CONVEX Removal/Replacement and IPB Guide (C201, C202, C210, C220)

Document No. 081-001030-201

First Edition, Rev. 1
February 1989

CONVEX Computer Corporation
Richardson, Texas USA

CONVEX Removal/Replacement
and IPB Guide
(C201, C202, C210, C220)
Order No. DHW-099
First Edition, Rev. 1

Printed in the United States of America

Revision Sheet

CONVEX Removal/Replacement and IPB Guide (C201, C202, C210, C220)

Edition	Document No.	Date	Description
First	081-001030-200	September 1988	First release.
First, Rev. 1	081-001030-201	February 1989	Made minor corrections.

FCC NOTICE

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in strict accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Do not connect external equipment to the utility outlets in CONVEX equipment cabinets. Unauthorized connection voids all agencies' emissions certifications.

Table of Contents

Appendixes

List of Tables

List of Figures

THIS PAGE INTENTIONALLY LEFT BLANK

Preface

Purpose and Intended Audience

The *CONVEX Removal/Replacement and IPB Guide (C201, C202, C210, C220)* is the sixth of six volumes in the *CONVEX Maintenance Documentation (C201, C202, C210, C220).* The other volumes include:

- *CONVEX Maintenance Documentation Overview (C201, C202, C210, C220)*
- *CONVEX Theory of Operation (C201, C202, C210, C220)*
- *CONVEX Installation Guide (C201, C202, C210, C220)*
- *CONVEX General Maintenance Guide (C201, C202, C210, C220)*
- *CONVEX Troubleshooting Guide (C201, C202, C210, C220)*

The main purpose of this document is to assist the Field Engineer (FE) in getting the customer's machine up and running as quickly and easily as possible. To that end, background information, removal/replacement procedures, and an Illustrated Parts Breakdown (IPB) assist the FE in ordering the required parts and repairing the customer's machine. Additionally, this volume may be used as a teaching text by the CONVEX Training department.

Scope

The material in this volume applies to CONVEX C201, C202, C210, and C220 supercomputers.

Outline

The content of each chapter is outlined below:

Chapter 1. Introduction—A general description of the purpose of the *CONVEX Removal/Replacement and IPB Guide*

Chapter 2. Safety—Discusses the common safety procedures that should be used to prevent damage to the equipment and injury to personnel performing maintenance on the computer

Chapter 3. Returned Item Documentation—Returning components to the factory is discussed to familiarize the FE with the proper forms required for returning a part to the factory and the process of how the part is monitored at the factory and returned to the FE inventory warehouse

Chapter 4. Removal and Replacement—Discusses the procedures for the proper removal and installation of components for CONVEX computers. Each component identified as a Field Replaceable Unit (FRU) is discussed in a step-by-step process and includes any safety hazards

that are associated with the removal and installation.

Chapter 5. Illustrated Parts Breakdown—Contains Illustrated Parts Breakdowns (IPBs) (exploded views) and parts lists of all FRUs and fasteners

Appendix A. Part Number Identification—Identifies the categories and family codes with standards used to assign CONVEX part numbers

Appendix B. Problem Reporting—Discusses how to use the *contact* facility to report problems.

Notational Conventions

The notational conventions used in this text are listed below:

- TBD is an abbreviation for *To Be Determined*
- All CONVEX illustrations have an illustration catalog number at the bottom right hand corner that is for CONVEX use only.

The following are examples of warnings, cautions, and notes and their typical content and location as used in CONVEX documents:

WARNING

Warnings highlight procedures or information necessary to avoid injury to personnel. A warning immediately precedes the critical information and includes a description of the hazard.

CAUTION

Cautions highlight procedures or information necessary to avoid damage to equipment, loss of data, or invalid test results. A caution immediately precedes the critical information and includes a description of the possible damage.

NOTE

A note highlights useful information that is supplemental in nature. A note may immediately precede or follow the information that is being highlighted.

Associated Documents

The following is a partial list of other manuals or books that may provide more detailed information on the topics presented in this manual:

- *CONVEX System Manager's Guide*, Product No. DSW-004

Ordering Documentation

To order the most current version of this or any other CONVEX document, use the product number. If the product number is not known, order by the exact title. In some situations, the most current version may not be desired. To receive a specific version of a manual, order the manual by its CONVEX document, or part, number, which can be obtained by contacting the local CONVEX office or by calling the Technical Assistance Center.

The product number for this manual is DHW-099.
The document number for this manual is 081-001030-201.

CONVEX documents can be ordered by mail by sending a request to:

CONVEX Computer Corporation
Customer Service
PO Box 833851
Richardson TX 75083-3851 USA

Technical Assistance

Hardware and software support can be obtained through the CONVEX Technical Assistance Center (TAC). In Texas, the TAC can be reached by calling (214)952-0379. From other locations in the continental United States, call 1(800)952-0379. Customers outside the United States should contact their local CONVEX office.

Electronic Mail

The Hardware Documentation Group has an email address for documentation comments. Use this service to give us a quick response mechanism if you have special documentation questions that you would like addressed immediately. If you have a technical question, you should still contact the Technical Assistance Center, as described previously. To use email response service, just send mail addressed to:

`cnvxhwdoc@convex.COM`

We will read your comments and give you a personal reply.

What to Include in an Email Message

When you use the electronic mail service, please provide the following information:

- The reader's name and company name
- A return email address in INTERNET notation or UUCP (bang) notation
- The manual that is being critiqued
- The chapter and page number in question
- The comment

Reader's Forum

If you wish to mail your comments to us, please use the form at the end of this manual and list the document page number with your questions and comments. Thank you.

Acknowledgments

I would like to thank the following people for their contributions to this document:

- Technical contributors and review team members: Art Clark, Don Davis, Ron Engelking, Steve Fieler, Art Kimmel, and Alan Peterson
- Hardware Documentation staff: Larry Bonura, Art Fischman, and Jimmie Holman
- Contributing writer: Barbara Morris

Without the efforts of all the aforementioned, this document would not have been possible.

Leigh Ellert, Lead Writer
CONVEX Hardware Documentation

THIS PAGE INTENTIONALLY LEFT BLANK

Chapter 1
Introduction

1.1 Overview

The *CONVEX Removal/Replacement and IPB Guide* includes specific safety considerations for working on the computer, the procedures and the forms affecting the return of parts to the factory, the steps to remove and replace the Field Replaceable Units (FRUs), and an Illustrated Parts Breakdown (IPB) for identifying and ordering parts.

1.2 Safety

An entire chapter discusses the various safety hazards that may be encountered when performing maintenance on the computer. The chapter defines types of safety hazards to familiarize the Field Engineer (FE) with safety awareness in relationship to the type of maintenance being performed.

1.3 Returned Parts

FEs are responsible for returning the removed FRU parts to the factory. The *Part & Assembly Failure Report* must be accompany each part. Chapter 3 details this report to assist the FE in preparing the report for submission. Failure reports *must* be filled out at the customer site after FRU replacements. Completing the report at the customer site allows access to the system for the information required on the report (e.g., site name, system serial number, account number, error logs, etc.).

1.4 Factory Repair

A brief overview explaining the parts handling at the factory provides the FE with the factory repair cycle. The factory attaches a test tag to all returned CONVEX designed boards to monitor the repair cycle status. This test tag remains with the board until the factory ships the board. The tag is then maintained for historical purposes to show the maintenance and upgrade of certain parts.

1.5 Replacement of Parts

Removal and replacement procedures are sequenced to assist the FE in the requirements and special precautions necessary to perform maintenance on the computer. Each procedure enables the FE to replace an FRU without damage to the equipment or causing personal injury. Reference to other sections describes procedures necessary to remove adjacent parts to get to the FRU.

1.6 Parts Ordering

The chapter on Illustrated Parts Breakdown (IPB) provides the part numbers for the FRUs as well as the supporting hardware and subassemblies. Each identified FRU has an illustration to show some of the subcomponents. Illustrations are indexed to provide a reference to the accompanying parts list. The parts list shows the index number, the part number, and the NCA Corporation name for the part. Parts are ordered and referred to by the information in the parts list.

Chapter 2
Safety Considerations

2.1 Overview

It is important to observe safety when servicing CONVEX computers and their peripheral devices. Some general guidelines are offered in this chapter.

2.2 Electrical Safety Precautions

> **WARNING**
>
> **LETHAL VOLTAGE HAZARD** — Remove power from the computer before servicing. Failure to do so may result in serious injury to personnel and damage to components and electronic assemblies.

Hazardous voltages are present inside the processor cabinet while the power cord is connected to the AC mains. Ensure the main circuit breakers on the power controller front panel are **OFF** before removing covers from the processor cabinet.

Disconnect the computer AC power cord from the electric service before disassembling the power controller. Hazardous voltages are present inside the power controller when the AC power cord is connected to a source of AC power, *even when the main circuit breakers are set to* **OFF**.

2.3 Electrostatic Discharge Precautions

> **CAUTION**
>
> **ELECTROSTATIC DISCHARGE DAMAGE HAZARD** — Observe all Electrostatic Discharge (ESD) precautions during service. Failure to comply with approved ESD procedures may result in damage to components and electronic assemblies.

Electrostatic Discharge (ESD) can damage many of the electronic components in CONVEX computers. High static charge levels often result when various objects are separated or rubbed together. Static damage can cause immediate or latent failures as well as intermittent failures that may not become apparent for weeks.

Ensure that all personnel who might come into contact with the machine when the covers are

removed, wear properly grounded wrist straps before removing any covers.

2.4 Thermal Safety Precautions

> **CAUTION**
>
> **THERMAL DAMAGE HAZARD** — Ensure that all cooling components are properly installed before powering up the system. Failure to do so may cause damage to equipment.

Operating the computer without the card cage cover, internal air dams, and other cooling components installed properly interferes with proper airflow through the processor card cage. Check that the card cage cover, internal air dams, and other cooling components are installed properly. If not installed or improperly installed, airflow is reduced through the processor card cage, which will cause high temperature warnings, system shutdown, and damage to components and electrical assemblies.

2.5 Mechanical

> **CAUTION**
>
> **MECHANICAL DAMAGE HAZARD** — Comply with approved processor card removal and installation procedures. Failure to do may cause damage to equipment.

Broken or bent pins cause processor malfunctions and require replacement of the damaged pins. Ensure that processor cards are removed and installed slowly and evenly by alternately turning each jack screw one-half turn at a time.

Chapter 3
Returned Item Documentation

3.1 Overview

This chapter discusses the two documents associated with parts returned to the factory:

1. ***PART & ASSEMBLY FAILURE REPORT***—The Field Engineer (FE) is responsible for originating a *PART & ASSEMBLY FAILURE REPORT*. This report is returned, along with each board or assembly, to the factory for testing, repair, or upgrading to current revision levels, or uprev.
2. **Test Tag**—A test tag is attached to the returned part on arrival at the factory by the Logistics Coordinator. The test tag is then filled in as the part moves through the uprev, testing, and repair process. A copy of the completed test tag, providing a history of the part while at the factory, is then returned to the field with the repaired part.

3.2 *PART & ASSEMBLY FAILURE REPORT*

The FE completes the *PART & ASSEMBLY FAILURE REPORT* when returning a part to the factory. Customer-specific machine information and file printouts that may be required on the report are dependent on the part being returned, and the type of system failure involved. This information allows Manufacturing to track quality control and to spot the development of trends that may signal problem areas.

> **NOTE**
>
> It is better to complete the report while at the customer site because the events of the service call will still be fresh and the machine is available for displaying or printing required information.

A *PART & ASSEMBLY FAILURE REPORT* form is shown in the figure below (a sample of a completed form appears at the end of the section):

Figure 3–1, *PART & ASSEMBLY FAILURE REPORT*

PART & ASSEMBLY FAILURE REPORT

Fill out **ONE** *form for* **EACH PART** *returned. Place form in shipping container with failed part.* **PLEASE PRINT!**

FIELD ENGINEER:_____ **DATE:**___/___/___

CUSTOMER/SITE INFORMATION

Site Name _____ **Account #**_____

System Serial #_____ **Service Request #**_____

Periph. Serial #(if applicable) _____ **RMA #** _____

PART INFORMATION

Descr. _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

☐ **No Fault or Uprev Only** ☐ **Replace IMMEDIATELY**

☐ **Failed During System Installation** ☐ **Replace when repairs/uprev complete**

☐ **Don't return/replace**

If other parts are being returned at this time that may eliminate one problem, please list those parts below:

1. **Descr.** _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐
2. **Descr.** _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐
3. **Descr.** _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

Use the following line **only** *if failed part is not a board assembly:*

Failure mode:_____

The following two boxes (FAILURE MODE DESCRIPTION & SYSTEM CONFIGURATION) are **REQUIRED** *for board assemblies. If multiple boards are returned, please fill out the following sections on only one of the forms. Attach required printouts to that form.*

FAILURE MODE DESCRIPTION *(required for board assemblies)*

Diagnostic Failure? ☐**NO** ☐**YES** **If YES, then: ☞ printout attached?** ☐

Check AT LEAST ONE of the following **(EVEN IF DIAGNOSTIC FAILURE)** *and attach associated paperwork:*

☐ **Fatal Convex UNIX Error? If YES, then: ☞ appropriate parts of** */mnt/errlog* **attached?** ☐

☐ **Hard Error? If YES, then: ☞ appropriate parts of** */mnt/errlog* **attached?** ☐

☐ **System Hang? If YES, then: ☞ jpstat attached?** ☐ **(spu> jpstat** *(sysreset first, if necessary)* **)**

☐ **Wrong Answers? If YES, then: ☞ source code, data sets, expected answers, and differences needed**

☐ **Other? If YES, then: ☞ please describe:**_____

SYSTEM CONFIGURATION *(required for board assemblies)*

HARDWARE CONFIGURATION/REVISION INFORMATION

☐ **cop output attached? (spu> cd /mnt/usr/sem; cat cop.out cop.mem)**

☐ **loconfig attached? (spu> cat /loconfig)**

SOFTWARE CONFIGURATION INFORMATION

CONVEX UNIX V___.___.___.___ **(see** */mnt/errlog* **entry made during last boot)**

more /mnt/DIAG_REV V___.___

more /mnt/DIAG_DB_REV V___.___

INTERMITTENT FAILURES *(required for intermittent failures only)*

Number of times observed:_____ **Approx. time to repeat failure:**_____

Have other parts been previously returned to eliminate this same failure mode?(y/n)____ **If yes, please describe what & when:**

_____

Are there any special environmental conditions worth noting?(y/n)____ **If yes, please describe:**

_____

MULTIBUS/VME VOLTAGES *(required if part is Multibus or VME board; measure to ± 100 mv at backplane of failing unit)*

+5_____**V** **-5**_____**V** **+12**_____**V** **-12**_____**V**

FEs Do not write below this line. *(The following is for in-house use only.)*

DATE	STATION	P/F	COMMENTS	TECH
__/__/__				
__/__/__				
__/__/__				
__/__/__				
__/__/__				

white copy: TEST ENG. canary copy: QA pink copy: TAC goldenrod copy: FE

H1004021

The failure report provides the following information to factory personnel:

- The name of the field engineer and the date the part is returned
- Basic customer site data
- A description of the returned part
- The failure mode of the part if it is not a CPU, VMEbus, or Multibus board
- The hardware configuration of the system containing the failed part
- The software configuration of the system containing the failed part
- A failure mode description
- Whether there were intermittent failures
- Voltage measurements for failed VMEbus or Multibus boards

The FE may have identified a failed board or may have decided to pull and return a set of boards for testing and repair. The failure report and return procedure varies somewhat depending on whether a single board or a set of boards is returned as a result of a service call:

1. If one board is returned, a failure report must be completed and placed in the shipping container with the board.
2. If more than one board is returned, one report must accompany *each* board returned. When returning multiple boards, complete all applicable sections and attach all required paperwork to the report that is returned with the board that is most suspect. Complete only the top portion of the report returned with each of the remaining boards in the shipment. (This separate form for each board ensures that factory records for that board can be located. Testing and repair can proceed even if the boards in a set are separated during shipment.) This information will be needed for the test tag that accompanies the board during the test and repair process.

3.2.1 Preliminary Information

The top portion of the failure report contains information on who is returning the part, from which customer site it is being returned, from which system it was removed, which part is being returned, and what other parts (if any) are being returned from the site at the same time.

> **NOTE**
>
> Each part returned must be accompanied by a failure report with this portion completely and accurately filled out.

The following figure shows the top portion of the failure report:

Figure 3–2, Preliminary Information

Fill out **ONE** *form for* **EACH PART** *returned. Place form in shipping container with failed part.* **PLEASE PRINT!**

FIELD ENGINEER:_____ **DATE:**____/____/____

CUSTOMER/SITE INFORMATION

Site Name _____ **Account #** _____

System Serial # _____ **Service Request #** _____

Periph. Serial #(If applicable) _____ **RMA #** _____

PART INFORMATION

Descr. _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

☐ **No Fault or Uprev Only** ☐ **Replace IMMEDIATELY**

☐ **Failed During System Installation** ☐ **Replace when repairs/uprev complete**

☐ **Don't return/replace**

If other parts are being returned at this time that may eliminate one problem, please list those parts below:

1. Descr. _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

2. Descr. _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

3. Descr. _____ **Serial #** _____ **Part #** _____ **Printouts enclosed with board?** ☐

Use the following line **only** *if failed part is not a board assembly:*

Failure mode: _____

H004022

The following section lists instructions on how to complete the preliminary information:

FIELD ENGINEER: *Print* the name of the person returning the part(s) in this blank (login is also helpful). Factory personnel may need to contact the FE responding to the service call if additional information is needed.

DATE Enter the date the part is returned.

CUSTOMER/SITE INFORMATION

Site Name Enter the official site name here. Use the exact onsite location when the customer has machines in different locations at that site.

Account # Enter the Field Spares Account Number here.

System Serial # Enter the system serial number here. The system serial number is found on the rear door of the processor cabinet.

Service Request # Enter the service request number here (domestic only). This number is assigned by the dispatcher when the service call is received.

Periph. Serial # If the failed item is part of a peripheral system, enter the serial number of the peripheral system here. Be sure to locate the serial number of the peripheral system involved (not the number on the rear door of the expansion cabinet, for example).

RMA # Enter the Returned Material Authorization (RMA) number here (international only). This number is assigned by Logistics.

PART INFORMATION

Descr. Enter a short description of the returned part (SP2, MMU, ASU, etc.).

Serial # Enter the serial number of the returned part here.

Part # Enter the part number of the returned item here.

Printouts enclosed with board? ☐

Check this box if printouts (in accordance with the requirements of the boxes below) are enclosed with *this* part.

A returned part is considered failed during normal operation unless one of the following two items are checked:

☐ **No Fault or Uprev Only**

Check this box if the part is being returned *only* for upgrading to current revision level. (All failed boards are upreved as necessary as part of the repair procedure.)

☐ **Failed During System Installation**

Check this box if the part failed during system installation. This information is tracked by factory personnel to detect and isolate latent component problems and any deficiencies in final test and shipping procedures.

The following three items present the preferred replacement procedure for the returned part:

☐ **Replace IMMEDIATELY**

Check this box if a replacement part is needed quickly to replenish spares inventory. Receiving notifies Logistics of the situation.

☐ **Replace when repairs/uprev complete**

Check this box if the part is not needed immediately and can wait until it goes through the repair–test cycle.

☐ **Don't return/replace**

Check this box if the returned part is not needed to replenish spares inventory.

The next three lines are for information on other parts that are being returned at this time. If more than four items are being returned, use the margins of the *PART & ASSEMBLY FAILURE REPORT* for information on the additional items.

Descr. Enter a short description of the returned part (MCM, VPC, SFU, etc.).

Serial # Enter the serial number of the returned part here.

Part # Enter the part number of the returned item here.

Printouts Enclosed? ☐

Check this box if printouts (in accordance with the requirements detailed for the boxes below) are enclosed with ***that*** part.

The line below should be used *only* if the returned part is *not* a logic board (fan, power controller, switch, etc).

Failure Mode: Briefly describe the part's failure mode on this line.

If the returned part is *not* a logic board assembly, the *Part and Assembly Failure Report* is now complete. Detach the bottom copy (keep for the FE's records), and place the form in the shipping container with the part.

3.2.2 Failure Mode Description

The **Failure Mode Description** portion of the report *must* be completed if a board assembly is returned. If more than one board is returned as a result of a single service call, however, complete this section on only one form—the form accompanying the most likely failed board. The following figure shows this portion of the failure report:

Figure 3–3, Failure Mode Information

The following two boxes (FAILURE MODE DESCRIPTION & SYSTEM CONFIGURATION) are* REQUIRED *for board assemblies. If multiple boards are returned, please fill out the following sections on only one of the forms. Attach required printouts to that form.

FAILURE MODE DESCRIPTION *(required for board assemblies)*

Diagnostic Failure? □NO □YES **If YES, then: ☞ printout attached?** □

Check AT LEAST ONE of the following **(EVEN IF DIAGNOSTIC FAILURE)** *and attach associated paperwork:*

□ **Fatal Convex UNIX Error?**	**If YES, then: ☞ appropriate parts of** */mnt/errlog* **attached?** □
□ **Hard Error?**	**If YES, then: ☞ appropriate parts of** */mnt/errlog* **attached?** □
□ **System Hang?**	**If YES, then: ☞ jpstat attached?** □ **(spu> jpstat** *(sysreset first, if necessary)*)
□ **Wrong Answers?**	**If YES, then: ☞ source code, data sets, expected answers, and differences needed**
□ **Other?**	**If YES, then: ☞ please describe:**_____

H004023

This section and the attached paperwork provide factory personnel with information on what type of error occurred, what the system was doing when the error occurred, and current and historical system error information.

Return the requested paperwork (and printouts) with the failure report. Although factory personnel can probably locate and repair board faults without the requested printouts, the printouts provides the information that speeds the testing and repair process. Printouts assists in building a complete and accurate reliability history of the product. If there is some reason printouts are not available, please explain in the margins.

Diagnostic Failure? Did the part fail during execution of a diagnostic? Check the **NO** or **YES** box as appropriate. If *YES*, then a diagnostic printout is needed.

printout attached? □ Check this box to show that a diagnostic printout is attached. Note that a printout is required only if the part failed a diagnostic test.

At least one item should be checked to reflect the system failure that originally prompted the service call. Check the appropriate box(es), *even if there was a diagnostic failure*, to show why an FE was called out to the site.

□ **Fatal Convex UNIX Error?**

Check this box if a fatal CONVEX UNIX error was the reason for the service call.

A CONVEX UNIX error is the detection of an error (caused by hardware or software) by the CONVEX UNIX Operating System. When this occurs, a CONVEX UNIX error message is displayed on the console. Error information is then written into the error log (*errlog*) on the SPU disk.

Factory personnel need as much information on the error condition as possible. Be sure to print a copy of the appropriate portions of */mnt/errlog* and attach it to the failure report. The following command prints the error log:

(spu)> tail -100 errlog <RETURN>

(-10, -20, -30 or whatever is needed to print that portion of the log that documents the error)

Check the box to show that the printout is attached.

☐ **Hard Error?**

Check this box if a hard error was the reason for the service call.

A hard error is the on-board logic detection of invalid or suspect data moving along a bus (90% are parity errors). When this occurs, all processor clocks are stopped (preserving the state of the machine at the moment of death). A hard error interrupt is then sent to the SPU. The SPU attempts to determine the source and possible cause of the hard error and reports accordingly to the error log.

Factory personnel need as much information on the error condition as possible. Be sure to print a copy of the appropriate portions of */mnt/errlog* and attach it to the failure report. The following commands provide the error log and a copy of the *jpstat:*

(spu)> tail -100 errlog <RETURN>

A copy of *jpstat* would be helpful as well:

cd /mnt/os <RETURN>

jpstat <RETURN>

> **NOTE**
>
> If running *jpstat* results in the display of error messages (PBUS errors, main memory errors, etc.) showing that the system cannot read main memory owing to MBU lockup, execute a *sysreset*, then print *jpstat.*

Check the box to show that the printout is attached.

☐ **System Hang?** Check this box if a system hang was the reason for the service call.

A system hang means no instructions are being processed, but the system is still alive and all clocks are running. Consoles do not respond, however, there are no front panel indications of trouble.

This condition is usually caused by a missed transaction. The system hangs when requested data is received in its intended location but the associated hazard bit is not cleared. Since processing cannot resume until the hazard bit is cleared, the next instruction is never executed.

Factory personnel need as much information on this condition as possible. Be sure to print a copy *jpstat* and attach it to the return form:

cd /mnt/os <RETURN>

jpstat <RETURN>

Check the box to show that the printout is attached.

☐ **Wrong Answer?** Check this box if an incorrect answer from an application program was the reason for the service call.

A wrong answer means the machine passes all diagnostics, but an application program returns an answer that is known to be incorrect.

Factory personnel need the following information to troubleshoot the problem:

- Application program source code
- Data set in use when incorrect answer returned
- Expected answers
- Returned answers

Contact TAC and Test Engineering to coordinate the return of this information.

☐ **Other** Check this box when the reason for the service call is other than those listed above.

3.2.3 System Configuration

The "System Configuration" portion of the failure report *must* be completed if a board assembly is returned. If more than one board is returned as a result of a single service call, complete this section on *only* one form. The form with this section *must* accompany the most likely failed board. The following figure shows this portion of the failure report:

Figure 3–4, System Configuration Information

SYSTEM CONFIGURATION ***(required for board assemblies)***
HARDWARE CONFIGURATION/REVISION INFORMATION
□ cop output attached? (spu> cd /mnt/usr/scn; cat cop.out cop.mem)
□ ioconfig attached? (spu> cat /ioconfig)
SOFTWARE CONFIGURATION INFORMATION
CONVEX UNIX V____.____.____.____ (see *mnt/errlog* entry made during last boot)
more /mnt/DIAG_REV V____.____
more /mnt/DIAG_DB_REV V____.____

H004024

This section and any attached paperwork provide factory personnel with detailed information on what hardware, I/O, and software is installed in the system. This information helps factory personnel duplicate the site configuration as closely as possible for testing of returned boards. For example, some failure modes are unknown outside certain memory configurations, and I/O configuration affects how many processes run.

HARDWARE CONFIGURATION

Both the *cop* output and the *ioconfig* printouts should be attached to the failure report. These two printouts will allow factory personnel to determine the exact hardware configuration of the machine at the site.

□ **cop output attached?**
Check this box to show that a printout of the *cop* output is attached:

(spu)> cd /mnt/usr/scn <RETURN>

cat cop.out cop.mem <RETURN>

□ ***ioconfig* attached?** Check this box to show that a printout of the *ioconfig* file is attached:

(spu)> cat /ioconfig <RETURN>.

SOFTWARE CONFIGURATION INFORMATION

Factory personnel need to know what version of CONVEX UNIX is running on the customer's machine, what revision level of diagnostics are installed (DIAG_REV), and what version of microcode is installed (DIAG_DB_REV).

CONVEX UNIX Enter the CONVEX UNIX version number here. Check the */mnt/errlog* from the most recent boot. The first two numbers are the most important.

DIAG_REV Enter the diagnostics revision level here:

more /mnt/DIAG_REV <RETURN>

DIAG_DB_REV Enter the diagnostics database revision level here:

more /mnt/DIAG_DB_REV <RETURN>

3.2.4 Intermittent Failures

The "Intermittent Failures" portion of the failure report *must* be completed if a board assembly is returned as a result of intermittent failures. If more than one board is returned as a result of a single service call, complete this section on only one form—the form accompanying the most likely failed board.

The following figure shows this portion of the failure report:

Figure 3–5, Intermittent Failure Information

INTERMITTENT FAILURES *(required for intermittent failures only)*

Number of times observed:_____ Approx. time to repeat failure:_____

Have other parts been previously returned to eliminate this same failure mode?(y/n)____ If yes, please describe what & when:

Are there any special environmental conditions worth noting?(y/n)____ If yes, please describe:

H004025

This section provides factory personnel with information on the history of a particular intermittent failure and any unusual operation conditions at the site.

Number of times observed:

Enter the number of times that the intermittent failure has been observed.

Approx. time to repeat failure:

If the intermittent failure was observed more than once, enter how much time elapsed before the additional failure(s) occurred.

parts previously returned?

Have parts been previously returned to eliminate this same failure mode? Enter **y** or **n** in the blank.

If *y*, describe the parts returned and when. A personal service call journal would be helpful here, as well as for other field activities.

Special environmental conditions?

Describe here anything special or different about the site where the intermittent failure occurred: High ambient temperature? Low ambient temperature? High altitude? High or low humidity? Site power disturbances?

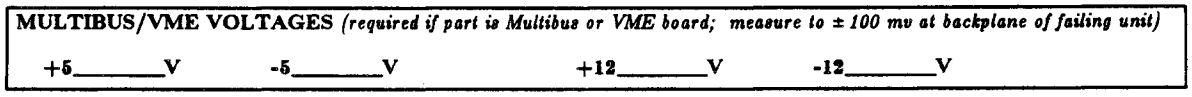
Enter **y** or **n**.

If *y*, describe those special or different conditions.

3.2.5 Multibus/VMEbus Voltages

The Multibus/VMEbus voltages portion of the failure report *must* be completed if the returned part is a Multibus or VMEbus board assembly. The following figure shows this portion of the failure report:

Figure 3–6, Multibus/VMEbus Voltage Information



11004026

Measure the voltages at the backplane of the failing unit to ± 100 mv and enter those values on the report.

The *PART & ASSEMBLY FAILURE REPORT* is now complete. *Do not write in the lowest box.*

Remove the bottom copy (keep for FE's records), attach all required paperwork (printouts) to the report, and place it in the shipping container with the part.

3.2.6 Sample *PART & ASSEMBLY FAILURE REPORT*

The following figure shows a sample completed failure report:

Figure 3–7, Sample *PART & ASSEMBLY FAILURE REPORT*

PART & ASSEMBLY FAILURE REPORT

Fill out **ONE** *form for* **EACH PART** *returned. Place form in shipping container with failed part.* **PLEASE PRINT!**

FIELD ENGINEER: A. B PARSEC **DATE:** 4/1/88

CUSTOMER/SITE INFORMATION

Site Name CONVEX **Account #**

System Serial # 777 **Service Request #**

Periph. Serial #(if applicable) **RMA #**

PART INFORMATION

Descr. ASP **Serial #** 507 **Part #** 410-001209-200 **Printouts enclosed with board?** X

☐ **No Fault or Uprev Only** X **Replace IMMEDIATELY**

☐ **Failed During System Installation** ☐ **Replace when repairs/uprev complete**

☐ **Don't return/replace**

If other parts are being returned at this time that may eliminate one problem, please list those parts below:

1. **Descr.** IPP **Serial #** 237 **Part #** 410-001207-200 **Printouts enclosed with board?** ☐
2. **Descr.** **Serial #** **Part #** **Printouts enclosed with board?** ☐
3. **Descr.** **Serial #** **Part #** **Printouts enclosed with board?** ☐

Use the following line only if failed part is not a board assembly:

Failure mode:

The following two boxes (FAILURE MODE DESCRIPTION & SYSTEM CONFIGURATION) are **REQUIRED** *for board assemblies. If multiple boards are returned, please fill out the following sections on only one of the forms. Attach required printouts to that form.*

FAILURE MODE DESCRIPTION *(required for board assemblies)*

Diagnostic Failure? ☐NO X**YES** **If YES, then:** ☞ **printout attached?** X

Check AT LEAST ONE of the following **(EVEN IF DIAGNOSTIC FAILURE)** *and attach associated paperwork:*

- ☐ **Fatal Convex UNIX Error?** **If YES, then:** ☞ **appropriate parts of** */mnt/errlog* **attached?** ☐
- ☐ **Hard Error?** **If YES, then:** ☞ **appropriate parts of** */mnt/errlog* **attached?** ☐
- X **System Hang?** **If YES, then:** ☞ **jpstat attached?** X **(spu> jpstat** *(syreset first, if necessary)* **)**
- ☐ **Wrong Answers?** **If YES, then:** ☞ **source code, data sets, expected answers, and differences needed**
- ☐ **Other?** **If YES, then:** ☞ **please describe:**

SYSTEM CONFIGURATION *(required for board assemblies)*

HARDWARE CONFIGURATION/REVISION INFORMATION

X **cop output attached?** (spu> ed /mnt/usr/scm; cat cop.out cop.mem)

X **loconfig attached?** (spu> cat /loconfig)

SOFTWARE CONFIGURATION INFORMATION

CONVEX UNIX V 6.1.9.9 (see */mnt/errlog* **entry made during last boot**)

more /mnt/DIAG_REV V 2.2

more /mnt/DIAG_DB_REV V 3.3

INTERMITTENT FAILURES *(required for intermittent failures only)*

Number of times observed: **Approx. time to repeat failure:**

Have other parts been previously returned to eliminate this same failure mode?(y/n) **If yes, please describe what & when:**

Are there any special environmental conditions worth noting?(y/n) **If yes, please describe:**

MULTIBUS/VME VOLTAGES *(required if part is Multibus or VME board; measure to ± 100 mv at backplane of failing unit)*

+5 V -5 V +12 V -12 V

FE: Do not write below this line. *(The following is for in-house use only.)*

DATE	STATION	P/F	COMMENTS	TECH
__/__/__				
__/__/__				
__/__/__				
__/__/__				
__/__/__				

white copy: TEST ENG. canary copy: QA pink copy: TAC goldenrod copy: FE

H004027

3.3 Test Tag

Parts returned to the factory fall into two categories:

- Vendor-Supplied
- CONVEX-Designed and Manufactured

A returned part is handled differently depending on into which category it falls.

When a vendor-supplied part is returned to the factory, it is shipped to the manufacturer for testing and repair. A CONVEX test tag is not involved.

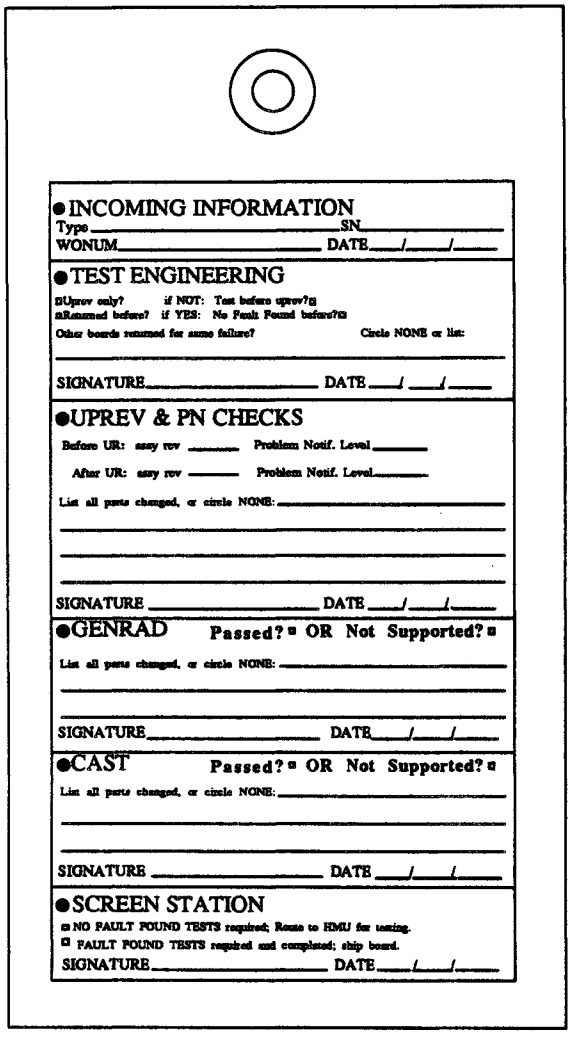
When a CONVEX-designed part is returned to the factory, a test tag is attached to it by receiving personnel.

Then, the test tag is filled out by Test Engineering personnel as the part progresses through the various stages of uprev, test, repair, and final test. The result of each phase of the process is noted on the test tag, which is subsequently returned to the field along with the part.

