IBM

IBM System/36
5362 System Unit
Maintenance Information Manual

Second Edition (March 1985)

Preface

This maintenance information manual contains the procedures and information needed to service a System/36 with a 5362 System Unit. These procedures are specifically for the system and I/O attachments, controllers, adapters, and most devices attached to the system.

This manual uses a specific range of words so that the text can be understood by customer engineers in countries where English is not the normal language.

It is assumed that the customer engineer (CE) or customer service representative (CSR) using this manual has been trained on the IBM 5362 System Unit, as described in the *System/36-5362 New Product Planning Technical Service Letter*.

About This Manual

This manual includes:

- A table of contents showing all the procedures in this manual, the reference number of each procedure, the procedure titles, and the page on which each procedure starts

- A section contents page showing all procedures in the section

- Nine sections containing maintenance procedures

- Three appendixes containing information about:

  - AC safety grounding
  - Safety inspections
  - Electrostatic discharge sensitive logic cards

- A glossary of terms and abbreviations used in this manual

- Three sections located between the glossary and the index:

  - An illustrated parts catalog
  - The I/PAR code guide
  - The CE/CSR log

- An index containing key words to procedures in this manual

Related Publications

Customer/Operator Publications

- *Setting Up Your Computer*, SA21-9487, contains procedures to:

  - Install the system
  - Attach work stations
  - Attach communications lines
  - Attach other I/O devices
  - Test the system

- *Installing Your New Features*, SA21-9486, contains procedures to install main storage, work stations, and communications features.

- *Operating Your Computer*, SC21-9026, contains system operating procedures for:

  - Work station operators
  - Subconsole operators
  - System console operators

- *System Messages*, SC21-7938, contains the system, licensed program, and utility program displayed messages, their causes, and their recovery procedures.

- *System Reference*, SC21-9020, contains information to perform tasks that use system commands, procedures, and OCL statements.

- *System Problem Determination*, SC21-9063, contains error analysis information to isolate and determine the cause of system and communications problems.

Service Publications

- *Program Service Information*, LY21-0590, contains the system overview and information on:

  - Function control flow
  - SSP interface
  - Problem diagnosis
  - Program support actions

- *System Data Areas*, LY21-0592, contains information to support SSP problem diagnosis, including:

  - Data area descriptions
  - Feature support information for programming languages and utilities

- *Program Problem Diagnosis and Diagnostic Aids*, LY21-0593, contains diagnostic aids for diagnosing SSP problems.

- *Functions Reference Manual*, SA21-9436, contains information needed to understand the system from a hardware point of view, including:

  - System instructions
  - Status bytes
  - Controls and indicators
  - Device characteristics

- *Control Storage Service Information*, LY31-0650, contains information to:

  - Analyze microcode problems
  - Make microcode temporary fixes

- *System Reference Codes (SRC)*, S230-9002, contains valid SRCs with probable failing FRUs, FRU part numbers, and MIM references.

Safety

Danger and Caution Notices

In this manual, the word *DANGER* informs you of conditions that could cause personal injury or death. (The word *HAZARDOUS* or *WARNING* may appear on machine labels and field-supply items.) The word *CAUTION* informs you of an action that could cause damage to a program, to a device or system, or to data.

There are blank lines below each notice. You can write these notices in your own words on the blank lines.

Safety When Servicing System

DANGER
If the power cord will not be disconnected when powering off the system for service, set the Security switch to the Locked position to prevent accidental power-on.

. . . .

. . . .

. . . .

. . . .

. . . .

Safety Label

The following safety label is a danger notice.
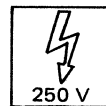
Meaning: There is voltage present with machine power off.

Danger Notices

Danger notices appear in the following procedures:

606	Diskette Drive Removal
612	AC Drive Motor Assembly Removal
616	Capacitor Removal

Caution Notices

Caution notices appear in the following procedures:

105	System Entry Procedure (Procedure 150)
350	Altering and Displaying Storage
410	Power System Reference Codes
507	Control Panel Service Check
618	Head/Carriage Cleaning Procedure
806	Shock Mount Removal and Replacement
808	Analog Card Removal and Replacement
812	Maple Block Removal and Replacement
814	Disk Enclosure Removal and Replacement

Rules for Safety

If you know the safety rules for working with electrical and mechanical equipment, and if you observe the rules, you can work safely with IBM equipment.

Do not fear electricity, but respect it.

While you are maintaining IBM equipment, observe every safety precaution possible and the following safety rules.

Work Environment

- Do not work alone in hazardous conditions or near equipment that has dangerous voltage. Always inform your manager if the conditions or voltages are a possible problem.

- Always look for possible hazards in your work environment. Examples of hazards are: moist floors, nongrounded extension cables, power surges, and missing grounds.

- Do not perform any action that makes the product unsafe or that causes hazards for customer personnel.

- Before you start the equipment, ensure that other CEs, and customer personnel, are not in a hazardous position.

- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that the sleeves of your clothing are fastened or are rolled above the elbow.

- Insert your necktie into your clothing or fasten it with a clip (preferably nonconductive) at approximately 8 centimeters (3 inches) from its end.

- Lift the equipment or parts by standing or pushing up with your stronger leg muscles; this action removes the strain from the muscles in your back. Do not lift any equipment or parts that are too heavy for you.

- Put removed machine covers in a safe place while you are servicing the machine. Reinstall the covers before returning the machine to the customer.

- Always keep your CE tool kit away from walk areas so that other persons cannot trip over it. For example, keep the kit under a desk or table.

- Observe good housekeeping practices in the area of the machines while you are performing maintenance and after completing it.

- After maintenance, reinstall all safety devices, such as guards, shields, labels, and grounding devices. Exchange safety devices that are worn or defective. Remember, the safety devices protect you from a hazard. You destroy their purpose if you do not reinstall them when you have completed the service call.

Electrical Safety

- If possible, always disconnect the power cord before you work on a machine. When you switch off power at the wall box, lock the switch in the off position or attach a DO NOT OPERATE tag (Z229-0237) to the switch.

  Note: A non-IBM attachment to an IBM machine may be powered from another source and may be controlled by a different switch or circuit breaker.

- Switch off all power and disconnect the power cord before:

  - Removing or assembling the main units of the equipment
  - Working near power supplies
  - Inspecting power supplies
  - Installing changes in machine circuits

- If you really need to work on equipment that has exposed live electrical circuits, observe the following precautions:

  - Ensure that another person who understands the power off controls, is near you. Another person must be there to switch off the power, if necessary.
  - Do not wear jewelry, chains, metal-frame eyeglasses, or other personal metal objects. Remember, if the metal touches the machine, the flow of current increases because the metal is a conductor.
  - Use only insulated probe tips or extenders. Remember, worn or cracked insulation is unsafe.

  - Use only one hand while you are working on live equipment. Keep the other hand in your pocket or behind your back. Remember, there must be a complete circuit for an electrical shock to occur. This precaution prevents your body from completing the circuit.
  - When you use a tester, set its controls correctly and use insulated probes that have the correct electrical specification.
  - Do not touch objects that are grounded, such as metal floor strips, machine frames, or other conductors. Use suitable rubber mats obtained locally, if necessary.

- When you are working with machines having voltages more than 30 Vac or 42 Vdc, observe the special safety instructions given in customer engineering memorandums (CEMs).

- Never assume that power has been removed from a circuit. First, ensure that power has been removed.

- Do not touch live circuits with the surface of a plastic dental mirror. Remember, the surface of the dental mirror is conductive and can cause damage or personal injury.

- If an electrical accident occurs:

  - Use caution. Do not be a victim yourself.
  - Switch off the power.
  - Instruct another person to get medical aid.
  - If the victim is not breathing, perform mouth-to-mouth rescue breathing. See "Electrical Accidents—First Aid."

Mechanical Safety

Do not touch moving mechanical parts when you are lubricating a part, checking for play, or doing other similar work.

Safety Glasses

Wear safety glasses when:

- Using a hammer to drive pins or other similar parts

- Using a power drill

- Using a spring hook to attach or remove a spring

- Soldering parts

- Cutting wire or removing steel bands

- Using solvents, chemicals, or cleaners to clean parts

- Working in any other conditions that could injure your eyes

Tools, Testers, and Field-Use Materials

- Do not use tools or testers that have not been approved by IBM. Ensure that electrical hand tools, such as Wire-Wrap[1] tools and power drills, are inspected regularly.

- Exchange worn or broken tools or testers.

- Do not use solvents, cleaners, or lubricants that have not been approved by IBM.

Summary

Prevention is the main aid to electrical safety. Always think about electrical safety and use good practice; for example:

- Ensure that the customer's power receptacle matches the IBM equipment specifications.

- Inspect power cables and plugs; check for loose, damaged, or worn parts.

- Review the procedures in the maintenance documents before you remove a part that can hold an electrical charge from the machine. Carefully discharge the necessary parts exactly as instructed by the procedure.

Never assume that a machine or a circuit is safe. No machine is always completely safe. You may not know the exact condition of a machine because, for example:

- The power receptacles could be wrongly wired.

- Safety devices or features could be missing or defective.

- The maintenance or machine level change history could be wrong or not complete.

- The design could have a problem.

- The machine could have damage, caused when it was shipped.

- The machine could have an unsafe change or attachment.

- An engineering change or a sales change could be wrongly installed.

- The machine could be deteriorated because it is old, or because it operates in an extreme environment.

- A part could be defective, therefore causing a hazard.

- A part could be wrongly assembled.

These are some of the ways that the condition of the machine could affect safety. Before you start a service call or procedure, have good judgment and use caution.

---

[1]   Trademark of the Gardner-Denver Co.

Electrical Accidents—First Aid

When performing rescue procedures for an electrical accident, do as follows:

- *Use Caution:* If the victim is touching the electrical-current source, remove the power. To do this, you may need to operate the room emergency power-off switch or the disconnecting switch. If you cannot find the switch, use a dry wooden rod or other nonconductive object to pull or push the victim away so he or she is not touching the electrical-current source.

- *Work Quickly:* If the victim is unconscious, he or she may need mouth-to-mouth rescue breathing and possibly external cardiac compression if the heart is not beating.

- *Get Medical Aid:* Instruct another person to dial the rescue service (such as the ambulance or the hospital).

Determine if the victim needs mouth-to-mouth rescue breathing. If he or she does, perform the following steps:

CAUTION
Use extreme care when you perform rescue breathing for a victim who may have breathed in toxic fumes. Do not breathe in air that the victim has breathed out.

. . . .

. . . .

. . . .

. . . .

. . . .

1. Prepare for rescue breathing:

   a. Ensure that the victim's airway is open and that it is not obstructed; check the mouth for objects that may be obstructing the airway, such as chewing gum, food, dentures, or the tongue.
   b. Place the victim on his or her back, put one hand behind the victim's neck, and put the other hand on his or her forehead.
   c. Lift the neck with one hand, and tilt the head backward by pressing on the forehead with the other hand.
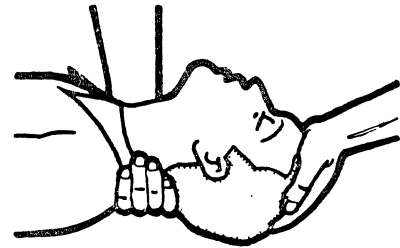
2. Look, listen, and feel to determine if the victim is breathing freely.

   a. Put your cheek near the victim's mouth and nose.
   b. Listen and feel for the breathing out of air. At the same time, look at the victim's chest and upper abdomen to see if they move up and down.

3. If the victim is not breathing correctly:

   a. Keep the victim's head tilted backward. Continue to press on the forehead with your hand; at the same time, position the same hand so that you can pinch together the victim's nostrils with your thumb and finger.
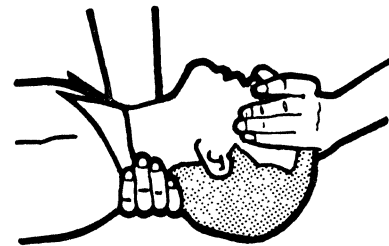
b. Open your mouth wide and take a deep breath. Make a tight seal with your mouth around the victim's and blow into the victim's mouth.

c. Remove your mouth to let the victim breathe out, and check that the victim's chest moves down.
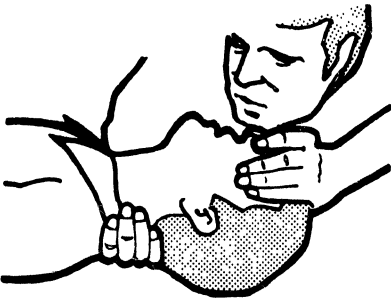
d. Repeat steps b and c once every 5 seconds either until the victim breathes for himself or herself, or until medical aid comes.

Reporting Accidents

Report, to your field manager, all electrical accidents, possible electrical hazards, and accidents that nearly occurred. Remember, an accident that nearly occurs might be caused by a design problem; your immediate reporting ensures that the problem will be solved quickly.

Also report all small electrical shocks. Remember, a condition that causes a small shock need only differ slightly to cause serious injury.

Contents

Section 1. System Entry and FRU Isolation Procedures

105 System Entry Procedure

Notes:

1. *Read and observe all safety procedures before servicing the system.*
2. *Unless instructed not to, always power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord before removing, exchanging, or installing a FRU.*
3. *Ensure that the customer problem determination (PD) procedures have been completed before you continue with these procedures. The PD procedures may supply additional information about the problem.*
4. *Use this entry procedure only if SRCs have failed to isolate the problem. While using this procedure, do not use any SRCs unless instructed to do so.*

---

1. Ensure that the Security switch is in the Service position.

2. If the system will not power on, go to "410 Power System Reference Codes" on page 4-3.

3. If the control panel does not appear to function, go to "505 Control Panel Symptom Table" on page 5-2.

4. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter FF00
   c. Press the Start Function key

   If the IPL Sign-On prompt appears, continue with step 5.

   If not, go to step 10.

5. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter 0000
   c. Press the Start Function key

   If the IPL Sign-On prompt appears, continue with step 6.

   If not, go to step 12.

6. Run ERAP ("360 Getting ERAP Reports" on page 3-19).

   If SRCs are recorded in ERAP, go to step 9.

   If no SRCs are recorded, continue with step 7.

7. Run SYSTEST with all devices selected for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

   If an SRC is displayed in the 4-character display, use it to isolate the problem.

   Analyze any errors that occur during SYSTEST ("360 Getting ERAP Reports" on page 3-19) to determine which device is failing. Continue with step 8.

   If no SRC is displayed or if no errors occur, go to step 8 and continue from there for the device you suspect is failing.

8. If the device is:

   a. Disk, go to "Procedure 121" on page 1-4.
   b. Work station, go to "Procedure 122" on page 1-4.
   c. Main storage processor, go to "Procedure 123" on page 1-5.
   d. Communications, go to "Procedure 124" on page 1-5.
   e. Other, go to "Procedure 120" on page 1-4.

9. Analyze any SRCs that are logged in ERAP near the time of the customer-reported problem to determine which device is failing. If the indicated device is:

   a. Disk, go to "Procedure 131" on page 1-7.
   b. Work station, go to "Procedure 132" on page 1-8.
   c. Main storage processor, go to "Procedure 133" on page 1-8.
   d. Communications, use the SRCs in the report to isolate the problem.

      If the problem is repaired, this procedure is complete.

      If not, go to "910 Isolating Communications Problems" on page 9-2 or "915 Isolating MLCA Controller Problems" on page 9-4.

   e. Diskette, use the SRCs in the report to isolate the problem.

      If the problem is repaired, this procedure is complete.

      If not, go to "602 Isolating Diskette Drive Problems" on page 6-2.

   f. CSP/channel, go to "Procedure 136" on page 1-10.

10. Load the system from diskette 3:

    a. Select function 3 (IPL Diagnostic Diskette)
    b. Enter FF00
    c. Press the Start Function key

    If the DCP Main menu appears, go to step 12.

    If not, continue with step 11.

11. Load the system from disk:

    a. Select function 1 (IPL)
    b. Enter 0000
    c. Press the Start Function key
    d. Go to "Procedure 155" on page 1-12

12. Load the system from diskette 1:

    a. Select function 3 (IPL Diagnostic Diskette)
    b. Enter 0000
    c. Press the Start Function key

    Note: This IPL may take 15 minutes.

    If SRC 194F or 195F appears, go to "Procedure 155" on page 1-12.

    If not, continue with step 13.

13. Use the SRC to isolate the problem.

    If the SRC does not isolate the problem, go to "Procedure 150" on page 1-10.

    If the SRC does isolate the problem, this procedure is complete.

Procedure 120

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Tighten the screws that attach the line filter to the frame.

3. Tighten the screws that hold the power cord wires to the line filter.

4. Ensure that the system frame is grounded to a service ground and that the AC input voltage is inside the tolerance. (See the manual *Planning a Place for Your Computer*, SA21-9475, for correct grounding and voltage information.)

5. Ensure that all ground straps, leads, and power supply screws are tight.

6. Ensure that the internal cables are in the correct position in the channels and are kept away from external covers and the frame.

7. Tighten the screws that hold the internal shields.

8. Reseat all cards and cables to give better contact points.

9. Connect the power cord and power on the system ("310 Powering On/Off the System" on page 3-3).

10. Load the system from disk.

    a. Select function 1 (IPL)
    b. Enter 0000
    c. Press the Start Function key

11. Run SYSTEST for 5 minutes with all devices selected ("328 Service Procedures under SSP" on page 3-7).

12. Run and analyze ERAP for errors ("360 Getting ERAP Reports" on page 3-19).

    If errors occur, use the SRC to isolate the problem.

    If no errors occur, this procedure is complete.

Procedure 121

If you have already run the pack analysis option of the disk utilities, go to "Procedure 120."

If not, continue with this procedure.

1. Load the system from diskette 3:

    a. Select function 3 (IPL Diagnostic Diskette)
    b. Enter FF00
    c. Press the Start Function key
    d. Run the pack analysis option of the disk utilities ("338 Diagnostic Tests under DCP" on page 3-12) and follow the recommended actions displayed

    If any repair action was taken, continue with step 2.

    If not, go to "Procedure 120."

2. Run SYSTEST for 10 minutes to verify any exchanged FRU ("328 Service Procedures under SSP" on page 3-7).

Procedure 122

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Ensure that the shield on the internal work station cable is grounded at both ends.

3. Ensure that the connectors on the twinaxial cables between the I/O panel and the work stations are tight and that the cables are correctly installed (not made into a coil or hung on the wall) ("714 Local Work Station Cable Ohmmeter Test" on page 7-12 and "710 Local Work Station Cable Signal Quality Check" on page 7-4).

4. Ensure that the work stations are grounded to a service ground.

5. If you have found and corrected a problem, this procedure is complete.

    If not, go to "Procedure 120."

Procedure 123

Load the system from diskette 3:

1. Select function 3 (IPL Diagnostic Diskette)

2. Enter FC03

3. Press the Start Function key

4. Run the test for 10 minutes

If an SRC is displayed, exchange the FRU indicated and then run SYSTEST for 10 minutes to verify any exchanged FRU ("328 Service Procedures under SSP" on page 3-7).

If not, go to "Procedure 120" on page 1-4.

Procedure 124

1. Run COMMTEST ("328 Service Procedures under SSP" on page 3-7) and follow the recommended actions displayed.

2. Ensure that all external modems are connected to a service ground.

3. If the problem is repaired, this procedure is complete.

If not, go to "Procedure 120" on page 1-4.

This page is intentionally left blank.

Procedure 131

Radio frequency interference (RFI) may cause errors on the disk drives when the system covers are removed and the disk drive gates are in the open position. All system covers must be in place before checking out the system.

1. If you were given an SRC by the customer, look for that SRC in the error history tables. Continue this procedure for the drive that has the customer's SRC. If the SRC was not found in the tables, continue for drive A.

2. If there is more than one SRC in the error history table:

   a. Analyze the SSA column of the report.
   b. If the errors occur at the same SSA, load the system from diskette 3:
      1) Select function 3 (IPL Diagnostic Diskette).
      2) Enter FF00.
      3) Press the Start Function key.
      4) Run the pack analysis option of the disk utilities ("338 Diagnostic Tests under DCP" on page 3-12) and follow the recommended actions displayed.
      5) Verify any exchanged FRU by running SYSTEST for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

      If the problem is repaired, this procedure is complete.

      If not, continue with step 3.

   If there is not a common SSA, continue with step 3.

3. For all SRCs from 191x through 197x:

   a. Add the numbers in the % column for each FRU in the list.
   b. Exchange the FRUs, starting with the FRU with the highest combined number.
   c. Verify any exchanged FRU by running SYSTEST for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

   If the problem is repaired, this procedure is complete.

   If not, continue with step 4.

4. For all SRCs from 199x through 19Fx:

   a. Add the numbers in the % column for each FRU in the list.
   b. Exchange the FRUs, starting with the FRU with the highest combined number.
   c. Verify any exchanged FRU by running SYSTEST for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

   If the problem is repaired, this procedure is complete.

   If not, continue with step 5.

5. For all SRCs of 190x:

   a. Add the numbers in the % column for each FRU in the list.
   b. Exchange the FRUs, starting with the FRU with the highest combined number.
   c. Verify any exchanged FRU by running SYSTEST for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

   If the problem is repaired, this procedure is complete.

   If not, go to "Procedure 121" on page 1-4.

Procedure 132

1. Exchange any FRU indicated by the SRCs that you have not already exchanged.

   If the failure is still present, check for the following:

   a. Work station (display or printer) problem ("706 Local Work Station Network Analysis Procedure" on page 7-2). (See the suitable work station maintenance manual.)
   b. Bad twinaxial cable: Check both ends for a good connection ("714 Local Work Station Cable Ohmmeter Test" on page 7-12 and "710 Local Work Station Cable Signal Quality Check" on page 7-4).

   If the problem is repaired, this procedure is complete.

   If not, go to "Procedure 122" on page 1-4.

Procedure 133

1. If the SRC is 12xx:

   a. Use Table 1 to analyze MSP status bytes 4 and 5 (MSP SB4 and MSP SB5 in the error history table).
   b. For the bits that are on, add the numbers in the % column for each FRU.
   c. Exchange the FRU with the highest combined number.
   d. Verify the exchanged FRU by running SYSTEST for 10 minutes ("328 Service Procedures under SSP" on page 3-7).

   If you still have a problem, repeat this procedure for the next highest combined number.

   If not, leave the FRU you last exchanged in the system and keep a copy of the ERAP report ("360 Getting ERAP Reports" on page 3-19) for a possible future call.

Table 1: MSP Status Bytes 4 and 5

Byte 4 Bit	FRU	%	Byte 5 Bit	FRU	%
0	A-A1J2 Main storage card[1] A-A1H2 A-A1G2	57 39 2 2	0	A-A1J2 Main storage card[1] A-A1H2	52 47 1
1	A-A1H2 A-A1J2	98 2	1	A-A1J2 Main storage card[1] A-A1H2	52 47 1
2	A-A1H2 A-A1J2	99 1			
3	Main storage card[1] A-A1J2 A-A1H2	89 6 5			
4	Main storage card[1] A-A1J2 A-A1G2 A-A1H2	59 29 8 4			
5	Main storage card[1] A-A1J2	99 1			
6 or 7	A-A1J2 A-A1G2 A-A1H2	76 22 2			

Table 2: Failing Main Storage Card (Use this table only when A-A1N2 is IBM part 2462206.)

Number in FAIL 2KMS Column	FRU
0000-003F	A-A1N2
0040-007F	A-A1M2
0080-00BF	A-A1L2
00C0-00FF	A-A1K2

Table 3: Failing Main Storage Card (Use this table only when A-A1N2 is IBM part 2462261.)

Number in FAIL 2KMS Column	FRU
0000-007F	A-A1N2
0080-00FF	A-A1M2
0100-017F	A-A1L2
0180-01FF	A-A1K2

---

[1] See Table 2 or Table 3 for the failing main storage card.

Procedure 136

1. If the SRC is 16FF:

   a. If channel error byte (CEB) bit 0, 1, 2, or 3 is on, use the following tables to determine which I/O device was communicating with the CSP when the error occurred.

   If CEB bit 6 is off, analyze the channel register (Ch Reg) and use Table 1. If CEB bit 6 is on, use Table 2.

   Table 1

Ch Reg Bits 0-7	I/O Device
4x	Communications
Ax	Data storage adapter 2
Bx	Data storage adapter 1
Cx	Work stations

   Table 2

Ch Reg Bits 0-7	I/O Device
1x	Communications
4x	Data storage adapter 2
5x	Data storage adapter 1
7x	Work stations

   b. If Processor Error Byte (PEB) bit 7 is on, the error occurred while the MSP was communicating with the CSP. If MSP Status Bytes (MSP SB) 4 and 5 are zeros, suspect A-A1J2. If not, go to "Procedure 133" on page 1-8 step 1a.

   c. If the conditions of steps 1a and 1b above are not met, suspect the following FRUs:

%	FRU
99	A-A1G2
1	A-A1F2

Procedure 150

1. Ensure that the Security switch is in the Service position.

2. Load the system from diskette 3:

   a. Select function 3 (IPL Diagnostic Diskette)
   b. Enter FF00
   c. Press the Start Function key

3. Run the Pack Analysis option of the disk utilities on the drive you suspect is failing ("338 Diagnostic Tests under DCP" on page 3-12).

   If pack analysis detects no problems, continue with step 4.

   If pack analysis detects problems, follow the recommended actions displayed and then continue with step 4.

   ## CAUTION
   The Pack Initialization option will destroy customer data on the disk.

   . . . .

   . . . .

   . . . .

   Notes:

   a. *If the recommended action is to run BUILD and the system will not IPL from disk, go to step 5.*
   b. *If the disk has a large number of errors, use the Pack Initialization option of the disk utilities, then go to step 5.*

4. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter 0000
   c. Press the Start Function key

   If the IPL Sign On prompt appears, this procedure is complete.

   If not, continue with step 5.

5. Perform "324 Reloading the System Microcode" on page 3-5.

CAUTION
The Pack Initialization option will destroy customer data on the disk.

. . . .

. . . .

. . . .

Note: *If you cannot perform step 5, initialize the disk first, then perform step 5, and then go to step 7.*

6. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter 0000
   c. Press the Start Function key

   If the IPL Sign On prompt appears, this procedure is complete.

   If not, continue with step 7.

7. Perform "322 Reloading the SSP Diskettes" on page 3-5.

8. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter 0000
   c. Press the Start Function key

   If the IPL Sign On prompt appears, this procedure is complete.

   If not, continue with step 9.

9. Load the system from disk:

   a. Select function 1 (IPL)
   b. Enter FF00
   c. Press the Start Function key

   If the IPL Sign On prompt appears, run ERAP ("360 Getting ERAP Reports" on page 3-19), and then go to "Procedure 131" on page 1-7.

   If not, go to "Procedure 121" on page 1-4.

Procedure 155

1. Ensure that the Security switch is in the Service position.

2. If you have one of the following SRCs:

    E029
    E099
    E09A
    E0A2

    continue with step 3.

    If not, go to step 6.

3. Remove the following cards (if installed); mark the location on each FRU as you remove it:

    A-A1T2 (communications)
    A-A1U2 (line adapter 1)
    A-A1Q2 (work station)
    A-A1C2 (if 60 Mb or more of disk storage)
    A-A1D2 (data storage adapter 1)

    Then, load the system from disk:

    a. Select function 1 (IPL)
    b. Enter 0000
    c. Press the Start Function key

    If the 4-character display contains 2100, continue with step 4.

    If not, one of the following cards is bad:

%	FRU
99	A-A1G2
1	A-A1F2

    Go to step 12.

4. Reinstall the cards removed in step 3 in the following sequence:

    A-A1T2
    A-A1U2
    A-A1Q2
    A-A1C2

    After each card is installed, load the system from disk:

    a. Select function 1 (IPL)
    b. Enter 0000
    c. Press the Start Function key

    If the 4-character display contains 2100, repeat this step. (If only A-A1D2 remains removed, continue with step 5).

    If the 4-character display does not contain 2100, the card just reinstalled is bad. Go to step 12.

5. Install A-A1D2 and load the system from disk:

    a. Select function 1 (IPL)
    b. Enter 0000
    c. Press the Start Function key

    If the IPL Sign On prompt appears, this procedure is complete.

    If not, the A-A1D2 card is bad. Go to step 12.

6. If the system stopped with an SRC of 0000, continue with step 7.

    If not, go to step 8.

7. Reset the system:

   a. Select function 5 (System Reset)
   b. Press the Start Function key
   c. Select function C (Display/Alter LSR)
   d. Enter xx0b
   e. Press the Start Function key

   The 4-character display will contain an SRC.
   Use this SRC to isolate the problem.

   If the problem is repaired, this procedure is
   complete.

   If not, continue with step 8.

8. Disconnect JA1 ("405 J-Connector
   Locations" on page 4-2).

9. Remove the following (if installed):

   A-A1C2 (if 60 Mb or more of disk
   storage)
   A-A1B2 (disk)
   A-A1T2 (SLCA or MLCA)
   A A1U2 (line adapter 1)

   Then, load the system from diskette 3:

   a. Select function 3 (IPL Diagnostic Diskette)
   b. Enter FF00
   c. Press the Start Function key

   If the DCP Main menu appears, continue with
   step 10.

   If both the Console and Processor lights are on
   and A1C2 is displayed in the 4-character
   display, the A-A1Q2 card is bad. Go to step
   12.

   If neither of the preceding conditions occurs,
   go to step 11.

10. Reinstall the cards removed in step 9 in the
    following sequence:

    a. A-A1C2
    b. A-A1B2 and the top card connector
    c. A-A1T2
    d. A-A1U2

    After each card is installed, load the system
    from diskette 3:

    a. Select function 3 (IPL Diagnostic Diskette)
    b. Enter FF00
    c. Press the Start Function key

    If the DCP Main menu appears, repeat step 10.

    If not, the card just reinstalled is bad. Go to
    step 12.

11. Exchange both the A-A1D2 card and the
    A-A1G2 card.

    Then, load the system from diskette 3:

    a. Select function 3 (IPL Diagnostic Diskette)
    b. Enter FF00
    c. Press the Start Function key

    If the DCP Main menu appears, either the old
    A-A1D2 card or the old A-A1G2 card is bad.
    Continue with step 12.

    If not, the A-A1F2 card is bad. Continue with
    step 12.

12. Perform the following:

    a. Exchange the bad card
    b. Reinstall all other cards and top card
       connectors
    c. If JA1 was disconnected, reconnect it
    d. Run SYSTEST for 10 minutes to verify the
       repair ("328 Service Procedures under
       SSP" on page 3-7)

160 Isolating Main Storage Problems Procedure

Note: Unless instructed not to, always power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord before removing, exchanging, or installing a FRU.

1. If A-A1M2 contains a main storage card, go to step 3.

   If not, continue with step 2.

2. Exchange the following cards in this sequence:

   A-A1N2 (base main storage)
   A-A1J2 (MSP data flow)
   A-A1H2 (MSP control)

   If no cards fail, go to "105 System Entry Procedure" on page 1-2.

3. Remove and label the following main storage cards (if installed):

   A-A1K2
   A-A1L2
   A-A1M2

4. Load the system from diskette 3:

   a. Select function 3 (IPL Diagnostic Diskette)
   b. Enter FA03
   c. Press the Start Function key

5. Wait until the Output Display light is on.

   If the Processor light is on, record this failure and continue with step 6.

   If not, perform the following:

   a. Remove and label the card in A-A1N2
   b. Go to step 7

6. Remove and label the card in A-A1N2. This card could have caused the failure in step 5; keep it separate from the other main storage cards.

7. Install the main storage cards removed in step 3, one at a time, into the A-A1N2 board location. Repeat steps 4 through 6 for each card.

   If all cards fail, the A-A1J2 card, the A-A1H2 card, or the A-A1 board is bad.

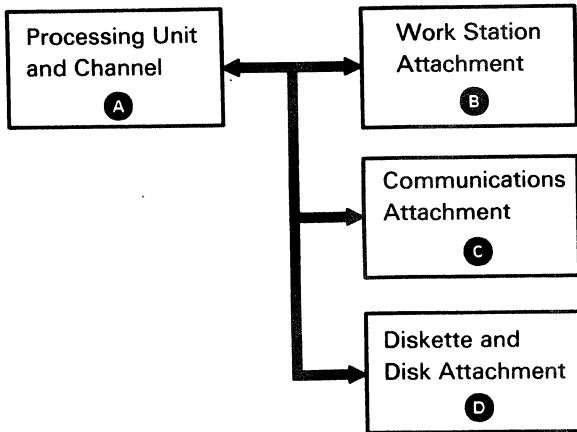   If at least one card passes and at least one card fails, the card(s) that fail are bad.

   If no cards fail, go to "105 System Entry Procedure" on page 1-2.
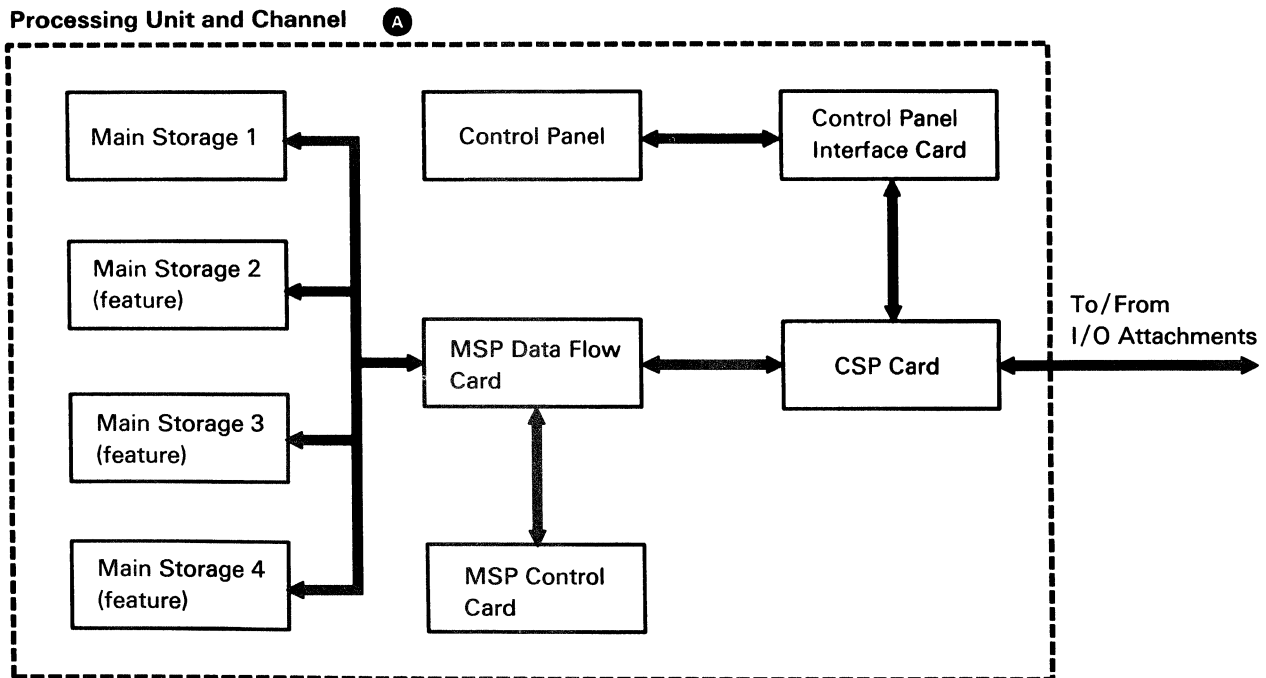
Section 2. Overviews and Locations Procedures
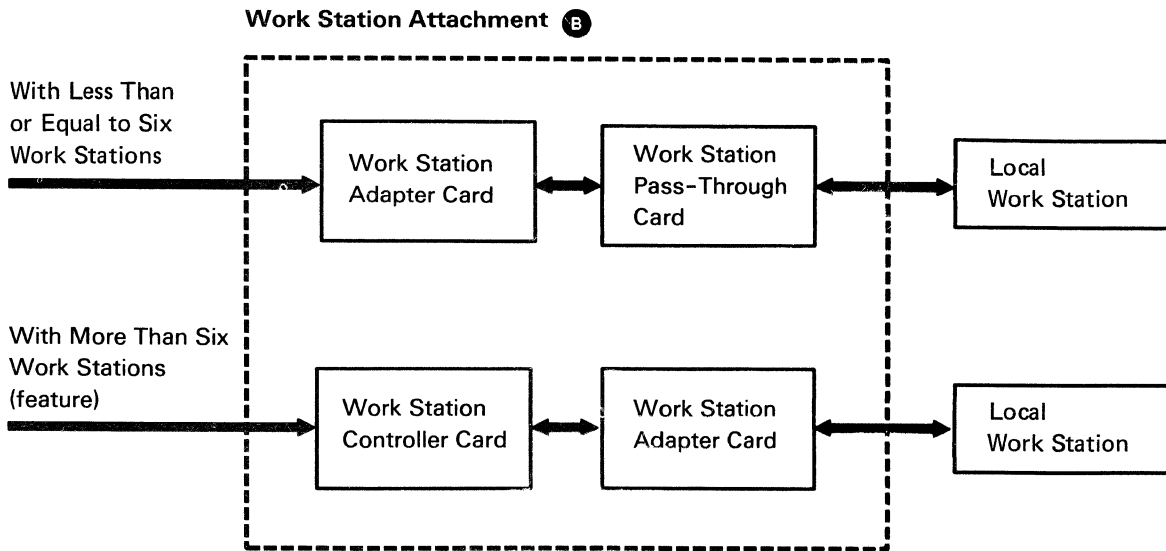
205 System Overview

The diagram on this page shows an overview of the
system. The circled alphabetic characters on the
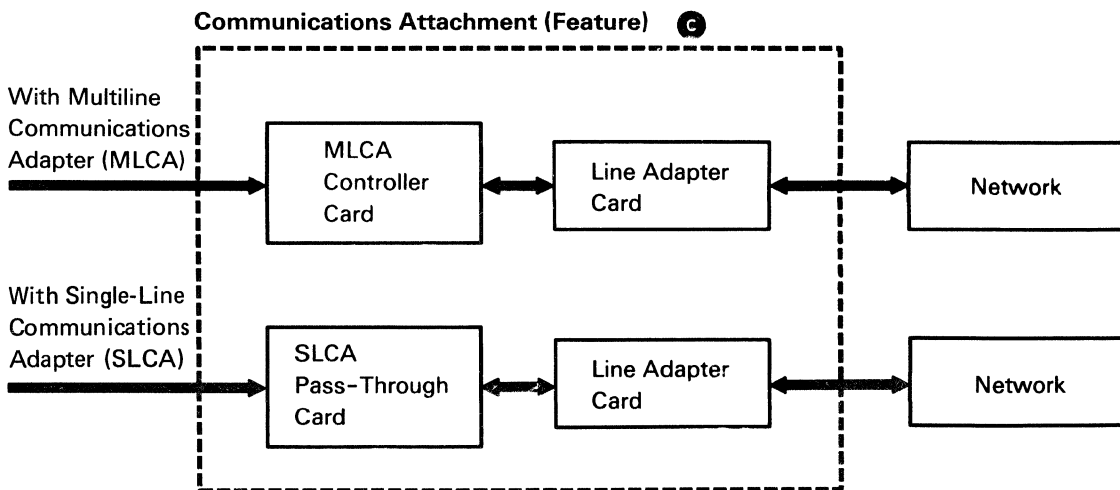diagram are references to expanded overview
diagrams on the pages that follow.

```
┌──────────────────┐       ┌──────────────────┐
│ Processing Unit  │◄─────►│ Work Station     │
│ and Channel      │       │ Attachment       │
│      (A)         │   ┌──►│      (B)         │
└──────────────────┘   │   └──────────────────┘
                       │
                       │   ┌──────────────────┐
                       ├──►│ Communications   │
                       │   │ Attachment       │
                       │   │      (C)         │
                       │   └──────────────────┘
                       │
                       │   ┌──────────────────┐
                       └──►│ Diskette and     │
                           │ Disk Attachment  │
                           │      (D)         │
                           └──────────────────┘
```

Processing Unit and Channel Overview

Processing Unit and Channel (A)

```
┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│  ┌──────────────┐         ┌──────────────┐    ┌──────────────────┐   │
│  │ Main Storage │◄──┐     │ Control Panel│◄──►│ Control Panel    │   │
│  │ 1            │   │     └──────────────┘    │ Interface Card   │   │
│  └──────────────┘   │                         └──────────────────┘   │
│  ┌──────────────┐   │                                 ▲              │
│  │ Main Storage │◄──┤                                 │              │
│  │ 2 (feature)  │   │     ┌──────────────┐            ▼           To/From
│  └──────────────┘   ├────►│ MSP Data Flow│◄──►┌──────────────┐ I/O Attachments
│  ┌──────────────┐   │     │ Card         │    │ CSP Card     │◄─────►
│  │ Main Storage │◄──┤     └──────────────┘    └──────────────┘      │
│  │ 3 (feature)  │   │            ▲                                   │
│  └──────────────┘   │            │                                  │
│  ┌──────────────┐   │            ▼                                  │
│  │ Main Storage │◄──┘     ┌──────────────┐                          │
│  │ 4 (feature)  │         │ MSP Control  │                          │
│  └──────────────┘         │ Card         │                          │
│                           └──────────────┘                          │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
```

Work Station Attachment Overview

Work Station Attachment Ⓑ

With Less Than
or Equal to Six
Work Stations

```
Work Station          Work Station                    Local
Adapter Card   ◄───►  Pass-Through   ◄───►            Work Station
                      Card
```

With More Than Six
Work Stations
(feature)

```
Work Station          Work Station                    Local
Controller Card ◄───► Adapter Card   ◄───►            Work Station
```

Communications Attachment Overview

Communications Attachment (Feature) Ⓒ

With Multiline
Communications
Adapter (MLCA)

```
MLCA                  Line Adapter
Controller     ◄───►  Card           ◄───►            Network
Card
```

With Single-Line
Communications
Adapter (SLCA)

```
SLCA                  Line Adapter
Pass-Through   ◄───►  Card           ◄───►            Network
Card
```

Diskette and Disk Attachment Overview

Diskette and Disk Attachment Ⓓ

With 30 Megabytes
of Disk Storage
(see note)

Data Storage
Adapter 1

Diskette Drive

Disk Drive
Adapter Card

Disk Drive A

With 60 Megabytes
or More of Disk
Storage

Data Storage
Adapter 1

Diskette Drive

Data Storage
Adapter 2

Disk Drive
Adapter Card

Disk Drive A

Disk Drive
Adapter Card
(if present)

Disk Drive B
(if present)
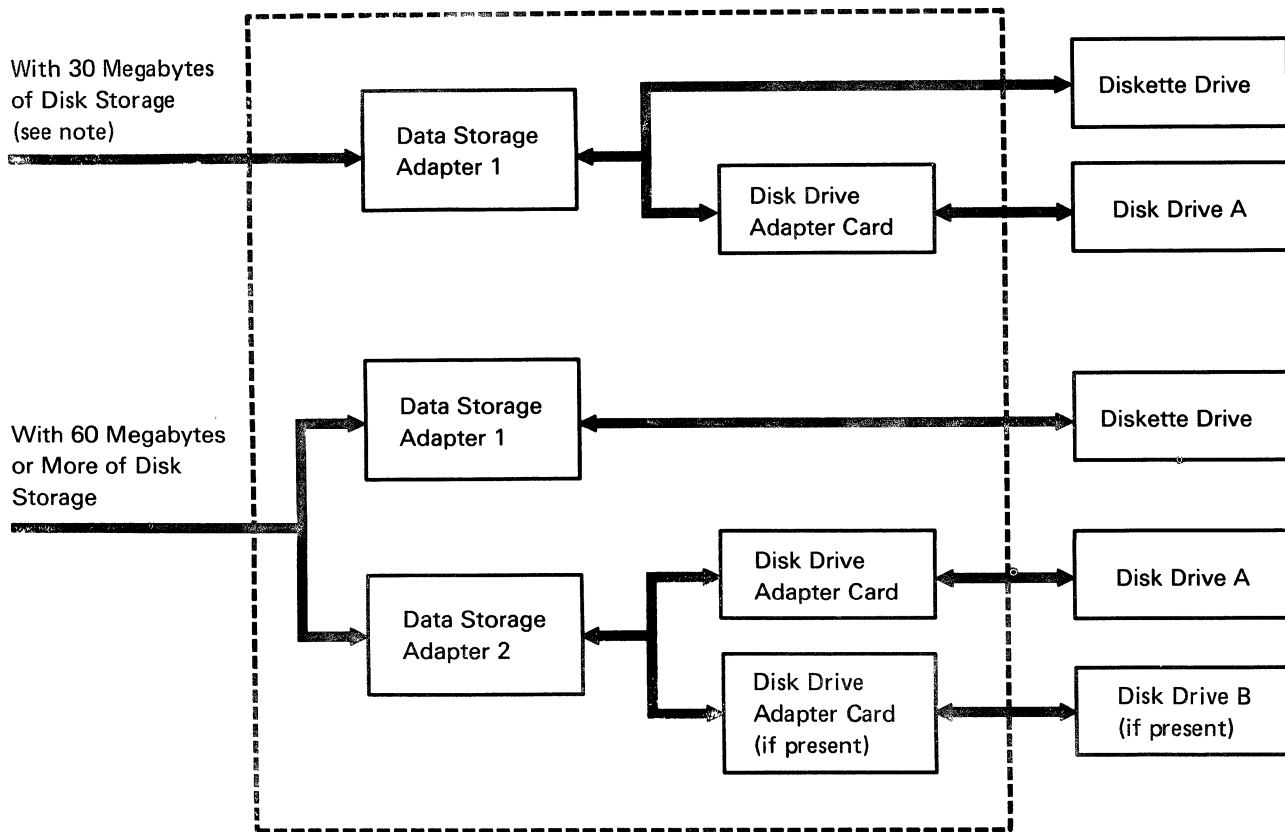
Note: On systems with 30 megabytes of disk storage,
a jumper card is installed in F5 to connect
board signals.

---

210 Power Overview

The system power supply generates the DC
voltages needed by the system and by the devices
located inside the system. The following diagram
shows the FRUs that receive AC and DC voltages
from the power supply. For point-to-point power
flow, see "425 Power Point-to-Point Overview"
on page 4-14.

215 System Locations

Disk Area Fan

Disk Drive A (1F)
(see 804)

Disk Drive B (1G)
(see 804)

Line Filter/
AC Cable Assembly

Control Panel

Unit Emergency
Switch

Thermal Switch

Diskette Drive

A-A1 Board

Communications
Lines 1-4 and
Autocall A/B

JMT1 Connector

Work Station Port

Power Supply
(under cover)

Gate Fans
(under card gate)

Power Cord Connector

I/O Panel
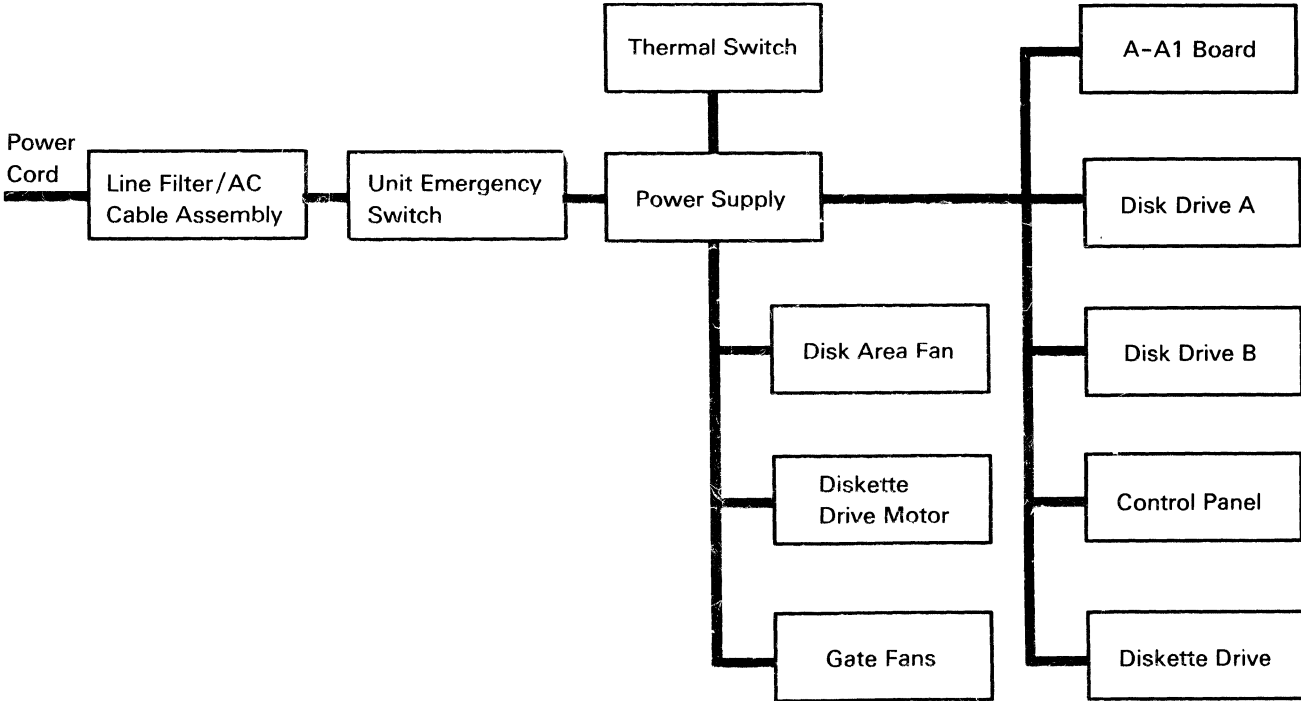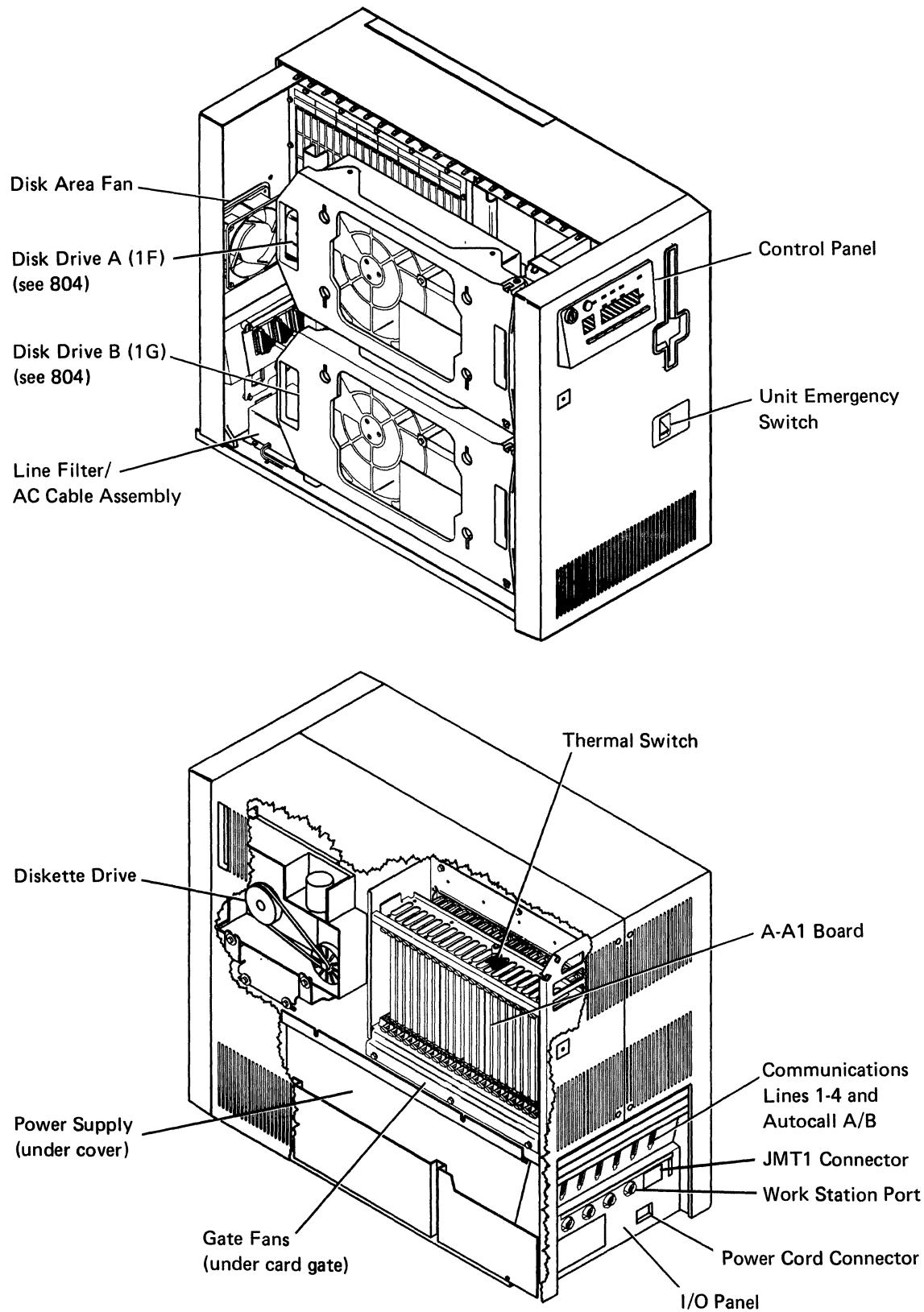
220 Board Locations

Top Card Connectors

No Card in Location C2
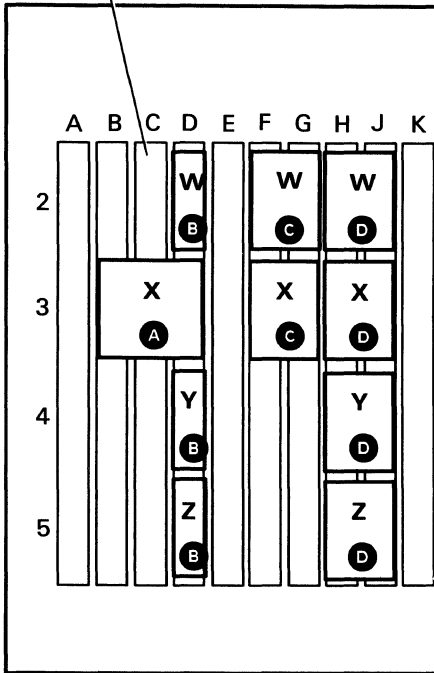
Card in Location C2
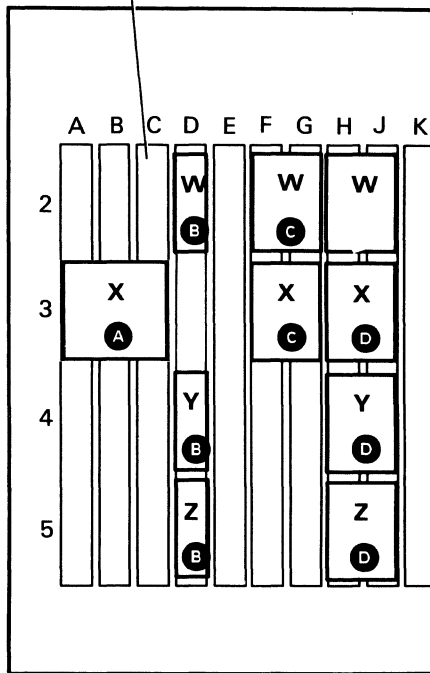
One-Wide B
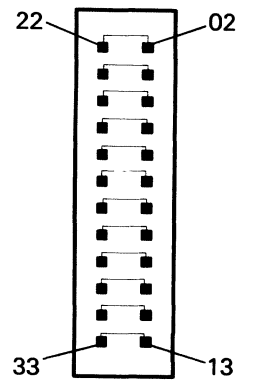
Three-Wide A
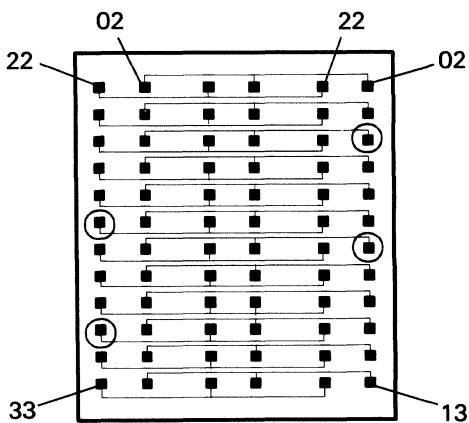
(●) = Ground Pin

Top View with Cover Removed

IBM Part 6819193 C
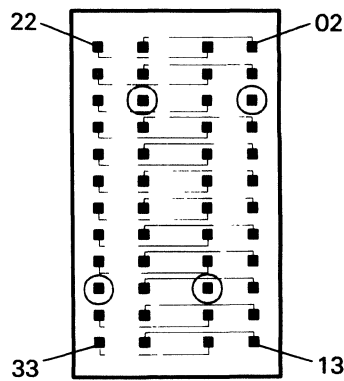
(●) = Ground Pin
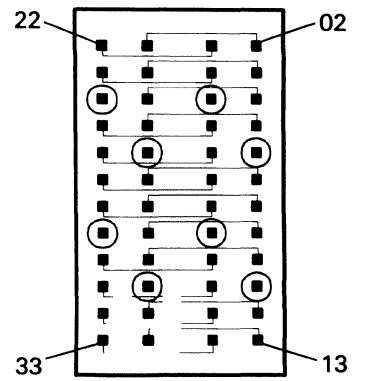
IBM Part 6819211 D

(●) = Ground Pin

Connectors C and D
are not interchangeable.

