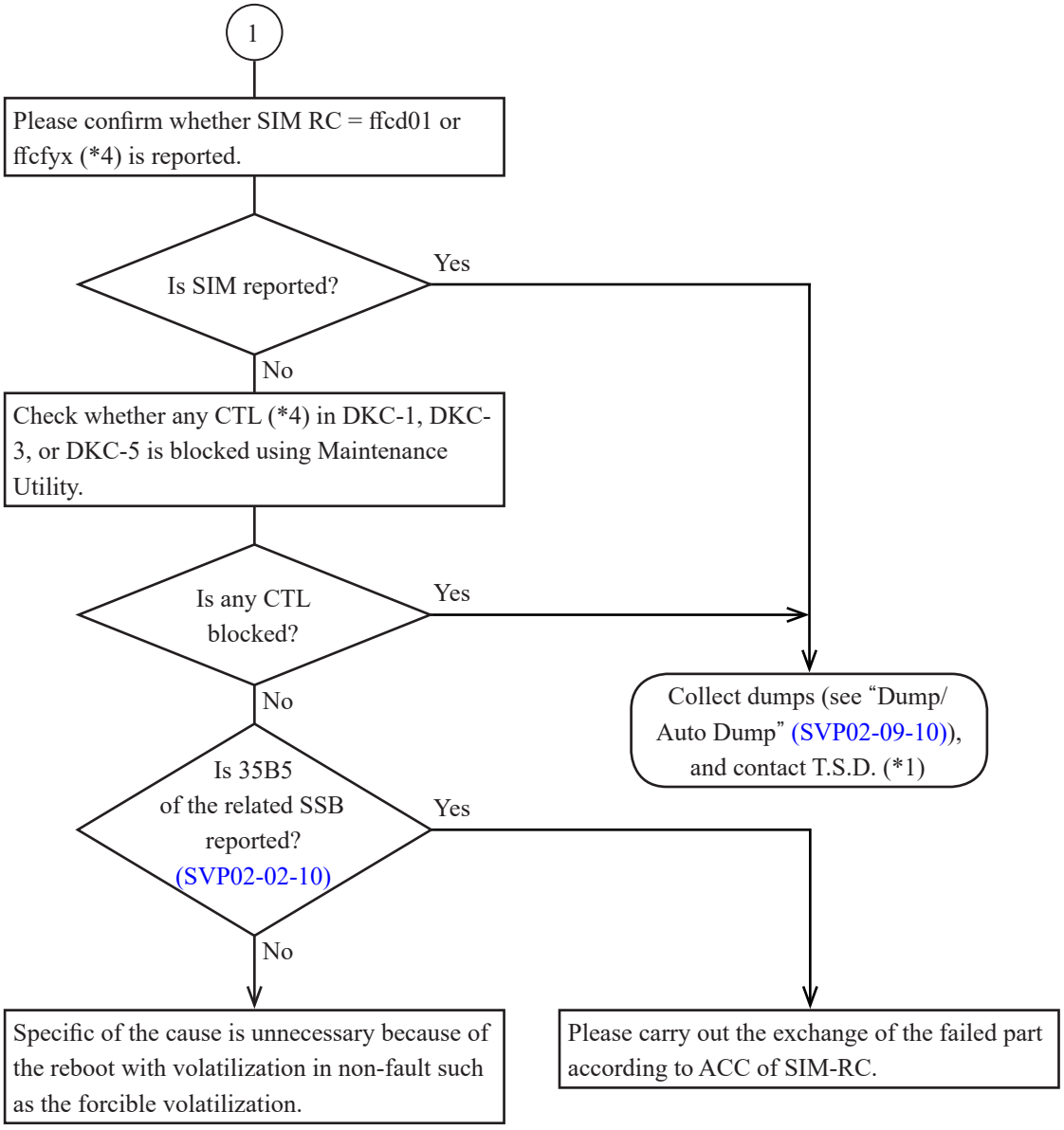
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3.25 Isolation Procedure for Failed Part in CACHE Volatilization (SIM = ffe700, ffcd0x, ffcfyx, 610002)

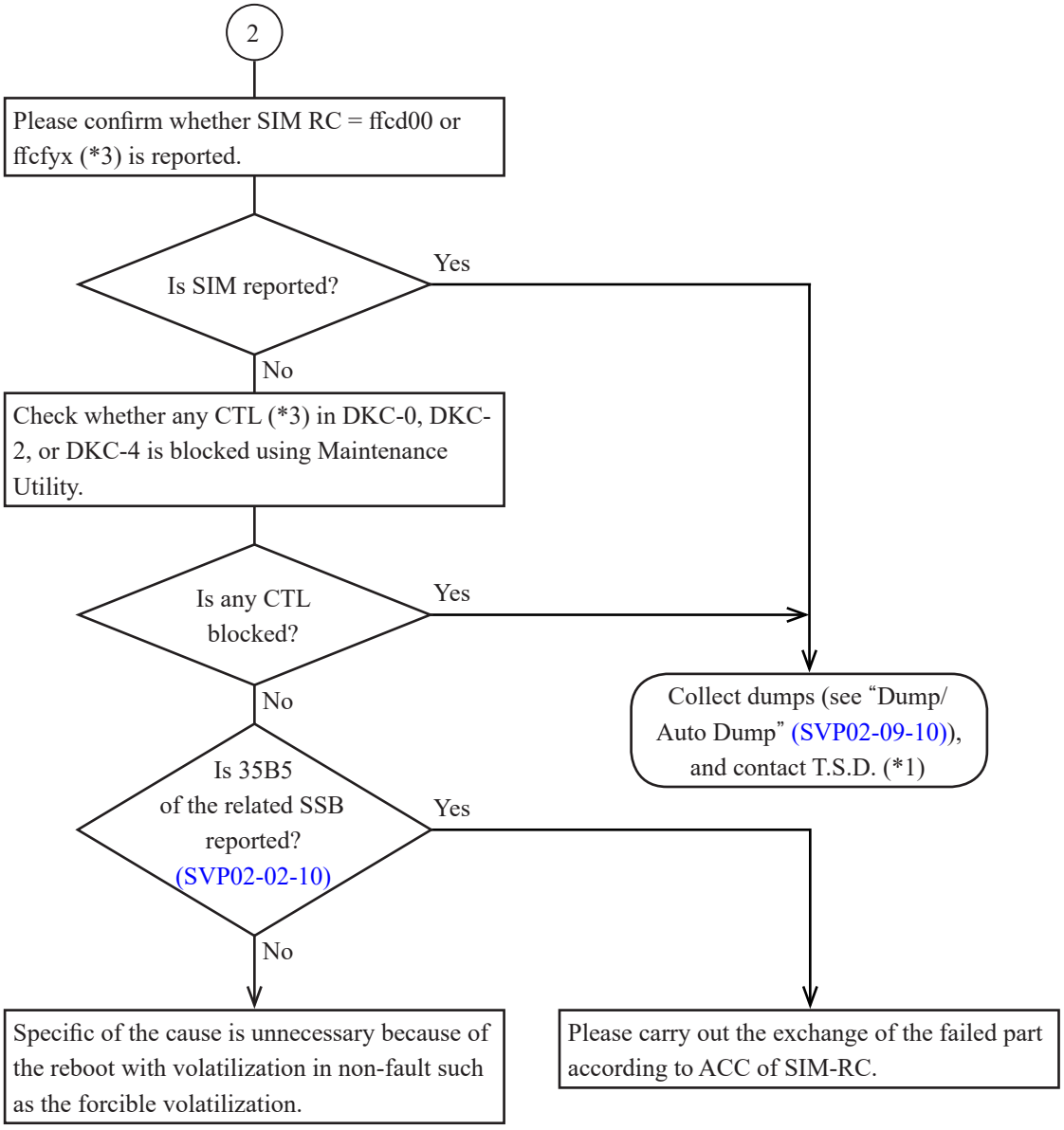
At the time of the cache volatilization, you carry out the recovery of the involved site according to the ACC of SIM-RC or the detailed information that it is displayed the following procedure by SSB window to classify involved sites after enforcement.



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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: “x” in “ffcfyx” indicates CTL#.

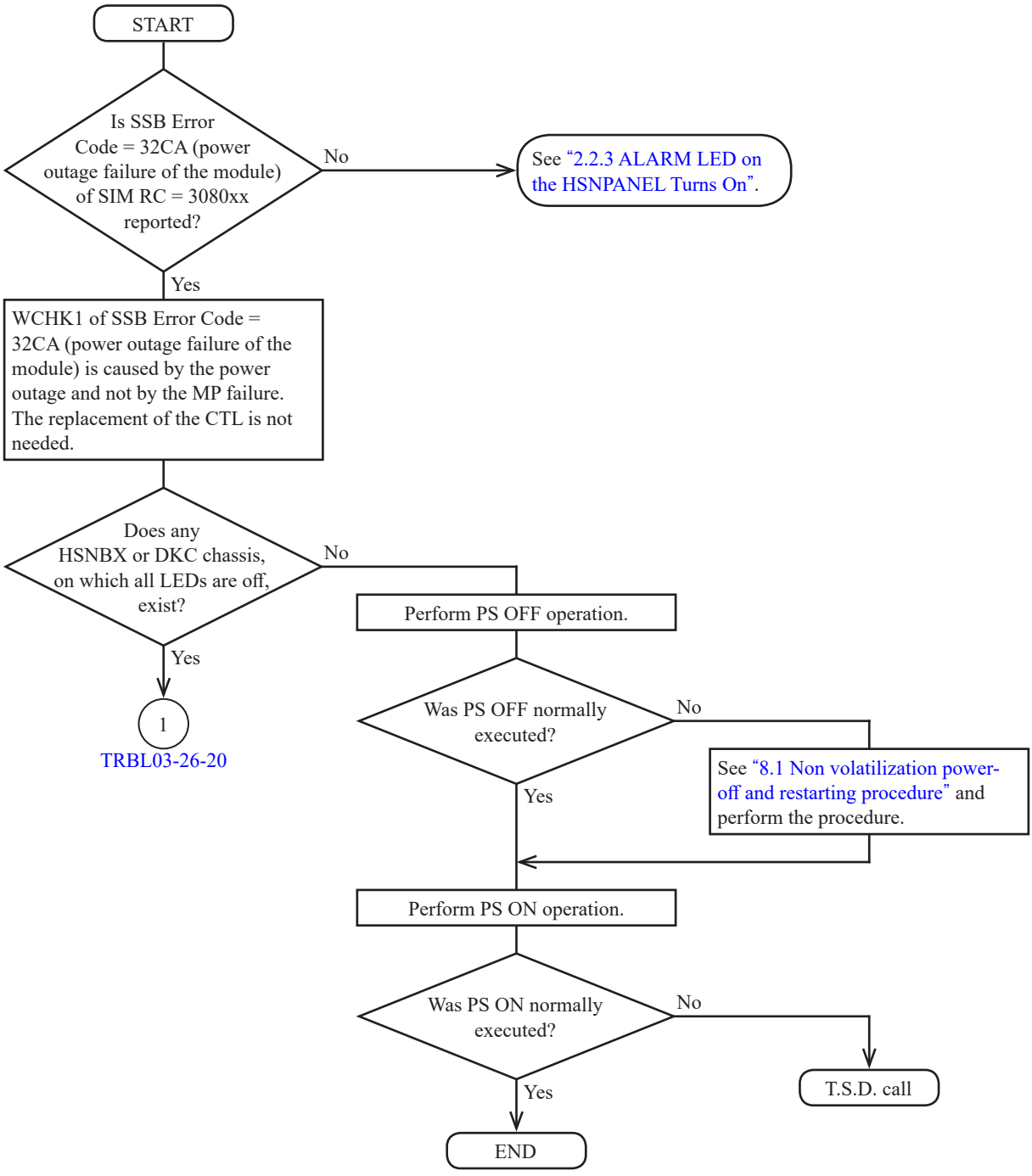
DKC	CTL Location	CTL# (HEX)
DKC-0	CTL01	x‘0’
	CTL02	x‘1’
DKC-2	CTL21	x‘4’
	CTL22	x‘5’
DKC-4	CTL41	x‘8’
	CTL42	x‘9’

*4: “x” in “ffcfyx” indicates CTL#.

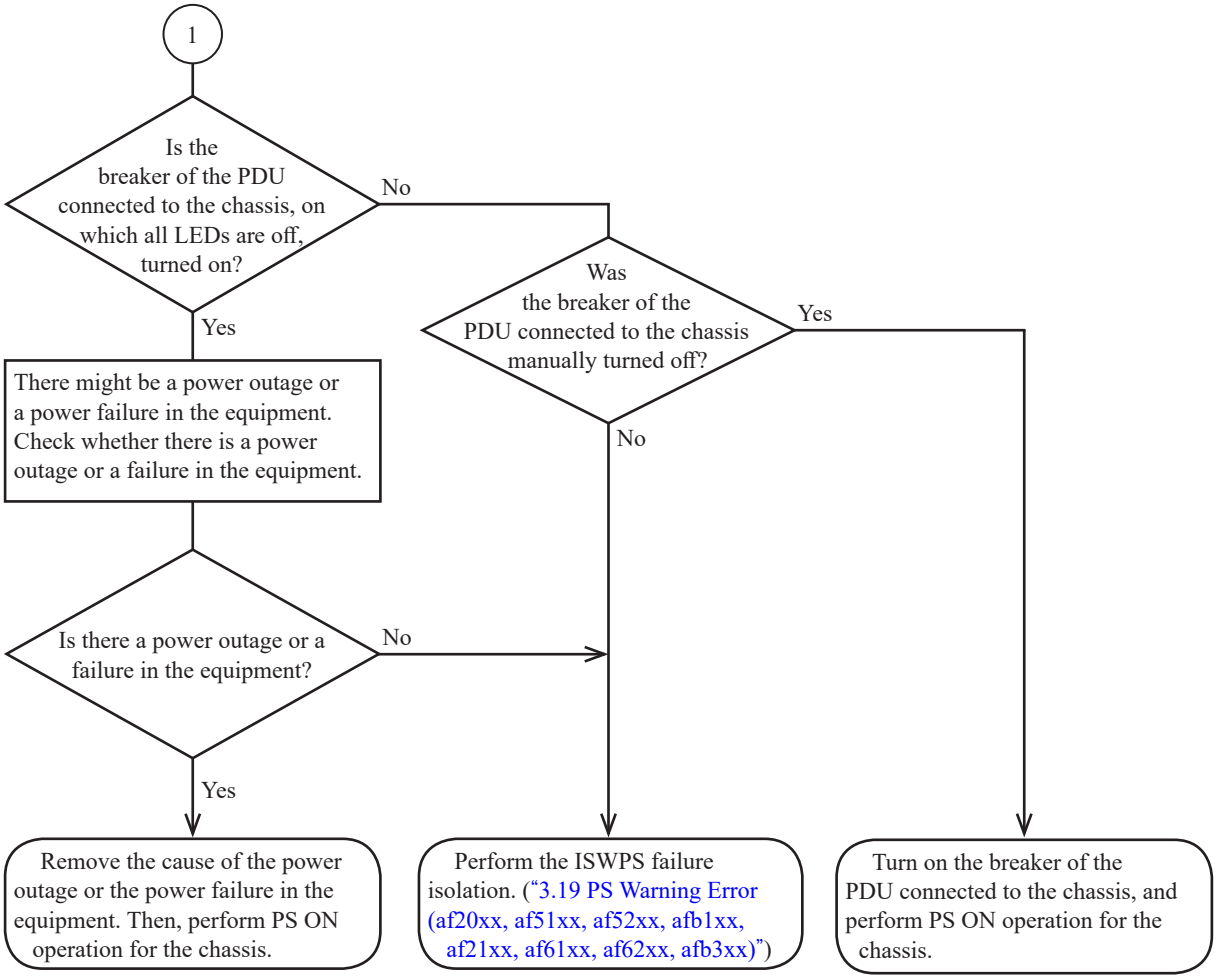
DKC	CTL Location	CTL# (HEX)
DKC-1	CTL11	x‘2’
	CTL12	x‘3’
DKC-3	CTL31	x‘6’
	CTL32	x‘7’
DKC-5	CTL51	x‘a’
	CTL52	x‘b’

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3.26 Receiving WCHK1 Dump (SIM = 3080xx)



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3.27 Isolation and Recovery Procedure for Drive Link Rate Error (SIM = dbcxxx, dbdxxx, dbexxx, dbfxxx)

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.

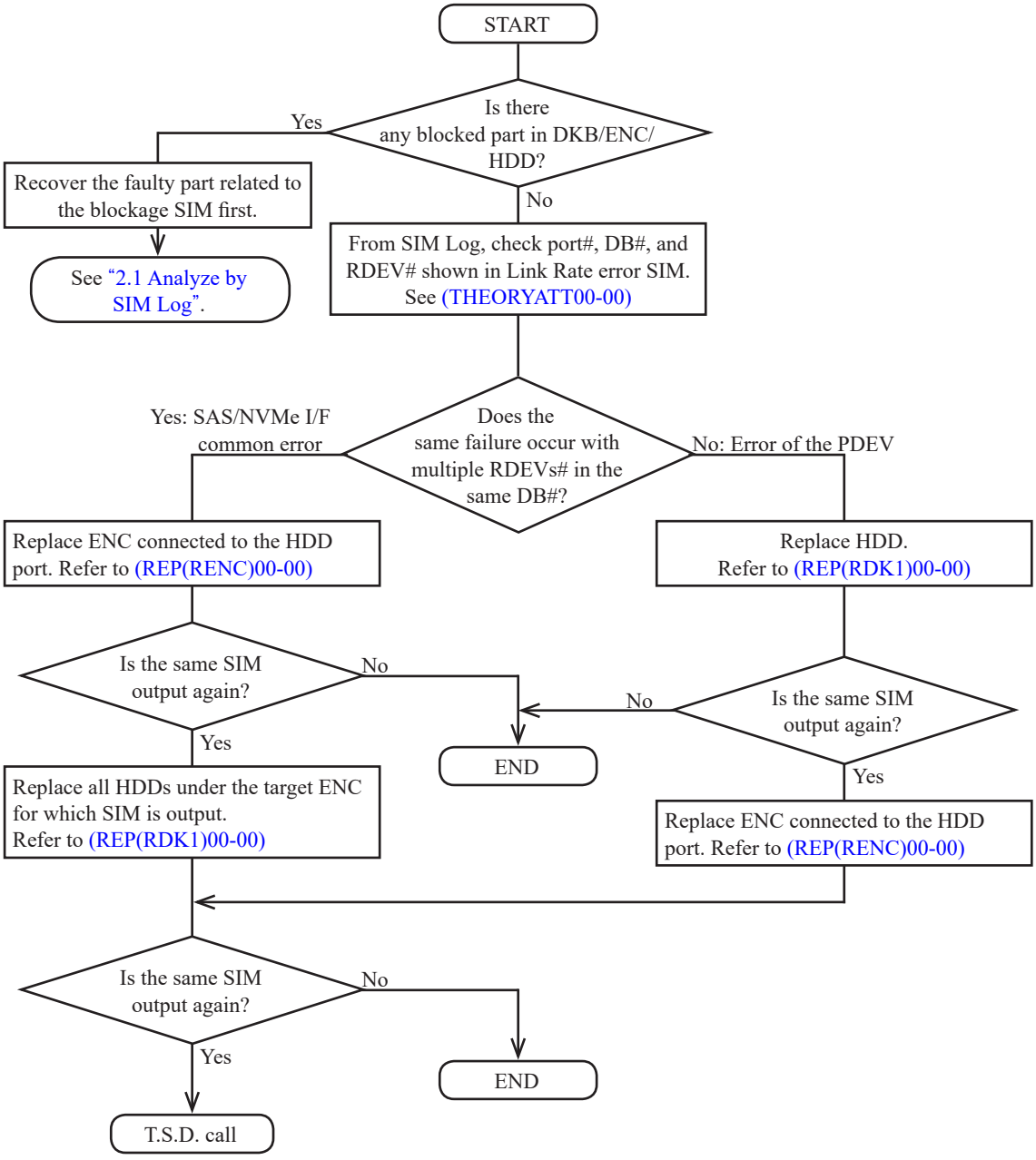
With this SIM, when setting Link Rate for each drive port of each PDEV fails, a drive port link rate error of Path 0 (REF code = dbcxxx, dbdxxx) or a drive port link rate error of Path 1 (REF code = dbexxx, dbfxxx) is reported. See (THEORY OF OPERATION SECTION [ATTACHMENT] (THEORYATT00-00))

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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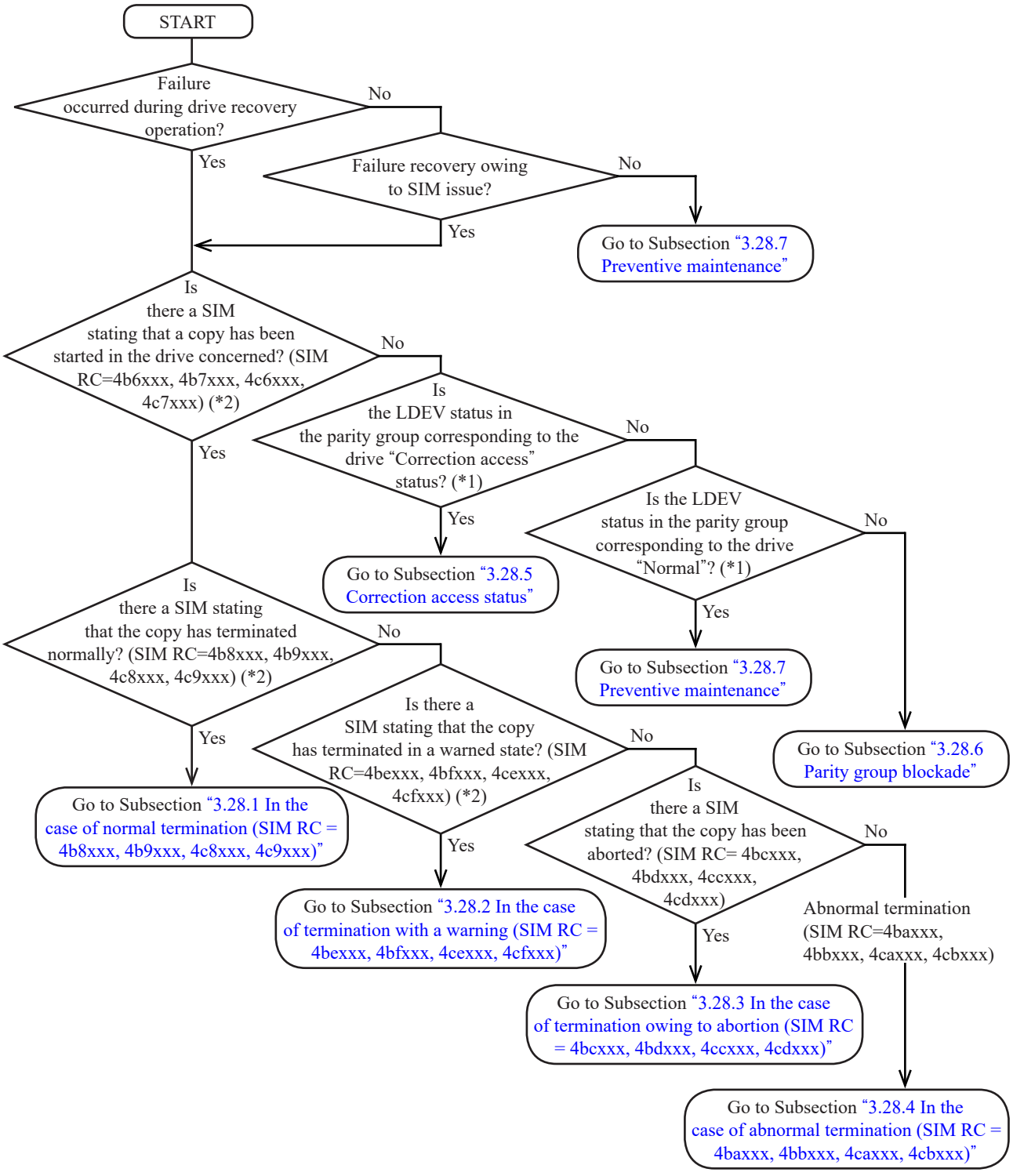
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3.28 Drive failure recovery procedure

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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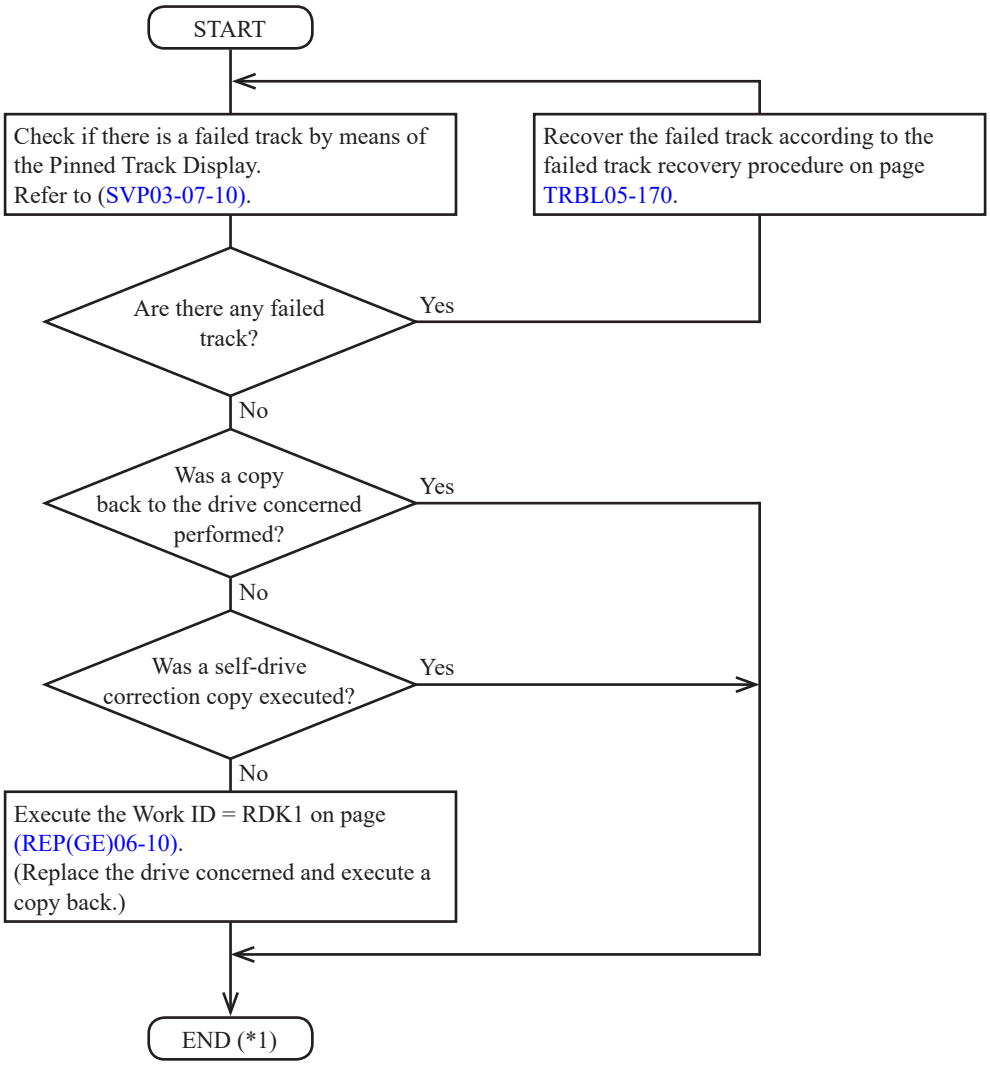
*1: Check the LDEV status in the parity group corresponding to the drive in the Logical Devices window on the Web Console (Refer to "Checking the Logical Devices" (WEBCON03-250)). Apply a filter to display the information about the specific parity groups only. For more details about filtering, refer to "System Administrator Guide".

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

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3.28.1 In the case of normal termination (SIM RC = 4b8xxx, 4b9xxx, 4c8xxx, 4c9xxx)

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



*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

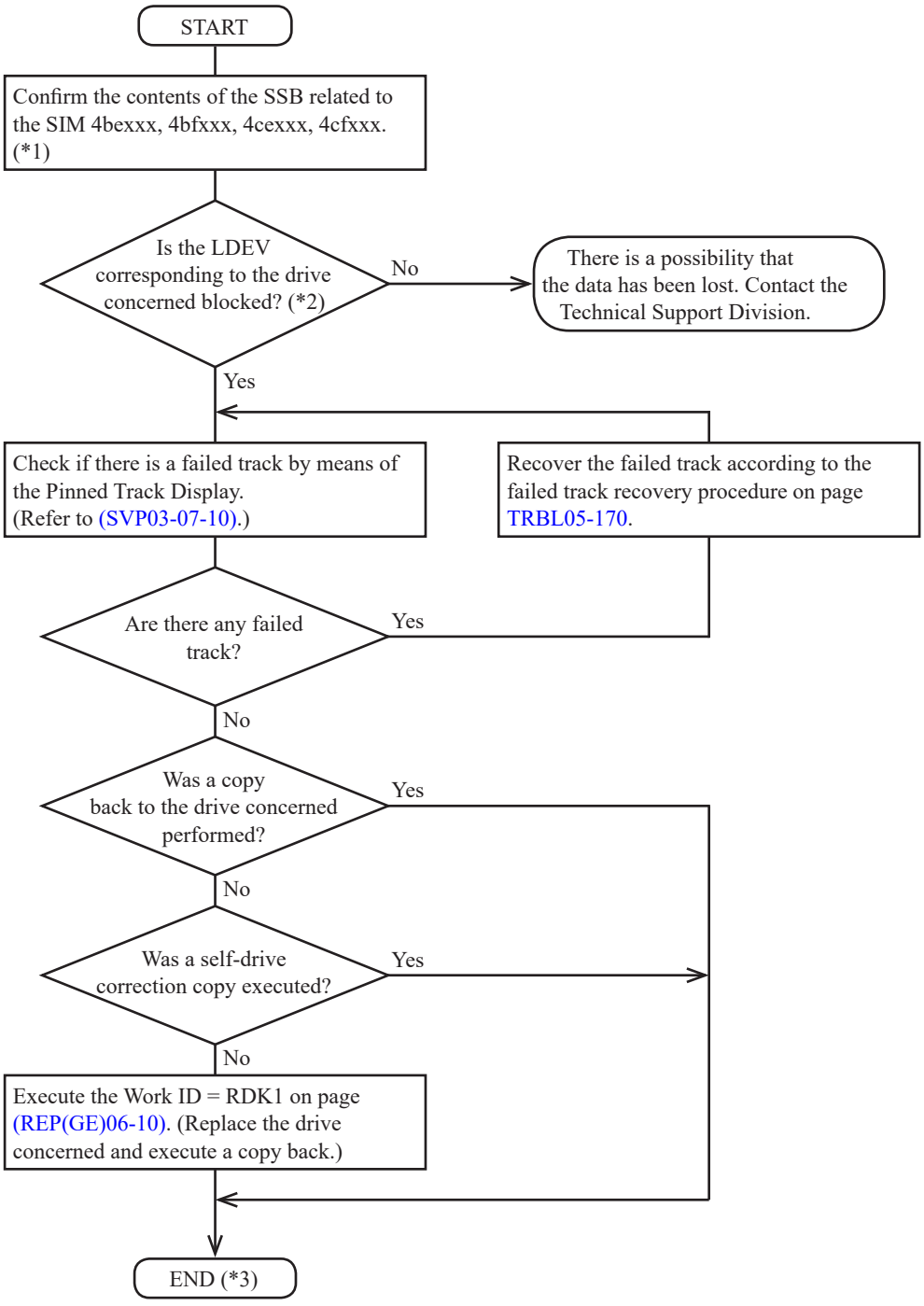
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3.28.2 In the case of termination with a warning (SIM RC = 4bexxx, 4bfxxx, 4cexxx, 4cfxxx)

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=4bexxx, 4bfxxx, 4cexxx, 4cfxxx

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 (WEBCON03-150).

*3: After finishing the error recovery, execute SIM complete and delete logs.
(SVP02-03-10), (SVP02-08-10)

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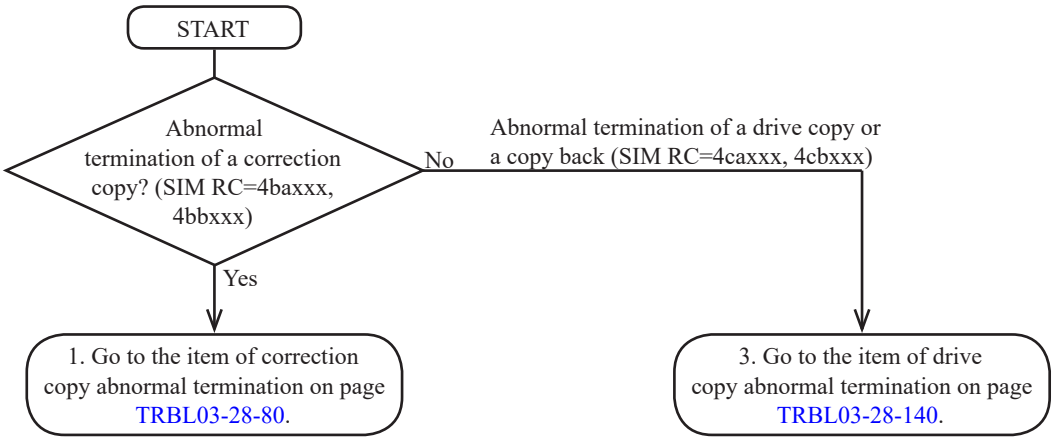
3.28.3 In the case of termination owing to abortion (SIM RC = 4bcxxx, 4bdxxx, 4ccxxx, 4cdxxx)

The procedure below is that used when a drive copy, copy back, or correction copy is aborted owing to the Maintenance Utility 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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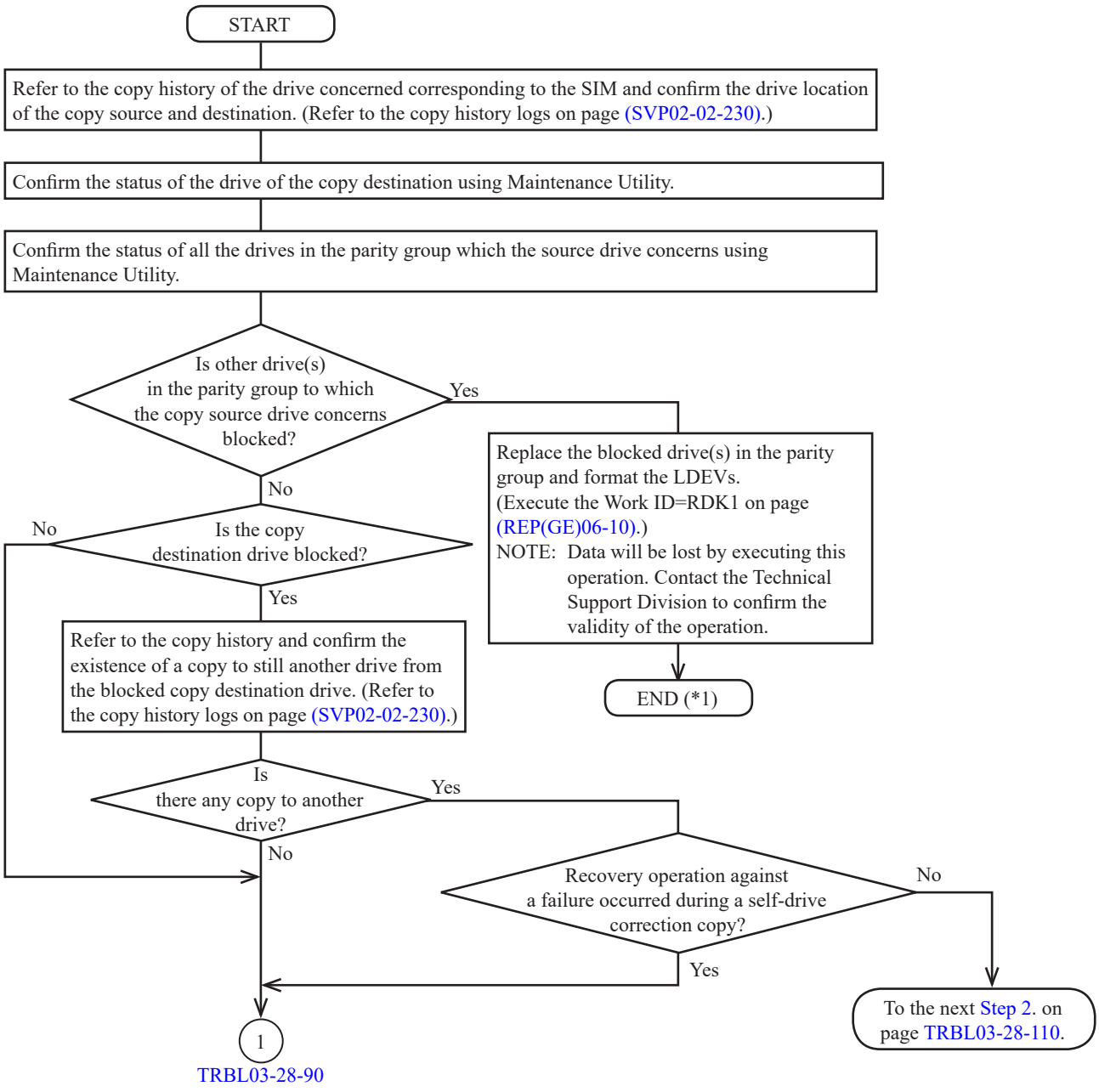
3.28.4 In the case of abnormal termination (SIM RC = 4baxxx, 4bbxxx, 4caxxx, 4cbxxx)

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 TRBL03-28-10 and execute the following procedure.



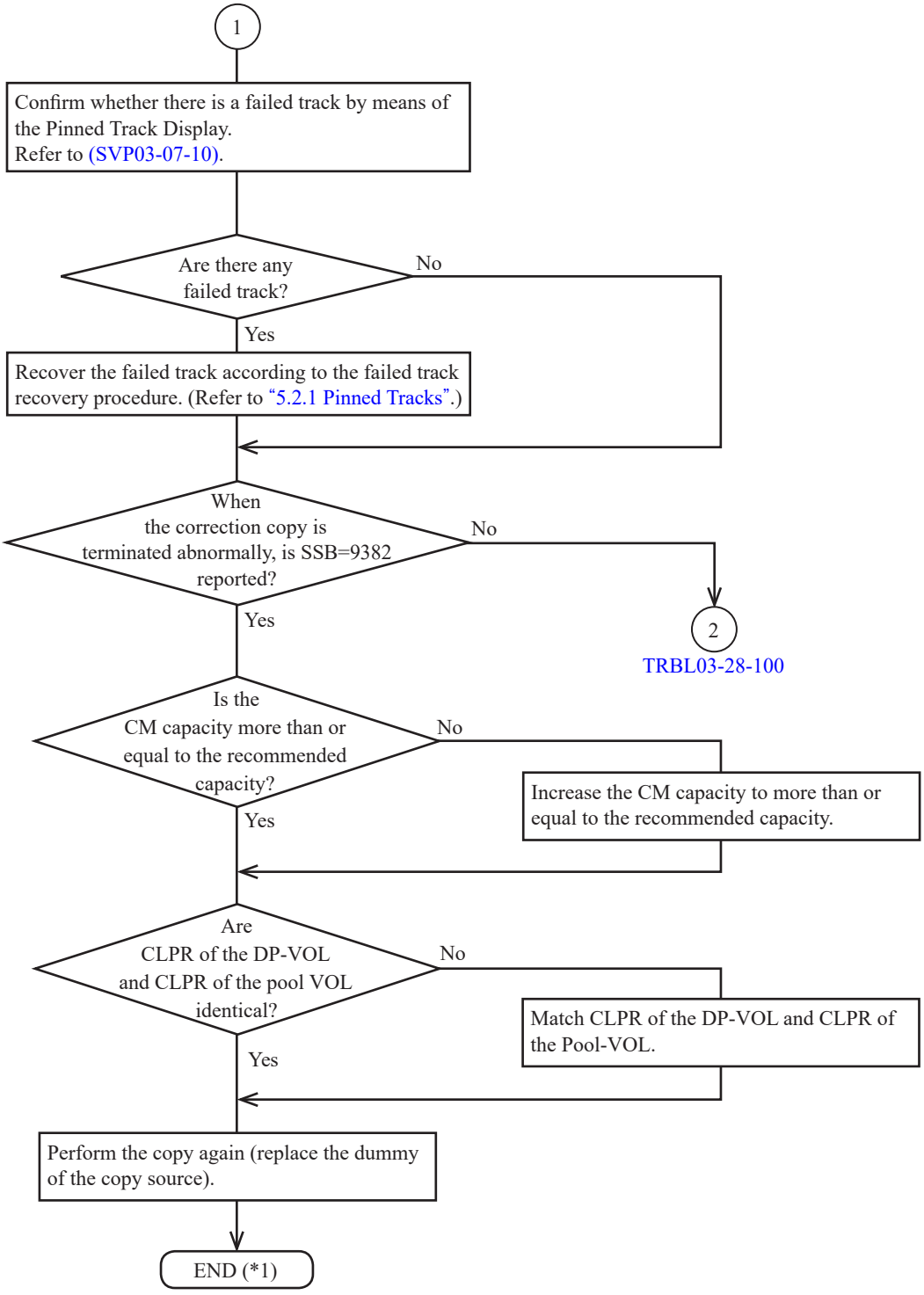
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1. In the case of correction copy abnormal termination
   The procedure below is that used when a correction copy terminates abnormally.



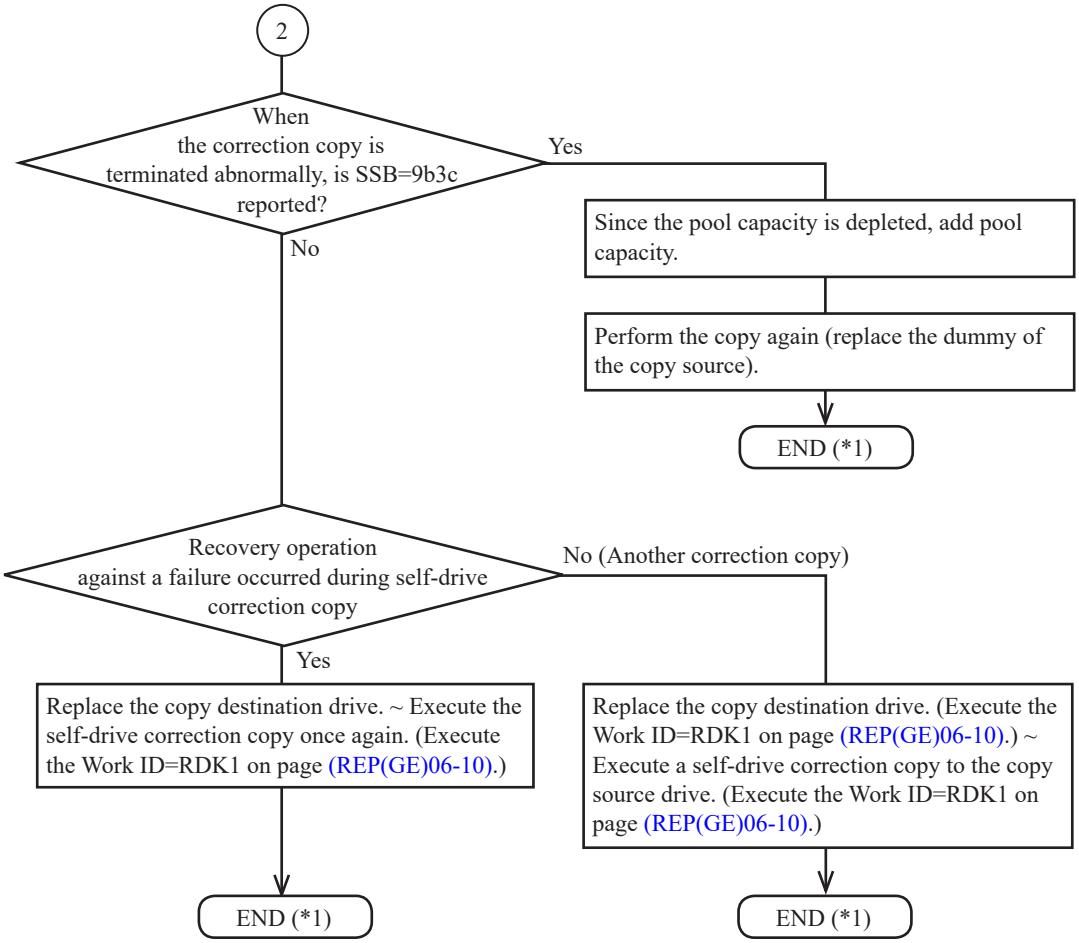
*1: After finishing the error recovery, execute SIM complete and delete logs.
(SVP02-03-10), (SVP02-08-10)

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*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

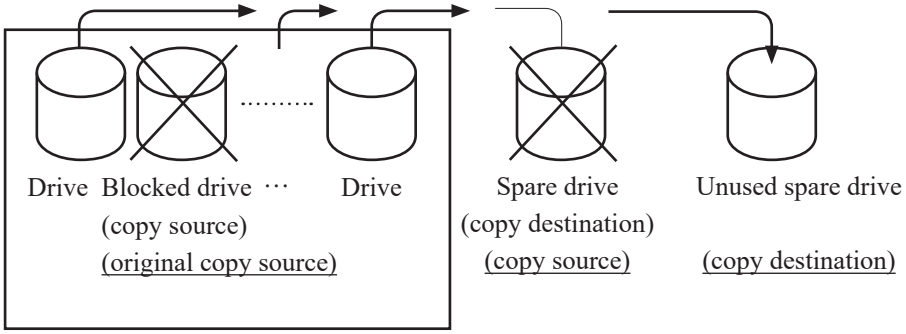
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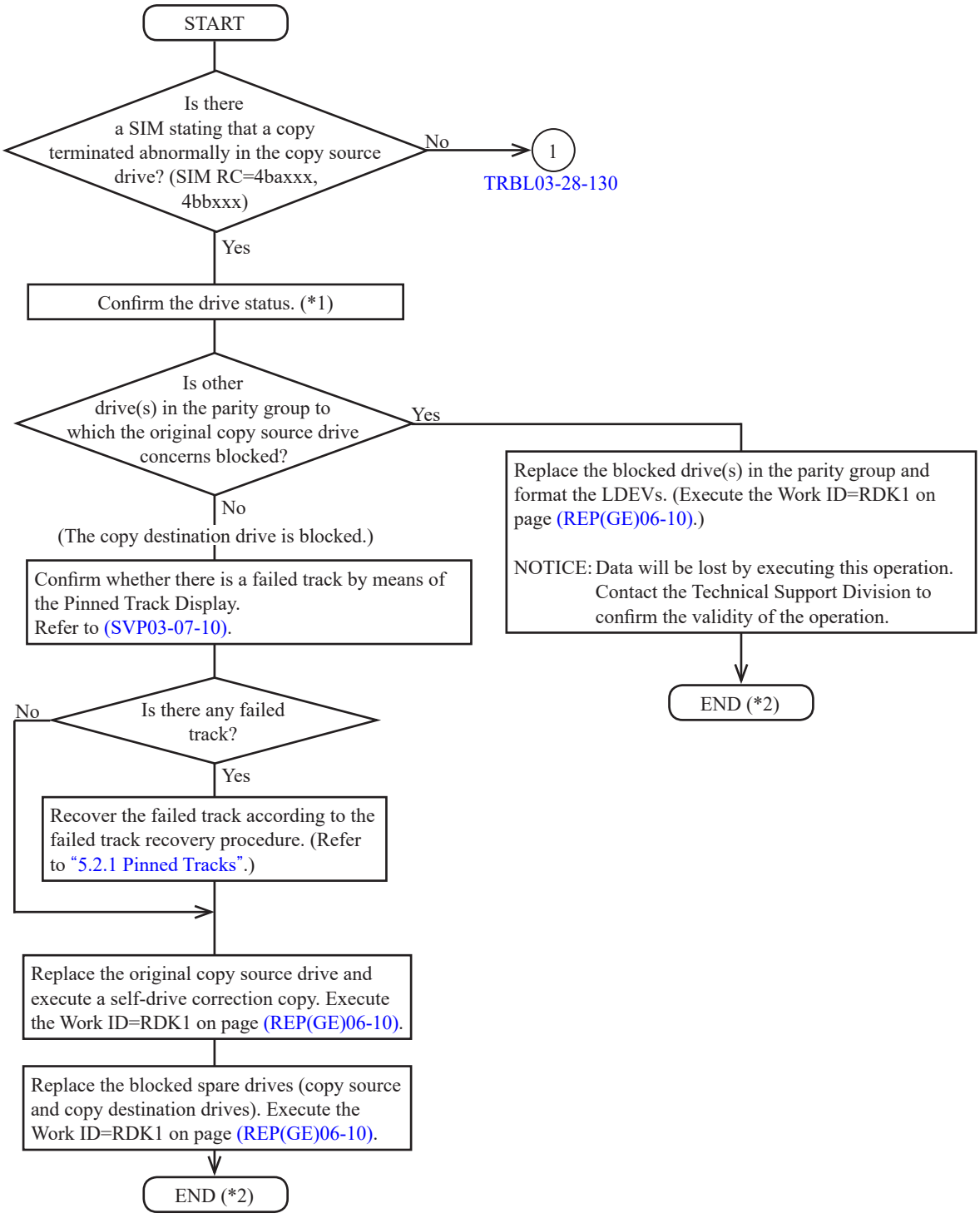
*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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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.



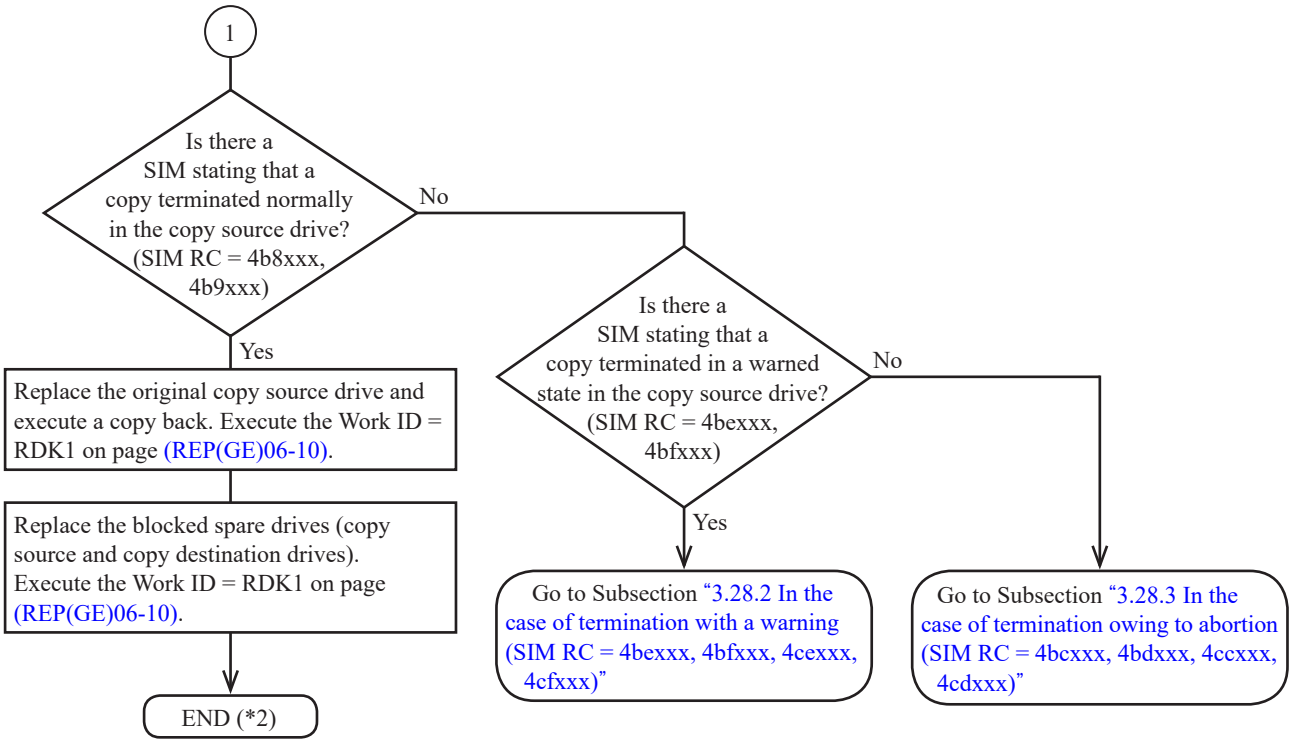
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*1: Confirm the following items.
- Confirm the location of the copy source and copy destination drives referring to the copy history. Refer to the copy history log on page (SVP02-02-230).
- Confirm the status of the copy destination drive and the status of all the drives in the parity group which the original copy source drive concerns using Maintenance Utility.

*2: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

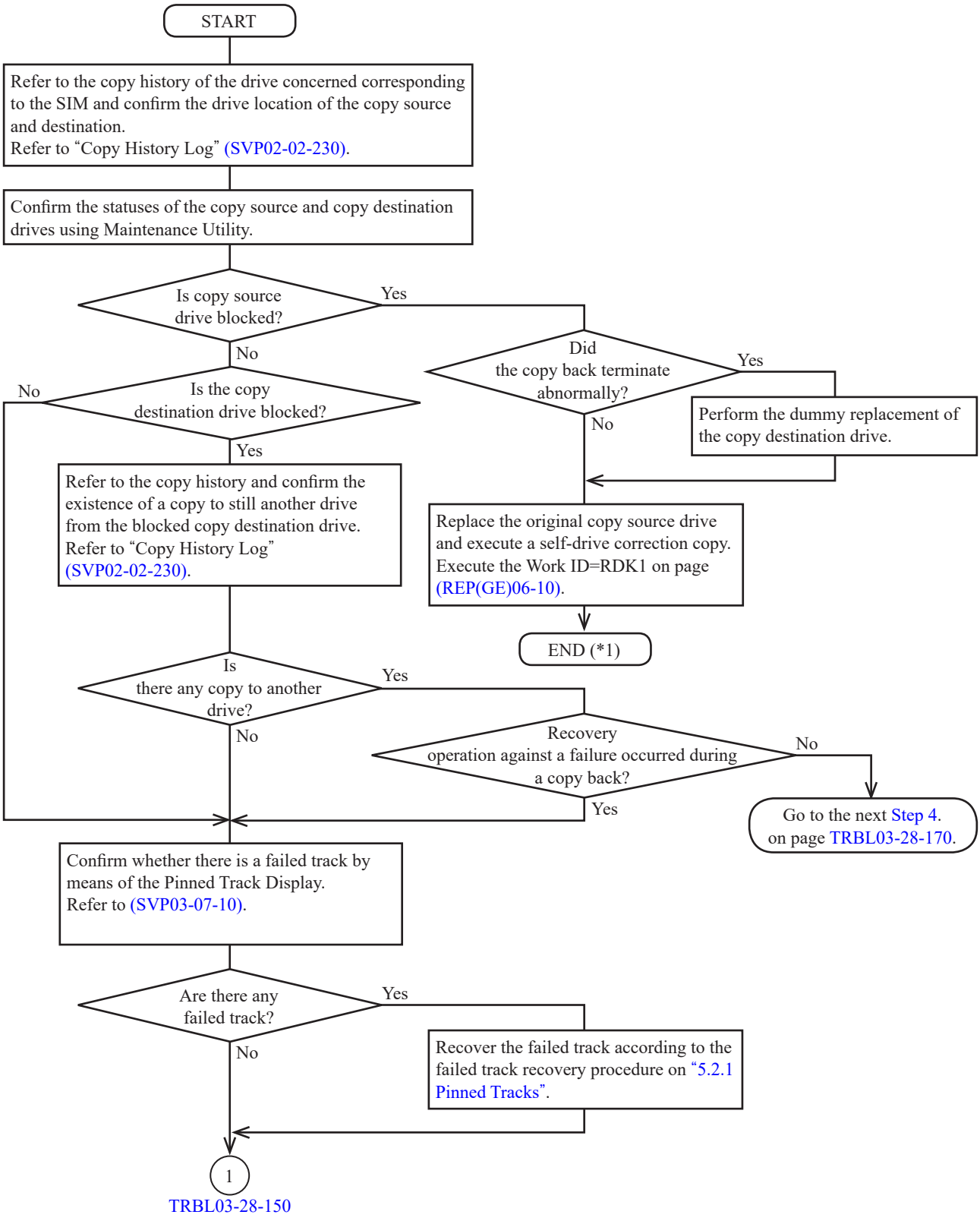
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*2: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

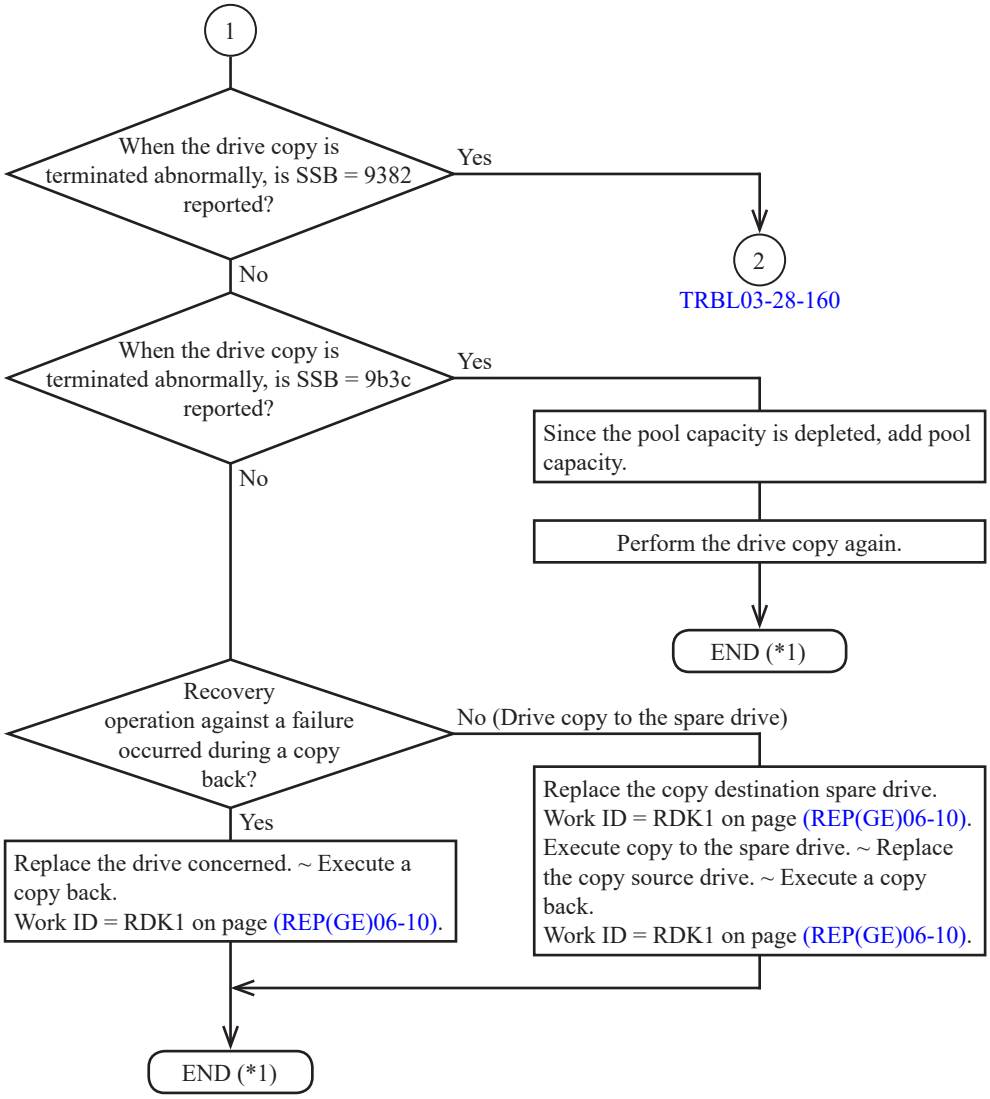
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3. In the case of drive copy abnormal termination
   The procedure below is that used when a drive copy or a copy back terminates abnormally.



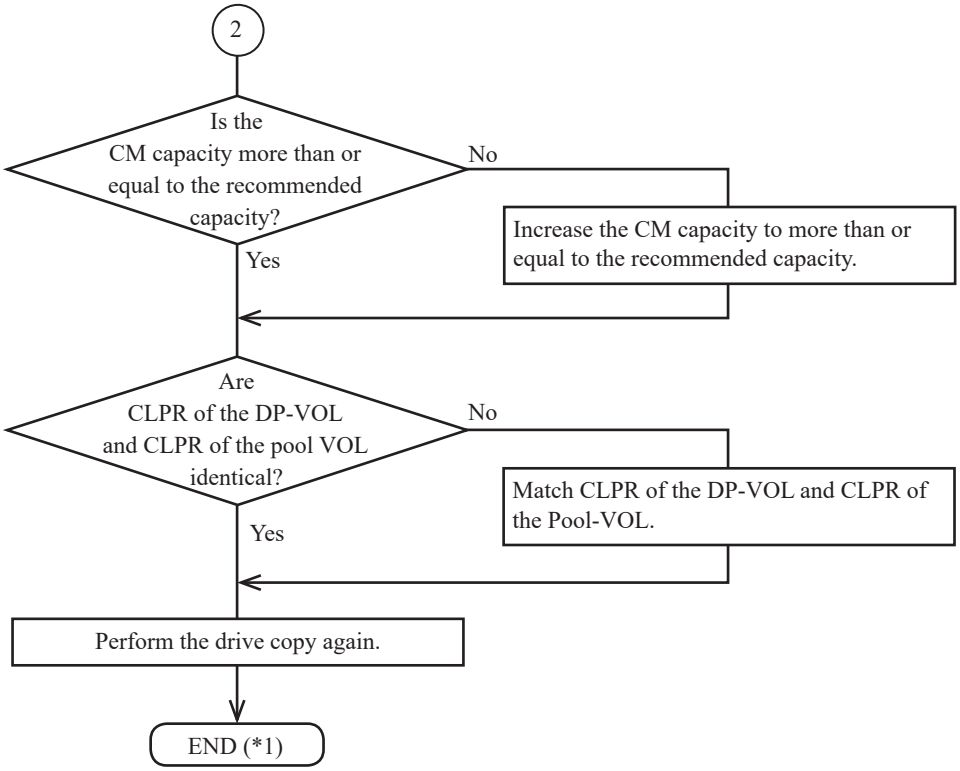
*1: After finishing the error recovery, execute SIM complete and delete logs.
(SVP02-03-10), (SVP02-08-10)

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*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

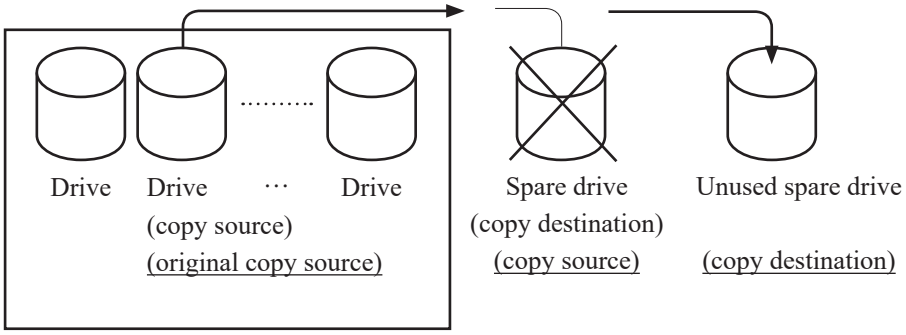
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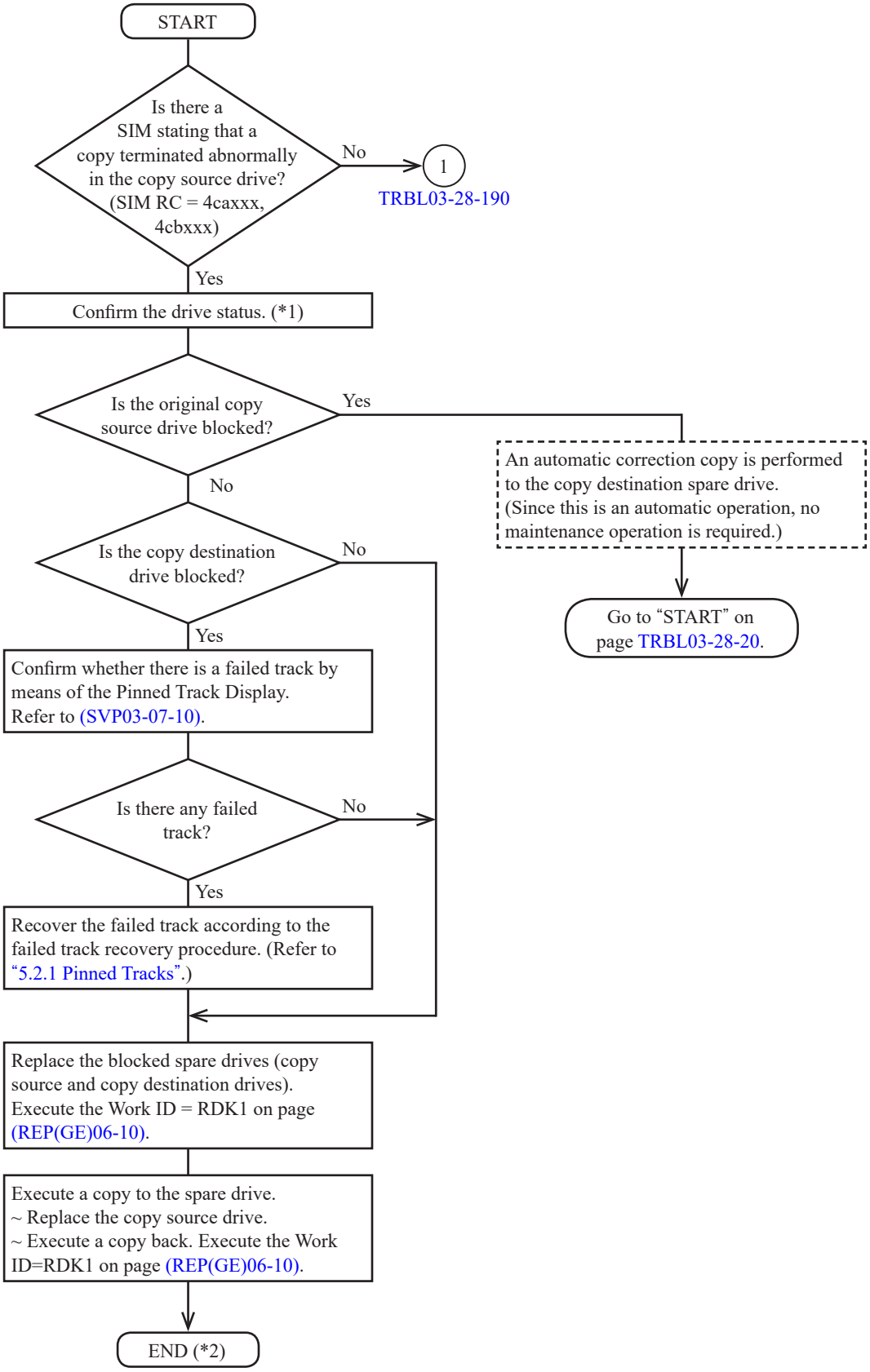
*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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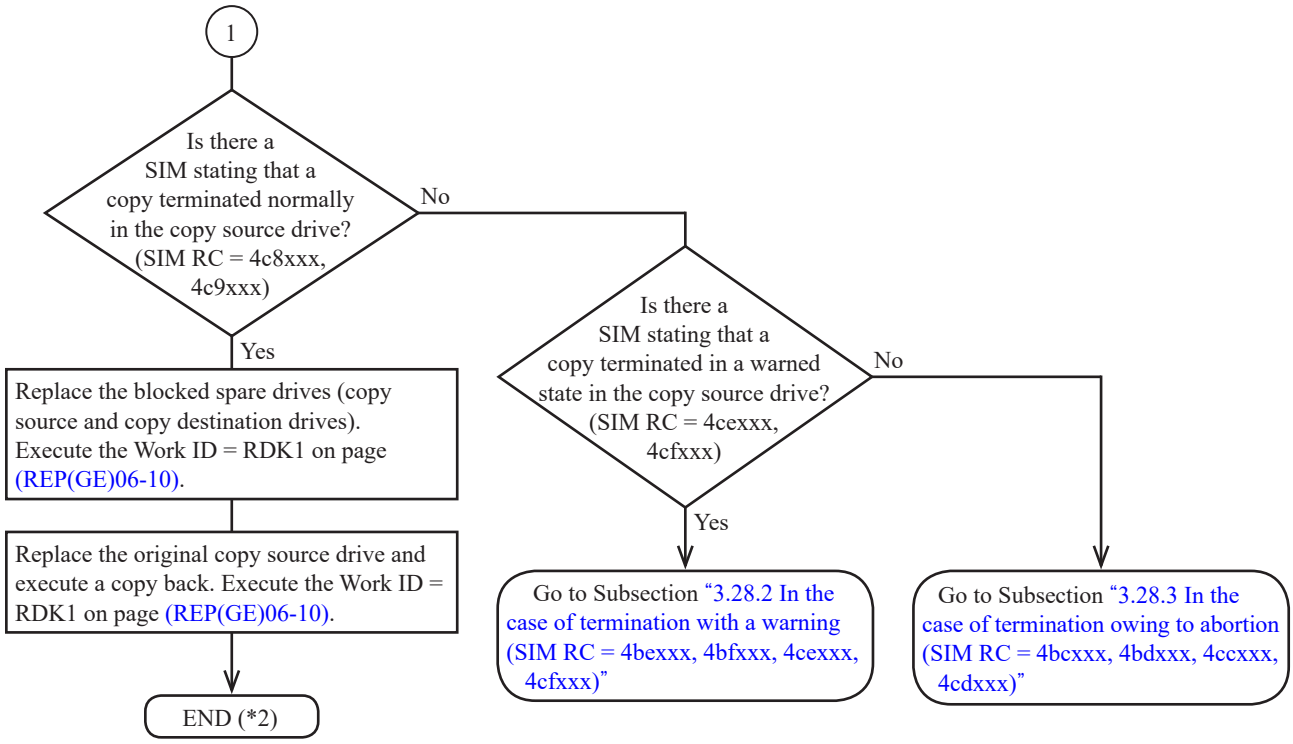
4. In the case of drive copy abnormal termination (in which an unused spare drive is available)
   This is a case in which a drive copy terminates abnormally owing to a failure in the copy destination drive. However, if an unused spare drive exists, the drive copy is automatically performed to the unused 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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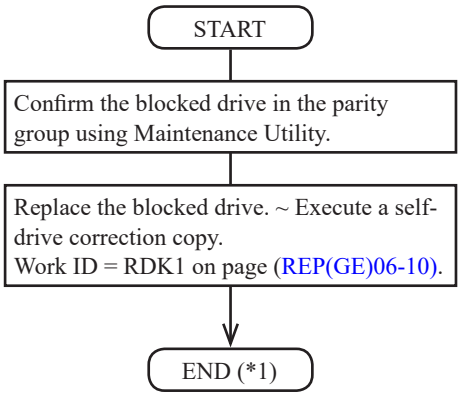
*1: Confirm the following items.
- Confirm the location of the copy source and copy destination drives referring to the copy history. Refer to the copy history log on page (SVP02-02-230).
- Confirm the status of the copy destination drive and the status of all the drives in the parity group which the original copy source drive concerns using Maintenance Utility.

*2: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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3.28.5 Correction access status

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



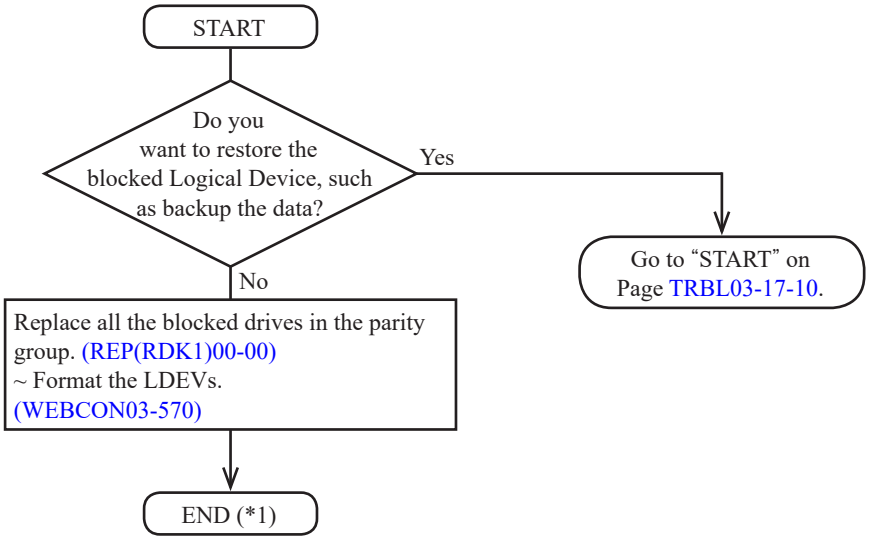
*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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3.28.6 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.

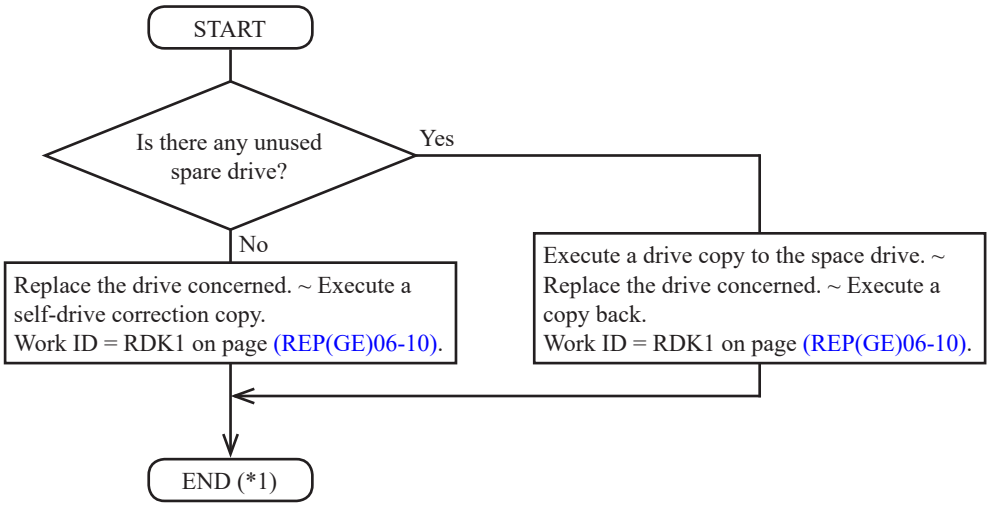


*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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3.28.7 Preventive maintenance

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



*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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3.29 Recovery Procedure for Pinned Track

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 data to a track on PDEV. (*2)	x: CU number (*1) yy: LDEV number
ff4xyy	Unable to read data from a track on cache.	
ef5xyy	Unable to write data to a track on a device in the external storage system. (*3)	
ff5xyy	Unable to read data from a track on 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 "SIM Log" (SVP02-02-70).

*2: Host I/O is not affected because data remains in cache (data can be accessed from a host in the same way as in normal state). If a pinned track occurs in the copy source drive during a drive copy, the pinned track is automatically resolved after completion of the drive copy.

*3: Host I/O is not affected because data remains in cache (data can be accessed from a host in the same way as in normal state).

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

- Address in LDEV (LDEV number, Cylinder & Head address, or last LBA)
- First and last Cylinder & Head addresses of the stripe including the pinned track
- Error type of the pinned track (Write or ECC/LRC)
- PDEV number including the pinned track

These information can be obtained by "Pin Slot Information" (SVP03-07-10).

Pinned track has the following four types.

Display on SVP	Meaning	Cause	Recovery method
Write Error	Unable to write to PDEV	Drive error	Write Error Refer to TRBL03-29-40
ECC/LRC Error	Unable to read from Cache	Cache error	ECC/LRC Error Refer to TRBL03-29-20
External VOL Write Error	Unable to write to the device in the external storage system	Device failure of external storage system	External VOL Write Error Refer to TRBL03-29-50
External VOL Read Error	Unable to read from the device in the external storage system	Device failure of external storage system	External VOL Read Error Refer to TRBL03-29-50

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The table shown below describes the error types of pinned tracks and the reference for the recovery procedure.

NOTE: Operations by the customer might be required for these recovery procedures.

Pinned Tracks Volume	References
Mainframe Volume	TRBL04-10
Open Volume	TRBL05-170
ShadowImage for Mainframe/ShadowImage/FlashCopy (R) V2/ FlashCopy (R) SE Volume	TRBL06-10
TrueCopy for Mainframe/TrueCopy Volume	TRBL07-210
UR Data Volume or Journal Volume	TRBL09-140
Thin Image Pool Volume	TRBL10-130
Global-active device pair volume or Quorum disk volume	TRBL18-110

ECC/LRC Error

Causes:

(1) 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.

(2) 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.

(3) 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.

(4) 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.

(5) This error occurs when the emergency destage, which is performed because of a cache failure or a cache maintenance operation or PS OFF, failed due to TOV etc., and the error could not be recovered despite retrying.

Result of host I/O operation:

(1) When a track with an ECC/LRC error is accessed by a host I/O and the data can be read, the result will be a normal end.

(2) If the data cannot be read, there will be a failure reported of Permanent Data Check. In this case the data is lost.

(3) Repeated Host Adapter CHK2 errors reported. Data is usually still readable but is not being destaged from cache.

Recovering ECC/LRC pinned tracks:

(1) Execute ICKDSF ANALYZE SCAN using LDEV, CC, HH information from the SVP PINNED TRACK display to determine whether Failure is reported or not.
  (a) No Failure. Data can be read. Read the data and save it to tape, another volume, or memory, etc.
  (b) Failure. Data cannot be read. It must be reconstructed by host from backup files, etc.

(2) Run ICKDSF INSPECT NOPRESRVE (NOCHECK if 3390-3R) to the affected track. This will write all zeros to the track and will clear the pinned track indication.

(3) Restore the track with the saved data from step (1) (a) or the reconstructed data (1) (b).

(4) If a Pinned Track recurs, resolve hardware problem and repeat steps (1)-(3).

(5) If CC and HH information in the SVP PINNED TRACK shows outside the user area, this indicates that a pinned track occurred in the management area. (You can check the number of cylinders in the user area by seeing [Capacity] in the Logical Devices window of Web Console. Select "Cyl" as the capacity unit from [Options] in the Logical Devices window to check [Capacity].)
Except in case of a DP volume, execute the following procedures:
  - Backup the data.
  - Execute the PIN deletion by the LDEV formatting.

In the case of the Open DP volumes, perform the following:
  - When capacity saving is disabled:
    Execute the "3.37 Reclaiming the control pages inside the DP-VOL(s)".
  - 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:
    Execute the "21.1 Recovery Procedure for dedupe and compression Operation Error (SIM = 680001)" from [A].

Pinned Track disappearance:

Under certain circumstances, pinned tracks may disappear with no recovery action having been taken. This can occur from:

(1) The entire stripe is written. This discards all the old data & parity in the stripe.

(2) A Format Write from R1 is issued to the pinned track. This rewrites the entire stripe and all old data in the stripe is discarded.

(3) If dirty data that could not be destaged due to CHK2 error is read successfully by the host, pinned tracks will be turned off.

(4) If a parity track is unable to be destaged due to a drive failure and the drive is replaced using Correction Copy (drive replacement by copying to a spare will not clear Pinned Tracks).

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Write Error

Cause:

A write error type of pinned track will be made when the data destaging process to a PDEV is unsuccessful due to a drive failure. When a drive failure occurs, the drive and the DKC both attempt to recover the problem. If the recovery attempts are unsuccessful, a Write type pinned track is posted. The recovery attempts are:

(1) Media failure : Automatic reallocation of data to an alternate sector.
(2) Other failure : Alternate path retry.

Write error count for each PDEV is stored in the DKC. If the write error count for a PDEV exceeds the threshold value, the PDEV is blocked. Only one PDEV per parity group will be blocked. One blocked PDEV in a parity group will not stop DKC operation to that parity group. However, the parity group will be in correction access mode. If a write type pinned track is accessed by the host after its PDEV has been blocked, the pinned track status will be reset.

Result of host I/O operation:

All access to write type pinned tracks will be successful and return a normal end.

Recovering Write Error pinned tracks:

Replace the PDEV with the pinned track. At this time if there is already a blocked PDEV in the same parity group, replace the blocked PDEV first. Then replace the PDEV with the pinned track. If more than one PDEV in a parity group has write error pinned tracks, check the ORM display on the SVP Panel. Replace the PDEV with the highest error rate first, then second highest, etc. The pinned track(s) will be recovered by correction copy.

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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.

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:
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.

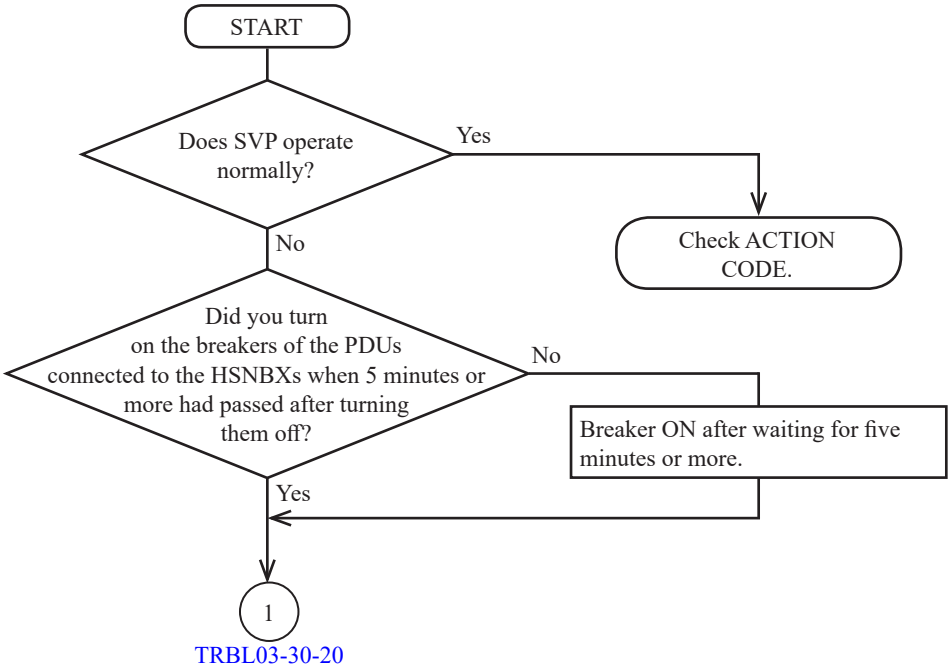
NOTE: After recovering the device in the external storage system, you can remove pinned track of the external devices by writing I/O from the host. However, please note that the customer data stored in external devices is destroyed. Because the data will be overwritten by the I/O.

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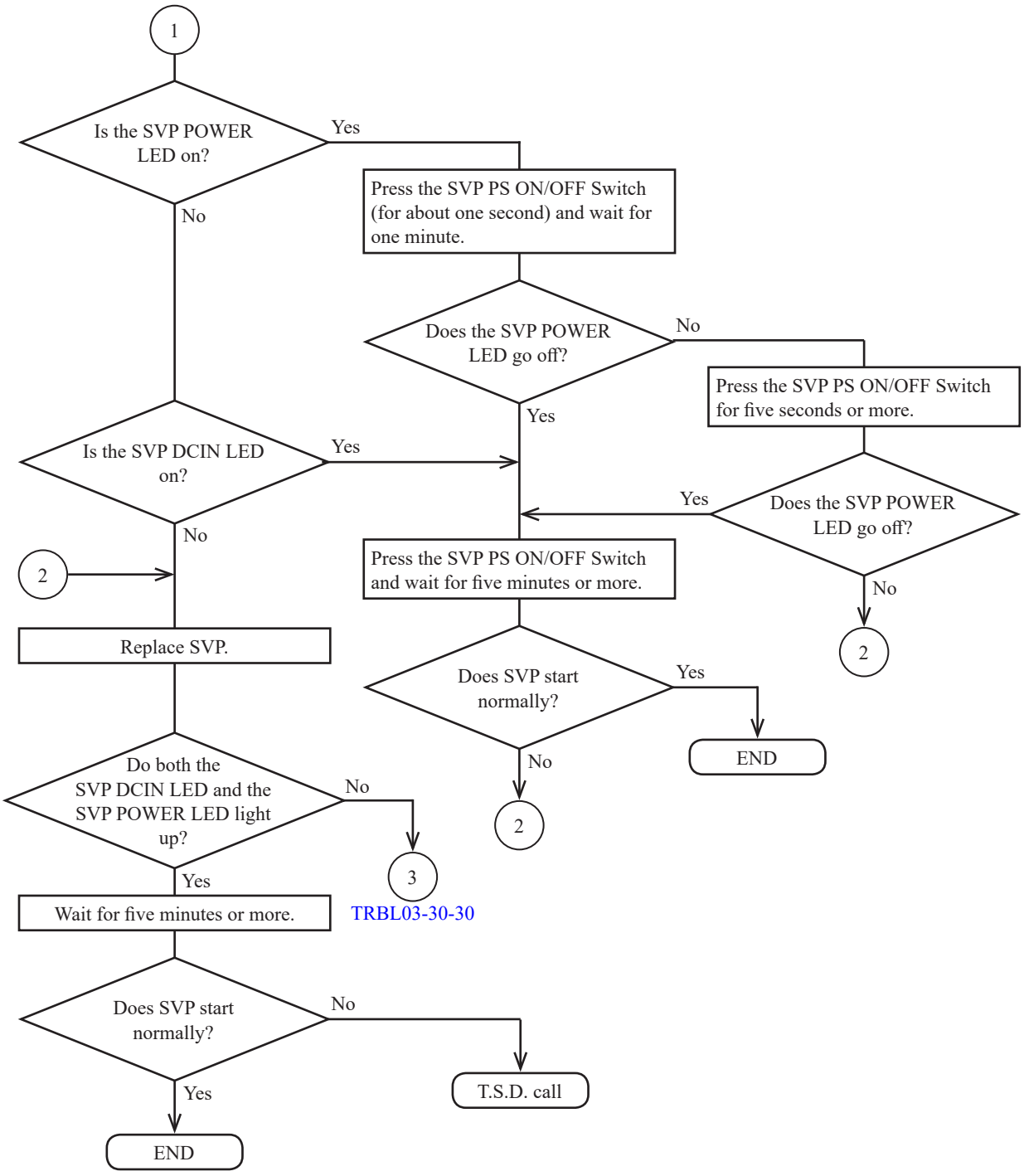
3.30 Recovery Procedure for SVP Failure

3.30.1 SVP Power Trouble Shooting

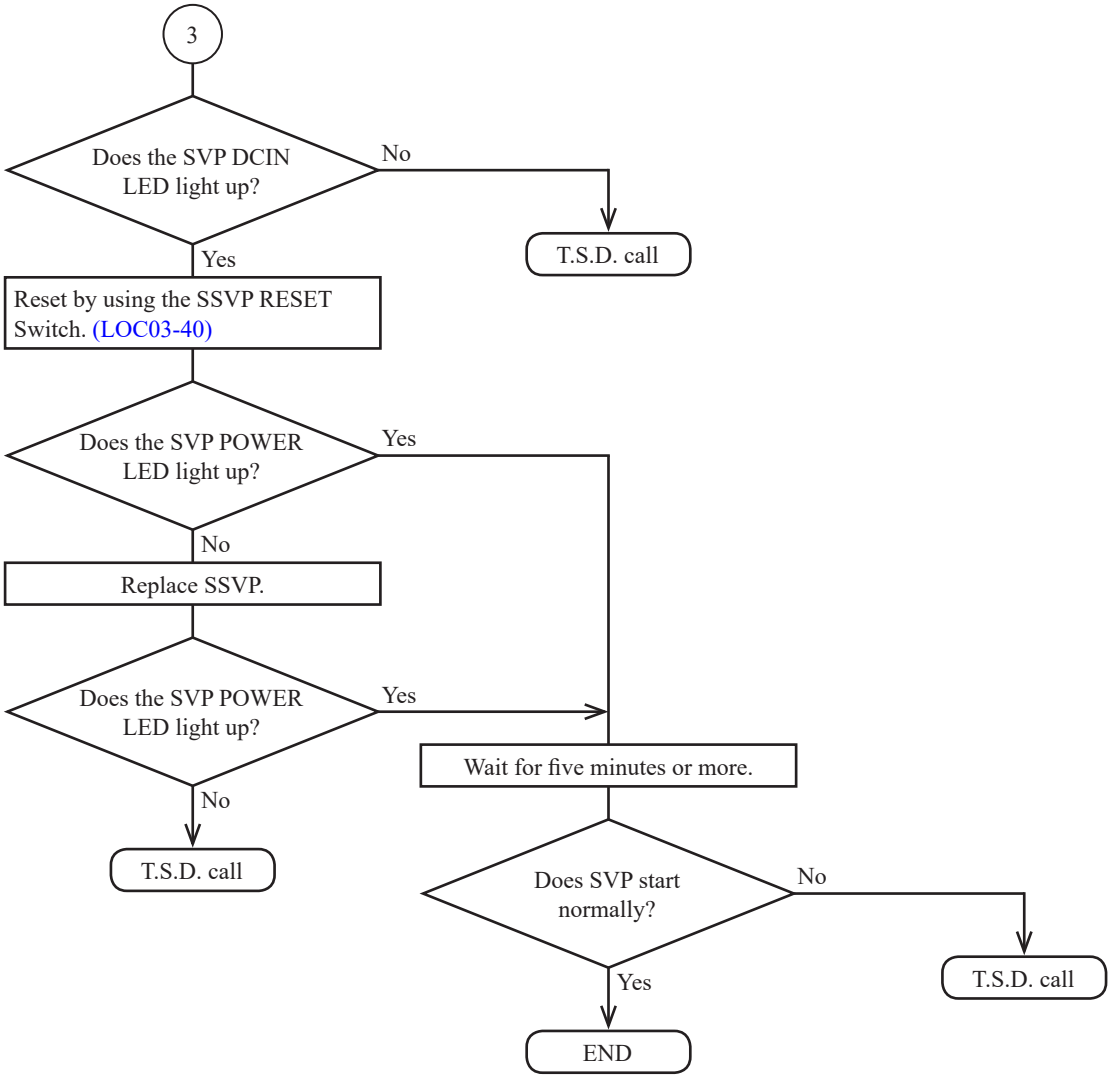
For locations of the LEDs and switches on the SVP, see (LOC03-30).



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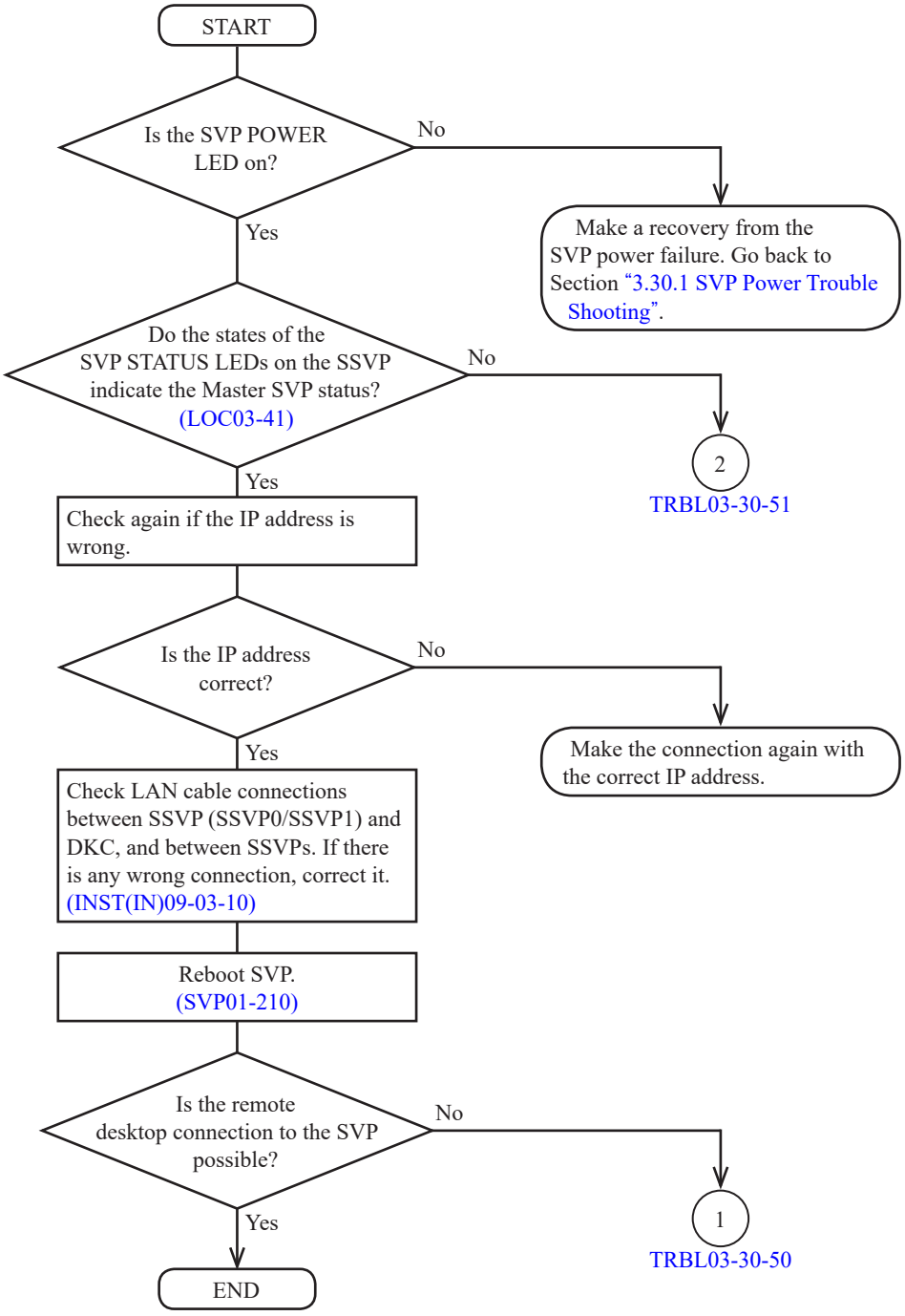


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3.30.2 When Connection to SVP (Remote Computer) Cannot Be Made

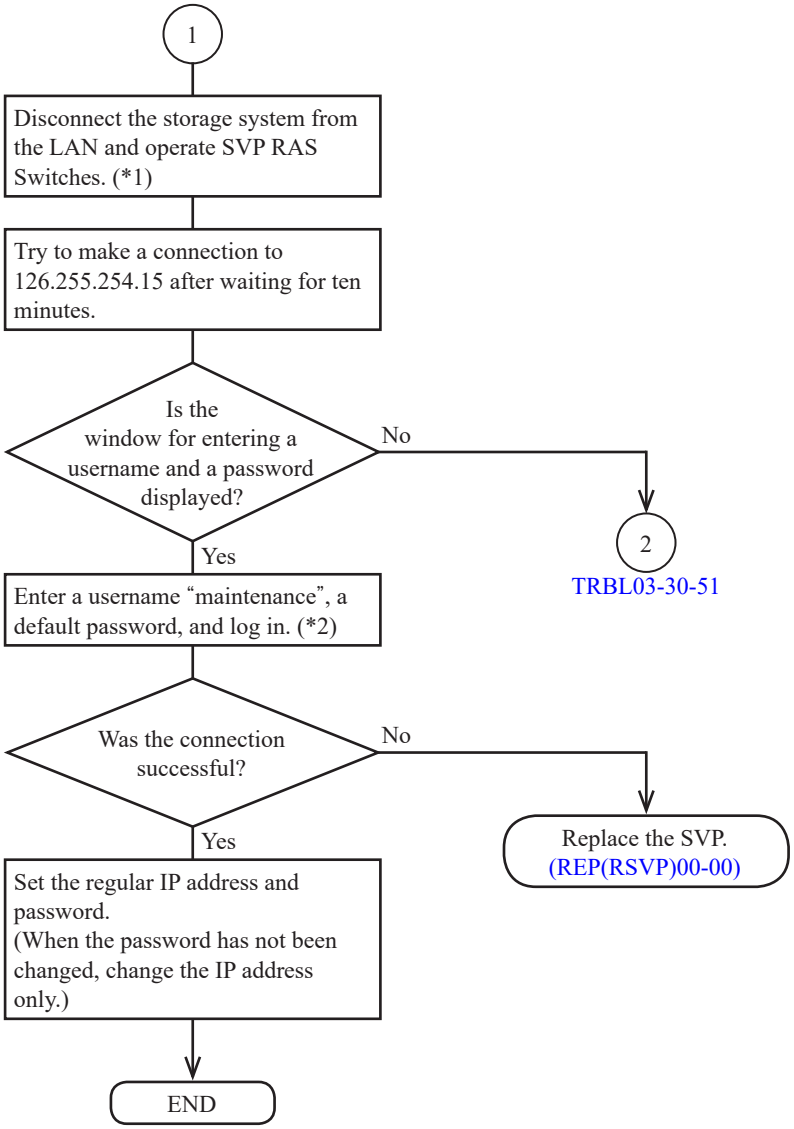
For locations of the LEDs and switches on the SVP, see (LOC03-30).
The following is the recovery procedure when the remote desktop connection to the SVP is not possible.

NOTE: If the customer asks you to prioritize the recovery of SVP and you need to recover the storage system by performing the SVP switching without hardware maintenance, ask the customer to perform the SVP switching according to "System Administrator Guide".



Erase the log when the recovery procedure is completed.
Refer to pages (SVP02-03-10) and (SVP02-08-10).

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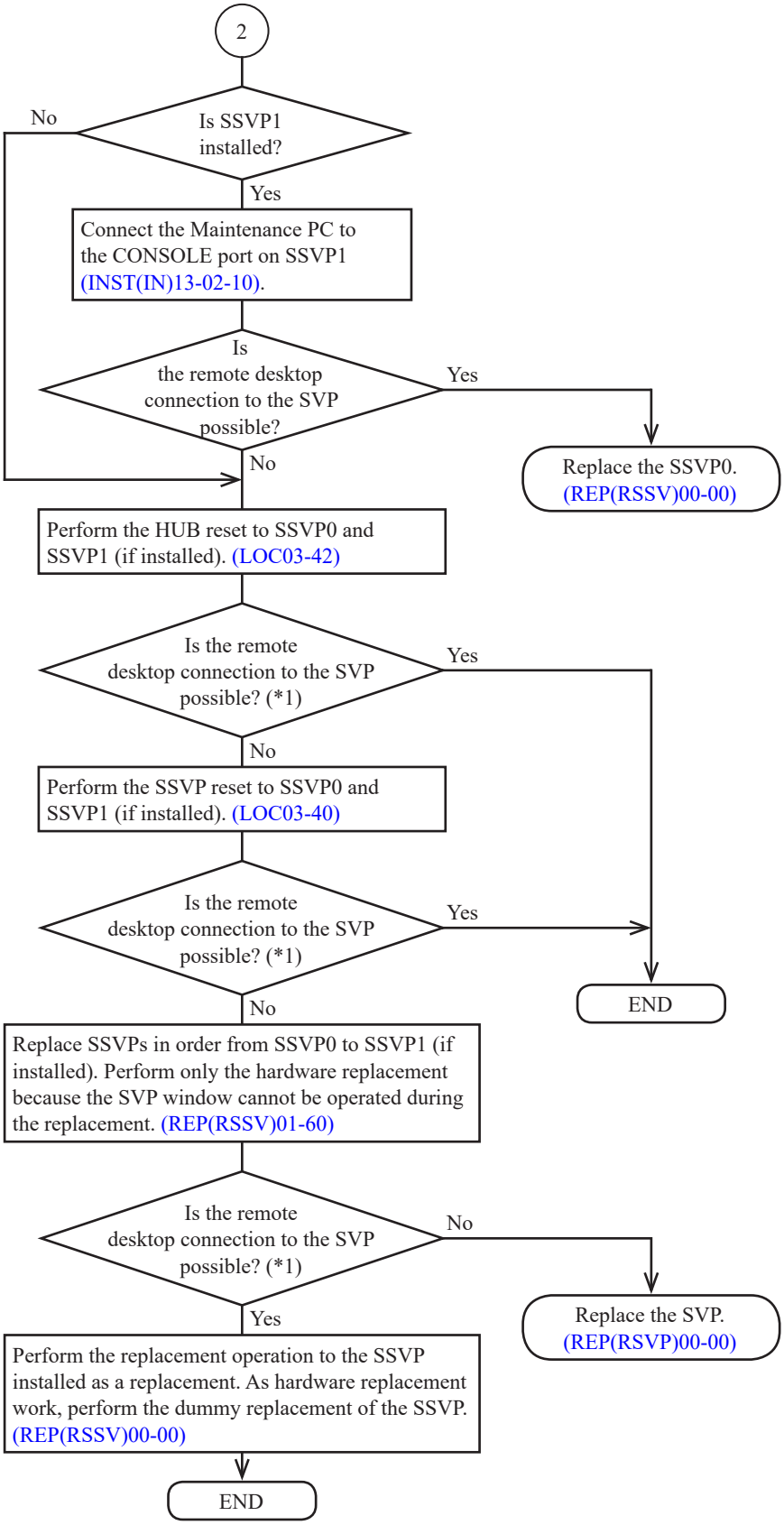


*1: An IP address and a password of SVP are initialized by SVP RAS Switches (see (LOC03-41)).
NOTE: Use an object with a sharp edge such as a pair of tweezers to manipulate the SVP RAS Switches.

*2: If you don't know the default password, please contact with the technical support division.

Erase the log when the recovery procedure is completed.
(Refer to pages (SVP02-03-10) and (SVP02-08-10).)

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*1: Check by connecting the Maintenance PC to the CONSOLE port on SSVP0 and SSVP1 (if installed).

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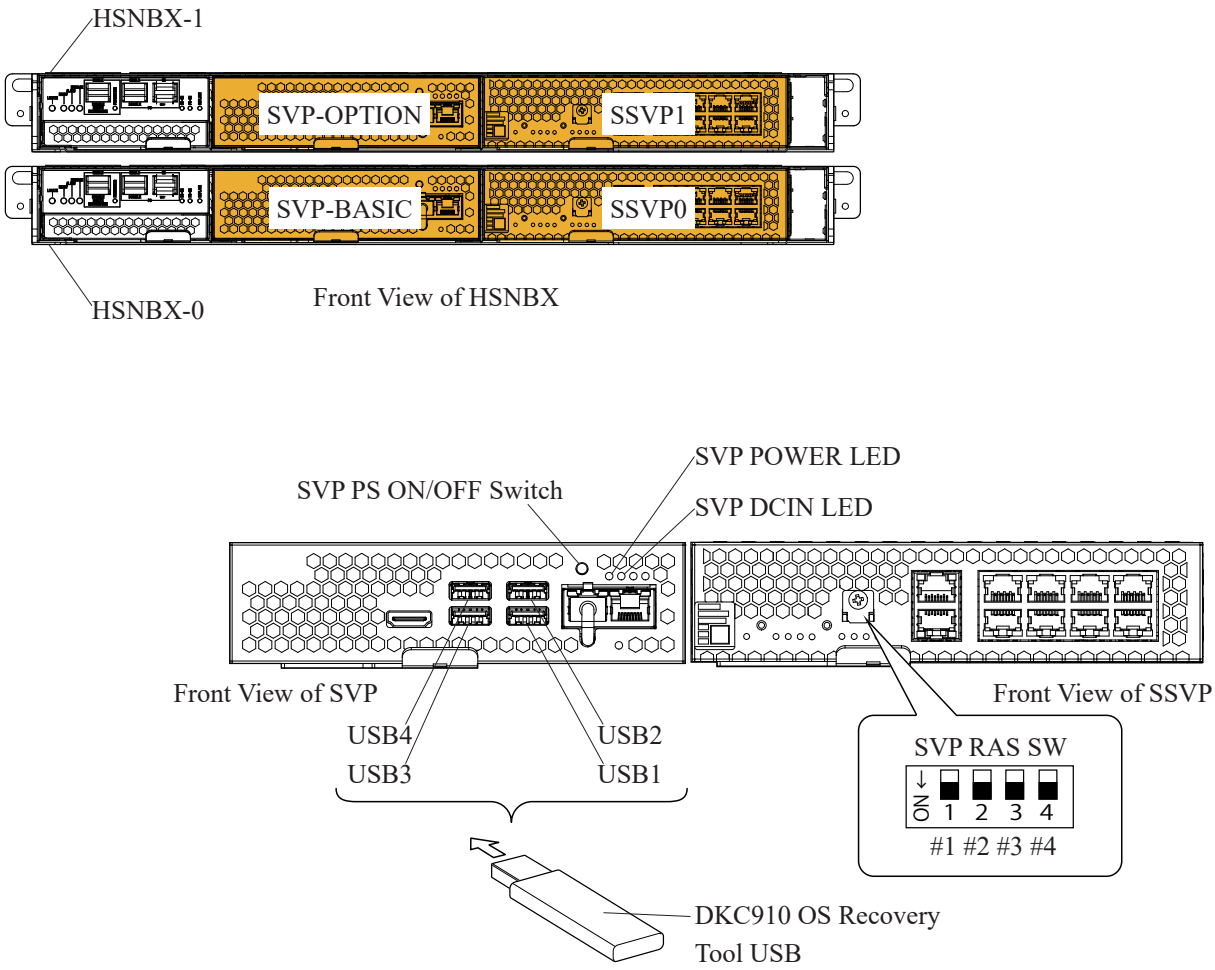
3.30.2.1 SVP OS Recovery Procedure

<Pre procedure>
1. Remove Front Bezel attached to HSNBX.
2. Turn off the power for the SVP. (Press the SVP PS ON/OFF switch for 5 seconds or more.)

[SVP OS Recovery Procedure]

1. Confirm the power status of the SVP (It should be off). If the SVP POWER LED is off, then the SVP's power status is off (The SVP DCIN LED is always on).

Figure 3-2 System structure of the DKC910I



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2. Set the SVP PS ON/OFF INH switch (SVP RAS SW #1) on the SSVP to ON (lower position) (*1). Insert the "DKC910I SVP OS Recovery Tool USB" to the USB port, and press the SVP PS ON/OFF switch. Then, the SVP will start (The SVP POWER LED will be on).

   *1: Use an object with a sharp edge such as a pair of tweezers to manipulate the switches on the SSVP.

3. A few minutes later from the start of the SVP, "OS Recovery Tool" will be loaded from the USB port, and executed.

4. "OS Recovery Tool" performs recovery of the OS from the Backup partition.
   This process requires 15 minutes (*2).

   *2: Do not turn off the power of SVP during this process. It might cause a fatal error in the SVP.

5. When the OS recovery ends normally, the SVP power is turned off (The SVP POWER LED will be off).
   If the SVP POWER LED does not turn off after 30 minutes, the recovery process has terminated abnormally.
   If the recovery process finished abnormally, then retry the recovery procedure.
   If the process finished abnormally again, the SVP has some hardware failure.
   (Replacing the SVP is necessary.)

6. After the OS is recovered normally, remove the "DKC910 OS Recovery Tool USB", and turn on the power of SVP again.

7. Wait about 10 minutes until the SVP starts. Then, connect the Maintenance PC to the SVP using the connection utility.

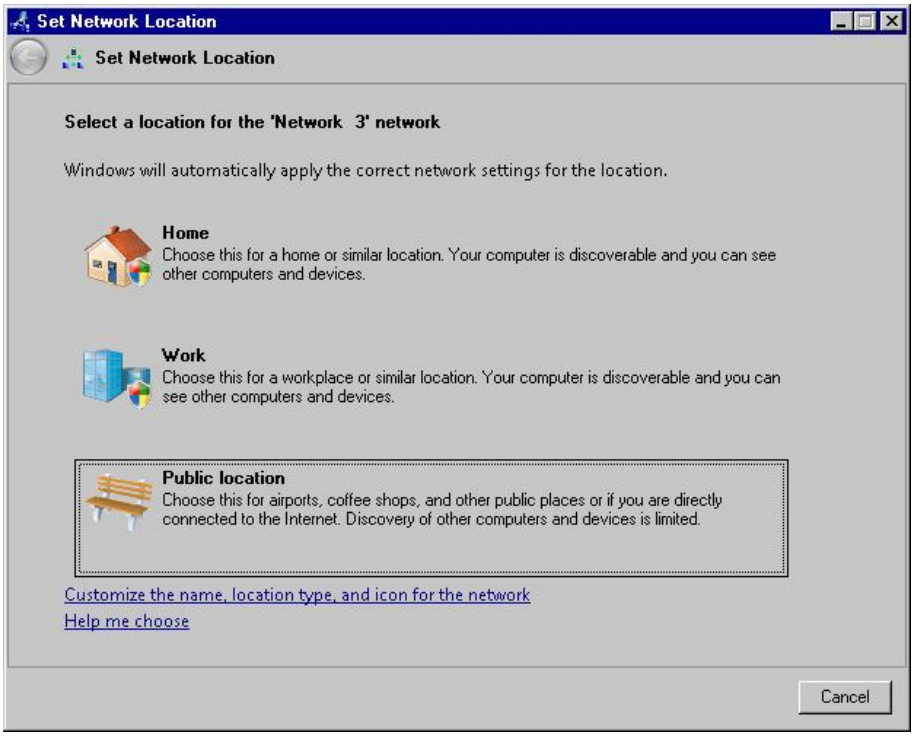
8. At the final step, install the micro-program to the SVP. And, after the final step finished, set the SVP PS ON/OFF INH switch (SVP RAS SW #1) on the SSVP to OFF (upper position).

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3.30.3 About Other SVP Troubles

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

   (1) The “Set Network Location” dialog.

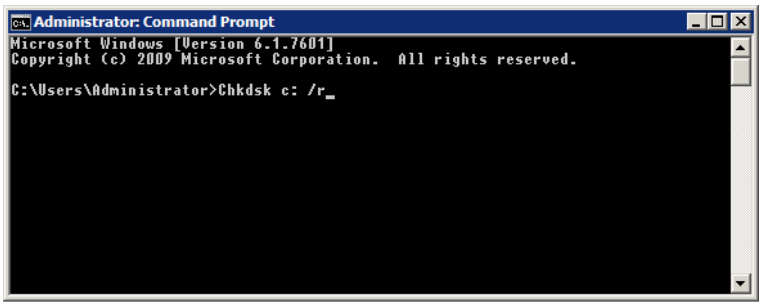


   (2) How to close the “Set Network Location” dialog.
   Click [Cancel] in the lower right of the dialog.

2. Action when the SVP Hard Disk may be failed.
   If SVP Hard Disk may be failed, do as following procedures.

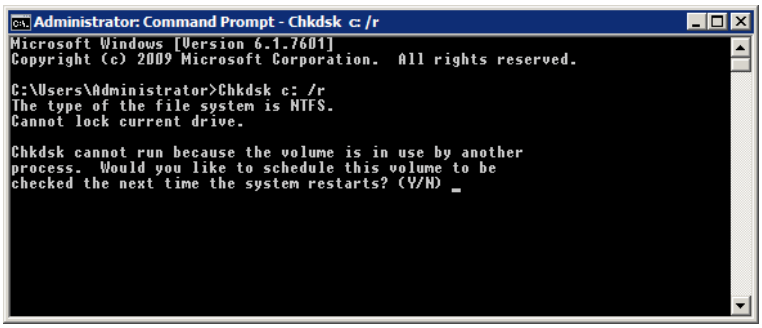
   (1) Open the command prompt
   Select [Start]-[Windows System], right-click the displayed [Command Prompt], and then select [More]-[Run as administrator].

   (2) Execute of disk check
   Enter “Chkdsk c: /r” in the command prompt window, and then press the [Enter] key.



   (3) Schedule of disk check
   Please input [Y] to the message of “Chkdsk cannot run because the volume is in use by another process. Would you like to schedule this volume to be checked the next time the system restarts?”.

   NOTE: The disk check of SVP is performed after the reboot of SVP. A disk check takes about 1 hour. (Time changes in the state of SVP PC.)

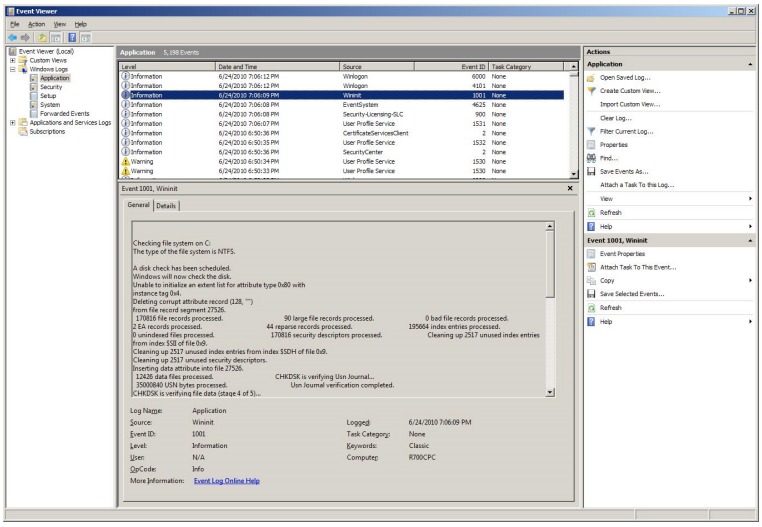


   (4) SVP reboot
   Reboot the SVP in accordance with the procedure of “SVP reboot” (SVP01-210).

   (5) Displaying the Event Viewer
   Please start an event viewer, after a disk check is completed and SVP started, and select [Windows Logs]-[Application].

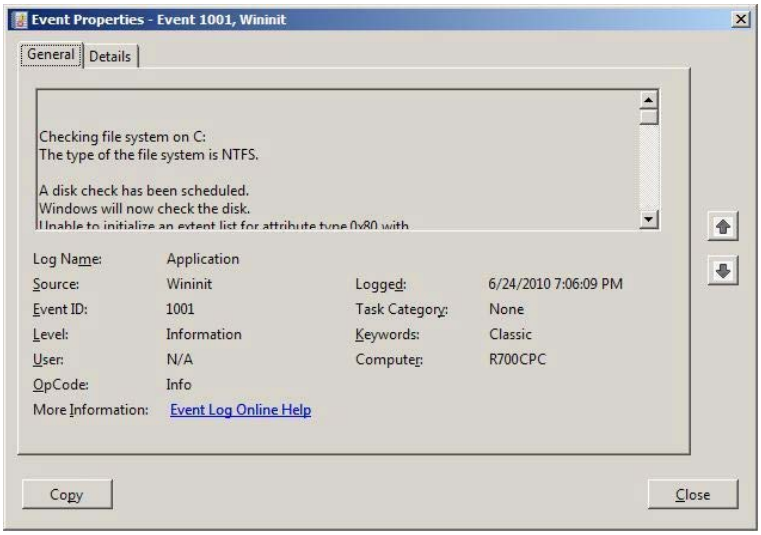
(6) Display of diagnosis result

Select the thing of “Wininit” from [Source] of the list of events.



(7) Details of diagnosis result

The result of the disk check is displayed.



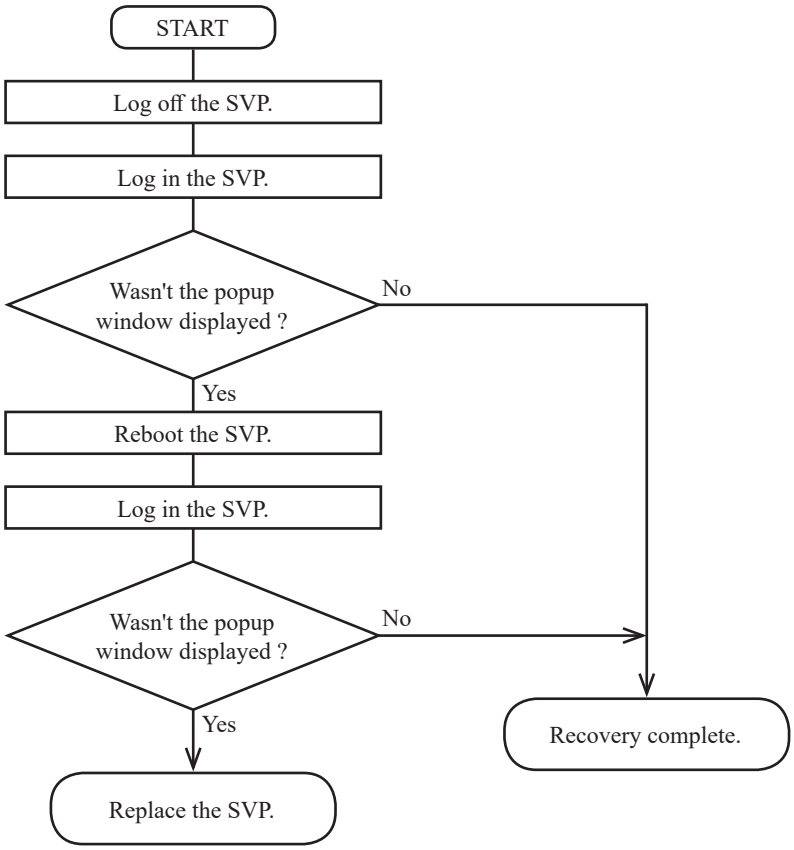
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3. Action when the “Your user profile was not loaded correctly.” popup is displayed.
“Your user profile was not loaded correctly.” popup might be displayed on the Task tray of Windows at the opportunity when the SVP logged in.
The SVP function might not work correctly.
Please deal with it according to the following procedure.

(1) The “Your user profile was not loaded correctly.” popup



(2) Action

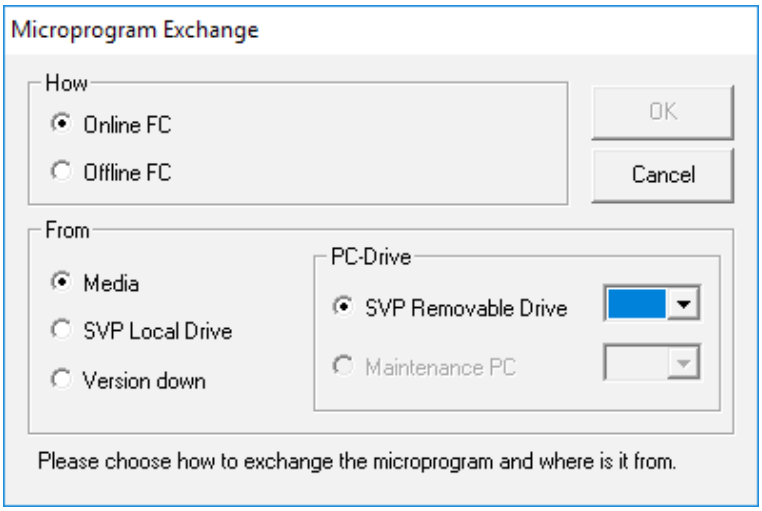


4. Action in the case where you cannot operate the SVP because any of the following phenomena occurs in the SVP window when you log in to the SVP.
   - The user name is not displayed in the login window.
   - The login window is not displayed (a black screen and so on).
   - After the login, no window is displayed (a black screen and so on).
   - After the login, the SVP window is displayed on a black screen and so on.
   - Other abnormality of window display

   Reboot SVP in accordance with the procedure of "SVP reboot" (SVP01-210) and log in again.

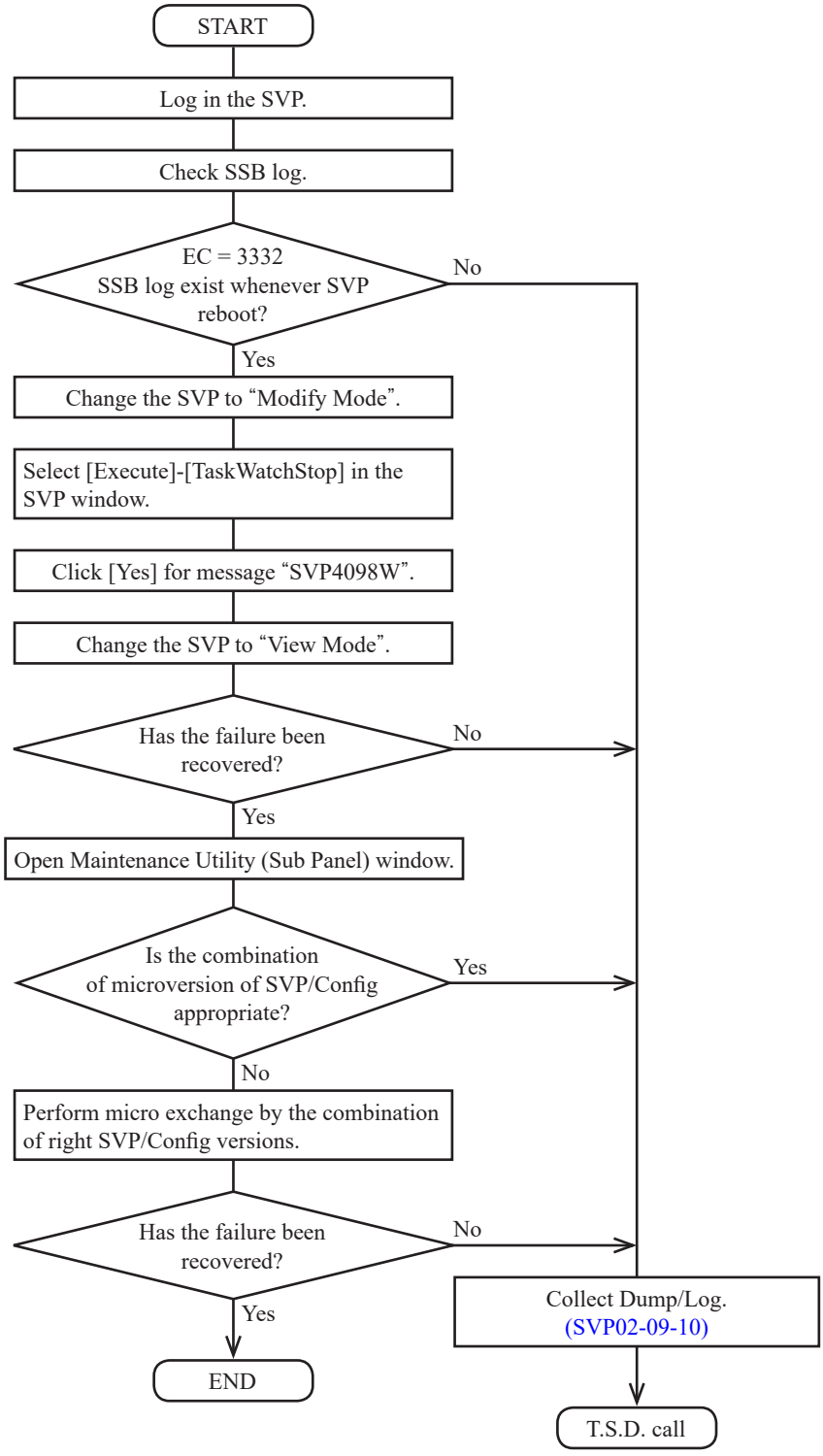
5. When performing maintenance operation through the remote connection (RDP) with the Maintenance PC, we sometimes have to choose a drive from the drive drop-down list displayed on the operation screens such as micro-replace screen and configuration-backup screen to continue an operation. Occasionally, 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 (RDP) again. After that we should make the drive drop-down list screen redisplay, and then we can continue our maintenance operation.

   Redisplay procedure:
   When operating on the micro-replace screen, to make the drive drop-down list screen redisplay, we should click [Cancel] to close the micro-replace screen and reopen it again, then the drive drop-down list will be refreshed.

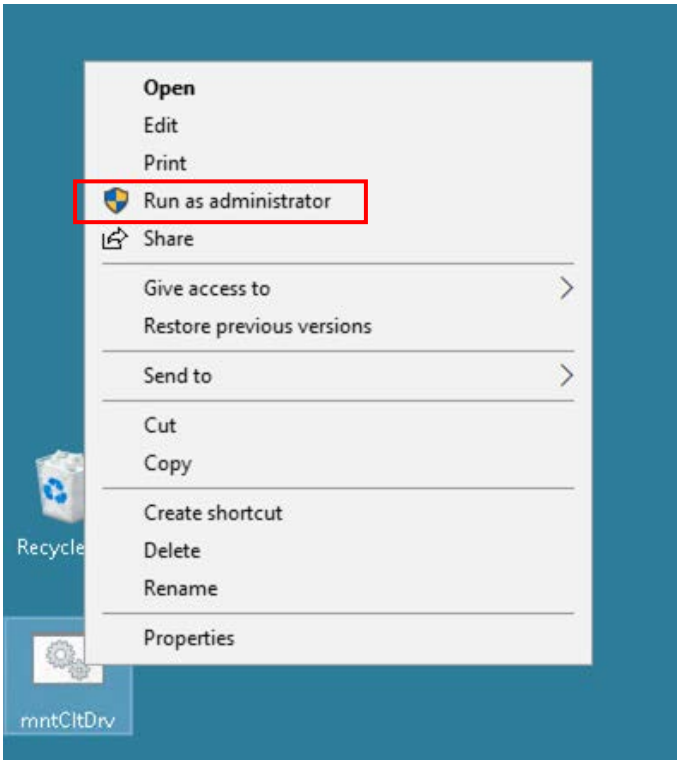


6. Action in case SVP repeats a reboot unfairly.

NOTE:
- When SSB EC = 3332 occurs whenever SVP reboots, SVP reboots every about 3-5 minutes. Therefore, Perform [TaskWatchStop] operation of the following procedure within three minutes from SVP start.
- When SVP reboots before the following procedure completion, do the following procedure again from a beginning.



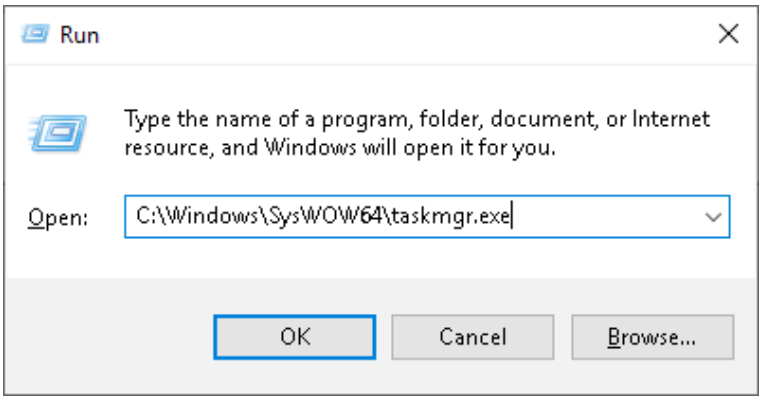
7. Action when a storage media in the Maintenance PC cannot be mounted to the SVP
   Right-click mntCltDrv.bat on the desktop of the SVP, and then select [Run as administrator] to execute the file.



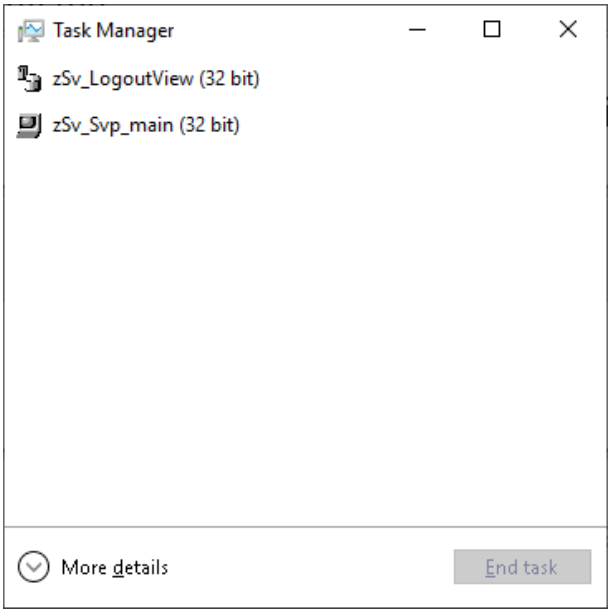
8. Action when the Windows OS freezes partially or entirely during SVP operations and you cannot operate the SVP
   When the Windows OS freezes partially or entirely during SVP operations and you cannot operate the SVP, power off and then on the SVP according to the procedure in “When you cannot connect to the SVP from a remote desktop” (SVP01-210).

9. How to collect the memory dump of the RisMan process is shown below.
   (1) Logging into SVP (See (SVP01-50))

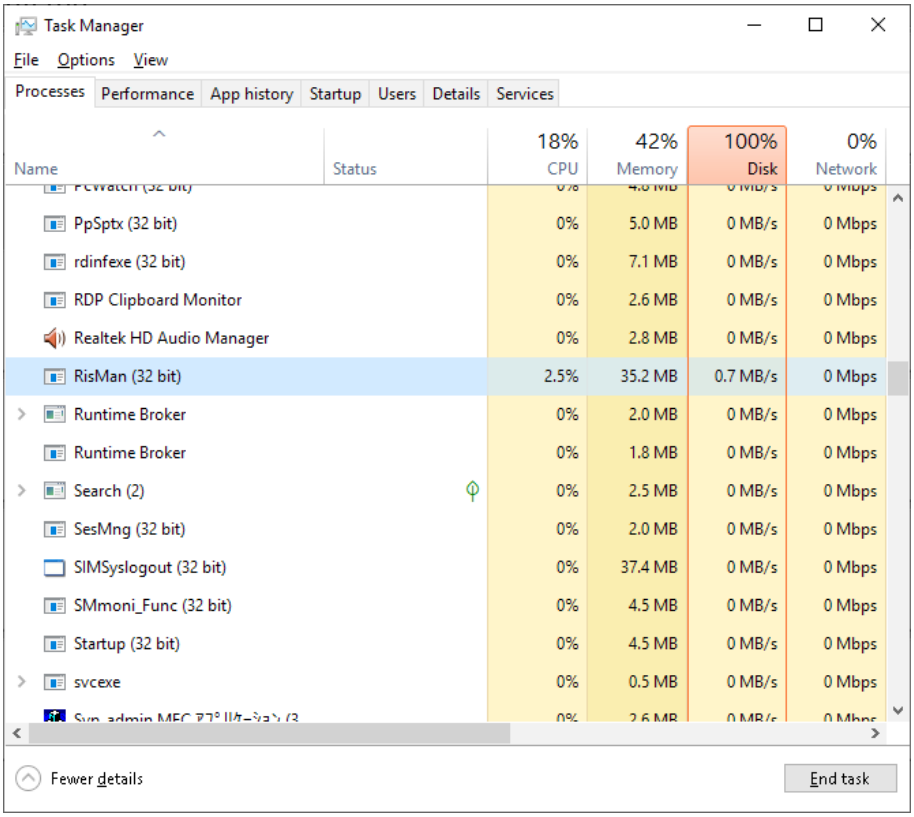
   (2) Start the task manager.
      (a) Open the Run window.
      Right-click [Start], and then select [Run].
      (b) Enter "C:\Windows\SysWOW64\taskmgr.exe" and then click [OK].



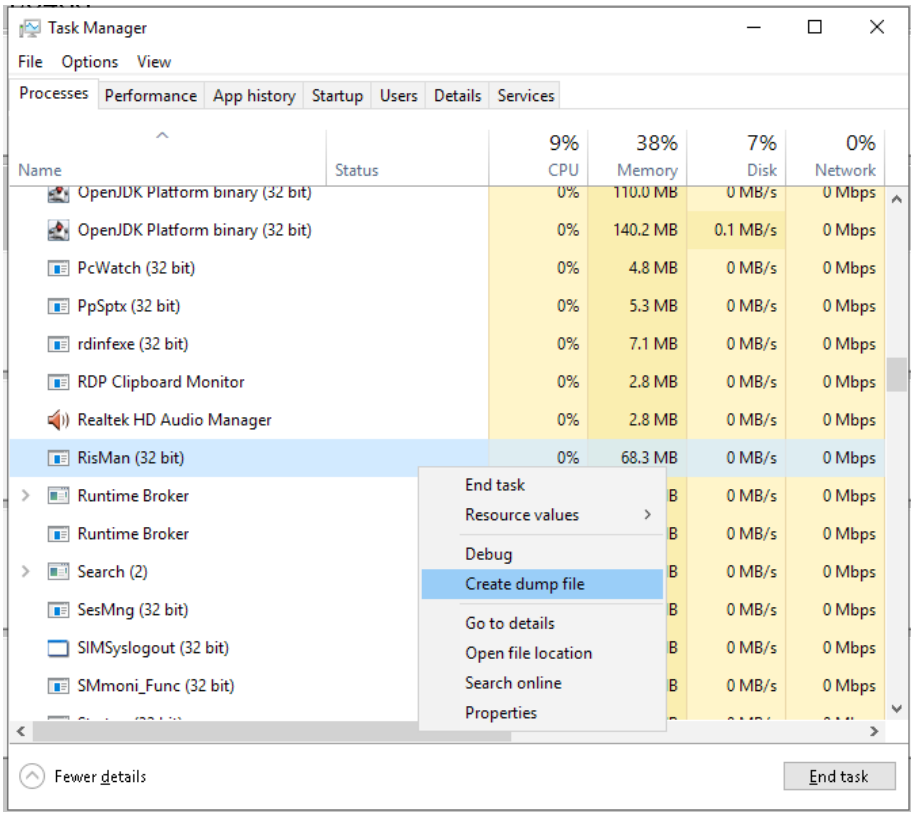
   (3) If the following window is displayed, click [More details].



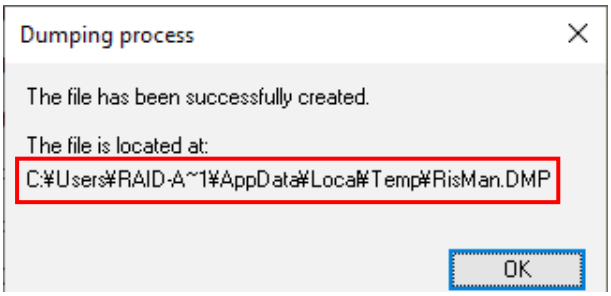
(4) Specify the process from the task manager.
Select “RisMan (32 bit)” as a process name for memory dump.



(5) Output the memory dump.
Right-click on the process selected in Step (4) to display the context menu.
Then click the “Create dump file”.



The “Dumping process” dialog is displayed and the output of the memory dump starts.
The output of the memory dump might take a few minutes because it depends on the process size.
Once the output of the memory dump is completed, the “Dumping process” dialog is displayed.



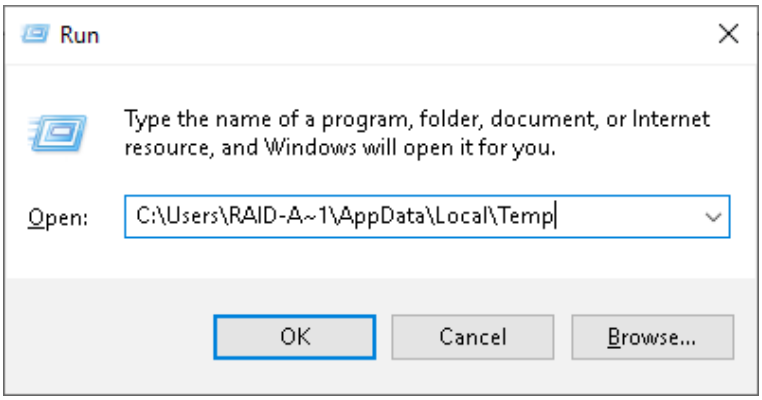
The file location in the red frame is the file name. A file name might vary depending on the environment.

(6) Collect the file of the output memory dump.

(a) When the memory dump file name (within the red frame) shown in Step (5) is selected with the mouse, right-click "Copy" from the context menu, and then copy the memory dump file name.

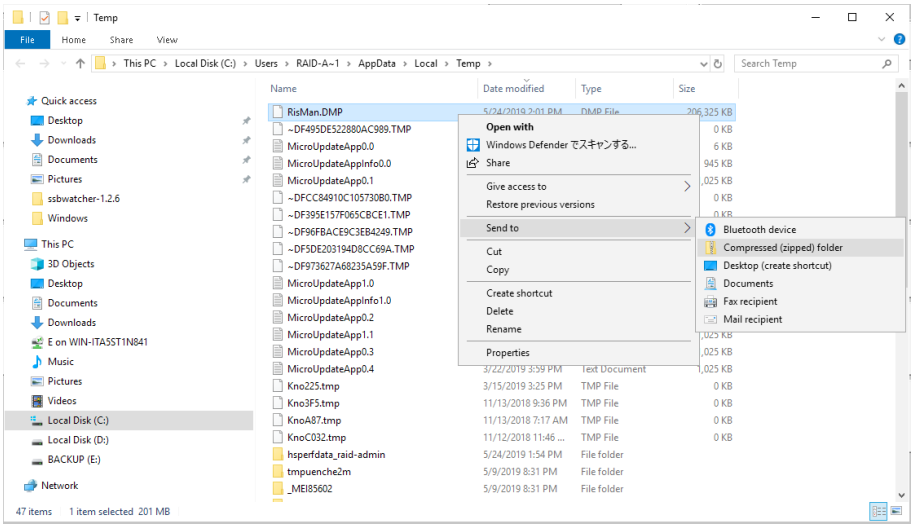
(b) Open the Run window.
Right-click [Start], and then select [Run].

(c) Enter only the copied memory dump file name (within the red frame) in "Open", and then click [OK].



(d) When Explorer starts up, select the memory dump file.

(e) When the memory dump file is selected, display the context menu by right-click. Select "Send to" → "Compressed (zipped) Folder".



(f) After the compression is completed, the same file name is crated in the same folder with the file extension "zip". Then save the corresponding file in the console PC.

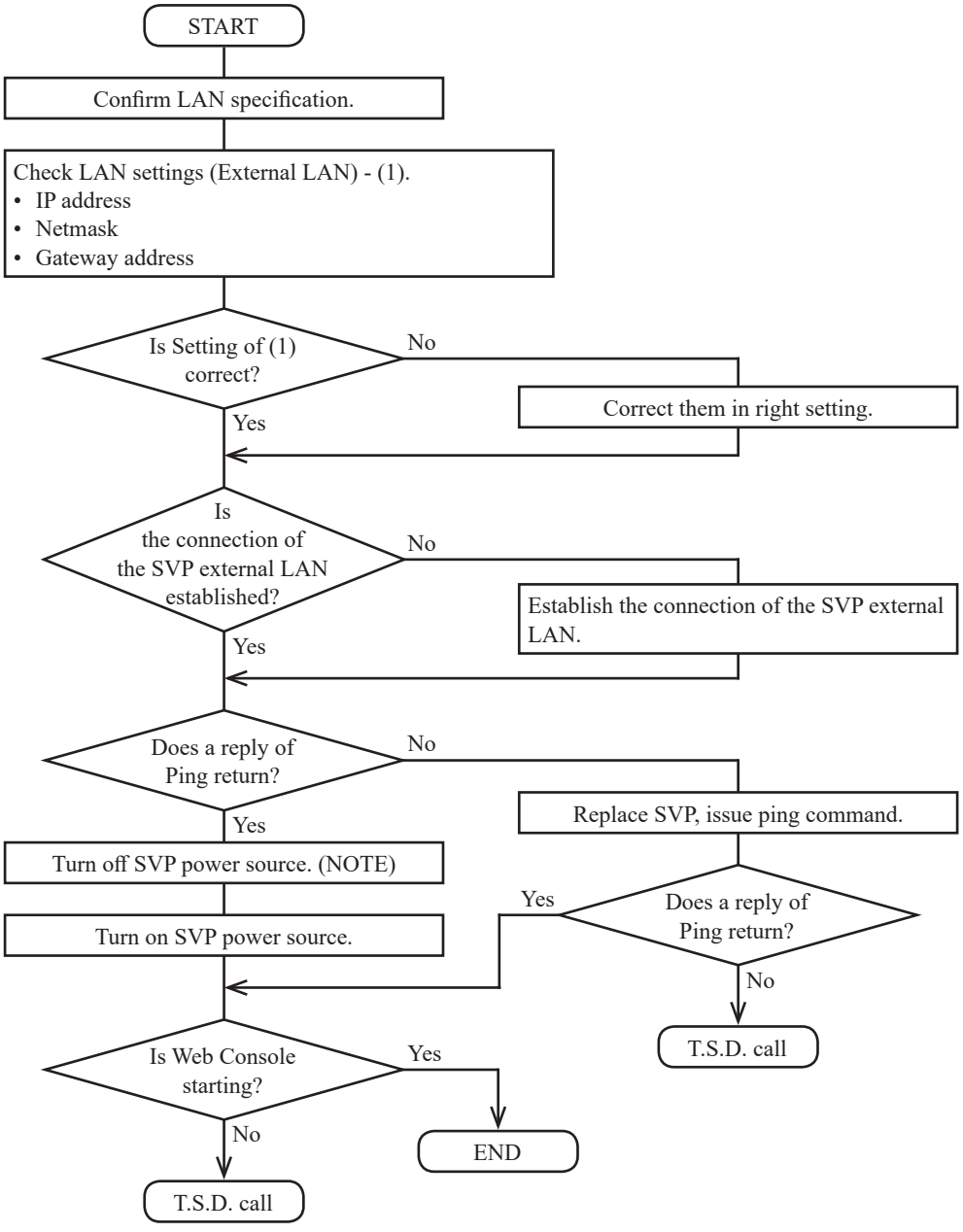
(7) Click [OK] in the "Dumping process" dialog, and then close the dialog.

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3.31 Web Console Failure Recovery

Recover it referring to trouble shooting in the WEB CONSOLE SECTION in advance.
If not solved yet, recover it according to the following procedure.

3.31.1 Web Console Trouble Shooting



NOTE: The state that excluded LAN cable connection of SVP side of External LAN or LAN cable connection of HUB side or a power supply of HUB is an Off state, and reboot SVP, and Web Console cannot start when connected outside LAN after that. Moreover, when you cannot start Web Console, please reboot SVP.

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3.32 Procedure for Responding to the Used Endurance of Flash Drives and Flash Module Drives (FMDs) (SIM = 50axxx, 50bxxx, 50cxxx, 50dxxx)

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

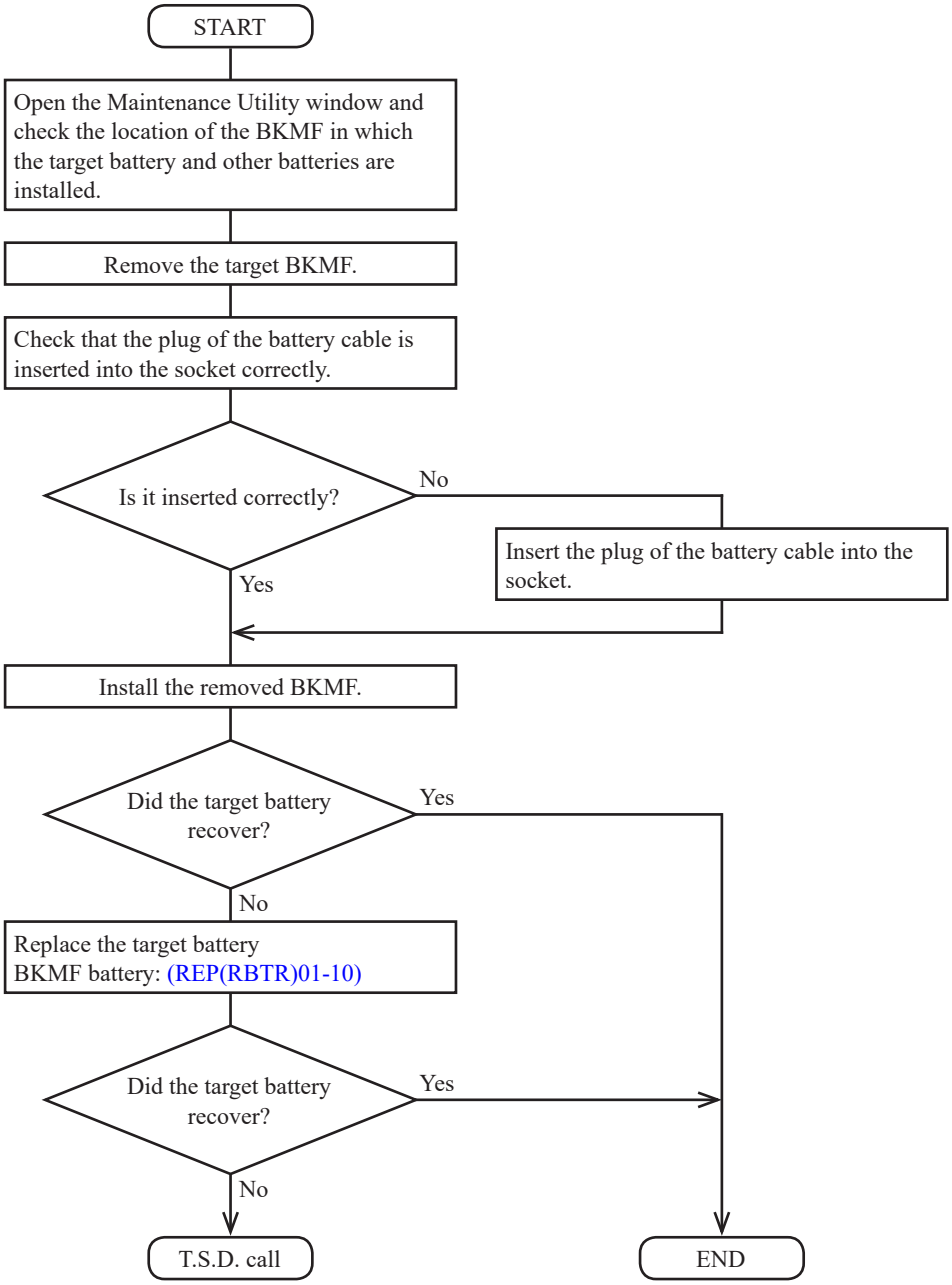
1. The SIMs are reported for the first time when the rate of write endurance reaches 95%, and then reported each time the percenrage rises by 1%.
   Replace the data drive while using the spare drive.
   - Copy the data in the data drive to the spare drive and remove the data drive.
   - Install a new 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 (SVP02-05-10) to check if the drive reaches 99% of the write endurance.
   When a drive reaches 99% of the write endurance, SIM = 50axxx, 50bxxx (Flash drive End of life) or SIM = 50cxxx, 50dxxx (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))
   4c6xxx, 4c7xxx (Dynamic sparing start)
   4c8xxx, 4c9xxx (Dynamic sparing normal end)

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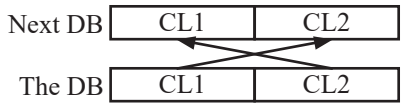
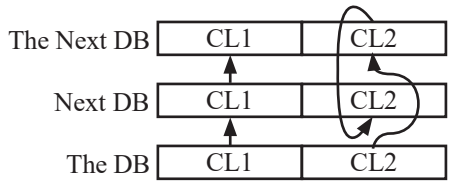
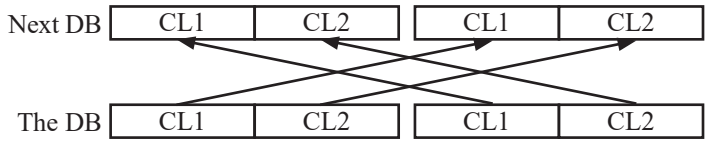
3.33 Response to the Occurrence of Battery Warning (SIM = fffa0x)



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3.34 Recovery Procedure when SAS Cable/NVMe 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/backend NVMe is as follows.
This SIM might occur by the CTL, DKB, ENC and other failures.
The Chassis connection error (REF code = effexx) or the Expander failure (REF code = effdxx) is reported (xx: SAS Port#/NVMe Port#) as the SIM of the failure managed by each SAS Port/NVMe Port.
As a cause of the error, it is assumed that one of the following failures occurs in the reported SAS port/NVMe port or in another SAS port/NVMe port of the opposite cluster.
If the SIM is generated at startup, the SAS port/NVMe port might be blocked, and more than one PDEV under the SAS port/NVMe port might be blocked. You can recover the blocked SAS port/NVMe port and the blocked PDEVs by performing the recovery procedure described in this section.
When this troubleshooting is performed during the initial installation, check that the system configuration is initialized after the recovery.

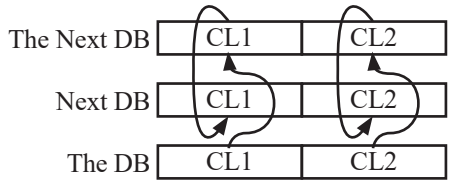
No.	Assumed cause	Details
1	SAS cable/NVMe cable is connected with wrong ENC (*1)	• Connected cluster is wrong.  • Connected with different ENCs between clusters.  • Connected with wrong DB. 

*1: See “SAS Cable/NVMe Cable Diagram” (LOC05-10) for right connection.

(To be continued)

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(Continued from preceding page)

No.	Assumed cause	Details
2	SAS cable/NVMe 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/NVMe 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 (DBS2/DBF3/DBL/DBN) is inconsistent with the DB type that is actually recosgnized.
6	SAS Ports/NVMe Port in both CL are blocked	When DKB in both CL or ENC has failure and cannot access to DB.
7	SAS cable/NVMe cable is connected to wrong port of ENC	See “SAS Cable/NVMe Cable Diagram” (LOC05-10) for right connection.

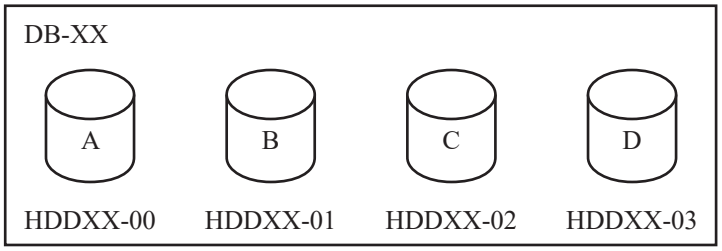
*1: See “SAS Cable/NVMe Cable Diagram” (LOC05-10) for right connection.

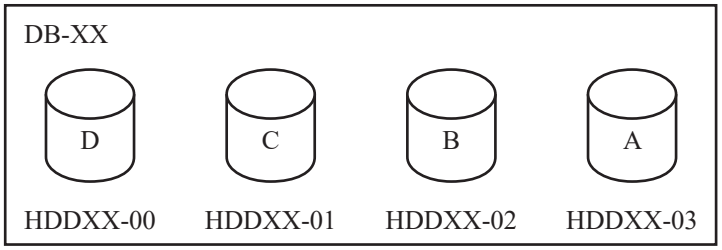
(To be continued)

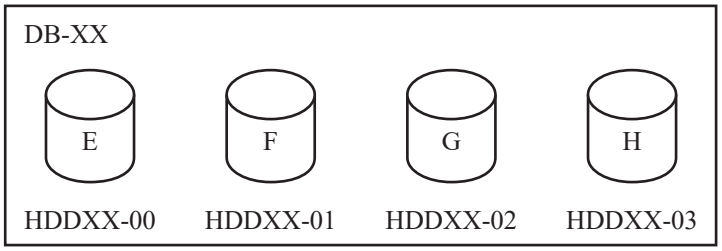
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(Continued from preceding page)

<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.