A test tag is shown in the following figure:

Figure 3–8, Test Tag

(FRONT)



● INCOMING INFORMATION
Type _____ SN _____
WONUM _____ DATE ___/___/___

● TEST ENGINEERING
☐Uprev only? if NOT: Test before uprev?☐
☐Returned before? if YES: No Fault Found before?☐
Other boards returned for same failure? Circle NONE or list:
_____
SIGNATURE _____ DATE ___/___/___

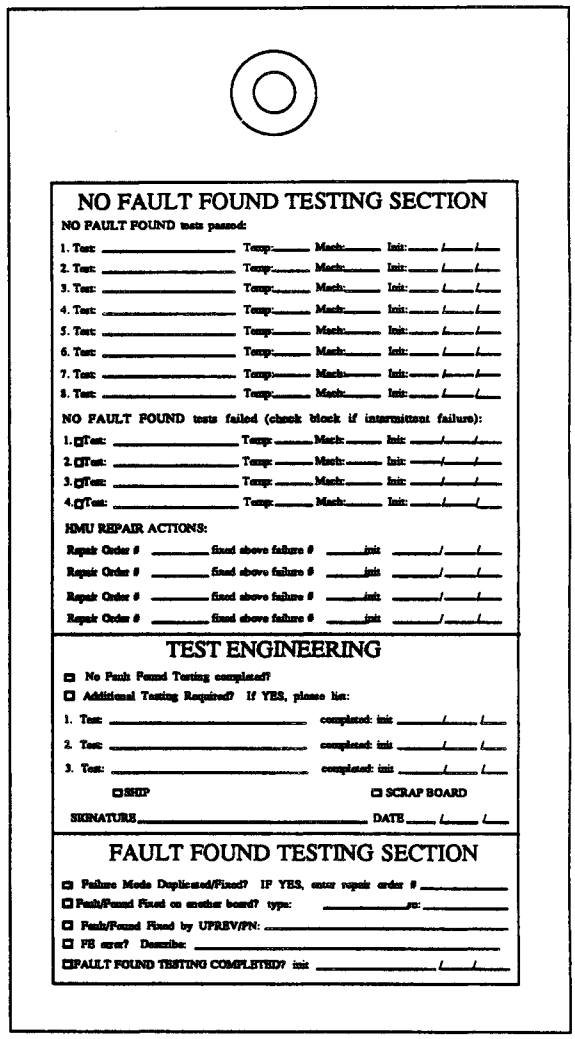
● UPREV & PN CHECKS
Before UR: assy rev _____ Problem Notif. Level _____
After UR: assy rev _____ Problem Notif. Level _____
List all parts changed, or circle NONE: _____
_____
_____
_____
SIGNATURE _____ DATE ___/___/___

● GENRAD Passed? ☐ OR Not Supported? ☐
List all parts changed, or circle NONE: _____
_____
_____
SIGNATURE _____ DATE ___/___/___

● CAST Passed? ☐ OR Not Supported? ☐
List all parts changed, or circle NONE: _____
_____
_____
SIGNATURE _____ DATE ___/___/___

● SCREEN STATION
☐ NO FAULT FOUND TESTS required; Route to HMU for testing.
☐ FAULT FOUND TESTS required and completed; ship board.
SIGNATURE _____ DATE ___/___/___

(REAR)



NO FAULT FOUND TESTING SECTION
NO FAULT FOUND tests passed:
1. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
2. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
3. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
4. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
5. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
6. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
7. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
8. Test: _____ Temp: ____ Mach: ____ Init: ____ /___/___
NO FAULT FOUND tests failed (check block if intermittent failure):
1. ☐Test: _____ Temp: ____ Mach: ____ Init: ____/___/___
2. ☐Test: _____ Temp: ____ Mach: ____ Init: ____/___/___
3. ☐Test: _____ Temp: ____ Mach: ____ Init: ____/___/___
4. ☐Test: _____ Temp: ____ Mach: ____ Init: ____/___/___
HMU REPAIR ACTIONS:
Repair Order # _____ fixed above failure # _____ init _____/___/___
Repair Order # _____ fixed above failure # _____ init _____/___/___
Repair Order # _____ fixed above failure # _____ init _____/___/___
Repair Order # _____ fixed above failure # _____ init _____/___/___

TEST ENGINEERING
☐ No Fault Found Testing completed?
☐ Additional Testing Required? If YES, please list:
1. Test: _____ completed: init ____/___/___
2. Test: _____ completed: init ____/___/___
3. Test: _____ completed: init ____/___/___
☐ SHIP ☐ SCRAP BOARD
SIGNATURE _____ DATE ___/___/___

FAULT FOUND TESTING SECTION
☐ Failure Mode Duplicated/Fixed? IF YES, enter repair order # _____
☐ Fault/Found Fixed on another board? type: _____ sn: _____
☐ Fault/Found Fixed by UPREV/PN: _____
☐ FE error? Describe: _____
☐FAULT FOUND TESTING COMPLETED? init _____ /___/___

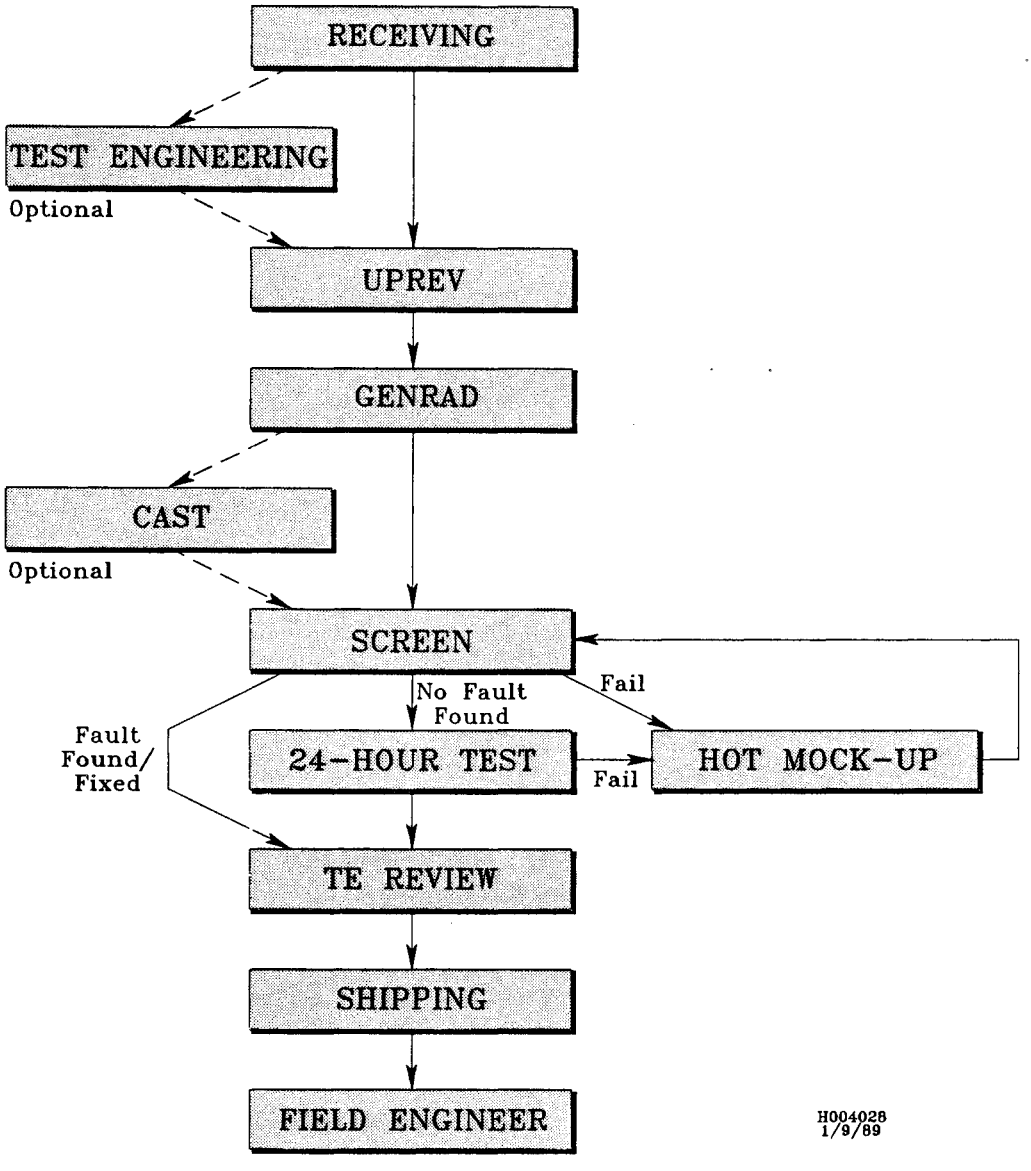
h004082

The test tag has a front and back side. The front side is mostly concerned with preliminary information, revision/problem levels, and automatic testing results.

If no faults are found by the automatic testing procedures, the back side of the test tag is used to document the No Fault-Found testing history of the board, the Fault-Found testing history prior to shipment to the field, and the Test Engineering determination of what will be done with a No Fault-Found board.

A flow chart of this process is shown below:

Figure 3–9, CONVEX Board Flow Diagram



The following paragraphs describe each step of the process.

Receiving Department

When a CONVEX-manufactured part is returned to the factory, the receiving department attaches a test tag and fills out the **INCOMING INFORMATION** portion. This information includes the type of part being returned, its serial number, a work-order number, and the date the part is received.

If a vendor-supplied board is returned from the field, QA is notified and the board is sent to shipping for return to the manufacturer.

Test Engineering Review

When a CONVEX-manufactured board arrives in Test Engineering, the *PART & ASSEMBLY FAILURE REPORT* is examined to determine its failure mode and other information which might affect its test and repair activity. Information from the return form and the board history file are entered on the test tag and the tag signed and dated by the test engineer.

If the board was returned for uprev only or if Test Engineering determines that the returned board should be upreved prior to testing and repair, this is noted on the test tag and the board is sent to Manufacturing for uprev to the latest revision level. If the board should be tested before uprev, this is noted on the tag and the board sent to testing.

If other boards are shown to have been returned to fix a particular problem in the field, they are also listed on the test tag. This allows the test process to be altered for those boards if a fault is found on this board during testing.

The history file for the board is also reviewed to see if the board has been returned in the past, and if so, if it was a No Fault-Found board (failed no tests and was returned to the field). This information is added to the test tag.

Revision Level

When a board requires an uprev, the manufacturing technician doing the work notes the revision level and problem notification level both before and after the uprev procedure on the test tag. All parts replaced are also listed on the tag before it is signed and dated by the technician.

The problem notification level is determined from a list of part locations on the board that must be checked for parts stamped with date-codes known to have problems (latent failures, thermal cycling problems, etc.). These parts have been shown to have failed or have caused problems on this board in the field and may be the cause for the return of the board.

Bringing a board up to the current problem notification level involves replacing all parts bearing date codes known to have problems or potential problems.

GENRAD

After the uprev process is complete, the board goes to GENRAD test. GENRAD is a automated tester that uses a bed-of-nails test fixture to connect to every net on the board to check for wiring errors and failed parts. It is not able to check the board as a functional unit, and may not find intermittent part failures.

If the board passes GENRAD test, the test tag is so noted and the board sent to either CONVEX At-Speed Test (CAST) or to the screen station.

If GENRAD finds failed parts, however, these parts are replaced and the board retested by GENRAD. This process is repeated until the board passes GENRAD and the board is sent to the screen station for Fault-Found Testing. All parts that were replaced are listed on the test tag.

The tag is signed and dated by the technician.

CONVEX At-Speed Test (CAST)

CAST is an automatic test for board functionality. Input signals are applied to the board, the board clocked, and then areas on the board checked for expected results. CAST exercises boards as they are used when installed in working computer systems. This type of test verifies the proper operation of the various functional blocks on the board. Although only a few boards have CAST systems at this time, systems for the remaining boards are under development.

If the board passes CAST, the test tag is so noted and the board sent to the screen station for testing.

If the board fails CAST, however, parts are replaced and the board is retested by CAST. This process is repeated until the board passes CAST and the board is sent to the screen station for 12 hour Fault-Found Testing. All parts that were replaced are listed on the test tag.

The tag is signed and dated by the technician.

Screen Station

If the board was returned for uprev only or a if fault was found as a result of any test and repaired, the board goes to the screen station for Fault-Found Testing. The board is installed in the appropriate C200 Series machine and special diagnostics run overnight to test the board at extreme power supply voltage and clock speed margins. New boards also undergo the testing at the screen station after manufacture.

If the board then passes screen testing, it is considered repaired and ready for return to the field. The test tag is so marked.

When a board arrives at the screen station without being upreved or having failed GENRAD or CAST, it is also subjected to screen testing. If it passes, however, it is routed to Hot Mock-Up (HMU) to undergo No Fault-Found testing. This is indicated on the tag.

Finally, the test tag is signed and dated.

Hot Mock-Up

In this department, the board is installed in a specially configured C200 Series processor cabinet and a specialist for the board under test runs a series of tests and manually troubleshoots the board to determine the fault with the board. As each test is run, the particulars are entered in the **NO FAULT FOUNDED TESTING** section of the test tag.

If a fault is found, the failing tests are noted on the test tag along with whether or not the failure was intermittent and the board is sent to be repaired. The board is fixed and information is entered on the test tag. Then the board is sent to the screen station for testing.

If hot mock-up testing fails to locate a fault on the board, the board is sent to Test Engineering again for review.

Test Engineering—No Fault-Found

If no faults have been found, the board goes to back to Test Engineering for evaluation. Test Engineering then determines if the board:

- Should be subjected to additional tests based on information returned with the board from the field (tests are specified on the test tag)
- Should be returned to the field (concluding that there really was no fault on the board, after all)
- Should be scrapped (if it has been returned before and no faults were found)

The test tag is marked, and the board disposed, accordingly.

Chapter 4
Removal and Replacement

4.1 Overview

This chapter pertains to the removal and replacement of the identified Field Replaceable Units (FRUs). Procedures describe the step-by-step process required to safely install or replace a component. Information about the hazards associated with the process are emphasized to prevent injury to personnel or damage to a component. All steps *must* be completed in the order described. Any deviation from these steps could render the system inoperable or cause internal damage to the system.

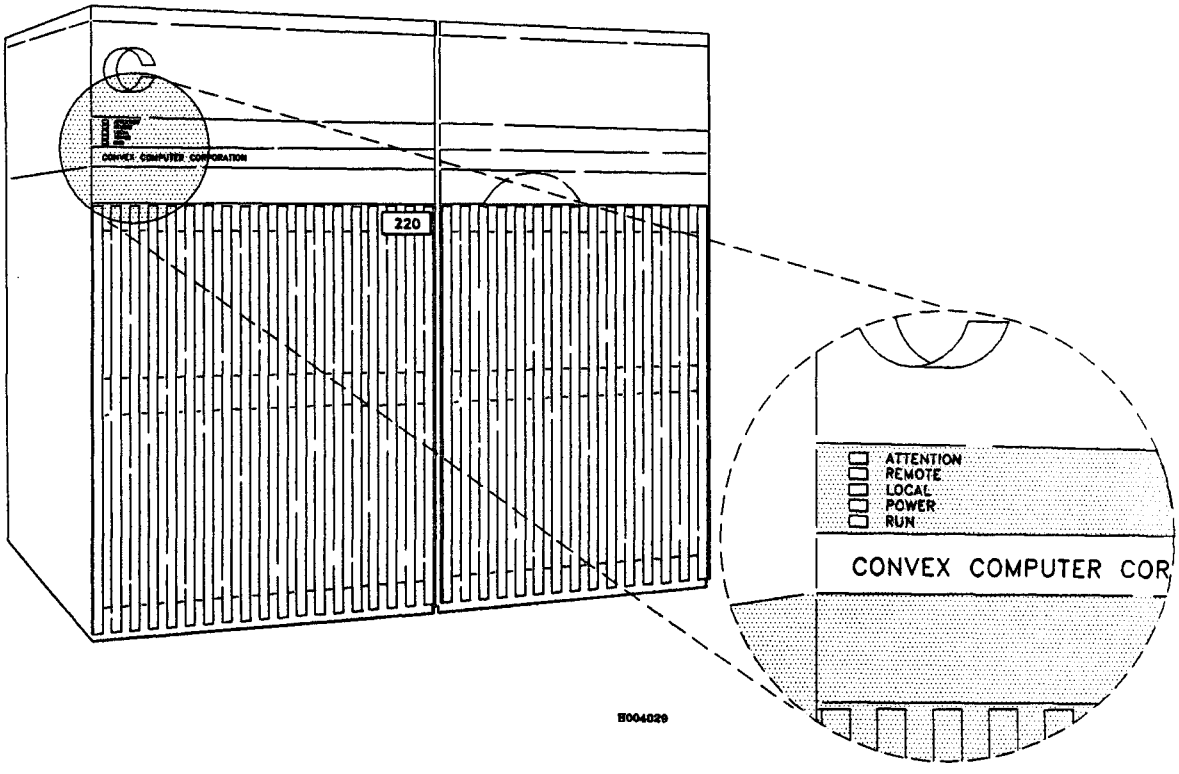
4.2 Removal & Replacement Preliminaries

> **WARNING**
>
> Follow the procedures established in the *CONVEX System Manager's Guide* to power the computer down and power it up. Failure to do so may cause injury to personnel and damage to equipment.

Before performing any maintenance on the computer, power down the system. After performing maintenance on the computer, the system must be powered back up. Use the procedures established in the *CONVEX System Manager's Guide* to power down and power up the system.

The following figure presents the power indicator lights on the front panel of the computer:

Figure 4–1, Power Indicators



4.2.1 Power Up

The power-up procedures assume the system has been powered down properly — all system components, e.g., hard disks and tape drives have been powered down.

Ensure the power-up-reboot is enabled (*power-up-reboot = enable*). If the system is down and the power-up-reboot is disabled, the system can not boot.

Ensure the automatic-reboot is enabled. If the automatic-reboot is disabled (*set automatic-reboot = disable*), the system does not automatically reboot when the system RESET switch is pressed, nor does it automatically reboot after a system crash that occurs at power-up.

> **NOTE**
>
> At power-up, the system runs SPU self-diagnostics. This is an initial hardware check that verifies that all boot devices are installed properly. Enable or disable the self-test from within the soft front panel computing environment (*set spu-selftest = [enable | disable]*).

The power-up procedure consists of eight steps. Each of these steps requires turning on a breaker or power-mode switch.

Follow each step *in sequence*. Any attempt at short-cuts may result in serious damage to the system. The easiest way to make sure the various breakers and switches are in the right position is to turn them all *off* as a preliminary step. Then work through the steps of the power-up procedures. User terminals can be turned on (or off) at any stage in the procedure.

> **CAUTION**
>
> Power up the disks *last*. Failure to do so may cause damage to equipment.

Switching on the disk drives last ensures that power fluctuations during the power-up sequence do not corrupt disk files.

Observe the following precautions *before* starting the power-up procedure:

- Make sure all disk drives are turned off.
- Ensure a cartridge tape drive is *not* loaded; i.e., no tape in the drive.
- Make sure the front panel switch is turned to the **OFF** position.

Perform the following steps in sequence to power up the computer:

1. Turn the power controller *mode switch* to **REMOTE**.
2. Turn the main system breaker to **ON**.
3. If additional power controllers exist in expansion cabinets:
   - Turn each power controller *mode switch* to **REMOTE** for each controller.
   - Turn each breaker switch on each power controller to **ON**.
4. Turn the breaker on each tape drive to **ON**.
5. Turn the **POWER** switch on the front of each tape drive to **ON**.
6. Turn the breaker on each disk drive to **ON**.
7. Turn the **START** button on the front of each disk drive to **ON**.
8. Turn the keyswitch to the **ON** position.

The peripheral cabinet power-up procedure is delayed about 15 seconds from the power-up of the processor cabinet.

The power-up sequence can complete successfully if the keyswitch is turned to any position but **OFF**. Ensure that the **POWER** LED on the front panel is lighted, that the power supply indicators on the front of the power controller are lighted (one for each DC power supply installed), that the power lights on all the peripherals are lighted, and that the disk drives spin up. Ensure that the power controller mode switch is in the **REMOTE** position. Ensure that the **SYSTEM STATUS** displays code *FF*. Any other code indicates the system has a problem.

If the system still fails to power-up, turn the keyswitch to the **0 OFF** position and start over.

4.2.2 Power Down

Before removing any covers, electrical assemblies, or components, power down the computer. Power down procedures are:

1. Enter the following command to obtain the SPU prompt on the system console:

   /etc/shutdown -h now [*warning or message*

   where:

   shutdown is the automatic shutdown procedure
   -h is the option to halt the system
   now is an immediate shutdown

   Refer to the man page for the *shutdown* command for more information on this procedure.
2. Type the following command: **pwrdwn** and enter it with a <**return**>.
3. Wait for the response: *Ready for power down. ^D to abort _.*
4. Open the processor cabinet door.
5. Turn the keyswitch counter-clockwise to the **0 OFF** position and wait for the machine to power down.
6. Set the main circuit breaker on the power controller front panel to **OFF**.

The main DC power supplies are OFF when the computer is in the powered down state.

The System Control Module (SCM), which drives various front panel indicators and decodes front panel switches, has its own on-board power supply. This power supply is ON whenever the computer is connected to AC power and the computer main circuit breakers (100 amp) on the front of the Power Controller are set to **ON**.

In the powered down state, the following indicators are extinguished:

- Front panel indicator **POWER**
- Front panel indicator **RUN**
- Eight green power supply AC indicators on the left side of the Power Controller front panel

In the powered down state, the front panel **ATTENTION** indicator flashes and the three green AC phase indicators remain illuminated. The three AC phase indicators are located near the main circuit breakers on the right side of the power controller front panel.

When the main breaker is **OFF**, the three green indicators near the main circuit breaker *and all other indicators* are extinguished and AC power is removed from all areas outside the power controller.

It is then safe to service all areas of the computer *EXCEPT THE POWER CONTROLLER.*

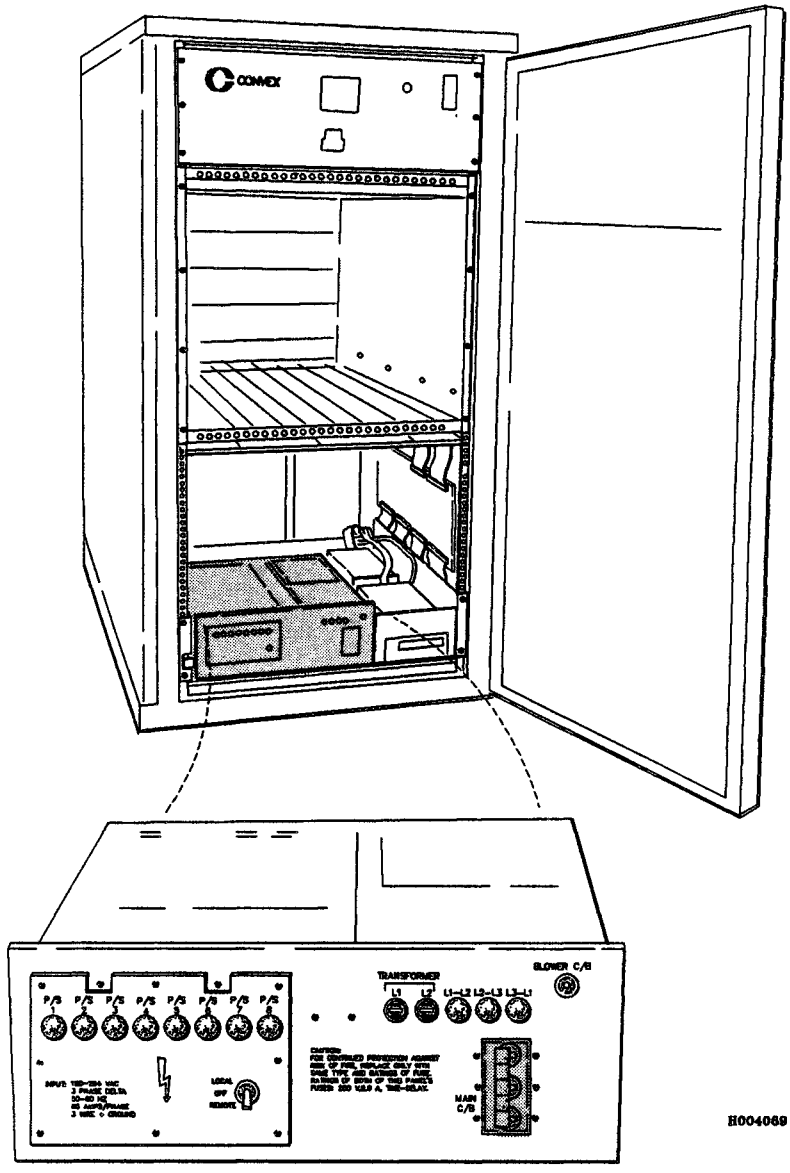
> **WARNING**
>
> Remove AC power from the processor cabinet before servicing the power controller. Failure to do so may result in serious injury to personnel and damage to components and electronic assemblies.

Hazardous voltages are present inside the power controller *even when the main circuit breaker is set to OFF.* Do not disassemble the power controller while the AC power cord is connected to a source of AC power.

4.3 AC Power

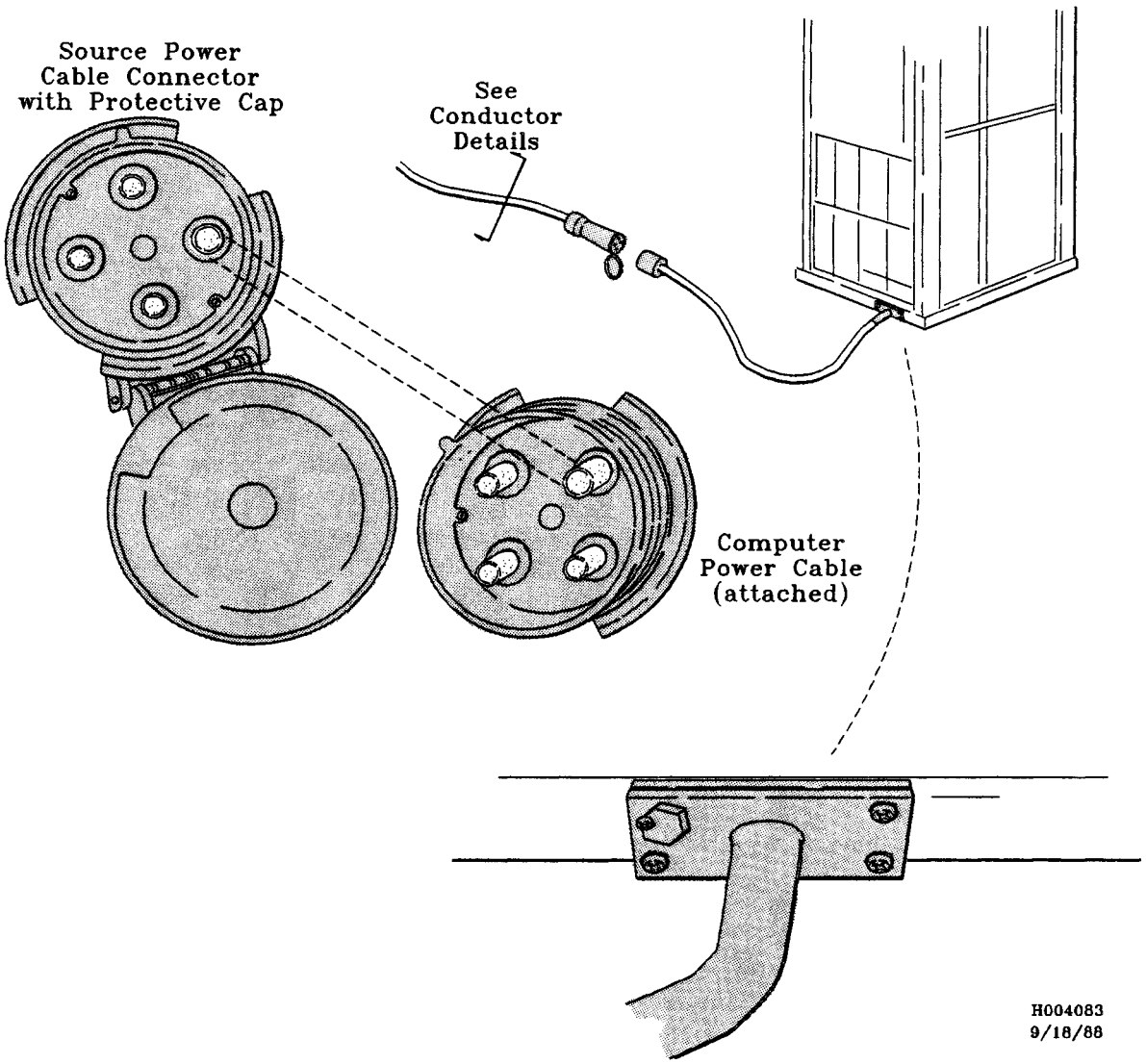
Remove AC power from the processor cabinet before servicing the power controller. AC power is present inside the power controller anytime the AC power cord is connected to a source of AC power, *even when the processor cabinet main circuit breakers are set to* **OFF**. The following figure shows the location of the main circuit breaker:

Figure 4–2, Location of Processor Cabinet Circuit Breaker



For processor cabinets equipped with an AC power connector, the site AC supply to the connection must be turned off before the AC power cord can be connected. The following figure illustrates the AC power cord connection to the AC service connector for domestic systems:

Figure 4–3, AC Power Cord Connectors



4.3.1 AC Power Cord Disconnection

1. Perform power down.
2. Set the 100 amp main circuit breakers on the power controller front panel to **OFF**.
3. Locate the site power panel for the area and set the circuit breakers serving the computer to **OFF**.
4. Loosen the locking collar on the AC power cord connector (about half a turn).
5. Pull apart the 2 halves of the connector.

4.3.2 AC Power Cord Connection

1. Set the computer main circuit breakers to **OFF**.
2. Locate the site power panel for the area and set the circuit breakers serving the computer to **OFF**.
3. Mate the AC power cord connector into the service connector by lining up the key on the computer end with the groove in the service end and inserting the computer end into the service end.
4. Ensure that the connector halves are seated then engage and rotate the locking collar (about half a turn) to lock the connector.
5. Locate the site power panel for the area and set the circuit breakers serving the computer to **ON**.
6. Set the main circuit breakers on the power controller front panel to **ON**.
7. Perform power up.

4.4 Cabinet

The computer processor cabinet has a front door that can be installed so that it opens on either the left or right side, a rear panel, and a side panel. The door attaches with a removable pivot pin and the rear and side panels secure with quick-release latches. There is no side panel on a side where the expansion cabinet attaches; the processor cabinet connector bulkhead is exposed.

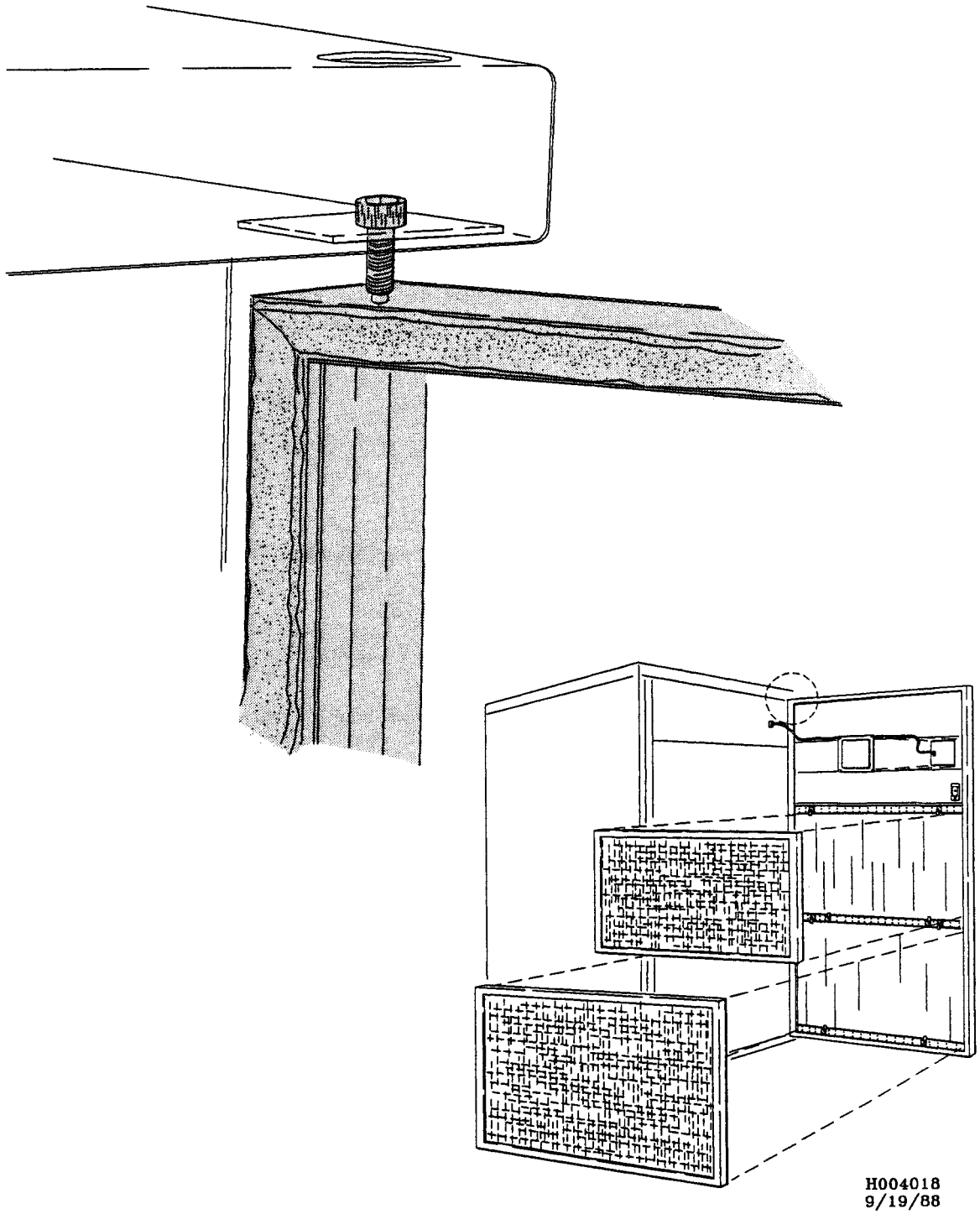
The front control panel mounts all operator indicators, the **SYSTEM STATUS** display, the keyswitch, the **SYSTEM RESET** switch, and the door indicator cable connector. In addition, a printed circuit board is mounted on the rear surface of the front control panel and a small printed circuit board mounted on the door.

4.4.1 Door

The cabinet door pivots on an upper and lower pin. Pivot pins are hex-head bolts with no threads on the lower 3/8 inch. The threaded portion engages threads in the cabinet top and bottom plates and the unthreaded portion fits into bores in the door. The lower pin assembly and a nylon washer support the weight of the door while the upper pin resists side forces and maintains proper door alignment.

The following figure shows the door and pivot pin arrangement:

Figure 4–4, Door and Pivot Pin



4.4.1.1 Tools

- Hex wrench, 3/16–inch
- Phillips screwdriver
- Slot screwdriver, small

4.4.1.2 Removal

1. Remove the screw attaching the door ground strap to the processor cabinet and remove the strap.
2. Remove the door indicator cable connector.
3. Support the door so that the upper pivot pin does not bind in its bore as it is loosened (a foot under the lower edge of the door works well for this).
4. Loosen the upper door pivot pin until it is clear of its bore in the upper inner corner of the door — be ready to support the weight of the door as the pin clears its bore.
5. Lower the outer edge of the door until the top corner is out from under the cabinet top plate.
6. Lift the door off the lower pivot pin.

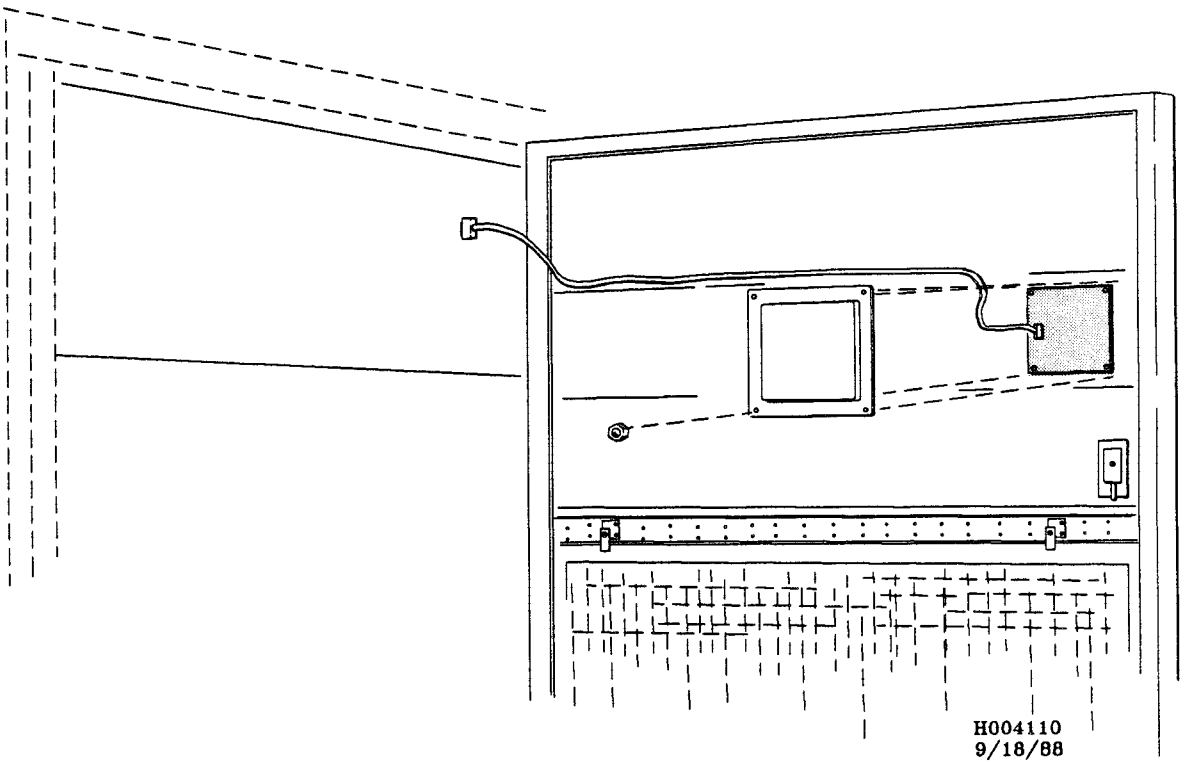
4.4.1.3 Installation

1. Ensure that the top pivot pin is retracted up into the cabinet top plate so that it does not interfere with door installation.
2. Position the door in its approximate installed position.
3. Lift the door and place the pin bore in its lower inner corner on the lower pivot pin that extends out of the cabinet bottom plate.
4. Support the lower outer corner and line up the top pivot pin with its bore in the top inner corner of the door.
5. Align the bore and pin and drive the pin into the door.
6. Tighten the pin until the threads touch the top surface of the door (the unthreaded portion of the pin is completely in the bore at this point) then back it out a complete turn.
7. Install the door indicator cable connector.
8. Install the ground strap to the processor cabinet.

4.4.2 Door Indicator Circuit Board

A door indicator circuit board attaches to the inside the processor cabinet door. This circuit board contains the LED indicators that show through the front of the door. The following figure shows the door indicator circuit board:

Figure 4–5, Door Indicator Circuit Board



4.4.2.1 Tools

- Hex nutdriver, 1/4–inch

4.4.2.2 Removal

1. Engage the personal grounding system.
2. Remove the 4 mounting nuts and washers on the indicator board cover plate.
3. Unplug the connector from the circuit board.
4. Remove the 4 mount nuts and washers from the circuit board.
5. Gently slide the circuit board off the mounting screws.
6. Place the circuit board into a static shielding bag.