Card Locations

Table 1

Card	Assembly Part Number	Description
A2	2462200	Disk B adapter (feature).
B2	2462200	Disk A adapter.
C2	2462209	Data storage adapter 2 (if 60 Mb or more of disk storage).
D2	2462201	Diskette adapter/data storage adapter 1.
E2	———	Not used.
F2 (F5)	2462202 (2453064)	Control panel interface. Jumper card (added when location C2 is empty).
G2	2462203	CSP.
H2	2462204	MSP control.
J2	2462205	MSP data flow.
K2-N2	2462206 2462261	Main storage 4-1 (128 Kb-main storage cards). See Table 2. Main storage 4-1 (256 Kb-main storage cards). See Table 3.
P2 P3	2462208 2462207	Work station adapter (feature only; adapter is in Q2 for base systems). Work station pass-through (base only).
Q2	2462208 2462210	Work station adapter (base). Work station controller (feature).
R2-S2	———	Not used.
T2	2462216 2462211	MLCA controller (feature). SLCA pass-through (feature).
U2-X2	2462212 2462213 2462214 2462215	Line adapters 1-4 (features; any line adapter can be in any location U2-X2). EIA. X.21. DDSA. V.35.

Table 2 (Valid main storage configurations when A-A1N2 is IBM part 2462206.)

Total Main Storage	N2	M2	L2	K2
128 Kb	128 Kb	———	———	———
256 Kb	128 Kb	128 Kb	———	———
384 Kb	128 Kb	128 Kb	128 Kb	———
512 Kb	128 Kb	128 Kb	128 Kb	128 Kb

Table 3 (Valid main storage configurations when A-A1N2 is IBM part 2462261.)

Total Main Storage	N2	M2	L2	K2
256 Kb	256 Kb	———	———	———
384 Kb	256 Kb	128 Kb	———	———
512 Kb	256 Kb	256 Kb	———	———
768 Kb	256 Kb	256 Kb	256 Kb	———
1024 Kb	256 Kb	256 Kb	256 Kb	256 Kb

Card Side


```
     A  B  C  D  E  F  G  H  J  K  L  M  N  P  Q  R  S  T  U  V  W  X

 2

 3

 4

 5
```

Jumpers

A jumper must be installed here.

Board Side

Do not change jumper position.
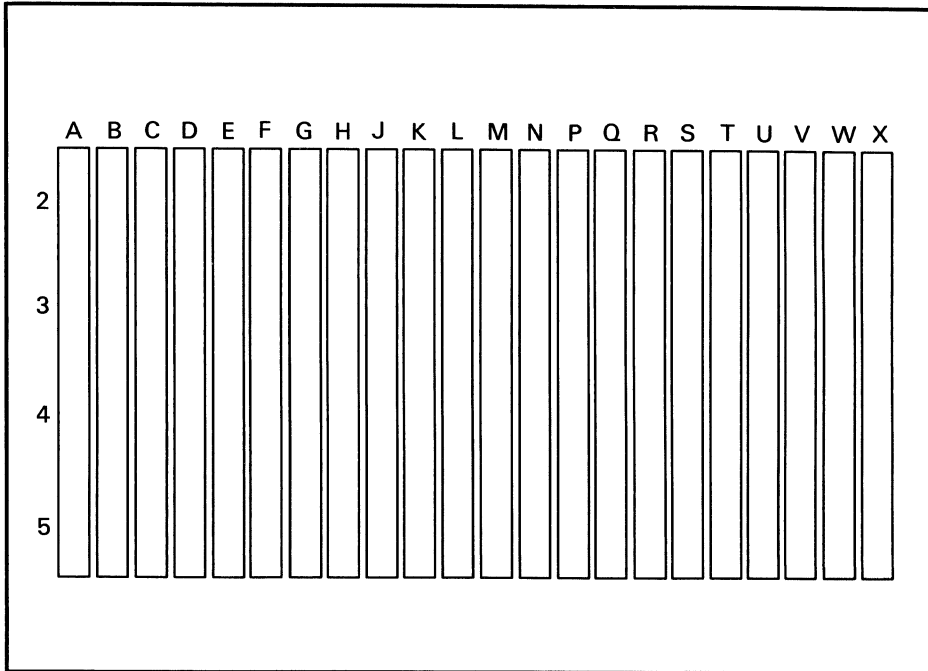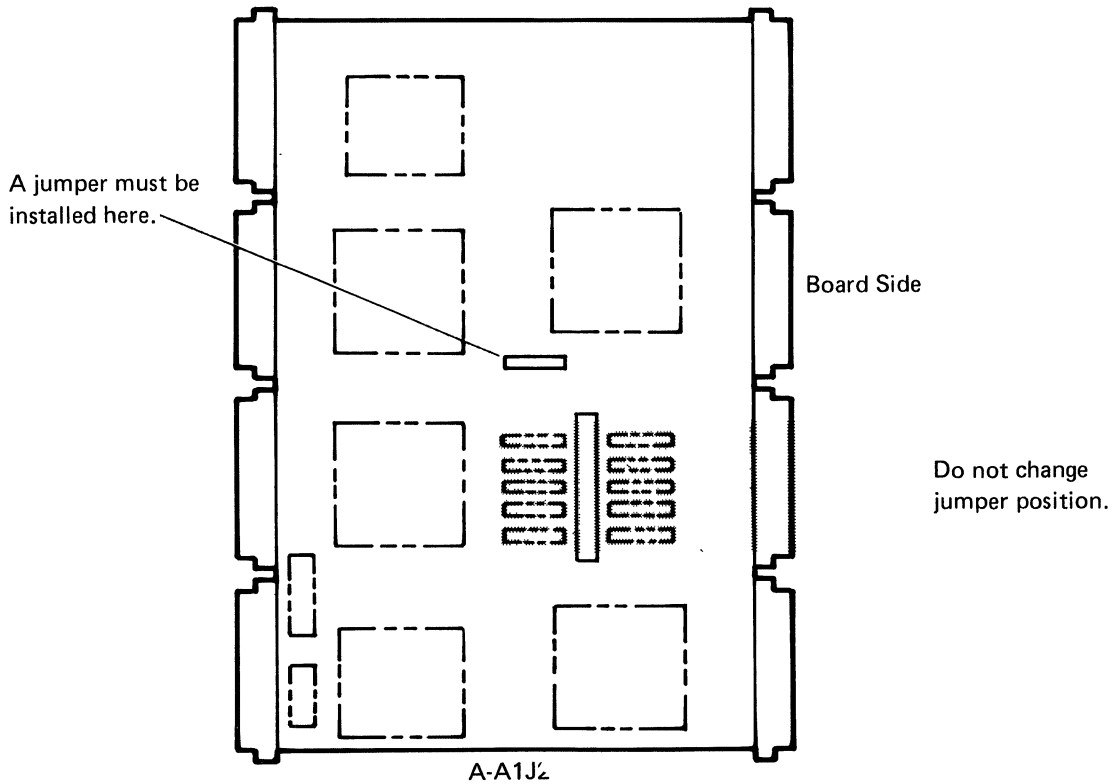
A-A1J2
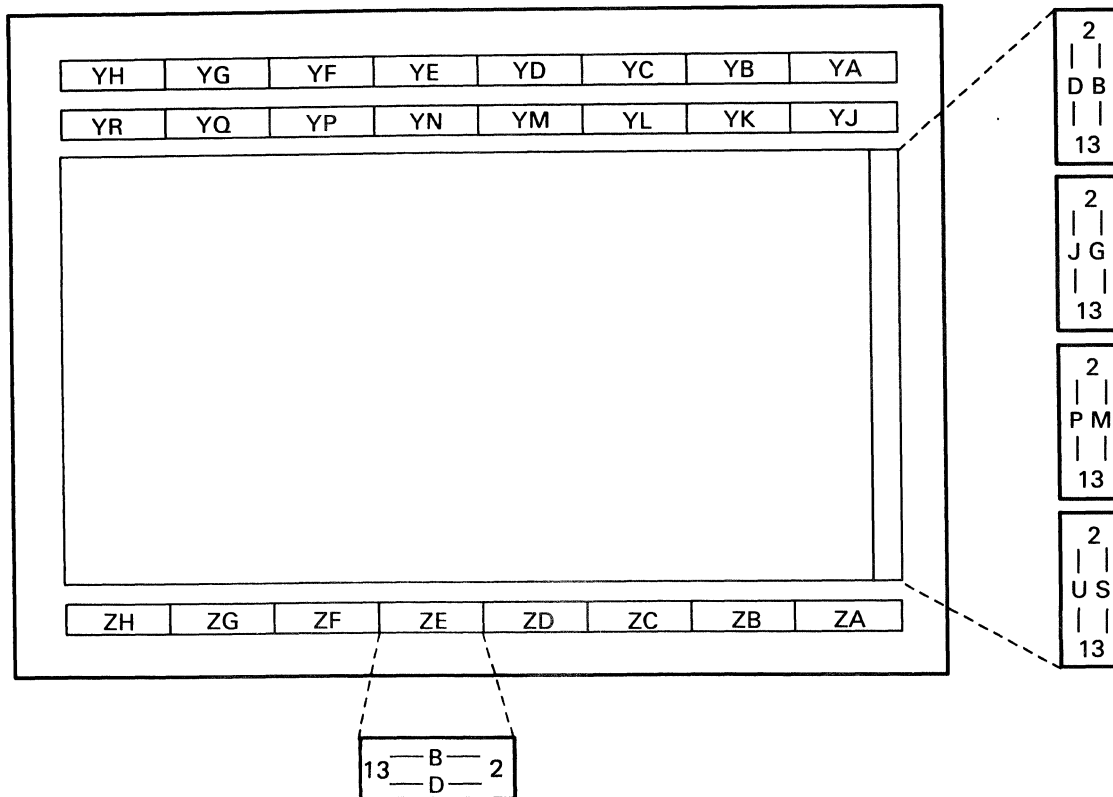
Note: The jumper position on *A-A1J2* is set at the factory and can be in any one of the ten positions. *Do not change the jumper position.*

Cable Locations

Pin Side

Cable	Description	Cable	Description
YA	Not used	YN	Not used
YB	Diskette	YP	DC power (see 425)
YC	Control panel	YQ	Not used
YD	Control panel	YR	Not used
YE	Not used	ZA	Disk B signal cable
YF	Autocall lines A and B	ZB	Not used
YG	Communications line 1	ZC	DC power (see 425)
YH	Communications line 3	ZD	Not used
YJ	Disk A signal cable	ZE	Work station
YK	Not used	ZF	DC power (see 425)
YL	DC power (see 425)	ZG	Communications line 2
YM	Not used	ZH	Communications line 4

Section 3. General Procedures

This page is intentionally left blank.

310 Powering On/Off the System

To Power On

1. Ensure that:

    a. The power cord is connected to the customer power outlet and to the power cord connector.
    b. The Unit Emergency switch is in the Power Enable position.
    c. The Security switch is in the Normal (for IPL) or Service (no IPL) position.

2. Press the Power key.

To Power Off under SSP, Using the System Console

1. Enter POWER OFF.

If jobs are running or if system tasks are active that cannot be interrupted, the system displays a message at the system console.

To Power Off, Using the Control Panel

1. Ensure that the Security switch is in the Service position.

2. Select function 6 (Power Off).

3. Press the Start Function key. The Function 6 display blinks (for approximately 20 seconds) until the power-off operation is complete.

Note: *If the power cord will not be disconnected after powering off the system for service, set the Security switch to the Locked position to prevent accidental power-on.*

312 Performing a System Reset

The system is normally reset during a power-on or IPL operation. To cause a system reset:

1. Ensure that the Security switch is in the Service position.

2. Select function 5 (System Reset).

3. Press the Start Function key.

314 Starting the CSP

1. Ensure that the Security switch is in the Service position.

2. Select function 9 (Start CSP).

3. Press the Start Function key.

316 Getting a System Dump

1. Ensure that the Security switch is in the Service position.

2. Select function 4 (Dump).

3. Press the Start Function key.

The system is reset and the CSP is started. If SSP was running before this function was selected, a system dump occurs.

320 Loading the SSP

The SSP is normally loaded at the time the system is powered on. Function 1 (IPL) permits the customer or CE/CSR to load the SSP at a later time without powering the system off and on again.

The Security switch determines the method of loading the SSP.

Security Switch—Normal Position

1. Select function 1 (IPL). The 4-character display is blank.

2. Press the Start Function key. This is the normal customer IPL; the IPL Sign-On prompt is displayed after IPL testing is complete (see Note 1).

Security Switch—Service Position

1. Select function 1 (IPL).

   The 4-character display contains 0000. If the Start Function key is pressed now, a normal customer IPL will occur.

   To bypass the wrap tests, alter the 4-character display to FF00.

2. Press the Start Function key. The IPL Sign-On prompt is displayed after IPL testing is complete (see Note 1).

Notes:

1. See "326 Load Options for SSP, Reload, and Customize" on page 3-6 for approximate IPL times.
2. See "328 Service Procedures under SSP" on page 3-7 for available tests under SSP.
3. See "329 Summary of Useful SSP Procedures" on page 3-8 for a summary of useful SSP procedures.

321 Auto Configuring the System

1. Ensure that the Security switch is in the Service position.

2. Insert diskette 1.

3. Select function 3 (IPL Diagnostic Diskette).

   The 4-character display contains 0000. To perform a normal customer auto configuration, alter the 4-character display to 1000. To perform a CSR auto configuration, alter the 4-character display to CECE. See "326 Load Options for SSP, Reload, and Customize" on page 3-6.

4. Press the Start Function key. Follow the displayed instructions to auto configure the system.

322 Reloading the SSP Diskettes

Note: Reloading the SSP diskettes is a customer reponsibility.

1. Ensure that the Security switch is in the Service position.

2. Insert the first SSP diskette (SSP01).

3. Select function 2 (Reload).

   The 4-character display contains 0000. If the Start Function key is pressed now, a normal reload of the SSP diskettes will occur. To bypass the wrap tests, alter the 4-character display to FF00.

4. Press the Start Function key. Follow the displayed instructions to load the SSP diskettes to disk.

5. Inform the customer that he or she can now reload the program products/utilities beginning with task 2 in the *Performing the First System Configuration for Your System* manual.

324 Reloading the System Microcode

1. Ensure that the Security switch is in the Service position.

2. Insert the diagnostic diskette (diskette 3).

3. Select function 3 (IPL Diagnostic Diskette).

   The 4-character display contains 0000. If the Start Function key is pressed now, a normal diskette IPL will occur. To bypass the wrap tests, alter the 4-character display to FF00.

4. Press the Start Function key. The DCP Main menu is displayed.

5. Insert the microcode diskette (diskette 2).

6. Select the System Customize option from the DCP Main menu.

7. Follow the displayed instructions.

8. When this procedure has completed, perform "321 Auto Configuring the System" on page 3-4.

326 Load Options for SSP, Reload, and Customize

Select Function	Load Option	Load From	Program Loaded	IPL Time[1]	Description
1	0000	Disk	SSP	7-10	Normal load
1	FF00	Disk	SSP	1-3	Bypass wrap tests
2	0000	Diskette (SSP01)	SSP	7-10	Load main storage SSP from diskette and reload SSP diskettes to disk
2	FF00	Diskette (SSP01)	SSP	1-3	Load main storage SSP from diskette, bypass wrap tests, and reload SSP diskettes to disk
3	0000	Diskette 3	DCP	7-10	Select the System Customize option from DCP Main menu and insert diskette 2
3	1000	Diskette 1	SSP	8-12	Sense devices, assemble UDT, and run I/O wraps
3	CECE	Diskette 1	SSP	8-12	Sense devices, assemble UDT, and run I/O wraps[2]
3	FF00	Diskette 3	DCP	1-3	Bypass wrap tests; select the System Customize option from DCP Main menu and insert diskette 2

---

[1] IPL times are approximate in minutes.

[2] The CECE load option displays the hardware configuration. You can select an option to change the machine serial number or to change the printer address. After you select the option, follow the prompts to completion.

328 Service Procedures under SSP

Note: To load SSP, see "320 Loading the SSP" on page 3-4.

Enter one of the following SSP procedures on the command line:

- SYSTEST (system test):

  - Disk exerciser
  - Diskette exerciser
  - Display station exerciser
  - Main storage processor exerciser
  - Printer exerciser
  - Communications exerciser

- COMMTEST (communications diagnostic tests):

  - Basic communications diagnostic test
  - Additional communications diagnostic tests
    - IBM 386x local and remote modem diagnostic tests
    - Remote loopback wrap tests
    - MLCA controller diagnostic test
    - Print data traces
    - Static driver on installation test (Japan only)
    - Static driver off installation test (Japan only)

- STATEST (SDLC station test)

- BSCTEST (BSC online test)

- SDLCTEST (SDLC online test)

- ERAP (error recording analysis program):

  - System summary
  - Elapsed time counters
  - Reports for all devices
  - Single reports by device

- TESTREQ (test request):

  - Display verification
  - Work station printer verification
  - Configuration data
  - ERAP (reports associated with work stations)

329 Summary of Useful SSP Procedures

The following table describes useful SSP procedures. See the *System Reference* manual and the *Program Problem Diagnosis and Diagnostic Aids* manual for more information.

Key in This SSP Name	Press This Key	Description or Action
ALTERCOM	Help	Gives the prompt to change some communications parameters.
APAR	Help	Gives the prompt to create APAR diskettes or to copy diagnostic information to disk or diskette.
BSCTEST	Enter	Gives the prompt to perform the BSC online tests.
BUILD	Enter	Displays the data on disk after a disk error with the option to correct data.
COMMTEST	Enter	Shows the menu with options to perform the communications diagnostic tests.
COPYI1	Help	Gives the prompt to copy files from an SSP diskette to one or more other SSP diskettes with the same format.
D C	Enter	Displays the communications configuration data set by the ALTERCOM procedure.
D H	Enter	Displays the communications configuration data set by the SETCOMM procedure.
DFA	Help	Gives the prompt to print or display the selected system data areas from disk or from a diskette made by the APAR procedure.
DIAGCOPY	Enter	Copies files from any diagnostic diskette to one or more other diagnostic diskettes with the same format.
DIAGINIT	Enter	Initializes a diagnostic diskette.
DUMP	Help	Gives the prompt to select and print or display information from the dump file.
ERAP	Enter	Shows the menu with options to display or print the error log reports.
HISTCRT	Enter	Displays entries from the system history file.
HISTORY	Enter	Gives the prompt to display or print selected entries from the system history file.
ICFDEBUG	Help	Runs the SSP-ICF debug program.
ICVERIFY	Help	Gives the prompt to verify that an SSP-ICF subsystem is installed correctly.
INIT	Help	Gives the prompt to initialize a system (SSP) diskette.
OFF	Enter	Signs off the user.
PATCH	Enter	Shows the menu with options to patch selected disk or diskette sectors.
POWER OFF	Enter	Powers off the system.

Key in This SSP Name	Press This Key	Description or Action
PROBLEM	Enter	Gives instructions to perform online problem determination.
PTF	Help	Gives the prompt to install or remove PTFs (program temporary fixes) or MPTFs (microcode program temporary fixes) to disk.
SDLCTEST	Enter	Gives the prompt to select options from menus to perform the SDLC online tests.
SERVICE	Help	Shows the menu with options to run service aid procedures.
SERVLOG	Help	Gives the prompt to add entries to the system service log.
SETCOMM	Help	Gives the prompt to change some communications parameters.
SETDUMP	Help	Gives the prompt to set the address compare dump values for programs running in main storage.
SMF	Help	Shows the menu with options to select options from menus to measure system actions.
SMFPRINT	Help	Gives the prompt to print a formatted report of the data collected by the system measurement program.
SMFSTART	Help	Gives the prompt to start the system measurement program.
SMFSTOP	Enter	Stops the system measurement program.
START	Help	Shows a menu that lets jobs run, start, or print. The option to start system service authorization lets you specify a display station to be used to enter any procedure or command to service the system.
STATEST	Enter	Gives the prompt to select options from menus to perform the remote work station tests.
STOP	Help	Shows a menu that prevents jobs from running, starting, or printing. The option to start system service authorization lets you return a display station to its normal use.
SYSTEST	Enter	Shows the menu to select exercisers to perform diagnostic testing of the system. No customer jobs can be running.
TESTDSKT	Help	Shows the menu with options to perform tests on the diskette drive and media.
TESTREQ	Enter	Shows the menu with options to perform the local and remote work station verification tests.
TRACE	Help	Gives the prompt to keep a record of selected events on the system.
VARY	Help	Gives the prompt to change the status of a display station, a printer, the system printer, or the diskette drive to online or offline.

330 Loading the DCP from Disk

1. Ensure that the Security switch is in the Service position.

2. Select function 2 (Reload).

   The 4-character display contains 0000. If the Start Function key is pressed now, a normal SSP reload will occur. To load the system for dedicated service, alter the 4-character display to F800 (bypass wraps) or F801 (run wraps).

3. Press the Start Function key. The DCP Main menu is displayed after IPL is complete (see Note 1).

Notes:

1. *See "336 Load Options for DCP" on page 3-11 for approximate IPL times.*
2. *See "338 Diagnostic Tests under DCP" on page 3-12 for available tests.*

332 Loading the DCP from Diskette

1. Ensure that the Security switch is in the Service position.

2. Insert the diagnostic diskette (diskette 3) in the diskette drive.

3. Select function 3 (IPL Diagnostic Diskette).

   The 4-character display contains 0000. If the Start Function key is pressed now, a normal diagnostic IPL will occur. To bypass the wrap tests, alter the 4-character display to FF00.

4. Press the Start Function key. The DCP Main menu is displayed after IPL is complete (see Note 1).

Notes:

1. *See "336 Load Options for DCP" on page 3-11 for approximate IPL times.*
2. *See "338 Diagnostic Tests under DCP" on page 3-12 for available tests.*

336 Load Options for DCP

Select Function	Load Option	Load From	Program Loaded	IPL Time	Description
2	F800	Disk	DCP	2-4	Bypass wrap tests
2	F801	Disk	DCP	6-8	Normal load
2	F8F0	Disk	DCP	2-4	No disk motor start or wrap tests
3	0000	Diskette 1	DCP	15	Disk drive problem determination
3	0000	Diskette 3	DCP	7-10	Normal load
3	FA03	Diskette 3	DCP	No IPL	Use only when directed (see "160 Isolating Main Storage Problems Procedure" on page 1-14)
3	FC03	Diskette 3	DCP	No IPL	Use only when directed (see "Procedure 123" on page 1-5)
3	FF00	Diskette 3	DCP	1-2	Bypass wrap tests
3	FFF0	Diskette 3	DCP	1-2	No disk motor start or wrap tests

Note: *IPL times are approximate in minutes.*

338 Diagnostic Tests under DCP

Notes:

1. *To load DCP, see "330 Loading the DCP from Disk" on page 3-10 or "332 Loading the DCP from Diskette" on page 3-10.*
2. *The DCP printer address defaults to hex 30. You can change the printer address by using the CECE IPL load option. See "326 Load Options for SSP, Reload, and Customize" on page 3-6.*

Select one of the following options from the DCP Main menu:

- Disk utilities (available on diskette 3 only):

  - Pack analysis
  - Pack initialization
  - Sector recover

- System customize (available on diskette 2 only)

- Program patch (available on diskette 3 only):

  - Disk patch only
  - Disk (and diskette) patch
  - Free-lance disk patch

- System records list (available on diskette 3 only):

  - Control storage directory (on disk)
  - Diskette directory (on diskette)
  - EC level table (on diskette)
  - Patch table (on disk or diskette)
  - Prerequisite list (on disk or diskette)
  - Microcode level table (on disk or diskette)

- Network analysis (for local work stations) (available on diskette 3 only)

- RPQ utilities

- Supervisor options:

  - Printed output to printer (default)
  - Printed output to console
  - Diagnostics from disk
  - Diagnostics from diskette (default)

340 Displaying CSP Status

1. Ensure that the Security switch is in the Service position.

2. Select function B (Display CSP Status).

3. Using the low-order Input key, select the register to be displayed (see table).

4. Press the Start Function key.

   The CSP stops at the end of the present instruction; the selected status is displayed in the 4-character display.

   Note: The local work station environment is interrupted but is restored when the CSP is started again (function 9).

5. Press the Display key and repeat steps 3 and 4 to display a different register, or start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

Register	Display Byte 0	Display Byte 1
1	Processor error byte	Interrupt level backup byte
2	Channel error byte	Channel device address backup byte
3	Storage error byte	Present operating level (displayed in the rightmost position of byte 1) as follows:

Number   *Operating Level*

Number	Operating Level
0	Machine check
1	Interrupt level 1
2	Interrupt level 2
3	Interrupt level 3
4	Interrupt level 4
5	Interrupt level 5
6	Main level

342 Stopping on a Control Storage Address

To Enable the Address Compare and Stop Function

1. Ensure that the Security switch is in the Service position.

2. Select function E (Address Compare and Stop).

3. Using the Input keys, enter the 2-byte address of the control storage location where the stop should occur.

4. Press the Display key.

   The rightmost character of the 4-character display indicates the address compare status as follows:

Display	Meaning
0	Address compare is disabled
1	Address compare is enabled
2	Address compare has occurred

5. Use the rightmost Input key to enter a 1 in the 4-character display.

6. Press the Start Function key to enable the address compare function in the CSP.

7. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

   When an address compare occurs, the CSP stops, the Function display is forced to E, and the Display Output display is forced on. The 4-character display will contain a 2 in the low-order position to indicate that an address compare occurred.

   The low-order Input key can be used to enable (1) or disable (0) the address compare function. The compare address can be changed by pressing the Display key and entering the new address using the Input keys.

To Disable the Address Compare and Stop Function

1. Ensure that the Security switch is in the Service position.

2. Select function E (Address Compare and Stop).

3. Press the Display key.

   The rightmost character of the 4-character display indicates the address compare status as follows:

Display	Meaning
0	Address compare is disabled
1	Address compare is enabled
2	Address compare has occurred

4. If the displayed character is a 1 or a 2, use the rightmost Input key to enter a 0 in the 4-character display.

5. Press the Start Function key to disable the address compare function in the CSP.

6. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

350 Alter or Display Storage

The alter/display utility is a dedicated utility that interrupts normal system operation to let you perform specific storage operations. For example, you can alter or display:

- Storage, including:

  - Real main storage
  - Translated main storage
  - Control storage

- Disk storage

- I/O controller storage (display only)

- MSP registers

CAUTION
All communications tasks should be completed or stopped before you start the alter/display utility.

. . . .

. . . .

. . . .

. . . .

You can determine if a communications line is active by inspecting the Communications Line Status lights for each line ("935 Displaying Communications Line Status" on page 9-11). The DTR (data terminal ready) light is on when the line is active.

Note: *If the spool writer is allocated to the system printer, the alter/display utility print options will not print. The spool writer must be stopped before you can allocate the system printer to the alter/display utility. All alter/display screens can be printed on the system printer, using the Print key.*

Selecting function 7 to start the alter/display utility, stops the main storage processor (MSP). However, the Alter/Display menu does not appear on the system console when the terminal unit block (TUB) chain is locked or if a work station error is being processed. If the Alter/Display menu does not appear on the system console, end the alter/display function and attempt to start the alter/display utility again.

If the Alter/Display Option menu still does not appear, it is probably because some program has the TUB chain locked. End the alter/display function and wait until a later time to start the alter/display utility.

To Start the Alter/Display Function

1. Ensure that the Security switch is in the Service position.

2. Select function 7 (Console Alter/Display) and press the Start Function key.

   The Alter/Display menu is displayed on the system console.

3. Select an alter/display option and follow the displayed instructions.

To End Any Alter/Display Option

There are two methods of ending the alter/display options. (For options 10 and 12, use only method 1.)

Method 1: Using the Cmd7 Key

On all displays except the Alter/Display Options menu, you can use the Cmd7 key to end the alter/display option. For the Alter/Display Options menu, see the procedure "To End the Alter/Display Function."

Method 2: Using the E Parameter

All alter/display options (except options 10 and 12) display an end (E) parameter. Key in E in the parameter field and press the Enter key; the Alter/Display Options menu is displayed.

Note: On storage displays, change the storage indicator (M, R, X, or C) on the first storage address to an E.

To End the Alter/Display Function

There are two methods of ending the alter/display function. Use method 1 when you can display the Alter/Display Options menu. Use method 2 when you cannot use method 1.

Method 1: Using the Alter/Display Menu

1. Select option 0 (Exit Alter/Display) from the Alter/Display Options menu.

2. Press the Field Exit key.

Method 2: Using the Control Panel

1. If the Output Display light is off, press the Display key. A 1 is displayed in the low-order position of the 4-character display; the three high-order positions are blank.

2. Change the 1 to a 0 using the low-order Input key.

3. Press the Start Function key.

Note: For more information about using the alter/display utility, see the **Program Problem Diagnosis and Diagnostic Aids** manual.

352 Display or Alter Control Storage, Using the Control Panel

If the alter/display utility (function 7) does not display the Alter/Display Option menu, use the control panel to display or alter control storage.

To Display a Control Storage Location

1. Ensure that the Security switch is in the Service position.

2. Select function D (Display/Alter Control Storage).

3. Using the Input keys, enter the 2-byte address of the control storage location to be displayed and press the Start Function key.

   The CSP stops at the end of the present instruction; the addressed location of control storage is displayed in the 4-character display.

   Note: *The local work station environment is interrupted but is restored when the CSP is started again (function 9).*

4. Perform one of the following steps:

   a. Press the Start Function key to increase the control storage address, displaying the next sequential control storage location.
   b. Press the Display key and repeat step 3 to display a different control storage location.
   c. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

To Alter a Control Storage Location

1. Ensure that the Security switch is in the Service position.

2. Select function D (Display/Alter Control Storage).

3. Using the Input keys, enter the 2-byte address of the control storage location to be altered.

4. Press the Display key and, using the Input keys, enter the new data for the selected control storage location.

5. Press the Start Function key to alter control storage.

   The CSP stops at the end of the present instruction; the addressed location of control storage is displayed in the 4-character display.

   Note: *The local work station environment is interrupted but is restored when the CSP is started again (function 9).*

6. Perform one of the following steps:

   a. Press the Start Function key to increase the control storage address, displaying the next sequential control storage location.
   b. Repeat steps 4 and 5 to alter the next sequential control storage location.
   c. Press the Display key and repeat steps 3 through 5 to alter a different control storage location.
   d. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

354 Display or Alter a Local Storage Register

To Display an LSR

1. Ensure that the Security switch is in the Service position.

2. Select function C (Display/Alter LSR).

3. Using the two low-order Input keys, select the local storage register (LSR) to be displayed (hex 00 through hex 3F are valid) and press the Start Function key.

   The CSP stops at the end of the present instruction; the selected LSR is displayed in the 4-character display.

   Note: The local work station environment is interrupted but is restored when the CSP is started again (function 9).

4. Perform one of the following steps:

   a. Press the Start Function key to step CSP, displaying the selected LSR.
   b. Press the Display key and repeat step 3 to display a different LSR.
   c. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

To Alter an LSR

1. Ensure that the Security switch is in the Service position.

2. Select function C (Display/Alter LSR).

3. Using the two low-order Input keys, select the local storage register (LSR) to be displayed (hex 00 through hex 3F are valid).

4. Press the Display key and, using the Input keys, enter the data that the local storage register (LSR) will be altered to.

5. Press the Start Function key to alter the LSR.

   The CSP stops at the end of the present instruction; the selected LSR is displayed in the 4-character display.

   Note: The local work station environment is interrupted but is restored when the CSP is started again (function 9).

6. Perform one of the following steps:

   a. Press the Start Function key to step CSP, displaying the selected LSR.
   b. Press the Display key and repeat steps 3 through 5 to alter a different LSR.
   c. Start the CSP ("314 Starting the CSP" on page 3-3) to continue processing.

360 Getting ERAP Reports

The error recording analysis procedure (ERAP) gets, formats, and displays or prints error statistical information. There are four methods of getting ERAP reports:

- The ERAP procedure under SSP lets you get system summary reports and detailed device reports from the system error log.

- The test request procedure (TESTREQ) under SSP lets you get ERAP reports associated with work stations and communications devices.

- The Test Request function key of any local or remote work station lets you get ERAP reports associated with work stations and communications devices.

- A system test (SYSTEST) option lets you get system summary reports and detailed device reports from the system error log.

To Get ERAP Reports under SSP

1. Enter ERAP.

2. Select the type of ERAP report.

3. Select the option to display or print the ERAP report.

To Get ERAP Reports Using the Test Request Procedure

1. Enter TESTREQ.

2. Select the ERAP option.

3. Select the type of ERAP report.

To Get ERAP Reports Using the Work Station Test Request Key

This procedure assumes that you have a sign-on display but have not signed on a work station.

1. Press the Cmd key and the Test Request function key (backspace key).

2. Select the ERAP option.

3. Select the type of ERAP report.

To Get ERAP Reports When Running the System Test

1. Press the Attn key.

2. Select option 4 (Set Inquiry Condition for Program) from the Inquiry menu.

3. Select the option that starts ERAP.

4. Select the ERAP reports you want.

5. Use the Cmd7 key to return to SYSTEST.

Example Error History Table

```
┌──────────────────────────────────────────────────────────────────────────────┐
│                                                                                │
│              ERROR  HISTORY  TABLE  FOR  XXXXXXXX                               │
│                                                                                │
│      FROM: XX/XX/XX  XX:XX:XX          TO: XX/XX/XX  XX:XX:XX                   │
│                                                                                │
│      DATE        TIME        SRC     (Information used to generate SRCs)        │
│    YY/MM/DD   HH:MM:SS             .................HEX.....................    │
│    XX/XX/XX   XX:XX:XX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX                 │
│    XX/XX/XX   XX:XX:XX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX                 │
│    XX/XX/XX   XX:XX:XX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX                 │
│    XX/XX/XX   XX:XX:XX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX  XXXX                 │
│                                                                                │
└──────────────────────────────────────────────────────────────────────────────┘
```

Notes:

1. *When you display ERAP reports for some devices, not all of the information available in the reports is shown. However, the additional information is available when you print or spool the reports (see the procedure "Spool and Display ERAP Reports" on the following page).*

2. *See the* **Program Problem Diagnosis and Diagnostic Aids** *manual to interpret special fields associated with communications SRCs.*

Spool and Display ERAP Reports

The local work station attachment and disk error history tables contain additional information that is not displayed. When a printer is busy, or is not available, you can send the ERAP report to the system spool writer. The spooled output can be displayed at a local work station using the following procedures.

To Spool the ERAP Output

1. From the ERAP Main menu, select the option for disk or local work station.

2. Select a disk drive or the local work station attachment.

3. Select the option to print the report.

4. Enter the ID of the printer to receive the output and the additional output option (S) to spool the output.

   Note: The printer ID must be valid but the printer does not need to be operational.

5. Enter the desired time range.

   Note: If the selected printer is not operational, a message is sent to the system console indicating that the printer and the system are not communicating. If this occurs, use option 1 to respond to the message.

6. End ERAP and return to the Main (help) menu.

To Display the Spooled Output

1. From the Main (help) menu, select the option to perform general system activities.

2. From the SYSSESN menu, select the option to control printing (spool file).

3. On the Spool File Status display (upper half of the display), locate and record the spool ID (SP-ID) number for the procedure (PROC) ERAP.

4. From the SPOOLJOB menu (lower half of the display), select the option to control the spool writer and stop spooling to the selected printer, or select the option to hold entries and enter the spool ID. Return to the SPOOLJOB menu.

5. From the SPOOLJOB menu, select the option to copy or display entries.

6. On the COPYPRT procedure prompt, enter the spool ID (first item) and CRT (last item).

   Note: You can also copy the ERAP data to a named file, and you can cancel or release the spool entry in the same operation.

7. On the display that shows the error history table, position the cursor to the DISP START POS field and enter 70. You are now displaying the last 62 positions of the spooled output. Use the Roll keys to view entries in the table.

8. Use the Cmd7 key to return through the prompts and menus. Restart the spool writer, or release or cancel entries as you return.

Section 4. Power Procedures

405 J-Connector Locations

JAC4
(gate fan)

JAC5
(gate fan)

JAC3
(diskette drive)

JAC1
(power supply)

Rear

JAC2
(disk area fan)

JC1 (control panel)

JD1 (diskette)

JA1 (disk A)

JB1 (disk B)

JMT1

J2

J3

J4

J5

Power Supply

Front
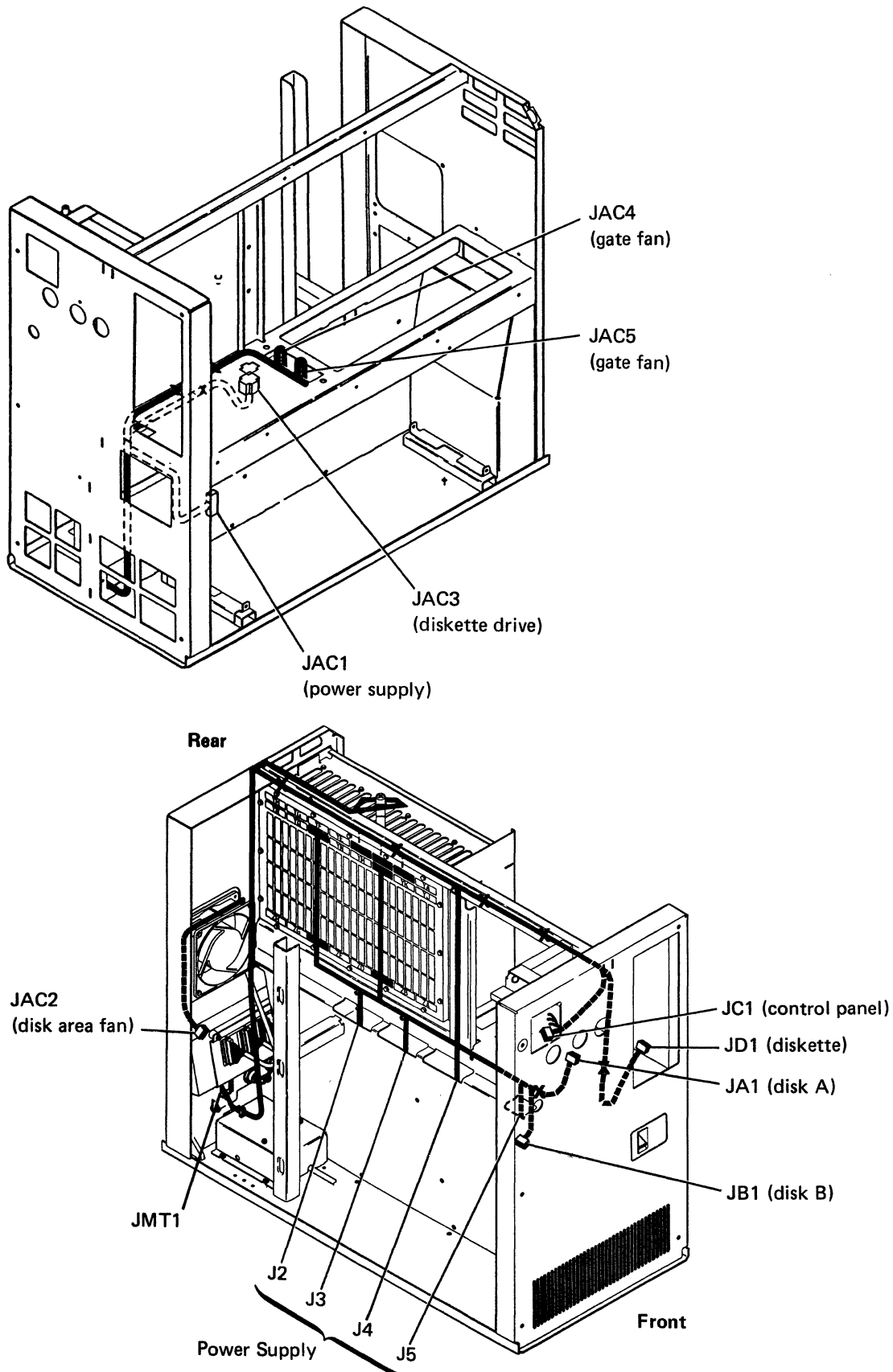
410 Power System Reference Codes

Start Conditions

This section assumes that the customer problem determination procedures have verified the following:

1. The correct voltage is available at the customer power outlet.

2. The power cord is connected to the customer power outlet and to the power cord connector.

3. The Unit Emergency switch is in the Power Enable position.

4. The Security switch is in either the Normal or the Service position.

Using the Power System Reference Codes

The customer determines power system reference codes (SRC) from the system problem determination procedures. Power SRCs are not recorded in the error history table or displayed on the control panel.

Go to the power SRC table for the reported SRC (9901 through 990C). Use the **Description** column and the % column to isolate the failing FRU.

Notes:

1. *Loose AC cable connectors can cause SRCs 9904 and 990B.*
2. *Loose DC cable connectors can cause SRCs 9907, 9908, 9909, and 990C.*
3. *All DC cable connectors have retainers. Ensure that the retainers are connected when you work on the DC cable assembly.*
4. *Unless you are instructed not to, always power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord before you remove, exchange, or install any FRU.*
5. *The following symbol means danger. When you see this symbol, remember that line voltage is present with the system powered off.*
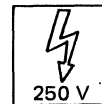
Power SRC Tables

SRC 9901: The Power On light is off. The customer circuit breaker for the system is tripped and trips when it is reset. The Unit Emergency switch is in the Power Off position (from customer problem determination procedures).

Note: *Power off and disconnect the power cord before you exchange any FRU.*

SRC	Description	FRU	%	MIM Ref
9901	A ground or a short circuit is present on one of the AC lines in the system. Disconnect the power cord. See "430 AC Point-to-Point" on page 4-15.	Line filter/AC cable assembly	66	430, 420
		Power cord	17	215
		Unit Emergency switch	17	430, 215

SRC 9902: The Power On light is off. The customer circuit breaker trips with the Unit Emergency switch in the Power Enable position but does not trip with the Unit Emergency switch in the Power Off position.

Note: *Power off and disconnect the power cord before you exchange any FRU.*

250 V

When the power cord is connected to the customer power outlet, line voltage is present with the system powered off.

SRC	Description	FRU	%	MIM Ref
9902	A ground or a short circuit is present on one of the AC lines in the system. Disconnect JAC1 from the power supply. Check for continuity between pin 8 and the frame. See "430 AC Point-to-Point" on page 4-15 and "405 J-Connector Locations" on page 4-2.	Power supply	78	430, 420
		Line filter/AC cable assembly	15	430, 420
		Unit Emergency switch	7	430, 215

SRC 9903: The Power On light is off. The customer circuit breaker trips when the Power On key is pressed.
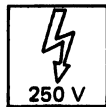
Note: Power off and disconnect the power cord before you exchange any FRU.

SRC	Description	FRU	%	MIM Ref
9903	A ground or a short circuit is present on one of the AC lines in the system. See "430 AC Point-to-Point" on page 4-15.	Power supply	50	430, 420
		Line filter/AC cable assembly	30	430, 420
		Gate fans	10	430, 420
		Diskette motor	5	430, 612
		Disk area fan	5	430, 215

SRC 9904: The Power On light is off. Customer power is correct.

Note: Power off and disconnect the power cord before you exchange any FRU.

SRC	Description	FRU	%	MIM Ref
9904	An open circuit is probably present in the AC input. Verify the start conditions ("410 Power System Reference Codes"). *Note: Loose AC cable connectors can cause this problem. The control panel also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.*	Power supply	56	430, 420
		Line filter/AC cable assembly (see note)	18	430, 420
		Control panel	10	510
		Unit Emergency switch	7	430, 215
		DC cable	5	435, 420
		Power cord	4	215

SRC 9905: The Power On light goes on when the Power On key is pressed, but does not remain on when the Power On key is released. The system does not power on.

Note: Power off and disconnect the power cord before you exchange any FRU.

SRC	Description	FRU	%	MIM Ref
9905	The control panel also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.	Power supply	79	435, 420
		DC cable	11	435, 420
		Control panel/ A-A1F2	10	510

SRC 9906: The Temp light is on. The system is powered off.

Note: Power off and disconnect the power cord before you exchange any FRU.

SRC	Description	FRU	%	MIM Ref
9906	Wait approximately 1 minute, then press the Power On key. If the system does not power on, a bad circuit, not a thermal condition, caused the temperature check.	Gate fans/disk area fan	50	430, 420
		Power supply	32	435, 420
		Thermal switch	9	435, 215
		DC cable	9	435, 420

SRC 9907: The Voltage light is on. The system is powered off.

Note: Power off and disconnect the power cord before you exchange any FRU.

SRC	Description	FRU	%	MIM Ref
9907	Either an overvoltage check or an undervoltage check is present. *Note: Loose DC cable connectors can cause this problem. The control panel also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.*	Power supply	80	435, 420
		DC cable (see note)	11	435, 420
		Control panel/ A-A1F2	9	510

SRC 9908: The Current light is on. The system is powered off.

Note: Power off and disconnect the power cord before you exchange any FRU.

250 V

When the power cord is connected to the customer power outlet, line voltage is present with the system powered off.

SRC	Description	FRU	%	MIM Ref
9908	An overcurrent check is present. The cause is probably in the load. With the power cord still connected, perform the following steps, one at a time, and press the Power On key after each step. 1. Disconnect JA1 and JB1 ("405 J-Connector Locations" on page 4-2). **CAUTION** **Do not reconnect JA1 and JB1 after pressing the Power On key. If you remove cards in step 3 and then power on, the disk drives will be damaged.** . . . . 2. Disconnect JD1 ("405 J-Connector Locations" on page 4-2). 3. Remove five cards from the A-A1 board. If the system will not power on, reinstall these cards and remove five more cards. Continue isolating FRUs until the system will power on. When you have isolated the failing FRU, reconnect the cables and ensure that all the cards are reinstalled. *Note: Loose DC cable connectors can cause this problem. The control panel also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.*	A-A1 cards (A-X)	34	220
		Power supply	22	435, 420
		Disk drive cards	13	435, 804
		Diskette drive control card	8	435, 610
		Control panel/ A-A1F2	8	510
		DC cable (see note)	7	435, 420
		A-A1 board	4	215
		Disk A/B power/driver cable	4	435, 804

SRC 9909: The Voltage and Current lights are on. The system is powered off.

Note: *Power off and disconnect the power cord before you exchange any FRU.*

250 V

When the power cord is connected to the customer power outlet, line voltage is present with the system powered off.

SRC	Description	FRU	%	MIM Ref
9909	An overcurrent check is present. The cause is probably in the A-A1 board (+1.7-volt load only). With the power cord still connected, remove five cards from the A-A1 board and press the Power On key. If the system will not power on, reinstall these cards and remove five more cards. Continue isolating FRUs until the system will power on. *Note:* *Loose DC cable connectors can cause this problem.*	A-A1 cards (A-X) Power supply DC cable (see note) A-A1 board	46 38 12 4	220 435, 420 435, 420 215

SRC 990A: The system will not power off.

Note: *Set the Unit Emergency switch to the Power Off position and disconnect the power cord before you exchange any FRU.*

SRC	Description	FRU	%	MIM Ref
990A	The control panel or A-A1F2 also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.	Power supply Control panel/ A-A1F2 DC cable	78 12 10	435, 420 510 435, 420

SRC 990B: An obvious power or mechanical
problem is present; a fan or motor is not operating
or is noisy.

*Note: Power off and disconnect the power cord before
you exchange any FRU.*

SRC	Description	FRU	%	MIM Ref
990B	If only one fan or motor is failing, suspect that device. If all fans and motors are failing, suspect the power supply or the line filter/AC cable assembly. *Note: Loose AC cable connectors can cause this problem.*	Power supply	53	430, 420
		Line filter/AC cable assembly (see note)	27	430, 420
		Gate fans	10	430, 420
		Diskette motor	5	430, 612
		Disk area fan	5	430, 215

SRC 990C: A problem relative to power is present,
but SRCs 9901 through 990B do not describe the
problem.

*Note: Power off and disconnect the power cord before
you exchange any FRU.*

SRC	Description	FRU	%	MIM Ref
990C	If the Temp, Voltage, or Current light is on and the system is not powered off, go to "505 Control Panel Symptom Table" on page 5-2. *Note: Loose DC cable connectors can cause this problem. The control panel or A-A1F2 also can cause this problem. See "505 Control Panel Symptom Table" on page 5-2.*	Power supply	64	435, 420
		Control panel/ A-A1F2	20	510
		DC cable (see note)	16	435, 420

415 DC Voltage Missing on Devices

When a DC voltage is missing on a device, use the table below to isolate the failing FRU.

Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord before you remove, exchange, or install any FRU.

Device	FRU	%	MIM Ref
A-A1 board, control panel, diskette drive, or disk drive	DC cable (see note)	55	420, 435
	Power supply	45	420, 435
Note: *Loose DC cable connectors can cause this problem.*			

420 Power FRU Removals

Power Supply

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord at the customer power outlet.

2. Disconnect the following ("405 J-Connector Locations" on page 4-2):

   a. JAC1
   b. J2
   c. J3
   d. J4
   e. J5

3. Remove the four screws that attach the power supply to the frame.

4. Slide the power supply out of the system.

Note: When you reconnect J2, J3, J4, and J5, ensure that they are correctly aligned with the power supply pins.

Line Filter/AC Cable Assembly

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord at the customer power outlet and at the power cord connector.

2. Disconnect the following ("405 J-Connector Locations" on page 4-2):

   a. JAC2
   b. JAC1
   c. JAC3
   d. JAC4
   e. JAC5
   f. The wires to the Unit Emergency switch

3. Remove the power supply ("420 Power FRU Removals").

4. Use a screwdriver to compress the two tabs that hold JAC3 in the frame and push JAC3 out of the frame.

5. Remove the clamps that attach the AC cable assembly to the frame.

6. Remove the six screws that attach the AC safety ground wires to the frame.

7. Remove the two screws that attach the line filter/AC cable assembly to the frame.

8. Observe the path of the AC cable assembly to aid in installing the new cable.

9. Slide out and lift up the line filter/AC cable assembly. The tabs on the bottom of the line filter should be straight for easy removal and installation.

DC Cable Assembly

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord at the customer power outlet.

2. Disconnect the following ("220 Board Locations" on page 2-7 and "405 J-Connector Locations" on page 4-2):

   a. ZA (for access to the DC cable if two-disk system)
   b. YP
   c. YL
   d. YD
   e. YC
   f. YB
   g. ZF
   h. ZC
   i. J2
   j. J3
   k. J4
   l. J5
   m. JA1
   n. JB1 (if two-disk system)

3. Remove the control panel ("510 Control Panel Removal" on page 5-10). Keep the control panel for reinstallation after the new DC cable is installed.

4. Disconnect the following:

   a. JD1
   b. The wires to the Thermal switch

5. From outside the system, use a screwdriver to compress the four tabs that hold JMT1 to the cable tower and push JMT1 into the system.

6. Observe the path of the DC cable assembly to aid in installing the new cable, then use a screwdriver to pry out the following clamps:

   a. Two clamps above the gate area
   b. Two clamps above the diskette drive
   c. One clamp below the diskette drive
   d. One clamp on the front cover

   Note: *Clamps are included with the new DC cable assembly.*

7. Remove the DC cable assembly.

Notes:

1. *All DC cable connectors have retainers. When you reconnect DC cable connectors, ensure that you connect the retainers correctly.*
2. *When you reconnect J2, J3, J4, and J5, ensure that they are correctly aligned with the power supply pins.*
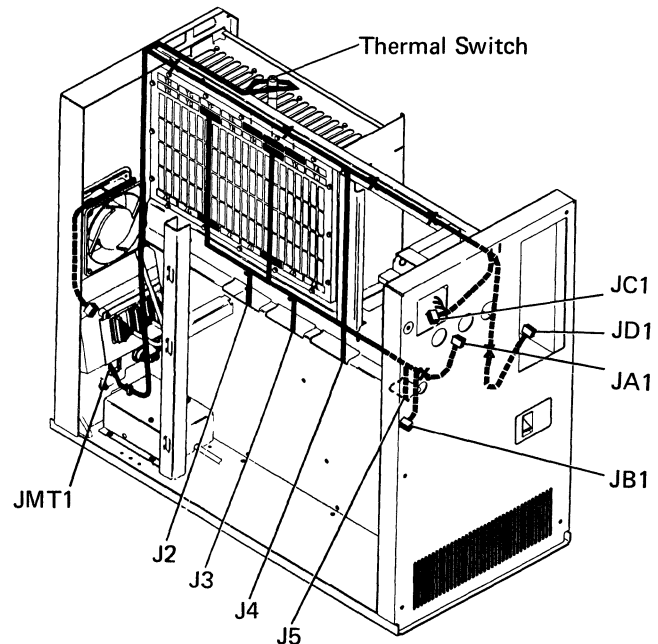
Gate Fan Assembly

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord at the customer power outlet.

2. Disconnect the following ("405 J-Connector Locations" on page 4-2):

   a. JAC4
   b. JAC5

3. Remove the two screws that attach the front of the gate fan assembly to the base (near JAC4 and JAC5).

4. Remove the two screws that attach the rear of the gate fan assembly to the base.

5. Slide the gate fan assembly out the rear of the system.

To reinstall the gate fan assembly, perform the following:

1. Slide the gate fan assembly into the system.

2. Install the two rear screws but do not tighten them.

3. Connect JAC4 and JAC5.

4. Install the two front screws but do not tighten them.

   Note: If necessary, lift the AC cable at JAC4 and JAC5 when you install the screws.

5. Lift the rear of the gate fan assembly and tighten the two rear screws.

6. Tighten the two front screws.

425 Power Point-to-Point Overview

Use this overview, "430 AC Point-to-Point" on page 4-15, and "435 DC Point-to-Point" on page 4-16 to determine point-to-point power flow.

```
                                    ┌──────────────────┐              ┌──────────────────┐
                                    │  Thermal Switch  │              │   A-A1 Board     │
                                    │                  │              │ YD               │
                                    └────────┬─────────┘              │ YL               │
                                             │                        │ YP               │
                                             │                        │ ZC               │
 Power    ┌──────────────┐  ┌──────────────┐ │  ┌───────────────┐     │ ZF               │
 Cord     │ Line Filter/AC│  │Unit Emergency│ │  │ Power Supply  │     └──────────────────┘
──────────│ Cable Assembly│──│ Switch       │────│              │
          │              │  │              │    │ JAC1      J2 │     ┌──────────────────┐
          └──────────────┘  └──────────────┘    │           J3 │     │  Disk Drive A    │
                                                │           J4 │     │                  │
                                                │           J5 │     │ JA1              │
                                                └──────┬───────┘     └──────────────────┘
                                                       │
                                             ┌─────────────────┐     ┌──────────────────┐
                                             │  Disk Area Fan  │     │  Disk Drive B    │
                                             │                 │     │                  │
                                             │  JAC2           │     │ JB1              │
                                             └─────────────────┘     └──────────────────┘

                                             ┌─────────────────┐     ┌──────────────────┐
                                             │  Diskette       │     │  Control Panel   │
                                             │  Drive Motor    │     │                  │
                                             │  JAC3           │     │ JC1              │
                                             └─────────────────┘     └──────────────────┘

                                             ┌─────────────────┐     ┌──────────────────┐
                                             │  Gate Fans      │     │  Diskette Drive  │
                                             │  JAC4           │     │                  │
                                             │  JAC5           │     │ JD1              │
                                             └─────────────────┘     └──────────────────┘
```
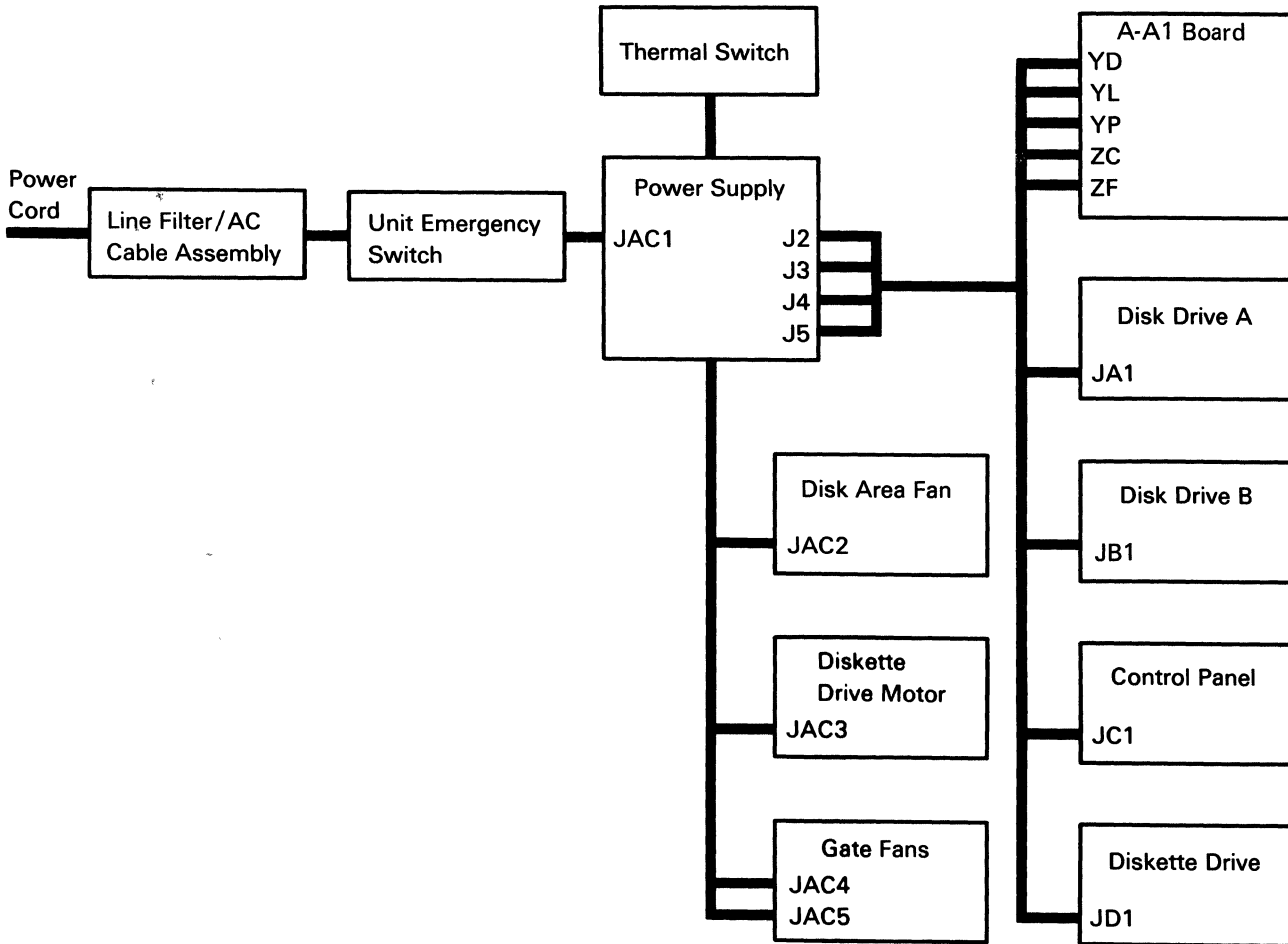
430 AC Point-to-Point

All J-connectors on this page have green and
yellow wires that are AC safety grounds. All AC
safety grounds must be installed correctly. See
Appendix A, "AC Safety Grounds" on page A-1
and "405 J-Connector Locations" on page 4-2.

Legend:

rh   Chassis Ground

⏚   Frame or System Ground
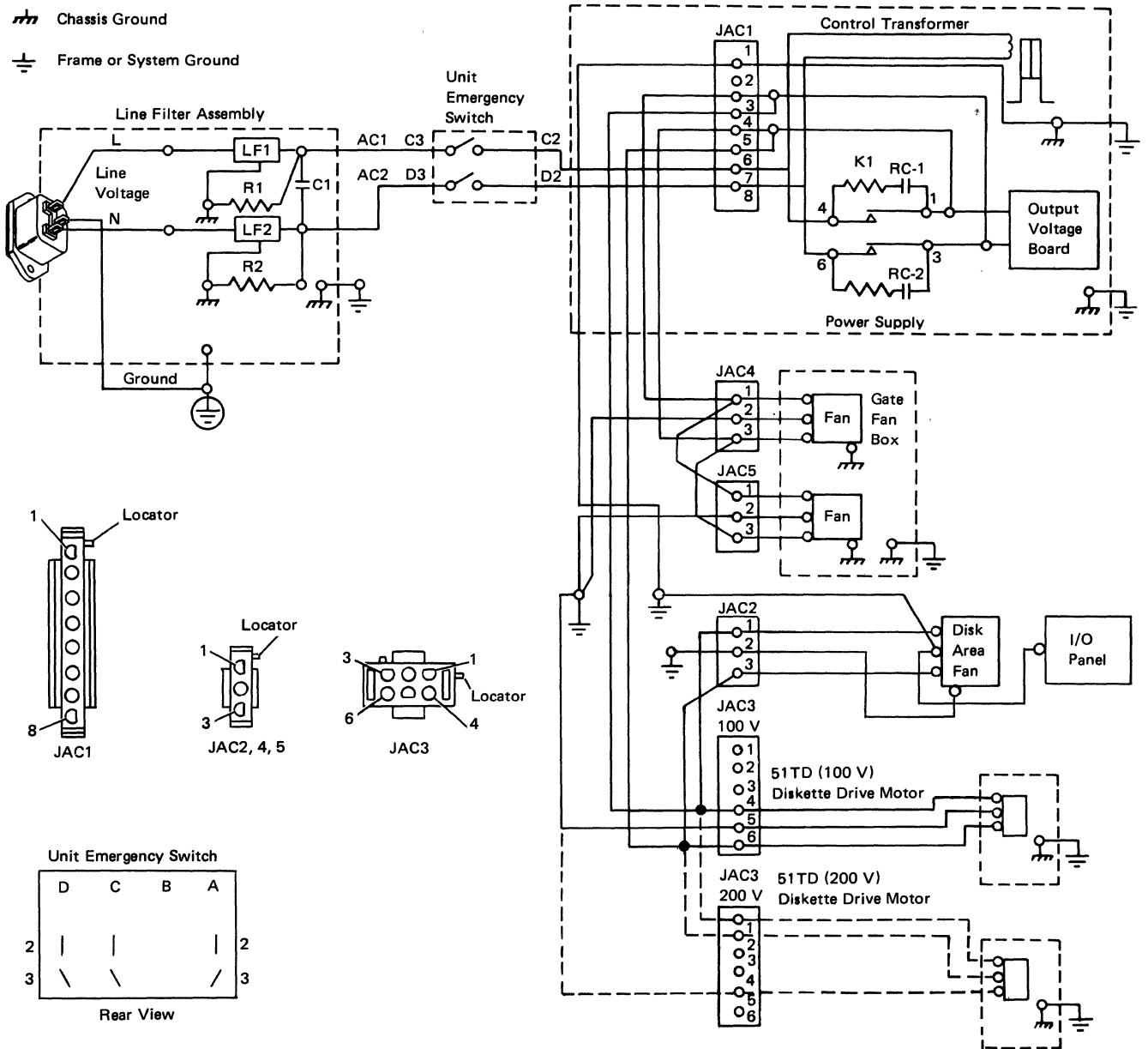
435 DC Point-to-Point

Device		System Voltage	Power Supply	
Connector	Pin		Connector	Pin
JA1 (disk drive A)	1	Ground	J3	A13, B13
	2			A12, B12
	3			A11, B11
	4			A10, B10
	5			A09, B09
	6	+5 Vdc	J4	A18, B18
	7			A17, B17
	8			A16, B16
	9	-5 Vdc		A07, B08
	10	+24 Vdc		A03, B03
	11			A02
JB1 (disk drive B)	1	Ground	J3	A08, B08
	2			A07, B07
	3			A06, B06
	4			A05, B05
	5			A04, B04
	6	+5 Vdc	J4	A15, B15
	7			A14, B14
	8			A13, B13
	9	-5 Vdc		B07, B10
	10	+24 Vdc		A01, B02
	11			B01
JC1 (control panel)	A14	+5 Vdc control	J5	A01
	A15	Ground	J3	A03
	A16	+5 Vdc	J4	A12
	B15	Ground	J3	B03
	B16	+5 Vdc	J4	B12
Security switch	3	Ground	J5	A04
JD1 (diskette drive)	A01	-5 Vdc	J4	A08
	A02	Ground	J3	A02
	A03			B02
	A12			A01
	B01	+5 Vdc	J4	A11
	B03	+24 Vdc		A04

JA1, JB1

JC1

JD1

J3, J4, J5
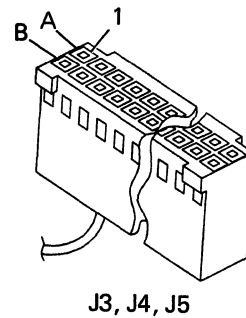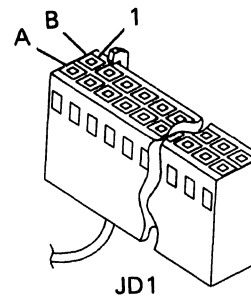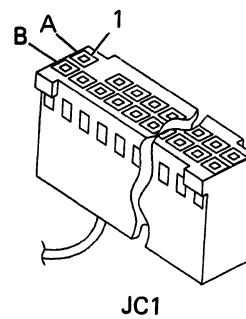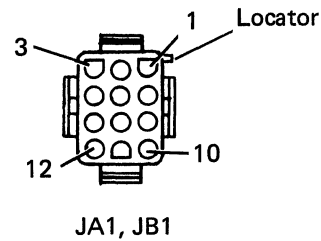
Device			Power Supply	
Connector	Pin	System Voltage	Connector	Pin
JMT1	1	Ground	J3	B01
YD	B13	+1.7 Vdc remote sense ground	J2	A25
	D13	+1.7 Vdc remote sense		B25
YL	B02	Ground	J2	B03
	B03			A02
	B04			B02
	B05			A01
	B06			B01
	B07		J3	A16
	B08			B16
	B09			A15
	B10			B15
	B11			A14
	B12			B14
	D02	+1.7 Vdc	J2	B17
	D03			A16
	D04			B16
	D05			A15
	D06			B15
	D07	+5 Vdc	J4	A24
	D08			B24
	D09			A23
	D10			B23
	D11			A22
	D12			B22
	D13			B25
YP	B02	Ground	J2	A05
	B03			B05
	B04			A04
	B05			B04
	B06			A03
	B07		J3	A19
	B08			B19
	B09			A18
	B10			B18
	B11			A17

JMT1

YD, YL, YP

J2, J3, J4
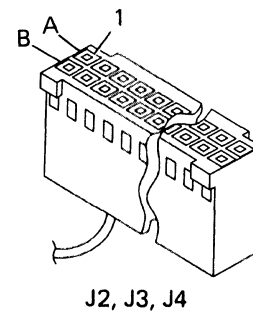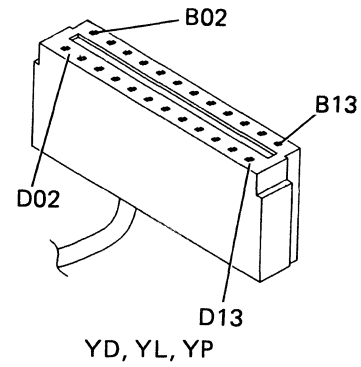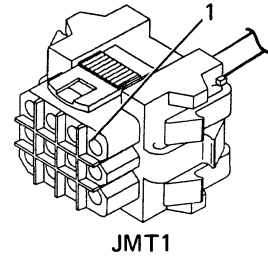
Device		System Voltage	Power Supply	
Connector	Pin		Connector	Pin
YP	B12	Ground	J3	B17
	B13	+8.5 Vdc	J4	B06
	D02	+1.7 Vdc	J2	A19
	D03			B19
	D04			A18
	D05			B18
	D06			A17
	D07	+5 Vdc	J4	A21
	D08			B21
	D09			A20
	D10			B20
	D11			A19
	D12			B19
	D13	+8.5 Vdc		A06
ZC	B02	+1.7 Vdc	J2	B22
	B03			A21
	B04			B21
	B05			A20
	B06			B20
	B07			A22
	B08	+5 Vdc	J4	B30
	B09			A29
	B10			B29
	B11			A28
	B12			B28
	B13			A30
	D02	Ground	J2	B08
	D03			A07
	D04			B07
	D05			A06
	D06			B06
	D07		J3	A22
	D08			B22
	D09			A21
	D10			B21
	D11			A20
	D12			B20
	D13		J2	B10

YP, ZC

J2, J3, J4
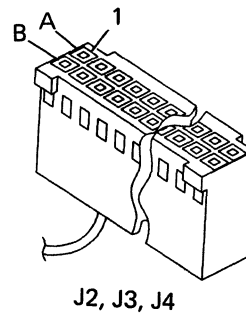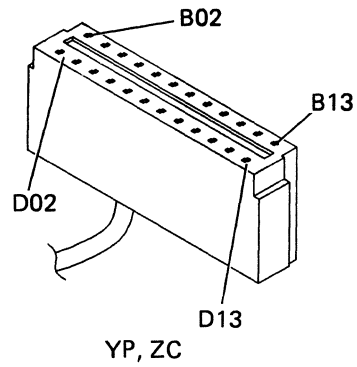
Device		System Voltage	Power Supply	
Connector	Pin		Connector	Pin
ZF	B02	+1.7 Vdc	J2	A24
	B03			B24
	B04			A23
	B05			B23
	B06	+5 Vdc	J4	A25
	B07			A27
	B08			B27
	B09			A26
	B10			B26
	B12	-12 Vdc		A05
	B13			B05
	D02	-5 Vdc		A09
	D03			B09
	D04	Ground	J2	A09
	D05			B09
	D06			A08
	D07		J3	A25
	D08			B25
	D09			A24
	D10			B24
	D11			A23
	D12			B23
	D13		J2	A10
Thermal switch		+Thermal switch	J5	B01
		Thermal switch ground		B06

ZF

J2, J3, J4, J5
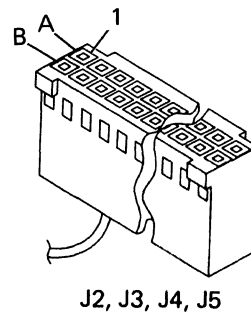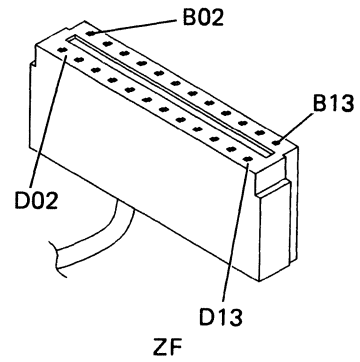
Section 5. Control Panel Procedures

505 Control Panel Symptom Table

Symptom	Information	Action
The system will not function.		Go to "507 Control Panel Service Check" on page 5-4.
The Temp, Voltage, or Current light is on, and the system is not powered off.		Go to "507 Control Panel Service Check" on page 5-4.
A system power problem is present.		Go to "507 Control Panel Service Check" on page 5-4.

The Console, Program, and Processor lights are all on.	The control panel interface card failed the self-test.	Perform the following:
		
		1. Exchange the following FRUs, one at a time, in this sequence:
		
		   a. A-A1F2
		   b. A-A1G2
		
		2. Load the system from disk ("330 Loading the DCP from Disk" on page 3-10) or diskette 3 ("332 Loading the DCP from Diskette" on page 3-10) to verify the repair.
		
		Note: If the Console, Program, and Processor lights are still on after performing steps 1 and 2, go to "Procedure 155" on page 1-12.

The control panel does not operate correctly.	The control panel and the control panel interface card are not communicating.	Go to "507 Control Panel Service Check" on page 5-4.

Symptom	Information	Action
The control panel is not operating, and the system appears to be stopped.	The CSP can be in a program loop while performing a control panel instruction.	Perform the following to stop the program loop: 1. Set the Unit Emergency switch to the Power Off position. 2. Wait 5 to 10 seconds. 3. Set the Unit Emergency switch to the Power Enable position. 4. Load the system from disk and run SYSTEST (see "328 Service Procedures under SSP" on page 3-7) to verify correct operation.

507 Control Panel Service Check

Notes:

1. *Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord before exchanging FRUs.*
2. *This service check needs a dedicated system. Ensure that the customer has ended all jobs and closed all files.*
3. *When this service check tells you to exchange the control panel, see "510 Control Panel Removal" on page 5-10.*
4. *Perform this service check to verify any repair.*

This service check tests the following control panel functions:

1. Power off/power on

2. Security switch

3. Lamp test

4. Select Function key/Input key

5. Display key

You must perform this service check in the sequence listed.

1. **Power Off/Power On Test**

   a. Set the Security switch to the Service position.

      If the system is powered on, continue with step 1b. If the system is powered off, go to step 1d.

   b. If the Function display shows a 1, continue with step 1c. If not, go to step 1g.

   c. Press the Select Function key, select function 6 (Power Off), then press the Start Function key.

      Note: While the system is powering off (it takes approximately 20 seconds), the Function display flashes with the selected function (6).

      If the system powers off after 20 seconds, continue with step 1d. If you cannot select or start function 6, or if the system does not power off after 20 seconds, go to step 1f.

   d. Ensure that the Unit Emergency switch is in the Power Enable position. Press and hold the Power On key.

      If the Power On light goes on, continue with step 1e. If the Power On light does not go on, record a power SRC of 9904. Suspect the following FRUs:

%	FRU
56	Power supply
18	Line filter/AC cable assembly
10	Control panel
7	Unit Emergency switch
5	DC cable assembly
4	Power cord

e. Release the Power On key.

If the Power On light remains on, go to step 2. If the Power On light goes off when you release the Power On key, record a power SRC of 9905 and go to step 1h.

CAUTION
Customer data can be lost if jobs are not ended and files are not closed before powering off with the Unit Emergency switch.

. . . .

. . . .

. . . .

. . . .

. . . .

f. Set the Unit Emergency switch to the Power Off position.

If the system powers off, continue with step 1g. If the system does not power off, record a power SRC of 990A and go to step 1h.

g. The control panel is not operating correctly. Suspect the following FRUs:

%	FRU
70	Control panel
25	A-A1F2
5	DC cable assembly

h. Suspect the following FRUs:

%	FRU
80	Power supply
20	DC cable assembly

2. Security Switch Test

a. Set the Security switch to the Normal position. If the Power On light is the only light or display that is on, go to step 3. If not, find the control panel lights that are on in the table below and go to the indicated step.

Control Panel Lights On	Go to Step
Console, Program, and Processor	2b
Console	2c
Program	.2c
Processor	2c
Temp, Voltage, Current, and Diskette In Use	2c
Temp	2d
Voltage	2d
Current	2d
Diskette In Use	2e
Displays	2c

b. Suspect the following FRU:

%	FRU
99	A-A1F2

c. Suspect the following FRUs:

%	FRU
75	Control panel
20	A-A1F2
5	DC cable assembly

d. Record a power SRC of 990C. Suspect the following FRUs:

%	FRU
70	Power supply
15	Control panel
10	DC cable assembly
5	Thermal switch (only if Temp light is on)

e. Suspect the following FRUs:

%	FRU
75	A-A1D2
20	Control panel
5	DC cable assembly

3. **Lamp Test**

a. Set the Security switch to the Service position. Press the Select Function key and select function 8 (Lamp Test). Then, press the Start Function key.

   If all of the control panel lights go on and an 8 appears in all of the displays, the control panel is correct. Continue with step 3b. If the control panel is not correct, go to step 6.

   If you cannot select and start function 8, suspect the following FRUs:

%	FRU
85	Control panel
10	DC cable assembly
5	A-A1F2

b. Press the Start Function key several times.

   If only the 8 in the Function display blinks, the control panel is correct. Continue with step 4. If the 8s in the Input displays blink, the control panel is not correct. Suspect the following FRUs:

%	FRU
85	Control panel
10	DC cable assembly
5	A-A1F2

4. **Select Function Key/Input Key Test**

a. Press the Select Function key and select function 1 (IPL).

   If a 1 appears in the Function display and 0s appear in the Input displays, the control panel is correct. Continue with step 4b. If the control panel is not correct, go to step 4d.

b. Press and hold the Select Function key. Repeat several times.

   If only the Function display loops characters 1 through E, the control panel is correct. Continue with step 4c. If the control panel is not correct, go to step 4d.

c. Press the Select Function key and select function 1 (IPL). Press and hold, in sequence, each of the four Input keys. Repeat several times.

   If only the Input display above the Input key you press loops characters 0 through F, the control panel is correct. Go to step 5. If the control panel is not correct, continue with step 4d.

d. The control panel is not operating correctly. Suspect the following FRUs:

%	FRU
70	Control panel
25	A-A1F2
5	DC cable assembly

5. **Display Key Test**

   a. Press the Select Function key and select function A (Communication Line Status).

      If the Input display is blank except for a 1 in the rightmost position, the control panel is correct. Continue with step 5b. If the control panel is not correct, suspect the following FRU:

%	FRU
99	A-A1F2

   b. Press the Display key.

      Note: If one or more communications lines are installed, it is normal for one or more bars to appear in the display.

      If the Output Display light goes on, continue with step 5c. If the Output Display light does not go on, go to step 5d.

   c. Press the Display key again.

      If the Output Display light goes off, go to step 5e. If the Output Display light does not go off, continue with step 5d.

   d. The control panel is not operating correctly. Suspect the following FRUs:

%	FRU
85	Control panel
10	DC cable assembly
5	A-A1F2

   e. Set the Security switch to the Normal position (only the Power On light is on). Press each of the four Input keys and the Display key several times.

      If the control panel does not change, go to "105 System Entry Procedure" on page 1-2. If the control panel changes in any way, or if the Power On light was not the only light on, suspect the following FRUs:

%	FRU
85	Control panel
10	DC cable assembly
5	A-A1F2

6. **Lamp Test Failed**

   a. Find the lamp test failure in the table below and go to the indicated step.

Lamp Test Failure	Go to Step
Blank panel (power on only)	6b
8 is in the Function display only.	6b
Only the Diskette In Use light is not on.	6c
One or more of the Temp, Voltage, and Current lights are not on.	6d
Only the Temp, Voltage, Current, and Diskette In Use lights are not on.	6b
One or more Input displays do not show an 8.	6e
One or more of the Console, Program, and Processor lights are not on.	6b
The failure is not in this list.	6e

   b. Suspect the following FRUs:

%	FRU
75	A-A1F2
20	Control panel
5	DC cable assembly

   c. Suspect the following FRUs:

%	FRU
75	A-A1D2
20	Control panel
5	DC cable assembly

   d. Record a power SRC of 990C. Suspect the following FRUs:

%	FRU
70	Power supply
15	Control panel
15	DC cable assembly

   e. Suspect the following FRUs:

%	FRU
80	Control panel
15	DC cable assembly
5	A-A1F2

510 Control Panel Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord at the customer power outlet.

2. Support the control panel from the front of the system. Remove the two mounting screws **A** that attach the control panel to the front cover. You can reach the screws from inside the system through two holes in the front frame.

   Note: Do not let the two screws fall between the front cover and the frame. If they fall into this area, you will have to remove the front cover to reach them.

3. Remove the control panel from the front cover by moving the bottom of the panel out while pulling down lightly on the panel.

4. Disconnect the three wires to the Security switch **B**:

   > Red wire to position 1
   > White wire to position 3
   > Black wire to position 5

5. Carefully lift each of the two latches on the bottom of the bezel. Lift each latch only enough to release the bottom of the control panel, then remove the bezel.

6. Disconnect JC1 ("405 J-Connector Locations" on page 4-2).

To reinstall the bezel to the control panel, perform the following:

1. Reconnect JC1.

2. Insert the top of the control panel into the bezel.

3. Move the bottom of the control panel into the bezel to a point just before the latches engage.

4. Ensure that the lights and keys are centered in the holes in the bezel.

5. Push on the bottom of the control panel until the latches engage.
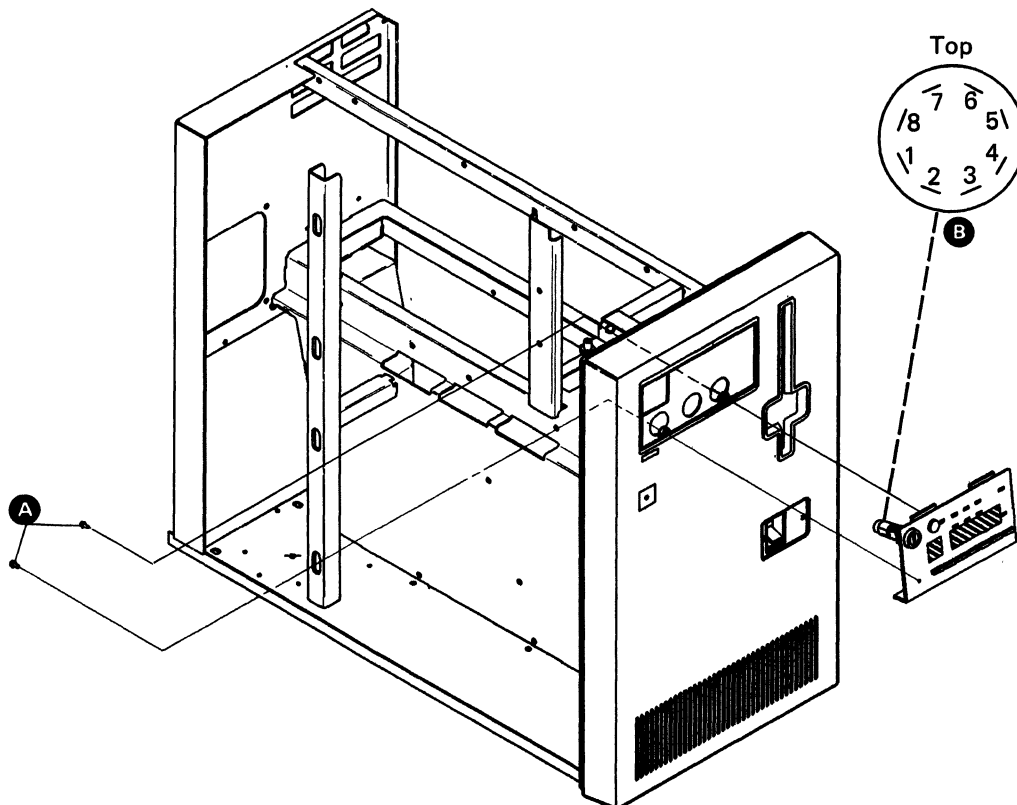
Section 6. Diskette Procedures

602 Isolating Diskette Drive Problems

Before using the following symptom table:

- Ensure that customer problem determination has been run.

- Ensure that the attachment signal cable is seated correctly.

- Ensure that no foreign material is in the diskette drive or on the diskette being used.

Symptom	Failing FRU
Diskette not turning	Drive belt damaged or off the pulley ("608 Drive Belt Removal" on page 6-5). Drive motor, capacitor, or AC voltage to drive motor. • Check to see if the voltage on drive motor connector pins 4 and 6 (pins 1 and 2 for World Trade) is 100 Vac (200 Vac for World Trade). • If the voltage is not correct, go to "410 Power System Reference Codes" on page 4-3. (See SRC 990B.) • If the voltage is correct, exchange the drive motor ("612 AC Drive Motor Assembly Removal" on page 6-6) or the capacitor ("616 Capacitor Removal" on page 6-8).
Diskette read, write, or seek failure	See "604 Voltage Check" on page 6-3 to determine the failing FRU.

Notes:

1. *When a separate replacement procedure is not given, reverse the removal procedure to install the FRU.*
2. *Always run SYSTEST to verify machine operation after a FRU is removed ("328 Service Procedures under SSP" on page 3-7).*
3. *Radio frequency interference (RFI) may cause errors on the diskette drive when the system covers are removed.*

604 Voltage Check

The system supplies DC voltage to the diskette drive through connector JD1. JD1 connects to the drive control card through the I/O connector pins (I/O CP) **E**. In World Trade countries, remove the ESD protection shield before verifying the voltages. Use a multimeter to verify the voltages.

If the voltages are missing or not correct, go to "425 Power Point-to-Point Overview" on page 4-14.

If the voltages are correct, exchange the drive control card ("610 Drive Control Card Removal" on page 6-5) or the diskette drive ("606 Diskette Drive Removal" on page 6-4).

Voltage	Test Point	I/O CP **E**
Ground	TPA-7 **B**	A02 A03 A12
24 Vdc ±2.4 V	TPB-1 **C**	B03
+5 Vdc ±0.5 V	TPA-9 **A**	B01
-5 Vdc ±0.5 V	TPC-3 **D**	A01
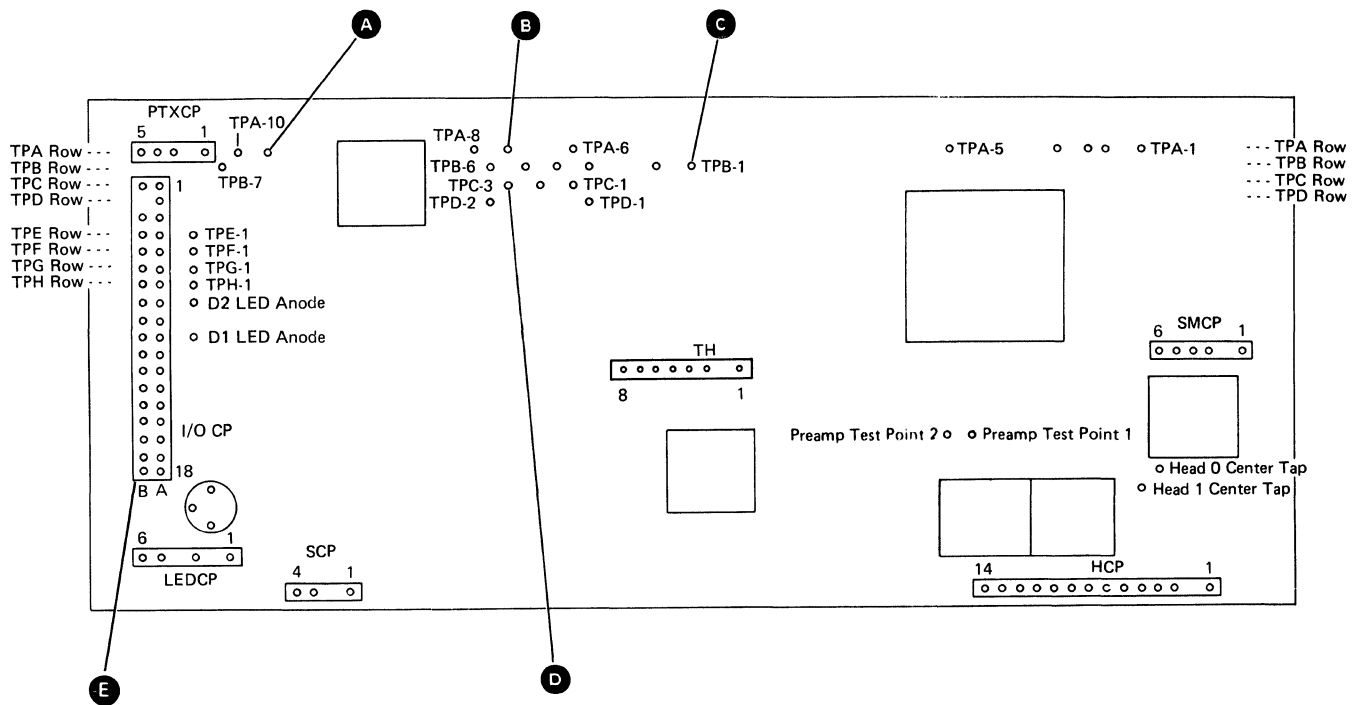
606 Diskette Drive Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

DANGER
Voltage may still be present at JAC3 when the power cord is disconnected.

. . . .

. . . .

. . . .

2. Disconnect JAC3 **B**.

3. Close the diskette locking lever **A**.

4. Remove the two rear mounting screws **C** from the diskette drive mounting bracket.

5. Loosen the two front mounting screws **E** on the diskette drive mounting bracket.

6. Remove the ESD protection shield **F** (World Trade only).

DANGER
The AC drive motor case may be hot.

. . . .

. . . .

7. Slide the diskette drive and mounting bracket to the rear and disconnect·JD1 **D**. Do not damage the cable retainer on the bottom of JD1.

8. Remove the diskette drive by sliding the rear of the unit outward, then toward the rear of the system.

9. Remove the mounting bracket (four screws) from the diskette drive and install the bracket on the new diskette drive.

Note: *Verify that the diskette locking lever will open and close before installing the system covers.*
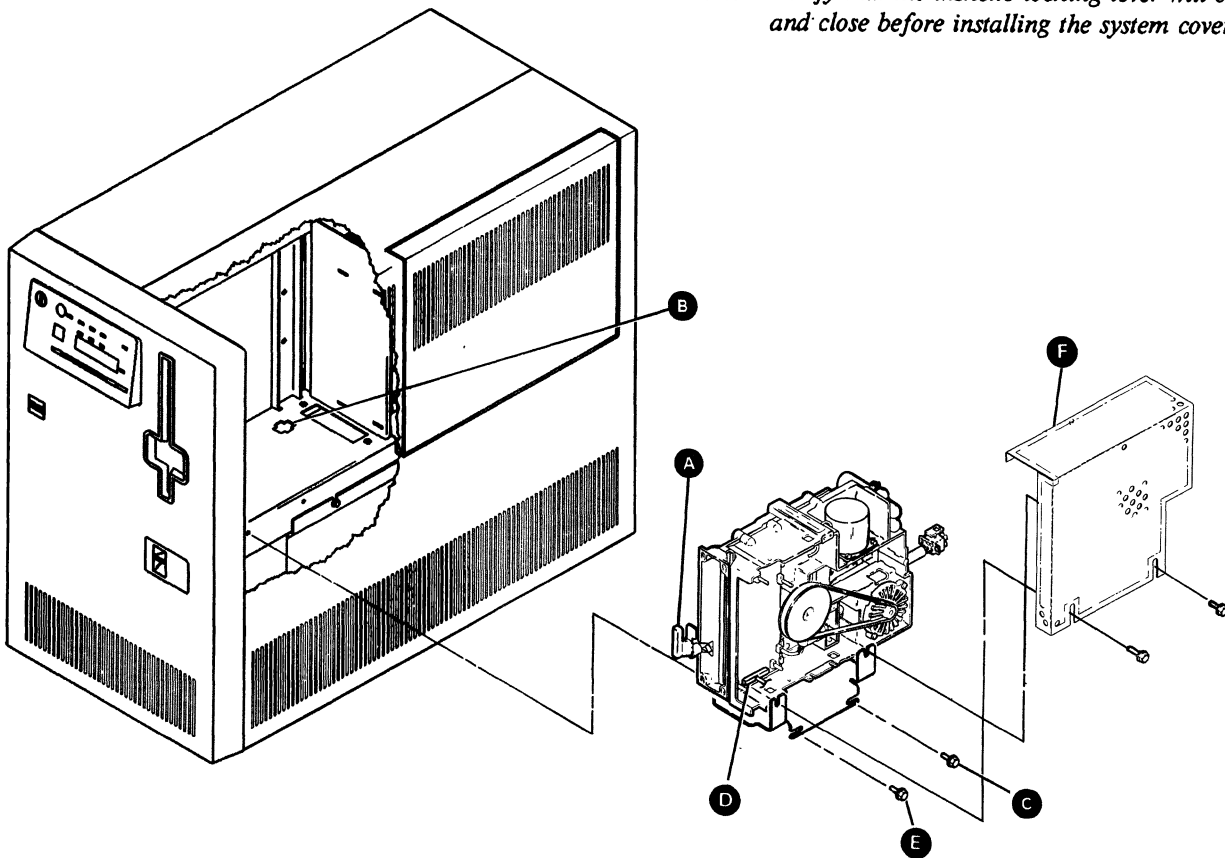
608 Drive Belt Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ESD protection shield **E** (World Trade only).

3. Remove the drive belt **A**.
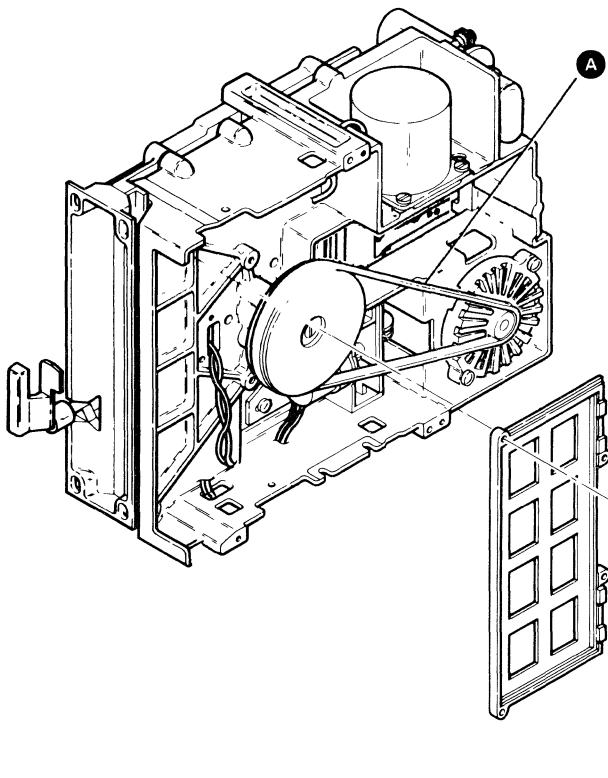
610 Drive Control Card Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the diskette drive ("606 Diskette Drive Removal" on page 6-4).

3. Remove the ESD protection shield **E** (World Trade only).

4. Remove the six connectors **D** from the control card.

5. Loosen the two retainer screws **C** and turn the two retainers **B** outward until they are no longer in the path of the control card.

6. Remove the control card.
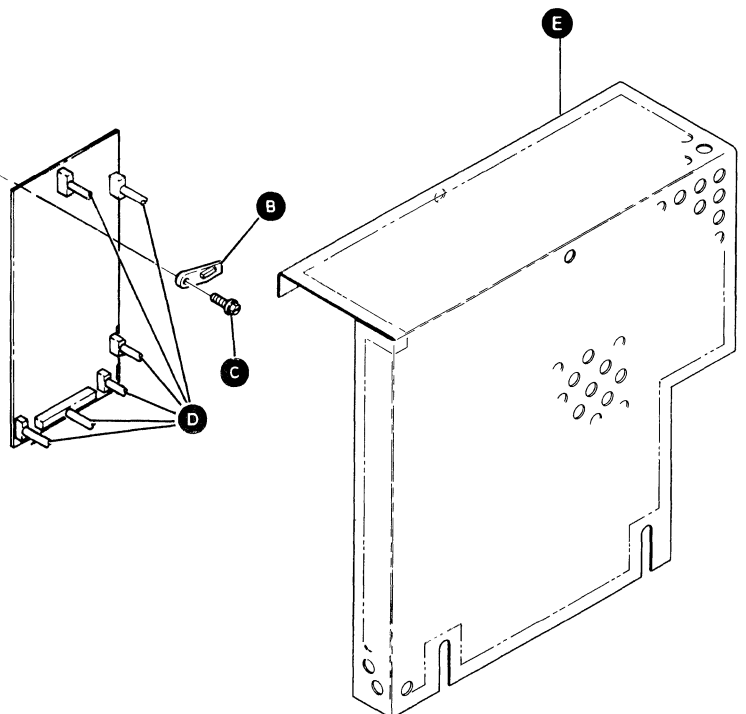
612 AC Drive Motor Assembly Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ESD protection shield 🔵 (World Trade only)

DANGER
Voltage may still be present at JAC3 and the capacitor terminals when the power cord is disconnected.

. . . .

. . . .

. . . .

. . . .

3. Disconnect JAC3 🔵.

4. Remove the drive belt 🔵.

5. Remove the capacitor insulator 🔵 from the capacitor terminals.

6. Discharge the capacitor by jumpering its terminals 🔵 with a large screwdriver.

7. Remove the leads from the capacitor terminals.

8. Remove the motor leads from the cable guide on the casting.

9. Remove the capacitor insulator 🔵 from the motor leads.

DANGER
The AC drive motor case may be hot.

. . . .

. . . .

10. Remove the four drive motor mounting screws 🔵 and remove the motor 🔵 and the fan enclosure 🔵.

11. Loosen the drive pulley/fan locking setscrew 🔵 and remove the pulley/fan assembly.
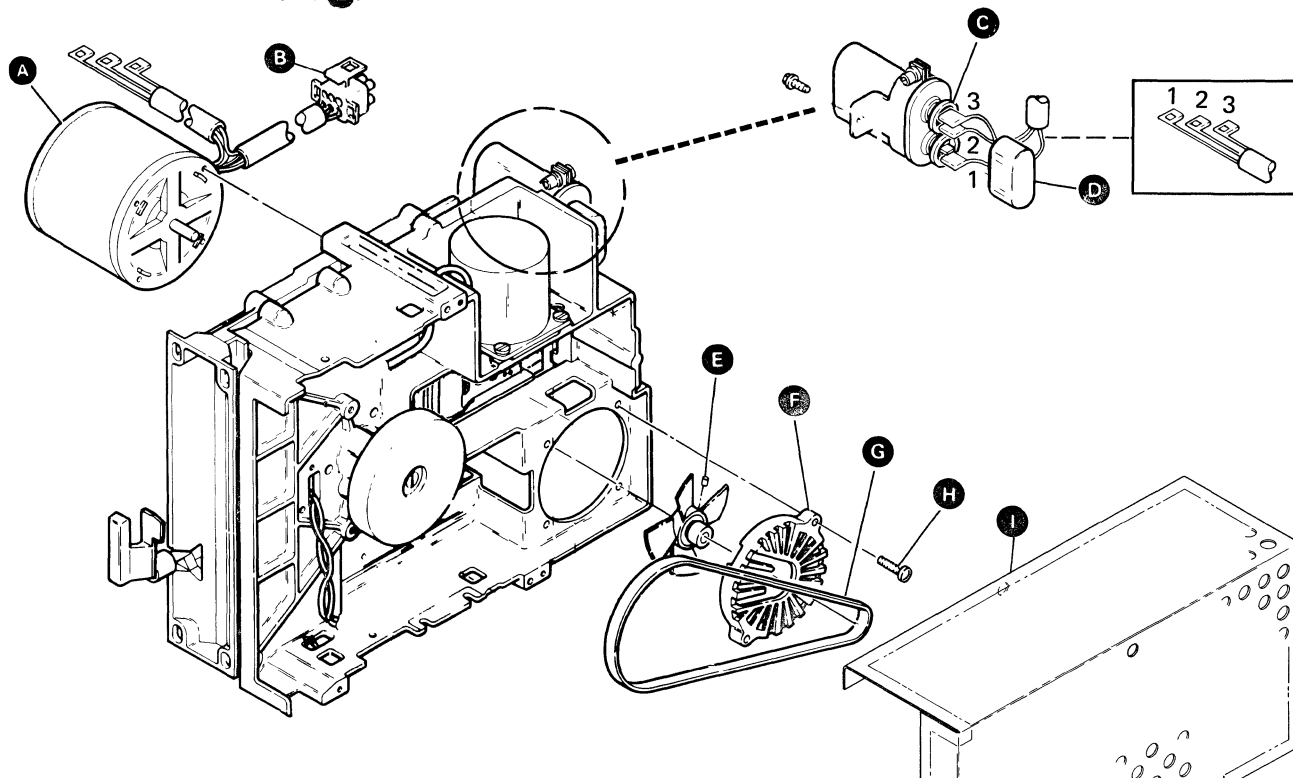
614 AC Drive Motor Assembly Replacement

1. Install the pulley/fan assembly on the new motor. Center the setscrew **E** on the flat surface of the motor shaft. Do not tighten the setscrew.

2. Locate the pulley/fan assembly on the motor shaft with a gap of 0.5 millimeter (0.020 inch) between the motor face and the pulley/fan hub. Tighten the setscrew.

3. Install the AC drive motor **A** and the fan enclosure **F** with the four mounting screws **H**. Ensure that the motor leads extend toward the rear of the diskette drive and that the belt slots in the fan enclosure are aligned with the drive hub.

4. Install the drive belt **G**.

5. Install the capacitor insulator **D** on the motor capacitor leads.

6. Reconnect the motor capacitor leads on the capacitor terminals **C**. Leads 2 and 3 go on the top terminal and lead 1 goes on the bottom terminal. Ensure that the motor capacitor cable is held in position by the cable guide.