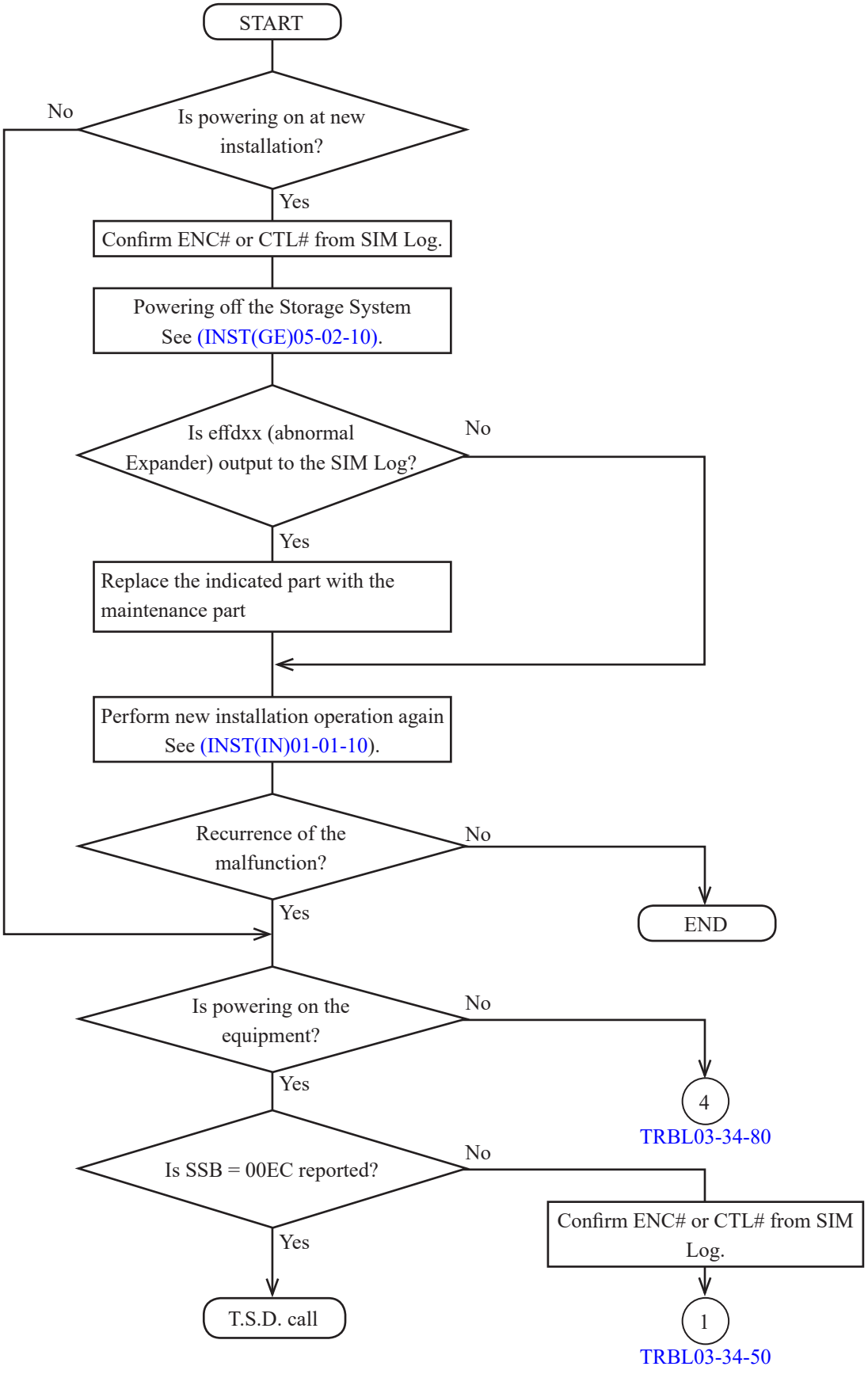
[Before restarting the Storage System/Before recovering DB power-off]
 

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

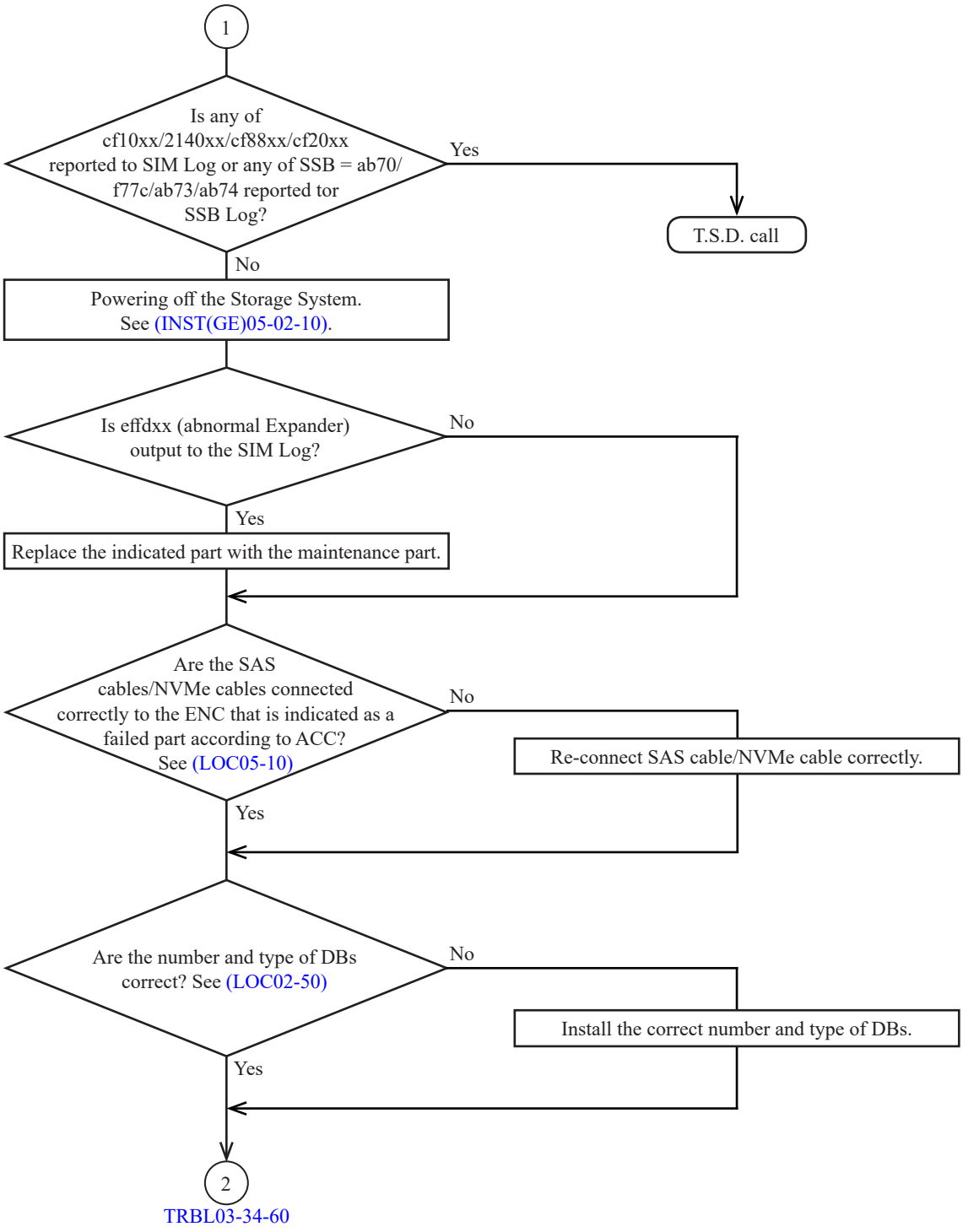
• All Drives in the DB are changed.
 
</td></tr>
<tr><td>9</td><td>Failures other than stated above occur.</td><td>The access to DB is abnormal due to the CTL/MP failures or other failures.</td></tr>
</table>

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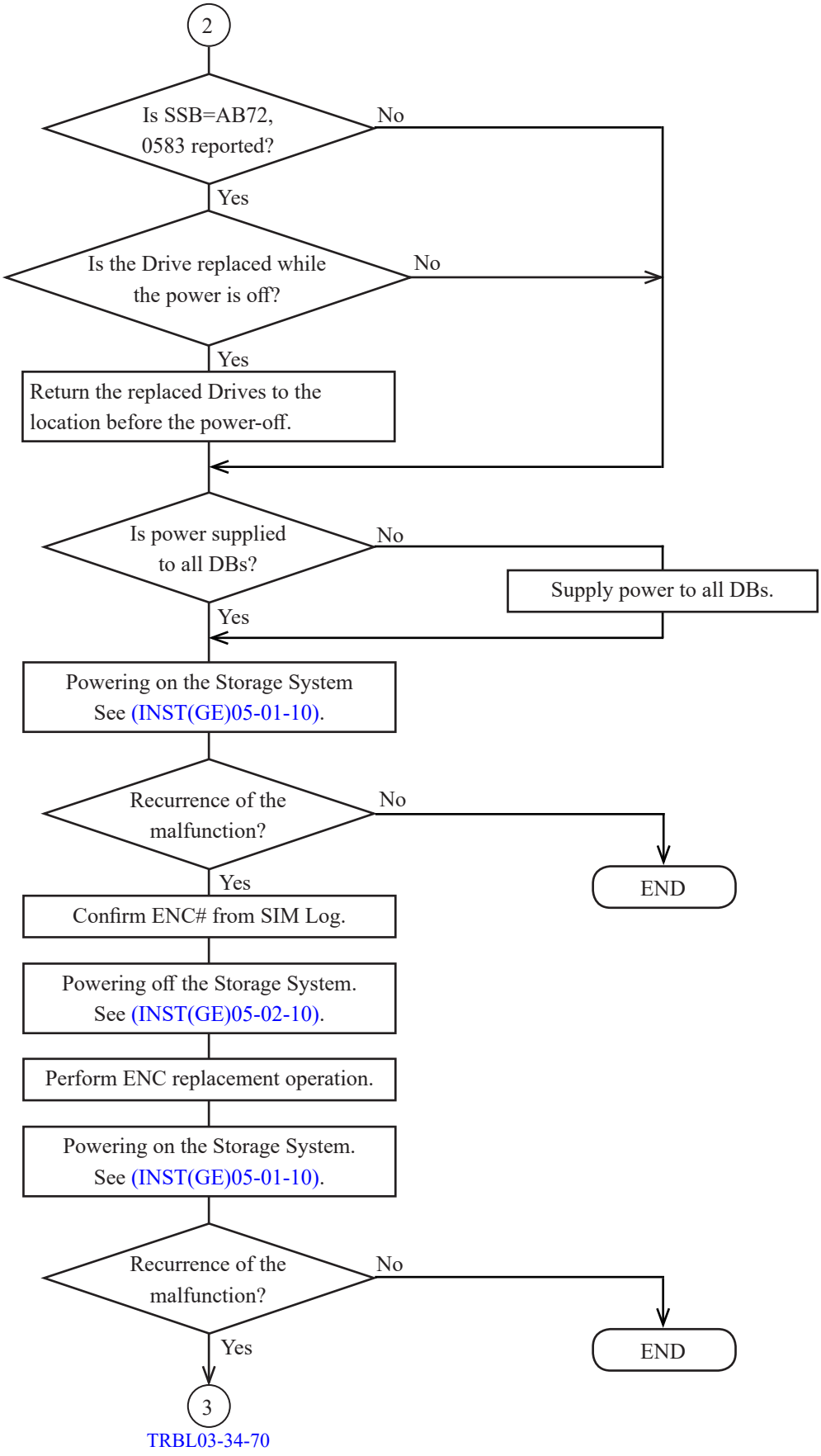
[Recovery procedure for SAS cable connection failure]



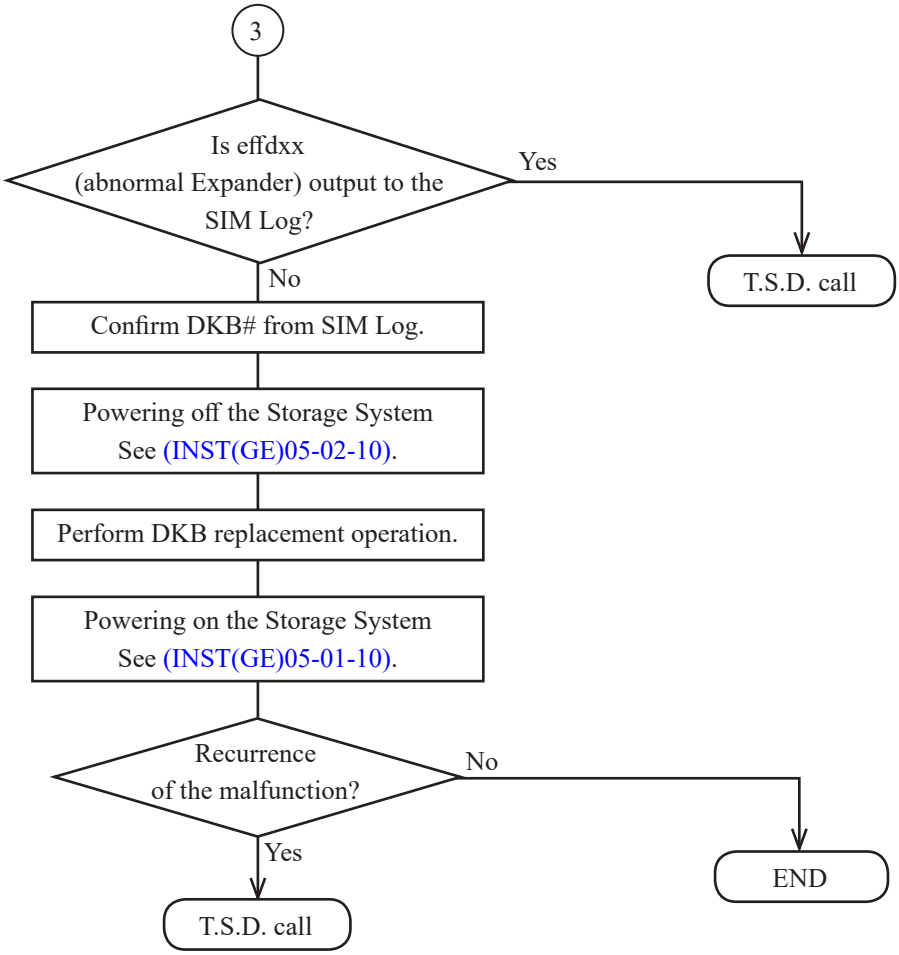
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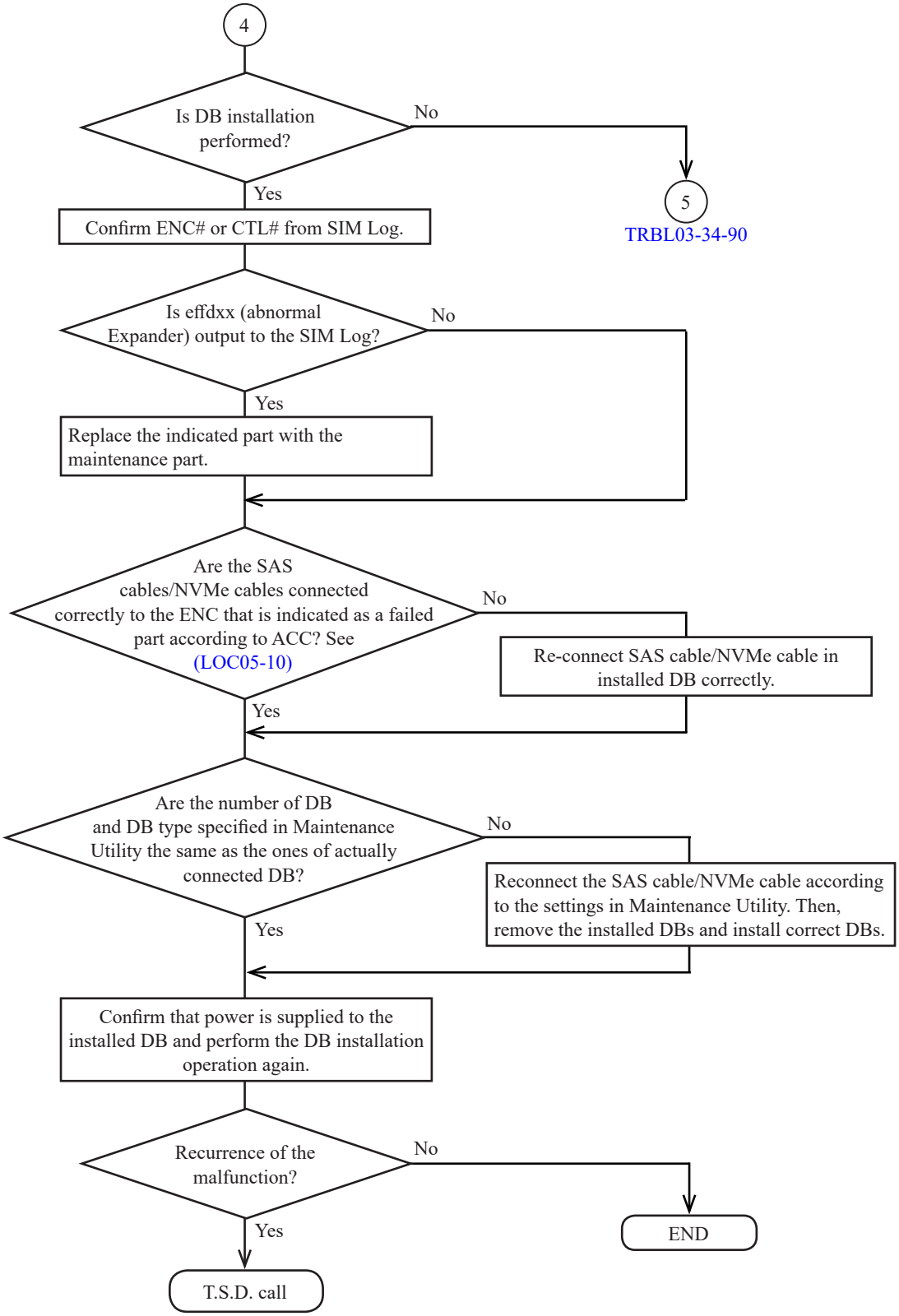
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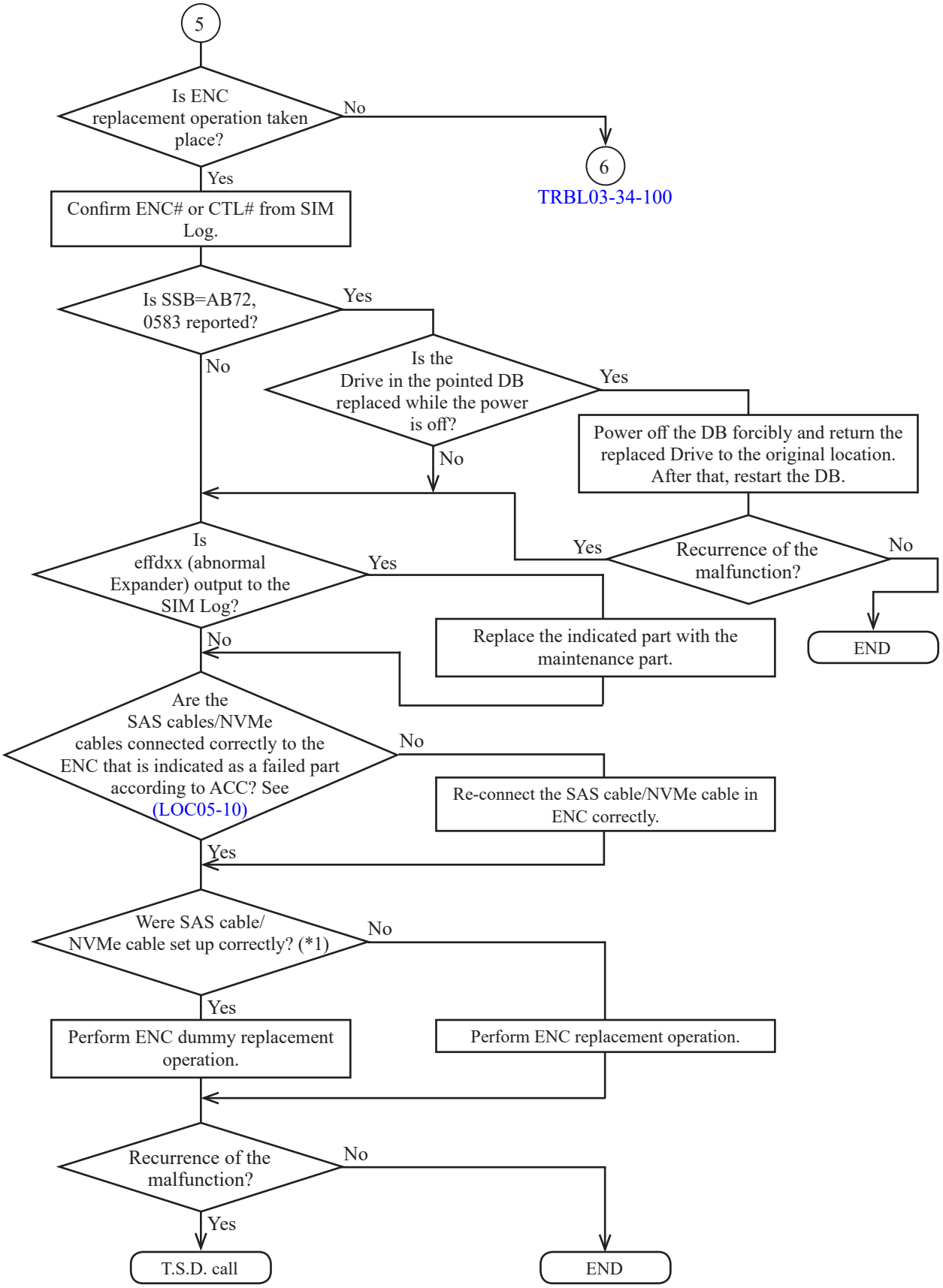
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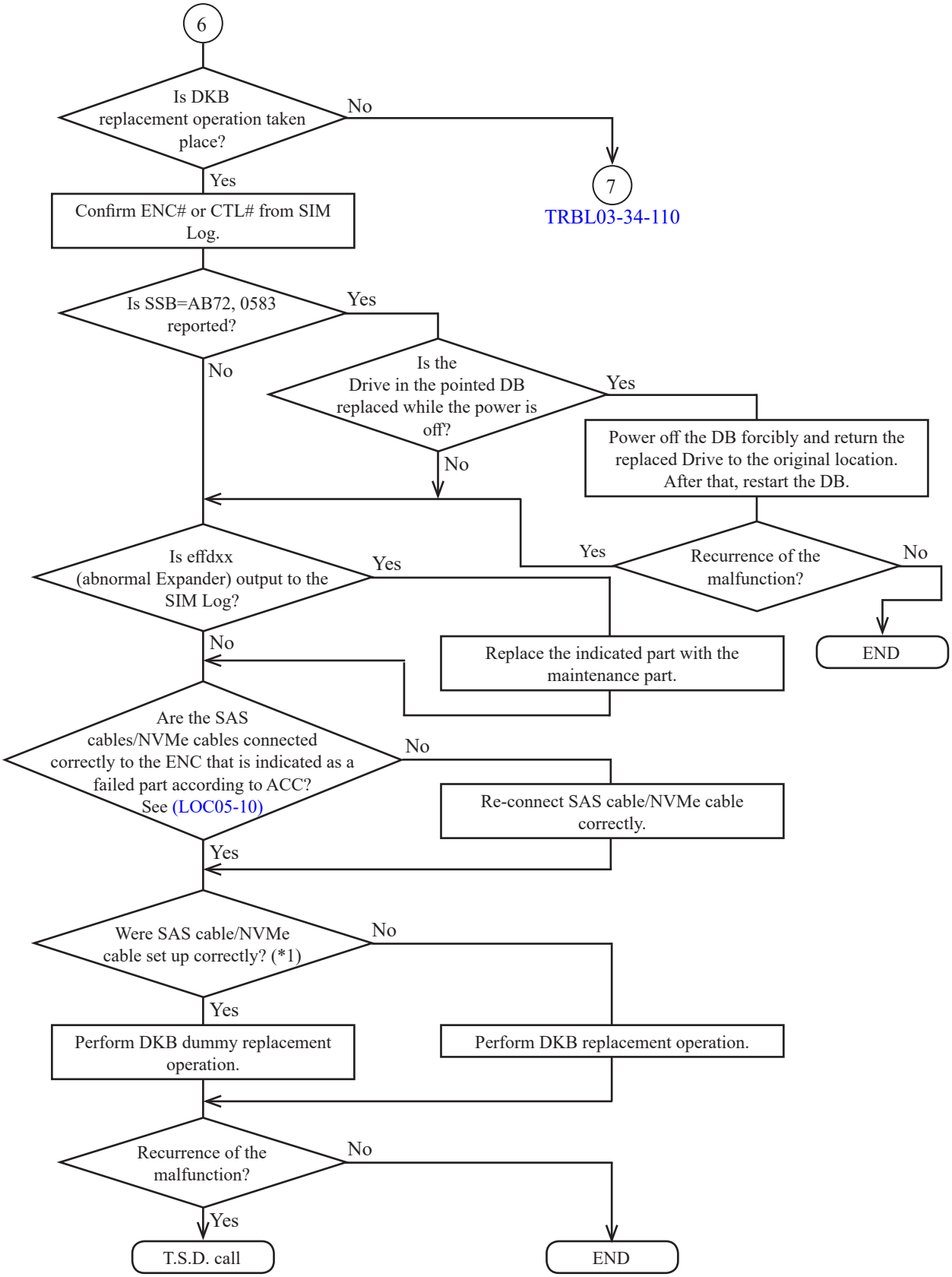


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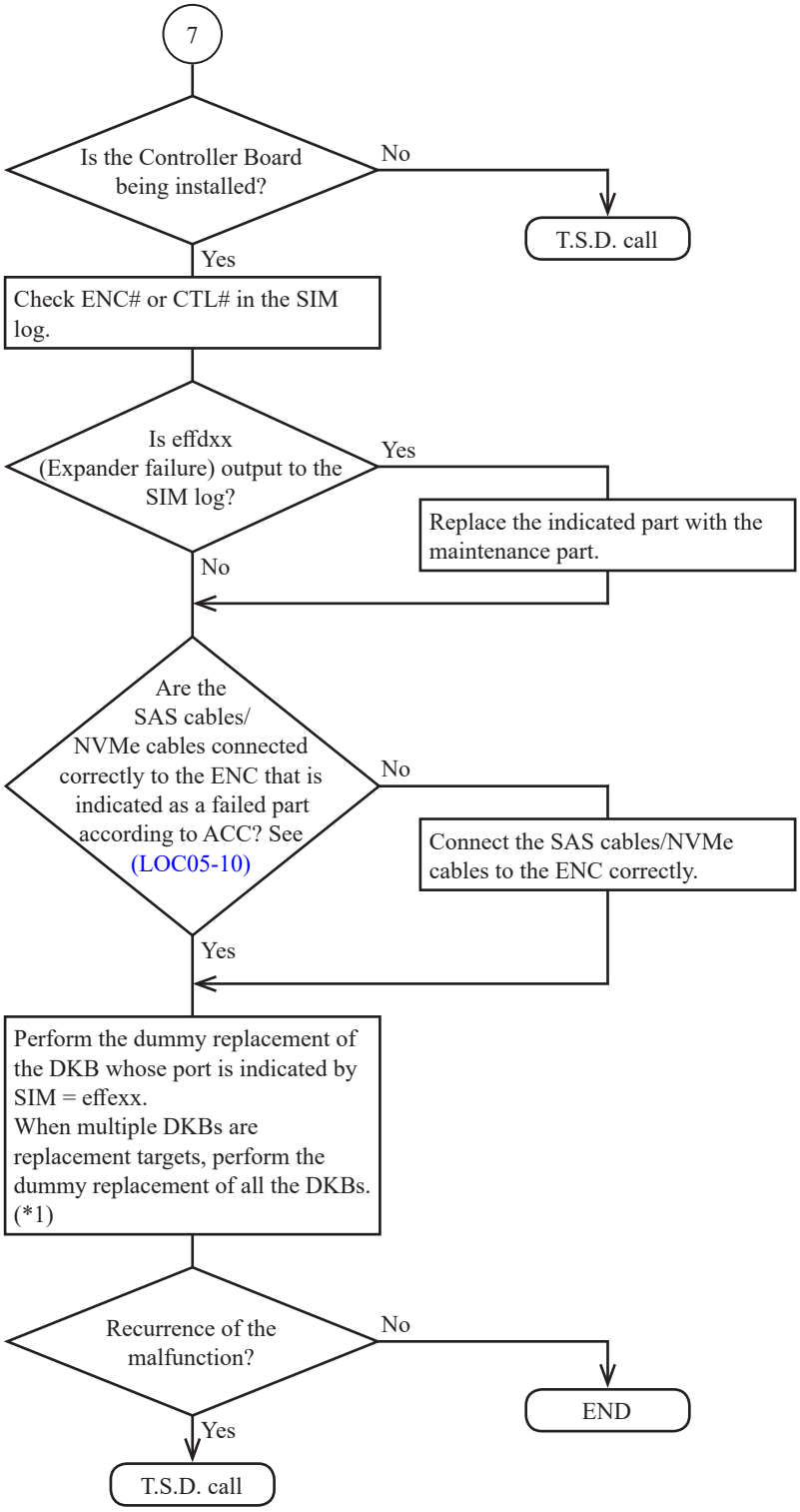


*1: When the replacement failed because of wrong connection of SAS cable/NVMe cable setting, make recovery by replacement operation as the failure was not caused by ENC failure.

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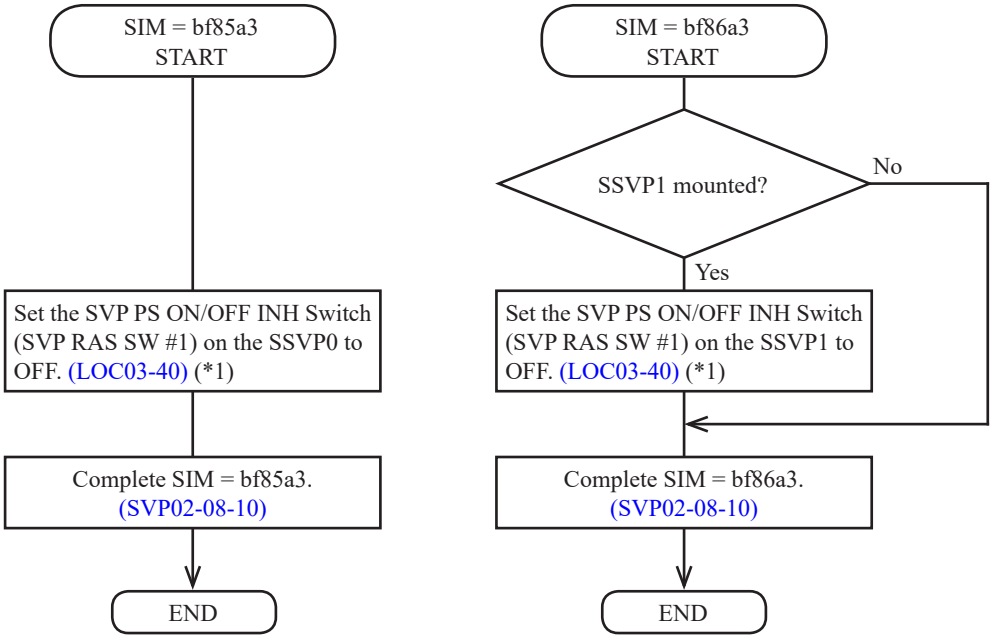
*1: When the replacement failed because of wrong connection of SAS cable/NVMe cable setting, make recovery by replacement operation as the failure was not caused by DKB failure. If not recovered by the dummy replacement, perform the normal replacement.



*1: When the replacement fails due to the wrong connections of SAS cables/NVMe cables, perform the dummy replacement as the recovery action because the DKB is not faulty. If the recovery by the dummy replacement fails, perform the hardware replacement.

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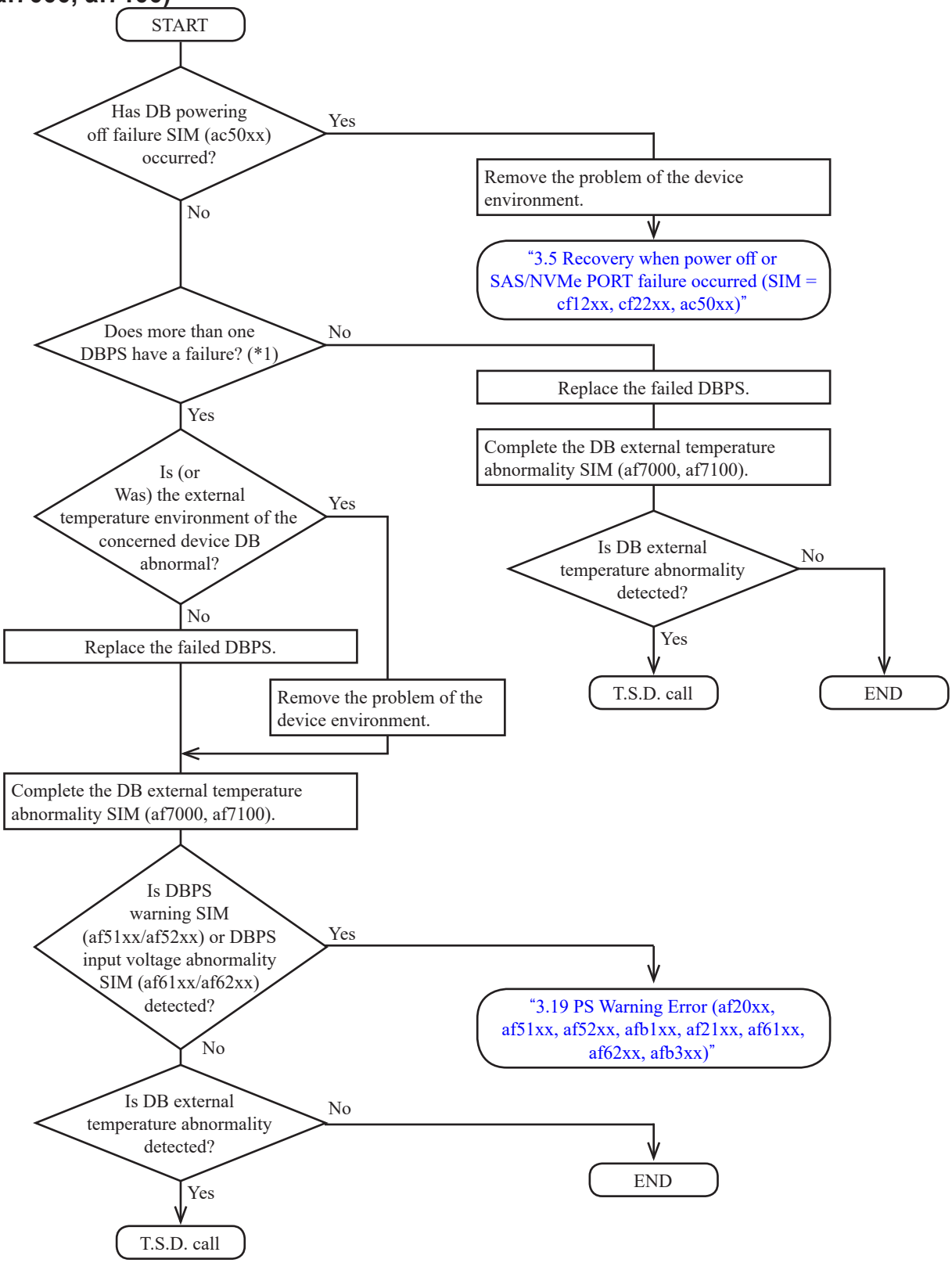
3.35 Recovery Procedure for SVP RAS Switch #1 remains (SIM = bf85a3, bf86a3)



*1: Use an object with a sharp edge such as a pair of tweezers to manipulate the SVP RAS Switches.

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3.36 Recovery Procedure When DB External Temperature Abnormality is detected (SIM = af7000, af7100)



*1: Check using Maintenance Utility.

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3.37 Reclaiming the control pages inside the DP-VOL(s)

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.

(Method 1) Format or delete LDEV

(1) Delete the TC/UR/GAD pairs with 4TB 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 micro-program version, restore the volumes from the backup if necessary.

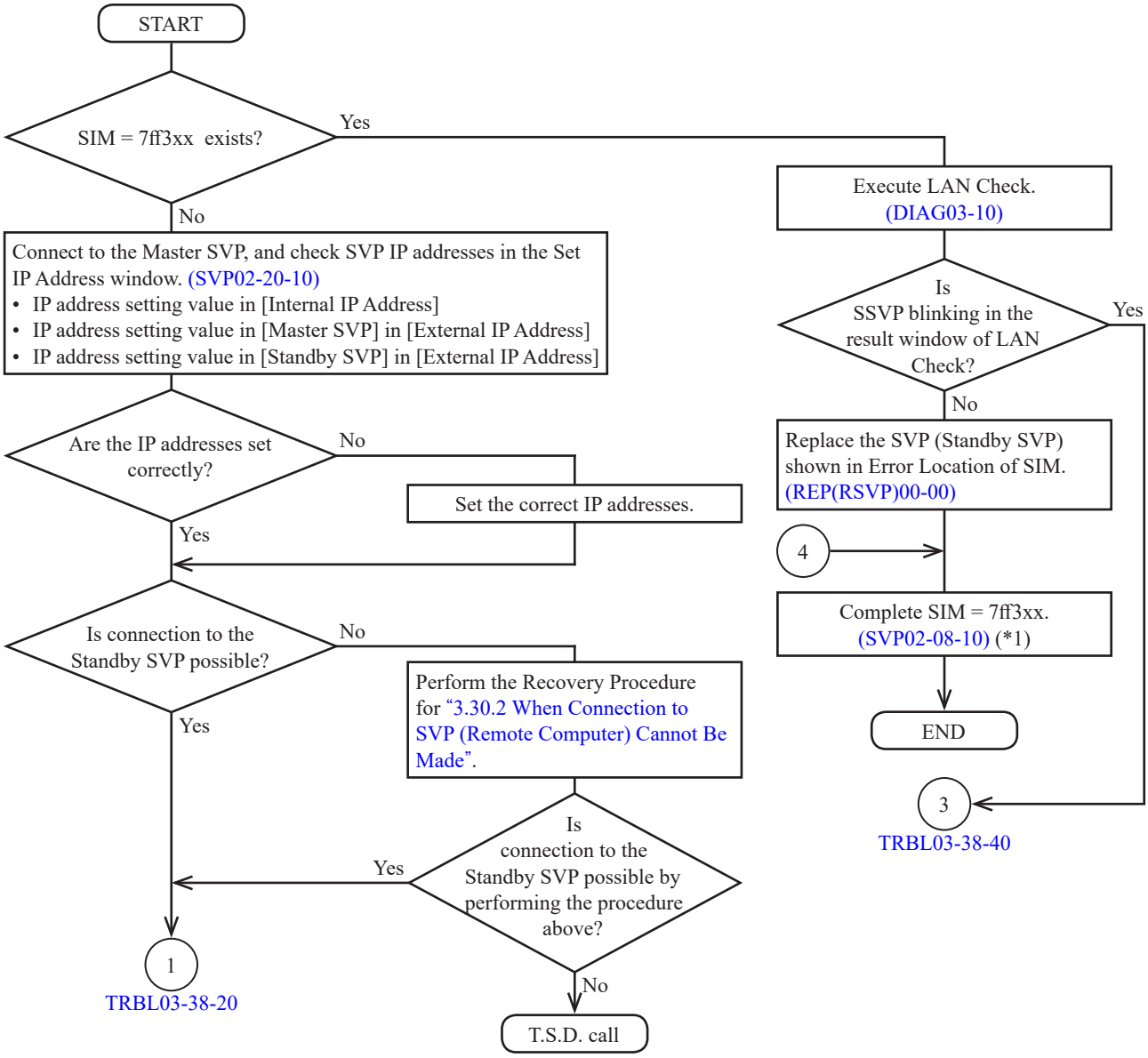
(Method 2) Reclaim the zero pages

(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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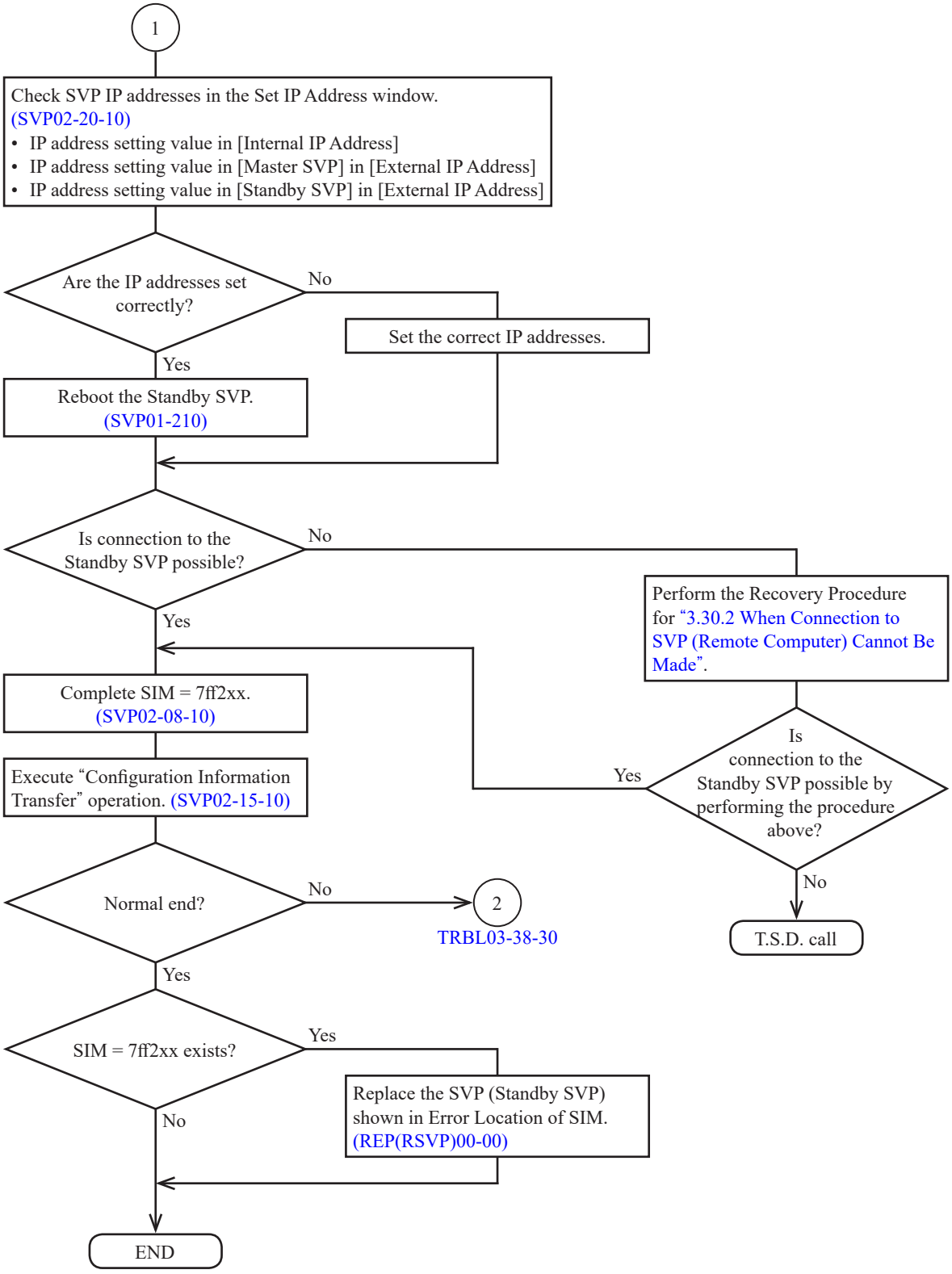
3.38 Recovery Procedure for Standby SVP Failure (SIM = 7ff2xx)

This SIM indicates that Standby SVP failure was occured.
Please to recover in the following procedure.

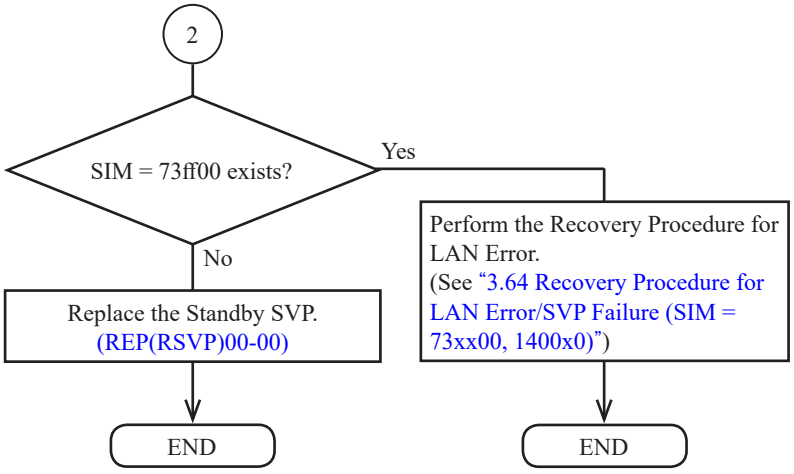


*1: If you have performed maintenance work for SSVP1 in this workflow, you do not need to complete SIM = 7ff3xx (the SIM is not displayed).

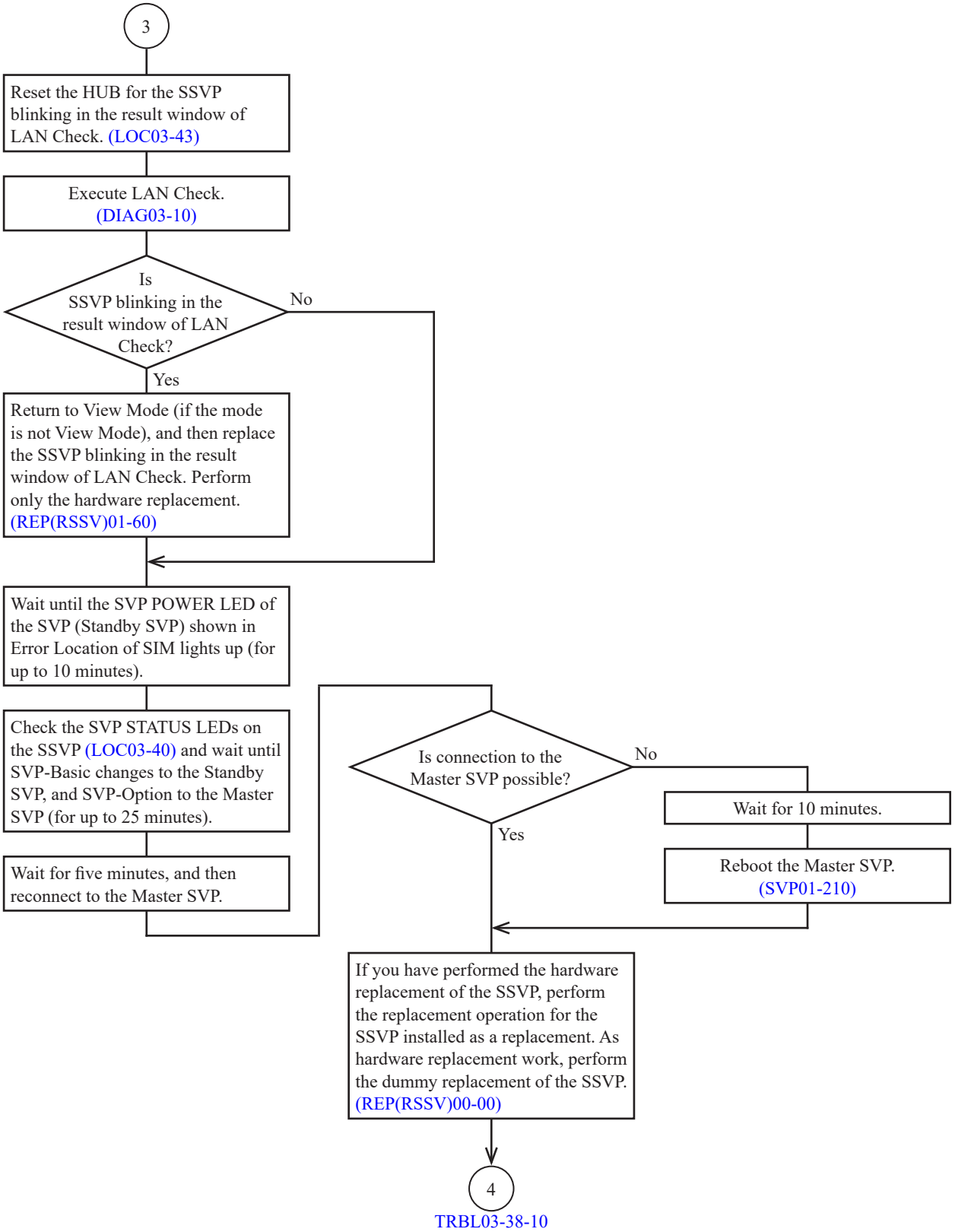
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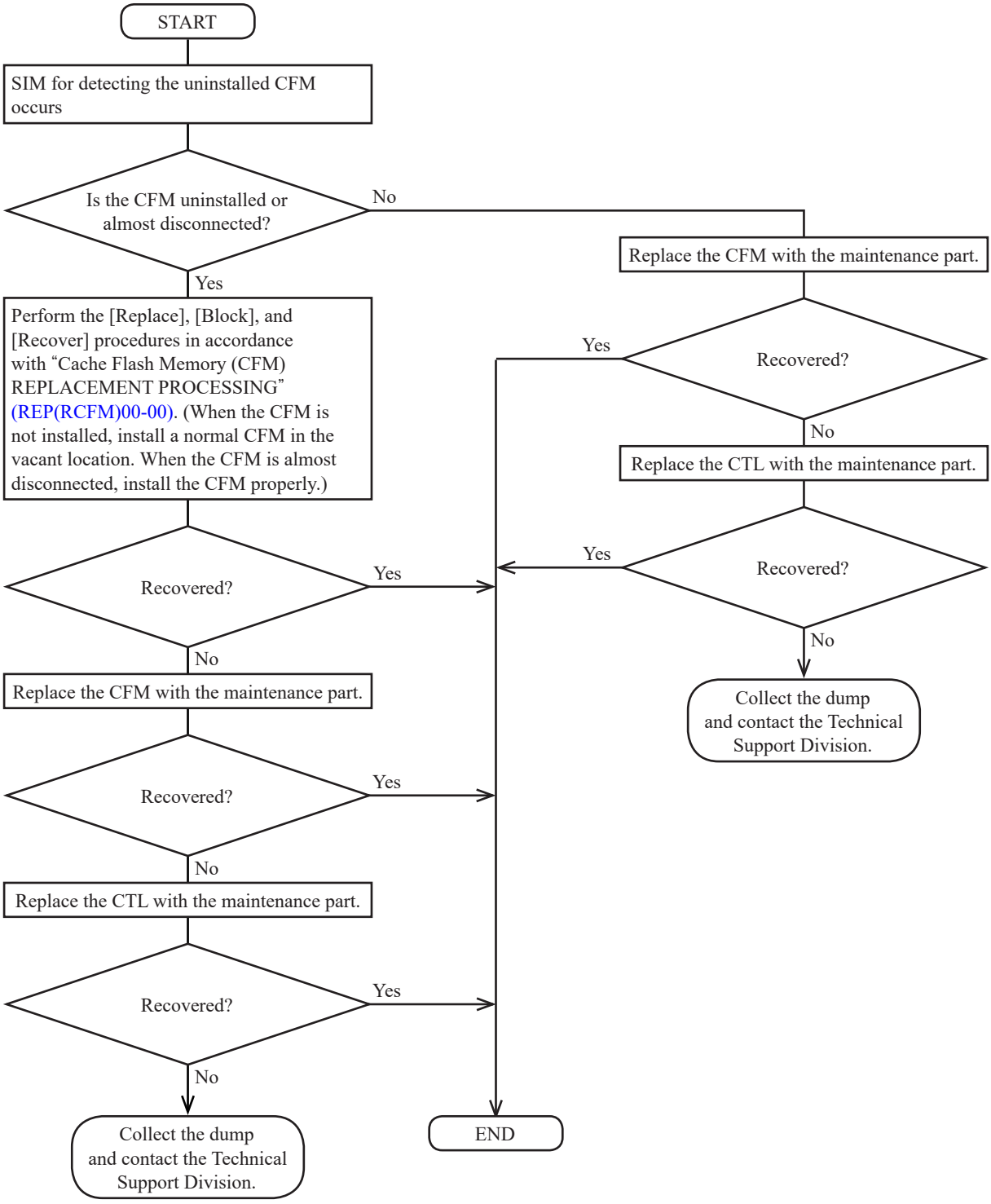


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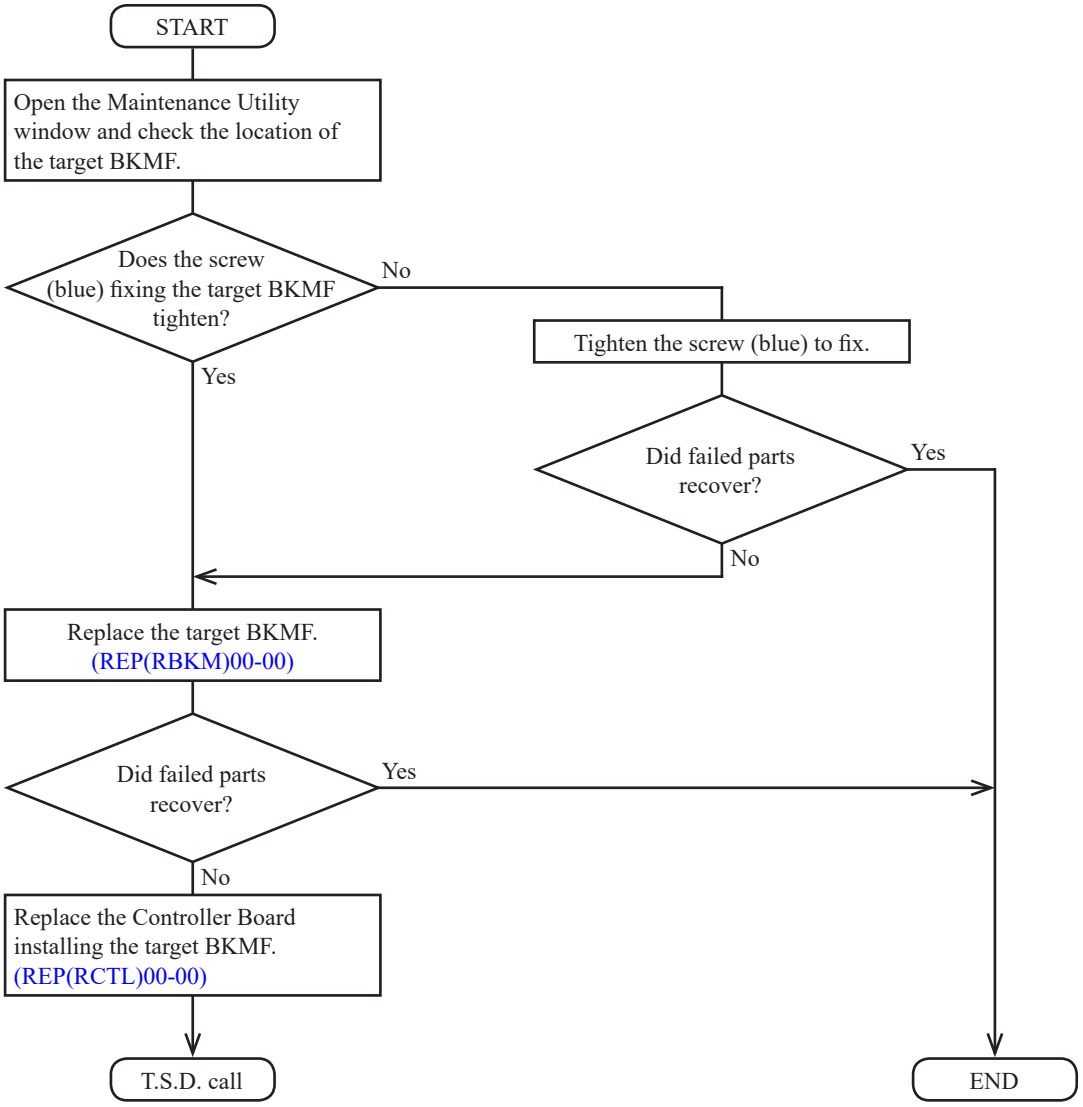
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3.39 Response to the Detection of Uninstalled CFM (SIM = aff20x)



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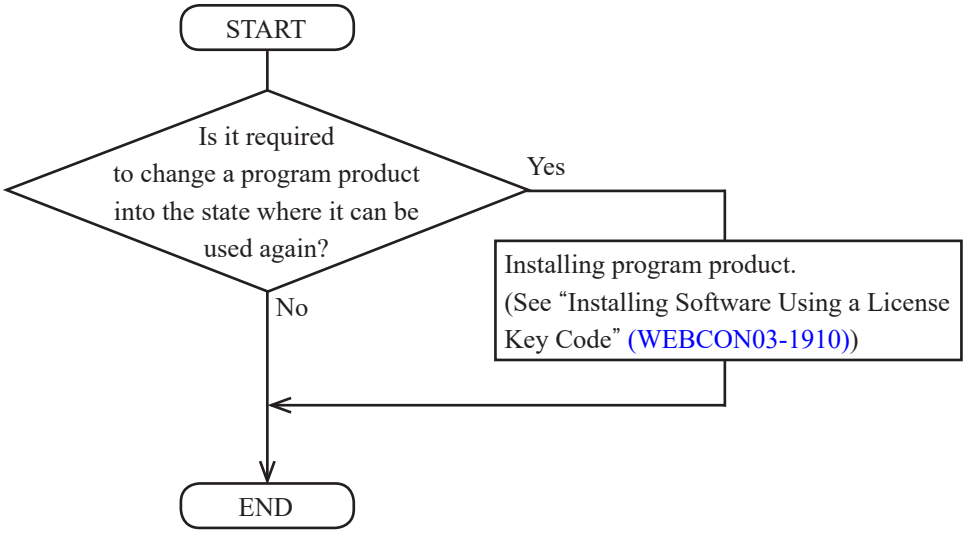
3.40 Response to the Occurrence of BKMF Warning (SIM = af400x)



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

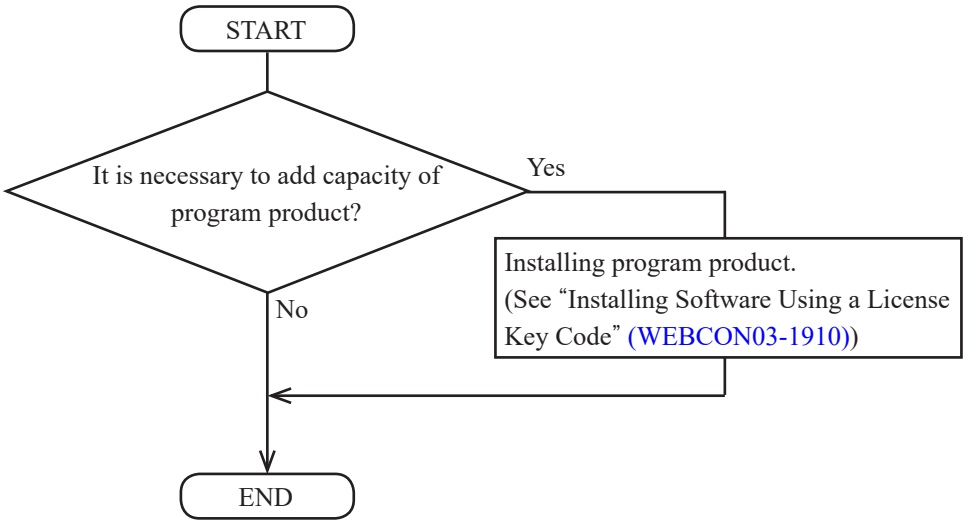
If this SIM is reported, the term of validity of the program product was lost.
About of which program product the term was lost, please refer to 7ff7xx of (SIMRC02-100).



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3.42 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 (SIMRC02-100).

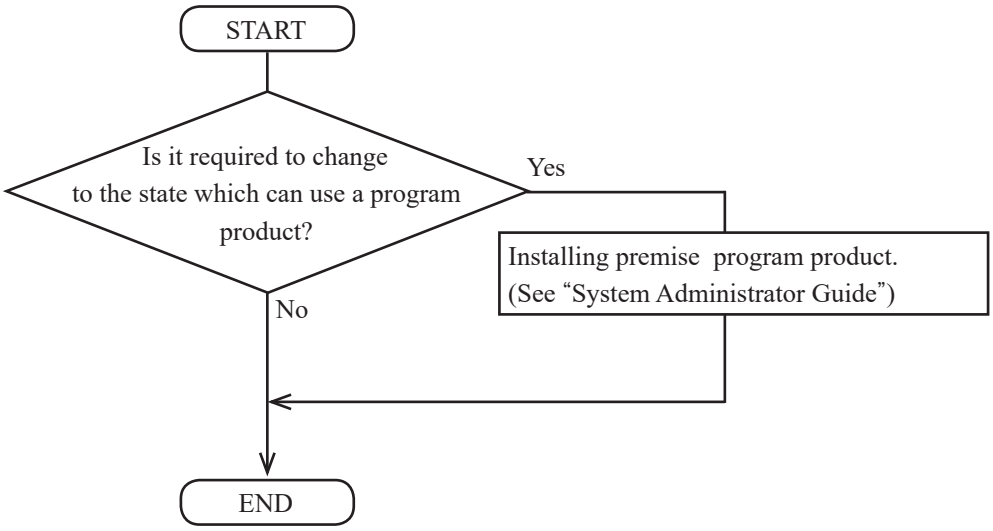


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3.43 Procedure for responding to the prerequisite program product expiration (SIM = 7ff9xx)

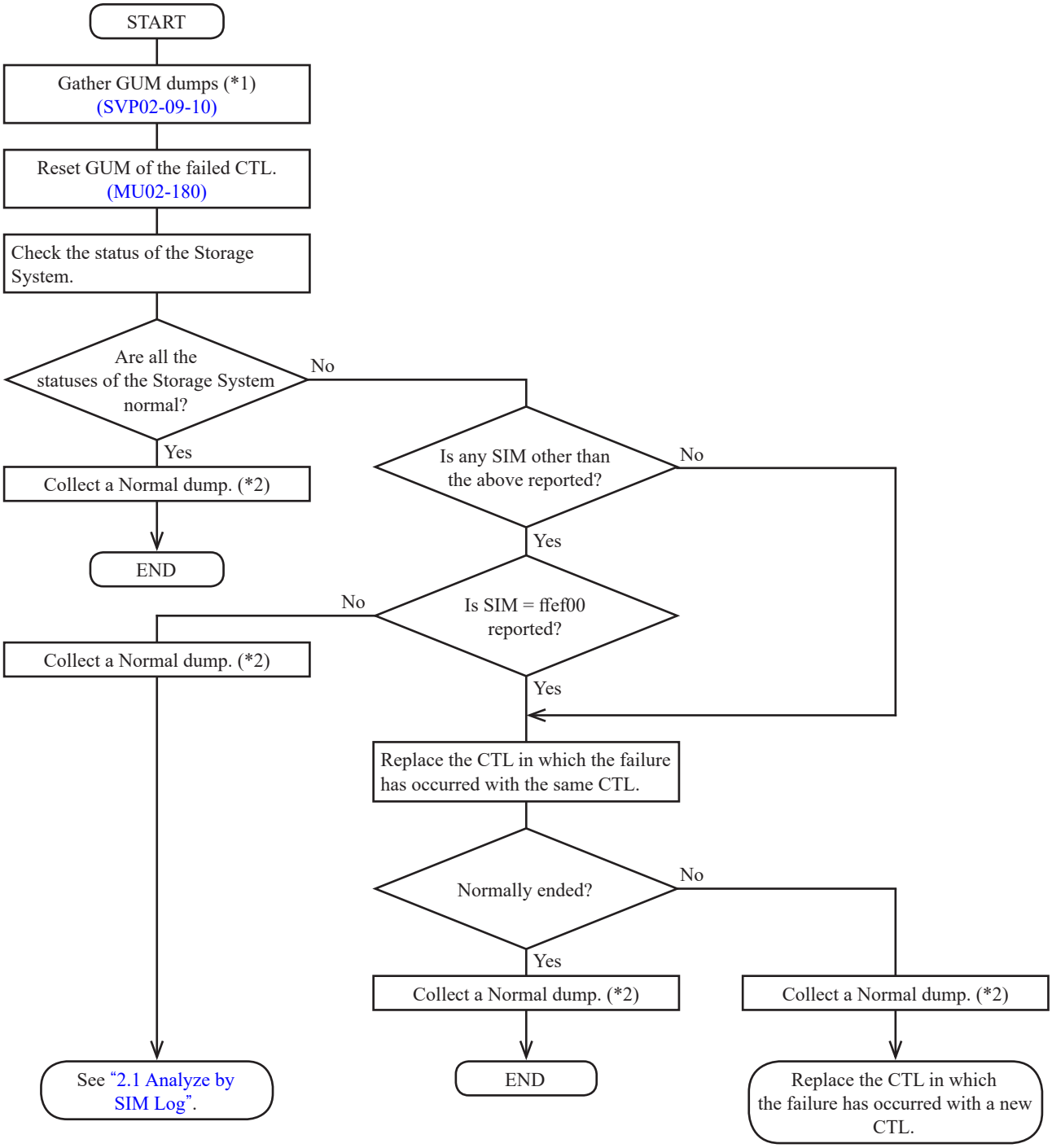
If this SIM is reported, A program product cannot be used by the term of validity of the premise program product.

About whether it became impossible which program product to use, please refer to 7ff9xx of (SIMRC02-100).



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



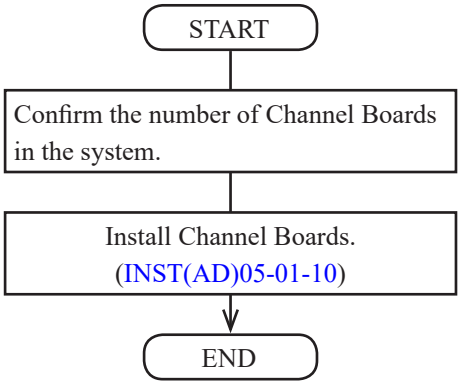
*1: Select "GUM" in the Auto Dump type selection.
Dump gathering may fail, but proceed to the next work.

*2: Regardless of the success or failure of the dump collection in (*1), collect Normal Dump.
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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3.45 Response to the Detection of Unmounted Channel Board (SIM = 3c9600)

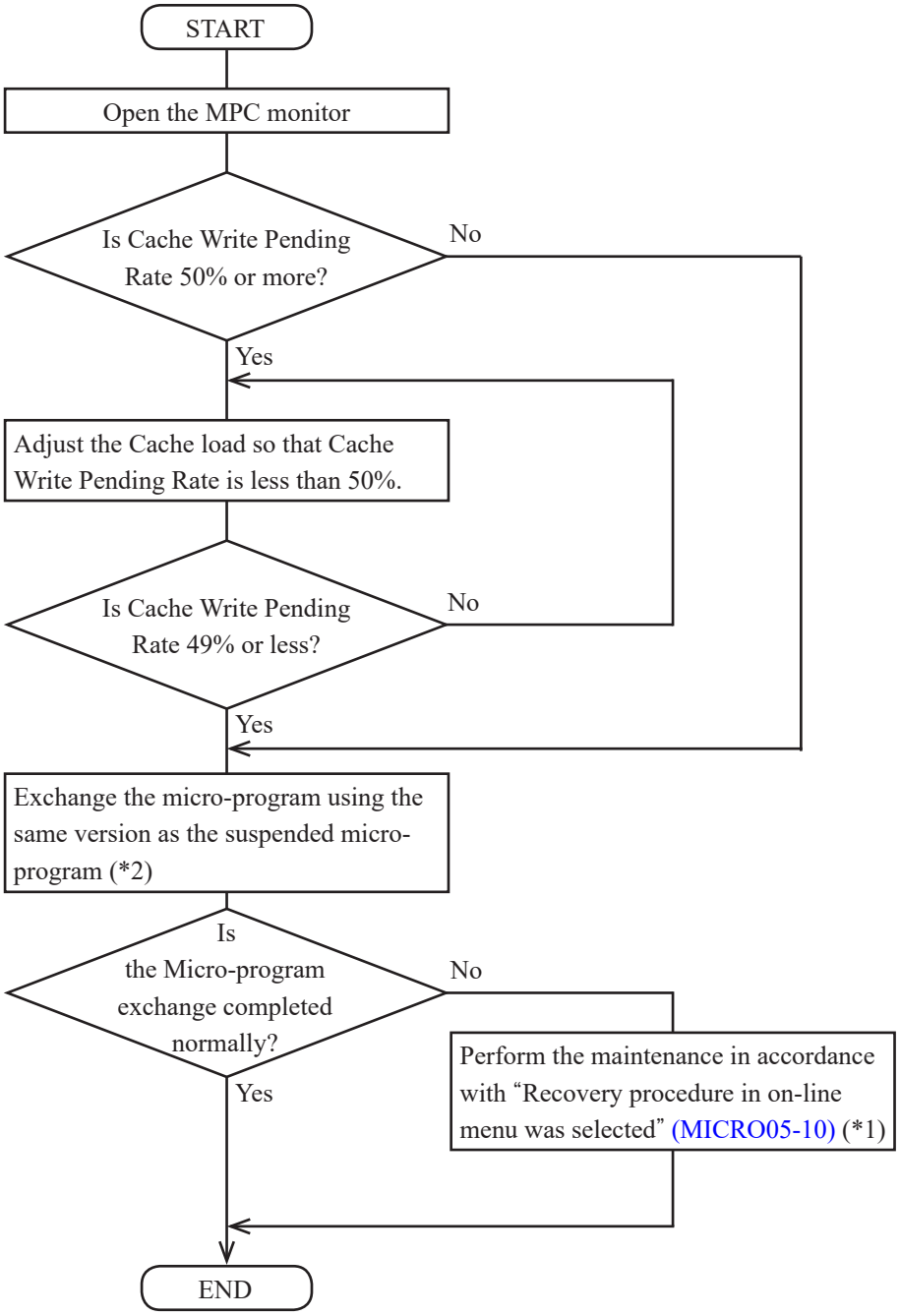
When there are no Channel Boards mounted at the time of start-up, SIM RC = 3c9600 is issued. In this case, please install Channel Boards.



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3.46 Procedure for Responding to the Micro-program Exchange Failure due to Cache High Load (SIM = eb8xxx, eb9xxx)

Since the write pending data on the Cache is large, the Drive Micro-program exchange was suspended. To restart the Micro-program exchange, reduce the Cache load and execute it.

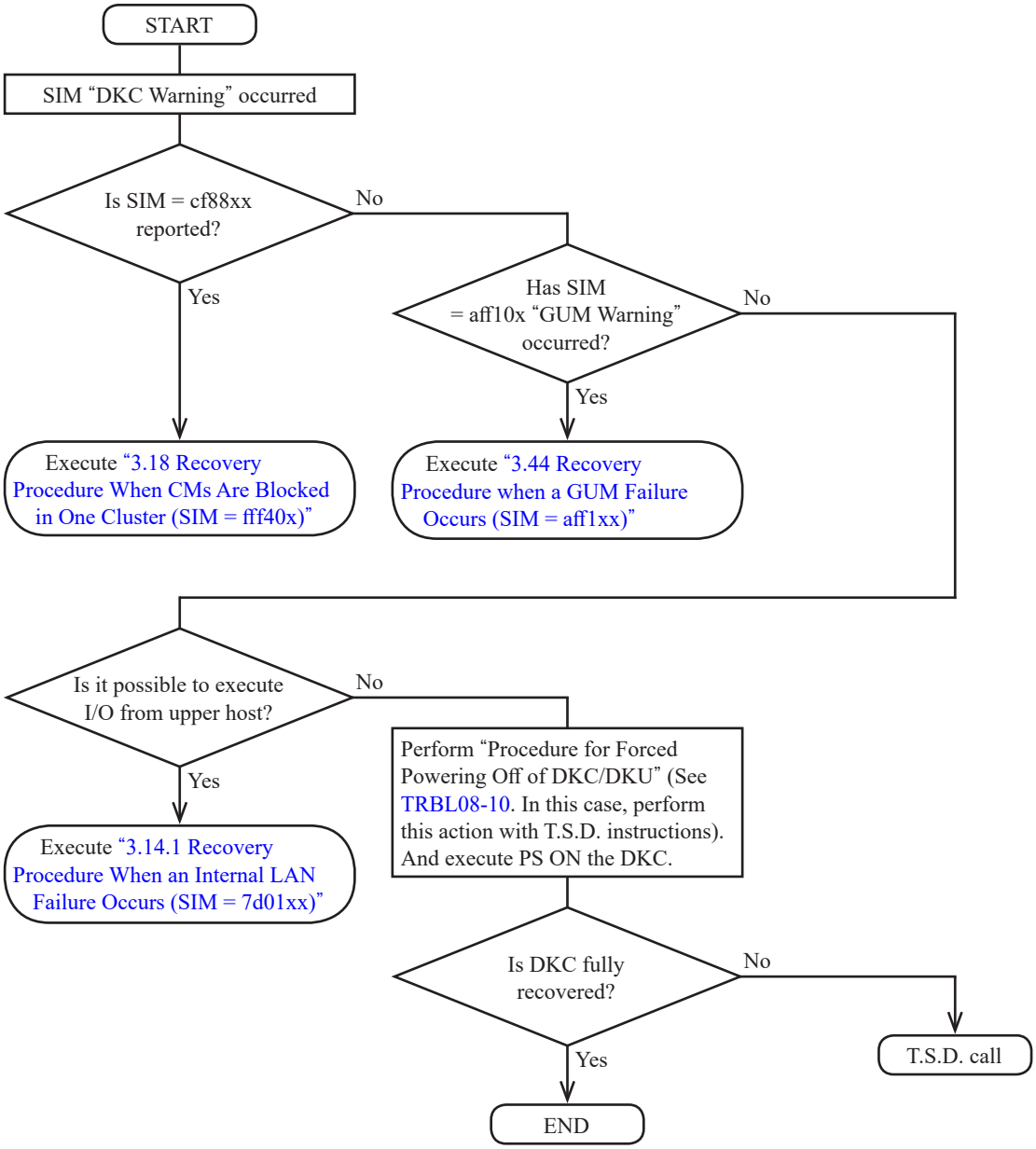


*1: When the same failure occurs repeatedly, contact the Technical Support Division.

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

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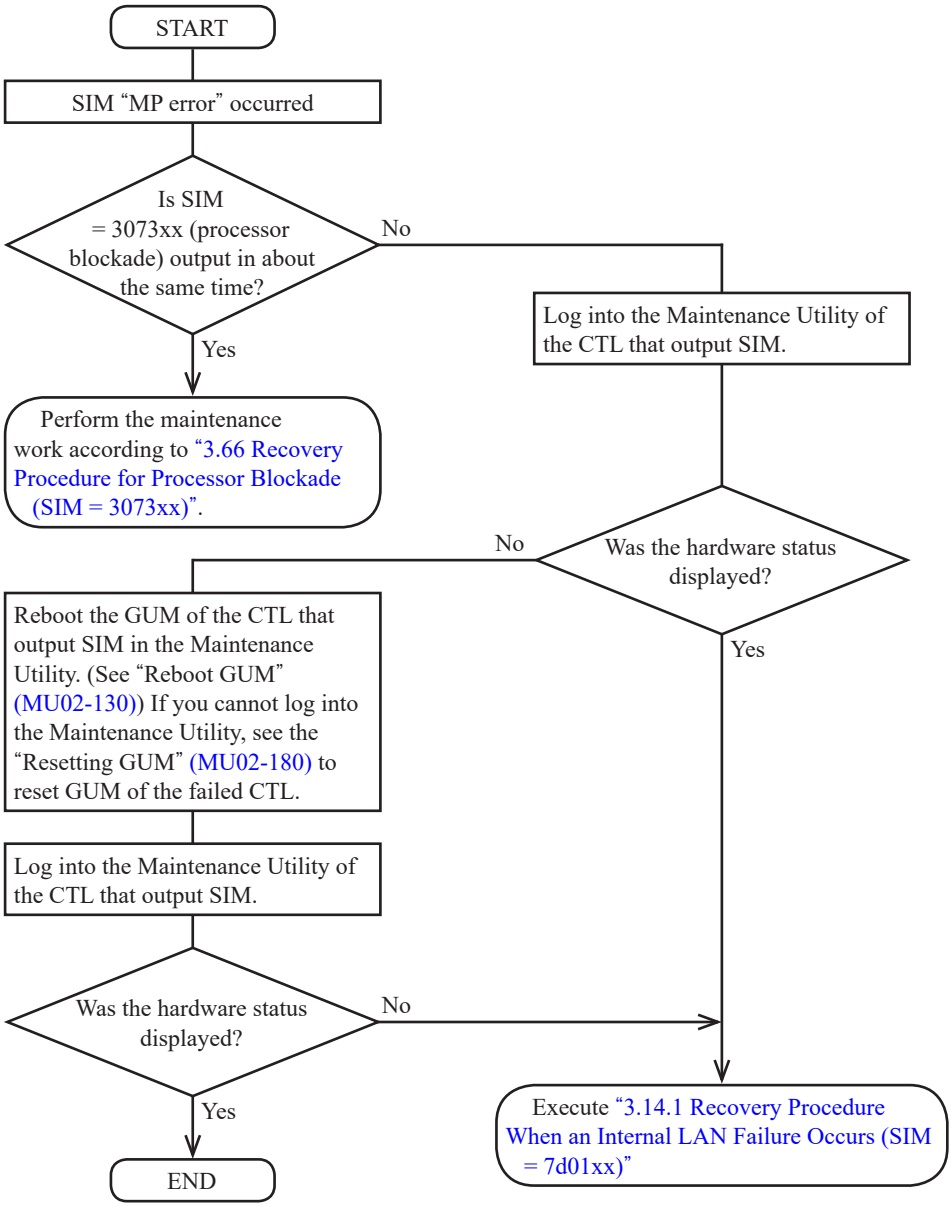
3.47 Recovery Procedure When DKC Warning Occurs (SIM = 7d090x)



NOTE: There is no problem if SIM = 7d090x is output when performing the offline micro-program exchange.
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 micro-program exchange is completed.

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



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3.49 (Blank)

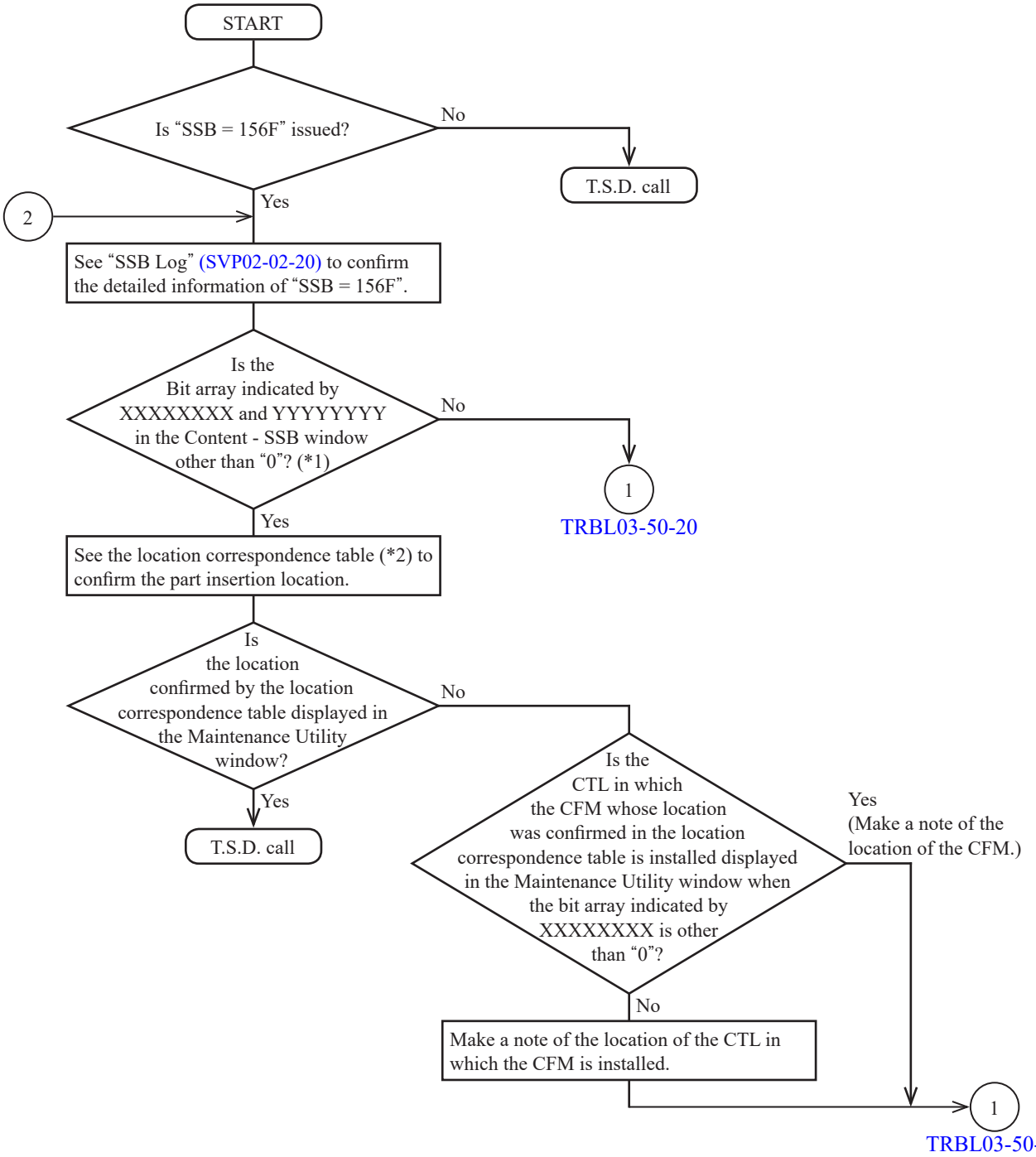
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3.50 Recovery Procedure When the Part Installation Error Occurs (SIM = ffd400)

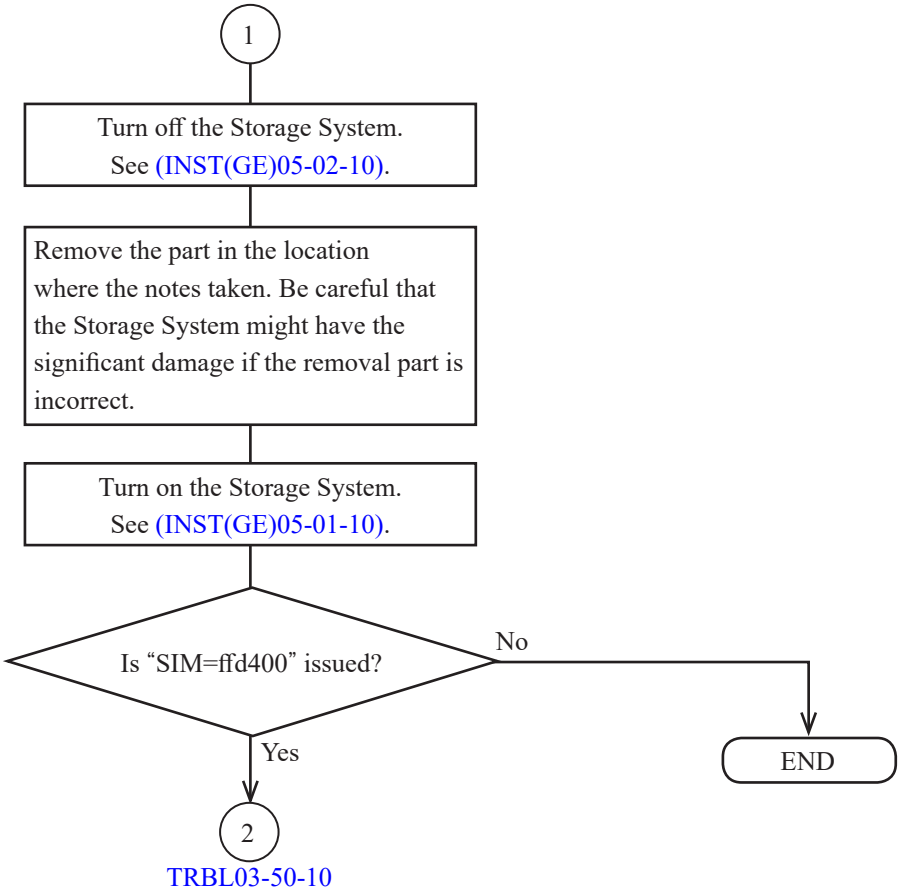
SIM = ffd400 notifies that the part, that is not embedded in the configuration, is inserted into the Storage System.
In this case, removing the part from the Storage System is required by identifying the part type/location in accordance with the following procedure.

⚠ 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	00000000
00000050:	00000000	YYYYYYYY	00000000	00000000

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

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

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*2: Location correspondence table

• CFM location correspondence table

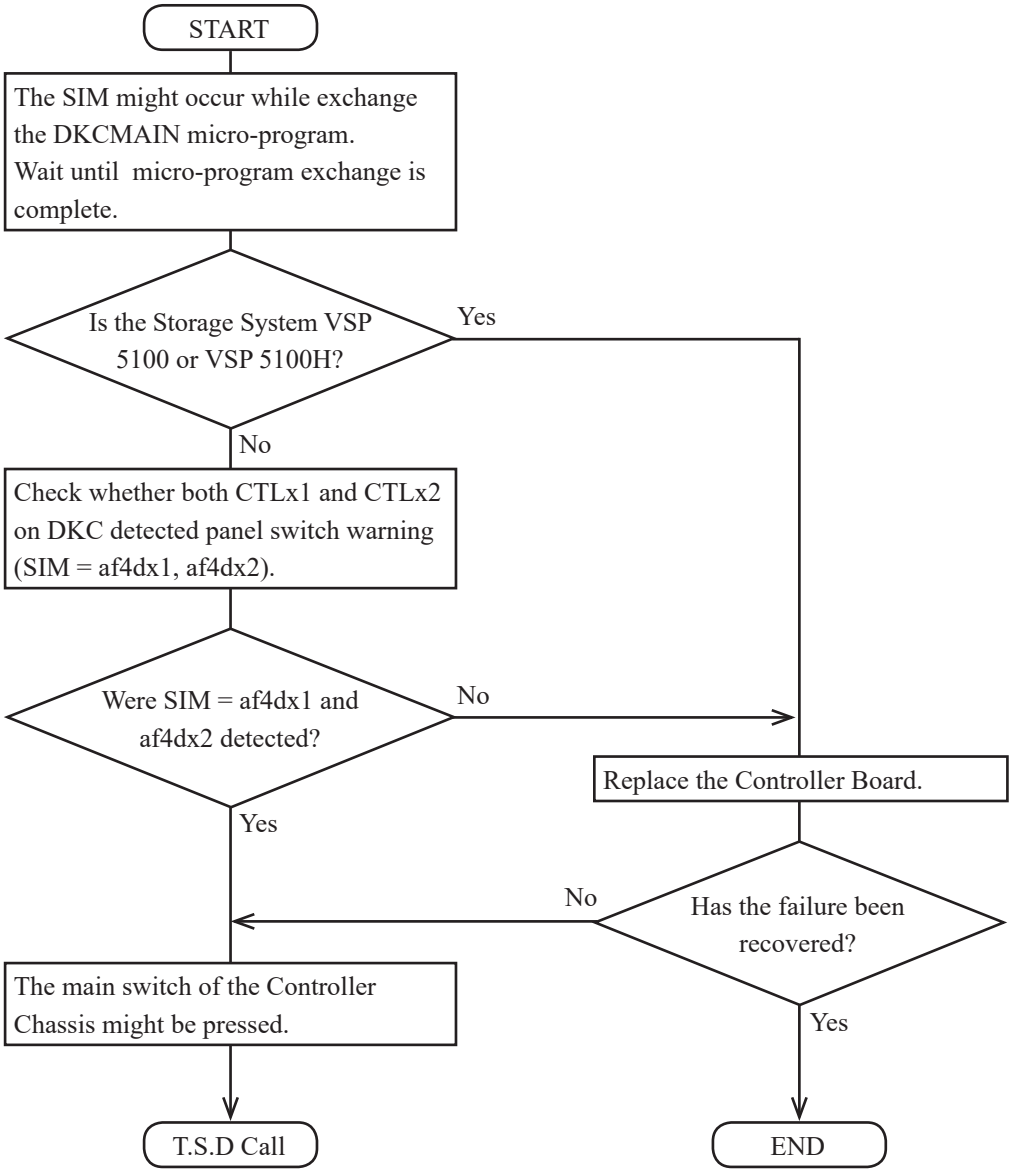
Bit location	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Part location (CFM-xxx)	010	011	020	021	110	111	120	121	210	211	220	221	310	311	320	321
Part location (CTL-xxx)	01		02		11		12		21		22		31		32	
Bit location	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Part location (CFM-xxx)	410	411	420	421	510	511	520	521	No used							
Part location (CTL-xxx)	41		42		51		52									

• HIE location correspondence table

Bit location	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Part location (HIE-xxx)	01G	01C	02G	02C	11G	11C	12G	12C	21G	21C	22G	22C	31G	31C	32G	32C
Bit location	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Part location (HIE-xxx)	41G	41C	42G	42C	51G	51C	52G	52C	No used							

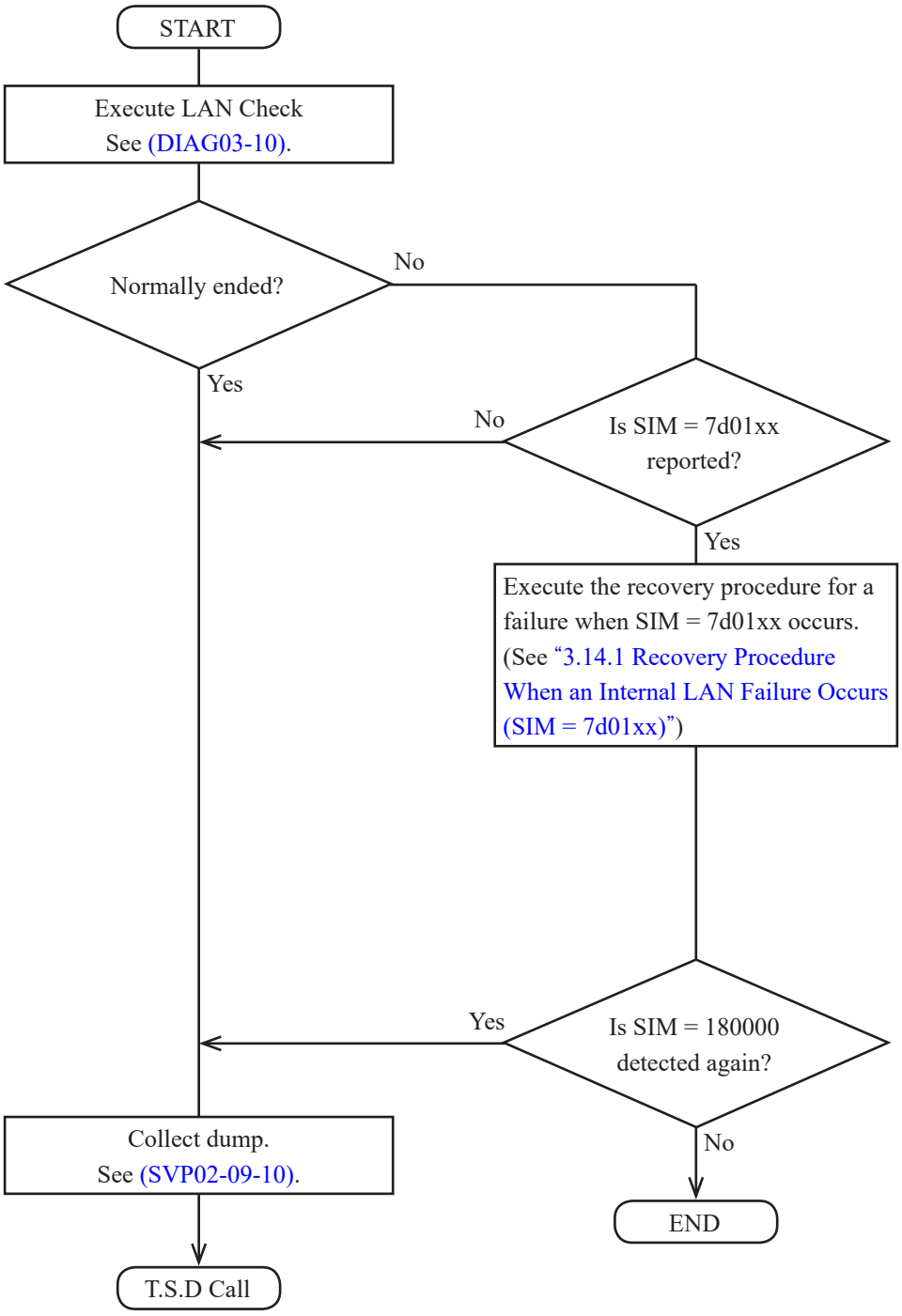
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3.51 Recovery Procedure When the Panel Switch Warning (SIM = af4dxx)



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

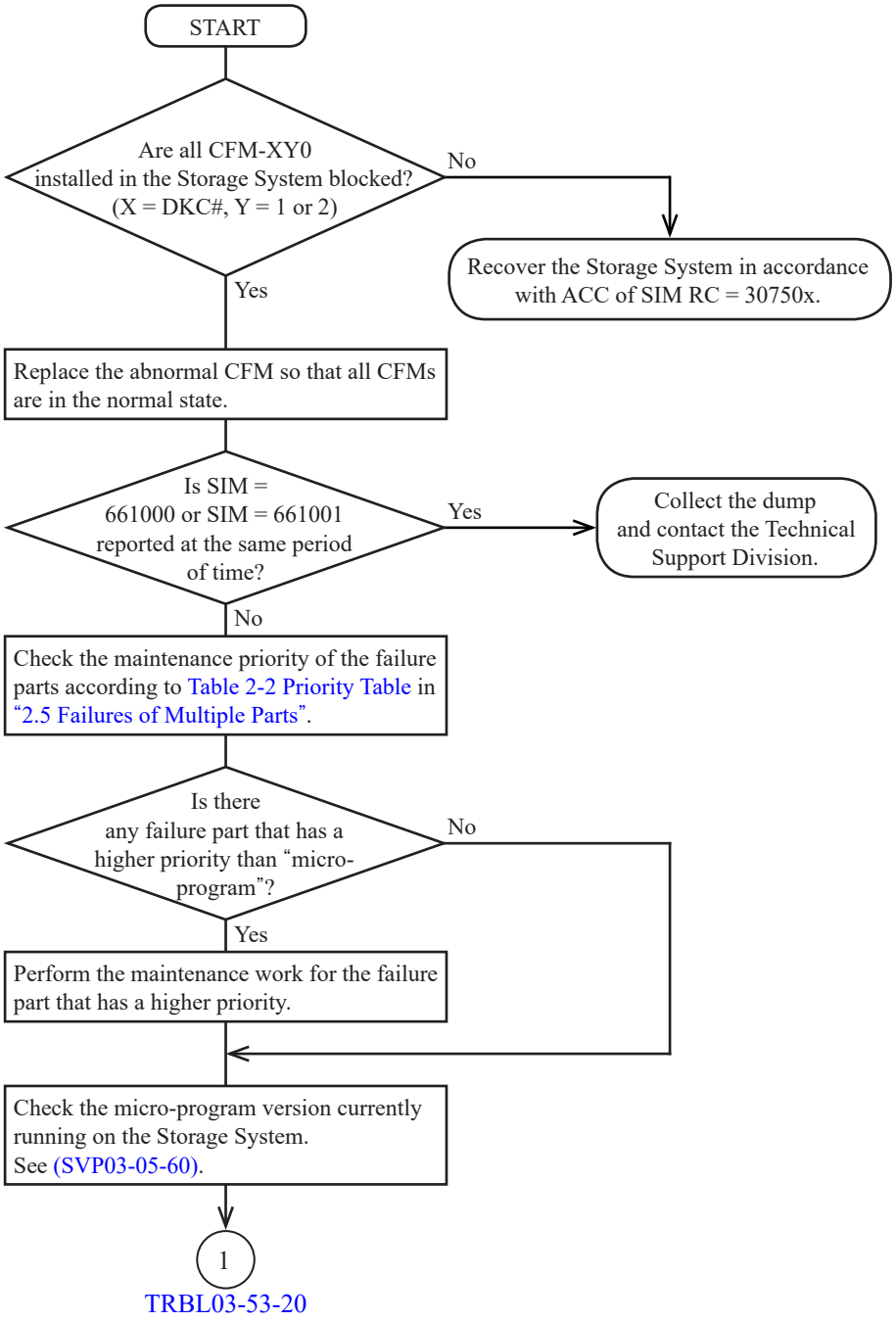


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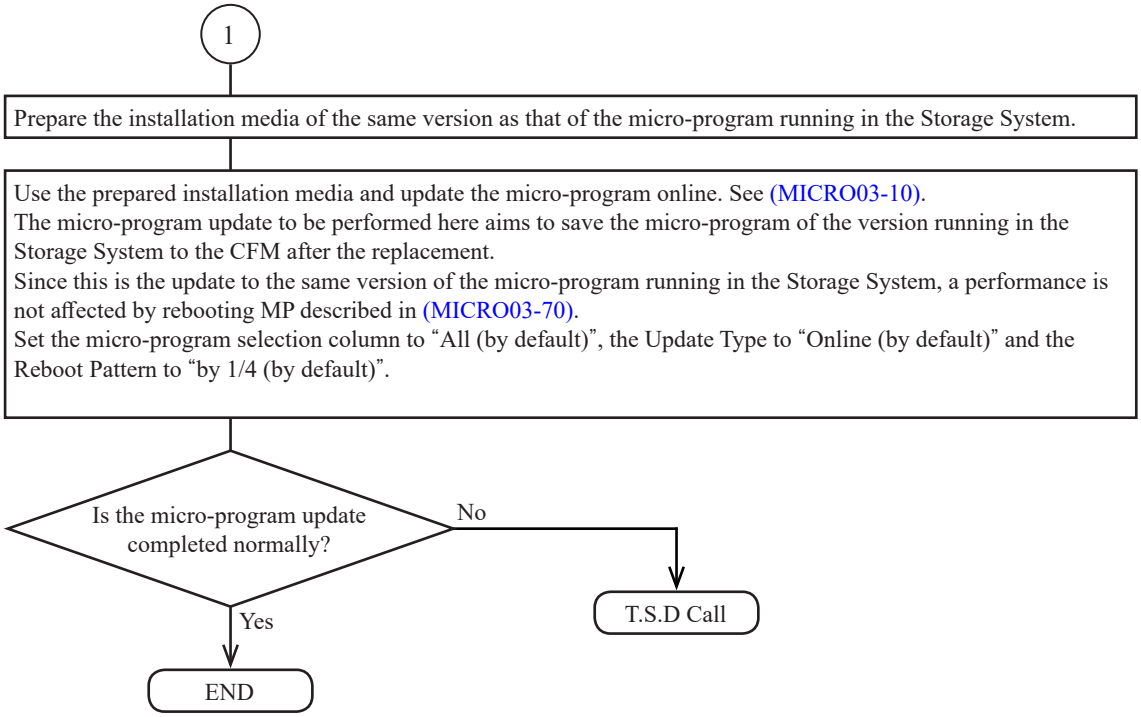
3.53 Recovery Procedure When CFM Failure Occurs (SIM = 30750x)

⚠ CAUTION

If the Storage System is powered off when its CFM is in abnormal state, customer data might be lost. To recover from CFM failure, follow the steps below.



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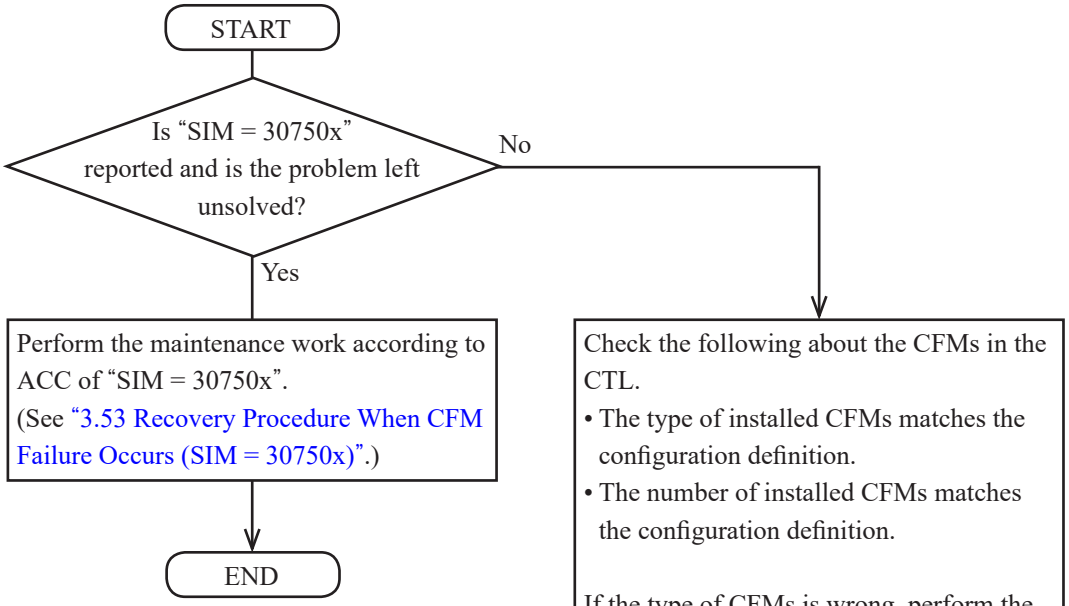


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3.54 (Blank)

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3.55 Recovery Procedure When an Incorrect CFM Type or a Shortage of CFM is detected (SIM = fe030x)



*1: The CFM replacement procedure differs depending on the state of the CTL. See Work ID = RCFM in "Parts Replacement Processing List" (REP(GE)06-10).

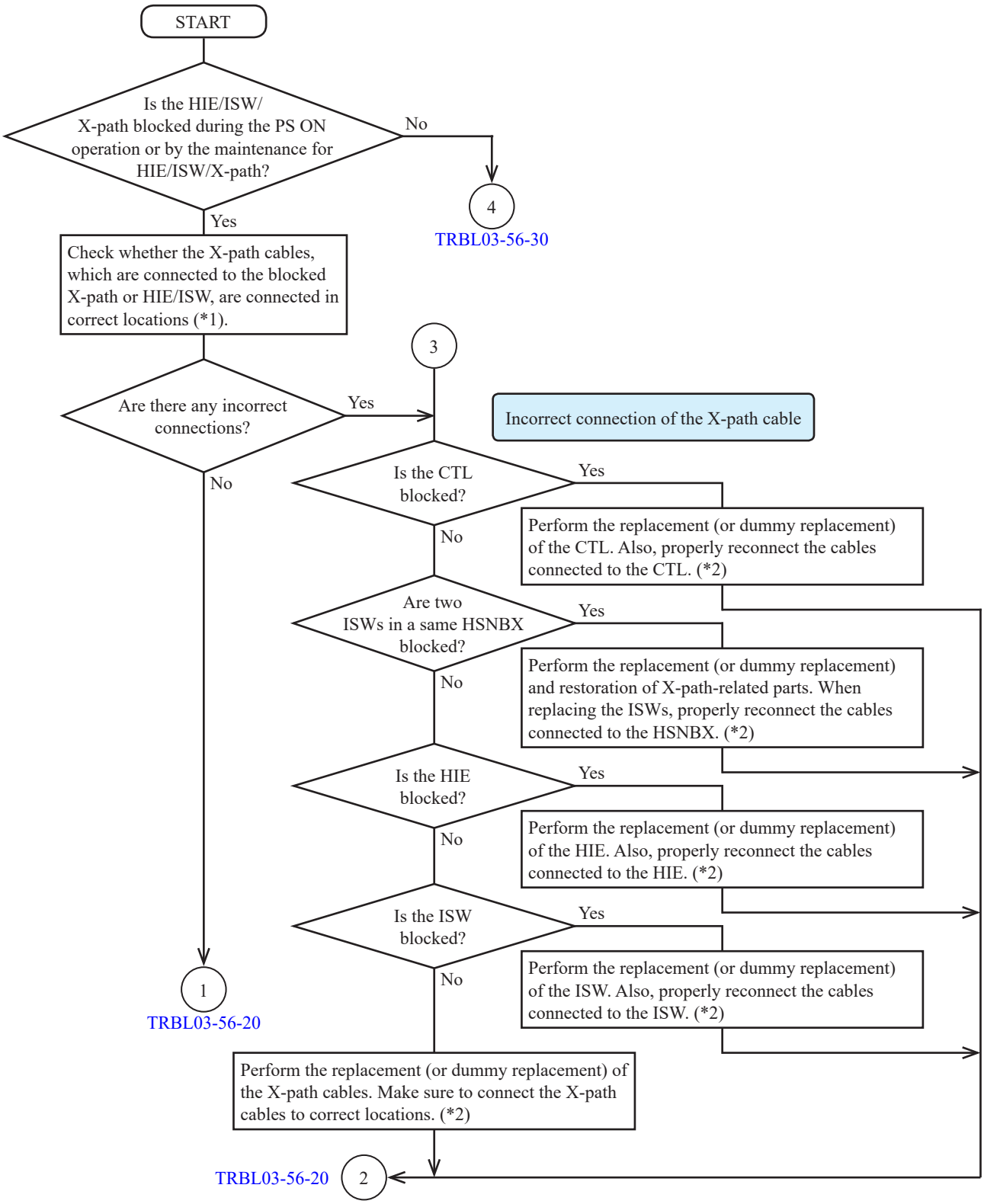
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3.56 Recovery Procedure for Blocked CTL/HIE/ISW/X-path (SIM = cf88xx, 2160xx, 2161xx, 2162xx)

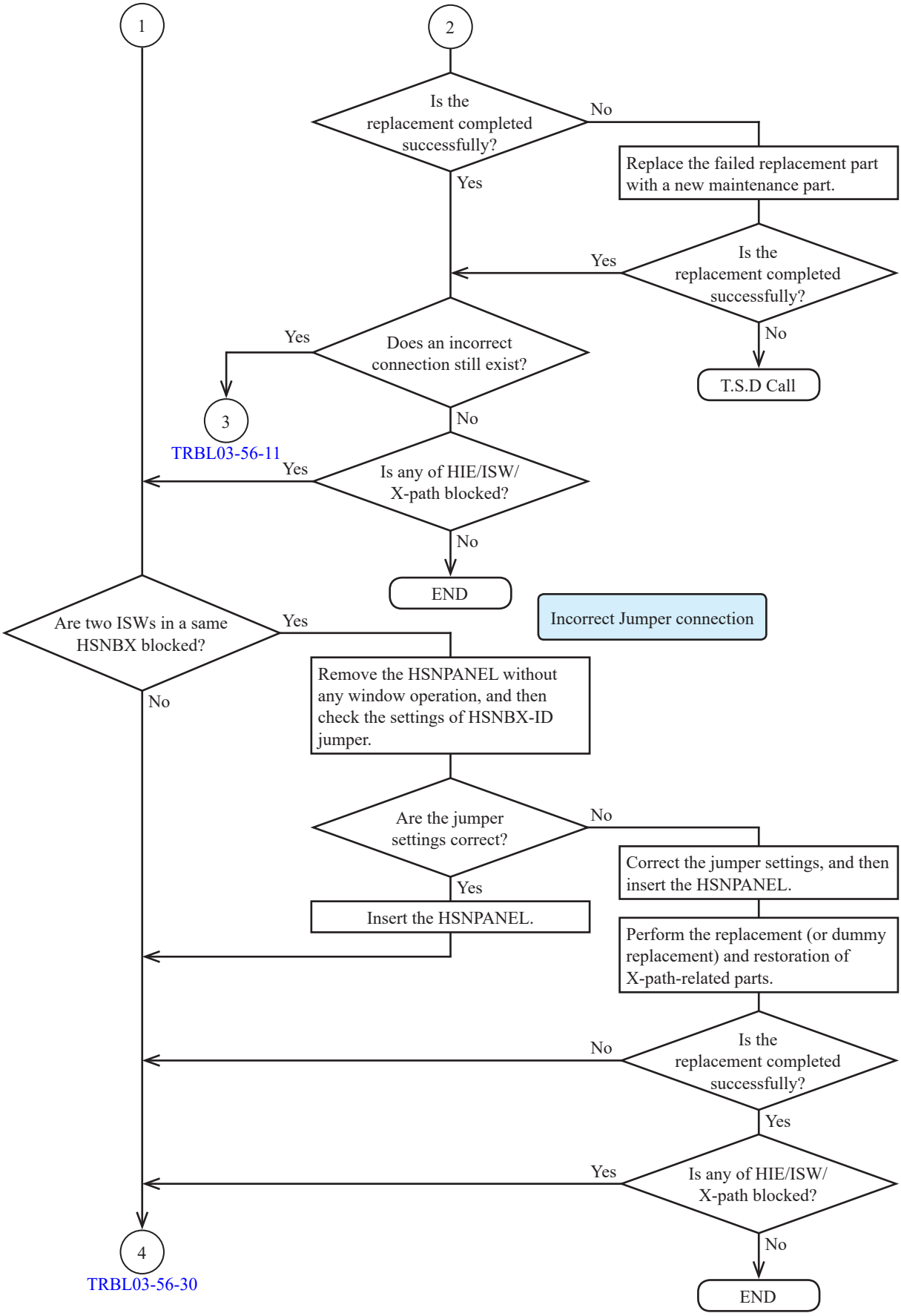
If this error occurs during the PS ON operation, perform the recovery procedure described in "2.2.4 Failure When Turning On the Power" first.
When the CTL is blocked during the maintenance work for the CTL, perform the recovery procedure described in "2.4.1 Error Recovery Procedure when Removing/Inserting CTL" first.

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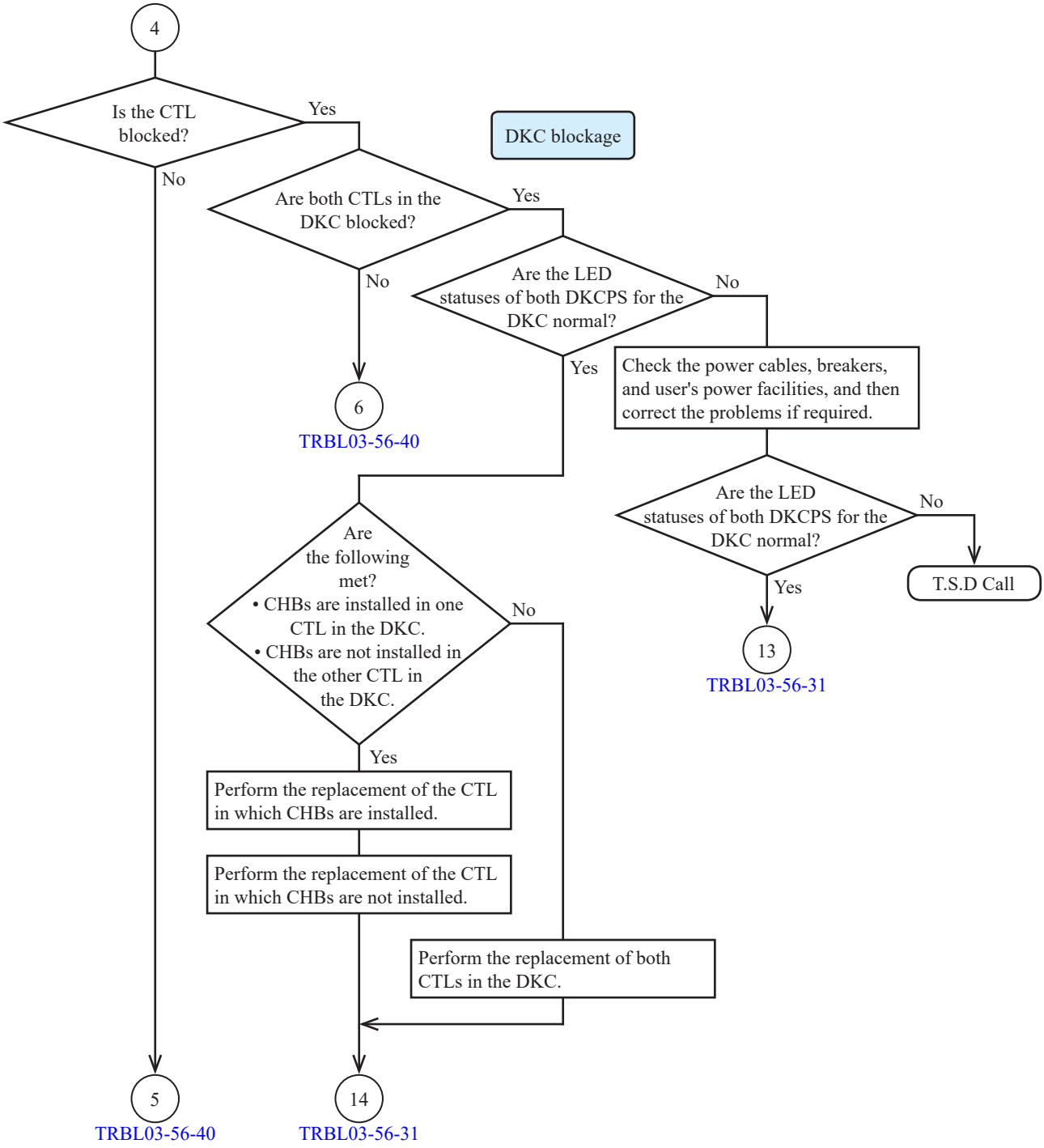
1. Detection of the Incorrect connection of X-path cable/incorrect jumper setting during the PS ON operation or the maintenance for HIE/ISW/X-path



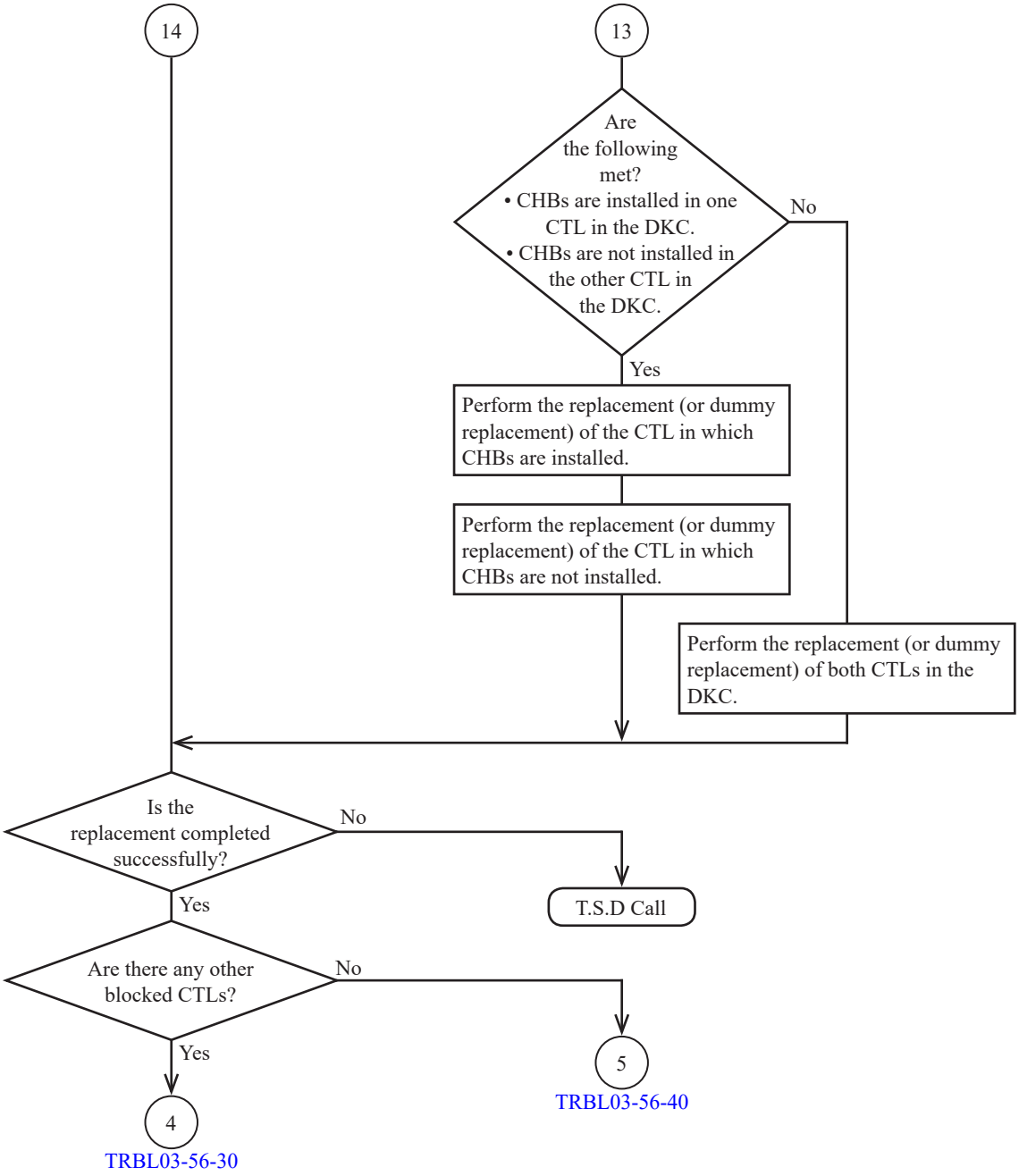
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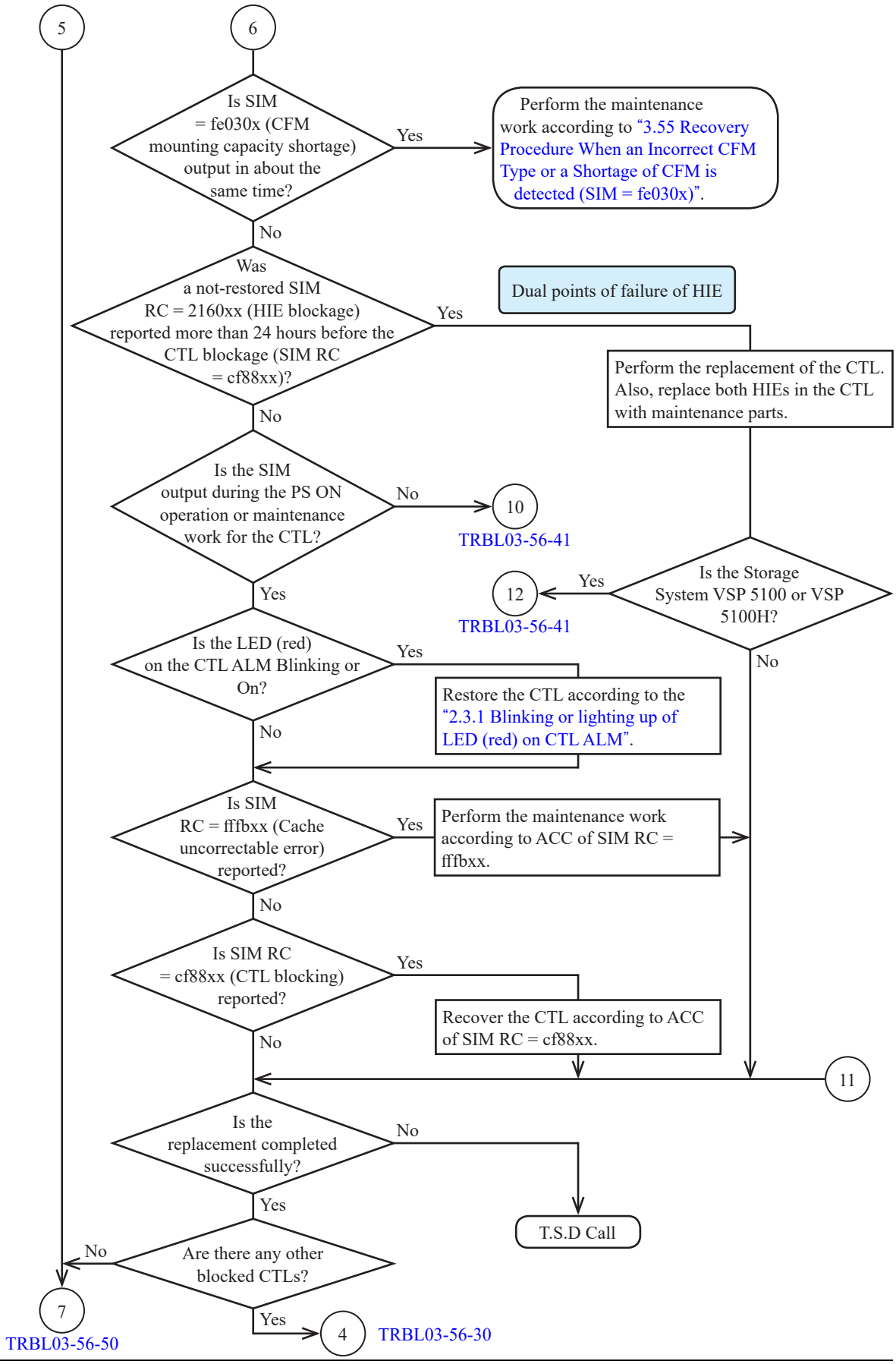
2. CTL blockage



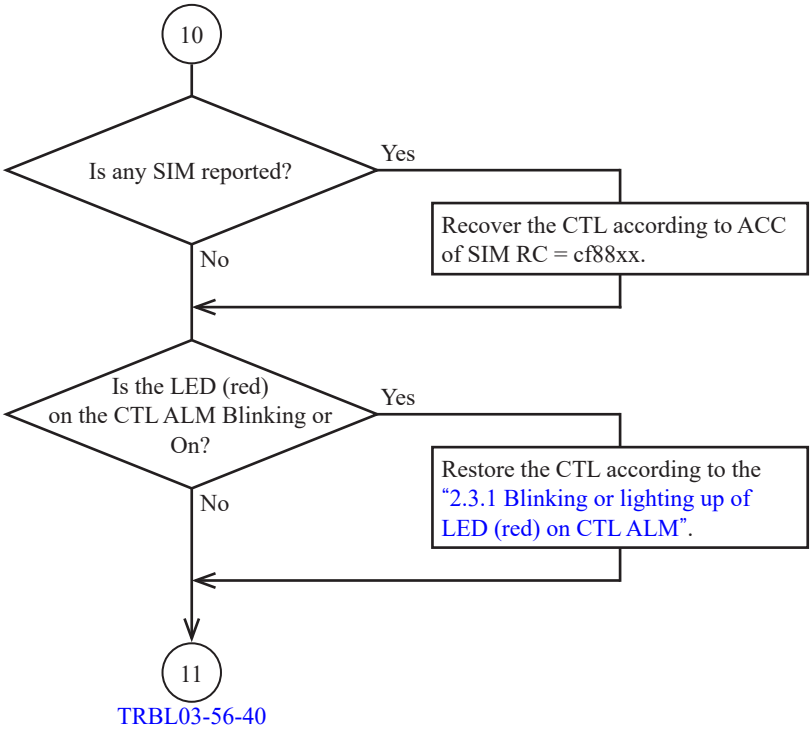
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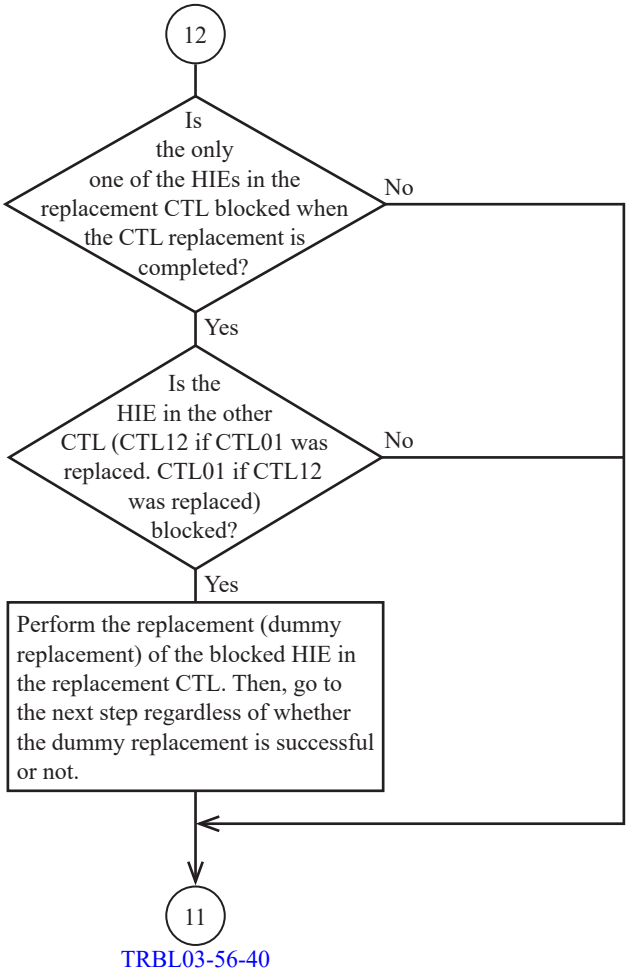


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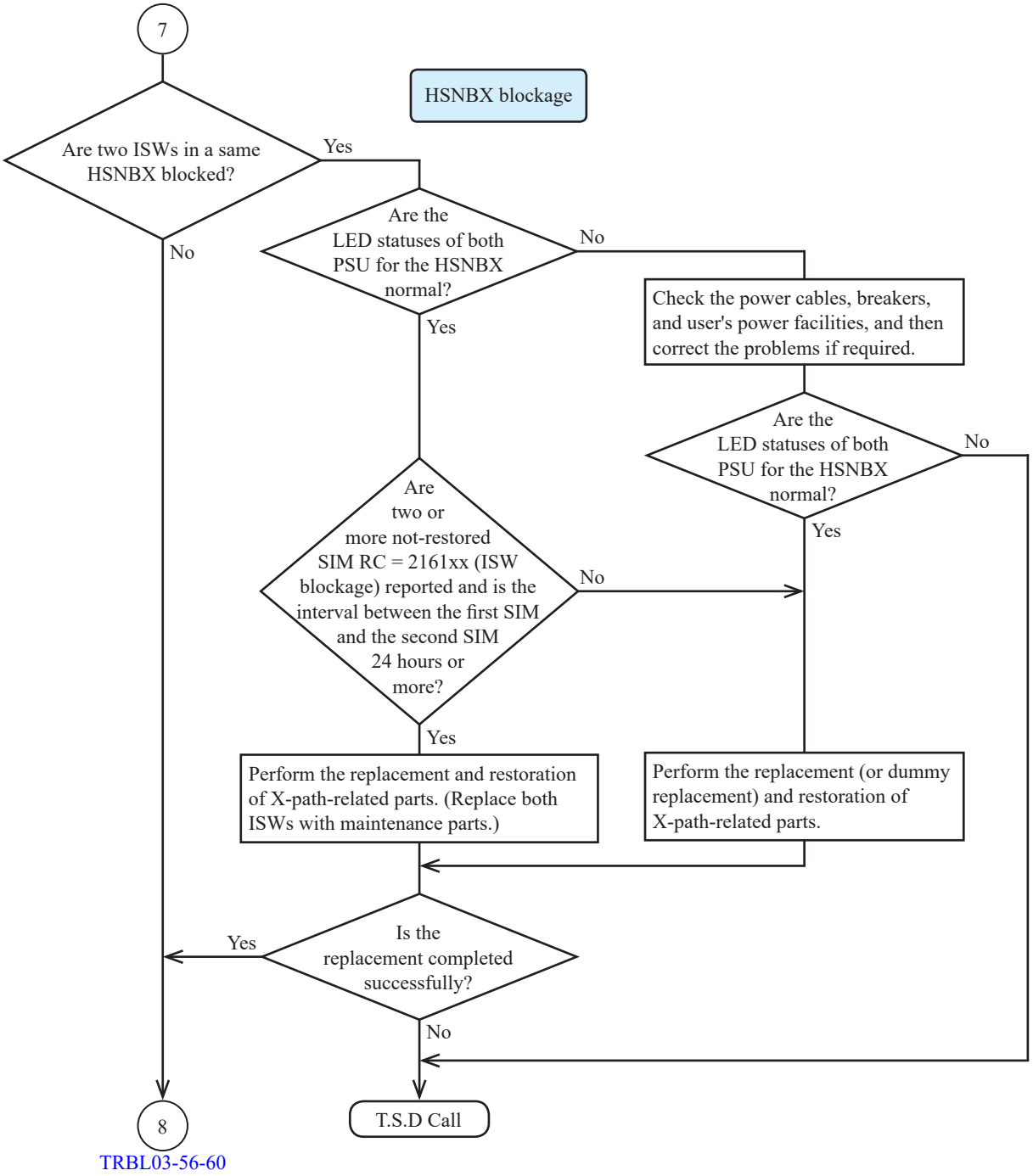
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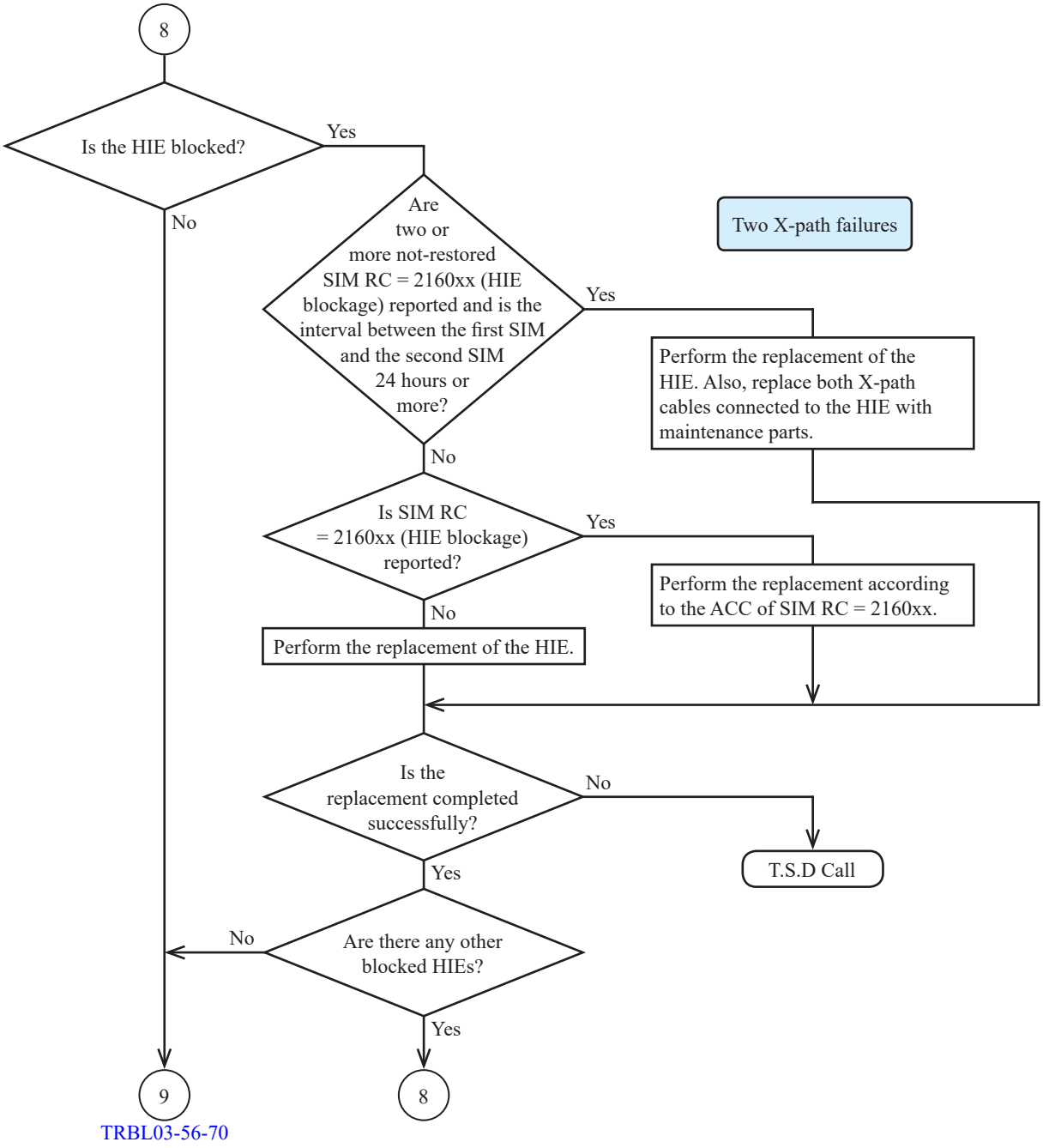
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3. Blockages of both ISWs in HSNBX



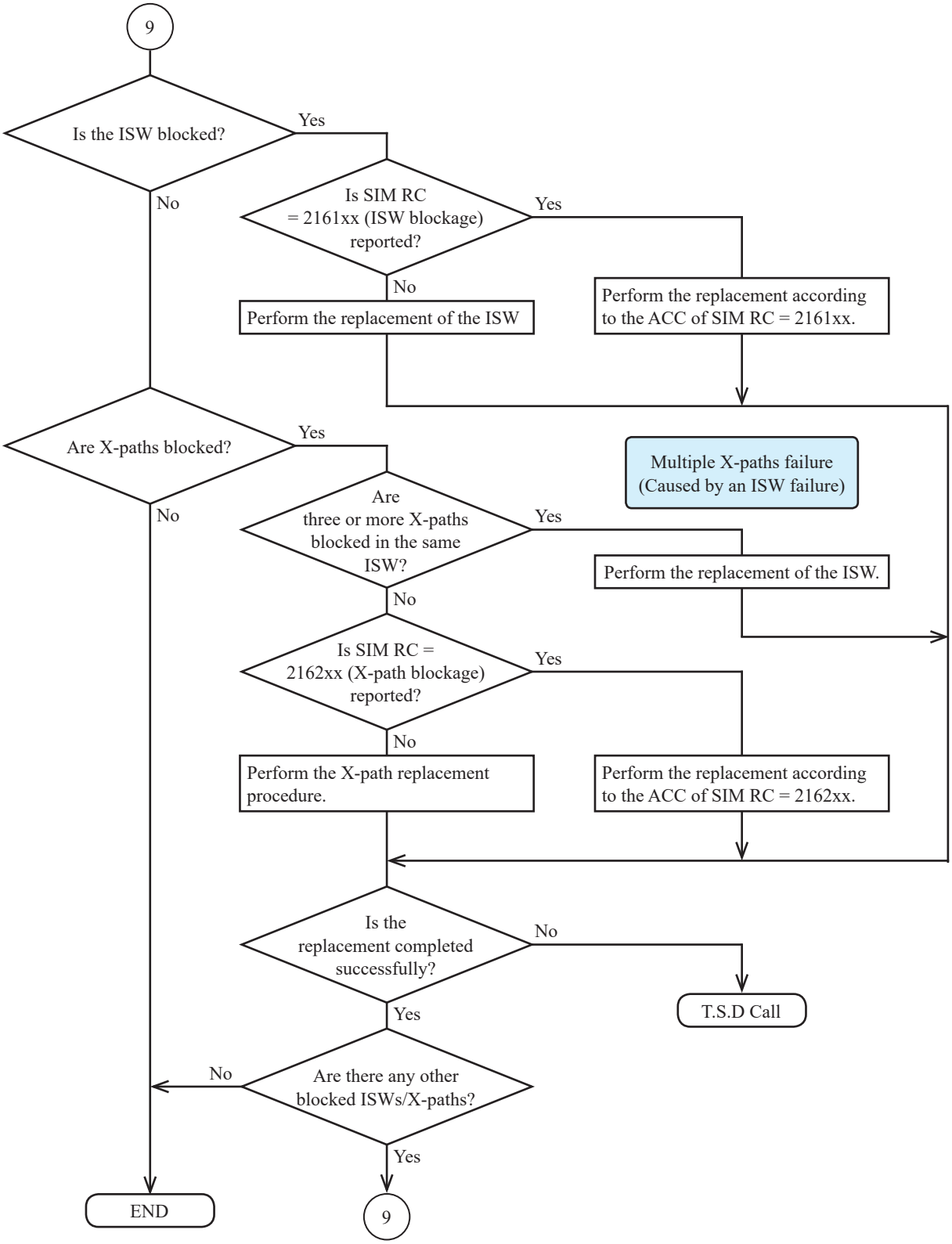
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4. HIE blockage



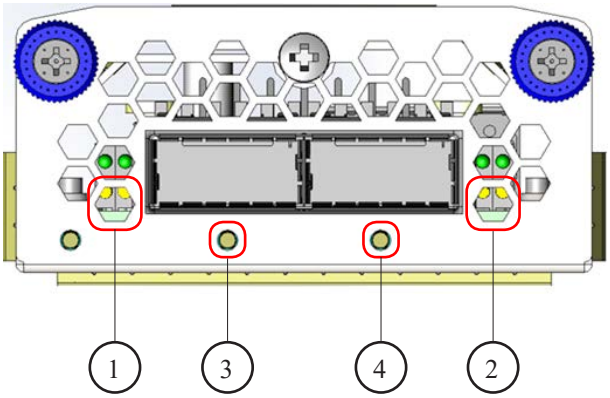
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5. ISW/X-path blockage



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*1: For X-path cable connections, see X-path Cable Diagram (LOC05-70).
The lighting or blinking of the General-purpose LED (Yellow) on HIE indicates that incorrect connection of the X-path cable or incorrect setting of HSNBX-ID jumper in HSNPANEL might be detected. (The General-purpose LED could light up when an HIE or CTL failure occurs even if there is no incorrect connection or incorrect setting.)
The normal link-up of the X-path can be confirmed by Port LED.



#	State of General-purpose LED (Yellow)	Description
1	Blinking ① only	It indicates the detection of an incorrect connection on Port 0 of the HIE. Check the connection of the cables to ISW.
2	Blinking ② only	It indicates the detection of an incorrect connection on Port 1 of the HIE. Check the connection of the cables to ISW.
3	Blinking or lighting both ① and ②	It indicates the possibilities of incorrect connections on Port 1 and Port 2 of the HIE or incorrect setting of HSNBX-ID jumper in the HSNPANEL. Check the connection of the cables to ISW and the setting of HSNBX-ID jumper.

#	State of Port LED (③④)	Description
1	Lighting in blue	X-path linked up normally.
2	Lighting in red/Off	The X-path is blocked. Check the possibilities of a loose connection or an incorrect connection of the cable.

When an incorrect connection of X-path cable is detected, the Port LED on the ISW also blinks in amber and green alternately.

NOTE: The Port LED on the ISW also blinks in amber and green when a link failure is detected.

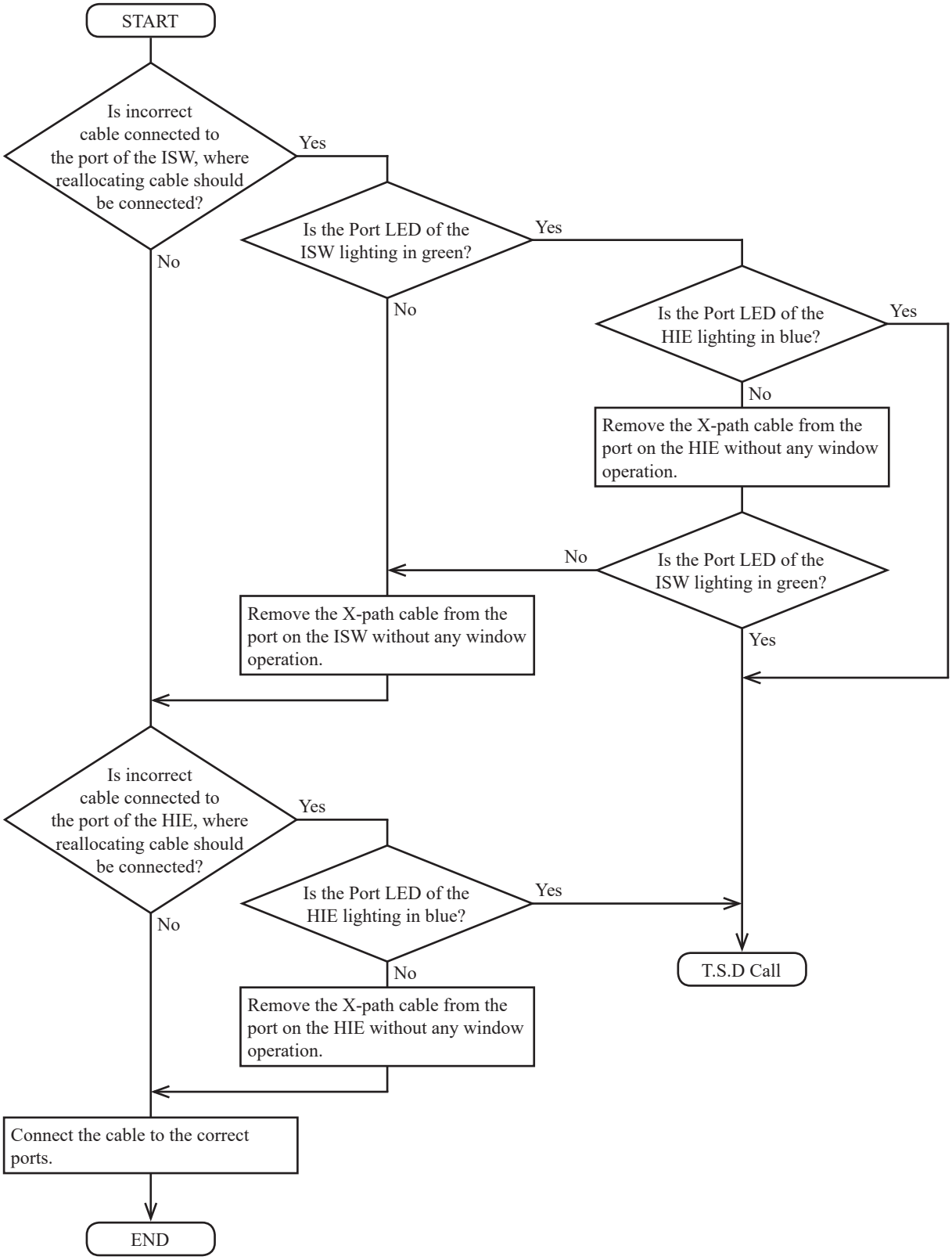
Check the possibilities of a loose connection or an incorrect connection of the cable on both ports on HIE and ISW.

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*2: When an incorrect cable is connected to the port on an ISW before reallocating a correct cable to the port, confirm that the Port LED of the port is not lighting in green (but blinking in red, lighting in red, blinking in red and amber alternately, or off), remove the incorrect cable without a maintenance window operation, and then insert a correct cable.
Moreover, when an incorrect cable is connected to the port on an HIE before reallocating a correct cable to the port, confirm that the Port LED of the port is not lighting in blue, remove the incorrect cable without any maintenance window operation, and then insert a correct cable. (See the following workflow.)

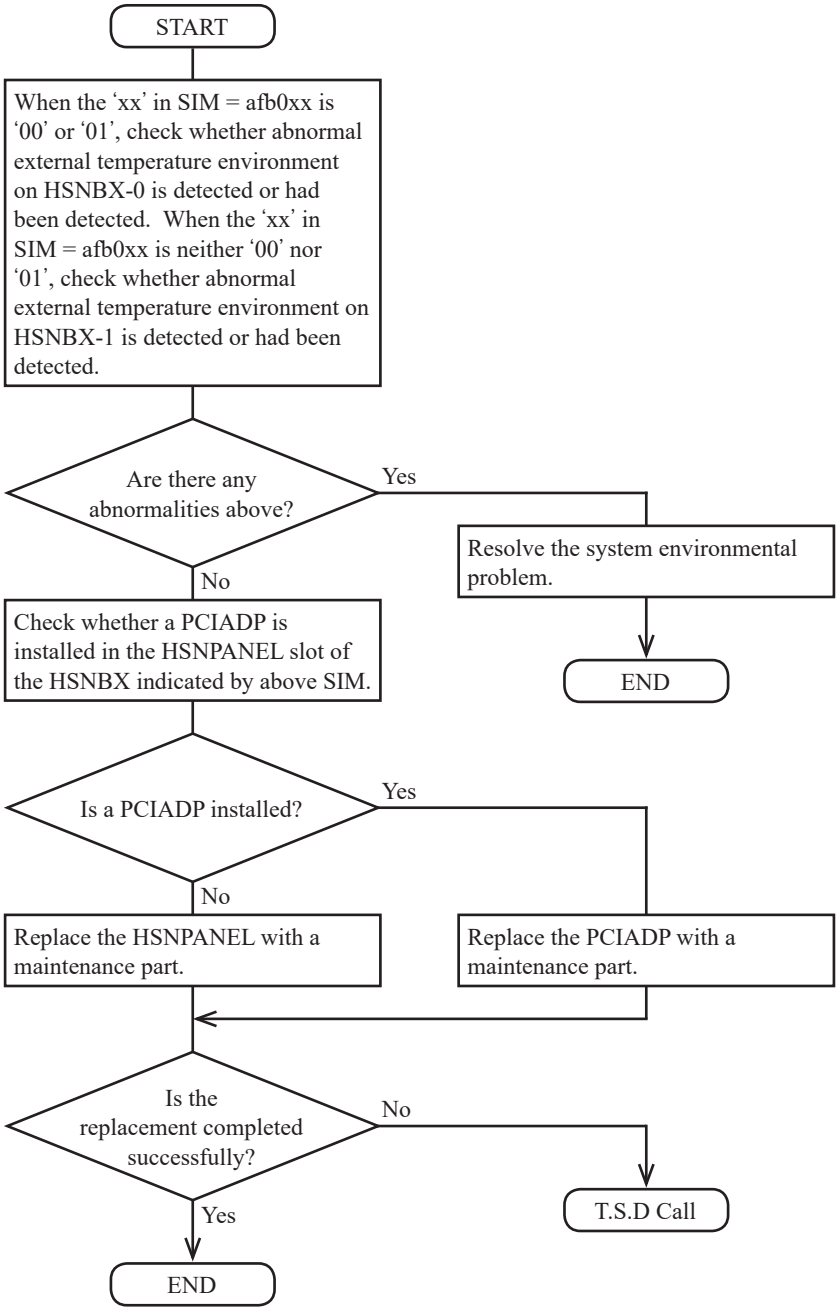
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Process flow when incorrect cable is connected to the port before reallocating correct cable to the port



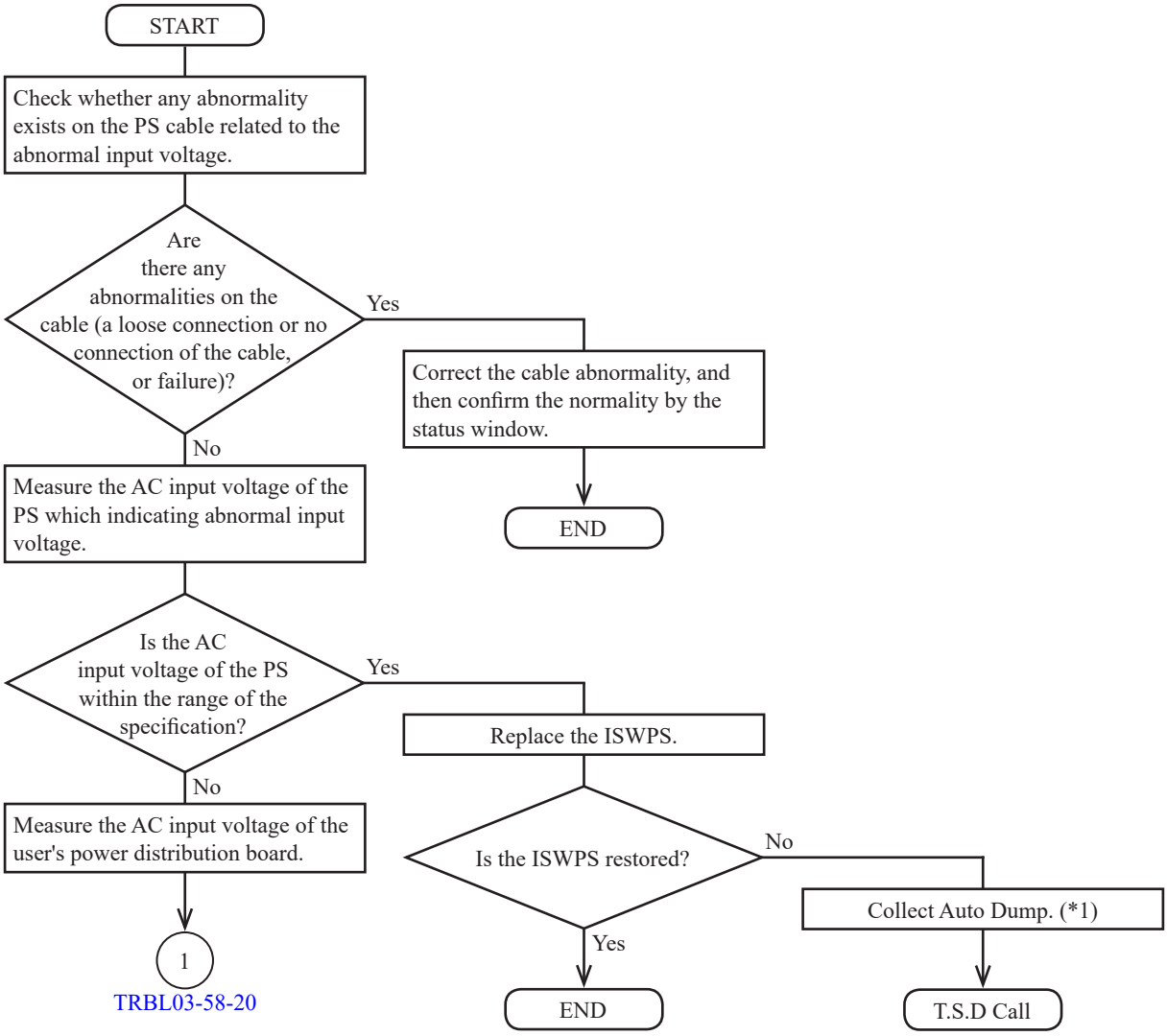
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3.57 Procedure When HSNBX External Temperature Warning Occurs (SIM = afb0xx)



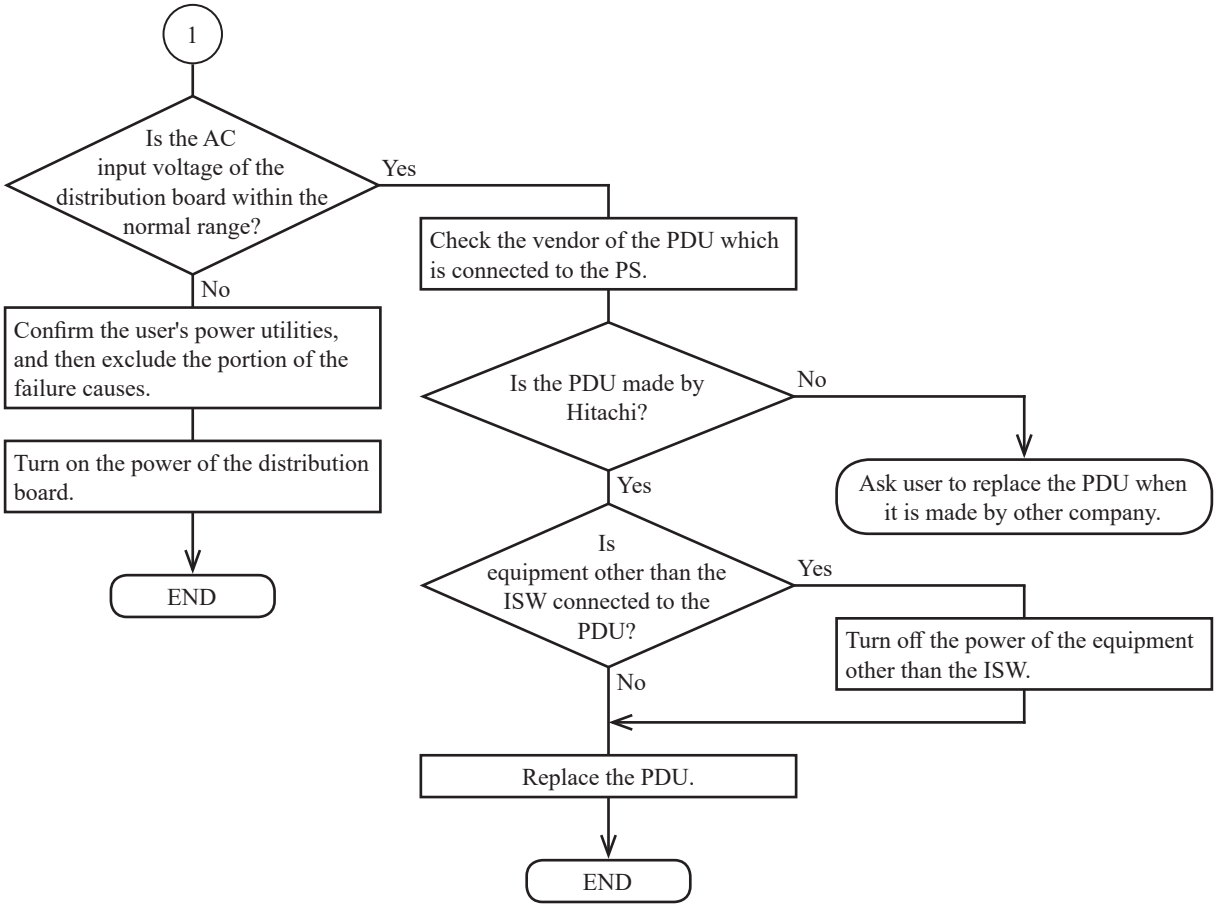
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3.58 Procedure When ISWPS AC Warning Occurs (SIM = afb3xx)



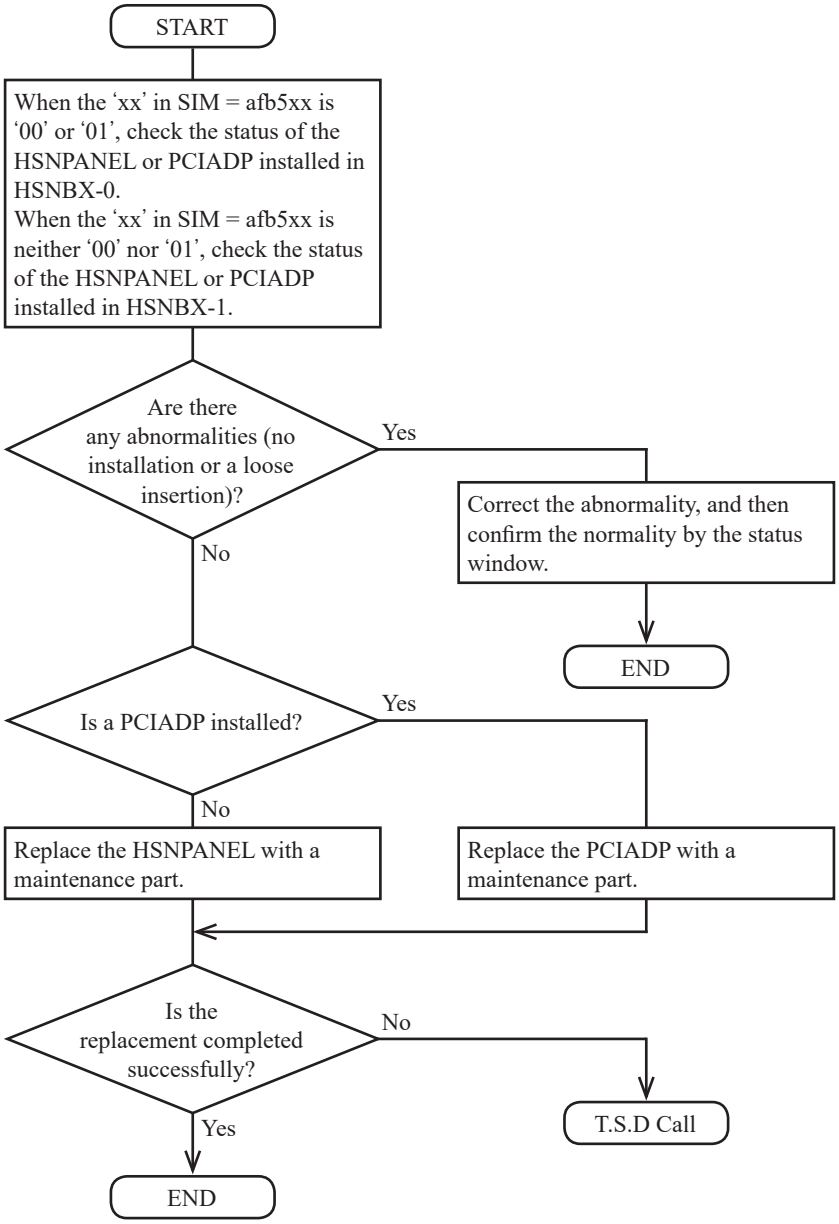
*1: If you have collected dumps by using the automatic log dump collection function, you do not need to perform Auto Dump.
When performing Auto Dump to collect dumps, stop the automatic log dump collection function (see "Aborting Dump Collection during Automatic Dump Collection" (SVP02-26-170)).

