Field Engineer's
Maintenance Series

6045 6050 6051
CARTRIDGE DISC
SUBSYSTEM

015-000058-05

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Field Engineer's Maintenance Series

6045, 6050, 6051 CARTRIDGE DISC SUBSYSTEM

PREFACE

This manual contains key maintenance procedures for DGC 6045, 6050 and 6051 Series Cartridge Disc Drives. For additional information, refer to Technical Manual DGC No. 015-000057 and the appendices in this manual. Note that each procedure has a list of the part numbers and special tool numbers required to perform that particular procedure.

DataGeneral

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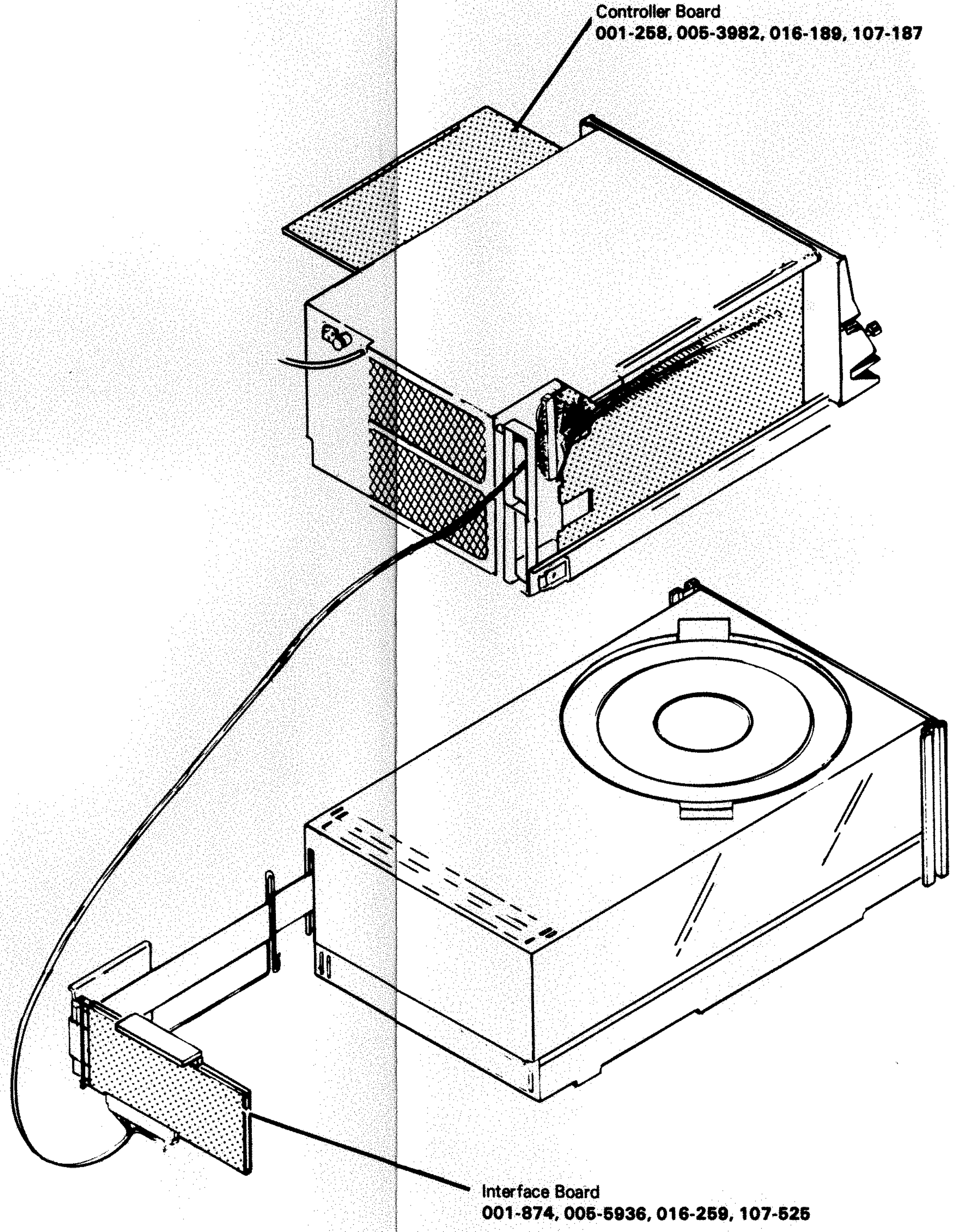
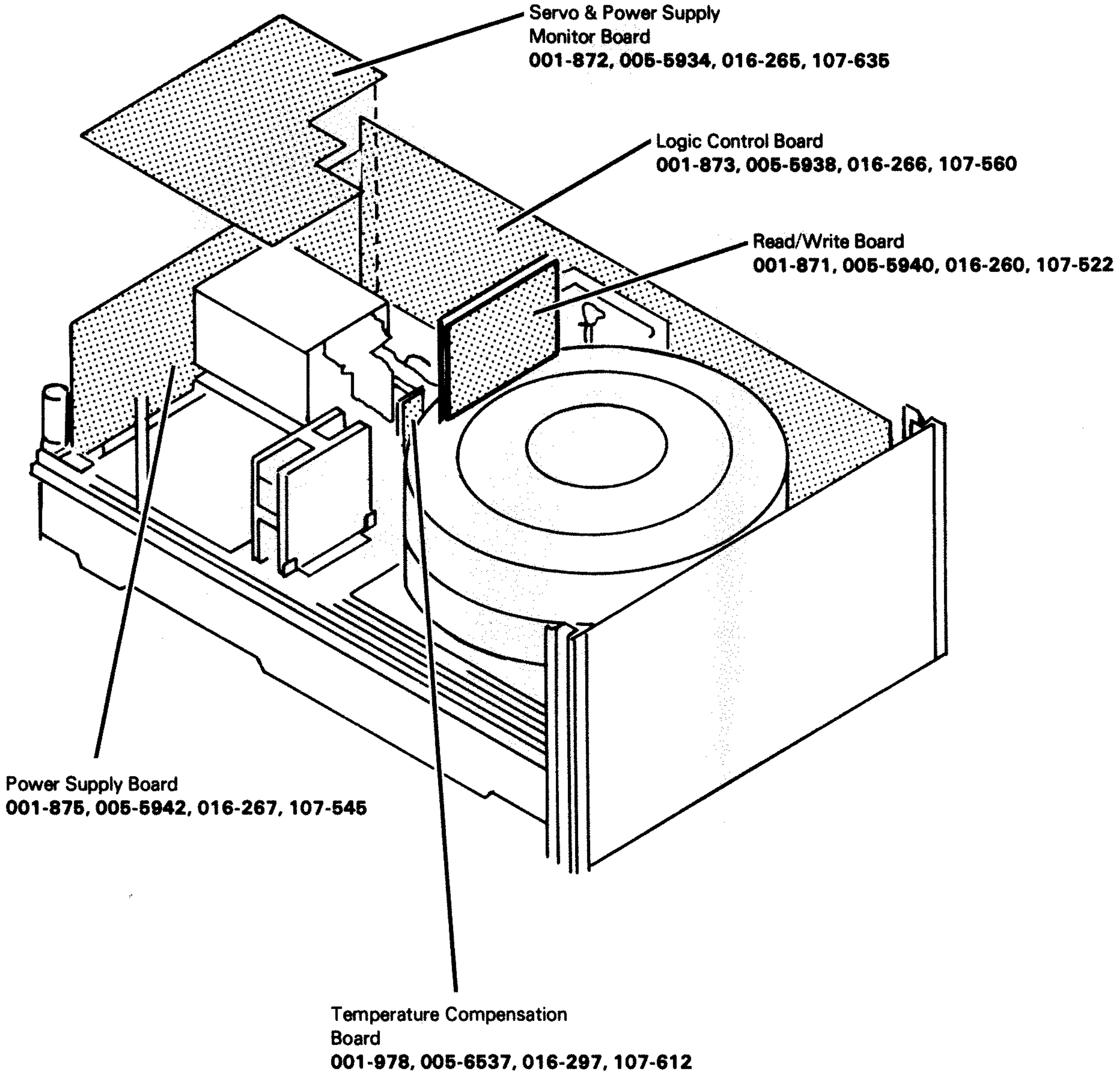
DISC SUBSYSTEM

MODELS 6045, 6050, 6051

Primary Document Index

This primary document index shows the seven printed circuit boards of the 6045, 6050, and 6051 Series Cartridge Disc Subsystem. It also supplies the corresponding schematic (001), assembly (005), IPL (016) and artwork (107) numbers for each board.


Controller Board
001-258, 005-3982, 016-189, 107-187
Interface Board
001-874, 005-5936, 016-259, 107-525


Servo & Power Supply Monitor Board
001-872, 005-5934, 016-265, 107-635
Logic Control Board
001-873, 005-5938, 016-266, 107-560
Read/Write Board
001-871, 005-5940, 016-260, 107-522
Power Supply Board
001-875, 005-5942, 016-267, 107-545
Temperature Compensation Board
001-978, 005-6537, 016-297, 107-612

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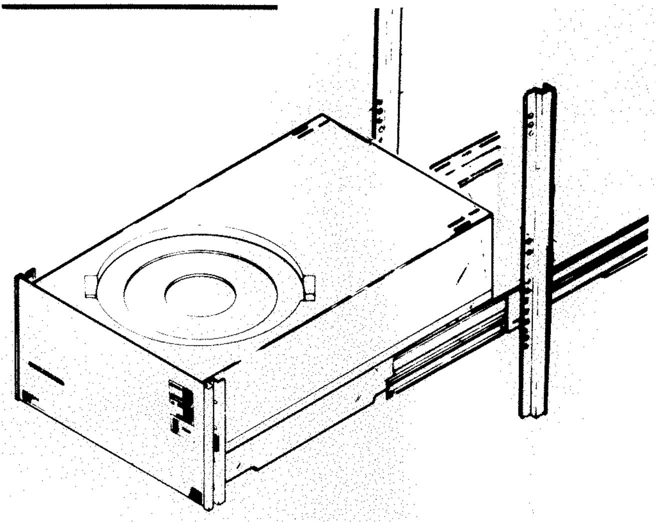
Filter Replacement

SPECIAL TOOLS & PARTS

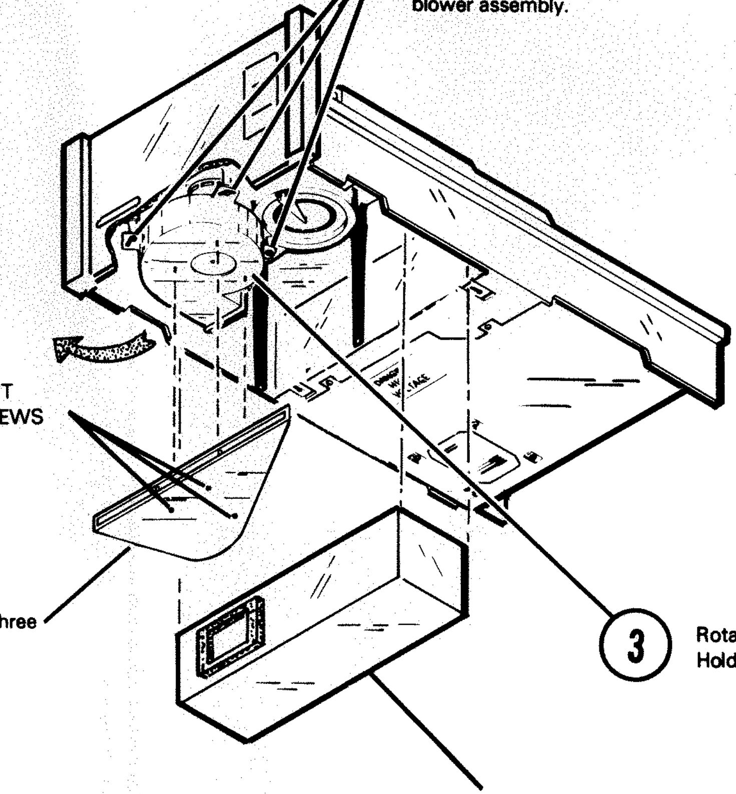
Filter
(118-000511)

Torque Wrench (0-100 in oz.)
(128-000255)

Replace filter every 1000 hrs. or 6 months, whichever comes first.



① Extend the drive fully.

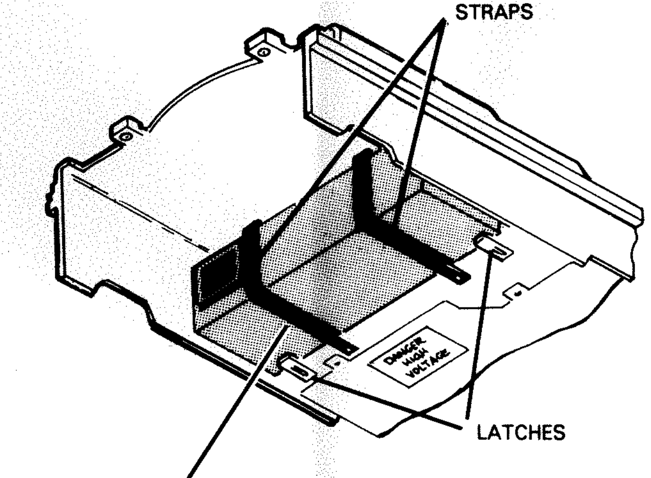


Loosen these screws on the blower assembly.

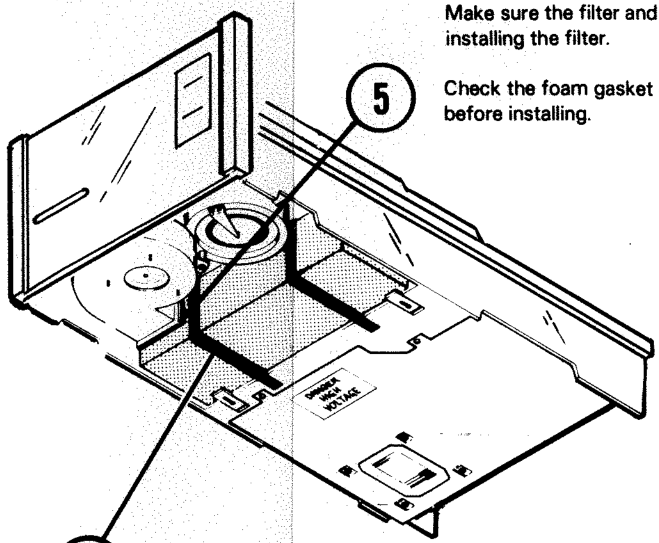
Do not remove blower assembly.

② Remove the air duct by unscrewing the three (captive) screws holding it to the blower.

③ Rotate the blower assembly away from the filter.
Hold the blower in this position and tighten the three screws.



④ Unhook the rubber straps, then loosen and slide back latches.
Remove the old filter.



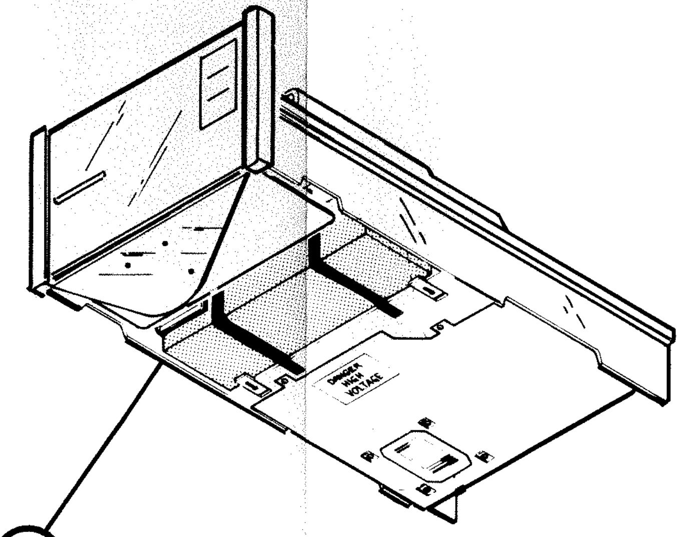
⑤ Make sure the filter and the casting are clean before installing the filter.

Check the foam gasket on the new filter for damage, before installing.

⑥ Install the filter. Hook the rubber straps over the filter. Also slide the two latches over the filter and tighten the two latch screws.

Keep face clear when securing rubber straps. Work from the side of the drive to prevent any injury from a flying strap.

⑦ Rotate the blower motor back into position. Apply some pressure so that the motor and the filter fit snugly. Hold the blower in this position and tighten the three screws.



⑧ Clean the air duct and the grill; then install the air duct and torque its three screws to 80in-oz (5in-lbs).

Blower Replacement

SPECIAL TOOLS & PARTS

Blower (115-000087) 60HZ (115-000088) 50HZ

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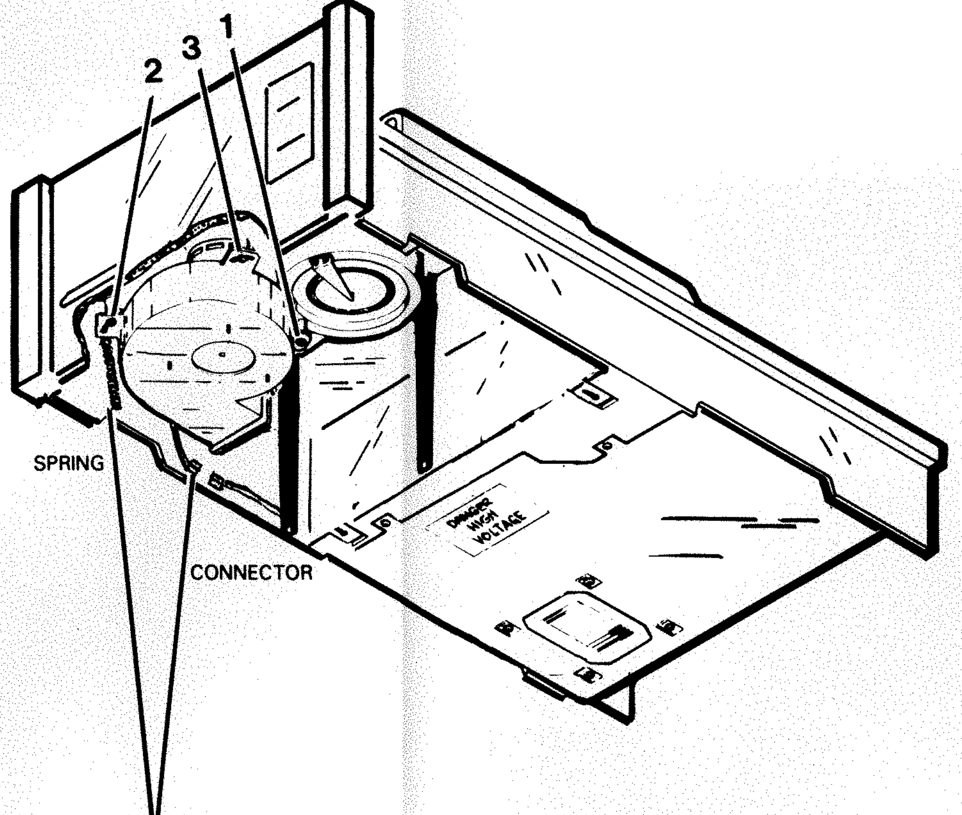
① Go to the Filter Replacement Procedure and follow steps 1-4.

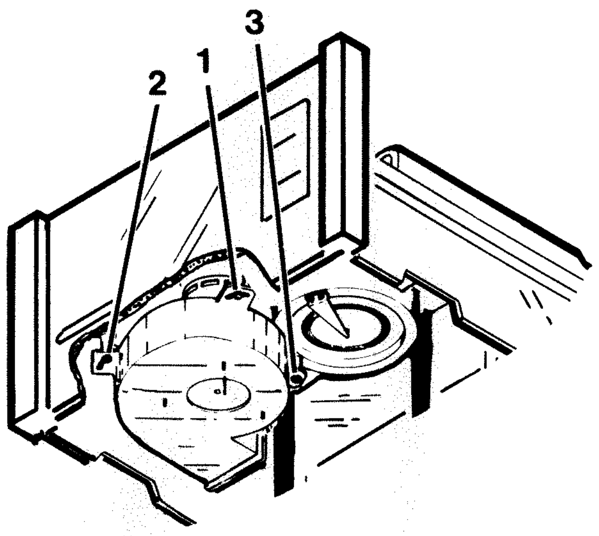
② To remove the blower, unscrew the three screws in the following order as shown.



③ Unhook the spring from the side of the casting and unplug the connector.

④ When replacing the blower, first plug in the connector and then hook the spring on the side of casting. Insert the three screws as shown below.

Rotate the blower and tighten the screws so that the filter may be replaced.



⑤ Go to the Filter Replacement Procedure and follow steps 5-8.

Brush Replacement

SPECIAL TOOLS & PARTS

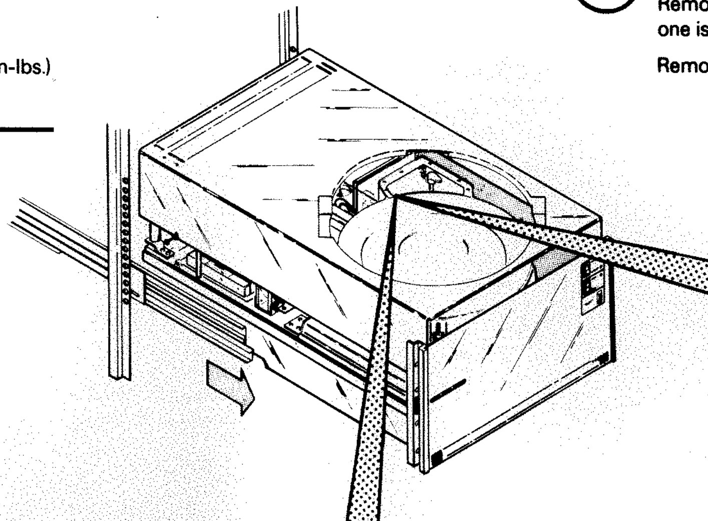
Brush
(123-00190)

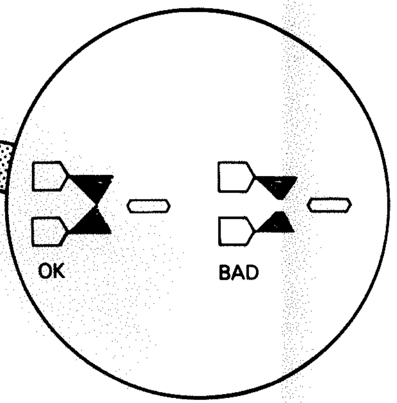
Torque Wrench (0-100 in-lbs.)
(128-001092)

① Extend the drive fully. Remove the cartridge disc if one is installed.

Remove the top cover.

Inspect brushes for wear or contaminations. (See sketch below.)





② Loosen the Allen screw and remove the retract lever.

③ Remove the five screws (and two PCB clamps) holding the transparent brush cover over the brush chamber and remove the cover.

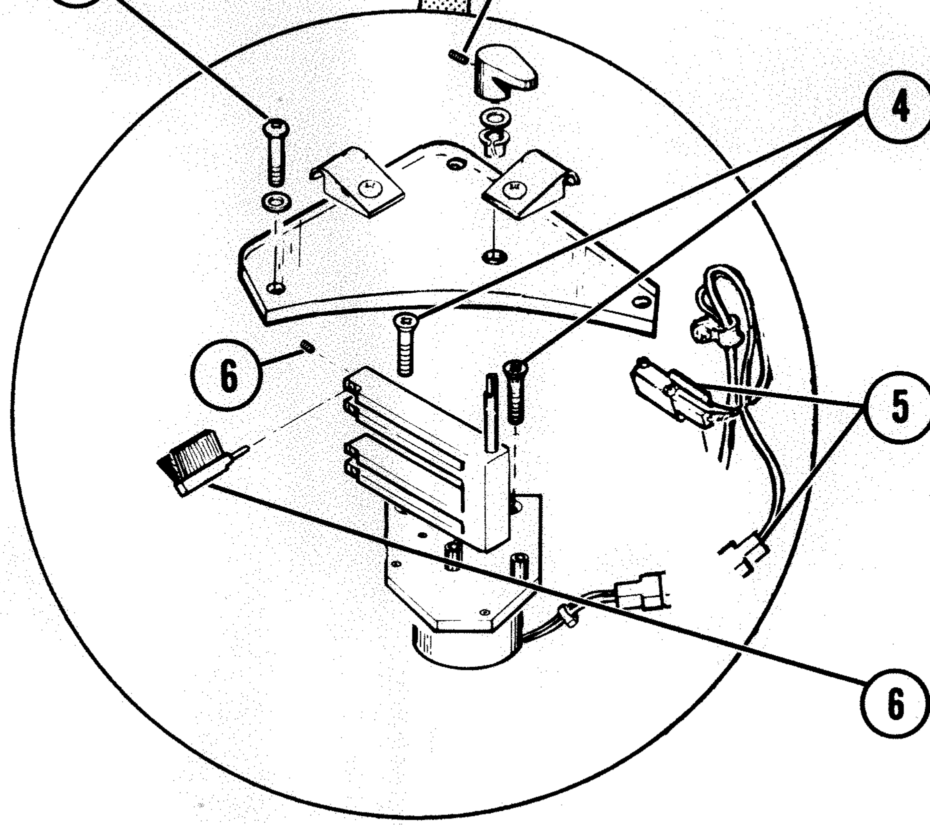
④ Loosen the two Allen screws securing the brush assembly to the casting and remove the assembly from the chamber.

⑤ Unplug the connector leading to the brush motor and the microswitch.

⑥ Loosen the Allen screw holding the worn brush to the arm and remove the brush.

Install the new brush and make sure that the brush fits snugly against the brush arm.

Hold the brush in place and tighten the Allen screw. Try not to touch the bristles of the brush with your fingers.



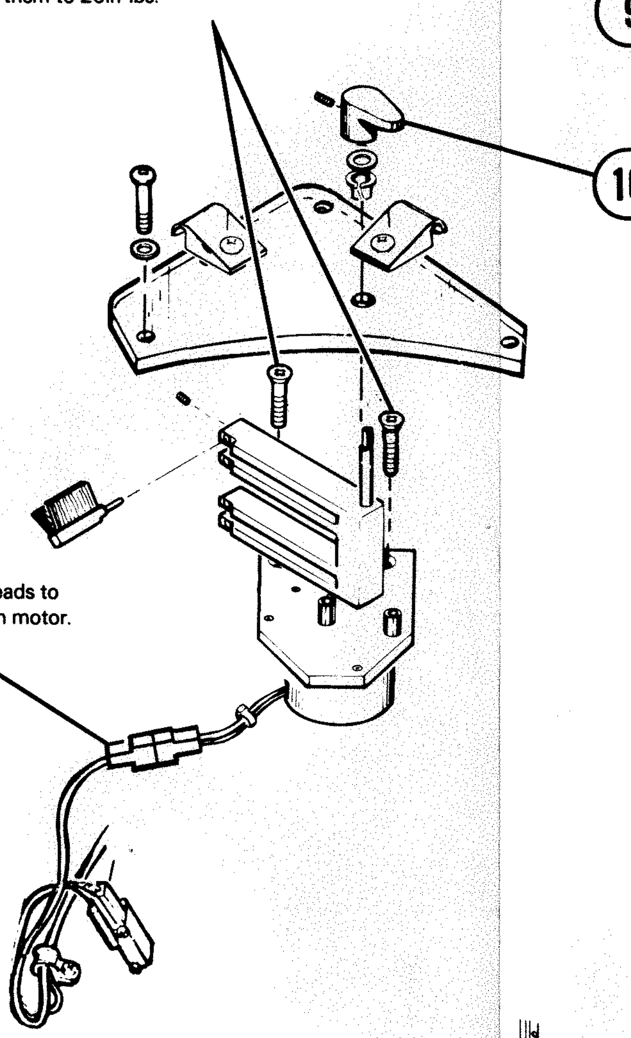
⑦ Plug in the connector which leads to the microswitch and the brush motor.

⑧ Place the brush assembly in the brush chamber. Insert the two retaining screws and torque them to 20in-lbs.

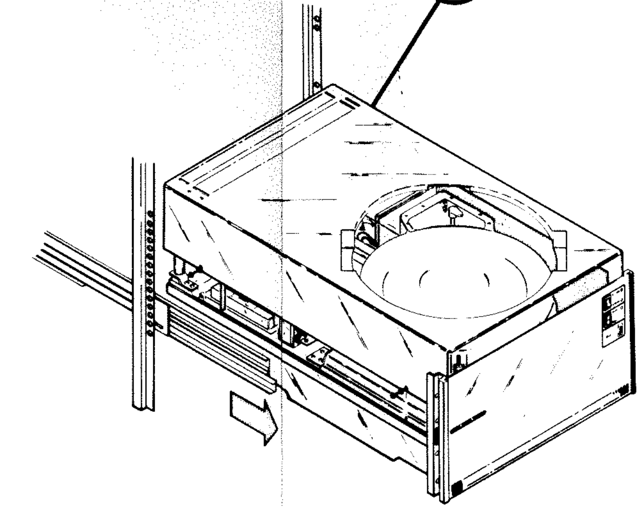
⑨ Place the transparent cover over the brush chamber.

Replace the two PCB clamps. Replace the five retaining screws and tighten.

⑩ Replace the retract lever and tighten the Allen screw.



⑪ Replace the top cover of the drive.



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Brush Motor Replacement

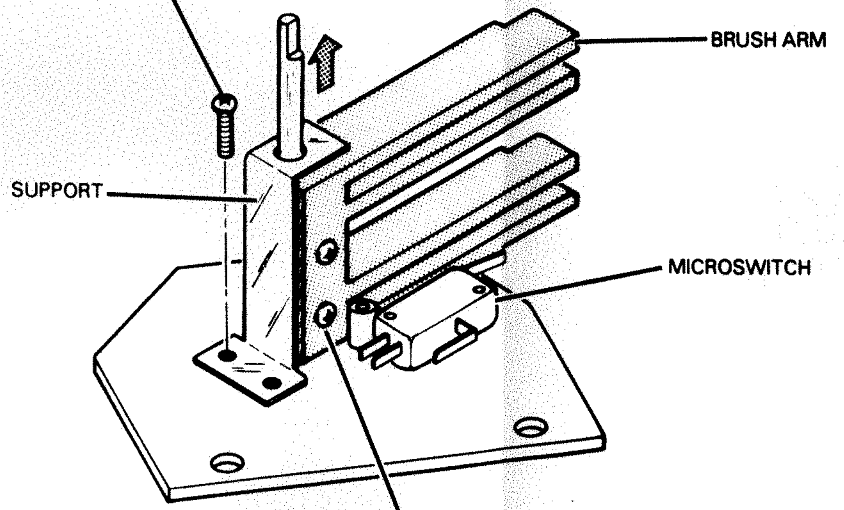
SPECIAL TOOLS & PARTS

Microswitch
(110-000229)

Brush Motor
(005-006133)

① Go to the Brush Replacement Procedure and follow steps 1-5.

② Unscrew the two screws holding the brush arm support and slide it off of the shaft.

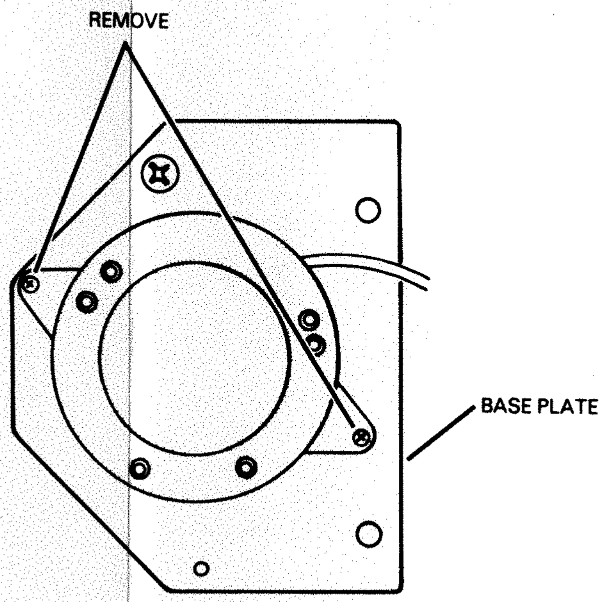


③ Loosen the bottom Allen screw on the brush arm and lift it off the motor shaft.

DO NOT TOUCH BRUSHES WITH FINGERS

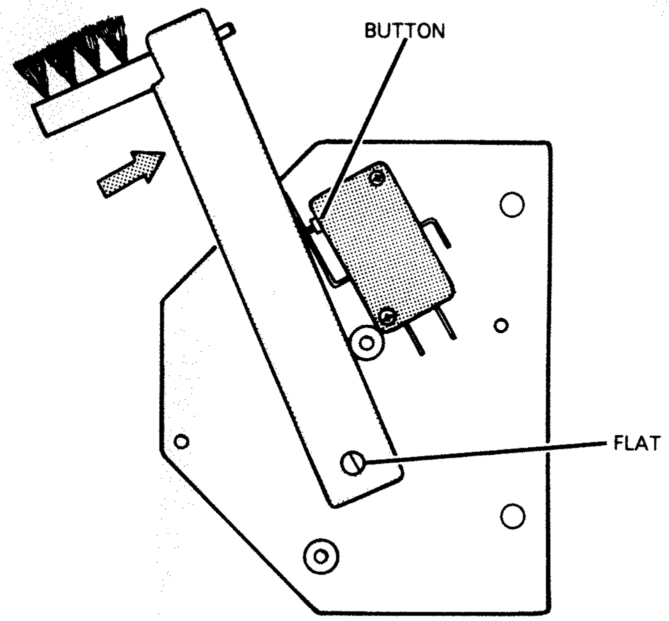
④ Remove the two screws holding the motor to the base plate.

The brush home microswitch may be replaced at this point by removing the two screws holding it to the base plate.



⑤ Place the new motor on the base plate. Replace the two screws and tighten.

⑥ Place the brush arm on the motor shaft and align the Allen screw with the flat on the shaft and tighten the Allen screw. (See step 3 for location of Allen screw.) Also replace brush arm support. (See step 2.)



⑦ Go to the Brush Replacement Procedure and follow steps 7-11.

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Fixed Disc Replacement

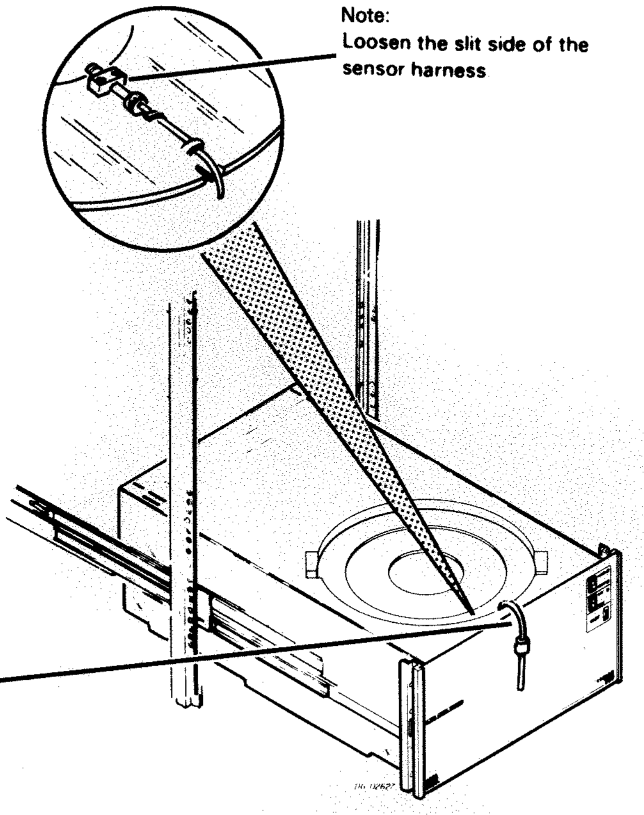
SPECIAL TOOLS & PARTS

Fixed Disc (118-000510)

Torque Wrench (0-100 in-lbs.) (128-001092)

Cartridge/Diskette Formatter (095-000300)

Cartridge/Diskette Reliability (095-000299)



Note:
Loosen the slit side of the sensor harness

① Extend drive to the load position.
Remove cartridge disc if one is installed.

② Loosen and unfasten pack sensor from the baffle plate.
Tape the sensor over the front of the drive.

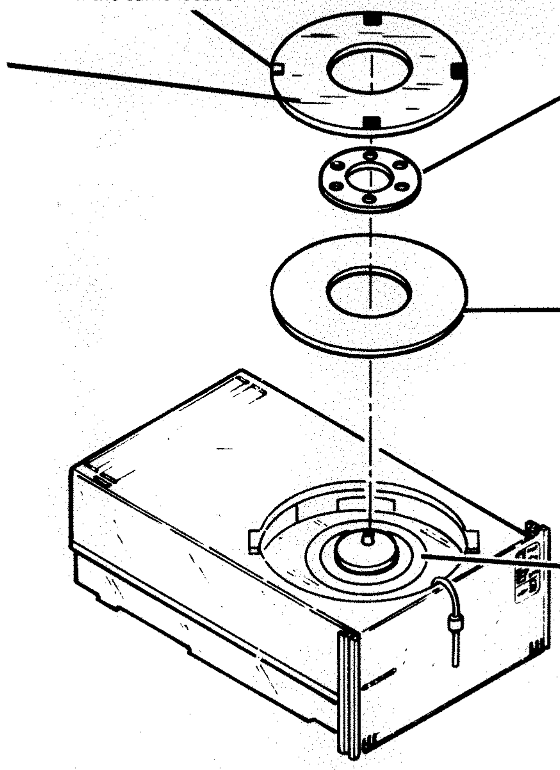
③ Unscrew and remove the three screws holding the mounting blocks to the side of the casting.

Remove the 4 white mounting blocks and baffle plate from the drive.

Work carefully around the spindle hub to prevent damaging it.

Wear white nylon gloves and face mask when working with the exposed disc.

This block is smaller than the others, note its location in the disc chamber, it must go back in the same location.



④ Unscrew and remove the six screws holding the ring clamp to the spindle and carefully remove the ring clamp from the drive.

Any foreign material or objects that touch the disc could damage it.

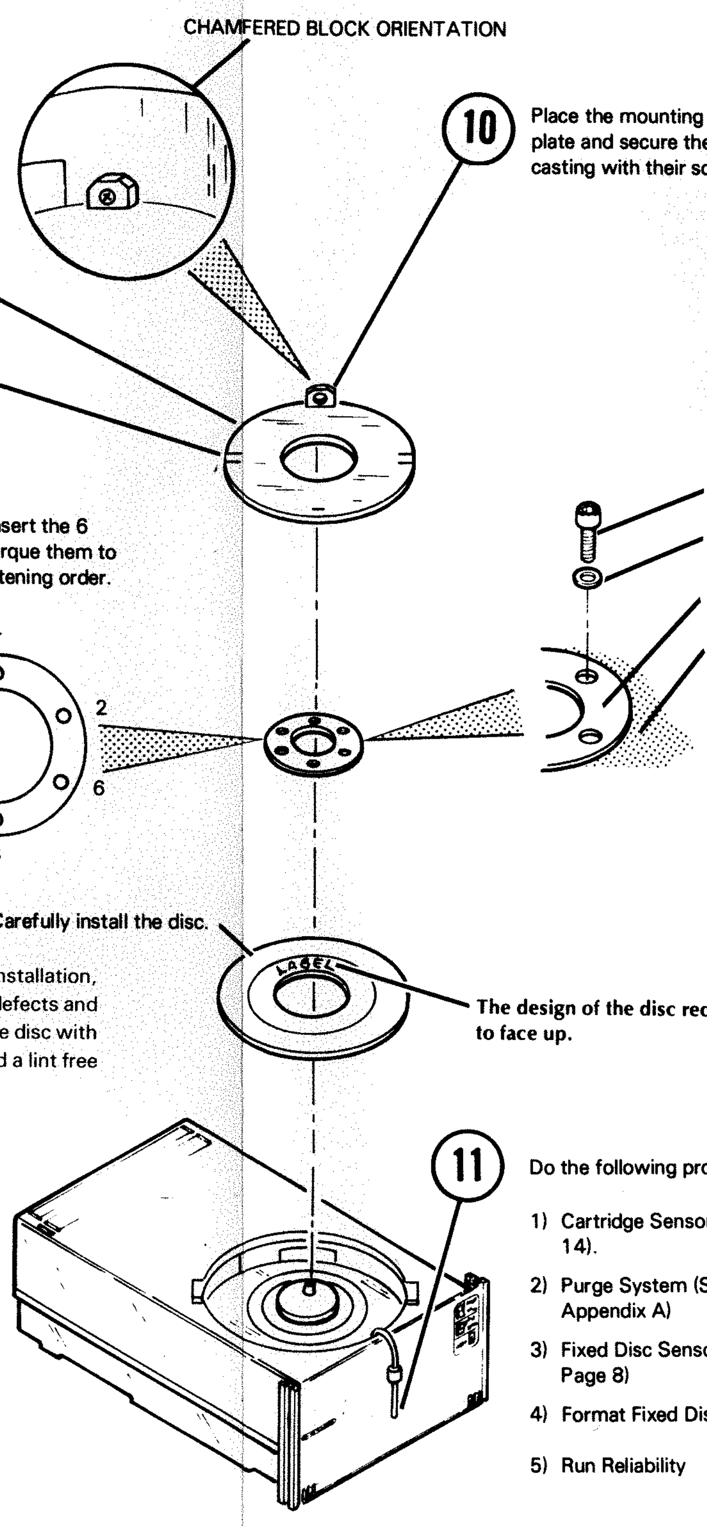
⑤ Remove the disc from the drive.

Removal of the fixed disc or heads disrupts all data and formatting on the fixed disc.

Nothing must touch or scratch the disc surface.

⑥ Carefully examine the disc chamber, heads, and the spindle hub for any foreign matter.