7. Install the capacitor insulator on the capacitor terminals.

8. Reconnect JAC3 **B**.

9. Reinstall the ESD protection shield **I** (World Trade only).
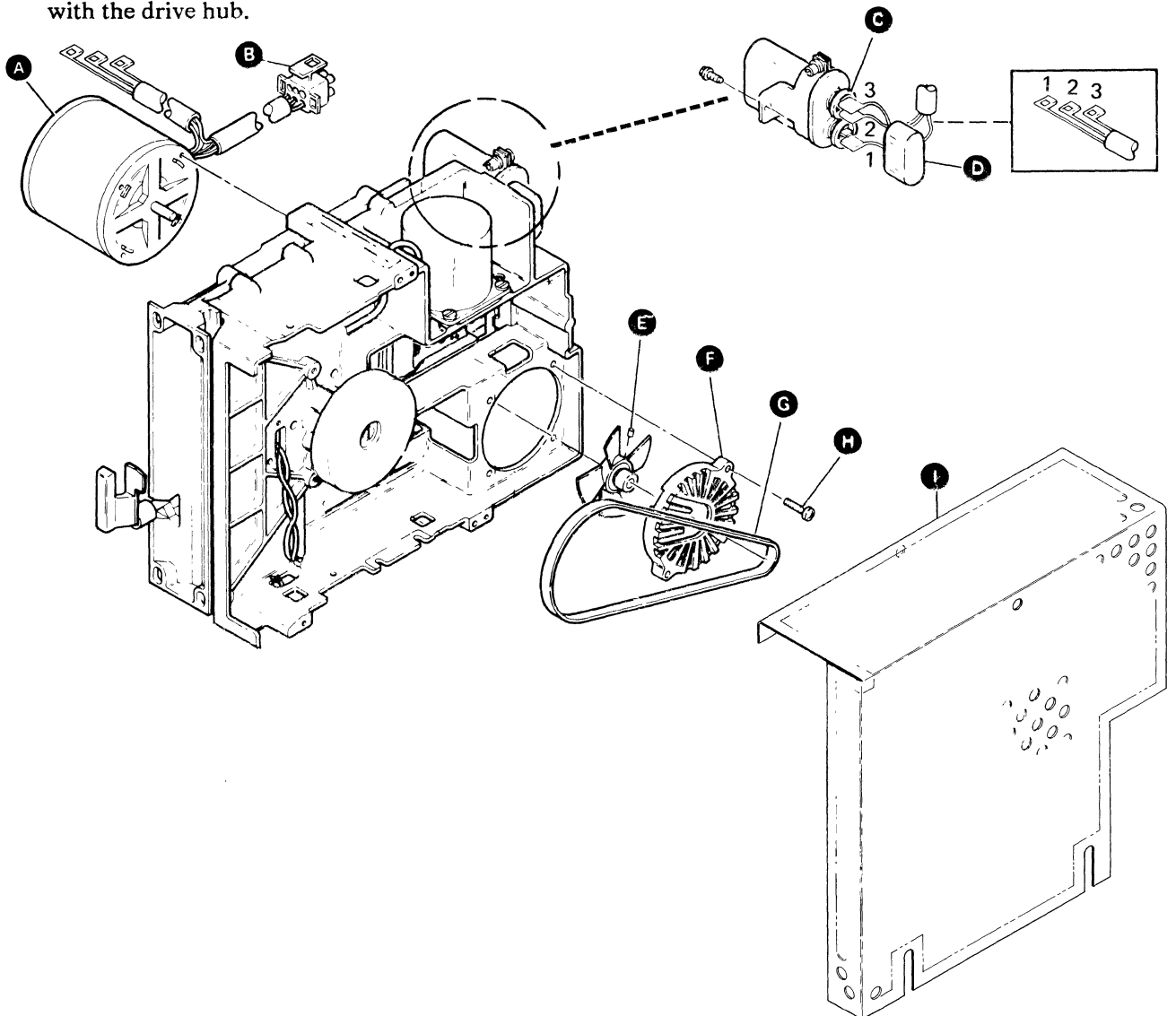
616 Capacitor Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ESD protection shield **E** (World Trade only).

DANGER
High voltage may be present at the capacitor terminals.

. . . .

. . . .

. . . .

3. Remove the capacitor insulator **D** from the terminals.

4. Discharge the capacitor by jumpering its terminals **C** with a large screwdriver.

5. Remove the three motor leads from the capacitor terminals.

6. Remove the mounting bracket screw **A**, then remove the capacitor and the bracket assembly **B**.
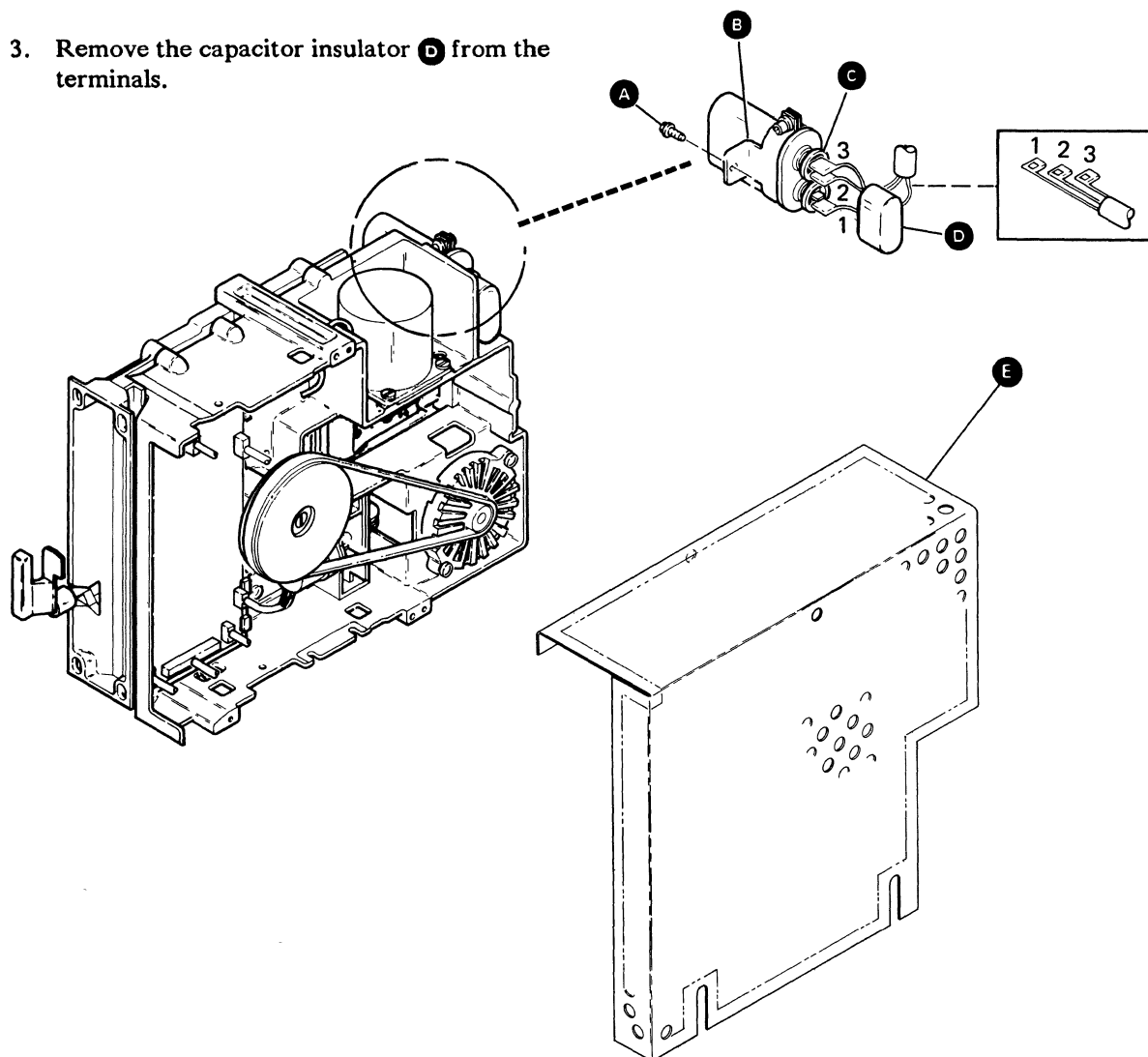
618 Head/Carriage Cleaning Procedure

The head/carriage cleaning procedure is not a normal maintenance routine. You should perform this procedure only if you suspect that the read/write heads are contaminated.

CAUTION
Read/write head damage may occur if you do not follow this procedure.

. . . .

. . . .

. . . .

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Put some drops of tape cleaner (part 453511) or isopropyl alcohol (part 2200200) on a clean strip of printer paper (or similar type of paper).

3. Insert the paper between the read/write heads.

CAUTION
To prevent damage to the read/write heads, always use the head load bail assembly to load the read/write heads.

. . . .

. . . .

. . . .

. . . .

4. Manually load the read/write heads by operating the head load bail assembly with your finger. Lightly rub the paper between the read/write head surfaces with a circular movement. Alternate between a clockwise and counterclockwise rotation.

5. Repeat steps 2 through 4 until the paper comes out clean.

6. Insert a dry strip of paper to remove excess fluid from the read/write heads.

7. Reconnect the power cord and power on ("310 Powering On/Off the System" on page 3-3).

8. Initialize a scratch IBM diskette to ensure that all excess fluid is removed.

9. Select the diskette SSP procedure TESTDSKT ("329 Summary of Useful SSP Procedures" on page 3-8) and run the Diskette Drive Test option.

Section 7. Local Work Station Procedures

706 Local Work Station Network Analysis Procedure

The system console must be working before this procedure can be used. Also, you need to know the addresses of the work stations that are attached to the system. The customer should give you this information.

This procedure uses the network analysis option of the DCP Main menu to isolate local work station problems. The network analysis option displays a matrix on the system console. The matrix shows:

- The cable and station addresses of all possible work stations across the top of the matrix.

- The conditions sensed for each address down the side of the matrix.

An X is placed at the position of the work station address and the condition that was sensed. The correct responses are as follows:

- Work station display: An X in the single-frame condition row.

- Work station printer: An X in the single-frame condition row for the first sense and an X in the multiframe condition row for following senses.

- No work station at the address: An X in the no-response row.

The following FRUs are partially tested:

- Adapter card (A-A1Q2 or A-A1P2):

  — A-A1Q2 for base system
  — A-A1P2 for system with work station expansion feature

- Controller card (A-A1Q2): The controller card is used only on systems with the work station expansion feature.

- Pass-through card (A-A1P3): The pass-through card is used only on base systems.

- Attachment cable (A-A1ZE)

- A-A1 board

- Twinaxial cables

- Work stations

To run network analysis:

1. Ensure that the Security switch is in the Service position.

2. Insert diskette 3.

3. Select function 3 (IPL Diskette).

4. Press the Start Function key.

5. When the DCP Main menu appears on the system console, select the network analysis option.

   The system displays a status matrix on the console after approximately 30 seconds.

6. Use the following table and the matrix that is displayed to isolate the failure.

7. To end network analysis, load the system again ("320 Loading the SSP" on page 3-4). Verify that the system is operating correctly.

Condition Sensed	Failing FRU or Action
RCV buffer overrun	A1P2, A1Q2.
Single-frame or multiframe	If the condition was sensed at an address where there is no work station, ensure that: 1. The cable is connected to the correct port at the system. 2. The address switches on the work station are set correctly. 3. The terminator switch on the work station is set correctly. If a work station display responded with a multiframe condition, see the device maintenance manual to isolate the failure. A multiframe response from a work station display is not valid. If a work station printer failed to respond with the multiframe condition, see the device maintenance manual to isolate the failure. The work station printer failed to perform the modeset command.
No response	If a work station did not respond: 1. Verify that the work station is powered on. 2. Verify that the address and terminator switches are set correctly. 3. If the above steps are OK, exchange A1Q2 or A1P2. 4. Check the twinaxial cable ("714 Local Work Station Cable Ohmmeter Test" on page 7-12 and "710 Local Work Station Cable Signal Quality Check" on page 7-4). If a work station printer failed to respond, also see the action under single-frame or multiframe condition.
Serial parity check	A1Q2 or A1P2.
Driver activity check	A1Q2, A1P2, or a short circuit in one of the work station cables.

710 Local Work Station Cable Signal Quality Check

For an alternative method of checking the cable, see "714 Local Work Station Cable Ohmmeter Test" on page 7-12.

The customer is responsible for installation and maintenance of the cable. However, if aid is requested, refer to the following manuals for additional information:

* For more information on twinaxial cabling, see the *IBM 5250 Information Display System Planning and Site Preparation Guide*, GA21-9337.

* For more information on the IBM Cabling System, see the *IBM Cabling System Planning and Installation Guide*, GA27-3361, and the *IBM Cabling System Problem Determination Guide for Twinaxial Applications*, GA21-9491.

The cable signal quality check determines if a failure is present in the cable, the cable connectors, or an attached work station. This test sends a signal down the cable, using the square wave from the B-gate output on the oscilloscope. Signal paths up to a maximum of 1524 meters (5000 feet) can be checked.

It is normal for a surge suppressor to cause a glitch of the signal. See sample oscilloscope signals **E** and **H** ("712 Sample Oscilloscope Signals" on page 7-10).

Defective Cables

If the cable is terminated by the correct load impedance, all the power of the transmitted signal is used by the terminating impedance.

If there is a cable failure that changes the impedance of the cable, part of the signal is returned to the signal source as a reflection.

A short circuit in the cable causes the impedance to be lower than normal. This causes a decrease in the amplitude of the signal.

An open circuit in the cable causes the impedance to be higher than normal. This causes an increase in the amplitude of the signal.
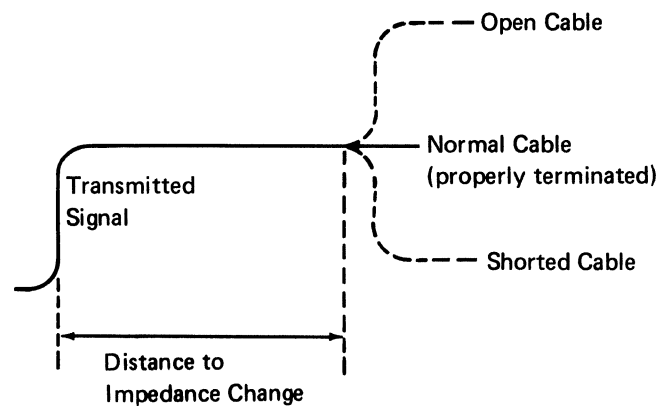
Test Equipment Needed

To perform the cable signal quality check, you should have the following (or similar) equipment:

- One Tektronix 453, 454, or 475 oscilloscope. (This procedure uses the 475 oscilloscope.)

- One BNC T-connector (part 1650789).

- One probe-tip-to-BNC adapter (part 453199).

- ' One coaxial cable with a BNC end and alligator clips (part 1650790), or a BNC-to-banana-plug adapter and multimeter leads.

- One times 1 (X1) probe (a times 10 (X10) probe may be used by changing the vertical input setting).

- Cable termination on the cable being checked. See step 5 of the setup procedure that follows.

Setup Procedure

1. Set the scope switches as follows:

   CH 1 VOLTS/DIV: 0.5 volts
   AC-GND-DC: AC
   INVERT: Inverted (out)
   VERT MODE: CH 1
   A and B TIME/DIV
   and DELAY Time:
     Set A to 10 microseconds,
     pull knob to unlock, and
     set B to 2 microseconds.
   HORIZ DISPLAY: B DLY'D
   TRIG MODE: AUTO
   COUPLING: AC
   SOURCE: STARTS AFTER DELAY
   SLOPE: Minus

2. Attach the T-connector **A** to B +GATE on the rear panel of the oscilloscope.

3. Use the probe tip adapter **B** (part 453199) to attach the channel 1 probe to one side of the T-connector.

4. Attach the probe **C** (part 1650790) to the other side of the T-connector.

5. If you are checking an IBM Cabling System, go to step 7. For twinaxial cables, continue with step 6.

A T- Connector
(part 1650789)

C Probe
(part 1650790)

Attach to B +Gate
on Rear Panel of
Oscilloscope

Ground Lead

CH 1
Input

B Probe Tip Adapter
(part 453199)

D

Signal Lead
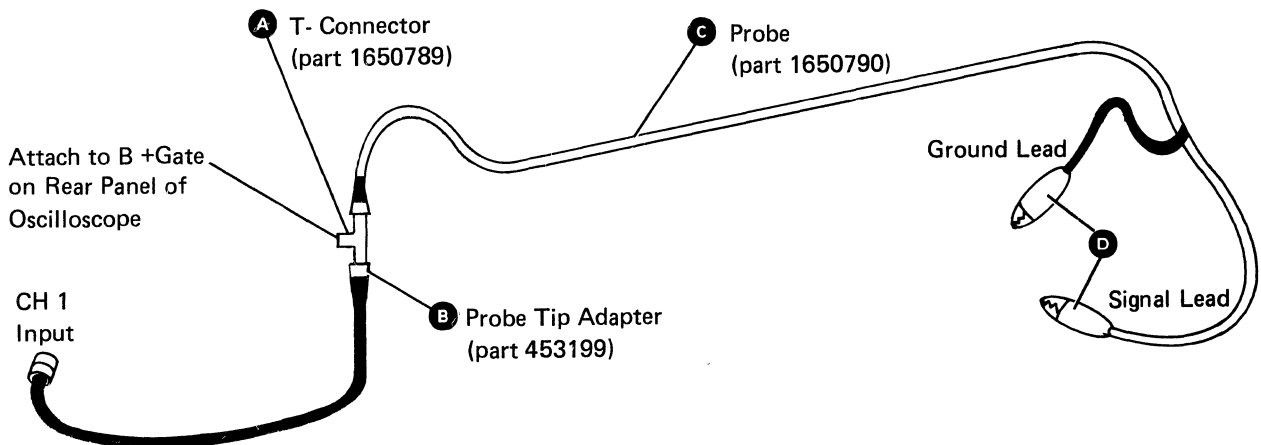
6. **Twinaxial Cable:**

Ensure the cable is attached to a work station. If the Cable Thru feature is present, ensure the cable is attached to the last work station on the port and set the terminator switch on the last work station to 1.

To check a cable not attached to a work station, terminate the end of the cable with a resistor assembly (part 7362344) as shown here:

```
Phase B _____
                        ⌇55 Ohms
                        ⌇55 Ohms
Phase A _____⌇
Shield _____
```
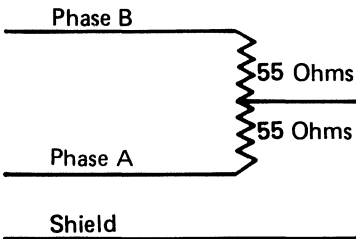
Go to step 8.

7. **IBM Cabling System:**

Ensure the cable from the IBM Cabling System outlet to the work station is part 6091070 (impedance matching).

If the Cable Thru feature is present, ensure the cable from the IBM Cabling System outlet to the work station is part 6091075 (direct connect). Set the terminator switch to the not terminated position and connect the twinaxial terminator (part 6091068) to port 2 on the work station.

If you want to test a cable that is not attached to a work station, terminate the end of the cable with a 75-ohm resistor assembly as follows:

```
Phase B _____
                        ⌇75 Ohms
                        ⌇75 Ohms
Phase A _____⌇
Shield _____
```
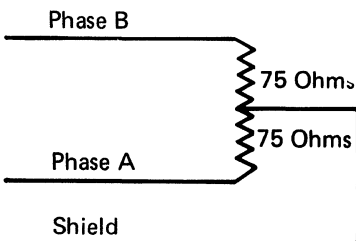
8. Disconnect the cable to be checked from the system. Connect the alligator clips **Ⓓ** on the probe to the end of the cable for each of the following combinations:

a. Ground lead to shield, signal lead to phase A.
b. Ground lead to shield, signal lead to phase B.
c. Ground lead to phase A, signal lead to phase B.

Look at the oscilloscope signal to determine if a cable failure is present. Use the tables and the sample oscilloscope signals on the following pages to find any problems that are present. The sample oscilloscope signals shown are for twinaxial cable. IBM Cabling System oscilloscope signals are similar.
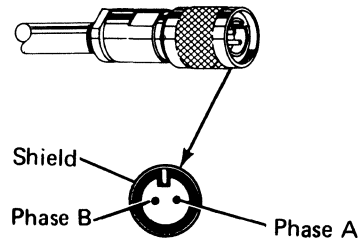
Adjusting the Oscilloscope

Display	Action
No reflection See **A** and **B** ("712 Sample Oscilloscope Signals" on page 7-10)	If the B-sweep time/div is set on 2 microseconds, the maximum cable length of 1524 meters (5000 feet) is displayed. No reflection indicates that the cable is good, if all the combinations in step 6 have been checked.
Multiple reflections See **D** and **G** ("712 Sample Oscilloscope Signals" on page 7-10)	Decrease the B-sweep time/div so that only a single reflection is displayed. See the action for single reflections.
Single reflections See **C**, **E**, **F**, and **H** ("712 Sample Oscilloscope Signals" on page 7-10)	Measure the time divisions on the oscilloscope to the point where the signal level just starts to change either upward or downward. Use the distance table on the following page to find the distance to the cable failure.

Notes:

1. *To increase the size of small changes, move the signal down (channel 1 Position knob) and decrease the channel 1 volts/div setting.*

2. *For long cables, failures at the far end may not be easy to see on the oscilloscope. Reconnect the cable to the system and disconnect or remove the terminating resistor from the other end of the cable. Repeat step 8 of the setup procedure.*

3. *Failures too close to the tested end of the cable cause reflections to occur during the rise time of the oscilloscope.*

4. *If you suspect that the cable is too long and you want to check the length, disconnect or remove the terminating resistor from the other end of the cable. Repeat step 8 of the setup procedure. The oscilloscope will show an open circuit, as shown in* **C** *or* **D** *("712 Sample Oscilloscope Signals" on page 7-10).*

Calculating the Distance to the Failure

For twinaxial cable, the total signal path length equals the total cable length.

For the IBM Cabling System, the total signal path is longer than the total cable length. For each cable from the distribution panel to a work station (except for the last work station or the only work station on the port), the signal path is twice the length of the cable. You must use the total length of the signal path, not the length of the cable, to find the failure.

In the diagram below, the total cable length is 290 meters (951 feet): 200 m + 25 m + 35 m + 30 m = 290 meters.

To determine the total signal path, use the following procedure:

1. Add together the lengths of the cables from the distribution panel to all the work stations except the last.

2. Multiply the total from step 1 by 2.

3. Add the length of the cable between the distribution panel and the last work station to the total from step 2.

4. Add the length of the cable between the distribution panel and the system to the total from step 3.

For the diagram at the right, this results in a total signal path of 350 m (1148 feet), as follows:

1. 25 m + 35 m = 60 m

2. 60 m x 2 = 120 m

3. 30 m + 120 m = 150 m

4. 200 m + 150 m = 350 m

To calculate the distance to the failure:

1. Determine the time in divisions between the start of the + B-Gate squarewave and the reflection caused by the failure.

   For example, sample oscilloscope signal ⊙ ("712 Sample Oscilloscope Signals" on page 7-10) shows 6.4 divisions to the reflection caused by the open.

2. Multiply the number of divisions times the length per division for the B-sweep setting shown in the following distance tables.

   Sample oscilloscope signal ⊙ has a B-sweep setting of 2.0 microseconds. Therefore, the distance to the failure would be 1267 meters for a twinaxial cable (6.4 x 198) and 1420 meters for an IBM Cabling System (6.4 x 222).

Distribution Panel (back view)

| Wiring Closet |
| Work Area   200 m   25 m   35 m   30 m |

System   Work Station 1   Work Station 2   Work Station 3

——————— Cable
— — — — Data Signal Path
m = Meters
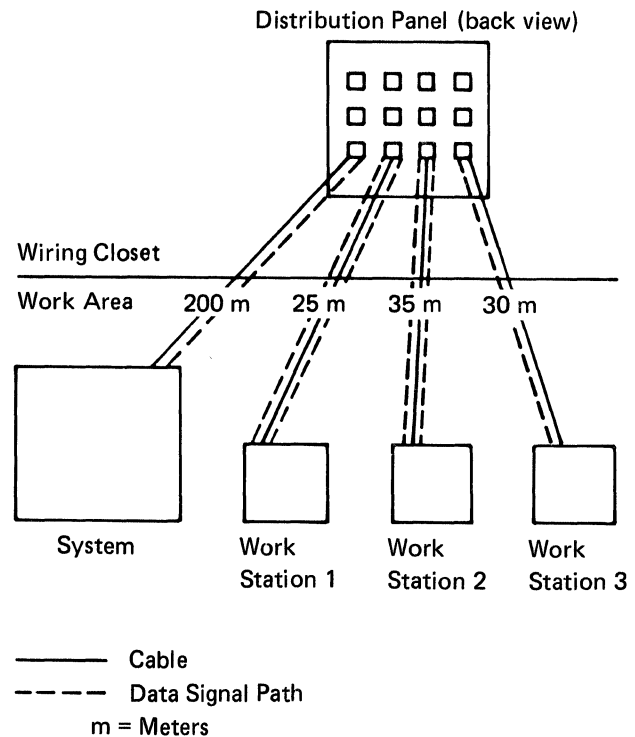
Distance Table for Twinaxial Cables

B-Sweep Setting (Microseconds)	Meters (Feet)/Div	Maximum Cable Displayed (10 Divisions)
2.0	198 (649.4)	1980 meters (6494 feet)—Maximum cable length permitted is 1524 meters (5000 feet)
1.0	99 (324.7)	990 meters (3247 feet)
0.5	49.5 (162.4)	495 meters (1624 feet)
0.2	19.8 (64.9)	198 meters (649 feet)
0.1	9.9 (32.5)	99 meters (325 feet)

Distance Table for IBM Cabling System

B-Sweep Setting (Microseconds)	Meters (Feet)/Div	Maximum Cable Displayed (10 Divisions)
2.0	222 (730)	2220 meters (7300 feet)—Maximum data signal path length permitted is 1524 meters (5000 feet)
1.0	111 (365)	1110 meters (3650 feet)
0.5	55.5 (182.5)	555 meters (1825 feet)
0.2	22.2 (73)	222 meters (730 feet)
0.1	11.1 (36.5)	111 meters (365 feet)

712 Sample Oscilloscope Signals

(A) Cable OK (1509 meters/4950 feet)
0.5 volts/div
A = 10 microseconds
B = 2 microseconds

(B) Cable OK (15.2 meters/50 feet)
0.2 volts/div
A = 10 microseconds
B = 2 microseconds
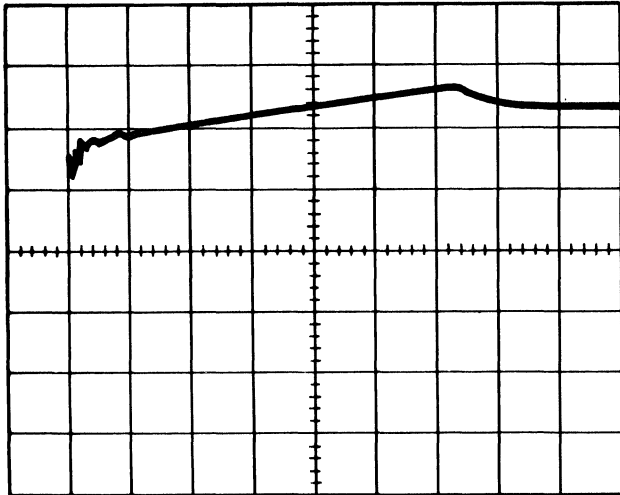
(C) Open Circuit (one reflection)
0.5 volts/div
A = 10 microseconds
B = 2 microseconds

6.4 Divisions
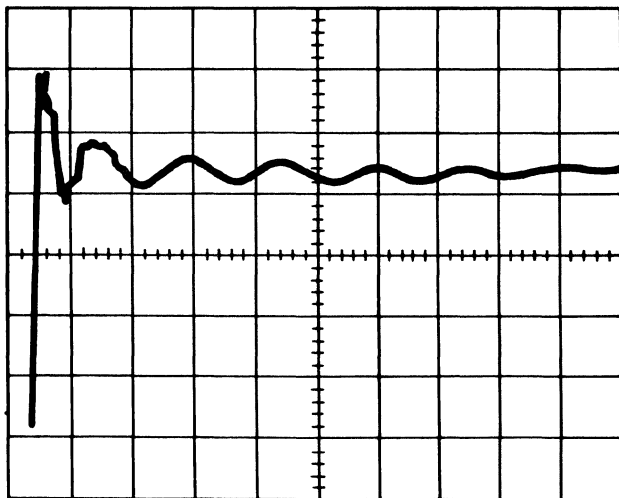
(D) Open Circuit (multiple reflections)
0.5 volts/div
A = 10 microseconds
B = 2 microseconds
Change B to 0.1 microsecond (see (E)).
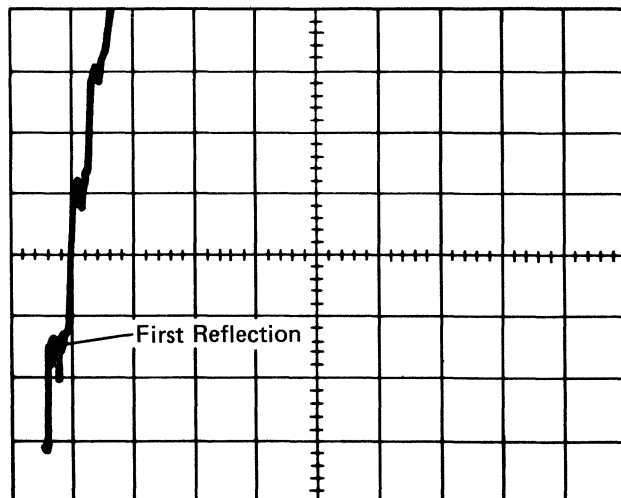
First Reflection

E Open Circuit (one reflection)
0.5 volts/div
A = 10 microseconds
B = 0.1 microsecond

Glitch Caused by Station Protector

6.2 Divisions
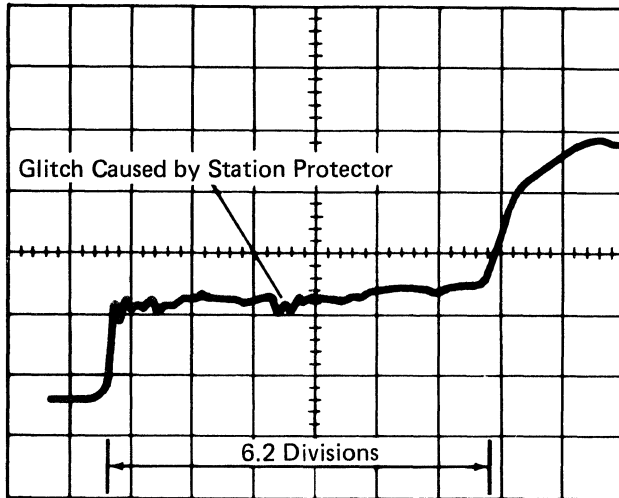
G Short Circuit (multiple reflections)
0.5 volts/div
A = 10 microseconds
B = 2 microseconds
Change B to 0.1 microsecond (see **H**).
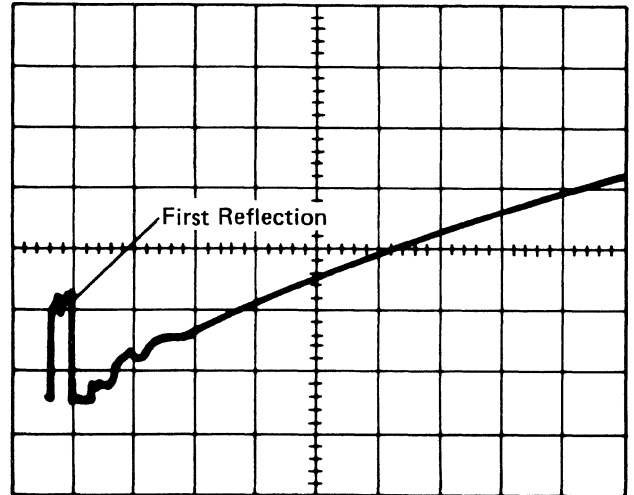
First Reflection

F Short Circuit (one reflection)
0.5 volts/div
A = 10 microseconds
B = 2 microseconds
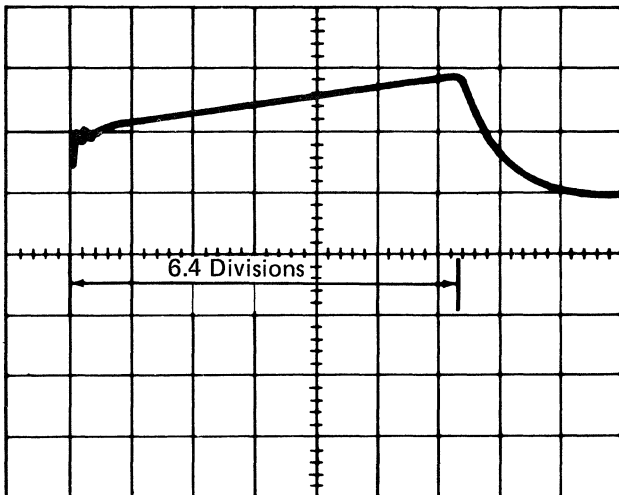
6.4 Divisions

H Short Circuit (one reflection)
0.5 volts/div
A = 10 microseconds
B = 0.1 microsecond

Glitch Caused by Station Protector

6.2 Divisions
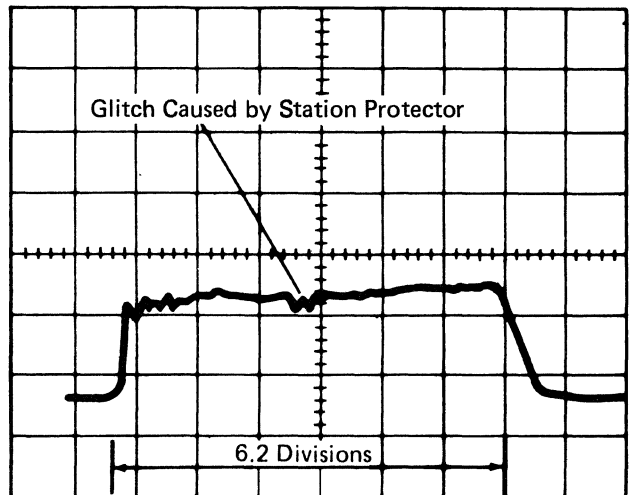
714 Local Work Station Cable Ohmmeter Test

Station protectors must be removed before using this procedure.

1. Set the ohmmeter to the times 10 (x10) scale.

2. Disconnect the cable to be checked from the system unit.

3. Measure the resistance between each pin of the cable and the ground shield of the cable.

    If the resistance is less than 20 ohms (short circuit) or more than 200 ohms (open circuit), repair or exchange the cable.

4. Measure the resistance between the two pins of the cable.

    If the resistance is less than 80 ohms (short circuit), repair or exchange the cable.

5. Disconnect the cable being checked from the last work station on the port. The system unit end of the cable should still be disconnected.

6. Measure the resistance between each pin of the cable and the ground shield of the cable.

    If the resistance is less than 200 ohms (short circuit), repair or exchange the cable. A low resistance can also be caused by a terminating resistor on the planar board in a display station.

7. Measure the resistance between the two pins of the cable.

    If the resistance is less than 200 ohms (short circuit), repair or exchange the cable.

8. At the work station end of the cable, jumper phase A of the connector to the shield.

    At the system unit end of the cable, measure the resistance between phase A and the shield.

    If the resistance is more than 200 ohms, phase A and phase B are reversed. Remove the jumper and repair the cable.

Shield

Phase B

Phase A
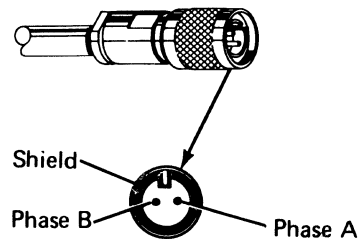
Section 8. Disk Procedures

This page is intentionally left blank.

802 Using Disk Drive Problem Determination

Load the system from diskette 1:

1. Select function 3 (IPL Diagnostic Diskette).

2. Enter 0000.

3. Press the Start Function key.

This procedure uses diskette 1 to test the disk drive. If an SRC other than 194F (one-drive system) or 195F (two-drive system) appears in the 4-character display, use that SRC to isolate the problem.

Note: This procedure may run for as long as 15 minutes.

804 Disk Drive FRU Locations

Shock Mount

Power/Driver Cable (B1A5)

Driver Card
(C1A1)

5

4

3

2

Digital Card
(component side)
(A1A2)

Maple
Block

Signal Cable
from System
(B1A2)

Disk
Enclosure

Analog Card
(pin side)
(B1A3)

Disk Enclosure   (J2 Connector)

Driver Card (C1A1)   (J1 Connector)
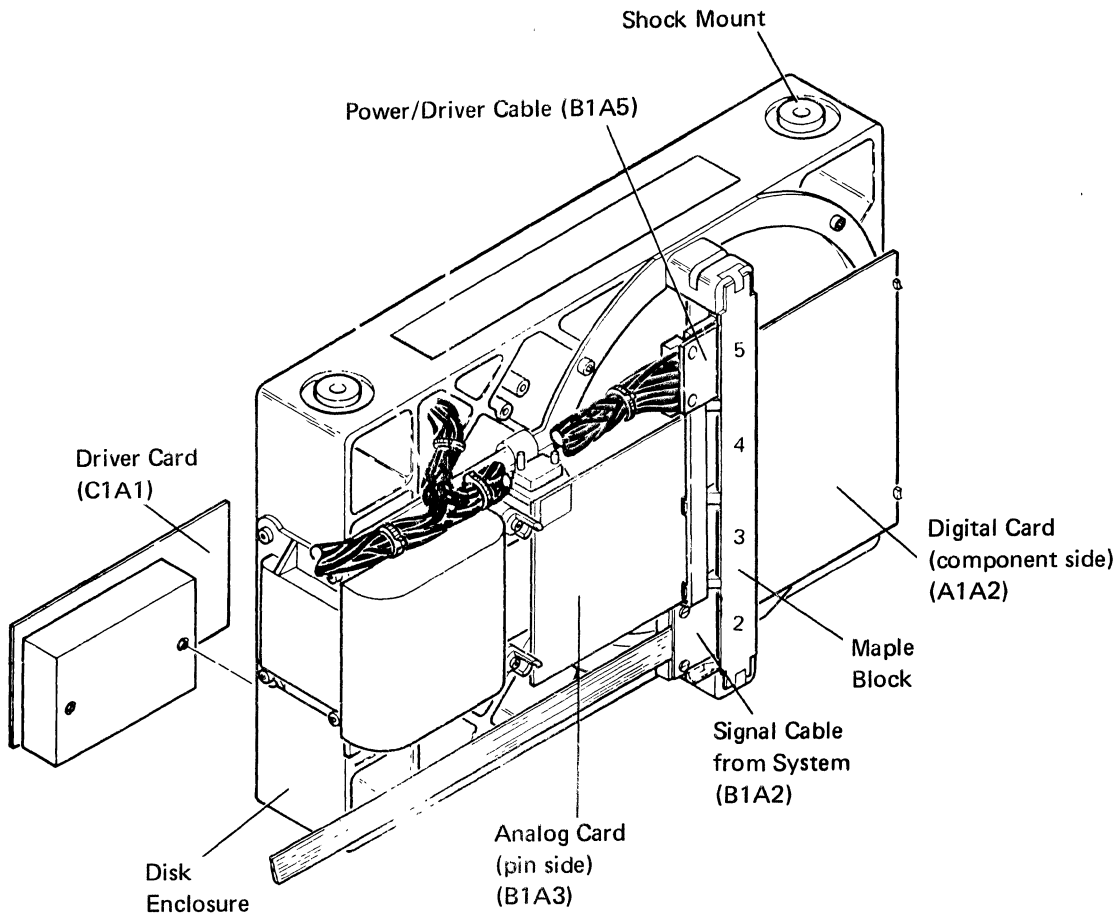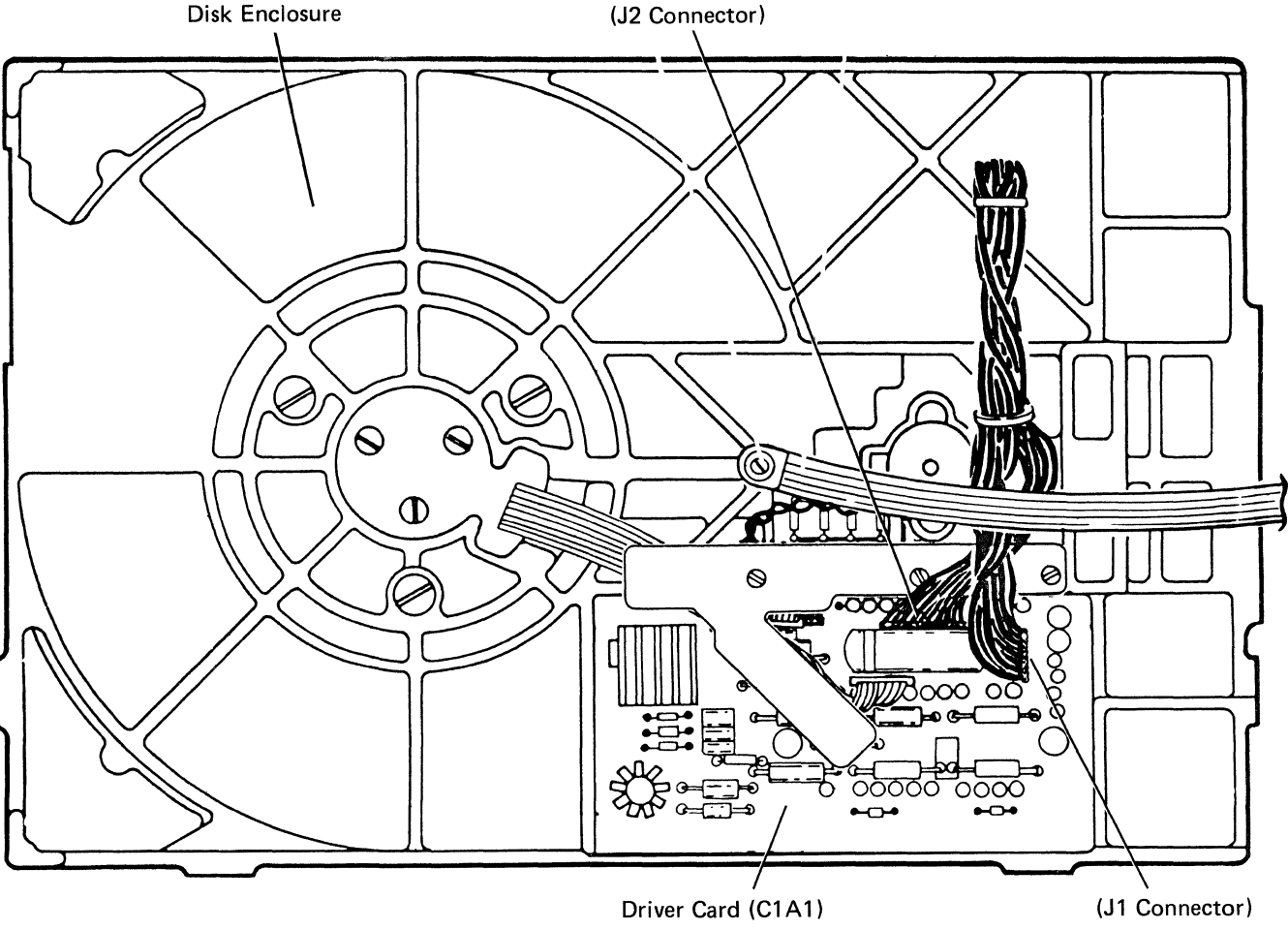
806 Shock Mount Removal and Replacement

Note: *An alternative method of shock mount removal and replacement is to first remove the disk drive and frame from the system.*

Upper Shock Mount Removal

CAUTION
Do not shake or hit the disk enclosure ⓗ while performing this procedure.

. . . .

. . . .

. . . .

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the screw ⓙ that holds each upper shock mount ⓛ in position.

3. Tilt the disk enclosure out of the disk drive frame ⓖ, and remove each spacer ⓚ and shock mount from the disk enclosure.

Upper Shock Mount Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Tilt the disk enclosure out of the disk drive frame ⓖ, and insert each shock mount ⓛ and spacer ⓚ into the disk enclosure. Ensure that each spacer goes completely through the shock mount and does not bind it.

3. Insert and tighten the screw ⓙ in each shock mount.

Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.
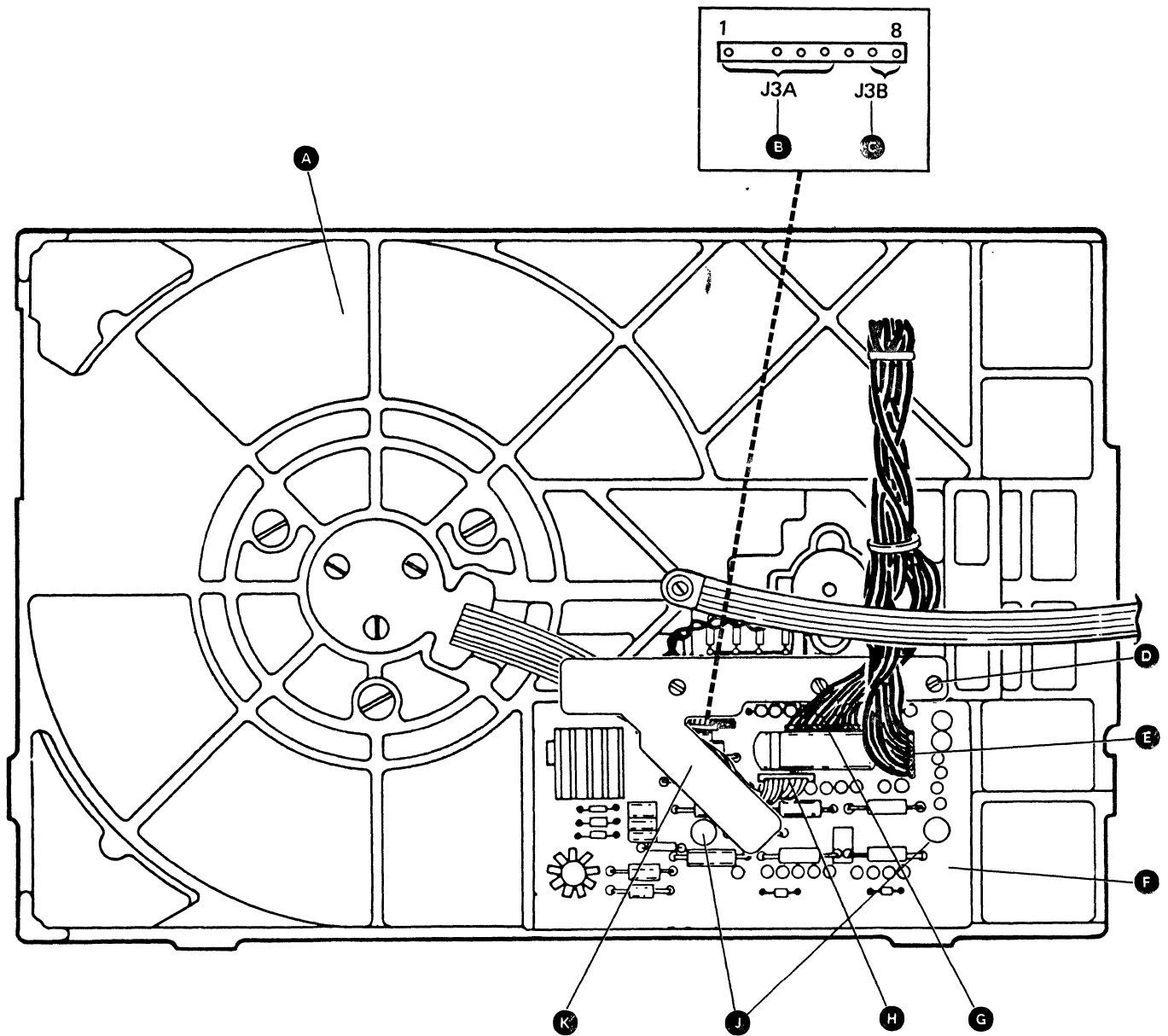
Alternative Method

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ground cable by removing the ground screw ⓑ.

3. Remove the signal cable connector (B1A2) ⓓ from the maple block ⓕ.

4. Remove the power/driver cable connectors (B1A5 ⓔ, P1 ⓜ, and P2 ⓝ) and then carefully remove the cable from the disk drive.

5. Remove the screw ⓒ, remove the disk drive and frame ⓐ from the system, and then remove the selected shock mount.

Shock Mounts

See the
following pages.

Lower Shock Mount Removal

Note: *An alternative method of shock mount removal and replacement is to first remove the disk drive and frame from the system.*

CAUTION
Do not shake or hit the disk enclosure ⑪ while performing this procedure.

. . . .

. . . .

. . . .

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the screw ⓛ that holds each lower shock mount in the disk drive frame ⑥.

3. Pull each spacer ⓚ and shock mount ⓙ out from the bottom of the disk enclosure and remove the disk drive.

Lower Shock Mount Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Insert each shock mount ⓙ and spacer ⓚ through the opening in the bottom of the disk drive frame ⑥ and the disk enclosure. Ensure that each spacer goes completely through the shock mount and does not bind it.

3. Insert and tighten the screw ⓛ in each shock mount.

Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.

Alternative Method

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ground cable by removing the ground screw ⓑ.

3. Remove the signal cable connector (B1A2) ⓓ from the maple block ⓕ.

4. Remove the power/driver cable connectors (B1A5 ⓔ, P1 ⓜ, and P2 ⓝ) and then carefully remove the cable from the disk drive.

5. Remove the screw ⓒ, remove the disk drive and frame ⓐ from the system, and then remove the selected shock mount.

Shock Mounts

808 Analog Card Removal and Replacement

Analog Card Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the power/driver cable connector (B1A5) ⓒ from the maple block ⓓ.

CAUTION
The head cable ⓛ is very easily broken and cannot be exchanged in the field.

. . . .

. . . .

. . . .

3. If a head cable cover ⓑ is present, remove it from the shipping holes ⓐ.

4. Disconnect the head cable plug ⓗ from the head cable connector ⓚ on the analog card ⓔ.

5. Insert the head cable plug into the head cable shipping holes ⓐ.

6. Loosen each analog card retainer screw ⓖ and turn each retainer ⓕ counterclockwise.

7. Remove the analog card from the maple block.

8. If exchanging the analog card, remove the plastic label ⓙ from the old analog card.

Analog Card Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. If exchanging the analog card ⓔ, place the plastic label ⓙ on the new analog card.

3. Insert the analog card into the maple block ⓓ.

4. Turn each retainer ⓕ counterclockwise over the analog card, ensure that the card is in the retainer notch, and tighten each analog card retainer screw ⓖ.

5. Connect the head cable plug ⓗ to the head cable connector ⓚ on the analog card.

6. Connect the power/driver cable connector (B1A5) ⓒ.

7. If the head cable cover ⓑ was removed, reinstall it.

Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.
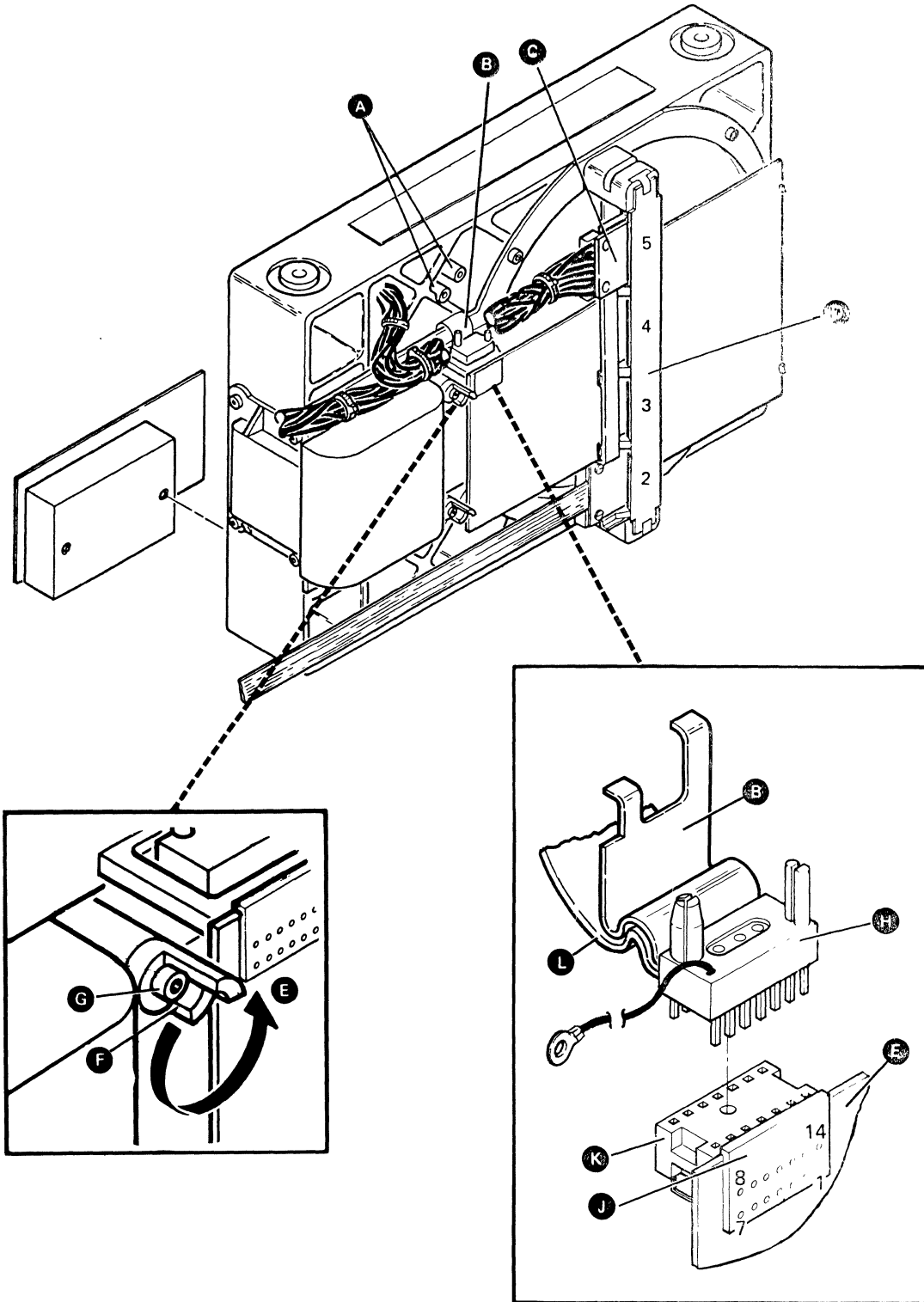
810 Driver Card Removal and Replacement

Driver Card Removal

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the three cable restrainer screws **D** and remove the cable restrainer **K** from the driver card **F**.

