

RA80 DISK DRIVE USER GUIDE

digital

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CHAPTER 1 INTRODUCTION

1.1 PURPOSE AND SCOPE

This manual describes the RA80 Disk Drive and tells how to install, checkout, and operate the equipment.

This manual was written primarily for the RA80 user, but information concerning such items as equipment installation and checkout are intended for qualified Field Service personnel.

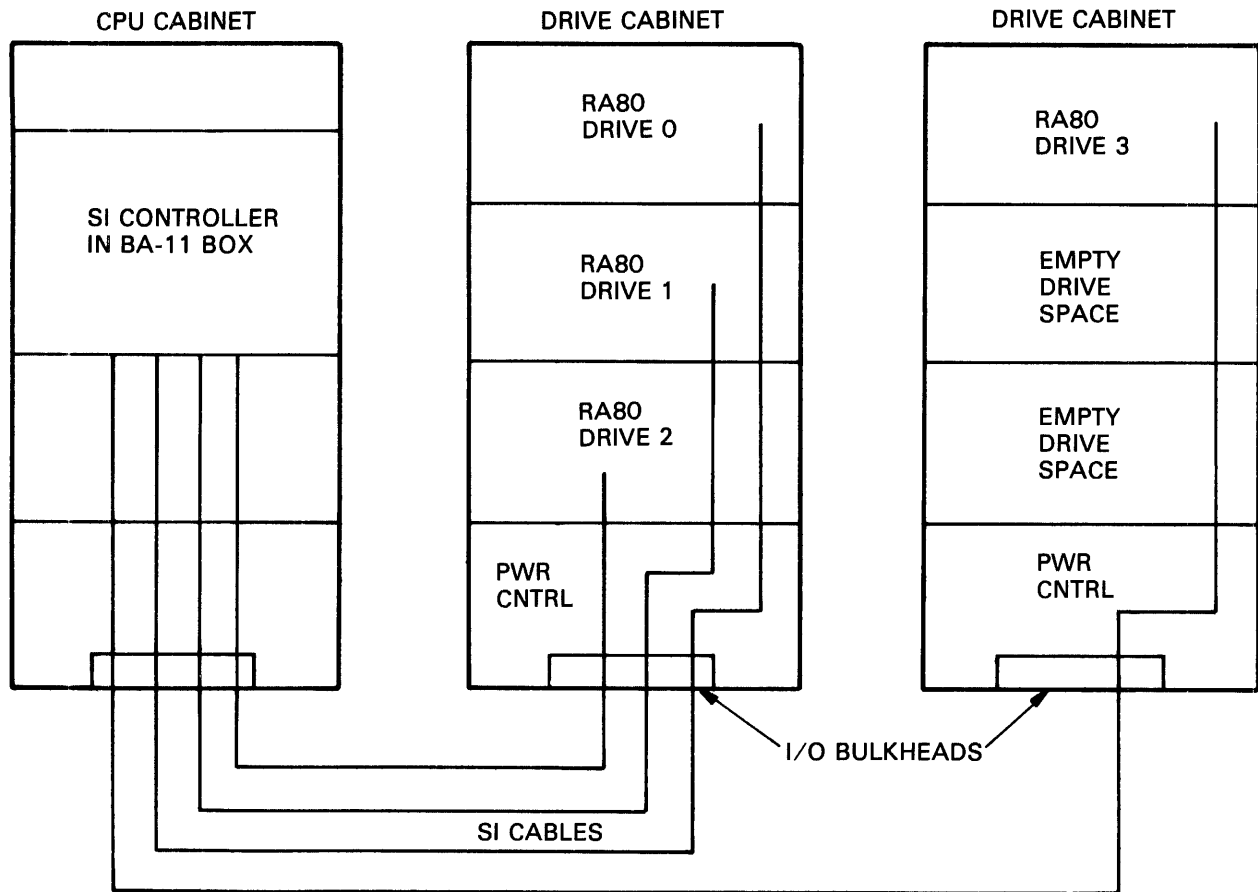
1.2 GENERAL INFORMATION

The RA80 is a rack-mountable disk drive using non-removable media. It has a data storage capacity of 121 megabytes. Each RA80 Disk Drive offers dual-port capability. The RA80 Disk Drive operates on the standard disk interface (SDI) bus, which connects the drive to the controller. (The generic term SI will be used to refer to this bus in this user guide.) As many as four drives can be connected to an SI controller.

Figure 1-1 shows the relationship between subsystem components.

The sealed head disk assembly (HDA) is a feature of the RA80 which protects data and improves hardware reliability. The following are characteristics of the RA80 HDA.

- Performance
 - 1.2 megabyte per second peak transfer rate
 - 25 ms average positioning time
 - 8.3 ms average rotational delay
- Data Integrity
 - Protected media
 - Microprocessor controlled servo
 - Automatic error correction
- Hardware Availability
 - Rugged design
 - Simple modular construction
 - Extensive microcoded diagnostics



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Figure 1-1 Subsystem Configuration Diagram

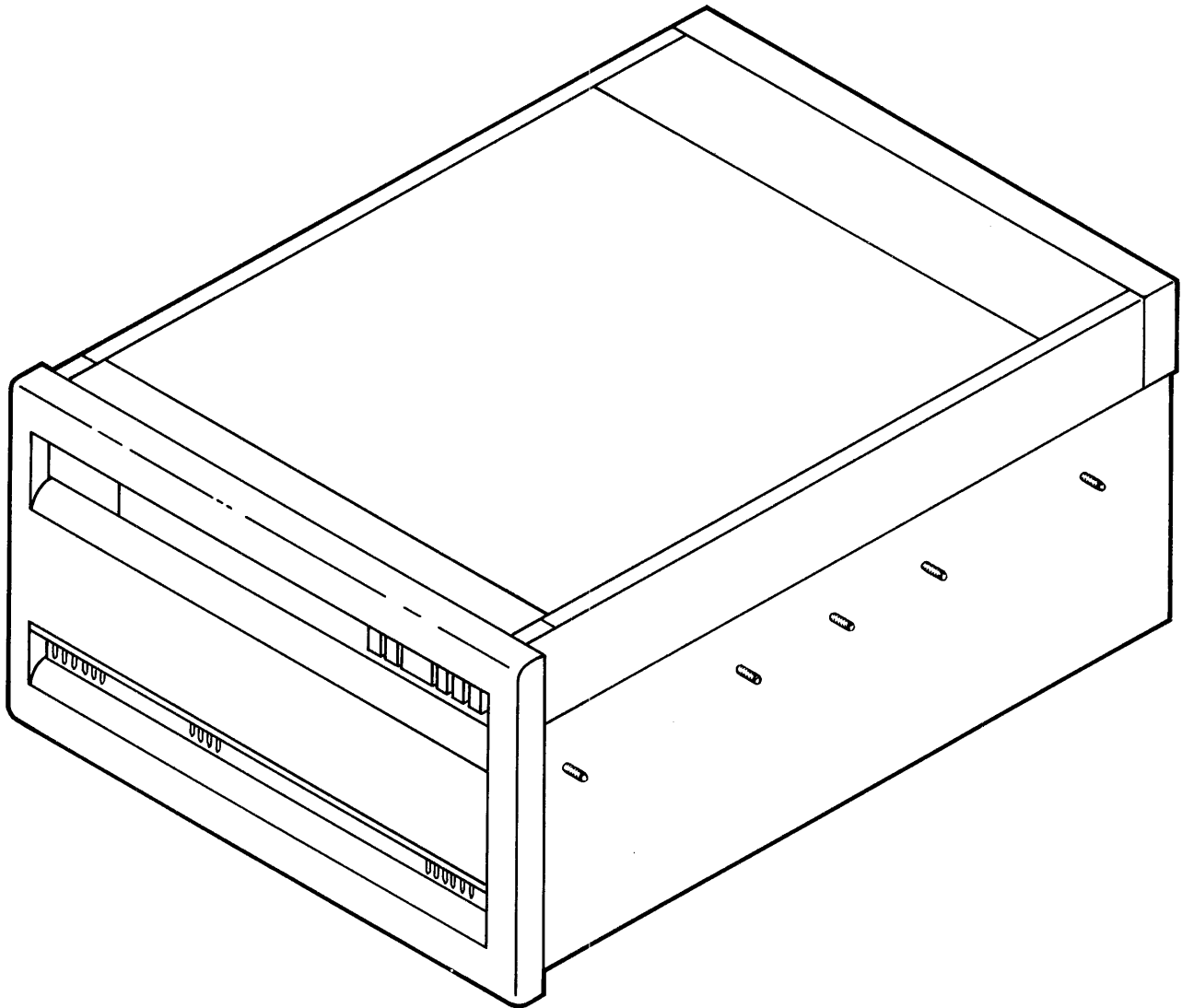
CAUTION

Data on an HDA that becomes inoperable cannot be recovered. Therefore, critical files stored on this media should be backed up on a regular basis. This will usually involve either incremental or volume backup to removable media, such as magnetic tape.

The use of journaling should also be used in transaction processing applications. This technique will allow rapid reconstruction of files up to the last checkpoint.

1.3 DRIVE DESCRIPTION

The RA80 drive storage assembly includes the HDA and associated logic. It is an independently powered, cooled, and rack-mounted disk drive. Three of the major circuit modules (servo, personality, and microprocessor) in the drive are located directly beneath the access cover on the top of the drive. These circuit modules are hinge-mounted to facilitate servicing by Field Service Engineers. Logic power is supplied by the drive's power supply which is contained in the rear of the drive. Cooling for the drive is provided by fans located inside the drive. Figure 1-2 shows the RA80 Disk Drive.



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Figure 1-2 RA80 Disk Drive

1.3.1 Head Disk Assembly

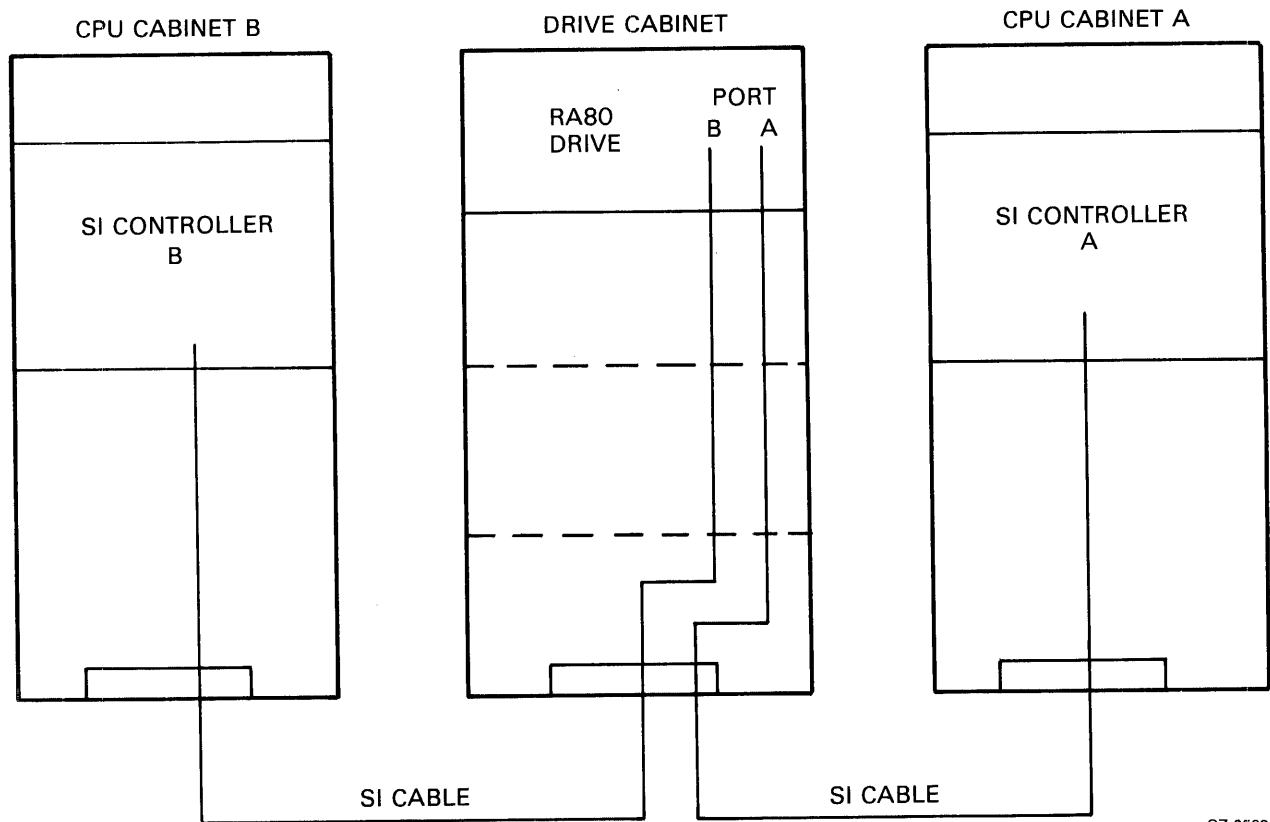
The sealed HDA contains the recording media (four platters), rotary positioner, read/write heads, and preamplifiers. Seven of the platter surfaces are used for recording data, and the eighth is a dedicated servo surface which is preformatted by DIGITAL at the time of manufacturing. The rotary positioner is controlled by a closed-loop dedicated servo system which allows track-following position control.

1.3.2 Internal Drive Diagnostics

Two groups of internal diagnostics are incorporated in the RA80 to permit error detection and fault isolation. The first group of diagnostics is run during the power-up cycle to validate initial operations. A second set of diagnostics has switch-selectable routines which are used by Field Service personnel only and are not part of the regular operating controls. Internal diagnostics can also be initiated from the SI controller when the subsystem diagnostics are run.

1.3.3 Dual-Port Capability

A second SI controller can be connected to the RA80 Disk Drive in a dual-port arrangement to permit time-shared access of the subsystem by either controller. Figure 1-3 shows a dual-port configuration. For simplicity, only one drive cabinet is shown in Figure 1-3.



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Figure 1-3 RA80 Dual-Port Configuration

1.4 RA80-RELATED DOCUMENTATION

A list of related RA80 documentation follows.

- RA80 Disk Drive Service Manual
- RA80 Disk Drive Illustrated Parts Breakdown

The above manuals may be ordered from Printing and Circulation Services, 444 Whitney St., Northboro, Massachusetts, 01532.

1.5 RA80 SPECIFICATIONS

Table 1-1 contains the performance, power, environmental, and physical characteristics of the RA80 Disk Drive.

1.6 RA80 OPTIONS

Table 1-2 lists the RA80 options that are currently available.

Table 1-1 RA80 Specifications

Characteristic	Specification
Data Storage Capacity (Single drive)	
HDA word format	16-bit
Storage capacity	121 MB
Bits/inch (inner track)	6339
Tracks/inch	478
Head Disk Assembly (HDA)	
Disk recording method	Modified frequency modulation (MFM)
Number of disks	4
Disk surfaces	7 data, 1 servo
Number of heads	14 data, 1 servo
Heads per disk surface	2
Number of tracks	561 per head
Logical cylinders	546 per head
Number of tracks used for revector and format control tables	14 per head
Number of sectors	31 (0 through 30)
Number of logical blocks	236,964 LBNs
Maximum Seek Times	
All cylinders	50 ms
One cylinder	6 ms
Average seek	25 ms
Latency	
Speed	3600 r/min + 4.3% - 3.5%
Maximum latency	16.6 ms
Average latency	8.33 ms
Single Start/Stop Time	
Start (maximum)	40 seconds
Start (typical)	15 seconds
Inhibit between stop and restart	3 minutes

Table 1-1 RA80 Specifications (Cont)

Characteristic	Specification
Data Rates	
Bit cell time	103.3 ns
Bit rate	9.677 MHz
Word rate (16-bit)	1.65 microseconds
RA80 Environmental Limits	
Temperature	
Operating	10° C to 38° C (50° F to 101° F) with a temperature gradient of 20° C/hour (36° F/hour)
Non-operating	-40° C to +60° C (-40° F to +140° F)
Relative humidity	
Operating	10% to 90% (non-condensing) with a maximum wet bulb temperature of 28° C (82° F) and a minimum dew point of 2° C (36° F)
Shipping and storage	10% to 90% with no condensation
Heat dissipation	2460 Btu/hour
Altitude	
Operating	Sea level to 2,400 meters (8,000 feet) Note: Maximum allowable operating temperatures are reduced by a factor of 1.8° C/1000 meters (1° F/1000 feet) for operation above sea level.
Non-operating and shipping	300 meters (1000 feet) below sea level to 3,600 meters (12,000 feet) above sea level (actual or effective by means of cabin pressurization)

Table 1-1 RA80 Specifications (Cont)

Characteristic	Specification
Physical Characteristics	
Drive	
Height	26 cm (10.38 inches)
Width	44 cm (17.50 inches) 48 cm (18.88 inches) including bezel
Depth	67 cm (26.50 inches) 71 cm (28.12 inches) including bezel
Weight	66.7 Kg (147 pounds) approximately
Electrical	
Voltages available (single-phase)	120 Volts ac + 8, -21; 60 Hz ± 1 Hz
	220-240 Volts ac + 16, -36; 50 Hz ± 1 Hz
Input Power (maximum)	
120 Volts ac, 60 Hz 220-240 Volts ac, 50 Hz	720 Watts 720 Watts
Starting current for:	
120 Volts ac, 60 Hz 220-240 Volts ac, 50 Hz	31 A (peak surge for five seconds) 17A (peak surge for five seconds)
Running current for:	
120 Volts ac, 60 Hz 220-240 Volts ac, 50 Hz	7.5 A (measured at 117 V) 3.75 A (estimated)
Power factor Line cord length (from cabinet)	0.8 (8.5 feet)
Plug type	
120 Volts ac, 60 Hz 220-240 Volts ac, 50 Hz	NEMA L5-30P NEMA 6-15P

Table 1-2 RA80 Options

Option	AC Power	Description
RA80-AA	120 V @ 60 Hz	Rack-mountable add-on disk drive with rails and slides
RA80-AD	220-240 V @ 50 Hz	Rack-mountable add-on disk drive with rails and slides
RA80-CA	120 V @ 60 Hz	RA80 Disk Drive in an expansion cabinet
RA80-CD	220-240 V @ 50 Hz	RA80 Disk Drive in an expansion cabinet
RUA80-CA	120 V @ 60 Hz	Expansion cabinet-mounted RA80 and SI controller
RUA80-CD	220-240 V @ 50 Hz	Expansion cabinet-mounted RA80 and SI controller
H9642-BM	120 V @ 60 Hz	RA80 expansion cabinet
H9642-BN	220-240 V @ 50 Hz	RA80 expansion cabinet
H9544-AA		End panels for RA80 expansion cabinet
BC26V-XX		Shielded SI cable Optional cable lengths XX = 3.65 m (12 ft), 7.62 m (25 ft), 17.24 m (50 ft), 22.86 m (75 ft)

CHAPTER 2 INSTALLATION

2.1 SITE PREPARATION AND PLANNING

A certain amount of preparation and planning are necessary before installing the RA80 Disk Drive. The paragraphs that follow outline some of the items that should be considered.

WARNING

Hazardous voltages are present inside this equipment. Installation and servicing should be performed by a qualified and trained service representative. Bodily injury or equipment damage may result from improper servicing.

2.1.1 Environmental Considerations

The RA80 is designed to operate in a business or light industry environment. Although cleanliness is important in the installation of any computer system, it is even more significant when disk drives are involved.

Since the RA80 has a sealed HDA, dust and dirt particles are not likely to enter the area containing the recording media. However, the equipment should still operate in an environment with less than five million particles (0.5 micron or larger in diameter) per cubic foot of air.

2.1.2 Floor Loading

The weight of one RA80 cabinet and disk drive is 148.3 Kg (327 lbs.). The weight of each additional disk drive is 66.7 Kg (147 lbs.).

2.1.3 Power and Safety Precautions

The RA80 presents no unusual or additional fire or safety hazards to an existing computer system. The ac power wiring should be carefully checked, however, to confirm that its capacity is adequate for any future expansion. The circuit breaker on the rear of the power controller regulates the power to every drive in the cabinet.

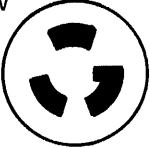
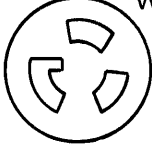
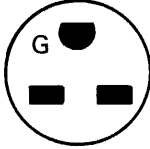
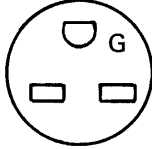
2.1.4 AC Power Wiring

The wiring used by Digital Equipment Corporation conforms to UL, CSA, and VDE standards. All equipment is shipped with a grounding connection on its frame.

The ac plugs and receptacles used on the H874 Power Controller are shown in Figure 2-1.

2.2 EQUIPMENT UNPACKING AND EXTERNAL INSPECTION

Before unpacking a carton, check it for external damage. Inspect it for holes, dents, smashed corners etc. Report any damage to the DIGITAL Field Service or Sales Office and the local carrier. If no external damage exists, the disk drive may be unpacked.

<p>120 V 30 A 1-PHASE</p>	<p>W</p>  <p>HUBBEL #2611 NEMA = L5-30P DEC = 12-11193</p>	 <p>W</p> <p>#2610 L5-30R 12-11194</p>
<p>240 V 15 A 1-PHASE</p>	<p>G</p>  <p>NEMA = 6-15P DEC = 90-08853</p>	 <p>G</p> <p>6-15R 12-11204</p>

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Figure 2-1 RA80 Cabinet AC Plugs

Use the following checklist to install the RA80 Disk Drive.

- Unpacking the system (2.2.1) _____
- Installing the leveler feet (2.2.2) _____
- Removing internal shipping brackets and packing material (2.2.3) _____

NOTE

For add-on drive installation, see Paragraph 2.4.

2.2.1 Unpacking the System on a Shipping Pallet

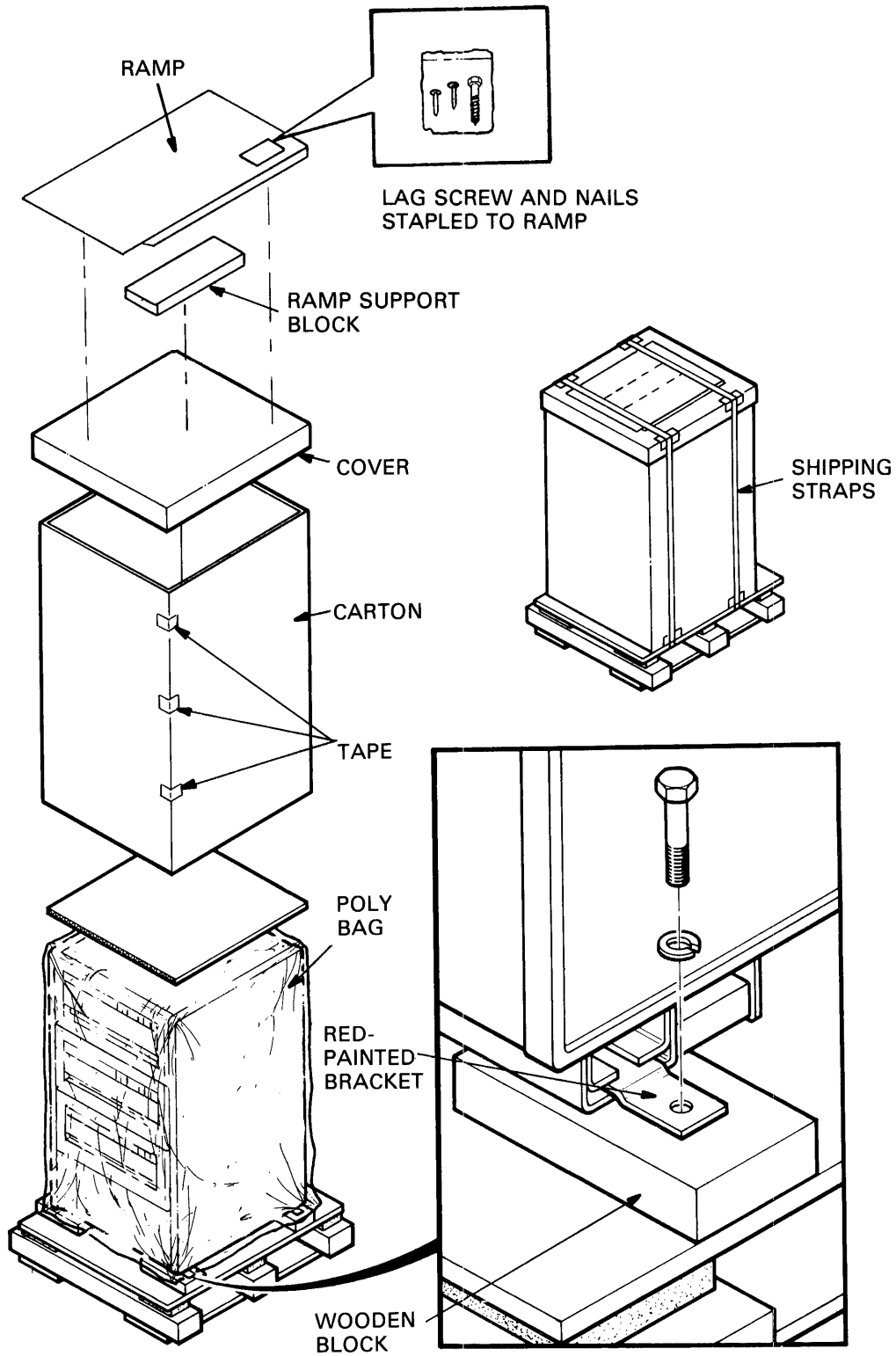
Figure 2-2 shows what a crated disk drive will look like. To unpack the disk drive and remove it from the pallet, use the following steps.

1. Remove all packaging materials. Refer to Figure 2-2.
2. Remove the four shipping bolts that secure the drive cabinet to the pallet. One is shown in the insert of Figure 2-2.
3. Construct the ramp to roll the disk drive off of the pallet. This is done by removing the plastic package enclosing the lag screw and nails from the bottom of the ramp. Use the lag screw to secure the ramp support block to the front of the shipping pallet. Then nail the ramp to the top of the ramp support block using the two nails provided. Refer to Figure 2-3.