4.4.2.3 Installation

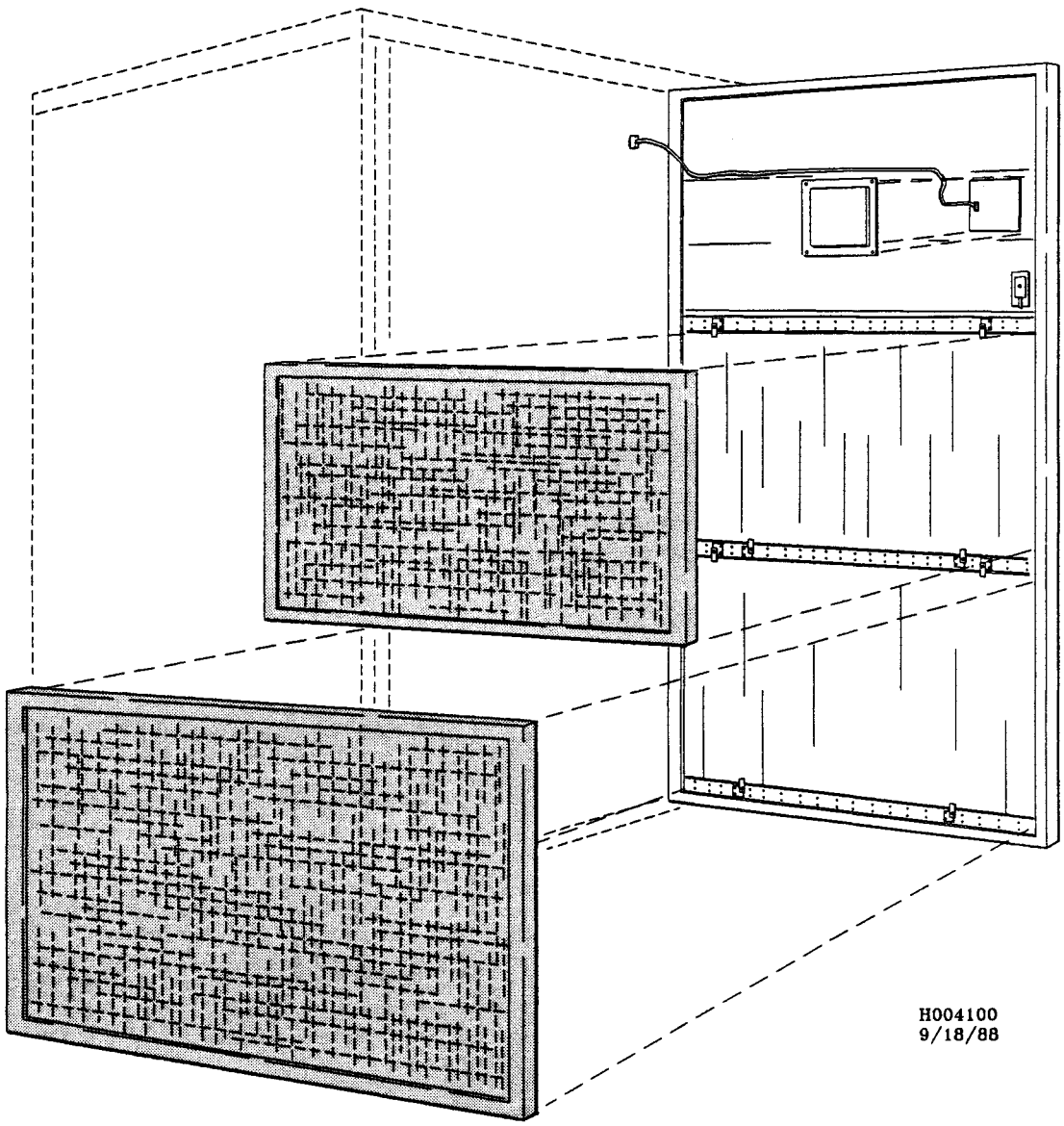
1. Remove the circuit board from the static shielding bag.
2. Position the circuit board to ensure the LEDs are aligned with the panel lights on the door.
3. Gently slide the circuit board onto the 4 mount screws on the backside of the door.
4. Install the 4 mount nuts and washers onto the mount screws and tighten until snug.
5. Attach the connector to the circuit board.
6. Install the cover plate over the 4 mount screws.
7. Place the 4 mount nuts and washers onto the mount screws and tighten with the nut driver.

4.4.3 Door Air Filter

There are two filters in the processor cabinet door. These filters should be cleaned periodically. Replace damaged filters to ensure proper filtration of the air flowing through the processor cabinet. The procedure to replace either door air filter is the same.

The following figure shows the door air filters and latches in the processor cabinet door:

Figure 4–6, Door Air Filters



4.4.3.1 Tools

- Phillips screwdriver

4.4.3.2 Removal

1. Loosen the 2 top latches that hold the filter against the door.
2. Rotate the 2 latches 90 degrees to either side.
3. Remove the filter from the door.

4.4.3.3 Installation

1. Position the filter into the door with the intake side facing the cabinet door.
2. Rotate the 2 latches to their proper position over the filter edge.
3. Tighten the screws on the latches that hold the filter against the door.

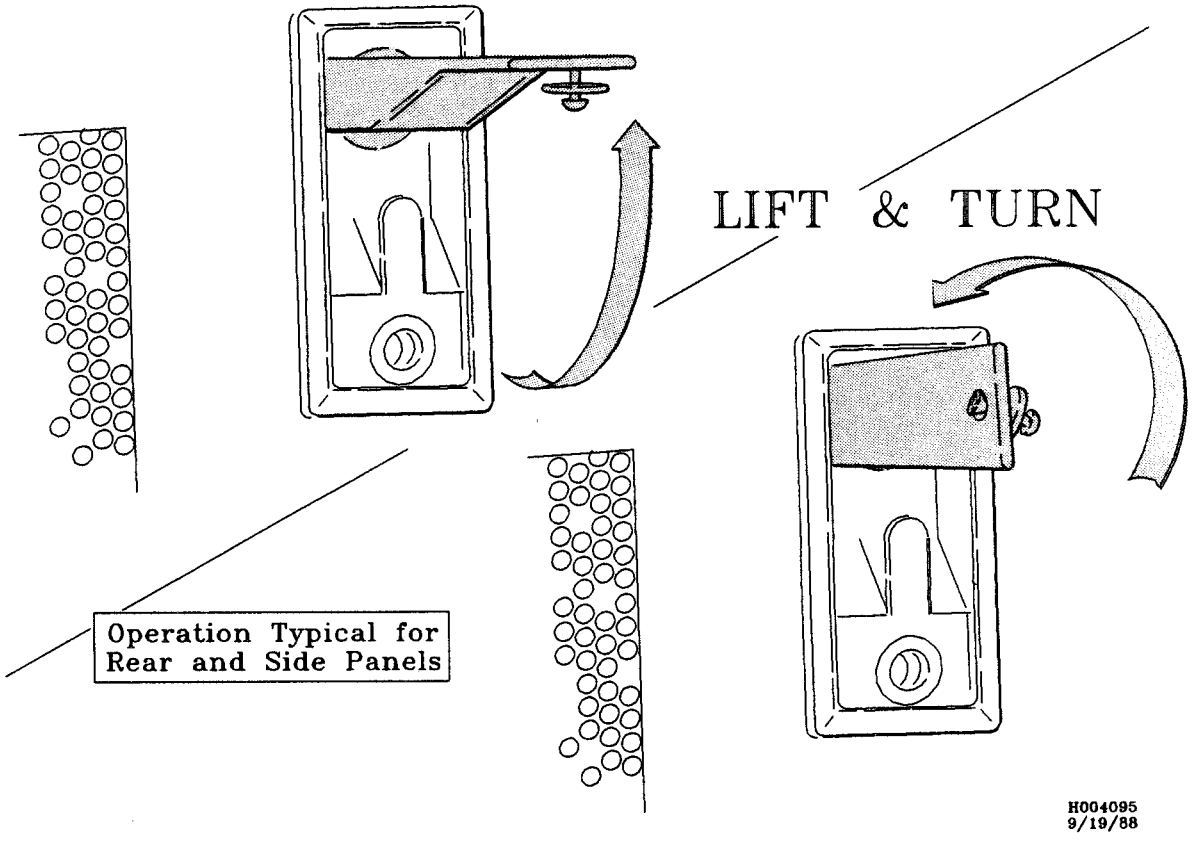
4.4.4 Side Panel

Remove the processor cabinet side panel for improved access to internal items. Bores in the lower edge of the side panel engage pins extending up from the cabinet bottom plate and the top of the panel is secured to the cabinet frame by quick-release latches.

> **NOTE**
>
> This procedure applies to exposed side panels only — it does not apply to connector bulkheads concealed by attached expansion cabinets.

The following figure shows the location and operation of the panel quick-release latches:

Figure 4–7, Panel Quick Release Latches



4.4.4.1 Tools

- Phillips screwdriver

4.4.4.2 Removal

1. Unlock the quarter-turn fasteners to free the latch handles.
2. Extend the latch handles and rotate each a quarter turn to unlatch the panel.
3. Pull the top of the panel away from the cabinet and lift it off the pins.

4.4.4.3 Installation

1. Ensure that the latch handles are extended and rotated to the unlatched (vertical) position.
2. Lower the panel onto the bottom plate taking care that the pins extending up from the bottom plate engage the bores in the lower edge of the panel.
3. Push the top of the panel against the cabinet frame.
4. Rotate the latch handles and press them down into their recesses.
5. Rotate the quarter-turn fasteners to lock the latch handles into their recesses.

4.4.5 Rear Panel

Remove the processor cabinet rear panel for access to items within. Hooks on the lower edge of the rear panel engage pins on the cabinet bottom plate and the top of the panel secures to the cabinet frame with quick-release latches.

4.4.5.1 Tools

- Phillips screwdriver

4.4.5.2 Removal

1. Unlock the quarter-turn fasteners to free the latch handles.
2. Extend the latch handles and rotate to unlatch the panel.
3. Pull the top of the panel away from the cabinet and lift it off the pins.

4.4.5.3 Installation

1. Ensure that the latch handles are extended and rotated to the unlatched (vertical) position.
2. Lower the panel onto the bottom plate taking care to engage the pins on the cabinet with the hooks on the panel.
3. Push the top of the panel against the cabinet frame.
4. Rotate the latch handles and press them down into their recesses.
5. Rotate the quarter-turn fasteners to lock the latch handles into their recesses.

4.4.6 Front Control Panel Assembly

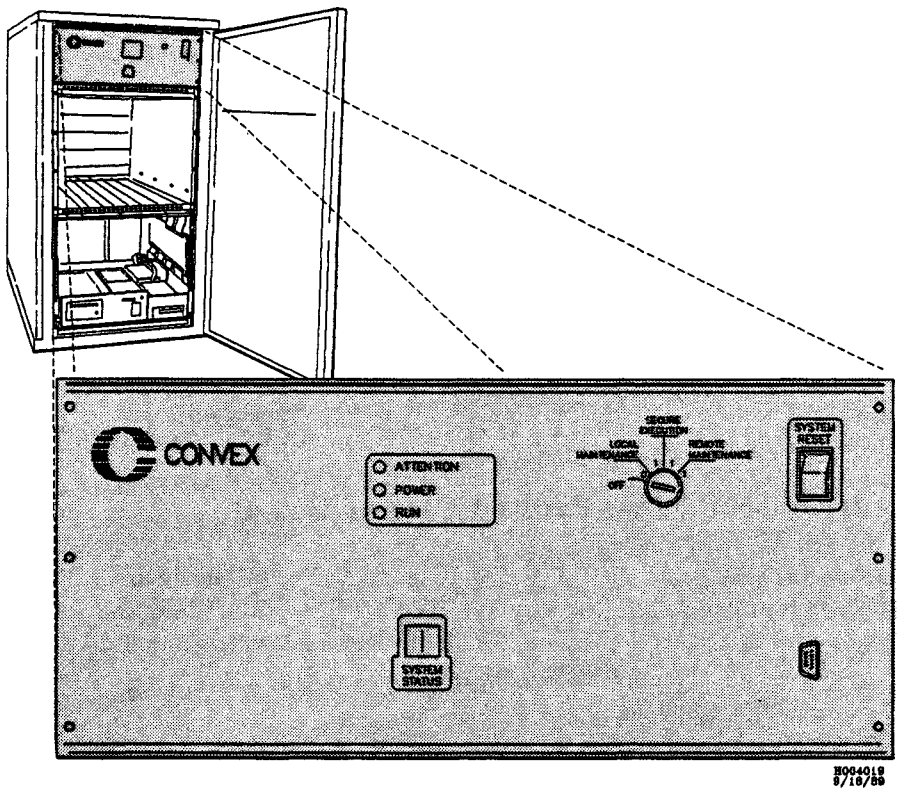
The front control panel assembly includes the front panel, the keyswitch, the **SYSTEM RESET** switch, the door indicator cable connector, and a printed circuit board on which are mounted all the front panel indicators and the **SYSTEM STATUS** hex display.

All the switches and the door indicator connector attach to the printed circuit board through individual connectors. The printed circuit board connects to the System Control Module (SCM) by a ribbon cable. Remove the front control panel assembly to gain access to all these items for service or removal and replacement.

> **CAUTION**
>
> **ELECTRO-STATIC DISCHARGE DAMAGE HAZARD** — Observe all Electrostatic Discharge (ESD) procedures during service. Failure to comply with approved ESD procedures may result in damage to components and electronic assemblies.

The following figure shows the front control panel assembly:

Figure 4–8, Front Control Panel Assembly



4.4.6.1 Tools

- Phillips screwdriver
- Slot screwdriver, small

4.4.6.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the door indicator cable connector.
5. Remove the 6 screws attaching the front control panel assembly to the processor cabinet frame.
6. Grasp the top edge of the front control panel assembly and pivot the panel down to gain access to the ribbon cable attached to the printed circuit board.
7. Mark the exposed side of the cable or connector to simplify the connection later.
8. Disconnect the ribbon connector from the printed circuit board.
9. Remove the front control panel assembly from the cabinet.

4.4.6.3 Installation

1. Place the front control panel assembly in position in the processor cabinet and pivot the top edge down to allow access to the printed circuit board.
2. Connect the ribbon cable to the printed circuit board taking care to orient the cable and connector correctly.
3. Push the panel up into its installed position.
4. Install the 6 screws to secure the front control panel assembly to the processor cabinet.
5. Install the door indicator cable connector to the front control panel.

4.4.7 Front Control Panel Printed Circuit Board

Remove the front control panel circuit board to gain access to the board. This circuit board supports the LED indicators and hex display (**SYSYTEM STATUS**) that show through the front panel, and provides connection points for the front panel switches and door indicators.

4.4.7.1 Tools

- Phillips screwdriver
- Slot screwdriver, small

4.4.7.2 Removal

1. Perform power down.

2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the door indicator cable connector.
5. Remove the 6 screws attaching the front control panel assembly to the processor cabinet frame.
6. Grasp the top edge of the front control panel assembly and pivot the panel down to gain access to the ribbon cable attached to the printed circuit board.
7. Mark the exposed side of the cable or connector to simplify the connection later.
8. Disconnect the ribbon connector from the printed circuit board.
9. Remove the front control panel assembly from the cabinet.
10. Note how the 3 connectors for the keyswitch, reset switch, and door indicators attach to the printed circuit board.
11. Mark these connectors to ensure proper installation at a later time.
12. Disconnect the 3 connectors from the board.
13. Remove the 4 mounting screws and washers.
14. Lift printed circuit board from the panel and place in a static shielding bag.

4.4.7.3 Installation

1. Align the mount holes of the printed circuit board to the standing mounts on the front control panel assembly.
2. Insert the 4 mounting screws with washers and secure board to the panel.
3. Connect the 3 connectors to the correct positions on the board as marked.
4. Place the front control panel assembly in position in the processor cabinet and pivot the top edge down to allow access to the printed circuit board.
5. Connect the ribbon cable to the printed circuit board taking care to orient the cable and connector correctly.
6. Push the front control panel assembly up into its installed position.
7. Secure the front control panel assembly to the processor cabinet with 6 Phillips head screws.
8. Install the door indicator cable connector to the front control panel assembly.

4.4.8 Floor Air Filter

The floor air filter is located under the power controller tray. Remove the lower bay cover to gain access to the filter.

4.4.8.1 Tools

- Slot screwdriver

4.4.8.2 Removal

1. Loosen, but do not remove, the 3 screws on the retainer strip at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
2. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
3. Remove the card cage cover.
4. Loosen each of the 3 quarter-turn fasteners along the bottom edge of the lower bay cover.
5. Pull the cover loose from the cabinet.
6. Grasp the end of the floor filter and slide the filter out of the processor cabinet.

4.4.8.3 Installation

1. Slide the new floor air filter into the slot in the front of the lower bay until it stops.
2. Insert the upper edge of the lower bay cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip and push the cover up so the 3 notches along its upper edge engage the 3 screws through the retainer strip.
3. Push the lower edge of the lower bay cover into position. Conductive gasketing material along this edge causes a snug friction fit.
4. Lock each of the 3 quarter-turn fasteners along the lower edge of the lower bay cover.
5. Install the card cage cover.
6. Tighten the 3 retainer strip screws sequentially, a few turns at a time until the retainer strip is tight against the card cage cover and the lower bay cover.

4.5 Processor Cards

All CPU, system memory, support, and IOP logic is contained on several printed circuit boards, collectively termed *processor cards*, that are installed in the processor cabinet card cage.

Access the processor cards from the front of the processor cabinet, after removing the card cage cover.

> **CAUTION**
>
> **MECHANICAL DAMAGE HAZARD** — Comply with all approved processor card removal and installation procedures. Failure to do so may result in bent or broken backplane connector pins, resulting in processor malfunction and requiring the location and replacement of damaged pins.

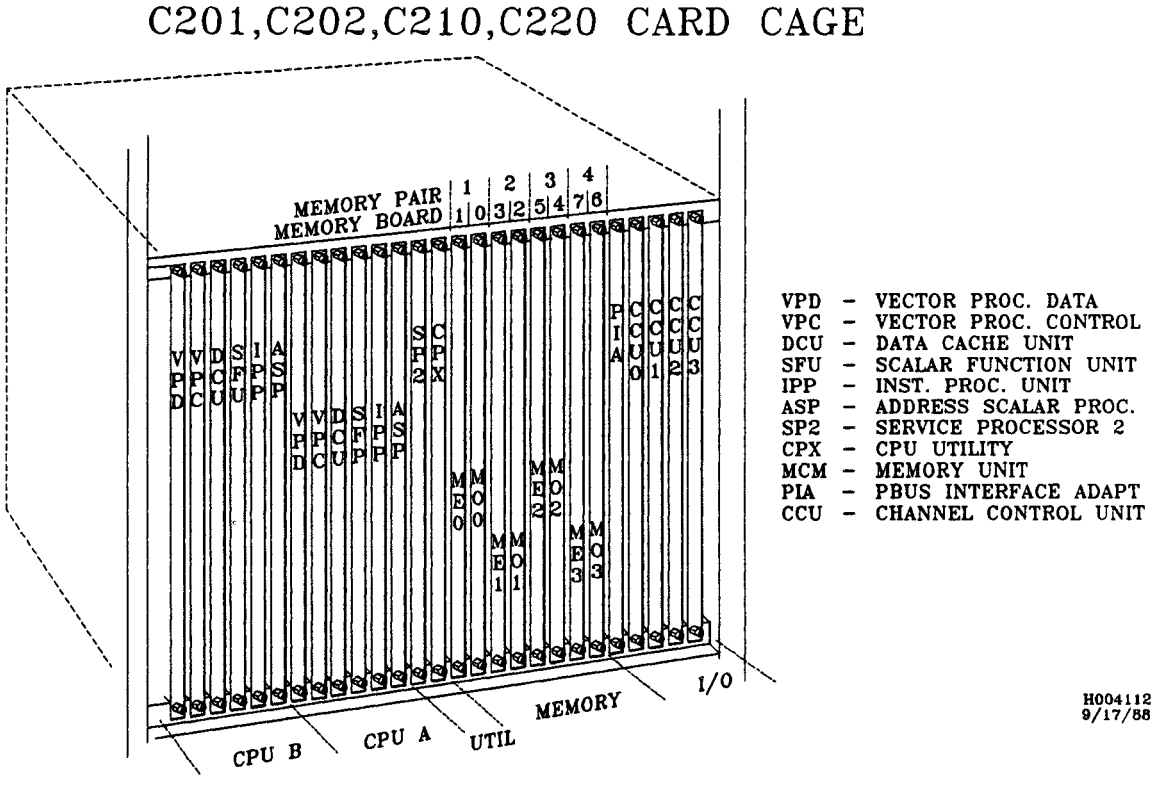
The connectors on the rear of each processor card mate with hundreds of fragile pins extending from the front surface of the backplane. These pins are most easily damaged during installation of processor cards if the processor card connectors are not absolutely parallel with the backplane as the card is installed.

Pins may be bent during removal of processor cards if jack screws are loosened more than one–half turn at a time. A pin bent slightly during card removal could be bent over or broken off during the next installation of a processor card in that slot.

When backplane pins do not properly engage the processor card connectors, the processor can malfunction. This malfunction may be immediately apparent, or may show up later, necessitating another service call. In addition, bent pins may cause false or misleading diagnostic indications.

The following figure shows the processor cards:

Figure 4–9, Processor Cards



4.5.1 Tools

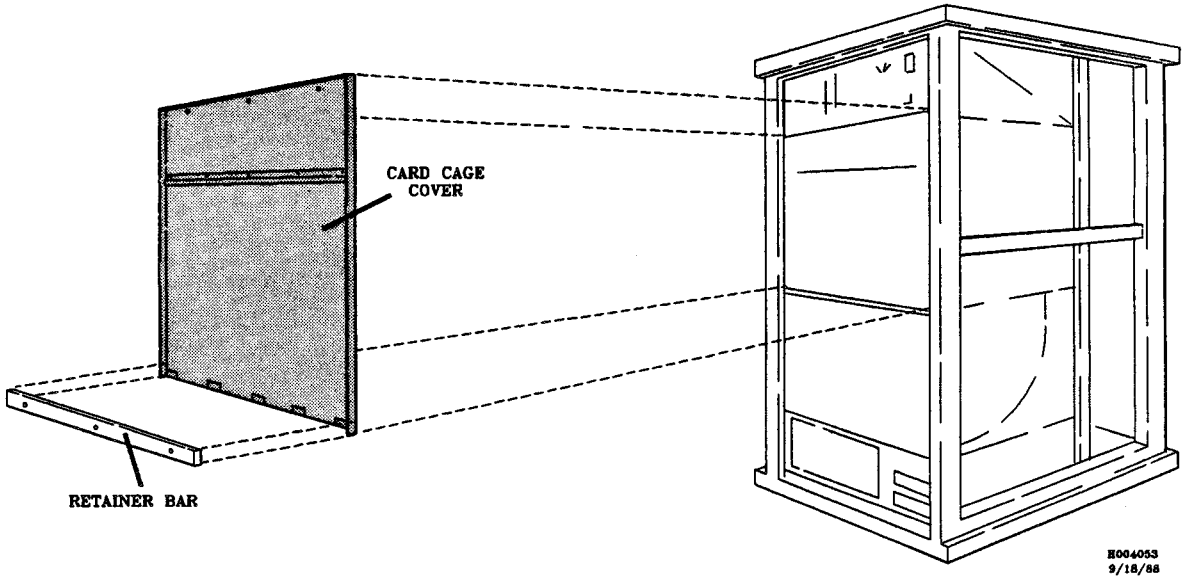
- Phillips screwdriver
- Slot screwdriver
- Nutdriver, 3/8–inch
- Portable light source

4.5.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Loosen, but do not remove, the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
5. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.

The following figure shows the card cage cover:

Figure 4–10, Card Cage Cover



6. Grasp the card cage cover by the cross member and pull it forward until its top edge disengages from the bottom edge of the front control panel assembly.
7. Lift the card cage cover up and out.
8. Locate the card to be removed (slot labels appear along the bottom edge of the card cage).

> **NOTE**
>
> If the processor card being removed contains a foreplane connector, refer to the "Foreplane Connector" removal procedure.

9. Alternately back out each jack screw, *one-half turn at a time* until both are free.
10. Grasp the processor card by the jack screws and pull the card *straight* out 1 to 2 inches until the card disengages from the backplane connector.
11. Insert the portion of the processor card extending from the front of the card cage into the open end of the protective packaging (conductive bag).
12. Pull the processor card from the card cage and work it into the conductive bag as it emerges from the card cage, taking care to avoid contact with the printed circuit side of the board.
13. Ensure that the processor card is completely enclosed by the conductive bag after being removed from the card cage.

4.5.3 Installation

1. Ensure personal grounding system is properly engaged.
2. Locate the card cage slot into which the processor card is to be installed and ensure that it is empty.
3. Visually inspect the backplane connector pins in the slot for bent or broken pins.

> **NOTE**
>
> If damaged pins are found, stop the processor card installation procedure and refer to "Backplane Connector Pin Replacement" procedure.

4. Leave the card to be installed inside its conductive bag until it is installed in the card cage. If the backplane connector end of the card is oriented toward the opening of the bag, the card can be installed without removing it from the bag first.
5. Orient the card so that the components are on the right hand surface.
6. Extend the backplane connector end of the board 1 to 2 inches from the open end of the bag. If the card is oriented incorrectly in the bag, remove it from the bag taking care to avoid contact with the printed circuit side of the board.

7. Start the card into the slot taking care to properly engage the card guides on the ceiling and floor of the card cage slot.
8. Slide the card into the slot until resistance is felt as the card connector bodies contact their mating connectors on the backplane.
9. Slowly and carefully push the card the rest of the way into the slot, engage the threads of both jack screws, and begin to tighten jack screws alternately, *one-half turn at a time using fingers only.*

> **NOTE**
>
> At some point the backplane connector bodies engage and slide easily, reducing the force needed to tighten the jack screws.

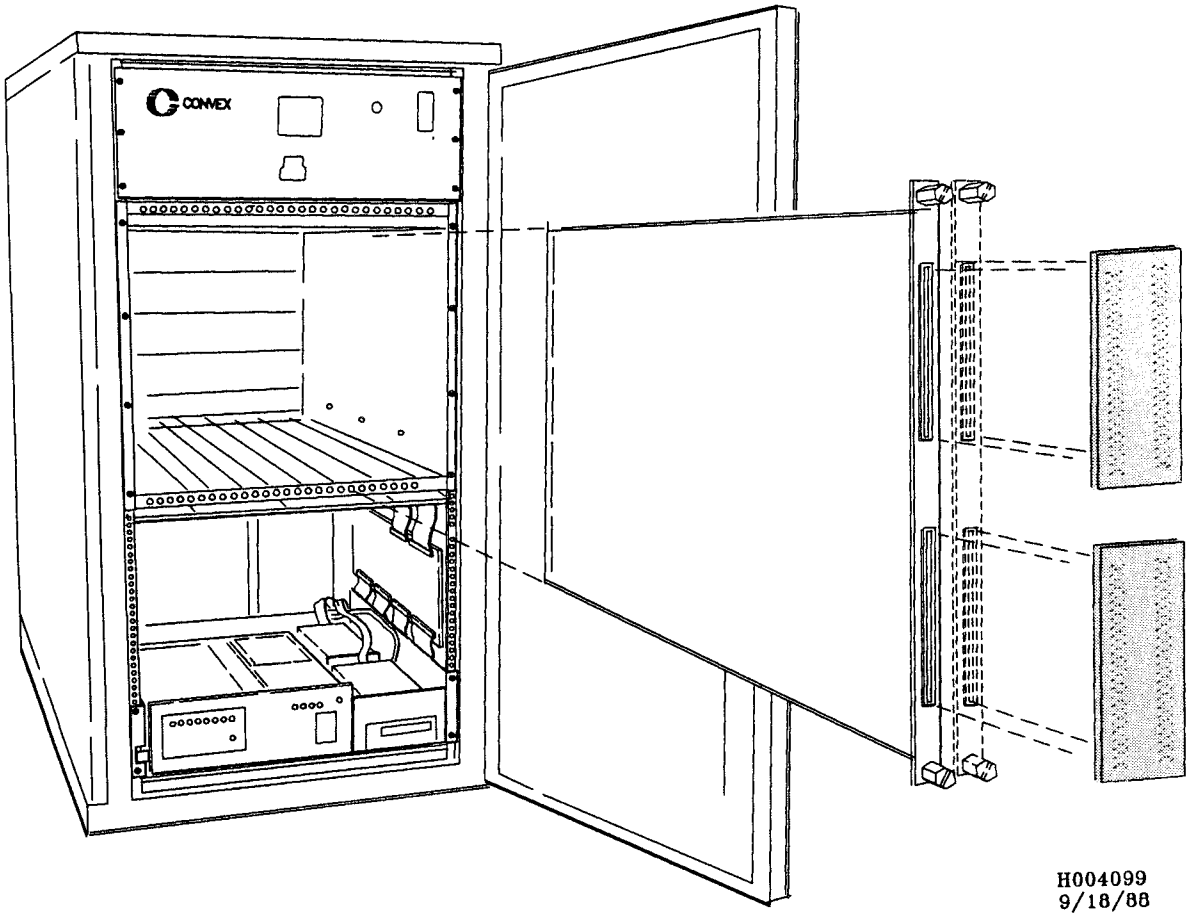
10. Continue alternately tightening the jack screws one-half turn at a time as far as possible by hand.
11. Alternately tighten each jack screw *one-half turn at a time* until both are snug.
12. Pull the retainer strip (at the lower edge of the card cage) away from the card cage so that it rests against the heads of its 3 screws.
13. Insert the lower edge of the card cage cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip.
14. Press the card cage cover down so the 3 notches along its lower edge engage the 3 screws holding the retainer strip.
15. Push the upper edge of the card cage cover into position under the lower edge of the front control panel assembly. Conductive gasketing material along this edge causes a snug friction fit.
16. Lock each of the 3 quarter-turn fasteners along the upper edge of the card cage cover.
17. Tighten the 3 retainer strip screws sequentially, a few turns at a time, until the retainer strip is tight against the card cage cover and the lower bay cover.

4.6 Processor Card Foreplane Connector

In the processor card cage, some processor cards connect to other processor cards via foreplane connectors. These connectors must be removed before either card of the pair can be removed from the card cage.

The following figure illustrates a foreplane connector:

Figure 4–11, Foreplane Connector



4.6.1 Tools

- Slot screwdriver, small

4.6.2 Removal

1. Disengage the foreplane connector from the processor card by alternately prying on opposite sides of the connector at evenly spaced intervals.
2. When the foreplane connector is loosened, pull it straight out from the processor card by hand.

4.6.3 Installation

1. Examine the foreplane connector for bent or broken pins.
2. Align the foreplane connector keyway notches with the keyway tabs on the processor card connector.
3. Use evenly applied pressure to push the foreplane connector straight onto the processor card.

> **NOTE**
>
> If not fully seated, use the handle of a screwdriver to apply pressure to the connector assembly *only in the areas where the connector pins are soldered to the printed circuit board.* The pressure is delivered on-axis directly to the connector body rather than off-axis through the connector assembly printed circuit board.

4.7 Lower Bay

The lower bay contains the SPU disk drive, SPU tape drive, and the power controller. These items are mounted on a tray at the bottom of the lower bay with screws through keyhole shaped mounting holes so that the screws need only be loosened for removal of the item. The lower bay also contains the System Control Module (SCM) that is mounted to the right side of the cabinet and an intake air temperature sensor. Remove the lower bay cover and the lower air plenum to access these items.

WARNING

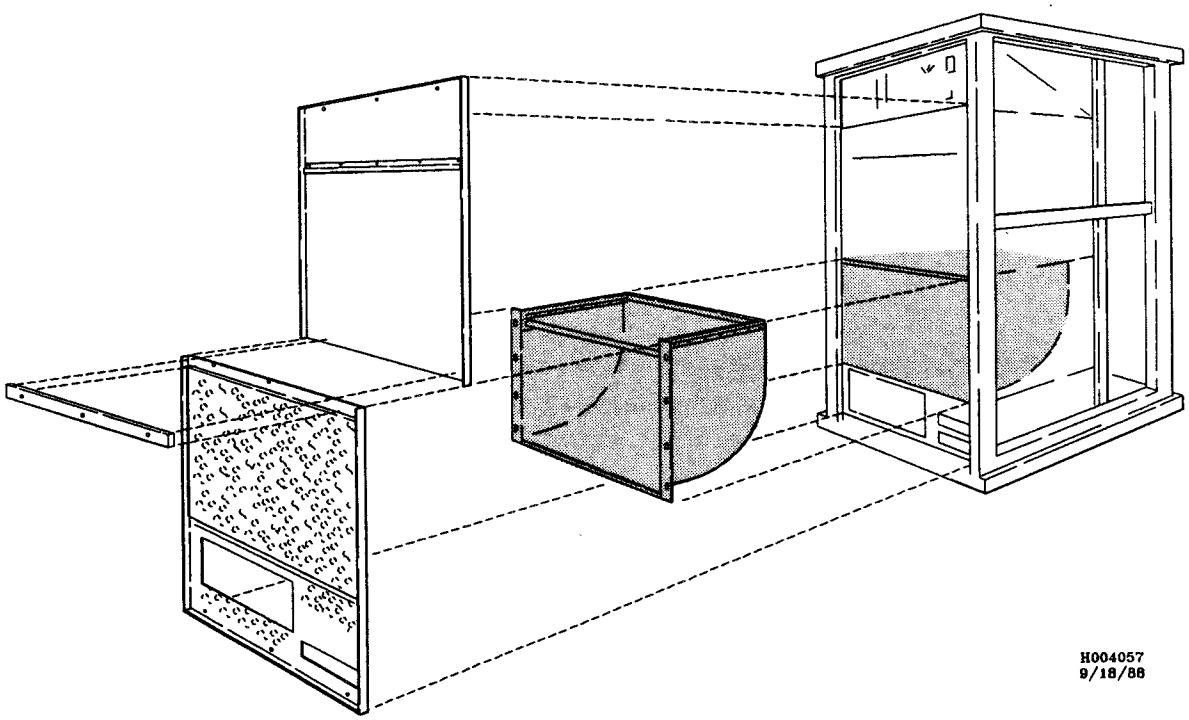
Disconnect the AC power cord before removing the power controller. Failure to do so may result in serious injury to personnel and damage to components and electronic assemblies.

Power down the computer and set the main circuit breakers to **OFF** before servicing any item in the lower bay. In addition, completely remove the AC power from the computer before removing the power controller. Hazardous voltages are present inside the power controller *even when the main circuit breaker is set to OFF*. Do not disassemble the power controller while the AC power cord is connected to a source of AC power.

4.7.1 Lower Bay Cover and Lower Air Plenum

Remove the lower bay cover and the lower air plenum to access all the other items in the lower bay. Removal of the lower air plenum may require removal of the processor card cage cover. The following figure illustrates the lower air plenum:

Figure 4–12, Lower Air Plenum



4.7.1.1 Tools

- Phillips screwdriver
- Slot screwdriver

4.7.1.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Loosen, but do not remove, the 3 screws on the retainer strip sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the lower bay cover).
4. Loosen each of the 3 quarter-turn fasteners along the bottom edge of the lower bay cover.
5. Remove the lower bay cover from the cabinet.

> **NOTE**
>
> Inspect the lower edge of the processor card cage cover (where it is clamped by the retainer strip) to see if it is notched to allow the removal of the lower air plenum. If it is not notched, engage personal grounding system and remove the processor card cage cover and continue with the next step.

6. Remove the 8 screws securing the lower air plenum to the processor cabinet frame.
7. Grasp the lower air plenum stiffener bar and slide the plenum out of the cabinet.

4.7.1.3 Installation

1. Install the lower air plenum in the lower bay taking care to engage the slide rails along the top of the plenum in the mating slide rails along the bottom of the card cage.
2. Insert, but do not tighten, the 8 mounting screws into the cabinet frame taking care that each screw has a flat washer in contact with the plenum material.
3. Tighten the 8 screws after all have been inserted.
4. Pull the retainer strip (at the lower edge of the card cage) away from the card cage so that it rests against the heads of its 3 screws.

> **NOTE**
>
> If the processor card cage cover was removed earlier, install it now.

5. Insert the upper edge of the lower bay cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip.
6. Push the cover up so the 3 notches along its upper edge engage the 3 screws holding the retainer strip.
7. Push the lower edge of the lower bay cover into position. Conductive gasketing material along this edge causes a snug friction fit.
8. Lock each of the 3 quarter-turn fasteners along the lower edge of the lower bay cover.
9. Tighten the 3 retainer strip screws sequentially, a few turns at a time, until the retainer strip is tight against the card cage cover and the lower bay cover.