3. Disconnect the power cable (P1) from the driver card connector (J1) **E**.

4. Disconnect the driver cable (P2) from the driver card connector (J2) **G**.

5. Disconnect the motor cable (P4) from the driver card connector (J4) **H**.

6. Disconnect the actuator cable (P3A) from the driver card connector (J3A) **B**.

7. Disconnect the actuator unlock cable (P3B) from the driver card connector (J3B) **C** (no polarity needed).

8. Loosen the two driver card screws **J** (the screws remain in the card).
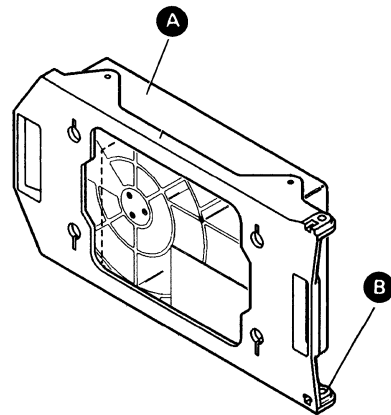
9. Remove the driver card from the disk enclosure **A**.

Driver Card Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Attach the driver card **F** to the disk enclosure **A**, using the two driver card screws **J**.

3. Connect the actuator cable (P3A) to the driver card connector (J3A) **B**.

4. Connect the actuator unlock cable (P3B) to the driver card connector (J3B) **C** (no polarity needed).

5. Connect the motor cable (P4) to the driver card connector (J4) **H**.

6. Connect the driver cable (P2) to the driver card connector (J2) **G**.

7. Connect the power cable (P1) to the driver card connector (J1) **E**.

8. Install the cable restrainer **K** with the three cable restrainer screws **D**. Ensure that the wires are not pinched; then, tighten the screws.

Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.

812 Maple Block Removal and Replacement

Maple Block Removal

CAUTION
Do not shake or hit the disk enclosure **G** while performing this procedure.

. . . .

. . . .

. . . .

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

CAUTION
Parts on the digital card may be hot.

. . . .

. . . .

2. Remove the digital card **C**.

3. Remove the analog card **F** ("808 Analog Card Removal and Replacement" on page 8-10).

4. Remove the signal cable connector (B1A2) **E**.

5. Remove each maple block clip **B** from the maple block **D** and the maple block holder **A**.

6. Remove the maple block.
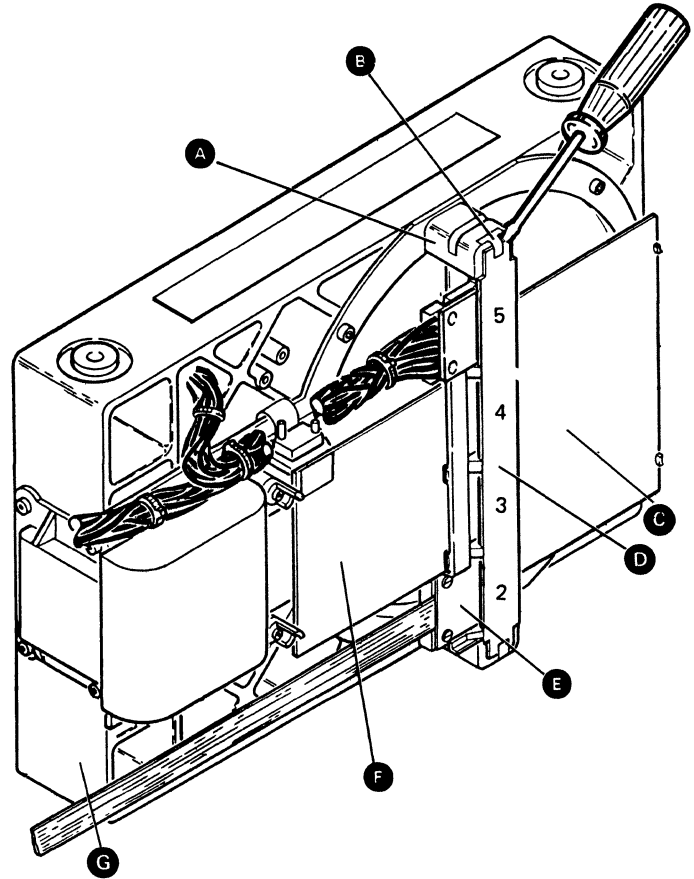
Maple Block Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Place the maple block **D** on each maple block holder **A**. Ensure that the maple block is placed with the part number **E** as shown.

3. Use a pliers to install each maple block clip **B**.

4. Install the digital card **C**.

5. Install the analog card **G** ("808 Analog Card Removal and Replacement" on page 8-10).

6. Connect the signal cable connector (B1A2) **F**.

Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.
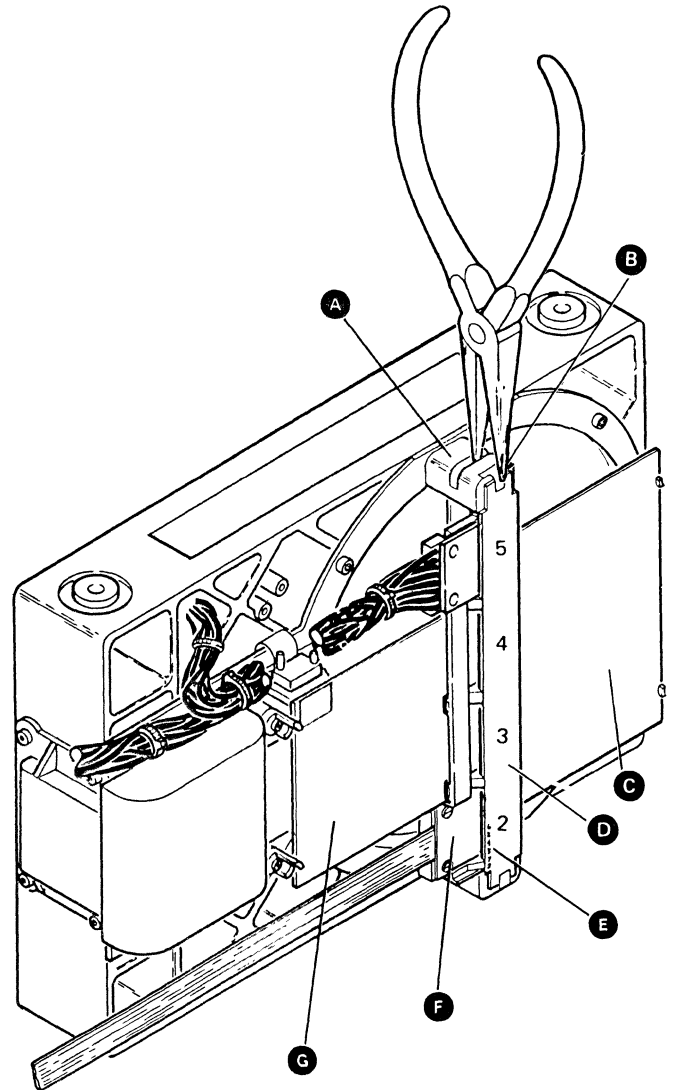
814 Disk Enclosure Removal and Replacement

Disk Enclosure Removal

CAUTION
Customer data may be lost if the disk enclosure ⊙ is exchanged.

. . . .

. . . .

. . . .

If you are exchanging the disk enclosure, do the following (if possible) before you remove the disk enclosure:

1. Have the customer copy his or her data.

2. Initialize the disk to destroy the customer's data.

CAUTION
Do not shake or hit the disk enclosure while performing this procedure.

. . . .

. . . .

. . . .

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove the ground cable ⊙ by removing the ground screw ⊙.

3. Remove the signal cable connector (B1A2) ⊙.

4. Remove the power/driver cable connectors (B1A5 ⊙, P1 ⊙, and P2 ⊙) and then carefully remove the cable from the disk drive.

5. Remove the screw ⊙ and then remove the disk drive and frame ⊙ from the system.

CAUTION
Parts on the digital card may be hot.

. . . .

. . . .

6. Remove the digital card ⊙ from the maple block ⊙.

7. Remove the analog card ⊙ ("808 Analog Card Removal and Replacement" on page 8-10).

8. Remove the driver card ⊙ ("810 Driver Card Removal and Replacement" on page 8-12) from the disk enclosure.

9. Remove the screws from the four shock mounts ⊙ and remove the disk enclosure from the disk drive frame ("806 Shock Mount Removal and Replacement" on page 8-6).

10. Fill out the disk enclosure return label ⊙, on the disk enclosure being returned, to aid the factory in finding the failure.

IBM 𝖆 ⊕ For field repl DE order P/N _____ Version ___ **21ED** | CE Comments.
ATTN: CUSTOMER ENGINEER
Head/Disk Asm P/N _____ EC _____ Sequence no. _____
Step 1. Mark relevant items [X] and add comments to aid in defining failure.
☐MES ☐Write ☐Read ☐Not ready ☐Unsafe ☐Seek ☐Intermittent
Step 2. Record· System type _____ System serial no. _____
Step 3. Repack in shipping container of new assembly.
Step 4. Return to branch office for shipment to factory. _____
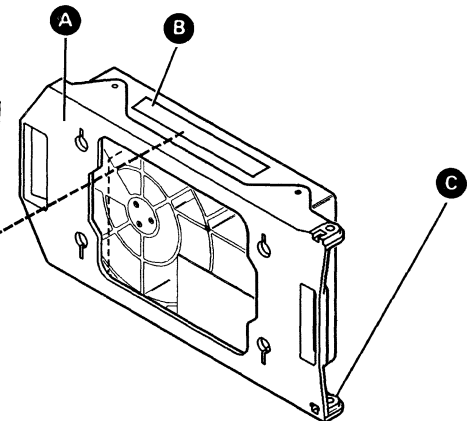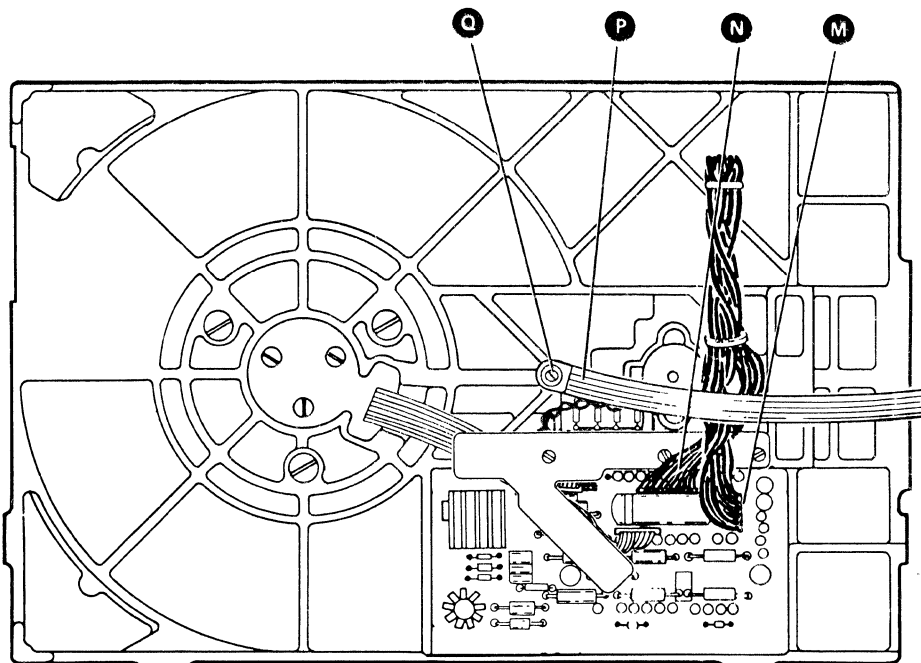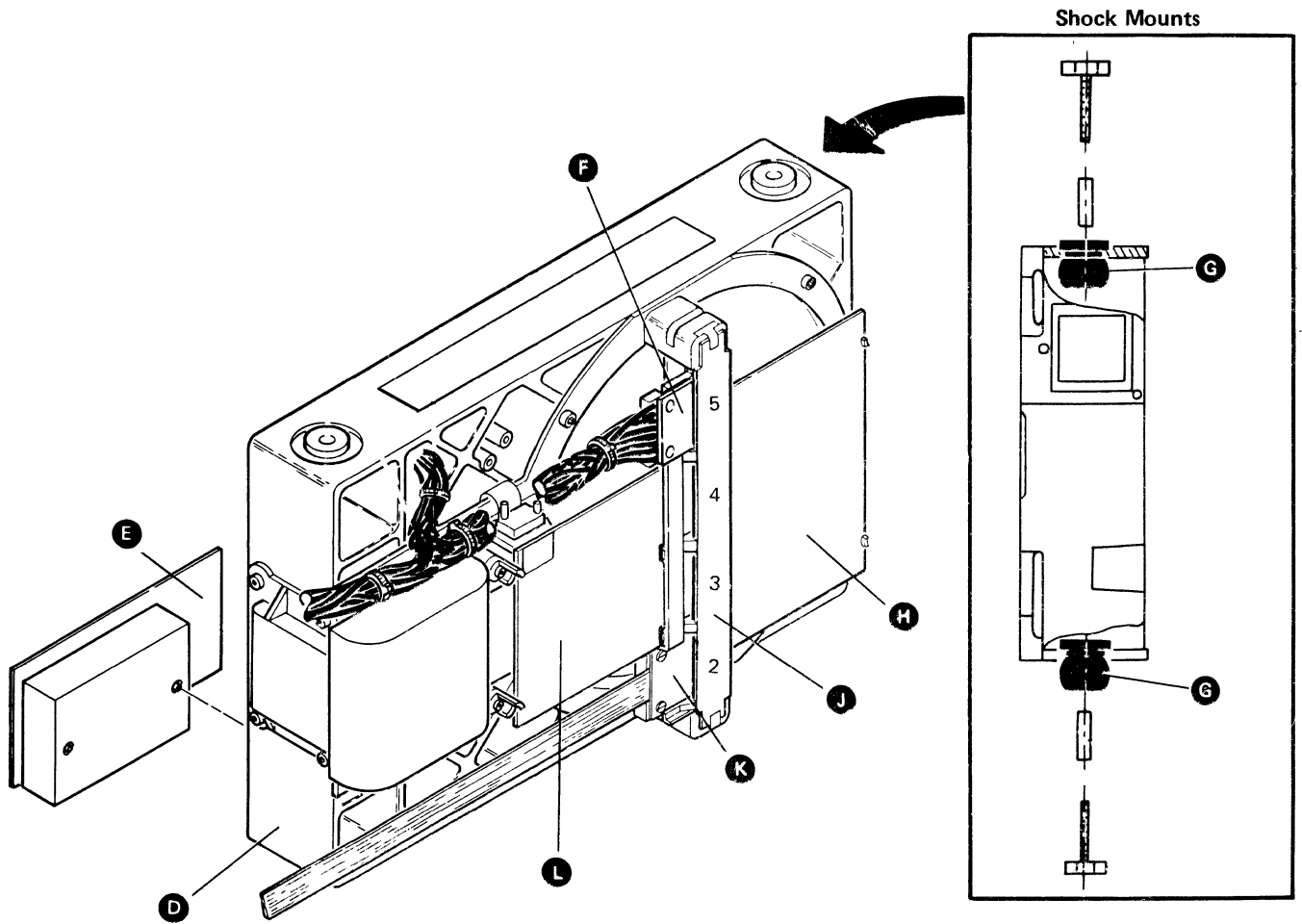
Shock Mounts

Disk Enclosure Replacement

1. Power off ("310 Powering On/Off the System" on page 3-3) and disconnect the power cord.

2. Remove each spacer ⓙ and shock mount ⓚ from the old disk enclosure ⓒ and insert them into the new disk enclosure. Ensure that each spacer goes completely through the shock mount and does not bind it.

3. Install the disk enclosure in the disk drive frame with the label facing up ("806 Shock Mount Removal and Replacement" on page 8-6). Insert and tighten each screw ⓗ in each shock mount.

4. Install the analog card ⓟ ("808 Analog Card Removal and Replacement" on page 8-10).

5. Install the digital card ⓛ.

6. Put the disk drive and frame ⓐ in position on the system and install the screw ⓑ.

7. Insert the power cable (P1) ⓔ and the driver cable (P2) ⓕ through the disk enclosure frame.

8. Install the driver card ⓓ ("810 Driver Card Removal and Replacement" on page 8-12).

9. Insert the signal cable connector (B1A2) ⓝ into the maple block ⓜ.

10. Insert the power/driver cable connectors (B1A5 ⓖ, P1 ⓠ, and P2 ⓡ).

11. Reconnect the ground cable ⓢ by tightening the ground screw ⓣ.

    Radio frequency interference (RFI) may cause errors on the disk drives when the covers are removed and the disk drive frames are in the open position. All system covers must be in place before checking out the system.

12. If you have installed a new disk enclosure:

    a. Ensure that the Security switch is in the Service position.
    b. Perform "802 Using Disk Drive Problem Determination" on page 8-3.
    c. Load the system from diskette 3.
       1) Select function 3 (IPL Diagnostic Diskette)
       2) Enter FF00
       3) Press the Start Function key
    d. Run the pack initialization option of the disk utilities ("338 Diagnostic Tests under DCP" on page 3-12).

13. If disk drive A was exchanged:

    a. Perform procedure "324 Reloading the System Microcode" on page 3-5.
    b. Inform the customer that he or she can now reload the SSP diskettes (see procedure "322 Reloading the SSP Diskettes" on page 3-5).
    c. Load the system from disk with the Security switch in the Normal position ("320 Loading the SSP" on page 3-4).

Shock Mounts
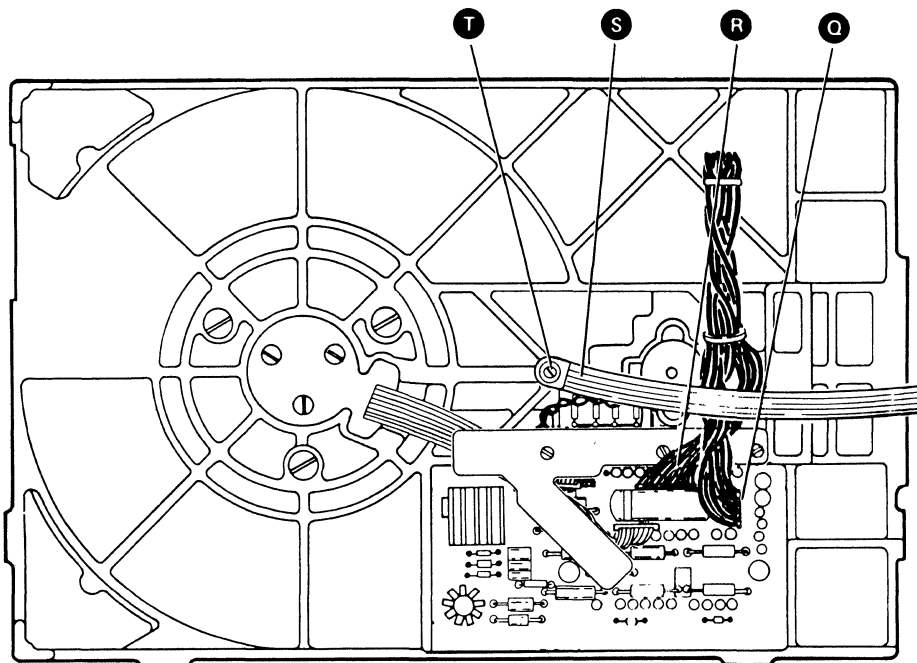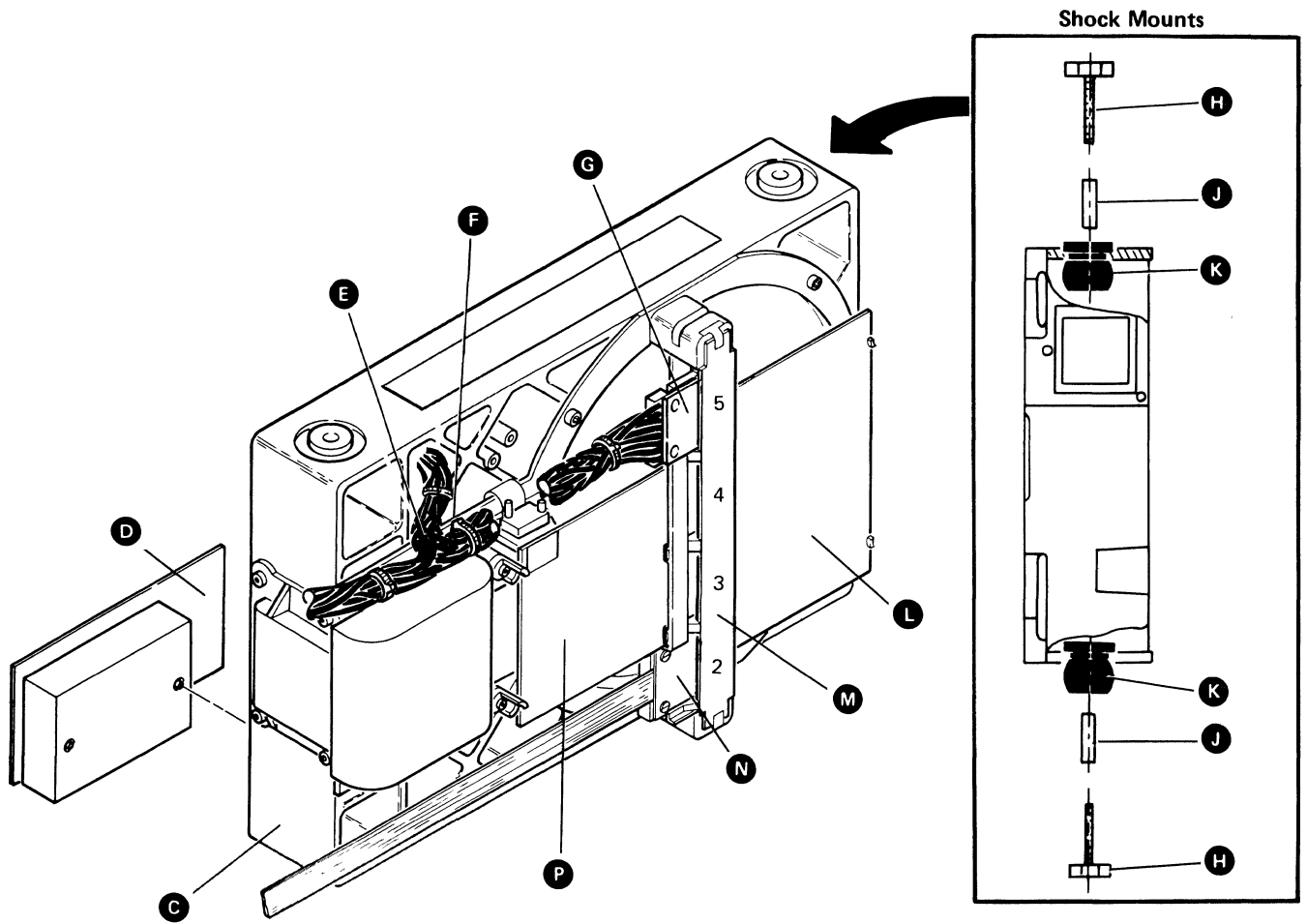
Section 9. Communications Procedures

910 Isolating Communications Problems

This procedure uses SSP procedures (for example, COMMTEST) to display status and diagnose communications problems. Use this procedure to diagnose communications problems when no SRCs are specified or when the SRC does not isolate a specific FRU or area of the communications network.

1. Run the Basic Communications Diagnostic Test option of COMMTEST.

   If no system hardware problems are found and SLCA is installed, continue with step 2.

   If no system hardware problems are found and MLCA is installed, inspect the error history tables for the MLCA controller and all communications lines. If the MLCA controller or more than one communications line have had intermittent problems, go to "915 Isolating MLCA Controller Problems" on page 9-4 and run the MLCA controller diagnostic test under COMMTEST several times.

2. Verify correct communications configuration, using the STATUS COMCNFIG (D H) procedure or the STATUS COMM (D C) procedure (use procedure "930 Displaying Communications Configuration Status" on page 9-11, or see the *System Reference* manual). If possible, use the D C procedure at the work station that is running the failing job; the configuration parameters for each work station can be different.

   Some communications configuration data can be changed by the SETCOMM procedure or by the ALTERCOM procedure under SSP. These changes can affect the way communications jobs run. See "930 Displaying Communications Configuration Status" on page 9-11 or the *System Reference* manual for descriptions of these two procedures.

If no problems are found, the problem might not be a system problem, although other system parameters might be in error. Continue with one of the following steps:

a. For problems associated with remote work stations, continue with step 3.
b. For problems not associated with remote work stations, go to step 4.

3. If the problem is associated with remote work station operations, perform one or more of the following steps to verify system operation:

a. Run the online problem determination procedures (PROBLEM) for communications.
b. Run the station test (STATEST).

   Note: When you run STATEST for switched lines:
   1) Select option 1 to display controllers and station addresses.
   2) Record the address that you want to test.
   3) Press Cmd3.
   4) Select option 3 and key in the address that you want to test. You can test only one address at a time.

c. Run the SDLC online test (SDLCTEST). See "955 Running the SDLC Online Test" on page 9-14.

   Note: These tests may not be valid for non-IBM work stations or work stations with non-IBM alterations.

If problems are found but were not isolated, go to step 5.

If no problems are found and the system is operating correctly, go to step 6.

4. If the problem is not associated with remote work station operations, perform one or more of the following steps (for X.25, perform only step 4c) to verify system operation:

   a. Run the BSC online test (BSCTEST). See "950 Running the BSC Online Test" on page 9-13.
   b. Run the SDLC online test (SDLCTEST). See "955 Running the SDLC Online Test" on page 9-14.
   c. Run the station test (STATEST).

   If problems are found but were not isolated, continue with step 5.

   If no problems are found and the system is operating correctly, go to step 6.

5. If external modems are being used, perform one or more of the following steps:

   a. For external IBM 386x modems, run the local and remote modem tests under COMMTEST.
   b. For all external modems on nonswitched lines, run the remote loopback transmit/receive test under COMMTEST to the local and remote modems. The modems must perform a loopback function. Usually there are switches on the modem to do this. (Tests to remote modems need support at the remote site.)

      Notes:
      1) Clocking must be supplied by the communications adapter (DDSA only or EIA with internal clock selected), the modem, or the network.
      2) The remote loopback test can also be run to existing network loopback functions.
      3) The wrap mode option of the remote loopback tests supplies the loopback function to other devices that are performing the transmit and receive function.

   c. If the external modem is an IBM modem, use the modem reference manual to perform diagnostic tests.

      If the external modem is a non-IBM modem, request the customer to perform the diagnostic tests.

6. If no problems are found and the system is operating correctly, print the communications error log, using ERAP.

   If requested, save the following information for the programming support representative:

   a. For MLCA systems, print the communications microcode automatic trace tables, using the print automatic data trace option of COMMTEST.
   b. Print the communications SVC traces, using the procedures described in the *Program Problem Diagnosis and Diagnostic Aids* manual.

915 Isolating MLCA Controller Problems

This procedure uses COMMTEST (an SSP procedure) to diagnose MLCA controller problems.

Note: When run under COMMTEST, MCLA controller test results are not recorded in the error history table.

1. Select the Additional Communications Diagnostic Tests option of COMMTEST.

2. Run the MLCA controller diagnostic test several times (no other communications jobs can be running).

3. If no MLCA controller problems are found, inspect the MLCA controller error history table (using ERAP) for the latest MLCA controller errors.

4. If no MLCA controller problems are found, return to "910 Isolating Communications Problems" on page 9-2 and continue with step 2.

5. If SRCs other than 1800 are logged, exchange the FRUs indicated by the SRCs.

6. If the latest SRCs logged are 1800, use the information in Figure 9-1 on page 9-5 through Figure 9-4 on page 9-6 to isolate the FRU.

PER Bit (Active)	FRU	%	Description
0	A-A1T2	80	Controller storage parity check
3	A-A1T2	80	Controller storage address not valid

Figure 9-1. Processor Error Register (PER), Bit 0 or 3 Active

Status 1 (Hex)	FRU	%	Description
4x	A-A1T2 A-A1U2	60 40	DBO and DBI parity checks
5x	A-A1T2 A-A1V2	60 40	DBO and DBI parity checks
6x	A-A1T2 A-A1W2	60 40	DBO and DBI parity checks
7x	A-A1T2 A-A1X2	60 40	DBO and DBI parity checks

Figure 9-2. Processor Error Register (PER), Bits 0 and 3 Not Active, and Status Byte 0, Bit 0 or 2 Active

Status 1 (Hex)	FRU	%	Description
4x	A-A1U2	65	DBO and DBI parity checks
	A-A1T2	35	
5x	A-A1V2	65	DBO and DBI parity checks
	A-A1T2	35	
6x	A-A1W2	65	DBO and DBI parity checks
	A-A1T2	35	
7x	A-A1X2	65	DBO and DBI parity checks
	A-A1T2	35	

Figure   9-3.   Processor Error Register (PER), Bits 0 and 3 Not Active, and Status Byte 0, Bit 1 or 3 Active

Status 1 (Hex)	FRU	%	Description
4x	A-A1U2	60	
	microcode	30	
5x	A-A1V2	60	
	microcode	30	
6x	A-A1W2	60	
	microcode	30	
7x	A-A1X2	60	
	microcode	30	
Fx	A-A1U2	20	Ask the customer or see the ERAP line
	A-A1V2	20	reports to determine the lines that were
	A-A1W2	20	running when the error occurred
	A-A1X2	20	
	A-A1T2	20	

Figure   9-4.   Processor Error Register (PER), Bits 0 and 3 Not Active, and Status Byte 0, Bits 0 through 3 Not Active

917 Isolating Communications Cable Problems

To isolate problems in external communications cables, use the following procedures:

920 Communications Diagnostic Tests

This procedure uses SSP procedures (for example, PROBLEM) to diagnose communications problems. Diagnostic tests for data communications attempt to locate problems with internal and some external data communications interfaces. There are four types of diagnostic tests for data communications:

- Diagnostic tests during IPL

- Diagnostic tests during online problem determination

- Diagnostic tests during concurrent maintenance

- Diagnostic tests during customer setup (CSU)

Diagnostic Tests During IPL

Diagnostic tests during IPL test the communications hardware; data is wrapped through the line adapters.

Diagnostic Tests During Online Problem Determination

Diagnostic tests during online problem determination (PROBLEM) test the communications hardware, microcode, and local and remote work stations. See the manual *System Problem Determination* for procedures.

Diagnostic Tests During Concurrent Maintenance

Concurrent diagnostic tests are run under SSP while the system is operating on other jobs. Except for the MLCA controller diagnostic test (COMMTEST), which uses all communications lines, only the line being tested must be assigned to the test when these tests are run for an MLCA system. The other lines can be used for system data communication.

Concurrent diagnostic tests include:

- SDLCTEST: The SDLC online test verifies correct operation of the communications link between two systems, or between the system and attached SDLC devices. See "955 Running the SDLC Online Test" on page 9-14.

- BSCTEST: The BSC online test verifies correct operation of the communications link between two systems, or between the system and attached BSC devices. See "950 Running the BSC Online Test" on page 9-13.

- STATEST: The station test verifies correct operation of the communications link between the system and the remote work stations.

   Note: When STATEST is started to test a switched line, the primary station (host) waits for a call from the secondary station (remote) to start the station test.

- COMMTEST: The communications concurrent diagnostic test has options for testing single-line communications attachments (SLCA) and multiline communications attachments.

  - Basic communications diagnostic test: This test checks out the communications hardware and external cables where possible. Locally attached IBM modems are also tested.
  - Additional diagnostic tests as follows:

  · IBM 386x local and remote modem diagnostic self tests: These tests cause the local and remote modems to perform internal diagnostic tests and return results to COMMTEST. The status tests get the data quality of the communications line (sensed by the local or remote modem) and display a data quality value from 0 through F; the lower the value, the better the line. A value of 8 or higher indicates bad quality.

  Remote loopback tests (transmit test): This test transmits data and verifies the received data. An external device must have the ability to wrap the transmitted data and to supply clocking when necessary.

  Remote loopback tests (echo test): The system will echo received data back on the transmit data line. This test is used for 4-wire point-to-point testing.

MLCA controller diagnostic test: This test runs internal tests of the MLCA controller. This test does not run if any communications line is in use.

Print data traces (print automatic data trace): On systems with MLCA installed, this option formats and prints the communications trace information that was stored when either the basic communications test (line wrap) or MLCA controller diagnostic test (controller wrap) was automatically run because a permanent error occurred.

Print data traces (print COMMTEST data trace): On systems with MLCA installed, this option formats and prints the communications trace information that was stored when either the basic communications test (line wrap) or MLCA controller diagnostic test (controller wrap) was run by the COMMTEST procedure.

Static driver on/off tests (Japan only): These tests hold the interface drivers on and off for interface testing.

Diagnostic Tests During Customer Setup

Diagnostic tests during customer setup (CSU) test the communications hardware; data is wrapped through the line adapters. See the manuals *Setting Up Your Computer* and *Installing Your New Features*.

Local System

Remote System

Communications

System Software | Microcode | Controller | Adapter | Line Intf

Cable

External OEM

External OEM

Telephone or Operating Company Facilities

External OEM

External OEM

Cable

Communications

Line Intf | Adapter | Controller | Microcode | System Software

Automatic Problem Determination Wraps

- CSIPL

Data
Data
(A) (B)

- Basic Communications Diagnostic Test

Data
(A) (B)
(C)
V.35 Japan DCE
X.21 DCE

— Local self test (386x modems)

Request
Results
External IBM 386x Modem

— Local status test (386x modems)

Request
Status
External IBM 386x Modem

Pt-Pt Secondary Modem

— Remote self test (local is pt-pt control)

Request
Remote Results
IBM 386x Modem

— Local/remote status test (local is pt-pt control)

Request
Remote Status
IBM 386x Modem

- MLCA Controller Wrap

Data
(A)

COMMTEST

- Basic Communications Diagnostic Test

Data
(A) (B) (E) (F) (C)
V.35 Japan DCE
X.21 DCE

— Local self test (386x modems)

Request
Results
External IBM 386x Modem

— Local status test (386x modems)

Request
Status
External IBM 386x Modem   Pt-Pt Secondary Modem

— Remote self test (local 386x is pt-pt or MPC)

Request
Remote Results
IBM 386x Modem

— Local/remote status test (local 386x is pt-pt or MPC)

Request
Remote Status
IBM 386x Modem

- MLCA Controller Wrap

Data

— Local self test (386x modems)

Request
Results
External IBM 386x Modem

— Local status test (386x modems)

Request
Status
External IBM 386x Modem

— Remote self test (local 386x modem is pt-pt or MPC)

Request
Remote Results
IBM 386x Modem

— Local/remote status test (local 386x modem is pt-pt or MPC)

Request
Remote Status
IBM 386x Modem

— Remote loopback test (transmit/receive)

Data
(H) (H) (L) (J) (L)
(K)
Wrap Cmd

— Local wrap mode (echo received data)

Wrap Cmd
Data

— Static interface driver on test (Japan)

— Static interface driver off test (Japan)

Other Tests

- BSCTEST

Requestor Command
Responder Data

- SDLCTEST

Requestor Command
Responder Data

- STATEST

Test Command
Remote Response

- Customer Setup Verification

Data
(G) (E) (B) (F)

(A) = All interfaces
(B) = DDSA, X.21
(C) = EIA (IBM 378x modems support wrap command on pin 18)

(E) = All interfaces
(F) = EIA, DDSA, Autocall
(G) = All MLCA interfaces
(H) = EIA with internal clock, DDSA
(J) = Common carrier wrap facility
(K) = DDSA, other wrap facilities
(L) = EIA w/ext modem wrapped via modem wrap switches

930 Displaying Communications Configuration Status

Some communications configuration data can be changed by the SETCOMM procedure or by the ALTERCOM procedure under SSP. These changes can affect the way communications jobs run. You can verify the configuration status of each communications line using the STATUS COMCNFIG and STATUS COMM procedures.

The SETCOMM and ALTERCOM procedures are described as follows:

- SETCOMM: The SETCOMM procedure under SSP changes some communications parameters in the system configuration record. An initial program load (IPL) must be performed before the changes take effect.

  You can use the STATUS COMCNFIG (D H) command to display the present settings.

- ALTERCOM: The ALTERCOM procedure under SSP changes some items associated with batch BSC, SDLC, or a communications line. ALTERCOM changes information only for the display station at which it is run. If ALTERCOM is run while an SSP-ICF (interactive communications feature) subsystem or batch BSC job is running, it will have no effect on the job that is running. Changes made using ALTERCOM remain in effect until the ALTERCOM procedure is run again, or until the SETCOMM procedure is run.

  You can use the STATUS COMM (D C) command to display the present settings.

Use the help menus or see the *System Reference* manual for additional information on these procedures.

935 Displaying Communications Line Status

Communications status for any line can be displayed at any time.

1. Ensure that the Security switch is in the Service position.

2. Select function A (Communications Line Status). A 1 appears in the low-order position of the 4-character display.

3. Select a communications line, using the low-order Input key.

4. Press the Start Function key. The selected line status is displayed in the 4-character display.

   Use the communications template found with this manual to decode the Communications Line Status/Autocall lights.

   Note: If the line selected is an autocall line, the 4-character display shows the autocall status while the line is being connected. When data terminal ready (DTR) and data set ready (DSR) become active, the line has been connected and the display shows the status for that line.

5. To select another communications line:

   a. If the Output Display light is on, press the Display key. The selected line number is displayed.
   b. Select a communications line, using the low-order Input key.
   c. Press the Display key again. The Output Display light is activated and the selected line status is displayed in the 4-character display.

Communications Line Status/Autocall
Template

Normal

Locked

Service

| Power On | Temp | Voltage | Current | Diskette in Use |

| Console | Program | Processor |

Function
1 IPL
2 Reload
3 IPL Diagnostic Diskette
4 Dump
5 System Reset
6 Power Off
7 Console Alter/Display
8 Lamp Test
9 Start CSP
A Communication Line Status
b Display CSP Status
C Display/Alter LSR
d Display/Alter Control
  Storage
E Compare Address & Stop

Function

Output Display

Select Function   Start Function

Input Keys

Display

| | CRQ | DPR | |
| DTR | RTS | TDS | |

| DSR | CTS | RDS | Sync |
| | DLO | PND | ACR |

Legend for Autocall Status:

Term	Meaning
ACR	Abandon call and retry
CRQ	Call request
DLO	Data line occupied
DPR	Digit present
PND	Present next digit

Legend for Line Status:

Term	Meaning
CTS	Clear to send
DSR	Data set ready
DTR	Data terminal ready
RDS	Receive data space
RTS	Request to send
TDS	Transmit data space
Sync	Character sync

Note: If the line selected is an *X.21 switched line*, the *4-character display shows the status of the X.21 phases, as in the following figures.*

Ready: The system is ready to accept an incoming call.

Call set-up: The system is answering or making a call. This status is of short duration and usually is not visible.

Data Transfer: The system is sending or receiving data.

950 Running the BSC Online Test

The BSC online test verifies correct operation of the communications link between two systems, or between the system and attached BSC devices. To run the BSC online test, a similar support program must be started at the remote location.

1. Insert diskette 3.

2. Key in BSCTEST on the SSP command line and press the Enter key.

3. Select:

    a. A line number to be tested (may not be needed on a system with SLCA installed).
    b. REQUESTOR (to start the BSC test to another system) or RESPONDER (to answer the BSC test request from another system).
    c. The data coding the customer has been using (ASCII or EBCDIC).
    d. YES to review or change the communications configuration. Always attempt to run the test with the present configuration before making any changes unless you are attempting to run to a system or device that the customer was not using.
    e. For switched line configurations, you may be prompted for security information (a customer option).

4. Select the test to be run.

5. Select the number of times the test should be run. You should run two or more tests at least 10 times each.

6. Analyze the results. If the test ends with no errors, the communications link is operating correctly at the present time.

955 Running the SDLC Online Test

The SDLC online test verifies correct operation of the communications link between two systems, or between the system and attached SDLC devices (for example, IBM 5251 Model 12 or IBM 5294 controllers). To run the SDLC online test to another system, a similar support program must be started at the remote location. To run the SDLC online test to a remote work station, you must use the VARY command (see "329 Summary of Useful SSP Procedures" on page 3-8) to change the selected work station status to offline.

1. Insert diskette 3.

2. Key in SDLCTEST on the SSP command line and press the Enter key.

3. Select:

   a. A line number to be tested (may not be needed on a system with SLCA installed).
   b. REQUESTOR (to start the SDLC test to another system or device) or RESPONDER (to answer the SDLC test request from another system).
   c. YES to review or change the communications configuration. Always attempt to run the test with the present configuration before making any changes unless you are attempting to run to a system or device that the customer was not using. ALTERCOM changes the configuration only for the display station at which it is run. If configuration is correct and diagnostics run at the system console, but the customer job fails when it is run from another display station, repeat step 3 at that display station.
   d. The hexadecimal address of the remote system, controller, or device to be tested.

      Note: If the network is a point-to-point network, you can use hex FF as the address. If the network is a multipoint network, you must obtain the correct address from the customer.

4. Select the test to be run.

5. Select the number of times the test should be run. You should run two or more of the first six tests at least 10 times each.

6. Analyze the results. If the test ends with no errors, the communications link is operating correctly at the present time.

980 EIA/CCITT Signal Pins

Signal Name	Signal Pins		Signals Wrapped
	System End	Cable End	
Transmit data space (TDS)	2	2	>
Receive data space (RDS)	3	3	<
Request to send (RTS)	4	4	>
Clear to send (CTS)	5	5	<
Data set ready (DSR)	6	6	<
Signal ground (GND)	7	7	
Received line signal detect (RLSD)	8	8	<
Select standby (SNBU)	11	11	>
New sync	14	14	>
Transmit timing (TX)	15	15	<
Receiving timing (RX)	17	17	<
Test control (WRAP)	18	18	>
Data terminal ready (DTR)	20	20	>
Ring indicate (RI)	22	22	<
Rate select (SELECT)	23	23	>

Cable Wrap Connector

Cable
Connector

External
Modem
or Stub Cable
for Belgium

13 12 11 10 9 8 7 6 5 4 3 2 1

25 24 23 22 21 20 19 18 17 16 15 14

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 23 24 25
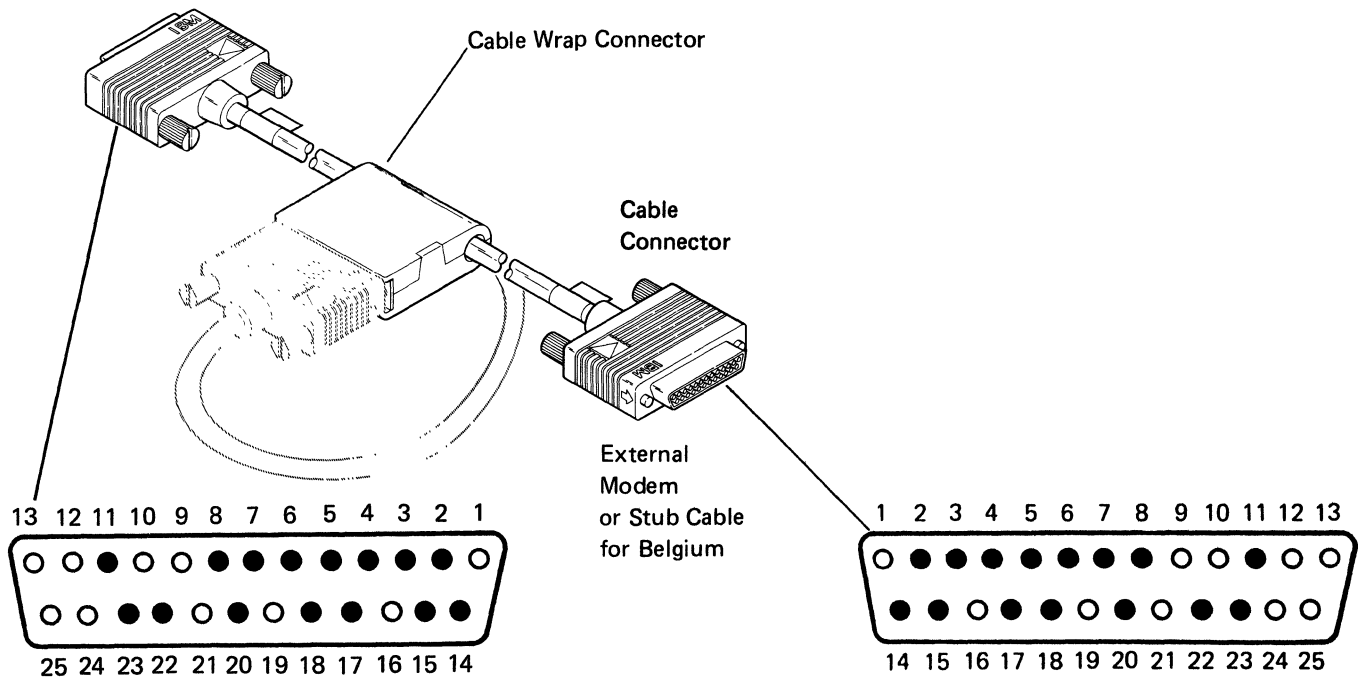
982 Autocall Signal Pins

Signal Name	Signal Pins		Signals Wrapped
	System End	Cable End	
Digit present (DPR)	2	2	>⌐
Abandon call and retry (ACR)	3	3	<⌐
Call request (CRQ)	4	4	>⌐
Present next digit (PND)	5	5	<⌐
Power indicate (PWI)	6	6	<
Signal ground (GND)	7 <———> 7		
Auto call cable sense	10 <——— 10		
Distant station connected (DSC)	13	13	<
Number digit 1 (NB1)	14	14	>
Number digit 2 (NB2)	15	15	>
Number digit 4 (NB4)	16	16	>
Number digit 8 (NB8)	17	17	>
Data line occupied (DTR)	22	22	<
Diag rcvr	23	23	<

Cable Wrap Connector

To Autocall Unit

13 12 11 10 9 8 7 6 5 4 3 2 1

25 24 23 22 21 20 19 18 17 16 15 14

1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20 21 22 23 24 25
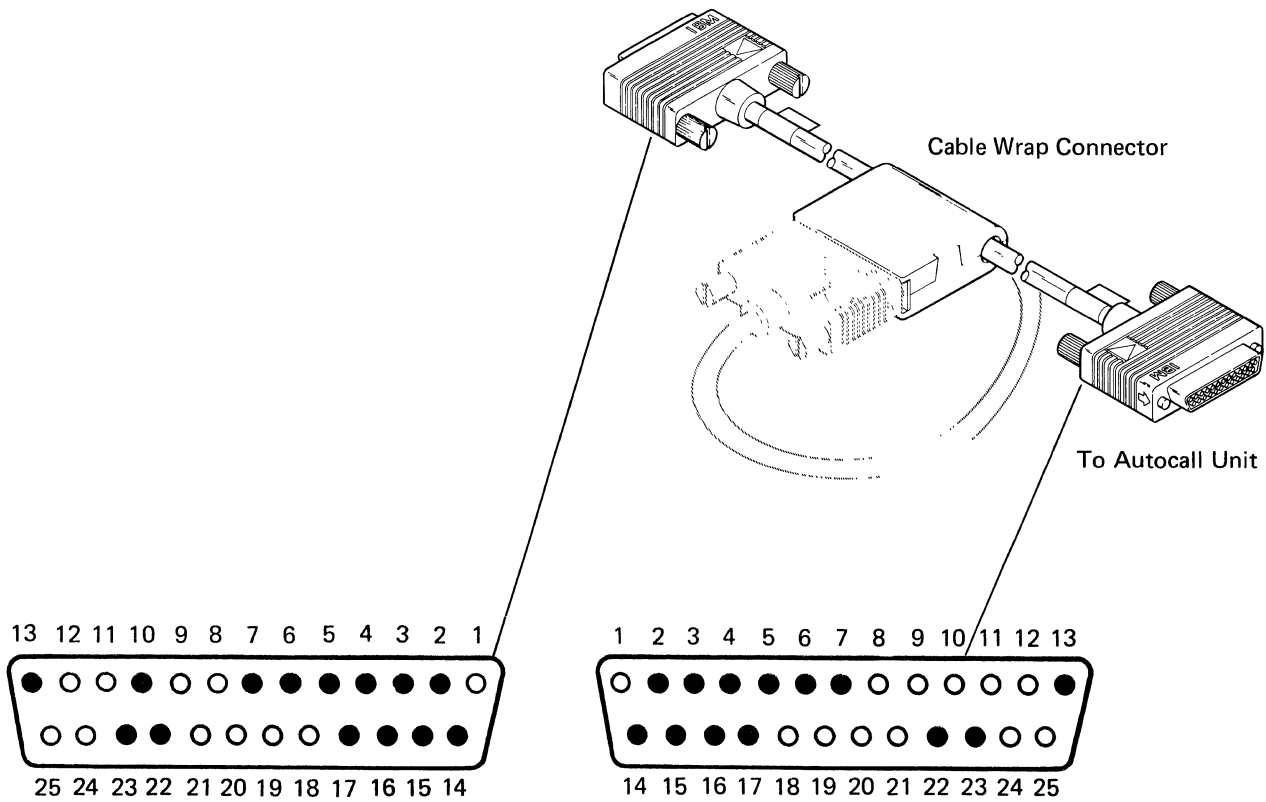
984 DDSA Signal Pins

Signal Name	Signal Pins		Signals Wrapped
	System End	Cable End	
-Receive (DT1)	12	3	<
+Receive (DR1)	13	4	<
-Transmit (DT)	19	5	>
+Transmit (DR)	24	6	>

Cable Wrap Connector

To Channel Service Unit
or
Adapter Cable (IBM part 4236967)
for Direct Local Attachment

13 12 11 10 9 8 7 6 5 4 3 2 1

25 24 23 22 21 20 19 18 17 16 15 14

1 2 3 4 5 6 7 8

9 10 11 12 13 14 15
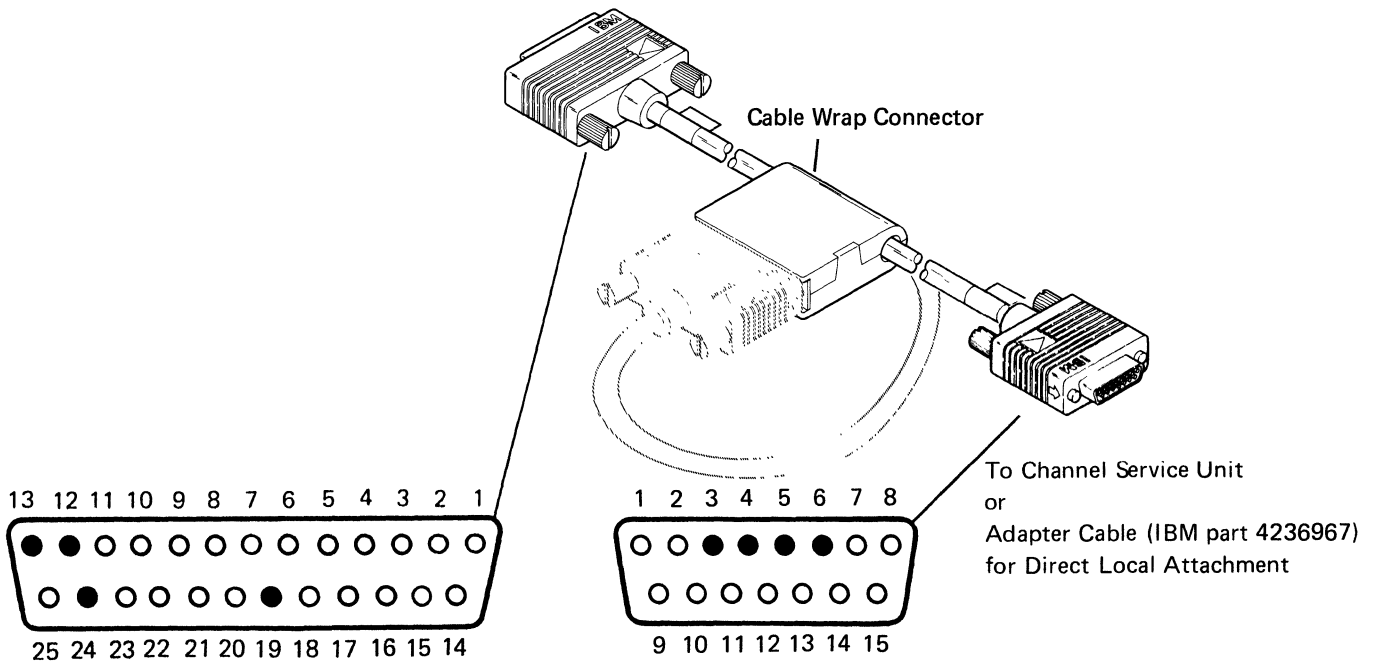
986 V.35 Signal Pins