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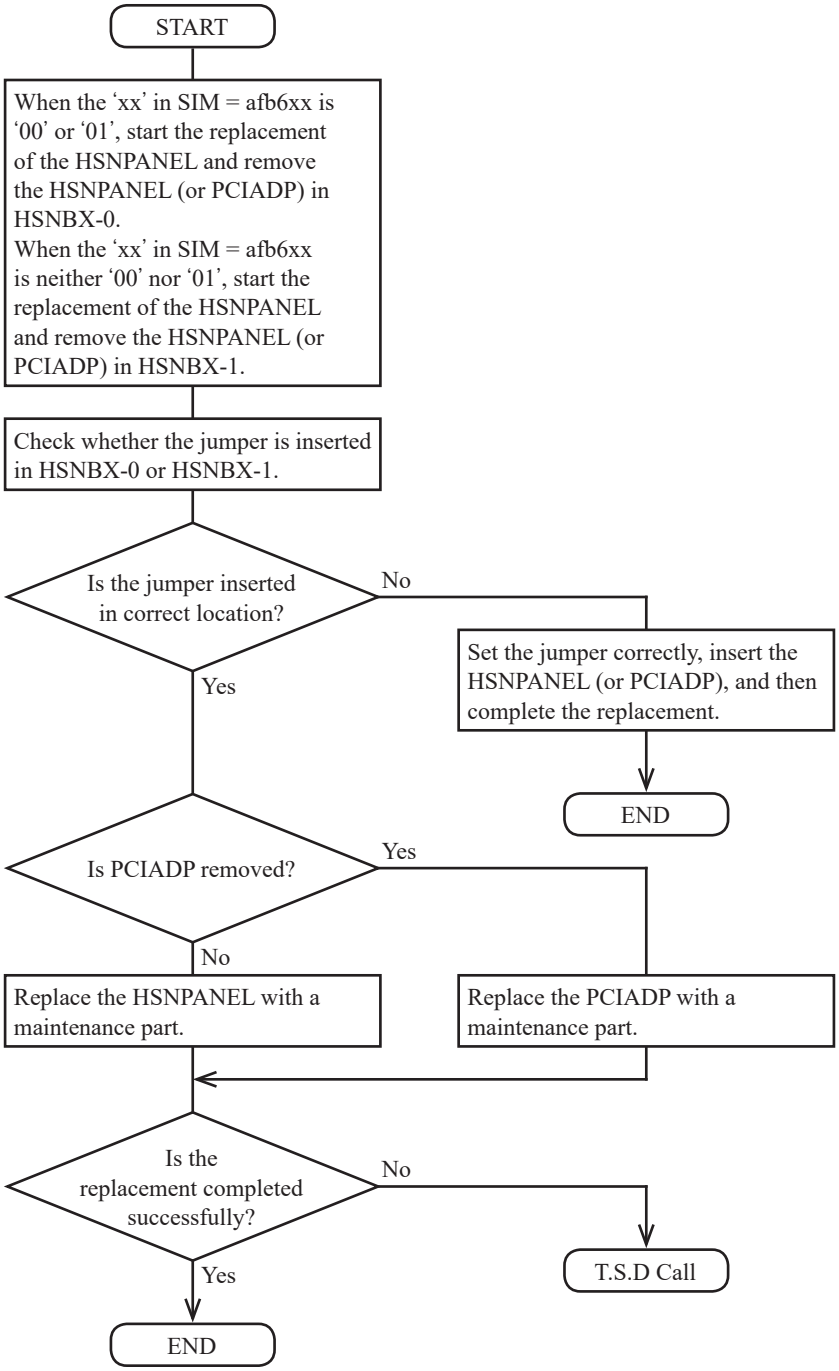
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3.59 Procedure When HSNBX Thermal Monitor Warning Occurs (SIM = afb5xx)



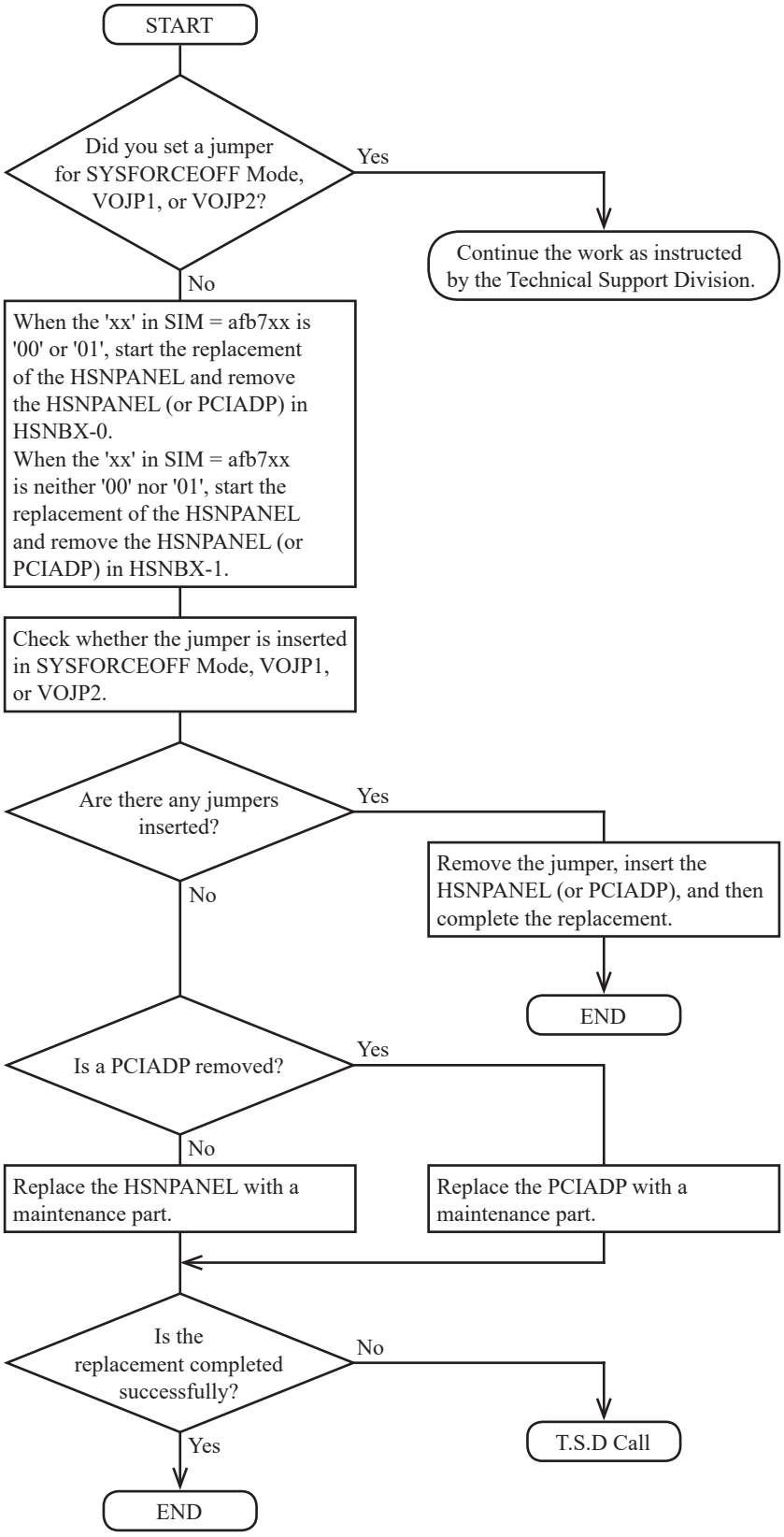
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3.60 Incorrect Setting of HSNBX Panel JP (SIM = afb6xx)



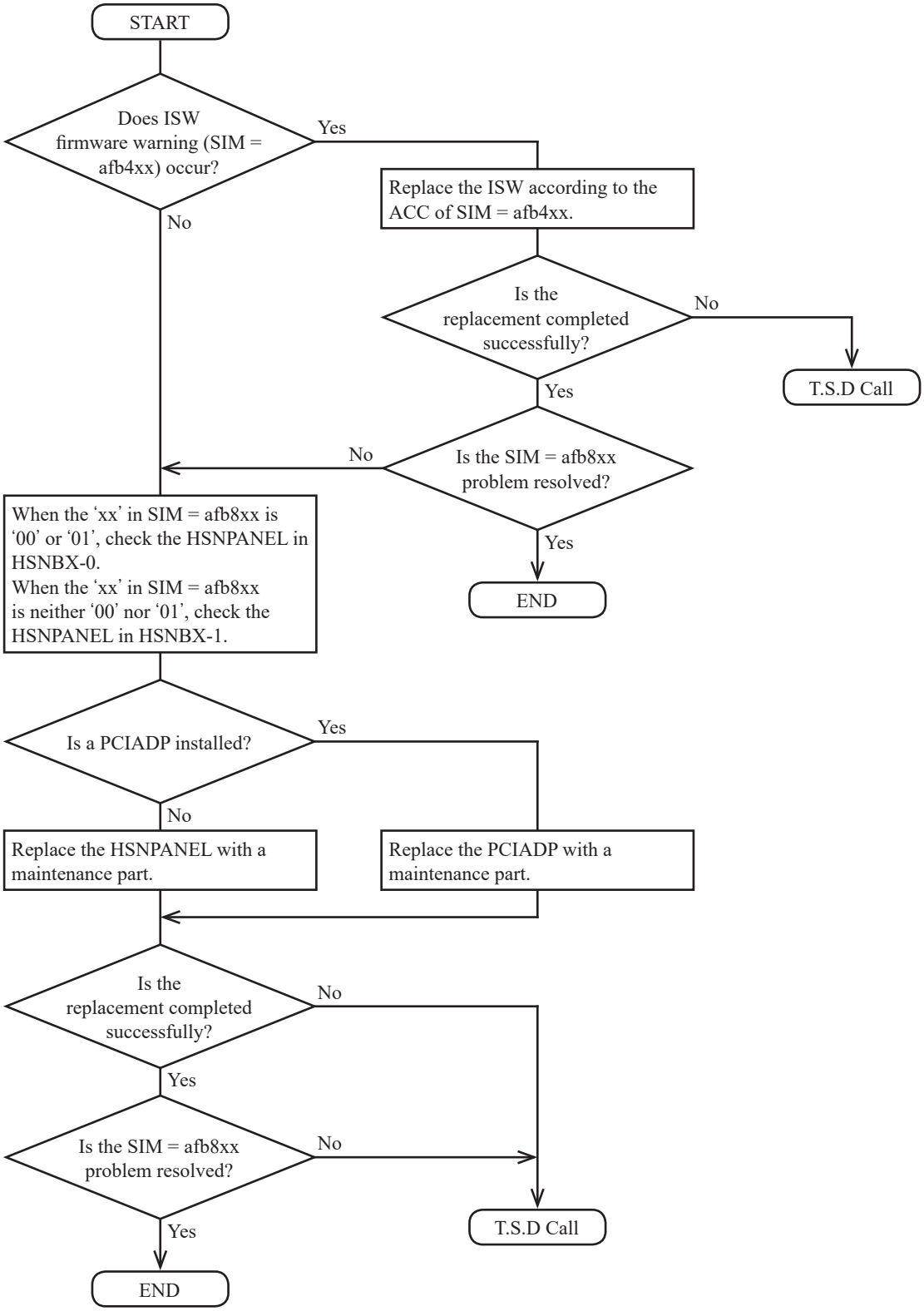
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3.61 HSNBX Panel JP Setting Warning (SIM = afb7xx)



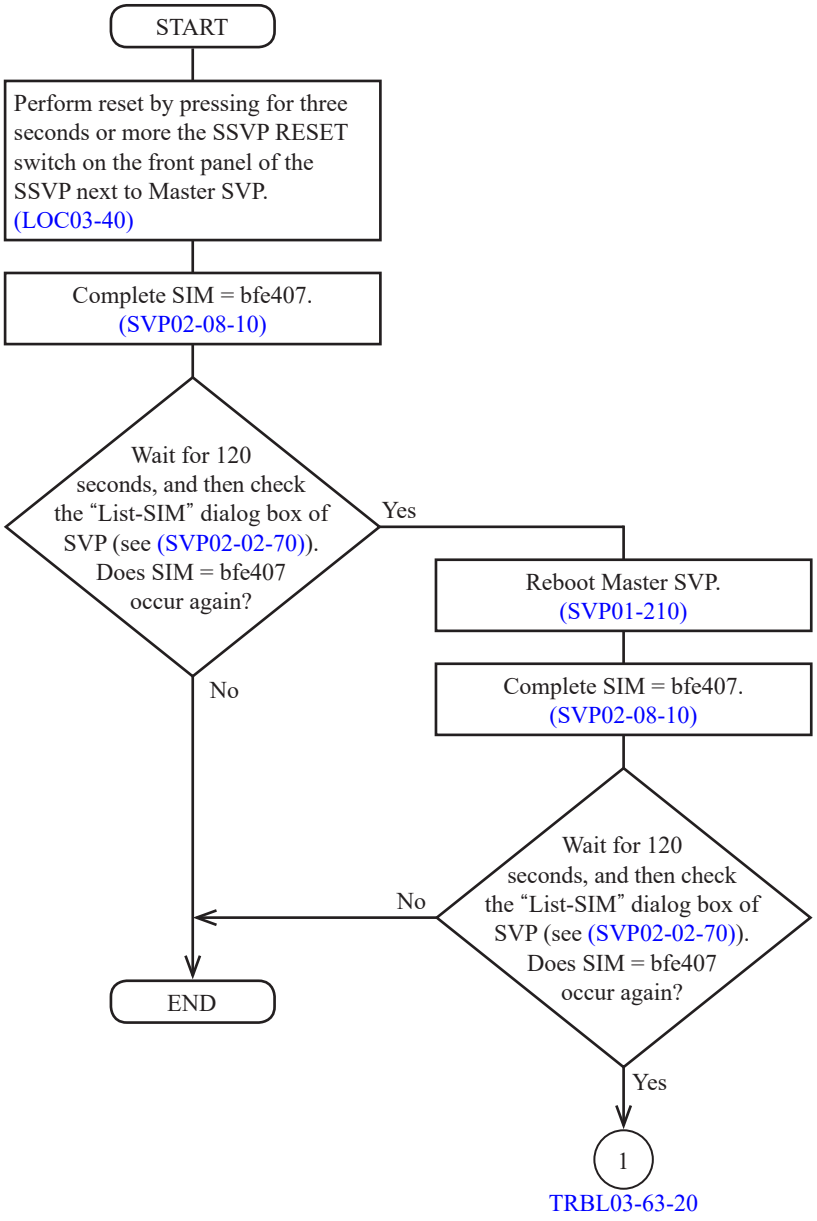
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3.62 Warning When HSNBX PS ON/OFF I/F Inconsistency Occurs (SIM = afb8xx)

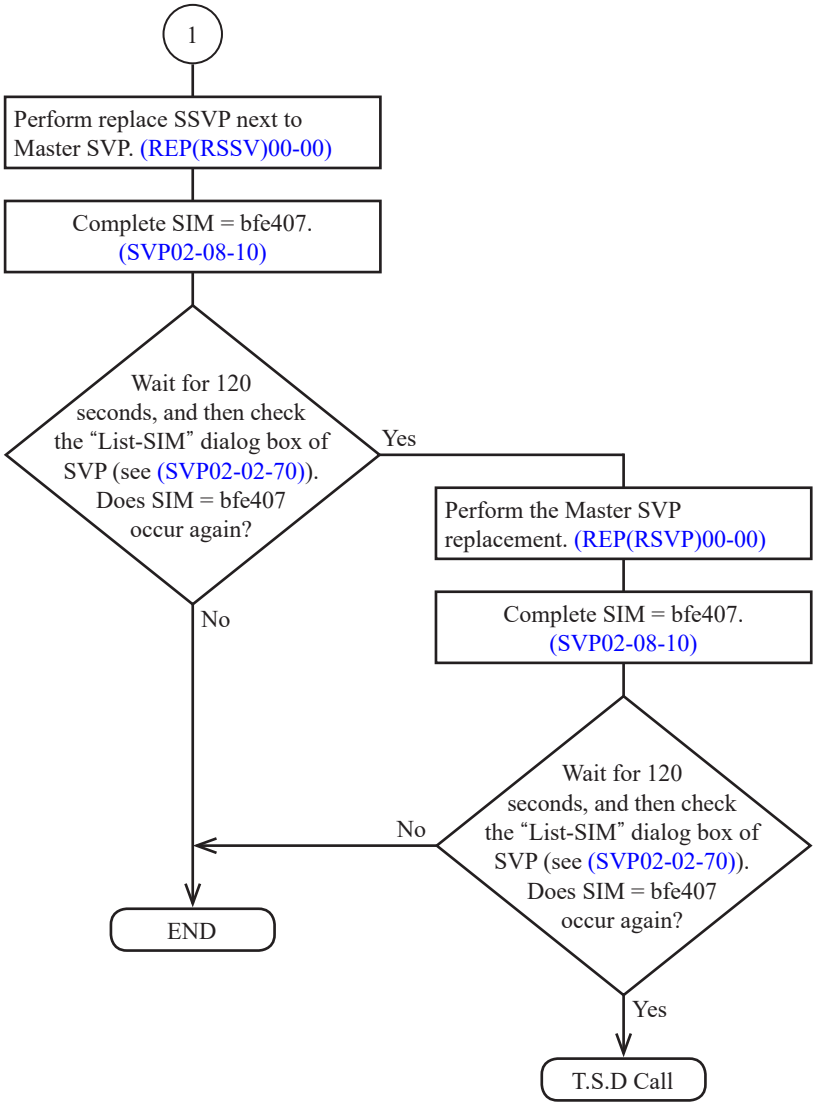


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3.63 Recovery Procedure When the USB Interface Error Occurs (SIM = bfe407)



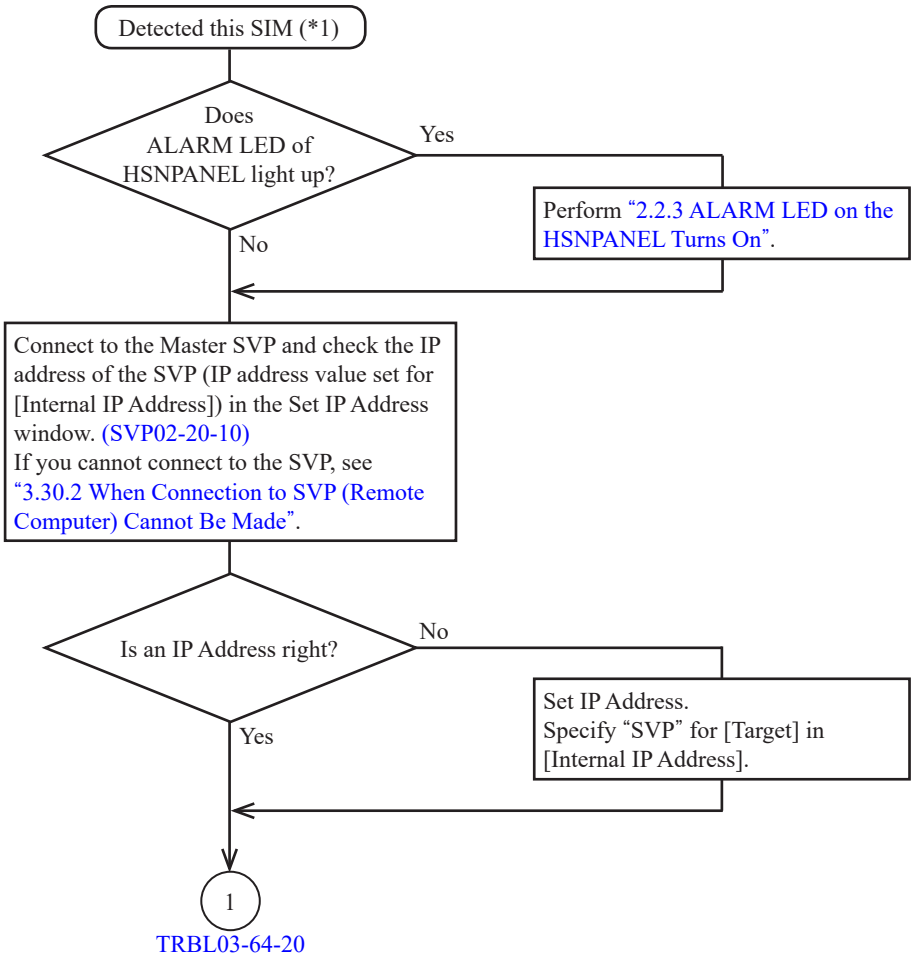
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3.64 Recovery Procedure for LAN Error/SVP Failure (SIM = 73xx00, 1400x0)

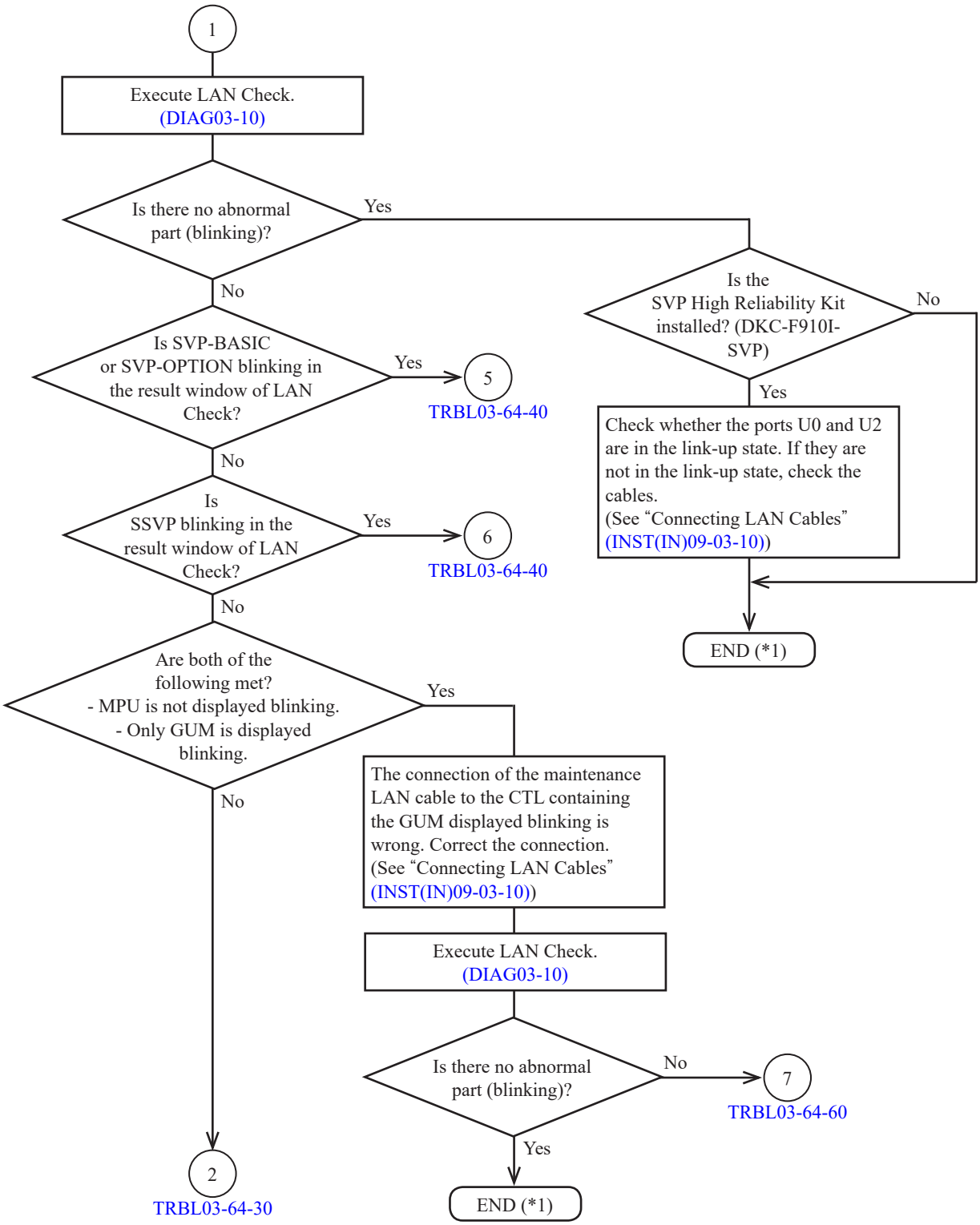
CAUTION

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)



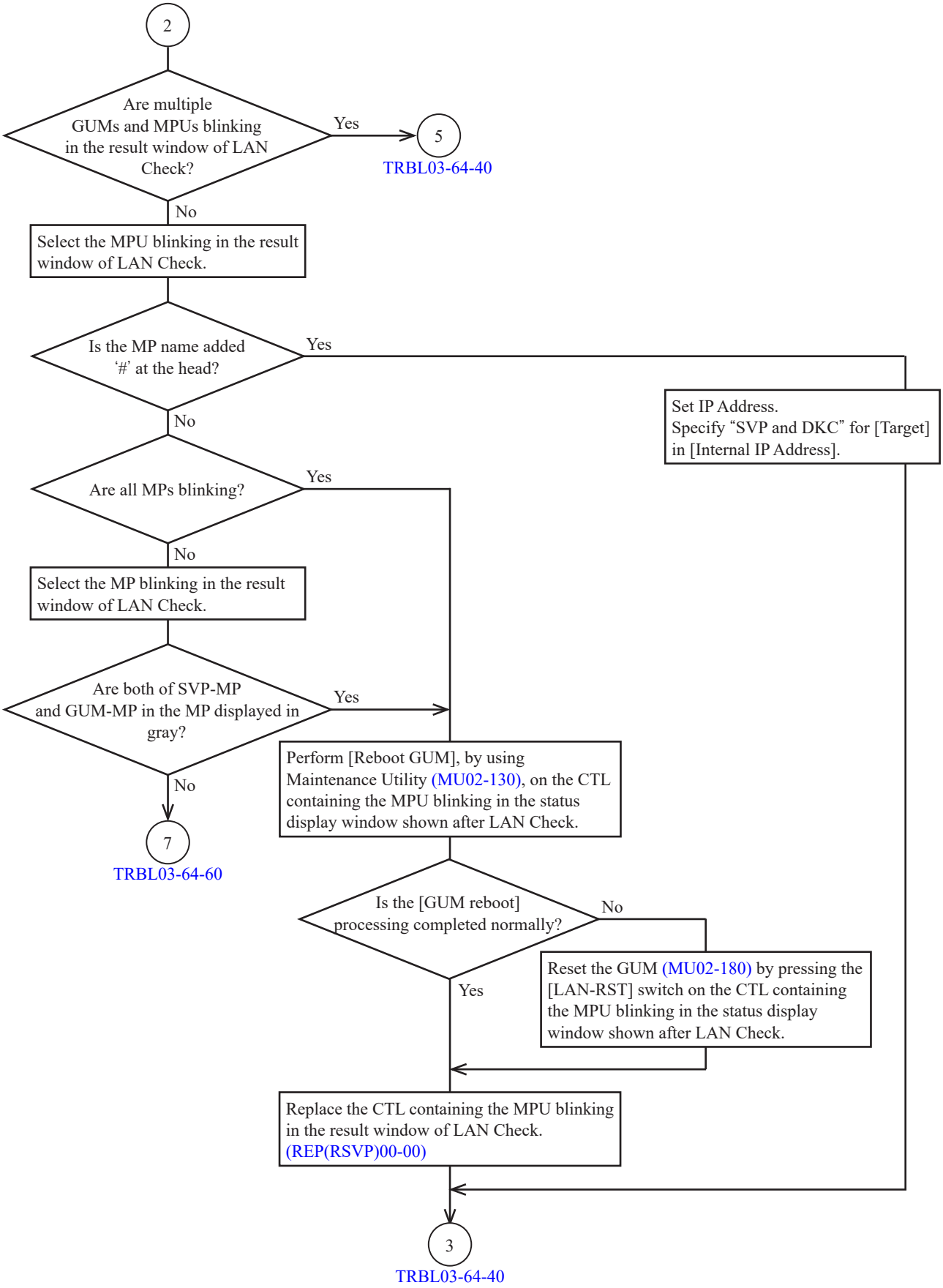
*1: This SIM might not be generated at LAN error.

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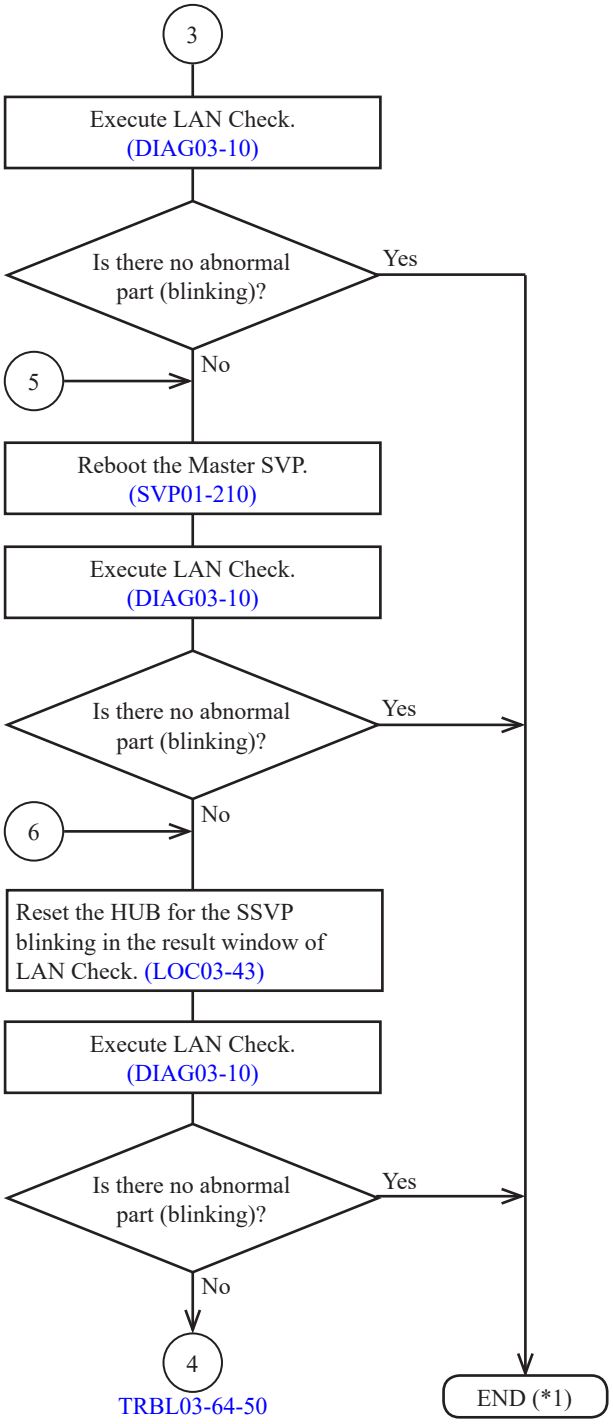


*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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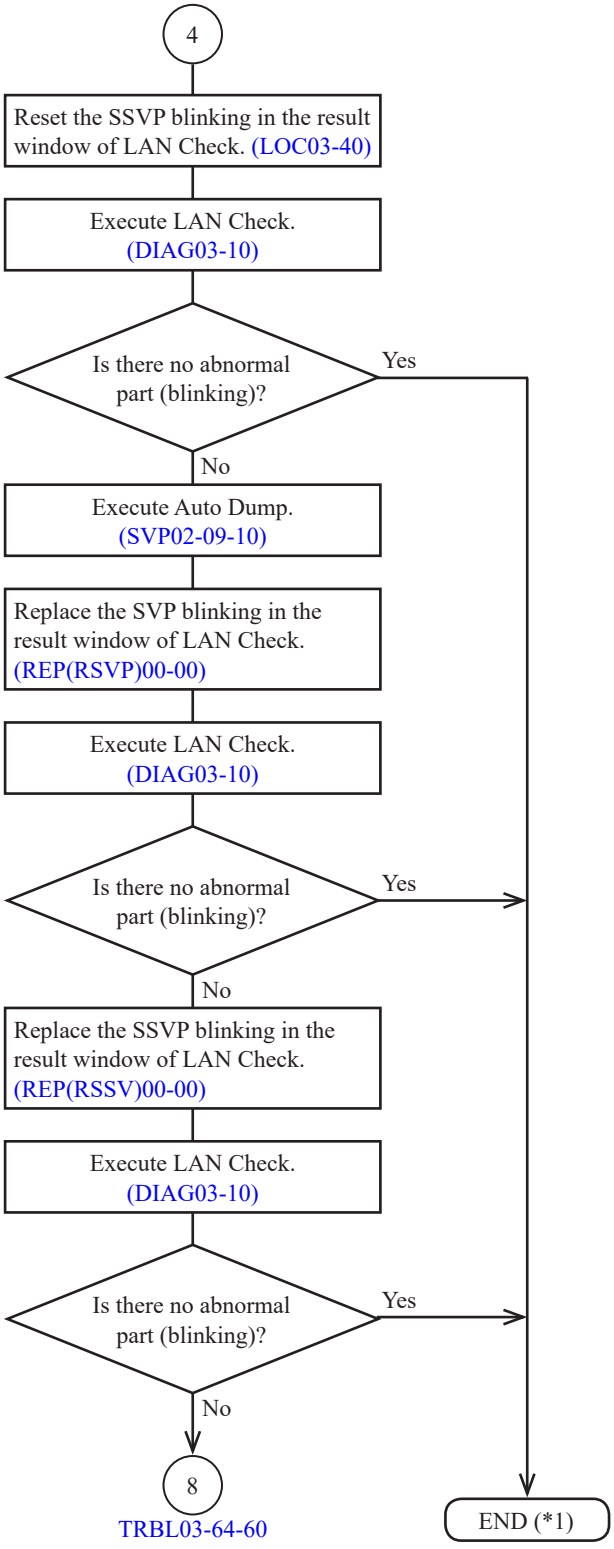


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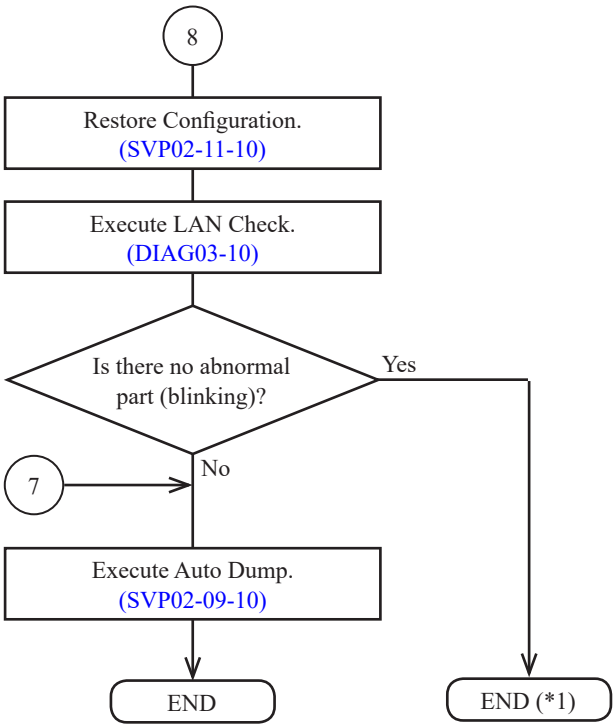
*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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*1: After finishing the error recovery, execute SIM complete and delete logs. (SVP02-03-10), (SVP02-08-10)

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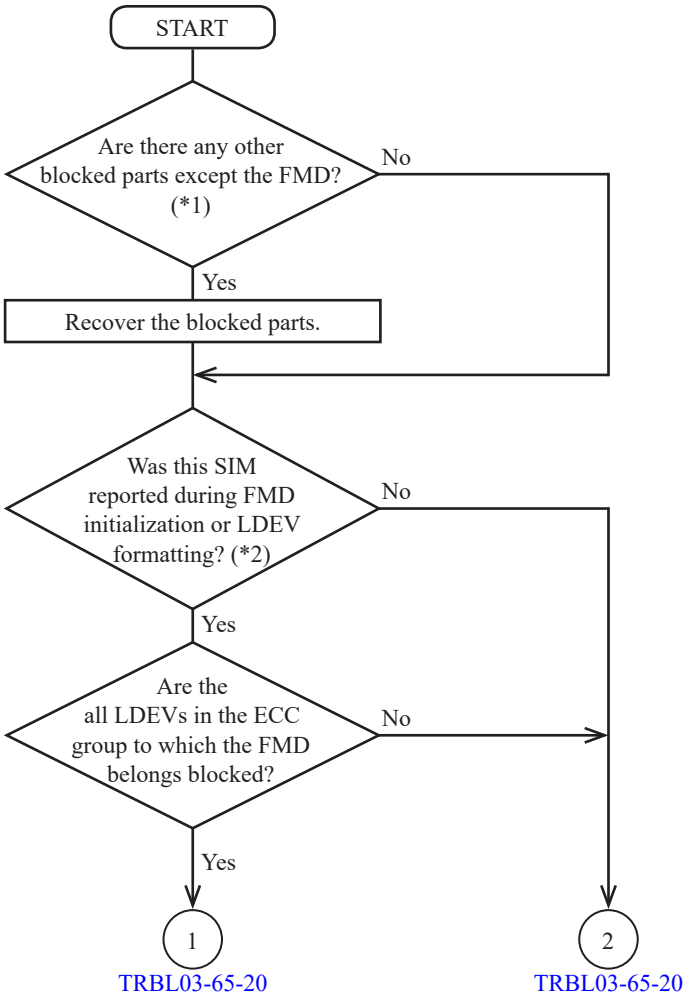


*1: After finishing the error recovery, execute SIM complete and delete logs.
(SVP02-03-10), (SVP02-08-10)

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3.65 Recovery from initialization failure of Flash Module Drive (SIM = 4c4xxx, 4c5xxx)

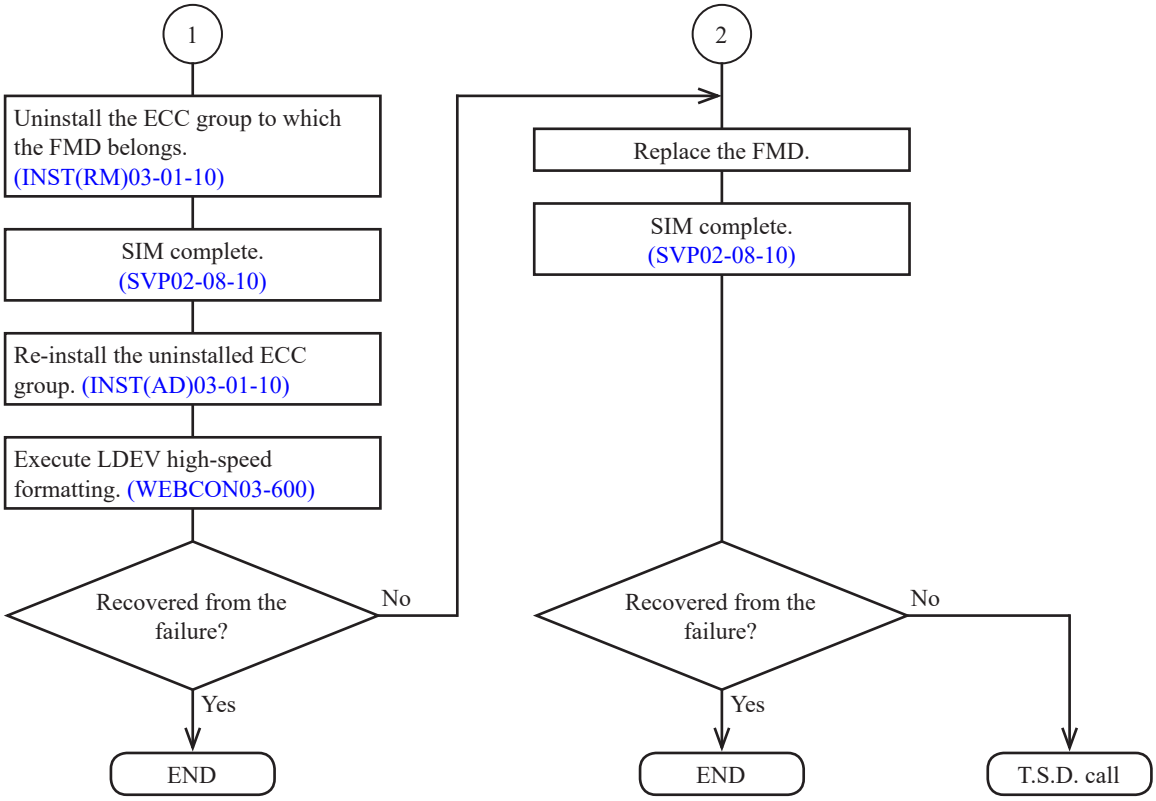
This SIM indicates that “Spin-up of Flash Module Drives (FMD)” or “Initialization failure of FMD during LDEV formatting” was occured.
An initialization failure of FMD occurs not only when FMD itself has a trouble, but also induced by other failures. If other failures are detected, please resolve them at first.
If this SIM is reported during FMD installation or LDEV formatting, please initialize FMD by uninstallation and re-installation of the ECC group.
In case the device isn’t recovered despite you have re-installed FMD, or if this SIM is reported in other cases, you need replace the FMD with new one.



*1: It seemed that this failure was induced by other failures. Please recover the other blocked parts that are pointed out by SIM = 4c4xxx, 4c5xxx or other SIMs.

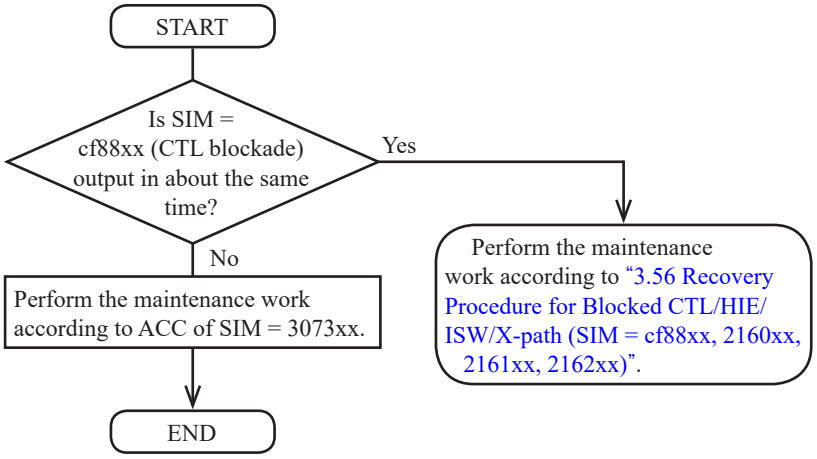
*2: If DKC/DB power off was occurred during FMD installation or LDEV formatting, this SIM may be reported soon after PS ON or recovery from DB power off. Please make sure that the data in the ECC group to which the FMD belongs can be deleted and then re-install the FMD.

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3.66 Recovery Procedure for Processor Blockade (SIM = 3073xx)

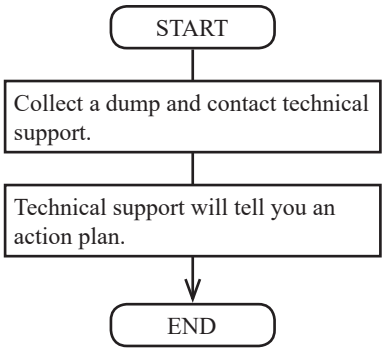


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3.67 Recovery Procedure When the SAS CTL Failure Is Detected (SIM = cf13xx)

CAUTION

The storage system reporting this SIM may have a serious failure. Collect a dump and contact the technical support immediately.



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4. Recovery from Mainframe Platform Failure

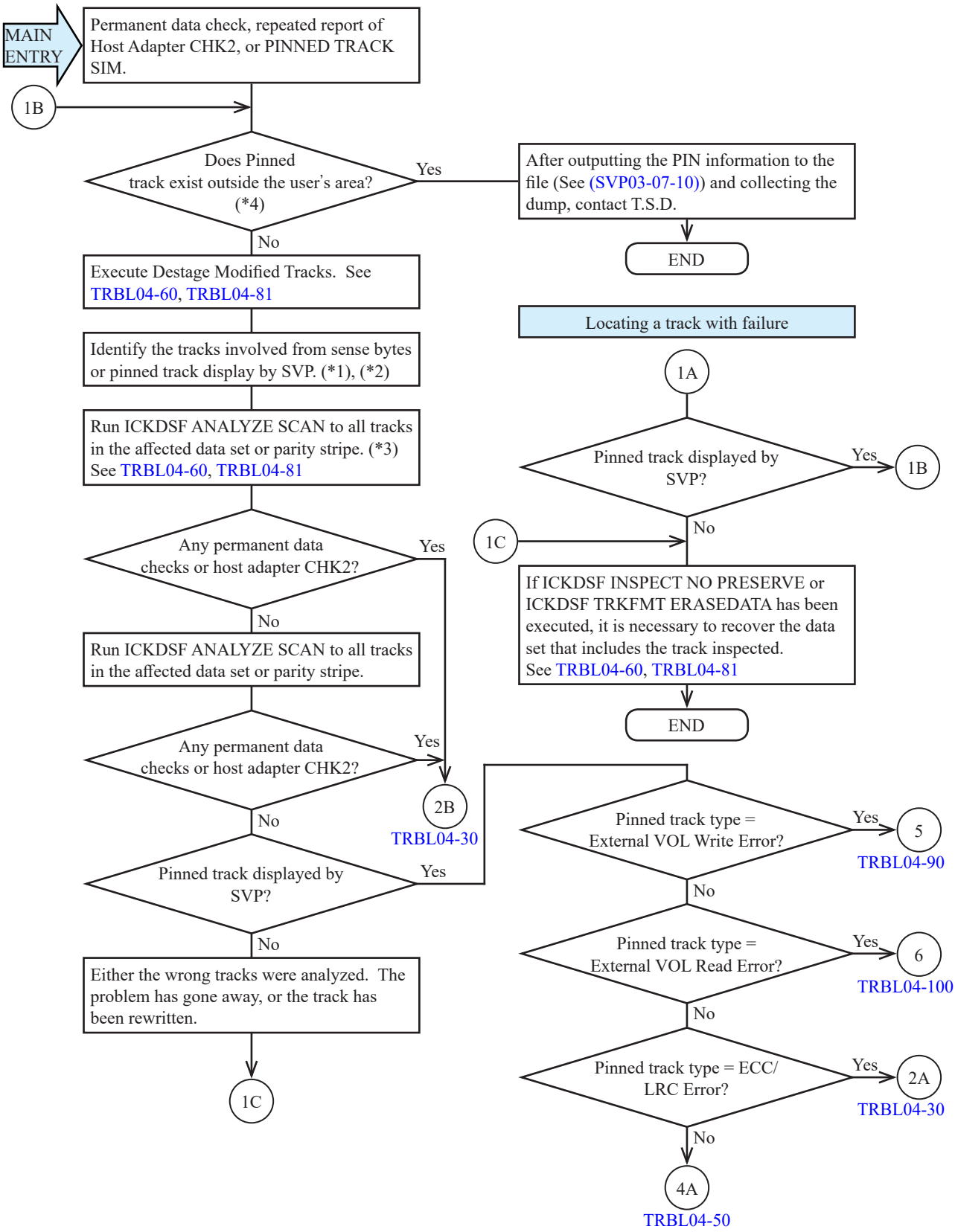
4.1 Recovery Procedure for Mainframe Pinned Track

NOTICE: When a pinned track is displayed by SVP and all the following conditions are met, the pinned track might be resolved by retrying the host job that ended abnormally.

1. "ECC/LRC Error" is displayed as the cause of the pinned track.
2. "DATA" is displayed as the type of the pinned track.
3. The SIM of the pinned track is reported after the latest System On time in the Power Event log (SVP02-02-150).
4. The host job using the data set containing the pinned track of Cyl#/HD# ends abnormally.

If the pinned track is not resolved by retrying the host job, perform the following recovery procedure for pinned tracks on mainframe systems.

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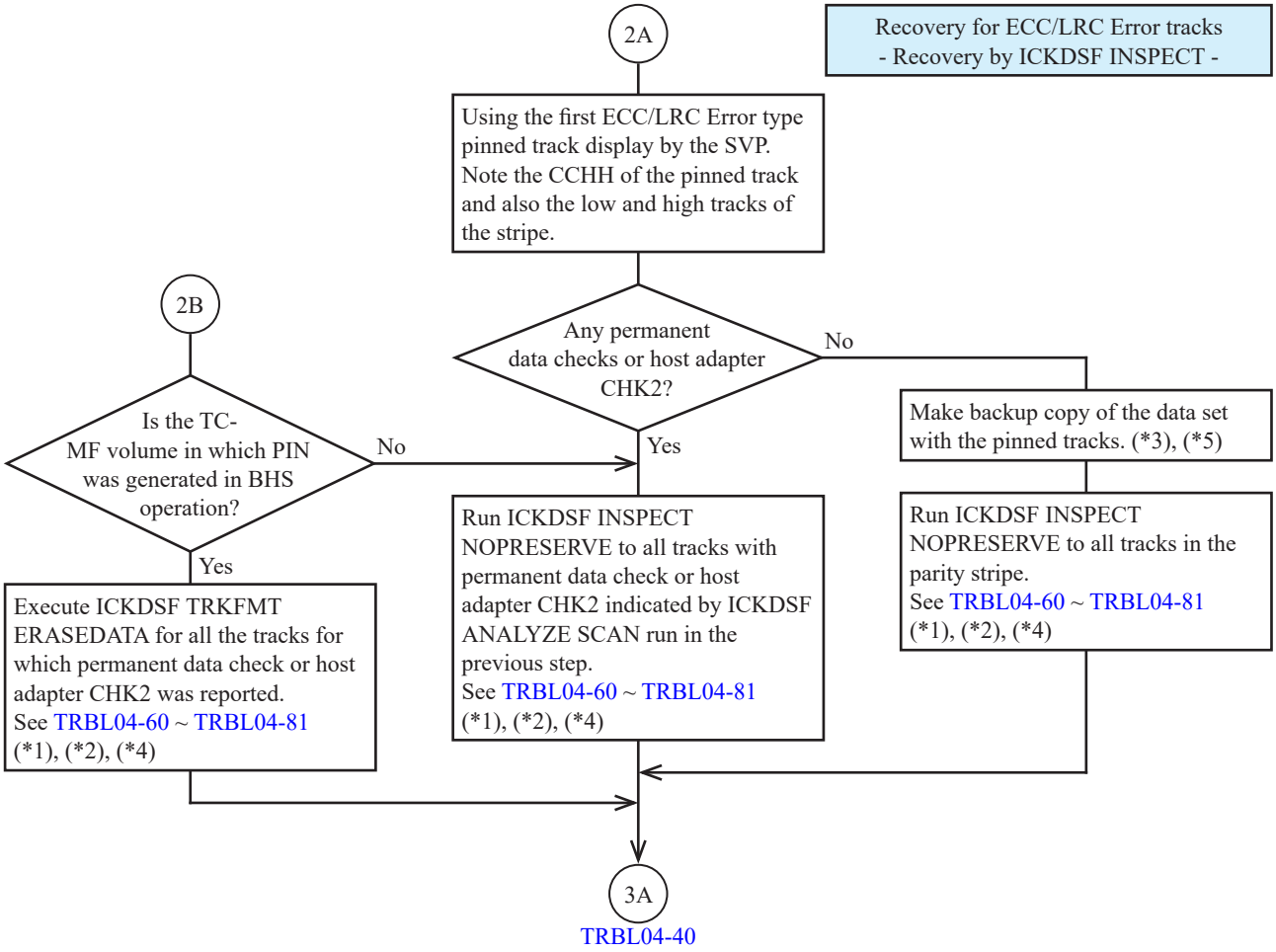
*1: Make a note of all the information in the SVP 'INFORMATION PINNED TRACK' display. You need the 'TYPE', 'PDEV', 'LDEV' and 'stripe begin / end' for use in the recovery procedure.

*2: A cylinder address (CC) and a track address (HH) in the SVP INFORMATION function are in 'HEX'.

*3: ICKDSF ANALYZE SCAN issues a BYPASS MODE READ request.
For the BYPASS MODE READ request, data in cache memory is purged after the data transfer to host. Therefore, if data exists in cache memory, executing ICKDSF ANALYZE SCAN repeatedly will insure the analyzed data is read from PDEV.

*4: If CC and HH information in the SVP PINNED TRACK shows outside the user area, this indicates that a pinned track occurred in the management area. (You can check the number of cylinders in the user area by seeing [Capacity] in the Logical Devices window of Web Console. Select "Cyl" as the capacity unit from [Options] in the Logical Devices window to check [Capacity].)

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*1: Remember all tracks on which the ICKDSF INSPECT NO PRESERVE is run as customer data has been lost. Customer will have to recover files for each data set.

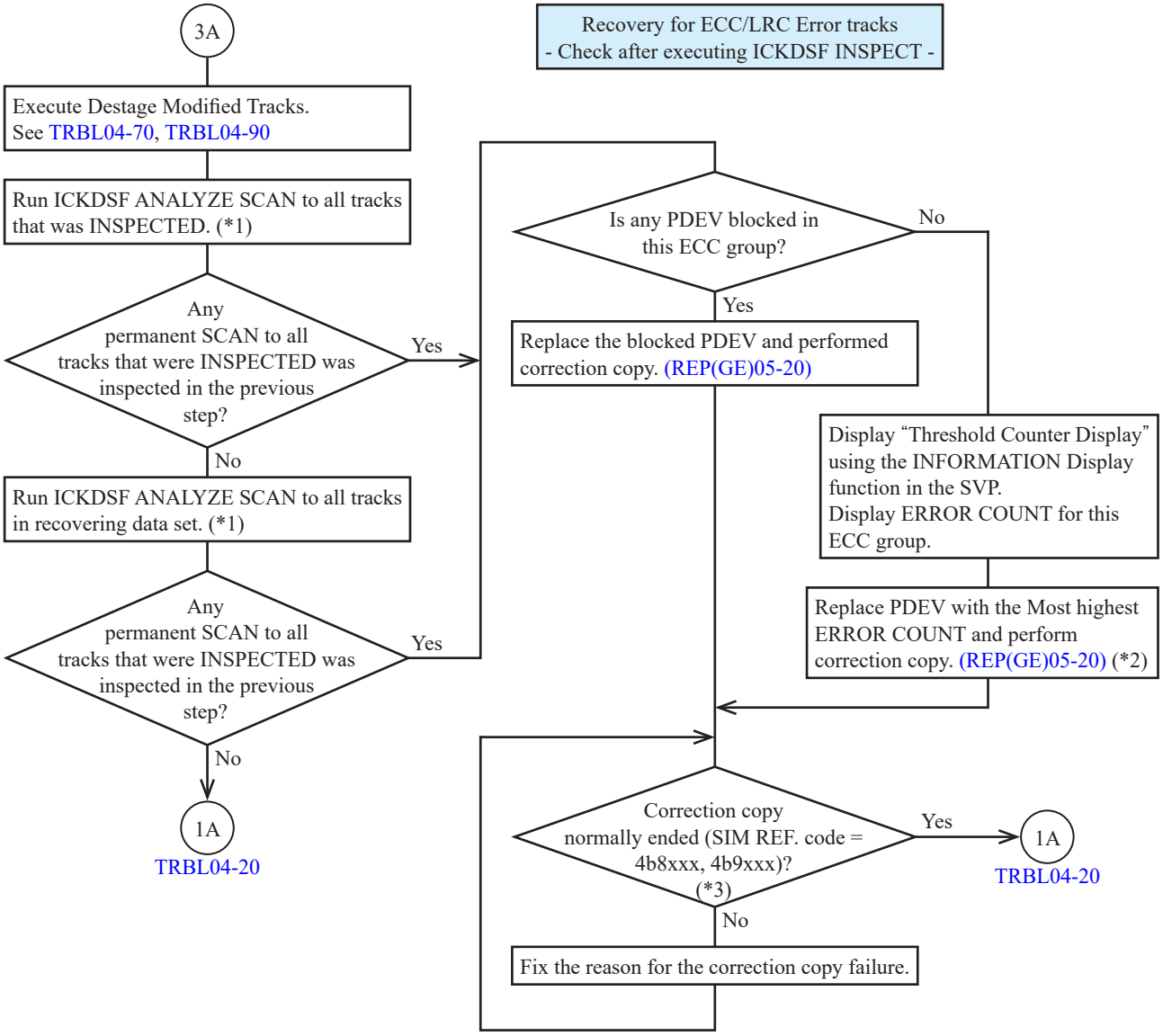
*2: If you execute ICKDSF INSPECT in the tracks of VTOC, the volume should be set to offline. In this case the entire volume will have to be restored.

*3: • During a file recovery from the backup procedure to the restore procedure of the data set, the data set cannot be accessed until the recovery is complete.
• If a file recovery for PDS data is set, execute the backup/restore procedure to the data set (all members).

*4: When the DKC emulation type is 2107, add NOCHECK to ICKDSF INSPECT parameter.

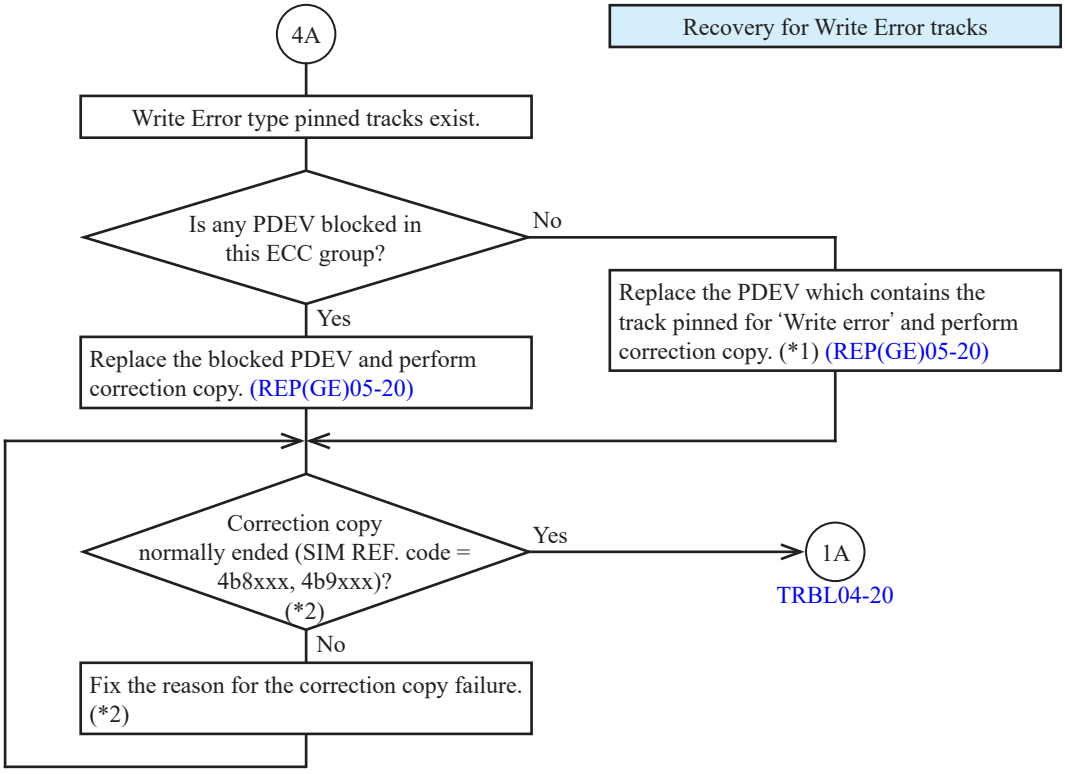
*5: ① Execute File Backup for dataset including pinned track. Store the backed-up file to another media (tape or another dasd).
② After executing NO PRESERVE INSPECT, restore the backed-up file to its original location.

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*1: Repeat ICKDSF ANALYZE SCAN twice for the purpose verifying the data written on the physical device actually.
*2: If Spare drives are available, you can perform Drive Copy instead of Correction copy.
*3: If Drive copy ended abnormally, SIM REF. code is "4caxxx, 4cbxxx" or "4cexxx, 4cfxxx".

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

*2: If Drive copy ended abnormally, SIM REF. code is "4caxxx, 4cbxxx" or "4cexxx, 4cfxxx".

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JCL example (under MVS)

A. Check if any pinned track by using DSF (ANALYZE).

[In case target LDEV to be recovered is ONLINE state]

```
//ANALYZE  JOB  MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC  PGM=ICKDSF
//SYSPRINT  DD  SYSOUT=*
//DASD      DD  UNIT=DASD,VOL=SER=xxxxxx,DISP=SHR
//SYSIN     DD  *
 ANALYZE DDNAME(DASD) SCAN
/*
//
```

[In case target LDEV to be recovered is OFFLINE state]

```
//ANALYZE  JOB  MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC  PGM=ICKDSF
//SYSPRINT  DD  SYSOUT=*
//SYSIN     DD  *
 ANALYZE UNIT(cuu) SCAN
/*
//
```

B. Recover pinned tracks by using DSF (INSPECT).
When the DKC emulation type is 2107.

[In case target LDEV to be recovered is ONLINE state]

```
//INSPECT  JOB  MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC  PGM=ICKDSF
//SYSPRINT  DD  SYSOUT=*
//DASD      DD  UNIT=DASD,VOL=SER=xxxxxx,DISP=SHR
//SYSIN     DD  *
 INSPECT DDNAME(DASD) NOVERIFY NOPRESERVE NOCHECK -
 TRACKS(X'ccc',X'h')
/*
//
```

[In case target LDEV to be recovered is OFFLINE state]

```
//INSPECT  JOB  MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC  PGM=ICKDSF
//SYSPRINT  DD  SYSOUT=*
//SYSIN     DD  *
 INSPECT UNIT(cuu) NOVERIFY NOPRESERVE NOCHKCK -
 TRACKS(X'ccc',X'h')
/*
//
```

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C. Execute Destage Modified Tracks

```
//DESTDATA JOB  MSGCLASS=x,MSGLEVEL=(1,1),REGION=nnnnK
//STEP1   EXEC  PGM=IDCAMS
//SYSPRINT  DD  SYSOUT=*
//SYSIN     DD  *
 SETCACHE VOLUME(xxxxxx) unit(DASD) DESTAGE
/*
//
```

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Operation example (under VM)

NOTE: This recovery procedure is executable only under VM/ESA 1.1 or higher release with DEVMAINT authority.

A. Check if any pinned track by using DSF (ANALYZE).

```
Ickdsf
ICK030E DEFINE INPUT...
Console
CONSOLE
ICK031E DEFINE OUTPUT...
Console
CONSOLE
ICKDSF - CMS DEVICE SUPPORT FACILITY...

ENTER INPUT COMMAND:
analyze unit(cuu) scan
    .
    .
end
 END
```

B. Recover pinned tracks by using DSF (INSPECT).

```
ickdsf
ICK030E DEFINE INPUT...
Console
CONSOLE
ICK031E DEFINE OUTPUT...
Console
CONSOLE
ICKDSF - CMS DEVICE SUPPORT FACILITY...

ENTER INPUT COMMAND:
inspect unit(cuu) norecovery nopriserve nocheck from(x'ccc',x'h')
to(x'ccc',x'h')
    .
    .
end
 END
```

C. Execute Destage Modified Tracks

```
destage rdev
```

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D. Execute ICKDSF TRKFMT ERASEDATA to delete the data of the failed tracks.

[When LDEV is ONLINE]

```
//TRKFMT   JOB MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC PGM=ICKDSF
//SYSPRINT  DD SYSOUT=*
//DASD      DD UNIT=DASD,VOL=SER=xxxxxx,DISP=SHR
//SYSIN     DD *
 TRKFMT DDNAME(DASD) VFY(xxxxxx) ERASEDATA TRK(X'ccc',X'h')
/*
//
```

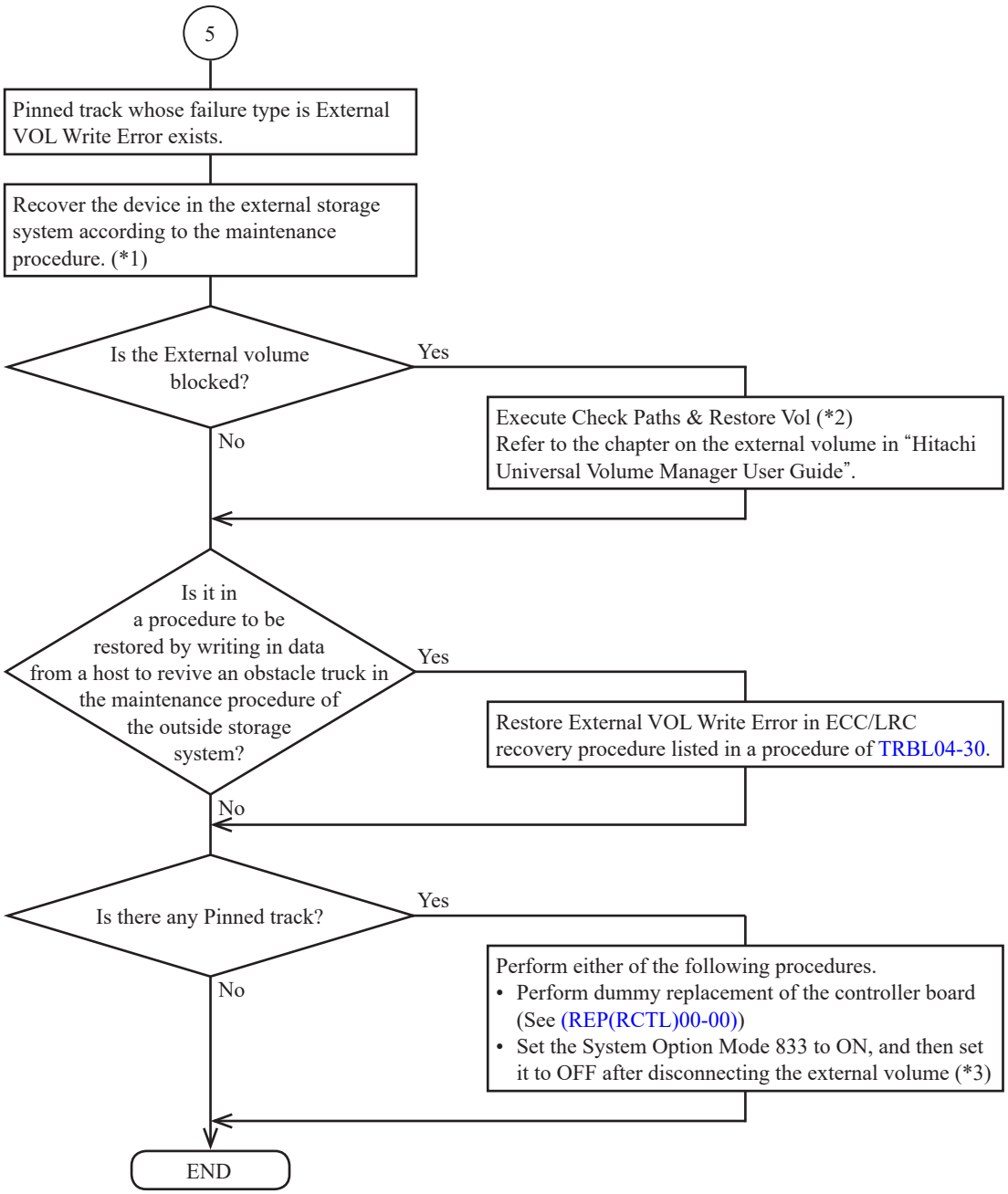
[When LDEV is OFFLINE]

```
//TRKFMT   JOB MSGCLASS=x,MSGLEVEL=(1,1)
//STEP    EXEC PGM=ICKDSF
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
 TRKFMT UNIT(cuu) VFY(xxxxxx) ERASEDATA TRK(X'ccc',X'h')
/*
//
```

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Recovery from External VOL Write Error

When an External VOL Write Error occurs, perform the following recovery procedure.



*1: It is the work for 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 a Hitachi storage, recover the fault location according to the maintenance manual.)

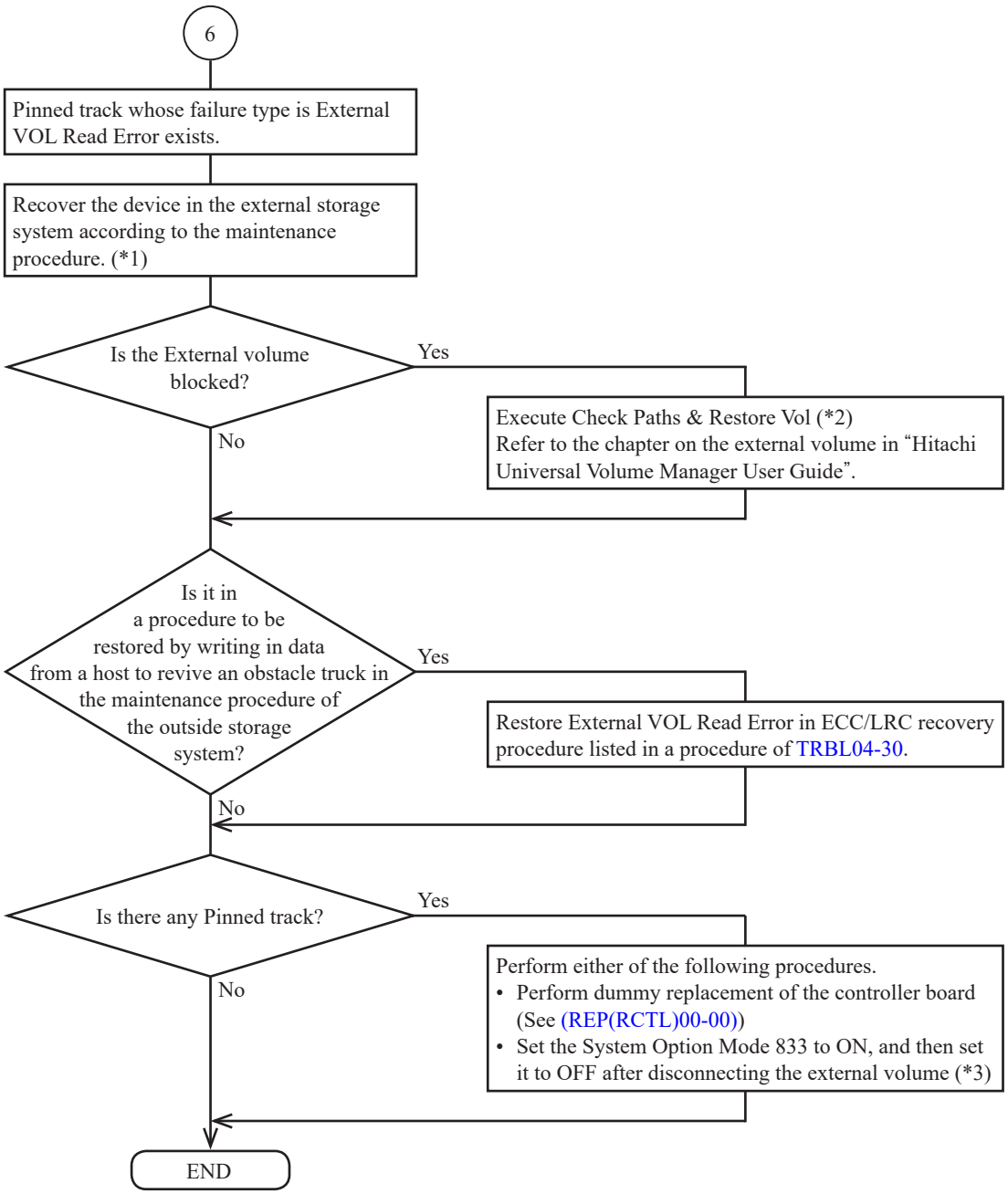
*2: It should be done using Storage Navigator. Ask the customer to perform the recovery operation by using Storage Navigator according to the User Guide.

*3: 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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Recovery from External VOL Read Error

When an External VOL Read Error occurs, perform the following recovery procedure.



*1: It is the work for 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 a Hitachi storage, recover the fault location 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: 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 Recovery Procedure When WDCP Information Is Lost (SIM = ffde01, ffde02, ffde03)

(1) When only this SIM is reported
When this SIM is reported at the time of OFFLINE micro exchange performed, no maintenance is required.
When this SIM is reported at the time of the storage system powering on, (a) failure(s) may occur in the cache memory. Replace the failed part(s).

(2) When another SIM is reported together with this SIM
When the SIM concerning the cache, perform the maintenance of the failed part(s).
When the SIM not concerning the above is reported at the same time, perform the maintenance of the failed part(s) and see “(1) When only this SIM is reported”.

(3) WDCP system recovery procedure
For the procedure for recovering the WDCP system, see the instruction manual of the OS concerned.

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5. Recovery from Open Platform Failure

5.1 Recovery Procedure for a Failure on Host Fibre Channel Interface

5.1.1 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.

5.1.1.1 Possible Failures and causes of them

Table 5-1 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

5.1.1.2 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 “Channel Interface” (LOC04-10).
4	Is the status of the CHB corresponding to the failed SCSI path normal?	Check the CHB status in the Maintenance Utility (Sub Panel) window. (Refer to “5.1.4 Procedure for Checking Normalcy of the Processor”.)
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. Click “SFP Status” of the CHB in the Maintenance Utility to check the status and type (Short or Long) of the SFP. 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 LDEV status in the Logical Devices window of Web Console. (Refer to “Checking the Logical Devices” (WEBCON03-250).)
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 of the Monitor. (Refer to “5.1.6 Isolation Procedure for Fibre Channel Failure”.)

(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 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)

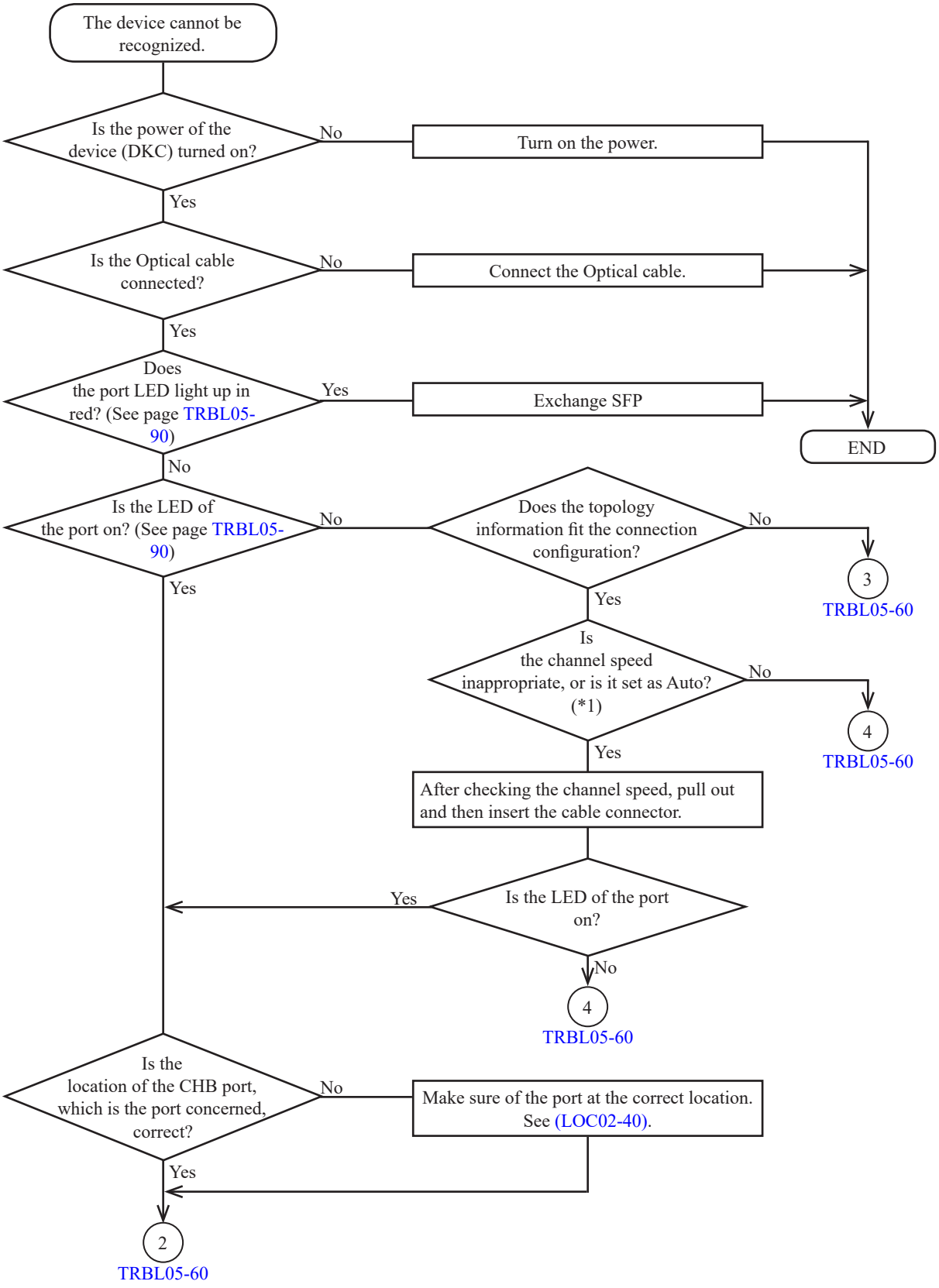
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(Continued from the preceding page)

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.

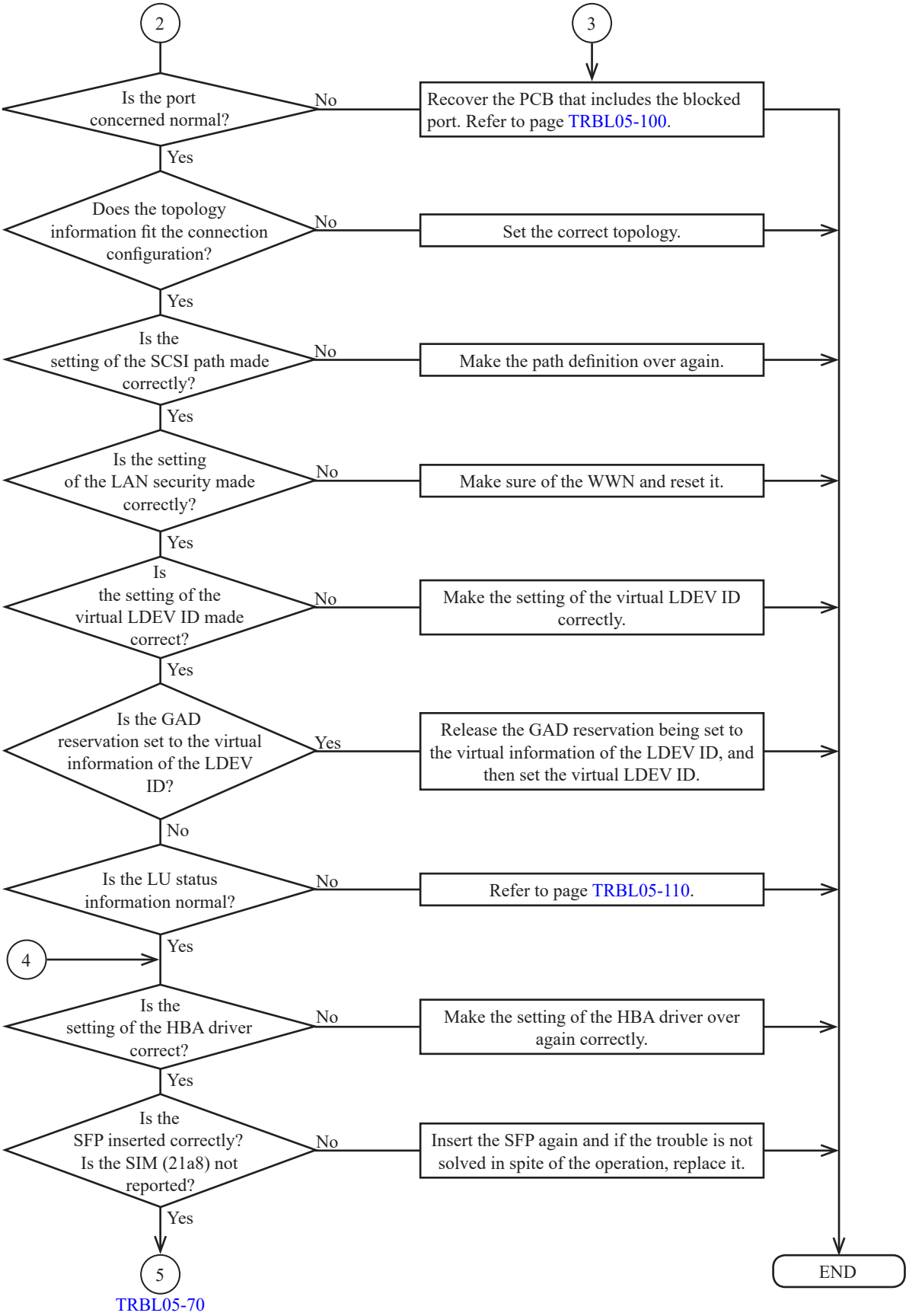
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5.1.2 Recovery Procedure When Device Is Not Recognized

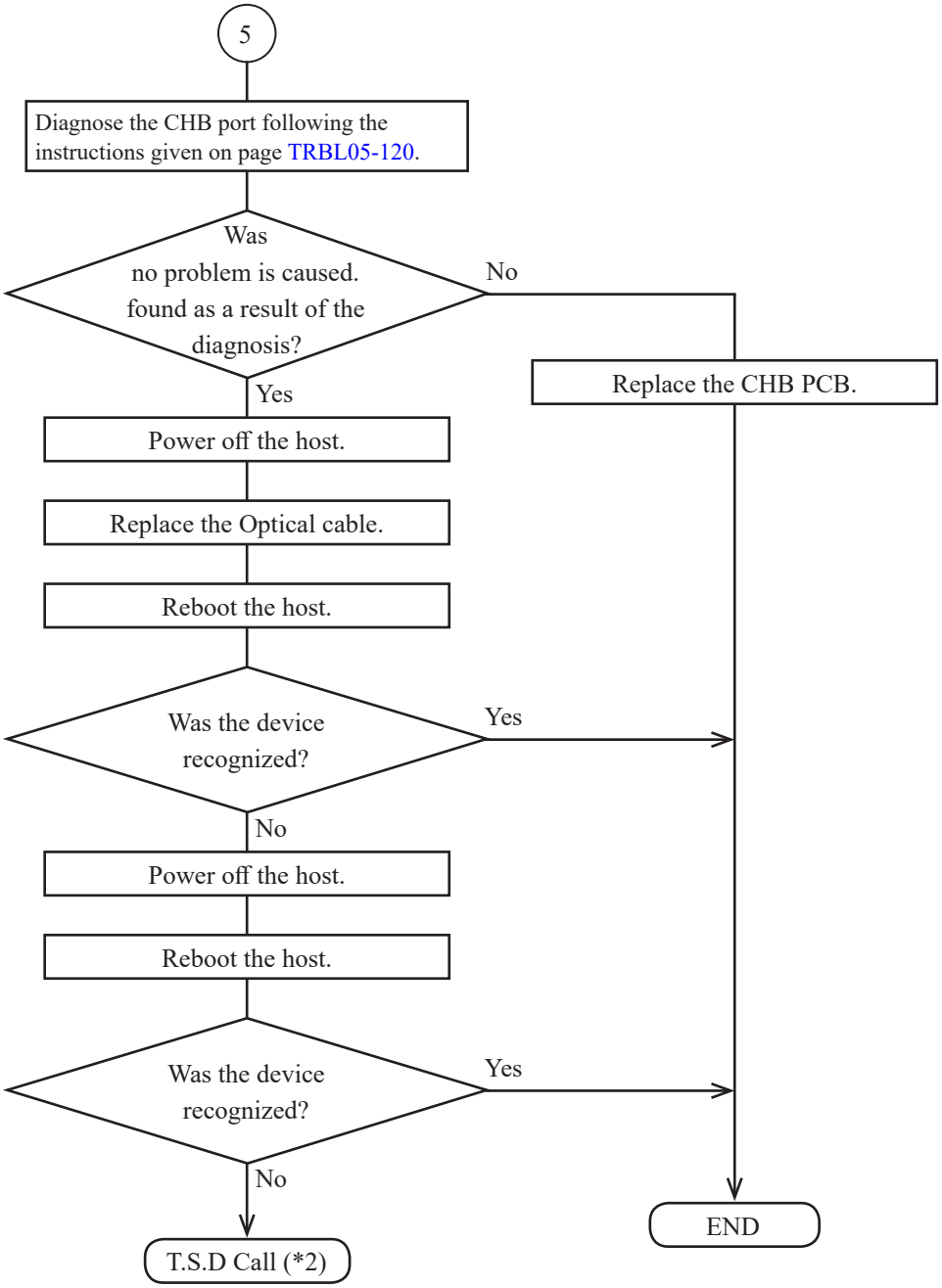


*1: See No 15 in "5.1.1.2 Matters must be or desirable to be checked".

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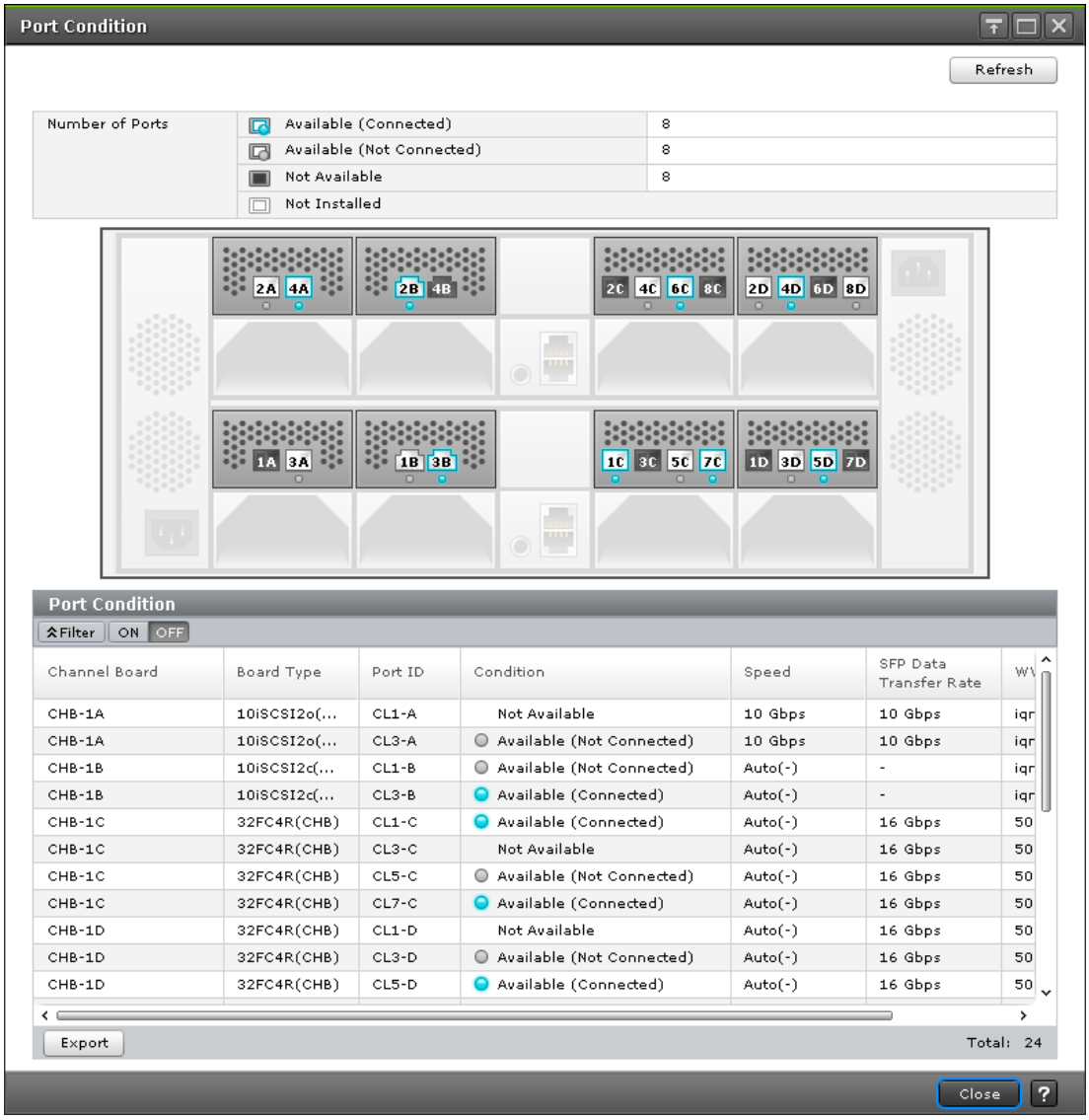
*2: Send the following information to the Technical Support Division (T.S.D.).
- Device configuration of the host
- Version of the OS
- Whether the OS is patched or not
- Version of the driver
- Model number of the fibre channel board
- Dump information on the DKC (See “Dump/Auto Dump” (SVP02-09-10).)
- Syslogs and/or Messages
- Logs of software when the alternative path exists
- Fibre channel monitoring information if available

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5.1.3 Procedure for Checking Storage System Port Status

The port information of the destination Storage System is displayed in the Port Condition 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.

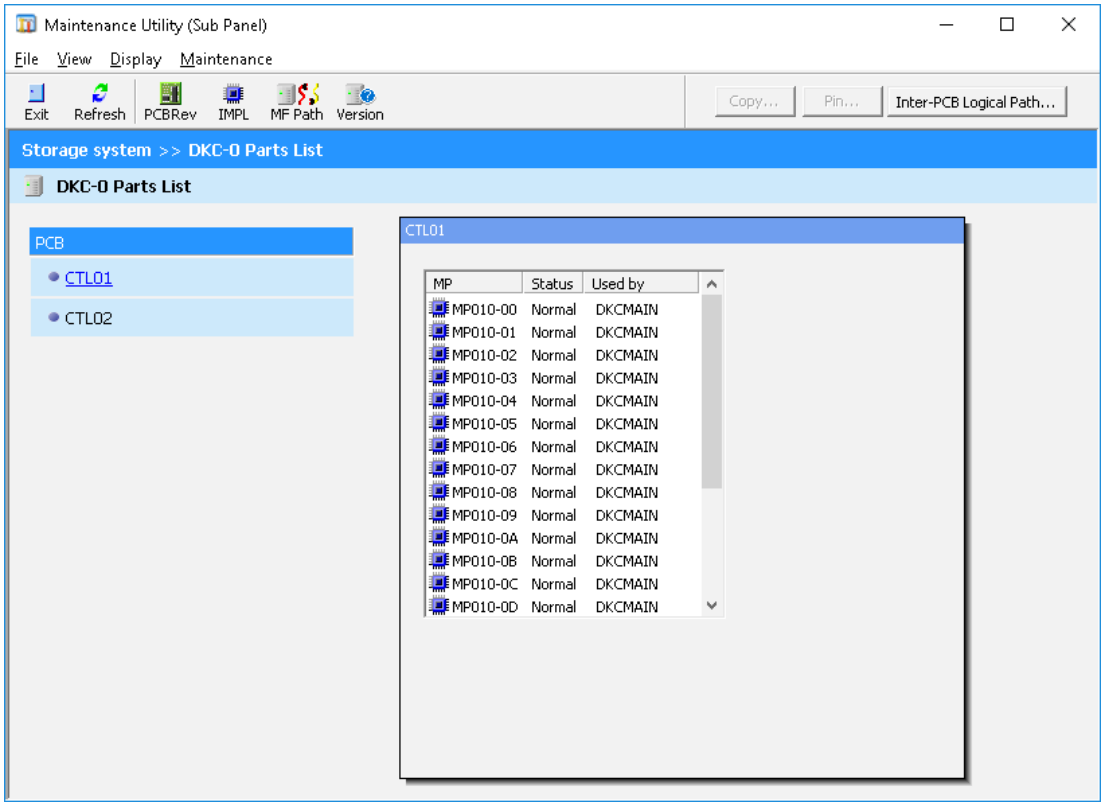
Channel Board, Adapter type, Port ID, Attribute and Condition are displayed for the each port.
The statuses of the displays of the port status are explained below.

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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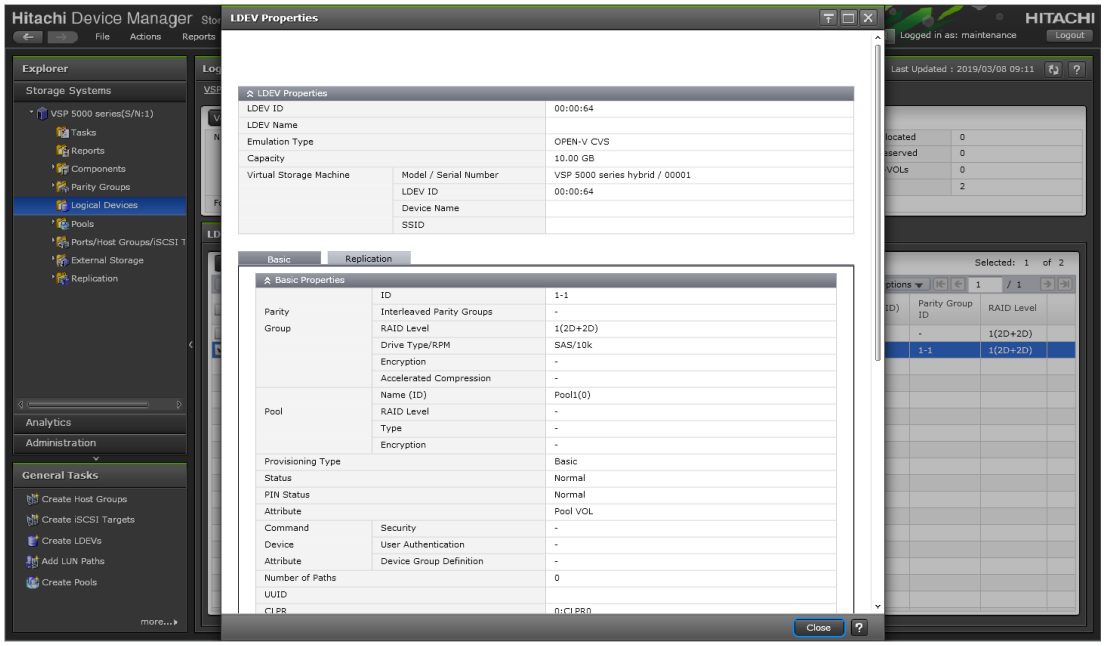
5.1.4 Procedure for Checking Normalcy of the Processor

Select the DKC in the Maintenance Utility (Sub Panel) 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.



5.1.5 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.



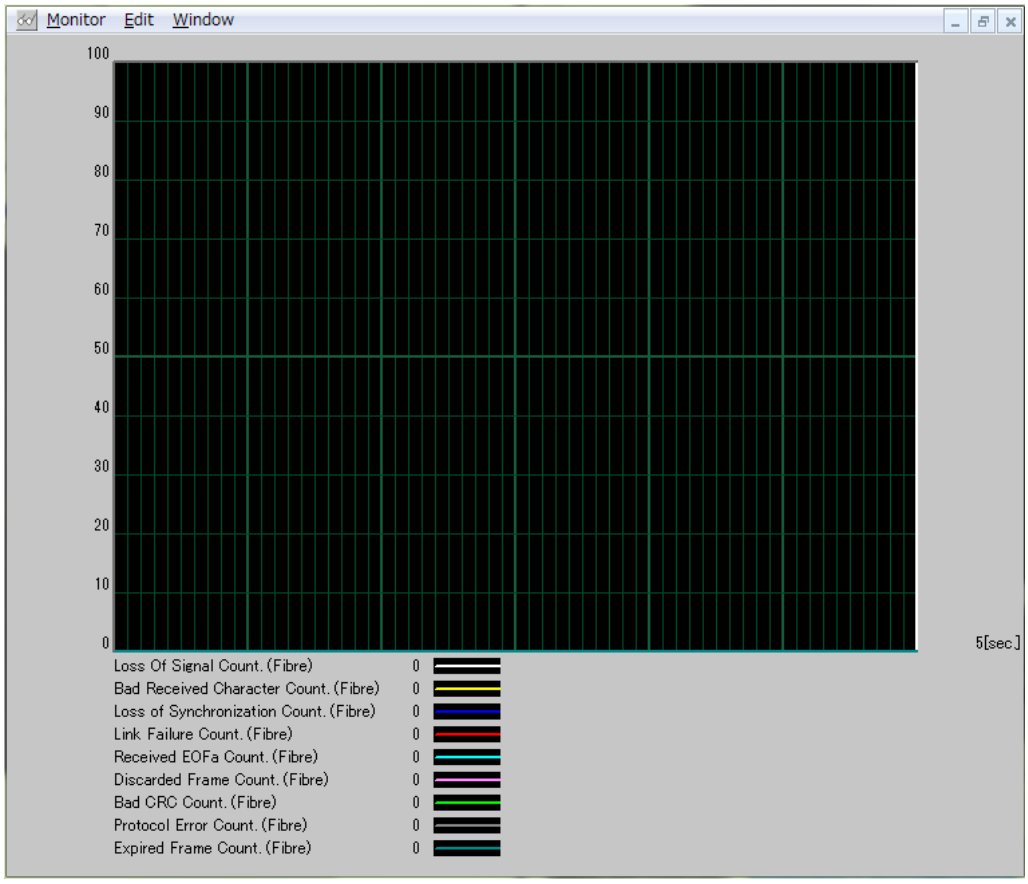
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5.1.6 Isolation Procedure for Fibre Channel Failure

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 5-2 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 transfer character 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. [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. [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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(Continued from the preceding page)

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. [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. [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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(Continued from the preceding page)

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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(Continued from the preceding page)

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.)

5.2 Pinned track recovery

5.2.1 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 “SIM Log” (SVP02-02-70).

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 “Pin Slot Indication” (SVP03-07-10).

*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 “5.2.2 Error Types”.

Pinned Tracks Volume	References
TrueCopy Volume	“7.3 Recovery Procedure for TrueCopy for Mainframe/TrueCopy Pinned Track”
UR Data Volume or Journal Volume	“9.5 Procedure for UR Pinned Track Recovery and Journal Volume Replacement”
Thin Image Pool Volume	“10.7 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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5.2.2 Error Types

Pinned track has 7 error types as follows.

Display		Meaning	Cause	Recovery method
Slot	Reason			
–	Write Error	Unable to write to PDEV.	Drive error	"5.2.2.2 Write Error"
DATA	ECC/LRC Error	Unable to read from Cache. (Data slot except CMPD, Meta and FPTD)	Cache error	"5.2.2.1 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 "5.2.3.10 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 procedures according to the [Capacity Saving] setting. (*4) • When set to [Compression] a. Set the System Option Mode 1115 to ON. If the System Option Mode 1115 is already set to ON, this operation is not required. b. Format the DP-VOLs whose [Capacity Saving] setting is [Compression], where errors occur. c. Set the System Option Mode 1115 to OFF. If the mode is not set to ON in this maintenance work, this operation is not required. • When set to [Deduplication and Compression] a. Block the virtual volumes whose [Deduplication Data] function is [Enabled], which are associated with the pool. b. Block the deduplication system data volume associated with the pool. c. Initialize all virtual volumes whose [Deduplication Data] function is [Enabled] in the pool. (In the [Initialize Duplicated Data] window, click [Apply]. (*3)) d. Format the blocked deduplication system data volume (data store). e. Format the virtual volumes whose [Deduplication Data] function is [Enabled].

(To be continued)

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(Continued from the preceding page)

Display		Meaning	Cause	Recovery method
Slot	Reason			
FPTD (*2)	ECC/LRC Error	Unable to read from Cache. (Deduplication system data volumes)	Cache error	Perform the pool initialization as follows (*4): a. Block the virtual volumes whose [Deduplication Data] function is [Enabled], which are associated with the pool. b. Block the deduplication system data volume associated with the pool. c. Initialize all virtual volumes whose [Deduplication Data] function is [Enabled] in the pool. (In the [Initialize Duplicated Data] window, click [Apply]. (*3)) d. Format the blocked deduplication system data volume (data store). e. Format the virtual volumes whose [Deduplication Data] function is [Enabled].
DATA	External VOL Write Error	Unable to write to a device in the external Storage System.	Device failure of external Storage System	"5.2.2.3 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	"5.2.2.4 External VOL Read Error"

*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.
*4: Before performing the pool initialization, check whether the pairs shown below exist in the storage system.
(1) The following copy pairs that use virtual volumes of Dynamic Provisioning:
- TrueCopy
- Universal Replicator
- ShadowImage
- Volume Migration
- global-active device

(2) Thin Image pairs

If there are any of the pairs shown in (1) and (2), delete all of them.
After the pool initialization is completed, create the pairs shown in (1) and (2) again.
Do not create the pairs shown in (1) and (2) during the pool initialization.
If you do, the pool initialization and the creation of the pairs shown in (1) and (2) might end abnormally.

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The following sections (from "5.2.2.1 ECC/LRC Error" to "5.2.2.4 External VOL Read Error") explain 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 "9.5 Procedure for UR Pinned Track Recovery and Journal Volume Replacement".
For Pool volumes of Thin Image, the flowcharts for recovery are shown in "10.7 Recovery Procedure for Thin Image pool-VOL Failure".

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5.2.2.1 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.

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 "Pin Slot Indication" (SVP03-07-10) 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 "Pin Slot Indication" (SVP03-07-10). 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 "Pin Slot Indication" (SVP03-07-10) 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 "3.37 Reclaiming the control pages inside the DP-VOL(s)".

    [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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5.2.2.2 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 SVP window, then replace the PDEV with the Highest Error Rate. A track with Write Error is recovered by a correction copy.

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5.2.2.3 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.

5.2.2.4 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

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

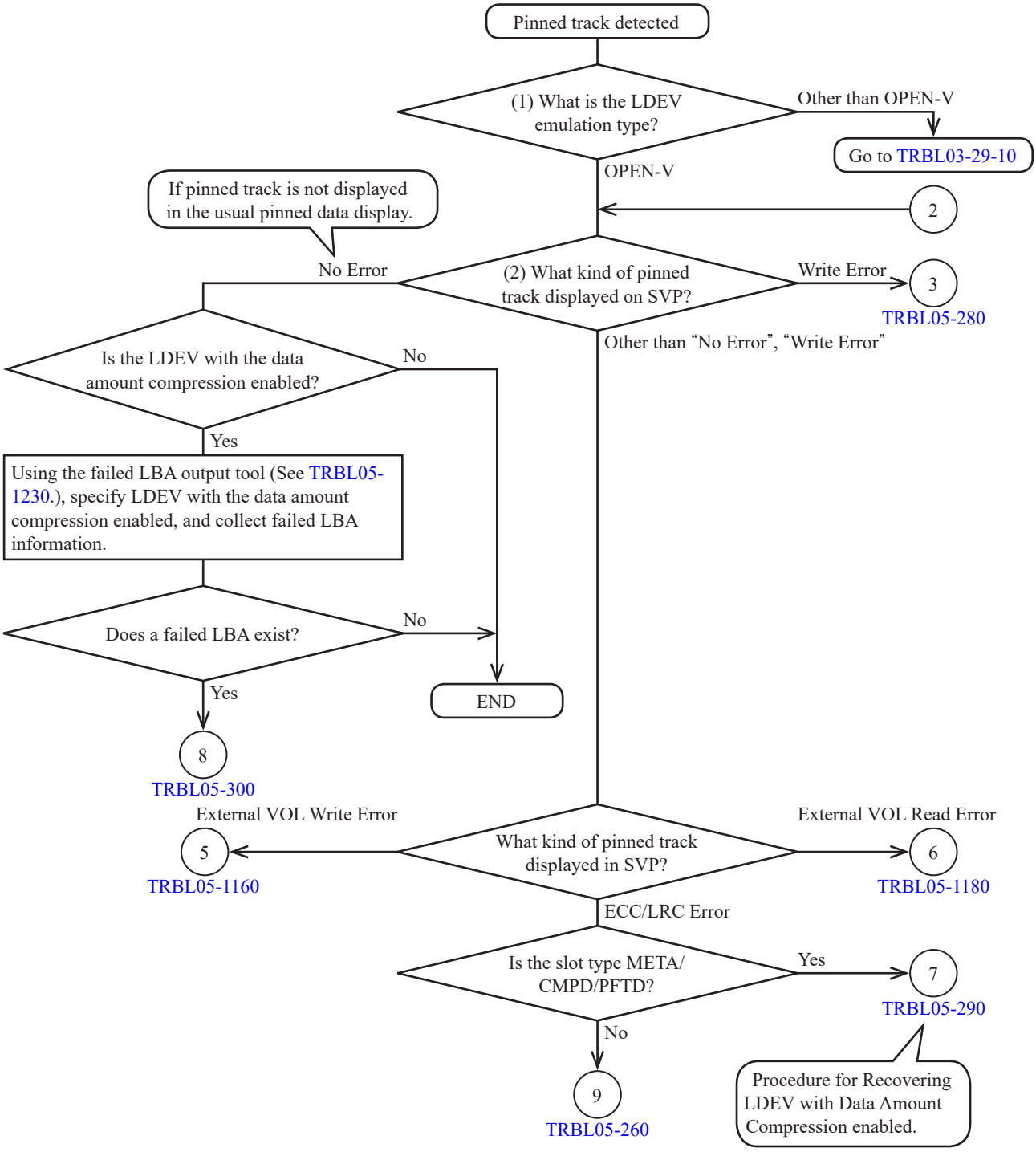
- Perform dummy replacement of the Controller Board.
- Set the System Option Mode 833 to ON, and then set it to OFF after disconnecting the external volume. When disconnecting the external volume, if the LDEV created from the target external volume is defined in the DP pool, all the DP volumes created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

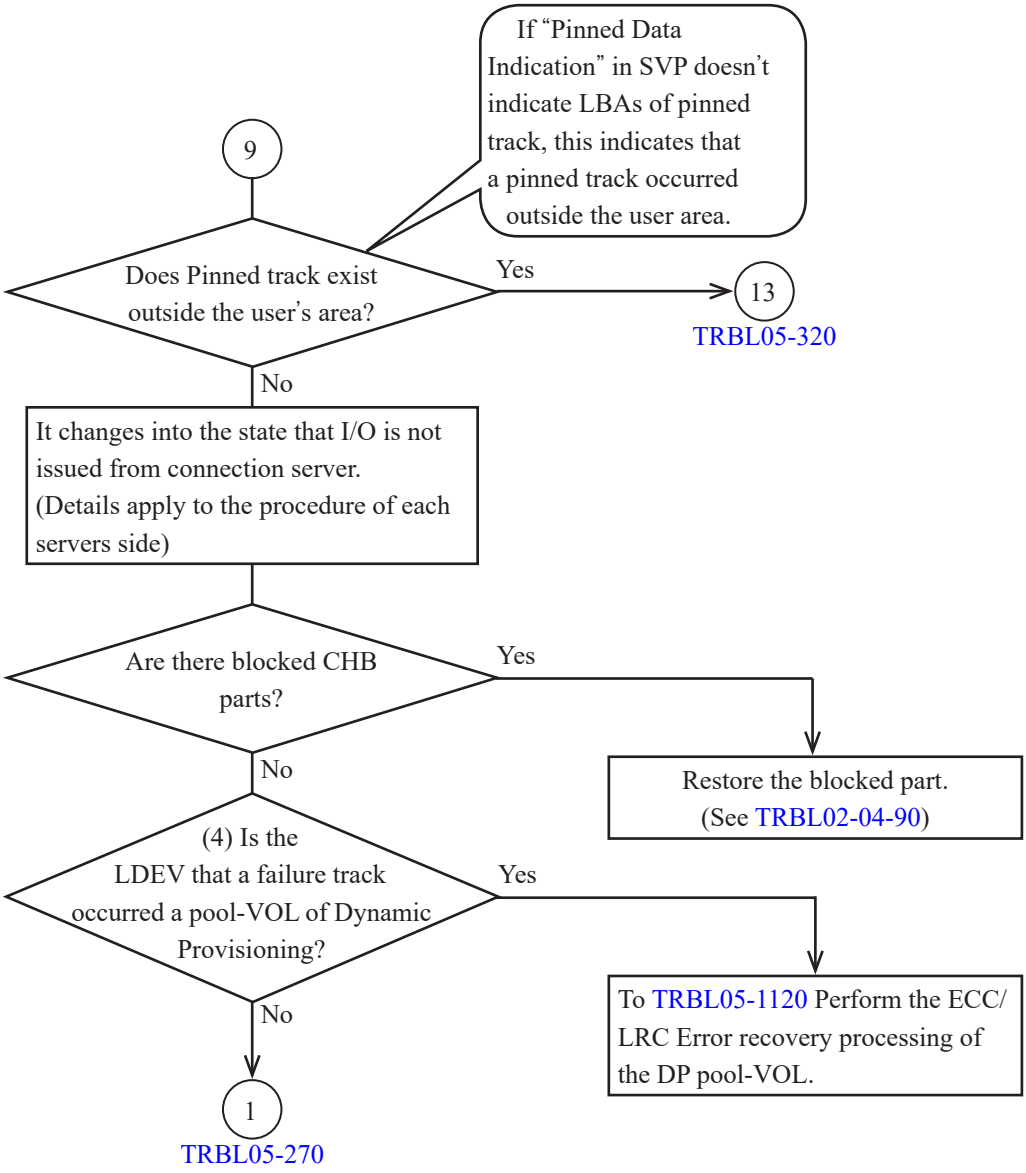
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5.2.3 Procedure for Erasing Pinned Track

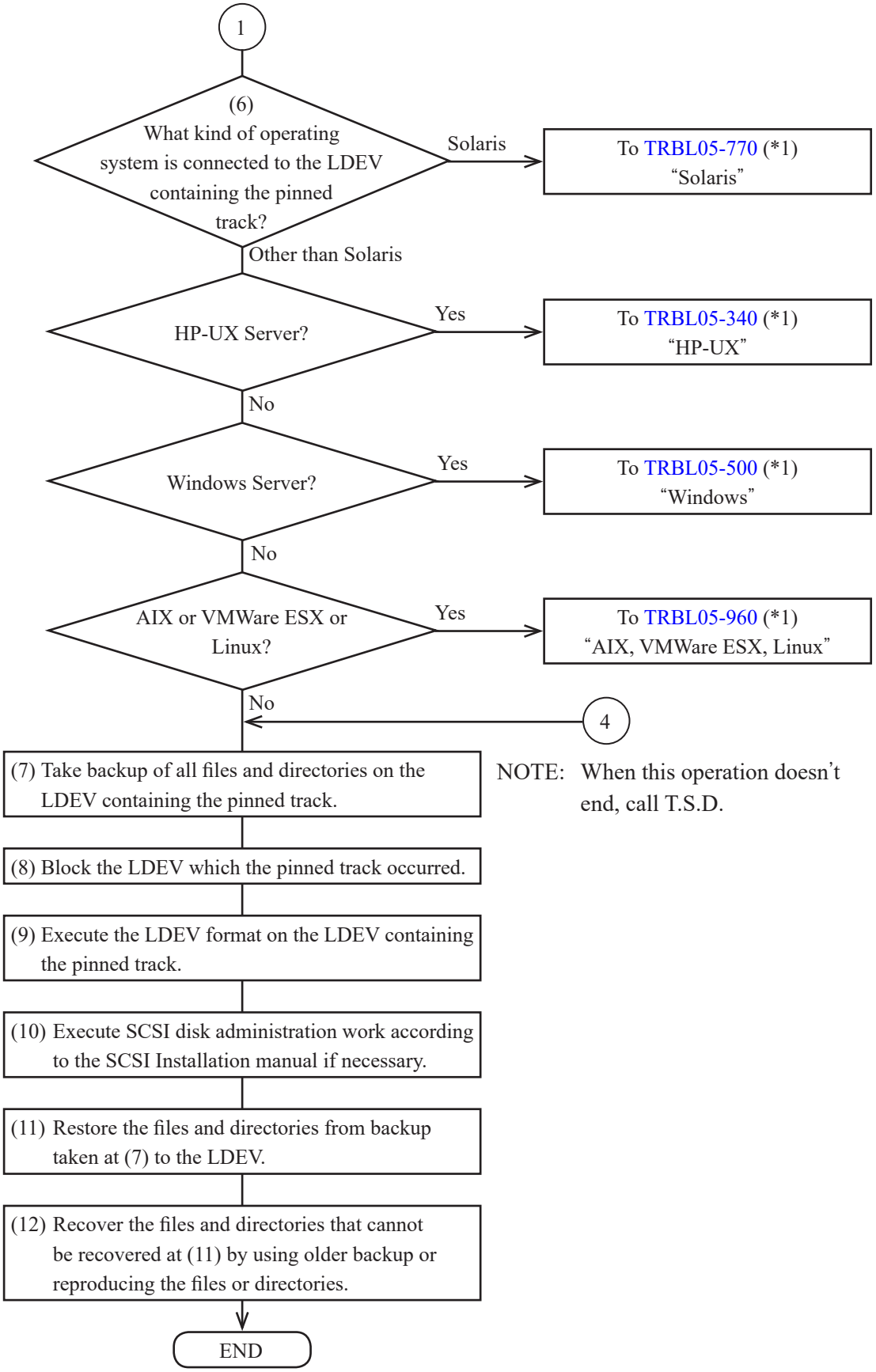
NOTE: If you want to use the tool in this page, confirm to the technical support division about using this tool.
If operating system is not Solaris, HP-UX, Windows, AIX, and VMWare ESX, Linux a procedure peculiar to the operating system does not exist.



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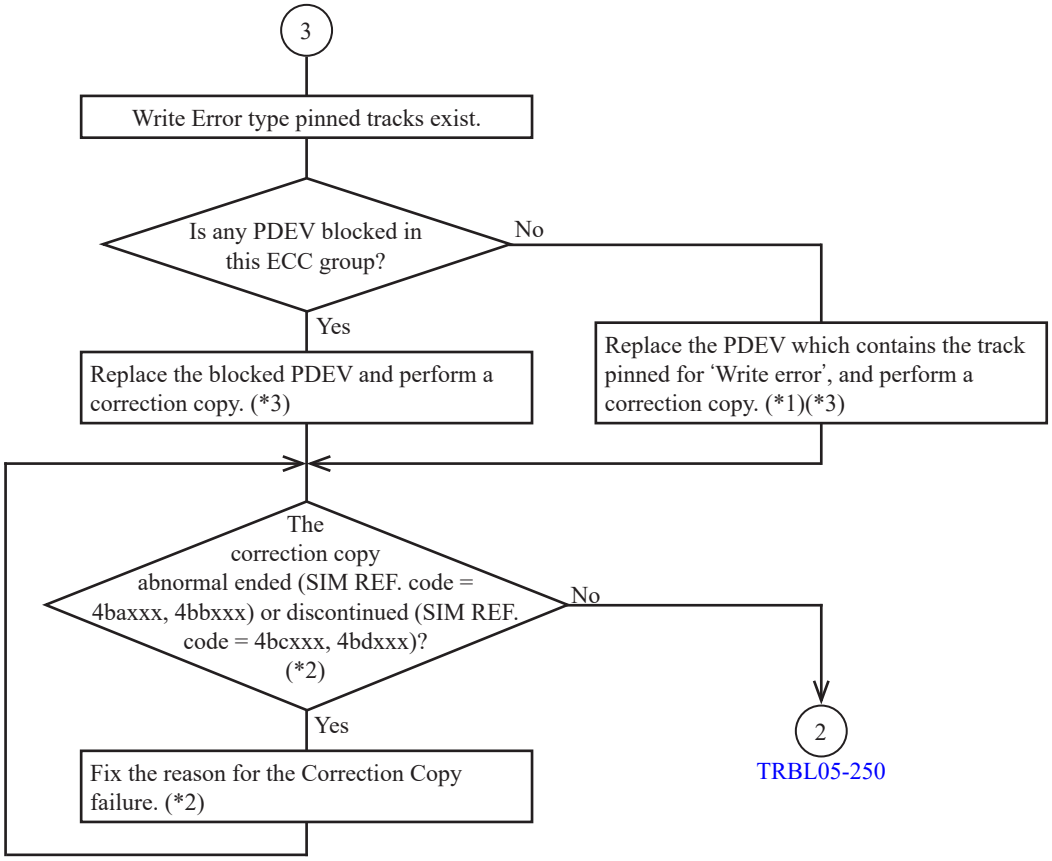


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*1: If the Pinned track is not erased by these actions, please start recovery action from ④.

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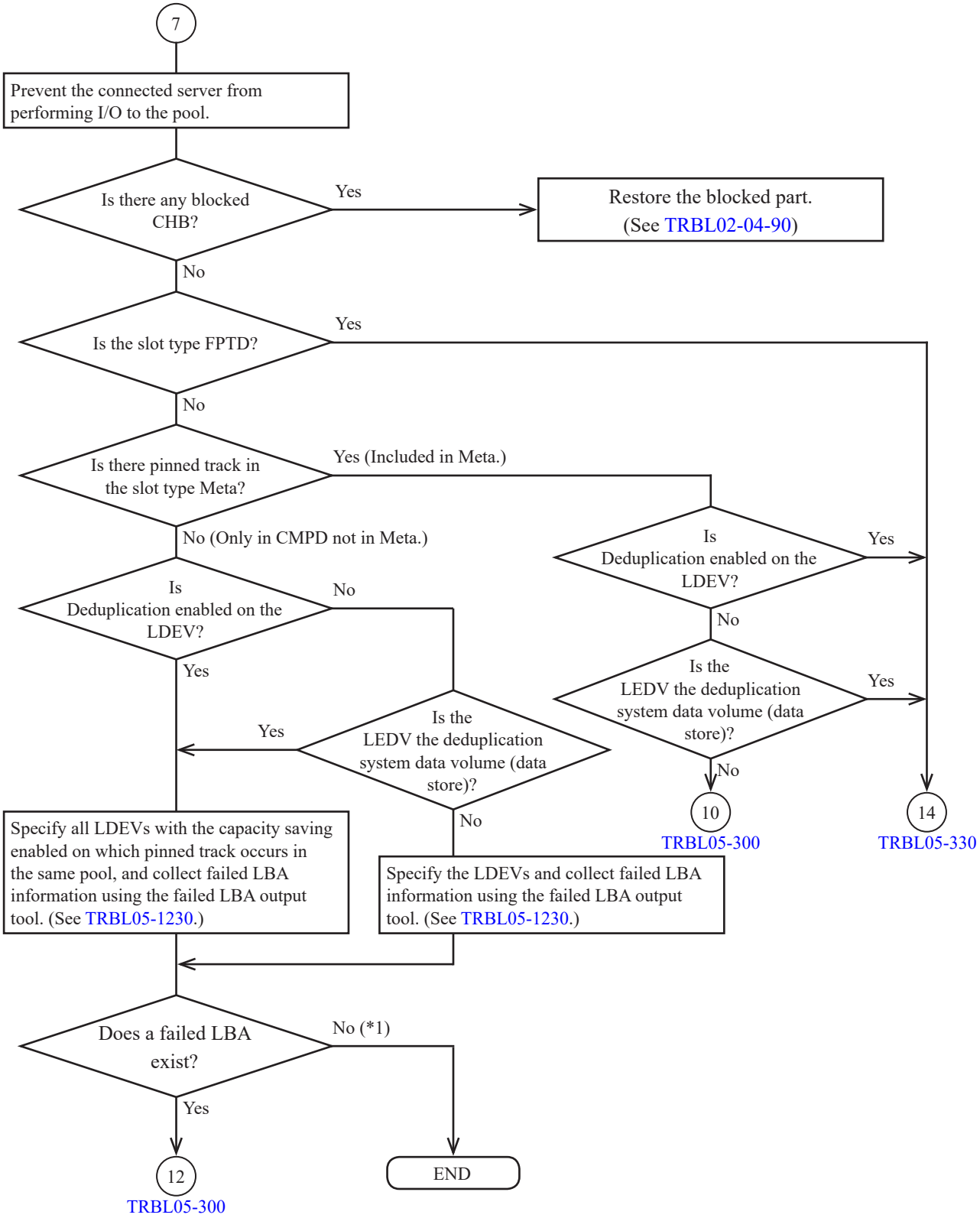


*1: If spare drives are available, you can perform Drive copy instead of Correction copy.

*2: When executing the Drive copy, the SIM REF. code for abnormal termination is "4caxxx, 4cbxxx" and that for suspension is "4ccxxx, 4cdxxx".

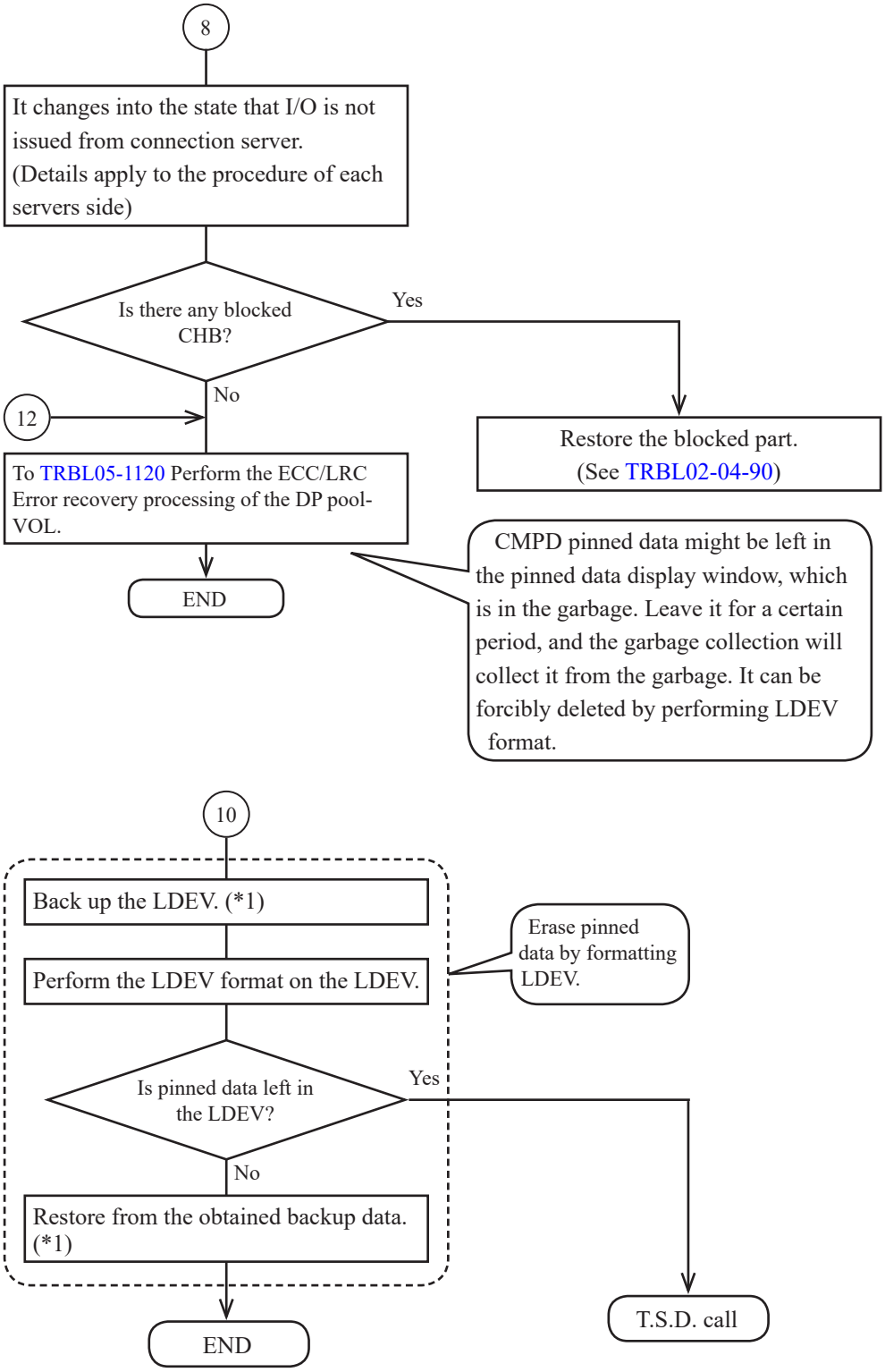
*3: If only "30762-208312" is output as error code when PDEV replacement fails, check the box for "Forcibly run without safety checks" in "<Block Drive>" (REP(RDK1)01-40), "DRIVE REPLACEMENT PROCESSING", and then replace the PDEV again.

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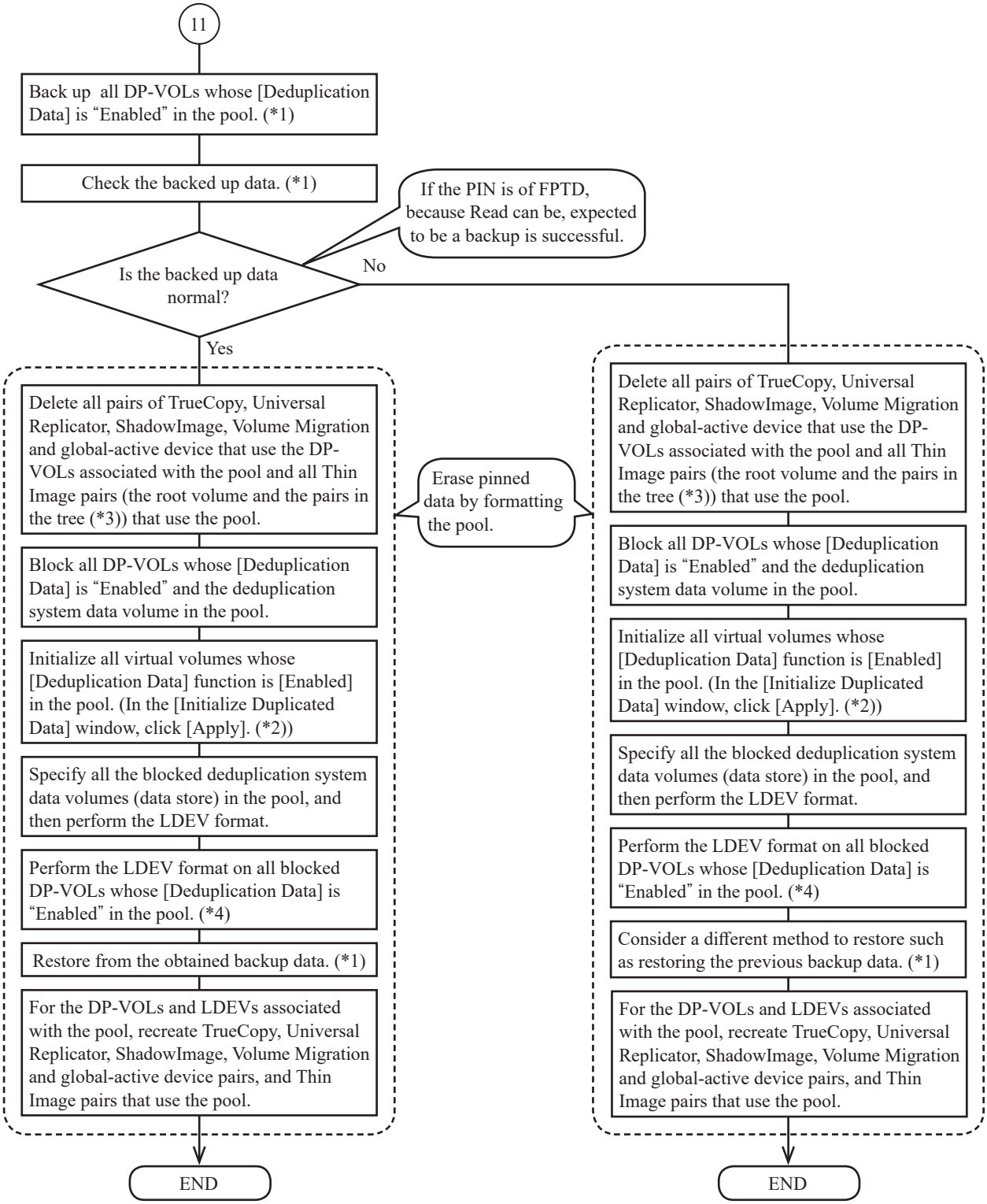
*1: CMPD pinned data might be left in thePinned Track window after the ECC/LRC error recovery processing is performed. But the customer data is not affected unless failed LBA is detected by using the “Failed LBA output tool”. In a certain period of time, it is removed by the garbage collection. It can 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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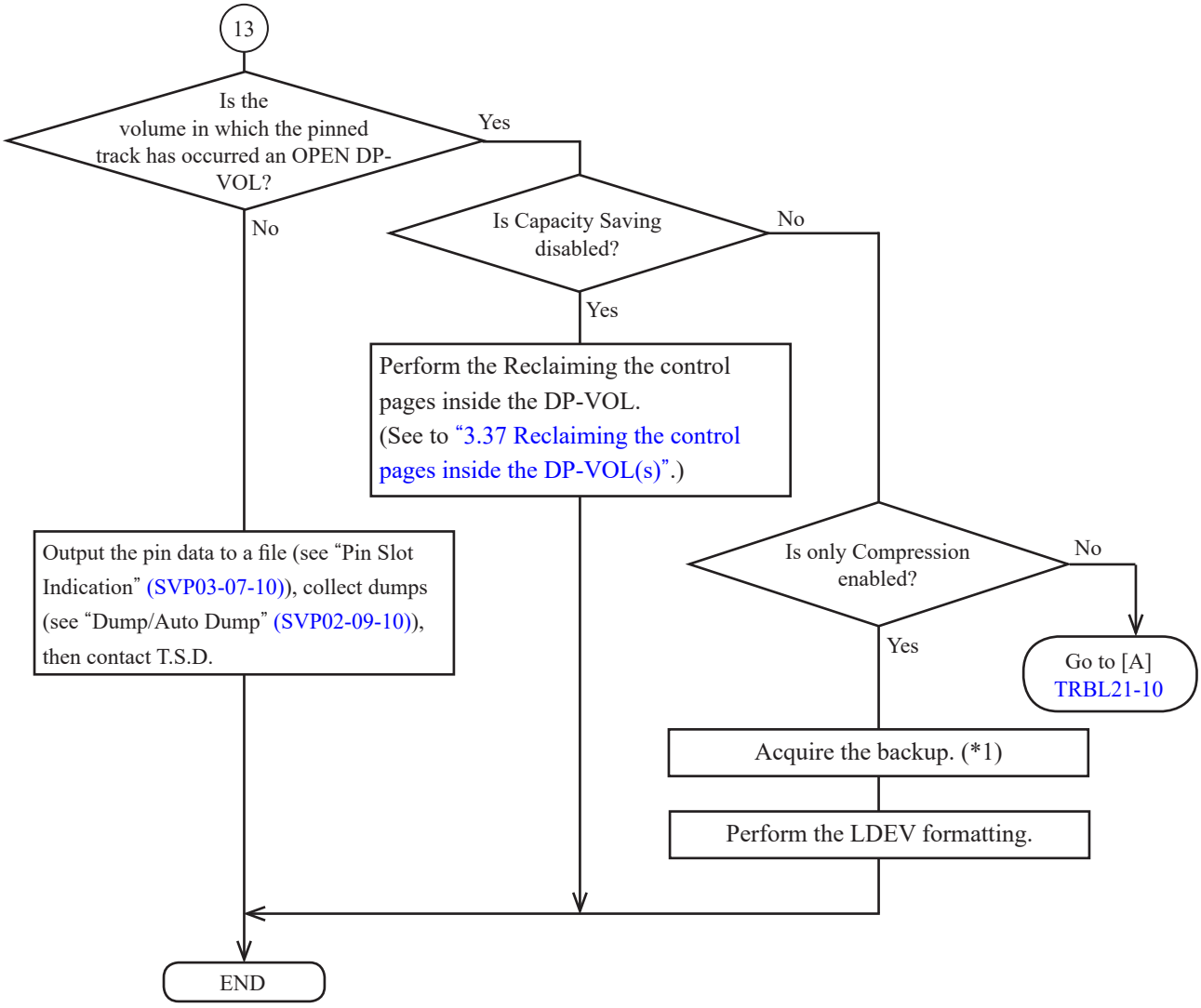
*1: Ask the SE or user to perform the operation.

*2: For Command Control Interface, use the [raidcom initialize pool] command.

*3: 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.

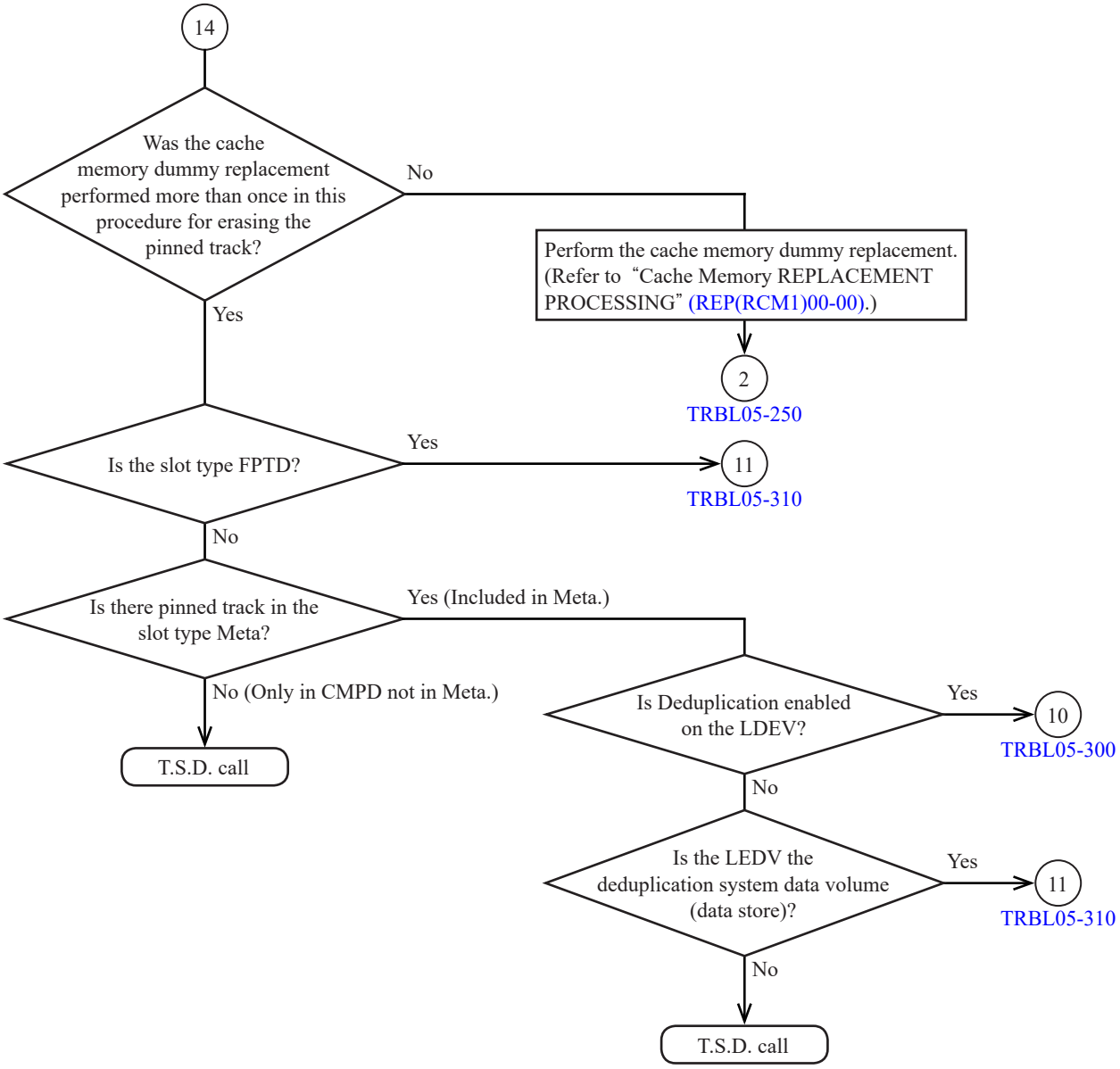
*4: Do not perform the procedure for LDEV recovery.

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

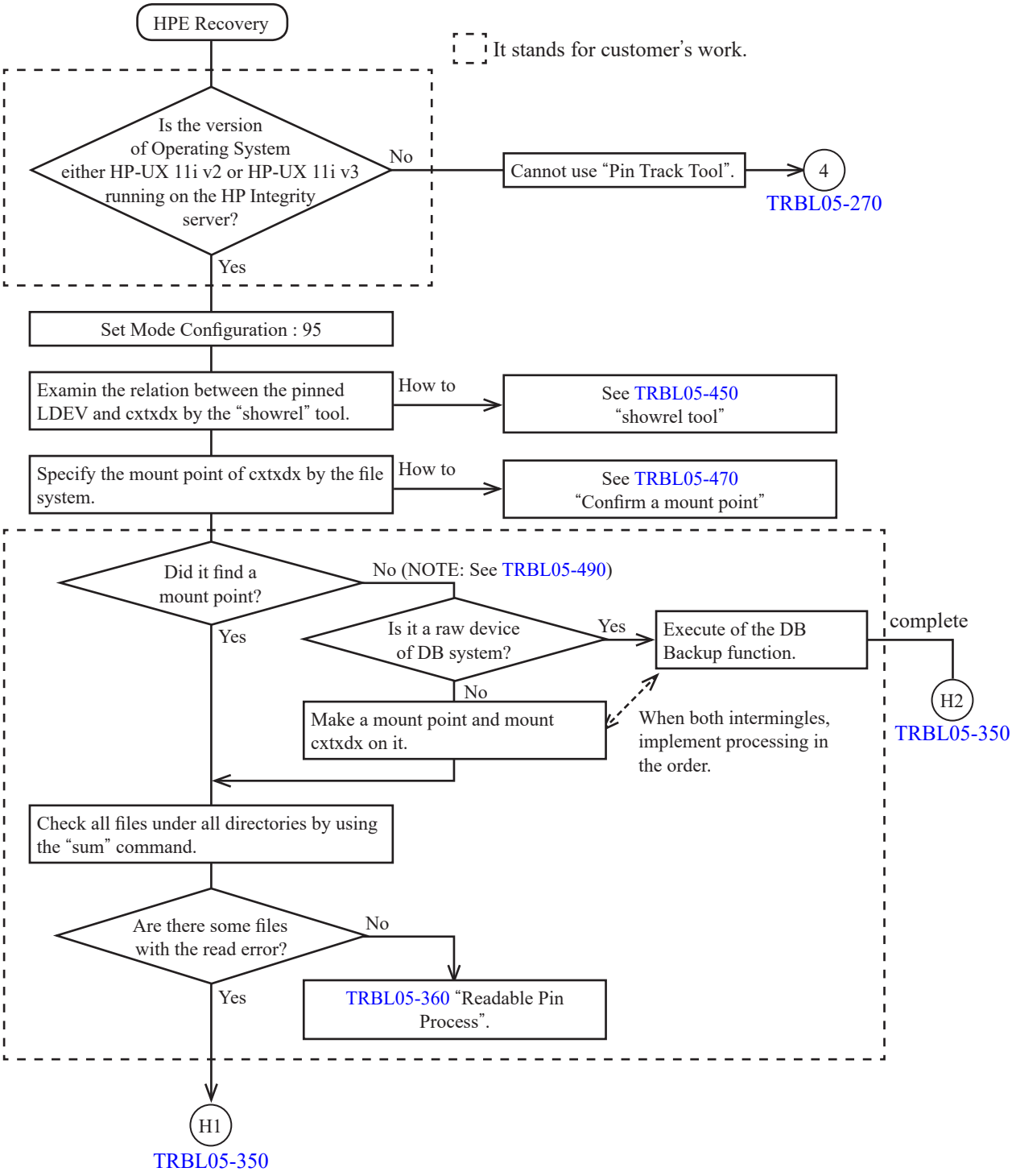
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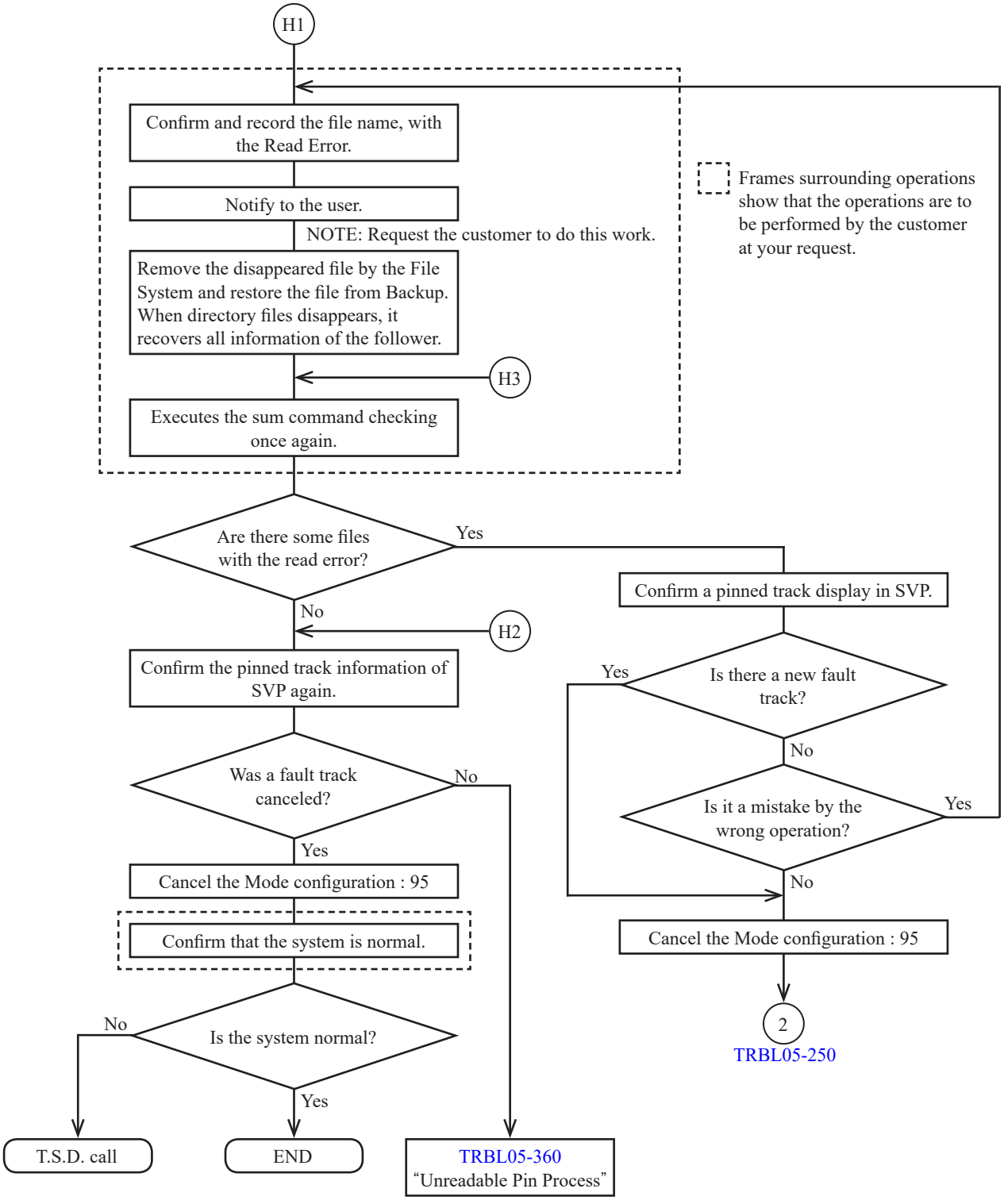
5.2.3.1 HP-UX Procedure

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

Procedure Flow



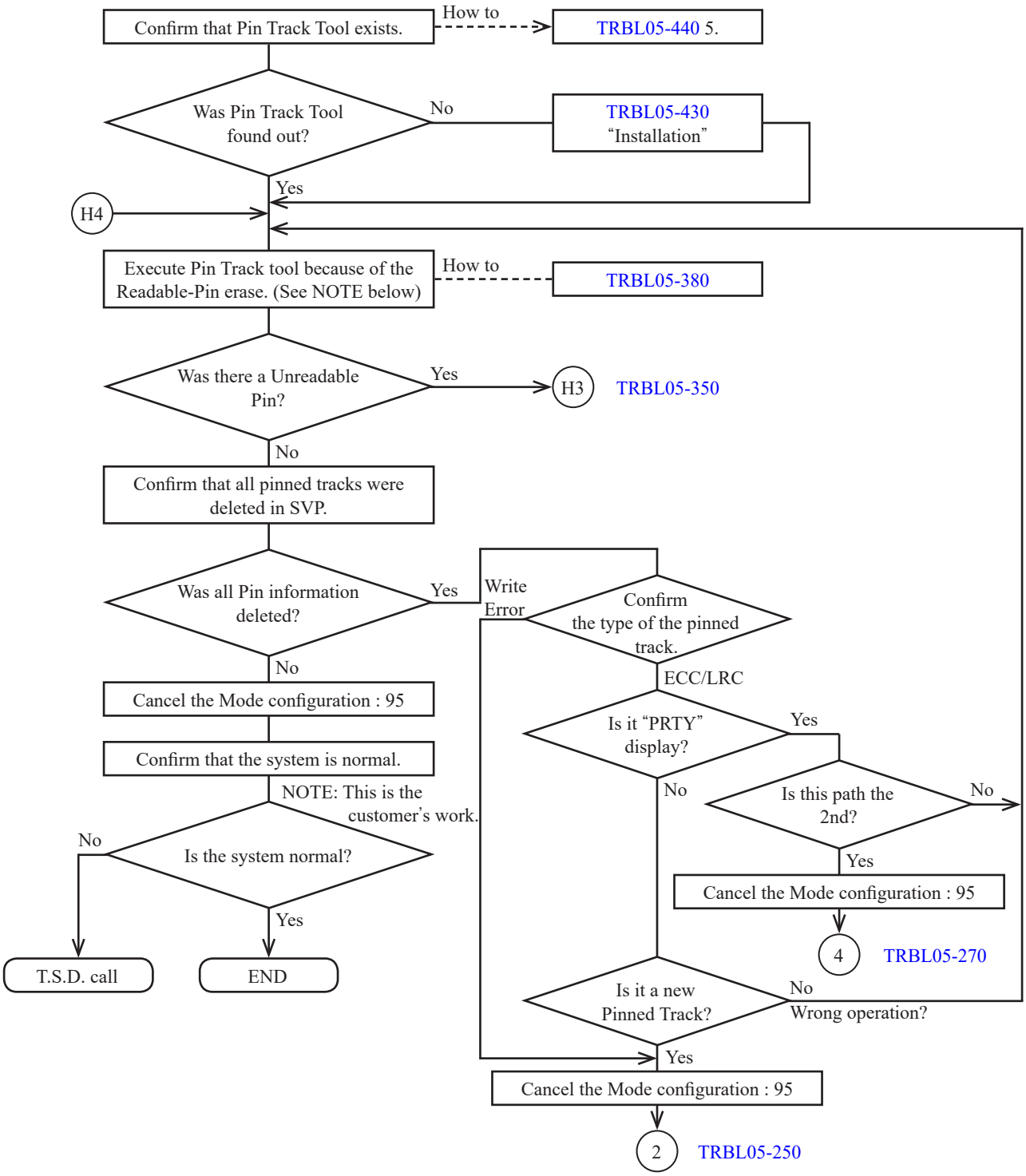
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Readable Pin Process

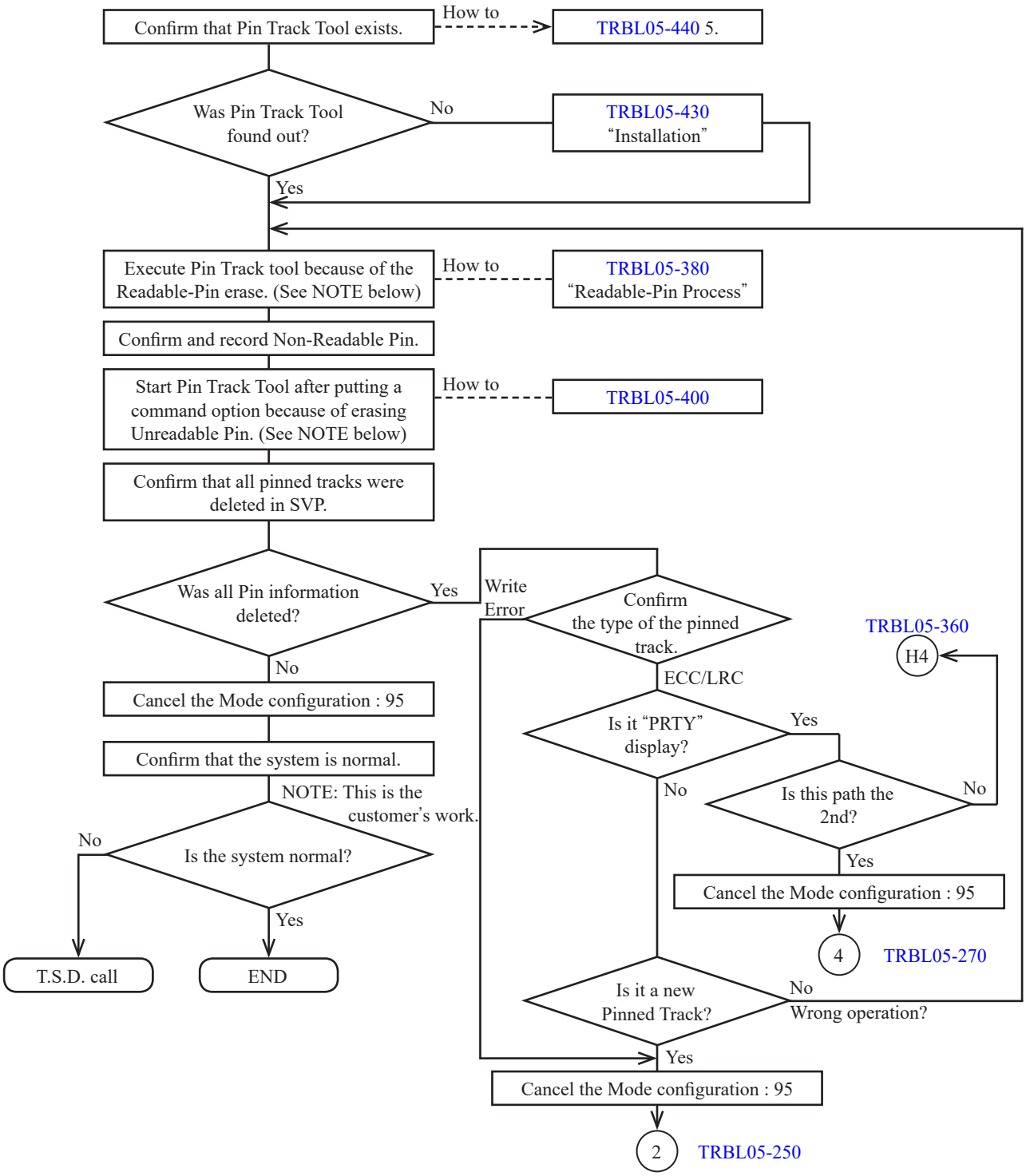
The erasing flow in the readable pinned track by Pin Track Tool is as follows.