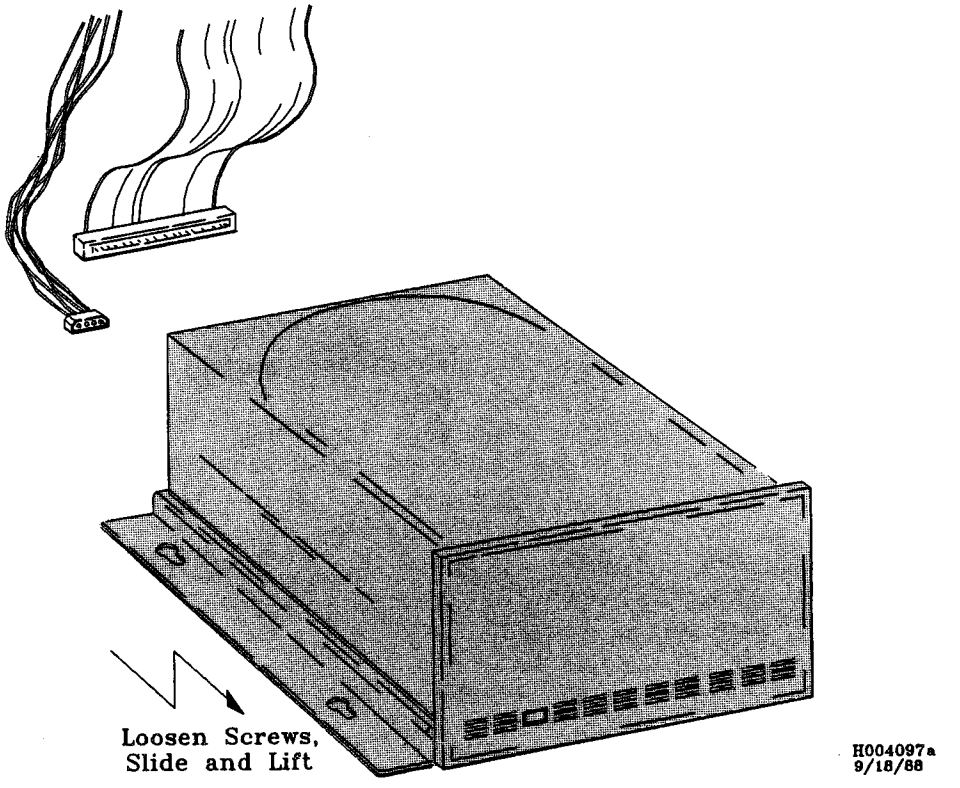
4.7.2 SPU Disk Drive

The SPU disk is a standard 5 1/4–inch SCSI hard disk drive that is mounted to the lower bay tray.

> **CAUTION**
>
> Exercise care when handling the SPU disk drive, avoiding bumps and collisions with other objects. Failure to do so may cause loss of data or damage to the drive unit.

The following figure illustrates the SPU disk:

Figure 4–13, SPU Disk



4.7.2.1 Tools

- Phillips screwdriver

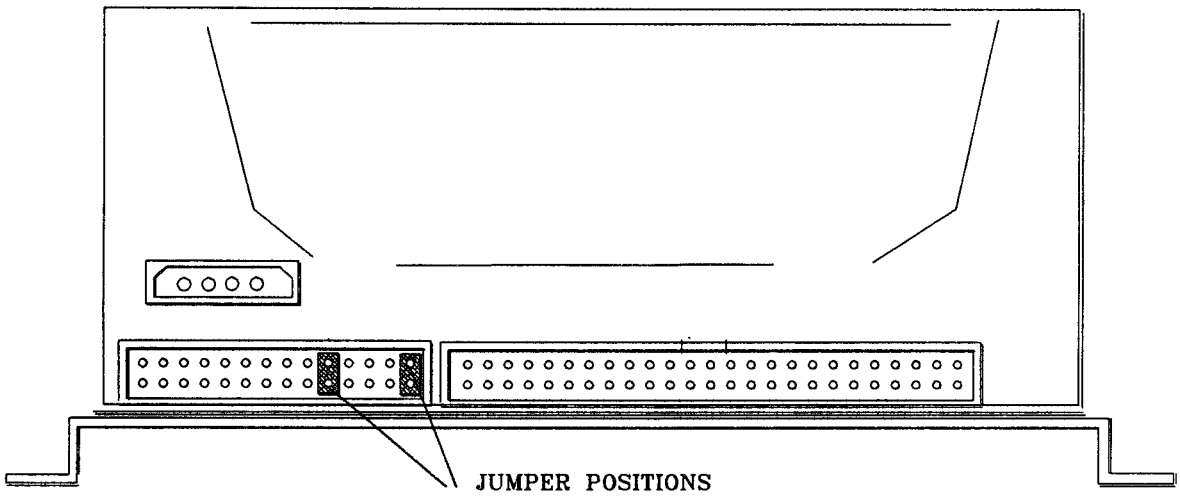
4.7.2.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the lower bay cover.
5. Remove the lower air plenum.
6. Loosen, but do not remove, the 4 screws securing the drive unit to the lower bay tray.
7. Slide the drive unit forward so that the large diameter portion of the keyhole mounting holes clears the screw heads.
8. Lift the drive unit straight up, off the mounting screws, rotate the unit slightly clockwise to clear the tape drive cables, and pull the unit forward as far as the cables allow.

9. Mark the top surface of the cable or connector to simplify connecting the cable later.
10. Disconnect the ribbon connector from the drive unit.
11. Disconnect the 4 conductor power cable from the drive unit. This connector is keyed.
12. Remove the drive unit from the lower bay.
13. Inspect the drive unit for jumpers.

The following figure shows the location of the SPU disk drive jumpers:

Figure 4–14, SPU Disk Jumper



4.7.2.3 Installation

1. Inspect the replacement drive unit for jumpers.

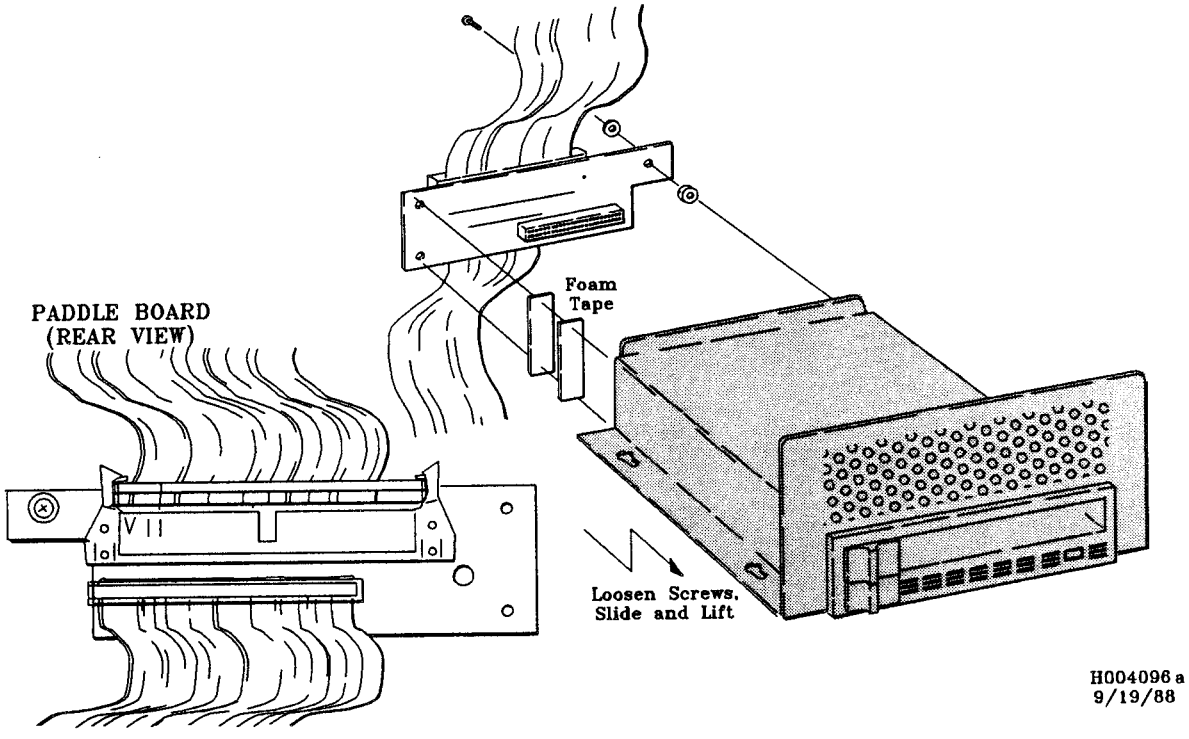
> **NOTE**
>
> If the removed drive unit has jumpers, ensure the replacement drive unit has jumpers.

2. Connect the power cable to the drive unit. The connections are keyed.
3. Connect the ribbon cable to the drive unit taking care to orient the cable and connector correctly.
4. Work the drive unit under the tape drive cables and position the drive unit so that the large opening of its mounting keyholes align over the mounting screws.
5. Gently lower the SPU disk onto the tray.
6. Slide the drive unit to the rear to position the narrow portion of the keyholes under the screw heads.
7. Tighten the 4 mounting screws.
8. Orient the SPU disk drive and SPU tape drive cables neatly towards the rear of the lower bay and out of the way.
9. Install the lower air plenum.
10. Install the lower bay cover.

4.7.3 SPU Tape Drive

The SPU tape drive is a standard cartridge tape drive that is mounted in the lower bay tray. The following figure illustrates SPU tape drive:

Figure 4–15, SPU Tape Drive



4.7.3.1 Tools

- Phillips screwdriver

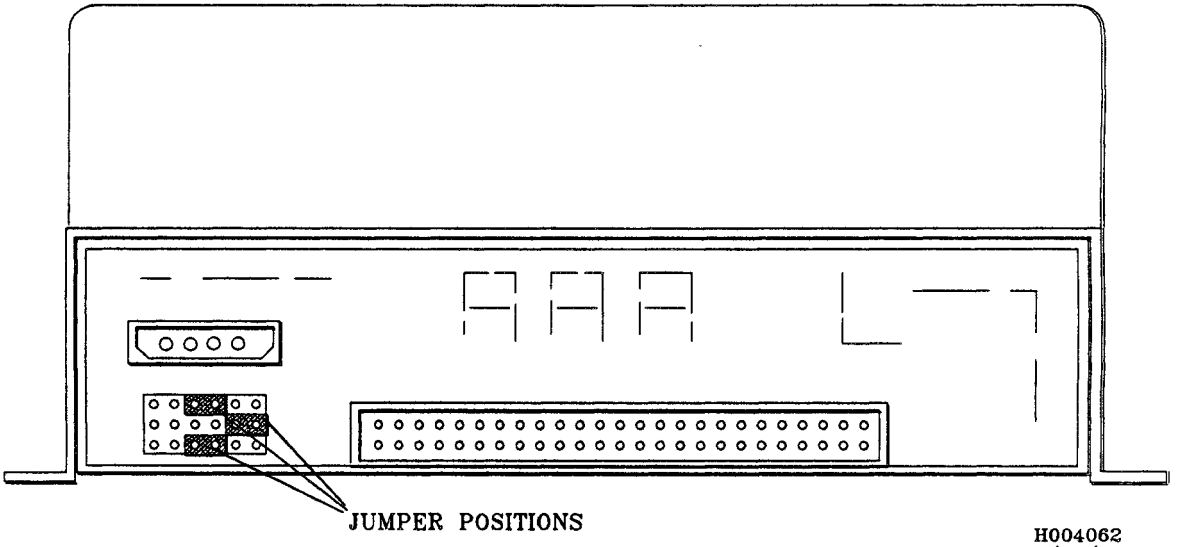
4.7.3.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the lower bay cover.
5. Remove the lower air plenum.
6. Loosen, but do not remove, the 4 screws securing the drive unit to the lower bay tray.
7. Slide the drive unit forward so that the large diameter opening of the keyhole mounting holes clears the screw heads.
8. Lift the drive unit straight up, off the mounting screws, and pull the unit forward as far as the cables allow. Take care to not damage the paddle board attached to the rear of the drive unit.

9. Mark the location and orientation of the 2 ribbon cables to simplify connections later.
10. Disconnect the ribbon connectors from the paddle board attached to the rear of the drive unit.
11. Disconnect the 4 conductor power cable from the drive unit. This connector is keyed.
12. Remove the drive unit from the lower bay.
13. Inspect the tape unit for jumpers.

The following figure shows the SPU tape drive jumper locations:

Figure 4–16, SPU Tape Jumper



4.7.3.3 Installation

1. Inspect the replacement tape unit for jumpers.

> **NOTE**
>
> If the removed drive unit had jumpers, ensure the replacement drive unit has a jumpers.

2. Connect the power cable to the drive unit. The connection is keyed.
3. Connect the ribbon cables to the paddle board attached to the rear of the drive unit. Take care to attach the cables to their appropriate connectors and to orient the connectors correctly. The top cable goes to the SPU disk drive and the lower cable comes from the backplane.
4. Push the ribbon cables toward the rear of the cabinet.
5. Position the drive unit so that the large opening of its mounting keyholes align over the mounting screws.
6. Lower the drive unit over the mounting screws.
7. Slide the drive unit to the rear to position the narrow opening of the keyholes under the screw heads.
8. Tighten the 4 mounting screws.
9. Position the cables neatly towards the rear of the cabinet and out of the way.
10. Install the lower air plenum.
11. Install the lower bay cover.

4.7.4 SPU Tape Paddle Board

The SPU tape drive paddle board is part of the SCSI daisy-chain, providing both a connection to the SPU tape drive and a through connection to the SPU disk drive.

The paddle board mounts on the tape drive data/control connector and secures to the drive chassis with one screw and two nylon washers. Two ribbon cable connectors allow connections to the SPU and the SPU disk.

4.7.4.1 Tools

- Phillips screwdriver

4.7.4.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.

4. Remove the lower bay cover.
5. Remove the lower air plenum.
6. Remove SPU tape drive unit.
7. Remove the screw and 2 washers attaching the paddle board to the tape drive chassis.

> **NOTE**
>
> Be sure to catch the second washer being used as a spacer as it falls out from the between the paddle board and tape drive chassis when the screw is removed.

8. Pull the paddle board straight off the tape drive connector.

4.7.4.3 Installation

1. Position the paddle board tape drive connector above the connector pins on the tape drive ensuring proper alignment.
2. Mate the 2 halves of the connector, ensuring that the paddle board is completely seated.
3. Place the nylon washer/spacer between the paddle board and the drive chassis, lining it up with the hole in the paddle board.
4. Ensure that the top nylon washer is on the screw, then secure the paddle board to the chassis with the screw.
5. Install the SPU tape drive in the lower bay.
6. Install the lower air plenum.
7. Install the lower bay cover.

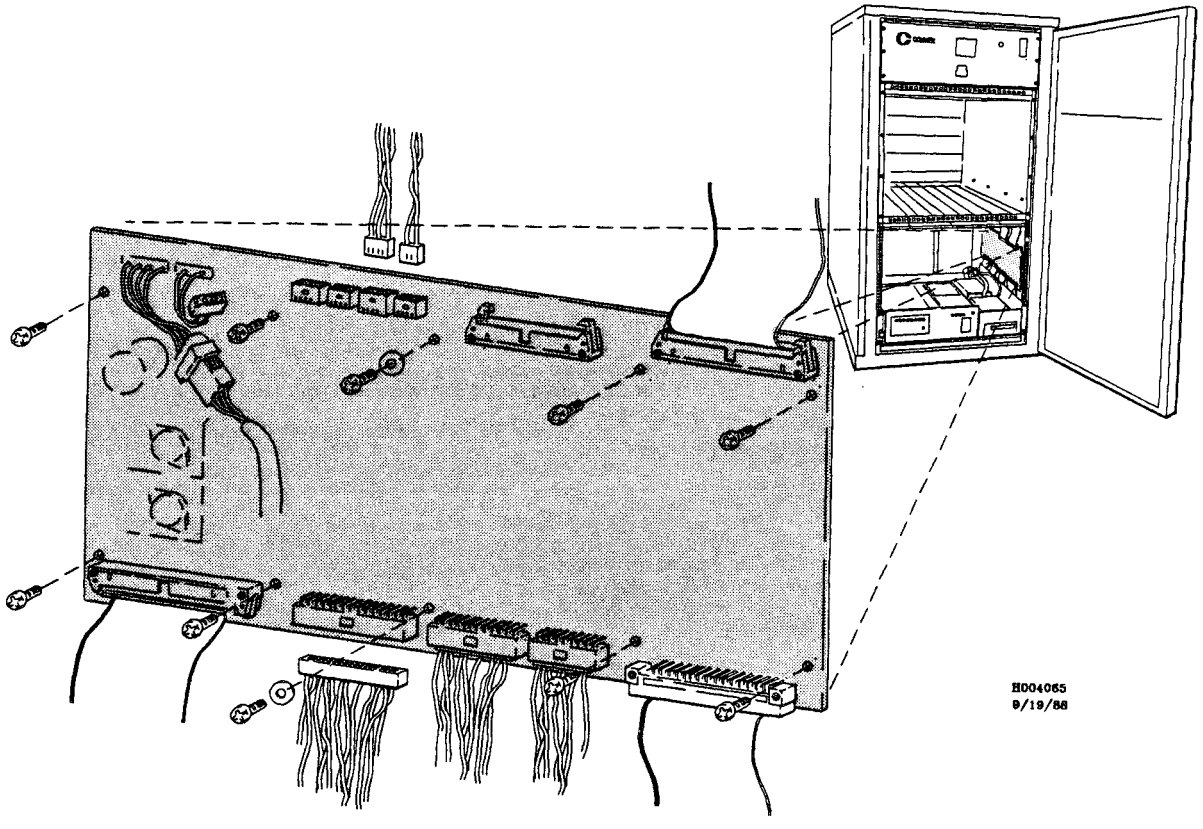
4.7.5 System Control Module

The System Control Module (SCM) monitors several operating parameters (DC voltages, airflow and air temperature, load sharing, etc.), provides decode logic for the front control panel switches, and provides drive logic for the front control panel indicators. All SCM logic is contained on a single printed circuit board that is mounted on the right side cabinet frame in the lower bay by screws into threaded spacers.

The SCM has its own on-board power supply operating independently of the boards in the card cage. It is active anytime the AC power cord is connected to a source of AC power and the main circuit breakers are set to ON.

The following figure illustrates the SCM:

Figure 4–17, System Control Module



4.7.5.1 Tools

- Phillips screwdriver

4.7.5.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the lower bay cover.
5. Remove the lower air plenum.
6. Disconnect all cables from the SCM board (taking care not to damage fragile connectors) and move the cables out of the way. Mark the unkeyed connectors to simplify connections later.
7. Remove the screws attaching the SCM board to the cabinet frame.

> **NOTE**
>
> There are *two different sizes* of mounting screws for the SCM board. Note from which mounting hole the short screws are removed.

8. Remove the SCM board from the lower bay.

4.7.5.3 Installation

1. Position the SCM board on the threaded spacers.

> **NOTE**
>
> Ensure that the correct length screw is installed in the correct location. The front four mounting screws are 6/32 x 5/8. The next two mounting screws are 6/32 SEMs. The back two mounting screws are 6/32 x 5/8. And the last two mount holes of the SCM board are not used.

2. Insert 2 screws through the holes near the forward end of the board and start them into the threaded spacers.
3. Install the remaining screws.

> **NOTE**
>
> Ensure that the correct length screw is installed in the correct location.

4. Connect all SCM cables taking care not to damage fragile connectors and to orient all connectors correctly.
5. Install the lower air plenum.
6. Install the lower bay cover.

4.7.6 Power Controller

The power controller controls and distributes AC power to the different areas of the processor cabinet.

Three phase indicators are located near the main circuit breakers on the power controller front panel. When illuminated, AC power is available to the load-side of the main circuit breakers. The power controller front panel has eight DC power supply status indicators. When illuminated, AC power is present at the power supply connector at the left rear corner of the power controller top surface.

> **WARNING**
>
> **LETHAL VOLTAGE HAZARD** — Hazardous voltages are present inside the power controller *even when the main circuit breaker is set to OFF.*
>
> Do not disassemble the power controller while the AC power cord is connected to a source of AC power. Failure to remove AC power from the processor cabinet before servicing the power controller may result in serious injury to personnel and damage to components and electronic assemblies.

The AC power cord comes up through the cabinet bottom plate and into the power controller immediately behind the power supply status indicator panel. Behind this panel, the individual conductors attach to studs that are part of the AC input power filter within the power controller.

WARNING

CRITICAL TORQUE REQUIREMENTS — Torque requirements for the AC power connection stud nuts must be observed. Failure to torque these nuts properly may result in excessive heating and the possibility of fire, or damage to the AC input power filter insulation.

There are specific torque requirements for the nuts securing the power cord terminals to the AC power contactor input studs. Too little torque may create a high-resistance connection resulting in the generation of heat at the connection. Too much torque may damage the AC input power filter insulating material.

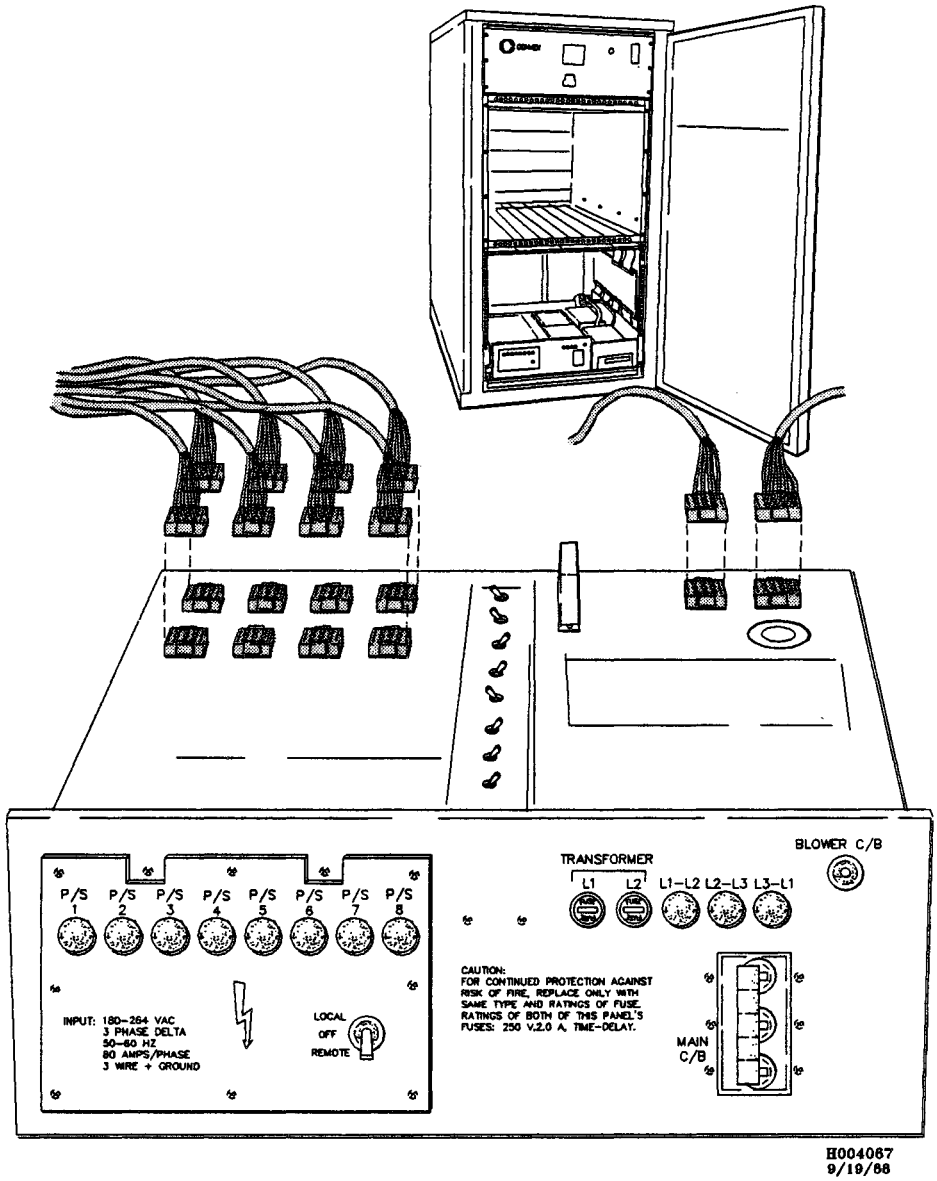
4.7.6.1 Tools

- Phillips screwdriver
- Slot screwdriver, small
- Nutdriver, 5/16–inch
- Open-end wrench, 1/2–inch
- Torque wrench with 1/2–inch socket

4.7.6.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Locate the site power panel for the area and set the circuit breakers serving the computer to **OFF**.
4. For domestic systems, loosen the locking collar on the AC power cord connector (about half a turn) and pull the 2 halves of the connector apart to separate the connector.
5. Engage personal grounding system.
6. Remove the lower bay cover.
7. Remove the lower air plenum.
8. Disconnect the DC power supply AC input cables from the left, rear, top surface of the power controller. The connector sockets and cables are labeled. The following figure shows the location of the power controller connectors:

Figure 4–18, Power Controller Connectors

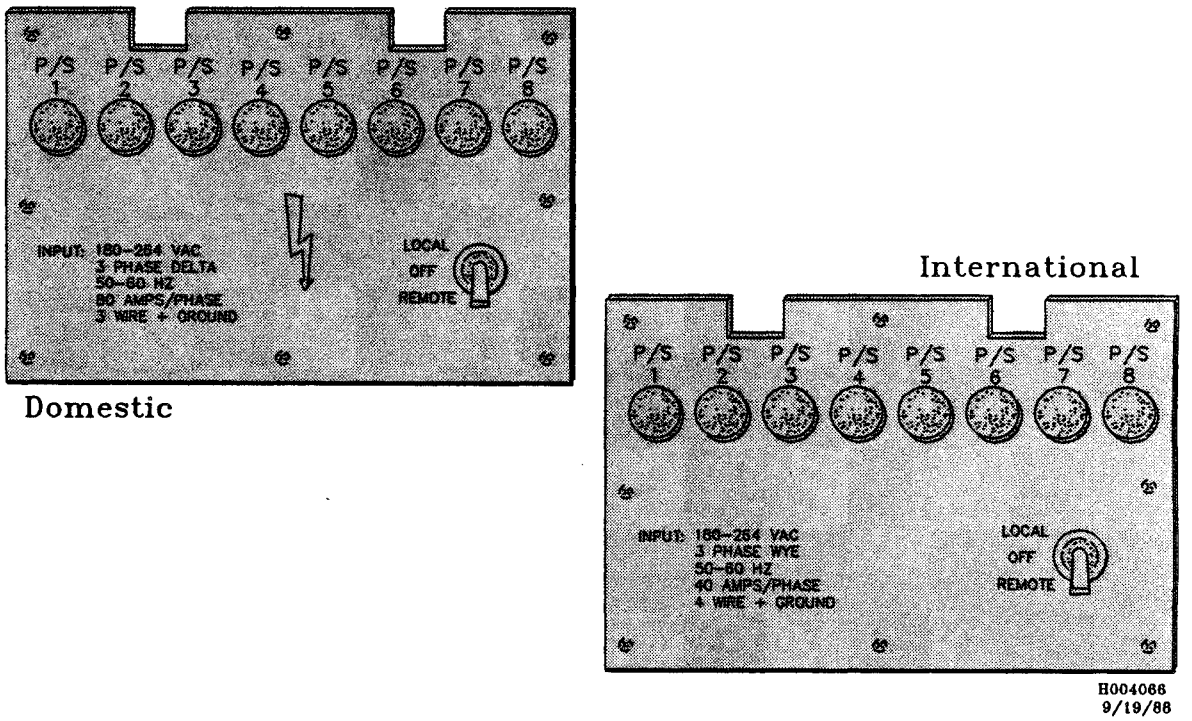


9. Loosen the 2 captive nuts and remove the master/slave connector attached to the power controller.

> **NOTE**
>
> This connector is not considered a part of the power controller FRU and must be installed on replacement of the power controller.

10. Disconnect the blower and SCM cables from the top of the power controller.
11. Remove the 8 screws attaching the power supply status indicator panel to the power controller front panel. The following figure shows the power controller status indicator panel:

Figure 4–19, Power Controller Indicator Panel



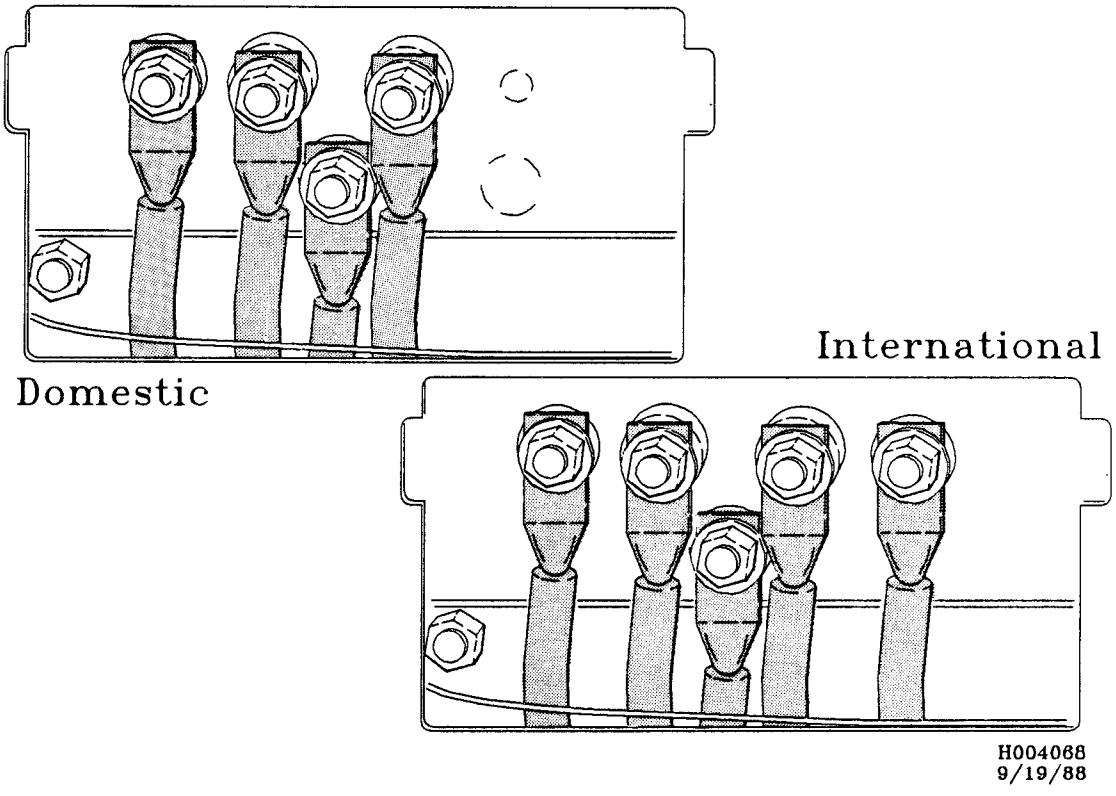
12. Pull the panel straight out from the power controller as far as the cable allows.
13. Disconnect the cable connector and remove the panel.
14. Push the power controller end of the connector back inside the power controller.
15. Remove the AC power cord access panel on top of the power controller.

> **CAUTION**
>
> Mark the wires and stud locations before removing wires. Improper connections during installation could result in damage to the equipment.

16. Record the location of the AC power cord terminals.

The following figure shows the AC power input stud configuration:

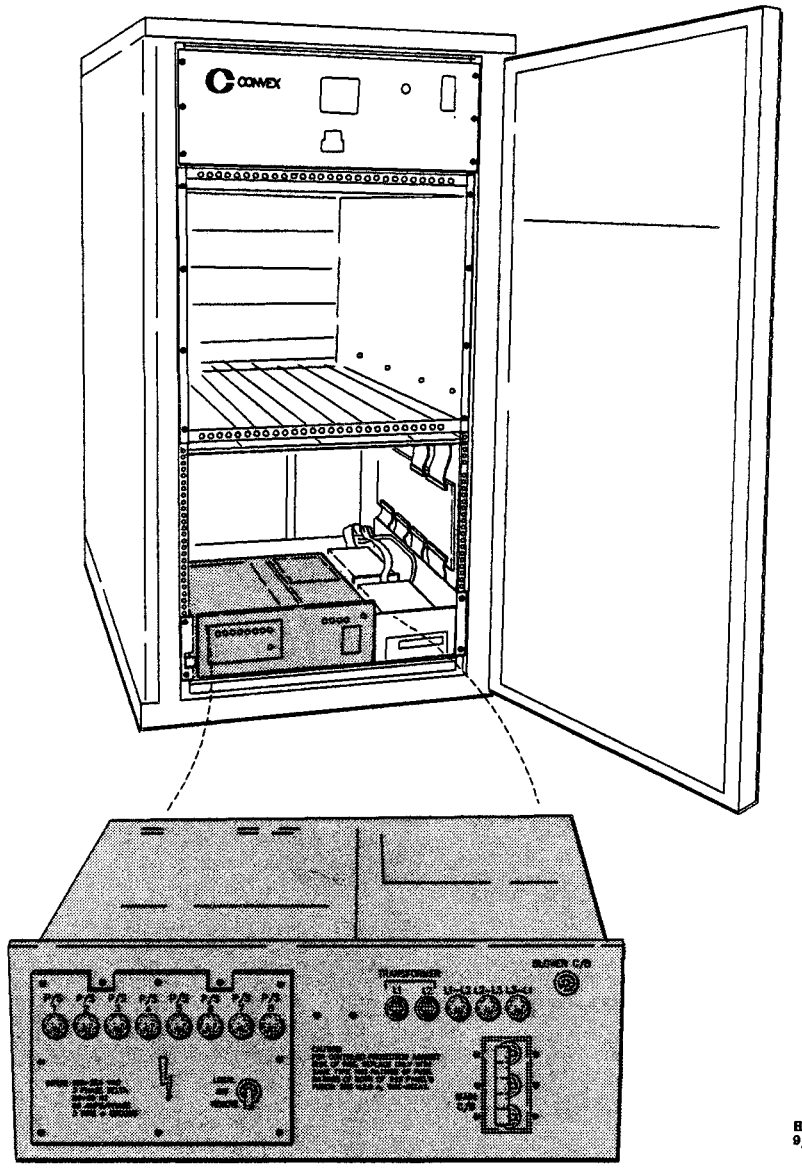
Figure 4–20, Power Controller AC Power Input Stud Configuration



17. Use a wrench from the top access to prevent the AC power input stud from turning.
18. Remove the nut from each stud and pull the wire off of the stud.
19. Repeat this process to remove each wire, taking care to record the position of each wire as it is removed.
20. Loosen, but do not remove, the 6 screws attaching the power controller to the bottom tray.

The following figure illustrates the power controller:

Figure 4–21, Power Controller



21. Slide the power controller toward the rear of the cabinet to align the large-diameter portion of the mounting keyholes with the the screw heads.

WARNING

The power controller weighs about 70 lb. Exercise care when lifting the power controller out of the lower bay to avoid personal injury.

22. Lift the power controller straight up 1 to 2 inches to clear the screw heads then carefully lower it back down so that it rests *on top of the screw heads.* Take care not to damage the mounting screws.
23. *CAREFULLY* lift the power controller out of the lower bay.
24. Replace the power supply status indicator panel and the top access panel and note the positions (**ON** or **OFF**) of the individual power supply circuit breakers on the top centerline of the power controller.

4.7.6.3 Installation

1. Replace any damaged mounting screws.
2. Remove the power supply status indicator panel and top access panel from the replacement power controller.
3. *CAREFULLY* lift the power controller and lower it into the lower bay.
4. Position the power controller *on top of the mounting screws,* taking care not to damage the mounting screws.
5. Lift the power controller to align the large diameter portion of the mounting keyholes over the screw heads and lower the power controller onto the tray.
6. Pull the power controller forward to position the narrow portion of the mounting keyholes under the screw heads.
7. Tighten the mounting screws.

WARNING

AC VOLTAGE HAZARD — AC voltages may be applied to incorrect areas of the computer (*including the processor cabinet*) if AC power cord wires connect to incorrect power controller AC input studs. Failure to connect AC power cord wires correctly may result in serious injury to personnel and damage to equipment when AC power is applied.

8. Place an AC power cord wire terminal *on the correct stud.*

CAUTION

The torque value and the connection of the AC power cord wire to the correct AC input stud are extremely important. Failure to properly torque the nut or improper wiring configuration could cause damage to the system and components.

9. Use a wrench from the top access to prevent the stud from turning, and torque the nut to 70 in/lb for domestic and 55 in/lb for international configurations.
10. Repeat this process for the remaining AC power cord wires taking care to install each wire on the correct stud and to torque each nut properly.
11. Position the top access panel on the power controller and attach it with mounting screws.
12. Connect the power supply status indicator panel cable connector to its mate in the power controller and position the panel over the mounting holes.
13. Start all 8 mounting screws that attach the panel to the power controller then tighten them.
14. Connect the power supply cable *of each installed DC power supply* to its matching connector on the top of the power controller (each cable and connector socket are labeled). Do not connect the cables for DC power supplies that are not installed.

NOTE

Install the master/slave connector, if the replacement power controller does not have connector installed.

15. Connect the blower and SCM power cables to the power controller.
16. Set the individual power supply circuit breakers on the top centerline of the power controller to the same positions as on the removed power controller.

NOTE

Each DC power supply installed should have its circuit breaker set to **ON**. All other circuit breakers should be set to **OFF**.

17. Set the **LOCAL OFF REMOTE** switch on the power supply status indicator panel to the **OFF** position.
18. Set the main circuit breaker on the power controller front panel to the **OFF** position.
19. Set the site power circuit breakers serving the computer to **OFF**.
20.

For domestic systems, mate the AC power cord connector into the service connector. Align the key on the computer end with the groove in the service end. Ensure that the connector halves are seated, then engage and rotate the locking collar (about half a turn) to lock the connector.

21. Set the site AC power circuit breakers serving the computer to **ON**.
22. Ensure the computer keyswitch is in the **0 OFF** position.
23. Set the **LOCAL OFF REMOTE** switch on the power supply status indicator panel to the **REMOTE** position.
24. Set the main circuit breakers on the power controller front panel to the **ON** Position.
25. Check to see that the 3 phase indicators near the main circuit breakers on the power controller front panel are illuminated. This shows that AC power is reaching the load side of the main circuit breakers.
26. Set the main circuit breakers on the power controller front panel to **OFF**.
27. Install the lower air plenum.
28. Install the lower bay cover.

4.7.7 Intake Air Temperature Sensor

The intake air temperature sensor is located under the front right corner of the card cage. Remove the intake plenum from the cabinet to access the sensor.

