Worldwide Response Center

HP 3000 APPLICATION NOTE #81

MPE/XL System Interrupt Recovery Procedures

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RESPONSE CENTER APPLICATION NOTES

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MPE/XL System Interrupt Recovery Procedures

Sometimes even the best of machines experience difficulties. The HP3000 is no different. It can experience problems that, in the worst case, can cause a total loss of functionality. While these failures are rare, they are nonetheless an unfortunate possibility for any HPPA S900 system. The trick is to be prepared for them and recognize the different ways that an XL machine can experience difficulties that require some sort of operator intervention for recovery (a condition we call a "System Interruption"). This application note should provide enough background on the potential cause(s) of the System Interruption to allow the reader to make proper decisions on exactly what steps to take to:

a) gather valuable troubleshooting data

b) bring the system back on line as quickly as possible

This Application Note will also describe the steps which must be taken to process a memory dump so the Response Center can remotely analyze the cause of the interruption. The initial content of this Application Note will consist of somewhat detailed background data for those who would like to understand the specifics. For others a quick check list is provided that should be kept near the system so that it is available if the system should experience these problems.

NOTE

For the purposes of this paper, it is assumed that AUTORESTART/XL is not installed or enabled. Users of this product should refer to the AUTORESTART/XL User's Guide Part Number 36375-90001.

I - An Overview of XL System Interrupt Types

The first thing that needs to be determined is "what is happening to the system". Invariably, the initial symptom will be one of a lack of system response to user input. For the purposes of this Application Note a distinction must be made between a "performance problem" and a "system interruption". A performance problem will be described as one where the system is responsive to one or more programs/users, but others just cannot seem to get things done (that is, the system is very SLOW....). A "system interruption" will be defined as any event which causes the TOTAL loss of CPU resources to ALL users/programs. We will be concentrating ONLY on system interruptions.

A. System Aborts

On the XL system there are basically five different types of interruptions. The first interrupt type we will call a SYSTEM ABORT. It is defined as "a condition experienced by the MPE/XL operating system in which either system or data integrity may be compromised by continued operation". While its causes are many and varied the result is always the same. The system is immediately halted and the System Abort information is printed on the physical console (Ldev #20). It will typically be of the following format:

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```
SYSTEM ABORT xxxx FROM SUBSYSTEM xxxx
SECONDARY STATUS:  INFO = xxxx,  SUBSYS = xxx   {this is an optional line!}
SYSTEM HALT 7, $xxxx
```

If you find one of these messages on your console, you have definitely experienced a System Abort. Record the message in its entirety. The system has intentionally halted itself and all user activity has stopped. You should also notice that the red HALT light on the CPU is lit and the Hex Display (on those systems that have external Hex Displays) is displaying a curious rotating message. This message will typically be of the following format (where the "x"s could be different characters for any given failure):

```
Bx07.....01xx.....02xx.....DEAD.....Bx07.....01xx.....02xx....DEAD.....
                                    \                                  /
                                      --- repeats this pattern ---
```

As shown, this pattern repeats until the system is reset. If you find a console message similar to that above, it is probably unnecessary to copy down this hex display pattern. However, if there was nothing printed on the console AND the Hex Display looks like that above (that is includes a "Bx07" sequence) then you have probably experienced a system abort which, for some reason, didn't identify itself on the console display. In this case, write the codes down - we can determine the system abort number from this information. Take a memory dump of all these types of system interruptions (see section II below).

B. Monitor Halts

Another condition which will cause a system interruption is a "Monitor Halt". This condition is somewhat analogous to the "System Halt" in the "MPE V" HP3000 world. In this case, there probably will not be a console message describing what happened - although if there is, copy it down. What you will typically find is that the machine has halted (red Fault light lit) and you have another curious rotating Hex Display very similar to the one described for the System Abort. Copy it down as well. It will typically begin with a "Bx00" in this case, to distinguish it from the Bx07 "System Halt 7" which is characteristic of every System Abort message sequence. This type of system interruption can have its roots in either software or hardware. A memory dump is recommended for this condition (see section II below).

C. High Priority Machine Checks

A third type of failure is called an HPMC - which is short for High Priority Machine Check. This condition is trapped by the CPU hardware itself as some sort of abnormal condition which has compromised the integrity of system processing and, therefore, it halts the system. If the failing CPU is of the S950 family (that is 950/955/960/980), there will be an HPMC error message (A.K.A. Tombstone) printed on the physical console. This message will be of the following format:

```
******* UNEXPECTED HPMC ON PROCESSOR# 0 *******
                GENERAL REGISTERS:

[what follows is a dumping of general registers 00 thru 31]

                CONTROL REGISTERS:

[what follows is a dumping of all control registers]

                MACHINE CHECK PARAMETERS:
Check Type = xxxxxxxx  CPU STATE = xxxxxxxx  Cache Check = xxxxxxxx
TLB CHECK = xxxxxxxx Bus Check = xxxxxxxx PIM State = x  SIU Status = xxxxxxxx
```

```
TCU State: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
CCU Log:   xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
CCU Flags: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
CCU Diags: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
MCX State: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
MCY State: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
BCX State: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
BCY State: xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
*******PROCESSOR SHUTDOWN - Please record data before restarting
```

If you should experience this message on the console, copy or print the "Machine Check Parameters" fields and take the memory dump. In many cases, there is enough data in these fields to determine what happened - and whether in depth memory dump analysis is needed. For the other S900 systems, this tombstone message will not be displayed. What you will probably see instead will be some form of "Monitor Halt" as previously explained. Follow the instructions for this type of halt (section "B" above) and report the failure to the Response Center. One note of warning should be mentioned here: it is not unusual for HPMCs to NOT allow the "TC" or Softboot command to process normally. If this happens, S950/955/960/980 systems may have to be Hardbooted (CM > RS) - invalidating the memory dump. If you find that repeated attempts to the TC command fail to boot the machine, do the RS and DO NOT take the memory dump, as this would be a waste of time.

D. Hardware Failures

There is another interrupt type which is purely hardware-caused and is catastrophic enough in nature that the CPU just cannot run. For these types of interrupts you should check all the CPU status lights and the current hex display contents (assuming they are even lit). Copy down all the status light conditions and hex display values and call the Response Center for assistance. To help determine that some form of hardware error has occurred, the following rule of thumb may be used: Anytime the Hex Display does not begin with an "F" (such as, F1FF), AND the red FAULT light is lit, AND none of the previous interruptions apply - call the Response Center for assistance.

E. System Hangs

The last type of interrupt which we will cover is the one which we will call a "System Hang" condition. This is the condition where the machine is running (green RUN light is lit) but no one can access the system. The system console may or may not be hung as well - and the Control-A ("=" prompt) may or may not be functioning. For this case, the Hex Display will typically be one of two possible states - F0FF/FFFF or FAFF/FFFF. The F0FF/FFFF state (display alternates between F0FF and FFFF) is indicative of a problem where for some reason no process is capable of running and the CPU is basically "paused" - waiting to do something. The other case is the FAFF/FFFF (display alternates between FAFF and FFFF) and it is indicative of the case where a high-priority process is not allowing any other process to obtain access to the CPU and the CPU is basically "looping" on some piece of code. In either case the only option is to halt the machine and take a memory dump. Be sure to halt the machine with the "TC" command - not the "RS" command. Also DO NOT do a "= SHUTDOWN" command first. This will potentially destroy the information needed to determine what happened. Just halt the system, dump it, and restart it as soon as the dump is finished (see section II below).

II TAKING THE MEMORY DUMP