WARNING

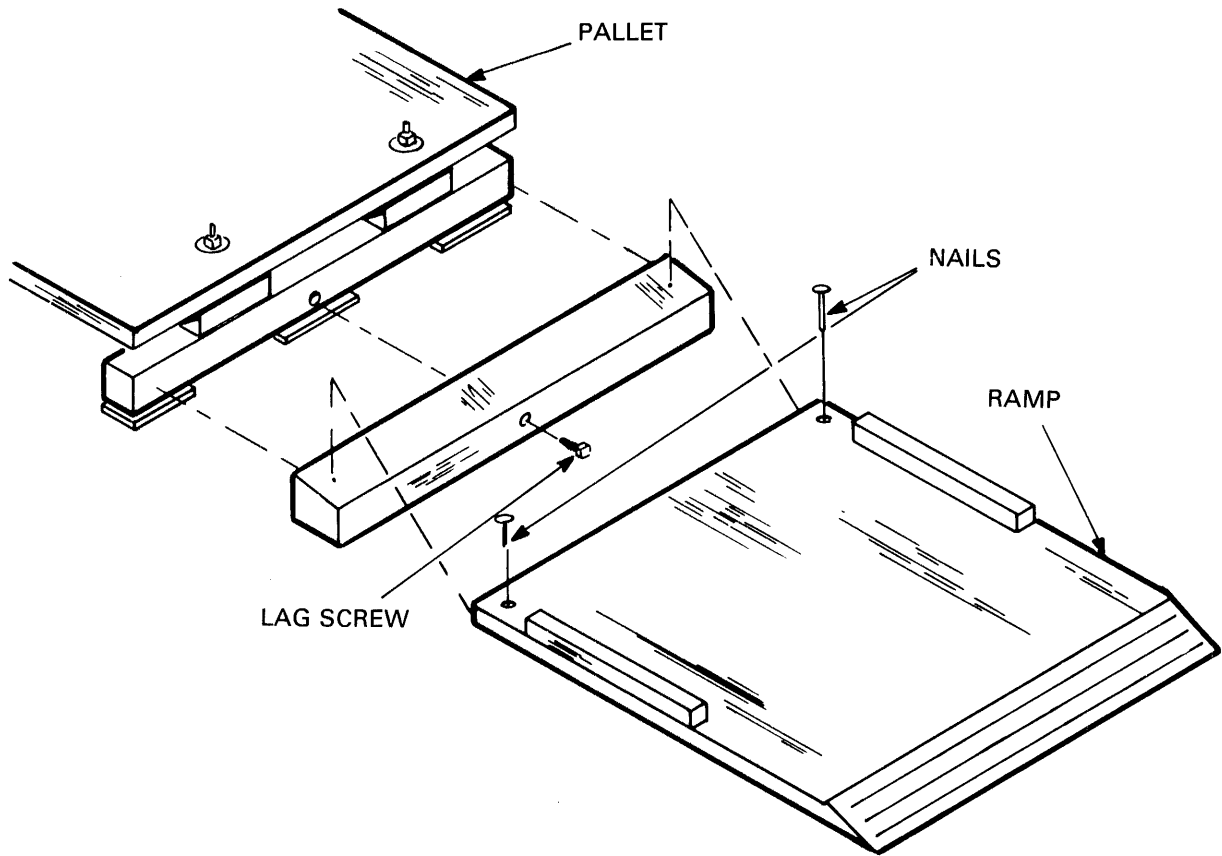
The next step requires at least two people.

4. Remove the four wooden blocks from under the drive cabinet.
5. Carefully roll the drive cabinet down the ramp



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Figure 2-2 Unpacking a System on a Shipping Pallet



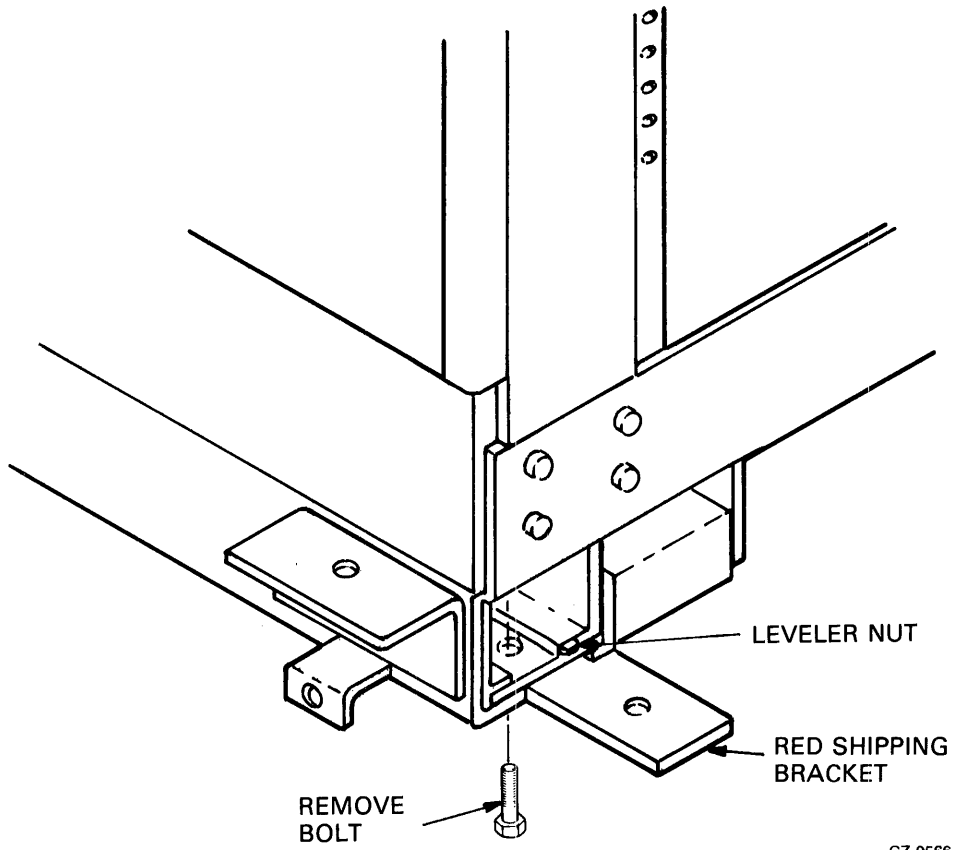
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Figure 2-3 Ramp Construction

2.2.2 Installing the Leveler Feet

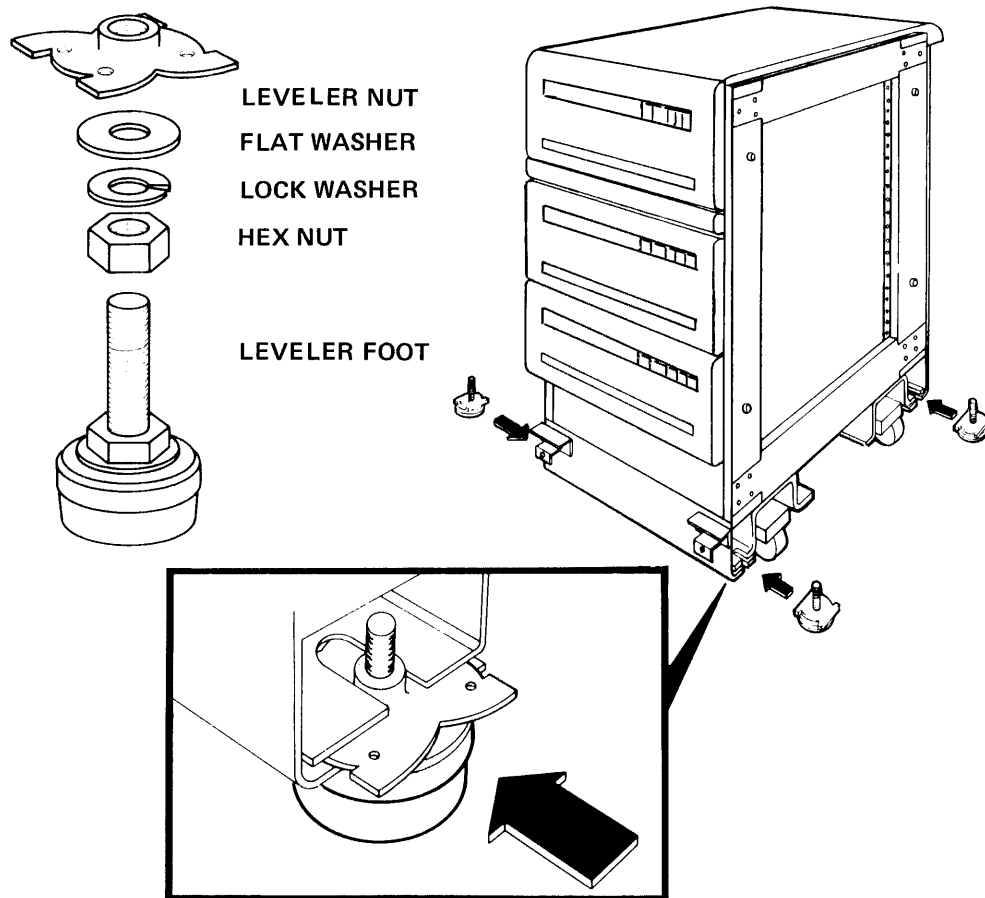
Use the following procedure to install the leveler feet.

1. Wheel the drive cabinet to its final location before installing the feet.
2. Unbolt and remove the four red shipping brackets and leveler nuts as shown in Figure 2-4.
3. Assemble the four leveler feet as shown in Figure 2-5. Screw the leveler foot up through the leveler nut far enough that the leveler nut may be slid back into place without raising the drive cabinet.
4. Slide the leveler feet into the slots in the cabinet as shown in Figure 2-6. Screw the leveler feet down until firm contact is made with the floor.
5. Adjust the leveler feet until the cabinet is level.



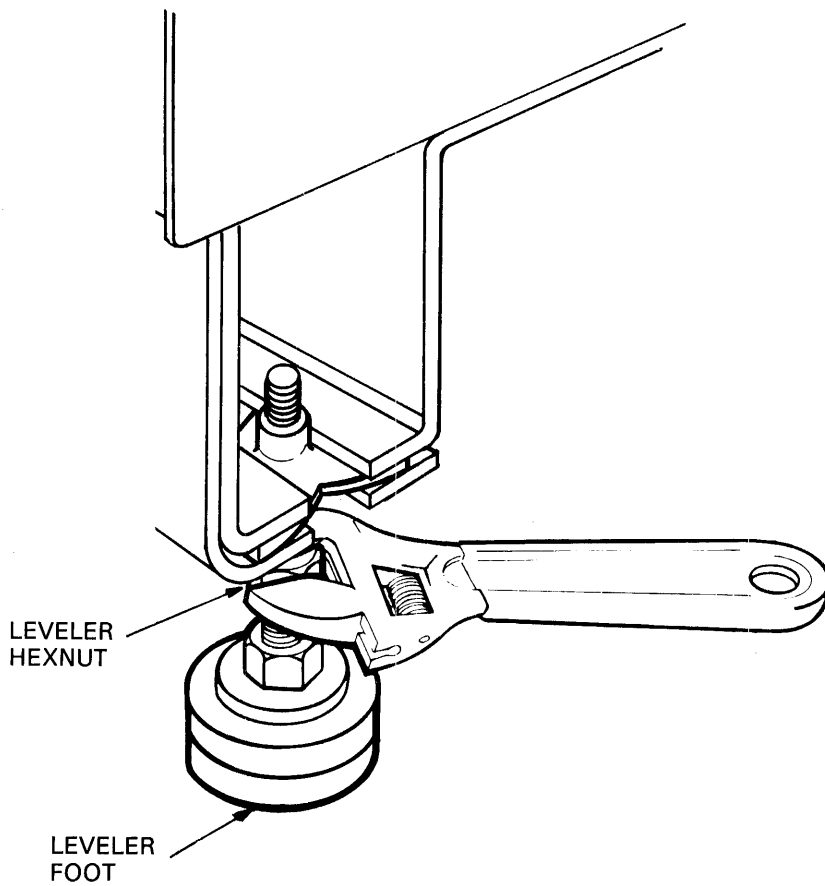
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Figure 2-4 Shipping Bracket Removal



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Figure 2-5 Installation of Leveler Feet



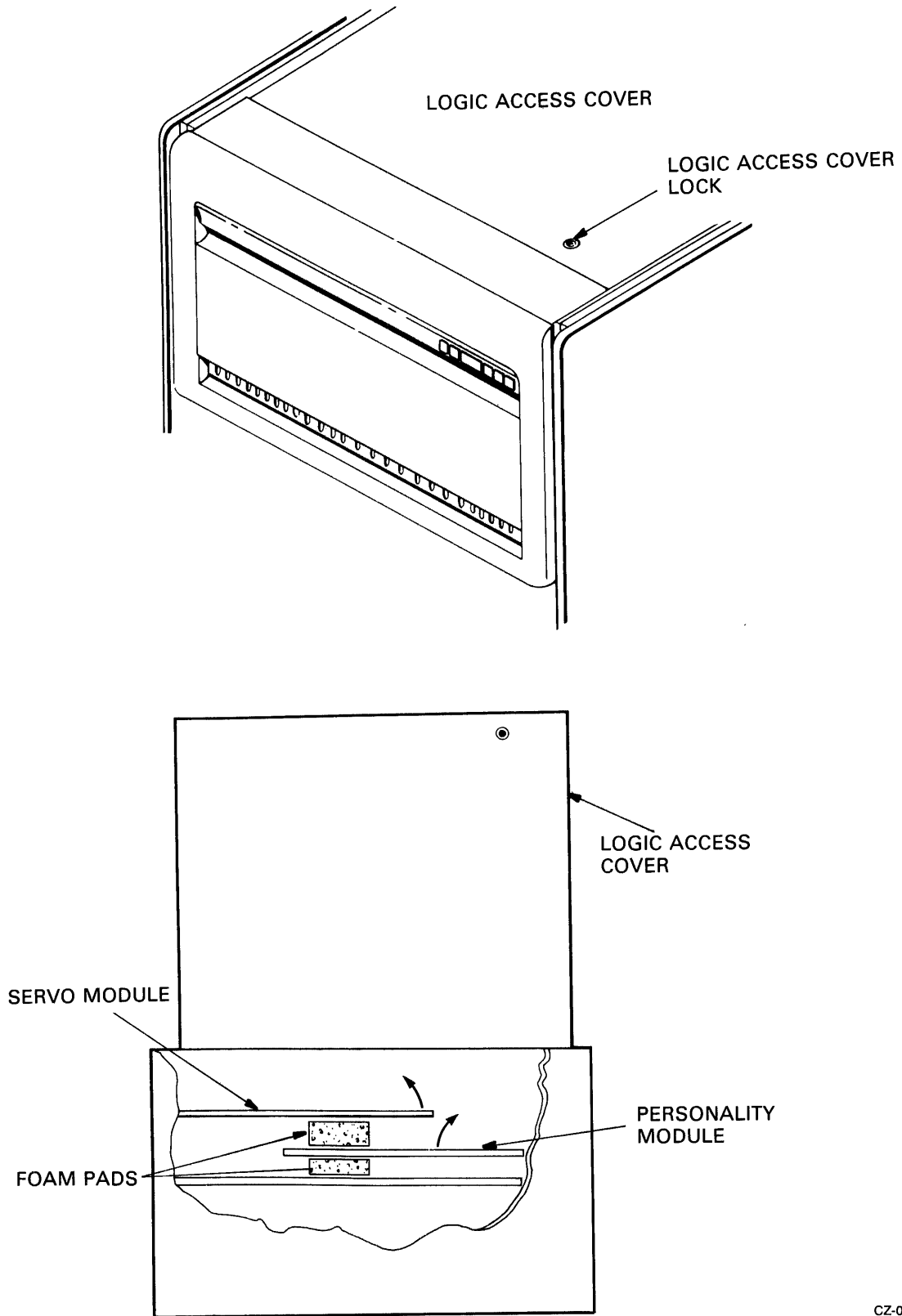
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Figure 2-6 Adjusting Leveler Feet

2.2.3 Removing the Internal Shipping Brackets and Packing Material

Packing material and shipping brackets are located inside each disk drive in the cabinet. Use the following procedure to remove this material and prepare the drive for operation.

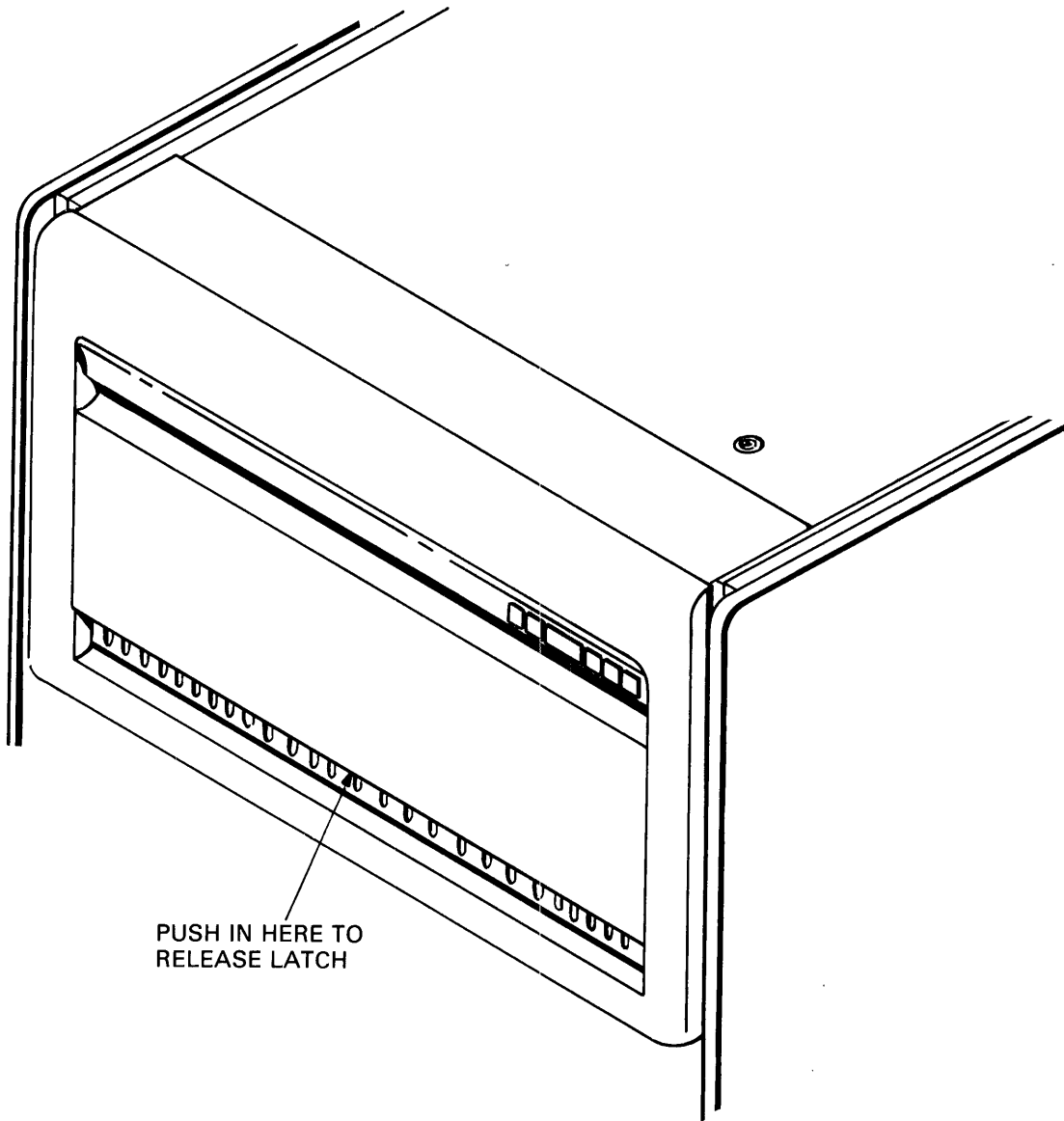
1. Raise the logic access cover by turning the cover lock 90° counterclockwise. Refer to Figure 2-7.



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Figure 2-7 Foam Pad Removal

2. Raise the servo module and the personality module to remove the two foam shipping pads shown in Figure 2-7.
3. Return the logic modules to their former position and lock the logic access cover back in place.
4. Raise the drive logic chassis by pushing in on the latch behind the center slot of the front bezel with a screwdriver. Refer to Figure 2-8.



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Figure 2-8 Raising the Drive Logic Chassis

5. Remove the four red shipping brackets which secure the HDA to its mountings (refer to Figure 2-9). Loosen each of the four HDA mounting nuts and remove the 5/16 inch hex-head bolts on three of the HDA mountings (refer to Figure 2-9). Then slide the shipping brackets out from under the HDA mounting nuts.
6. Remove the shipping bracket nearest the spindle motor by removing the shipping bolt and jam nuts which secure the bracket to the spindle motor assembly (refer to Figure 2-9). Slide the shipping bracket out from under the HDA mounting nut.

NOTE

Save all shipping brackets and hardware for future use when moving equipment.

7. Retighten all four HDA mounting nuts.
8. Be sure that the belt tension lever is in the locked (forward) position as shown in Figure 2-10.
9. Place the positioner lock lever on the HDA into the UNLOCK position (refer to Figure 2-9).

NOTE

An interlock switch (shown in Figure 2-11) prevents the spindle motor from operating while the belt tension is released. A spin-up cannot be accomplished unless the belt-tension lever is in the full forward position.

10. Lower the logic chassis until it is closed and latched.

2.3 RUA80 INSTALLATION

An RUA80 disk subsystem consists of a UDA50 disk controller and at least one RA80 Disk Drive in a cabinet. The installation procedure involves joining the disk drive cabinet to the CPU cabinet, installing the SI cables, and programming the unit address plug. Use the following checklist to check off the installation milestones.

- Join CPU and disk drive cabinets (2.3.1) _____
- Install the SI cables (2.3.2) _____
- Program the drive unit address plug (2.3.3) _____
- Install add-on disk drive, if necessary (2.4) _____

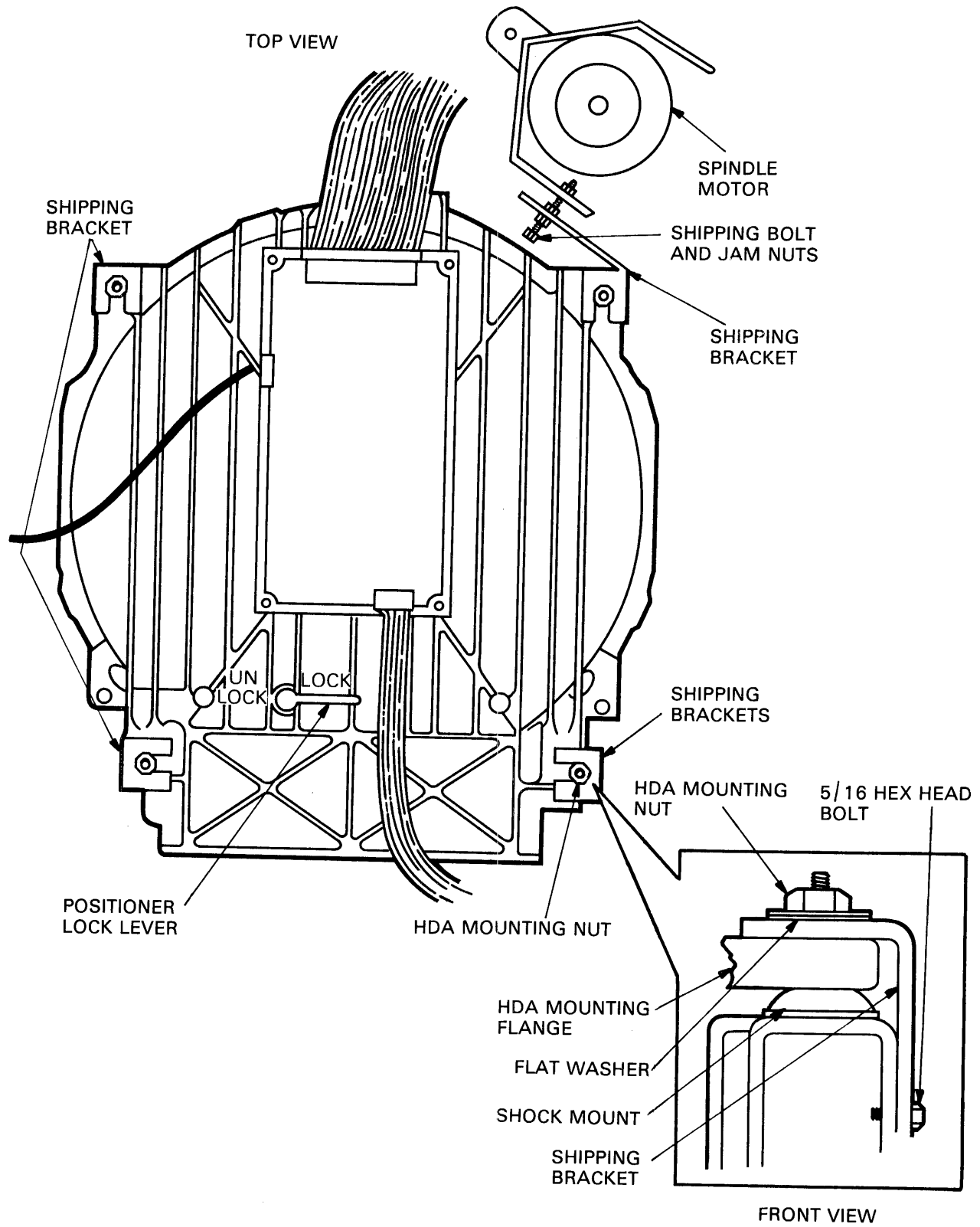
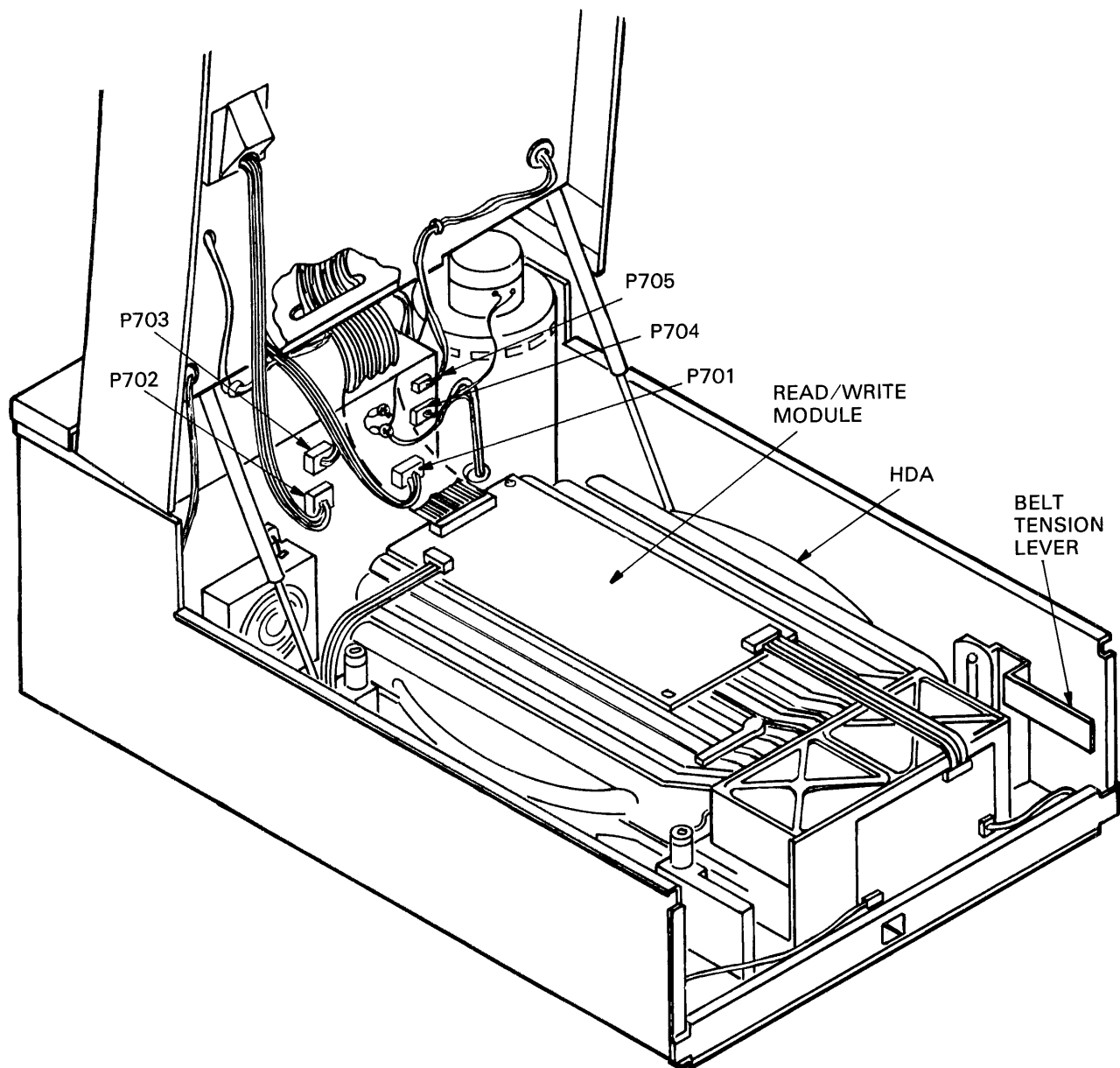