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.

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.

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 TRBL05-460)

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 SVP.
   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 SVP.
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 SVP.
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 TRBL05-400.

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 TRBL05-460)

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 SVP.
   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 SVP.
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 SVP.
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 SVP.

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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>

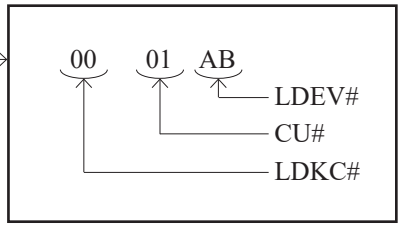
The display depends on the specification of the storage system.

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 SVP 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”)

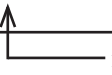
PV(cxtxdx) which composes volume group “/dev/vg11” is displayed.

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.

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 SVP 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 TRBL05-270 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.

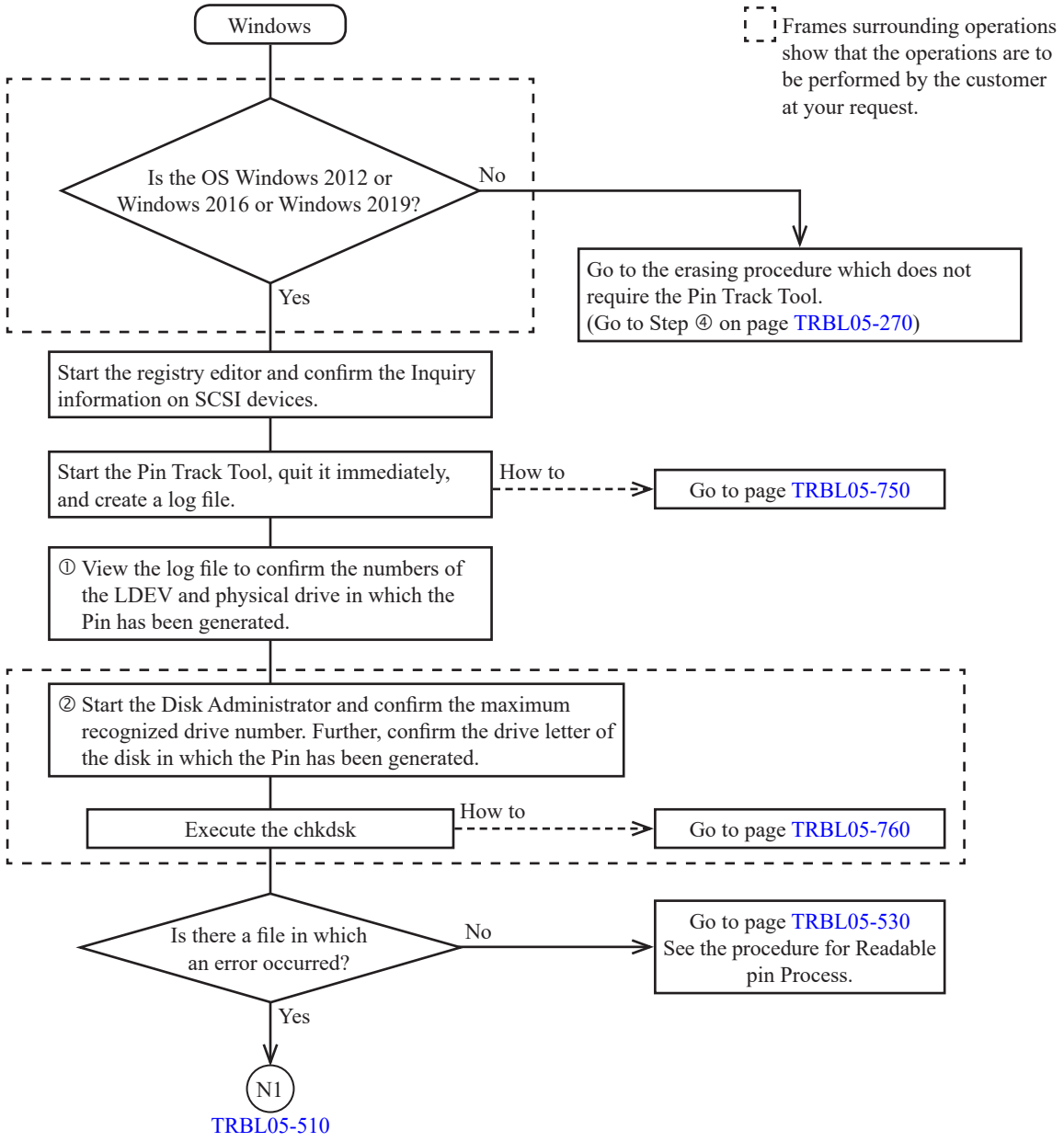
If a pin is left after the data recovers, erase a pin by the Pin Track Tool.
The most important thing is to execute the recovery function in the DB software.

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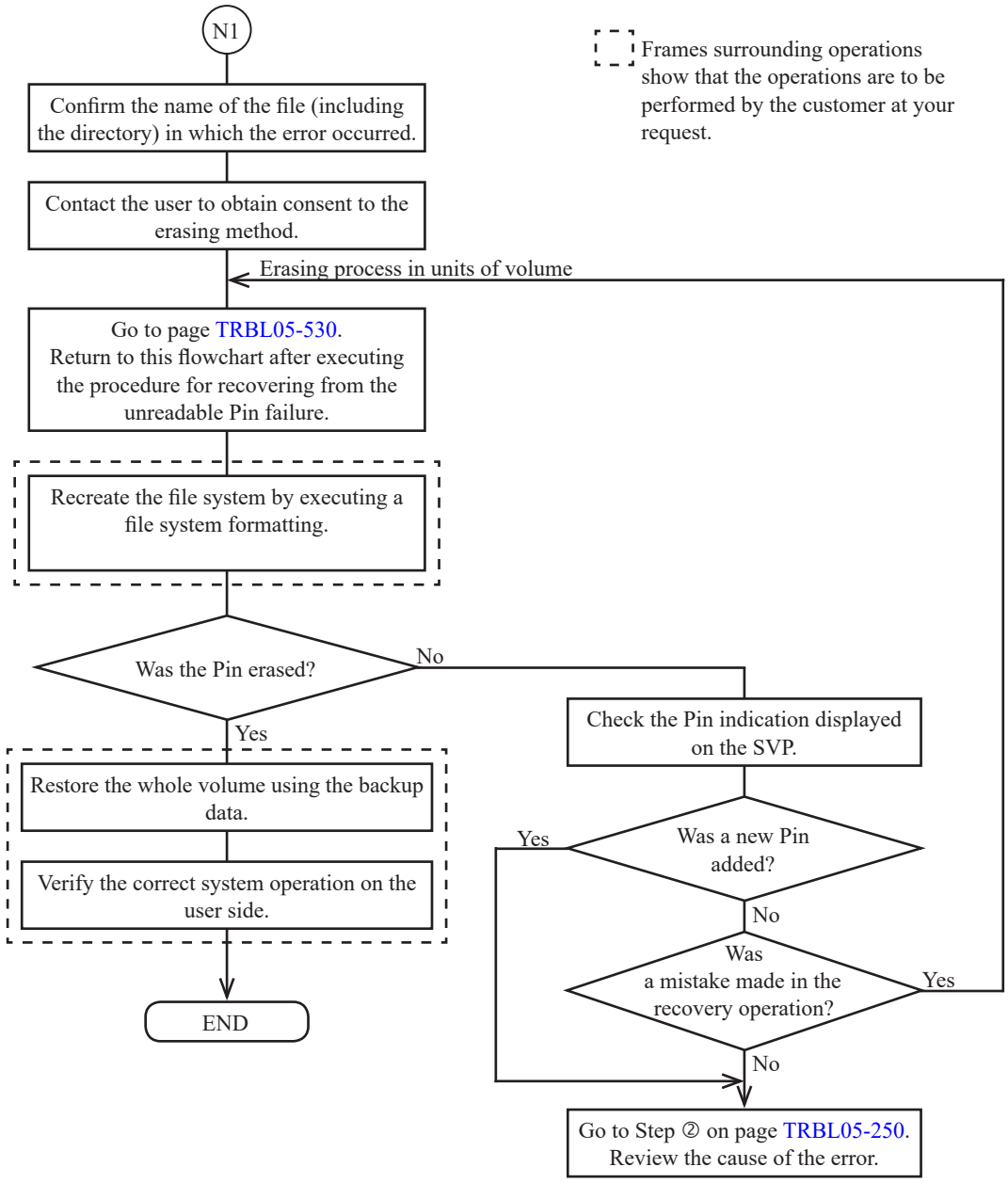
5.2.3.2 Procedure on Windows

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

NOTE: Do not use the Help menu in the Pin Track Tool window because it is not supported.



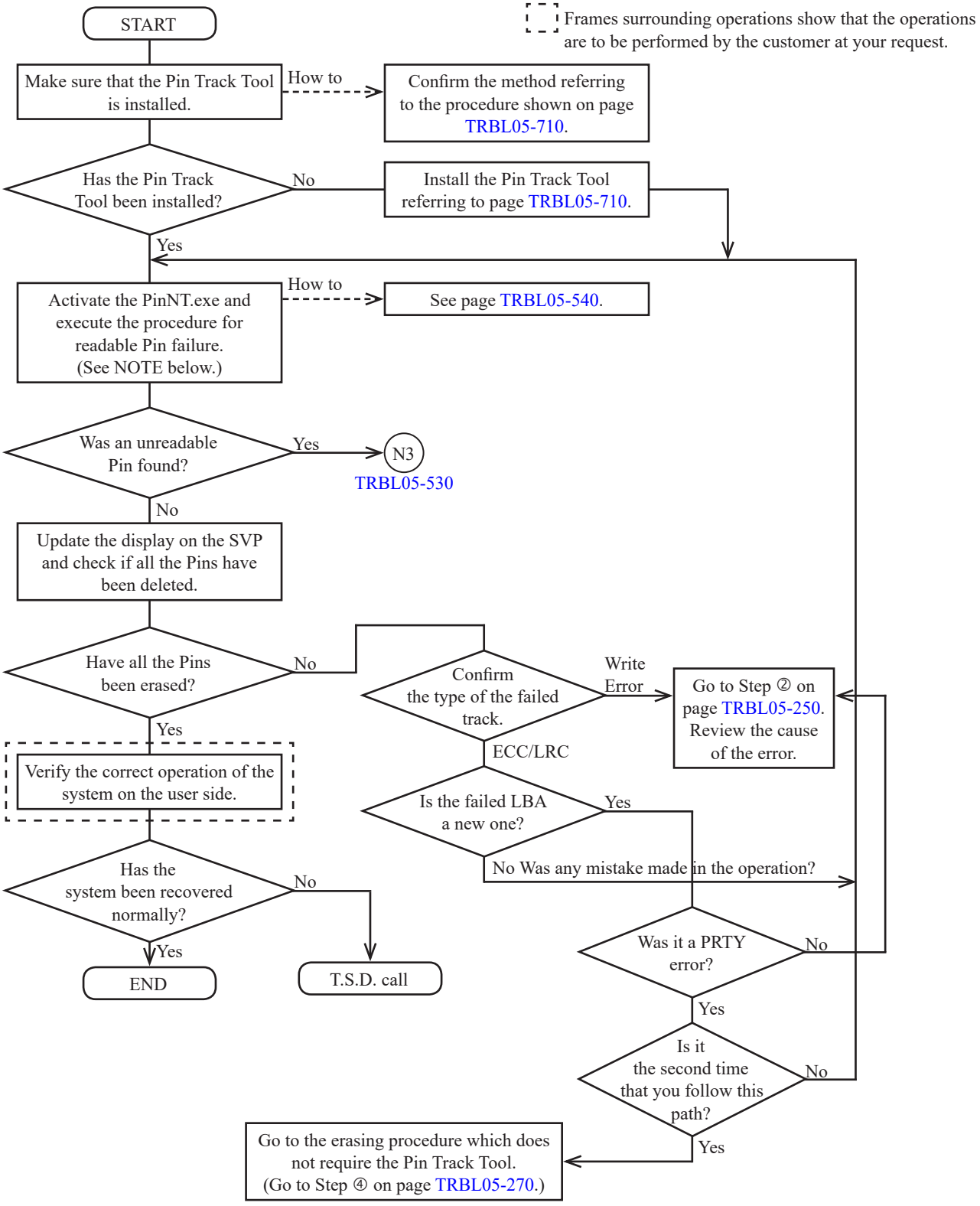
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NOTE: When the Chkdsk is executed, the sector (equivalent to one LBA) with a Pin failure is treated as a faulty sector.
Therefore, the effective capacity is decreased because the sector is treated as an unusable one under the control of Windows even 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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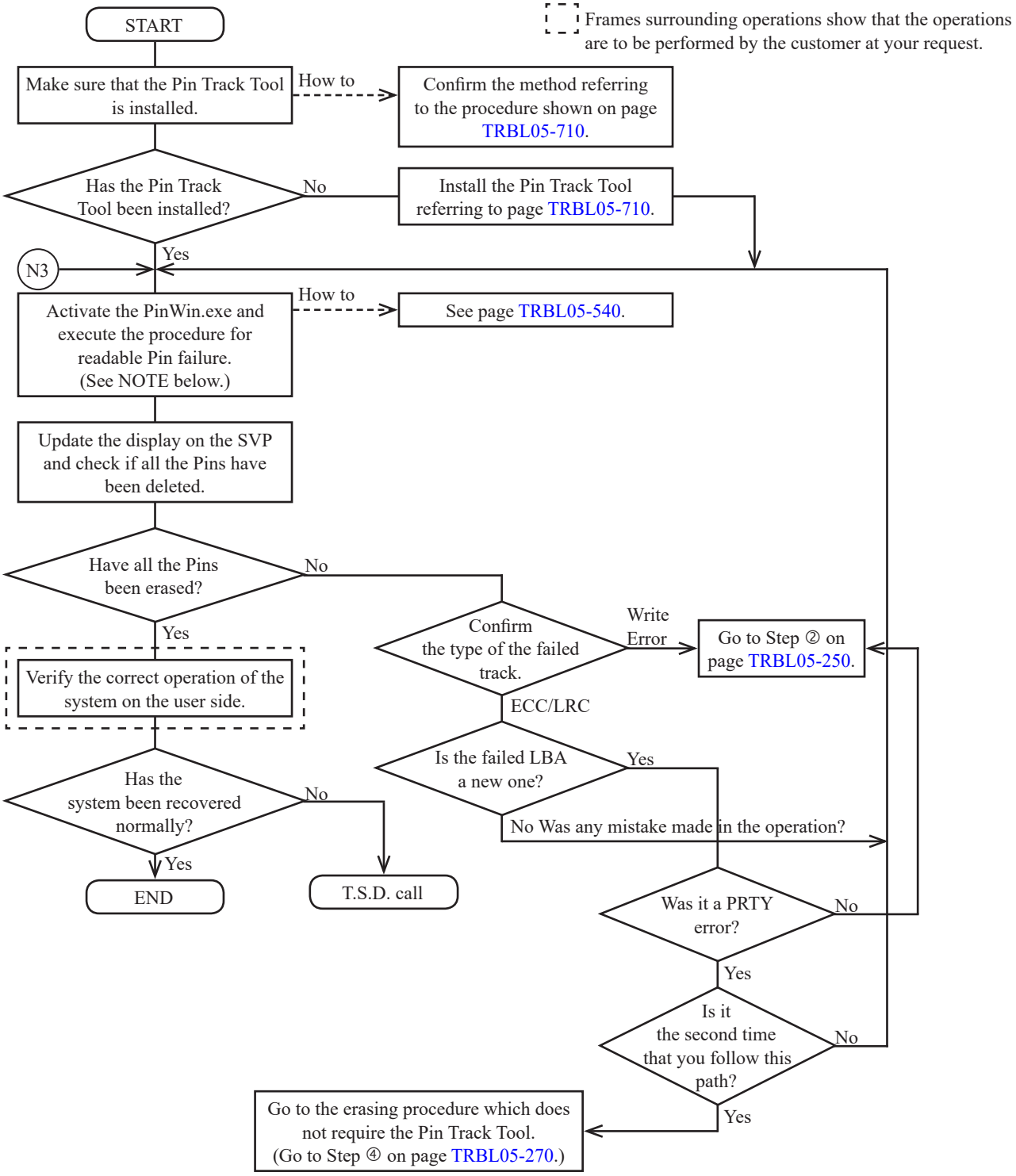
Unreadable Pin Process (Windows)



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.

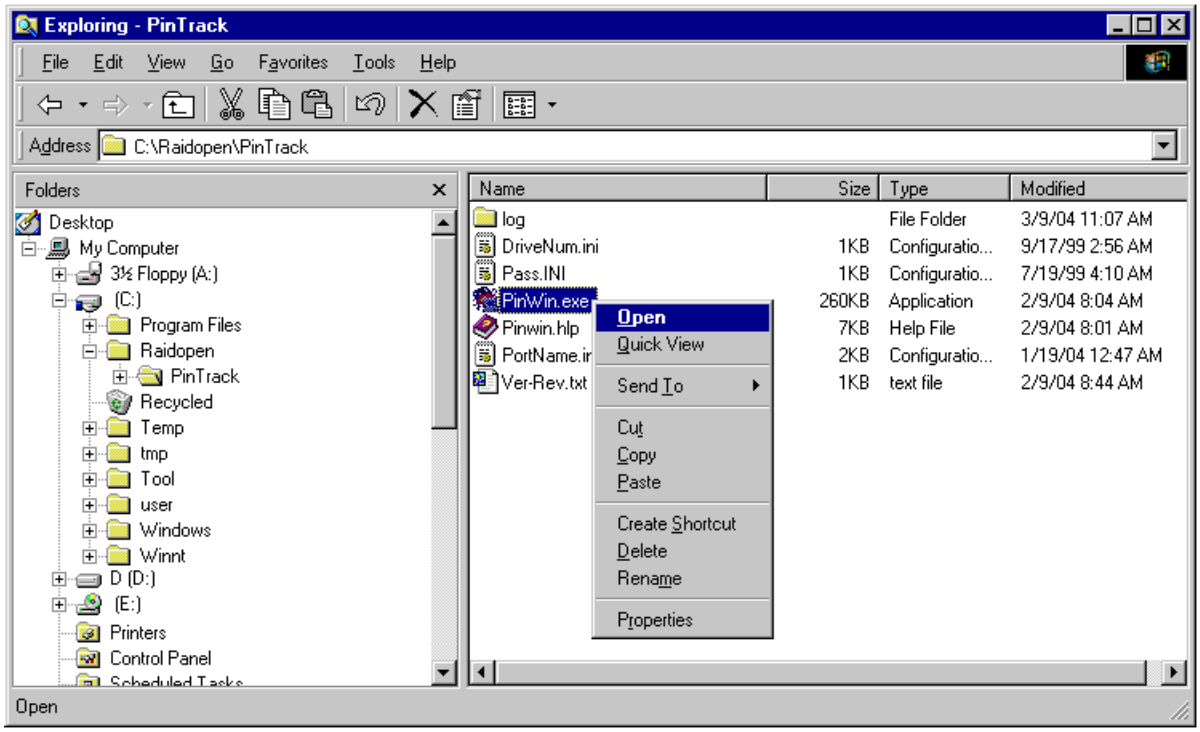
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Operation of Readable Pin Process (Windows)

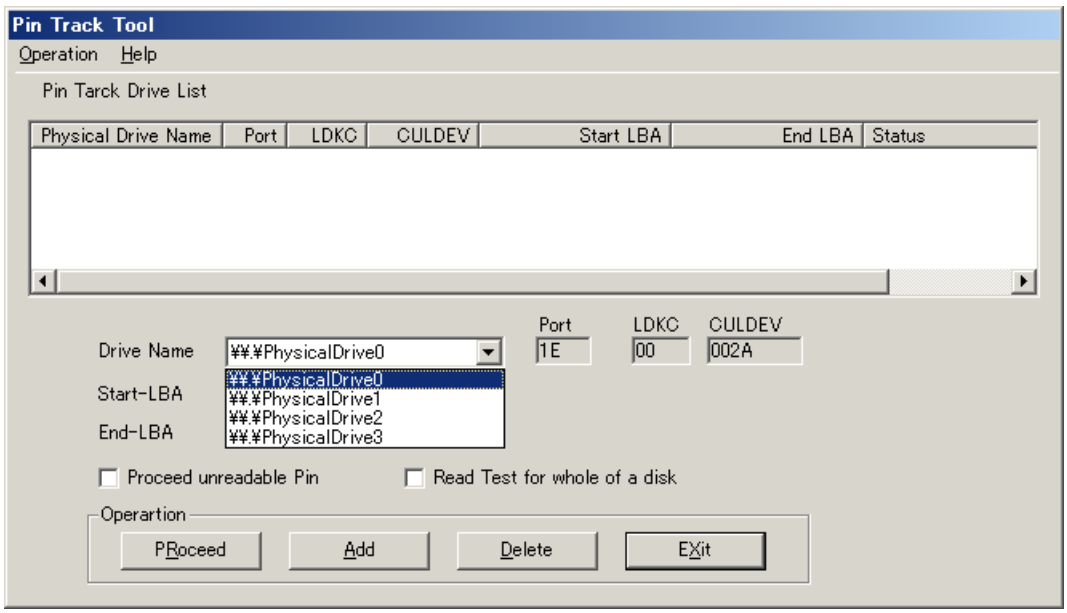
The following explains how to operate the Pin Track Tool for erasing a readable Pin.
The procedure for erasing a readable Pin is to be firstly applied to all types of Pins.
A Pin which cannot be erased by the readable Pin erasing process will be erased by a process which treats it as an unreadable Pin.

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.



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

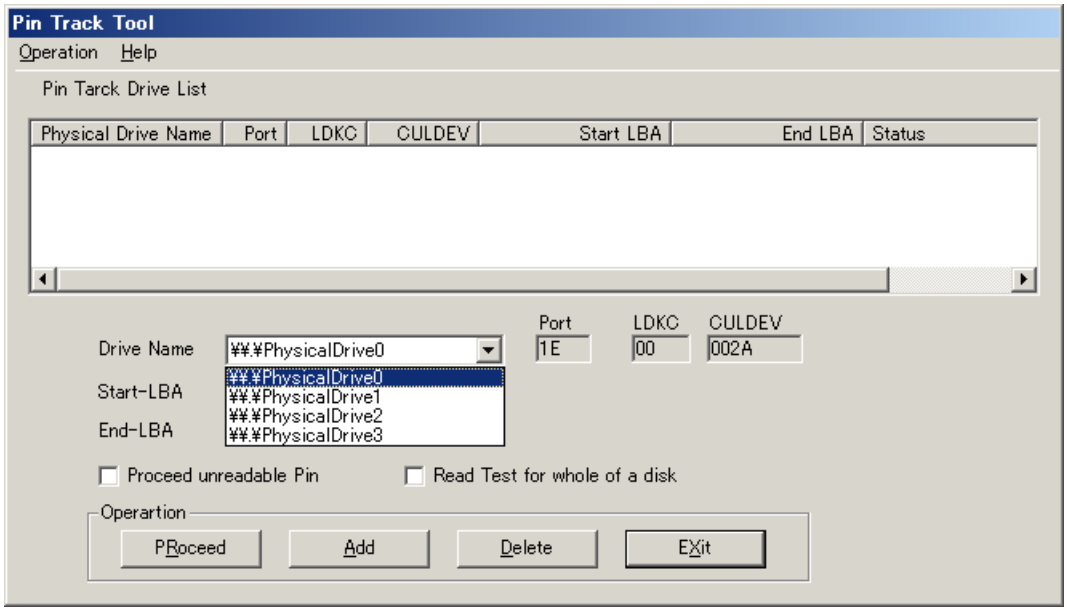


2. Input the information, which has been got from the SVP, on the device from which the Pin is to be erased.

   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.

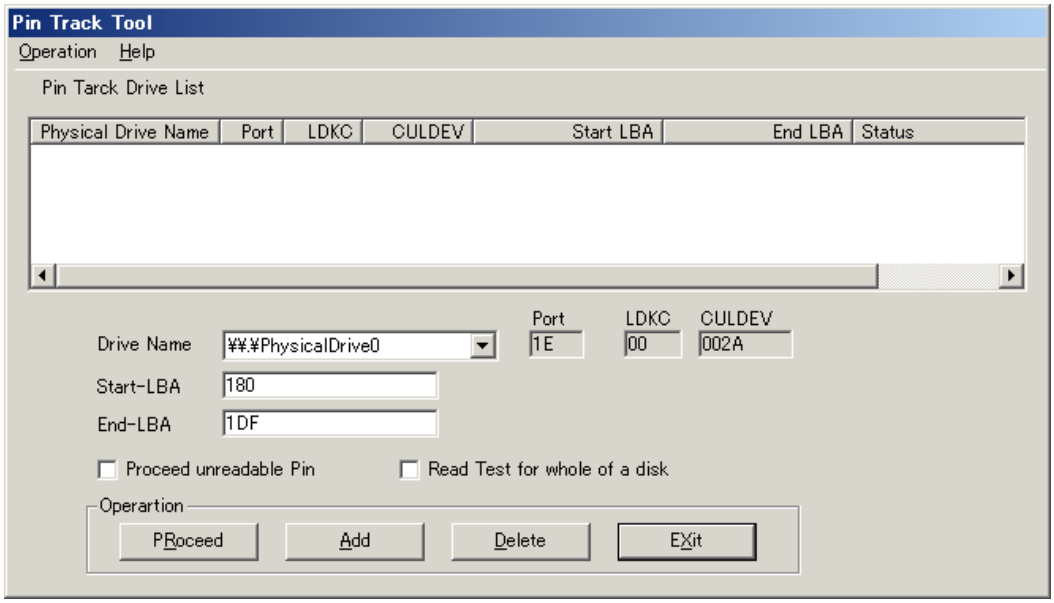
- Select a physical drive for which the LDEV number of the device in which the Pin has been generated is displayed using an acquired port number (e.g. 1J for CL1J).



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.

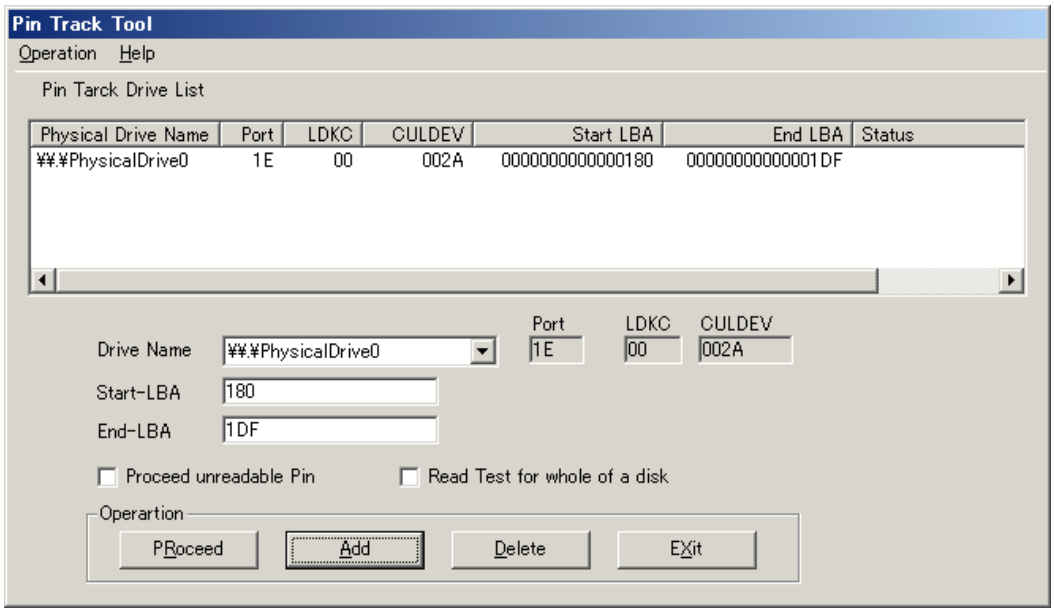


- When specifying the LBAs, the allowable range for them is as follows.
  [End LBA - Start LBA ≤ 0x1FF]

  Input the range of the or 0x1FF shown on the SVP.

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

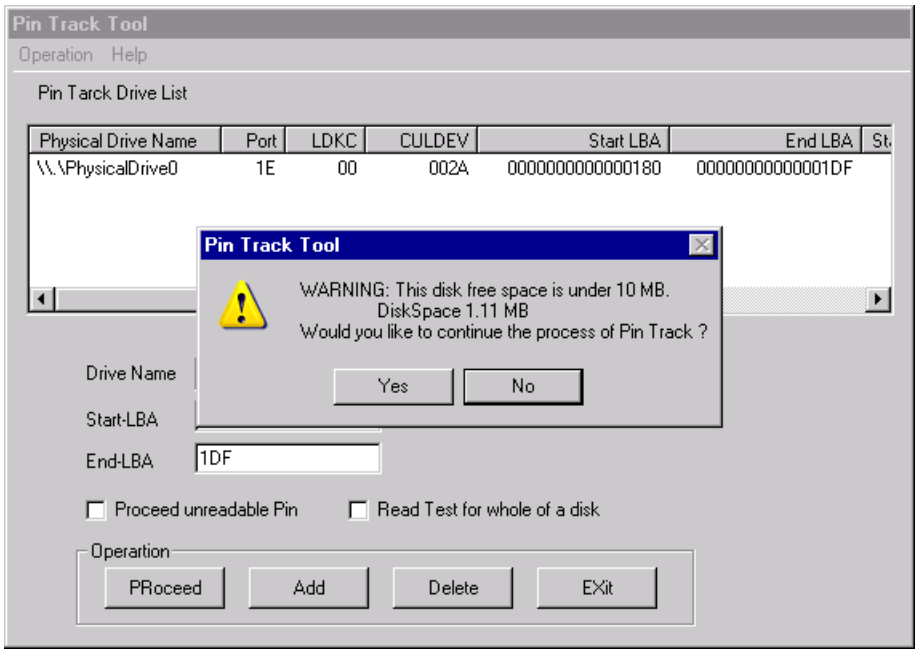


4. Erase the readable Pin.
   - Check if the input information is correct. When correcting it, select the device and input the LBA over again by selecting the item concerned from the list and clicking [Delete].
   - When you want to add two or more devices, you can do it by repeating the input.
     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.

- When no wrong input is found, click [PRoceed] to erase the readable Pin.

When [PRoceed] 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.

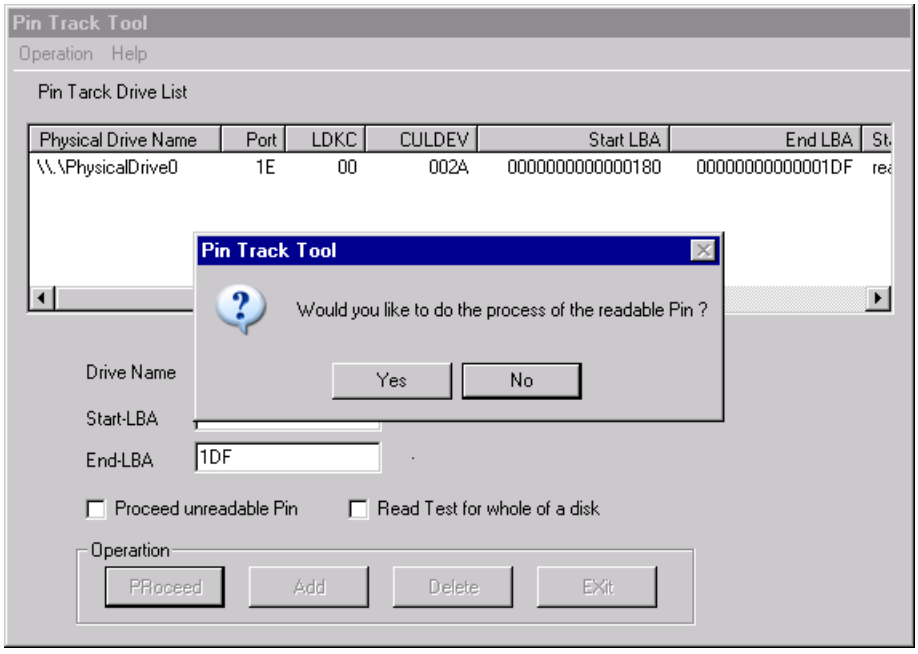
NOTE: Install the program in a drive in which the enough free area can be ensured.

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 [PRoceed] is clicked to continue the processing, the status of each drive is displayed in the main window and the following dialog box is displayed.

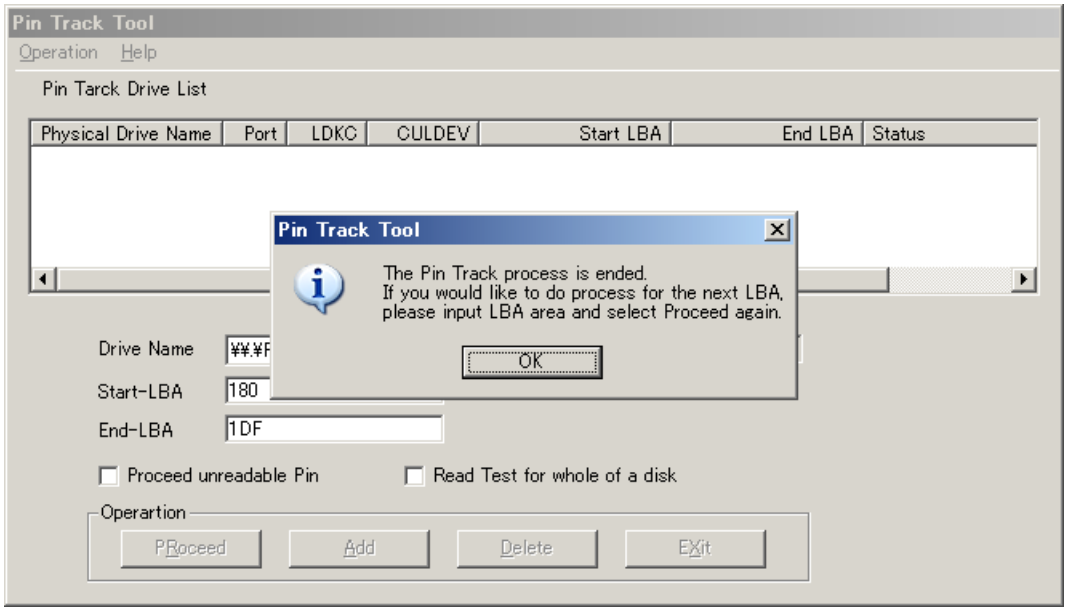


When “readable-pin” is displayed in the “Status” column, it shows that the slot is a readable Pin.
When “Unreadable-pin” is displayed in the “Status” column, it shows that the slot is an unreadable Pin.

- Update the display on the SVP 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 [No] to return to the main window.
  When the Pin has not been erased, click [Yes] 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.

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- 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

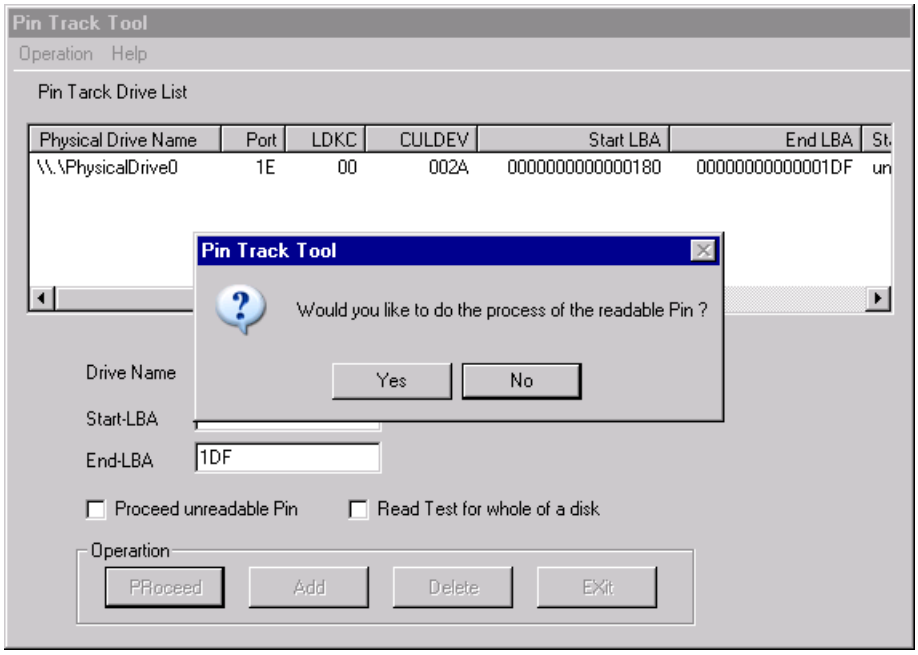
2000/03/27 13:23:13
\\.\PhysicalDrive9,Start LBA=0000000000000180,End LBA=00000000000001DF,The Pin Track
process is completed.
2000/03/27 13:23:48 Pin Track Tool is exited.
```

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 SVP 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 [PRoceed] 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.

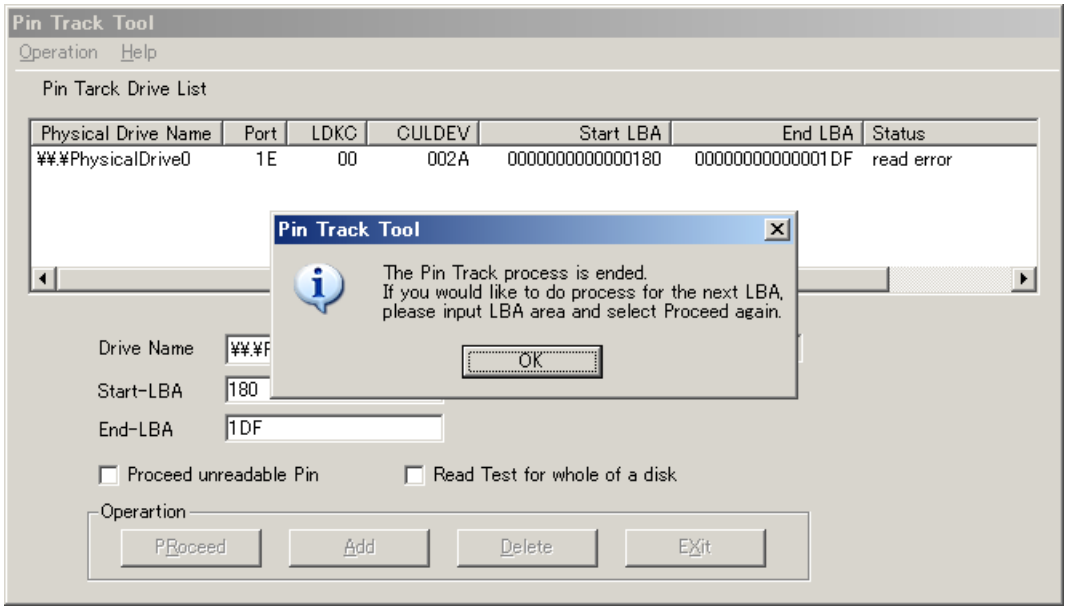
¥¥.¥PhysicalDrive0
    No information
¥¥.¥PhysicalDrive1
    Product Serial No information
    Port Number NG
    LDKC Number NG
    LDEV Number NG
    Disk Capacity 0 bytes
    Maximum LBA FFFFFFFFFFFFFFFF

¥¥.¥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.



When the status is changed to “read error” and the device remains in the list, go to Subsection TRBL05-650, “Operation of Unreadable Pin Process”.

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Operation of Unreadable Pin Process (Windows)

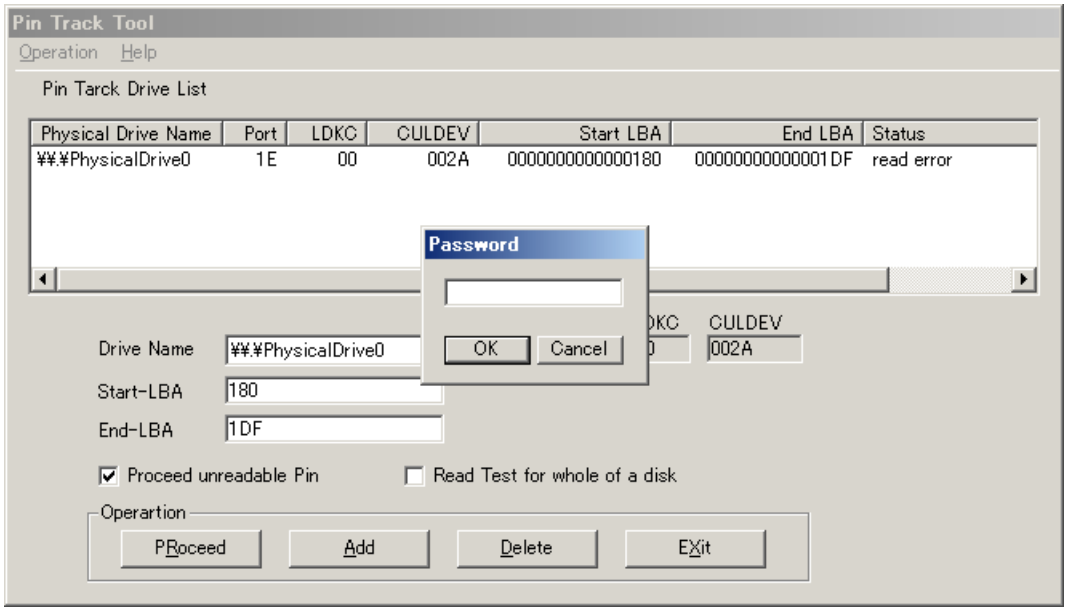
The following explains how to operate the Pin Track Tool for erasing an unreadable Pin. Since the procedure for erasing a readable Pin is to be applied to all the Pins first,
follow the procedure below after executing the procedure given in Subsection TRBL05-540, "Operation of Readable Pin Process".

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 SVP.

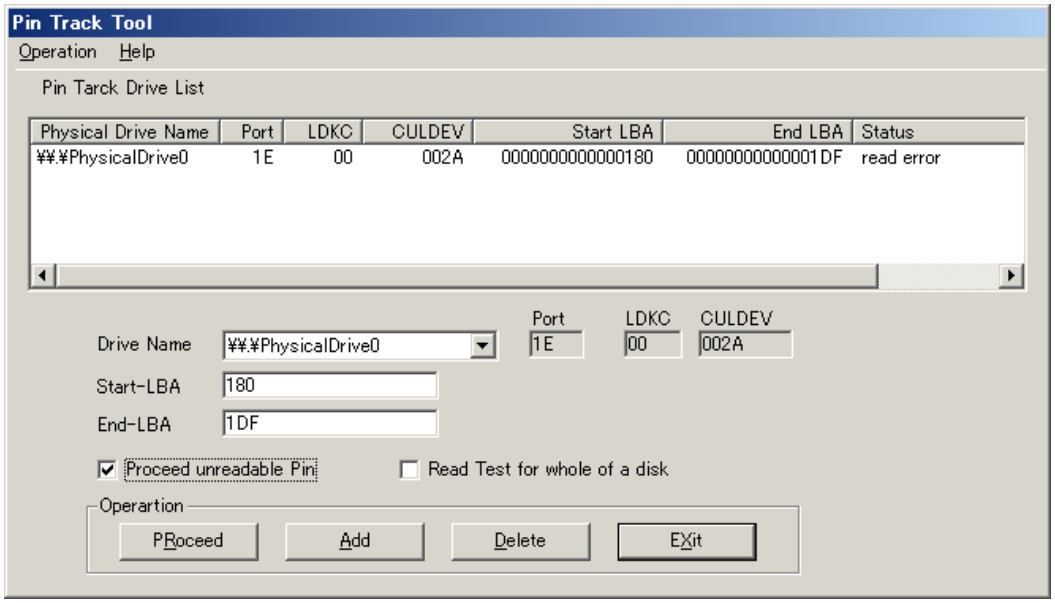
3. Specify the unreadable Pin erasing process.
After confirming that the input information is correct, check off the check box of the Unreadable Pin.
When it is checked off, the password dialog box is displayed.



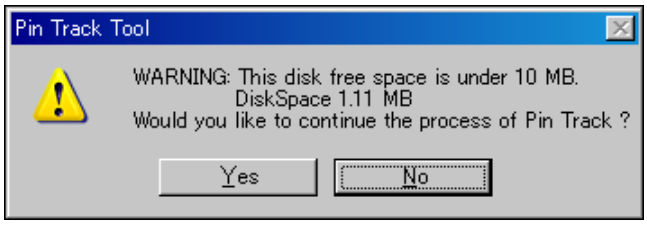
The password is to be obtained from the Technical Support Division. Without the password, the unreadable Pin cannot be erased.
Input the password and click [OK].
When the correct password is input, the check box is checked off.

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.

4. Erase the unreadable Pin.
   • Check off the check box. When no wrong input is found, click [PRoceed] to erase the unreadable Pin.



When [PRoceed] 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.

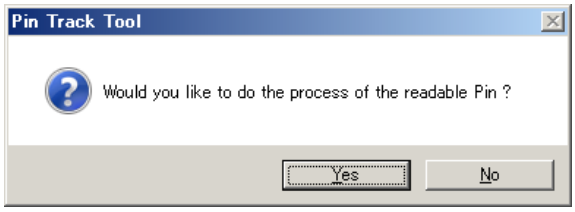
NOTE: Install the program in a drive in which the enough free area can be ensured.

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.

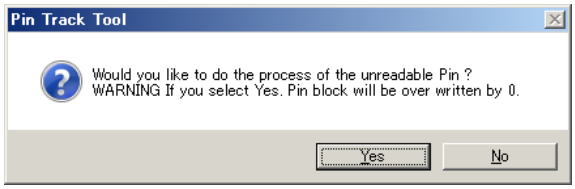
When “No” is selected, the routine is returned to the main window. If the option has been checked off, it is cancelled. Ensure a free area in the drive, put the collected log file in order, or install the program in another drive.

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When [PRoceed] is clicked to continue the processing, the following dialog box is displayed.

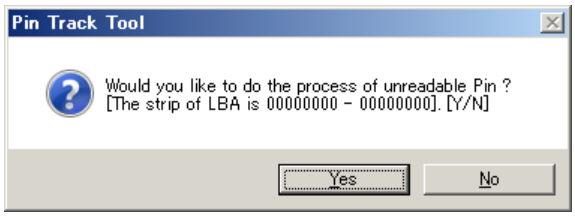


Try to erase the readable Pin first. When the readable Pin Track process cannot be executed when the “Yes” is clicked here, the following dialog box is displayed.



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.

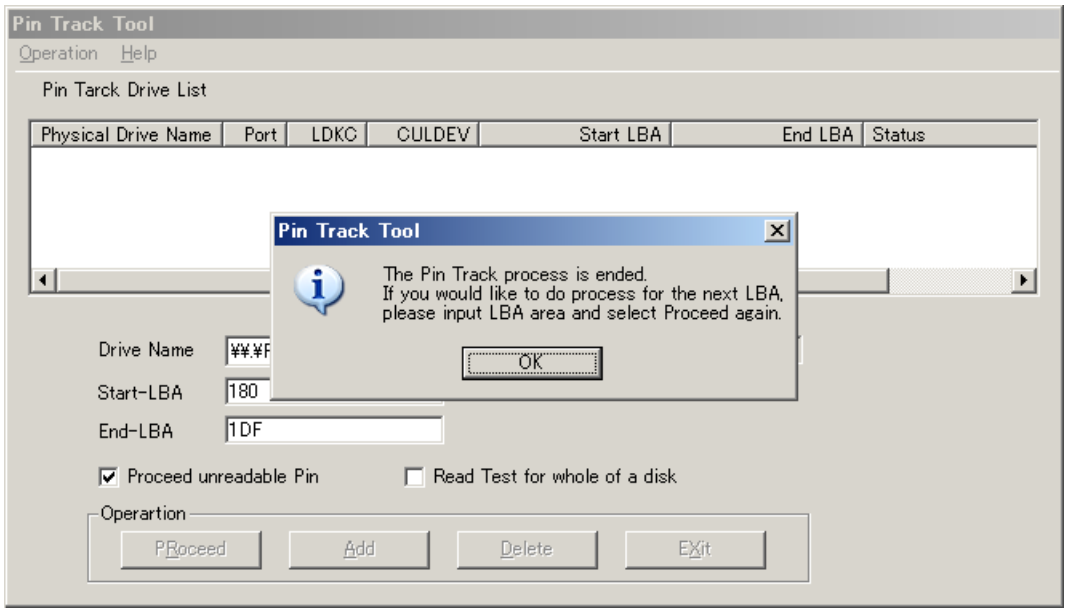
In case of the unreadable pin erasing operation, Confirmation of execution is demanded every contents in the pin track drive list. Operator can select execution or cancellation for each operation.



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- Update the display on the SVP 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 [No] to return to the main window.

- When the Pin has not been erased, click [Yes] to erase the unreadable Pin. When "Yes" 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 SVP to confirm that the Pin has been erased.

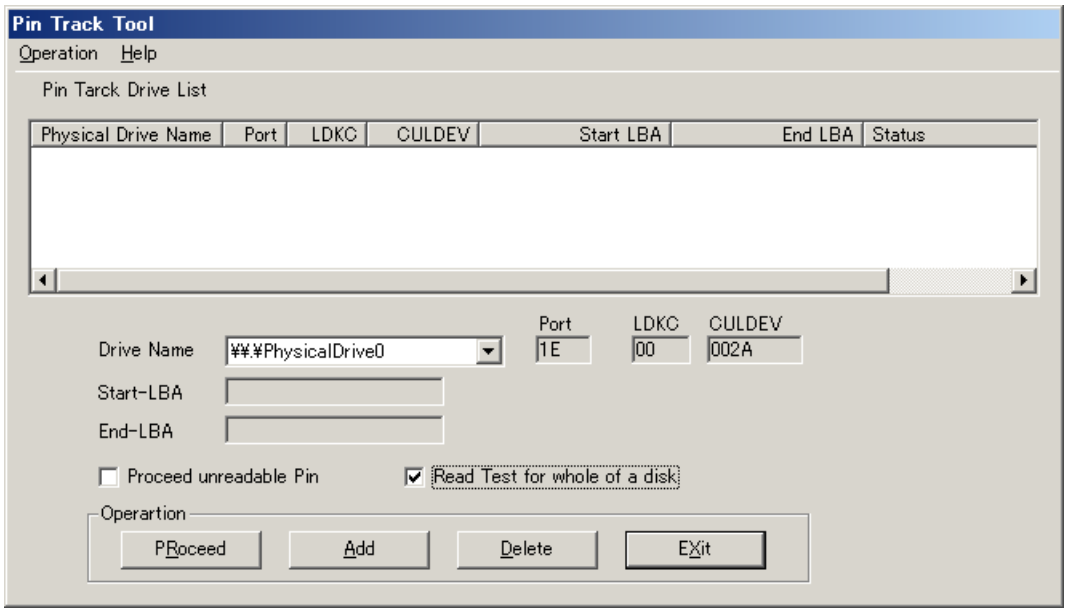
6. When you proceed another Pin successively, repeat the "Operation of Readable Pin Process" in TRBL05-540.

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

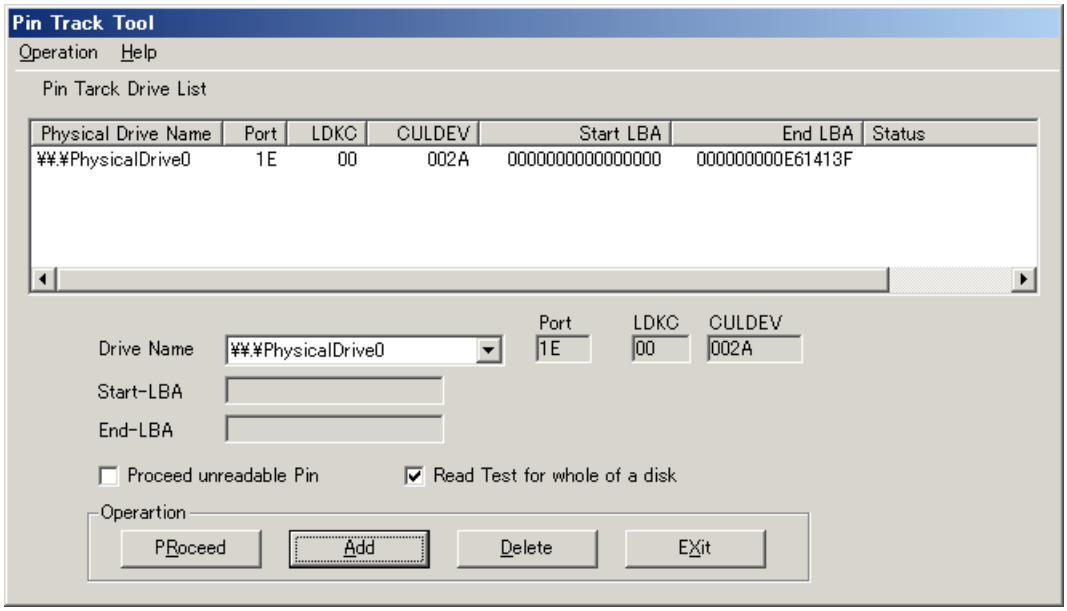
This chapter describes how to discover the Unreadable Pin on select device.
This processing requires long time.

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 [Add], 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].
(This function is only reading and writing is not performed.)

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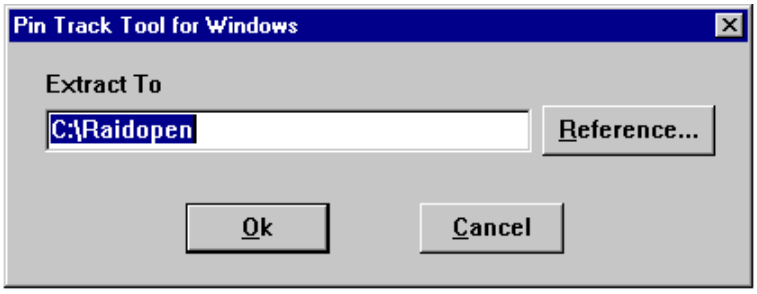
Installation of Pin Track Tool (Windows)

NOTE: Perform the installation only when it is required.

<Preparation>
The Pin Track Tool is provided being contained in one 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.

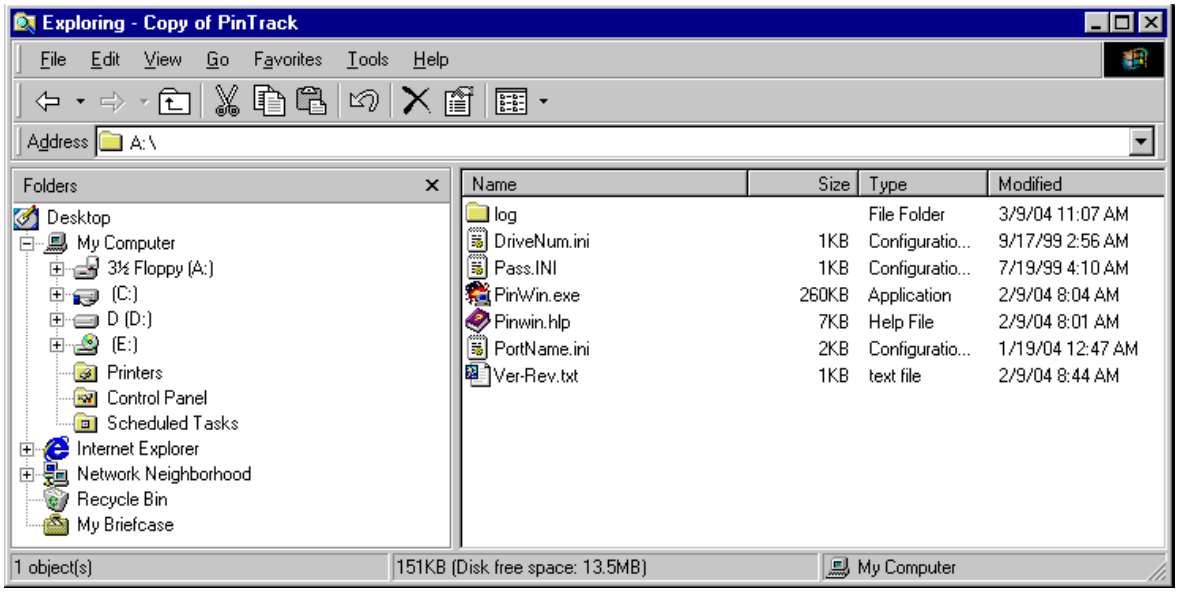
<Copying from floppy disk to local disk>
1. Logon to the Windows system as administrator permission.
2. Execute the Explorer, and open the CD-ROM.
   (Path example : X:\Program\Ment\PINTRACK\WIN\)

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



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

- 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”.

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.

<Variation of device information>

The display in the log file varies depending on the storage system configuration.

For the HITACHI Specification

```
\\.\PhysicalDrive14
Product Serial HITACHI 5033ABE000C
Port Number 2N
LDKC Number 00
LDEV Number 000C
Disk Capacity 2461040640 bytes
Maximum LBA 000000000049583F
```

The “LDEV Number” is the intact “Product Serial” expressed in hexadecimal.

For the OEM Specification

```
\\.\PhysicalDrive13
Product Serial R500 50315038 0012
Port Number 1J
LDKC Number 00
LDEV Number 000C
Disk Capacity 1874903040 bytes
Maximum LBA 000000000037E05F
```

The “LDEV Number” is the “Product Serial” converted from decimal to hexadecimal.

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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 [Start]F.
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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5.2.3.3 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 SVP, 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 SVP 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

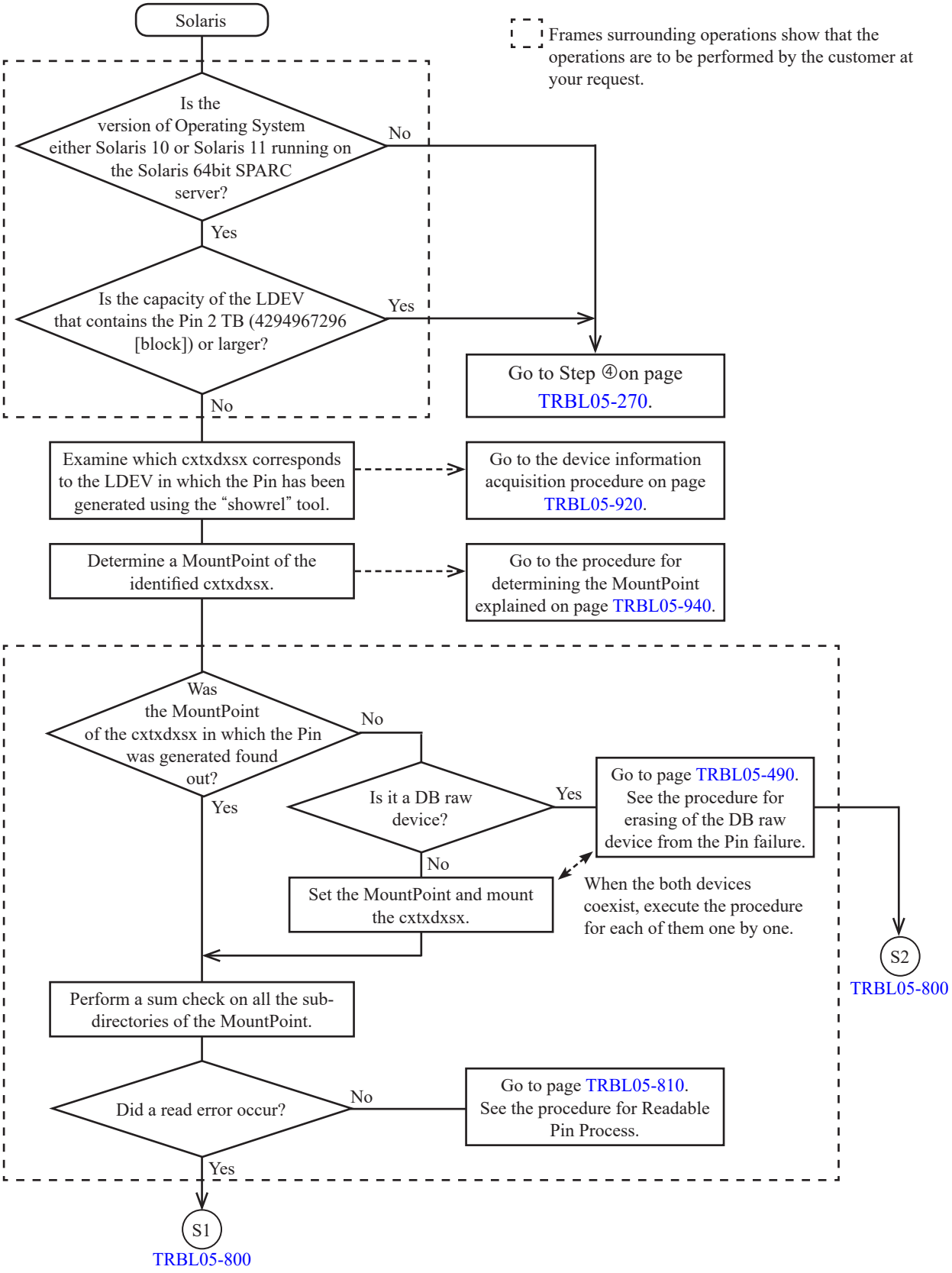
(Continued from the preceding page)

- 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.

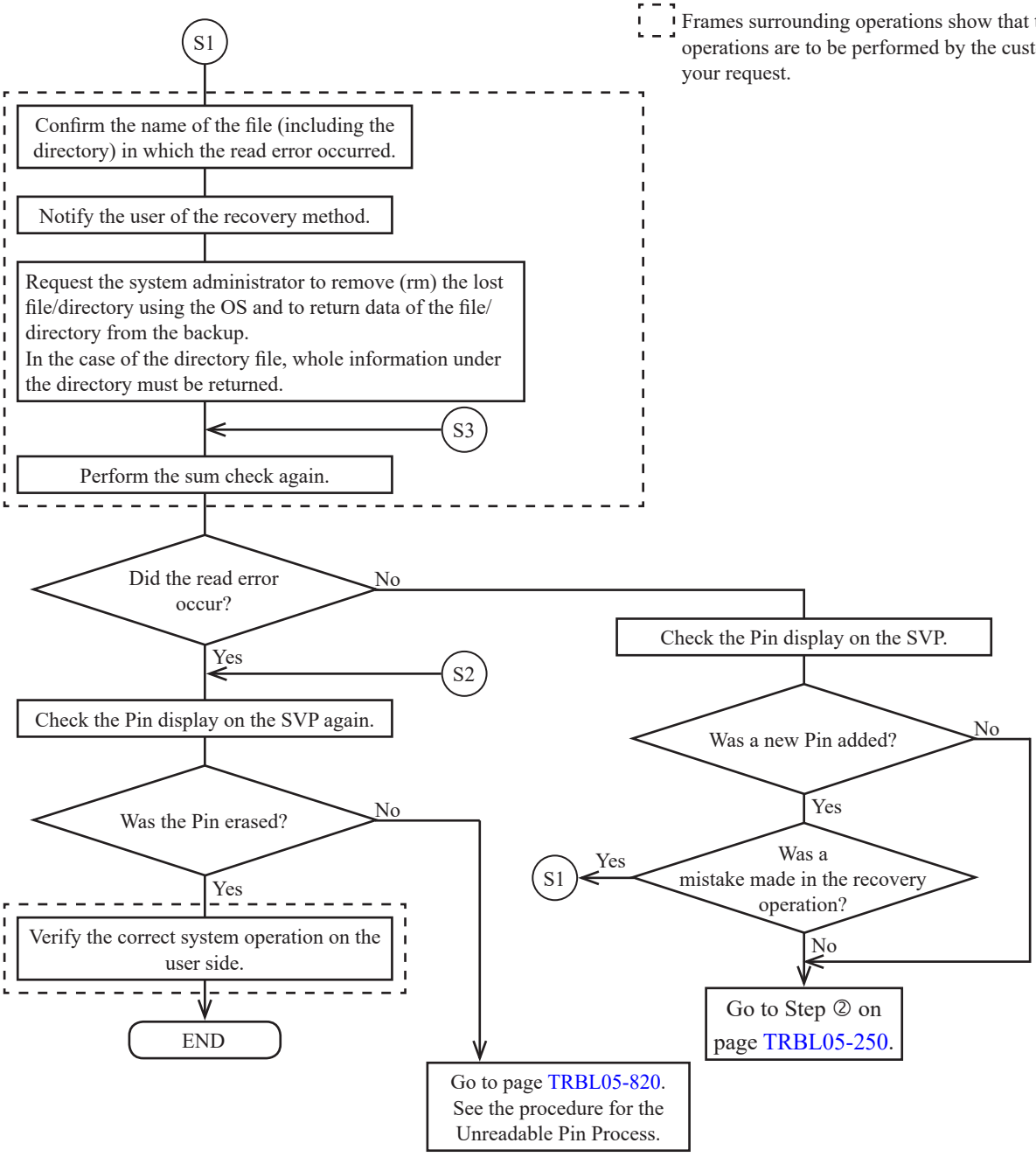
When you have to eliminate the unreadable LBA in the file system on the above conditions, operate according to the flowchart on the following pages.

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

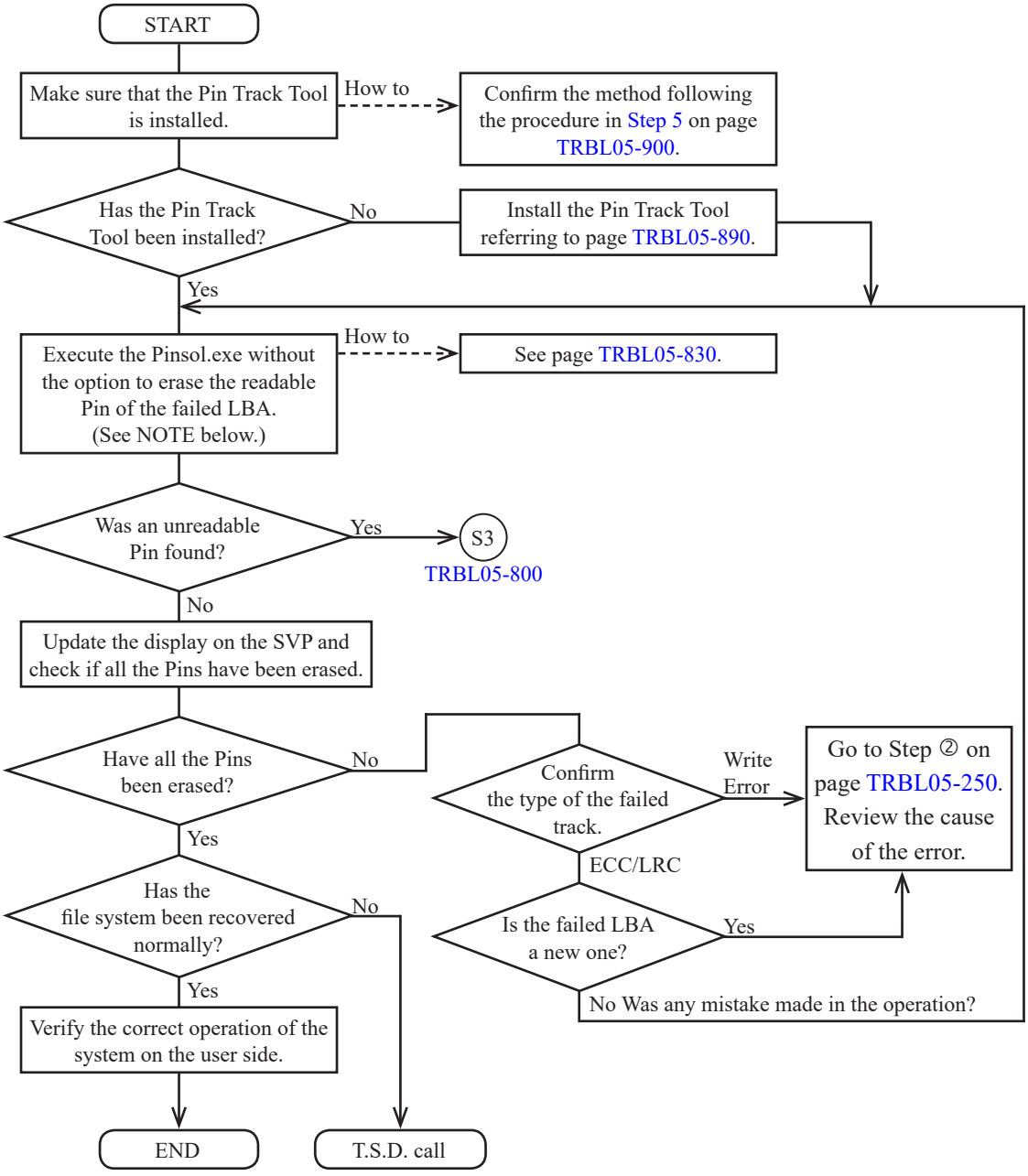


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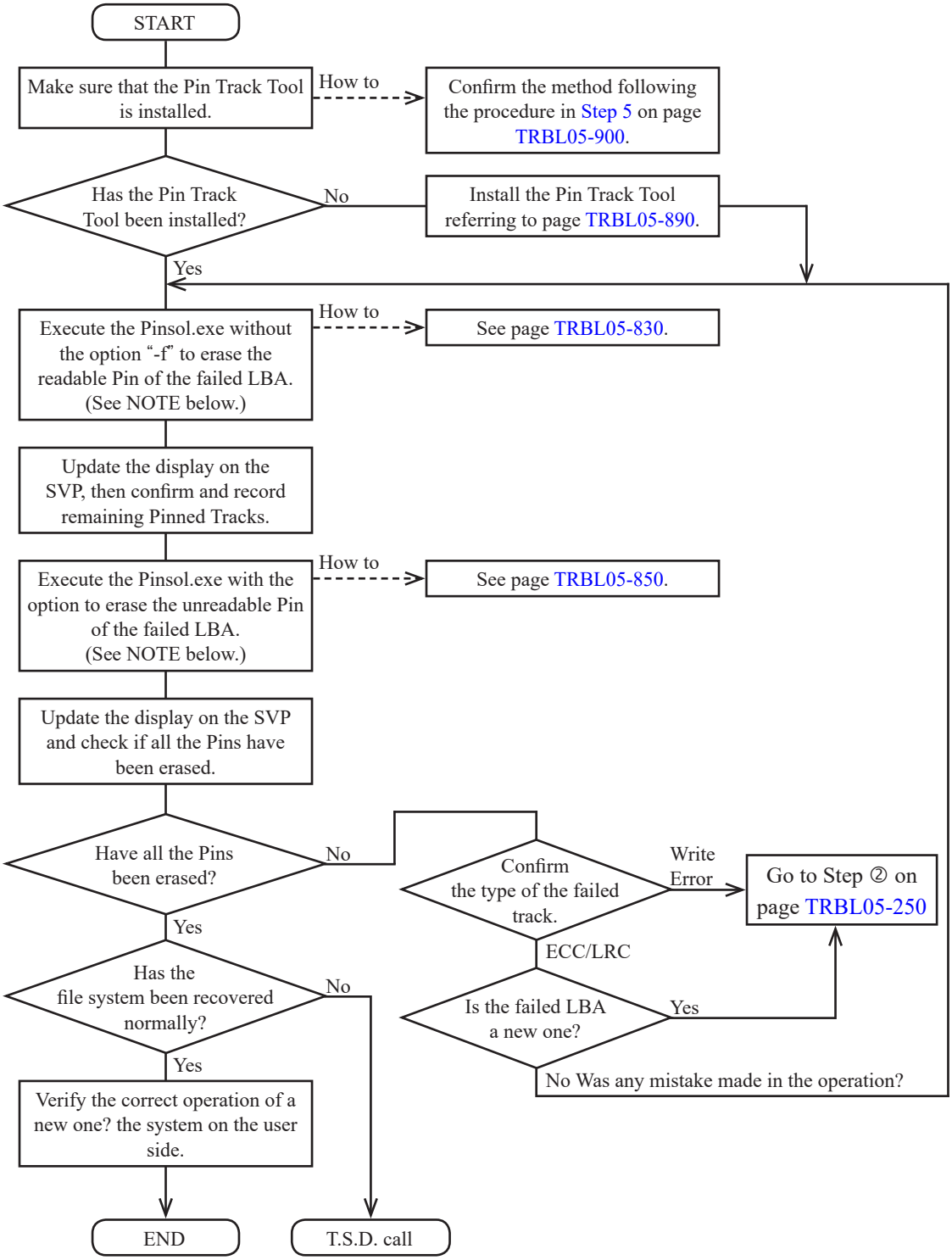
Readable Pin Process (Solaris)



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.

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 SVP 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" TRBL05-920.
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 SVP 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 SVP.
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 SVP 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 TRBL05-850.

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 SVP 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" TRBL05-920.
   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 SVP 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 SVP.
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 SVP 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 SVP.

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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 CD-ROM, 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.
   confirm the label, and copy the files from the distribution medium.
   # volcheck recognize a media
   # tar -xvf /cdrom/zzzz/program/ment/pintrack/solaris/pinsolXX.tar

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

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

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.
```

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.

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 SVP.
Input LDEV -> 000A                        Input the CU:LDEV# shown on the SVP.
Input Start LBA -> 0000000000044000       Input the start LBA shown on the SVP.
Input End LBA -> 000000000004405F         Input the End LBA shown on the SVP.
```

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 SVP 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.

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 SVP 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 SVP 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 TRBL05-920 is used, the LDKC number, and the LDEV number shown on the SVP and to which device file the range between the Start LBA and End LBA corresponds are displayed. Refer to TRBL05-920, “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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5.2.3.4 Procedure on AIX, VMWare ESX, Linux

The following shows how to erase a pin failure on AIX, VMWare ESX, Linux.

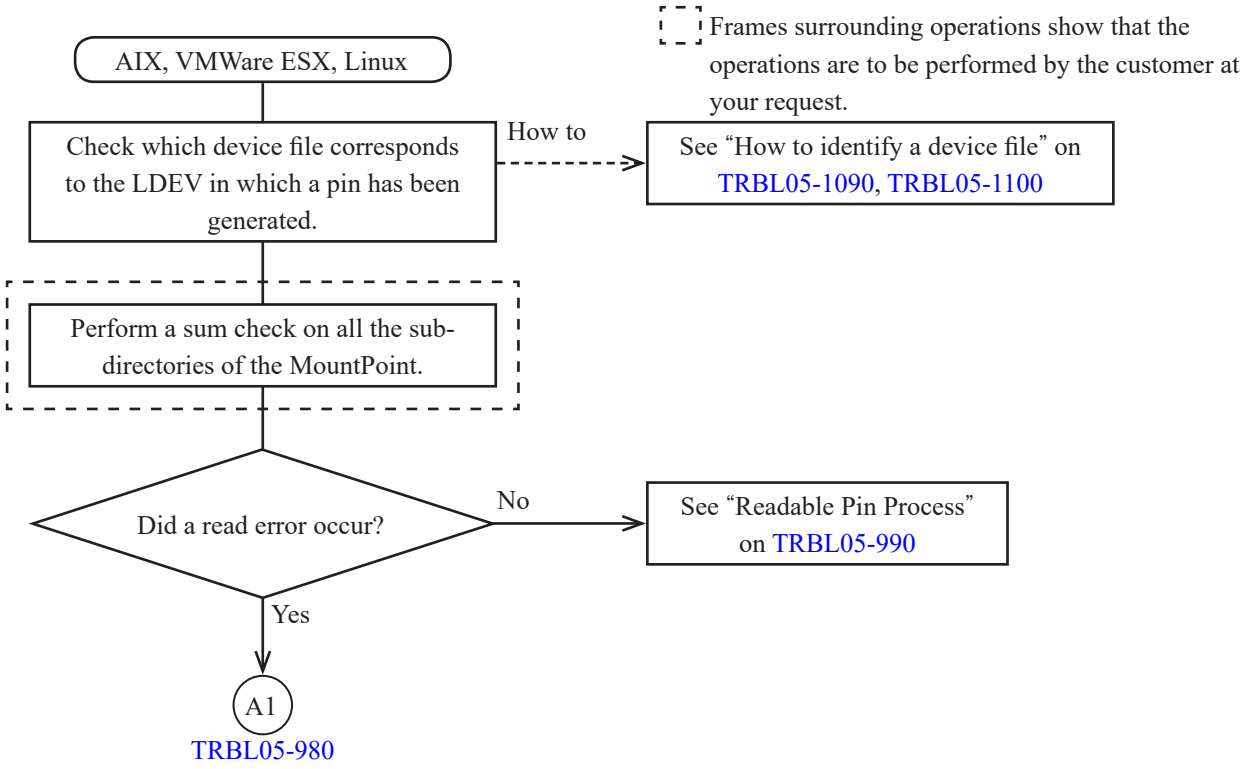
⚠ CAUTION

- 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.

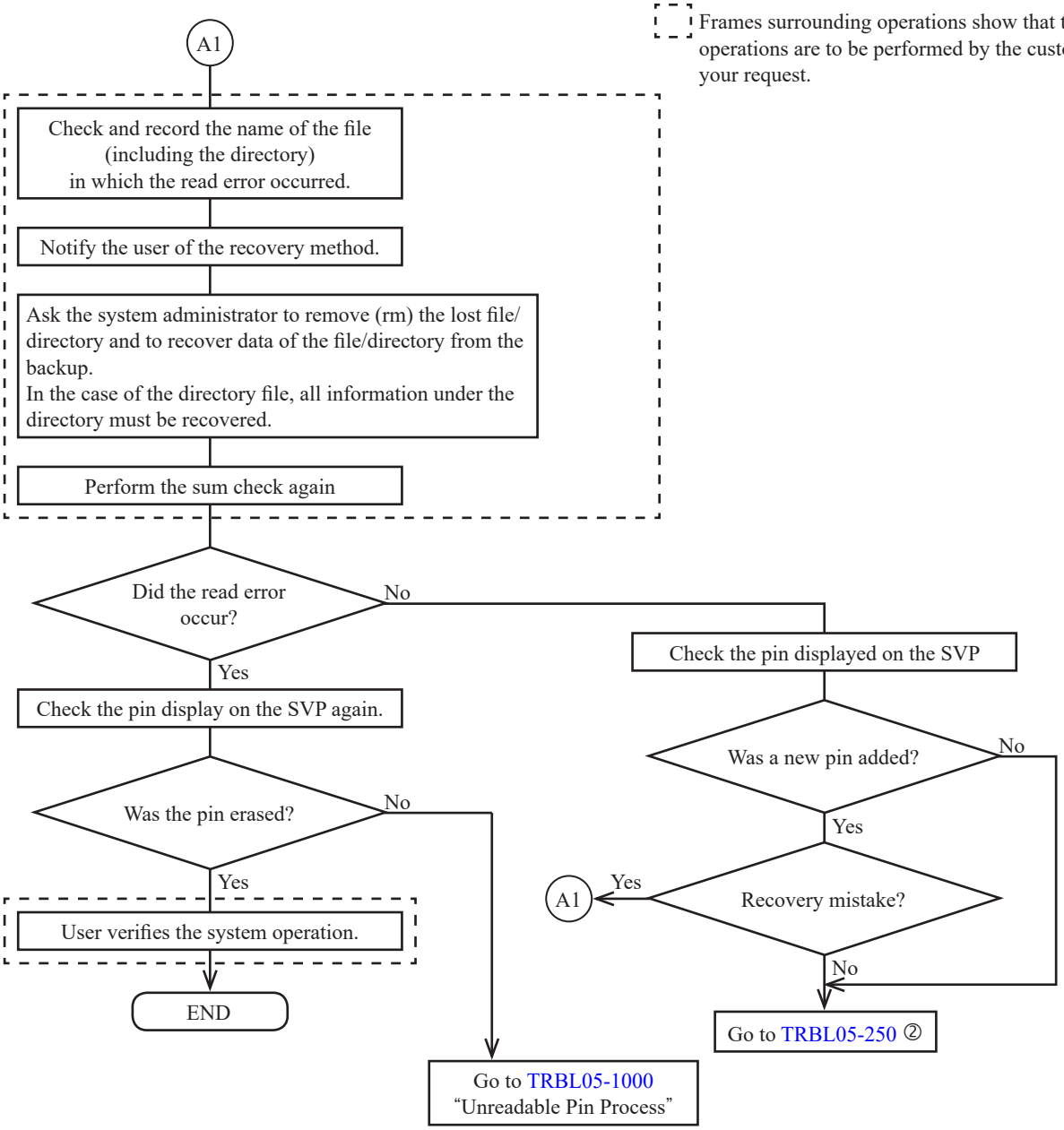
To delete the unreadable LBA in the file system under the above-described conditions, perform operations according to the flowchart on the following pages.

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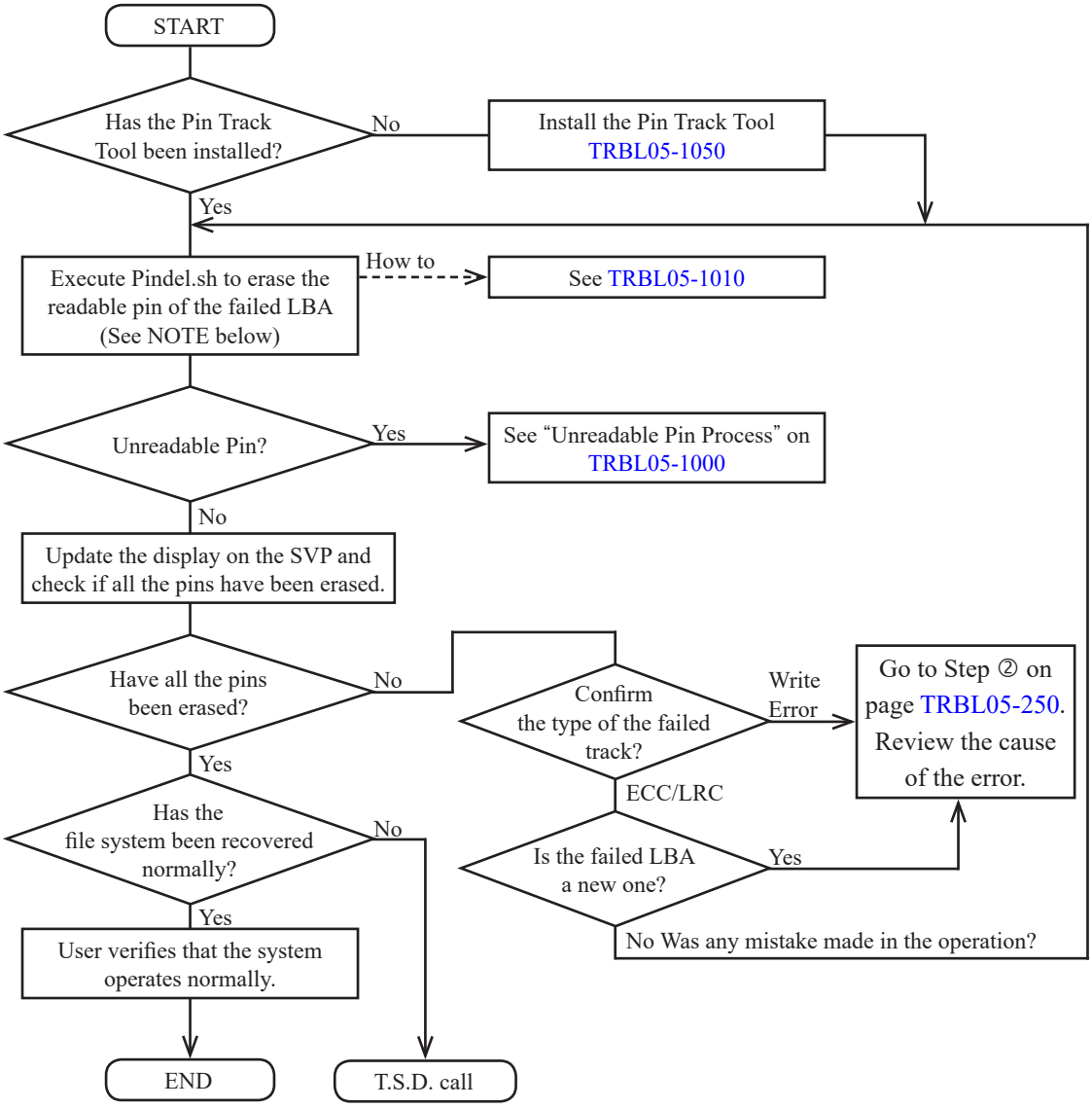
- The flow shows the procedure in the case a pin failure occurs on AIX, VMWare ESX, Linux.



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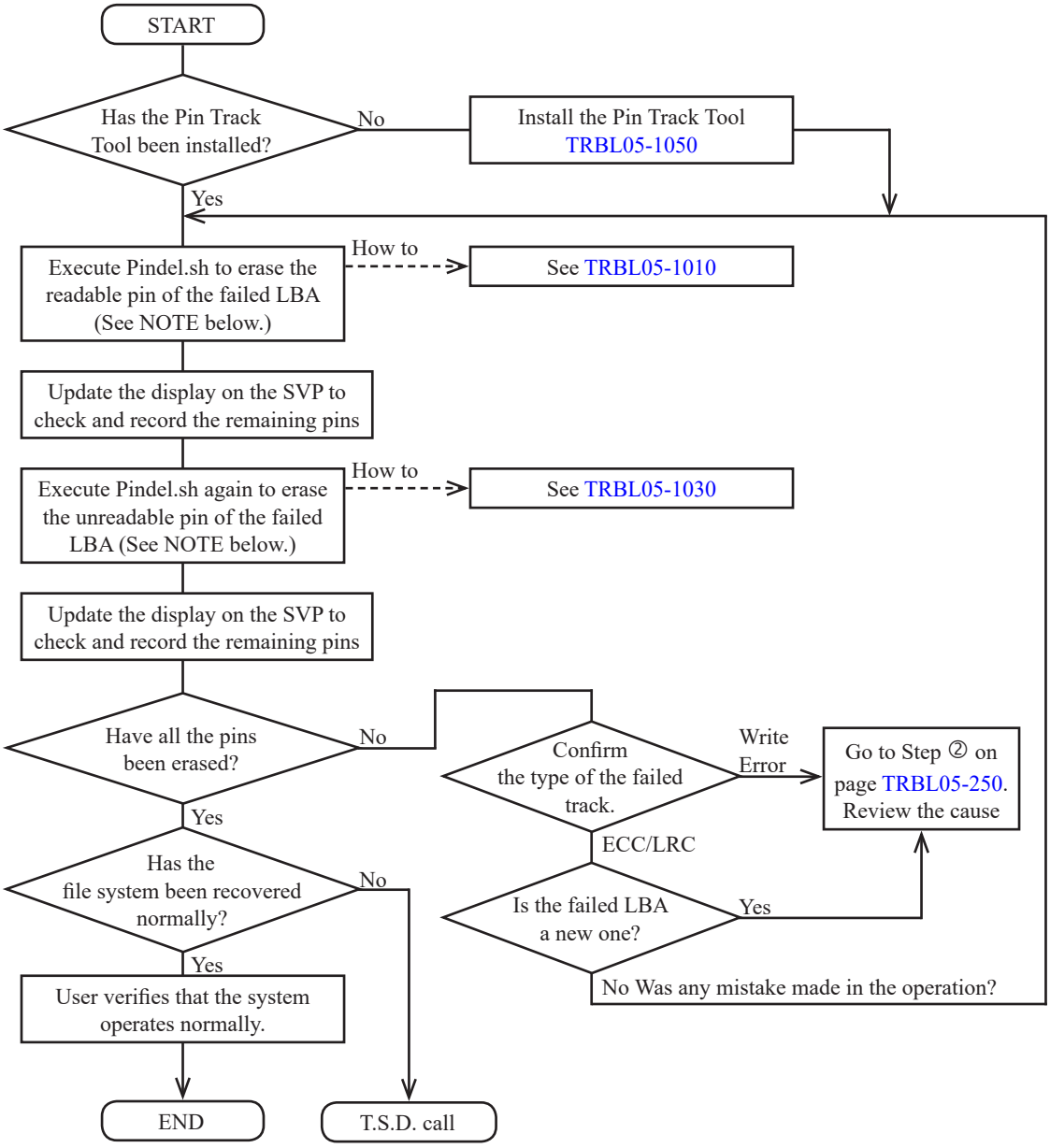
Readable Pin Process (AIX, VMWare ESX, Linux)



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 SVP. See TRBL05-1090 “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 SVP.
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 SVP 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 TRBL05-1030.

```
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 SVP. See TRBL05-1090 “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.

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 SVP.
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 SVP 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 TRBL05-1000 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 CD-ROM, 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

   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 SVP 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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5.2.3.5 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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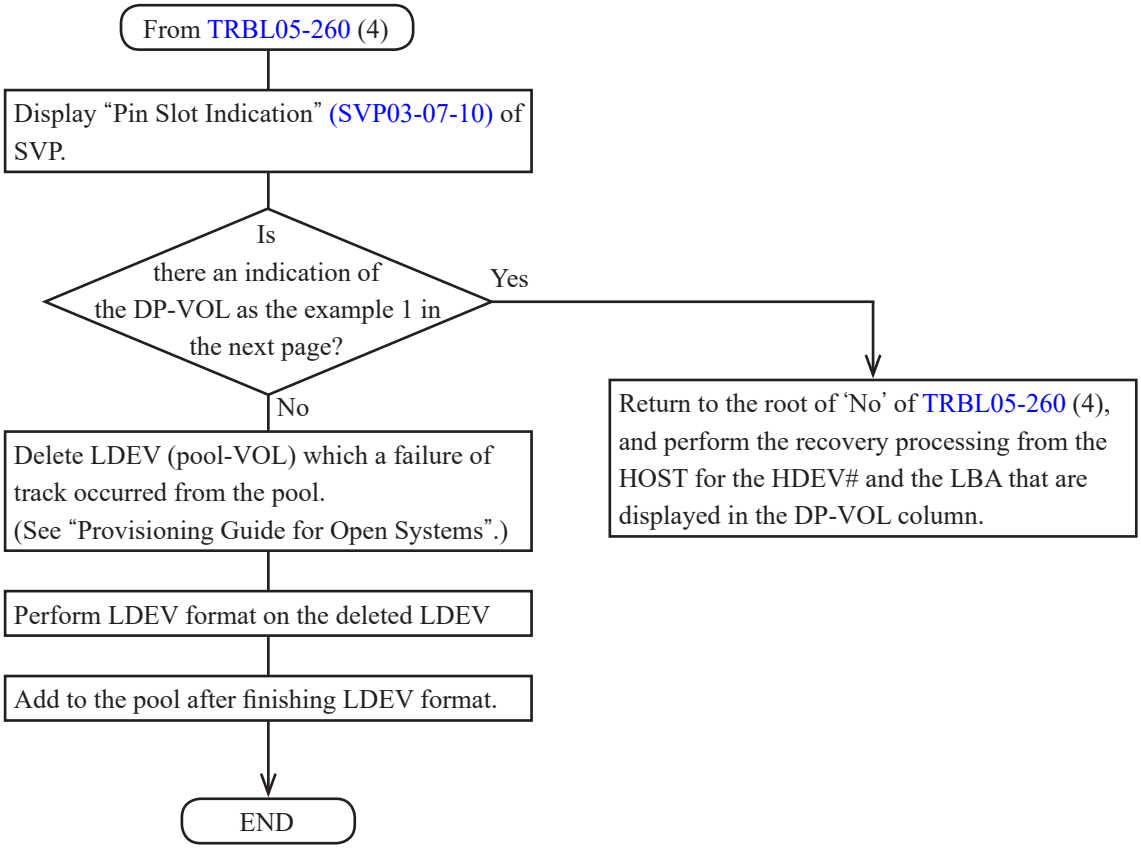
5.2.3.6 ECC/LRC Error Recovery Processing of DP pool-VOL

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.

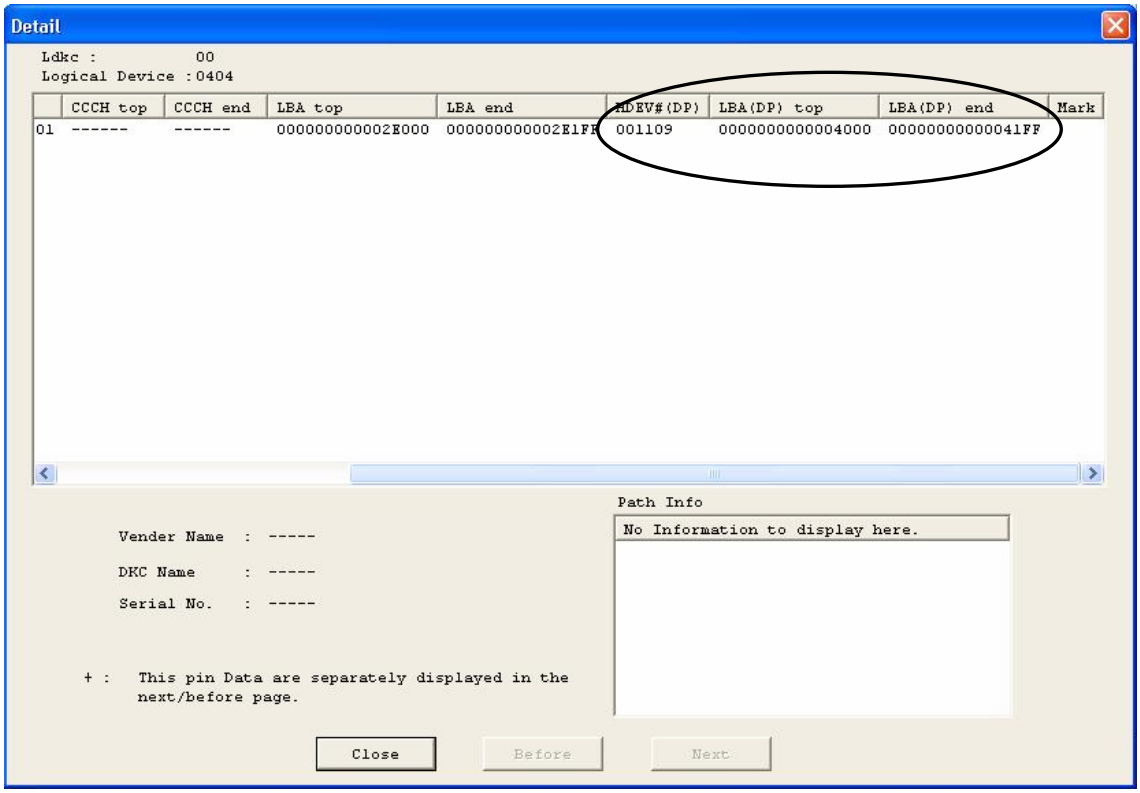
NOTE1 : In case of a Write Error, perform TRBL05-280 as well as the normal VOL and recover it.

NOTE2 : The LDEV that a POOL ID is displayed on the logical device window is a pool-VOL.

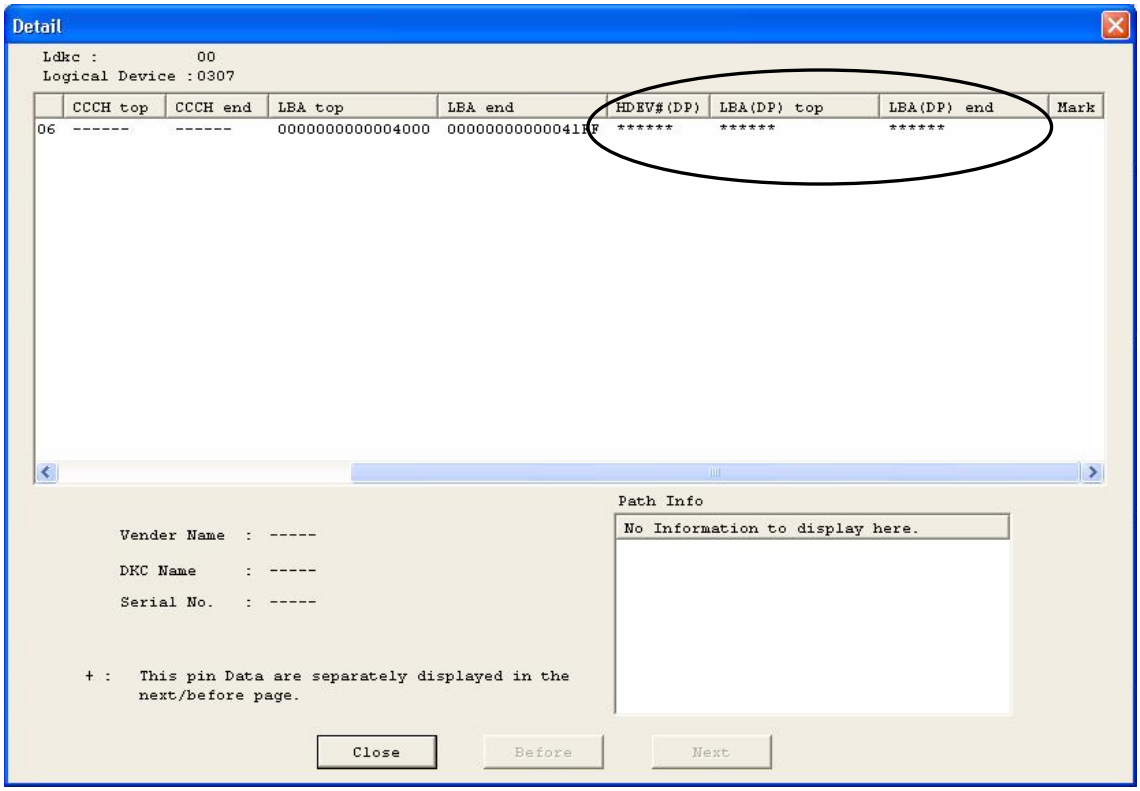
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Example 1: When there is an indication of a DP-VOL



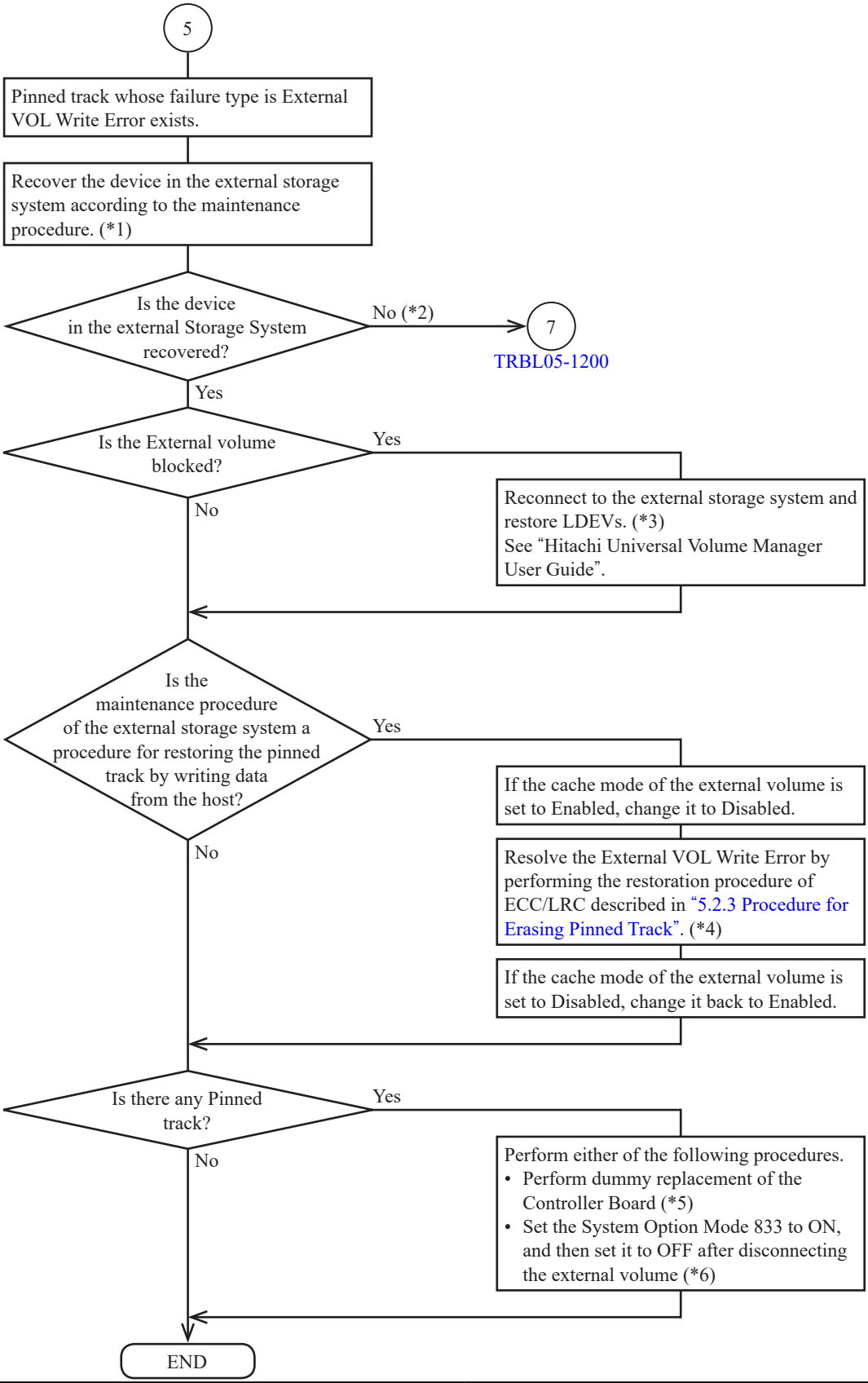
Example 2: When there is no indication of a DP-VOL



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5.2.3.7 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, you might be able to perform the procedure in the emergency case that the recovery from the hardware failure of only the local storage system is prioritized because the maintenance work of the local storage system which is suppressed due to the presence of the pinned track (for example, micro-program exchange) can be performed.

*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: If the LDEV formatting is required, select Normal Format.

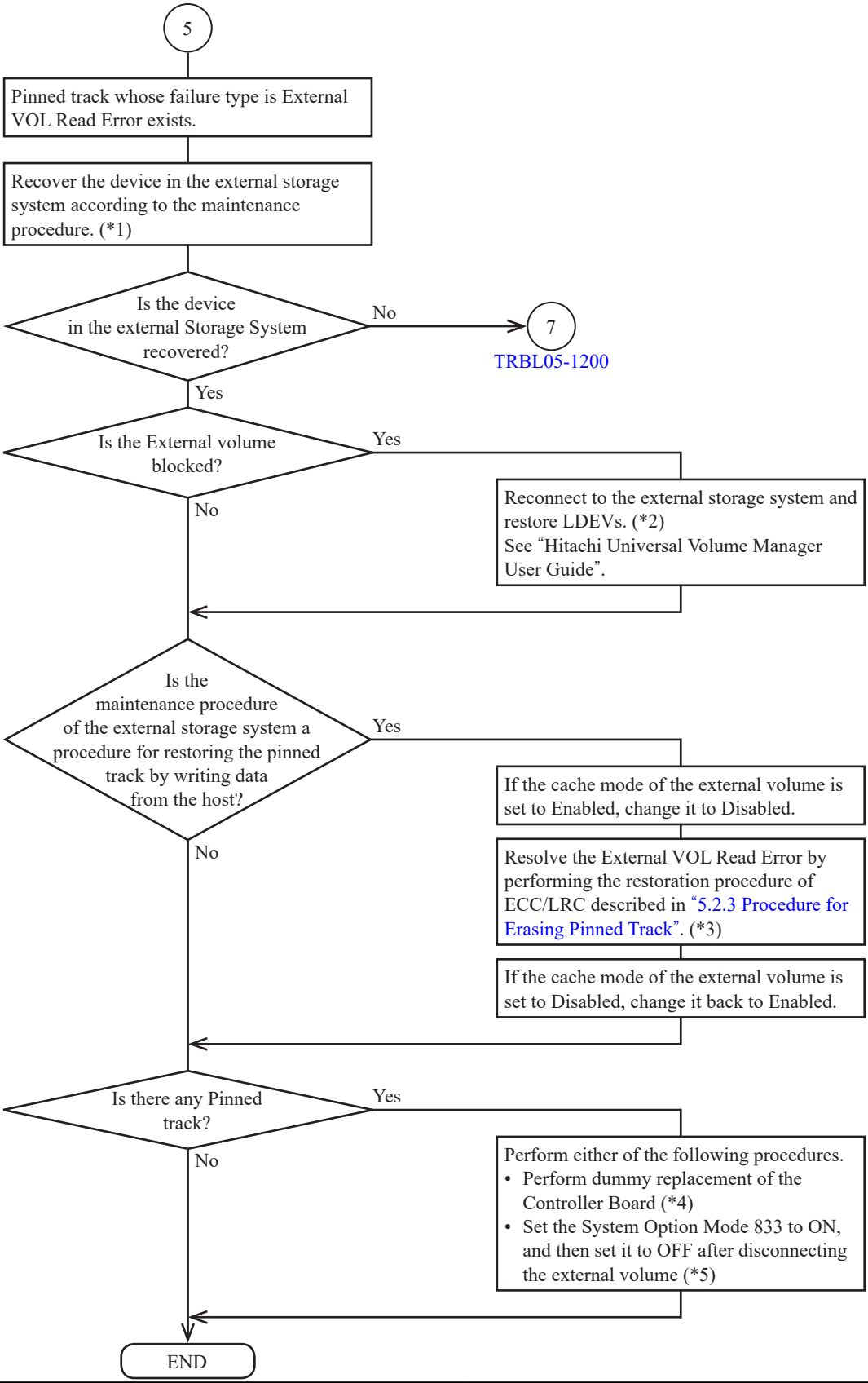
*5: Perform the dummy replacement of all Controller Boards belonging to the cluster 1 or all Controller Boards belonging to the cluster 2. See “Controller Board REPLACEMENT PROCESSING” (REP(RCTL)00-00) to know how to replace.

*6: 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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5.2.3.8 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: If the LDEV formatting is required, select Normal Format.

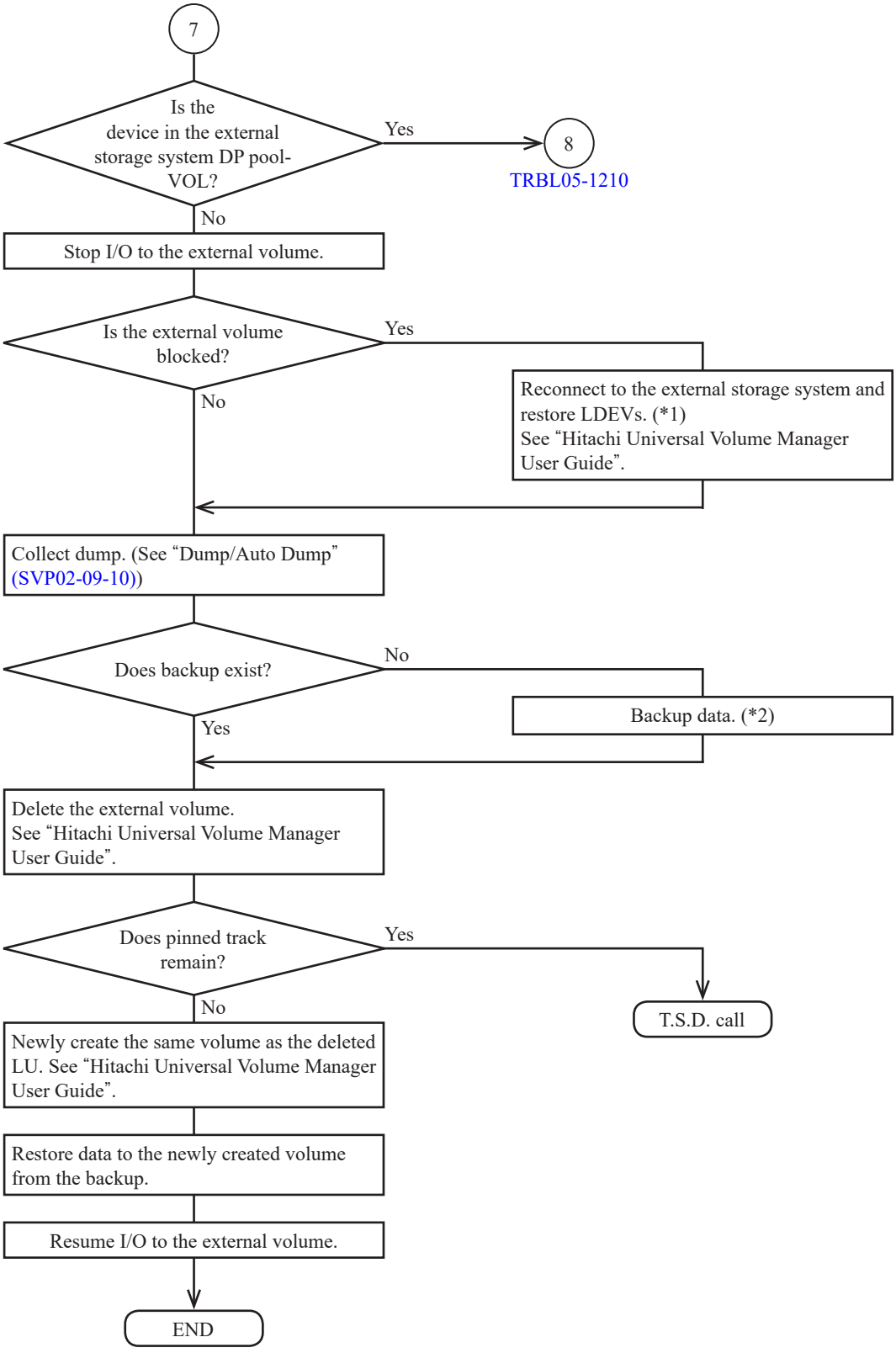
*4: Perform the dummy replacement of all Controller Boards belonging to the cluster 1 or all Controller Boards belonging to the cluster 2. See “Controller Board REPLACEMENT PROCESSING” (REP(RCTL)00-00) to know how to replace.

*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.

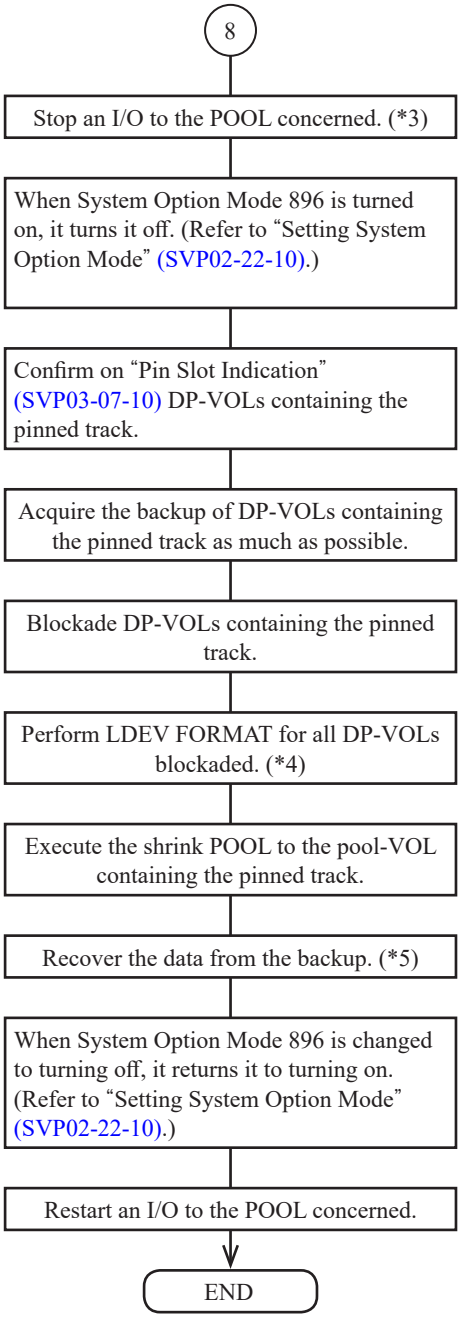
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5.2.3.9 Recovery Processing of the Device in the External Storage System

When the device of an external storage system is not recovered, perform the following recovery procedure.



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*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.

*3: It is necessary to stop an I/O, so that other DP-VOLs should not use the area released by LDEV FORMAT again.

*4: 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.

*5: 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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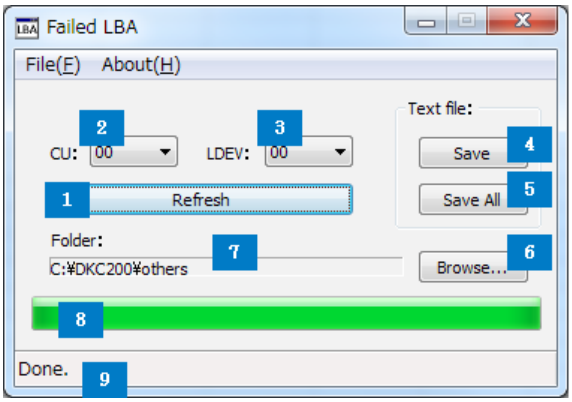
5.2.3.10 Using Failed LBA Output Tool

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:\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:\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)

(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\88xxxxyyyyyy\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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5.3 (Blank)

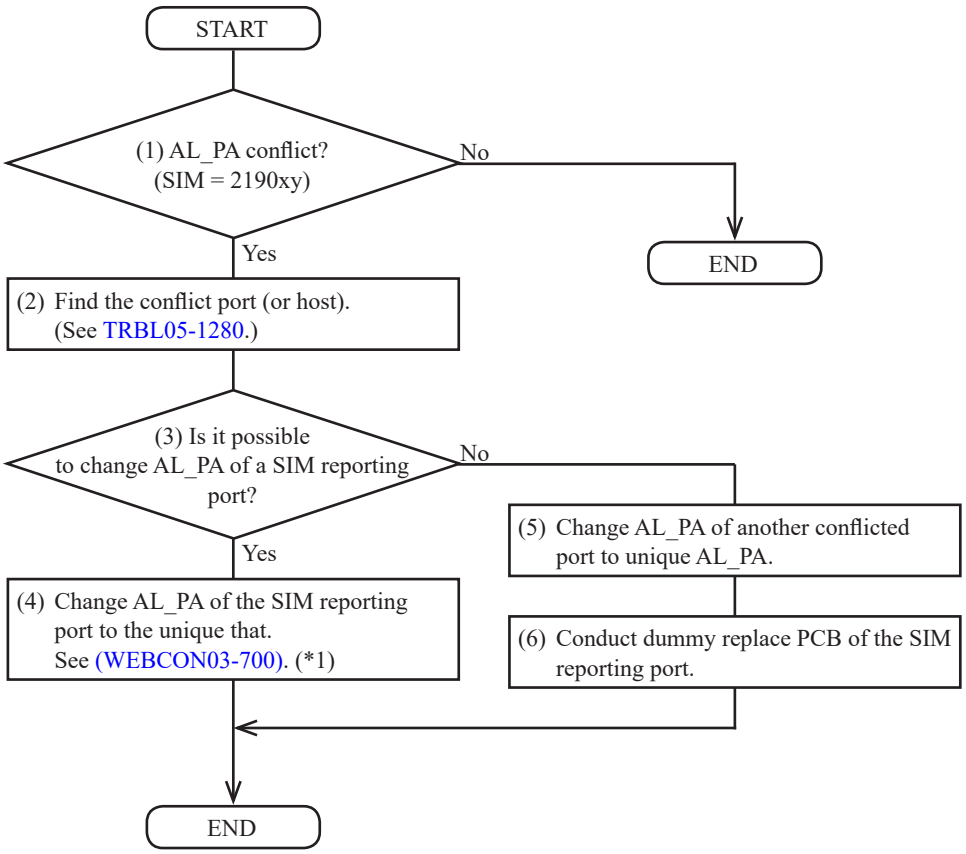
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Blank Sheet

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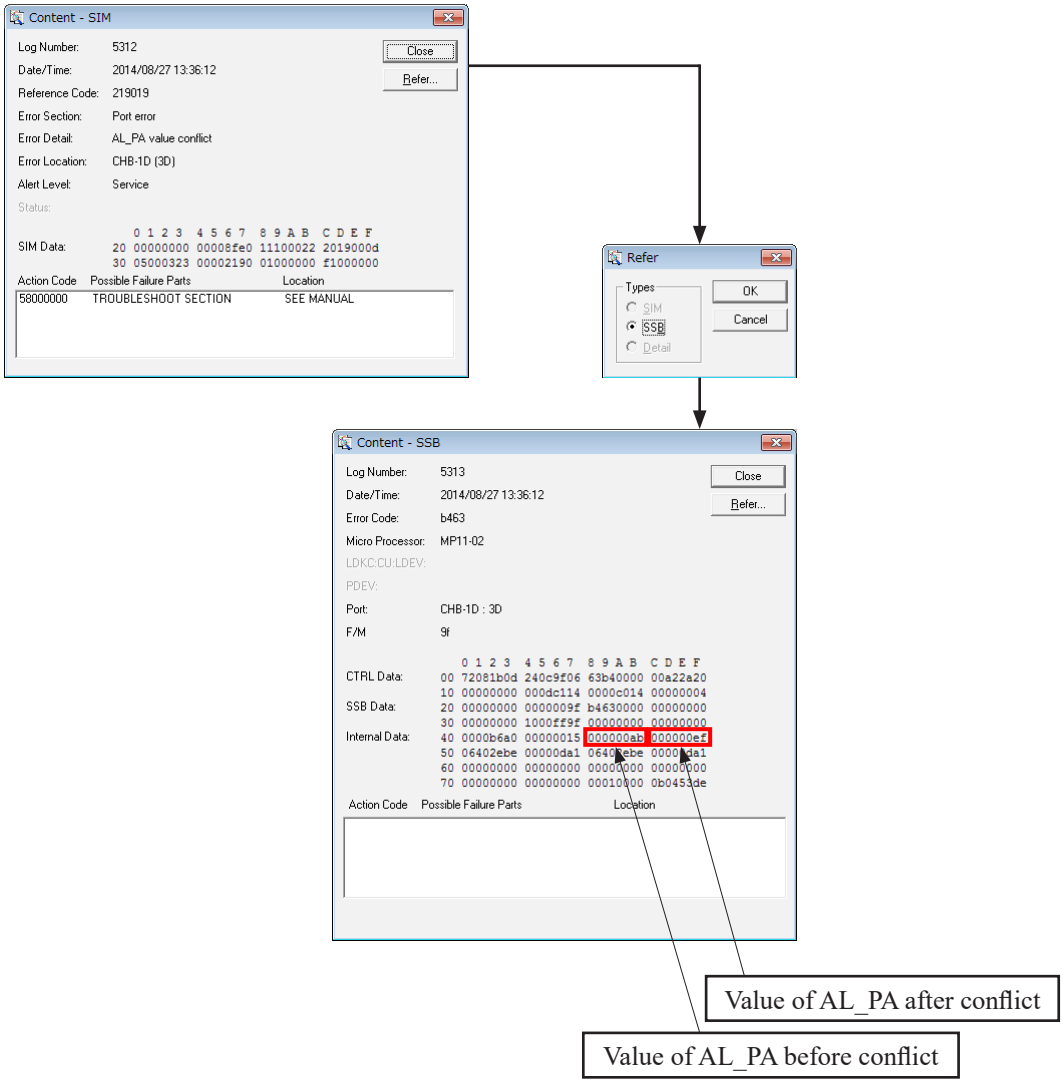
5.4 Recovery Procedure for AL_PA Conflict (SIM = 2190xy)

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 another AL_PA from an AL_PA previously given by Storage Navigator or CCI (Command Control Interface) (e.g., EF → 01). However, the value on Storage Navigator or CCI (Command Control Interface) remains the same.



*1: When using CCI (Command Control Interface), run the raidcom modify port command.

NOTE: Whether AL_PA of (3) is changed or not depends on the condition under operation.



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.
3. If the value of AL_PA before conflict is an expected value of AL_PA when the value of AL_PA after conflict is "00000000", you do not need to perform the recovery procedure for AL_PA conflict.
   (The SIM of AL_PA conflict might be reported in the process of changing the port attribute and the loop connection might be completed while the value remains the value of AL_PA before conflict.)

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5.5 Recovery Procedure for a Failure on Host iSCSI Interface

5.5.1 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.

5.5.1.1 Possible Failures and causes of them

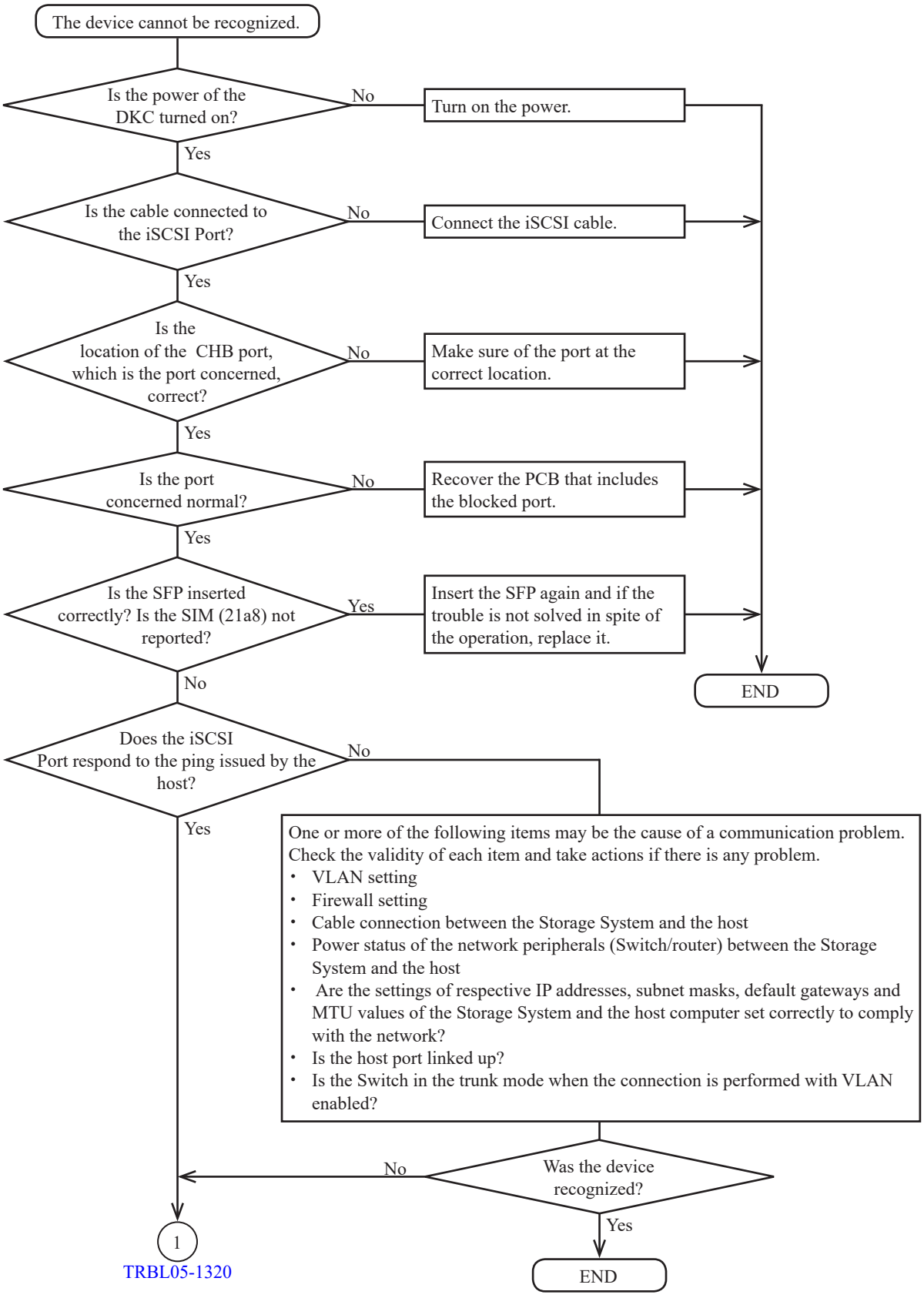
No.	Possible error	Cause
1	LDEV is not recognized by iSCSI initiator.	(1) SCSI installation, i.e. recognition and connecting procedure from SCSI initiator is not executed correctly. (2) Problem of iSCSI cable or connection. (3) Problem of iSCSI initiator. iSCSI board, device driver version, parameters,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

5.5.1.2 Matters must be or desirable to be checked

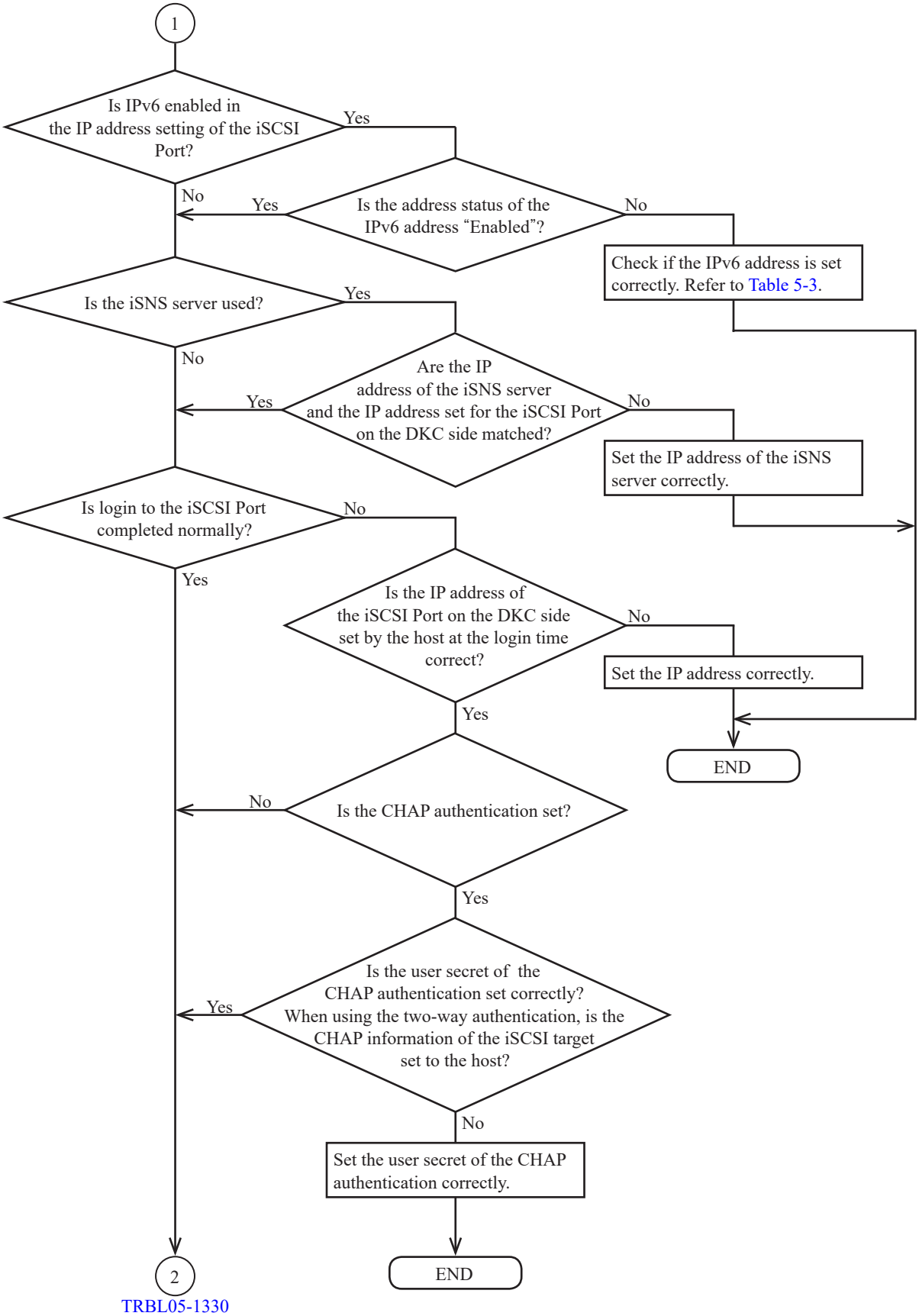
No.	Checkpoint	Check method
1	Is the READY LED on the DKC on?	Check the storage system visually.
2	Is the LED of the port, which corresponds to the failed SCSI port, on? Open the System window from Action menu of Storage Navigator main window and check whether the port status indicator is on.	Check the storage system visually.
3	Is the location of the CHB port correctly understood?	Refer to “Channel Interface” (LOC04-10).
4	Is the status of the CHB corresponding to the failed SCSI path normal?	Check the CHB status in the Maintenance Utility (Sub Panel) window. (Refer to “5.1.4 Procedure for Checking Normalcy of the Processor”.)
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. Check the SFP status of the CHB on Maintenance Utility. 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 LDEV status in the Logical Devices window of Web Console. (Refer to “Checking the Logical Devices” (WEBCON03-250).)
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) size set for the Switch is large enough to accommodate the packet of the MTU size set for the host or the MTU size set for the DKC iSCSI port.
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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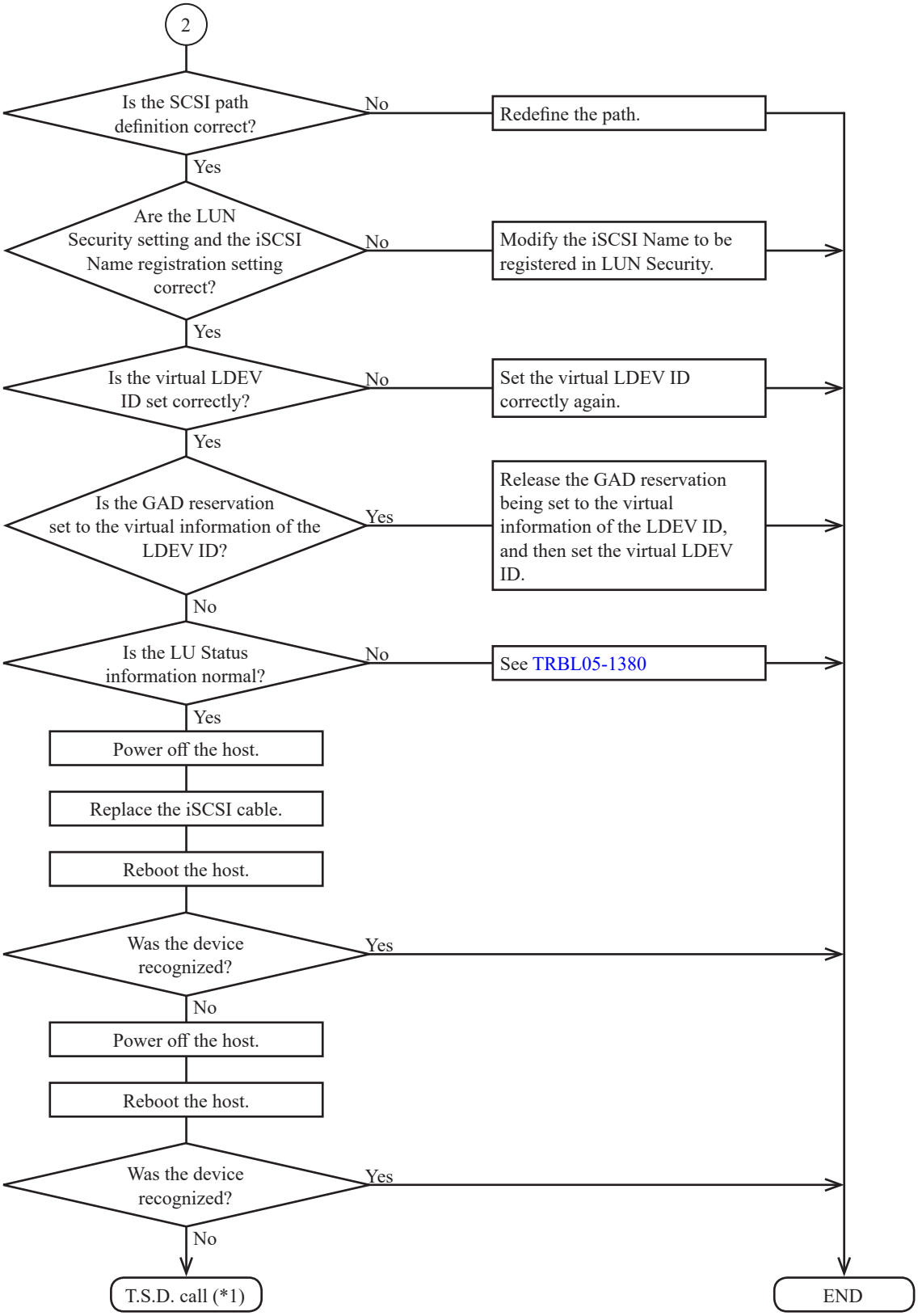
5.5.2 Recovery Procedure When Device Is Not Recognized



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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 (See “Dump/Auto Dump” (SVP02-09-10).)
- Syslogs and/or Messages
- Logs of software when the alternative path exists
- Packet capture information

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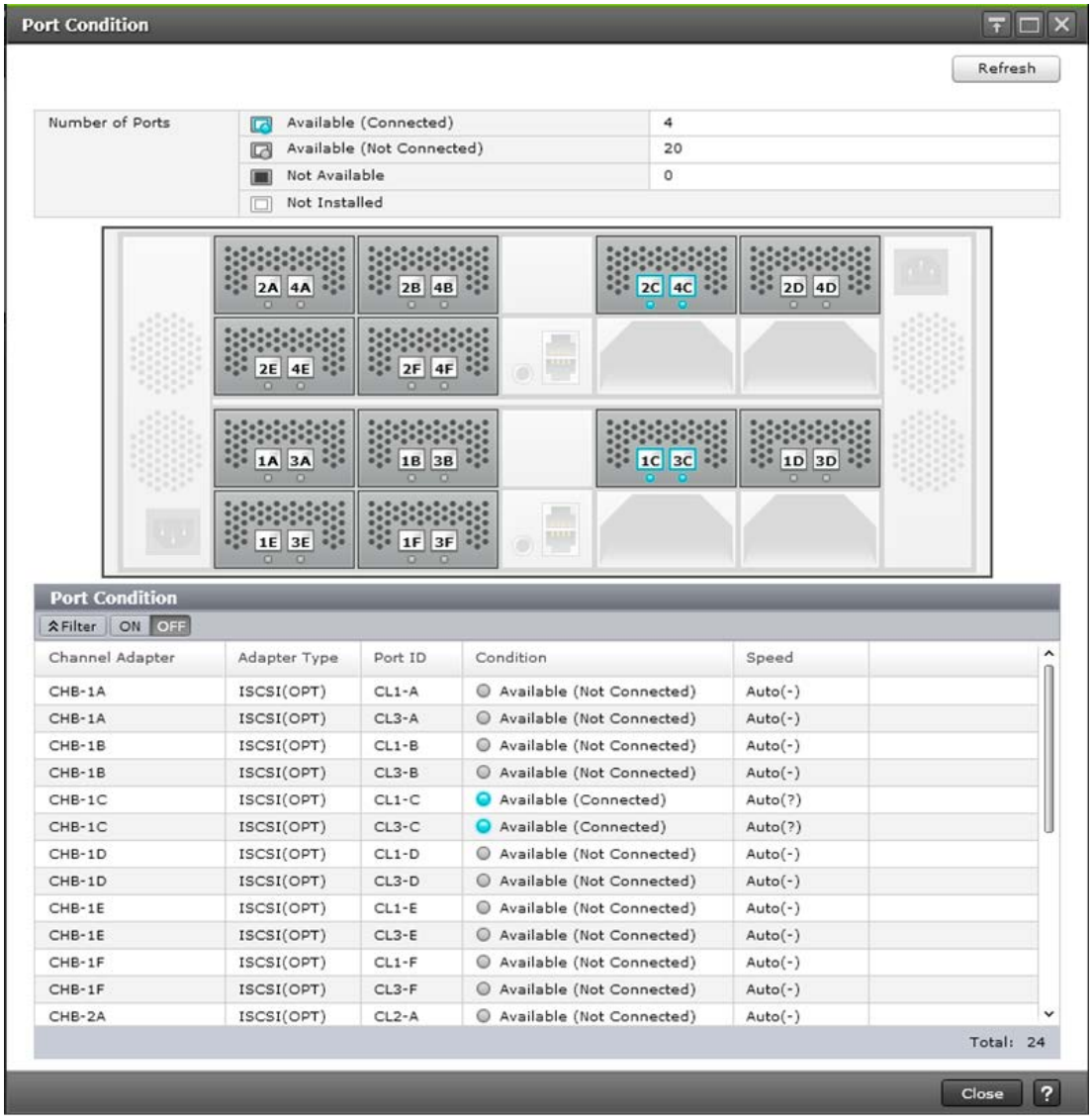
Table 5-3 iSCSI IPv6 Connection Failure Troubleshooting Table

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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5.5.3 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.



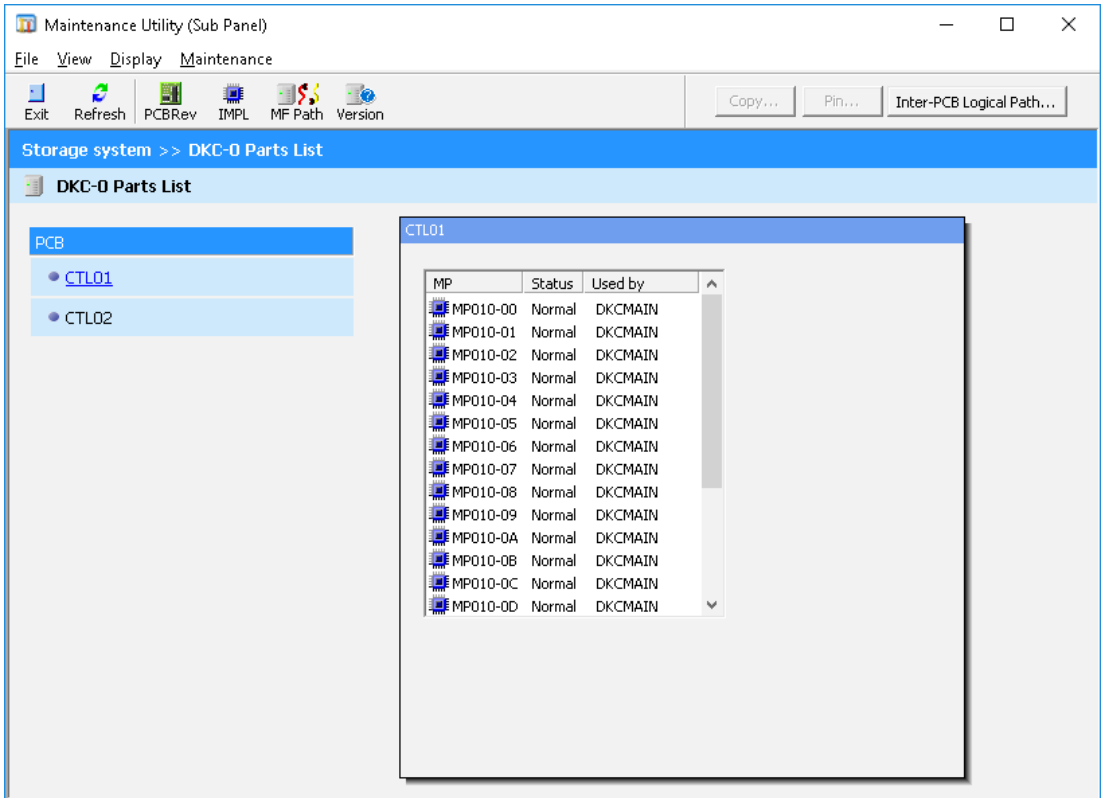
In the “Port Condition” box, the statuses of the ports are displayed in the image of the practical storage system.
Channel Board, Adapter type, Port ID, Attribute and Condition are displayed for the each port.
The statuses of the displays of the port status are explained below.

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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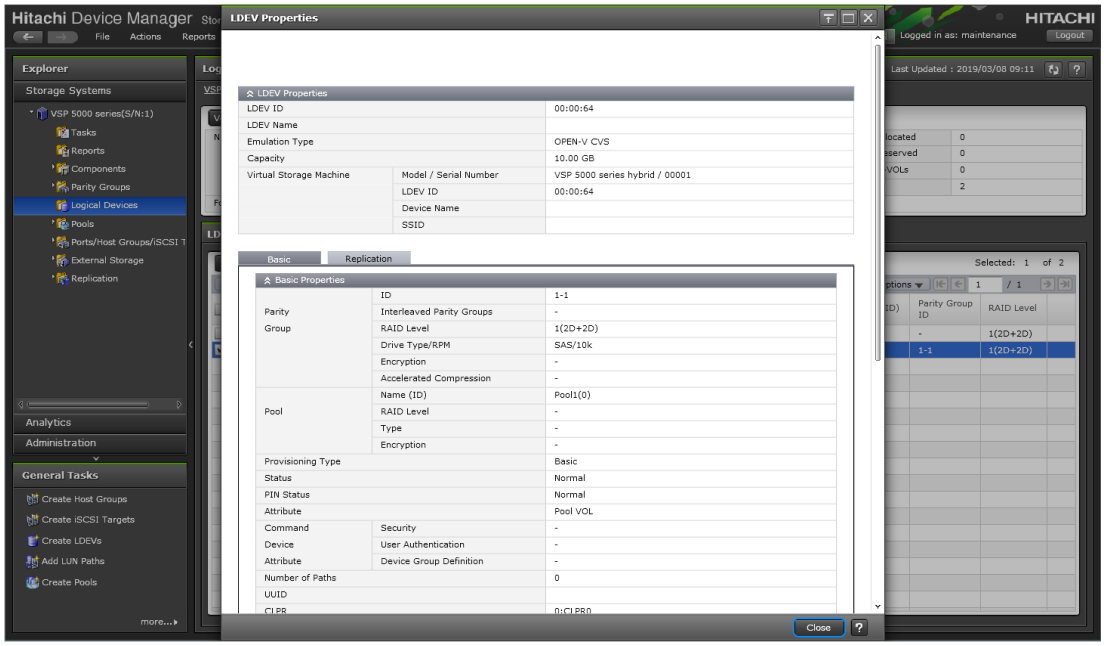
5.5.4 Procedure for Checking Normalcy of the Processor

Select the DKC in the Maintenance Utility (Sub Panel) 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.



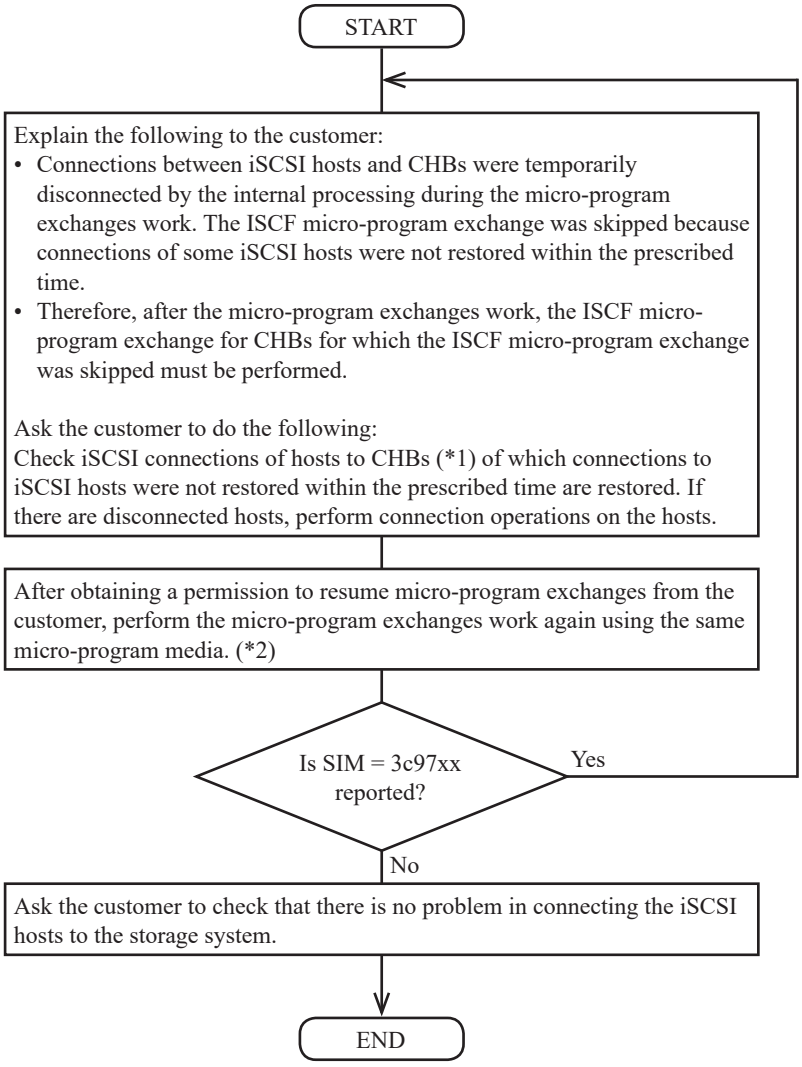
5.5.5 Procedure for Checking LUN Status Information

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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5.6 Recovery Procedure When Disconnection of Host Is Detected during ISCF Micro-Program Exchange (SIM = 3c97xx)



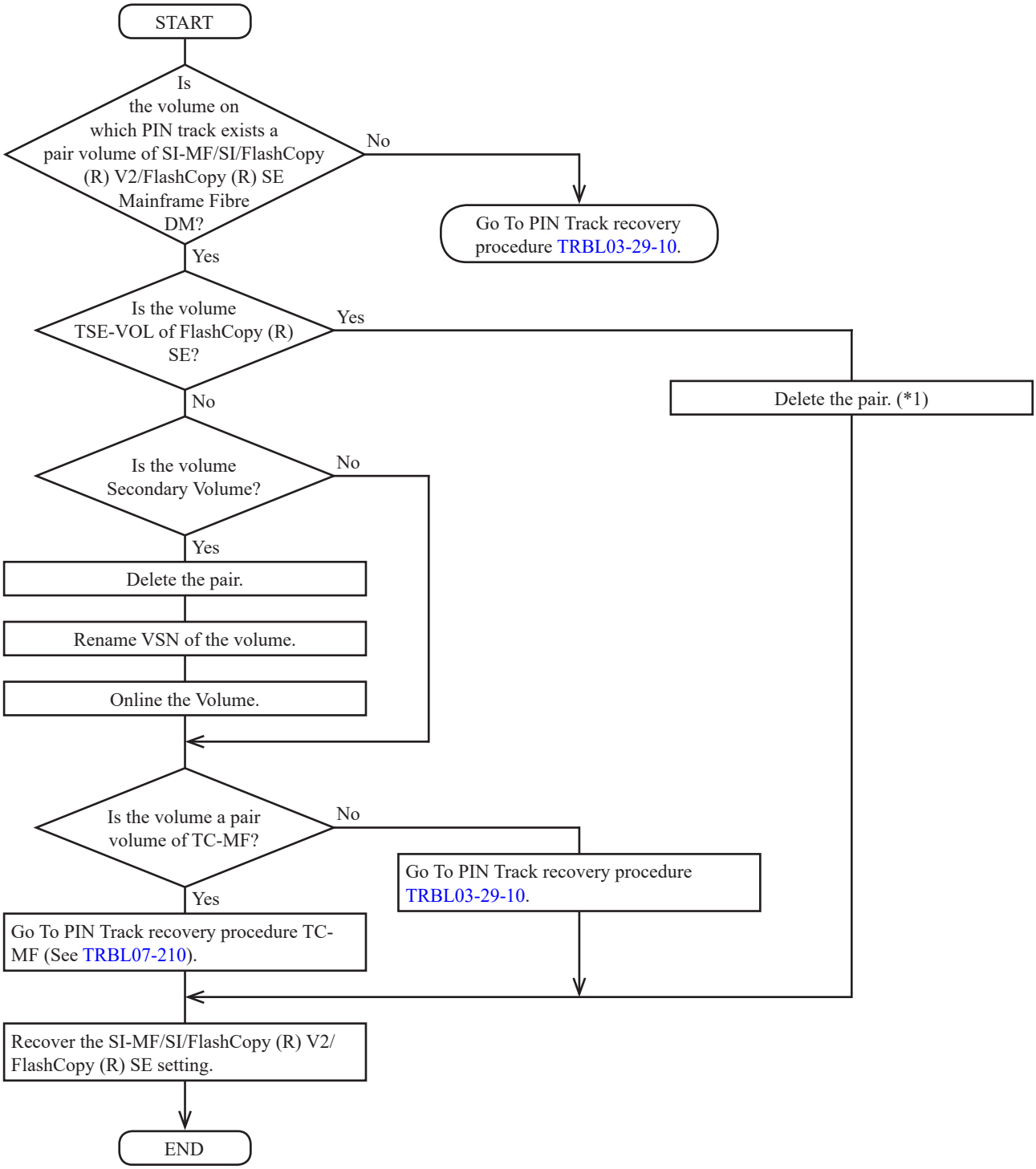
*1: The lower two digits of the SIM reference code represent a CHB on which a disconnection to a host is detected. See the Remarks column of SIM = 3c97xx in SIM RC SECTION.

*2: The ISCF micro-program exchange for CHBs for which the ISCF micro-program exchange was skipped is executed. The ISCF micro-program exchange for CHBs for which the ISCF micro-program exchange was executed is skipped. If SIM = 3c97xx (detection of disconnection of host) is reported during the ISCF micro-program exchange for a CHB of a succeeding location number, perform the recovery procedure again.

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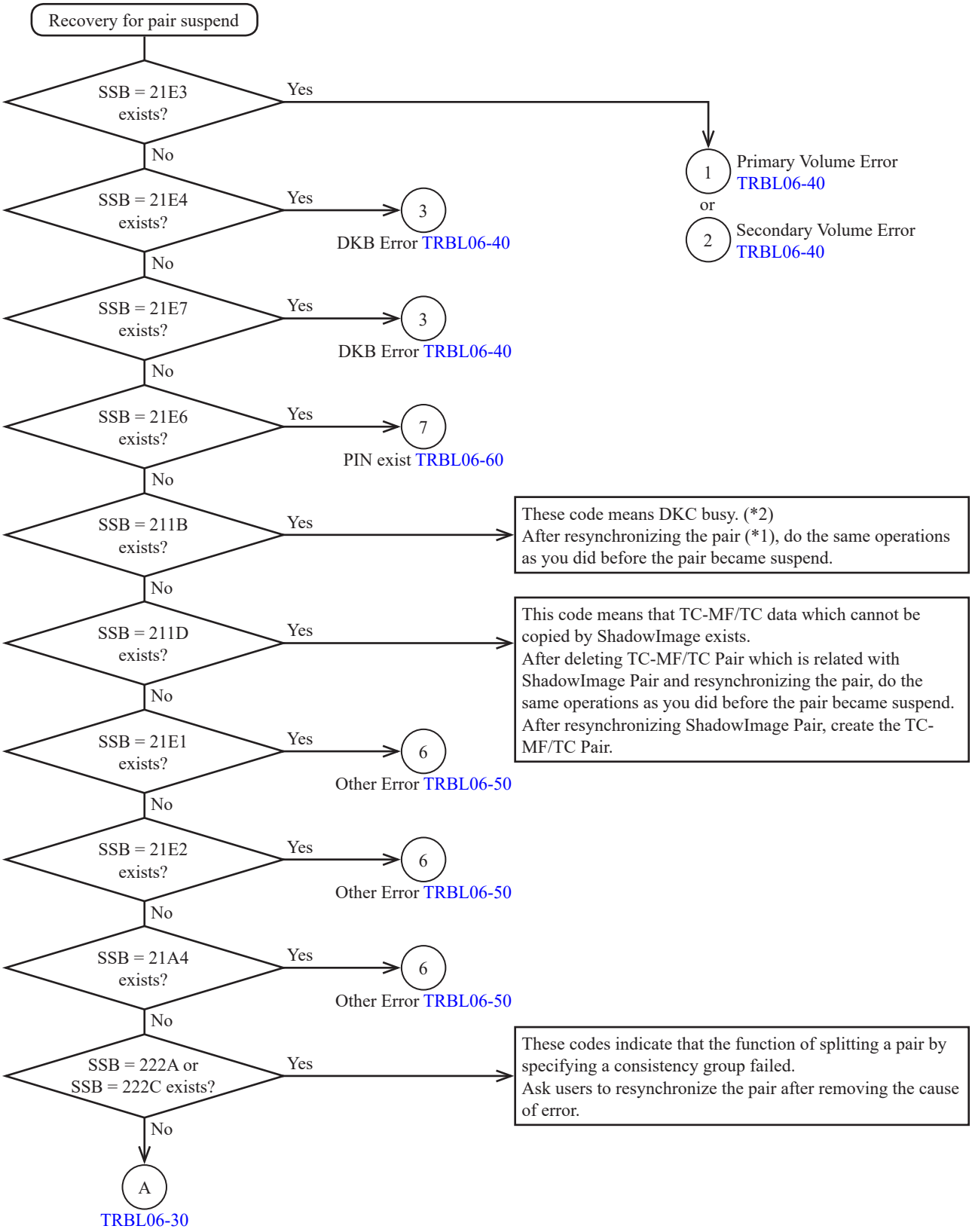
6. Recovery from ShadowImage for Mainframe/ShadowImage/FlashCopy (R) V2/FlashCopy (R) SE Failure

6.1 Recovery Procedure for Pinned Track

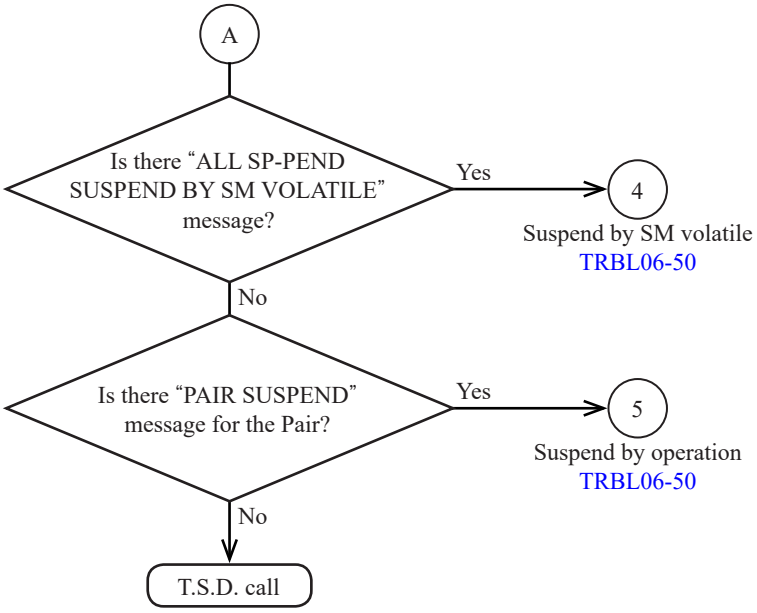


*1: The PIN track is recovered by establishing the pair or executing volume initialization again.

