

S E R V I C E N O T E

Supersedes:

HP 7900A-2 C

HP 7900A DISC DRIVE

All Serial No. Prefixes

TOOLS, TEST EQUIPMENT AND MAINTENANCE SUPPLIES

Listed below are the Tools, Test Equipment and Maintenance supplies required for maintaining, aligning and repairing the HP 7900A Disc Drive:

OSCILLOSCOPE SET, AS FOLLOWS OR EQUIVALENT:

HP 180A	Oscilloscope	1 each
HP 1801A	Dual Chan. Vertical Amp.	1 each
HP 1821A	Time Base	1 each
HP 10006A	Probe, 10:1	3 each

DIGITAL VOLTMETER SET, AS FOLLOWS OR EQUIVALENT:

HP 3469B	Digital Voltmeter or	1 each
HP 427A	Multi-Function Meter	

DISC SERVICE UNIT:

HP 13219A Service Unit		1 each
Head Cleaning Tool	07900-00091	1 each
Extender Board	07900-60014	1 each
Head Adjustment Tool	07900-60044	1 each
Alignment Cartridge	1535-2531 or 1535-0066	1 each
Mylar Feeler Gauge 0.005"	1535-0648	1 each
Filtered Alcohol (6 oz.)	1535-1432	1 each
Lint Free Tissue (Kimwipe)	9300-0001	1 each
Down Head Installation Tool	1460-1333	1 each
Up Head Installation Tool	1460-1334	1 each

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For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

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STANDARD TOOLS:

Posi Drive Screwdriver	(Stanley 2951)
Posi Drive Screwdriver	(Stanley 2952)
Long Noise Pliers	(Xcelite 71CG)
Wire Cutters	(Xcelite 74CG)
Screwdriver 4" x 1/4"	(Xcelite R-144)
Screwdriver 4" x 1/8"	(Xcelite R-184)
Wire Stripper	(K-Miller 101-S)
6' Steel Rule	(General 616)
Soldering Iron	(Ungar 6010)
Inspection Iron	(G.C. Elect. 5090-P)
IC Pin Clip	(A-P Inc.)
Socket Keys	(Xcelite 99PS-40)

S E R V I C E N O T E

Supersedes:

HP7900A-12

HP7900A CARTRIDGE DISC DRIVE

All Serial Numbers

OPERATOR PRECAUTION

Information contained in this note
has been replaced by HP7900A-16C.

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S E R V I C E N O T E

Supersedes:

HP7900A-13

HP7900A CARTRIDGE DISC DRIVE

All Serial Numbers

STATIC DISCHARGE STRAP

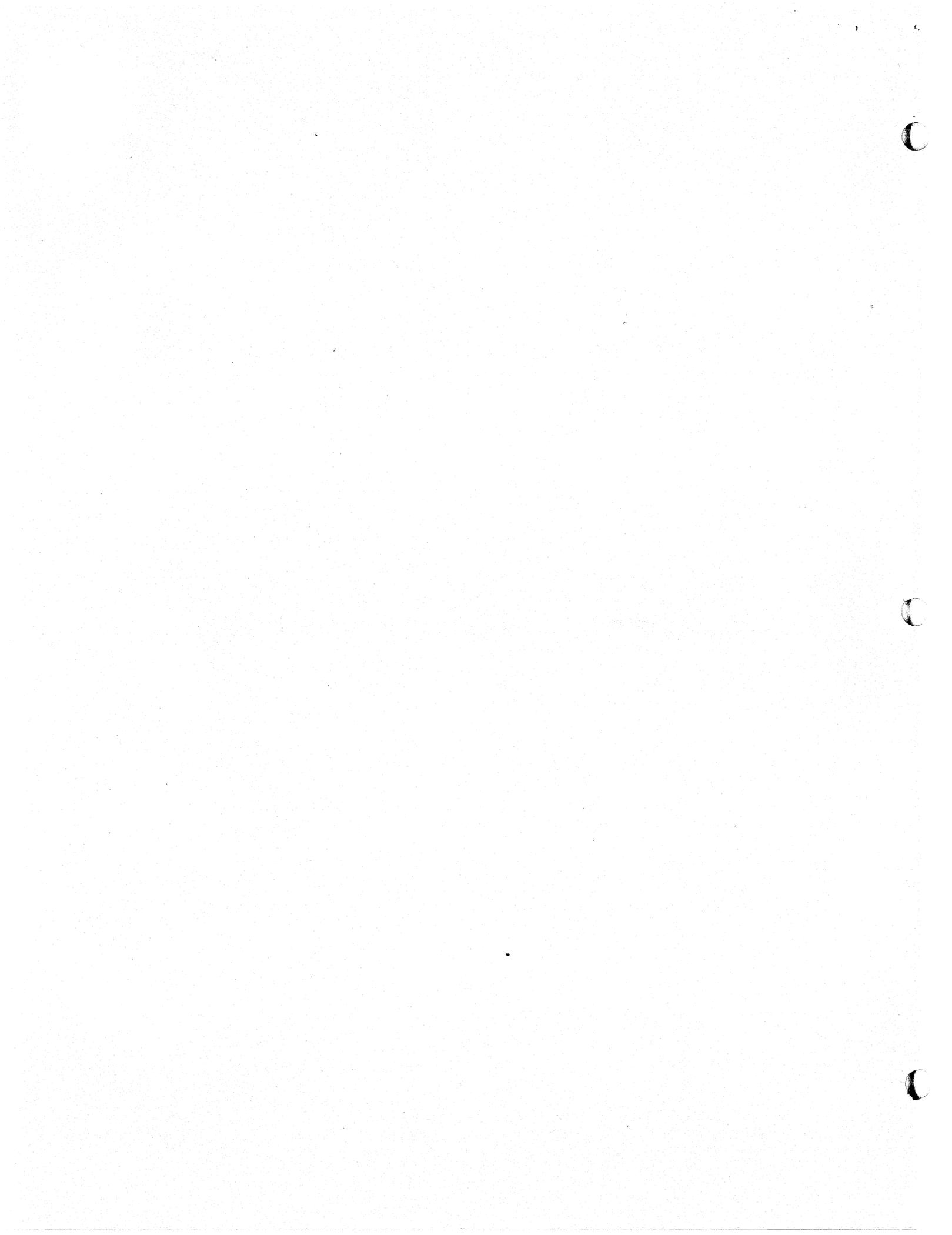
Information contained in this
note has been replaced by
P-7900-60081-1.

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S E R V I C E N O T E

SUPERSEDES:

7900A-16B
7901A-5B

HP 7900A/7901A DISC DRIVES

Serial No. Prefix 1415 and Below for 7900A

Serial No. Prefix 1415 and Below for 7901A

RETROFIT KIT INSTRUCTIONS FOR UPPER HEAD ALIGNMENT PROBLEM

Under present circumstances, if a disc cartridge is vigorously installed in the disc drive, the possibility exists that the disc can come in contact with the upper heads, causing the alignment to deteriorate.

A retrofit kit (P/N 07900-60084) has been developed to remove this problem. This service note contains the instructions for installing this kit.

PARTS INCLUDED IN RETROFIT KIT 07900-60084

<u>Quantity</u>	<u>Description</u>	<u>HP Part No.</u>
2	Head Clamp	07900-20083
1	Upper Head Cam	07900-40044
1	Cartridge Receiver Assy.	07900-60083
2	Post Cartridge Position	07900-20098
1	Spacer	07900-20055
1	Go-No-Go Gauges	07900-00120
1	Manual Update	No Part Number
6	Flat Shim Washers	3050-0032
1	Service Note	7900A-16C/7901A-5C

INSTALLATION PROCEDURE

1. Remove receiver (P/N 07900-60030).

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2. Remove cartridge post positioners (P/N 07900-20025) and replace with new positioners furnished with kit (P/N 07900-20098).

NOTE: Lower disc of 7900A Disc Drive must be removed to make screws holding the cartridge post positioners accessible.

3. Place folded Kimwipe between upper heads, and remove upper head cam assembly. (P/N 07900-40014)
4. Loosen holding screws for pivot blocks. Move blocks to their extreme rear position. Tighten holding screws while applying pressure to pivot block.
5. Install new upper head cam furnished with kit (P/N 07900-40044). Check height using Go-No-Go guage (P/N 07900-00120, Figure 2). Install shims (P/N 3050-0032) between upper head cam and the pivot block as required to obtain the correct height. Caution must be used to obtain the correct height to prevent head crashes.
6. Disconnect yellow and orange wires connected to head retracted switch (S7). DO NOT allow wires to come in contact with any adjacent parts. This could cause a retract operation which would deplete the retract batteries.
7. Remove Heads Retracted switch and associated spacer. Replace the old spacer with the new spacer provided in the kit (P/N 07900-20055). Reinstall switch and spacer in drive, leaving mounting screws snug but not tight.

-C A U T I O N-

In next step, do not push heads off cam.

8. Adjust the switch to activate approximately 75% up the carriage switch cam slope (Fig.1). Tighten screws. When properly adjusted, switch should never bottom when heads are unloaded.
9. Reconnect wires to switch as shown in Figure 1.
10. Remove head clamps on heads 0 and 1. Install new head clamps (P/N 07900-20083) provided in kit.
11. Remove modesty shield from old cartridge receiver and install on new cartridge receiver (P/N 07900-60033) provided in kit.
12. Install new cartridge receiver.
13. Re-assemble drive and load heads. Place the load/unload switch in Unload position. Check for full carriage retraction. (Carriage should be flush with magnet end plate when fully retracted.)
14. Place the Load/Unload switch to Load position. After heads have loaded, align heads 0 and 1.
15. Type a 1415A prefix and drive serial number on new serial number tag supplied with kit. Affix new serial number tag over old serial number tag.
16. Update Operating and Service Manual to reflect changes.

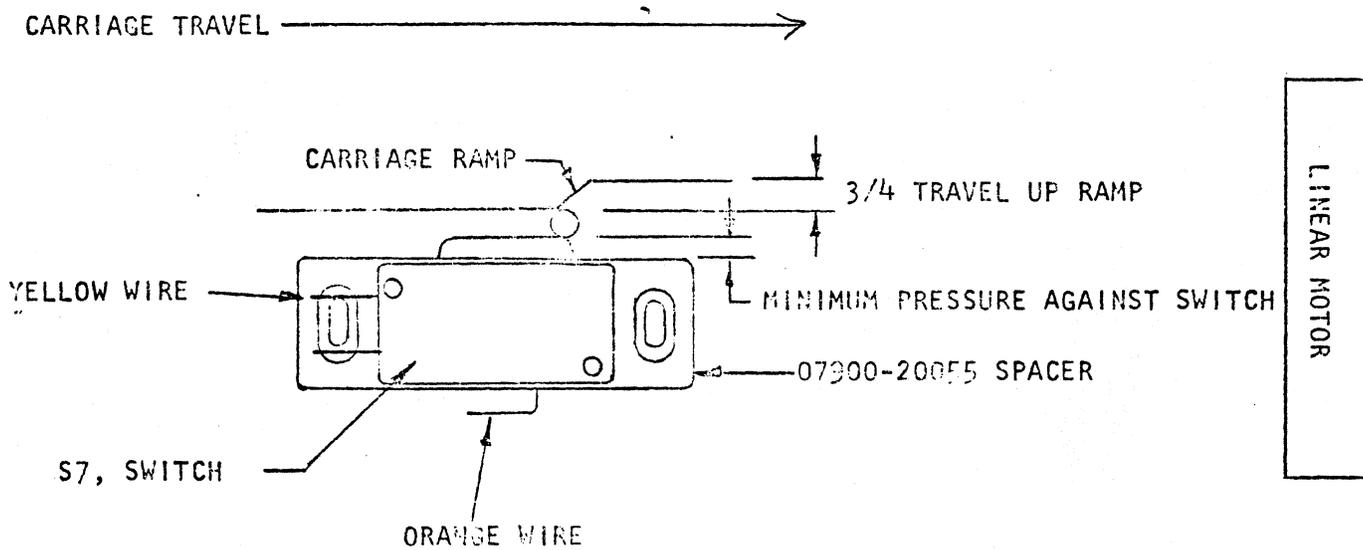


FIGURE 1

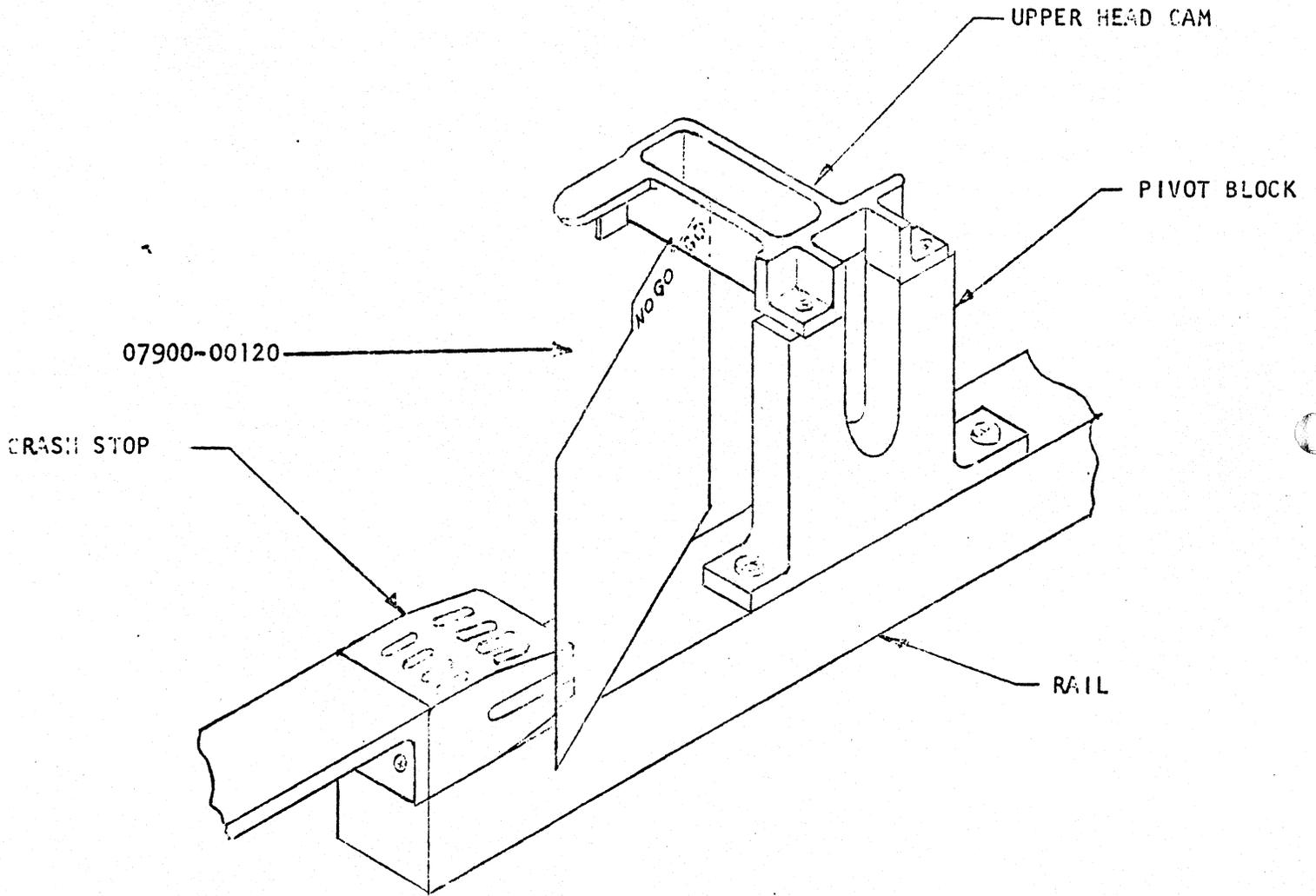


FIGURE 2

S E R V I C E N O T E

Supersedes:
None

7900A/7901A DISC DRIVES

Serial No. Prefix and Above (7900A)

Serial No. Prefix and Above (7901A)

READING VERNIER SCALE

A vernier scale has been added to both the 7900A and the 7901A to facilitate discerning cylinder address location while performing maintenance tasks.

The scale is quite simple to read. When the carriage stops, look on the fixed scale opposite the "0" mark on the moving scale. This will give a general indication of where the carriage is (in the middle left illustration, the "0" mark is between 90 and 100). After the general location is found, scan down the moving scale until one of the lines exactly runs onto a line on the fixed scale. Add the number opposite the line on moving scale to the "0" mark number and you have the cylinder number. (In the illustration above, "5" lined up with the fixed scale, hence 95 is the cylinder number.)