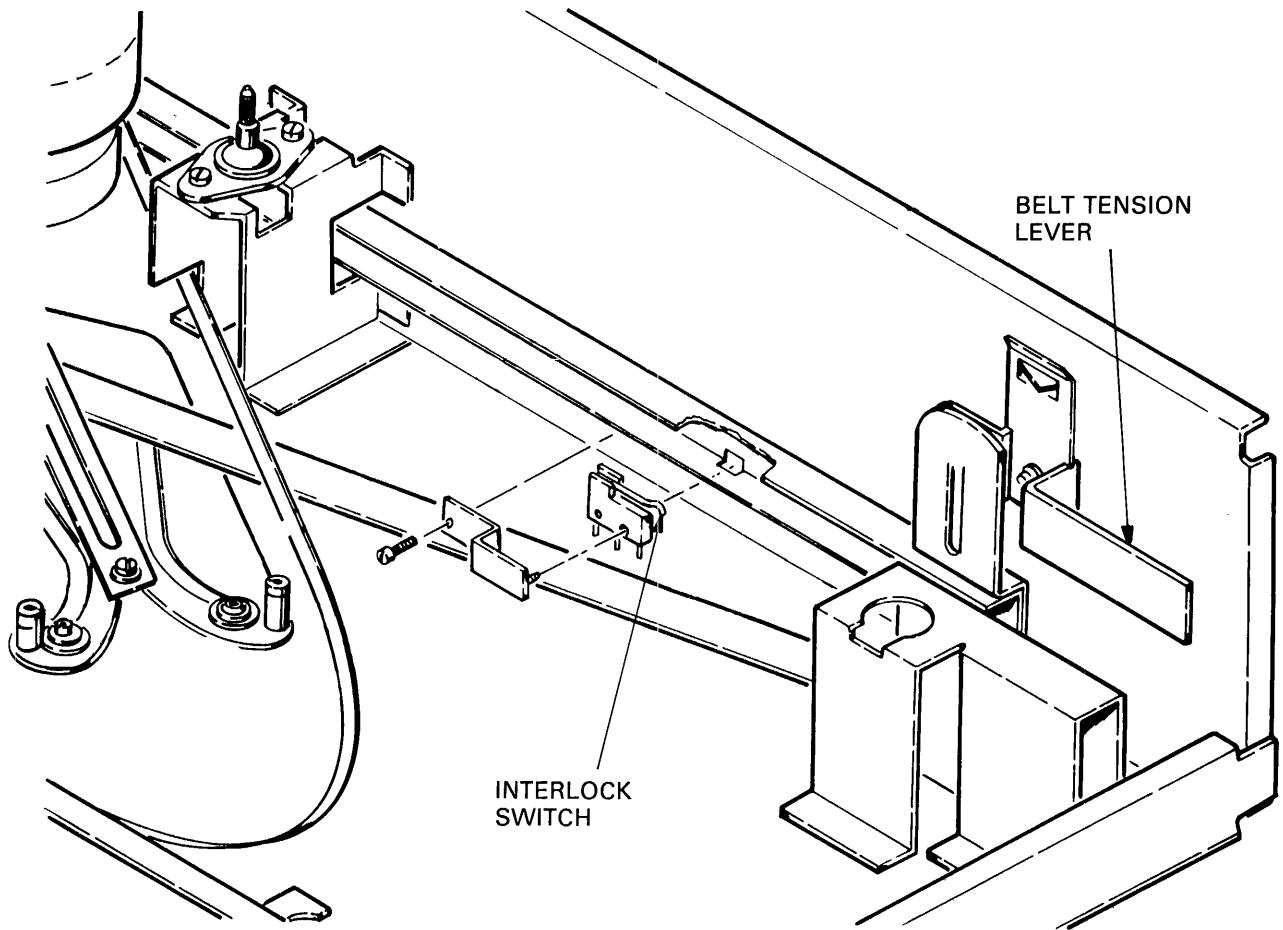
Figure 2-9 HDA Details

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Figure 2-10 Belt Tension Lever



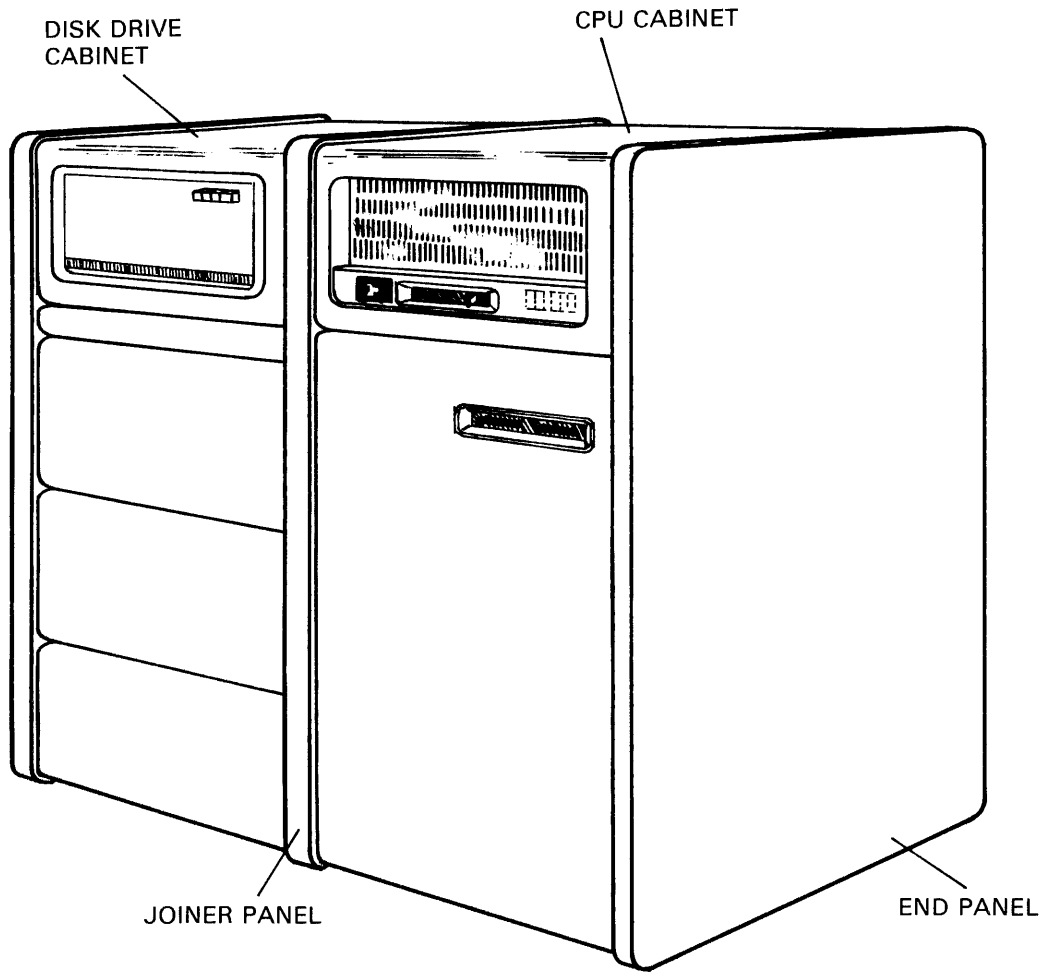
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Figure 2-11 Belt Tension Lever and Interlock Switch

2.3.1 Joining Cabinets

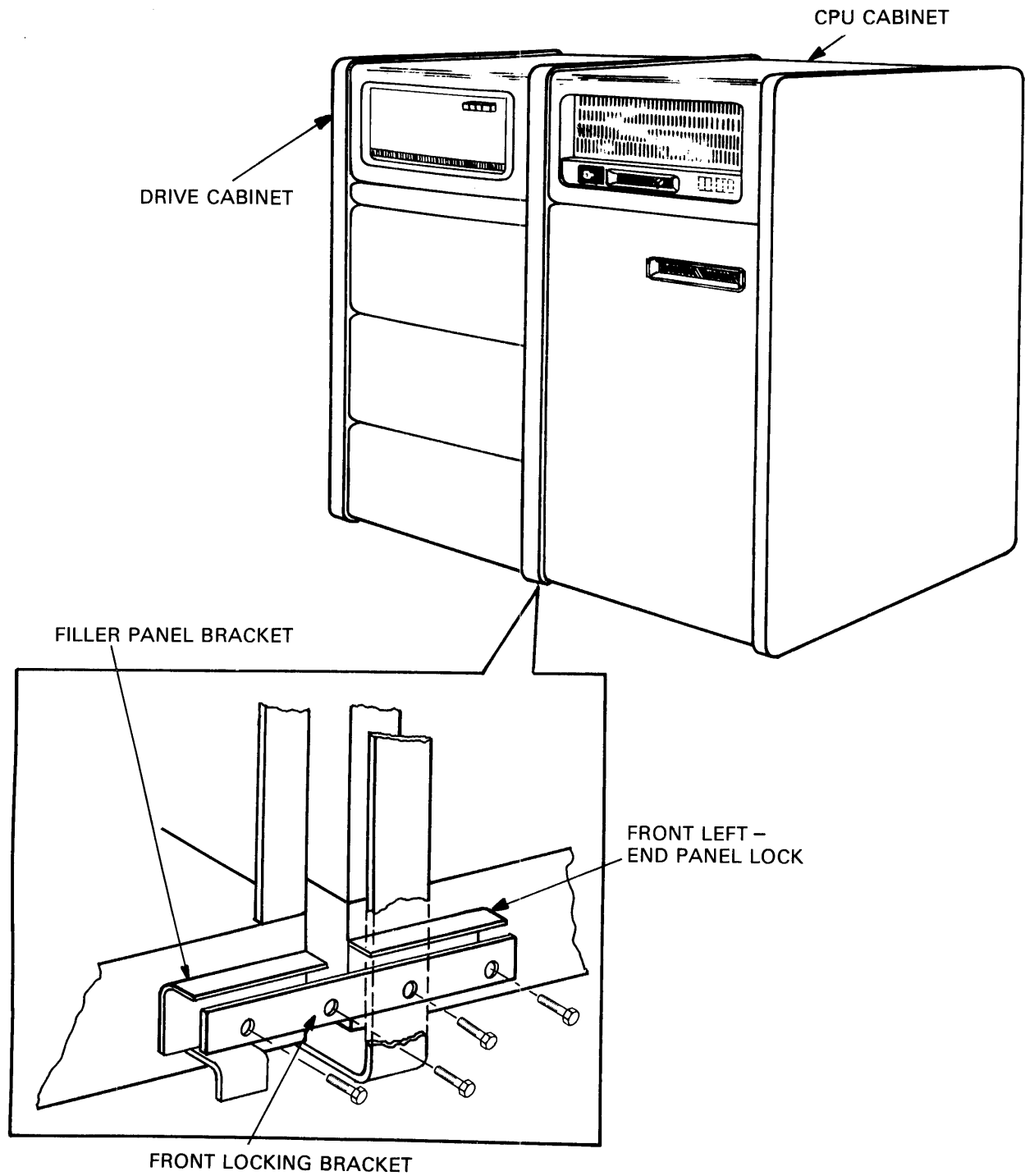
The RA80 Disk Drive cabinet comes with a joiner panel. The joiner panel permits the drive cabinet to be joined to any cross-product CPU cabinet as shown in Figure 2-12. Use the following procedure to join the CPU and drive cabinets.

1. Open the front door of the CPU cabinet. If the CPU cabinet does not have a front door, remove the lowest front filler panel to expose the end panel lock shown in Figure 2-13.



CZ-0522

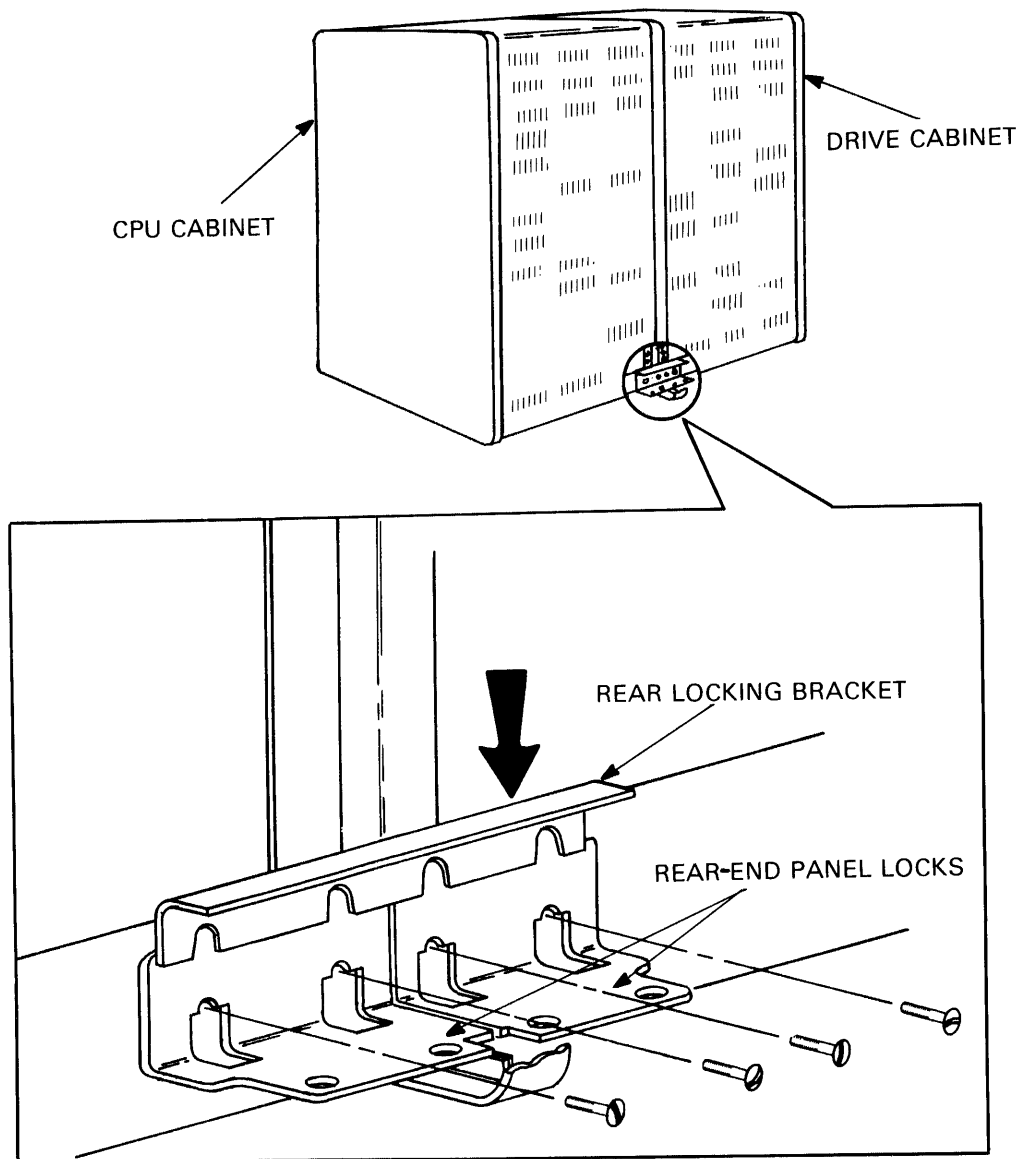
Figure 2-12 Joining Cross-Product Cabinets



CZ-0523

Figure 2-13 Removing Front-End Panel Lock

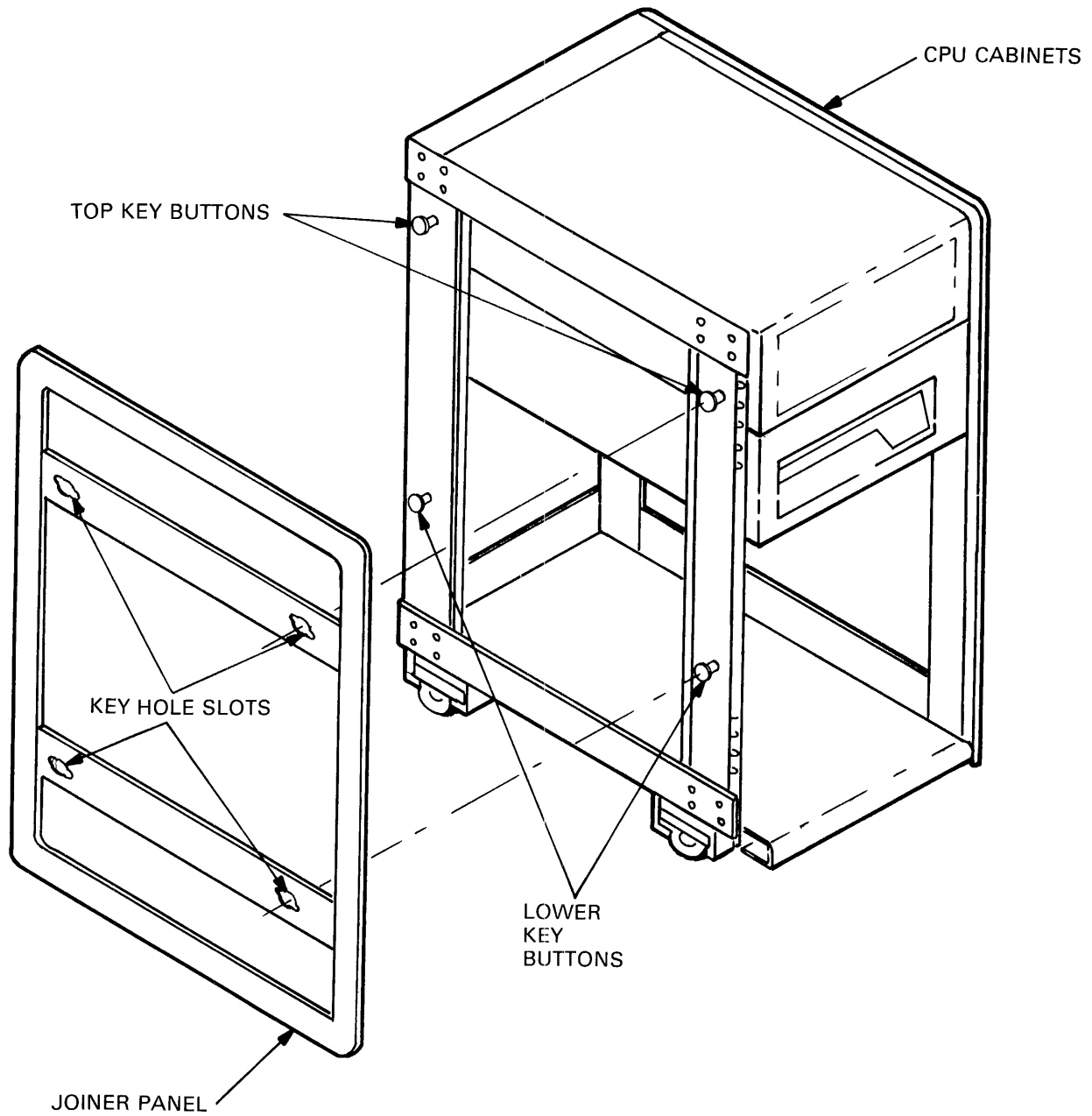
2. Remove the front left-end panel lock from the CPU cabinet.
3. Open the rear door of the CPU cabinet.
4. Loosen the screws that secure the right rear-end panel lock. Refer to Figure 2-14.
5. Remove the CPU cabinet end panel and its ground strap (if there is one).



CZ-0524

Figure 2-14 Removing Rear-End Panel Lock

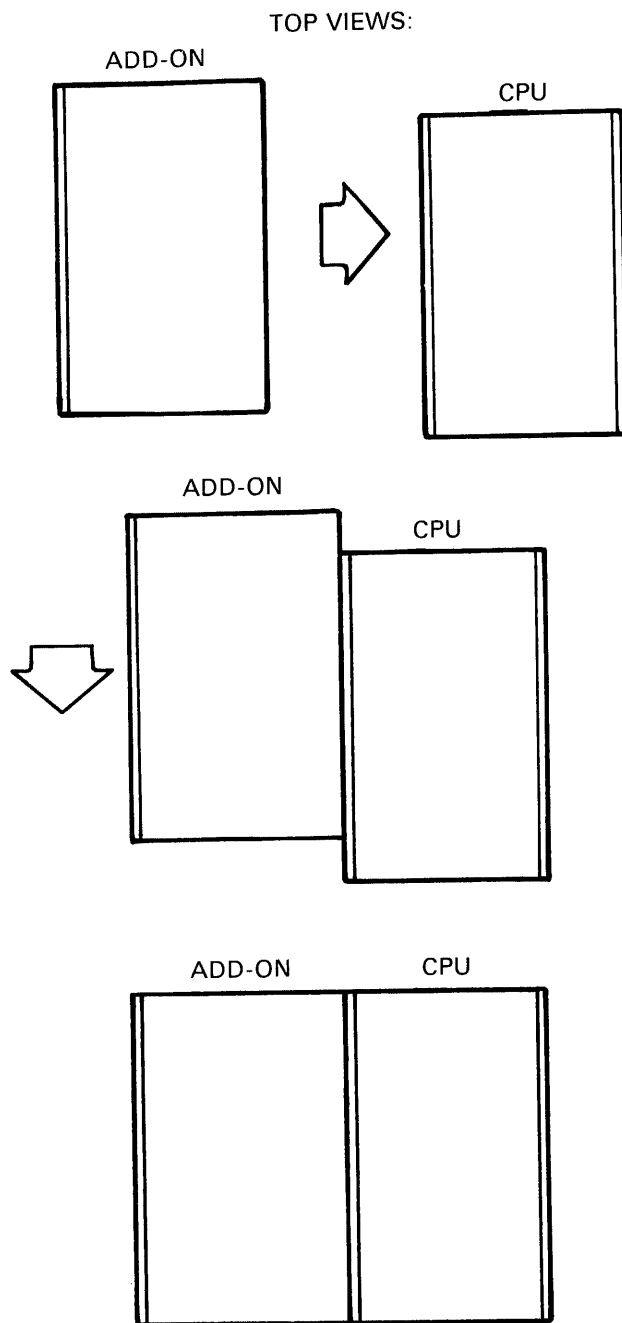
6. Remove the two lower key buttons from the left side of the CPU cabinet uprights. These buttons are removed by unscrewing the screws in their center. Refer to Figure 2-15.



CZ-0525

Figure 2-15 Removing Bottom Key Buttons

- Slide the two cabinets together and engage the top two key buttons on the CPU cabinet in the keyhole slots on the drive cabinet joiner panel. Adjust the cabinets until their fronts are flush. Refer to Figures 2-15 and 2-16.



CZ-0526

Figure 2-16 Joining the Cabinets

8. Remove the bottom front filler panel from the disk drive cabinet by removing the two screws at its base. Refer to Figure 2-17.
9. Remove the front right filler panel bracket from the disk drive cabinet.
10. Place the front locking bracket over the filler panel bracket and end panel lock as shown in Figure 2-13. Then bolt the two cabinets together with the existing hardware.
11. Open the rear door of the disk drive cabinet and loosen the screws that secure the rear left-end panel lock. Refer to Figure 2-14.
12. Slide the rear locking bracket over the end panel locks as shown in Figure 2-14. Then tighten the four screws.
13. Install the end panel that was removed from the left side of the CPU cabinet onto the left side of the drive cabinet. If an end panel is needed for drives in cross-product cabinets, order part number H9544-AA. Be sure to reattach any ground straps that might have been removed.