Clean the spindle and disc chamber with 91% isopropyl alcohol and a lint-free cloth. When replacing the disc because of a head crash, also replace the brushes. Clean the linear motor rails with a Q-tip and alcohol.



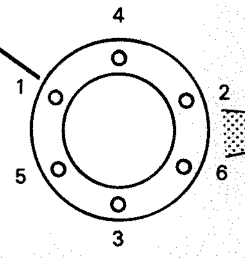
⑨ Install the baffle plate.

Three slots indicate the position of the baffle plate in the chamber.

Do not let the baffle plate touch or fall, onto the fixed disc.

⑩ Place the mounting blocks on the baffle plate and secure them to the side of the casting with their screws.

⑧ Install the ring clamp. Insert the 6 retaining screws and torque them to 10 in-lbs. Note the tightening order.



⑦ Carefully install the disc.

Note: Prior to installation, inspect the disc for defects and cleanliness. Clean the disc with isopropyl alcohol and a lint free cloth, if necessary.

The design of the disc requires the label to face up.

⑪ Do the following procedures:

1) Cartridge Sensor Alignment (See Page 14).
2) Purge System (See Purge System, Appendix A)
3) Fixed Disc Sensor Alignment (See Page 8)
4) Format Fixed Disk
5) Run Reliability

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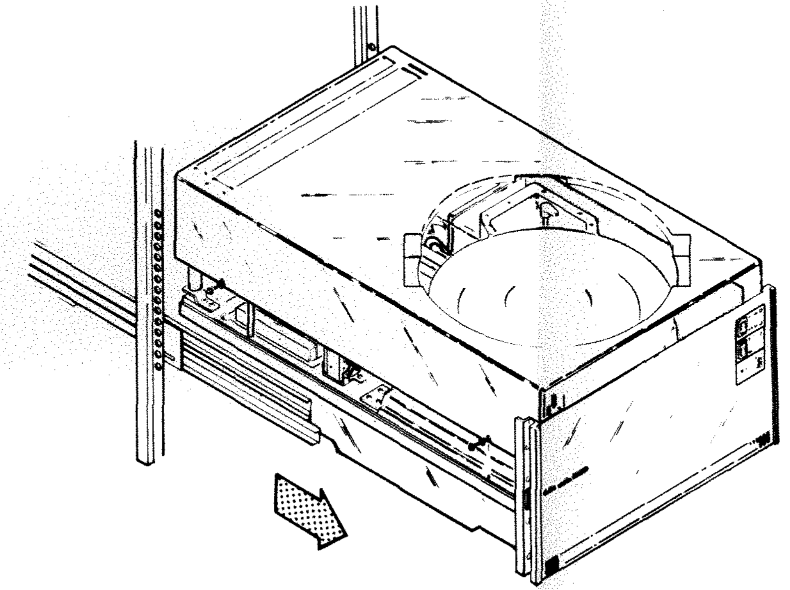
Fixed Disc Sensor Replacement

SPECIAL TOOLS & PARTS

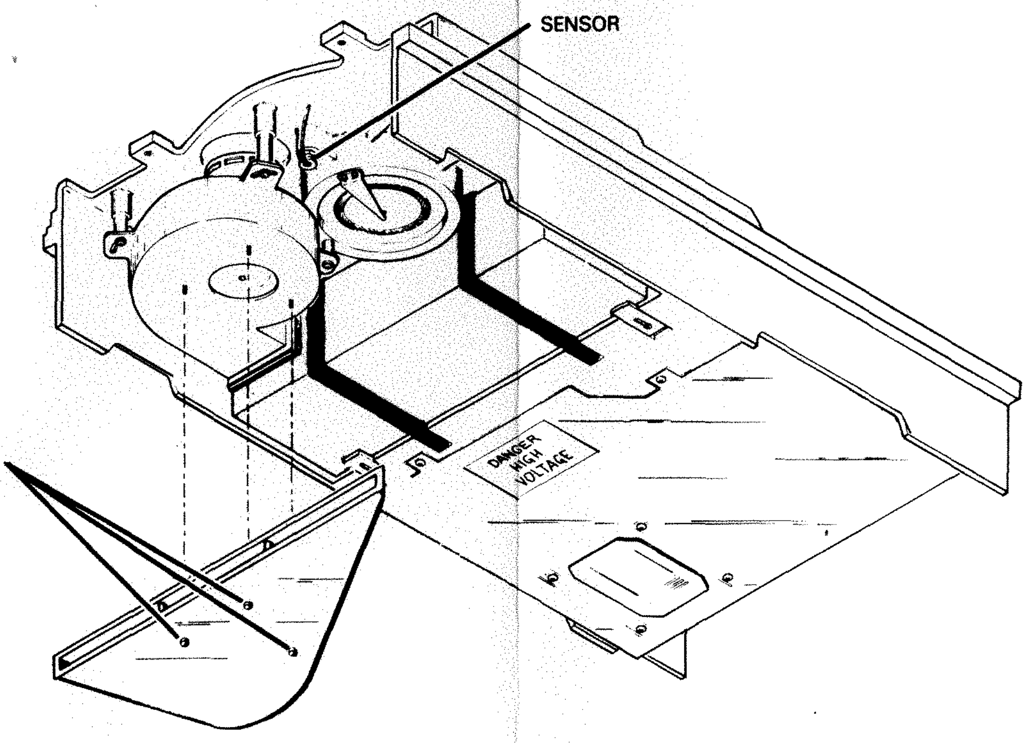
Fixed Disc Sensor
(005-006129)
Pin Removal Tool
(128-000052)
Adapter
(128-000059)

① Extend the drive fully and remove the top cover.

Proceed to the underside of the drive.

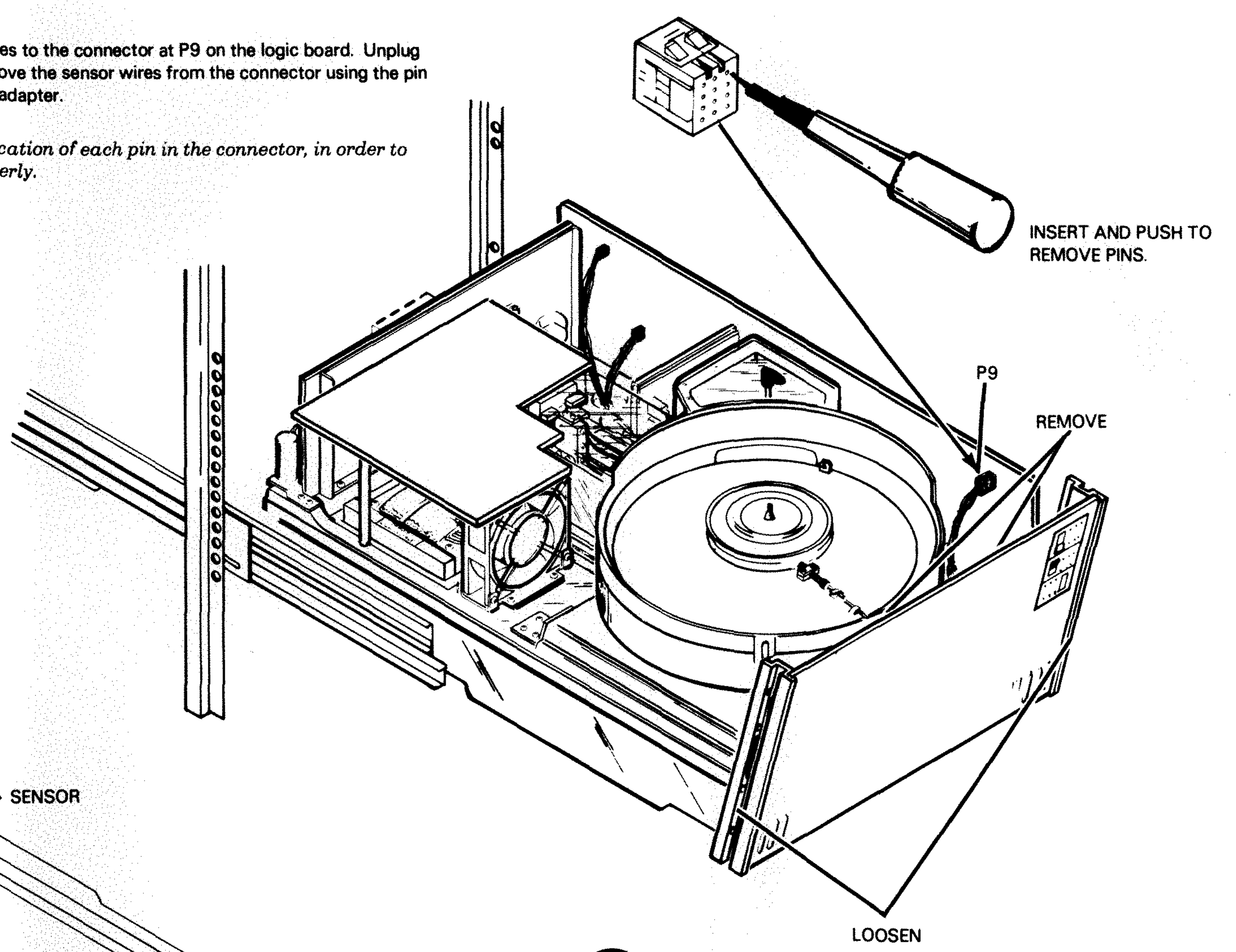


② Remove the air duct by unscrewing the three (captive) screws holding it to the blower.



③ Trace the sensor wires to the connector at P9 on the logic board. Unplug the connector. Remove the sensor wires from the connector using the pin removal tool and its adapter.

Note the proper location of each pin in the connector, in order to replace them properly.



④ Proceed to the front of the drive and remove the two top screws holding the front panel and loosen the two side screws. Tilt the panel forward.

This will allow easier access to the sensor wires.

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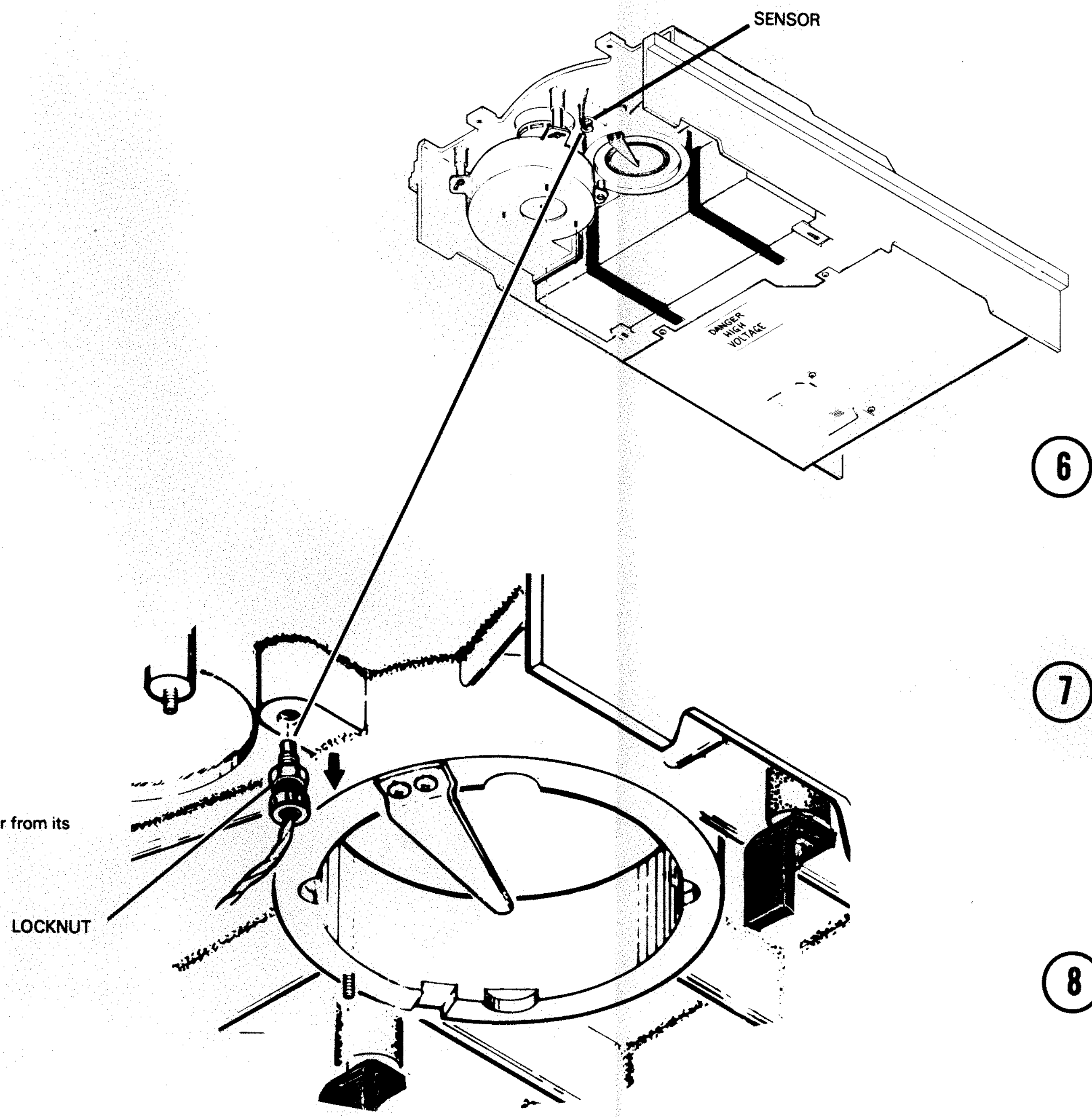
Fixed Disc Sensor Replacement (Cont.)



⑤ Loosen the locknut holding the sensor and unscrew the sensor from its socket.

⑥ Place the new sensor in its socket and run the wires back to the connector at P9. Insert the pins into their sockets and plug the connector into the logic board.

Make sure the pins go into their proper sockets.

⑦ Replace the two screws in the front panel and tighten all four screws.

Be sure to reconnect the ground wire.

⑧ Proceed to the Fixed Disc Sensor Alignment (page 8).

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Fixed Disc Sensor Alignment

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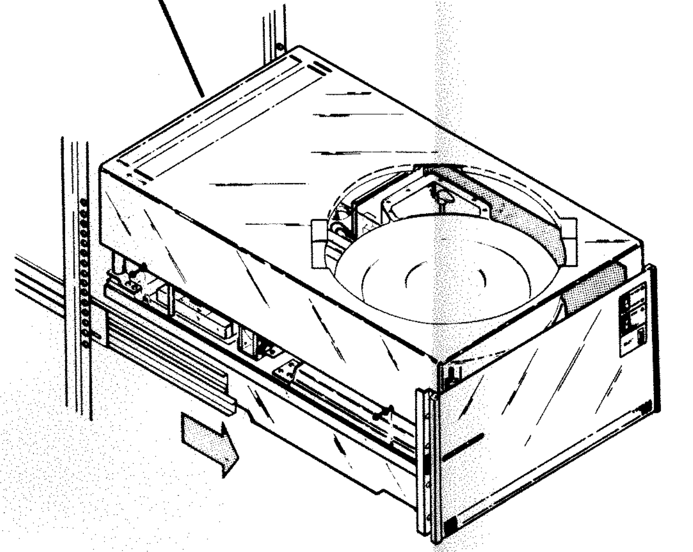
SPECIAL TOOLS & PARTS

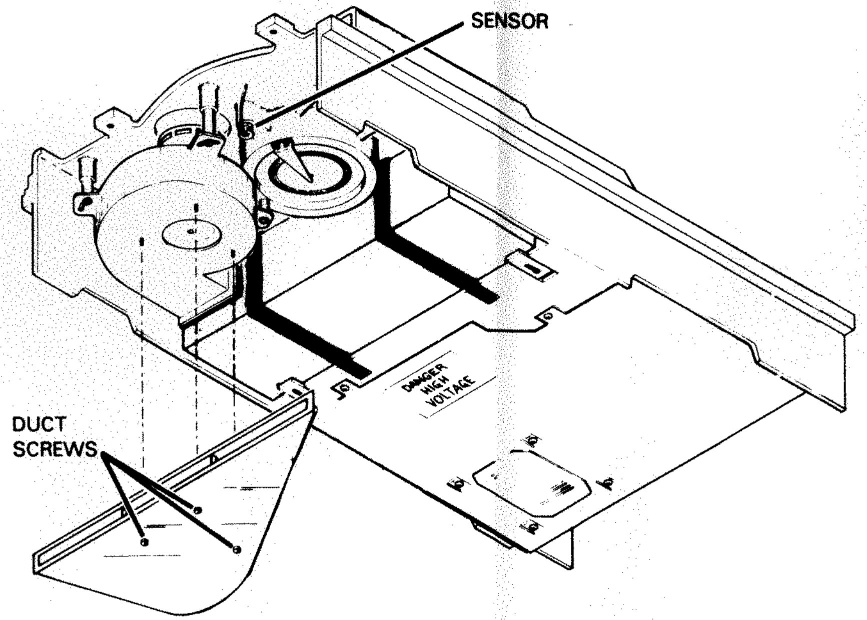
None

① Extend the drive fully and remove the top cover. Install a cartridge disc if one is not installed already.

Proceed to the underside of the drive.



② Remove the air duct by unscrewing the three (captive) screws holding it to the blower.

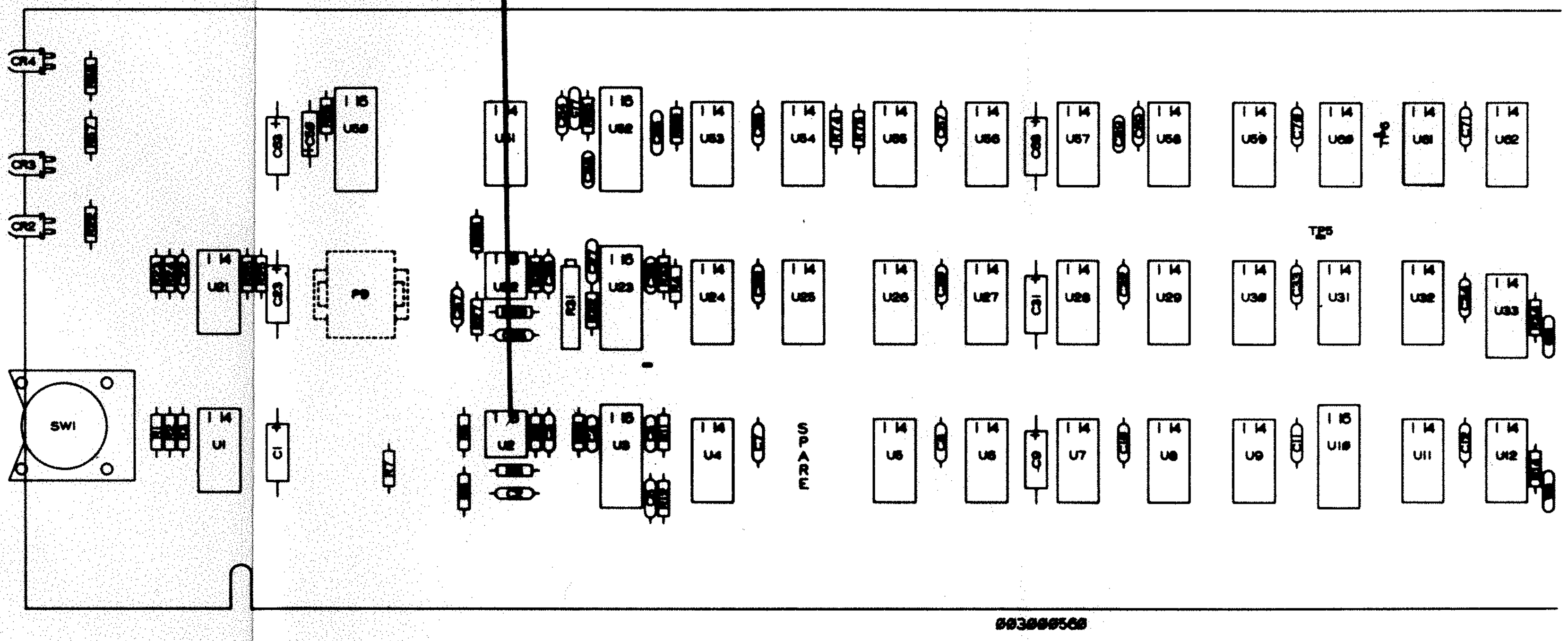

SENSOR
DUCT SCREWS
DANGER HIGH VOLTAGE

③ Connect Channel 1 of your scope to Pin 3 of U2 on the logic board.

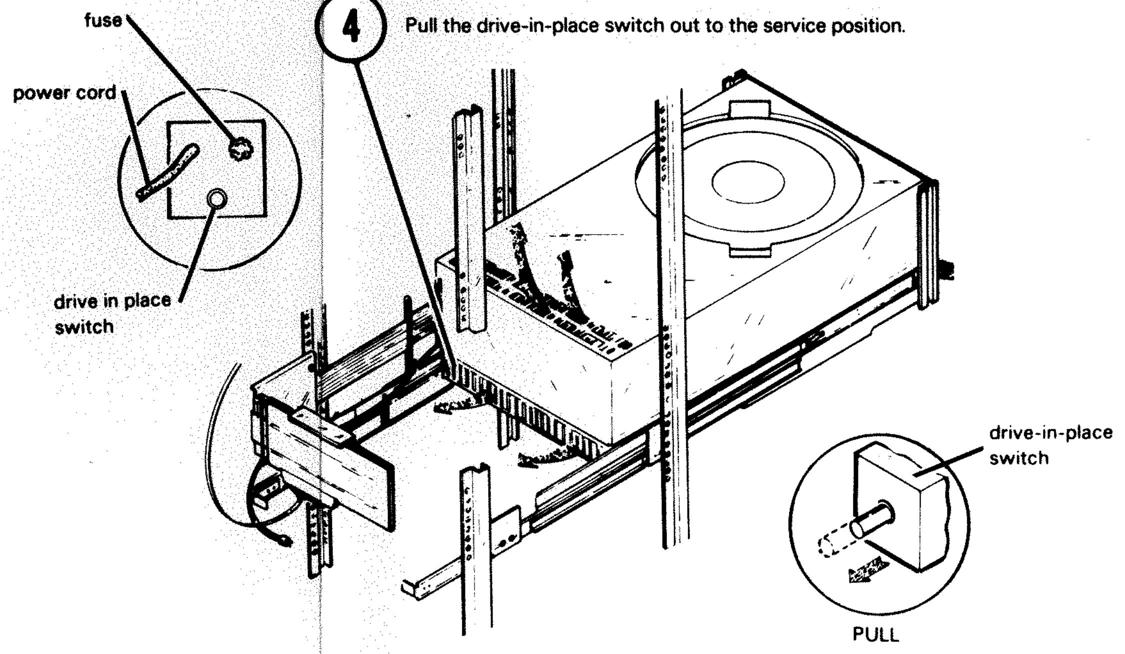
SCOPE SETUP

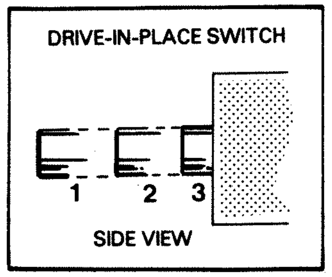
Channel 1	0.1v/div D.C.	Trigger Mode	Auto
Channel 2	N/A	Sync	N/A
Time Base	0.2ms/div	Coupling	N/A
Vert Mode	Channel 1	Source	N/A

N/A = Not Applicable


CR4
CR3
CR2
SW1
U1
U2
U3
U4
SPARE
U21
U23
U24
U25
U26
U27
U28
U29
U30
U31
U32
U33
U51
U52
U53
U54
U55
U56
U57
U58
U59
U60
U61
U62
003000568

④ Pull the drive-in-place switch out to the service position.


fuse
power cord
drive in place switch
drive-in-place switch
PULL


DRIVE-IN-PLACE SWITCH
1
2
3
SIDE VIEW

1) SERVICE POSITION
2) DRIVE OUT OF POSITION (HEADS WILL NOT LOAD)
3) NORMAL OPERATING POSITION

Fixed Disc Sensor Alignment (Cont.)

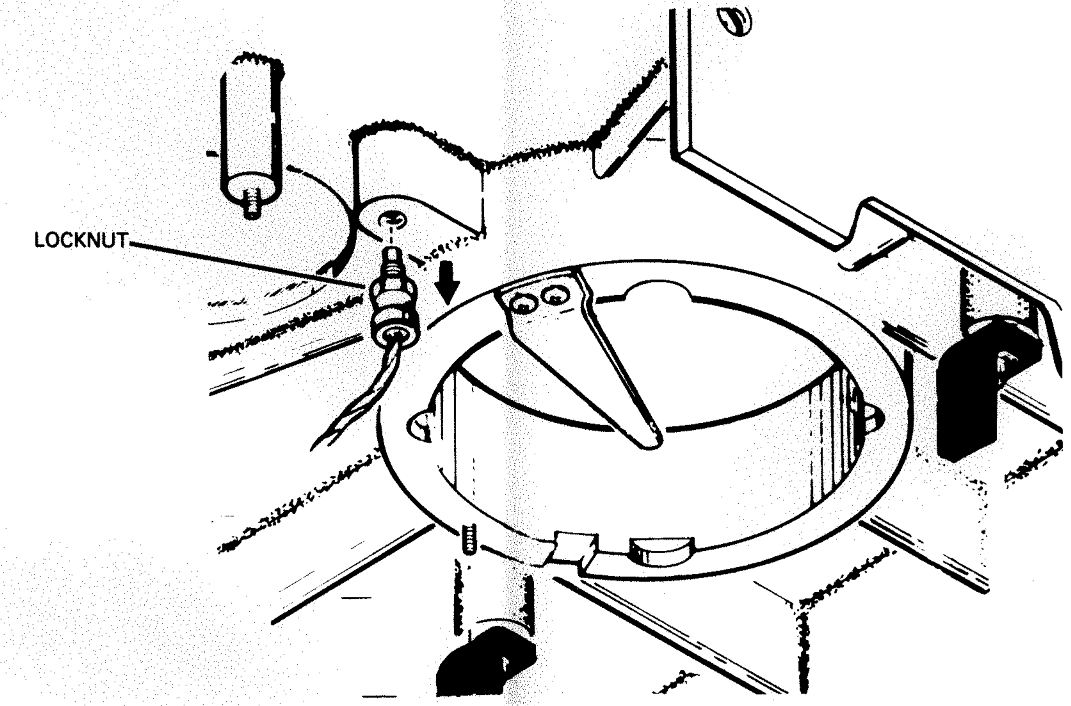
⑤ Set the servo enable/disable switch to disable. Power on the drive and set the load/ ready switch to ready.

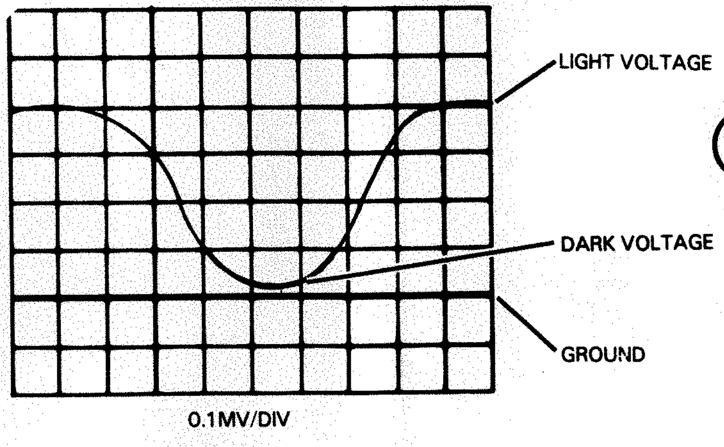
⑥ Loosen the locknut holding the sensor in place and rotate it so that the following specifications are met by the waveform shown below.

A) Light voltage is a minimum of 400 millivolts above ground.

B) Dark voltage is a maximum of 150 millivolts above ground.

Try to adjust for maximum light voltage and minimum dark voltage.

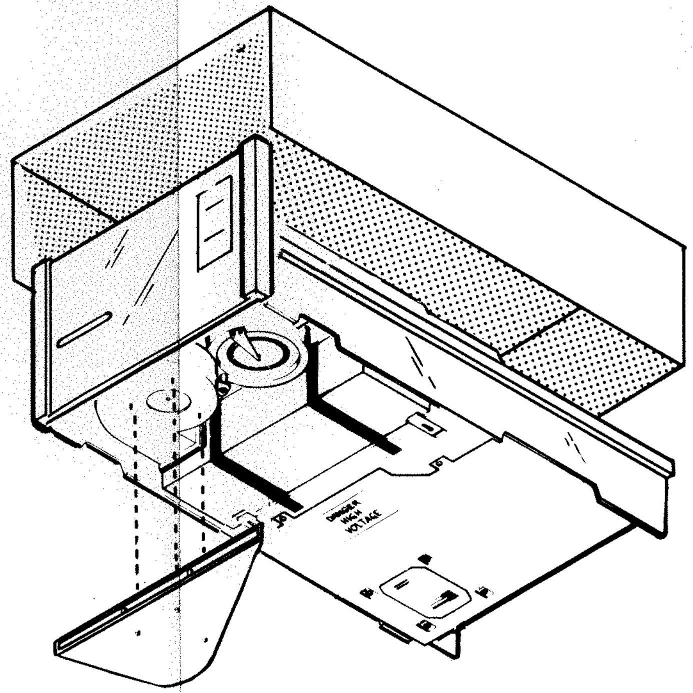




⑦ When the waveform meets specifications, tighten the locknut and recheck the waveform.

⑧ Set the load/ready switch to load and wait for the load light to come on. Set the servo enable/disable switch to enable and power down the drive.

⑨ Replace the air duct and the top cover.



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Spindle Replacement

SPECIAL TOOLS & PARTS

Spindle
(005-008920)

Torque Wrench (0-100 in-lbs.)
(128-001092)

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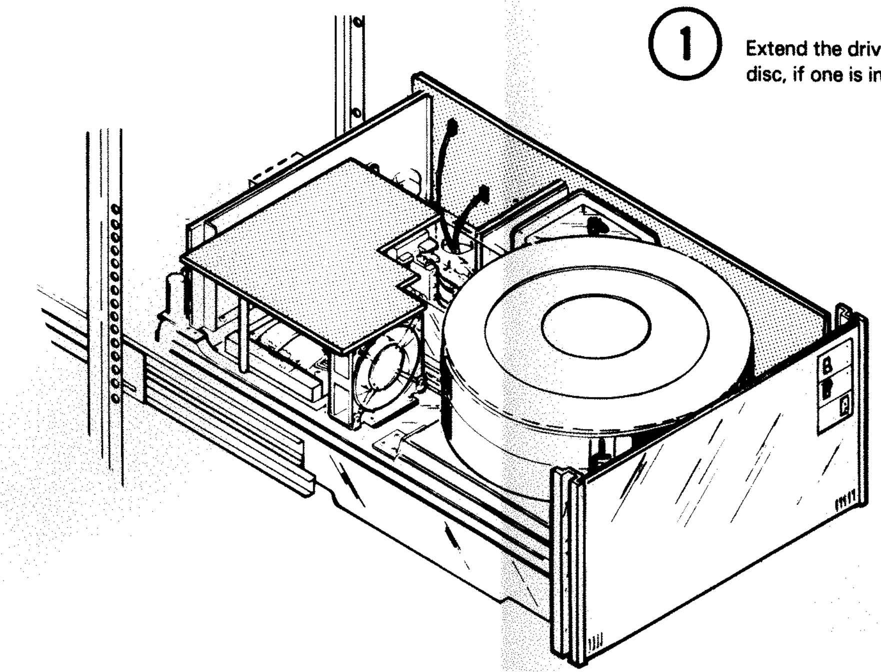
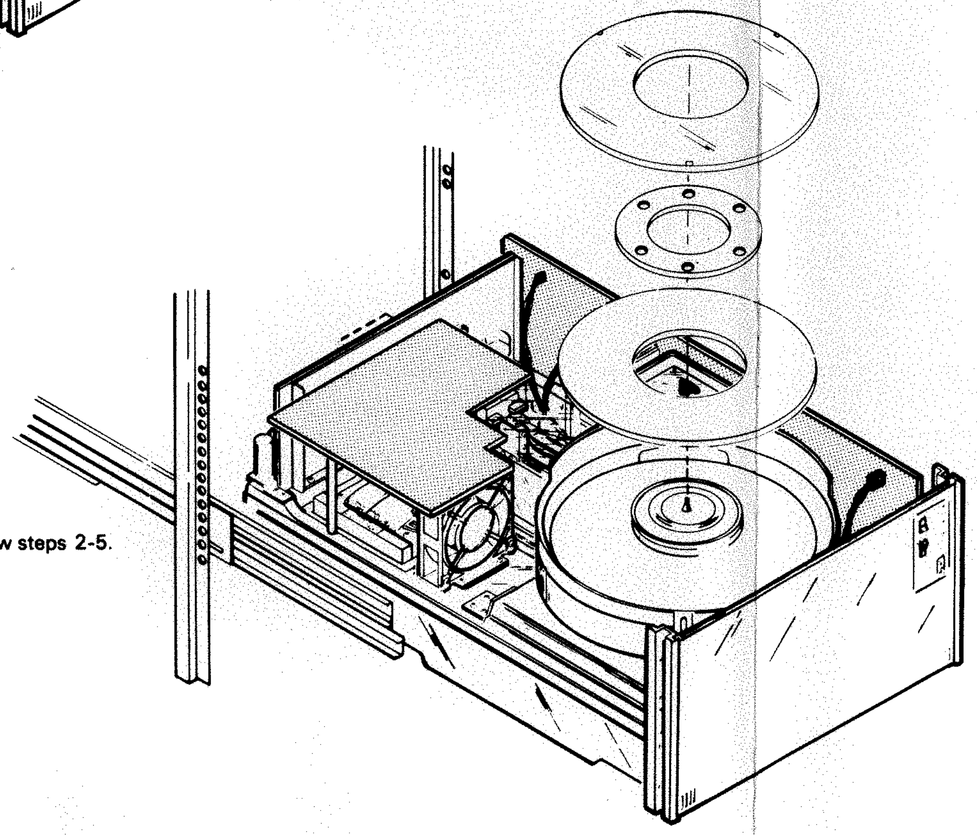
① Extend the drive fully and remove the top cover. Remove the cartridge disc, if one is installed.



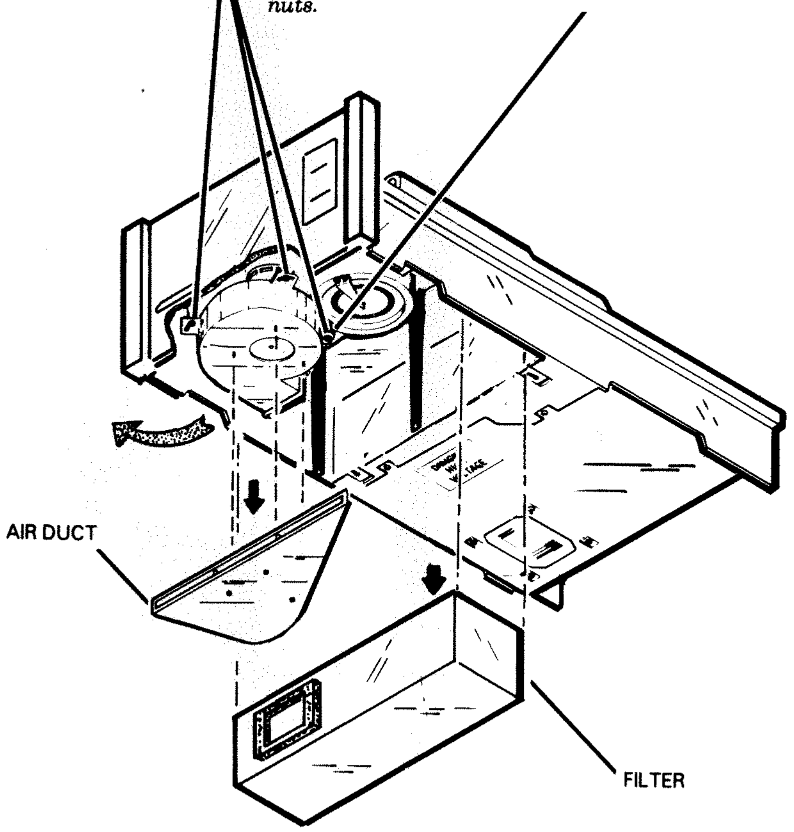


② Go to the Fixed Disc Replacement Procedure and follow steps 2-5.

③ Go to the Filter Replacement Procedure and follow steps 2-4.

④ Loosen the three screws holding the blower to the casting and ease the blower back into its operating position.

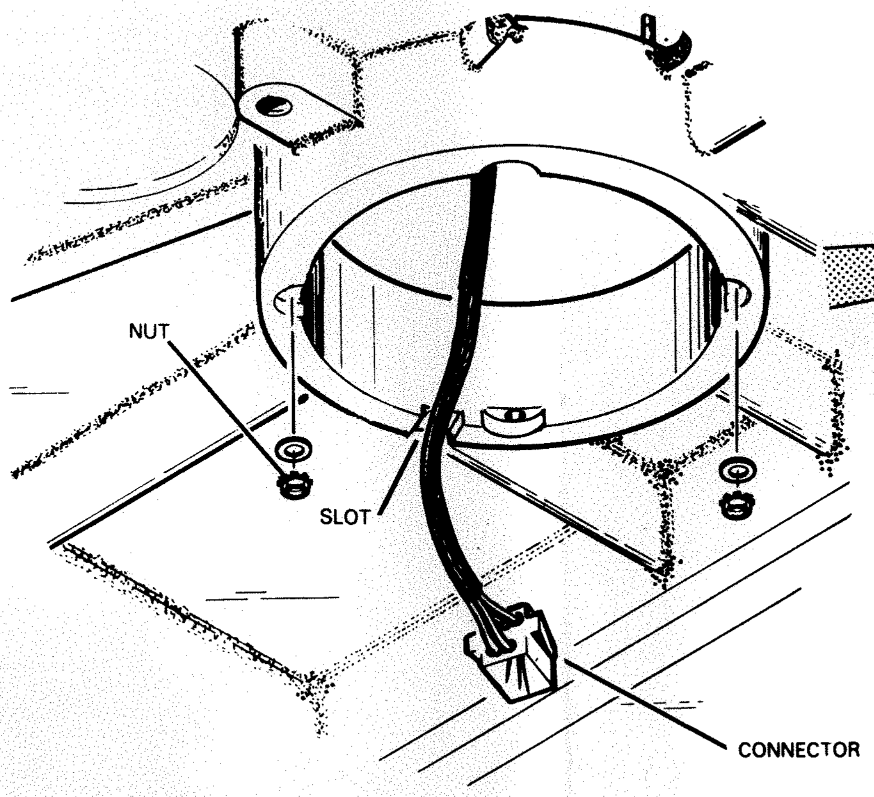
This screw should be removed, to allow easier access to one of the nuts.



Spindle Replacement (Cont.)

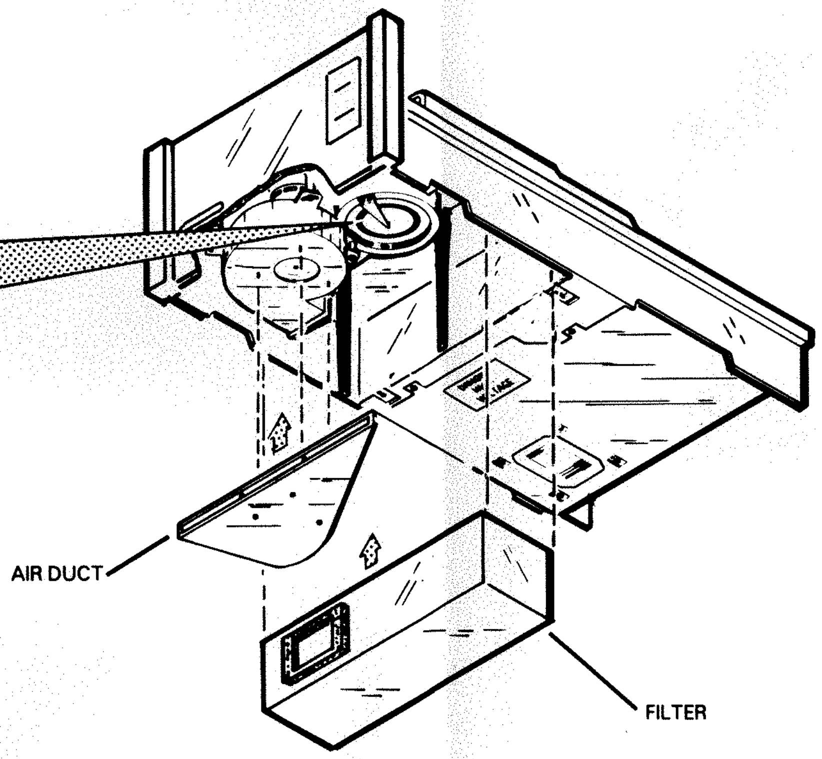
5 Remove the four nuts holding the spindle to the casting and unplug the connector. Lift the spindle out of the drive.

At this point, the stator may be changed. (See the Stator Replacement Procedure, page 12.)