(Over)

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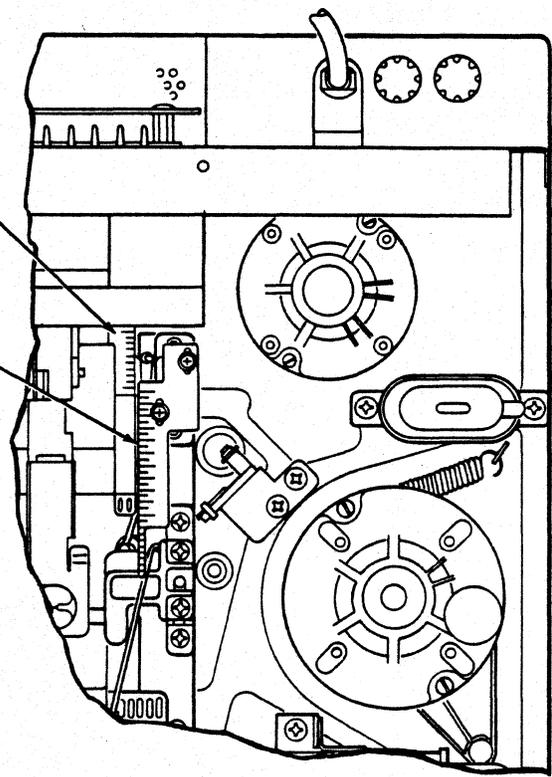
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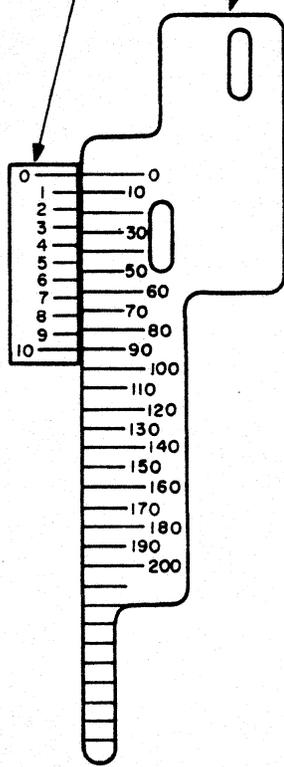
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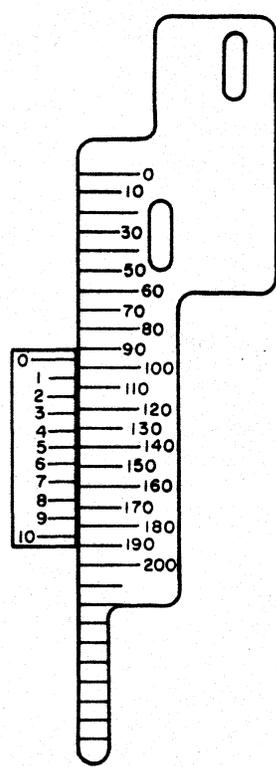
MOVING SCALE
FIXED SCALE



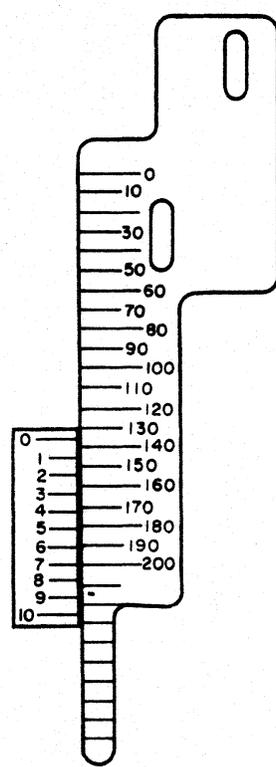
MOVING SCALE
FIXED SCALE



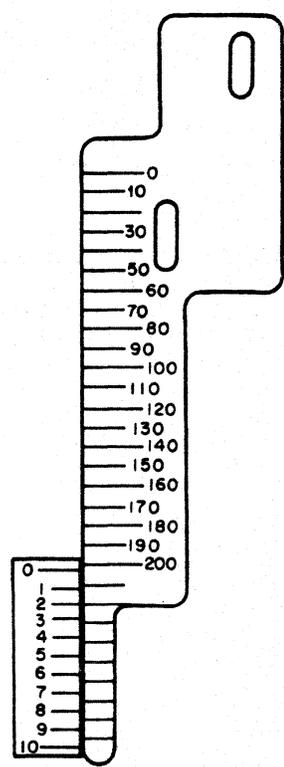
CYLINDER 000



CYLINDER 95



CYLINDER 137



CYLINDER 202

S E R V I C E N O T E

Supersedes:
None

HP 7900A, HP 7901A, HP 2870A DISC CARTRIDGE

All Serial No. Prefixes

DISC CARTRIDGE AND DISC PACK CLEANING AND INSPECTION

Many problems arise from users of Hewlett-Packard Disc Drives not keeping their disc cartridges and disc packs clean. Some of these problems are:

1. Costly equipment repairs
2. Loss of data
3. Increased down time

For this reason, H-P strongly recommends that every cartridge and disc be cleaned and inspected at least once every six months by a professional organization geared for this type of service.

The following is a list of companies and address of organizations that perform this type of service:

FOR 2316 TYPE PACKS:

Precision Methods, Inc. Shirley Highway at Edsall Rd. Alexandria, VA 22314 (703) 354-5100	Computer Resources, Inc. 5091 W. 164 th St. Cleveland, OH 44142 (216) 267-6400	Randomex, Inc.* 27303 Warrior Drive Palos Verdes Peninsula, CA. 90274 (213) 377-9887
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*Randomex, Inc. does not actually clean and certify packs. They do, however, manufacture an automatic cleaning device for 2316 type packs.

FOR 2315 TYPE DISC CARTRIDGES:

Precision Methods, Inc.
Shirley Highway at Edsall Rd.
Alexandria, Va. 22314
(703) 354-5100

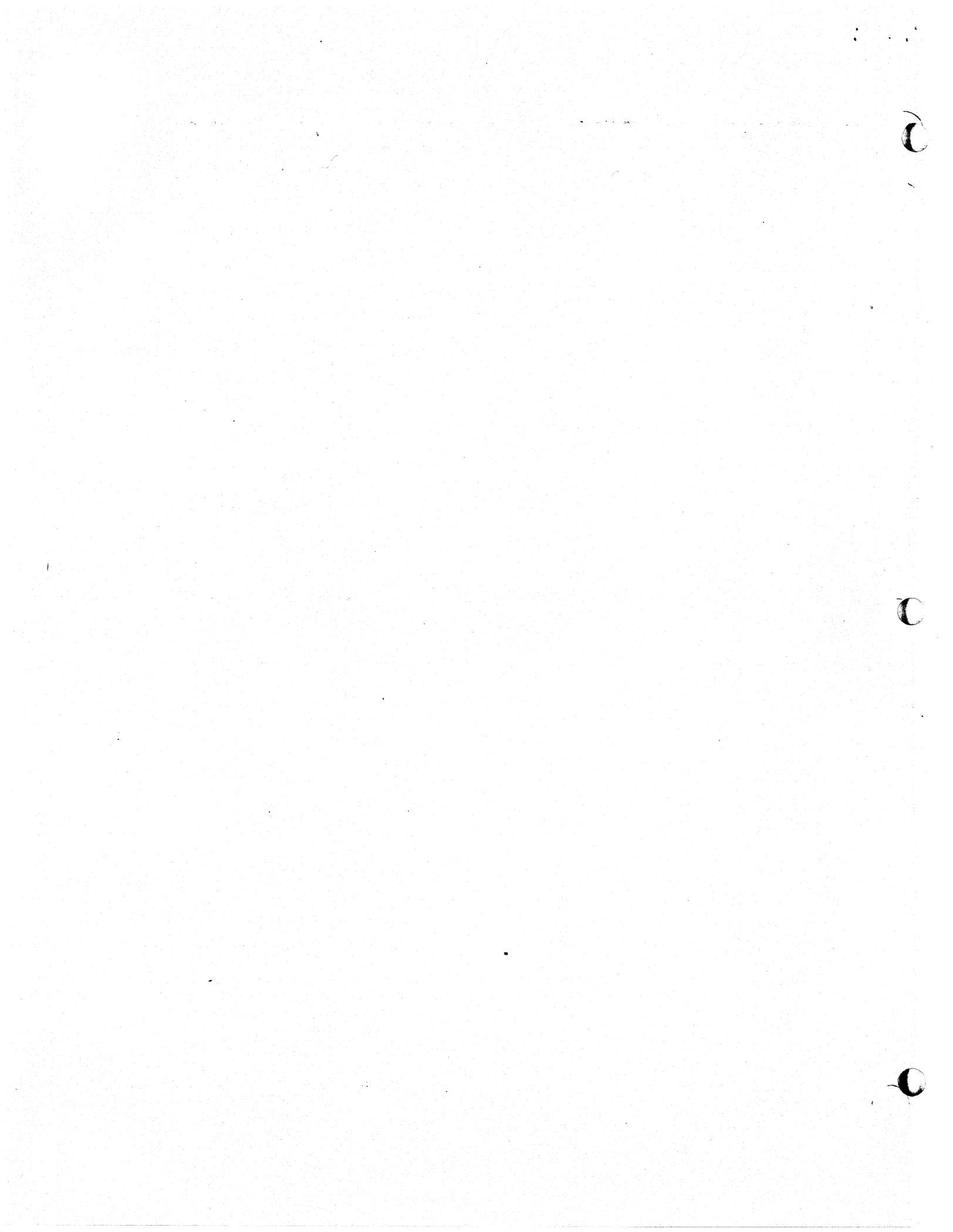
This list is by no means a recommendation for these companies. Furthermore, Hewlett-Packard accepts no responsibility, implied or otherwise, for the actions of these service organizations.

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S E R V I C E N O T E

Supersedes:
None

HP7900A DISC DRIVE

Serial No. 1236A-00690 and Below

DISC UNLOCK LAMP MODIFICATION

The newer 7900A Disc Drives (S/N 1236A-00691 and above) have a "Drive Unlocked" indicator, something the older drives did not have. This service note contains instruction on how to modify the older drives to add this indicator.

The following parts are required:

- | | | |
|----|-------------|---------------------|
| 1. | 07900-00105 | PC Board Insulation |
| 2. | 07900-20078 | Drive Unlock Lens |
| 3. | 07900-20079 | Data Protect Lens |
| 4. | 07900-60063 | Indicator Assembly |
| 5. | 07900-40041 | Horizontal Divider |
| 6. | 07900-40042 | Window Frame |

The modification should be made as follows:

1. Run diagnostics to assure correct drive operation.
2. Unload the drive, remove the cartridge, and turn off the power supply.
3. Remove top cover of drive, and cartridge receiver.
4. Remove the two (2) connect plugs going to the AI Indicator Assembly.
5. Remove the six (6) screws [three (3) on each side] holding the front casting. Pivot casting out from the top. Remove the small screw holding the ground wire under the AI PCA.
6. Remove front casting. Remove the two (2) screws holding the AI PCA in place.
7. Unsolder the wires from AI. Label the wires as they will return to the same pins on the new assembly.

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8. Remove and save color filter strips behind front lenses.
9. Remove both "Data Protect" lenses. Replace the new "Data Protect" lens in the left opening. Place the new "Drive Unlock" lens in the right opening.
10. Cut the filter strips the size of the lens. Place the green filter behind the "Drive Ready" lens, the amber filter behind the "Drive Unlock" lens, and the red filter behind the "Drive Fault" lens.
11. Place the window frame and horizontal divider behind the "Data Protect" lens.
12. Glue the aluminum lens holders back in place behind the "Drive Unlock" lens.
13. Solder the wires back in place on the new AI Indicator Assembly. Be sure that the wire going to the "Data Protect" lamp goes to the correct pin.
14. Place the PC Board insulator between the AI assembly and the front casting. Screw the AI assembly back in place.
15. Install front panel. Be sure to re-connect ground wire on front casting. Screw the AI assembly back in place.
16. Install cartridge receiver.
17. Turn-on power supply. Check "Disc Unlock" lamp lights. Check operation of upper and lower Data Protect lamps.
18. Run diagnostics. Replace the top cover and return it to service.

S E R V I C E N O T E

Supersedes:
None

HP7900A/7901A CARTRIDGE DISC DRIVES

All Serial Numbers

CARRIAGE PRELOAD SPRING REPLACEMENT

If it becomes necessary to replace the preload spring on the carriage, the entire carriage must be replaced. The reason the spring cannot be replaced as an individual part is due to the critical alignment of the spring to the carriage.

The part number for the carriage assembly is 07900-60022. This assembly contains the carriage and spring, minus heads, encoder plate and coil ribbon cable.

IMPLEMENTATION

1. Remove old Carriage Assembly.
2. Install new appropriate hardware except heads from old assembly on new assembly.
3. Install new carriage assembly and insure free movement of carriage and check encoder clearance.
4. Install heads and rest of hardware removed to install carriage.
5. Load scratch pack and turn the Load/Unload switch to Load.
6. Using DSU perform alternate seeks from 0 to 202.
7. Replace scratch pack with a CE pack (ensure that upped disc protect switch is on).
8. Perform head alignment.
9. Remove the CE cartridge.
10. Install scratch pack and run the diagnostic.

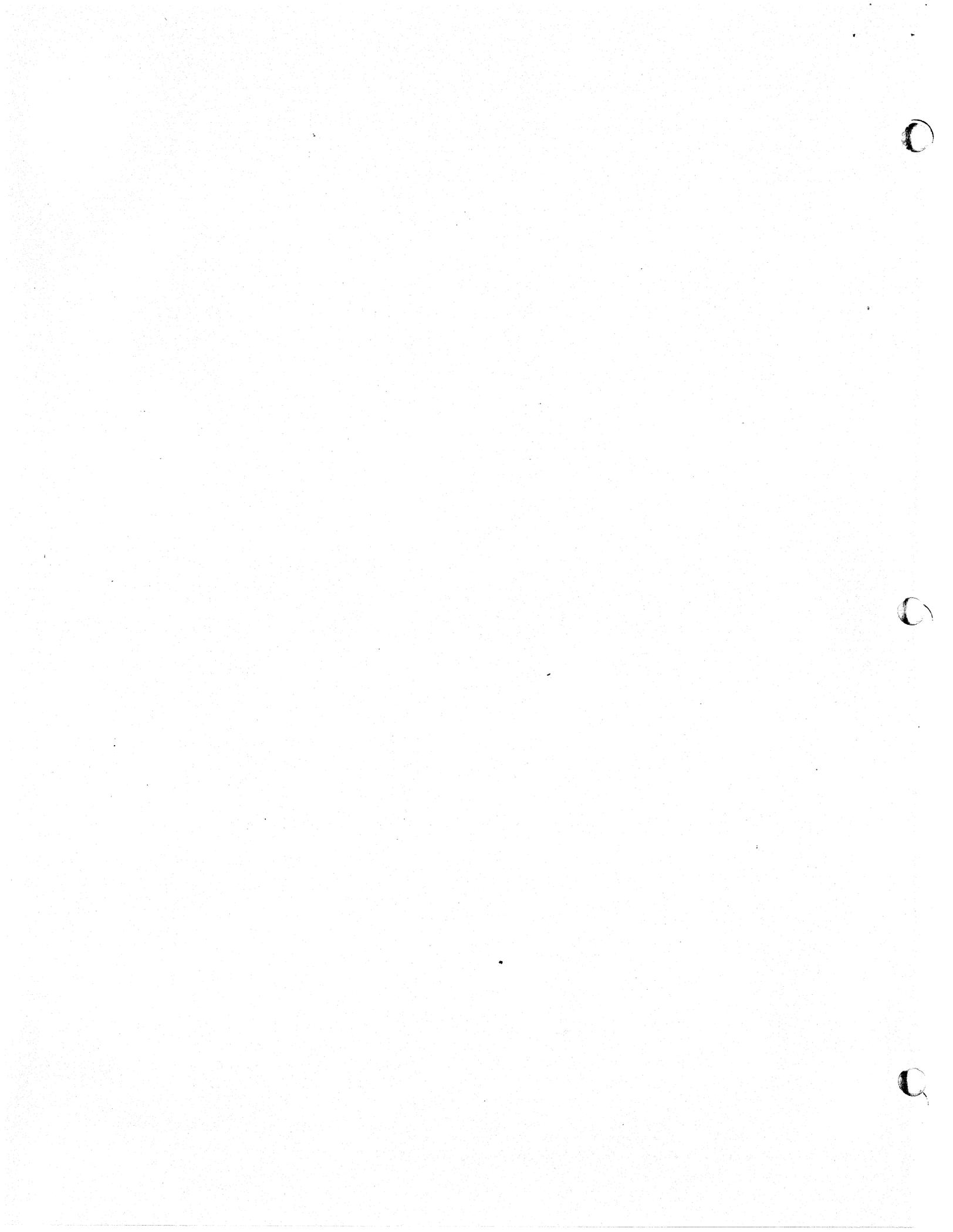
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S E R V I C E N O T E

Supersedes:

None

HP7900A CARTRIDGE DISC DRIVES

All Serial Prefixes

SPINDLE GROUND BUTTON KIT

HP 07900-60081

This kit contains the required parts to incorporate the new ground strap button for the 7900A Cartridge Disc Drive.

SPECIAL TOOLS

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
Not Supplied	Gauge, 0 - 150 Gram	8750-0091

PARTS FURNISHED IN KIT (07900-60081)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	Strap, Ground	07900-60080
1	Spring, Compression	1460-0844
3	Screw, 8-32 x 1"	3030-0046
3	Washer, #8 Lock	2190-0429
1	Ground Button Assy.	07900-60078
1	Service Note	P-07900-60081-1

INSTALLATION PROCEDURE

1. Remove power from the drive.
2. Remove ground strap and discard.
3. Remove drive belt.
4. Remove drive pulley. Discard three 8-32 x.625" screws and no 8 lock washers.
5. Remove ground button

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5. Remove ground button from spindle shaft end using an XACTO-KNIFE.
6. Remove Epoxy Residue using an XACTO-KNIFE and a fine grade of Emery paper.
7. Using Figure 1 as a Guide, reassemble pulley assembly.
8. Install Drive Belt.
9. Install new ground strap, and check for 70 ± 20 grams.
10. Reassemble drive and perform normal diagnostic tests.
11. Insert this service note (P-07900-60081-1) into customer manual.