2.3.2 SI Cabling Procedure

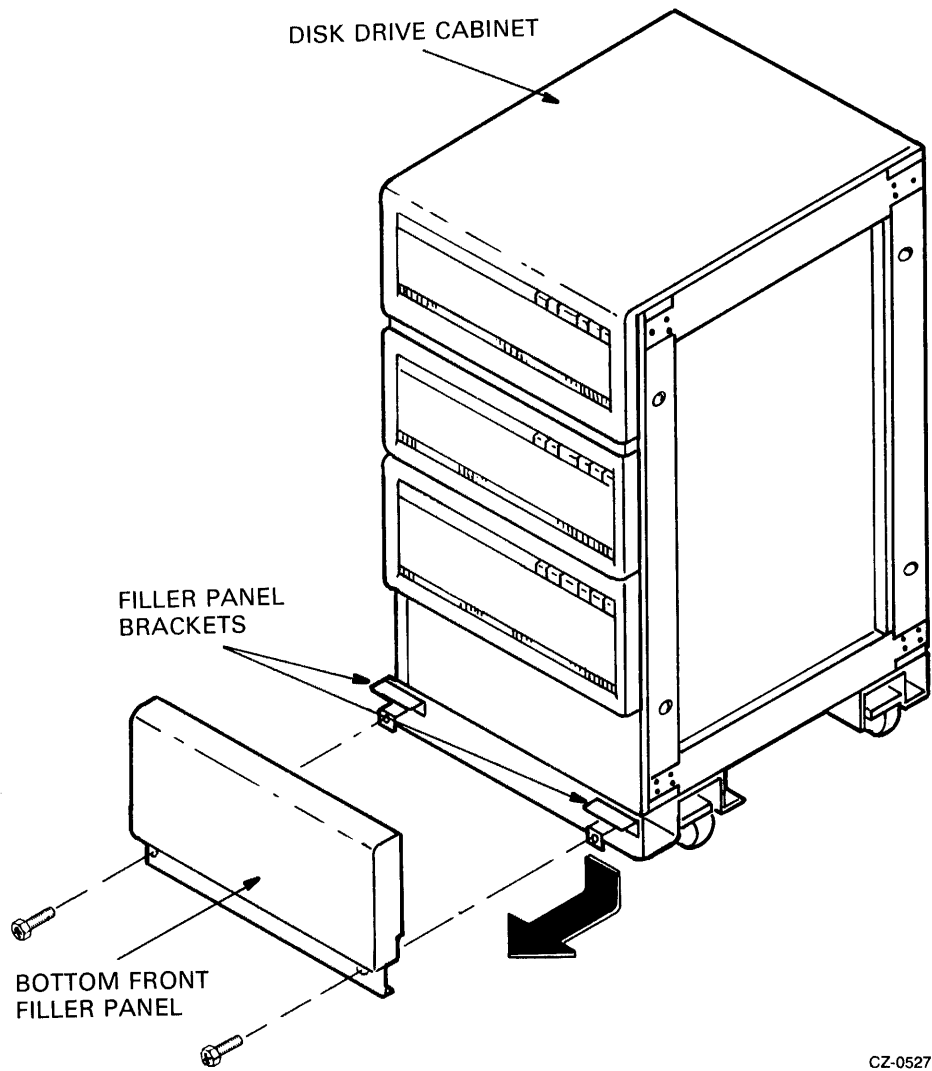
Both internal and external SI cables must be mounted in the I/O bulkhead assembly. The internal SI cables mount in the top of the I/O bulkhead while the external SI cables are mounted in the bottom of the I/O bulkhead.

2.3.2.1 Internal SI Cabling Procedure – The following procedure describes how to install the internal SI cables. Refer to Figures 2-18 and 2-19.

1. Plug the port A SI cable from the rear of the disk drive into the port A connector on the top of the I/O bulkhead. Note the orientation key.
2. Secure the port A SI cable shield terminator to the top of the I/O bulkhead with the mounting screws provided. SI cables may have captive mounting screws on their shield terminators in the future.
3. Plug the port B SI cable from the rear of the disk drive into the port B connector on the top of the I/O bulkhead. Note the orientation key.
4. Secure the port B SI cable shield terminator to the top of the I/O bulkhead with the mounting screws provided.

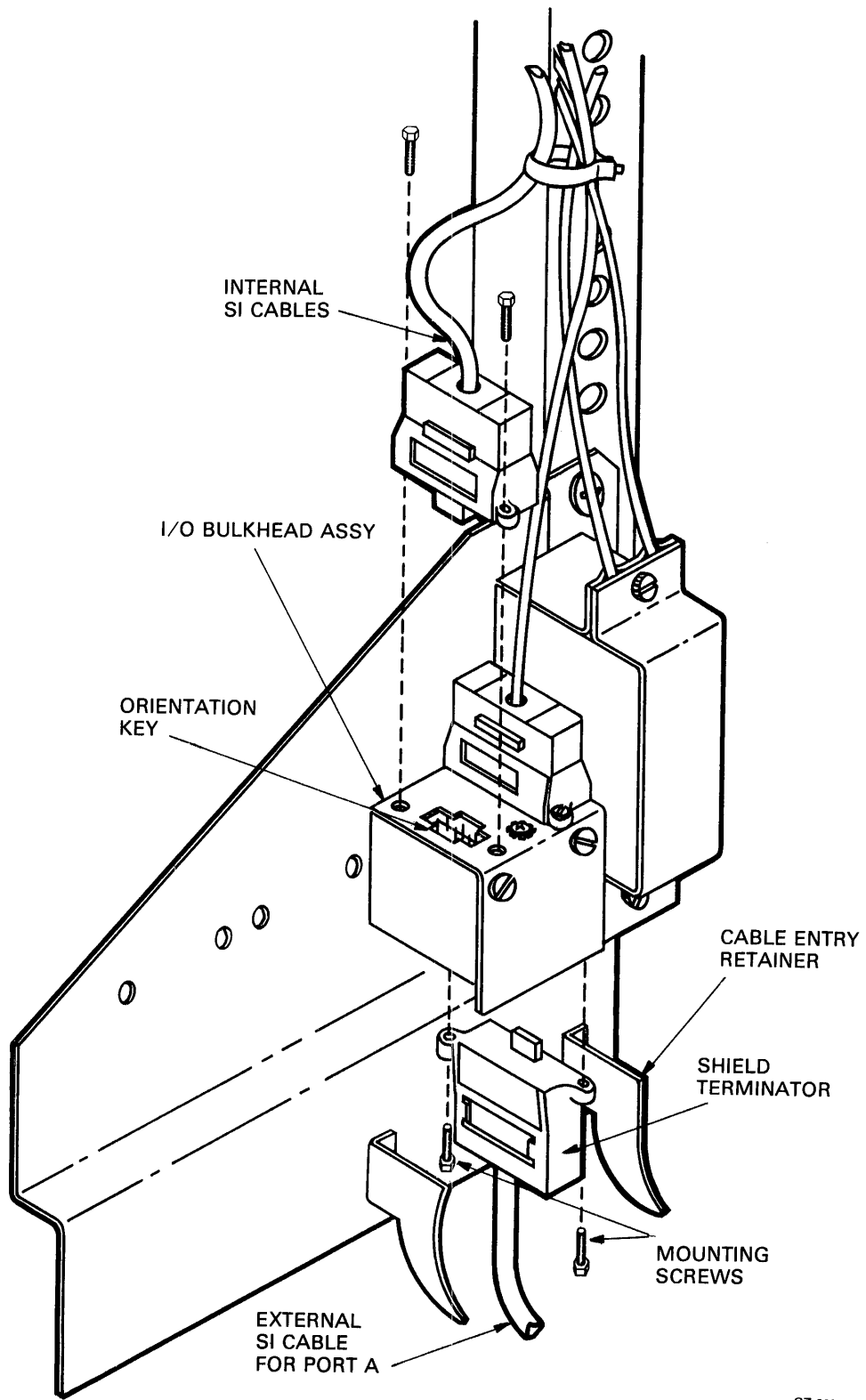
2.3.2.2 External SI Cabling Procedure – The external SI cables must be installed between the CPU cabinet, I/O bulkhead connector, and the drive cabinet I/O bulkhead connector. The CPU I/O bulkhead connector should already be installed. If this is not the case, refer to the disk controller user guide and follow the installation procedure. When the CPU cabinet I/O bulkhead connector has been installed, follow the instructions in the disk controller user guide to install the SI cables at the CPU cabinet end. The following procedure describes how to install the SI cables at the drive cabinet end.

1. Plug the external SI cable into port A of the SI bulkhead shown in Figure 2-18. External SI cables should enter from the bottom.
2. Install the two screws that hold the SI cable shield terminator in place and tighten them securely. Refer to Figure 2-18.



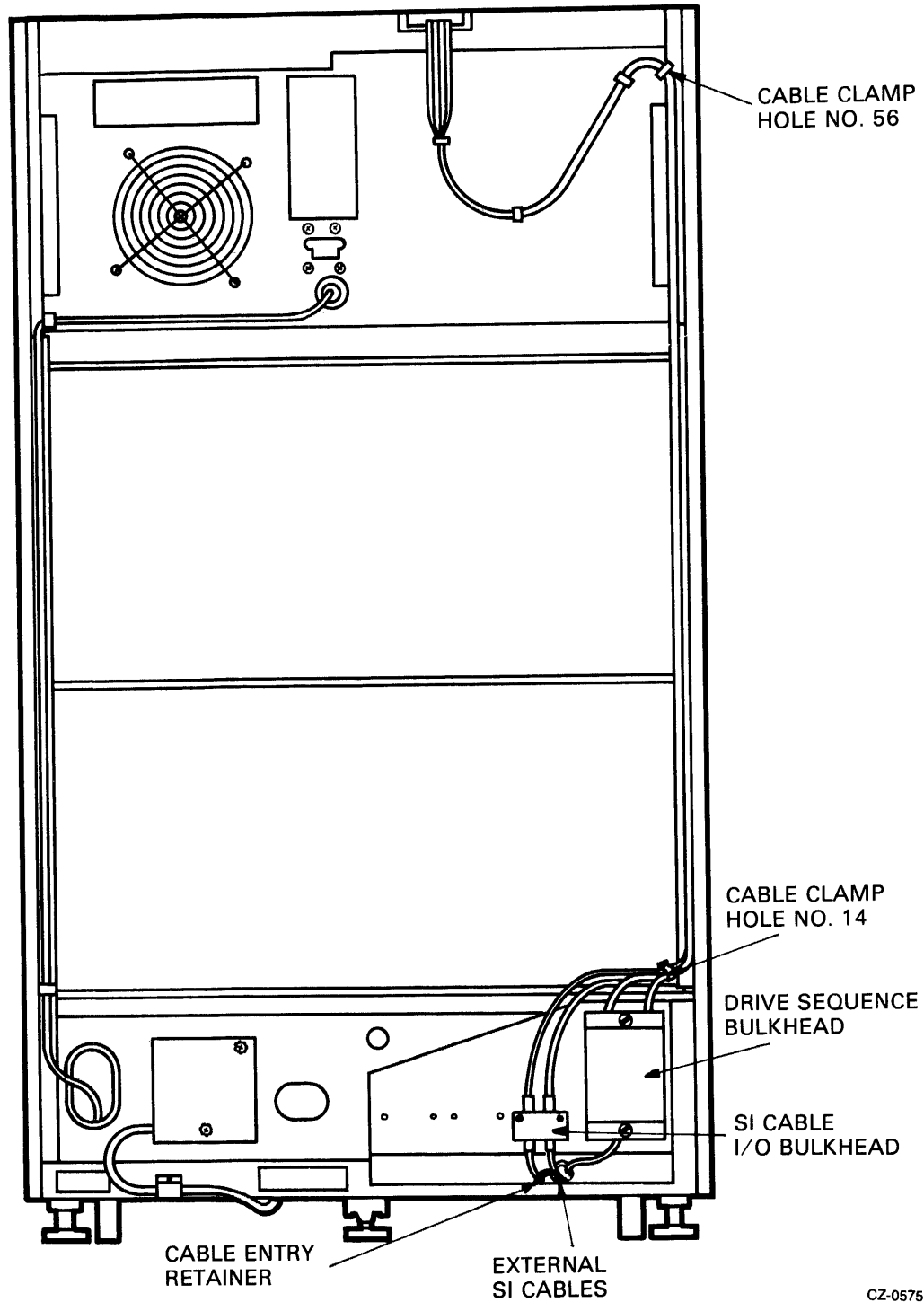
CZ-0527

Figure 2-17 Removing the Filler Panel Brackets



CZ-0574

Figure 2-18 SI Cable Shield Terminator Installation



CZ-0575

Figure 2-19 Single Drive External SI Cables

3. If more than one disk drive is in the cabinet, additional SI cables must be installed. Refer to the RA80 add-on installation procedure (paragraph 2.4) for instructions.
4. Clamp the external SI cables to the cable entry retainers below the I/O bulkheads with either a hose clamp or tie-wrap.

2.3.3 Programming the Drive Unit Address Plug

The READY switch cap on the operator control panel serves as the drive unit address plug. A drive unit number between 0 and 251 must be programmed into the unit address plug. To select a drive unit number, remove the READY switch cap and cut off the tabs that add up to the selected number. (Figure 2-20 shows the binary value of each tab.) For example, if address 7 is selected, tabs 1, 2, and 4 would be cut off. Leave all of the tabs on if the unit number 0 is desired. After the drive unit number has been selected, paste the chosen number gum label in the recessed rectangle on the READY switch cap.

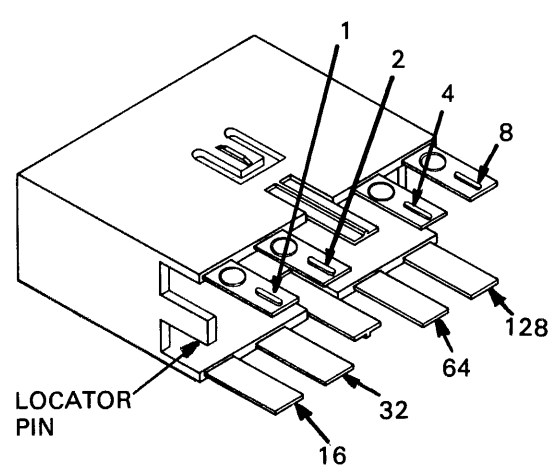
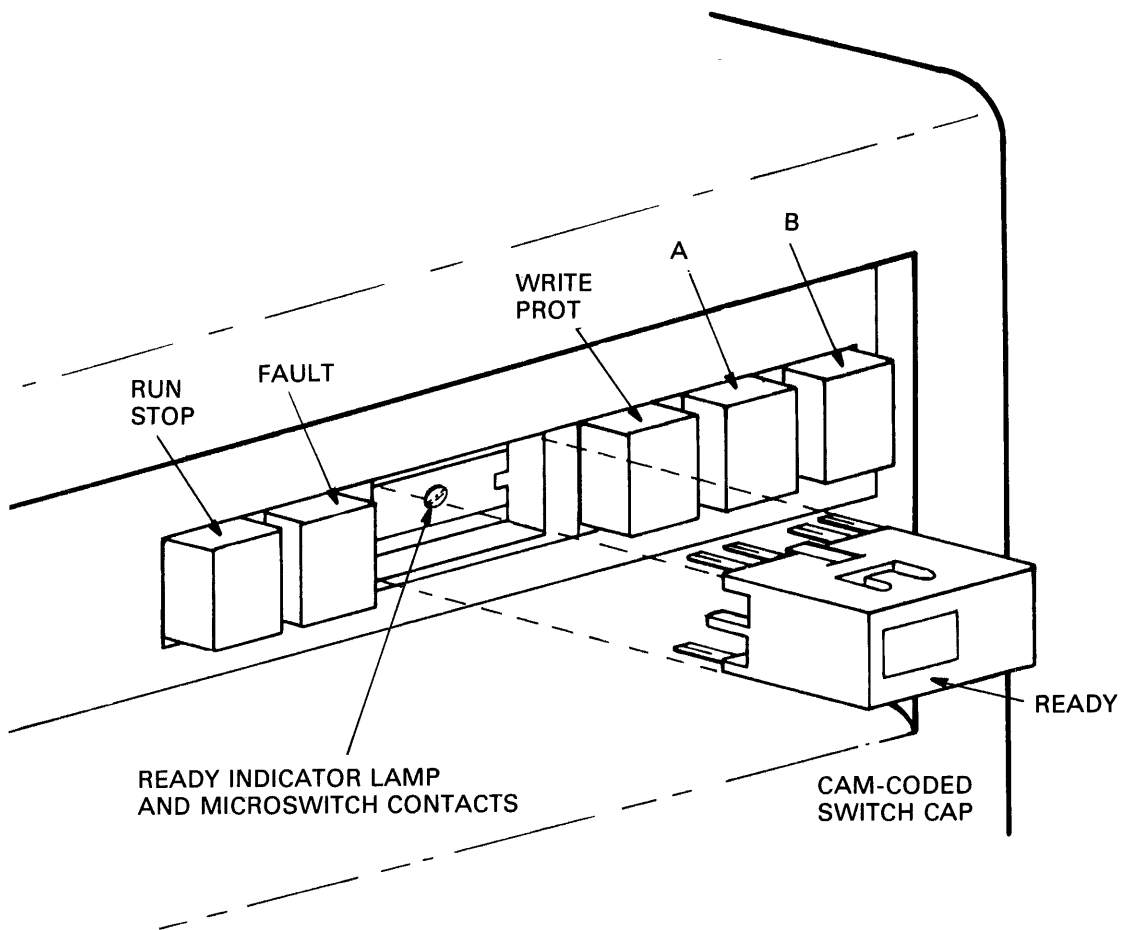
2.4 RA80 ADD-ON INSTALLATION

The RA80 disk subsystem comes with only one RA80 disk drive in its basic configuration. The maximum configuration allows up to four RA80 disk drives. Use the following installation procedures for RA80 add-ons. A checklist is provided here to check off each installation step accomplished.

- Remove the front filler panel (2.4.1) _____
- Install the chassis slide assembly (2.4.2) _____
- Mount the RA80 on the slides (2.4.3) _____
- Remove the internal shipping brackets and packing material (2.4.4) _____
- Program the drive unit address plug (2.4.5) _____
- Secure the electrostatic discharge bracket (2.4.6) _____
- Install the SI cables (2.4.7) _____
- Mount the I/O bulkhead (2.4.8) _____
- Install the drive sequence cables (2.4.9) _____
- Plug in the AC cord (2.4.10) _____
- Route and clamp the cables (2.4.11) _____

2.4.1 Remove the Front Filler Panel

The first add-on drive is placed in the middle bay of the RA80 cabinet. The second add-on drive goes in the bottom bay. Remove the filler panel for the correct location. The filler panel is removed by unscrewing the four 10-32 hex nuts that hold it to the cabinet frame. Access to these hex nuts is through the rear of the cabinet. Refer to Figure 2-21.



REAR PIN CONFIGURATION

CZ-0576

Figure 2-20 Drive Unit Address Plug

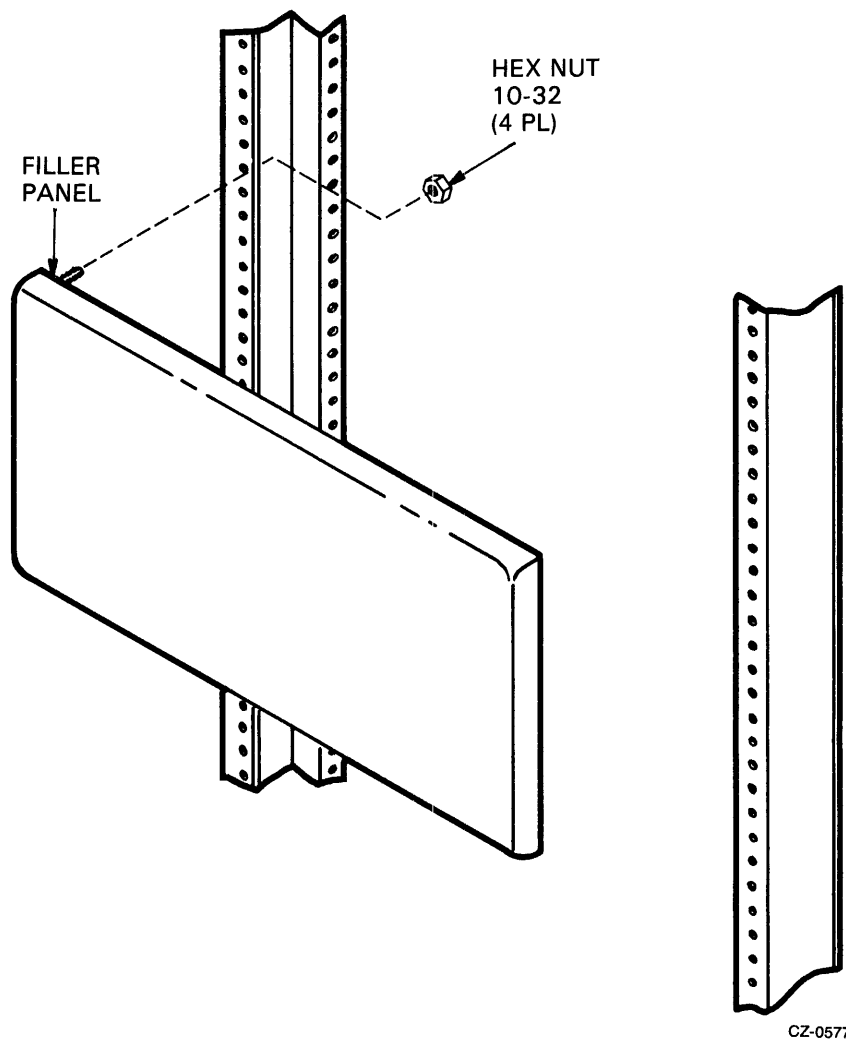
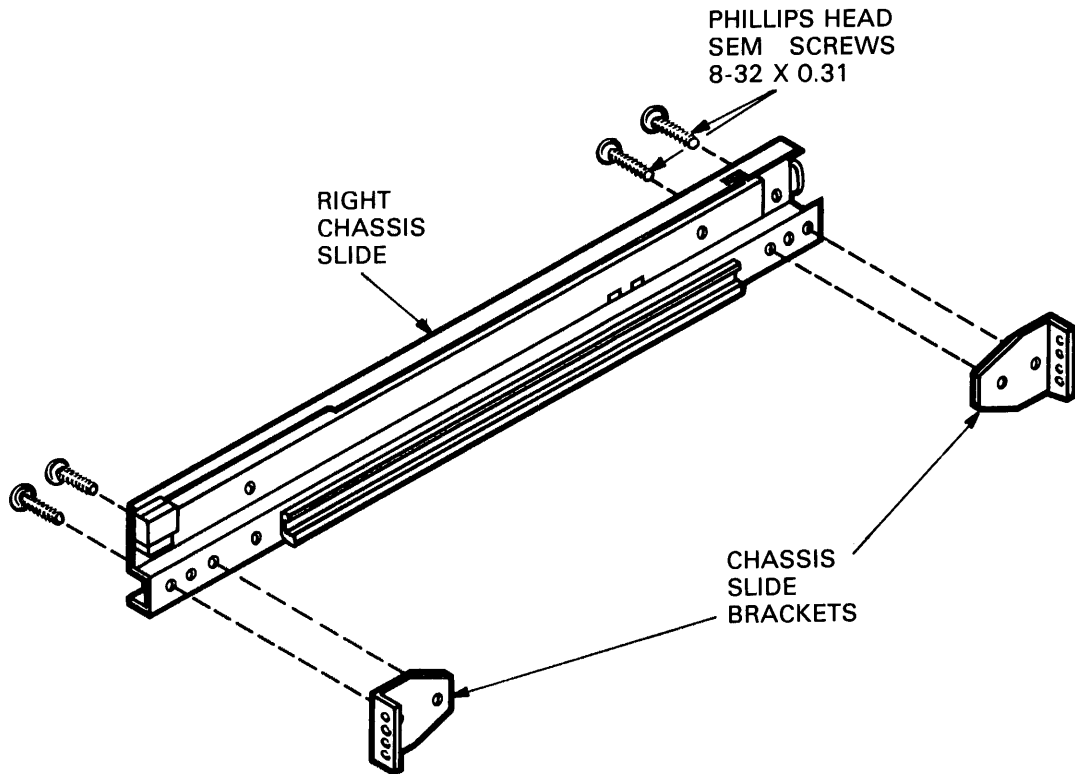


Figure 2-21 Removing Cabinet Filler Panels

2.4.2 Install the Slide Assembly

Each RA80 add-on disk drive has to be mounted into the drive cabinet on a slide assembly. Use the following procedure to install the slides into the drive cabinet.

1. Locate the left and right chassis slides and screw a chassis slide bracket onto each end. Two 8-32 \times 0.31 inch Phillips head sem screws are used to mount each chassis slide bracket. Refer to Figure 2-22. Sem are screws with star washers attached.



NOTE

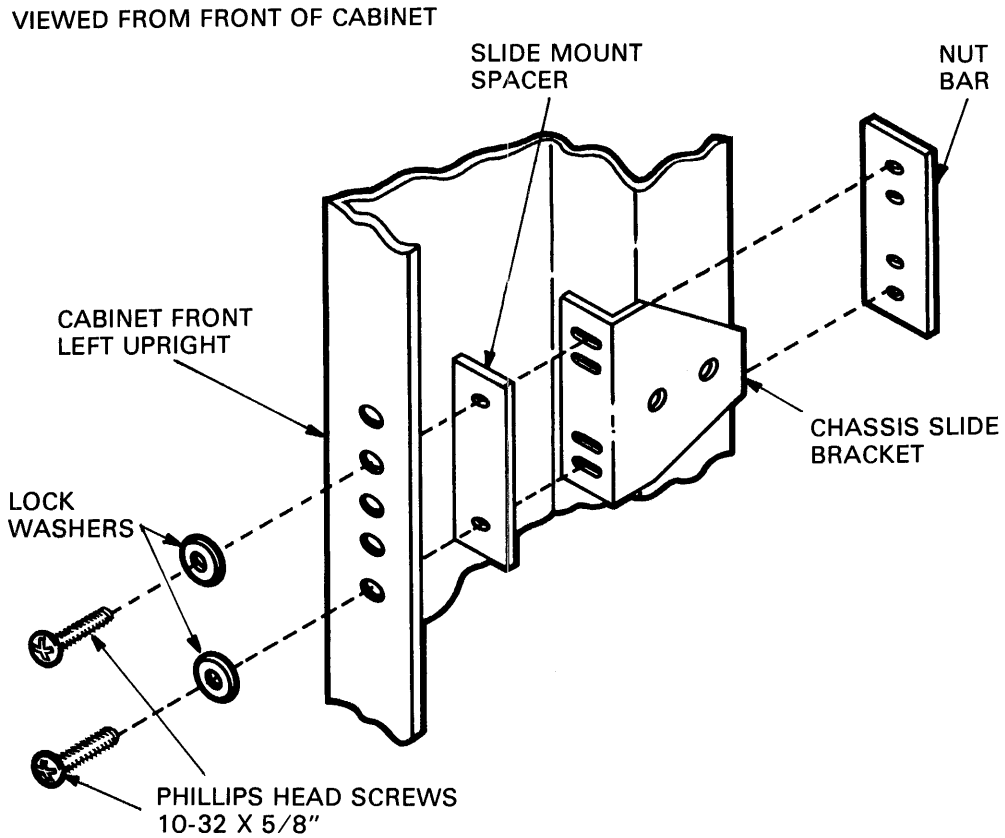
1. REPEAT FOR LEFT CHASSIS SLIDE.

CZ-0578

Figure 2-22 Chassis Slide Bracket Installation

2. Gather together the following hardware.
 - 4 Phillips head screws – 10-32 \times 5/8 inch
 - 4 lock washers – 0.380 inch O.D. \times 0.200 inch I.D.
 - 2 slide mount spacers (2 holes)
 - 4 Phillips head sem screws – 10-32 \times 1/2 inch
 - 4 nut bars (4 holes)

3. Mount the chassis slides to the front vertical upright as shown in Figure 2-23. If this is a first add-on drive (middle bay), use mounting holes 27 and 31, counting from the bottom. If this is a second add-on drive (bottom bay), use mounting holes 9 and 13, counting from the bottom. Notice that this installation to the front vertical upright requires both a slide mount spacer and a nut bar.