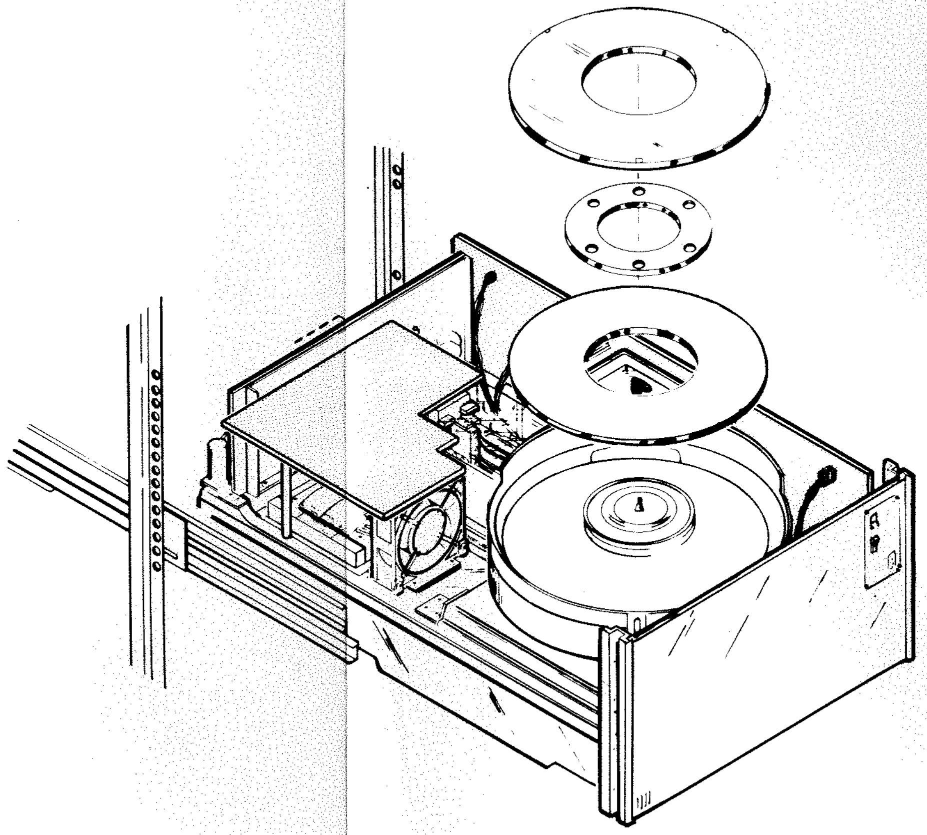


6 Place the new spindle in the disc cavity and align the stator cable with the slot in the casting. Torque the four nuts to 8 in-lbs and plug in the connector.

7 Rotate the blower and tighten the three screws so that the filter may be replaced.



8 Go to the Filter Replacement Procedure and follow steps 5-8.



9 Go to the Fixed Disc Replacement Procedure and follow steps 6-11.

Reliability does not have to be run.

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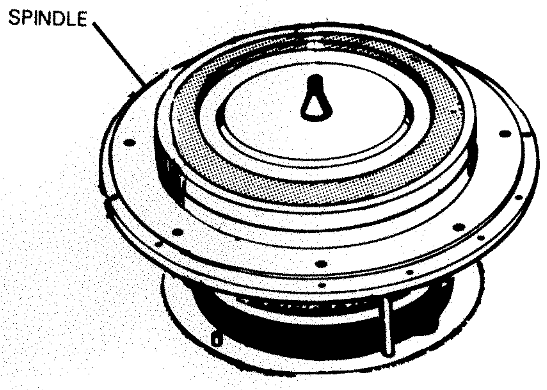
Stator Replacement

SPECIAL TOOLS & PARTS

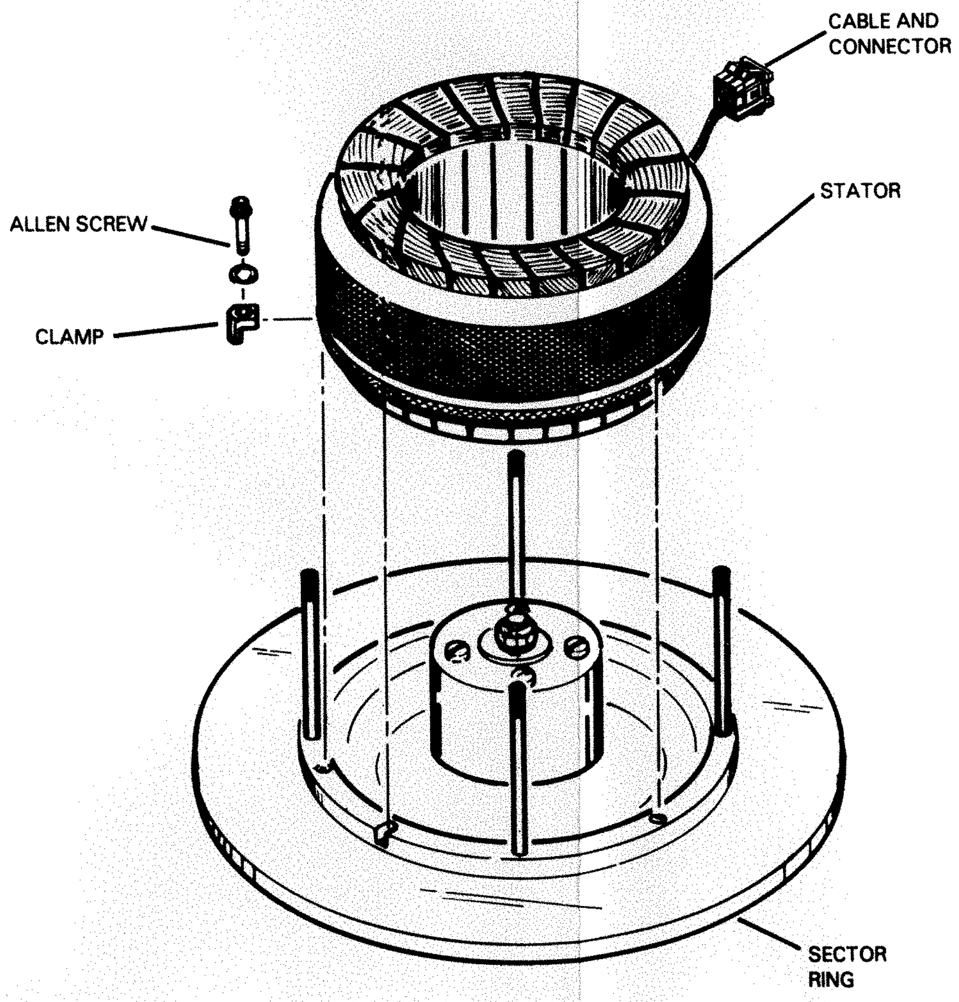
Stator
(118-000416)

Torque Wrench (0-100 in-lbs.)
(128-001092)

1. Go to the Spindle Replacement Procedure and follow steps 1-5.



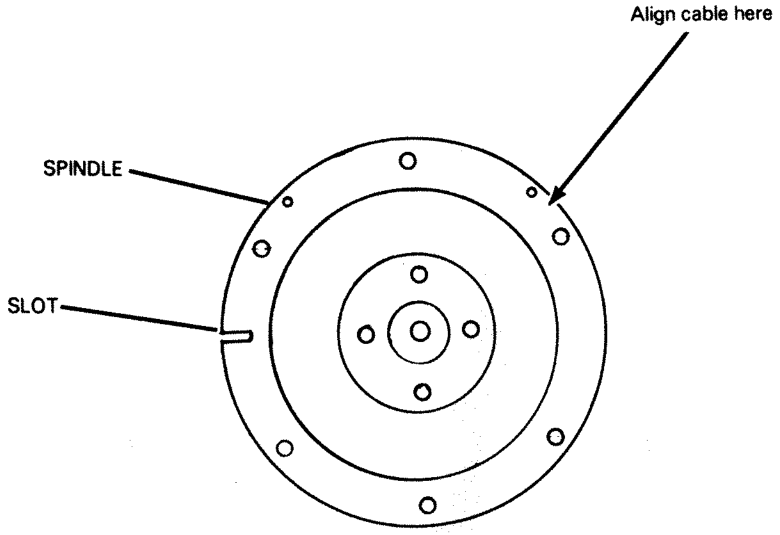
2. With the spindle free of the drive, unscrew the three Allenscrews holding the stator clamps.


CABLE AND CONNECTOR
STATOR
ALLEN SCREW
CLAMP
SECTOR RING

3. Remove the stator from the spindle.

Do not scratch sector ring.

4. Place the new stator on the spindle and align the cable as shown. Replace the three stator clamps and screws. Torque the screws to 6 in-lbs.


Align cable here
SPINDLE
SLOT

BOTTOM VIEW

5. Go to the Spindle Replacement Procedure and follow steps 6-9.

Cartridge Sensor Replacement

SPECIAL TOOLS & PARTS

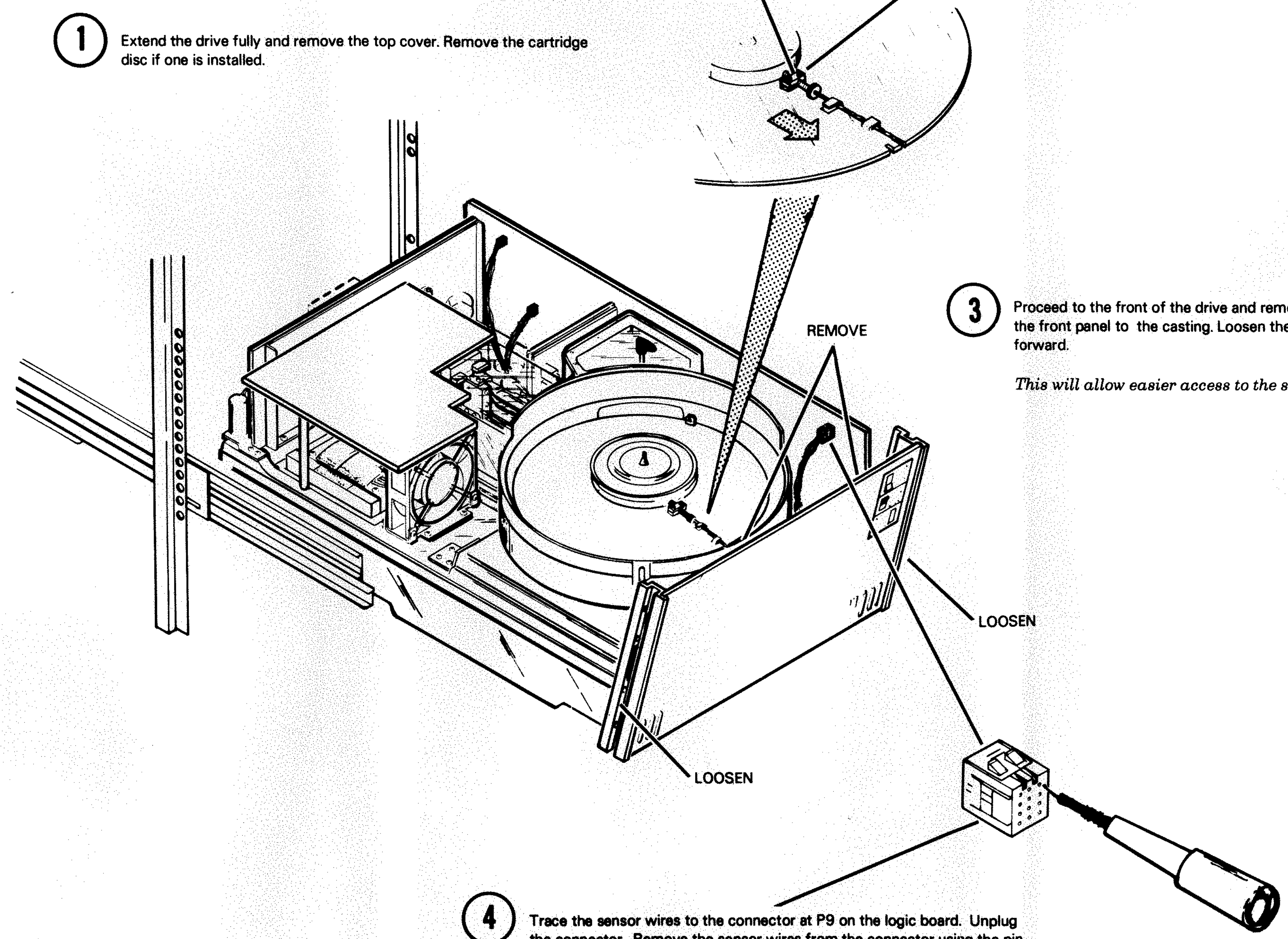
Cartridge Sensor
(005-006130)

Pin Removal Tool
(128-000052)

Adapter
(128-000059)

① Extend the drive fully and remove the top cover. Remove the cartridge disc if one is installed.

② Loosen the two Allen screws holding the sensor to the baffle plate and withdraw it from the harness.


Loosen the slit side of the sensor harness.
REMOVE
LOOSEN
LOOSEN
INSERT AND PUSH TO REMOVE PINS.

③ Proceed to the front of the drive and remove the two top screws holding the front panel to the casting. Loosen the two side screws. Tilt the panel forward.

This will allow easier access to the sensor wires.

④ Trace the sensor wires to the connector at P9 on the logic board. Unplug the connector. Remove the sensor wires from the connector using the pin removal tool and its adapter.

⑤ Remove the sensor from the disc cavity.

⑥ Put the new sensor in the disc cavity and run its wires back to the connector at P9. Insert the pins in their sockets and plug the connector into the logic board.

Make sure the pins go in their proper sockets.

⑦ Replace the two screws in the front panel and tighten all four screws.

Be sure to reconnect the ground wire.

⑧ Insert the sensor in its harness and proceed to the Cartridge Sensor Alignment. (See page 14.)

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Cartridge Sensor Alignment

SPECIAL TOOLS & PARTS

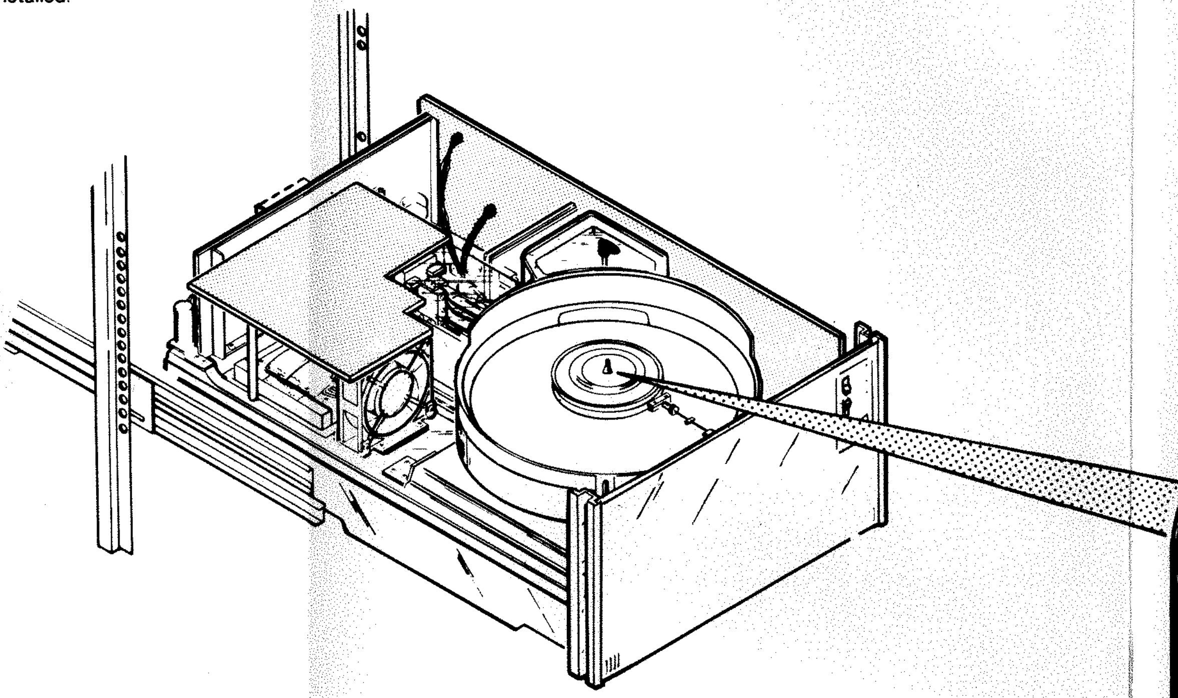
Sensor Gauge
(117-000436)

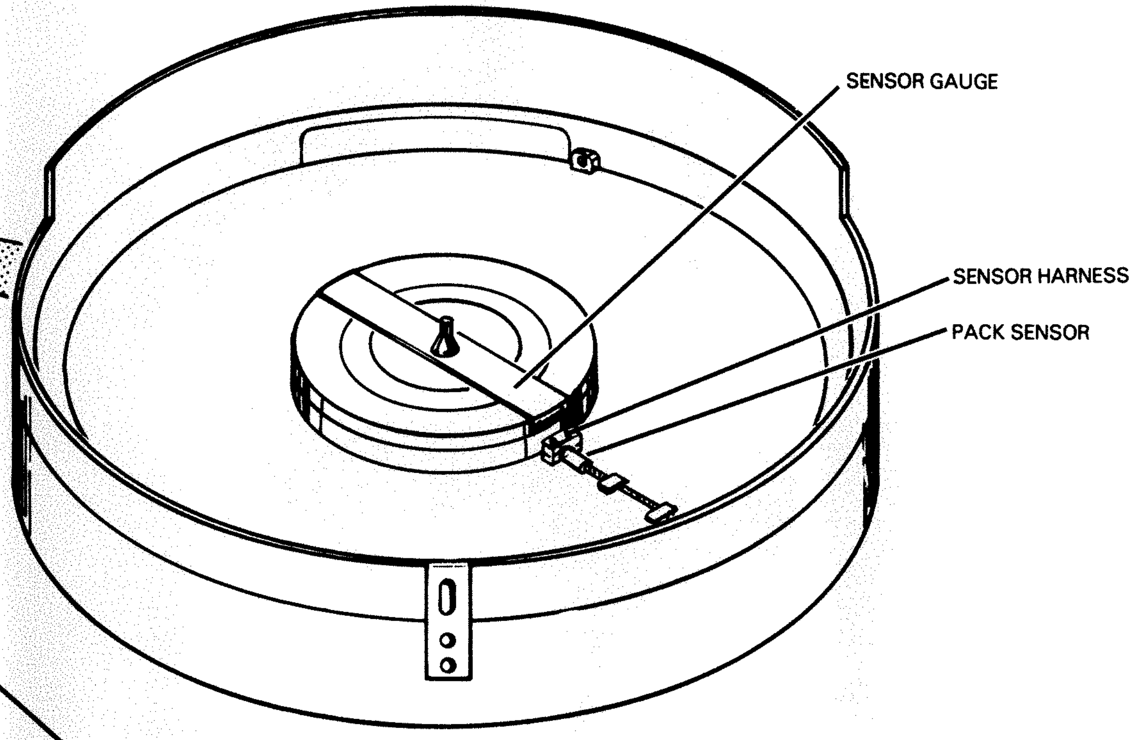
① Extend the drive fully out and remove the top cover. Remove the cartridge disc, if one is installed.

② Place the sensor gauge onto the spindle hub.

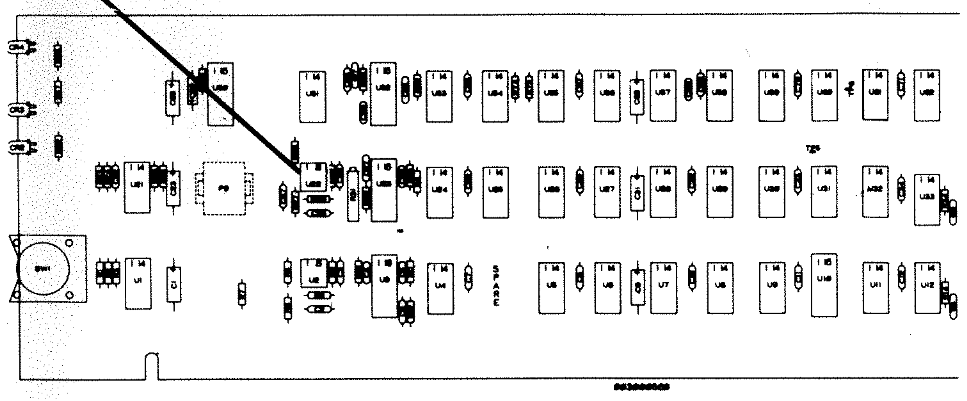
Loosen and slide back the sensor to avoid contact with the gauge.

③ With the gauge installed, rotate the spindle so that the end of the gauge is aligned with the sensor. Place a 0.025 in. +0.005 feeler gauge between the sensor gauge and the sensor and tighten the harness screws.





④ Carefully remove the sensor gauge. Connect a scope probe to U22 pin 3 on the logic board.



SCOPE SETUP

Channel 1	0.2 volts/div DC
Channel 2	N/A
Time Base	0.2 ms/div
Vert Mode	Channel 1
Trigger Mode	Auto
Sync	N/A
Coupling	N/A
Source	N/A

N/A = Not applicable

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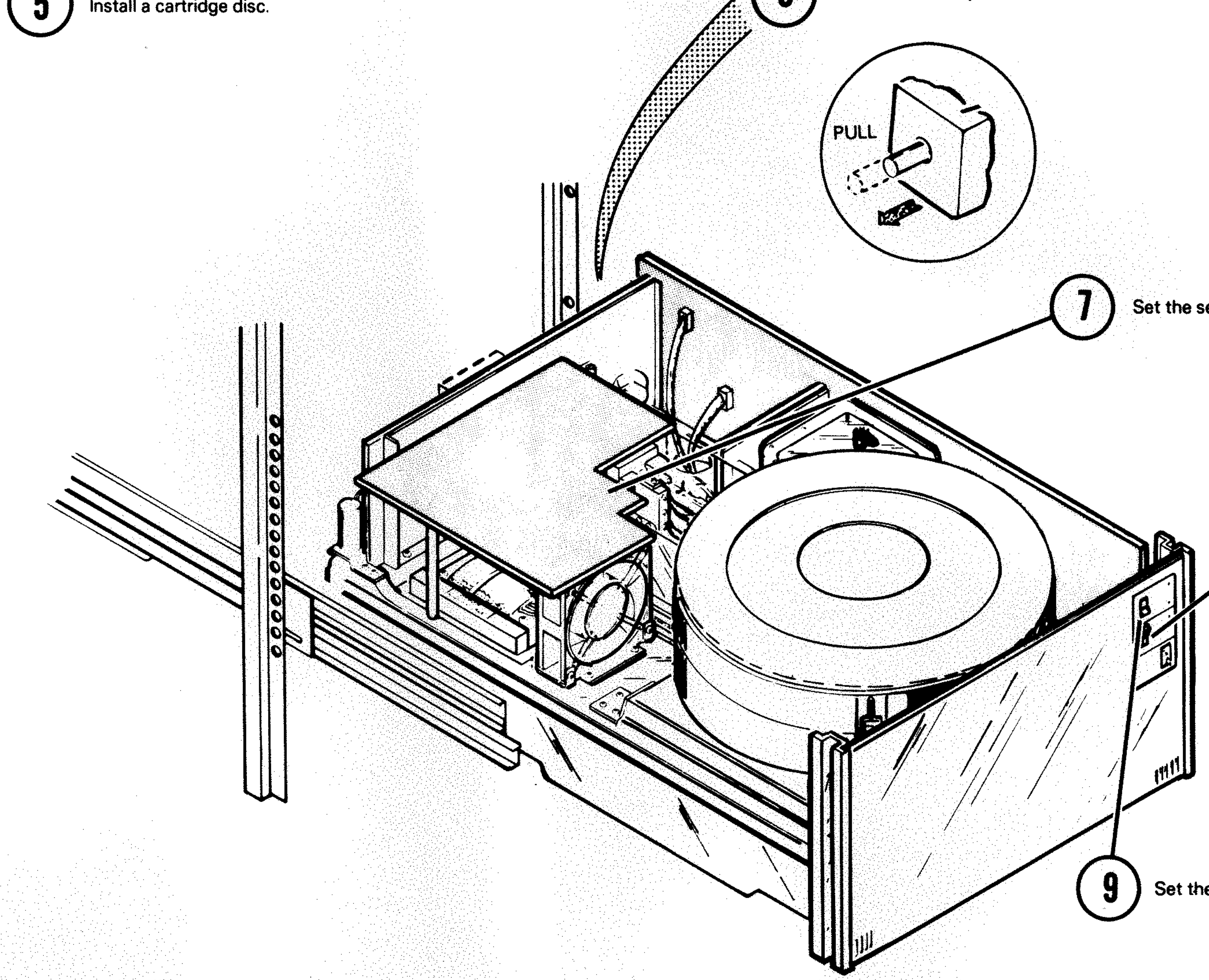
Cartridge Sensor Alignment (Cont.)

5 Install a cartridge disc.

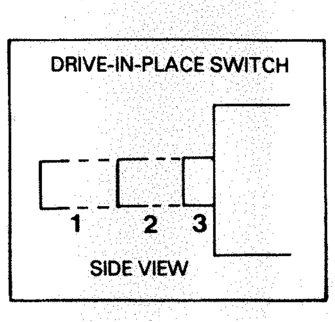
6 Pull the drive-in-place switch out to the service position.



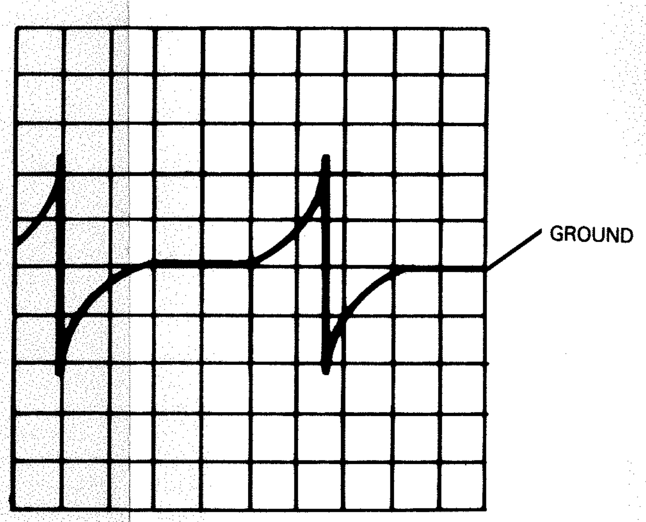
7 Set the servo enable/disable switch to disable.

8 Set the on/off switch to on.

9 Set the load/ready switch to ready.



1) SERVICE POSITION
2) DRIVE OUT OF POSITION
(HEADS WILL NOT LOAD)
3) NORMAL OPERATING POSITION



0.2 VOLTS/DIV

10 Check the waveform for a minimum output voltage of 150 millivolts above and below ground.

If voltage does not meet specifications, power down the drive and realign the sensor.

When the sensor is aligned, power down the drive and set the servo enable/disable switch to enable.

11 Remove the cartridge disc.

12 Go to the Upper Head Alignment procedure (page 21) and follow steps 5-8, 10-11, 18-23 and 26.

Head Cleaning

The following paragraphs define the types of contamination and head-to-disc interference that may adversely affect the read/write heads.

During normal read/write operations the disc surfaces may become slightly scratched. This type of scratch looks similar to a "polishing" scratch and is insignificant as long as data can be properly recovered. However, there are types of head-to-disc interference which can cause significant damage to the read/write heads, fixed disc, and cartridge disc. Some of the most common are: particles of dirt or dust, oxide or residue buildup.

Dirt and dust particle damage occurs when foreign material becomes wedged between the "flying" read/write head and the spinning disc. The particle could become embedded in the disc surface or in the ceramic of the read/write head and leave a deep groove at the point of entry. If it remains embedded in the read/write head, it will eventually destroy the disc surface. If it is not detected during preventive maintenance procedures, the particle may eventually become dislodged and damage another head and/or disc surface.

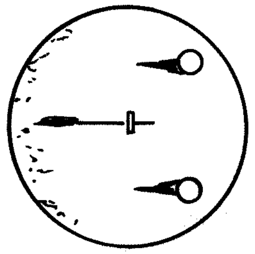
Either residue or oxide buildup may occur on a disc surface or a read/write head. Residue buildup is usually the result of contaminants that are introduced onto a read/write head or a disc surface. These contaminants are usually alcohol residues which remain after the cleaning process. Fingerprints, which contain oils and salts, and smoke in the atmosphere can also promote residue buildup. Oxide may be picked up by a read/write head from a dirty disc surface. When the amount of oxide exceeds a set point on the read/write head, it begins to rub on the disc surface and accumulate more oxide.

If residue or oxide buildup is not detected, the result may be a useless head or a damaged disc surface.

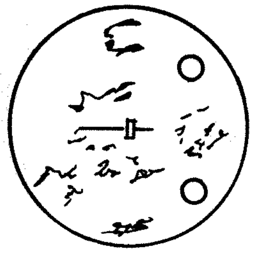
An early indication of head-to-disc interference is an excessive number of intermittent read errors. Therefore, the importance of preventive maintenance cannot be overemphasized. The head should be cleaned at six month intervals.

During the preventive maintenance procedures the read/write heads should be inspected for the following conditions:

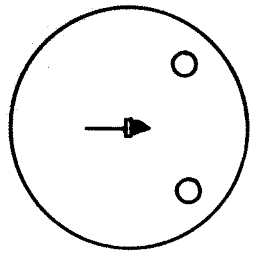
- Scratches and grooves
- Fingerprints and other oily stains
- Oxide buildup
- Residue buildup



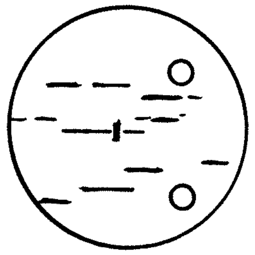
Slight oxide buildup.
Head should be cleaned
and used.



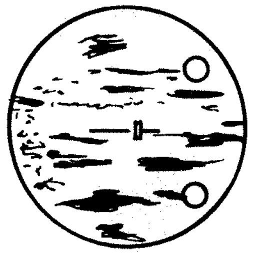
Alcohol residue.
Head must be cleaned.



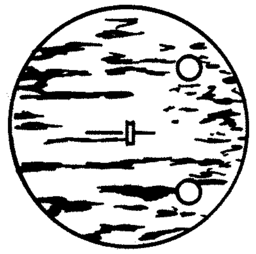
Oxide buildup in
pole piece. Head
must be replaced.



Slight scratches.
No oxide buildup.
Clean the head.



Oxide buildup due
to scratches. Head
must be replaced.

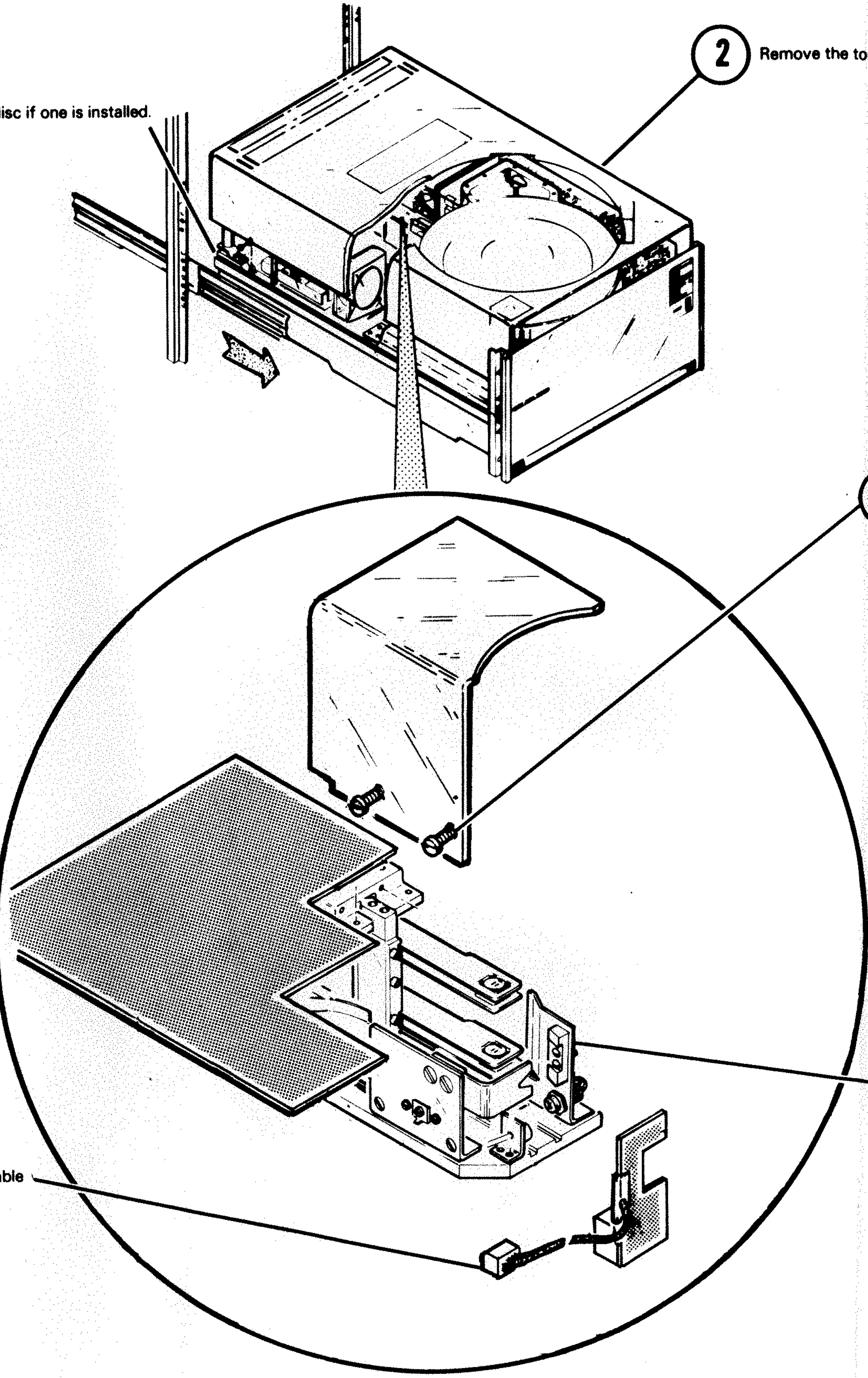


Crashed (usually
burned). Head must
be replaced.

Head Cleaning (Cont.)

SPECIAL TOOLS & PARTS

NONE



① Extend the drive fully.
Remove the cartridge disc if one is installed.

② Remove the top cover.

③ Unplug the thermistor cable from the servo board.

④ Unscrew the two screws holding the head shield.

To remove shield from drive, lift and rotate clockwise.

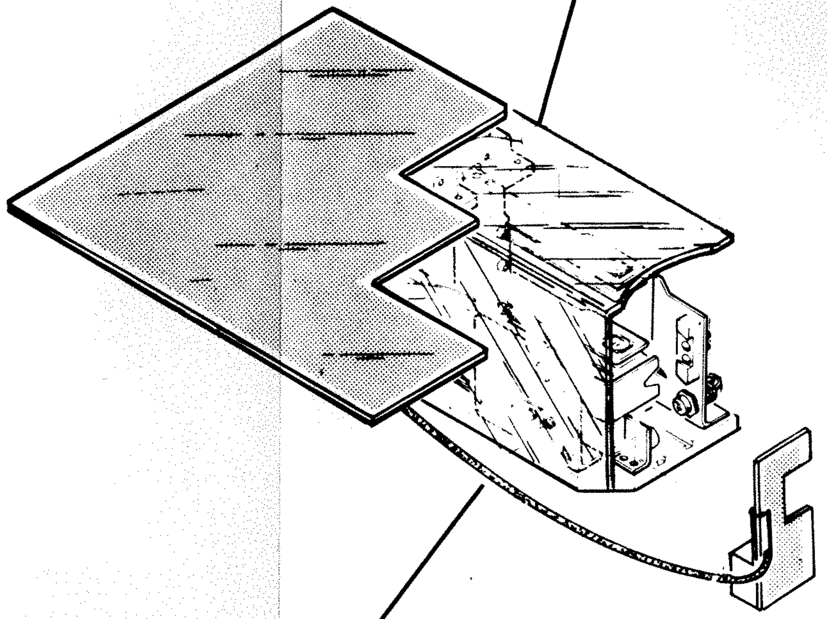
⑤ Use a lint-free cloth soaked in 91% isopropyl alcohol to clean the heads, and a dry lint-free cloth to remove the residue.

Approach the upper heads from the disc cavity area. Approach the lower head from the side.

Use a small dental mirror to inspect the downward facing heads.

Damage to the disc surface may occur if the heads move out of the detent position.

No fingerprints or lint should be left on the heads.



⑥ Replace and secure shield.

⑦ Reconnect the thermistor cable.

⑧ Replace the top cover of the drive.

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Head Replacement

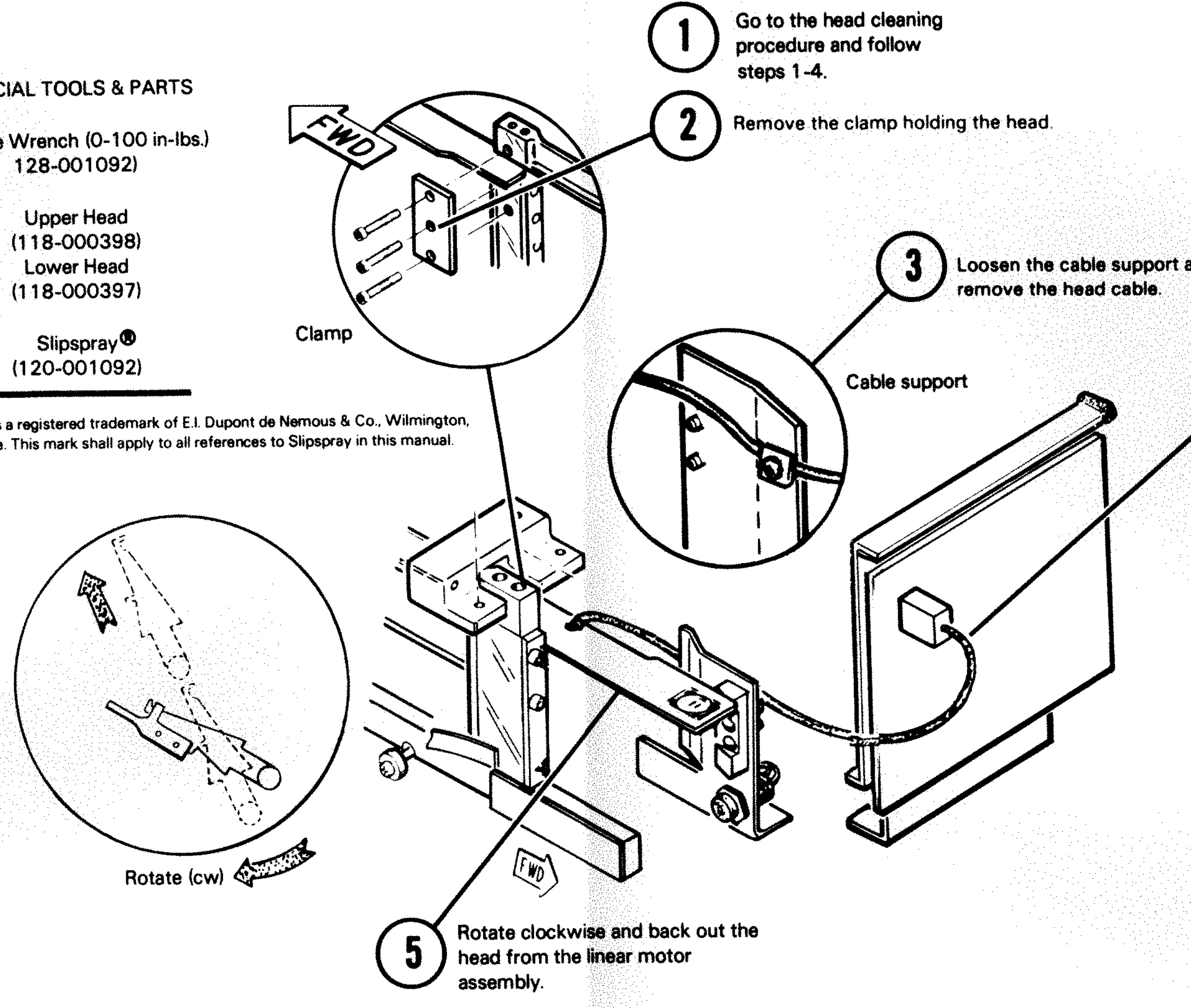
SPECIAL TOOLS & PARTS

Torque Wrench (0-100 in-lbs.)
128-001092)

Upper Head
(118-000398)
Lower Head
(118-000397)

Slipspray®
(120-001092)

Slipspray is a registered trademark of E.I. Dupont de Nemous & Co., Wilmington, Delaware. This mark shall apply to all references to Slipspray in this manual.



① Go to the head cleaning procedure and follow steps 1-4.

② Remove the clamp holding the head.

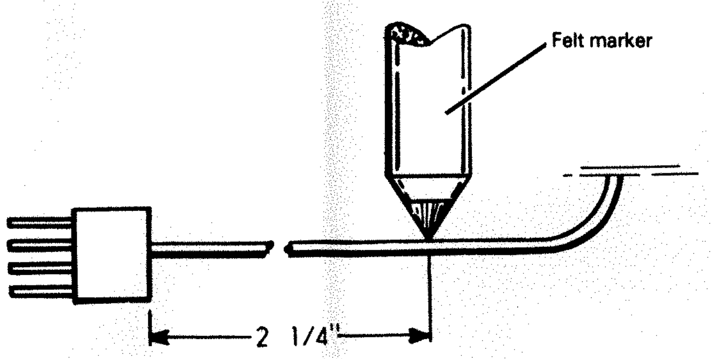
③ Loosen the cable support and remove the head cable.

④ Unplug the head cable from the read/write board.