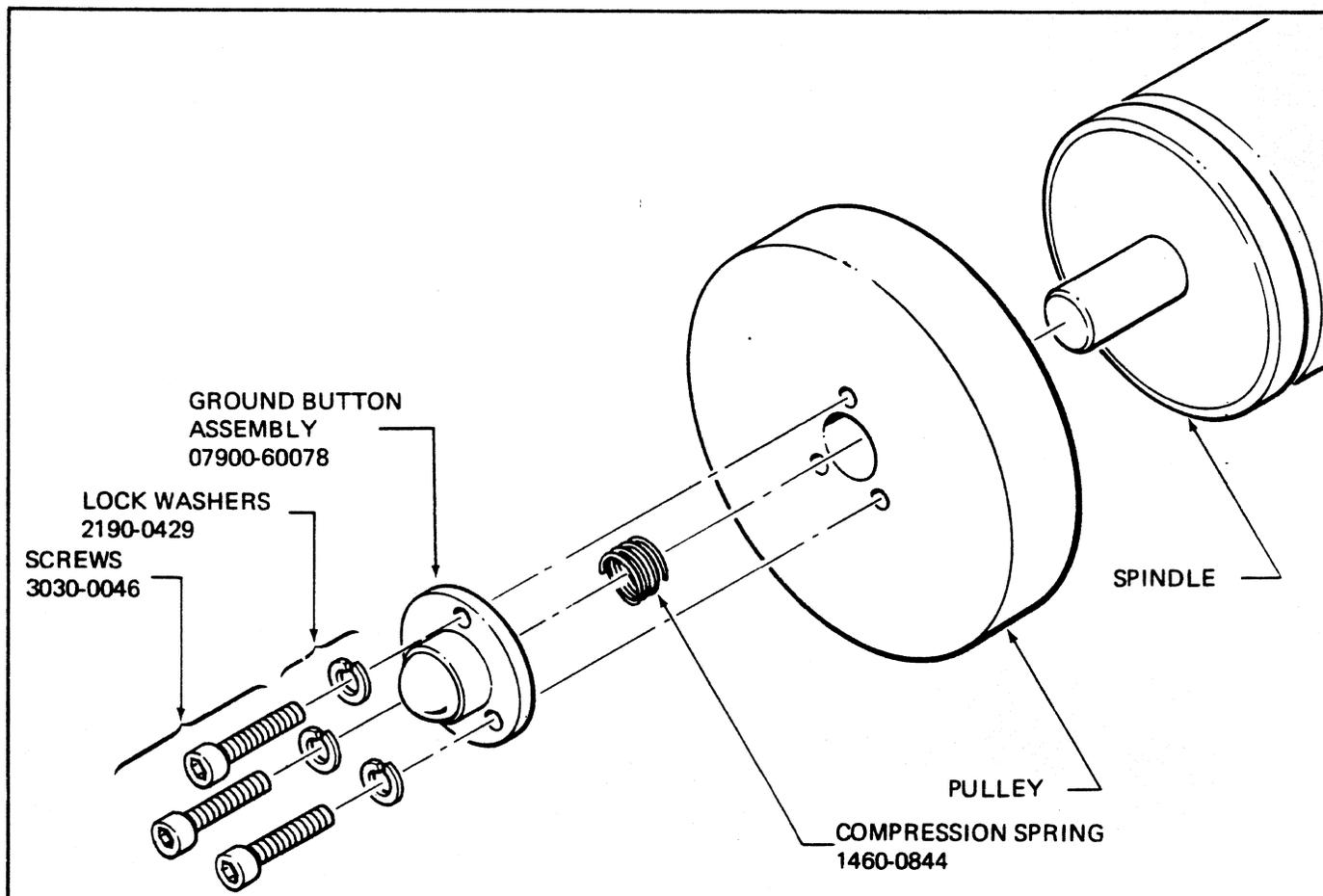
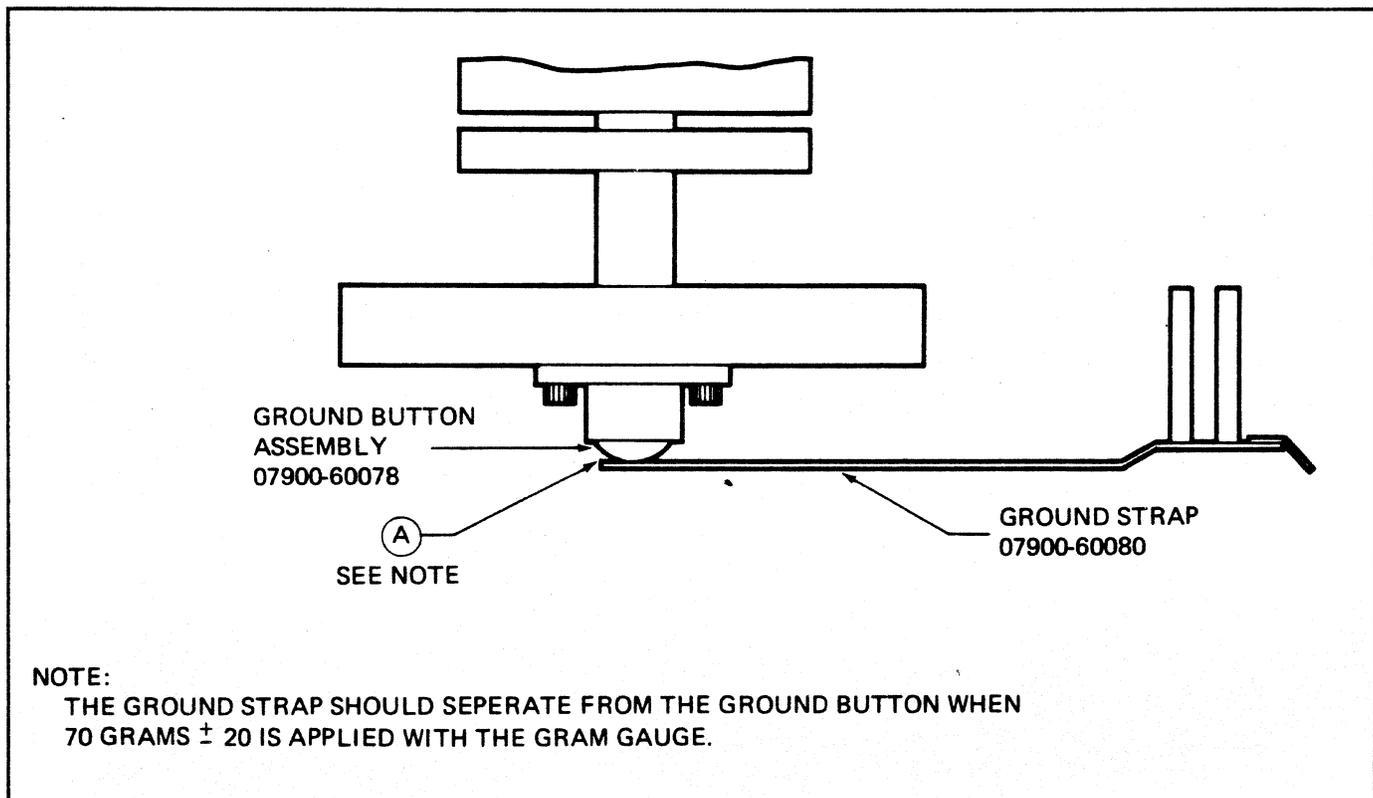


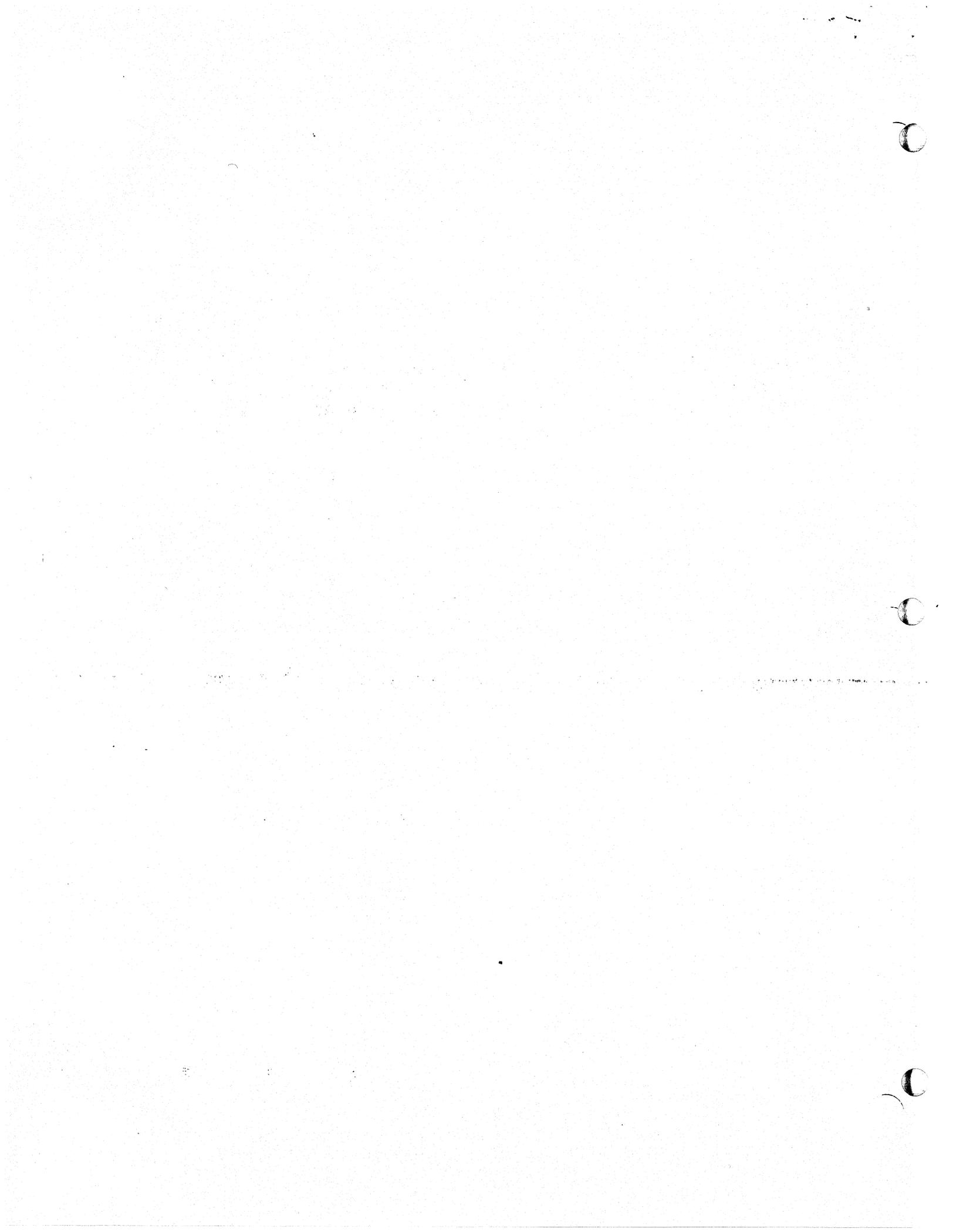
Figure 1.



NOTE:

THE GROUND STRAP SHOULD SEPERATE FROM THE GROUND BUTTON WHEN 70 GRAMS \pm 20 IS APPLIED WITH THE GRAM GAUGE.

Figure 2.



S E R V I C E N O T E

Supersedes:

HP7901A-2A

HP 7901A DISC DRIVE

All Serial No. Prefixes

TOOLS, TEST EQUIPMENT AND MAINTENANCE SUPPLIES

Listed below are the tools, test equipment and maintenance supplies required for maintaining, aligning and repairing the HP 7901A Disc Drive.

Oscilloscope Set as follows or equivalent:

HP 180A, Oscilloscope	1 each
HP 1801A, Dual Chan. Vertical Amp	1 each
HP 1821A, Time Base	1 each
HP 10006A, Probe, 10:1	3 each

Digital Voltmeter Set as follows or equivalent:

HP 427A, Multi-Function Meter or HP 3469B Digital Voltmeter	1 each
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Disc Service Unit:

HP 13219A Service Unit	1 each
Head Cleaning Tool, 07900-00091	1 each
Extender Board, 07901-60012	1 each
Preamp Extender Board, 5060-0049	1 each
Alignment Cartridge, 1535-0066/1535-2531	1 each
Mylar Feeler Gauge 0.005", 1535-0648	1 each
Filtered Alcohol (6 oz), 1535-1432	1 each
Lint Free Tissue (Kimwipe), 9300-0001	1 box
Down Head Installation Tools 1460-1333	1 each
Up Head Installation Tool 1460-1334	1 each

Standard Tools

Posi Drive Screwdriver	(Stanley 2951)
Posi Drive Screwdriver	(Stanley 2952)
Long Nose Pliers	(Xcelite 71CG)
Wire Cutters	(Xcelite 74CG)

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Standard Tools (continued)

Screwdriver 4" x 1/4"
Screwdriver 4" x 1/8"
Wire Stripper
6' Steel Rule
Soldering Iron
Inspection Mirror
IC Pin Clip
Socket Keys

(Xcelite R-144)
(Xcelite R-184)
(K-Miller 101-S)
(General 616)
(Ungar 6010)
(G.C. Elect. 5090P)
(A-P Inc)
(Xcelite 99 PS-40)

S E R V I C E N O T E

Supersedes:

None

HP7901A CARTRIDGE DISC DRIVE

All Serial Numbers

SPINDLE GROUND BUTTON ASSEMBLY

An engineering change has been implemented for the 7901A. This change was necessary to eliminate excessive wear of the ground strap and ground button. Previously used replacement part numbers for these parts have been obsoleted. If replacement parts are required, replace parts with parts listed below under the following conditions:

1. The ground button is attached to the ground strap.
2. The ground button is epoxied to spindle end.

In all other cases, order only the defective part using the part numbers supplied in this service note.

SPECIAL TOOLS

<u>Quantity</u>	<u>Description</u>	<u>Part Number</u>
Not supplied	Gauge, 0-150 Grams	8759-0091

PARTS REQUIRED

<u>Quantity</u>	<u>Description</u>	<u>Part Number</u>
1	Button, Ground Assy.	07901-60040
1	Strap, Ground.	07901-60044

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S E R V I C E N O T E

Supersedes:

None

7900A and 7901A DISC DRIVE OPT. 001

Below Serial Prefix 1415

DISC CARTRIDGE RECEIVER MOD KIT (50 HZ)

An engineering change has been implemented for all 50 HZ Disc Drives that have Head Zero Retrofit Kit (07900-60074) previously installed. This change is necessary to facilitate the handling of 2315 type disc cartridges other than the Hewlett-Packard certified cartridge (12869A).

PARTS FURNISHED IN KIT (07900-60085)

<u>Quantity</u>	<u>Description</u>	<u>Part Number</u>
1	Receiver, Cartridge	07900-60083
2	Post, Receiver	07900-20092
1	Service Note	P-07900-60085-1

INSTALLATION PROCEDURE

1. Remove power from drive.
2. Remove cartridge receiver (HP 07900-60073). "Discard"
 - a. Remove lower disc assembly "7900A only."
3. Remove both cartridge positioning posts.
4. Install new cartridge positioning posts (HP 07900-20082).
 - a. Reinstall lower disc assembly "7900A only."
5. Loosen both pivot block assemblies (Figure 1) and move pivot blocks to their extreme rear position "Toward Magnet Assembly." Tighten holding screws while maintaining pressure on pivot block.
6. Install new cartridge receiver HP07900-60083.
7. Re-assemble drive and perform normal diagnostic testing.
8. Insert this service note (P-07900-60085-1) into customer manual.