Hopefully, the preceding information will help you determine that you have indeed experienced a "System Interruption" and assist you in gathering the appropriate data to determine its cause(s). If you are instructed to "take a memory dump", the proper steps must be taken in the proper order or the result could be an invalid dump, lost data, and an unnecessary waste of valuable system processing time. This section should help you do it right the first time.

Step 1. Do the Transfer of Control (TC)

The first thing to be done is to initiate a "Transfer of Control" of the CPU from whatever its current state is to the ISL > prompt (hopefully) without destroying the current environment in the process. The easiest way to do this is to get into the "Command Mode" on the physical console. Type Control-B (hold the Control key "[CRTL]" down and simultaneously press the "B" key). The result should be a "CM >" prompt. If you cannot get this prompt, check the key switch position on the CPU. All HPPA systems have a key switch position which "secures" the system from acquiring Command Mode on the console. Ensure that the key switch position is in the "enabled" position and retry the Control B key sequence. If you get a CM > prompt this time type TC and a single Carriage Return. To ensure that the TC took effect watch the hex display which is located in the lower left hand corner of the console when in CM mode. It should change from whatever it was prior to the Transfer of Control to a new series of codes which are associated with the selftest of the CPU and the subsequent boot to ISL. If the hex code DOES NOT change, the Transfer of Control did not take effect. Try typing a Control-M (no carriage return). If still no effect, do a hard reset of the terminal and attempt another Control-B TC key sequence. If the hex display still does not change, there is still hope - at least for S925/935/949/922/923 machines. Most of these smaller systems have a "Forced Transfer of Control" which can be initiated via a unique momentary position on the key switch located on the front of the SPU. By turning this key switch to the indicated position, the hardware will attempt a TC itself. If this works - fine; if it does not then call the Response Center for assistance. We may be able to help. Otherwise, it will probably be necessary to do a Hard Hard Reset ("RS" command at the CM > prompt). Unfortunately, this will invalidate the memory dump - so do not bother taking one. Just bring the machine up and report the problem to the Response Center.

Step 2. Boot to ISL.

At this point, you have successfully initiated a TC and are watching the hex display change through all of its selftest codes. Very soon, the console should print out a message requesting that you either enter the boot path you want to use or prompts you to "Boot from Primary Path (Y/N)?". Optionally, you may be prompted to "Hit Any Key" within 10 seconds to abort the Autoboot sequence. A word of warning is appropriate here. For those sites which opt to use the Autoboot feature [which is basically a script of ISL commands that are automatically executed], care must be taken to ensure the Autoboot sequence is aborted. Else, the memory dump will be lost if the Autoboot file does not contain a "DUMP" command in it (which is a good bet). Somewhere around hex code of "9120" for 925/935/949/922/932 or "C402" for 950/955/960/980 you should be prompted to enter the boot path (or boot from Primary Path). If you find that you do not get this console prompt - but instead seem to be hanging at the 9120 or C402 code, try typing "CO" at the CM > Prompt. This should switch you into Console Mode and, if Autoboot is not enabled or if the 10 second Autoboot sequence has not expired, you should be able to boot to ISL. At any rate, be sure to boot from the PRIMARY PATH - as you would for any normal system Start attempt. One more word of warning: if you find that your inputs to the ISL > prompt are being rejected (or considered invalid), check the console configuration (MODES softkey). Ensure that AUTOLINEFEED and BLOCK MODE are not enabled (only REMOTE should be enabled) !

Step 3. Dump the System.