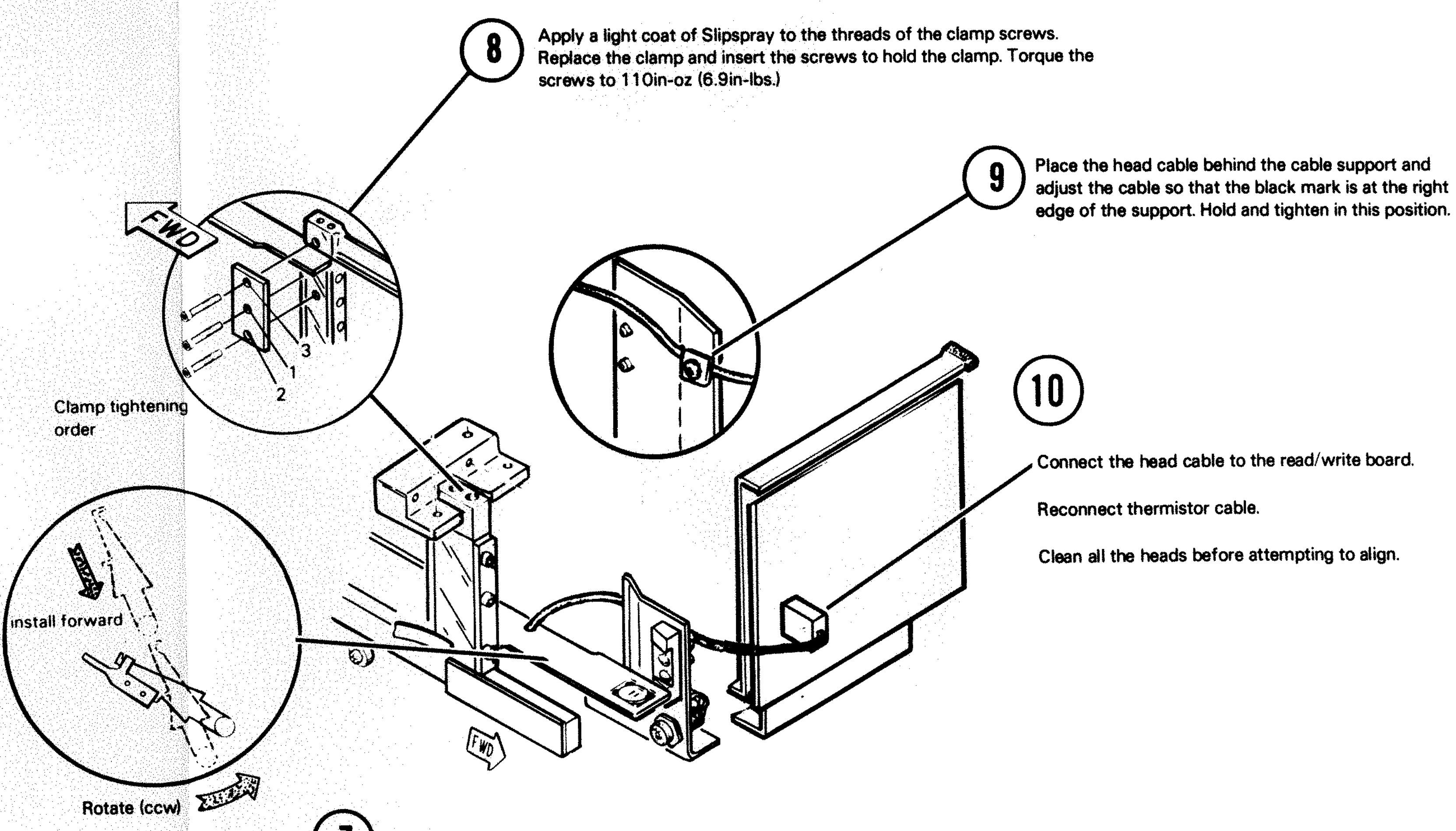
⑤ Rotate clockwise and back out the head from the linear motor assembly.

Damage to the head will occur if two heads touch.

Removal of the heads disrupts all data and formatting on the disc.



⑥ Starting at the read/write board connector, measure 2 1/4 inches along the new head cable. Mark this point with a felt marker.



⑦ Install the new head by rotating it counter-clockwise into position.

Damage will occur if the new head touches any other head.
Hold the head such that it does not float while securing it against the carriage.
Place the front of the head onto the ramp loader.

CAUTION: **Hold the head so that it does not float while securing it against the carriage.**

⑧ Apply a light coat of Slipspray to the threads of the clamp screws. Replace the clamp and insert the screws to hold the clamp. Torque the screws to 110in-oz (6.9in-lbs.)

⑨ Place the head cable behind the cable support and adjust the cable so that the black mark is at the right edge of the support. Hold and tighten in this position.

⑩ Connect the head cable to the read/write board.

Reconnect thermistor cable.

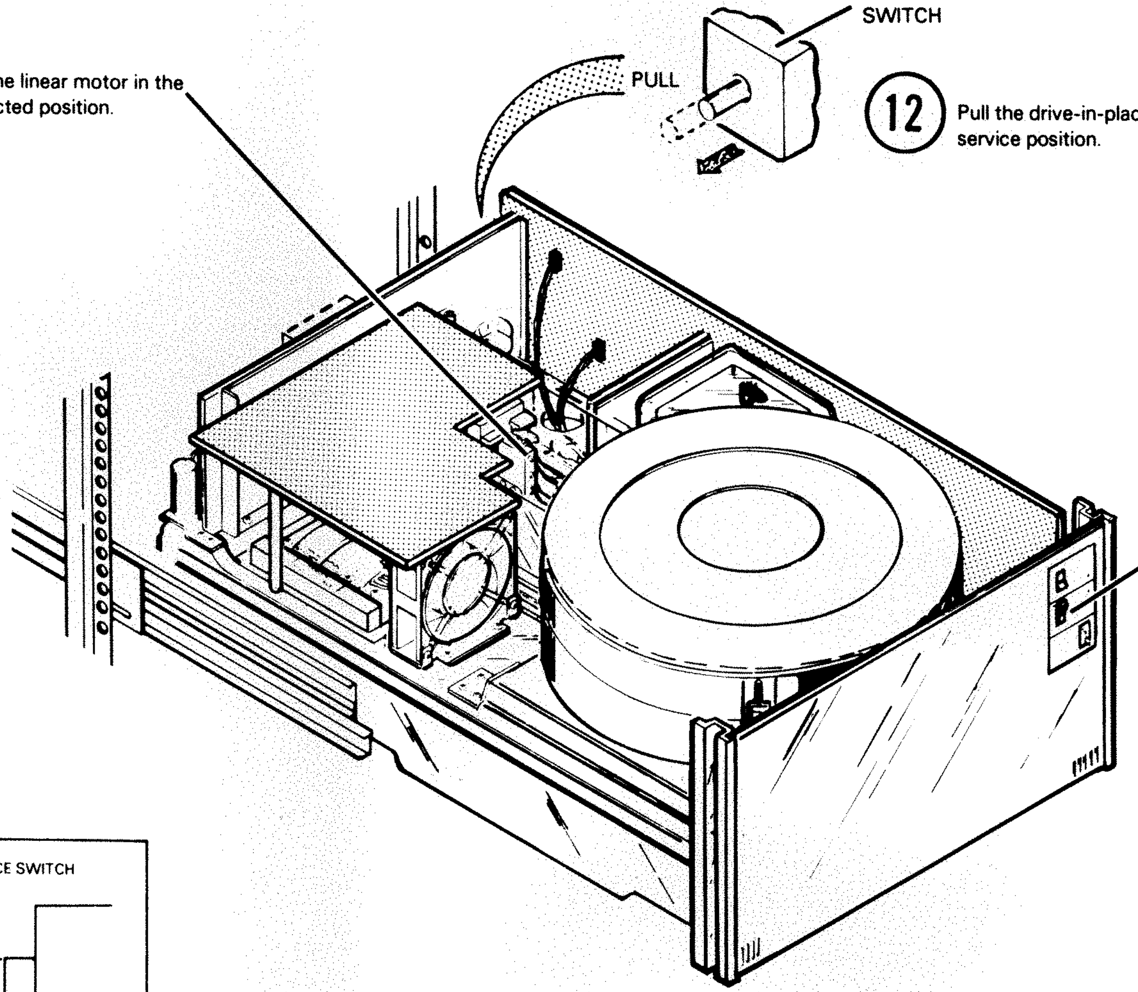
Clean all the heads before attempting to align.

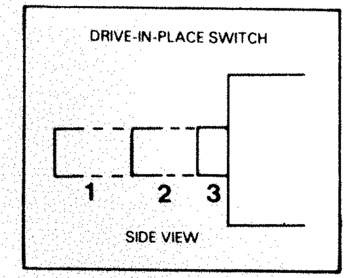
Head Replacement (Cont.)

(11) Position the linear motor in the fully retracted position.

(12) Pull the drive-in-place switch out to the service position.

(13) Set the on/off switch to on.

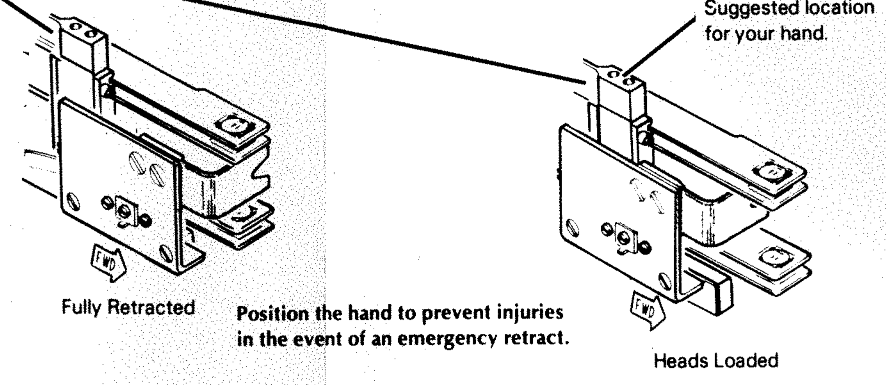

DRIVE-IN-PLACE SWITCH
PULL


DRIVE-IN-PLACE SWITCH
1
2
3
SIDE VIEW

1) SERVICE POSITION
2) DRIVE OUT OF POSITION (HEADS WILL NOT LOAD)
3) NORMAL OPERATING POSITION

(14) Install a cartridge disc, switch the load/ready switch to ready.

(15) After the heads load, set the servo/enable/disable switch to disable.


Suggested location for your hand.
Fully Retracted
Heads Loaded

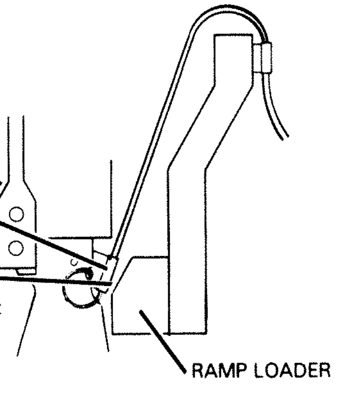
Position the hand to prevent injuries in the event of an emergency retract.

(16) Move the carriage forward until it hits the front stop.

(17) Check the clearance between the head cable restraint and the ramp loader with a feeler gauge. It should be a min. of 0.030 inches.

If less than this tolerance is seen, unload the heads and bend the restraint in the direction that will increase the clearance.

Recheck the clearance.


HEAD CABLE RESTRAINT
RAMP LOADER

(18) Set the enable/disable switch to enable.

Heads will detent to track zero.

(19) Set the load/ready switch to load and wait for the load light to come on.

Wait at least 2 sec. after the load light has come on before removing the cartridge.

Power off the drive.

(20) Proceed to the Head Alignment procedures. There is a separate procedure for the upper heads and a separate procedure for the lower heads.

Lower Head Alignment

SPECIAL TOOLS & PARTS

Wire Gauge
(128-001086)

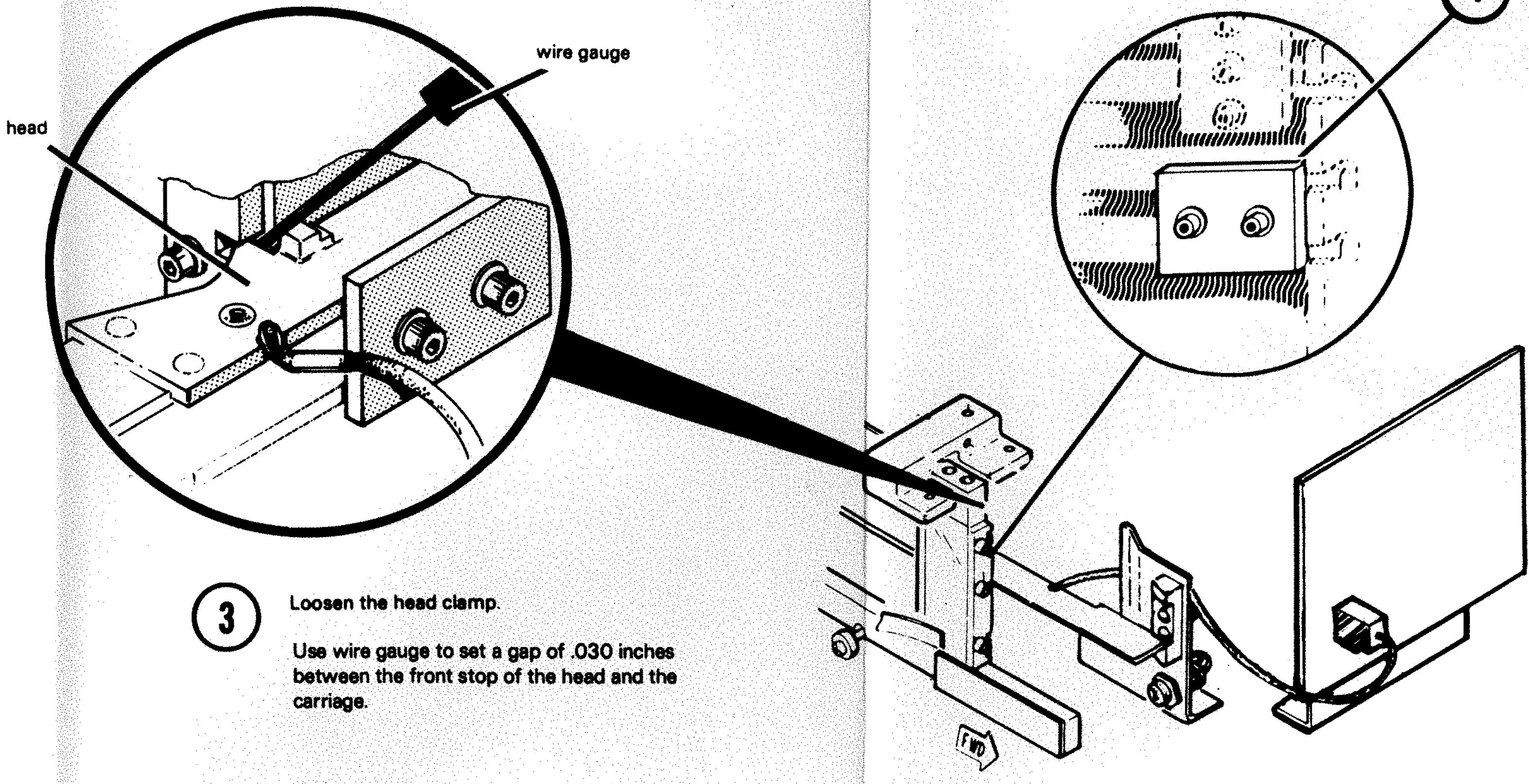
Torque Wrench (0-100 in-oz.)
(128-001092)

Slipspray
(120-000156)

Ball Head Allen Wrench
(128-001083)

① Go to the head cleaning procedure (page 17) and follow steps 1-5.

② Unscrew the two screws holding the lower head clamp and apply a light coat of Slipspray to the screwthreads to prevent binding. Replace the screws.



③ Loosen the head clamp.

Use wire gauge to set a gap of .030 inches between the front stop of the head and the carriage.

④ Use the torque wrench to torque the head clamp to 110 in-oz. (6.9 in.lbs.) Torquing the lower head clamp may be difficult, due to the unusual angle provided by the hole in the logic board. To insure proper torquing use a ball head Allen wrench or remove the logic board for easier access (See Logic Board Removal, Page 38).

⑤ Go to the Head Cleaning procedure and do steps 6-8.

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Upper Head Alignment

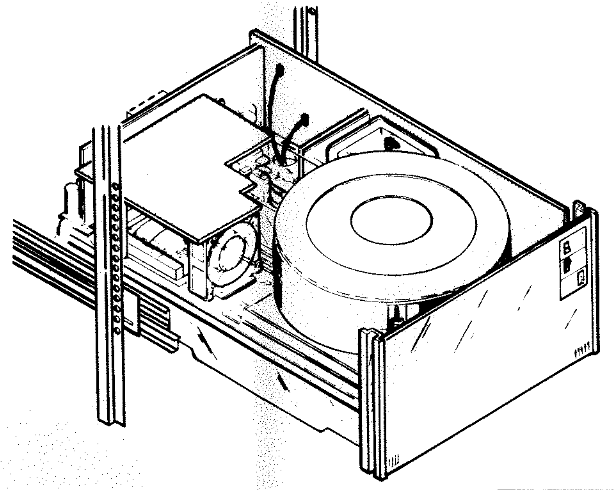
SPECIAL TOOLS & PARTS

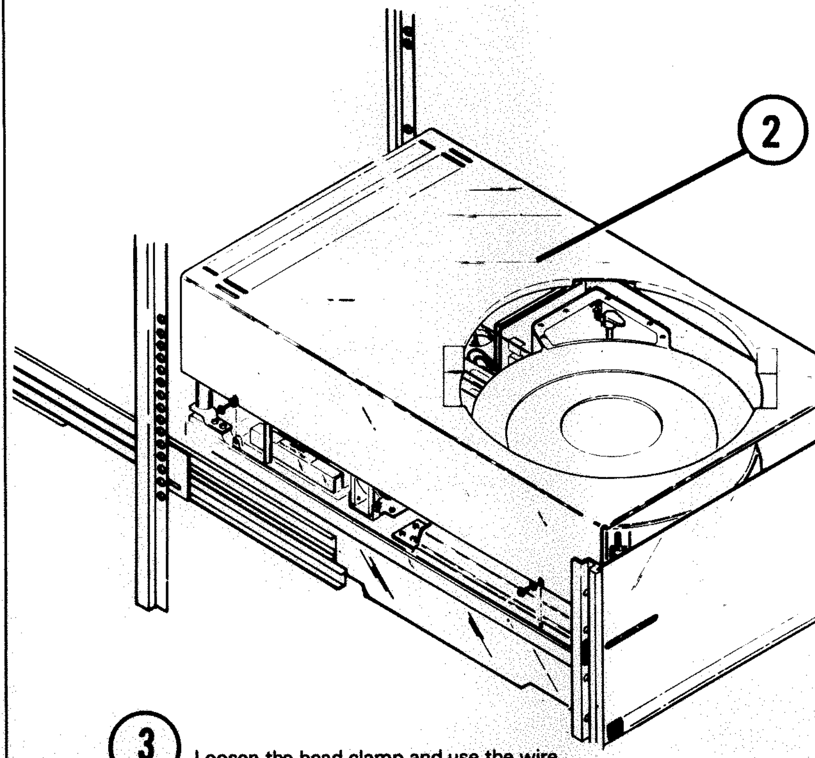
Wire Gauge	(128-001086)
Torque Wrench (0-100 in-lbs.)	(128-001092)
Cartridge/Diskette Reliability	(095-000300)
Alignment Cartridge	(005-003670)

① Verify correct electrical alignment of the servo board before attempting to align the heads. (See Servo Alignient Procedure, page 25.)

IMPORTANT: The drive must be in the cartridge load position when you check the alignment.

For the actual alignment, the drive MUST be in the cartridge load position. If the drive is fully extended, the weight of the drive may bow the casting slightly and possibly throw off the alignment.

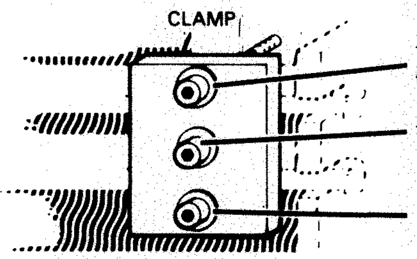




② Extend the drive fully during the setup for the head alignment. Remove the top cover. Remove the head shield if it has not already been removed.

③ Loosen the head clamp and use the wire gauge to set a gap of .030 inches between the front stop of the head and the carriage.

Remove the head clamp screws and apply a light coat of Slipspray to the threads of the screws if you have not already done so.

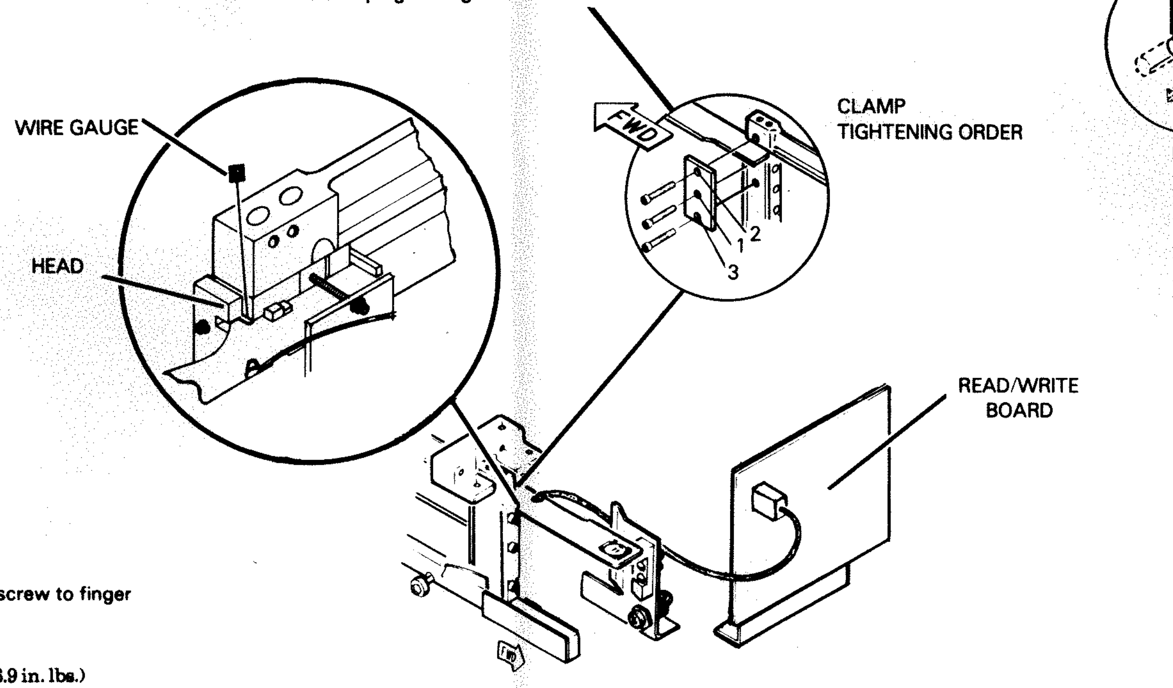


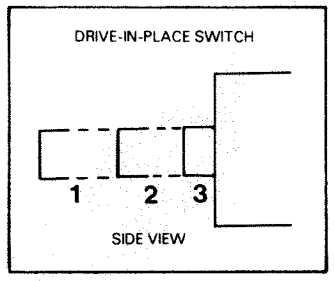
To align the downward facing head loosen only the top screw to finger tight.

The center screw should remain torqued at 110 in-oz. (6.9 in. lbs.)

To align the upward facing head loosen only the bottom screw to finger tight.

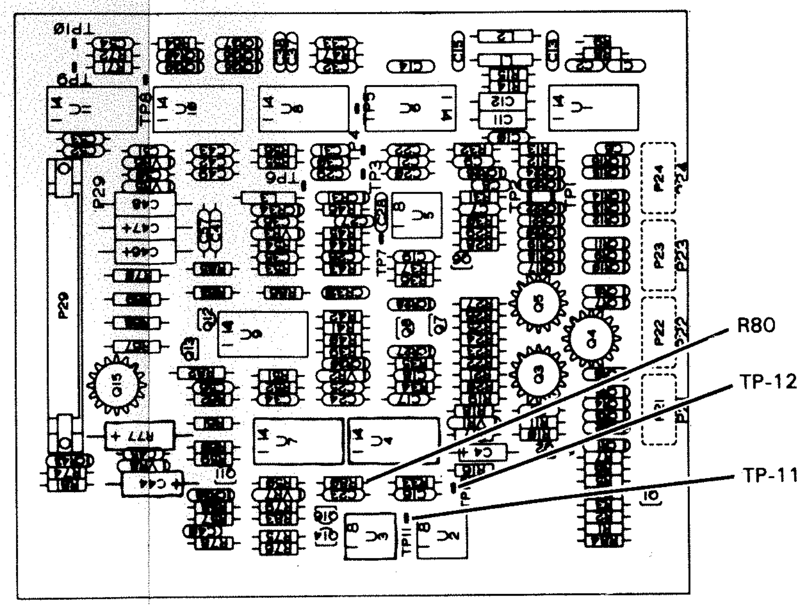
④ Use the torque wrench and torque the head clamp screws to 110 in-oz (6.9 in.lbs). Note the clamp tightening order.



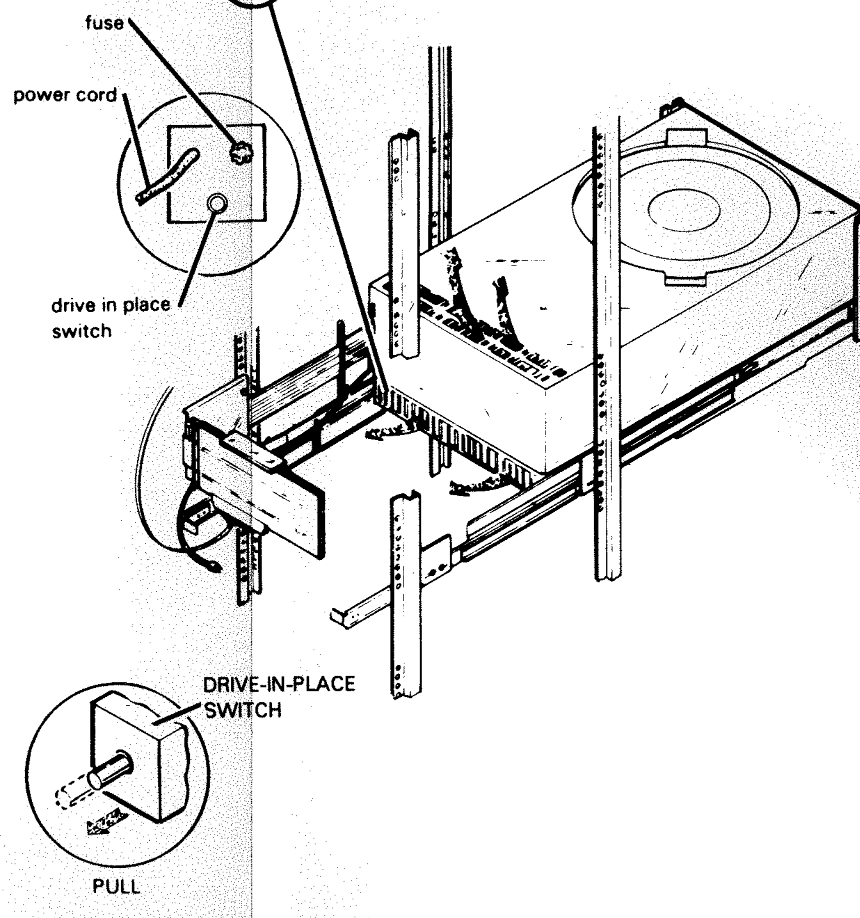


1) SERVICE POSITION
2) DRIVE OUT OF POSITION
(HEADS WILL NOT LOAD)
3) NORMAL OPERATING POSITION

⑤ Remove the read/write board shield. Short out R80 on the read/write board by placing a jumper between TP-11 and TP-12.



⑥ Pull the drive-in-place switch out to the service position.



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Upper Head Alignment (Cont.)

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⑦ *If the alignment cartridge is moved from one area to another where the room temperature is different, allow it one full hour to equilibrate at the new temperature before using it to align a drive. After the stabilization period, a cartridge can be freely moved from unit to unit with no additional waiting period.*

Cleanliness of the alignment cartridge and the disc spindle are essential. Clean the disk cavity with a lint-free cloth using 91% isopropyl alcohol. Do not use a material for cleaning which will tear or leave lint.

An alignment cartridge which shows visible evidence of damage to the armature plate or locating cone (including flaking of the armature plate) will cause an erroneous alignment.

Load the cartridge/diskette reliability program.

Load the relaibility tape via the binary loader.

Set the data switches to start the Command String Interpreter.

Press Start to execute the reliability program.

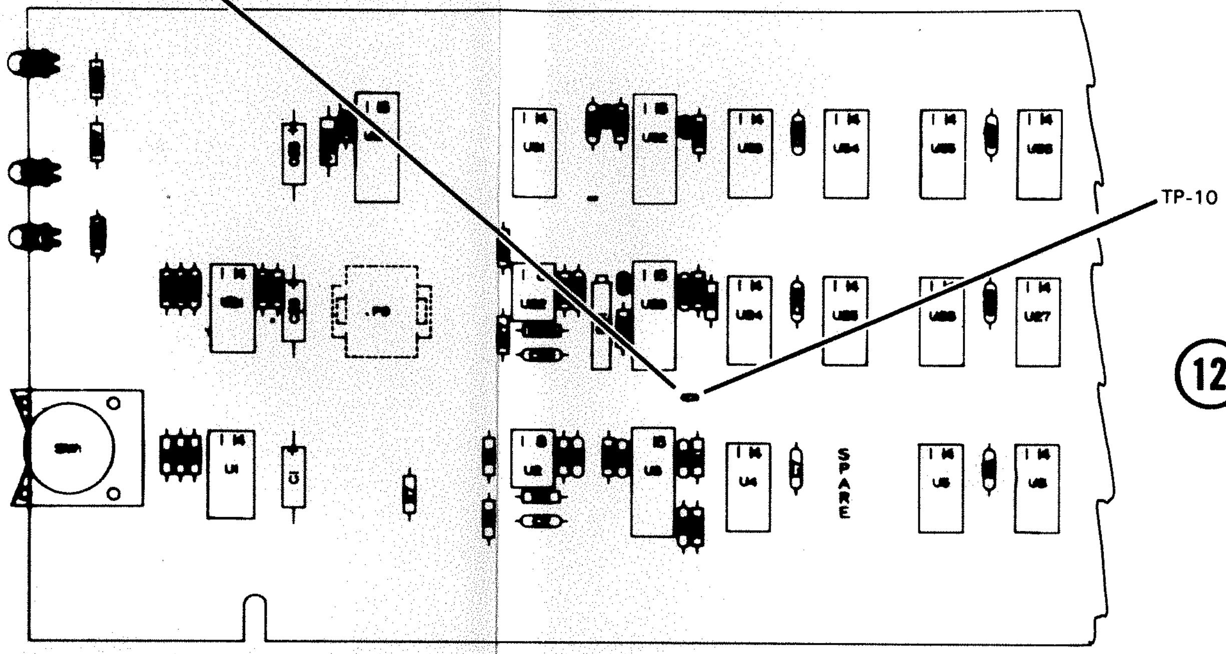
⑧ Install the alignment cartridge.

Run the disc drive for 1/2 hour with the heads loaded.

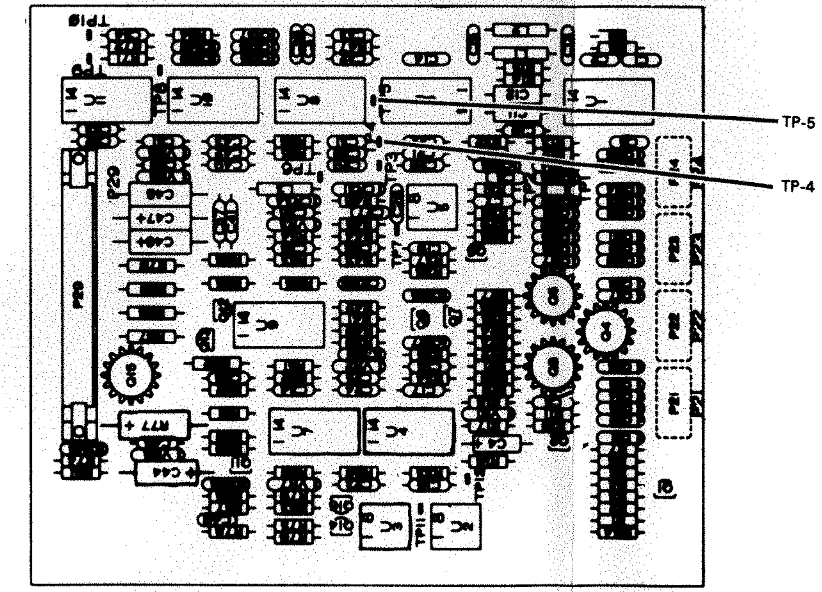
⑨ SCOPE SETUP

Channel 1	0.2 volt/div	AC
Channel 2	2.0 volt/div.	DC
Trigger	Positive	
Sync	Channel 2	
Time Base	2.0 ms/div.	
Vert Mode	Channel 2	
Coupling	AC	
Source	Channel 2	

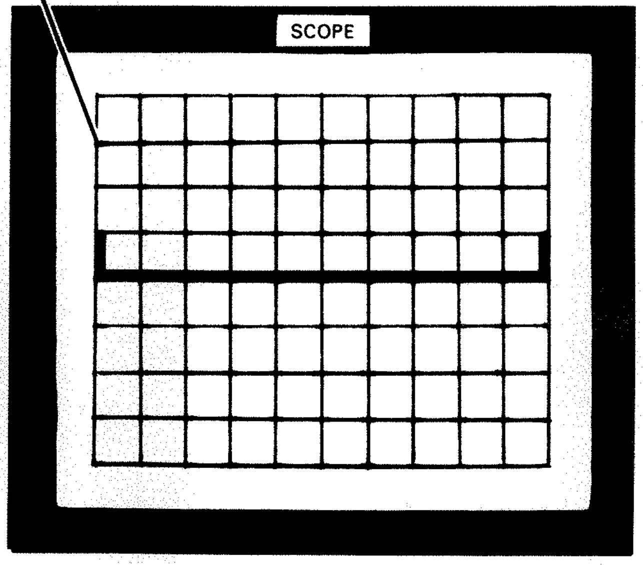
⑩ Connect channel 2 to TP-10 on the logic board.



⑪ Connect channel 1 to TP-4 and ground to TP-5 on the read/write board.



⑫ Uncalibrate the Time Base so that two index pulses can be seen. Position these two index pulses 10cm apart.



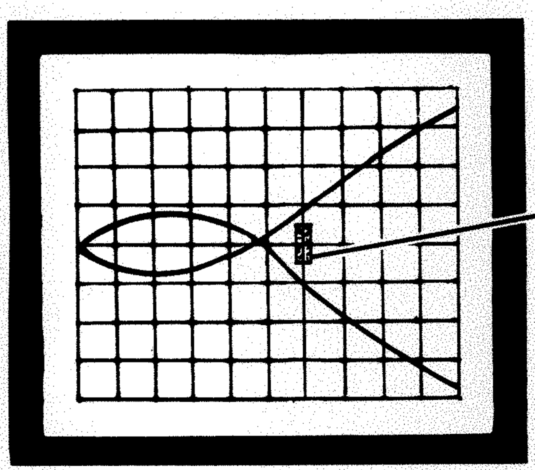
⑬ Adjust the vertical mode to select Channel 1.

Upper Head Alignment (Cont.)

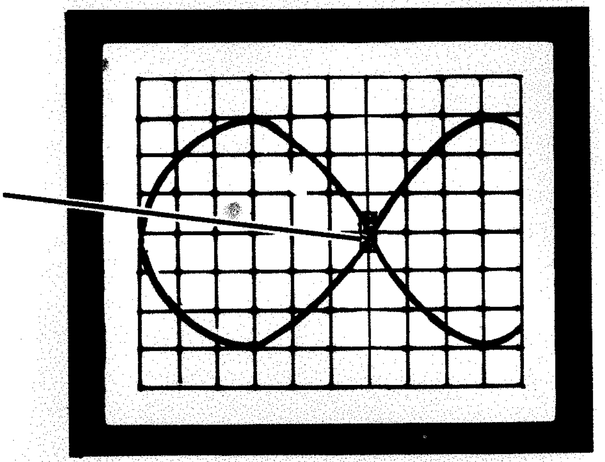
IMPORTANT: The drive must be in the pack load position when checking the alignment.

⑭ Using the Command String Interpreter select Head 0 and seek to 222_8

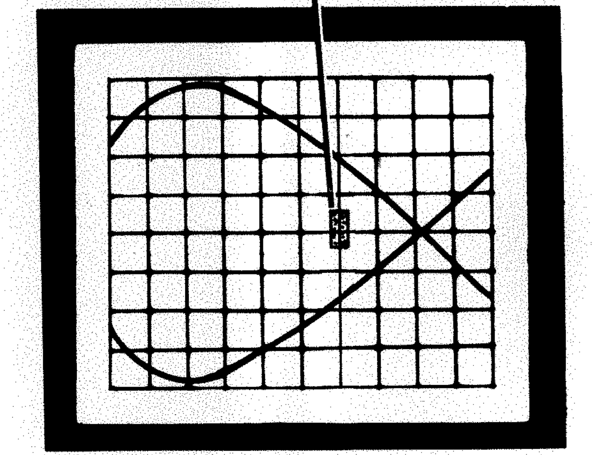
The scope trace will approximate one of the following waveforms.



The Head is too far in.



The Head is aligned.

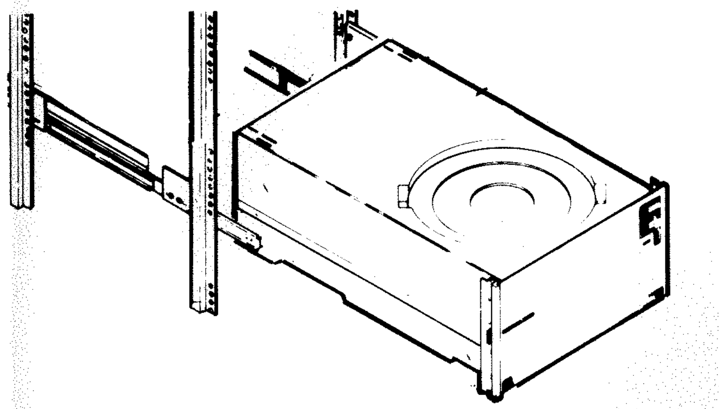


The Head is too far out.

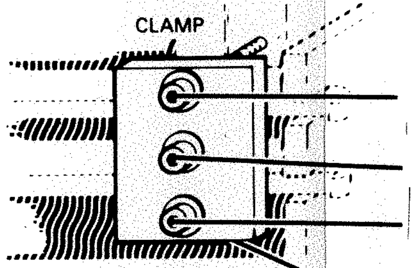
⑮ If the Head is not aligned, go to step 17 or 18.

When Head 0 is aligned repeat step 15 for Head 1.

When both Heads are aligned go to step 19.



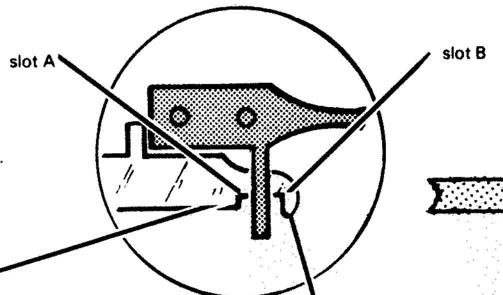
For the actual alignment, the drive MUST be in the pack load position. If the drive is fully extended out, the weight of the drive may tend to bow the casting slightly and possibly throw off the alignment.



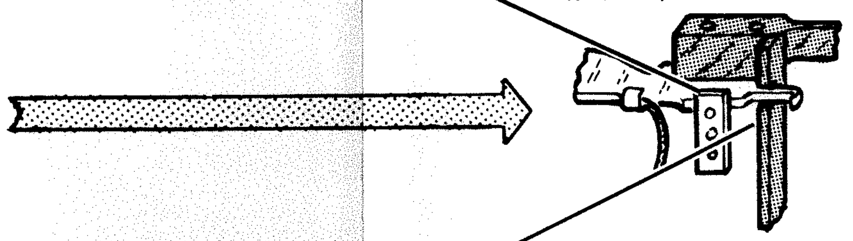
To align the downward facing head loosen only the top screw Retorque to 110 in-oz. (6.9 in. lbs.).

The center screw should remain torqued at 110 in-oz (6.9 in. lbs.).

To align the upward facing head loosen only the bottom screw Retorque to 110 in-oz. (6.9 in. lbs.).



Loosen the head clamp.

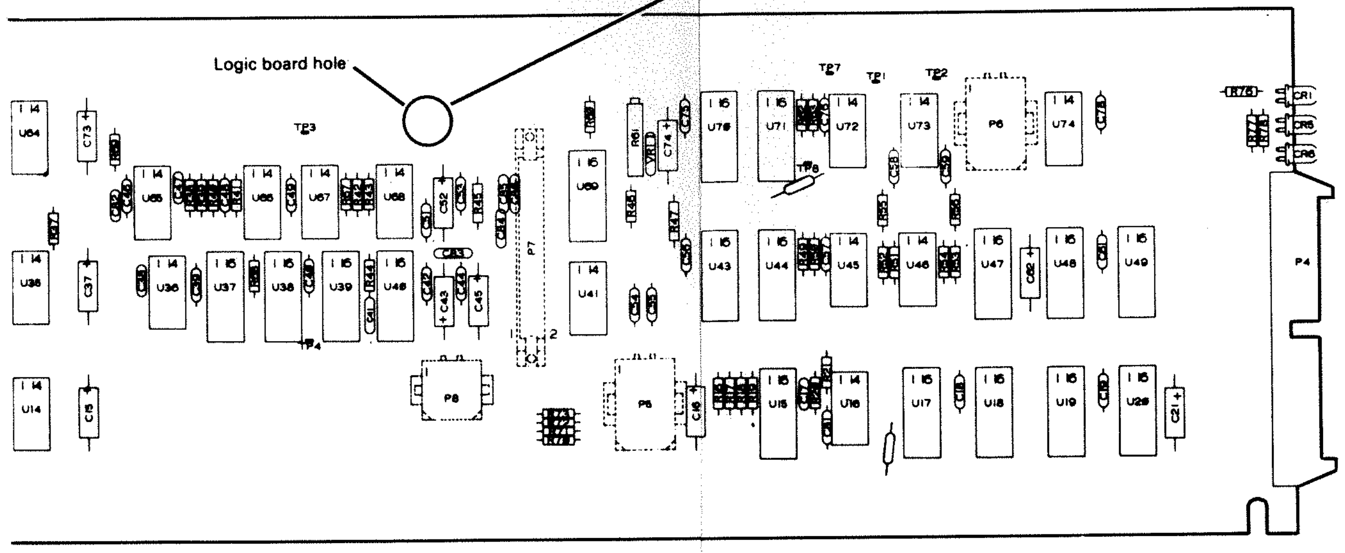


To make sure the alignment is correct, do a reseek.