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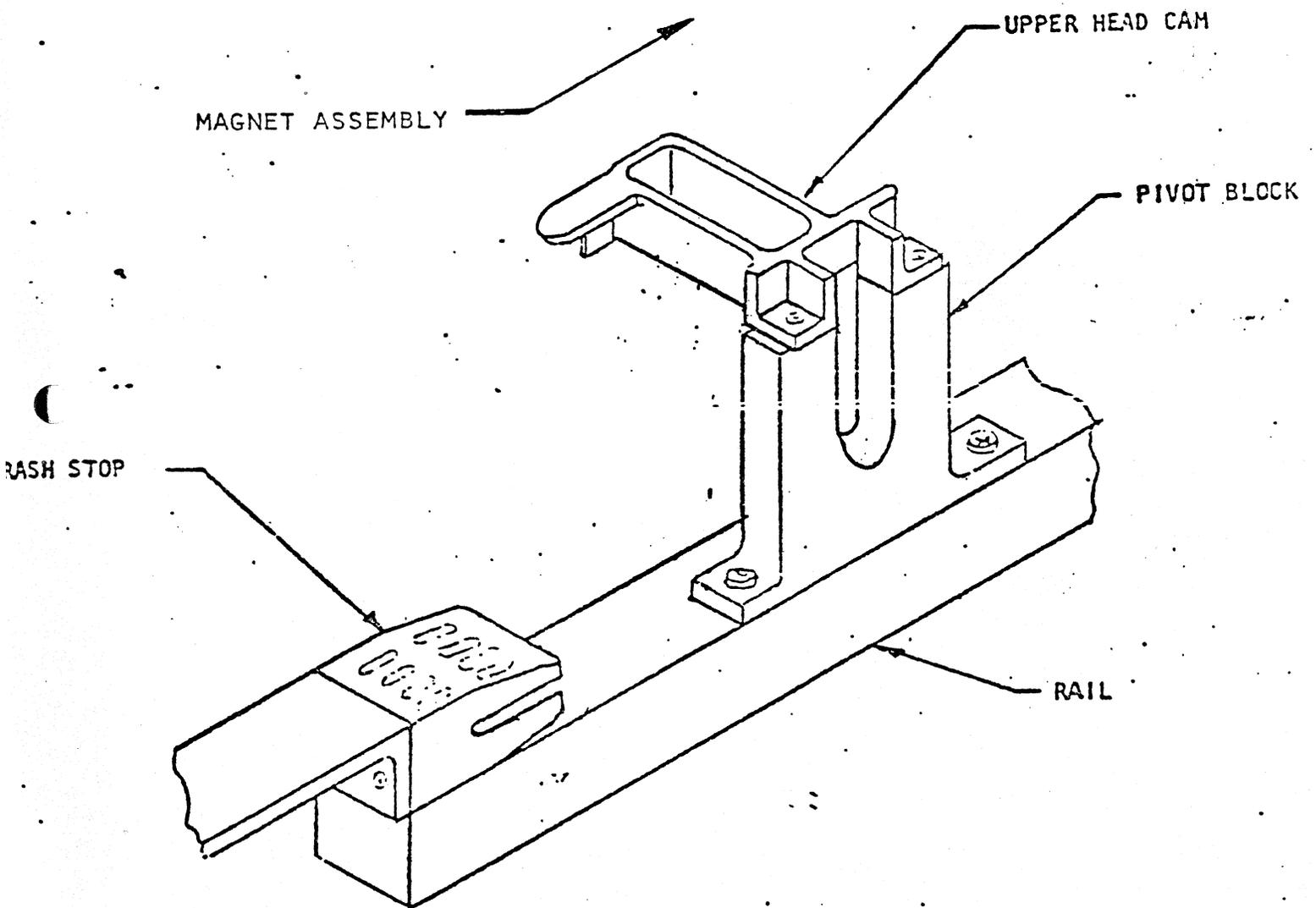
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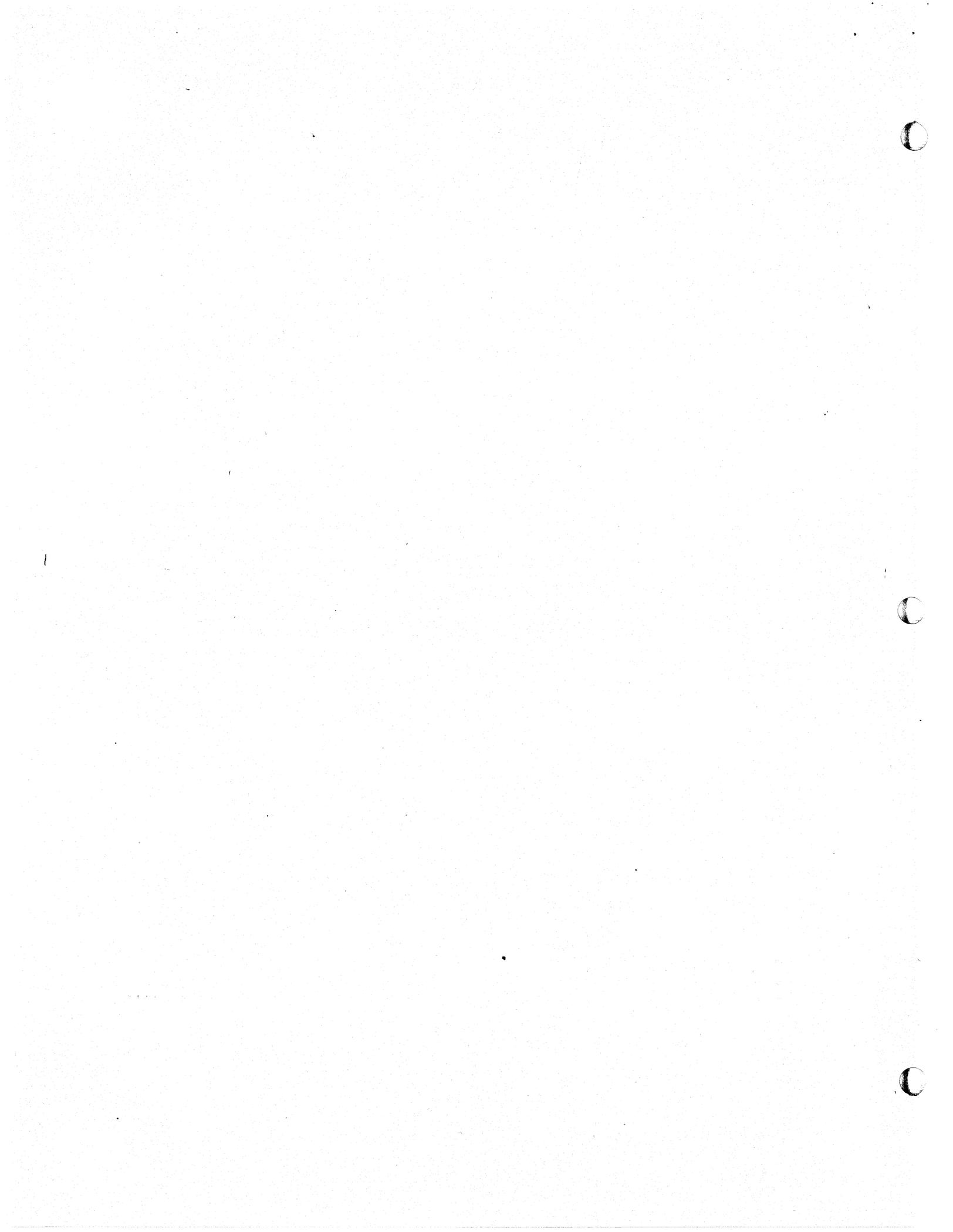
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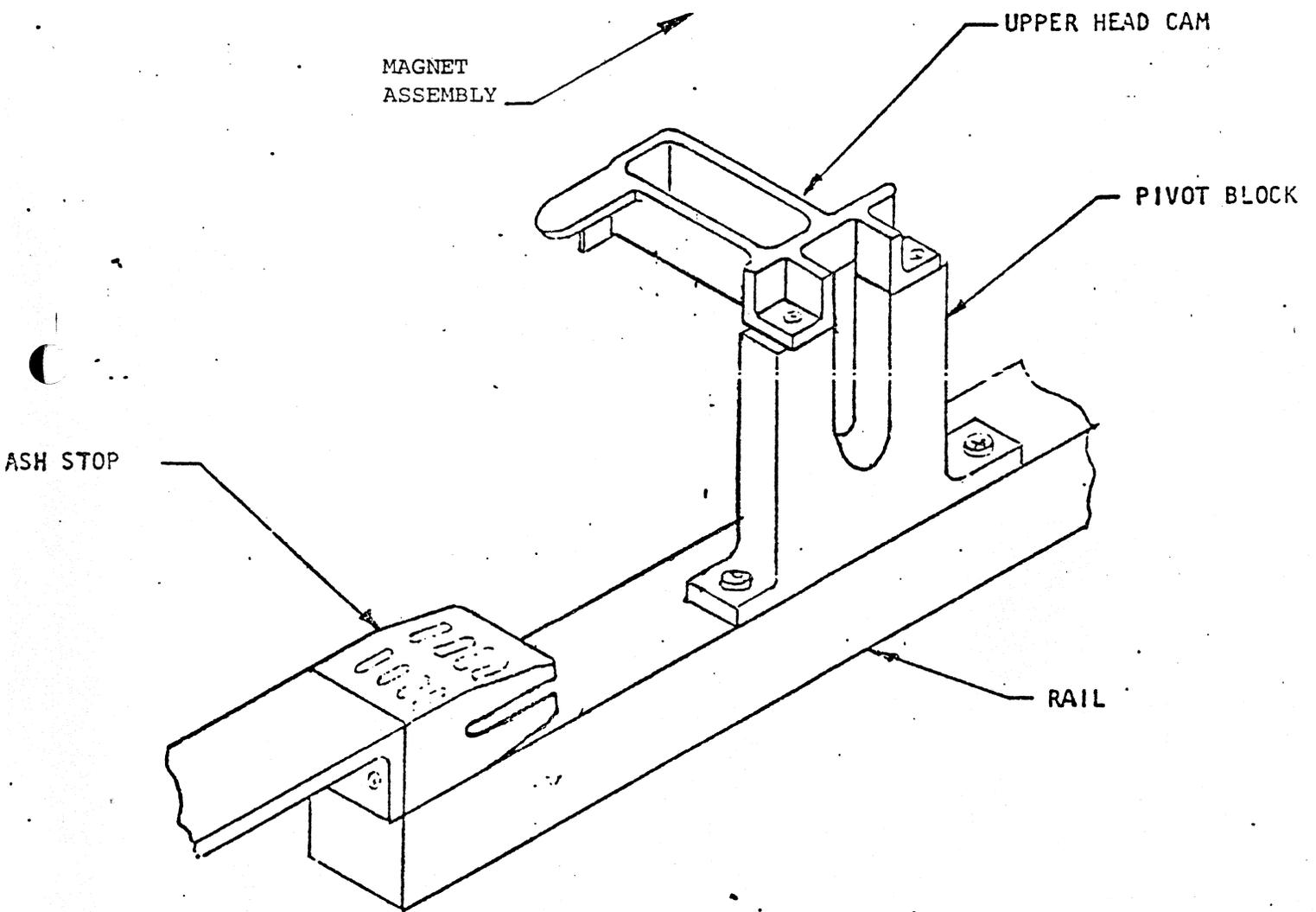
C



RIGHT HAND PIVOT BLOCK

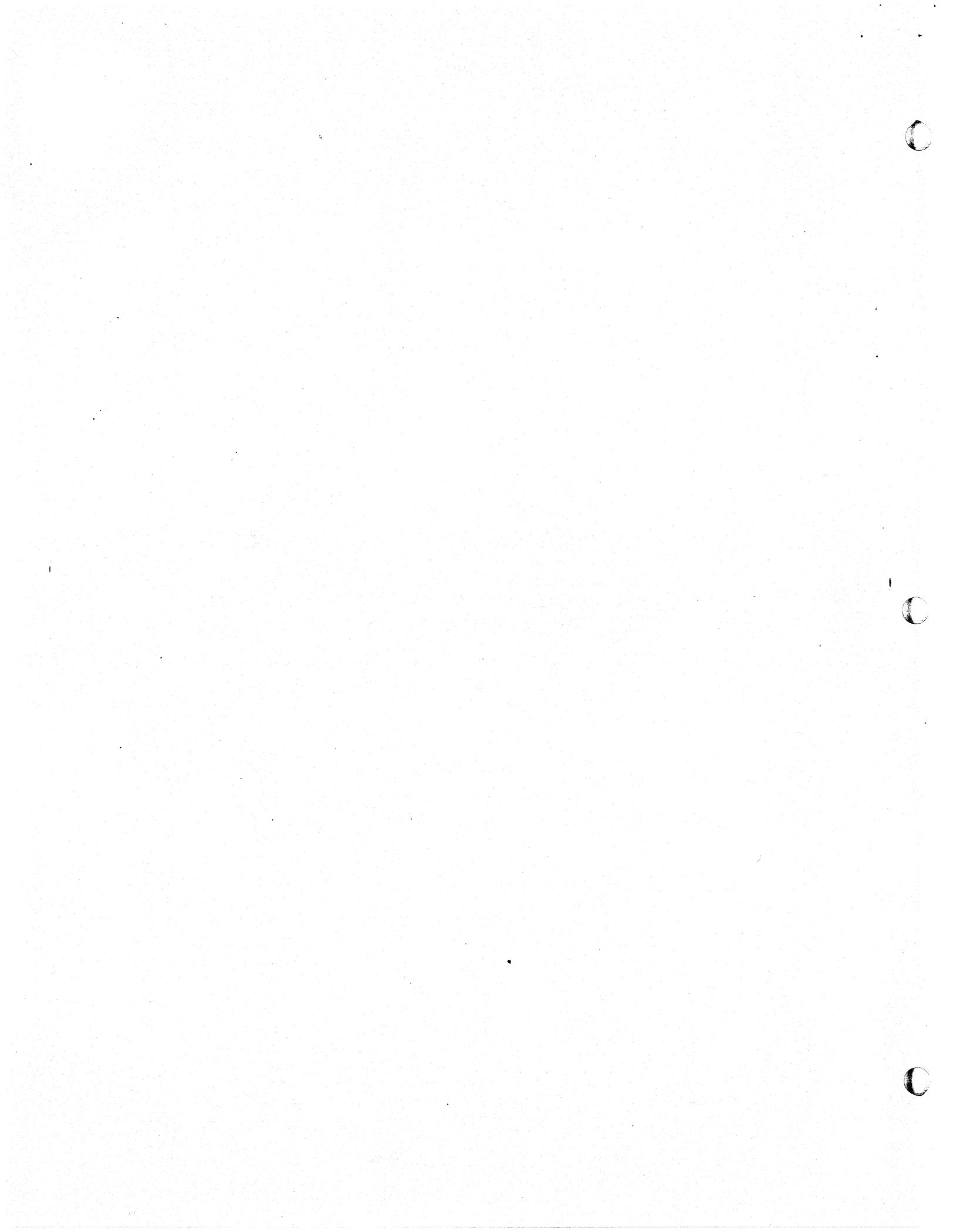
FIGURE 1





RIGHT HAND PIVOT BLOCK

FIGURE 1.



S E R V I C E N O T E

Supersedes:

None

7900A and 7901A CARTRIDGE DISC

Below Serial Prefix 1415

CARTRIDGE SEATING DIFFICULTIES (60 HZ ONLY)

An engineering change has been implemented for all 60 HZ Disc Drives that have previously been retrofited with Head Zero Kit (07900-60074).

The change is applicable only to Disc Drives experiencing difficulties with Cartridge seating. Difficulties are defined as either the spindle motor not starting or evidence of the Cartridge rubbing during start up.

PARTS FURNISHED IN KIT (07900-60085)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	Receiver, Cartridge	07900-60083
2	Post, Positioning	07900-20090
1	Service Note	P-07900-60085-2

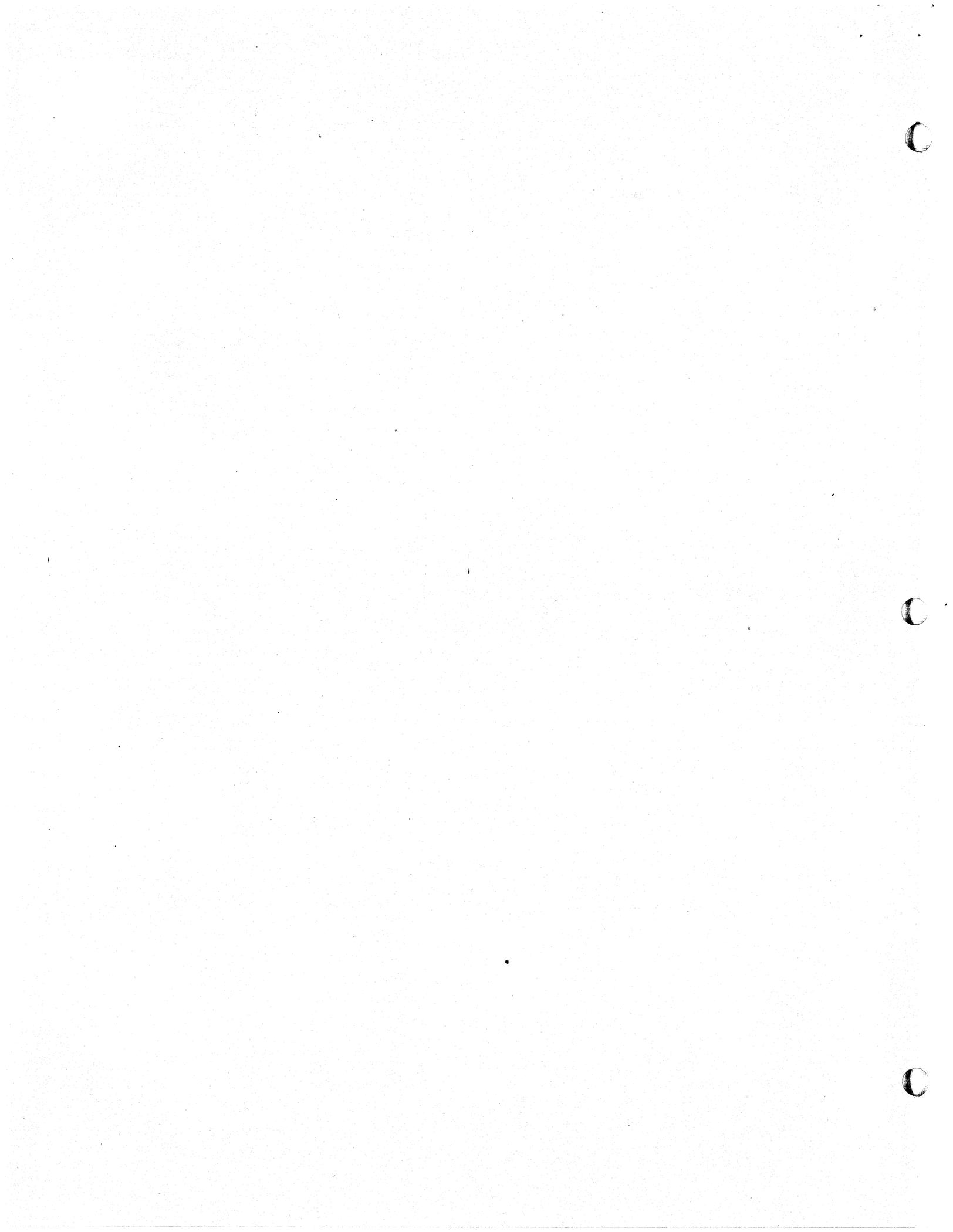
INSTALLATION PROCEDURE

1. Remove power from drive.
2. Remove cartridge receiver (07900-60073).
 - a. Remove lower disc assembly "7900A only."
3. Remove both cartridge positioning posts.
4. Install new cartridge positioning posts.
 - a. Reinstall lower disc assembly "7900A only."
5. Loosen both pivot block assemblies (See Figure 1) and move pivot blocks to their extreme rear position. "Toward Magnet Assembly." Tighten holding screws while maintaining pressure on pivot block.
6. Install new cartridge receiver (07900-60083).
7. Reassemble drive and perform normal diagnostic testing.
8. Insert this service note (P-07900-60085-2) into customer manual.

FDR/lm/WA

5/74-22

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INSTALLATION PROCEDURE

1. Remove power from the drive.
2. Remove ground strap (discard).
3. Remove ground button from spindle end.
 - a. Use an XACTO knife to remove old button.
 - b. Remove epoxy residue using XACTO knife and a fine grade of emery paper.
4. Install new ground button assembly.
5. Install new ground strap.
 - a. Use the gram gauge to assure the separation of the ground strap from the ground button when 70 grams + or - 20 grams is applied at point (A) . See Figure 1.