Signal Name	Signal Pins		Signals Wrapped
	System End	Cable End	
			I/O panel only
+Wrap A	18		>
-Wrap B	24		>
+Xmit clk A	9	Y	<
-Xmit clk B	17	a	<
+Rcv clk A	8	V	<
-Rcv clk B)	13	X	<
+Rcv data A	3	R	<
-Rcv data B	5	T	<
+Xmit data A	2	P	>
-Xmit data B	4	S	>
Data terminal ready (DTR)	19	H	>
Received line signal detect (RLSD)	16	F	<
Data set ready (DSR)	12	E	<
Request to send (RTS)	20	C	>
Clear to send (CTS)	6	D	<
Signal ground (GND)	7	B	

13 12 11 10 9 8 7 6 / 5 4 3 2 1

25 24 23 22 21 20 19 18 17 16 15 14

To V.35
Modem, Stub
Cable (France or
Switzerland), or
Modem Eliminator
for Local
Connection
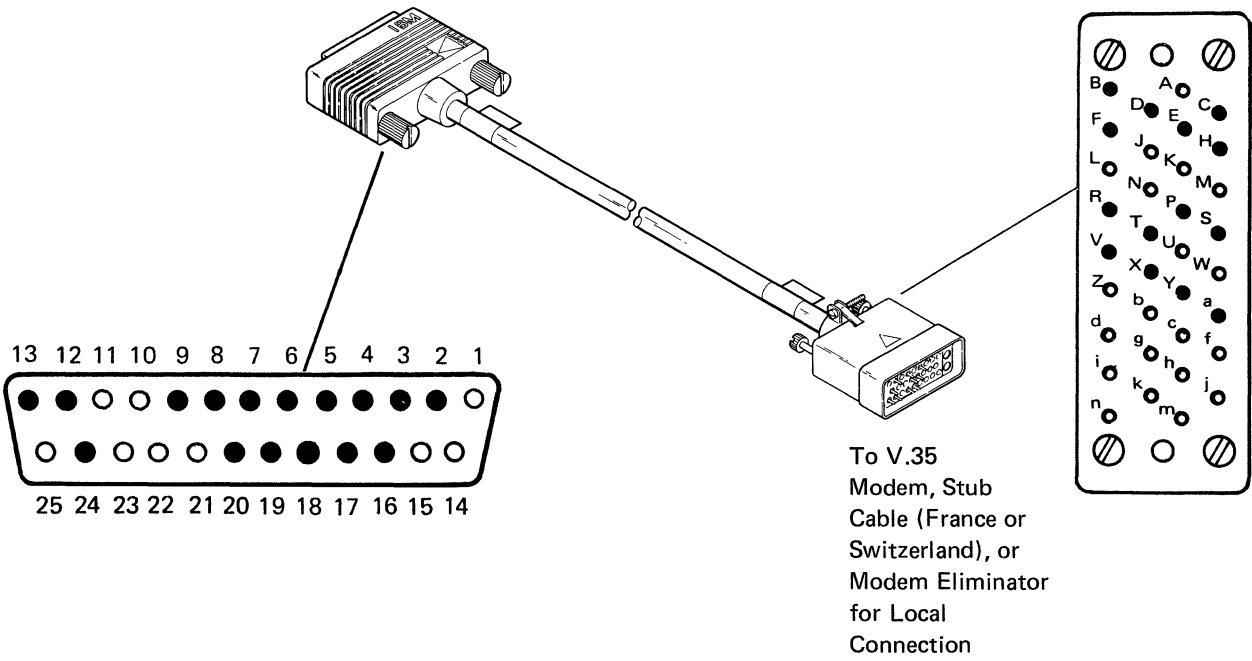
988 X.21 Signal Pins

Signal Name	Signal Pins		Signals Wrapped
	System End	Cable End	
			I/O panel only
Control A	20	3	>
Control B	23	10	>
Diag clk A	11		>
Diag clk B	18		>
Signal element timing A	17	6	<
Signal element timing B	8	13	<
Rcv data A	3	4	<
Rcv data B	5	11	<
Xmit data A	2	2	>
Xmit data B	4	9	>
Indicate A	6	5	<
Indicate B	15	12	<
Signal ground (GND)	7	8	

13 12 11 10 9 8 7 6 5 4 3 2 1

25 24 23 22 21 20 19 18 17 16 15 14

1 2 3 4 5 6 7 8

9 10 11 12 13 14 15
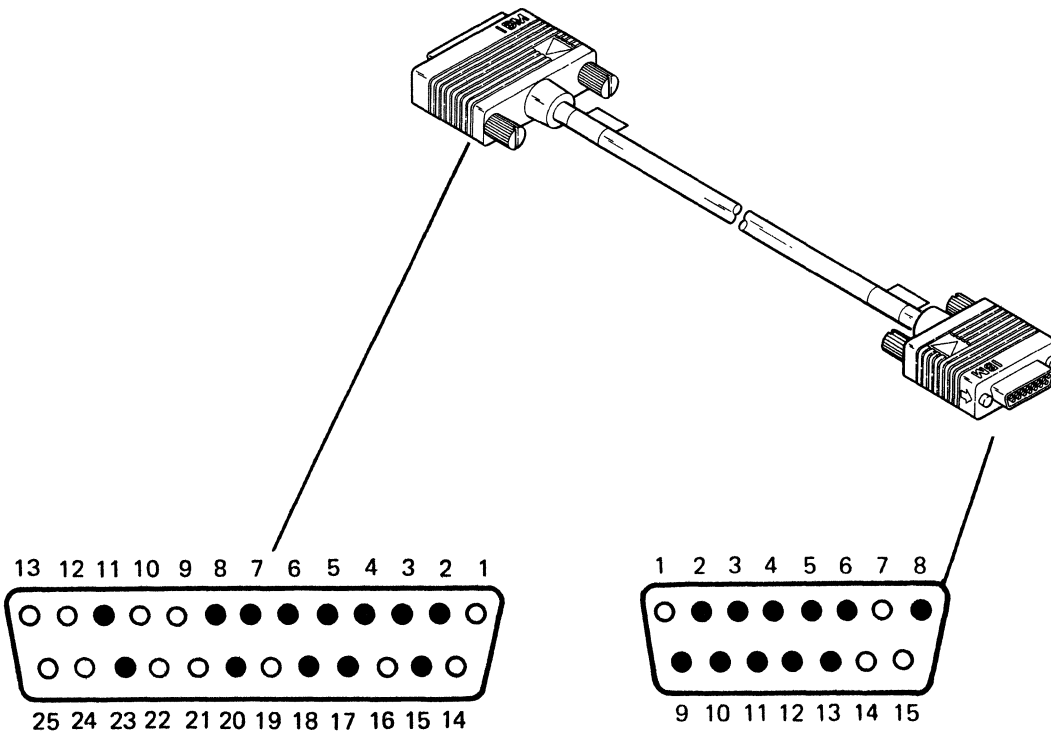
Appendix A. AC Safety Grounds

The figure below is an AC grounding schematic. The locations of the AC safety ground points are shown on the following page.

All J-connectors on this page have green and yellow wires that are AC safety grounds. All AC safety ground wires must be installed correctly.

Legend:

1   Star washer

2   Thread-forming screw

3   Grounding continuity by direct metal-to-metal contact

⎁   Chassis ground

⏚   Frame or system ground

Gate Fan Grounds

51TD Drive
Motor Ground

Frame Ground for
51TD Drive Motor
and Gate Fans

Disk Area
Fan Ground

Frame Ground for
Power Cord and
Line Filter

Frame Ground for
Power Supply and
Disk Area Fan
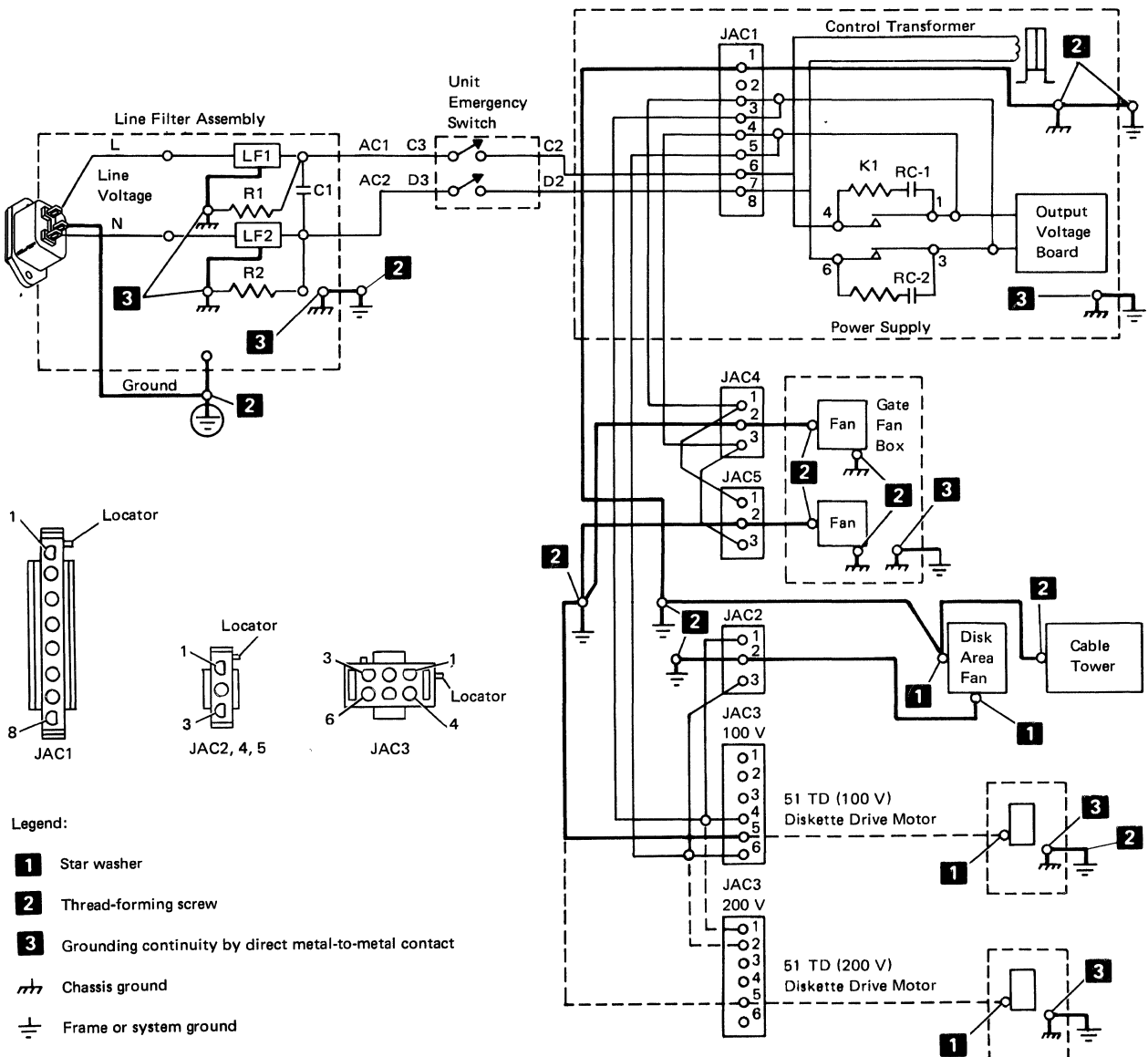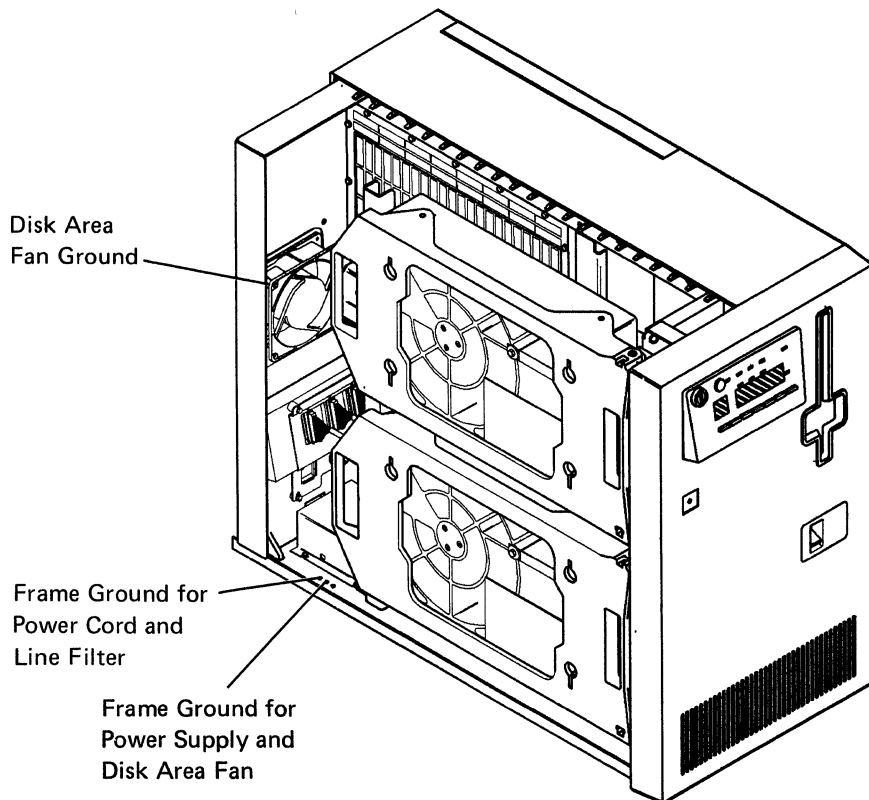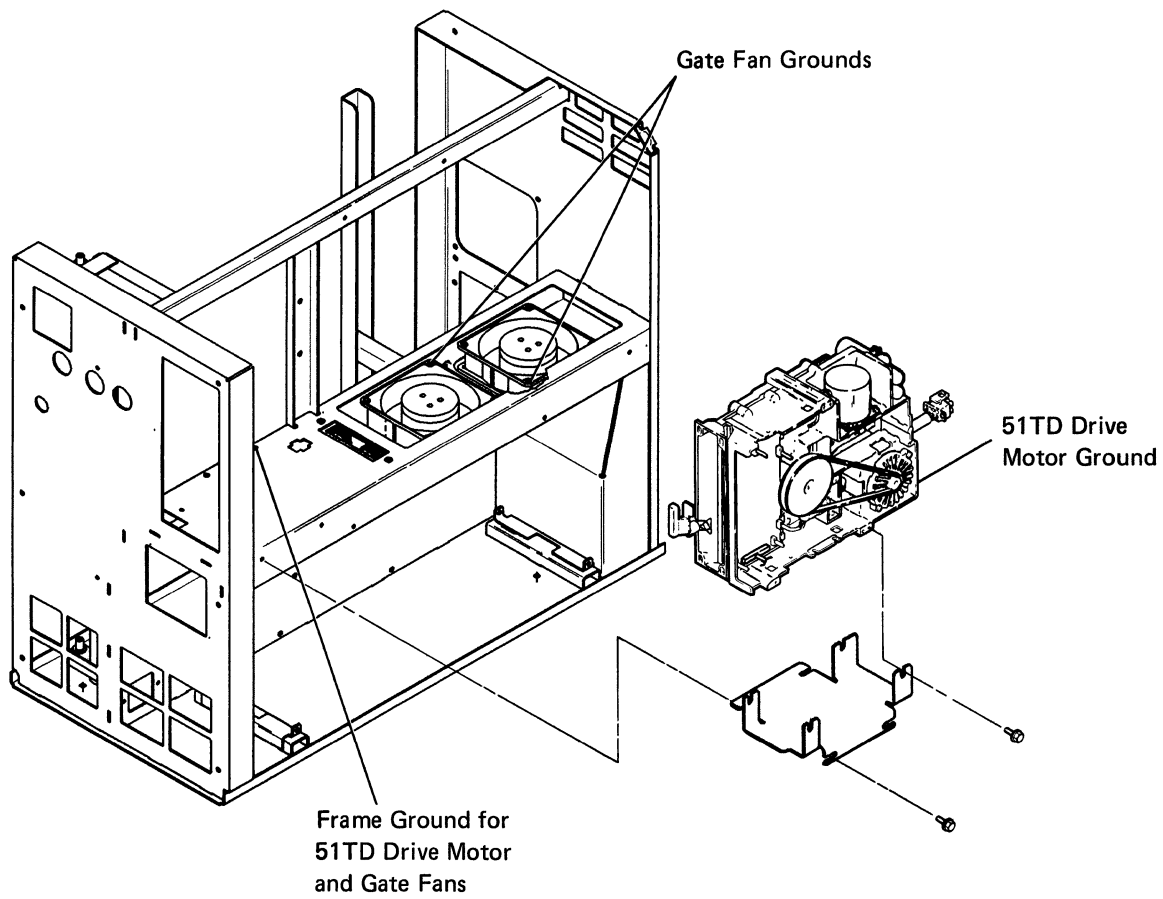
Appendix B. Safety Inspection Guide

Getting Ready

Before performing the inspection procedures
contained in this guide, ensure that present
conditions are safe, the machine is powered off,
and the power cord is removed.

Safety Conditions

If present conditions are not safe, you must
determine if the condition is serious. For example,
the following conditions are not safe:

- Electrical: In the primary power area, a frame
  that is not grounded

- Mechanical: Missing covers

- Other: Leaking capacitors or a damaged CRT
  face

You must determine if the problem should be
repaired before you can continue with this
inspection.

Safety Education

Before performing the inspection procedures
contained in this guide, you must have completed
the *Electrical Safety Training Course for IBM
Customer Engineers* self-study course (77170 or
latest level).

Chemicals

Do not use solvents, cleaners, or other chemicals
not approved by IBM.

Performing the Inspection

IBM machines are designed and assembled with
safety items installed to protect operators and
service personnel from injury. This inspection
guide identifies areas of the machine that may not
be safe. Use good judgment to identify other
safety conditions not covered by this inspection
guide.

Reference Information

Ensure that the following reference information is
available:

- *Customer Engineering Memorandums* (CEMs),
  including *Engineering Change Announcements*
  (ECAs) and *Service Aids* (SAs) for this machine
  type

- The manual *What to Do Before Your Computer
  Arrives*, SBOF-4778

- The manual *Electrical Safety for IBM Customer
  Engineers*, S229-8124

AC Power Cord

Check	Step
☐	Remove the power cord from the customer outlet.
☐	Check the power cord for visible cracks, wear, or damage.
☐	Ensure that the power cord has the correct power plug. See the manual *What to Do Before Your Computer Arrives* for the correct plug type.
☐	Check for 0.2 ohm or less of resistance between the power cord ground and the ground pin on the power plug (customer end).

Power Plug
Ground Pin

Power Cord
Ground
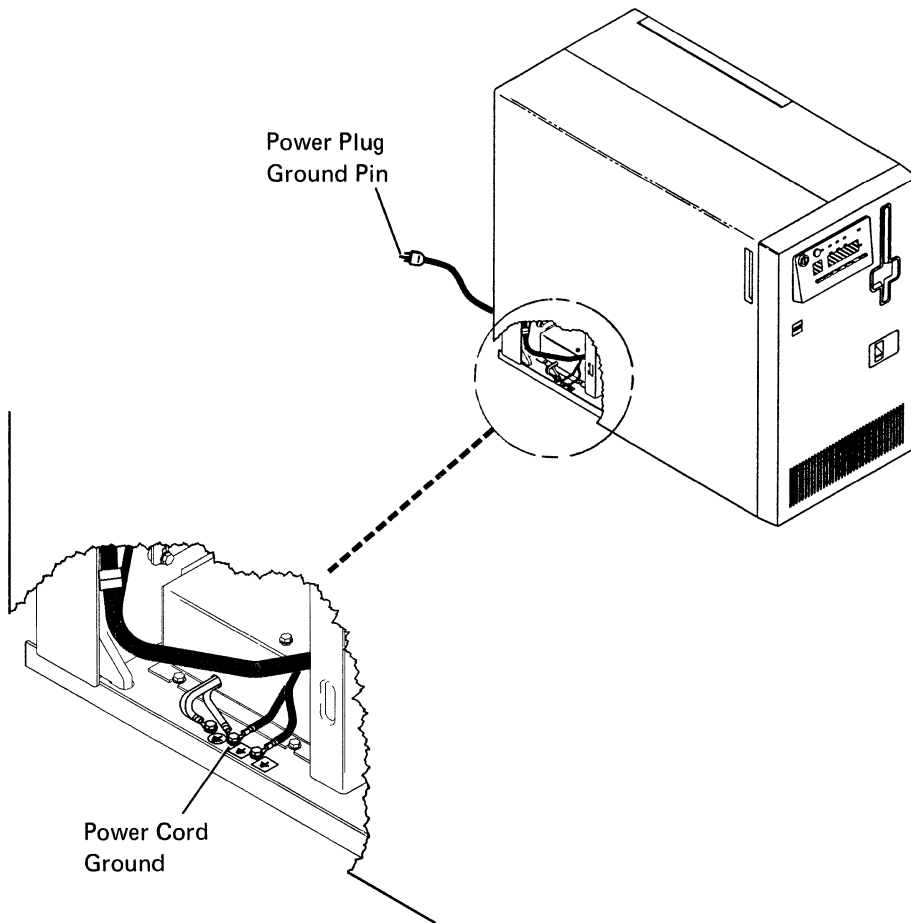
AC Safety Grounds

Check **Step**

☐　　Ensure that all of the AC safety ground
　　　screws shown in Appendix A are tight.

☐　　Check the power area for loose or
　　　damaged cables.

☐　　Check the inside of the system for
　　　foreign materials.

Safety Labels

Check   **Step**

☐   Ensure that the system has all of the safety labels shown below and on the following page.

Label Ⓐ (one)

HAZARDOUS AREA TRAINED SERVICE PERSONNEL ONLY
ZONE DANGEREUSE RESERVEE AU PERSONNEL AUTORISE
ZONE DANGEREUSE PERSONNEL QUALIFIÉ SEULEMENT
GEFÄHRL BEREICH NUR FÜR FACHPERSONAL!
PERICOLO! SOLO PERSONALE ADDESTRATO
AREA PELIGROSA SOLO PERSONAL MANTENIMIENTO
ÁREA PERIGOSA SOMENTE PESSOAL TÉCNICO TREINADO
FARLIGT OMRÅDE ENDAST FÖR UTBILDAD PERSONAL
FARLIG OMRÅDE KUN FOR UTDANNET SEVICEPERSONELL
VAARALLINEN ALUE VAIN KOULUTETULLE HUOLTOHENKILÖSTÖLLE
GEVAAR ENKEL VOOR BEVOEGD PERSONEEL
DANGER PERSONNEL AUTORISE SEULEMENT
危険個所　専門の技術員以外の取扱い禁止

Labels Ⓑ (one)

250 V

P/N 8116107

Label Ⓒ (one)

250 V
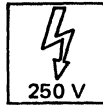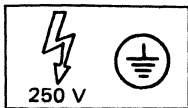
P/N 4178448

Labels Ⓓ (six)

P/N 1680269
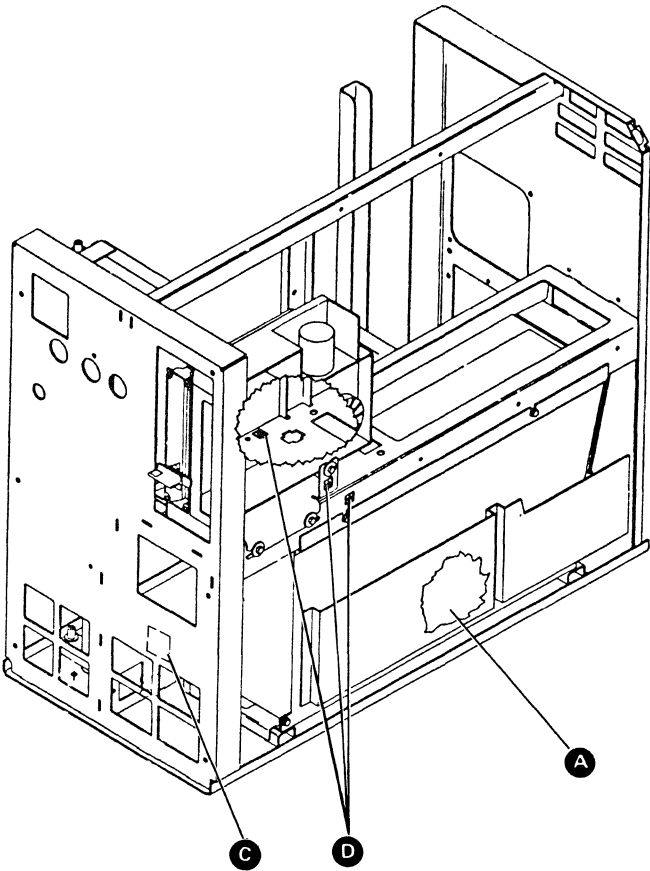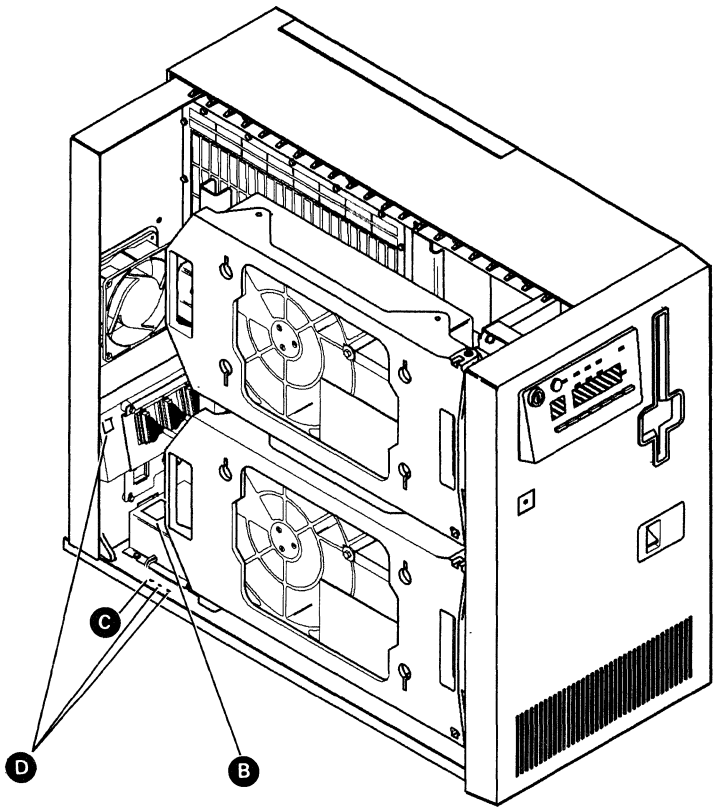
Unit Emergency Switch

Check	Step
☐	Ensure that the Unit Emergency switch is set to the Power Off position. Connect the power cord to the customer outlet. Verify that the Power On light is off.
☐	Press the Power On key and verify that the system does not power on with the Unit Emergency switch set to the Power Off position.
☐	Set the Unit Emergency switch to the Power Enable position and press the Power On key. Verify that the system is powered on and that the Power On light is on.
☐	With the system power on, set the Unit Emergency switch to the Power Off position. Verify that the system is powered off and that the Power On light is off.

System Covers

Check	Step
☐	Remove the power cord from the customer outlet.
☐	Ensure that the system covers are not loose or broken.
☐	Ensure that the covers have no sharp edges.
☐	Connect the power cord to the customer outlet and set the Unit Emergency switch to the Power Enable position.
☐	Return the system to the customer and inform the local branch office that the safety inspection is complete.

Appendix C. Working with ESD-Sensitive Cards

Many system logic cards are sensitive to electrostatic discharge (ESD). To prevent damage to ESD-sensitive logic cards, follow these instructions:

- Power off the system or device before removing logic cards.

- Keep the ESD-sensitive card in the original shipping container until you are ready to install the card in the machine.

- When holding logic cards, move your body as little as possible to prevent an increase of static electricity from clothing fibers, carpet fibers, and furniture.

- Just before touching the ESD-sensitive card, discharge any static electricity in your body by touching the metal frame or cover of the machine. If possible, keep one hand on the frame when, for example, you are installing or removing a logic card.

- Hold the ESD-sensitive card by the edge or connector shroud (cover). Do not touch the pins. If you are removing a field-replaceable module, use the correct tool.

- Return the card to the special container when it is not being used. Do not place the ESD-sensitive card on the machine cover or on a metal table. Machine covers and metal tables are electrical grounds. They make a discharge path from the ESD-sensitive card through your body to ground, increasing the risk of damage to the card. Large metal objects can be discharge paths without being grounded.

- Prevent ESD-sensitive cards from being accidentally touched by other persons. Reinstall machine covers when you are not working on the machine. Do not place unprotected ESD-sensitive cards on a table.

- Keep all ESD-sensitive cards in a metal case if possible.

- Be careful when working with ESD-sensitive cards during cold weather heating. Cold weather heating causes low humidity and increases the risk of static electricity.

Appendix D. Glossary

This glossary includes terms and definitions from the *IBM Vocabulary for Data Processing, Telecommunications, and Office Systems*, GC20-1699.

A. Ampere.

ac. Alternating current.

ACR. Abandon call and retry.

alter. To change something. Same as *modify*.

ALTERCOM. Alter communications (configuration procedure). See also *SETCOMM*.

alternative cylinder. A cylinder on a diskette that is used by the system when the selected cylinder cannot be used.

alternative sector. A sector on a disk that is used by the system when the selected sector cannot be used.

APAR. Authorized program analysis report.

assistance. Aid. See also *RETAIN*.

Attn. Attention (key).

authorized program analysis report (APAR). A request for correction of a problem caused by a defect in the present release of a program.

auto. Automatic.

autocall. A communications feature that permits one processing unit to automatically place a call over telephone lines.

backup. Pertaining to a system, device, or file that can be used in the event of a failure or loss of data. See *backup copy*, *backup diskette*, and *switched network backup (SNBU)*.

backup copy. A copy of a file or data set that is kept for reference in the event the original file or data set is destroyed. See also *backup diskette*.

backup diskette. A diskette that contains information that was copied from a diskette or from disk. The backup diskette is used in the event the original information is accidentally altered or destroyed. See also *backup copy*.

batch. A group of records or jobs put together for processing or transmission.

binary synchronous communications (BSC). A type of line control with a set of rules for transmitting data over a communications line connecting two devices that use a communications adapter.

BSC. Binary synchronous communications.

BSCTEST. BSC online test (procedure). See also *COMMTEST*, *SDLCTEST*, and *STATEST*.

call. (1) A service call. (2) To activate a program or procedure at its entry point. (3) In data communications, the action performed by the calling person or station, or the operations necessary in making a call, or the effective use made of a connection between two stations.

call request (CRQ). To request a call. See also *call*.

called station. On a switched line, in data communications, the location to which a connection is made.

calling station. On a switched line, in data communications, the location making a connection.

CCITT. The International Telephone and Telegraph Consultative Committee.

CE. Customer engineer (World Trade countries). See also *CSR*.

CE cylinder. An area on disk that is used as a read/write area for diagnostic testing.

CE track. See *CE cylinder*.

CEB. Channel error byte.

characteristics. Information about a program, device, or communications protocol that is not specifications.

clocking. In data communications, the use of clock pulses to control synchronization of data and control characters.

Cmd. Command (key).

CNTLCOMM. Control communications (procedure).

COMCNFIG. Communications configuration.

COMM. Communications.

COMMTEST. Communications concurrent diagnostic test (procedure). See also *BSCTEST, SDLCTEST,* and *STATEST.*

completion code. See *condition code.*

condition code. A code that shows the results of a processing operation.

configure. To make or describe a configuration.

control panel. A panel that contains keys, lights, and displays used by the operator (for normal operation) and by the CE/CSR (for system maintenance).

control storage directory. An area on disk that contains the address of all programs in the control storage library.

control storage library. An area on disk that contains the diagnostic programs that are loaded to control storage.

CRC. Cyclic redundancy check (character).

CRQ. Call request.

CSP. Control storage processor.

CSR. Customer service representative (U.S.). See also *CE.*

CSU. Customer setup.

CTS. Clear to send.

customize. To update the unit definition table and system microcode on disk. See also *system customize utility.*

cycle steal (CS). The process by which a device uses cycles of another machine or device. If, for example, the processing unit is performing an ALU operation when the disk needs service, the ALU operation is stopped while a byte of data is moved to or from the disk.

cyclic redundancy check character (CRC). A character code used for error sensing and correction.

cylinder. In disk and diskette storage devices, a cylinder contains all the data under all heads without moving the actuator or the head and carriage assembly.

data set ready (DSR). A communications signal that indicates the modem is ready to transmit or receive data.

data terminal equipment (DTE). The processing unit that uses data communications lines.

data terminal ready (DTR). An EIA/CCITT interface line that signals the modem when the terminal is ready to transmit or receive data.

dB. Decibel.

DBI. Data bus in.

dBm. Decibel based on one milliwatt.

DBO. Data bus out.

DCE. Data communications equipment.

DCP. Diagnostic control program.

DDSA. Digital Data Service Adapter.

DE. Disk enclosure.

decibel (dB). A unit of measure that is the ratio of two power or voltage levels.

dedicated. (1) Pertaining to one application or purpose. (2) A time during maintenance when no customer jobs are running.

defect. (1) A failure. (2) A bad area on a disk, diskette, or tape surface. (3) An error in a released program or program module.

determination. See *problem determination.*

diagnostic control program (DCP). The supervisor program that controls diagnostic programs.

Digital Data Service Adapter (DDSA). In data communications, a device used in place of a modem when transmitting data over the AT&T Digital Data Service Network. (A DDSA can also be used for local connections.)

directory. See *control storage directory* and *diskette directory.*

disk enclosure (DE). The sealed unit of the disk storage device that contains the disks, the spindle, and the actuator.

diskette directory. An area of a diskette that contains the addresses of all records on the diskette.

DLO. Data line occupied.

DMR. Data modem ready.

DPR. Digit present.

DSA. Data storage attachment/adapter.

DSKTEST. Diskette test (procedure).

DSR. Data set ready.

DTE. Data terminal equipment.

DTR. Data terminal ready.

dump. (1) To copy the contents of all or part of storage, usually from storage to an output device. (2) Data that has been dumped.

duplex. A data communications network that permits data communications in opposite directions at the same time. See also *half duplex.*

EIA. Electronic Industries Association.

enclosure. See *disk enclosure (DE).*

ERAP. Error recording analysis procedure.

fix. See *MPTF* and *PTF.*

free-lance. To diagnose machine problems with minimum instructions.

FRU. Field-replaceable unit.

full duplex. Same as *duplex.*

half duplex. Permitting data communications in opposite directions, but not at the same time. See also *duplex.*

Help. (1) A key on work station keyboards. (2) A display that gives additional information about the task you are performing. (3) A system procedure that displays a sequence of menus associated with system tasks.

hex. Hexadecimal.

I/O panel. An area of a machine where I/O cables are connected to the system. This area is accessible to the customer.

ICF. Interactive communications feature.

ID. Identifier.

identifier (ID). A label or name that identifies something.

IL. Interrupt level.

ILBB. Interrupt level backup byte.

IM. Integrated modem.

initial program load (IPL). A sequence of events that loads the system programs and prepares the system to run jobs.

IPL. Initial program load.

K. 1024, when making reference to a quantity of data or data storage.

Kb. 1024 bytes. (Kb may also be displayed as KB.)

line filter. A device used to prevent ripple or electrical noise on the AC power source from reaching machine power supplies and to prevent ripple or electrical noise generated by a machine from reaching the AC power source.

local storage register (LSR). A register used for general-purpose storage.

log. (1) A document containing written entries. (2) A system record containing recorded entries. (3) To write or record an entry in a log.

logged. Having written or recorded an entry in a log.

loopback test. A test in which signals are looped from a test unit, through a data set or loopback switch, and back to the test unit for measurement.

LSR. Local storage register.

M. 1 048 576, when making reference to a quantity of data or data storage. See also *megabyte.*

MAP. Maintenance analysis procedure.

Mb. 1 048 576 bytes. (Mb may also be displayed as MB.) See also *megabyte*.

megabyte. 1 000 000 bytes, when making reference specifically to the storage size of a disk storage device. See also *M* and *Mb*.

MIM. Maintenance information manual.

MLCA. Multiline communications attachment/adapter.

modifier. Something that modifies or changes.

modify. To change something. Same as *alter*.

MPTF. Microprogram temporary fix.

MS. Main storage.

MSP. Main storage processor.

multidevice. More than one device.

multiline. More than one communications line.

multinational. More than one country.

multiple. More than one.

multipoint. In data communications, a network that has more than one station.

OC. Overcurrent.

occupied. Busy. See also *DLO*.

OV. Overvoltage.

overcurrent (OC). A condition that occurs when power supply current is too high.

overview. A summary.

overvoltage (OV). A condition that occurs when power supply voltage is too high.

panel. See *I/O panel* and *control panel*.

PEB. Processor error byte.

PND. Present next digit.

POR. Power-on reset.

problem determination. The process of identifying why the system is not working. Often this process identifies programs, hardware, data communications equipment, or user errors as the source of the problem.

program temporary fix (PTF). A temporary solution or bypass of a problem diagnosed by IBM service representatives as a result of a defect in an existing program. See also *authorized program analysis report (APAR)*.

protocol. In SNA, the rules for transmitting and receiving data.

PTF. Program temporary fix.

PUMP. Pack utility maintenance program.

R/W. Read/write.

RDS. Receive data space.

reload. To load again.

RETAIN. Remote technical assistance information network.

retry. An attempt to perform an operation a specified number of times, or until the operation is completed. See also *ACR*.

RNR. Receive not ready.

ROS. Read-only storage.

RPQ. Request for price quotation.

RS-232-C. An EIA interface specification.

RTR. Ready to receive.

RTS. Request to send.

RWS. Remote work station.

SDLC. Synchronous data link control.

SDLCTEST. SDLC online test (procedure). See also *BSCTEST, COMMTEST*, and *STATEST*.

SETCOMM. Set communications (configuration procedure). See also *ALTERCOM*.

SLCA. Single-line communications adapter.

SNA. Systems network architecture.

SNA profile. A description of the characteristics of a systems network architecture protocol.

SNBU. Switched network backup.

spindle. The shaft that turns the disk.

SRC. System reference code.

SSA. Sequential sector address.

SSP. System support program product.

STATEST. Station test (procedure). See also *BSCTEST*, *COMMTEST*, and *SDLCTEST*.

supervisor call (SVC). An instruction that causes control to be passed to the control storage processor.

SVC. Supervisor call.

switched network backup (SNBU). In data communications, an alternative method of connecting two systems over telephone lines when the primary method of connection is by leased lines.

synchronous data link control (SDLC). Rules that control data movement over a communications line connecting two devices that use a communications adapter.

Sys Req. System Request (key).

system customize utility. A utility under dedicated DCP that lets you update the system microcode on disk, using the diagnostic diskettes.

system reference code (SRC). A 4-character code displayed as part of a system message, as part of a diagnostic message, or displayed in the control panel display.

systems network architecture (SNA). An IBM communications protocol for controlling information transfer in a data communications network.

SYSTEST. System test.

task. A unit of work.

TB. Terminal block.

TCC. Top card connector.

TDS. Transmit data space.

Tektronix. Trademark of Tektronix, Inc.

template. An overlay panel used as a mask to interpret the communications line status or autocall status displayed in the 4-character display on the control panel.

TESTREQ. Test request (procedure).

TI. Test indicate.

TP. Test point.

trade. See *World Trade*.

TU. Test unit.

twinaxial cable. A twisted-pair shielded cable that connects a keyboard/display or work station printer to the system.

UDT. Unit definition table.

UE. Unit Emergency (switch).

undervoltage (UV). A condition that occurs when power supply voltage is too low.

unit definition table (UDT). An area on disk or in storage that contains entries that describe the devices that run under control of the SSP.

UV. Undervoltage.

V. Volt.

Vac. Volts, alternating current.

Vdc. Volts, direct current.

World Trade. Pertaining to all countries except the U.S. and Canada.

wrap tests. I/O device diagnostic tests that are run when the Load key is pressed.

Appendix E. Parts Catalog

CONTENTS

PART 1

To find parts quickly, a general understanding of the structure of this catalog is necessary. The catalog is divided into three major sections:

- The Visual Index, containing overall views of the machine, with call-outs pointing to detailed figures.
- The Catalog Section, containing a pictorial breakdown of assemblies and subassemblies.
- The Numerical Index, which is a numerical list of all parts used in the machine, with cross-references to the figure on which the part is found.

VISUAL INDEX

The Visual Index, located before the Catalog Section, contains a reduced illustration of every figure in the Catalog Section. The reduced illustrations are tied together with flow arrows to form a natural progression from large assemblies to small assemblies and possibly subassemblies. In effect, a visual table of contents is formed by the Visual Index illustrations.

CATALOG SECTION

The Catalog Section contains the full-sized illustrations previously noted in the Visual Index. Index numbers on figures refer to corresponding entries in the Group Assembly Parts List accompanying each figure. Refer to part II for explanation of terms used in the Group Assembly Parts List.

NUMERICAL INDEX

The Numerical Index is located after the Catalog Section and contains a complete list, in numerical order, of all part numbers used on the machine. Listed with the part number is the index and figure number on which the part is illustrated. The numerical index makes it possible to locate a part when only the part number is known.

STACKED INDEX NUMBERS

Stacked Index numbers are used when showing a part and its attaching hardware. The circled index number indicates the assembly is broken down within the figure.

1 Plate Asm
2 Plate
3 Screw
4 Washer
5 L'Washer
6 Nut
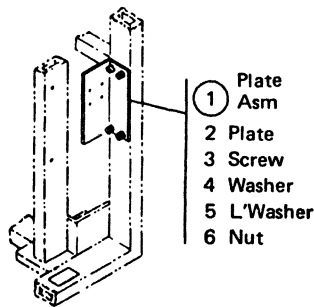
ILLUSTRATION NOTES

Cross-reference notes are directly on the illustration. The illustration's next higher assembly reference, normally located in the upper left corner of the page will read: "For Parts Not Shown See Figure X". If an assembly is referenced to a lower level figure, the note located next to the index number will read: " 5 See Figure X."

DOUBLE LINED DETAIL BOX

The double lined box differentiates between parts shown on the basic model and parts related to a level and/or feature difference. An explanation of the level or feature difference is given in the double lined box.

FINDING A PART

The Visual Index is the starting point for locating a part. The illustrations in the Visual Index are reduced versions of all illustrations in the Catalog Section; therefore, the illustrations can be used to find the assembly containing the desired part. Use references to the detailed figure in the Catalog Section, or to another Visual Index illustration, to determine location of part number.

Once the detailed figure in the catalog section is determined, finding the part on the figure and referring to the listing for the part number and description is all that is required in most cases. If the first catalog section figure referenced shows the assembly containing the required part, the index number for the assembly will reference a lower-level figure where the assembly is broken down to its component parts. If the figure referenced by the Visual Index contains neither the part nor an assembly containing the part, it is then necessary to go to the next higher assembly figure. This figure should then contain the part or an assembly containing the part; if not, an even higher level figure must be used. Refer back to the Visual Index for some other figure that could show the desired part.

Note: Many detailed parts are unavailable, because they are part of an inseparable assembly (two or more parts welded or bonded together), or because they are part of an assembly purchased as a unit. If the part is found on a purchased assembly, and the detail parts of this assembly do not have IBM part numbers, in either case, you need to obtain the part number of the assembly, rather than the detailed part.

EXAMPLE FOR ORDERING PARTS

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION FOR FIGURE 25
			1 2 3 4
25	2592881		FAN ASM,60 HZ
- 1	2172166	1	. GUARD
- 2	2591483	AR	. SEAL
- 3	2592692	1	. BRACKET
- 4	2591431	1	. FAN ASM
- 5	334932	1	. . RING,TERMINAL
- 6	1166117	1	. . CONNECTOR
- 7	1166114	3	. . TERMINAL
- 8	2591402	1	. . FAN

If the entire fan is required, part number 2592881 should be ordered (all one dot items will be received). If only the subassembly is required, part number 2591431 should be ordered (all two dot items will be received). Each part may be ordered individually.

Note: If you order a part that requires a label, make sure you order the label in the correct langauge. For example: A part of a Quebec machine should have a French Canadian language label rather than a French language label.

Part II

(A) *AR*

As Required (AR) in the units per assembly column denotes that the quantity is used as required.

(B) *INDENTURE*

The relationship of a part to its next higher assembly is indicated by indentures. For example:

```
1  2  3  4
Unit
.  Assemblies and Detail Parts of Unit
.  Attaching Parts for Assemblies & Detail Parts
.  .  Subassemblies
.  .  Attaching Parts of Subassemblies
.  .  .  Detail Parts for Subassemblies, etc.
```

(C) *NR*

The NR in the part number column denotes the part is procurable but not recommended for field replacement, and that the next higher assembly should be ordered.

(D) *NP*

The entry NP in the part number column denotes the assembly is non-procurable and the detail parts should be ordered separately.

(E) *NO NO.*

When this indication appears in the part number column, it denotes a group of parts for which no assembly part number has been assigned, and the detail parts should be ordered separately.