⑯ To move the Head in, place the screwdriver into slot A and rotate clockwise slowly until the proper waveform is achieved.

⑰ To move the Head out, place the screwdriver into slot B and rotate counter-clockwise slowly until the proper waveform is achieved.

These slots are accessible through a hole in the logic board.



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Upper Head Alignment (Cont.)

⑱ Reset the time base to calibrated.

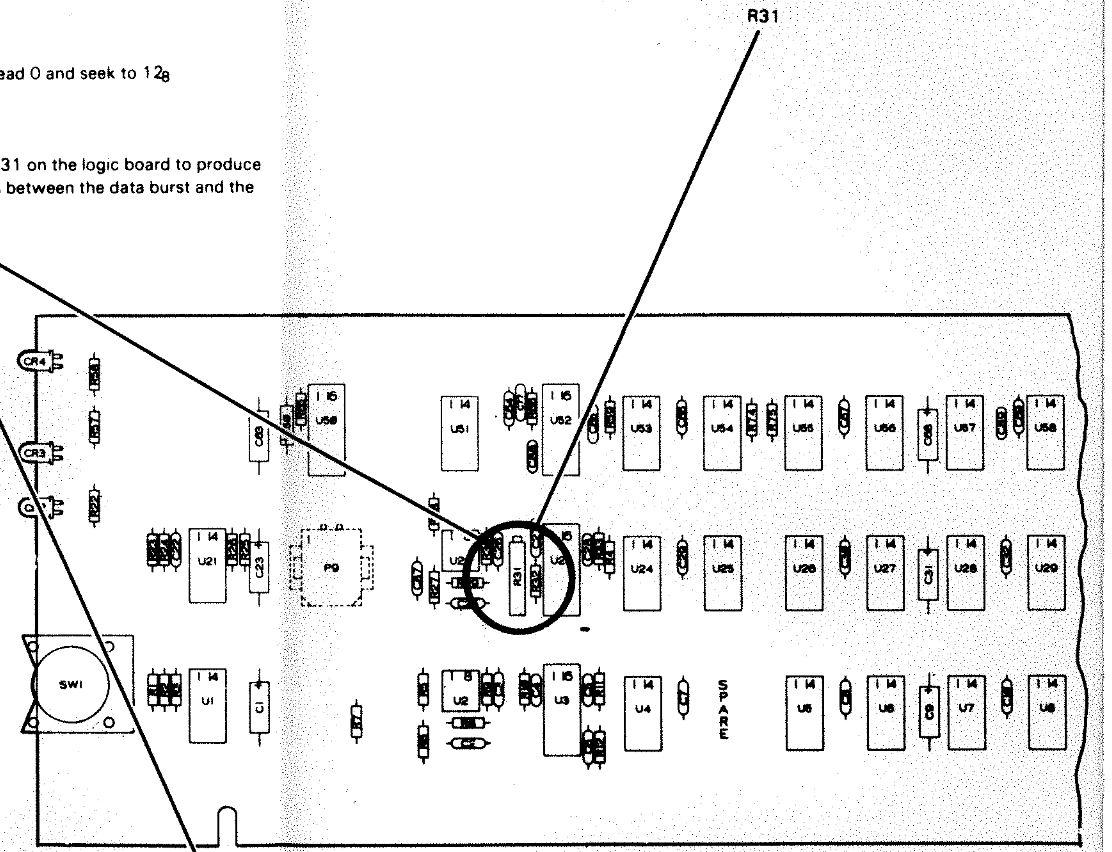
SCOPE SETUP

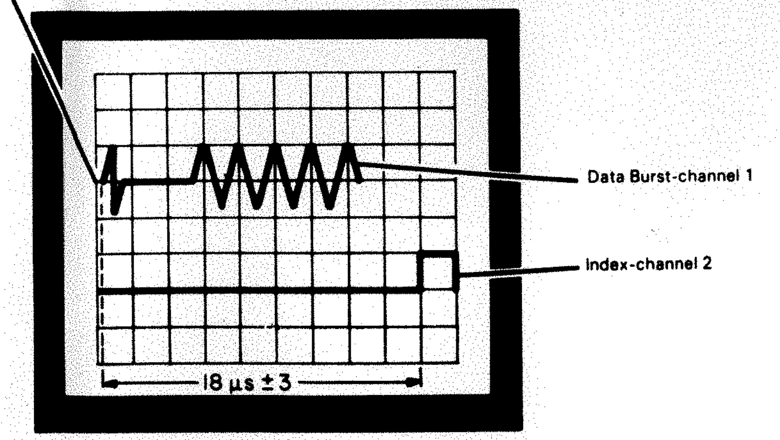
Channel 1	0.5v/div	AC
Channel 2	2.0v/div	DC
Time Base	2us/div	
Vert Mode	Alternate	
Trigger	Positive	
Sync	Channel 1	
Coupling	AC	
Source	Channel 2	

The probe placements remain unchanged.

⑲ Select Head 0 and seek to 12_8

⑳ Adjust R31 on the logic board to produce 18±3 µs between the data burst and the index





㉑ Repeat for Head 1

NOTE:

This procedure may have to be repeated so that both Heads meet alignment specifications.

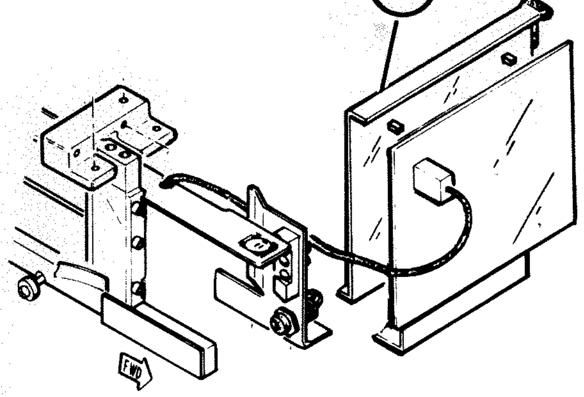
㉒ Unload the Heads and wait for the load light to turn on.

Wait at least 2 seconds after the load light has come on before removing the cartridge.

Remove the Alignment cartridge and power off the drive.

Remove all probes and jumpers used in this procedure.

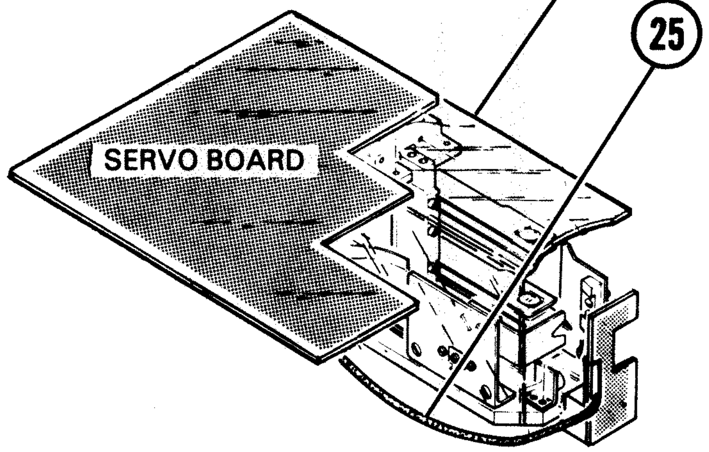
㉓ Replace the read/write board shield.



㉔ Replace and secure the Head shield.

The thermistor cable will have to be disconnected to install the shield.

㉕ Reconnect the thermistor cable.



㉖ Replace the top cover of the drive.

Servo Alignment

SPECIAL TOOLS & PARTS

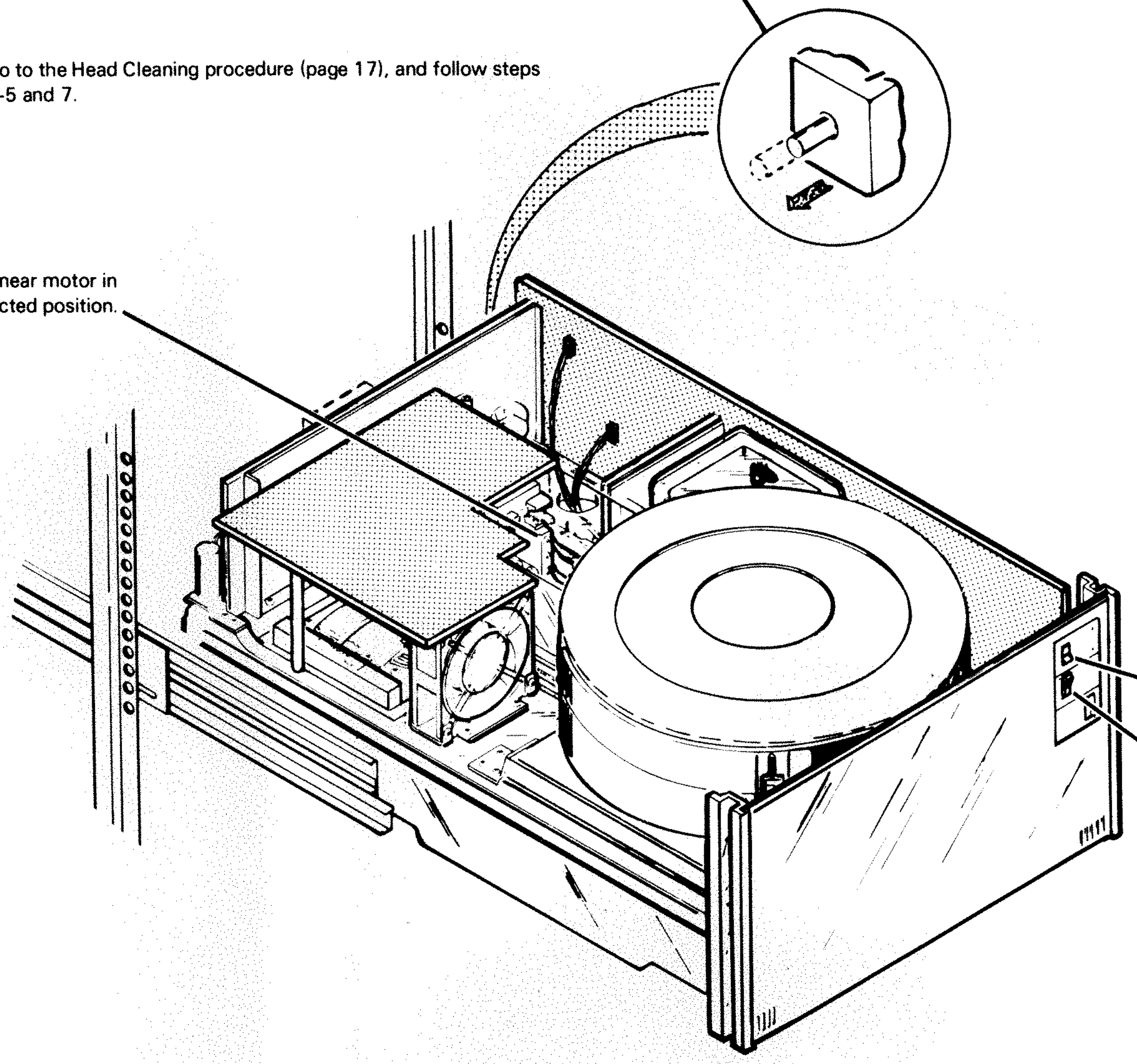
Digital Multimeter

Cartridge/Diskette Reliability
(095-000300)

① Go to the Head Cleaning procedure (page 17), and follow steps 1-5 and 7.

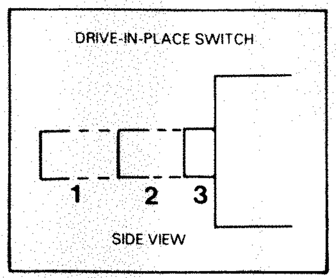
② Position the linear motor in the fully retracted position.

③ Pull the drive-in-place switch out to the service position.

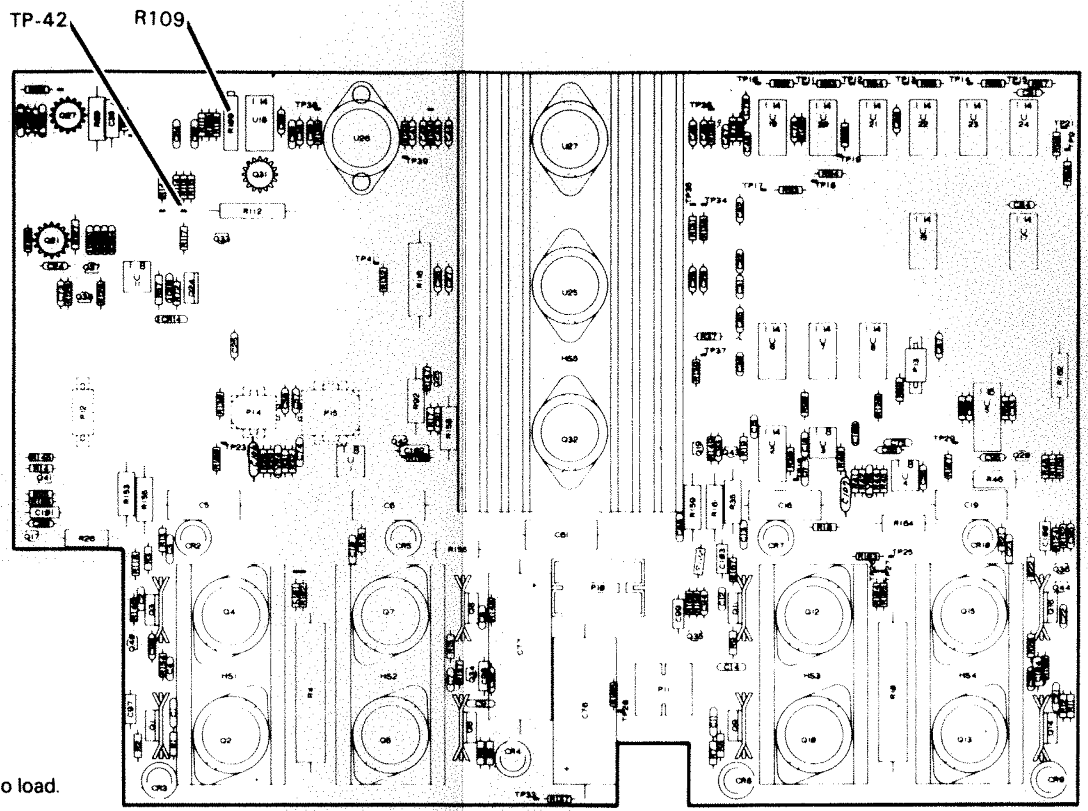


④ Set the load/ready switch to load.

⑤ Set the on/off switch to on.



1) SERVICE POSITION
2) DRIVE OUT OF POSITION
(HEADS WILL NOT LOAD)
3) NORMAL OPERATING POSITION



POWER SUPPLY BOARD

⑥ Use the multimeter to measure the voltage at TP-42 on the power supply board. Adjust R109 for 5±0.1 volts dc on the power supply board.

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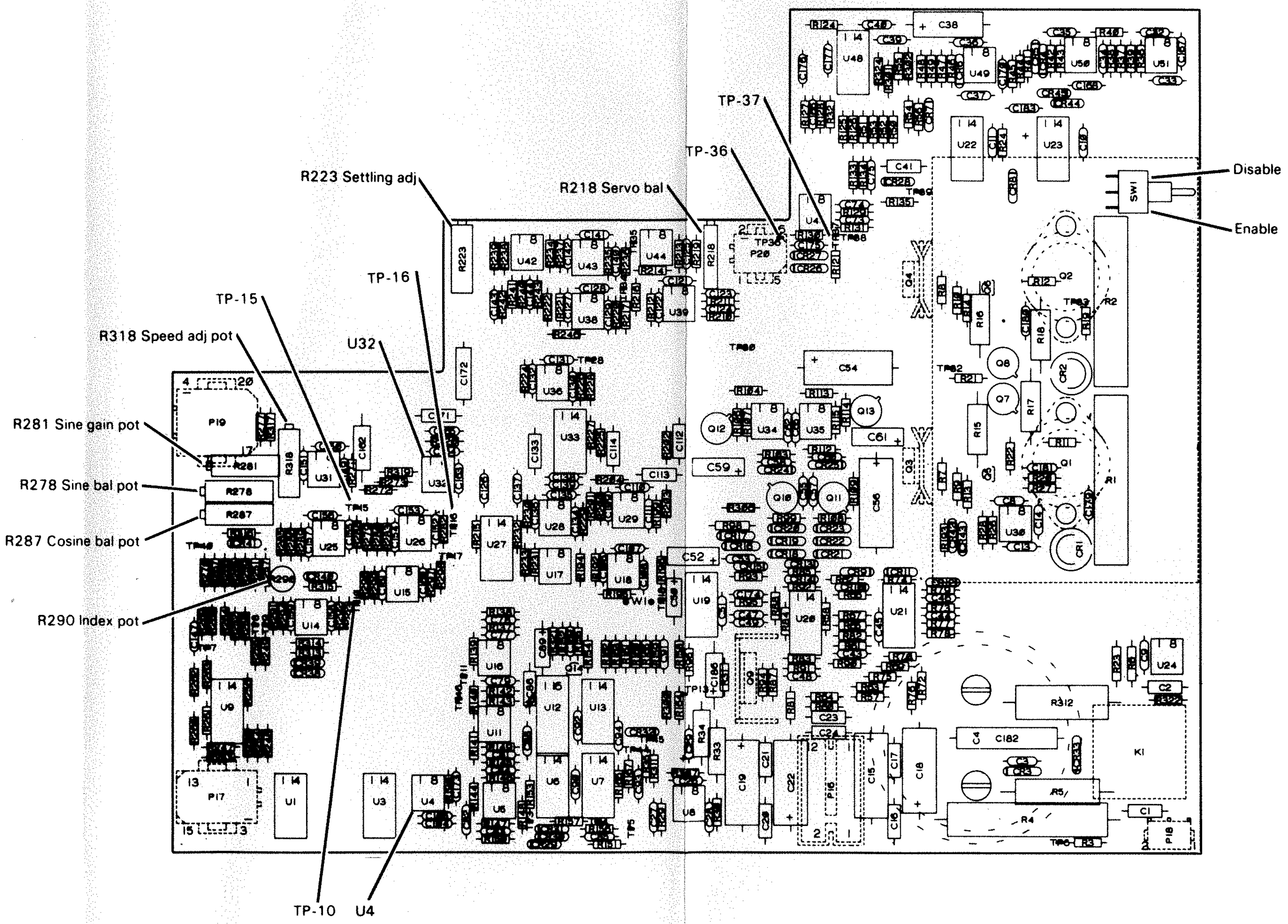
Servo Alignment (Cont.)

ALL POT ADJ AND TEST POINTS REFER TO THE SERVO BOARD UNLESS OTHERWISE SPECIFIED.

SERVO BOARD


TP-37
TP-36
R223 Settling adj
R218 Servo bal
Disable
Enable
TP-16
TP-15
R318 Speed adj pot
U32
R281 Sine gain pot
R278 Sine bal pot
R287 Cosine bal pot
R290 Index pot
TP-10
U4

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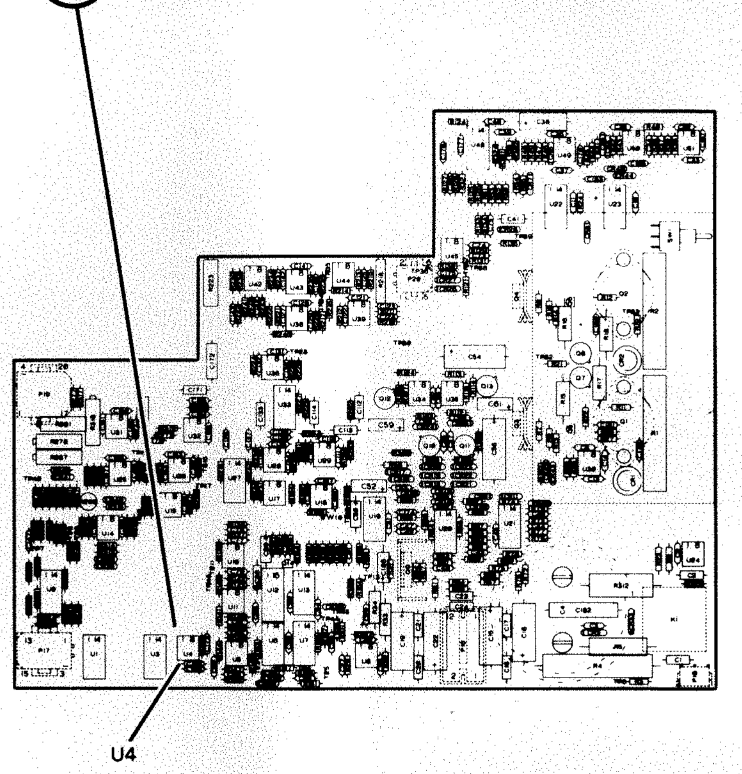
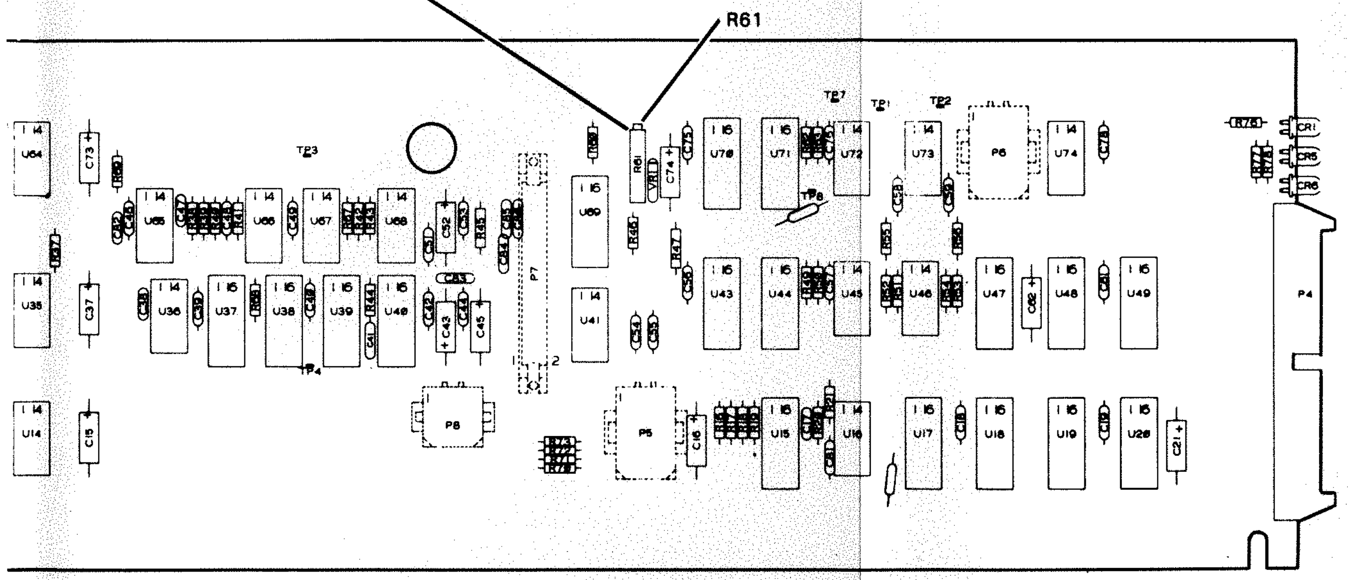
Servo Alignment (Cont.)

⑦ VELOCITY COMMAND OFFSET

A Use the multimeter to observe the output of U4 at pin 6 on the servo board.



B Adjust R61 on the logic board for 0 ± .02 volts dc.



LOGIC BOARD

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Servo Alignment (Cont.)

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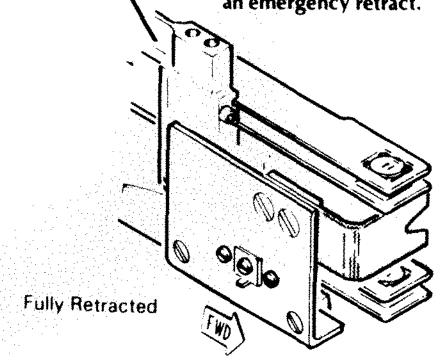
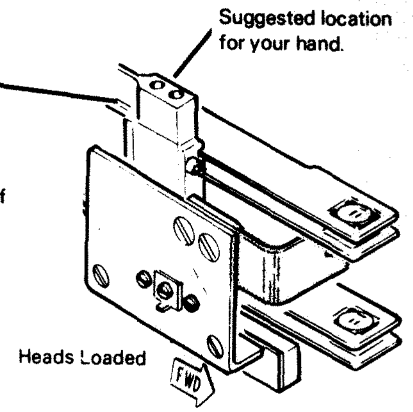
⑧ Sine signal gain and DC BALANCE.

Ⓐ Install a cartridge disc, set the load/ready switch to ready.

Ⓑ As soon as the heads load, set the servo enable/disable switch to disable.

Position the hand to prevent injuries in the event of an emergency retract.



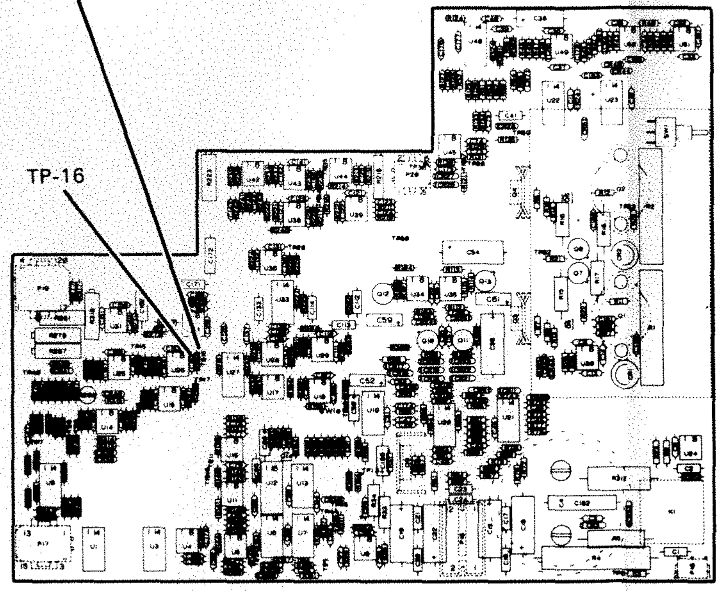


SCOPE SETUP

Channel 1	0.5 v/div DC
Channel 2	N/A
Time Base	2 ms/div
Vert Mode	Channel 1
Trigger Mode	Auto
Sync	N/A
Coupling	N/A
Source	N/A

N/A = Not applicable

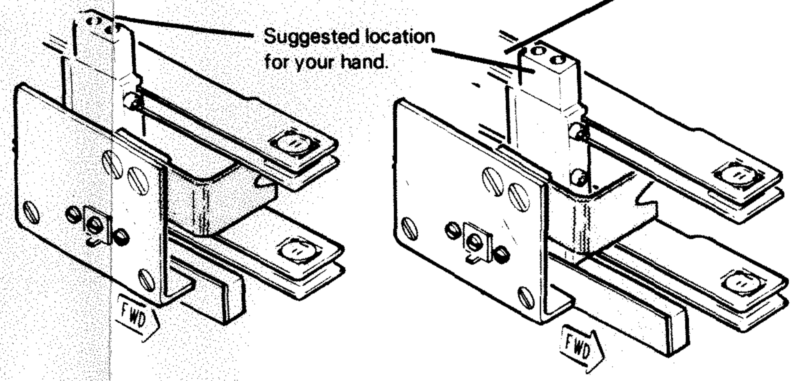
Ⓒ Connect Channel 1 of the scope to TP-16 on the servo board. See detailed location, page 26.



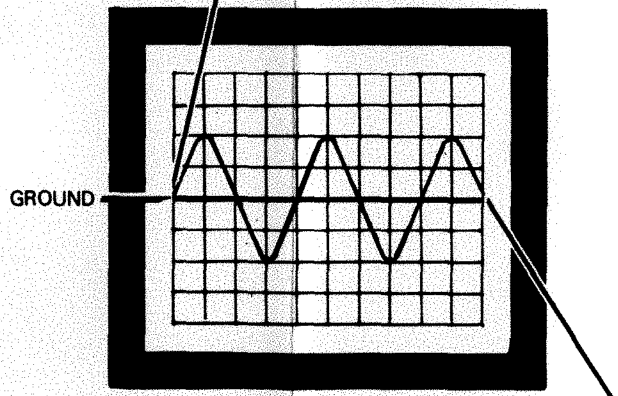
Ⓓ Generate a waveform by moving the actuator back and forth by hand.

Position the hand to prevent injuries in the event of an emergency retract.

The actuator will have to move approximately 1/4 inch from the point where the heads are first loaded before a waveform will appear. Vary the speed of the actuator until a usable waveform is obtained.



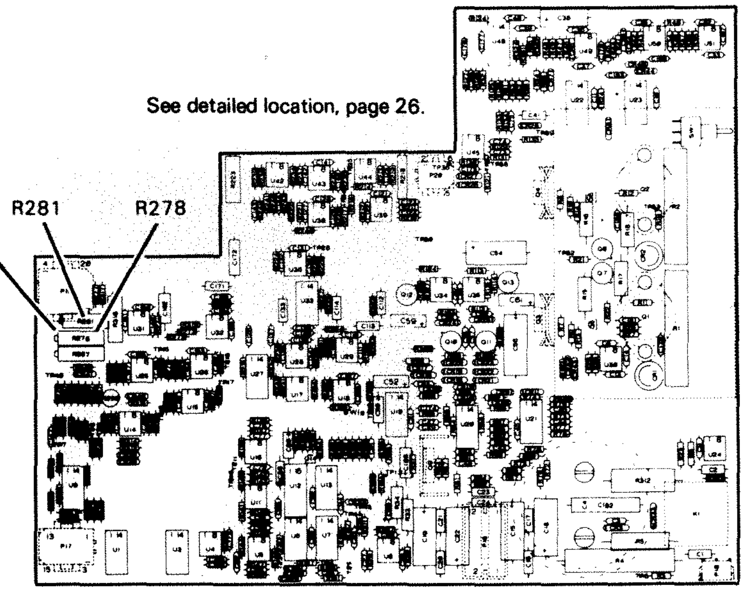
Ⓔ Adjust R281 for an amplitude of 2.0 ± .2 volts p-p.



2 mS/div

Both steps E and F must meet the specification simultaneously. Repeat if necessary.

See detailed location, page 26.



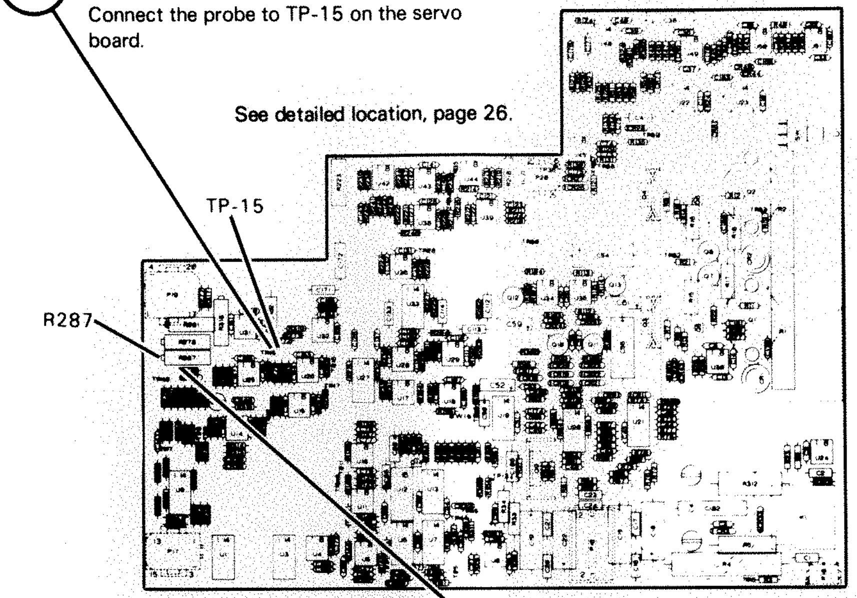
Ⓕ Adust R278 for a symmetrical waveform about 0 ± 1 volts

9 COSINE SIGNAL DC BALANCE

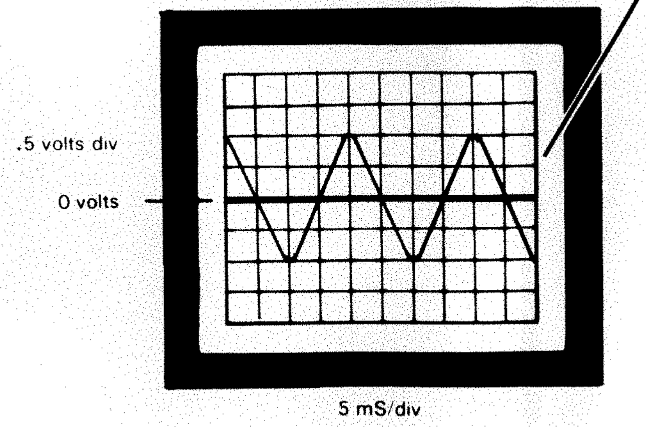
Ⓐ Scope setting remains the same.

Connect the probe to TP-15 on the servo board.

See detailed location, page 26.



Ⓒ Adjust R287 for a symmetrical waveform about 0 ± .1 volts.



SCOPE SETUP

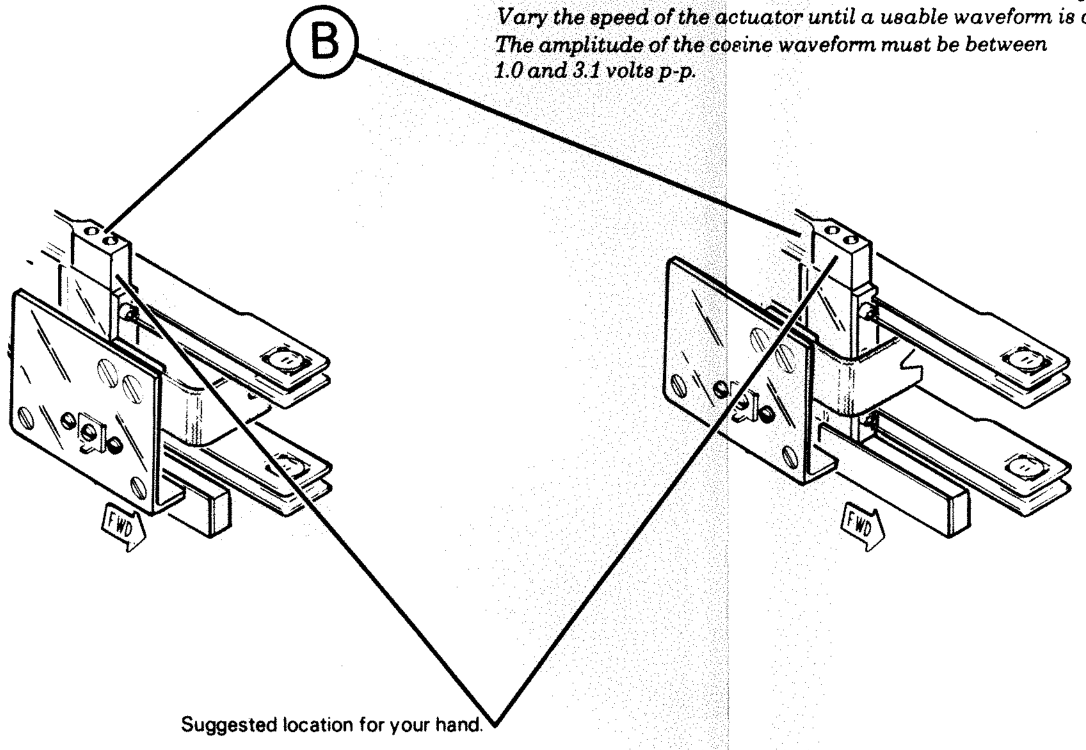
Channel 1	0.5 volts/div DC
Channel 2	N/A
Time Base	2 ms/div
Vert Mode	Channel 1
Trigger Mode	Auto
Sync	N/A
Coupling	N/A
Source	N/A

N/A = Not applicable

Generate a waveform by moving the actuator back and forth by hand.

Position the hand to prevent injuries in the event of an emergency retract.

The actuator will have to move approximately 1/4 inch from the point where the heads are first loaded before a waveform will appear. Vary the speed of the actuator until a usable waveform is obtained. The amplitude of the cosine waveform must be between 1.0 and 3.1 volts p-p.



Suggested location for your hand.

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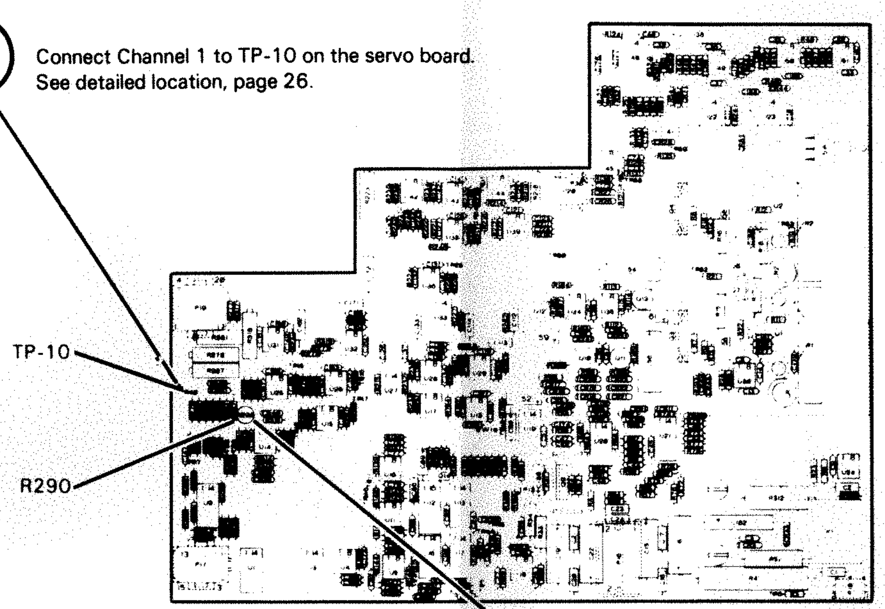
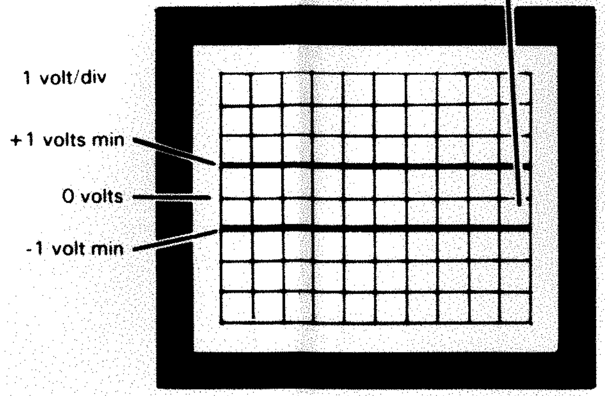
Servo Alignment (Cont.)

⑩ INDEX BALANCE

Ⓐ Connect Channel 1 to TP-10 on the servo board. See detailed location, page 26.



Ⓒ Adjust R290 for symmetrical dc levels about 0 ± .2 volts. The amplitude of the dc levels must be ± 1 volt minimum.



2 mS/div

SCOPE SETUP

Channel 1	1.0 volt/div DC
Channel 2	N/A
Time Base	2 ms/div
Vert Mode	Channel 1
Trigger Mode	Auto
Sync	N/A
Coupling	N/A
Source	N/A

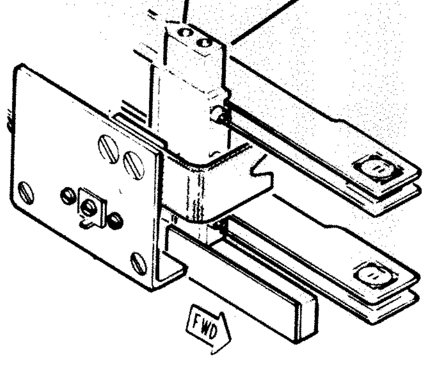
N/A = Not applicable

Ⓑ Move the actuator by hand back and forth against the front stop

Forward motion will product a + output.
Backward motion will produce a - output.

Position the hand to prevent injuries in the event of an emergency retract.

Suggested location for your hand.