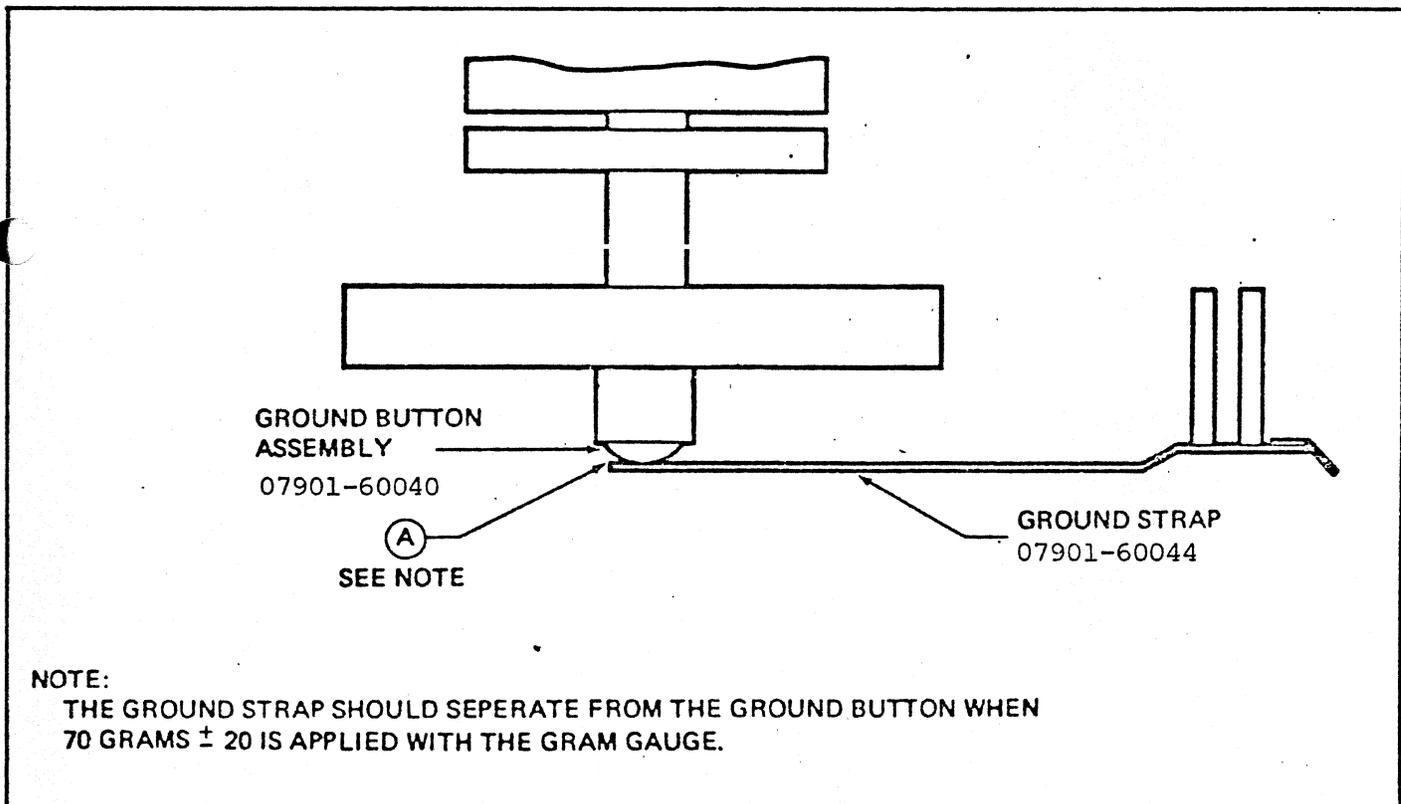
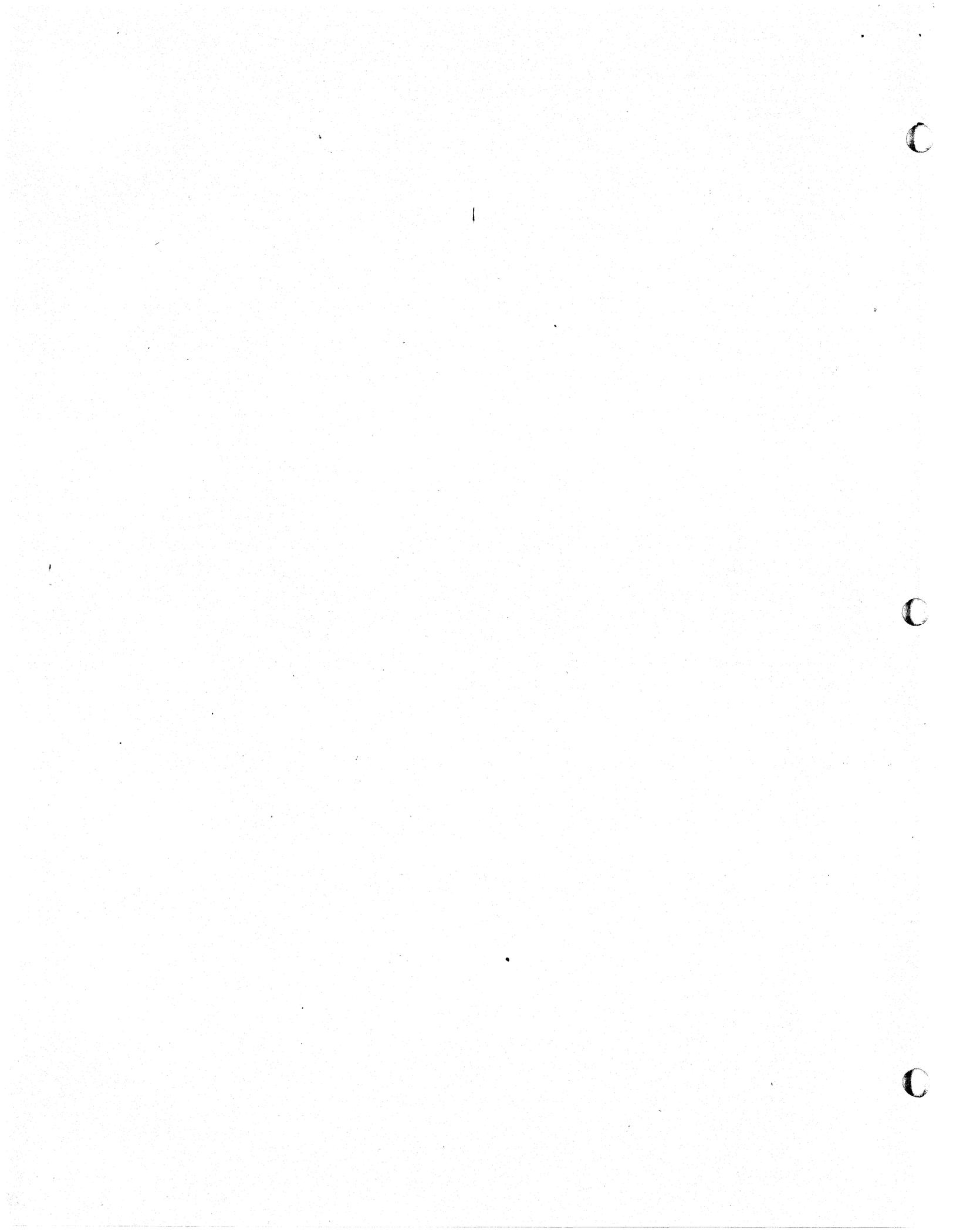


Figure 1



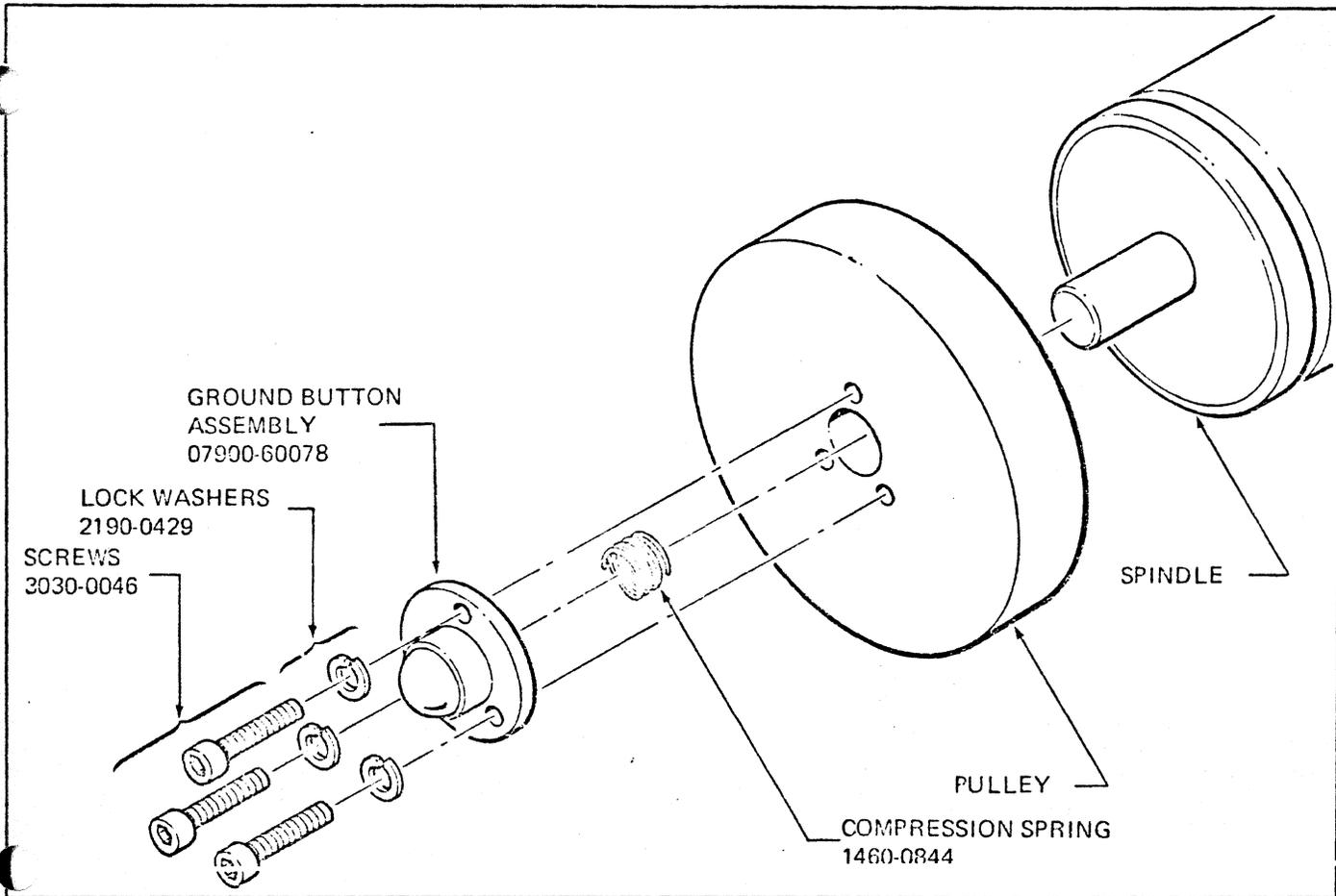


Figure 1.

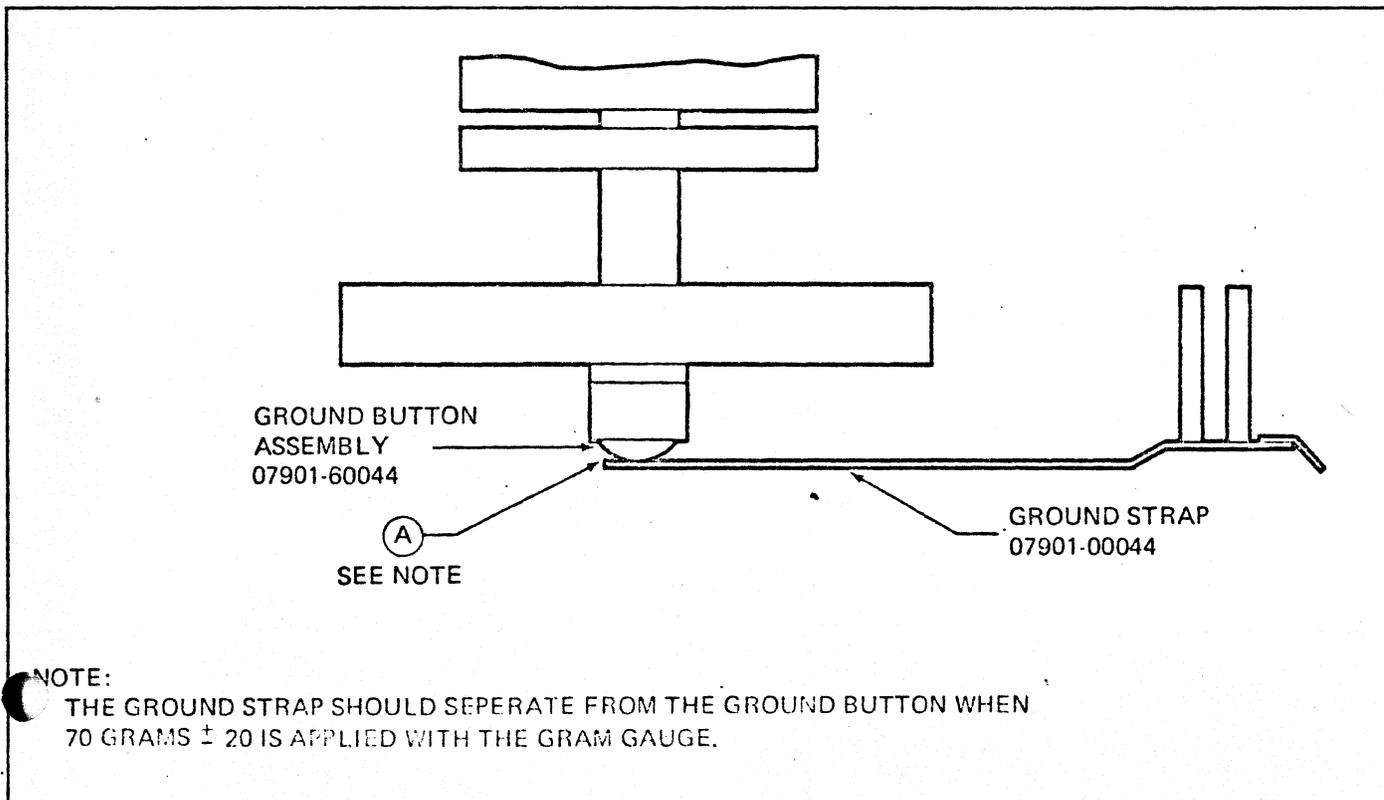
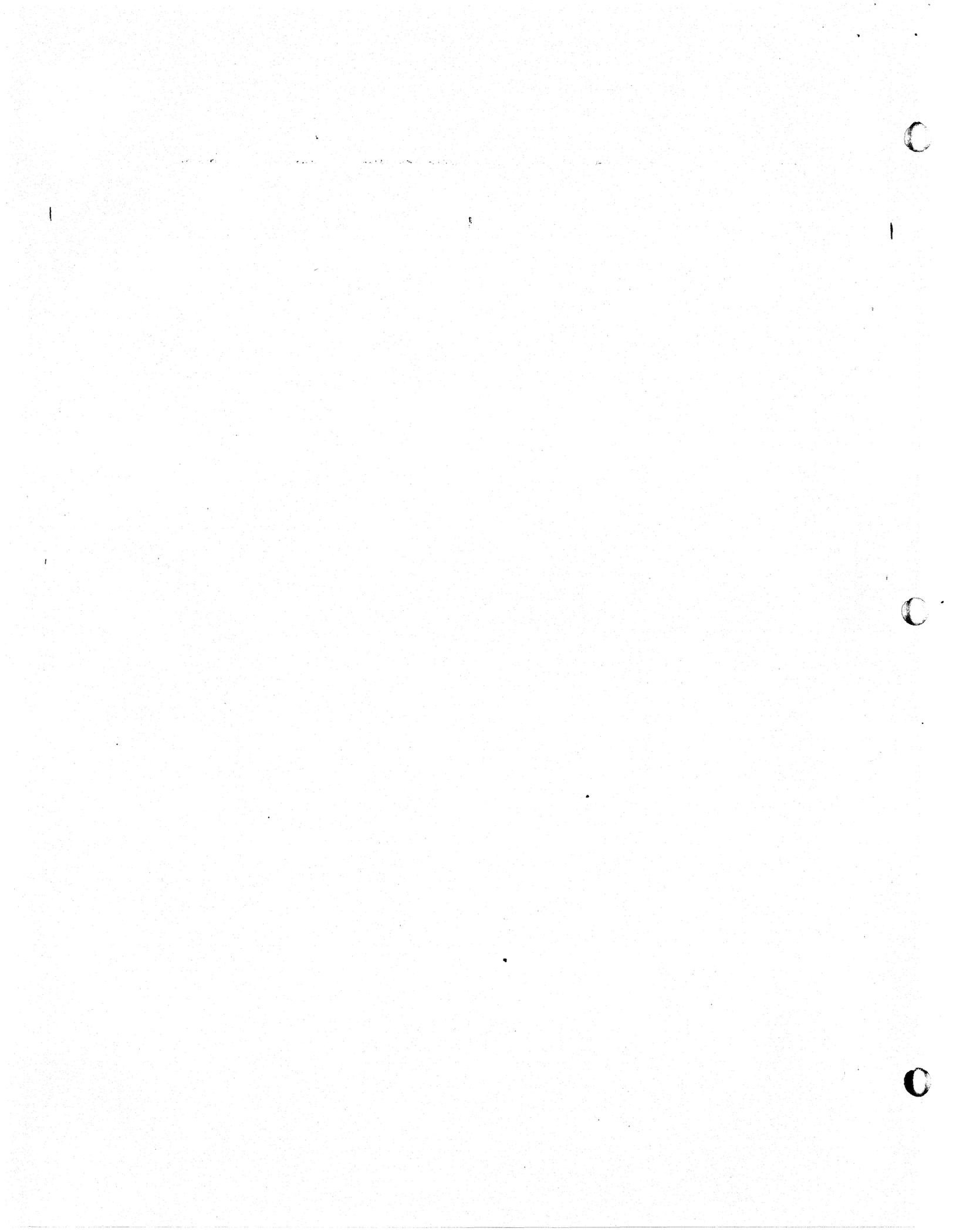


Figure 1.