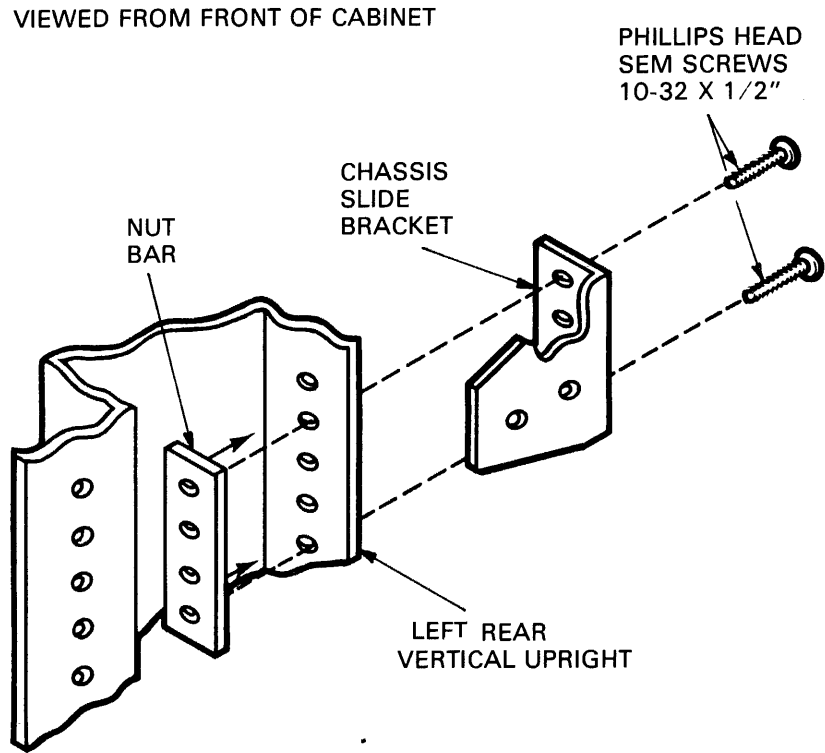


- NOTE
1. REPEAT FOR FRONT RIGHT UPRIGHT.

CZ-0579

Figure 2-23 Mounting Chassis Slide to Front Upright

4. Mount the chassis slides to the rear vertical uprights as shown in Figure 2-24. Note that only a nut bar is used here with sem screws. Use the same vertical upright mounting holes specified in Step 3.



NOTE

1. REPEAT FOR RIGHT REAR VERTICAL UPRIGHT.

CZ-0580

Figure 2-24 Mounting Chassis Slide to Rear Upright

5. Mount the electrostatic discharge bracket on the rear left vertical upright. It will mount over the chassis slide bracket. The two sem screws will pass through the two center holes of the chassis slide bracket and be held by the nut bar inside. Refer to Figure 2-25. If this is a first add-on drive (middle bay), use mounting holes 28 and 30. If this is a second add-on drive (bottom bay), use mounting holes 10 and 12.

VIEWED FROM REAR OF CABINET

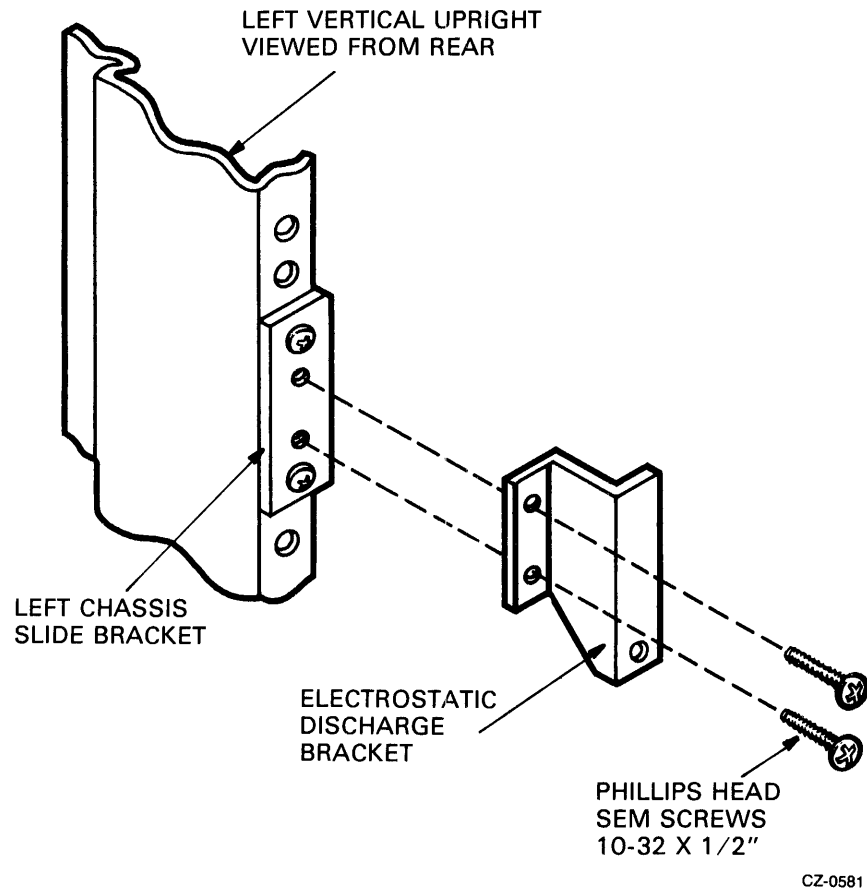
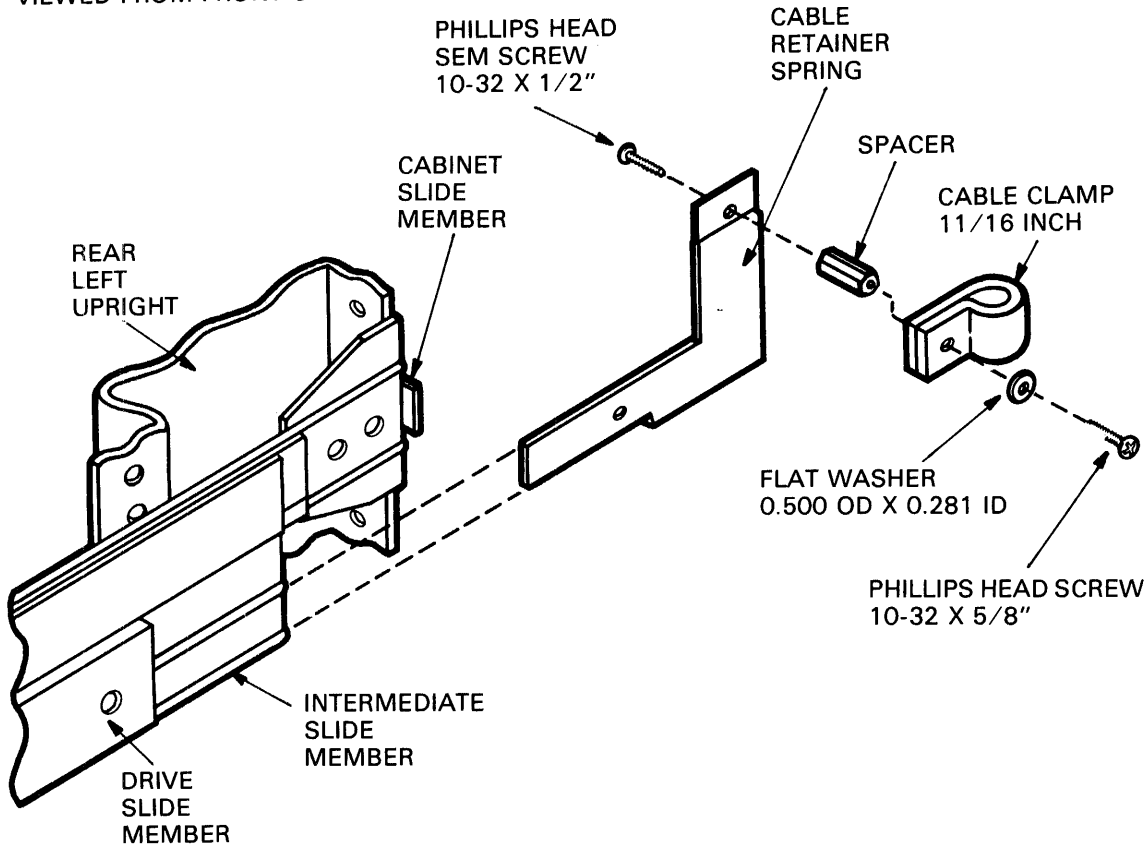


Figure 2-25 Mounting the Electrostatic Discharge Bracket

6. Insert the two cable retainer springs into the rear of the left and right chassis slides as shown in Figure 2-26. Push the cable retainer springs in until they latch into place and cannot be removed.
7. Mount an 11/16 inch cable clamp onto each cable retainer spring as shown in Figure 2-26. Each cable clamp should be mounted on the side of the cable retainer spring that is away from the outside of the cabinet.

VIEWED FROM FRONT OF CABINET



NOTE

1. REPEAT FOR CHASSIS SLIDE ON RIGHT SIDE.

CZ-0582

Figure 2-26 Installation of Cable Retainer Springs

8. Install the drive detent latch onto the left side vertical upright (when viewed from the rear of the cabinet as shown in Figure 2-27). Tighten the screws just enough so that the drive detent latch will not move freely, but can be later adjusted when the drive is pushed in. If this is a first add-on drive (middle bay), use mounting holes 36 and 37. If this is a second add-on drive (bottom bay), use mounting holes 18 and 19.

VIEWED FROM FRONT OF CABINET

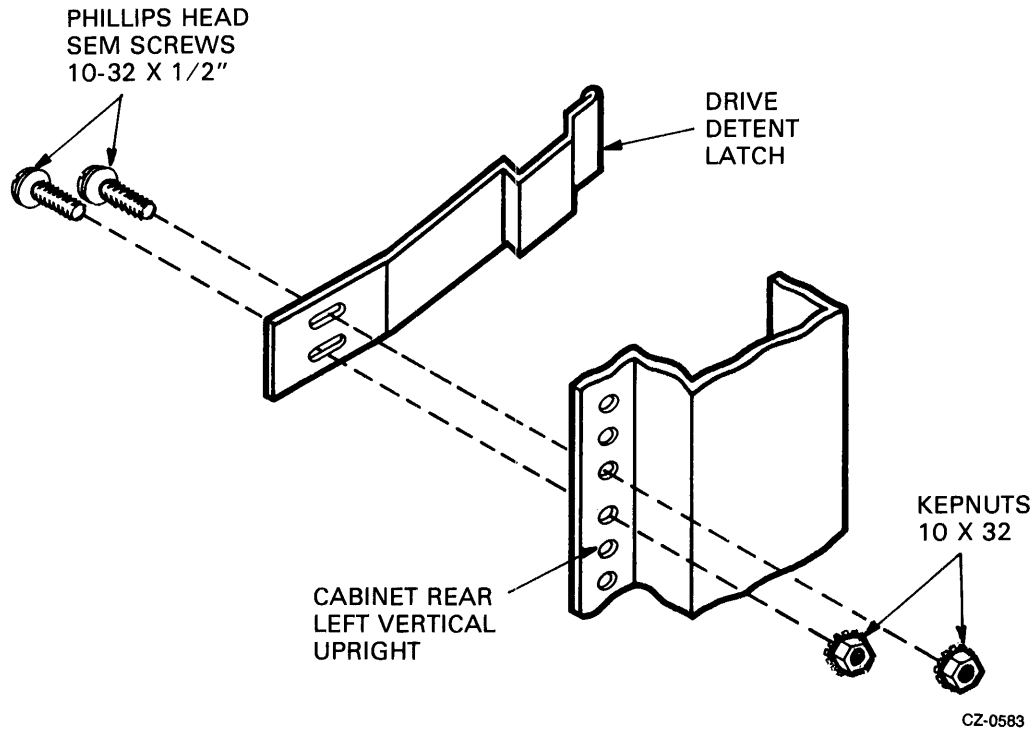


Figure 2-27 Installation of Drive Detent Latch

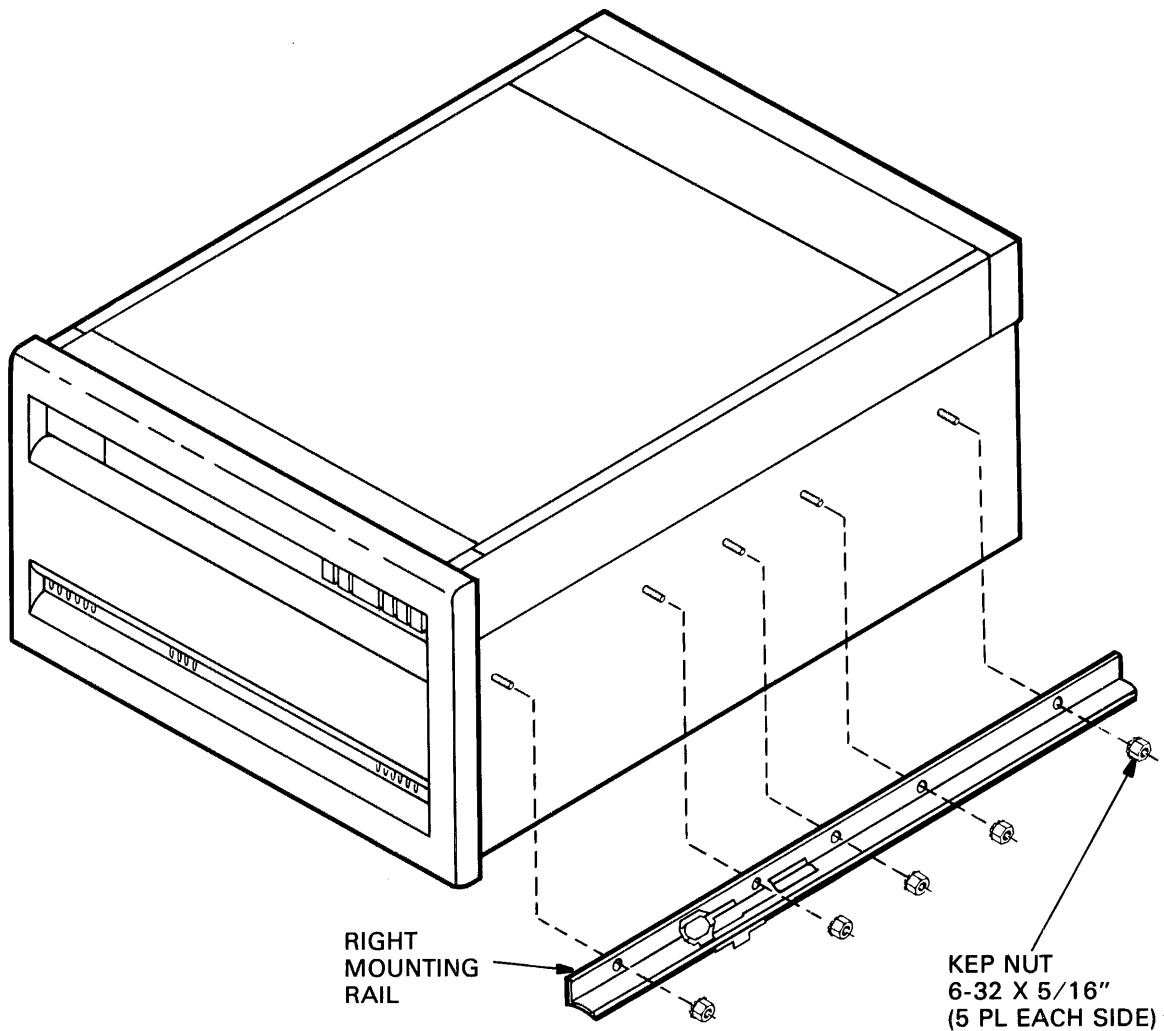
2.4.3 Mount the RA80 on the Slides

Use the following procedure to mount the drive on its slides.

WARNING

Mounting the RA80 Disk Drive onto the slides is a two-person operation because of its weight.

1. Install the left and right mounting rails onto the sides of the disk drive as shown in Figure 2-28. Ten 6-32 keps are required.



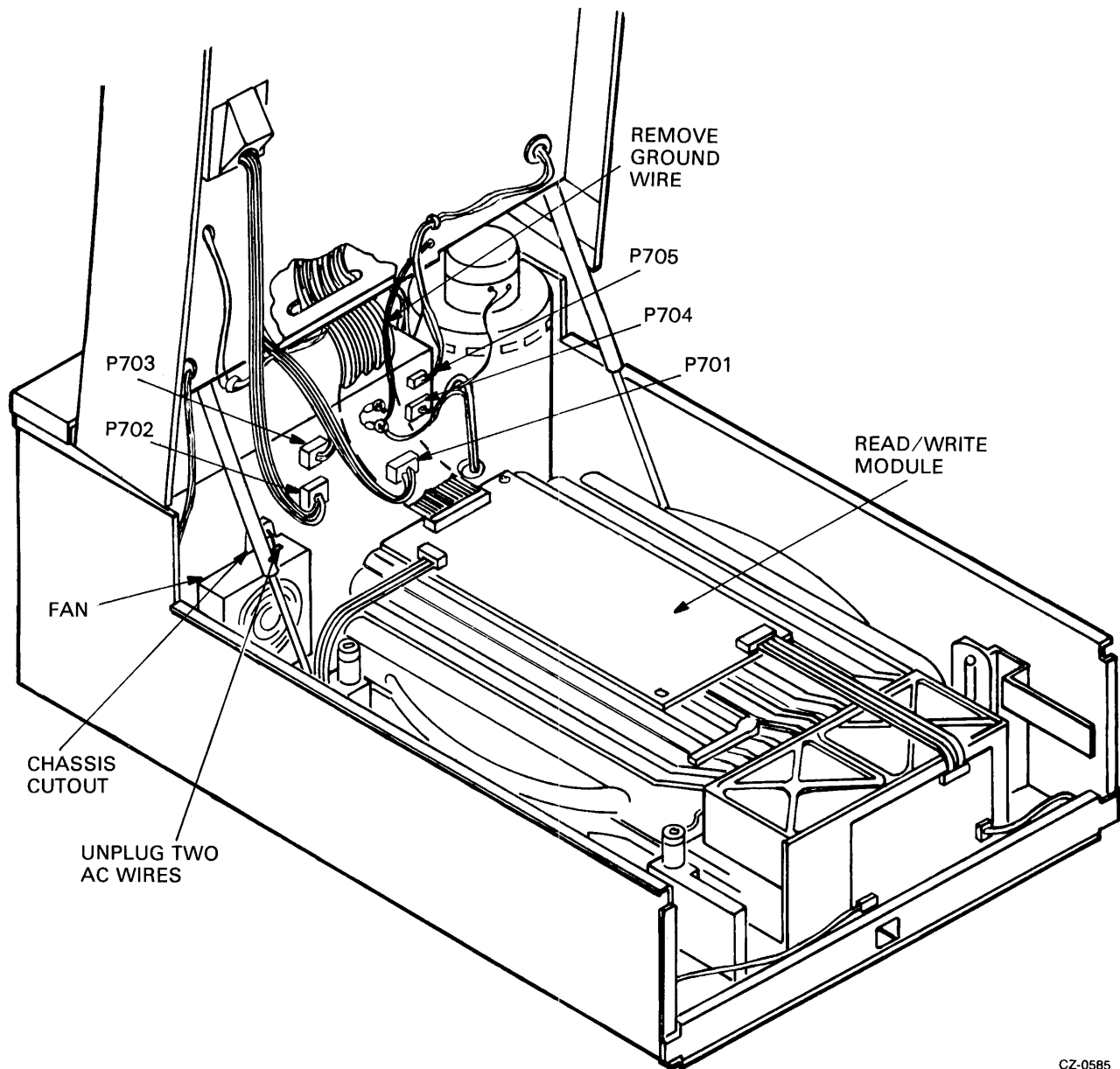
NOTES

1. REPEAT FOR LEFT MOUNTING RAIL.

CZ-0584

Figure 2-28 Installation of Drive Mounting Rails

2. Remove the drive power supply using the following procedure.
 - a. Raise the drive logic chassis. Refer to Figure 2-8.
 - b. Unplug P701, P702, P703, P704, and P705 from the drive power supply. Refer to Figure 2-29.
 - c. Remove the ground wire from the top ground terminal on the front of the power supply. Refer to Figure 2-29.



CZ-0585

Figure 2-29 Removal of Power Supply Connections

- d. Remove the six hex-head slotted screws and washers that hold the power supply in place. Set the hardware aside for re-installation. Refer to Figure 2-30.
 - e. Pull the power supply out of the rear of the drive while guiding the molded plug through the chassis cutout.
3. Extend the stabilizer foot forward, as shown in Figure 2-31.

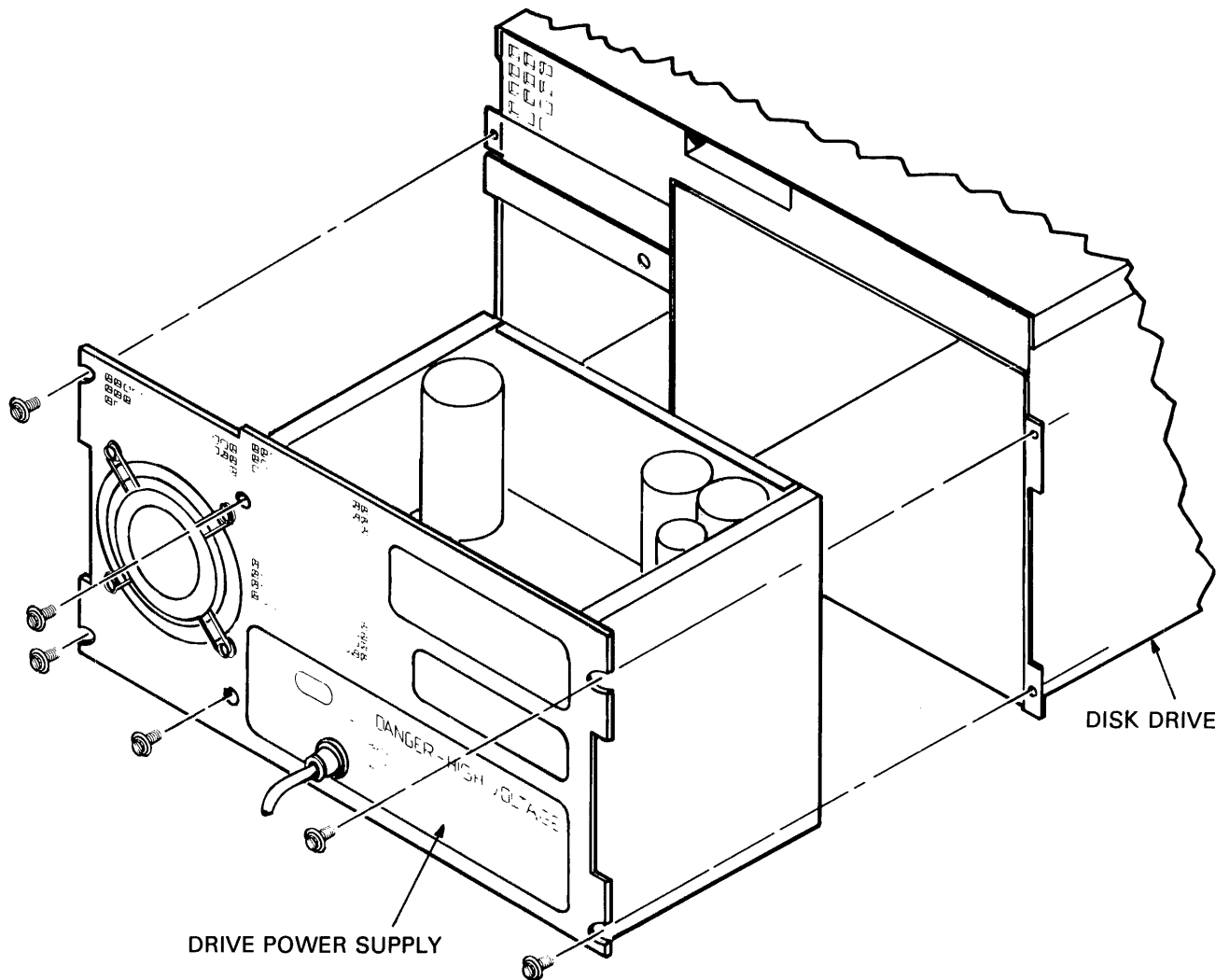
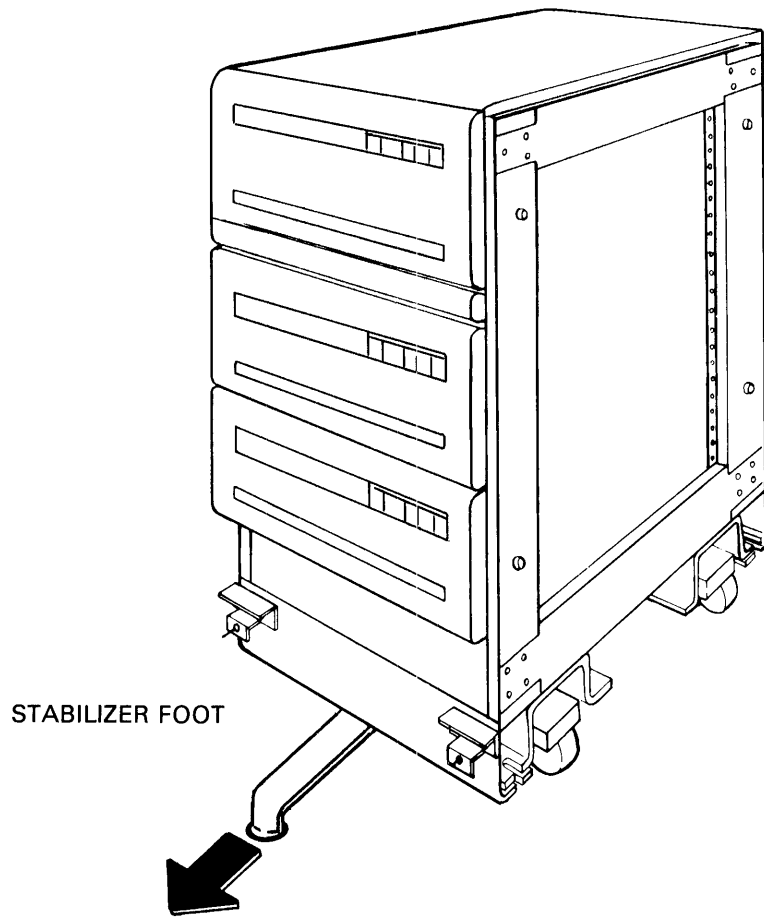


Figure 2-30 Removal of Drive Power Supply

CZ-0087



CZ-0608

Figure 2-31 Extending Cabinet Stabilizer Foot

4. Extend each chassis slide all the way forward until it locks, as shown in Figure 2-32.
5. Pick up the drive (using two persons) and place it on top of the chassis slides, as shown in Figure 2-32. Push the drive towards the rear of the slides until its mounting rails hit the stop.
6. Secure the drive to the chassis slides using four 8-32 \times 0.31 inch Phillips head sem screws, as shown in Figure 2-32.
7. Push the drive into the cabinet by releasing lock arms B and then lock arms A, as shown in Figure 2-32.
8. Re-install the power supply in the drive through the rear. Slide the drive forward again to reconnect the internal power supply connectors and the ground wire.
9. Adjust the drive detent latch so that it prevents the drive from sliding forward and then tighten the drive detent latch screws.