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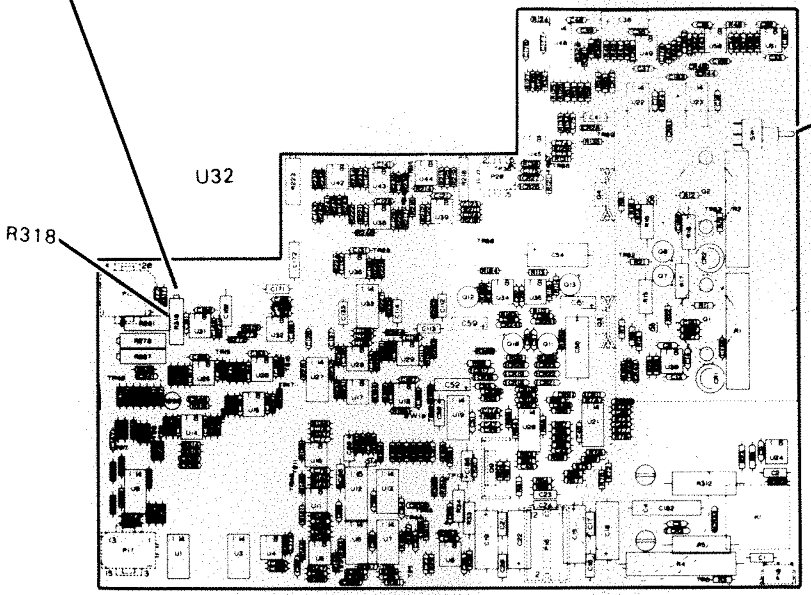
Servo Alignment (Cont.)

(A) Turn R318 FULLY counter-clockwise and connect Channel 1 of the scope pin 6 of U32.

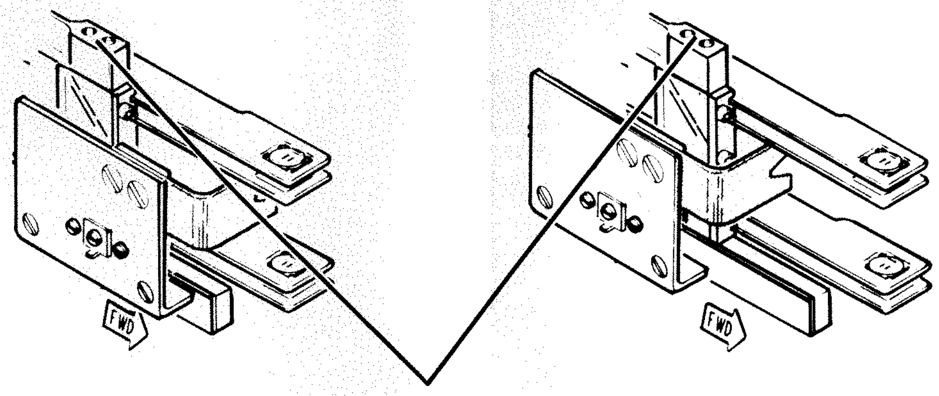


See detailed location, page 26.

(B) Move the actuator by hand back and forth to verify that forward motion will give you a negative output.

Do not move the heads out of the load position when moving the heads back and forth.

Position the hand to prevent injuries in the event of an emergency retract.



Suggested location for your hand.

(11) SPEED ADJUSTMENT

(C) Set the enable/disable switch to enable. Heads will detent to track 0.

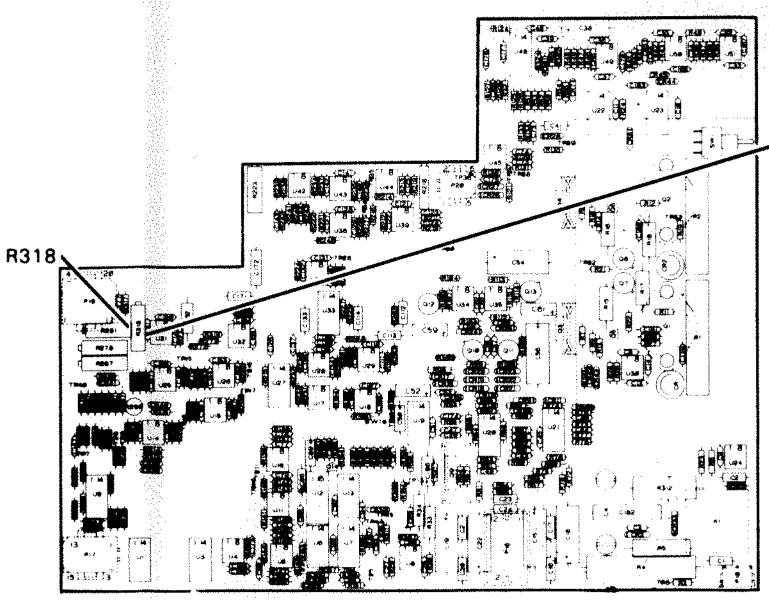
(D) Load the cartridge/diskette reliability program.

Load the reliability tape via the binary loader.

Set the data switches to the Command String Interpreter.

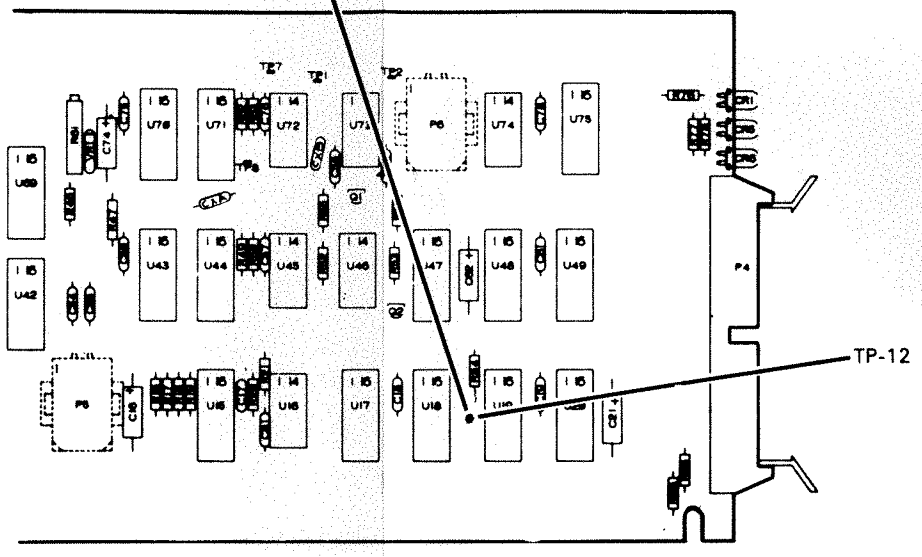
Press Start to execute the reliability program.

(E) RELIABILITY: COMMAND STRING INTERPRETER
COMMAND STRING: SEE 0 SEE 577 LOO



See detailed location, page 26.

(F) Connect Channel 1 to pin 3 of U19 on the logic board.

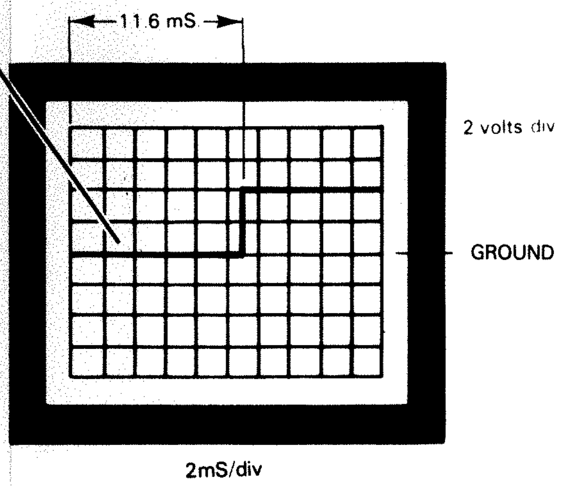


SCOPE SETUP

Channel 1	2.0 volts/div DC
Channel 2	N/A
Time Base	2 ms/div
Vert Mode	Channel 1
Trigger Mode	Norm
Sync	Negative
Coupling	DC
Source	Channel 1

N/A = Not applicable

(G) Adjust R318 for a 0 logic signal for 11.6 ± .2 mS



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Servo Alignment (Cont.)

⑫ SERVO BALANCE

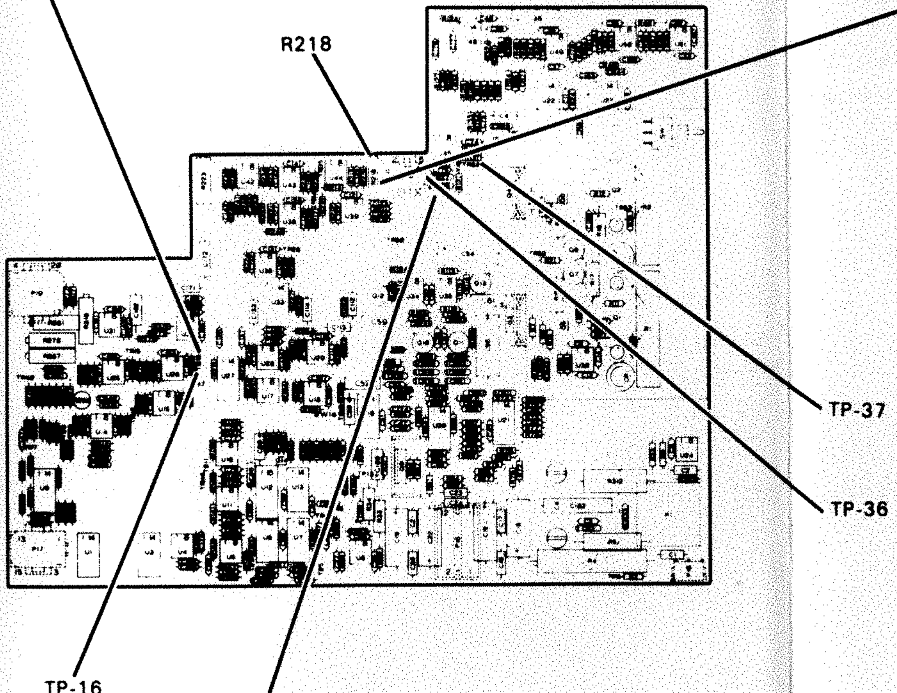
Ⓐ RELIABILITY: COMMAND STRING INTERPRETER

COMMAND STRING: **REC**

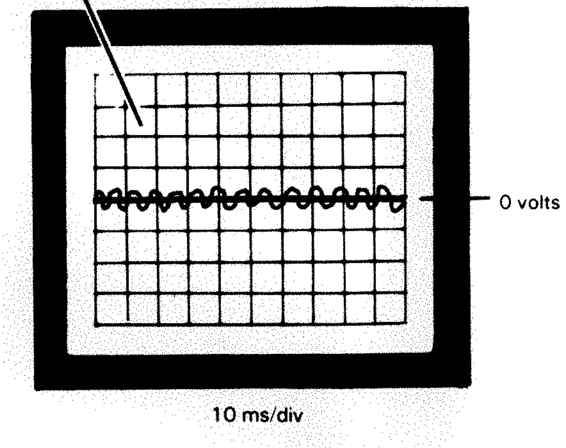
Ⓑ Connect a jumper between TP-36 and TP-37.

Ⓒ Connect the probe to TP-16.

See detailed location, page 26.



Ⓓ Adjust R218 for a symmetrical waveform about 0 ± .01 volts.



SCOPE SETUP

Channel 1	0.05 volts/div DC
Channel 2	N/A
Time Base	10 ms/div
Vert Mode	Channel 1
Trigger Mode	Auto
Sync	N/A
Coupling	N/A
Source	N/A

N/A= Not applicable

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Servo Alignment (Cont.)

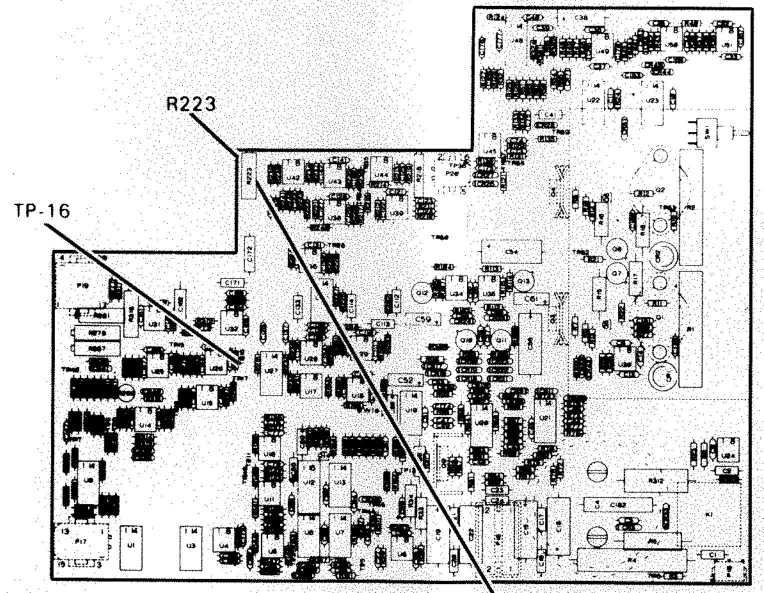
⑬ SETTLING ADJUSTMENT

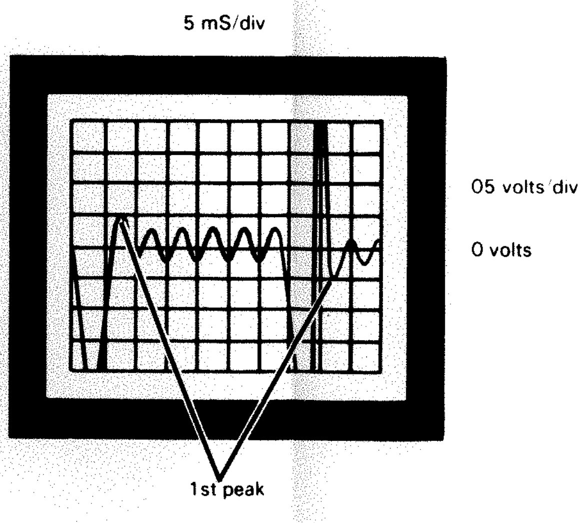
Ⓐ *The Speed adjustment and the Servo Balance must be performed prior to this operation.*

RELIABILITY: COMMAND STRING INTERPRETER
COMMAND STRING:

SEE 1 DEL 30 SEE 0 DEL 30 LOO

Connect channel 1 of the scope to TP-16.
See detailed location, page 26.



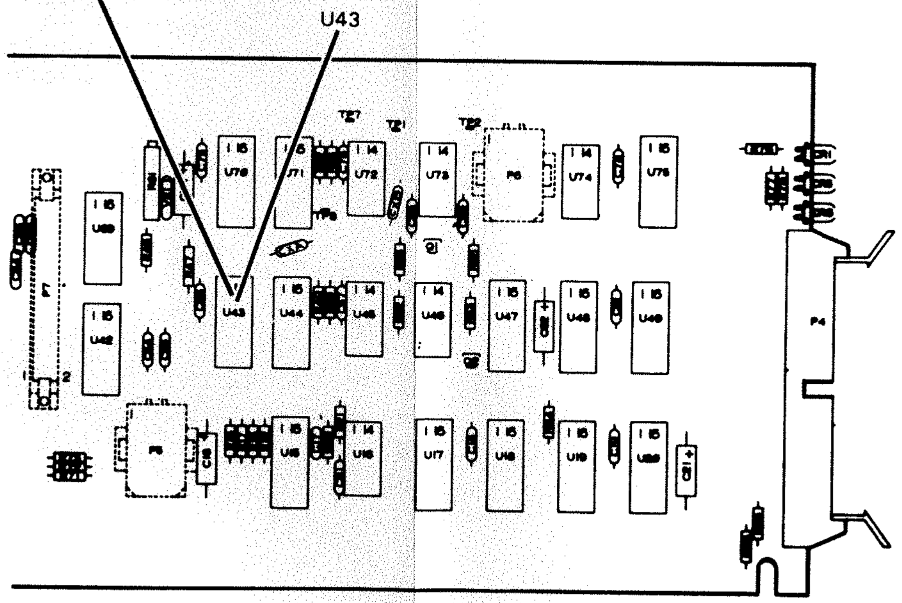


Ⓒ Adjust R223 so that the amplitude of the 1st peak in both directions falls between 0 and 150mV.

Try to adjust both peaks for equal amplitude.

THE FIRST PEAK IN EACH DIRECTION MUST BE LARGER THAN THE FOLLOWING PEAKS. IF THEY ARE NOT, THE LINEAR MOTOR MUST BE REPLACED. (See the Servo Board and Linear Motor Replacement procedure page 35.)

Ⓑ Connect channel 2 of the scope to U43 pin 9 on the logic board.



SCOPE SETUP

Channel 1	0.05 volts/div DC
Channel 2	2.0 volts/div DC
Time Base	5 ms/div
Vert Mode	Channel 1
Trigger Mode	Norm
Sync	Negative
Source	Channel 2
Coupling	DC

Sync on Channel 2, then switch Vert Mode to Channel 1.

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Servo Alignment (Cont.)

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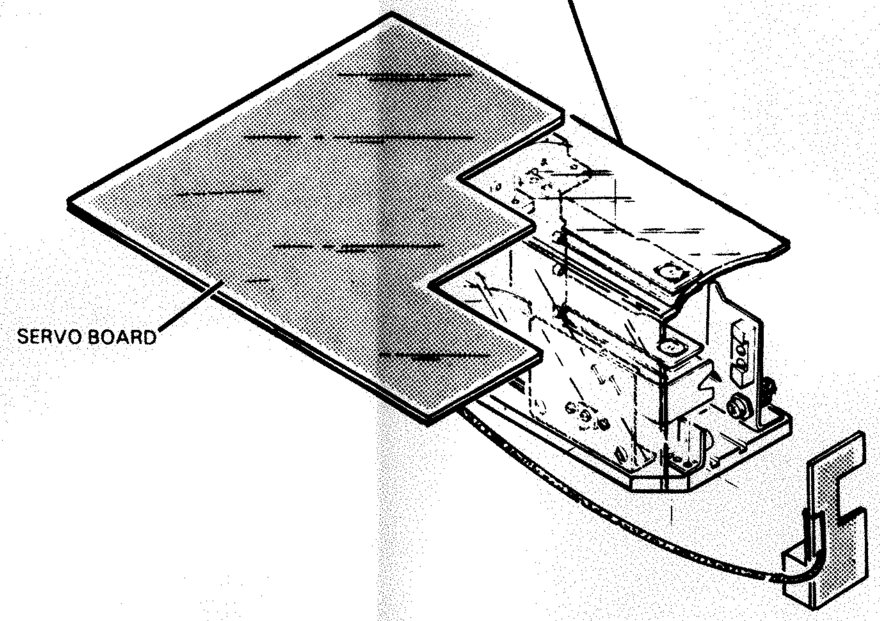
⑭ Set the load/ready switch to load. Wait at least 2 seconds after the load light has come on before removing the cartridge.

Remove all probes and jumpers used in this procedure.

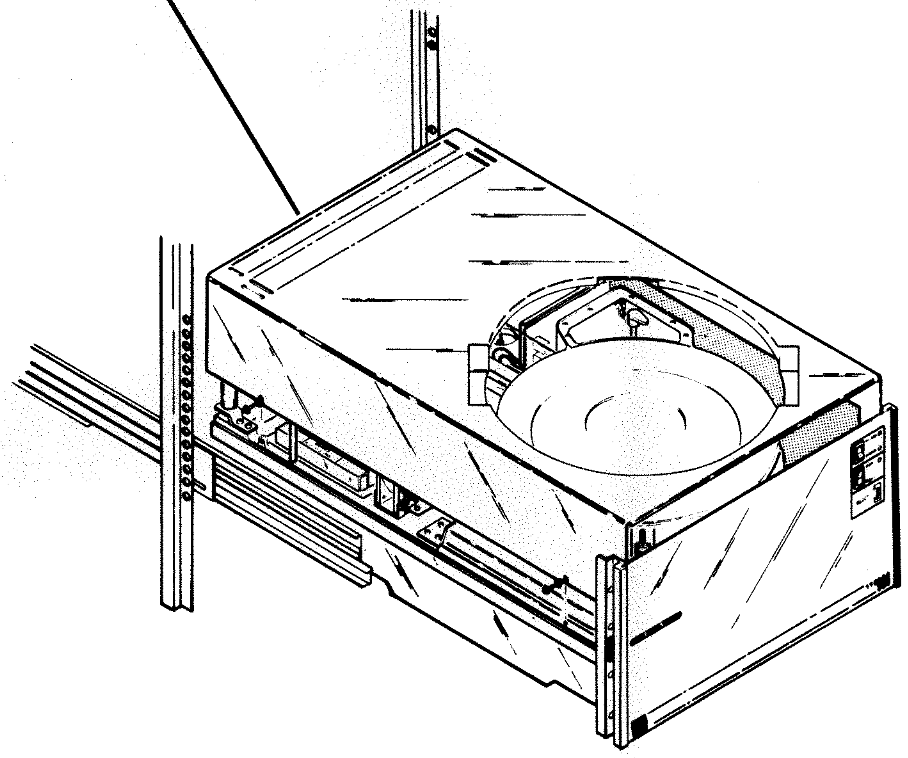
Power off the drive.

⑮ Disconnect the thermistor cable and replace the head shield.

Reconnect the thermistor cable.



⑯ Replace the top cover of the drive.



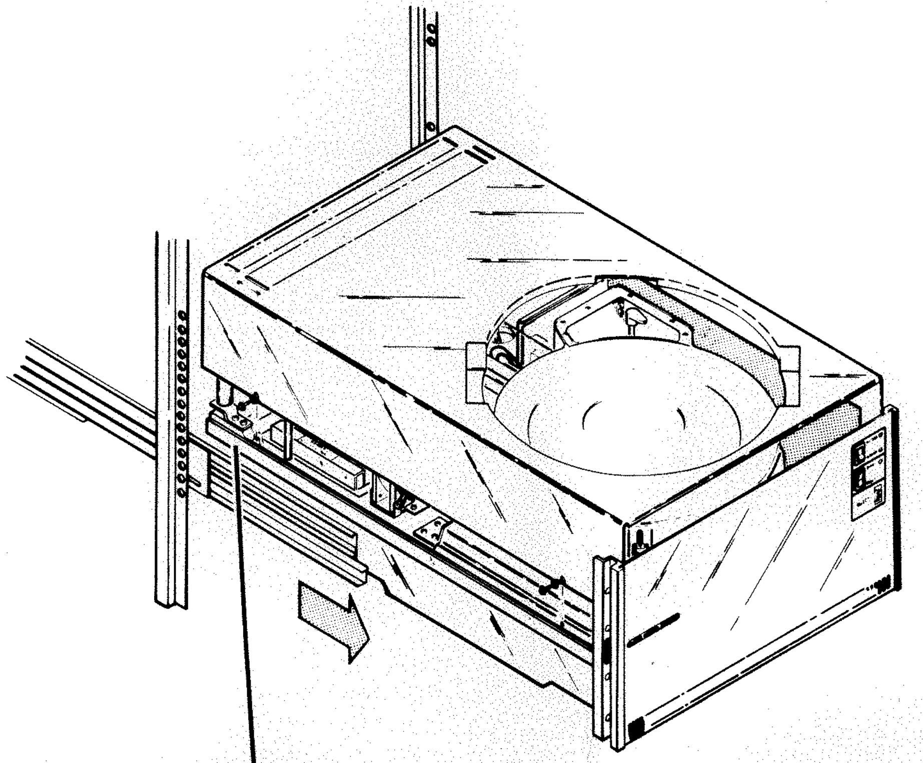
Servo Board and Linear Motor Replacement

SPECIAL TOOLS & PARTS

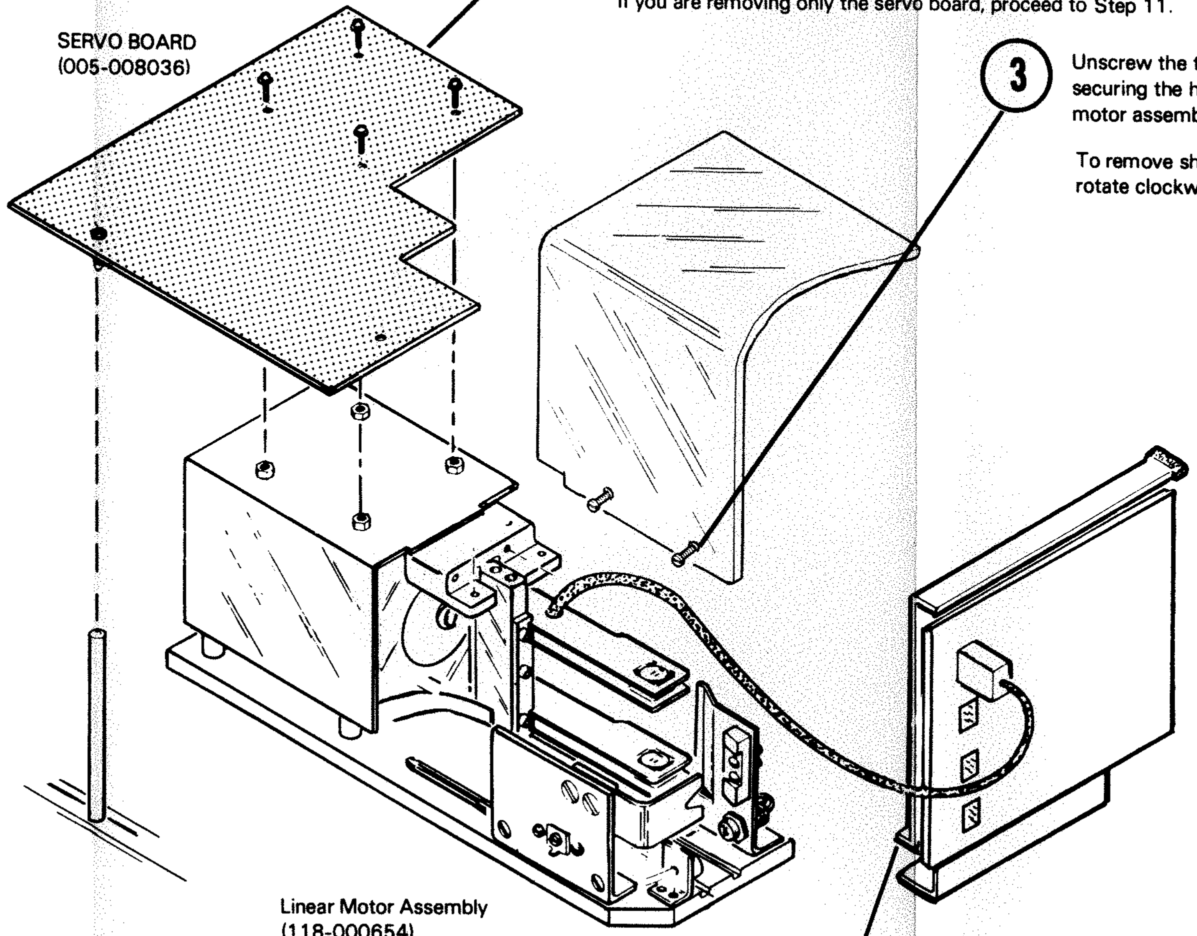
Linear Motor
(118-000392)

Servo Board
(005-008036)

Torque Wrench (0-100 in-lbs.)
(128-001092)



① Pull the drive fully out of the chassis.
Remove the cartridge disc if one is installed.
Remove the top cover.



② Remove the four screws and nylon washers holding the servo board. Unplug the five cables connected to the servo board and lift it off the chassis.

If you are removing only the servo board, proceed to Step 11.

③ Unscrew the two captive screws securing the head shield to the linear motor assembly.

To remove shield, lift and rotate clockwise.

④ Unplug all four head cables from the read/write board.

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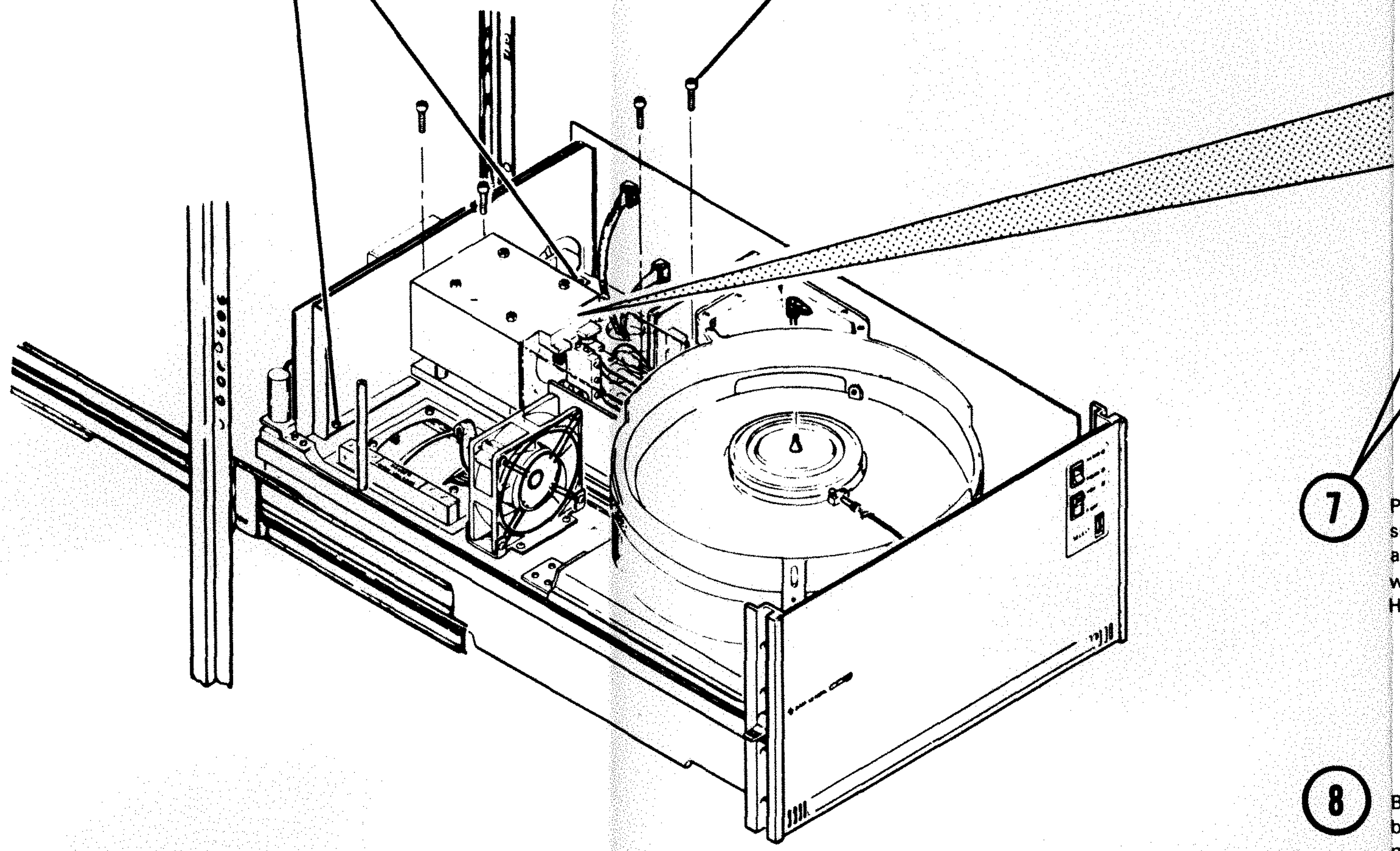
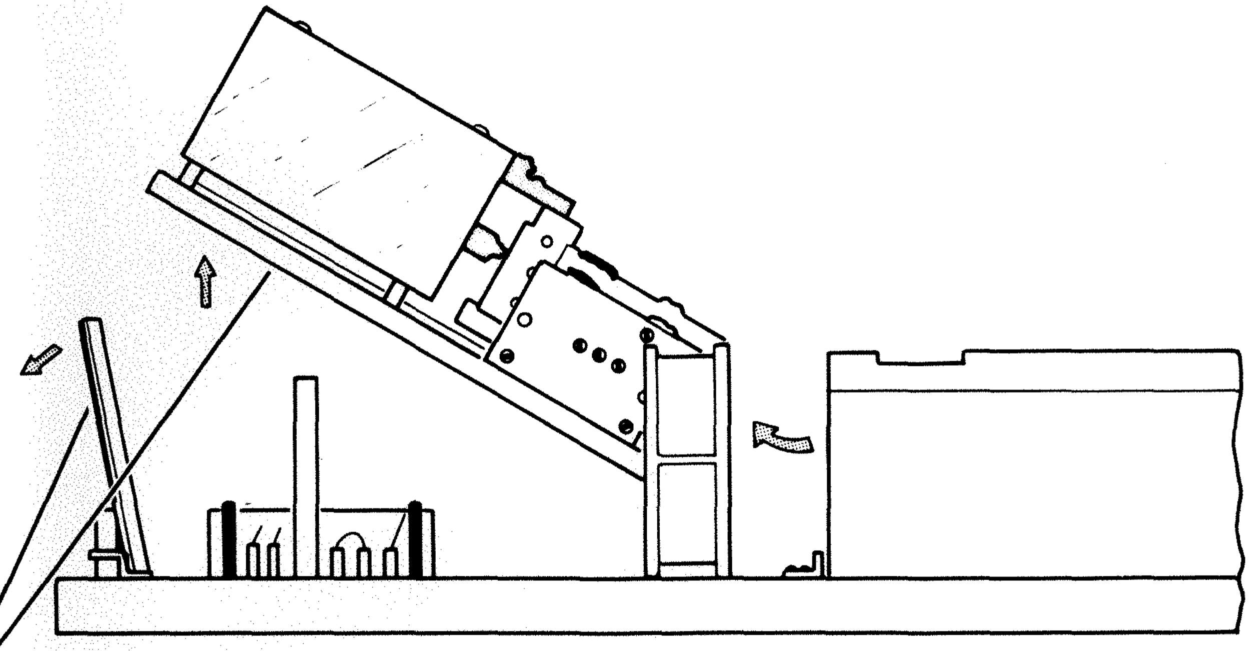
Servo Board And Linear Motor Replacement (Cont.)

⑤ Loosen the two screws holding the power supply board to the chassis.

⑥ Remove the four screws holding the linear motor to the chassis.



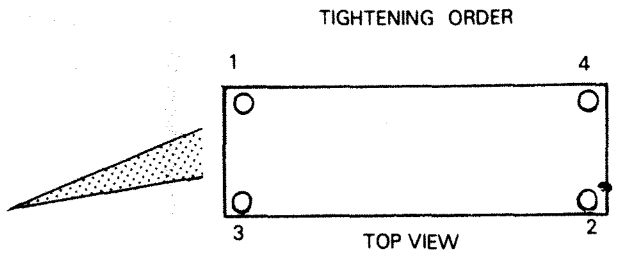


⑦ Position yourself on the left side of the drive and tilt the power supply board away from the motor. Grab the motor at the back and lift it out carefully so that the heads do not come in contact with the disc cavity. Remove the heads from the motor (See Head Replacement [page 18] steps 2-5.)

⑧ Before installing the motor, clean out any debris from the casting that may become trapped under the motor. Carefully clean the bottom plate of the motor and inspect it for damage.

Use a rubber band or some other means of restraint, to keep the heads from moving out of the home position when replacing the motor.

⑨ Place the motor in the chassis carefully, making sure that it seats itself correctly on the alignment pin. Torque the screws to 36 in-lbs. Tighten the power supply board screws.



⑩ Replace the heads (See Head Replacement [page 18] steps 6-21.)

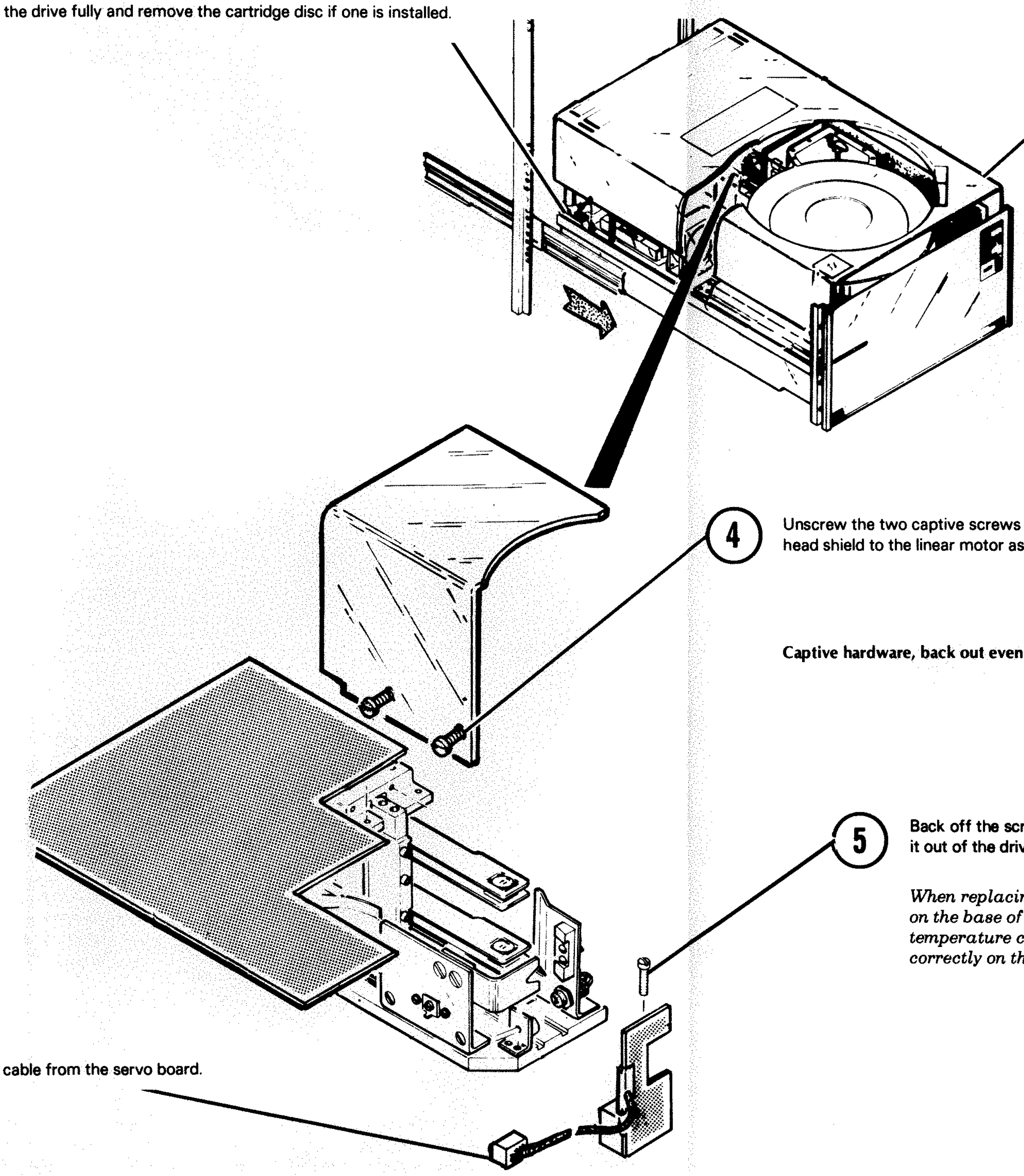
⑪ Reconnect the five cables to the servo board and replace the four screws and nylon washers holding it to the motor.

⑫ If a new servo board has been installed, do the Servo Alignment, (page 25). If a new motor has been installed, do the Servo and Head Alignment procedures (Head Alignments Pages 20-24).

Thermistor Board Replacement

SPECIAL TOOLS & PARTS

Thermistor Board
(005-006537)



① Extend the drive fully and remove the cartridge disc if one is installed.

② Remove the top cover.

③ Unplug the thermistor cable from the servo board.

④ Unscrew the two captive screws securing the head shield to the linear motor assembly.

Captive hardware, back out evenly.

⑤ Back off the screw holding the thermistor board to the casting and lift it out of the drive.

When replacing the thermistor board, use some thermal grease on the base of the aluminum mounting block to ensure good temperature conductivity. Also, make sure the block is seated correctly on the alignment pin.