4.7.7.1 Tools

- Phillips screwdriver

4.7.7.2 Removal

1. Remove the lower bay cover.
2. Remove the lower intake plenum.
3. Unplug the intake air temperature sensor from the wiring connector.
4. Remove the 2 mount screws from the sensor.
5. Slide the sensor out toward the left side of the cabinet until the sensing probe is clear of the mount bracket.
6. Remove sensor from the cabinet.

4.7.7.3 Installation

1. Install the air temperature probe into the cabinet by positioning the sensor probe in alignment with the hole in the mounting bracket.
2. Slide the sensor onto the bracket, aligning the holes of the mount bracket with the holes of the sensor.

> **NOTE**
>
> Use care when tightening the mounting screws of the intake air temperature sensor. The screws attach the sensor to plastic containers in the mount bracket. Tighten only until the screws are snug and do not allow the sensor to move.

3. Attach the sensor on the mount bracket with the 2 mount screws and washers.
4. Connect the sensor to the wiring harness.
5. Install the lower air plenum.
6. Install the lower bay cover.

4.8 Cooling

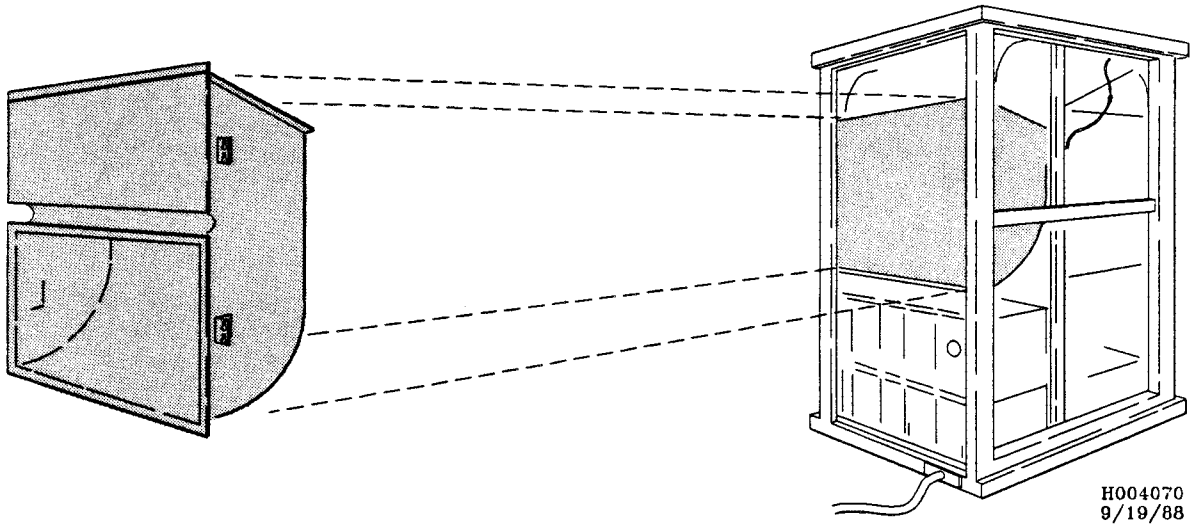
The fan assembly consists of six fans, six airflow sensors, and an exhaust air temperature sensor mounted in a short section of plenum. Sitting above the card cage, the fan assembly draws air up through the processor cards in the card cage and exhausts it (through two series-connected plenums) out the rear of the processor cabinet.

The power controller provides AC power for the fans in the fan assembly, while the System Control Module monitors the airflow and exhaust air temperature. Access to the fan assembly is gained by removing the rear panel, the two rear plenum sections, the front control panel assembly, and the card cage cover. Remove the fan assembly to access the airflow and exhaust temperature sensors.

4.8.1 Lower and Upper Rear Plenum

The lower rear plenum and upper rear plenum must be removed to gain access to the fan assembly. The following figure illustrates lower rear plenum:

Figure 4–22, Lower Rear Plenum



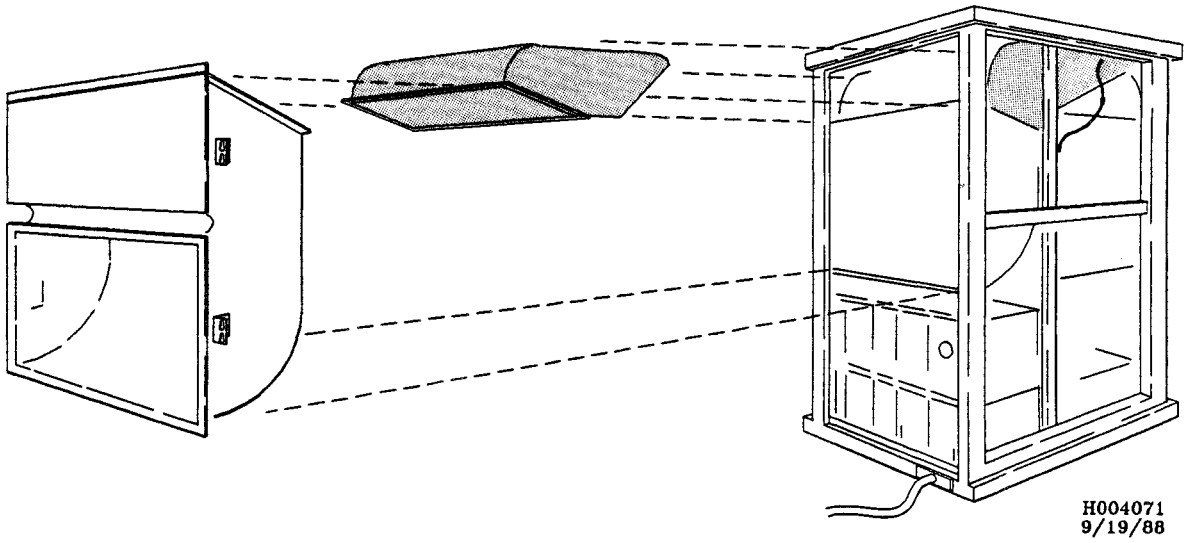
4.8.1.1 Tools

- Phillips screwdriver

4.8.1.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the rear cabinet panel.
5. Loosen, but do not remove, the 8 screws attaching the lower rear plenum to the cabinet frame.
6. Remove the top 3 screws on each side of the lower rear plenum.
7. Support the lower rear plenum and remove the remaining top screw on each side.
8. Pull the lower rear plenum straight out of the processor cabinet.
9. Remove the 4 screws attaching the upper rear plenum to the cabinet crossmember. The following figure illustrates upper rear plenum:

Figure 4–23, Upper Rear Plenum



10. Note the orientation of the plenum in the cabinet.
11. Pull the upper rear plenum out of the processor cabinet at a slightly downward angle.

4.8.1.3 Installation

1. Orient the upper rear plenum with the short radius curve toward the front of the cabinet.
2. Insert the upper rear plenum into the processor cabinet taking care to mate it properly to the fan assembly.
3. Ensure that cables from the fan assembly engage notches in the upper rear plenum where the plenum mates with the fan assembly.
4. Attach the upper rear plenum to the cabinet crossmember with 4 screws, washers, and nuts (the screws extend *up* from beneath the cabinet crossmember).
5. Insert the lower rear plenum into the processor cabinet and start, but do not tighten, the lowest screw on each side into the cabinet frame.
6. Start the remaining 6 screws into the processor cabinet frame.
7. Evenly tighten all lower rear plenum mounting screws.
8. Install the rear panel.

4.8.2 Fan Assembly

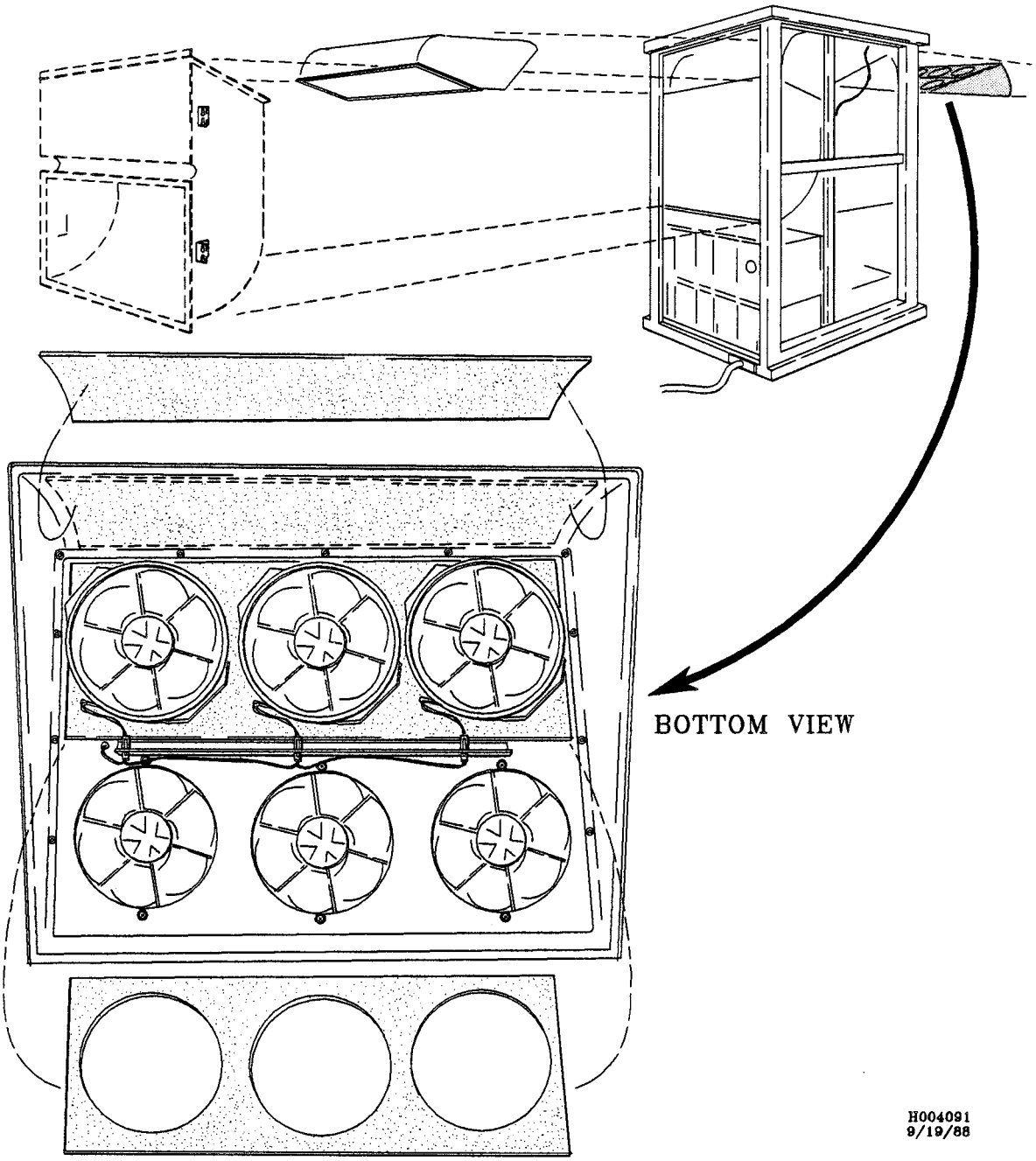
Remove the rear panel, the rear plenums, the front control panel assembly, and the card cage cover to access the fan assembly. Although not necessary for fan assembly service, removing the side panel that is not concealed by an expansion cabinet simplifies the procedure.

> **CAUTION**
>
> **ELECTROSTATIC DISCHARGE DAMAGE HAZARD** — Observe all Electrostatic Discharge (ESD) precautions during service. Failure to comply with approved ESD procedures may result in damage to components and electronic assemblies.

When the card cage cover is removed from the card cage, electrical contacts on the rear of the foreplane connector assemblies are exposed and easily contacted. This presents an ESD hazard for the processor cards. Ensure that all personnel that might come into contact with the processor cabinet while the card cage cover is removed are properly grounded and take steps to avoid contact with the foreplane connectors.

The following figure illustrates fan assembly:

Figure 4–24, Fan Assembly



4.8.2.1 Tools

- Phillips screwdriver
- Phillips screwdriver, short

4.8.2.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the rear panel.
5. Remove the lower rear plenum.
6. Remove the upper rear plenum. procedure).
7. Remove the side panel.
8. Remove the front control panel assembly.
9. Disengage the front control panel assembly ribbon cable from the cable keeps on the front of the fan assembly and move the ribbon cable aside.
10. Disconnect the fan assembly power connector.
11. Remove one side of the sensor cable retainer strap. Move the cables out from under the strap and disconnect the cables.
12. Loosen, but do not remove, the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
13. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
14. Grasp the card cage cover by the cross member and pull it forward until its top edge disengages from the bottom edge of the front control panel assembly.
15. Lift the card cage cover up and out.
16. Remove the 6 screws attaching the locking bar (containing the quarter-turn locking mechanism for the card cage cover) to the the top of the card cage. *Do not remove the 9 screws attaching the plastic material of the fan assembly to the metal locking bar.*
17. Grasp the quarter-turn locking mechanism tabs and pull out and upward to disengage the forward end of the fan assembly from the top of the card cage.
18. Raise the forward edge of the fan assembly enough to get a hand inside.
19. Lift the fan assembly slightly from the top of the card cage.
20. Pull the fan assembly out of the processor cabinet from the front.

4.8.2.3 Installation

1. Ensure that fan assembly and front control panel cables do not interfere with fan assembly installation.
2. Position the fan assembly at the front of the cabinet, resting the rear edge on the card cage.
3. Lift the fan assembly slightly above the card cage and work it back into the processor cabinet into approximate position.

> **NOTE**
>
> If there is left or right side access, lift the rear of the fan assembly from the side and the front moving the fan assembly into the processor cabinet and into its approximate final position.

4. Ensure that the fan assembly is properly seated on the top of the card cage. The lower side edges of the fan assembly go on the *outside* of the lip at the top of the card cage. Raise the front or back of the fan assembly to position it properly on the card cage.
5. Secure the fan assembly/locking bar to the card cage with 6 screws.
6. Connect the fan assembly power cable.
7. Connect the sensor cables from the rear of the cabinet (the identical connectors are interchangeable).
8. Route the sensor cables under the retaining strap and secure with a screw.
9. Install the front control panel assembly ribbon cables in its keeps on the front of the fan assembly.
10. Install the front control panel assembly.
11. Pull the retainer strip (at the lower edge of the card cage) out, away from the card cage so that it rests against the heads of its 3 screws.
12. Insert the lower edge of the card cage cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip.
13. Press the cover down so the 3 notches along its lower edge engage the 3 screws through the retainer strip.
14. Push the upper edge of the card cage cover into position under the lower edge of the front control panel assembly. Conductive gasketing material along this edge causes a snug friction fit.
15. Lock each of the 3 quarter-turn fasteners along the upper edge of the card cage cover.
16. Tighten the 3 retainer strip screws sequentially, a few turns at a time until the retainer strip is tight against the card cage cover and the lower bay cover.
17. Install the side panel.
18. Install the upper rear plenum.
19. Install the lower rear plenum.
20. Install the rear panel.

4.8.3 Fan Subassembly

The fan subassembly is mounted to the fan assembly. Remove the fan assembly to replace the fan subassembly. The following procedure describes the removal and replacement of the fan subassembly.

4.8.3.1 Tools

- Phillips screwdriver
- Phillips screwdriver, short

4.8.3.2 Removal

1. Remove the fan assembly.
2. Place the fan assembly on a table or flat surface to work.
3. Unplug the fan AC power connection from the fan assembly.
4. Remove the 2 mount screws and nuts from the fan.
5. Lift the fan from the fan assembly mount plate.

4.8.3.3 Installation

1. Place the fan onto the fan assembly mount plate aligning the mount holes.
2. Attach the fan to the mount plate with 2 screws and nuts.
3. Connect the fan AC power cable to the fan assembly AC power connection on the mount plate.
4. Install the fan assembly into the computer.

4.8.4 Fan Assembly Airflow Sensors

There are six airflow sensors mounted on the fan assembly. Two boards attached to a mounting bracket each have three sensors mounted on them. Install a new sensor board to replace the sensors if any are defective. The following procedures detail the steps required to replace one of these sensor boards.

4.8.4.1 Tools

- Phillips screwdriver

4.8.4.2 Removal

1. Remove the fan assembly from the processor cabinet.
2. Lay the fan assembly on a table top or flat surface to work.
3. Remove the 8 screws mounting the sensor board to the mounting bracket.
4. Note the side of the board with the connector to assure proper position of the sensor board during installation.
5. Lift the sensor board from the fan assembly.

4.8.4.3 Installation

1. Position the sensor board so that the holes align with the mounting bracket and the connector is on the correct side for installation.
2. Insert the screws into the holes and snug each screw until all screws are inserted and snug.

> **CAUTION**
>
> Use extreme care when tightening the screws on the sensor board. Apply torque evenly to the the screws. Failure to do so may crack the sensor board.

3. Tighten each screw one-quarter turn, alternating until each screw is tightened.
4. Install the fan assembly into the processor cabinet.

4.8.5 Fan Assembly Exhaust Temperature Sensor

The fan assembly exhaust air temperature sensor is located between the airflow sensor boards of the fan assembly. The fan assembly must be removed and placed on a table to replace the exhaust air temperature sensor.

4.8.5.1 Tools

- Phillips screwdriver

4.8.5.2 Removal

1. Remove the fan assembly.
2. Place the fan assembly on a table for working purposes.
3. Pry the holder clips of the sensor connector to disengage the connector from the fan mount plate.
4. Remove the 2 mounting screws from the exhaust sensor.
5. Slide the sensor back from the mounting bracket until the sensor probe is clear of the bracket.
6. Lift the exhaust sensor from the fan assembly.

4.8.5.3 Installation

1. Slide the sensor probe into the hole of the mounting bracket to install the exhaust air temperature sensor into the fan assembly.
2. Align the holes of the mounting bracket with the mounting holes of the temperature sensor.

3. Secure the sensor on the mount bracket by tightening the 2 mount screws.
4. Insert the sensor connector into the fan mount plate until the holder clips snap onto the opposite side of the mount plate. Ensure both clips are secure and the connector does not fall back.
5. Connect the sensor to the wiring harness.
6. Install the fan assembly into the processor cabinet

4.9 Card Cage

All processor cards are contained in the processor cabinet card cage. The processor cards must be removed from the card cage before the card cage can be replaced. Anytime the card cage is replaced, careful attention must be noted to the alignment of the card cage being installed. The pins of the backplane and the position of the card cage must be in the same configuration to ensure proper alignment of the processor cards during the installation. Mark the alignment of the card cage in the cabinet to ensure correct positioning of the new card cage.

4.9.1 Tools

1. Slot screwdriver
2. Phillips screwdriver
3. Nutdriver, 3/8 inch
4. Felt tip marker
5. Portable light source

4.9.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Loosen, but do not remove, the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
5. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
6. Grasp the card cage cover by the cross member and pull it forward until its top edge disengages from the bottom edge of the front control panel assembly.
7. Lift the card cage cover up and out.
8. Remove all the card foreplanes and processor cards from the card cage.

CAUTION

Insert the portion of each processor card extending from the front of the card cage into the open end of a protective packaging (conductive bag). Pull the processor card from the card cage and work it into the conductive bag as it emerges from the card cage, taking care to avoid contact with the printed circuit side of the card. Failure to enclose the processor card in its protective bag may result in ESD damage.

9. Mark the frame at the corners of the card cage with a felt tip marker that is visibly seen for alignment purposes.
10. Remove the card cage mounting fasteners and mounting screws for the backplane support frame.
11. Slide the card cage straight out of the processor cabinet.

4.9.3 Installation

1. Position the card cage assembly in the cabinet frame.
2. Align the top, right-hand mounting hole in the cardcage with the appropriate clip nut and install the first RETMA fastener (#10-32 x 5/8–inch Star Washer SEMs). Thread this fastener only enough to support the weight of the card cage.
3. Align the top, left-hand mounting hole in the cardcage with the appropriate clip nut and install the first RETMA fastener (#10-32 x 5/8–inch Star Washer SEMs). Thread this fastener only enough to support the weight of the card cage.
4. Install the remaining RETMA fasteners, starting at the bottom right side, complete the right side, then complete the left side.
5. Position the card cage in alignment with the marks at each corner of the card cage.
6. Secure all the card cage mounting fasteners; torque all 10-32 SEMs fasteners securing the card cage in the cabinet to 25 in/lb.
7. Install the processor cards and foreplanes.
8. Pull the retainer strip (at the lower edge of the card cage) out, away from the card cage so that it rests against the heads of its 3 screws.
9. Insert the lower edge of the card cage cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip and press the cover down so the 3 notches along its lower edge engage the 3 screws through the retainer strip.
10. Push the upper edge of the card cage cover into position under the lower edge of the front control panel assembly. Conductive gasketing material along this edge causes a snug friction fit.
11. Lock each of the 3 quarter-turn fasteners along the upper edge of the card cage cover.
12. Tighten the 3 retainer strip screws sequentially, a few turns at a time until the retainer strip is tight against the card cage cover and the lower bay cover.

4.10 Backplane and Backplane Connector Pins

The backplane provides a bus structure and power distribution for the boards in the cardcage. Pins in the backplane provide the connections to the boards. The sense board attaches to the rear of the backplane and provides voltage pick-off points for the SCM monitoring circuitry.

4.10.1 Backplane

To replace the backplane several additional components and panels must be removed. Remove the rear panel and exhaust plenum to allow access to the backplane from the rear of the cabinet. Remove the lower intake plenum to allow access to the screw nuts of the backplane to powerplane connection. Pull out the processor boards far enough to disengage from the backplane before removing them. Mark the current alignment of the backplane with a felt tip marker to simplify the alignment of the new backplane during installation.

> **CAUTION**
>
> When replacing the backplane, examine to determine the revision level of the backplane and powerplane. The revision level of the backplane being installed must be compatible with the existing powerplane. Incompatibility between the backplane and powerplane may cause damage to equipment.

To determine the compatibility between the backplane and powerplane, examine the powerplane for a bus bar on the PS5 power studs. If the bus bar exists on the powerplane, the compatible backplane part number is 500-001128-200. If the powerplane does not have a bus bar, the compatible backplane part number is 500-001156-200. When upgrading the backplane, the compatible powerplane must be installed at that time. The following procedures describe the necessary steps to remove and replace the backplane.

4.10.1.1 Tools

- Phillips screwdriver
- Slot screwdriver, small
- Nutdriver, 3/8–inch
- Felt tip marker
- Portable light source

4.10.1.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.

3. Engage personal grounding system.
4. Loosen, but do not remove, the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
5. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
6. Grasp the card cage cover by the cross member and pull it forward until its top edge disengages from the bottom edge of the front control panel assembly.
7. Lift the card cage cover up and out.
8. Remove each of the foreplane connector assemblies from the processor cards
9. Alternately back out each jack screw *one-half turn at a time* until both are free from each processor board in the card cage.
10. Grasp the processor card by the jack screws and pull the card *straight* out 1 to 2 inches until the card disengages from the backplane connector.
11. Remove the lower bay cover.
12. Remove the lower air plenum.
13. Remove the rear panel.
14. Remove the 8 screws attaching the lower rear plenum to the cabinet frame.
15. Pull the lower rear plenum straight out of the processor cabinet.
16. Note the position of the 3 ribbon cables on the lower backplane. Disconnect the ribbon cables by gently pulling straight out.
17. Disconnect the power supply cables on the sense board by marking the location of each cable as it is removed.
18. Remove the plastic shield from the lower edge of the backplane that covers the rows of screws attaching the backplane to the powerplane.
19. Disconnect the wires from the sense board to the backplane marking the location of the wires to the backplane. (White to VTT backplane screw, blue to VEE backplane screw, 2 black wires to backplane ground screws.)
20. Disconnect the orange and black wires on the lower left side of the backplane. Mark each wire removed and the location to the backplane. (Orange wire to **P1-ME3**, black wire to **P1-PIA**.)
21. Remove the 2 ribbon cables for locations **J10** and **J11** located on the top of the backplane and mark each cable.
22. Disconnect the SPU tape and cartridge tape wires from the top center of the backplane. Mark each wire as it is removed. (Yellow wire for **−12V**, white wire for **+12V**, 2 black wires for ground.)
23. Remove the tie wraps for the wiring harnesses on the backplane.
24. Remove the rows of screws on the bottom of the backplane that attach the backplane to the powerplane.

NOTE

Six of the screws for the backplane to powerplane connection are longer than the others. These six screws have a nut attached and can be accessed from inside the lower bay. Four of these screws are at each corner of the rows of screws and two are at the top center and bottom center of the rows of screws.

25. Remove the row of screws attaching the lower backplane to the bottom of the card cage.
26. Remove the top row of screws that attach the backplane to the top of the card cage.
27. Mark the top and side edges of the top protruding mounts on the backplane frame for alignment when installing new backplane.

NOTE

Mark the alignment of the backplane frame assembly to ensure that the backplane pins align with the pins of the processor cards when the new backplane is installed.

28. Remove the 8 backplane frame mount screws.
29. Lift the backplane from the processor cabinet.

4.10.1.3 Installation

CAUTION

When installing the backplane, examine to determine the revision level of the backplane and powerplane. The revision level of the backplane being installed must be compatible with the existing powerplane. Incompatibility between the backplane and powerplane may cause damage to equipment.

1. Examine the backplane pins for bent or broken pins.
2. Lift the backplane into the processor cabinet.
3. Insert the 8 backplane mount screws and finger tighten.
4. Align the top protruding mounts to the marks made during the removal process and tighten. Proper alignment allows you to see into the holes of the card cage. Loosen the screws and move the backplane for proper alignment.

NOTE

Randomly insert several screws into the bottom screw holes to check the alignment of the backplane with the powerplane.

5. Insert the rows of screws on the bottom of the backplane that attach the backplane to the powerplane. Do not tighten at this point.

NOTE

Six of the screws for the backplane to powerplane connection are longer than the others. These screws have a nut attached that can be accessed from inside the lower bay. These screws are at each corner of the rows of screws and one each at the top center and bottom center of the rows of screws.

6. Insert the top row of screws that attach the backplane to the top of the card cage. Do not tighten at this point.

NOTE

If the holes are not aligned it may be necessary to remove some processor boards from the card cage. This allows enough space to reach inside the card cage and push up on the top of the card cage to align the holes for inserting the mount screws.

7. Insert the row of screws attaching the lower backplane to the bottom of the card cage. Do not tighten at this point.

CAUTION

Do not force the processor cards when checking their alignment to backplane. If there is not a snug fit as the cards are pushed into the card cage, pull the card out and examine the connector. Use the portable light source and recheck the pins of the backplane to ensure no damage has occurred. Retry inserting the boards after careful examination.

8. Push the processor boards into the card cage to ensure the processor board connectors engage properly to the backplane pins. If the boards do not engage properly, pull out and examine the board(s) and the backplane.

CAUTION

Screws must be tightened to specified torques. Tighten to 10 in/lb all screws that attach the backplane to the powerplane. Tighten to 14 in/lb screws that connect metal to metal. Failure to properly torque the screws could result in damage to equipment.

DO NOT tighten screws at random selection. This could cause a ripple effect on the powerplane and backplane as pressure is applied to the board when screws are torqued.

9. Tighten the screws on the backplane to powerplane connection to 10 in/lb in the following sequence:
   a. Tighten the center vertical column of screws from top to bottom.
   b. Tighten the vertical column of screws to the right of the center column from top to bottom.
   c. Continue tightening the vertical columns of screws from the center, 1 column at a time from top to bottom until all screws on the right side are tightened.
   d. Tighten the vertical column of screws to the left of the center column from top to bottom.
   e. Continue tightening the vertical columns of screws from the center, 1 column at a time from top to bottom until all screws on the left side are tightened.
10. Attach the wires from the sense board to the marked location on the backplane. (White to VTT backplane screw, blue to VEE backplane screw, 2 black wires to backplane ground screws.)
11. Mount the sense board to the backplane stiffener with 2 screws.
12. Install the plastic shield to the lower edge of the backplane to cover the rows of screws attaching the backplane to the powerplane.
13. Connect the power supply cables on the sense board to the location for each cable as marked.
14. Install the 3 ribbon cables on the lower backplane by gently pushing straight in with the ribbon cable connector.
15. Connect the SPU tape and cartridge tape wires to the top center of the backplane. Attach each wire as it was marked during removal. (Yellow wire for **–12V**, white wire for **+ 12V**, 2 black wires for ground.)
16. Install the 2 ribbon cables for locations **J10** and **J11** on the top of the backplane, as marked during removal.
17. Connect the orange and black wires on the lower left side of the backplane to the connector location on the backplane as marked. (Orange wire to **P1-ME3**, black wire to **P1-PIA**.)
18. Install the tie wraps for the wiring harnesses on the backplane.
19. Install the lower rear plenum.

20. Alternately tighten each jack screw on the processor cards, *one-half turn at a time* until both are tightened for each processor board in the card cage.
21. Install each of the foreplane connector assemblies on the processor cards
22. Install the card cage cover.
    a. Pull the retainer strip (at the lower edge of the card cage) out, away from the card cage so that it rests against the heads of its 3 screws.
    b. Insert the lower edge of the card cage cover *under* the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip and press the cover down so the 3 notches along its lower edge engage the 3 screws through the retainer strip.
    c. Push the upper edge of the card cage cover into position under the lower edge of the front control panel assembly. Conductive gasketing material along this edge causes a snug friction fit.
    d. Lock each of the 3 quarter-turn fasteners along the upper edge of the card cage cover.
    e. Tighten the 3 retainer strip screws sequentially, a few turns at a time until the retainer strip is tight against the card cage cover and the lower bay cover.
23. Attach each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
24. Tighten the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is secure.
25. Set the main circuit breaker on the power controller front panel to ON
26. Perform power up.
27. Install the lower bay cover.
28. Install the lower air plenum.

4.10.2 Backplane Connector Pin

Processor cards make electrical connection to the backplane by the pins that extend from the front surface of the backplane (inside a plastic connector body) and mate with sockets on the rear edge of the processor cards. These pins are bent easily if processor cards are removed or installed using incorrect procedures.

There are three variations of the pin currently in the field:

- Standard — end extends beyond the rear surface of the backplane
- Short — end does not extend beyond the rear surface of the backplane
- Insulated — does not make electrical contact with the backplane hole plating

Standard pins are installed in all current productions, short pins were installed in early backplane assemblies, and insulated pins are used to correct defective backplane wiring.

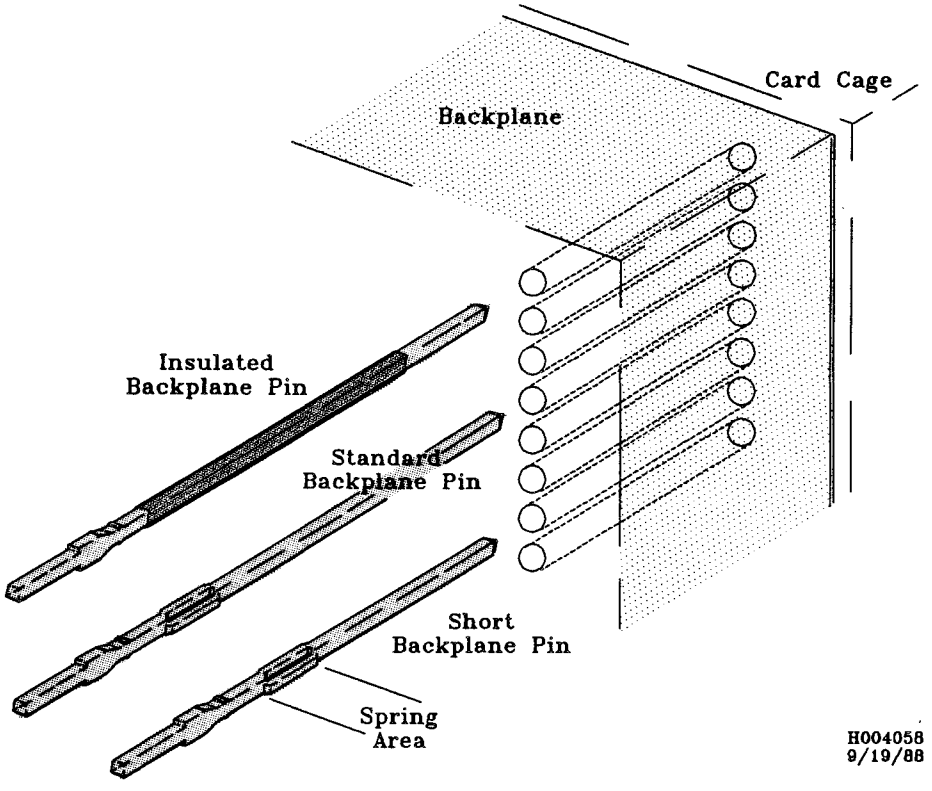
During manufacturing of the backplane assembly, pins are inserted into metal-plated holes in the backplane board. The plating of each hole connects to the appropriate signal or power conductor on some layer of the backplane board so that a standard or short pin inserted into a backplane hole connects electrically to that backplane conductor.

Insulated pins do not make electrical contact with the hole plating and bypass damaged backplane conductors. Reconstruct a conductor net by connecting coax or twisted pair wiring to the rear portion of insulated pins extending out of the rear surface of the backplane directly to the processor card connector — bypassing the defective backplane conductor.

The pin is of a new design that incorporates a tiny spring-like structure in the pin shaft. This ensures good mechanical and electrical contact (standard and short pins only) with the walls of the bore in the backplane circuit board, but allows for repeated pin removals and insertions without damage to either the pin or the backplane holes.

The following figure illustrates the backplane pins:

Figure 4–25, Backplane Pins



The pin is gold-plated on one end and bright-plated on the other end. The gold end extends from the front surface of the backplane and engages the socket on the processor card. A shoulder, located on the shaft of the pin at the gold/bright transition, locates the pin correctly in the connector (orientation and installation depth) when it is installed. The shoulder also allows the forces applied to the pin by the insertion tool during installation to be applied some distance down the shaft of the pin instead of at the end, reducing the chance of bending the pin during installation.

A special tool with extraction and insertion fixtures is required to replace backplane pins.

Use the extraction tool to push the pin out of its hole from the rear of the backplane then use pliers to pull it out the rest of the way from inside the card cage.

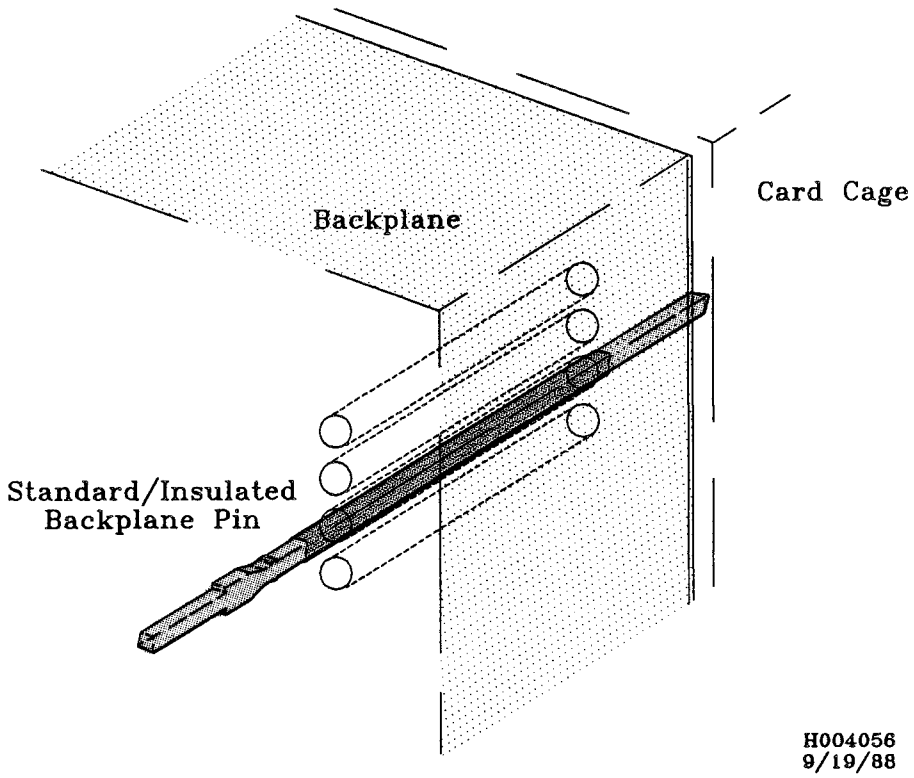
Pins are installed in a two-step process. Start the pin into its hole with the installation tool, then use the tool to seat the pin in the connector body to the correct depth.

Replacement procedures for backplane pins varies somewhat depending on which type of pin is involved.

4.10.3 Backplane Connector Pin (Standard)

The end of standard pins extends beyond the rear surface of the backplane board allowing the extraction tool to contact the pin directly. The following figure shows the standard backplane pin:

Figure 4–26, Backplane Standard Pin



4.10.3.1 Tools

- Backplane pin extraction/insertion tool
- Long-nosed pliers

4.10.3.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the rear panel.
5. Remove the processor card cage cover.
6. Remove the processor card with the bent pin(s).
7. Remove the processor card on either side of the 1 with the bent pin(s) to make space to work.
8. Attach the pin extraction fixture to the pin installation tool.
9. Identify the pin to be removed from the card cage side of the backplane and note its location. Find the back end of the same pin on the rear surface of the backplane.
10. Insert the exposed end of the pin into the bore in the extraction tool.
11. While keeping the tool absolutely perpendicular to the backplane, push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should unseat the pin. Repeat if necessary.
12. Locate the unseated pin on the card cage side of the backplane and pull it out of the connector body with long nosed pliers.
13. Inspect the connectors for additional bent pins and repeat the removal procedure for each.