NOTE:
THE GROUND STRAP SHOULD SEPERATE FROM THE GROUND BUTTON WHEN
70 GRAMS \pm 20 IS APPLIED WITH THE GRAM GAUGE.



S E R V I C E N O T E

Supersedes:

NONE

**29400 SERIES RACK CABINETS
INSTRUMENT SLIDE FAILURE**

We have recently discovered failures in instrument slides used to rack mount equipment in 29400 Series Rack Cabinets. Failures have typically involved cracking and breaking of the ball bearing wheel hub. A photographed example is shown on page 2.

Such failures are potentially dangerous. Excessive lateral movement of slide mounted equipment, either during servicing with the instrument extended, or during normal operation with the instrument in place, could result in the instrument falling completely free of the slides. If this should occur during servicing, injury to service personnel could result.

WARNING

Under no circumstances should any person attempt to work under an extended instrument before carefully inspecting the slide assembly.

Any assemblies found to be cracked should be replaced. Consult the replacement parts list supplied with the system, or order accessory number 12692B, with Option 02 or 03 as required, direct from Manufacturing Division, Palo Alto.

If replacement is to be done under warranty, charges will be paid for by the product division which sold the system or cabinet. Please include the sales order number the system or cabinet was shipped under with your request for warranty payment.

NRH/RH

5/74-03

HEWLETT  PACKARD

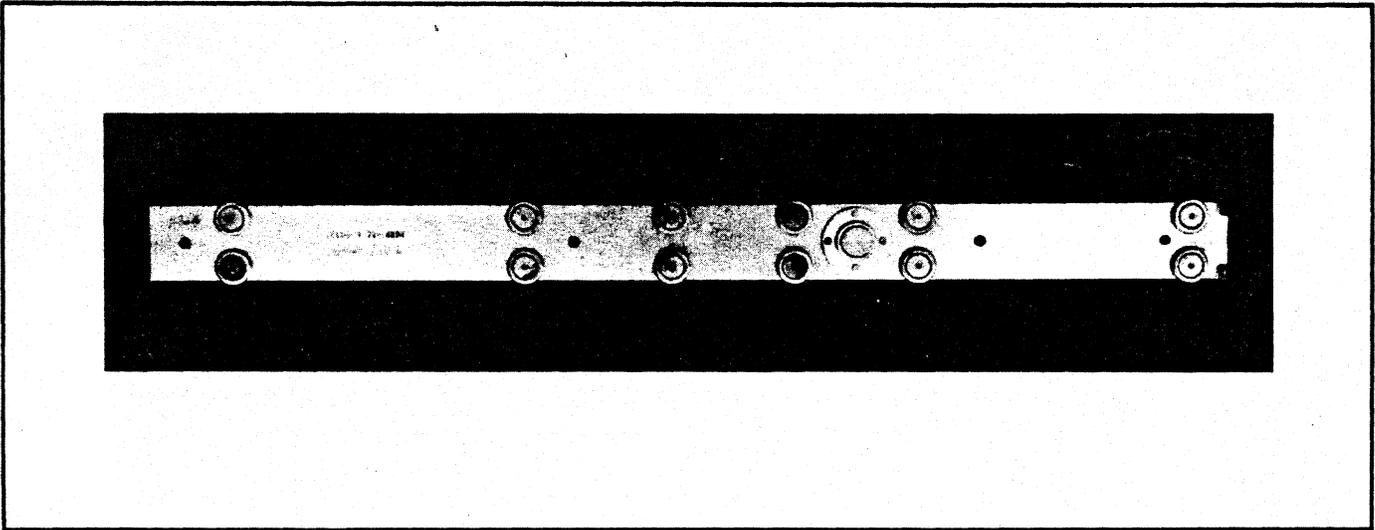


Figure 1

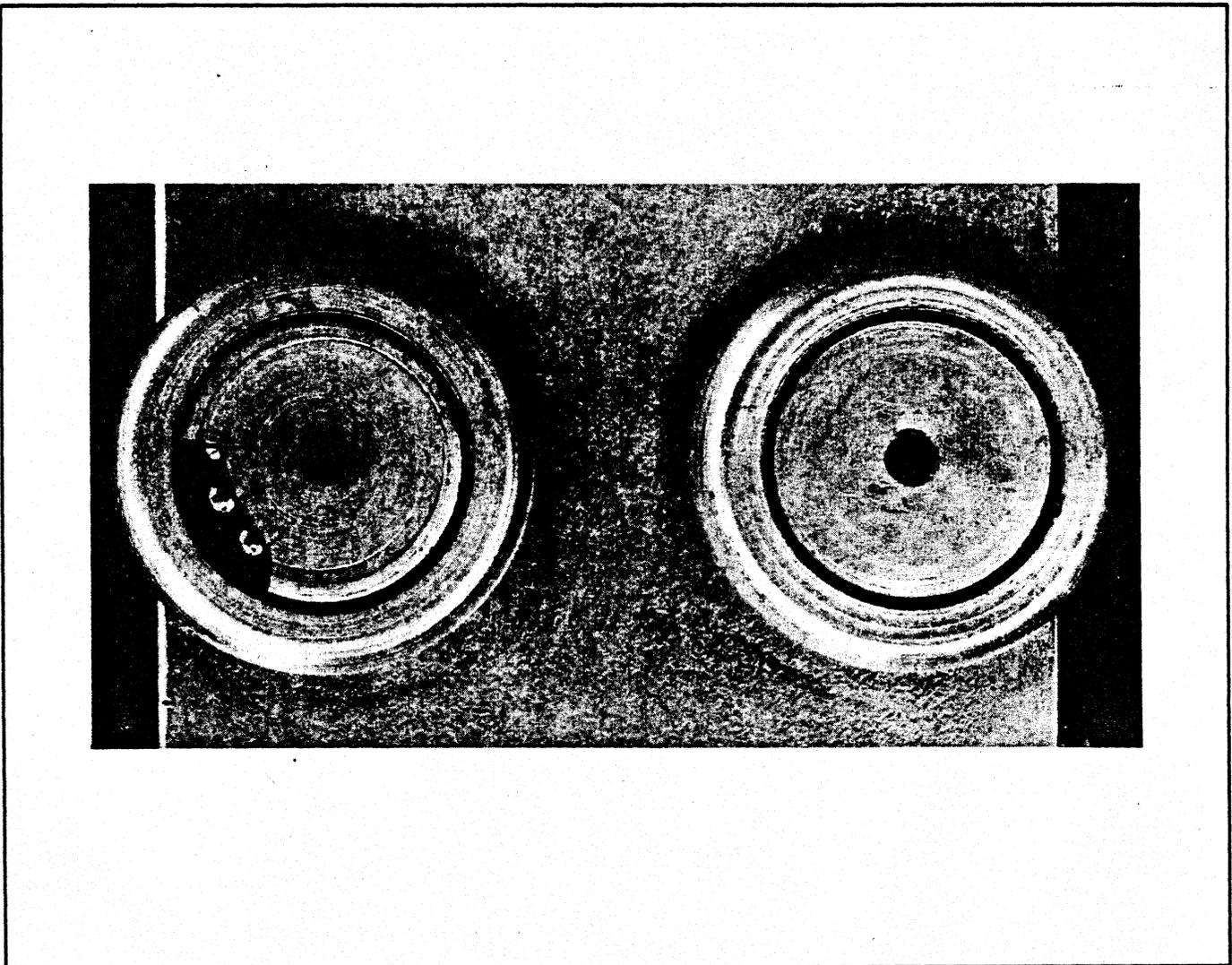


Figure 2

7900/7901 INCORRECT KIT MATERIALS

Fred Reynolds

The following service notes contain incorrect part numbers for the cartridge receiver and cartridge positioning post.

P07900-60085-1	P07900-60085-2
HP 7900A-16	HP 7901A-10
HP 7900A-22	HP 7901A-11
HP 7900A-23	

The correct stock numbers are

Receiver, Cartridge	07900-60083
Post, Cartridge Positioning	07900-20098

ELECTRICAL HAZARD

Fred Reynolds

The HP 13215A, when connected for electrical power other than 115 VAC, has the AC Neutral and AC common at different potentials. To assure that this condition will not happen, locate the AC power line going to the HP 7900A from the HP 13215A (TB 1) Pin 1 and Pin 7. Remove both wires and connect the black lead to Pin 2 of TB 1. Connect the remaining lead to Pin 6 of TB 1. A service note will be generated for this change.

city
at...

S E R V I C E N O T E

Supersedes:

None

HP7900A CARTRIDGE DISC DRIVES

All Serial Prefixes

SPINDLE GROUND BUTTON KIT

HP 07900-60081

This kit contains the required parts to incorporate the new ground strap button for the 7900A Cartridge Disc Drive.

SPECIAL TOOLS

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
Not Supplied	Gauge, 0 - 150 Gram	8750-0091

PARTS FURNISHED IN KIT (07900-60081)

<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	Strap, Ground	07900-60080
1	Spring, Compression	1460-0844
3	Screw, 8-32 x 1"	3030-0046
3	Washer, #8 Lock	2190-0429
1	Ground Button Assy.	07900-60078
1	Service Note	P-07900-60081-1

INSTALLATION PROCEDURE

1. Remove power from the drive.
2. Remove ground strap and discard.
3. Remove drive belt.
4. Remove drive pulley. Discard three 8-32 x.625" screws and no 8 lock washers.
5. Remove ground button

FDR/lm/ WO

2/74-22

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For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

Printed in U.S.A.

5. Remove ground button from spindle shaft end using an XACTO-KNIFE.
6. Remove Epoxy Residue using an XACTO-KNIFE and a fine grade of Emery paper.
7. Using Figure 1 as a Guide, reassemble pulley assembly.
8. Install Drive Belt.
9. Install new ground strap, and check for 70 ± 20 grams.
10. Reassemble drive and perform normal diagnostic tests.
11. Insert this service note (P-07900-60081-1) into customer manual.

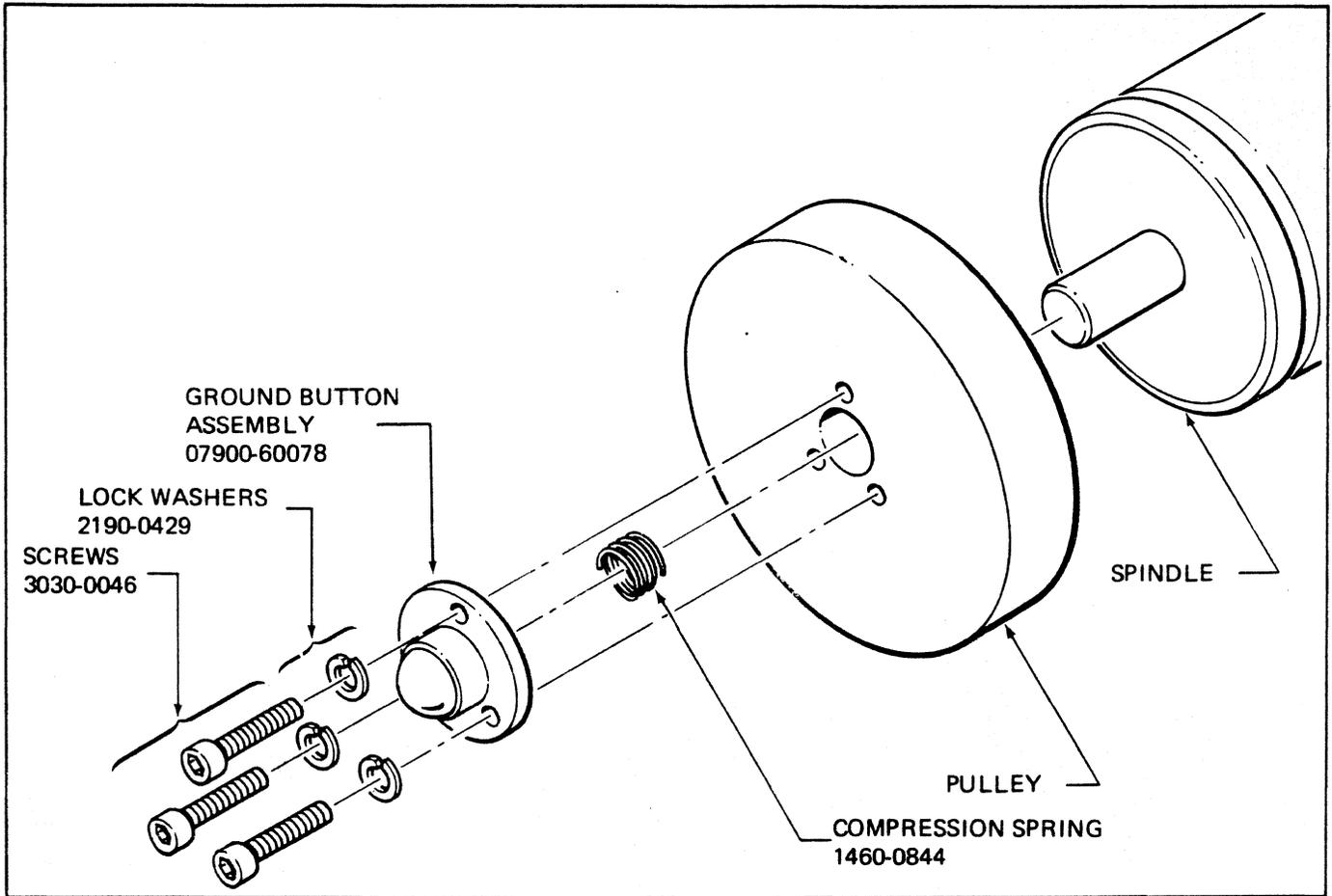
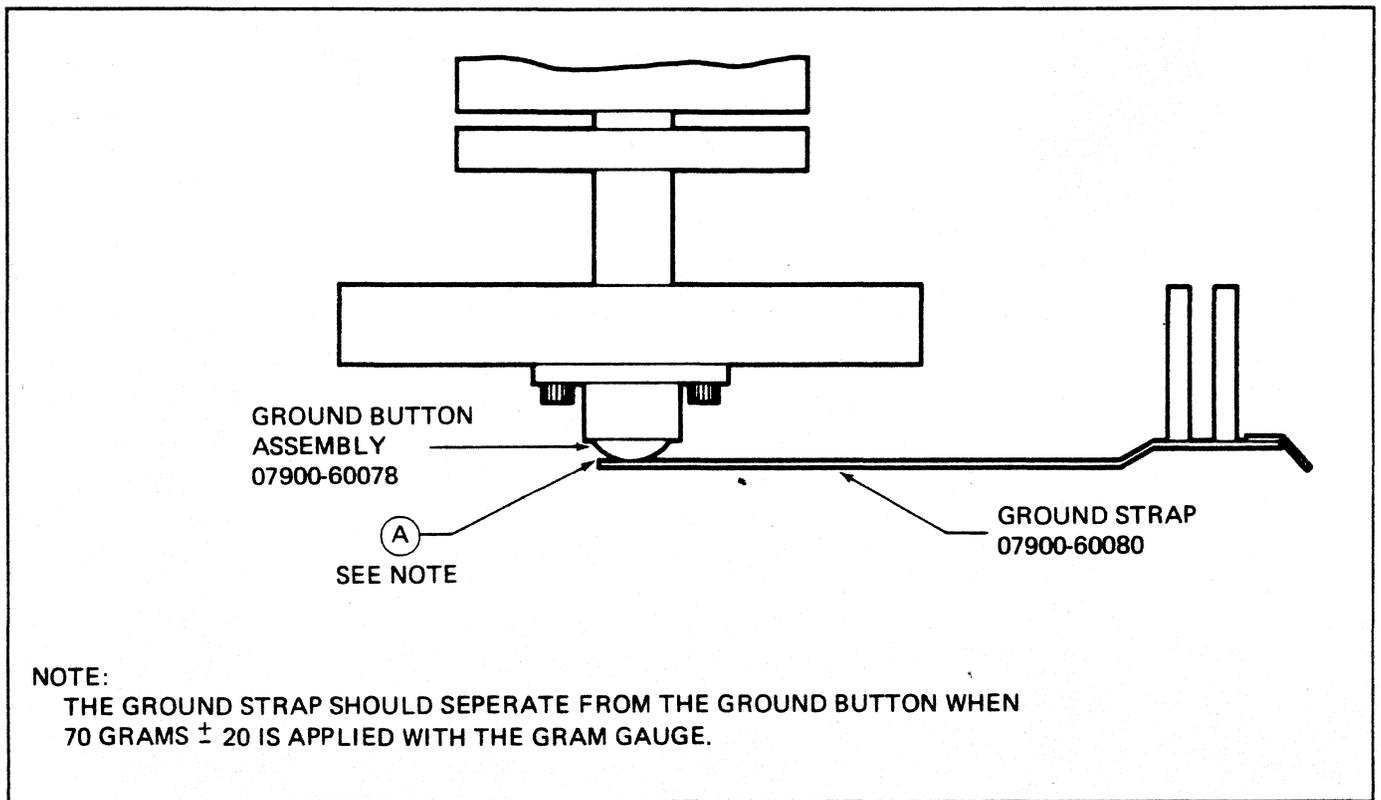
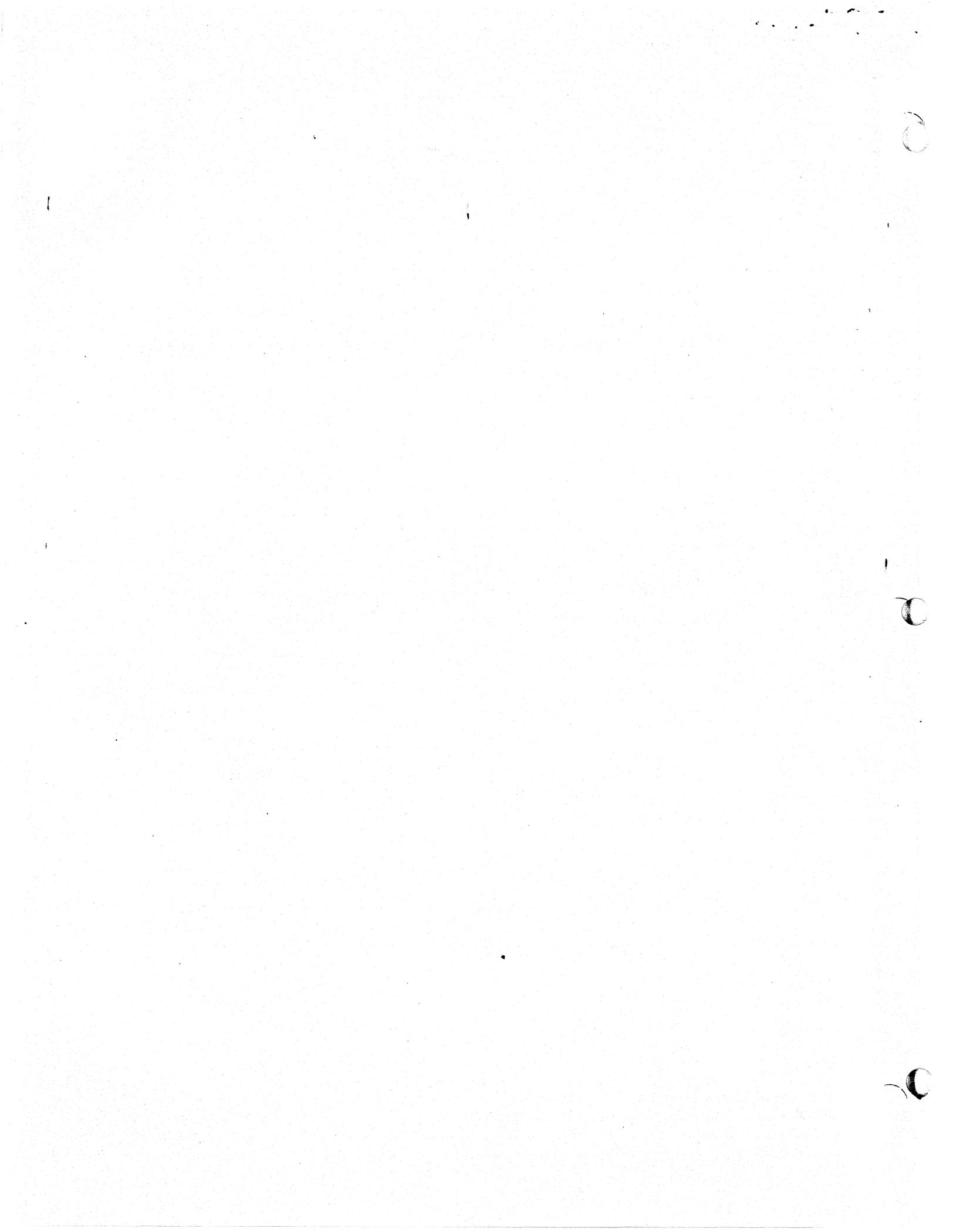