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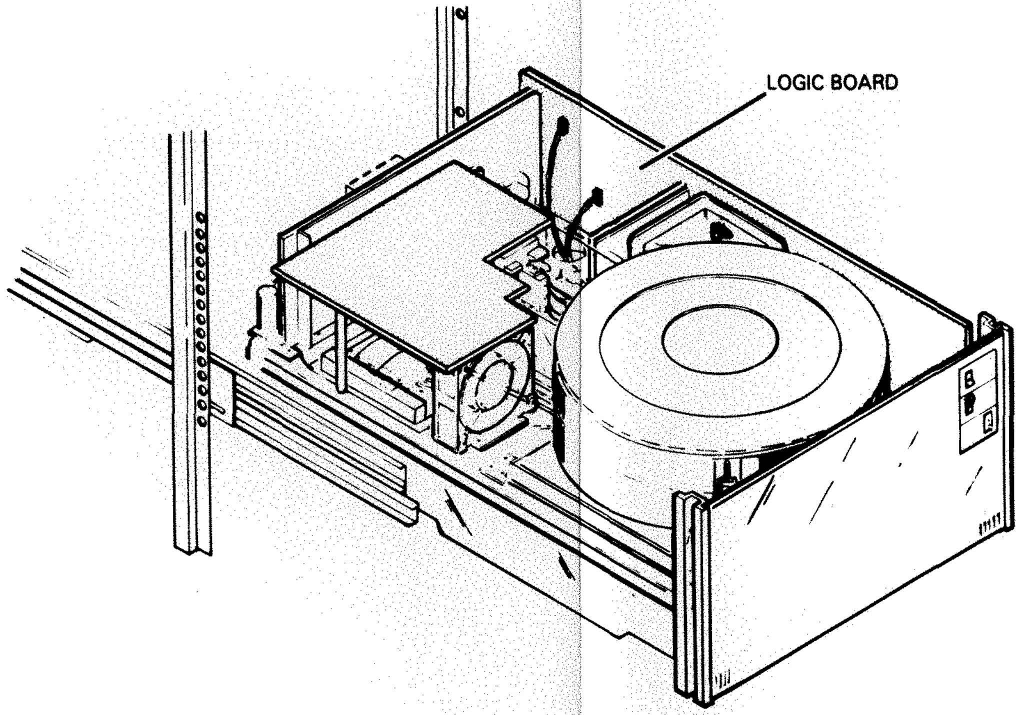
Logic Board Removal

SPECIAL TOOLS & PARTS

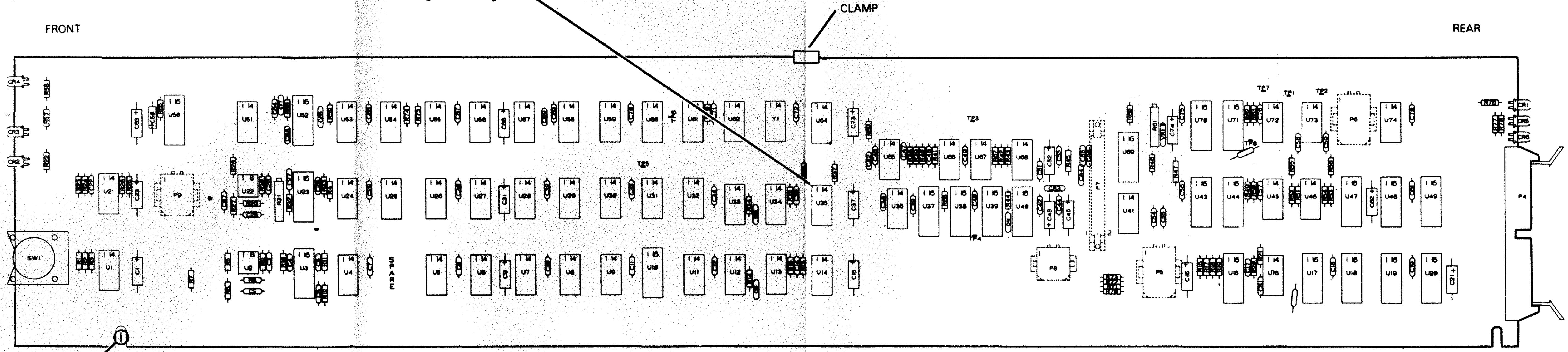
Logic Board
(005-005938)

(1) Extend the drive fully and remove the top cover.



(2) Disconnect the ribbon cable, at the rear of the drive, from the logic board. Also remove the five connectors and the cable leading to the read/write board.

The nylon standoff located above U35 prevents the logic board from touching the casting.



(3) Remove the two screws and clamp holding the logic board to the casting.

(4) Remove the logic board from the casting.

Do not bend the LED's, located on the front of the logic board.

(5) If you are installing a new logic board, go to the Upper Head Alignment and follow steps 5-8, 10-11, and 18-26. Then go to Servo Alignment Procedure and do step 7. If a new board is not being installed, no adjustments are necessary.

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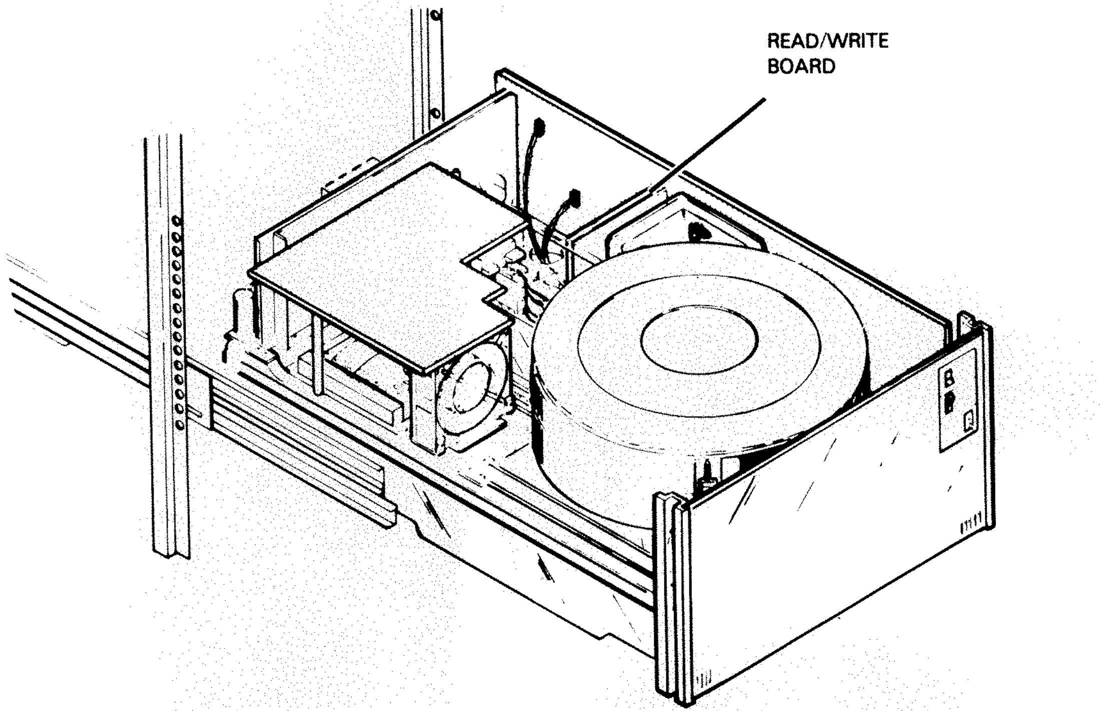
Read/Write Board Removal

SPECIAL TOOLS & PARTS

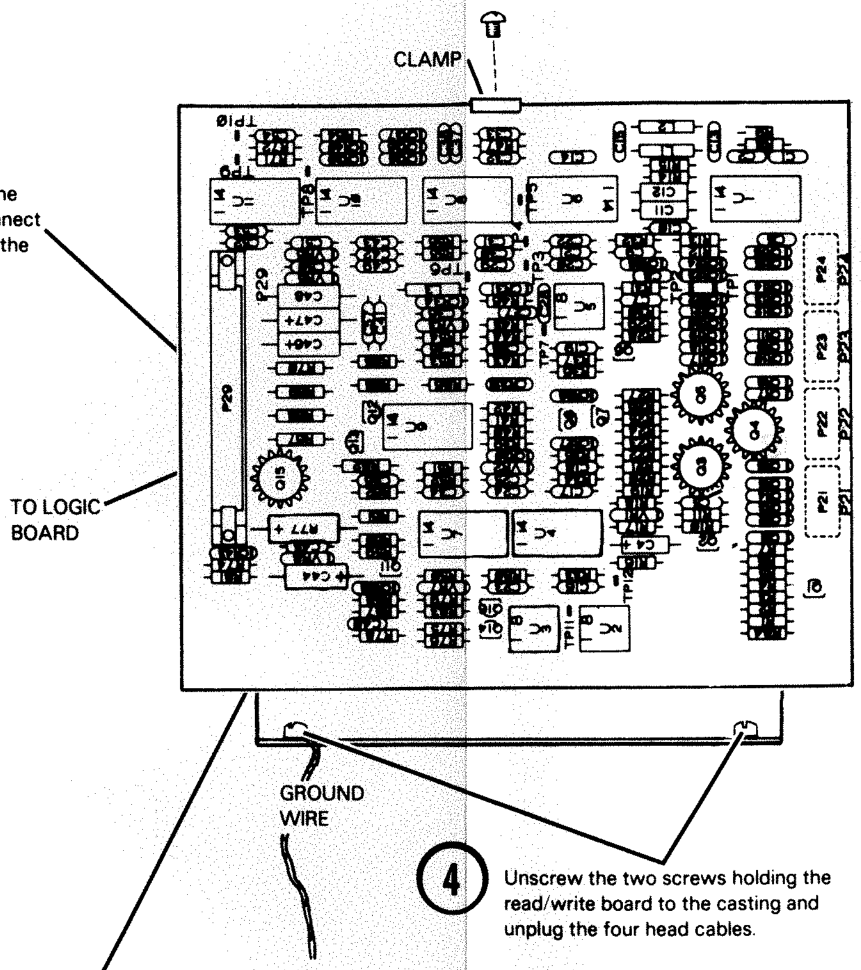
Read/Write Board
(005-005940)

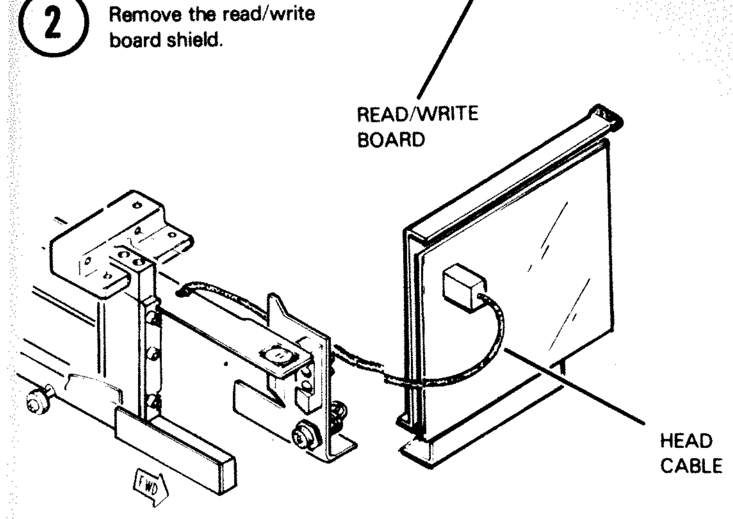
① Extend the drive fully and remove the top cover.



② Remove the read/write board shield.

③ Unscrew the clamp holding the read/write board. Also disconnect the cable (at P29) running to the logic board.





④ Unscrew the two screws holding the read/write board to the casting and unplug the four head cables.

Captive hardware, back out evenly.

When installing the read/write board, be sure to reconnect the ground wire to the base and the cable from the logic board to P29. Also make sure the head cables are connected in the proper order.

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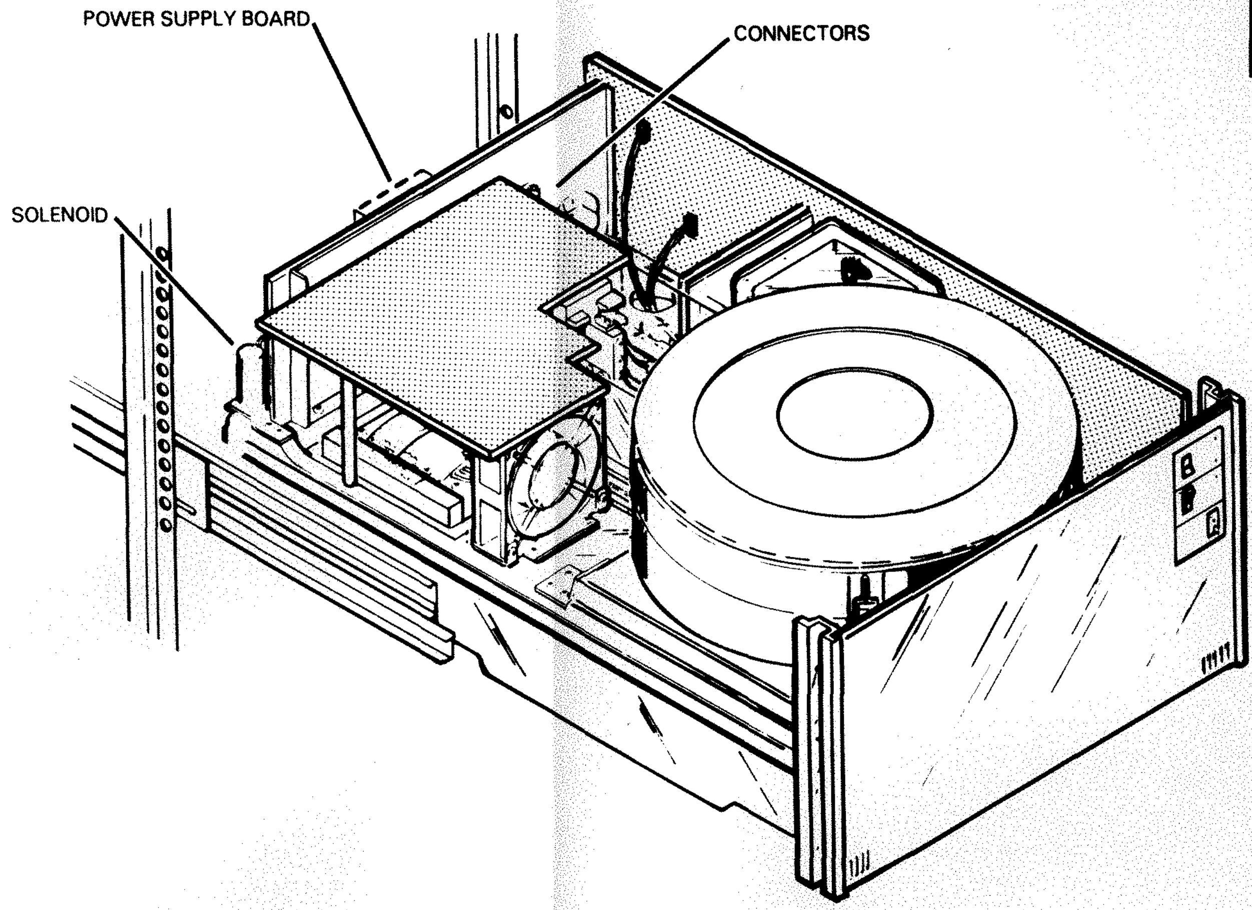
Power Supply Board Removal

SPECIAL TOOLS & PARTS

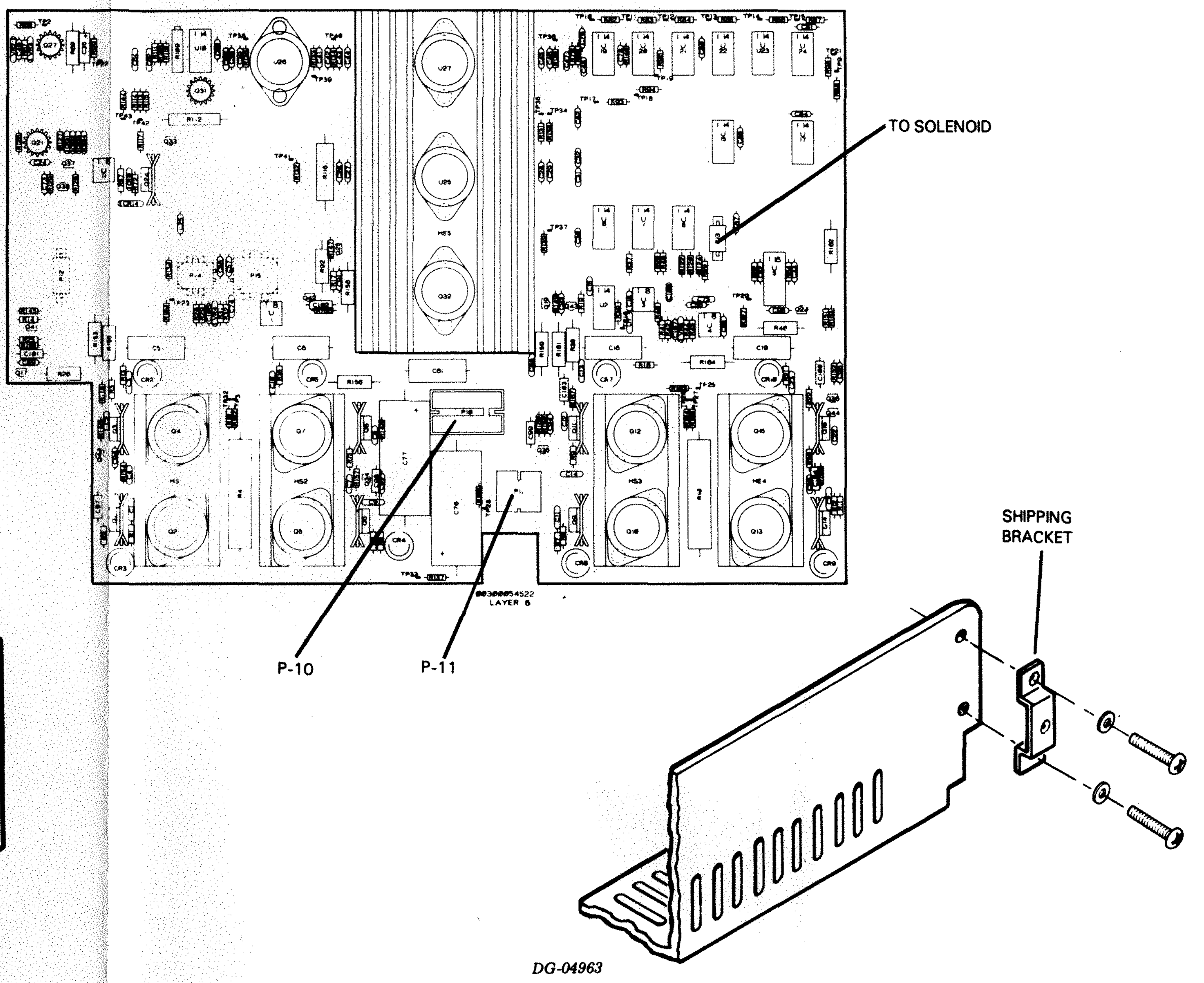
Power Supply Board
(005-005942)

① Extend the drive fully and remove the top cover.

② Remove the three connectors attached to the power supply board (at P-12, P-14, P-15) inside the drive.



③ Remove the drawer latch solenoid connector (P-13) from the power supply board at the rear of the drive.



④ Unscrew the four screws holding the rear cover and the two shipping brackets on the drive. Unplug the two connectors (P-10, P-11) on the lower portion of the power supply board.

⑤ Unscrew the two screws holding the board to the casting and lift it out of the drive.

Captive hardware, back out evenly.

⑥ If you have installed a new power supply board, go to the Servo Alignment procedure (page 25), and follow steps 3-6.

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Power Supply Removal

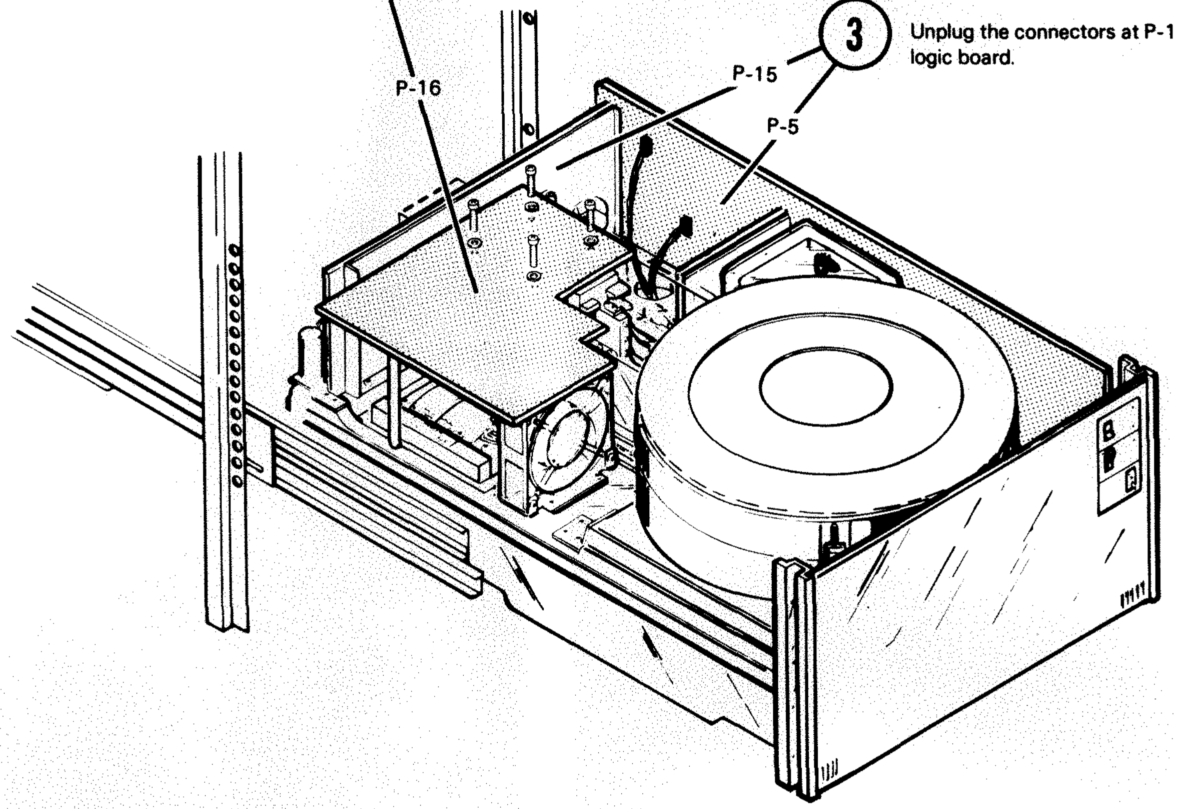
SPECIAL TOOLS & PARTS

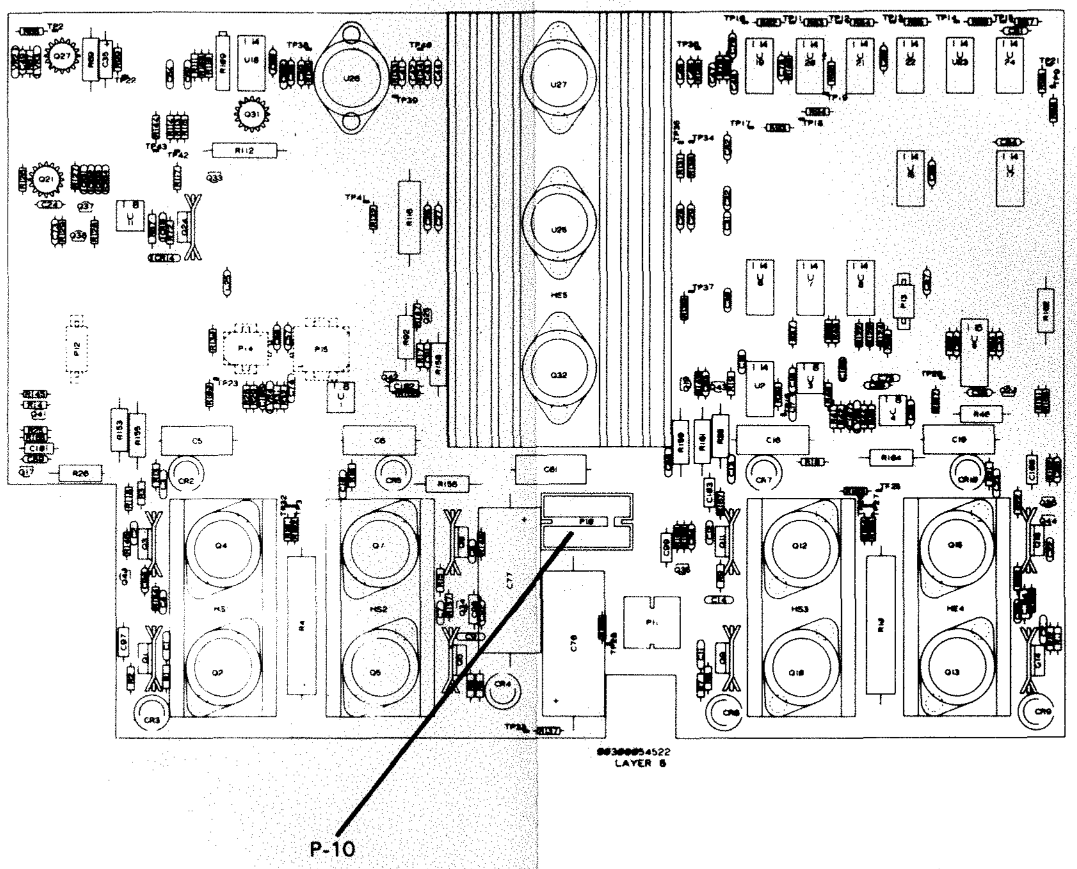
None

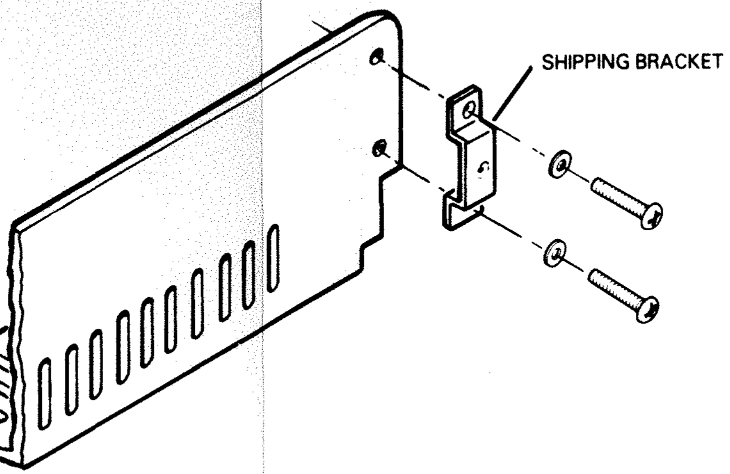
① Unplug the line cord.
Extend the drive fully and remove the top cover.

② Remove the four screws and nylon washers holding the servo board. Lift up the board and unplug the connector at P-16.

③ Unplug the connectors at P-15 on the power supply board and P-5 on the logic board.



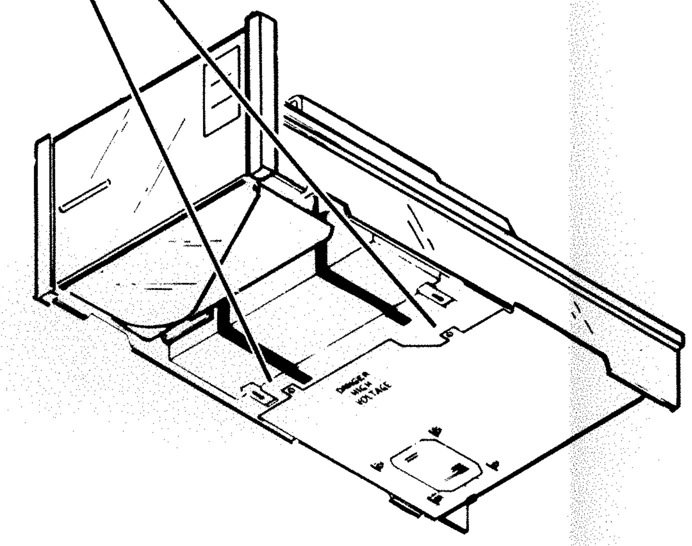




④ Unscrew the four screws holding the rear cover and shipping brackets on the drive. Unplug the connector at P-10 on the lower portion of the power supply board.

Power Supply Removal (Cont.)

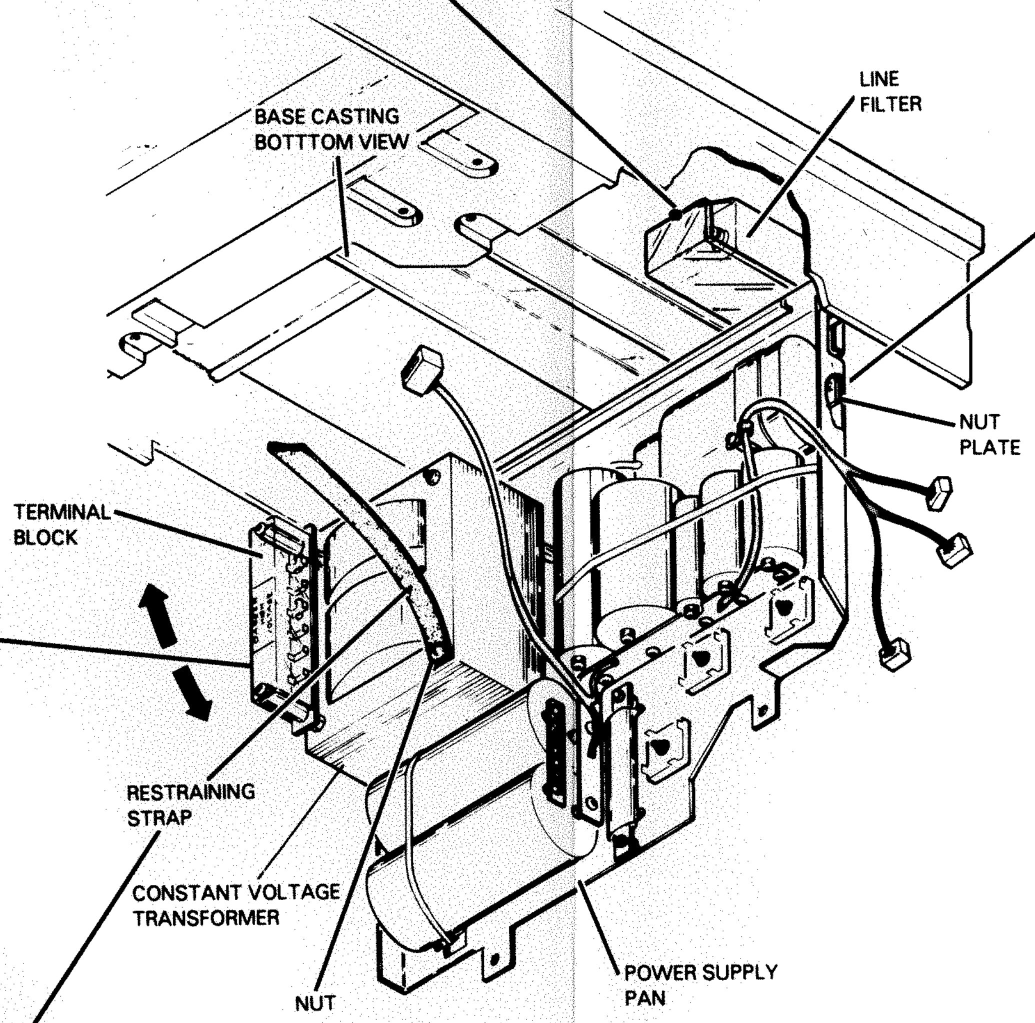
⑤ Proceed to the underside of the drive. Place one hand on the power supply pan and push up. Remove the two screws and lower the pan slowly.



⑥ Unscrew the two screws holding the cover of the transformer terminal block. Remove the cover and disconnect all the wires.

Make a chart of where each wire is to be connected for the new power supply.

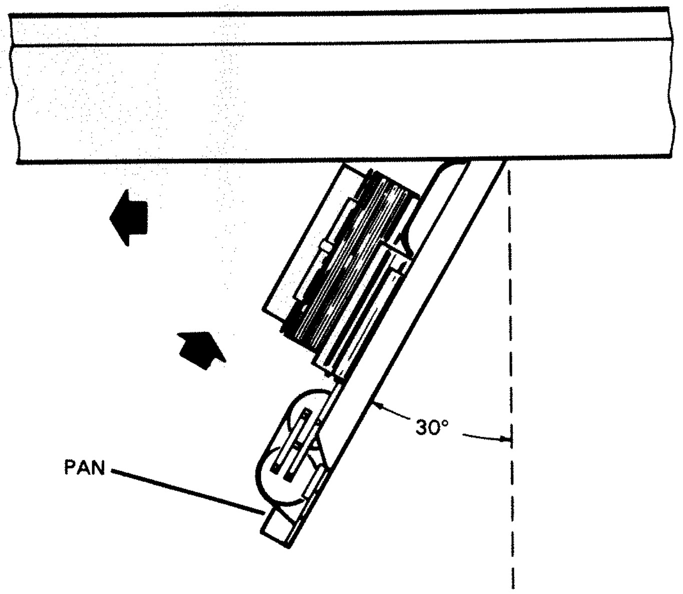
⑦ Unscrew the two screws holding the plastic cover for the line filter and remove it.


BASE CASTING
BOTTTOM VIEW
LINE
FILTER
NUT
PLATE
TERMINAL
BLOCK
RESTRAINING
STRAP
CONSTANT VOLTAGE
TRANSFORMER
NUT
POWER SUPPLY
PAN

⑧ Hold the pan so that there is no tension on the restraining strap. Remove the nut and washer holding it to the transformer.

⑨ Loosen the nut plates on both sides of the pan and slide them down.

⑩ Take a firm grip of the pan and hold it at approximately a 30 degree angle. Push the pan up and then pull it towards the front of the drive.



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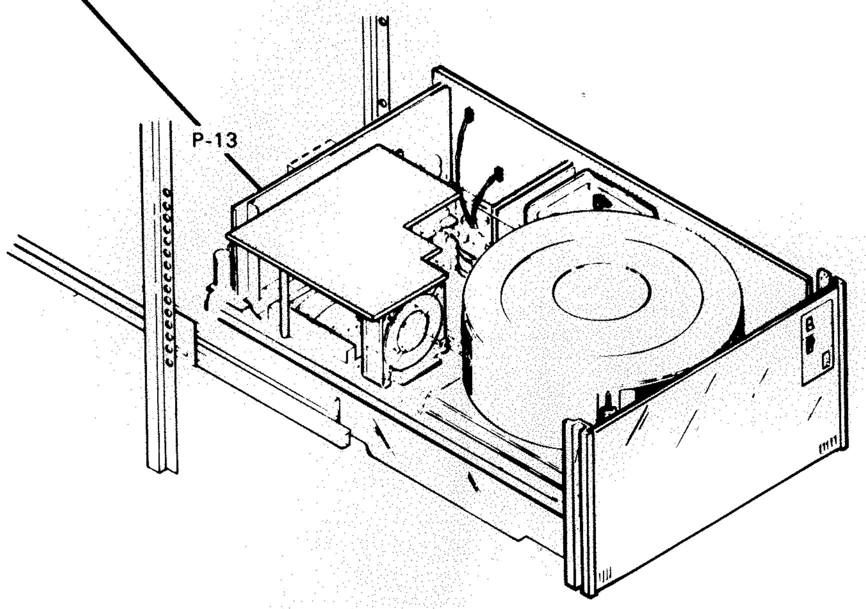
Solenoid Replacement

SPECIAL TOOLS & PARTS

Wrench 11/32" (128-000040)
Spring Pin (123-000276)
Spring (123-000941)
Solenoid & Plunger (005-006157)
Link Bracket (002-005053)

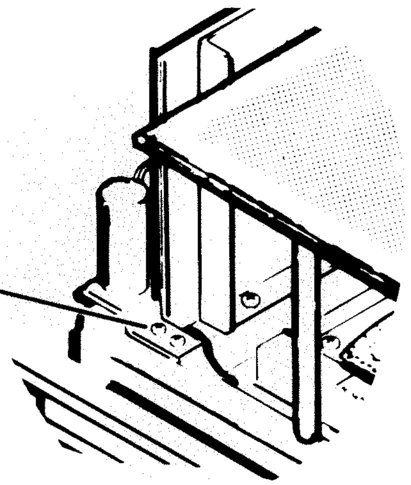
① Extend the drive fully and remove the top cover.

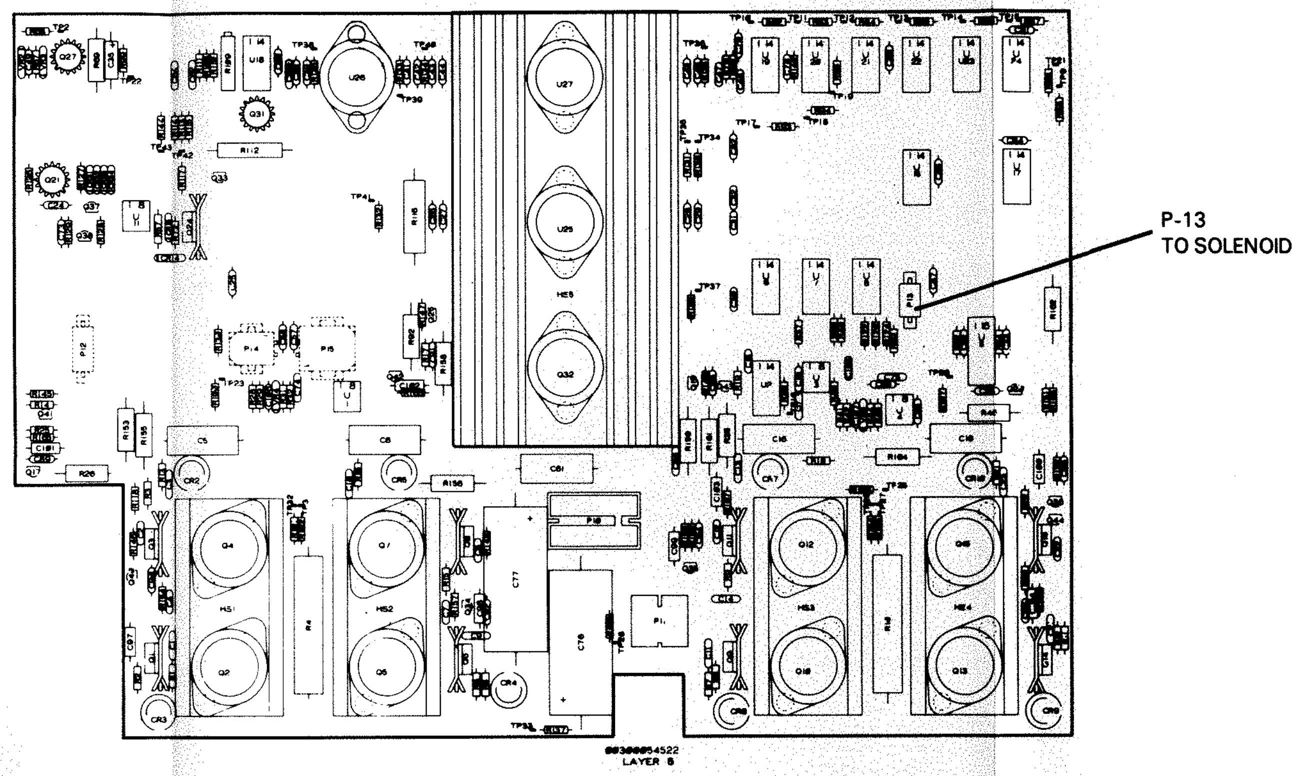
② Unplug the solenoid connector from the power supply board at P-13.

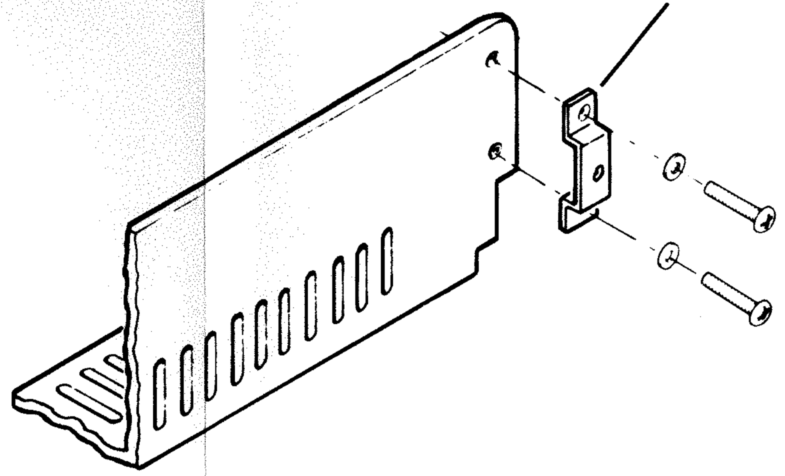


③ Unscrew the two screws holding it to the drive and lift it off.

Data General is presently using two solenoid assemblies from different manufacturers. These assemblies are not interchangeable. If the solenoid does not fit on the plunger, proceed to step 4. If it does, proceed to step 9.







④ Unscrew the four screws holding the rear cover and shipping brackets on the drive.

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Solenoid Replacement (Cont.)

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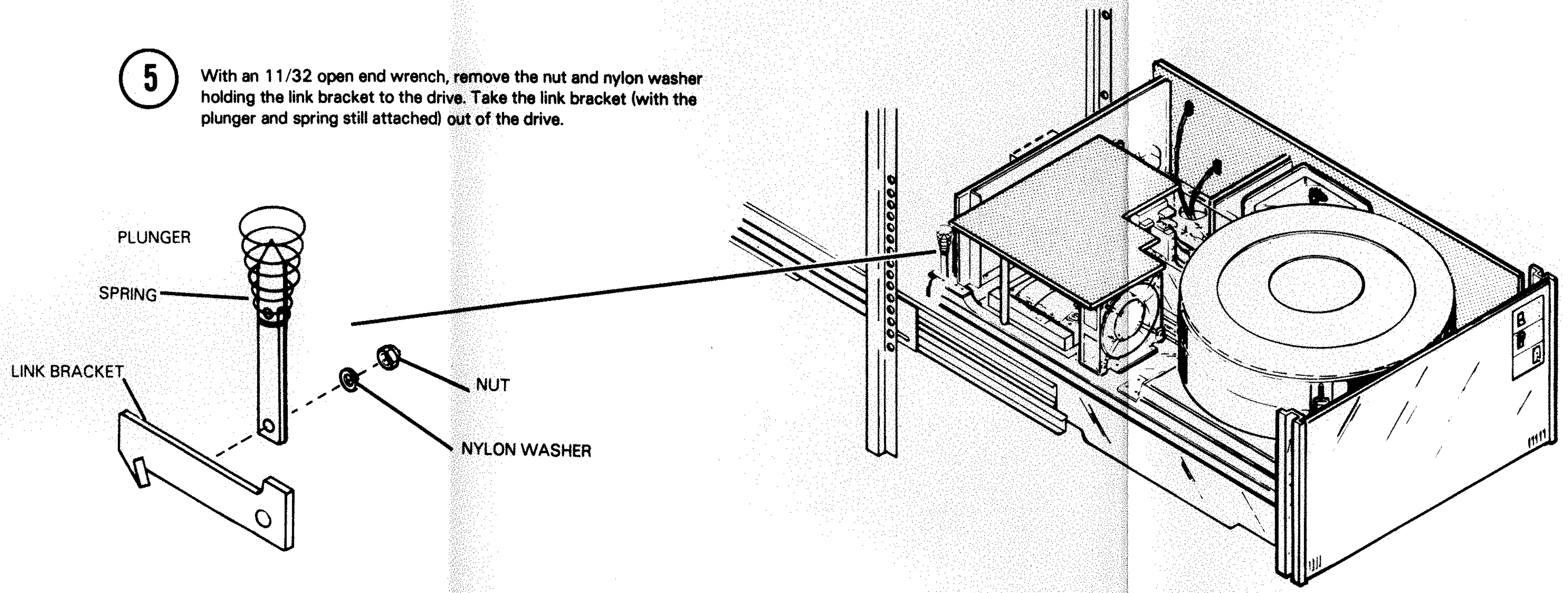
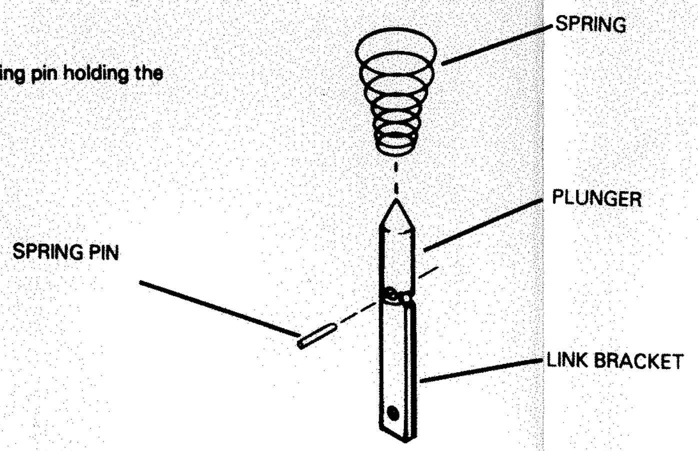
⑤ With an 11/32 open end wrench, remove the nut and nylon washer holding the link bracket to the drive. Take the link bracket (with the plunger and spring still attached) out of the drive.