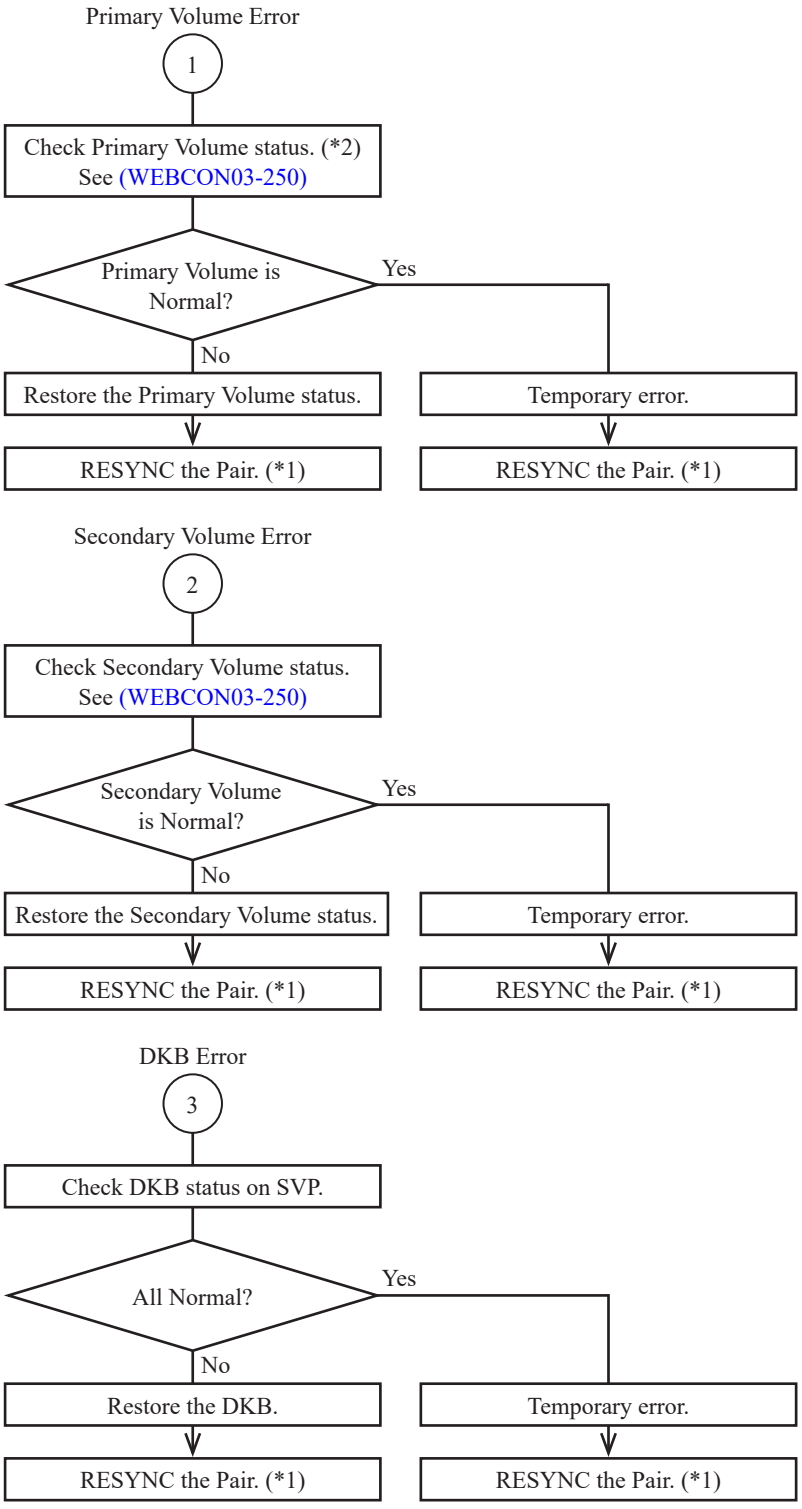
6.2 Recovery Procedure for ShadowImage for Mainframe/ShadowImage/Mainframe Fibre DM Suspended Pair (SIM = 47dxyy, 7ff102, 47e700)



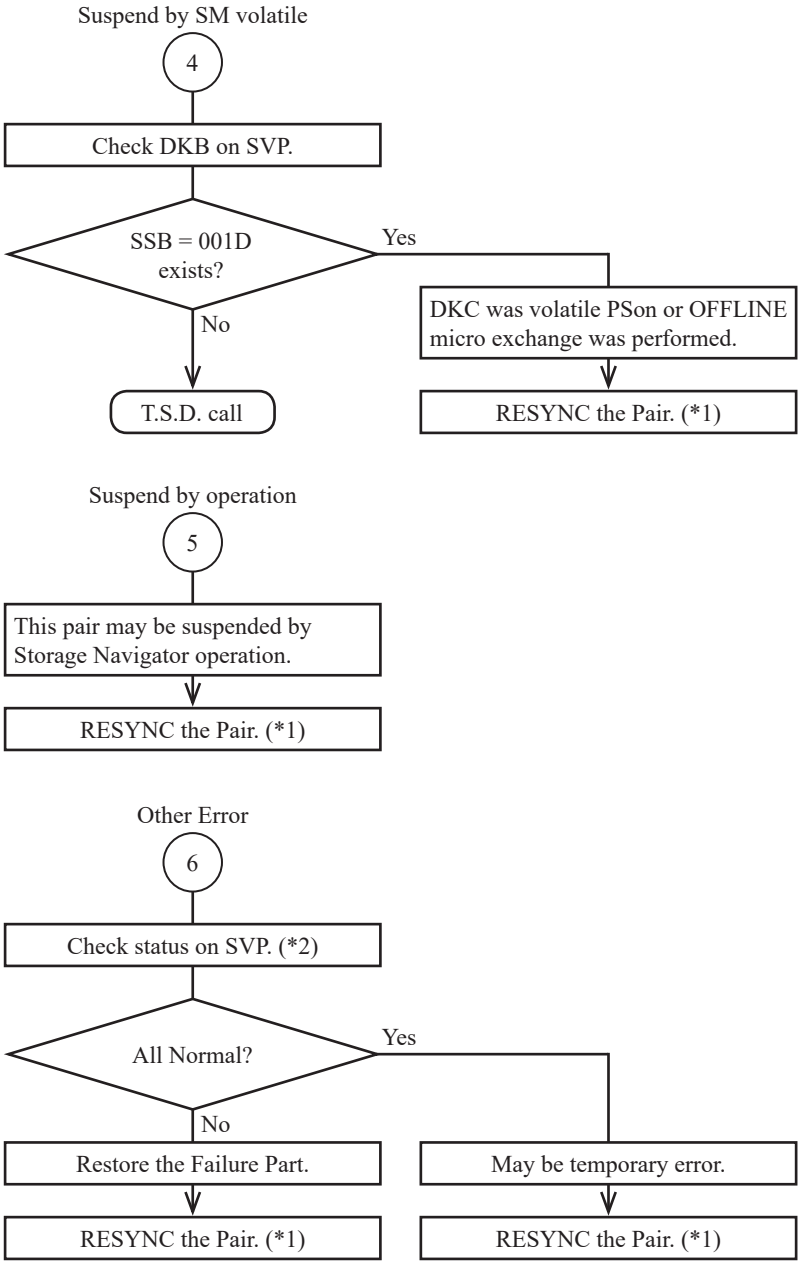
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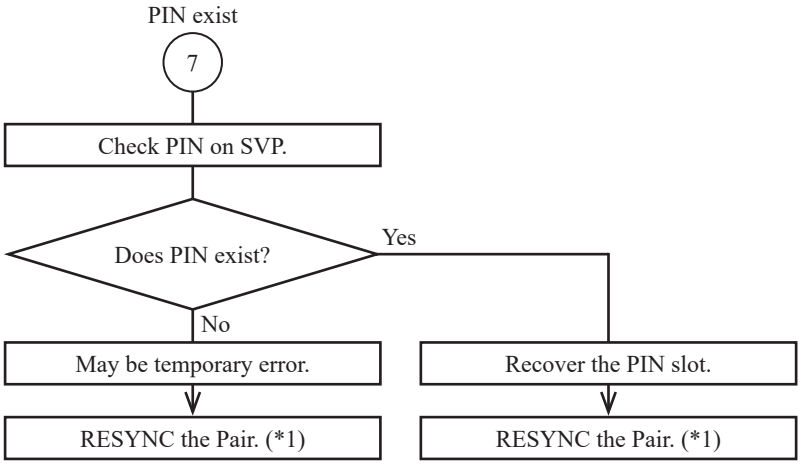


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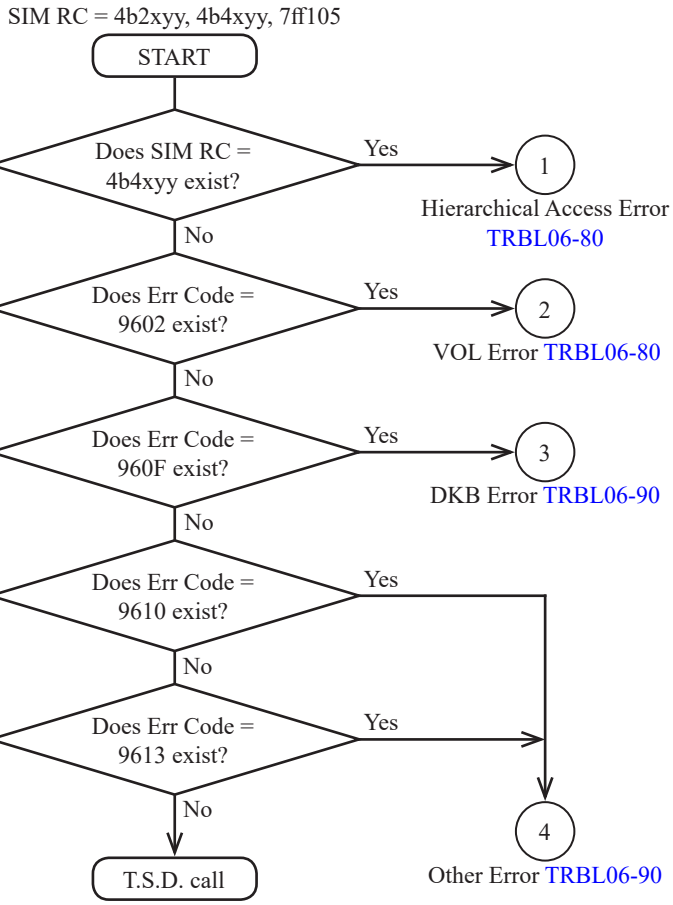
*1: In the case of Mainframe Fibre DM pair, resync the pair if pair status is Suspend (Mig) or create the pair again after deleting the pair if pair status is Suspend.

*2: In the case of Mainframe Fibre DM pair, follow the Mainframe Fibre DM recovery procedure. (See TRBL12-10.)

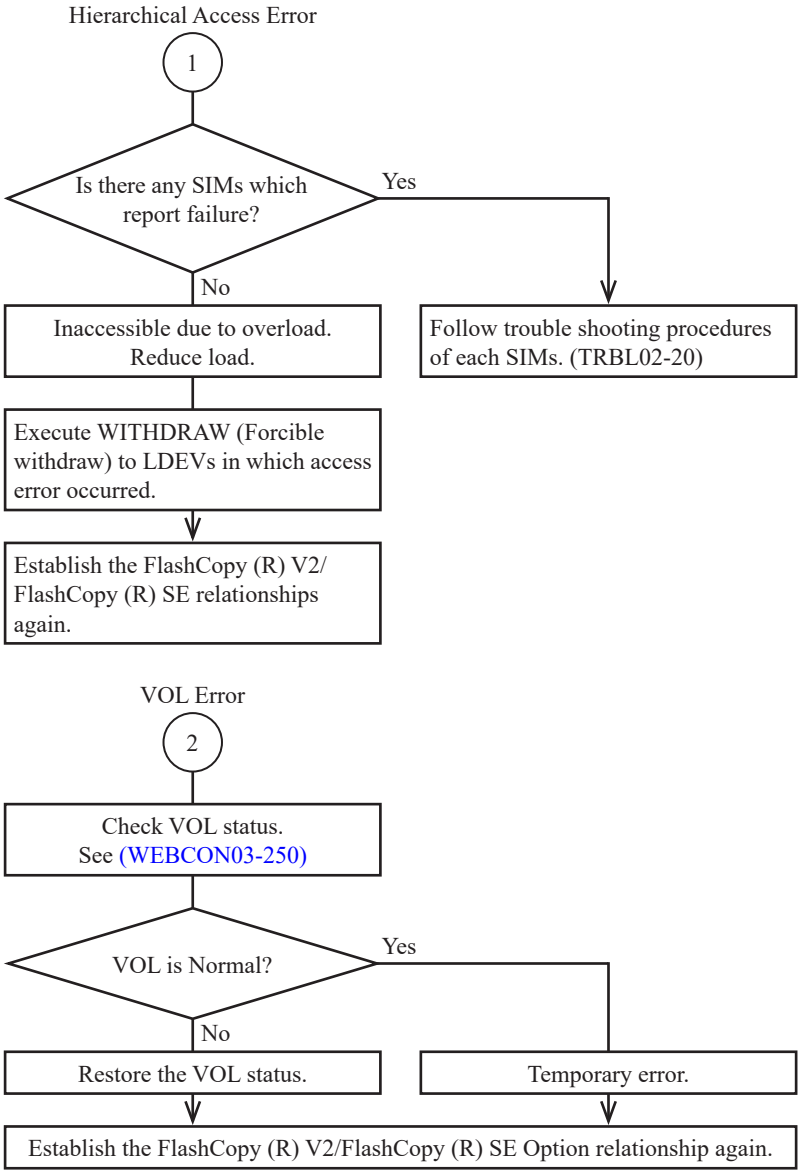
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6.3 Recovery Procedure for FlashCopy (R) V2/FlashCopy (R) SE Option Failure (SIM = 4b2xyy, 4b4xyy, 7ff105, 47e500)

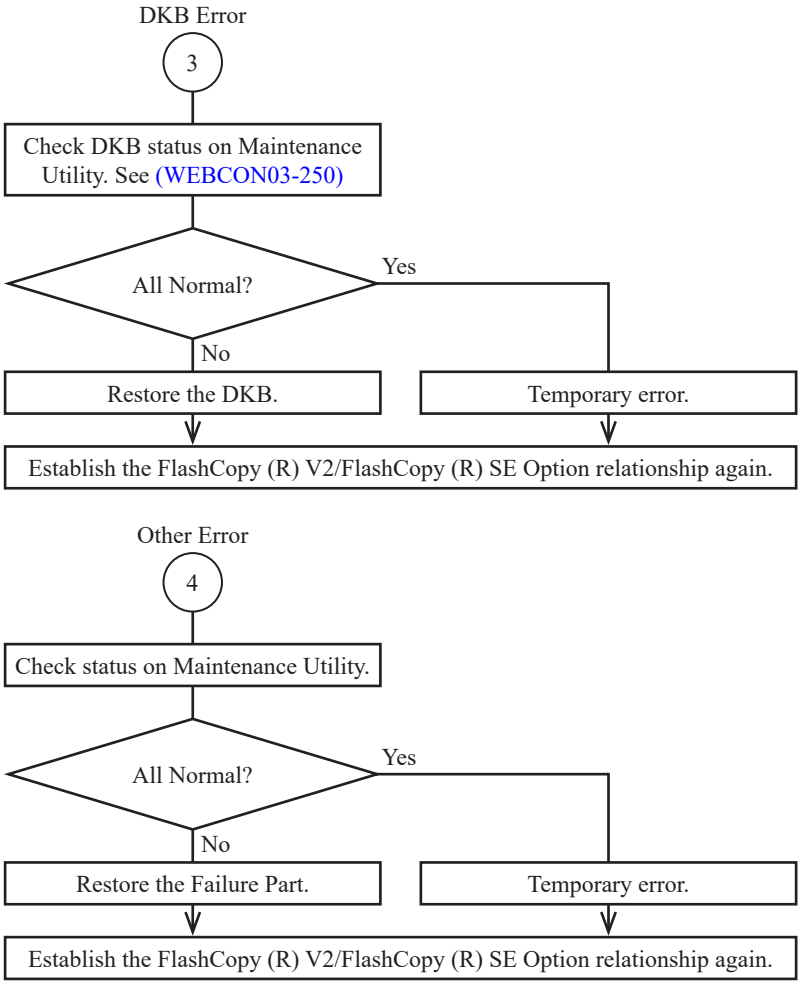
The procedure for recovery from a failure occurs in a pair of FlashCopy (R) V2/FlashCopy (R) SE Option is explained below.



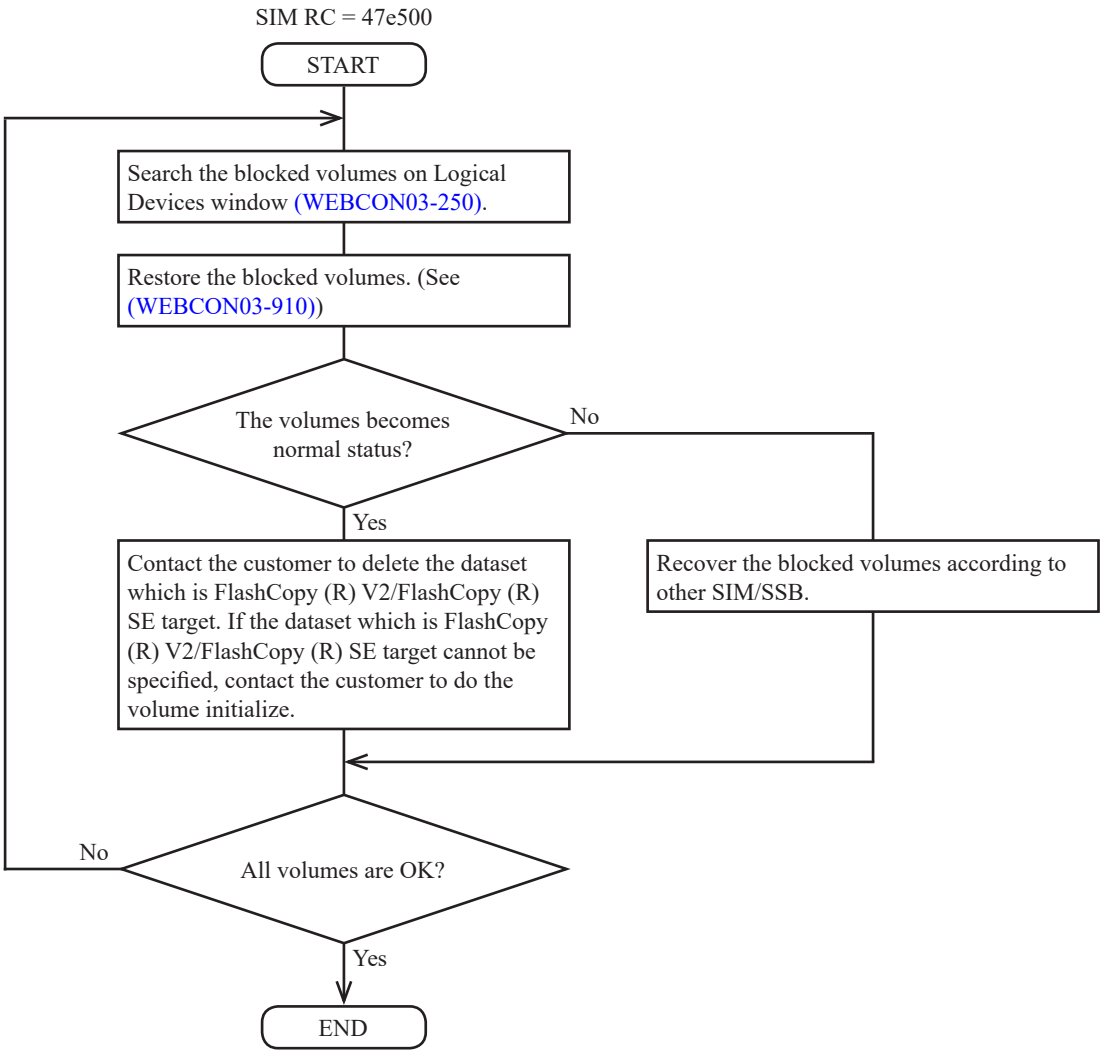
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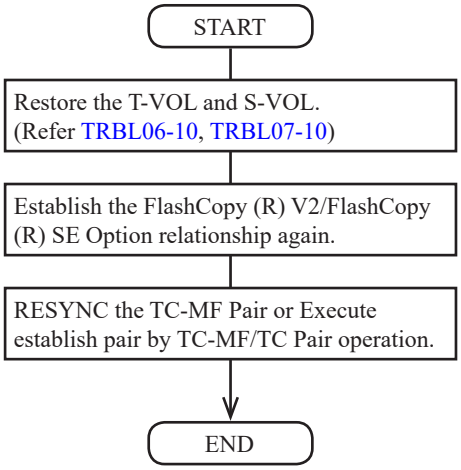


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6.3.1 Recovery Procedure for a Failure When FlashCopy (R) V2/FlashCopy (R) SE Cooperated with TrueCopy for Mainframe (SIM = 4b2xyy, 47e500)



6.4 Output of Online Path Information (SSB EC= 2084)

There is a case where the following commands such as the P.P. pair operation become a command reject and cannot be executed because the target device is online.
ShadowImage, ShadowImage for Mainframe, FlashCopy (R) V2, FlashCopy (R) SE

When they become a command reject, specify the online path from the contents of SSB=2084, and make the target path offline.

NOTE: The number of SSB = 2084 is limited by about 1 in ten seconds. Therefore, after taking paths offline by way of Figure 6-3, P.P. command operation might fail with SSB = 2084 again. If this happens, repeat steps of Figure 6-3.

6.4.1 Output Information

Display SSB = 2084 from the SSB log referring to (SVP02-02-10).
The information shown below is output to Internal Data of SSB = 2084.

- The maximum of seven PIDs are output with SSB = 2084 to be output.
- The total number of online paths of the device shown in the byte 0x40 ~ 0x43 is output.

Table 6-1 SSB = 2084: Details of output information

Byte	Contents	Remarks
0x40 ~ 0x43	Device number (CU: LDEV number) of which the online path check was performed	
0x44	The number (1 ~ 7) of effective PIDs output in SSB concerned	
0x45 ~ 0x46	The total number of online paths (1 ~ 2048) shown in the byte 0x40 ~ 0x43	
0x47	Preparation (0)	
0x48 ~ 0x4F	PID1	Refer to the details of PID.
0x50 ~ 0x57	PID2	Refer to the details of PID.
0x58 ~ 0x5F	PID3	Refer to the details of PID.
0x60 ~ 0x67	PID4	Refer to the details of PID.
0x68 ~ 0x6F	PID5	Refer to the details of PID.
0x70 ~ 0x77	PID6	Refer to the details of PID.
0x78 ~ 0x7F	PID7	Refer to the details of PID.

NOTE: When the total number of online paths > effective PIDs output, there is the information of the online path which is not output. Retry the command operation after making the path offline referring to Figure 6-3.

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Figure 6-1 SSB = 2084: Position of output information

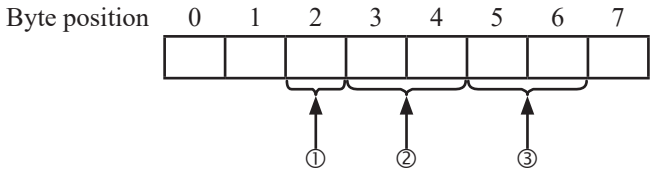
Internal Data		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
	40	HDEV#				(*1)	(*2)		(*3)	PID1							
	50	PID2								PID3							
	60	PID4								PID5							
	70	PID6								PID7							

*1: The number of effective PIDs output in SSB concerned

*2: The total number of online paths of the device shown in the byte 0x40 ~ 0x43

*3: Preparation (0)

Figure 6-2 Details of PID



① LPAR number
② Last 4 digit of CPU serial number
③ Host type

NOTE: This does not show All digits of CPU serial number. Therefore, you might not be able to determine the host that has an online path. If this is the case, it is necessary to confirm online paths from all the hosts that have the same 4 digit of CPU serial number. If you use a volume from two or more hosts with the same last four digits of serial number and host type, it is recommended to use the volume from different LPAR number of the hosts.

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6.4.2 To Continue the Operation

When the volume of the operation target is online, acquire the online path information of the target volume according to the following procedure, and make it offline. After that, retry the command.

Figure 6-3 Procedure for continuing the operation

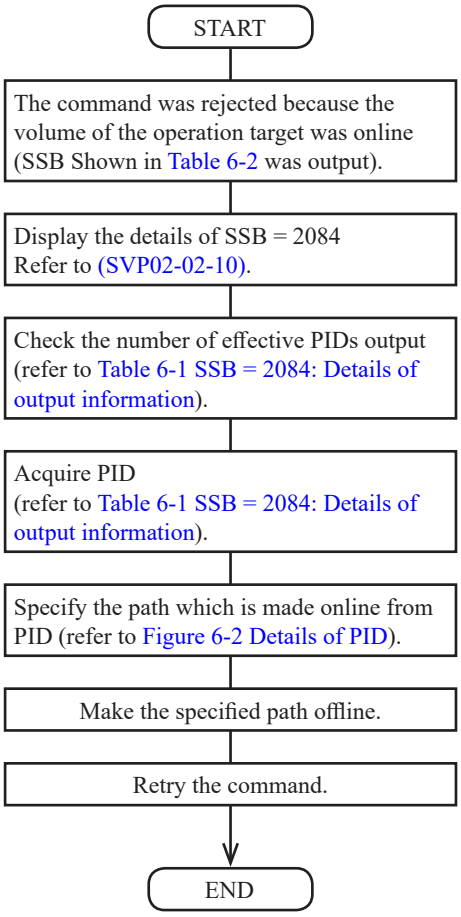


Table 6-2 SSB output by command operation

Output SSB	command	P.P.
2312	Pair create	ShadowImage ShadowImage for Mainframe
	Resync	
	Restore	
2352	Pair create	ShadowImage ShadowImage for Mainframe
231F		
9655		FlashCopy (R) V2 FlashCopy (R) SE

NOTE: When the total number of online paths > effective PIDs output, SSB = 2084 is output again (refer to Table 6-1 SSB = 2084: Details of output information).

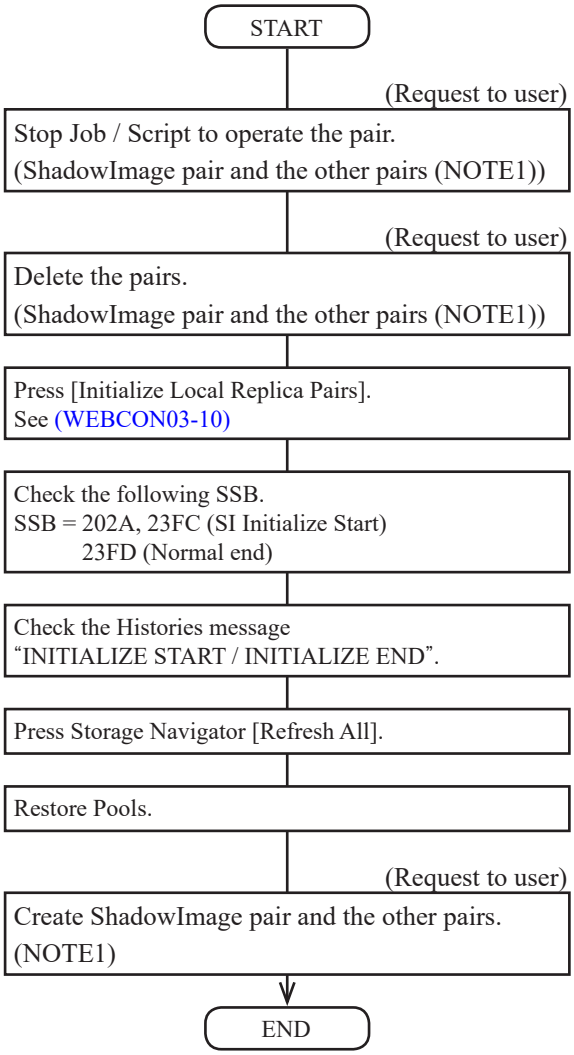
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6.5 Initialization Procedure for ShadowImage

NOTE1: When [Initialize Local Replica Pairs] is pressed, pairs formed by the following P.P. are also deleted. And VOLs of reserve attribute are also deleted.
[ShadowImage / ShadowImage z/OS (R) / Volume Migration / FlashCopy (R) V2 / FlashCopy (R) SE / Thin Image]

NOTE2: Perform the operation only when it is directed by the Technical Service Division.

NOTE3: For the password, refer to the Technical Service Division.



SSB LIST (After pressing [Initialize], the following SSB are of no matter)
9693, AFB2, AFB3

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7. Recovery from TrueCopy for Mainframe/TrueCopy Failure

7.1 Recovery Procedure for TrueCopy for Mainframe Failure

Hardware error sometimes causes TrueCopy for Mainframe error which is a pair suspend or a path disable. This document explain the TrueCopy for Mainframe Error and how to recover it.
Following reports indicate TrueCopy for Mainframe error occurrence.

- SIM report of TC-MF path disable occurrence
- SIM report of TC-MF pair suspend occurrence
- SIM report of RCU Acute or Serious Level SIM detection
- SIM report of RCU Moderate Level SIM detection

Table 7-1 TrueCopy for Mainframe SIM REF.CODE

SIM REF. CODE	Meaning	Remarks
d4xyyy	TC-MF pair is suspended	x: 0 - 2, 4 - 6 or F yyy: LDEV number
d4eyyy	RCU Acute or Serious Level SIM reported	yyy: LDEV number
d4dyyy	RCU Moderate Level SIM reported	yyy: LDEV number
2180xy	TC-MF path is disabled	x: CHB PCB # y: Port# in PCB
2182xy	MCU has received the notification of communication line error detection from extender.	x: CHB PCB # y: Port# in PCB

Following pages explain each error type of TrueCopy for Mainframe Error and recovery flow chart for the TrueCopy for Mainframe Error is showed. Concerning to the Disaster Recovery Procedures.

NOTE: Please check a fence Level Parameter for the suspended pair by SVP Pair Option. And if M-VOL Fence Level is 'R-VOL Data' or M-VOL Fence Level is 'R-VOL Status' and suspended SIM is 'd4fyyy', write I/O operations to the M-VOL will be rejected. So you must execute Delete Pair for the suspended pair, before execution of the recovery flow chart.
If you find out the F/M = '8F' SSB log which have following error code (C870, C871, C872), it is not the original cause of the suspended pair. It means that the SSB log is created by the pair status change timing. So you have no need to execute a recovery action.

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7.2 Recovery Procedure for TrueCopy Failure

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 7-2 TrueCopy SIM REF.CODE

SIM REF. CODE	Meaning	Remarks
d4xyyy	TrueCopy pair suspend	x: 0 - 2, 4 - 5 or f yyy: LDEV number
2180xy	TrueCopy pass blockade	x: CHB PCB # y: Port# in PCB
2182xy	MCU has received the notification of communication line error detection from extender.	x: CHB PCB # y: Port# in PCB

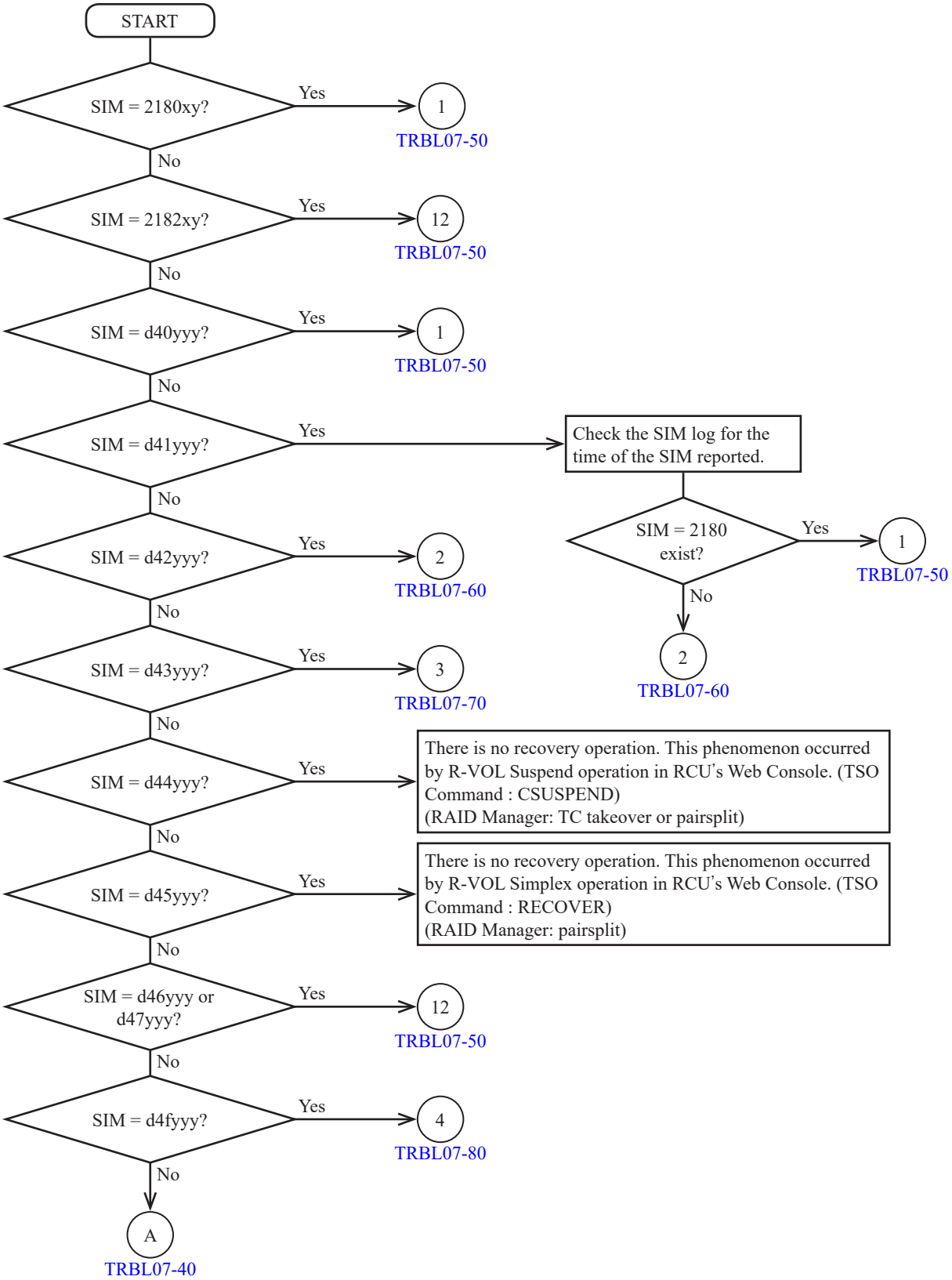
SIM outputted when the TrueCopy is suspended or the TrueCopy pass is blocked has the same REF. CODE and meaning as those outputted when the TrueCopy for Mainframe pair is suspended or the TrueCopy for Mainframe pass is blocked.
Furthermore, the error recovery procedure is the same as that against an TrueCopy for Mainframe error. Therefore, follow the procedures shown in the flowcharts on page TRBL07-30 and succeeding pages to recover from a TrueCopy pair error.

*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: ○○○○).
○○○○ : Volume name
○○○○ : Factor code (The item [d4x] of SIM RC SECTION is referred to.)

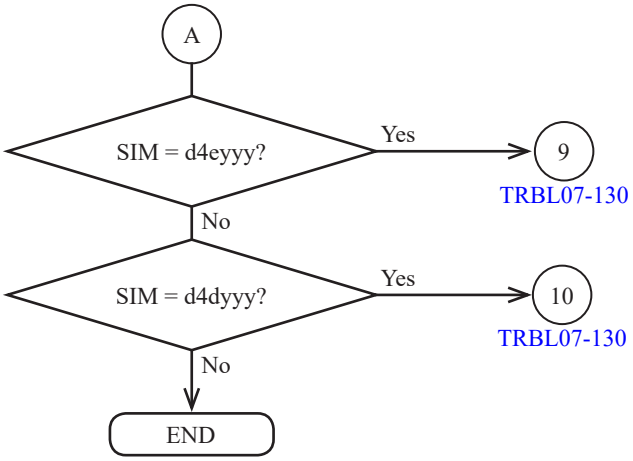
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Recovery for TrueCopy Error



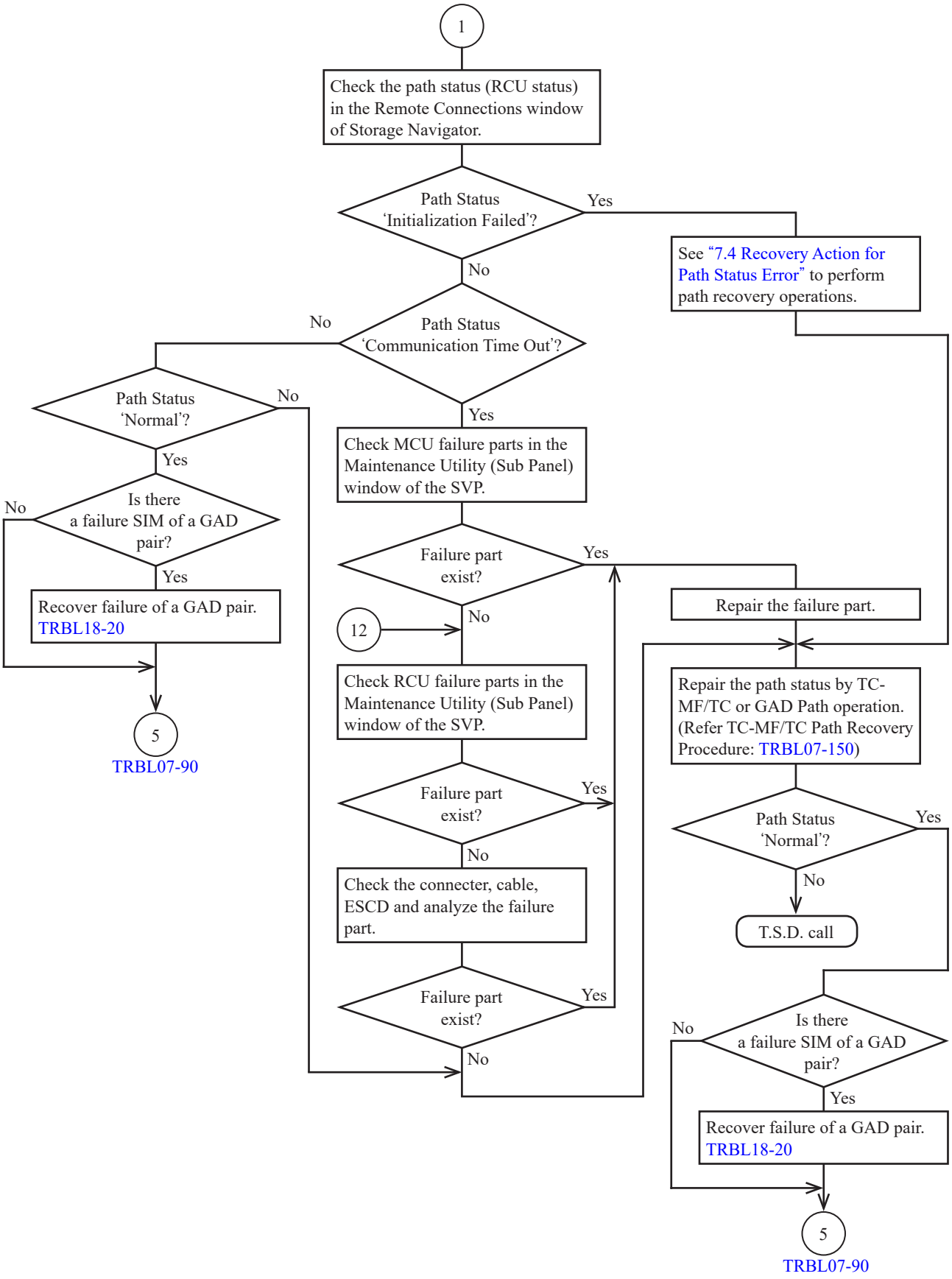
NOTE: You can control and manage your TC-MF configuration by using TSO commands or DSF commands for PPRC.

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TC-MF/TC/GAD Path Recovery Section



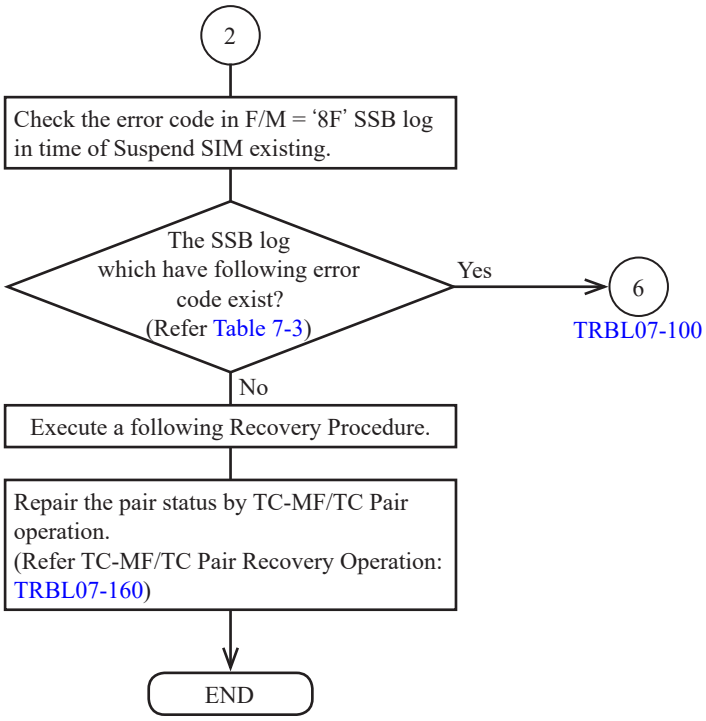
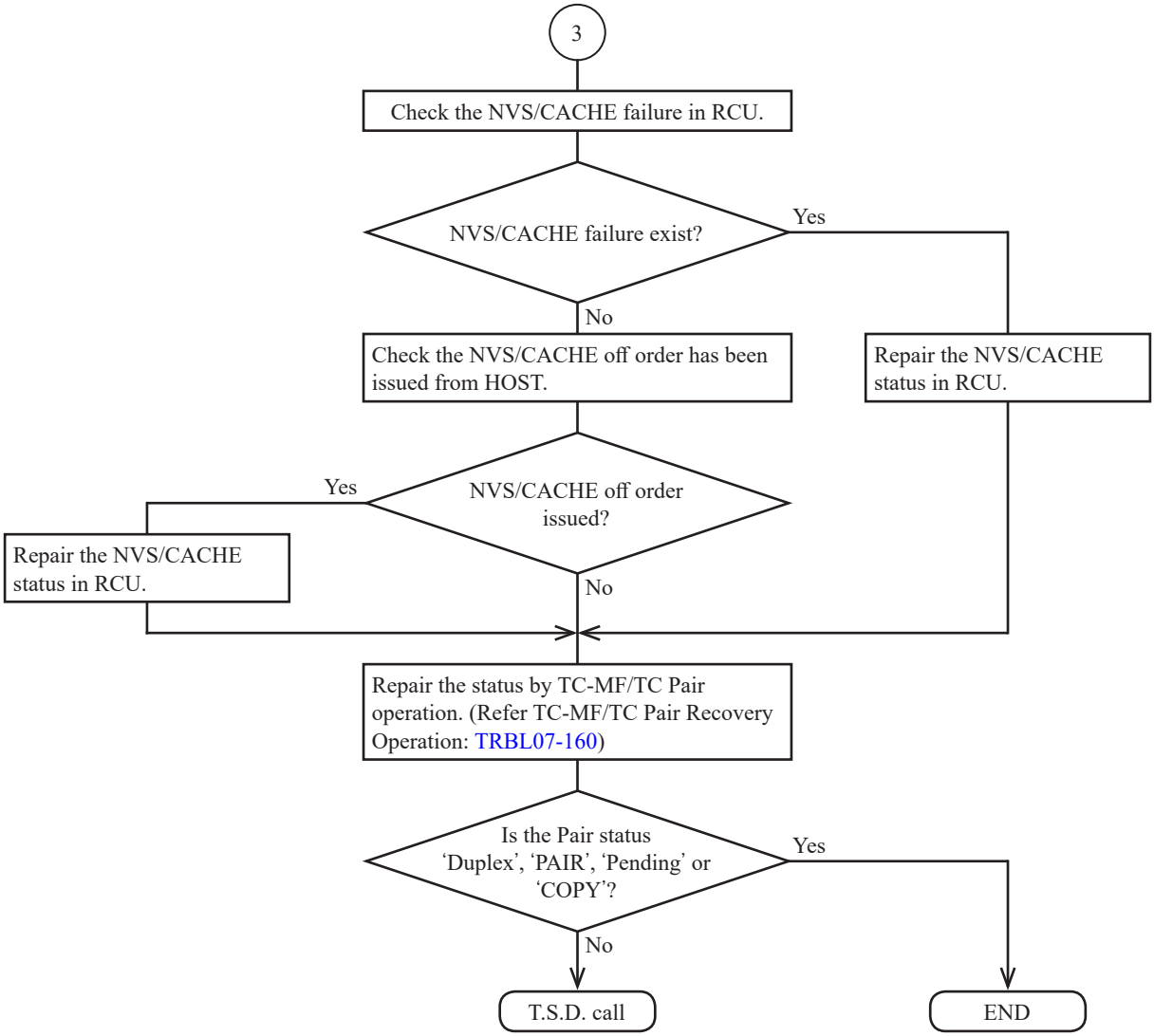


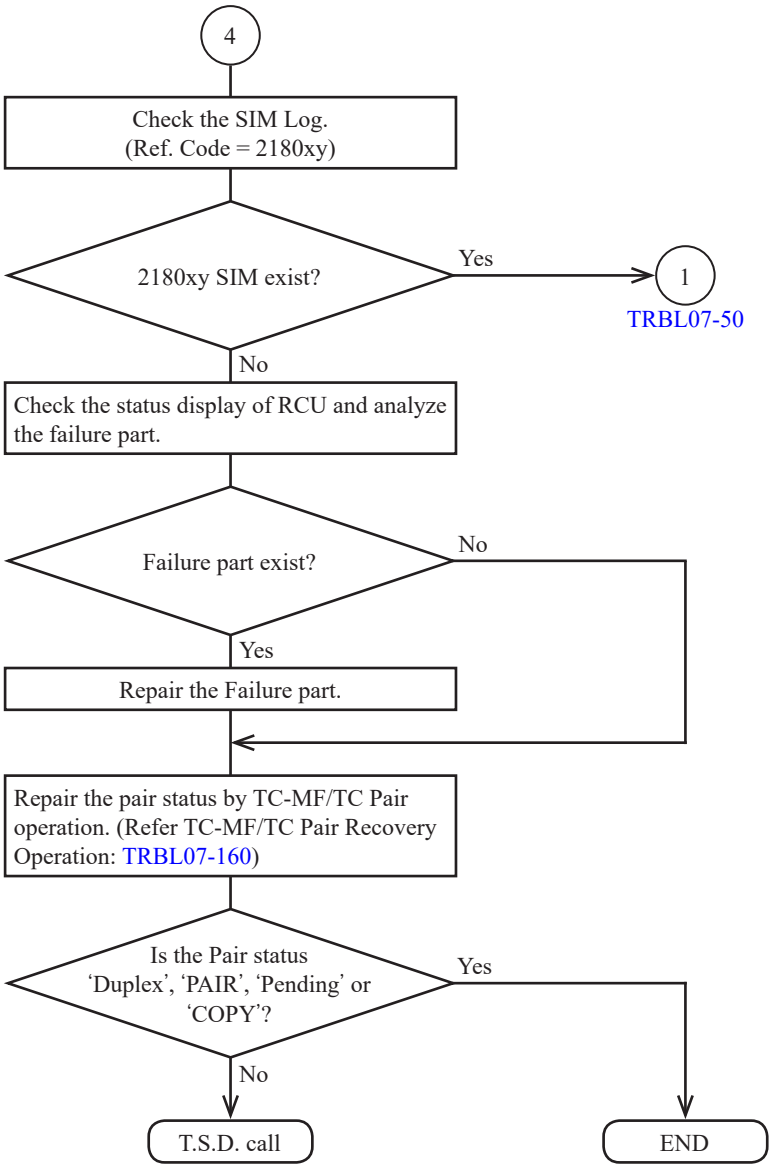
Table 7-3 TrueCopy for Mainframe Recovery Procedure for F/M = '8F'

No.	F/M	error code	mean	Recovery Procedure
1	8F	C4CE	Detect a nonstandard R0 track in M-VOL. (TC-MF or PPRC operation)	Change the track format to standard R0 track for the following track. CCHD is as follows. (use DSF INSPECT NOPRESERVE) LDEV in the SSB log window : M-VOL# SSB log byte44/45:CYL# byte46:HD#

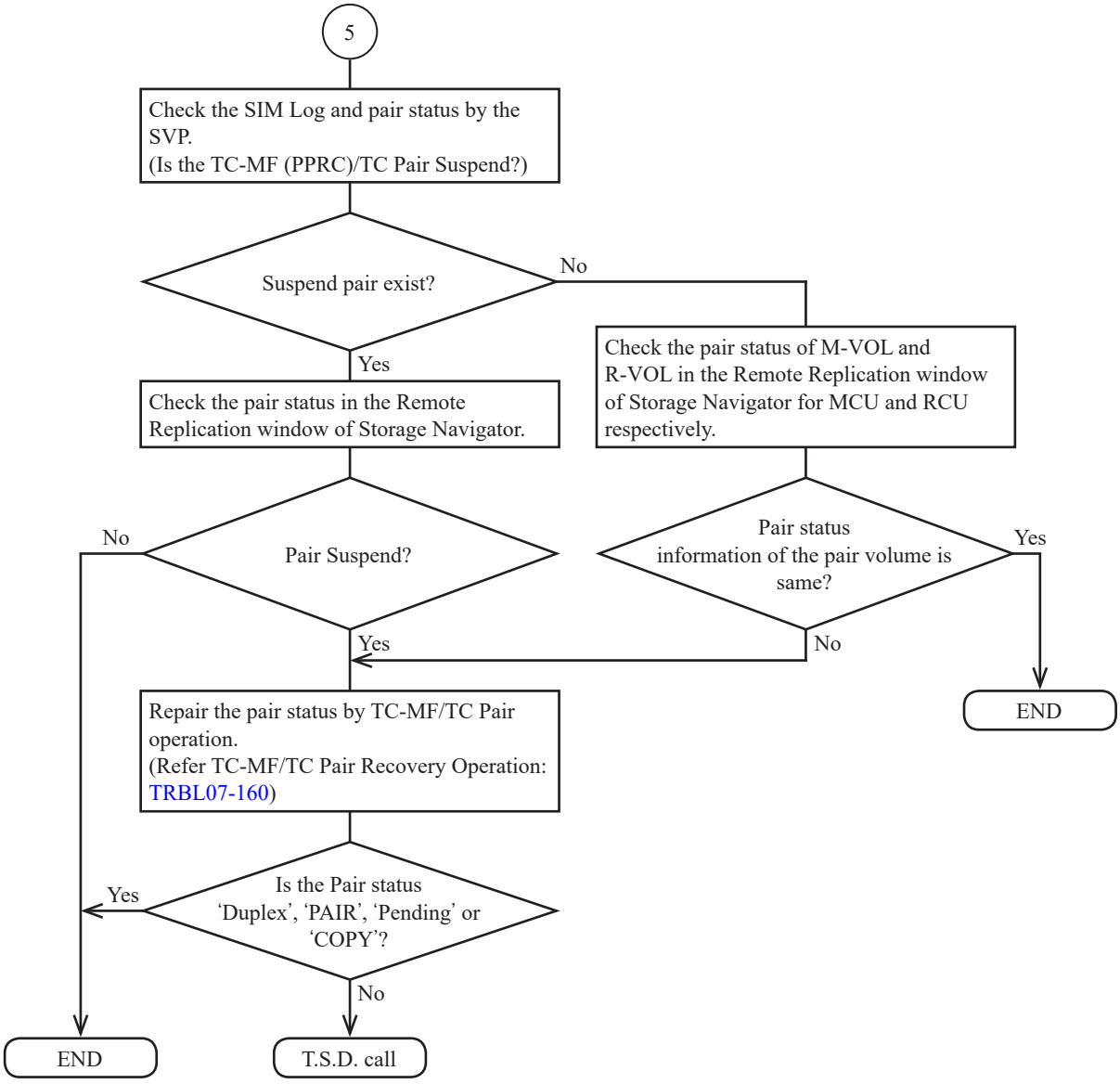
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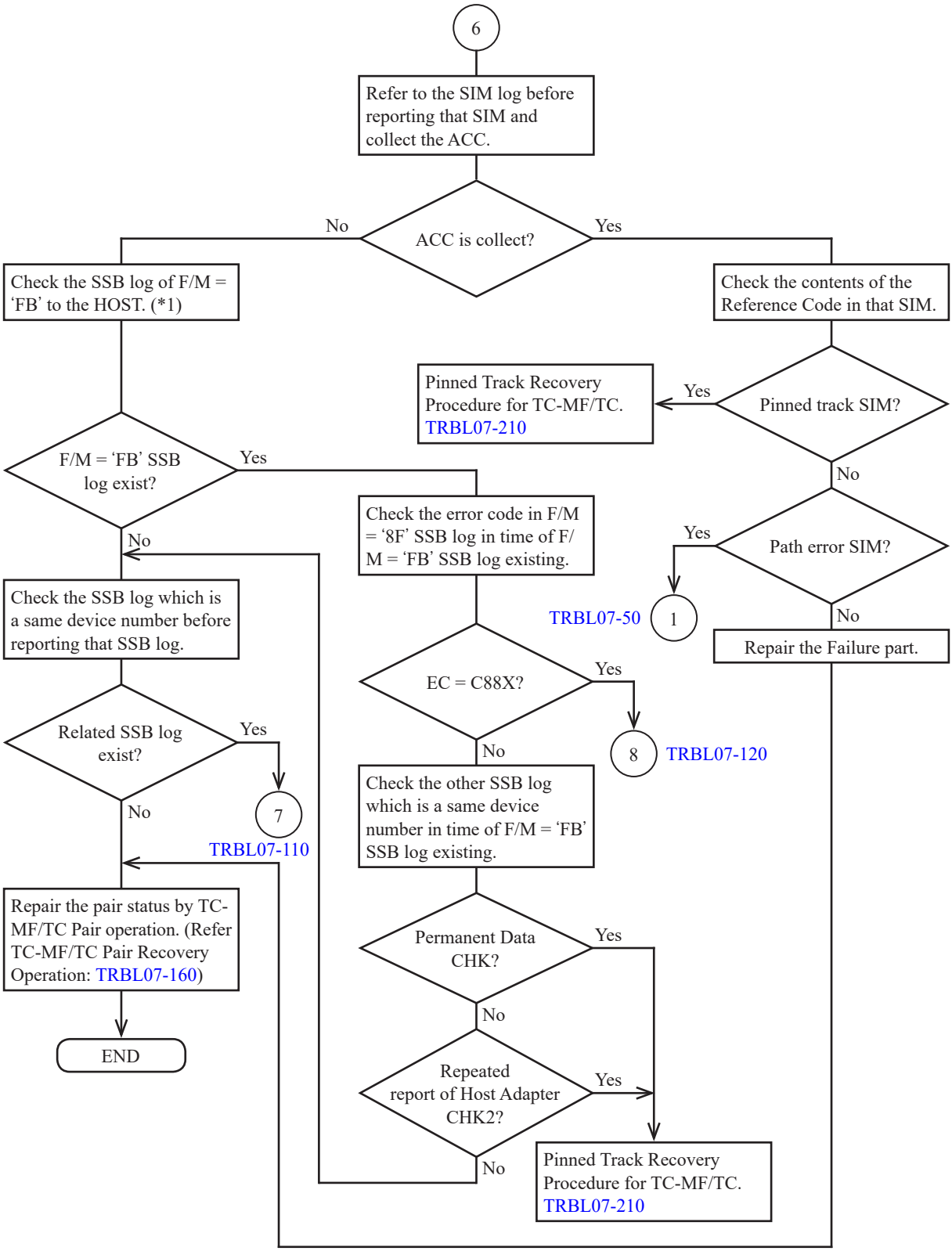


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*1: In the case of the TrueCopy, confirm the SSB Log of F/M = 'FB' in the suspended volume concerned. When the log of 'FB' does not exist, confirm the SSB error code of F/M = '8F' reported around the same time as the SIM was reported.

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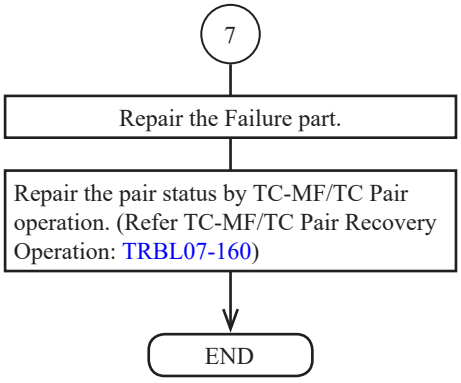
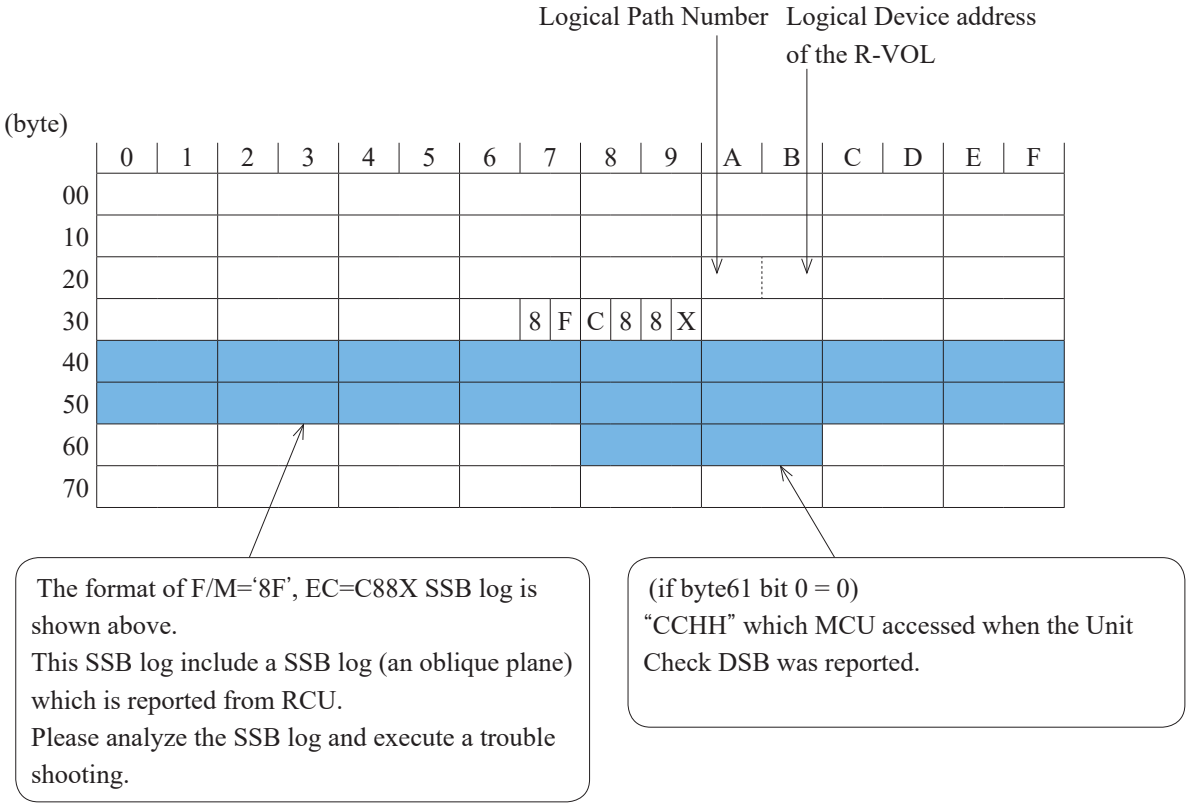
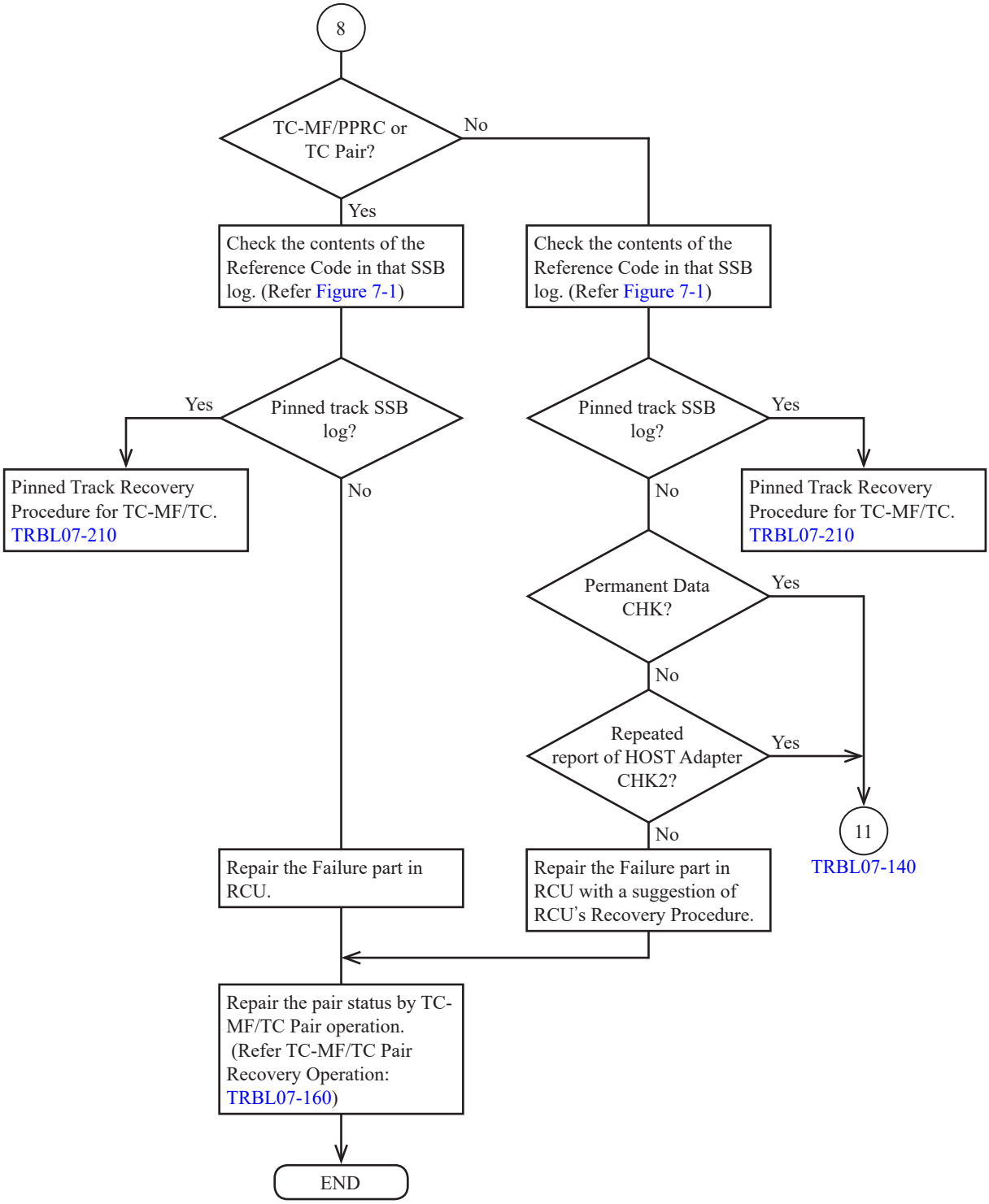
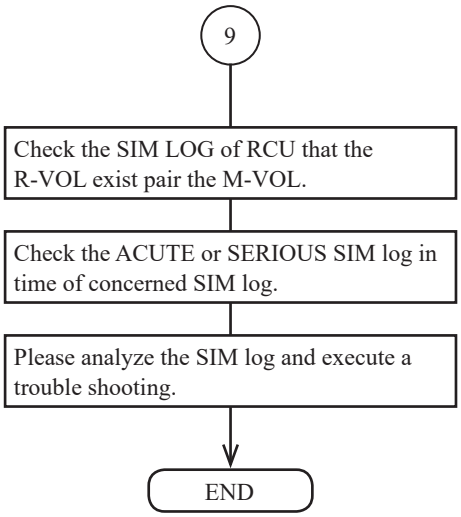


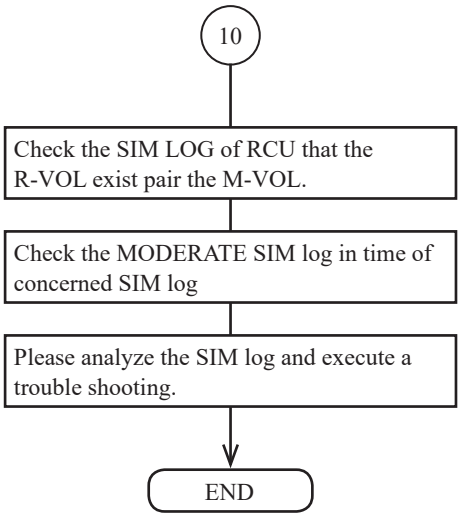
Figure 7-1 F/M = '8F', EC = C88X SSB logformat



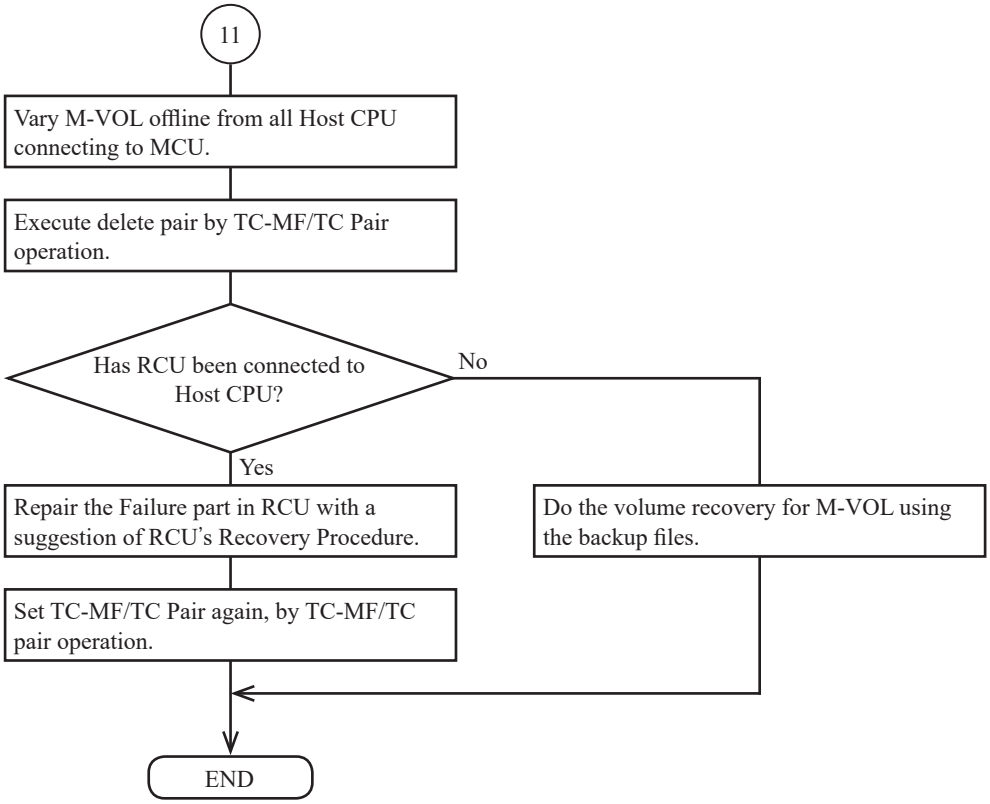
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9
Check the SIM LOG of RCU that the R-VOL exist pair the M-VOL.
Check the ACUTE or SERIOUS SIM log in time of concerned SIM log.
Please analyze the SIM log and execute a trouble shooting.
END

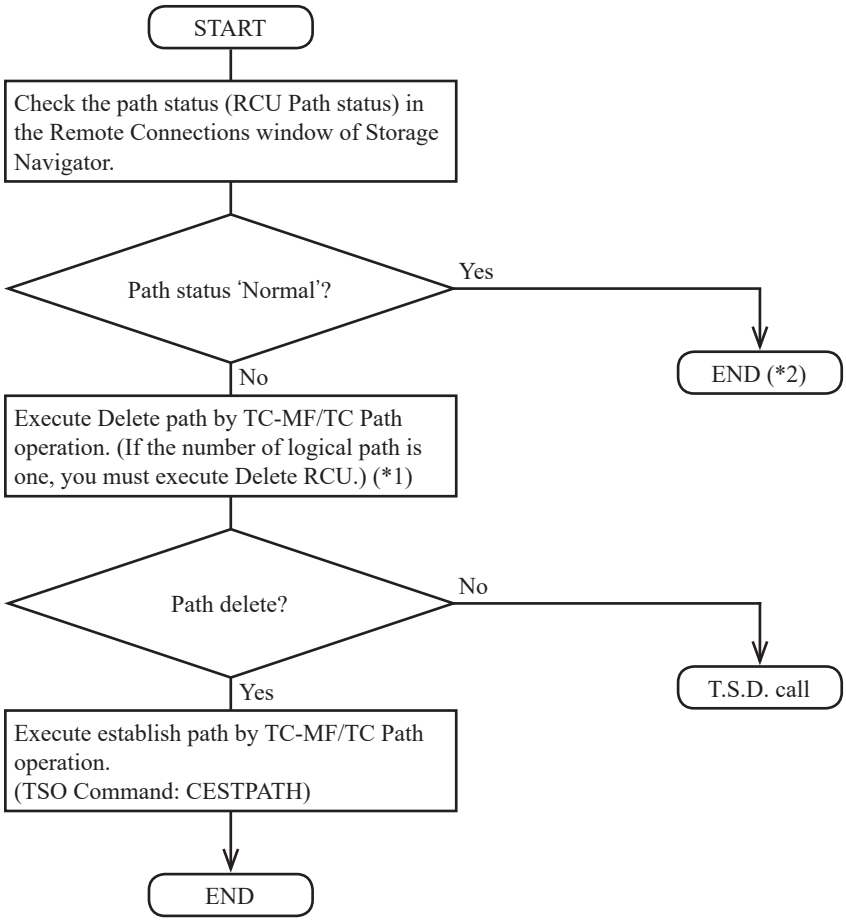

10
Check the SIM LOG of RCU that the R-VOL exist pair the M-VOL.
Check the MODERATE SIM log in time of concerned SIM log
Please analyze the SIM log and execute a trouble shooting.
END

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TC-MF/TC Path Recovery Procedure

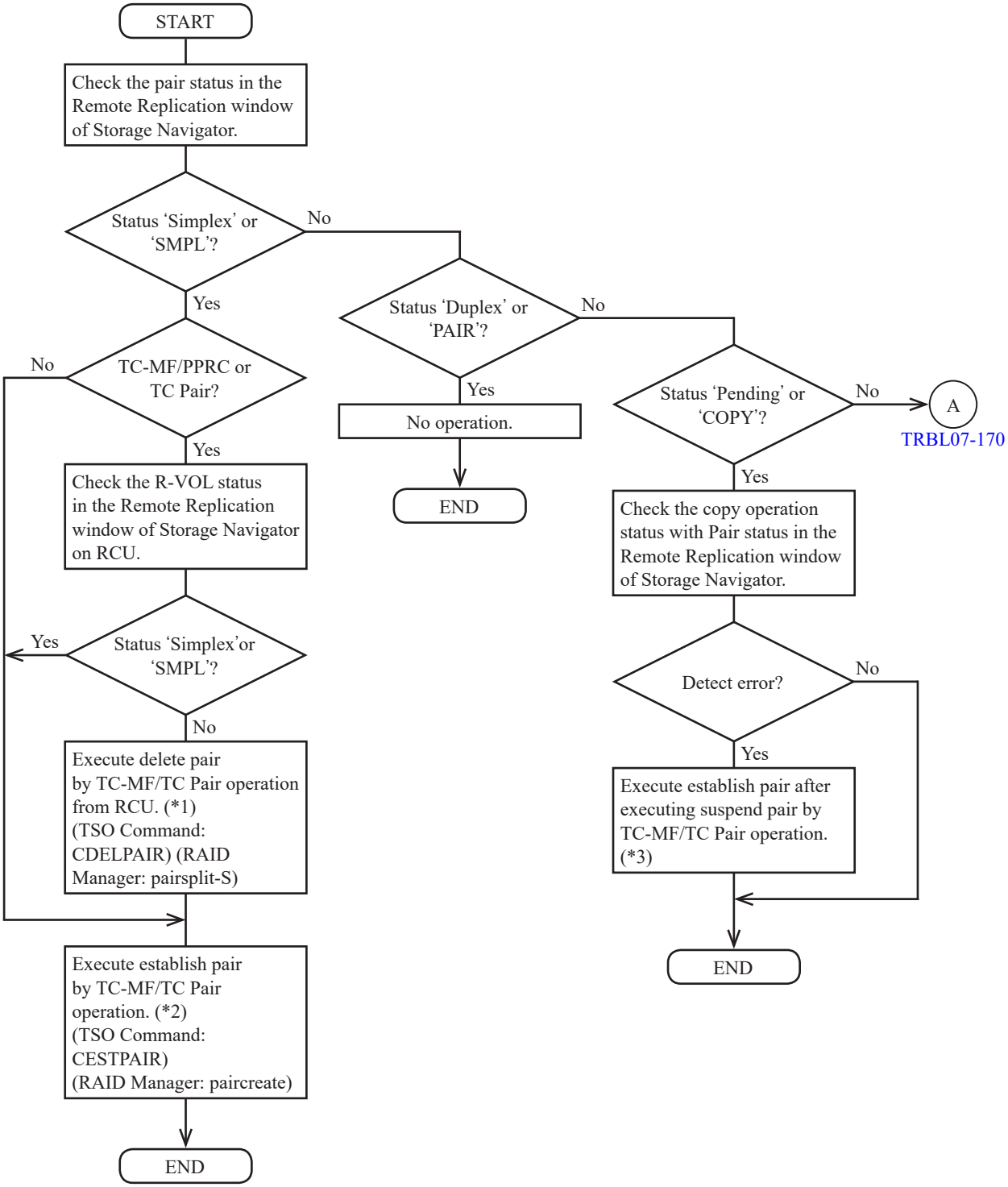


*1: For TSO Command operation, you issue CESTPATH Command, specified the path that established by the last CESTPATH Command issued except failed path. If the number of logical path is one, you must issue CDELPATH Command. (Refer IBM PPRCOPY Commands Manual)

*2: It seems that path has been normal status automatically caused by repairing failure part.

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TC-MF/TC Pair Recovery Operation (1/2)

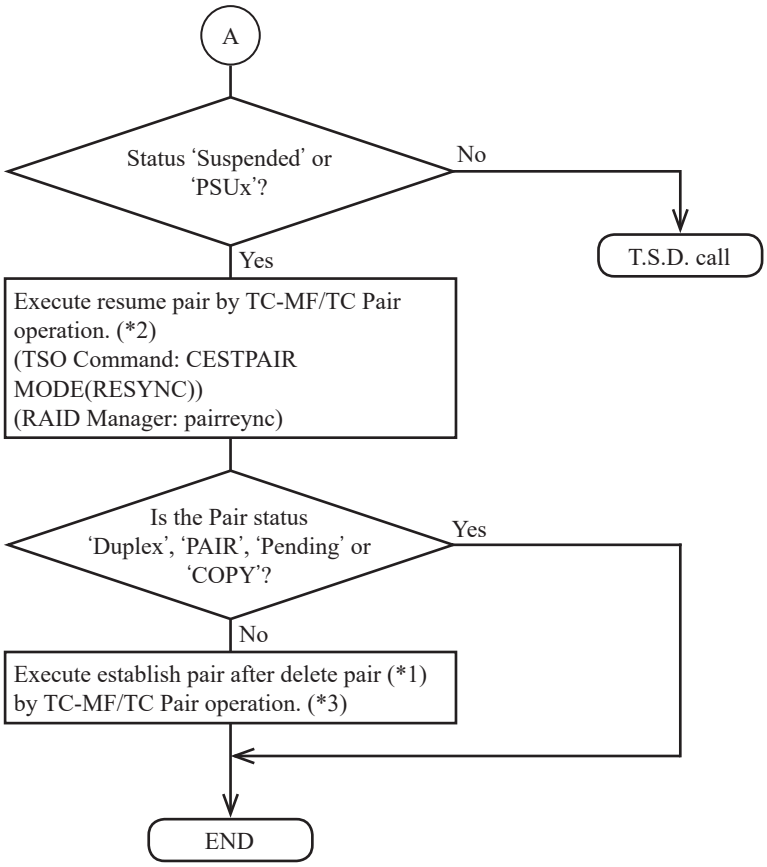


*2: If delete pair operation is executed according to *1, please establish pair operation to these TC-MF/TC pairs.

*3: For TSO Commnad operation, you issue CESTPAIR Command after CSUSPEND Command issued In the case of the RAID Manager, issue the Pairresync command after the Pairsplit command is issued.

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TC-MF/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 TSO Command operation, you issue CESTPAIR Command after CDELPAIR Command issued.

In the case of the RAID Manager, issue the Paircreate command after the Pairsplit-S command is issued.

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Recovery Operation of the Suspended TrueCopy Pair

This document which is addition of the TrueCopy for Mainframe/TrueCopy Pair Recovery Operation TRBL07-160 explain the recovery operation for the suspended TrueCopy pair in the extended LU.

After repairing the failure part, execute a resume (pair resync) operation for the suspended pair. TrueCopy resume operation can be executed from SVP, Web Console, and RAID Manager. A means, an object and a procedure of the resume operation are shown in a following table.

Table 7-4 TrueCopy Resume Operation Procedure in the extended LU

means	object	procedure
Web Console	Logical Unit	(1) Check the volume number of the suspend pair from the F/M = “FB” SSB. (2) Check the LU pair status which comprises the suspended pair volume is a “PSUS”, “PSUE”, or “PDUB”. (3) Execute a “Pairresync” operation to the LU pair. (4) Check the pair status is a “PAIR” (“Duplex”) or a “COPY” (“Pending”).
RAID Manager	Logical Unit	(1) Check the volume number of the suspend pair from the F/M = “FB” SSB. (2) Check the LU pair status which comprises the suspended pair volume is a “PSUS”, “PSUE”, or “PDUB”. (3) A pairresync command issues to the suspended LU pair. (4) Check the pair status is a “PAIR” (“Duplex”) or a “COPY” (“Pending”).

If pair status does not change “PAIR” (“Duplex”) or a “COPY” (“Pending”) after executing a “Pairresync” operation (pairresync command for RAID Manager), please try “Pairsplit -S” operation (pairsplit -s command for RAID Manager), and execute “Paircreate” operation (paircreate command for RAID Manager) again.

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Procedure when the host hangs
If a host hangs up while it is writing data in TrueCopy P-VOLs, data difference between paird 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.

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.

Special mentions on SIM = 2182xy
The SIM = 2182 host report is supported for the TrueCopy for Mainframe/TrueCopy activity with the CNT extender (Ultranet) between the MCU and RCU.
The SIM = 2182 indicates that the extender has detected a failure that occurred in a communication line and the failure has been reported to the MCU.
However, there are several special mentions on the SIM = 2182 report.

[Special mentions]

(1) When one extender has some alternative communication lines and a failure occurs on one line, the device will retry for another active line. Therefore, no line failure report is sent from the extender when the retrying succeeds.

(2) - The remote copy logical path that has received a line failure notification from the line extender is blocked (Path status: Communication Time Out).
- When recovering the logical path, please follow the TrueCopy for Mainframe/TrueCopy Path Recovery Procedure TRBL07-150.

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Special note of pair recovery procedure when SIM = d4fyyy is generated
The special note in the recovery procedure from Web Console when this SIM is generated when Paircreate or the Resume operation is executed, and the state of the pair enters the following states is shown below.

- When this SIM is generated when pair create is operated
  It ..state of the pair.. ..following.. explains the deletion of the object pair (make to Simplex (SMPL)) on the RCU side when becoming PVOL = Simplex (SMPL), SVOL = Duplex (PAIR) or Pending (COPY).

  The recovery procedure:
  Please execute the recovery work referring to this TROUBLE SHOOTING SECTION usually.

  (1) For TrueCopy/TrueCopy for Mainframe
  The Delete pair operation is executed to SVOL, and it wishes the execution of Pair create again.

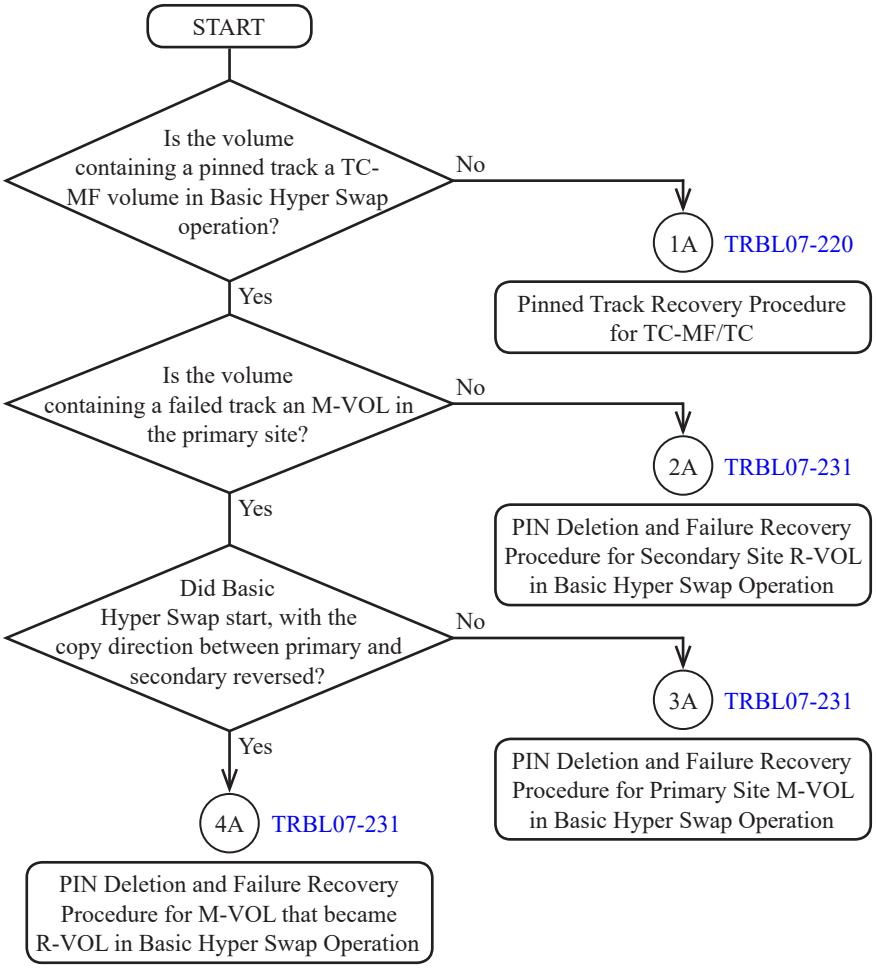
- When this SIM is generated when Resume is operated
  The state of the pair is PVOL = Suspend (PSUx), SVOL = Duplex (PAIR) or Pending. (COPY)

  The recovery procedure:
  Please execute the recovery work referring to this TROUBLE SHOOTING SECTION usually.

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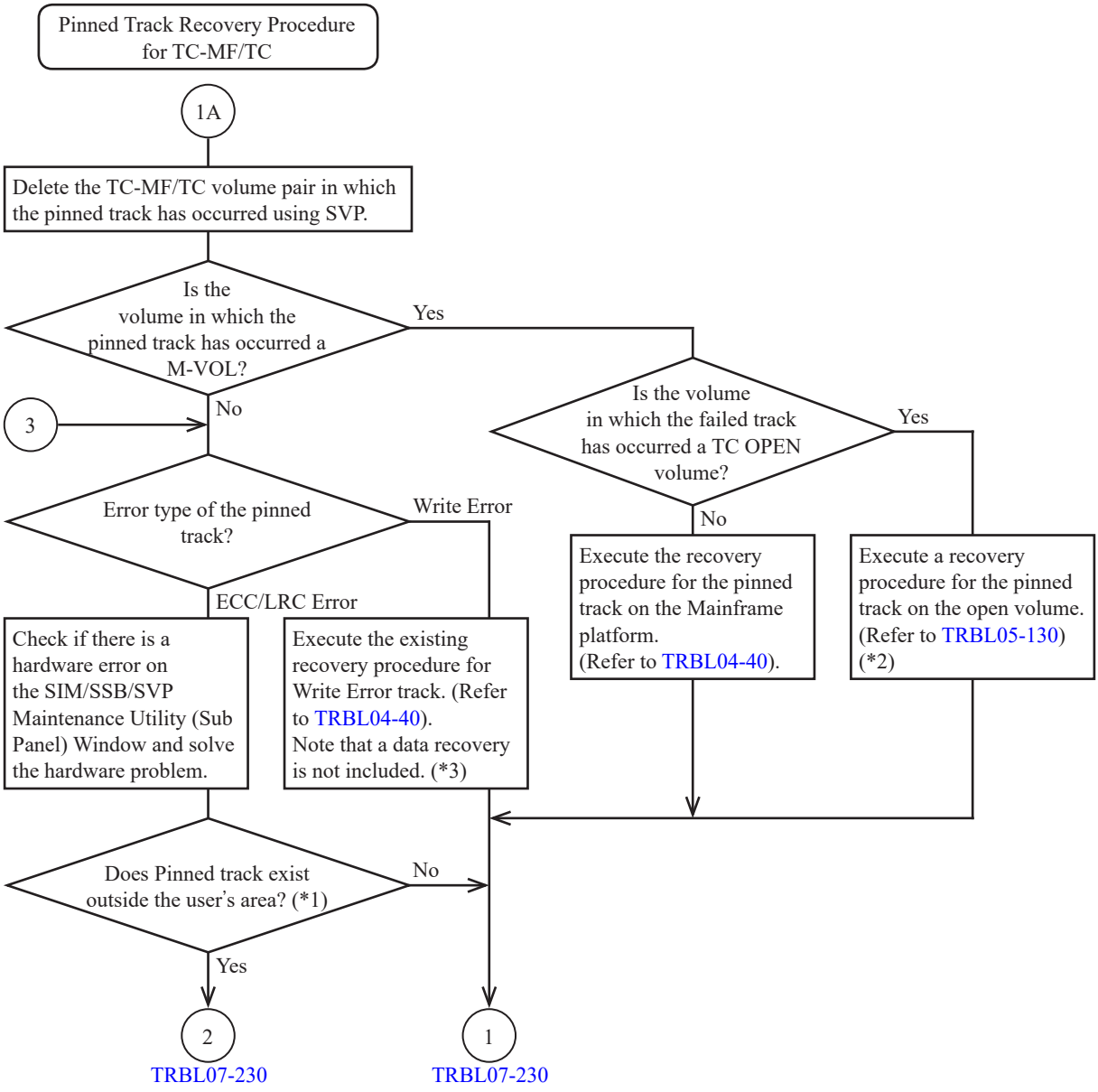
7.3 Recovery Procedure for TrueCopy for Mainframe/TrueCopy Pinned Track

Pinned track recovery procedure for TrueCopy for Mainframe/TrueCopy is as follows.



NOTE: If the pinned track has occurred in both M-VOL and R-VOL, recover the volumes according to the following sequence.
TrueCopy for Mainframe/TrueCopy : ① M-VOL → ② R-VOL

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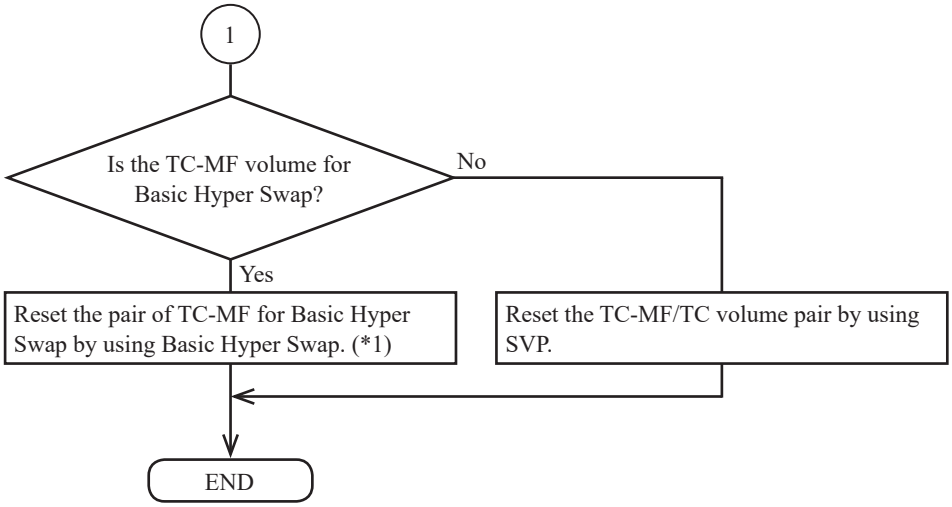


*1: If CC and HH information in the SVP PINNED TRACK shows outside the user area, this indicates that a pinned track occurred in the management area. (You can check the number of cylinders in the user area by seeing [Capacity] in the Logical Devices window of Web Console. Select "Cyl" as the capacity unit from [Options] in the Logical Devices window to check [Capacity].)

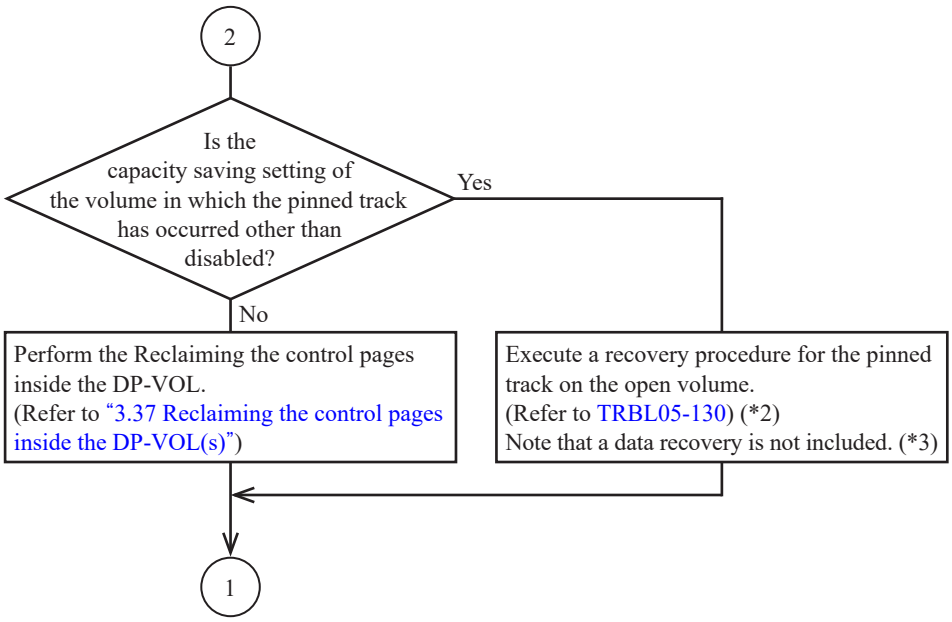
*2: In the recovery from a failed track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a failed track by means of the analyze command is executed. However, the LDEV formatting or the analyze command executing is not required if the failed track is a DP volume and out of the user area.

*3: Perform the data recovery by resetting the TC volume pair.

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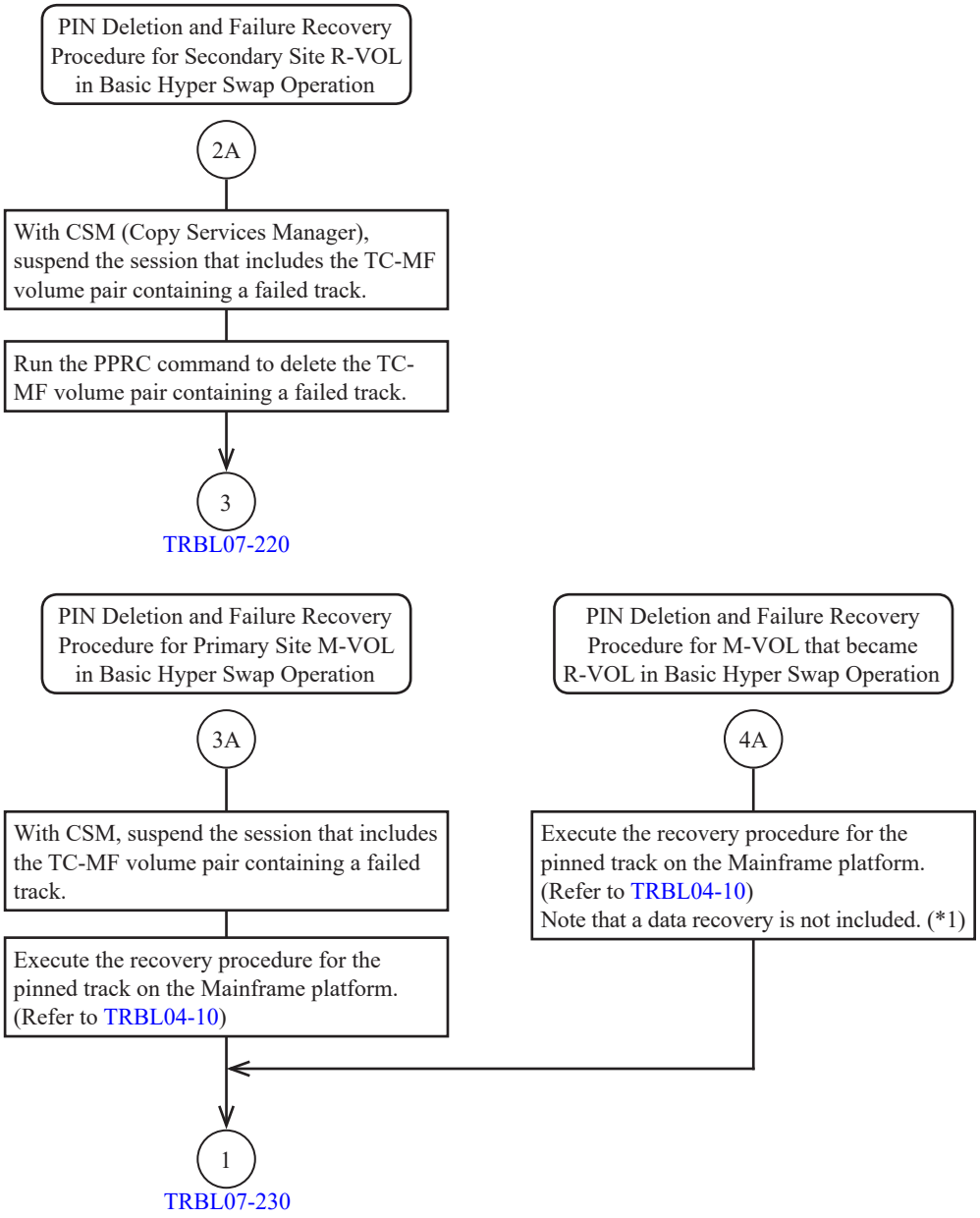
*1: When continuing the operation with the former R-VOL by Basic Hyper Swap, reset the pair using the former R-VOL data.



*2: In the recovery from a failed track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a failed track by means of the analyze command is executed. However, the LDEV formatting or the analyze command executing is not required if the failed track is a DP volume and out of the user area.

*3: Perform the data recovery by resetting the TC volume pair.

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*1: Perform the data recovery by resetting the TC volume pair.

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7.4 Recovery Action for 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 “Serial/Fibre”.	Delete the path with “Edit Path” or “Delete RCU”, add a new path with correct port type “Serial/Fibre” again.
	Specified MCU port type is not Bidirectional.	Change the channel type of the MCU port to Bidirectional.
	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.
“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 Bidirectional.	Change the channel type of the RCU port to Bidirectional.
“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

(To be continued)

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(Continued from the preceding page)

Path Status	Factor	Recovery Action
“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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7.5 Recovery Procedure for Related to BCM Operation Error

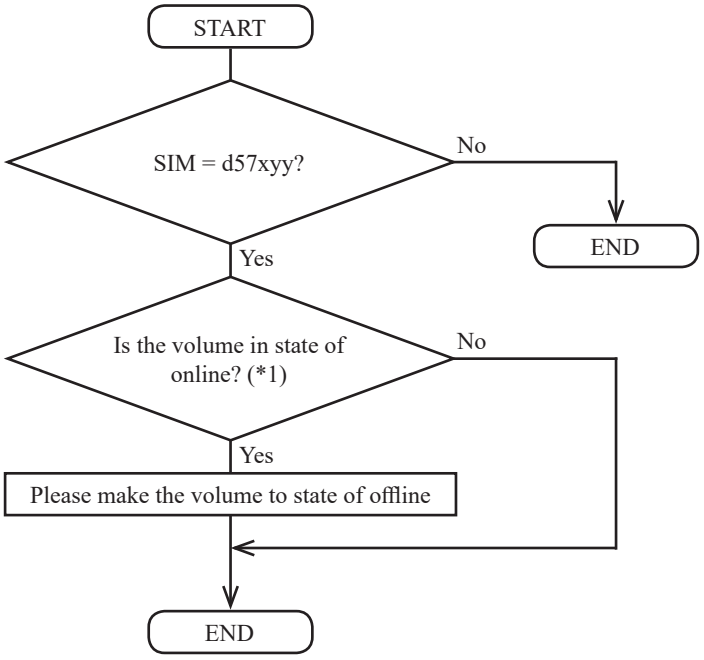
The following SIM may be reported by BCM operation. The meaning and the recovery procedure are described to the following.

Table 7-5 SIM related to BCM operation

SIM REF. CODE	Meaning	Remarks
d57xyy	Command device operation was executed in state of Command device was ONLINE	x: CU# yy: LDEV#

The flow chart of recovery procedure when the above-mentioned SIM was reported by the BCM operation is shown as follows.

Recovery Procedure for Related to BCM Operation Error



*1: Please refer to “Error Location” of SIM for the volume number.

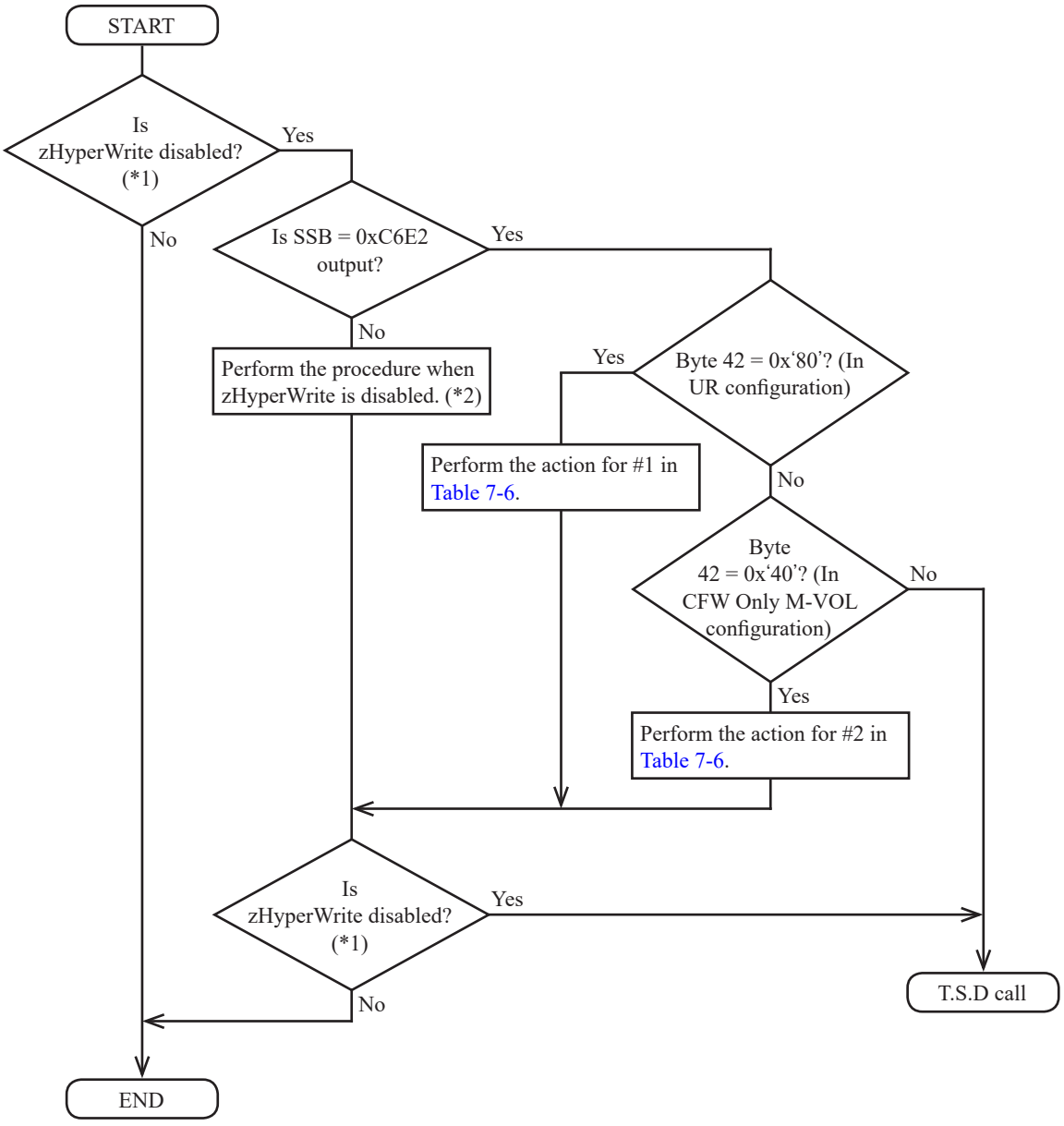
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7.6 Recovery Procedure when zHyperWrite Function is Disabled

Recovery procedure when zHyperWrite is disabled is as follows.
Note that there are two recovery procedures depending on the case.

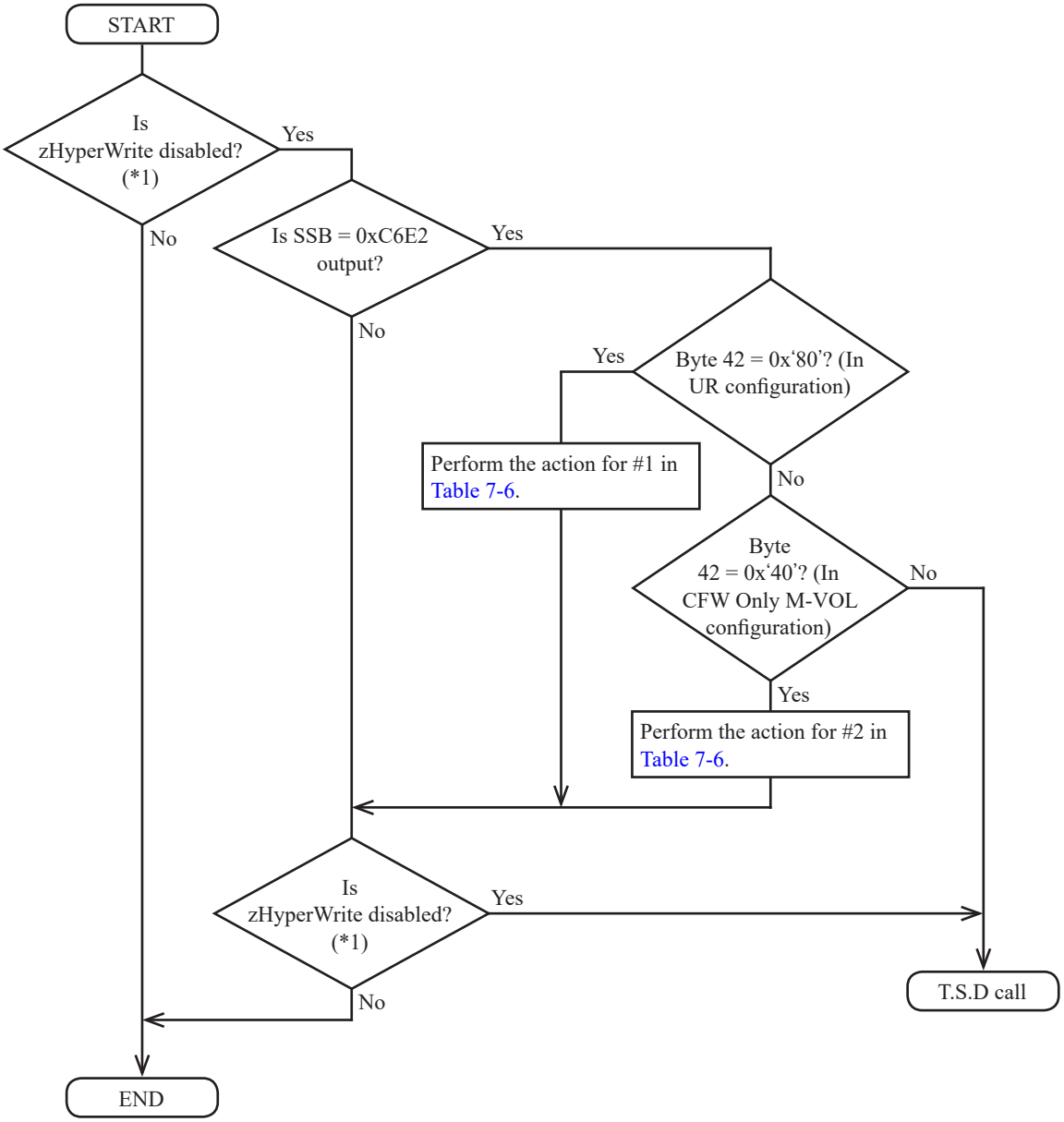
(1) Recovery in new installation : zHyperWrite is disabled when it is newly installed.
(2) Recovery in operation : zHyperWrite is disabled while being operated.

(1) Recovery in new installation



*1: Verify that zHyperWrite is enabled (or disabled) by using RMF to see if the host is writing DB2 (R) logs directly to the S-VOL of a TrueCopy for Mainframe pair in which the DB2 (R) log dataset is stored.
*2: See "TrueCopy (R) for Mainframe User Guide".

(2) Recovery in operation



*1: Verify that zHyperWrite is enabled (or disabled) by using RMF to see if the host is writing DB2 (R) logs directly to the S-VOL of a TrueCopy for Mainframe pair in which the DB2 (R) log dataset is stored.

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Table 7-6 Recovery Procedure when the zHyperWrite Function is Disabled (SSB = 0xC6E2 reported)

No	Cause	Meaning	Action
1	Byte 0x42 = 0x‘80’ (In URz/TCz configuration)	In 3DC Universal Replicator for Mainframe/ TrueCopy for Mainframe configuration, zHyperWrite is not available.	Remove a volume with DB2 (R) log data set from the 3DC configuration.
2	Byte 0x42 = 0x‘40’ (In CFW Only M-VOL configuration)	zHyperWrite is not available because “Only M-VOL” is specified for CFW Data mode.	Delete the target pair of TrueCopy for Mainframe, disable the function switch #12, and then create a pair again. See “Hitachi TrueCopy (R) for Mainframe User Guide”.

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7.7 Failure Recovery Procedure and Planned Shutdown Procedure of the TC-UR Configuration (Multi Target/Cascade)

7.7.1 Failure Recovery Procedure of the TC-UR Configuration (Multi Target/Cascade)

The descriptions of the TC-UR delta configuration in the failure recovery procedure and planned shutdown procedure for the TC-UR configuration are defined as follows:

TC-UR Delta Configuration	Definition of the Description
TC between PDKC and LDKC (IDKC (*1))	TC
UR between PDKC and RDKC (multi target configuration), or UR between IDKC and RDKC (cascade configuration)	UR
UR delta between LDKC and RDKC (multi target configuration)	UR delta

*1: Storage system in the intermediate site of IDKC (Intermediate DKC) and UR (Cascade 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 is the recovery procedure to maintain the disaster discovery configuration. Also, a failure is recovered in the same procedure in the MF configuration as well.

1. Multi Target Configuration: Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
-	[Normal Operation]	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
1	PDKC → LDKC Path failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	PAIR	1. TC failure suspension is detected in PVOL. (The pair status of SVOL does not change.) 2. Failure recovery site (Recover paths). 3. TC pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	PDKC → RDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	RDKC → PDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	

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2. Multi Target Configuration: Pool Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR pair deletion by RVOL. 2. TC pair takeover by LVOL. 3. UR pair (between LVOL and RVOL) creation by LVOL. 4. Failure recovery site (Expand the pool capacity). 5. TC pair takeover by PVOL. 6. UR pair (between LVOL and RVOL) deletion by LVOL. NOTE: In the configuration other than cascade, delete the UR pair before performing 5. 7. UR pair (between PVOL and RVOL) creation by PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	PVOL pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR pair deletion by RVOL. 2. TC pair takeover by LVOL. 3. UR pair (between LVOL and RVOL) creation by LVOL. 4. Failure recovery site (see TRBL13-10) 5. TC pair takeover by PVOL. 6. UR pair (between LVOL and RVOL) deletion by LVOL. NOTE: In the configuration other than cascade, delete the UR pair before performing 5. 7. UR pair (between PVOL and RVOL) creation by PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
3	LVOL pool full	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
4	LVOL pool failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site (see TRBL13-10). 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	

(To be continued)

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No.	Item	Mirror ID	Pair Status				Recovery operation
5	RVOL pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PFUS**	
6	RVOL pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (see TRBL13-10). 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

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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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
2	PDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
3	RDKC journal volume full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
4	RDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

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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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
2	PDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
3	RDKC journal volume pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
4	RDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

*1: Recovery procedures for failure in the pool where virtual volumes of Dynamic Provisioning (DP-VOLs) which are set as journal volumes exist 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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR pair deletion by RVOL. 2. TC pair takeover by LVOL. 3. UR pair (between LVOL and RVOL) creation by LVOL. 4. Failure recovery site. 5. TC pair takeover by PVOL. 6. UR pair (between LVOL and RVOL) deletion by LVOL. NOTE: In the configuration other than cascade, delete the UR pair before performing 5. 7. UR pair (between PVOL and RVOL) creation by PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	LVOL failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site. 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
3	RVOL failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

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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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR pair deletion by RVOL. 2. TC pair takeover by LVOL. 3. UR pair (between LVOL and RVOL) creation by LVOL. 4. DKC recovery. 5. TC pair takeover by PVOL. 6. UR pair (between LVOL and RVOL) deletion by LVOL. NOTE: In the configuration other than cascade, delete the UR pair before performing 5. 7. UR pair (between PVOL and RVOL) creation by PVOL.
		1	PVOL (UR PVOL)	PAIR (*1)	RVOL (UR SVOL)	PAIR (*1)	
2	LDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**PAIR**	1. DKC recovery. 2. TC pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. DKC recovery.
		1	PVOL (UR PVOL)	PAIR (*2)	RVOL (UR SVOL)	PAIR (*2)	

*1: TC and UR pair information of PDKC (PVOL) is retained, which changes the UR pair state to PSUE/SSUE after PDKC (PVOL) PS is on.

*2: If the Edit Advanced System Setting No.16 is set to ON in PDKC, the UR pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR pair.

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7. Cascade Configuration: Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
-	[Normal Operation]	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
1	PDKC → IDKC Path failure	0	PVOL (TC PVOL)	**PSUE**	IVOL (TC SVOL)	PAIR	1. TC failure suspension is detected in PVOL. (The pair status of SVOL does not change.) 2. Failure recovery site (Recover paths). 3. TC pair resync in PVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	IDKC → RDKC Path failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
3	RDKC → IDKC Path failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR pair resync in PVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	

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8. Cascade Configuration: Pool Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	PVOL pool full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. TC pair takeover by IVOL. 2. Failure recovery site (Expand the pool capacity). 3. TC pair takeover by PVOL. 4. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	PVOL pool failure	0	PVOL (TC PVOL)	PAIR (*1)	IVOL (TC SVOL)	PAIR (*1)	1. TC pair takeover by IVOL. 2. Failure recovery site (see TRBL13-10) 3. TC pair takeover by PVOL. 4. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
3	IVOL pool full	0	PVOL (TC PVOL)	**PSUE**	IVOL (TC SVOL)	**SSUE**	1. UR pair deletion by RVOL. 2. UR pair (between PVOL and RVOL) creation by PVOL. 3. Failure recovery site (Expand the pool capacity). 4. TC pair recovery in PVOL. 5. UR pair deletion by PVOL. 6. UR pair (between IVOL and RVOL) creation by IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
4	IVOL pool failure	0	PVOL (TC PVOL)	**PSUE**	IVOL (TC SVOL)	**SSUE**	1. UR pair deletion by RVOL. 2. UR pair (between PVOL and RVOL) creation by PVOL. 3. Failure recovery site (see TRBL13-10) 4. TC pair recovery in PVOL. 5. UR pair deletion by PVOL. 6. UR pair (between IVOL and RVOL) creation by IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	

(To be continued)

*1: The pair status is PSUE during UR pair creation or resynchronization.

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No.	Item	Mirror ID	Pair Status				Recovery operation
5	RVOL pool full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR pair recovery in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PFUS**	
6	RVOL pool failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (TRBL13-10) 3. UR pair recovery in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

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9. Cascade Configuration: Journal Volumes

No.	Item	Mirror ID	Pair Status				Recovery operation
1	IDKC journal volume full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
2	IDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
3	RDKC journal volume full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
4	RDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

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10. Cascade Configuration: Journal Volumes (Pool Volumes) (*1)

No.	Item	Mirror ID	Pair Status				Recovery operation
1	IDKC journal volume pool full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
2	IDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
3	RDKC journal volume pool full	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
4	RDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

*1: Recovery procedures for failure in the pool where virtual volumes of Dynamic Provisioning (DP-VOLs) which are set as journal volumes exist 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 (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. TC pair takeover by IVOL. 2. Failure recovery site. 3. TC pair takeover by PVOL. 4. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	IVOL failure	0	PVOL (TC PVOL)	**PSUE**	IVOL (TC SVOL)	**SSUE**	1. UR pair deletion by RVOL. 2. UR pair (between PVOL and RVOL) creation by PVOL. 3. Failure recovery site. 4. TC pair recovery in PVOL. 5. UR pair deletion by PVOL. 6. UR pair (between IVOL and RVOL) creation by IVOL.
		1	IVOL (UR PVOL)	PAIR (*1)	RVOL (UR SVOL)	PAIR (*1)	
3	RVOL failure	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery in IVOL.
		1	IVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	

*1: The pair status is PSUE during UR 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)	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. TC pair takeover by IVOL. 2. DKC recovery. 3. TC pair takeover by PVOL. 4. UR pair resync in IVOL.
		1	IVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
2	IDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	**PSUE**	IVOL (TC SVOL)	**PAIR**	1. UR pair deletion by RVOL. 2. UR pair (between PVOL and RVOL) creation by PVOL. 3. DKC recovery. 4. TC pair resync in PVOL. 5. UR pair deletion by PVOL. 6. UR pair (between IVOL and RVOL) creation by IVOL.
		1	IVOL (UR PVOL)	PAIR (*1)	RVOL (UR SVOL)	PAIR (*1)	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	PAIR	IVOL (TC SVOL)	PAIR	1. DKC recovery.
		1	IVOL (UR PVOL)	PAIR (*2)	RVOL (UR SVOL)	PAIR (*2)	

*1: TC and UR pair information of IDKC (IVOL) is retained, which changes the UR pair state to PSUE/SSUE after IDKC (IVOL) PS is on.

*2: If the Edit Advanced System Setting No.16 is set to ON in IDKC, the UR pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR pair.

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7.8 Failure Recovery Procedure and Planned Shutdown Procedure of the TC-UR Delta Configuration (Multi Target)

7.8.1 Failure Recovery Procedure of the TC-UR Delta Configuration (Multi Target)

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 is the recovery procedure to maintain the disaster discovery configuration. Also, a failure is recovered in the same procedure in the MF configuration as well.

1. Multi Target Configuration: Path between DKC

No.	Item	Mirror ID	Pair Status				Recovery operation
-	[Normal Operation]	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
1	PDKC → LDKC Path failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	PAIR	1. TC failure suspension is detected in PVOL. (The pair status of SVOL does not change.) 2. Failure recovery site (Recover paths). 3. TC pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LDKC → RDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (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
3	RDKC → LDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	PDKC → RDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC → PDKC Path failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. Any of the above, the recovery in the following procedure. 1. Failure recovery site (Recover paths). 2. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	Path failure for remote command device	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site (Recover paths).
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. TC pair swap suspension in LVOL. 2. Delta resync (UR delta resync in LVOL). 3. Failure recovery site (Expand the pool capacity). 4. TC and UR pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	PVOL pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. TC pair swap suspension in LVOL. 2. Delta resync (UR delta resync in LVOL). 3. Failure recovery site (see TRBL13-10) 4. TC and UR pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	LVOL pool full	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	LVOL pool failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site (see TRBL13-10) 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RVOL pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the pool capacity). 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
6	RVOL pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (see TRBL13-10) 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: TC-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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
2	PDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
3	LDKC journal volume full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR delta the delta recover.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE/ PJES (HLDE)**	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
4	LDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE/ PJES (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site (Expand the journal volume capacity). 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PFUS**	RVOL (UR SVOL)	**PFUS**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
6	RDKC journal volume failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	

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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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
2	PDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
3	LDKC journal volume pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE/ PJES (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	LDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR delta failure (PSUE(J)) detected. 2. Failure recovery site. 3. UR delta the delta recover.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	**PSUE/ PJES (HLDE)**	RVOL (UR delta SVOL)	SSUS (HOLD)	
5	RDKC journal volume pool full	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	
6	RDKC journal volume pool failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair resync in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS/ PJNS (HOLD)	RVOL (UR delta SVOL)	SSUS/ SJNS (HOLD)	

*1: Recovery procedures for failure in the pool where virtual volumes of Dynamic Provisioning (DP-VOLs) which are set as journal volumes exist 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 (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. TC pair swap suspension in LVOL. 2. Delta resync (UR delta resync in LVOL). 3. Failure recovery site. 4. TC and UR pair recovery. (*1)
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LVOL failure	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**SSUE**	1. TC failure suspension is detected. 2. Failure recovery site. 3. TC pair recovery in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RVOL failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. UR failure suspension is detected. 2. Failure recovery site. 3. UR pair recovery in PVOL.
		1	PVOL (UR PVOL)	**PSUE**	RVOL (UR SVOL)	**SSUE**	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
4	Remote command device failure	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. Failure recovery site. * If the remote command device settings are cancelled, make the settings again.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: TC-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) (*1)	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. TC pair swap suspension in LVOL. 2. Delta resync (UR delta resync in LVOL). 3. DKC recovery. 4. If the remote command device settings are cancelled, make the settings again. 5. TC pair swap resync in LVOL.
		1	PVOL (UR PVOL)	PAIR (*1)	RVOL (UR SVOL)	PAIR (*1)	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
2	LDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	**PSUE**	LVOL (TC SVOL)	**PAIR**	1. DKC recovery. 2. If the remote command device settings are cancelled, make the settings again. 3. TC pair resync in PVOL.
		1	PVOL (UR PVOL)	PAIR	RVOL (UR SVOL)	PAIR	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	
3	RDKC failure (SM/CM Non-Volatile)	0	PVOL (TC PVOL)	PAIR	LVOL (TC SVOL)	PAIR	1. DKC recovery. 2. If the remote command device settings are cancelled, make the settings again.
		1	PVOL (UR PVOL)	PAIR (*2)	RVOL (UR SVOL)	PAIR (*2)	
		2	LVOL (UR delta PVOL)	PSUS (HOLD)	RVOL (UR delta SVOL)	SSUS (HOLD)	

*1: TC and UR pair information of PDKC (PVOL) is retained, which changes the UR pair state to PSUE/SSUE after PDKC (PVOL) PS is on.

*2: If the Edit Advanced System Setting No.16 is set to ON in PDKC, the UR pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR pair.

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7.9 DKC Planned Shutdown Procedure of the TC-UR Configuration (Multi Target)

Following is the procedure of the planned shutdown (PS OFF/ON) of the PDKC/LDKC/RDKC in the TC-UR configuration (multi target). Because suspending all TC and 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. (If you stop host I/O and execute the Flush-specified suspension in advance, the data in the primary volume and the data in the secondary volume will be the same.)
The same shutdown procedure can be applied to the MF configuration.

7.9.1 Planned Shutdown Procedure of the PDKC

Table 7-7 Planned Shutdown Procedure of the PDKC of the TC-UR Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	UR pair deletion	Execute UR pair deletion on the PDKC. ↓ UR pair deletion PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **SMPL** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **SMPL**	#UR pair deletion % pairsplit -g UR -S -IH0
2	UR pair creation	Execute UR pair creation on the LDKC (between LDKC and RDKC). ↓ UR pair creation PDKC [PS ON]: TC PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#UR pair creation % paircreate -g UR -jp 1 -js 2 -IH1
3	Stop of host I/O to the PDKC	Suspend I/O from host to the PDKC (switch the operation to LDKC).	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
4	TC pair takeover	Execute TC pair takeover on the LDKC. ↓ TC pair takeover PDKC [PS ON]: TC SVOL: **PAIR** LDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair takeover % horctakeover -g TC -IH1
5	Start of host I/O to the LDKC	Consolidate host I/O to the LDKC.	
6	TC pair suspension	Execute TC pair suspension in the LDKC. ↓ TC pair suspension PDKC [PS ON]: TC SVOL: **SSUS** LDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair suspension % pairsplit -g TC -IH1
7	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF]: TC SVOL: **SSUS** LDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
-	During planned shutdown		
8	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON]: TC SVOL: **SSUS** LDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
9	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
10	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
11	TC pair resync	Execute TC pair resync in the LDKC. ↓ TC pair resync PDKC [PS ON]: TC SVOL: **PAIR** LDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair resync % pairresync -g TC -IH1
12	UR pair deletion	Execute UR pair deletion on the LDKC. ↓ UR pair deletion PDKC [PS ON]: TC SVOL: **PAIR** LDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **SMPL** RDKC [PS ON]: UR SVOL: **SMPL**	#UR pair deletion % pairsplit -g UR -S -IH1
13	UR pair creation	Execute UR pair creation on the PDKC (between PDKC and RDKC). ↓ UR pair creation PDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PAIR** LDKC [PS ON]: TC PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#UR pair creation % paircreate -g UR -jp 0 -js 2 -IH0
14	Stop of host I/O to the LDKC	Suspend I/O from host to the LDKC (return the operation to PDKC).	
15	TC pair takeover	Execute TC pair takeover on the PDKC. ↓ TC pair takeover PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair takeover % horctakeover -g TC -IH0
16	Start of host I/O to the PDKC	Consolidate host I/O to the PDKC.	

7.9.2 Planned Shutdown Procedure of the LDKC

Table 7-8 Planned Shutdown Procedure of the LDKC of the TC-UR Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	TC pair suspension	Execute TC pair suspension on the PDKC. ↓ TC pair suspension PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair suspension % pairsplit -g TC -IH0
2	LDKC PS OFF	Set the LDKC to PS OFF. ↓ PS OFF PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS OFF]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	
-	During planned shutdown		
3	LDKC PS ON	Set the LDKC to PS ON. ↓ PS ON PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(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</th></tr>
<tr><td>6</td><td>TC pair resync</td><td>Execute TC pair resync on the PDKC.
↓ TC pair resync
PDKC [PS ON]
TC PVOL: <u>PAIR</u>
UR PVOL: PAIR
LDKC [PS ON]
TC SVOL: <u>PAIR</u>
RDKC [PS ON]
UR SVOL: PAIR</td><td>#TC pair resync
% pairresync -g TC -IH0</td></tr>
</table>

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7.9.3 Planned Shutdown Procedure of the RDKC

Table 7-9 Planned Shutdown Procedure of the RDKC of the TC-UR Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	UR pair suspension	Execute UR pair suspension on the PDKC. ↓ UR pair suspension PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **SSUS**	#UR pair suspension % pairsplit -g UR -IH0
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR** ↓ PS OFF RDKC [PS OFF]: UR SVOL: **SSUS**	
-	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR** ↓ PS ON RDKC [PS ON]: UR SVOL: **SSUS**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(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</th></tr>
<tr><td>6</td><td>UR pair resync</td><td>Execute UR pair resync on the PDKC.
↓ UR pair resync
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC PVOL: PAIR
UR PVOL: <u>PAIR</u></td><td>TC SVOL: PAIR</td></tr></table>
<table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>PAIR</u></td></tr></table></td><td>#UR pair resync
% pairresync -g UR -IH0</td></tr>
</table>

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7.10 DKC Planned Shutdown Procedure of the TC-UR Configuration (Cascade)

Following is the procedure of the planned shutdown (PS OFF/ON) of the PDKC/IDKC/RDKC in the TC-UR configuration (cascade). Because suspending all TC and 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. (If you stop host I/O and execute the Flush-specified suspension in advance, the data in the primary volume and the data in the secondary volume will be the same.)
The same shutdown procedure can be applied to the MF configuration.

7.10.1 Planned Shutdown Procedure of the PDKC

Table 7-10 Planned Shutdown Procedure of the PDKC of the TC-UR Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	Stop of host I/O to the PDKC	Suspend I/O from host to the PDKC (switch the operation to IDKC).	
2	TC pair takeover	Execute TC pair takeover on the IDKC. ↓ TC pair takeover PDKC [PS ON]: TC SVOL: **PAIR** IDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair takeover % horctakeover -g TC -IH1
3	Start of host I/O to the IDKC	Consolidate host I/O to the IDKC.	
4	TC pair suspension	Execute TC pair suspension on the IDKC. ↓ TC pair suspension PDKC [PS ON]: TC SVOL: **SSUS** IDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair suspension % pairsplit -g TC -IH1

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
5	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF]: TC SVOL: **SSUS** IDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
-	During planned shutdown		
6	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON]: TC SVOL: **SSUS** IDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
7	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
8	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
9	TC pair resync	Execute TC pair resync on the IDKC. ↓ TC pair resync PDKC [PS ON]: TC SVOL: **PAIR** IDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair resync % pairresync -g TC -IH1
10	Stop of host I/O to the IDKC	Suspend I/O from host to the IDKC (return the operation to PDKC).	
11	TC pair takeover	Execute TC pair takeover on the PDKC. ↓ TC pair takeover PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PSUS** RDKC [PS ON]: UR SVOL: **SSUS**	TC pair takeover % horctakeover -g TC -IH0 * Executing TC pair takeover suspends the UR pair.

(To be continued)

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<table>
<tr><th>No.</th><th>Procedure item</th><th>Description
(Underlining means a part that changes from the previous status.)</th><th>Note</th></tr>
<tr><td>12</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>13</td><td>UR pair resync</td><td>Execute UR pair resync on the IDKC.
↓ UR pair resync
PDKC [PS ON]
TC PVOL: PAIR
IDKC [PS ON]
TC SVOL: PAIR
UR PVOL: <u>PAIR</u>
RDKC [PS ON]
UR SVOL: <u>PAIR</u></td><td>#UR pair resync
% pairresync -g UR -IH1</td></tr>
</table>

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7.10.2 Planned Shutdown Procedure of the IDKC

Table 7-11 Planned Shutdown Procedure of the IDKC of the TC-UR Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	UR pair deletion	Execute UR pair deletion on the IDKC. ↓ UR pair deletion PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **SMPL** RDKC [PS ON]: UR SVOL: **SMPL**	# UR pair deletion % pairsplit -g UR -S -IH1
2	UR pair creation	Execute UR pair creation on the PDKC (between PDKC and RDKC). ↓ UR pair creation PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#UR pair creation % paircreate -g UR -jp 0 -js 2 -IH0
3	TC pair suspension	Execute TC pair suspension on the PDKC. ↓ TC pair suspension PDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair suspension % pairsplit -g TC -IH0

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
4	IDKC PS OFF	Set the IDKC to PS OFF. ↓ PS OFF PDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** IDKC [PS OFF]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	
-	During planned shutdown		
5	IDKC PS ON	Set the IDKC to PS ON. ↓ PS ON PDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **SSUS** RDKC [PS ON]: UR SVOL: **PAIR**	
6	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
7	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
8	TC pair resync * For the multi target operation, skip Step 8 and Step 9.	Execute TC pair resync on the PDKC. ↓ TC pair resync PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	#TC pair resync % pairresync -g TC -IH0
9	UR pair deletion	Execute UR pair deletion on the PDKC. ↓ UR pair deletion PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **SMPL** IDKC [PS ON]: TC SVOL: **PAIR** RDKC [PS ON]: UR SVOL: **SMPL**	#UR pair deletion % pairsplit -g UR -S -IH0

(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</th></tr>
<tr><td>10</td><td>UR pair creation</td><td>Execute UR pair creation on the IDKC (between IDKC and RDKC).
↓ UR pair creation
<table><tr><th>PDKC [PS ON]</th><th>IDKC [PS ON]</th></tr><tr><td>TC PVOL: PAIR</td><td>TC SVOL: PAIR
UR PVOL: <u>PAIR</u></td></tr></table><table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>PAIR</u></td></tr></table></td><td>#UR pair creation
% paircreate -g UR -jp 1 -js 2 -IH1</td></tr>
</table>

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7.10.3 Planned Shutdown Procedure of the RDKC

Table 7-12 Planned Shutdown Procedure of the RDKC of the TC-UR Configuration (Cascade Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**	
1	UR pair suspension	Execute UR pair suspension on the IDKC. ↓ UR pair suspension PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PSUS** RDKC [PS ON]: UR SVOL: **SSUS**	#UR pair suspension % pairsplit -g UR -IH1
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PSUS** ↓ PS OFF RDKC [PS OFF]: UR SVOL: **SSUS**	
-	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON]: TC PVOL: **PAIR** IDKC [PS ON]: TC SVOL: **PAIR**, UR PVOL: **PSUS** ↓ PS ON RDKC [PS ON]: UR SVOL: **SSUS**	
4	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(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</th></tr>
<tr><td>6</td><td>UR pair resync</td><td>Execute UR pair resync on the IDKC.
↓ UR pair resync
<table><tr><th>PDKC [PS ON]</th><th>IDKC [PS ON]</th></tr><tr><td>TC PVOL: PAIR</td><td>TC SVOL: PAIR
UR PVOL: <u>PAIR</u></td></tr></table>
<table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>PAIR</u></td></tr></table></td><td>#UR pair resync
% pairresync -g UR -IH1</td></tr>
</table>

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7.11 DKC Planned Shutdown Procedure of the TC-UR Delta Configuration (Multi Target)

Following is the procedure of the planned shutdown (PS OFF/ON) of the PDKC/LDKC/RDKC in the TC-UR delta configuration (multi target). Because suspending all TC and 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. (If you stop host I/O and execute the Flush-specified suspension in advance, the data in the primary volume and the data in the secondary volume will be the same.)
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 is the planned shutdown procedure to maintain the disaster discovery configuration.
The same shutdown procedure can be applied to the MF configuration.

7.11.1 Planned Shutdown Procedure of the PDKC

Table 7-13 Planned Shutdown Procedure of the PDKC of the TC-UR Delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR 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	TC pair swap suspension	Execute TC pair swap suspension on the LDKC. ↓ TC pair swap suspension PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **SSWS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**; UR delta SVOL: **SSUS (HOLD)**	#TC pair swap suspension % pairsplit -g TC -RS -IH1
3	Delta resync (UR delta pair resync)	Execute delta resync (UR delta pair resync) on the LDKC. ↓ Delta resync PDKC [PS ON]: TC PVOL: **PSUS**; UR delta PVOL: **PSUS (HOLD)** LDKC [PS ON]: TC SVOL: **SSWS**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	#Delta resync % pairresync -g URdelta -IH1

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
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]: TC PVOL: **PSUS**; UR delta PVOL: **PSUS (HOLD)** LDKC [PS ON]: TC SVOL: **SSWS**; UR PVOL: **PAIR** RDKC [PS ON]: UR 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]: TC PVOL: **PSUS**; UR delta PVOL: **PSUS (HOLD)** LDKC [PS ON]: TC SVOL: **SSWS**; UR PVOL: **PAIR** RDKC [PS ON]: UR 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 check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
9	TC pair swap resync	Execute TC pair swap resync on the LDKC. ↓ TC pair swap resync PDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** LDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	#TC pair swap resync % pairresync -g TC -swaps -IH1
10	Stop of host I/O to the LDKC	Suspend I/O from host to the LDKC (return the operation to PDKC).	

(To be continued)

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<table>
<tr><th>No.</th><th>Procedure item</th><th>Description
(Underlining means a part that changes from the previous status.)</th><th>Note</th></tr>
<tr><td>11</td><td>TC pair swap suspension</td><td>Execute TC pair swap suspension on the PDKC.
↓ TC pair swap suspension
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC SVOL: <u>SSWS</u>
UR delta PVOL: PSUS (HOLD)</td><td>TC PVOL: <u>PSUS</u>
UR PVOL: <u>PSUS</u></td></tr></table><table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>SSUS</u>
UR delta SVOL: SSUS (HOLD)</td></tr></table></td><td>#TC pair swap suspension
% pairsplit -g TC -RS -IH0</td></tr>
<tr><td>12</td><td>Delta resync (UR delta pair resync)</td><td>Execute delta resync (UR delta pair resync) on the PDKC.
↓ Delta resync
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC SVOL: SSWS
UR PVOL: <u>PAIR</u></td><td>TC PVOL: PSUS
UR delta PVOL: <u>PSUS (HOLD)</u></td></tr></table><table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>PAIR</u>
UR delta SVOL: <u>SSUS (HOLD)</u></td></tr></table></td><td>#Delta resync
% pairresync -g UR -IH0</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>TC pair swap resync</td><td>Execute TC pair swap resync on the PDKC.
↓ TC pair swap resync
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC PVOL: <u>PAIR</u>
UR PVOL: PAIR</td><td>TC SVOL: <u>PAIR</u>
UR delta PVOL: PSUS (HOLD)</td></tr></table><table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: PAIR
UR delta SVOL: SSUS (HOLD)</td></tr></table></td><td>#TC pair swap resync
% pairresync -g TC -swaps -IH0</td></tr>
</table>

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7.11.2 Planned Shutdown Procedure of the LDKC

Table 7-14 Planned Shutdown Procedure of the LDKC of the TC-UR Delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	
1	TC pair suspension	Execute TC pair suspension on the PDKC. ↓ TC pair suspension PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **SSUS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	#TC pair suspension % pairsplit -g TC -H0
2	LDKC PS OFF	Set the LDKC to PS OFF. ↓ PS OFF PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS OFF]: TC SVOL: **SSUS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR 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]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **SSUS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR 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.	
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(To be continued)

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<table>
<tr><th>No.</th><th>Procedure item</th><th>Description
(Underlining means a part that changes from the previous status.)</th><th>Note</th></tr>
<tr><td>6</td><td>TC pair resync</td><td>Execute TC pair resync on the PDKC.
↓ TC pair resync
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC PVOL: <u>PAIR</u>
UR PVOL: PAIR</td><td>TC SVOL: <u>PAIR</u>
UR delta PVOL: PSUS (HOLD)</td></tr></table>
<table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: PAIR
UR delta SVOL: SSUS (HOLD)</td></tr></table></td><td>#TC pair resync
% pairresync -g TC -IH0</td></tr>
</table>

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7.11.3 Planned Shutdown Procedure of the RDKC

Table 7-15 Planned Shutdown Procedure of the RDKC of the TC-UR Delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	
1	UR pair suspension	Execute UR pair suspension on the PDKC. ↓ UR pair suspension PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**; UR delta SVOL: **SSUS (HOLD)**	#UR pair suspension % pairsplit -g UR -IH0
2	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** ↓ PS OFF RDKC [PS OFF]: UR SVOL: **SSUS**; UR delta SVOL: **SSUS (HOLD)**	
-	During planned shutdown		
3	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** ↓ PS ON RDKC [PS ON]: UR 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.	
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	

(To be continued)

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<table>
<tr><th>No.</th><th>Procedure item</th><th>Description
(Underlining means a part that changes from the previous status.)</th><th>Note</th></tr>
<tr><td>6</td><td>UR pair resync</td><td>Execute UR pair resync on the PDKC.
↓ UR pair resync
<table><tr><th>PDKC [PS ON]</th><th>LDKC [PS ON]</th></tr><tr><td>TC PVOL: PAIR
UR PVOL: <u>PAIR</u></td><td>TC SVOL: PAIR
UR delta PVOL: PSUS (HOLD)</td></tr></table>
<table><tr><th>RDKC [PS ON]</th></tr><tr><td>UR SVOL: <u>PAIR</u>
UR delta SVOL: SSUS (HOLD)</td></tr></table></td><td>#UR pair resync
% pairresync -g UR -IH0</td></tr>
</table>

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7.12 Planned Shutdown Procedure of All DKCs in 3DC Configuration

The following is the planned shutdown procedure of all DKCs in the 3DC configuration. The table below shows the procedure for the TC-UR delta configuration (multi target). The same procedure can be applied to the TC-UR configuration (multi target/cascade).

*: For the cascade configuration, replace “LDKC” with “IDKC”.

Table 7-16 Planned Shutdown Procedure of All DKCs in TC-UR Delta Configuration (Multi Target Configuration)

No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
-	Initial status	The PDKC is under operation. PDKC [PS ON]: TC PVOL: **PAIR**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	
1	Stop of host I/O to the PDKC	Suspend I/O from host to the PDKC.	
2	TC pair suspension	Execute TC pair suspension on the PDKC. ↓ TC pair suspension PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **SSUS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**; UR delta SVOL: **SSUS (HOLD)**	#TC pair suspension % pairsplit -g TC -IH0
3	UR pair suspension	Execute UR pair suspension on the PDKC. ↓ UR pair suspension PDKC [PS ON]: TC PVOL: **PSUS**; UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **SSUS**; UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**; UR delta SVOL: **SSUS (HOLD)**	#UR pair suspension % pairsplit -g UR -IH0

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
4	PDKC PS OFF	Set the PDKC to PS OFF. ↓ PS OFF PDKC [PS OFF] TC PVOL: **PSUS** UR PVOL: **PSUS** LDKC [PS ON] TC SVOL: **SSUS** UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON] UR SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
5	LDKC PS OFF	Set the LDKC to PS OFF. ↓ PS OFF PDKC [PS OFF] TC PVOL: **PSUS** UR PVOL: **PSUS** LDKC [PS OFF] TC SVOL: **SSUS** UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON] UR SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
6	RDKC PS OFF	Set the RDKC to PS OFF. PDKC [PS OFF] TC PVOL: **PSUS** UR PVOL: **PSUS** LDKC [PS OFF] TC SVOL: **SSUS** UR delta PVOL: **PSUS (HOLD)** ↓ PS OFF RDKC [PS OFF] UR SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	
-	During planned shutdown		
7	RDKC PS ON	Set the RDKC to PS ON. PDKC [PS OFF] TC PVOL: **PSUS** UR PVOL: **PSUS** LDKC [PS OFF] TC SVOL: **SSUS** UR delta PVOL: **PSUS (HOLD)** ↓ PS ON RDKC [PS ON] UR SVOL: **SSUS** UR delta SVOL: **SSUS (HOLD)**	

(To be continued)

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note
8	LDKC PS ON	Set the LDKC to PS ON. ↓ PS ON PDKC [PS OFF]: TC PVOL: **PSUS**, UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **SSUS**, UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**, UR delta SVOL: **SSUS (HOLD)**	
9	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON]: TC PVOL: **PSUS**, UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **SSUS**, UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**, UR delta SVOL: **SSUS (HOLD)**	
10	Check of the block part	Confirm each DKC has no block part. If there are block parts, recover them.	
11	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
12	TC pair resync	Execute TC pair resync on the PDKC. ↓ TC pair resync PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PSUS** LDKC [PS ON]: TC SVOL: **PAIR**, UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **SSUS**, UR delta SVOL: **SSUS (HOLD)**	#TC pair resync % pairresync -g TC -IH0
13	Start of host I/O to the PDKC	Consolidate host I/O to the PDKC.	
14	UR pair resync	Execute UR pair resync on the PDKC. ↓ UR pair resync PDKC [PS ON]: TC PVOL: **PAIR**, UR PVOL: **PAIR** LDKC [PS ON]: TC SVOL: **PAIR**, UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON]: UR SVOL: **PAIR**, UR delta SVOL: **SSUS (HOLD)**	#UR pair resync % pairresync -g UR -IH0

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8. Forced Outage and Restart of HSNBX/DKC/DKU

⚠ 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 five 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 (*1)	Yes	TRBL08-20
2	Forced volatilization (full) power-off and restarting procedure 1-1 (*3)	Volatilization (All data in SM/CM is deleted.)	No	Yes	TRBL08-80
3	Forced volatilization (full) power-off and restarting procedure 1-2 (*3)	Volatilization (All data in SM/CM is deleted.)	No	Yes	TRBL08-100
4	Forced volatilization (part) power-off and restarting procedure 2-1	Volatilization (Only specific data (*2) in SM/CM is restored from CFMs.)	Yes (*1)	No	TRBL08-130
5	Forced volatilization (part) power-off and restarting procedure 2-2	Volatilization (Only specific data (*2) in SM/CM is restored from CFMs.)	Yes (*1)	Yes	TRBL08-150

*1: When data in SM/CM is stored in CFMs, batteries are used. Therefore, energy in batteries is consumed.

*2: Only management information of both Quick Format and HDP is restored from CFMs. The other data in SM/CM is deleted.

*3: If there is a blocked CTL when performing the forced volatilization procedure, remove the CTL before performing a restart, or perform the forced volatilization again after performing a restart.

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8.1 Non volatilization power-off and restarting procedure

When this procedure is executed, the AC input of the power supply of the HSNBX, DKC and the DKU 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 "8.2 Forced volatilization (full) power-off and restarting procedure 1-1" and "8.3 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.
- The DKC processor failure / SVP failure SIM (73xx00) may occur during this work. Just complete them, when the work is finished.
- Before starting the operation, stop I/Os from the host. If you perform the operation without stopping I/Os, the host might detect an error of a job being executed, and the storage system might detect an error where I/O processes are not completed.
- 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 CFMs 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 [Exit], close Maintenance Utility window, and go to the next section.

3. Turn off the power of the SVP referring to the "Power Off" (SVP01-200)

NOTICE: Make sure to perform Step 4. within 15 minutes after turning OFF the power of SVP. If the condition that SVP is OFF and breaker is ON continues for 15 minutes or more, the following occurs.
- (If SVP High Availability kit is not installed) SVP power is forcibly turned ON.
- (If SVP High Availability kit is installed) SVP failover takes place.

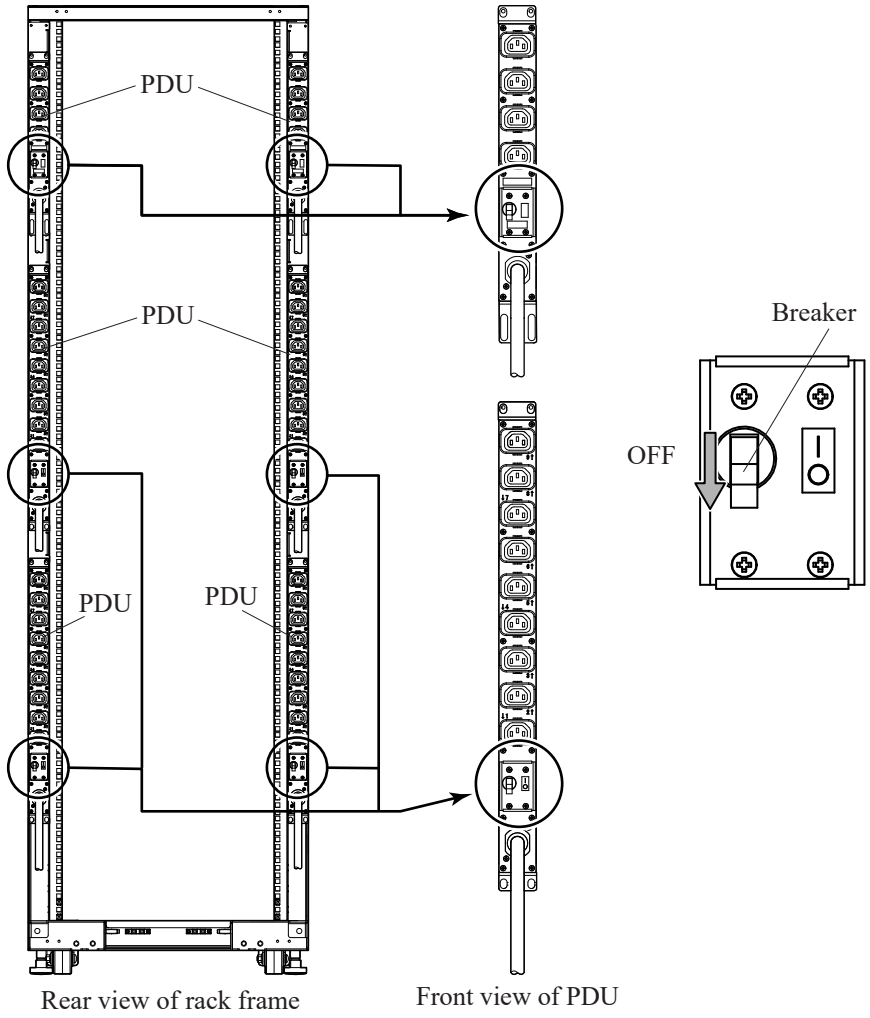
If it will take 15 minutes or more to perform the procedure, set the SVP RAS switch #1 (LOC03-40) on the SSVP to ON before starting.
After completion of the procedure, set the SVP RAS switch #1 to OFF.

4. Remove the AC cables from the ISWPSs in the HSNBXs.
   (More than one SIM = 2160xx and more than one SIM = 2161xx are reported.)

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5. Turn off the PDU breakers that are connected to the DKC.

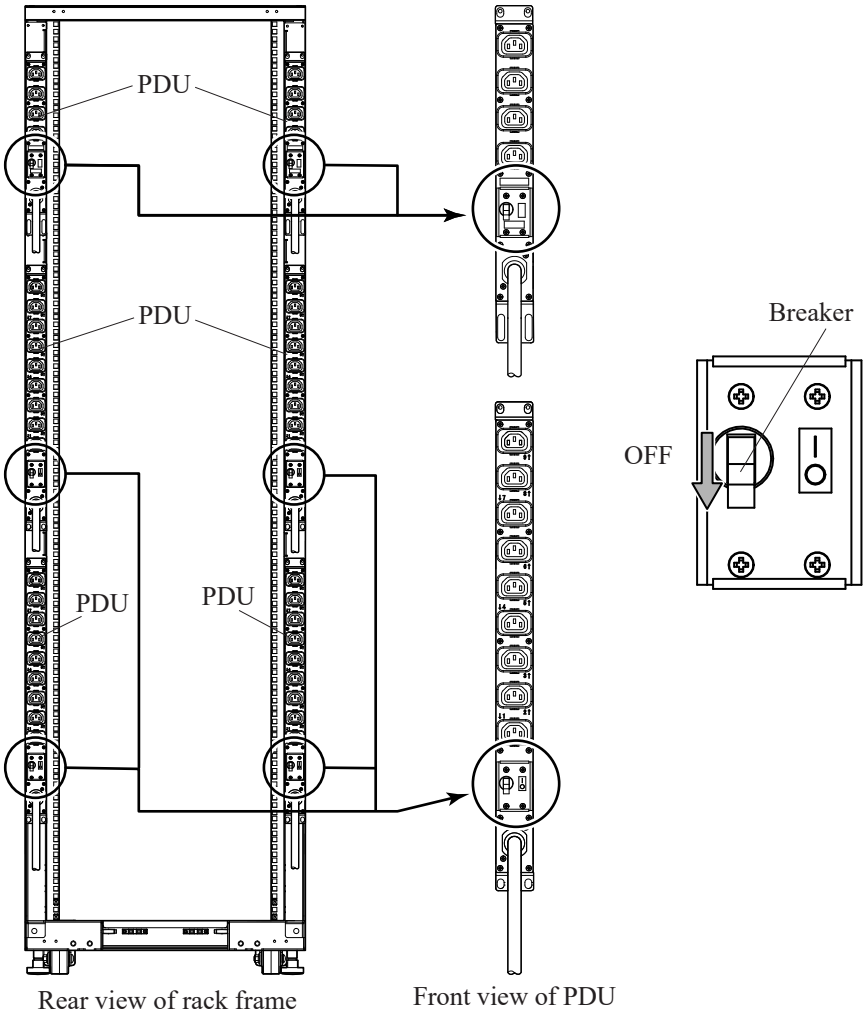
Figure 8-1 Turning Off PDU Breaker



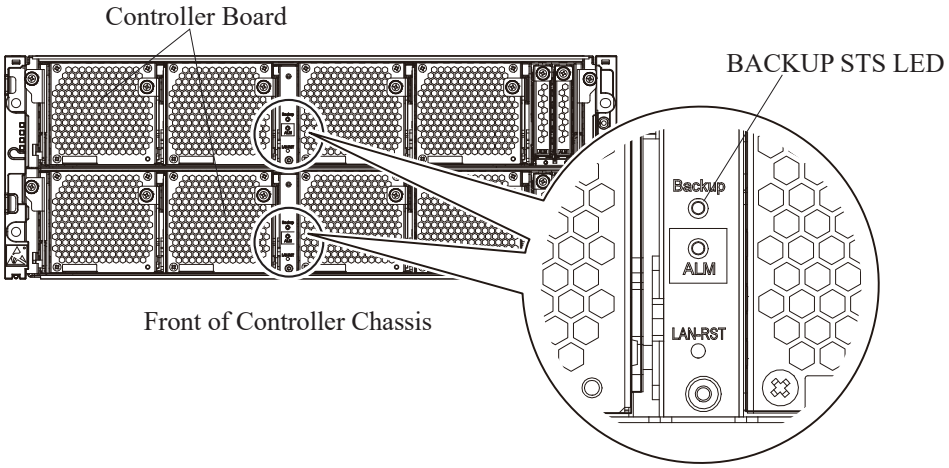
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6. Turn off the PDU breakers that are connected to the DKU.

Figure 8-2 Turning Off PDU Breaker



7. Wait for 30 seconds or more until the BACKUP STS LED in off state starts blinking at low speed (On and off are repeated at 0.5-second intervals).