EXAMPLE OF PARTS LIST

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION FOR FIGURE 5 1 2 3 4
5 (E)	NO NO. (C)	(B)	BEZEL AND OPERATOR PANEL ASSEMBLY
- 1	2767400	1	. Bracket, LED and Switch
- 2	7362104 NR	1	. Potentiometer
- 3	7363983	1	. Potentiometer
- 4	7362299	2	. Knob Asm
- 5	8330754 (A)	5	. LED, Light
- 6	5552875	1	. Block, LED
- 7	1621811	AR	. Clip
- 8	1940	5	. Screw, Thd Form-h Wshr Hd 6-19 x 1/2 Lg
- 9	5552875 (D)	1	. Cable Asm, CE Diag Ind and Switch
- 10	7362322	1	. Cable Asm, AC Distribution
- 11	7362939	1	. . Switch
- 12	2767401 NP	1	. Bezel, English
- 12	7364967 NP	1	. Bezel, French
- 12	7362142 NP	1	. Bezel, Japanese
- 12	2767391 NP	1	. Bezel, Spanish
- 12	8330738 NP	1	. Bezel, German
- 12	515661 NP	1	. Bezel, Italian
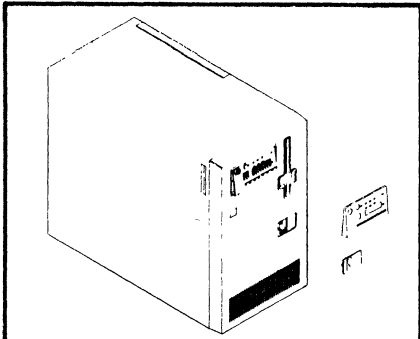
Final Asm - Language Panels
Figure 1
Page E-8
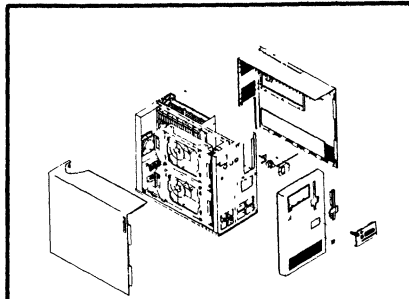
Final Asm - Covers,
                Control Panel Asm,
                Unit Emergency Switch
Figure 2
Page E-9
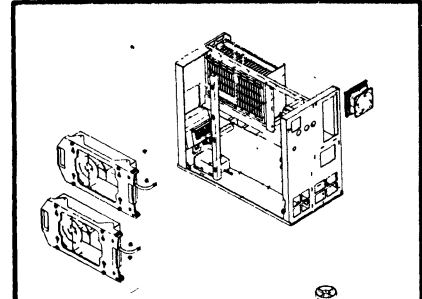
Final Asm - Disk/Frame Asm,
                Fan Asm (Disk Area)
Figure 3
Page E-10
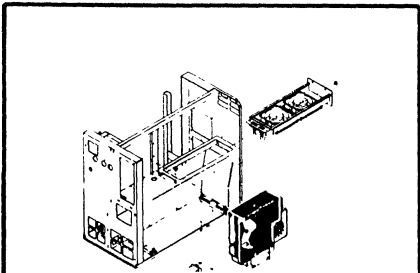
Final Asm - Fan/Box Asm,
           51TD/Bracket Asm
Figure 4
Page E-11
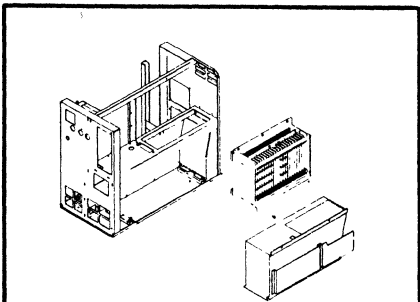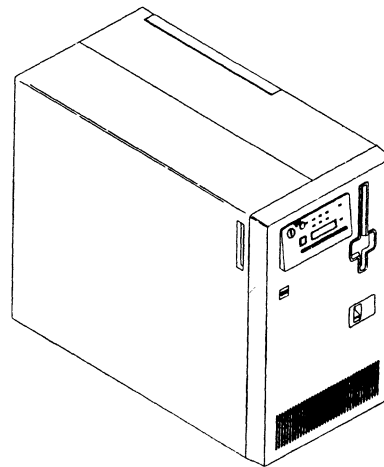
Final Asm - Logic Gate Asm,
              Power Supply
Figure 5
Page E-12
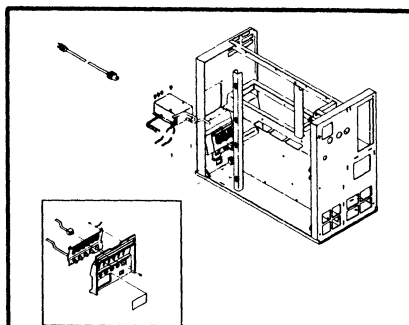
Final Asm - Filter Box,
              I/O Panel Asm
Figure 6
Page E-13
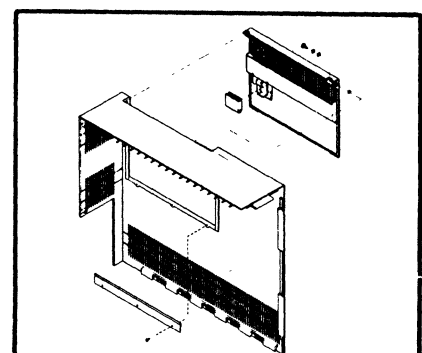
Cover/Door Asm (Right)
Figure 7
Page E-14
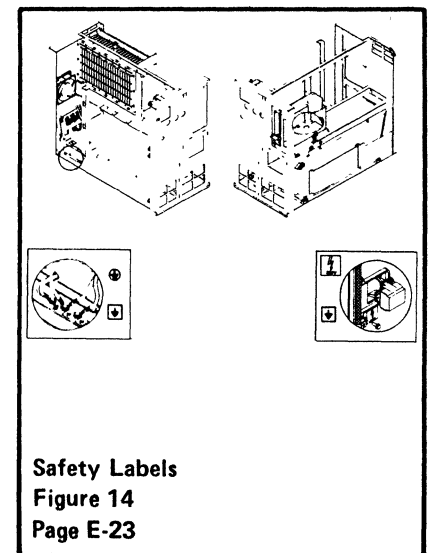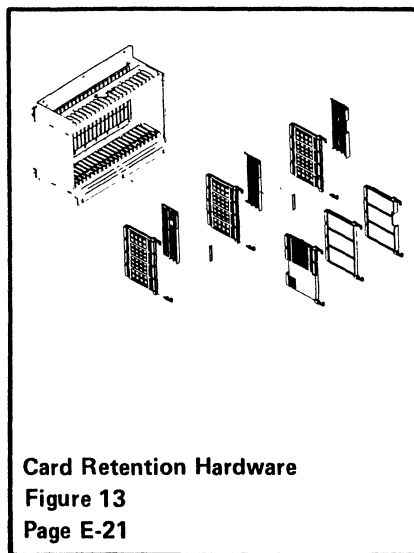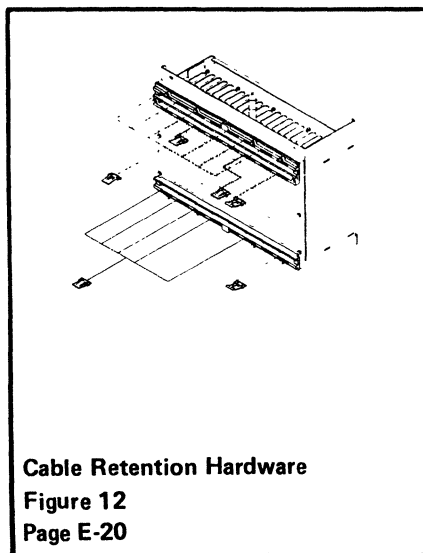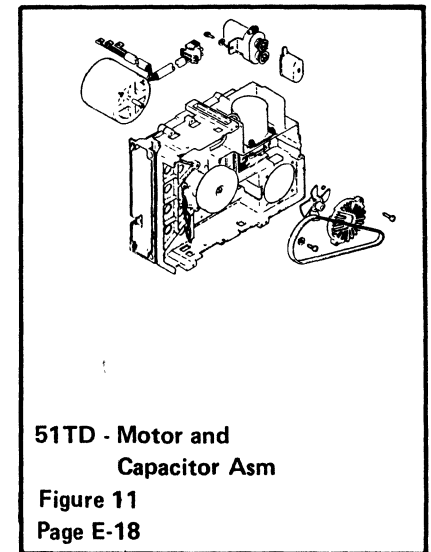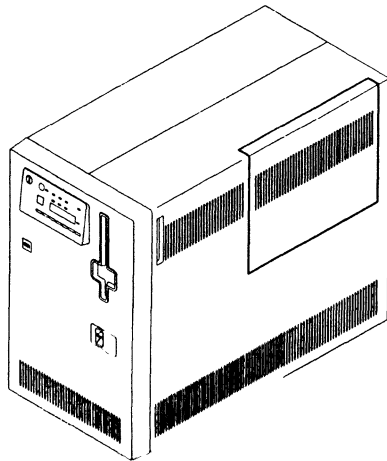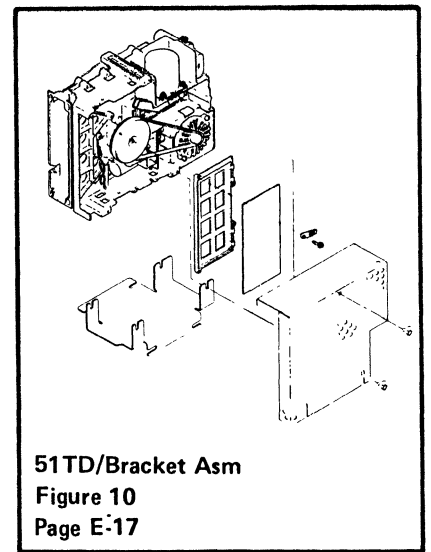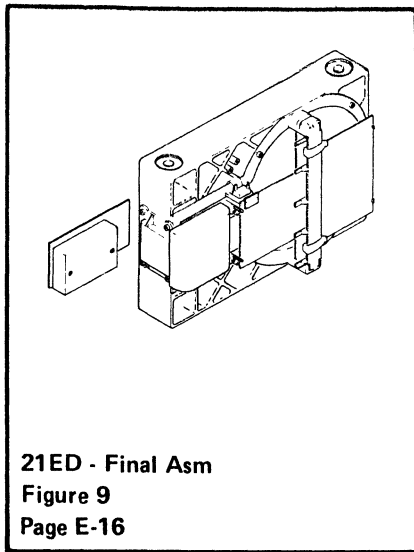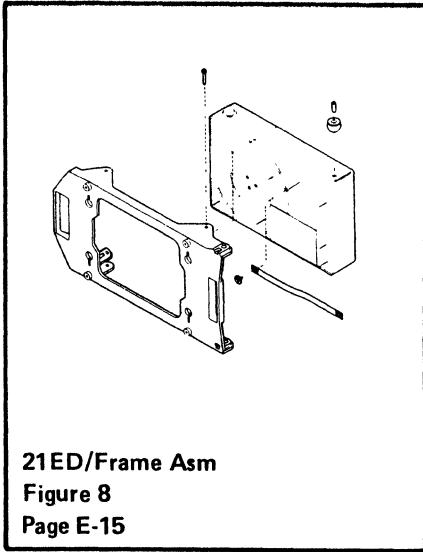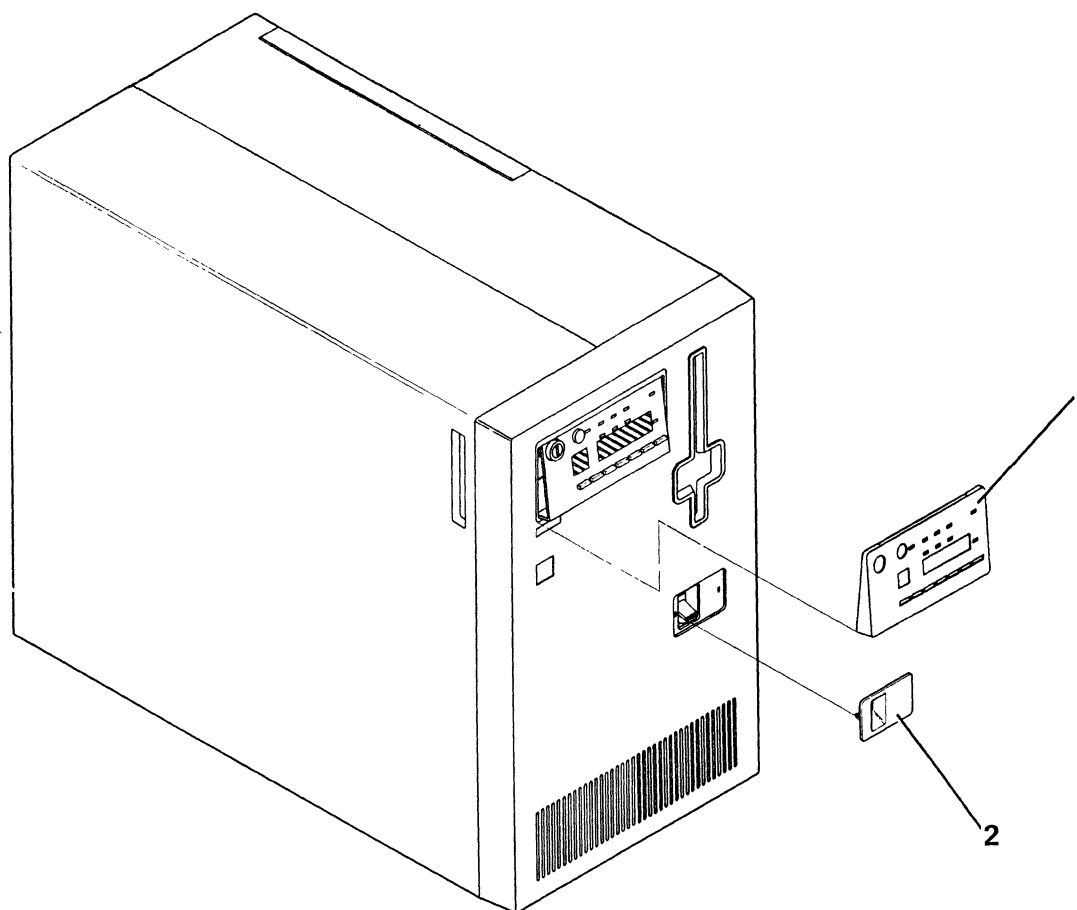
21ED/Frame Asm
Figure 8
Page E-15

21ED - Final Asm
Figure 9
Page E-16

51TD/Bracket Asm
Figure 10
Page E-17

51TD - Motor and
Capacitor Asm
Figure 11
Page E-18

Cable Retention Hardware
Figure 12
Page E-20

Card Retention Hardware
Figure 13
Page E-21

Safety Labels
Figure 14
Page E-23

INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 1
1					FINAL ASM - LANGUAGE PANELS
–	1	2453168	1		• Control Panel/Panel-English
–	1	2453281	1		• Control Panel/Panel-French/Canadian French
–	1	2453283	1		• Control Panel/Panel-German
–	1	2453285	1		• Control Panel/Panel-Spanish
–	1	2453287	1		• Control Panel/Panel-Italian
–	1	2453289	1		• Control Panel/Panel-Japanese
–	1	2453277	1		• Control Panel/Panel-Dutch
–	1	2453291	1		• Control Panel/Panel-Portuguese
–	2	2453293	1		• Unit Emergency Switch/Panel-English
–	2	2453909	1		• Unit Emergency Switch/Panel-French/Canadian French
–	2	2453297	1		• Unit Emergency Switch/Panel-German
–	2	2453299	1		• Unit Emergency Switch/Panel-Spanish
–	2	2453932	1		• Unit Emergency Switch/Panel-Italian
–	2	2453933	1		• Unit Emergency Switch/Panel-Japanese
–	2	2453275	1		• Unit Emergency Switch/Panel-Dutch
–	2	4178362	1		• Unit Emergency Switch/Panel-Portuguese
–	2	4178364	1		• Unit Emergency Switch/Panel-Danish
–	2	4178365	1		• Unit Emergency Switch/Panel-Belgium/Bilingual

Figure 1. FINAL ASM - LANGUAGE PANELS

For Parts
Not Shown
See Fig. 1
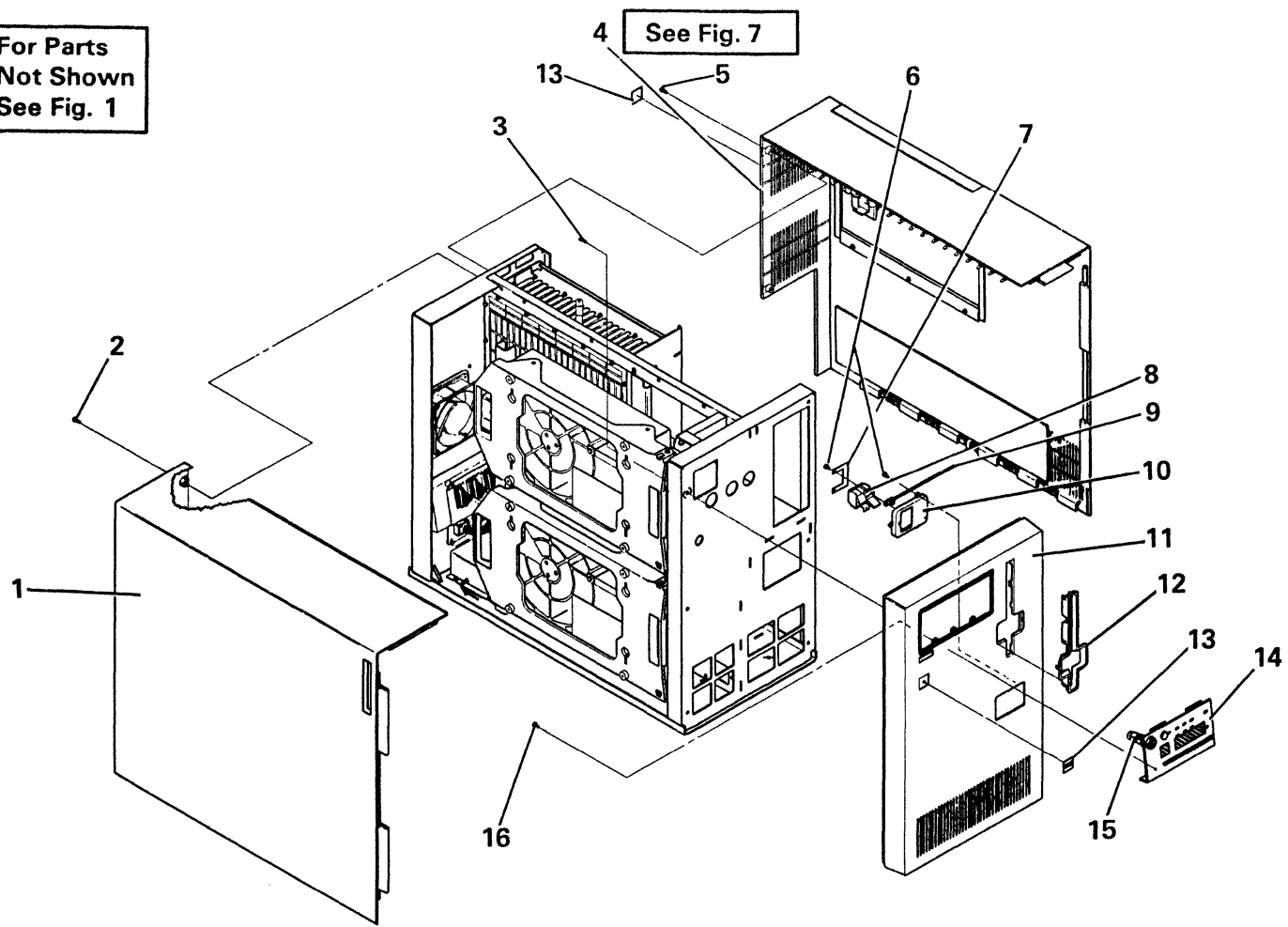
4 | See Fig. 7

Figure 2. FINAL ASM - COVERS, CONTROL PANEL ASM, UNIT EMERGENCY SWITCH

INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 2
2				FINAL ASM - COVERS, CONTROL PANEL ASM, UNIT EMERGENCY SWITCH
- 1	2462248	1		• Cover Asm (Left)
- 2	1621521	2		• Screw, Hex Socket Hd Cap M5 x .8 x 20 Lg
- 3	2549531	6		• Screw, Thd-Form Hex Hd M4.5 x 1.5 x 12 Lg
- 4	2462247	1		• Cover Asm (Right)
- 5	1621521	2		• Screw, Hex Socket Hd Cap M5 x .8 x 20 Lg
- 6	1622676	5		• Screw, Thd-Form Hex-Wshr Hd M3.5 x 1.34 x 10 Lg
- 7	8264774	1		• Safety Guard
- 8	1608874	1		• Switch, (Unit Emergency)
- 9	5323931	1		• Clamp
- 10	2453212	1		• Bracket
- 11	2462246	1		• Cover Asm (Front)
- 12	6060806	1		• Bezel
- 13	2453310	1		• Label (IBM Logo)
- 14	2453093	1		• Control Panel Asm
- 15	2595136	1		• Keylock
- 16	2549526	2		• Screw, Thd-Form Hex-Wshr Hd M3.5 x 1.34 x 8 Lg

Figure 2. FINAL ASM - COVERS, CONTROL PANEL ASM, UNIT EMERGENCY SWITCH
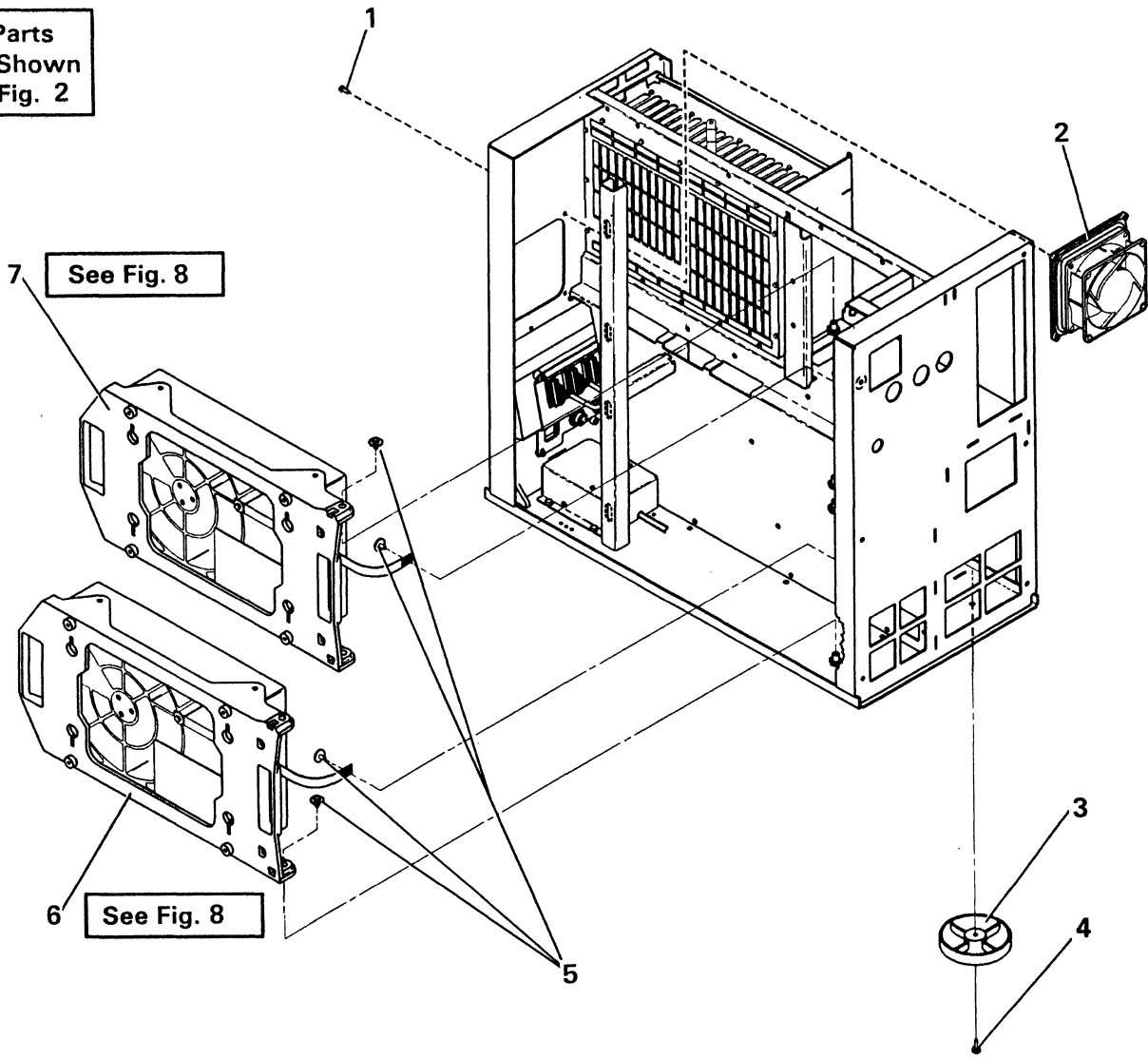
INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 3
3					FINAL ASM - DISK/FRAME ASM, FAN ASM (DISK AREA)
–	1	1622866	4	•	Screw, Hex Wshr Hd Thd-Form M5.5 x 1.6 x 12 Lg
–	2	2453184	1	•	Fan Asm 100 V 50 Hz
–	2	2453189	1	•	Fan Asm 200 V 50 Hz
–	2	2453199	1	•	Fan Asm 100 V 60 Hz
–	2	2453200	1	•	Fan Asm 200 V 60 Hz
–	3	2453252	4	•	Skid Pad
–	4	1621821	4	•	Screw, Thd-Form Hex Wshr Hd M6 x 1 x 10 Lg
–	5	8265370	4	•	Screw, Thd-Form Hex Hd M5 x .8 x 12 Lg
–	6	2453083 NP	1	•	21ED A3 (60 MB) Disk/Frame Asm
–	7	2453082 NP	1	•	21ED A2 (30 MB) Disk/Frame Asm
–	7	2453083 NP	1	•	21ED A3 (60 MB) Disk/Frame Asm

Figure 3. FINAL ASM - DISK/FRAME ASM, FAN ASM (DISK AREA)

1

2

3 See Fig. 10

4

7

8

6

5
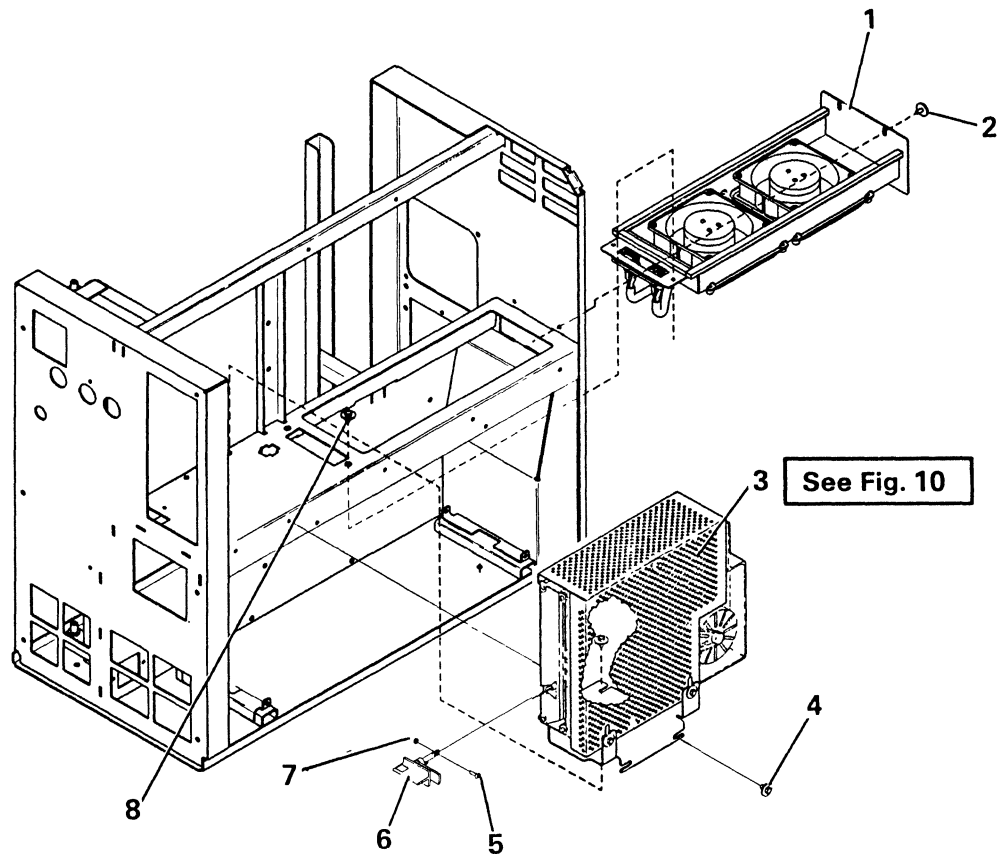
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 4
4				FINAL ASM - FAN/BOX ASM, 51TD/BRACKET ASM
– 1	2453210	1		• Fan/Box Asm 100 V 50 Hz
– 1	2453211	1		• Fan/Box Asm 200 V 50 Hz
– 1	2453201	1		• Fan/Box Asm 100 V 60 Hz
– 1	2453202	1		• Fan/Box Asm 200 V 60 Hz
– 2	8265370	2		• Screw, Thd-Form Hex Hd M5 x .8 x 12 Lg
– 3	2453014 NP	1		• 51TD/Bracket Asm 100 V 50 Hz
– 3	2453015 NP	1		• 51TD/Bracket Asm 200 V 50 Hz
– 3	2453016 NP	1		• 51TD/Bracket Asm 100 V 60 Hz
– 3	2453017 NP	1		• 51TD/Bracket Asm 200 V 60 Hz
– 4	8265370	4		• Screw, Thd-Form Hex Hd M5 x .8 x 12 Lg
– 5	1621182	1		• Screw, Mach-Slot Pan Hd M3.5 x .6 x 8 Lg
– 6	6842908	1		• Latch
– 7	1622402	1		• Nut, Hex-Double Chamfer M3.5 x .6 Fl W x 2.8 Thk
– 8	8264773	2		• Screw, Thd-Form Hex-Wshr Hd M5 x .8 x 20 Lg

Figure 4. FINAL ASM - FAN/BOX ASM, 51TD/BRACKET ASM
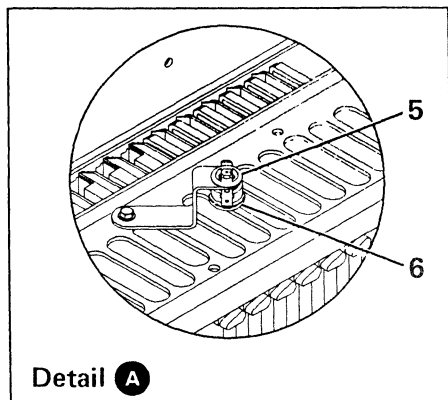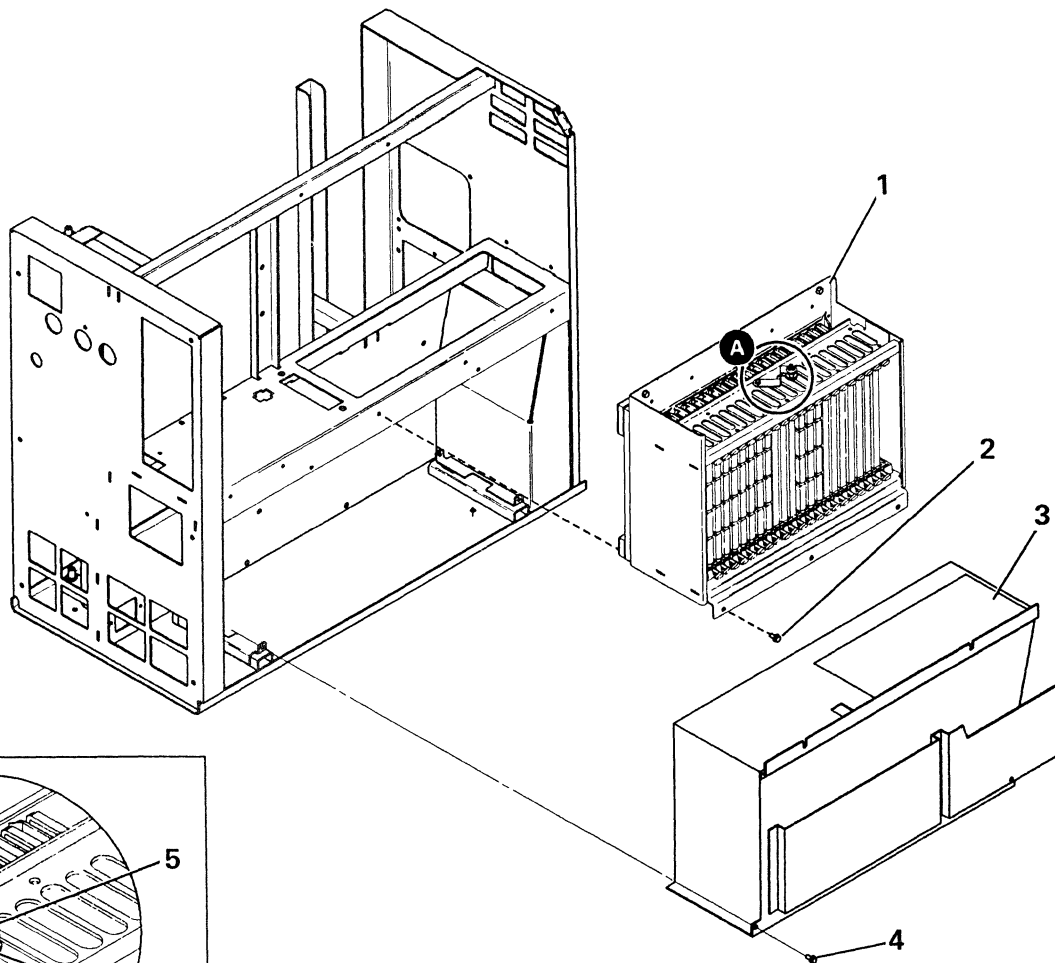
Detail **A**

INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 5
5				FINAL ASM - LOGIC GATE ASM, POWER SUPPLY
- 1	2453218	1		• Logic Gate Asm (One Disk - A01)
- 1	2453325	1		• Logic Gate Asm (One Disk - A02)
- 1	2453219	1		• Logic Gate Asm (Two Disk - A03, A04)
- 2	2549782	4		• Screw, Thd-Form Hex-Wshr Hd M5 x .8 x 10 Lg
- 3	5561773	1		• Power Supply, 100 V 50/60 Hz
- 3	5561774	1		• Power Supply, 200 V 50/60 Hz
- 4	2549782	4		• Screw, Thd-Form Hex-Wshr Hd M5 x .8 x 10 Lg
- 5	2588053	1		• Clip Nut
- 6	5428337	1		• Sensor

Figure 5. FINAL ASM - LOGIC GATE ASM, POWER SUPPLY

See Figure 15

Figure 6. FINAL ASM - FILTER BOX, I/O PANEL ASM
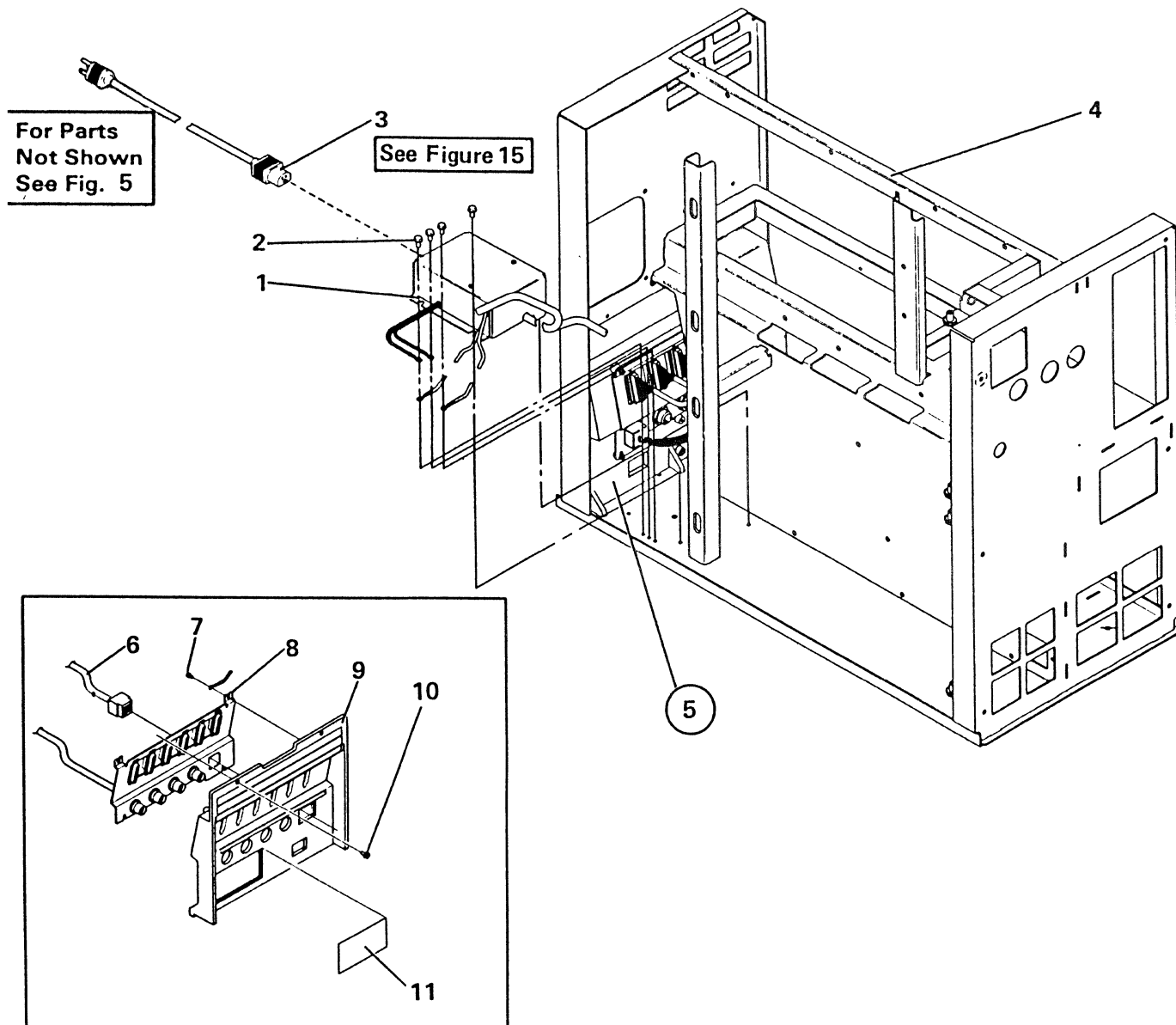
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 6
6				FINAL ASM - FILTER BOX, I/O PANEL ASM
- 1	2453068	1		• Filter Box Asm, 100 V
- 1	2453069	1		• Filter Box Asm, 200 V
- 2	2549782	5		• Screw, Thd-Form Hex-Wshr Hd M5 x .8 x 10 Lg
- 3	xxxxxxx	1		• AC Power Cord (see Figure 15)
- 4	2453248	1		• Frame
- 5	2453033	1		• I/O Panel Asm
- 6	2453107	1		• • Cable Asm (Reference Only)
- 7	1622675	4		• • Screw, Thd-Form Hex-Wshr Hd M3.5 x 1.34 x 8 Lg
- 8	2453104	1		• • Cable/Bracket Asm
- 9	2453279	1		• • I/O Panel
- 10	4236318	2		• • Screw, Thd-Form Hex Wshr Hd M5 x .8 x 12 Lg
- 11	2453332	1		• • Cover

INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 7
7				COVER/DOOR ASM (RIGHT)
– 1	2462245	1		• Cover Assembly
– 2	2453261	1		• Access Door Assembly
– 3	1615266	2		• Screw, Grommet-M4 x .7 x 15 Lg
– 4	620052	4		• Washer, Bellville
– 5	1159567	2		• Washer, Lock
– 6	2453336	1		• Wrap Connector (Feature)
– 7	2453934	1		• Latch Strip
– 8	1622675	3		• Screw, Thd-Form Hex-Wshr Hd M3.5 x 1.34 x 8 Lg

Figure 7. COVER/DOOR ASM (RIGHT)

2

3

4

5

1

6

7
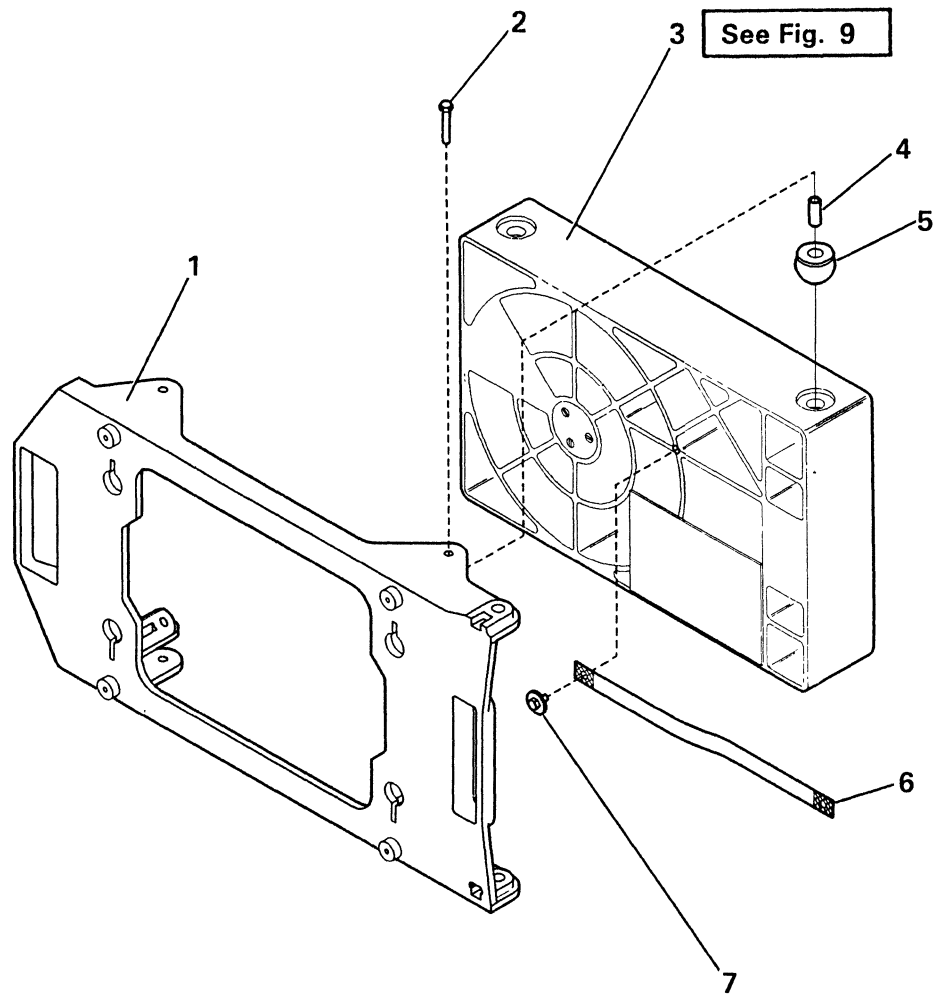
INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4 DESCRIPTION FOR FIGURE 8
8		2453082 NP		21ED A2 (30 MB)/FRAME ASM
		2453083 NP		21ED A3 (60 MB)/FRAME ASM
-	1	4178389	1	• Frame
-	2	1622869	4	• Screw, Hex-Wshr Hd M5.5 x 1.6 x 40-1.2 Lg
-	3	1616514	1	• 21ED A2 (30 MB)
-	3	1616060	1	• 21ED A3 (60 MB)
-	4	1616733	4	• Spacer
-	5	1616580	4	• Shockmount
-	6	2453926	1	• Ground Strap
-	7	4233722	1	• Screw, Thd-Form Hex-Wshr Hd M4 x .7 x 10.8 Lg

Figure 8. 21ED/FRAME ASM
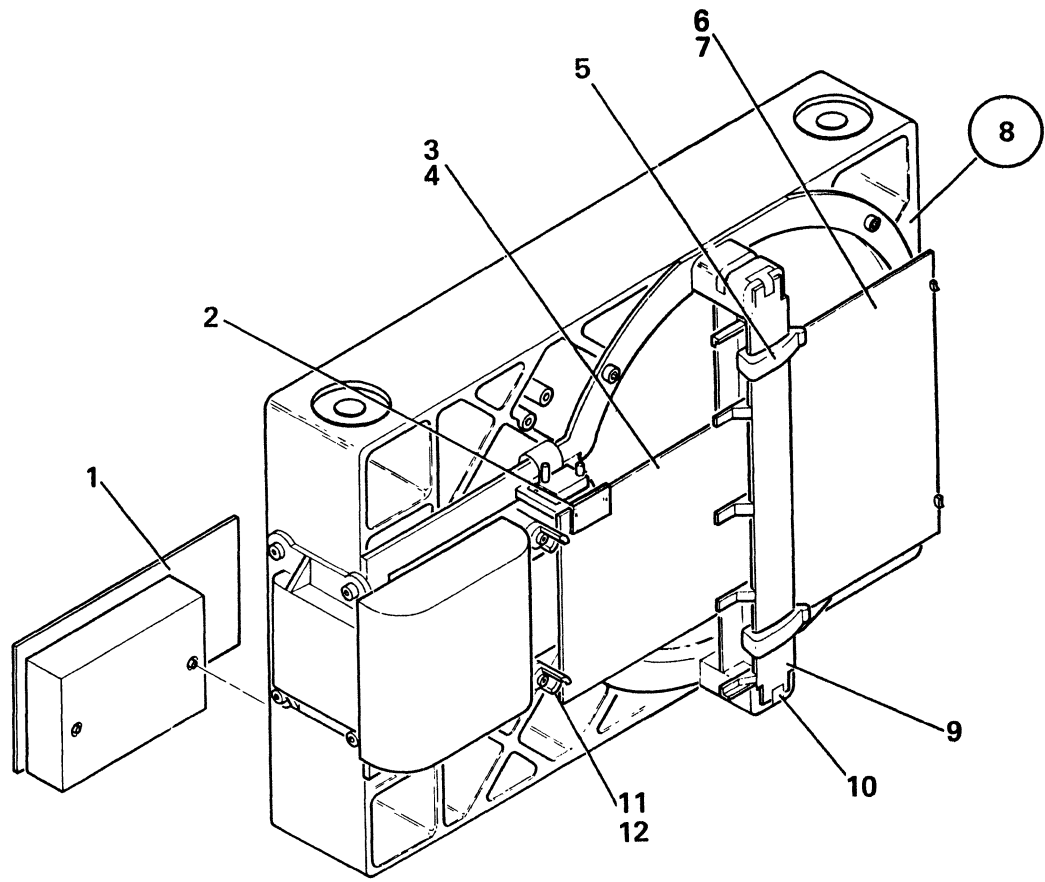
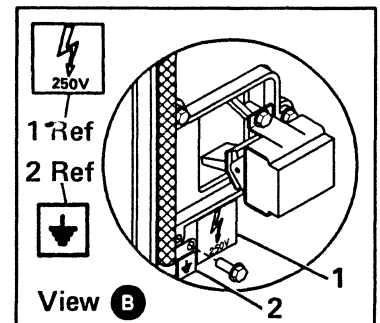| INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 9
9	1616514			21ED A2-FINAL ASM
	1616060			21ED A3-FINAL ASM
- 1	xxxxxxx	1		• Drive Card
- 2	1616634	1		• Label
- 3	xxxxxxx	1		• Analog Card
- 4	811804	1		• Card Guide
- 5	4233751	2		• Retainer-Cable
- 6	xxxxxxx	1		• Digital Card
- 7	813590	1		• Card Guide
- 8	1616699	1		• Disk Enclosure, A2 (30 MB)
- 9	1616119	1		• Disk Enclosure, A3 (60 MB)
- 9	818039	1		• • Maple Block
- 10	1616617	2		• • Retainer Clip
- 11	1616752	4		• • Retainer
- 12	1621182	4		• • Screw, Mach-Slot Pan Hd M3 x .5 x 8 Lg

Figure 9. 21ED A2-FINAL ASM
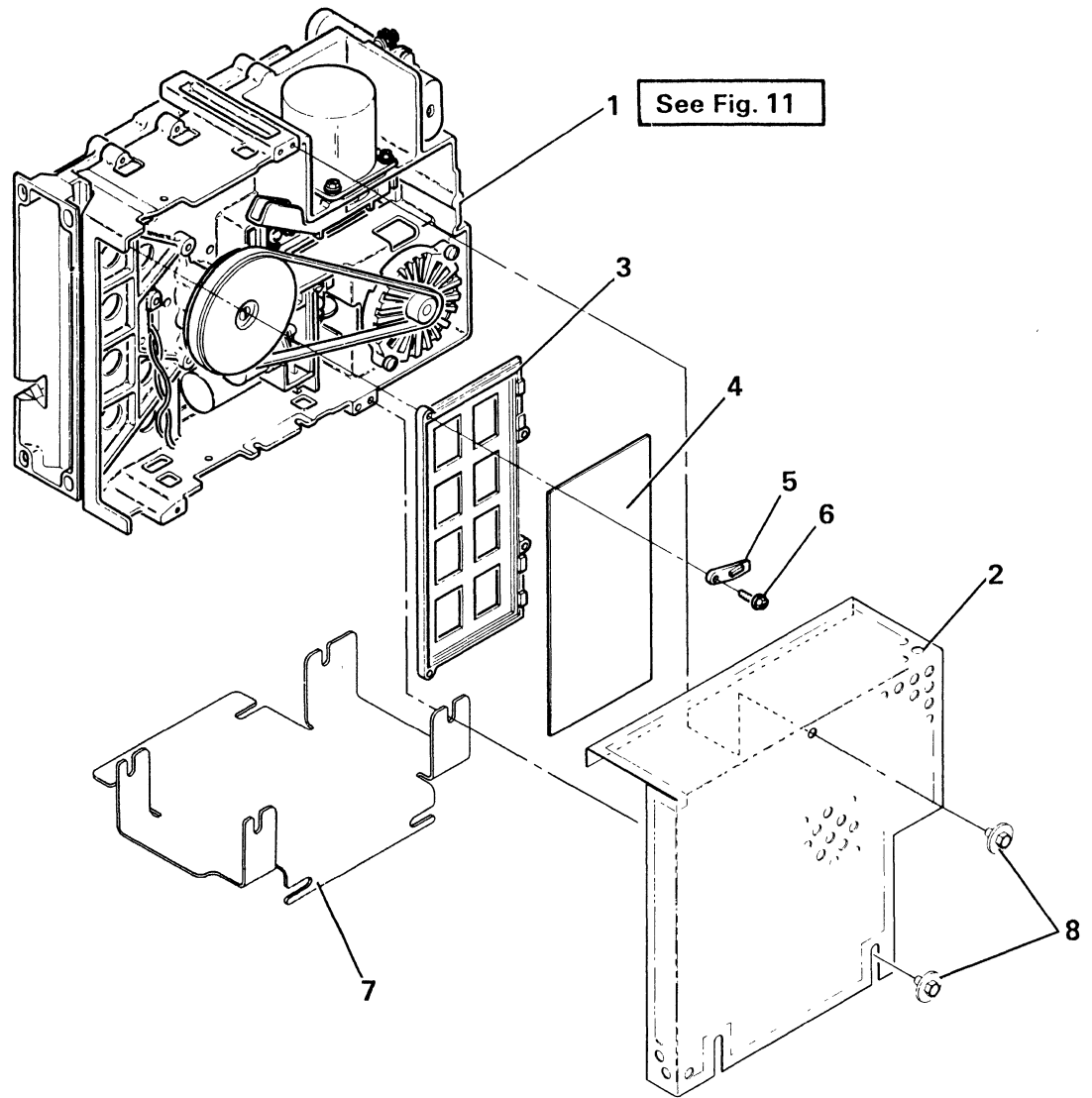
INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 10
10		2453014 NP			51TD/BRACKET ASM 100 V 50 Hz
		2453015 NP			51TD/BRACKET ASM 200 V 50 Hz
		2453016 NP			51TD/BRACKET ASM 100 V 60 Hz
		2453017 NP			51TD/BRACKET ASM 200 V 60 Hz
-	1	4240512	1	•	51TD Asm 100 V 50 Hz
-	1	4240513	1	•	51TD Asm 200 V 50 Hz
-	1	4240516	1	•	51TD Asm 100 V 60 Hz
-	1	4240517	1	•	51TD Asm 200 V 60 Hz
-	2	4178373	1	• •	Shield, ESD Protection (W/T Only)
-	3	4240638	1	• •	Card Holder
-	4	xxxxxxx	1	• •	Card Asm (51TD)
-	5	4240584	2	• •	Card Retainer
-	6	2462686	6	• •	Screw,Thd-form M4 x .7 x 16 Lg
-	7	2453253	1	• •	Bracket
-	8	4233722	4	• •	Screw, Thd-Form Hex Wshr Hd M4 x .7 x 10-.8 Lg

Figure 10. 51TD/BRACKET ASM
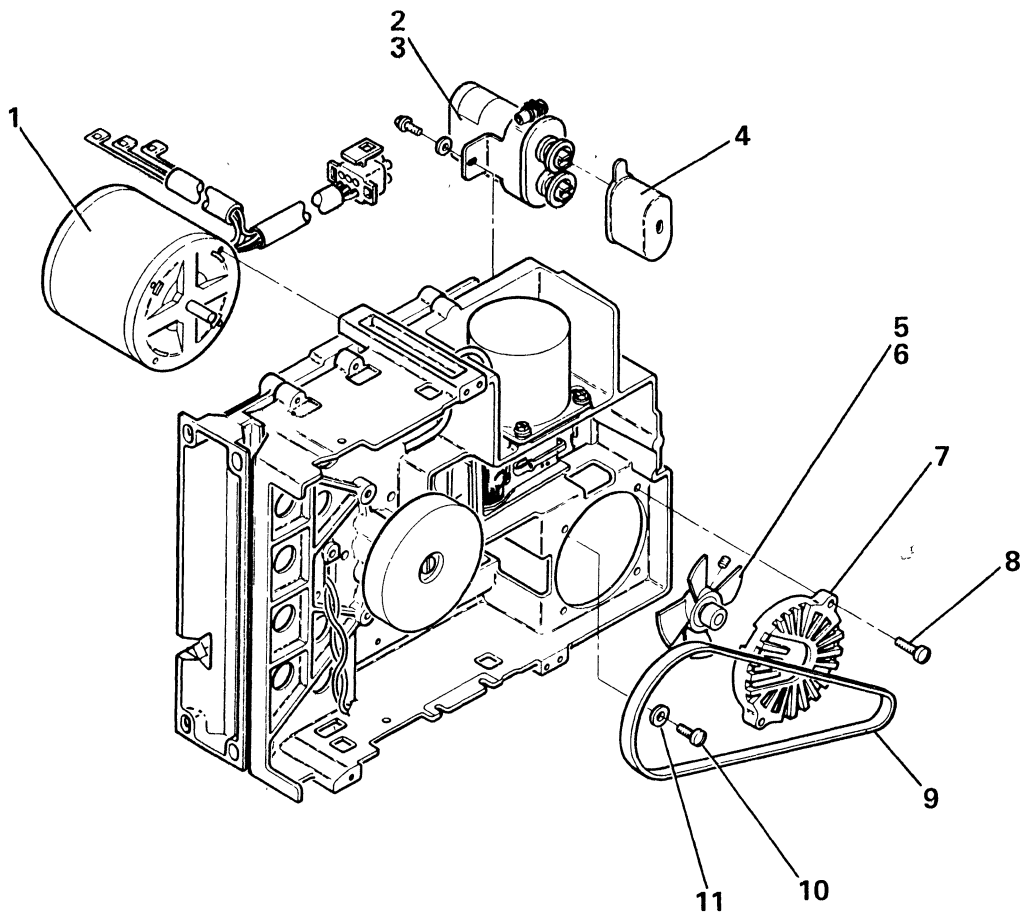
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 11
11	NO NO.			51TD-MOTOR AND CAPACITOR ASM
- 1	4240679	1		• Motor Asm 220 V/50-60 Hz
- 1	4240677	1		• Motor Asm 110 V/50-60 Hz
- 2	4240635	1		• Capacitor Asm
- 3	2462686	1		• Screw,Thd-form M4 x .7 x 16 Lg
- 4	363001	1		• Capacitor Shield
- 5	4240675	1		• Pulley And Fan - 60 Hz
- 5	4240673	1		• Pulley And Fan - 50 Hz
- 6	1621719	1		• Setscrew,Spline Socket M4 x .7 x 5 Lg
- 7	4240671	1		• Enclosure
- 8	1621194	2		• Screw,Mach-Slot Pan Hd M4 x .7 x 20 Lg
- 9	4240605	1		• Belt, 60 Hz
- 9	4240604	1		• Belt, 50 Hz
- 10	1621192	2		• Screw,Mach-Slot Pan Hd M4 x .7 x 12 Lg
- 11	35229	4		• Washer, 11/64 ID x 7/16 OD

Figure 11. 51TD MOTOR AND CAPACITOR ASM (Part 1 of 2)

Detail **Ⓐ**   WTC Only
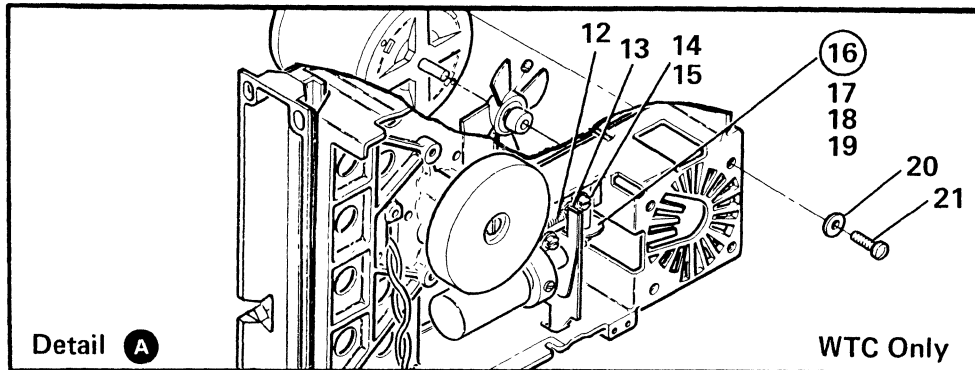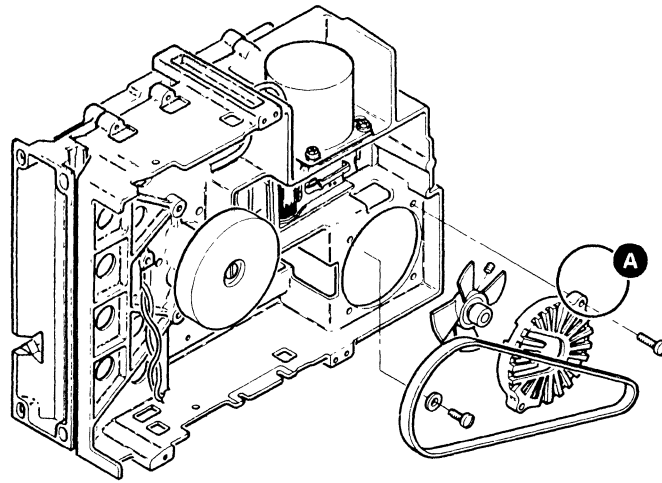
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 11
11 - 12	4240563	1	•	Spring
- 13	104702	1	•	Pin Dowel 3/16 Dia x 1 Lg (WTC Only)
- 14	2462685	1	•	Screw,Thd-form M4 x .7 x 10 Lg (WTC Only)
- 15	35229	1	•	Washer, 11/64 ID x 7/16 OD (WTC Only)
- 16	2420943	1	•	Pulley Asm (WTC Only)
- 17	2420944	1	• •	Shaft (WTC Only)
- 18	147297	2	• •	Ring,Retaining-Ext 3/32 x 1/32 Thk (WTC Only)
- 19	1256071	1	• •	Pulley (WTC Only)
- 20	22478	4	•	Washer,Flat 11/64 ID x 3/8 OD x 1/32 Thk (WTC Only)
- 21	1621192	4	•	Screw,Mach-Slot Pan Hd M4 x .7 x 12 Lg (WTC Only)