4.10.3.3 Installation

1. Locate the empty backplane pin hole by looking for ambient light at the rear of the cabinet shining through the empty hole.
2. Attach the insertion fixture to the installation tool.
3. Place the gold end of the new pin in the insertion fixture and orient it so that the flats of the shoulder fit into the groove machined in the face of the insertion fixture.
4. Orient the pin/fixture so that the pin shoulder is vertical and gently start the exposed end of the pin into its hole.
5. While keeping the tool absolutely perpendicular to the backplane, push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should insert the pin most of the way into its hole. Repeat if necessary.
6. Withdraw the installation tool far enough that the shoulders on the pin clear the groove in the insertion fixture and rotate the tool 90 degrees so that the face of the insertion fixture rests on the shoulders of the pin.
7. Ensure that the tool is still absolutely perpendicular to the backplane and push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should seat the pin.

8. Remove the installation tool and inspect the pin to ensure that it has been installed to the correct depth. Check the level of the pin with a finger to make sure it is installed to the same depth as its neighbors. Re-seat the pin if necessary.
9. Repeat for any other pins to be installed.
10. Check to ensure that all pins installed are properly seated and that there are no additional bent pins.
11. Install the processor cards.
12. Install the processor card cage cover.
13. Install the rear panel.

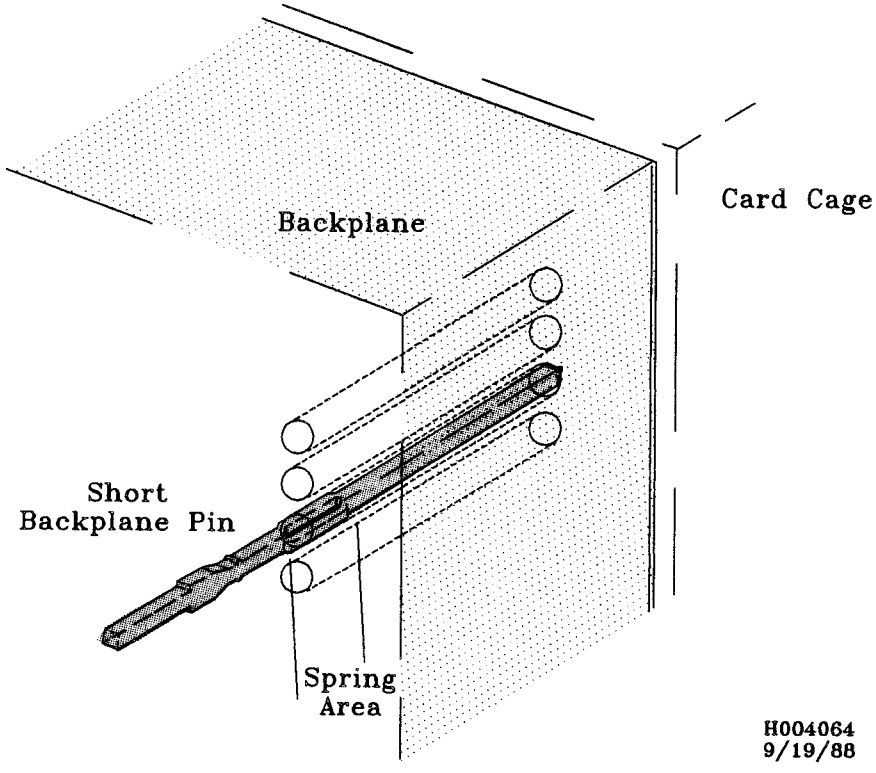
4.10.4 Backplane Connector Pin (Short)

The end of standard pins do not extend beyond the rear surface of the backplane board. An extension must first be placed in the backplane pin hole and the extraction fixture used to unseat the pin.

Standard pins may be used for replacement of short pins.

The following figure illustrates the backplane short pin:

Figure 4–27, Backplane Short Pins



4.10.4.1 Tools

- Backplane pin extraction/insertion tool
- Extraction fixture extender
- Long-nosed pliers

4.10.4.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Remove the rear panel.
5. Remove the processor card cage cover.
6. Remove the processor card with the bent pin(s).
7. Remove the processor card on either side of the 1 with the bent pin(s) to make space to work.
8. Attach the pin extraction fixture to the pin installation tool.
9. Identify the pin to be removed from the card cage side of the backplane and note its location. Find the back end of the same pin on the rear surface of the backplane.
10. Insert the extraction fixture extender into the backplane hole from which the pin is to be removed.
11. Insert the exposed end of the extraction fixture extender into the bore of the extraction tool.
12. While keeping the tool absolutely perpendicular to the backplane, push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should unseat the pin. Repeat if necessary.
13. Locate the unseated pin on the card cage side of the backplane and pull it out of the connector body with long nosed pliers.
14. Inspect the connectors for additional bent pins and repeat the removal procedure for each.

4.10.4.3 Installation

1. Locate the empty backplane pin hole by looking for ambient light at the rear of the cabinet shining through the empty hole.
2. Attach the insertion fixture to the installation tool.
3. Place the gold end of the new pin in the insertion fixture and orient it so that the flats of the shoulder fit into the groove machined in the face of the insertion fixture.
4. Orient the pin/fixture so that the pin shoulder is vertical and gently start the exposed end of the pin into its hole.
5. While keeping the tool absolutely perpendicular to the backplane, push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should insert the pin most of the way into its hole. Repeat if necessary.

6. Withdraw the installation tool far enough that the shoulders on the pin clear the groove in the insertion fixture and rotate the tool 90 degrees so that the face of the insertion fixture rests on the shoulders of the pin.
7. Ensure that the tool is still absolutely perpendicular to the backplane and push the installation tool against the pin, compressing the installation tool's spring until the stored energy is released. This should seat the pin.
8. Remove the installation tool and inspect the pin to ensure that it has been installed to the correct depth. Check the level of the pin with a finger to make sure it is installed to the same depth as its neighbors. Re-seat the pin if necessary.
9. Check to ensure that all pins installed are properly seated and that there are no additional bent pins.
10. Install the processor cards.
11. Install the processor card cage cover.
12. Install the rear panel.

4.10.5 Backplane Connector Pin (Insulated)

Insulated pins have an adhesive on the back side of the backplane. Remove the adhesive before attempting to knock the pin out. Scrape the adhesive with an xacto knife or apply heat using a soldering iron. A wire may also be soldered to the pin. All solder must be wicked off the pin and the wire should be held out of the way of the pin removal tool.

Inspect the pin after removing it from the backplane. If the pin has a black sleeve around it, use the procedure to install a short backplane connector pin to install the insulated pin. If the removed pin does not have a black sleeve, clear the hole in the backplane. Use the extractor extender to drive the sleeve out through the front of the backplane.

4.10.6 Sense Board

The following table lists the sense boards, the wires, and the backplane screws that connect to the backplane:

Table 4–1, Sense Board to Backplane Connections

SENSE BOARD	WIRE	BACKPLANE SCREW
PB1	White – VTT	Backplane VTT
PB2	Black – GND	Backplane GND
PB3	Black – GND	Backplane GND
PB4	Blue – VEE	Backplane VEE

4.10.6.1 Tools

- Torque driver
- Phillips screwdriver
- Slot screwdriver, small

4.10.6.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage the personal grounding system.
4. Remove the rear panel.
5. Remove the exhaust plenum.
6. Note the position of the 4 power supply cables that connect to the sense board.
7. Remove the power supply cables from the sense board.
8. Disconnect the 3 ribbon cables that connect to the bottom edge of the backplane. DO NOT remove the cable clamps that secure these cables.
9. Remove the plastic shield from the backplane-to-powerplane interconnect area. This shield covers the 329 screws on the lower back of the backplane.
10. Note the position of the 4 wire connections from the sense board to the screws on the backplane.
11. Disconnect the 4 sense board wires from the backplane.
12. Remove the 2 sense board mount screws and lift out the sense board.

4.10.6.3 Installation

1. Mount the sense board at the bottom rear of the backplane using two #6-32 x 1/4 star washers in the upper two holes, and two #6-32 x 1.0 inch square cone washers in the two plated through-holes.
2. Connect the 4 wires from the sense board to the screws on the backplane.
3. Ensure the screw location is labeled with the proper voltage type (VTT, VEE, etc).
4. Position each terminal leading from the sense board so the terminal does not overlap a "voltage" zone other than the voltage of the line connecting to that terminal.

> **NOTE**
>
> The body of each terminal may be bent about 30 degrees to install the terminal in a vertical position.

5. Remove the paper backing from both sides of the shield.
6. Place the cut out in the shield over the sense board, and place the shield into position over the backplane stiffener.

7. Install two #6-32 x 1.0 square cone screws, 1 on the far-left and 1 on the far-right side of the shield.
8. Hold the shield flat against the ground plane/stiffener and place one #6-32 x 1 1/4 screw with washers in this order; one #6 cone washer, one #6 flat washer, one large washer, and one flat nylon washer into the large diameter holes on one side of the sense board.
9. Repeat step 8 for the hole on the other side of the sense board.
10. Use the torque driver to tighten the 4 screws to 14 in/lb.
11. Connect the 3 ribbon cables that attach to the bottom edge of the backplane.
12. Use the tie wrap anchor to route the grey cables that connect to the power supply assembly through holes along the top of the power supply tray assembly.
13. Connect all cables from the power supplies to the sense board as marked during removal process.
14. Inspect the CPU system for loose hardware, cables, or incorrectly installed assemblies. Make all corrections as necessary.
15. Install the exhaust plenum.
16. Install the rear panel.

4.11 DC Power

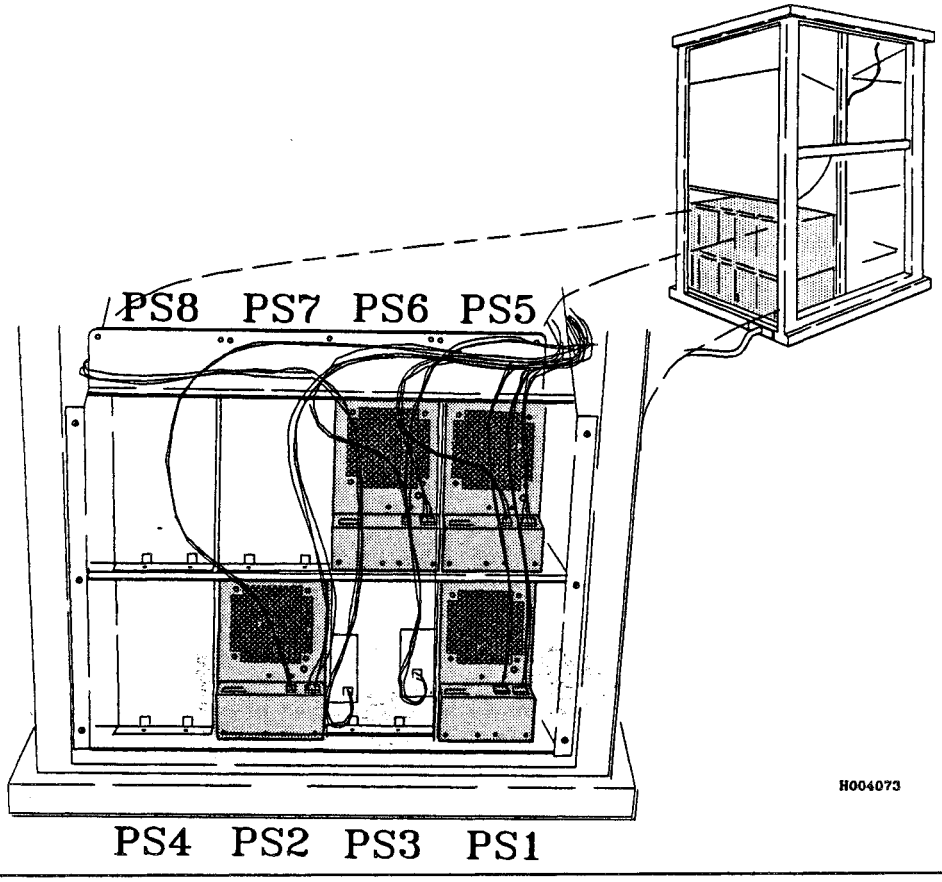
The power supplies provide DC power to boards in the cardcage, the SPU tape drive, and the SPU disk drive. DC power to the cardcage is conveyed by the powerplane which attaches to both the cardcage and the DC power supplies.

4.11.1 Power Supply

These procedures tell how to replace the power supply assembly and to prepare the system to run.

The following figure shows the positions of the power supplies:

Figure 4–28, Power Supplies



4.11.1.1 Tools

- Phillips screwdriver, #2, 4 inch long
- 1/4–inch square drive torque wrench with a 1/2–inch (6-point) socket

4.11.1.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage the personal grounding system.
4. Remove the left side panel.
5. Remove the lower bay cover.
6. Remove the front cover on the cardcage.
7. Remove the lower air plenum.

8. Install the cover on the cardcage to reduce the possibility of damaging a board.
9. Loosen and remove the hex nut, cone washer, and flat washer from the power studs protruding through the powerplane, under the card cage area.

> **NOTE**
>
> This hardware, except the cone washers, is plated, non-ferrous metal and can not be retrieved with magnets. Take care not to drop the fasteners to avoid removing the AC power cord and the power controller.

10. Remove the rear panel.
11. Remove the exhaust plenum.
12. Disconnect the AC distribution cables (the brown connectors) from PS1, PS2, PS5, and PS6.
13. Disconnect the ribbon cable connectors (the white connectors) that attach to PS1, PS2, PS5, and PS6.
14. Remove the two #10-32 pan head screws that secure the power supply mounting brackets to the power supply shelf for PS1, PS2, PS5, and PS6.
15. Remove PS1, PS2, PS5, and PS6. *Do not remove PS3, the multi-volt power supply assembly.*
16. Place the tin-plated flat washers, 1 cone washer, and 1 hex nut previously removed, on the power adapter/stud of each power supply that was removed.
17. Place the old power supply in the packaging material after the new power supply is removed.
18. Return each power supply assembly with 2 plated flat washers, 1 cone washer, and 1 hex nut.

4.11.1.3 Installation

1. Remove the label on the multi-voltage power supply and replace it with the new label in the upgrade kit.
2. Install two #10-32 x 3/8 star washer screws in each of the threaded holes at the front of the power supply frame, in both upper and lower shelves. These screws must be fully seated BEFORE installing the power supply assemblies.
3. Ensure that 1 plated flat washer remains in place on each of the 4 power adapter/studs PS1, PS2, PS5, and PS6.
4. Place the power supply assembly onto the power supply frame, holding the round portion of the mounting "keyhole" over the 2 screws.
5. Loosen each of the 2 screws until both the head of the screw, protruding from the round portion of the "keyhole", and the star washer raise completely above the surface of the sheet metal mounting bracket.

NOTE

DO NOT remove the screw; if the screw is released form the threaded hole, remove the power supply assembly and repeat the installation procedures.

6. Align each of the 4 power adapter/studs with the 4 corresponding holes in the power plane.
7. Slide the power supply assembly completely onto the system until the flat washers touch the power plane.
8. Place 1 plated flat washer on each of the power adapter/studs.
9. Place 1 cone washer, curved side out, on each of the power adapter/studs.
10. Thread 1 hex nut on each of the power adapter/studs.
11. Tighten each nut on the supply stud.
12. Tighten each hex nut on each power adapter/stud to 100 in/lb (8 ft/lb).
13. Tighten each of the 10–32 x 3/8 star washer screws that secure the power supply mounting brackets to the power supply frame.
14. Install the AC cables (power controller to power supplies) to the power controller.
15. Remove the cover on the cardcage.
16. Install the lower air plenum.
17. Install the front cover on the cardcage.
18. Install the lower bay cover.
19. Install the left side panel.
20. Install the exhaust plenum.
21. Install the rear panel.

4.11.2 Powerplane

Additional components must be removed when performing maintenance on the powerplane assembly. Do not remove the power supplies from the power supply self. Pull the power supply self back from the powerplane to ensure proper alignment with the powerplane when installing the power suply self into the cabinet.

CAUTION

The revision level of the powerplane being installed must be compatible with the existing backplane. Incompatibility between the backplane and powerplane may cause damage to equipment.

When replacing the powerplane, examine to determine the revision level of the backplane and powerplane.

4.11.2.1 Tools

- Phillips screwdriver
- Slot screwdriver, small
- Hex socket, 1/2–inch
- Portable light source

4.11.2.2 Removal

1. Perform power down.
2. Set the main circuit breaker on the power controller front panel to **OFF**.
3. Engage personal grounding system.
4. Loosen, but do not remove, the 3 screws at the lower edge of the card cage cover sequentially a few turns at a time until the retainer strip is loose (no pressure is exerted against the card cage cover).
5. Loosen each of the 3 quarter-turn fasteners along the top edge of the card cage cover.
6. Grasp the card cage cover by the cross member and pull it forward until its top edge disengages from the bottom edge of the front control panel assembly.
7. Remove the card cage cover.
8. Remove the lower bay cover.
9. Remove the lower air plenum
10. Disconnect the connectors on the top, back of the power controller.
11. Remove the nuts and washers from the power supply studs protruding through the powerplane.
12. Remove the rear panel.
13. Remove the 8 screws attaching the lower rear plenum to the cabinet frame.
14. Pull the lower rear plenum straight out of the processor cabinet.
15. Note the position of the 3 ribbon cables on the lower backplane. Disconnect the ribbon cables by gently pulling straight out.
16. Disconnect the power supply cables on the sense board by marking the location of each cable as it is removed.
17. Remove the plastic shield from the lower edge of the backplane that covers the rows of screws attaching the backplane to the powerplane.
18. Disconnect the wires from the sense board to the backplane marking the location of the wires to the backplane. (White to VTT backplane screw, blue to VEE backplane screw, 2 black wires to backplane ground screws.)
19. Remove the rows of screws on the bottom of the backplane that attach the backplane to the powerplane.

NOTE

Six of the screws for the backplane-to-powerplane connection are longer than the others. These six screws have a nut attached to them and can be accessed from inside the lower bay. Four of these longer screws are at the corners of the rows of screws and two are at the top center and bottom center of the rows of screws.

20. Remove the power supplies from the power supply self.
21. Remove the 4 screws for the mount brackets on each side of the power supply self.
22. Remove the 6 front mount screws of the power supply self.
23. Lift up on the bottom of the power supply self and pull the self out from the powerplane about 6 inches. This provides enough space during removal to angle the powerplane for clearing the card cage side panels.

CAUTION

Support the powerplane so it does not drop when removing the mount screws from the powerplane. Failure to support the powerplane may cause damage to the powerplane if dropped.

24. Remove the mount screws from the powerplane mounting brackets. Support the powerplane when removing the screws to prevent it from dropping.
25. Slide the lower part of the powerplane toward the back of the computer allowing the top to clear the bottom of the card cage.
26. Carefully lift the powerplane out of the lower bay of the processor cabinet.

4.11.2.3 Installation

CAUTION

The revision level of the powerplane being installed must be compatible with the existing backplane. Incompatibility between the backplane and powerplane may cause damage to equipment.

When installing the powerplane, examine to determine the revision level of the backplane and powerplane.

1. Lift the powerplane into the processor cabinet.
2. Position the powerplane in the lower bay and align the mount holes with the holes of the mounting brackets.

CAUTION

Support the powerplane so it does not drop when installing the final screws into the powerplane. Failure to support the powerplane may cause damage to the powerplane if dropped.

3. Hold the powerplane in position and insert and finger tighten the mount screws.
4. Insert several screws randomly into the positions attaching the backplane to the powerplane.
5. Carefully slide the power supply self into the processor cabinet paying attention to the alignment of the studs protruding from the power supplies and the holes of the powerplane.
6. When the power supply self is installed into the processor cabinet, finger tighten the nuts and washers onto the power supply studs.
7. Insert the screws for the 2 mount brackets on the sides of the power supply self.
8. Install the 6 screws for the front of the power supply self and tighten.
9. Tighten the 4 screws in the 2 mount brackets on the sides of the power supply self.
10. Insert the powerplane mounting screws and finger tighten.
11. Insert several screws randomly into the bottom screw holes to check the alignment of the backplane with the powerplane.
12. Insert, but do not tighten, the remaining screws on the bottom of the backplane that attach the backplane to the powerplane.

NOTE

Six of the screws for the backplane to powerplane connection are longer than the others. These screws have a nut attached that can be accessed from inside the lower bay. Four of these longer screws are at the corners of the rows of screws and two are at the top center and bottom center of the rows of screws.

13. Tighten all screws on the bottom of the backplane where it attaches to the powerplane in the prescribed sequence.

CAUTION

Screws must be tightened to specified torques. Tighten to 10 in/lb all screws that attach the backplane to the powerplane. Tighten to 14 in/lb screws that connect metal to metal. Failure to properly torque the screws could result in damage to the system or equipment.

DO NOT tighten screws at random selection. This could cause a ripple effect on the powerplane and backplane as pressure is applied to the board when screws are torqued.

14. Tighten the screws on the backplane to powerplane connection to 10 in/lb in the following sequence:
    a. Tighten the center vertical column of screws from top to bottom.
    b. Tighten the vertical column of screws to the right of the center column from top to bottom.
    c. Continue tightening the vertical columns of screws from the center, 1 column at a time from top to bottom until all screws on the right side are tightened.
    d. Tighten the vertical column of screws to the left of the center column from top to bottom.
    e. Continue tightening the vertical columns of screws from the center 1 column at a time from top to bottom until all screws on the left side are tightened.
    f. Attach the wires from the sense board to the marked location on the backplane. (White to VTT backplane screw, blue to VEE backplane screw, 2 black wires to backplane ground screws.)
    g. Mount the sense board to the backplane stiffener with 2 screws.
    h. Install the plastic shield to the lower edge of the backplane to cover the rows of screws attaching the backplane to the powerplane.
    i. Connect the power supply cables on the sense board to the location for each cable as marked.
    j. Install the 3 ribbon cables on the lower backplane by gently pushing straight in with the ribbon cable connector.
    k. Tighten the nuts on the power supply studs.
    l. Tighten the mounts screws on the mounting brackets on each side of the powerplane.
    m. Connect the wiring connections to the top, back of the power controller.
    n. Install the lower rear plenum.

o. Install the card cage cover using the following procedure:

1. Pull the retainer strip (at the lower edge of the card cage) away from the card cage so that it rests against the heads of its 3 screws.
2. Insert the lower edge of the card cage cover ***under*** the retainer strip so that the card cage cover is between the card cage lower edge and the retainer strip.
3. Press the cover down so the 3 notches along its lower edge engage the 3 screws holding the retainer strip.
4. Push the upper edge of the card cage cover into position under the lower edge of the front control panel assembly. Conductive gasketing material along this edge causes a snug friction fit.
5. Lock each of the 3 quarter-turn fasteners along the upper edge of the card cage cover.
6. Tighten the 3 retainer strip screws sequentially, a few turns at a time until the retainer strip is tight against the card cage cover and the lower bay cover.

p. Set the main circuit breaker on the power controller front panel to **ON** and perform power up.

q. Install the lower air plenum.

r. Install the lower bay cover.

Chapter 5
Illustrated Parts Breakdown

5.1 Overview

This chapter provides instructions for using the Illustrated Parts Breakdown (IPB) lists and figures. IPB figures illustrate the location of the parts in relationship to the cabinet. Each part shown has a reference in the IPB parts list. Supporting hardware is listed in the parts list under the associated part number. The parts lists precede the illustration when possible, appearing on the facing page.

5.2 How to Use the Parts List

The parts list consists of the figure number, item number, part number, and description (nomenclature). The following example shows the figure number location in bold characters:

Figure/ Item Number	Part Number	Description
1-3	500-001015-200	Assy, Control Panel
1	411-000150-201	BD Assy, Control Panel W/O Idle
2	500-000114-200	Assy, Keylock Switch

An item number references the part in the associated figure to the part number and description in the parts list. When a parts list continues on subsequent pages, the first line of the parts list on the following page(s) repeats the figure number and gives the next part number to be listed. The following example shows the item numbers in an IPB parts list in bold characters:

Figure/ Item Number	Part Number	Description
1-3	500-001015-200	Assy, Control Panel
1	411-000150-201	BD Assy, Control Panel W/O Idle
2	500-000114-200	Assy, Keylock Switch

Part numbers and descriptions define all callouts (item numbers) in the figure. All parts are identified with the part number and nomenclature defined using NCA Corporation standards. References to any part numbers or descriptions must use the exact nomenclature (or an abbreviated form) of what appears in the IPB parts list.

Some attaching parts, and supporting hardware such as screws, washers, or gaskets are not illustrated, however, they are referenced in the parts list under the assembly or subassembly to which they are applicable. The following example displays part numbers and descriptions for a major assembly with supporting hardware in bold characters:

Figure/ Item Number	Part Number	Description
1-3	500-001015-200	Assy, Control Panel
1	**411-000150-201**	**BD Assy, Control Panel W/O Idle**
	601-100004-200	**Cable Assy**
	312-000124-001	**Screw Lock**
2	500-000114-200	Assy, Keylock Switch

Some major assemblies may refer to another illustration for further breakdown. The parts list contains the appropriate figure reference shown in the following table in bold characters:

Figure/ Item Number	Part Number	Description
1-3	500-001015-200	Assy, Control Panel
1	411-000150-201	BD Assy, Control Panel W/O Idle
	601-100004-200	Cable Assy
	312-000124-001	Screw Lock
2	**500-000114-200**	**Assy, Keylock Switch (See Figure 5-12 for detail)**

The following example illustrates a sample parts list and IPB figure:

Table 5–1, Sample Parts List

Figure/ Item Number	Part Number	Description
5-11		
1	500-001015-200	Assy, Control Panel
2	500-000114-200	Assy, Reset Switch

Figure 5–1, Sample Parts Breakdown

Figure 5–11, Assy, Control Panel

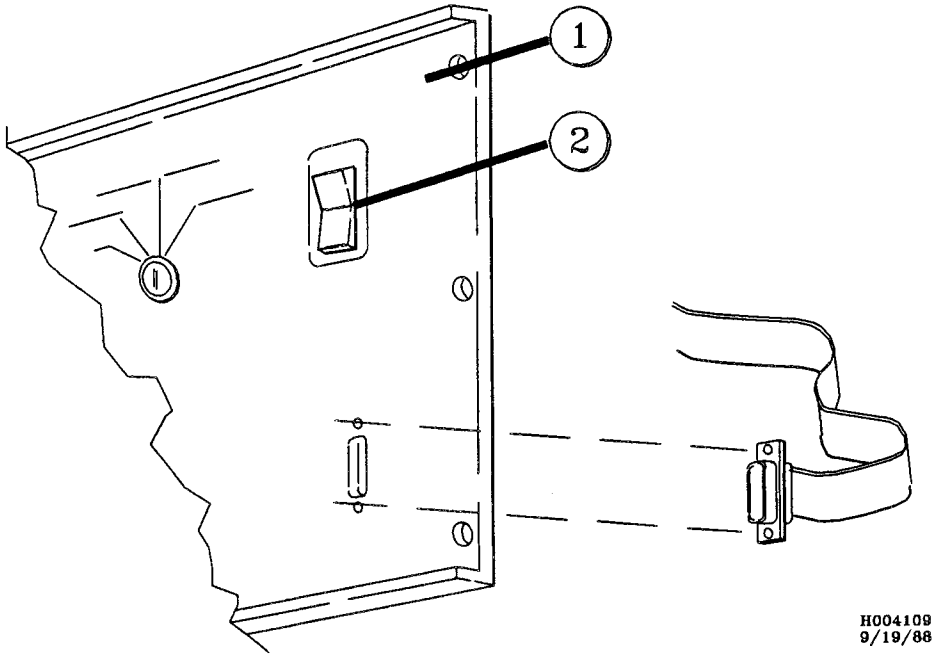


Table 5–2, C2 Door Parts List

Figure/ Item Number	Part Number	Description
5-2	506-001004-211	PURCH Assy, C2 Full Door
1	320-000984-500	Assy, Full Door
2	312-000136-005	Air Filter, Top
3	312-000136-006	Air Filter, Bottom
4	312-000152-001	Latch, Cab Door Hidden
	320-000249-500	MFAB, Spacer Latch
	310-150401-001	Nut, 8-32, KEP
5	320-000251-500	MFAB, Filter Ret Clip
	310-002301-001	SCR, 6-32X3/8, PHH, PNH, SEM
6	320-000272-500	MFAB, Slig, C1 Door Stop
	310-000501-005	SCR, 10-32X1/2, PHH, PNH, BL OX
	310-200520-001	WSH, #10, EX Tooth
	310-200501-001	WSH, #10, Flat, BL OX
	310-150502-001	Nut, 10-32, KEP
7	604-100006-202	Cable Assy, CPU Ind Shield 40 in
8	411-000111-201	Assy, C2 Door Ind PCB
9	320-000915-500	Cover, Indicator Board, MFAB

Figure 5–2, C2 Door Parts Breakdown

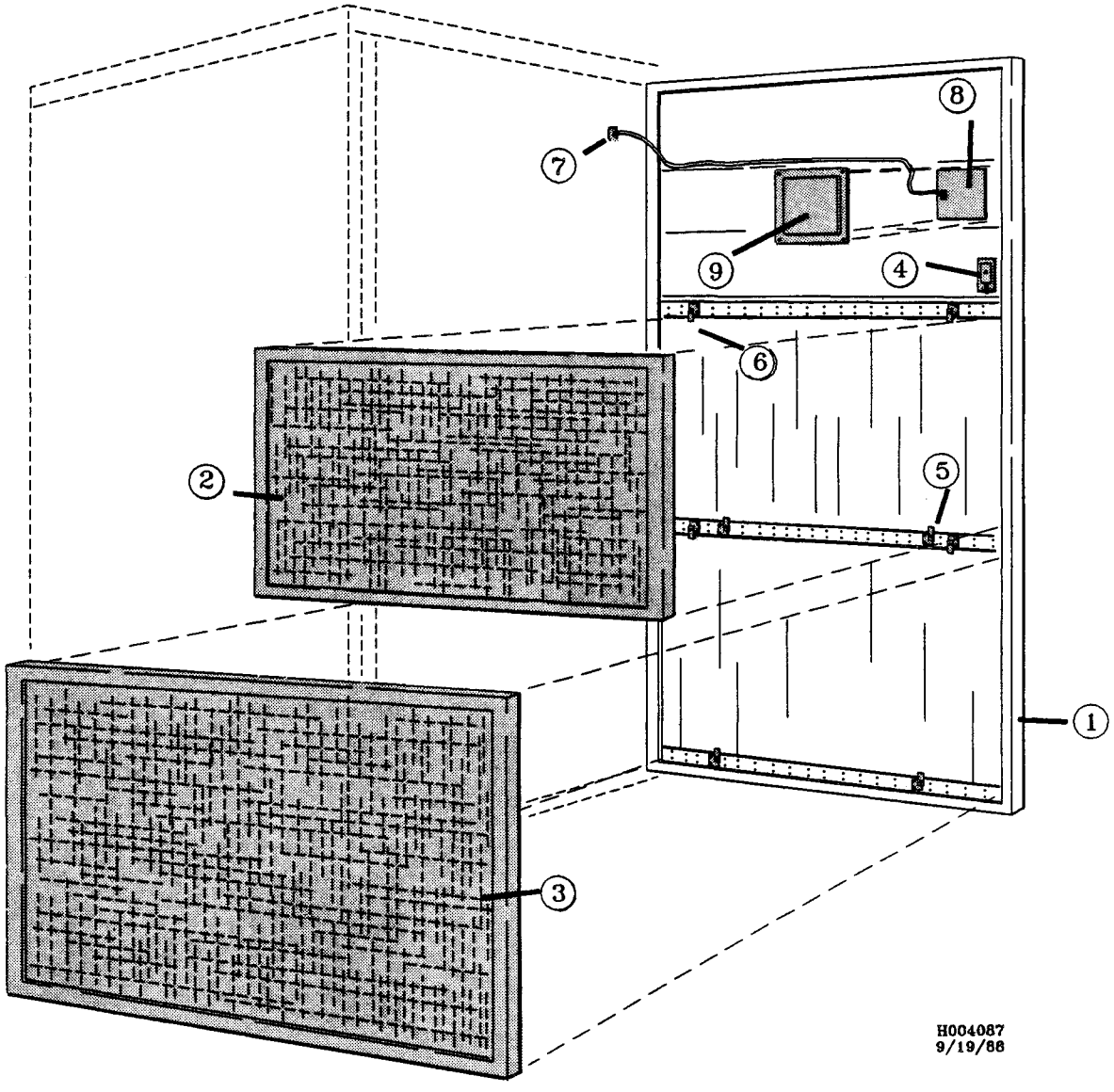


Table 5–3, Front Cabinet Parts List

Figure/ Item Number	Part Number	Description
5-3		
1	500-000245-200	Assy, C2 CPU Bottom Panel
	320-001039-500	Panel, Lower Front EMI
	320-000247-509	FAB, EMI Gasket Clip 20 5/8"
	320-000247-507	FAB, EMI Gasket Clip 25"
	312-000154-006	Stud, 1/4 Turn, Oval HD, Slot
	310-250001-001	Washer, Retaining Spring
	312-000148-001	Gasket EMI 3/4 X 1/8 ADH
2	320-000370-500	Front Panel Retainer
3	500-000244-200	Assy, C2 CPU CC Panel
	320-001011-500	MFAB, Panel, Front, Card Cage
	320-000247-508	FAB,EMI Gasket Clip 24"
	320-000247-507	FAB, EMI Gasket Clip 25"
	312-000154-004	Stud, 1/4 Turn #4
	312-000256-001	Grommet, Half .210 ID
4	500-001020-200	Assy, Plenum, Intake (See Figure 5-4 for detail)
5	312-000136-007	Air Filter, Floor
6	500-001015-200	Assy, Control Panel (See Figure 5-5 for detail)

Figure 5–3, Front Cabinet Parts Breakdown

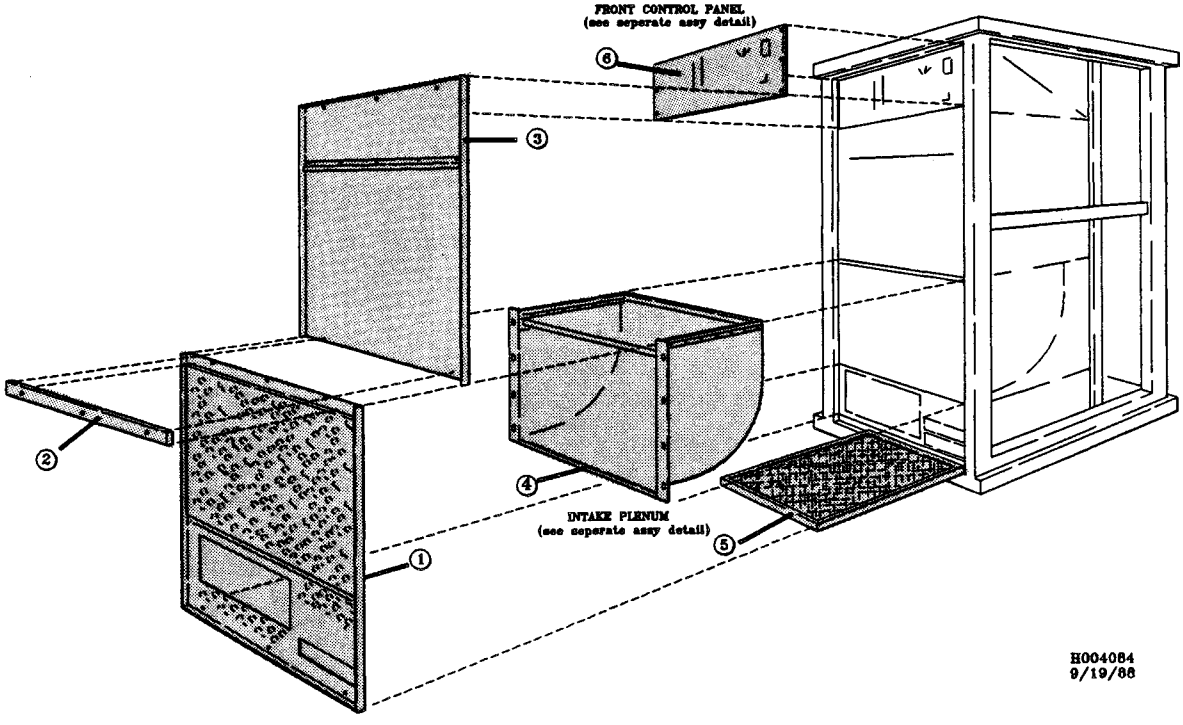


Table 5–4, Intake Plenum Parts List

Figure/ Item Number	Part Number	Description
5-4	500-001020-200	Assy, Intake Plenum
1	330-000112-500	Intake Plenum
2	320-001057-502	Guide, Intake Plenum (R)
3	320-001057-501	Guide, Intake Plenum (L)
4	320-001058-500	Bar, Intake Plenum
5	310-002302-001	Screw, 6-32x1/2, PHH, PNH, W/SQ CN WSH
6	310-000200-006	Screw, 4-40x1/2,PHH, PNH, SST
7	312-000242-001	Foam, Intake 2
8	312-000241-002	Foam, Intake 1
9	312-000241-001	Foam, Intake 1
10	312-000251-001	Foam, Intake 3