At this point, you should be at the "ISL >" prompt. Your next step should be to select a known "good" 2400' reel of tape (assuming you are dumping to a 1/2" tape drive) and mount it on the tape drive which is configured as the "Alternate Path" device. This is going to be the tape drive which you would normally UPDATE or INSTALL from. Put the drive On Line and ensure that the tape loaded properly. Now simply type "DUMP" at the ISL prompt. This should initiate the Dump program and prompt you with a "Enter Dump Name" command. This dump name will be written to tape as an identifier which can be useful if the tape is accidentally mislabeled or is mixed up with another dump tape. Type in your name, reason for taking the dump, site name and timestamp of the system interruption - Note that the dump will continue without input after a few seconds of waiting but no harm will be done to its contents. From this point, all you should have to do is to monitor the progress of the dump. Note any error messages that occur during the process. Report them to the Response Center when you call.

Step 4. Restart the System.

At this point, the dump has completed and you should be at the ISL > prompt. You can now restart the system using a START RECOVERY (Warmstart) or a START NORECOVERY (Coolstart) at your option. Note that if you elect to do a START RECOVERY, it is typically not necessary to turn around and do a START NORECOVERY after spoolfile processing as is recommended on the "MPE V" HP3000s. Also note that it is normally OK to perform your typical system/data base recovery procedures and resume system processing after this point.

Step 5. Process the Memory Dump.

At this point, your system should be back up and running normally. You should also have a memory dump tape of the failure which completed without error. The next step will be to process the dump tape so that its contents can be remotely analyzed. This is accomplished by running a utility called DAT which resides in the DAT.TELESUP group/account. Logon as MGR.TELESUP,DAT and type DAT at the colon prompt. This should initiate the Dump Analysis Tool and provide you with a "$ nmdat>" prompt. Your next command will be "GETDUMP xxxxx" where the xxxxx is a 5 character dump name which should begin with an alpha character. We recommend that System Aborts be named "Axxxx" where the xxxx is the System Abort number. HPMCs can be named "HPMC" and hangs can be labeled "HANG", etc. The GETDUMP command should result in an I/O Request message at the console for the dump tape. Reply as normal and monitor the subsequent process for any unusual error messages. Once the dump is finished you can EXIT the utility. The memory dump will now reside as file(s) in the DAT.TELESUP account. Be aware, however, of the following potential problems:

- You may get the following error message when attempting to run DAT utility:

  "Program requires more capabilities than group is allowed (LDERR 505)".

  This message is produced if the DAT group was not created with full capabilities. If you encounter this problem, type ":ALTGROUP DAT;CAP=IA,BA,PH,MR,DS,PM and then retry the DAT command.

- DAT utility may abort because of insufficient disk space. The memory dump may potentially require hundreds of thousands of sectors of permanent disk space on the system. If there is not enough space to accomplish this task, the DAT utility will abort. Report this event to the Response Center.

Step 6. Call the Response Center.

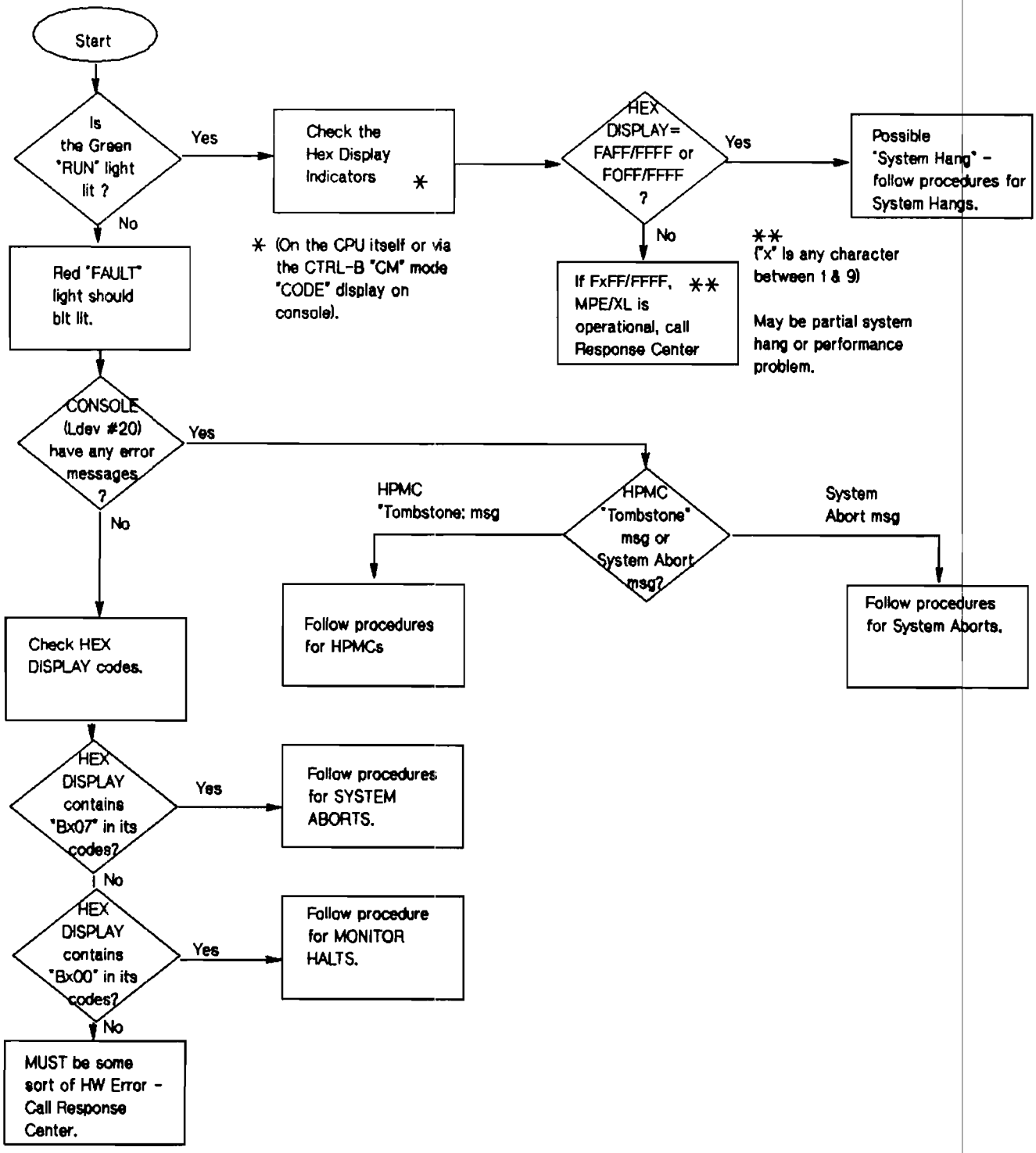
It is now time to call the Response center and report the System Interruption. However, before doing so, be prepared to provide the following to the Engineer who will be calling back:

- The modem telephone number and baud rate.
- The passwords to MGR.TELESUP and any additional security provisions needed to access the system on which the memory dump resides.
- The operating system release (type :SHOWME to get current release number).
- All the troubleshooting information gathered so far.