⑥ Remove the spring from the plunger and pull the spring pin holding the link bracket to the plunger.



⑦ Put the new plunger and link bracket together and insert the spring pin. Place the spring on the plunger.

Do not bend the link bracket when inserting the spring pin.

Check the plunger and link bracket for free movement.

⑧ Put the link bracket (with the new plunger and spring attached) back on its screw and replace the nylon washer and nut holding it to the drive.

If the nut is too tight the link bracket will not move freely. Check the bracket for free movement.

⑨ Place the solenoid over the plunger and replace the two screws that hold it to the chassis. Plug the connector into the power supply board at P-13.

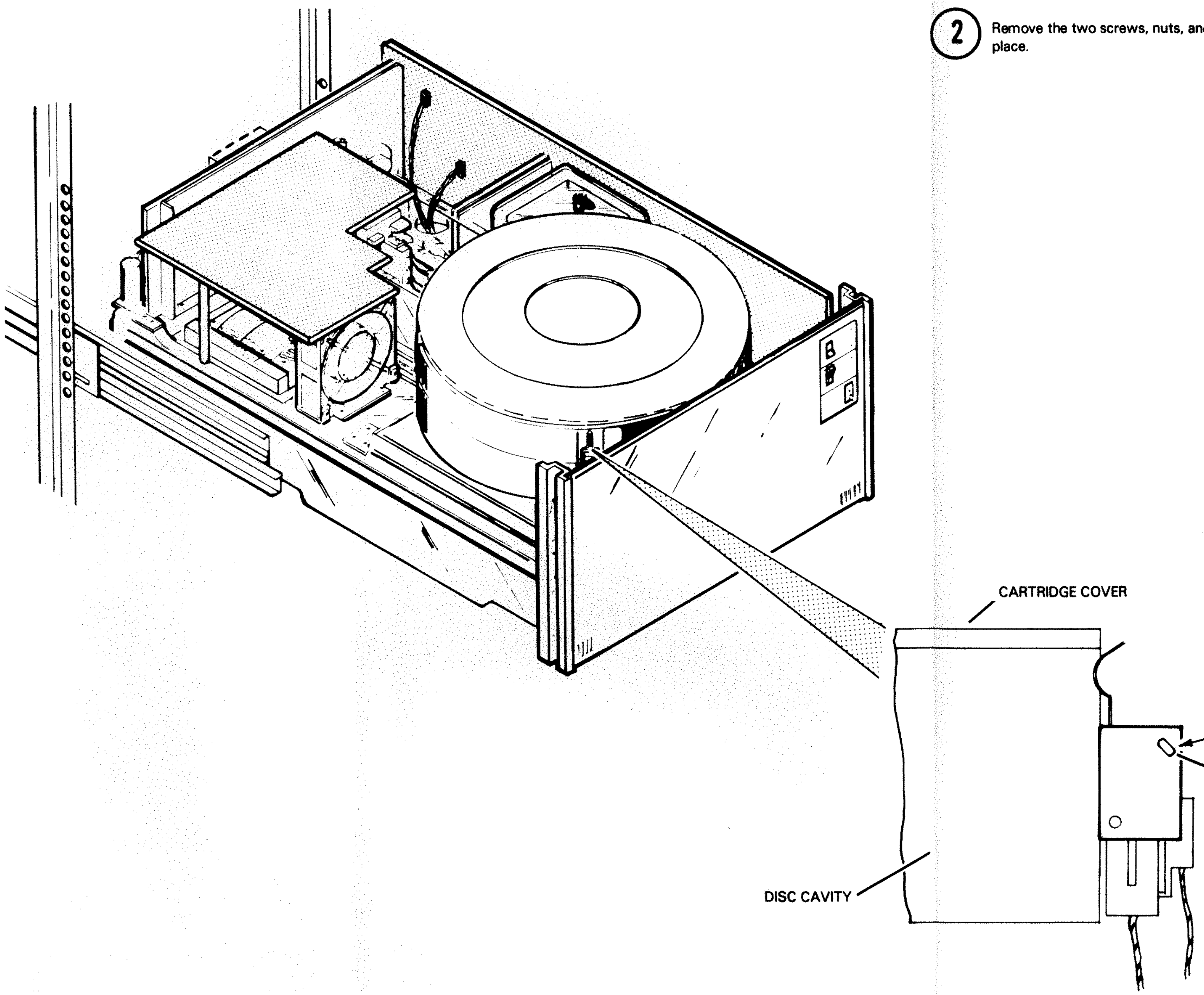
⑩ Replace the top cover.

Cover On Switch Replacement

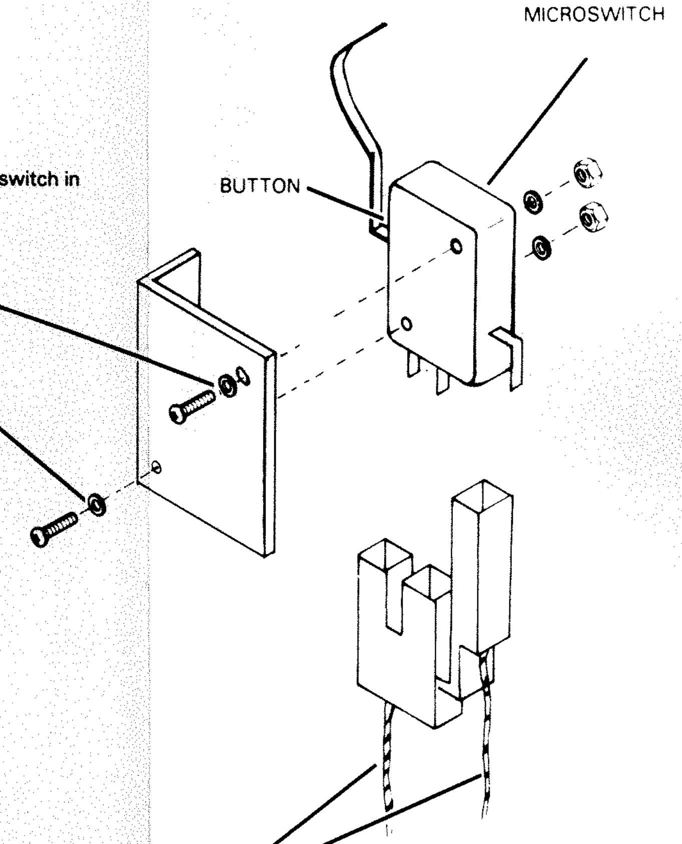
SPECIAL TOOLS & PARTS

Switch
(002-003459)

① Extend the drive fully and remove the top cover.



② Remove the two screws, nuts, and washers holding the cover on switch in place.



③ Remove the wires connected to the switch.

④ When replacing the cover on switch, a cartridge disc must be installed.

⑤ Reconnect the wires to the switch. Insert the two screws (with washers) into their nuts (finger tight only).

⑥ Adjust the switch so that the button on the switch is depressed fully and tighten the two screws.

Remove the cartridge cover to check the positioning of the switch. It may be the casting, not the cover, which is keeping the button depressed.

Shift the cartridge cover away from the switch and check to see if the button is still depressed. If it is not, make the necessary adjustment.

Fan Removal

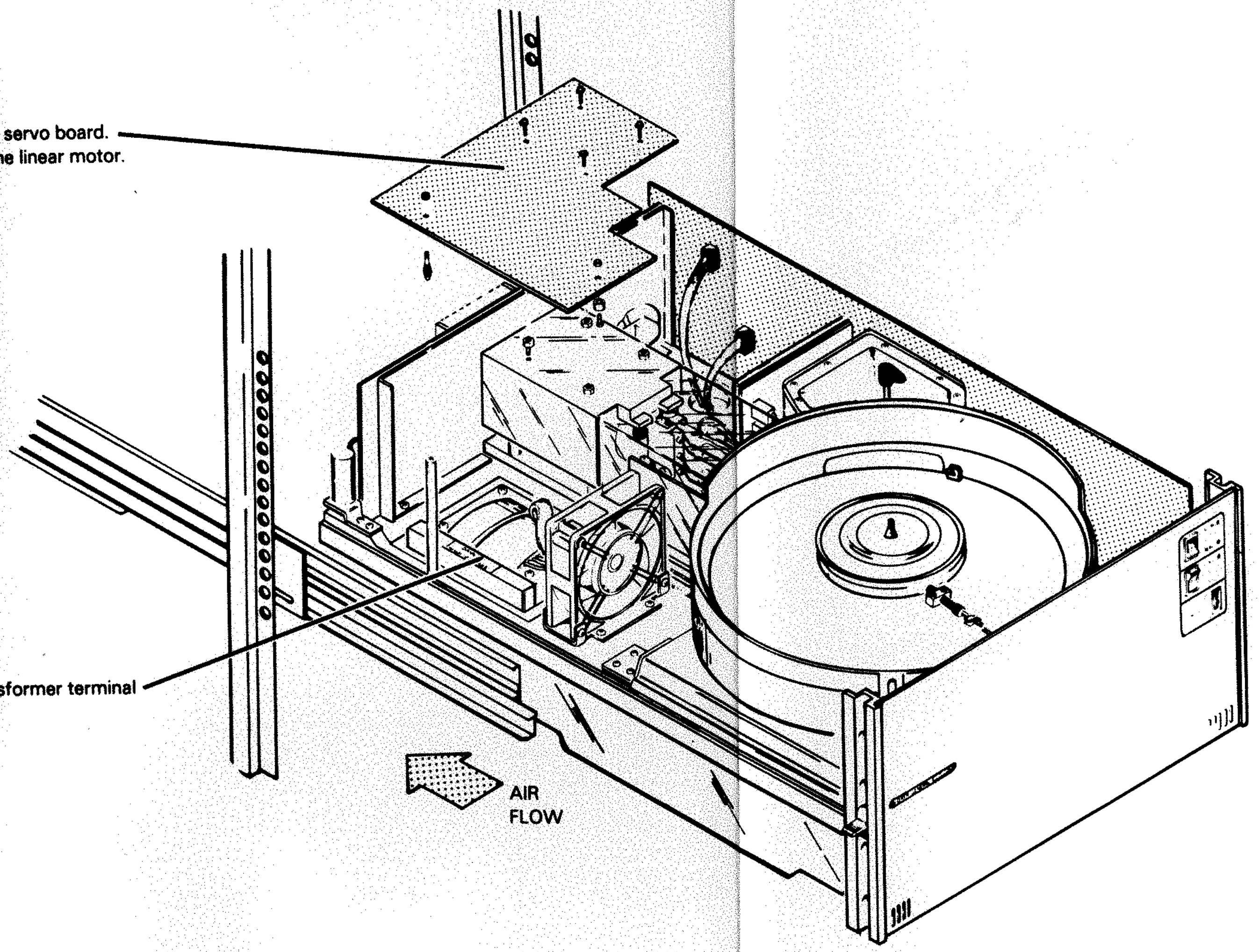
SPECIAL TOOLS & PARTS

Fan
(115-000121)

① Extend the drive fully and remove the top cover.

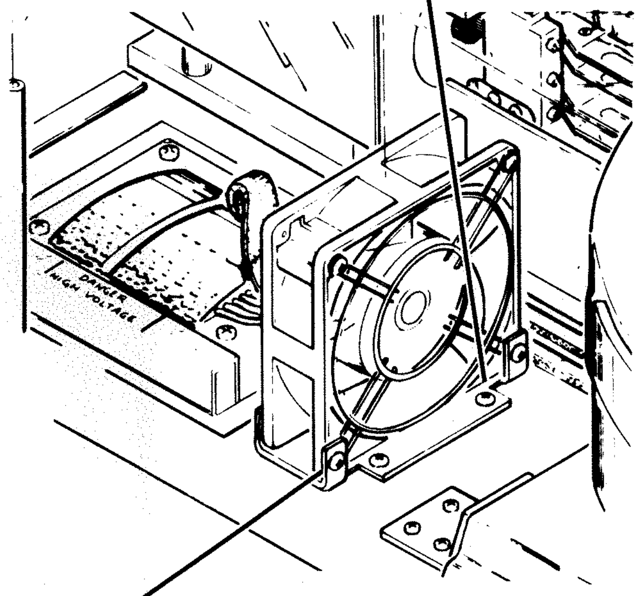
② Remove the four screws and nylon washers holding the servo board. Unplug the five cables connected to it and lift it off of the linear motor.

③ Unscrew the two screws holding the cover of the transformer terminal block and remove it.



④ Disconnect the two wires that supply power to the fan.

⑤ Unscrew the three screws and one nut that are holding the fan to the casting.



⑥ Now unscrew the four screws holding the fan to its mounting.

When replacing the fan, reconnect the power supply restraining strap. Make sure the wires of the fan are connected to their proper points on the transformer. Check the direction of air flow.

The new fan does not come with wires attached; use the wires from the old fan.

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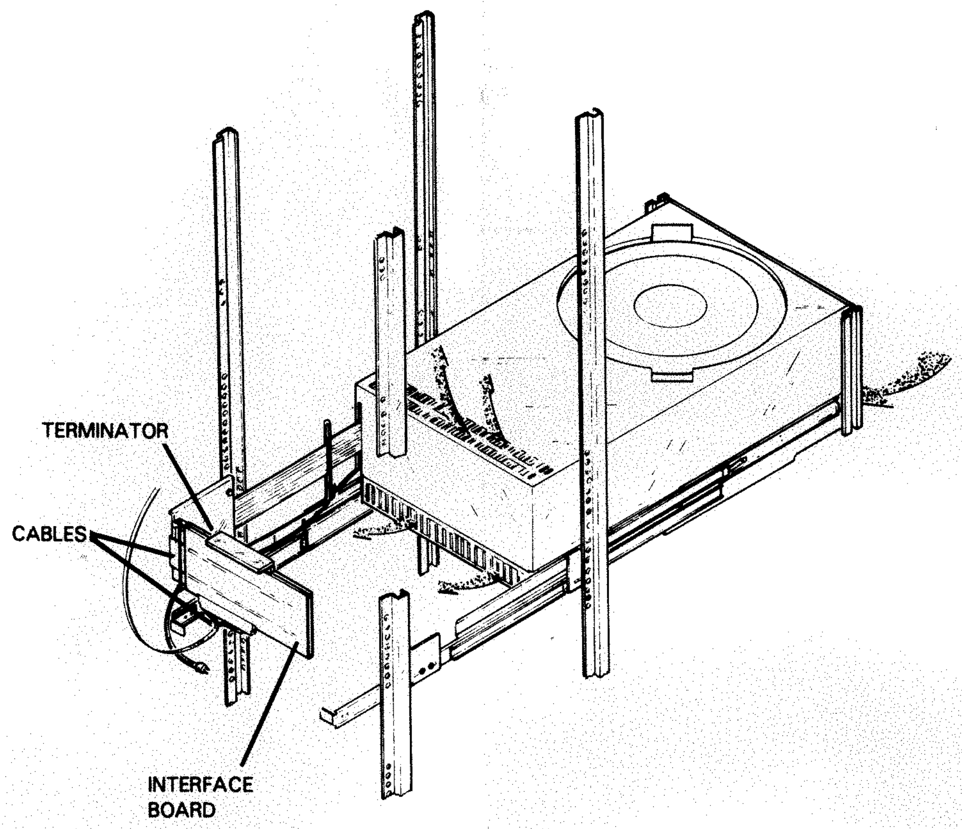
Interface Board Removal

SPECIAL TOOLS & PARTS

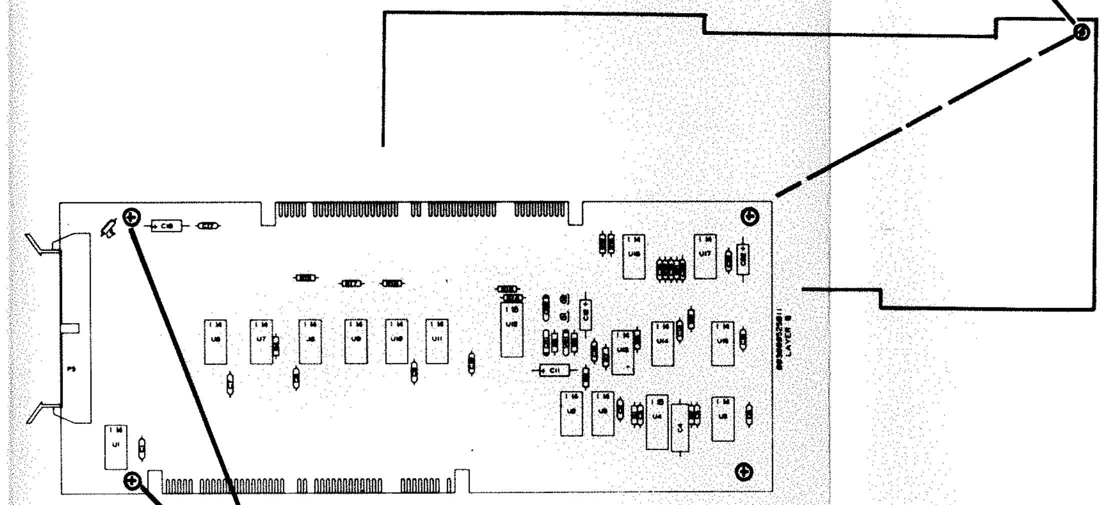
Interface Board
(005-005936)

1. Proceed to the rear of the cabinet.



2. Disconnect the cables and the terminator (if one is being used), from the interface board.

3. Unscrew the two screws holding the cover of the interface board mounting and remove it.



4. Unscrew the four screws holding the board to the mounting and remove it.

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APPENDIX A
Additional Information

RELATED DOCUMENTATION

The following is a list of Data General publications, tools, parts, and drawings dealing with the 6045 Series Cartridge Disc Subsystem.

001-000258	SCHEM	DISC CARTRIDGE CONTROL
001-000870	SCHEM	CART DISC, TERMINATOR
001-000871	SCHEM	CART DISC, READ/WRITE AMP
001-000872	SCHEM	CART DISC, SERVO
001-000873	SCHEM	CART DISC, LOGIC
001-000874	SCHEM	CART DISC, CABLE INTERFACE
001-000875	SCHEM	CART DISC, POWER SUPPLY-SPINDLE
001-000906	SCHEM	P/S PAN PHOENIX
001-000978	SCHEM	THERM BD PHOENIX
001-001115	SCHEM	TIMING DIAGRAM 6050
002-003459	MECH PT	SWITCH, CVR DETECT CTG DISC
002-004819	MECH PT	DUCT, AIR INTAKE, CTG DISC
002-005053	MECH PT	BRACKET, SOLENOID LINK
005-000469	ASSY	CABLE INT BK PNL-50PIN CONN 4046
005-001802	ASSY	CA INT GP PD BD N2
005-002208	ASSY	CABLE EXTERNAL ADPTR-CONT
005-003670	ASSY	ALIGNMENT CRT 200 TRACK
005-003696	ASSY	CA EXT FLEXIBLE DISC 800/1200
005-003982	ASSY	MAIN CTG DISC CONTROL
005-005927	ASSY	HDW MTG KIT 200TPI CTG DISC
005-005929	ASSY	DOC PKG 200 TPI CTG DISC
005-005930	ASSY	TERMINATOR PCB TESTED CTG DISC
005-005931	ASSY	AC JUMPER 60HZ
005-005932	ASSY	DISC BRUSH 200 TPI CTG DISC
005-005936	ASSY	INTERFACE PCB TESTED, CTG DISC
005-005938	ASSY	LOGIC PCB TESTED, CTG DISC
005-005940	ASSY	READ/WRITE PCB TESTED, CTG DISC
005-005942	ASSY	POWER SUPPLY PCB TESTED, CTG DISC
005-005943	ASSY	POWER SUPPLY CHASSIS, CTG DISC
005-005944	ASSY	SPINDLE & MOTOR 200 TPI CTG DISC
005-005946	ASSY	BLOWER 20 TPI, CTG DISC
005-006129	ASSY	PHOTO SENSING DEVICE, CTG DISC
005-006130	ASSY	(D) MAGNETIC SENSOR DEVICE CTG DISC
005-006133	ASSY	PREP DISC BRUSH MOTOR CTG DISC
005-006150	ASSY	HARNESS, POWER SUPPLY CTG DISC
005-006157	ASSY	PREP SOLENOID, 200TPI CTG DISC
005-006158	ASSY	POWER SUPPLY JUMPER KIT 50/60 HZ
005-006160	ASSY	PREP TRANSFORMER 60HZ CTG DISC
005-006161	ASSY	HARNESS, POWER SUPPLY GND DISC
005-006279	ASSY	HARNESS, SPINDLE LOGIC CTG DISC
005-006280	ASSY	HARNESS, BRUSH MOTOR CTG DISC
005-006282	ASSY	HARNESS, SERVO 200 TPI CTG DISC
005-006283	ASSY	CABLE READ/WRITE 200 TPI CTG DISC
005-006284	ASSY	CABLE INTERFACE 200 TPI CTG DISC
005-006286	ASSY	HARNESS, AC CONTROL CTG DISC
005-006289	ASSY	POWER CORD 60HZ 200 TPI CTG DISC
005-006292	ASSY	DC JMPR KIT, P/S PHOENIX
005-006303	ASSY	I/O CA, SHORT PHOENIX
005-006428	ASSY	HARNESS SENSOR AND SWITCHES, DISC
005-006537	ASSY	TEMP COMPENSATION PCB TESTED
005-006824	ASSY	CA FAN PHOENIX
005-007094	ASSY	DISC CTG DGC SPEC PHOENIX
005-007927	ASSY	DOC PKG CONTROLLER
005-007928	ASSY	DOC PKG, CTG DISC & CONTROLLER
005-008036	ASSY	SERVO BOARD FINAL TEST 2
005-008920	ASSY	SPINDLE & '2 SECTOR RING 6050
005-105947	ASSY	COMPLETE CARTRIDGE DISC 200 TPI
008-000111	WL	INT CBL BP-50P CONN 20"
008-000426	WL	CA INT GP PD BD N2
008-000534	WL	CA EXT VAC COL TAPE UNIT 820/1220
008-000760	WL	CA EXT I/O FLEXIBLE DISC 800/1200
008-000835	WL	CA RIBBON INTFC PHOENIX
008-000836	WL	CA RIBBON R/W PHOENIX
008-000837	WL	CA P/S (GND) PHOENIX
008-000838	WL	CA SOLENOID PHOENIX
008-000840	WL	CA P/S MAIN PHOENIX
008-000841	WL	XFRMR 60HZ PHOENIX
008-000843	WL	CA CTG DISC SERVO PHOENIX
008-000844	WL	CA CTG SPINDLE LGC PHOENIX
008-000845	WL	CA BRUSH MOTOR PHOENIX
008-000849	WL	DC JUMPER WIRE KIT P/S PHOENIX
008-000850	WL	PWR CORD 50HZ PHOENIX
008-000851	WL	PWR CORD 60HZ PHOENIX
008-000852	WL	P/S JUMPER KIT 60HZ/50HZ PHOENIX
008-000853	WL	AC JUMPER 60HZ PHOENIX
008-000854	WL	AC JUMPER 50HZ PHOENIX
008-000855	WL	CA AC CTL PHOENIX
008-000857	WL	CA SENSOR PHOENIX
008-000871	WL	CA EXT I/O SHORT PHOENIX
008-000889	WL	CA THERM PHOENIX
008-000892	WL	CA FAN PHOENIX
008-000978	WL	SPNDL MTR CA PHOENIX
015-000021	TM	PERIPHERAL PROGRAMMERS
015-000057	TM	DISC CTG DRIVE 6045/50/51
016-000189	IPL	CONTROL CARD
016-000259	IPL	INTERFACE PCB
016-000260	IPL	READ/WRITE PCB
016-000265	IPL	SERVO PCB
016-000266	IPL	LOGIC PCB
016-000267	IPL	POWER SUPPLY SPINDLE
016-000297	IPL	TEMPERATURE COMPENSATION PCB, PHOENIX
016-000381	IPL	MECH 6050
016-000382	IPL	INT CABLE 6050
016-000386	IPL	HDW MTG KIT 200TPI CTG DISC
095-000299	DIAG	AB CRT/DISKETTE DIAGNOSTIC
*095-000300	DIAG	AB CRT/DISKETTE RELIABILITY
*095-000301	DIAG	AB CRT/DISKETTE FORMATTER
096-000299	DIAG	LS CRT/DISKETTE DIAGNOSTIC
*096-000300	DIAG	LS CRT/DISKETTE RELIABILITY
096-000301	DIAG	LS CRT/DISKETTE FORMATTER
110-000229	SWITCH	MIN BASIC STYLE 35 1.40 LG
115-000087	BLOWER	RADIAL 60HZ CTG DISC 4 SURFACE
115-000088	BLOWER	RADIAL 50HZ CTG DISC 4 SURFACE
115-000121	BLOWER	TUBE-AXIAL 4 11/16" HI-PERFORM (FAN)
*117-000436	SPEC TOOL	STG GAUGE MAG SNS-ARM PLATE
*117-001972	SPEC TOOL	SETTING GAGE PHOENIX
118-000392	PUR ASSY	ACTUATOR, HD POS SYS/CTG DISC
118-000397	PUR ASSY	0 ANG RMP LD HEAD/ARM A UP
118-000398	PUR ASSY	0 ANG RMP LD HEAD/ARM A DOWN
118-000416	PUR ASSY	STATOR 4 SURF CTG DISC
118-000510	PUR ASSY	SINGLE DISC .050 THICK
118-000511	PUR ASSY	AIR FILTER CTG DISC
120-000156	CHEM	LITHIUM CARBONATE (SLIPSPRAY)
123-000190	STD PT	BRUSH, DISC CLEANING #264-016
123-000276	STD PT	PIN ROLL 1/8D X5/8LD
123-000924	STD PT	SPRING, EXTENSION LE-0410-8
123-000941	STD PT	SPRING, HI-RETURN MO62346-11
*128-000040	TOOL	WRENCH OFF SET OPEN END 11/32
*128-000052	TOOL	HANDLE CANNON #204-9500-000
*128-000059	TOOL	SOCKET #324-9501-000
*128-000255	TOOL	TORQUE WRENCH 9901 (0-100 IN-OZ.)
128-001083	TOOL	XCELITE HEX DRIVER BL PNT 9923BP
*128-001086	TOOL	GAUGE .030 WIRE FORM 93811
*128-001092	TOOL	TORQUE WRENCH (0-100 IN-LBS.)

*These items are needed to perform all the field service procedures in this manual.

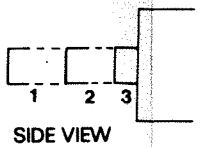
CRITICAL TORQUES

Air Duct to Base Casting	5.0 IN-LBS
Brush Assembly to Plate Casting	20.0 IN-LBS
Fixed Disc Clamping Ring	10.0 IN-LBS
Linear Motor to Base Casting	36.0 IN-LBS
R/W Head Clamps	6.9 IN-LBS (110 IN-OZ)
Spindle & Motor Assy to Base Casting	8.0 IN-LBS
Stator Clamps to Spindle Motor	7.0 IN-LBS

HOW TO PURGE THE SYSTEM

1. Set the servo enable/disable switch to disable.
2. Replace the top cover.
3. Install a cartridge disc.
4. Pull the Drive-in-Place Switch out to the service position.

DRIVE-IN-PLACE SWITCH



SIDE VIEW

1) Service position
2) Drive out of position (heads will not load)
3) Normal operating position

5. Turn power on and set the load/ready switch to ready.
6. Let the drive run for one hour.
7. Power down the drive. Remove the top cover and place the servo enable/disable switch to enable.

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APPENDIX B
Programming Summary

INTRODUCTION

This disc subsystem includes a maximum of four moving head disc drives plus one or two controllers. The subsystem controller occupies a single slot of the computer chassis and directs the activities of the disc drives. Control over the subsystem may be shared between two NOVA line or ECLIPSE line central processors by installing a subsystem controller in each processor.

This section discusses the programming protocols for driving model 6070 disc cartridge units in both single and dual processor environments. Each disc unit contains four program-accessible surfaces. Surfaces 0 and 1 are on a platter in a removable disc cartridge; surfaces 2 and 3 are on a platter permanently located in the lower half of the drive unit. There are 408 cylinders in each unit, numbered $0\text{-}627_8$. Each of the four tracks in a cylinder contains 24 sectors, numbered $0\text{-}27_8$. Each sector contains an address header and a data field that stores 256 (400_8) 16-bit data words and a 16-bit checkword. The data storage capacity is 6144 words/track or 10,027,008 words/drive unit.

Data moves to and from the subsystem via the data channel at a maximum rate of 312,500 words per second. From 1 to 16 consecutive sectors in one cylinder - containing a total of 4096 words - can be transferred in one operation. The controller contains a 16-bit memory address register: it supports extended memory addressing on NOVA 3 computers and map selection on those ECLIPSE and NOVA computers with more than one data channel map.

CONTROLLER REGISTERS

The disc drive controller contains four program-accessible registers: a 16-bit Memory Address Register, a 16-bit Status Register, a 16-bit combined Command and Cylinder Select Register, and a combined Disc Address Register and Sector Counter. The Memory Address Register is self-incrementing and contains the address of the next location whose contents are to be transferred to or from the disc subsystem via the data channel. The Status Register contains four Seek Done flags, a Read/Write (R/W) Command Done flag, a Unit Ready flag, a Valid Status flag, and seven Error flags.

The Seek Done flag and the R/W Done flag each initiate a program interrupt request when set to 1. The combined Command and Cylinder Select Register contains the last command issued to the subsystem and the number of the desired cylinder on the selected unit. The combined Disc Address Register and Sector Counter contains the number of the next surface and sector to be read or written and the two's complement of the number of sectors remaining to be read or written. The **surface** and the **sector** portions of this register self- increment immediately after each sector transfer.

INSTRUCTIONS

Six instructions program data channel transfers to and from the subsystem. Three of these instructions supply the controller with all the necessary information for any disc operation. The remaining instructions allow the program to determine, in detail, the current state of the subsystem.

The device flag commands control the disc controller's Busy and Done flags as follows:

f=**S**	Sets the Busy flag to 1, sets the Done flag to 0, sets the Address Error, End of Cylinder, Checkword Error, Data Late, and Unsafe flags to 0, and initiates the operation specified by the contents of the Command Register.
f=**C**	Sets the Busy flag to 0, sets the Done flag to 0, sets all error flags to 0, sets all Seek Done flags to 0, and stops all data transfer operations; does not terminate a seek operation already in progress.
f=**P**	Sets the Done flag to 0, sets all error flags to 0 and initiates the operation specified by the contents of the Command Register.
IORST	Same as clear.

NOTE: *The* **P** *flag command does not affect the controller's Busy flag. If the Busy flag is 0 and the program starts an operation with the* **P** *command, the controller does not initiate a program interrupt request at the conclusion of the operation unless it is a Seek or Recalibrate. The controller initiates an interrupt at the end of all Seek or Recalibrate operations.*

Instruction Coding Conventions

In the descriptions that follow, we use certain coding conventions to help you properly write the instructions for Data General's assembler. We describe those conventions in one of the appendices of this publication.

Specify Disc Address And Sector Count

DOC *[f]* *ac*,**DKP**

0	1	1	AC		1	1	0	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Loads bits 0-15 of the specified AC into the controller's Disc Address Register and Sector Counter. After the data transfer, sets the controller's Busy and Done flags according to the function specifed by **F**. The contents of the specified AC remain unchanged. The format of the accumulator depends on the contents of the Diagnostic Mode flag (bit 3) as follows:

DRIVE		F	D	SURF			SECTOR					- SECT CNT			
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0-1	DRIVE	Selects drive $0\text{-}3_8$
2[1]	FORMAT	If 1, places controller in FORMAT mode
2,6[1]	TEST	In diagnostic mode, bits 2 and 6 specify test conditions as follows: 0 - 0 Test Buffer Control, (surf=0,2) 0 - 1 Test Unsafe logic, (surf=1,3) 1 - 0 Test CRC logic, (surf=0,2) 1 - 1 Test Data Late logic (surf=1,3)
3[1]	DIAGNOSTIC MODE	If 1, places controller in DIAGNOSTIC MODE
4[1]-6[2]	SURFACE	Selects the surface (head) ($0\text{-}3_8$) for the start of a Read or a Write operation
7-11	START SECTOR	Selects the starting sector ($0\text{-}27_8$) for the start of a Read or a Write operation.
12-15	-SECTOR COUNT	Two's complement of the number of sectors to read or write.

[1] *When the* Diagnostic *flag is 1, the contents of bits 2 and 6 specify test conditions. Note that bit 6 is also used for surface selection; therefore, for any one Diagnostic test only 2 of the four surfaces are available.*

[2] *Bit 4 is the high order bit for the surface field; it must be zero at the start of all operations. Upon an End of Cylinder Error it is one.*

Read Disc Address

DIC *[f]* *ac*,**DKP**

0	1	1	AC		1	0	1	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Places the contents of the controller's Disc Address Register and Sector Counter in bits 0-15 of the specified AC. After the data transfer, sets the controller's Busy and Done flags according to the function specified by **F**. The format of the specified accumulator is as follows:

DRIVE		F	D	SURF			SECTOR					- SECT CNT			
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0-1	DRIVE	Number (0-3) of the selected drive
2	FORMAT	When 1, the controller is in FORMAT mode
3[1]	DIAGNOSTIC MODE	If 1, controller is in DIAGNOSTIC mode
4-6[2]	SURFACE	Surface number (0-3) of the selected head on the drive.
7-11[3]	SECTOR	Number of the sector ($0\text{-}27_8$) immediately following the last sector read or written
12-15	-SECTOR COUNT	Two's complement of the number of sectors to read or write

[1] *When the Diagnostic mode bit is 1 the Format mode bit will always be 0 even when the controller is performing a Data Late or Checkword logic test.*

[2] *Bit 4 is the high order bit for the surface field; it must be zero at the start of all operations. Upon an End of Cylinder Error it is one.*

[3] *If a Read or Write operation ends at the last sector (27_8) of a surface, this field contains the value 30_8.*

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Programming Summary (Cont.)

Read Status

DIA *[f]* *ac*,DKP

0	1	1	AC		0	0	1	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Places the contents of the controller's Status Register in bits 0-15 of the specified AC. After the data transfer, sets the controller's Busy and Done flags according to the function specified by F. The format of the specified accumulator is as follows:

D	SEEK DN				▨	V	B	U	R	SE	EC	AD	CE	DL	ER
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0	R/W DONE	The subsystem has completed a Read or a Write operation
1-4[1]	SEEK DONE 0-3	Drive 0-3, respectively, has finished a Seek or Recalibrate operation
5	---	Reserved for future use.
6[2]	VALID	When the Read Status command was issued, the controller had control of the disc subsystem
7	BAD SECTOR	Last data transfer attempted to read or write a sector previously designated as bad
8[3]	UNSAFE	Selected drive is in an unsafe condition.
9	UNIT READY	The selected drive is not performing any head movements and is ready to carry out a command (Read, Write, Seek, or Recalibrate)
10	SEEK ERROR	The selected drive was not able to carry out the last Seek or Recalibrate operation issued
11	END OF CYLINDER	The last Read or Write operation attempted to continue beyond the fourth surface on the drive unit
12	ADDRESS ERROR	The address read from the address field at the beginning of a sector does not match the last address specified to the disc controller
13	CHECKWORD ERROR	The checkword read from the disc at the end of a sector does not match the checkword calculated by the controller during the transfer
14	DATA LATE	The data channel failed to respond in time to a data channel request
15	ERROR	One or more of these bits is 1: 7, 8, 10, 11, 12, 13, or 14.

[1] *More than one of these bits can be set at any time.*

[2] *This bit is used in dual CPU - multiple drive environments. It allows the program to test the status of a drive unit without first issuing a dummy Seek to guarantee its control of the shared subsystem. When 0, the bit indicates that the controller lost control of the subsystem before status was read and the word returned may be inaccurate. The programming considerations for dual CPU operation are discussed later in this section.*

[3] *Reset the Unsafe flag with an* S, C, P, *or* IORST *command, but this action will not remove the drive's Unsafe condition. Try to remedy the Unsafe condition by powering down the drive, and then restarting it.*

Specify Command And Cylinder

DOA *[f]* *ac*,DKP

0	1	1	AC		0	1	0	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Loads bits 0-15 of the specified AC into the controller's combined Command and Cylinder Select Register. After the data transfer, sets the controller's Busy and Done flags according to the function specified by F. The contents of the specified AC remain unchanged; the format of the accumulator is as follows:

C	CLR SEEK DN				CMND		CYLINDER								
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0	CLEAR	Sets the status register's DC Done flag to 0; sets the following error flags to 0: Address Error, Checkword Error, End of Cylinder, and Unsafe
1-4	CLEAR SEEK DONE	Sets the Seek Done flags to 0 on drives 0-3, respectively
5-6	COMMAND	Specifies the command for the selected drive as follows: 00 Read 01 Write 10 Seek 11 Recalibrate
7-15	CYLINDER	Specifies desired cylinder (0-627$_8$) for a Seek, Read or Write operation

Load Memory Address Counter

DOB *[f]* *ac*,DKP

0	1	1	AC		1	0	0	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Loads Bits 0-15 of the specified AC into the controller's Memory Address Counter. After the data transfer, sets the controller's Busy and Done flags according to the function specified by F. The contents of the specified AC remain unchanged; the format of the accumulator is as follows:

B	MEMORY ADDRESS														
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0[1]	MAP	If 0, selects data channel map A If 1, selects data channel map B
1-15	MEMORY ADDRESS	Location of the next memory word for a data channel transfer

[1] *Only on NOVA or ECLIPSE computers with more than one data channel map. In all cases, however, this bit may be altered by a carry from the low order bits during a data transfer.*

Read Memory Address Register

DIB *[f]* *ac*,DKP

0	1	1	AC		0	1	1	F		0	1	1	0	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Places the contents of the controller's Memory Address Register in bits 0-15 of the specified AC; sets bit 0 to 0. After the data transfer, sets the controller's Busy and Done flags according to the function specified by F. The format of the specified AC is shown below.

> **NOTE:** *At the end of a Write operation, the Memory Address Register points to a memory location one greater than that of the most recent word written to disc.*

B	MEMORY ADDRESS														
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

BITS	NAME	CONTENTS or FUNCTION
0[1]	MAP	If 0, data channel map A is selected If 1, data channel map B is selected
1-15	MEMORY ADDRESS	Location of the next memory word for a data channel transfer

[1] *Only on NOVA and ECLIPSE computers with more than one data channel map. In all cases, however, this bit may be altered by a carry from the low order bits during a data transfer.*

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MPT Family		

Other ____________
(Specify) ____________
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3. Software

- ☐ AOS
- ☐ AOS/VS
- ☐ AOS/RT32
- ☐ MP/OS
- ☐ MP/AOS
- ☐ RDOS
- ☐ DOS
- ☐ RTOS
- ☐ Other

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4. Languages

- ☐ ALGOL
- ☐ DG/L
- ☐ COBOL
- ☐ Interactive COBOL
- ☐ PASCAL
- ☐ Business BASIC
- ☐ BASIC
- ☐ Assembler
- ☐ FORTRAN 77
- ☐ FORTRAN 5
- ☐ RPG II
- ☐ PL/1
- ☐ APL
- ☐ Other

Specify ____________
____

5. Mode of Operation

- ☐ Batch (Central)
- ☐ Batch (Via RJE)
- ☐ On-Line Interactive

6. Communication

- ☐ HASP
- ☐ HASP II
- ☐ RJE80
- ☐ RCX 70
- ☐ RSTCP
- ☐ 4025
- ☐ X.25
- ☐ SAM
- ☐ CAM
- ☐ XODIAC™
- ☐ DG/SNA
- ☐ 3270
- ☐ Other

Specify ____________
____

7. Application Description

○ ____________
____
____
____

8. Purchase

From whom was your machine(s) purchased?

- ☐ **Data General Corp.**
- ☐ Other

Specify ____________
____

9. Users Group

Are you interested in joining a special interest or regional Data General Users Group?

○ ____________
____
____

Data General

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