Figure 5–4, Intake Plenum Parts Breakdown

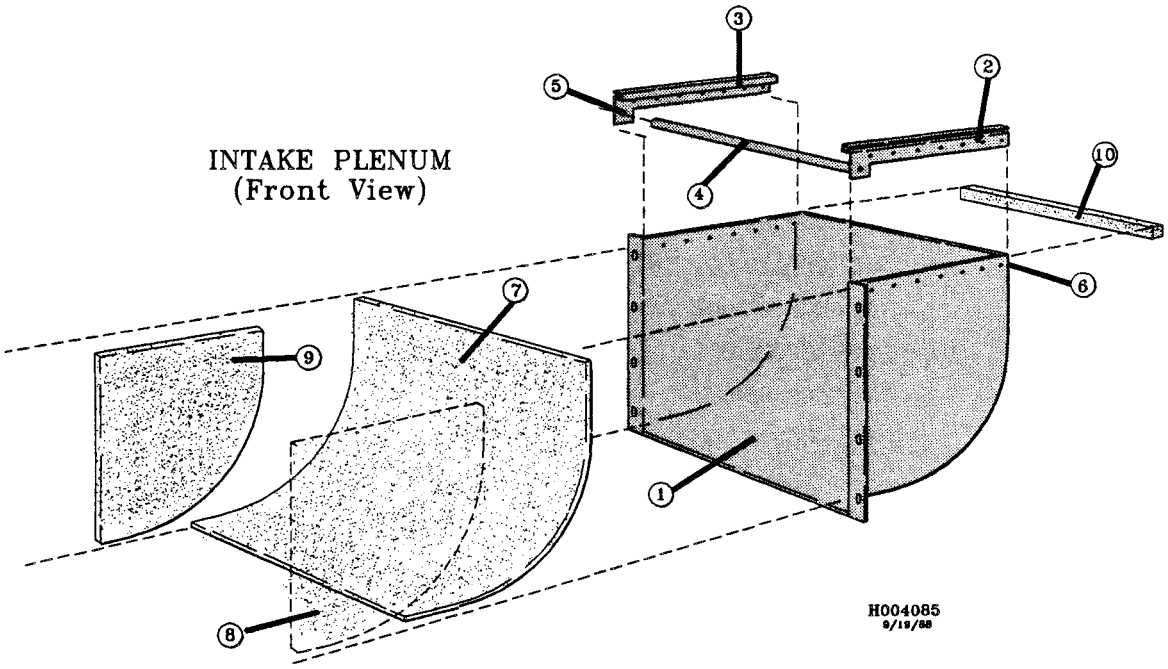


Table 5–5, Control Panel Parts List

Figure/ Item Number	Part Number	Description
5-5	500-001015-200	Assy, Control Panel
1	320-001182-500	MFAB, Control Panel
	312-000124-001	Screw Lock, D Connector Female
	310-000201-003	Screw, 4-40 X 5/16, PHH, PNH, NYLK
	310-200201-001	Washer, #4, .250 OD, Flat
	312-000149-001	Gasket EMI 5/16 X .343 Clip
	312-000148-001	Gasket EMI 3/4 X 1/8 ADH
	310-400002-001	STDF, 4-40 X 9/16, F/F, 1/4 Hex
	320-000395-500	MFAB, Cover Plate, J1
	320-000396-500	MFAB, Shield Plate, J1
	310-150201-001	Nut, 4-40, KEP
2	411-000150-201	BD Assy, Control Panel W/O Idle
3	500-000114-200	Assy, Keylock Switch
4	500-000115-202	Assy, Reset Switch, 9"

Figure 5–5, Front Control Panel Parts Breakdown

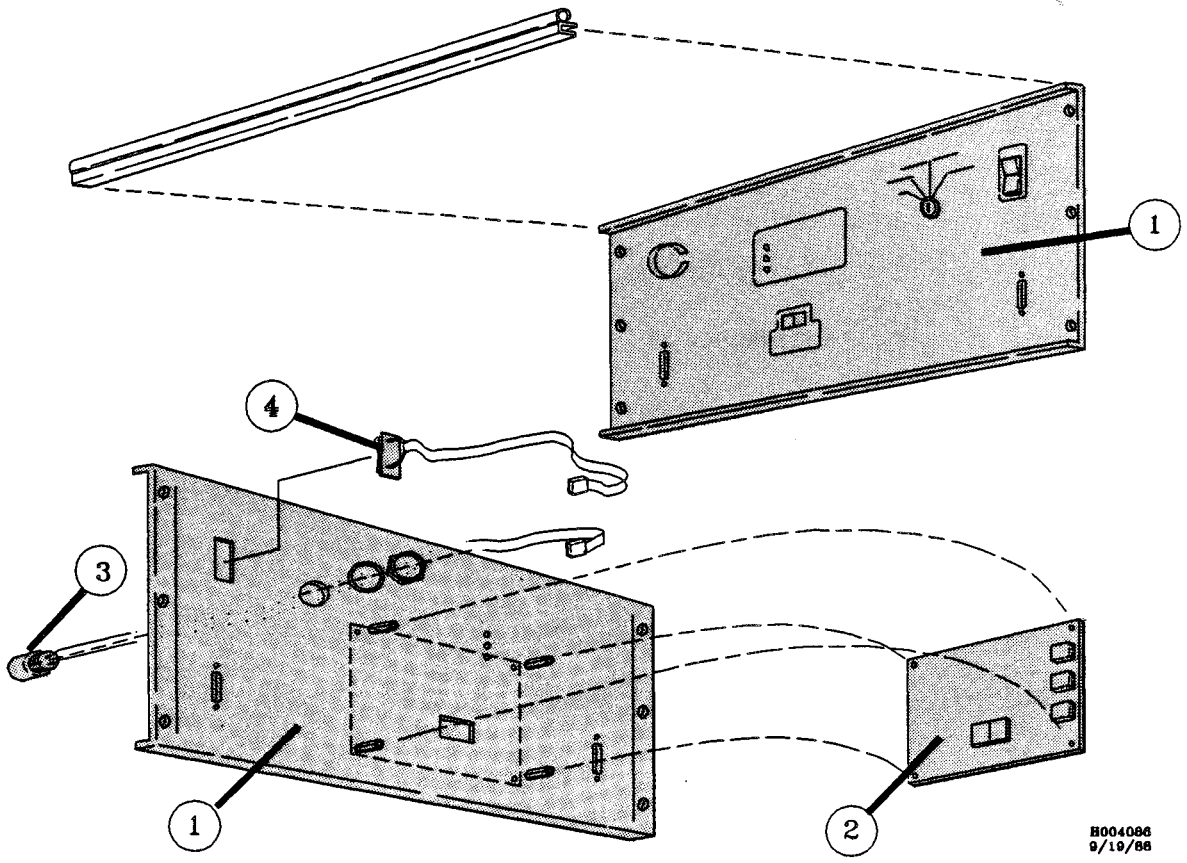


Table 5–6, Lower Bay Parts List

Figure/ Item Number	Part Number	Description
5-6		
1	500-001159-200	Assy, Power Controller-Master, II (D) (See Figure 5-7 for detail)
	500-000241-200	Assy, Power Controller-Master, Int'l (See Figure 5-8 for detail)
2	500-001013-200	Assy, Spu Peripherals (See Figure 5-10 for detail)
3	204-000010-200	Disk Drive, 172MB (See Figure 5-9 for detail)
4	411-000130-20	Board Assy, System Control Monitor (See Figure 5-11 for detail)
5	500-000250-200	Assy, Temp Probe, Inlet

Figure 5–6, Lower Bay Parts Breakdown

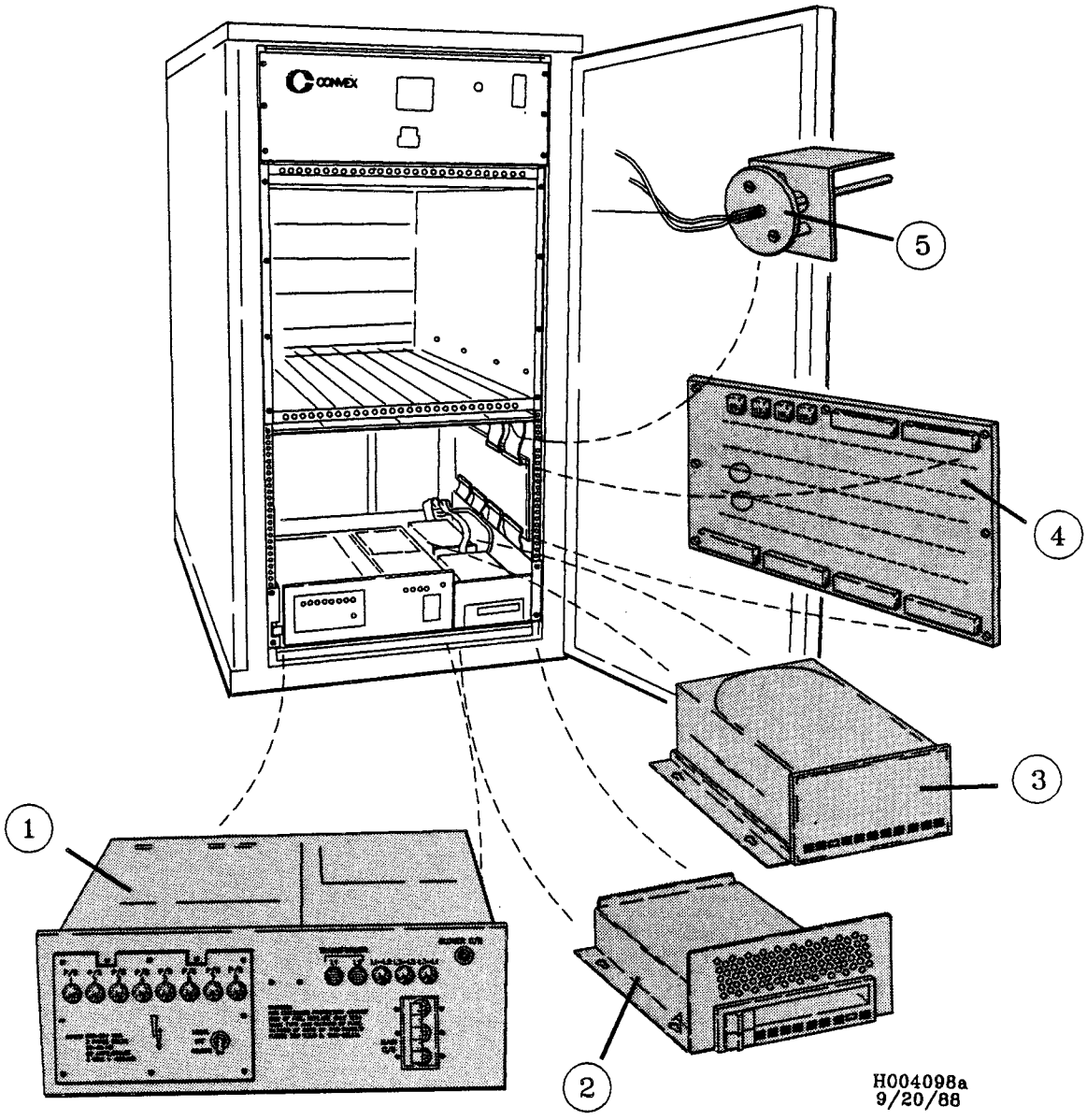


Table 5–7, Power Controller (Domestic) Parts List

Figure/ Item Number	Part Number	Description
5-7		
1	500-001159-200	Assy, Power Controller-Master, II
	500-001157-200	Assy, Power Controller W/O Ind Panel, II
2	500-000218-200	Zassy, Indicator Panel-Master
3	603-260003-200	Cable Assy, Indicator Panel-Master
	021-000142-001	Label, Shock Hazard
4	330-000136-500	PFAB, Shield, Stud, Line, Filter
5	605-040003-200	Assy, Power Cord, AC, 1 or 2 HD, Domestic
6	310-400800-001	STDF, 5/16-18 X 3/4, M/F, 1/2 HEX
7	310-400011-001	Spacer, RND, 3/4 OD X 1/8 L, 5/16 ID Brass
8	603-080014-200	Cable Assy, AC Power 60 in
9	603-080014-202	Cable Assy, AC Power 76 in
10	603-080014-203	Cable Assy, AC Power 80 in
11	603-080014-201	Cable Assy, AC Power 66 in
12	603-010014-200	Cable Assy, Signal, Power Controller
13	603-030017-200	Cable Assy, AC Fan, Main
14	603-040014-200	Cable Assy, C2 SCM Power
15	253-000109-002	Fuse Holder, Panel Mount
16	253-000116-002	Fuse, 2A SB 250V 1.25 Long

Figure 5–7, Power Controller (Domestic) Parts Breakdown

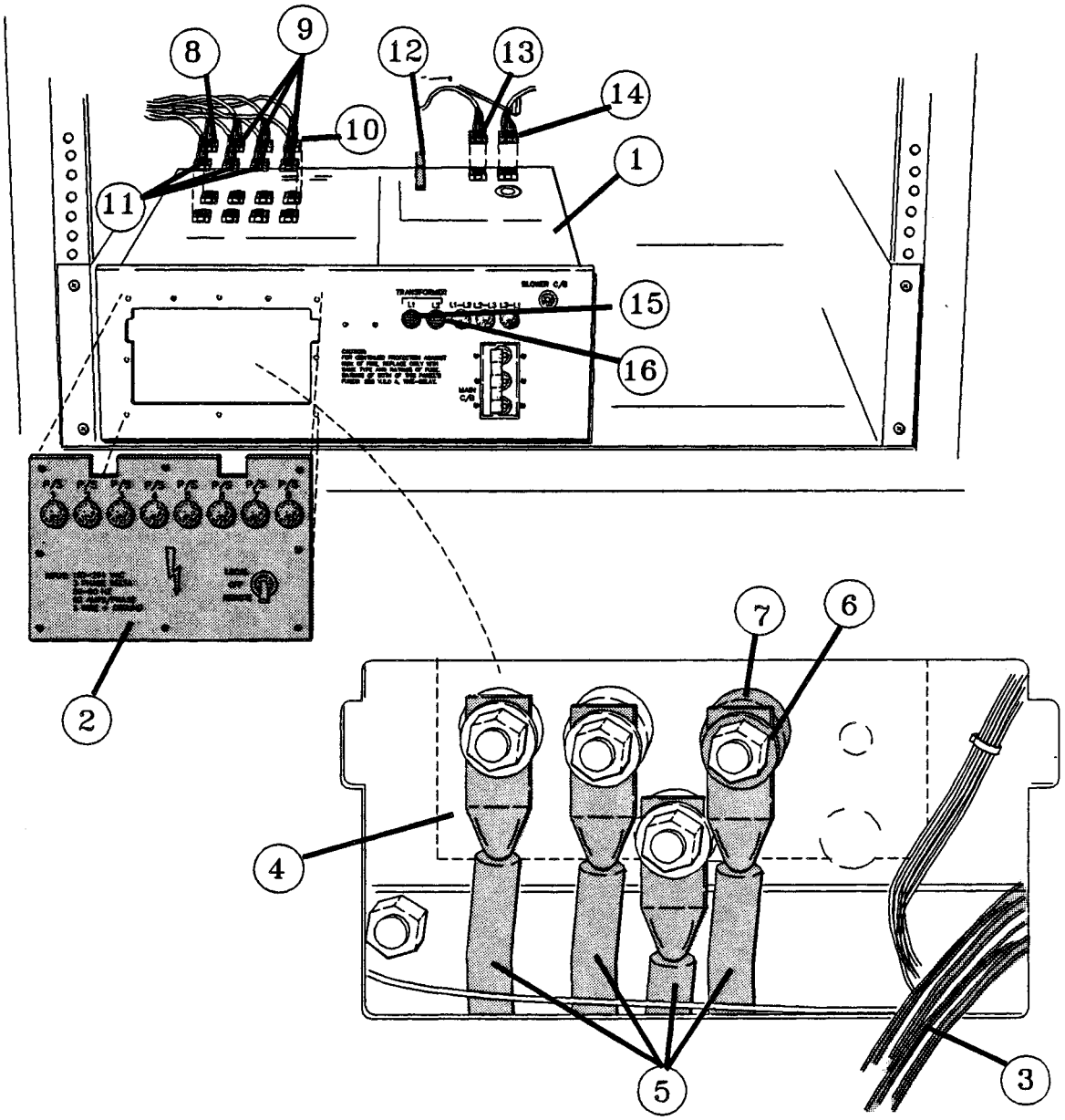


Table 5–8, Power Controller (International) Parts List

Figure/ Item Number	Part Number	Description
5-8		
1	500-000241-200	Assy, Power Controller-Master, Int'l
	500-001029-200	Assy, Power Controller W/O Ind Panel, Int'l
2	500-000218-202	Zassy, Ind Panel-Master, INT'L
3	603-260002-200	Cable Assy, Ind Panel, INT'L Master
4	330-000136-500	PFAB, Shield, Stud, Line, Filter
	021-000142-001	Label, Shock Hazard
5	605-050002-200	Assy, PWR CD(Rev A.1), AC, 1 or 2 HD, Int'l
6	310-400600-001	STDF, 1/4-20 X 3/4, M/F, 1/2 HEX
7	310-400009-001	Spacer, RND, 5/8 OD X 1/8 L, 1/4 ID Brass
8	603-080014-200	Cable Assy, AC Power 60 in
9	603-080014-202	Cable Assy, AC Power 76 in
10	603-080014-203	Cable Assy, AC Power 80 in
11	603-080014-201	Cable Assy, AC Power 66 in
12	603-010014-200	Cable Assy, Signal, Power Controller
13	603-030017-200	Cable Assy, AC Fan, Main
14	603-040014-200	Cable Assy, C2 SCM Power

Figure 5–8, Power Controller (Int'l) Parts Breakdown

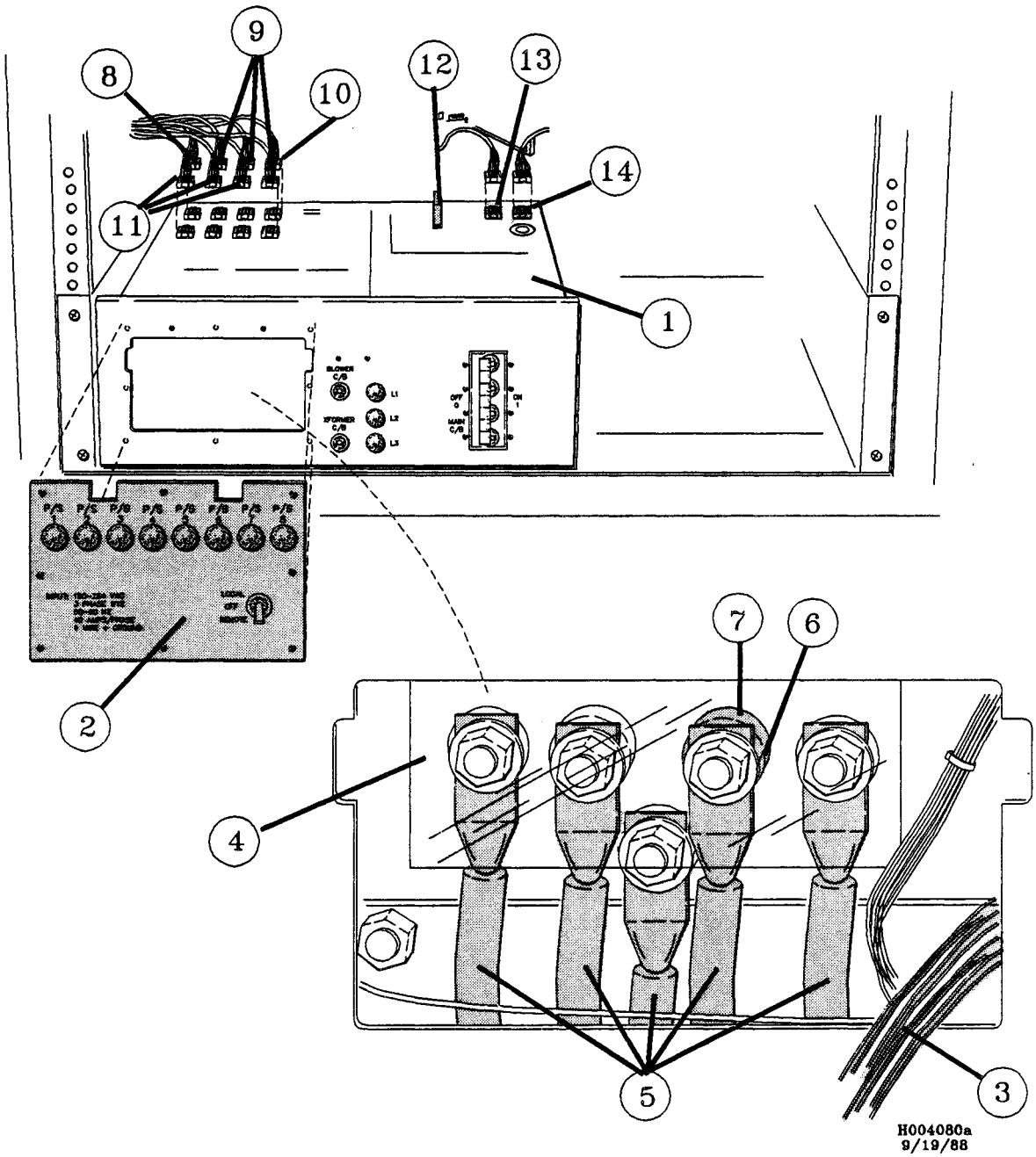


Table 5–9, SPU Disk Parts List

Figure/ Item Number	Part Number	Description
5-9		
1	204-000010-200	Disk Drive, 172MB
2	601-500019-200	Cable Assy, 60 Std/50 Std
3	603-140002-200	Cable Assy, C2 Aux Power
	312-000139-001	Clamp

Figure 5–9, SPU Disk Parts Breakdown

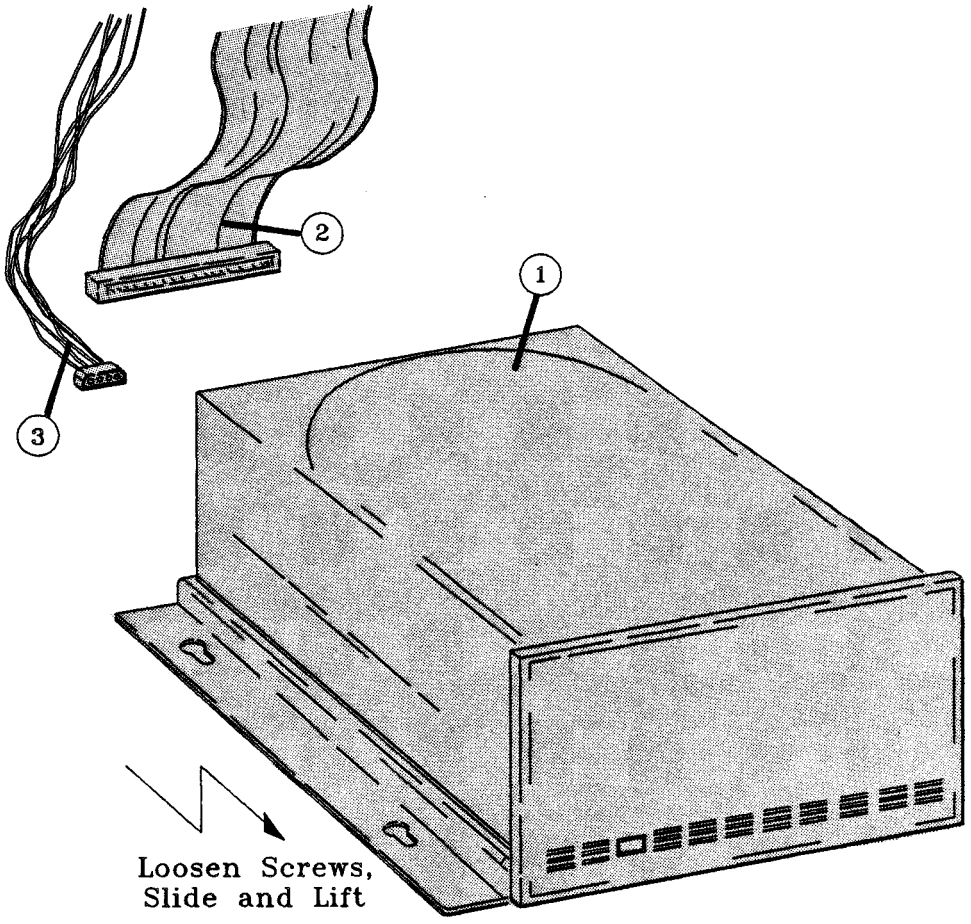


Table 5–10, SPU Peripherals Parts List

Figure/ Item Number	Part Number	Description
5-10	500-001013-200	ZAssy, Spu Peripherals
1	207-000009-200	Tape Drive, Cartridge, 2150S
2	411-000158-200	BD Assy, Viper Paddle Card
3	310-200502-001	WSH, #10, FLAT, NYLON
4	310-002302-001	SCR, 6-32X1/2, PHH, PNH, W/SQ CN WSH
5	330-000134-500	PFAB, Insulator, Viper Tape

Figure 5–10, Spu Peripherals Parts Breakdown

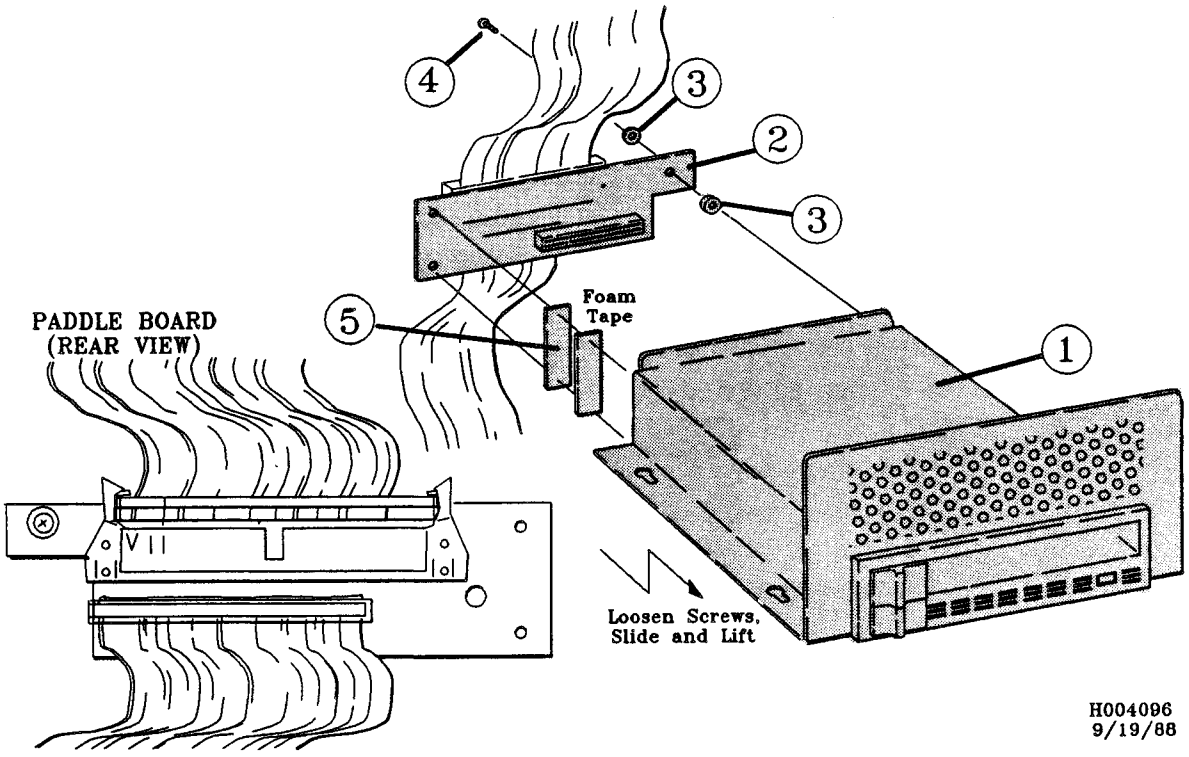


Table 5–11, System Control Module Parts List

Figure/ Item Number	Part Number	Description
5-11		
1	411-000130-200	BD Assy, System Control Monitor
2	310-002301-001	SCR, 6-32 x 3/8, PHH, PNH, SEM
3	310-200502-001	WSH, #10, Flat, Nylon
4	310-002301-001	SCR, 6-32 x 1/2, PHH, PNH, W/SQ CN WSH
5	601-640001-200	Cable Assy, DIN/DIN Z 63 in
6	603-320002-200	Cable Assy, C2 LH VTT Cntl
7	603-320001-200	Cable Assy, C2 LH VEE Cntl
8	601-600016-200	Cable Assy, 60 STD/60 STD Z
9	603-040014-200	Cable Assy, C2 SCM Power
10	603-010024-200	Cable Assy, C210/220 SCM Sensor
11	603-100001-200	Cable Assy, C2 Air Sensors
12	601-600002-202	Cable Assy, STD/STD Z

Figure 5–11, System Control Module Parts Breakdown

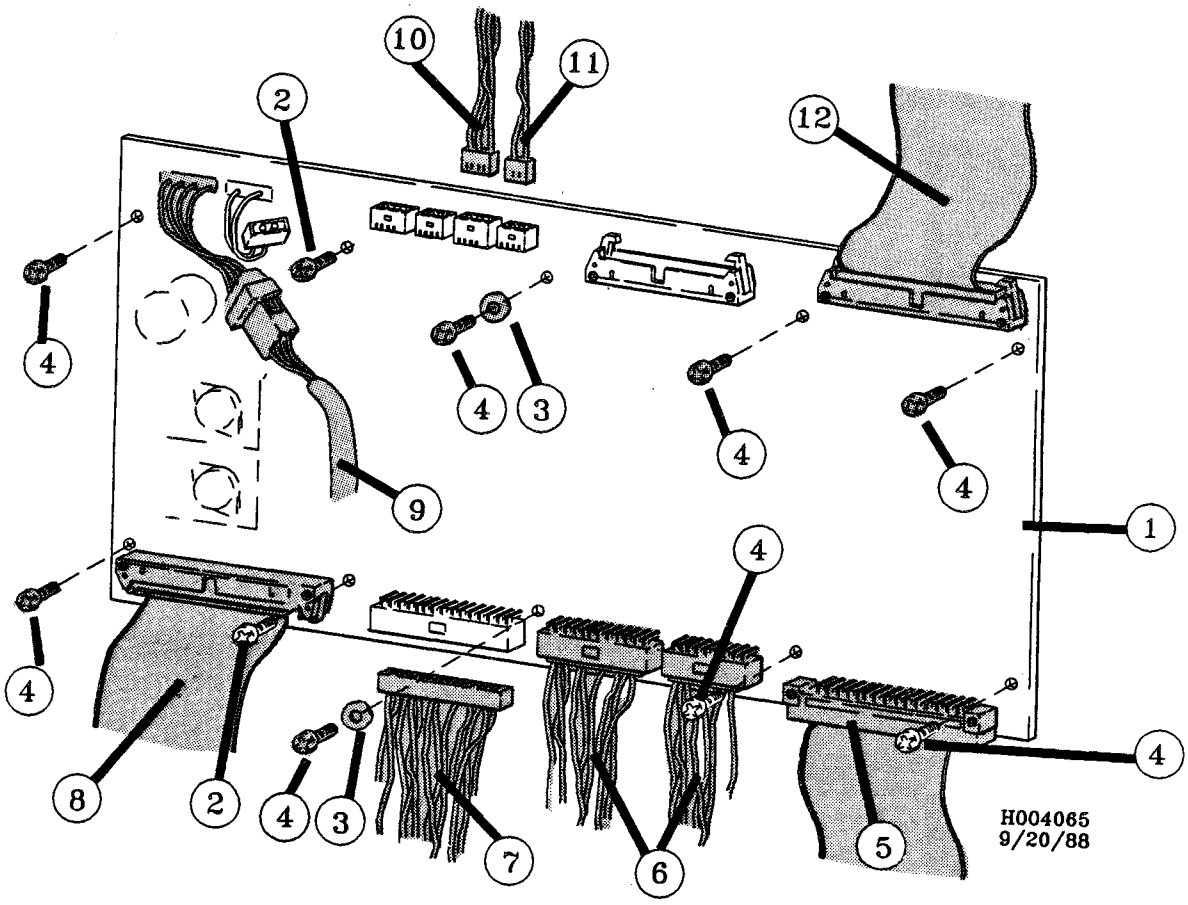


Table 5–12, Rear Cabinet Parts List

Figure/ Item Number	Part Number	Description
5-12		
1	330-000114-500	Plenum, Exhaust (See Figure 5-13 for detail)
2	500-001156-200	Assy, Backplane, C2 (Used with Powerplane, Part No. 411-000155-200)
3	411-000155-200	Board Assy, Power Plane (Used with Backplane, Part No. 500-001156-200)
4	411-000176-200	BD Assy, Power Sense
5	500-001014-200	Assy, Fans (See Figure 5-14 for detail)
6	500-000238-201	Assy, Power Supply, -4.5V
7	500-000238-200	Assy, Power Supply, -2.0V
8	500-000238-202	Assy, Power Supply, +5V
9	500-000239-200	Assy, Power Supply, Multi-Volt

Figure 5–12, Rear Cabinet Parts Breakdown

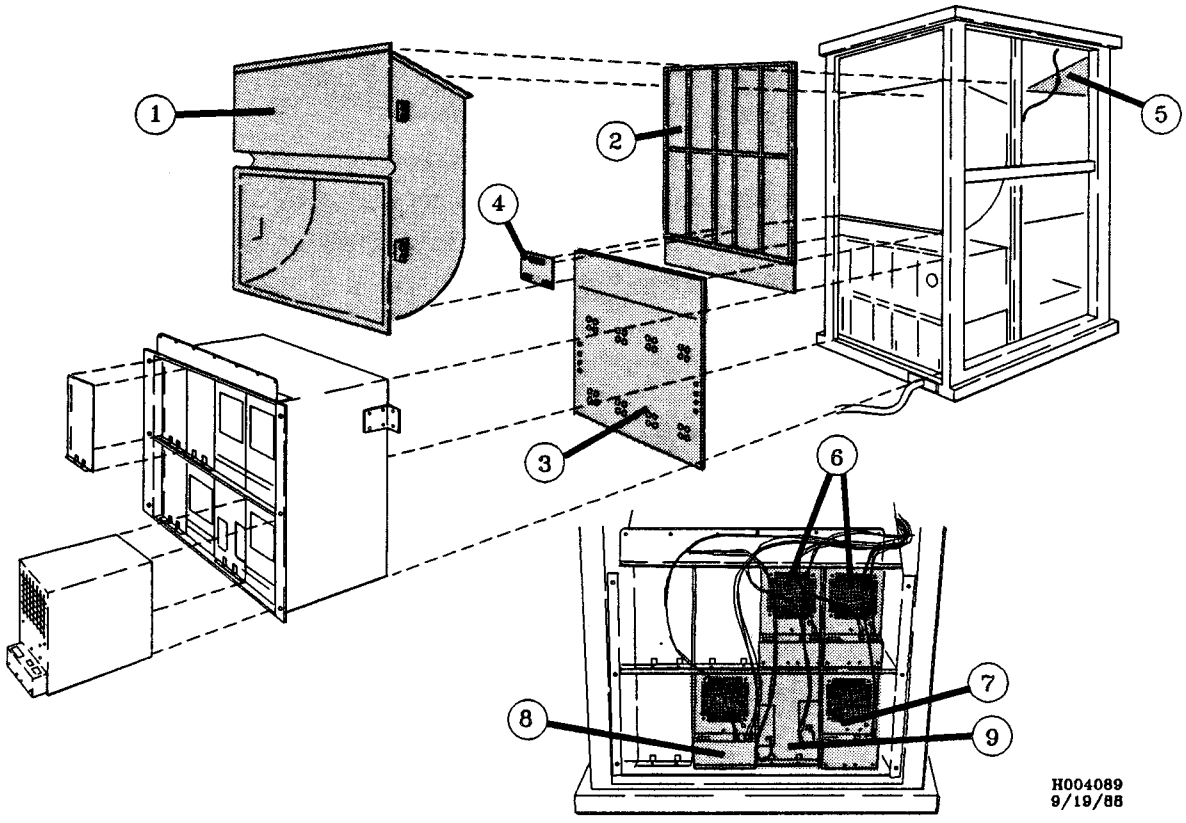


Table 5–13, Exhaust Plenum Parts List

Figure/ Item Number	Part Number	Description
1-1	330-000114-500	Plenum Exhaust
1	330-000114-501	Plenum Exhaust
2	312-000248-001	Foam, Exhaust 2
3	312-000247-001	Foam, Exhaust 1
4	312-000247-002	Foam, Exhaust 1
5	312-000259-002	Foam, Sound 1/2" THK X 1/2" Wide
6	320-001060-500	Plate, Exhaust Plenum
7	320-001003-501	MFAB, Bracket, Rail Mounting