Figure 1.



NOTE:
THE GROUND STRAP SHOULD SEPERATE FROM THE GROUND BUTTON WHEN
70 GRAMS \pm 20 IS APPLIED WITH THE GRAM GAUGE.

Figure 2.



S E R V I C E N O T E

Supersedes:

HP7901A-3

HP7901A DISC DRIVE

All Serial Number Prefixes

INSTALLATION GUIDE

This service note is intended to facilitate installation of the 7901A Disc Drive and associated equipment at end user sites using HP2100 Series Computer. Documents referenced to in this note have been provided with the disc system.

This device must be installed by HP trained personnel who are familiar with installation and service techniques. If system is damaged as a result of installation by unauthorized personnel, the warranty will be void.

A complete 7901A Disc System consists of a 13210 Interface Kit and one-to-four 7901 Disc Drives. This service note is intended to assist in installing such a system in an HP2940A Cabinet.

The following materials will be received when a complete system is installed:

13210A Interface

13210-60000	Disc 2 Interface Board
13210-60004	Disc 1 Interface Board
13210-60003	Interface Cable
13210-90003	Operating and Service Manual
13210-90004	Diagnostic Manual
13041-60001	Diagnostic Tape

7901A Disc Unit

9164-0045	24 Sector Cartridge
07901-90003	Disc Operating and Service Manual
07901-60013	Termination P.C. Assembly
07900-60034	Multi-unit Cable (required if two or more drives are installed)

Remove all packing materials, straps, etc. Inspect all equipment thoroughly for damage which may have occurred during shipment. Report any damage to the carrier and nearest HP sales office immediately.

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5/74-22

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For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181 • West (213) 877-1281. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-Ku, Tokyo, 151.

Printed in U.S.A.

-CAUTION-

Dangerous voltages are present in the system which requires application of standard safety precautions.

Special tools and equipment are required to install the 7901A Disc System. These tools are described in Service Note 7901A-2.

Refer to Section II of the 13211A Rack Slide Mounting Kit Installation Manual for additional information.

1. Install the mounting kit in the 2940A Cabinet.
2. Mount the slide on the 7901A Drive
3. Extend the slide racks and install the 7901A Drive in the cabinet.

Refer to Section 2 of the 7901A Operating and Service Manual to insure that TBI is wired for the proper primary power source.

-NOTE-

If this unit is to be connected to any power source other than 110-120 VAC, 60 Hz, a power cable plug must be locally purchased to meet requirements.

Check to insure that no electrical continuity exists between the 7901A and 2940A Cabinet.

Refer to Section 5 of the 7901A Operating and Service Manual.

1. Extend the drive units slides out and remove the top cover. Remove the carriage shipping detent to allow carriage motion. The carriage shipping detent should be saved for future use in the event the equipment is relocated.
2. To insure proper cartridge seating, clean any foreign material from the spindle magnet.
3. Check the drive alignment as specified in Section 5 of the Operating and Service Manual. Insure that the following adjustments are within the required specifications:

Encoder Clearance	Para. 5-42
Encoder Parallelism	Para. 5-44
Encoder Alignment	Para. 5-46
Servo Adjustment	Para. 5-48

4. To insure cartridge interchangeability, check the following adjustments:

Head Alignment	Para. 5-50
Sector Circumferential	Para. 5-52

Refer to Section II of the 13210A Operating and Service Manual.

1. Install the disc interface P.C. Boards in the desired I/O select code slots in the computer. The Disc I interface board will be installed in the high priority (lower number) I/O slot.

-NOTE-

If the interface kit is being installed in a 2116A, Resistor R-22 on the Disc I board must be desoldered and moved to the empty connection pad (+5V) between R22 and C-16. Refer to Figure 4-1 (parts location) and the schematic diagram (grid location D-8) in the 13210A Operating & Service Manual.

2. Connect the interface cable between the interface boards and the A13 P.C.A. receptacle on the back of the drive.
3. Install the termination P.C. Board in the A14 receptacle on the drive.
4. If more than one drive is connected to the interface, a multi-unit cable must be used to daisy chain the drives together. This cable should be connected between the A14 (using an I/O extender in place of the terminator board) and A14 of the adjacent drive. The terminator P.C.A. must be installed in the last unit on line.
5. Insure that the correct drive address is selected (Drive address switch under front door).

-NOTE-

Insure that no two drives have the same select address.

Refer to the 7900/13210 Diagnostic Manual for operating instructions and failure analysis.

1. Install a spare cartridge and load the drive being installed.
2. Use the diagnostic program to initialize the disc. This may be accomplished as follows:

Set the DATA PROTECT switch to off. Set the PROTECT/OVERRIDE switch (located behind course filter screen) to OVERRIDE.

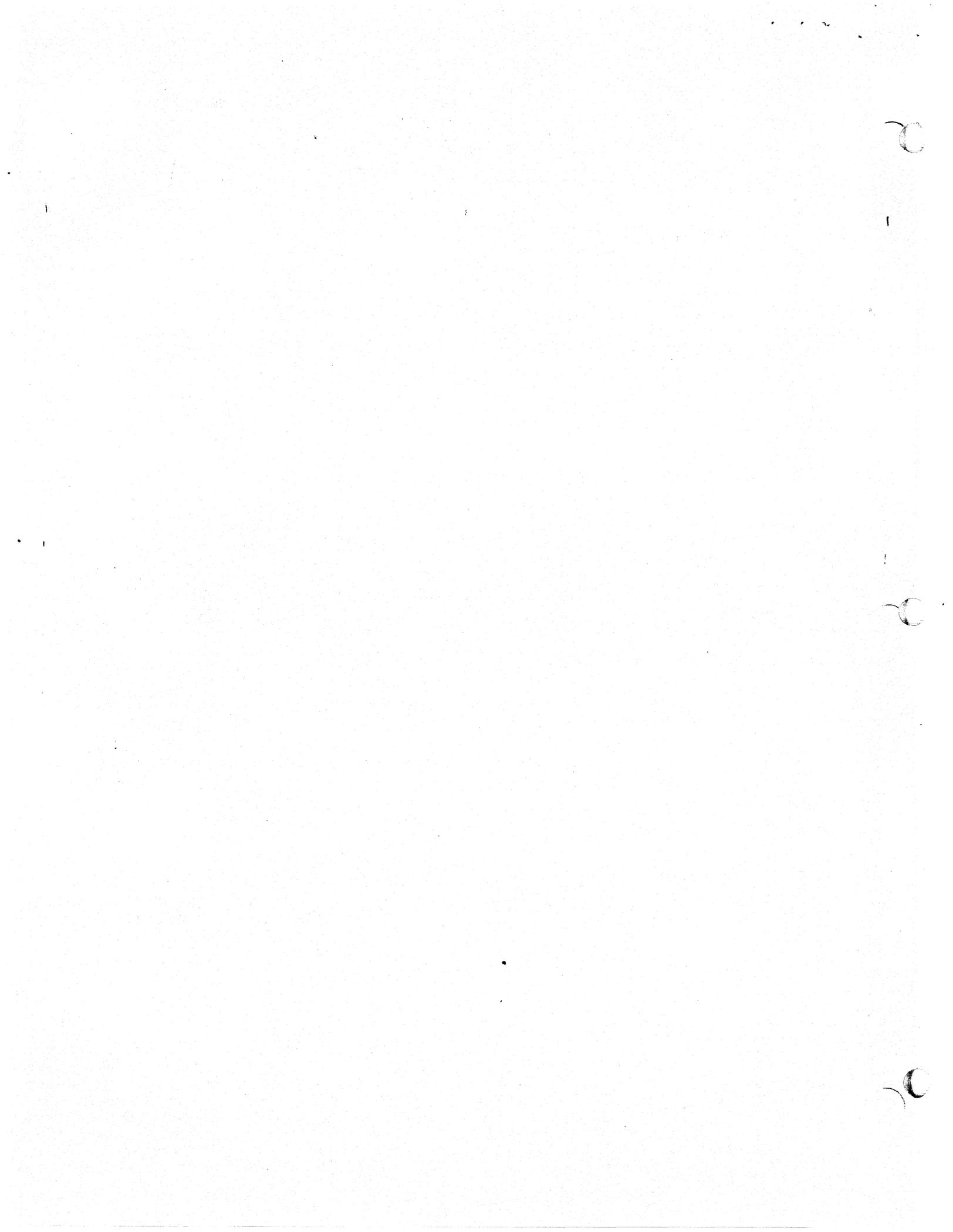
Use the diagnostic starting address 100.

SW Reg = Octal 24

Preset, Run

Select which surface to be formatted.

3. Verify proper operation of the drive by running the complete diagnostic program.



handout

PURPOSE To familiarize the student with the handshake signals and the sequence in which they are used to control the HP7900 Disc Drive by the 13210 Interface.

Looking at page 2-1 in the student workbook, first let's examine the signals that go between the interface card and any one HP7900 disc drive. The first line is labeled "Drive Select". It is actually two lines which carries the logical drive number from the interface to the disc drive. The next three lines are labeled Set Cylinder, Set Head and Sector and Control. The main purpose of these three signals is to inform the disc drive what information is coming to it by way of the 8-bit Outbus. The 8-bit Outbus is represented by the wide arrow going from the interface to the disc drive.

The table below the 8-bit Outbus with the three main sections in it has information relating to the 8-bit Outbus. This table, by labeling the three groups of information as word one, word two and word three, implies the major sequence of operation needed by the disc drive to achieve it's ultimate goal, which is, to read or write data. The three main types of information sent to the disc drive is a cylinder address, a head and sector address and some type of control information. Notice that Bit-0 is the most significant bit and Bit-7 is the least significant bit of this information when sent over the Outbus. This labeling is the way the lines are labeled in the disc drive diagrams and has nothing to do with which type of computer the disc drive may be connected too.

Below this table, is a wide arrow that goes from the disc drive to the interface card. It is a 6-bit bus called the Inbus. Below this bus is a second table. This table tells what information is carried from the disc drive to the interface card. This status information is often called "Non-stable Status" information because it must be asked for by the interface before the disc drive sends it over to the interface.

Below this second table is a twisted pair bi-directional line which carries the data or clock bits to and from the disc drive. Below the twisted pair data lines are five lines which go from the disc drive to the interface. These five lines are active at all times when one of the four possible disc drives connected to an interface is selected by using the two drive select lines. The information carried by the Inbus is also status information. Since the lines are active all the time one of the drives is selected, it is called "Stable Status".

All of the signals that go between the interface card and the disc drive are low active with the exception of the data carried over the twisted pair data lines. This includes the two buses.

It is appropriate at this time to define the five stable status signals. Drive Ready is an active signal whenever the disc drive has it's heads loaded. This is the only requirement to have the signal Drive Ready active.

Access Ready is active any time the heads are not moving and the heads are loaded. The signal Access Ready then, is a means for the interface card to find out when that disc drive selected has its heads moving to do a seek operation other than loading or unloading the heads.

The signal Sector Pulse is a signal generated by the disc drive which is 24 microseconds in duration (pulse width = 24 microseconds) each time the disc drive senses a sector pulse from the skirt of whichever platter has been previously selected by a head address. The Sector Pulse signal is used in the 13210 interface for finite timing as to when to actually start a read, write, or refine sector operation.

The signal Sector Compare is generated by the disc drive when the sector address sent to the disc drive compares with the sector number of the physical sector that is under the head that was selected by the head address sent to the drive at the same time the sector address was sent (see Word two for the Outbus in the figure). As soon as the interface detects the signal Sector Compare, the interface turns its attention to the Sector Pulse signal.

The Ground signal provides a common logic ground between the disc drive and the interface. This ground is needed because the chassis of the equipment is not signal ground. It should be brought to the reader's attention that test point 1 on each logic card on the HP7900 Disc Drive is logic ground. Therefore, it is recommended that the student ground the oscilloscope on test point one of any logic card in the drive when trying to use the oscilloscope to look at signals. Do not try to use the chassis of the disc drive. This will cause the oscilloscope to float and sinking will be very difficult if not impossible to achieve.

The logical drive address is sent to the disc drive by the Drive Select lines. This address is sent over to the daisy chained disc drives at all times because the address is ungated in the interface. This means that one of the possible four drives on the daisy chain is actually selected at all times. Because the flip-flops on the interface card can be in only one of two states it may be logical drive \emptyset which is selected.

In the following discussion, the student will see where it is specified that a logical drive number is needed to complete an operation. Since atleast one disc drive is always selected, the Drive Select specification is add to differentiate between when the Drive Select or Logical Drive Number is needed and when it is not needed to cause an action within the disc drive. The following sequence of operation will also discuss the signals not previously discussed

HP7900 Disc Drive

and tell what they do within the disc drive or interface.

In any moving head disc drive, the major sequence of operation to move data is to first seek the heads to a given position on the platter, second is to select a head and sector where the data can be found and lastly to move the data itself. The HP7900 is not any different. These then, are the major operations, however, sub-operations do occur between the major operations.

As previously stated, the first major operation needed is to position the heads to a given position on the platter. This is done in the HP7900 Disc Drive by sending a logical drive address, the signal Set Cylinder and a cylinder address by the Outbus from the interface to the disc drive. The cylinder address has a legitimate range of from 0 to 202 in decimal and 0 to 312 in octal. The signal Set Cylinder informs the disc drive that the value found on the Outbus is a cylinder address. The disc drive will then load the cylinder address into a "New Cylinder Address Register". If the disc drive finds a difference between where the heads are currently positioned and where they should be positioned (by virtue of the cylinder address just sent to it) the disc drive will automatically do a seek operation to the address specified by the value received over the Outbus.

The interface card must have a way of determining when the disc drive has selected the cylinder address so that it can drop the information off the Outbus. The interface wants to drop the cylinder address off the outbus so it can be released to go to other disc drives and do other operations while the previously selected disc drive is completing the seek operation. It is desirable to do this because the disc drive previously selected to do a seek operation may take as much as 53 milliseconds to complete this seek operation. The stable status from the disc drive "Access Ready" is used for this purpose. Whenever a cylinder address is sent to a disc drive, the drive will deactivate the signal Access Ready. This occurs even if the disc drive is already at the cylinder being specified by the value sent to it over the Outbus lines. As soon as the interface detects the signal Access Ready going not active (high) the interface will be released from the disc drive and it can service other disc drives.

The interface can detect any drive needing service by the signal called Attention. Look at the table below the sis Inbus lines. The left hand column has four Attention signals listed as the value coming back over the Inbus lines to the interface. These Attention signals are the means the interface has of detecting when a disc drive has completed any seek operation whatsoever. This includes loading the heads, doing a recalibrate operation or seeking because a cylinder address has been sent to it. Each disc drive only has one Attention signal from it. That Attention signal will be sent over the Inbus line that corresponds to the logical drive number that the signal came from. This means, that if Inbus line 0 is active, disc drive logical number 0 has generated an Attention signal. If disc drive logical number 1 had generated an Attention signal it would be sent to the interface over Inbus line 1. Since we can attach up to four disc drives on a daisy chain from the interface, all four disc drives could, at one point in time, have their Attention signals

active. For this reason, up to four Attention signals could be active on the Inbus line whenever the disc drives are polled for their Attention signals.