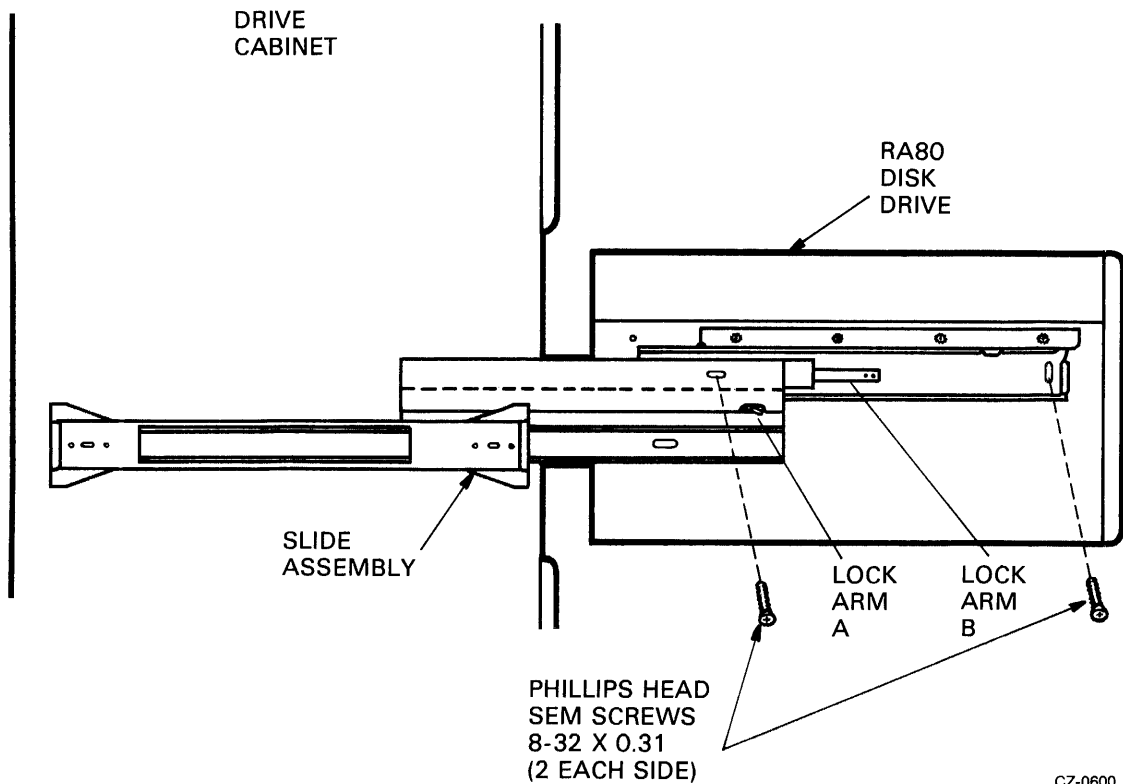


Figure 2-32 Extending the Chassis Slides

2.4.4 Remove the Internal Shipping Brackets and Packing Material

Remove the internal shipping brackets and packing material from inside the drive using the procedure already described in Paragraph 2.2.3.

2.4.5 Program the Drive Unit Address Plug

Program the drive unit address plug according to the instructions already provided in Paragraph 2.3.3.

2.4.6 Secure the Electrostatic Discharge Bracket

The electrostatic discharge bracket is intended to ground the disk drive to the cabinet whenever the drive is operating. To complete this ground path, the bottom left drive power supply screw should be removed and screwed back in through the electrostatic discharge bracket as shown in Figure 2-33. This ground connection must always be made whenever the drive is operating.

To slide the drive forward, remove the power supply, screw in the electrostatic discharge bracket, and push on the drive detent latch. Remember to reconnect the electrostatic discharge bracket each time the drive is pushed back in the cabinet.

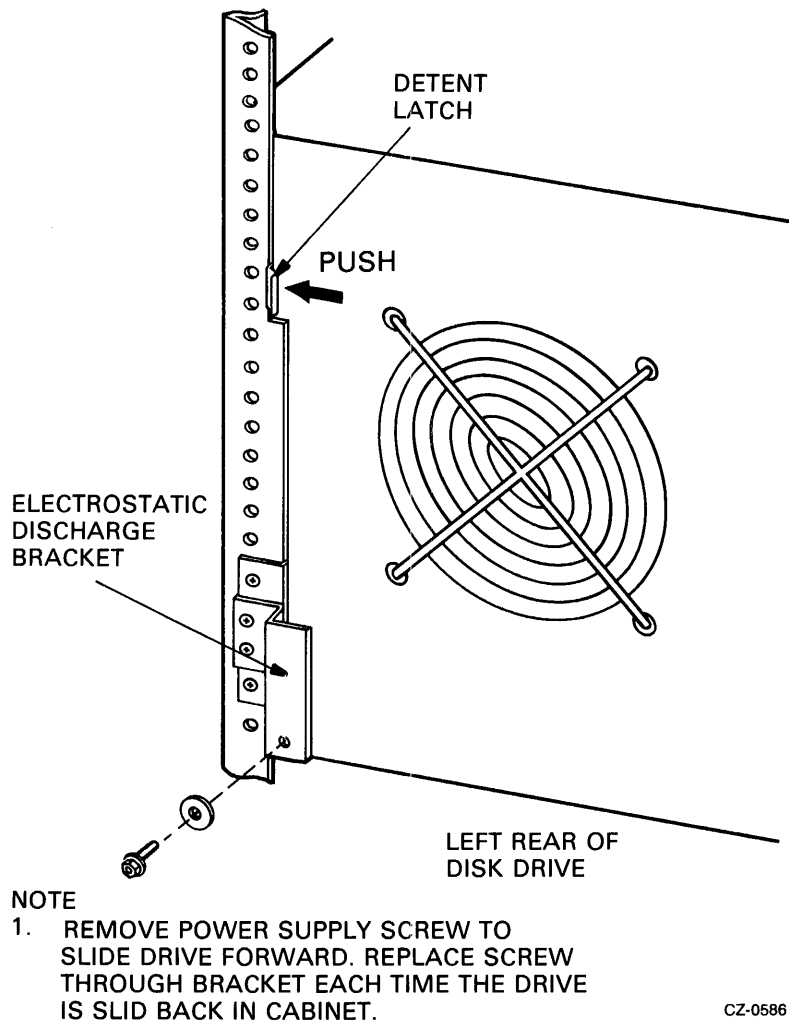
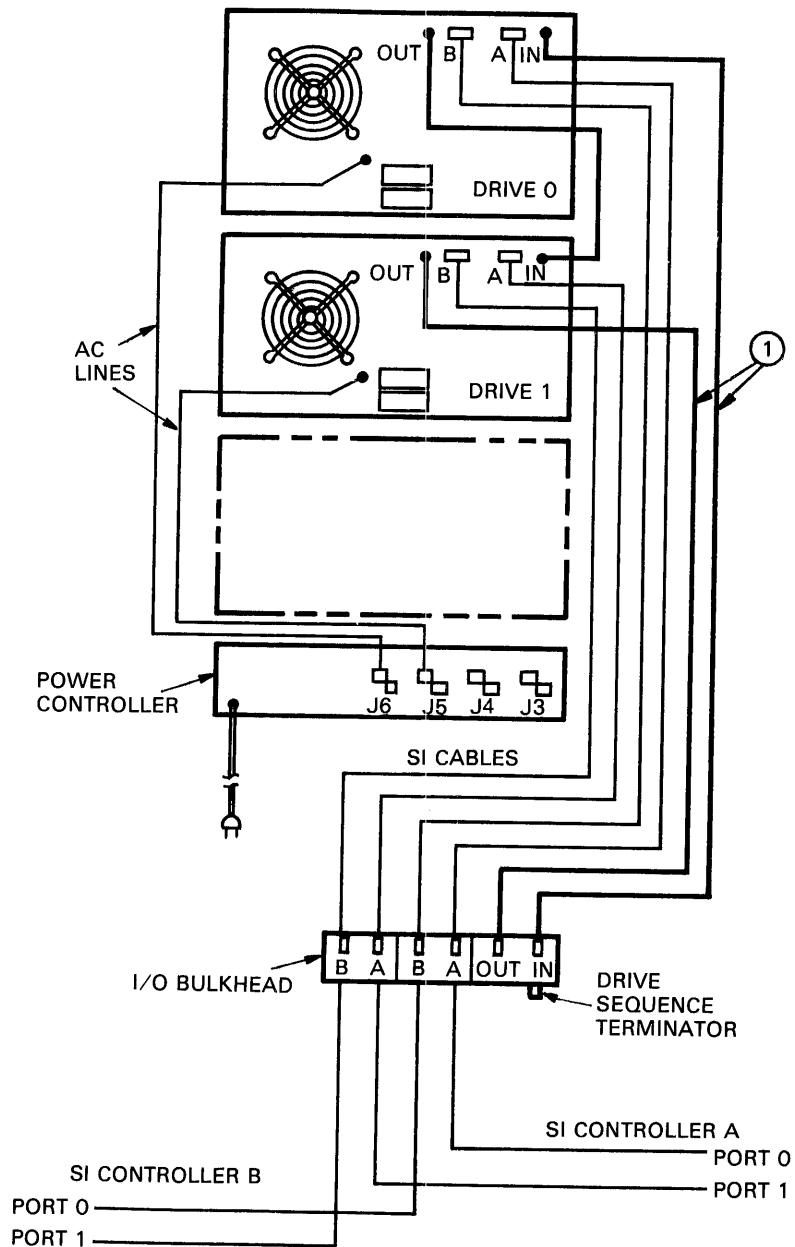


Figure 2-33 Securing the Electrostatic Discharge Bracket

2.4.7 Install the SI Cables

The two internal SI cables that exit from the rear of the add-on drive must be connected to the top of the I/O bulkhead assembly. The external SI cable that connects the drive cabinet to the disk controller must be mounted on the bottom of the I/O bulkhead assembly. If two disk controllers are used for dual-port operation, a second external SI cable must be installed. The SI cables are connected to the I/O bulkhead before its installation onto the drive cabinet. Field Service engineers can hold the I/O bulkhead in their hands and install the SI cables with more ease. Figures 2-34 and 2-35 show the electrical wiring diagrams for add-on disk drives. Use the following procedure to install the SI cables.

1. Locate the port A SI cable where it exits the rear of the disk drive. Follow the cable down to its end and plug the connector into port A on top of the I/O bulkhead assembly. Note the orientation key.
2. Screw the port A SI cable shield terminator into the I/O bulkhead assembly. Early versions of the disk drive will need separate screws to mount the shield terminator. Future versions will have captive hardware so the screws will not be lost. Refer to Figure 2-36.
3. Repeat Steps 1 and 2 for the port B SI cable.
4. Plug the SI cable from the first disk controller into the port A connector on the bottom of the I/O bulkhead assembly. Note the orientation key.
5. Screw the shield terminator of this cable into the I/O bulkhead assembly as in Step 2.
6. If a second disk controller is used, mount its SI cable into port B on the I/O bulkhead assembly.



- NOTES
 1. HEAVY LINE INDICATES THE DRIVE SEQUENCE CABLE.

CZ-0587

Figure 2-34 Cabling for the Two-Drive System

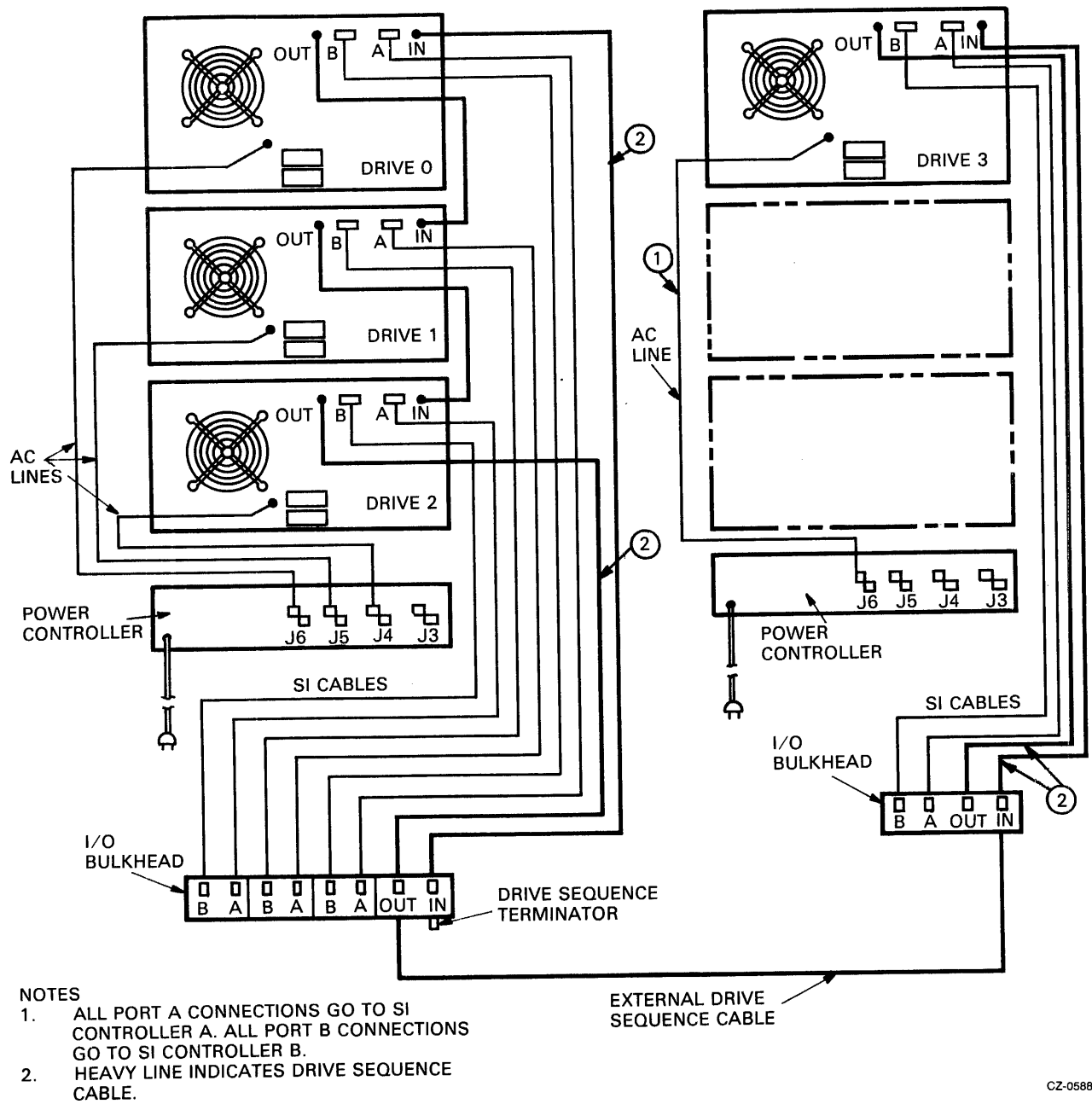
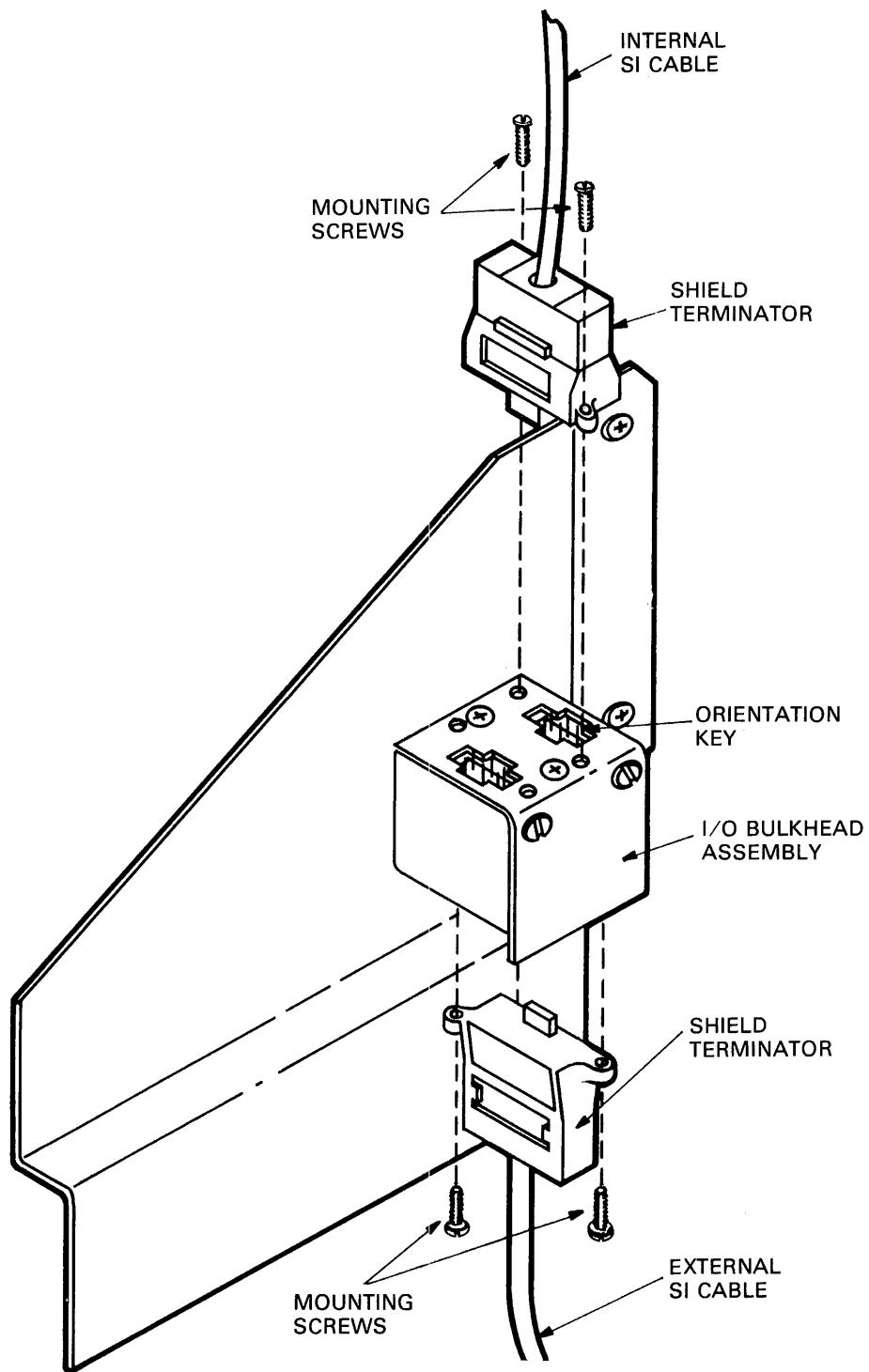


Figure 2-35 Cabling for the Three- and Four-Drive System



NOTES

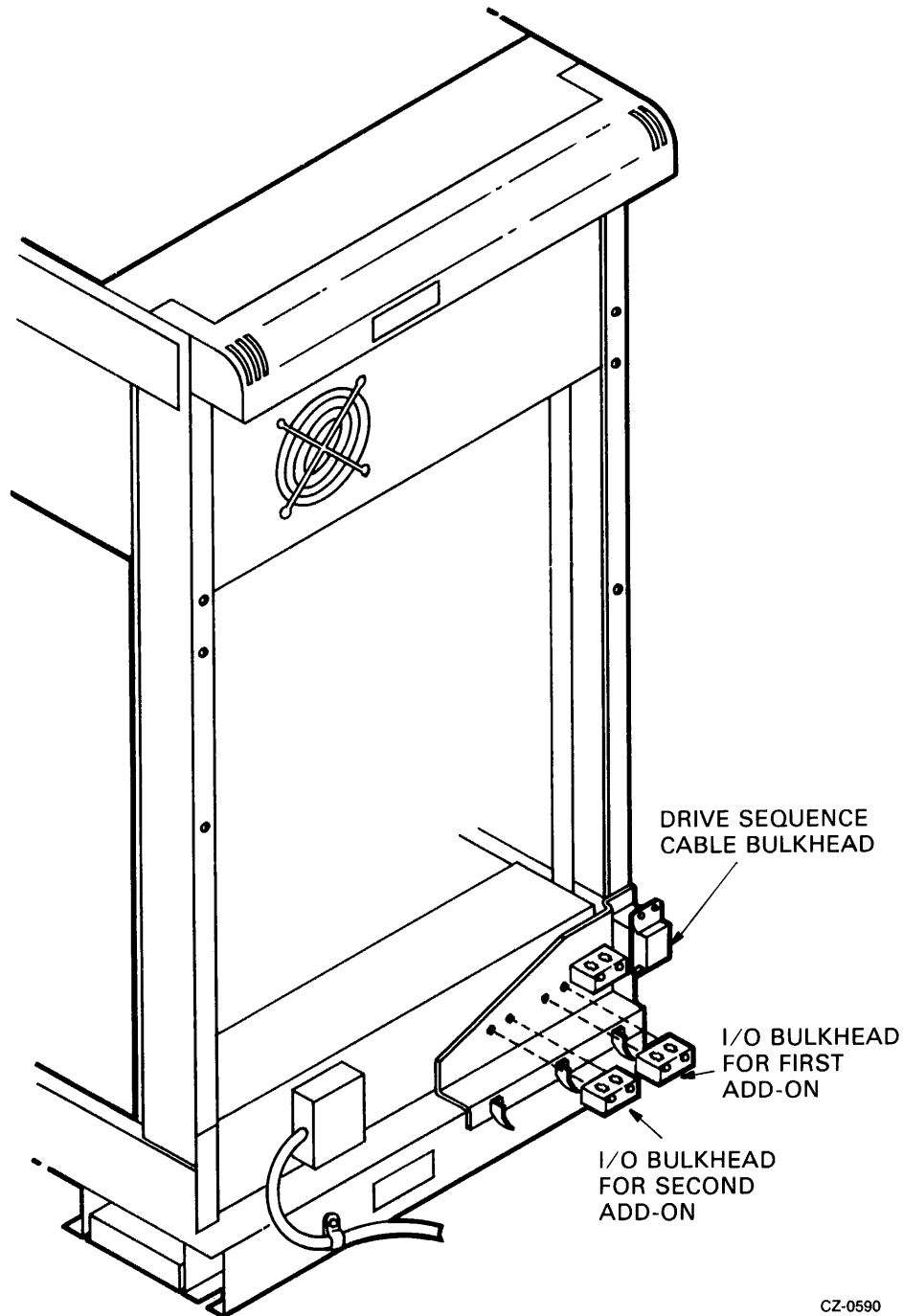
1. LATER VERSIONS OF SHIELD TERMINATORS WILL HAVE CAPTIVE MOUNTING SCREWS.

CZ-0589

Figure 2-36 Mounting SI Cable Shield Terminators

2.4.8 Mount the I/O Bulkhead

The I/O bulkhead assembly must be installed on the rear base of the drive cabinet for each add-on disk drive. Screw the I/O bulkhead assembly onto the rear of the cabinet as shown in Figure 2-37. For the first add-on drive, mount the I/O bulkhead assembly in the drive 1 location. For a second add-on drive, mount the I/O bulkhead assembly in the drive 2 location.



CZ-0590

Figure 2-37 Mounting the I/O Bulkhead Assembly

2.4.9 Install the Drive Sequence Cables

Figures 2-34 and 2-35 show the electrical wiring diagrams for add-on disk drives and should be used as a reference when installing drive sequence cables. Use the following procedures to install these cables.

1. Unplug the drive sequence cable from the output connector on drive 0 (top drive). This is accomplished by raising the rear cover and removing the drive sequence cable from its cable clamp. Refer to Figure 2-38.
2. Plug the drive sequence cable, which was removed from the output connector of drive 0, into the output connector on drive 1 (for one add-on), or into the output connector of drive 2 (for two add-ons).
3. Install the new 8 foot drive sequence cable between the output connector of drive 0 and the input connector on drive 1. If a second add-on drive is installed, install another 8 foot drive sequence cable between the output connector of drive 1 and the input connector of drive 2.
4. Tie-wrap the drive sequence cable to the existing SI cable clamps.
5. Add a drive sequence cable between the drive sequence bulkheads on each drive cabinet whenever a second cabinet is used. Refer to Figure 2-35 and 2-38.

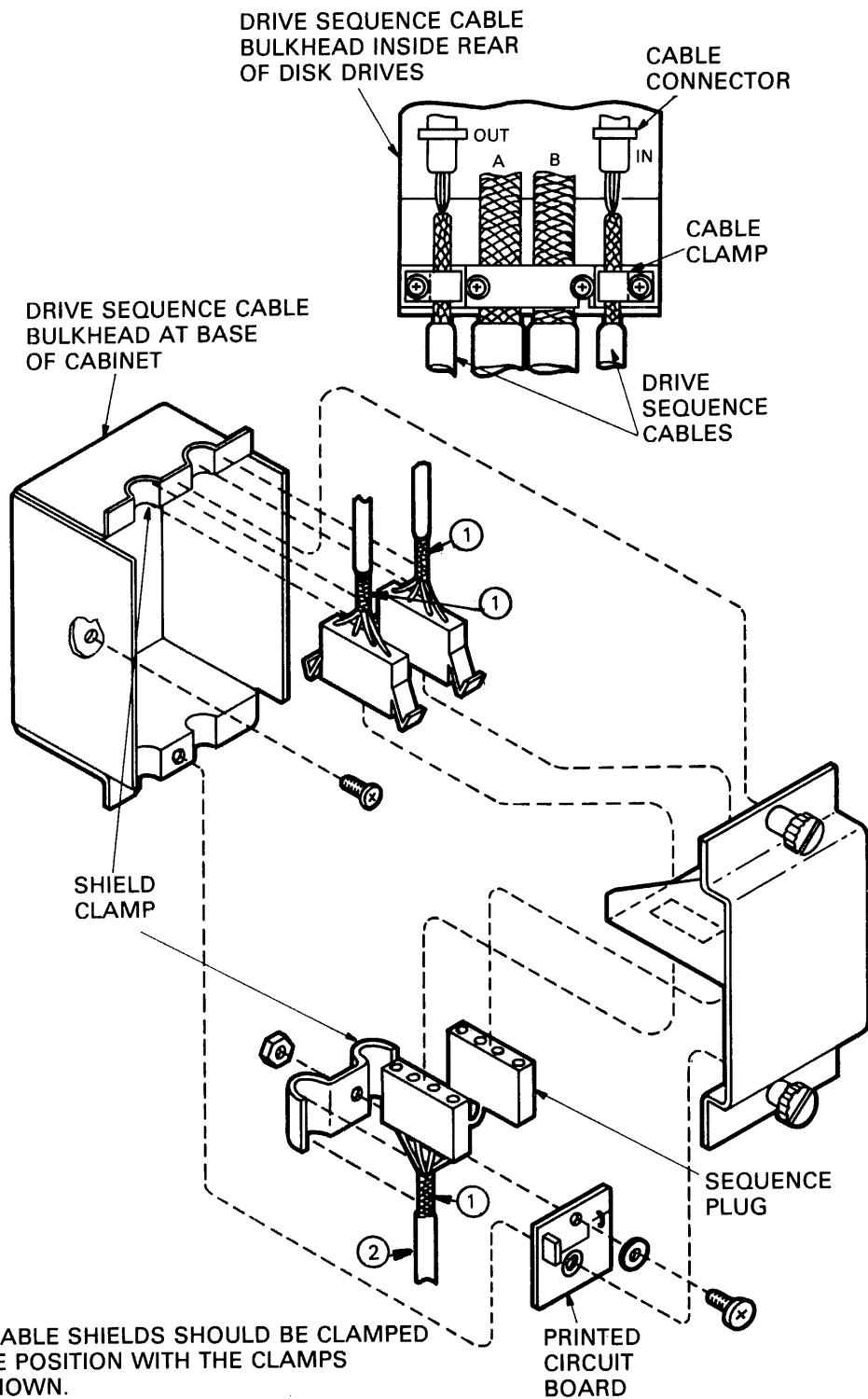
2.4.10 Plug in the AC Power Cord

The ac power cord on each add-on disk drive must be plugged into the ac receptacle on the power controller at the base of the cabinet. Refer to Figure 2-39.