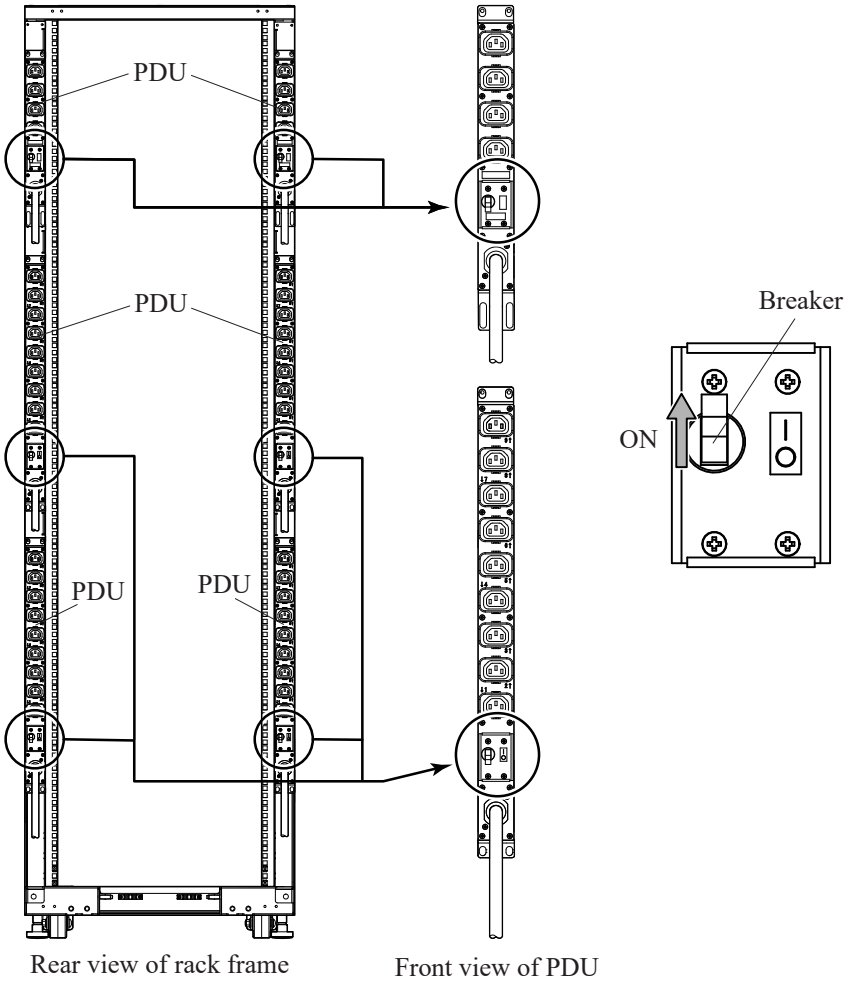


NOTE: For VSP 5100 and VSP 5100H, only one Controller Board is installed in DKC.

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8. Turn on the PDU breakers that are connected to the DKU.

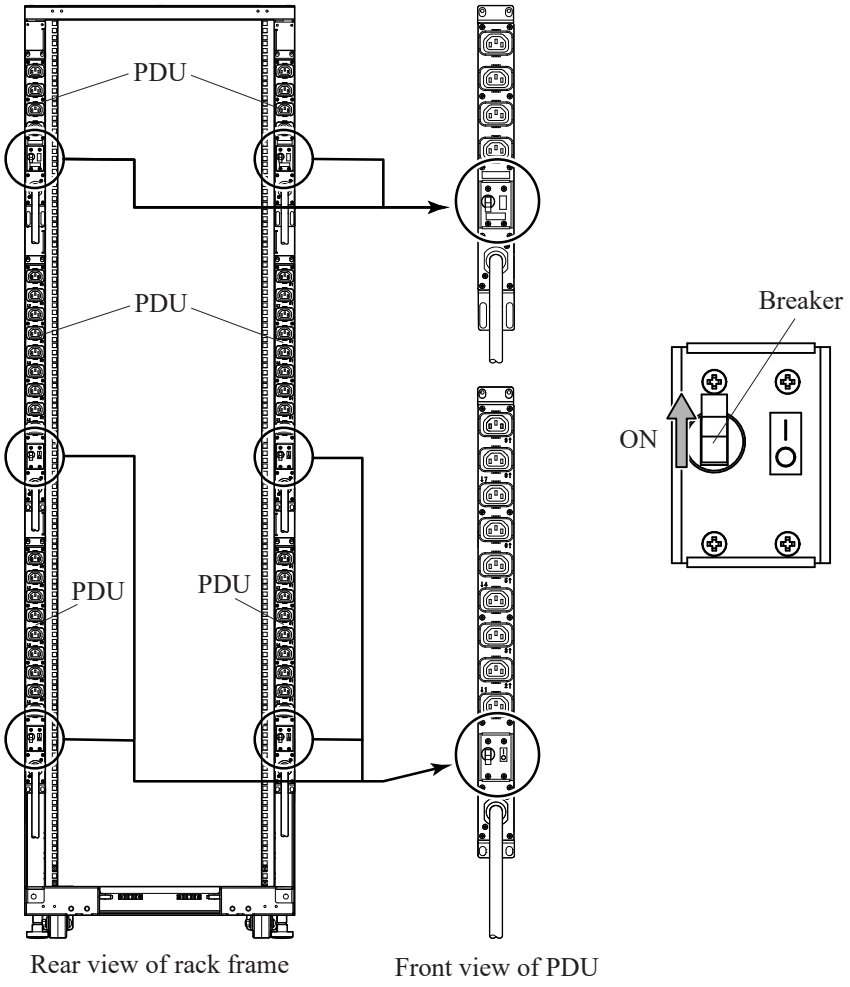
Figure 8-3 Turning On PDU Breaker



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9. Turn on the PDU breakers that are connected to the DKC.

Figure 8-4 Turning On PDU Breaker



10. Connect the AC cables to the ISWPSs in the HSNBXs.

11. Wait until the state of the BACKUP STS LED changes from low-speed blinking to off.

12. Power on the storage system (see “Storage System Power On” (INST(GE)05-01-10)).

8.2 Forced volatilization (full) power-off and restarting procedure 1-1

When this procedure is executed, the AC input of the power supply of the HSNBX, DKC and the DKU 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 "8.1 Non volatilization power-off and restarting procedure".

⚠ 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 / SVP failure SIM (73xx00) or warning for forcible volatile mode (fffe0x) may occur during this work. Just complete them, when the work is finished.
- 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 to "Restoring Configuration Information" (SVP02-11-10), 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 CFMs 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 [Exit], close Maintenance Utility window, and go to the next section.

   <When there is a blocked CTL>
   Remove the blocked CTL by following the instructions from the Technical Support Division.

3. Set the jumper used for cache memory volatilization on each DKC to Enable (see "Edit System Parameters" (MU02-100)).

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4. Turn off the power of the SVP referring to the "Power Off" (SVP01-200)

NOTICE: Make sure to perform Step 5. within 15 minutes after turning OFF the power of SVP. If the condition that SVP is OFF and breaker is ON continues for 15 minutes or more, the following occurs.
- (If SVP High Availability kit is not installed) SVP power is forcibly turned ON.
- (If SVP High Availability kit is installed) SVP failover takes place.

If it will take 15 minutes or more to perform the procedure, set the SVP RAS switch #1 (LOC03-40) on the SSVP to ON before starting.
After completion of the procedure, set the SVP RAS switch #1 to OFF.

5. Remove the AC cables from the ISWPSs in the HSNBXs.
   (More than one SIM = 2160xx and more than one SIM = 2161xx are reported.)

6. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 8-1.

7. Turn off the PDU breakers that are connected to the DKU.
   → Refer to Figure 8-2.

8. Wait for 30 seconds or more until the BACKUP STS LED goes out.

9. Turn on the PDU breakers that are connected to the DKU.
   → Refer to Figure 8-3.

10. Turn on the PDU breakers that are connected to the DKC.
    → Refer to Figure 8-4.

11. Connect the AC cables to the ISWPSs in the HSNBXs.

12. Refer to "Edit System Parameters" (MU02-100) 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.

13. Install the removed CTL.
    If there is a removed CTL, install the CTL, and then perform the restoration procedure for the CTL.

14. Power on the storage system (see "Storage System Power On" (INST(GE)05-01-10)).

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8.3 Forced volatilization (full) power-off and restarting procedure 1-2

When this procedure is executed, the AC input of the power supply of the HSNBX, DKC and the DKU 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 "8.1 Non volatilization power-off and restarting procedure".

⚠ 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 / SVP failure SIM (73xx00) or warning for forcible volatile mode (fffe0x) may occur during this work. Just complete them, when the work is finished.
- 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 to "Restoring Configuration Information" (SVP02-11-10), 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 CFMs and the batteries installed in the device.

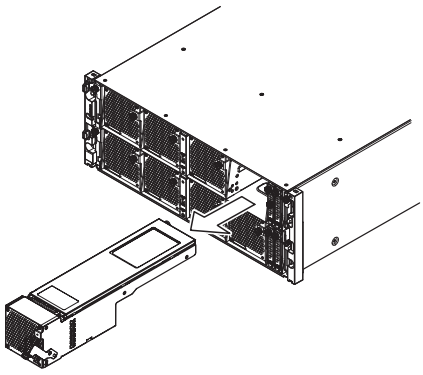
   <When there is a blinking part>
   Try this procedure again after recovering the problem part, except when other instructions exist from T.S.D.

   <When there is no blinking part or the recovery of all the problem parts is completed>
   Click [Exit], close Maintenance Utility window, and go to the next section.

   <When there is a blocked CTL>
   Remove the blocked CTL by following the instructions from the Technical Support Division.

3. Remove the BKMFs.
   Remove BKMF-x13 and BKMF-x23 from all DKCs.

   NOTE: For VSP 5100 and VSP 5100H, either of BKMF-x13 or BKMF-x23 is installed in each DKC.



4. Turn off the power of the SVP referring to the "Power Off" (SVP01-200)

NOTICE:	Make sure to perform Step 5. within 15 minutes after turning OFF the power of SVP. If the condition that SVP is OFF and breaker is ON continues for 15 minutes or more, the following occurs. • (If SVP High Availability kit is not installed) SVP power is forcibly turned ON. • (If SVP High Availability kit is installed) SVP failover takes place. If it will take 15 minutes or more to perform the procedure, set the SVP RAS switch #1 (LOC03-40) on the SSVP to ON before starting. After completion of the procedure, set the SVP RAS switch #1 to OFF.

5. Remove the AC cables from the ISWPSs in the HSNBXs.
   (More than one SIM = 2160xx and more than one SIM = 2161xx are reported.)

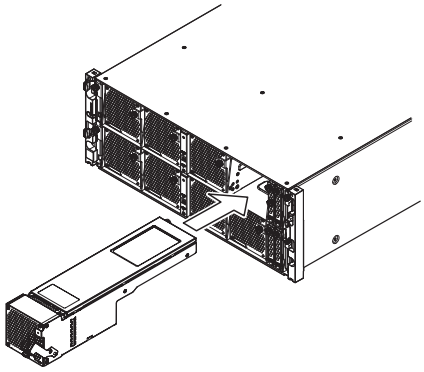
6. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 8-1.

7. Turn off the PDU breakers that are connected to the DKU.
   → Refer to Figure 8-2.

8. Wait for 30 seconds or more until the BACKUP STS LED goes out.

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9. Attach the BKMFs.
   Install all removed BKMFs in DKCs.



10. Turn on the PDU breakers that are connected to the DKU.
    → Refer to Figure 8-3.
11. Turn on the PDU breakers that are connected to the DKC.
    → Refer to Figure 8-4.

12. Connect the AC cables to the ISWPSs in the HSNBXs.

13. Install the removed CTL.
    If there is a removed CTL, install the CTL, and then perform the restoration procedure for the CTL.

14. Power on the storage system (see “Storage System Power On” (INST(GE)05-01-10)).

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8.4 Forced volatilization (part) power-off and restarting procedure 2-1

Performing this work forcibly disconnects the AC input of HSNBX, DKC and DKU 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 / SVP failure SIM (73xx00) or warning for forcible volatile mode (fffe0x) may occur during this work. Just complete them, when the work is finished.
- 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 to "Restoring Configuration Information" (SVP02-11-10), 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 CFMs 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 [Exit], close Maintenance Utility window, and go to the next section.

3. Refer to "Storage System Power Off (Planned Shutdown)" (INST(GE)05-02-10) and turn off the main switch.

4. Confirm that PS ON LED on the front surface of the HSNBX changes from lighting in green to going out.
   It takes about 10 minutes at the maximum for the LED to go out. The ACT LEDs (Green) on drives might be blinking after the PS ON LED goes out, but there is no problem.

5. Set the jumper used for cache memory volatilization on each DKC to Enable (see "Edit System Parameters" (MU02-100)).

6. Power on the storage system (see “Storage System Power On” (INST(GE)05-01-10)).

7. Set the jumper used for cache memory volatilization on each DKC to Disable (see “Edit System Parameters” (MU02-100)).

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8.5 Forced volatilization (part) power-off and restarting procedure 2-2

Performing this work forcibly disconnects the AC input of HSNBX, DKC and DKU 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 / SVP failure SIM (73xx00) or warning for forcible volatile mode (fffe0x) may occur during this work. Just complete them, when the work is finished.
- 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 to "Restoring Configuration Information" (SVP02-11-10), 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 CFMs 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 [Exit], close Maintenance Utility window, and go to the next section.

3. Turn off the power of the SVP referring to the "Power Off" (SVP01-200)

NOTICE: Make sure to perform Step 4. within 15 minutes after turning OFF the power of SVP. If the condition that SVP is OFF and breaker is ON continues for 15 minutes or more, the following occurs.
- (If SVP High Availability kit is not installed) SVP power is forcibly turned ON.
- (If SVP High Availability kit is installed) SVP failover takes place.

If it will take 15 minutes or more to perform the procedure, set the SVP RAS switch #1 (LOC03-40) on the SSVP to ON before starting.
After completion of the procedure, set the SVP RAS switch #1 to OFF.

4. Remove the AC cables from the ISWPSs in the HSNBXs.
   (More than one SIM = 2160xx and more than one SIM = 2161xx are reported.)

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5. Turn off the PDU breakers that are connected to the DKC.
   → Refer to Figure 8-1.

6. Turn off the PDU breakers that are connected to the DKU.
   → Refer to Figure 8-2.

7. Wait until the BACKUP STS LED of the CTL turns from blinking (Low-speed) to going out.
   Note that it takes about 20 minutes at a maximum until all LEDs go out.

8. Remove the CFMs.
   Remove CFM-x10 and CFM-x20 from each DKC.

   NOTE: For VSP 5100 and VSP 5100H, either of CFM-x10 or CFM-x20 is installed in each DKC.

9. Turn on the PDU breakers that are connected to the DKU.
   → Refer to Figure 8-3.

10. Turn on the PDU breakers that are connected to the DKC.
    → Refer to Figure 8-4.

11. Connect the AC cables to the ISWPSs in the HSNBXs.

12. Take an interval of 30 seconds or more.

13. Install the CFMs.
    Install all removed CFMs in DKCs.

14. Refer to “Edit System Parameters” (MU02-100) and change A jumper used for cache memory volatilization to Enable.

15. Power on the storage system (see “Storage System Power On” (INST(GE)05-01-10)).

16. Wait until it becomes READY.

17. Refer to “Edit System Parameters” (MU02-100) and change A jumper used for cache memory volatilization to Disable.

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9. Recovery from UR Failure

9.1 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
2180xy	Path blockade	x: CHB PCB # y: Port# in PCB
dcxyyy	UR pair suspension	x: 0 to 2, 4 to A, or F yyy: LDEV number
dcexzz	JNL overflow warning	x: 0 to 3 zz: Journal group number
dcfxzz	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.

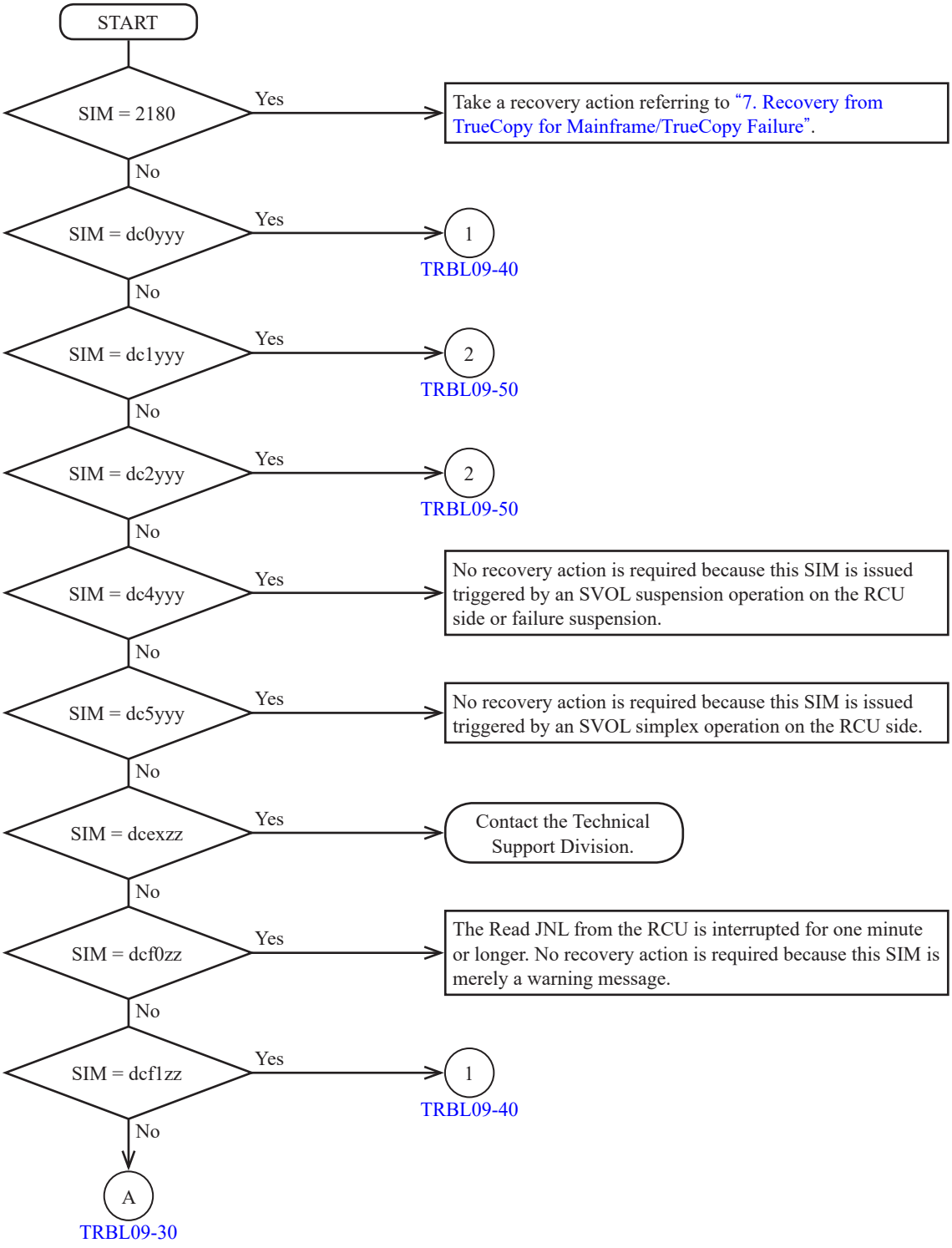
*1: When an UR pair is suspended, RAID Manager/UR or RAID Manager/TT displays the following message in the Syslog.

[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

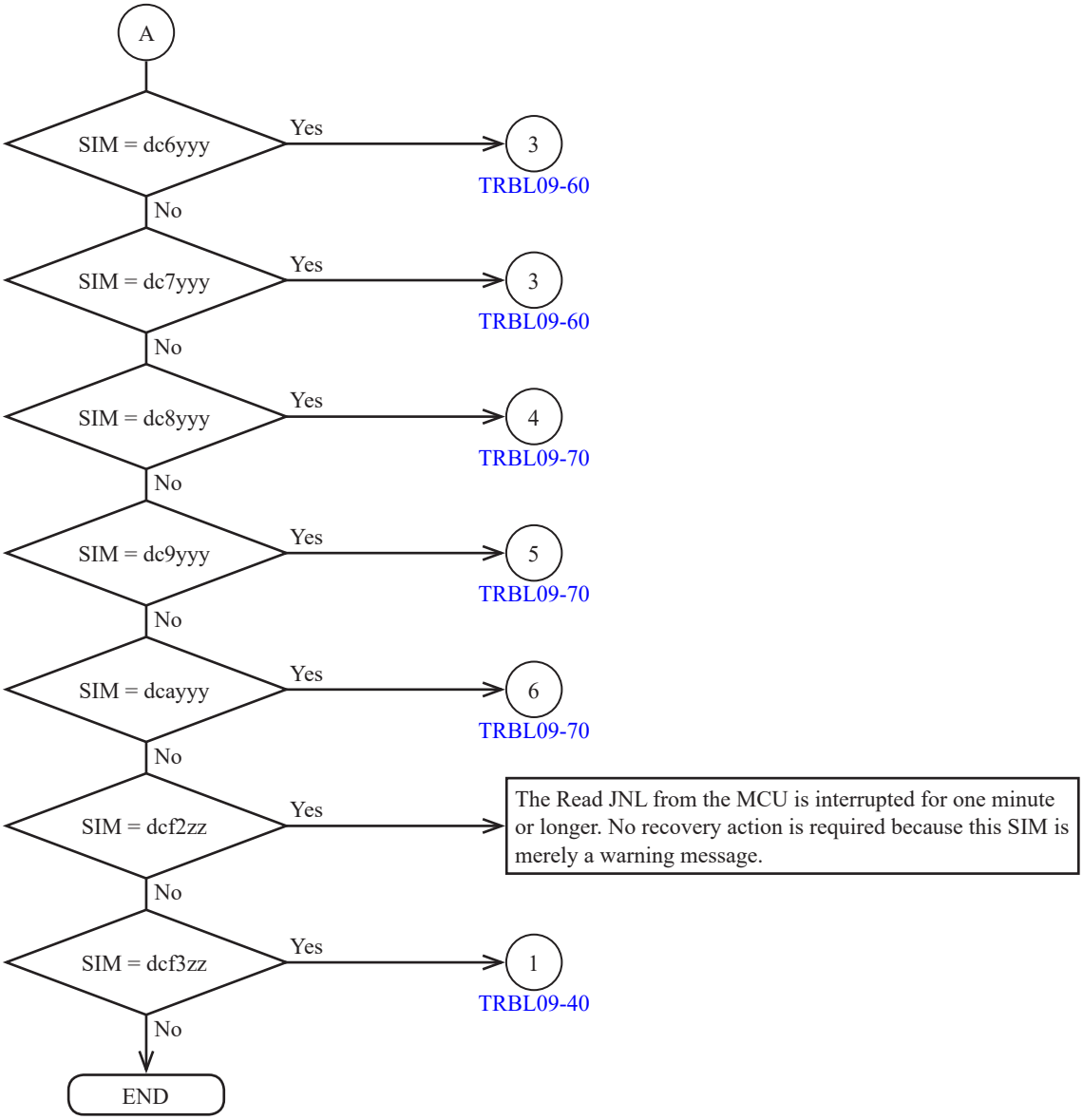
When a message that informs of occurrence of an UR pair failure is displayed in the Syslog, it is required to check the SIM(s) of the connected DKC and understand correspondence of messages in the Syslog to SIMs logged on the DKC side before starting the recovery action.

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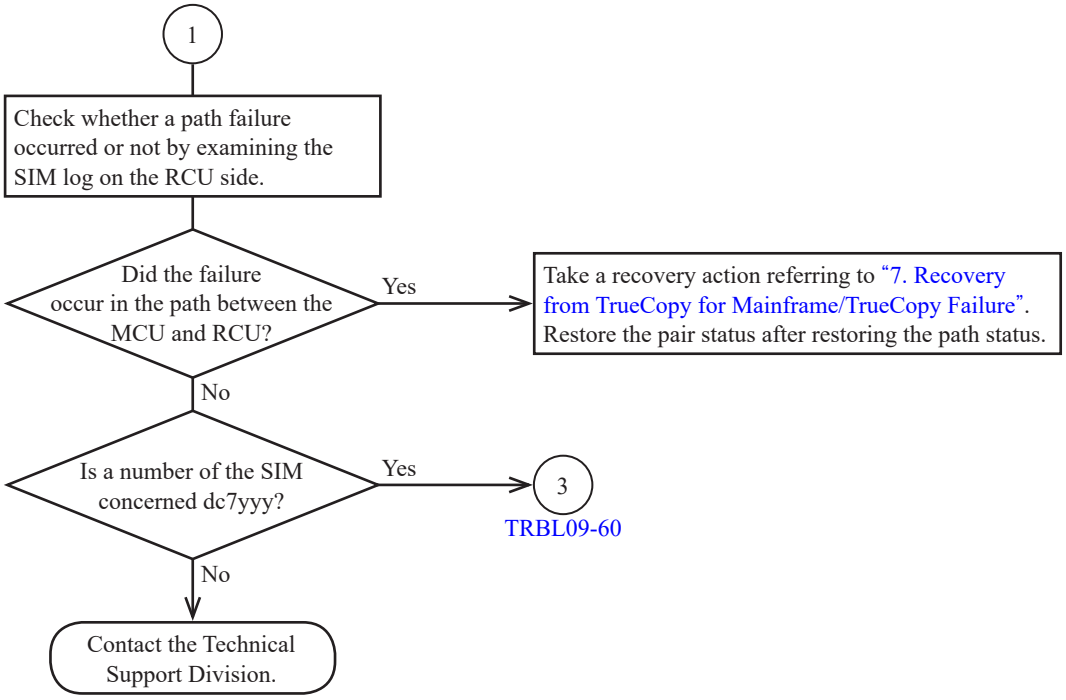
[Recovery from the UR failure]



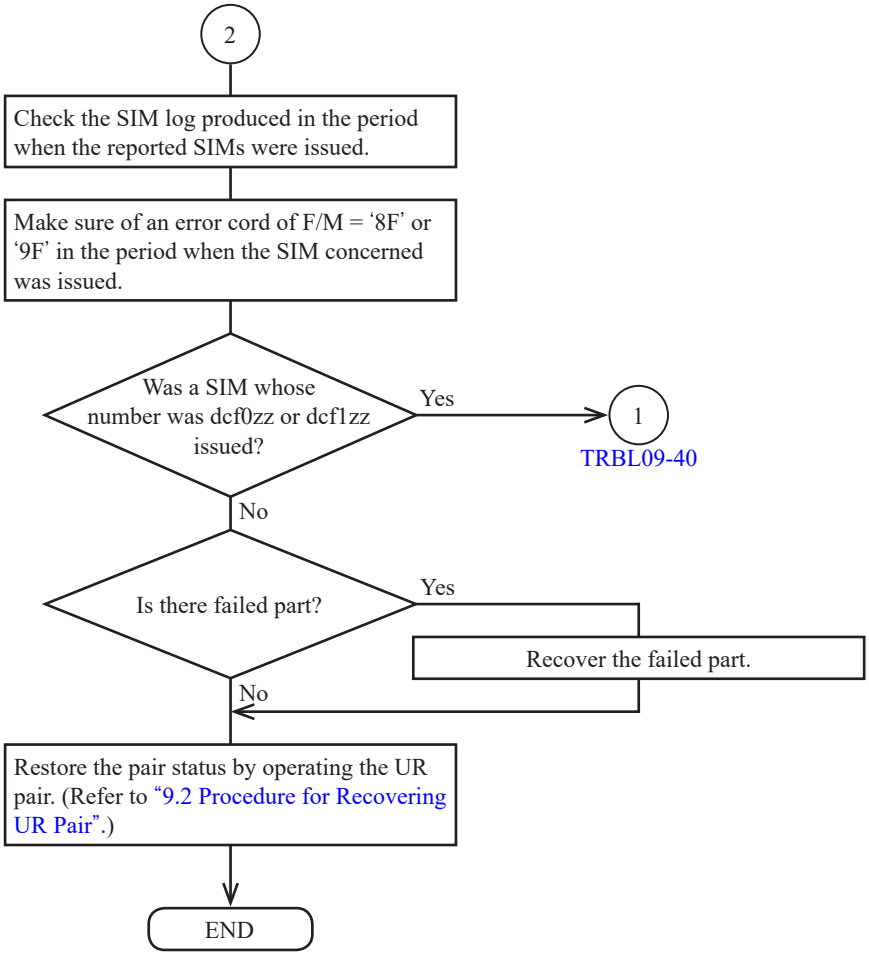
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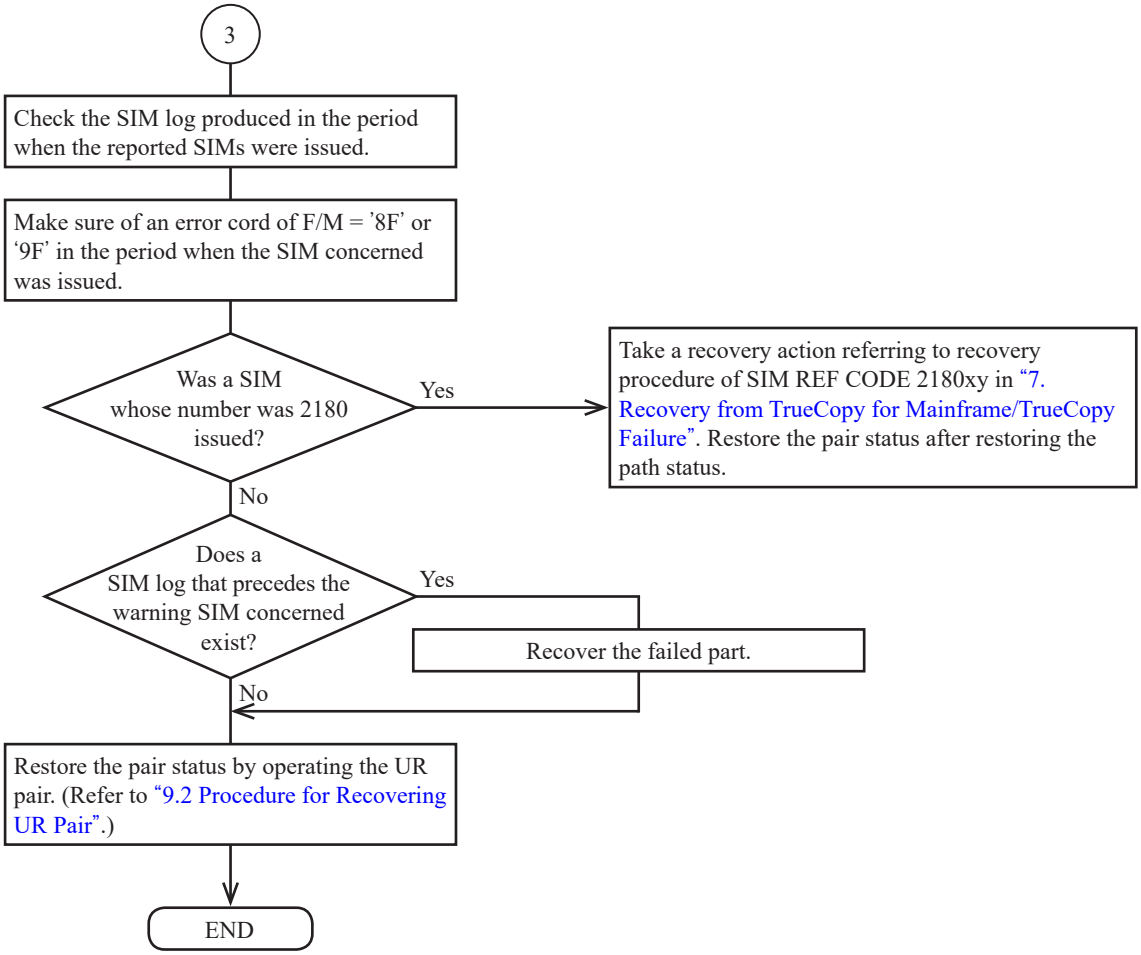
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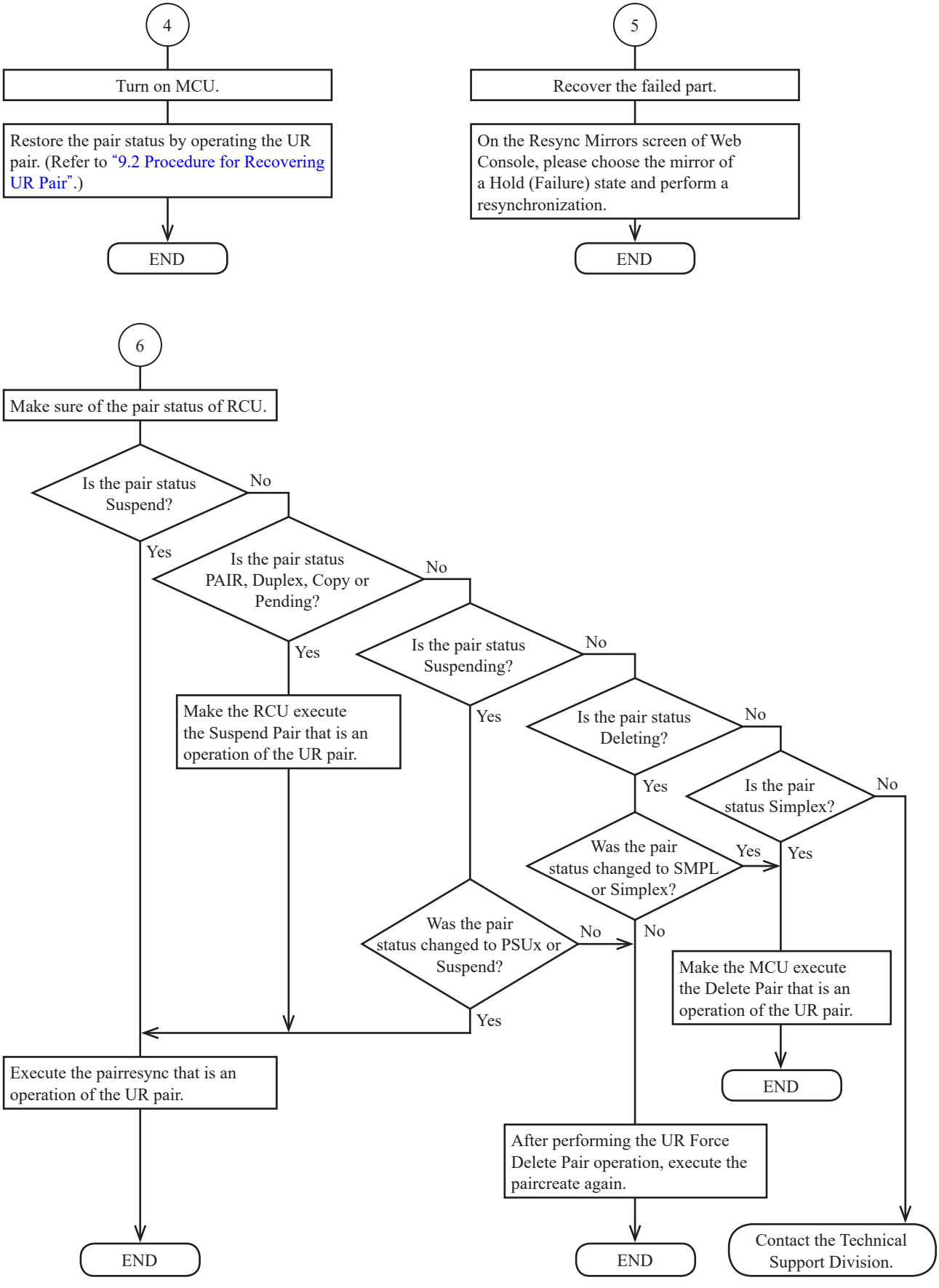
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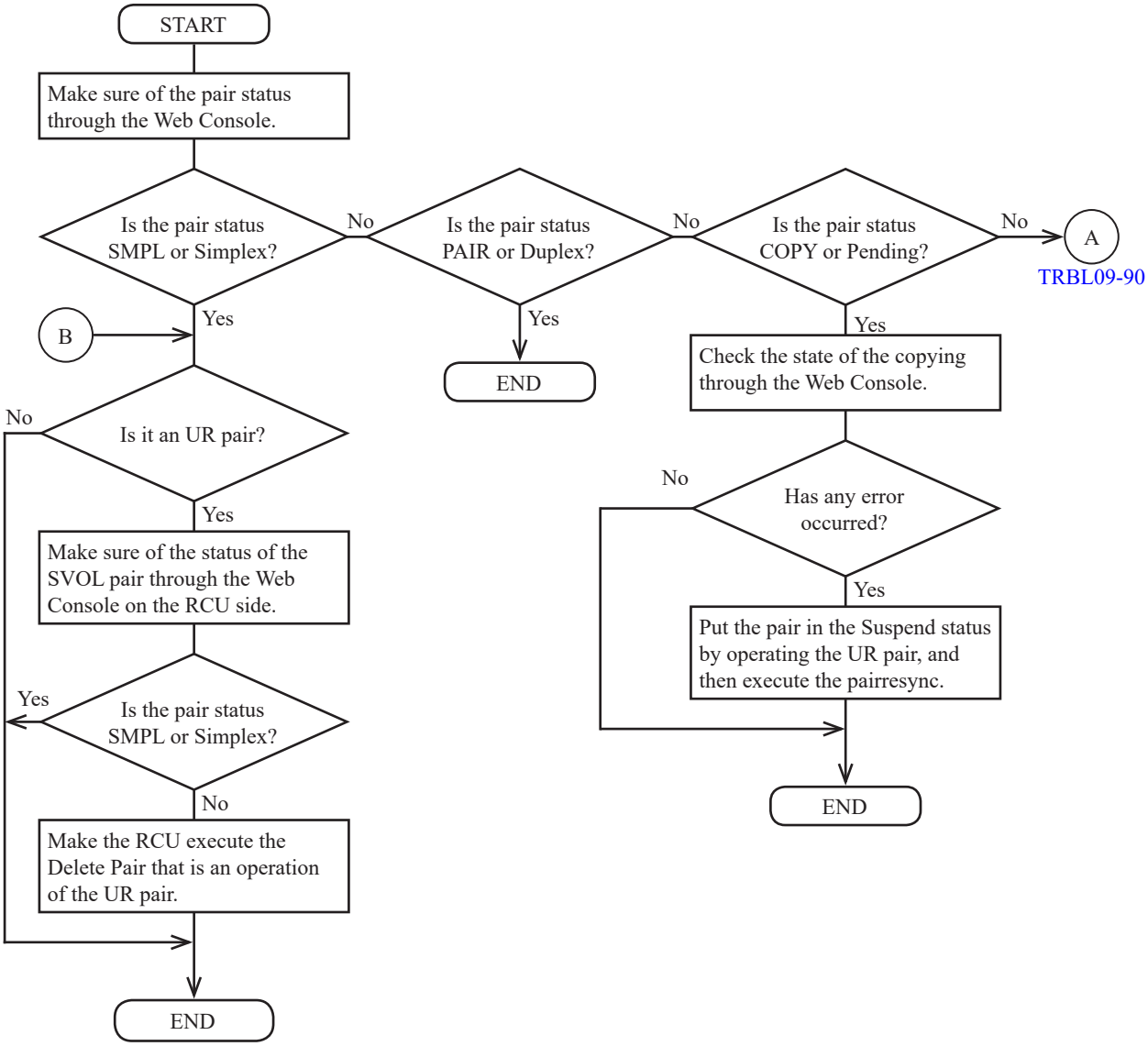


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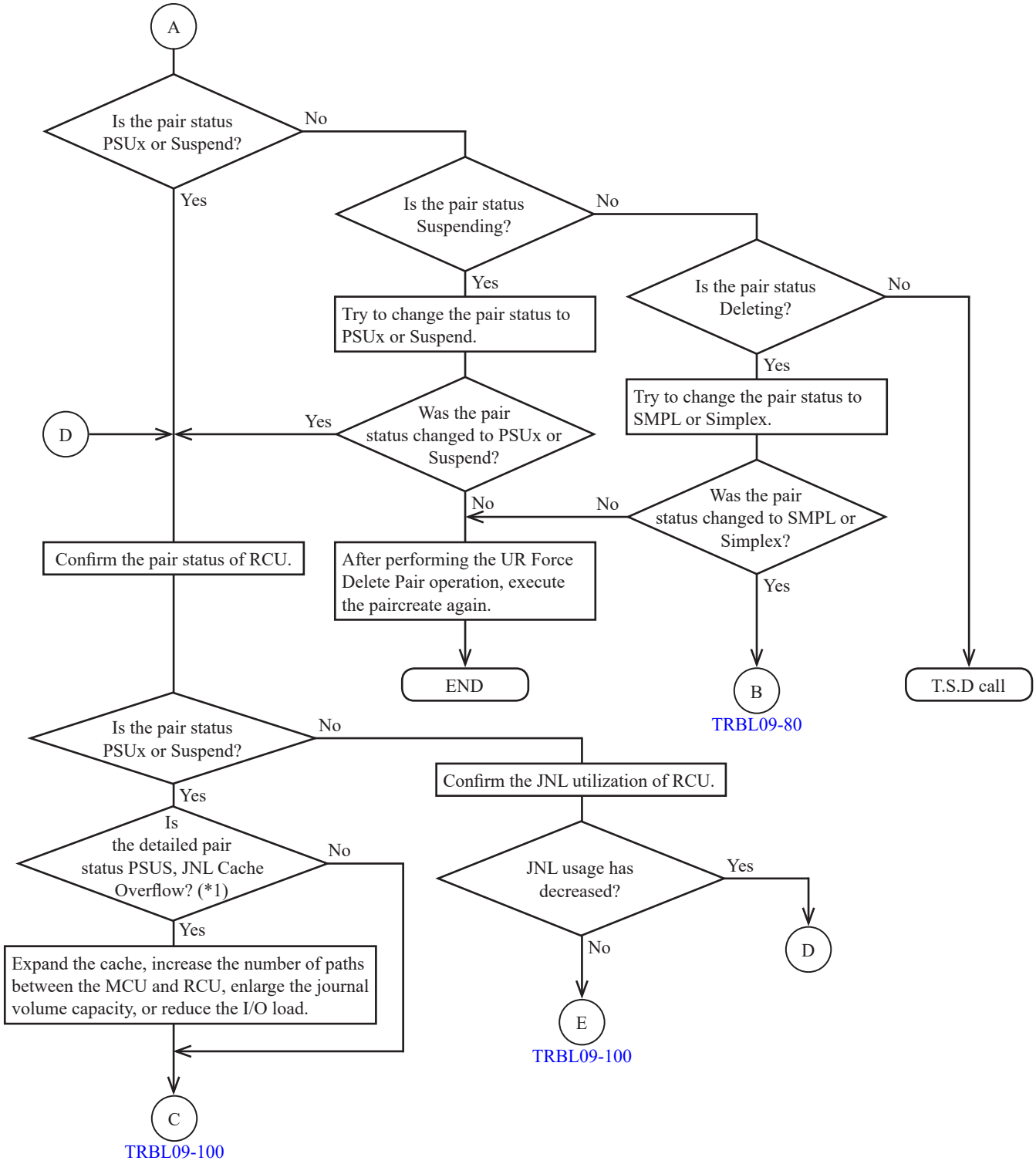


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9.2 Procedure for Recovering UR Pair



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*1: On the Web Console, in the View Pair Properties window, see [Status] in the [Pair Detail] table to check the detailed pair status. To open the View Pair Properties window, perform the following steps:

1. From the [Storage Systems] tree, select [Replication]-[Remote Replication].
2. Select the check box of the UR pair, and then from the [Actions] menu, select [Remote Replication]-[View Pair Properties].

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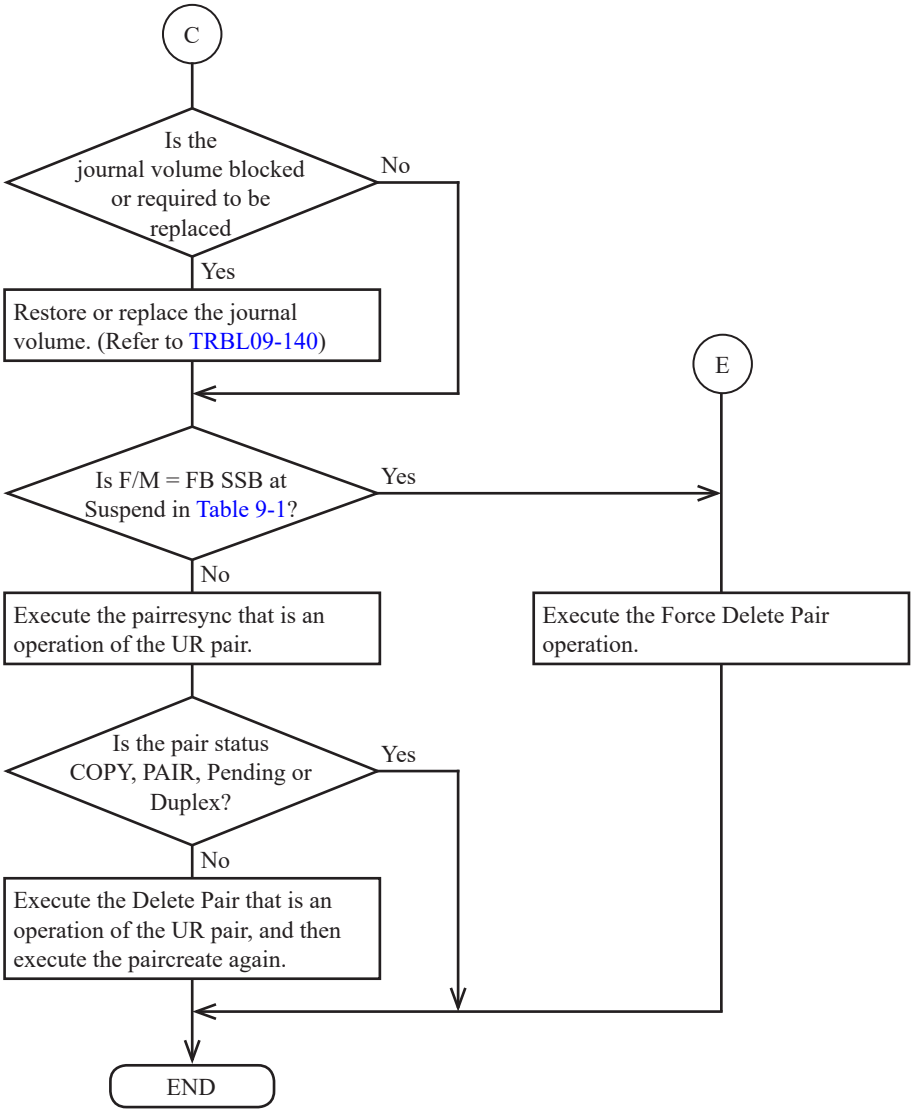


Table 9-1 Force Delete Pair Target F/M = FB SSB

No.	F/M	Error Code	Meaning
1	FB	EF60 to EF66	JNL-cache remains with the device of remote-side.

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9.3 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.

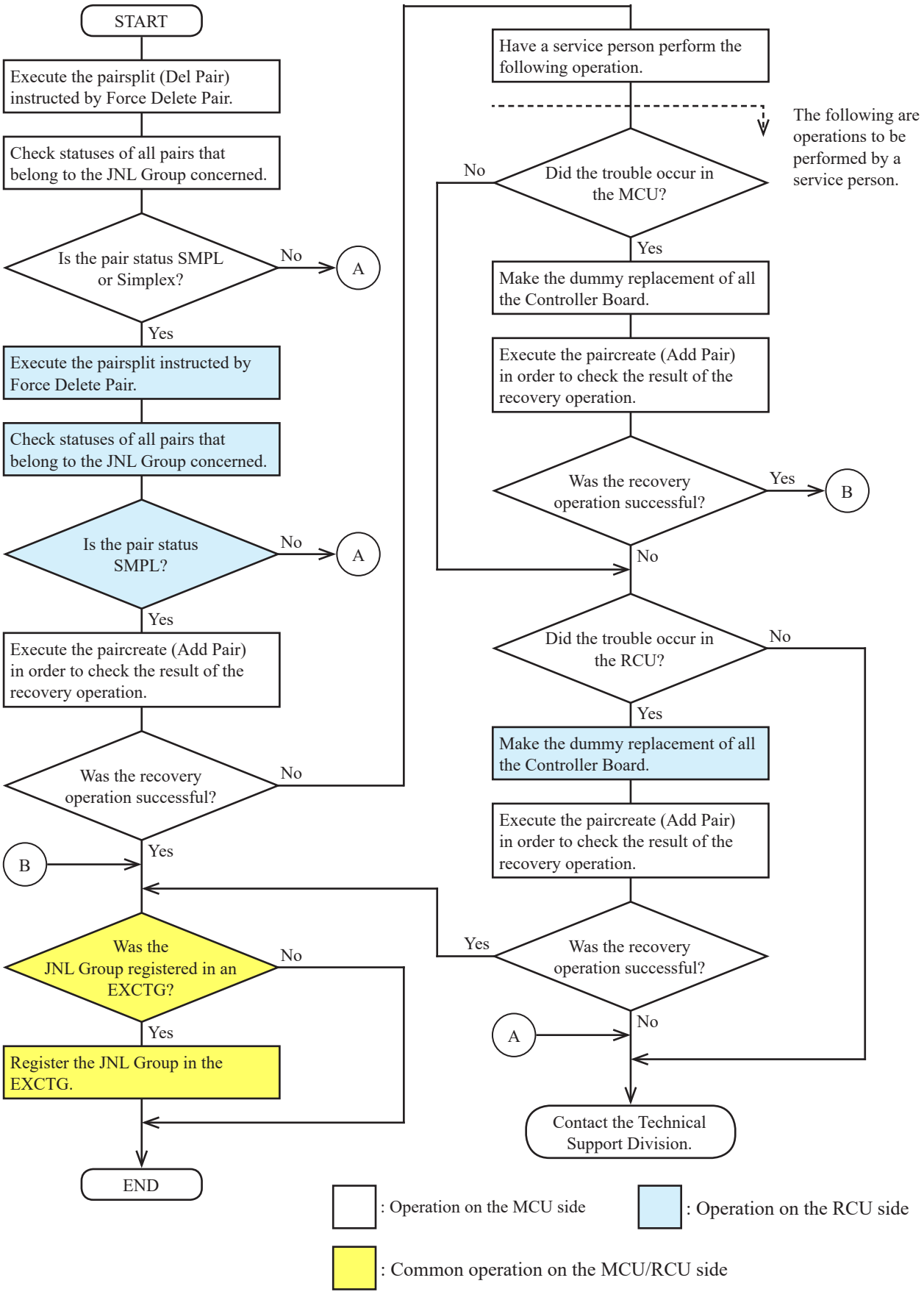
⚠ CAUTION

- 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 Boards for the storage system concerned.

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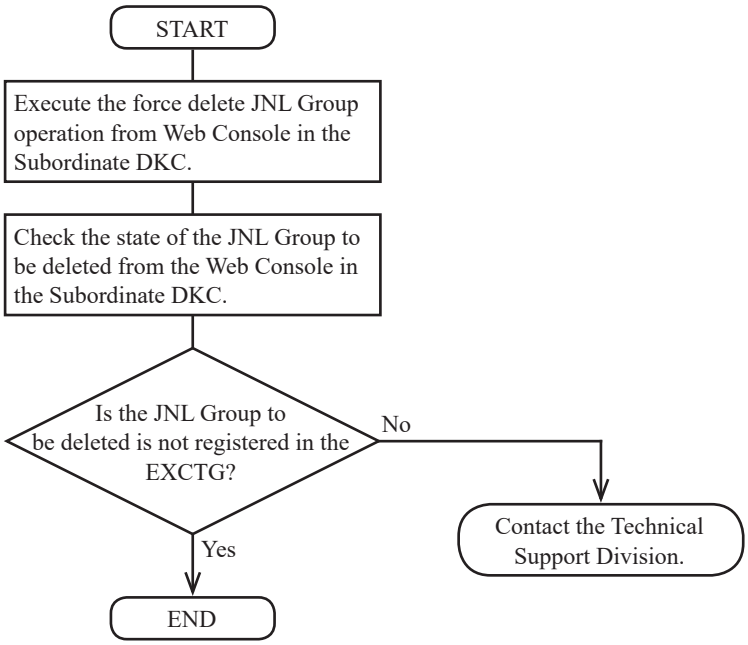


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9.4 Force Delete JNL Group Operation

In the UR 4x4, the registration or deletion to Extended Consistency Group (EXCTG) of JNL Group in Subordinate DKC are operated from Supervisor DKC. The Force Delete JNL Group operation is a remedy function to delete JNL Group from EXCTG forcibly when deleting JNL Group of Subordinate DKC from EXCTG cannot be executed.

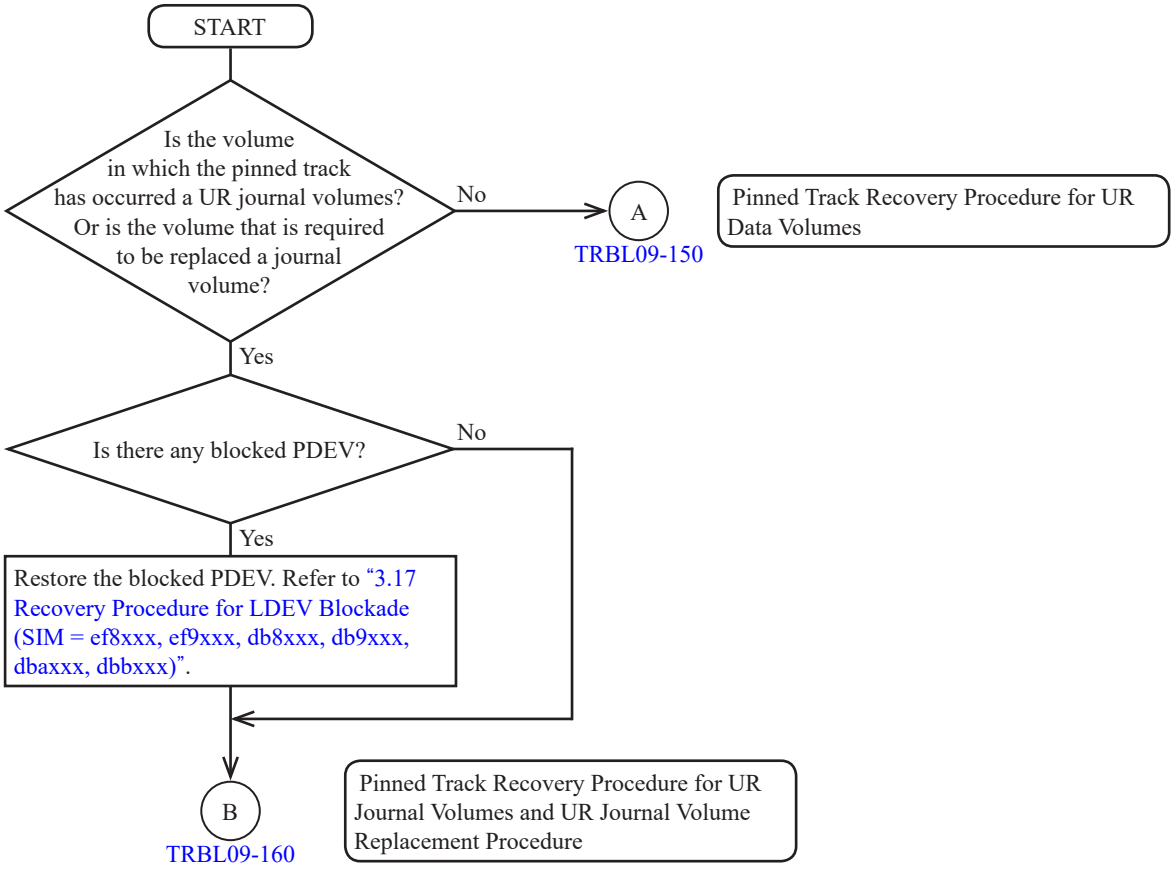
NOTE:
- The force Delete JNL Group operation can be executed regardless of the state of JNL Group.
- JNL Group deleted from the EXCTG forcibly continues operation as JNL Group that is unregistered to EXCTG. Therefore, a remote copy from MCU to RCU is continued.



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9.5 Procedure for UR Pinned Track Recovery and Journal Volume Replacement

Procedure for UR pinned track recovery and journal volume replacement is as follows.
For the UR pair/GAD pair status check and the journal volume check/operation in the following recovery procedure, ask the customer to do them.



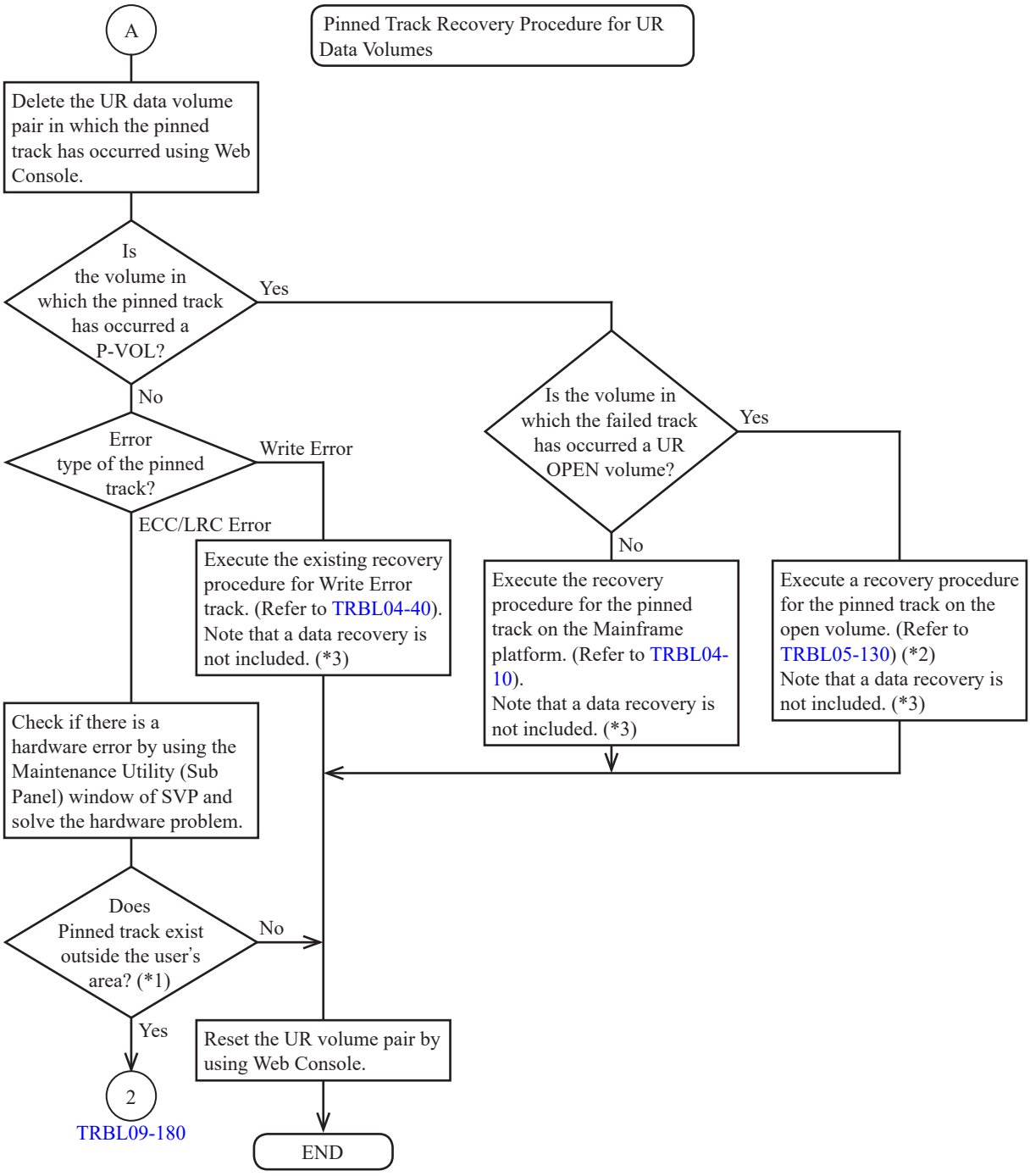
NOTE: If the pinned track has occurred in both P-VOL and S-VOL, recover the volumes according to the following sequence.

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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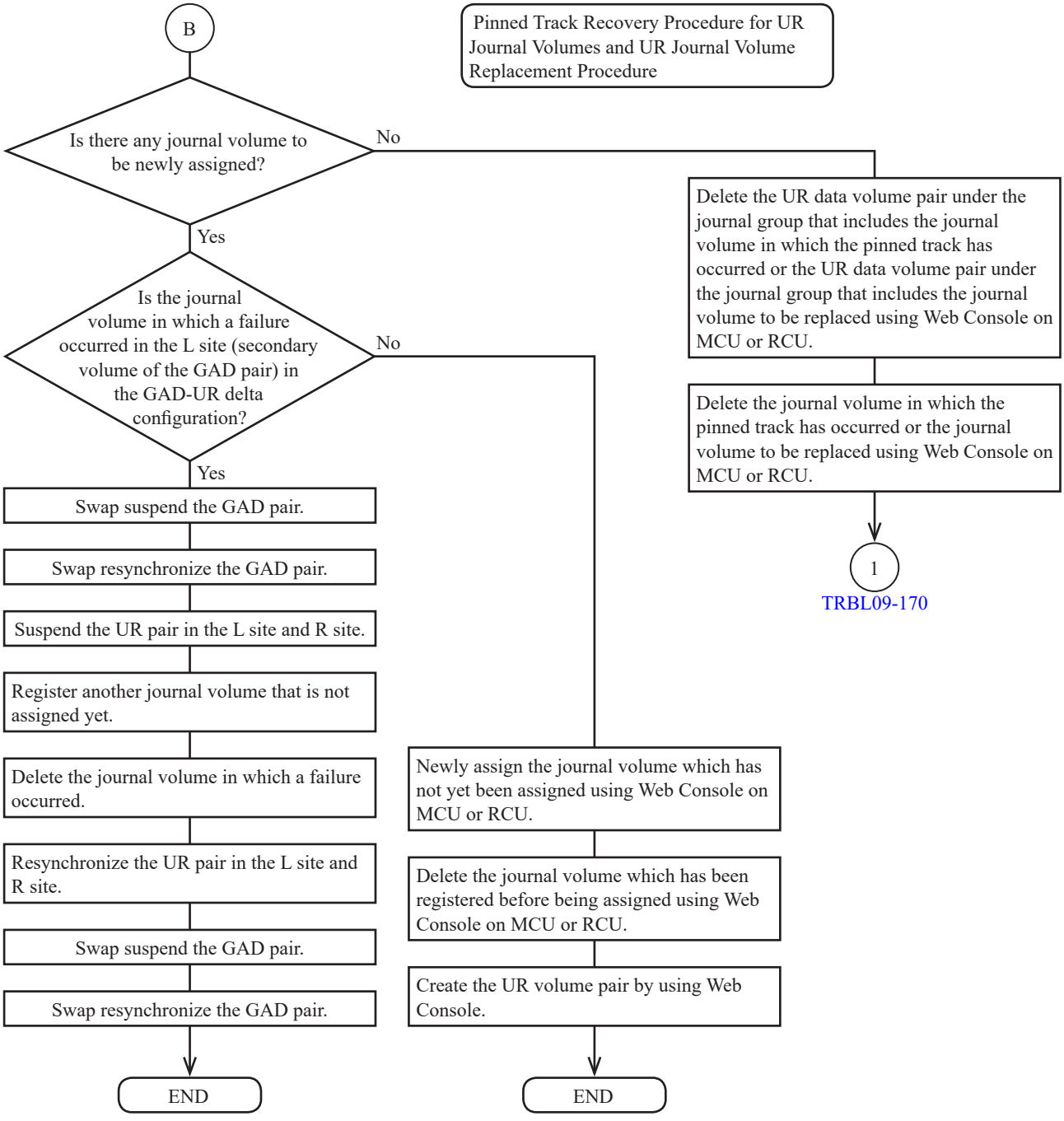


*1: If CC and HH information in the SVP PINNED TRACK shows outside the user area, this indicates that a pinned track occurred in the management area. (You can check the number of cylinders in the user area by seeing [Capacity] in the Logical Devices window of Web Console. Select "Cyl" as the capacity unit from [Options] in the Logical Devices window to check [Capacity].)

*2: In the recovery from a failed track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a failed track by means of the analyze command is executed. However, the LDEV formatting or the analyze command executing is not required if the failed track is a DP volume and out of the user area.

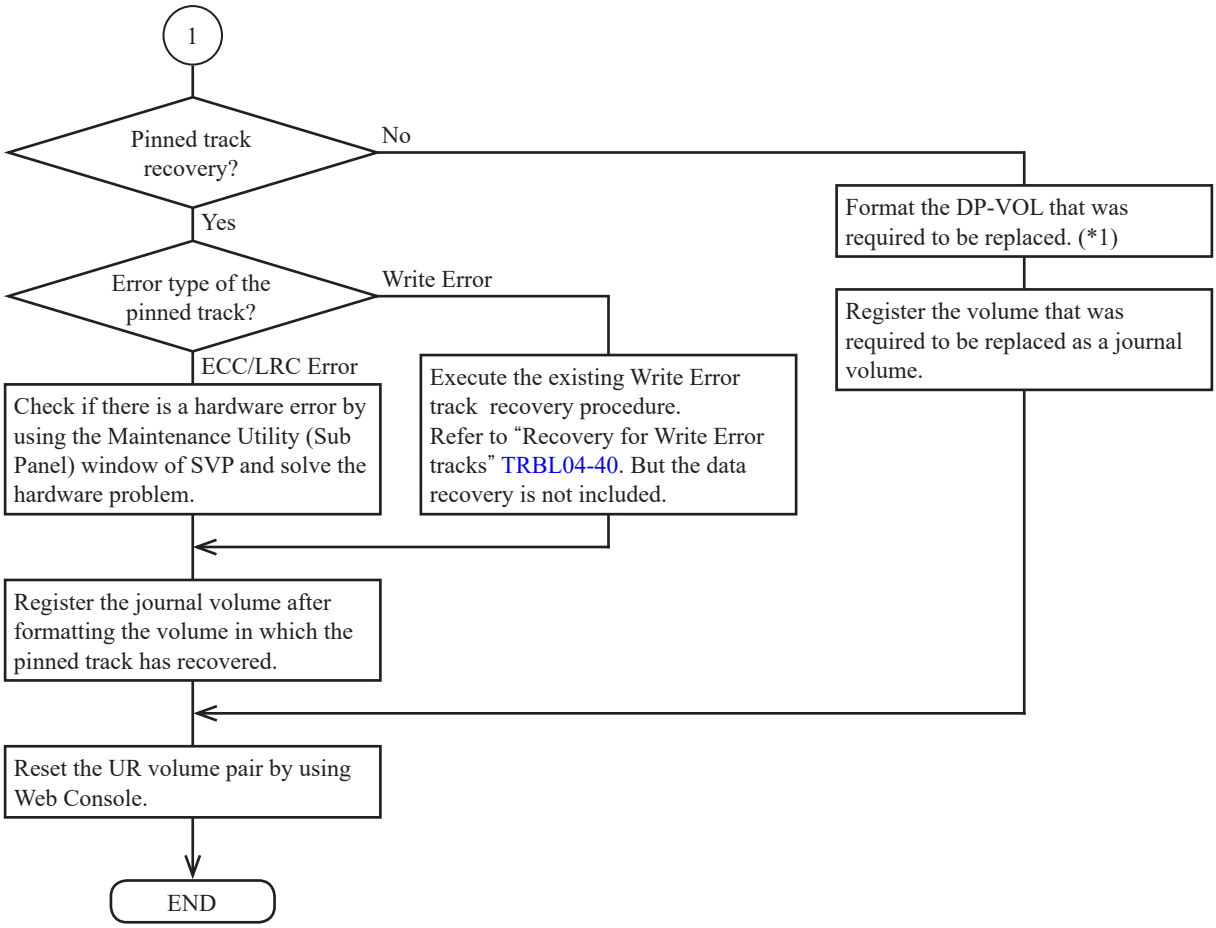
*3: Perform the data recovery by resetting the UR volume pair.

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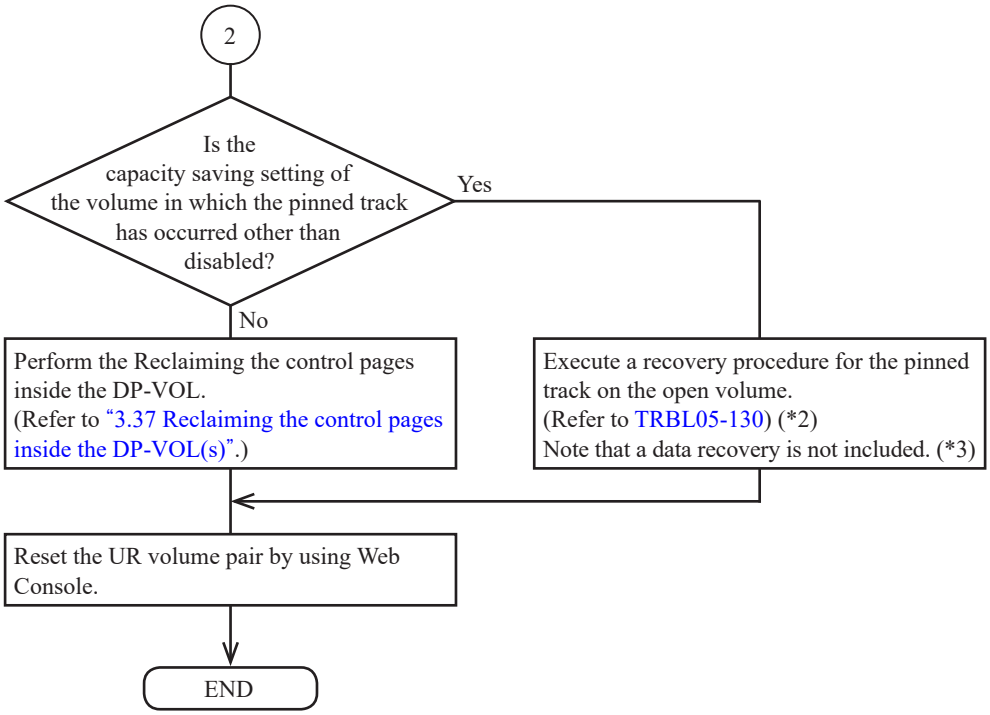
NOTE: If the journal volume to be assigned exists, prioritize recovery or replacement of UR pair. After the recovery of UR pair, format the blocked virtual volume to reduce the recovery or replacement time.

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*1: 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" TRBL13-10). Register the volume that was required to be replaced as a journal volume after completion of recovery procedure.

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*2: In the recovery from a failed track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a failed track by means of the analyze command is executed. However, the LDEV formatting or the analyze command executing is not required if the failed track is a DP volume and out of the user area.

*3: Perform the data recovery by resetting the UR volume pair.

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9.6 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 “Universal Replicator User 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)

9.6.1 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 CCI.

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. Also, a failure is recovered in the same procedure in the MF configuration as well.

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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	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. Any of the above, the recovery in the following procedure. 2. Failure recovery site (Recover paths). 3. 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	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. 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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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 TRBL13-10). 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 TRBL13-10). 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)	

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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 TRBL13-10). 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**	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR1 and UR2. (*3) 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1, UR2 resync in PVOL. When there are no unused journal volumes: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
2	PDKC journal volume failure	0	PVOL (UR1 PVOL)	**PFUS**	LVOL (UR1 SVOL)	**SSUE**	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR1 and UR2. (*3) 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1, UR2 resync in PVOL. When there are no unused journal volumes: 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)	

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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**	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR1 and UR delta. 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. When there are no unused journal volumes: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
6	RDKC journal volume failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR2 and UR delta. 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR2 resync in PVOL. When there are no unused journal volumes: 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.

*3: When assigning a new journal volume, specify the journal volume whose capacity is larger than the journal volume which is already full.

*4: For cases requiring LDEV formatting due to a 2PDEV failure, you can recover from the failure or reduce the replacement time by restoring the UR pair according to this procedure and then resolving the PDEV/LDEV blockade.

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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	When the recovery by the LDEV format is necessary: 1. UR1 swap suspend. 2. Delta resync (Swap resync the UR delta). 3. Delete UR1 and UR2. 4. Failure recovery site. 5. UR1/UR2 recovery. (*1) 6. Assign the remote command device for the journal mirror ID in each site. 7. UR1 swap suspend. 8. Delta resync (Swap resync the UR2). 9. Swap resync the UR1. When the recovery by the LDEV format is not necessary: 1. UR1 swap suspend in LVOL. 2. Delta resync (Resync the UR delta pair). 3. Failure recovery site. 4. UR1, UR2 pairs recovery. (*2) 5. UR delta pair recovery.
		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**	When the recovery by the LDEV format is necessary: 1. Detection of UR1 in failure suspend status. 2. Delete UR1. 3. Failure recovery site. 4. UR1 pair recovery. (*2) 5. UR delta pair recovery. When the recovery by the LDEV format is not necessary: 1. UR1 failure suspension is detected. 2. Failure recovery site. 3. UR1 pair recovery. (*2) 4. UR delta pair recovery.
		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	RVOL failure	0	PVOL (UR1 PVOL)	PAIR	LVOL (UR1 SVOL)	PAIR	When the recovery by the LDEV format is necessary: 1. Detection of UR2 in failure suspend status. 2. Delete UR2. 3. Failure recovery site. 4. UR2 recovery. 5. UR delta pair recovery. When the recovery by the LDEV format is not necessary: 1. UR2 failure suspension is detected. 2. Failure recovery site. 3. UR2 pair recovery. (*2) 4. UR delta pair recovery.
		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: Create UR1 by copying LVOL to PVOL, and UR2 as a delta resync pair.
*2: 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 the Edit Advanced System Setting No.16 is set to ON in PDKC, the UR1 pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR1 pair.

*3: If the Edit Advanced System Setting No.16 is set to ON in PDKC, the UR2 pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR2 pair.

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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	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. 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	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. 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 TRBL13-10). 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 TRBL13-10). 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 TRBL13-10). 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**	When there are unused journal volumes: 1. According to TRBL09-160, assign the unused journal volumes to UR1. (*3) 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. When there are no unused journal volumes: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
2	PDKC journal volume failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR1. 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. When there are no unused journal volumes: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	IDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS (*1)**	IVOL (UR1 SVOL)	**PFUS (*1)**	When there are unused journal volumes: 1. According to TRBL09-160, assign the unused journal volumes to UR1 and UR2. (*3) 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. 4. UR2 resync in IVOL. When there are no unused journal volumes: 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)	**PSUE**	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR1 and UR2. 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. 4. UR2 resync in IVOL. When there are no unused journal volumes: 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)	**PSUE**	
		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
5	RDKC journal volume full	0	PVOL (UR1 PVOL)	**PFUS (*2)**	IVOL (UR1 SVOL)	**PFUS (*2)**	When there are unused journal volumes: 1. According to TRBL09-160, assign the unused journal volumes to UR2 and UR delta. (*3) 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR1 resync in PVOL. 4. UR2 resync in IVOL. When there are no unused journal volumes: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
6	RDKC journal volume failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	When there are unused journal volumes (*4): 1. According to TRBL09-160, assign the unused journal volumes to UR2 and UR delta. 2. Delete the journal volumes which were already registered prior to the assignment of the unused journal volumes in step (1). 3. UR2 resync in IVOL. When there are no unused journal volumes: 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.

*3: When assigning a new journal volume, specify the journal volume whose capacity is larger than the journal volume which is already full.

*4: For cases requiring LDEV formatting due to a 2PDEV failure, you can recover from the failure or reduce the replacement time by restoring the UR pair according to this procedure and then resolving the PDEV/LDEV blockade.

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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)	**PSUE**	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)	**PSUE**	
		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	When the recovery by the LDEV format is necessary: 1. UR1 swap suspend. 2. Delete UR1. 3. Failure recovery site. 4. UR1 pair recovery. 5. UR1 swap suspend. 6. Swap resync the UR1. 7. UR2 resync in IVOL. 8. UR delta pair recovery. When the recovery by the LDEV format is not necessary: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
2	IVOL failure	0	PVOL (UR1 PVOL)	**PSUE**	IVOL (UR1 SVOL)	**SSUE**	When the recovery by the LDEV format is necessary: 1. Delta resync (Resync the UR delta in PVOL). 2. Delete UR1 and UR2. 3. Failure recovery site. 4. UR1 pair recovery in PVOL. (*1) 5. Delete UR delta. 6. UR2 creation using IVOL 7. Create UR delta. 8. Assign the remote command device for the journal mirror ID in each site. When the recovery by the LDEV format is not necessary: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	RVOL failure	0	PVOL (UR1 PVOL)	PAIR	IVOL (UR1 SVOL)	PAIR	When the recovery by the LDEV format is necessary: 1. Detection of UR2 in failure suspend status 2. Delete UR2. 3. Failure recovery site. 4. UR2 pair creation using IVOL. When the recovery by the LDEV format is not necessary: 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 the Edit Advanced System Setting No.16 is set to ON in IDKC, the UR2 pair status will be PSUE/SSUE. After the DKC is recovered, you need to resynchronize the UR2 pair.

9.6.2 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 CCI. 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. Also, a plan is shut down in the same procedure in the MF configuration as well.

9.6.2.1 Planned Shutdown Procedure of the PDKC

Table 9-2 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: **PSUS (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: **PSUS (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 resync (Swap resync the UR delta)	Execute the delta resync in LDKC (Swap resync the UR delta). ↓ Delta resync PDKC [PS ON] UR1 PVOL: **PSUS** UR delta PVOL: **PSUS (HOLD)** LDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#Delta resync % 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: **PSUS (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: **PSUS (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 check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
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: **PSUS (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)

(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: PSUS (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 resync (Swap resync the UR delta)</td><td>Execute the delta resync in PDKC (Swap resync the UR delta).
↓ Delta resync
PDKC [PS ON]
UR1 SVOL: SSWS
UR2 PVOL: <u>PAIR</u>
LDKC [PS ON]
UR1 PVOL: PSUS
UR delta PVOL: <u>PSUS (HOLD)</u>
RDKC [PS ON]
UR2 SVOL: <u>PAIR</u>
UR delta SVOL: <u>SSUS (HOLD)</u></td><td>#Delta resync
% 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: PSUS (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 9-3 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: **PSUS (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: **PSUS (HOLD)** IDKC [PS ON] UR1 SVOL: **SSWS** UR2 PVOL: **PAIR** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	

(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.)
–	During planned shutdown		
5	PDKC PS ON	Set the PDKC to PS ON. ↓ PS ON PDKC [PS ON]: UR1 PVOL: **PSUS**; UR delta PVOL: **PSUS (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 check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
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: **PSUS (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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<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>11</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>12</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>
UR delta PVOL: PSUS (HOLD)
IDKC [PS ON]
UR1 SVOL: <u>PAIR</u>
UR2 PVOL: PSUS
RDKC [PS ON]
UR2 SVOL: SSUS
UR delta SVOL: SSUS (HOLD)</td><td>#UR1 pair swap resync
% pairresync -g UR1 -swaps -IH0</td></tr>
<tr><td>13</td><td>UR2 pair resync</td><td>Execute UR2 pair resync in the IDKC.
↓ UR2 pair resync
PDKC [PS ON]
UR1 PVOL: <u>PAIR</u>
UR delta PVOL: PSUS (HOLD)
IDKC [PS ON]
UR1 SVOL: PAIR
UR2 PVOL: <u>PAIR</u>
RDKC [PS ON]
UR2 SVOL: <u>PAIR</u>
UR delta SVOL: SSUS (HOLD)</td><td>#UR2 pair resync
% pairresync -g UR2 -IH1</td></tr>
</table>

9.6.2.2 Planned Shutdown Procedure of the LDKC

Table 9-4 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: **PSUS (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: **PSUS (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: **PSUS (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: **PSUS (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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<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>5</td><td>SIM check</td><td>If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).</td><td></td></tr>
<tr><td>6</td><td>UR1 pair resync</td><td>Execute UR1 pair resync in the PDKC.
↓ UR1 pair resync
PDKC [PS ON]
UR1 PVOL: <u>PAIR</u>
UR2 PVOL: PAIR
LDKC [PS ON]
UR1 SVOL: <u>PAIR</u>
UR delta PVOL: PSUS (HOLD)
RDKC [PS ON]
UR2 SVOL: PAIR
UR delta SVOL: SSUS (HOLD)</td><td>#UR1 pair resync
% pairresync -g UR1 -IH0</td></tr>
</table>

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9.6.2.3 Planned Shutdown Procedure of the IDKC

Table 9-5 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 resync (resync the UR delta pair)	Execute the delta resync in PDKC (resync the UR delta pair) ↓ Delta resync PDKC [PS ON] UR1 PVOL: **PAIR** UR2 PVOL: **PAIR** IDKC [PS ON] UR1 SVOL: **PAIR** UR delta PVOL: **PSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	#Delta resync % 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: **PSUS (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: **PSUS (HOLD)** RDKC [PS ON] UR2 SVOL: **PAIR** UR delta SVOL: **SSUS (HOLD)**	

(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.)
–	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: **PSUS (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 check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
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: **PSUS (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)

(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.

9.6.2.4 Planned Shutdown Procedure of the RDKC

Table 9-6 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: **PSUS (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: **PSUS (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: **PSUS (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: **PSUS (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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<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>5</td><td>SIM check</td><td>If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).</td><td></td></tr>
<tr><td>6</td><td>UR2 pair resync</td><td>Execute UR2 pair resync in the PDKC.
↓ UR2 pair resync
PDKC [PS ON]
UR1 PVOL: PAIR
UR2 PVOL: <u>PAIR</u>
LDKC [PS ON]
UR1 SVOL: PAIR
UR delta PVOL: PSUS (HOLD)
RDKC [PS ON]
UR2 SVOL: <u>PAIR</u>
UR delta SVOL: SSUS (HOLD)</td><td>#UR2 pair resync
% pairresync -g UR2 -IH0</td></tr>
</table>

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Table 9-7 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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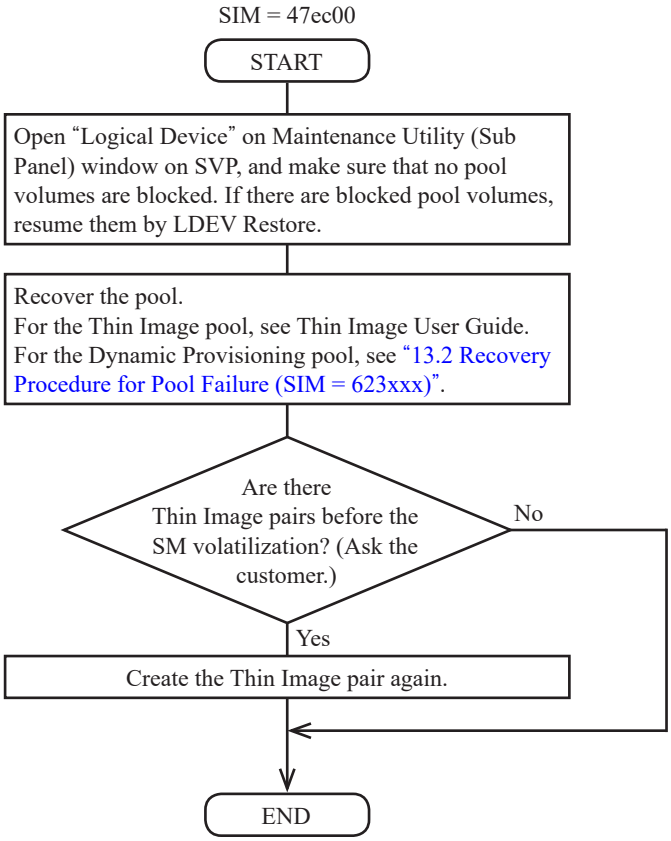
No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
5	SIM check	If SIMs related to the path block are generated in each DKC, complete the SIMs (for VSP Gx00/Fx00, view the SIMs and take necessary actions).	
6	UR2 pair resync	Execute 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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10. Recovery from Thin Image Failure

10.1 Recovery Procedure for Thin Image Failure due to SM Volatilization (SIM = 47ec00)

The procedure for recovering from a Thin Image failure when the SM is volatile is as follows. (*1)

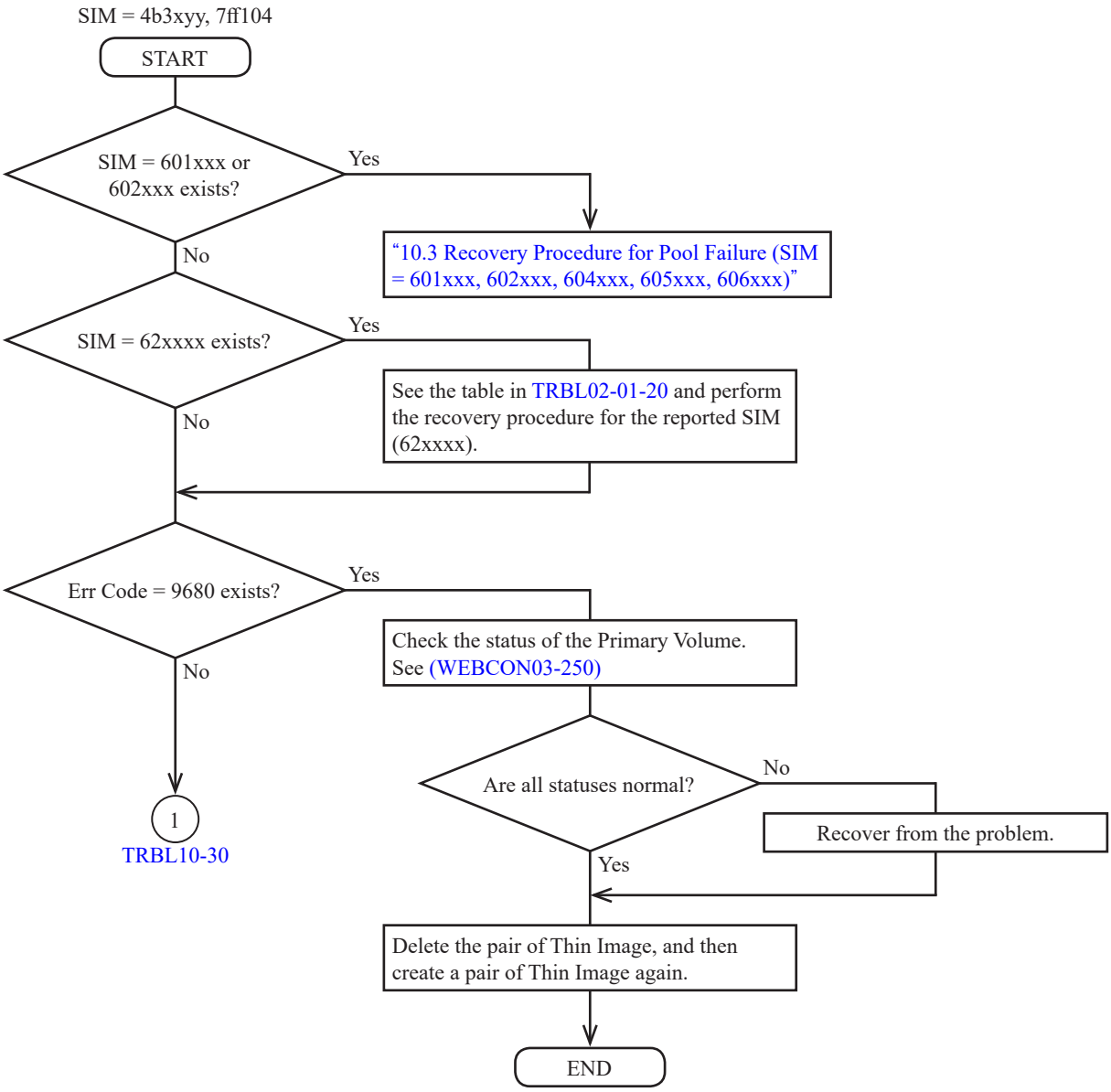


*1: Regardless of whether or not there were Thin Image pairs before restoration of configuration information (New Installation (Restore Configuration)) or volatilization of SM, “SIM = 47ec00” might be reported if either of the following pools exists in the storage system:
- Thin Image pool
- Dynamic Provisioning pool

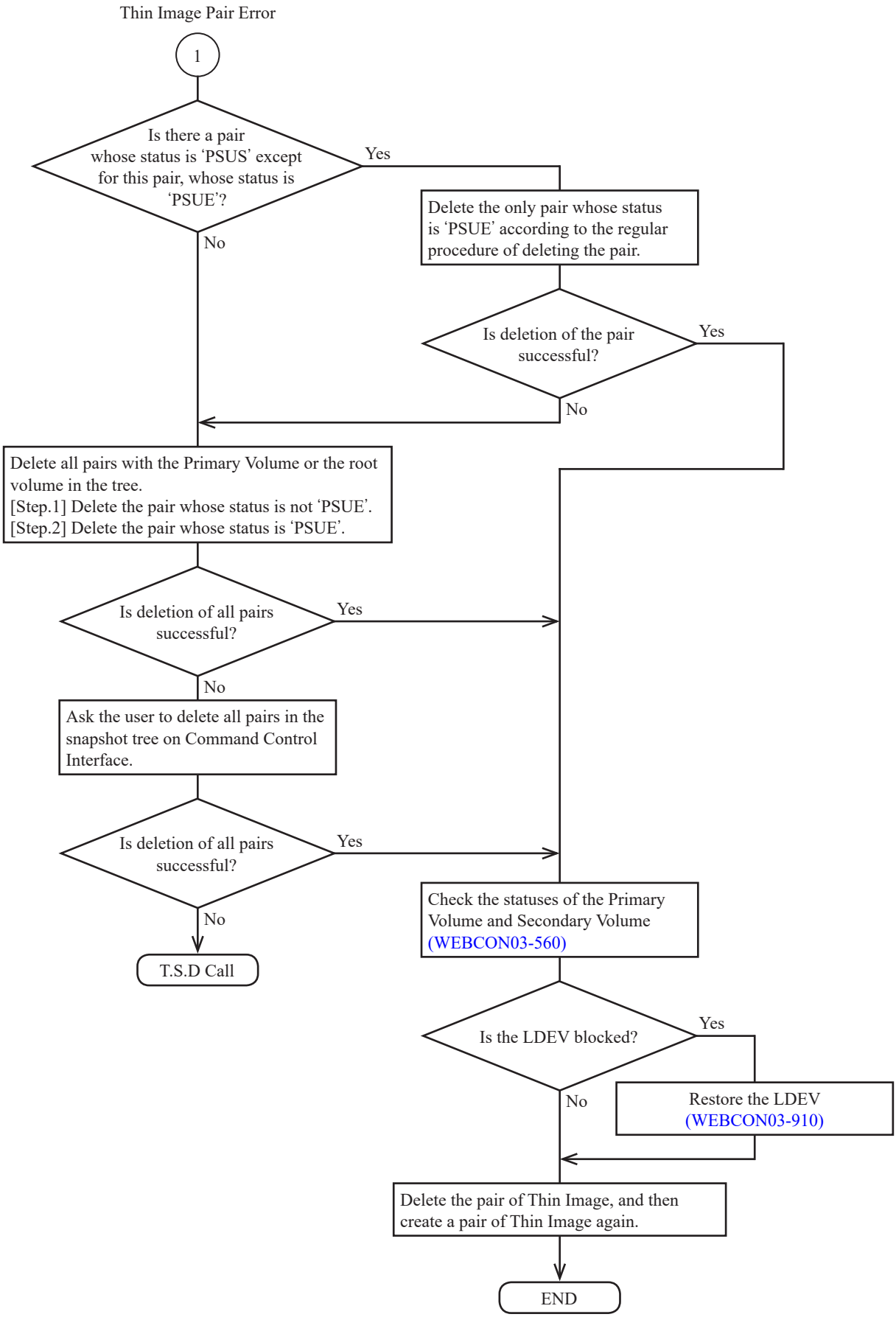
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10.2 Recovery Procedure for Thin Image Failure (SIM = 4b3xyy, 7ff104)

The procedure for recovery from a failure occurs in a pair of Thin Image is explained below.



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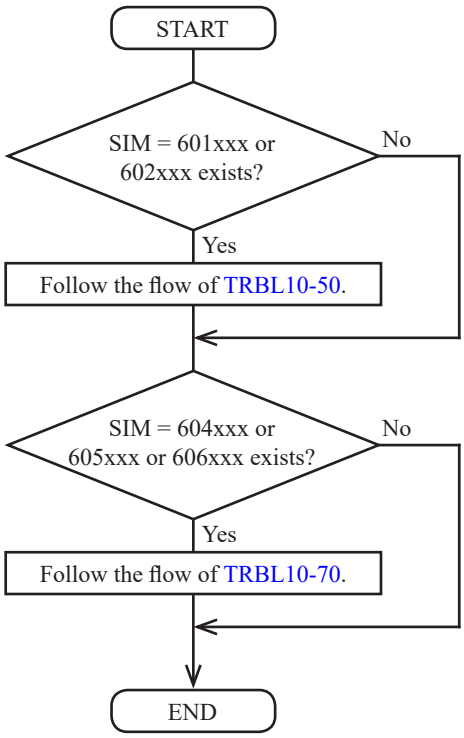


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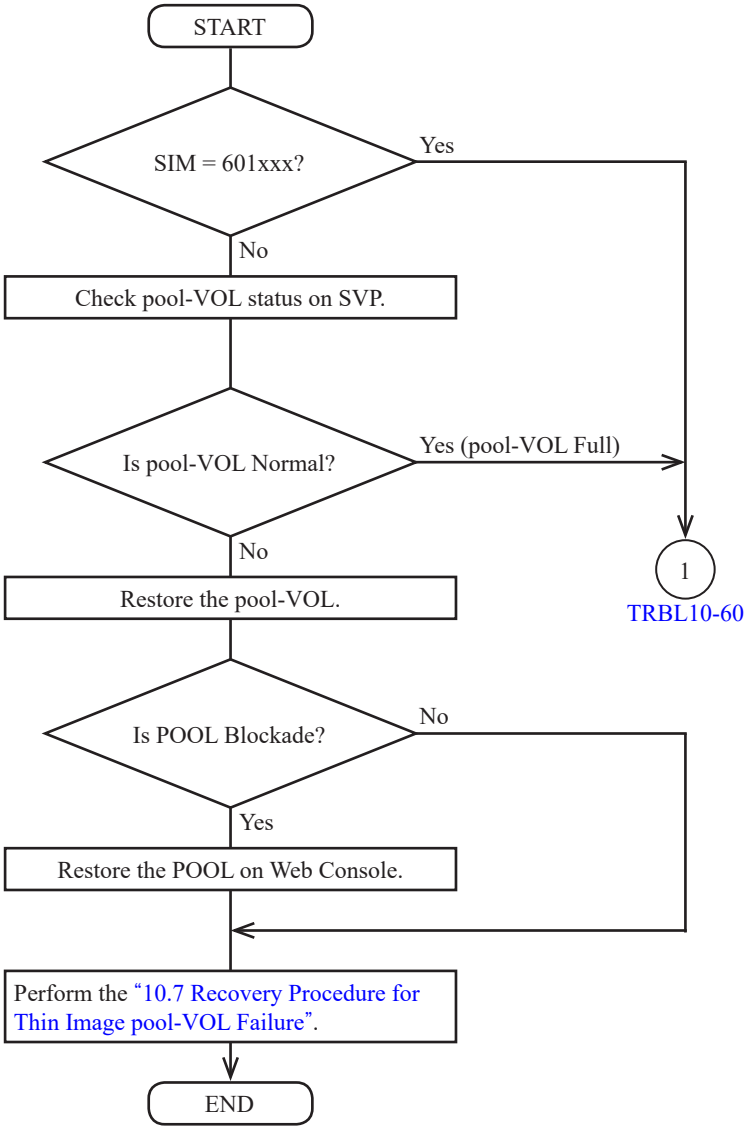
10.3 Recovery Procedure for Pool Failure (SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx)

The procedure for recovery from a failure occurs in the Pool is explained below.

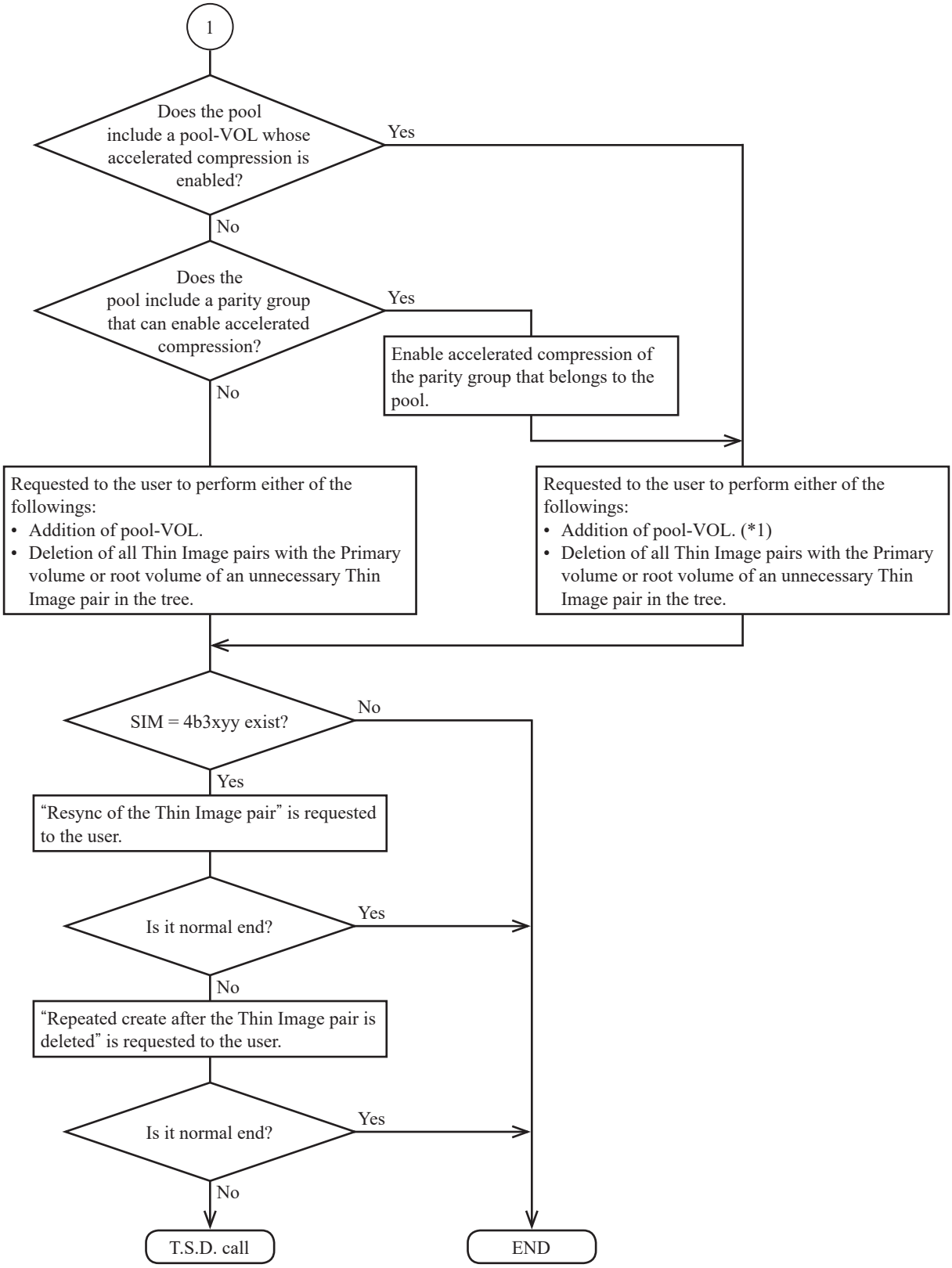
SIM = 601xxx, 602xxx, 604xxx, 605xxx, 606xxx



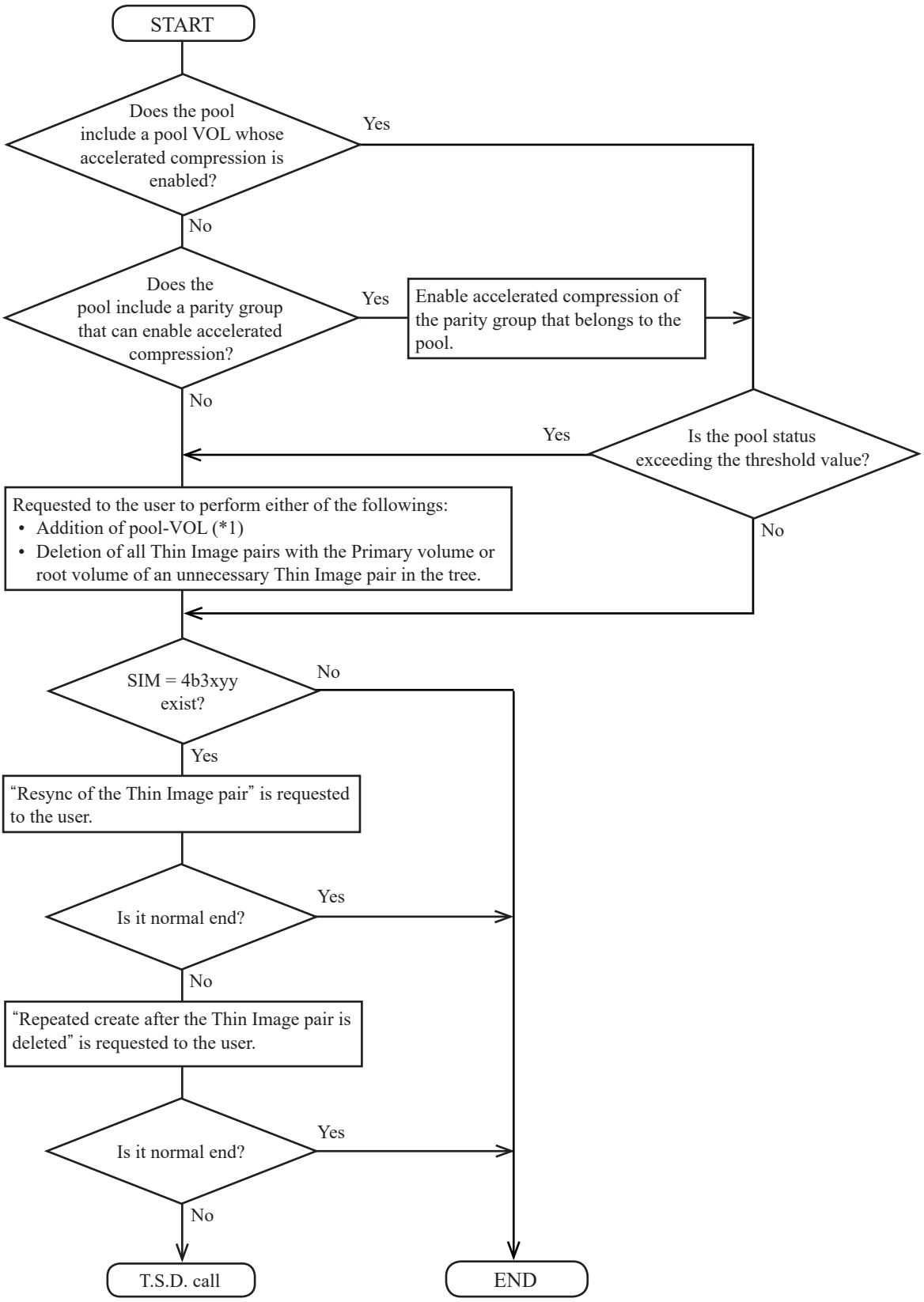
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*1: The logical capacity required for resolving SIM is calculated by the following formula (1).

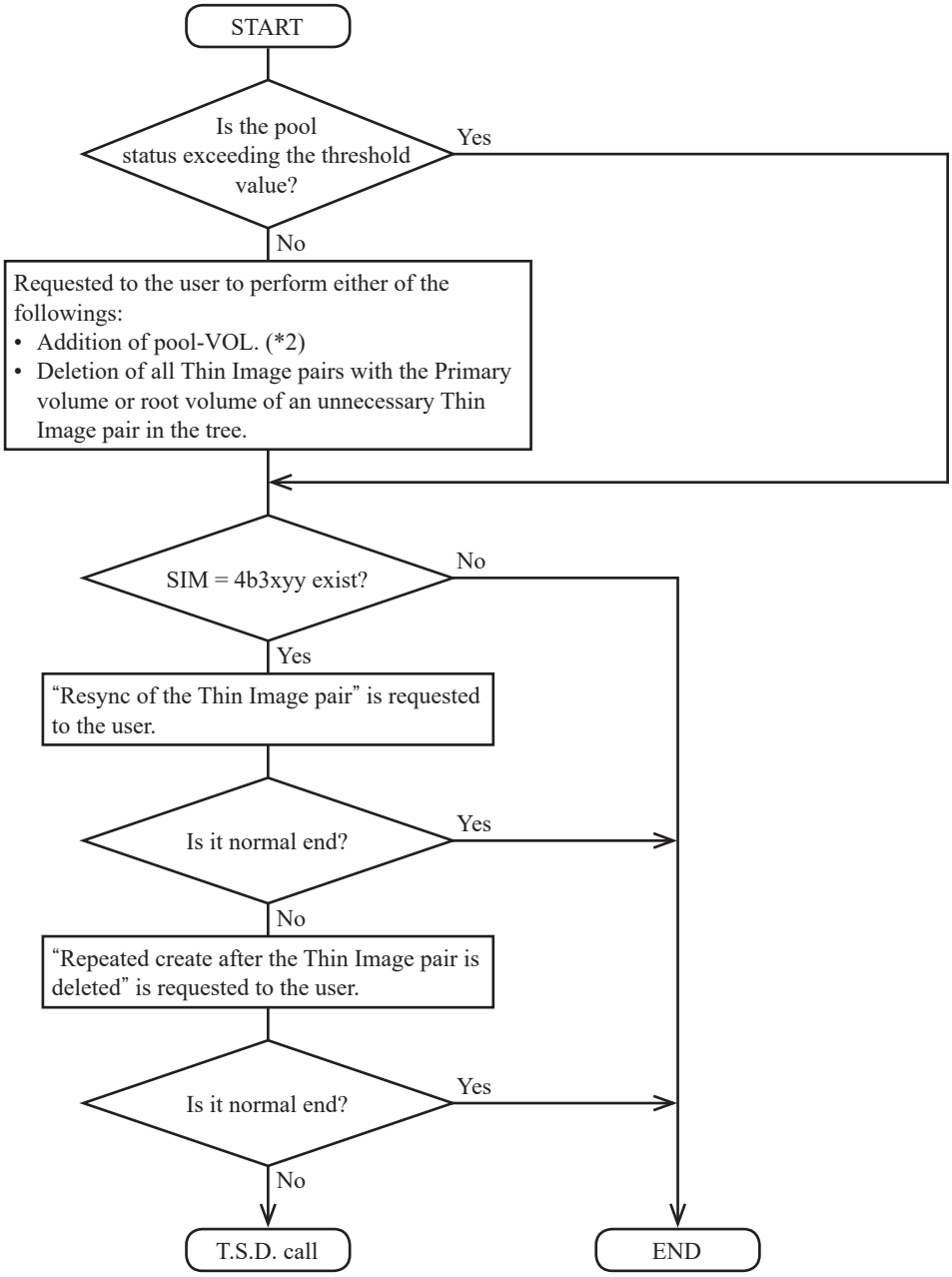
Required logical capacity =
(Logical usage of pool ÷ Threshold value of pool) – Logical capacity of pool before expansion (1)

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.

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 (2)

In the case of (Required logical capacity) ≤ (Total LDEV capacity to be created) :
Insufficient logical volume can be covered 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) :
To compensate for the differences, add a parity group and expand the pool capacity.
Also, convert the percentage into 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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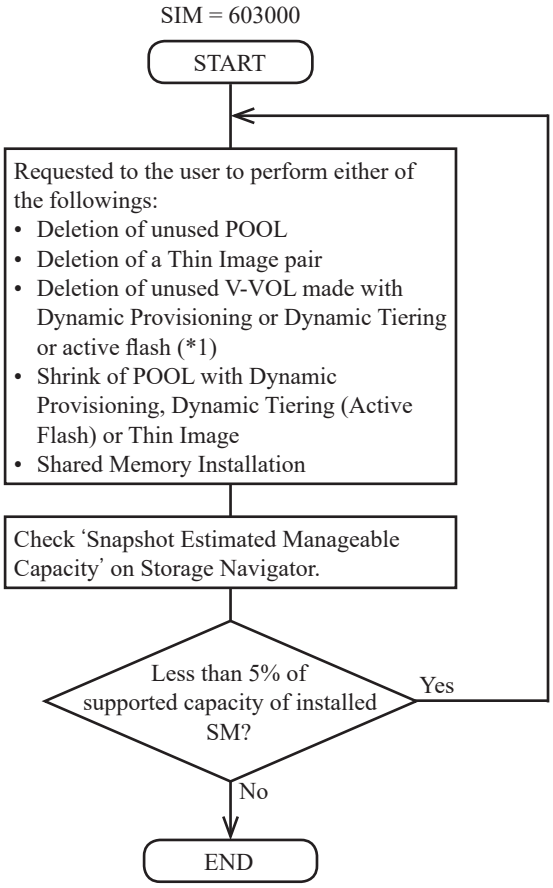
*2: To revolve SIM, add a parity group to expand the pool.
The required physical capacity to resolve SIM is calculated by the following formula (3).

Required physical capacity =
(Physical usage of pool ÷ Threshold value of pool) – Physical capacity of pool before expansion (3)

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10.4 Recovery Procedure for Pool Failure (SIM = 603000)

The procedure for recovery from a failure occurs in the Pool is explained below.



*1: For more information about deleting V-VOLs, refer to the procedure described in the "Provisioning Guide for Open Systems".

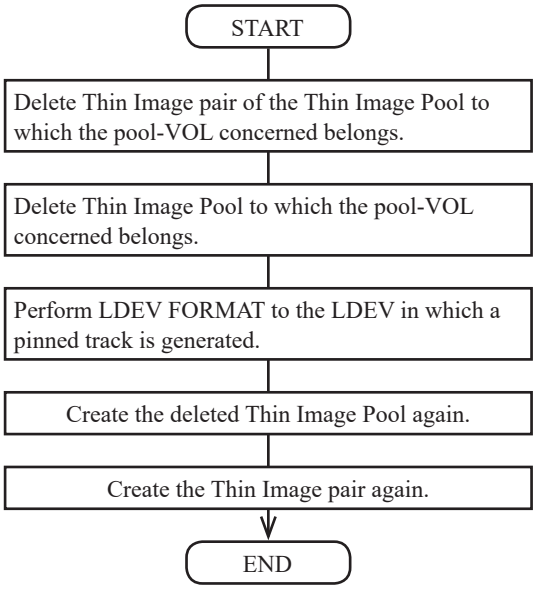
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10.5 Recovery Procedure for Thin Image pool-VOL ECC/LRC Error

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 TRBL05-280 as well as the normal VOL and recover it.

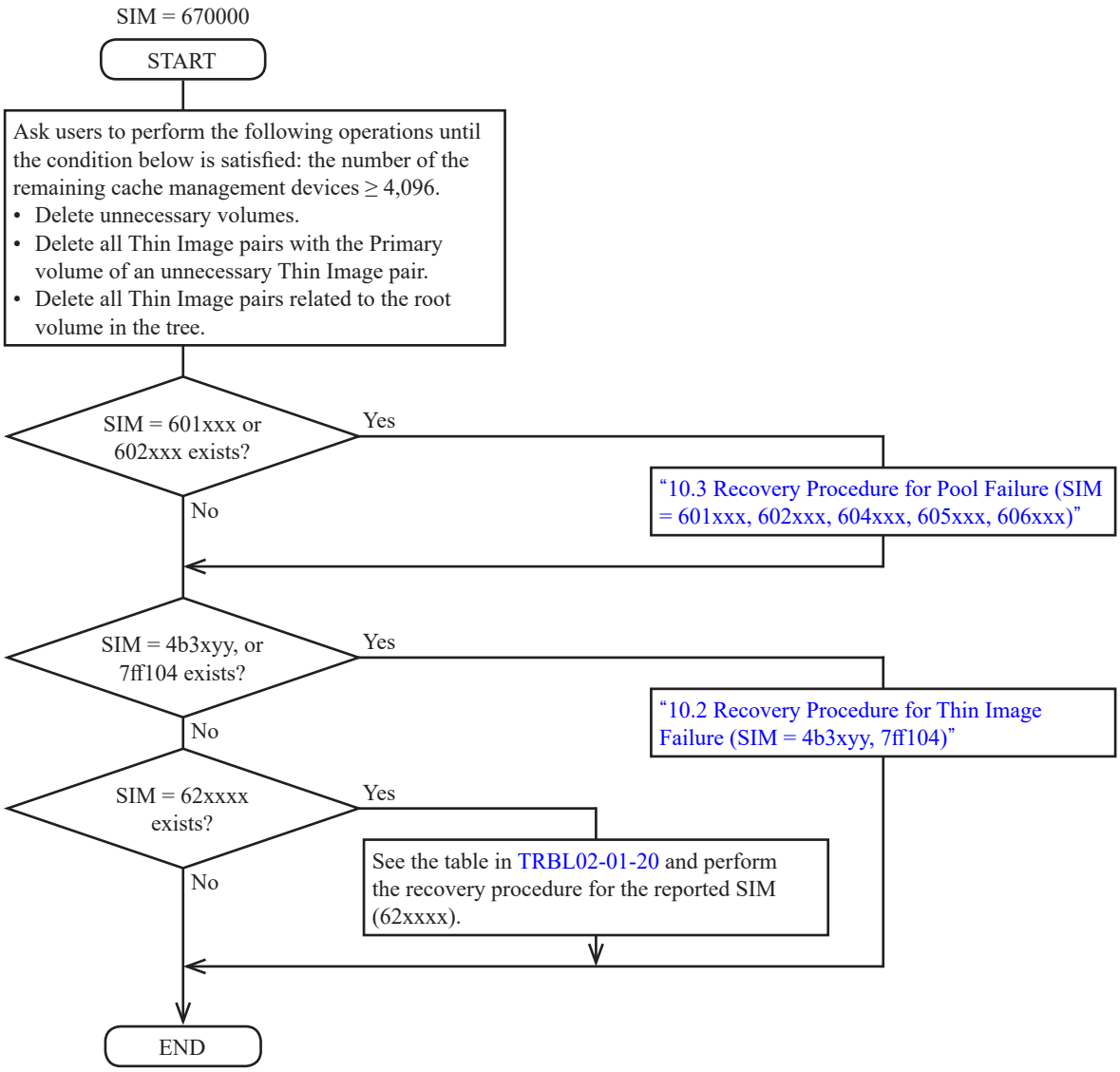
NOTE2 : The LDEV that a POOL ID is displayed on the Logical Devices window of the Web Console Window is a pool-VOL.



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10.6 Recovery Procedure for Thin Image Failure (SIM = 670000)

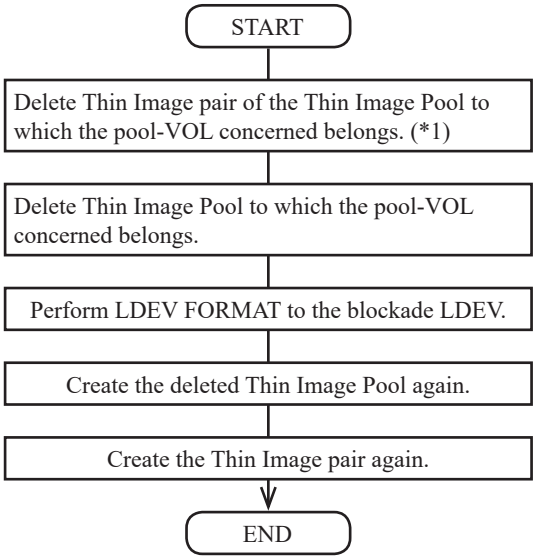
The procedure to recovery from a Thin Image failure is explained below.



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10.7 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.
For the Thin Image pair status check, pool status check, and pool operation in the following recovery procedure, ask the customer to do them.



*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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11. Recovery from Volume Migration Failure

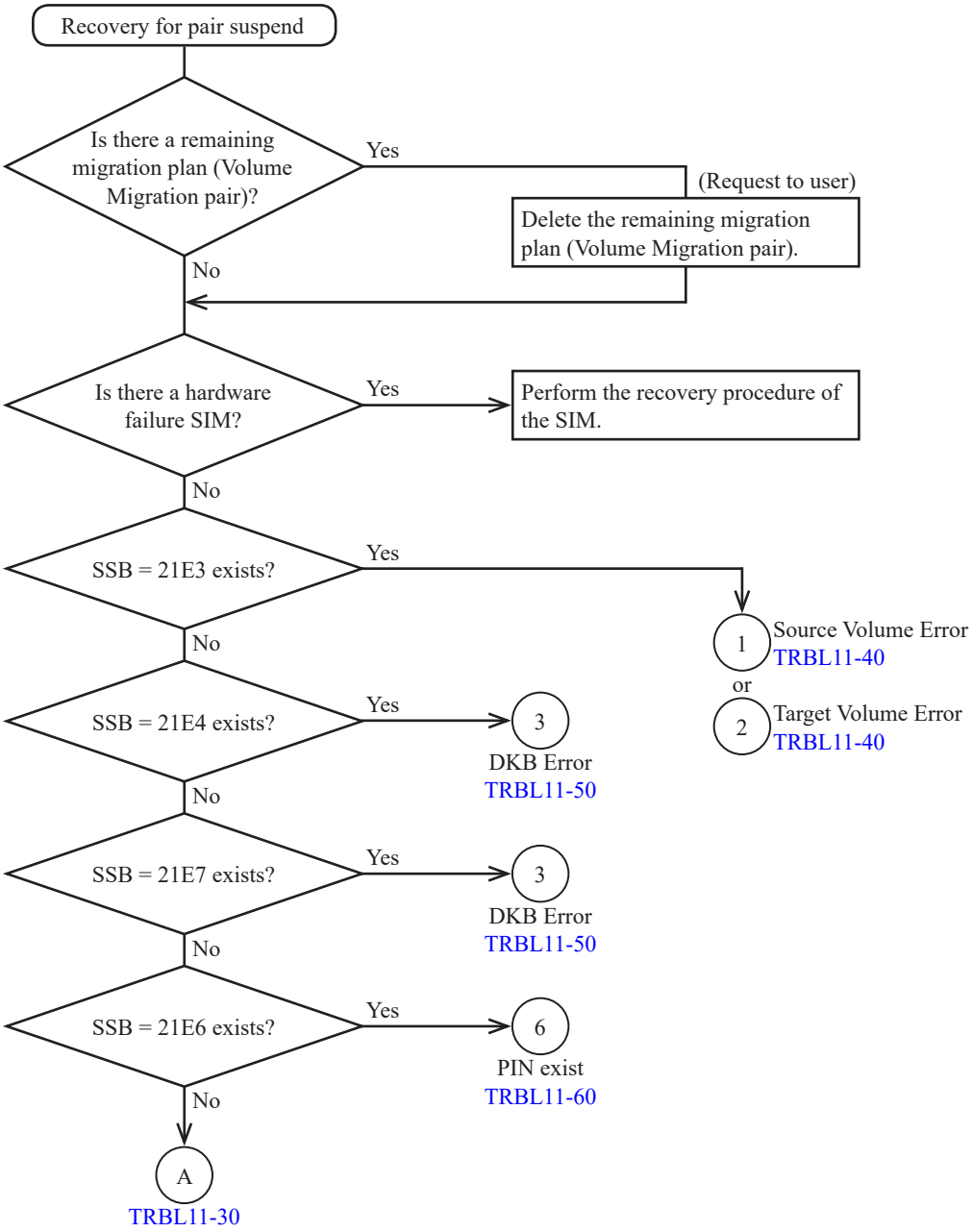
When it lapses into the state where a system does not expect, volume move processing of Volume Migration sometimes carries out an unusual end. In this case, the state of Source Volume and Target Volume which was during movement is not changing from the state before movement. So, there is no necessity 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 11-1 Volume Migration SIM REF.CODE

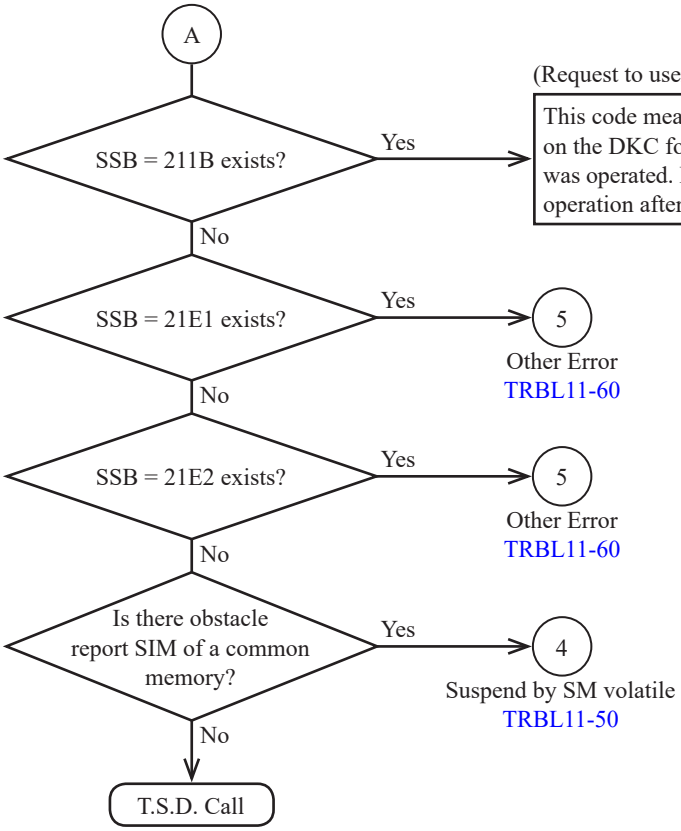
SIM REF. CODE	meaning	comment
47fyxx 7ff106	Volume Migration VOL Move unusual end	yxx: The lower 12 bits of Target Volume #. y = The lower 4 bits of CU# xx = LDEV#

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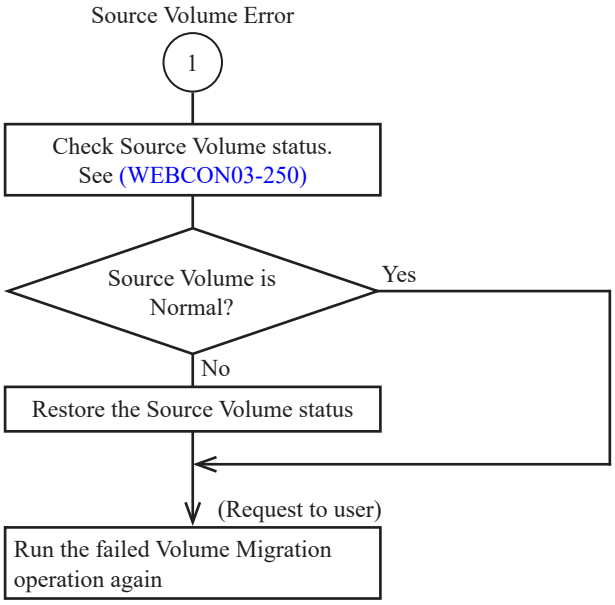
11.1 Recovery Procedure for Volume Migration Failure

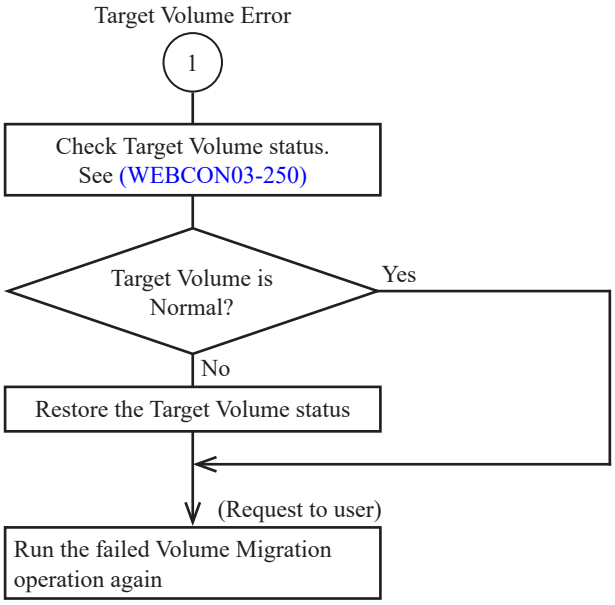


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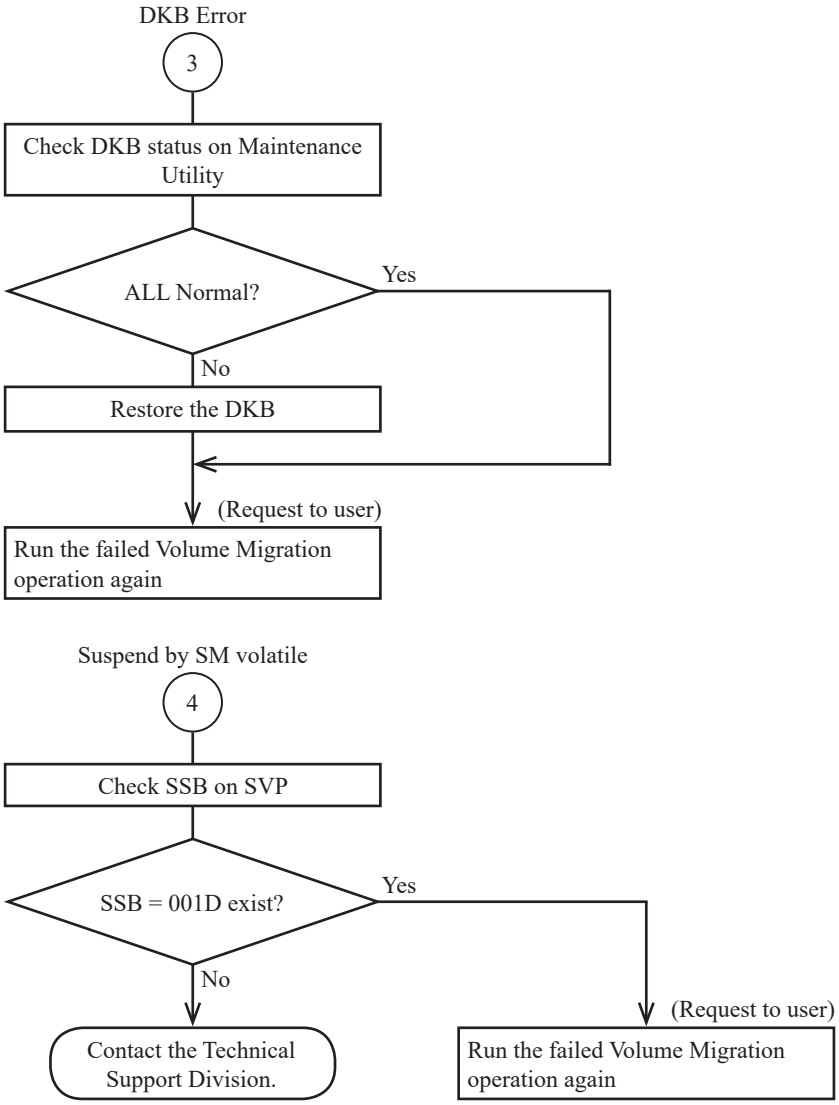


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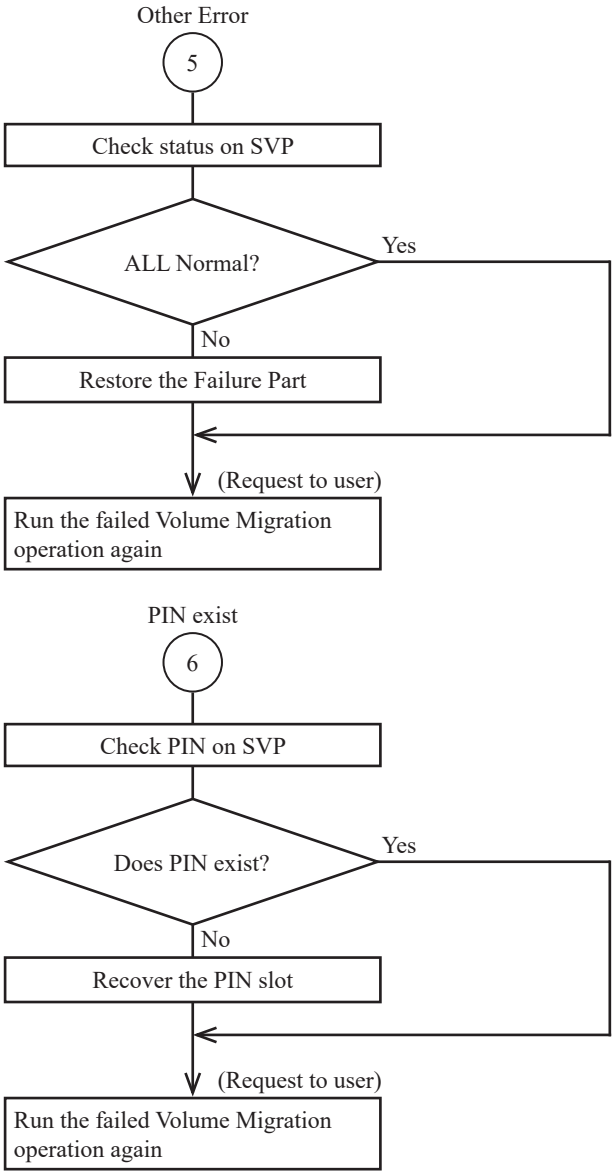




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11.2 Output of Online Path Information (SSB EC = 2084)

There is a case where volume migration operation becomes a command reject and cannot be executed because the target device is online.

When it becomes a command reject, specify the online path from the contents of SSB=2084, and make the target path offline.

NOTE: The number of SSB = 2084 is limited by about 1 in ten seconds. Therefore, after taking paths offline by way of Figure 11-3, P.P. command operation might fail with SSB=2084 again. If this happens, repeat steps of Figure 11-3.

11.2.1 Output information

Display SSB = 2084 from the SSB log referring to (SVP02-02-10).
The information shown below is output to Internal Data of SSB = 2084.

- The maximum of seven PIDs are output with SSB = 2084 to be output.
- The total number of online paths of the device shown in the byte 0x40 ~ 0x43 is output.

Table 11-2 SSB = 2084: Details of output information

Byte	Contents	Remarks
0x40 ~ 0x43	Device number (CU: LDEV number) of which the online path check was performed	
0x44	The number (1 ~ 7) of effective PIDs output in SSB concerned	
0x45 ~ 0x46	The total number of online paths (1 ~ 2048) shown in the byte 0x40 ~ 0x43	
0x47	Preparation (0)	
0x48 ~ 0x4F	PID1	Refer to the details of PID.
0x50 ~ 0x57	PID2	Refer to the details of PID.
0x58 ~ 0x5F	PID3	Refer to the details of PID.
0x60 ~ 0x67	PID4	Refer to the details of PID.
0x68 ~ 0x6F	PID5	Refer to the details of PID.
0x70 ~ 0x77	PID6	Refer to the details of PID.
0x78 ~ 0x7F	PID7	Refer to the details of PID.

NOTE: When the total number of online paths > effective PIDs output, there is the information of the online path which is not output. Retry the command operation after making the path offline referring to Figure 11-3.

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Figure 11-1 SSB = 2084: Position of output information

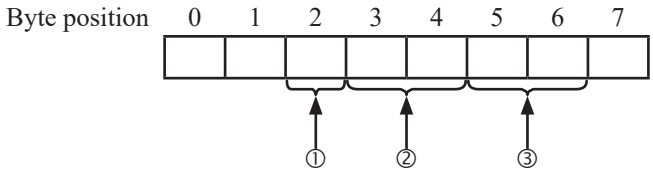
Internal Data		0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
	40	HDEV#				(*1)	(*2)		(*3)	PID1							
	50	PID2								PID3							
	60	PID4								PID5							
	70	PID6								PID7							

*1: The number of effective PIDs output in SSB concerned

*2: The total number of online paths of the device shown in the byte 0x40 ~ 0x43

*3: Preparation (0)

Figure 11-2 Details of PID



① LPAR number
② Last 4 digit of CPU serial number
③ Host type

NOTE: This does not show All digits of CPU serial number. Therefore, you might not be able to determine the host that has an online path. If this is the case, it is necessary to confirm online paths from all the hosts that have the same 4 digit of CPU serial number. If you use a volume from two or more hosts with the same last four digits of serial number and host type, it is recommended to use the volume from different LPAR number of the hosts.

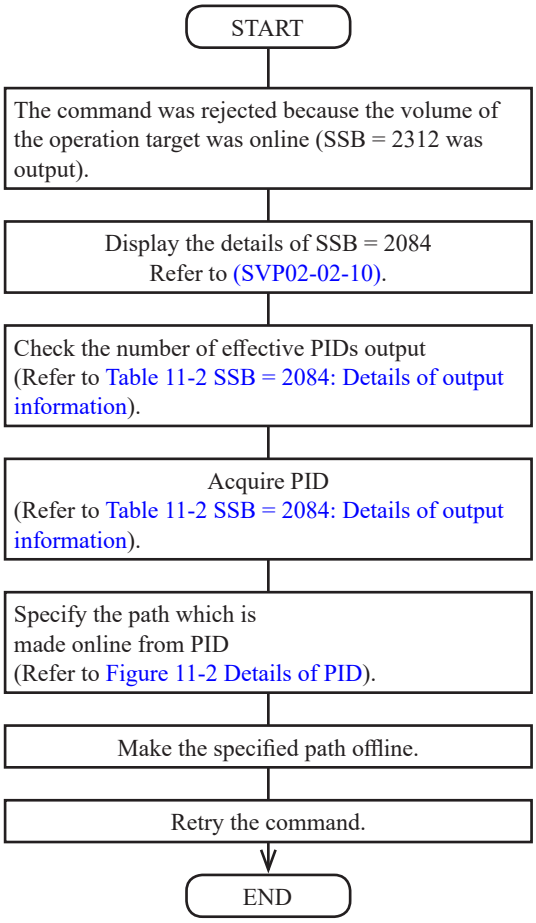
NOTICE: If the command that is tried again after the online path with the LPAR number is placed offline is still rejected due to the same online path, check the item "LGCL" in Logical Path Information (See (SVP03-04-30)) in the SVP screen to identify the path.

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11.2.2 To Continue the Operation

When the volume of the operation target is online, acquire the online path information of the target volume according to the following procedure, and make it offline. After that, retry the command.

Figure 11-3 Procedure for continuing the operation



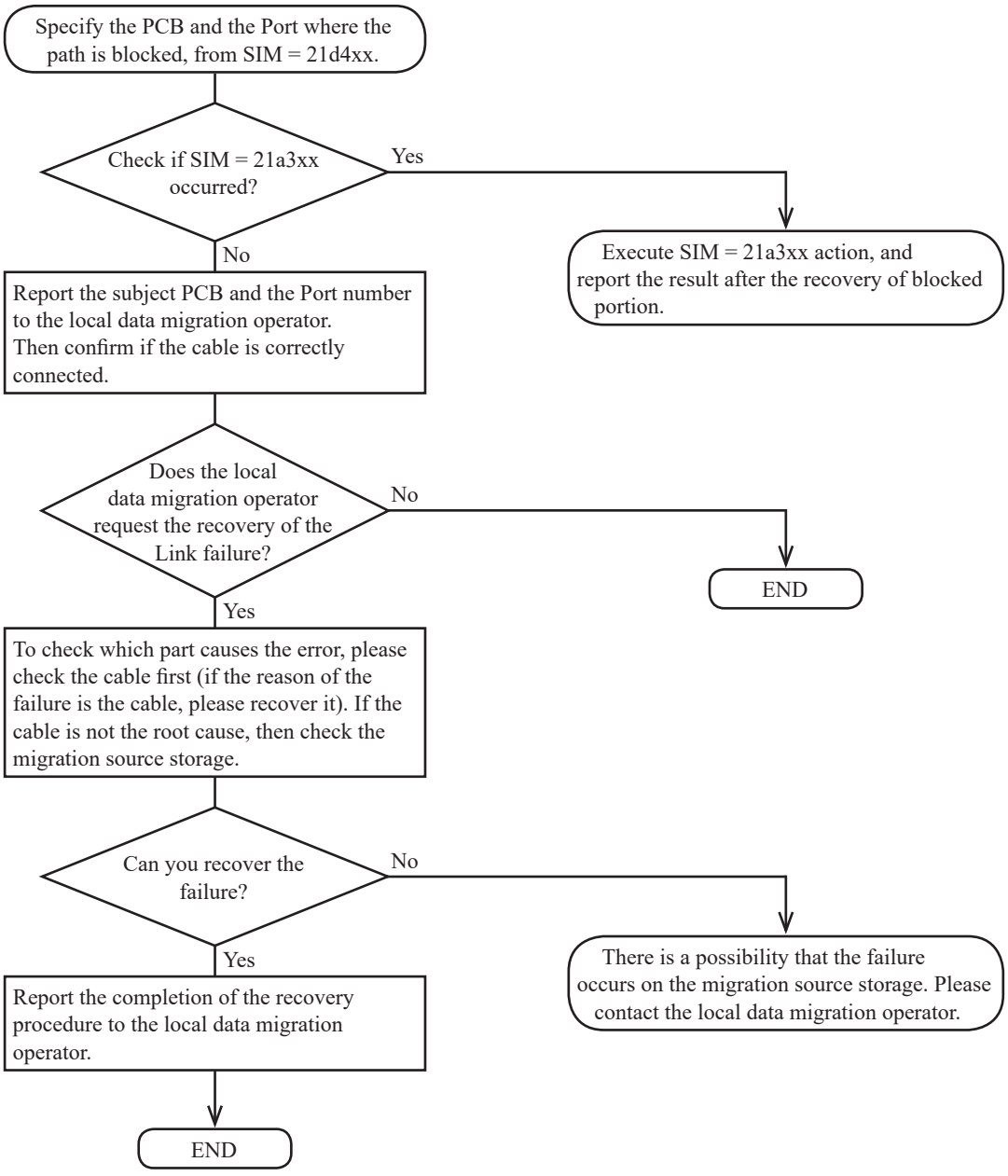
NOTE: When the total number of online paths > effective PIDs output, SSB = 2084 is output again (refer to Table 11-2 SSB = 2084: Details of output information).

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12. Recovery from Mainframe Fibre Data Migration Failure (SIM = 21d4xx, efd400, 47dxyy, 47e700)

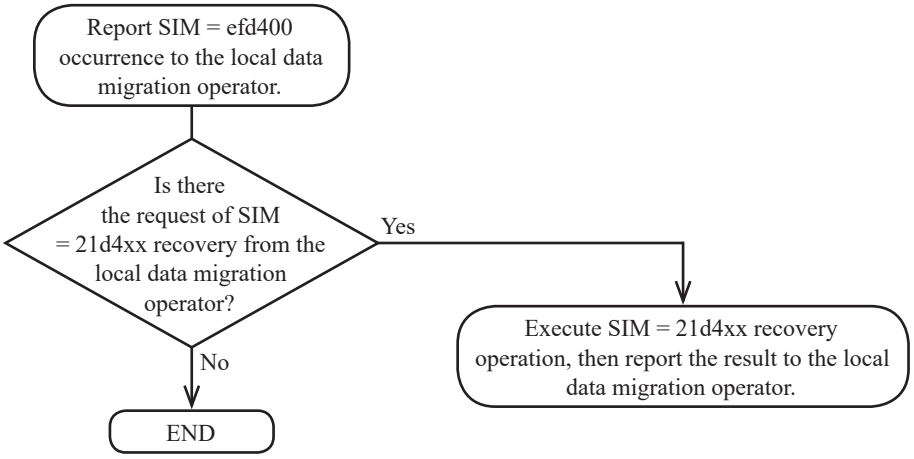
On the failure of the Mainframe Fibre Data Migration, the following shows the recovery procedures for the each of factors: SIM = 21d4xx (Mainframe Fibre DM Path blocked, SIM = efd400 (Mainframe Fibre DM Source Device blocked), and SIM = 47dxyy/47e700 (ShadowImage pair of Mainframe Fibre DM is suspended).

1. SIM = 21d4xx

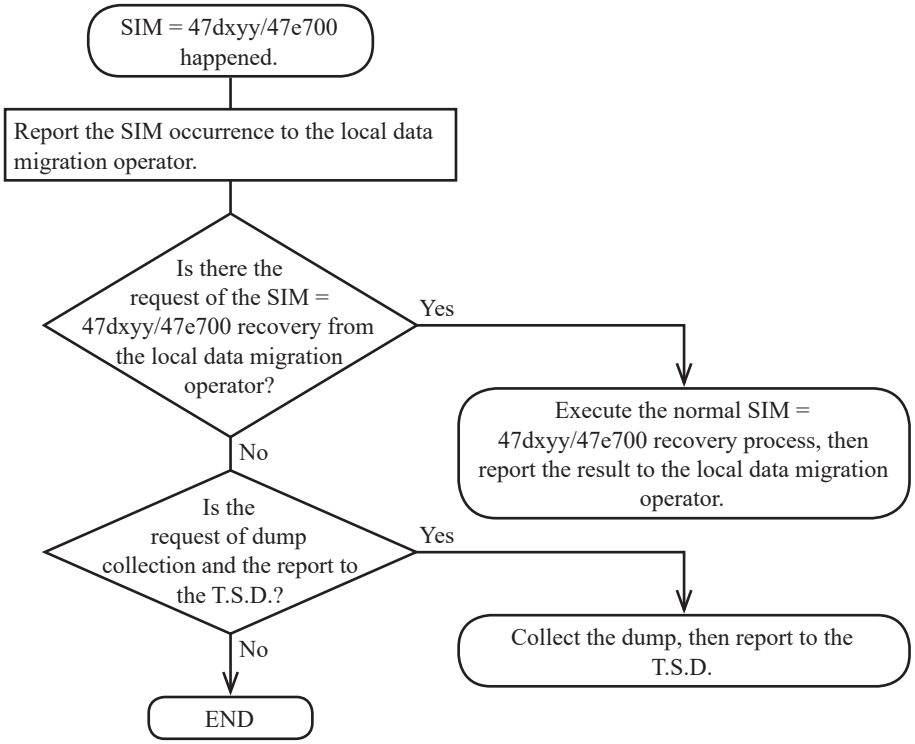


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2. SIM = efd400



3. SIM = 47dxyy/47e700



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13. Recovery from Dynamic Provisioning or Dynamic Tiering or active flash Failure

13.1 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 (*1)
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

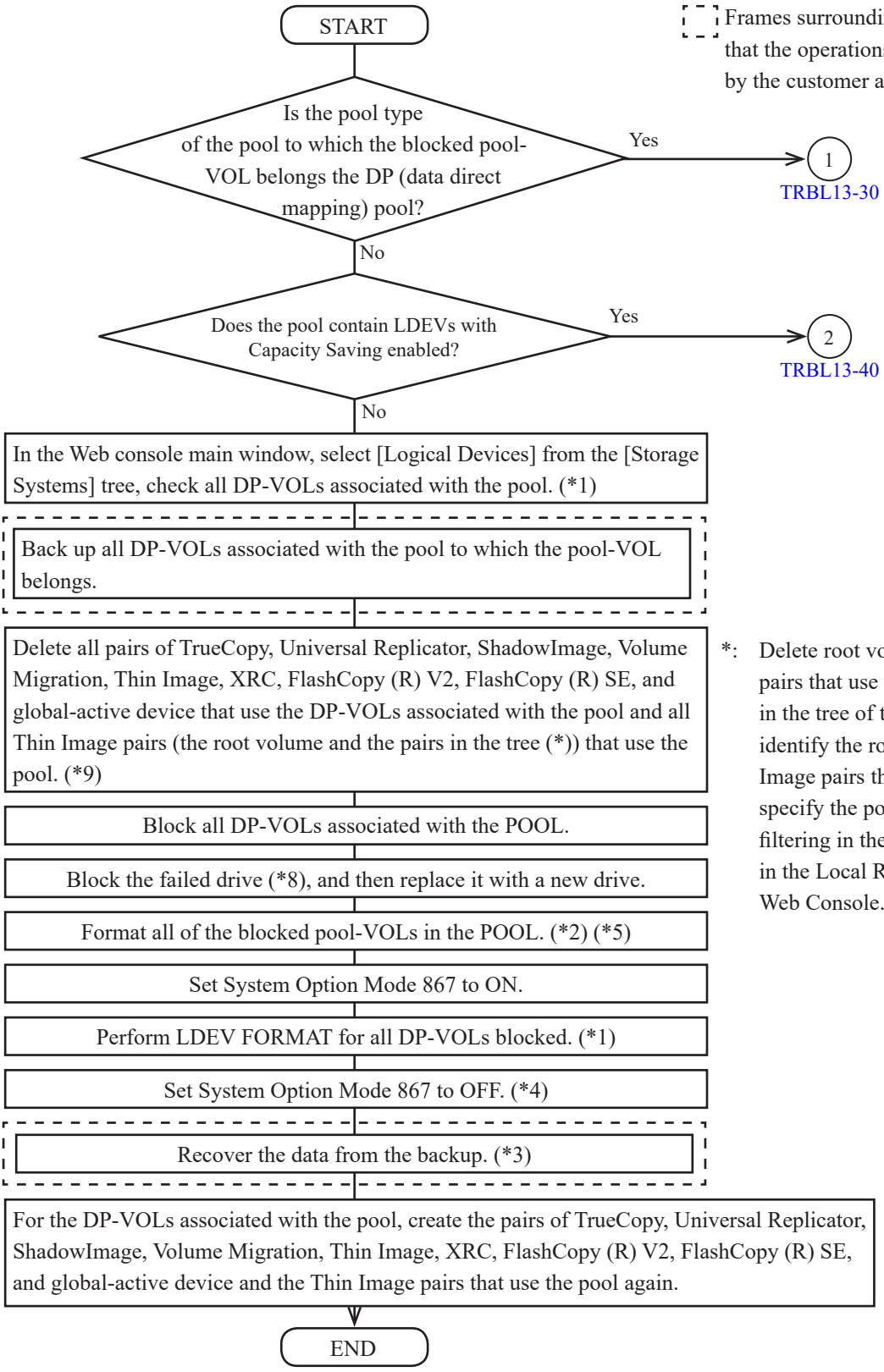
*1: When the Capacity Saving is enabled, the DP-VOL status is either Normal or Blocked.

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Recovery method

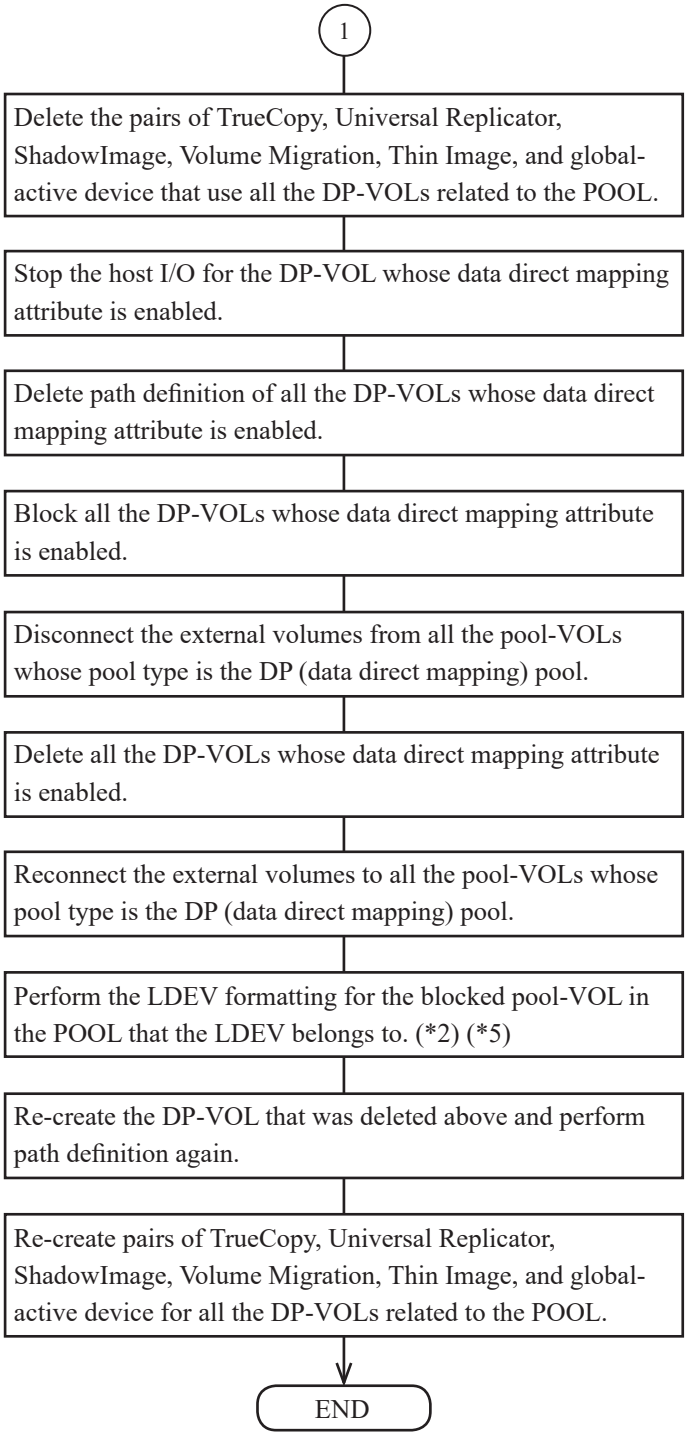
Perform the recovery processing in the following flow.

Recovery processing at the time of pool-VOL blockade



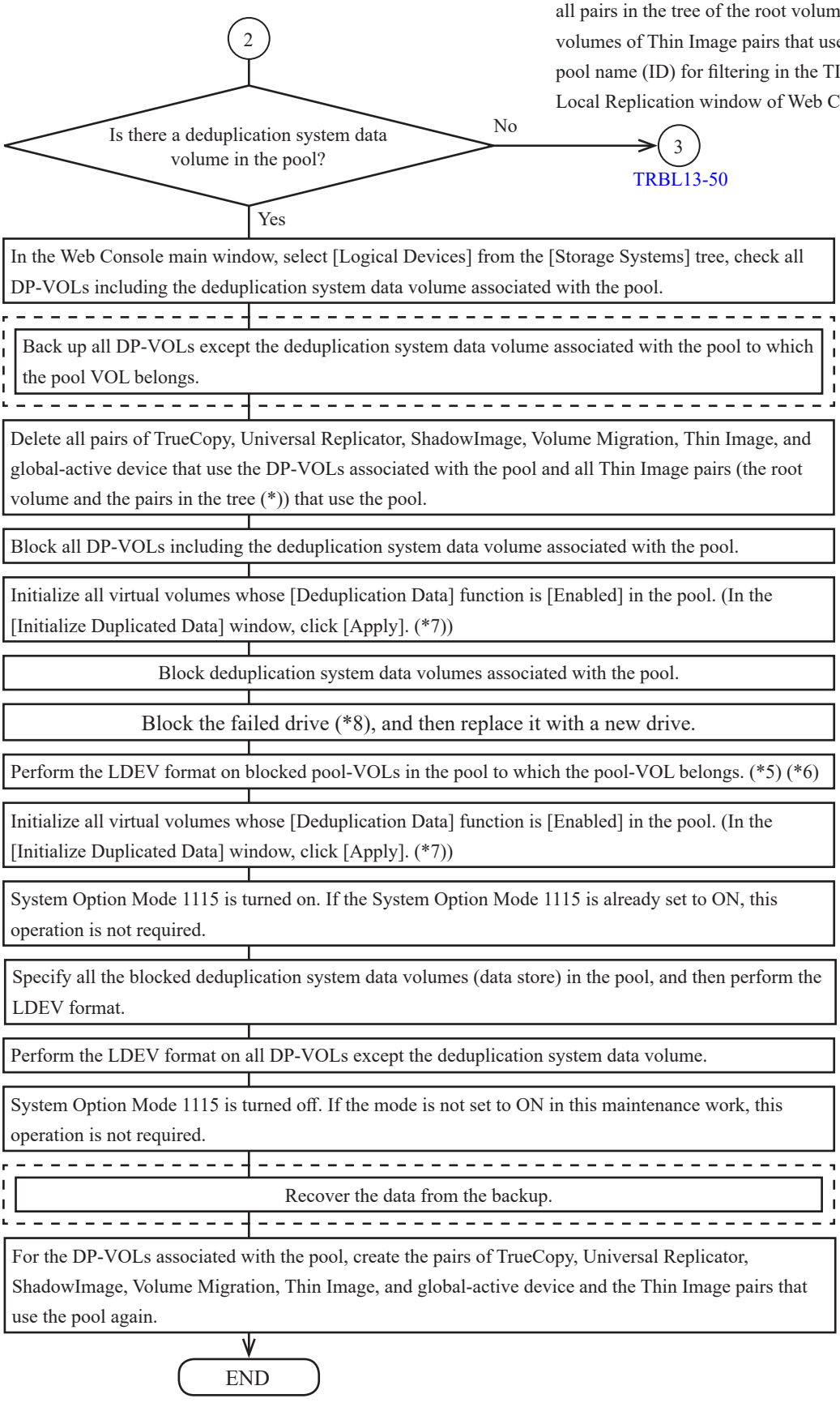
*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the Local Replication window of Web Console.