The disc drives are polled for their Attention signals by ascertaining the signal Control and Bit-6 of the Outbus lines at the same time. No Drive Select is needed to poll for the Attention signals. When the Attention signals from all drives are requested, all drives on the daisy chain having an Attention signal active will send it back over the corresponding line of the Inbus. The interface will then look at the Inbus and determine if any of the lines has an active Attention signal. In the case of the 13210 interface, if an Attention signal is active at this point, the interface would generate either an interrupt back to the CPU or it will set the channel flag depending upon the mode of programming used in the computer. It will then be the responsibility of the programmer to go out to each of the disc drives available and ascertain which disc drive needs service and choose which disc drive he wants to be serviced as a result of having just completed a seek operation. At this time the programmer could choose to do anything he desired with whichever disc drive he chooses to work with. This could be either initiate another seek operation or to go ahead and initiate a read or write operation.

If the programmer chooses to initiate a read or write operation, the following sequence of events will be achieved by the interface. It will be assumed that the interface has received from the CPU the head and sector address of where the data is to be found.

The first thing the interface will do, regardless of whether it was asked to do it by the programmer or not, is to status the disc drive. Since the status desired is from only one of the four possible disc drives, a logical drive address must be on the Drive Select lines to select the drive that is to send back its status. Outbus Bit-6 and the signal Control is also needed to gate the status back to the interface.

The reason the interface does this status operation, is that doing the status operation causes the Attention signal for that one disc drive to be reset. The Attention signals that may be active on any of the other drives are not reset because only one drive is being addressed. This is the way the interface has of informing the disc drive that it is being serviced. From this point on in the sequence the interface is dedicated to that one disc drive until all of the data desired has been moved, an error condition is detected or the operation is terminated by the operator. The sequence from the status operation thru the actual data moving operation is caused by a data moving command having been received by the interface. All of the status bits fetched via the Inbus are passed back to the CPU. Only the Drive Ready "Stable Status" is passed back to the CPU as status information.

The following is a brief explanation of each of the status bits available from the disc drive:

1. First Seek is a status developed by the disc drive upon

loading the heads. An example of the use of the First Seek status would be that it provides a means for a programmer to determine when a cartridge disc has been changed by the operator upon the programmer's instructions.

2. Seek Check status is developed when an illegal address is sent to the disc drive. It is an error status that is checked by the interface after it does the mandatory status operation previously described. An example of something that would cause a Seek Check status would be a cylinder address greater than octal 312.
3. The Data Protected status is a copy of one of the two Data Protect switches available to the operator inside the door of the disc drive. The Data Protected status is developed by directly copying whichever one of the two switches corresponds to the platter last selected by the last head address sent to the disc drive.
4. The On-line status is a direct copy of the Protect/Override switch in the disc drive. The On-line status is a high or logic 0 when the switch is in the Override position. The status is a low or logic 1 when the switch is in the Protect position.
5. The Drive Unsafe status is developed when the disc drive detects a fault condition. The fault could have been developed as a result of the disc drive detecting a read/write fault or a carriage control fault. A read/write fault is caused by such things as the drive detecting Write Gate with no Erase Gate or Read Gate with Erase Gate. A carriage control fault would indicate that something went wrong with the drive which caused the carriage not to be positioned over the desired cylinder in 760 milliseconds.
6. The Drive Select status is developed by the disc drive, but not used with any of HP's interfaces. It was intended to indicate to an OEM customer who connects two interface subsystems to one disc drive that one of the subsystems has selected that drive and is using it.

When the status bits are received in the interface, certain status bits are checked for error conditions. Those checked are Seek Check, Data Protected and Drive Unsafe for most operations. The Write Data operation also checks Data Protected and the Initialize Data command (not to be discussed here) causes the On-line status bit to be checked. If all of these status bits are okay, the interface will proceed to the next operation.

The next operation the interface accomplishes, is to send a head and sector address to the disc drive. Looking at the table just below the Outbus on page 2-1 of the Student Workbook, it can be seen that the head address has two bit positions. Since the HP7900 Disc Drive has four heads, it has a legitimate head address range of from 0 to 3. Since the HP7901 Disc Drive only has a cartridge platter, it only has two heads. Therefore, its legal head

HP7900 Disc Drive

address range is from 0 to 1. On the HP7901, if the most significant bit of the head address is a logic 1, the head address would have to be of a value greater than 1. This would cause a Seek Check status code to be developed by the HP7901 Disc Drive.

Looking at the same table, it can be seen that the sector address is carried to the disc drive over Outbus lines 3 thru 7. The legal range of sector address is from 0 to 24 in decimal and from 0 to 27 in octal. An address of octal 30 or greater would cause a Seek Check on either the HP7900 or HP7901 Disc Drive.

The head and sector address is sent to the disc drive over the Outbus lines along with the signal Set Head and Sector and a logical drive address. When the disc drive detects that the selected platter has its sector address equal to the sector address just sent to it, the "Stable Status" signal Sector Compare will go active. This signal will be active for the entire duration of the time the sector is passing under the heads (1.04 milliseconds). While the interface is sending the head and sector address to the disc drive, it is monitoring the Sector Compare signal coming back to it. This means the interface has of knowing when the head and sector address has been accepted by the disc drive. If the interface is supposed to cause the disc drive to do a write operation, the interface will immediately bring up the signals needed to cause the disc drive to begin to write. If the interface is supposed to cause the disc drive to do a read operation, the interface will monitor the Sector Pulse. It will then begin the read operation on the trailing edge of the Sector Pulse.

The last operation, then, is to actually do the read, write or erase operation. To do any of these operations, the interface must send a logical drive address and the signal Control to the disc drive. These two signals along with control information sent via the Outbus must be active for the entire duration that data is being moved for that sector.

To do a read operation, the Read Gate signal would go to the disc drive over Outbus Bit-1 line. To do a write operation, both Write Gate and Erase Gate is needed (Outbus Bit-0 & 2 respectively). To do an erase operation, just the Erase Gate would be sent to the disc drive over Outbus Bit-2.

After the subsystem has finished moving the data for that sector the data transfer operation is terminated. If one or more subsequent sectors of information is needed, the interface will increment the sector address (and head address if needed) and send it to the disc drive. The operation is the same from this point on as previously described. This loop will then continue until all sectors of information requested has been moved or the logical end of cylinder for the disc drive has been reached.

If a data error or any error which does not cause the heads to unload is detected, the operation will continue until the end of that sector before being terminated by the interface. If a fault condition occurs, the heads will immediately unload and the data moving operation will immediately be terminated by the interface.

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One other operation can be initiated in the disc drive. This is a Recalibrate (often called a Return-To-Home) operation. The operation is initiated by sending the drive address (Drive Select) with the two signals Set Cylinder and Set Head & Sector at the same time. No address is sent over the Outbus. The Recalibrate operation will cause the drive to return the heads to cylinder 0, regardless of where the loaded heads were positioned. In the 13210 interface this operation cannot be initiated by sending a command to the interface. The interface will initiate this operation when the interface detects an address error or the programmer has tried to do a data moving operation beyond the logical end of cylinder.

This is the main sequence needed by the HP7900 Disc Drive. However, due to one particular item, a slightly different sequence is actually used by the 13210 interface. The disc sequence is listed below along with the signals needed to accomplish the operation and the resulting action caused by each group of signals being sent to the disc drive:

1. Do a seek operation.
 - a. Signals needed:
 1. Drive Select
 2. Set Cylinder
 3. Cylinder address on the Outbus
 - b. Results: The heads will do a seek operation. The interface will know when the address has been accepted by monitoring the Access Ready signal.
2. Send a head and sector address.
 - a. Signals needed:
 1. Drive Select
 2. Set Head & Sector
 3. Head & sector address on the Outbus
 - b. Results: The next time the interface does a status operation, the data protected status bit will be monitoring the correct Data Protect switch.
3. Request the Attention signals from all disc drives.
 - a. Signals needed:
 1. Control
 2. Outbus Bit-6
 - b. Results: All disc drives that have an Attention signal active will gate that Attention signal over the Inbus line which corresponds to its logical drive number.
4. Request the drive status.
 - a. Signals needed:
 1. Drive Select
 2. Control
 3. Outbus Bit-7
 - b. Results: The status from the selected disc drive will be gated over the Inbus to the interface.
5. Send a head and sector address to the disc drive.
 - a. Signals needed:
 1. Drive Select

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2. Set Head & Sector
 3. Head & sector address on the Outbus
 - b. Results: The disc drive will select a platter and a head and monitor that platter until the sector below the head is the same sector requested by the sector address. The disc drive will then send an active Sector Compare signal back to the interface.
6. Do the read, write or erase operation.
 - a. Signals needed:
 1. Drive Select
 2. Control
 3. An operation code over Outbus Bits-0, 1 or 2
 - b. Results: The disc drive will read, write or erase as requested by the opcode.

Notice that the head and sector address is sent to the disc drive two times. The first time (Step 2) is strictly to make the disc drive monitor the correct Data Protect switch. This address is the same as the one sent in step 5 the first time step 5 is accomplished, but the address sent over in step 2 is never used for a data moving operation because the steps are executed in the sequence shown.

handout

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MODULE: HP7900 Disc Drive
TOPIC REF: Disc Drive Relay Circuitry
APPLICABLE REF: HP7900 Student Workbook
Page 2-5 (97900-90037)

PURPOSE To familiarize the student with the relays in the HP7900 Disc Drive and the sequence of operation used to load and unload the heads.

Page 2-5 of the HP7900 Student Workbook shows all of the relays contained in the HP7900 Disc Drive and the applicable circuitry needed to control those relays. It does not show all of the contacts of the relays. It only shows those contacts needed for a thorough explanation of how the relays work.

Since the relays are all +24v relays this voltage is the only voltage needed on this diagram from the power supply. Upon initial power up, the 0.5 second delay bleeds off the +24v until it has timed out. The +24v is then applied to the Interlock relay. If all safety conditions are met (Ref. Student Workbook pp. 2-13) the Interlock relay will then energize. This will allow +24v to be applied to the other three relays in the disc drive thru contacts 9 & 10 of the Interlock relay. When the Interlock relay energizes a low signal developed thru contacts 12 & 13 of the Interlock relay is sent to the 30 sec. Drive Ready Delay Enable gate (A9U22D). Since the power up delay has timed out, the other leg of this Enable gate is also made. However, the 30 sec. Drive Ready Delay does not begin to time out until the Load Switch is turned to "Load" position. This additional term needed to enable the 30 sec. Drive Ready Delay is not shown on the diagram on pp. 2-5 of the Student Workbook.

When the Load switch is switched to the "on" or "Load" position the Run Relay Enable gate (A9U32B) will be enabled if the carriage has been fully retracted, the Interlock relay is made and DC braking is not being applied to the Spindle motor (Pin 13). If all of these conditions are met A9U32B will have a low out which will be inverted to a high by A9U23A. This will turn on the relay driver for the Run relay. The relay driver will then furnish a ground to the Run relay and the Run relay will energize. When the Run relay energizes a second ground will be applied to the Run relay thru contacts 5 & 8 of the Run relay and thru the Load switch. Also, contact pin 9 of the Run relay will not be made to contact pin 3 of the relay. This will cause a high to be applied to A9U13A. This high will prevent the Brake relay from being able to be energized.

When the Run relay is energized, the Triac Control line will be completed thru contacts 4 & 7 of the Run relay (Ref. pp.2-15 Student Workbook). Since the Brake relay is de-energized AC power will be applied to one winding of the Spindle motor and the pack will begin turning up to speed. No further action with the disc drive will happen until the disc pack is up to speed and the 30 sec. Drive Ready delay has timed out.

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Since the disc should have gotten up to speed long before the 30 sec. Drive Ready delay has time out the A9U32A input to A9U22A should be effective first. In order to make the NAND gate A9U32A the last unload operation must have been completed (the spindle must have come to a full stop), the disc must be up to speed and the drive must not have a fault condition. The purpose of the 30 sec. Drive Ready delay is to purge the bad or old air from around both platters and purge any dust away from the platters. When the 30 sec. Drive Ready delay has timed out the other leg of A9U22A will be made and a high will be output. This will turn on the relay driver and furnish ground to the Servo-amp relay. When the Servo-amp relay energizes the carriage can be driven to load the heads.

As soon as the carriage starts to move the first action that will occur is the Carriage Retracted switch will be de-energized. This will cause the signal Carriage Retracted going into pin 9 of A9U32B to go to a low. The resulting high out of A9U32B will turn off the Run relay driver. The Run relay, however, will not drop out since it has the ground furnished to it thru contacts 5 & 8 of itself and thru the Load switch.

When the heads have completed the load operation, the Drive Ready signal, Access Ready signal, and Attention signal will be active to the interface. The disc drive can then be used by the computer system.

The disc drive can be turned down (unload the heads) by three ways. The normal way is to turn the Load switch to the "Unload" position. However, breaking an interlock condition in the disc drive or a fault condition occurring in the disc drive could also cause the disc drive to shut down. We will take the condition of the Load switch being turned to the "Unload" position first.

When the Load Switch is turned to the "off" or "Unload" position this will open the path for the ground holding the Run relay energized. When the Run relay drops out it will break the Triac Control line and stop AC power from being applied to the Spindle motor (Ref. pp. 2-15). Also, pin 9 of the Run relay will energize to pin 3 of the Run relay sending a low signal to A9U42F. This will cause a Retract signal to go thru the normal servo drive circuitry and start retracting the heads. This will also place a low into A9U13A.

The other input to A9U13A will be made when the heads have fully retracted. This will turn on the relay driver for the Brake relay and the Brake relay will energize. Energizing the Brake relay (Ref. pp. 2-15) will allow DC power to be applied to the other winding of the Spindle motor. When DC power is applied to the other winding of the Spindle motor it will effectively brake the Spindle motor and help the pack to stop spinning faster. When the pack has stopped spinning, DC power will be removed from the Spindle motor and the Brake relay will be de-energized. The Brake relay is de-energized

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by the "Speed Sense FF Set" input to A9U12C. This will turn off the Brake relay driver and the Brake relay will de-energize.

As soon as the pack has slowed down to approximately 90% of its speed the Disc Speed Up signal into A9U32A will go low. This will turn off the relay driver for the Servo-amp relay. De-energizing the Servo-amp relay will cause the heads to finish retracting if they have not done so. Remember, that the carriage must be retracted before DC braking can be applied to the Spindle motor.

Once the heads have been fully retracted and the spindle has stopped spinning for 1.0 sec. the heads can be loaded again if all conditions to do so are present.

The second condition which could shut down the disc drive is to have one of the interlock conditions break or turn off the interlock circuitry. This will drop out the Interlock relay. When the Interlock relay drops out, pin 9 of the Interlock relay will be made to pin 8 instead of pin 10. This will remove +24v to the Run relay, Brake relay and Servo-amp relay. Removing +24v to the Run relay causes the Run relay to drop out and AC power will no longer be applied to the spindle motor. The +24v dropping off the Servo-amp relay will also cause it to drop out. This, of course, will cause the heads to retract. Notice also, that the Brake relay cannot be energized. This means that the spindle will take longer to stop spinning because the only braking action is the friction on the spindle. When the Interlock relay drops out, the heads cannot be loaded until the condition that caused the Interlock relay to drop out is corrected.

The third item which will cause the heads to unload is a fault condition. When a fault condition occurs the "Not Drive Unsafe" signal into A9U32A goes low. This will cause the relay driver for the Servo-amp relay to be turned off and the Servo-amp relay to drop out. When the Servo-amp relay drops out the heads will be retracted. Notice, that the Run relay was not affected. Since the Run relay is not affected, the spindle will not stop. When the fault condition is no longer detected the only thing needed to load the heads is for the 30 sec. Drive Ready delay to time out once more. (The signal controlling the 30 sec. Drive Ready delay when a fault condition occurs is not on the drawing on pp. 2-5 of the Student Workbook.) Thus, if a fault condition occurred that could only be detected when the heads are loaded, the fault condition having occurred would cause the heads to unload, but 30 seconds after they unload the heads would load again. An example of this occurring would be for something to go wrong with the disc drive which caused the heads to take longer than 760 milliseconds to complete a seek operation. This could include either a logic problem or a head crash.

If the disc drive is recycling every 30 seconds it is recommended that the student place the P6 plug on the A2 board in the test position (J7). This will allow the student to see what the heads are doing after removing the top cover. This will also prevent most serious head crashes from occurring.

7900 RELAY ENABLE CIRCUITRY

There are four relays in the 7900. Two major points should be brought out.

- (1) The +24V power for the Servo-Amp Relay, the Brake Relay and the Run Relay goes through one set of contacts of the Interlock Relay. Therefore, if any of the interlock conditions are broken, any of the three relays that are energized at that moment will drop out.
- (2) When the carriage drives forward to load the heads the signal "CARRIAGE RETRACTED" will turn off the relay driver for the Run Relay. The relay does not deactivate, however, because at the time the relay driver is turned off the relay has already been energized and a ground is furnished to the coil of the Run Relay from the Run Switch thru one set of contacts of the Run Relay.

The purpose of each of the relays is listed below:

INTERLOCK RELAY – to monitor all safety conditions necessary to prevent the drive from being damaged if certain conditions should fail. Items monitored by the Interlock Relay are:

- (1) All DC voltages from the power supply.
- (2) The encoder lamp must not be burned out.
- (3) The door must be closed.
- (4) A cartridge must be loaded.
- (5) The door must be locked.
- (6) All PC boards must be plugged into the A6 Motherboard.

SERVO-AMP RELAY – in the energized position it allows the current to be applied to the carriage servo to drive the heads for any reason. In the de-energized position it causes the heads to retract via the batteries or +5V according to conditions present.

BRAKE RELAY – in the energized position it allows DC braking to be applied to the spindle motor. In the de-energized position it allows AC power to be applied to the spindle motor.

RUN RELAY – this relay causes AC power to be applied to the spindle motor.