It is not recommended that customers wait for the engineer to call back from the Response Center before allowing users to log back on. If you elect to do so, please note it to the Response Center Coordinator so that your call is appropriately prioritized. Include in your comments the full system abort message printed on the console or the Hex Display contents. Also note any unusual messages encountered on the subsequent system startup.

In summary: The proper response to any MPE/XL System Interruption can be broken down into the following steps:

1) DETERMINE THE TYPE OF SYSTEM INTERRUPTION WHICH HAS TAKEN PLACE:



2) PERFORM A SYSTEM MEMORY DUMP

a) Do a Transfer of Control (TC).

* Type CTRL-B to get to "CM >" prompt on console.

* Type "TC" and hit RETURN key.

* If Autoboot is enabled, Hit any key to interrupt it.

b) Boot from PRIMARY PATH.

* Type "yes" to the "Interact with IPL" prompt.

c) Perform a Memory Dump

* Mount a good 2400' reel of tape (with a write ring) on the ALTPATH tape drive and put the drive On Line.

* At "ISL >" prompt, type "DUMP" command.

* Enter appropriate site and problem data at "Enter Dump Name" prompt.

d) Restart the Operating System

* At "ISL >" prompt, type "START" or "START NORECOVERY" as desired.

* Resume normal system processing.
  If there is concern about turning the system over to the users until the Response Center Engineer approves further processing call the Response Center and denote this to the Response Center Coordinator and request a Priority One code.

e) Process the Memory Dump.

* Mount the first Dump Tape on the tape drive.

* Logon as MGR.TELESUP,DAT.

* Type "DAT" to initiate the Dump Analysis Tool program.

* Type "GETDUMP xxxxx" at the DAT program prompt (where xxxx is the 5 character dump identifier name.

* Reply to the Tape I/O request at the system console.

* When all tapes are read in, EXIT the DAT utility.

f) Call the Response Center and report the problem.

Published Application Notes

HP 3000

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1	5958-5824	Printer Configuration Guide - Version 1
2	5960-2841	Terminal types for HP 3000 HPIB Computers - Version 1
3	5960-2842	Plotter Configuration Guide
4	5960-2843	Printer Configuration Guide - Version 2
5	5960-2844	MPE System Logfile Record Formats
6	5960-2845	Stack Operation
7	5960-2846	COBOL II/3000 Programs: Tracing Illegal Data
8	5960-2847	KSAM Topics: COBOL's Index I/O: File Data Integrity
9	5960-2848	Port Failures, Terminal Hangs, TERMDSM
10	5960-2849	Serial Printers - Configuration, Cabling, Muxes
11	5960-2850	System Configuration or System Table Related Errors
12	5960-2851	Pascal 3000 - Using Dynamic Variables
13	5960-2852	Terminal Types for HP 3000 HPIB Computers - Version 2
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15	5960-2854	FORTRAN Language Considerations - A Guide to Common Problems
16	5960-2855	IMAGE: Updating to TurboIMAGE & Improving Database Loads
17	5960-2856	Optimizing VPLUS Utilization
18	5960-2857	The Case of the Suspect Track for 792X Disc Drives
19	5960-2858	Stack Overflows: Causes & Cures for COBOL II Programs
20	5960-2859	Output Spooling
21	5960-2860	COBOLII and MPE Intrinsics
22	5960-2861	Asynchronous Modems

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28	5960-2867	The Startup State Configurator
29	5960-2868	A Programmer's Guide to VPLUS 3000
30	5960-2869	Disc Cache
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32	5960-2871	Configuring Terminal Buffers
33	5960-2872	Printer Configuration Guide - Version 3
34A	5960-2873	RIN Management (Using COBOLII Examples) (A)
34B	5960-2874	Process Handling (Using COBOLII Examples) (B)
35	5960-2875	HPDESK IV (Script files, FSC, and Installation Considerations)
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69	5960-2901	Nonsystem Volume Sets and the Migration of Private Volumes to an S9000 HP 3000
70	5960-2907	Modem Links for Remote Console and Standard DTC Connections on Commercial XL HPPA Systems
71	5960-2918	Asynchronous Cabling
72	5960-2919	BRW Tips and Tricks
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74	5960-2999	SNA IMF Configuration
75	5060-3000	XL NRJE Configuration

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