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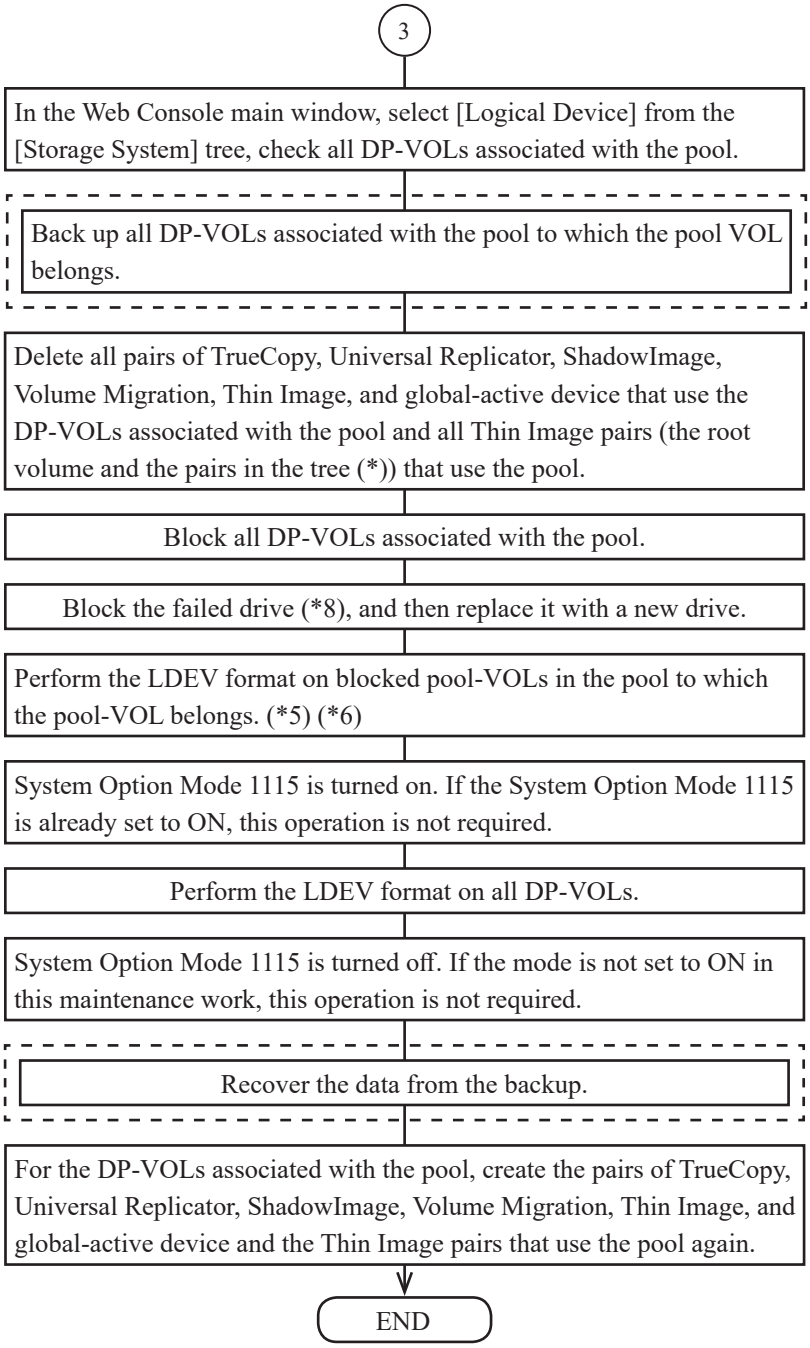


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*: Delete root volumes of Thin Image pairs that use the pool and all pairs in the tree of the root volume. To identify the root volumes of Thin Image pairs that use the pool, specify the pool name (ID) for filtering in the TI Root Volume tab in the 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.

*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 "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 "Formatting Parity Group" (WEBCON03-460))

*6: You don't have to perform LDEV format on pool-VOLs which have already been recovered by other operations.

*7: For Command Control Interface, use the [raidcom initialize pool] command.

*8: If multiple drives whose states are "Failed" exist in the same parity group, you need to forcibly block the drives and replace them.
When performing the drive replacement operation, select the checkbox of "Forcibly run without safety checks" in the Block Drives window.

*9: When you delete FlashCopy (R) V2 / FlashCopy (R) SE pairs using DP-VOLs, please execute following procedure.

If a LDEV to be blocked has both source and target extents of relationships with other LDEVs not to be maintained, please perform following procedure (1), (2) and (3).

(1) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please specify a DP-VOL as TDEVN. In addition, please don't specify extent option such as XTNTLST.

(2) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please don't specify extent option such as XTNTLST.

(3) Perform forcible Withdraw by specifying TDEVN, and DDSW(NO) options. Please don't specify SDEVN option and extent option such as XTNTLST.

The other cases, please perform following procedure (1) and (2).

(1) Perform forcible Withdraw by specifying SDEVN, TDEVN, and DDSW(NO) options. Please don't specify extent option such as XTNTLST.

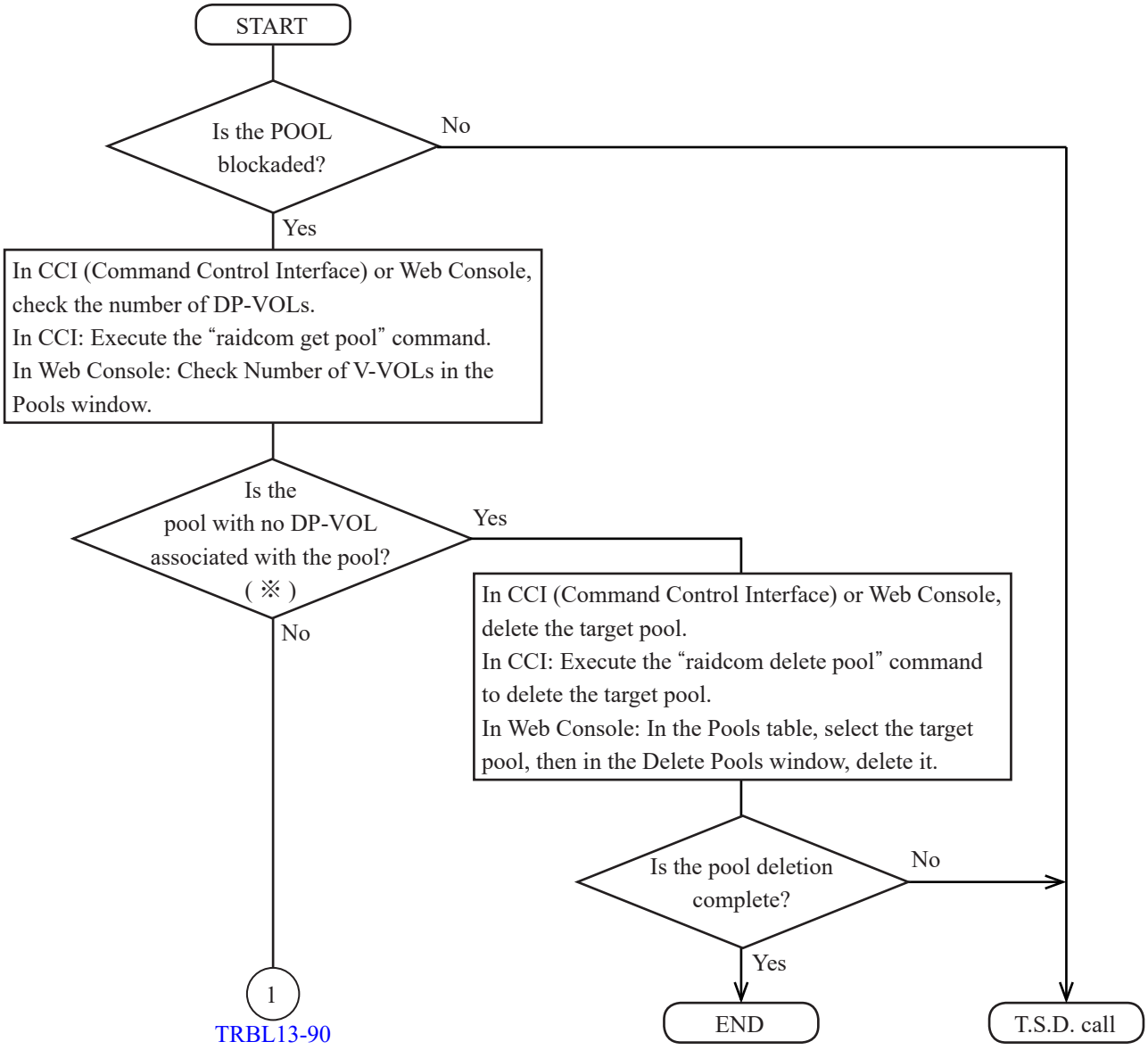
(2) Perform forcible Withdraw by specifying TDEVN, and DDSW(NO) options. Please don't specify SDEVN option and extent option such as XTNTLST.

When DP-VOLs are set as journal volumes of Universal Replicator, remove the settings (see TRBL09-140).

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13.2 Recovery Procedure for Pool Failure (SIM = 623xxx)

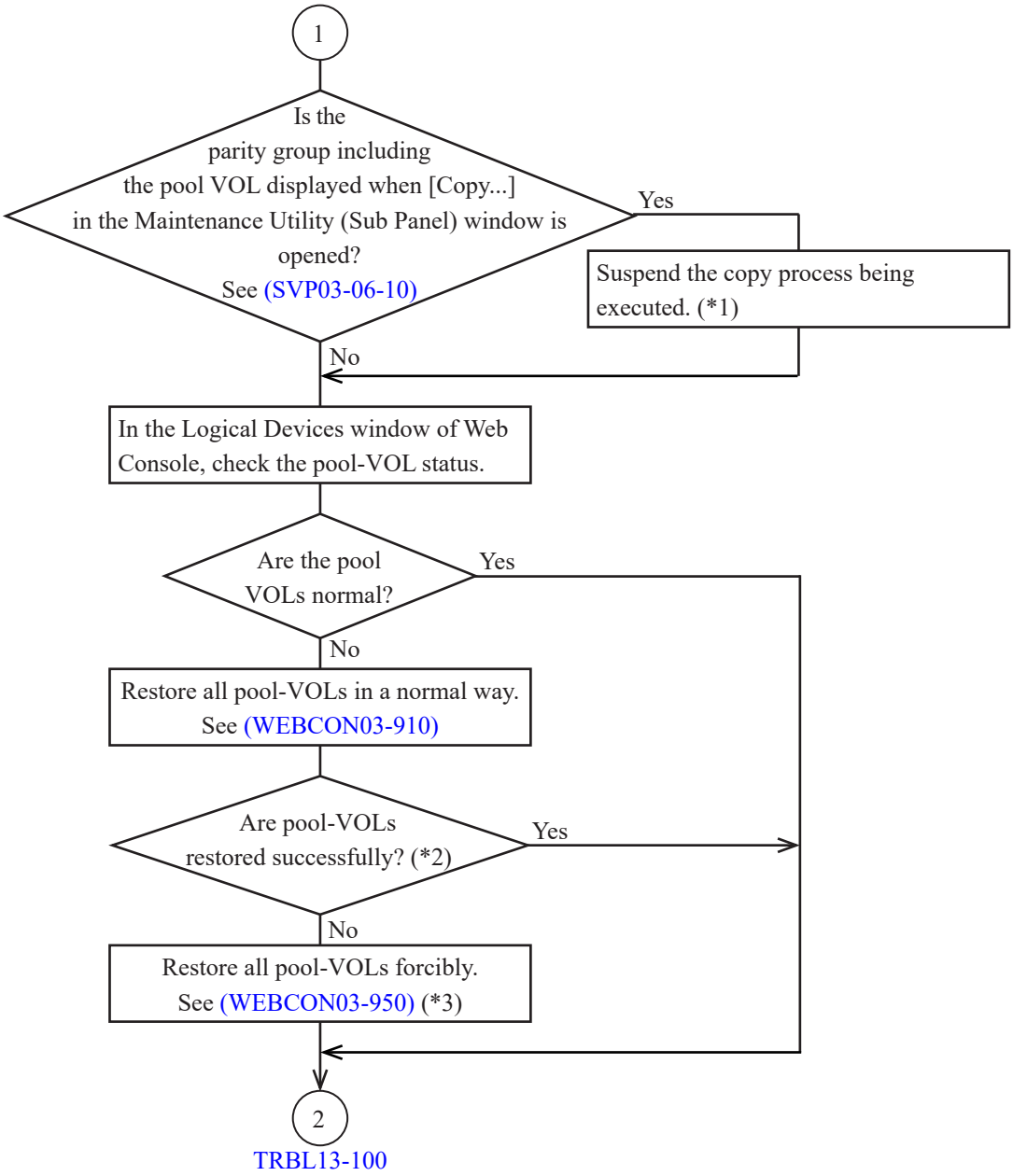
The recovery procedure for the failure of the pool used in the Dynamic Provisioning is shown here.



※ In CCI: Confirm that SSCNT = 0 is output as a result of the command execution.
In Web Console: Confirm that Number of V-VOLs is 0.

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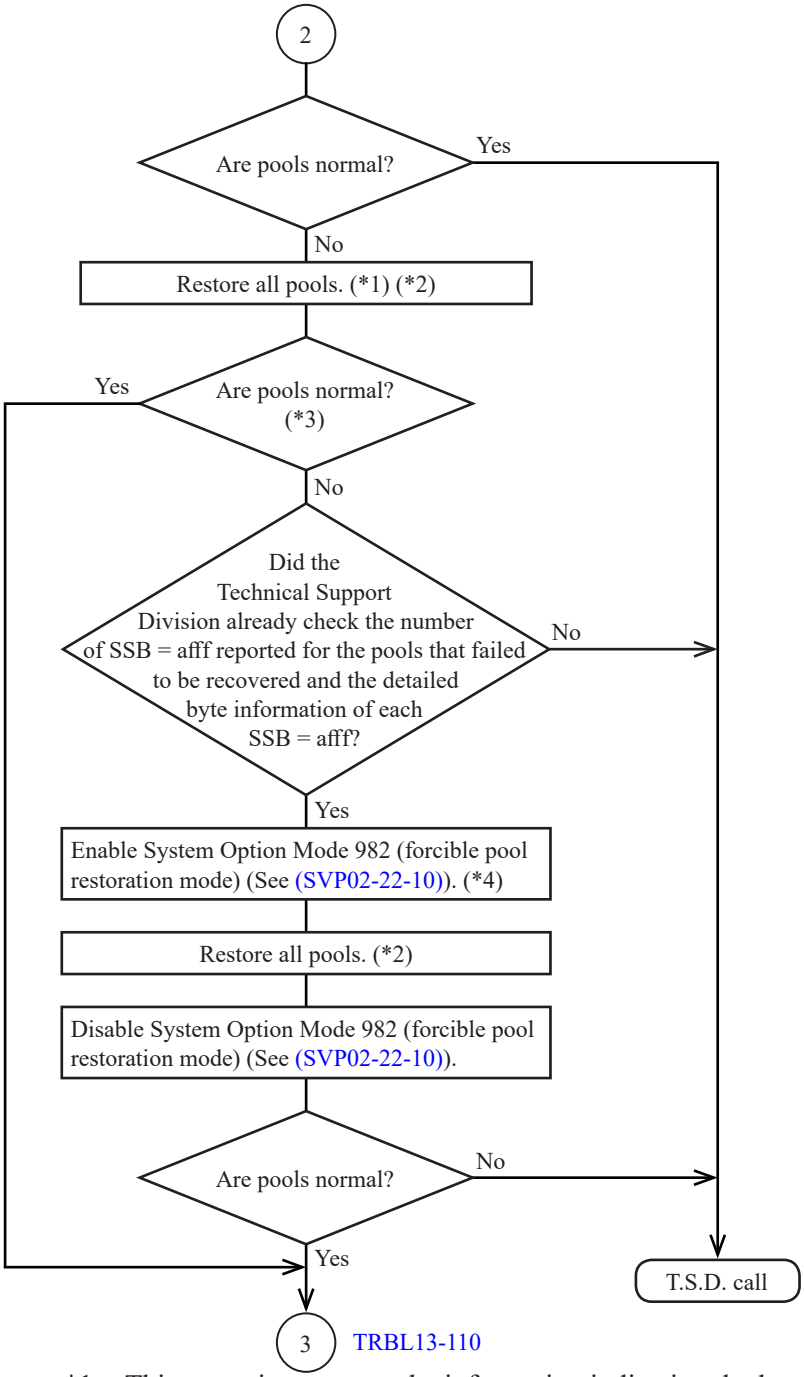
NOTICE: Only in an unusual case such as cache volatilization in both clusters, perform the procedures described on this page and later. Do not perform the following procedures unless the Technical Support Division (T.S.D.) instructs you to do so. If you perform the following procedures without permission, data in the DP-VOL might be lost.



*1: In Maintenance Utility, click the [Drives] tab, select the target drive, and then click [Stop Copy].

*2: If the Shared Memory volatilizes, the normal restoration inevitably fails because the data cannot be ensured.

*3: Input of the one-time password is required for the forcible restoration.



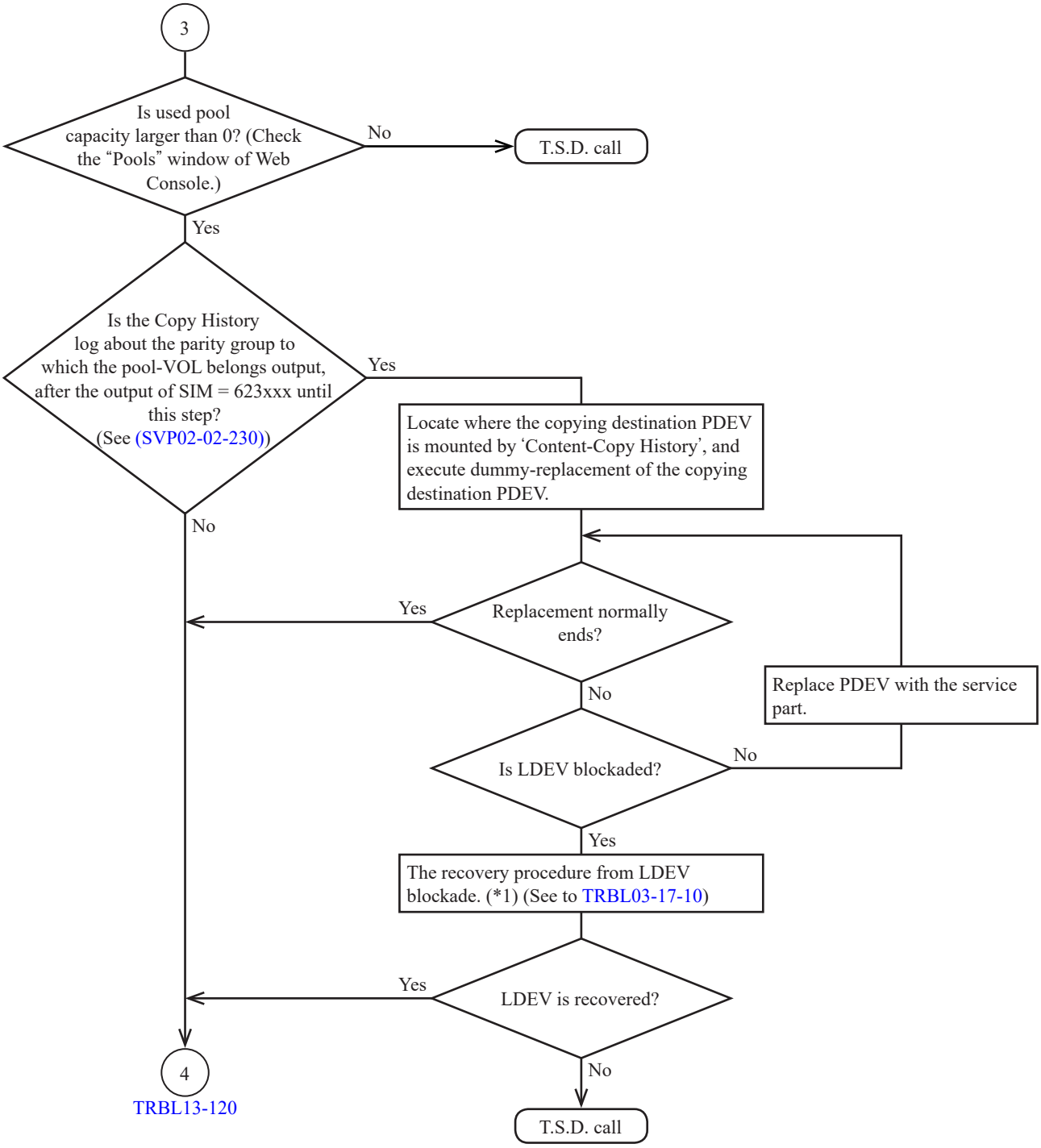
*1: This operation restores the information indicating the location where the DP-VOL data that was lost due to the Shared Memory volatilization is stored, from the system pool VOL.

*2:
- In Web Console: Use the Pools window to restore pools (see Provisioning Guide for Open Systems).
- In CCI: Execute the following command to restore pools (see Command Control Interface Command Reference):

```
raidcom modify pool -pool pool# -status nml
```

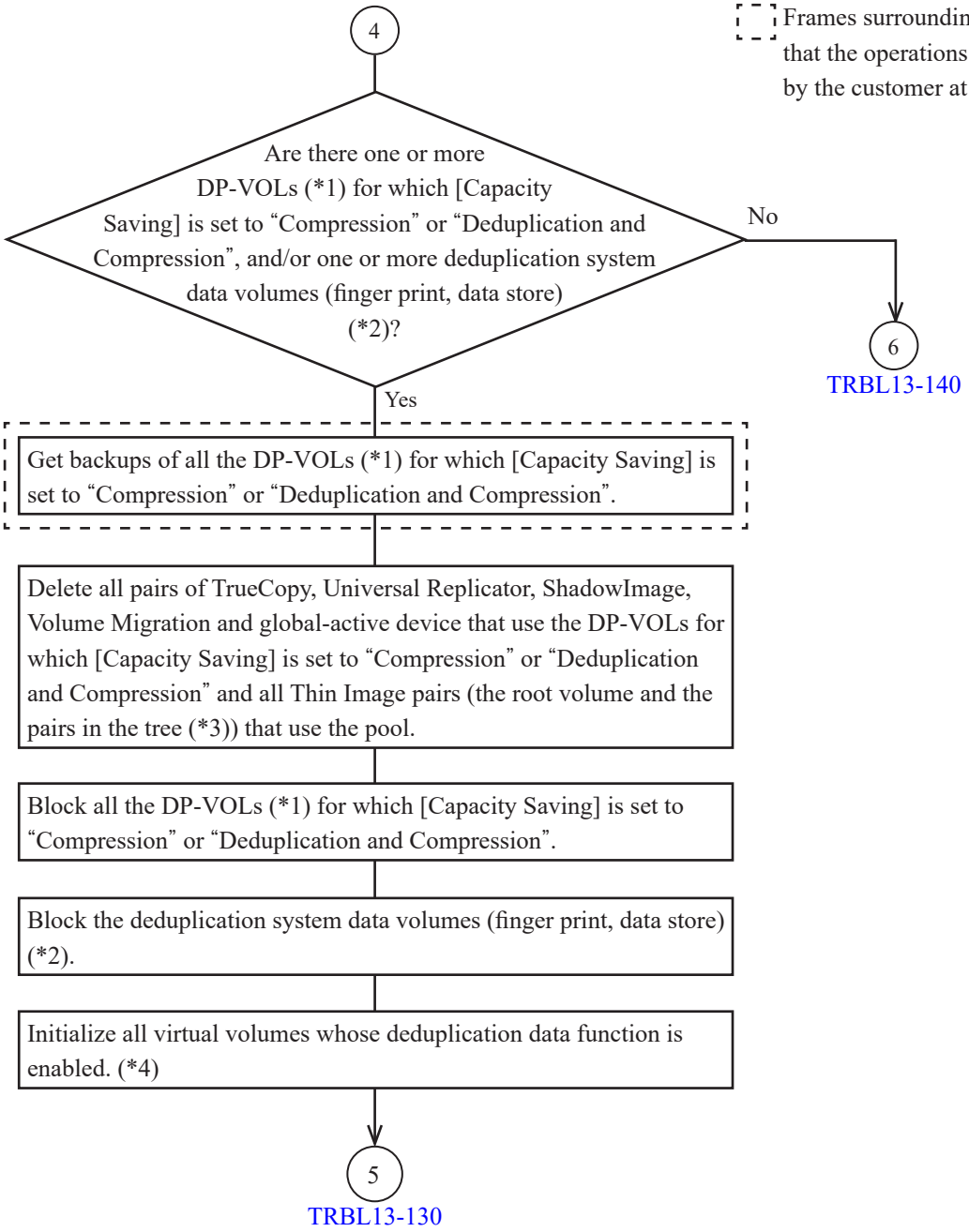
*3:
- If you power on the storage system after a planned shutdown, pools can be restored successfully.
- If you power on the storage system after a power outage, pools cannot be restored.
- After Initialize Pools (WEBCON03-120), pools cannot be restored.

*4: Ask T.S.D to tell you the password.



*1: In the flowchart of the recovery procedure on the reference page, be sure to choose “B” for the action to be taken. If you choose “A”, data recovery will fail.

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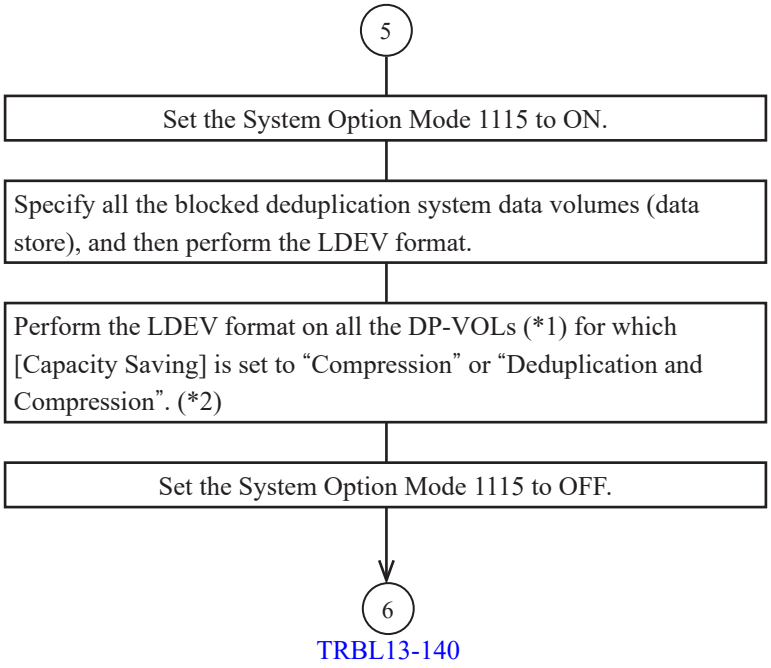


*1: You can check them in the [Capacity Saving] column in the Logical Devices window of Web Console.

*2: You can check them in the [Attribute] column in the Logical Devices window of Web Console.

*3: 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.

*4: For Command Control Interface, use the “raidcom initialize pool” command.
Specify “initialize_deduplication” for the -operation option.
For Web Console, use the [Initialize Duplicated Data] window. For details, see the “Provisioning Guide for Open Systems”.

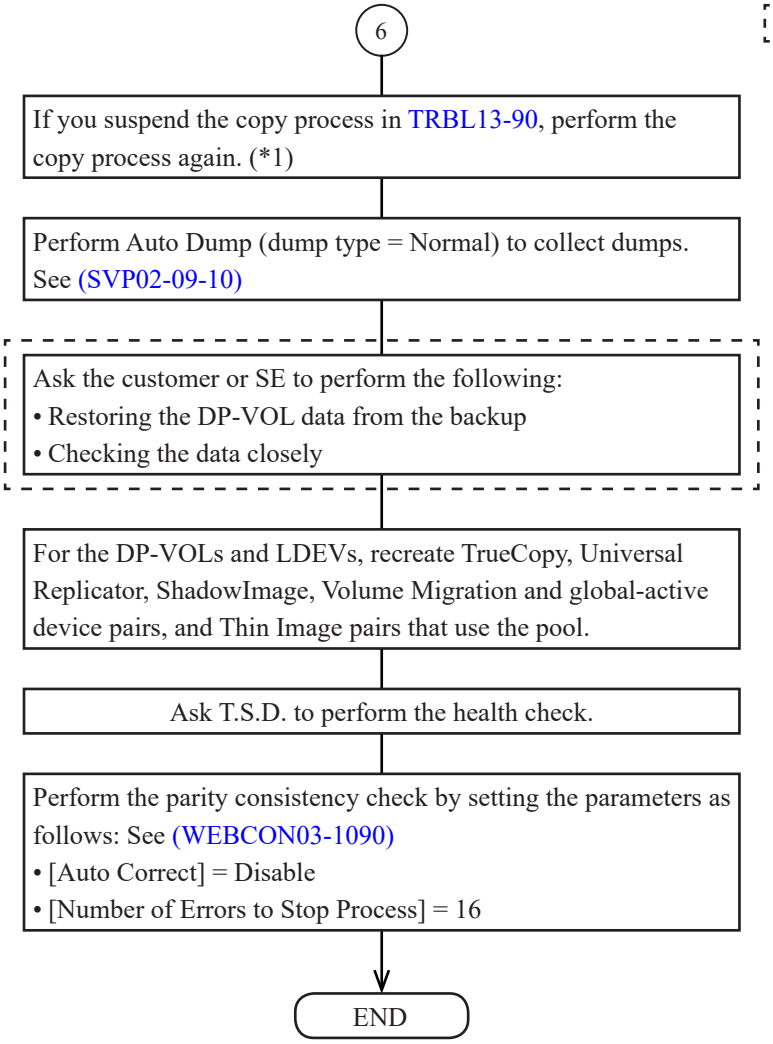


TRBL13-140

*1: You can check them in the [Capacity Saving] column in the Logical Devices window of Web Console.

*2: Do not perform the procedure for LDEV recovery.

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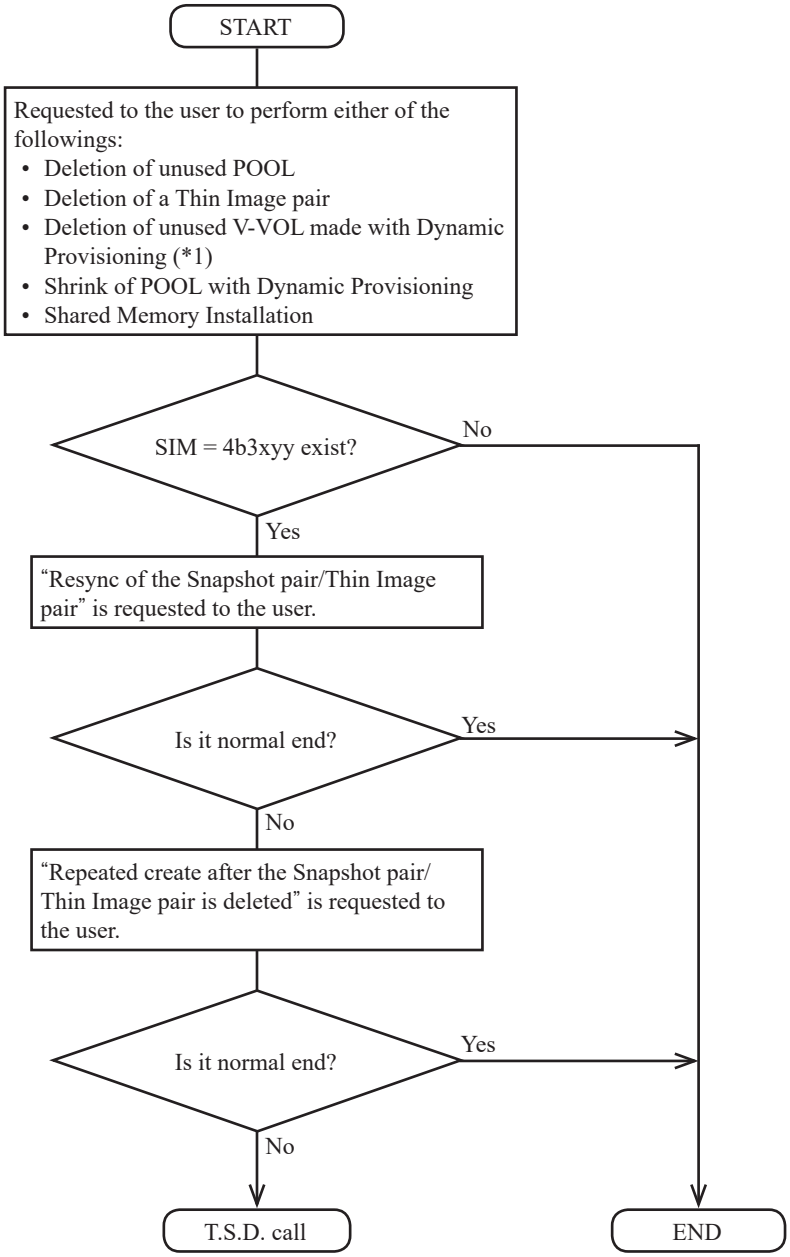
Frames surrounding operations show that the operations are to be performed by the customer at your request.

*1: Set the mode to [Modify Mode], open the Maintenance Utility (Sub Panel) window, and then click [Correction Copy] in the HDD detail information view.

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13.3 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.

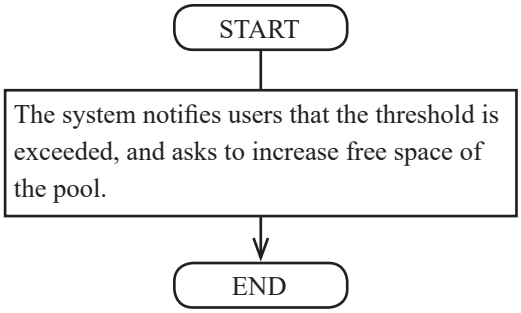


*1: For more information about deleting V-VOLs, refer to the procedure described in the “Provisioning Guide for Open Systems”.

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13.4 Recovery Procedure for Pool Failure (SIM = 62b000)

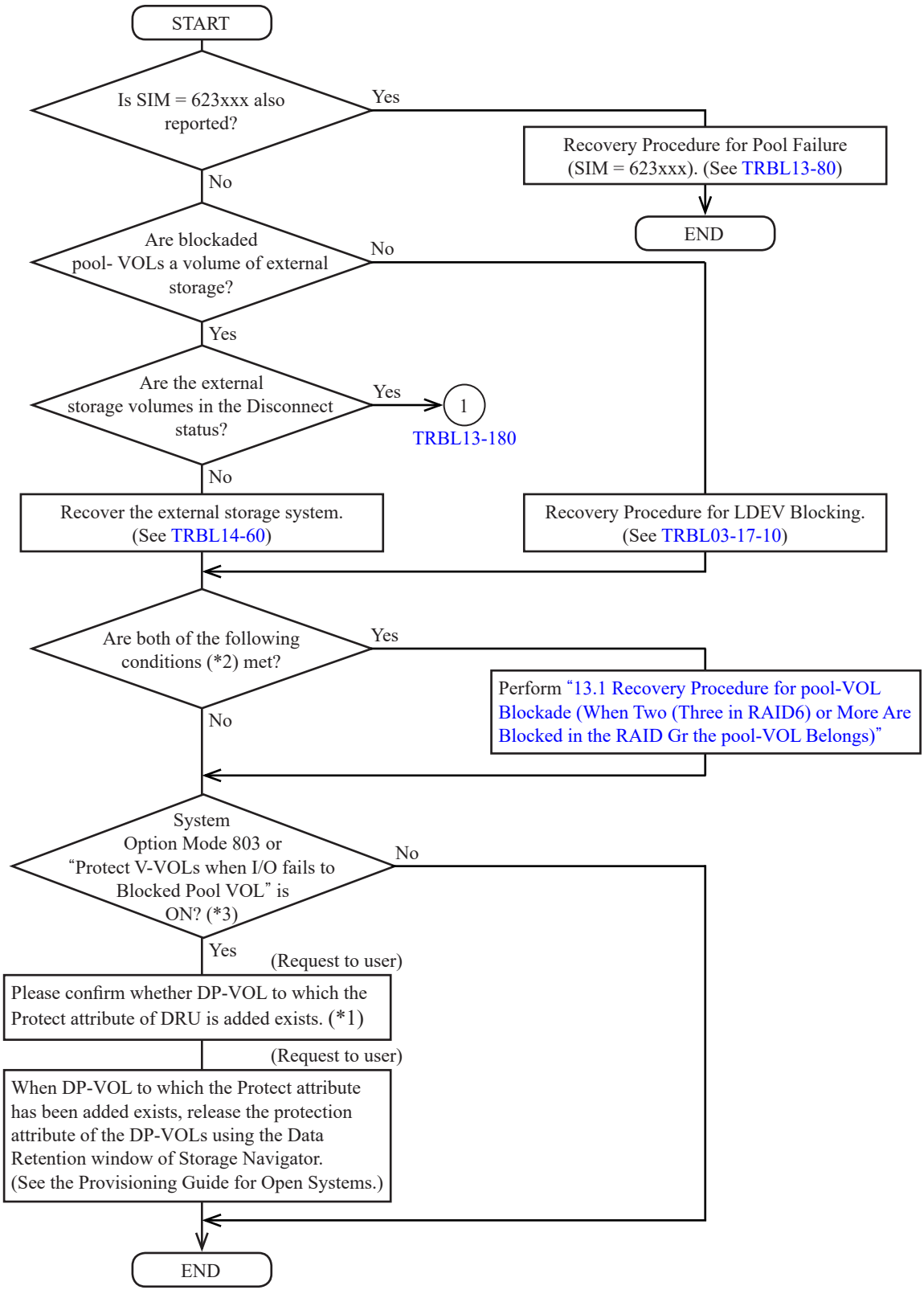
The recovery procedure for the failure of the pool used in the Dynamic Provisioning is shown here.



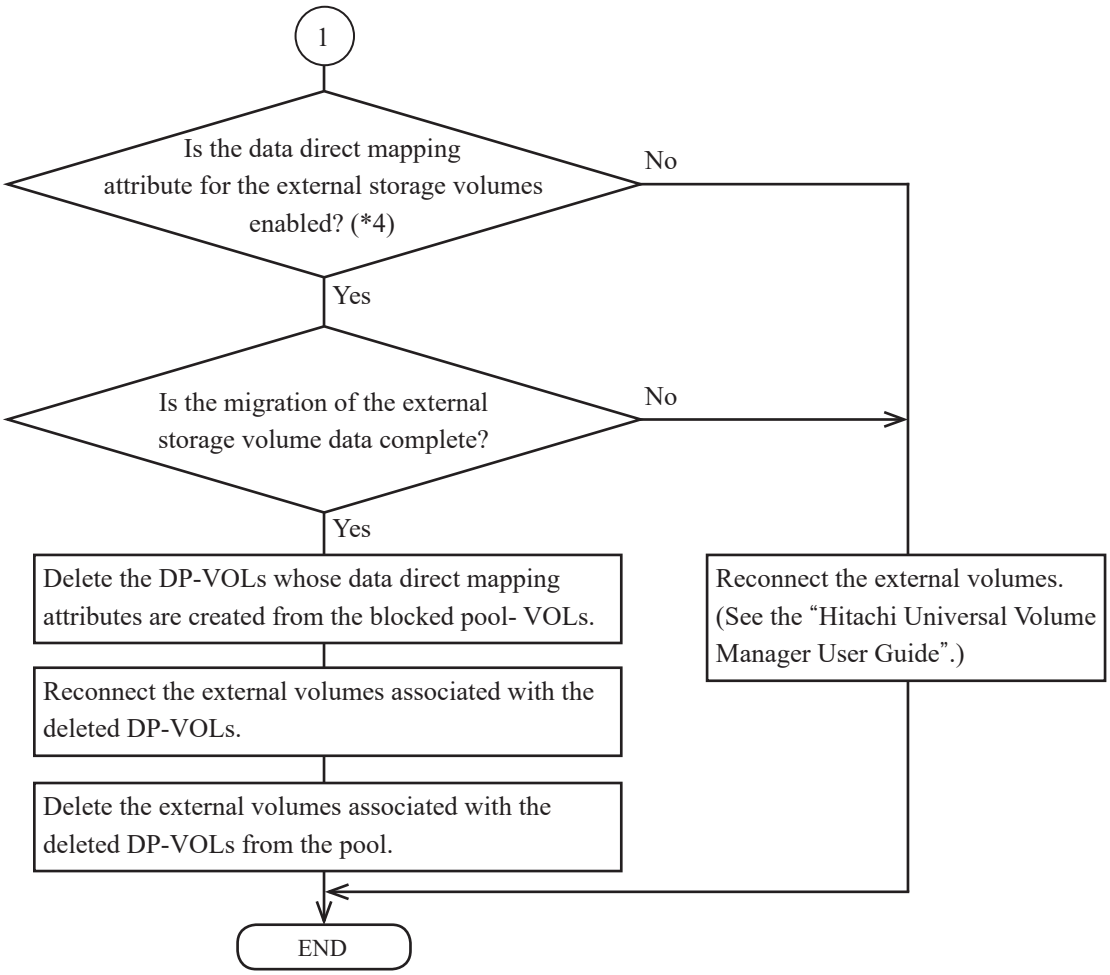
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13.5 Recovery Procedure for pool-VOL Blockade (SIM = 627xxx)

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".

*3: Check V-VOL protection function settings when the pool-VOL is blocked in [Protect V-VOLs when I/O fails to Blocked Pool VOL] of the Pools window, or the window displayed after selecting a pool in the Pools window of Storage Navigator.
[Yes] indicates that the V-VOL protection function is set to ON.

*4: SIM = 627xxx ("xxx" is a pool number) might be output if a connection to the external volume group of the migration destination storage system is disconnected.

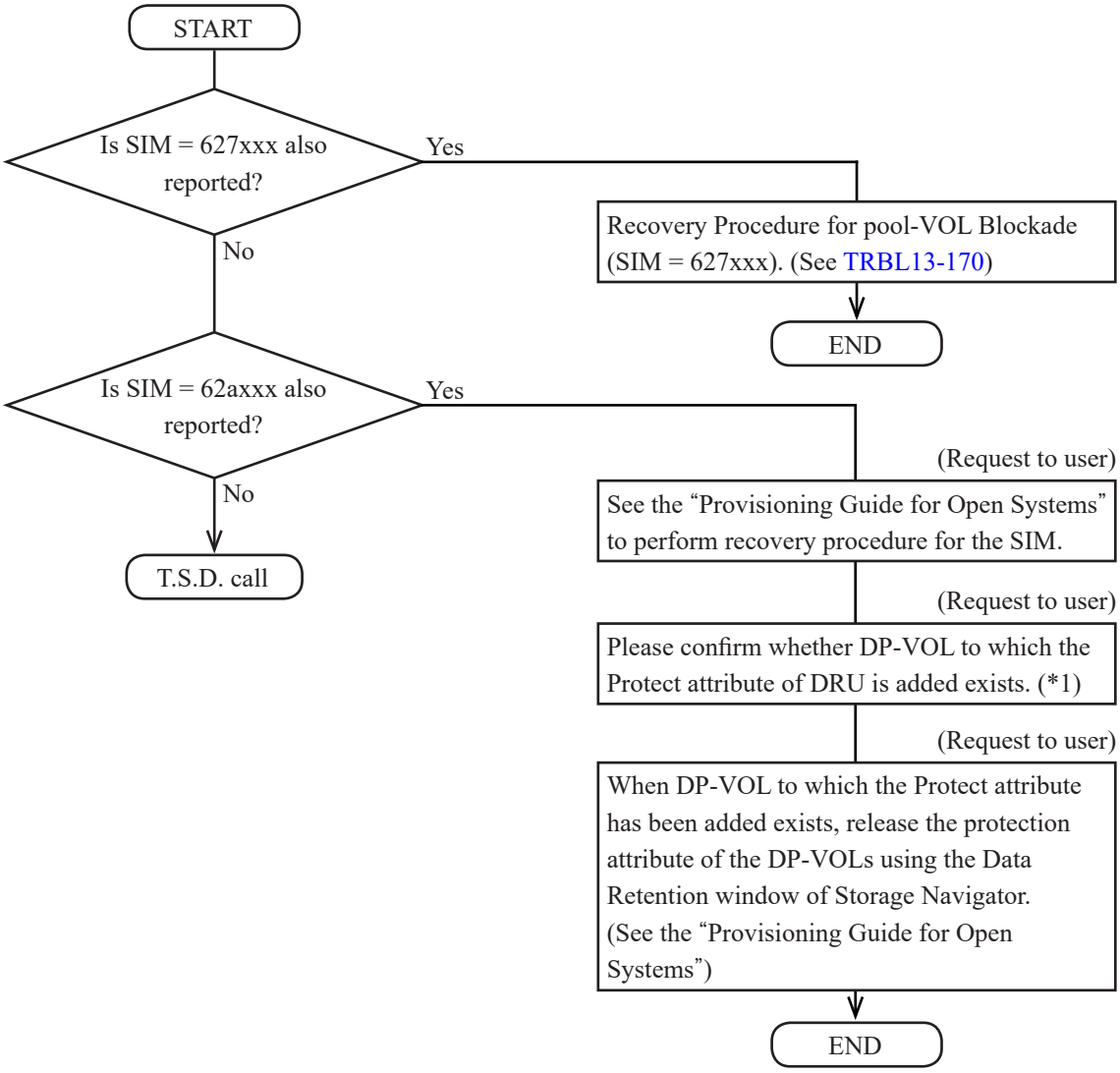
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13.6 Procedure for Releasing Protect Attribute of Data Retention Utility (SIM = 628000)

In the pool for which the DP-VOL protection function is enabled, the Protect attribute of Data Retention Utility might be set for DP-VOLs when the following errors occur:

- The pool-VOL is blocked. (SIM = 627xxx)
- The pool is full. (SIM = 62axxx)

The following is the procedure for releasing the Protect attribute of Data Retention Utility which is set for DP-VOLs of Dynamic Provisioning, Dynamic Tiering, or active flash.



*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.)

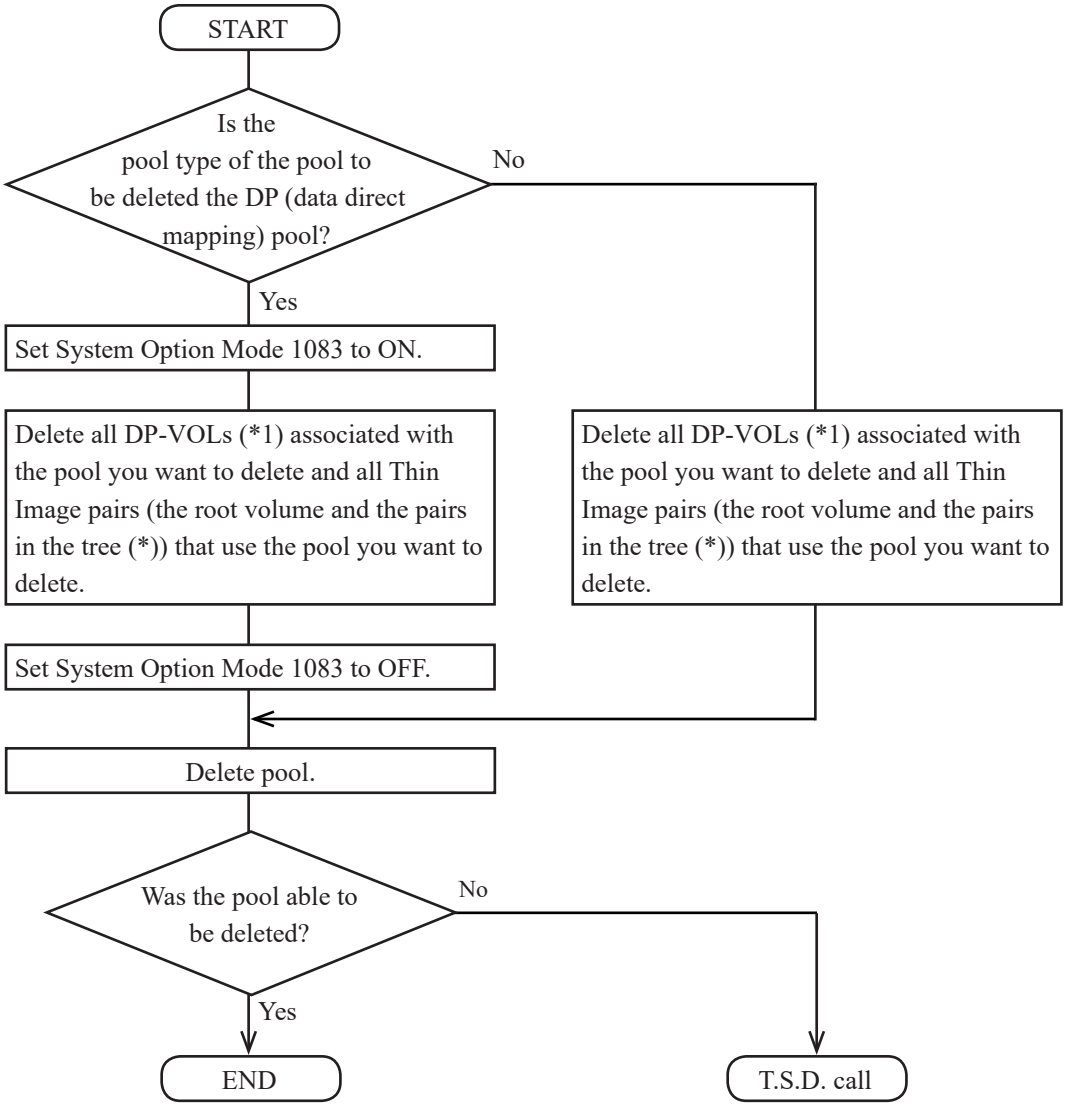
- Please input "protect" specifying the access attribute for conditional expression. See "System Administrator Guide" for details.

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13.7 Deleting Procedure for Pool at the time of pool-VOL Blockade (When External Volume the pool-VOL Belongs Is Removed)

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.

*1: For more information about deleting V-VOLs, refer to the procedure described in the “Provisioning Guide for Open Systems”.

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13.8 Initialization Procedure for Pool

NOTE 1: When Initialize Pools executed, the pool of all Dynamic Provisioning/Thin Image is blockaded. When the pool is blocked, the information of the volumes associated with the pool is not displayed in the Pools window. After the pool restoration is performed, the information is displayed.

NOTE 2: In the case [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/XRC/global-active device] use virtual volumes of Dynamic Provisioning, delete all [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/XRC/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/XRC/global-active device] pairs again. During Initialize Pools, don't create [TrueCopy/Universal Replicator/ShadowImage/Volume Migration/XRC/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.

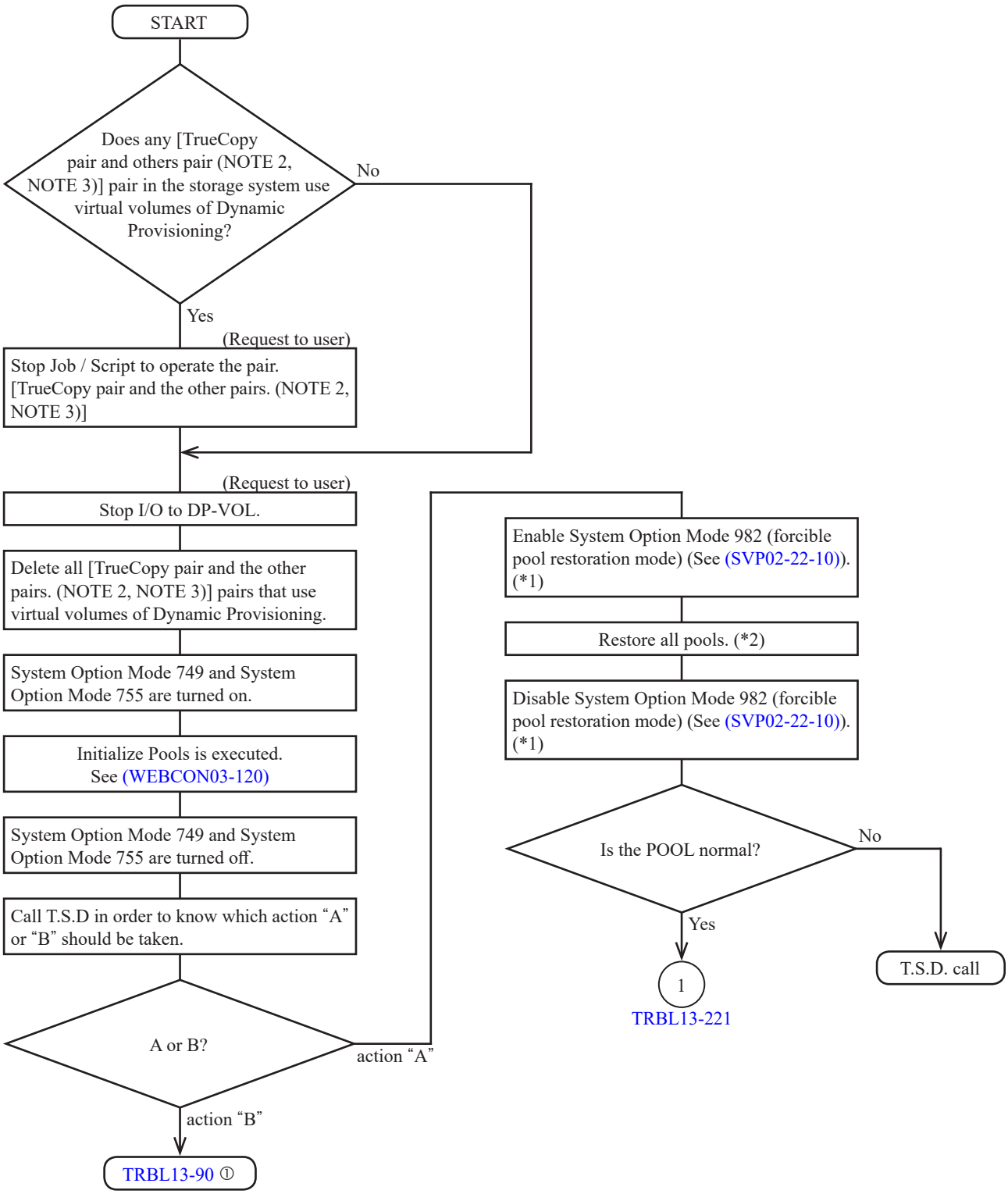
NOTE 6: Perform the operation only when it is directed by the Technical Support Division.

NOTE 7: For the password, refer to the Technical Support Division.

NOTE 8: Ask the SE or user to perform the operation.

NOTICE: Only in an unusual case such as cache volatilization in both clusters, perform the procedures described on this page and later. Do not perform the following procedures unless the Technical Support Division (T.S.D.) instructs you to do so. If you perform the following procedures without permission, data in the DP-VOL might be lost.

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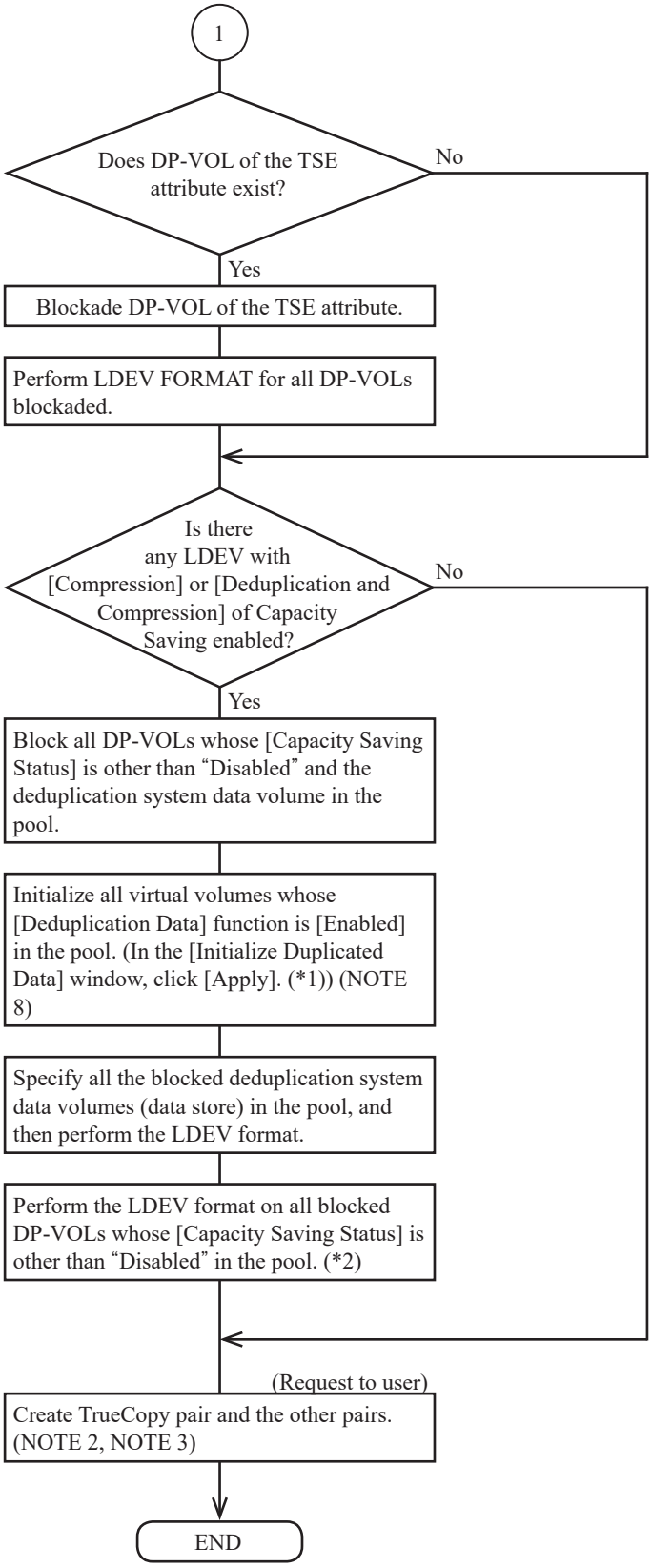


*1: Ask T.S.D to tell you the password.

*2: In Web Console: Use the Pools window to restore pools (see the "Provisioning Guide for Open Systems").
In CCI: Execute the following command to restore pools (see the Command Control Interface Command Reference):

```
raidcom modify pool -pool pool# -status nml
```

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*1: For Command Control Interface, use the [raidcom initialize pool] command.

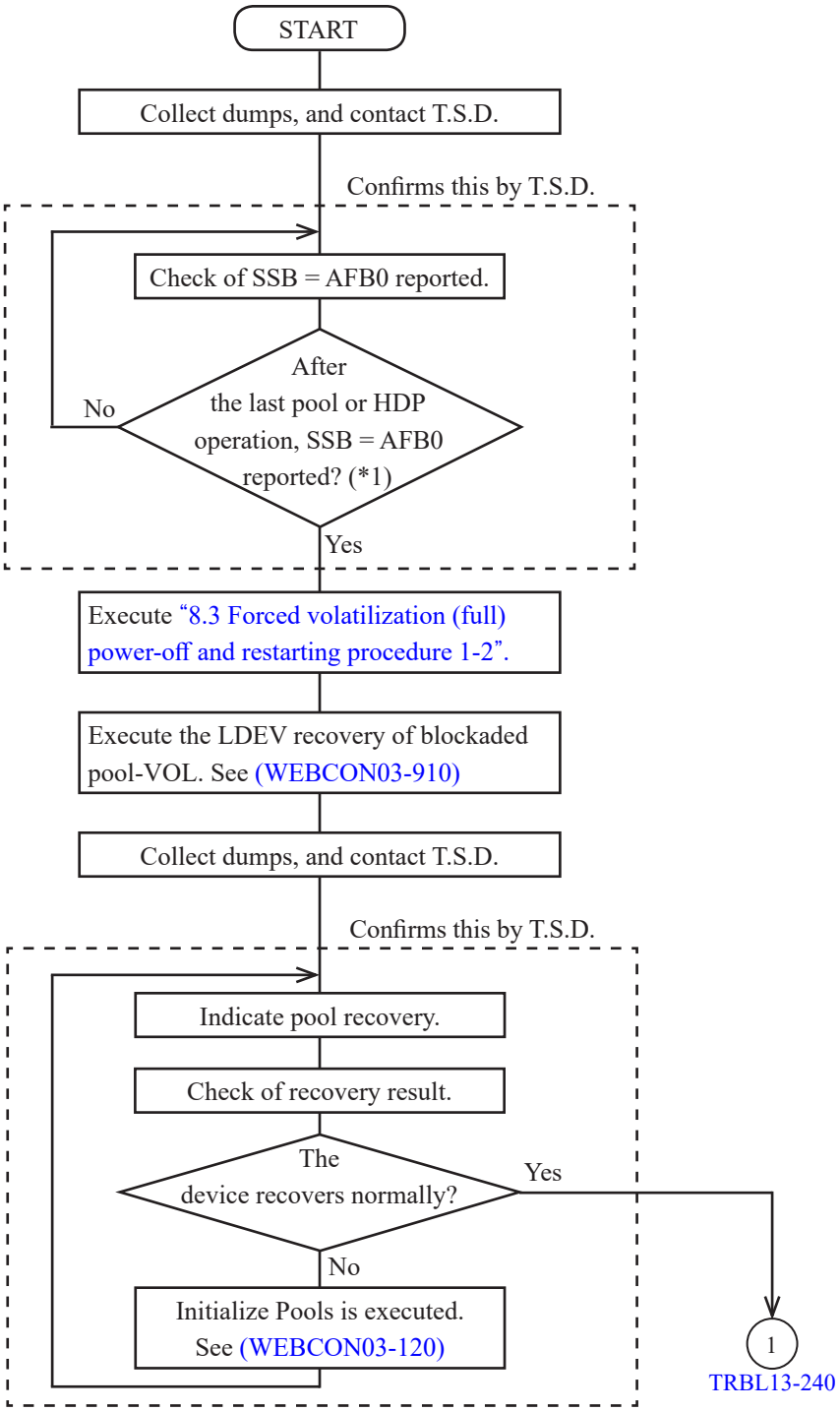
*2: Do not perform the procedure for LDEV recovery.

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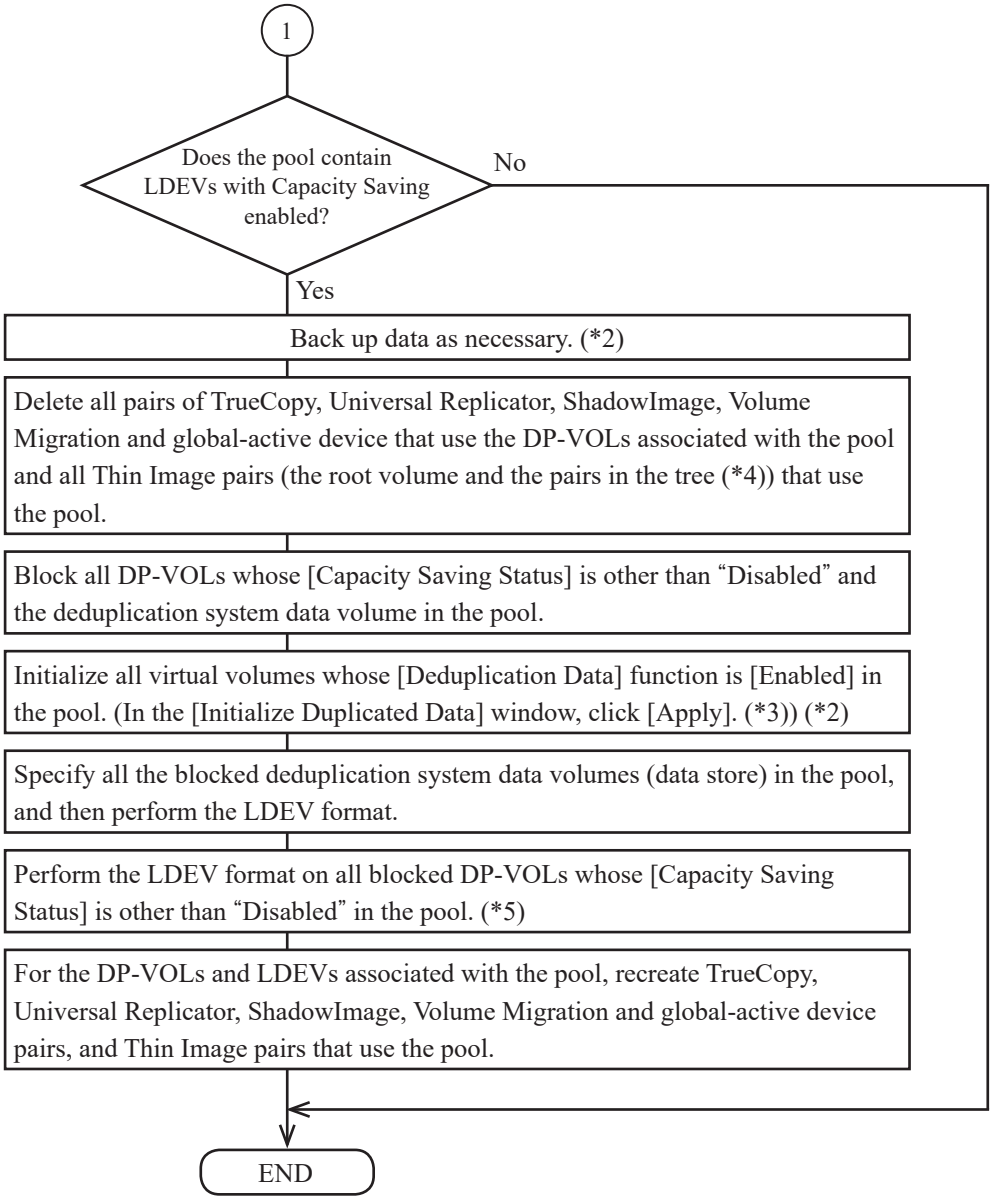
13.9 Recovery Procedure for Dynamic Provisioning by Turning Off the Power and Volatilizing PS ON

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.

*3: For Command Control Interface, use the [raidcom initialize pool] command.

*4: 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.

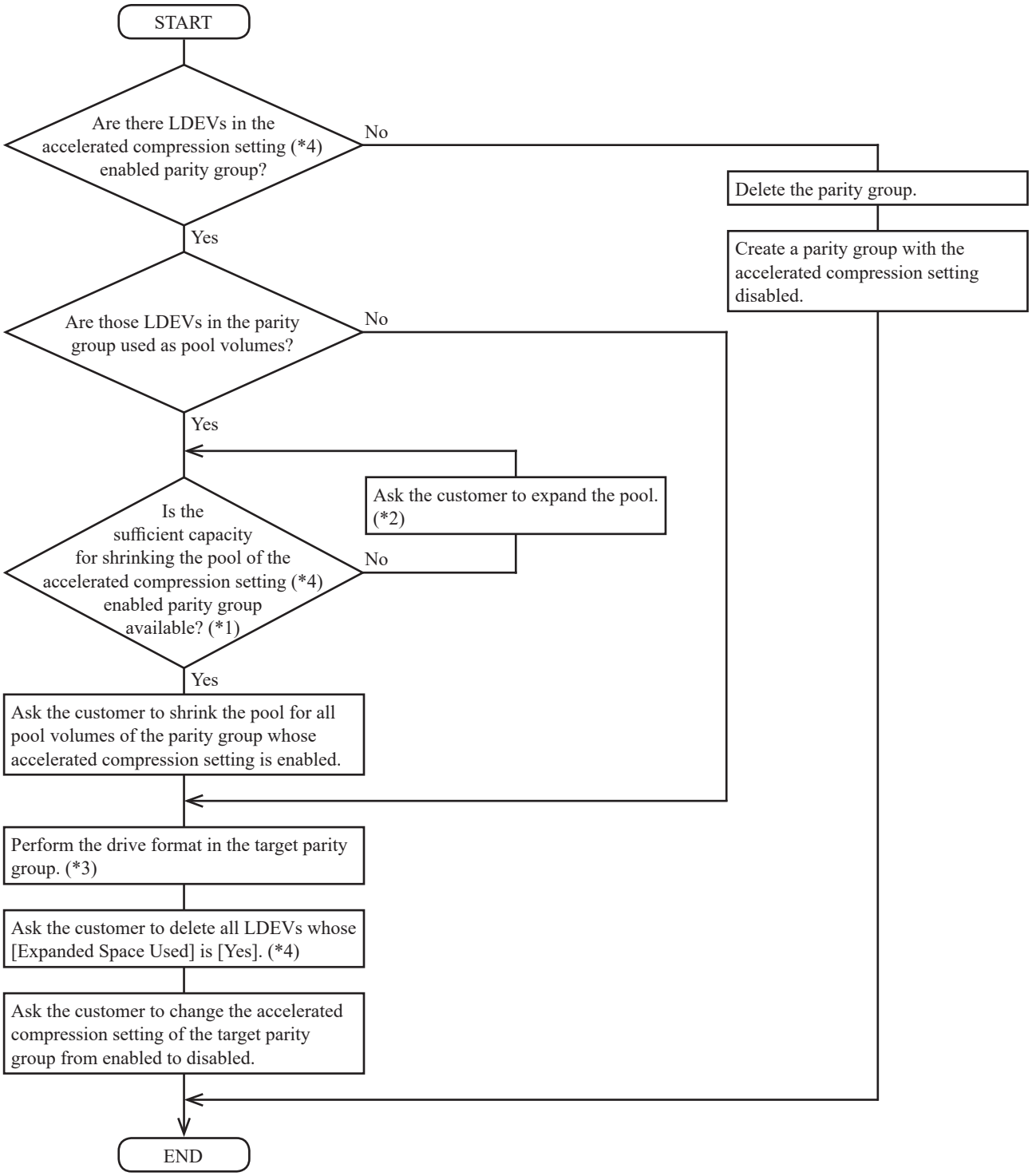
*5: Do not perform the procedure for LDEV recovery.

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13.10 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.



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*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

*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 formatting is performed by specifying LDEVs, the accelerated compression setting is not disabled.
See “Formatting Parity Group” (WEBCON03-460).

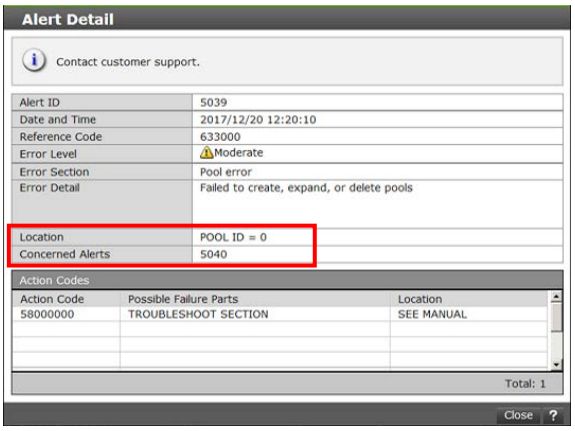
*4: For the accelerated compression setting and Expanded Space Used, see “Provisioning Guide for Open Systems”.

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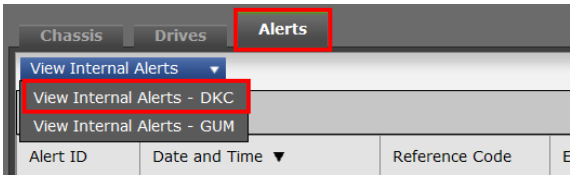
13.11 Recovery Procedures from Failures on Pool Creation, Expansion, and Deletion

The following are the recovery procedures from the failures when SIM = “633xxx” is output. Confirm the error information by following the procedure shown in Step 1 through Step 3, and then perform the failure recovery procedure in Step 4.

1. Confirm the error information on SIM = “633xxx” through the Maintenance Utility, and then write down the POOL ID and the “Concerned Alerts”.

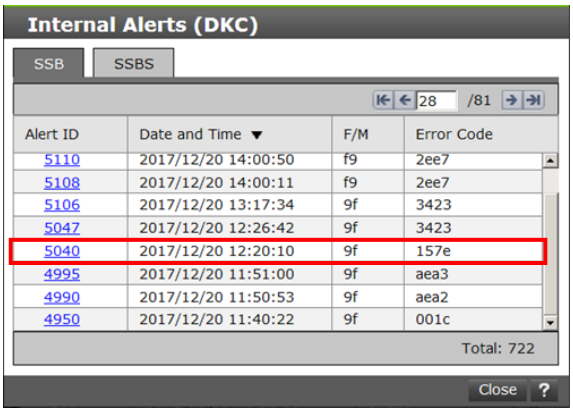


2. Select [View Internal Alerts - DKC] from the [Alerts] tab, and display the “Internal Alerts (DKC)” window.

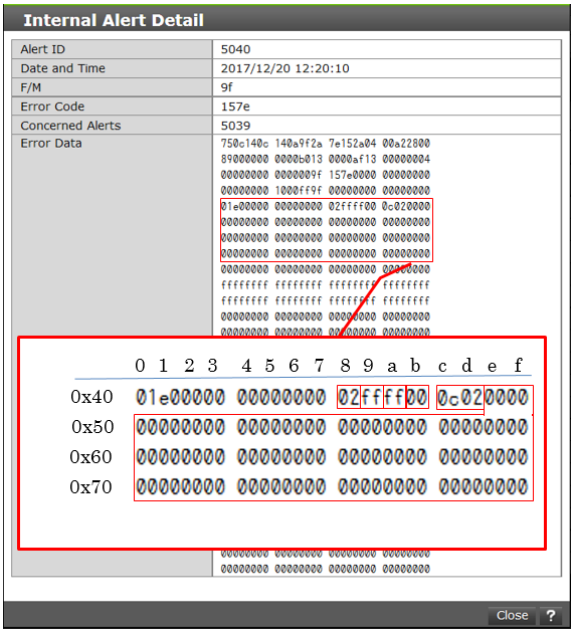


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3. In the “Internal Alerts (DKC)” window, select the same Alert ID as the “Concerned Alerts” written down in Step 1, and display the “Internal Alert Detail” window.



Perform Step 4 by referring to 0x48 byte through 0x7f byte of “Error Data” displayed in the “Internal Alert Detail” window. Refer to the following figures and table for more details about how to check 0x48 byte through 0x7f byte.

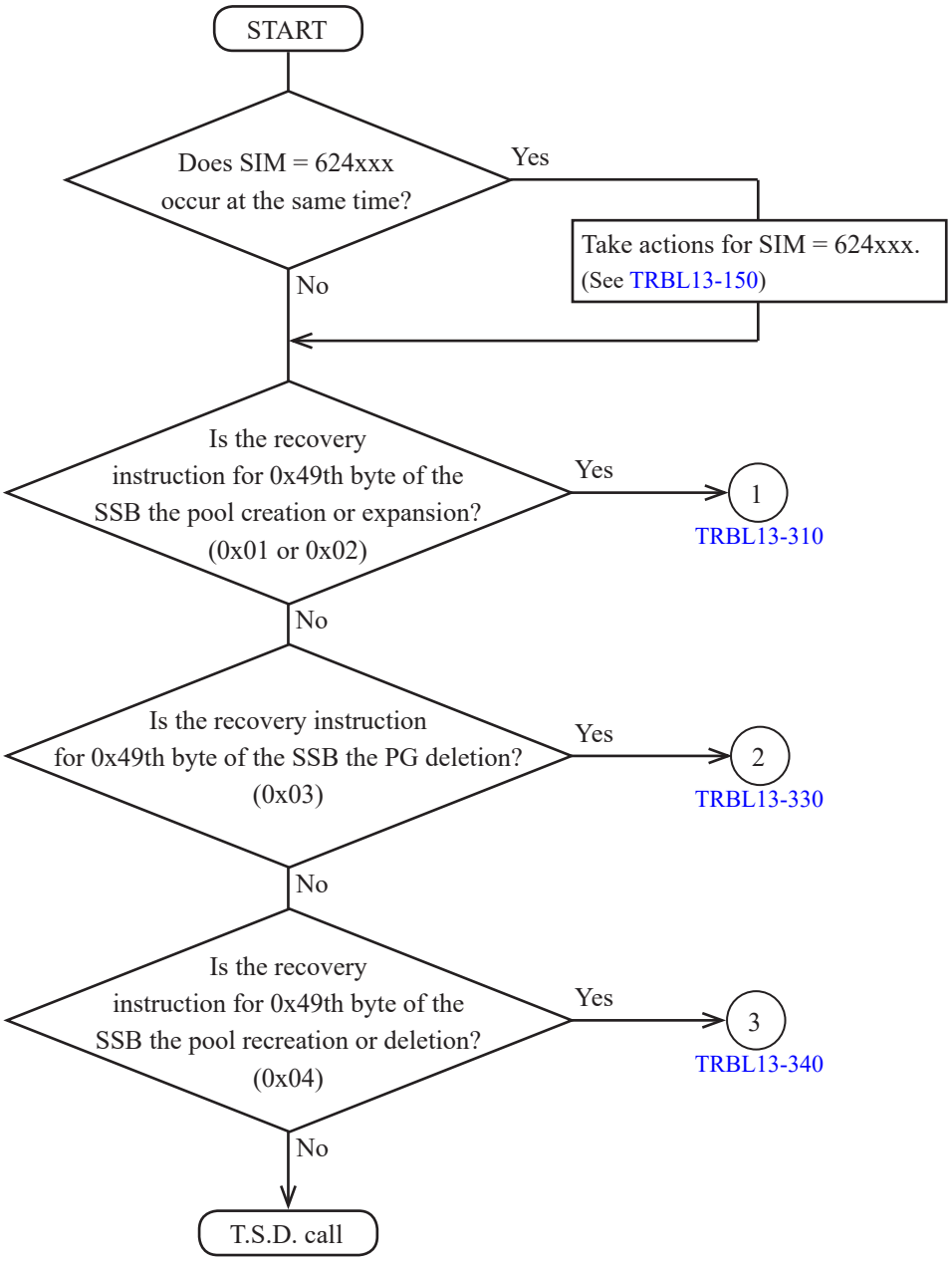


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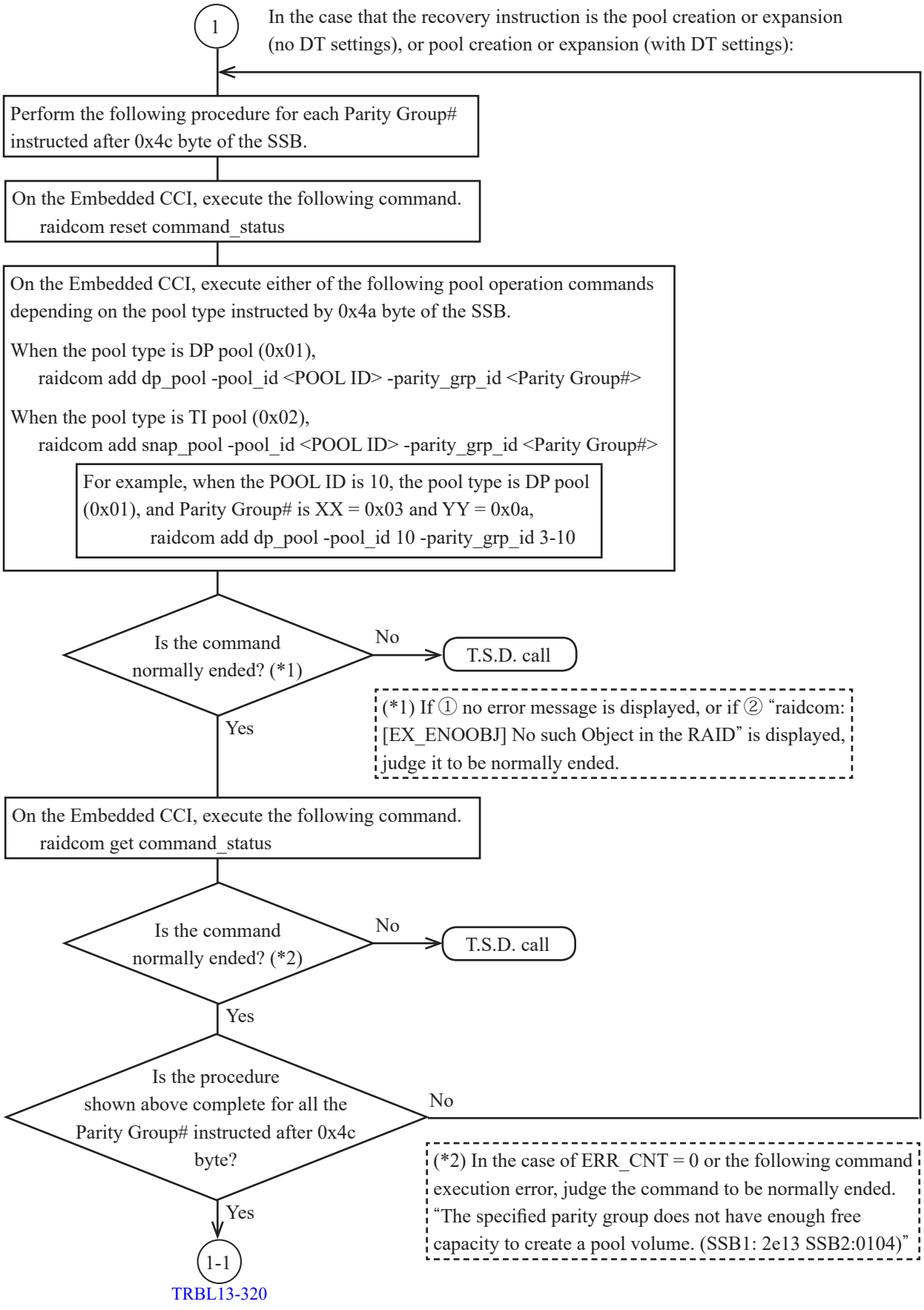
Byte (HEX)	Item	Description	
48	Operation type	Operation types in case of failures	
		• Pool creation or expansion	: 0x01
		• Pool deletion	: 0x02
49	Recovery instruction	Recovery instruction types	
		• Pool creation or expansion (no DT settings)	: 0x01
		• Pool creation or expansion (with DT settings)	: 0x02
		• PG deletion	: 0x03
		• Pool recreation or deletion	: 0x04
		• Contact the Technical Support Division	: 0xff
4a	Pool type	Pool types to be performed the operations	
		• DP pool	: 0x01
		• TI pool	: 0x02
		• N/A (only for pool deletion)	: 0xff
4b	Reserved	Unused	Unused
4c through 4d	Parity Group#	Target Parity Group# 0x4c byte: XX (HEX) 0x4d byte: YY (HEX) If XX/YY is 0x00, it is invalid. For example, if XX = 0x0c and YY=0x02, the Parity Group# to be input from the Embedded CCI is “12-2”.	
4e through 4f : 7e through 7f	Parity Group#	Target Parity Group# Consecutive formats just like 0x4c byte through 0x4d byte	

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4. Perform the recovery procedures in accordance with the following flowcharts by referring to the POOL ID to be recovered that you have checked in Step 1 and the Internal Alert Detail that you have checked in Step 3.

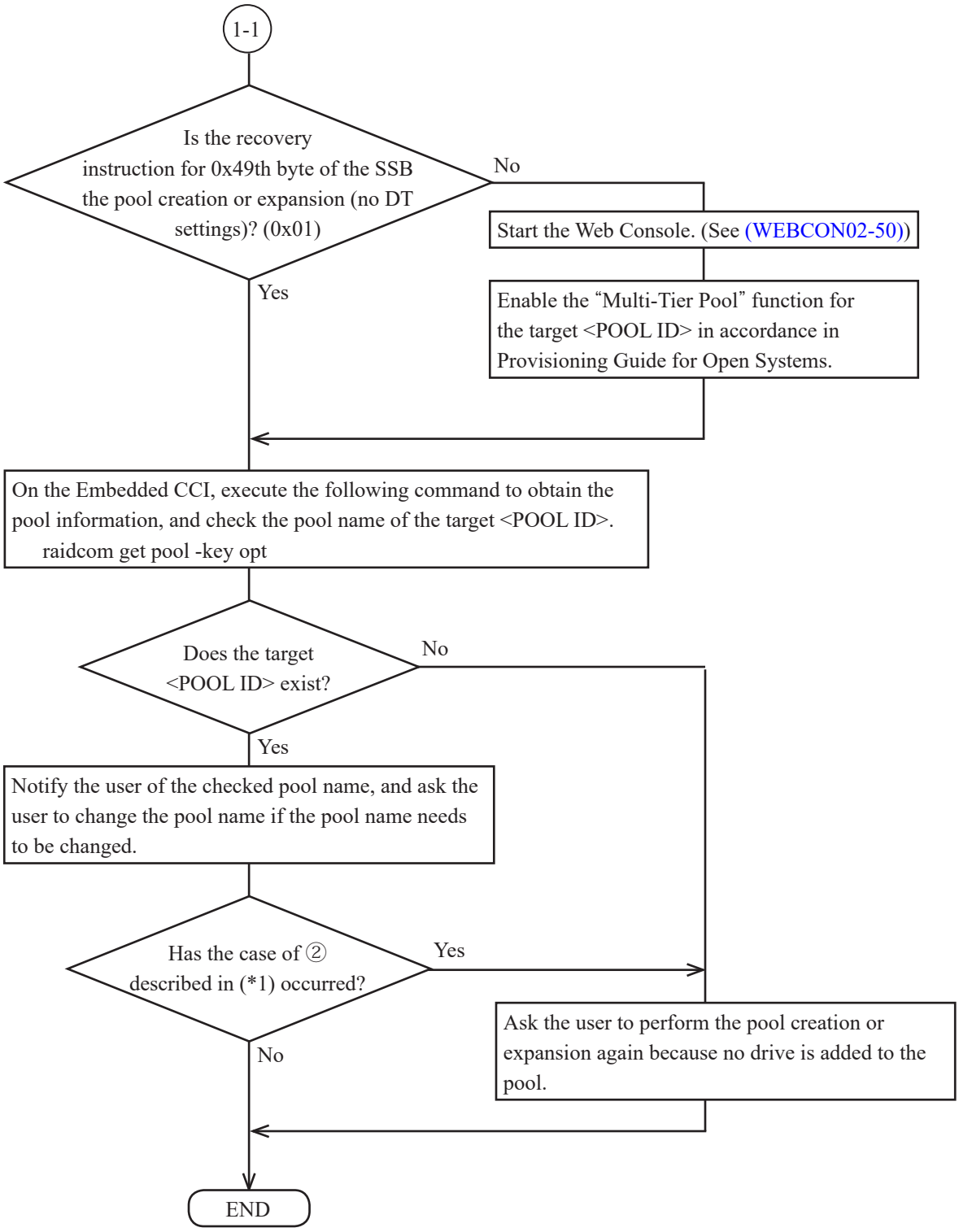


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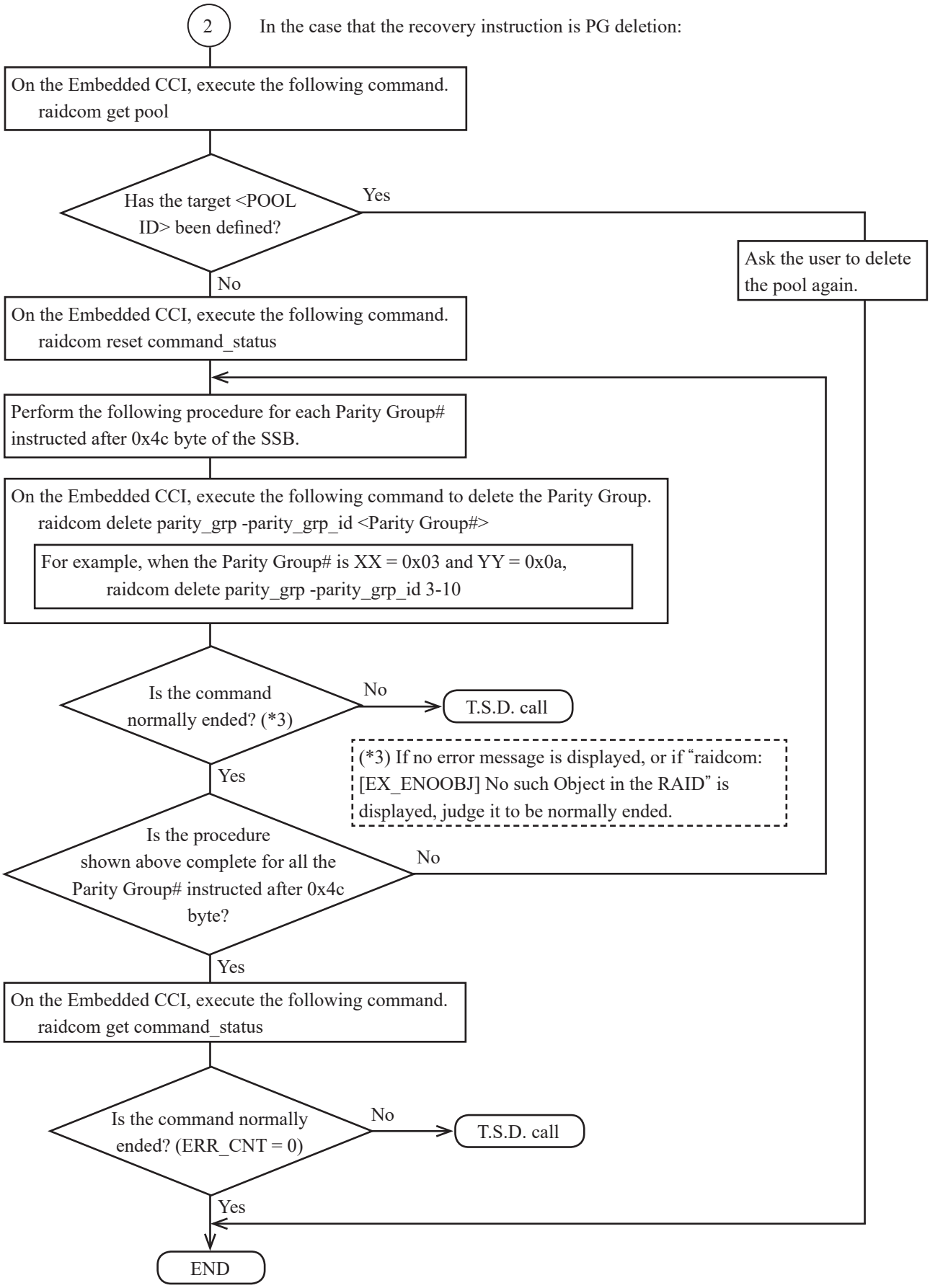


TRBL13-320

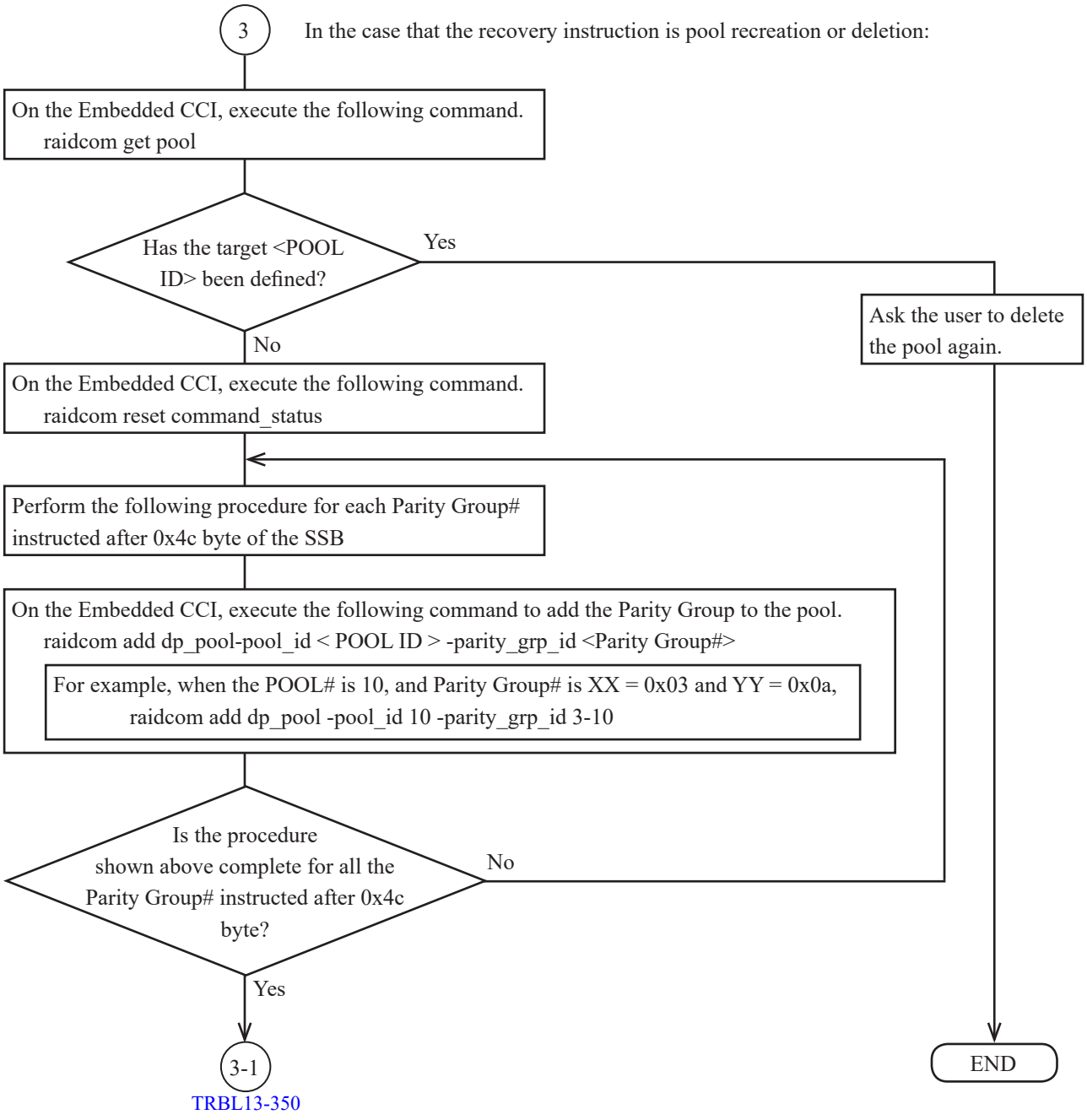
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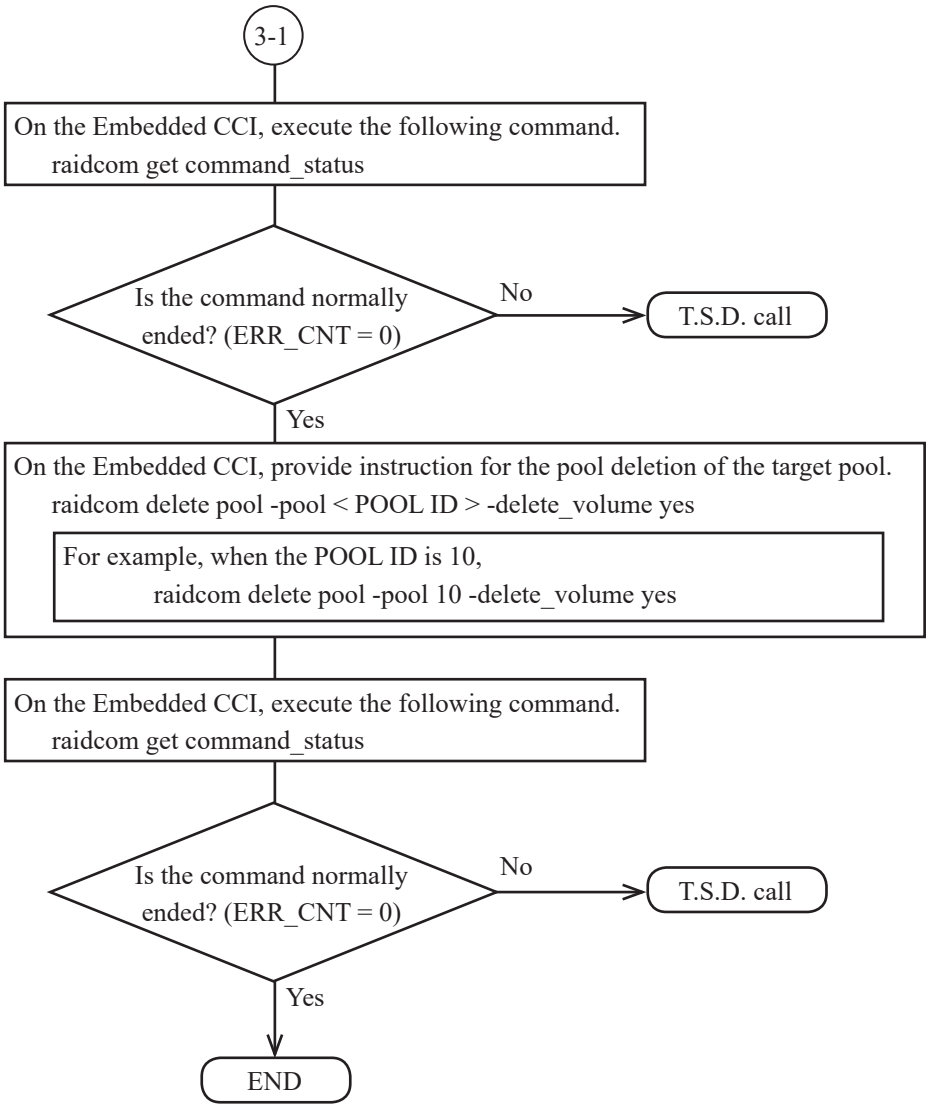
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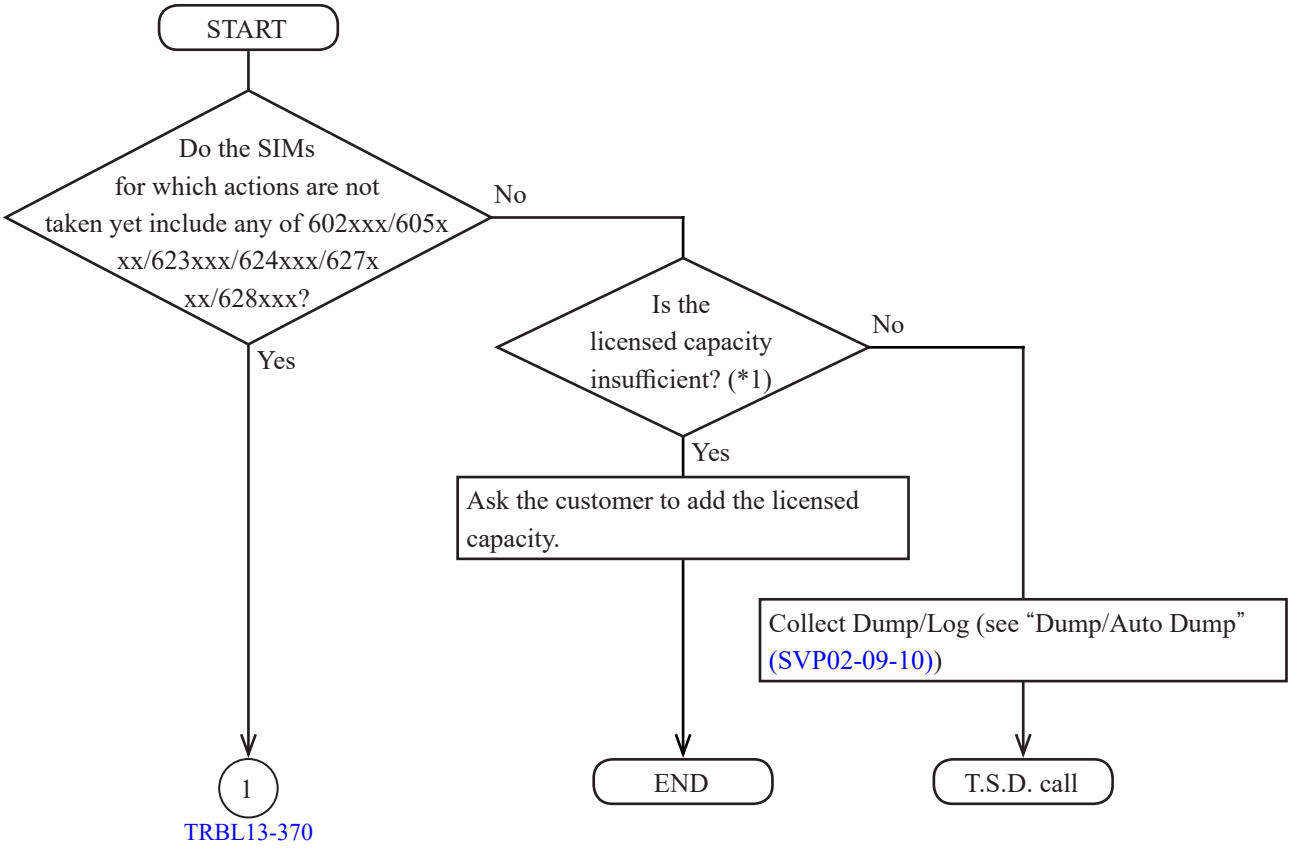
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13.12 Recovery Procedure When Automatic Pool Capacity Expansion Failed due to a Pool-associated Factor (SIM = 632xxx)

The procedure to recover from an automatic pool capacity expansion failure caused by a factor associated with a pool is shown below.



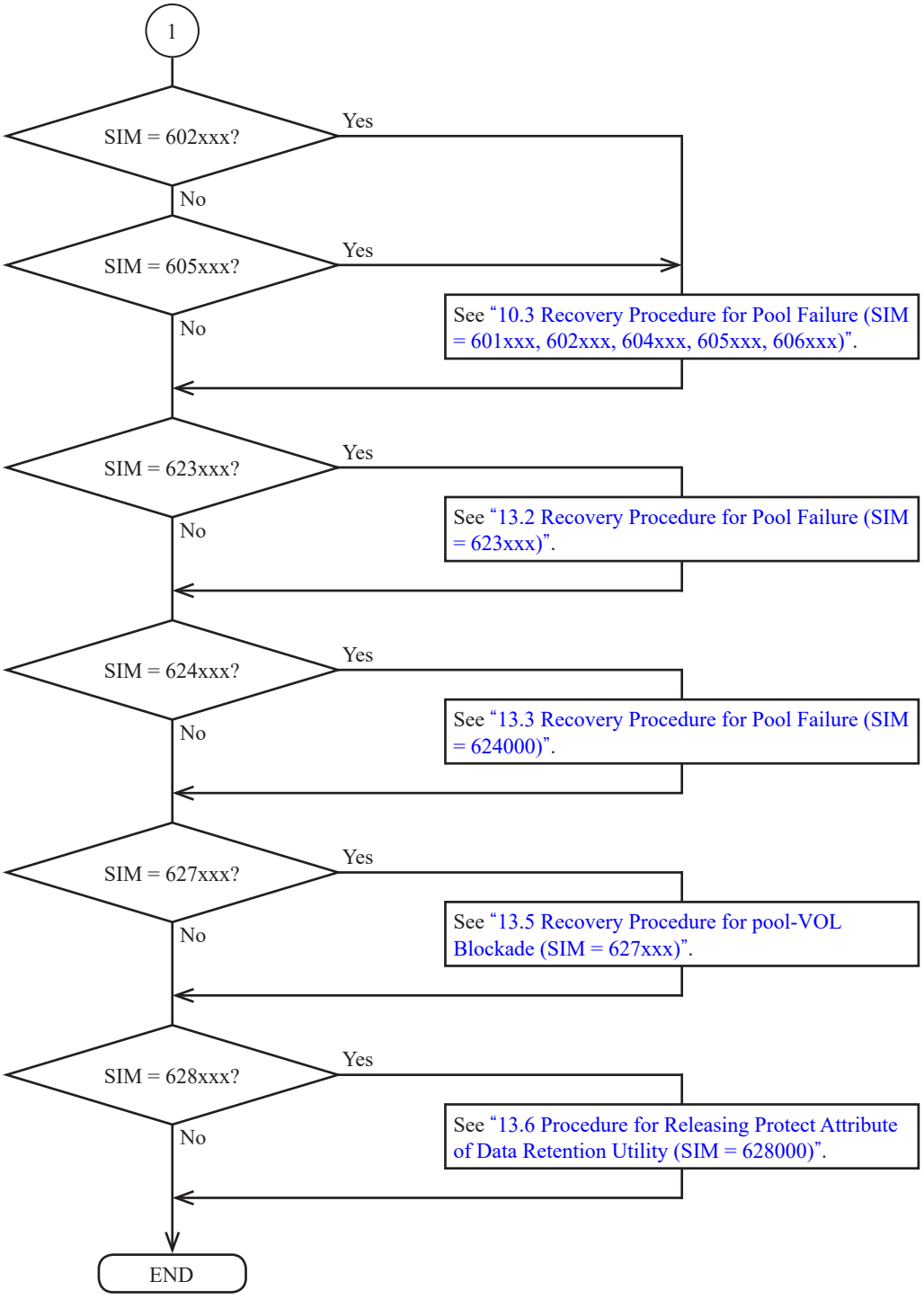
*1: When the licensed capacity is smaller than the total capacity of parity groups composing the pool-VOL, the licensed capacity is insufficient. In such a case, the automatic pool capacity expansion might fail. The shortage of the licensed capacity can be calculated as follows:

Shortage of licensed capacity = Total capacity of parity groups composing the pool-VOL – Licensed capacity

- To check the licensed capacity, see [Licensed] of [Licensed Capacity (Used/Licensed)] in the "Pools" window of Web Console.
- To check the parity group capacity, see [Total] in the [Capacity] column in the "Parity Groups" window of Web Console.

For details of the windows of Web Console, see "Provisioning Guide for Open Systems".

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14. External Storage Maintenance

14.1 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.

14.1.1 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 local 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 local 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 local 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 “Hitachi Universal Volume Manager User Guide”.
For detailed information on mapping external volume, see “Hitachi Universal Volume Manager User Guide”.

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NOTICE: When the following conditions 1 and 2 are met, perform "13.1 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 for the external storage, an SIM report (remote maintenance report) may be issued by the storage system during the maintenance work (when the path is switched to the alternative path) for the external storage.
When a maintenance work is done on the external storage system side, an external path blockade may be caused by the maintenance work, and an SIM report (remote maintenance) may be issued on the Storage System side. Therefore, before starting a maintenance work on the external storage system side, set the REMOTE MAINTENANCE switch on the Storage System side to DISABLE.
After the maintenance work is completed, check that SIMs other than SIM = 21d0xy (path blockade), SIM = 21d1xy (path recovery), or SIM = efd000 (external storage device blockade), which could be caused from the maintenance work, are not generated, and then set the REMOTE MAINTENANCE switch to ENABLE. If SIMs other than the above are generated, take actions according to the customer's conditions (depending on the 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 "14.1.3 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 "14.1.3 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 "14.1.3 Procedure for Operating Storage Navigator".)

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.
- The path recovery SIM (21d1) occurs when at least one of the external paths recovers.
  To confirm that all the paths have recovered at the completion of the maintenance, check the path status not only with the output of the path recovery SIM (21d1) but with the following procedure:
  (1) Check the status displayed in the [Status] field of the [External Storage] window that is displayed when selecting [External Storage] from the [Storage System] tree in the Storage Navigator window.
  (2) Confirm that the status displayed in the [Status] field is “Normal”.

  NOTE: If the status displayed in the [Status] field is other than “Normal”, it indicates that at least one or more external paths are in the maintenance status or in the blocked status.
- 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 “14.1.3 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 G1500/VSP F1500, VSP5000 series, VSP G200/G400/G600/G800, VSP G130/G350/G370/G700/G900, VSP F400/F600/F800, VSP F350/F370/F700/F900 device, make sure that the path is recovered from the blockade (the path status is changed to Normal). Also, after all maintenance work is completed, check that SIM = 21d0xy (path blockade), SIM = 21d1xy (path recovery), or SIM = efd000 (external storage device blockade), which could be caused from the maintenance work, is generated. If any of the above SIMs is generated, enable the remote maintenance. If the SIM is the one described above, execute the turn on the remote maintenance report.

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14.1.2 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, check if a remote maintenance 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 “Dump/Auto Dump” (SVP02-09-10).

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 14-1

SIM code	SSB code	Host report	Detailed description	References
efd0	AD10	Issued	Blockade of the external device	TRBL14-60
21d0	AD11	Issued	Blockade of the path connecting the external device	TRBL14-60 TRBL14-80
21d1	AD12	Not issued	Recovery of the path connecting the external device	
21d2	AD60	Issued	Response time-out of external device	TRBL14-110
ef5x	89CB	Not issued	Abnormal end of Write in External storage system	TRBL05-170
ff5x	89CC	Not issued	Abnormal end of Read in External storage system	TRBL05-170

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14.1.3 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 [External Storage] window, click the [External Paths] tab, and see the list of external paths to check that some paths other than the path for which the maintenance work is performed are in the “Normal” status.

[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”.

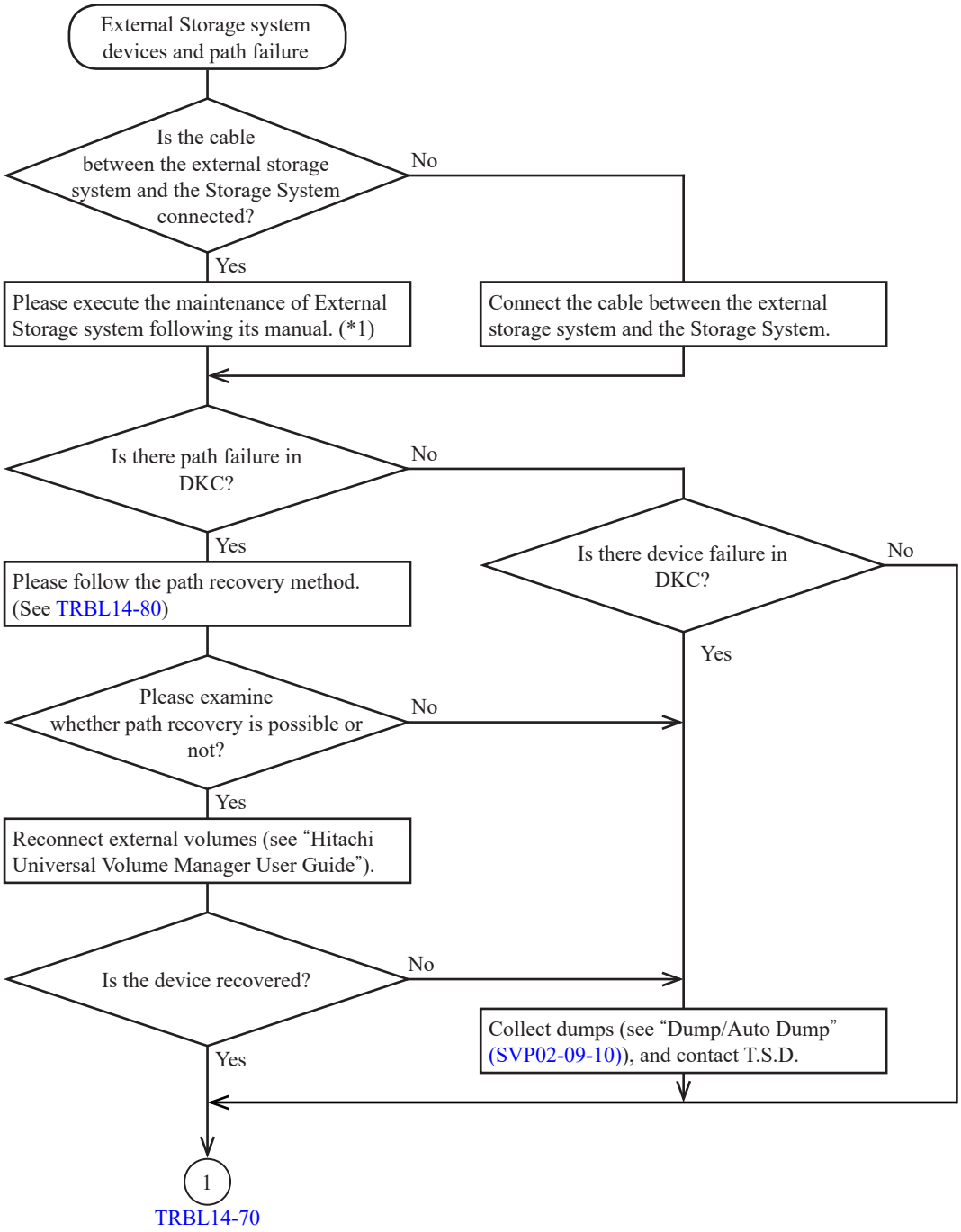
[Procedure 4] Procedure for making sure that the alternative path has been switched back
See the chapter on the external volume in “Hitachi Universal Volume Manager User Guide”.
In the [External Storage] window, click the [External Paths] tab, and see the list of external paths to check that the status of the path for which the maintenance work was performed is “Normal”. If the status is not “Normal”, close the path setting window, wait for five minutes, and then open the path setting window again.

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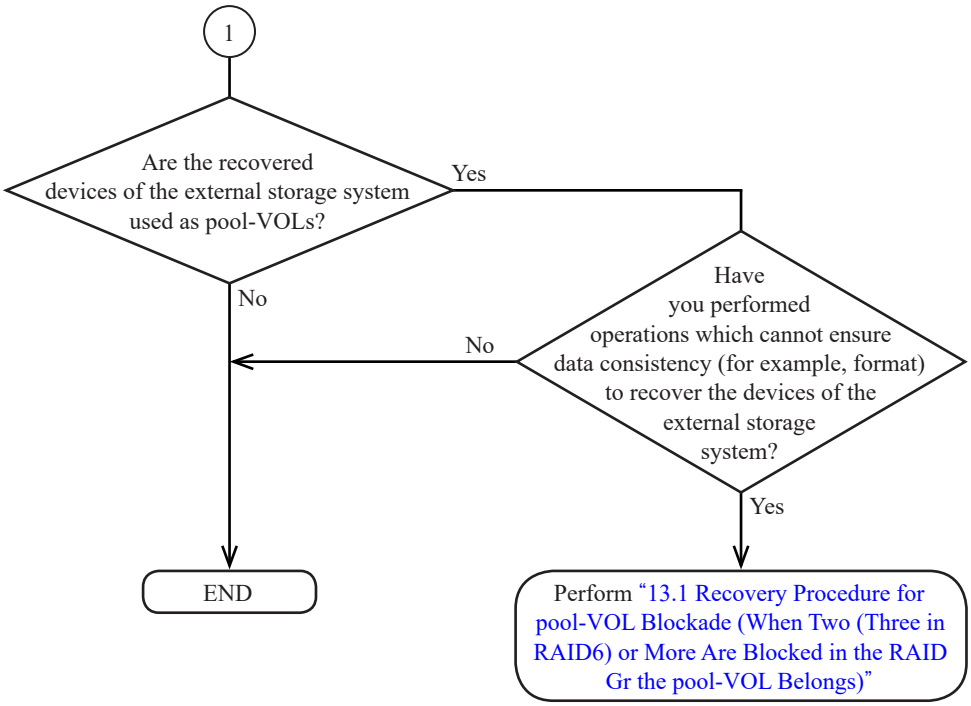
14.2 Recovery Procedure for External Device Failure

The following is the recovery procedure when the External Devices Error (SIM = 21d0xy, efd000) is occurred.

14.2.1 Recovery Procedure for Path Failure While Device is Blocked (SIM = 21d0xy, efd000)



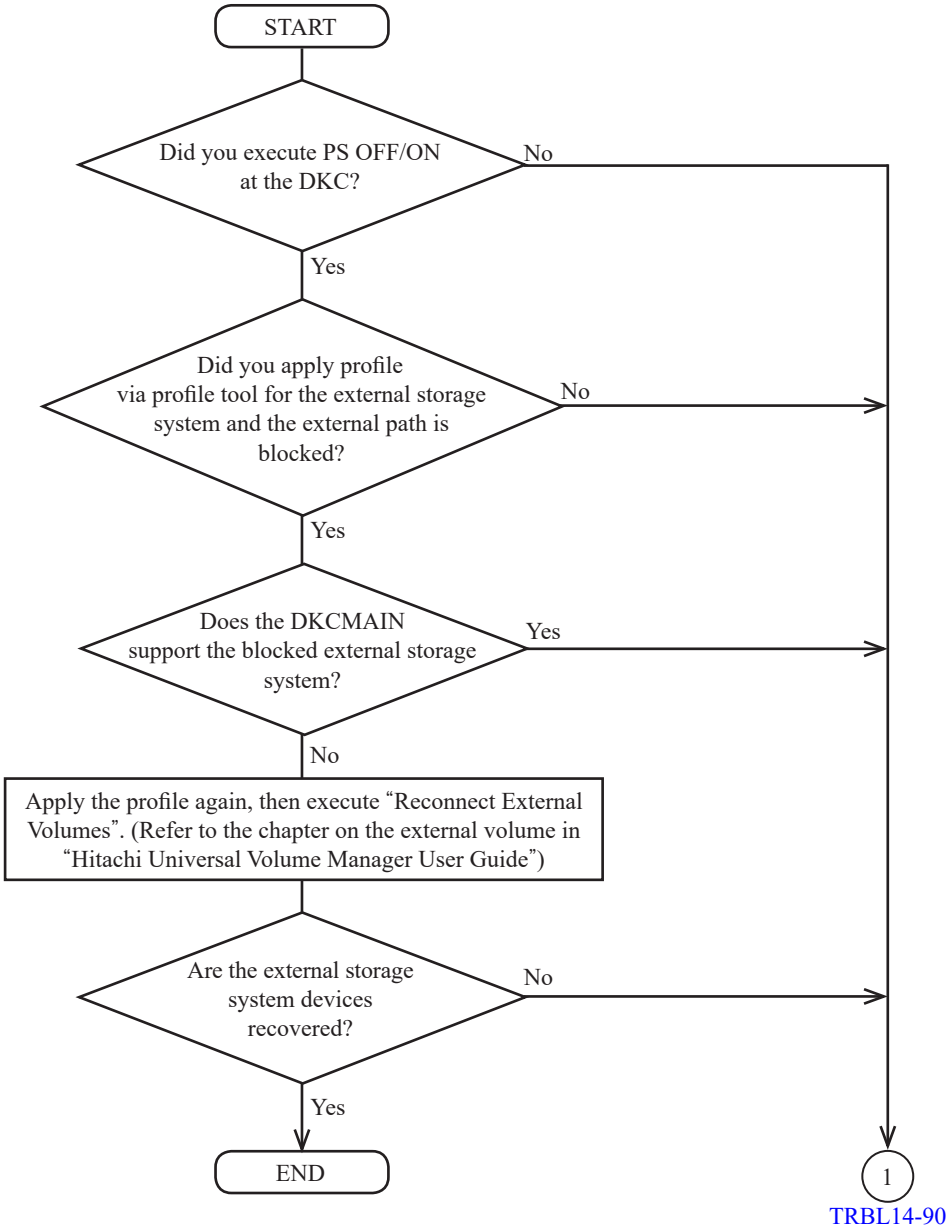
Copyright © 2019, Hitachi, Ltd.



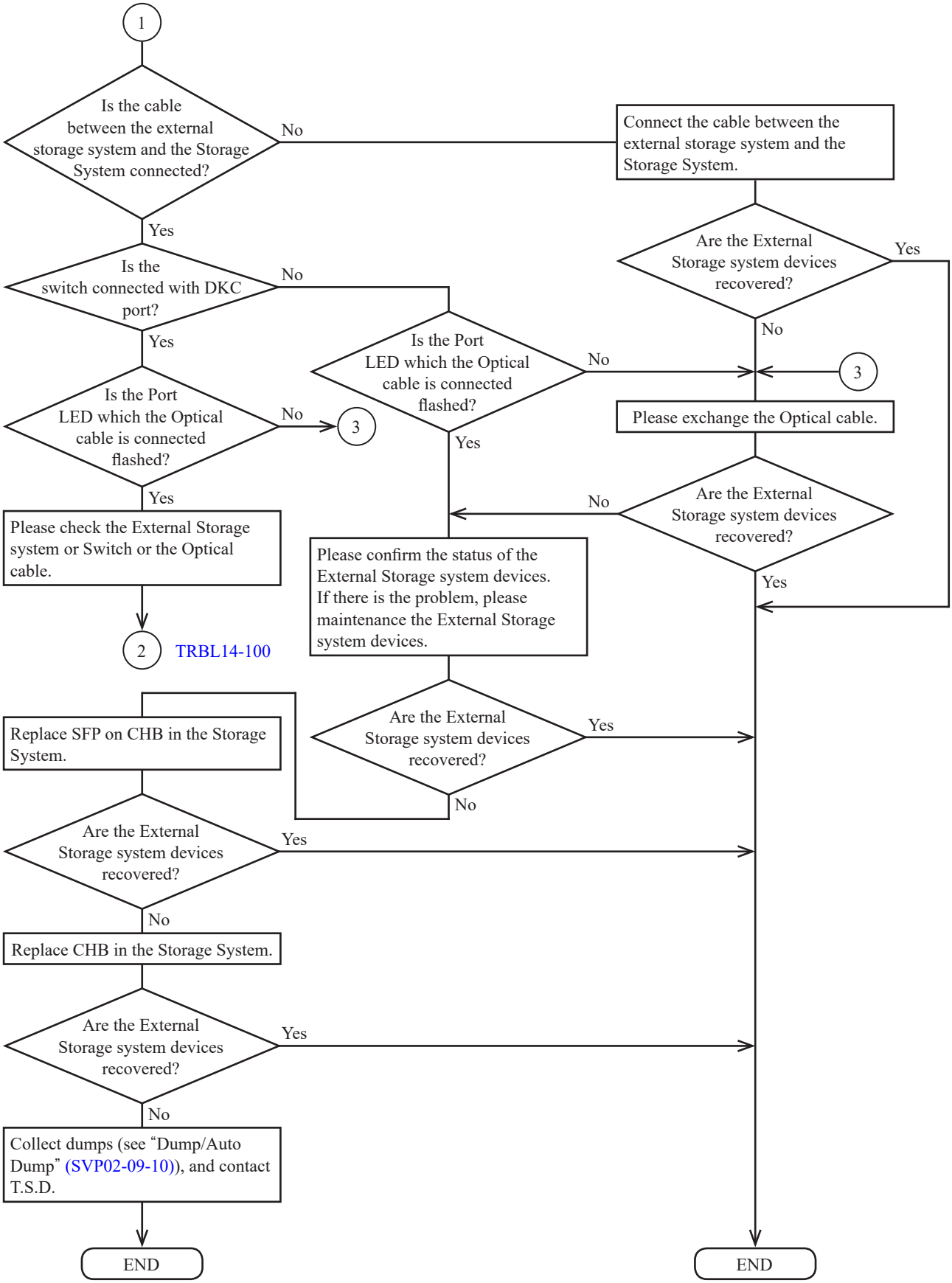
*1: If the data of the blocked device is unnecessary, you can format the device at the external storage system to recover it.
When the formatted devices of the external storage system are used as pool-VOLs, it meets the condition to perform "13.1 Recovery Procedure for pool-VOL Blockade (When Two (Three 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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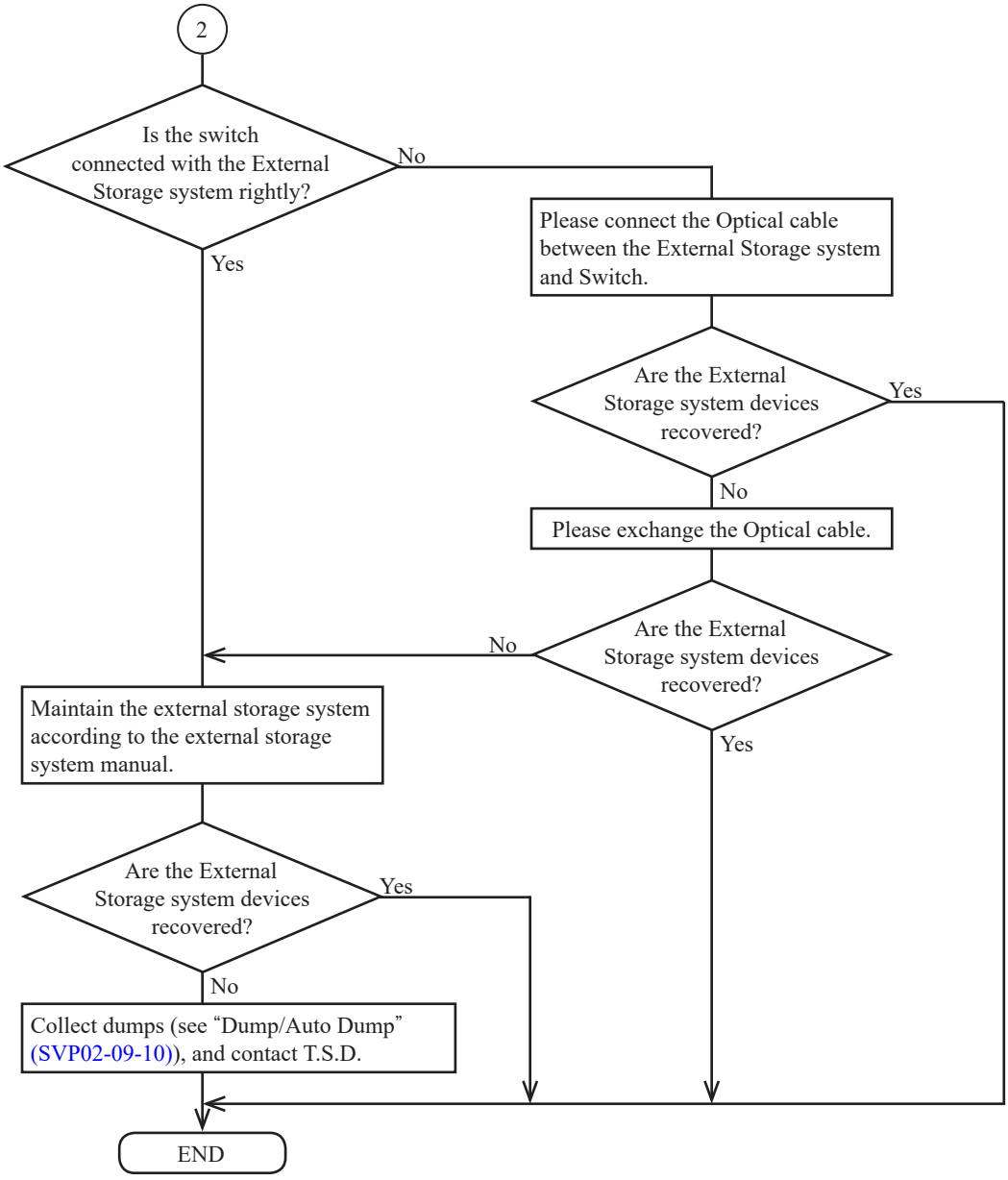
14.2.2 Recovery Procedure for Path Single Failure (SIM = 21d0xy)



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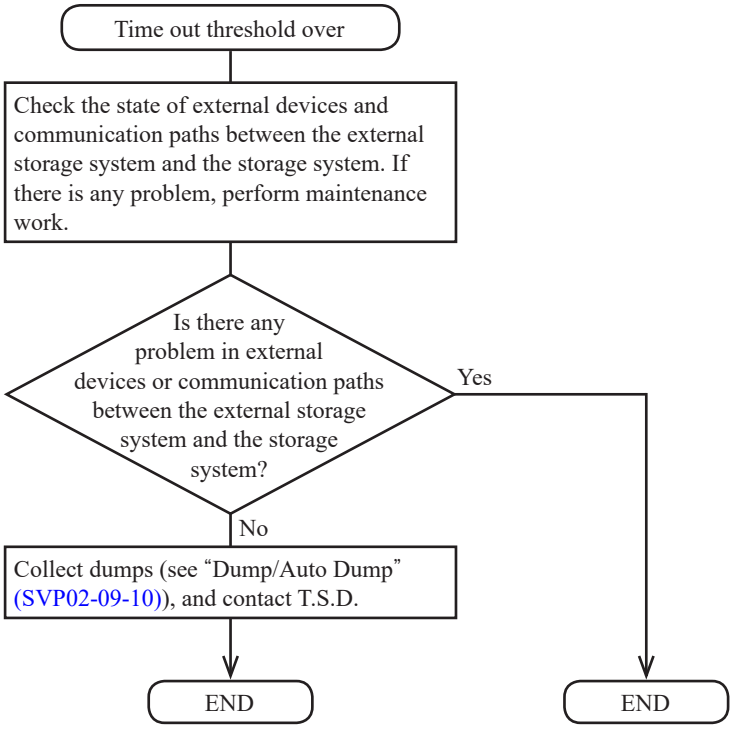


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14.2.3 Recovery Procedure for External Storage system Path Response Time Out Threshold Over (SIM = 21d2xy)



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14.2.4 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 14-2 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 Micro-program 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 the local storage system.
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 Micro-program 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.

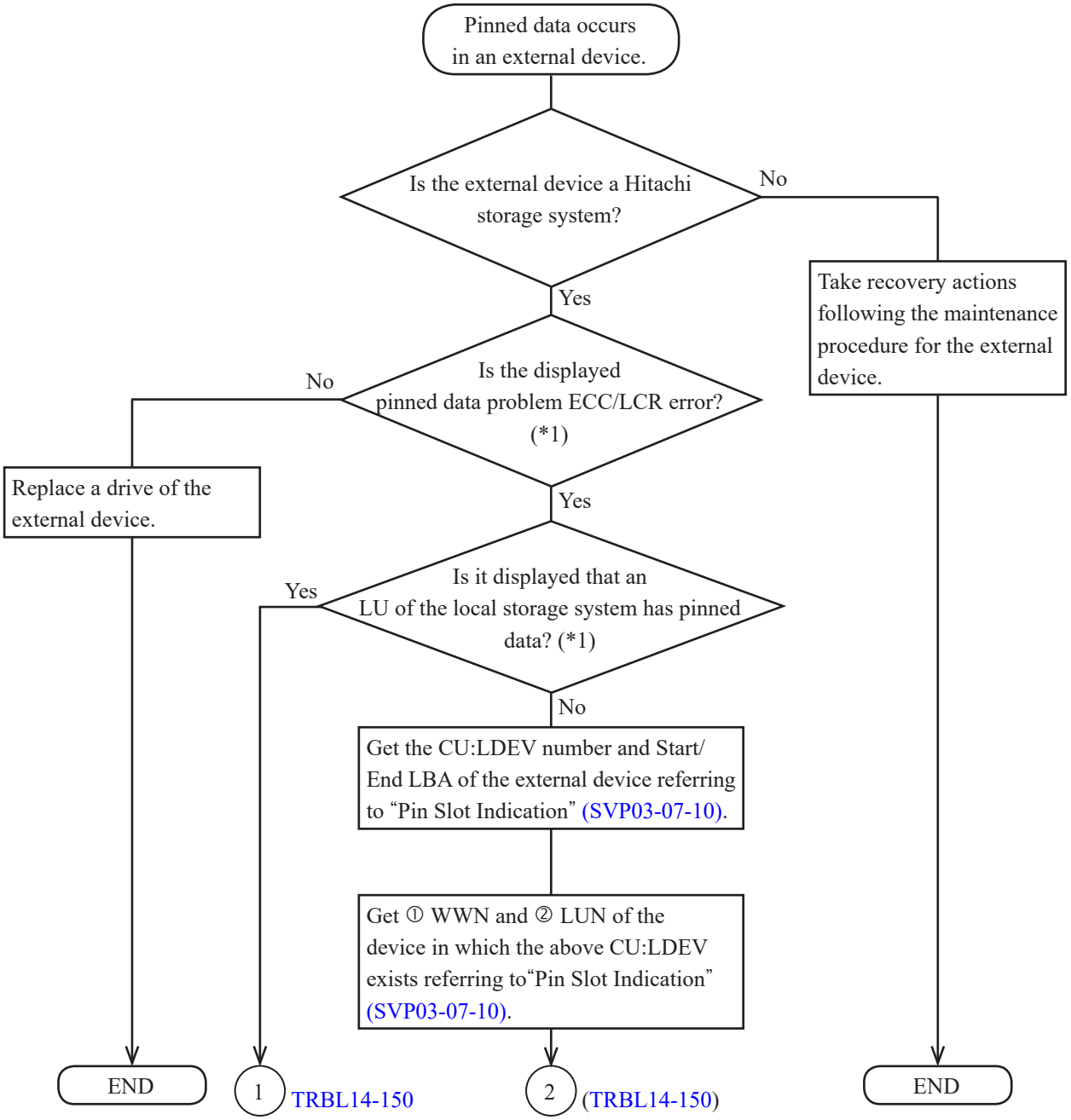
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Factor code	Content	Coping Method
0x00000007	• The device concerned is other than the direct access device.	• Check the status of the external storage and the external device, and make it normal.
0x00000008	• The capacity of the external device is 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 the local storage system.
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 the local storage system 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 the local storage system. • 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.
0x00000012	• The LU discovery was performed to the external storage system connected by using the path (*) that cannot be used as an external path. *: Path being used as the I/O path from the port of the third-party external storage system to the port of the local storage system	• Use a path that can be used as an external path.
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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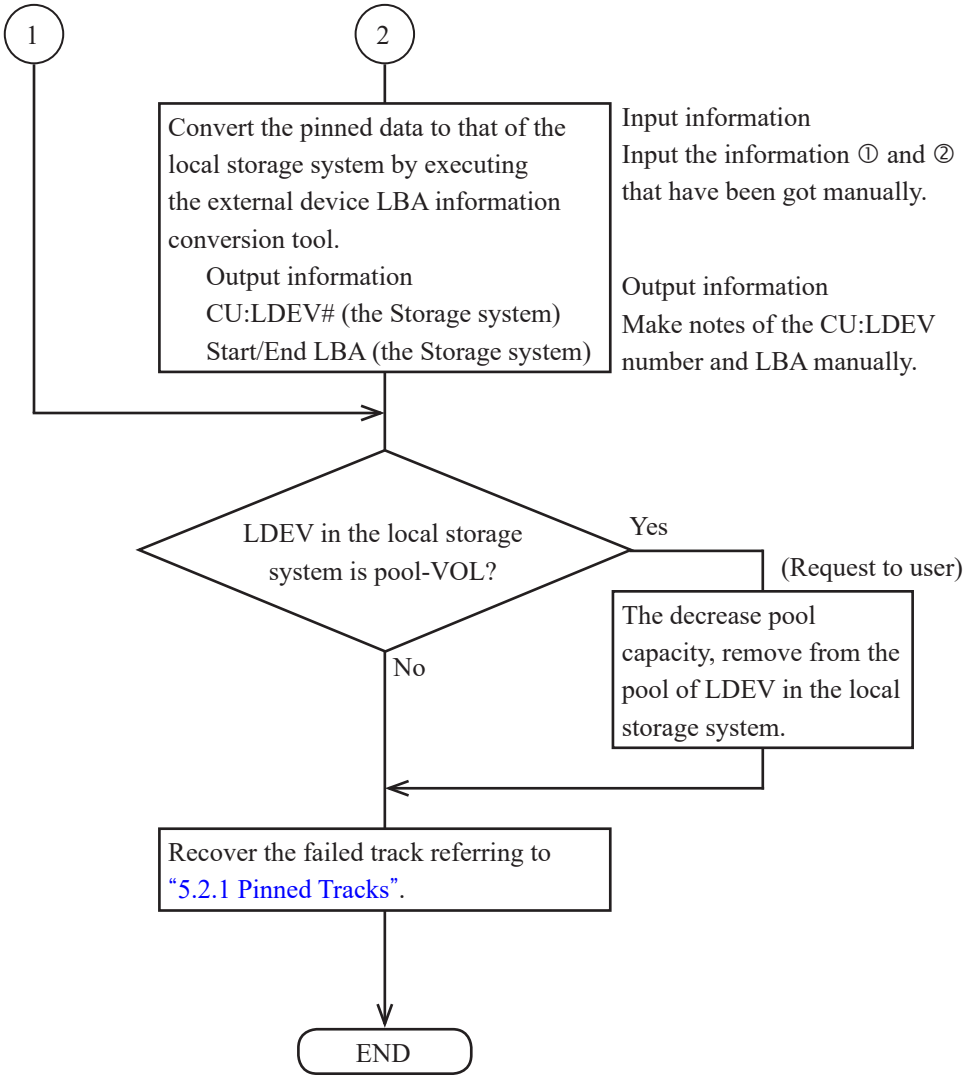
14.3 Elimination Procedure for Pinned Data on External Storage

A procedure for eliminating pinned data when it occurs in an external device is shown below.



*1: For the PIN indication, see “Pin Slot Indication” (SVP03-07-10).

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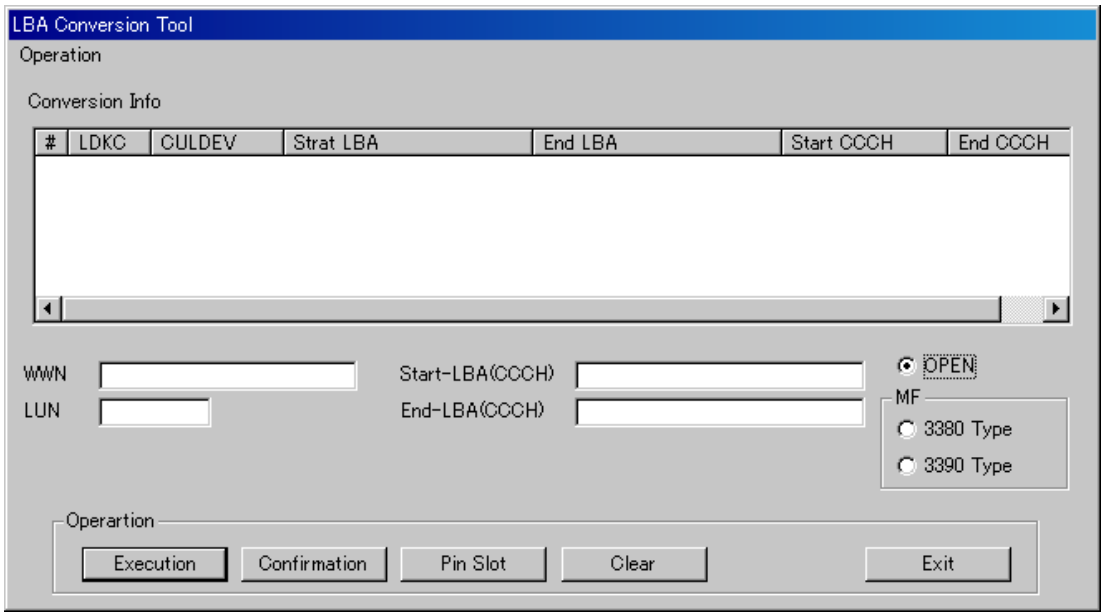


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14.4 Procedure for Operating External Device LBA Conversion Tool

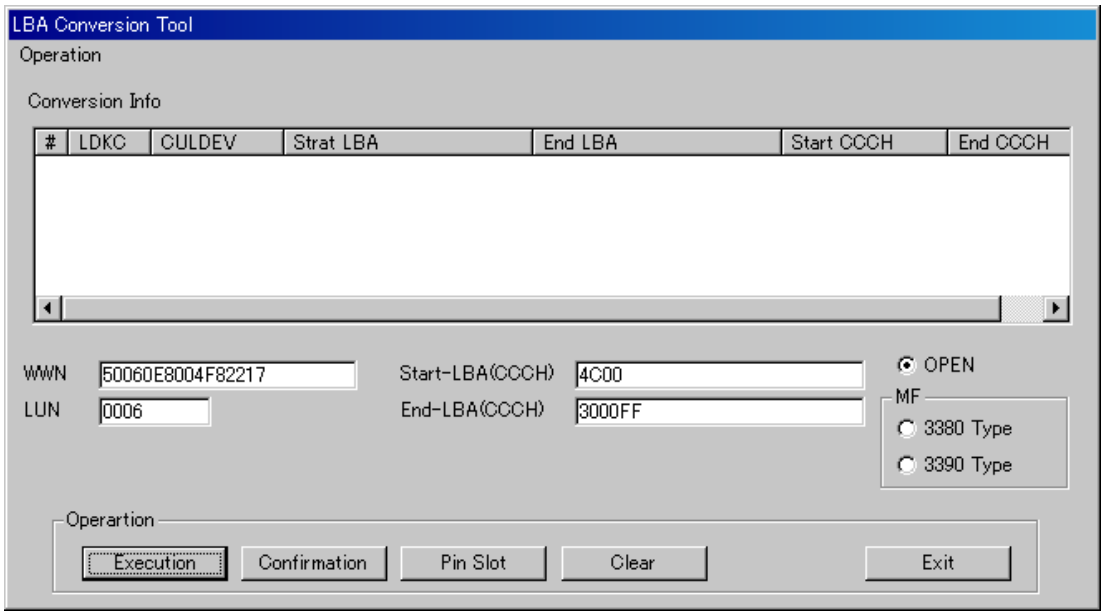
1. <Procedure for starting the tool>
   Open the Run window.
   Right-click [Start], and then select [Run].
   Enter “C:\dkc200\mp\pc\LbaCon.exe” and then click [OK].

   When the above operation is performed, the following window is displayed.

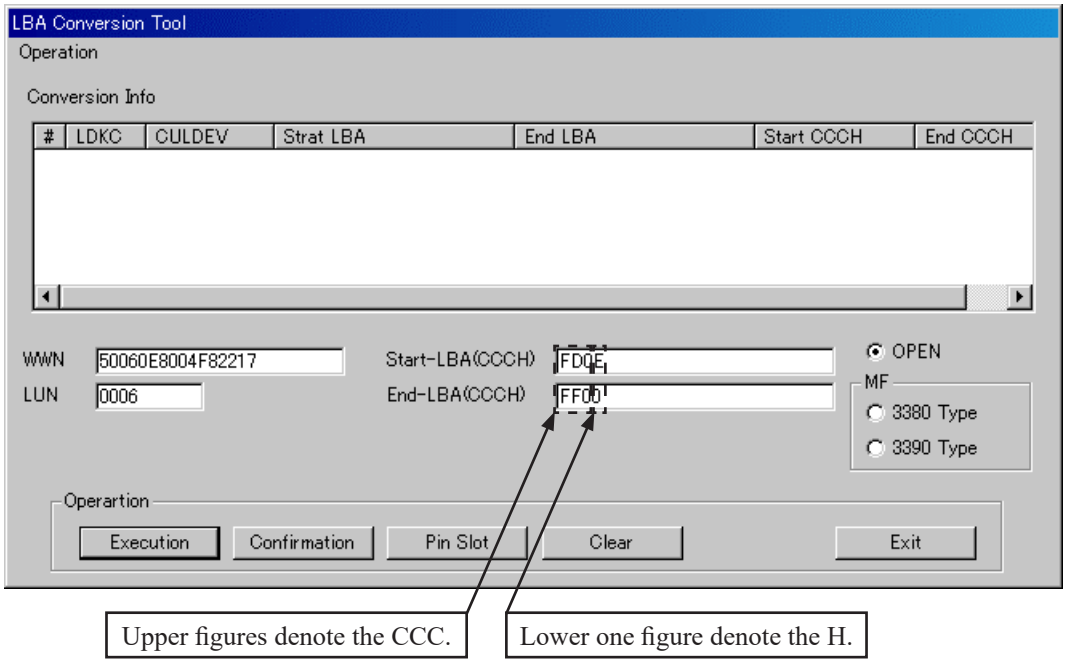


2. <Entering the information to be converted>
   Enter the WWN, LUN, and Start and End LBA (CCCH, in the case of the MF type device) of the external device and select the emulation type (OPEN, 3380, or 3390) of the device whose LBA you want to convert using the radio button.

   When the emulation type of the external device is OPEN



   When the emulation type of the external device is MF (3390)

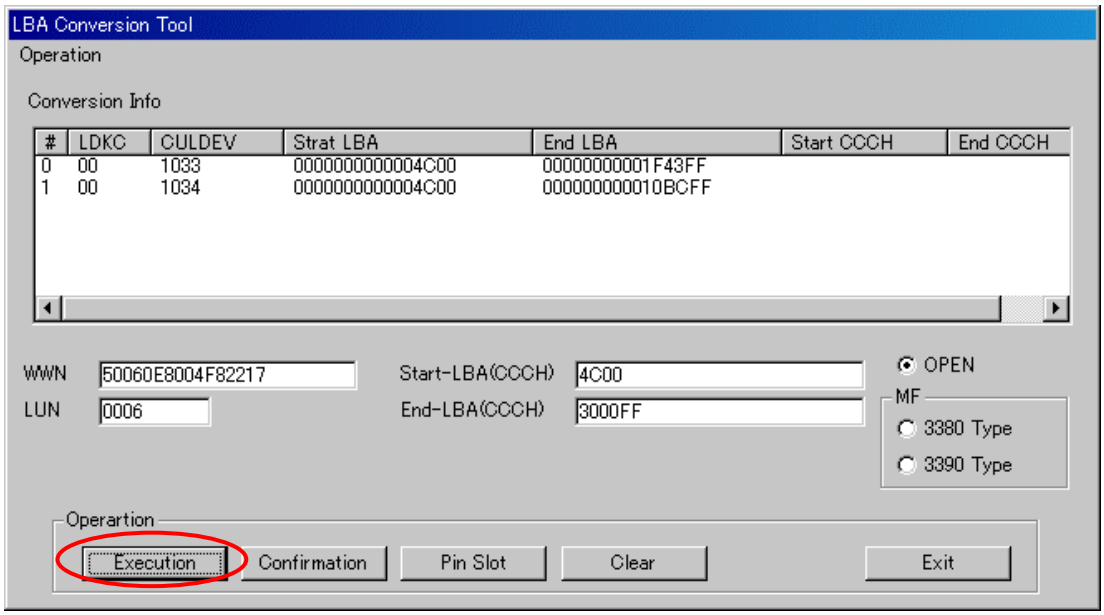


NOTE: (1) The maximum number of figures of the Start/End LBA is 16.
(2) As to the Start/End CCCH, enter H as the lower one figure and CCC as the upper figures.
(3) If you make a wrong selection of the emulation type (OPEN, 3380, or 3390), you cannot get correct information.

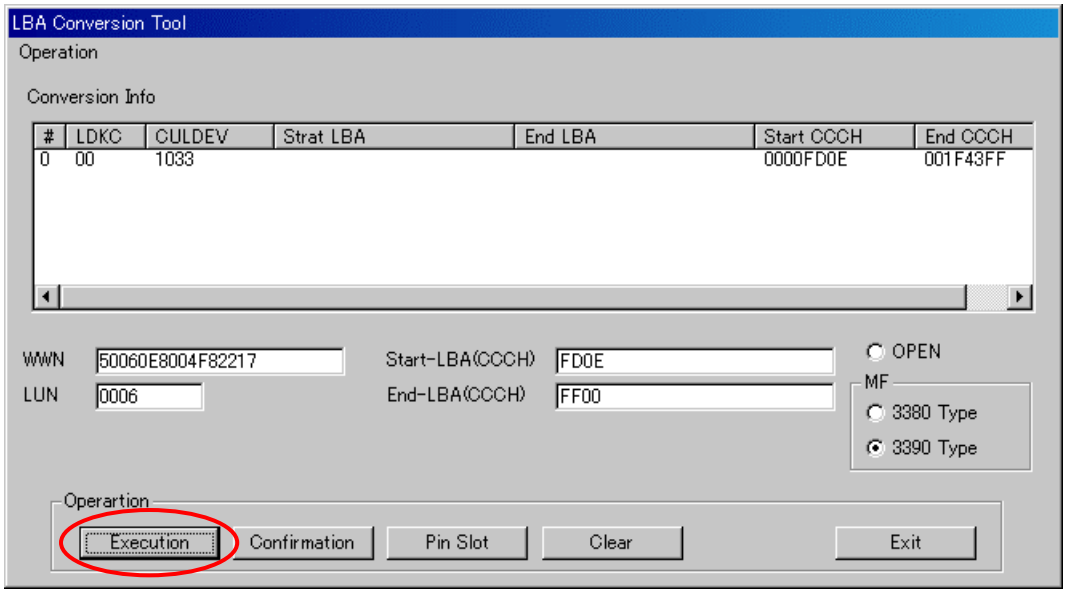
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3. <Executing the conversion>
   When you press [Execution] after making sure that the information you have entered is correct, the converted LDKC#, CULDEV#, start LBA (CCCH), and end LBA (CCCH) for the local storage system is displayed in the Conversion Info list.

   When the emulation type for the local storage system is OPEN

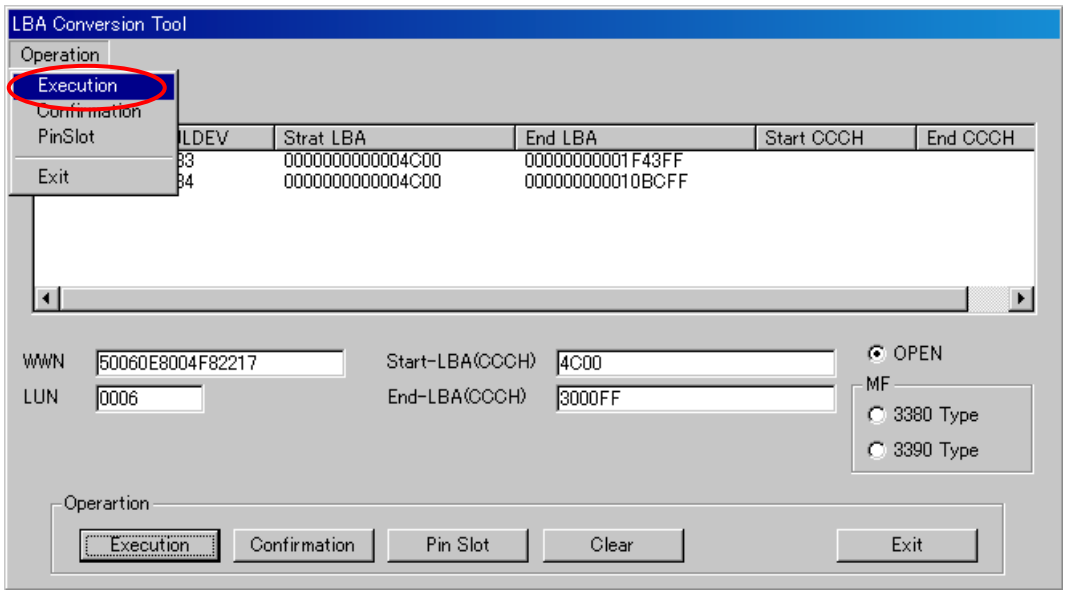


   When the emulation type for the local storage system is MF (3390)



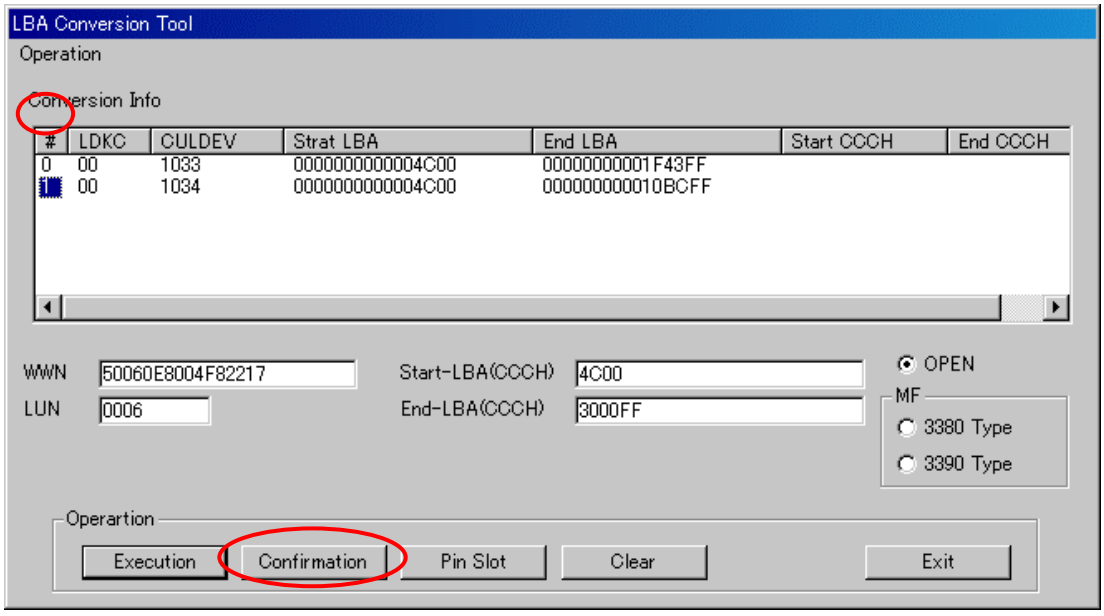
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You can also execute the conversion by selecting [Execution] from [Operation] menu bar.