2.4.11 Route and Clamp the Cables

The cables from the add-on drives must now be routed and clamped properly to allow the drive to slide out of the cabinet. Use the following procedures to route and clamp the cables.

1. Mount the spacers and cable clamps into the rear vertical uprights as shown in Figure 2-40. If this is the first add-on drive (middle bay), mount the cable clamps in mounting holes 44 of the left and right vertical uprights. If this is the second add-on drive (bottom bay), mount the cable clamps in mounting holes 23 of the left and right vertical uprights.
2. Use the 15 cable ties provided with each add-on drive to route and tie the cables approximately where shown in Figure 2-41. Three cable ties are used on the ac power cord, and seven cable ties are used on the SI and drive sequence cables.
3. The cables should be tie-wrapped to the clamp previously mounted on the rear of the chassis slides.
4. Form a service loop in the cables approximately 8 inches in diameter, as shown in Figure 2-40. Clamp the output of the service loop with the cable clamps just installed on the vertical uprights.
5. Tie-wrap the cables at the bottom of the cabinet to the cable clamp at mounting hole 14.

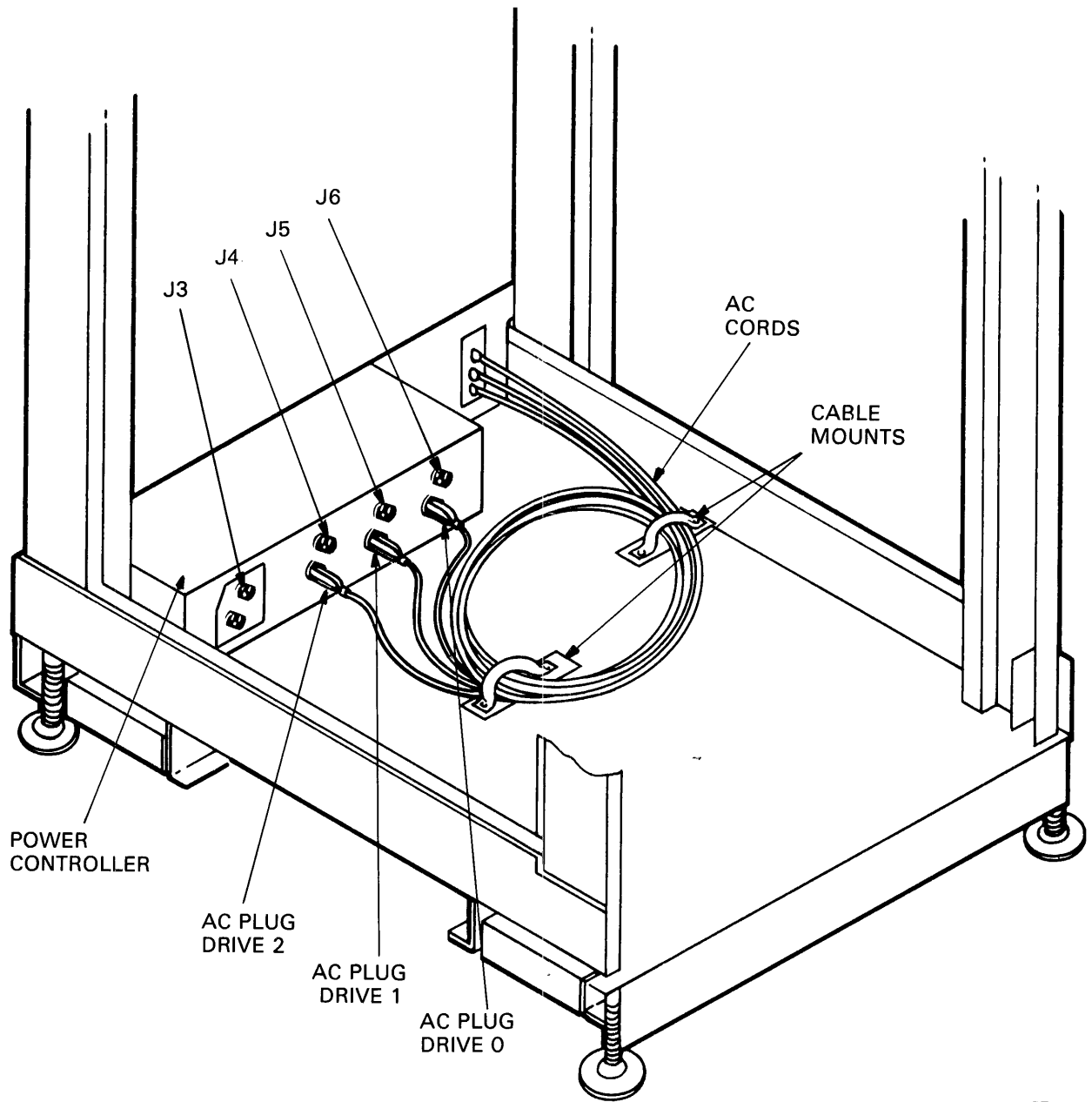


NOTES

1. ALL CABLE SHIELDS SHOULD BE CLAMPED IN THE POSITION WITH THE CLAMPS AS SHOWN.
2. THIS DRIVE SEQUENCE CABLE IS ONLY INSTALLED WHEN A FOURTH DRIVE IS USED IN AN ADJACENT CABINET.

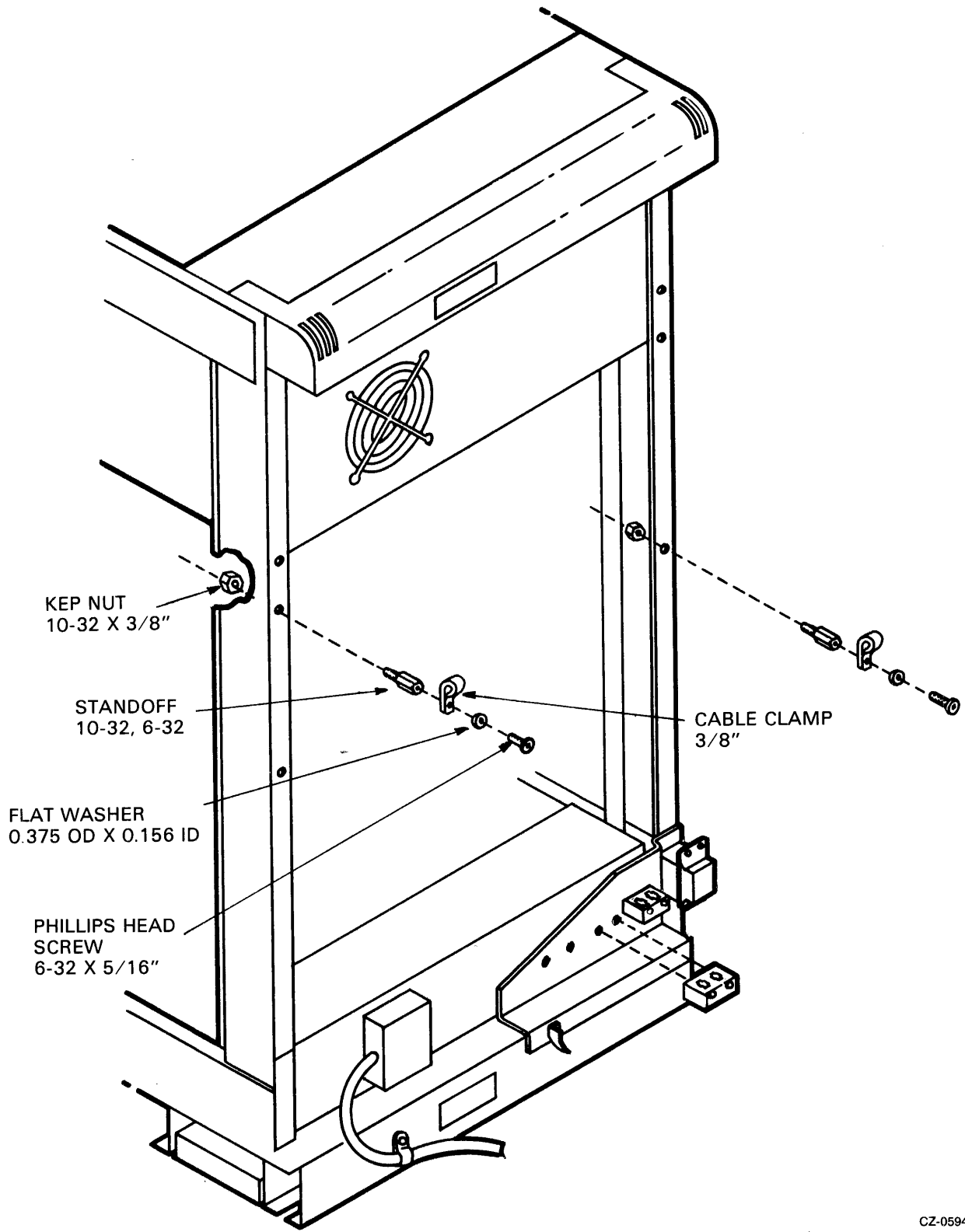
CZ-0591

Figure 2-38 Drive Sequence Cable Installation



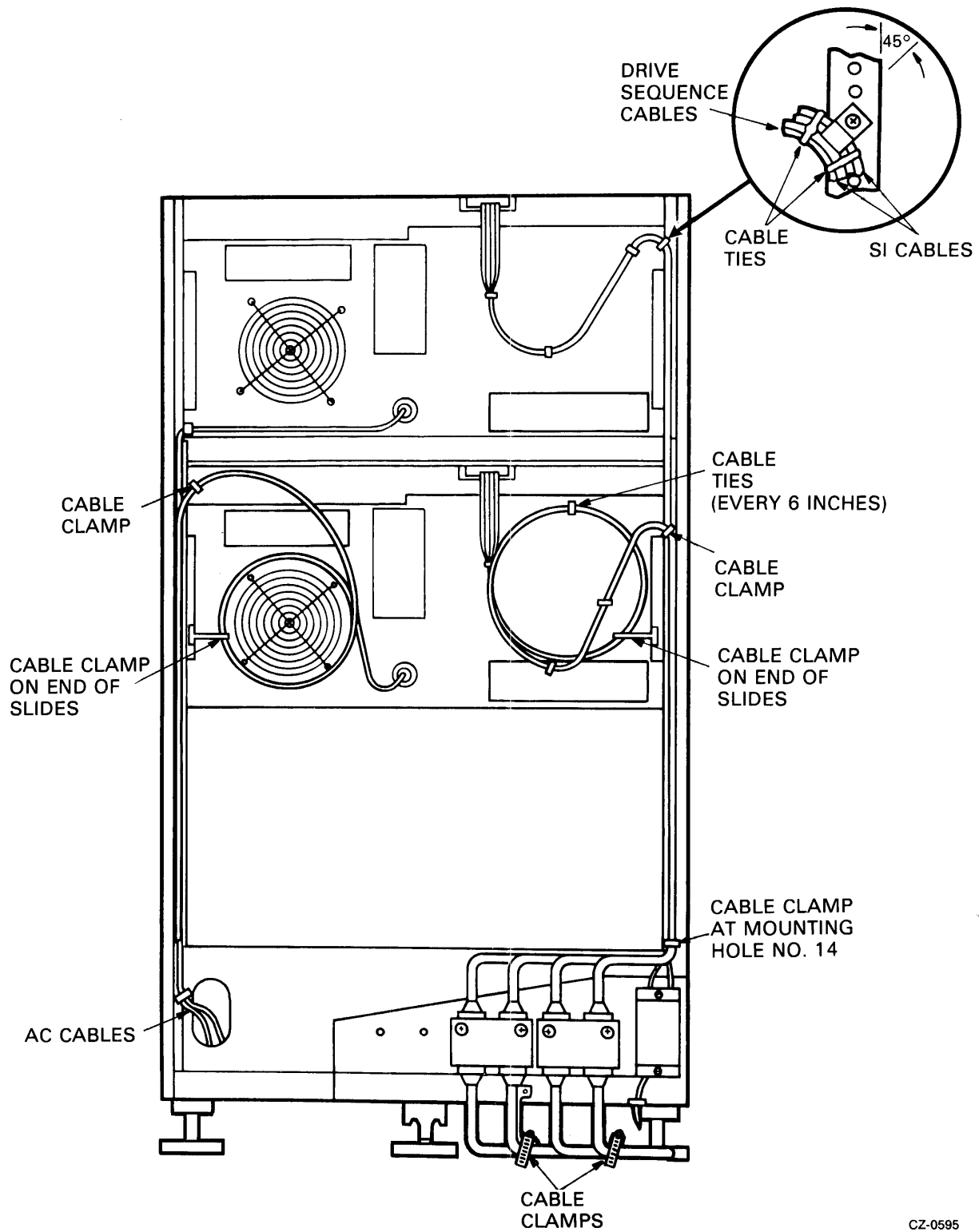
CZ-0593

Figure 2-39 Power Controller AC Receptacles



CZ-0594

Figure 2-40 Mounting Cable Clamps on Uprights



CZ-0595

Figure 2-41 Cable Routing and Clamping

2.5 RUA80 CHECKOUT PROCEDURE

Use the following RA80 checkout procedure for checking out each RA80 Disk Drive after installation.

2.5.1 Applying Power

1. Verify that the ac circuit breaker on the power control unit is off. Also verify that the circuit breaker on each disk drive is off. (Refer to Figure 2-42.)
2. If this is an add-on drive, plug the RA80 power cord into the ac power outlet on the power control unit at the bottom of the cabinet.
3. Check that the LOCAL/REMOTE switch on the power controller is in the LOCAL position.
4. Plug the ac power cord from the power control unit into an ac receptacle.
5. Switch on the ac circuit breakers on the power control unit. The circuit breaker on each drive is switched on during the drive checkout procedure that follows.

2.5.2 Drive Checkout Procedure

The following procedure is used to check out each RA80 Disk Drive. The HDA should be received preformatted from the factory. Both customer data areas and maintenance cylinders are formatted. Replacement HDA format information is available in the RA80 Disk Drive Service Manual, Section 5.2.

NOTE

This checkout procedure should be used only by trained maintenance personnel.

1. Switch on the ac circuit breaker at the rear of the drive. Refer to Figure 2-42. The front panel lights will go off if the drive hardcore diagnostics successfully complete.
2. Open the logic access cover and raise the servo and personality modules to expose the maintenance controls on the microprocessor module. Figure 2-43 shows the location of the LED display, the ENTER/RESET switch, and the rotary switches. Using these controls, perform the drive diagnostic tests listed in Table 2-1.

The servo velocity test in Table 2-1 requires the adjustment of potentiometer R281 on the servo module. Figure 2-44 shows the location of R281. Figure 2-45 shows the patterns seen in LED display on the microprocessor module as the servo velocity adjustment is made.

NOTE

If any one of these drive-resident diagnostic tests described in Table 2-1 fails, refer to the RA80 Disk Drive Service Manual or the RA80 Disk Drive Maintenance Guide for further troubleshooting procedures.

2.5.3 Disk Subsystem Checkout Procedure

Refer to the installation chapter in the appropriate controller user guide.

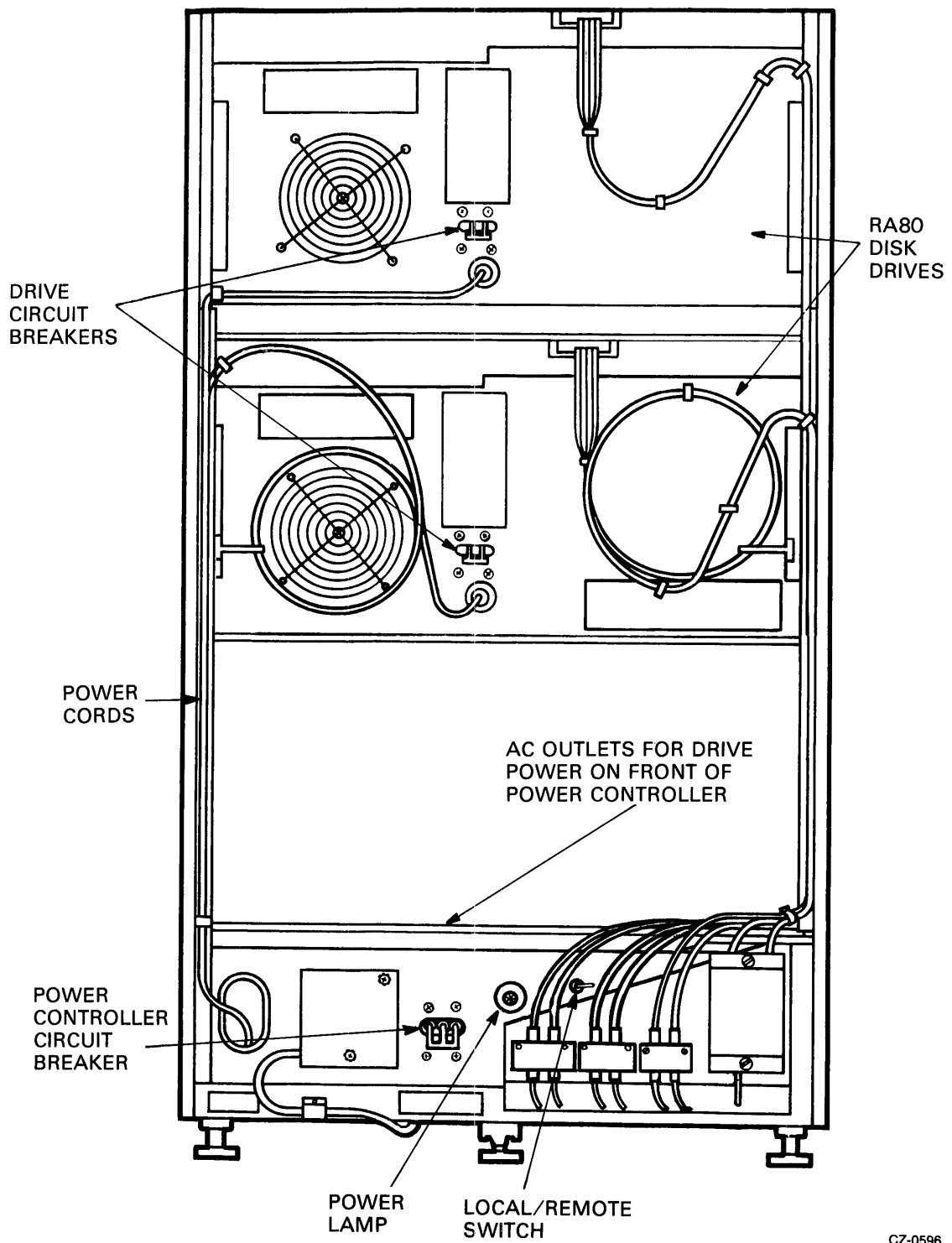
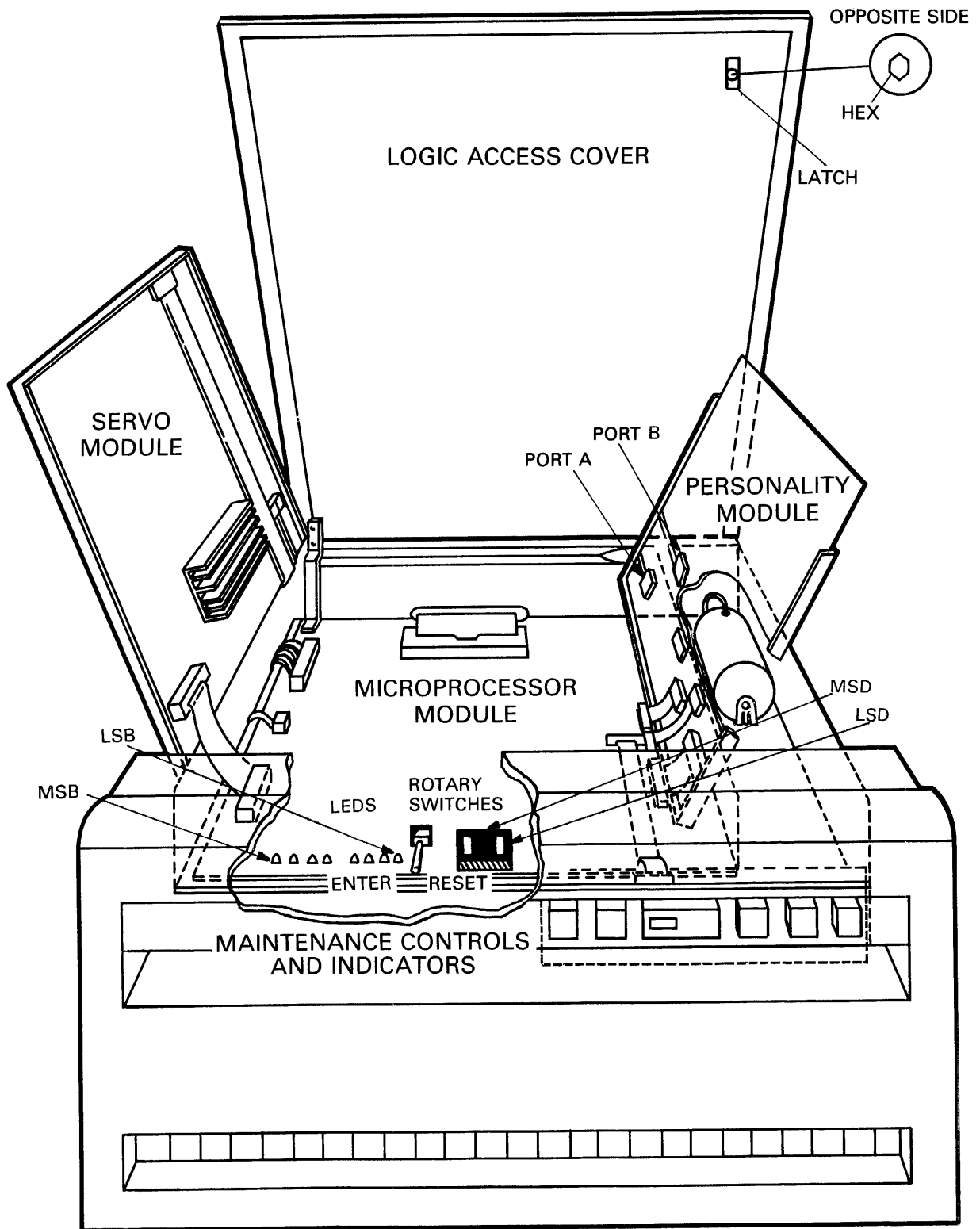


Figure 2-42 Circuit Breakers



CZ-0597

Figure 2-43 Microprocessor Module Maintenance Controls

Table 2-1 Drive-Resident Diagnostic Tests

Rotary Switch	Action	*LED Response
FF 00	1. Go Off-Line a. Set FF, push ENTER b. Push ENTER c. Set 00, push ENTER d. Push ENTER	Blinking FF ●●●●●●●● Steady FF ●●●●●●●● Steady 00 00000000 Blinking EC ●●●●●●00
22	2. Logic Test a. Set 22, push ENTER b. Push ENTER	Momentary 22 00●000●0 Steady AA ●0●0●0●0 Blinking EC ●●●0●●00
0D	3. Operator Control Panel Test a. Set 0D, push ENTER b. Push RUN c. Push WRITE PROTECT d. Push port A switch e. Push port B switch	Momentary 0D 0000●●●● Steady E7 ●●●0●●●● Steady 00 00000000 Steady 01 0000000● Steady 02 000000●0 Steady 04 00000●00
NOTE Front panel indicator should light as each switch is pushed.		
f. Remove unit plug; READY indicator should go out g. Replace unit plug; READY indicator should light h. Push ENTER i. Push ENTER j. Push ENTER k. Push ENTER l. Push ENTER m. Push ENTER		
27	4. Static Servo Test a. Set 27, push ENTER b. Push ENTER	LSB of ser. no. 2nd byte of ser. no. 3rd byte of ser. no. Unit plug no. Steady AA ●0●0●0●0 Blinking EC ●●●0●●00
Momentary 27 00●00●●● Steady AA ●0●0●0●0 Blinking EC ●●●0●●00		

* A ● equals ON and a o equals OFF. If anything other than the given response occurs, refer to the maintenance guide or call your field service representative.