Figure 5–13, Exhaust Plenum Parts Breakdown

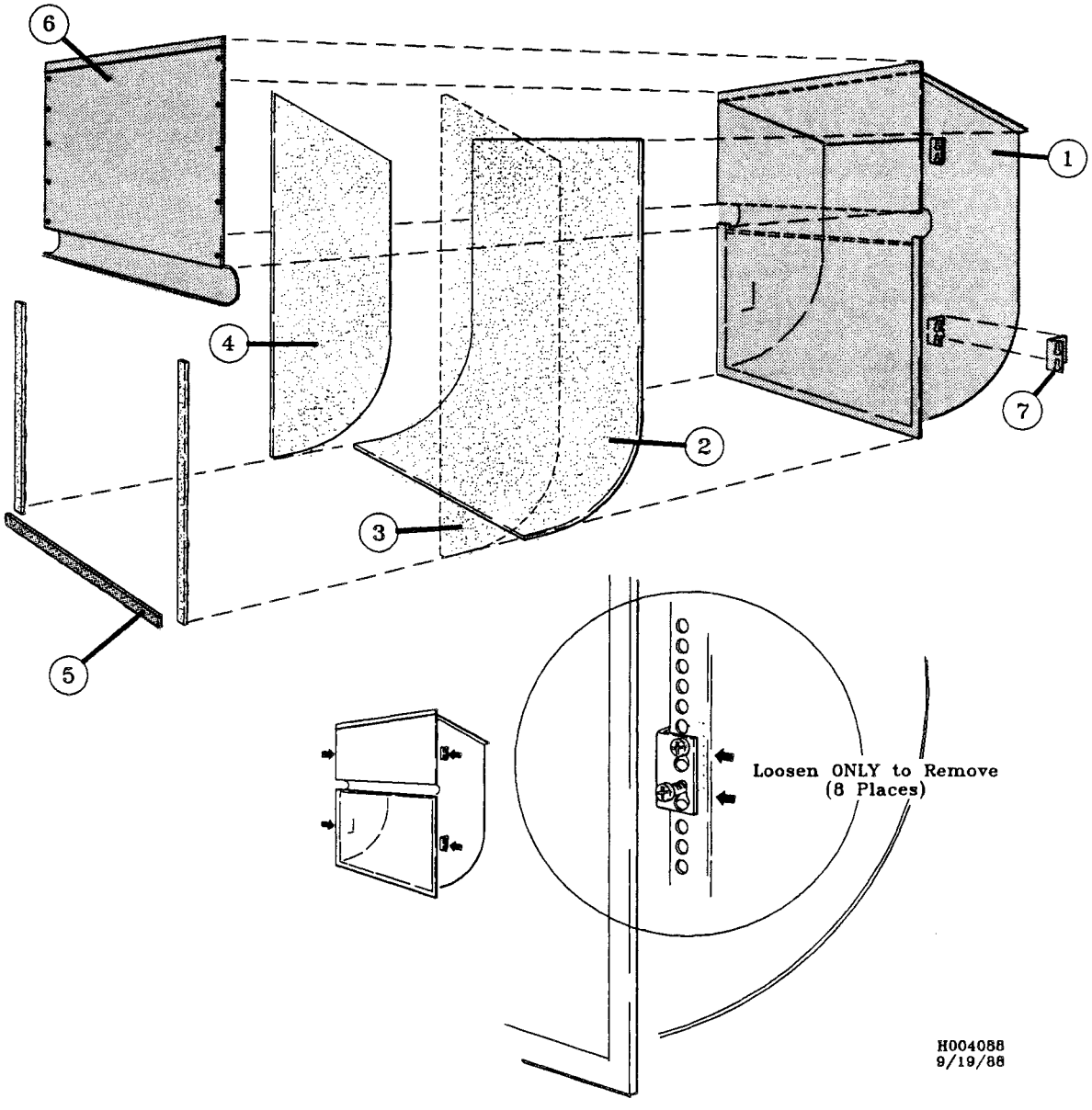


Table 5–14, Fans Parts List

Figure/ Item Number	Part Number	Description
5-14	500-001014-200	ZAssy, Fans
1	500-001017-200	Assy, Fan, Tube axial 6"
	320-001155-500	MFAB, Bracket, Fan Mnt Connector
	310-200402-001	WSH, .18 ID X .63 OD Flat
	310-100400-001	Nut, 8-32 Lock
	310-000431-004	SCR, 8-32 X 1.00, PHH, PNH
	603-030014-200	Cable Assy, AC Fan, Upper
	603-030016-200	Cable Assy, AC Fan, Lower
	312-000142-001	Tie Wrap
2	411-000141-200	BD Assy, PC Air Flow Sensor
	310-002302-001	SCR, 6-32 x 1/2, PHH, PNH, W/SQ CN WSH
	603-050002-200	Cable Assy, Air Sensors B/H
	312-000142-001	Tie Wrap
3	500-000251-200	Assy, Temp Probe, Exhaust
	310-002302-001	SCR, 6-32 x 1/2, PHH, PNH, W/SQ CN WSH
4	320-001056-500	Plate, Fan Mount
	312-000254-001	Grommet, .219 ID, PNL THKNS = 1/8"
5	320-001063-500	MFAB, Bracket, Air Sensor
6	320-001156-500	MFAB, Bracket, Temp Sensor
	310-150301-001	Nut, 6-32, KEP
7	312-000249-001	Foam, Fan Plate

Figure 5–14, Fans Parts Breakdown

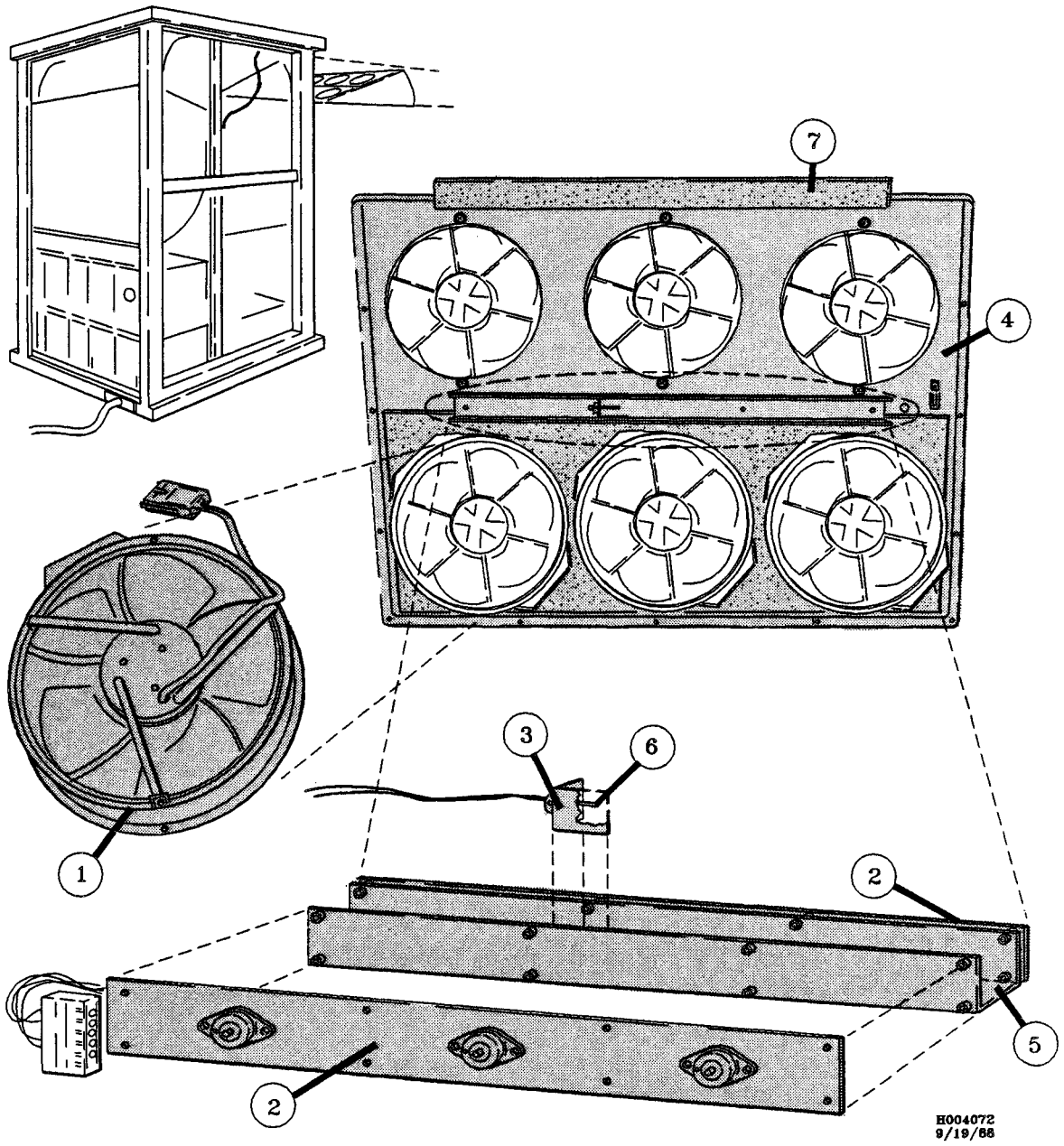
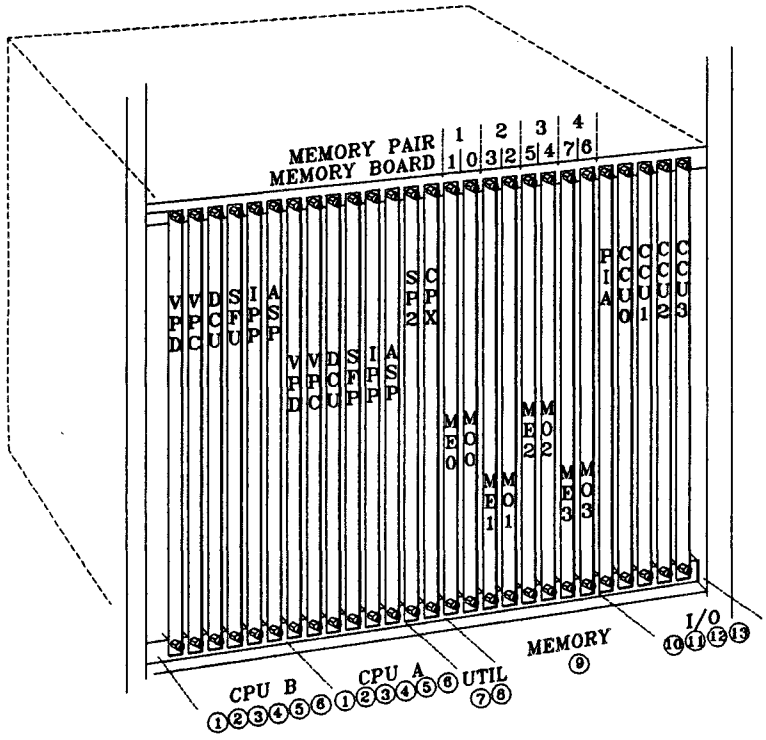


Table 5–15, Board Set Parts List

Figure/ Item Number	Part Number	Description
5-15		
1	410-001206-200	Board Assy, VPD
2	410-002205-200	Board Assy, (Rev D.4) VPC
3	410-001208-200	Board Assy, (Rev E.2) DCU
4	410-001210-200	Board Assy, (Rev F.4) SFU
5	410-001207-200	Board Assy, IPP
6	410-001209-200	Board Assy, ASP
7	410-001200-200	Board Assy, (Rev G.1) SP2 MW
8	410-002201-200	Board Assy, (Rev H.3) CPX
9	550-000193-200	Assy, 16MB MCM
	550-000194-200	Assy, 32MB MCM
	550-000195-200	Assy, 64MB MCM
10	410-002212-200	Board Assy, (Rev F.2) PIA
11	550-000122-202	Assy, MIOP
12	550-000181-204	Assy, VIOP
13	550-000165-200	Assy, HSP
	500-000246-200	Assy, Paddle Card Assy
	320-001150-500	MFAB, Brkt, Paddle Card
	411-002139-200	Assy, Foreplane

Figure 5–15, Board Set Parts Breakdown

C201,C202,C210,C220 CARD CAGE



1 VPD – VECTOR PROC. DATA
2 VPC – VECTOR PROC. CONTROL
3 DCU – DATA CACHE UNIT
4 SFU – SCALAR FUNCTION UNIT
5 IPP – INST. PROC. UNIT
6 ASP – ADDRESS SCALAR PROC.
7 SP2 – SERVICE PROCESSOR 2
8 CPX – CPU UTILITY
9 MCM – MEMORY UNIT
10 PIA – PBUS INTERFACE ADAPT
11 MIVP – MULTIBUS I/O PROCESSOR
12 VIVP – VMEBUS I/O PROCESSOR
13 HSP – HIGH SPEED PROCESSOR

H004075
9/19/88

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix A
Part Number Identification

A.1 Overview

This instruction is written to establish the format of the Identification numbering scheme used by CONVEX to identify its products and documentation. It is a significant numbering method with intelligence assigned to different fields of the number. There are two categories of numbers, Production and Marketing.

A.2 Production Numbers

Production type numbers are used for all items that are to be purchased, inventoried, used in the product, or for support documentation. The following examples identify the different fields within the number format:

- FAMILY CODE: The family code is the first three digits in the fourteen digit number shown below.

410-000125-200

- SEQUENTIAL FIELD: This field consists of the middle six digits and is usually assigned sequentially within each 'Family Code'. However, some families of parts do have intelligence assigned to this field as explained later in this text.

410-000125-200

- DASH NUMBER: The Dash Number is the last three digits of the identification number and has intelligence assigned as shown in the following table.

410-000125-200

Table A–1, Part Number Assignment Codes

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
020 Corporate Forms	*Format abbbbb* a = all other Variables bbbbb = Sequential Number	*Format ccc* = Sequential number for minor variations of the same form.
021 Product Labels	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequential number for minor variations of the same label.

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
022 Publication Supplies	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same part
070 IC Pkg. Specs.	*Format aaaaaa* Sequuential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same part
079 Process Specs.	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same spec.
080 Documents w/ Global Significance	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same document.
081 Hardware Publications	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same part.
101 Resistors (Discrete)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value as they are assigned
102 Resistors (DIP)	*Format aabccc* aa=# pins/ package b = resistor configuration 1 = isolated resistors 2 = bussed or pullup 3 = dual terminator ccc = open	*Format bbb* = Sequence number by value as they are assigned
103 Resistors (SIP)	*Format aabccc* aa = pins/ package b = resistor configuration 1 = isolated resistors 2 = bussed or pullup 3 = dual terminator ccc = open	*Format bbb* = Sequence number by value as they are assigned

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
104 Resistor (Network)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value as they are assigned
105 Resistors (Variable)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value as they are assigned
107 Thermistors & Varistor	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
109 Terminators	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* bbb = Res. Value
110 Capacitors (Ceramic)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
111 Capacitors (Tantalum)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
112 Capacitors (Mica)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
113 Capacitors (Alum.)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
114 Capacitor (Polystyrene)	*Format aaaaaa* Sequence number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
115 Capacitors (Variable)	*Format aaaaaa* Sequence number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned
116 Inductors (Ferrite Beads)	*Format aaaaaa* Sequence number assigned by Document Control	*Format bbb* = Sequence number by value. As they are assigned.
120 Diodes (Rect.& Sig.)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = (TBD) (Use -001)
121 Diodes (Zener)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by voltage value for same series Zeners
125 Filters (Power)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by minor variations as they are assigned.
140 Transistors (Power)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = (TBD) (use -001)
141 Transistors (Signal)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = (TBD) (use -001)
145 Oscillators (Hybrid)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by frequency value for same series oscillator or crystal
146 Crystals	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number by frequency value for same series oscillator or crystal
148 Delay Lines (Std.)	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = -001

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
149 Delay Line	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = -001
150 LEDs	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* = Sequence number for color, dispersion and intensity variations of the same diode series
160 Bipolar SSI, MSI, & LSI	*Format aaaaaa* This number matches industry std. number as close as possible. (i.e. 74LS04 = 007404)	*Format abc* a = speed pwr class 1 = low pwr Schottky 2 = Schottky 3 = fast 4 = regular TTL 5 = ALS 6 = ECL b = package 0 = dual in line 1 = single in line 2 = pin grid array 3 = leadless carrier 4 = leaded carrier 5 = flat pack 6 = SOIC (sm. outline) c = package material 0 = plastic 1 = ceramic 2 = cerdip
161 Bipolar (Analog)	*Format aaaaaa* This number matches Industry std. number as close as possible	*Format abc* a = process technology 2 = Schottky b = package 0 = dual in line 1 = single in line 2 = pin grid array 3 = leadless carrier 4 = leaded carrier 5 = TOx c = package material 0 = plastic 1 = ceramic 2 - cerdip

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
165 NMOS LSI & Memory	*Format abbbbb* a= all other variables bbbbb=This number matches Industry std.number as close as possible i.e. 2147 = 002147 68000 = 068000	*Format bbb* bbb = nsec speed grade (Refer to component specification for pkg. type and material).
166 CMOS LSI & Memory	*Format abbbbb* a= all other variables bbbbb=This number matches Industry std. number as close as possible	*Format bbb* bbb = nsec speed grade (Refer to component specification for pkg. type and material).
179 Sets of like programmed devices used in the same circuit assembly.	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* = -001
180 Customizable Logic blank parts, PALS, PROMS, GATE ARRAYS	*Format abbbbb* a= all other variables bbbbb= This number matches industry std. number as close as possible. i.e. for PALS: 01608 = 16L8 01609 = 16LD8 01618 = 16H8 01619 = 16HD8 01624 = 16R4 01626 = 16R6 01628 = 16R8 i.e for PROMS: 02764 = 2764 EPROM	*Format: aaa* aaa = nsec speed grade (Refer to component specification for pkg. type and matl.)

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
181 PALS & PROMS (Customized parts from Family Code #180)	*Format abbbbb* a= all other variables bbbbb= PALS(00000-49999) PROMS(50000-99999) (This number & rev. marked on parts)	*Format aaa* = numeric revision lvl. of programmed part.
182 Custom Gate Arrays	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* = 500 (Asm.)
200 Pwr.Supplies and Pwr Controllers	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* 000 = Spec. 100 = BOM 200 = Assembly Number 300 = Logic Drwgs. 400 = Wire Lists 700 = Test Program 900 = Assy. or Fab. Methods
201 Misc. PCB Assem.	(Same as #200 above)	(Same as #200 above)
202 Periph. Configurators	(Same as #200 above)	(Same as #200 above)
204 Disk Drives	(Same as #200 above)	(Same as #200 above)
207 Tape Drives	(Same as #200 above)	(Same as #200 above)
210 Terminals	(Same as #200 above)	(Same as #200 above)
211 Modems	*Format aaaaaa* Sequential Number assigned by Document Control	*Formt aaa* 000 = Spec. 100 = BOM 200 = Assembly Number 300 = Logic Drwgs. 350 = Rev. Control 400 = Wire Lists 600 = Configurator 700 = Test Program 900 = Assy. or Fab. Methods

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
215 Printers	(Same as #200 above)	(Same as #200 above)
216 Plotters	(Same as #200 above)	(Same as #200 above)
217 Work Stations	(Same as #200 above)	(Same as #200 above)
220 Multibus Cards	(Same as #200 above)	(Same as #200 above)
221 Multibus Subsystems	(Same as #200 above)	(same as #200 above)
225 System Related Furniture	(Same as #200 above)	(Same as #200 above)
230 Fan & Fan Subsystems	(Same as #200 above)	(Same as #200 above)
250 Switches, Panel	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* = -001
251 Relays	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* = -001
252 Switches, PCB	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* = -001
253 Fuse and Circuit Br.	*Format aaaaaa* Sequential number assigned by Document Control.	*Format aaa* Sequence number by rating as they are assigned.
300 Sockets	*Format aaaaaa* Sequential number assigned by Document Control	*Format aaa* Dash numbers tie together series of connectors & sockets that differ by number of positions
301 Connectors, PCB	(Same as #300 above)	(Same as #300 above)
302 Connectors DIN	(Same as #300 above)	(Same as #300 above)
303 Connectors, Cable/ Mass Term.	(Same as #300 above)	(Same as #300 above)
304 Connectors, Cable/ Discrete Wire	(Same as #300 above)	(Same as #300 above)

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
310 Fasteners, Hardware	*Format aaabcc* aaa = category 000 = Screws 002 = Sems Screws 005 = Metric Screws 008 = Shoulder Screws 100 = Nuts 150 = KEP Nuts 200 = Washers 250 = Spec. Washers 300 = Roll Pins 400 = Spacers b = Size 1 = #2-56 2 = #4-40 3 = #6-32 4 = #8-32 5 = #10-32 6 = 1/4-20 7 = 1/4-28 (For other sizes/ bbb) cc = Sequential Number	*Format ddd* -001 for washers, nuts, & rollpins All others are for lengths of screws and spacers.
312 Misc. Assem. Accessories	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations of the same part.
314 Connector Pins, Terminals, Lugs, etc.	(Same as #312 above)	(Same as #312 above)
315 Manufacturing Tooling	(Same as #312 above)	(Same as #312 above)
316 Manufacturing Supplies	(Same as #312 above)	(Same as #312 above)
320 Fabrications, Metal	(Same as #312 above)	*Format bbb* -500 = Fab. Pt. -501 - 5xx for different versions of the same part.
330 Fabrications, Plastic	(Same as #320 above)	(Same as #320 above)

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
400 Board Set Configurators	*Format aaaaaa* Numbers assigned in sequence by Document Control. Starting with 000100.	*Format bbb*
410 Circuit Cards, (Daughter Bds.)	*Format aaaaaa* Numbers assigned in sequence by Document Control. Starting with 000100.	*Format cdd* c = classification 0 = Specification 1 = Partial Asm. 2 = Assembly -200 = BOM/ Asm. -201 = Stuff Illustr. -202 = Stuff List -203 = Configurator -204 = Full Asm. -205 = Rework Instr. 3 = Logic/ Schematic -300 = Schematic -301 = RNET -302 = BONL -303 = PLIST -304 = GLIST 4 = Net List 5 = Detail Drawing 6 = Artwork (Photo Tools -601-619 Film starting at component side thru silk screen -630 = Drill Tape -641 = Gerber List -650 = Compensated Tape -651 = Gerber Tape -652 = Non-Compensated Tape -653 = Test Tape -670 = Tooling -671 = VALID Tape/ prefixloc-offsite -672 = VAX785 Tape/ prefixloc-offsite -673 = VALID Tape/ prefixloc-onsite -674 = VAX785 Tape/ prefixloc=onsite 8 = Support Doc. -800 = Safety Stock BOM dd = Sequential number for variations of the above.

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
411 Prtd. Ckts., Non-std.	(Same as #410 above)	(Same as #410 above)
412 Prtd. Ckts., Surf. Mt.	(Same as #410 above)	(Same as #410 above)
413 Ckt. Cards, ORION	(Same as #410 above)	(Same as #410 above)
420 Multibus Cards	(Same as #410 above)	(Same as #410 above)
422 FARSIDE/ ECHO Circuit Bds.	(Same as #410 above)	(Same as #410 above)
500 Sub-assemblies, E/ M.	*Format aaaaaa* Numbers assigned in sequence by Document Control, starting at 000100.	*Format cdd* c = classification 0 = Specification 070 = Installation Man. 1 = Parts List 2 = Assembly 5 = Detail Drawing 7 = Test Info. 9 = Assem. Procedure dd = Sequential number for variations of above.
501 Kits, Installation	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb*
503 Assembly,CPU Configuration	*Format aaaaaa* Sequential number assigned by Document Control.	*Format bbb*
504 Assembly, Peripheral Configuration	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb*
505 Assembly, System Test Configuration	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb*

Table A–1, Part Number Assignment Codes (continued)

	Assignment Codes	
Family Code	**Sequential Field**	**Dash Number**
506 Assembly, Drop Ship Configurations	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb*
507 Assembly, Packaged Systems	*Format aaaaaa* Sequential number starting with 000100 and assigned by Document Control	*Format bbb*
508 Kits, Skin Configuration	*Format aaaaaa* Sequential number starting with 000100 and assigned by Document Control	*Format bcc* b = 2 cc = Sequential number starting with 00 reflecting kit variations.
509 Assembly, Final Systems	*Format aaaaaa* Sequential number, starting with 000100, assigned by Document Control.	*Format bcc* b = 2 cc = Sequential number, starting with 00, for variations.
510 Configurations, Final System	(Same as #509 above)	(Same as #509 above)
511 Configurations, Ship Level	(Same as #509 above)	(Same as #509 above)
550 Sub-systems, Peripheral	*Format aaaaaa* Sequential number, starting with 000100, and assigned by Document Control.	*Format bcc* b = classification 0 = Specification 070 = Installation Manual 1 = Parts List 2 = Assembly 5 = Detail Drawing 7 = Test Info. 9 = Assem. Procedure cc = Sequential number for variations of the above.
559 Configurations, Prototype Systems	*Format aaaaaa* Sequential numbers assigned by Document Control.	*Format bbb* Sequential number assigned for variations of above.
560 - 599 Manuals	*Format aaaaaa*	*Format bbb*

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
601 Cable Assemblies, Mass Terminated	*Format aabbbb* aa = # of conductors bbbb = variations defined in the spec. Start at 0001.	*Format bcc* b = Classification 0 = Specification 1 = Parts List 2 = Assembly 4 = Net List 5 = Detail Drawing 7 = Test Info. 9 = Assem. Procedure cc = Sequence number for length. Starting at 01
602 Cable Assemblies, Mass Terminated (Shielded)	(Same as #601 above)	(Same as #601 above)
603 Cable Assemblies, Discrete Wire	(Same as #601 above)	(Same as #601 above)
604 Cable Assemblies, Discrete Wire (Shielded)	(Same as #601 above)	(Same as #601 above)
605 Cable Assemblies, AC Power	(Same as #601 above)	(Same as #601 above)
610 Flat Cable	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number assigned for number of conductors
611 Jacketed Cable	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number assigned for minor variations
612 Special Cable	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number assigned for minor variations
613 Hook-up Wire	*Format aaaaab* *aaaaa* = Sequential number *b* = wire gage	*Format bbb* Sequential number assigned for difference in color
621 Magnetic Tape Supplies	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number assigned for minor variations

Table A–1, Part Number Assignment Codes (continued)

Assignment Codes		
Family Code	**Sequential Field**	**Dash Number**
700 General Software	*Format aaaabb* aaaa = Sequential Numbers bb = Type of Parts 15 = Tapes 18 = Release Notes 19 = Update Packages 20 = Handbooks 21 = Texts 22 = Doc. Kits 25 = Doc. Sets 30 = User's Guides 50 = Reference Manuals 51 = Reference Manuals (Complete) 52 = Reference Cards 55 = Royalty Obligations 60 = Configurators 75 = Internal Doc. 79 = Course Materials 80 = Marketing Literature 81 = Spines 82 = Covers 85 = Doc Kit Dividers 90 = Object Code Licenses 93 = Source Code Licenses 99 = Addenda	*Format bbb* bbb = 000 = Major Rel. All others are in numeric sequence for minor releases. (i.e. -001, 002, etc.)
710 Operating Systems	(Same as #700 above)	(Same as #700 above)
720 Compilers	(Same as #700 above)	(Same as #700 above)
740 Software Tools	(Same as #700 above)	(Same as #700 above)
760 Diagnostics	(Same as #700 above)	(Same as #700 above)
900-901 Field Service		
902 Field Service Supplies/ Tools	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number assigned for minor variations
999 Development Adv. Order BOMs	*Format aaaaaa* Sequential number assigned by Document Control	*Format bbb* Sequential number for minor variations

Table A–2, Part Number Family Descriptions

Assignment Codes	
Family Number	**Description**
000-099	**Corporate Documentation**
000-009	Open
010	Corporate Policies
011-019	Open
020	Corporate Forms
021	Product Labels
022	Publication Supplies
023-029	Open
030	Corporate Procedures
031-059	Open
060	Manufacturing Procedures/ Specifications
061-069	Open
070	IC Package Specifications
071-078	Open
079	Process Specifications
080	Documents, other than above, with global significance
081	Hardware Publications
082-099	Open
100-109	**Resistors**
100	Open
101	Resistors, Discrete
102	Resistors, DIP
103	Resistors, SIP
104	Resistor Network
105	Resistors, Variable
106	Open
107	Thermistors/ Varistors
108	Open
109	Terminators
110-119	**Capacitors**
110	Capacitors, Ceramic
111	Capacitors, Tantalum
112	Capacitors, Mica
113	Capacitors, Aluminum Electrolytic
114	Capacitors, Polystyrene
115	Capacitors, Variable
116	Inductors
117-119	Open
120-124	**Diodes**
120	Diodes, Rectifier and Signal
121	Diodes, Zener
122-124	Open

Table A–2, Part Number Family Descriptions (continued)

Assignment Codes	
Family Number	**Description**
125	**Filters**
126-139	**Open**
140-144	**Transistors**
140	Transistors, Power
141	Transistors, Signal
142-144	Open
145-149	**Crystals, Oscillators, Delay Lines**
145	Oscillators, Hybrid
146	Crystals
147	Open
148	Delay Lines, Standard
149	Delay Lines, Custom
150-154	**Display and Indicators**
150	Light Emitting Diodes
151-154	Open
155-159	**Open**
160-164	**Bipolar Integrated Circuits**
160	Bipolar Digital
161	Bipolar Analog
162-164	Open
165-169	**MOS Integrated Circuits**
165	NMOS LSI and Memories
166	CMOS LSI and Memories
167-169	Open
170-178	**Open**
179-189	**Programmable Logic**
179	Lists, Programmable Device Sets
180	Customizable Logic Blanks
181	Customized Parts From Family 180
182	Custom Gate Arrays
183-189	Open
190-199	**Open**

Table A–2, Part Number Family Descriptions (continued)

Assignment Codes	
Family Number	**Description**
200-229	**Purchased Peripherals/ Assemblies**
200	Power Supplies and Controllers
201	Misc. PCB Assemblies
202	Peripheral Configurators
203	Open
204	Disk Drives
205	Open
206	Open
207	Tape Drives
208	Open
209	Open
210	Terminals
211	Modems
212-214	Open
215	Printers
216	Plotters
217	Work Stations
218-219	Open
220	Multibus
221	Multibus Subsystems
222-224	Open
225	System Related Furniture
226-229	Open
230	**Fans and Fan Subsystems**
231-249	**Open**
250-254	**Switches**
250	Panel Switches
251	Relays
252	PCB Switches
253	Fuse and Circuit Brkrs.
254	Open
255-299	**Open**
300-309	**Sockets and Connectors**
300	Sockets
301	PC Board Connectors (non DIN)
302	DIN Connectors
303	Mass Terminated Connectors
304	Discrete Wire Connectors
305-309	Open

Table A–2, Part Number Family Descriptions (continued)

Assignment Codes	
Family Number	**Description**
310-314	**Hardware and Accessories**
310	Screws, Bolts, Rivets, Nuts, Washers
311	Open
312	Misc. Assembly Accessories
313	Open
314	Connector Pins, Terminals, Lugs
315-319	**Manufacturing Tooling Supplies**
315	Manufacturing Tooling
316	Manufacturing Supplies
320-324	**Metal Fabrications**
320	Metal Fabs
321-324	Open
325-329	**Open**
330	**Plastic Fabs**
331-399	**Open**
400	**Board Set Configurators**
401-409	**Open**
410-424	**CONVEX PCB Assemblies**
410	C1 PCB Daughter Cards
411	Non-Standard PCB's
412	Surface Mount Circuit Boards
413	ORION Daughter Circuit Boards
414-419	Open
420	Multibus PCB's
421	Open
422	FARSIDE/ ECHO Circuits
423-424	Open
425-499	**Open**

Table A–2, Part Number Family Descriptions (continued)

Assignment Codes	
Family Number	**Description**
500-599	**Electro/ Mech. Assemblies**
500	Electro./ Mech. Assemblies
501	Installation Kits
502	Open
503	Assemblies, CPU Configurations
504	Assemblies, Peripheral Configurations
505	Assemblies, System Test Configurations
506	Assemblies, Drop Ship Configurations
507	Assemblies, Packaged Systems Configuration
508	Kits, Skin Configuration
509	Assemblies, Final Systems
510	Configuration, Final System
511	Configurations, Ship Level
512-549	Open
550	Sub-Systems, Peripheral
551-558	Open
559	Configurations, Prototype Systems
560-599	Manuals
600-609	**Cable Assemblies**
600	Open
601	Cable Assembly, Mass Terminated
602	Cable Assembly, Mass Terminated (Shielded)
603	Cable Assembly, Discrete Wire
604	Cable Assembly, Discrete Wire (Shielded)
605	Cable Assembly, AC Power
606-609	Open
610-614	**Cable Material**
610	Flat Cable
611	Jacketed Cable
612	Special Cable (Coax., Controlled Impedance)
613	Hook-Up Wire
614-620	Open
621	Magnetic Tape Supplies
622-699	Open

Table A–2, Part Number Family Descriptions (continued)

Assignment Codes	
Family Number	**Description**
700-799	**Software**
700	General Software
701-709	Open
710	Operating Systems
711-719	Open
720	Compilers
721-739	Open
740	Software Tools
741-759	Open
760	Diagnostics
761-799	Open
800-899	**Open**
900-999	**Field Service**
900	Field Service Vendor Spares
901	Field Service Vendor Spare Kits
902	Field Service Tools and Supplies
903-998	Open
999	Advance Order BOMs

A.3 Marketing Numbers

Marketing numbers are assigned to all end items that are configured and marketed by CONVEX. These numbers are alpha-numeric and are constructed having a three letter prefix, a dash, and a three digit suffix. The following is an example:

MTC-001

The following examples identify the different fields within the number format:

- FAMILY CODE: The family code is a three letter acronym for the product being identified (i.e. MTC for the Mag. Tape Controller, MBS for the Multibus Sub-System, and etc.). The exception to this is the two letters listed in the Price Book (i.e. SP-010 for the CDC 9766 Disk Drive).

MTC-001

- DASH NUMBER: The Dash Number is the last field in the identification number and it is constructed of a dash followed by three numerics (i.e. -001) or by a dash, three numerics, another dash and one numeric (i.e. -001-1). This field is used to identify variations to the basic product.

MTC-001

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix B
Reporting Problems

B.1 Overview

The *contact* utility is the recommended way to report minor hardware deficiencies and technical documentation problems to the Technical Assistance Center (TAC). This utility is an interactive tool that prompts the user for the information to properly file a problem report.

> NOTE
>
> The *contact* utility is not intended for requesting customer service for hardware failures. To restore your CONVEX equipment to operational status, faster service can be obtained by directly telephoning the TAC (refer to "Technical Assistance" in the preface).

To use the *contact* utility, there must be a phone connection to the TAC. A UNIX-to-UNIX Communication Protocols (UUCP) allows communication between UNIX systems by either dial-in or hard-wired communication lines. For more information, refer to *uucp(1)* or to the *info(1)* entry in the UNIX man pages.

The name and version number of the product involved is required. Use the *vers* command to ascertain the program or utility name and version. The syntax for the command is **vers** *filename*, where *filename* is the full pathname of the program. If the full pathname of the program is not known, enter **which** *program*. For more information, refer to the *vers(1)* and *which(1)* entries in the UNIX man pages.

B.2 Information Required to Report a Problem

The *contact* utility requires the following information:

1. The customer name, title, phone number, and corporate name
2. The hardware nomenclature, part number, and revision level, or the technical manual name, document number, and version

> NOTE
>
> Use *vers* and *which* to identify product name and version.

3. A short (one line) summary of the problem
4. The more information provided, the more quickly the problem can be isolated and solved. At a minimum, include a detailed description of the problem (including page references, if applicable), the source code, and a stack backtrace whenever possible.

> **NOTE**
>
> See the *adb(1)* or *csd(1)* man pages for information on obtaining stack backtraces.

5. The priority of the problem, selected from a list of six levels
6. Instructions on how to reproduce the problem, including the command syntax used, any flags invoked, or anything else attempted to make the program run
7. Any other comments about the problem or files to be submitted

The *contact* user has a chance to review and edit the report prior to submitting it. If the user decides to delay submitting the report, the session can be aborted. The report is automatically saved in the user's top-level directory in a file named *dead.report*.

See the following figure for a sample *contact* session. User input is in bold lettering, and the system response is in monospace type.

Figure B–1, Sample *contact* Session

```
%contact (RETURN)
Welcome to contact version 0.11 ()

Enter your name, title, phone number, and corporate name (^D to terminate)
> Margaret Atwood, systems programmer, 814-4444, University r
> of Chicago (RETURN)
> (CTRL-D)

Enter the name of the product involved
> CONVEX UNIX Programmer's Manual, Part I (RETURN)

Enter the version number (in the form X.X or X.X.X.X) of the product
> Revision 4.0 (RETURN)

Enter a short (1 line) summary of the problem
> The finger command manual page lists nonexistent bug (RETURN)

Enter a detailed description of the problem (^D to terminate)
> The finger(1) man page says, under the BUGS section, that "Only the first
line of the .project file is printed."  Happily, this is not true! (RETURN)
> (CTRL-D)

Enter a problem priority, based on the following:
1) Critical    - work cannot proceed until the problem is resolved.
2) Serious     - work can proceed around the problem, with difficulty.
3) Necessary   - problem has to be fixed.
4) Annoying    - problem is bothersome.
5) Enhancement - requested enhancement.
6) Informative - for informational purposes only.
> 4 (RETURN)

Enter the instructions by which the problem may be reproduced (^D to terminate)
> a) put more than one line in .project (RETURN)
> b) read the man page for finger(1) (RETURN)
> (CTRL-D)

Enter any comments that are applicable (^D to terminate) (RETURN)
> (CTRL-D)

Do you have any suggestions or comments on the documentation that you
referenced when you were trying to resolve your problem (for example,
additions, corrections organization, accessibility)? (^D to terminate)
> The man page should be updated. (RETURN)
> (CTRL-D)

Are there any files that should be included in this report (yes | no)?
> no (RETURN)

Please select one of the following options:
1) Review the problem report.
2) Edit the problem report.
3) Submit the problem report.
4) Abort the problem report.
> 3 (RETURN)

Problem report submitted.
%
```

THIS PAGE INTENTIONALLY LEFT BLANK

Index

R

S

T

U

CONVEX Removal/Replacement
and IPB Guide
(C201, C202, C210, C220)
Document No. 081-001030-201, First Edition, Rev. 1

Reader's Forum

You are invited to submit comments concerning the clarity and service of this manual. Constructive critical comments are most welcome, and will help us continue in our efforts to generate quality customer documentation. Please list the document page number with your questions and comments.

_____

_____

_____

_____

_____

_____

_____

_____

From:

Name_____ Title_____

Company_____ Date_____

Address and Phone No._____

FOR ADDITIONAL INFORMATION OR DOCUMENTATION:

Location	Phone Number
In Texas	(214)952-0200
Other continental locations	1(800)952-0379
Outside continental US	Contact local CONVEX office

Direct mail orders to:

CONVEX Computer Corporation
Customer Service
PO Box 833851
Richardson TX 75083-3851 USA

(Fold Here First)

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 1046 RICHARDSON, TEXAS

POSTAGE WILL BE PAID BY ADDRESSEE

CUSTOMER SERVICE
CONVEX Computer Corp.
P.O. Box 833851
Richardson, TX 75083-3851

(Fold Here Second)

(Tape or Staple)