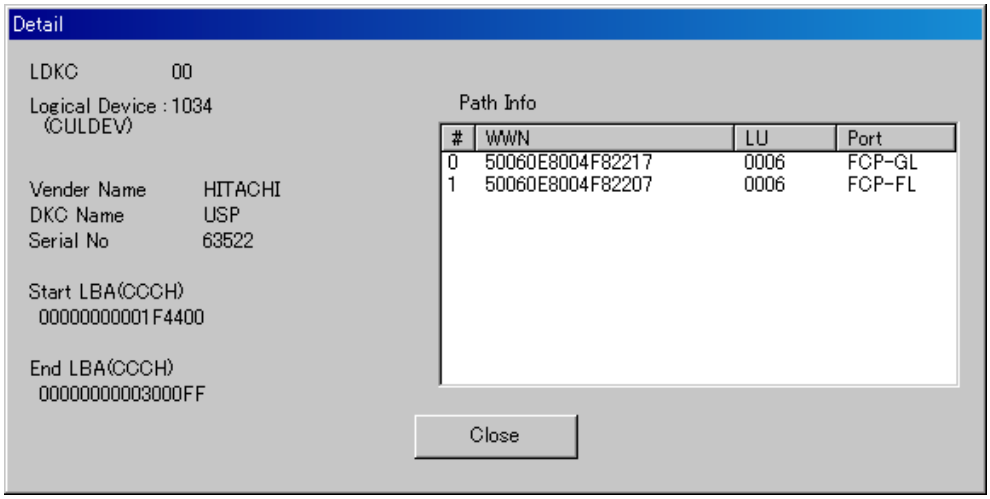


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4. <Verifying the converted information>
   Click an item number of the converted information (in the "#" column) and press [Confirmation].



When the process is completed, the LDKC number and the CULDEV number for the local storage system, the Start and End LBA (CCCH, in the case of the MF type) for the external device, and the Vender Name, DKC Name, Serial No, and path information of the external device are displayed.

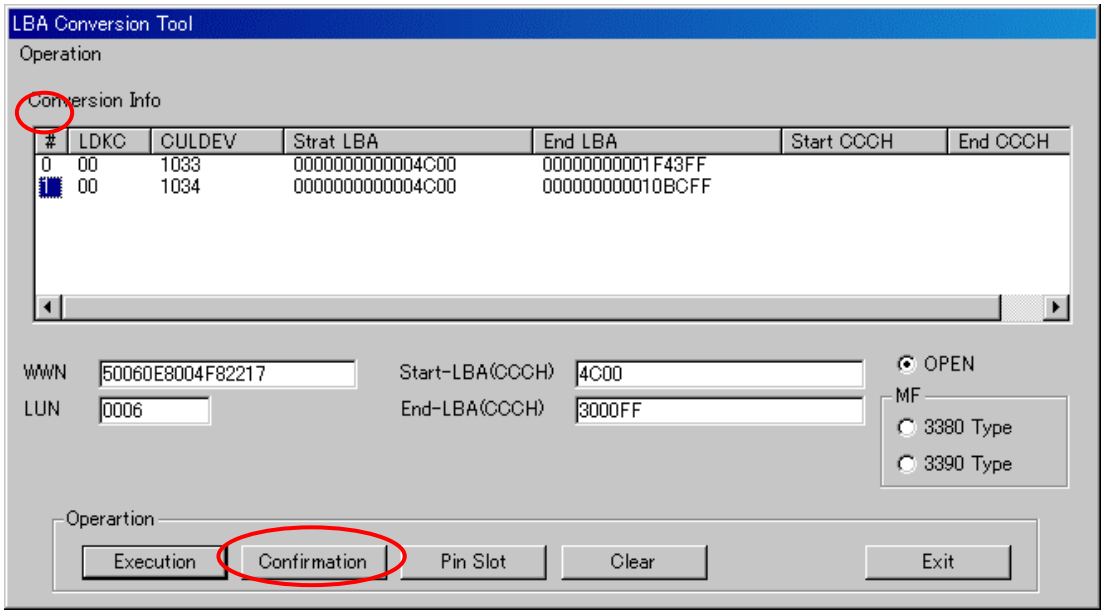


NOTE: Up to eight (the maximum number of paths) pieces of path information are displayed.

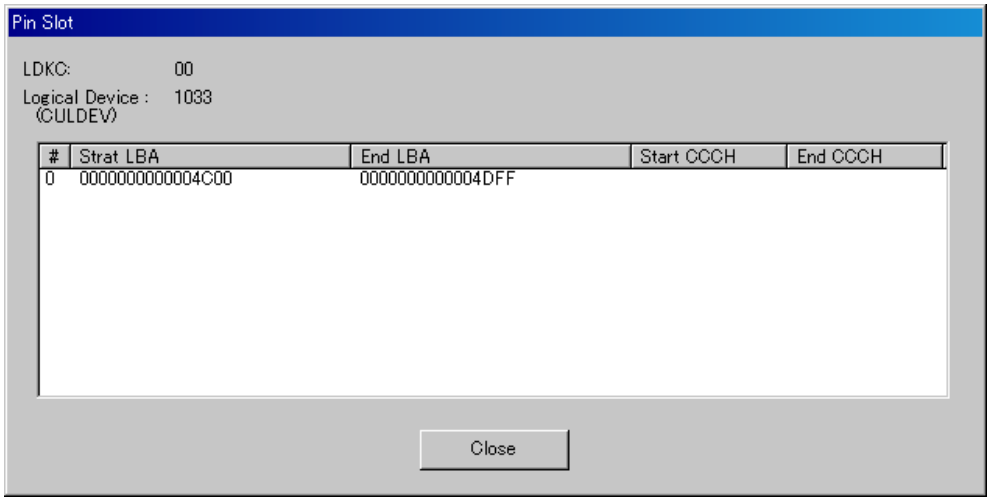
You can also execute this process by selecting [Confirmation] from the [Operation] menu bar besides pressing [Execution].

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5. <Displaying the Pin Slot>
   Click an item number of the converted information (in the "#" column) and press [Pin Slot].



When the process is completed, the Start and End LBA (CCCH) of the slot concerning the converted LBA are displayed. (Display of the Start/End LBA (CCCH) in the case where the Pin Erasure Tool is used: The display is done for each slot.)

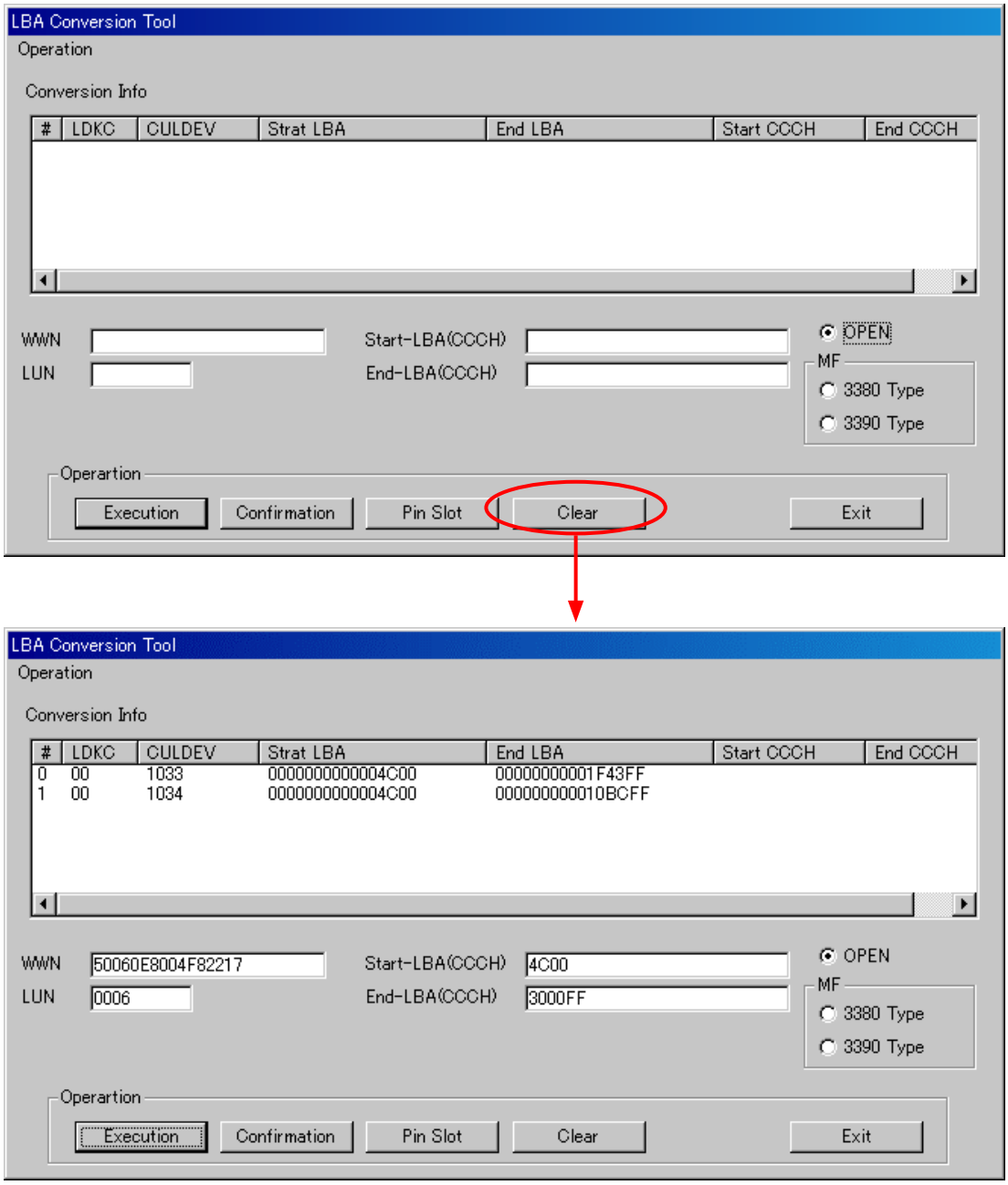


NOTE:
- Up to 128 pieces of information can be displayed.
- When the terminal slot is displayed, it may be displayed as smaller than one slot size.

You can also execute this process by selecting [Pin Slot] from the [Operation] menu bar besides pressing [Execution].

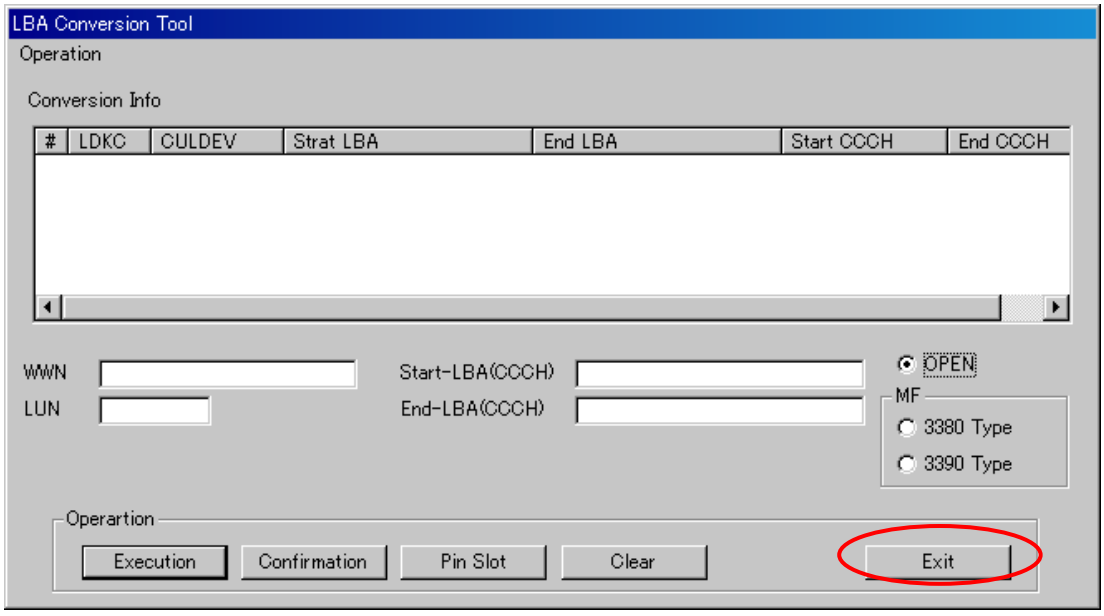
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6. <Procedure for erasing information displayed in the main window>
   When you press [Clear] in the main window, information displayed in the window is erased.



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7. <Procedure for quitting the tool>
   To quit the tool, press [Exit] in the main window.

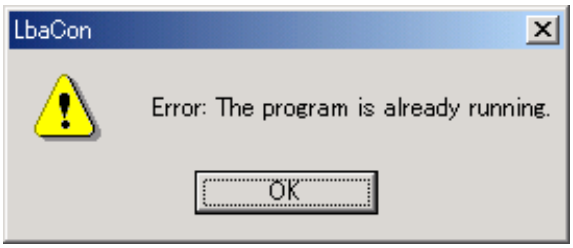


You can also execute this process by selecting [Exit] from the [Operation] menu bar besides pressing [Execution].

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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.

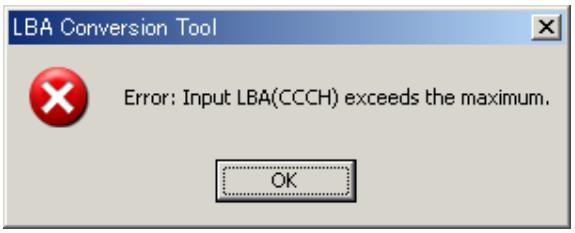
Check the WWN and LUN that you entered.



(5) LBA specification error

When the following dialog box is displayed, the value of the specified LBA (CCCH) 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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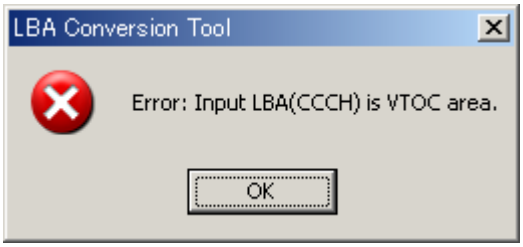
(10) Internal logical error

When the following dialog box is displayed, an error occurred in the internal logic.



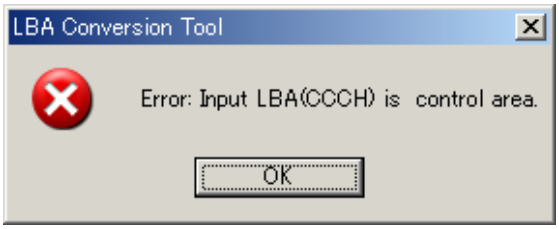
(11) VTOC area specification error

The specified LBA (CCCH) is the VTOC area.



(12) Control area specification error

The specified LBA (CCCH) is a control area.



(13) 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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9. <Restriction>
Restriction on this tool is shown below.

(1) Display of a converted LBA at the time when the LBA is verified
An LBA that is displayed when it is verified may be different from that which was entered in the case where the information on an external device whose emulation type is open is converted to that on a device that is mapped onto the MF (intermediate) type.

NOTE: When information on an external device whose emulation type is open is converted to that on a device that is mapped onto the MF (intermediate) type, the LBA is converted to the CCCH. When the converted information is verified, on the other hand, the converted CCCH is returned to the LBA. Therefore, the inconsistency is resulted. (The information displayed is edited for each slot.)

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14.5 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) Perform the “Reconnect External Volumes” operation for the external volume from the storage system to restore the external volume.
   (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) Perform the “Reconnect External Volumes” operation for the external volume from the storage system to restore the external volume.
   (3) Restore the data using the Storage system function.

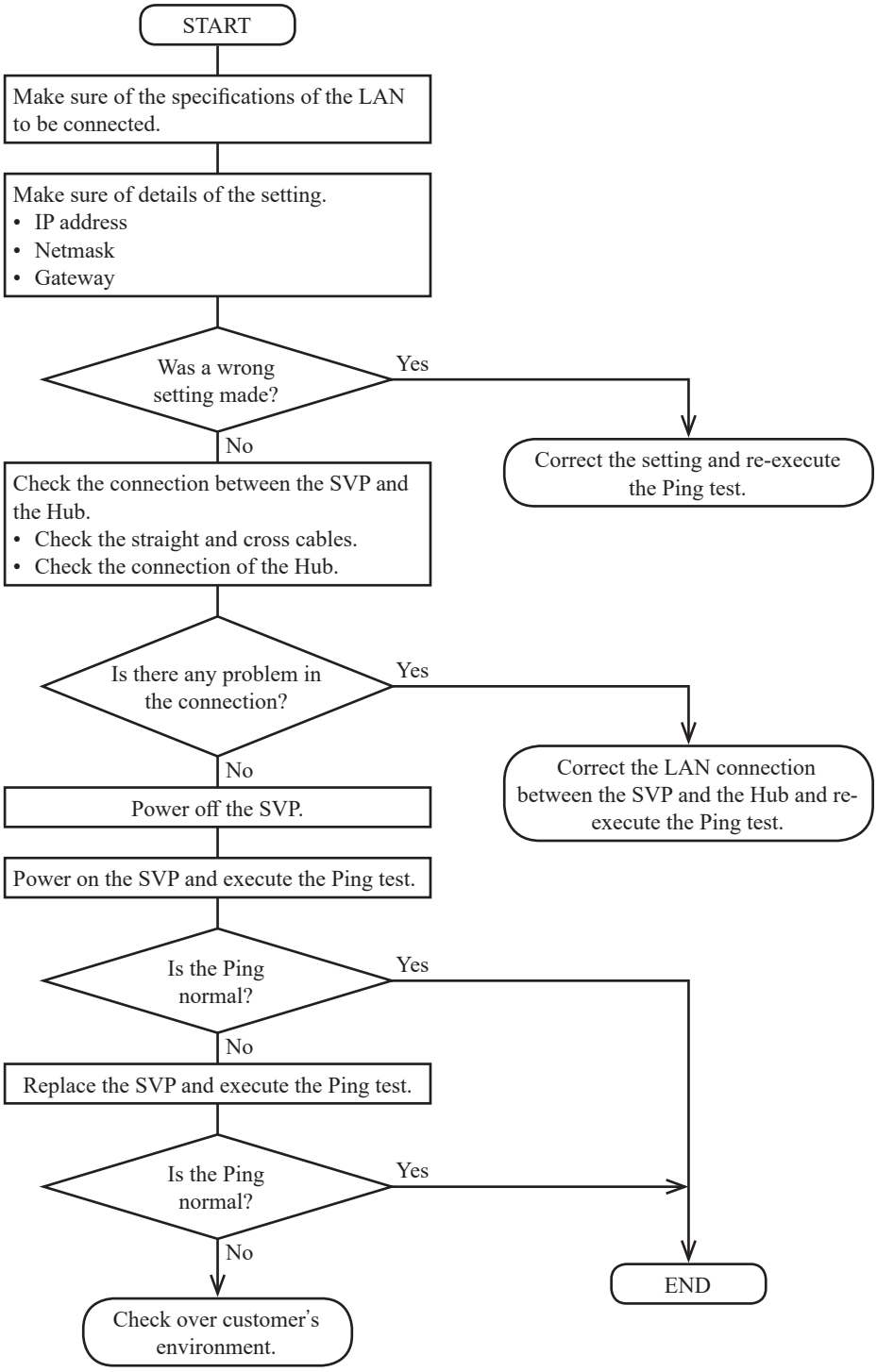
3. When making restoration using backup data of the external device
   (1) Restore an LU of the external device.
   (2) Perform the “Reconnect External Volumes” operation for the external volume from the storage system to restore the external volume.
   (3) Make the Storage system execute the “Disconnect 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) Perform the “Reconnect External Volumes” operation for the external volume from the storage system to restore the external volume.

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15. 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.

15.1 SNMP Ping Test Trouble Shooting



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15.2 When Trap Cannot Be Received While Ping Reaches Manager PC Prepared by Customer

1. Check the setting of the SNMP Agent. (Check it in the SNMP setting window on Web Console.)
   (1) Make sure that the "Extension SNMP" has been chosen.
   → If not, it choose.

   (2) Check if the Community name has been added.
   → If not, add it.

   (3) Check if the setting of the SNMP Agent 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 SVP 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 SVP 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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15.3 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 table 2 below.	
Extended Trap PDU	See the table 3 below.	

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 DKC 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 (SIMRC00-00).
EventTrapPartsID	Object IDENTIFIER	Part in which a failure occurred.

4. Reference codes

   See SIM RC SECTION (SIMRC00-00).

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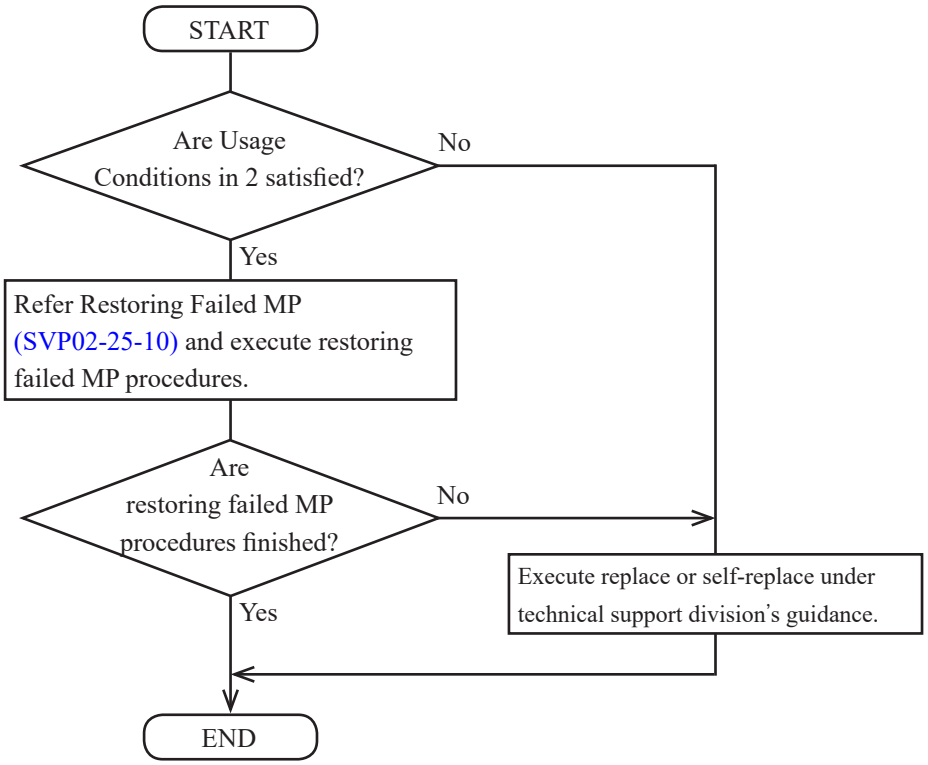
16. MP Blockade Reset Function

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 microprogram problem.
     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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17. Failure recovery of Encryption License Key

17.1 Recovery procedure when acquisition failure from key management server (SIM = 661000, 661001)

Key encryption key or encryption key acquisition from key management server at the time of DKC start fails and no volumes can be accessed.
The following are the statuses of drives and LDEVs when the error occurs.

All drives: Failed

All LDEVs other than DP-VOLs for which Capacity Saving is disabled: Blocked

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 Recovery procedure (See TRBL17-20).

NOTICE: The following volumes are blocked:
- DP-VOL for which Capacity Saving is enabled
- Deduplication system data volume (finger print)
- Deduplication system data volume (data store)

These volumes are automatically recovered from the blockade by performing the Recovery procedure (See TRBL17-20).

NOTICE: When key encryption key or 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 Recovery procedures (See TRBL17-20).

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Recovery procedure

(1) Checking the connection with the key management server

Check that the LAN cable between the SVP and the key management server is properly connected. Then, ask a user who has the Security Administrator role (View & Modify) to click [Sever Configuration Test: Check] of Edit Encryption Environmental Settings of Web Console or Storage Navigator.

- When the check result of the server configuration test shows a normal state, go to Step (4).
- When the check result of the server configuration test shows an error message, go to Step (2).

(2) Restoring the connection with the external key management server

The SVP fails in acquiring the key from the key management server when the DKC is started. Ask the customer to check and restore the connection between the SVP and the key management server according to the error message shown in the server configuration test and the following table that shows major causes of the key acquisition failure.

Category	Cause of failure
Problem of network	The key management server is not running.
	There is a problem in a communication path between the SVP and the key management server. Examples: • The LAN cable is disconnected or damaged. • Firewall blocks communications. • The network circuit is overloaded. • Network devices are damaged or not running.
Problem of client certificate	The client certificate of the SVP is expired.
	The client certificate of the key management server is expired.
	The client certificate of the SVP is invalid .
	The client certificate of the key management server is invalid .
	The client certificate of the SVP is updated and the Common Name in the client certificate after the update is different from the Common Name of the client certificate before the update.
Other	The key encryption key and encryption key are deleted from the key management server. If the deleted key cannot be restored, contact the Technical Support Division.

(3) Checking the connection with the key management server

Perform the server configuration test using the same procedure as Step (1) to check that the connection between the SVP and the key management server is established.

(4) Restoring the DKC

Power off the DKC, and then power on the DKC. Then, check that all volumes are restored. If the DKC is not restored, contact the Technical Support Division.

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17.2 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. (*1)

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
   - The numbers of encryption keys consumed by maintenance operations while the encryption environment setting is enabled are as follows:

Adding/replacing the drives.	1 encryption key per drive
Replacing DKBs (EDKBs) supporting encryption	3 encryption keys per DKB

*1: When this SIM occurs at the time of Initialize Encryption Environmental Settings, this recovery procedure is not necessary

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17.3 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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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

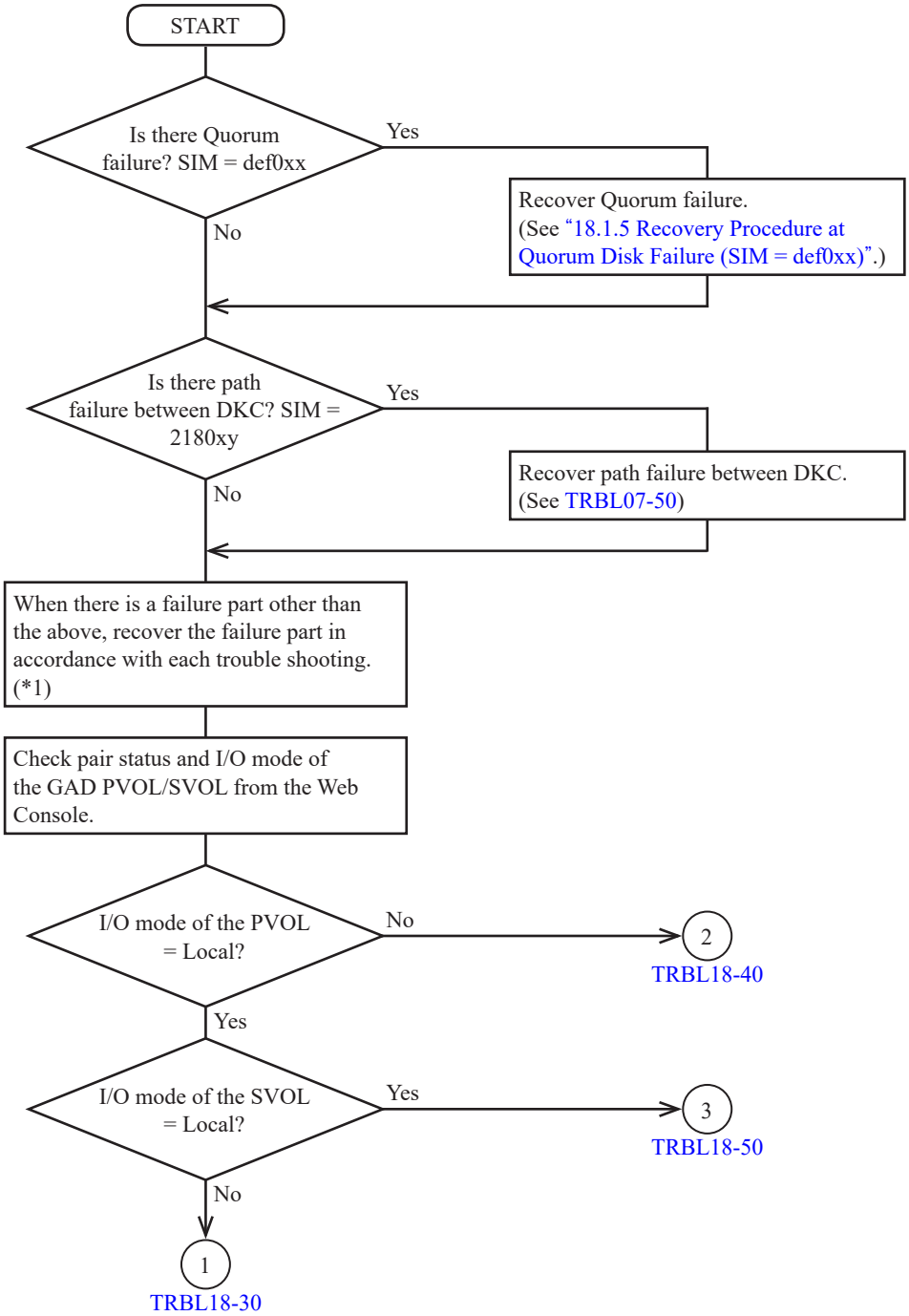
SIM REF.CODE	Meaning	Remarks
ddxyzz	Failure suspension of a GAD pair	x: Failure suspension type (0~3) y: The lowest digit of CU number zz: LDEV number
2180xy	Path block between a GAD pair	x: CHB PCB # y: Port# in PCB
dee0xx	Quorum Disk recovery	xx: Quorum Disk ID
def0xx	Quorum Disk block	xx: Quorum Disk 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 TRBL07-50.

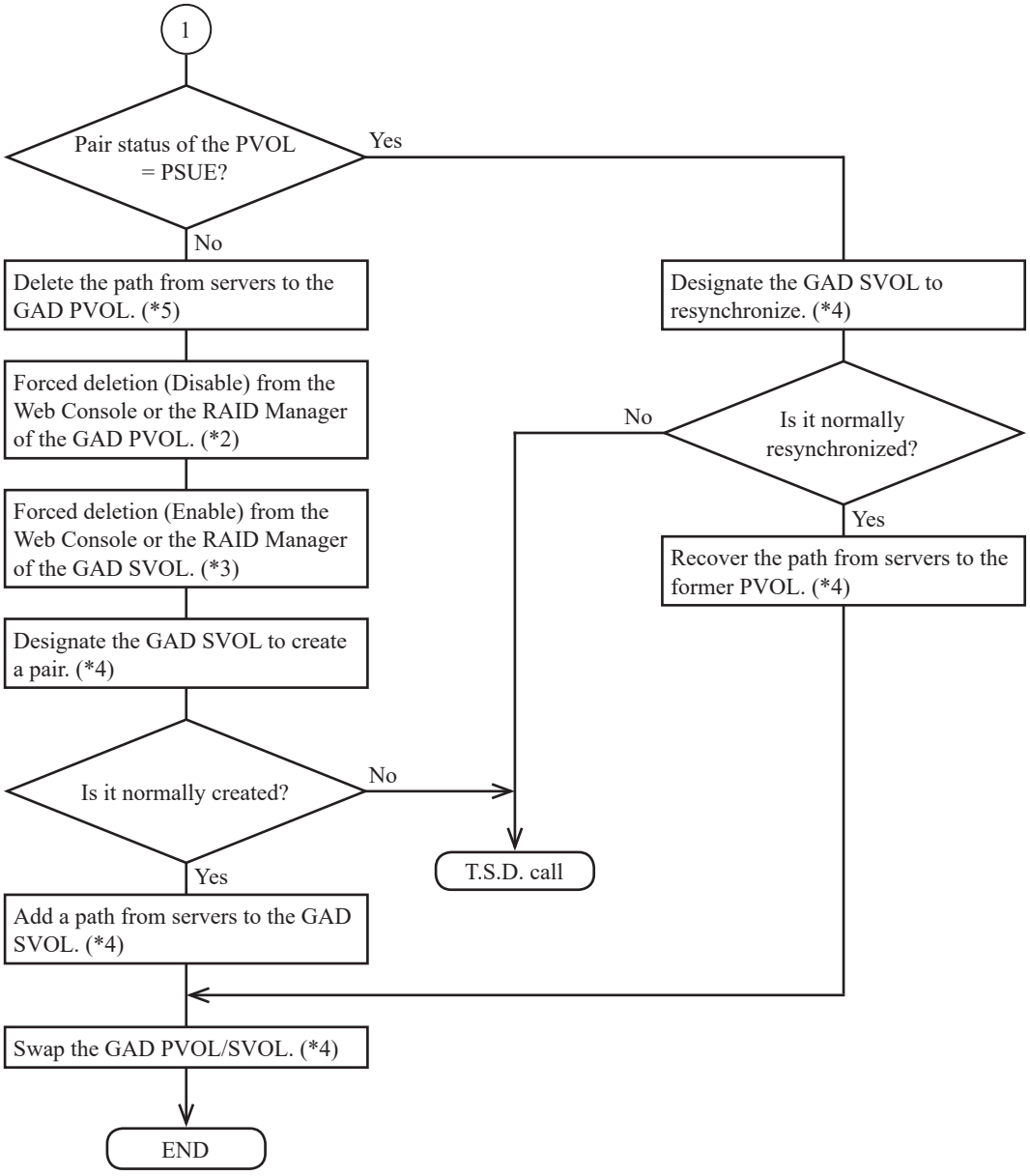
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18.1.1 Recovery Procedure at Failure Suspension of a GAD Pair (SIM = ddxyzz)

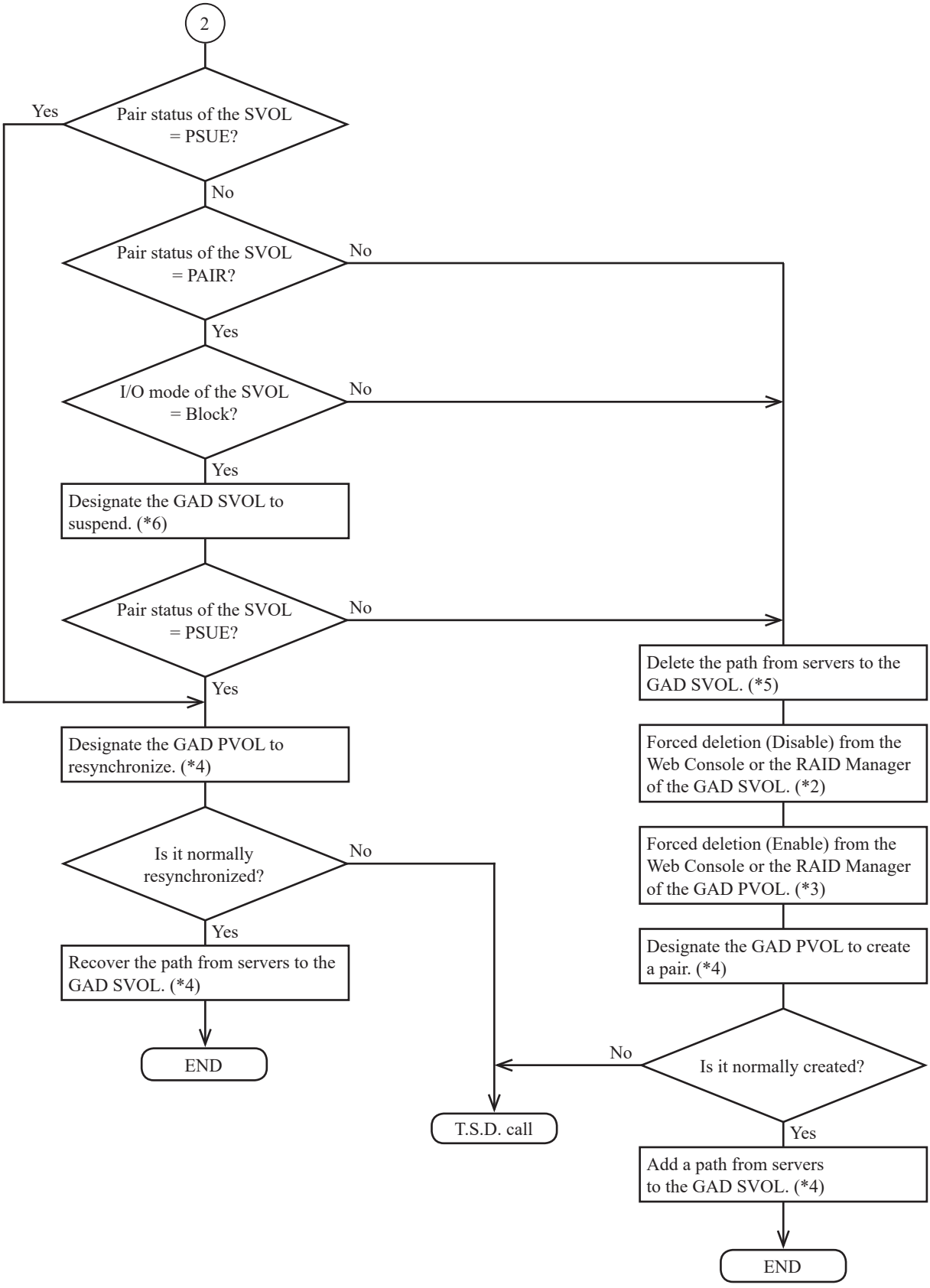
NOTE:
- In the following procedure, ask SE or the customer to check the pair status and I/O mode of the GAD pair. For the procedure, see "How to check pair status and I/O mode of GAD pair".
- If you contact the Technical Support Division in the following procedure, see "Dump collection in this recovery procedure" to collect dumps.



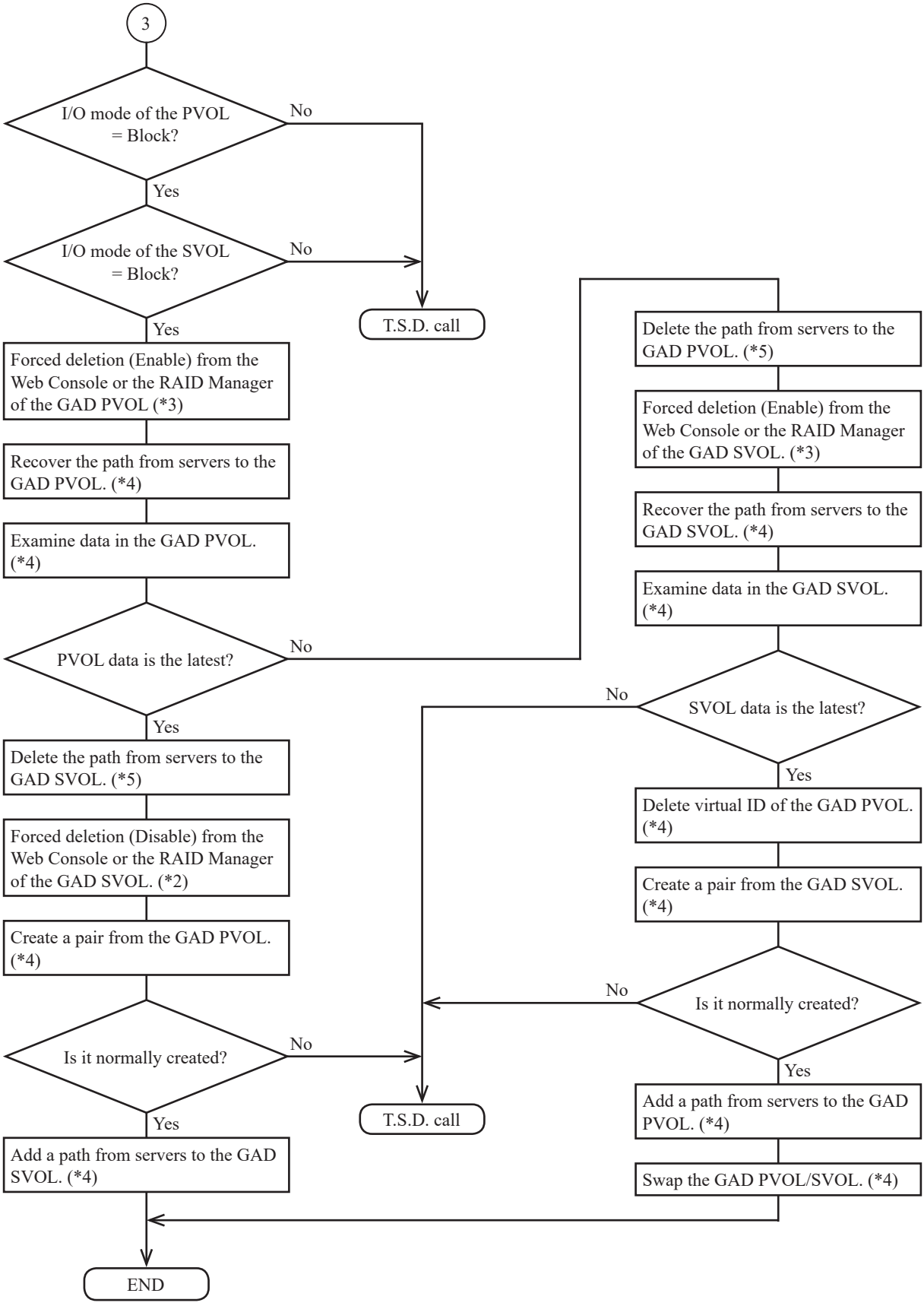
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*1: When an LDEV is blocked in a GAD pair, recover in accordance with the recover procedure at LDEV block occurrence TRBL18-70.
*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, forced deletion (Disable) 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.

How to check pair status and I/O mode of GAD pair

1. For Web Console
   Expand the Storage Systems tree, click [Replication]-[Remote Replication], and then select the [GAD Pairs] tab.
   In the displayed list of GAD pairs, see [Status] to check the pair status, and [I/O Mode] in the [Local Storage System] table to check the I/O mode.

2. For RAID Manager
   Execute the pairdisplay command. The following is a command example:
   `pairdisplay -g oraHA -fcxe -IH1`
   "oraHA" indicates the group name defined in the configuration definition file, and "-IH1" indicates the instance number 1.
   In the execution result, the "Status" column shows the pair status, and the "R/W" column shows the I/O mode.

3. I/O mode terms displayed in Web Console and RAID Manager
   The following table lists the I/O mode terms described in this procedure and those displayed in the Web Console and the RAID Manager.

Term in this procedure	Term in Web Console	Term in RAID Manager
Mirror	Mirror (Read Local)	L/M
Local	Local	L/L
Block	Block	B/B

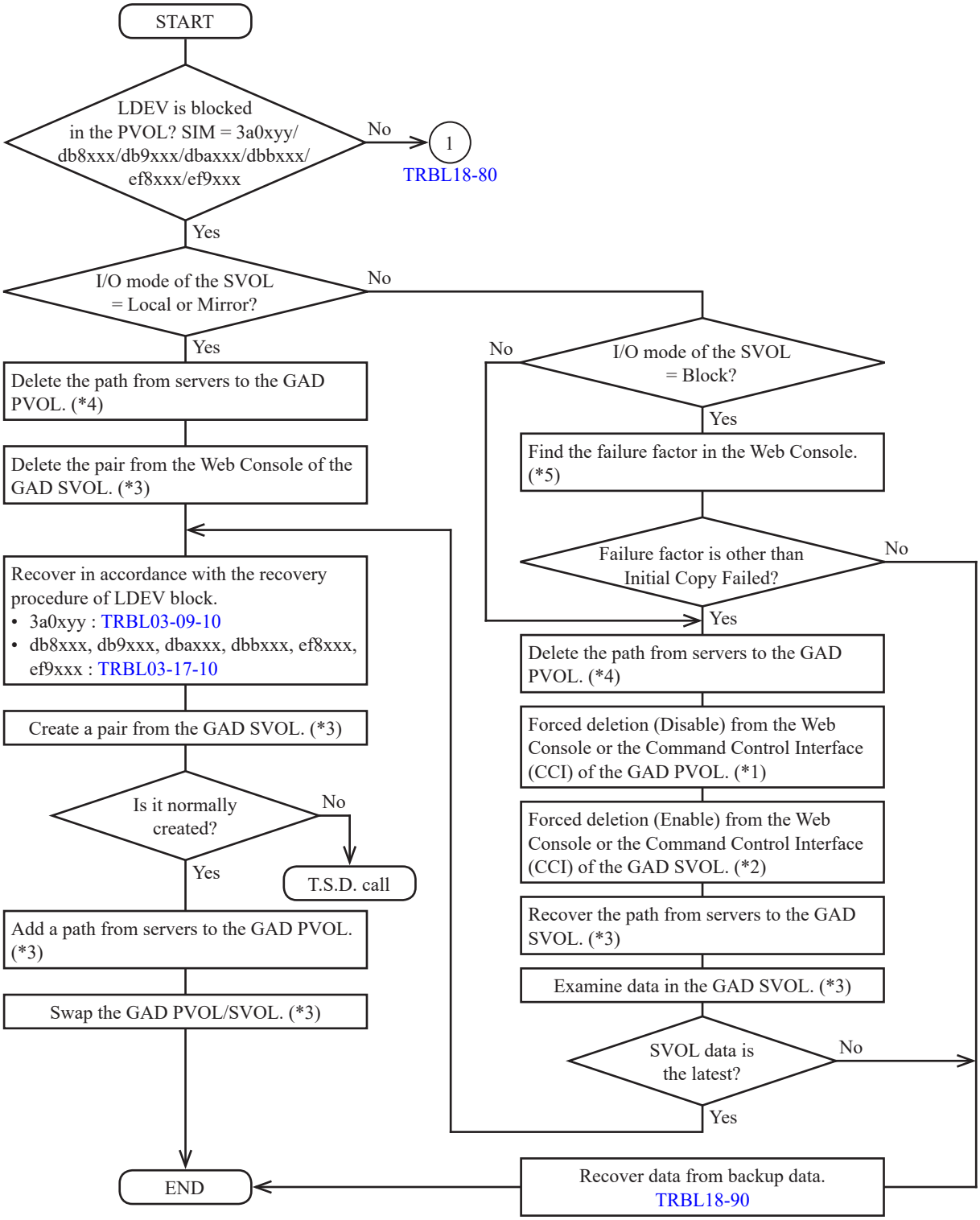
Dump collection in this recovery procedure

Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump.
For the procedure, see (SVP02-09-10).
When performing Auto Dump, specify "Normal" for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify "Monitor" for the dump type.

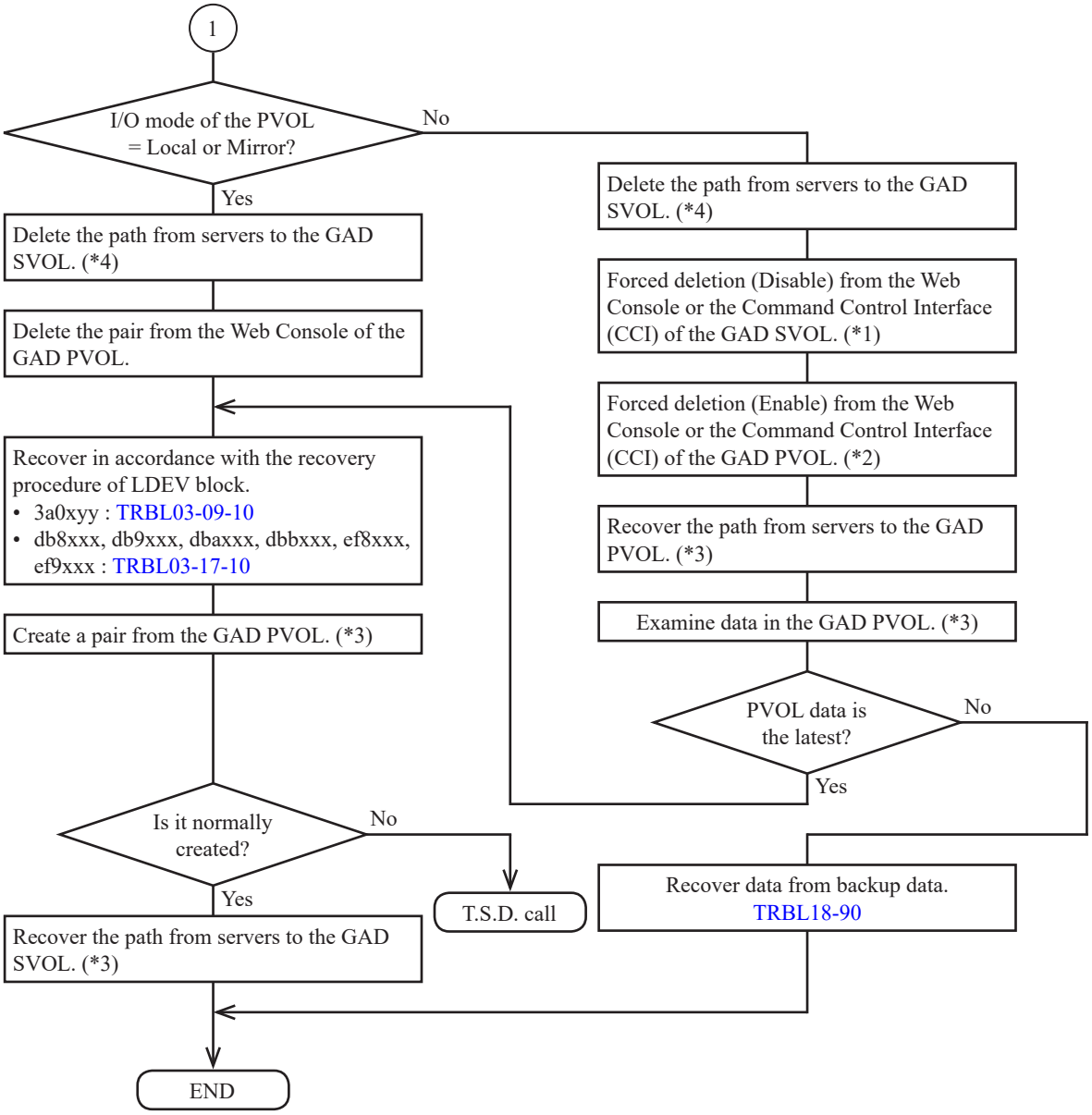
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18.1.2 Recovery Procedure at LDEV Block in the GAD Pair (SIM = 3a0xyy, db8xxx, db9xxx, dbaxxx, dbbxxx, ef8xxx, ef9xxx)

NOTE:
- In the following procedure, ask SE or the customer to check the pair status and I/O mode of the GAD pair. For the procedure, see "How to check pair status and I/O mode of GAD pair".
- If you contact the Technical Support Division in the following procedure, see "Dump collection in this recovery procedure" to collect dumps.



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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.

*5: Ask SE or the customer to perform operation.
In the Web Console, expand the Storage Systems tree, click [Replication]-[Remote Replication], select the [GAD Pairs] tab, and then click [More Actions]-[View Pair Properties]. Check [Failure Factor] of [Pair Detail].

How to check pair status and I/O mode of GAD pair

1. For Web Console
   Expand the Storage Systems tree, click [Replication]-[Remote Replication], and then select the [GAD Pairs] tab.
   In the displayed list of GAD pairs, see [Status] to check the pair status, and [I/O Mode] in the [Local Storage System] table to check the I/O mode.

2. For RAID Manager
   Execute the pairdisplay command. The following is a command example:
   `pairdisplay -g oraHA -fcxe -IH1`
   "oraHA" indicates the group name defined in the configuration definition file, and "-IH1" indicates the instance number 1.
   In the execution result, the "Status" column shows the pair status, and the "R/W" column shows the I/O mode.

3. I/O mode terms displayed in Web Console and RAID Manager
   The following table lists the I/O mode terms described in this procedure and those displayed in the Web Console and the RAID Manager.

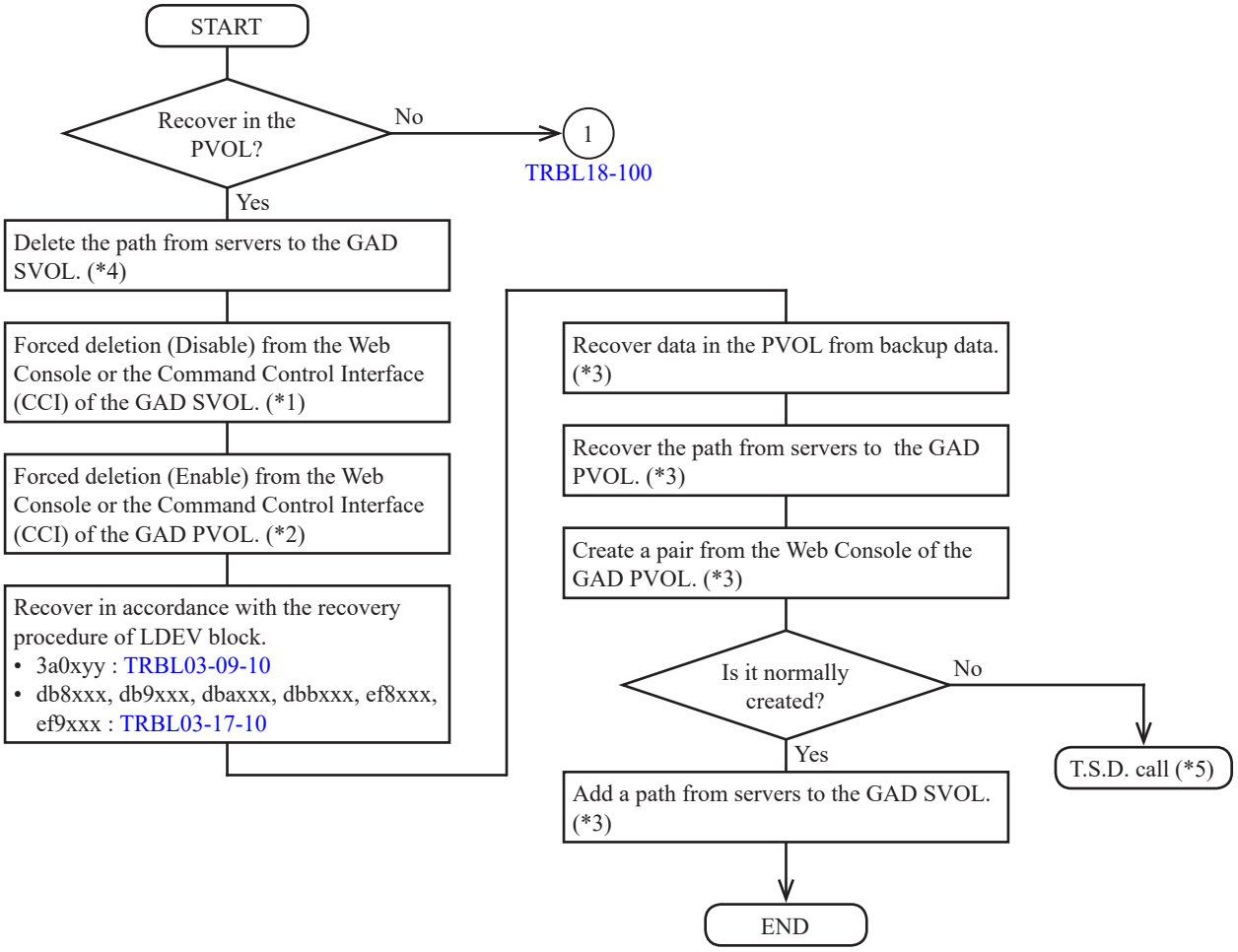
Term in this procedure	Term in Web Console	Term in RAID Manager
Mirror	Mirror (Read Local)	L/M
Local	Local	L/L
Block	Block	B/B

Dump collection in this recovery procedure

Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump.
For the procedure, see (SVP02-09-10).
When performing Auto Dump, specify "Normal" for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify "Monitor" for the dump type.

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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.

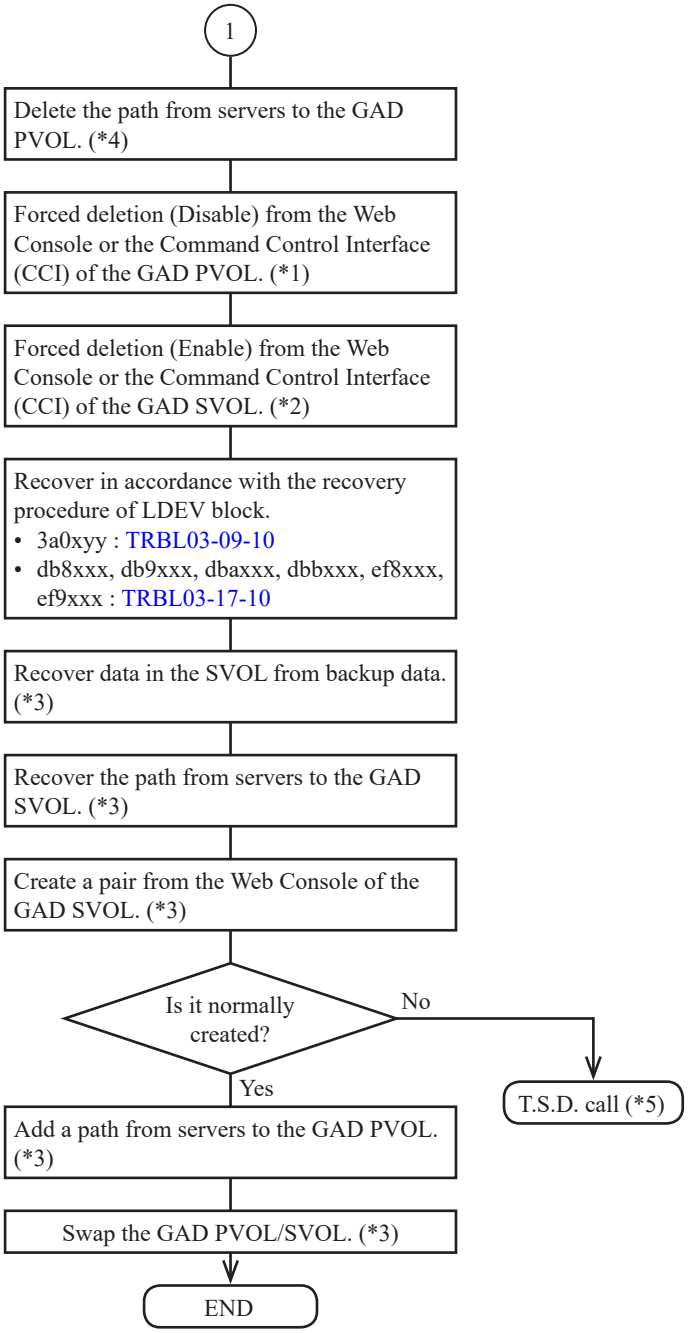
*2: When pair status of the GAD pair is released and it is the status of the GAD reserved volume, ask the customer to configure virtual LDEV ID instead of forced deletion (Enable).

*3: Ask the customer to perform operation.

*4: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

*5: Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump. For the procedure, see “Dump/Auto Dump” (SVP02-09-10). When performing Auto Dump, specify “Normal” for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify “Monitor” for the dump type.

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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.

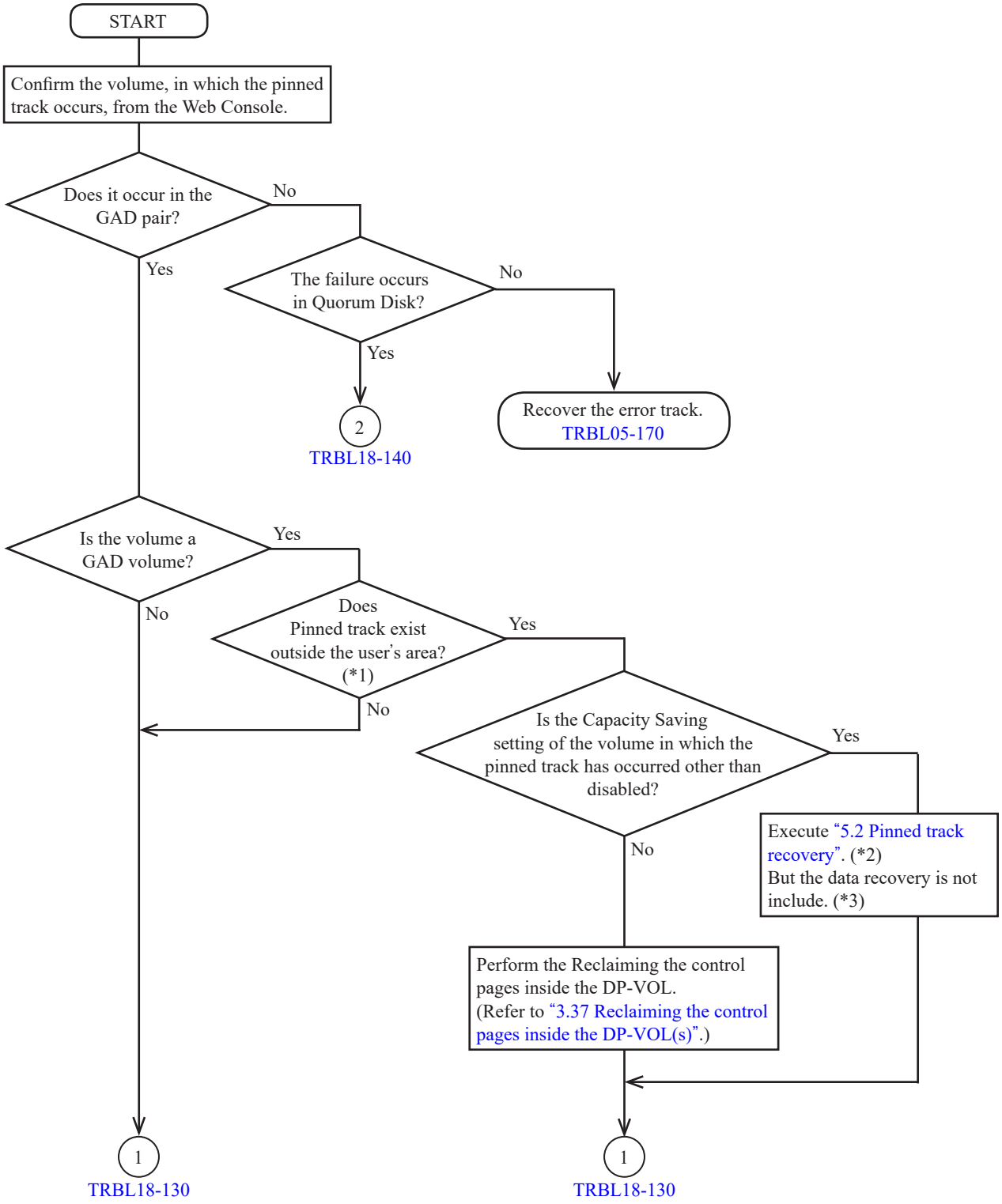
*4: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.

*5: Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump. For the procedure, see “Dump/Auto Dump” (SVP02-09-10). When performing Auto Dump, specify “Normal” for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify “Monitor” for the dump type.

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18.1.4 Recovery Procedure of the Pinned Track in the GAD Environment

NOTE:
- In the following procedure, ask SE or the customer to check the pair status and I/O mode of the GAD pair. For the procedure, see "How to check pair status and I/O mode of GAD pair".
- If you contact the Technical Support Division in the following procedure, see "Dump collection in this recovery procedure" to collect dumps.

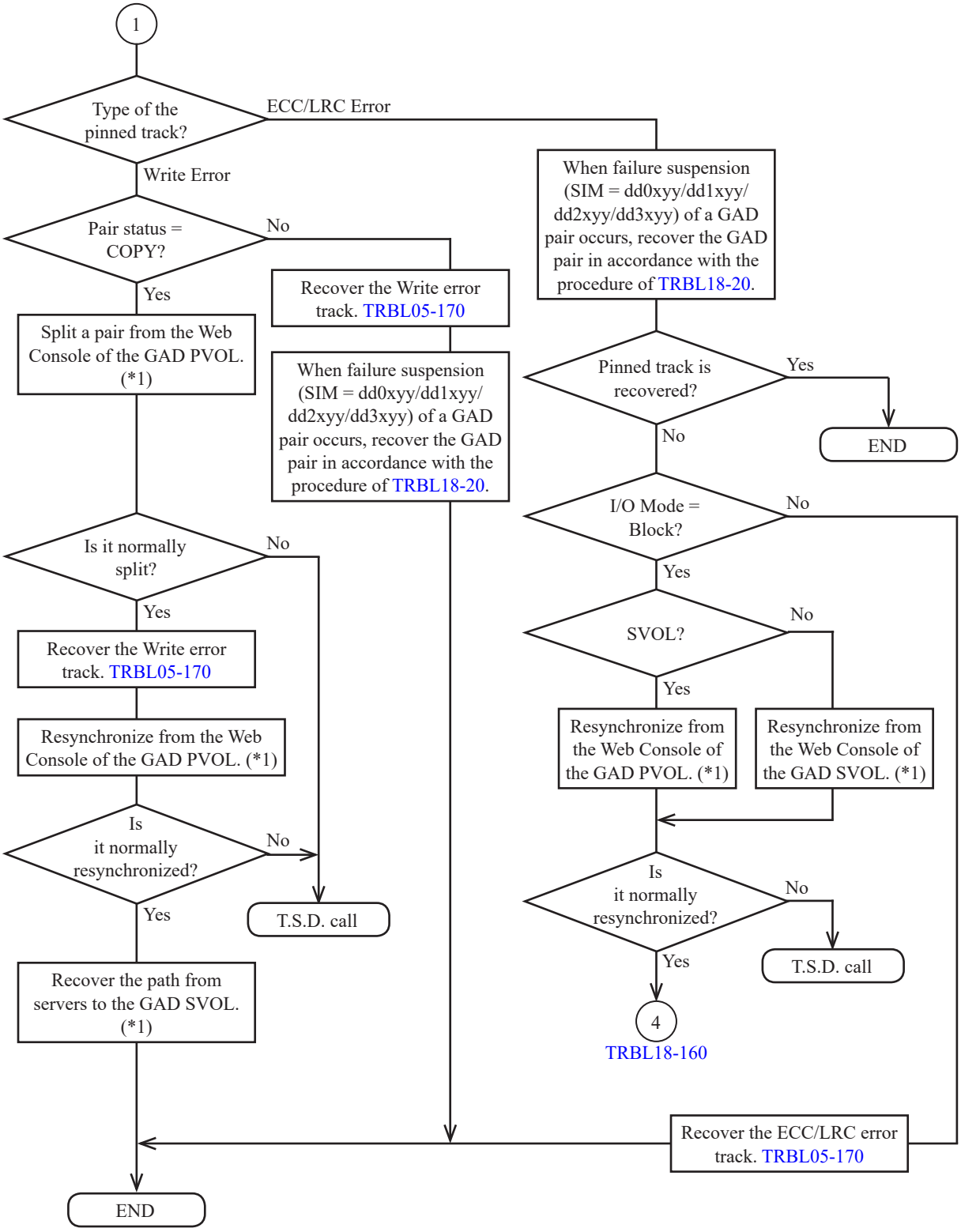


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*1: If CC and HH information in the SVP PINNED TRACK shows outside the user area, this indicates that a pinned track occurred in the management area.
(You can check the number of cylinders in the user area by seeing [Capacity] in the Logical Devices window of Web Console. Select “Cyl” as the capacity unit from [Options] in the Logical Devices window to check [Capacity].)

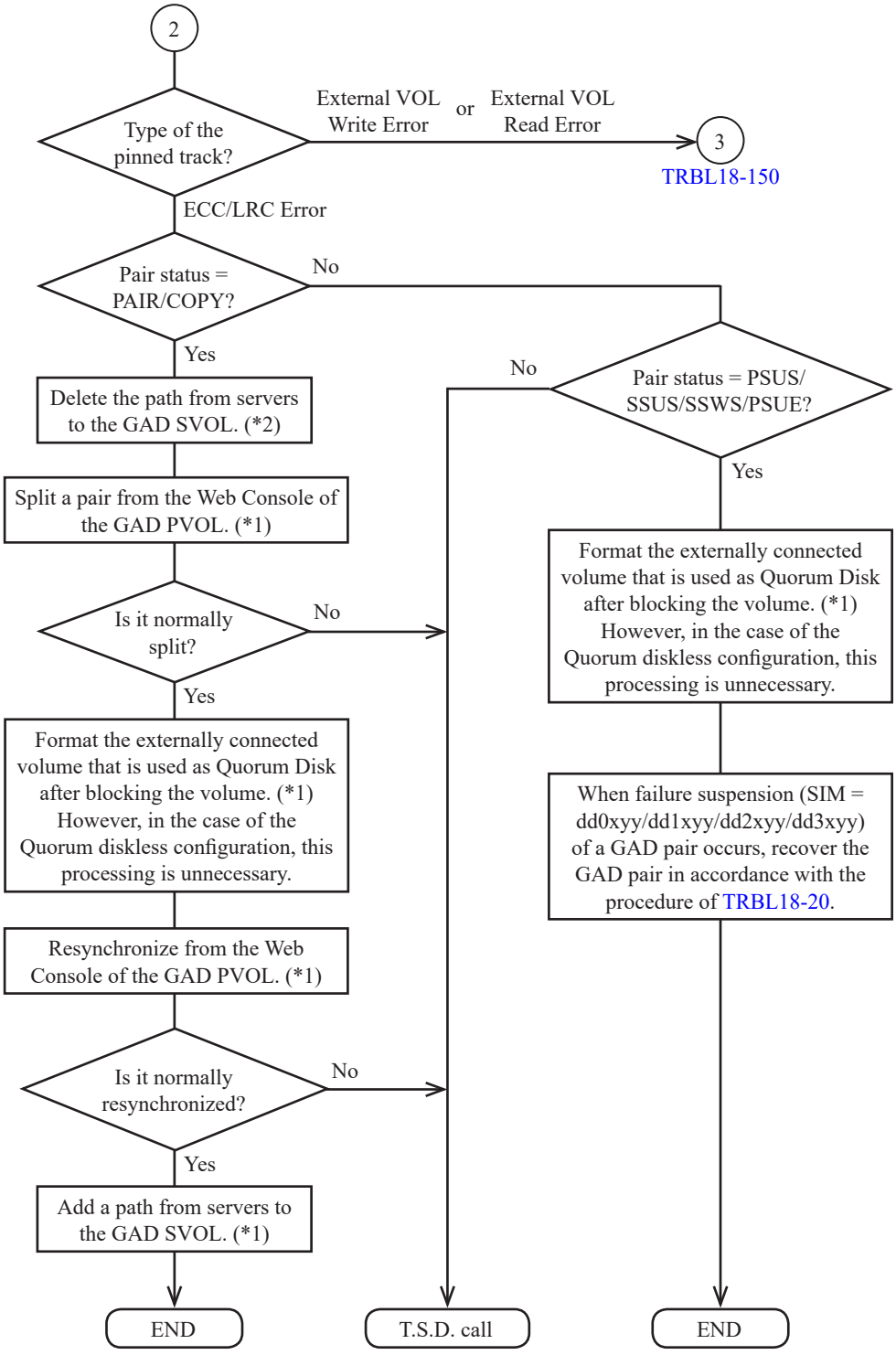
*2: In the recovery from a pinned track, only the LDEV formatting is executed except in the case of Solaris. For Solaris, only the correction of a pinned track by means of the analyze command is executed. Data is recovered by resetting a GAD volume pair.
However, the LDEV formatting or the analyze command 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.



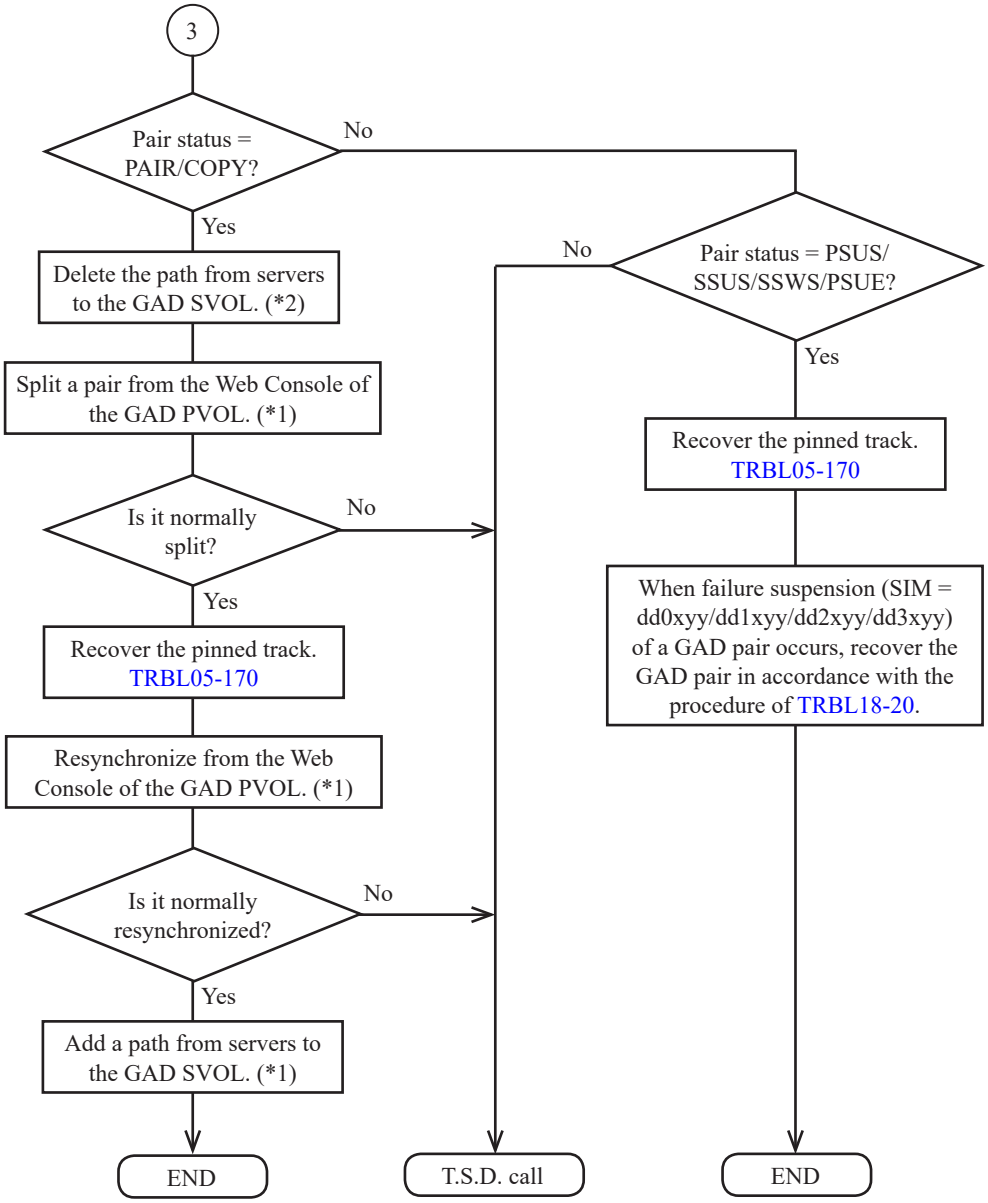
*1: Ask the customer to perform operation.

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*1: Ask the customer to perform operation.

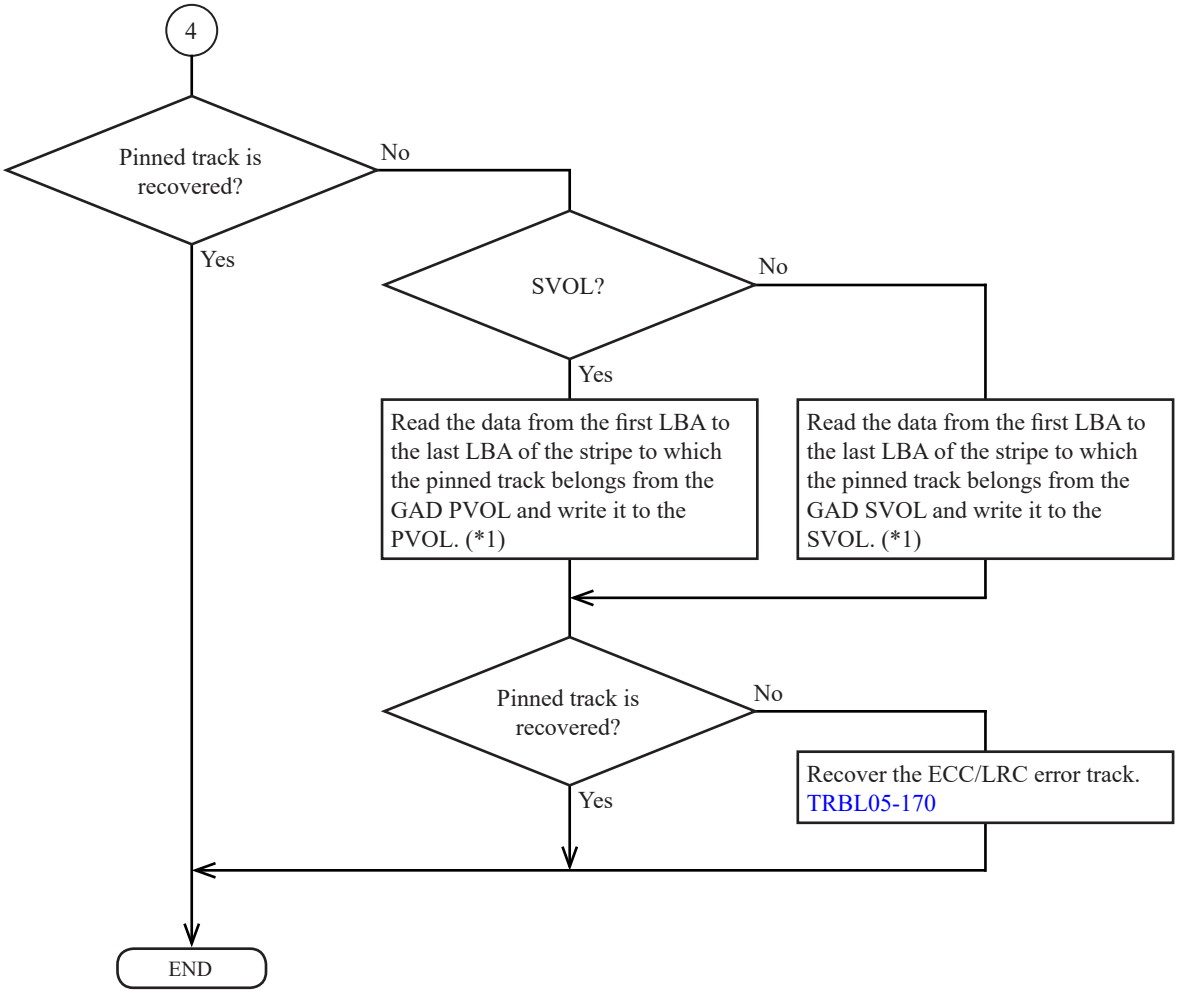
*2: Ask the customer to perform operation. When the path cannot be deleted, perform the next step.



*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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*1: Refer to recover the ECC/LRC error track. TRBL05-170

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How to check pair status and I/O mode of GAD pair

1. For Web Console
   Expand the Storage Systems tree, click [Replication]-[Remote Replication], and then select the [GAD Pairs] tab.
   In the displayed list of GAD pairs, see [Status] to check the pair status, and [I/O Mode] in the [Local Storage System] table to check the I/O mode.

2. For RAID Manager
   Execute the pairdisplay command. The following is a command example:
   `pairdisplay -g oraHA -fcxe -IH1`
   "oraHA" indicates the group name defined in the configuration definition file, and "-IH1" indicates the instance number 1.
   In the execution result, the "Status" column shows the pair status, and the "R/W" column shows the I/O mode.

3. I/O mode terms displayed in Web Console and RAID Manager
   The following table lists the I/O mode terms described in this procedure and those displayed in the Web Console and the RAID Manager.

Term in this procedure	Term in Web Console	Term in RAID Manager
Mirror	Mirror (Read Local)	L/M
Local	Local	L/L
Block	Block	B/B

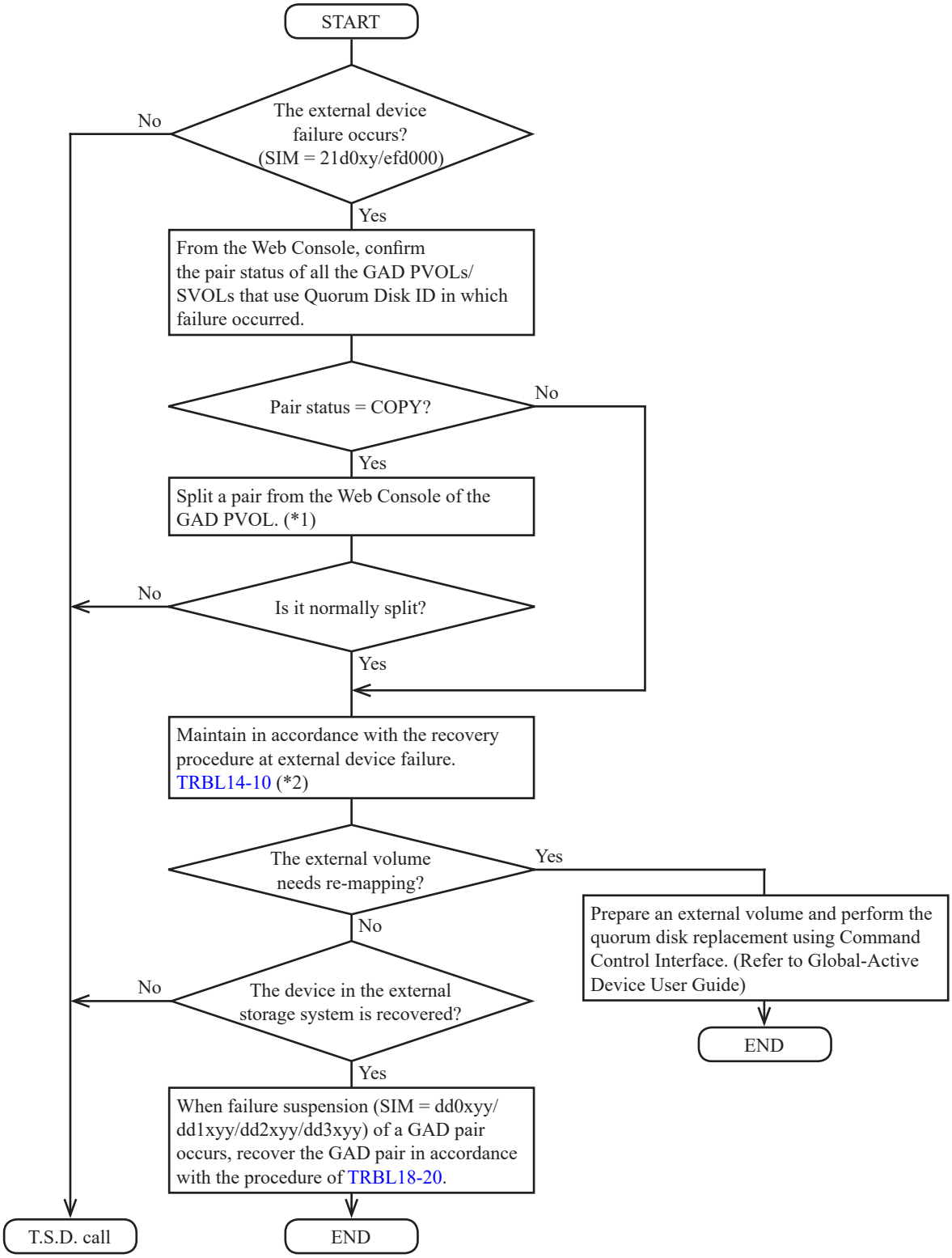
Dump collection in this recovery procedure

Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump.
For the procedure, see (SVP02-09-10).
When performing Auto Dump, specify "Normal" for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify "Monitor" for the dump type.

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18.1.5 Recovery Procedure at Quorum Disk Failure (SIM = def0xx)

NOTE:
- In the following procedure, ask SE or the customer to check the pair status and I/O mode of the GAD pair. For the procedure, see "How to check pair status and I/O mode of GAD pair".
- If you contact the Technical Support Division in the following procedure, see "Dump collection in this recovery procedure" to collect dumps.



*1: Ask the customer to perform operation.

*2: When the recovery procedure at external device failure TRBL14-10 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. However, 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).

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How to check pair status and I/O mode of GAD pair

1. For Web Console
   Expand the Storage Systems tree, click [Replication]-[Remote Replication], and then select the [GAD Pairs] tab.
   In the displayed list of GAD pairs, see [Status] to check the pair status, and [I/O Mode] in the [Local Storage System] table to check the I/O mode.

2. For RAID Manager
   Execute the pairdisplay command. The following is a command example:
   `pairdisplay -g oraHA -fcxe -IH1`
   "oraHA" indicates the group name defined in the configuration definition file, and "-IH1" indicates the instance number 1.
   In the execution result, the "Status" column shows the pair status, and the "R/W" column shows the I/O mode.

3. I/O mode terms displayed in Web Console and RAID Manager
   The following table lists the I/O mode terms described in this procedure and those displayed in the Web Console and the RAID Manager.

Term in this procedure	Term in Web Console	Term in RAID Manager
Mirror	Mirror (Read Local)	L/M
Local	Local	L/L
Block	Block	B/B

Dump collection in this recovery procedure

Before contacting the Technical Support Division, collect dumps from both MCU and RCU by performing Auto Dump.
For the procedure, see (SVP02-09-10).
When performing Auto Dump, specify "Normal" for the dump type.
However, if the performance of the storage system is deteriorated when the error occurs, specify "Monitor" for the dump type.

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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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(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”. 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 Bidirectional.	Change the channel type of the MCU port to Bidirectional.
	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 Bidirectional.	Change the channel type of the RCU port to Bidirectional.
“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)].

■ 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.

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 CCI 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"	TRBL18-270
2	"2. Pool Volumes"	TRBL18-300
3	"3. Journal Volumes"	TRBL18-320
4	"5. LDEV (LDEV Blockade)"	TRBL18-360
5	"6. Storage system"	TRBL18-380

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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)	

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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))	• Edit Advanced System Setting No.15 = ON, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within a minute after a communication break is detected, the UR pair will be suspended by error. • Edit Advanced System Setting No.15 = OFF, and Edit Advanced System Setting No.16 = ON: If the path is not recovered within the path watch time after a communication break is detected, the UR pair will be suspended by error. 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 CCI, 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)	

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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 CCI, 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)	

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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 CCI, 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 CCI, 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)**	When the recovery by the LDEV format is necessary: 1. UR pair deletion. 2. UR delta resync pair deletion. 3. GAD pair deletion. (SVOL side first) 4. Failure recovery site. 5. GAD pair creation. (SVOL side first) 6. Exchange PVOL for SVOL in the GAD pair as required. 7. UR delta resync pair creation. 8. UR pair creation. (*1) When the recovery by the LDEV format is not necessary: 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)**	When the recovery by the LDEV format is necessary: 1. UR pair deletion. 2. UR delta resync pair deletion. 3. GAD pair deletion. 4. Failure recovery site. 5. GAD pair creation. 6. UR delta resync pair creation. 7. UR pair creation. (*1) When the recovery by the LDEV format is not necessary: 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)	

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No.	Item	Mirror ID	Pair Status				Recovery operation
3	RVOL failure	0	PVOL (GAD PVOL)	PAIR (Mirror (RL))	LVOL (GAD SVOL)	PAIR (Mirror (RL))	When the recovery by the LDEV format is necessary: 1. UR pair deletion. 2. UR delta resync pair deletion. 3. Failure recovery site. 4. UR delta resync pair creation. 5. UR pair creation. (*1) When the recovery by the LDEV format is not necessary: 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)	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 CCI, 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 CCI, 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 the Edit Advanced System Setting No.16 is set to ON in PDKC, UR pair status PSUE, LVOL of UR delta pair state changes to HOLDING.

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.

(To be continued)

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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 CCI, 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"	TRBL18-420
2	"2. Planned Shutdown Procedure of the LDKC"	TRBL18-450
3	"3. Planned Shutdown Procedure of the RDKC"	TRBL18-480
4	"4. Planned Shutdown Procedure of External Storage (when host I/O continues to the PDKC)"	TRBL18-500
5	"5. Planned Shutdown Procedure of External Storage (when host I/O continues to the LDKC)"	TRBL18-540

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

(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.)
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 CCI, 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 “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**	

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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 CCI, 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	

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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)

NOTE: For the configuration (*) where volumes are not set as quorum disks, skip the steps related to GAD or quorum disks when performing the planned shutdown of the external storage because the external storage for quorum disks is not used.
If none of the volumes is set as a quorum disk, perform only PS OFF/ON of the external storage.

*: Execute the [raidcom get quorum] command with Command Control Interface to check the configuration. (For details, see Command Control Interface Command Reference.)

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**	

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
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)
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.	

(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.)
8	Reconnection of Quorum disk	Reconnect Quorum disk (external volume) in the PDKC and RDKC. ↓ Reconnection of Quorum disk PDKC [PS ON] GAD PVOL: **PSUS** (Local) UR PVOL: **PAIR** ↓ Reconnection 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 reconnection % raidcom check_ ext_storage external_ grp -ldev_id <quorum ldev#> -IH0 (or -IH1)
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.	

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
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)	
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 CCI, 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)

NOTE: For the configuration (*) where volumes are not set as quorum disks, skip the steps related to GAD or quorum disks when performing the planned shutdown of the external storage because the external storage for quorum disks is not used.
If none of the volumes is set as a quorum disk, perform only PS OFF/ON of the external storage.

*: Execute the [raidcom get quorum] command with Command Control Interface to check the configuration. (For details, see Command Control Interface Command Reference.)

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

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No.	Procedure item	Description (Underlining means a part that changes from the previous status.)	Note (RM command, etc.)
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)
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.	

(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.)
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)
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.	

(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.)
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)	
14	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.

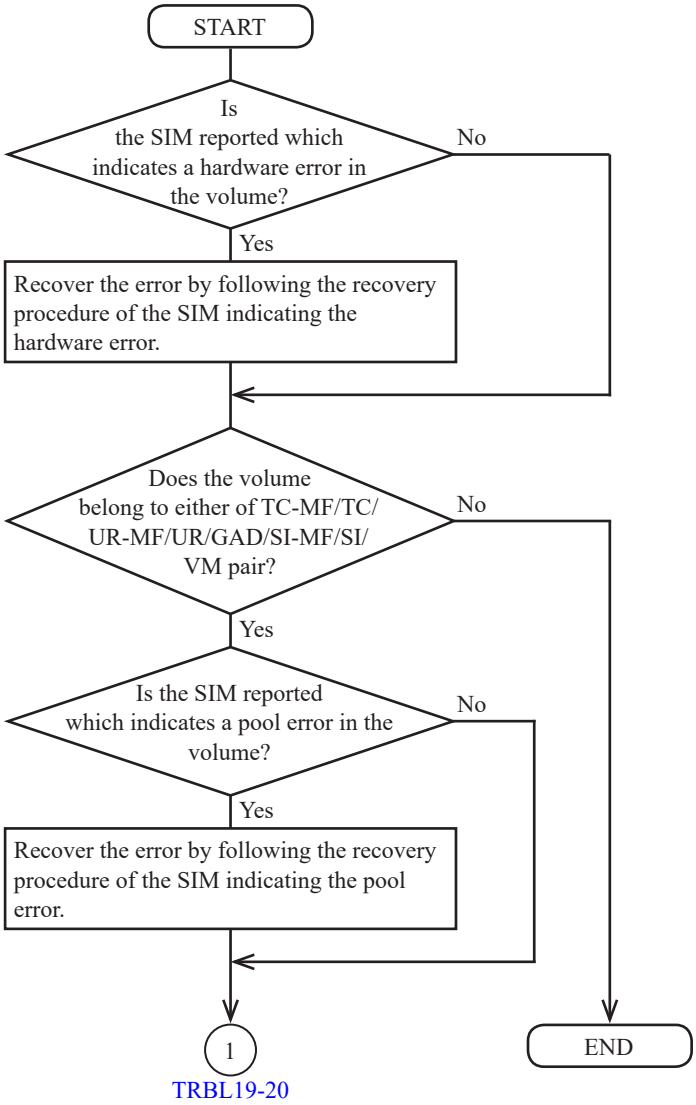
1. Continue to issue I/O for about two minutes from the server to the primary volume or secondary of the GAD pair.
2. Check the pair status.
   - To check the pair status from CCI, confirm that the primary volume status of the UR delta resync pair changes from "PSUE" to "PSUS". At the same time, confirm 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 "Global-Active Device User Guide".

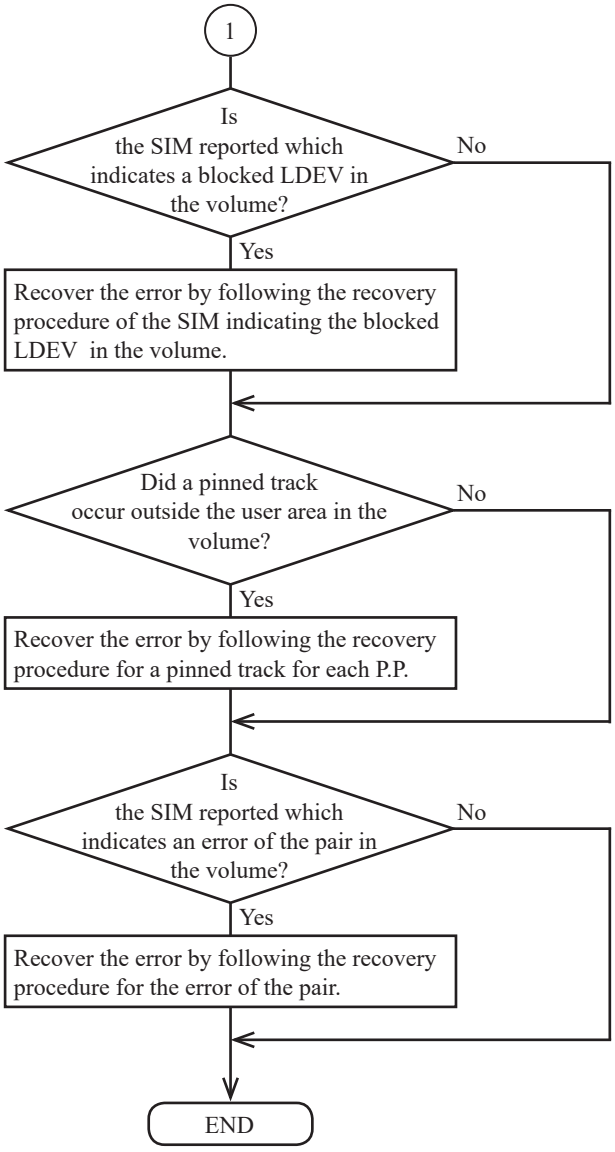
19. Recovery from Differential area error

19.1 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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20. (Blank)

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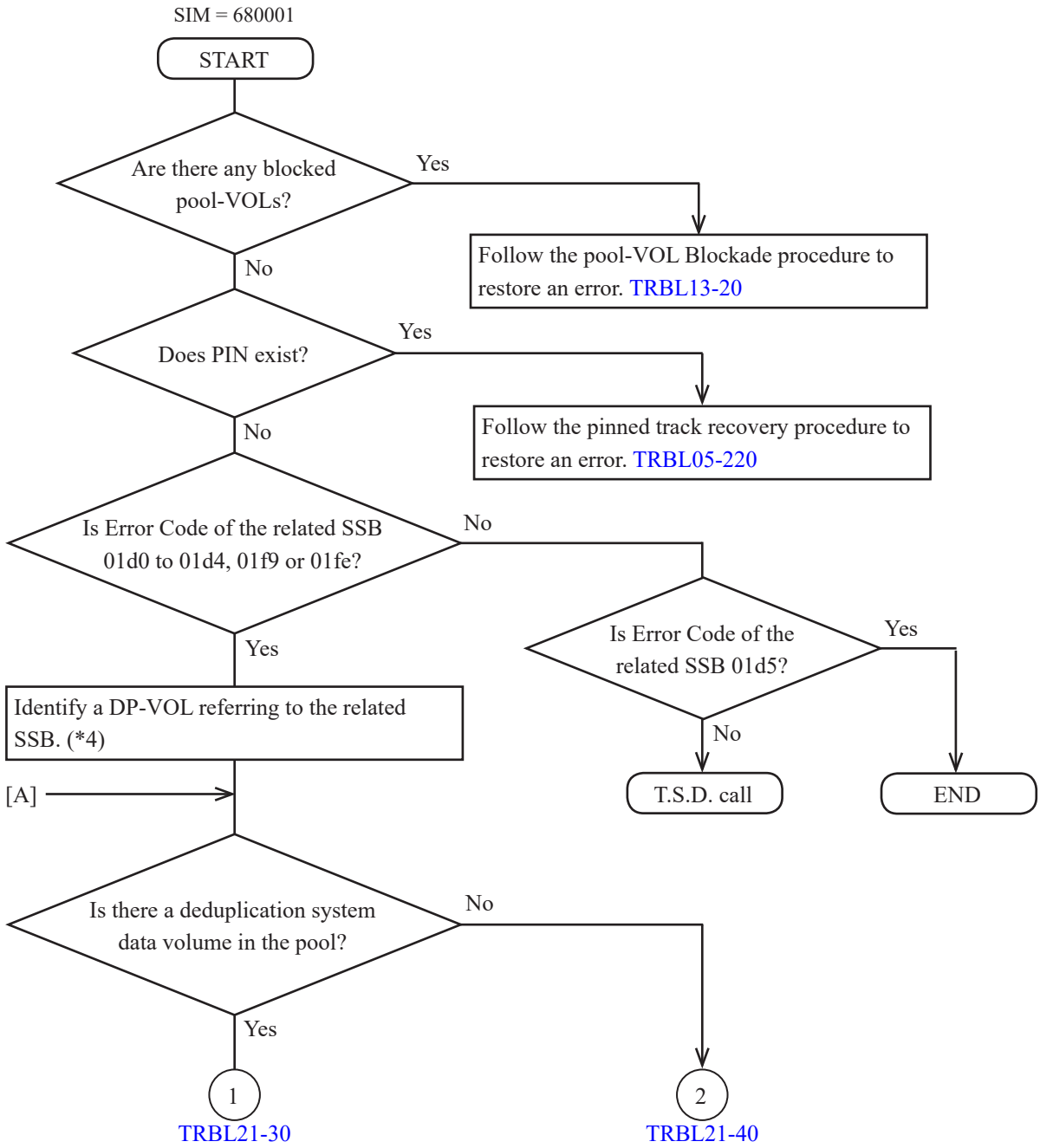
21. dedupe and compression Error Recovery

21.1 Recovery Procedure for dedupe and compression Operation Error (SIM = 680001)

NOTICE: When the following conditions 1 and 2 are met, perform "13.1 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.

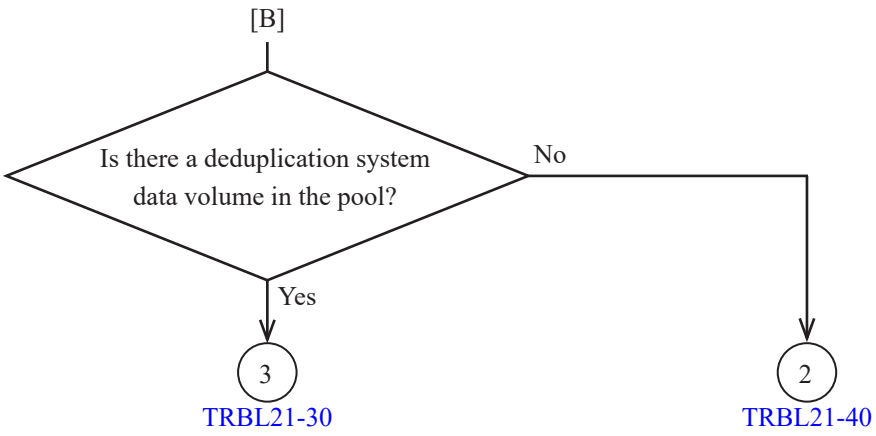
1. Error Code of the related SSB is 01d6.
2. Operations which cannot ensure data consistency (for example, format) have been performed for the volumes of external storage used as pool-VOLs.

The following describes a procedure for restoring a dedupe and compression operation error.

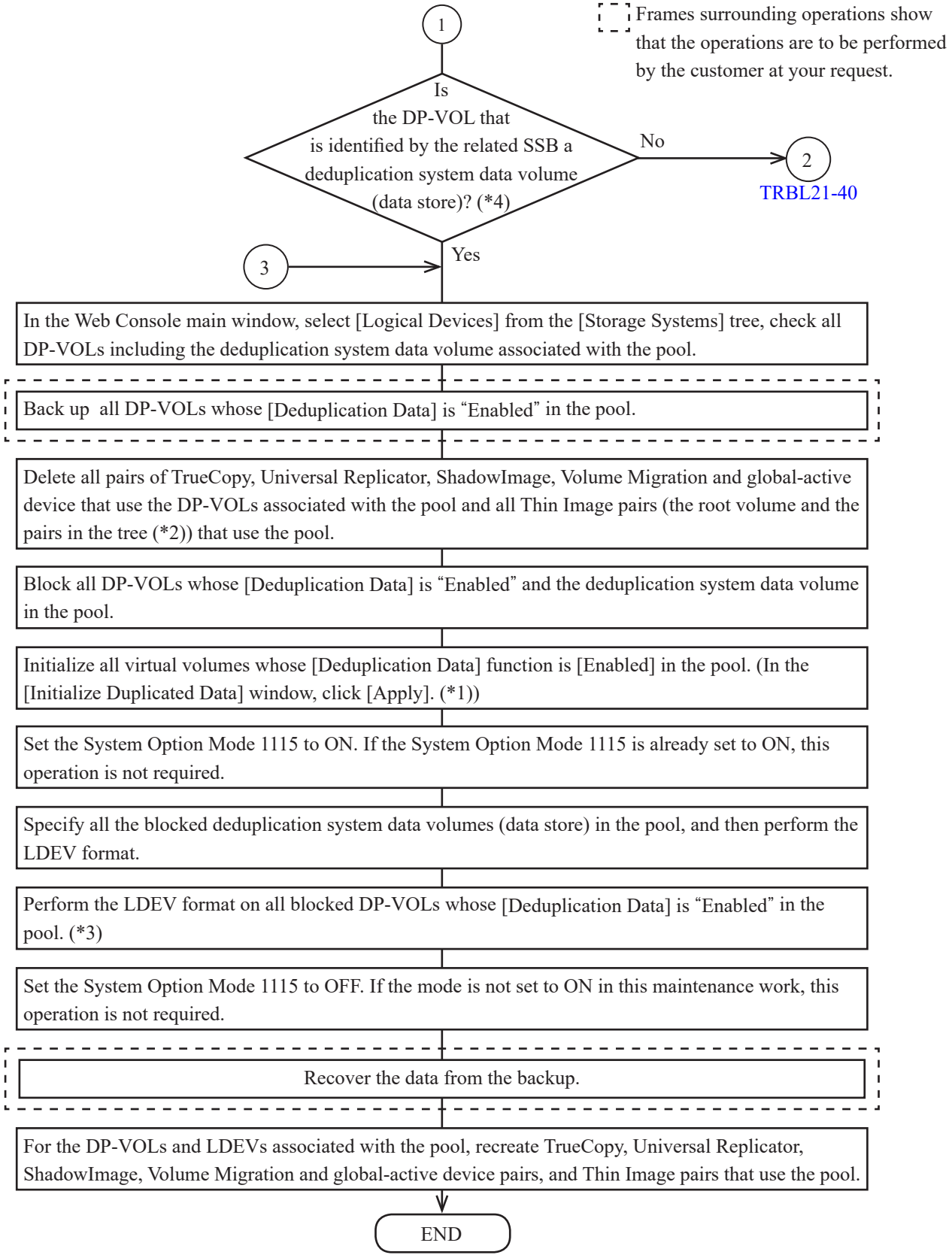


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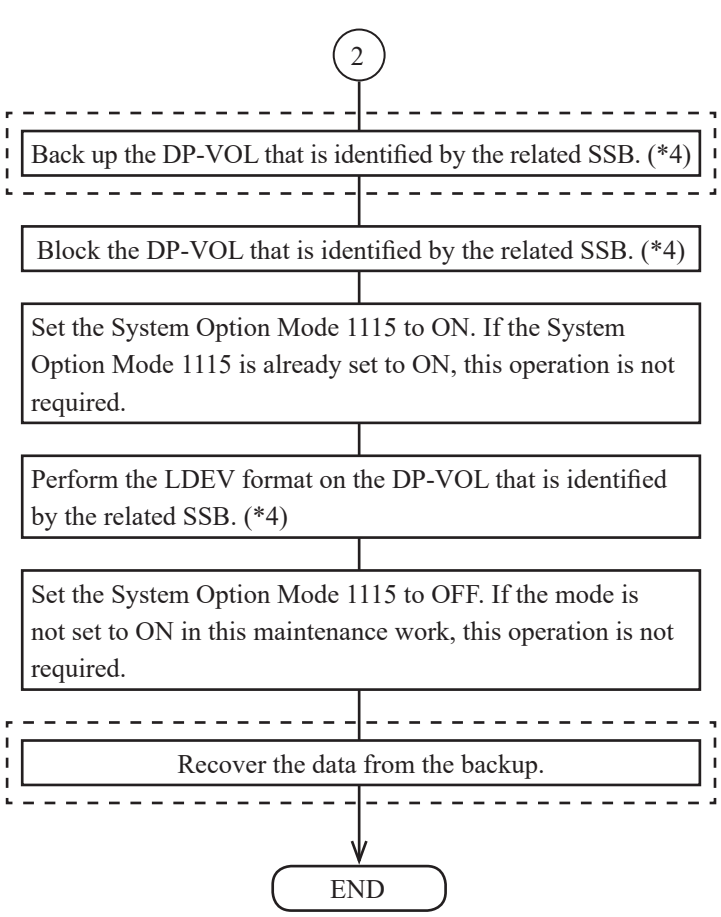
[B] is the flowchart for SVP SECTION “Restoring Configuration Information”.



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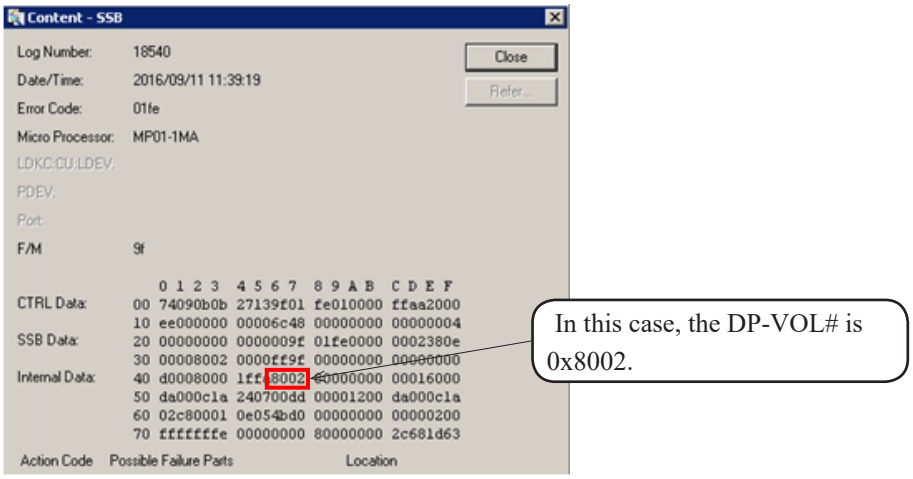
Frames surrounding operations show that the operations are to be performed by the customer at your request.

*1: For Command Control Interface, use the [raidcom initialize pool] command.

*2: 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.

*3: Do not perform the procedure for LDEV recovery.

*4: For a DP-VOL#, refer to SSB: 01d0 to 01d4, 01f9 or 01fe (byte 0x46 to 0x47).

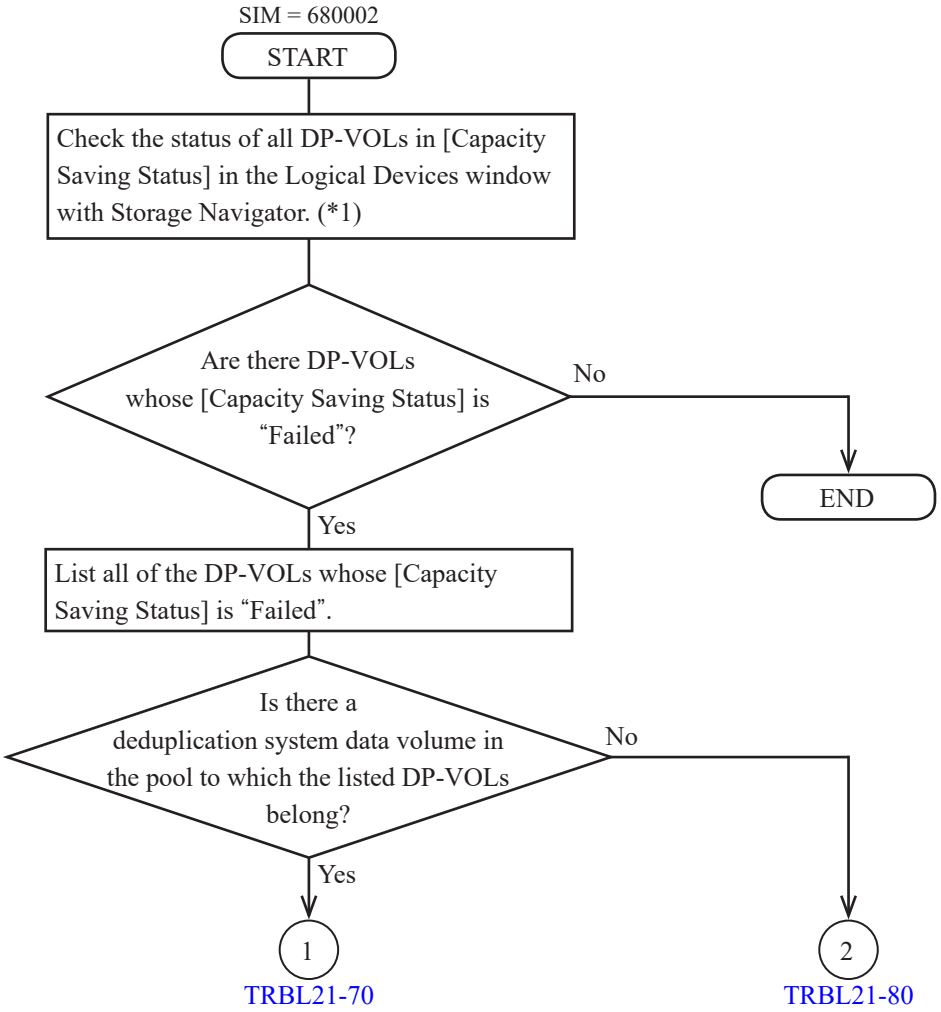


However, when you back up the DP-VOL, block it, and perform the LDEV format on it in the post procedure of “Perform the restoration of Configuration Information” (SVP02-11-30), the related SSB is not displayed. So, back up all DP-VOLs for which [Capacity Saving] is set to “Compression” in the pool, block them, and perform the LDEV format on them.

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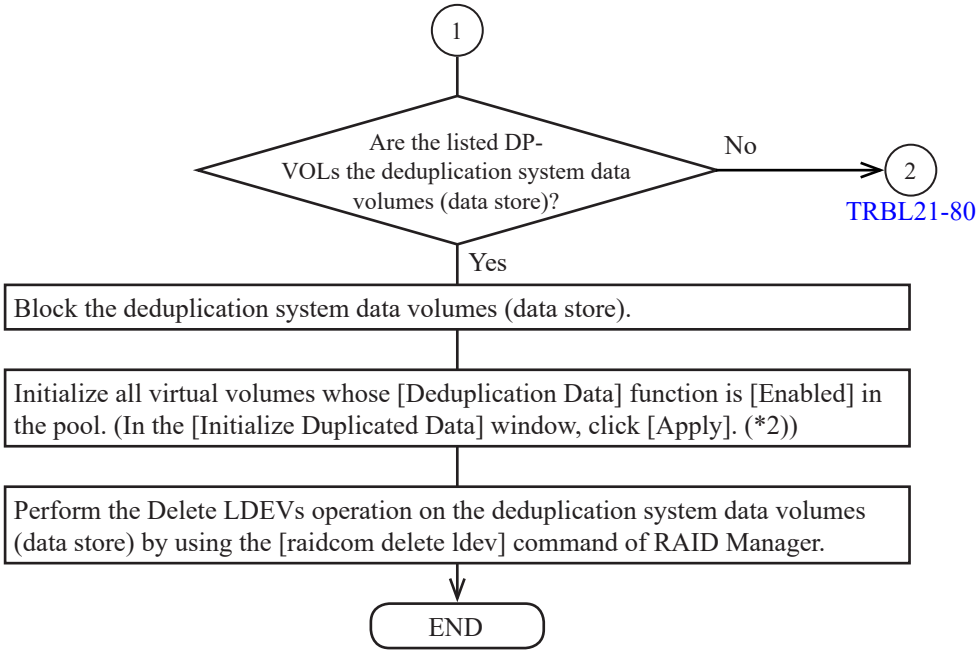
21.2 Recovery Procedure for Operation Error in Deleting Capacity-Saving-Enabled DP-VOLs (without blocking/formatting) (SIM = 680002)

The following is the recovery procedure when SIM “680002” is output.

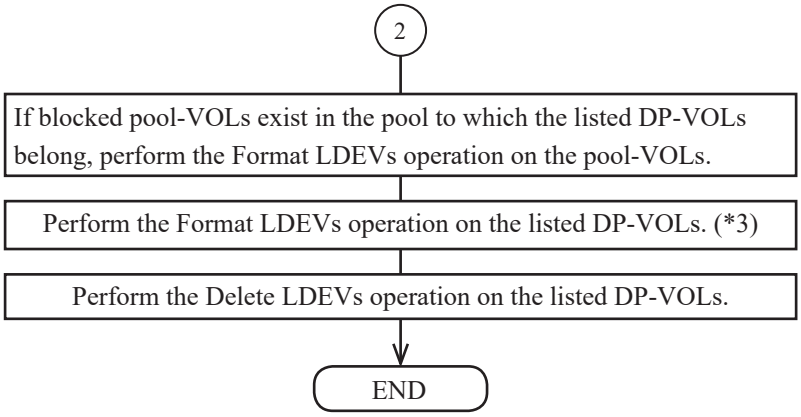


*1: This item does not appear in the default state. To display the item, change the setting in the Column Settings window. For details about the Column Settings window, see “System Administrator Guide”

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*2: For Command Control Interface, use the [raidcom initialize pool] command.

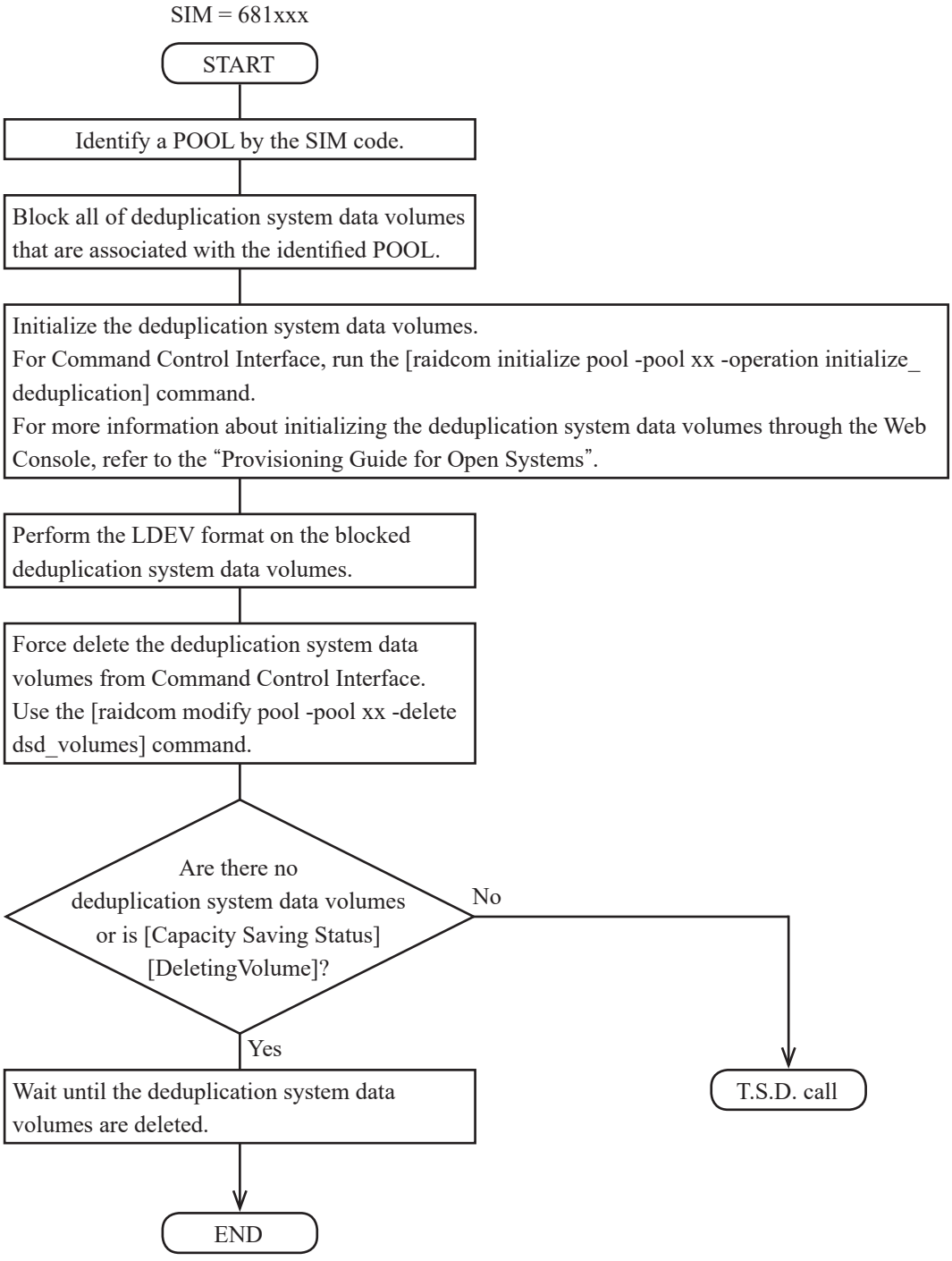


*3: Do not perform the procedure for LDEV recovery.

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21.3 Recovery Procedure when Operation Error of Deduplication System Data Volume Automatic Deletion is Detected (SIM = 681xxx)

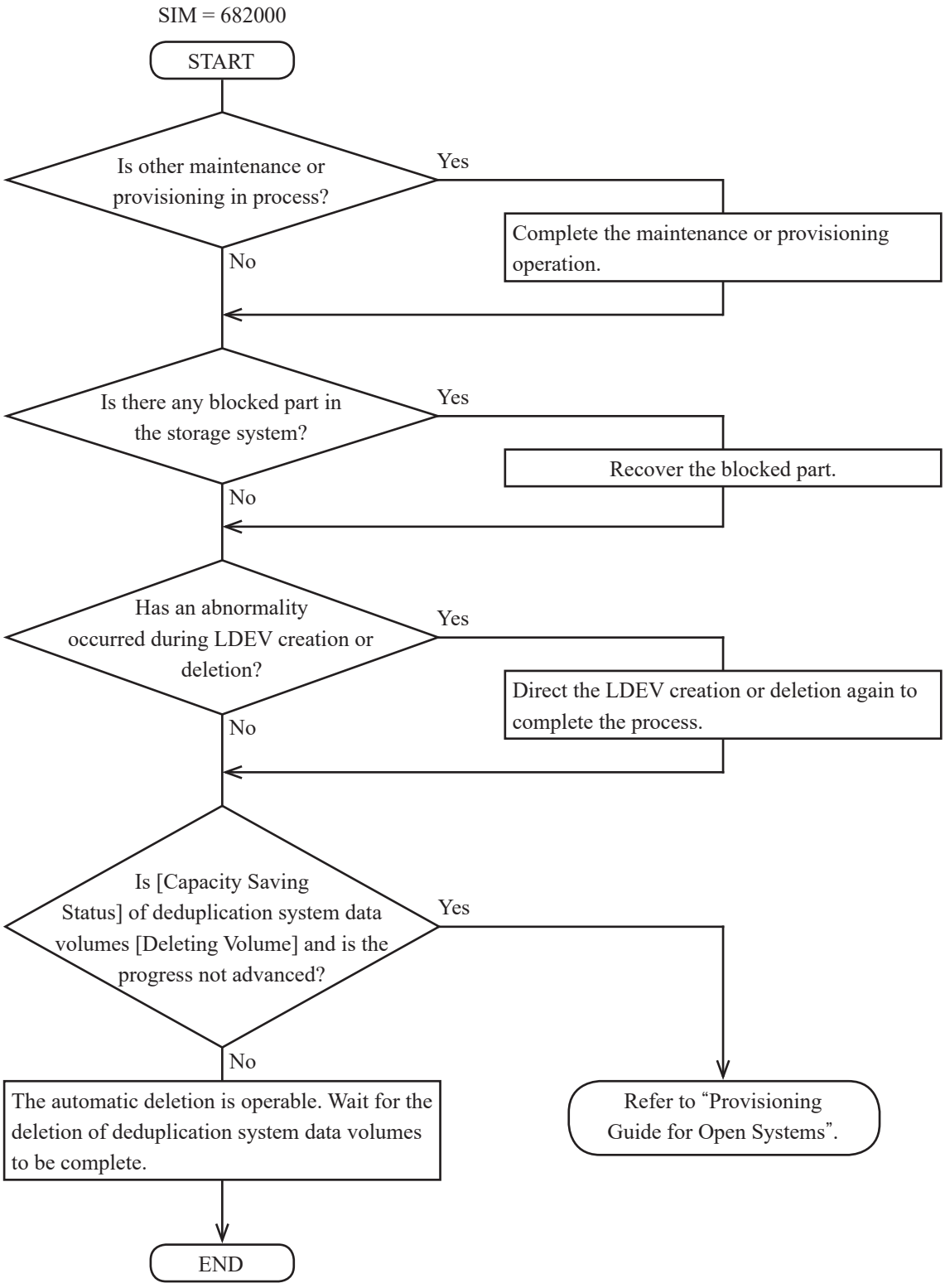
The following is the recovery procedure when SIM “681xxx” is output.



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21.4 Recovery Procedure when Deduplication System Data Volumes are Suspended (SIM = 682000)

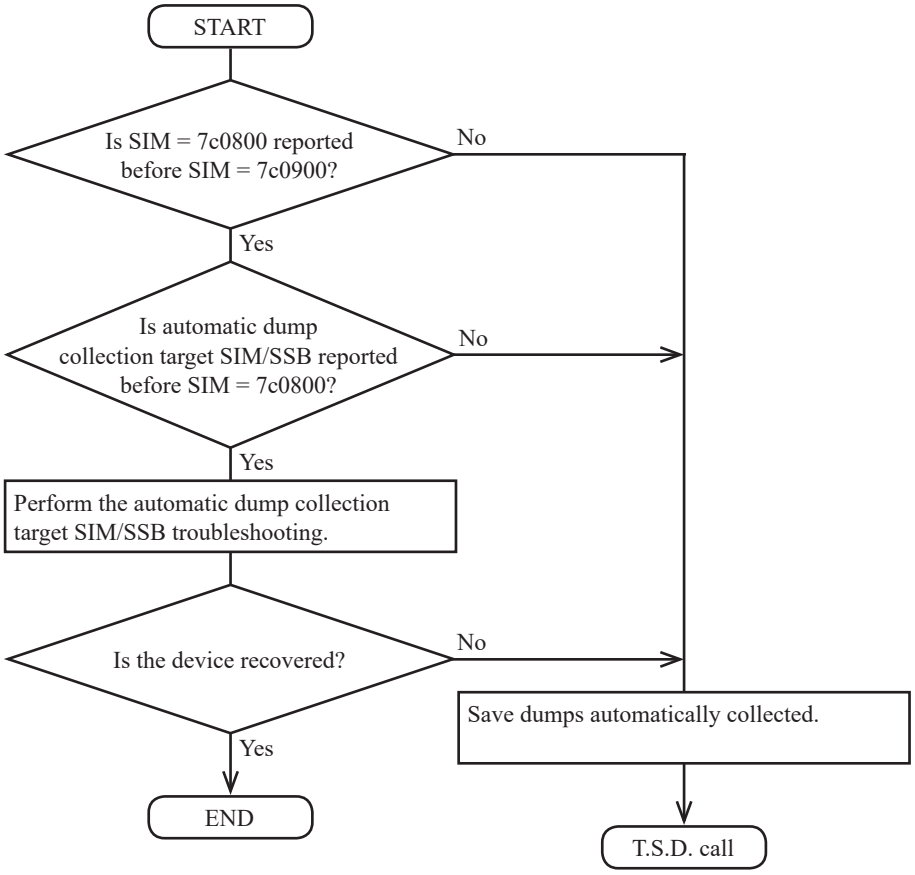
SIM “682000” is output to indicate that the deduplication system data volume automatic deletion cannot operate in the storage system.
The deduplication system data volume automatic deletion is resumed by performing the following procedure.



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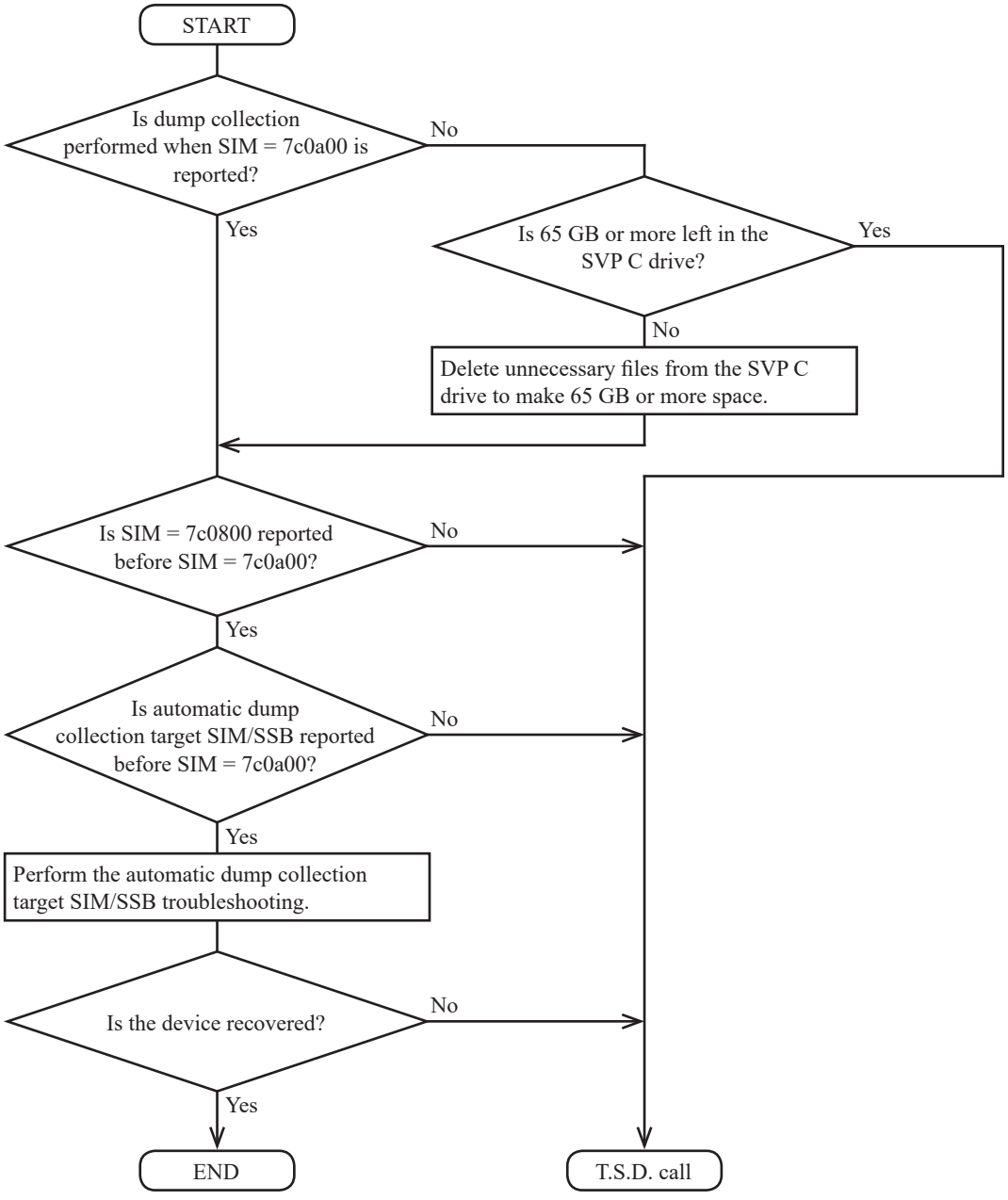
22. Troubleshooting when performing dump collection

22.1 Procedure when dump collection is normally completed (SIM = 7c0900)



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22.2 Procedure when dump collection is abnormally terminated (SIM = 7c0a00)



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23. Dump Collection Troubleshooting

1. How to deal with a trouble in dump collection

No.	Trouble	Action
1	The “Dump of the following processors could not be done.” dialog is displayed.	Refer to “Dump/Auto Dump” (SVP02-09-10) (b) “When an error occurs“ (SVP02-09-90).
2	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.
3	GUM dump is not stored.	GUM Warning might occur, or GUM might be down. reboot GUM and try dump collection again.

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, and SVP 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.

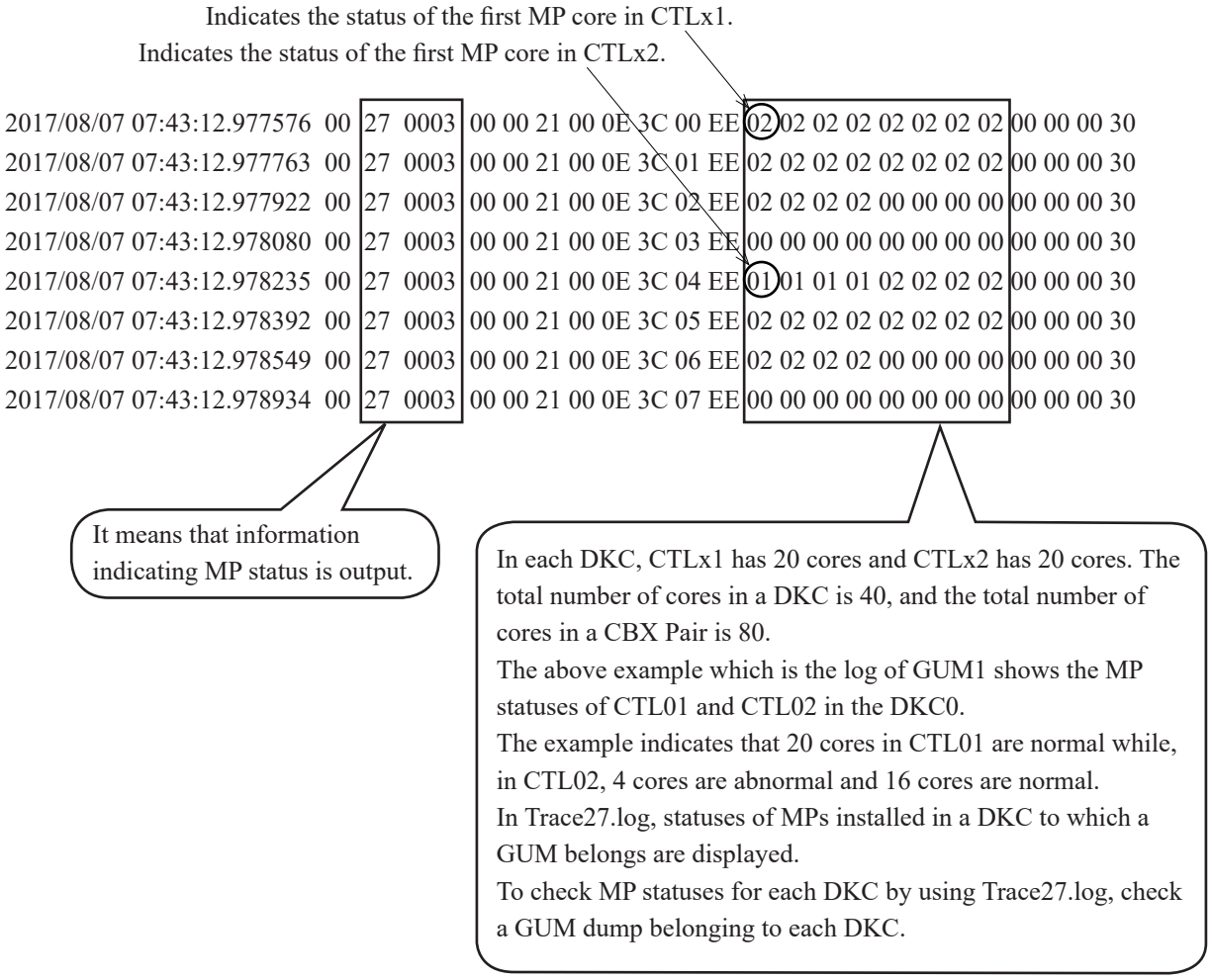
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3. How to check MP operating condition

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.



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4. Checking the heartbeat status of MP

   \gum1\tmp\hitachi\gumdump\var\log\hitachi\Trace23.log.txt

5. 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.

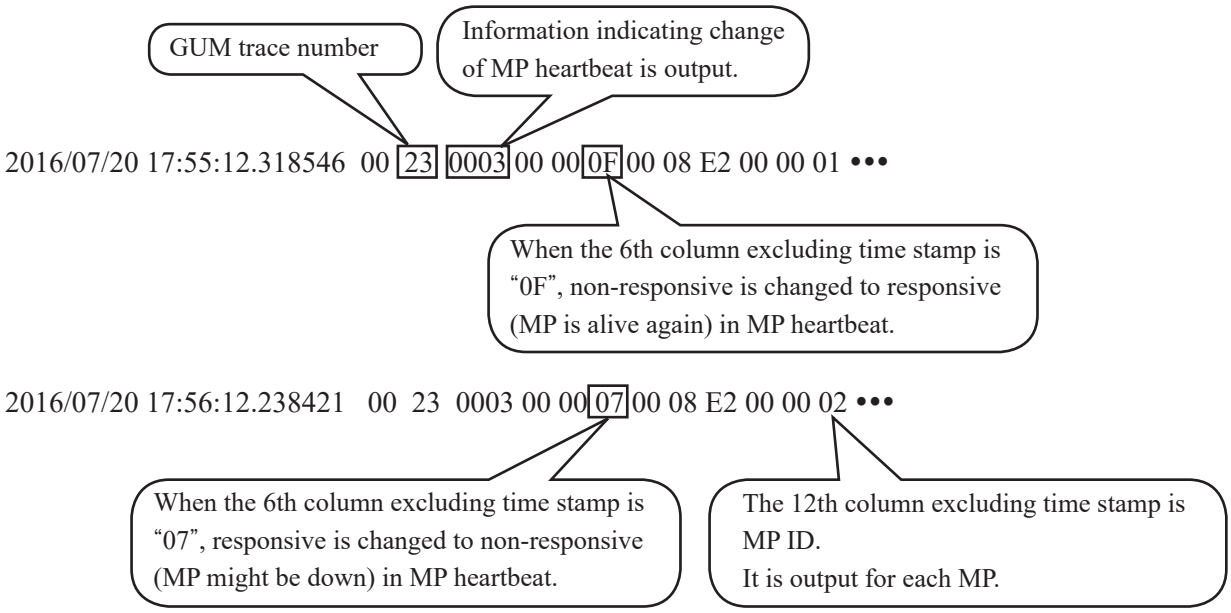
   The trace is output when response from MP is changed from the non-responsive status to the responsive status and when it is changed from the responsive status to the non-responsive status.

   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.



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6. Collecting dump files manually

   If the dump file collection by Auto Dump fails, collect the files shown in the list of files to be collected manually.

   List of files to be collected manually
   - c:\dkc200\svp_env\rmiserver\log*.log
   - c:\dkc200\svp_env\dkcman\cnf*.*
   - c:\dkc200\svp_env\dkcman\log*.*
   - c:\dkc200\svp_env\comweb\logs*.*
   - c:\dkc200\svp_env\sdlist\log*.*
   - c:\dkc200\svp_env\initstup\log*.*
   - c:\dkc200\svp_env\microsetup\log*.*
   - c:\dkc200\svp_env\rmiserver\cnf*.properties
   - c:\dkc200\svp_env\supervisor.properties
   - c:\dkc200\svp_env\mpc.ini
   - c:\dkc200\svp_env\secruise\log\secruise.log
   - c:\dkc200\svp_env\secruise\log\secruise.trc
   - c:\dkc200\svp_env\mappiniset\logs\mappiniset*.*
   - c:\dkc200\svp_env\mappiniset\mpexauth\data
   - c:\dkc200\svp_env\mappiniset\mpprt\cnf
   - c:\svp\oss\apache\logs*.*
   - c:\svp\oss\jetty\logs*.*
   - c:\svp\oss\apache\oss_version.inf
   - c:\svp\oss\apache\conf\httpd.conf
   - c:\svp\oss\apache\conf\httpd-proxy.conf
   - c:\svp\oss\apache\conf\extra\httpd-ssl.conf
   - c:\svp\oss\apache\conf\extra\httpd-gum-proxy.conf
   - c:\svp\oss\java\oss_version.inf
   - c:\svp\oss\java\logs*.*
   - c:\svp\oss\java_libs\oss_version.inf
   - c:\svp\oss\flash\flash_install.log
   - c:\svp\oss\jetty\oss_version.inf
   - c:\svp\oss\openssl\oss_version.inf
   - c:\svp\oss\perl\oss_version.inf
   - c:\svp\oss\Version.txt
   - c:\svp\oss\OSS_Version.txt

(To be continued)

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(Continued from the preceding page)

- c:\dkc200\svp_env\setup\log*.*
- c:\dkc200\svp_env\Assist\history*.*
- c:\dkc200\svp_env\Assist\cnf*.*
- c:\dkc200\svp_env\Assist\log*.*
- c:\dkc200\svp_env\Assist\data*.*
- c:\dkc200\svp_env\portmanager\logs\PortManager*.*
- c:\dkc200\svp_env\portmanager\cnf*.properties
- c:\dkc200\svp_env\mappiniset\mpprt\cnf*.properties
- c:\dkc200\svp_env\system\log*.*
- c:\dkc200\svp_env\restapi\data
- c:\dkc200\svp_env\restapi\logs
- c:\dkc200\svp_env\restapi\build.json
- c:\dkc200\svp_env\restapi\version.json
- c:\dkc200\svp_env\comweb\inf*.*
- c:\dkc200\svp_env\MappIniSet\MpSsl*.*
- c:\dkc200\svp_env\nasbackup\log*.*
- c:\dkc200\svp_env\RMAPI\log*.*
- c:\dkc200\svp_env\comweb\san\cnf*.*
- c:\restapi\data
- c:\restapi\logs
- c:\restapi\build.json
- c:\restapi\version.json
- C:\Program Files\Apache Group\Apache2\logs*.log
- C:\Program Files\Apache Group\Apache2\logs\ssl*.log
- c:\DKC200\config*.cfg
- c:\DKC200\mp\pc*.dbg
- c:\DKC200\mp\pc*.dmb
- c:\DKC200\mp\pc*.dmp
- c:\DKC200\mp\pc*.inf
- c:\DKC200\mp\pc*.ini
- c:\DKC200\mp\pc*.trc
- c:\DKC200\others\commdata*.*
- c:\DKC200\san\cgi-bin\utility\log*.*
- c:\DKC200\san\SN2\SN2\logs*.*
- c:\DKC200\san\SN2\SN2Files\logs*.*

(To be continued)

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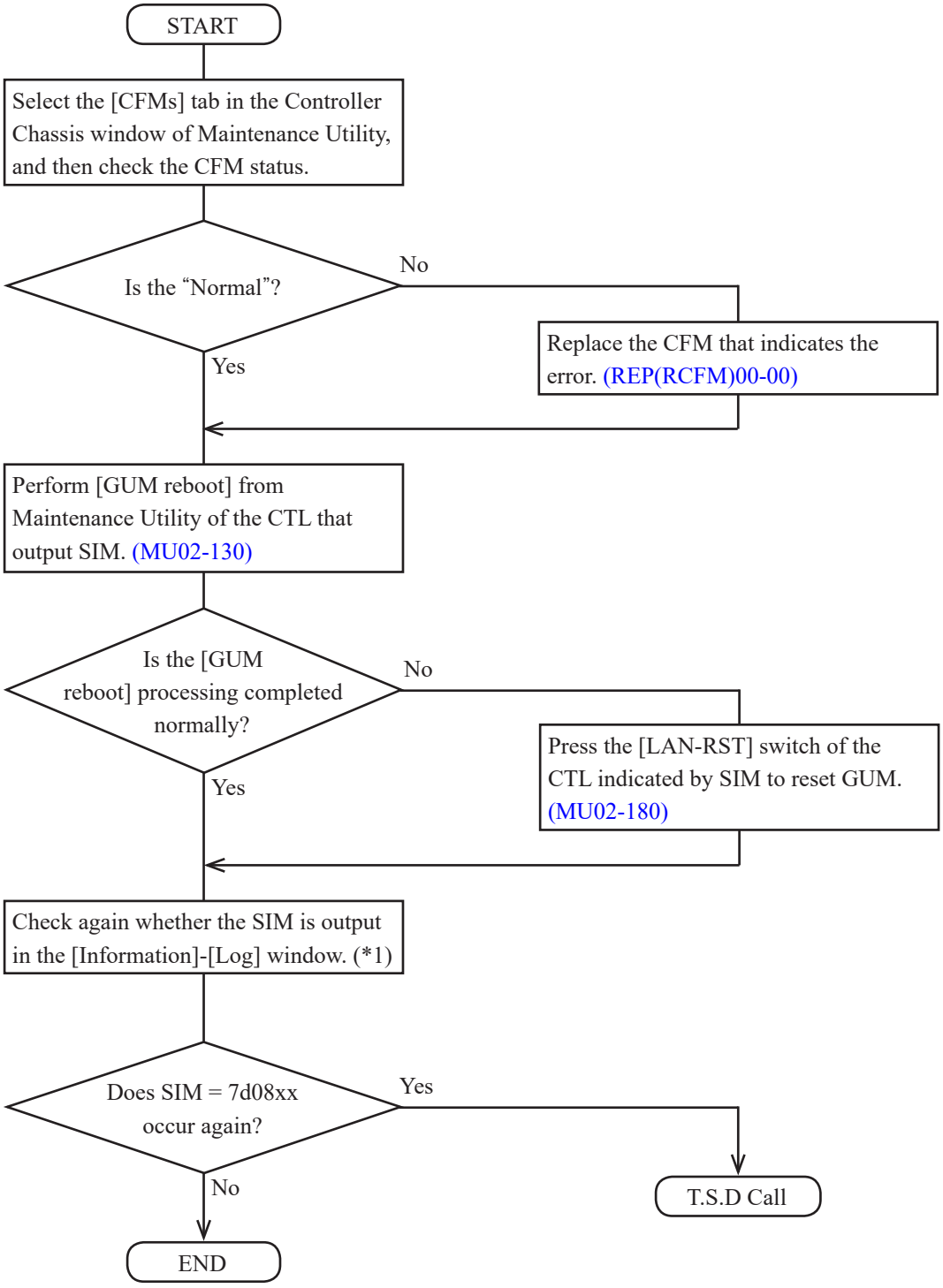
(Continued from the preceding page)

- %USERPROFILE%\AppData\LocalLow\Sun\Java\Deployment\log
- %WINDIR%\system32\config\SysEvent.Evt
- %WINDIR%\system32\config\SecEvent.Evt
- %WINDIR%\system32\config\AppEvent.Evt
- %WINDIR%\minidump*.dmp
- %WINDIR%\System32\Winevt\Logs\Application.evtx
- %WINDIR%\System32\Winevt\Logs\Security.evtx
- %WINDIR%\System32\Winevt\Logs\System.evtx
- %WINDIR%\system32\drivers\etc\HOSTS*
- %WINDIR%\system32\drivers\etc\services*
- c:\SetupTrace*.*

NOTE:
- %USERPROFILE%
  Indicates the folder of the SVP installation login user. (=C:¥Users¥<username>)
- %WINDIR%
  Indicates the Windows folder in the system drive. (=C:¥Windows)
- Some files do not exist depending on the environment. Ignore such files.

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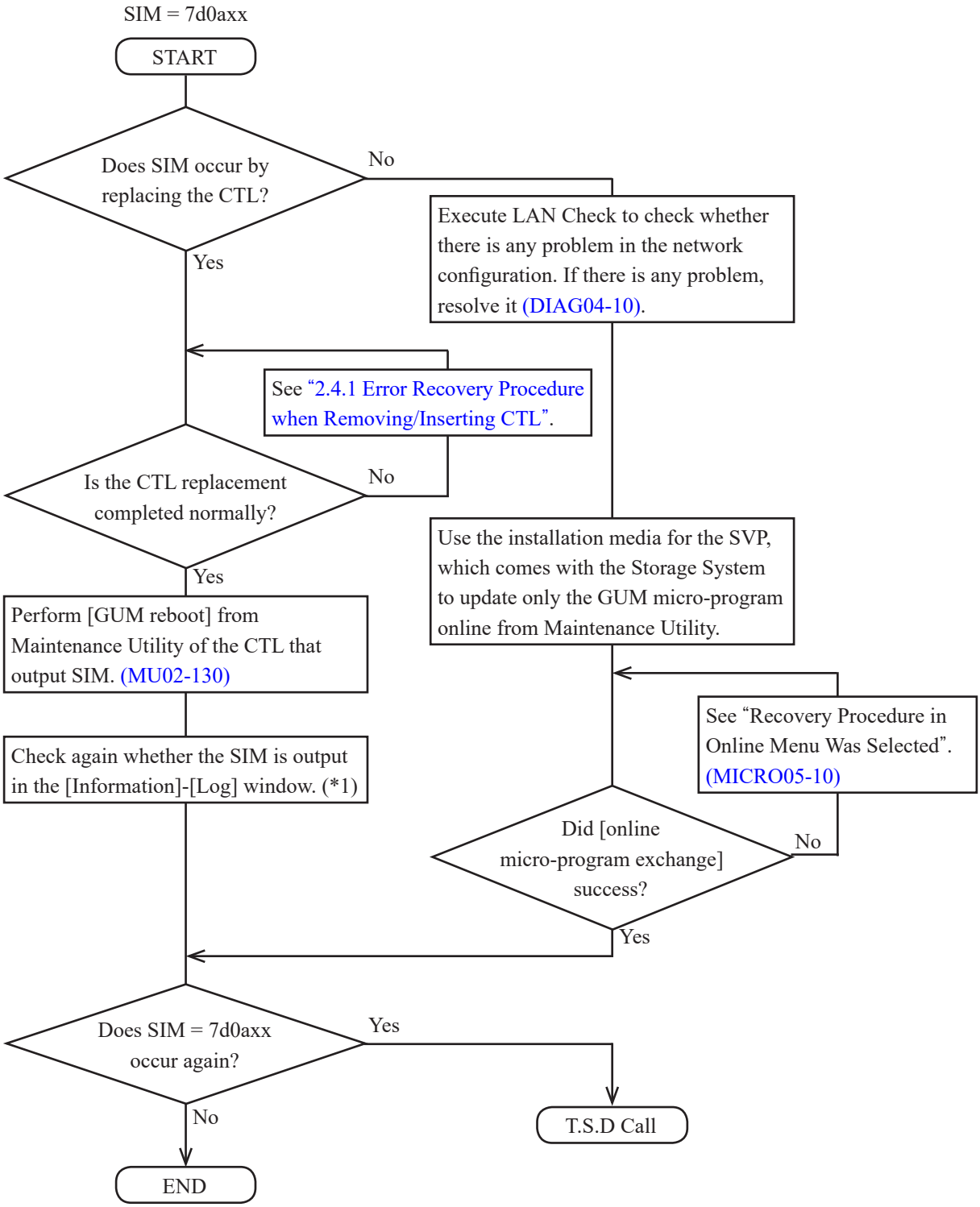
24. Recovery Procedure for GUM Information Recover Failure (SIM = 7d08xx)



*1: Check the SIM after you can open the Maintenance Utility window in which you performed the GUM reboot.
If you cannot open the Maintenance Utility window, wait for one or two minutes, and then try to open it again.
It might take a maximum of 20 minutes to be able to open the Maintenance Utility window.

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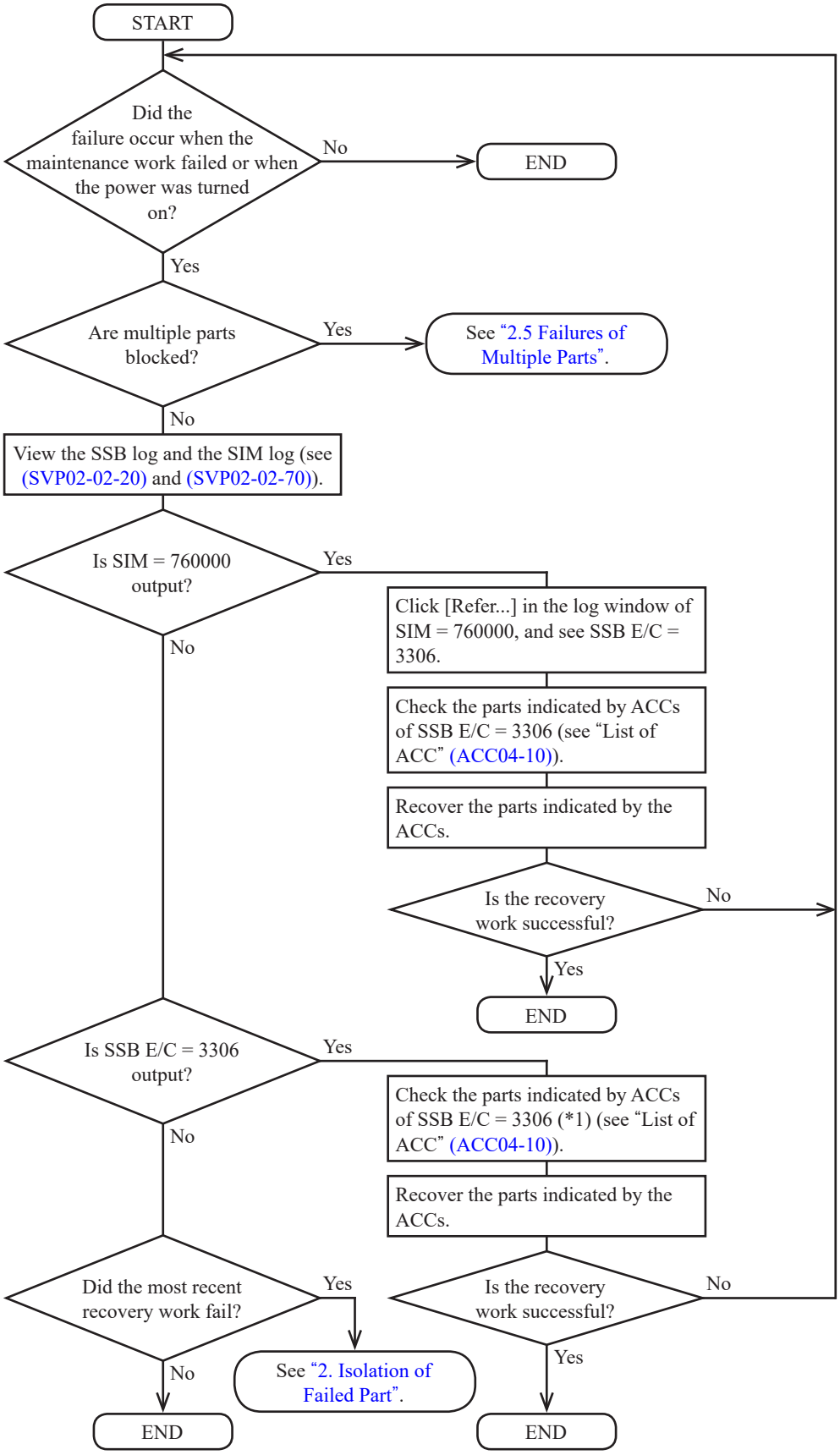
25. Recovery Procedure for GUM Version Warning (SIM = 7d0axx)



*1: Check the SIM after you can open the Maintenance Utility window in which you performed the GUM reboot.
If you cannot open the Maintenance Utility window, wait for one or two minutes, and then try to open it again.
It might take a maximum of 20 minutes to be able to open the Maintenance Utility window.

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26. CUDG Troubleshooting (SIM = 760000, SSB E/C = 3306)



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*1: If multiple SSB E/C = 3306 are output, see the five earliest SSBs among SSB E/C = 3306 output in about the same time.

If any ACC of the SSBs indicates DIMM:

Replace the DIMM. If the problem is not resolved, SSB E/C = 3306 is output again.

If any ACC of the SSBs does not indicate DIMM:

Perform the recovery action for the common part indicated by the largest number of ACCs of the SSBs. If there are multiple common parts, perform the recovery actions according to "Table 2-2 Priority Table" in "2.5 Failures of Multiple Parts". If the problem is not resolved, SSB E/C = 3306 is output again.