Figure 11. 51TD MOTOR AND CAPACITOR ASM (Part 2 of 2)
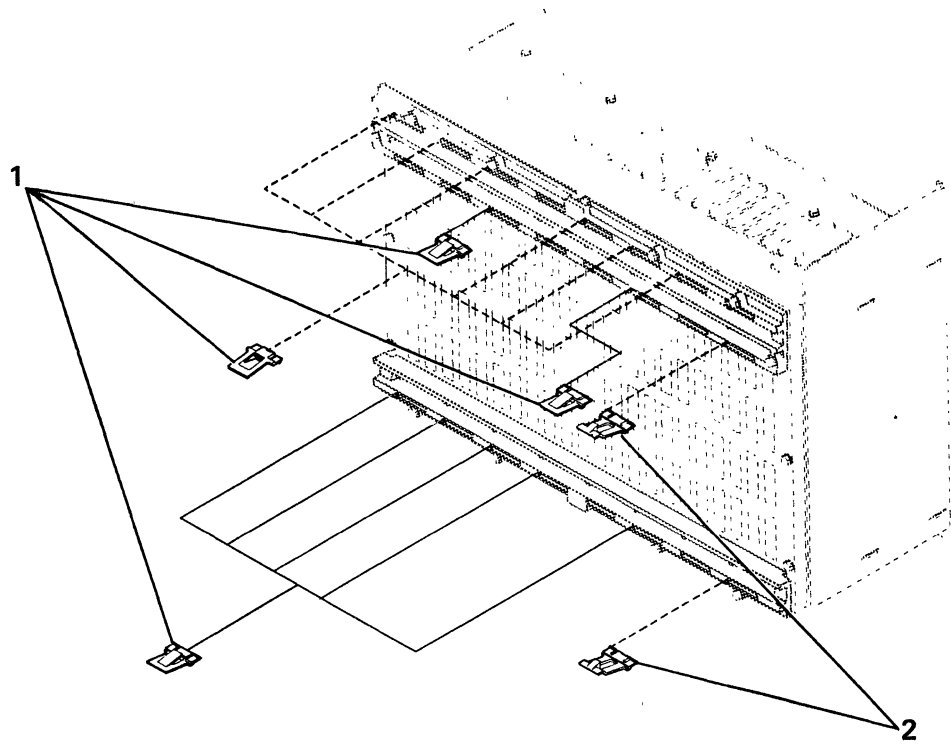
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 12
12	No No.			Cable Retention Hardware
- 1	2453907	AR		• Retainer, Cable
- 2	2453327	AR		• Retainer, Cable

Figure 12. Cable Retention Hardware
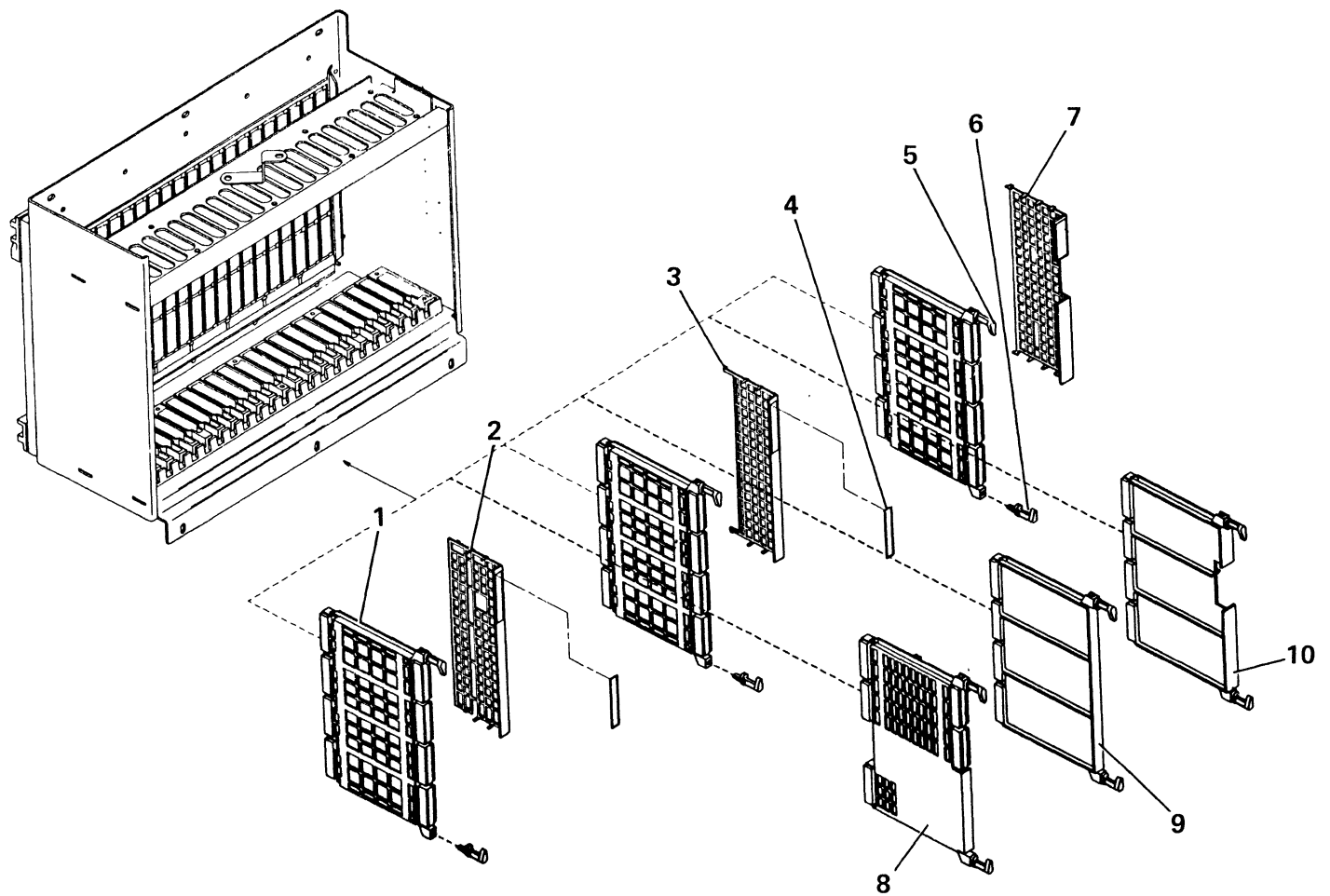
INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 13
13		No No.			CARD RETENTION HARDWARE
–	1	2453241	AR		• Card Holder, 4W3H with TCC
–	2	2453306	AR		• Shield
–	3	2453307	AR		• Shield
–	4	2462278	AR		• Label, CSU (Double Blue Hexagons)
–	4	2462279	AR		• Label, CSU (Double Yellow Circles)
–	4	2462280	AR		• Label, CSU (Single Green Triangle – V35)
–	4	2462281	AR		• Label, CSU (Single Green Triangle – X21)
–	4	2462282	AR		• Label, CSU (Single Green Triangle – DDSA)
–	4	2462284	AR		• Label, CSU (Single Green Triangle – EIA/CCITT)
–	5	2453023	AR		• Card Retainer, (White)
–	6	2453240	AR		• Card Retainer, (Black)
–	7	2453935	AR		• Shield
–	8	2453952	AR		• Card Holder, 2W3H with TCC/1W1H without TCC
–	9	2453319	AR		• Filler Card, 4W3H
–	10	2453193	AR		• Filler Card, 4W3H

Figure 13. CARD RETENTION HARDWARE   (Part   1 of 2)
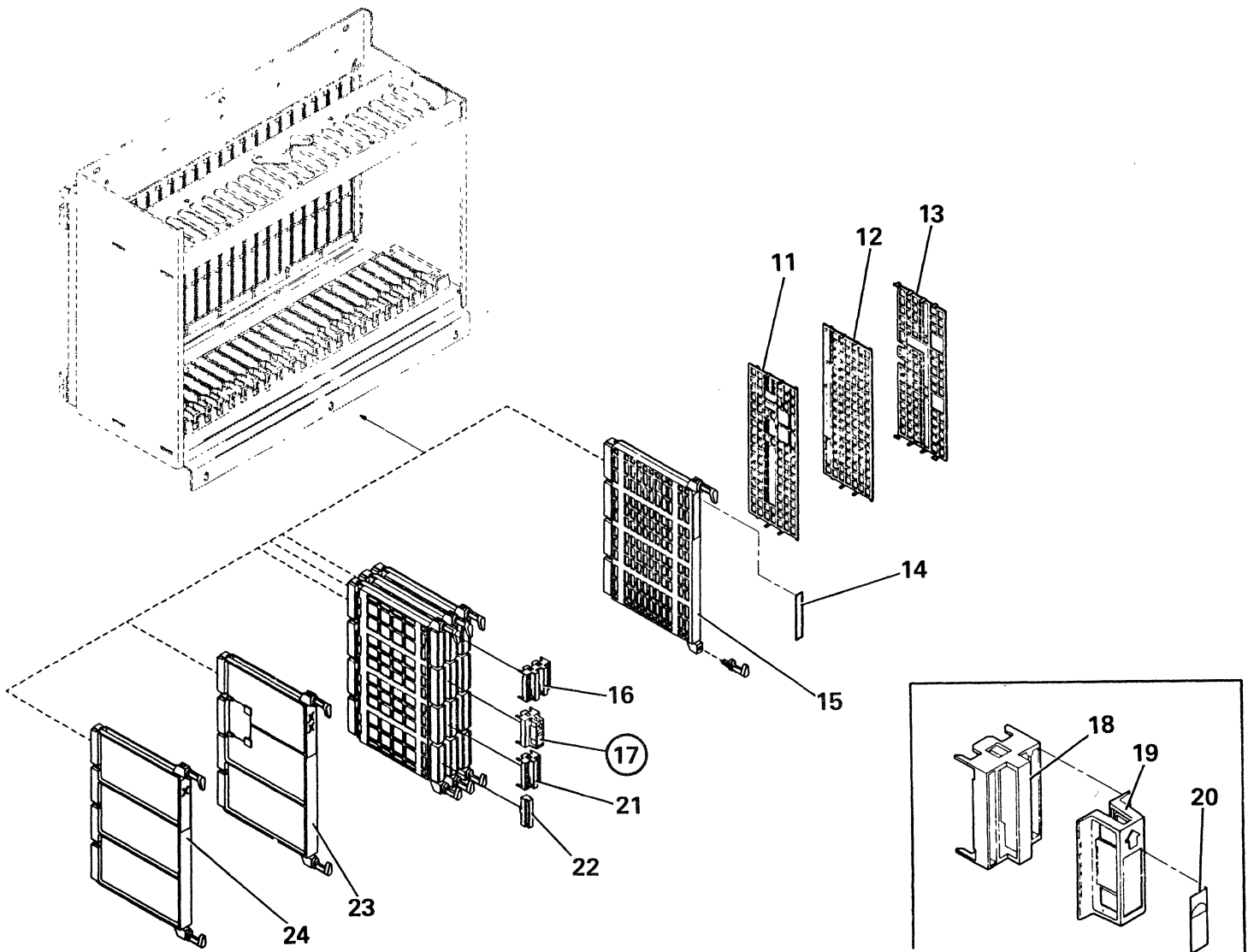
INDEX NUMBER		PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 13
13 -	11	2453308	AR	•	Shield
-	12	2453019	AR	•	Shield
-	13	2453311	AR	•	Shield
-	14	2462273	AR	•	Label, CSU (Single Orange Square)
-	14	2462274	AR	•	Label, CSU (Single Blue Hexagon)
-	14	2462283	AR	•	Label, CSU (Single Green Triangle - SLCA)
-	14	2462269	AR	•	Label, CSU (Single Orange Square with 256)
-	15	2453242	AR	•	Card Holder, 4W3H without TCC
-	16	6819205	AR	•	Top-Card Connector, 3-Card
-	17	4178396	AR	•	Top-Card Connector/Housing Asm, 2-Card
-	18	6819202	AR	• •	Top-Card Connector, 2-Card
-	19	4178400	AR	• •	Top-Card Connector Housing
-	20	4178434	AR	• •	Label
-	21	6819193	AR	•	Top-Card Connector, 2-Card
-	21	6819211	AR	•	Top-Card Connector, 2-Card
-	22	4138510	AR	•	Top-Card Connector, 1-Card
-	23	2453020	AR	•	Card Holder, 1W1H without TCC
-	24	2453192	AR	•	Filler Card, 4W3H

Figure 13. CARD RETENTION HARDWARE   (Part   2 of 2)
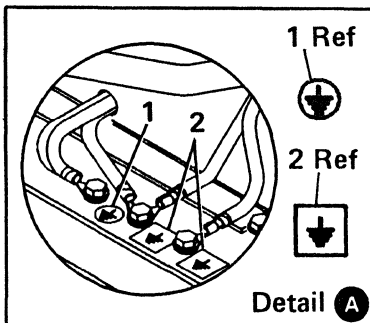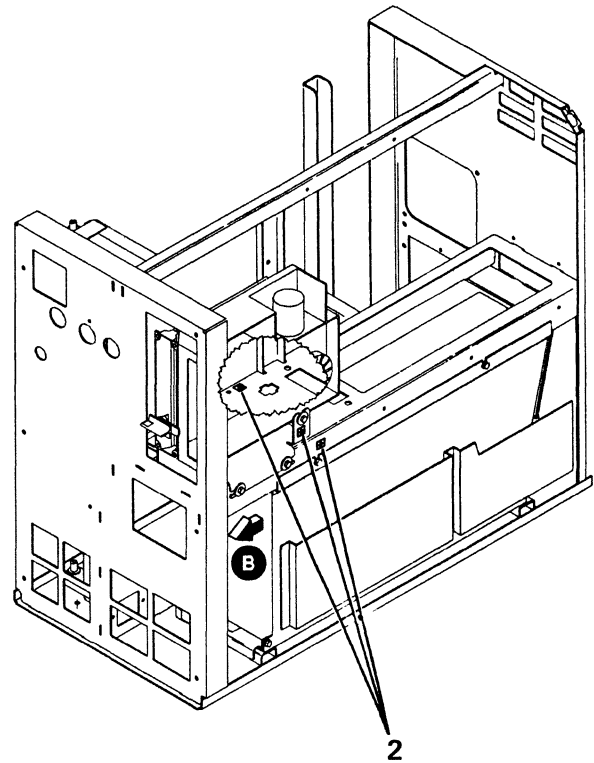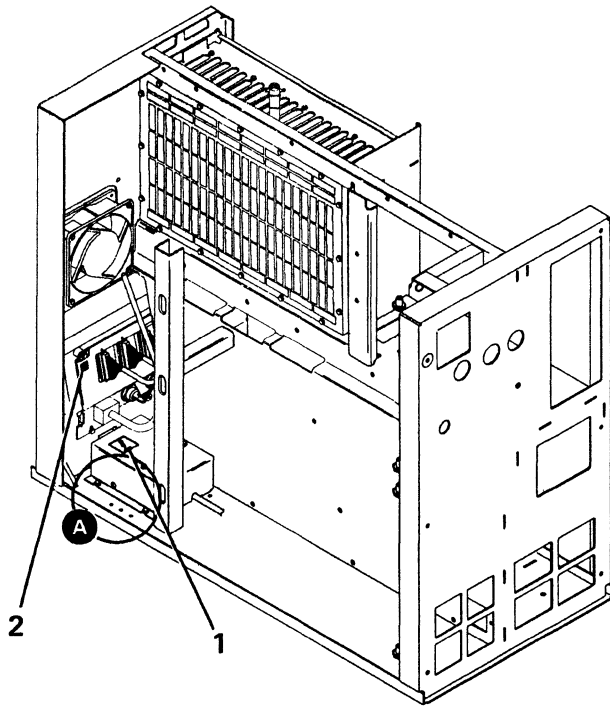
INDEX NUMBER	PART NUMBER	UNITS /ASM	1 2 3 4	DESCRIPTION FOR FIGURE 14
14	No No.			SAFETY LABELS
– 1	1680269	6		• Label, (Ground)
– 2	4178448	2		• Label, (Ground and Line Voltage)

Figure 14. SAFETY LABELS

Power Cord Chart

Plug	Line Cord P/N	Country
	2453011	6 Ft. Lg. U.S. (Chicago)
	2453010	10 Ft. Lg. Bahamas, Bermuda, U.S./Canada, Cayman Islands, Columbia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Japan, Korea (South), Panama, Philippines, Surinam, Taiwan, Trinidad, Venezuela
	4437612	50Hz Barbados, Bolivia, Guyana, Jamaica, Netherland Antilles, Thailand
	4437611	60Hz Peru
No Plug	4437621	60Hz - Bermuda, Columbia, Nicaragua
No Plug	4437620	50Hz - Argentina, Paraguay, Uruguay
	4437604	Italy, Chile
	2453003	Lichtenstein, Switzerland
	4437602	Denmark
	4437605	Israel
	4437606	Bangladesh, Burma, Pakistan, South Africa, Sri Lanka
	4437601	Bahrain, Channel Islands, Cyprus, Hong Kong, India, Ireland, Kenya, Kuwait, Malaysia, Oman, Qatar, Saudi Arabia, Sierra Leone, Singapore, United Kingdom, United Arab Emirates
	4437600	Austria, Belgium, Bulgaria, Egypt, Finland, France, Germany, Iceland, Lebanon, Luxembourg, Morocco, Netherlands, Norway, Portugal, Spain, Sweden, Turkey, Uruguay, Yugoslavia
	2453001	Australia, New Zealand

Figure 15. POWER CORD CHART
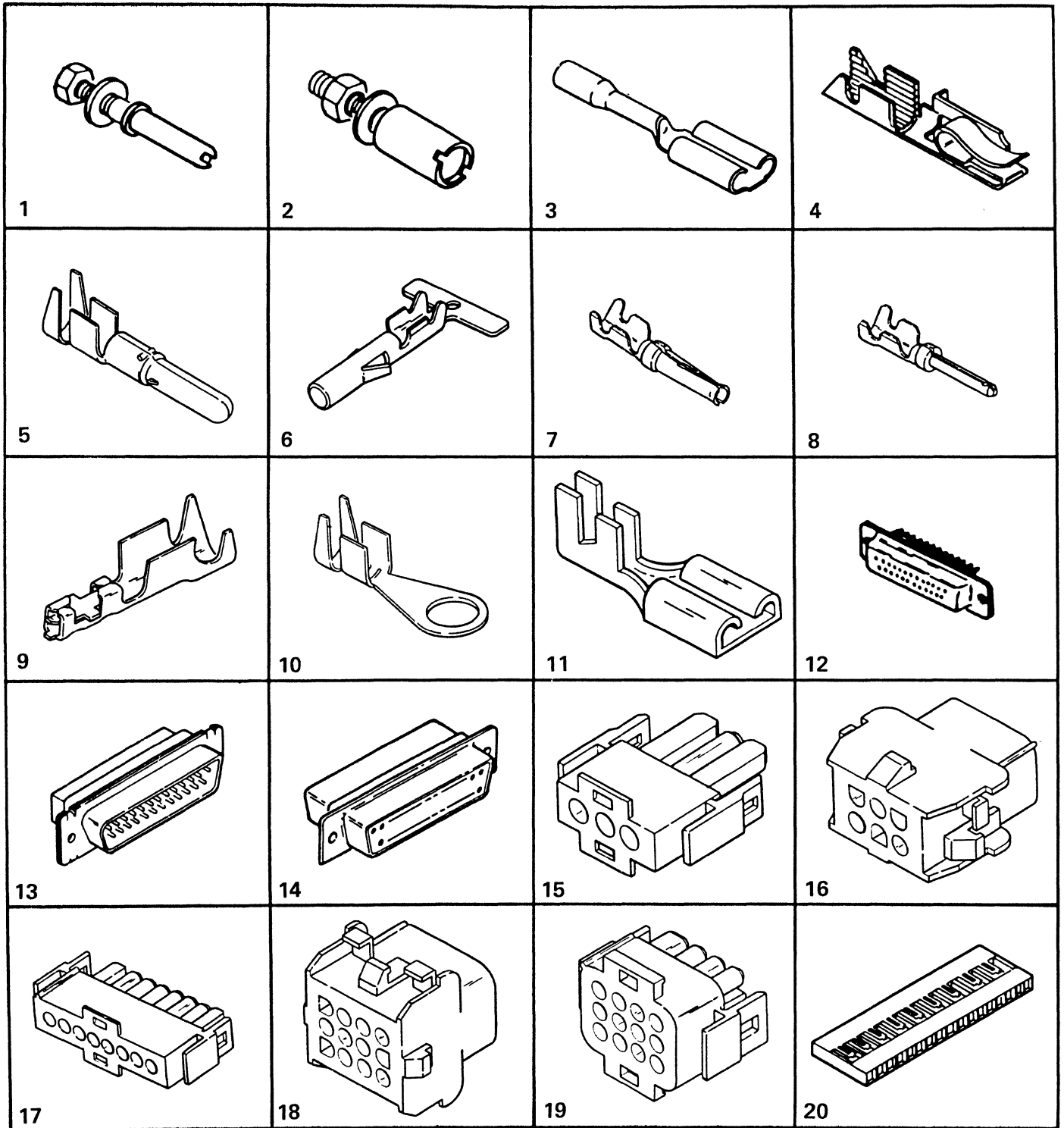
Figure 16. CABLE AND JUMPER COMPONENT PARTS   (1 of 3)

21	22	23	24
25	26	27	28
29	30	31	32
33	34		
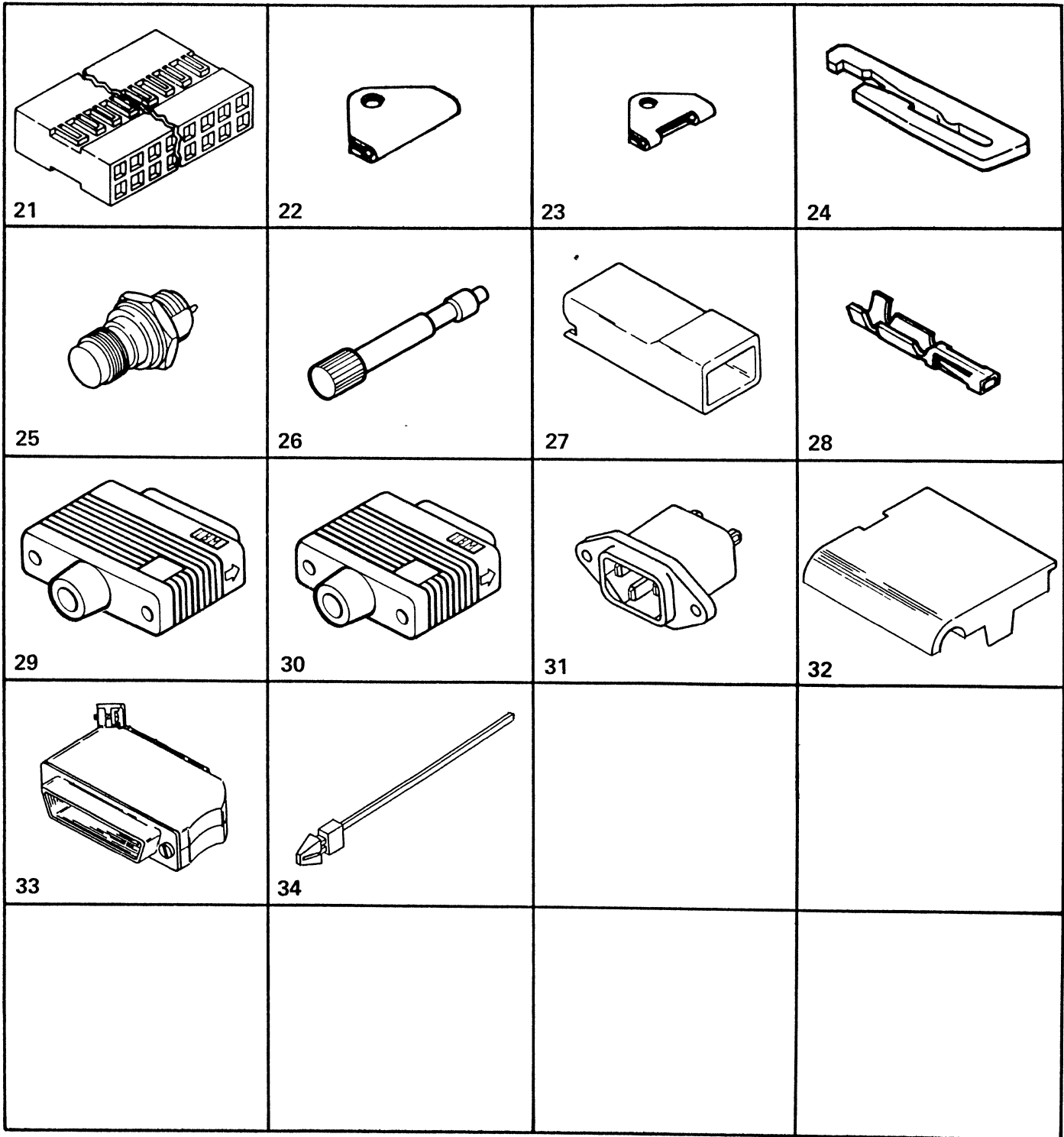
Figure 16. CABLE AND JUMPER COMPONENT PARTS   (2 of 3)

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	1 2 3 4	DESCRIPTION FOR FIGURE 16
16				CABLE AND JUMPER COMPONENT PARTS
- 1	2122734			Pin, Guide
- 2	2122202			Socket, Centerguide .180 Dia x .780 Lg
- 3	236916			Terminal, Contact Female (22-24 AWG)
- 4	5486851			Terminal, Large Serpent (22-26 AWG)
- 5	1661131			Terminal, Pin (18-22 AWG)
- 5	1847522			Terminal, Pin (14-20 AWG - .200 Insulation)
- 6	1661132			Terminal, Socket (18-24 AWG - .100 Insulation)
- 6	1847521			Terminal, Socket (14-20 AWG - .130 Insulation)
- 6	1847523			Terminal, Socket (14-20 AWG - .200 Insulation)
- 7	1655337			Terminal, Socket (20-24 AWG - .068 Insulation)
- 7	1655358			Terminal, Socket (24-28 AWG - .040 Insulation)
- 8	1655339			Terminal, Pin (20-24 AWG - .068 Insulation)
- 8	1655359			Terminal, Pin (24-28 AWG - .040 Insulation)
- 9	2637681			Terminal, Pin Slip On (18-20 AWG)
- 10	483681			Terminal, Ring (18-20 AWG - No. 8 Stud)
- 10	483682			Terminal, Ring (14-16 AWG - No. 8 Stud)
- 10	483688			Terminal, Ring (18-20 AWG - No. .250 Stud)
- 10	483689			Terminal, Ring (14-16 AWG - No. .250 Stud)
- 11	2502307			Terminal, 0.0250 Tab Slip On (10-14 AWG - .275 Insulation)
- 11	5412817			Terminal, 0.1870 Tab Slip On (20-24 AWG - .070 Insulation)
- 12	5302662			Receptacle, 25 Circuit
- 12	5302663			Receptacle, 25 Circuit
- 13	1608649			Connector, 15 Position Plug
- 14	1608648			Receptacle, 15 Circuit
- 14	1655336			Receptacle, 25 Circuit
- 14	6031046			Receptacle, 25 Circuit
- 14	6031047			Receptacle, 25 Circuit
- 15	1847526			Plug, 3 Circuit
- 16	1847531			Housing, 6 Circuit (2 x 3)
- 17	1495409			Plug, 8 Circuit (1 x 8)
- 18	1847535			Housing, 12 Circuit (3 x 4)
- 19	1847534			Plug, 12 Circuit (3 x 4)
- 20	2731391			Housing, 16 Circuit (1 x 16)
- 20	2731406			Housing, 10 Circuit (1 x 10)
- 21	2453021			Housing, 24 Circuit (2 x 12)
- 21	2453022			Housing, 50 Circuit (2 x 25)
- 21	2453961			Housing, 60 Circuit (2 x 30)
- 21	2731847			Housing, 32 Circuit (2 x 16)
- 21	8324648			Housing, 36 Circuit (2 x 18)
- 22	1855559			Retainer
- 23	1608438			Retainer
- 24	4177188			Key, Polarizing
- 25	7362179			Receptacle, Twinax
- 26	2453170			Jack Screw, 4-40 Thd
- 26	2453169			Jack Screw, M3 Thd
- 26	4178371			Jack Screw, M2.6 Thd (Japan Only)
- 27	5761882			Housing, 0.0250 Tab Slip On Terminal
- 28	2757998			Terminal, High Pressure (20-24 AWG)
- 29	2453127			Plug, 25-Pin (Molded)
- 30	2453128			Plug, 15-Pin D Type (Molded)
- 31	2453012			Power Cord Receptacle
- 32	8264758			Cover - Wrap Connector
- 33	5824321			Connector - 25 Way
- 34	2282931			Cable Clamp
- 34	5811801			Cable Clamp
- 34	533783			Cable Clamp

Figure 16. CABLE AND JUMPER COMPONENT PARTS (3 of 3)

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION FOR FIGURE 18
			1 2 3 4
			CABLE ASMS
			EXTERNAL CABLES
	2453129		Cable Asm-External-EIA/Autocall
	2453143		Cable Asm-External-X-21
	2453145		Cable Asm-External-DDSA
	2462238		Cable Asm-External-V.35
	1749352		Cable Asm-Adapter-V.35 France/Switzerland
			INTERNAL CABLES
	2453100		Cable Asm-Flat Signal Cable
	2453101		Cable Asm-DC Cable to 21ED (A2,A3)
	2453102		Cable Asm-100 V AC (Line Filter)
	2453104		Cable Asm-Communication Cable
	2453106		Cable Asm-200 V AC (Line Filter)
	2453107		Cable Asm-To 51TD and Control Panel

Figure 17. CABLE ASMS

PART NUMBER	LIST AND INDEX NO.	PART NUMBER	LIST AND INDEX NO.	PART NUMBER	LIST AND INDEX NO.	PART NUMBER	LIST AND INDEX NO.
22478	11 - 20	1680269	14 - 1	2453279	6 - 9	4177188	16 - 24
35229	11 - 11	1847521	16 - 6	2453281	1 - 1	4178362	1 - 2
35229	11 - 15	1847522	16 - 5	2453283	1 - 1	4178364	1 - 2
104702	11 - 13	1847523	16 - 6	2453285	1 - 1	4178365	1 - 2
147297	11 - 18	1847526	16 - 15	2453287	1 - 1	4178371	16 - 26
236916	16 - 3	1847531	16 - 16	2453289	1 - 1	4178373	10 - 2
363001	11 - 4	1847534	16 - 19	2453291	1 - 1	4178389	8 - 1
483681	16 - 10	1847535	16 - 18	2453293	1 - 2	4178396	13 - 17
483682	16 - 10	1855559	16 - 22	2453297	1 - 2	4178400	13 - 19
483688	16 - 10	2122202	16 - 2	2453299	1 - 2	4178434	13 - 20
483689	16 - 10	2122734	16 - 1	2453306	13 - 2	4178448	14 - 2
533783	16 - 34	2282931	16 - 34	2453307	13 - 3	4233722	8 - 7
620052	7 - 4	2420943	11 - 16	2453308	13 - 11	4233722	10 - 8
811804	9 - 4	2420944	11 - 17	2453310	2 - 13	4233751	9 - 5
813590	9 - 7	2453012	16 - 31	2453311	13 - 13	4236318	6 - 10
818039	9 - 9	2453014	4 - 3	2453319	13 - 9	4240512	10 - 1
xxxxxxx	6 - 3	2453015	4 - 3	2453325	5 - 1	4240513	10 - 1
xxxxxxx	9 - 1	2453016	4 - 3	2453327	12 - 2	4240516	10 - 1
xxxxxxx	9 - 3	2453017	4 - 3	2453332	6 - 11	4240517	10 - 1
xxxxxxx	9 - 6	2453019	13 - 12	2453336	7 - 6	4240563	11 - 12
xxxxxxx	10 - 4	2453020	13 - 23	2453907	12 - 1	4240584	10 - 5
1159567	7 - 5	2453021	16 - 21	2453909	1 - 2	4240604	11 - 9
1256071	11 - 19	2453022	16 - 21	2453926	8 - 6	4240605	11 - 9
1495409	16 - 17	2453023	13 - 5	2453932	1 - 2	4240635	11 - 2
1608438	16 - 23	2453033	6 - 5	2453933	1 - 2	4240638	10 - 3
1608648	16 - 14	2453068	6 - 1	2453934	7 - 7	4240671	11 - 7
1608649	16 - 13	2453069	6 - 1	2453935	13 - 7	4240673	11 - 5
1608874	2 - 8	2453082	3 - 7	2453952	13 - 8	4240675	11 - 5
1615266	7 - 3	2453083	3 - 6	2453961	16 - 21	4240677	11 - 1
1616060	9 - 9	2453083	3 - 7	2462245	7 - 1	4240679	11 - 1
1616119	8 - 3	2453093	2 - 14	2462246	2 - 11	5302662	16 - 12
1616514	9 - 8	2453104	6 - 8	2462247	2 - 4	5302663	16 - 12
1616580	8 - 5	2453107	6 - 6	2462248	2 - 1	5323931	2 - 9
1616617	9 - 10	2453127	16 - 29	2462269	13 - 14	5412817	16 - 11
1616634	9 - 2	2453128	16 - 30	2462273	13 - 14	5428337	5 - 6
1616699	8 - 3	2453168	1 - 1	2462274	13 - 14	5486851	16 - 4
1616733	8 - 4	2453169	16 - 26	2462278	13 - 4	5561773	5 - 3
1616752	9 - 11	2453170	16 - 26	2462279	13 - 4	5561774	5 - 3
1621182	4 - 5	2453184	3 - 2	2462280	13 - 4	5761882	16 - 27
1621182	9 - 12	2453189	3 - 2	2462281	13 - 4	5811801	16 - 34
1621192	11 - 10	2453192	13 - 24	2462282	13 - 4	5824321	16 - 33
1621192	11 - 21	2453193	13 - 10	2462283	13 - 14	6031046	16 - 14
1621194	11 - 8	2453199	3 - 2	2462284	13 - 4	6031047	16 - 14
1621521	2 - 2	2453200	3 - 2	2462685	11 - 14	6060806	2 - 12
1621521	2 - 5	2453201	4 - 1	2462686	10 - 6	6819193	13 - 21
1621719	11 - 6	2453202	4 - 1	2462686	11 - 3	6819202	13 - 18
1621821	3 - 4	2453210	4 - 1	2502307	16 - 11	6819205	13 - 16
1622402	4 - 7	2453211	4 - 1	2549526	2 - 16	6819211	13 - 21
1622675	6 - 7	2453212	2 - 10	2549531	2 - 3	6842908	4 - 6
1622675	7 - 8	2453218	5 - 1	2549782	5 - 2	7362179	16 - 25
1622676	2 - 6	2453219	5 - 1	2549782	5 - 4	8264758	16 - 32
1622866	3 - 1	2453240	13 - 6	2549782	6 - 2	8264773	4 - 8
1622869	8 - 2	2453241	13 - 1	2588053	5 - 5	8264774	2 - 7
1655336	16 - 14	2453242	13 - 15	2595136	2 - 15	8265370	3 - 5
1655337	16 - 7	2453248	6 - 4	2637681	16 - 9	8265370	4 - 2
1655339	16 - 8	2453252	3 - 3	2731391	16 - 20	8265370	4 - 4
1655358	16 - 7	2453253	10 - 7	2731406	16 - 20	8324648	16 - 21
1655359	16 - 8	2453261	7 - 2	2731847	16 - 21		
1661131	16 - 5	2453275	1 - 2	2757998	16 - 28		
1661132	16 - 6	2453277	1 - 1	4138510	13 - 22		

This page intentionally left blank.

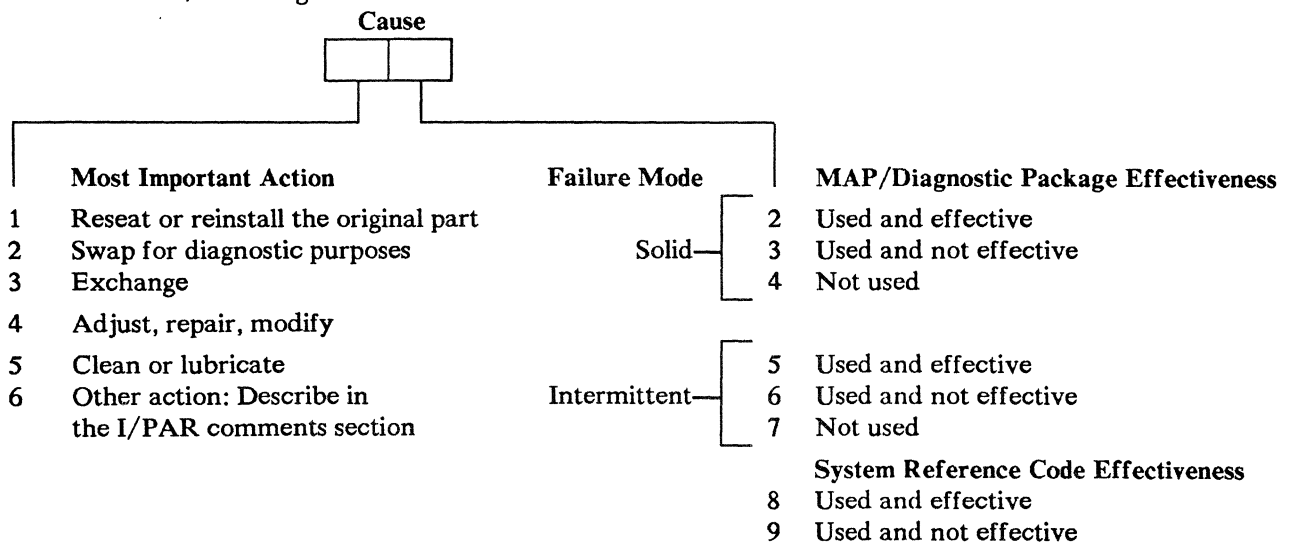# Appendix F. I/PAR Code Guide

Instructions for Using This Guide

Use this guide with the *CE Service Codes and I/PAR Preparation Guide*, ZZ60-0375.

- For problems that need a repair action:

  - Record the major and minor codes. For logic cards and cables, go to the page for the logic board, read down to the card or cable location, then across to the major and minor codes. Make a selection when there are optional devices.
  - Record the cause code that best describes the action.
  - Record the system reference code in the I/PAR comments section.
  - Record the problem and action taken in the CE/CSR Log.

- For problems that do not need a repair action:

  - No trouble found (NTF)-Record the major unit that you most suspect to be the problem and a minor unit of 93. If you cannot determine a major unit, use the major unit under which you spent time analyzing the problem. Describe the problem in the I/PAR comments section.
  - Record the system reference code in the I/PAR comments section.
  - Record the problem and action taken, if any, in the CE/CSR Log.

DO NOT USE MAJOR UNITS 000, 960, AND 980

Cause Codes: Select one digit from each column.

Cause

Most Important Action	Failure Mode	MAP/Diagnostic Package Effectiveness
1 Reseat or reinstall the original part		2 Used and effective
2 Swap for diagnostic purposes	Solid—	3 Used and not effective
3 Exchange		4 Not used
4 Adjust, repair, modify		
5 Clean or lubricate		5 Used and effective
6 Other action: Describe in the I/PAR comments section	Intermittent—	6 Used and not effective
		7 Not used

System Reference Code Effectiveness

8 Used and effective
9 Used and not effective

Note: The MAPs/diagnostics/system reference codes are effective if they identify the failing FRU or send you to the correct repair action.

001 Base

Note: *Minor codes 00 and 93 are not valid with major code 001.*

02 Covers
04 Frame
05 Gate hardware
03 Grounding/finger stock strip
06 Latches/hinges

020 Control Panel

01 Board, display

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

080 Cooling

82 Cables/connectors
01 Fan, disk area
02 Fan, logic area
05 Thermal switch

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

Cause

	Most Important Action	Failure Mode		MAP/Diagnostic Package Effectiveness
1	Reseat or reinstall the original part		2	Used and effective
2	Swap for diagnostic purposes	Solid	3	Used and not effective
3	Exchange		4	Not used
4	Adjust, repair, modify			
5	Clean or lubricate		5	Used and effective
6	Other action: Describe in	Intermittent	6	Used and not effective
	the I/PAR comments section		7	Not used
				System Reference Code Effectiveness
			8	Used and effective
			9	Used and not effective
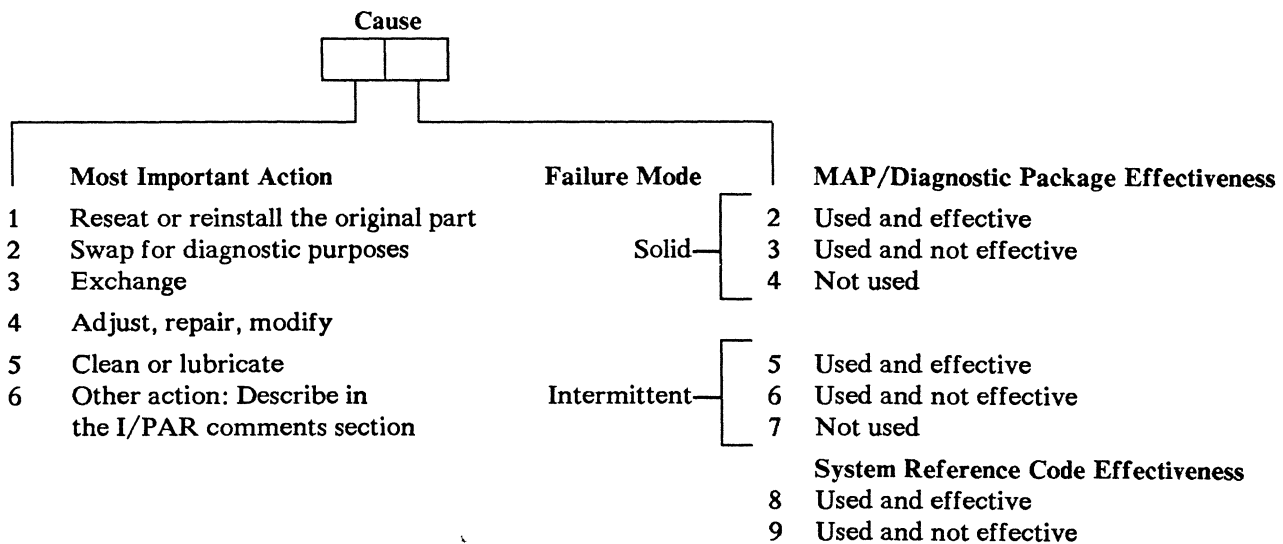
Note: *The MAPs/diagnostics/system reference codes are effective if they identify the failing FRU or send you to the correct repair action.*

A-A1 Logic

Card/Cable Locations	Major Code	Minor Code	Description
A-A1A2	306	01	Disk drive B adapter
B2	305	01	Disk drive A adapter
C2	319	01	Data storage adapter 2
D2	304	01	Data storage adapter 1
F2	303	01	Control panel interface
F5	305	02	Jumper card
G2	311	01	CSP
H2	310	01	MSP control
J2	310	02	MSP data flow
K2	320	04	Main storage
L2	320	03	Main storage
M2	320	02	Main storage
N2	320	01	Main storage
P2	317	01	Work station adapter
P3	317	02	Pass-through card
Q2 Work station expansion No work station expansion	 316 317	 01 01	 Work station controller Work station adapter
T2 With SLCA With MLCA	 101 112	 02 01	 Pass-through card MLCA controller
U2/V2/W2/X2 EIA Autocall X.21 DDSA V.35	 106 109 110 108 111	 01 01 01 01 01	Line adapters
YB	302	82	Diskette cable
YC/YD	303	82	Control panel cables
YF	109	82	Autocall cable
YG/YH	101	82	Communication cables
YJ	305	82	Disk A signal cable
YL/YP	602	82	DC power cable
ZA	306	82	Disk B signal cable
ZC/ZF	602	82	DC power cable
ZE	317	82	Work station cable
ZG/ZH	101	82	Communication cables

Card/Cable Locations	Major Code	Minor Code	Description
A-A1 board	300	01	Discrete wire
A-A1 board	300	02	Land pattern
A-A1 board	300	03	Pin

Other minor codes that you can use with a logic major code:

50   Card jumpers
60   Top card connectors

93   No trouble found—record the details in the I/PAR comments section
00   Other—explain fully in the I/PAR comments section

No Trouble Found: When you suspect that a *communications* problem is outside the system, record the major unit that you most suspect to be the problem and a minor unit of 93 (see the table below). If you cannot determine a major unit, use the major unit under which you spent time analyzing the problem. Record system reference code(s), if available, and other details in the I/PAR comments section.

No Trouble Found	Major Code	Minor Code
Common carrier facilities	150	93
Customer application (programming)	151	93
Customer procedures	152	93
Environment	153	93
External non-IBM local DCE (modem)	154	93
External non-IBM remote DCE (modem)	155	93
Remote DTE (work station)	156	93
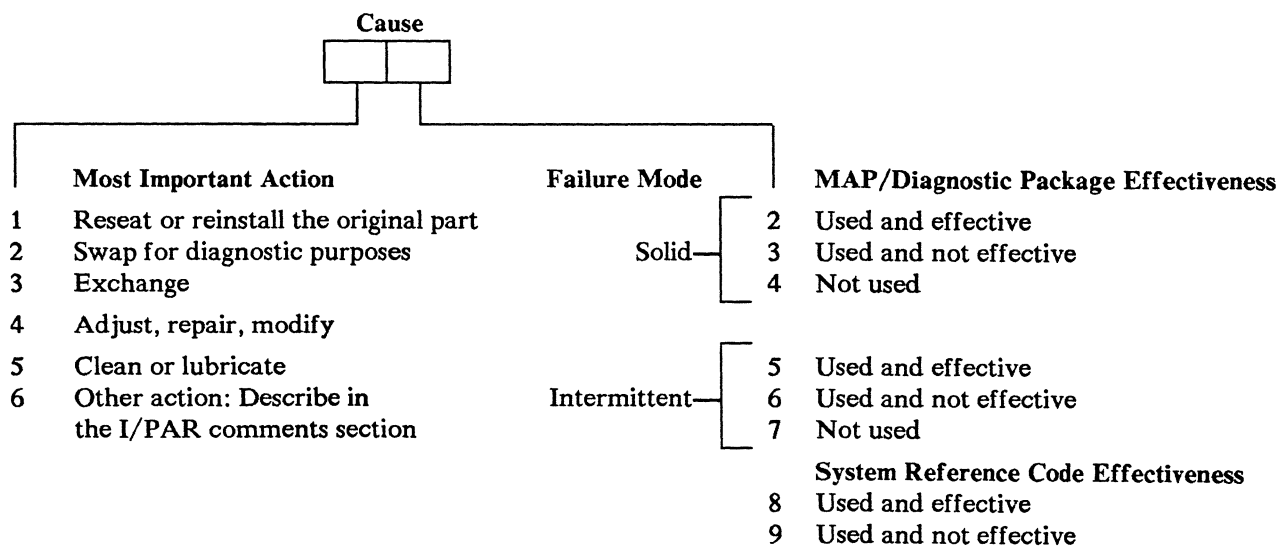
Cause

Most Important Action	**Failure Mode**	**MAP/Diagnostic Package Effectiveness**
1 Reseat or reinstall the original part		2 Used and effective
2 Swap for diagnostic purposes	Solid	3 Used and not effective
3 Exchange		4 Not used
4 Adjust, repair, modify		
5 Clean or lubricate		5 Used and effective
6 Other action: Describe in the I/PAR comments section	Intermittent	6 Used and not effective
		7 Not used

System Reference Code Effectiveness

8   Used and effective
9   Used and not effective

Note: *The MAPs/diagnostics/system reference codes are effective if they identify the failing FRU or send you to the correct repair action.*

600 AC Power

82 Cables/connectors
03 Line filter/AC cable assembly
02 Power cord

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

602 Base Power

82 Cables/connectors
03 Power supply

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

825 51TD Diskette Drive

02 Belt, drive
82 Cables/connectors
04 Card, drive control
11 Motor, AC drive
99 Unit exchange

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

851 21ED Disk Drive (A2, 30 Mb)

01 Disk enclosure
02 Logic card, analog, B1A3
03 Logic card, digital, A1A2
04 Logic card, driver, C1A1
05 Maple block

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

852 21ED Disk Drive (A3, 60 Mb)

01 Disk enclosure
02 Logic card, analog, B1A3
03 Logic card, digital, A1A2
04 Logic card, driver, C1A1
05 Maple block

93 No trouble found—record the details in the I/PAR comments section
00 Other—explain fully in the I/PAR comments section

870   Customer Responsibility

Minor Codes

Tens

7   Customer problem determination—not used/not provided
8   Customer problem determination—used and effective
9   Customer problem determination—used and not effective

Units

1   Electrical/mechanical noise/ESD
2   Environment—temperature/humidity
3   Hardware compatibility
4   Procedural error
5   Programming error
6   Power failure/incorrect voltage (external)/power line disturbance
7   Wiring error
8   Customer-owned cables
9   Media
0   Other

900   Functional Microcode

Note: Include APAR/MTR or patch number if applicable.

Minor Codes

72   Failure identified incidents

Cause Codes

20   Error in IBM functional microcode
21   Permanent restriction
22   Error in IBM documentation
23   Error in EC/APAR
24   Wrong EC level

75   Problem determination

Cause Codes

50   User cancelled/NTF
51   Operator/user error
52   Non-IBM software/customer program
53   Non-IBM hardware
54   IBM hardware

Appendix G. CE/CSR Log

Machine Type and Serial: 5362—

Date	Description of Problem/Action Taken (Do not record hours or part numbers.)	CE/CSR Name

Date	Description of Problem/Action Taken (Do not record hours or part numbers.)	CE/CSR Name

Date	Description of Problem/Action Taken (Do not record hours or part numbers.)	CE/CSR Name

Date	Description of Problem/Action Taken (Do not record hours or part numbers.)	CE/CSR Name

Index

D

E

S

READER'S COMMENT FORM

Please use this form only to identify publication errors or to request changes in publications. Direct any requests for additional publications, technical questions about IBM systems, changes in IBM programming support, and so on, to your IBM representative or to your nearest IBM branch office. You may use this form to communicate your comments about this publication, its organization, or subject matter, with the understanding that IBM may use or distribute whatever information you supply in any way it believes appropriate without incurring any obligation to you.

☐ If your comment does not need a reply (for example, pointing out a typing error) check this box and do not include your name and address below. If your comment is applicable, we will include it in the next revision of the manual.

☐ If you would like a reply, check this box. Be sure to print your name and address below.

Page number(s):   Comment(s):

Please contact your nearest IBM branch office to request additional publications.

Name _____

Company or
Organization _____

Address _____

No postage necessary if mailed in the U.S.A.

City   State   Zip Code

Phone No.   (   ) _____
            Area Code

Fold and tape. **Please do not staple.**

BUSINESS REPLY MAIL

FIRST CLASS / PERMIT NO. 40 / ARMONK, NEW YORK

NO POSTAGE
NECESSARY
IF MAILED IN THE
UNITED STATES

POSTAGE WILL BE PAID BY ADDRESSEE

International Business Machines Corporation
Information Development
Department 245
Rochester, Minnesota, U.S.A. 55901
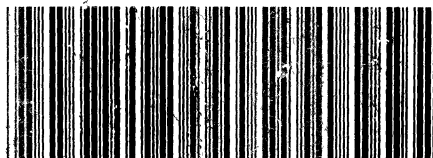
Fold and tape. **Please do not staple.**

IBM

IBM ®