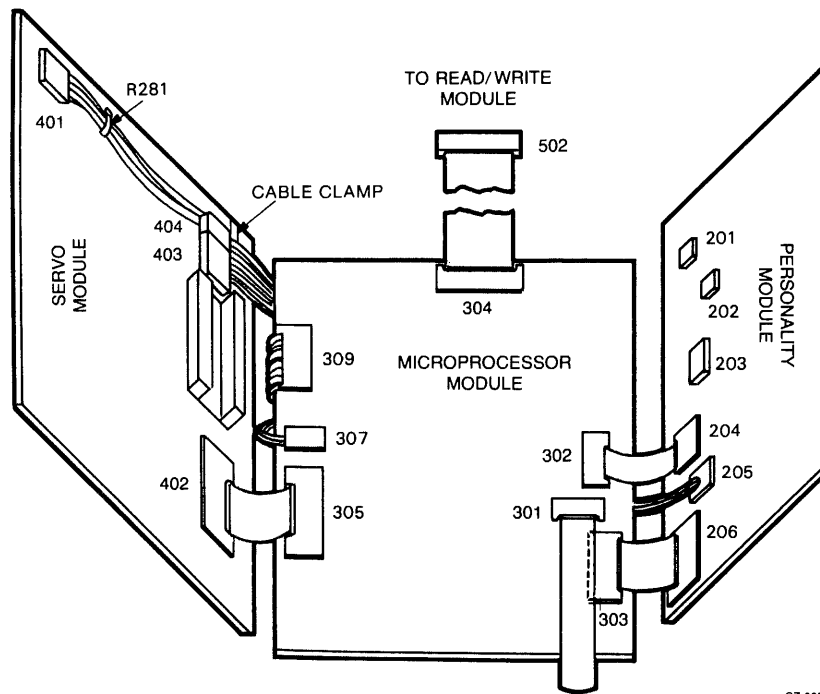
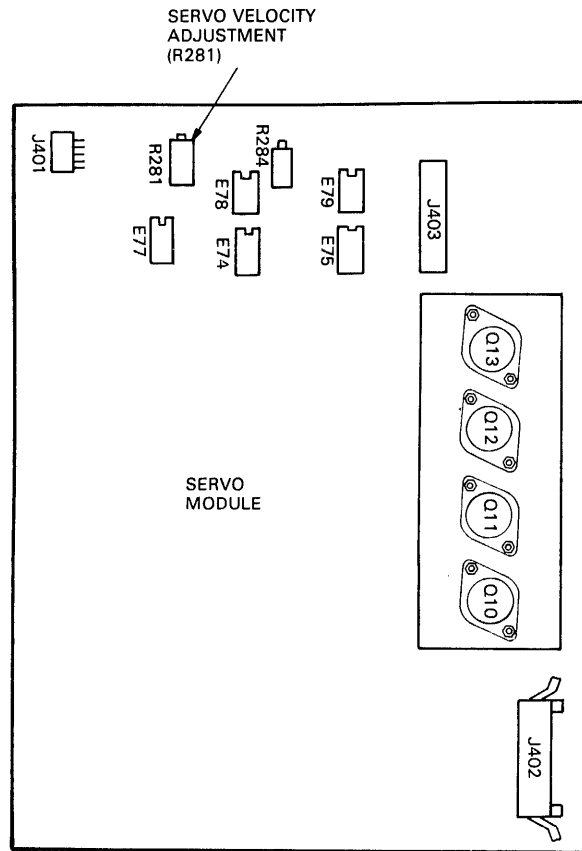
Table 2-1 Drive-Resident Diagnostic Tests (Cont)

Rotary Switch	Action	*LED Response
1E	5. Spindle Control Utility a. Set 1E, push ENTER b. Push RUN to start spin-up; spin-up complete indicated by AA c. Push ENTER	Momentary 1E 000●●●●0 Steady E7 ●●●00●●● Steady AA ●0●00●●0 Blinking EC ●●●00●●0
26	6. Servo Velocity Test a. Set 26, push ENTER b. Let test run for 20 minutes for temperature stability c. Monitor LED display; Slowly adjust R281 on servo module until the velocity is $\pm 1\%$ (refer to Figures 2-29 and 2-30)	Momentary 26 00●00●●0 Momentary E7 ●●●00●●● % Speed deviation
DD	d. Set DD, push ENTER e. If solid AA is displayed, push ENTER to return to EC prompt	Steady AA or blinking EC ●0●00●●0 ●●●00●●0
CF	7. Loop Mode Utility a. Set CF, push ENTER	Momentary CF ●●00●●●● Blinking 01 0000000●
4F	b. Set 4F, push ENTER c. Push ENTER	Momentary 4F 0●00●●●● Steady AA ●0●00●●0 Blinking EC ●●●00●●0
25	8. Entire Unit Test a. Set 25, push ENTER	Momentary 25 00●00●●● Steady E7 ●●●00●●●
DD	b. Let run for 10 min. c. Set DD, push ENTER d. If solid AA is displayed, push ENTER to return to EC prompt	Steady AA or blinking EC ●0●00●●0 ●●●00●●0

Table 2-1 Drive-Resident Diagnostic Tests (Cont)

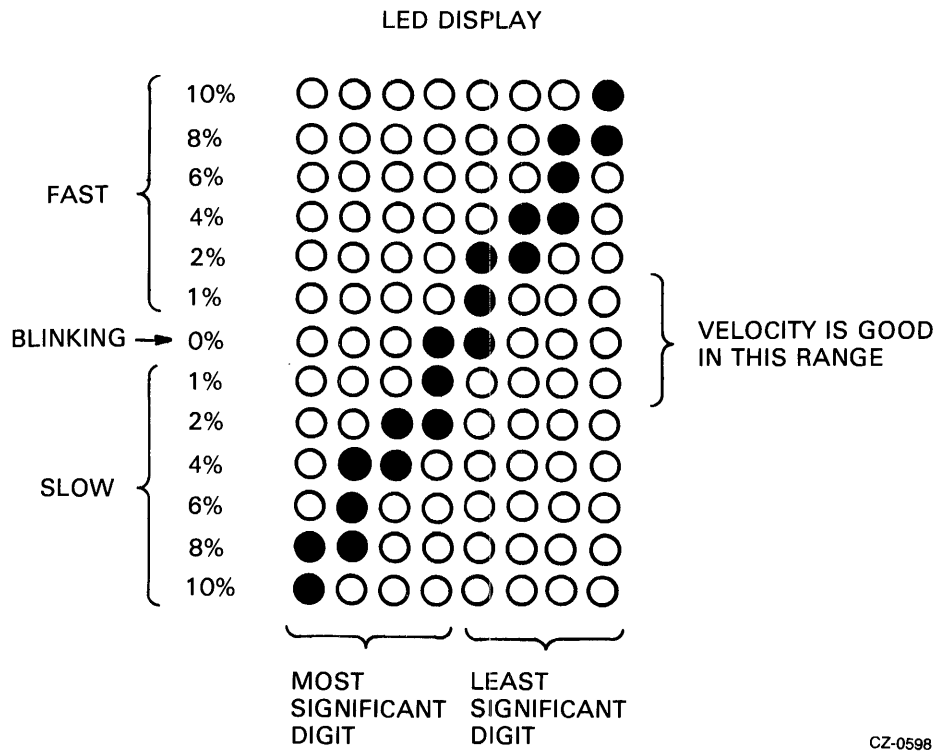
Rotary Switch	Action	*LED Response
1D 00	<p>9. Go On-Line</p> <p>a. Set 1D, push ENTER</p> <p>b. Set 00, push ENTER</p> <p style="text-align: center;">NOTE</p> <p>Drive is back on-line when READY light comes on.</p>	Momentary 1D 000●●●0●

* A ● equals ON and a o equals OFF. If anything other than the given response occurs, refer to the maintenance guide or call your field service representative.



CZ-0605

Figure 2-44 Servo Velocity Adjustment



CZ-0598

Figure 2-45 Velocity Adjustment LED Pattern

CHAPTER 3 OPERATING INSTRUCTIONS

3.1 OPERATOR CONTROLS AND INDICATORS

Operating controls for the RA80 are located on the front and rear panels of the disk unit.

3.1.1 Front Panel Controls and Indicators

The paragraphs that follow (3.1.1.1 through 3.1.1.5) describe the function of each control and indicator located on the front panel of the disk unit (Figure 3-1). The front panel controls will not function when the drive is placed off-line (in the diagnostic mode), unless the diagnostic test calls for the use of that particular control.

3.1.1.1 RUN/STOP Switch and Indicator (A Two-Position Push Button with Built-In Indicator Lamp) –

In the RUN position (button pushed in), the switch indicator lights up and a spin-up sequence begins if all power has been turned on and no faults are detected. An automatic spin-up attempt will be made following power interruptions as long as the switch remains in this position.

NOTE

A three-minute delay is recommended between each stop and restart to prevent opening the thermal circuit breaker associated with the spindle motor.

In the STOP position (out), power to the spindle motor is turned off. As soon as spindle rotation stops, the RUN/STOP indicator goes off.

3.1.1.2 FAULT Indicator and Reset Switch (A Momentary Contact Push-Button Switch with Built-In Indicator Lamp) – The FAULT indicator lights up whenever a device-unsafe or error condition occurs within the disk drive. (Refer to Paragraph 3.1.3.) If a fault occurs during a spin-up attempt, the spin-up will be aborted.

The FAULT indicator and five other front-panel indicators also provide a lamp display code that identifies various faults and errors as they occur. (Fault code identification is discussed in Paragraph 3.1.3.)

3.1.1.3 READY Indicator – The READY indicator lights following a successful (fault-free) spin-up sequence, indicating that the drive is up to speed and ready to receive commands. The READY indicator goes out during seek operations.

The numbered switch cap over the READY indicator lamp also serves as a unit address plug which distinguishes one drive unit from another in multi-drive arrangements. Paragraph 2.3.3 discusses how to address the unit address plug. (Refer to Figure 2-20.)

3.1.1.4 WRITE PROTECT Switch and Indicator (A Two-Position Button with Built-In Indicator Lamp) –

Pushing this switch (to the in position) places the disk drive in the write-protect mode and lights the indicator lamp. In this mode, the write circuits of the disk drive are disabled and no data can be written.

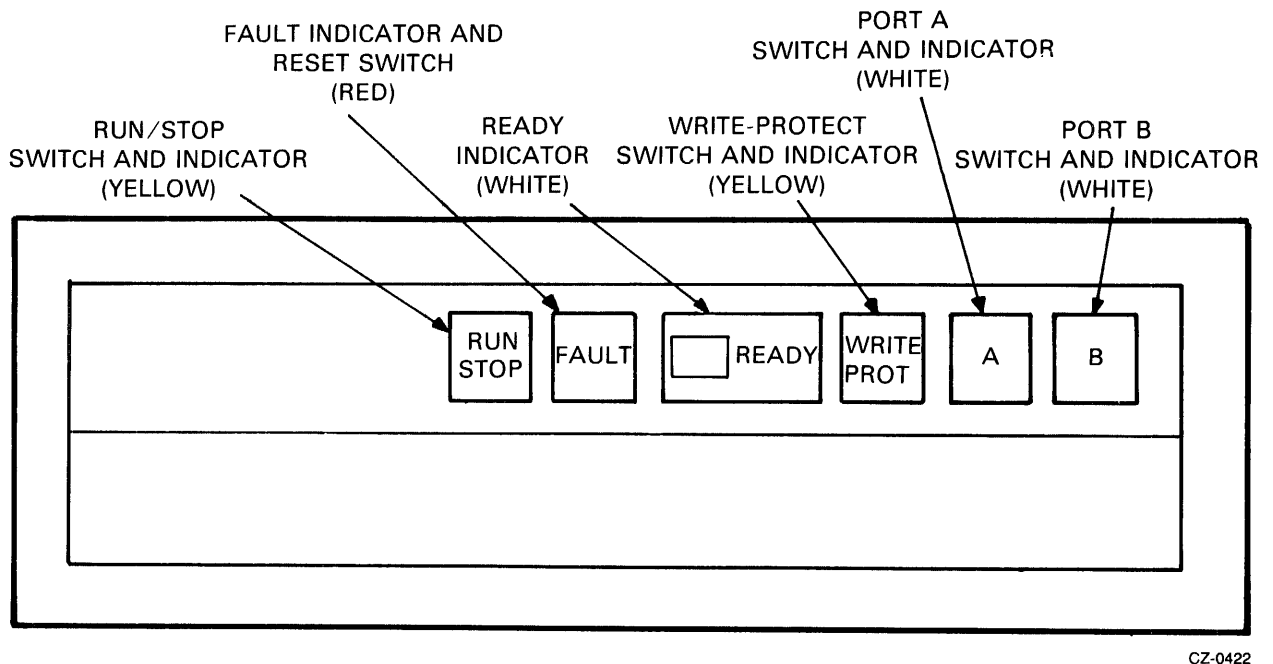


Figure 3-1 Front Panel Controls and Indicators

Releasing the push button (out position) enables the write circuitry and turns off the WRITE PROTECT indicator. The WRITE PROTECT switch is functionally inoperable when the drive is placed off-line (diagnostic mode).

3.1.1.5 Port-Select Switches – The RA80 drive is equipped with two port-select push-buttons. These switches (designated A and B) have built-in lamps, which indicate the port through which the drive is being accessed. Any one of the following three operating modes can be selected with these two switches.

- Port A operation only
- Port B operation only
- Port A/B (programmable) operation

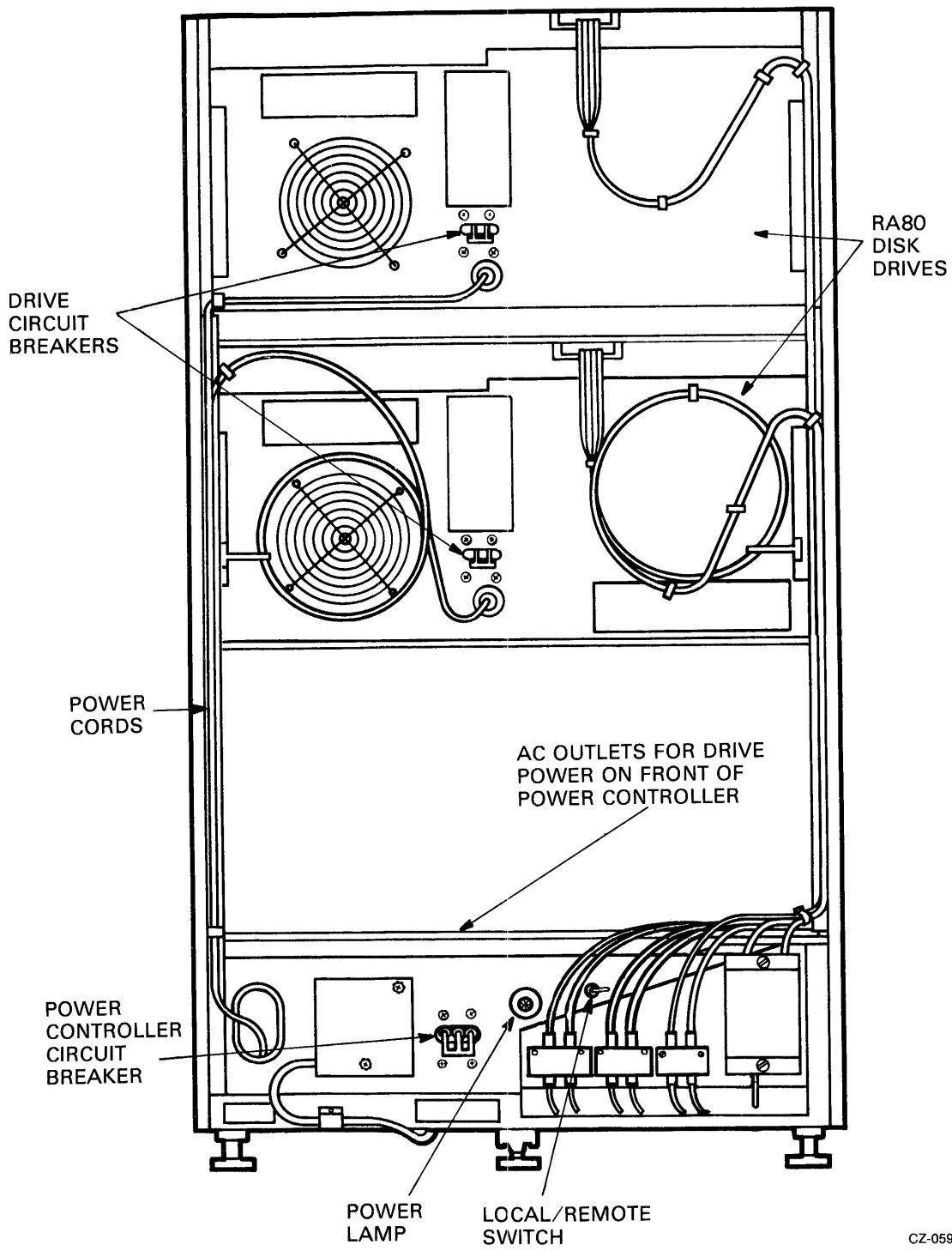
When the port A button is pushed in and the port B button is out, only port A can be accessed. When the opposite condition exists, only port B can be accessed. However, when both push buttons are in, either port A or port B can be accessed as determined by program control. The push button indicator will light to signify which port has been seized by an SI controller.

3.1.2 Circuit Breakers

A circuit breaker is located on the rear panel of each disk unit. (Refer to Figure 3-2.) Open the rear door to gain access to the circuit breaker. This circuit breaker controls the ac power to the dc power supply, the cooling-fans, and the spindle motor. The circuit breaker must be in the ON position before the drive will operate.

The power controller also has a circuit breaker. It is located on the rear of the power controller. (Refer to Figure 3-2.) This circuit breaker controls power to all assemblies within the RA80 cabinet.

The local/remote switch also controls power to the drive. It should always be turned to the local position (refer to Figure 3-2).



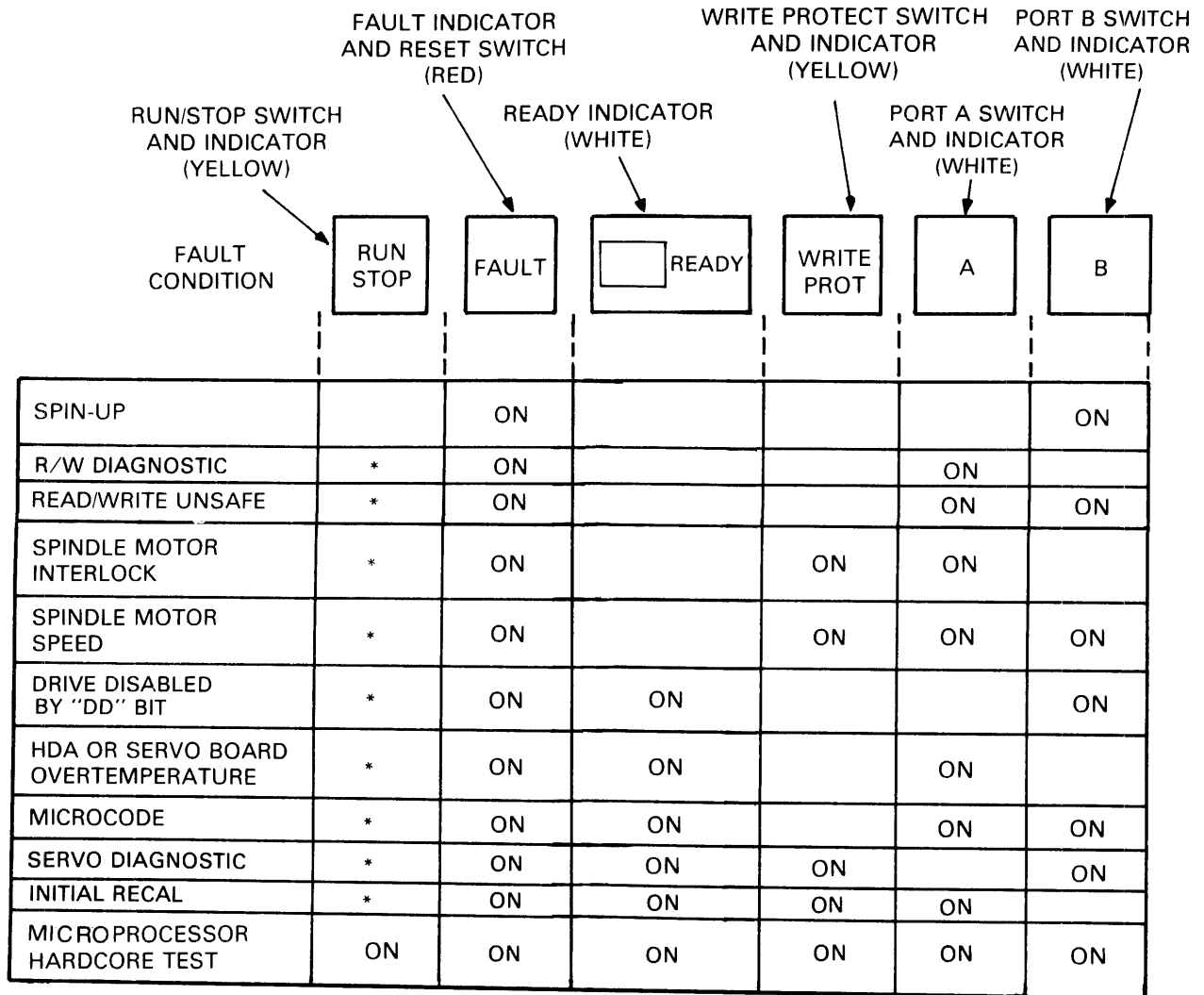
CZ-0596

Figure 3-2 Circuit Breakers

3.1.3 Front Panel Fault Indications

In addition to their usual functions, the six front panel controls and indicators provide a visual code that identifies generic faults within the RA80. Figure 3-3 shows the faults that can occur and the indicator lamp combinations that identify each particular fault.

When the FAULT indicator light comes on, pressing the FAULT switch once causes all of the indicator lamps to light momentarily as a means of verifying that the lamps are functioning. Pushing the FAULT switch a second time stores the identity of the fault in the microprocessor and clears the fault.



*THE INDICATOR STATE WILL BE THE SAME AS IT WAS BEFORE THE FAULT SWITCH WAS PUSHED

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Figure 3-3 Operator Control Panel General Fault Indicators

3.2 DRIVE OPERATION

3.2.1 Spin-Up

Push in the RUN/STOP button on the drive front panel to begin the spin-up cycle. The RUN/STOP indicator will immediately light and the READY indicator will light as soon as the drive has completed its spin-up cycle.

3.2.2 Spin-Down

Release the RUN/STOP button on the drive front panel to spin-down the disks. The READY and RUN/STOP indicators will go out. Power is still applied to the drive until the circuit breaker is switched off.

3.2.3 Removing RA80 Power

To remove power from the RA80, release the RUN/STOP button to spin-down the disks. Wait until the RUN/STOP indicator goes off. Then switch off the circuit breaker at the rear of the disk drive and unplug its ac cord from the power controller.

3.3 CUSTOMER CARE

The air filter in the logic chassis assembly should be inspected and cleaned every six months.

3.3.1 Filter Removal

To remove the foam air filter, proceed as follows:

1. Pull down the access door on the front bezel of the drive. (Refer to Figure 3-4.)

CAUTION

Do not lay tools on the open access door or lean on it as the hinge mechanism can be damaged.

2. Grasp the filter material and pull outward until it is free of the bezel.

3.3.2 Cleaning

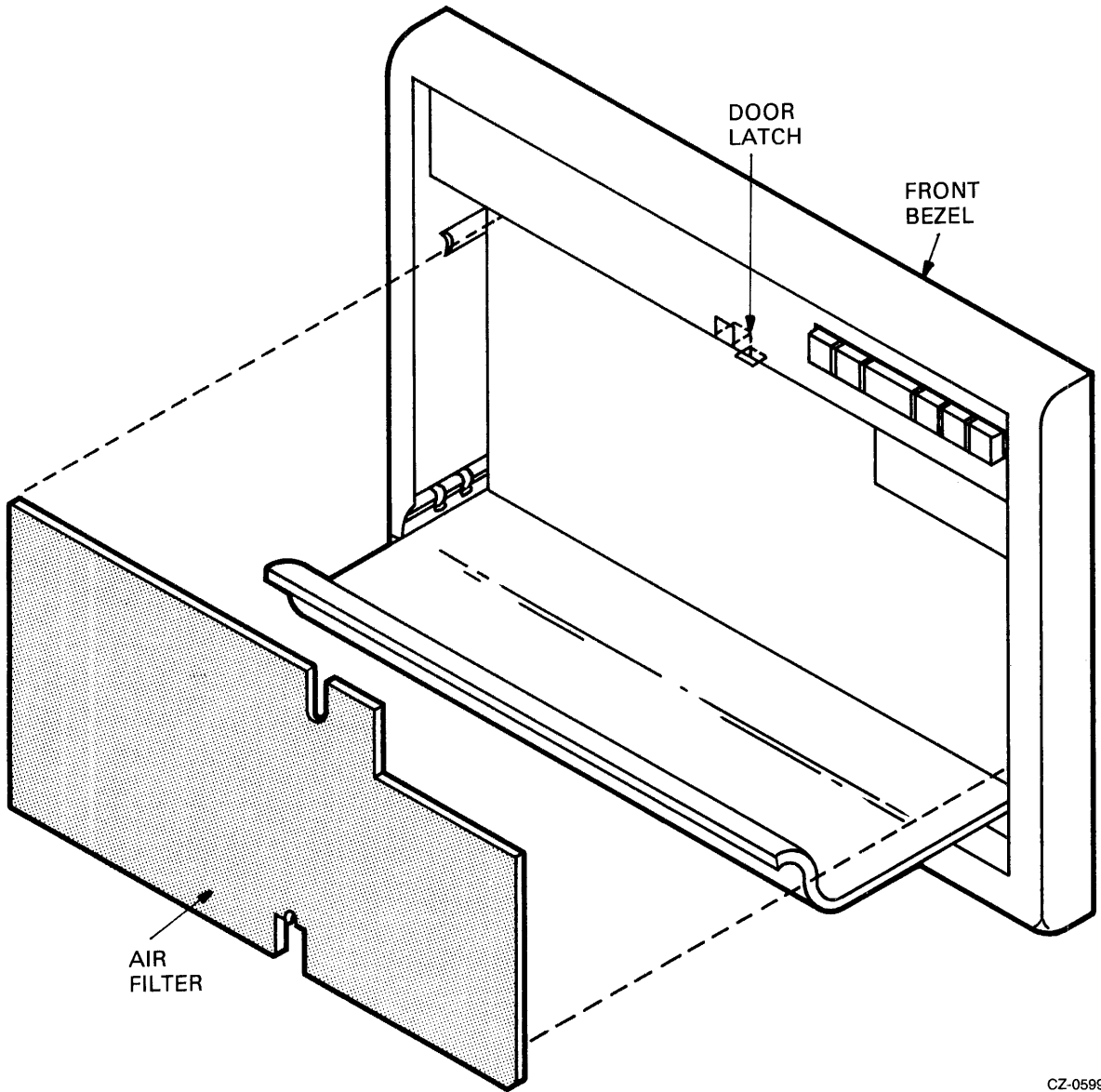
1. Wash the foam air filter in warm water using a mild detergent.
2. Rinse the filter material off with clear water and then allow it to dry.

3.3.3 Replacement

1. Slide the filter into place inside the bezel.
2. Close the access door.

NOTE

If it becomes necessary to replace the existing filter, order DIGITAL Part No. 7422816-00.



CZ-0599

Figure 3-4 Air Filter Location

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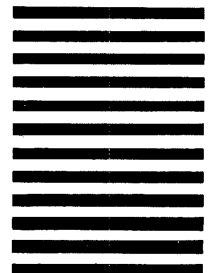


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